

## **webMethods EntireX**

### **Software AG IDL Extractor for COBOL**

Version 9.10

April 2016

This document applies to webMethods EntireX Version 9.10 and all subsequent releases.

Specifications contained herein are subject to change and these changes will be reported in subsequent release notes or new editions.

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**Document ID: EXX-EEXXC0BEXTRACTOR-910-20181116**

## Table of Contents

1 About this Documentation .....	1
Document Conventions .....	2
Online Information and Support .....	2
Data Protection .....	3
I Introduction to the IDL Extractor for COBOL .....	5
2 Introduction to the IDL Extractor for COBOL .....	7
Introduction .....	8
Extractor Wizard .....	9
Mapping Editor .....	10
Supported COBOL Interface Types .....	11
II Using the IDL Extractor for COBOL - Overview .....	21
3 Scenario I: Create New IDL and Server Mapping Files .....	25
Step 1: Start the IDL Extractor for COBOL Wizard .....	26
Step 2: Select a COBOL Extractor Environment or Create a New One .....	27
Step 3: Select the COBOL Source .....	29
Step 4: Define the Extraction Settings and Start Extraction .....	36
Step 5: Select the COBOL Interface and Map to IDL Interface .....	45
Step 6: Finish the Mapping Editor .....	46
Step 7: Validate the Extraction and Test the IDL File .....	49
4 Scenario II: Append to Existing IDL and Server Mapping Files .....	51
5 Scenario III: Modify Existing IDL and Server Mapping Files .....	53
III COBOL Mapping Editor .....	57
6 CICS with DFHCOMMAREA Calling Convention - In same as Out .....	61
Introduction .....	62
Extracting from a CICS DFHCOMMAREA Program .....	62
Mapping Editor User Interface .....	64
Mapping Editor IDL Interface Mapping Functions .....	71
Programming Techniques .....	88
7 CICS with DFHCOMMAREA Calling Convention - In different to Out .....	95
Introduction .....	96
Extracting from a CICS DFHCOMMAREA Program .....	96
Mapping Editor User Interface .....	98
Mapping Editor IDL Interface Mapping Functions .....	105
Programming Techniques .....	122
8 CICS with DFHCOMMAREA Large Buffer Interface - In same as Out .....	129
Introduction .....	130
Extracting from a CICS DFHCOMMAREA Large Buffer Program .....	131
Mapping Editor User Interface .....	132
Mapping Editor IDL Interface Mapping Functions .....	139
Programming Techniques .....	156
9 CICS with DFHCOMMAREA Large Buffer Interface - In different to Out .....	163
Introduction .....	164
Extracting from a CICS DFHCOMMAREA Large Buffer Program .....	165

Mapping Editor User Interface .....	167
Mapping Editor IDL Interface Mapping Functions .....	174
Programming Techniques .....	192
10 CICS with Channel Container Calling Convention .....	199
Introduction .....	200
Extracting from a CICS Channel Container Program .....	200
Mapping Editor User Interface .....	203
Mapping Editor IDL Interface Mapping Functions .....	210
Programming Techniques .....	227
11 Batch with Standard Linkage Calling Convention .....	235
Introduction .....	236
Extracting from a Standard Call Interface .....	236
Mapping Editor User Interface .....	238
Mapping Editor IDL Interface Mapping Functions .....	245
Programming Techniques .....	254
12 IMS BMP with Standard Linkage Calling Convention .....	257
Introduction .....	258
Extracting from an IMS BMP Standard Call Interface .....	258
Mapping Editor User Interface .....	260
Mapping Editor IDL Interface Mapping Functions .....	267
Programming Techniques .....	276
13 IMS MPP Message Interface (IMS Connect) .....	279
Introduction .....	280
Extracting from an IMS MPP Message Interface Program .....	281
Mapping Editor User Interface .....	284
Mapping Editor IDL Interface Mapping Functions .....	292
Programming Techniques .....	310
14 Micro Focus with Standard Linkage Calling Convention .....	317
Introduction .....	318
Extracting from a Standard Call Interface .....	318
Mapping Editor User Interface .....	320
Mapping Editor IDL Interface Mapping Functions .....	327
Programming Techniques .....	336
15 IDL Extractor for COBOL Preferences .....	339
Create New Local Extractor Environment (z/OS, z/VSE, BS2000/OSD and IBM i) .....	342
Create New Local Extractor Environment for Micro Focus (UNIX and Windows) .....	346
Create New Remote Extractor Environment (z/OS) .....	350
Create New Remote Extractor Environment (BS2000/OSD) .....	354
16 COBOL to IDL Mapping .....	359
COBOL Data Type to Software AG IDL Mapping .....	360
User-decided Mapping .....	363
DATA DIVISION Mapping .....	370
PROCEDURE DIVISION Mapping .....	376

Copybooks ..... 377

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# 1 About this Documentation

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▪ Document Conventions .....	2
▪ Online Information and Support .....	2
▪ Data Protection .....	3

## Document Conventions

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Convention	Description
<b>Bold</b>	Identifies elements on a screen.
Monospace font	Identifies service names and locations in the format <i>folder.subfolder.service</i> , APIs, Java classes, methods, properties.
<i>Italic</i>	Identifies:  Variables for which you must supply values specific to your own situation or environment. New terms the first time they occur in the text. References to other documentation sources.
Monospace font	Identifies:  Text you must type in. Messages displayed by the system. Program code.
{ }	Indicates a set of choices from which you must choose one. Type only the information inside the curly braces. Do not type the { } symbols.
	Separates two mutually exclusive choices in a syntax line. Type one of these choices. Do not type the   symbol.
[ ]	Indicates one or more options. Type only the information inside the square brackets. Do not type the [ ] symbols.
...	Indicates that you can type multiple options of the same type. Type only the information. Do not type the ellipsis (...).

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- Link to external websites that discuss open standards and web technology.

## **Data Protection**

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Software AG products provide functionality with respect to processing of personal data according to the EU General Data Protection Regulation (GDPR). Where applicable, appropriate steps are documented in the respective administration documentation.

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# I Introduction to the IDL Extractor for COBOL

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# 2 Introduction to the IDL Extractor for COBOL

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- Introduction ..... 8
- Extractor Wizard ..... 9
- Mapping Editor ..... 10
- Supported COBOL Interface Types ..... 11

## Introduction

The Software AG IDL Extractor for COBOL inspects a COBOL source and its copybooks for COBOL data items to extract. It can also extract directly from copybooks. In a user-driven process supported by an *Extractor Wizard*, the interface of a COBOL server is extracted and - with various features offered by a *Mapping Editor* - modelled to a client interface.



- 1 Start the wizard, select your server program and make COBOL-specific settings.
- 2 Optional. This step is not always necessary: it is possible that parameters have already been selected, for example as a result of the COBOL USING clause.
- 3 Optional. If necessary, you can modify the parameter selection from the Mapping Editor.
- 4 Fine-tune the COBOL to IDL mapping.
- 5 Generate an IDL file and a server mapping file. These two related files map the client interface to the COBOL server program and are described below:

### ■ IDL File

The Software AG IDL file (interface definition language) contains the modelled interface of the COBOL server. In a follow-up step the IDL file is the starting point for the RPC client-side wrapping generation tools to generate client interface objects. See *EntireX Wrappers*.

### ■ Server Mapping File

A server mapping file to complete the mapping is generated only if it is required by the RPC server during runtime to call the COBOL server. See *Server Mapping Files for COBOL*.

## Extractor Wizard

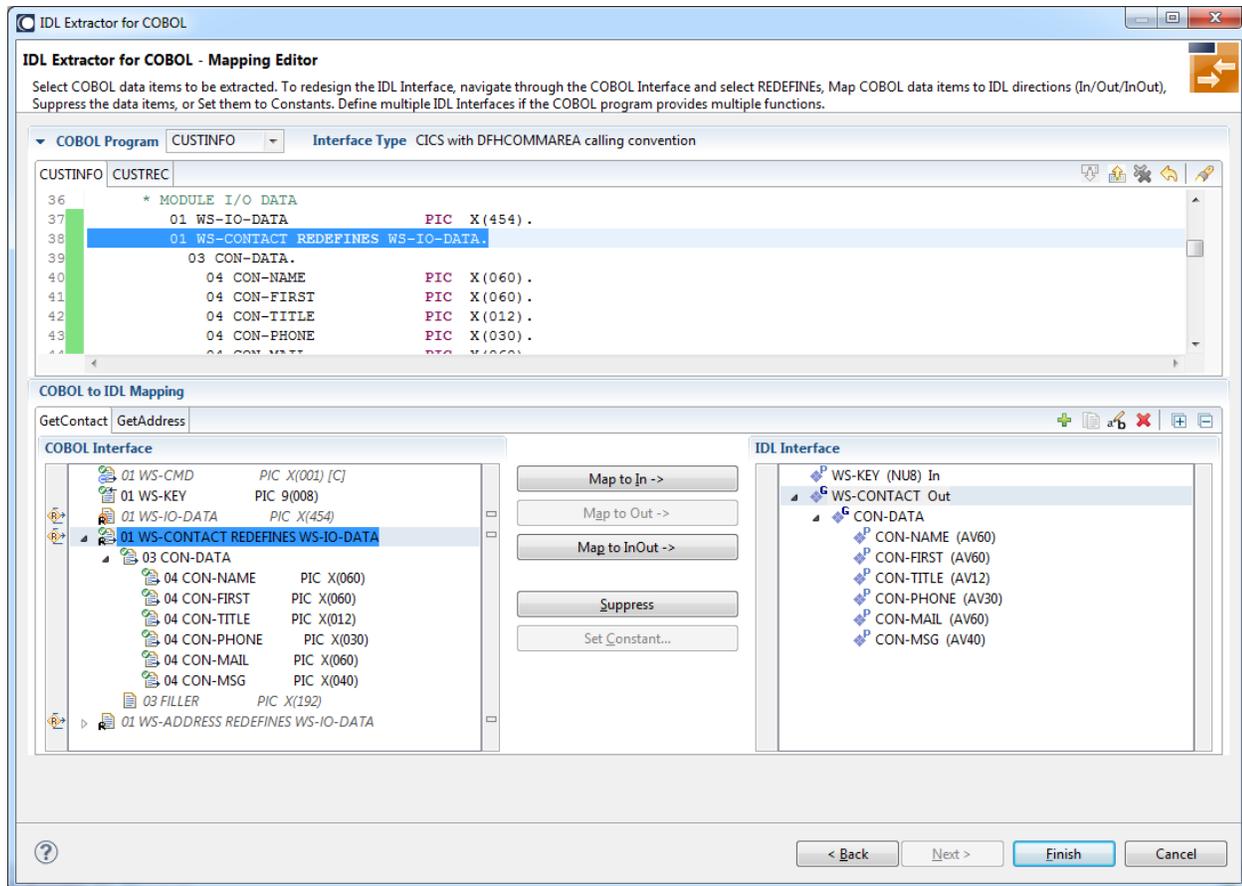
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The extractor wizard guides you through the extraction process. The wizard supports the following tasks:

- Accessing COBOL source files, either in the local file system where the EntireX Workbench runs or remotely from the host computer with the RPC server extractor service. The wizard supports the following: z/OS partitioned data sets and CA Librarian data sets (including member archive levels) as well as BS2000/OSD LMS libraries. See *Extractor Service* in the RPC Server documentation for Batch | IMS | BS2000/OSD. For this purpose, define a local or remote COBOL extractor environment. See [IDL Extractor for COBOL Preferences](#).
- Resolving of COBOL copybooks. If a relevant copybook from the COBOL DATA DIVISION is missing, a browse dialog is offered where you can locate the copybook - either a folder (local extractor environment) or data set (remote extractor environment) - interactively. Copybook folder or data sets can also be predefined in the COBOL extractor environment. See [IDL Extractor for COBOL Preferences](#).
- Resolving of COBOL copybooks with the REPLACE option.
- CA Librarian (-INC) and CA Panvalet(++INCLUDE) control statements are supported. They are handled in a similar way to copybooks.
- Various COBOL server interface types, such as standard CICS DFHCOMMAREA, CICS with different structures on input and output, CICS with a large buffer compatible to webMethods WMTLSRVR, standard batch, Micro Focus standard calling conventions, and IMS BMP server with PCB pointers. See [Supported COBOL Interface Types](#).
- Selecting the COBOL server interface manually within the [COBOL Mapping Editor](#) page. This allows you to extract from a COBOL server where the interface definition is not completely given by the parameters provided in the [PROCEDURE DIVISION Mapping](#), making it impossible to detect the parameters automatically.
- Defining the default COBOL to IDL mapping in the [IDL Extractor for COBOL Preferences](#) for the following fields:
  - COBOL pseudo-parameter FILLER fields. You can define whether they should be part of the RPC client interface or not. By default, they are not contained in the IDL.
  - The name prefix for FILLER and anonymous groups used for IDL parameters.
  - COBOL alphanumeric fields (PICTURE X, A, G, N). They can be mapped either to variable-length or fixed-length strings in the IDL. This option is provided for modern RPC clients that support variable-length strings, and also for legacy RPC clients that support fixed-length strings only.

The extractor wizard is described in a step-by-step tutorial; see [Using the IDL Extractor for COBOL - Overview](#).

## Mapping Editor



The *COBOL Mapping Editor* is the tool to select and map the COBOL server interface to IDL. This section gives a short overview of the mapping features provided. These features are described in more detail in the documentation section for the respective interface type.

- Add and remove the parameters of the COBOL server in the top window of the COBOL Mapping Editor page. The current selection is shown in the bottom window for fine tuning.
- Provide IDL directions for parameters of the COBOL server. A COBOL server does not contain IDL direction information, so you can add this information manually in the Mapping Editor.
- Select REDEFINE paths used in the IDL. The Mapping Editor allows you to select a single REDEFINE path for every REDEFINE unit (all redefine paths addressing the same storage location).
- Suppress unneeded fields in the IDL. This keeps the IDL client interface lean and also minimizes the amount of data transferred during runtime.
- Define parameter constants as input for the COBOL server. Constant parameters are not contained in the IDL file, which means they are invisible for RPC clients. This makes the IDL client interface easier and safer to use, minimizing improper usage.

- For one COBOL server program, you can create and model multiple interfaces. If the IDL is processed further with a wrapper of the EntireX Workbench, the business functions are provided as
  - Web service operations if exposed as a Web service instead of a Web service with a single operation
  - methods if wrapped with the Java Wrapper or .NET Wrapper instead of a Java class with a single method
  - etc.

See [COBOL Mapping Editor](#) for more information.

## Supported COBOL Interface Types

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The IDL Extractor for COBOL supports as input a COBOL server with various interface types. This section covers the following topics:

- [Supported CICS COBOL Interface Types](#)
- [Micro Focus with Standard Linkage Calling Convention](#)
- [Batch with Standard Linkage Calling Convention](#)
- [IMS MPP Message Interface \(IMS Connect\)](#)
- [IMS BMP with Standard Linkage Calling Convention](#)
- [What to do with other Interface Types?](#)
- [Compatibility between COBOL Interface Types and RPC Server](#)

The interface type you are mostly working with can be set in the preferences. See [IDL Extractor for COBOL Preferences](#).

### Supported CICS COBOL Interface Types

Analyzing the technique used to access the interface with COBOL and CICS statements is the safest way to determine the interface type. The following CICS COBOL interface types are supported:

- [CICS with DFHCOMMAREA Calling Convention](#)
- [CICS with Channel Container Calling Convention](#)
- [CICS with DFHCOMMAREA Large Buffer Interface](#)

There is no clear and easy indication how to identify the interface type of a CICS COBOL server without COBOL and CICS knowledge. Below are some criteria that might help to determine the interface type. If you are unsure, consult a CICS COBOL specialist.

- The payload size of the CICS COBOL server is greater than 32 KB:

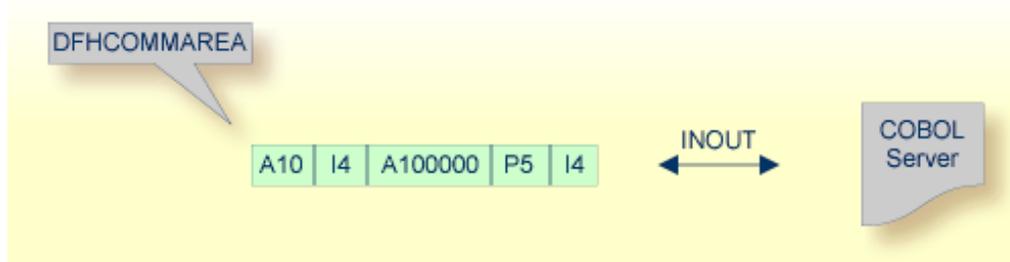
- In this case it is *not* a DFHCOMMAREA interface, because the DFHCOMMAREA is limited to 32 KB.
- It could be a large buffer or channel container interface, which are only limited by the storage (memory) available to them.
- The CICS COBOL server is located in a remote CICS region:
  - In this case it is *not* a large buffer interface (designed to assist with webMethods mainframe migration), because large buffer programs must reside on the same CICS region as the caller, that is, the CICS RPC Server (z/OS | z/VSE).
  - It could be a DFHCOMMAREA or channel container interface, which can reside in a remote CICS region.



**Note:** The most used interface type is the DFHCOMMAREA interface. Large buffer and channel container interfaces are used much less frequently.

### CICS with DFHCOMMAREA Calling Convention

The IDL Extractor for COBOL supports CICS programs using the standard DFHCOMMAREA calling convention.



The following illustrates roughly how you can determine whether a COBOL server follows the DFHCOMMAREA calling convention standard:

```
LINKAGE SECTION.
01 DFHCOMMAREA.
   02 OPERATION          PIC X(1).
   02 OPERAND-1         PIC S9(9) BINARY.
   02 OPERAND-2         PIC S9(9) BINARY.
   02 FUNCTION-RESULT   PIC S9(9) BINARY.

PROCEDURE DIVISION USING DFHCOMMAREA.
. . .
```

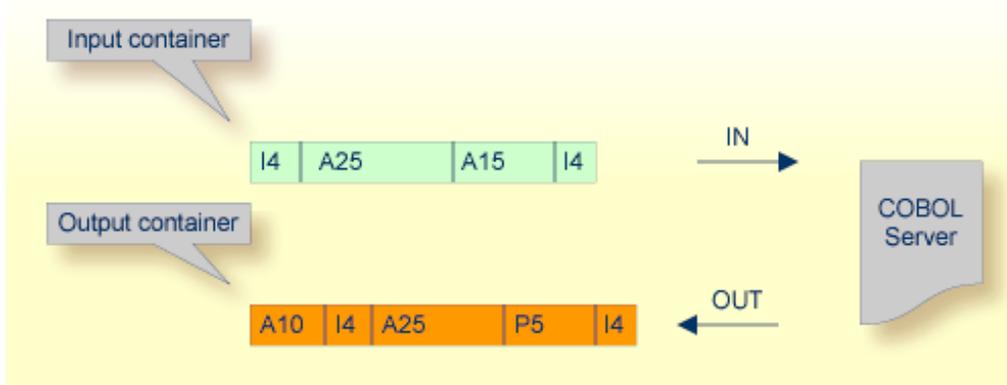
Most DFHCOMMAREA programs have a DFHCOMMAREA data item in their LINKAGE SECTION and may address this item in the PROCEDURE DIVISION header. If you find this in your COBOL source it's a clear indication it is a DFHCOMMAREA server program. But even if this is missing, it can be a

DFHCOMMAREA program, because there are alternative programming styles. If you are unsure, consult a COBOL CICS specialist or see [Supported CICS COBOL Interface Types](#) for more information.

See [Step 4: Define the Extraction Settings and Start Extraction](#) and [CICS with DFHCOMMAREA Calling Convention - In same as Out](#) for more information on extracting COBOL servers with this interface type.

### CICS with Channel Container Calling Convention

The IDL Extractor for COBOL supports CICS programs using the channel container calling convention.



The following illustrates roughly how you can determine whether a COBOL server follows the Channel Container standard.

```

WORKING-STORAGE SECTION.
01 WS-CONTAINER-IN-NAME          PIC X(16) VALUE "CALC-IN".
01 WS-CONTAINER-OUT-NAME        PIC X(16) VALUE "CALC-OUT".
. . .
LINKAGE SECTION.
01 LS-CONTAINER-IN-LAYOUT.
   02 OPERATION                  PIC X(1).
   02 OPERAND1                   PIC S9(9) BINARY.
   02 OPERAND2                   PIC S9(9) BINARY.
01 LS-CONTAINER-OUT-LAYOUT.
   02 FUNCTION-RESULT            PIC S9(9) BINARY.

PROCEDURE DIVISION.
. . .
   EXEC CICS GET CONTAINER (WS-CONTAINER-IN-NAME) SET (ADDRESS OF ↵
LS-CONTAINER-IN-LAYOUT) ...
. . .
   EXEC CICS PUT CONTAINER (WS-CONTAINER-OUT-NAME) FROM (ADDRESS OF ↵
LS-CONTAINER-OUT-LAYOUT) ...
. . .

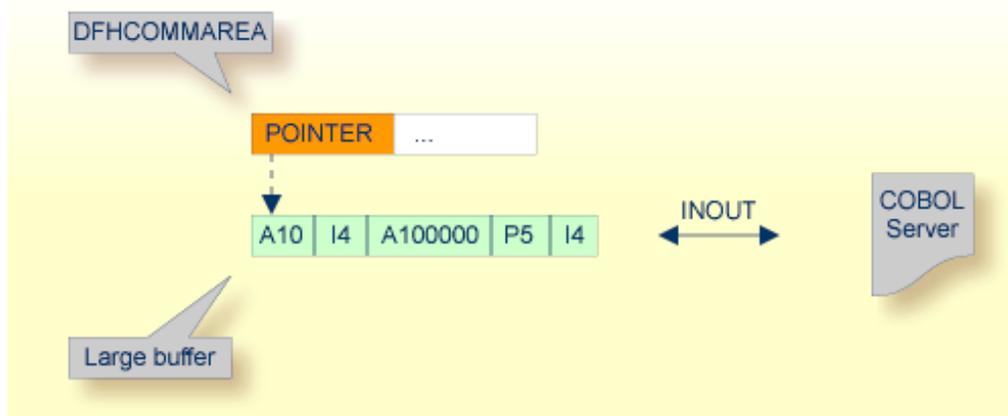
```

Channel Container programs use EXEC CICS GET CONTAINER in their program body (PROCEDURE DIVISION) to read their input parameters. Output parameters are written using EXEC CICS PUT CONTAINER. There is no clear indication in the linkage or working storage section to identify a channel container program. If you are unsure, consult a COBOL CICS specialist for clarification.

See [Step 4: Define the Extraction Settings and Start Extraction](#) for more information on extracting COBOL servers with this interface type.

### CICS with DFHCOMMAREA Large Buffer Interface

This type of program has a defined DFHCOMMAREA interface to access more than 31 KB of data in CICS. The interface is the same as the webMethods WMTLSRVR interface. This enables webMethods customers to migrate to EntireX.



Technically,

- the DFHCOMMAREA layout contains a *length* and a *pointer* to a large buffer. The following illustrates this:

```
LINKAGE SECTION.

01 DFHCOMMAREA.
  10 WM-LCB-MARKER                PIC X(4).
  10 WM-LCB-INPUT-BUFFER          POINTER.
  10 WM-LCB-INPUT-BUFFER-SIZE     PIC S9(8) BINARY.
  10 WM-LCB-OUTPUT-BUFFER        POINTER.
  10 WM-LCB-OUTPUT-BUFFER-SIZE   PIC S9(8) BINARY.
  10 WM-LCB-FLAGS                 PIC X(1).
  88 WM-LCB-FREE-OUTPUT-BUFFER    VALUE 'F'.
  10 WM-LCB-RESERVED              PIC X(3).
01 INOUT-BUFFER.
  02 OPERATION                    PIC X(1).
  02 OPERAND-1                   PIC S9(9) BINARY.
  02 OPERAND-2                   PIC S9(9) BINARY.
```

```
02 FUNCTION-RESULT                                PIC S9(9) BINARY.  
. . .  
PROCEDURE DIVISION USING DFHCOMMAREA.  
. . .  
    SET ADDRESS OF INOUT-BUFFER TO WM-LCB-INPUT-BUFFER.  
*  process the INOUT-BUFFER and provide result  
    EXEC CICS RETURN.
```

The fields subordinated under DFHCOMMAREA prefixed with WM-LCB describe this structure. The field names themselves can be different, but the COBOL data types must match exactly.

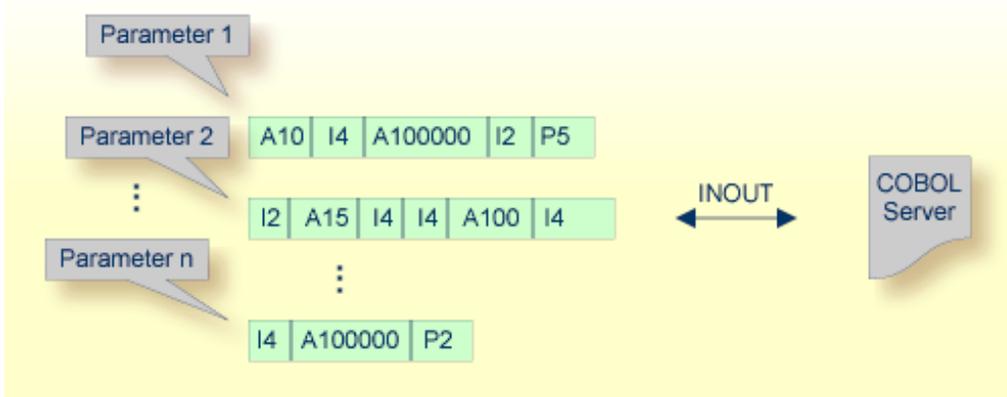
- data is described by separate structures, here INOUT-BUFFER in the linkage section.

If you find this in your COBOL source, it's a clear indication it is a large buffer program. If you are unsure, consult a COBOL CICS specialist for clarification.

See [Step 4: Define the Extraction Settings and Start Extraction](#) and [CICS with DFHCOMMAREA Large Buffer Interface - In same as Out](#) for more information on extracting COBOL servers with this interface type.

## Micro Focus with Standard Linkage Calling Convention

Standard call interfaces with a given number of parameters are supported. Every parameter addresses a fixed COBOL structure.



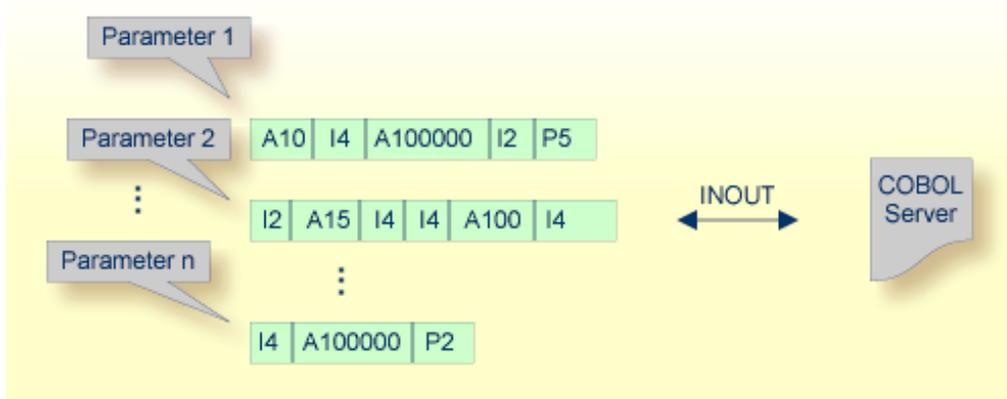
Technically, the generated COBOL server skeleton contains

- a parameter list: `PROCEDURE DIVISION USING PARM1 PARM2 ... PARMn`
- the parameters in the linkage section as COBOL data items on level 1

See [Step 4: Define the Extraction Settings and Start Extraction](#) and [Micro Focus with Standard Linkage Calling Convention](#) for more information on extracting COBOL servers with this interface type.

## Batch with Standard Linkage Calling Convention

Standard call interfaces with a given number of parameters are supported. Every parameter addresses a fixed COBOL structure.

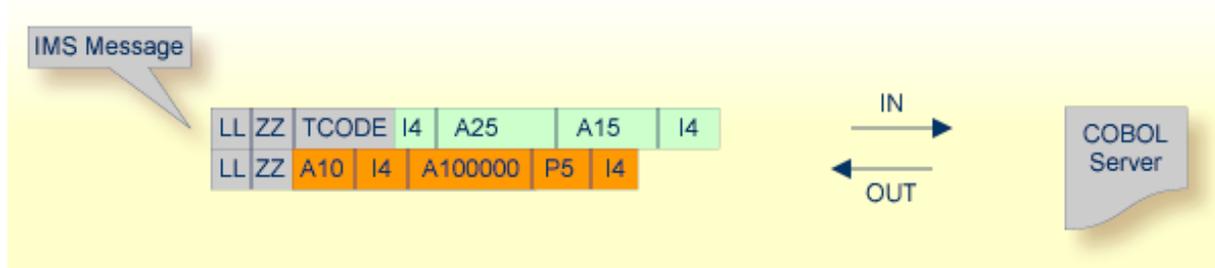


Technically, the COBOL server contains

- a parameter list: `PROCEDURE DIVISION USING PARM1 PARM2 ... PARMn`
- the parameters in the linkage section as COBOL data items on level 1

See [Step 4: Define the Extraction Settings and Start Extraction](#) and [Batch with Standard Linkage Calling Convention](#) for more information on extracting COBOL servers with this interface type.

## IMS MPP Message Interface (IMS Connect)



IMS message processing programs (MPP) get their parameters through an IMS message and return the result by sending an output message to IMS. The IDL Extractor for COBOL enables extractions from such programs.

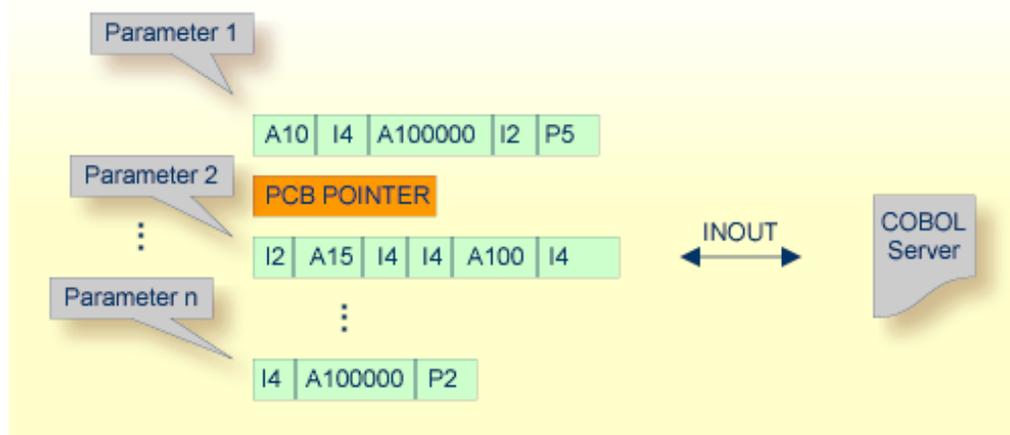
The COBOL server contains:

- a structure in the working storage section for the input and the output message.
- an IOPCB in the linkage section used to read input messages and write output messages using an IMS system call (i.e. CALL "CBLTDLI").
- The message contains also technical fields specific to IMS (see fields LL, ZZ and TRANCODE in the picture above).

See [Step 4: Define the Extraction Settings and Start Extraction](#) and [IMS MPP Message Interface \(IMS Connect\)](#) for more information on extracting COBOL servers with this interface type.

## IMS BMP with Standard Linkage Calling Convention

IMS batch message processing programs (BMP) with PCB parameters are directly supported. You have the option to specify a PSB list as input to the extractor to locate PCB parameters.



Technically, the COBOL server contains

- a parameter list: `PROCEDURE DIVISION USING PARM1 PCB PARM2 ... PARMn`
- IMS-specific *PCB pointers* within the parameter list
- the parameters in the linkage section as COBOL data items on level 1

See [Step 4: Define the Extraction Settings and Start Extraction](#) and [IMS BMP with Standard Linkage Calling Convention](#) for more information on extracting COBOL servers with this interface type.

### What to do with other Interface Types?

Other interface types, for example CICS with non-DPL-enabled `DFHCOMMAREA`, can be supported by means of a custom wrapper. If you have to extract from such a COBOL server, proceed as follows:

1. Implement a custom wrapper, providing one of the supported interface types above.
2. Extract from this custom wrapper.

## Compatibility between COBOL Interface Types and RPC Server

To call a server successfully, the RPC server used must support the interface type of the COBOL server. The table below gives an overview of possible combinations of an interface type and a supporting RPC server:

Interface Type	Supported by EntireX Component		Supported by EntireX Adapter	Supported by RPC Server									
				z/OS			UNIX/Windows			BS2000/OSD	z/VSE		
				CICS	Batch	IMS	CICS ECI	Micro Focus	IMS Connect	Batch	CICS	Batch	
CICS with DFHCOMMAREA Calling Convention	Extractor	Wrapper	x	x			x					x	
CICS with DFHCOMMAREA Large Buffer Interface	Extractor	Wrapper		x								x	
CICS with Channel Container Calling Convention	Extractor	Wrapper		x									
Batch with Standard Linkage Calling Convention	Extractor	Wrapper			x	x					x		x
Micro Focus with Standard Linkage Calling Convention	Extractor	Wrapper						x					
IMS BMP with Standard Linkage Calling Convention	Extractor	Wrapper				x							
IMS MPP Message Interface (IMS Connect)	Extractor		x						x				

# II

## Using the IDL Extractor for COBOL - Overview

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This chapter describes how to extract IDL from a COBOL source, using the IDL Extractor for COBOL, deploy, validate and test the extraction results. IDL extraction is supported by wizards, editors and generators.

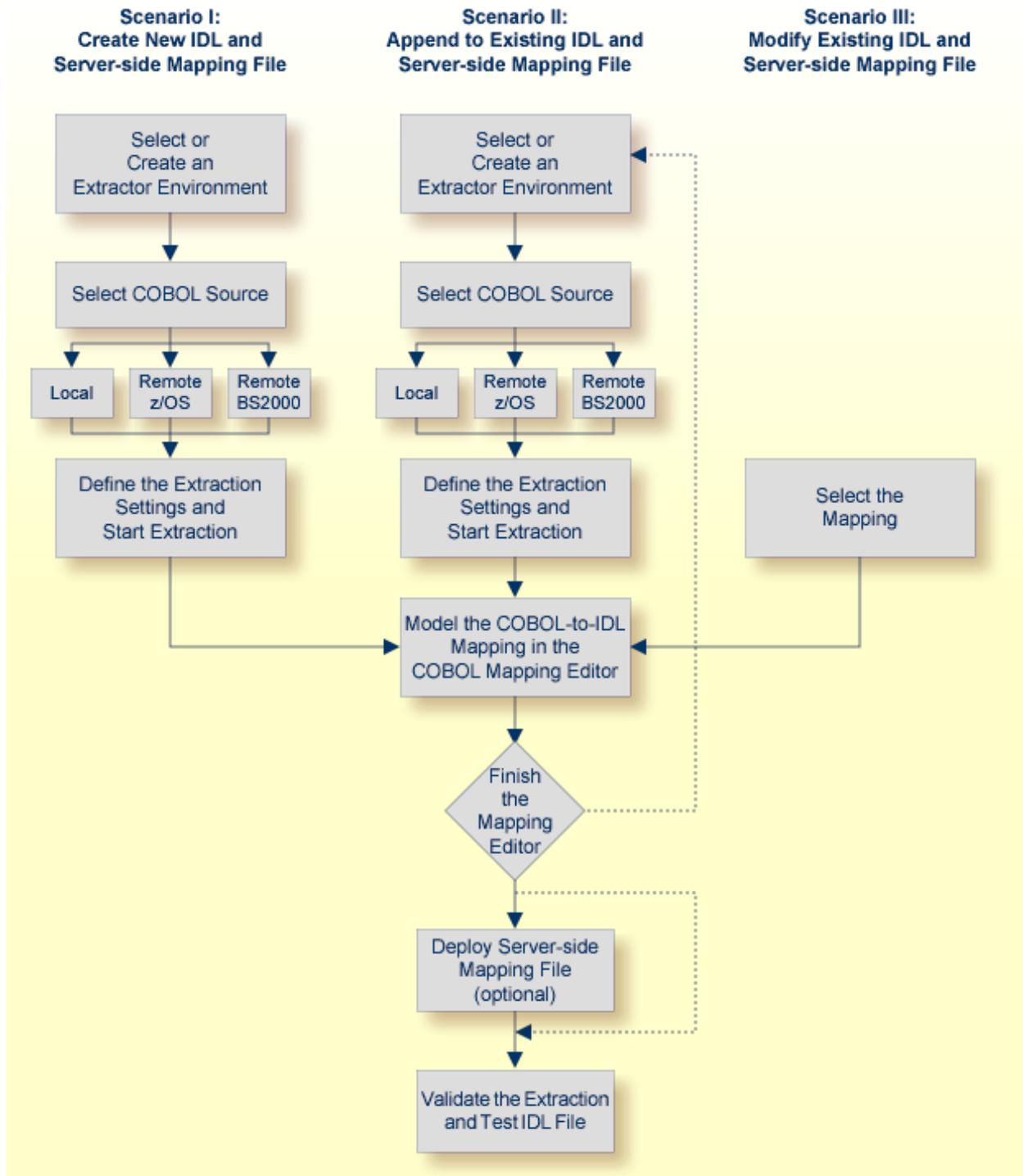
### Choosing a Scenario

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The following scenarios are supported and are described in separate sections:

- *Scenario I: Create New IDL and Server Mapping Files*
- *Scenario II: Append to Existing IDL and Server Mapping Files*
- *Scenario III: Modify Existing IDL and Server Mapping Files*

See also *COBOL Mapping Editor*.



## Before Starting an Extraction

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Before you start an extraction, we recommend you first clarify the following issues:

- The interface type of your COBOL program, see [Supported COBOL Interface Types](#).
- The input and output parameters of your COBOL server. Note the following:
  - COBOL REDEFINES are used in CICS as well as in batch servers. For all COBOL REDEFINES you have to clarify which redefine paths are the relevant ones for your extraction.
  - Particularly in CICS, the interface of a COBOL server is in most cases not described by the parameters given in the PROCEDURE DIVISION header. See [PROCEDURE DIVISION Mapping](#) and see DFHCOMMAREA examples under [Programming Techniques](#).
- We recommend you have a basic understanding of your COBOL server, especially if you can simplify your IDL with the following:
  - Map functions of the COBOL server to IDL programs.
  - Suppress unneeded fields.
  - Map COBOL data items to constants.

The COBOL sources can contain

- copybook references; see [Copybooks](#) under [COBOL to IDL Mapping](#)
- CA Librarian (-INC) or CA Panvalet(++INCLUDE) control statements

In section [COBOL to IDL Mapping](#) you will find information on how the COBOL syntax is mapped to Software AG IDL using this wizard and the Mapping Editor. We recommend you read this document because it describes possibilities and alternatives for handling COBOL syntax constructs.

Make sure the COBOL source

- can be compiled with no errors and no warning
- is written in COBOL fixed format, consisting of sequence number (column 1-6), indicator area (column 7), area A, (column 8-11) and area B (column 12-72) for z/OS, z/VSE, BS2000/OSD and IBM i extractions
- is either written in COBOL fixed or variable format for Micro Focus UNIX or Windows extractions and your preferences are adjusted accordingly; see [Step 2: Define the Default Settings](#) under [Create New Local Extractor Environment for Micro Focus \(UNIX and Windows\)](#).



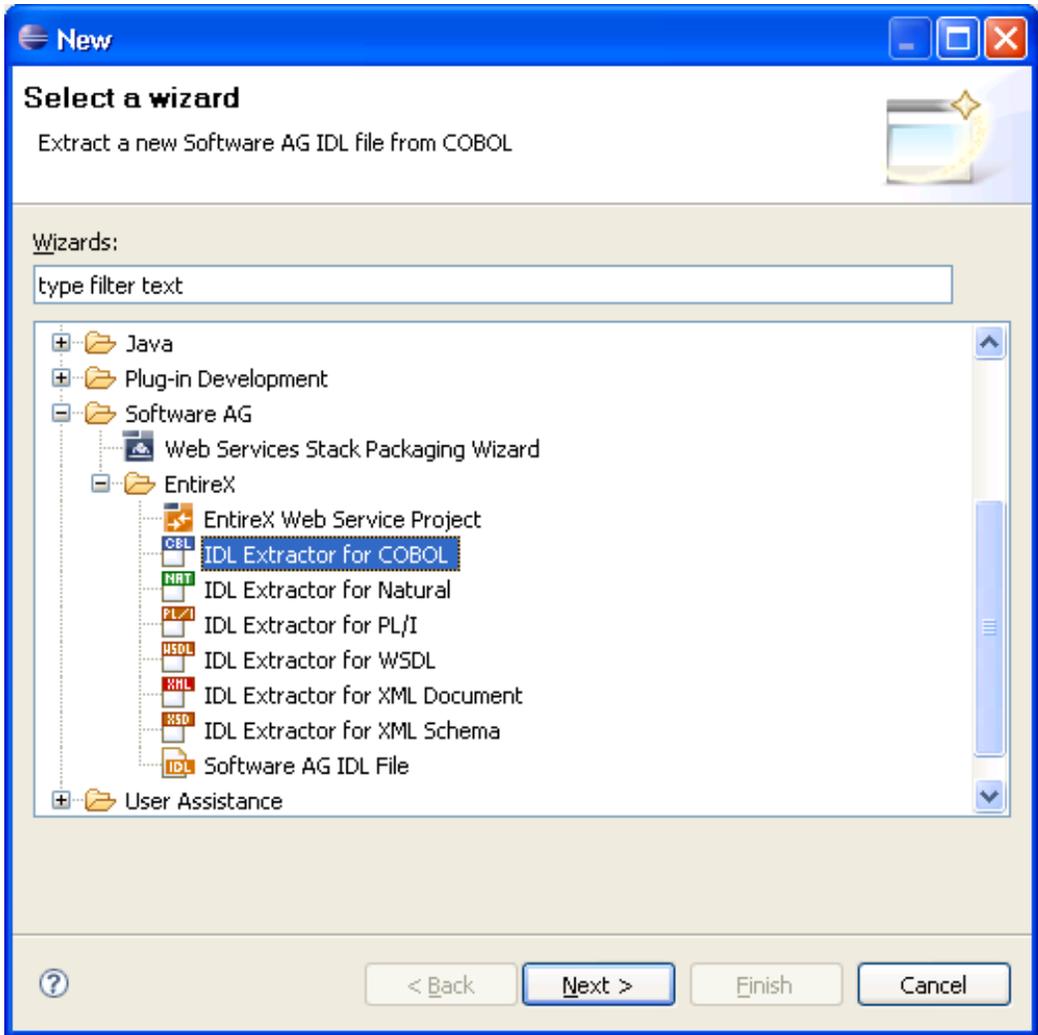
# 3

## Scenario I: Create New IDL and Server Mapping Files

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- Step 1: Start the IDL Extractor for COBOL Wizard ..... 26
- Step 2: Select a COBOL Extractor Environment or Create a New One ..... 27
- Step 3: Select the COBOL Source ..... 29
- Step 4: Define the Extraction Settings and Start Extraction ..... 36
- Step 5: Select the COBOL Interface and Map to IDL Interface ..... 45
- Step 6: Finish the Mapping Editor ..... 46
- Step 7: Validate the Extraction and Test the IDL File ..... 49

## Step 1: Start the IDL Extractor for COBOL Wizard



To continue, press **Next** and continue with *Step 2: Select a COBOL Extractor Environment or Create a New One*.

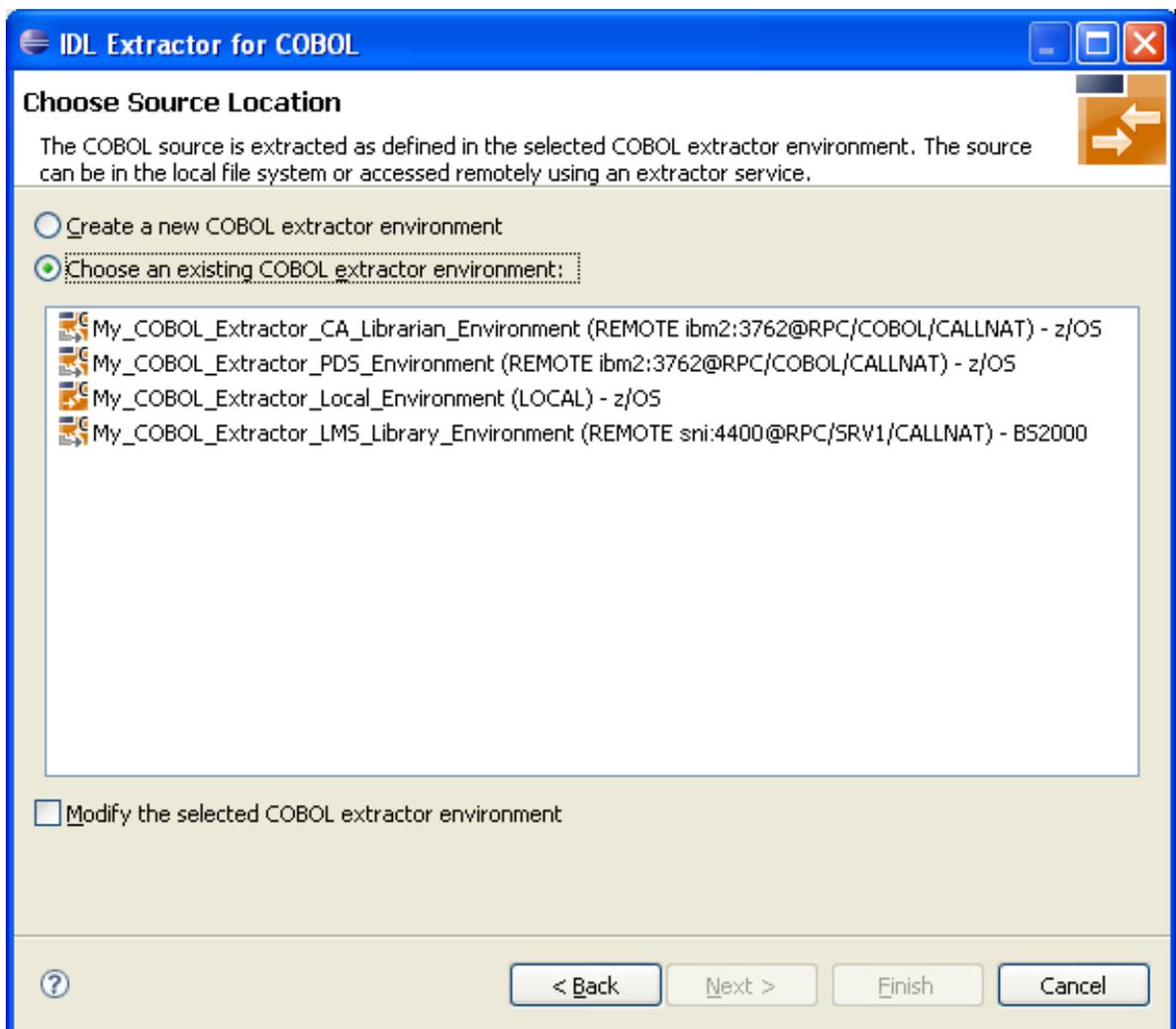
## Step 2: Select a COBOL Extractor Environment or Create a New One

If no COBOL extractor environments are defined, you only have the option to create a new environment. An IDL Extractor for COBOL environment provides defaults for the extraction and refers to COBOL programs and copybooks that are

- stored locally on the same machine where the EntireX Workbench is running: a *local* COBOL extractor environment

or

- stored remotely on a host computer: a *remote* COBOL extractor environment. The extractor service is required to access COBOL programs and copybooks remotely with a remote COBOL extractor environment. The extractor service is supported on platforms z/OS and BS2000/OSD. See *Extractor Service* in the RPC Server documentation for Batch | IMS | BS2000/OSD.



This page offers the following options:

➤ **To select an existing local COBOL extractor environment**

- 1 Check radio button **Choose an existing COBOL extractor environment** and select a local COBOL extractor environment.
- 2 Continue with *Step 3: Select the COBOL Source* below.

➤ **To select an existing remote COBOL extractor environment**

- 1 Check radio button **Choose an existing COBOL extractor environment** and select a remote COBOL extractor environment.
- 2 Continue with *Step 3: Select the COBOL Source* below.

➤ **To create a new local COBOL extractor environment**

- 1 Check radio button **Create a new COBOL extractor environment**.
- 2 Follow the instructions in the Preferences section under *Create New Local Extractor Environment* (z/OS, z/VSE, BS2000/OSD and IBM i) | Micro Focus (UNIX and Windows) in the IDL Extractor for COBOL documentation.
- 3 Continue with *Step 3: Select the COBOL Source* below.

➤ **To create a new remote COBOL extractor environment**

- 1 Check radio button **Create a new COBOL extractor environment**.
- 2 Follow the instructions in the Preferences section under *Create New Remote Extractor Environment* z/OS | BS2000/OSD in the IDL Extractor for COBOL documentation.
- 3 Continue with *Step 3: Select the COBOL Source* below.

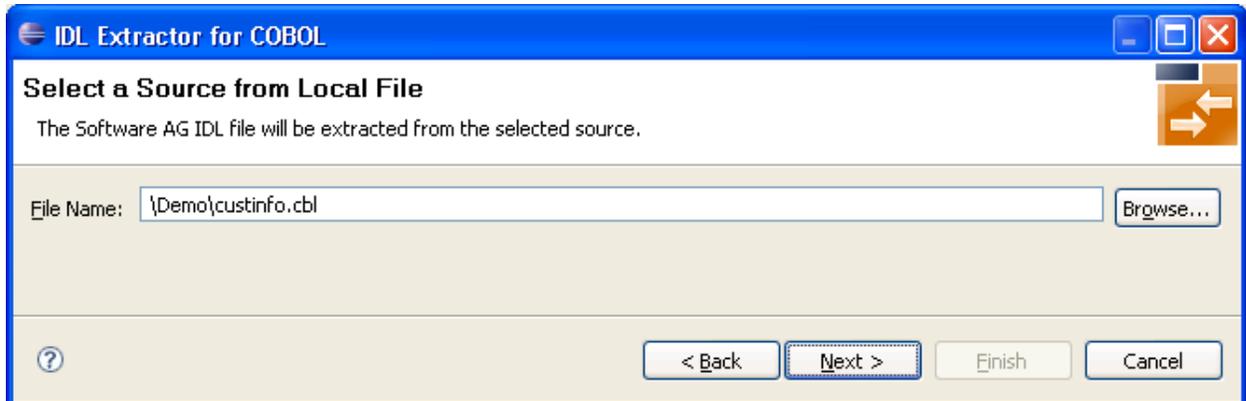
## Step 3: Select the COBOL Source

Selecting the COBOL source is different depending on whether the COBOL source is stored locally on the same machine where the *EntireX Workbench* is running, or on a remote host computer.

- [Selecting a COBOL Source Stored Locally](#)
- [Selecting a Member from a Partitioned Data Set on Remote Host \(z/OS\)](#)
- [Selecting a Member from a CA Librarian Data Set on Remote Host \(z/OS\)](#)
- [Selecting a Member Archive Level from a CA Librarian Data Set on Remote Host \(z/OS\)](#)
- [Selecting an Element \(S\) from an LMS Library on Remote Host \(BS2000/OSD\)](#)

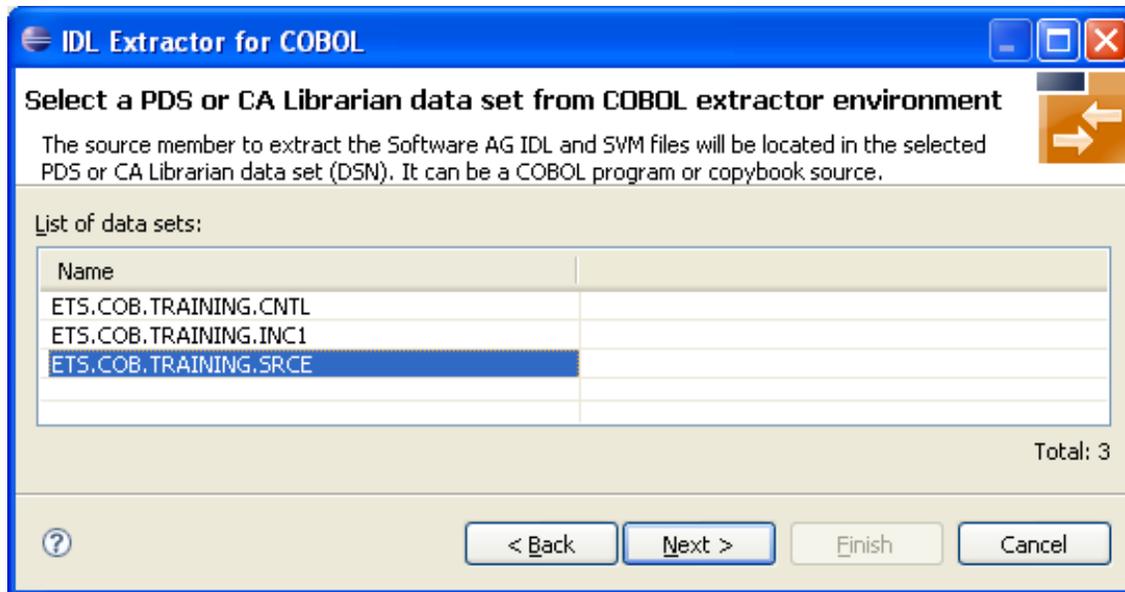
### Selecting a COBOL Source Stored Locally

In step 2 above you selected or created a local extractor environment for z/OS. If you select a local COBOL extractor environment, you can browse for the COBOL program in the local file system. If you selected the COBOL source file before you started the wizard, and do not have a directory defined in the preferences of your Local Extractor Environment, the file location is already present. See *Create New Local Extractor Environment (z/OS, z/VSE, BS2000/OSD and IBM i) | Micro Focus (UNIX and Windows)* in the IDL Extractor for COBOL documentation. To browse for the COBOL source file, choose **Browse**.



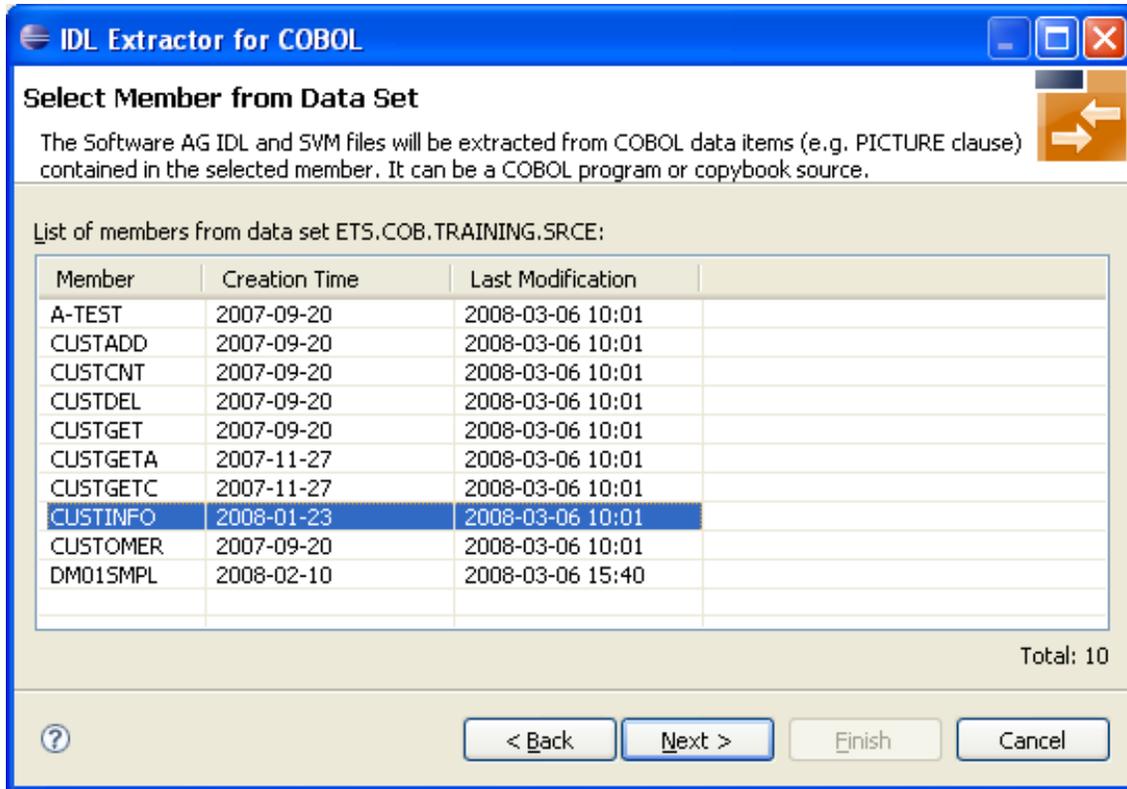
### Selecting a Member from a Partitioned Data Set on Remote Host (z/OS)

In step 2 above you selected or created a remote extractor environment. The following page offers all data sets starting with the high-level qualifier defined in the **Filter Settings** of the remote extractor environment. See [Create New Remote Extractor Environment \(z/OS\)](#) under *IDL Extractor for COBOL Preferences*.



Select the partitioned data set from which you want to extract and choose **Next**. Proceed depending on the selected data set type. See [Selecting a Member from a Partitioned Data Set on Remote Host \(z/OS\)](#).

The following page offers all members contained in the partitioned data set selected in the previous step, starting with the member name prefix defined in the **Filter Settings** of the remote extractor environment. See [Step 3: Define the Remote Extractor Environment](#) under [IDL Extractor for COBOL Preferences](#).

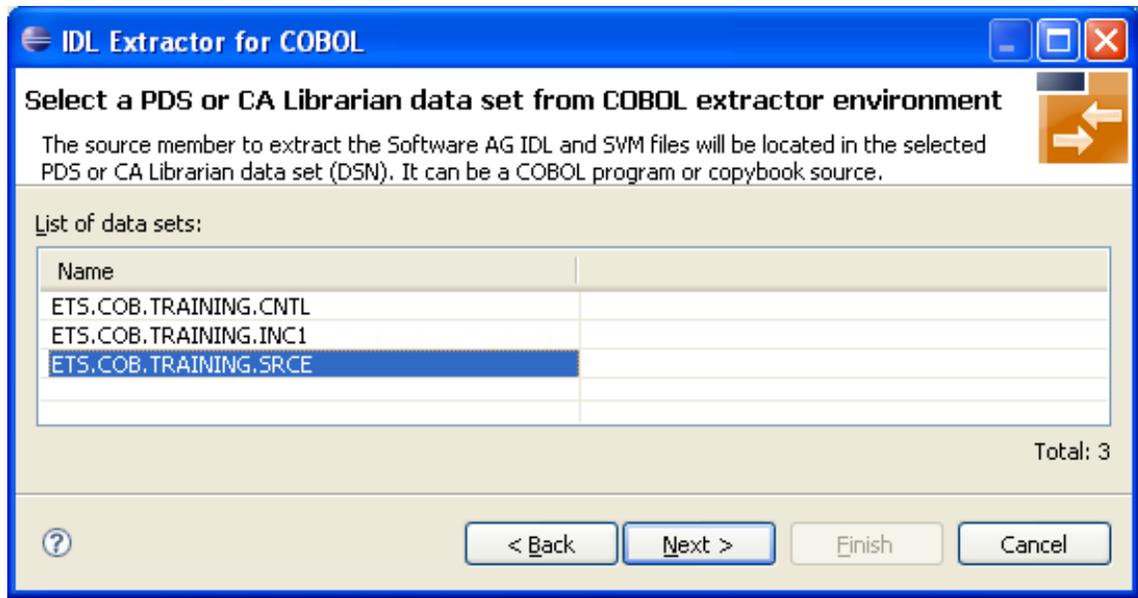


Select the member from which you want to extract. You can select only one COBOL source. The source can be a COBOL program or a COBOL copybook.

Choose **Next** and continue with [Step 4: Define the Extraction Settings and Start Extraction](#) below.

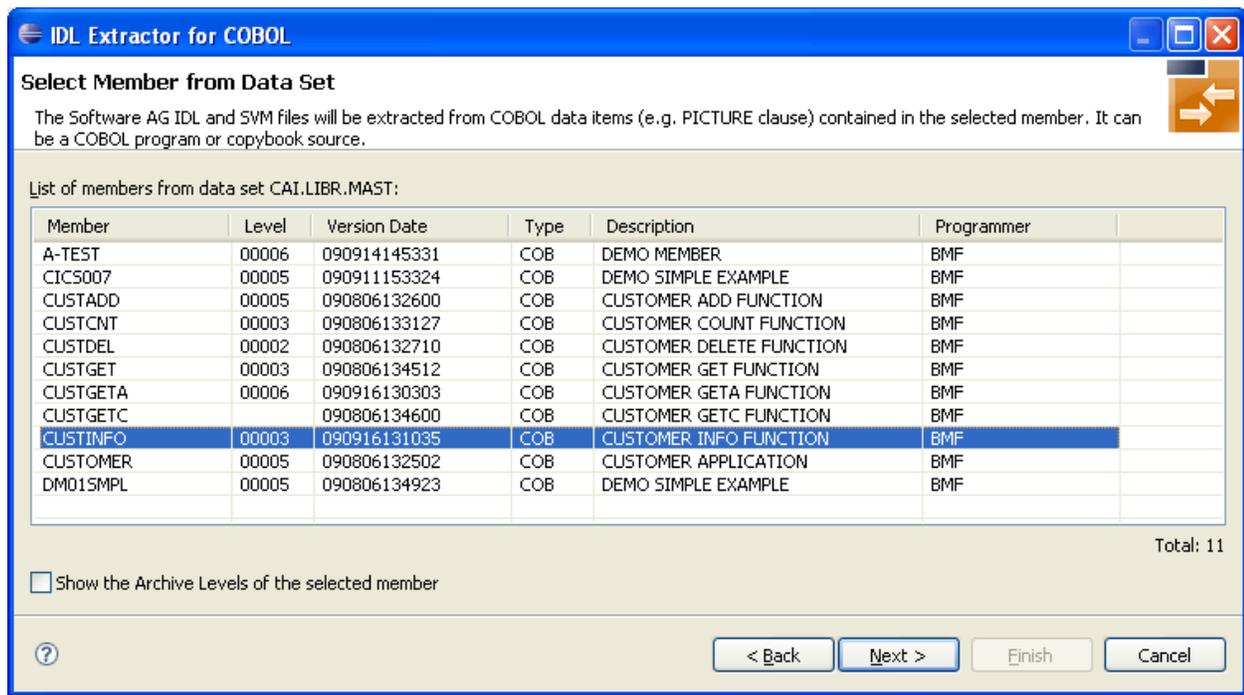
### Selecting a Member from a CA Librarian Data Set on Remote Host (z/OS)

In step 2 above you selected or created a remote extractor environment. The following page offers all data sets starting with the high-level qualifier defined in the **Filter Settings** of the remote extractor environment. See [Create New Remote Extractor Environment \(z/OS\)](#) under [IDL Extractor for COBOL Preferences](#).



Select the CA Librarian data set from which you want to extract and choose **Next**. Proceed depending on the selected data set type. See [Selecting a Member from a CA Librarian Data Set on Remote Host \(z/OS\)](#).

The following page offers all members contained in the CA Librarian data set selected in the previous step, starting with the member name prefix defined in the **Filter Settings** of the remote extractor environment. See [Step 3: Define the Remote Extractor Environment](#) under *IDL Extractor for COBOL Preferences*.

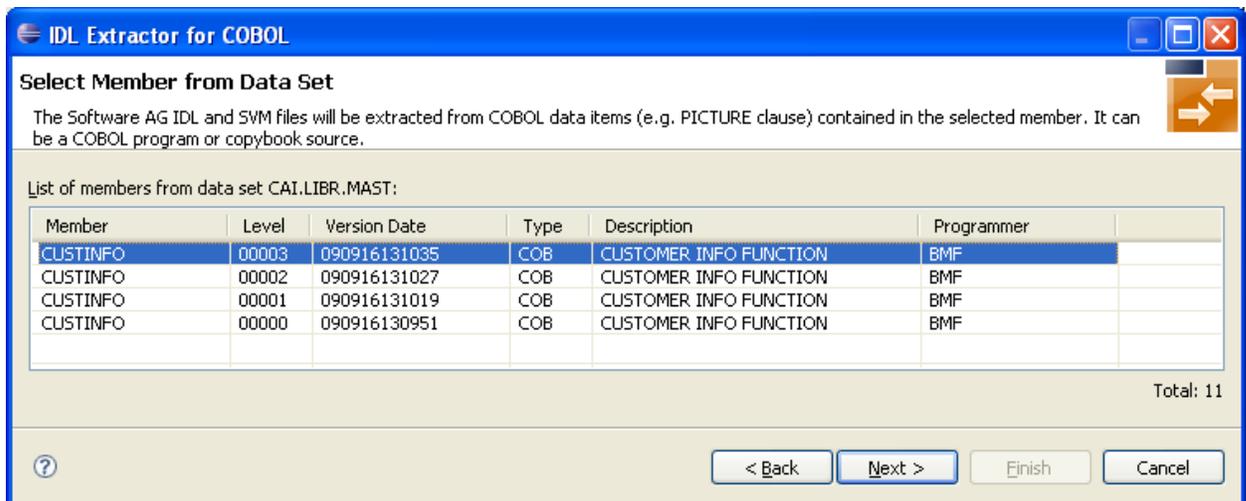


You can select only one COBOL source. The source can be a COBOL program or a COBOL copybook. If you want to extract from

- the latest (current) version of the member, select the member, choose **Next** and continue with [Step 4: Define the Extraction Settings and Start Extraction](#) below.
- a previous (archived) version of the member, check the box **Show the Archive Levels of the selected member**, select the member, choose **Next** and continue with [Selecting a Member Archive Level from a CA Librarian Data Set on Remote Host \(z/OS\)](#).

### Selecting a Member Archive Level from a CA Librarian Data Set on Remote Host (z/OS)

The following page offers all archive levels of the previously selected member.

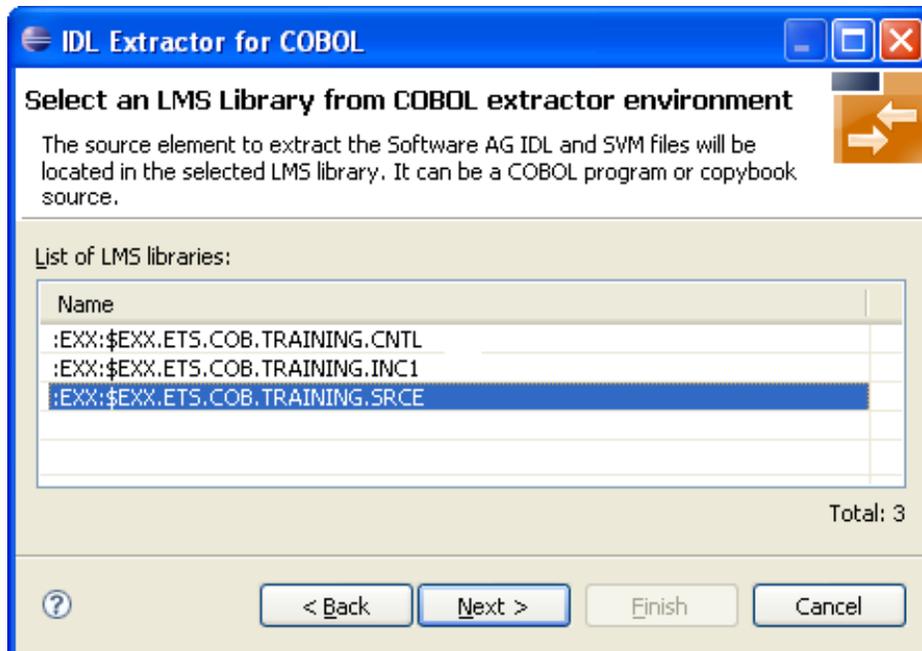


Select the member from which you want to extract. You can select only one archive level. Choose **Next** and continue with [Step 4: Define the Extraction Settings and Start Extraction](#) below.

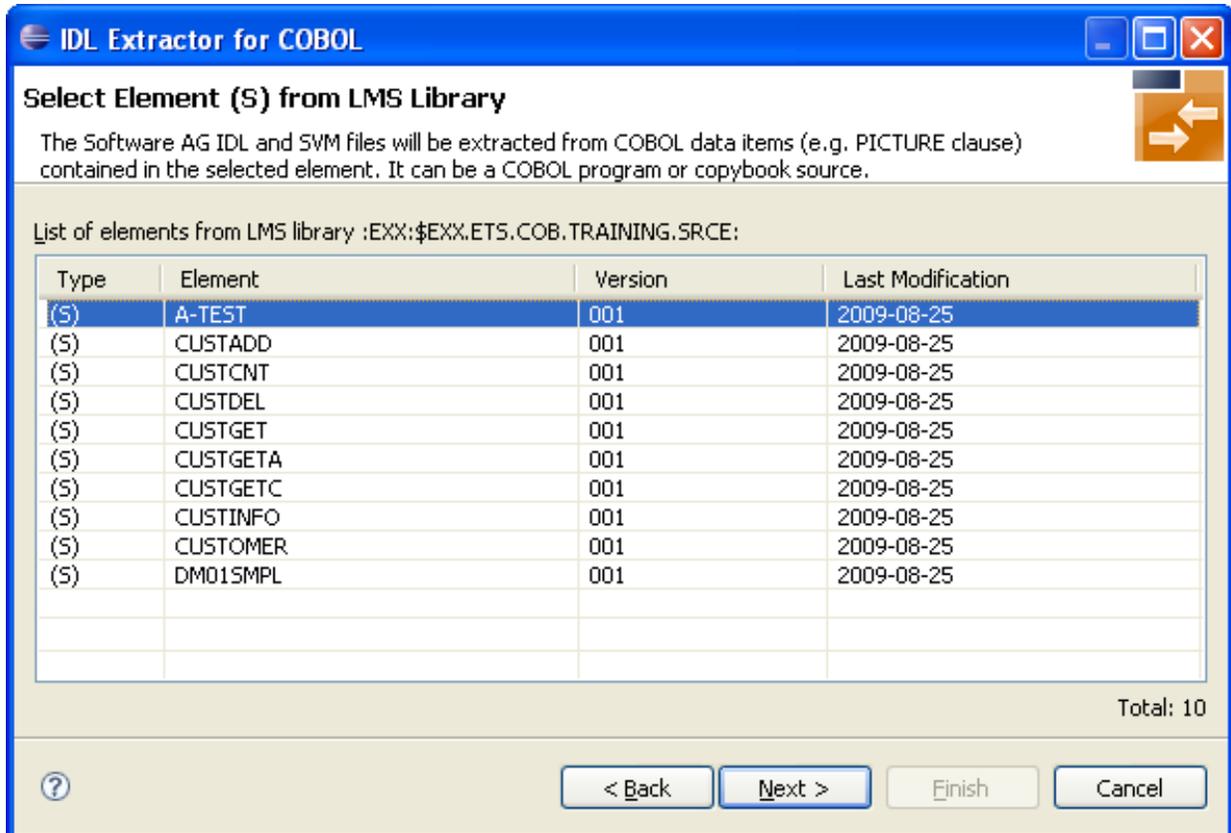
### Selecting an Element (S) from an LMS Library on Remote Host (BS2000/OSD)

In step 2 above you selected or created a remote extractor environment.

The following page offers all data sets starting with the high-level qualifier defined in the **Filter Settings** of the remote extractor environment. See [Create New Remote Extractor Environment \(BS2000/OSD\)](#) under [IDL Extractor for COBOL Preferences](#).



The following page offers all elements contained in the LMS library selected in the previous step, starting with the member name prefix defined in the Filter Settings of the remote extractor environment. See [Step 3: Define the Remote Extractor Environment](#) under *IDL Extractor for COBOL Preferences*.



Select the element from which you want to extract. You can select only one COBOL source. The source can be a COBOL program or a COBOL copybook.

Choose **Next** and continue with [Step 4: Define the Extraction Settings and Start Extraction](#) below.

## Step 4: Define the Extraction Settings and Start Extraction

In this page you specify the COBOL source and Software AG IDL target options used for IDL extraction.

The screenshot shows the 'IDL Extractor for COBOL' dialog box. The 'Extraction Settings' section contains the following fields and options:

- COBOL Source:**
  - File Name: CUSTINFO
  - Operating System: z/OS
  - Interface Type: CICS with DFHCOMMAREA calling convention
  - Input Message same as Output Message
- IMS MPP message interface (IMS Connect):**
  - Transaction field length in COBOL source: 10
  - Transaction Name: \*
  - Create IDL parameter for Transaction Name - specification at runtime
- IMS BMP with standard linkage calling convention:**
  - IMS PSB List: [ ] Browse...
- CICS with Channel Container calling convention:**
  - Channel Name: EntireXChannel
- Software AG IDL File:**
  - File Name: \* CUSTINFO
  - Modify existing File
  - Library Name: \* CUSTINFO
  - Container: \* /Demo [ ] Browse...
- COBOL to IDL Mapping:**
  - Map alphanumeric fields (PICTURE X, A, G, N) to:
    - Strings with variable length (Java, .NET, DCOM, C, Natural, SOAP, XML)
    - Strings with fixed length (COBOL, PL/I)
  - Map FILLER fields to IDL

At the bottom, there are navigation buttons: < Back, Next >, Finish, and Cancel.

### Operating System

The operating system is already defined in the extractor environment in the IDL Extractor for COBOL preferences, see [IDL Extractor for COBOL Preferences](#).

### Interface Type

The interface type must match the type of your COBOL server program. It is used by the RPC server and the EntireX Adapter at runtime to correctly call the COBOL server and must be a supported interface type of the RPC server used. See [Compatibility between COBOL Interface Types and RPC Server](#).

Additional information may be required depending on the interface type:

- **CICS with DFHCOMMAREA Calling Convention**

Specify **Input Message same as Output Message**. If the COBOL server program uses a different COBOL output data structure compared to its input data structure, that is, the input message layout is overlaid with another layout on output, you need to *uncheck* **Input Message same as Output Message**. See the following COBOL server examples:

- [Example 2: Redefines](#)
- [Example 3: Buffer Technique](#)
- [Example 4: COBOL SET ADDRESS Statements](#)

If the COBOL server program uses the same COBOL data structure on input as well as on output, you need to *check* **Input Message same as Output Message**. See the following COBOL server examples:

- [Example 2: Redefines](#)
- [Example 3: Buffer Technique](#)
- [Example 4: COBOL SET ADDRESS Statements](#)

- **CICS with Channel Container Calling Convention**

Optionally, specify a channel name. See [Extracting from a CICS Channel Container Program](#).

- **CICS with DFHCOMMAREA Large Buffer Calling Convention**

Specify **Input Message same as Output Message**. If the COBOL server program uses a different COBOL large output buffer data structure compared to its large input buffer data structure, you need to *uncheck* **Input Message same as Output Message**.

- **IMS MPP Message Interface (IMS Connect)**

Specify how you want the transaction name to be determined. See [Extracting from an IMS MPP Message Interface Program](#).

- **IMS BMP with Standard Linkage Calling Convention**

You can optionally set the IMS PSB List. See [Extracting from an IMS BMP Standard Call Interface](#).

- **Batch with Standard Linkage Convention**

No further information is required.

- **MicroFocus with Standard Linkage Convention**

No further information is required.

For an introduction to interface types, see [Supported COBOL Interface Types](#).

### Software AG IDL File

With the Software AG IDL file target options you specify the IDL file and IDL library names used:

- **File name** specifies the file name used by the operating system.
- **Modify existing file** is enabled only when the IDL file already exists. If enabled, check this option to continue the extraction.

- **Library name** defines the IDL library name used in the IDL file. The dialog box cannot be edited when you modify an existing IDL file. If there are multiple libraries, you can select one of these; if there is only one library, the box is disabled. When you extract the IDL the first time or you specify the name of an existing IDL file, the box can be edited (like a text widget). If you specified an existing IDL file, the currently existing library names are available in the box.

For the interface type "Micro Focus with standard linkage calling convention" and if the COBOL server is an operating system standard library (.so|.sl on UNIX or .dll on Windows) or a Micro Focus proprietary library (\*.lbr), the IDL library name used must match the operating system file name. For Micro Focus proprietary formats, intermediate code (\*.int) and generated code (\*.gnt), any IDL library name can be used. See *Locating and Calling the Target Server* in the Micro Focus RPC Server documentation.

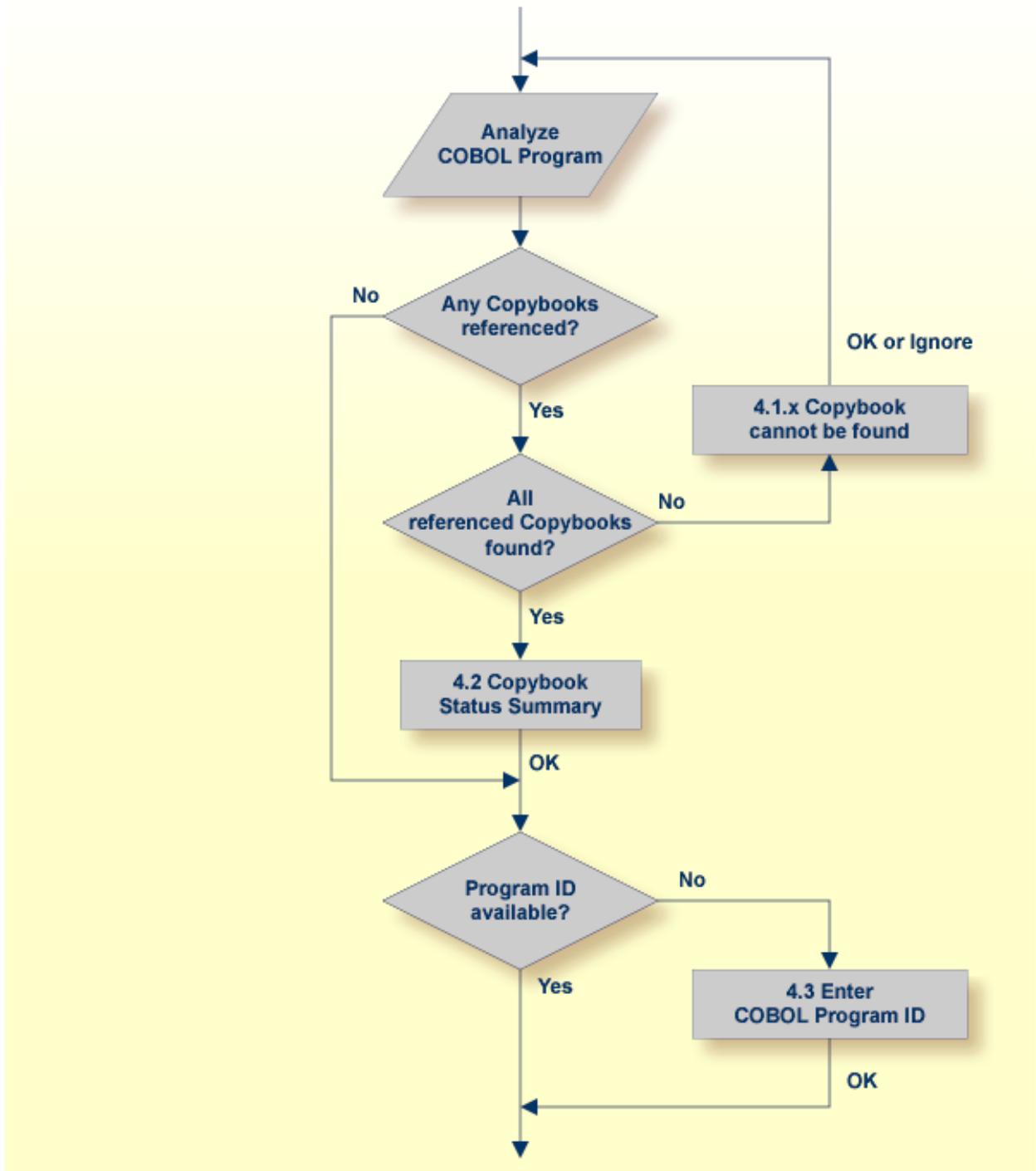
- **Container** specifies the eclipse container used for the IDL file

### COBOL to IDL Mapping

With these target options you specify how COBOL data items are mapped to IDL:

- If the target RPC clients support variable length strings without any restriction, we recommend you map alphanumeric fields to "Strings with variable length". This is true for most modern target environments such as Java, .NET, DCOM, C, Natural, SOAP, XML.
- If the target RPC clients do not support variable length strings or support them with restrictions, we recommend you map alphanumeric fields to "Strings with fixed length"
- Check the box **Map FILLER fields to IDL** if COBOL FILLER pseudo-parameters are to be part of the RPC client interface. By default they are not mapped to IDL.

Choose **Next** and start the extraction. The wizard now analyzes the COBOL program. During this process the following situations are possible:

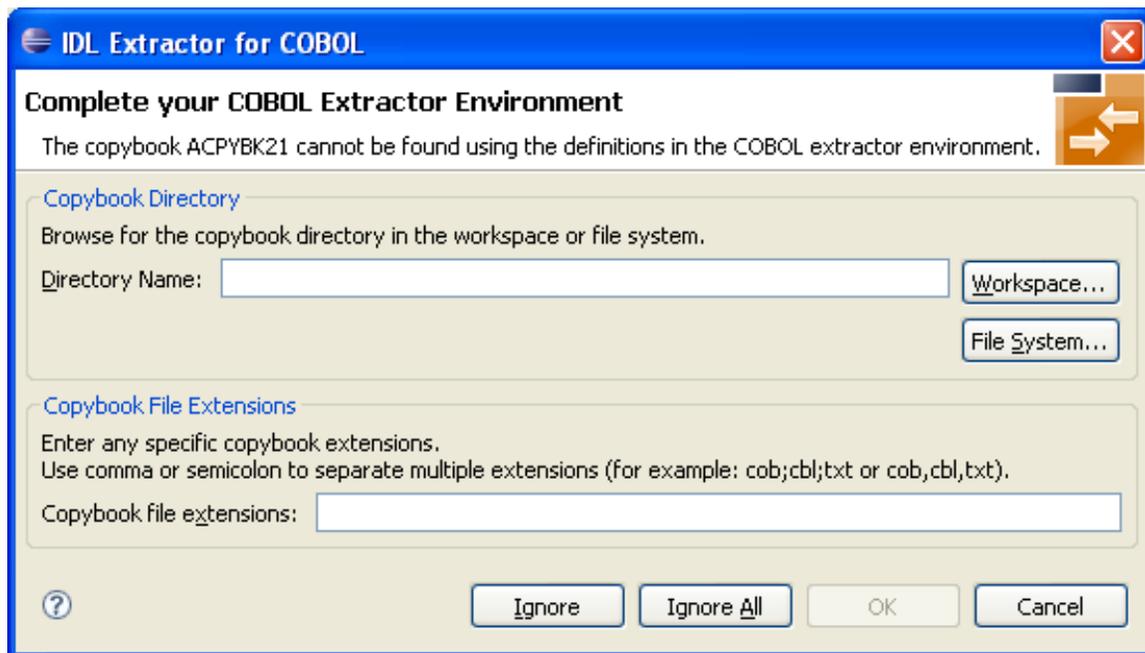


- Referenced copybooks cannot be found. In this case the wizard prompts you for every missing copybook. Continue with optional step *Step 4.1x: Copybook Cannot be Found - Local Extraction | Remote Extraction (z/OS) | Remote Extraction (BS2000/OSD)* in the IDL Extractor for COBOL documentation depending on your situation.

- If referenced copybooks are not available, you can choose **Ignore** or **Ignore All**, a copybook status summary page is displayed, see [Step 4.2: Copybook Status Summary \(Optional\)](#).
- No COBOL program ID can be located if you extract, for example, from a copybook that contains COBOL data items only. In this case, the wizard prompts you to enter the COBOL program ID. Continue with [Step 4.3: Enter COBOL Program ID \(Optional\)](#).
- There is no copybook reference in your COBOL source or all referenced copybooks are found. Also the COBOL program ID can be located. In this case continue with [Step 5: Select the COBOL Interface and Map to IDL Interface](#) under [Scenario I: Create New IDL and Server Mapping Files](#).

### Step 4.1a: Copybook Cannot be Found - Local Extraction

This dialog enables you to browse directories where missing copybooks might be found. If there are any specific copybook file extensions, you can define them here.



The copybook that cannot be found is given in the window, here its name is "ACPYBK21". In the extractor Preferences, the copybook directory that contains the copybook or the copybook file extension is not defined.

Continue with one of the following actions:

#### > To ignore this copybook only

- 1 Choose **Ignore** and go back to [Step 4: Define the Extraction Settings and Start Extraction](#).
- 2 Choose **Next** to start extraction again.

➤ **To ignore this and all further copybooks**

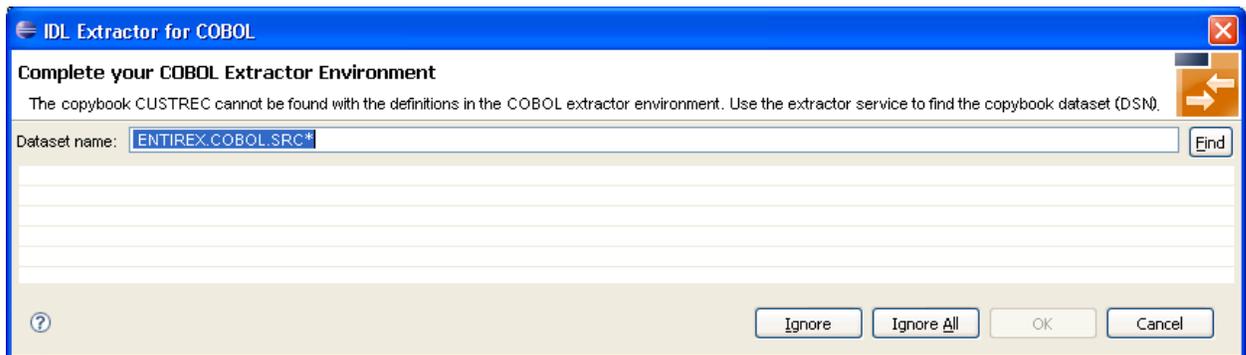
- 1 Choose **Ignore All** and go back to *Step 4: Define the Extraction Settings and Start Extraction*.
- 2 Choose **Next** to start extraction again.

➤ **To complete the extractor environment**

- 1 Choose **Workspace** or **File System** to browse for the copybook directory.
- 2 Check the copybook file extensions. Both will be saved in the COBOL extractor preferences and reused in further extractions.
- 3 Choose **OK** and go back to *Step 4: Define the Extraction Settings and Start Extraction*.
- 4 Choose **Next** to start extraction again.

### Step 4.1b: Copybook Cannot be Found - z/OS Remote Extraction

This dialog enables you to browse remote locations (partitioned or CA Librarian data sets) where missing copybooks might be found.



The copybook that cannot be found is given in the window; here its name is "CUSTREC". In the extractor preferences, the copybook data set that contains the copybook is not defined.

Continue with one of the following choices:

➤ **To ignore this copybook only**

- 1 Choose **Ignore** and go back to *Step 4: Define the Extraction Settings and Start Extraction*.
- 2 Choose **Next** to start extraction again.

➤ **To ignore this and all further copybooks**

- 1 Choose **Ignore All** and go back to *Step 4: Define the Extraction Settings and Start Extraction*.

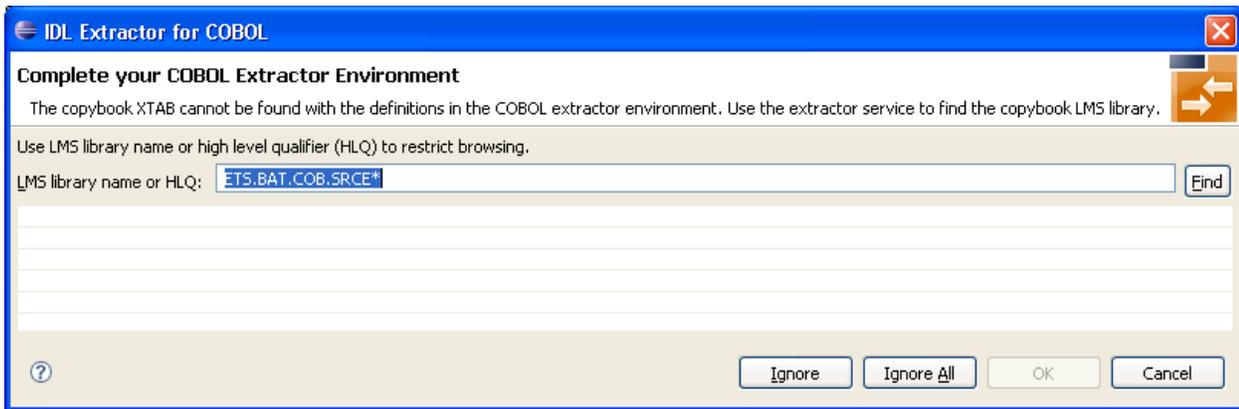
2 Choose **Next** to start extraction again.

➤ **To complete the extractor environment**

- 1 Choose **Find** to browse for the copybook data set. It will be saved in the COBOL extractor preferences and reused in further extractions.
- 2 Choose **OK** and go back to *Step 4: Define the Extraction Settings and Start Extraction*.
- 3 Choose **Next** to start extraction again.

### Step 4.1c: Copybook Cannot be Found - BS2000/OSD Remote Extraction

This dialog enables you to browse remote locations (LMS libraries) where missing copybooks might be found.



The copybook that cannot be found is given in the window; here its name is "XTAB". In the extractor preferences, the copybook LMS library that contains the copybook is not defined.

Continue with one of the following choices:

➤ **To ignore this copybook only**

- 1 Choose **Ignore** and go back to *Step 4: Define the Extraction Settings and Start Extraction*.
- 2 Choose **Next** to start extraction again.

➤ **To ignore this and all further copybooks**

- 1 Choose **Ignore All** and go back to *Step 4: Define the Extraction Settings and Start Extraction*.
- 2 Choose **Next** to start extraction again.

➤ **To complete the extractor environment**

- 1 Choose **Find** to browse for the copybook LMS library. It will be saved in the COBOL extractor preferences and reused in further extractions.
- 2 Choose **OK** and go back to *Step 4: Define the Extraction Settings and Start Extraction*.
- 3 Choose **Next** to start extraction again.

**Step 4.2: Copybook Status Summary (Optional)**

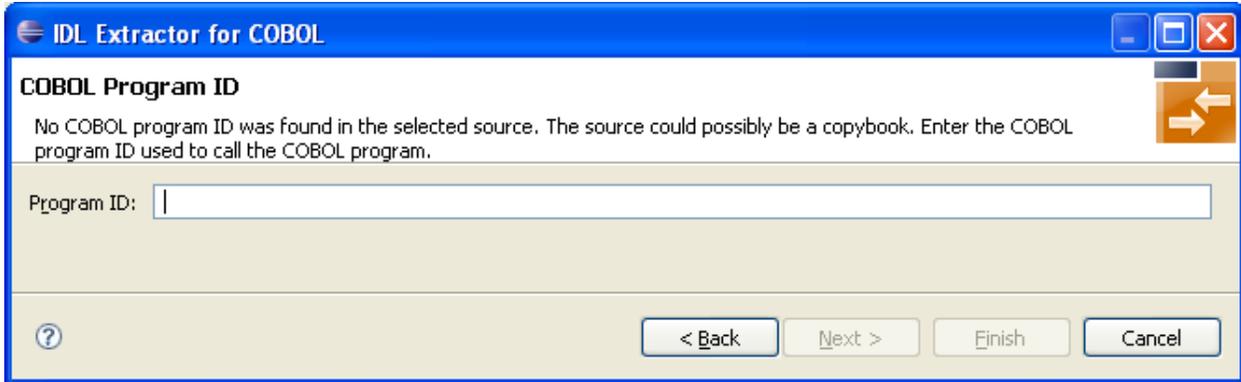
This summary page lists all COBOL copybooks which were not available during extraction.



- If any relevant COBOL data item describing the server interface is contained in one of the listed copybooks, you cannot continue. Terminate the extraction and try to get the missing copybooks.
- If no relevant COBOL data item describing the server interface is contained in the copybooks, you can continue. Choose **OK**.

**Step 4.3: Enter COBOL Program ID (Optional)**

This page is shown whenever the program ID of the COBOL source is missing. Entering a COBOL program name is compulsory.



No COBOL program ID can be located if you extract, for example, from a copybook that contains COBOL data items only. The COBOL program ID

- is the COBOL program name
- is often the name of the executable or load module
- can be found in the IDENTIFICATION DIVISION (abbreviated to "ID" ). Example

```
ID DIVISION.  
PROGRAM-ID.    CUSTINFO.  
AUTHOR.       BMF.  
DATE-WRITTEN. 26-11-1996
```

> **To complete the extraction**

- 1 Enter the COBOL program ID.
- 2 Choose **OK** to continue with [Step 5: Select the COBOL Interface and Map to IDL Interface](#).

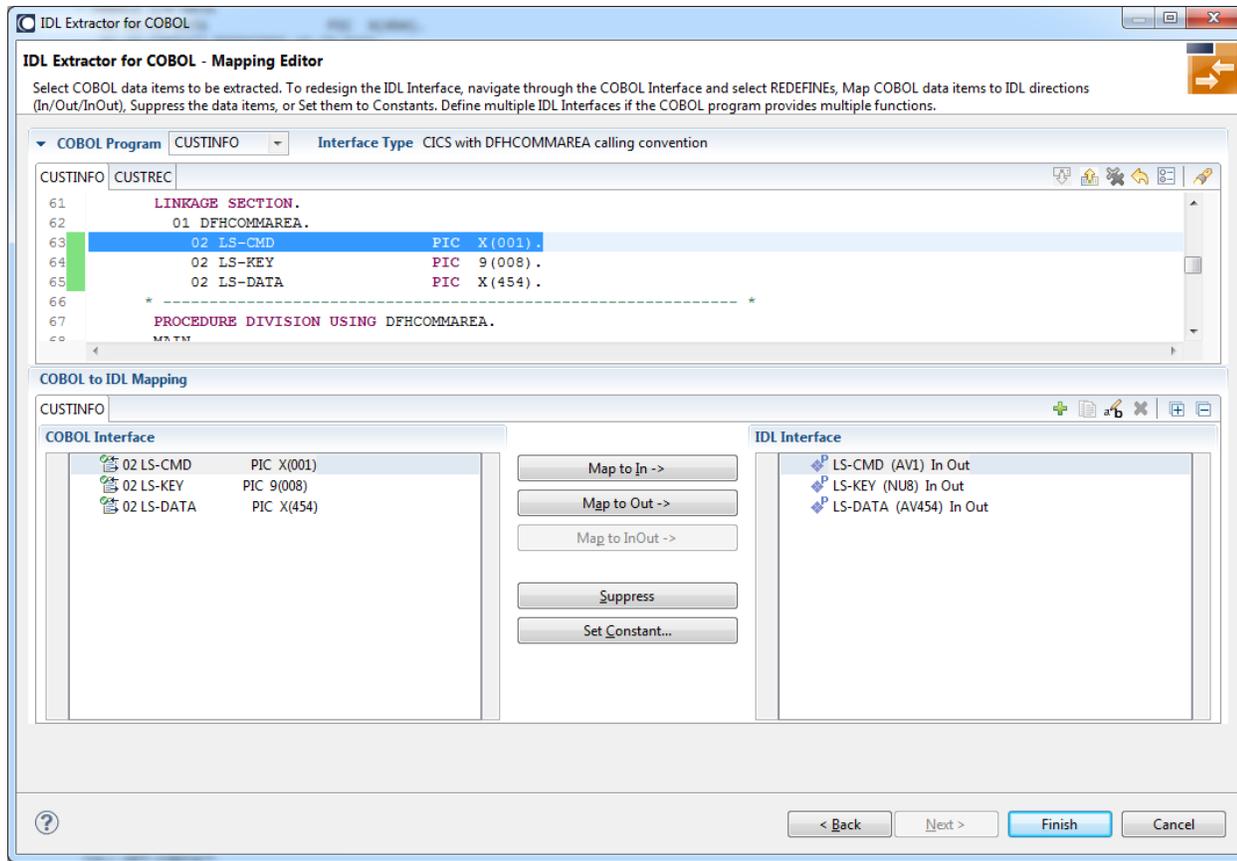
## Step 5: Select the COBOL Interface and Map to IDL Interface

---

A COBOL source program mostly does not contain all the information needed for IDL mapping. With the Mapping Editor you enter this missing information. In general, mapping the COBOL data items to IDL with the Mapping Editor is a two-step process:

1. First, select the COBOL data items of the COBOL interface.
2. Then map the COBOL interface to the IDL interface. Define
  - which COBOL data items are mapped to IDL (**Select REDEFINE paths, Suppress Unneeded COBOL Data Items**)
  - the direction of the COBOL data items (**Map to [In, Out, InOut]**)
  - field values for COBOL data items that are not sent by clients to the COBOL server (**Set COBOL Data Items to Constant**)
  - multiple IDL interfaces (**Map to Multiple IDL Interfaces**)
  - etc.

See the guidelines on [IDL Extraction per Interface Type](#) for the [COBOL Mapping Editor](#) or by COBOL syntax in [User-decided Mapping](#) under [COBOL to IDL Mapping](#) for further information on this important extraction step.



The outcome of the Mapping Editor is the IDL file and a server mapping file (optional). See *When is a Server Mapping File Required?* in the EntireX Workbench documentation. Both files are written with the file name entered for the IDL file in [Step 4: Define the Extraction Settings and Start Extraction](#).

## Step 6: Finish the Mapping Editor

When you choose **Save** in the Mapping Editor, the IDL file is generated. If required, a server mapping file is generated, too. The server mapping file is either of type client-side (extension .cvm) or server-side (extension .svm). See *How to Set the Type of Server Mapping Files*.

- If you are using *client-side* mapping files, continue with [Step 7: Validate the Extraction and Test the IDL File](#).
- If you are using *server-side* mapping files, the dialog below is displayed whenever the COBOL Mapping Editor is saved. There are two options to choose from:

- **Save IDL and server mapping files**

will save the generated files into the workspace and quit the COBOL Mapping Editor

The generated server-side mapping file need to be synchronized with the server-side mapping container of the target RPC server, except for IMS Connect and CICS ECI connections with the EntireX Adapter, where they are wrapped into the Integration Server connection - the same as client-side mapping files, see *Integration Server Wrapper*.

- Check the option **Synchronize with server-side mapping container now** for the following RPC servers:

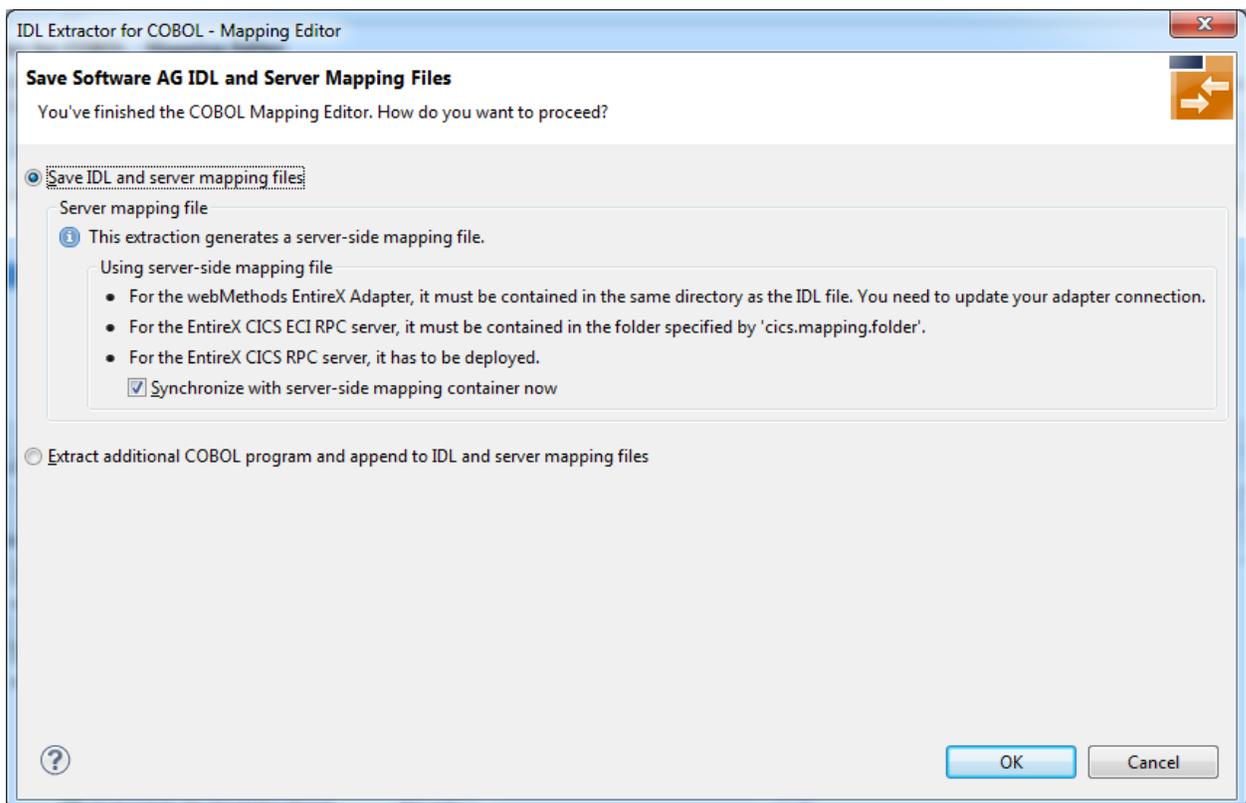
- z/OS (CICS, Batch, IMS) | Micro Focus | BS2000/OSD | z/VSE (CICS, Batch)

- Uncheck the option **Synchronize with server-side mapping container now** for

- EntireX Adapter and IMS Connect and CICS ECI connections
  - the following RPC servers: CICS ECI | IMS Connect
  - later synchronization of other RPC servers

- **Extract additional COBOL program and append to the IDL and server mapping files**

will save the generated files into the workspace, quit the Mapping Editor and start the IDL Extractor for COBOL again. The additionally extracted COBOL source will then be added to the previously generated IDL and server mapping files.



➤ **To save the generated files into the workspace, quit the Mapping Editor and deploy the server-side mapping file**

- 1 Select **Save IDL and server mapping files**.
- 2 Check the option **Synchronize with server-side mapping container now** and choose **OK**. This calls the Deployment Wizard. See *Server Mapping Deployment Wizard* in the EntireX Workbench documentation.
  - If you are using the Server Mapping Deployment Wizard for first time with no predefined deployment environment preferences, continue with *Step 2a: Create a New Deployment Environment* in the Server Mapping Deployment Wizard documentation.
  - If deployment environments are already defined, you may also continue with *Step 3: Select and Existing Deployment Environment and Deploy*.
- 3 Continue with *Step 7: Validate the Extraction and Test the IDL File*.

➤ **To save the generated files into the workspace and quit the Mapping Editor without deploying the server-side mapping file**

- 1 Select **Save IDL and server mapping files**.
- 2 Clear the option **Synchronize with server-side mapping container now** and choose **OK**.
  - Synchronize the server-side mapping container of the target RPC server later. See *Deploying Server-side Mapping Files to the RPC Server* in the respective sections of the documentation.
  - For the webMethods EntireX Adapter and IMS Connect or CICS ECI connections, update your Adapter connection. See *Step 3: Select the Connection Type* in the Integration Server Wrapper documentation.
- 3 Continue with *Step 7: Validate the Extraction and Test the IDL File*.

➤ **To save the generated files into the workspace, quit the Mapping Editor and start the IDL Extractor for COBOL again**

- Select **Extract additional COBOL program and append to the IDL and server mapping files** and choose **OK**. Continue with *Step 2: Select a COBOL Extractor Environment or Create a New One*.



**Caution:** Do not edit the IDL file manually or with the IDL Editor, except for changing parameter names. Otherwise, consistency between the IDL file and the server mapping file will be lost, resulting in unexpected behavior. For this purpose use the COBOL Mapping Editor instead and choose *Scenario III: Modify Existing IDL and Server Mapping Files*.

-  **Caution:** A server mapping file extracted this way must not be re-created by the COBOL Wrapper. Server mapping specifications of such a file would not be powerful enough to adequately describe your COBOL server program extracted here.

## Step 7: Validate the Extraction and Test the IDL File

---

The IDL file is used to build RPC clients using an EntireX Workbench wrapper of your choice. See *EntireX Wrappers* in the EntireX Workbench documentation.

If you are using client-side mapping files:

- You need to rebuild all RPC clients communicating with this RPC server program and re-generate the client interface objects.
- For connections with the webMethods EntireX Adapter you need to update your Adapter connection, see *Step 3: Select the Connection Type* in the Integration Server Wrapper documentation.

If you are using the CICS RPC Server, before calling your extracted RPC server, check if you need to alter

- CICS settings, for example `TWASIZE`. See *CICS Settings* in the z/OS or z/VSE RPC Server documentation.
- For z/OS additionally *IBM LE Runtime Options* - for example `AMODE24`, how to trap ABENDs etc.

For a quick validation of your extraction, you can

- use the IDL Tester to validate the extraction, see *EntireX IDL Tester* in the EntireX Workbench documentation.
- generate an XML mapping file (XMM) and use the XML Tester for verification. See *EntireX XML Tester* in the XML/SOAP Wrapper documentation.



# 4 Scenario II: Append to Existing IDL and Server Mapping

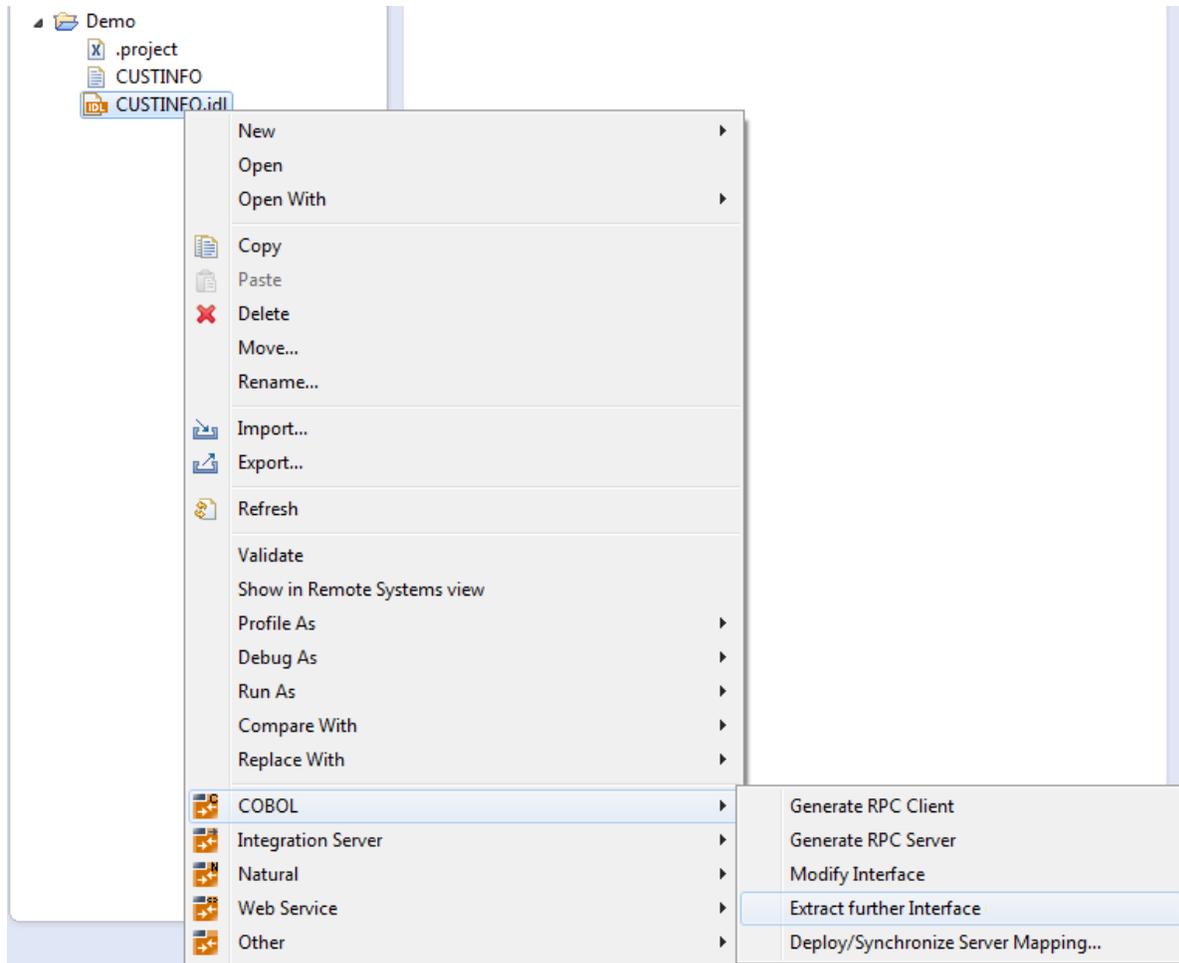
## Files

---

The IDL Extractor for COBOL can be started from an existing pair of IDL and server mapping files. A server mapping file is an EntireX Workbench file with extension `.svm` or `.cvm`. See *Server Mapping Files for COBOL*.

➤ **To start the IDL Extractor for COBOL**

- Open the context menu of an IDL file and choose **COBOL > Extract further Interface**.



Continue with [Step 2: Select a COBOL Extractor Environment or Create a New One](#) as described under [Scenario I: Create New IDL and Server Mapping Files](#).

# 5

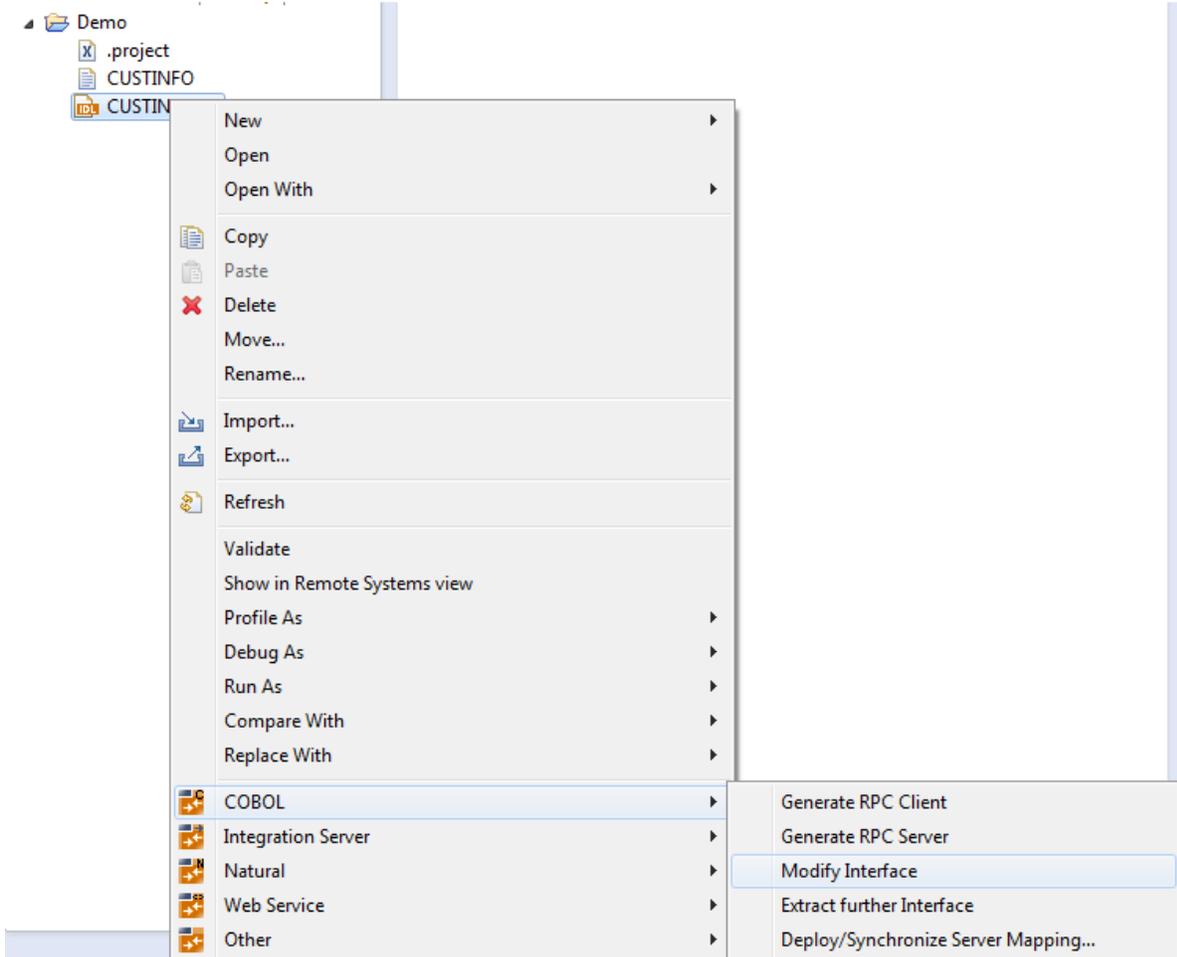
## Scenario III: Modify Existing IDL and Server Mapping Files

---

The IDL Extractor for COBOL can be started from an existing pair of IDL and server mapping files. A server mapping file is an EntireX Workbench file with extension `.svm` or `.cvm`. See *Server Mapping Files for COBOL*.

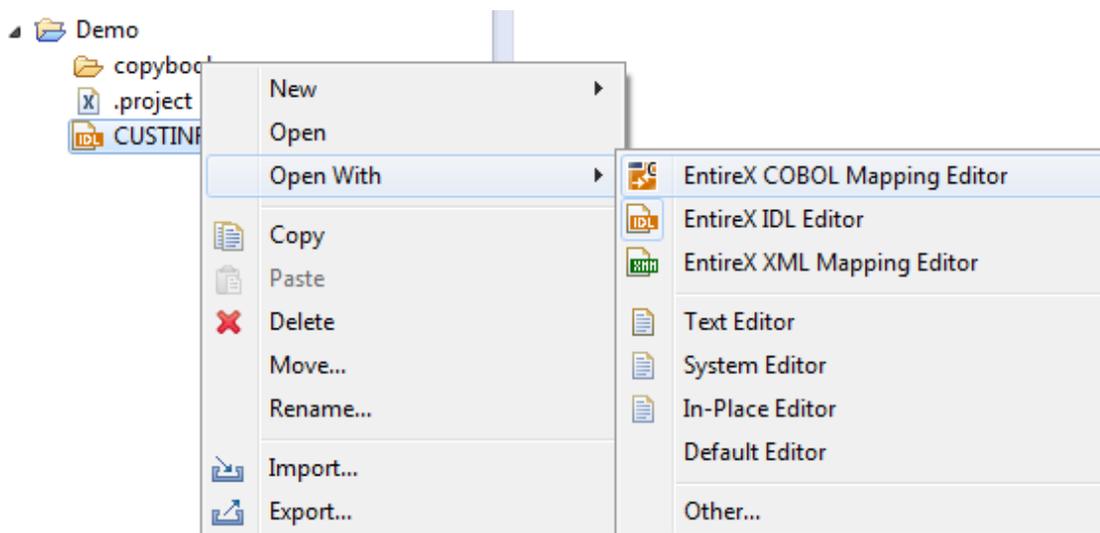
➤ **To start the COBOL Mapping Editor**

- Open the context menu of an IDL file and choose **COBOL > Modify Interface**.



Or:

Choose **Open With > EntireX COBOL Mapping Editor**.



Continue with *Step 5: Select the COBOL Interface and Map to IDL Interface* as described under *Scenario I: Create New IDL and Server Mapping Files*.



# III

## COBOL Mapping Editor

---

See also *User-decided Mapping* under *COBOL to IDL Mapping* for guidelines on IDL extraction by COBOL syntax.

### Introduction

---

A COBOL source program mostly does not contain all the information needed for IDL mapping. With the Mapping Editor you enter this missing information. In general, mapping the COBOL data items to IDL with the Mapping Editor is a two-step process:

1. First, select the COBOL data items of the COBOL interface.
2. Then map the COBOL interface to the IDL interface. Define
  - which COBOL data items are mapped to IDL (**Select REDEFINE paths, Suppress Unneeded COBOL Data Items**)
  - the direction of the COBOL data items (**Map to [In, Out, InOut]**)
  - field values for COBOL data items that are not sent by clients to the COBOL server (**Set COBOL Data Items to Constant**)
  - multiple IDL interfaces (**Map to Multiple IDL Interfaces**)
  - etc.

## IDL Extraction per Interface Type

The following table provides guidelines on IDL extraction per interface type. See [Supported COBOL Interface Types](#). For the CICS interface types DFHCOMMAREA and DFHCOMMAREA Large Buffer, the guidelines distinguish further between COBOL server programs overlaying the input data structure with a different output data structure and COBOL server programs using same structures on input and output. You already selected this in the checkbox **Input Message same as Output Message** in [Step 4: Define the Extraction Settings and Start Extraction](#):

COBOL Source

File Name:

Operating System:

Interface Type:

**Input Message same as Output Message**

Environment	Interface Type	CICS Message on Input and Output
CICS	DFHCOMMAREA <sup>(3)</sup>	same <sup>(1,4)</sup>
		different <sup>(2,5)</sup>
	Large Buffer	same <sup>(1)</sup>
		different <sup>(2)</sup>
	Channel Container	
Batch	Standard Linkage	
IMS	BMP with Standard Linkage	
	MPP Message Interface (IMS Connect)	
Micro Focus	Standard Linkage	

 **Notes:**

1. Checkbox **Input Message same as Output Message** in [Step 4: Define the Extraction Settings and Start Extraction](#) is checked. The COBOL data structure of the CICS input message is the same as the structure of the CICS output message.
2. Checkbox **Input Message same as Output Message** in [Step 4: Define the Extraction Settings and Start Extraction](#) is cleared. The COBOL data structure of the CICS input message is different to the structure of the CICS output message (that is, the output overlays the input).
3. Your DFHCOMMAREA COBOL server must be DPL-enabled to be directly supported by EntireX. The distributed program (DPL) link function enables a CICS client program to call another CICS program (the server program) in a remote CICS region. Technically, a COBOL server is DPL-enabled if

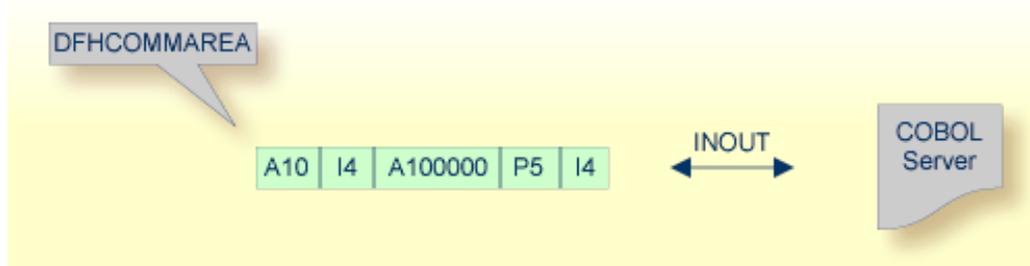
- 
- CICS is able to call the COBOL server remotely
  - the DFHCOMMAREA layout does *not* contain pointers
- If your program is not DPL-enabled, see [What to do with other Interface Types?](#) in [Introduction to the IDL Extractor for COBOL](#)
4. See the following COBOL server examples for CICS input message *the same as* CICS output message:
    - [Example 2: Redefines](#)
    - [Example 3: Buffer Technique](#)
    - [Example 4: COBOL SET ADDRESS Statements](#)
  5. See the following COBOL server examples for CICS input message *different to* CICS output message:
    - [Example 2: Redefines](#)
    - [Example 3: Buffer Technique](#)
    - [Example 4: COBOL SET ADDRESS Statements](#)



# 6 CICS with DFHCOMMAREA Calling Convention - In same as Out

---

- Introduction ..... 62
- Extracting from a CICS DFHCOMMAREA Program ..... 62
- Mapping Editor User Interface ..... 64
- Mapping Editor IDL Interface Mapping Functions ..... 71
- Programming Techniques ..... 88



## Introduction

Depending on the programming style used in the CICS program and the various different techniques for accessing the CICS DFHCOMMAREA interface, finding the relevant COBOL data structures can be a complex and time-consuming task that may require CICS COBOL programming knowledge. Please note also the following:

- A CICS program does not require a PROCEDURE DIVISION header, where parameters are normally defined. See [PROCEDURE DIVISION Mapping](#).
- The DFHCOMMAREA can be omitted in the linkage section.
- If there is no DFHCOMMAREA in the linkage section or no PROCEDURE DIVISION header present in the PROCEDURE DIVISION, the CICS preprocessor completes the interface of the COBOL server and adds a DFHCOMMAREA and a PROCEDURE DIVISION header to the CICS program before compilation.

If you have selected an IDL file and opened the COBOL Mapping Editor with an existing COBOL to IDL mapping, continue with [Mapping Editor User Interface](#).

## Extracting from a CICS DFHCOMMAREA Program

This section assumes **Input Message same as Output Message** is checked. COBOL output and COBOL input parameters are the same, that is, the DFHCOMMAREA on output is not overlaid with a data structure different to the data structure on input.

If you are extracting IDL from a COBOL source or extending the IDL file by extracting an additional COBOL source with interface type CICS with DFHCOMMAREA calling convention, the **Extractor Settings** dialog appears (see also [Step 4: Define the Extraction Settings and Start Extraction](#)).

Make sure the interface type is correct and checkbox **Input Message same as Output Message** is not cleared.

COBOL Source	
File Name:	custinfo.cbl
Operating System:	z/OS
Interface Type:	CICS with DFHCOMMAREA calling convention ▼
	<input checked="" type="checkbox"/> Input Message same as Output Message

Press **Next** to open the COBOL Mapping Editor.

➤ **To select the COBOL interface data items of your COBOL server**

- 1 Add the COBOL data items of the CICS message to **COBOL Interface** by using the context menu or toolbar available in the *COBOL Source View* and *COBOL Interface*. See **Notes**.
- 2 Continue with *COBOL to IDL Mapping*.



**Notes:**

1. If a DFHCOMMAREA is present, the DFHCOMMAREA COBOL data item itself cannot be selected. In this case, select the COBOL data items directly subordinated to DFHCOMMAREA and map to IDL. See *Map to In, Out, InOut*.
2. It is very important to select the right COBOL data items describing the interface of the COBOL server correctly. This means the COBOL data items used as parameters must match in number and in sequence of formats (COBOL usage clause).
3. See the examples provided under *Programming Techniques*.
4. If your COBOL server contain REDEFINES, the first REDEFINE path is offered by default. Check manually whether this is the one you want. If not, correct it. You can select any other REDEFINE path.

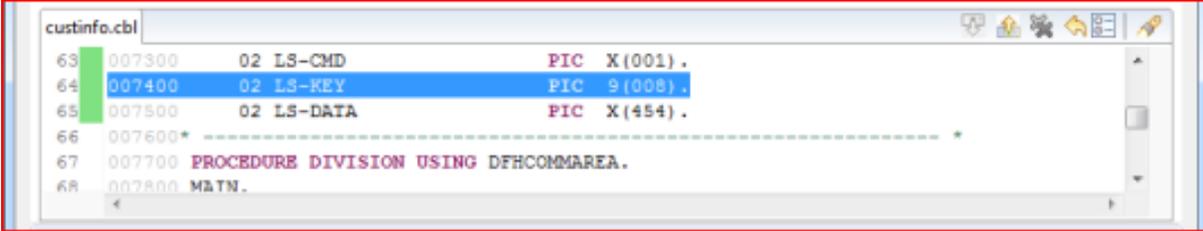
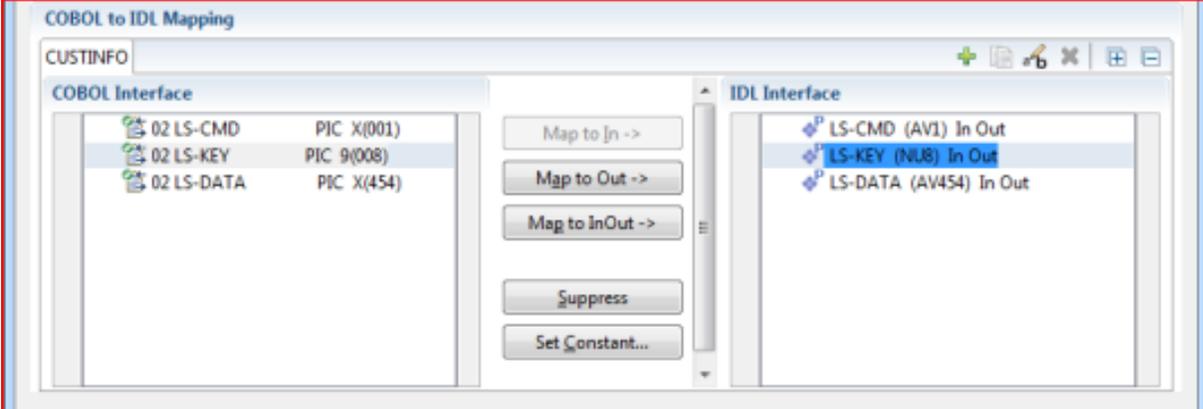
The user interface of the COBOL Mapping Editor is described below.

## Mapping Editor User Interface

This section assumes you have set the extraction settings as described above. The following areas of the COBOL Mapping Editor user interface are described here:

- [COBOL Program Selection](#)
- [COBOL Source View](#)
- [COBOL to IDL Mapping](#)

For COBOL interface type CICS with DFHCOMMAREA interface, the user interface of the COBOL Mapping Editor looks like this:

1. 
2. 
3. 

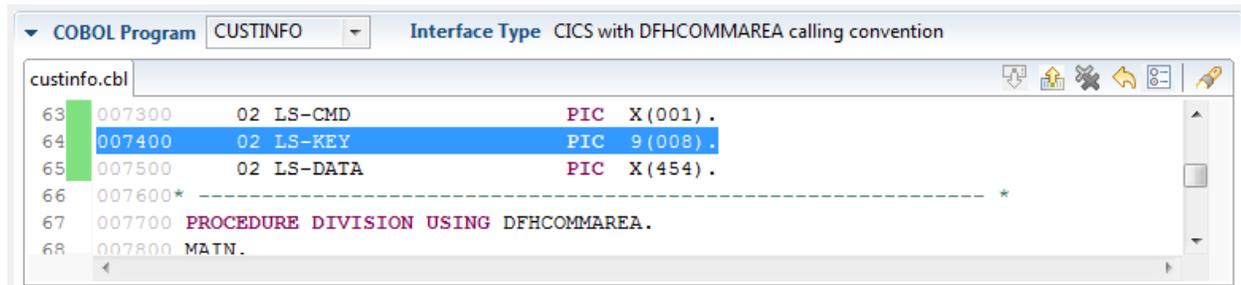
1. **COBOL Program Selection.** Currently selected program with interface type
2. **COBOL Source View.** Contains all related sources for the currently selected COBOL program
3. **COBOL to IDL Mapping.** Tree view of your selected COBOL data items and mapping buttons with which you can map these items to your IDL interface

## COBOL Program Selection

▼ COBOL Program CUSTINFO ▼ Interface Type CICS with DFHCOMMAREA calling convention

The COBOL Program Selection displays the current selected COBOL program with its interface type. If you have extracted more than one COBOL program within the associated IDL file, you can switch to another COBOL program with its mapping by selecting the name in the combo box.

## COBOL Source View



All COBOL data items contained in the LINKAGE and WORKING-STORAGE SECTION are offered in a text view. The text view contains all related sources (including copybooks) for the currently selected COBOL program. It is used for selecting data items and retrieving information from the original COBOL sources. The light green bar indicates that the data item is already contained in the COBOL Interface; a dark green bar indicates the data item is selectable and can be added to the COBOL Interface. This section can be collapsed. If you open the Editor with **Modify Interface** it is collapsed by default. The toolbar provides the following actions:

-  Add selected COBOL data item to COBOL Interface.
-  Remove selected COBOL data item from COBOL Interface.
-  Remove all COBOL data items from COBOL Interface.
-  Reset COBOL Interface to initial state.
-  Show dialog to modify COBOL Source Characteristics.
-  Show dialog to find text in Source.

The same functionality is also available from the context menu.

## COBOL to IDL Mapping

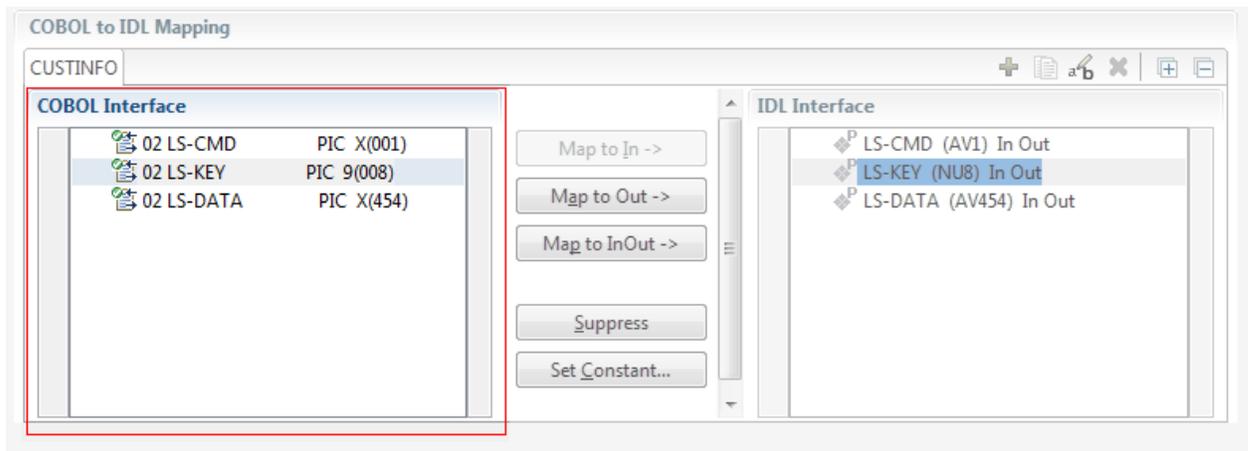
This section covers the following topics:

- [COBOL Interface](#)
- [Mapping Buttons](#)
- [IDL Interface](#)

### COBOL Interface

The **COBOL Interface** shows a tree view of your selected COBOL data items describing the interface of the COBOL server. A context menu is available for the COBOL data items, which provides mapping and other functions. On some COBOL data items, decision icons indicate where particular attention is needed, including mapping icons to visualize the COBOL data type and your current mapping.

The COBOL data item names are derived from the COBOL source from which they were extracted. If your COBOL interface contains parameters without a name, that is, the keyword `FILLER` is used, those COBOL data items are shown as `[FILLER]`. See [FILLER Pseudo-Parameter](#).



You can modify the COBOL interface using context menu or toolbar; decision and mapping icons provide additional information.

### Context Menu

The context menu on COBOL data items provides the following mapping and other functions, depending on the data item type, the COBOL level and the current mapping.

<b>Map to In   Out   InOut</b>	A suppressed COBOL data item becomes visible in the IDL interface. Used also to select another <code>REDEFINE</code> path.
<b>Suppress</b>	Suppress unneeded COBOL data items.
<b>Set Constant</b>	Set COBOL data items to constant.

- Set Multiple Possible Output (MPO) Structures** Set COBOL data items where the server program decides the output structure used on return. Specify the set of multiple possible output (MPO) structures and the criteria when a structure is used.
- Remove from COBOL Interface** Remove the data item from the COBOL interface. This also removes the mapped IDL parameter from all IDL interfaces for the current COBOL program. See [COBOL Program Selection](#).

See also [Mapping Editor IDL Interface Mapping Functions](#).

## Toolbar

The toolbar offers the following actions:

-  Create IDL Interface. Creates a new IDL interface based on the current COBOL interface: all IDL parameters are of IDL direction InOut; no IDL parameters are set to constant; for COBOL REDEFINE, the first REDEFINE path is mapped to IDL; FILLERS are suppressed according to your selection, see [Step 4: Define the Extraction Settings and Start Extraction](#).
-  Copy current IDL Interface. Creates a duplicate of the current IDL interface: all modifications such as IDL directions, suppress, selection of REDEFINE paths etc. are kept.
-  Remove current IDL Interface.
-  Rename current IDL Interface.
-  Expand the full tree.
-  Collapse the full tree.

See also [Map to Multiple IDL Interfaces](#).

## Decision Icons

The decision icons in the first column are set on COBOL data items where particular attention is needed:

-  This icon visualizes a COBOL REDEFINE. It is essential that you map the correct redefine path for your mapping to In, Out or InOut using the context menu. If you map a REDEFINE path, all other sibling REDEFINE paths are automatically set to "Suppress".

## Mapping Icons

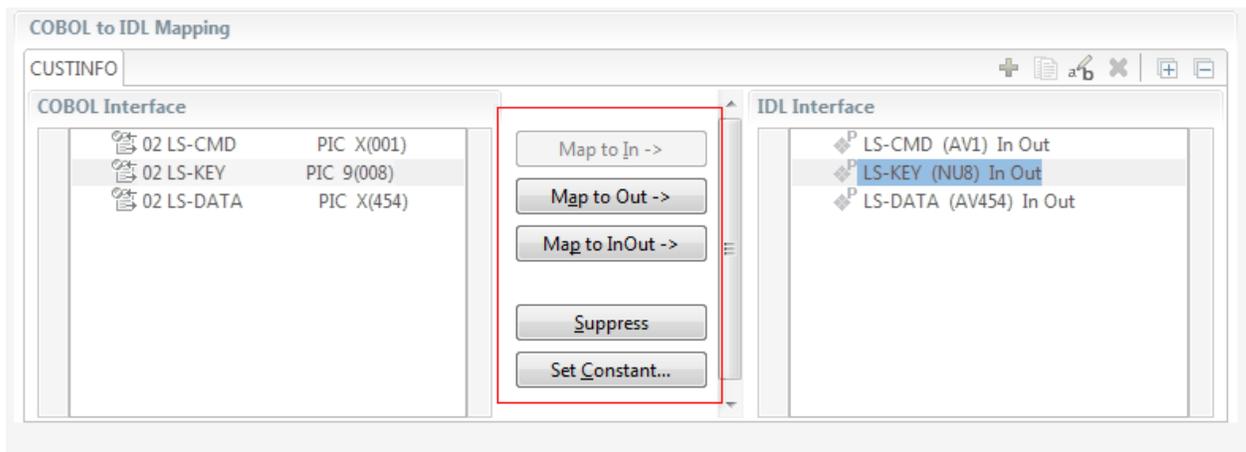
The following mapping icons on the COBOL data items indicate your current IDL mapping:

-  Scalar parameter, mapped to In.
-  Scalar parameter, mapped to InOut.
-  Scalar parameter, mapped to Out.

-  Group parameter, here mapped to InOut.
-  REDEFINE parameter, here mapped to InOut.
-  Parameter set to Constant.

## Mapping Buttons

The following buttons are available:



### Map to In | Out | InOut ->

See *Map to In, Out, InOut*. A suppressed COBOL data item becomes visible in the IDL interface. Used also to select another REDEFINE path.

### Suppress

See *Suppress Unneeded COBOL Data Items*.

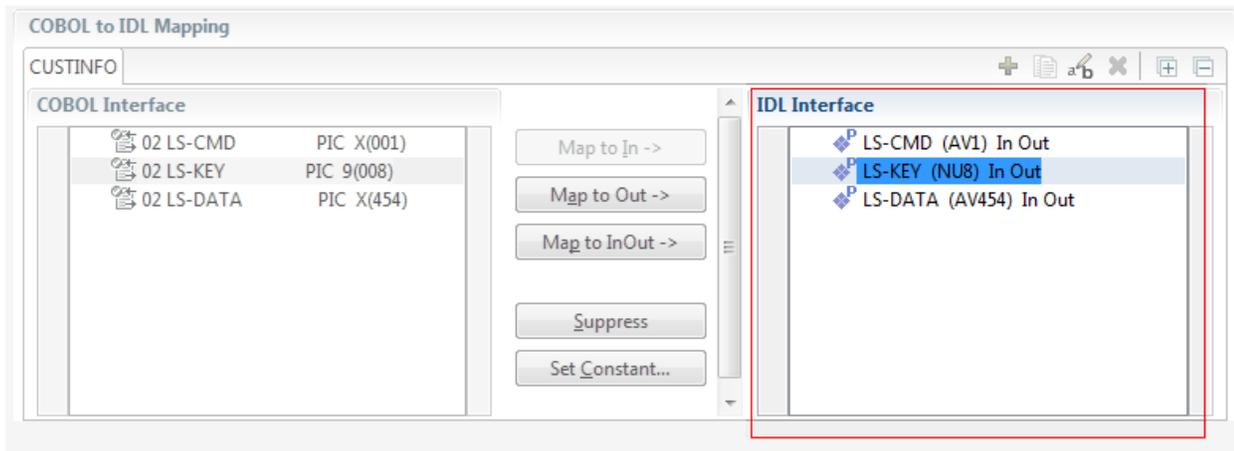
### Set Constant...

See *Set COBOL Data Items to Constants*.

## IDL Interface

If you have mapped the COBOL interface to multiple IDL interfaces, select the IDL interface by choosing the tabs. In the **IDL Interface** tree view, a context menu is also available with the following possibilities:

- Rename
- Remove from COBOL Interface. This also removes the mapped IDL parameter from all IDL interfaces for the current COBOL program. See *COBOL Program Selection* above.



## Mapping Editor IDL Interface Mapping Functions

This section covers the following topics:

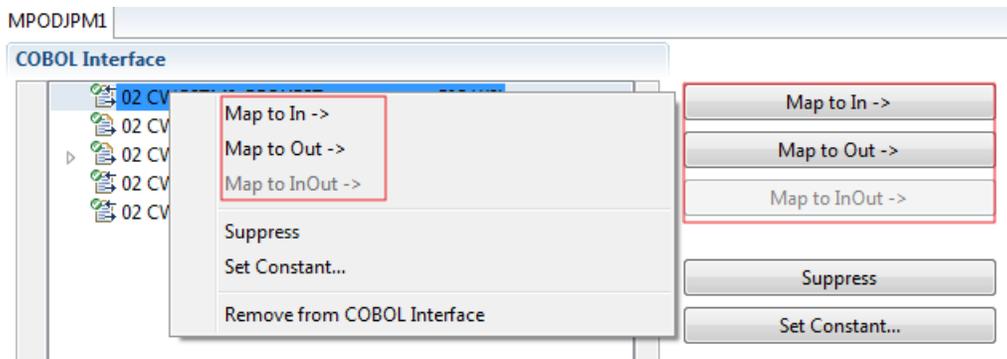
- Map to In, Out, InOut
- Map OCCURS DEPENDING ON
- Map to Multiple IDL Interfaces
- Select REDEFINE Paths
- Suppress Unneeded COBOL Data Items
- Set COBOL Data Items to Constants
- Set Multiple Possible Output (MPO) Structures

### Map to In, Out, InOut

With the **Map to In**, **Out**, **InOut** functions you make a COBOL data item visible as an IDL parameter in the IDL interface. With correct IDL directions you design the IDL interface by defining input and output parameters. COBOL programs have no parameter directions, so you need to set IDL directions manually.

#### › To provide IDL directions

- Go *step-by-step* through all *top-level* COBOL data items in the COBOL interface and use the **Map to In**, **Out** and **InOut** functions available in the context menu of the COBOL interface and as mapping buttons to make the COBOL data items visible and provide IDL directions in the IDL interface:



#### Notes:

1. If a *top-level* COBOL *group* is mapped, the IDL direction is inherited by all subordinate COBOL data items and thus to the related IDL parameters in the IDL interface.

2. Subordinate COBOL data items can only be mapped to the same IDL direction as their *top-level* COBOL *group* data item.
3. With the inverse function **Suppress Unneeded COBOL Data Items** (see below) available in the context menu of the COBOL interface and as mapping button, a COBOL data item can be removed from the IDL interface.
4. IDL directions are described in the direction-attribute in `attribute-list` under *Software AG IDL Grammar* in the IDL Editor documentation.

If you are using an RPC server such as the z/OS (CICS | Batch), z/VSE (CICS | Batch), Micro Focus or BS2000/OSD RPC server, the amount of data to be transferred to/from the RPC client is reduced with correct IDL directions.

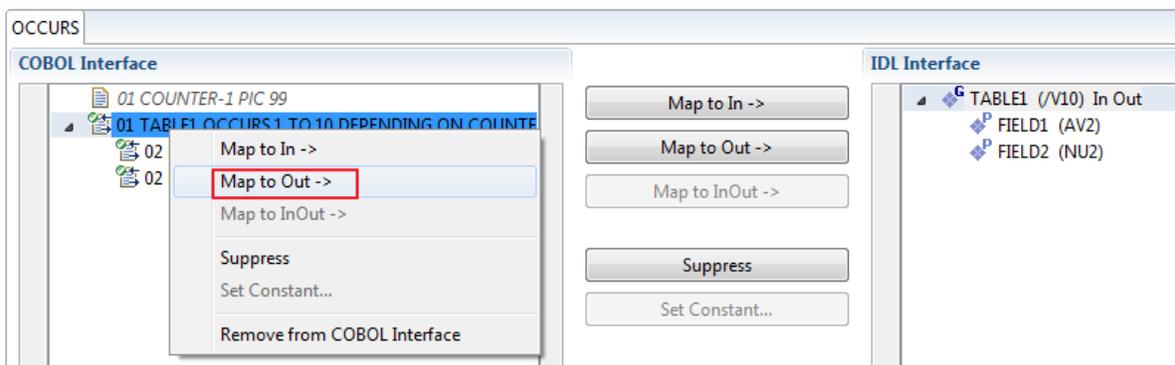
## Map OCCURS DEPENDING ON

With the **Map to In**, **Out**, **InOut** functions you can make the COBOL ODO subject (here COBOL data item TABLE) of a variable-sized COBOL table (see [COBOL Tables with Variable Size - DEPENDING ON Clause](#)) visible as an IDL unbounded group (with maximum). The ODO object (here COBOL data item COUNTER-1) is suppressed and therefore not part of the IDL interface. This is because the number of elements of the IDL unbounded group is already implicitly available. See the following example:

```
01 COUNTER-1 PIC 99.
01 TABLE OCCURS 1 TO 10 DEPENDING ON COUNTER-1
  02 FIELD1 PIC XX.
  02 FIELD2 PIC 99.
```

### > To map OCCURS DEPENDING ON

- 1 Add the COBOL ODO subject (here data item TABLE) and ODO object (here data item COUNTER-1) to the COBOL interface. It is important both data items are in the COBOL interface.
- 2 Use the **Map to In**, **Out** and **InOut** functions available in the context menu of the COBOL interface and as mapping buttons and apply IDL directions for the ODO subject (data item TABLE):

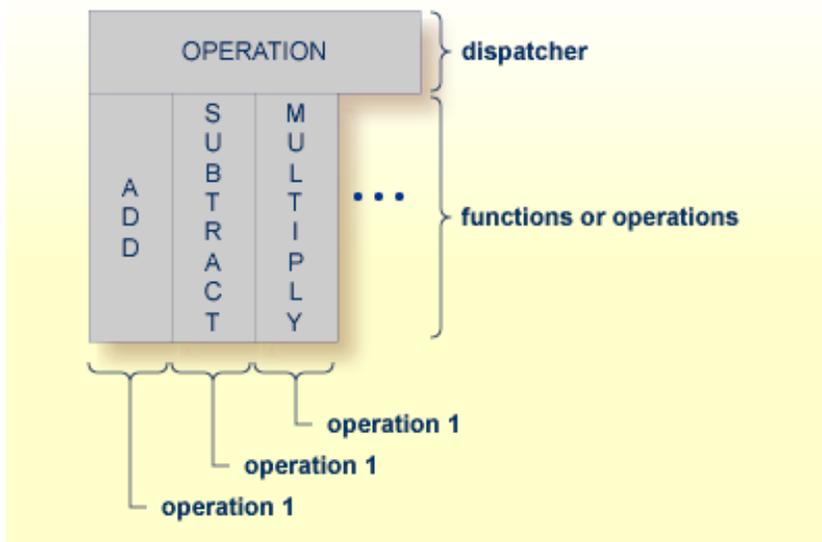


 **Notes:**

1. The ODO subject can be mapped to the IDL interface.
2. The ODO object is always suppressed, but is required to be part of the COBOL interface.
3. IDL directions are described in the direction-attribute in `attribute-list` under *Software AG IDL Grammar* in the IDL Editor documentation.

### Map to Multiple IDL Interfaces

Assume the COBOL server program provides multiple functions or operations, in the following example ADD, SUBTRACT, MULTIPLY. Some dispatcher front-end code executes the correct function, for example, depending on a *function-code* or *operation-code* parameter:



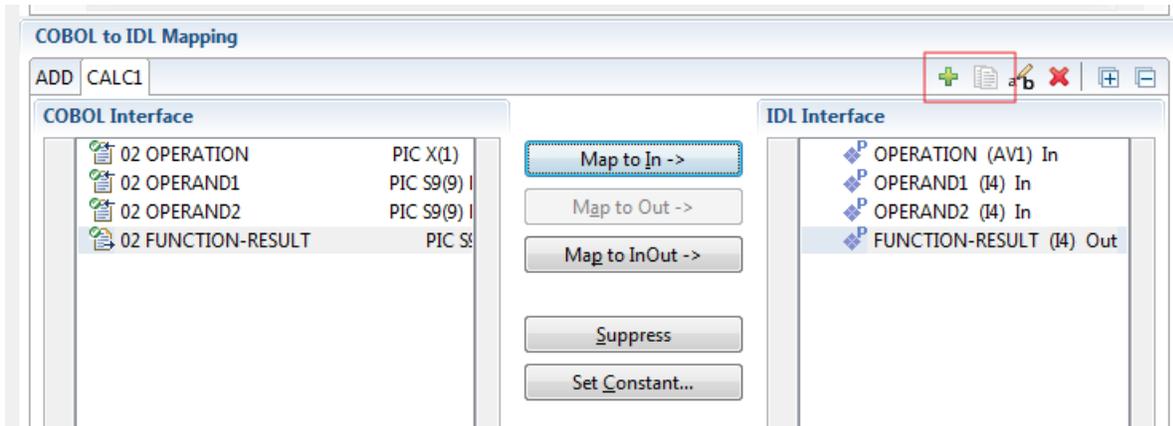
This example is described in more detail under [Example 1: COBOL Server with Multiple Functions](#).

If you have such a situation, a good approach is to expose each COBOL server program function separately as an IDL program. This gives advantages in further processing of the IDL and COBOL mapping files (SVM and CVM). For example:

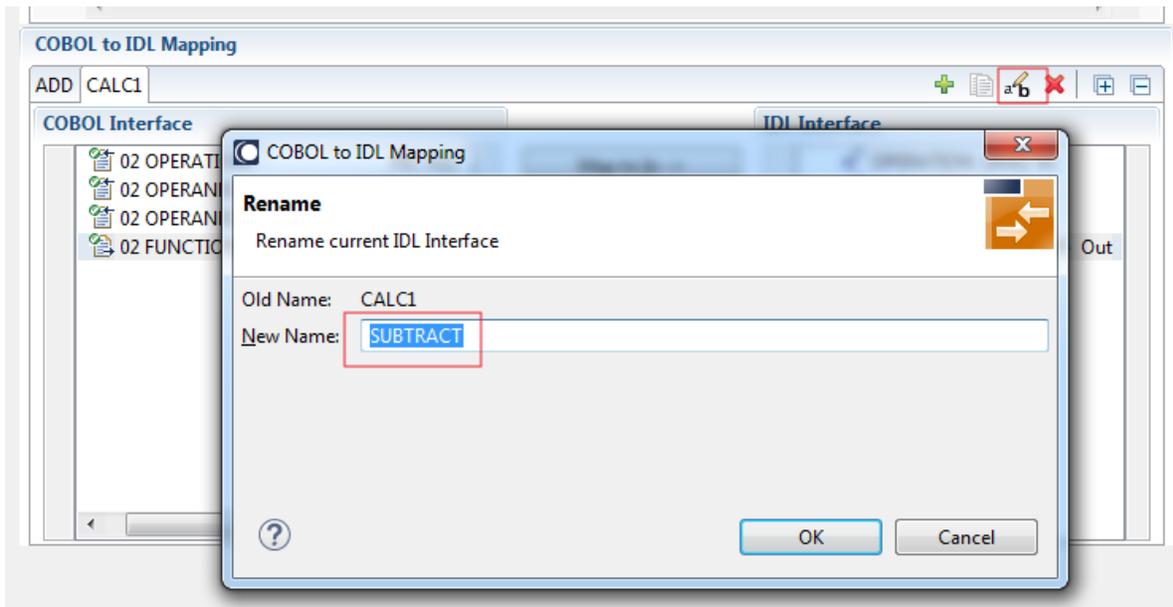
- If your target endpoint is a web service: instead having a Web service with a single operation, you get a web service with multiple operation, one operation for each COBOL function.
- If your target endpoint is Java or .NET: instead having a class with a single method, you get a class with multiple methods, one method for each COBOL function.

> To map a COBOL interface to multiple IDL interfaces

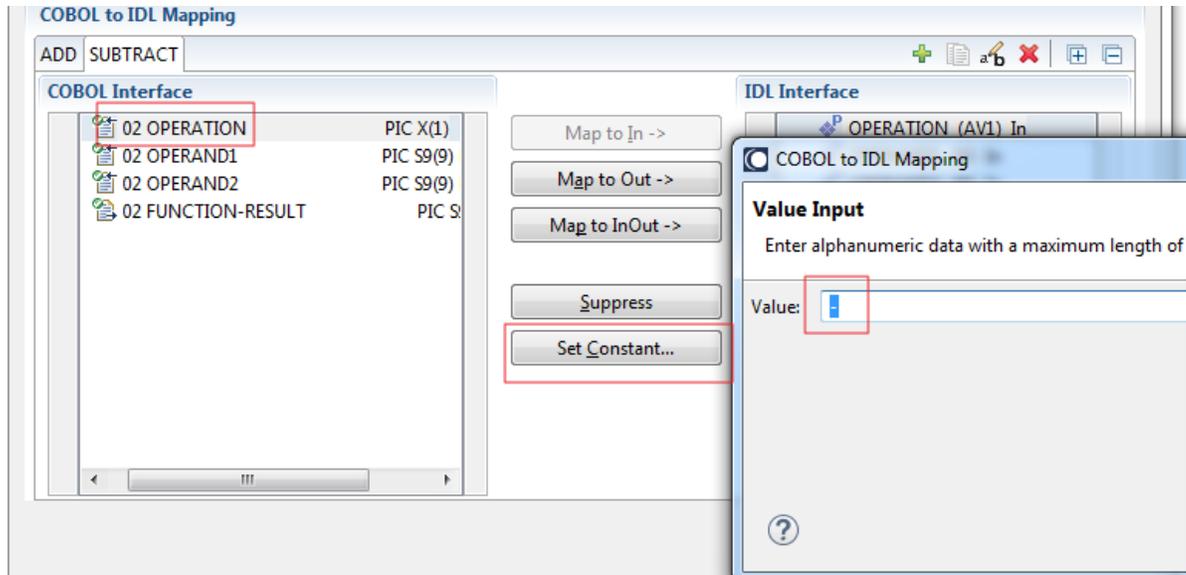
- 1 Select the tab with COBOL to IDL Mapping. For each function, define a separate IDL interface with the toolbar functions  or :



- 2 Give the IDL interfaces meaningful names with the toolbar function :



- 3 Define the required constant values to the *function-code* or *operation-code* parameter, see *Set COBOL Data Items to Constants* above:



For the delivered Example 1: COBOL Server with Multiple Functions:

- First, for step 1 above: Extract and define 3 separate IDL programs ADD, SUBTRACT, MULTIPLY.
- Second, for step 2 above: Rename them to suitable names, e.g. 'ADD', 'SUBTRACT', 'MULTIPLY'.
- Third, for step 3 above: Define the constants '+', '-' and '\*' to the parameter OPERATION respectively.
- After pressing **Finish**, the following IDL together with a server mapping file is created. See *Server Mapping Files for COBOL*.

```

Library 'EXAMPLE' is

program 'ADD' is
  define data parameter
    1 OPERAND1 (I4) In
    1 OPERAND2 (I4) In
    1 FUNCTION-RESULT (I4) Out
  end-define

program 'SUBTRACT' is
  define data parameter
    1 OPERAND1 (I4) In
    1 OPERAND2 (I4) In
    1 FUNCTION-RESULT (I4) Out
  end-define

program 'MULTIPLY' is
  define data parameter
    1 OPERAND1 (I4) In
    1 OPERAND2 (I4) In
    1 FUNCTION-RESULT (I4) Out
  end-define

```

**Notes:**

1. The following functions are offered to create further mappings from the COBOL interface, resulting in multiple IDL interfaces (IDL programs).

Icon	Function	Description
	Create IDL Interface	Creates a new IDL interface based on the current COBOL interface. All IDL parameters are of IDL direction InOut; no IDL parameters are set to constant; for COBOL REDEFINE, the first REDEFINE path is mapped to IDL; FILLERS are suppressed according to your selection, see <a href="#">Step 4: Define the Extraction Settings and Start Extraction</a> .
	Copy current IDL Interface	Creates a duplicate of current IDL interface. All modifications such as IDL directions, suppress, selection of REDEFINE paths etc. are kept.
	Rename current IDL Interface	The default name for the IDL interface is based on the COBOL program name plus appended number. With this function you can give the IDL interface a suitable name.
	Remove current IDL Interface	Deletes the current IDL interface.

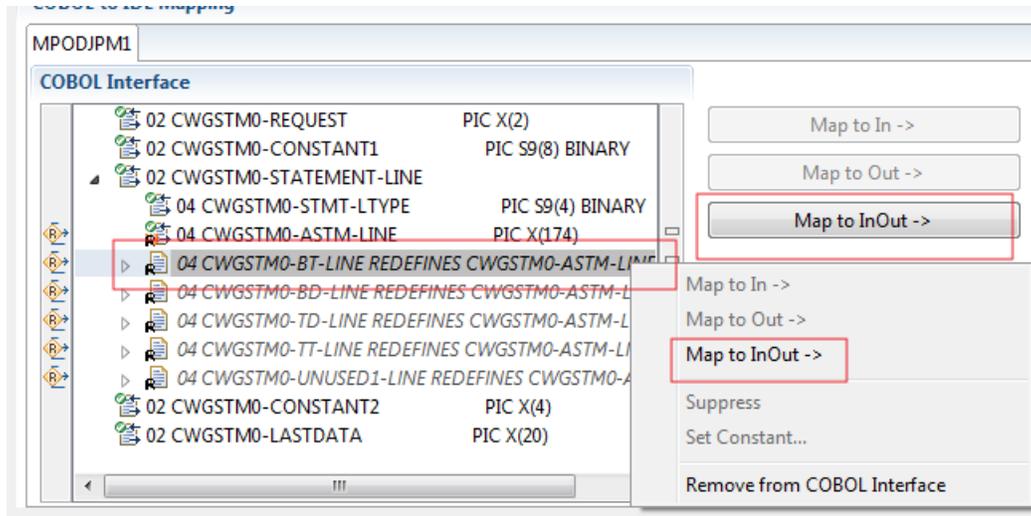
2. With the steps 1 thru 3 described here you can emulate the behavior of function Map to Operation of EntireX version 9.6 and earlier.

**Select REDEFINE Paths**

For COBOL server programs containing COBOL REDEFINES, the correct REDEFINE path needs to be chosen for the IDL interface.

**> To select redefine paths**

- Use the **Map to In, Out** or **InOut** functions available in the context menu of the COBOL interface and as mapping buttons to make the COBOL REDEFINE path available in the IDL interface.



Begin with the COBOL REDEFINE defined at the highest level first. Work through all inner COBOL REDEFINE data items, going from higher levels to lower levels.

#### Notes:

1. Only one REDEFINE path of a COBOL REDEFINE can be mapped to the IDL interface. All COBOL REDEFINE siblings are suppressed.
2. If a REDEFINE path is actively mapped to the IDL interface, all COBOL REDEFINE siblings are suppressed.
3. You can suppress all REDEFINE paths of a COBOL REDEFINE. Simply suppress the active REDEFINE path, see *Suppress Unneeded COBOL Data Items* above.

### Suppress Unneeded COBOL Data Items

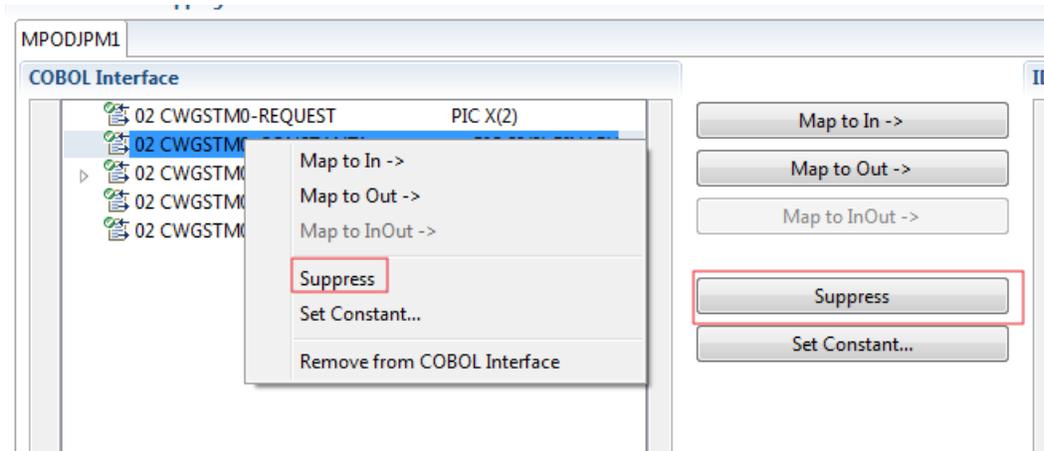
COBOL data items without any relevant information can be made invisible in the IDL interface. The IDL interface is simplified - it becomes shorter and tidier. This is useful, for example

- for FILLER data items
- if the RPC client or Adapter Service does not need an Out parameter
- if the RPC server or Adapter Service does not need an In parameter and a low value can be provided

If you are using an RPC server such as the z/OS (CICS | Batch), z/VSE (CICS | Batch), Micro Focus or BS2000/OSD RPC server, the amount of data to be transferred to/from the RPC client is also reduced.

### ➤ To suppress unneeded COBOL data items

- Use the **Suppress** function available in the context menu of the COBOL interface and as mapping button to make the COBOL data item invisible in the IDL interface:



#### Notes:

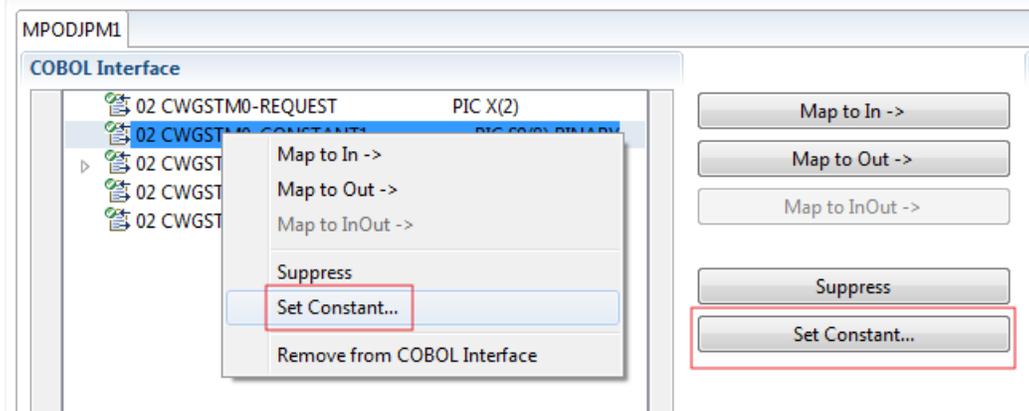
1. The COBOL data item is not part of the IDL interface. It is invisible for RPC clients or Adapter Service.
2. The RPC server or Adapter Service provides the COBOL data item to your COBOL server with low value, managing the offset to the next COBOL data item.
3. If a COBOL group is suppressed, all subordinate COBOL data items are suppressed as well.
4. With the inverse functions **Map to In**, **Out** or **InOut** (see above) available in the context menu of the COBOL interface and as mapping buttons, a COBOL data item is made visible in the IDL interface again.

### Set COBOL Data Items to Constants

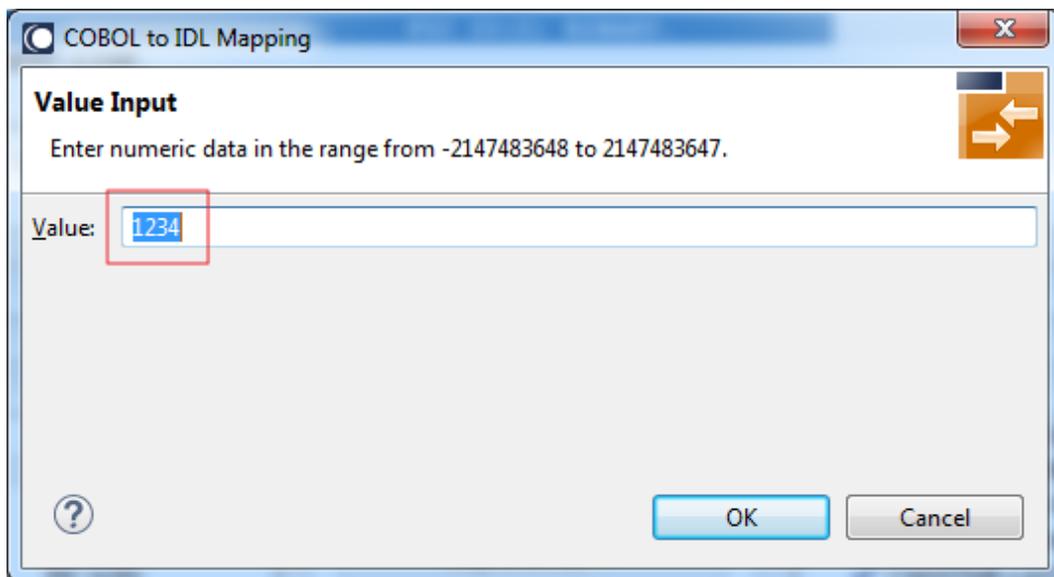
COBOL data items that always require fixed constant values on input to the COBOL server program can be made invisible in the IDL interface and initialized with the required constant values. This is useful for keeping the IDL interface short and tidy. RPC clients or Adapter Services are not bothered with IDL parameters that always contain constants, such as `RECORD-TYPES`. This function is often used in conjunction with **Map to Multiple IDL Interfaces** (see above).

### ➤ To set COBOL data items to constants

- 1 Use the **Set Constant** function available in the context menu of the COBOL interface and as mapping button to define a constant value for a COBOL data item:



- 2 You are prompted with a window to enter the constant value:



 **Notes:**

1. The COBOL data item is not part of the IDL interface. It is invisible for RPC clients or Adapter Services.
2. The RPC server or Adapter Service provides the defined constant in the COBOL data item to your COBOL server.
3. With the functions **Map to In**, **Out**, **InOut** (see above) available in the context menu of the COBOL interface and as mapping buttons, a COBOL data item can be made visible in the IDL interface again.

## Set Multiple Possible Output (MPO) Structures

A COBOL server program produces more than one type of output. The layout of the output can therefore take two or more dissimilar shapes. The COBOL server program decides at runtime the output structure returned, that is, the COBOL layout on output varies.

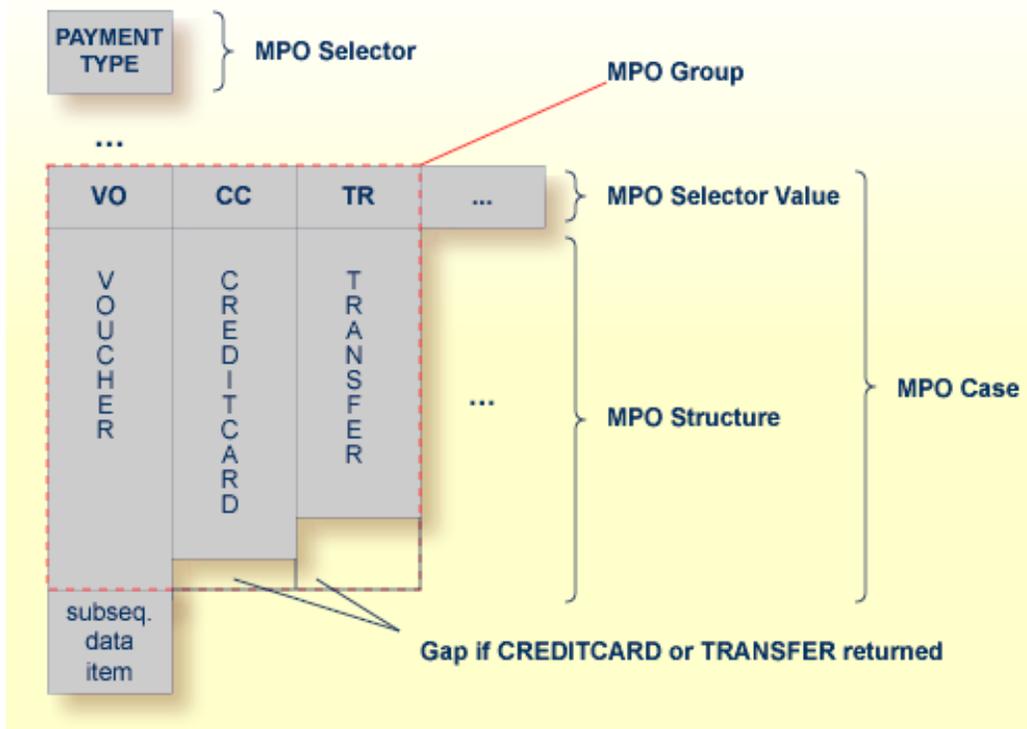
- [Multiple Possible Output with REDEFINES](#)
- [Optional Output with Groups](#)
- [MPO Terminology](#)
- [Steps](#)

### Multiple Possible Output with REDEFINES

As illustrated in *Example 5: COBOL Server Using Multiple Possible Output (MPO)*, a COBOL *REDEFINES Clause* is often used to describe the possible output structures. In COBOL this is the standard way to describe multiple possible output.

In addition, the COBOL interface

- limits the number of possible output structures returned
- defines all possible output structures, that is, they are known during extraction. In the example these are the structures `PAYMENT-DATA-VOUCHER`, `PAYMENT-DATA-CREDITCARD` and `PAYMENT-DATA-TRANSFER`. These are the MPO structures.
- contains an additional COBOL data item carrying a value related to the returned output structure. By inspecting this data item first, the appropriate output structure can be selected to address the data correctly. In the example it is `PAYMENT-TYPE`. This item is the MPO selector.
- always occupies memory to be able to transfer the longest output structure. If the actual returned output structure is shorter than the longest possible output structure, there is a gap (space) between the multiple possible output and the subsequent data item.



This abstract concept is known as *multiple possible output* (MPO) EntireX bundles all MPO structures into an MPO group. See *MPO Terminology* below.

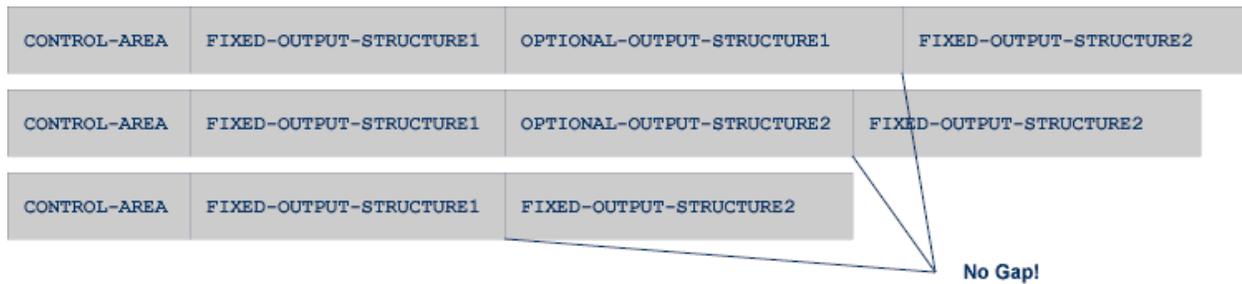
### Optional Output with Groups

As illustrated in [Example 6: COBOL Server Using Optional Output](#), COBOL group data items can be used to describe optional output structures. See *Optional COBOL Group Data Items*. Optional output with group data items are a variant of multiple possible output (MPO).

In addition, the COBOL interface

- limits the number of possible output structures returned
- defines all optional output structures, that is, they are known during extraction. In the example these are the structures `OPTIONAL-OUTPUT-STRUCTURE1` and `OPTIONAL-OUTPUT-STRUCTURE2`. These are the MPO structures.
- contains an additional COBOL data item carrying an indication if the optional output is present. By inspecting this data item first, the appropriate optional output structure can be selected to address the data correctly. If its value does not match, the optional output is not present. In the example it is `OPTIONAL-OUTPUT`. This item is the MPO selector.
- If the optional output is not present no memory is occupied. There is no gap between the optional output and the subsequent data item, as opposed to *Multiple Possible Output with REDEFINES* above.

In the example there are three different shapes of output:



## MPO Terminology

The following terminology is used with MPOs:

### MPO structure

A COBOL group describing the output layout used in an MPO case. All alternative layouts in an MPO group are often described with COBOL `REDEFINES`. An MPO structure can also contain other MPO groups.

### MPO group

Bundles together all MPO structures that can be used alternatively. A COBOL interface can contain more than one MPO group.

### MPO case

An MPO structure together with its MPO selector values (one or more).

### MPO selector

A COBOL data item containing a specific value (MPO selector value) where the actual MPO case can be determined. The MPO selector precedes the MPO group and is located outside the MPO group.

### MPO selector value

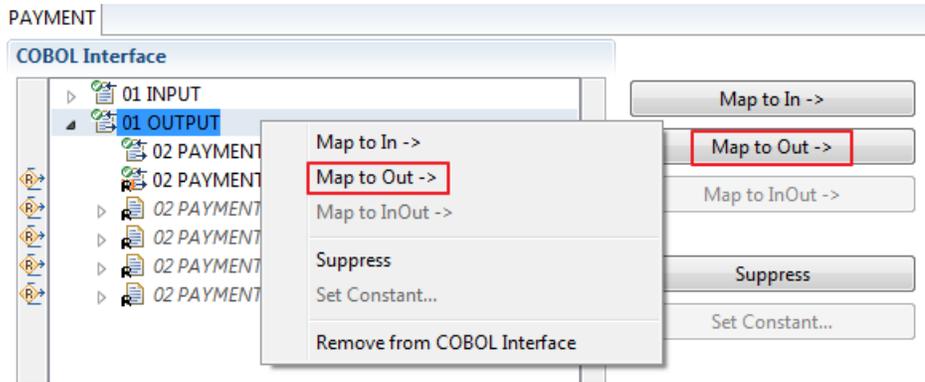
Each value indicates exactly one output structure. An output structure can be indicated by further values.

## Steps

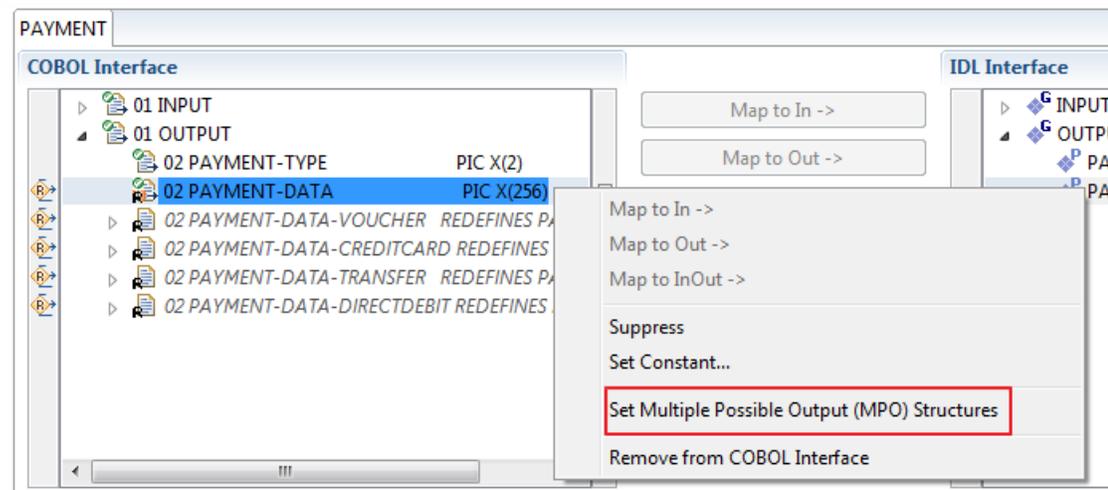
### ➤ To set multiple possible output (MPO) structures

Use the **Set Multiple Possible Output (MPO) Structures** function available in the context menu of the COBOL interface to create new or modify existing MPO groups.

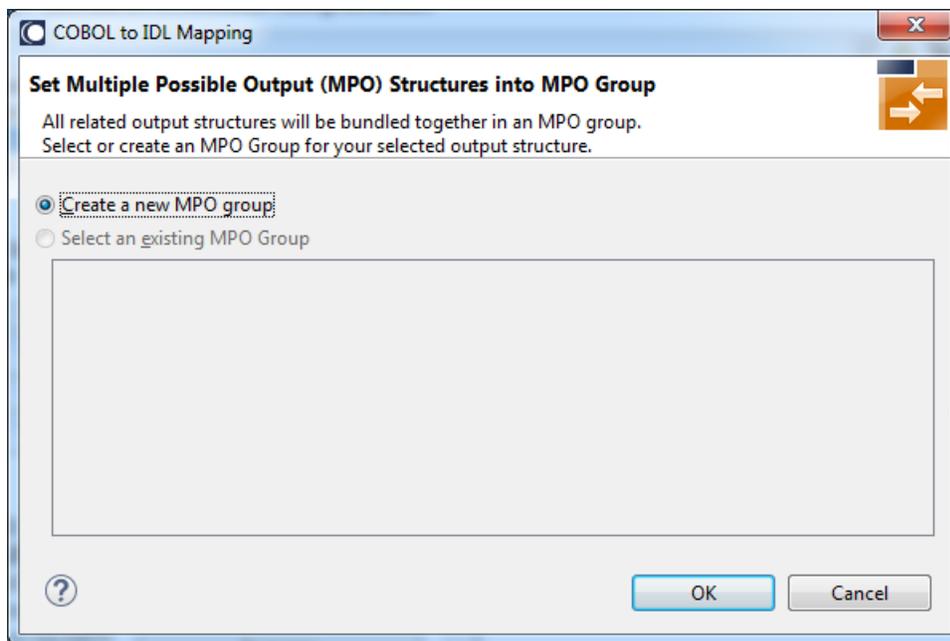
- 1 Set the top-level COBOL data item where the MPO structures are contained to IDL direction Out. Use the **Map to Out** function for this purpose:



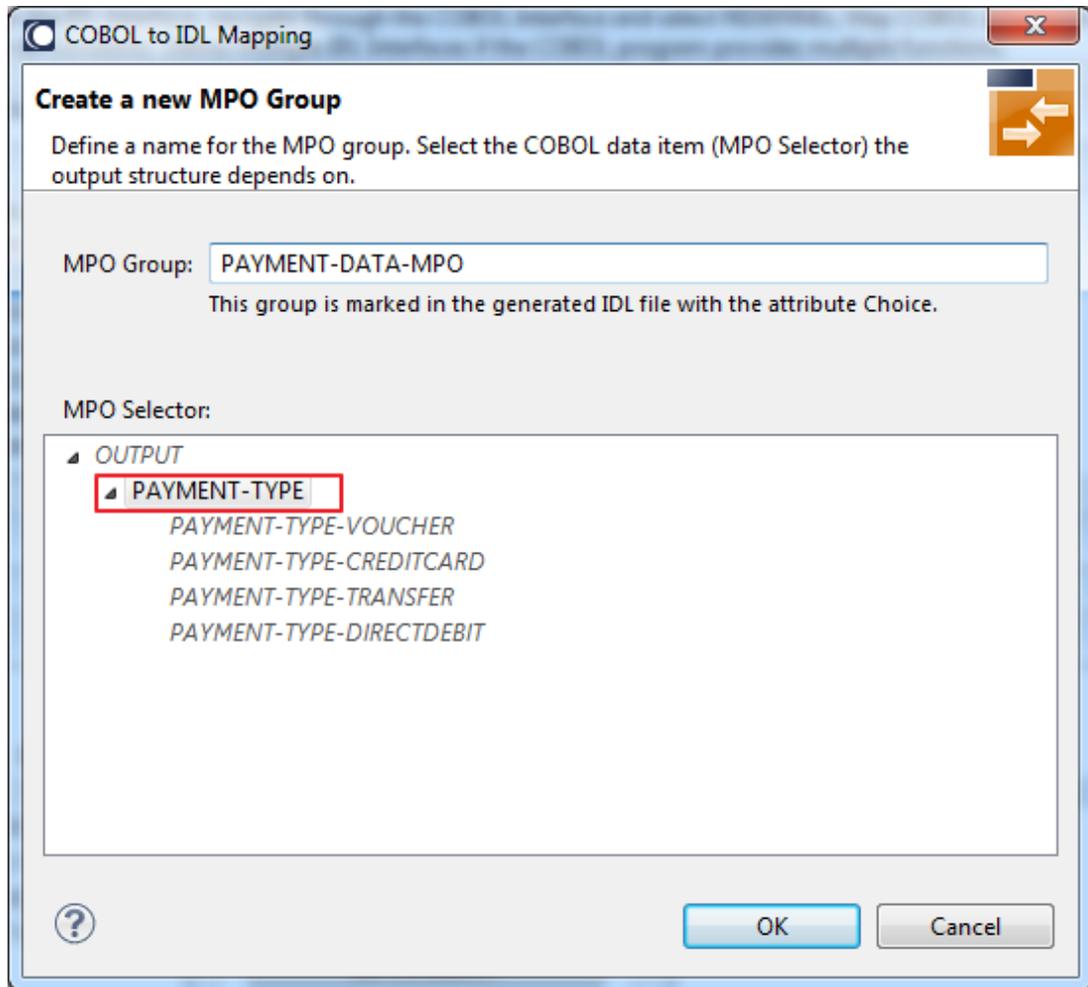
- From the context menu of the COBOL interface of the COBOL REDEFINE, choose **Set Multiple Possible Output (MPO) Structures**.



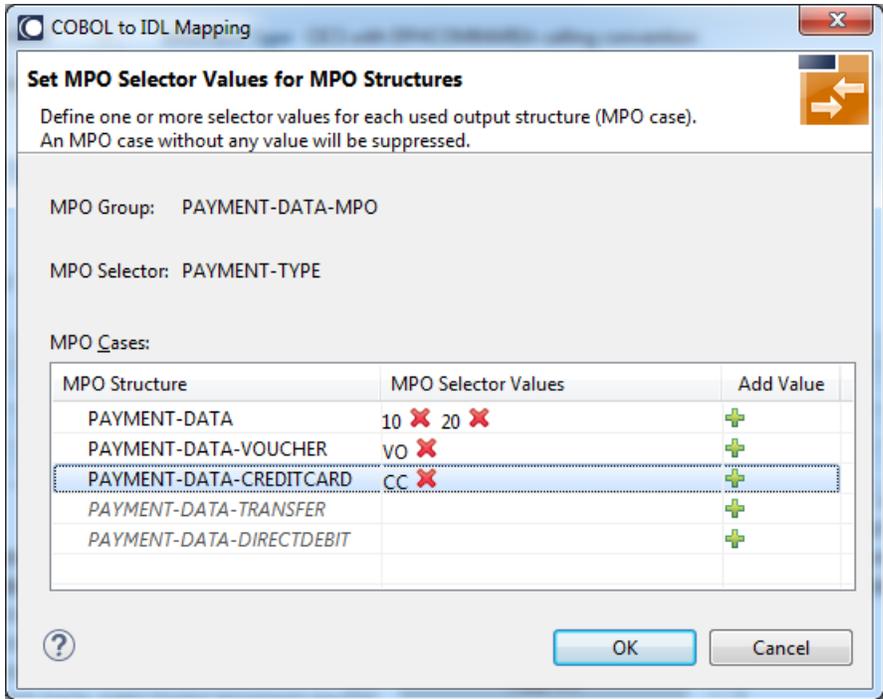
- Set Multiple Possible Output (MPO) Structures into MPO Group.



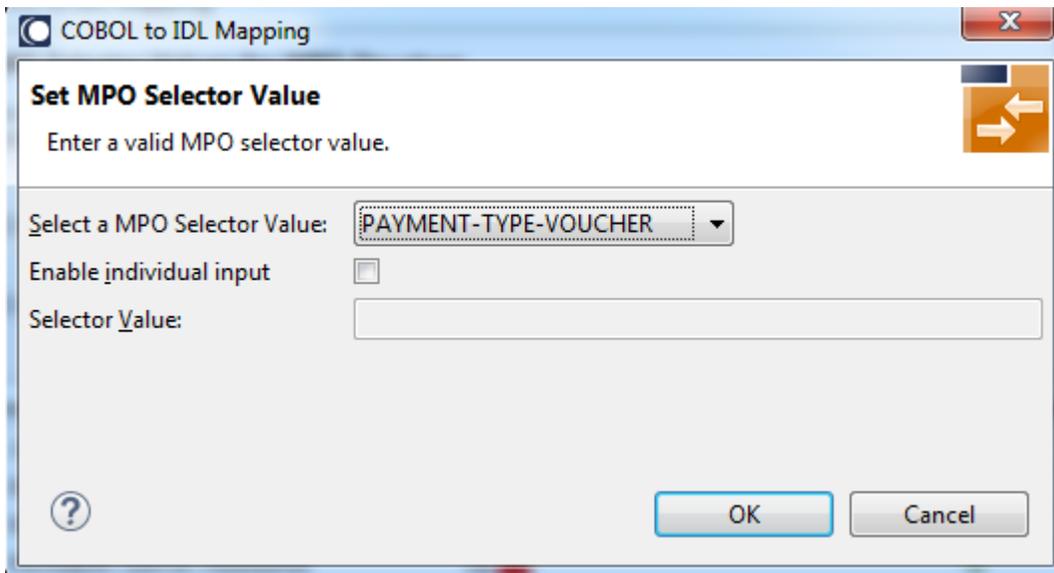
- 4 Create a new MPO group.



- 5 Set MPO selector values for MPO Structures.



Use the functions ✖ to delete and + to add MPO selector values:



**Notes:**

1. To add multiple MPO selector values per MPO structure, use the function + multiple times for the same MPO structure (see value 10 and 20 for structure PAYMENT-DATA).
2. MPO structures without any MPO selector are unused and suppressed in the IDL interface value (e.g. see structure PAYMENT-DATA-TRANSFER).

3. Each MPO selector value must uniquely identify an MPO structure. The same value cannot be used more than once for different MPO structures.
4. If no defined MPO selector value matches during runtime, an empty MPO group is delivered to the RPC client, that is, none of the MPO cases contain any data. No runtime error is produced.
- 6 For the delivered example *COBOL Server Using Multiple Possible Output (MPO)* (see below): After pressing **Finish**, the following IDL together with a server mapping file is created. See *Server Mapping Files for COBOL*.

```
library 'PAYMENT' is

program 'PAYMENT' is
  define data parameter
    1 INPUT          In
      2 ORDER-NUMBER      (NU10)
    1 OUTPUT         Out
      2 PAYMENT-TYPE      (A2)
      2 PAYMENT-DATA-MPO Choice
        3 PAYMENT-DATA    (/V1)
        4 PAYMENT-DATA    (AV256)
        3 PAYMENT-DATA-VOUCHER (/V1)
        4 VOUCHER-ORIGIN  (AV128)
        4 VOUCHER-SERIES  (AV128)
        3 PAYMENT-DATA-CREDITCARD (/V1)
        4 CREDITCARD-NUMBER (NU18)
        4 CREDITCARD-CODE  (NU12)
        4 CREDITCARD-VALIDITY (AV8)
  end-define
```

## Programming Techniques

- [Example 1: COBOL Server with Multiple Functions](#)
- [Example 2: Redefines](#)
- [Example 3: Buffer Technique](#)
- [Example 4: COBOL SET ADDRESS Statements](#)
- [Example 5: COBOL Server Using Multiple Possible Output \(MPO\)](#)
- [Example 6: COBOL Server Using Optional Output](#)

### Example 1: COBOL Server with Multiple Functions

Assume a COBOL server program has a FUNCTION or OPERATION code COBOL data item in its COBOL interface. The COBOL server program behaves differently depending on field values of this data item. See the following example where a COBOL programs implements a calculator with the functions ADD, SUBTRACT, MULTIPLY, etc. The execution of the different functions is controlled by the COBOL data item OPERATION:

```
. . .  
  
01 OPERATION          PIC X(1).  
01 OPERAND1          PIC S9(9) BINARY.  
01 OPERAND2          PIC S9(9) BINARY.  
01 FUNCTION-RESULT   PIC S9(9) BINARY.  
. . .  
MOVE 0 TO FUNCTION-RESULT.  
EVALUATE OPERATION  
  WHEN "+"  
    ADD OPERAND1 OPERAND2  
    GIVING FUNCTION-RESULT  
  WHEN "-"  
    SUBTRACT OPERAND2 FROM OPERAND1  
    GIVING FUNCTION-RESULT  
  WHEN "*"  
    MULTIPLY OPERAND1 BY OPERAND2  
    GIVING FUNCTION-RESULT  
  WHEN . . .  
  
END-EVALUATE.  
. . .
```

You can expose each COBOL server program function separately. The advantages or reasons for wanting this depend on the target endpoint. For example:

- **Web Service**

Instead having a Web service with a single operation, you want a web service with multiple operations, one operation for each COBOL function.

- **Java or .NET**

Instead having a class with a single method, you want a class with multiple methods, one method for each COBOL function.

- etc.

To do this you need to extract the COBOL server program as described under [Map to Multiple IDL Interfaces](#).

### Example 2: Redefines

The input and output data is described with a REDEFINE as in the following example. In this case you need to select REDEFINE path BUFFER2 for the COBOL interface.

```
LINKAGE SECTION.
01 DFHCOMMAREA.

02 BUFFER1.
   03 FIELD-1          PIC X(4).
   03 FIELD-2          PIC X(2).
   . . .
02 BUFFER2 REDEFINES BUFFER1.
   03 OPERATION        PIC X(1).
   03 OPERAND-1        PIC S9(9) BINARY.
   03 OPERAND-2        PIC S9(9) BINARY.
   03 FUNCTION-RESULT  PIC S9(9) BINARY.
   . . .
PROCEDURE DIVISION USING DFHCOMMAREA.
* process BUFFER2
  EXEC CICS RETURN.
```

Often a similar looking technique is used to allow full 32K input and full 32K completely different output, thus circumventing CICS 32K restrictions somewhat: A REDEFINE is used to describe output data that overlays the input data, that is, the CICS input message is *different* to CICS output message. For more information see [Example 2: Redefines](#) in section *CICS with DFHCOMMAREA Calling Convention - In different to Out*.

### Example 3: Buffer Technique

On entry, the server moves linkage section field(s) - often an entire buffer - into the working storage and processes the input data inside the working storage field(s). Before return, it moves the working storage field(s) - often an entire buffer - back to the linkage section. In this case, the relevant COBOL data items are described within the working storage section. You need to select WS-BUFFER for the COBOL interface.

```

WORKING STORAGE SECTION.
01 WS-BUFFER.
   02 OPERATION                PIC X(1).
   02 OPERAND-1                PIC S9(9) BINARY.
   02 OPERAND-2                PIC S9(9) BINARY.
   02 FUNCTION-RESULT          PIC S9(9) BINARY.
LINKAGE SECTION.
01 DFHCOMMAREA.
   02 IO-BUFFER                PIC X(9).
. . .
PROCEDURE DIVISION USING DFHCOMMAREA.
  MOVE IO-BUFFER TO WS-BUFFER.
* process the WS-BUFFER and provide result in WS-BUFFER
  MOVE WS-BUFFER TO IO-BUFFER.
  EXEC CICS RETURN.

```

A similar looking technique is used to allow full 32K input and full 32K completely different output, thus circumventing CICS 32K restrictions somewhat: The buffer technique may be used to describe output data that overlays the input data, that is, the CICS input message is *different* to CICS output message. For more information see [Example 3: Buffer Technique](#) in section *CICS with DFHCOMMAREA Calling Convention - In different to Out*.

### Example 4: COBOL SET ADDRESS Statements

COBOL SET ADDRESS statements are used to manipulate the interface of the CICS server. On entry, the server addresses the data with a (dummy) structure LS-BUFFER defined in the linkage section. You need to select LS-BUFFER for the COBOL interface.

```

LINKAGE SECTION.
01 LS-BUFFER.
   02 OPERATION                PIC X(1).
   02 OPERAND-1                PIC S9(9) BINARY.
   02 OPERAND-2                PIC S9(9) BINARY.
   02 FUNCTION-RESULT          PIC S9(9) BINARY.
. . .
PROCEDURE DIVISION.
  SET ADDRESS OF LS-BUFFER TO DFHCOMMAREA.
* process the LS-BUFFER and provide result.
  EXEC CICS RETURN.

```

A similar looking technique is used to allow full 32K input and full 32K completely different output, thus circumventing CICS 32K restrictions somewhat: COBOL SET ADDRESS statements may be used to describe output data that overlays the input data, that is, the CICS input message is *different* to CICS output message. For more information see [Example 4: COBOL SET ADDRESS Statements](#) in section *CICS with DFHCOMMAREA Calling Convention - In different to Out*.

### Example 5: COBOL Server Using Multiple Possible Output (MPO)

A COBOL REDEFINE can be used in a COBOL server program to return multiple possible output (MPO) structures, similar to COBOL data item PAYMENT-DATA in the example below; for this purpose, PAYMENT-DATA is redefined; each redefinition represents an output structure (MPO case); on return exactly one output structure is used; by inspecting COBOL data item PAYMENT-TYPE (MPO selector) first, a caller can determine the returned output structure; the caller then uses the correct redefinition to access the data.

```

. . .
01 INPUT-DATA.
   02 ORDER-NUMBER                PIC 9(10).

. . .
01 OUTPUT-DATA.
   02 <some fields>                PIC <clause>.
   . . .

   02 PAYMENT-TYPE                PIC X(2).
      88 PAYMENT-TYPE-VOUCHER     VALUE "V0".
      88 PAYMENT-TYPE-CREDITCARD  VALUE "CC".
      88 PAYMENT-TYPE-TRANSFER    VALUE "TR".
      88 PAYMENT-TYPE-DIRECTDEBIT VALUE "DB".
   . . .
   02 <preceding data items>      PIC <clause>.
   . . .
   02 PAYMENT-DATA                PIC X(256).
   02 PAYMENT-DATA-VOUCHER        REDEFINES PAYMENT-DATA.
      04 VOUCHER-ORIGIN           PIC X(128).
      04 VOUCHER-SERIES           PIC X(128).
   02 PAYMENT-DATA-CREDITCARD     REDEFINES PAYMENT-DATA.
      04 CREDITCARD-NUMBER        PIC 9(18).
      04 CREDITCARD-COMPANY       PIC X(128).
      04 CREDITCARD-CODE          PIC 9(12).
      04 CREDITCARD-VALIDITY      PIC X(8).
   02 PAYMENT-DATA-TRANSFER       REDEFINES PAYMENT-DATA.
      04 TRANSFER-NAME            PIC X(128).
      04 TRANSFER-IBAN            PIC X(34).
      04 TRANSFER-BIC             PIC X(11).
   02 PAYMENT-DATA-DIRECTDEBIT    REDEFINES PAYMENT-DATA.
      04 DIRECTDEBIT-IBAN        PIC X(34).
      04 DIRECTDEBIT-NAME        PIC X(128).
      04 DIRECTDEBIT-EXPIRES     PIC 9(8).

```

```
      . . .
      02 <subsequent data items>          PIC <clause>.
      . . .

      . . .

*   read order record using ORDER-NUMBER
      . . .

*   set value indicating type of reply (MPO selector)
      IF <some-condition> THEN
          SET PAYMENT-TYPE-VOUCHER TO TRUE
      ELSE IF <some-other-condition> THEN
          SET PAYMENT-TYPE-CREDITCARD TO TRUE
      ELSE IF <some-further-condition> THEN
          SET PAYMENT-TYPE-TRANSFER TO TRUE
      ELSE
          SET PAYMENT-TYPE-DIRECTDEBIT TO TRUE
      END-IF.
      . . .

*   set fields (MPO case) depending on type of reply
      INITIALIZE PAYMENT-DATA.
      EVALUATE TRUE
          WHEN PAYMENT-TYPE-VOUCHER
              MOVE . . . TO VOUCHER-ORIGIN
              MOVE . . . TO VOUCHER-SERIES
          WHEN PAYMENT-TYPE-CREDITCARD
              MOVE . . . TO CREDITCARD-NUMBER
              MOVE . . . TO CREDITCARD-CODE
              MOVE . . . TO CREDITCARD-VALIDITY
          WHEN PAYMENT-TYPE-TRANSFER
              MOVE . . . TO TRANSFER-NAME
              MOVE . . . TO TRANSFER-IBAN
              MOVE . . . TO TRANSFER-BIC
          WHEN PAYMENT-TYPE-DIRECTDEBIT
              MOVE . . . TO DIRECTDEBIT-IBAN
              MOVE . . . TO DIRECTDEBIT-NAME
              MOVE . . . TO DIRECTDEBIT-EXPIRES
          WHEN
              . . .
      END-EVALUATE.
      . . .
```

COBOL server programs using alternative and dissimilar shapes for the output layout are extracted as described under [Set Multiple Possible Output \(MPO\) Structures](#).

**Example 6: COBOL Server Using Optional Output**

COBOL group data items can be used in a COBOL server program to return optional output similar to the example below; the returned data is built by copying the necessary COBOL structures into an output area. The optional output is one of OPTIONAL-OUTPUT-STRUCTURE1, OPTIONAL-OUTPUT-STRUCTURE2 or nothing. The presence of the optional output is controlled by a structure named CONTROL-AREA. Optional output with group data items are a variant of MPO, see [Example 5: COBOL Server Using Multiple Possible Output \(MPO\)](#).

```

WORKING-STORAGE SECTION.

01 INPUT-AREA.
   02 FIX-INPUT-ITEM1                PIC X(4).
   02 <some fields>                  PIC <clause>.
   . . .

01 OUTPUT-OFFSET                     PIC S9(9) BINARY.
01 OUTPUT-AREA                       PIC X(32000).
   . . .

01 CONTROL-AREA.
   02 OPTIONAL-OUTPUT                PIC X(1).
      88 OPTIONAL-OUTPUT-1          VALUE "1".
      88 OPTIONAL-OUTPUT-2          VALUE "2".
      88 OPTIONAL-OUTPUT-NONE       VALUE "N".
   . . .

01 OPTIONAL-OUTPUT-STRUCTURE1.
   02 OPTIONAL-OUTPUT-ITEM11         PIC X(10).
   02 OPTIONAL-OUTPUT-ITEM12         PIC X(100).
   02 OPTIONAL-OUTPUT-ITEM13         PIC X(20).
   . . .

01 OPTIONAL-OUTPUT-STRUCTURE2.
   02 OPTIONAL-OUTPUT-ITEM21         PIC X(4).
   02 OPTIONAL-OUTPUT-ITEM22         PIC X(50).
   02 OPTIONAL-OUTPUT-ITEM23         PIC X(50).
   . . .

01 FIX-OUTPUT-STRUCTURE1.
   02 FIX-OUTPUT-ITEM11              PIC X(4).
   02 FIX-OUTPUT-ITEM12              PIC X(20).
   02 FIX-OUTPUT-ITEM13              PIC X(8).
   . . .

01 FIX-OUTPUT-STRUCTURE2.
   02 FIX-OUTPUT-ITEM21              PIC X(2).
   02 FIX-OUTPUT-ITEM22              PIC X(10).
   02 FIX-OUTPUT-ITEM23              PIC X(10).
   . . .

```

```
IF <some-condition> THEN
  SET OPTIONAL-OUTPUT-1 TO TRUE
ELSE IF <some-other-condition> THEN
  SET OPTIONAL-OUTPUT-2 TO TRUE
ELSE
  SET OPTIONAL-OUTPUT-NONE TO TRUE
END-IF.

. . .

*   provide control area for optional output
    MOVE 1 TO OUTPUT-OFFSET.
    STRING CONTROL-AREA DELIMITED BY SIZE
    INTO OUTPUT-AREA WITH POINTER OUTPUT-OFFSET.

*   provide data items before optional output
    STRING FIX CONTROL-AREA DELIMITED BY SIZE
    INTO OUTPUT-AREA WITH POINTER OUTPUT-OFFSET.

*   provide optional output
    EVALUATE TRUE
      WHEN OPTIONAL-OUTPUT-1
        STRING OPTIONAL-OUTPUT-STRUCTURE1 DELIMITED BY SIZE
        INTO OUTPUT-AREA WITH POINTER OUTPUT-OFFSET
      WHEN OPTIONAL-OUTPUT-2
        STRING OPTIONAL-OUTPUT-STRUCTURE2 DELIMITED BY SIZE
        INTO OUTPUT-AREA WITH POINTER OUTPUT-OFFSET
    END-EVALUATE.

*   provide data items after optional output
    STRING FIX-OUTPUT-STRUCTURE2 DELIMITED BY SIZE
    INTO OUTPUT-AREA WITH POINTER OUTPUT-OFFSET.

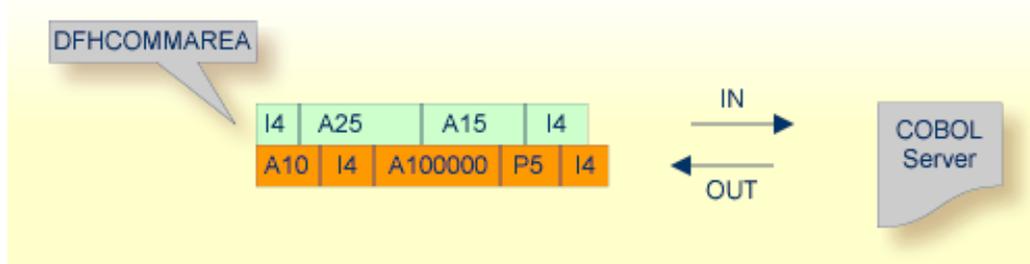
. . .
```

COBOL server programs using optional shapes for the output layout are extracted as described under [Set Multiple Possible Output \(MPO\) Structures](#).

# 7 CICS with DFHCOMMAREA Calling Convention - In different to Out

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- Introduction ..... 96
- Extracting from a CICS DFHCOMMAREA Program ..... 96
- Mapping Editor User Interface ..... 98
- Mapping Editor IDL Interface Mapping Functions ..... 105
- Programming Techniques ..... 122



## Introduction

Depending on the programming style used in the CICS program and the various different techniques for accessing the CICS DFHCOMMAREA interface, finding the relevant COBOL data structures can be a complex and time-consuming task that may require CICS COBOL programming knowledge. Please note also the following:

- A CICS program does not require a PROCEDURE DIVISION header, where parameters are normally defined. See [PROCEDURE DIVISION Mapping](#).
- The DFHCOMMAREA can be omitted in the linkage section.
- If there is no DFHCOMMAREA in the linkage section or no PROCEDURE DIVISION header present in the PROCEDURE DIVISION, the CICS preprocessor completes the interface of the COBOL server and adds a DFHCOMMAREA and a PROCEDURE DIVISION header to the CICS program before compilation.

If you have selected an IDL file and opened the COBOL Mapping Editor with an existing COBOL to IDL mapping, continue with [Mapping Editor User Interface](#).

## Extracting from a CICS DFHCOMMAREA Program

This section assumes **Input Message same as Output Message** is not checked. COBOL output and COBOL input parameters are different, that is, the DFHCOMMAREA on output is overlaid with a data structure that is different to the data structure on input. See the examples provided under [Programming Techniques](#).

If you are extracting IDL from a COBOL source or extending the IDL file by extracting an additional COBOL source with interface type CICS with DFHCOMMAREA calling convention, the **Extractor Settings** dialog appears (see also [Step 4: Define the Extraction Settings and Start Extraction](#)).

Make sure the interface type is correct and check box **Input Message same as Output Message** is cleared.

COBOL Source

File Name:

Operating System:

Interface Type:

Input Message same as Output Message

Press **Next** to open the COBOL Mapping Editor.

➤ **To select the COBOL interface data items of your COBOL server**

- 1 Add the COBOL data items of the CICS input message to **Input Message** by using the context menu or toolbar available in the *COBOL Source View* and *COBOL Interface*. See **Notes**.
- 2 Add the COBOL data items of the CICS output message to **Output Message** by using the context menu and toolbars available in the *COBOL Interface* and *IDL Interface*. See **Notes**.
- 3 Continue with *COBOL to IDL Mapping*.



**Notes:**

1. If a DFHCOMMAREA is present, the DFHCOMMAREA COBOL data item itself cannot be selected. In this case, select the COBOL data items directly subordinated to DFHCOMMAREA and map to IDL. See *Map to*.
2. It is very important to select the right COBOL data items describing the interface of the COBOL server correctly. This means the COBOL data items used as parameters must match in number and in sequence of formats (COBOL usage clause).
3. If your COBOL server contain REDEFINES, the first REDEFINE path is offered by default. Check manually whether this is the one you want. If not, correct it. You can select any other REDEFINE path.
4. See the examples provided under *Programming Techniques*.

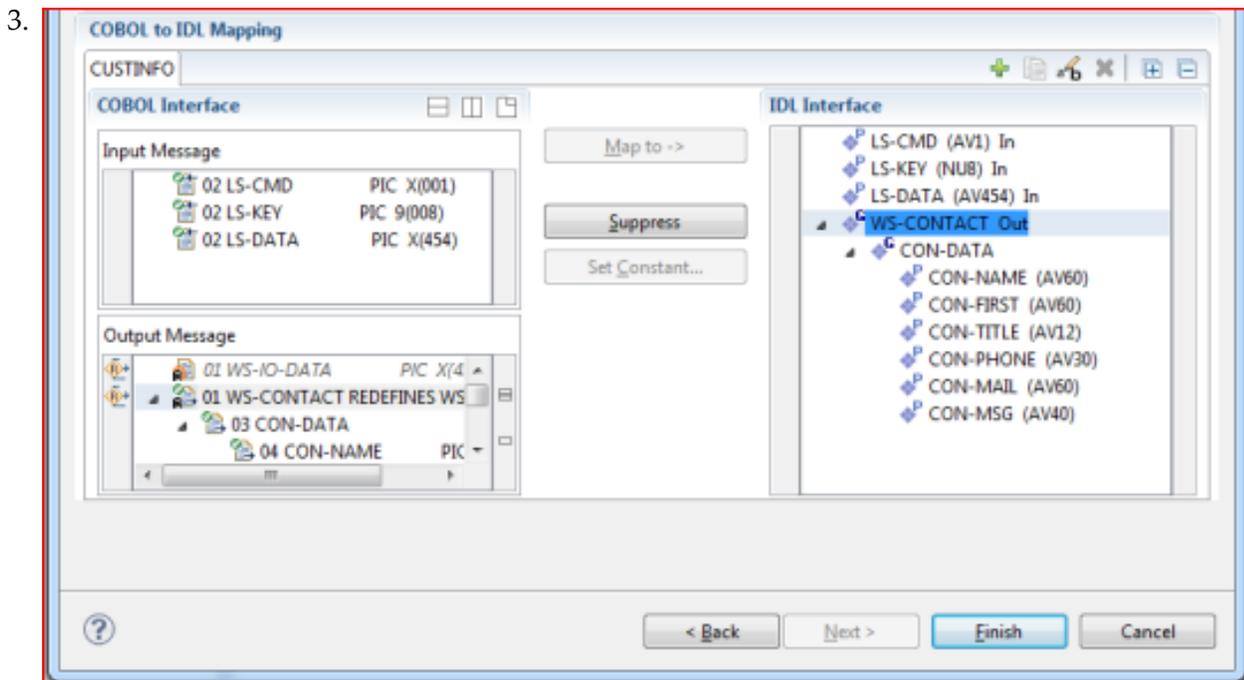
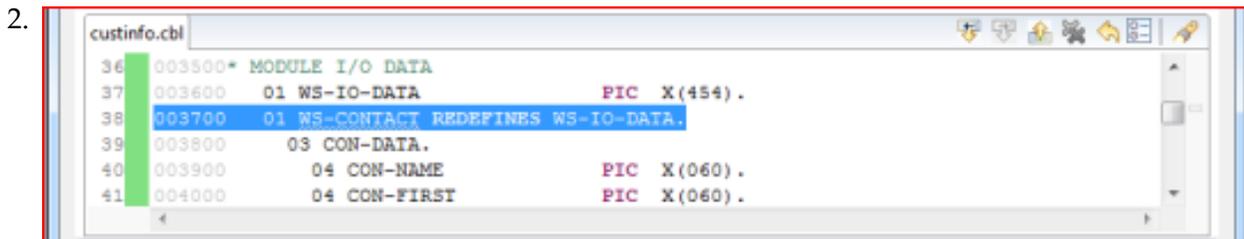
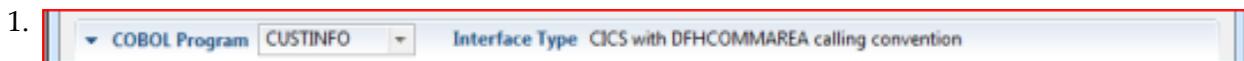
The user interface of the COBOL Mapping Editor is described below.

## Mapping Editor User Interface

This section assumes you have set the extraction settings as described above. The following areas of the COBOL Mapping Editor user interface are described here:

- [COBOL Program Selection](#)
- [COBOL Source View](#)
- [COBOL to IDL Mapping](#)

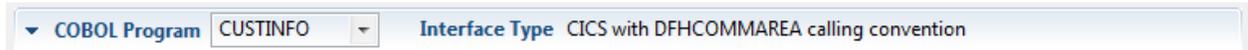
For COBOL interface types where COBOL input and COBOL output parameters are different, the user interface of the COBOL Mapping Editor looks like this:



1. **COBOL Program Selection.** Currently selected program with interface type

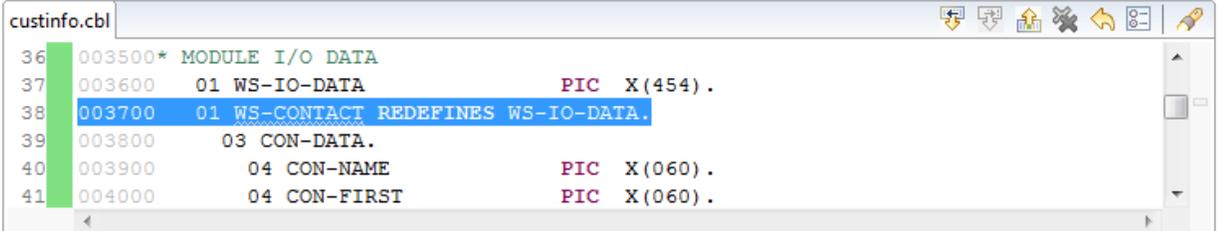
2. **COBOL Source View.** Contains all related sources for the currently selected COBOL program
3. **COBOL to IDL Mapping.** Tree view of your selected COBOL data items and mapping buttons with which you can map these items to your IDL interface

### COBOL Program Selection



The COBOL Program Selection displays the current selected COBOL program with its interface type. If you have extracted more than one COBOL program within the associated IDL file, you can switch to another COBOL program with its mapping by selecting the name in the combo box.

## COBOL Source View



```

36 003500* MODULE I/O DATA
37 003600 01 WS-IO-DATA          PIC X(454) .
38 003700 01 WS-CONTACT REDEFINES WS-IO-DATA.
39 003800 03 CON-DATA.
40 003900 04 CON-NAME          PIC X(060) .
41 004000 04 CON-FIRST        PIC X(060) .

```

All COBOL data items contained in the LINKAGE and WORKING-STORAGE SECTION are offered in a text view. The text view contains all related sources (including copybooks) for the currently selected COBOL program. It is used for selecting data items and retrieving information from the original COBOL sources. The light green bar indicates that the data item is already contained in the COBOL Interface; a dark green bar indicates the data item is selectable and can be added to the COBOL Interface. This section can be collapsed. If you open the Editor with **Modify Interface** it is collapsed by default. The toolbar provides the following actions:

-  Add selected COBOL data item to COBOL Interface as Input Message.
-  Add selected COBOL data item to COBOL Interface as Output Message.
-  Remove selected COBOL data item from COBOL Interface.
-  Remove all COBOL data items from COBOL Interface.
-  Reset COBOL Interface to initial state.
-  Show dialog to modify COBOL Source Characteristics.
-  Show dialog to find text in Source.

The same functionality is also available from the context menu.

## COBOL to IDL Mapping

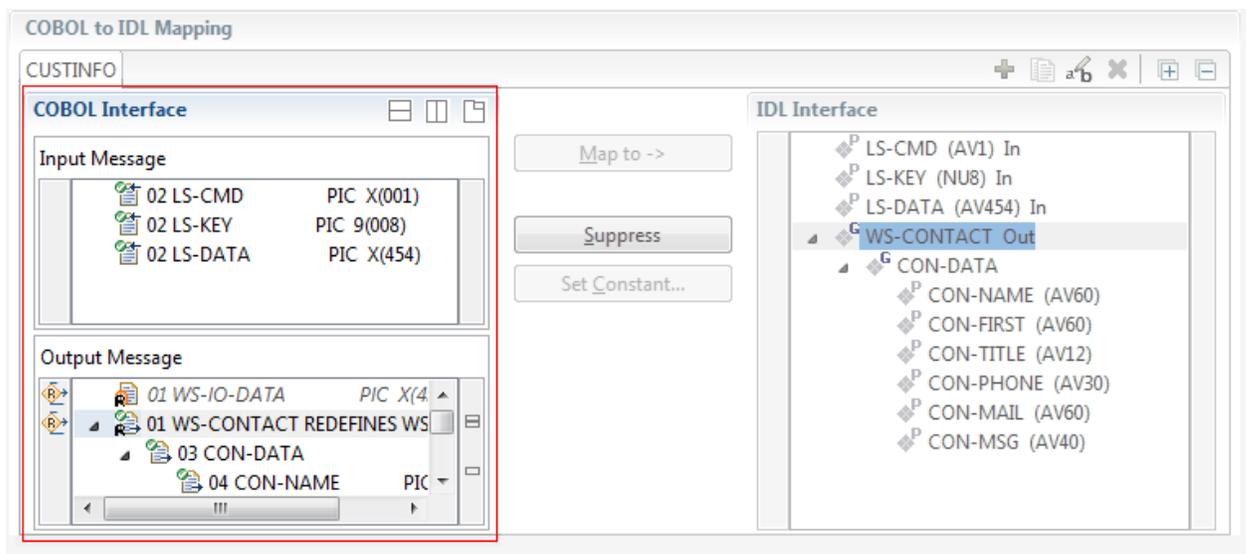
This section covers the following topics:

- [COBOL Interface](#)
- [Mapping Buttons](#)
- [IDL Interface](#)

### COBOL Interface

The **COBOL Interface** shows a tree view of your selected COBOL data items describing the interface of the COBOL server. A context menu is available for the COBOL data items, which provides mapping and other functions. On some COBOL data items, decision icons indicate where particular attention is needed, including mapping icons to visualize the COBOL data type and your current mapping.

The COBOL data item names are derived from the COBOL source from which they were extracted. If your COBOL interface contains parameters without a name, that is, the keyword `FILLER` is used, those COBOL data items are shown as `[FILLER]`. See [FILLER Pseudo-Parameter](#).



You can modify the COBOL interface using context menu or toolbar; decision and mapping icons provide additional information.

### Context Menu

The context menu on COBOL data items provides the following mapping and other functions, depending on the data item type, the COBOL level and the current mapping.

#### Map to

A suppressed COBOL data item becomes visible in the IDL interface. Used also to select another `REDEFINE` path.

<b>Suppress</b>	Suppress unneeded COBOL data items.
<b>Set Constant</b>	Set COBOL data items to constant.
<b>Set Multiple Possible Output (MPO) Structures</b>	Set COBOL data items where the server program decides the output structure used on return. Specify the set of multiple possible output (MPO) structures and the criteria when a structure is used.
<b>Remove from COBOL Interface</b>	Remove the data item from the COBOL interface. This also removes the mapped IDL parameter from all IDL interfaces for the current COBOL program. See <a href="#">COBOL Program Selection</a> .

See also [Mapping Editor IDL Interface Mapping Functions](#).

### Toolbar

The toolbar offers the following actions:

-  Create IDL Interface. Creates a new IDL interface based on the current COBOL interface: all IDL parameters are of IDL direction InOut; no IDL parameters are set to constant; for COBOL REDEFINE, the first REDEFINE path is mapped to IDL; FILLERS are suppressed according to your selection, see [Step 4: Define the Extraction Settings and Start Extraction](#).
-  Copy current IDL Interface. Creates a duplicate of the current IDL interface: all modifications such as IDL directions, suppress, selection of REDEFINE paths etc. are kept.
-  Remove current IDL Interface.
-  Rename current IDL Interface.
-  Expand the full tree.
-  Collapse the full tree.

See also [Map to Multiple IDL Interfaces](#).

### Decision Icons

The decision icons in the first column are set on COBOL data items where particular attention is needed:

-  This icon visualizes a COBOL REDEFINE. It is essential that you map the correct redefine path for your mapping to In, Out or InOut using the context menu. If you map a REDEFINE path, all other sibling REDEFINE paths are automatically set to "Suppress".

### Mapping Icons

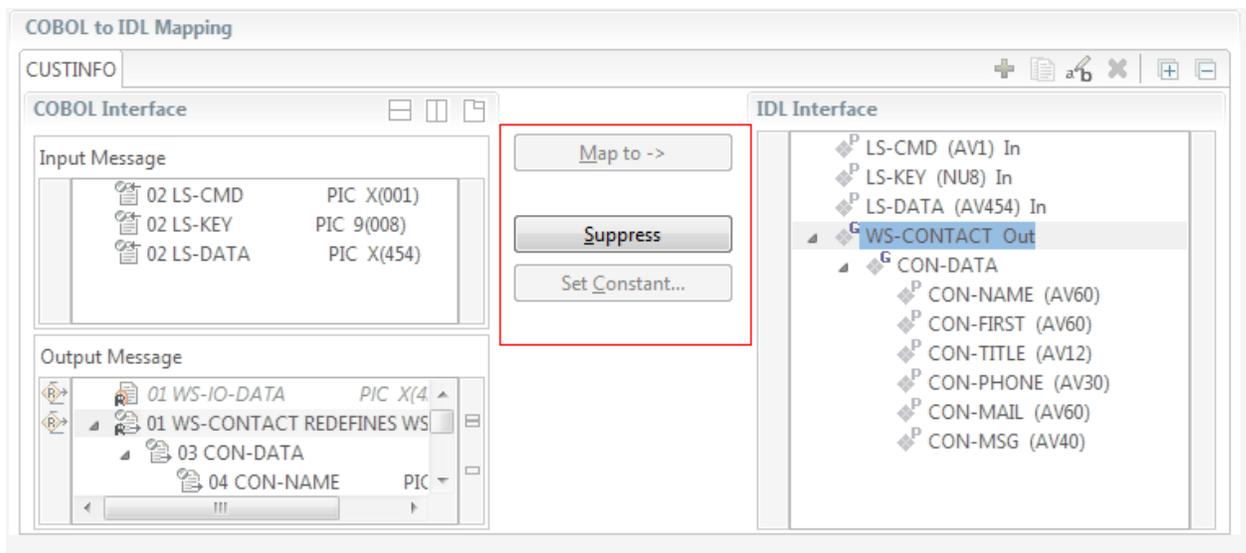
The following mapping icons on the COBOL data items indicate your current IDL mapping:

-  Scalar parameter, mapped to In.

-  Scalar parameter, mapped to Out.
-  Group parameter, here mapped to In.
-  REDEFINE parameter, here mapped to Out.
-  Parameter set to Constant.

## Mapping Buttons

The following buttons are available:



### Map to ->

A suppressed COBOL data item becomes visible in the IDL interface. Used also to select another REDEFINE path.

### Suppress

See *Suppress Unneeded COBOL Data Items*.

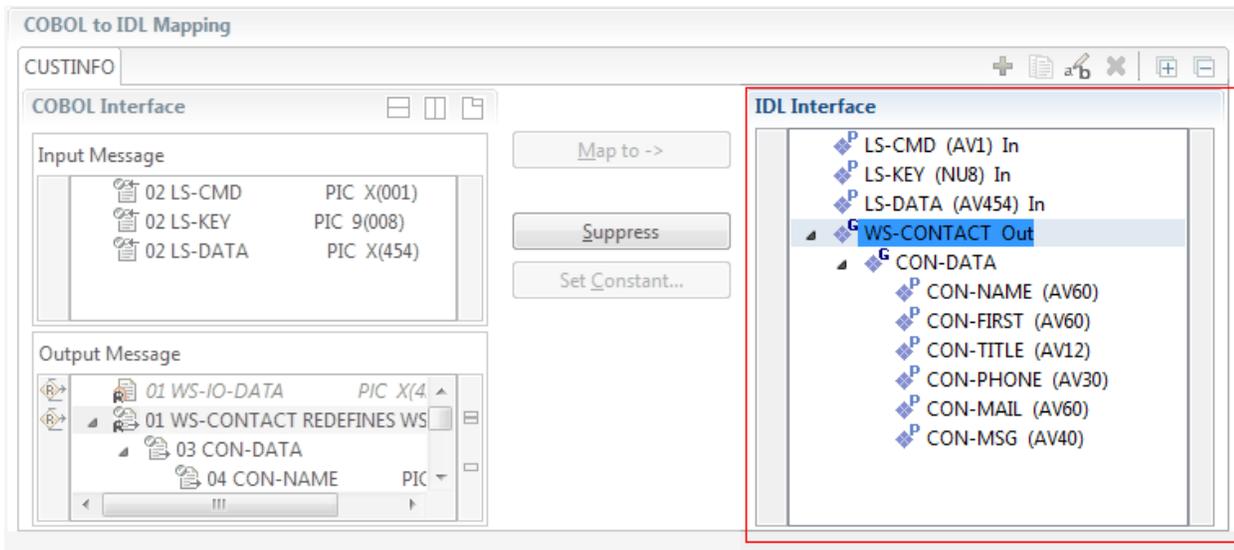
### Set Constant...

See *Set COBOL Data Items to Constants*.

### IDL Interface

If you have mapped the COBOL interface to multiple IDL interfaces, select the IDL interface by choosing the tabs. In the **IDL Interface** tree view, a context menu is also available with the following possibilities:

- Rename
- Remove from COBOL Interface. This also removes the mapped IDL parameter from all IDL interfaces for the current COBOL program. See *COBOL Program Selection* above.



## Mapping Editor IDL Interface Mapping Functions

This section covers the following topics:

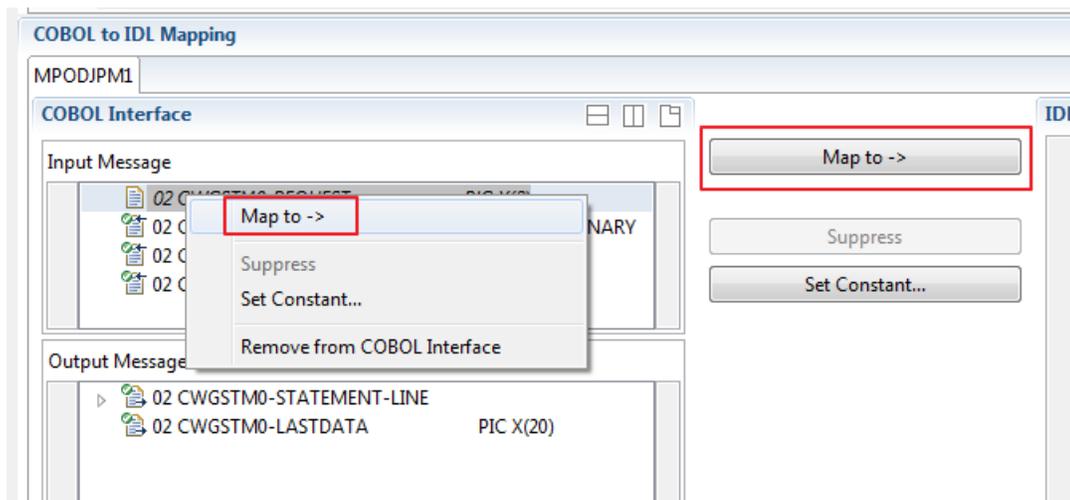
- Map to
- Map OCCURS DEPENDING ON
- Map to Multiple IDL Interfaces
- Select REDEFINE Paths
- Suppress Unneeded COBOL Data Items
- Set COBOL Data Items to Constants
- Set Multiple Possible Output (MPO) Structures

### Map to

With the **Map to** functions you make a COBOL data item visible as an IDL parameter in the IDL interface, that is, you design the IDL interface by defining input and output parameters.

#### ➤ To map COBOL data items to IDL interface

- 1 Go *step-by-step* through all *top-level* COBOL data items in the COBOL interface and use the **Map to** function available in the context menu of the COBOL interface and as mapping button to make a COBOL data item visible as an IDL parameter in the IDL interface:



- 2 Do the same for the output message of the COBOL interface.



#### Notes:

1. If a COBOL group is mapped, all subordinate COBOL data items are also made visible in the IDL interface.
2. With the inverse function **Suppress Unneeded COBOL Data Items** (see below) available in the context menu of the COBOL interface and as mapping button, a COBOL data item can be removed from the IDL interface.

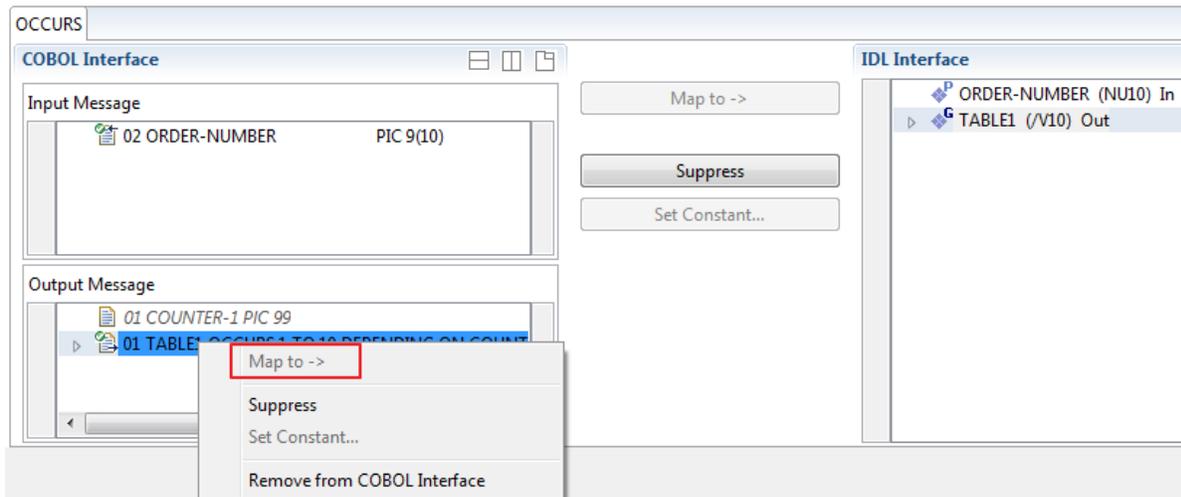
### Map OCCURS DEPENDING ON

You can make the COBOL ODO subject (here COBOL data item TABLE) of a variable-sized COBOL table (see *COBOL Tables with Variable Size - DEPENDING ON Clause*) visible as an IDL unbounded group (with maximum). The ODO object (here COBOL data item COUNTER-1) is suppressed and therefore not part of the IDL interface. This is because the number of elements of the IDL unbounded group is already implicitly available. See the following example:

```
01 COUNTER-1 PIC 99.
01 TABLE OCCURS 1 TO 10 DEPENDING ON COUNTER-1
  02 FIELD1 PIC XX.
  02 FIELD2 PIC 99.
```

> **To map OCCURS DEPENDING ON**

- Add the COBOL subject (here data item TABLE) and ODO object (here data item COUNTER-1) to the input message or to the output message, wherever they belong. It is important both data items are always together per message direction (input or output).



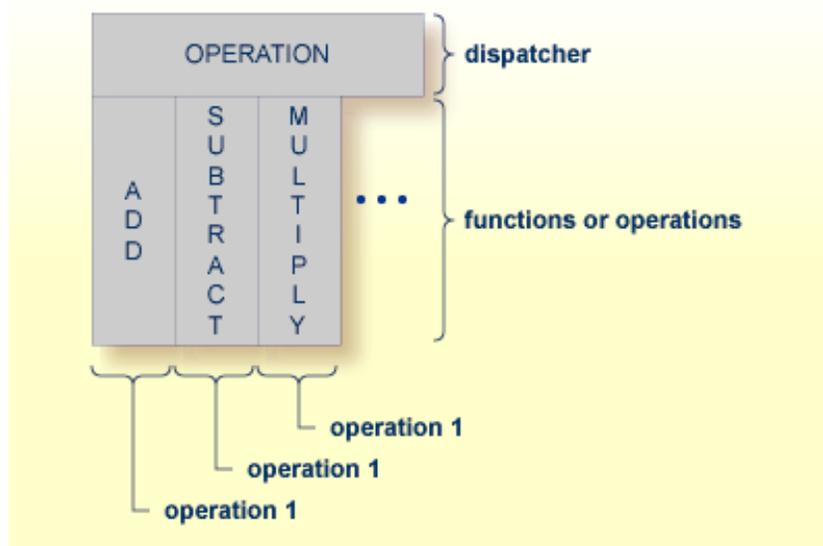
 **Notes:**

1. The ODO subject can be mapped to the IDL interface.

2. The ODO object is always suppressed, but is required to be part of the same message direction (Input Message or Output Message) of the COBOL interface.
3. IDL directions are described in the direction-attribute in `attribute-list` under *Software AG IDL Grammar* in the IDL Editor documentation.

### Map to Multiple IDL Interfaces

Assume the COBOL server program provides multiple functions or operations, in the following example `ADD`, `SUBTRACT`, `MULTIPLY`. Some dispatcher front-end code executes the correct function, for example, depending on a *function-code* or *operation-code* parameter:



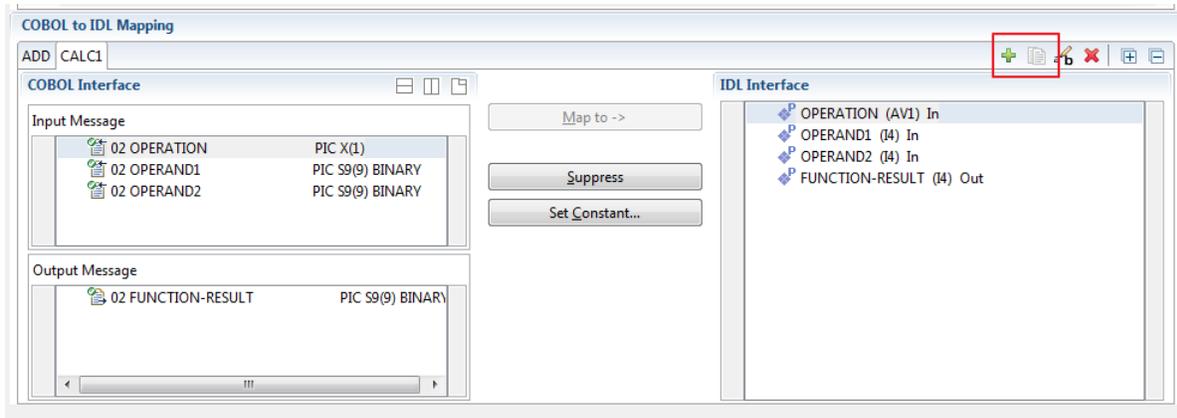
This example is described in more detail under [Example 1: COBOL Server with Multiple Functions](#).

If you have such a situation, a good approach is to expose each COBOL server program function separately as an IDL program. This gives advantages in further processing of the IDL and COBOL mapping files (SVM and CVM). For example:

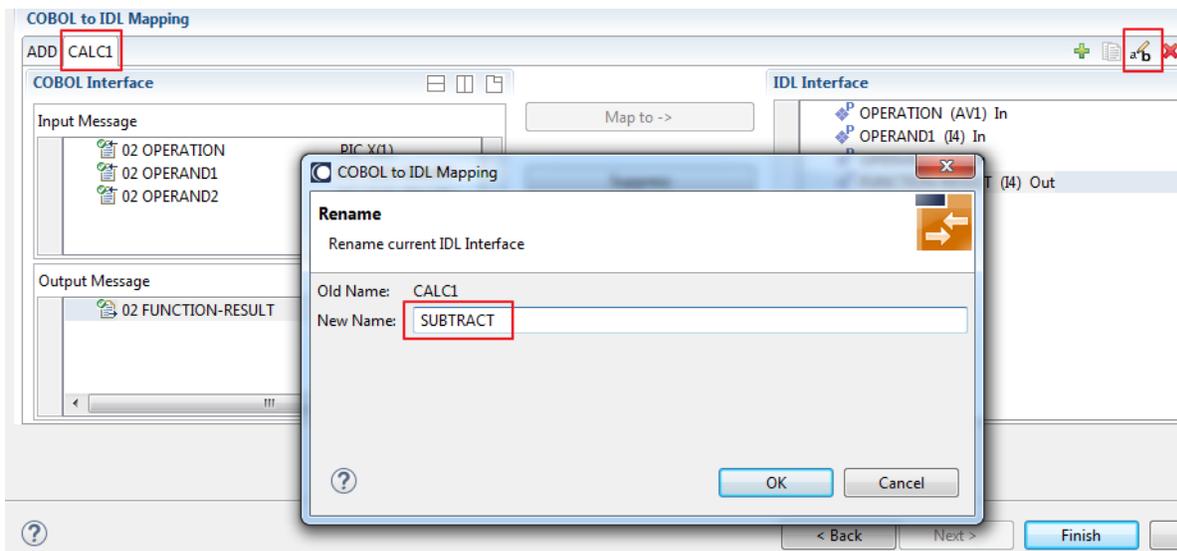
- If your target endpoint is a web service: instead having a Web service with a single operation, you get a web service with multiple operation, one operation for each COBOL function.
- If your target endpoint is Java or .NET: instead having a class with a single method, you get a class with multiple methods, one method for each COBOL function.

#### » To map a COBOL interface to multiple IDL interfaces

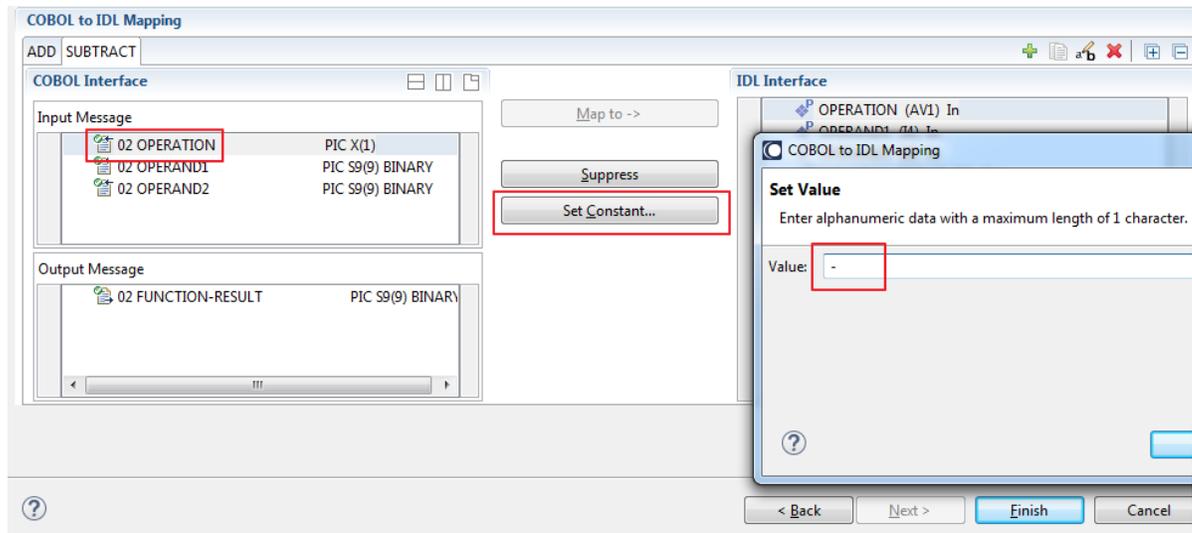
- 1 Select the tab with COBOL to IDL Mapping. For each function, define a separate IDL interface with the toolbar functions or :



2 Give the IDL interfaces meaningful names with the toolbar function :



3 Define the required constant values to the *function-code* or *operation-code* parameter, see *Set COBOL Data Items to Constants* above:



For the delivered Example 1: COBOL Server with Multiple Functions:

- First, for step 1 above: Extract and define 3 separate IDL programs ADD, SUBTRACT, MULTIPLY.
- Second, for step 2 above: Rename them to suitable names, e.g. 'ADD', 'SUBTRACT', 'MULTIPLY'.
- Third, for step 3 above: Define the constants '+', '-' and '\*' to the parameter OPERATION respectively.
- After pressing **Finish**, the following IDL together with a server mapping file is created. See *Server Mapping Files for COBOL*.

```

library 'EXAMPLE' is

program 'ADD' is
define data parameter
  1 OPERAND1 (I4) In
  1 OPERAND2 (I4) In
  1 FUNCTION-RESULT (I4) Out
end-define

program 'SUBTRACT' is
define data parameter
  1 OPERAND1 (I4) In
  1 OPERAND2 (I4) In
  1 FUNCTION-RESULT (I4) Out
end-define

program 'MULTIPLY' is
define data parameter
  1 OPERAND1 (I4) In
  1 OPERAND2 (I4) In
  1 FUNCTION-RESULT (I4) Out
end-define

```

**Notes:**

1. The following functions are offered to create further mappings from the COBOL interface, resulting in multiple IDL interfaces (IDL programs).

Icon	Function	Description
	Create IDL Interface	Creates a new IDL interface based on the current COBOL interface. All IDL parameters are of IDL direction InOut; no IDL parameters are set to constant; for COBOL REDEFINE, the first REDEFINE path is mapped to IDL; FILLERs are suppressed according to your selection, see <a href="#">Step 4: Define the Extraction Settings and Start Extraction</a> .
	Copy current IDL Interface	Creates a duplicate of current IDL interface. All modifications such as IDL directions, suppress, selection of REDEFINE paths etc. are kept.
	Rename current IDL Interface	The default name for the IDL interface is based on the COBOL program name plus appended number. With this function you can give the IDL interface a suitable name.
	Remove current IDL Interface	Deletes the current IDL interface.

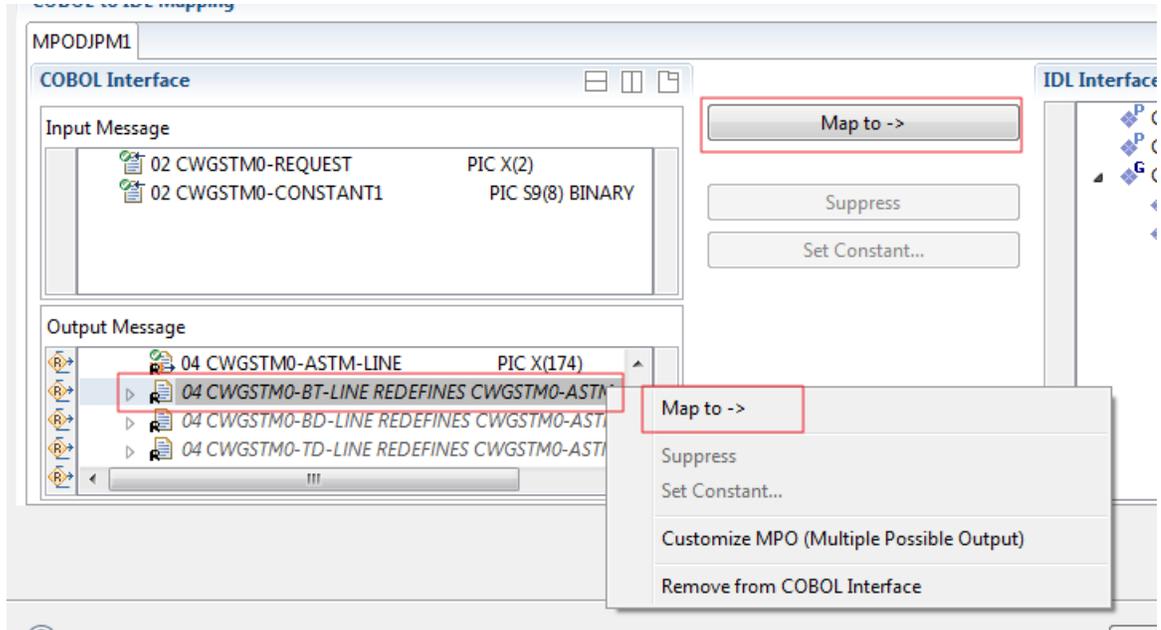
2. With the steps 1 thru 3 described here you can emulate the behavior of function Map to Operation of EntireX version 9.6 and earlier.

**Select REDEFINE Paths**

For COBOL server programs containing COBOL REDEFINES, the correct REDEFINE path needs to be chosen for the IDL interface.

**> To select redefine paths**

- Use the **Map to** function available in the context menu of the COBOL interface and as mapping button to make the COBOL REDEFINE path available in the IDL interface.



Begin with the COBOL REDEFINE defined at the highest level first. Work through all inner COBOL REDEFINE data items, going from higher levels to lower levels.

#### Notes:

1. Only one REDEFINE path of a COBOL REDEFINE can be mapped to the IDL interface. All COBOL REDEFINE siblings are suppressed.
2. If a REDEFINE path is actively mapped to the IDL interface, all COBOL REDEFINE siblings are suppressed.
3. You can suppress all REDEFINE paths of a COBOL REDEFINE. Simply suppress the active REDEFINE path, see *Suppress Unneeded COBOL Data Items* above.

### Suppress Unneeded COBOL Data Items

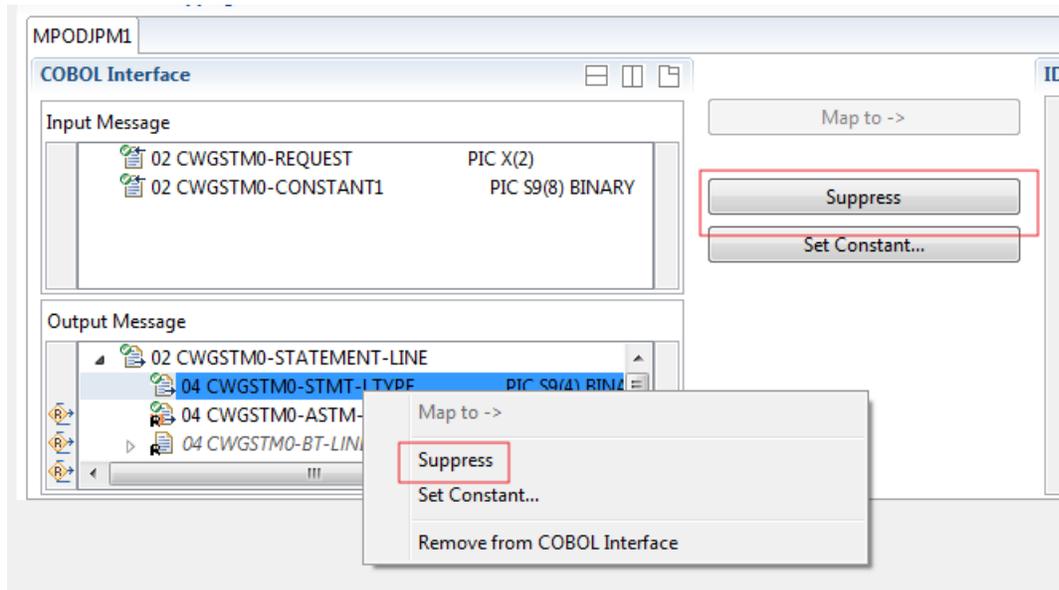
COBOL data items without any relevant information can be made invisible in the IDL interface. The IDL interface is simplified - it becomes shorter and tidier. This is useful, for example

- for FILLER data items
- if the RPC client or Adapter Service does not need an Out parameter
- if the RPC server or Adapter Service does not need an In parameter and a low value can be provided

If you are using an RPC server such as the z/OS (CICS | Batch), z/VSE (CICS | Batch), Micro Focus or BS2000/OSD RPC server, the amount of data to be transferred to/from the RPC client is also reduced.

➤ To suppress unneeded COBOL data items

- Use the **Suppress** function available in the context menu of the COBOL interface and as mapping button to make the COBOL data item invisible in the IDL interface:



**Notes:**

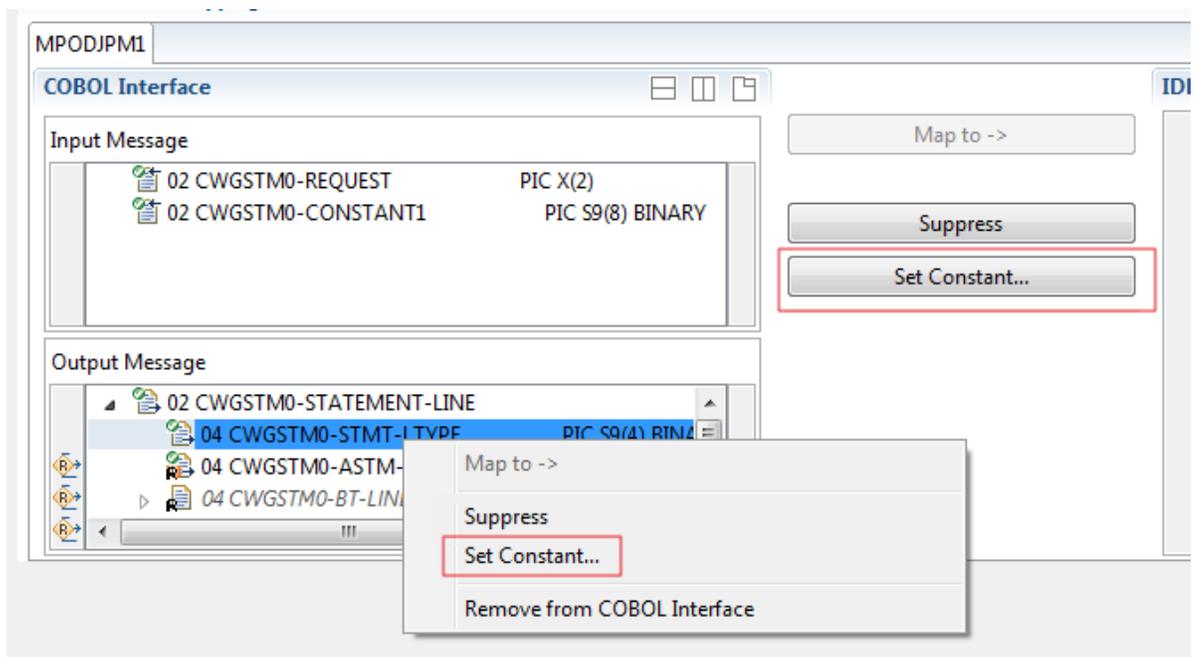
1. The COBOL data item is not part of the IDL interface. It is invisible for RPC clients or Adapter Service.
2. The RPC server or Adapter Service provides the COBOL data item to your COBOL server with low value, managing the offset to the next COBOL data item.
3. If a COBOL group is suppressed, all subordinate COBOL data items are suppressed as well.
4. With the inverse function **Map to** (see above) available in the context menu of the COBOL interface and as a mapping button, a COBOL data item can be made visible in the IDL interface again.

## Set COBOL Data Items to Constants

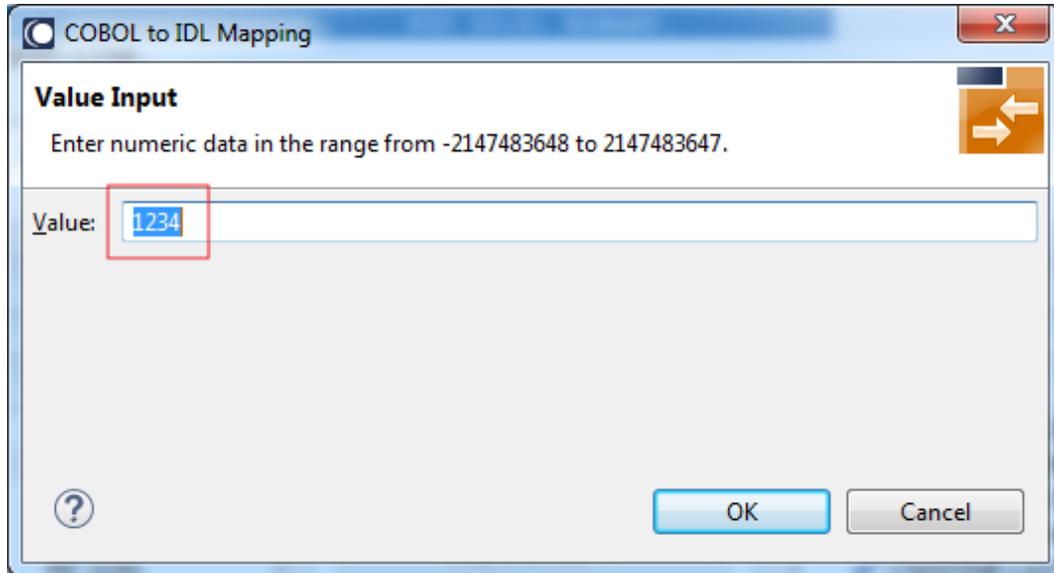
COBOL data items that always require fixed constant values on input to the COBOL server program can be made invisible in the IDL interface and initialized with the required constant values. This is useful for keeping the IDL interface short and tidy. RPC clients or Adapter Services are not bothered with IDL parameters that always contain constants, such as `RECORD-TYPES`. This function is often used in conjunction with **Map to Multiple IDL Interfaces** (see above).

### › To set COBOL data items to constants

- 1 Use the **Set Constant** function available in the context menu of the COBOL interface and as mapping button to define a constant value for a COBOL data item:



- 2 You are prompted with a window to enter the constant value:



**Notes:**

1. The COBOL data item is not part of the IDL interface. It is invisible for RPC clients or Adapter Services.
2. The RPC server or Adapter Service provides the defined constant in the COBOL data item to your COBOL server.
3. With the function **Map to** (see above) available in the context menu of the COBOL interface and as a mapping button, a COBOL data item can be made visible in the IDL interface again.

**Set Multiple Possible Output (MPO) Structures**

A COBOL server program produces more than one type of output. The layout of the output can therefore take two or more dissimilar shapes. The COBOL server program decides at runtime the output structure returned, that is, the COBOL layout on output varies.

- [Multiple Possible Output with REDEFINES](#)
- [Optional Output with Groups](#)
- [MPO Terminology](#)

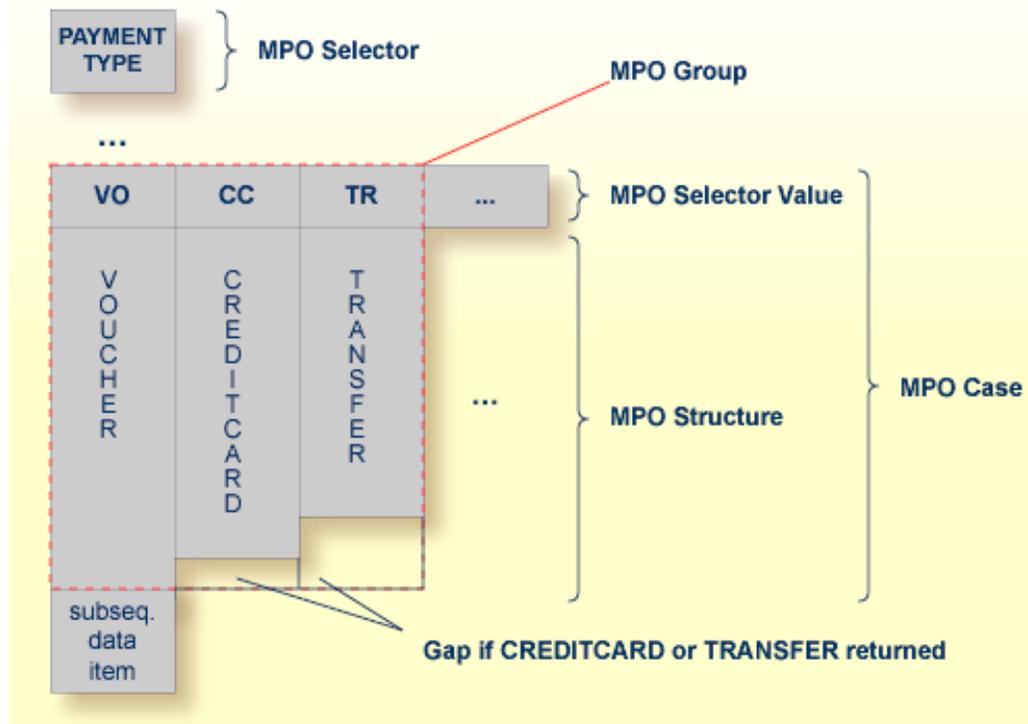
- Steps

### Multiple Possible Output with REDEFINES

As illustrated in *Example 5: COBOL Server Using Multiple Possible Output (MPO)*, a COBOL *REDEFINES Clause* is often used to describe the possible output structures. In COBOL this is the standard way to describe multiple possible output.

In addition, the COBOL interface

- limits the number of possible output structures returned
- defines all possible output structures, that is, they are known during extraction. In the example these are the structures `PAYMENT-DATA-VOUCHER`, `PAYMENT-DATA-CREDITCARD` and `PAYMENT-DATA-TRANSFER`. These are the MPO structures.
- contains an additional COBOL data item carrying a value related to the returned output structure. By inspecting this data item first, the appropriate output structure can be selected to address the data correctly. In the example it is `PAYMENT-TYPE`. This item is the MPO selector.
- always occupies memory to be able to transfer the longest output structure. If the actual returned output structure is shorter than the longest possible output structure, there is a gap (space) between the multiple possible output and the subsequent data item.



This abstract concept is known as *multiple possible output* (MPO) EntireX bundles all MPO structures into an MPO group. See *MPO Terminology* below.

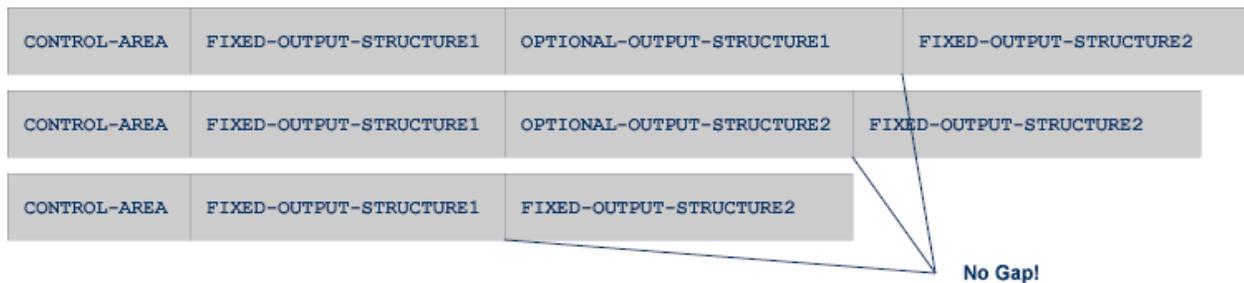
### Optional Output with Groups

As illustrated in *Example 6: COBOL Server Using Optional Output*, COBOL group data items can be used to describe optional output structures. See *Optional COBOL Group Data Items*. Optional output with group data items are a variant of multiple possible output (MPO).

In addition, the COBOL interface

- limits the number of possible output structures returned
- defines all optional output structures, that is, they are known during extraction. In the example these are the structures `OPTIONAL-OUTPUT-STRUCTURE1` and `OPTIONAL-OUTPUT-STRUCTURE2`. These are the MPO structures.
- contains an additional COBOL data item carrying an indication if the optional output is present. By inspecting this data item first, the appropriate optional output structure can be selected to address the data correctly. If its value does not match, the optional output is not present. In the example it is `OPTIONAL-OUTPUT`. This item is the MPO selector.
- If the optional output is not present no memory is occupied. There is no gap between the optional output and the subsequent data item, as opposed to *Multiple Possible Output with REDEFINES* above.

In the example there are three different shapes of output:



### MPO Terminology

The following terminology is used with MPOs:

#### MPO structure

A COBOL group describing the output layout used in an MPO case. All alternative layouts in an MPO group are often described with COBOL `REDEFINES`. An MPO structure can also contain other MPO groups.

**MPO group**

Bundles together all MPO structures that can be used alternatively. A COBOL interface can contain more than one MPO group.

**MPO case**

An MPO structure together with its MPO selector values (one or more).

**MPO selector**

A COBOL data item containing a specific value (MPO selector value) where the actual MPO case can be determined. The MPO selector precedes the MPO group and is located outside the MPO group.

**MPO selector value**

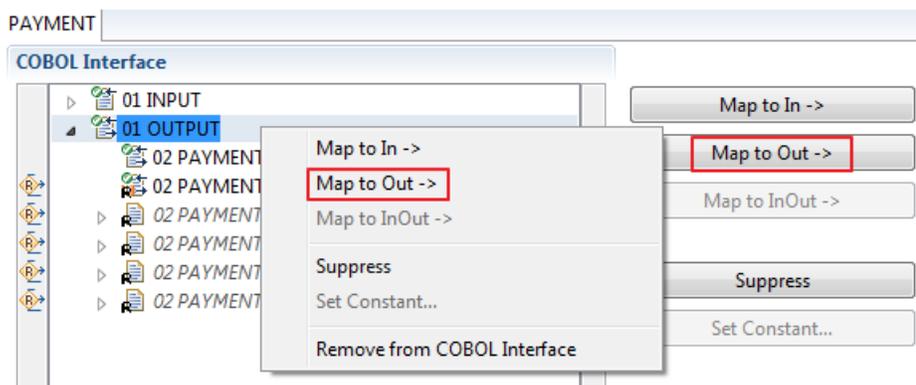
Each value indicates exactly one output structure. An output structure can be indicated by further values.

**Steps**

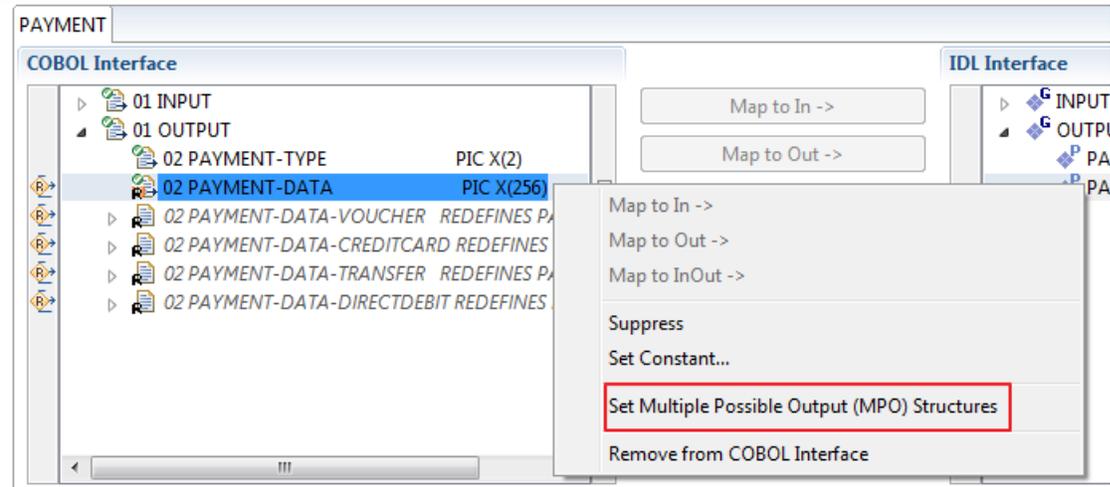
➤ **To set multiple possible output (MPO) structures**

Use the **Set Multiple Possible Output (MPO) Structures** function available in the context menu of the COBOL interface to create new or modify existing MPO groups.

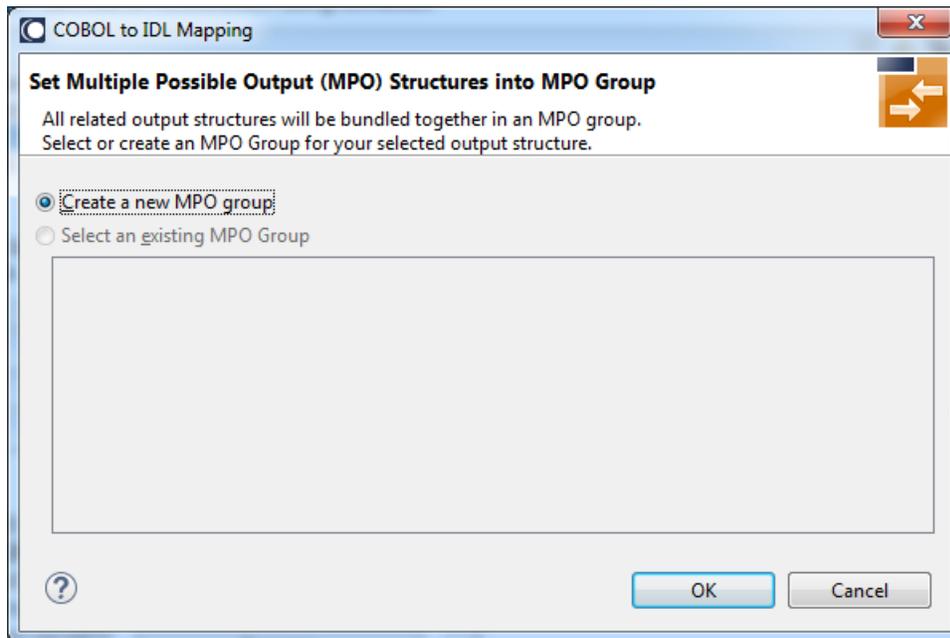
- 1 Set the top-level COBOL data item where the MPO structures are contained to IDL direction Out. Use the **Map to Out** function for this purpose:



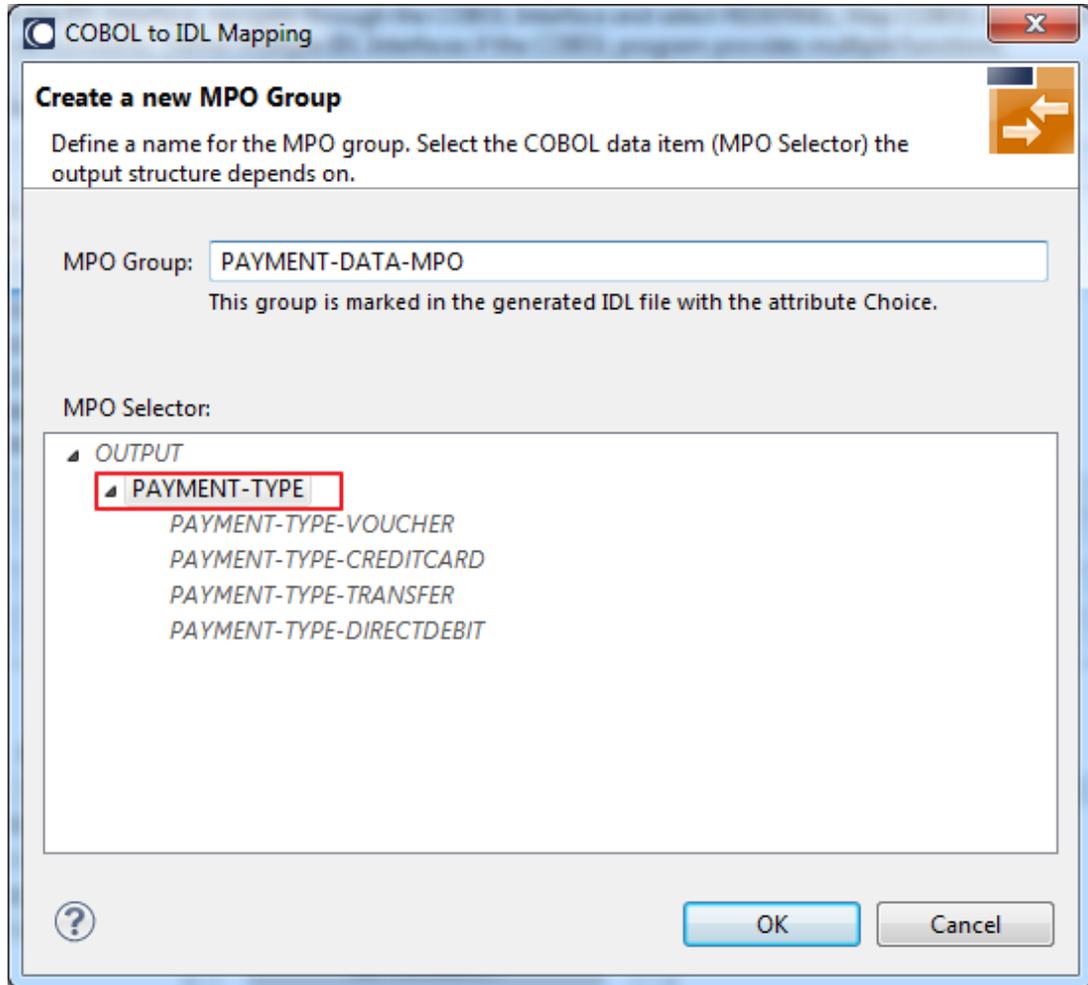
- 2 From the context menu of the COBOL interface of the COBOL REDEFINE, choose **Set Multiple Possible Output (MPO) Structures**.



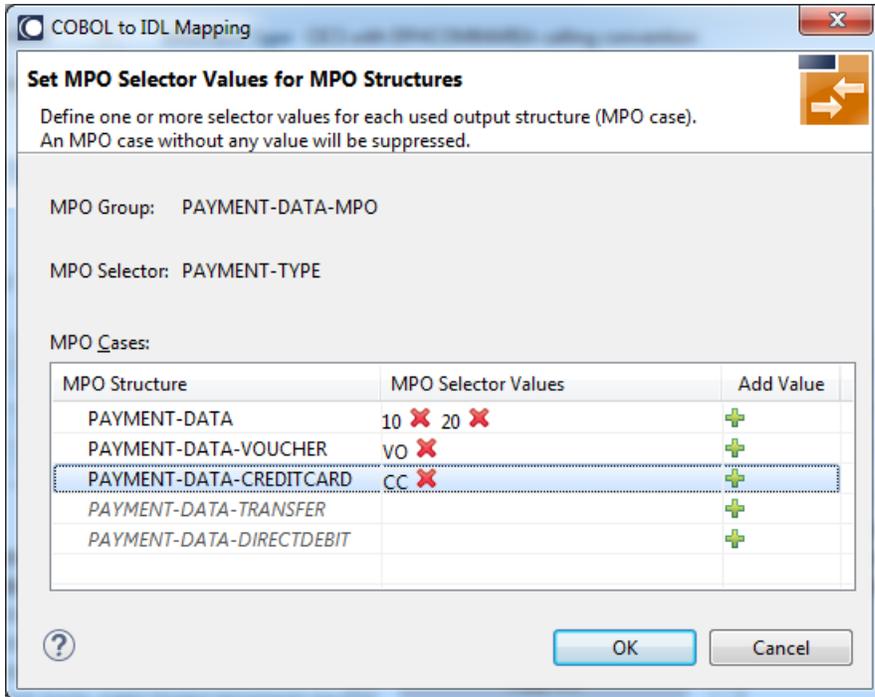
3 Set Multiple Possible Output (MPO) Structures into MPO Group.



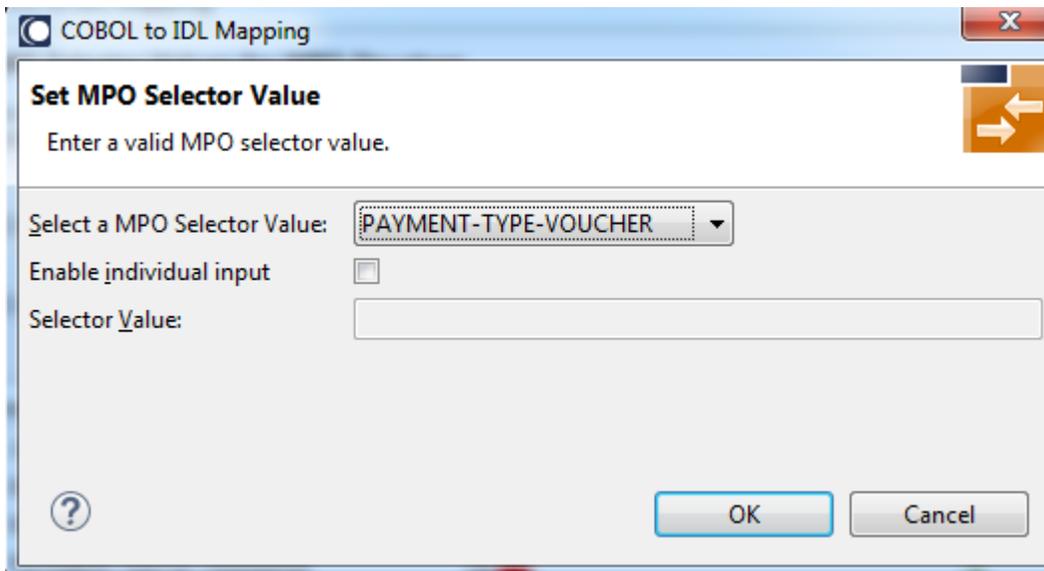
4 Create a new MPO group.



- 5 Set MPO selector values for MPO Structures.



Use the functions ✘ to delete and + to add MPO selector values:



**Notes:**

1. To add multiple MPO selector values per MPO structure, use the function + multiple times for the same MPO structure (see value 10 and 20 for structure PAYMENT-DATA).
2. MPO structures without any MPO selector are unused and suppressed in the IDL interface value (e.g. see structure PAYMENT-DATA-TRANSFER).

3. Each MPO selector value must uniquely identify an MPO structure. The same value cannot be used more than once for different MPO structures.
4. If no defined MPO selector value matches during runtime, an empty MPO group is delivered to the RPC client, that is, none of the MPO cases contain any data. No runtime error is produced.
- 6 For the delivered example *COBOL Server Using Multiple Possible Output (MPO)* (see below): After pressing **Finish**, the following IDL together with a server mapping file is created. See *Server Mapping Files for COBOL*.

```
library 'PAYMENT' is

program 'PAYMENT' is
  define data parameter
    1 INPUT          In
      2 ORDER-NUMBER      (NU10)
    1 OUTPUT         Out
      2 PAYMENT-TYPE      (A2)
      2 PAYMENT-DATA-MPO Choice
        3 PAYMENT-DATA    (/V1)
        4 PAYMENT-DATA    (AV256)
        3 PAYMENT-DATA-VOUCHER (/V1)
        4 VOUCHER-ORIGIN  (AV128)
        4 VOUCHER-SERIES  (AV128)
        3 PAYMENT-DATA-CREDITCARD (/V1)
        4 CREDITCARD-NUMBER (NU18)
        4 CREDITCARD-CODE  (NU12)
        4 CREDITCARD-VALIDITY (AV8)
  end-define
```

## Programming Techniques

- [Example 1: COBOL Server with Multiple Functions](#)
- [Example 2: Redefines](#)
- [Example 3: Buffer Technique](#)
- [Example 4: COBOL SET ADDRESS Statements](#)
- [Example 5: COBOL Server Using Multiple Possible Output \(MPO\)](#)
- [Example 6: COBOL Server Using Optional Output](#)

### Example 1: COBOL Server with Multiple Functions

Assume a COBOL server program has a FUNCTION or OPERATION code COBOL data item in its COBOL interface. The COBOL server program behaves differently depending on field values of this data item. See the following example where a COBOL programs implements a calculator with the functions ADD, SUBTRACT, MULTIPLY, etc. The execution of the different functions is controlled by the COBOL data item OPERATION:

```

. . .
01 OPERATION                PIC X(1).
01 OPERAND1                 PIC S9(9) BINARY.
01 OPERAND2                 PIC S9(9) BINARY.
01 FUNCTION-RESULT         PIC S9(9) BINARY.
. . .
MOVE 0 TO FUNCTION-RESULT.
EVALUATE OPERATION
  WHEN "+"
    ADD OPERAND1 OPERAND2
    GIVING FUNCTION-RESULT
  WHEN "-"
    SUBTRACT OPERAND2 FROM OPERAND1
    GIVING FUNCTION-RESULT
  WHEN "*"
    MULTIPLY OPERAND1 BY OPERAND2
    GIVING FUNCTION-RESULT
  WHEN . . .

END-EVALUATE.
. . .

```

You can expose each COBOL server program function separately. The advantages or reasons for wanting this depend on the target endpoint. For example:

- **Web Service**

Instead having a Web service with a single operation, you want a web service with multiple operations, one operation for each COBOL function.

- **Java or .NET**

Instead having a class with a single method, you want a class with multiple methods, one method for each COBOL function.

- etc.

To do this you need to extract the COBOL server program as described under [Map to Multiple IDL Interfaces](#).

### Example 2: Redefines

The output data is described with a REDEFINE that overlays the input data as in the following example. In this case you need to select IN-BUFFER for the input message and OUT-BUFFER for the output message of the COBOL interface. This technique is often used to allow full 32K input and full 32K completely different output, thus circumventing CICS 32K restrictions somewhat.

```
LINKAGE SECTION.
01 DFHCOMMAREA.

02 IN-BUFFER.
   03 OPERATION                PIC X(1).
   03 OPERAND-1                PIC S9(9) BINARY.
   03 OPERAND-2                PIC S9(9) BINARY.
02 OUT-BUFFER REDEFINES IN-BUFFER.
   03 FUNCTION-RESULT          PIC S9(9) BINARY.
. . .
PROCEDURE DIVISION USING DFHCOMMAREA.
* process the IN-BUFFER and provide result in OUT-BUFFER
EXEC CICS RETURN.
```

REDEFINES can also be used to describe a single buffer used for input and output, that is, the CICS input message is the same as the CICS output message. For more information see [Example 2: Redefines](#) in the section *CICS with DFHCOMMAREA Calling Convention - In same as Out*.

### Example 3: Buffer Technique

On entry, the server moves linkage section field(s) - often an entire buffer - into the working storage and processes the input data inside the working storage field(s). Before return, it moves the working storage field(s) - often an entire buffer - back to the linkage section. In this case, the relevant COBOL data items are described within the working storage section. You need to select IN-BUFFER for the input message and OUT-BUFFER for the output message of the COBOL interface. This technique can be used to allow full 32K input and full 32K completely different output, thus circumventing CICS 32K restrictions somewhat.

```

WORKING STORAGE SECTION
01 IN-BUFFER.
   02 OPERATION                PIC X(1).
   02 OPERAND-1                PIC S9(9) BINARY.
   02 OPERAND-2                PIC S9(9) BINARY.
01 OUT-BUFFER.
   02 FUNCTION-RESULT          PIC S9(9) BINARY.
LINKAGE SECTION
01 DFHCOMMAREA.
   02 IO-BUFFER                PIC X(9).
. . .
PROCEDURE DIVISION USING DFHCOMMAREA.
  MOVE IO-BUFFER TO IN-BUFFER.
* process the IN-BUFFER and provide result in OUT-BUFFER
  MOVE OUT-BUFFER TO IO-BUFFER.
  EXEC CICS RETURN.

```

The buffer technique can also be used to describe a single buffer used for input and output, that is, the CICS input message is the same as the CICS output message. For more information see [Example 3: Buffer Technique](#) in the section *CICS with DFHCOMMAREA Calling Convention - In same as Out*.

#### Example 4: COBOL SET ADDRESS Statements

COBOL SET ADDRESS statements are used to manipulate the interface of the CICS server. On entry, the server addresses the input data with a (dummy) structure IN-BUFFER defined in the linkage section. Upon return, the server addresses the output data again with a different (dummy) structure OUT-BUFFER defined in the linkage section. You need to select IN-BUFFER for the input message and OUT-BUFFER for the output message of the COBOL interface. This technique can be used to allow full 32K input and full 32K completely different output, thus circumventing CICS 32K restrictions somewhat.

```

LINKAGE SECTION.
01 IN-BUFFER.
   02 OPERATION                PIC X(1).
   02 OPERAND-1                PIC S9(9) BINARY.
   02 OPERAND-2                PIC S9(9) BINARY.
01 OUT-BUFFER.
   02 FUNCTION-RESULT          PIC S9(9) BINARY.
. . .
PROCEDURE DIVISION.
  SET ADDRESS OF IN-BUFFER TO DFHCOMMAREA.
* process the IN-BUFFER and provide result in OUT-BUFFER
  SET ADDRESS OF OUT-BUFFER TO DFHCOMMAREA.
  EXEC CICS RETURN.

```

COBOL SET ADDRESS statements can also be used to describe a single buffer used for input and output, that is, the CICS input message is the same as the CICS output message. For more information see [Example 4: COBOL SET ADDRESS Statements](#) in the section *CICS with DFHCOMMAREA Calling Convention - In same as Out*.

**Example 5: COBOL Server Using Multiple Possible Output (MPO)**

A COBOL REDEFINE can be used in a COBOL server program to return multiple possible output (MPO) structures, similar to COBOL data item PAYMENT-DATA in the example below; for this purpose, PAYMENT-DATA is redefined; each redefinition represents an output structure (MPO case); on return exactly one output structure is used; by inspecting COBOL data item PAYMENT-TYPE (MPO selector) first, a caller can determine the returned output structure; the caller then uses the correct redefinition to access the data.

```

. . .
01 INPUT-DATA.
   02 ORDER-NUMBER                               PIC 9(10).

. . .
01 OUTPUT-DATA.
   02 <some fields>                               PIC <clause>.
   . . .

   02 PAYMENT-TYPE                               PIC X(2).
      88 PAYMENT-TYPE-VOUCHER                     VALUE "V0".
      88 PAYMENT-TYPE-CREDITCARD                  VALUE "CC".
      88 PAYMENT-TYPE-TRANSFER                    VALUE "TR".
      88 PAYMENT-TYPE-DIRECTDEBIT                 VALUE "DB".
   . . .
   02 <preceding data items>                       PIC <clause>.
. . .
   02 PAYMENT-DATA                               PIC X(256).
   02 PAYMENT-DATA-VOUCHER                       REDEFINES PAYMENT-DATA.
      04 VOUCHER-ORIGIN                           PIC X(128).
      04 VOUCHER-SERIES                           PIC X(128).
   02 PAYMENT-DATA-CREDITCARD                     REDEFINES PAYMENT-DATA.
      04 CREDITCARD-NUMBER                         PIC 9(18).
      04 CREDITCARD-COMPANY                        PIC X(128).
      04 CREDITCARD-CODE                           PIC 9(12).
      04 CREDITCARD-VALIDITY                       PIC X(8).
   02 PAYMENT-DATA-TRANSFER                       REDEFINES PAYMENT-DATA.
      04 TRANSFER-NAME                             PIC X(128).
      04 TRANSFER-IBAN                             PIC X(34).
      04 TRANSFER-BIC                              PIC X(11).
   02 PAYMENT-DATA-DIRECTDEBIT                   REDEFINES PAYMENT-DATA.
      04 DIRECTDEBIT-IBAN                         PIC X(34).
      04 DIRECTDEBIT-NAME                          PIC X(128).
      04 DIRECTDEBIT-EXPIRES                       PIC 9(8).
   . . .
   02 <subsequent data items>                     PIC <clause>.
. . .

. . .
* read order record using ORDER-NUMBER
. . .

```

```

*  set value indicating type of reply (MPO selector)
  IF <some-condition> THEN
    SET PAYMENT-TYPE-VOUCHER TO TRUE
  ELSE IF <some-other-condition> THEN
    SET PAYMENT-TYPE-CREDITCARD TO TRUE
  ELSE IF <some-further-condition> THEN
    SET PAYMENT-TYPE-TRANSFER TO TRUE
  ELSE
    SET PAYMENT-TYPE-DIRECTDEBIT TO TRUE
  END-IF.
. . .

*  set fields (MPO case) depending on type of reply
  INITIALIZE PAYMENT-DATA.
  EVALUATE TRUE
    WHEN PAYMENT-TYPE-VOUCHER
      MOVE . . . TO VOUCHER-ORIGIN
      MOVE . . . TO VOUCHER-SERIES
    WHEN PAYMENT-TYPE-CREDITCARD
      MOVE . . . TO CREDITCARD-NUMBER
      MOVE . . . TO CREDITCARD-CODE
      MOVE . . . TO CREDITCARD-VALIDITY
    WHEN PAYMENT-TYPE-TRANSFER
      MOVE . . . TO TRANSFER-NAME
      MOVE . . . TO TRANSFER-IBAN
      MOVE . . . TO TRANSFER-BIC
    WHEN PAYMENT-TYPE-DIRECTDEBIT
      MOVE . . . TO DIRECTDEBIT-IBAN
      MOVE . . . TO DIRECTDEBIT-NAME
      MOVE . . . TO DIRECTDEBIT-EXPIRES
    WHEN
      . . .
  END-EVALUATE.
. . .

```

COBOL server programs using alternative and dissimilar shapes for the output layout are extracted as described under [Set Multiple Possible Output \(MPO\) Structures](#).

### Example 6: COBOL Server Using Optional Output

COBOL group data items can be used in a COBOL server program to return optional output similar to the example below; the returned data is built by copying the necessary COBOL structures into an output area. The optional output is one of OPTIONAL-OUTPUT-STRUCTURE1, OPTIONAL-OUTPUT-STRUCTURE2 or nothing. The presence of the optional output is controlled by a structure named CONTROL-AREA. Optional output with group data items are a variant of MPO, see [Example 5: COBOL Server Using Multiple Possible Output \(MPO\)](#).

```

WORKING-STORAGE SECTION.

01 INPUT-AREA.
  02 FIX-INPUT-ITEM1          PIC X(4).
  02 <some fields>          PIC <clause>.
  . . .

01 OUTPUT-OFFSET            PIC S9(9) BINARY.
01 OUTPUT-AREA              PIC X(32000).
  . . .

01 CONTROL-AREA.
  02 OPTIONAL-OUTPUT          PIC X(1).
    88 OPTIONAL-OUTPUT-1      VALUE "1".
    88 OPTIONAL-OUTPUT-2      VALUE "2".
    88 OPTIONAL-OUTPUT-NONE    VALUE "N".
  . . .

01 OPTIONAL-OUTPUT-STRUCTURE1.
  02 OPTIONAL-OUTPUT-ITEM11    PIC X(10).
  02 OPTIONAL-OUTPUT-ITEM12    PIC X(100).
  02 OPTIONAL-OUTPUT-ITEM13    PIC X(20).
  . . .

01 OPTIONAL-OUTPUT-STRUCTURE2.
  02 OPTIONAL-OUTPUT-ITEM21    PIC X(4).
  02 OPTIONAL-OUTPUT-ITEM22    PIC X(50).
  02 OPTIONAL-OUTPUT-ITEM23    PIC X(50).
  . . .

01 FIX-OUTPUT-STRUCTURE1.
  02 FIX-OUTPUT-ITEM11         PIC X(4).
  02 FIX-OUTPUT-ITEM12         PIC X(20).
  02 FIX-OUTPUT-ITEM13         PIC X(8).
  . . .

01 FIX-OUTPUT-STRUCTURE2.
  02 FIX-OUTPUT-ITEM21         PIC X(2).
  02 FIX-OUTPUT-ITEM22         PIC X(10).
  02 FIX-OUTPUT-ITEM23         PIC X(10).
  . . .

IF <some-condition> THEN
  SET OPTIONAL-OUTPUT-1 TO TRUE
ELSE IF <some-other-condition> THEN
  SET OPTIONAL-OUTPUT-2 TO TRUE
ELSE
  SET OPTIONAL-OUTPUT-NONE TO TRUE
END-IF.

. . .

```

```
*      provide control area for optional output
MOVE 1 TO OUTPUT-OFFSET.
STRING CONTROL-AREA DELIMITED BY SIZE
INTO OUTPUT-AREA WITH POINTER OUTPUT-OFFSET.

*      provide data items before optional output
STRING FIX CONTROL-AREA DELIMITED BY SIZE
INTO OUTPUT-AREA WITH POINTER OUTPUT-OFFSET.

*      provide optional output
EVALUATE TRUE
    WHEN OPTIONAL-OUTPUT-1
        STRING OPTIONAL-OUTPUT-STRUCTURE1 DELIMITED BY SIZE
        INTO OUTPUT-AREA WITH POINTER OUTPUT-OFFSET
    WHEN OPTIONAL-OUTPUT-2
        STRING OPTIONAL-OUTPUT-STRUCTURE2 DELIMITED BY SIZE
        INTO OUTPUT-AREA WITH POINTER OUTPUT-OFFSET
END-EVALUATE.

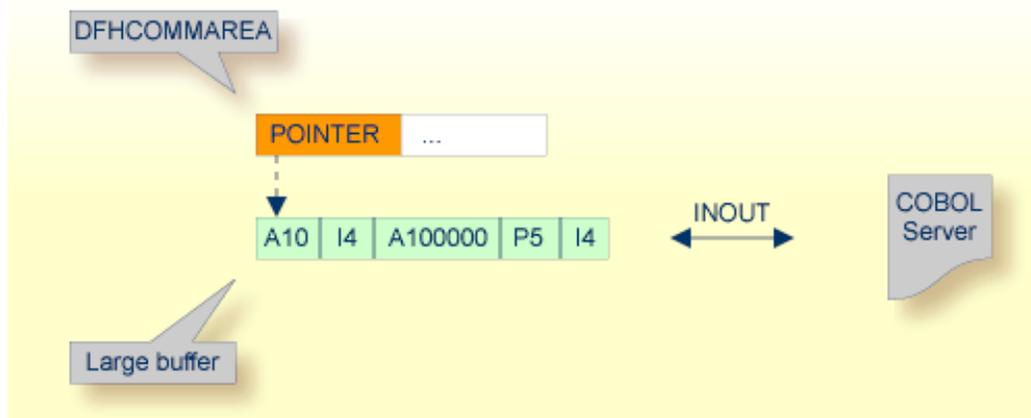
*      provide data items after optional output
STRING FIX-OUTPUT-STRUCTURE2 DELIMITED BY SIZE
INTO OUTPUT-AREA WITH POINTER OUTPUT-OFFSET.
. . .
```

COBOL server programs using optional shapes for the output layout are extracted as described under [Set Multiple Possible Output \(MPO\) Structures](#).

# 8 CICS with DFHCOMMAREA Large Buffer Interface - In same as Out

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▪ Introduction .....	130
▪ Extracting from a CICS DFHCOMMAREA Large Buffer Program .....	131
▪ Mapping Editor User Interface .....	132
▪ Mapping Editor IDL Interface Mapping Functions .....	139
▪ Programming Techniques .....	156



## Introduction

A DFHCOMMAREA Large Buffer Interface has the structure given below in the linkage section. The field subordinated under DFHCOMMAREA prefixed with WM-LCB describe this structure. The field names themselves can be different, but the COBOL data types (usage clauses) must match exactly.

```
LINKAGE SECTION.

01 DFHCOMMAREA.
   10 WM-LCB-MARKER                PIC X(4).
   10 WM-LCB-INPUT-BUFFER          POINTER.
   10 WM-LCB-INPUT-BUFFER-SIZE    PIC S9(8) BINARY.
   10 WM-LCB-OUTPUT-BUFFER        POINTER.
   10 WM-LCB-OUTPUT-BUFFER-SIZE   PIC S9(8) BINARY.
   10 WM-LCB-FLAGS                PIC X(1).
   88 WM-LCB-FREE-OUTPUT-BUFFER   VALUE 'F'.
   10 WM-LCB-RESERVED              PIC X(3).
01 INOUT-BUFFER.
   02 OPERATION                    PIC X(1).
   02 OPERAND-1                   PIC S9(9) BINARY.
   02 OPERAND-2                   PIC S9(9) BINARY.
   02 FUNCTION-RESULT              PIC S9(9) BINARY.
. . .
PROCEDURE DIVISION USING DFHCOMMAREA.
. . .
  SET ADDRESS OF INOUT-BUFFER TO WM-LCB-INPUT-BUFFER.
* process the INOUT-BUFFER and provide result
  EXEC CICS RETURN.
```

If you have selected an IDL file and opened the COBOL Mapping Editor with an existing COBOL to IDL mapping, continue with [Mapping Editor User Interface](#).

## Extracting from a CICS DFHCOMMAREA Large Buffer Program

This section assumes **Input Message same as Output Message** is checked. COBOL output and COBOL input parameters are the same, that is, WM-LCB-OUTPUT-BUFFER is set to the same address as WM-LCB-INPUT-BUFFER (as in the DFHCOMMAREA large buffer example above).

If you are extracting IDL from a COBOL source or extending the IDL file by extracting an additional COBOL source with interface type CICS with DFHCOMMAREA large buffer interface, the **Extractor Settings** dialog appears (see also [Step 4: Define the Extraction Settings and Start Extraction](#)).

Make sure the interface type is correct.

The screenshot shows a dialog box titled "COBOL Source". It contains the following fields and options:

- File Name:** LargeBuf
- Operating System:** z/OS
- Interface Type:** CICS with DFHCOMMAREA large buffer interface (selected from a dropdown menu)
- Input Message same as Output Message**

Press **Next** to open the COBOL Mapping Editor.

### ➤ To select the COBOL interface data items of your COBOL server

- 1 Add the COBOL data items of the large buffer to **COBOL Interface** by using the context menu or toolbar available in the [COBOL Source View](#) and [COBOL Interface](#). To do this, locate in the PROCEDURE DIVISION the SET ADDRESS OF <x> TO WM-LCB-INPUT-BUFFER statement and the SET ADDRESS OF <y> TO WM-LCB-OUTPUT-BUFFER statement. The COBOL data items <x> and <y> are identical, and this is the large buffer you are looking for. See [Notes](#).
- 2 Continue with [COBOL to IDL Mapping](#).



#### Notes:

1. Do not select the pointers in the DFHCOMMAREA pointing to the large buffers, in the example above, WM-LCB-INPUT-BUFFER and WM-LCB-OUTPUT-BUFFER.
2. It is very important to select the right COBOL data items describing the interface of the COBOL server correctly. This means the COBOL data items used as parameters must match in number and in sequence of formats (COBOL usage clause).
3. If your COBOL server contain REDEFINES, the first REDEFINE path is offered by default. Check manually whether this is the one you want. If not, correct it. You can select any other REDEFINE path.

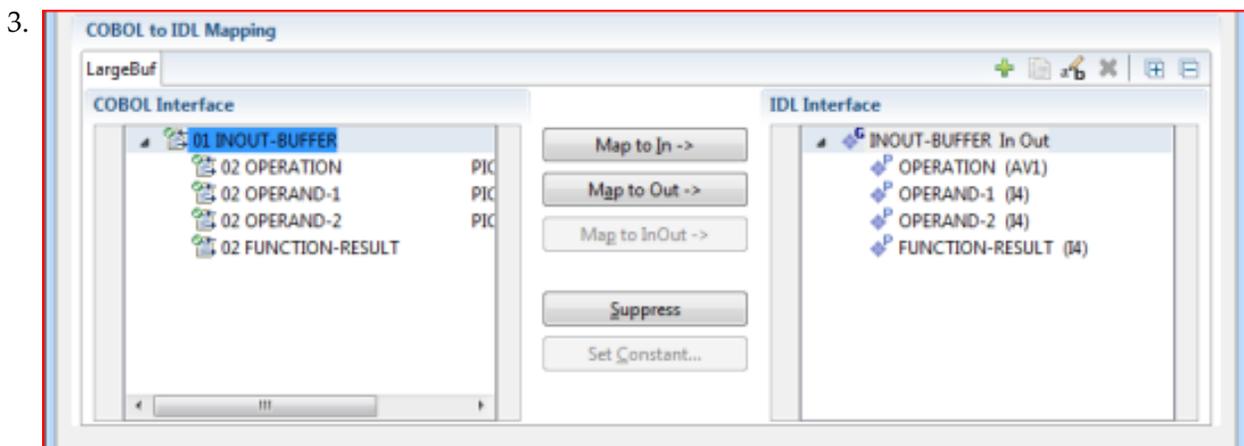
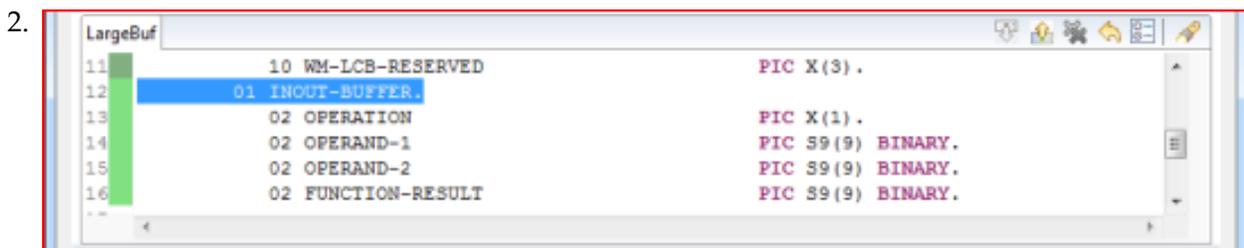
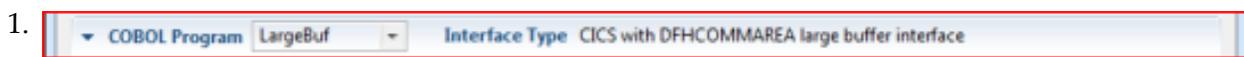
The user interface of the COBOL Mapping Editor is described below.

## Mapping Editor User Interface

This section assumes you have set the extraction settings as described above. The following areas of the COBOL Mapping Editor user interface are described here:

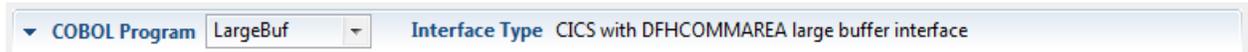
- [COBOL Program Selection](#)
- [COBOL Source View](#)
- [COBOL to IDL Mapping](#)

For COBOL interface type CICS with DFHCOMMAREA large buffer interface, the user interface of the COBOL Mapping Editor looks like this:



1. **COBOL Program Selection.** Currently selected program with interface type
2. **COBOL Source View.** Contains all related sources for the currently selected COBOL program
3. **COBOL to IDL Mapping.** Tree view of your selected COBOL data items and mapping buttons with which you can map these items to your IDL interface

## COBOL Program Selection



The COBOL Program Selection displays the current selected COBOL program with its interface type. If you have extracted more than one COBOL program within the associated IDL file, you can switch to another COBOL program with its mapping by selecting the name in the combo box.

## COBOL Source View

```

LargeBuf
11 10 WM-LCB-RESERVED          PIC X(3) .
12 01 INOUT-BUFFER.
13 02 OPERATION              PIC X(1) .
14 02 OPERAND-1              PIC S9(9) BINARY .
15 02 OPERAND-2              PIC S9(9) BINARY .
16 02 FUNCTION-RESULT        PIC S9(9) BINARY .
--

```

All COBOL data items contained in the LINKAGE and WORKING-STORAGE SECTION are offered in a text view. The text view contains all related sources (including copybooks) for the currently selected COBOL program. It is used for selecting data items and retrieving information from the original COBOL sources. The light green bar indicates that the data item is already contained in the COBOL Interface; a dark green bar indicates the data item is selectable and can be added to the COBOL Interface. This section can be collapsed. If you open the Editor with **Modify Interface** it is collapsed by default. The toolbar provides the following actions:

-  Add selected COBOL data item to COBOL Interface.
-  Remove selected COBOL data item from COBOL Interface.
-  Remove all COBOL data items from COBOL Interface.
-  Reset COBOL Interface to initial state.
-  Show dialog to modify COBOL Source Characteristics.
-  Show dialog to find text in Source.

The same functionality is also available from the context menu.

## COBOL to IDL Mapping

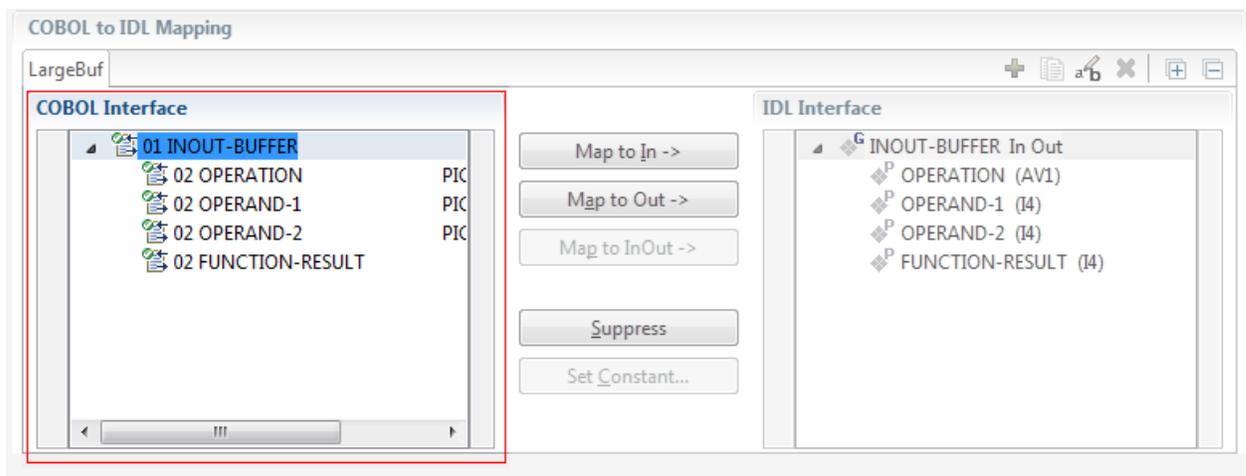
This section covers the following topics:

- [COBOL Interface](#)
- [Mapping Buttons](#)
- [IDL Interface](#)

### COBOL Interface

The **COBOL Interface** shows a tree view of your selected COBOL data items describing the interface of the COBOL server. A context menu is available for the COBOL data items, which provides mapping and other functions. On some COBOL data items, decision icons indicate where particular attention is needed, including mapping icons to visualize the COBOL data type and your current mapping.

The COBOL data item names are derived from the COBOL source from which they were extracted. If your COBOL interface contains parameters without a name, that is, the keyword `FILLER` is used, those COBOL data items are shown as `[FILLER]`. See [FILLER Pseudo-Parameter](#).



You can modify the COBOL interface using context menu or toolbar; decision and mapping icons provide additional information.

### Context Menu

The context menu on COBOL data items provides the following mapping and other functions, depending on the data item type, the COBOL level and the current mapping.

<b>Map to In   Out   InOut</b>	A suppressed COBOL data item becomes visible in the IDL interface. Used also to select another <code>REDEFINE</code> path.
<b>Suppress</b>	Suppress unneeded COBOL data items.
<b>Set Constant</b>	Set COBOL data items to constant.

<b>Set Array Mapping</b>	Map an array to a fixed sized or unbounded array.
<b>Set Multiple Possible Output (MPO) Structures</b>	Set COBOL data items where the server program decides the output structure used on return. Specify the set of multiple possible output (MPO) structures and the criteria when a structure is used.
<b>Remove from COBOL Interface</b>	Remove the data item from the COBOL interface. This also removes the mapped IDL parameter from all IDL interfaces for the current COBOL program. See <a href="#">COBOL Program Selection</a> .

See also [Mapping Editor IDL Interface Mapping Functions](#).

### Toolbar

The toolbar offers the following actions:

-  Create IDL Interface. Creates a new IDL interface based on the current COBOL interface: all IDL parameters are of IDL direction InOut; no IDL parameters are set to constant; for COBOL REDEFINE, the first REDEFINE path is mapped to IDL; FILLERS are suppressed according to your selection, see [Step 4: Define the Extraction Settings and Start Extraction](#).
-  Copy current IDL Interface. Creates a duplicate of the current IDL interface: all modifications such as IDL directions, suppress, selection of REDEFINE paths etc. are kept.
-  Remove current IDL Interface.
-  Rename current IDL Interface.
-  Expand the full tree.
-  Collapse the full tree.

See also [Map to Multiple IDL Interfaces](#).

### Decision Icons

The decision icons in the first column are set on COBOL data items where particular attention is needed:

-  This icon visualizes a COBOL REDEFINE. It is essential that you map the correct redefine path for your mapping to In, Out or InOut using the context menu. If you map a REDEFINE path, all other sibling REDEFINE paths are automatically set to "Suppress".

### Mapping Icons

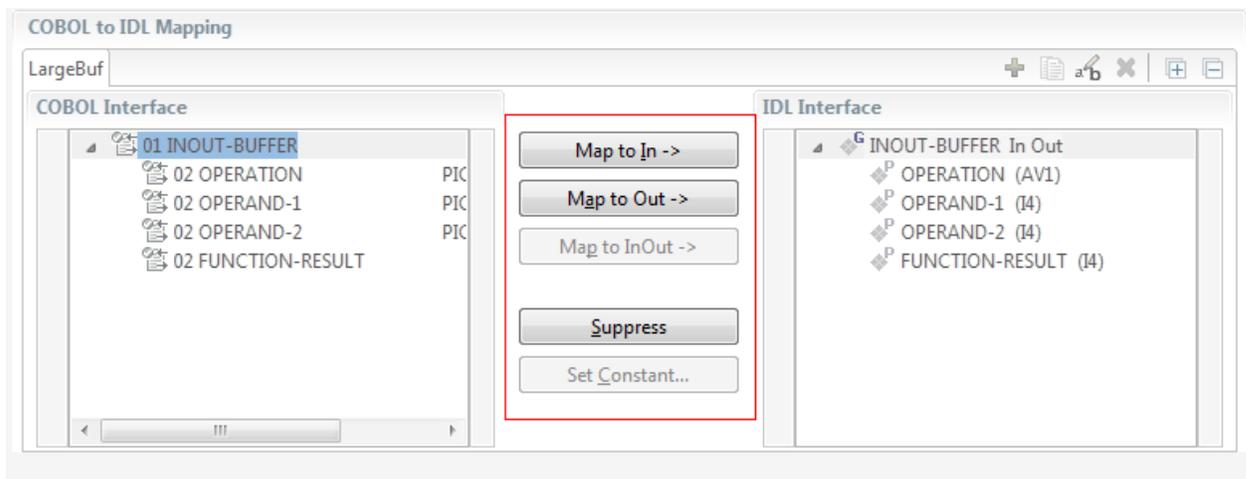
The following mapping icons on the COBOL data items indicate your current IDL mapping:

-  Scalar parameter, mapped to In.
-  Scalar parameter, mapped to InOut.

-  Scalar parameter, mapped to Out.
-  Group parameter, here mapped to InOut.
-  REDEFINE parameter, here mapped to InOut.
-  Parameter set to Constant.

## Mapping Buttons

The following buttons are available:



### Map to In | Out | InOut ->

See *Map to In, Out, InOut*. A suppressed COBOL data item becomes visible in the IDL interface. Used also to select another REDEFINE path.

### Suppress

See *Suppress Unneeded COBOL Data Items*.

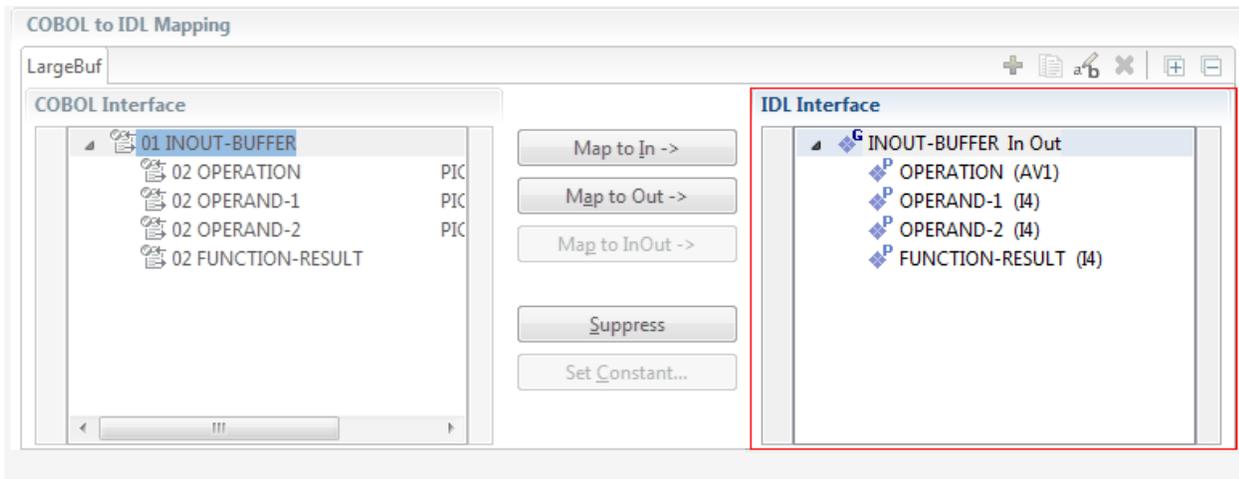
### Set Constant...

See *Set COBOL Data Items to Constants*.

### IDL Interface

If you have mapped the COBOL interface to multiple IDL interfaces, select the IDL interface by choosing the tabs. In the **IDL Interface** tree view, a context menu is also available with the following possibilities:

- Rename
- Remove from COBOL Interface. This also removes the mapped IDL parameter from all IDL interfaces for the current COBOL program. See *COBOL Program Selection* above.



## Mapping Editor IDL Interface Mapping Functions

This section covers the following topics:

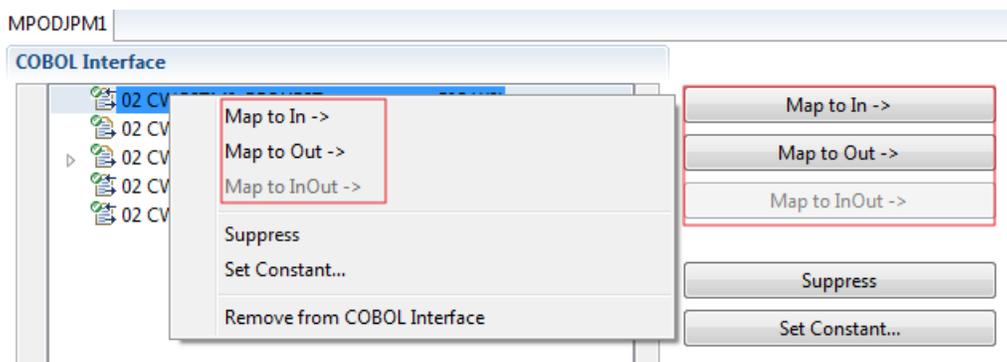
- Map to In, Out, InOut
- Map OCCURS DEPENDING ON
- Map to Multiple IDL Interfaces
- Select REDEFINE Paths
- Suppress Unneeded COBOL Data Items
- Set COBOL Data Items to Constants
- Set Arrays (Fixed <-> Unbounded)
- Set Multiple Possible Output (MPO) Structures

### Map to In, Out, InOut

With the **Map to In**, **Out**, **InOut** functions you make a COBOL data item visible as an IDL parameter in the IDL interface. With correct IDL directions you design the IDL interface by defining input and output parameters. COBOL programs have no parameter directions, so you need to set IDL directions manually.

#### › To provide IDL directions

- Go *step-by-step* through all *top-level* COBOL data items in the COBOL interface and use the **Map to In**, **Out** and **InOut** functions available in the context menu of the COBOL interface and as mapping buttons to make the COBOL data items visible and provide IDL directions in the IDL interface:



#### Notes:

1. If a *top-level* COBOL *group* is mapped, the IDL direction is inherited by all subordinate COBOL data items and thus to the related IDL parameters in the IDL interface.

- Subordinate COBOL data items can only be mapped to the same IDL direction as their *top-level* COBOL *group* data item.
- With the inverse function **Suppress Unneeded COBOL Data Items** (see below) available in the context menu of the COBOL interface and as mapping button, a COBOL data item can be removed from the IDL interface.
- IDL directions are described in the direction-attribute in `attribute-list` under *Software AG IDL Grammar* in the IDL Editor documentation.

If you are using an RPC server such as the z/OS (CICS | Batch), z/VSE (CICS | Batch), Micro Focus or BS2000/OSD RPC server, the amount of data to be transferred to/from the RPC client is reduced with correct IDL directions.

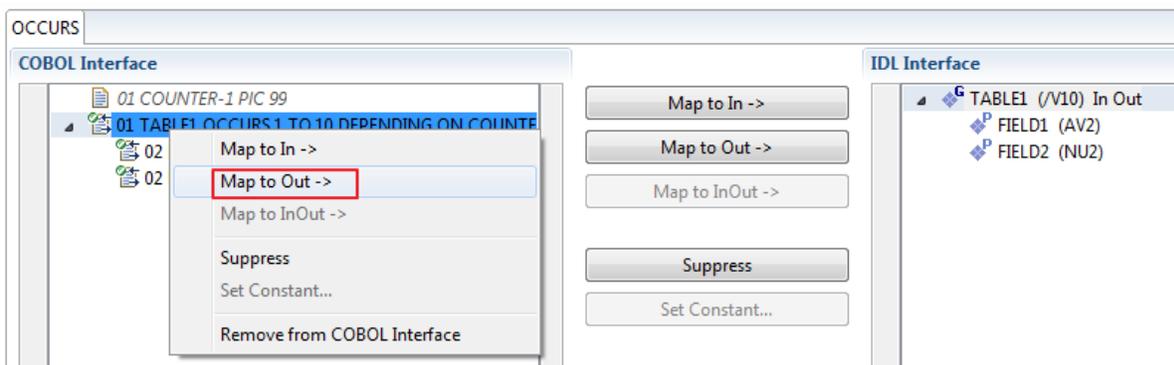
## Map OCCURS DEPENDING ON

With the **Map to In**, **Out**, **InOut** functions you can make the COBOL ODO subject (here COBOL data item `TABLE`) of a variable-sized COBOL table (see [COBOL Tables with Variable Size - DEPENDING ON Clause](#)) visible as an IDL unbounded group (with maximum). The ODO object (here COBOL data item `COUNTER-1`) is suppressed and therefore not part of the IDL interface. This is because the number of elements of the IDL unbounded group is already implicitly available. See the following example:

```
01 COUNTER-1 PIC 99.
01 TABLE OCCURS 1 TO 10 DEPENDING ON COUNTER-1
  02 FIELD1 PIC XX.
  02 FIELD2 PIC 99.
```

### > To map OCCURS DEPENDING ON

- Add the COBOL ODO subject (here data item `TABLE`) and ODO object (here data item `COUNTER-1`) to the COBOL interface. It is important both data items are in the COBOL interface.
- Use the **Map to In**, **Out** and **InOut** functions available in the context menu of the COBOL interface and as mapping buttons and apply IDL directions for the ODO subject (data item `TABLE`):

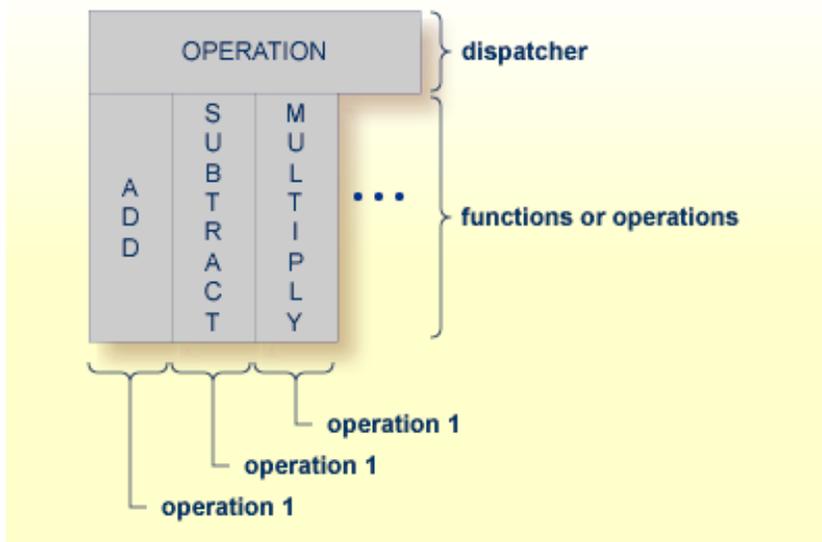


 **Notes:**

1. The ODO subject can be mapped to the IDL interface.
2. The ODO object is always suppressed, but is required to be part of the COBOL interface.
3. IDL directions are described in the direction-attribute in `attribute-list` under *Software AG IDL Grammar* in the IDL Editor documentation.

### Map to Multiple IDL Interfaces

Assume the COBOL server program provides multiple functions or operations, in the following example ADD, SUBTRACT, MULTIPLY. Some dispatcher front-end code executes the correct function, for example, depending on a *function-code* or *operation-code* parameter:



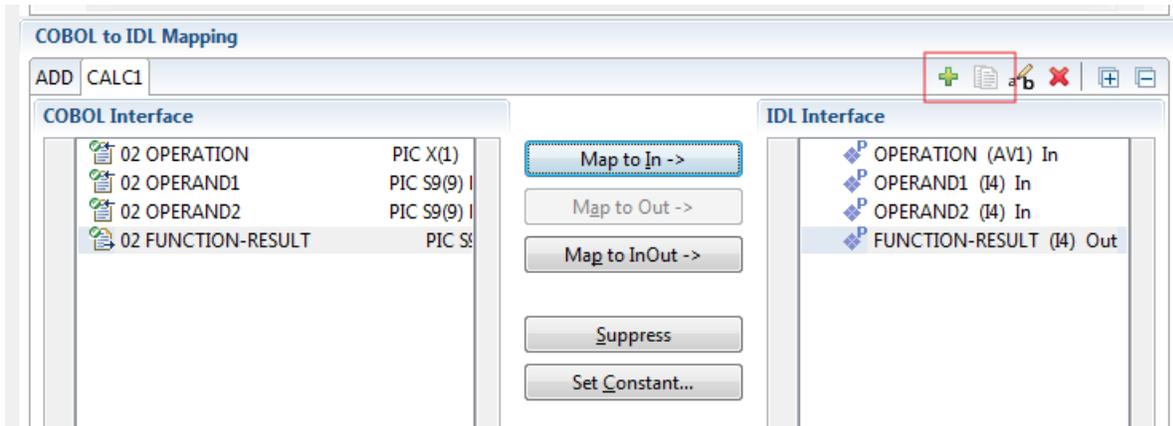
This example is described in more detail under [Example 1: COBOL Server with Multiple Functions](#).

If you have such a situation, a good approach is to expose each COBOL server program function separately as an IDL program. This gives advantages in further processing of the IDL and COBOL mapping files (SVM and CVM). For example:

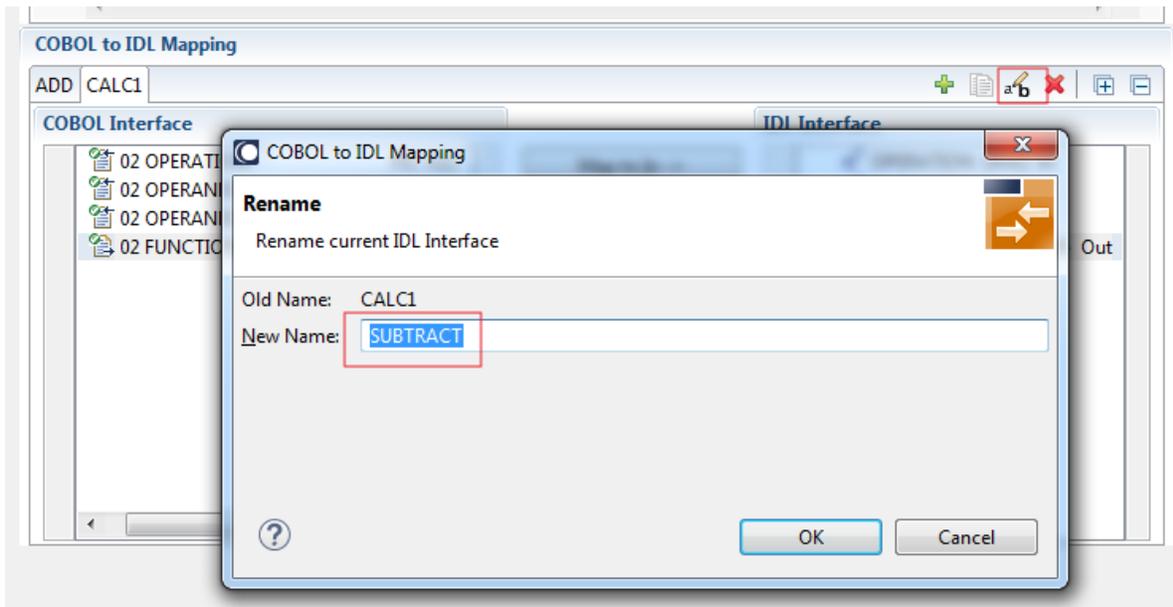
- If your target endpoint is a web service: instead having a Web service with a single operation, you get a web service with multiple operation, one operation for each COBOL function.
- If your target endpoint is Java or .NET: instead having a class with a single method, you get a class with multiple methods, one method for each COBOL function.

> To map a COBOL interface to multiple IDL interfaces

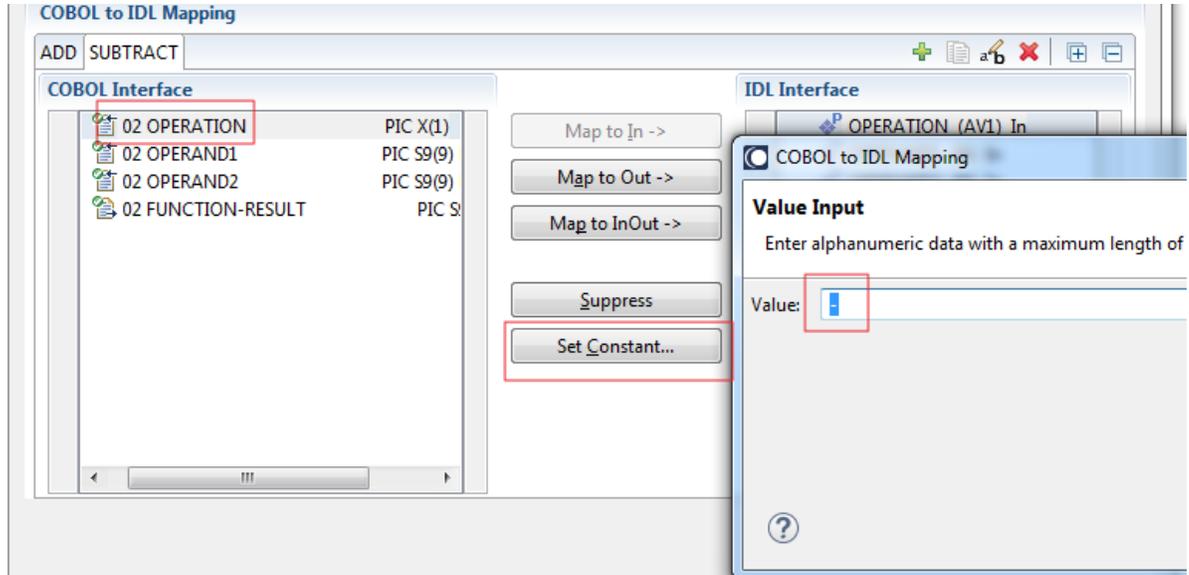
- 1 Select the tab with COBOL to IDL Mapping. For each function, define a separate IDL interface with the toolbar functions  or :



- 2 Give the IDL interfaces meaningful names with the toolbar function :



- 3 Define the required constant values to the *function-code* or *operation-code* parameter, see *Set COBOL Data Items to Constants* above:



For the delivered Example 1: COBOL Server with Multiple Functions:

- First, for step 1 above: Extract and define 3 separate IDL programs ADD, SUBTRACT, MULTIPLY.
- Second, for step 2 above: Rename them to suitable names, e.g. 'ADD', 'SUBTRACT', 'MULTIPLY'.
- Third, for step 3 above: Define the constants '+', '-' and '\*' to the parameter OPERATION respectively.
- After pressing **Finish**, the following IDL together with a server mapping file is created. See *Server Mapping Files for COBOL*.

```

Library 'EXAMPLE' is

program 'ADD' is
  define data parameter
    1 OPERAND1 (I4) In
    1 OPERAND2 (I4) In
    1 FUNCTION-RESULT (I4) Out
  end-define

program 'SUBTRACT' is
  define data parameter
    1 OPERAND1 (I4) In
    1 OPERAND2 (I4) In
    1 FUNCTION-RESULT (I4) Out
  end-define

program 'MULTIPLY' is
  define data parameter
    1 OPERAND1 (I4) In
    1 OPERAND2 (I4) In
    1 FUNCTION-RESULT (I4) Out
  end-define
  
```

**Notes:**

1. The following functions are offered to create further mappings from the COBOL interface, resulting in multiple IDL interfaces (IDL programs).

Icon	Function	Description
	Create IDL Interface	Creates a new IDL interface based on the current COBOL interface. All IDL parameters are of IDL direction InOut; no IDL parameters are set to constant; for COBOL REDEFINE, the first REDEFINE path is mapped to IDL; FILLERs are suppressed according to your selection, see <a href="#">Step 4: Define the Extraction Settings and Start Extraction</a> .
	Copy current IDL Interface	Creates a duplicate of current IDL interface. All modifications such as IDL directions, suppress, selection of REDEFINE paths etc. are kept.
	Rename current IDL Interface	The default name for the IDL interface is based on the COBOL program name plus appended number. With this function you can give the IDL interface a suitable name.
	Remove current IDL Interface	Deletes the current IDL interface.

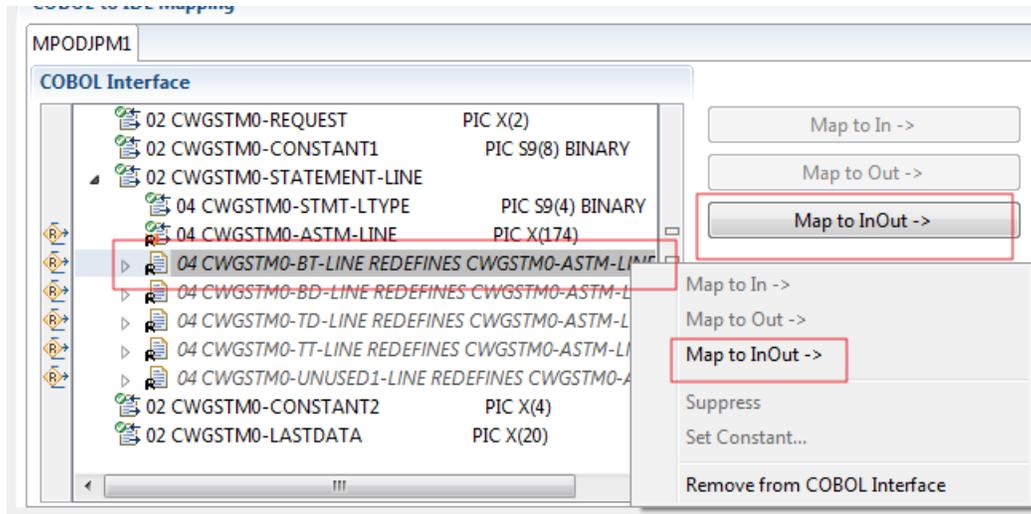
2. With the steps 1 thru 3 described here you can emulate the behavior of function Map to Operation of EntireX version 9.6 and earlier.

**Select REDEFINE Paths**

For COBOL server programs containing COBOL REDEFINES, the correct REDEFINE path needs to be chosen for the IDL interface.

**> To select redefine paths**

- Use the **Map to In, Out** or **InOut** functions available in the context menu of the COBOL interface and as mapping buttons to make the COBOL REDEFINE path available in the IDL interface.



Begin with the COBOL REDEFINE defined at the highest level first. Work through all inner COBOL REDEFINE data items, going from higher levels to lower levels.

#### Notes:

1. Only one REDEFINE path of a COBOL REDEFINE can be mapped to the IDL interface. All COBOL REDEFINE siblings are suppressed.
2. If a REDEFINE path is actively mapped to the IDL interface, all COBOL REDEFINE siblings are suppressed.
3. You can suppress all REDEFINE paths of a COBOL REDEFINE. Simply suppress the active REDEFINE path, see *Suppress Unneeded COBOL Data Items* above.

### Suppress Unneeded COBOL Data Items

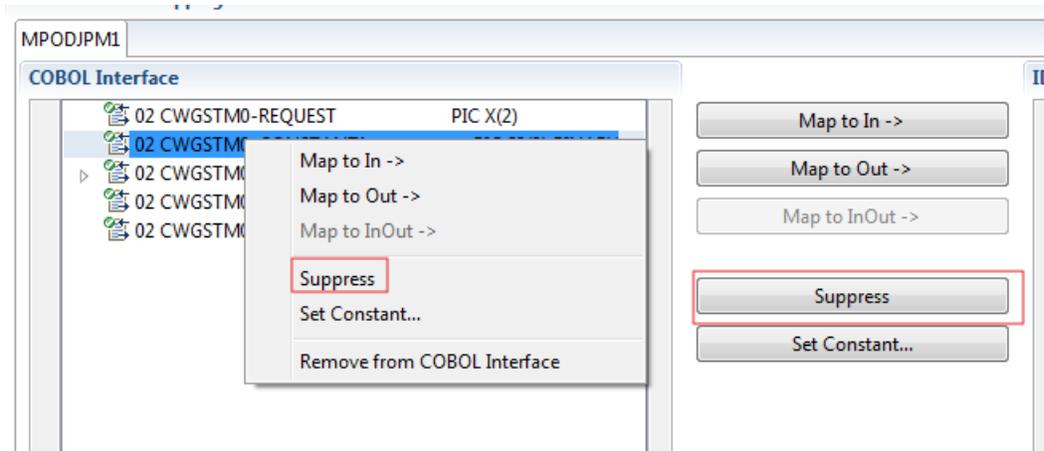
COBOL data items without any relevant information can be made invisible in the IDL interface. The IDL interface is simplified - it becomes shorter and tidier. This is useful, for example

- for FILLER data items
- if the RPC client or Adapter Service does not need an Out parameter
- if the RPC server or Adapter Service does not need an In parameter and a low value can be provided

If you are using an RPC server such as the z/OS (CICS | Batch), z/VSE (CICS | Batch), Micro Focus or BS2000/OSD RPC server, the amount of data to be transferred to/from the RPC client is also reduced.

➤ **To suppress unneeded COBOL data items**

- Use the **Suppress** function available in the context menu of the COBOL interface and as mapping button to make the COBOL data item invisible in the IDL interface:



**Notes:**

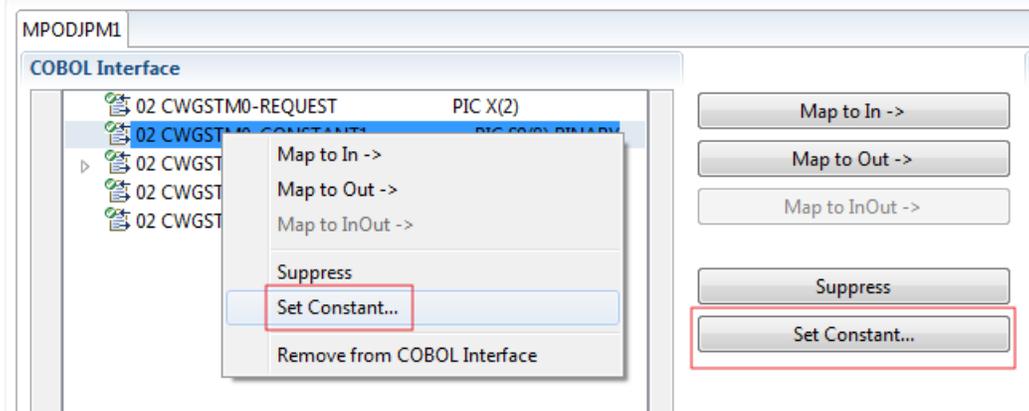
1. The COBOL data item is not part of the IDL interface. It is invisible for RPC clients or Adapter Service.
2. The RPC server or Adapter Service provides the COBOL data item to your COBOL server with low value, managing the offset to the next COBOL data item.
3. If a COBOL group is suppressed, all subordinate COBOL data items are suppressed as well.
4. With the inverse functions **Map to In**, **Out** or **InOut** (see above) available in the context menu of the COBOL interface and as mapping buttons, a COBOL data item is made visible in the IDL interface again.

### Set COBOL Data Items to Constants

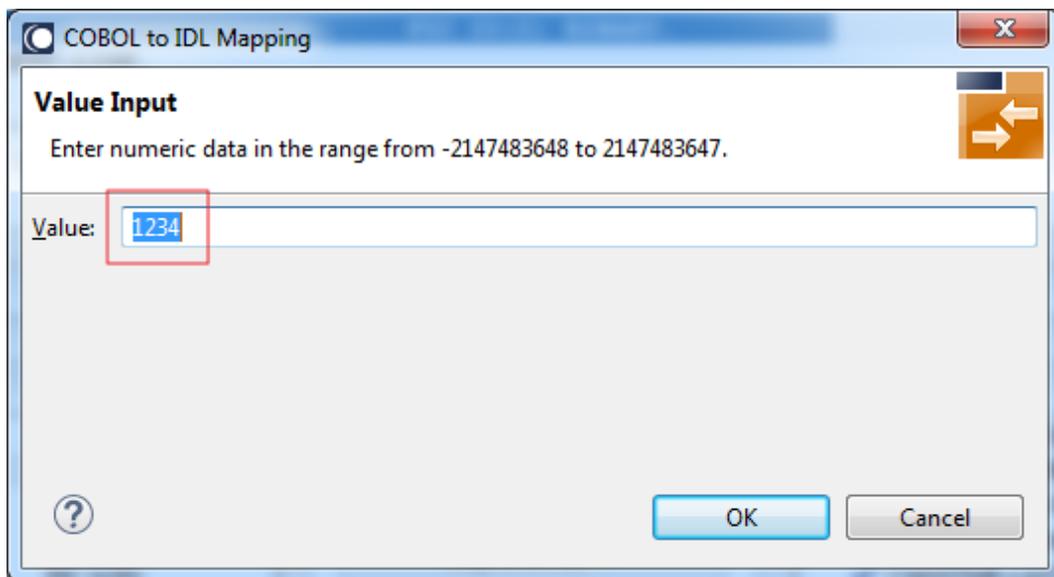
COBOL data items that always require fixed constant values on input to the COBOL server program can be made invisible in the IDL interface and initialized with the required constant values. This is useful for keeping the IDL interface short and tidy. RPC clients or Adapter Services are not bothered with IDL parameters that always contain constants, such as `RECORD-TYPES`. This function is often used in conjunction with **Map to Multiple IDL Interfaces** (see above).

➤ **To set COBOL data items to constants**

- 1 Use the **Set Constant** function available in the context menu of the COBOL interface and as mapping button to define a constant value for a COBOL data item:



- 2 You are prompted with a window to enter the constant value:



 **Notes:**

1. The COBOL data item is not part of the IDL interface. It is invisible for RPC clients or Adapter Services.
2. The RPC server or Adapter Service provides the defined constant in the COBOL data item to your COBOL server.
3. With the functions **Map to In**, **Out**, **InOut** (see above) available in the context menu of the COBOL interface and as mapping buttons, a COBOL data item can be made visible in the IDL interface again.

## Set Arrays (Fixed <-> Unbounded)

For COBOL server programs using the message length to transfer a variable number of elements in a COBOL table with a fixed size (see [COBOL Tables with Fixed Size](#)) in a variable manner (see [COBOL Tables with Variable Size - DEPENDING ON Clause](#)) you need to set the mapping to unbounded array.

For details of such a COBOL server program see [Example 2: COBOL Server Using Fixed-length Tables in Variable Manner](#).

### » To set arrays from fixed to unbounded or vice versa

- Select the COBOL table and use the function **Set Arrays (Fixed<->Unbounded)** available in the context menu. A modal window is displayed. Select **Unbounded array**. The IDL array parameter will be changed from fixed array */number* to an unbounded array */Nnumber*, see *array-definition* under *Software AG IDL Grammar* in the IDL Editor documentation.



#### Notes:

1. This option should be used carefully and requires knowledge of the COBOL server program. Be aware that an incorrect mapping results in runtime errors.
2. The COBOL Table with a fixed size (see [COBOL Tables with Fixed Size](#)) used in this manner must be the last parameter of the COBOL interface; it must not be a subparameter of any other COBOL table and must not contain any `DEPENDING ON` clause (see [COBOL Tables with Variable Size - DEPENDING ON Clause](#)).

## Set Multiple Possible Output (MPO) Structures

A COBOL server program produces more than one type of output. The layout of the output can therefore take two or more dissimilar shapes. The COBOL server program decides at runtime the output structure returned, that is, the COBOL layout on output varies.

- [Multiple Possible Output with REDEFINES](#)
- [Optional Output with Groups](#)
- [MPO Terminology](#)

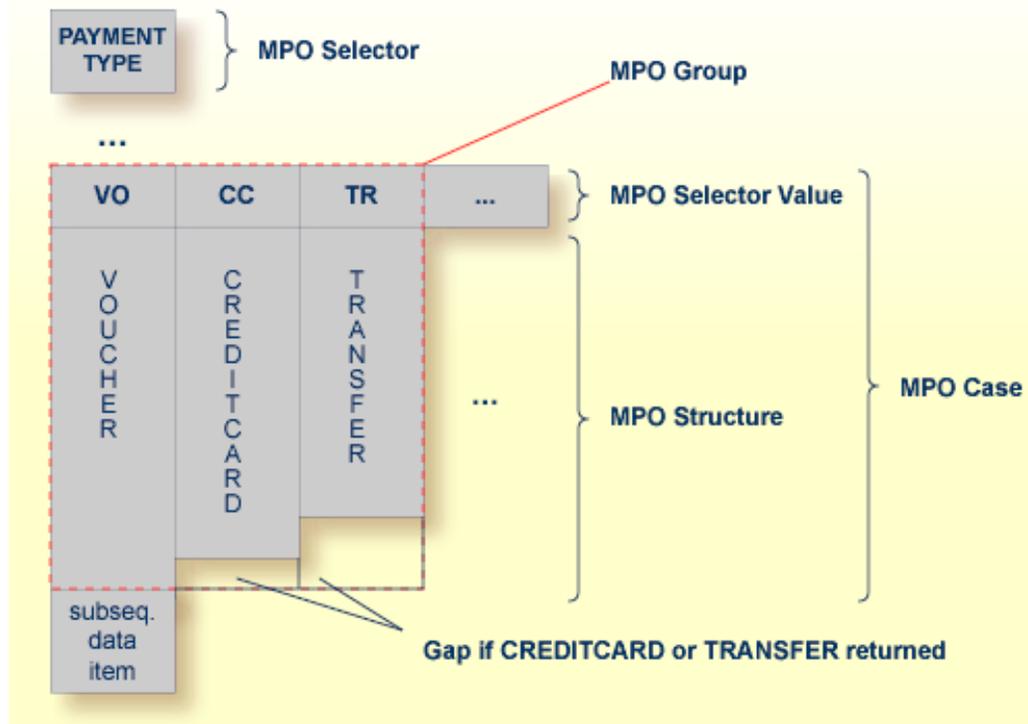
- Steps

### Multiple Possible Output with REDEFINES

As illustrated in *Example 3: COBOL Server Using Multiple Possible Output (MPO)*, a COBOL *REDEFINES Clause* is often used to describe the possible output structures. In COBOL this is the standard way to describe multiple possible output.

In addition, the COBOL interface

- limits the number of possible output structures returned
- defines all possible output structures, that is, they are known during extraction. In the example these are the structures `PAYMENT-DATA-VOUCHER`, `PAYMENT-DATA-CREDITCARD` and `PAYMENT-DATA-TRANSFER`. These are the MPO structures.
- contains an additional COBOL data item carrying a value related to the returned output structure. By inspecting this data item first, the appropriate output structure can be selected to address the data correctly. In the example it is `PAYMENT-TYPE`. This item is the MPO selector.
- always occupies memory to be able to transfer the longest output structure. If the actual returned output structure is shorter than the longest possible output structure, there is a gap (space) between the multiple possible output and the subsequent data item.



This abstract concept is known as *multiple possible output* (MPO) EntireX bundles all MPO structures into an MPO group. See *MPO Terminology* below.

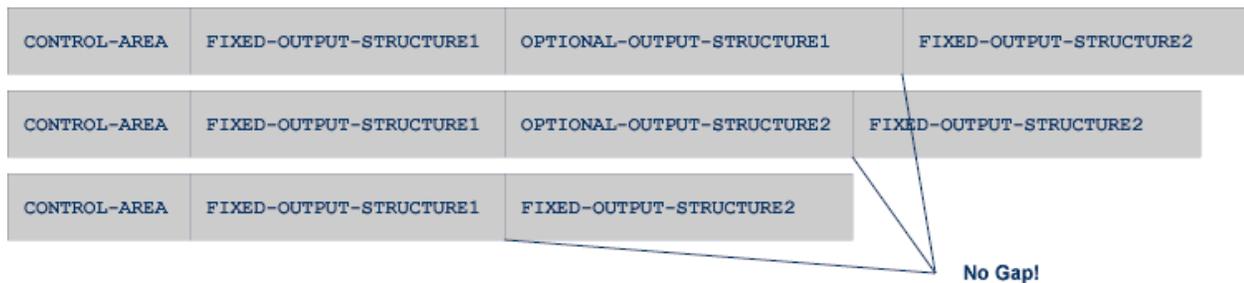
### Optional Output with Groups

As illustrated in *Example 4: COBOL Server Using Optional Output*, COBOL group data items can be used to describe optional output structures. See *Optional COBOL Group Data Items*. Optional output with group data items are a variant of multiple possible output (MPO).

In addition, the COBOL interface

- limits the number of possible output structures returned
- defines all optional output structures, that is, they are known during extraction. In the example these are the structures `OPTIONAL-OUTPUT-STRUCTURE1` and `OPTIONAL-OUTPUT-STRUCTURE2`. These are the MPO structures.
- contains an additional COBOL data item carrying an indication if the optional output is present. By inspecting this data item first, the appropriate optional output structure can be selected to address the data correctly. If its value does not match, the optional output is not present. In the example it is `OPTIONAL-OUTPUT`. This item is the MPO selector.
- If the optional output is not present no memory is occupied. There is no gap between the optional output and the subsequent data item, as opposed to *Multiple Possible Output with REDEFINES* above.

In the example there are three different shapes of output:



### MPO Terminology

The following terminology is used with MPOs:

#### MPO structure

A COBOL group describing the output layout used in an MPO case. All alternative layouts in an MPO group are often described with COBOL `REDEFINES`. An MPO structure can also contain other MPO groups.

**MPO group**

Bundles together all MPO structures that can be used alternatively. A COBOL interface can contain more than one MPO group.

**MPO case**

An MPO structure together with its MPO selector values (one or more).

**MPO selector**

A COBOL data item containing a specific value (MPO selector value) where the actual MPO case can be determined. The MPO selector precedes the MPO group and is located outside the MPO group.

**MPO selector value**

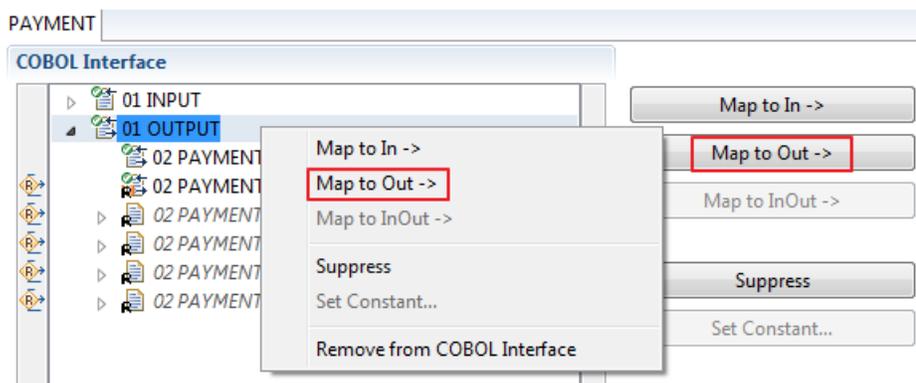
Each value indicates exactly one output structure. An output structure can be indicated by further values.

**Steps**

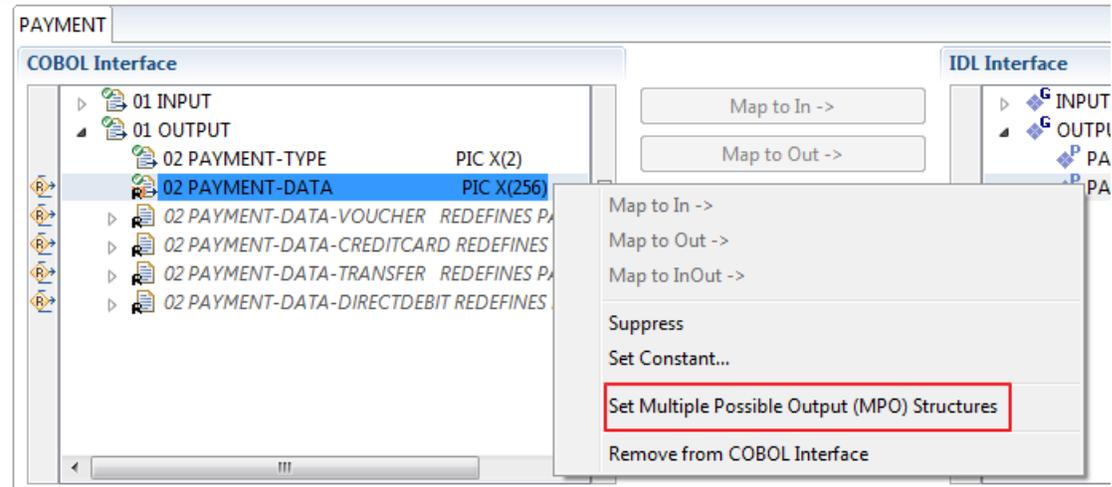
➤ **To set multiple possible output (MPO) structures**

Use the **Set Multiple Possible Output (MPO) Structures** function available in the context menu of the COBOL interface to create new or modify existing MPO groups.

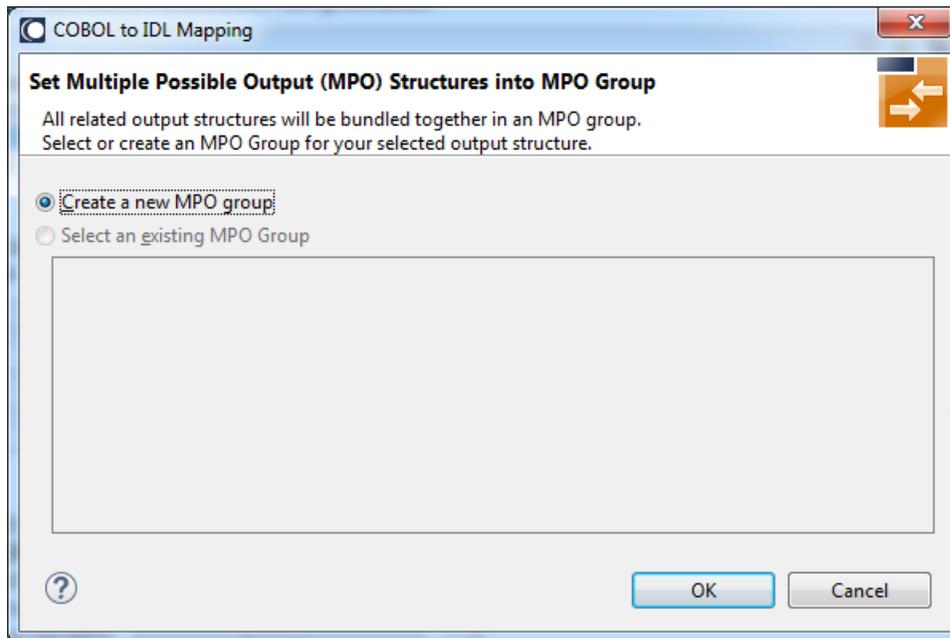
- 1 Set the top-level COBOL data item where the MPO structures are contained to IDL direction Out. Use the **Map to Out** function for this purpose:



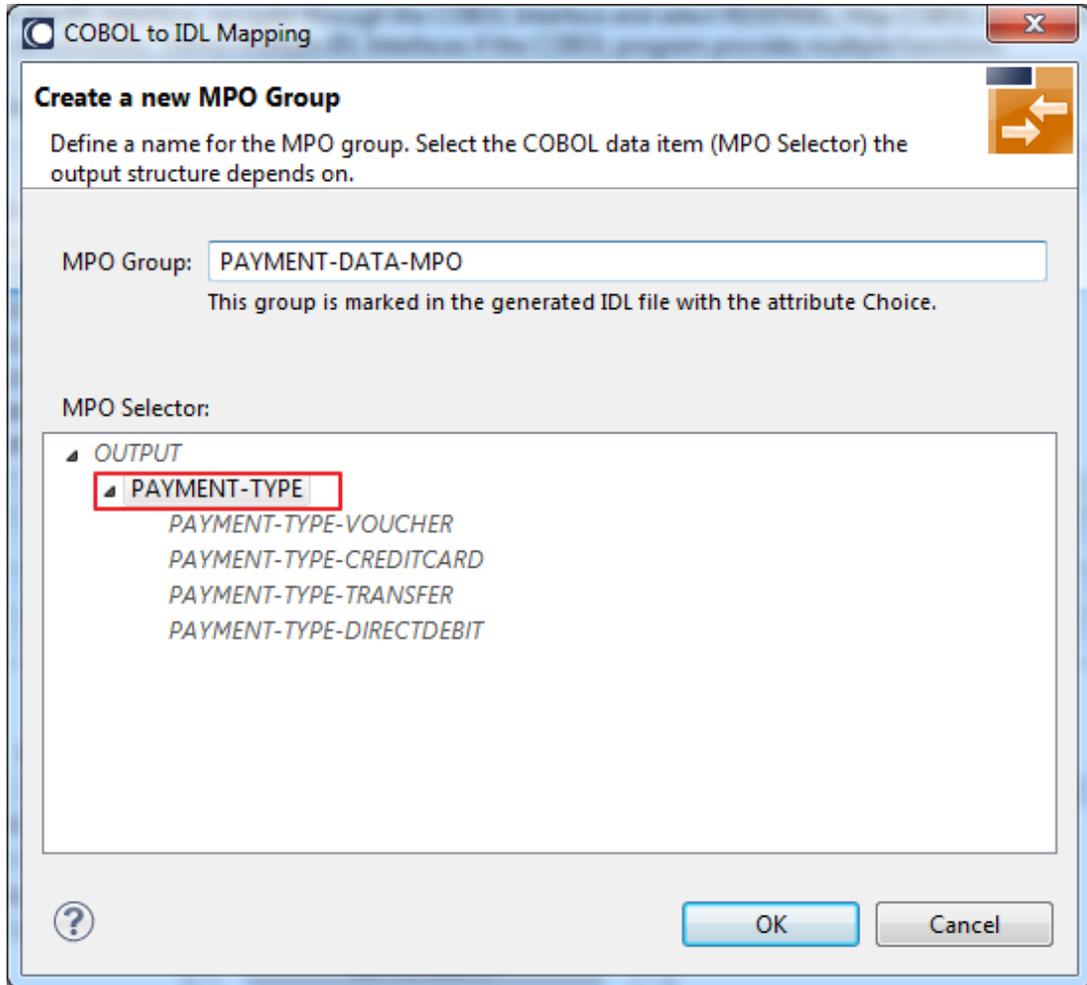
- 2 From the context menu of the COBOL interface of the COBOL REDEFINE, choose **Set Multiple Possible Output (MPO) Structures**.



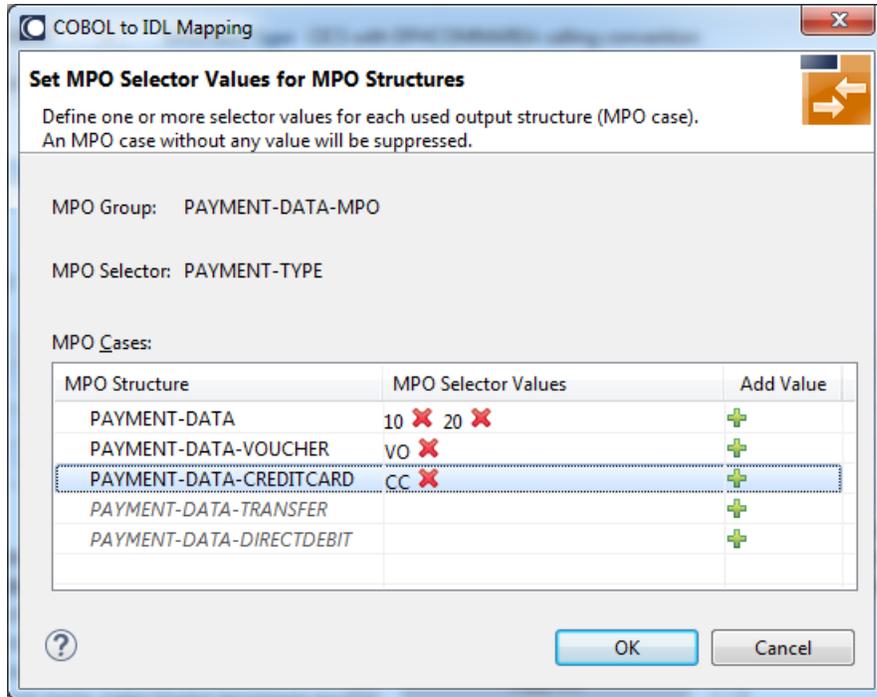
3 Set Multiple Possible Output (MPO) Structures into MPO Group.



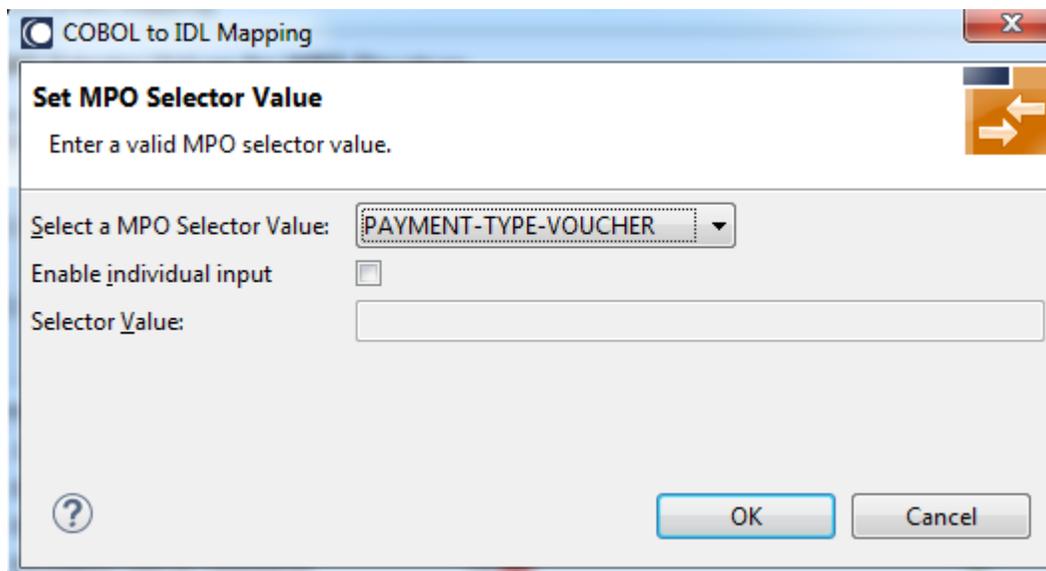
4 Create a new MPO group.



- 5 Set MPO selector values for MPO Structures.



Use the functions ✖ to delete and + to add MPO selector values:



**Notes:**

1. To add multiple MPO selector values per MPO structure, use the function + multiple times for the same MPO structure (see value 10 and 20 for structure PAYMENT-DATA).
2. MPO structures without any MPO selector are unused and suppressed in the IDL interface value (e.g. see structure PAYMENT-DATA-TRANSFER).

3. Each MPO selector value must uniquely identify an MPO structure. The same value cannot be used more than once for different MPO structures.
4. If no defined MPO selector value matches during runtime, an empty MPO group is delivered to the RPC client, that is, none of the MPO cases contain any data. No runtime error is produced.
- 6 For the delivered example *COBOL Server Using Multiple Possible Output (MPO)* (see below): After pressing **Finish**, the following IDL together with a server mapping file is created. See *Server Mapping Files for COBOL*.

```
library 'PAYMENT' is

program 'PAYMENT' is
  define data parameter
    1 INPUT          In
      2 ORDER-NUMBER      (NU10)
    1 OUTPUT         Out
      2 PAYMENT-TYPE      (A2)
      2 PAYMENT-DATA-MPO Choice
        3 PAYMENT-DATA    (/V1)
        4 PAYMENT-DATA    (AV256)
        3 PAYMENT-DATA-VOUCHER (/V1)
        4 VOUCHER-ORIGIN  (AV128)
        4 VOUCHER-SERIES  (AV128)
        3 PAYMENT-DATA-CREDITCARD (/V1)
        4 CREDITCARD-NUMBER (NU18)
        4 CREDITCARD-CODE  (NU12)
        4 CREDITCARD-VALIDITY (AV8)
  end-define
```

## Programming Techniques

- [Example 1: COBOL Server with Multiple Functions](#)
- [Example 2: COBOL Server Using Fixed-length Tables in Variable Manner](#)
- [Example 3: COBOL Server Using Multiple Possible Output \(MPO\)](#)
- [Example 4: COBOL Server Using Optional Output](#)

### Example 1: COBOL Server with Multiple Functions

Assume a COBOL server program has a FUNCTION or OPERATION code COBOL data item in its COBOL interface. The COBOL server program behaves differently depending on field values of this data item. See the following example where a COBOL programs implements a calculator with the functions ADD, SUBTRACT, MULTIPLY, etc. The execution of the different functions is controlled by the COBOL data item OPERATION:

```

. . .
01 OPERATION                PIC X(1).
01 OPERAND1                 PIC S9(9) BINARY.
01 OPERAND2                 PIC S9(9) BINARY.
01 FUNCTION-RESULT         PIC S9(9) BINARY.
. . .
MOVE 0 TO FUNCTION-RESULT.
EVALUATE OPERATION
  WHEN "+"
    ADD OPERAND1 OPERAND2
    GIVING FUNCTION-RESULT
  WHEN "-"
    SUBTRACT OPERAND2 FROM OPERAND1
    GIVING FUNCTION-RESULT
  WHEN "*"
    MULTIPLY OPERAND1 BY OPERAND2
    GIVING FUNCTION-RESULT
  WHEN . . .
END-EVALUATE.
. . .

```

You can expose each COBOL server program function separately. The advantages or reasons for wanting this depend on the target endpoint. For example:

#### ■ Web Service

Instead having a Web service with a single operation, you want a web service with multiple operations, one operation for each COBOL function.

- **Java or .NET**

Instead having a class with a single method, you want a class with multiple methods, one method for each COBOL function.

- etc.

To do this you need to extract the COBOL server program as described under [Map to Multiple IDL Interfaces](#).

### Example 2: COBOL Server Using Fixed-length Tables in Variable Manner

Assume a COBOL CICS large buffer server program has a fixed-sized COBOL table as its last parameter, similar to COBOL data item COBOL-TABLE-FIX in the example below; each table element is 100 bytes; the length of COBOL-FIELD1 + COBOL-FIELD2 + COBOL-FIELD3; the length of the data preceding the COBOL table is described by COBOL-GROUP1; its length is 1000 bytes.

```

WORKING-STORAGE SECTION.
01 NUMBER-OF-INCOMING-ELEMENTS      PIC S9(8) BINARY.
01 NUMBER-OF-OUTGOMING-ELEMENTS     PIC S9(8) BINARY.

. . .

LINKAGE SECTION.
01 DFHCOMMAREA.
  10 WM-LCB-MARKER                   PIC X(4).
  10 WM-LCB-INPUT-BUFFER             POINTER.
  10 WM-LCB-INPUT-BUFFER-SIZE        PIC S9(8) BINARY.
  10 WM-LCB-OUTPUT-BUFFER           POINTER.
  10 WM-LCB-OUTPUT-BUFFER-SIZE       PIC S9(8) BINARY.
  10 WM-LCB-FLAGS                    PIC X(1).
  88 WM-LCB-FREE-OUTPUT-BUFFER       VALUE "F".
  10 WM-LCB-RESERVED                 PIC X(3).

01 INOUT-BUFFER.
10 COBOL-GROUP1.
  20 COBOL-TABLE-PREFIX              PIC X(1000).
  10 COBOL-TABLE-FIX                 OCCURS 20.
  20 COBOL-GROUP2.
    25 COBOL-FIELD1                 PIC X(30).
    25 COBOL-FIELD2                 PIC X(20).
    25 COBOL-FIELD3                 PIC X(50).
. . .

PROCEDURE DIVISION USING DFHCOMMAREA.
  SET ADDRESS OF INOUT-BUFFER TO WM-LCB-INPUT-BUFFER.
  SET ADDRESS OF INOUT-BUFFER TO WM-LCB-OUTPUT-BUFFER.
  COMPUTE NUMBER-OF-INCOMING-ELEMENTS = (WM-LCB-INPUT-BUFFER-SIZE
    - LENGTH OF COBOL-GROUP1)
    / LENGTH OF COBOL-GROUP2.

. . .

```

```

      COMPUTE WM-LCB-OUTPUT-BUFFER-SIZE = LENGTH OF COBOL-GROUP1
      + NUMBER-OF-OUTGOING-ELEMENTS * LENGTH OF COBOL-GROUP2

EXEC CICS RETURN END-EXEC.

```

During input the COBOL CICS large buffer server program uses the large buffer input length WM-LCB-INPUT-BUFFER-SIZE to evaluate the NUMBER-OF-INCOMING-ELEMENTS. During output the large buffer output length is determined accordingly to the NUMBER-OF-OUTGOING-ELEMENTS and set in WM-LCB-OUTPUT-BUFFER-SIZE.

Although the COBOL table is defined as a table with a fixed size (see [COBOL Tables with Fixed Size](#)) it is used in a variable manner, similar to tables with variable Size (see [COBOL Tables with Variable Size - DEPENDING ON Clause](#)). In this case it is required to map the COBOL table to an IDL unbounded array, see [Set Arrays \(Fixed <-> Unbounded\)](#).

### Example 3: COBOL Server Using Multiple Possible Output (MPO)

A COBOL REDEFINE can be used in a COBOL server program to return multiple possible output (MPO) structures, similar to COBOL data item PAYMENT-DATA in the example below; for this purpose, PAYMENT-DATA is redefined; each redefinition represents an output structure (MPO case); on return exactly one output structure is used; by inspecting COBOL data item PAYMENT-TYPE (MPO selector) first, a caller can determine the returned output structure; the caller then uses the correct redefinition to access the data.

```

. . .
01 INPUT-DATA.
   02 ORDER-NUMBER                               PIC 9(10).

. . .
01 OUTPUT-DATA.
   02 <some fields>                               PIC <clause>.
   . . .

   02 PAYMENT-TYPE                               PIC X(2).
      88 PAYMENT-TYPE-VOUCHER                     VALUE "V0".
      88 PAYMENT-TYPE-CREDITCARD                   VALUE "CC".
      88 PAYMENT-TYPE-TRANSFER                     VALUE "TR".
      88 PAYMENT-TYPE-DIRECTDEBIT                   VALUE "DB".
   . . .
   02 <preceding data items>                       PIC <clause>.
. . .
   02 PAYMENT-DATA                               PIC X(256).
   02 PAYMENT-DATA-VOUCHER                       REDEFINES PAYMENT-DATA.
      04 VOUCHER-ORIGIN                           PIC X(128).
      04 VOUCHER-SERIES                           PIC X(128).
   02 PAYMENT-DATA-CREDITCARD                     REDEFINES PAYMENT-DATA.
      04 CREDITCARD-NUMBER                         PIC 9(18).
      04 CREDITCARD-COMPANY                        PIC X(128).
      04 CREDITCARD-CODE                          PIC 9(12).

```

```

    04 CREDITCARD-VALIDITY          PIC X(8).
    02 PAYMENT-DATA-TRANSFER        REDEFINES PAYMENT-DATA.
    04 TRANSFER-NAME                PIC X(128).
    04 TRANSFER-IBAN                PIC X(34).
    04 TRANSFER-BIC                 PIC X(11).
    02 PAYMENT-DATA-DIRECTDEBIT     REDEFINES PAYMENT-DATA.
    04 DIRECTDEBIT-IBAN             PIC X(34).
    04 DIRECTDEBIT-NAME             PIC X(128).
    04 DIRECTDEBIT-EXPIRES          PIC 9(8).
    . . .
    02 <subsequent data items>      PIC <clause>.
    . . .

. . .

*   read order record using ORDER-NUMBER
    . . .

*   set value indicating type of reply (MPO selector)
    IF <some-condition> THEN
        SET PAYMENT-TYPE-VOUCHER TO TRUE
    ELSE IF <some-other-condition> THEN
        SET PAYMENT-TYPE-CREDITCARD TO TRUE
    ELSE IF <some-further-condition> THEN
        SET PAYMENT-TYPE-TRANSFER TO TRUE
    ELSE
        SET PAYMENT-TYPE-DIRECTDEBIT TO TRUE
    END-IF.
    . . .

*   set fields (MPO case) depending on type of reply
    INITIALIZE PAYMENT-DATA.
    EVALUATE TRUE
        WHEN PAYMENT-TYPE-VOUCHER
            MOVE . . . TO VOUCHER-ORIGIN
            MOVE . . . TO VOUCHER-SERIES
        WHEN PAYMENT-TYPE-CREDITCARD
            MOVE . . . TO CREDITCARD-NUMBER
            MOVE . . . TO CREDITCARD-CODE
            MOVE . . . TO CREDITCARD-VALIDITY
        WHEN PAYMENT-TYPE-TRANSFER
            MOVE . . . TO TRANSFER-NAME
            MOVE . . . TO TRANSFER-IBAN
            MOVE . . . TO TRANSFER-BIC
        WHEN PAYMENT-TYPE-DIRECTDEBIT
            MOVE . . . TO DIRECTDEBIT-IBAN
            MOVE . . . TO DIRECTDEBIT-NAME
            MOVE . . . TO DIRECTDEBIT-EXPIRES
        WHEN
            . . .
    END-EVALUATE.
    . . .

```

COBOL server programs using alternative and dissimilar shapes for the output layout are extracted as described under [Set Multiple Possible Output \(MPO\) Structures](#).

#### Example 4: COBOL Server Using Optional Output

COBOL group data items can be used in a COBOL server program to return optional output similar to the example below; the returned data is built by copying the necessary COBOL structures into an output area. The optional output is one of OPTIONAL-OUTPUT-STRUCTURE1, OPTIONAL-OUTPUT-STRUCTURE2 or nothing. The presence of the optional output is controlled by a structure named CONTROL-AREA. Optional output with group data items are a variant of MPO, see [Example 3: COBOL Server Using Multiple Possible Output \(MPO\)](#).

```

WORKING-STORAGE SECTION.

01 INPUT-AREA.
   02 FIX-INPUT-ITEM1          PIC X(4).
   02 <some fields>           PIC <clause>.
   . . .

01 OUTPUT-OFFSET              PIC S9(9) BINARY.
01 OUTPUT-AREA                PIC X(32000).
. . .

01 CONTROL-AREA.
   02 OPTIONAL-OUTPUT         PIC X(1).
   88 OPTIONAL-OUTPUT-1      VALUE "1".
   88 OPTIONAL-OUTPUT-2      VALUE "2".
   88 OPTIONAL-OUTPUT-NONE   VALUE "N".
   . . .

01 OPTIONAL-OUTPUT-STRUCTURE1.
   02 OPTIONAL-OUTPUT-ITEM11  PIC X(10).
   02 OPTIONAL-OUTPUT-ITEM12  PIC X(100).
   02 OPTIONAL-OUTPUT-ITEM13  PIC X(20).
   . . .

01 OPTIONAL-OUTPUT-STRUCTURE2.
   02 OPTIONAL-OUTPUT-ITEM21  PIC X(4).
   02 OPTIONAL-OUTPUT-ITEM22  PIC X(50).
   02 OPTIONAL-OUTPUT-ITEM23  PIC X(50).
   . . .

01 FIX-OUTPUT-STRUCTURE1.
   02 FIX-OUTPUT-ITEM11       PIC X(4).
   02 FIX-OUTPUT-ITEM12       PIC X(20).
   02 FIX-OUTPUT-ITEM13       PIC X(8).
   . . .

01 FIX-OUTPUT-STRUCTURE2.
   02 FIX-OUTPUT-ITEM21       PIC X(2).

```

```

02 FIX-OUTPUT-ITEM22          PIC X(10).
02 FIX-OUTPUT-ITEM23          PIC X(10).
. . .

IF <some-condition> THEN
  SET OPTIONAL-OUTPUT-1 TO TRUE
ELSE IF <some-other-condition> THEN
  SET OPTIONAL-OUTPUT-2 TO TRUE
ELSE
  SET OPTIONAL-OUTPUT-NONE TO TRUE
END-IF.

. . .

*   provide control area for optional output
MOVE 1 TO OUTPUT-OFFSET.
STRING CONTROL-AREA DELIMITED BY SIZE
INTO OUTPUT-AREA WITH POINTER OUTPUT-OFFSET.

*   provide data items before optional output
STRING FIX CONTROL-AREA DELIMITED BY SIZE
INTO OUTPUT-AREA WITH POINTER OUTPUT-OFFSET.

*   provide optional output
EVALUATE TRUE
  WHEN OPTIONAL-OUTPUT-1
    STRING OPTIONAL-OUTPUT-STRUCTURE1 DELIMITED BY SIZE
    INTO OUTPUT-AREA WITH POINTER OUTPUT-OFFSET
  WHEN OPTIONAL-OUTPUT-2
    STRING OPTIONAL-OUTPUT-STRUCTURE2 DELIMITED BY SIZE
    INTO OUTPUT-AREA WITH POINTER OUTPUT-OFFSET
END-EVALUATE.

*   provide data items after optional output
STRING FIX-OUTPUT-STRUCTURE2 DELIMITED BY SIZE
INTO OUTPUT-AREA WITH POINTER OUTPUT-OFFSET.

. . .

```

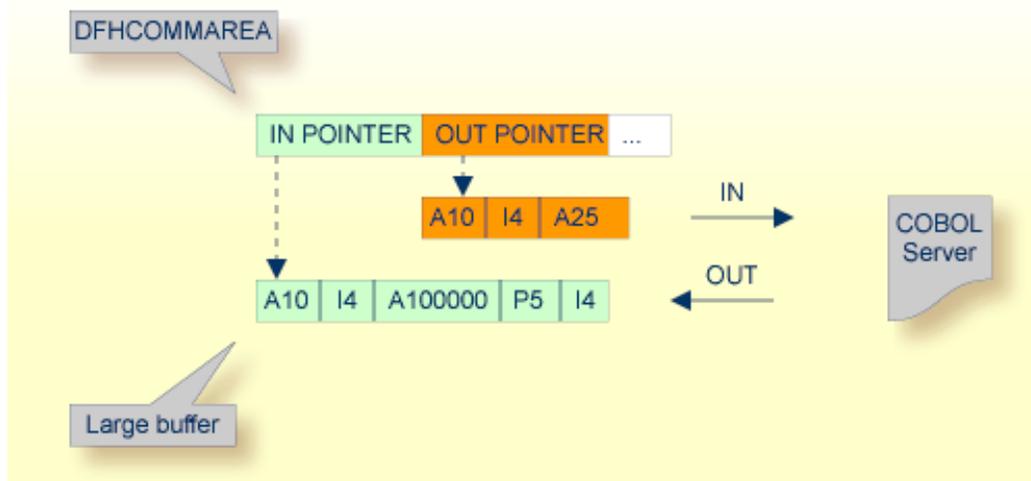
COBOL server programs using optional shapes for the output layout are extracted as described under [Set Multiple Possible Output \(MPO\) Structures](#).



# 9 CICS with DFHCOMMAREA Large Buffer Interface - In different to Out

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■ Introduction .....	164
■ Extracting from a CICS DFHCOMMAREA Large Buffer Program .....	165
■ Mapping Editor User Interface .....	167
■ Mapping Editor IDL Interface Mapping Functions .....	174
■ Programming Techniques .....	192



## Introduction

A DFHCOMMAREA Large Buffer Interface has the structure given below in the linkage section. The field subordinated under DFHCOMMAREA prefixed with WM-LCB describe this structure. The field names themselves can be different, but the COBOL data types (usage clauses) must match exactly.

```
LINKAGE SECTION.
01 DFHCOMMAREA.
  10 WM-LCB-MARKER          PIC X(4).
  10 WM-LCB-INPUT-BUFFER   POINTER.
  10 WM-LCB-INPUT-BUFFER-SIZE PIC S9(8) BINARY.
  10 WM-LCB-OUTPUT-BUFFER  POINTER.
  10 WM-LCB-OUTPUT-BUFFER-SIZE PIC S9(8) BINARY.
  10 WM-LCB-FLAGS          PIC X(1).
  88 WM-LCB-FREE-OUTPUT-BUFFER VALUE 'F'.
  10 WM-LCB-RESERVED       PIC X(3).
01 IN-BUFFER.
  02 OPERATION              PIC X(1).
  02 OPERAND-1              PIC S9(9) BINARY.
  02 OPERAND-2              PIC S9(9) BINARY.
01 OUT-BUFFER.
  02 FUNCTION-RESULT        PIC S9(9) BINARY.
. . .
PROCEDURE DIVISION USING DFHCOMMAREA.
. . .
  SET ADDRESS OF IN-BUFFER TO WM-LCB-INPUT-BUFFER.
  SET ADDRESS OF OUT-BUFFER TO WM-LCB-OUTPUT-BUFFER.
* process the IN-BUFFER and provide result in OUT-BUFFER
  EXEC CICS RETURN.
```

If you have selected an IDL file and opened the COBOL Mapping Editor with an existing COBOL to IDL mapping, continue with [Mapping Editor User Interface](#).

## Extracting from a CICS DFHCOMMAREA Large Buffer Program

This section assumes **Input Message same as Output Message** is not checked. COBOL output and COBOL input parameters are different, that is, the WM-LCB-OUTPUT-BUFFER (as in the large buffer example above) is set to an address that is different to WM-LCB-INPUT-BUFFER.

If you are extracting IDL from a COBOL source or extending the IDL file by extracting an additional COBOL source with interface type CICS with DFHCOMMAREA large buffer, the **Extractor Settings** dialog appears (see also [Step 4: Define the Extraction Settings and Start Extraction](#)).

Make sure the interface type is correct and check box **Input Message same as Output Message** is cleared.

The screenshot shows a dialog box titled "COBOL Source". It contains the following fields and options:

- File Name:** LargeBuf
- Operating System:** z/OS
- Interface Type:** CICS with DFHCOMMAREA large buffer interface (selected from a dropdown menu)
- Input Message same as Output Message:** An unchecked checkbox.

Press **Next** to open the COBOL Mapping Editor.

### ➤ To select the COBOL interface data items of your COBOL server

- 1 Add the COBOL data items of the input large buffer to **Input Message** by using the context menu or toolbar available in the [COBOL Source View](#) and [COBOL Interface](#). To do this, locate in the PROCEDURE DIVISION the SET ADDRESS OF <x> TO WM-LCB-INPUT-BUFFER statement. The COBOL data item <x> is the input large buffer you are looking for. See [Notes](#).
- 2 Add the COBOL data items of the output large buffer to **Output Message** by using the context menu and toolbars available in the [COBOL Interface](#) and [IDL Interface](#). To do this, locate in the PROCEDURE DIVISION the SET ADDRESS OF <y> TO WM-LCB-OUTPUT-BUFFER statement. The COBOL data item <y> is the output large buffer you are looking for. See [Notes](#).
- 3 Continue with [COBOL to IDL Mapping](#).



#### Notes:

1. Do not select the pointers in the DFHCOMMAREA pointing to the large buffers, in the example above, WM-LCB-INPUT-BUFFER and WM-LCB-OUTPUT-BUFFER.

2. It is very important to select the right COBOL data items describing the interface of the COBOL server correctly. This means the COBOL data items used as parameters must match in number and in sequence of formats (COBOL usage clause).
3. If your COBOL server contain REDEFINES, the first REDEFINE path is offered by default. Check manually whether this is the one you want. If not, correct it. You can select any other REDEFINE path.

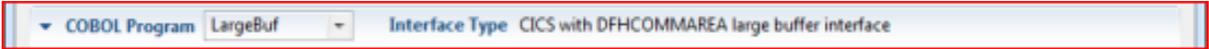
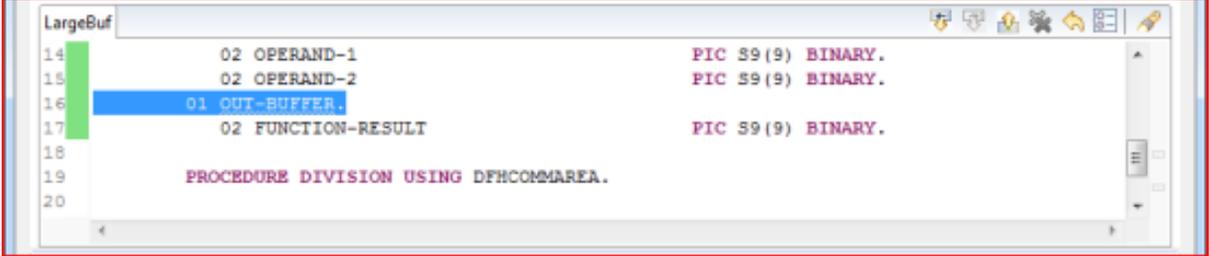
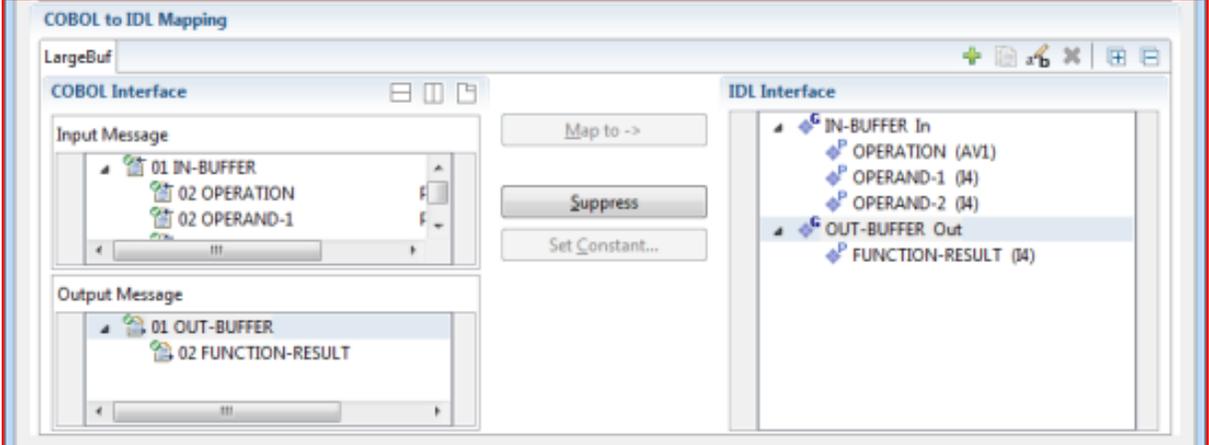
The user interface of the COBOL Mapping Editor is described below.

## Mapping Editor User Interface

This section assumes you have set the extraction settings as described above. The following areas of the COBOL Mapping Editor user interface are described here:

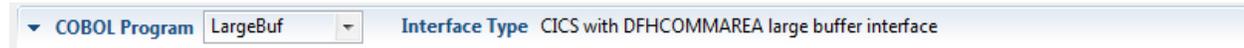
- [COBOL Program Selection](#)
- [COBOL Source View](#)
- [COBOL to IDL Mapping](#)

For COBOL interface types where COBOL input and COBOL output parameters are different, the user interface of the COBOL Mapping Editor looks like this:

1. 
2. 
3. 

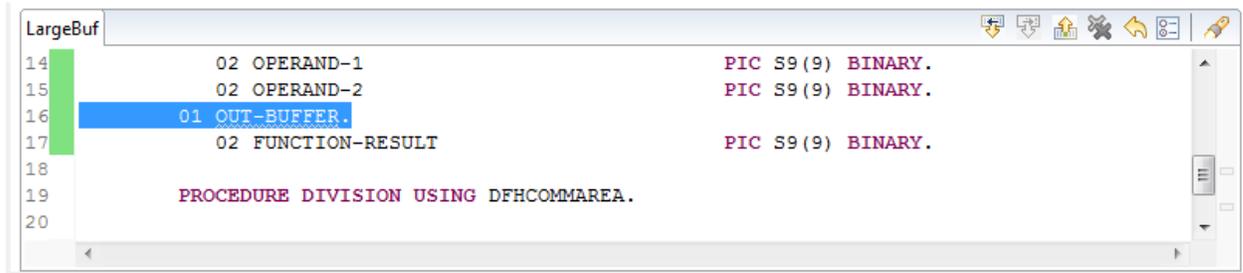
1. **COBOL Program Selection.** Currently selected program with interface type
2. **COBOL Source View.** Contains all related sources for the currently selected COBOL program
3. **COBOL to IDL Mapping.** Tree view of your selected COBOL data items and mapping buttons with which you can map these items to your IDL interface

## COBOL Program Selection



The COBOL Program Selection displays the current selected COBOL program with its interface type. If you have extracted more than one COBOL program within the associated IDL file, you can switch to another COBOL program with its mapping by selecting the name in the combo box.

## COBOL Source View



All COBOL data items contained in the LINKAGE and WORKING-STORAGE SECTION are offered in a text view. The text view contains all related sources (including copybooks) for the currently selected COBOL program. It is used for selecting data items and retrieving information from the original COBOL sources. The light green bar indicates that the data item is already contained in the COBOL Interface; a dark green bar indicates the data item is selectable and can be added to the COBOL Interface. This section can be collapsed. If you open the Editor with **Modify Interface** it is collapsed by default. The toolbar provides the following actions:

-  Add selected COBOL data item to COBOL Interface as Input Message.
-  Add selected COBOL data item to COBOL Interface as Output Message.
-  Remove selected COBOL data item from COBOL Interface.
-  Remove all COBOL data items from COBOL Interface.
-  Reset COBOL Interface to initial state.
-  Show dialog to modify COBOL Source Characteristics.
-  Show dialog to find text in Source.

The same functionality is also available from the context menu.

## COBOL to IDL Mapping

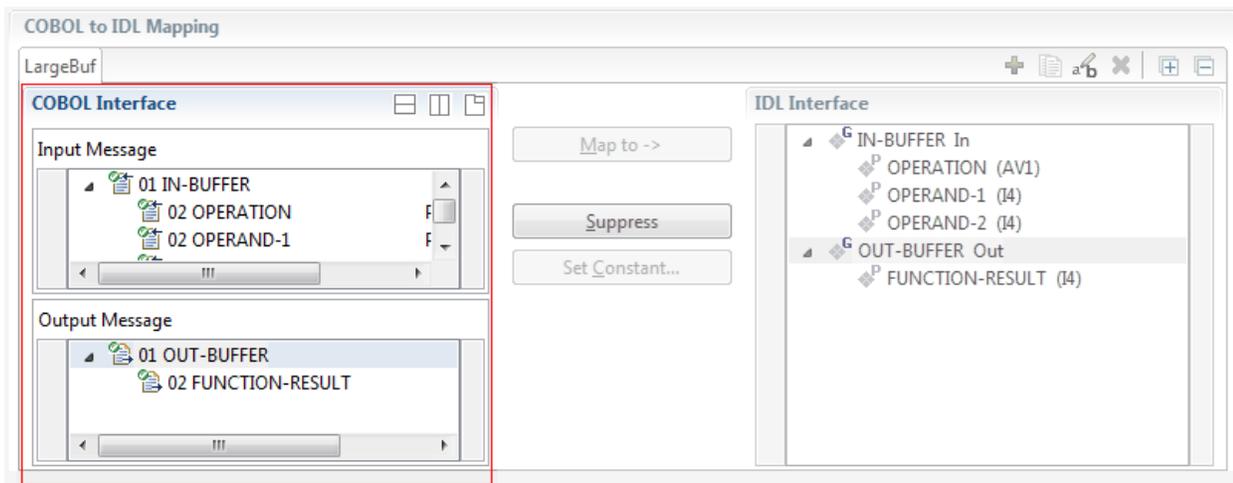
This section covers the following topics:

- [COBOL Interface](#)
- [Mapping Buttons](#)
- [IDL Interface](#)

### COBOL Interface

The **COBOL Interface** shows a tree view of your selected COBOL data items describing the interface of the COBOL server. A context menu is available for the COBOL data items, which provides mapping and other functions. On some COBOL data items, decision icons indicate where particular attention is needed, including mapping icons to visualize the COBOL data type and your current mapping.

The COBOL data item names are derived from the COBOL source from which they were extracted. If your COBOL interface contains parameters without a name, that is, the keyword `FILLER` is used, those COBOL data items are shown as `[FILLER]`. See [FILLER Pseudo-Parameter](#).



You can modify the COBOL interface using context menu or toolbar; decision and mapping icons provide additional information.

### Context Menu

The context menu on COBOL data items provides the following mapping and other functions, depending on the data item type, the COBOL level and the current mapping.

<b>Map to</b>	A suppressed COBOL data item becomes visible in the IDL interface. Used also to select another <code>REDEFINE</code> path.
<b>Suppress</b>	Suppress unneeded COBOL data items.
<b>Set Constant</b>	Set COBOL data items to constant.

<b>Set Array Mapping</b>	Map an array to a fixed sized or unbounded array.
<b>Set Multiple Possible Output (MPO) Structures</b>	Set COBOL data items where the server program decides the output structure used on return. Specify the set of multiple possible output (MPO) structures and the criteria when a structure is used.
<b>Remove from COBOL Interface</b>	Remove the data item from the COBOL interface. This also removes the mapped IDL parameter from all IDL interfaces for the current COBOL program. See <a href="#">COBOL Program Selection</a> .

See also [Mapping Editor IDL Interface Mapping Functions](#).

### Toolbar

The toolbar offers the following actions:

-  Create IDL Interface. Creates a new IDL interface based on the current COBOL interface: all IDL parameters are of IDL direction InOut; no IDL parameters are set to constant; for COBOL REDEFINE, the first REDEFINE path is mapped to IDL; FILLERS are suppressed according to your selection, see [Step 4: Define the Extraction Settings and Start Extraction](#).
-  Copy current IDL Interface. Creates a duplicate of the current IDL interface: all modifications such as IDL directions, suppress, selection of REDEFINE paths etc. are kept.
-  Remove current IDL Interface.
-  Rename current IDL Interface.
-  Expand the full tree.
-  Collapse the full tree.

See also [Map to Multiple IDL Interfaces](#).

### Decision Icons

The decision icons in the first column are set on COBOL data items where particular attention is needed:

-  This icon visualizes a COBOL REDEFINE. It is essential that you map the correct redefine path for your mapping to In, Out or InOut using the context menu. If you map a REDEFINE path, all other sibling REDEFINE paths are automatically set to "Suppress".

### Mapping Icons

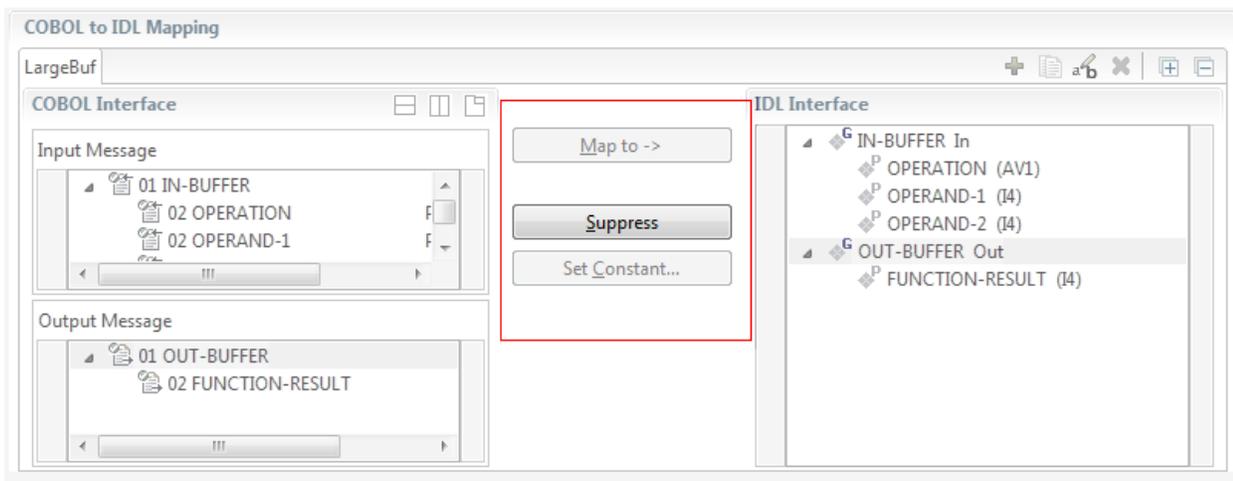
The following mapping icons on the COBOL data items indicate your current IDL mapping:

-  Scalar parameter, mapped to In.
-  Scalar parameter, mapped to Out.

-  Group parameter, here mapped to In.
-  REDEFINE parameter, here mapped to Out.
-  Parameter set to Constant.

## Mapping Buttons

The following buttons are available:



### Map to ->

A suppressed COBOL data item becomes visible in the IDL interface. Used also to select another REDEFINE path.

### Suppress

See *Suppress Unneeded COBOL Data Items*.

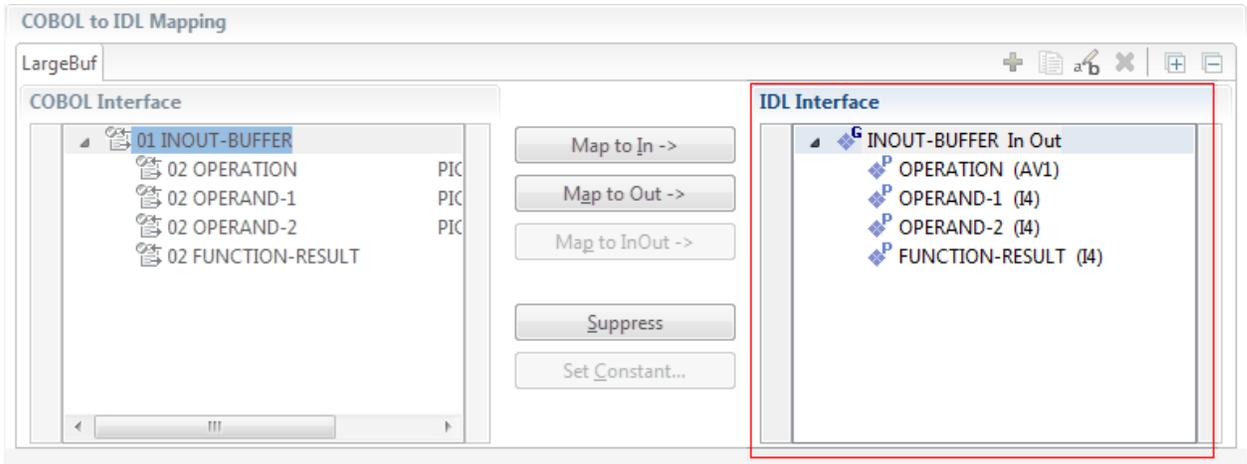
### Set Constant...

See *Set COBOL Data Items to Constants*.

## IDL Interface

If you have mapped the COBOL interface to multiple IDL interfaces, select the IDL interface by choosing the tabs. In the **IDL Interface** tree view, a context menu is also available with the following possibilities:

- Rename
- Remove from COBOL Interface. This also removes the mapped IDL parameter from all IDL interfaces for the current COBOL program. See *COBOL Program Selection* above.



## Mapping Editor IDL Interface Mapping Functions

This section covers the following topics:

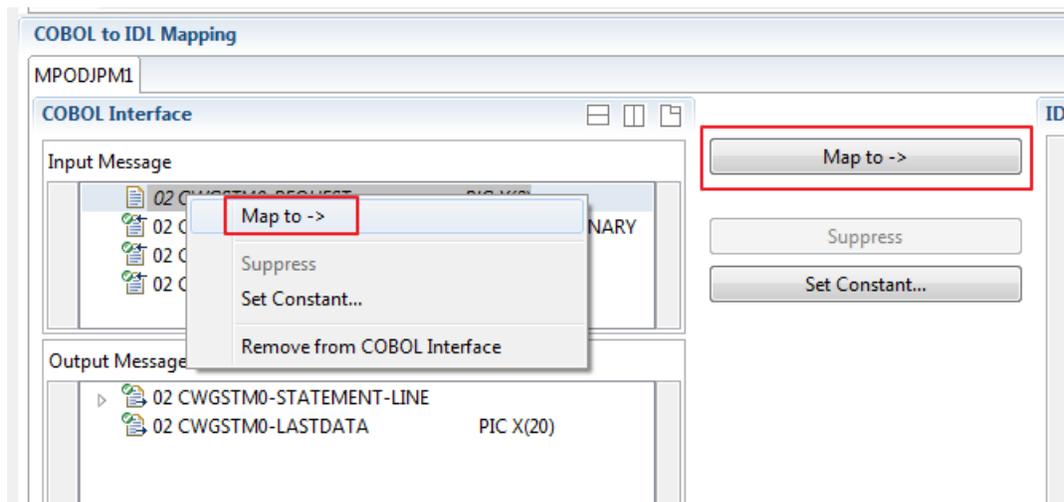
- Map to
- Map OCCURS DEPENDING ON
- Map to Multiple IDL Interfaces
- Select REDEFINE Paths
- Suppress Unneeded COBOL Data Items
- Set COBOL Data Items to Constants
- Set Arrays (Fixed <-> Unbounded)
- Set Multiple Possible Output (MPO) Structures

### Map to

With the **Map to** functions you make a COBOL data item visible as an IDL parameter in the IDL interface, that is, you design the IDL interface by defining input and output parameters.

#### > To map COBOL data items to IDL interface

- 1 Go *step-by-step* through all *top-level* COBOL data items in the COBOL interface and use the **Map to** function available in the context menu of the COBOL interface and as mapping button to make a COBOL data item visible as an IDL parameter in the IDL interface:



- 2 Do the same for the output message of the COBOL interface.



#### Notes:

1. If a COBOL group is mapped, all subordinate COBOL data items are also made visible in the IDL interface.
2. With the inverse function **Suppress Unneeded COBOL Data Items** (see below) available in the context menu of the COBOL interface and as mapping button, a COBOL data item can be removed from the IDL interface.

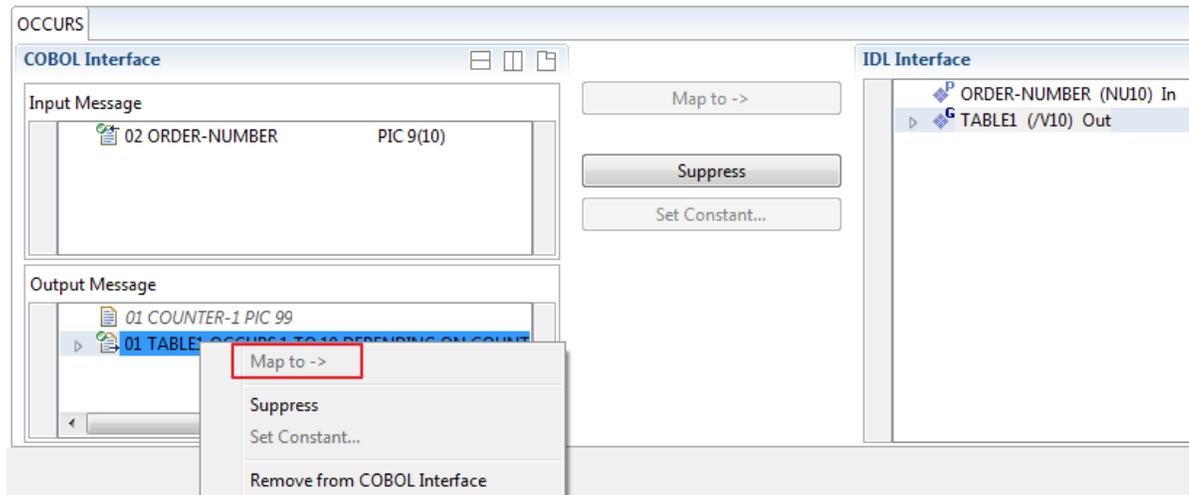
## Map OCCURS DEPENDING ON

You can make the COBOL ODO subject (here COBOL data item TABLE) of a variable-sized COBOL table (see [COBOL Tables with Variable Size - DEPENDING ON Clause](#)) visible as an IDL unbounded group (with maximum). The ODO object (here COBOL data item COUNTER-1) is suppressed and therefore not part of the IDL interface. This is because the number of elements of the IDL unbounded group is already implicitly available. See the following example:

```
01 COUNTER-1 PIC 99.
01 TABLE OCCURS 1 TO 10 DEPENDING ON COUNTER-1
  02 FIELD1 PIC XX.
  02 FIELD2 PIC 99.
```

### > To map OCCURS DEPENDING ON

- Add the COBOL subject (here data item TABLE) and ODO object (here data item COUNTER-1) to the input message or to the output message, wherever they belong. It is important both data items are always together per message direction (input or output).



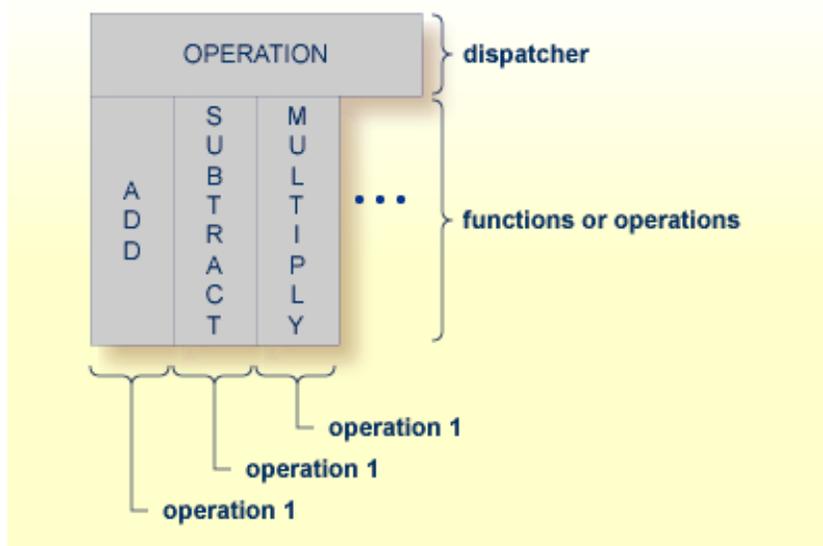
### Notes:

1. The ODO subject can be mapped to the IDL interface.

2. The ODO object is always suppressed, but is required to be part of the same message direction (Input Message or Output Message) of the COBOL interface.
3. IDL directions are described in the direction-attribute in `attribute-list` under *Software AG IDL Grammar* in the IDL Editor documentation.

### Map to Multiple IDL Interfaces

Assume the COBOL server program provides multiple functions or operations, in the following example ADD, SUBTRACT, MULTIPLY. Some dispatcher front-end code executes the correct function, for example, depending on a *function-code* or *operation-code* parameter:



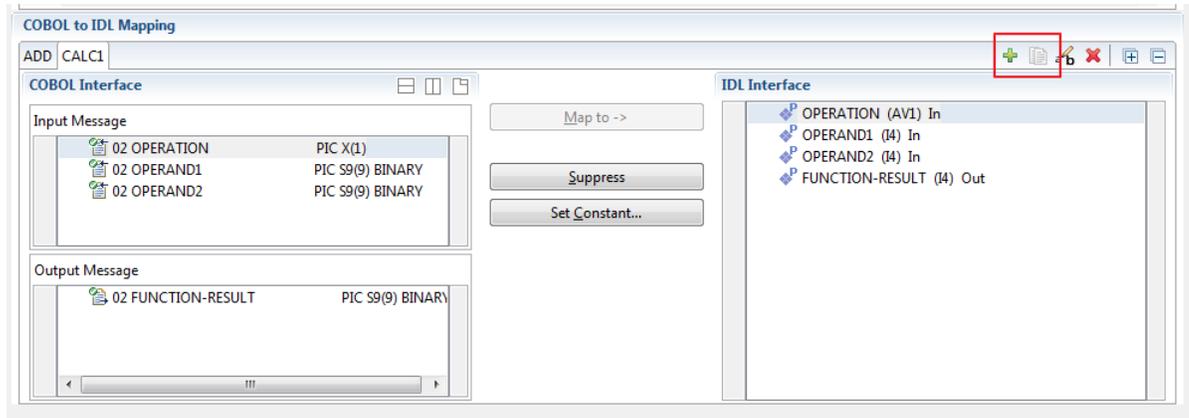
This example is described in more detail under [Example 1: COBOL Server with Multiple Functions](#).

If you have such a situation, a good approach is to expose each COBOL server program function separately as an IDL program. This gives advantages in further processing of the IDL and COBOL mapping files (SVM and CVM). For example:

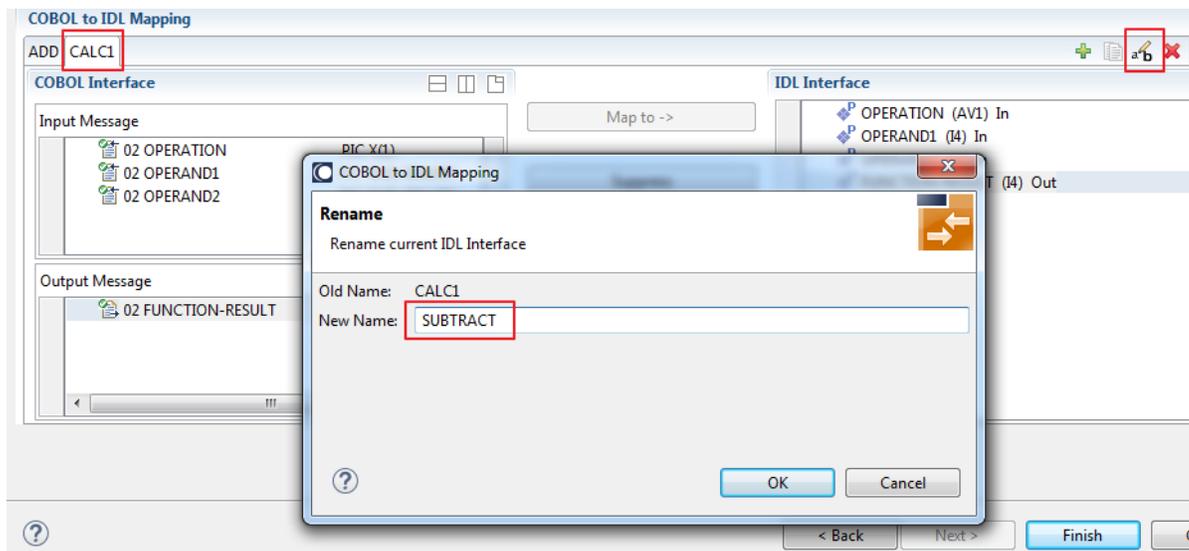
- If your target endpoint is a web service: instead having a Web service with a single operation, you get a web service with multiple operation, one operation for each COBOL function.
- If your target endpoint is Java or .NET: instead having a class with a single method, you get a class with multiple methods, one method for each COBOL function.

#### » To map a COBOL interface to multiple IDL interfaces

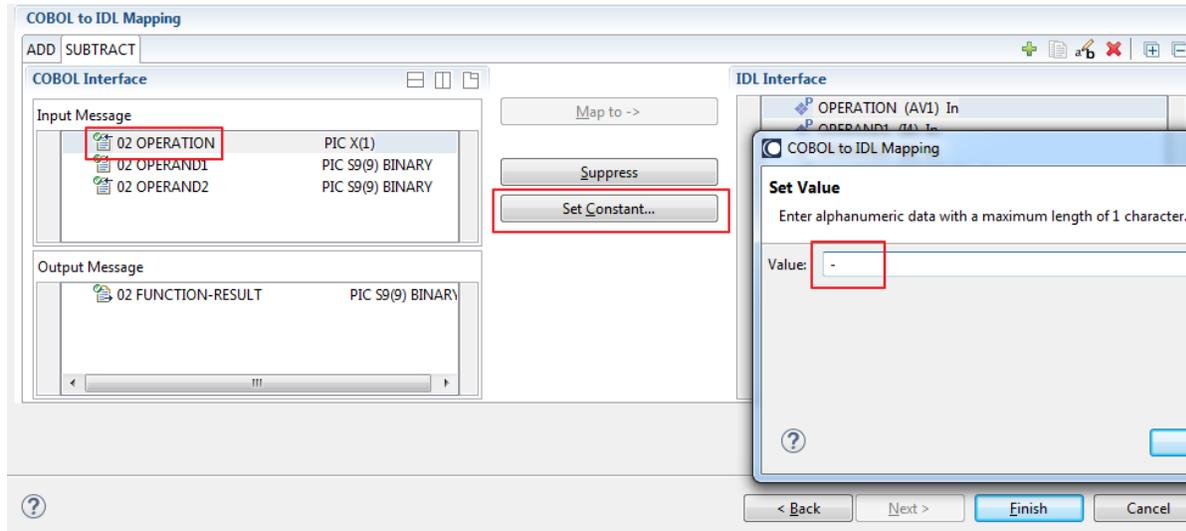
- 1 Select the tab with COBOL to IDL Mapping. For each function, define a separate IDL interface with the toolbar functions or :



- 2 Give the IDL interfaces meaningful names with the toolbar function .



- 3 Define the required constant values to the *function-code* or *operation-code* parameter, see *Set COBOL Data Items to Constants* above:



For the delivered Example 1: COBOL Server with Multiple Functions:

- First, for step 1 above: Extract and define 3 separate IDL programs ADD, SUBTRACT, MULTIPLY.
- Second, for step 2 above: Rename them to suitable names, e.g. 'ADD', 'SUBTRACT', 'MULTIPLY'.
- Third, for step 3 above: Define the constants '+', '-' and '\*' to the parameter OPERATION respectively.
- After pressing **Finish**, the following IDL together with a server mapping file is created. See *Server Mapping Files for COBOL*.

```
library 'EXAMPLE' is

program 'ADD' is
define data parameter
  1 OPERAND1 (I4) In
  1 OPERAND2 (I4) In
  1 FUNCTION-RESULT (I4) Out
end-define

program 'SUBTRACT' is
define data parameter
  1 OPERAND1 (I4) In
  1 OPERAND2 (I4) In
  1 FUNCTION-RESULT (I4) Out
end-define

program 'MULTIPLY' is
define data parameter
  1 OPERAND1 (I4) In
  1 OPERAND2 (I4) In
  1 FUNCTION-RESULT (I4) Out
end-define
```

**Notes:**

1. The following functions are offered to create further mappings from the COBOL interface, resulting in multiple IDL interfaces (IDL programs).

Icon	Function	Description
	Create IDL Interface	Creates a new IDL interface based on the current COBOL interface. All IDL parameters are of IDL direction InOut; no IDL parameters are set to constant; for COBOL REDEFINE, the first REDEFINE path is mapped to IDL; FILLERs are suppressed according to your selection, see <a href="#">Step 4: Define the Extraction Settings and Start Extraction</a> .
	Copy current IDL Interface	Creates a duplicate of current IDL interface. All modifications such as IDL directions, suppress, selection of REDEFINE paths etc. are kept.
	Rename current IDL Interface	The default name for the IDL interface is based on the COBOL program name plus appended number. With this function you can give the IDL interface a suitable name.
	Remove current IDL Interface	Deletes the current IDL interface.

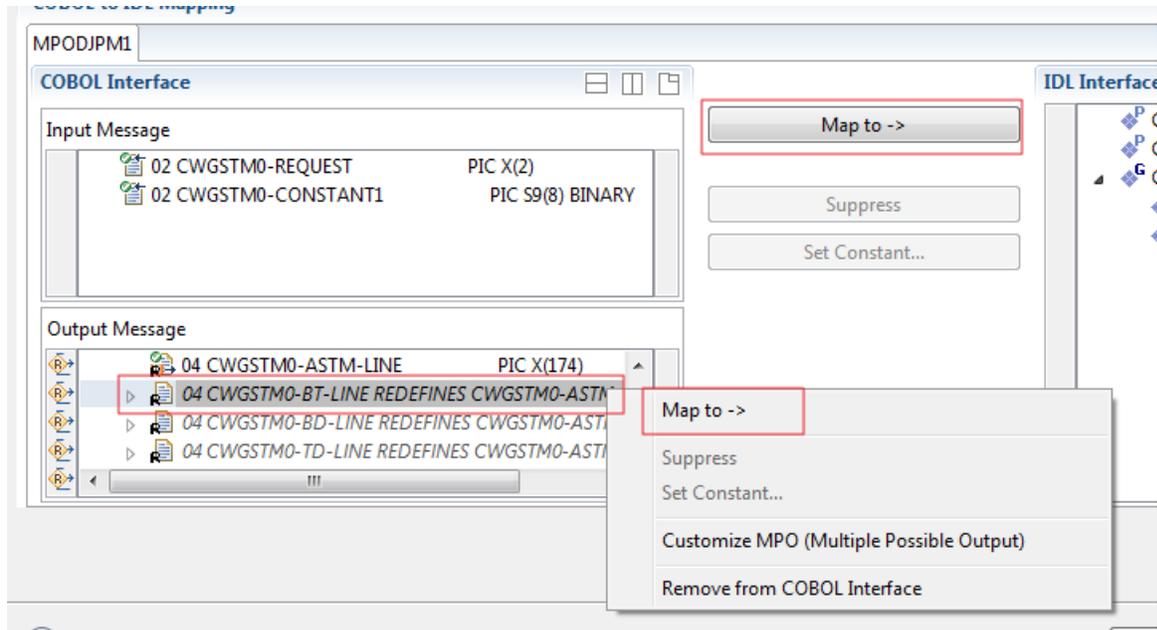
2. With the steps 1 thru 3 described here you can emulate the behavior of function Map to Operation of EntireX version 9.6 and earlier.

**Select REDEFINE Paths**

For COBOL server programs containing COBOL REDEFINES, the correct REDEFINE path needs to be chosen for the IDL interface.

**> To select redefine paths**

- Use the **Map to** function available in the context menu of the COBOL interface and as mapping button to make the COBOL REDEFINE path available in the IDL interface.



Begin with the COBOL REDEFINE defined at the highest level first. Work through all inner COBOL REDEFINE data items, going from higher levels to lower levels.

#### Notes:

1. Only one REDEFINE path of a COBOL REDEFINE can be mapped to the IDL interface. All COBOL REDEFINE siblings are suppressed.
2. If a REDEFINE path is actively mapped to the IDL interface, all COBOL REDEFINE siblings are suppressed.
3. You can suppress all REDEFINE paths of a COBOL REDEFINE. Simply suppress the active REDEFINE path, see *Suppress Unneeded COBOL Data Items* above.

### Suppress Unneeded COBOL Data Items

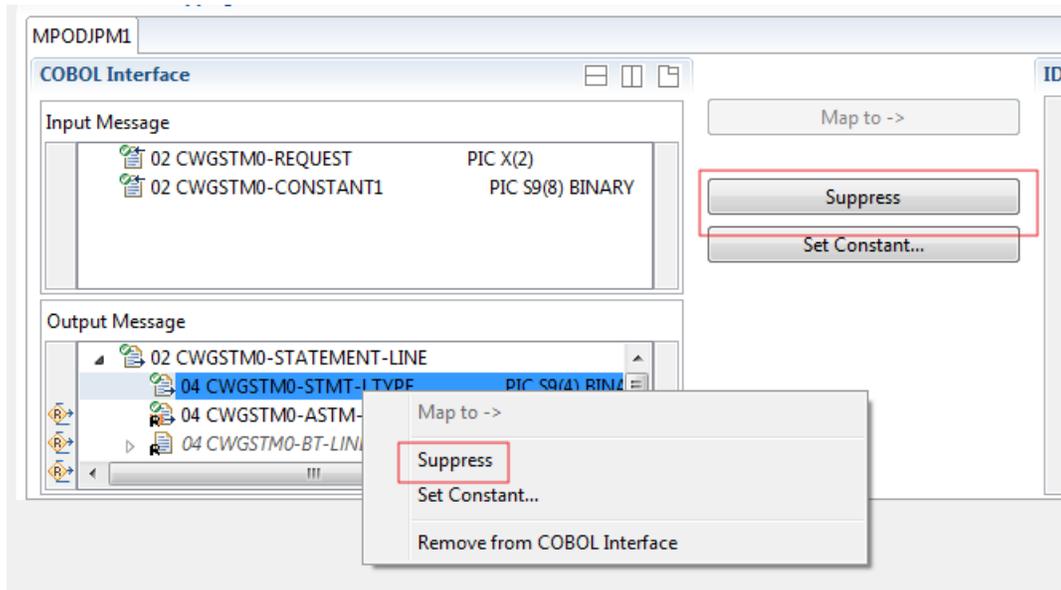
COBOL data items without any relevant information can be made invisible in the IDL interface. The IDL interface is simplified - it becomes shorter and tidier. This is useful, for example

- for FILLER data items
- if the RPC client or Adapter Service does not need an Out parameter
- if the RPC server or Adapter Service does not need an In parameter and a low value can be provided

If you are using an RPC server such as the z/OS (CICS | Batch), z/VSE (CICS | Batch), Micro Focus or BS2000/OSD RPC server, the amount of data to be transferred to/from the RPC client is also reduced.

➤ To suppress unneeded COBOL data items

- Use the **Suppress** function available in the context menu of the COBOL interface and as mapping button to make the COBOL data item invisible in the IDL interface:



**Notes:**

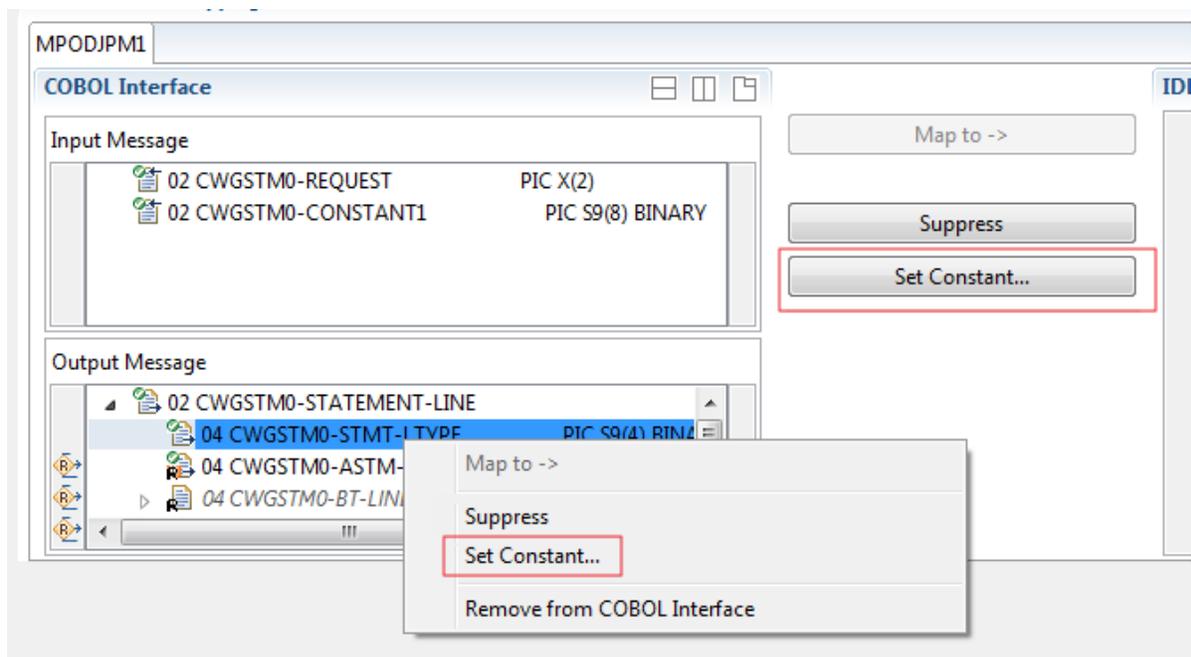
1. The COBOL data item is not part of the IDL interface. It is invisible for RPC clients or Adapter Service.
2. The RPC server or Adapter Service provides the COBOL data item to your COBOL server with low value, managing the offset to the next COBOL data item.
3. If a COBOL group is suppressed, all subordinate COBOL data items are suppressed as well.
4. With the inverse function **Map to** (see above) available in the context menu of the COBOL interface and as a mapping button, a COBOL data item can be made visible in the IDL interface again.

## Set COBOL Data Items to Constants

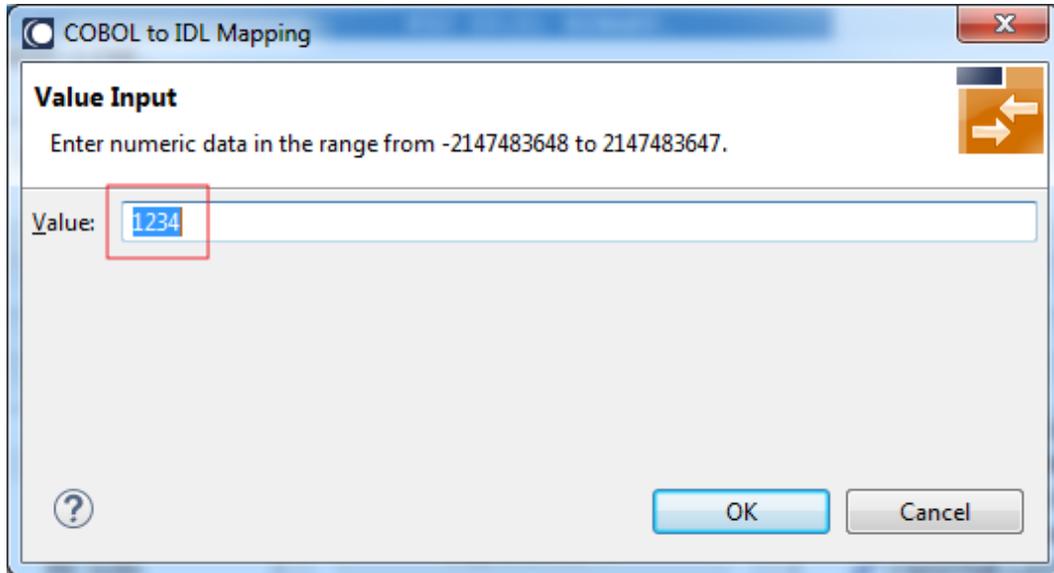
COBOL data items that always require fixed constant values on input to the COBOL server program can be made invisible in the IDL interface and initialized with the required constant values. This is useful for keeping the IDL interface short and tidy. RPC clients or Adapter Services are not bothered with IDL parameters that always contain constants, such as `RECORD-TYPES`. This function is often used in conjunction with **Map to Multiple IDL Interfaces** (see above).

### › To set COBOL data items to constants

- 1 Use the **Set Constant** function available in the context menu of the COBOL interface and as mapping button to define a constant value for a COBOL data item:



- 2 You are prompted with a window to enter the constant value:



 **Notes:**

1. The COBOL data item is not part of the IDL interface. It is invisible for RPC clients or Adapter Services.
2. The RPC server or Adapter Service provides the defined constant in the COBOL data item to your COBOL server.
3. With the function **Map to** (see above) available in the context menu of the COBOL interface and as a mapping button, a COBOL data item can be made visible in the IDL interface again.

### Set Arrays (Fixed <-> Unbounded)

For COBOL server programs using the message length to transfer a variable number of elements in a COBOL table with a fixed size (see [COBOL Tables with Fixed Size](#)) in a variable manner (see [COBOL Tables with Variable Size - DEPENDING ON Clause](#)) you need to set the mapping to unbounded array.

For details of such a COBOL server program see [Example 2: COBOL Server Using Fixed-length Tables in Variable Manner](#).

#### ➤ To set arrays from fixed to unbounded or vice versa

- Select the COBOL table and use the function **Set Arrays (Fixed<->Unbounded)** available in the context menu. A modal window is displayed. Select **Unbounded array**. The IDL array parameter will be changed from fixed array */number* to an unbounded array */Nnumber*, see *array-definition* under *Software AG IDL Grammar* in the IDL Editor documentation.

 **Notes:**

1. This option should be used carefully and requires knowledge of the COBOL server program. Be aware that an incorrect mapping results in runtime errors.
2. The COBOL Table with a fixed size (see *COBOL Tables with Fixed Size*) used in this manner must be the last parameter of the COBOL interface; it must not be a subparameter of any other COBOL table and must not contain any `DEPENDING ON` clause (see *COBOL Tables with Variable Size - DEPENDING ON Clause*).

## Set Multiple Possible Output (MPO) Structures

A COBOL server program produces more than one type of output. The layout of the output can therefore take two or more dissimilar shapes. The COBOL server program decides at runtime the output structure returned, that is, the COBOL layout on output varies.

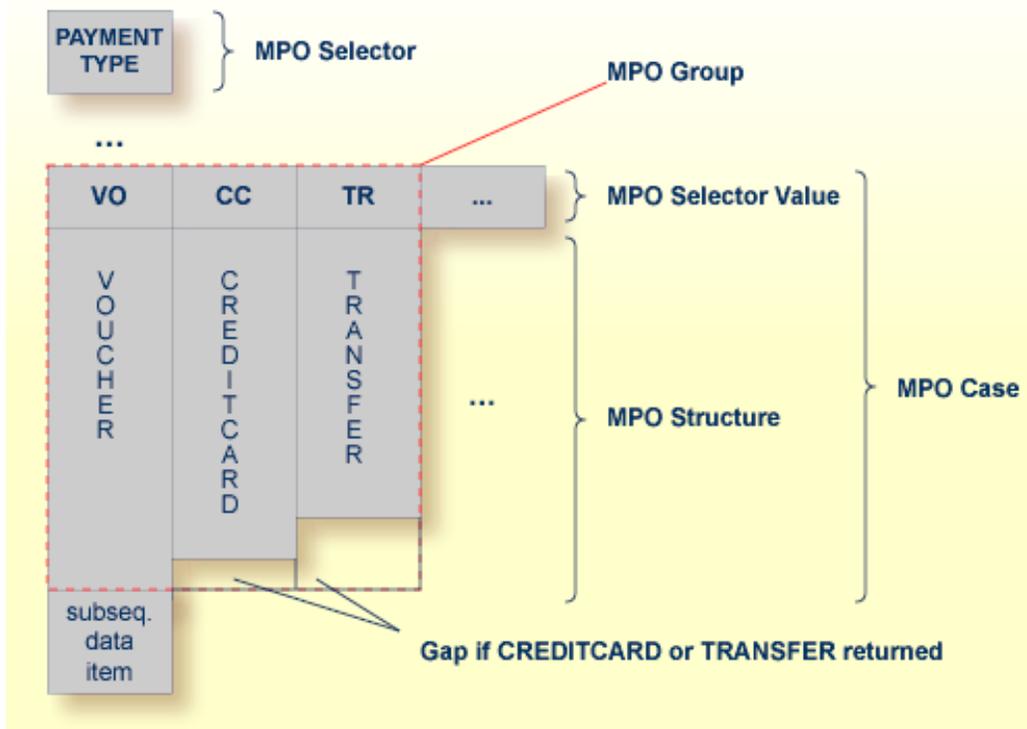
- [Multiple Possible Output with REDEFINES](#)
- [Optional Output with Groups](#)
- [MPO Terminology](#)
- [Steps](#)

## Multiple Possible Output with REDEFINES

As illustrated in *Example 3: COBOL Server Using Multiple Possible Output (MPO)*, a COBOL *REDEFINES Clause* is often used to describe the possible output structures. In COBOL this is the standard way to describe multiple possible output.

In addition, the COBOL interface

- limits the number of possible output structures returned
- defines all possible output structures, that is, they are known during extraction. In the example these are the structures `PAYMENT-DATA-VOUCHER`, `PAYMENT-DATA-CREDITCARD` and `PAYMENT-DATA-TRANSFER`. These are the MPO structures.
- contains an additional COBOL data item carrying a value related to the returned output structure. By inspecting this data item first, the appropriate output structure can be selected to address the data correctly. In the example it is `PAYMENT-TYPE`. This item is the MPO selector.
- always occupies memory to be able to transfer the longest output structure. If the actual returned output structure is shorter than the longest possible output structure, there is a gap (space) between the multiple possible output and the subsequent data item.



This abstract concept is known as *multiple possible output* (MPO). EntireX bundles all MPO structures into an MPO group. See *MPO Terminology* below.

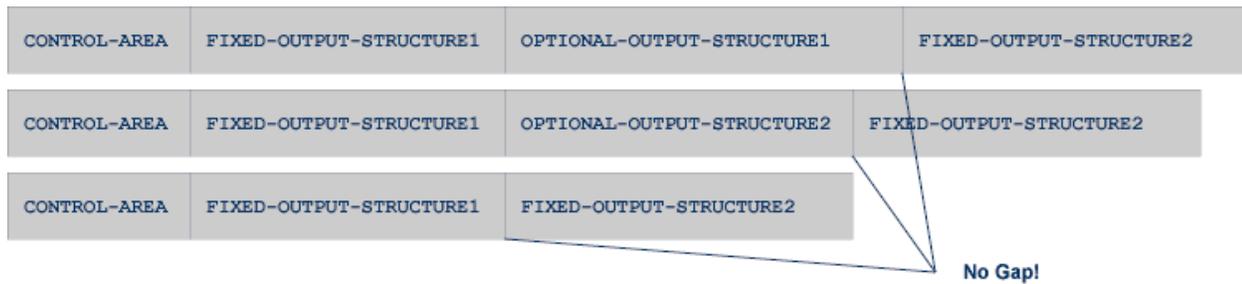
### Optional Output with Groups

As illustrated in [Example 4: COBOL Server Using Optional Output](#), COBOL group data items can be used to describe optional output structures. See *Optional COBOL Group Data Items*. Optional output with group data items are a variant of multiple possible output (MPO).

In addition, the COBOL interface

- limits the number of possible output structures returned
- defines all optional output structures, that is, they are known during extraction. In the example these are the structures `OPTIONAL-OUTPUT-STRUCTURE1` and `OPTIONAL-OUTPUT-STRUCTURE2`. These are the MPO structures.
- contains an additional COBOL data item carrying an indication if the optional output is present. By inspecting this data item first, the appropriate optional output structure can be selected to address the data correctly. If its value does not match, the optional output is not present. In the example it is `OPTIONAL-OUTPUT`. This item is the MPO selector.
- If the optional output is not present no memory is occupied. There is no gap between the optional output and the subsequent data item, as opposed to *Multiple Possible Output with REDEFINES* above.

In the example there are three different shapes of output:



## MPO Terminology

The following terminology is used with MPOs:

### MPO structure

A COBOL group describing the output layout used in an MPO case. All alternative layouts in an MPO group are often described with COBOL `REDEFINES`. An MPO structure can also contain other MPO groups.

### MPO group

Bundles together all MPO structures that can be used alternatively. A COBOL interface can contain more than one MPO group.

### MPO case

An MPO structure together with its MPO selector values (one or more).

### MPO selector

A COBOL data item containing a specific value (MPO selector value) where the actual MPO case can be determined. The MPO selector precedes the MPO group and is located outside the MPO group.

### MPO selector value

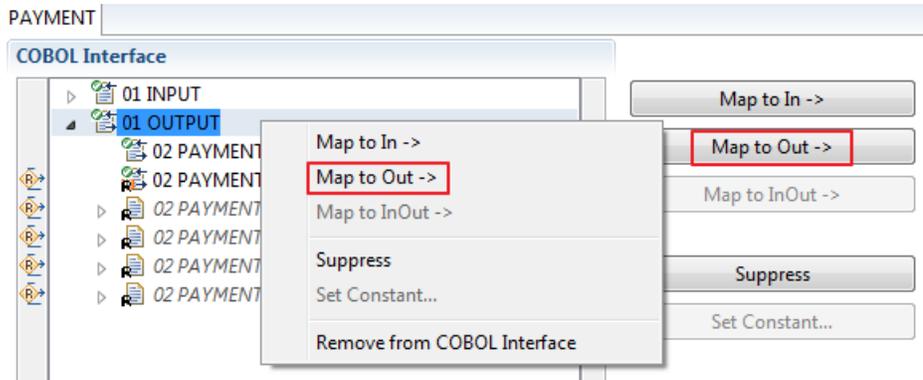
Each value indicates exactly one output structure. An output structure can be indicated by further values.

## Steps

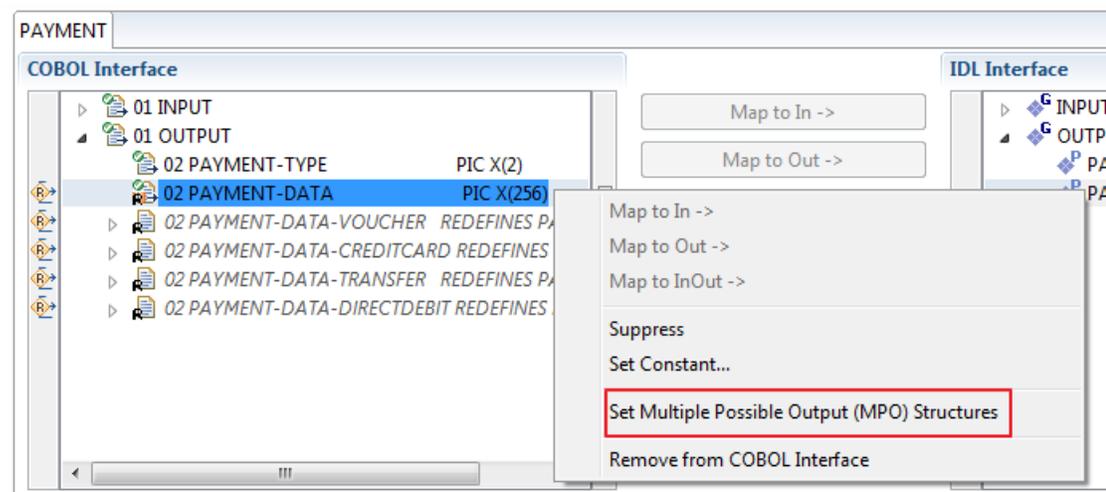
### ➤ To set multiple possible output (MPO) structures

Use the **Set Multiple Possible Output (MPO) Structures** function available in the context menu of the COBOL interface to create new or modify existing MPO groups.

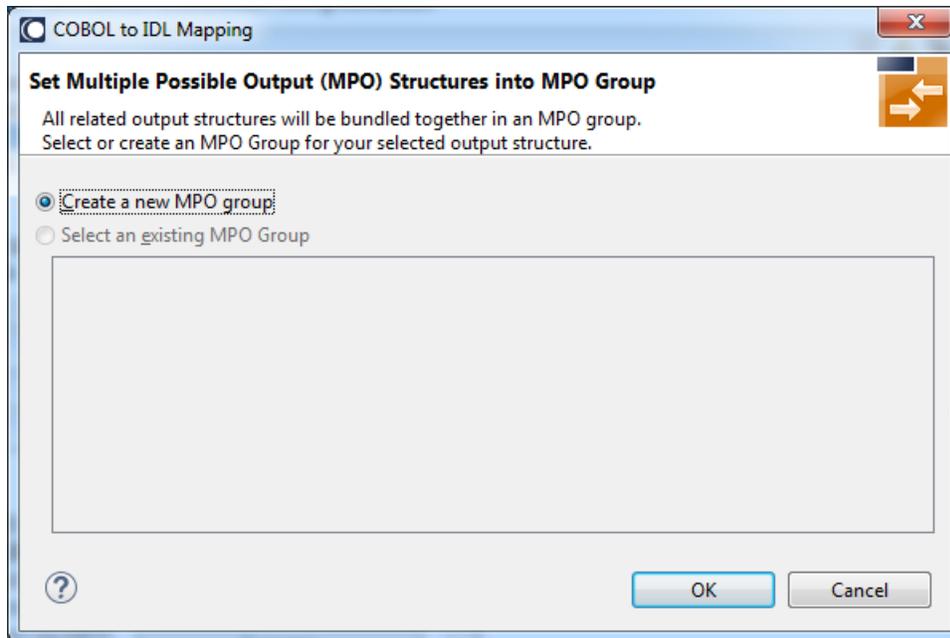
- 1 Set the top-level COBOL data item where the MPO structures are contained to IDL direction Out. Use the **Map to Out** function for this purpose:



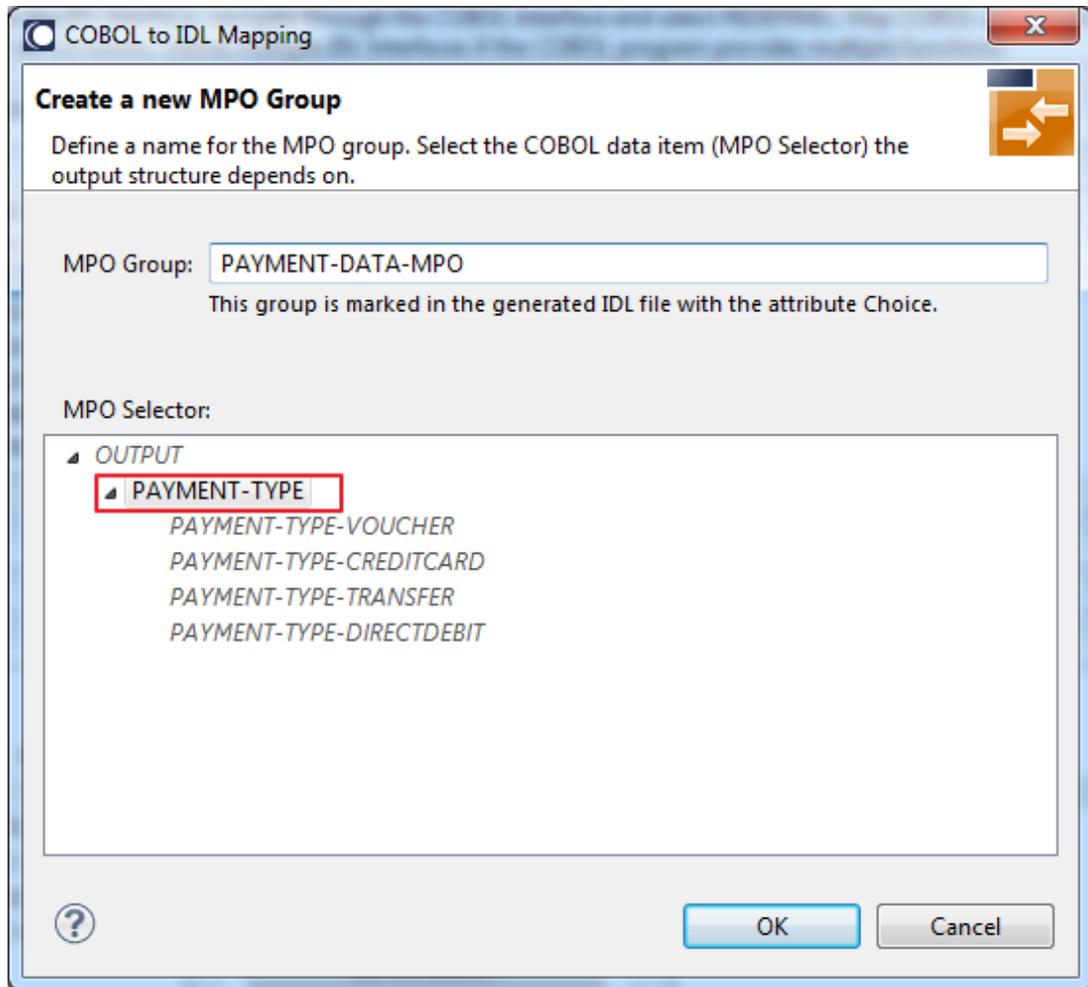
- From the context menu of the COBOL interface of the COBOL REDEFINE, choose **Set Multiple Possible Output (MPO) Structures**.



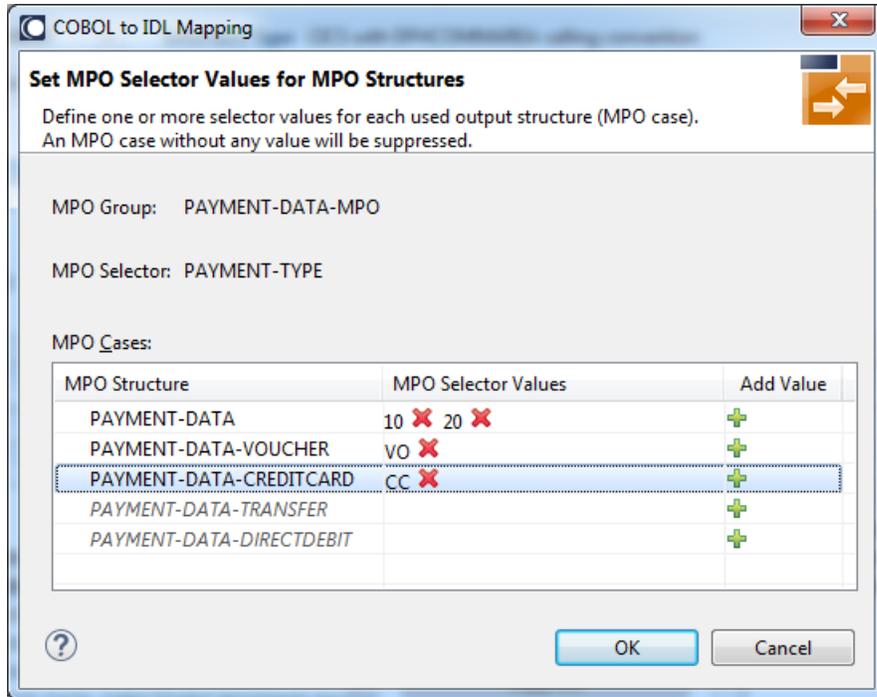
- Set Multiple Possible Output (MPO) Structures into MPO Group.



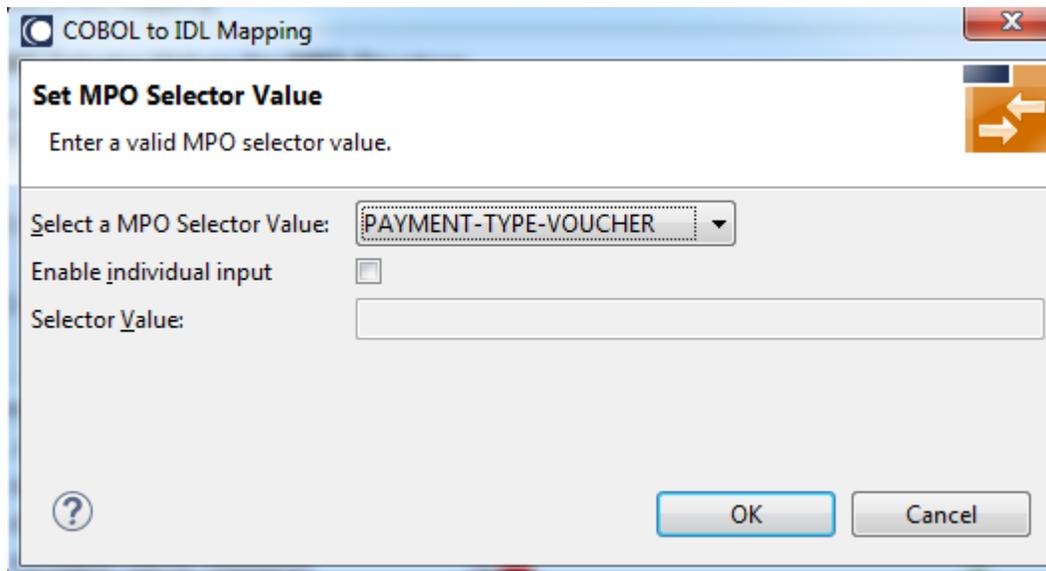
- 4 Create a new MPO group.



- 5 Set MPO selector values for MPO Structures.



Use the functions ✗ to delete and + to add MPO selector values:



**Notes:**

1. To add multiple MPO selector values per MPO structure, use the function + multiple times for the same MPO structure (see value 10 and 20 for structure PAYMENT-DATA).
2. MPO structures without any MPO selector are unused and suppressed in the IDL interface value (e.g. see structure PAYMENT-DATA-TRANSFER).

3. Each MPO selector value must uniquely identify an MPO structure. The same value cannot be used more than once for different MPO structures.
4. If no defined MPO selector value matches during runtime, an empty MPO group is delivered to the RPC client, that is, none of the MPO cases contain any data. No runtime error is produced.
- 6 For the delivered example *COBOL Server Using Multiple Possible Output (MPO)* (see below): After pressing **Finish**, the following IDL together with a server mapping file is created. See *Server Mapping Files for COBOL*.

```
library 'PAYMENT' is

program 'PAYMENT' is
  define data parameter
    1 INPUT          In
      2 ORDER-NUMBER      (NU10)
    1 OUTPUT         Out
      2 PAYMENT-TYPE      (A2)
      2 PAYMENT-DATA-MPO Choice
        3 PAYMENT-DATA    (/V1)
        4 PAYMENT-DATA    (AV256)
        3 PAYMENT-DATA-VOUCHER (/V1)
        4 VOUCHER-ORIGIN  (AV128)
        4 VOUCHER-SERIES  (AV128)
        3 PAYMENT-DATA-CREDITCARD (/V1)
        4 CREDITCARD-NUMBER (NU18)
        4 CREDITCARD-CODE  (NU12)
        4 CREDITCARD-VALIDITY (AV8)
  end-define
```

## Programming Techniques

- [Example 1: COBOL Server with Multiple Functions](#)
- [Example 2: COBOL Server Using Fixed-length Tables in Variable Manner](#)
- [Example 3: COBOL Server Using Multiple Possible Output \(MPO\)](#)
- [Example 4: COBOL Server Using Optional Output](#)

### Example 1: COBOL Server with Multiple Functions

Assume a COBOL server program has a FUNCTION or OPERATION code COBOL data item in its COBOL interface. The COBOL server program behaves differently depending on field values of this data item. See the following example where a COBOL programs implements a calculator with the functions ADD, SUBTRACT, MULTIPLY, etc. The execution of the different functions is controlled by the COBOL data item OPERATION:

```

. . .
01 OPERATION                PIC X(1).
01 OPERAND1                 PIC S9(9) BINARY.
01 OPERAND2                 PIC S9(9) BINARY.
01 FUNCTION-RESULT         PIC S9(9) BINARY.
. . .
MOVE 0 TO FUNCTION-RESULT.
EVALUATE OPERATION
  WHEN "+"
    ADD OPERAND1 OPERAND2
    GIVING FUNCTION-RESULT
  WHEN "-"
    SUBTRACT OPERAND2 FROM OPERAND1
    GIVING FUNCTION-RESULT
  WHEN "*"
    MULTIPLY OPERAND1 BY OPERAND2
    GIVING FUNCTION-RESULT
  WHEN . . .
END-EVALUATE.
. . .

```

You can expose each COBOL server program function separately. The advantages or reasons for wanting this depend on the target endpoint. For example:

#### ■ Web Service

Instead having a Web service with a single operation, you want a web service with multiple operations, one operation for each COBOL function.

- **Java or .NET**

Instead having a class with a single method, you want a class with multiple methods, one method for each COBOL function.

- etc.

To do this you need to extract the COBOL server program as described under [Map to Multiple IDL Interfaces](#).

### Example 2: COBOL Server Using Fixed-length Tables in Variable Manner

Assume a COBOL CICS large buffer server program has a fixed-sized COBOL table as its last parameter, similar to COBOL data item COBOL-TABLE-FIX in the example below; each table element is 100 bytes; the length of COBOL-FIELD1 + COBOL-FIELD2 + COBOL-FIELD3; the length of the data preceding the COBOL table is described by COBOL-GROUP1; its length is 1000 bytes.

```

WORKING-STORAGE SECTION.
01 NUMBER-OF-INCOMING-ELEMENTS      PIC S9(8) BINARY.
01 NUMBER-OF-OUTGOMING-ELEMENTS     PIC S9(8) BINARY.

. . .

LINKAGE SECTION.
01 DFHCOMMAREA.
  10 WM-LCB-MARKER                   PIC X(4).
  10 WM-LCB-INPUT-BUFFER             POINTER.
  10 WM-LCB-INPUT-BUFFER-SIZE        PIC S9(8) BINARY.
  10 WM-LCB-OUTPUT-BUFFER            POINTER.
  10 WM-LCB-OUTPUT-BUFFER-SIZE       PIC S9(8) BINARY.
  10 WM-LCB-FLAGS                    PIC X(1).
  88 WM-LCB-FREE-OUTPUT-BUFFER       VALUE "F".
  10 WM-LCB-RESERVED                 PIC X(3).

01 INOUT-BUFFER.
10 COBOL-GROUP1.
  20 COBOL-TABLE-PREFIX              PIC X(1000).
  10 COBOL-TABLE-FIX                 OCCURS 20.
  20 COBOL-GROUP2.
    25 COBOL-FIELD1                 PIC X(30).
    25 COBOL-FIELD2                 PIC X(20).
    25 COBOL-FIELD3                 PIC X(50).
. . .

PROCEDURE DIVISION USING DFHCOMMAREA.
  SET ADDRESS OF INOUT-BUFFER TO WM-LCB-INPUT-BUFFER.
  SET ADDRESS OF INOUT-BUFFER TO WM-LCB-OUTPUT-BUFFER.
  COMPUTE NUMBER-OF-INCOMING-ELEMENTS = (WM-LCB-INPUT-BUFFER-SIZE
    - LENGTH OF COBOL-GROUP1)
    / LENGTH OF COBOL-GROUP2.

. . .

```

```

      COMPUTE WM-LCB-OUTPUT-BUFFER-SIZE = LENGTH OF COBOL-GROUP1
      + NUMBER-OF-OUTGOING-ELEMENTS * LENGTH OF COBOL-GROUP2

EXEC CICS RETURN END-EXEC.

```

During input the COBOL CICS large buffer server program uses the large buffer input length WM-LCB-INPUT-BUFFER-SIZE to evaluate the NUMBER-OF-INCOMING-ELEMENTS. During output the large buffer output length is determined accordingly to the NUMBER-OF-OUTGOING-ELEMENTS and set in WM-LCB-OUTPUT-BUFFER-SIZE.

Although the COBOL table is defined as a table with a fixed size (see [COBOL Tables with Fixed Size](#)) it is used in a variable manner, similar to tables with variable Size (see [COBOL Tables with Variable Size - DEPENDING ON Clause](#)). In this case it is required to map the COBOL table to an IDL unbounded array, see [Set Arrays \(Fixed <-> Unbounded\)](#).

### Example 3: COBOL Server Using Multiple Possible Output (MPO)

A COBOL REDEFINE can be used in a COBOL server program to return multiple possible output (MPO) structures, similar to COBOL data item PAYMENT-DATA in the example below; for this purpose, PAYMENT-DATA is redefined; each redefinition represents an output structure (MPO case); on return exactly one output structure is used; by inspecting COBOL data item PAYMENT-TYPE (MPO selector) first, a caller can determine the returned output structure; the caller then uses the correct redefinition to access the data.

```

. . .
01 INPUT-DATA.
   02 ORDER-NUMBER                               PIC 9(10).

. . .
01 OUTPUT-DATA.
   02 <some fields>                               PIC <clause>.
   . . .

   02 PAYMENT-TYPE                               PIC X(2).
      88 PAYMENT-TYPE-VOUCHER                     VALUE "VO".
      88 PAYMENT-TYPE-CREDITCARD                   VALUE "CC".
      88 PAYMENT-TYPE-TRANSFER                     VALUE "TR".
      88 PAYMENT-TYPE-DIRECTDEBIT                   VALUE "DB".
   . . .
   02 <preceding data items>                       PIC <clause>.
   . . .
   02 PAYMENT-DATA                               PIC X(256).
   02 PAYMENT-DATA-VOUCHER                       REDEFINES PAYMENT-DATA.
      04 VOUCHER-ORIGIN                           PIC X(128).
      04 VOUCHER-SERIES                           PIC X(128).
   02 PAYMENT-DATA-CREDITCARD                     REDEFINES PAYMENT-DATA.
      04 CREDITCARD-NUMBER                         PIC 9(18).
      04 CREDITCARD-COMPANY                       PIC X(128).
      04 CREDITCARD-CODE                          PIC 9(12).

```

```

    04 CREDITCARD-VALIDITY          PIC X(8).
    02 PAYMENT-DATA-TRANSFER        REDEFINES PAYMENT-DATA.
    04 TRANSFER-NAME                PIC X(128).
    04 TRANSFER-IBAN                PIC X(34).
    04 TRANSFER-BIC                 PIC X(11).
    02 PAYMENT-DATA-DIRECTDEBIT    REDEFINES PAYMENT-DATA.
    04 DIRECTDEBIT-IBAN            PIC X(34).
    04 DIRECTDEBIT-NAME            PIC X(128).
    04 DIRECTDEBIT-EXPIRES         PIC 9(8).
    . . .
    02 <subsequent data items>      PIC <clause>.
    . . .

. . .

*  read order record using ORDER-NUMBER
    . . .

*  set value indicating type of reply (MPO selector)
    IF <some-condition> THEN
        SET PAYMENT-TYPE-VOUCHER TO TRUE
    ELSE IF <some-other-condition> THEN
        SET PAYMENT-TYPE-CREDITCARD TO TRUE
    ELSE IF <some-further-condition> THEN
        SET PAYMENT-TYPE-TRANSFER TO TRUE
    ELSE
        SET PAYMENT-TYPE-DIRECTDEBIT TO TRUE
    END-IF.
    . . .

*  set fields (MPO case) depending on type of reply
    INITIALIZE PAYMENT-DATA.
    EVALUATE TRUE
        WHEN PAYMENT-TYPE-VOUCHER
            MOVE . . . TO VOUCHER-ORIGIN
            MOVE . . . TO VOUCHER-SERIES
        WHEN PAYMENT-TYPE-CREDITCARD
            MOVE . . . TO CREDITCARD-NUMBER
            MOVE . . . TO CREDITCARD-CODE
            MOVE . . . TO CREDITCARD-VALIDITY
        WHEN PAYMENT-TYPE-TRANSFER
            MOVE . . . TO TRANSFER-NAME
            MOVE . . . TO TRANSFER-IBAN
            MOVE . . . TO TRANSFER-BIC
        WHEN PAYMENT-TYPE-DIRECTDEBIT
            MOVE . . . TO DIRECTDEBIT-IBAN
            MOVE . . . TO DIRECTDEBIT-NAME
            MOVE . . . TO DIRECTDEBIT-EXPIRES
        WHEN
            . . .
    END-EVALUATE.
    . . .

```

COBOL server programs using alternative and dissimilar shapes for the output layout are extracted as described under [Set Multiple Possible Output \(MPO\) Structures](#).

#### Example 4: COBOL Server Using Optional Output

COBOL group data items can be used in a COBOL server program to return optional output similar to the example below; the returned data is built by copying the necessary COBOL structures into an output area. The optional output is one of OPTIONAL-OUTPUT-STRUCTURE1, OPTIONAL-OUTPUT-STRUCTURE2 or nothing. The presence of the optional output is controlled by a structure named CONTROL-AREA. Optional output with group data items are a variant of MPO, see [Example 3: COBOL Server Using Multiple Possible Output \(MPO\)](#).

```

WORKING-STORAGE SECTION.

01 INPUT-AREA.
   02 FIX-INPUT-ITEM1          PIC X(4).
   02 <some fields>           PIC <clause>.
   . . .

01 OUTPUT-OFFSET              PIC S9(9) BINARY.
01 OUTPUT-AREA                PIC X(32000).
. . .

01 CONTROL-AREA.
   02 OPTIONAL-OUTPUT          PIC X(1).
   88 OPTIONAL-OUTPUT-1       VALUE "1".
   88 OPTIONAL-OUTPUT-2       VALUE "2".
   88 OPTIONAL-OUTPUT-NONE    VALUE "N".
   . . .

01 OPTIONAL-OUTPUT-STRUCTURE1.
   02 OPTIONAL-OUTPUT-ITEM11   PIC X(10).
   02 OPTIONAL-OUTPUT-ITEM12   PIC X(100).
   02 OPTIONAL-OUTPUT-ITEM13   PIC X(20).
   . . .

01 OPTIONAL-OUTPUT-STRUCTURE2.
   02 OPTIONAL-OUTPUT-ITEM21   PIC X(4).
   02 OPTIONAL-OUTPUT-ITEM22   PIC X(50).
   02 OPTIONAL-OUTPUT-ITEM23   PIC X(50).
   . . .

01 FIX-OUTPUT-STRUCTURE1.
   02 FIX-OUTPUT-ITEM11        PIC X(4).
   02 FIX-OUTPUT-ITEM12        PIC X(20).
   02 FIX-OUTPUT-ITEM13        PIC X(8).
   . . .

01 FIX-OUTPUT-STRUCTURE2.
   02 FIX-OUTPUT-ITEM21        PIC X(2).

```

```

02 FIX-OUTPUT-ITEM22          PIC X(10).
02 FIX-OUTPUT-ITEM23          PIC X(10).
. . .

IF <some-condition> THEN
  SET OPTIONAL-OUTPUT-1 TO TRUE
ELSE IF <some-other-condition> THEN
  SET OPTIONAL-OUTPUT-2 TO TRUE
ELSE
  SET OPTIONAL-OUTPUT-NONE TO TRUE
END-IF.

. . .

*   provide control area for optional output
    MOVE 1 TO OUTPUT-OFFSET.
    STRING CONTROL-AREA DELIMITED BY SIZE
    INTO OUTPUT-AREA WITH POINTER OUTPUT-OFFSET.

*   provide data items before optional output
    STRING FIX CONTROL-AREA DELIMITED BY SIZE
    INTO OUTPUT-AREA WITH POINTER OUTPUT-OFFSET.

*   provide optional output
    EVALUATE TRUE
      WHEN OPTIONAL-OUTPUT-1
        STRING OPTIONAL-OUTPUT-STRUCTURE1 DELIMITED BY SIZE
        INTO OUTPUT-AREA WITH POINTER OUTPUT-OFFSET
      WHEN OPTIONAL-OUTPUT-2
        STRING OPTIONAL-OUTPUT-STRUCTURE2 DELIMITED BY SIZE
        INTO OUTPUT-AREA WITH POINTER OUTPUT-OFFSET
    END-EVALUATE.

*   provide data items after optional output
    STRING FIX-OUTPUT-STRUCTURE2 DELIMITED BY SIZE
    INTO OUTPUT-AREA WITH POINTER OUTPUT-OFFSET.

. . .

```

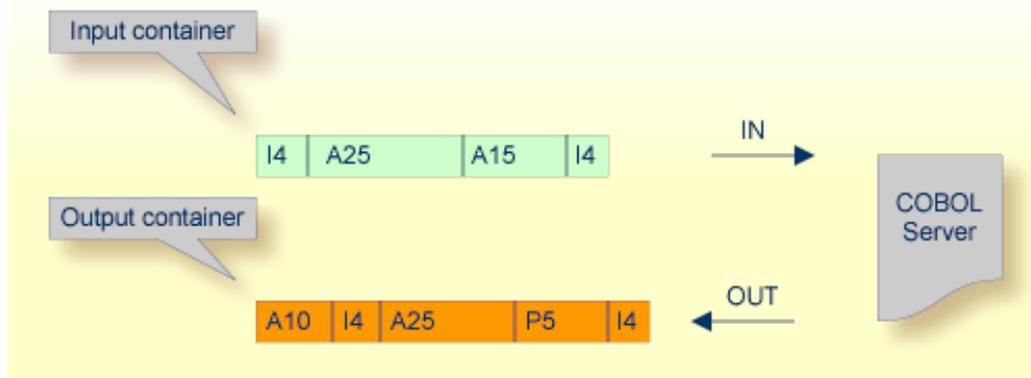
COBOL server programs using optional shapes for the output layout are extracted as described under [Set Multiple Possible Output \(MPO\) Structures](#).



# 10 CICS with Channel Container Calling Convention

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■ Introduction .....	200
■ Extracting from a CICS Channel Container Program .....	200
■ Mapping Editor User Interface .....	203
■ Mapping Editor IDL Interface Mapping Functions .....	210
■ Programming Techniques .....	227



## Introduction

Modern CICS programs may use the CICS channels and containers model. During extraction, containers are mapped to IDL structures. See `structure-parameter-definition (IDL)` under *Software AG IDL Grammar* in the IDL Editor documentation.

If you have selected an IDL file and opened the COBOL Mapping Editor with an existing COBOL to IDL mapping, continue with [Mapping Editor User Interface](#).

## Extracting from a CICS Channel Container Program

If you are extracting IDL from a COBOL source or extending the IDL file by extracting an additional COBOL source with interface type CICS with channel container calling convention, the **Extractor Settings** dialog appears (see also [Step 4: Define the Extraction Settings and Start Extraction](#)).

Make sure the interface type is correct and, if required, that the channel name (max. 16 characters) is provided. If you do not provide a channel name, "EntireXChannel" is used as the default value.

The screenshot shows the 'COBOL Source' dialog box with the following settings:

- File Name: ChanCon
- Operating System: z/OS
- Interface Type: CICS with Channel Container calling convention
- Input Message same as Output Message

Press **Next** to open the COBOL Mapping Editor.

➤ To select the COBOL interface data items of your COBOL server

- 1 Define all the CICS input containers, one after another: in the **Source View**, use the toolbar icon **Find text in Source**  and enter "EXEC CICS" to find a GET call containing "EXEC CICS GET", function "CONTAINER" etc. Example:

```
EXEC CICS GET
  CONTAINER(<container name constant>)
  CHANNEL (<channel>)
  INTO (<container>)
  NOHANDLE
END-EXEC
```

The COBOL data item <container> is the item you are looking for. Add the COBOL data item <container> to **Input Message** by using the context menu or toolbar available in the [COBOL Source View](#) and [COBOL Interface](#). In the **Input Message** pane, select the corresponding COBOL data item <container>. Enter the container name, found in the value of <container name constant>. You can select multiple CICS input containers. See [Notes](#).

- 2 Define all the CICS output containers using the steps as above, but look for "EXEC CICS PUT". Example:

```
EXEC CICS PUT
  CONTAINER(<container name constant>)
  CHANNEL (<channel>)
  FROM (<container>)
  FLENGTH (LENGTH OF <container>)
  NOHANDLE
END-EXEC
```

Add the corresponding COBOL data item <container> to **Output Message**. In the **Output Message** pane, select the corresponding COBOL data item <container>. Enter the container name, found in the value of <container name constant>. The EXEC CICS PUT statement can be executed multiple times (for example in a loop) for the same container definition, creating an array of container. If this is true, set the column Array in the wizard to "Yes" and enter the maximum number of occurrences for the container in the **Max** column. You can select multiple CICS output containers. See [Notes](#).

- 3 Continue with [COBOL to IDL Mapping](#).



**Notes:**

1. It is very important to select the right COBOL data items describing the interface of the COBOL server correctly. This means the COBOL data items used as parameters must match in number and in sequence of formats (COBOL usage clause).

2. If your COBOL server contain REDEFINES, the first REDEFINE path is offered by default. Check manually whether this is the one you want. If not, correct it. You can select any other REDEFINE path.
3. The container name length is restricted to 16 characters.
4. Container arrays will enlarge the container name, because the number of occurrences (**Max** column) will be added to the name (max. 16 characters). Example:  
For MYCONTAINER as the container name and 99999 as the number of occurrences, the container names are MYCONTAINER00001 - MYCONTAINER99999.

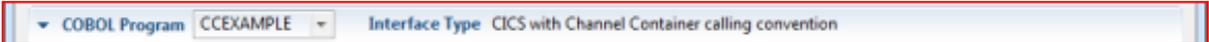
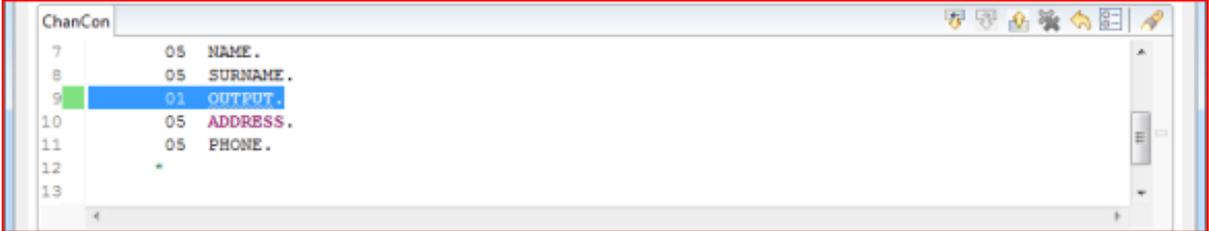
The user interface of the COBOL Mapping Editor is described below.

## Mapping Editor User Interface

This section assumes you have set the extraction settings as described above. The following areas of the COBOL Mapping Editor user interface are described here:

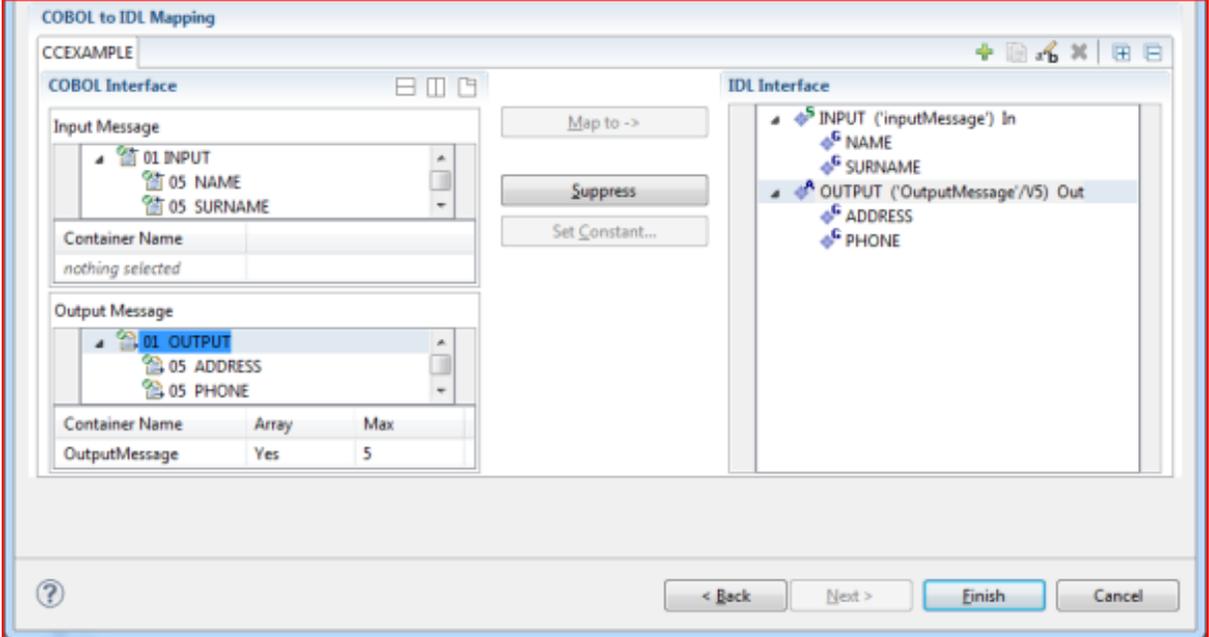
- [COBOL Program Selection](#)
- [COBOL Source View](#)
- [COBOL to IDL Mapping](#)

For COBOL server programs with CICS channel container interface, the user interface of the COBOL Mapping Editor looks like this:

1. 
2. 

```

7      05  NAME .
8      05  SURNAME .
9      01  OUTPUT .
10     05  ADDRESS .
11     05  PHONE .
12     *
13

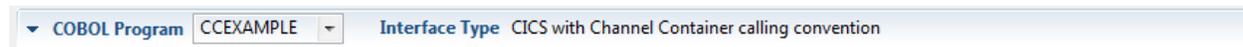
```
3. 

Container Name	Array	Max
OutputMessage	Yes	5

1. **COBOL Program Selection.** Currently selected program with interface type
2. **COBOL Source View.** Contains all related sources for the currently selected COBOL program

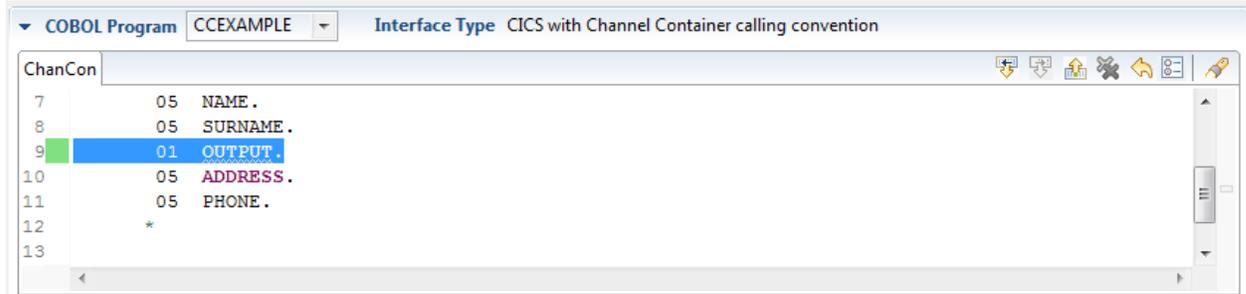
3. **COBOL to IDL Mapping.** Tree view of your selected COBOL data items and mapping buttons with which you can map these items to your IDL interface

### COBOL Program Selection



The COBOL Program Selection displays the current selected COBOL program with its interface type. If you have extracted more than one COBOL program within the associated IDL file, you can switch to another COBOL program with its mapping by selecting the name in the combo box.

## COBOL Source View



All COBOL data items contained in the LINKAGE and WORKING-STORAGE SECTION are offered in a text view. The text view contains all related sources (including copybooks) for the currently selected COBOL program. It is used for selecting data items and retrieving information from the original COBOL sources. The light green bar indicates that the data item is already contained in the COBOL Interface; a dark green bar indicates the data item is selectable and can be added to the COBOL Interface. This section can be collapsed. If you open the Editor with **Modify Interface** it is collapsed by default. The toolbar provides the following actions:

-  Add selected COBOL data item to COBOL Interface as Input Message.
-  Add selected COBOL data item to COBOL Interface as Output Message.
-  Remove selected COBOL data item from COBOL Interface.
-  Remove all COBOL data items from COBOL Interface.
-  Reset COBOL Interface to initial state.
-  Show dialog to modify COBOL Source Characteristics.
-  Show dialog to find text in Source.

The same functionality is also available from the context menu.

## COBOL to IDL Mapping

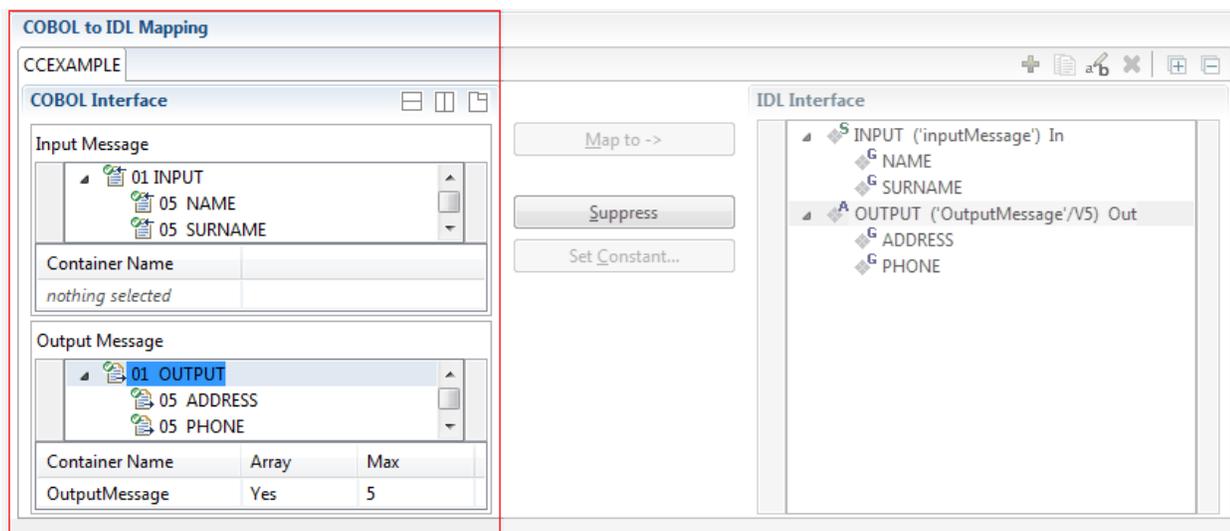
This section covers the following topics:

- [COBOL Interface](#)
- [Mapping Buttons](#)
- [IDL Interface](#)

### COBOL Interface

The **COBOL Interface** shows a tree view of your selected COBOL data items describing the interface of the COBOL server. A context menu is available for the COBOL data items, which provides mapping and other functions. On some COBOL data items, decision icons indicate where particular attention is needed, including mapping icons to visualize the COBOL data type and your current mapping.

The COBOL data item names are derived from the COBOL source from which they were extracted. If your COBOL interface contains parameters without a name, that is, the keyword `FILLER` is used, those COBOL data items are shown as `[FILLER]`. See [FILLER Pseudo-Parameter](#).



You can modify the COBOL interface using context menu or toolbar; decision and mapping icons provide additional information.

### Context Menu

The context menu on COBOL data items provides the following mapping and other functions, depending on the data item type, the COBOL level and the current mapping.

- |                 |  |
|-----------------|--|
| <b>Map to</b>   | A suppressed COBOL data item becomes visible in the IDL interface. Used also to select another <code>REDEFINE</code> path. |
| <b>Suppress</b> | Suppress unneeded COBOL data items.  |

<b>Set Constant</b>	Set COBOL data items to constant.
<b>Set Array Mapping</b>	Map an array to a fixed sized or unbounded array.
<b>Set Multiple Possible Output (MPO) Structures</b>	Set COBOL data items where the server program decides the output structure used on return. Specify the set of multiple possible output (MPO) structures and the criteria when a structure is used.
<b>Remove from COBOL Interface</b>	Remove the data item from the COBOL interface. This also removes the mapped IDL parameter from all IDL interfaces for the current COBOL program. See <a href="#">COBOL Program Selection</a> .

See also [Mapping Editor IDL Interface Mapping Functions](#).

### Toolbar

The toolbar offers the following actions:

-  Create IDL Interface. Creates a new IDL interface based on the current COBOL interface: all IDL parameters are of IDL direction InOut; no IDL parameters are set to constant; for COBOL REDEFINE, the first REDEFINE path is mapped to IDL; FILLERS are suppressed according to your selection, see [Step 4: Define the Extraction Settings and Start Extraction](#).
-  Copy current IDL Interface. Creates a duplicate of the current IDL interface: all modifications such as IDL directions, suppress, selection of REDEFINE paths etc. are kept.
-  Remove current IDL Interface.
-  Rename current IDL Interface.
-  Expand the full tree.
-  Collapse the full tree.

See also [Map to Multiple IDL Interfaces](#).

### Decision Icons

The decision icons in the first column are set on COBOL data items where particular attention is needed:

-  This icon visualizes a COBOL REDEFINE. It is essential that you map the correct redefine path for your mapping to In, Out or InOut using the context menu. If you map a REDEFINE path, all other sibling REDEFINE paths are automatically set to "Suppress".

### Mapping Icons

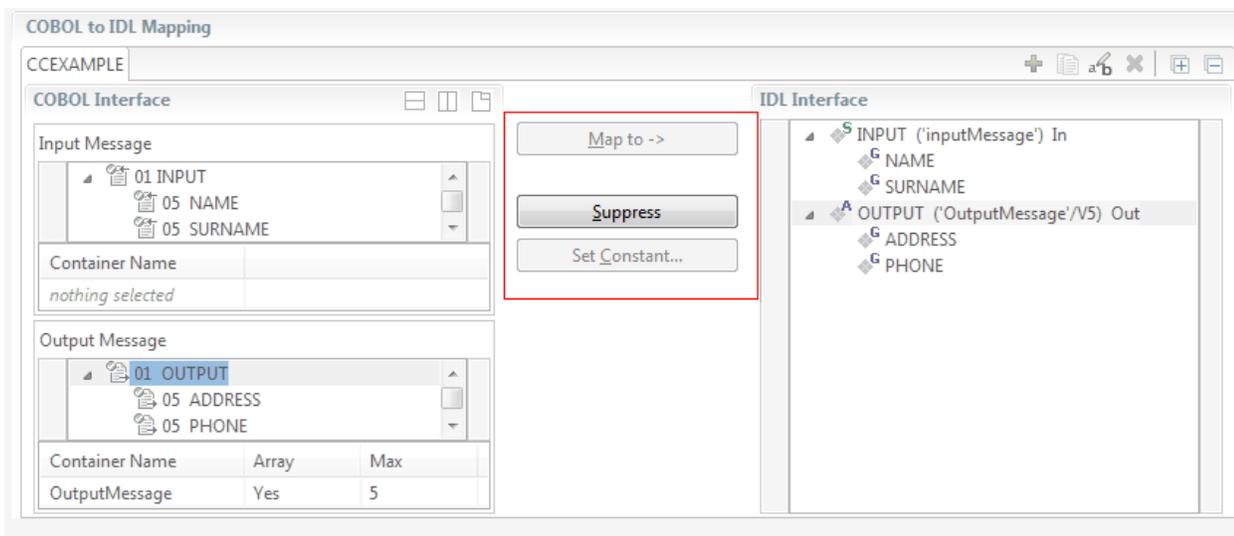
The following mapping icons on the COBOL data items indicate your current IDL mapping:

-  Scalar parameter, mapped to In.

-  Scalar parameter, mapped to Out.
-  Group parameter, here mapped to In.
-  REDEFINE parameter, here mapped to Out.
-  Parameter set to Constant.

## Mapping Buttons

The following buttons are available:



### Map to ->

A suppressed COBOL data item becomes visible in the IDL interface. Used also to select another REDEFINE path.

### Suppress

See *Suppress Unneeded COBOL Data Items*.

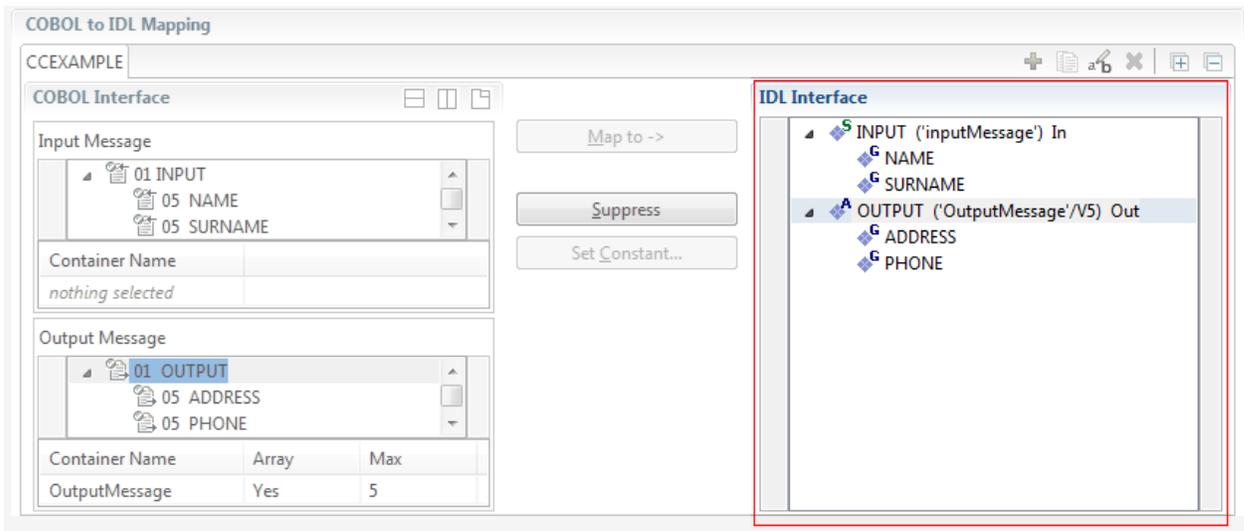
### Set Constant...

See *Set COBOL Data Items to Constants*.

## IDL Interface

If you have mapped the COBOL interface to multiple IDL interfaces, select the IDL interface by choosing the tabs. In the **IDL Interface** tree view, a context menu is also available with the following possibilities:

- Rename
- Remove from COBOL Interface. This also removes the mapped IDL parameter from all IDL interfaces for the current COBOL program. See *COBOL Program Selection* above.



## Mapping Editor IDL Interface Mapping Functions

This section covers the following topics:

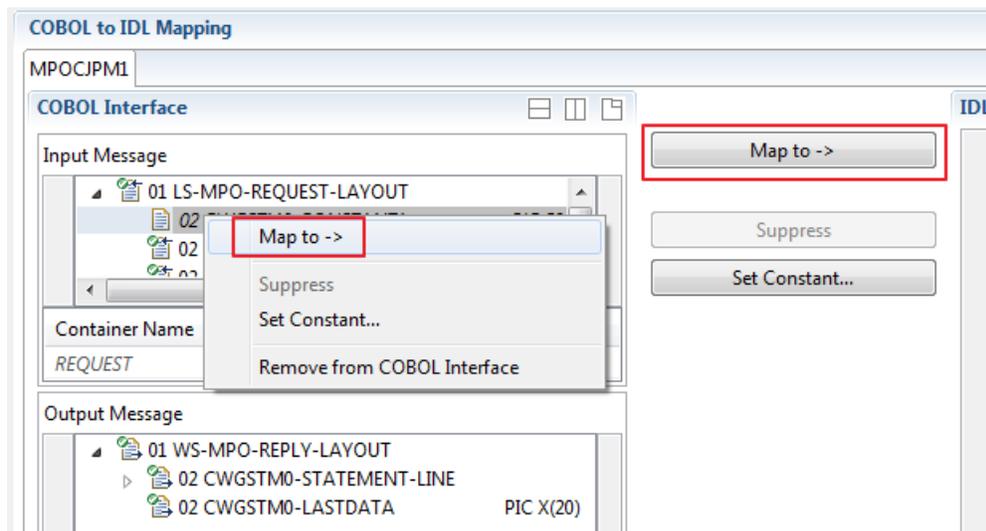
- Map to
- Map OCCURS DEPENDING ON
- Map to Multiple IDL Interfaces
- Select REDEFINE Paths
- Suppress Unneeded COBOL Data Items
- Set COBOL Data Items to Constants
- Set Arrays (Fixed <-> Unbounded)
- Set Multiple Possible Output (MPO) Structures

### Map to

With the **Map to** functions you make a COBOL data item visible as an IDL parameter in the IDL interface, that is, you design the IDL interface by defining input and output parameters.

#### ➤ To map COBOL data items to IDL interface

- 1 Go *step-by-step* through all *top-level* COBOL data items in the COBOL interface and use the **Map to** function available in the context menu of the COBOL interface and as mapping button to make a COBOL data item visible as an IDL parameter in the IDL interface:



- 2 Do the same for the output message of the COBOL interface.



#### Notes:

1. If a COBOL group is mapped, all subordinate COBOL data items are also made visible in the IDL interface.
2. With the inverse function **Suppress Unneeded COBOL Data Items** (see below) available in the context menu of the COBOL interface and as mapping button, a COBOL data item can be removed from the IDL interface.

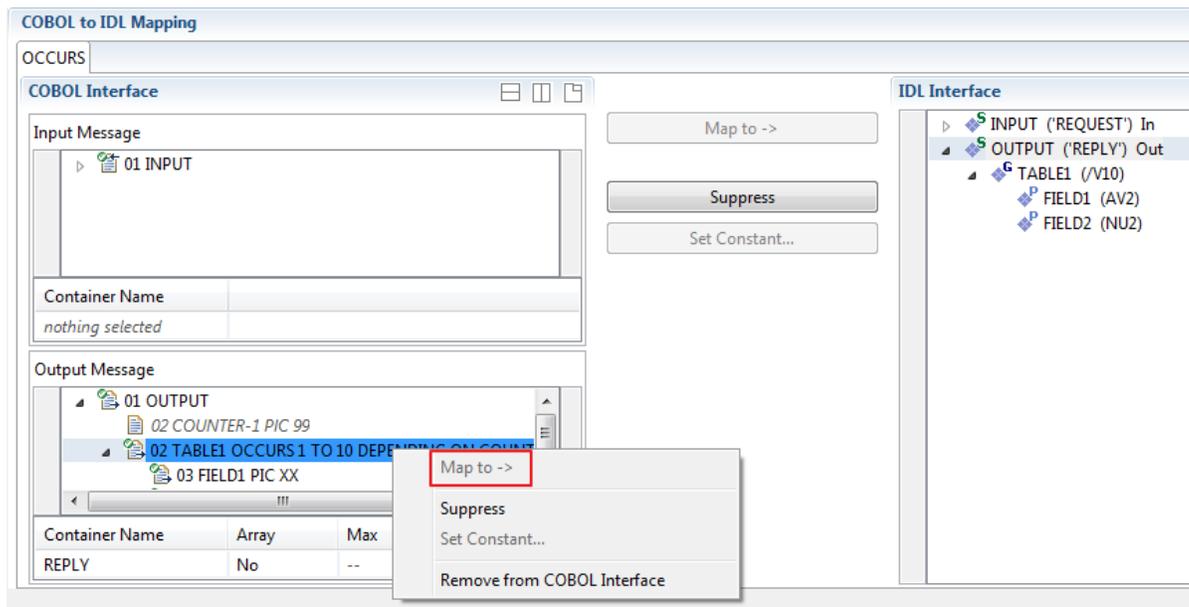
## Map OCCURS DEPENDING ON

You can make the COBOL ODO subject (here COBOL data item TABLE) of a variable-sized COBOL table (see [COBOL Tables with Variable Size - DEPENDING ON Clause](#)) visible as an IDL unbounded group (with maximum). The ODO object (here COBOL data item COUNTER-1) is suppressed and therefore not part of the IDL interface. This is because the number of elements of the IDL unbounded group is already implicitly available. See the following example:

```
01 COUNTER-1 PIC 99.
01 TABLE OCCURS 1 TO 10 DEPENDING ON COUNTER-1
  02 FIELD1 PIC XX.
  02 FIELD2 PIC 99.
```

### > To map OCCURS DEPENDING ON

- Add the COBOL subject (here data item TABLE) and ODO object (here data item COUNTER-1) to the input message or to the output message, wherever they belong. It is important both data items are always together per message direction (input or output).

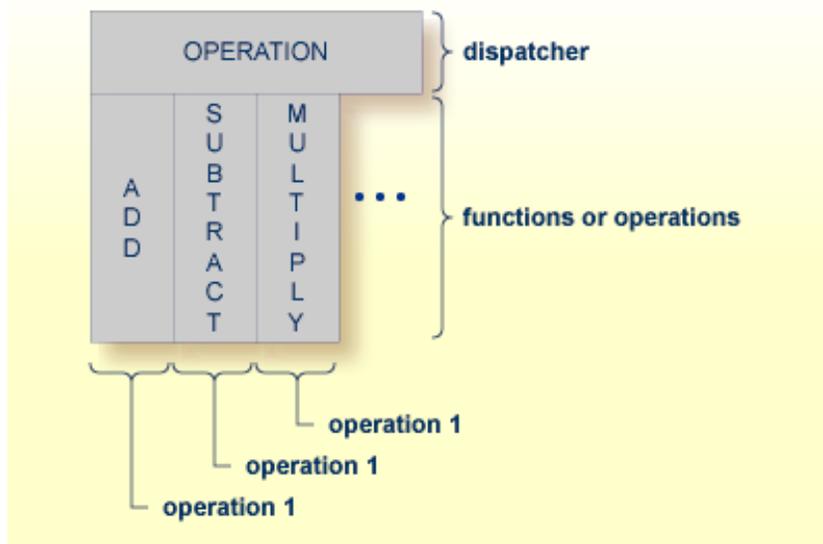


### Notes:

1. The ODO subject can be mapped to the IDL interface.
2. The ODO object is always suppressed, but is required to be part of the same message direction (Input Message or Output Message) of the COBOL interface.
3. IDL directions are described in the direction-attribute in `attribute-list` under *Software AG IDL Grammar* in the IDL Editor documentation.

### Map to Multiple IDL Interfaces

Assume the COBOL server program provides multiple functions or operations, in the following example `ADD`, `SUBTRACT`, `MULTIPLY`. Some dispatcher front-end code executes the correct function, for example, depending on a *function-code* or *operation-code* parameter:



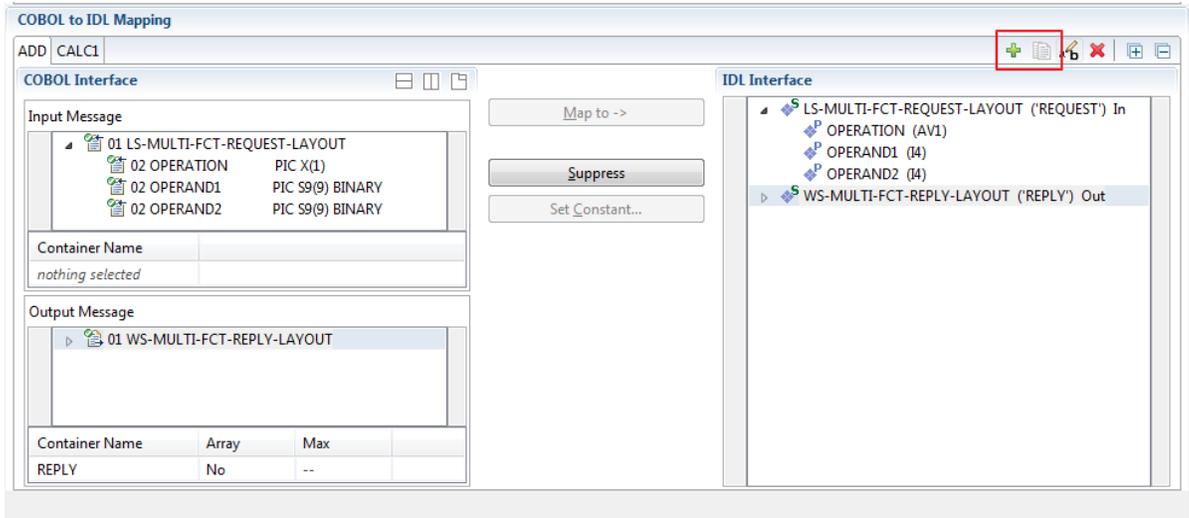
This example is described in more detail under [Example 1: COBOL Server with Multiple Functions](#).

If you have such a situation, a good approach is to expose each COBOL server program function separately as an IDL program. This gives advantages in further processing of the IDL and COBOL mapping files (SVM and CVM). For example:

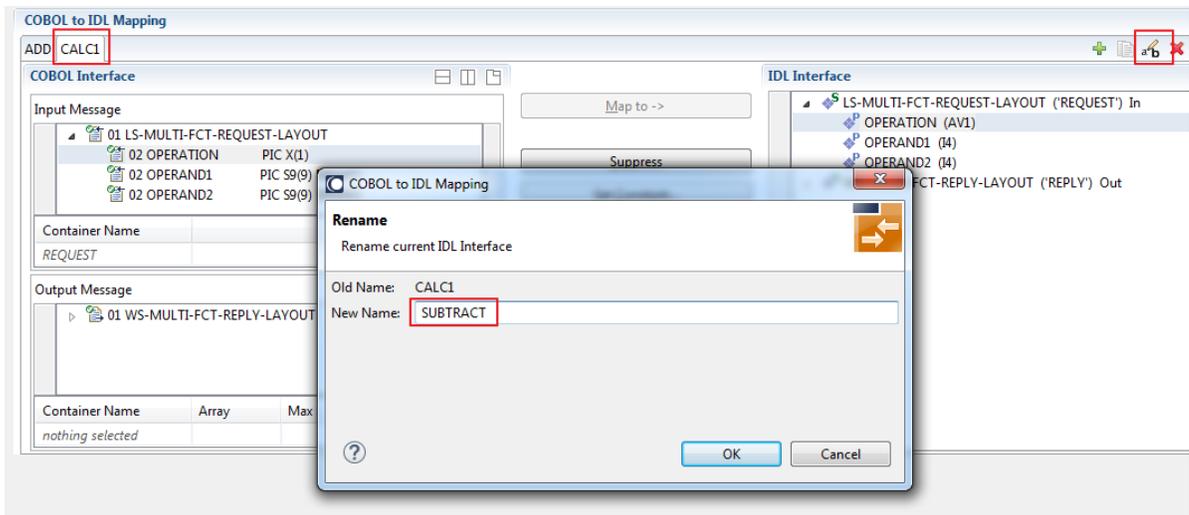
- If your target endpoint is a web service: instead having a Web service with a single operation, you get a web service with multiple operation, one operation for each COBOL function.
- If your target endpoint is Java or .NET: instead having a class with a single method, you get a class with multiple methods, one method for each COBOL function.

#### ➤ To map a COBOL interface to multiple IDL interfaces

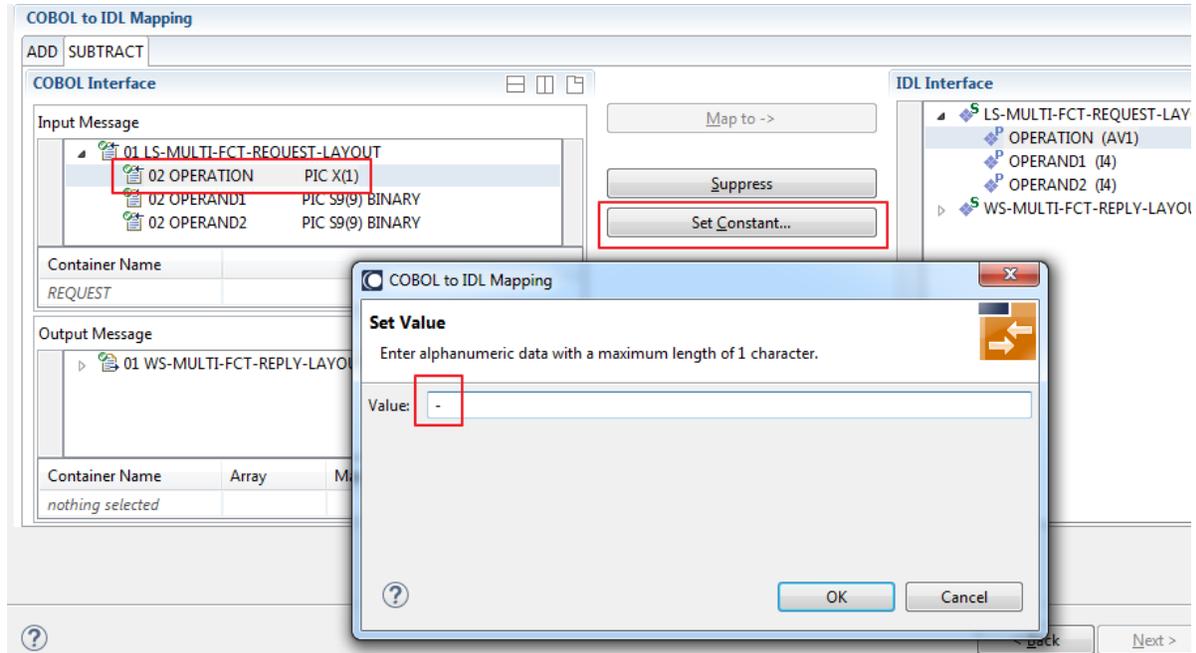
- 1 Select the tab with COBOL to IDL Mapping. For each function, define a separate IDL interface with the toolbar functions or :



- 2 Give the IDL interfaces meaningful names with the toolbar function :



- 3 Define the required constant values to the *function-code* or *operation-code* parameter, see *Set COBOL Data Items to Constants* above:



For the delivered Example 1: COBOL Server with Multiple Functions:

- First, for step 1 above: Extract and define 3 separate IDL programs ADD, SUBTRACT, MULTIPLY.
- Second, for step 2 above: Rename them to suitable names, e.g. 'ADD', 'SUBTRACT', 'MULTIPLY'.
- Third, for step 3 above: Define the constants '+', '-' and '\*' to the parameter OPERATION respectively.
- After pressing **Finish**, the following IDL together with a server mapping file is created. See *Server Mapping Files for COBOL*.

```

library 'EXAMPLE' is

program 'ADD' is
  define data parameter
    1 INPUT ('REQUEST') In
    1 OUTPUT ('REPLY') Out
  end-define

  struct 'REQUEST' is
    define data parameter
      1 OPERAND1 (I4)
      1 OPERAND2 (I4)
    end-define

    struct 'REPLY' is
      define data parameter
        1 FUNCTION-RESULT (I4)
      end-define
  
```

```

program 'SUBTRACT' is
  define data parameter
    1 INPUT ('REQUEST') In
    1 OUTPUT ('REPLY') Out
  end-define

program 'MULTIPLY' is
  define data parameter
    1 INPUT ('REQUEST') In
    1 OUTPUT ('REPLY') Out
  end-define

```



### Notes:

1. The following functions are offered to create further mappings from the COBOL interface, resulting in multiple IDL interfaces (IDL programs).

Icon	Function	Description
	Create IDL Interface	Creates a new IDL interface based on the current COBOL interface. All IDL parameters are of IDL direction InOut; no IDL parameters are set to constant; for COBOL REDEFINE, the first REDEFINE path is mapped to IDL; FILLERS are suppressed according to your selection, see <a href="#">Step 4: Define the Extraction Settings and Start Extraction</a> .
	Copy current IDL Interface	Creates a duplicate of current IDL interface. All modifications such as IDL directions, suppress, selection of REDEFINE paths etc. are kept.
	Rename current IDL Interface	The default name for the IDL interface is based on the COBOL program name plus appended number. With this function you can give the IDL interface a suitable name.
	Remove current IDL Interface	Deletes the current IDL interface.

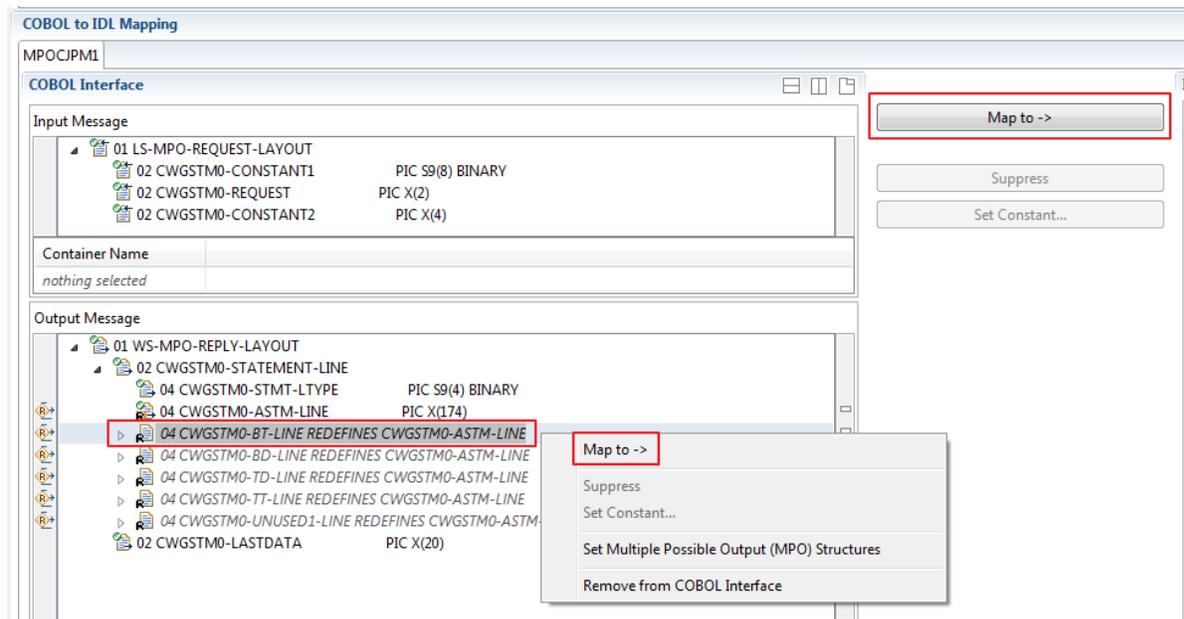
2. With the steps 1 thru 3 described here you can emulate the behavior of function Map to Operation of EntireX version 9.6 and earlier.

### Select REDEFINE Paths

For COBOL server programs containing COBOL REDEFINES, the correct REDEFINE path needs to be chosen for the IDL interface.

#### > To select redefine paths

- Use the **Map to** function available in the context menu of the COBOL interface and as mapping button to make the COBOL REDEFINE path available in the IDL interface.



Begin with the COBOL REDEFINE defined at the highest level first. Work through all inner COBOL REDEFINE data items, going from higher levels to lower levels.



#### Notes:

1. Only one REDEFINE path of a COBOL REDEFINE can be mapped to the IDL interface. All COBOL REDEFINE siblings are suppressed.
2. If a REDEFINE path is actively mapped to the IDL interface, all COBOL REDEFINE siblings are suppressed.
3. You can suppress all REDEFINE paths of a COBOL REDEFINE. Simply suppress the active REDEFINE path, see *Suppress Unneeded COBOL Data Items* above.

### Suppress Unneeded COBOL Data Items

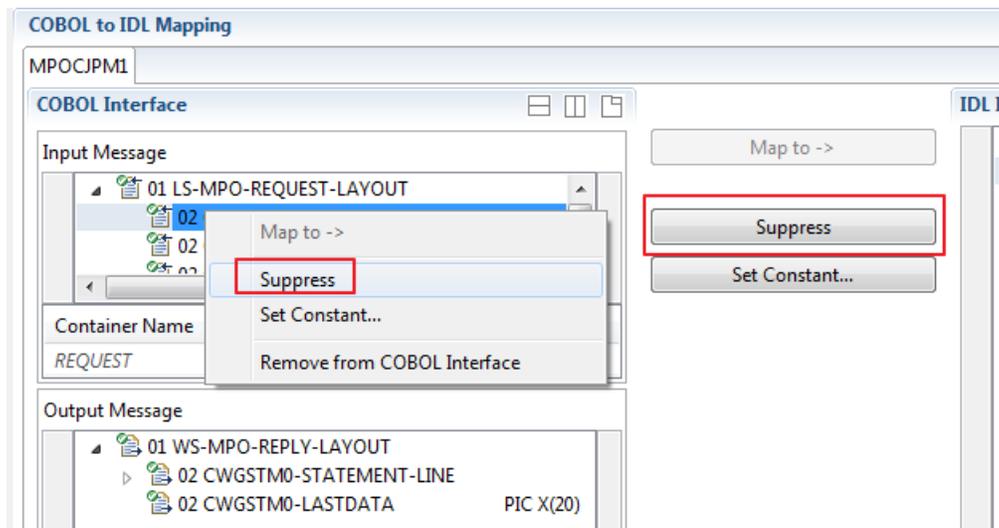
COBOL data items without any relevant information can be made invisible in the IDL interface. The IDL interface is simplified - it becomes shorter and tidier. This is useful, for example

- for FILLER data items
- if the RPC client or Adapter Service does not need an Out parameter
- if the RPC server or Adapter Service does not need an In parameter and a low value can be provided

If you are using an RPC server such as the z/OS (CICS | Batch), z/VSE (CICS | Batch), Micro Focus or BS2000/OSD RPC server, the amount of data to be transferred to/from the RPC client is also reduced.

➤ **To suppress unneeded COBOL data items**

- Use the **Suppress** function available in the context menu of the COBOL interface and as mapping button to make the COBOL data item invisible in the IDL interface:



**Notes:**

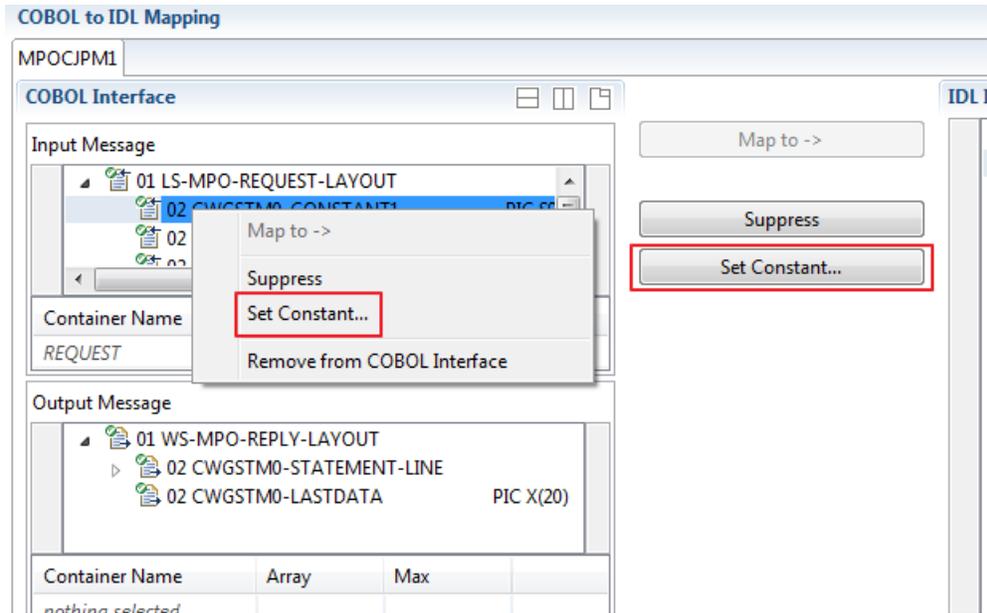
1. The COBOL data item is not part of the IDL interface. It is invisible for RPC clients or Adapter Service.
2. The RPC server or Adapter Service provides the COBOL data item to your COBOL server with low value, managing the offset to the next COBOL data item.
3. If a COBOL group is suppressed, all subordinate COBOL data items are suppressed as well.
4. With the inverse function **Map to** (see above) available in the context menu of the COBOL interface and as a mapping button, a COBOL data item can be made visible in the IDL interface again.

### Set COBOL Data Items to Constants

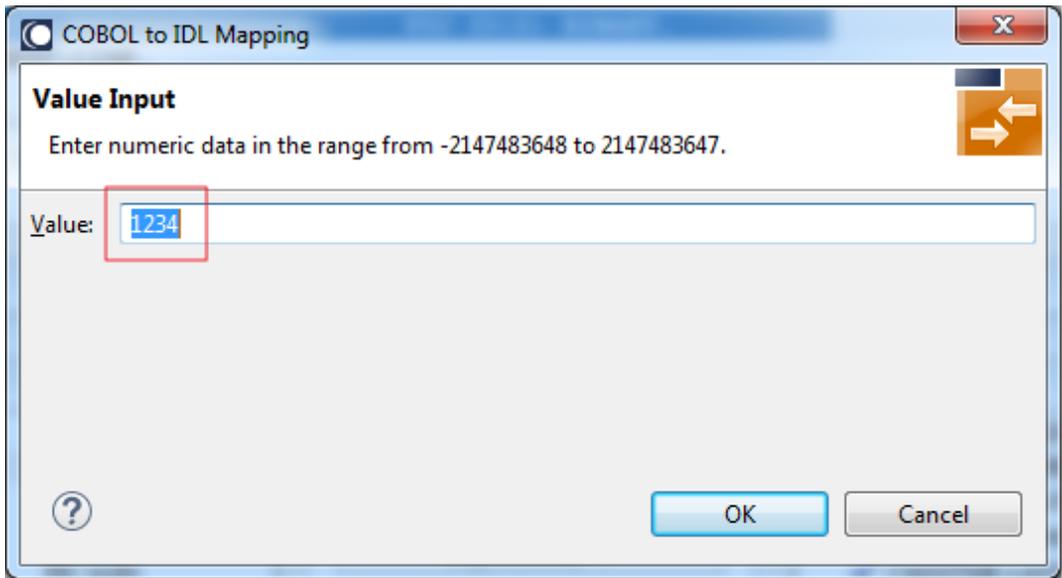
COBOL data items that always require fixed constant values on input to the COBOL server program can be made invisible in the IDL interface and initialized with the required constant values. This is useful for keeping the IDL interface short and tidy. RPC clients or Adapter Services are not bothered with IDL parameters that always contain constants, such as `RECORD-TYPES`. This function is often used in conjunction with **Map to Multiple IDL Interfaces** (see above).

> To set COBOL data items to constants

- 1 Use the **Set Constant** function available in the context menu of the COBOL interface and as mapping button to define a constant value for a COBOL data item:



- 2 You are prompted with a window to enter the constant value:



 **Notes:**

1. The COBOL data item is not part of the IDL interface. It is invisible for RPC clients or Adapter Services.
2. The RPC server or Adapter Service provides the defined constant in the COBOL data item to your COBOL server.
3. With the function **Map to** (see above) available in the context menu of the COBOL interface and as a mapping button, a COBOL data item can be made visible in the IDL interface again.

### Set Arrays (Fixed <-> Unbounded)

For COBOL server programs using the message length to transfer a variable number of elements in a COBOL table with a fixed size (see [COBOL Tables with Fixed Size](#)) in a variable manner (see [COBOL Tables with Variable Size - DEPENDING ON Clause](#)) you need to set the mapping to unbounded array.

For details of such a COBOL server program see [Example 2: COBOL Server Using Fixed-length Tables in Variable Manner](#).

#### » To set arrays from fixed to unbounded or vice versa

- Select the COBOL table and use the function **Set Arrays (Fixed<->Unbounded)** available in the context menu. A modal window is displayed. Select **Unbounded array**. The IDL array parameter will be changed from fixed array */number* to an unbounded array */Nnumber*, see *array-definition* under *Software AG IDL Grammar* in the IDL Editor documentation.



#### Notes:

1. This option should be used carefully and requires knowledge of the COBOL server program. Be aware that an incorrect mapping results in runtime errors.
2. The COBOL Table with a fixed size (see [COBOL Tables with Fixed Size](#)) used in this manner must be the last parameter of the COBOL interface; it must not be a subparameter of any other COBOL table and must not contain any `DEPENDING ON` clause (see [COBOL Tables with Variable Size - DEPENDING ON Clause](#)).

### Set Multiple Possible Output (MPO) Structures

A COBOL server program produces more than one type of output. The layout of the output can therefore take two or more dissimilar shapes. The COBOL server program decides at runtime the output structure returned, that is, the COBOL layout on output varies.

- [Multiple Possible Output with REDEFINES](#)
- [Optional Output with Groups](#)
- [MPO Terminology](#)

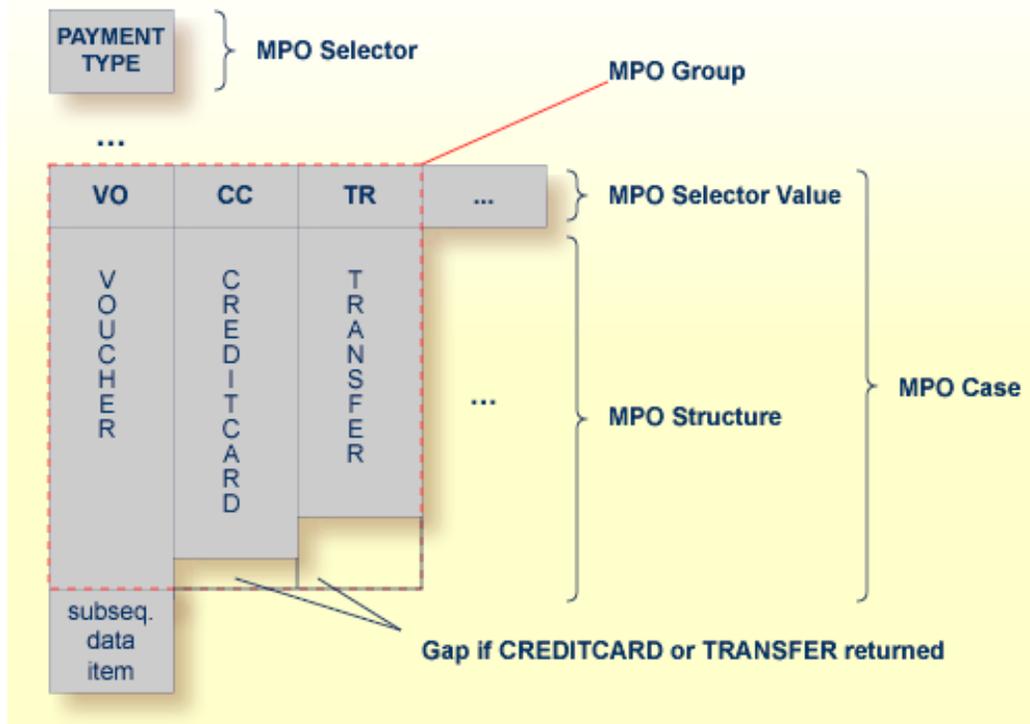
- Steps

### Multiple Possible Output with REDEFINES

As illustrated in *Example 3: COBOL Server Using Multiple Possible Output (MPO)*, a COBOL *REDEFINES Clause* is often used to describe the possible output structures. In COBOL this is the standard way to describe multiple possible output.

In addition, the COBOL interface

- limits the number of possible output structures returned
- defines all possible output structures, that is, they are known during extraction. In the example these are the structures `PAYMENT-DATA-VOUCHER`, `PAYMENT-DATA-CREDITCARD` and `PAYMENT-DATA-TRANSFER`. These are the MPO structures.
- contains an additional COBOL data item carrying a value related to the returned output structure. By inspecting this data item first, the appropriate output structure can be selected to address the data correctly. In the example it is `PAYMENT-TYPE`. This item is the MPO selector.
- always occupies memory to be able to transfer the longest output structure. If the actual returned output structure is shorter than the longest possible output structure, there is a gap (space) between the multiple possible output and the subsequent data item.



This abstract concept is known as *multiple possible output* (MPO) EntireX bundles all MPO structures into an MPO group. See *MPO Terminology* below.

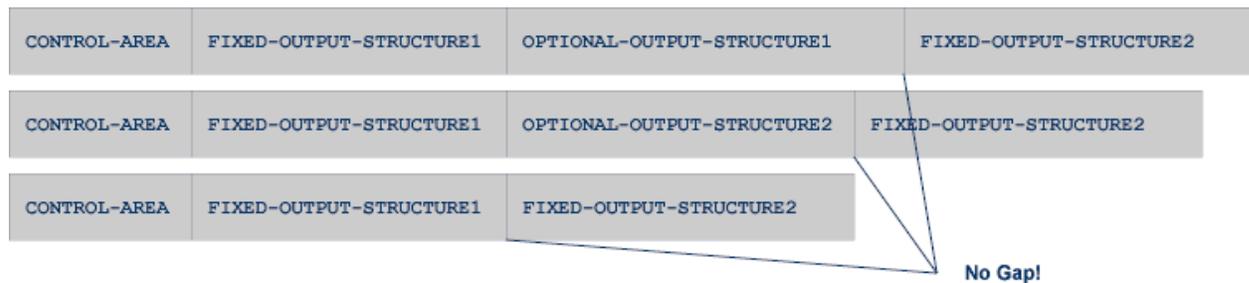
### Optional Output with Groups

As illustrated in [Example 4: COBOL Server Using Optional Output](#), COBOL group data items can be used to describe optional output structures. See *Optional COBOL Group Data Items*. Optional output with group data items are a variant of multiple possible output (MPO).

In addition, the COBOL interface

- limits the number of possible output structures returned
- defines all optional output structures, that is, they are known during extraction. In the example these are the structures `OPTIONAL-OUTPUT-STRUCTURE1` and `OPTIONAL-OUTPUT-STRUCTURE2`. These are the MPO structures.
- contains an additional COBOL data item carrying an indication if the optional output is present. By inspecting this data item first, the appropriate optional output structure can be selected to address the data correctly. If its value does not match, the optional output is not present. In the example it is `OPTIONAL-OUTPUT`. This item is the MPO selector.
- If the optional output is not present no memory is occupied. There is no gap between the optional output and the subsequent data item, as opposed to *Multiple Possible Output with REDEFINES* above.

In the example there are three different shapes of output:



### MPO Terminology

The following terminology is used with MPOs:

#### MPO structure

A COBOL group describing the output layout used in an MPO case. All alternative layouts in an MPO group are often described with COBOL `REDEFINES`s. An MPO structure can also contain other MPO groups.

**MPO group**

Bundles together all MPO structures that can be used alternatively. A COBOL interface can contain more than one MPO group.

**MPO case**

An MPO structure together with its MPO selector values (one or more).

**MPO selector**

A COBOL data item containing a specific value (MPO selector value) where the actual MPO case can be determined. The MPO selector precedes the MPO group and is located outside the MPO group.

**MPO selector value**

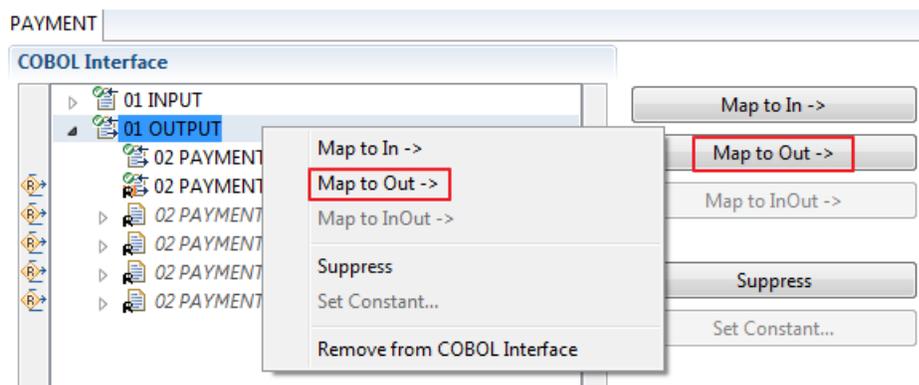
Each value indicates exactly one output structure. An output structure can be indicated by further values.

**Steps**

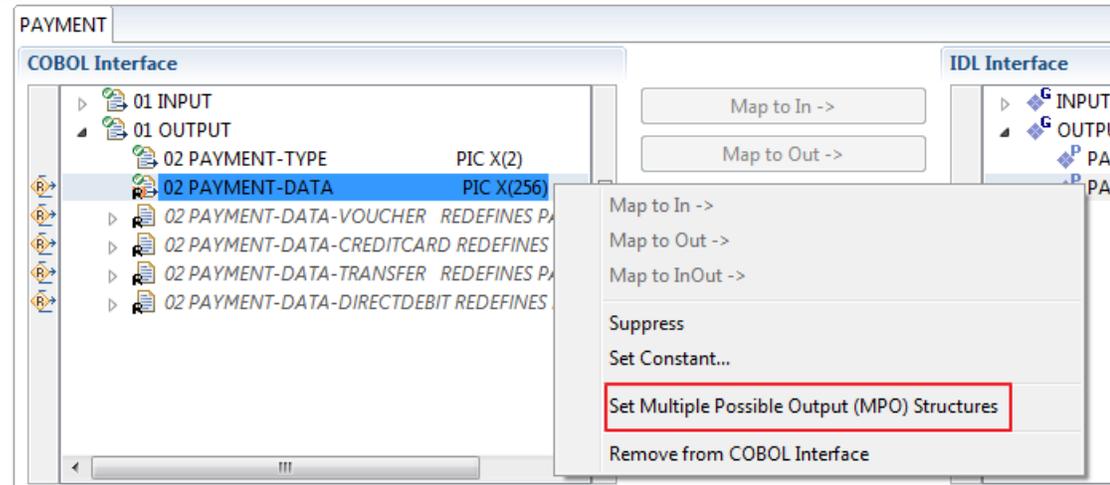
» **To set multiple possible output (MPO) structures**

Use the **Set Multiple Possible Output (MPO) Structures** function available in the context menu of the COBOL interface to create new or modify existing MPO groups.

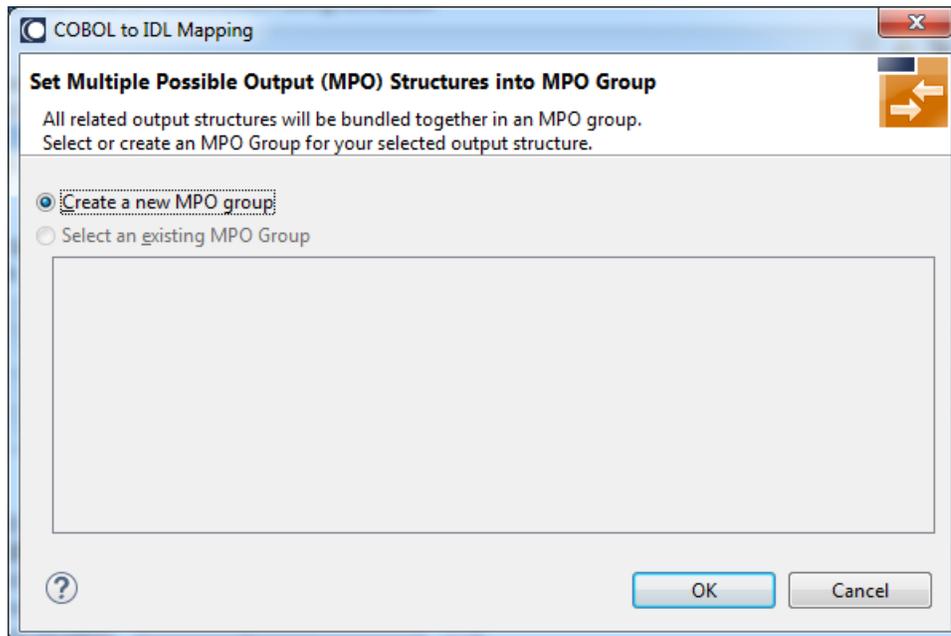
- 1 Set the top-level COBOL data item where the MPO structures are contained to IDL direction Out. Use the **Map to Out** function for this purpose:



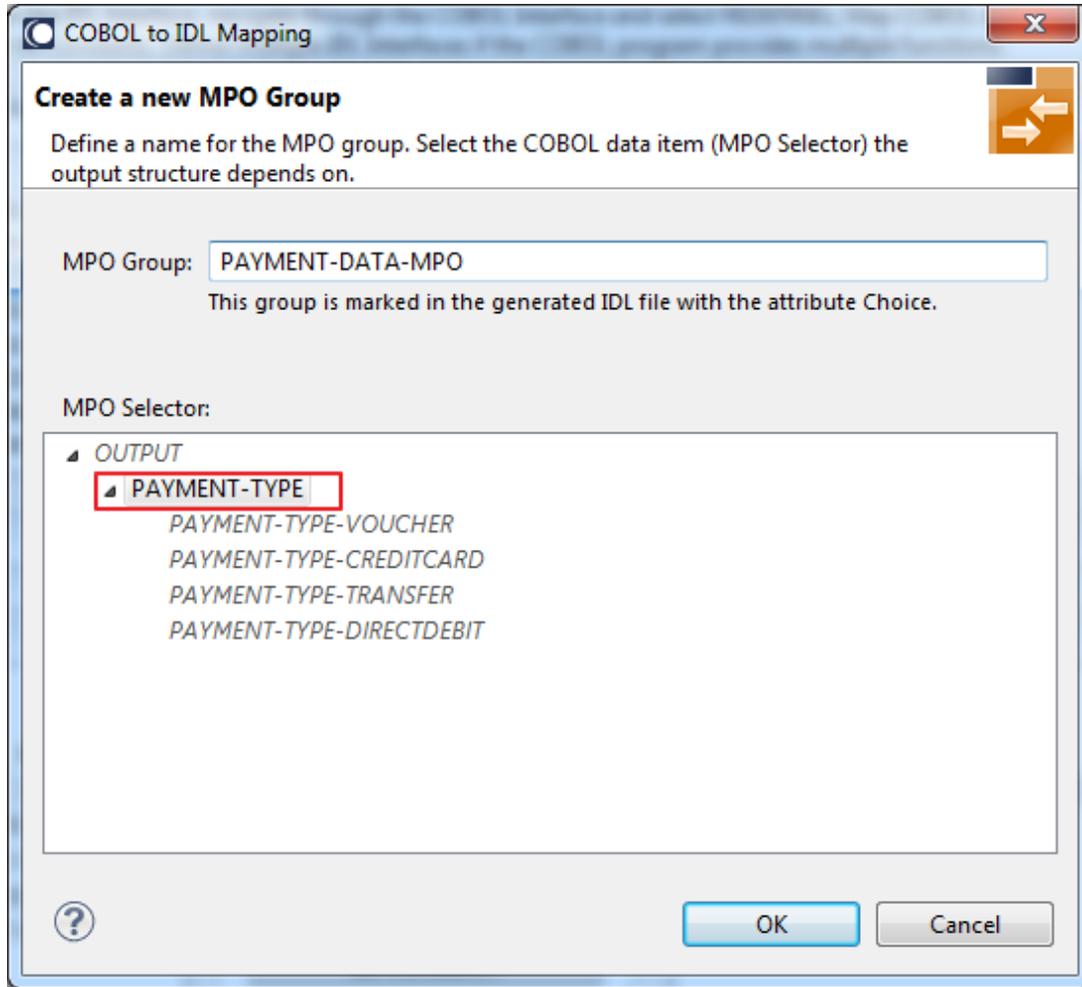
- 2 From the context menu of the COBOL interface of the COBOL REDEFINE, choose **Set Multiple Possible Output (MPO) Structures**.



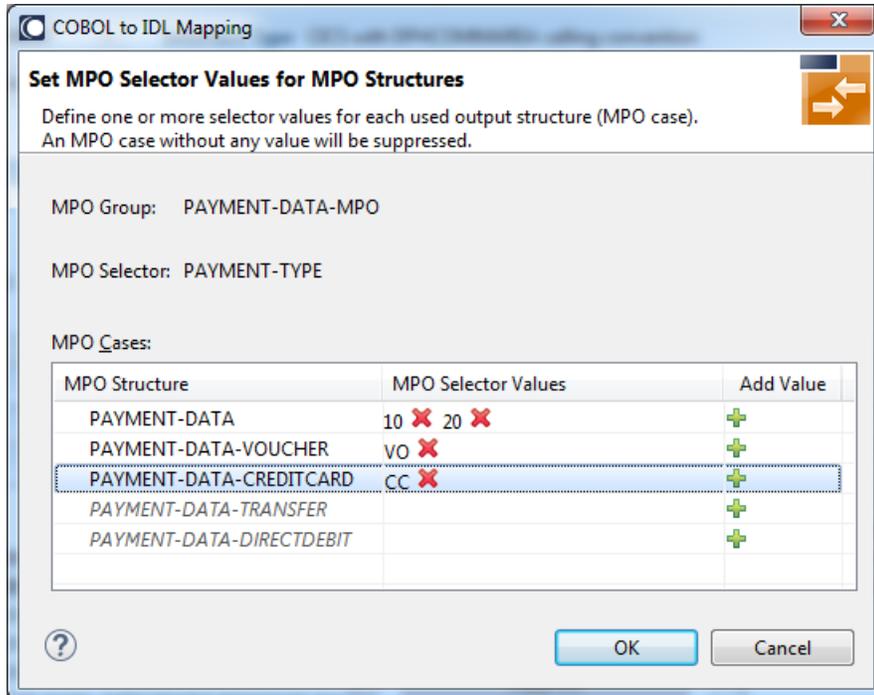
- 3 Set Multiple Possible Output (MPO) Structures into MPO Group.



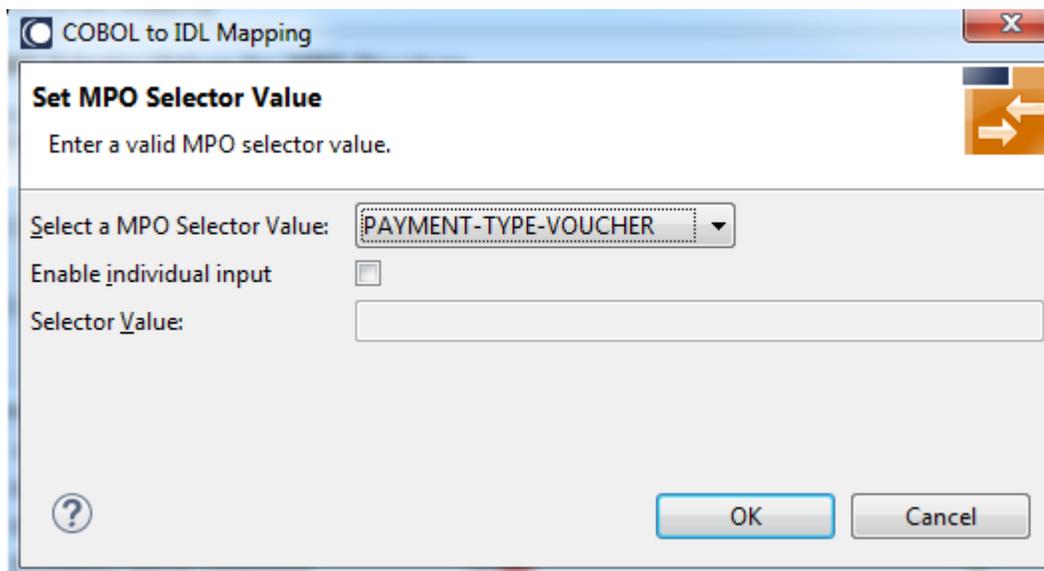
- 4 Create a new MPO group.



- 5 Set MPO selector values for MPO Structures.



Use the functions ✗ to delete and + to add MPO selector values:



**Notes:**

1. To add multiple MPO selector values per MPO structure, use the function + multiple times for the same MPO structure (see value 10 and 20 for structure PAYMENT-DATA).
2. MPO structures without any MPO selector are unused and suppressed in the IDL interface value (e.g. see structure PAYMENT-DATA-TRANSFER).

3. Each MPO selector value must uniquely identify an MPO structure. The same value cannot be used more than once for different MPO structures.
  4. If no defined MPO selector value matches during runtime, an empty MPO group is delivered to the RPC client, that is, none of the MPO cases contain any data. No runtime error is produced.
- 6 For the delivered example *COBOL Server Using Multiple Possible Output (MPO)* (see below): After pressing **Finish**, the following IDL together with a server mapping file is created. See *Server Mapping Files for COBOL*.

```
library 'PAYMENT' is

program 'PAYMENT' is
  define data parameter
    1 INPUT ('REQUEST') In
    1 OUTPUT ('REPLY') Out
  end-define

  struct 'REQUEST' is
    define data parameter
      1 ORDER-NUMBER (NU10)
    end-define

  struct 'REPLY' is
    define data parameter
      1 PAYMENT-TYPE (AV2)
      2 PAYMENT-DATA-MPO Choice
      3 PAYMENT-DATA (/V1)
      4 PAYMENT-DATA (AV256)
      3 PAYMENT-DATA-VOUCHER (/V1)
      4 VOUCHER-ORIGIN (AV128)
      4 VOUCHER-SERIES (AV128)
      3 PAYMENT-DATA-CREDITCARD (/V1)
      4 CREDITCARD-NUMBER (NU18)
      4 CREDITCARD-CODE (NU12)
      4 CREDITCARD-VALIDITY (AV8)
    end-define
```

## Programming Techniques

- [Example 1: COBOL Server with Multiple Functions](#)
- [Example 2: COBOL Server Using Fixed-length Tables in Variable Manner](#)
- [Example 3: COBOL Server Using Multiple Possible Output \(MPO\)](#)
- [Example 4: COBOL Server Using Optional Output](#)

### Example 1: COBOL Server with Multiple Functions

Assume a COBOL server program has a FUNCTION or OPERATION code COBOL data item in its COBOL interface. The COBOL server program behaves differently depending on field values of this data item. See the following example where a COBOL programs implements a calculator with the functions ADD, SUBTRACT, MULTIPLY, etc. The execution of the different functions is controlled by the COBOL data item OPERATION:

```

. . .
01 OPERATION                PIC X(1).
01 OPERAND1                 PIC S9(9) BINARY.
01 OPERAND2                 PIC S9(9) BINARY.
01 FUNCTION-RESULT         PIC S9(9) BINARY.
. . .
MOVE 0 TO FUNCTION-RESULT.
EVALUATE OPERATION
  WHEN "+"
    ADD OPERAND1 OPERAND2
    GIVING FUNCTION-RESULT
  WHEN "-"
    SUBTRACT OPERAND2 FROM OPERAND1
    GIVING FUNCTION-RESULT
  WHEN "*"
    MULTIPLY OPERAND1 BY OPERAND2
    GIVING FUNCTION-RESULT
  WHEN . . .
END-EVALUATE.
. . .

```

You can expose each COBOL server program function separately. The advantages or reasons for wanting this depend on the target endpoint. For example:

#### ■ Web Service

Instead having a Web service with a single operation, you want a web service with multiple operations, one operation for each COBOL function.

- **Java or .NET**

Instead having a class with a single method, you want a class with multiple methods, one method for each COBOL function.

- etc.

To do this you need to extract the COBOL server program as described under [Map to Multiple IDL Interfaces](#).

### Example 2: COBOL Server Using Fixed-length Tables in Variable Manner

Assume a COBOL CICS channel container server program has a fixed-length COBOL table as its last parameter, similar to COBOL data item COBOL-TABLE-FIX in the example below; each table element is 100 bytes; the length of COBOL-FIELD1 + COBOL-FIELD2 + COBOL-FIELD3; the length of the data preceding the COBOL table is described by COBOL-GROUP1; its length is 1000 bytes.

```

WORKING-STORAGE SECTION.
01 LS-CONTAINER-NAME          PIC X(16) VALUE "VAR-INPUT".
01 WS-CONTAINER-NAME          PIC X(16) VALUE "VAR-OUTPUT".
01 NUMBER-OF-INCOMING-ELEMENTS PIC S9(8) BINARY.
01 NUMBER-OF-OUTGOMING-ELEMENTS PIC S9(8) BINARY.

. . .

01 WS-CONTAINER-LAYOUT.
  10 COBOL-GROUP1.
    20 COBOL-TABLE-PREFIX          PIC X(1000).
  10 COBOL-TABLE-FIX              OCCURS 20.
    20 COBOL-GROUP2.
      25 COBOL-FIELD1              PIC X(4).
      25 COBOL-FIELD2              PIC X(3).
      25 COBOL-FIELD3              PIC X(50).
LINKAGE SECTION.
01 LS-CONTAINER-LAYOUT.
  10 COBOL-GROUP1.
    20 COBOL-TABLE-PREFIX          PIC X(1000).
  10 COBOL-TABLE-FIX              OCCURS 20.
    20 COBOL-GROUP2.
      25 COBOL-FIELD1              PIC X(30).
      25 COBOL-FIELD2              PIC X(20).
      25 COBOL-FIELD3              PIC X(50).
. . .
PROCEDURE DIVISION.
  EXEC CICS GET
    CONTAINER (LS-CONTAINER-NAME
  SET        (ADDRESS OF LS-CONTAINER-LAYOUT)
  FLNGTH    (WS-CONTAINER-LENGTH)
  RESP      (WS-RESP)
  RESP2     (WS-RESP2)
  END-EXEC.

```

```

      COMPUTE NUMBER-OF-INCOMING-ELEMENTS = (WS-CONTAINER-LENGTH
      - LENGTH OF COBOL-GROUP1 IN AREA LS-CONTAINER-LAYOUT)
      / LENGTH OF COBOL-GROUP2 IN AREA LS-CONTAINER-LAYOUT.
      . . .
      COMPUTE WS-CONTAINER-LENGTH = LENGTH OF COBOL-GROUP1 IN AREA ←
WS-CONTAINER-LAYOUT
      + (NUMBER-OF-OUTGOING-ELEMENTS
      * LENGTH OF COBOL-GROUP2 IN AREA WS-CONTAINER-LAYOUT).

      EXEC CICS PUT
          CONTAINER (WS-CONTAINER-NAME)
          FROM      (WS-CONTAINER-LAYOUT)
          FLENGTH   (WS-CONTAINER-LENGTH)
          RESP      (WS-RESP)
          RESP2     (WS-RESP2)
      END-EXEC.
      EXEC CICS RETURN END-EXEC.

```

During input the COBOL channel container server program uses the container length `WS-CONTAINER-LENGTH` to evaluate the `NUMBER-OF-INCOMING-ELEMENTS`. During output the `WS-CONTAINER-LENGTH` is determined according to the `NUMBER-OF-OUTGOING-ELEMENTS` and set in the `EXEC CICS PUT CONTAINER` statement.

Although the COBOL table is defined as a table with a fixed size (see [COBOL Tables with Fixed Size](#)) it is used in a variable manner, similar to tables with variable size (see [COBOL Tables with Variable Size - DEPENDING ON Clause](#)). In this case you need to map the COBOL table to an IDL unbounded array. See [Set Arrays \(Fixed <-> Unbounded\)](#).

### Example 3: COBOL Server Using Multiple Possible Output (MPO)

A COBOL `REDEFINE` can be used in a COBOL server program to return multiple possible output (MPO) structures, similar to COBOL data item `PAYMENT-DATA` in the example below; for this purpose, `PAYMENT-DATA` is redefined; each redefinition represents an output structure (MPO case); on return exactly one output structure is used; by inspecting COBOL data item `PAYMENT-TYPE` (MPO selector) first, a caller can determine the returned output structure; the caller then uses the correct redefinition to access the data.

```

      . . .
      01 INPUT-DATA.
          02 ORDER-NUMBER                PIC 9(10).

      . . .
      01 OUTPUT-DATA.
          02 <some fields>                PIC <clause>.
          . . .

          02 PAYMENT-TYPE                PIC X(2).
              88 PAYMENT-TYPE-VOUCHER    VALUE "VO".
              88 PAYMENT-TYPE-CREDITCARD VALUE "CC".

```

```

      88 PAYMENT-TYPE-TRANSFER          VALUE "TR".
      88 PAYMENT-TYPE-DIRECTDEBIT      VALUE "DB".
      . . .
    02 <preceding data items>          PIC <clause>.
      . . .
    02 PAYMENT-DATA                    PIC X(256).
    02 PAYMENT-DATA-VOUCHER            REDEFINES PAYMENT-DATA.
      04 VOUCHER-ORIGIN                PIC X(128).
      04 VOUCHER-SERIES                PIC X(128).
    02 PAYMENT-DATA-CREDITCARD        REDEFINES PAYMENT-DATA.
      04 CREDITCARD-NUMBER            PIC 9(18).
      04 CREDITCARD-COMPANY           PIC X(128).
      04 CREDITCARD-CODE              PIC 9(12).
      04 CREDITCARD-VALIDITY          PIC X(8).
    02 PAYMENT-DATA-TRANSFER          REDEFINES PAYMENT-DATA.
      04 TRANSFER-NAME                PIC X(128).
      04 TRANSFER-IBAN                PIC X(34).
      04 TRANSFER-BIC                 PIC X(11).
    02 PAYMENT-DATA-DIRECTDEBIT       REDEFINES PAYMENT-DATA.
      04 DIRECTDEBIT-IBAN             PIC X(34).
      04 DIRECTDEBIT-NAME             PIC X(128).
      04 DIRECTDEBIT-EXPIRES          PIC 9(8).
      . . .
    02 <subsequent data items>        PIC <clause>.
      . . .

      . . .

*   read order record using ORDER-NUMBER
      . . .

*   set value indicating type of reply (MPO selector)
      IF <some-condition> THEN
        SET PAYMENT-TYPE-VOUCHER TO TRUE
      ELSE IF <some-other-condition> THEN
        SET PAYMENT-TYPE-CREDITCARD TO TRUE
      ELSE IF <some-further-condition> THEN
        SET PAYMENT-TYPE-TRANSFER TO TRUE
      ELSE
        SET PAYMENT-TYPE-DIRECTDEBIT TO TRUE
      END-IF.
      . . .

*   set fields (MPO case) depending on type of reply
      INITIALIZE PAYMENT-DATA.
      EVALUATE TRUE
        WHEN PAYMENT-TYPE-VOUCHER
          MOVE . . . TO VOUCHER-ORIGIN
          MOVE . . . TO VOUCHER-SERIES
        WHEN PAYMENT-TYPE-CREDITCARD
          MOVE . . . TO CREDITCARD-NUMBER
          MOVE . . . TO CREDITCARD-CODE

```

```

        MOVE . . . TO CREDITCARD-VALIDITY
    WHEN PAYMENT-TYPE-TRANSFER
        MOVE . . . TO TRANSFER-NAME
        MOVE . . . TO TRANSFER-IBAN
        MOVE . . . TO TRANSFER-BIC
    WHEN PAYMENT-TYPE-DIRECTDEBIT
        MOVE . . . TO DIRECTDEBIT-IBAN
        MOVE . . . TO DIRECTDEBIT-NAME
        MOVE . . . TO DIRECTDEBIT-EXPIRES
    WHEN
        . . .
END-EVALUATE.
. . .

```

COBOL server programs using alternative and dissimilar shapes for the output layout are extracted as described under [Set Multiple Possible Output \(MPO\) Structures](#).

#### Example 4: COBOL Server Using Optional Output

COBOL group data items can be used in a COBOL server program to return optional output similar to the example below; the returned data is built by copying the necessary COBOL structures into an output area. The optional output is one of OPTIONAL-OUTPUT-STRUCTURE1, OPTIONAL-OUTPUT-STRUCTURE2 or nothing. The presence of the optional output is controlled by a structure named CONTROL-AREA. Optional output with group data items are a variant of MPO, see [Example 3: COBOL Server Using Multiple Possible Output \(MPO\)](#).

```

WORKING-STORAGE SECTION.

01 INPUT-AREA.
   02 FIX-INPUT-ITEM1                PIC X(4).
   02 <some fields>                  PIC <clause>.
   . . .

01 OUTPUT-OFFSET                     PIC S9(9) BINARY.
01 OUTPUT-AREA                       PIC X(32000).
   . . .

01 CONTROL-AREA.
   02 OPTIONAL-OUTPUT                PIC X(1).
      88 OPTIONAL-OUTPUT-1          VALUE "1".
      88 OPTIONAL-OUTPUT-2          VALUE "2".
      88 OPTIONAL-OUTPUT-NONE       VALUE "N".
   . . .

01 OPTIONAL-OUTPUT-STRUCTURE1.
   02 OPTIONAL-OUTPUT-ITEM11         PIC X(10).
   02 OPTIONAL-OUTPUT-ITEM12         PIC X(100).
   02 OPTIONAL-OUTPUT-ITEM13         PIC X(20).
   . . .

```

```

01 OPTIONAL-OUTPUT-STRUCTURE2.
  02 OPTIONAL-OUTPUT-ITEM21          PIC X(4).
  02 OPTIONAL-OUTPUT-ITEM22          PIC X(50).
  02 OPTIONAL-OUTPUT-ITEM23          PIC X(50).
  . . .

01 FIX-OUTPUT-STRUCTURE1.
  02 FIX-OUTPUT-ITEM11                PIC X(4).
  02 FIX-OUTPUT-ITEM12                PIC X(20).
  02 FIX-OUTPUT-ITEM13                PIC X(8).
  . . .

01 FIX-OUTPUT-STRUCTURE2.
  02 FIX-OUTPUT-ITEM21                PIC X(2).
  02 FIX-OUTPUT-ITEM22                PIC X(10).
  02 FIX-OUTPUT-ITEM23                PIC X(10).
  . . .

IF <some-condition> THEN
  SET OPTIONAL-OUTPUT-1 TO TRUE
ELSE IF <some-other-condition> THEN
  SET OPTIONAL-OUTPUT-2 TO TRUE
ELSE
  SET OPTIONAL-OUTPUT-NONE TO TRUE
END-IF.

. . .

*   provide control area for optional output
    MOVE 1 TO OUTPUT-OFFSET.
    STRING CONTROL-AREA DELIMITED BY SIZE
    INTO OUTPUT-AREA WITH POINTER OUTPUT-OFFSET.

*   provide data items before optional output
    STRING FIX CONTROL-AREA DELIMITED BY SIZE
    INTO OUTPUT-AREA WITH POINTER OUTPUT-OFFSET.

*   provide optional output
    EVALUATE TRUE
      WHEN OPTIONAL-OUTPUT-1
        STRING OPTIONAL-OUTPUT-STRUCTURE1 DELIMITED BY SIZE
        INTO OUTPUT-AREA WITH POINTER OUTPUT-OFFSET
      WHEN OPTIONAL-OUTPUT-2
        STRING OPTIONAL-OUTPUT-STRUCTURE2 DELIMITED BY SIZE
        INTO OUTPUT-AREA WITH POINTER OUTPUT-OFFSET
    END-EVALUATE.

*   provide data items after optional output
    STRING FIX-OUTPUT-STRUCTURE2 DELIMITED BY SIZE
    INTO OUTPUT-AREA WITH POINTER OUTPUT-OFFSET.
  . . .

```

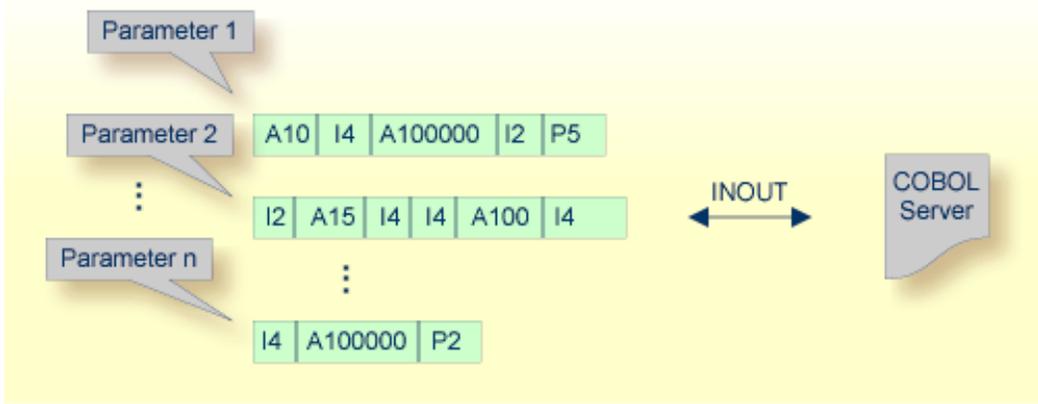
COBOL server programs using optional shapes for the output layout are extracted as described under *Set Multiple Possible Output (MPO) Structures*.



# 11 Batch with Standard Linkage Calling Convention

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■ Introduction .....	236
■ Extracting from a Standard Call Interface .....	236
■ Mapping Editor User Interface .....	238
■ Mapping Editor IDL Interface Mapping Functions .....	245
■ Programming Techniques .....	254



## Introduction

Because COBOL servers with a standard call interface always contain a `PROCEDURE DIVISION` header (see [PROCEDURE DIVISION Mapping](#)) with all parameters, the COBOL data items of the interface can be evaluated by the IDL Extractor for COBOL and are already offered by the wizard. In most cases the offered COBOL data items will be correct, but you should always check them manually.

If you have selected an IDL file and opened the COBOL Mapping Editor with an existing COBOL to IDL mapping, continue with [Mapping Editor User Interface](#).

## Extracting from a Standard Call Interface

If you are extracting IDL from a COBOL source or extending the IDL file by extracting an additional COBOL source with interface type Batch with standard linkage calling convention, the **Extractor Settings** dialog appears (see also [Step 4: Define the Extraction Settings and Start Extraction](#)).

Make sure the interface type is correct.

The screenshot shows the 'COBOL Source' dialog box. It contains the following fields and options:

- File Name:
- Operating System:
- Interface Type:
- Input Message same as Output Message

Press **Next** to open the COBOL Mapping Editor.

➤ **To select the COBOL interface data items of your COBOL server**

- 1 Add the COBOL data items to the **COBOL Interface**, using the context menu or toolbar available in the *COBOL Source View* and *COBOL Interface*. See **Notes**.
- 2 Continue with *COBOL to IDL Mapping*.



**Notes:**

1. If there is a `PROCEDURE DIVISION` header available, the parameters listed define exactly the COBOL interface. These COBOL data items are within the `LINKAGE SECTION` and are already selected to the COBOL interface in initial state when you enter the COBOL Mapping Editor. The `PROCEDURE DIVISION` header might not be available if you are extracting from a copybook or part of the COBOL source.
2. It is very important to select the right COBOL data items describing the interface of the COBOL server correctly. This means the COBOL data items used as parameters must match in number and in sequence of formats (COBOL usage clause).
3. If your COBOL server contain `REDEFINES`, the first `REDEFINE` path is offered by default. Check manually whether this is the one you want. If not, correct it. You can select any other `REDEFINE` path.

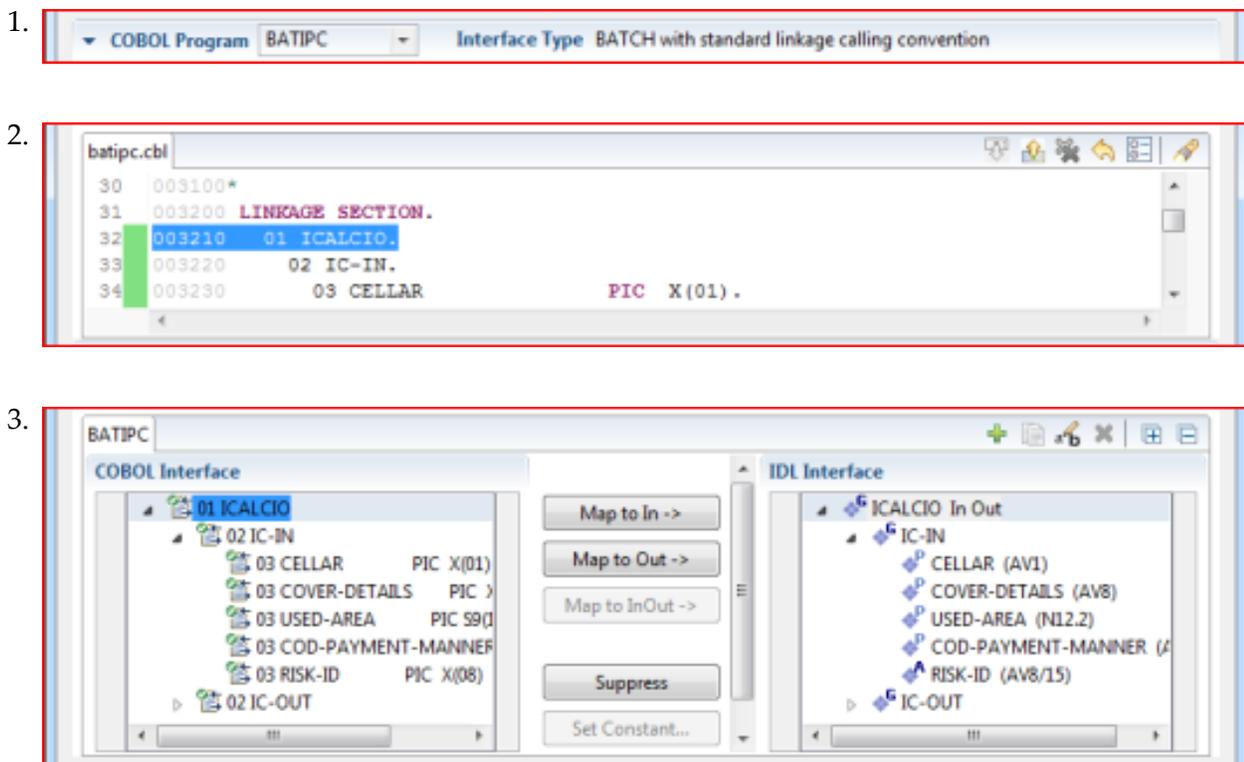
The user interface of the COBOL Mapping Editor is described below.

## Mapping Editor User Interface

This section assumes you have set the extraction settings as described above. The following areas of the COBOL Mapping Editor user interface are described here:

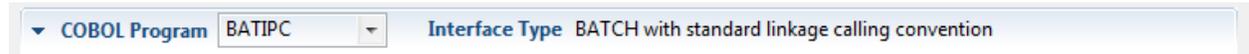
- [COBOL Program Selection](#)
- [COBOL Source View](#)
- [COBOL to IDL Mapping](#)

For COBOL server programs with standard call interface types, the user interface of the COBOL Mapping Editor looks like this:



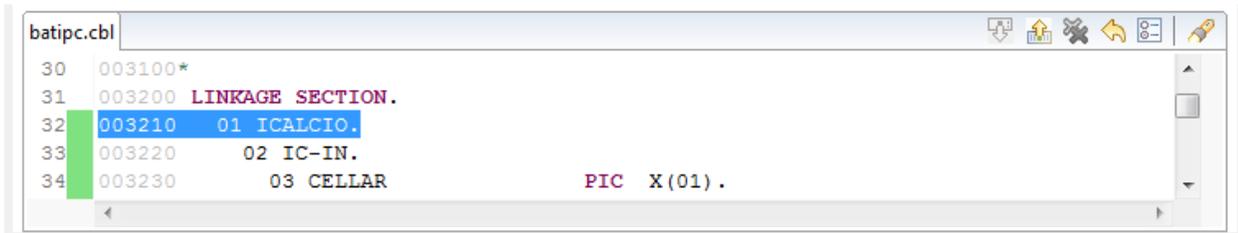
1. **COBOL Program Selection.** Currently selected program with interface type
2. **COBOL Source View.** Contains all related sources for the currently selected COBOL program
3. **COBOL to IDL Mapping.** Tree view of your selected COBOL data items and mapping buttons with which you can map these items to your IDL interface

## COBOL Program Selection



The COBOL Program Selection displays the current selected COBOL program with its interface type. If you have extracted more than one COBOL program within the associated IDL file, you can switch to another COBOL program with its mapping by selecting the name in the combo box.

## COBOL Source View



```
batipc.cbl
30 003100*
31 003200 LINKAGE SECTION.
32 003210 01 ICALCIO.
33 003220 02 IC-IN.
34 003230 03 CELLAR PIC X(01).
```

All COBOL data items contained in the `LINKAGE` and `WORKING-STORAGE SECTION` are offered in a text view. The text view contains all related sources (including copybooks) for the currently selected COBOL program. It is used for selecting data items and retrieving information from the original COBOL sources. The light green bar indicates that the data item is already contained in the COBOL Interface; a dark green bar indicates the data item is selectable and can be added to the COBOL Interface. This section can be collapsed. If you open the Editor with **Modify Interface** it is collapsed by default. The toolbar provides the following actions:

-  Add selected COBOL data item to COBOL Interface.
-  Remove selected COBOL data item from COBOL Interface.
-  Remove all COBOL data items from COBOL Interface.
-  Reset COBOL Interface to initial state.
-  Show dialog to modify COBOL Source Characteristics.
-  Show dialog to find text in Source.

The same functionality is also available from the context menu.

## COBOL to IDL Mapping

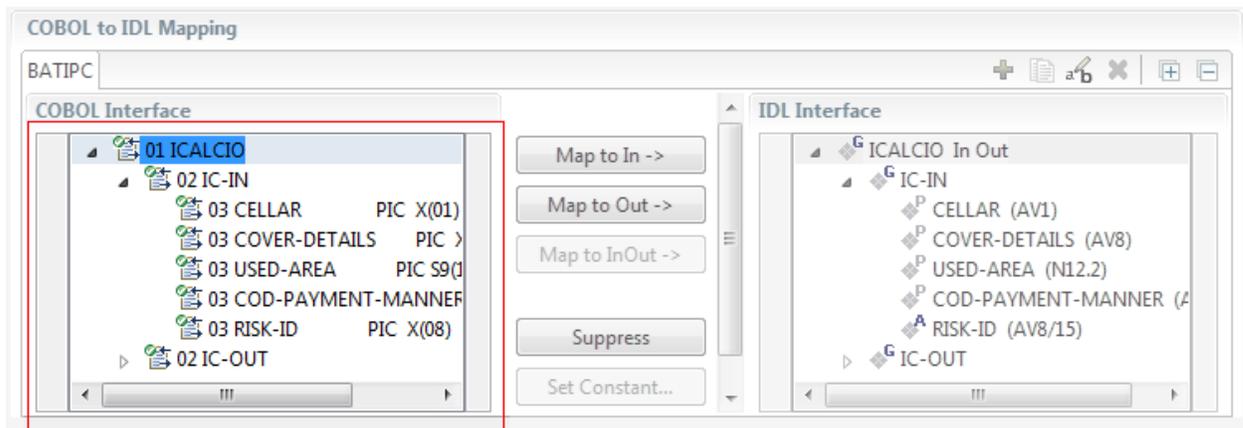
This section covers the following topics:

- [COBOL Interface](#)
- [Mapping Buttons](#)
- [IDL Interface](#)

### COBOL Interface

The **COBOL Interface** shows a tree view of your selected COBOL data items describing the interface of the COBOL server. A context menu is available for the COBOL data items, which provides mapping and other functions. On some COBOL data items, decision icons indicate where particular attention is needed, including mapping icons to visualize the COBOL data type and your current mapping.

The COBOL data item names are derived from the COBOL source from which they were extracted. If your COBOL interface contains parameters without a name, that is, the keyword `FILLER` is used, those COBOL data items are shown as `[FILLER]`. See [FILLER Pseudo-Parameter](#).



You can modify the COBOL interface using context menu or toolbar; decision and mapping icons provide additional information.

### Context Menu

The context menu on COBOL data items provides the following mapping and other functions, depending on the data item type, the COBOL level and the current mapping.

- |                                |  |
|--------------------------------|--|
| <b>Map to In   Out   InOut</b> | A suppressed COBOL data item becomes visible in the IDL interface. Used also to select another <code>REDEFINE</code> path. |
| <b>Suppress</b>                | Suppress unneeded COBOL data items.  |
| <b>Set Constant</b>            | Set COBOL data items to constant.  |

**Remove from COBOL Interface** - Remove the data item from the COBOL interface. This also removes the mapped IDL parameter from all IDL interfaces for the current COBOL program. See [COBOL Program Selection](#).

See also [Mapping Editor IDL Interface Mapping Functions](#).

### Toolbar

The toolbar offers the following actions:

-  Create IDL Interface. Creates a new IDL interface based on the current COBOL interface: all IDL parameters are of IDL direction InOut; no IDL parameters are set to constant; for COBOL REDEFINE, the first REDEFINE path is mapped to IDL; FILLERS are suppressed according to your selection, see [Step 4: Define the Extraction Settings and Start Extraction](#).
-  Copy current IDL Interface. Creates a duplicate of the current IDL interface: all modifications such as IDL directions, suppress, selection of REDEFINE paths etc. are kept.
-  Remove current IDL Interface.
-  Rename current IDL Interface.
-  Expand the full tree.
-  Collapse the full tree.

See also [Map to Multiple IDL Interfaces](#).

### Decision Icons

The decision icons in the first column are set on COBOL data items where particular attention is needed:

-  This icon visualizes a COBOL REDEFINE. It is essential that you map the correct redefine path for your mapping to In, Out or InOut using the context menu. If you map a REDEFINE path, all other sibling REDEFINE paths are automatically set to "Suppress".

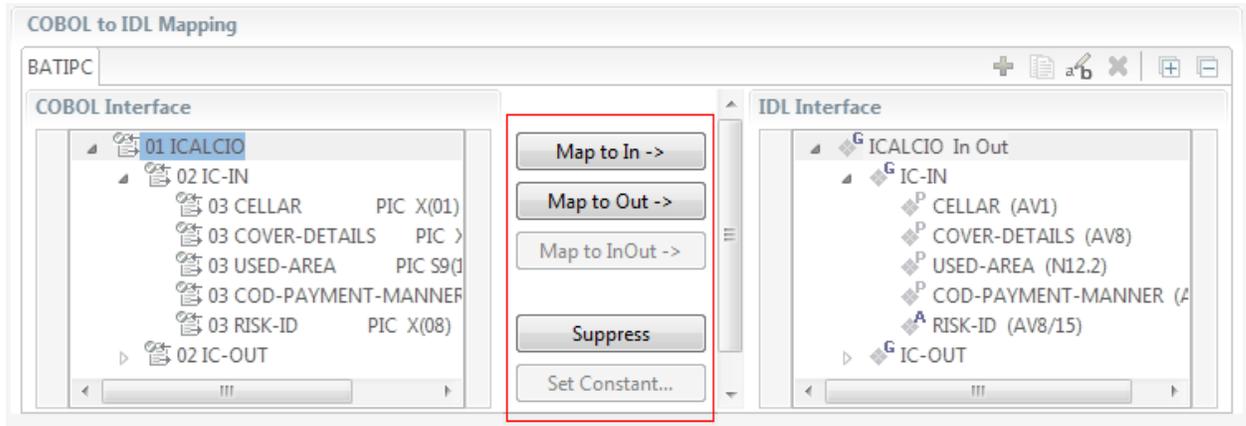
### Mapping Icons

The following mapping icons on the COBOL data items indicate your current IDL mapping:

-  Scalar parameter, mapped to In.
-  Scalar parameter, mapped to InOut.
-  Scalar parameter, mapped to Out.
-  Group parameter, here mapped to InOut.
-  REDEFINE parameter, here mapped to InOut.
-  Parameter set to Constant.

## Mapping Buttons

The following buttons are available:



### Map to In | Out | InOut ->

See *Map to In, Out, InOut*. A suppressed COBOL data item becomes visible in the IDL interface. Used also to select another REDEFINE path.

### Suppress

See *Suppress Unneeded COBOL Data Items*.

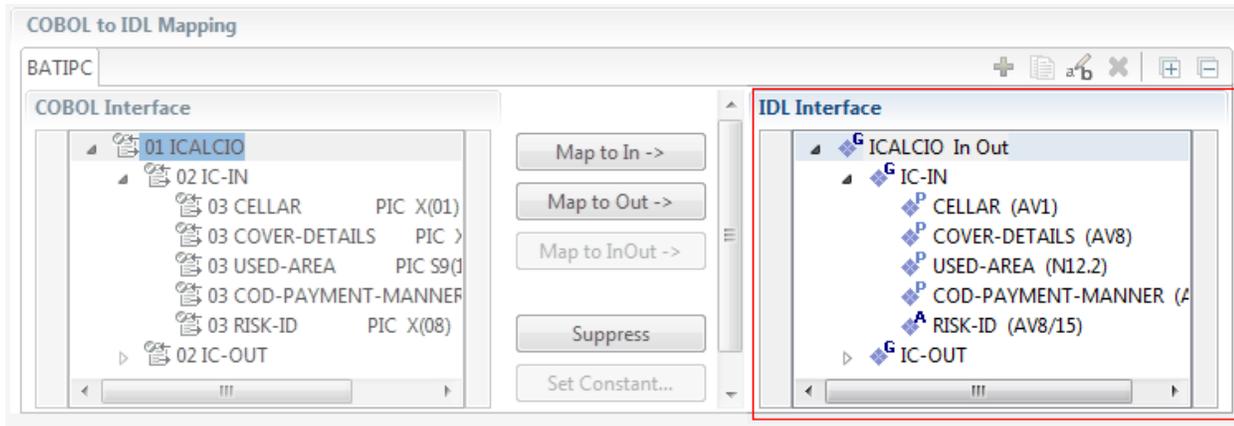
### Set Constant...

See *Set COBOL Data Items to Constants*.

### IDL Interface

If you have mapped the COBOL interface to multiple IDL interfaces, select the IDL interface by choosing the tabs. In the **IDL Interface** tree view, a context menu is also available with the following possibilities:

- Rename
- Remove from COBOL Interface. This also removes the mapped IDL parameter from all IDL interfaces for the current COBOL program. See *COBOL Program Selection* above.



## Mapping Editor IDL Interface Mapping Functions

This section covers the following topics:

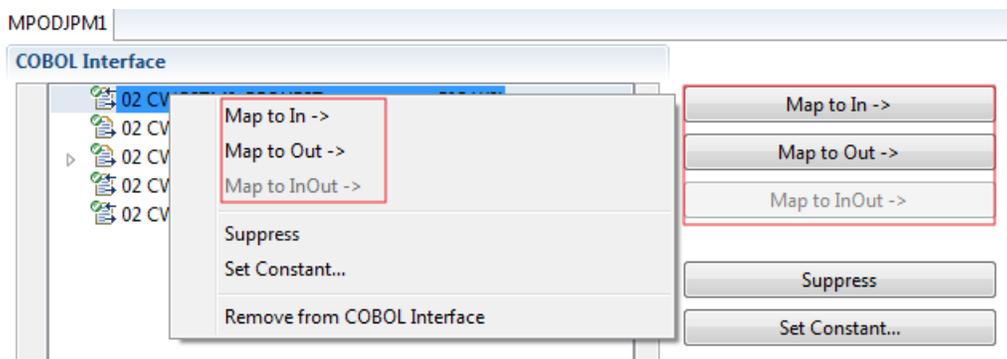
- [Map to In, Out, InOut](#)
- [Map OCCURS DEPENDING ON](#)
- [Map to Multiple IDL Interfaces](#)
- [Select REDEFINE Paths](#)
- [Suppress Unneeded COBOL Data Items](#)
- [Set COBOL Data Items to Constants](#)

### Map to In, Out, InOut

With the **Map to In**, **Out**, **InOut** functions you make a COBOL data item visible as an IDL parameter in the IDL interface. With correct IDL directions you design the IDL interface by defining input and output parameters. COBOL programs have no parameter directions, so you need to set IDL directions manually.

#### > To provide IDL directions

- Go *step-by-step* through all *top-level* COBOL data items in the COBOL interface and use the **Map to In**, **Out** and **InOut** functions available in the context menu of the COBOL interface and as mapping buttons to make the COBOL data items visible and provide IDL directions in the IDL interface:



#### Notes:

1. If a *top-level* COBOL *group* is mapped, the IDL direction is inherited by all subordinate COBOL data items and thus to the related IDL parameters in the IDL interface.
2. Subordinate COBOL data items can only be mapped to the same IDL direction as their *top-level* COBOL *group* data item.

3. With the inverse function **Suppress Unneeded COBOL Data Items** (see below) available in the context menu of the COBOL interface and as mapping button, a COBOL data item can be removed from the IDL interface.
4. IDL directions are described in the direction-attribute in `attribute-list` under *Software AG IDL Grammar* in the IDL Editor documentation.

If you are using an RPC server such as the z/OS (CICS | Batch), z/VSE (CICS | Batch), Micro Focus or BS2000/OSD RPC server, the amount of data to be transferred to/from the RPC client is reduced with correct IDL directions.

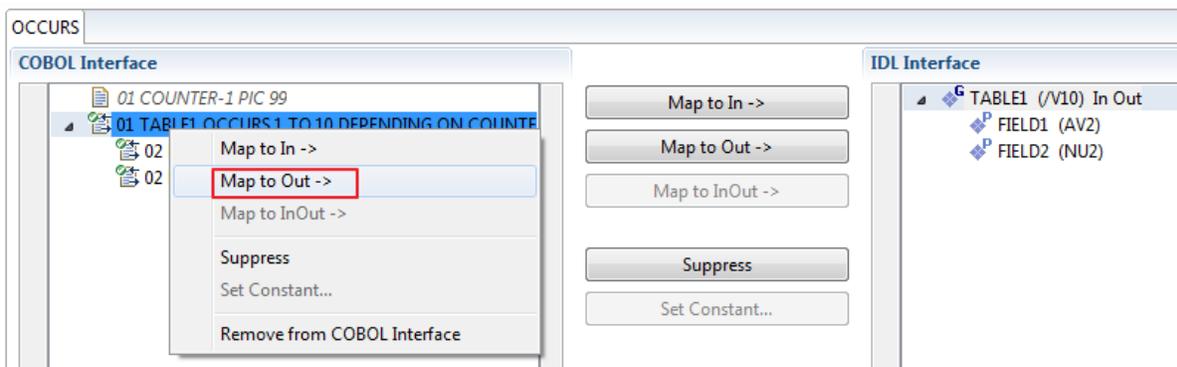
### Map OCCURS DEPENDING ON

With the **Map to In**, **Out**, **InOut** functions you can make the COBOL ODO subject (here COBOL data item TABLE) of a variable-sized COBOL table (see [COBOL Tables with Variable Size - DEPENDING ON Clause](#)) visible as an IDL unbounded group (with maximum). The ODO object (here COBOL data item COUNTER-1) is suppressed and therefore not part of the IDL interface. This is because the number of elements of the IDL unbounded group is already implicitly available. See the following example:

```
01 COUNTER-1 PIC 99.
01 TABLE OCCURS 1 TO 10 DEPENDING ON COUNTER-1
  02 FIELD1 PIC XX.
  02 FIELD2 PIC 99.
```

#### ➤ To map OCCURS DEPENDING ON

- 1 Add the COBOL ODO subject (here data item TABLE) and ODO object (here data item COUNTER-1) to the COBOL interface. It is important both data items are in the COBOL interface.
- 2 Use the **Map to In**, **Out** and **InOut** functions available in the context menu of the COBOL interface and as mapping buttons and apply IDL directions for the ODO subject (data item TABLE):

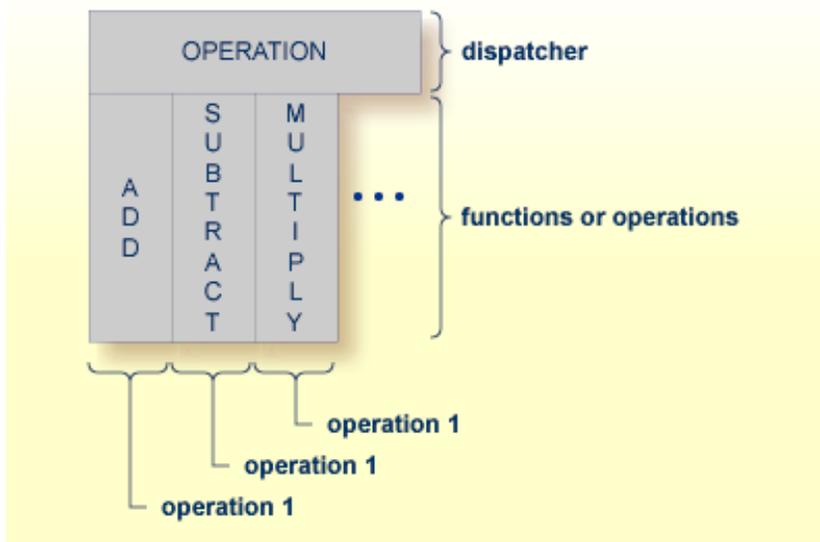


 **Notes:**

1. The ODO subject can be mapped to the IDL interface.
2. The ODO object is always suppressed, but is required to be part of the COBOL interface.
3. IDL directions are described in the direction-attribute in `attribute-list` under *Software AG IDL Grammar* in the IDL Editor documentation.

### Map to Multiple IDL Interfaces

Assume the COBOL server program provides multiple functions or operations, in the following example `ADD`, `SUBTRACT`, `MULTIPLY`. Some dispatcher front-end code executes the correct function, for example, depending on a *function-code* or *operation-code* parameter:



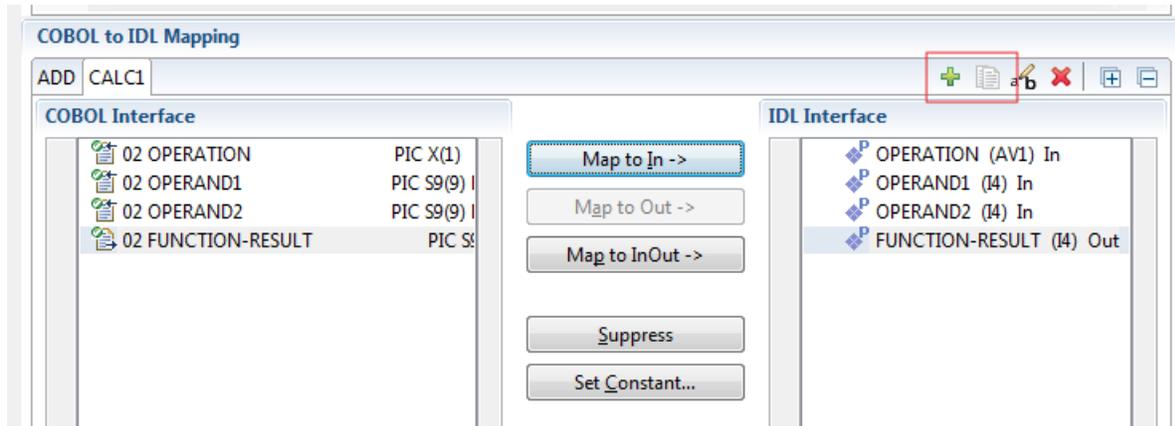
This example is described in more detail under [Example 1: COBOL Server with Multiple Functions](#).

If you have such a situation, a good approach is to expose each COBOL server program function separately as an IDL program. This gives advantages in further processing of the IDL and COBOL mapping files (SVM and CVM). For example:

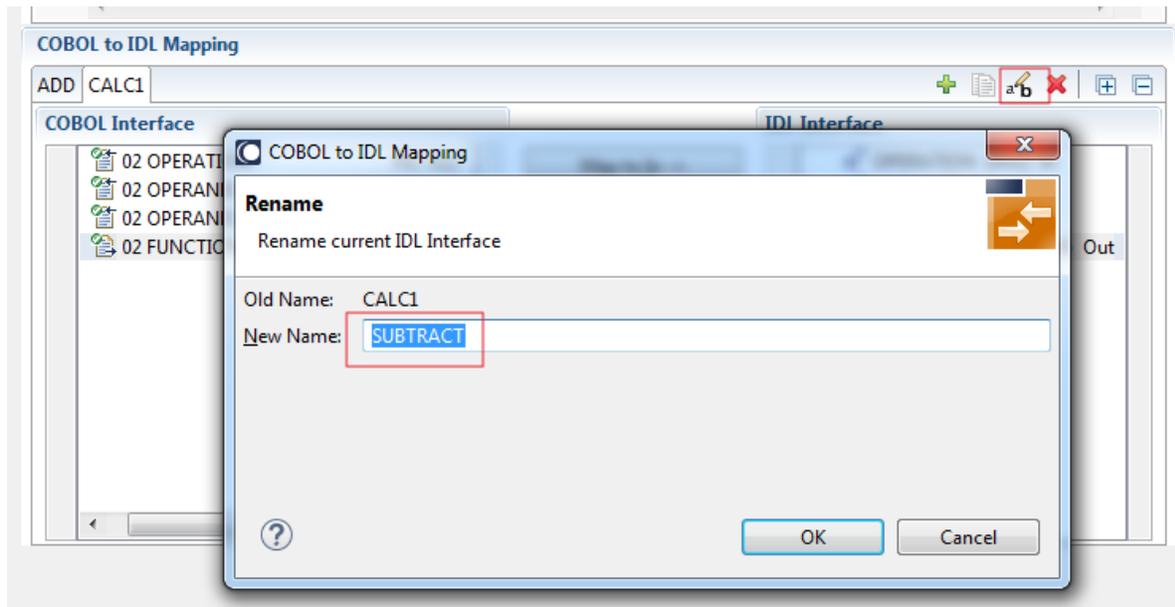
- If your target endpoint is a web service: instead having a Web service with a single operation, you get a web service with multiple operation, one operation for each COBOL function.
- If your target endpoint is Java or .NET: instead having a class with a single method, you get a class with multiple methods, one method for each COBOL function.

> To map a COBOL interface to multiple IDL interfaces

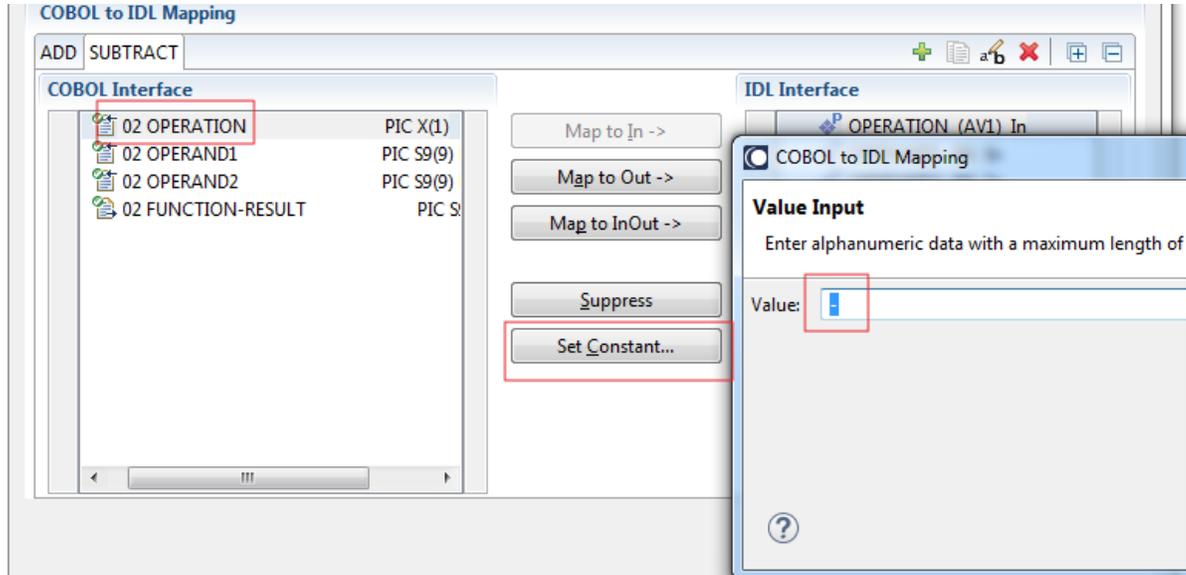
- 1 Select the tab with COBOL to IDL Mapping. For each function, define a separate IDL interface with the toolbar functions  or :



- 2 Give the IDL interfaces meaningful names with the toolbar function :



- 3 Define the required constant values to the *function-code* or *operation-code* parameter, see *Set COBOL Data Items to Constants* above:



For the delivered Example 1: COBOL Server with Multiple Functions:

- First, for step 1 above: Extract and define 3 separate IDL programs ADD, SUBTRACT, MULTIPLY.
- Second, for step 2 above: Rename them to suitable names, e.g. 'ADD', 'SUBTRACT', 'MULTIPLY'.
- Third, for step 3 above: Define the constants '+', '-' and '\*' to the parameter OPERATION respectively.
- After pressing **Finish**, the following IDL together with a server mapping file is created. See *Server Mapping Files for COBOL*.

```

Library 'EXAMPLE' is

program 'ADD' is
  define data parameter
    1 OPERAND1 (I4) In
    1 OPERAND2 (I4) In
    1 FUNCTION-RESULT (I4) Out
  end-define

program 'SUBTRACT' is
  define data parameter
    1 OPERAND1 (I4) In
    1 OPERAND2 (I4) In
    1 FUNCTION-RESULT (I4) Out
  end-define

program 'MULTIPLY' is
  define data parameter
    1 OPERAND1 (I4) In
    1 OPERAND2 (I4) In
    1 FUNCTION-RESULT (I4) Out
  end-define

```



**Notes:**

1. The following functions are offered to create further mappings from the COBOL interface, resulting in multiple IDL interfaces (IDL programs).

Icon	Function	Description
	Create IDL Interface	Creates a new IDL interface based on the current COBOL interface. All IDL parameters are of IDL direction InOut; no IDL parameters are set to constant; for COBOL REDEFINE, the first REDEFINE path is mapped to IDL; FILLERS are suppressed according to your selection, see <a href="#">Step 4: Define the Extraction Settings and Start Extraction</a> .
	Copy current IDL Interface	Creates a duplicate of current IDL interface. All modifications such as IDL directions, suppress, selection of REDEFINE paths etc. are kept.
	Rename current IDL Interface	The default name for the IDL interface is based on the COBOL program name plus appended number. With this function you can give the IDL interface a suitable name.
	Remove current IDL Interface	Deletes the current IDL interface.

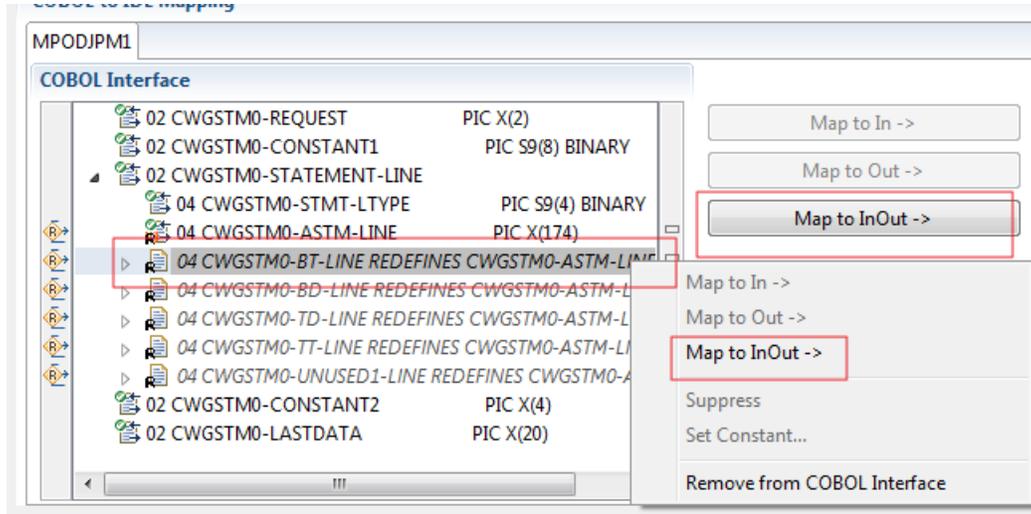
2. With the steps 1 thru 3 described here you can emulate the behavior of function Map to Operation of EntireX version 9.6 and earlier.

**Select REDEFINE Paths**

For COBOL server programs containing COBOL REDEFINES, the correct REDEFINE path needs to be chosen for the IDL interface.

> **To select redefine paths**

- Use the **Map to In, Out** or **InOut** functions available in the context menu of the COBOL interface and as mapping buttons to make the COBOL REDEFINE path available in the IDL interface.



Begin with the COBOL REDEFINE defined at the highest level first. Work through all inner COBOL REDEFINE data items, going from higher levels to lower levels.

#### Notes:

1. Only one REDEFINE path of a COBOL REDEFINE can be mapped to the IDL interface. All COBOL REDEFINE siblings are suppressed.
2. If a REDEFINE path is actively mapped to the IDL interface, all COBOL REDEFINE siblings are suppressed.
3. You can suppress all REDEFINE paths of a COBOL REDEFINE. Simply suppress the active REDEFINE path, see *Suppress Unneeded COBOL Data Items* above.

### Suppress Unneeded COBOL Data Items

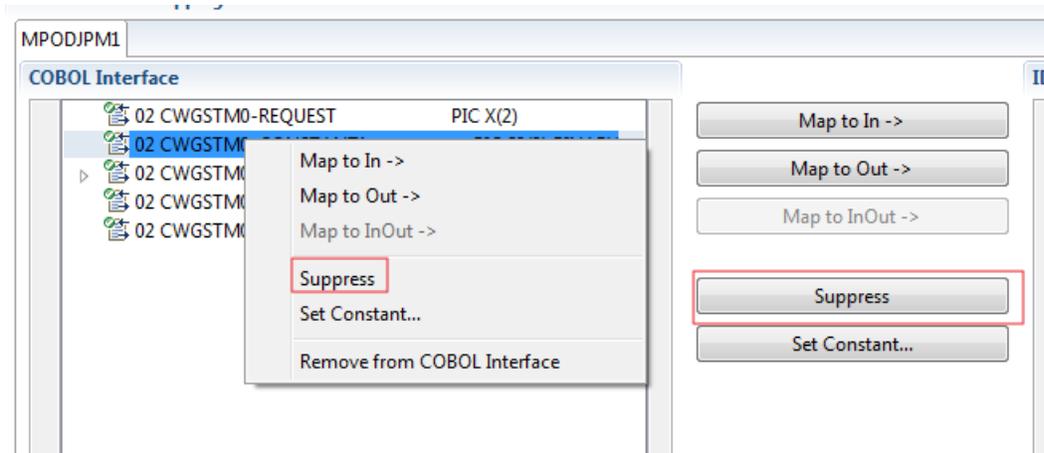
COBOL data items without any relevant information can be made invisible in the IDL interface. The IDL interface is simplified - it becomes shorter and tidier. This is useful, for example

- for FILLER data items
- if the RPC client or Adapter Service does not need an Out parameter
- if the RPC server or Adapter Service does not need an In parameter and a low value can be provided

If you are using an RPC server such as the z/OS (CICS | Batch), z/VSE (CICS | Batch), Micro Focus or BS2000/OSD RPC server, the amount of data to be transferred to/from the RPC client is also reduced.

### ➤ To suppress unneeded COBOL data items

- Use the **Suppress** function available in the context menu of the COBOL interface and as mapping button to make the COBOL data item invisible in the IDL interface:



#### 📄 Notes:

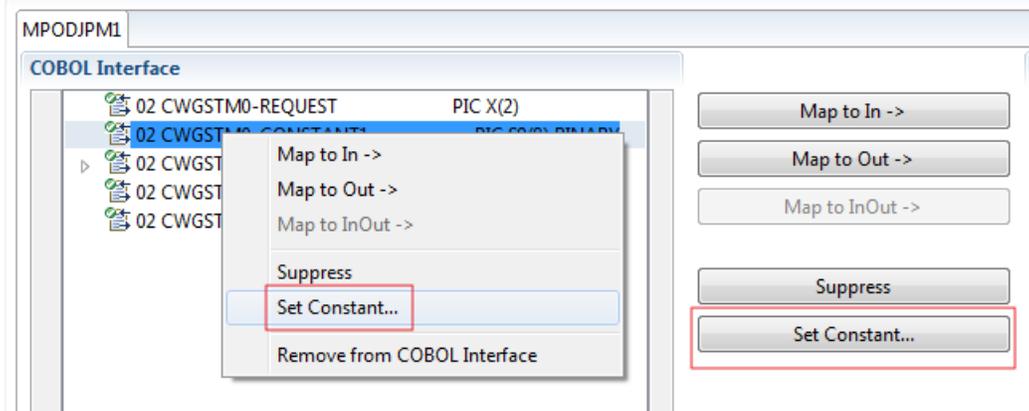
1. The COBOL data item is not part of the IDL interface. It is invisible for RPC clients or Adapter Service.
2. The RPC server or Adapter Service provides the COBOL data item to your COBOL server with low value, managing the offset to the next COBOL data item.
3. If a COBOL group is suppressed, all subordinate COBOL data items are suppressed as well.
4. With the inverse functions **Map to In**, **Out** or **InOut** (see above) available in the context menu of the COBOL interface and as mapping buttons, a COBOL data item is made visible in the IDL interface again.

### Set COBOL Data Items to Constants

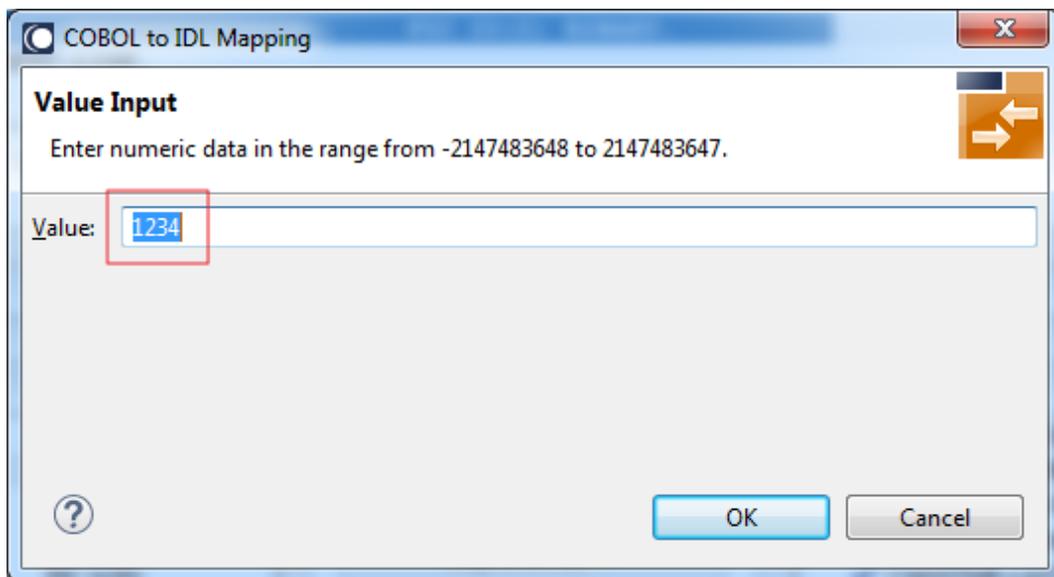
COBOL data items that always require fixed constant values on input to the COBOL server program can be made invisible in the IDL interface and initialized with the required constant values. This is useful for keeping the IDL interface short and tidy. RPC clients or Adapter Services are not bothered with IDL parameters that always contain constants, such as `RECORD-TYPES`. This function is often used in conjunction with **Map to Multiple IDL Interfaces** (see above).

### ➤ To set COBOL data items to constants

- 1 Use the **Set Constant** function available in the context menu of the COBOL interface and as mapping button to define a constant value for a COBOL data item:



- 2 You are prompted with a window to enter the constant value:



 **Notes:**

1. The COBOL data item is not part of the IDL interface. It is invisible for RPC clients or Adapter Services.
2. The RPC server or Adapter Service provides the defined constant in the COBOL data item to your COBOL server.
3. With the functions **Map to In**, **Out**, **InOut** (see above) available in the context menu of the COBOL interface and as mapping buttons, a COBOL data item can be made visible in the IDL interface again.

## Programming Techniques

- [Example 1: COBOL Server with Multiple Functions](#)

### Example 1: COBOL Server with Multiple Functions

Assume a COBOL server program has a FUNCTION or OPERATION code COBOL data item in its COBOL interface. The COBOL server program behaves differently depending on field values of this data item. See the following example where a COBOL programs implements a calculator with the functions ADD, SUBTRACT, MULTIPLY, etc. The execution of the different functions is controlled by the COBOL data item OPERATION:

```

. . .
01 OPERATION                PIC X(1).
01 OPERAND1                 PIC S9(9) BINARY.
01 OPERAND2                 PIC S9(9) BINARY.
01 FUNCTION-RESULT         PIC S9(9) BINARY.
. . .
MOVE 0 TO FUNCTION-RESULT.
EVALUATE OPERATION
  WHEN "+"
    ADD OPERAND1 OPERAND2
    GIVING FUNCTION-RESULT
  WHEN "-"
    SUBTRACT OPERAND2 FROM OPERAND1
    GIVING FUNCTION-RESULT
  WHEN "*"
    MULTIPLY OPERAND1 BY OPERAND2
    GIVING FUNCTION-RESULT
  WHEN . . .

END-EVALUATE.
. . .

```

You can expose each COBOL server program function separately. The advantages or reasons for wanting this depend on the target endpoint. For example:

- **Web Service**

Instead having a Web service with a single operation, you want a web service with multiple operations, one operation for each COBOL function.

- **Java or .NET**

Instead having a class with a single method, you want a class with multiple methods, one method for each COBOL function.

- etc.

To do this you need to extract the COBOL server program as described under *Map to Multiple IDL Interfaces*.

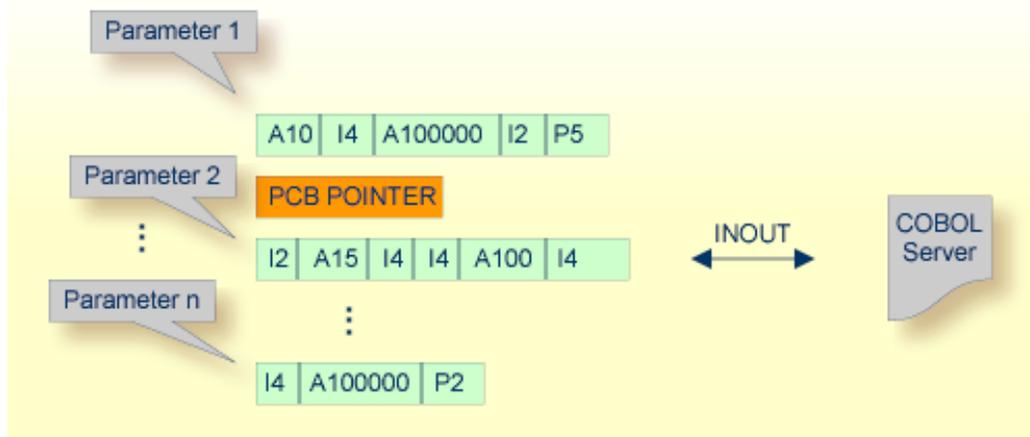


# 12

## IMS BMP with Standard Linkage Calling Convention

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- Introduction ..... 258
- Extracting from an IMS BMP Standard Call Interface ..... 258
- Mapping Editor User Interface ..... 260
- Mapping Editor IDL Interface Mapping Functions ..... 267
- Programming Techniques ..... 276



## Introduction

If your IMS BMP program contains PCB pointers, you have assigned the IMS PSB list in the previous step [Step 4: Define the Extraction Settings and Start Extraction](#). If a required IMS PSB list is not assigned, the PCB pointers are not detected; go back to [Step 4: Define the Extraction Settings and Start Extraction](#) and assign the IMS PSB list first.

If the IMS PSB list is correctly assigned, the COBOL data items (including the PCB pointers) can be evaluated by the extractor because this type of COBOL server contains a `PROCEDURE DIVISION` header (see [PROCEDURE DIVISION Mapping](#)) with all parameters. In most cases the offered COBOL data items will be correct, but you should always check them manually.

If you have selected an IDL file and opened the COBOL Mapping Editor with an existing COBOL to IDL mapping, continue with [Mapping Editor User Interface](#).

## Extracting from an IMS BMP Standard Call Interface

If you are extracting IDL from a COBOL source or extending the IDL file by extracting an additional COBOL source with interface type IMS BMP with standard linkage calling convention, the **Extractor Settings** dialog appears (see also [Step 4: Define the Extraction Settings and Start Extraction](#)).

Make sure the interface type is correct.

The screenshot shows the COBOL Mapping Editor interface. At the top, the 'COBOL Source' section includes a 'File Name' field with 'CALC', an 'Operating System' dropdown with 'z/OS', and an 'Interface Type' dropdown with 'IMS BMP with standard linkage calling convention'. Below this is a checked checkbox for 'Input Message same as Output Message'. The main area is divided into two panels. The left panel, titled 'IMS MPP message interface (IMS Connect)', has a 'Transaction field length in COBOL source' spinner set to '10', a 'Transaction Name' field with an asterisk, and a radio button for 'Create IDL parameter for Transaction Name - specification at runtime'. The right panel, titled 'IMS BMP with standard linkage calling convention', has an 'IMS PSB List' field with 'C:\Demo\IMSBMP\MYPSBLST' and a 'Browse...' button. Below it is a section for 'CICS with Channel Container calling convention' with a 'Channel Name' field containing 'EntireXChannel'.

You can set optionally the IMS PSB List. If your COBOL server contains PCB pointers, choose **Browse**. Otherwise, the PCB pointers are not detected and cannot be provided by the IMS RPC Server to your COBOL server at runtime, and unexpected behavior may occur. For the contents of the IMS PSB list, see *IMS PCB Pointer IDL Rules*.

➤ **To select the COBOL interface data items of your COBOL server**

- 1 Add the COBOL data items to the **COBOL Interface** using the context menu or toolbar available in the *COBOL Source View* and *COBOL Interface*. See [Notes](#).
- 2 Continue with *COBOL to IDL Mapping*.

 **Notes:**

1. If there is a `PROCEDURE DIVISION` header available, the parameters listed define exactly the COBOL interface. These COBOL data items are within the `LINKAGE SECTION` and are already selected to the COBOL interface in initial state when you enter the COBOL Mapping Editor. The `PROCEDURE DIVISION` header might not be available if you are extracting from a copybook or part of the COBOL source.
2. It is very important to select the right COBOL data items describing the interface of the COBOL server correctly. This means the COBOL data items used as parameters must match in number and in sequence of formats (COBOL usage clause).
3. If your COBOL server contain `REDEFINES`, the first `REDEFINE` path is offered by default. Check manually whether this is the one you want. If not, correct it. You can select any other `REDEFINE` path.
4. Make sure the PCB pointers are also selected at the correct position.

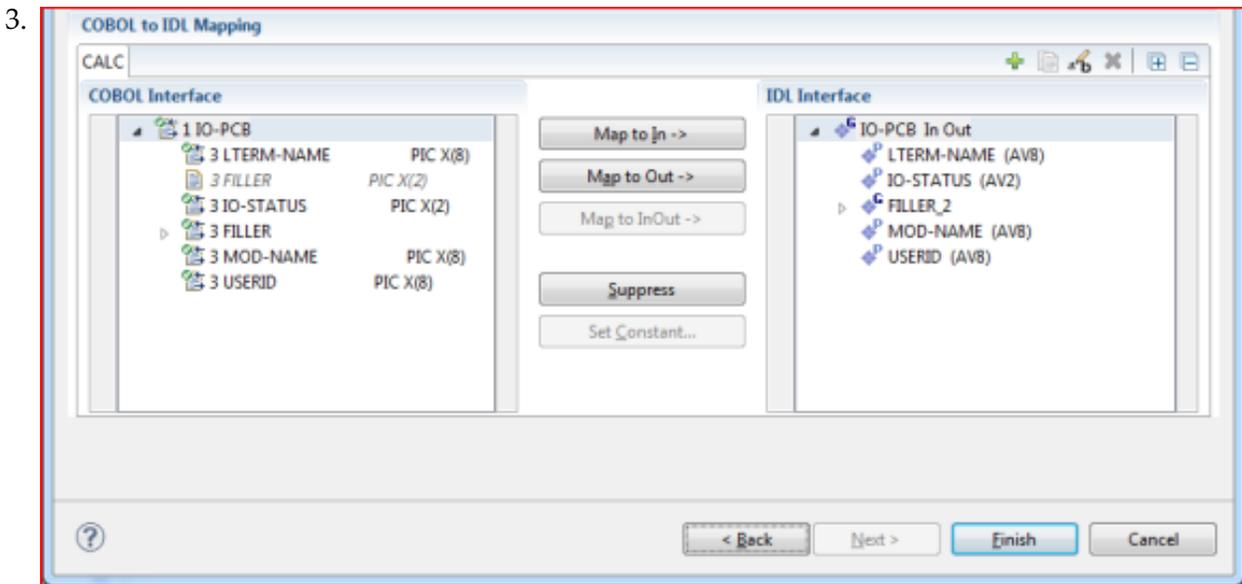
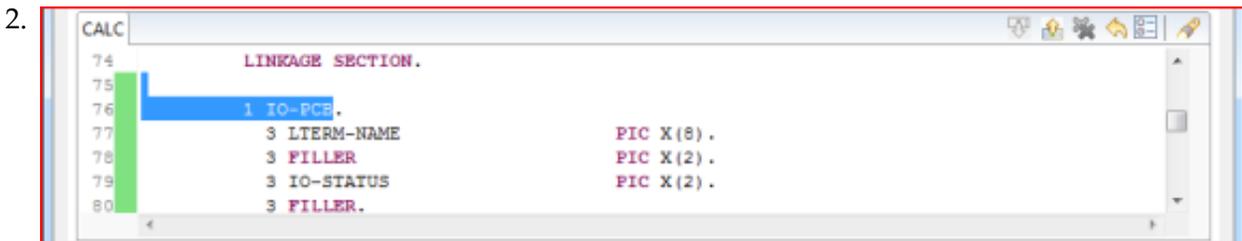
The user interface of the COBOL Mapping Editor is described below.

## Mapping Editor User Interface

This section assumes you have set the extraction settings as described above. The following areas of the COBOL Mapping Editor user interface are described here:

- [COBOL Program Selection](#)
- [COBOL Source View](#)
- [COBOL to IDL Mapping](#)

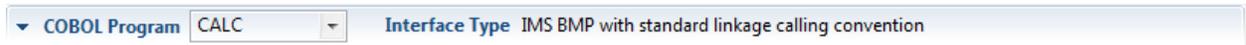
For COBOL server programs with standard call interface types, the user interface of the COBOL Mapping Editor looks like this:



1. **COBOL Program Selection.** Currently selected program with interface type
2. **COBOL Source View.** Contains all related sources for the currently selected COBOL program

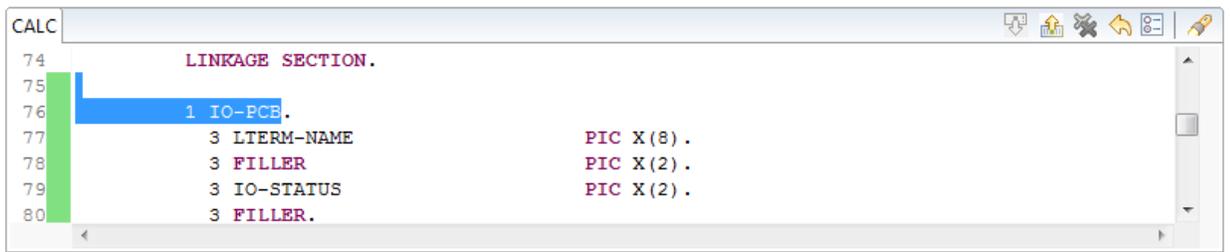
3. **COBOL to IDL Mapping.** Tree view of your selected COBOL data items and mapping buttons with which you can map these items to your IDL interface

### COBOL Program Selection



The COBOL Program Selection displays the current selected COBOL program with its interface type. If you have extracted more than one COBOL program within the associated IDL file, you can switch to another COBOL program with its mapping by selecting the name in the combo box.

## COBOL Source View



All COBOL data items contained in the LINKAGE and WORKING-STORAGE SECTION are offered in a text view. The text view contains all related sources (including copybooks) for the currently selected COBOL program. It is used for selecting data items and retrieving information from the original COBOL sources. The light green bar indicates that the data item is already contained in the COBOL Interface; a dark green bar indicates the data item is selectable and can be added to the COBOL Interface. This section can be collapsed. If you open the Editor with **Modify Interface** it is collapsed by default. The toolbar provides the following actions:

-  Add selected COBOL data item to COBOL Interface.
-  Remove selected COBOL data item from COBOL Interface.
-  Remove all COBOL data items from COBOL Interface.
-  Reset COBOL Interface to initial state.
-  Show dialog to modify COBOL Source Characteristics.
-  Show dialog to find text in Source.

The same functionality is also available from the context menu.

## COBOL to IDL Mapping

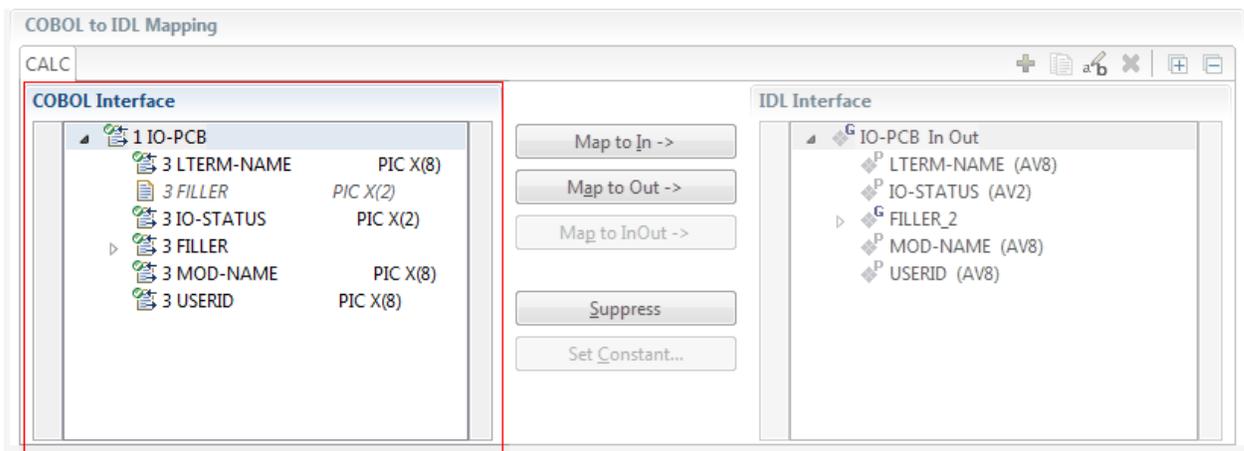
This section covers the following topics:

- [COBOL Interface](#)
- [Mapping Buttons](#)
- [IDL Interface](#)

### COBOL Interface

The **COBOL Interface** shows a tree view of your selected COBOL data items describing the interface of the COBOL server. A context menu is available for the COBOL data items, which provides mapping and other functions. On some COBOL data items, decision icons indicate where particular attention is needed, including mapping icons to visualize the COBOL data type and your current mapping.

The COBOL data item names are derived from the COBOL source from which they were extracted. If your COBOL interface contains parameters without a name, that is, the keyword `FILLER` is used, those COBOL data items are shown as `[FILLER]`. See [FILLER Pseudo-Parameter](#).



You can modify the COBOL interface using context menu or toolbar; decision and mapping icons provide additional information.

### Context Menu

The context menu on COBOL data items provides the following mapping and other functions, depending on the data item type, the COBOL level and the current mapping.

<b>Map to In   Out   InOut</b>	A suppressed COBOL data item becomes visible in the IDL interface. Used also to select another <code>REDEFINE</code> path.
<b>Suppress</b>	Suppress unneeded COBOL data items.
<b>Set Constant</b>	Set COBOL data items to constant.

**Remove from COBOL Interface** - Remove the data item from the COBOL interface. This also removes the mapped IDL parameter from all IDL interfaces for the current COBOL program. See [COBOL Program Selection](#).

See also [Mapping Editor IDL Interface Mapping Functions](#).

### Toolbar

The toolbar offers the following actions:

-  Create IDL Interface. Creates a new IDL interface based on the current COBOL interface: all IDL parameters are of IDL direction InOut; no IDL parameters are set to constant; for COBOL REDEFINE, the first REDEFINE path is mapped to IDL; FILLERS are suppressed according to your selection, see [Step 4: Define the Extraction Settings and Start Extraction](#).
-  Copy current IDL Interface. Creates a duplicate of the current IDL interface: all modifications such as IDL directions, suppress, selection of REDEFINE paths etc. are kept.
-  Remove current IDL Interface.
-  Rename current IDL Interface.
-  Expand the full tree.
-  Collapse the full tree.

See also [Map to Multiple IDL Interfaces](#).

### Decision Icons

The decision icons in the first column are set on COBOL data items where particular attention is needed:

-  This icon visualizes a COBOL REDEFINE. It is essential that you map the correct redefine path for your mapping to In, Out or InOut using the context menu. If you map a REDEFINE path, all other sibling REDEFINE paths are automatically set to "Suppress".

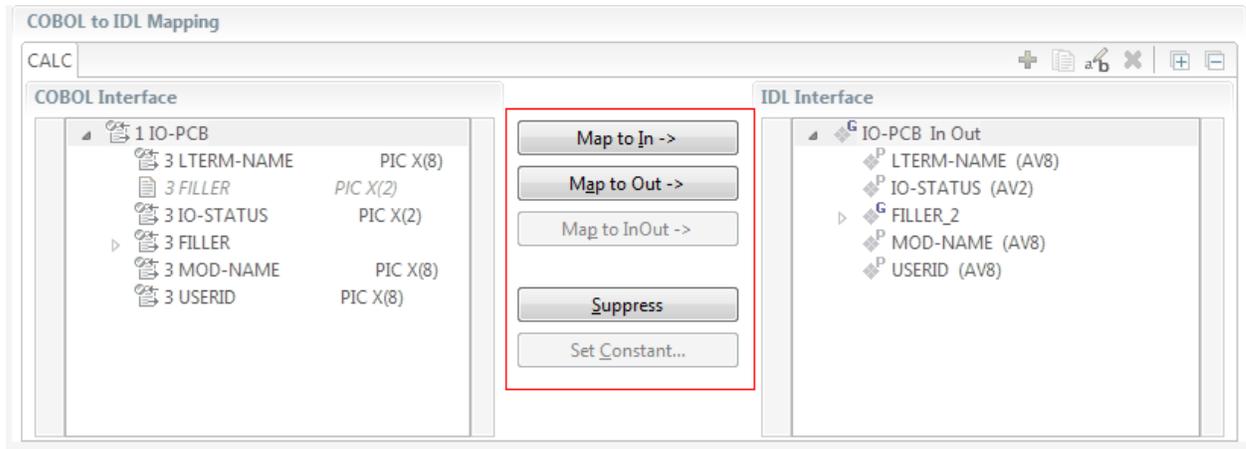
### Mapping Icons

The following mapping icons on the COBOL data items indicate your current IDL mapping:

-  Scalar parameter, mapped to In.
-  Scalar parameter, mapped to InOut.
-  Scalar parameter, mapped to Out.
-  Group parameter, here mapped to InOut.
-  REDEFINE parameter, here mapped to InOut.
-  Parameter set to Constant.

## Mapping Buttons

The following buttons are available:



### Map to In | Out | InOut ->

See *Map to In, Out, InOut*. A suppressed COBOL data item becomes visible in the IDL interface. Used also to select another REDEFINE path.

### Suppress

See *Suppress Unneeded COBOL Data Items*.

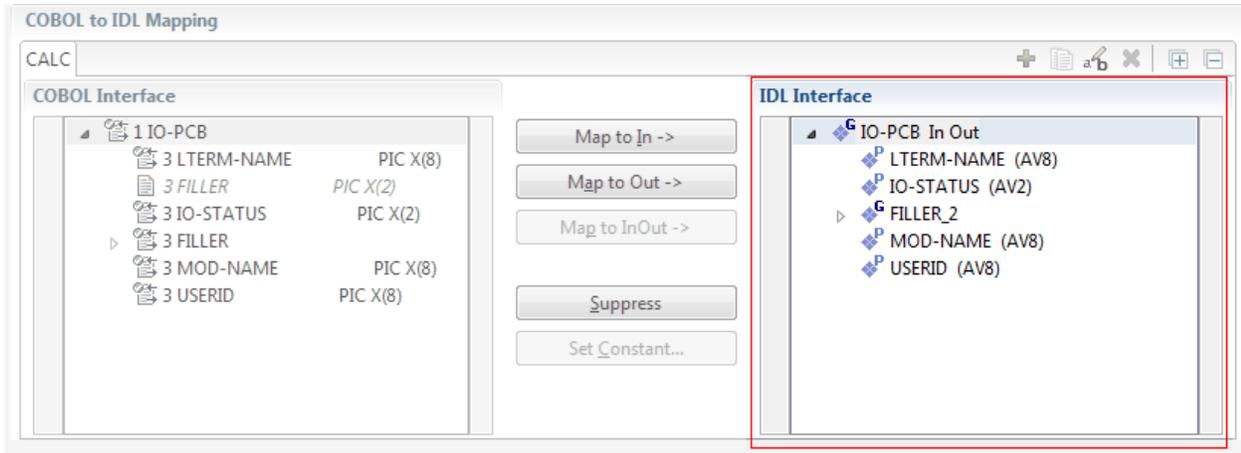
### Set Constant...

See *Set COBOL Data Items to Constants*.

## IDL Interface

If you have mapped the COBOL interface to multiple IDL interfaces, select the IDL interface by choosing the tabs. In the **IDL Interface** tree view, a context menu is also available with the following possibilities:

- Rename
- Remove from COBOL Interface. This also removes the mapped IDL parameter from all IDL interfaces for the current COBOL program. See *COBOL Program Selection* above.



## Mapping Editor IDL Interface Mapping Functions

This section covers the following topics:

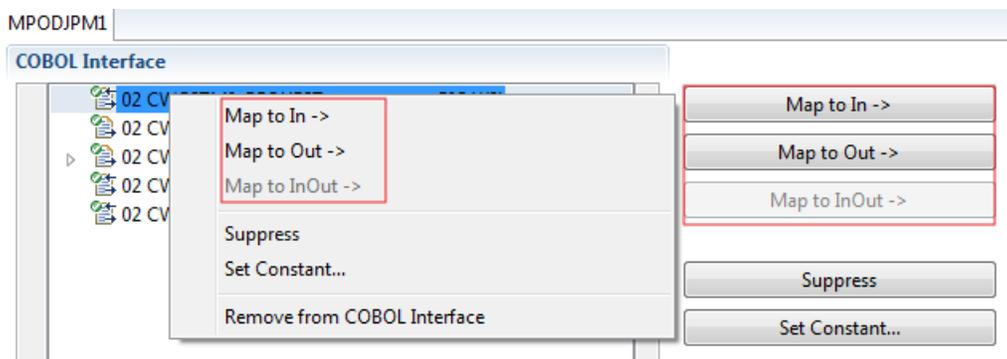
- Map to In, Out, InOut
- Map OCCURS DEPENDING ON
- Map to Multiple IDL Interfaces
- Select REDEFINE Paths
- Suppress Unneeded COBOL Data Items
- Set COBOL Data Items to Constants

### Map to In, Out, InOut

With the **Map to In**, **Map to Out**, **InOut** functions you make a COBOL data item visible as an IDL parameter in the IDL interface. With correct IDL directions you design the IDL interface by defining input and output parameters. COBOL programs have no parameter directions, so you need to set IDL directions manually.

#### > To provide IDL directions

- Go *step-by-step* through all *top-level* COBOL data items in the COBOL interface and use the **Map to In**, **Map to Out** and **InOut** functions available in the context menu of the COBOL interface and as mapping buttons to make the COBOL data items visible and provide IDL directions in the IDL interface:



#### Notes:

1. If a *top-level* COBOL *group* is mapped, the IDL direction is inherited by all subordinate COBOL data items and thus to the related IDL parameters in the IDL interface.
2. Subordinate COBOL data items can only be mapped to the same IDL direction as their *top-level* COBOL *group* data item.

3. With the inverse function **Suppress Unneeded COBOL Data Items** (see below) available in the context menu of the COBOL interface and as mapping button, a COBOL data item can be removed from the IDL interface.
4. IDL directions are described in the direction-attribute in `attribute-list` under *Software AG IDL Grammar* in the IDL Editor documentation.

If you are using an RPC server such as the z/OS (CICS | Batch), z/VSE (CICS | Batch), Micro Focus or BS2000/OSD RPC server, the amount of data to be transferred to/from the RPC client is reduced with correct IDL directions.

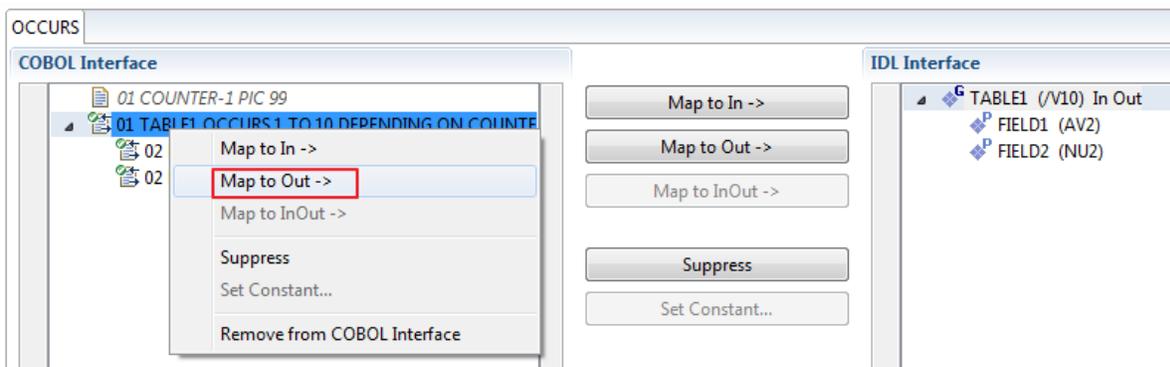
### Map OCCURS DEPENDING ON

With the **Map to In**, **Out**, **InOut** functions you can make the COBOL ODO subject (here COBOL data item TABLE) of a variable-sized COBOL table (see [COBOL Tables with Variable Size - DEPENDING ON Clause](#)) visible as an IDL unbounded group (with maximum). The ODO object (here COBOL data item COUNTER-1) is suppressed and therefore not part of the IDL interface. This is because the number of elements of the IDL unbounded group is already implicitly available. See the following example:

```
01 COUNTER-1 PIC 99.
01 TABLE OCCURS 1 TO 10 DEPENDING ON COUNTER-1
  02 FIELD1 PIC XX.
  02 FIELD2 PIC 99.
```

#### ➤ To map OCCURS DEPENDING ON

- 1 Add the COBOL ODO subject (here data item TABLE) and ODO object (here data item COUNTER-1) to the COBOL interface. It is important both data items are in the COBOL interface.
- 2 Use the **Map to In**, **Out** and **InOut** functions available in the context menu of the COBOL interface and as mapping buttons and apply IDL directions for the ODO subject (data item TABLE):

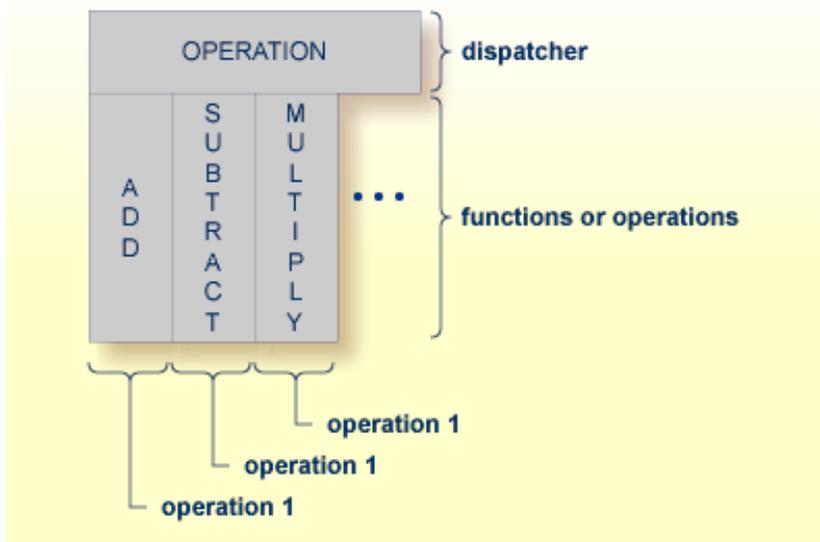


 **Notes:**

1. The ODO subject can be mapped to the IDL interface.
2. The ODO object is always suppressed, but is required to be part of the COBOL interface.
3. IDL directions are described in the direction-attribute in `attribute-list` under *Software AG IDL Grammar* in the IDL Editor documentation.

### Map to Multiple IDL Interfaces

Assume the COBOL server program provides multiple functions or operations, in the following example `ADD`, `SUBTRACT`, `MULTIPLY`. Some dispatcher front-end code executes the correct function, for example, depending on a *function-code* or *operation-code* parameter:



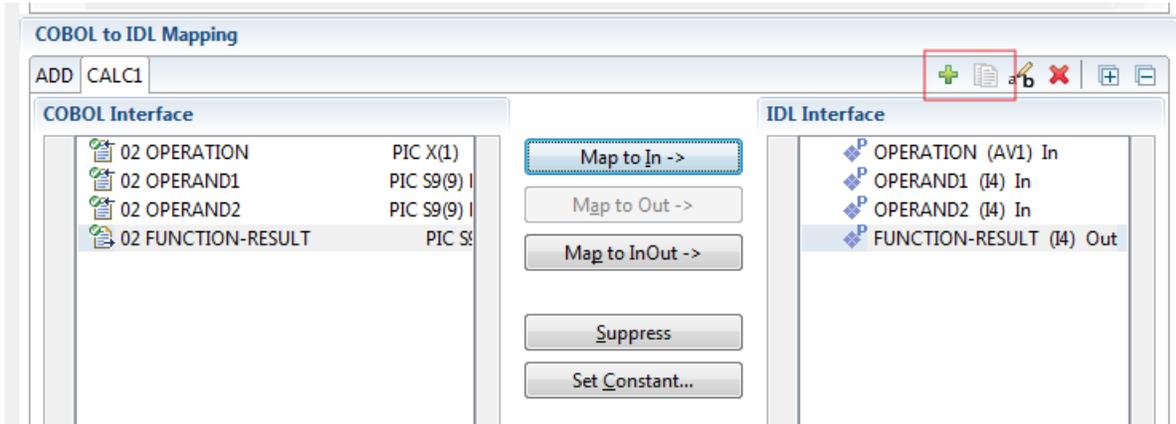
This example is described in more detail under [Example 1: COBOL Server with Multiple Functions](#).

If you have such a situation, a good approach is to expose each COBOL server program function separately as an IDL program. This gives advantages in further processing of the IDL and COBOL mapping files (SVM and CVM). For example:

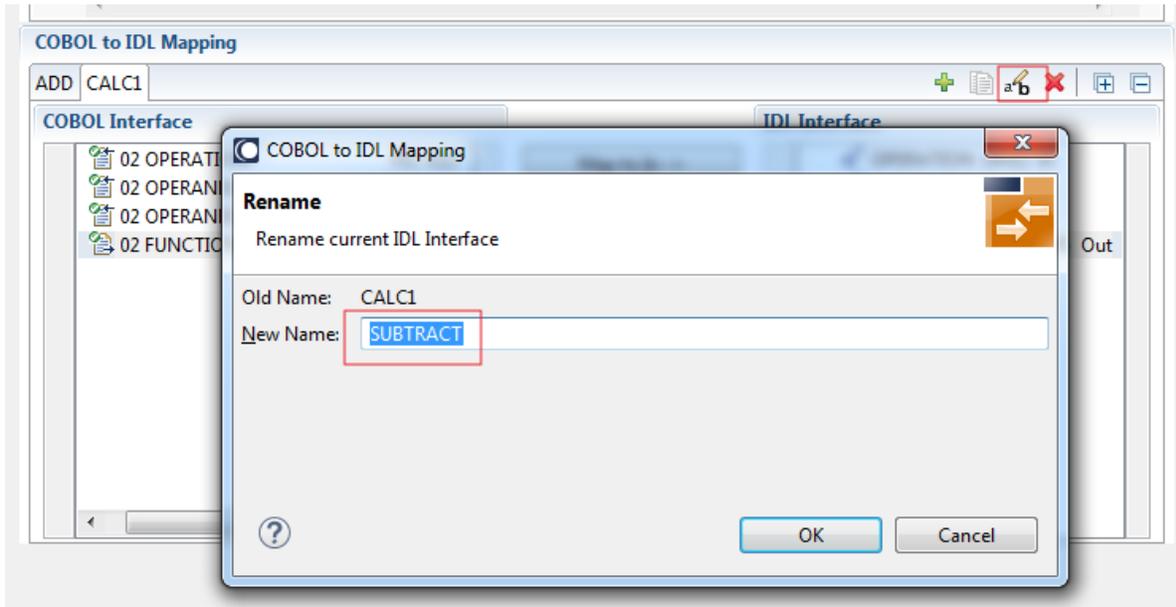
- If your target endpoint is a web service: instead having a Web service with a single operation, you get a web service with multiple operation, one operation for each COBOL function.
- If your target endpoint is Java or .NET: instead having a class with a single method, you get a class with multiple methods, one method for each COBOL function.

> To map a COBOL interface to multiple IDL interfaces

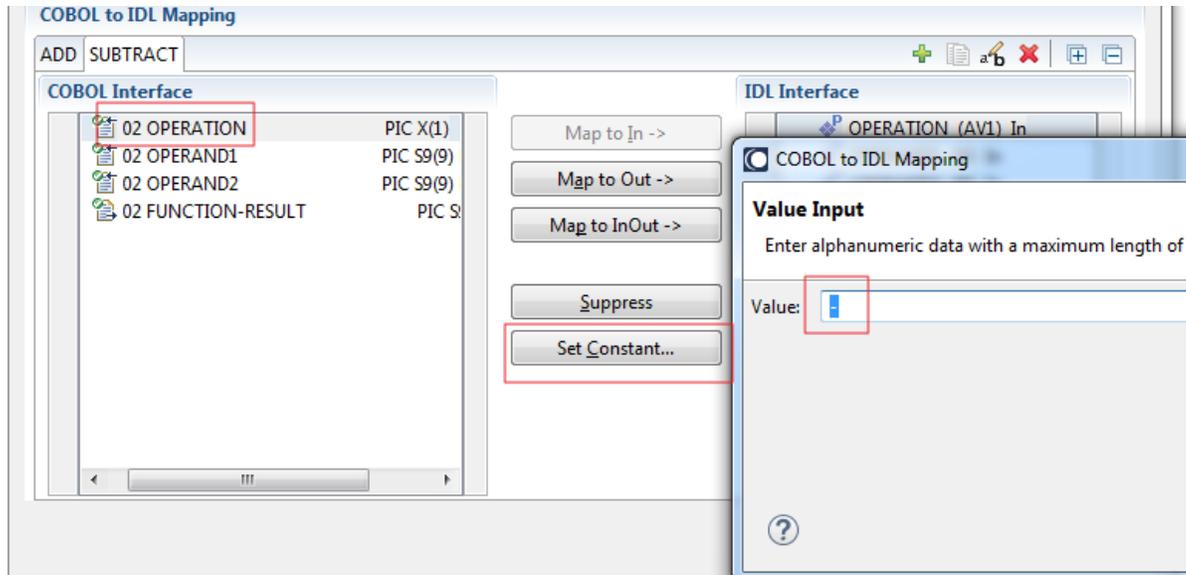
- 1 Select the tab with COBOL to IDL Mapping. For each function, define a separate IDL interface with the toolbar functions  or :



- 2 Give the IDL interfaces meaningful names with the toolbar function :



- 3 Define the required constant values to the *function-code* or *operation-code* parameter, see *Set COBOL Data Items to Constants* above:



For the delivered Example 1: COBOL Server with Multiple Functions:

- First, for step 1 above: Extract and define 3 separate IDL programs ADD, SUBTRACT, MULTIPLY.
- Second, for step 2 above: Rename them to suitable names, e.g. 'ADD', 'SUBTRACT', 'MULTIPLY'.
- Third, for step 3 above: Define the constants '+', '-' and '\*' to the parameter OPERATION respectively.
- After pressing **Finish**, the following IDL together with a server mapping file is created. See *Server Mapping Files for COBOL*.

```

Library 'EXAMPLE' is

program 'ADD' is
  define data parameter
    1 OPERAND1 (I4) In
    1 OPERAND2 (I4) In
    1 FUNCTION-RESULT (I4) Out
  end-define

program 'SUBTRACT' is
  define data parameter
    1 OPERAND1 (I4) In
    1 OPERAND2 (I4) In
    1 FUNCTION-RESULT (I4) Out
  end-define

program 'MULTIPLY' is
  define data parameter
    1 OPERAND1 (I4) In
    1 OPERAND2 (I4) In
    1 FUNCTION-RESULT (I4) Out
  end-define

```

**Notes:**

1. The following functions are offered to create further mappings from the COBOL interface, resulting in multiple IDL interfaces (IDL programs).

Icon	Function	Description
	Create IDL Interface	Creates a new IDL interface based on the current COBOL interface. All IDL parameters are of IDL direction InOut; no IDL parameters are set to constant; for COBOL REDEFINE, the first REDEFINE path is mapped to IDL; FILLERS are suppressed according to your selection, see <a href="#">Step 4: Define the Extraction Settings and Start Extraction</a> .
	Copy current IDL Interface	Creates a duplicate of current IDL interface. All modifications such as IDL directions, suppress, selection of REDEFINE paths etc. are kept.
	Rename current IDL Interface	The default name for the IDL interface is based on the COBOL program name plus appended number. With this function you can give the IDL interface a suitable name.
	Remove current IDL Interface	Deletes the current IDL interface.

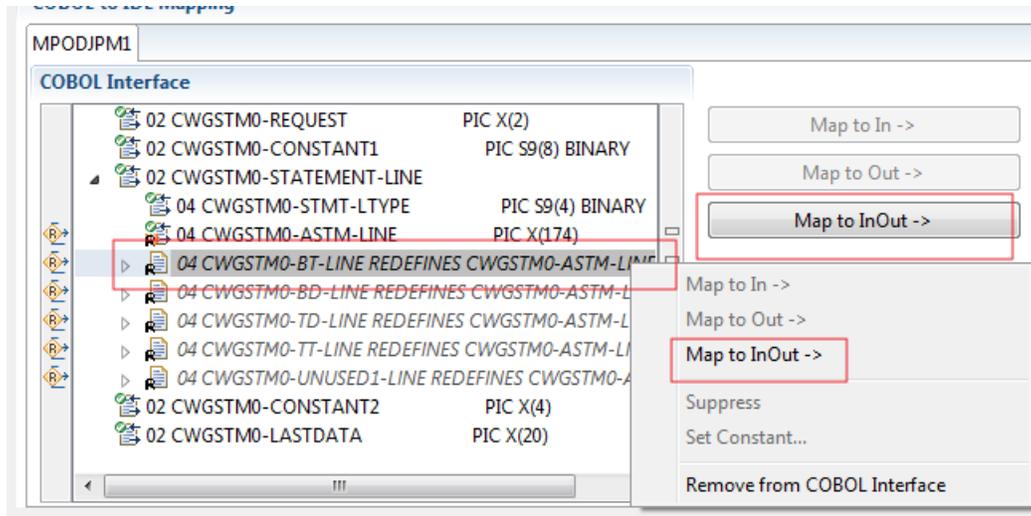
2. With the steps 1 thru 3 described here you can emulate the behavior of function Map to Operation of EntireX version 9.6 and earlier.

**Select REDEFINE Paths**

For COBOL server programs containing COBOL REDEFINES, the correct REDEFINE path needs to be chosen for the IDL interface.

**> To select redefine paths**

- Use the **Map to In, Out** or **InOut** functions available in the context menu of the COBOL interface and as mapping buttons to make the COBOL REDEFINE path available in the IDL interface.



Begin with the COBOL REDEFINE defined at the highest level first. Work through all inner COBOL REDEFINE data items, going from higher levels to lower levels.

#### Notes:

1. Only one REDEFINE path of a COBOL REDEFINE can be mapped to the IDL interface. All COBOL REDEFINE siblings are suppressed.
2. If a REDEFINE path is actively mapped to the IDL interface, all COBOL REDEFINE siblings are suppressed.
3. You can suppress all REDEFINE paths of a COBOL REDEFINE. Simply suppress the active REDEFINE path, see *Suppress Unneeded COBOL Data Items* above.

### Suppress Unneeded COBOL Data Items

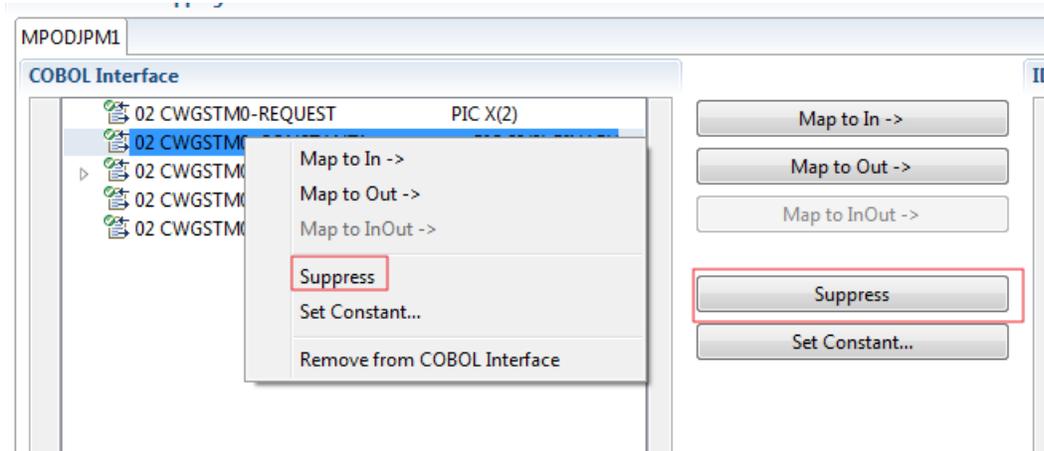
COBOL data items without any relevant information can be made invisible in the IDL interface. The IDL interface is simplified - it becomes shorter and tidier. This is useful, for example

- for FILLER data items
- if the RPC client or Adapter Service does not need an Out parameter
- if the RPC server or Adapter Service does not need an In parameter and a low value can be provided

If you are using an RPC server such as the z/OS (CICS | Batch), z/VSE (CICS | Batch), Micro Focus or BS2000/OSD RPC server, the amount of data to be transferred to/from the RPC client is also reduced.

### ➤ To suppress unneeded COBOL data items

- Use the **Suppress** function available in the context menu of the COBOL interface and as mapping button to make the COBOL data item invisible in the IDL interface:



#### Notes:

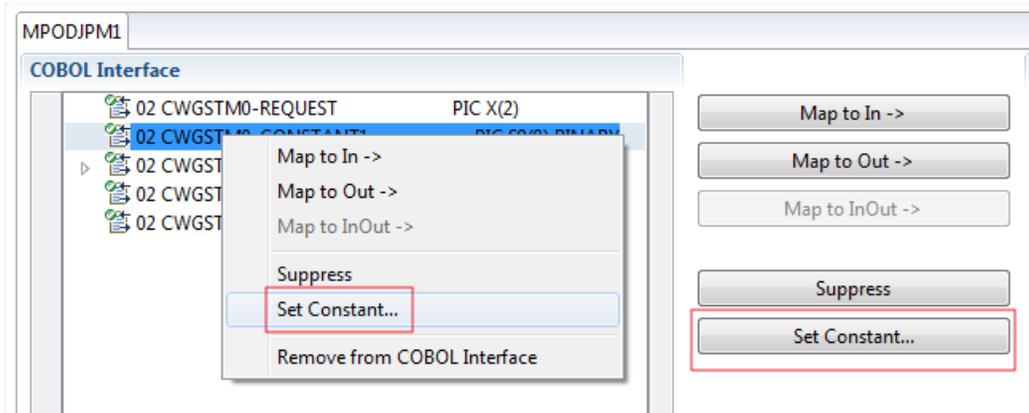
1. The COBOL data item is not part of the IDL interface. It is invisible for RPC clients or Adapter Service.
2. The RPC server or Adapter Service provides the COBOL data item to your COBOL server with low value, managing the offset to the next COBOL data item.
3. If a COBOL group is suppressed, all subordinate COBOL data items are suppressed as well.
4. With the inverse functions **Map to In**, **Out** or **InOut** (see above) available in the context menu of the COBOL interface and as mapping buttons, a COBOL data item is made visible in the IDL interface again.

### Set COBOL Data Items to Constants

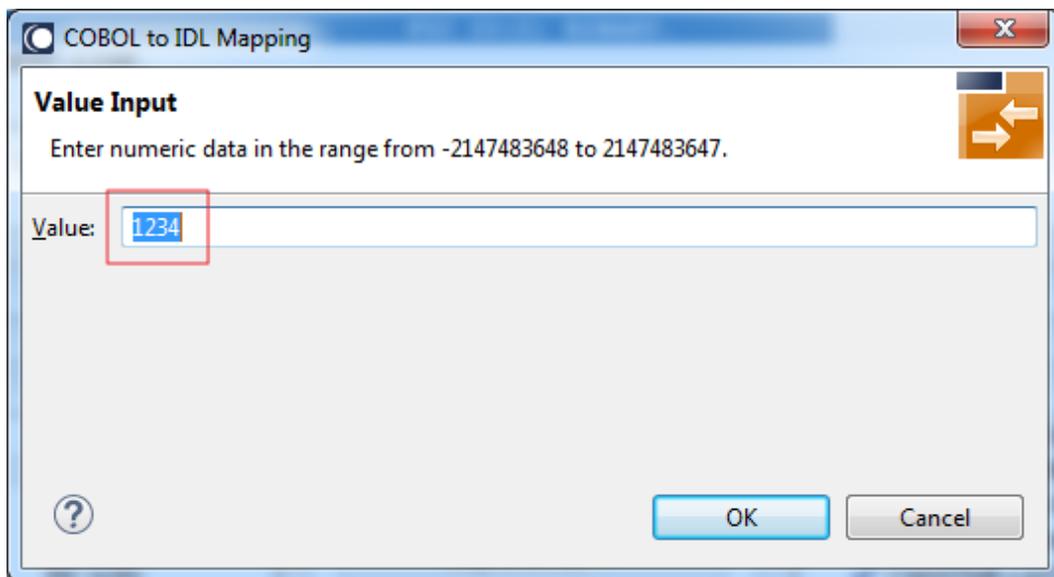
COBOL data items that always require fixed constant values on input to the COBOL server program can be made invisible in the IDL interface and initialized with the required constant values. This is useful for keeping the IDL interface short and tidy. RPC clients or Adapter Services are not bothered with IDL parameters that always contain constants, such as `RECORD-TYPES`. This function is often used in conjunction with **Map to Multiple IDL Interfaces** (see above).

### ➤ To set COBOL data items to constants

- 1 Use the **Set Constant** function available in the context menu of the COBOL interface and as mapping button to define a constant value for a COBOL data item:



- 2 You are prompted with a window to enter the constant value:



 **Notes:**

1. The COBOL data item is not part of the IDL interface. It is invisible for RPC clients or Adapter Services.
2. The RPC server or Adapter Service provides the defined constant in the COBOL data item to your COBOL server.
3. With the functions **Map to In**, **Out**, **InOut** (see above) available in the context menu of the COBOL interface and as mapping buttons, a COBOL data item can be made visible in the IDL interface again.

## Programming Techniques

- [Example 1: COBOL Server with Multiple Functions](#)

### Example 1: COBOL Server with Multiple Functions

Assume a COBOL server program has a FUNCTION or OPERATION code COBOL data item in its COBOL interface. The COBOL server program behaves differently depending on field values of this data item. See the following example where a COBOL programs implements a calculator with the functions ADD, SUBTRACT, MULTIPLY, etc. The execution of the different functions is controlled by the COBOL data item OPERATION:

```

. . .
01 OPERATION                PIC X(1).
01 OPERAND1                 PIC S9(9) BINARY.
01 OPERAND2                 PIC S9(9) BINARY.
01 FUNCTION-RESULT         PIC S9(9) BINARY.
. . .
MOVE 0 TO FUNCTION-RESULT.
EVALUATE OPERATION
  WHEN "+"
    ADD OPERAND1 OPERAND2
    GIVING FUNCTION-RESULT
  WHEN "-"
    SUBTRACT OPERAND2 FROM OPERAND1
    GIVING FUNCTION-RESULT
  WHEN "*"
    MULTIPLY OPERAND1 BY OPERAND2
    GIVING FUNCTION-RESULT
  WHEN . . .

END-EVALUATE.
. . .

```

You can expose each COBOL server program function separately. The advantages or reasons for wanting this depend on the target endpoint. For example:

- **Web Service**

Instead having a Web service with a single operation, you want a web service with multiple operations, one operation for each COBOL function.

- **Java or .NET**

Instead having a class with a single method, you want a class with multiple methods, one method for each COBOL function.

- etc.

To do this you need to extract the COBOL server program as described under *Map to Multiple IDL Interfaces*.

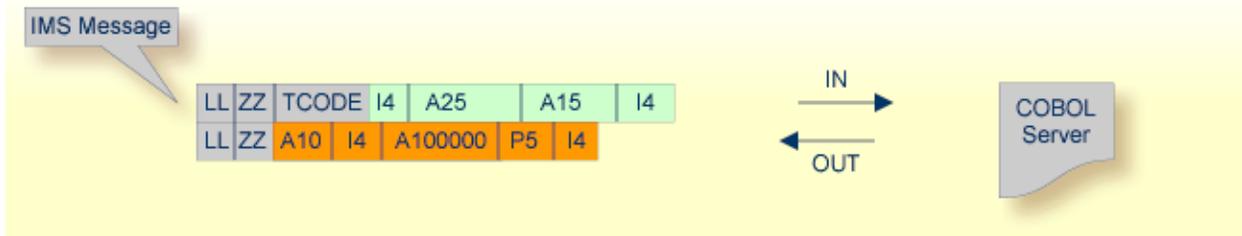


# 13

## IMS MPP Message Interface (IMS Connect)

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- Introduction ..... 280
- Extracting from an IMS MPP Message Interface Program ..... 281
- Mapping Editor User Interface ..... 284
- Mapping Editor IDL Interface Mapping Functions ..... 292
- Programming Techniques ..... 310



## Introduction

Depending on the programming style used in the IMS processing program (MPP) and the various techniques for accessing the IMS input and output messages, finding the relevant COBOL data structures can be a complex and time-consuming task that may require IMS programming knowledge.

IMS Message Processing Programs (MPPs) work as follows:

- IMS message processing programs (MPP) are invoked using an IMS transaction code. Transaction codes are linked to programs by the IMS system definition.
- An IMS message processing program (MPP) gets its parameters through an IMS message and returns the result by sending an output message to IMS. The structure of both messages is defined in the COBOL source program during the application design phase. Sender and receiver of the message must use the same data structure to interpret the message content.
- The server program accesses input and output messages using the IMS system call `CALL 'CBLTDLI' USING <function> IOPCB <message>`. The parameters are as follows:

Parameter	Description
GU	Flag indicating that an input message is to be read. In this case <i>&lt;message&gt;</i> describes the input message.
ISRT	Flag indicating that an output message is to be written. In this case <i>&lt;message&gt;</i> describes the output message.
IOPCB	The IO PCB pointer. An IMS-specific section defined in the linkage section of the program to access the IMS input and output message queue.
<i>&lt;message&gt;</i>	The layout of the message. For GU it is the structure of the input message, for ISRT it is the structure of the output message. The first two fields in every message (input as well as output), LL and ZZ, are technical fields, each two bytes long. LL contains the length of the message. The third field in an input message contains the transaction code and has a variable length (commonly 8 or 9 bytes). IMS can link one program to various different transaction codes. For each transaction, the program can apply a separate logic, or even accept a separate message layout.



**Notes:**

1. Instead of the IOPCB pointer, CALL 'CBLTDLI' statements are also used with database PCB pointers to access IMS databases.
2. IOPCB, GU and ISRT are defined in the COBOL source (often in a copybook) using COBOL data items. Names can differ in your program. The value of the COBOL VALUE clauses with 'GU' and 'ISRT' is fixed. In the example below, the IMS system call would be CALL 'CBLTDLI' USING FCT-GU IO-PCB <message> to read the input message:

```

WORKING-STORAGE SECTION.
. . .
* DLI Function Codes
77 FCT-GU                PIC X(4) VALUE 'GU  '.
77 FCT-ISRT             PIC X(4) VALUE 'ISRT'.
. . .
LINKAGE SECTION.
. . .
1 IO-PCB.
  3 LTERM-NAME          PIC X(8).
  3 FILLER              PIC X(2).
  3 IO-STATUS          PIC X(2).
. . .

```

If you have selected an IDL file and opened the COBOL Mapping Editor with an existing COBOL to IDL mapping, continue with [Mapping Editor User Interface](#).

## Extracting from an IMS MPP Message Interface Program

If you are extracting IDL from a COBOL source or extending the IDL file by extracting an additional COBOL source with interface type IMS MPP message interface (IMS Connect), the **Extractor Settings** dialog appears (see also [Step 4: Define the Extraction Settings and Start Extraction](#)).

Make sure the interface type is correct and specify how you want the transaction name to be determined.

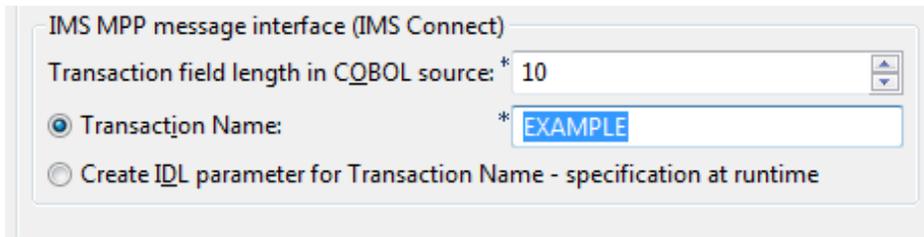
The screenshot shows a dialog box titled "COBOL Source" with the following fields and options:

- File Name:
- Operating System:
- Interface Type:  (dropdown menu)
- Input Message same as Output Message

There are two ways of defining **Transaction Name**:

■ **Fixed Value**

Check **Transaction Name** and specify a fixed value for the transaction name in extractor settings. Your IDL interface is free of this technical parameter, and RPC clients do not have to specify it at runtime.



Specify the length of the transaction field, which is usually the third physical field starting from offset 5 (bytes) declared in the input message layout within the server program. Example:

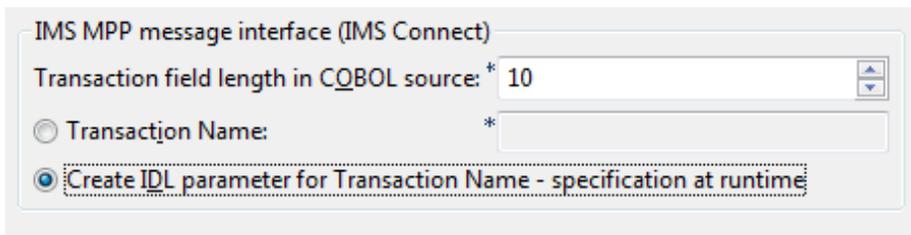
```

1 INPUT-MESSAGE.
2 INPUT-IMS-META.
3 INPUT-LL          PIC S9(3) BINARY.
3 INPUT-ZZ          PIC S9(3) BINARY.
3 INPUT-TRANSACTION PIC X(10).
2 INPUT-DATA.
3 OPERATION         PIC X(1).
3 OPERAND1          PIC S9(9) BINARY.
3 OPERAND2          PIC S9(9) BINARY.
    
```

In this example, the length to specify is "10".

■ **Dynamically at Runtime**

Check **Create IDL parameter for Transaction Name...** Your *IDL Interface* will contain an IDL parameter for the transaction name. RPC clients are responsible for setting the correct transaction name dynamically at runtime.



➤ **To select the COBOL interface data items of your COBOL server**

- 1 Define the IMS MPP (IMS Connect) input message. With toolbar icon **Find text in Source** , enter "CBLTDLI" to look for an IMS system call containing 'CBLTDLI', function GU and the IOPCB pointer, example:

```
CALL 'CBLTDLI' USING GU IOPCB input_message
```

Add the relevant COBOL data items of *input\_message* to **Input Message** by using the context menu or toolbar available in the [COBOL Source View](#) and [COBOL Interface](#). The relevant COBOL data items are contained in fields after the technical fields LL (length of message), ZZ and the COBOL data item containing the transaction code which is mostly the third physical field starting from offset 5 (bytes) in the *input\_message*. Do not select the fields LL, ZZ and the transaction code. See [Notes](#).

- Similar to step 1, define the IMS MPP (IMS Connect) output message. Enter "CBLTDLI" in toolbar icon **Find text in Source**  to look for an IMS system call containing "CBLTDLI", function ISRT and the IOPCB pointer, example:

```
CALL 'CBLTDLI' USING ISRT IOPCB <output-message>
```

Select the corresponding *output\_message* in **COBOL Interface**. See [Notes](#).

Select the relevant COBOL data items of *output\_message* to **Output Message** by using the context menu or toolbar. The relevant COBOL data items are the fields after the technical fields LL (length of message) and ZZ. Also, do not select LL and ZZ here.

- Continue with [COBOL to IDL Mapping](#).



#### Notes:

- It is very important to select the right COBOL data items describing the interface of the COBOL server correctly. This means the COBOL data items used as parameters must match in number and in sequence of formats (COBOL usage clause).
- If your COBOL server contain REDEFINES, the first REDEFINE path is offered by default. Check manually whether this is the one you want. If not, correct it. You can select any other REDEFINE path.

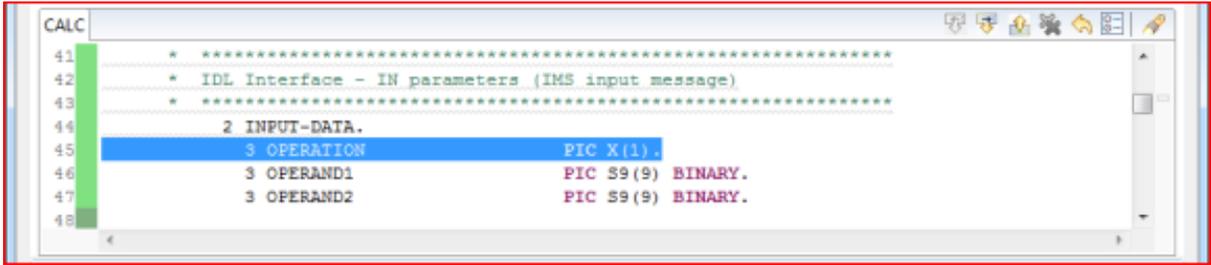
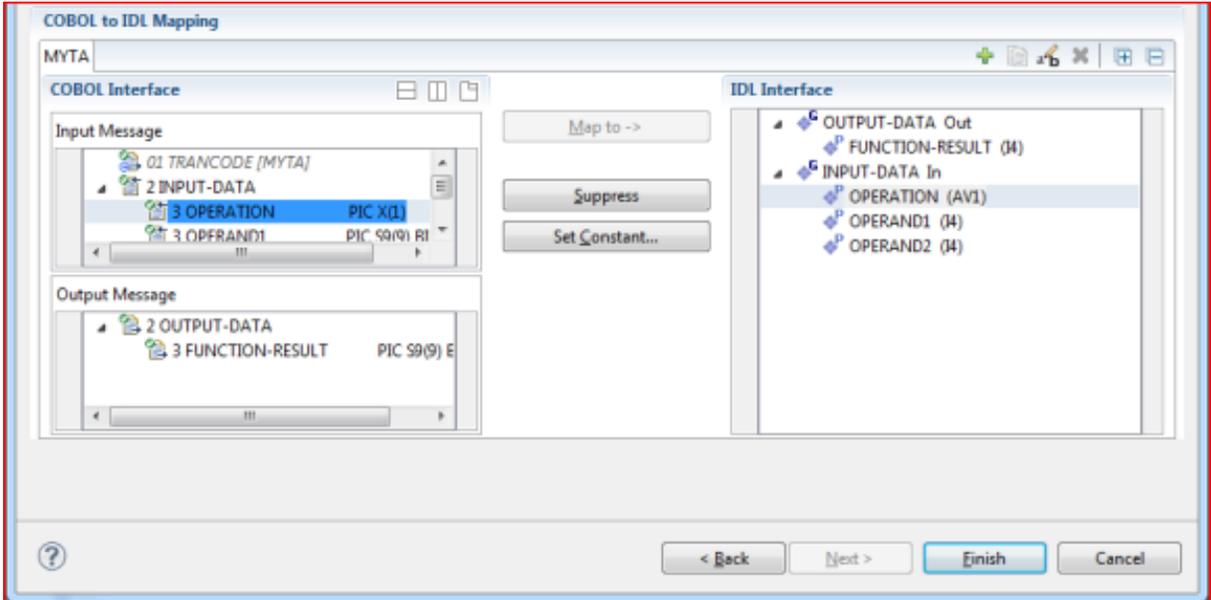
The user interface of the COBOL Mapping Editor is described below.

## Mapping Editor User Interface

This section assumes you have set the extraction settings as described above. The following areas of the COBOL Mapping Editor user interface are described here:

- [COBOL Program Selection](#)
- [COBOL Source View](#)
- [COBOL to IDL Mapping](#)

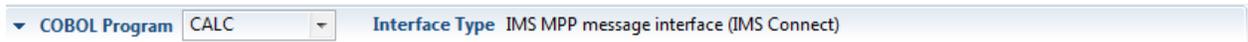
For COBOL server programs with IMS MPP message interface (IMS Connect), the user interface of the COBOL Mapping Editor looks like this:

1. 
2. 
3. 

1. **COBOL Program Selection.** Currently selected program with interface type
2. **COBOL Source View.** Contains all related sources for the currently selected COBOL program

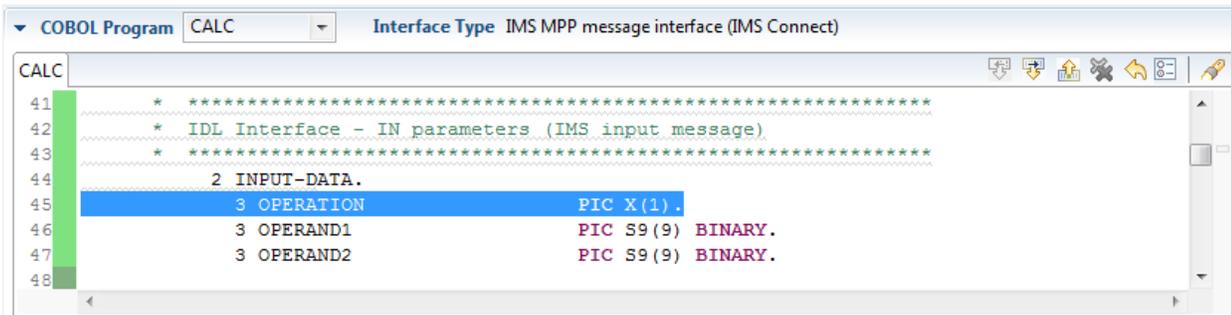
3. **COBOL to IDL Mapping.** Tree view of your selected COBOL data items and mapping buttons with which you can map these items to your IDL interface

### COBOL Program Selection



The COBOL Program Selection displays the current selected COBOL program with its interface type. If you have extracted more than one COBOL program within the associated IDL file, you can switch to another COBOL program with its mapping by selecting the name in the combo box.

## COBOL Source View



All COBOL data items contained in the LINKAGE and WORKING-STORAGE SECTION are offered in a text view. The text view contains all related sources (including copybooks) for the currently selected COBOL program. It is used for selecting data items and retrieving information from the original COBOL sources. The light green bar indicates that the data item is already contained in the COBOL Interface; a dark green bar indicates the data item is selectable and can be added to the COBOL Interface. This section can be collapsed. If you open the Editor with **Modify Interface** it is collapsed by default. The toolbar provides the following actions:

-  Add selected COBOL data item to COBOL Interface as Input Message.
-  Add selected COBOL data item to COBOL Interface as Output Message.
-  Remove selected COBOL data item from COBOL Interface.
-  Remove all COBOL data items from COBOL Interface.
-  Reset COBOL Interface to initial state.
-  Show dialog to modify COBOL Source Characteristics.
-  Show dialog to find text in Source.

The same functionality is also available from the context menu.

## COBOL to IDL Mapping

This section covers the following topics:

- [COBOL Interface](#)
- [Mapping Buttons](#)
- [IDL Interface](#)

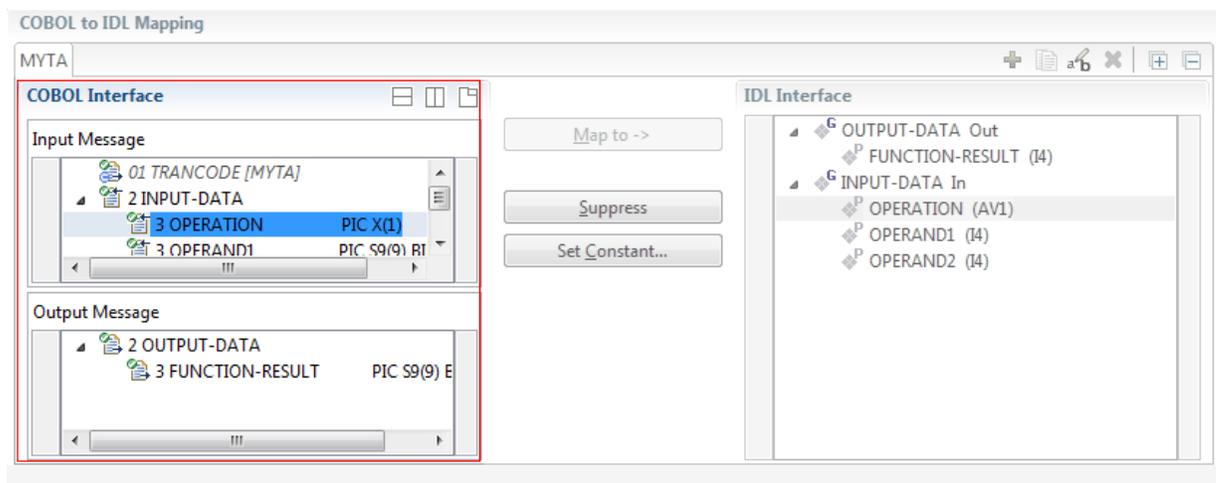
### COBOL Interface

The **COBOL Interface** shows a tree view of your selected COBOL data items describing the interface of the COBOL server. A context menu is available for the COBOL data items, which provides mapping and other functions. On some COBOL data items, decision icons indicate where particular attention is needed, including mapping icons to visualize the COBOL data type and your current mapping.

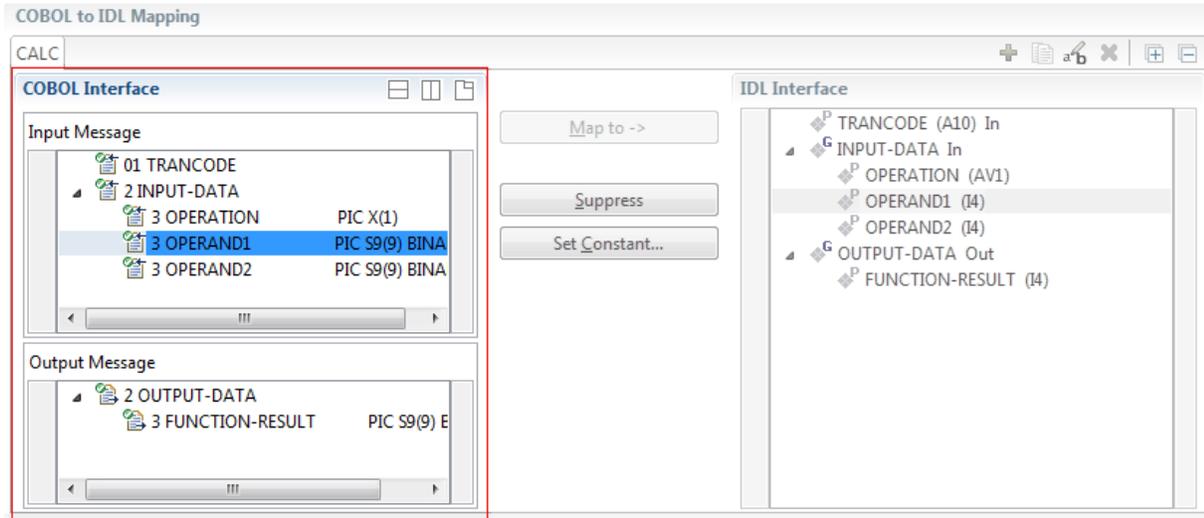
The COBOL data item names are derived from the COBOL source from which they were extracted. If your COBOL interface contains parameters without a name, that is, the keyword `FILLER` is used, those COBOL data items are shown as `[FILLER]`. See [FILLER Pseudo-Parameter](#).

The appearance of the **COBOL Interface** depends on how the transaction name is specified in the **Extractor Settings**:

- If **Transaction Name** is checked, a hidden parameter with this fixed value appears:



- If **Create IDL parameter for Transaction Name...** is checked, the IDL parameter "TRANCODE" sets the transaction name dynamically at runtime.



You can modify the COBOL interface using context menu or toolbar; decision and mapping icons provide additional information.

### Context Menu

The context menu on COBOL data items provides the following mapping and other functions, depending on the data item type, the COBOL level and the current mapping.

<b>Map to</b>	A suppressed COBOL data item becomes visible in the IDL interface. Used also to select another REDEFINE path.
<b>Suppress</b>	Suppress unneeded COBOL data items.
<b>Set Constant</b>	Set COBOL data items to constant.
<b>Set Array Mapping</b>	Map an array to a fixed sized or unbounded array.
<b>Set Multiple Possible Output (MPO) Structures</b>	Set COBOL data items where the server program decides the output structure used on return. Specify the set of multiple possible output (MPO) structures and the criteria when a structure is used.
<b>Remove from COBOL Interface</b>	Remove the data item from the COBOL interface. This also removes the mapped IDL parameter from all IDL interfaces for the current COBOL program. See <a href="#">COBOL Program Selection</a> .

See also [Mapping Editor IDL Interface Mapping Functions](#).

### Toolbar

The toolbar offers the following actions:

-  Create IDL Interface. Creates a new IDL interface based on the current COBOL interface: all IDL parameters are of IDL direction InOut; no IDL parameters are set to constant; for

COBOL REDEFINE, the first REDEFINE path is mapped to IDL; FILLERS are suppressed according to your selection, see [Step 4: Define the Extraction Settings and Start Extraction](#).

-  Copy current IDL Interface. Creates a duplicate of the current IDL interface: all modifications such as IDL directions, suppress, selection of REDEFINE paths etc. are kept.
-  Remove current IDL Interface.
-  Rename current IDL Interface.
-  Expand the full tree.
-  Collapse the full tree.

See also [Map to Multiple IDL Interfaces](#)

### Decision Icons

The decision icons in the first column are set on COBOL data items where particular attention is needed:

-  This icon visualizes a COBOL REDEFINE. It is essential that you map the correct redefine path for your mapping to In, Out or InOut using the context menu. If you map a REDEFINE path, all other sibling REDEFINE paths are automatically set to "Suppress".

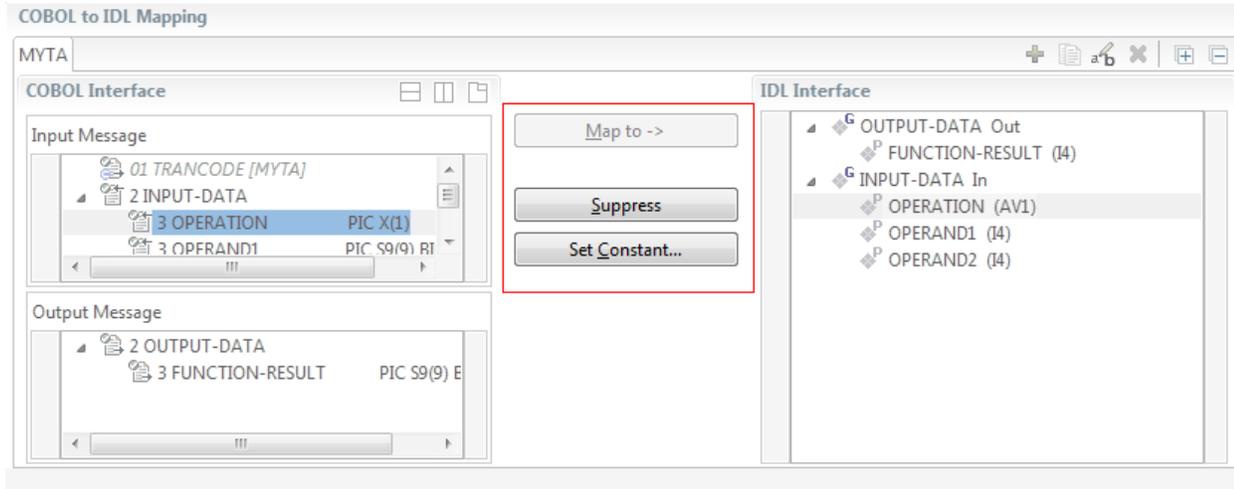
### Mapping Icons

The following mapping icons on the COBOL data items indicate your current IDL mapping:

-  Scalar parameter, mapped to In.
-  Scalar parameter, mapped to Out.
-  Group parameter, here mapped to In.
-  REDEFINE parameter, here mapped to Out.
-  Parameter set to Constant.

### Mapping Buttons

The following buttons are available:



**Note:** In this example, a fixed value for transaction name was specified in the **Extractor Settings**.

**Map to ->**

A suppressed COBOL data item becomes visible in the IDL interface. Used also to select another REDEFINE path.

**Suppress**

See *Suppress Unneeded COBOL Data Items*.

**Set Constant...**

See *Set COBOL Data Items to Constants*.

**IDL Interface**

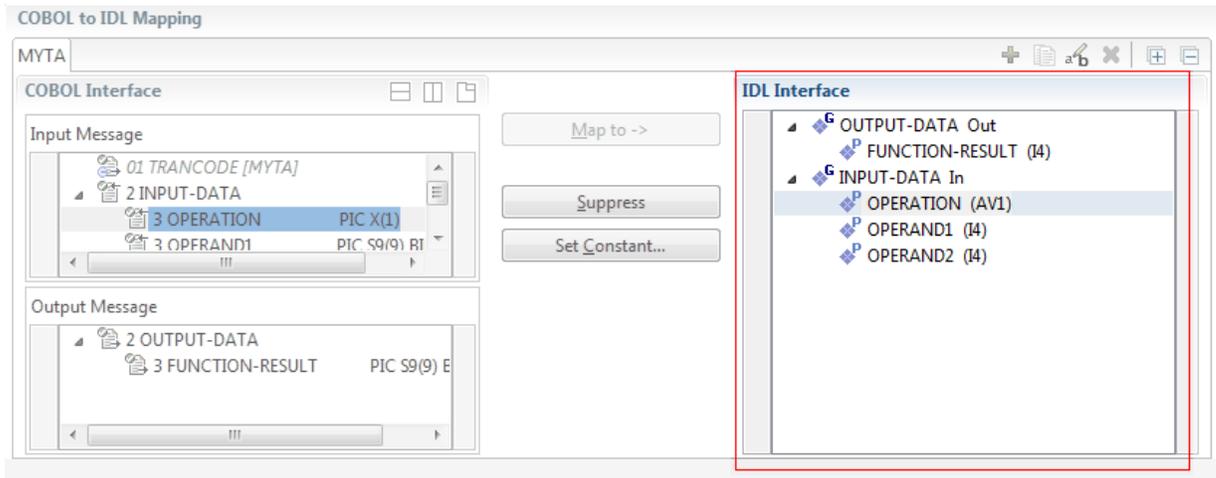
If you have mapped the COBOL interface to multiple IDL interfaces, select the IDL interface by choosing the tabs. In the **IDL Interface** tree view, a context menu is also available with the following possibilities:

- Rename
- Remove from COBOL Interface. This also removes the mapped IDL parameter from all IDL interfaces for the current COBOL program. See *COBOL Program Selection* above.

The appearance of the **IDL Interface** depends on how the transaction name is specified in the **Extractor Settings**. See [Extracting from an IMS MPP Message Interface Program](#).

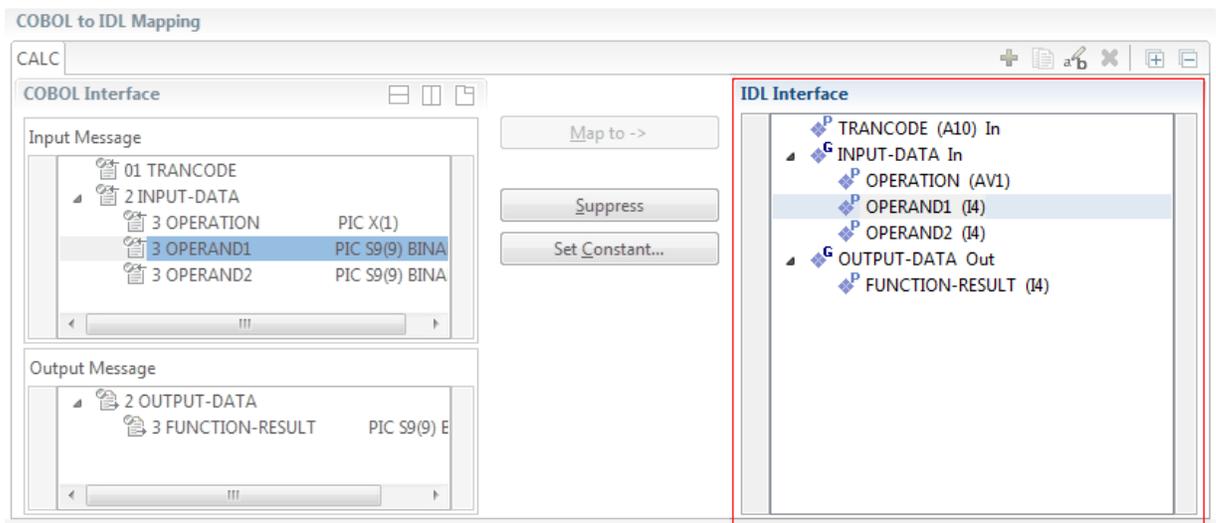
■ **Fixed Value**

In the **COBOL Interface** pane the first parameter shows the value for your transaction name in square brackets. There is no IDL parameter contained in the **IDL Interface** for it. Your IDL interface is free of this technical parameter, and RPC clients do not have to specify it at runtime.



■ **Dynamically at Runtime**

Your *IDL Interface* contains an IDL parameter for the transaction name ("TRANCODE"). RPC clients set the name dynamically at runtime.



## Mapping Editor IDL Interface Mapping Functions

This section covers the following topics:

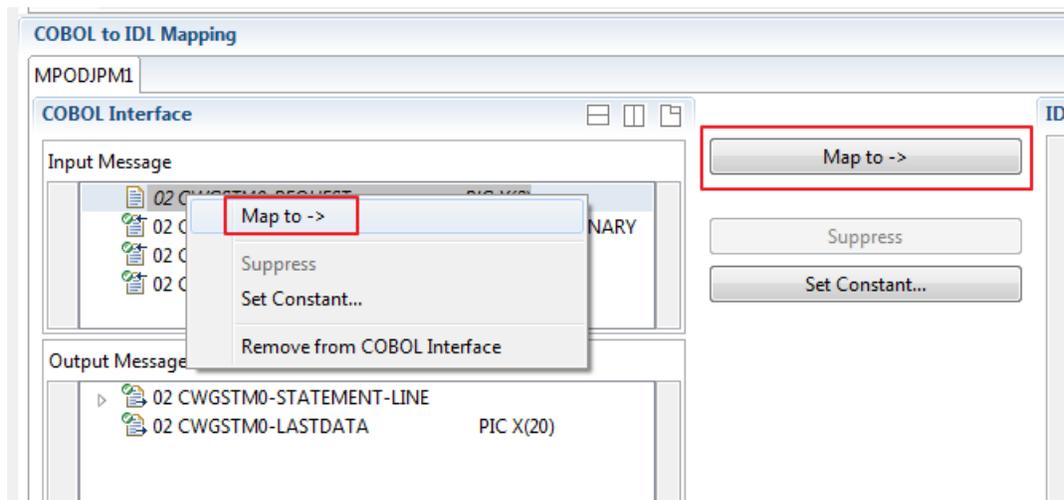
- Map to
- Map OCCURS DEPENDING ON
- Map to Multiple IDL Interfaces
- Select REDEFINE Paths
- Suppress Unneeded COBOL Data Items
- Set COBOL Data Items to Constants
- Set Arrays (Fixed <-> Unbounded)
- Set Multiple Possible Output (MPO) Structures

### Map to

With the **Map to** functions you make a COBOL data item visible as an IDL parameter in the IDL interface, that is, you design the IDL interface by defining input and output parameters.

#### > To map COBOL data items to IDL interface

- 1 Go *step-by-step* through all *top-level* COBOL data items in the COBOL interface and use the **Map to** function available in the context menu of the COBOL interface and as mapping button to make a COBOL data item visible as an IDL parameter in the IDL interface:



- 2 Do the same for the output message of the COBOL interface.



#### Notes:

1. If a COBOL group is mapped, all subordinate COBOL data items are also made visible in the IDL interface.
2. With the inverse function **Suppress Unneeded COBOL Data Items** (see below) available in the context menu of the COBOL interface and as mapping button, a COBOL data item can be removed from the IDL interface.

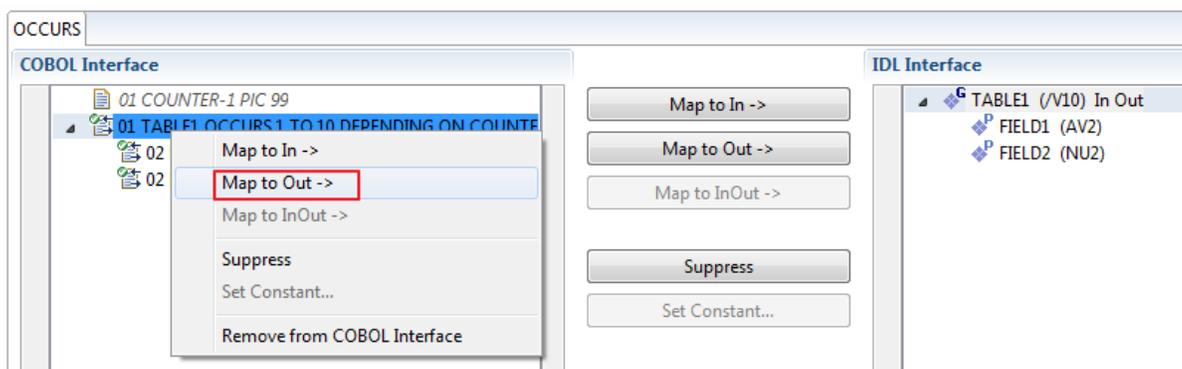
## Map OCCURS DEPENDING ON

With the **Map to In, Out, InOut** functions you can make the COBOL ODO subject (here COBOL data item TABLE) of a variable-sized COBOL table (see *COBOL Tables with Variable Size - DEPENDING ON Clause*) visible as an IDL unbounded group (with maximum). The ODO object (here COBOL data item COUNTER-1) is suppressed and therefore not part of the IDL interface. This is because the number of elements of the IDL unbounded group is already implicitly available. See the following example:

```
01 COUNTER-1 PIC 99.
01 TABLE OCCURS 1 TO 10 DEPENDING ON COUNTER-1
  02 FIELD1 PIC XX.
  02 FIELD2 PIC 99.
```

### ➤ To map OCCURS DEPENDING ON

1. Add the COBOL ODO subject (here data item TABLE) and ODO object (here data item COUNTER-1) to the COBOL interface. It is important both data items are in the COBOL interface.
2. Use the **Map to In, Out** and **InOut** functions available in the context menu of the COBOL interface and as mapping buttons and apply IDL directions for the ODO subject (data item TABLE):



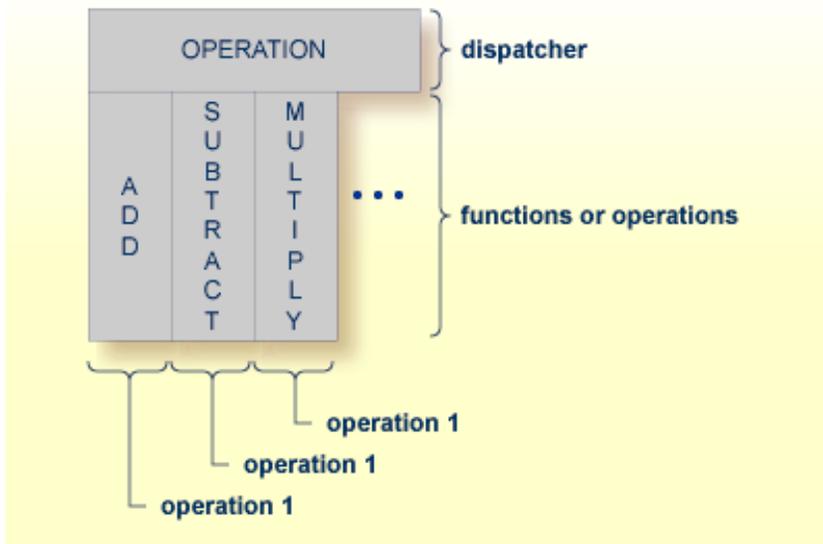
### Notes:

1. The ODO subject can be mapped to the IDL interface.
2. The ODO object is always suppressed, but is required to be part of the COBOL interface.

3. IDL directions are described in the direction-attribute in `attribute-list` under *Software AG IDL Grammar* in the IDL Editor documentation.

### Map to Multiple IDL Interfaces

Assume the COBOL server program provides multiple functions or operations, in the following example ADD, SUBTRACT, MULTIPLY. Some dispatcher front-end code executes the correct function, for example, depending on a *function-code* or *operation-code* parameter:



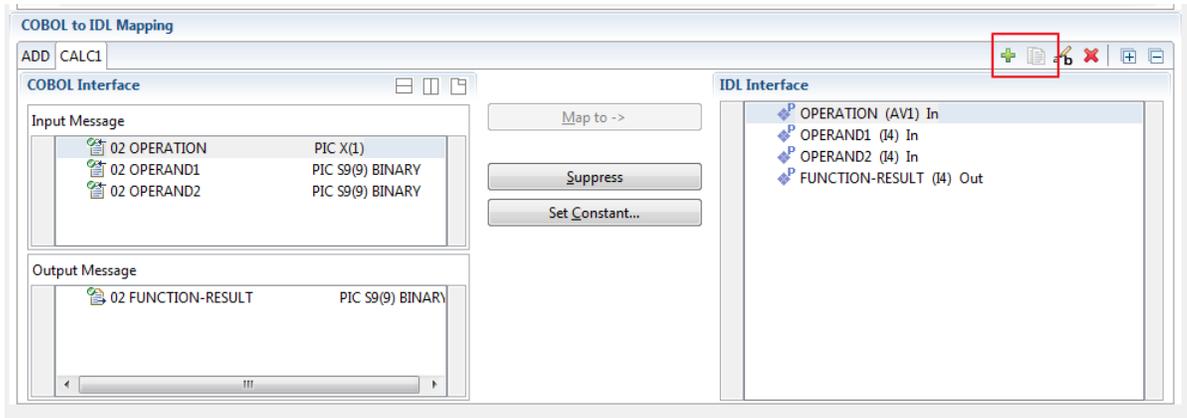
This example is described in more detail under [Example 1: COBOL Server with Multiple Functions](#).

If you have such a situation, a good approach is to expose each COBOL server program function separately as an IDL program. This gives advantages in further processing of the IDL and COBOL mapping files (SVM and CVM). For example:

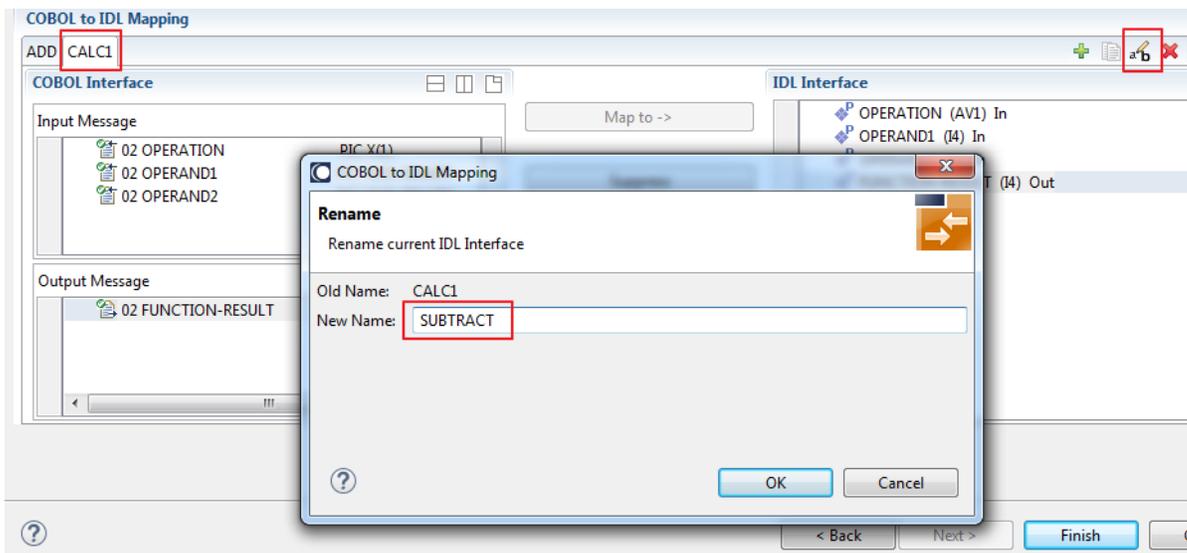
- If your target endpoint is a web service: instead having a Web service with a single operation, you get a web service with multiple operation, one operation for each COBOL function.
- If your target endpoint is Java or .NET: instead having a class with a single method, you get a class with multiple methods, one method for each COBOL function.

#### ➤ To map a COBOL interface to multiple IDL interfaces

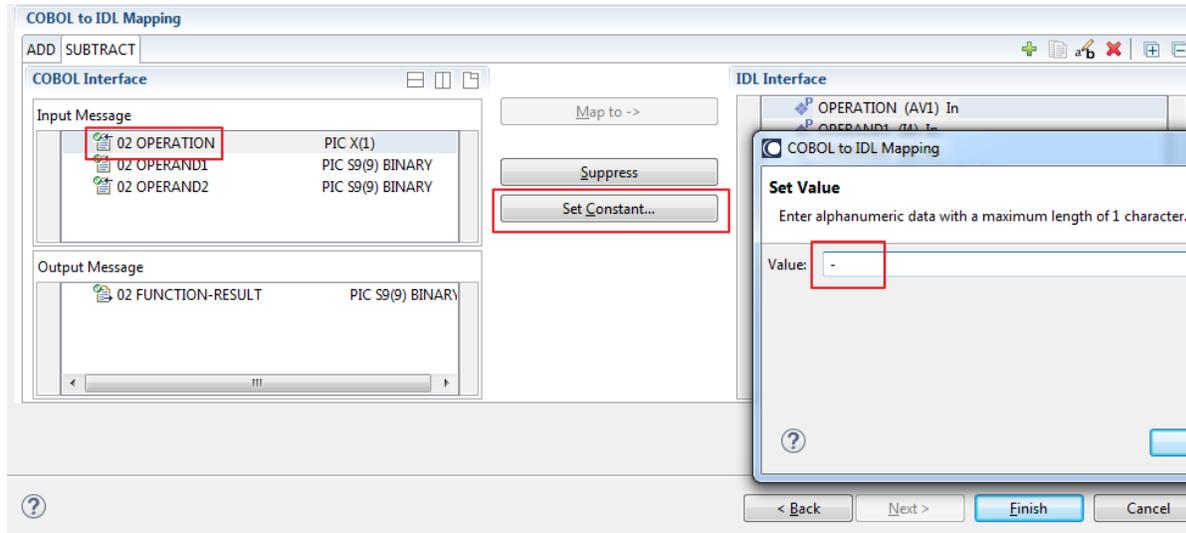
- 1 Select the tab with COBOL to IDL Mapping. For each function, define a separate IDL interface with the toolbar functions  or .



- 2 Give the IDL interfaces meaningful names with the toolbar function :



- 3 Define the required constant values to the *function-code* or *operation-code* parameter, see *Set COBOL Data Items to Constants* above:



For the delivered Example 1: COBOL Server with Multiple Functions:

- First, for step 1 above: Extract and define 3 separate IDL programs ADD, SUBTRACT, MULTIPLY.
- Second, for step 2 above: Rename them to suitable names, e.g. 'ADD', 'SUBTRACT', 'MULTIPLY'.
- Third, for step 3 above: Define the constants '+', '-' and '\*' to the parameter OPERATION respectively.
- After pressing **Finish**, the following IDL together with a server mapping file is created. See *Server Mapping Files for COBOL*.

```

library 'EXAMPLE' is

program 'ADD' is
define data parameter
1 OPERAND1 (I4) In
1 OPERAND2 (I4) In
1 FUNCTION-RESULT (I4) Out
end-define

program 'SUBTRACT' is
define data parameter
1 OPERAND1 (I4) In
1 OPERAND2 (I4) In
1 FUNCTION-RESULT (I4) Out
end-define

program 'MULTIPLY' is
define data parameter
1 OPERAND1 (I4) In
1 OPERAND2 (I4) In
1 FUNCTION-RESULT (I4) Out
end-define
    
```

**Notes:**

1. The following functions are offered to create further mappings from the COBOL interface, resulting in multiple IDL interfaces (IDL programs).

Icon	Function	Description
	Create IDL Interface	Creates a new IDL interface based on the current COBOL interface. All IDL parameters are of IDL direction InOut; no IDL parameters are set to constant; for COBOL REDEFINE, the first REDEFINE path is mapped to IDL; FILLERS are suppressed according to your selection, see <a href="#">Step 4: Define the Extraction Settings and Start Extraction</a> .
	Copy current IDL Interface	Creates a duplicate of current IDL interface. All modifications such as IDL directions, suppress, selection of REDEFINE paths etc. are kept.
	Rename current IDL Interface	The default name for the IDL interface is based on the COBOL program name plus appended number. With this function you can give the IDL interface a suitable name.
	Remove current IDL Interface	Deletes the current IDL interface.

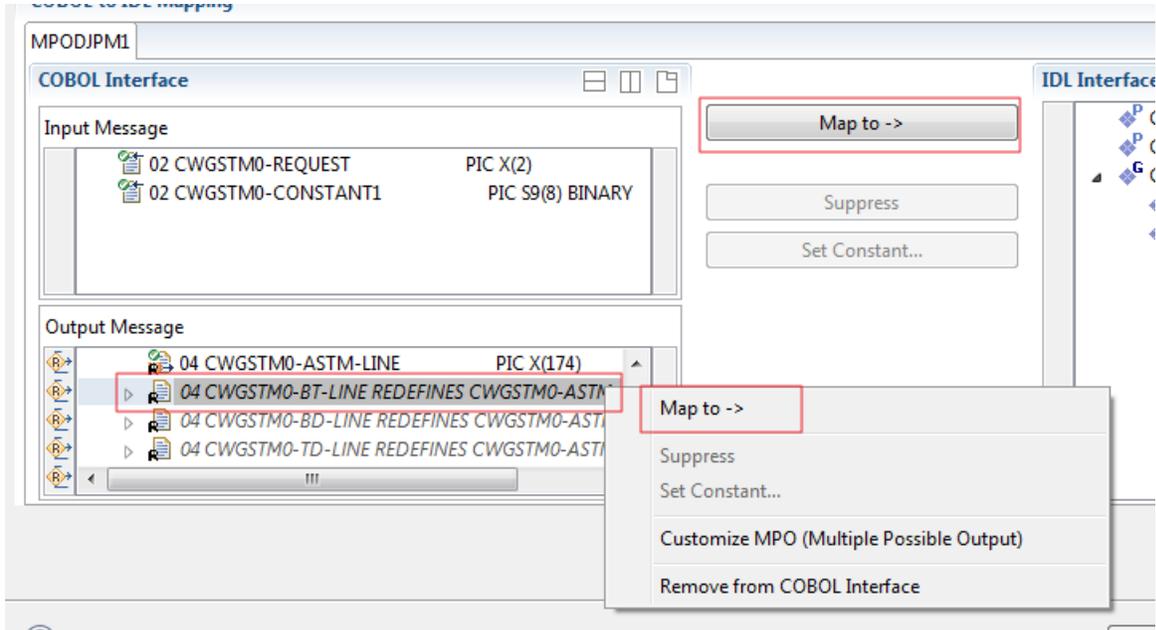
2. With the steps 1 thru 3 described here you can emulate the behavior of function Map to Operation of EntireX version 9.6 and earlier.

**Select REDEFINE Paths**

For COBOL server programs containing COBOL REDEFINES, the correct REDEFINE path needs to be chosen for the IDL interface.

**> To select redefine paths**

- Use the **Map to** function available in the context menu of the COBOL interface and as mapping button to make the COBOL REDEFINE path available in the IDL interface.



Begin with the COBOL REDEFINE defined at the highest level first. Work through all inner COBOL REDEFINE data items, going from higher levels to lower levels.

**Notes:**

1. Only one REDEFINE path of a COBOL REDEFINE can be mapped to the IDL interface. All COBOL REDEFINE siblings are suppressed.
2. If a REDEFINE path is actively mapped to the IDL interface, all COBOL REDEFINE siblings are suppressed.
3. You can suppress all REDEFINE paths of a COBOL REDEFINE. Simply suppress the active REDEFINE path, see *Suppress Unneeded COBOL Data Items* above.

**Suppress Unneeded COBOL Data Items**

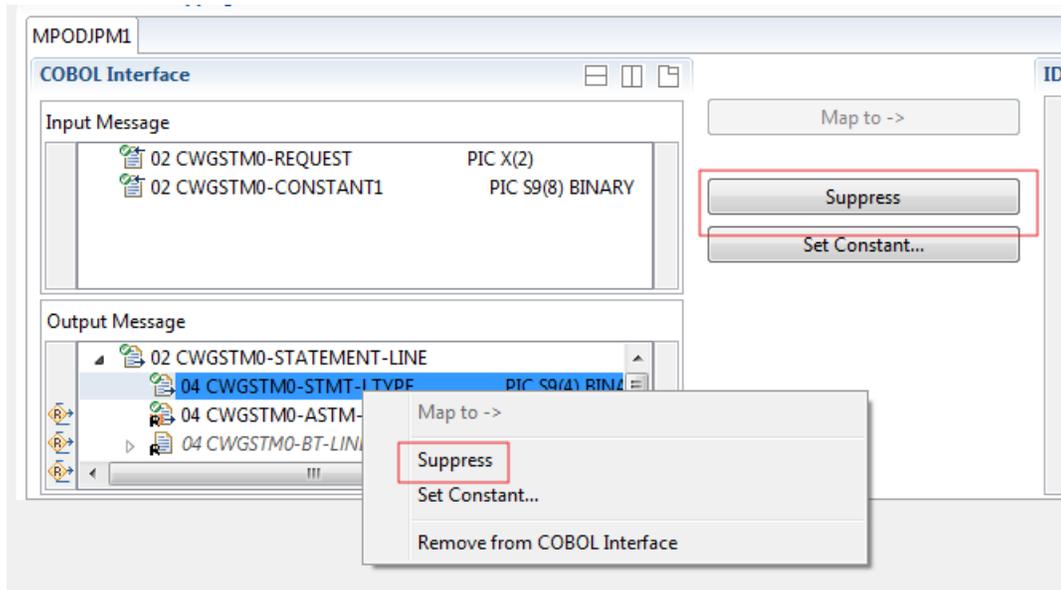
COBOL data items without any relevant information can be made invisible in the IDL interface. The IDL interface is simplified - it becomes shorter and tidier. This is useful, for example

- for FILLER data items
- if the RPC client or Adapter Service does not need an Out parameter
- if the RPC server or Adapter Service does not need an In parameter and a low value can be provided

If you are using an RPC server such as the z/OS (CICS | Batch), z/VSE (CICS | Batch), Micro Focus or BS2000/OSD RPC server, the amount of data to be transferred to/from the RPC client is also reduced.

➤ To suppress unneeded COBOL data items

- Use the **Suppress** function available in the context menu of the COBOL interface and as mapping button to make the COBOL data item invisible in the IDL interface:



**Notes:**

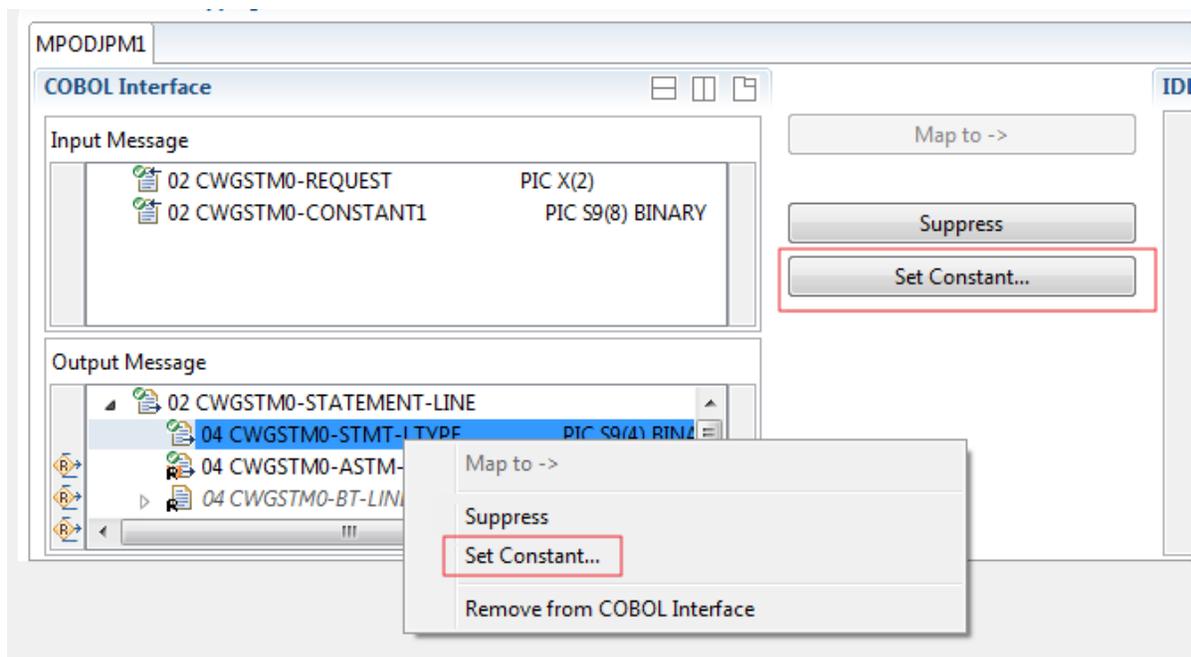
1. The COBOL data item is not part of the IDL interface. It is invisible for RPC clients or Adapter Service.
2. The RPC server or Adapter Service provides the COBOL data item to your COBOL server with low value, managing the offset to the next COBOL data item.
3. If a COBOL group is suppressed, all subordinate COBOL data items are suppressed as well.
4. With the inverse function **Map to** (see above) available in the context menu of the COBOL interface and as a mapping button, a COBOL data item can be made visible in the IDL interface again.

## Set COBOL Data Items to Constants

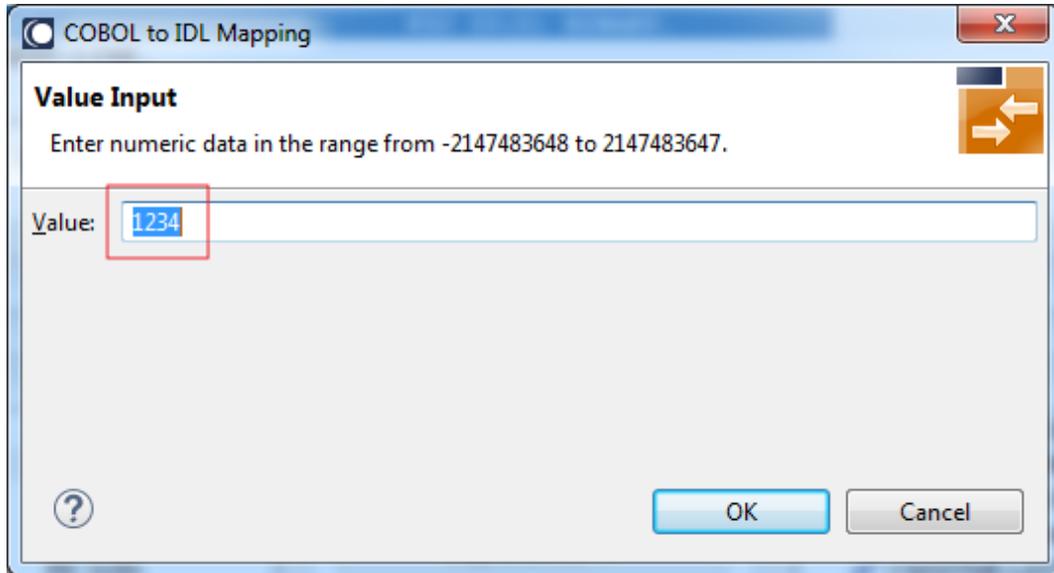
COBOL data items that always require fixed constant values on input to the COBOL server program can be made invisible in the IDL interface and initialized with the required constant values. This is useful for keeping the IDL interface short and tidy. RPC clients or Adapter Services are not bothered with IDL parameters that always contain constants, such as `RECORD-TYPES`. This function is often used in conjunction with **Map to Multiple IDL Interfaces** (see above).

### ➤ To set COBOL data items to constants

- 1 Use the **Set Constant** function available in the context menu of the COBOL interface and as mapping button to define a constant value for a COBOL data item:



- 2 You are prompted with a window to enter the constant value:



 **Notes:**

1. The COBOL data item is not part of the IDL interface. It is invisible for RPC clients or Adapter Services.
2. The RPC server or Adapter Service provides the defined constant in the COBOL data item to your COBOL server.
3. With the function **Map to** (see above) available in the context menu of the COBOL interface and as a mapping button, a COBOL data item can be made visible in the IDL interface again.

### Set Arrays (Fixed <-> Unbounded)

For COBOL server programs using the message length to transfer a variable number of elements in a COBOL table with a fixed size (see [COBOL Tables with Fixed Size](#)) in a variable manner (see [COBOL Tables with Variable Size - DEPENDING ON Clause](#)) you need to set the mapping to unbounded array.

For details of such a COBOL server program see [Example 2: COBOL Server Using Fixed-length Tables in Variable Manner](#).

#### ➤ To set arrays from fixed to unbounded or vice versa

- Select the COBOL table and use the function **Set Arrays (Fixed<->Unbounded)** available in the context menu. A modal window is displayed. Select **Unbounded array**. The IDL array parameter will be changed from fixed array */number* to an unbounded array */Nnumber*, see *array-definition* under *Software AG IDL Grammar* in the IDL Editor documentation.

 **Notes:**

1. This option should be used carefully and requires knowledge of the COBOL server program. Be aware that an incorrect mapping results in runtime errors.
2. The COBOL Table with a fixed size (see *COBOL Tables with Fixed Size*) used in this manner must be the last parameter of the COBOL interface; it must not be a subparameter of any other COBOL table and must not contain any `DEPENDING ON` clause (see *COBOL Tables with Variable Size - DEPENDING ON Clause*).

## Set Multiple Possible Output (MPO) Structures

A COBOL server program produces more than one type of output. The layout of the output can therefore take two or more dissimilar shapes. The COBOL server program decides at runtime the output structure returned, that is, the COBOL layout on output varies.

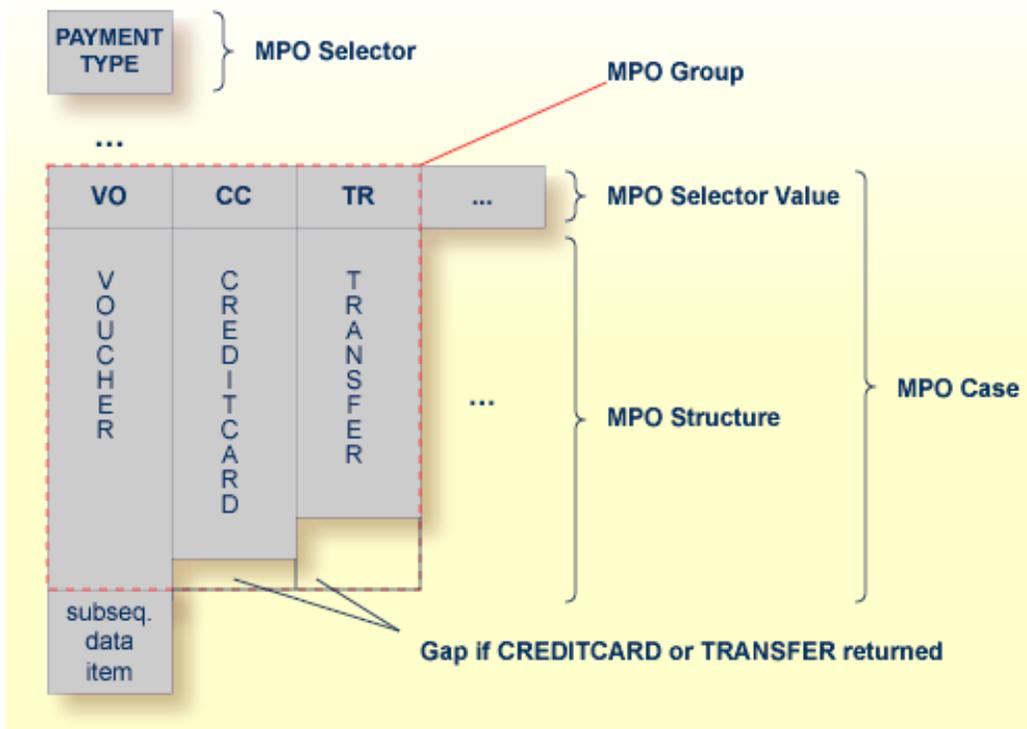
- [Multiple Possible Output with REDEFINES](#)
- [Optional Output with Groups](#)
- [MPO Terminology](#)
- [Steps](#)

## Multiple Possible Output with REDEFINES

As illustrated in *Example 3: COBOL Server Using Multiple Possible Output (MPO)*, a COBOL *REDEFINES Clause* is often used to describe the possible output structures. In COBOL this is the standard way to describe multiple possible output.

In addition, the COBOL interface

- limits the number of possible output structures returned
- defines all possible output structures, that is, they are known during extraction. In the example these are the structures `PAYMENT-DATA-VOUCHER`, `PAYMENT-DATA-CREDITCARD` and `PAYMENT-DATA-TRANSFER`. These are the MPO structures.
- contains an additional COBOL data item carrying a value related to the returned output structure. By inspecting this data item first, the appropriate output structure can be selected to address the data correctly. In the example it is `PAYMENT-TYPE`. This item is the MPO selector.
- always occupies memory to be able to transfer the longest output structure. If the actual returned output structure is shorter than the longest possible output structure, there is a gap (space) between the multiple possible output and the subsequent data item.



This abstract concept is known as *multiple possible output* (MPO). EntireX bundles all MPO structures into an MPO group. See *MPO Terminology* below.

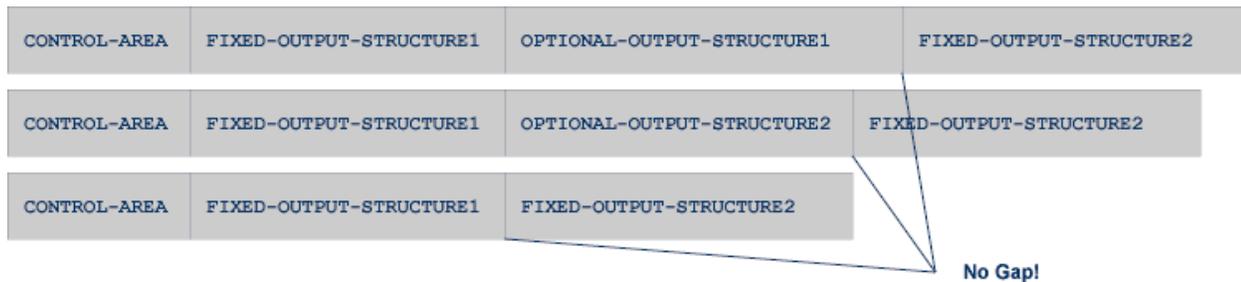
### Optional Output with Groups

As illustrated in [Example 4: COBOL Server Using Optional Output](#), COBOL group data items can be used to describe optional output structures. See *Optional COBOL Group Data Items*. Optional output with group data items are a variant of multiple possible output (MPO).

In addition, the COBOL interface

- limits the number of possible output structures returned
- defines all optional output structures, that is, they are known during extraction. In the example these are the structures `OPTIONAL-OUTPUT-STRUCTURE1` and `OPTIONAL-OUTPUT-STRUCTURE2`. These are the MPO structures.
- contains an additional COBOL data item carrying an indication if the optional output is present. By inspecting this data item first, the appropriate optional output structure can be selected to address the data correctly. If its value does not match, the optional output is not present. In the example it is `OPTIONAL-OUTPUT`. This item is the MPO selector.
- If the optional output is not present no memory is occupied. There is no gap between the optional output and the subsequent data item, as opposed to *Multiple Possible Output with REDEFINES* above.

In the example there are three different shapes of output:



## MPO Terminology

The following terminology is used with MPOs:

### MPO structure

A COBOL group describing the output layout used in an MPO case. All alternative layouts in an MPO group are often described with COBOL `REDEFINES`. An MPO structure can also contain other MPO groups.

### MPO group

Bundles together all MPO structures that can be used alternatively. A COBOL interface can contain more than one MPO group.

### MPO case

An MPO structure together with its MPO selector values (one or more).

### MPO selector

A COBOL data item containing a specific value (MPO selector value) where the actual MPO case can be determined. The MPO selector precedes the MPO group and is located outside the MPO group.

### MPO selector value

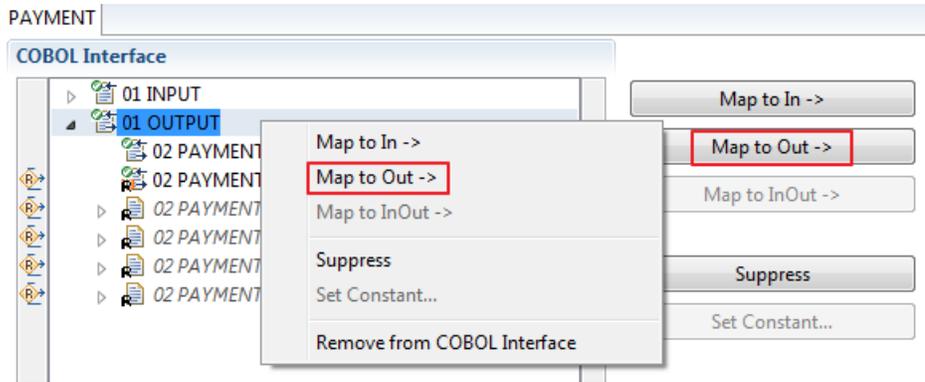
Each value indicates exactly one output structure. An output structure can be indicated by further values.

## Steps

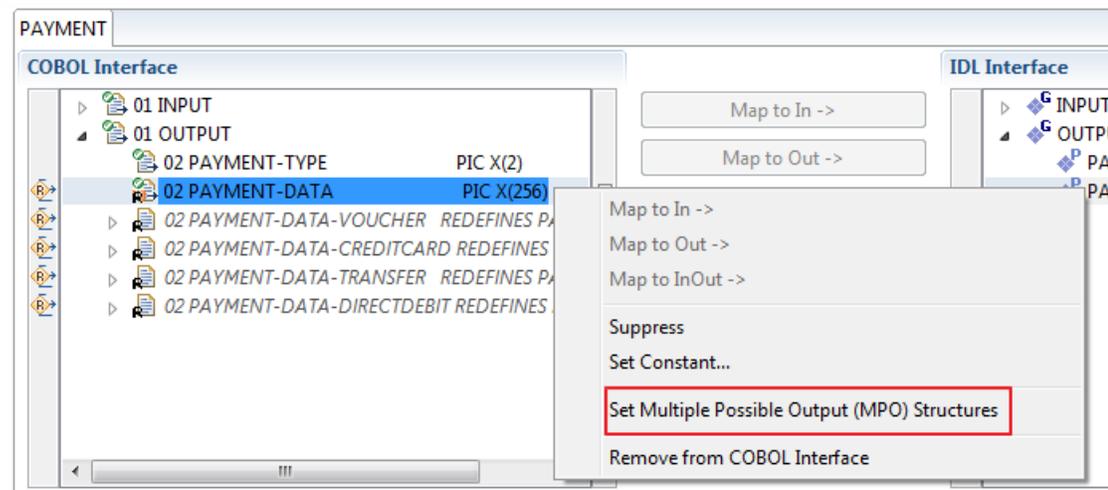
### ➤ To set multiple possible output (MPO) structures

Use the **Set Multiple Possible Output (MPO) Structures** function available in the context menu of the COBOL interface to create new or modify existing MPO groups.

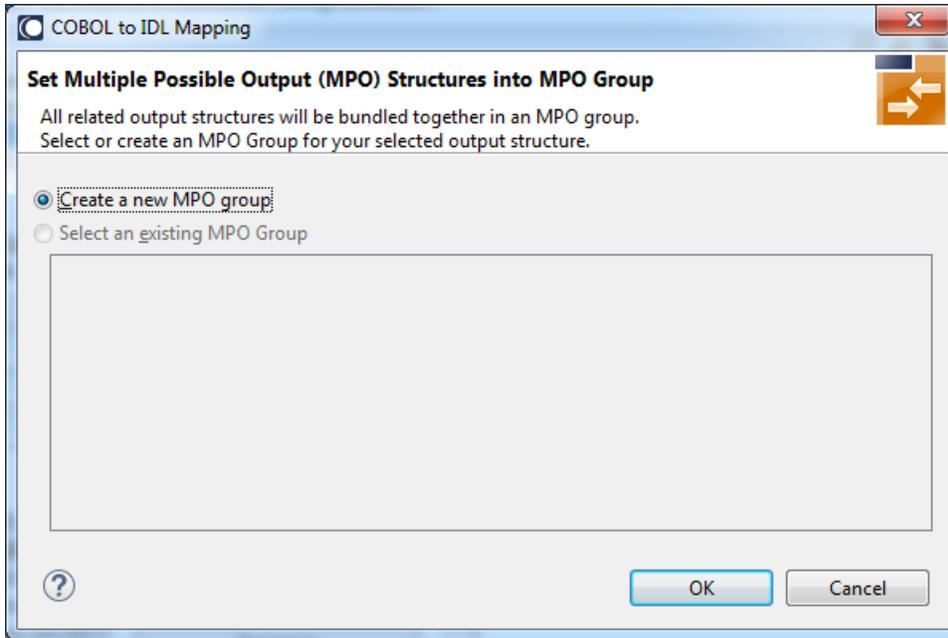
- 1 Set the top-level COBOL data item where the MPO structures are contained to IDL direction Out. Use the **Map to Out** function for this purpose:



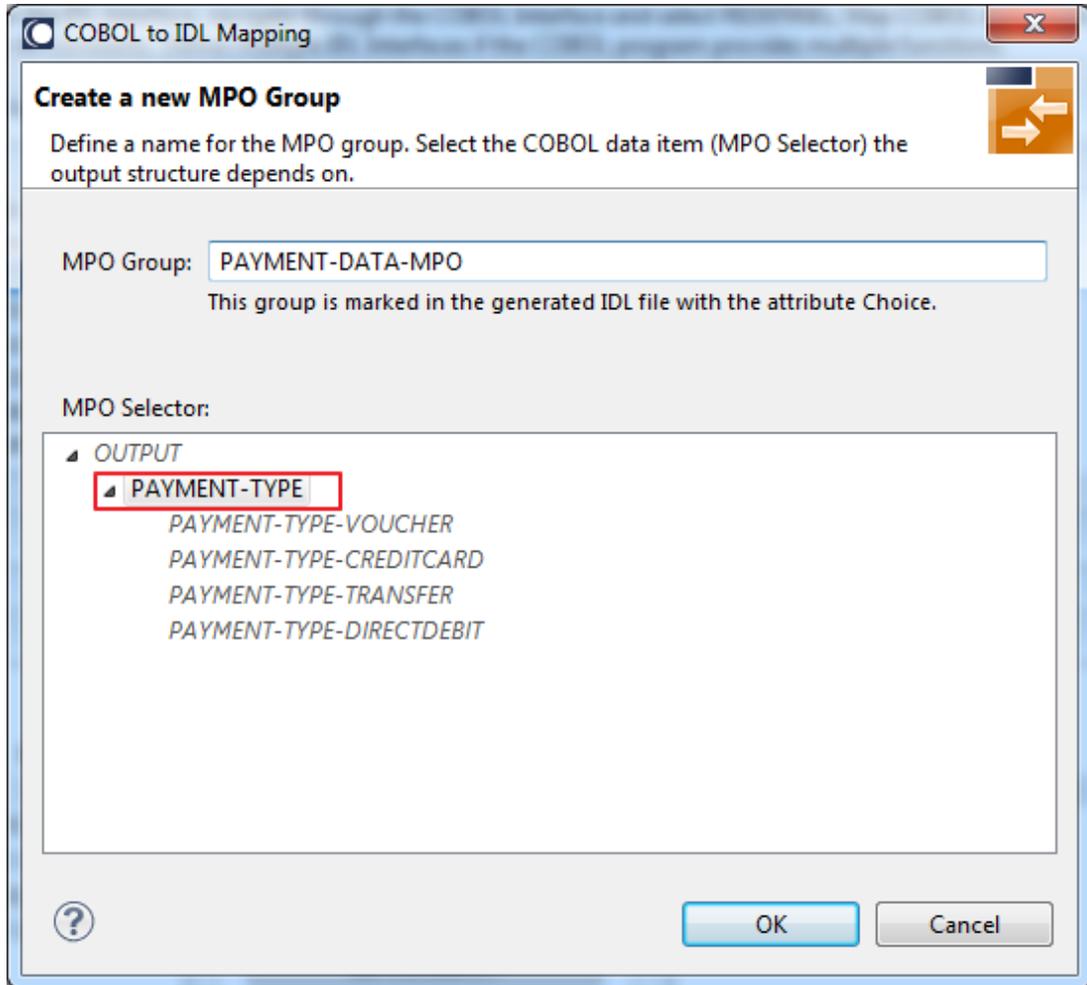
- From the context menu of the COBOL interface of the COBOL REDEFINE, choose **Set Multiple Possible Output (MPO) Structures**.



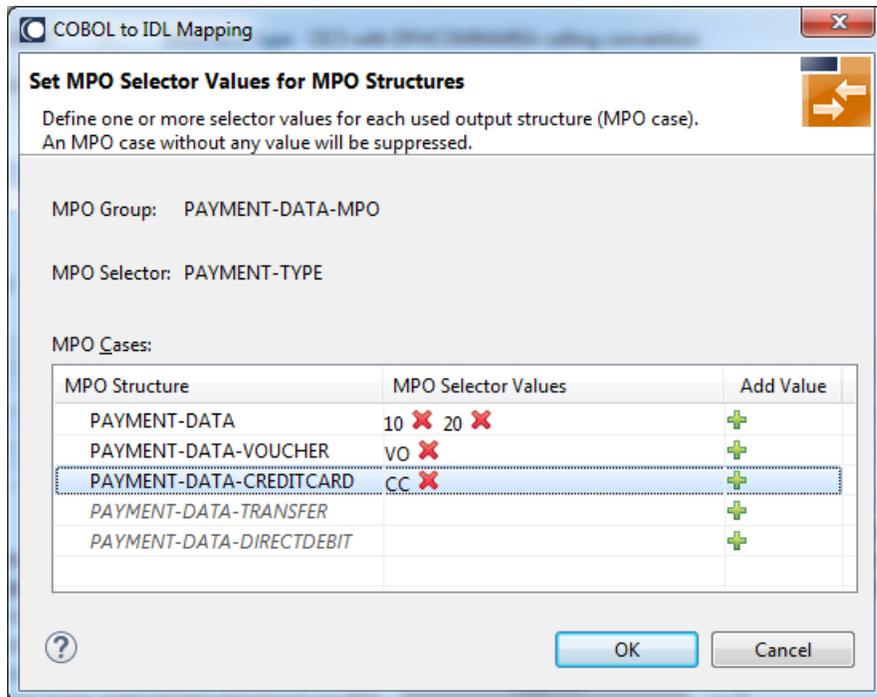
- Set Multiple Possible Output (MPO) Structures into MPO Group.



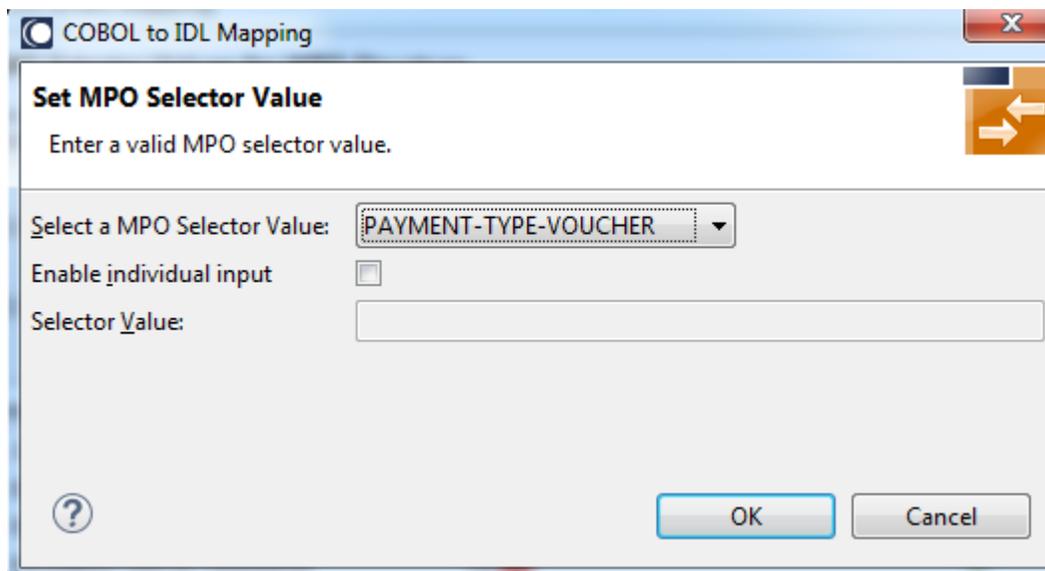
- 4 Create a new MPO group.



- 5 Set MPO selector values for MPO Structures.



Use the functions ✗ to delete and + to add MPO selector values:



**Notes:**

1. To add multiple MPO selector values per MPO structure, use the function + multiple times for the same MPO structure (see value 10 and 20 for structure PAYMENT-DATA).
2. MPO structures without any MPO selector are unused and suppressed in the IDL interface value (e.g. see structure PAYMENT-DATA-TRANSFER).

3. Each MPO selector value must uniquely identify an MPO structure. The same value cannot be used more than once for different MPO structures.
4. If no defined MPO selector value matches during runtime, an empty MPO group is delivered to the RPC client, that is, none of the MPO cases contain any data. No runtime error is produced.
- 6 For the delivered example *COBOL Server Using Multiple Possible Output (MPO)* (see below): After pressing **Finish**, the following IDL together with a server mapping file is created. See *Server Mapping Files for COBOL*.

```
library 'PAYMENT' is

program 'PAYMENT' is
  define data parameter
    1 INPUT          In
      2 ORDER-NUMBER      (NU10)
    1 OUTPUT         Out
      2 PAYMENT-TYPE      (A2)
      2 PAYMENT-DATA-MPO Choice
        3 PAYMENT-DATA    (/V1)
        4 PAYMENT-DATA    (AV256)
        3 PAYMENT-DATA-VOUCHER (/V1)
        4 VOUCHER-ORIGIN  (AV128)
        4 VOUCHER-SERIES  (AV128)
        3 PAYMENT-DATA-CREDITCARD (/V1)
        4 CREDITCARD-NUMBER (NU18)
        4 CREDITCARD-CODE  (NU12)
        4 CREDITCARD-VALIDITY (AV8)
  end-define
```

## Programming Techniques

- [Example 1: COBOL Server with Multiple Functions](#)
- [Example 2: COBOL Server Using Fixed-length Tables in Variable Manner](#)
- [Example 3: COBOL Server Using Multiple Possible Output \(MPO\)](#)
- [Example 4: COBOL Server Using Optional Output](#)

### Example 1: COBOL Server with Multiple Functions

Assume a COBOL server program has a FUNCTION or OPERATION code COBOL data item in its COBOL interface. The COBOL server program behaves differently depending on field values of this data item. See the following example where a COBOL programs implements a calculator with the functions ADD, SUBTRACT, MULTIPLY, etc. The execution of the different functions is controlled by the COBOL data item OPERATION:

```
. . .  
01 OPERATION                PIC X(1).  
01 OPERAND1                 PIC S9(9) BINARY.  
01 OPERAND2                 PIC S9(9) BINARY.  
01 FUNCTION-RESULT         PIC S9(9) BINARY.  
. . .  
MOVE 0 TO FUNCTION-RESULT.  
EVALUATE OPERATION  
  WHEN "+"  
    ADD OPERAND1 OPERAND2  
    GIVING FUNCTION-RESULT  
  WHEN "-"  
    SUBTRACT OPERAND2 FROM OPERAND1  
    GIVING FUNCTION-RESULT  
  WHEN "*"  
    MULTIPLY OPERAND1 BY OPERAND2  
    GIVING FUNCTION-RESULT  
  WHEN . . .  
  
END-EVALUATE.  
. . .
```

You can expose each COBOL server program function separately. The advantages or reasons for wanting this depend on the target endpoint. For example:

#### ■ Web Service

Instead having a Web service with a single operation, you want a web service with multiple operations, one operation for each COBOL function.

- **Java or .NET**

Instead having a class with a single method, you want a class with multiple methods, one method for each COBOL function.

- etc.

To do this you need to extract the COBOL server program as described under [Map to Multiple IDL Interfaces](#).

### Example 2: COBOL Server Using Fixed-length Tables in Variable Manner

Assume a COBOL IMS MPP (IMS Connect) server program has a fixed-sized COBOL table as its last parameter, similar to COBOL data item COBOL-TABLE-FIX in the example below; each table element is 100 bytes; the length of COBOL-FIELD1 + COBOL-FIELD2 + COBOL-FIELD3; the length of the data preceding the COBOL table is described by COBOL-GROUP1; its length is 1000 bytes.

```

WORKING-STORAGE SECTION.
01 NUMBER-OF-INCOMING-ELEMENTS      PIC S9(8) BINARY.
01 NUMBER-OF-OUTGOMING-ELEMENTS     PIC S9(8) BINARY.
. . .

01 INPUT-MESSAGE.
05 INPUT-IMS-META.
10 INPUT-LL                          PIC S9(3) BINARY.
10 INPUT-ZZ                          PIC S9(3) BINARY.
10 INPUT-TRANSACTION                 PIC X(10).
05 INPUT-DATA.
10 COBOL-GROUP1.
20 COBOL-TABLE-PREFIX                PIC X(1000).
10 COBOL-TABLE-FIX                   OCCURS 20.
20 COBOL-GROUP2.
25 COBOL-FIELD1                      PIC X(4).
25 COBOL-FIELD2                      PIC X(3).
25 COBOL-FIELD3                      PIC X(50).
01 OUTPUT-MESSAGE.
05 OUTPUT-IMS-META.
10 OUTPUT-LL                         PIC S9(3) BINARY.
10 OUTPUT-ZZ                         PIC S9(3) BINARY.
05 OUTPUT-DATA.
10 COBOL-GROUP1.
20 COBOL-TABLE-PREFIX                PIC X(1000).
10 COBOL-TABLE-FIX                   OCCURS 20.
20 COBOL-GROUP2.
25 COBOL-FIELD1                      PIC X(30).
25 COBOL-FIELD2                      PIC X(20).
25 COBOL-FIELD3                      PIC X(50).

LINKAGE SECTION.
. . .

PROCEDURE DIVISION USING IO-PCB.
CALL "CBLTDLI" USING GU, IO-PCB, INPUT-MESSAGE.

```

```

. . .
COMPUTE NUMBER-OF-INCOMING-ELEMENTS = (INPUT-LL
- LENGTH OF COBOL-GROUP1 IN AREA INPUT-MESSAGE)
/ LENGTH OF COBOL-GROUP2 IN AREA INPUT-MESSAGE.

. . .
COMPUTE OUTPUT-LL = LENGTH OF OUTPUT-LL
+ LENGTH OF OUTPUT-ZZ
+ LENGTH OF COBOL-GROUP1 IN AREA OUTPUT-MESSAGE
+ (NUMBER-OF-OUTGOING-ELEMENTS
* LENGTH OF COBOL-GROUP2 IN AREA OUTPUT-MESSAGE).

CALL "CBLTDLI" USING ISRT, IO-PCB, OUTPUT-MESSAGE.
. . .

GOBACK.

```

During input the COBOL IMS MPP (IMS Connect) server program uses the IMS input message length INPUT-LL to evaluate the NUMBER-OF-INCOMING-ELEMENTS. During output the IMS output message length is determined accordingly to the NUMBER-OF-OUTGOING-ELEMENTS and set in OUTPUT-LL.

Although the COBOL table is defined as a table with a fixed size (see [COBOL Tables with Fixed Size](#)) it is used in a variable manner, similar to tables with variable size (see [COBOL Tables with Variable Size - DEPENDING ON Clause.](#)) In this case you need to map the COBOL table to an IDL unbounded array. See [Set Arrays \(Fixed <-> Unbounded\)](#).

### Example 3: COBOL Server Using Multiple Possible Output (MPO)

A COBOL REDEFINE can be used in a COBOL server program to return multiple possible output (MPO) structures, similar to COBOL data item PAYMENT-DATA in the example below; for this purpose, PAYMENT-DATA is redefined; each redefinition represents an output structure (MPO case); on return exactly one output structure is used; by inspecting COBOL data item PAYMENT-TYPE (MPO selector) first, a caller can determine the returned output structure; the caller then uses the correct redefinition to access the data.

```

. . .
01 INPUT-DATA.
   02 ORDER-NUMBER                               PIC 9(10).

. . .
01 OUTPUT-DATA.
   02 <some fields>                               PIC <clause>.
   . . .

   02 PAYMENT-TYPE                               PIC X(2).
      88 PAYMENT-TYPE-VOUCHER                     VALUE "VO".
      88 PAYMENT-TYPE-CREDITCARD                   VALUE "CC".
      88 PAYMENT-TYPE-TRANSFER                     VALUE "TR".
      88 PAYMENT-TYPE-DIRECTDEBIT                   VALUE "DB".

```

```

    . . .
    02 <preceding data items>          PIC <clause>.
    . . .
    02 PAYMENT-DATA                    PIC X(256).
    02 PAYMENT-DATA-VOUCHER           REDEFINES PAYMENT-DATA.
        04 VOUCHER-ORIGIN             PIC X(128).
        04 VOUCHER-SERIES             PIC X(128).
    02 PAYMENT-DATA-CREDITCARD        REDEFINES PAYMENT-DATA.
        04 CREDITCARD-NUMBER         PIC 9(18).
        04 CREDITCARD-COMPANY        PIC X(128).
        04 CREDITCARD-CODE           PIC 9(12).
        04 CREDITCARD-VALIDITY       PIC X(8).
    02 PAYMENT-DATA-TRANSFER          REDEFINES PAYMENT-DATA.
        04 TRANSFER-NAME             PIC X(128).
        04 TRANSFER-IBAN             PIC X(34).
        04 TRANSFER-BIC              PIC X(11).
    02 PAYMENT-DATA-DIRECTDEBIT        REDEFINES PAYMENT-DATA.
        04 DIRECTDEBIT-IBAN         PIC X(34).
        04 DIRECTDEBIT-NAME          PIC X(128).
        04 DIRECTDEBIT-EXPIRES       PIC 9(8).
    . . .
    02 <subsequent data items>        PIC <clause>.
    . . .

    . . .

*   read order record using ORDER-NUMBER
    . . .

*   set value indicating type of reply (MPO selector)
    IF <some-condition> THEN
        SET PAYMENT-TYPE-VOUCHER TO TRUE
    ELSE IF <some-other-condition> THEN
        SET PAYMENT-TYPE-CREDITCARD TO TRUE
    ELSE IF <some-further-condition> THEN
        SET PAYMENT-TYPE-TRANSFER TO TRUE
    ELSE
        SET PAYMENT-TYPE-DIRECTDEBIT TO TRUE
    END-IF.
    . . .

*   set fields (MPO case) depending on type of reply
    INITIALIZE PAYMENT-DATA.
    EVALUATE TRUE
        WHEN PAYMENT-TYPE-VOUCHER
            MOVE . . . TO VOUCHER-ORIGIN
            MOVE . . . TO VOUCHER-SERIES
        WHEN PAYMENT-TYPE-CREDITCARD
            MOVE . . . TO CREDITCARD-NUMBER
            MOVE . . . TO CREDITCARD-CODE
            MOVE . . . TO CREDITCARD-VALIDITY
        WHEN PAYMENT-TYPE-TRANSFER

```

```

        MOVE . . . TO TRANSFER-NAME
        MOVE . . . TO TRANSFER-IBAN
        MOVE . . . TO TRANSFER-BIC
    WHEN PAYMENT-TYPE-DIRECTDEBIT
        MOVE . . . TO DIRECTDEBIT-IBAN
        MOVE . . . TO DIRECTDEBIT-NAME
        MOVE . . . TO DIRECTDEBIT-EXPIRES
    WHEN
        . . .
END-EVALUATE.
. . .

```

COBOL server programs using alternative and dissimilar shapes for the output layout are extracted as described under [Set Multiple Possible Output \(MPO\) Structures](#).

#### Example 4: COBOL Server Using Optional Output

COBOL group data items can be used in a COBOL server program to return optional output similar to the example below; the returned data is built by copying the necessary COBOL structures into an output area. The optional output is one of OPTIONAL-OUTPUT-STRUCTURE1, OPTIONAL-OUTPUT-STRUCTURE2 or nothing. The presence of the optional output is controlled by a structure named CONTROL-AREA. Optional output with group data items are a variant of MPO, see [Example 3: COBOL Server Using Multiple Possible Output \(MPO\)](#).

```

WORKING-STORAGE SECTION.

01 INPUT-AREA.
   02 FIX-INPUT-ITEM1                PIC X(4).
   02 <some fields>                  PIC <clause>.
   . . .

01 OUTPUT-OFFSET                     PIC S9(9) BINARY.
01 OUTPUT-AREA                       PIC X(32000).
. . .

01 CONTROL-AREA.
   02 OPTIONAL-OUTPUT                PIC X(1).
      88 OPTIONAL-OUTPUT-1          VALUE "1".
      88 OPTIONAL-OUTPUT-2          VALUE "2".
      88 OPTIONAL-OUTPUT-NONE       VALUE "N".
   . . .

01 OPTIONAL-OUTPUT-STRUCTURE1.
   02 OPTIONAL-OUTPUT-ITEM11         PIC X(10).
   02 OPTIONAL-OUTPUT-ITEM12         PIC X(100).
   02 OPTIONAL-OUTPUT-ITEM13         PIC X(20).
   . . .

01 OPTIONAL-OUTPUT-STRUCTURE2.
   02 OPTIONAL-OUTPUT-ITEM21         PIC X(4).

```

```

02 OPTIONAL-OUTPUT-ITEM22          PIC X(50).
02 OPTIONAL-OUTPUT-ITEM23          PIC X(50).
. . .

01 FIX-OUTPUT-STRUCTURE1.
02 FIX-OUTPUT-ITEM11              PIC X(4).
02 FIX-OUTPUT-ITEM12              PIC X(20).
02 FIX-OUTPUT-ITEM13              PIC X(8).
. . .

01 FIX-OUTPUT-STRUCTURE2.
02 FIX-OUTPUT-ITEM21              PIC X(2).
02 FIX-OUTPUT-ITEM22              PIC X(10).
02 FIX-OUTPUT-ITEM23              PIC X(10).
. . .

IF <some-condition> THEN
  SET OPTIONAL-OUTPUT-1 TO TRUE
ELSE IF <some-other-condition> THEN
  SET OPTIONAL-OUTPUT-2 TO TRUE
ELSE
  SET OPTIONAL-OUTPUT-NONE TO TRUE
END-IF.

. . .

*   provide control area for optional output
    MOVE 1 TO OUTPUT-OFFSET.
    STRING CONTROL-AREA DELIMITED BY SIZE
    INTO OUTPUT-AREA WITH POINTER OUTPUT-OFFSET.

*   provide data items before optional output
    STRING FIX CONTROL-AREA DELIMITED BY SIZE
    INTO OUTPUT-AREA WITH POINTER OUTPUT-OFFSET.

*   provide optional output
    EVALUATE TRUE
      WHEN OPTIONAL-OUTPUT-1
        STRING OPTIONAL-OUTPUT-STRUCTURE1 DELIMITED BY SIZE
        INTO OUTPUT-AREA WITH POINTER OUTPUT-OFFSET
      WHEN OPTIONAL-OUTPUT-2
        STRING OPTIONAL-OUTPUT-STRUCTURE2 DELIMITED BY SIZE
        INTO OUTPUT-AREA WITH POINTER OUTPUT-OFFSET
    END-EVALUATE.

*   provide data items after optional output
    STRING FIX-OUTPUT-STRUCTURE2 DELIMITED BY SIZE
    INTO OUTPUT-AREA WITH POINTER OUTPUT-OFFSET.
. . .

```

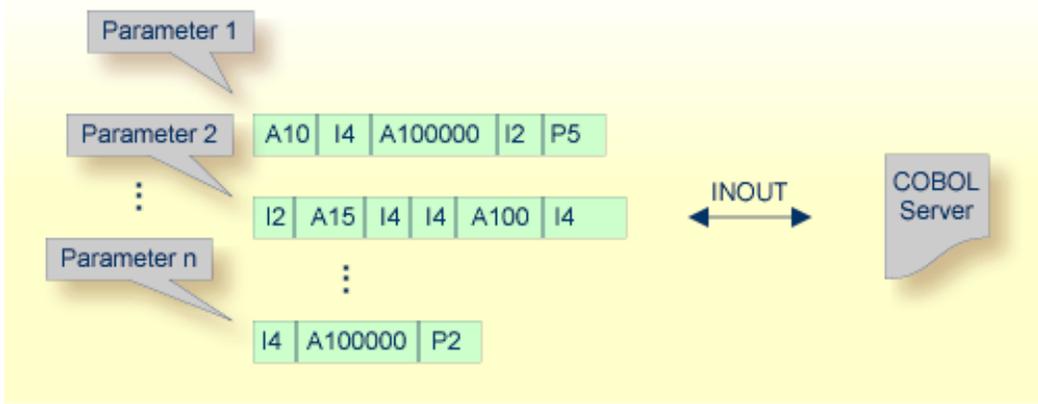
COBOL server programs using optional shapes for the output layout are extracted as described under *Set Multiple Possible Output (MPO) Structures*.

# 14

## Micro Focus with Standard Linkage Calling Convention

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■ Introduction .....	318
■ Extracting from a Standard Call Interface .....	318
■ Mapping Editor User Interface .....	320
■ Mapping Editor IDL Interface Mapping Functions .....	327
■ Programming Techniques .....	336



## Introduction

Because COBOL servers with a standard call interface always contain a `PROCEDURE DIVISION` header (see [PROCEDURE DIVISION Mapping](#)) with all parameters, the COBOL data items of the interface can be evaluated by the IDL Extractor for COBOL and are already offered by the wizard. In most cases the offered COBOL data items will be correct, but you should always check them manually.

If you have selected an IDL file and opened the COBOL Mapping Editor with an existing COBOL to IDL mapping, continue with [Mapping Editor User Interface](#).

## Extracting from a Standard Call Interface

If you are extracting IDL from a COBOL source or extending the IDL file by extracting an additional COBOL source with interface type Micro Focus with standard linkage calling convention, the **Extractor Settings** dialog appears (see also [Step 4: Define the Extraction Settings and Start Extraction](#)).

Make sure the interface type is correct.

COBOL Source	
File Name:	<input type="text" value="mftipc.cbl"/>
Operating System:	<input type="text" value="Windows"/>
Interface Type:	<input type="text" value="Micro Focus with standard linkage calling convention"/>

Press **Next** to open the COBOL Mapping Editor.

➤ **To select the COBOL interface data items of your COBOL server**

- 1 Add the COBOL data items to **COBOL Interface** by using the context menu or toolbar available in the *COBOL Source View* and *COBOL Interface*. See **Notes**.
- 2 Continue with *COBOL to IDL Mapping*.



**Notes:**

1. If there is a `PROCEDURE DIVISION` header available, the parameters listed define exactly the COBOL interface. These COBOL data items are within the `LINKAGE SECTION` and are already selected to the COBOL interface in initial state when you enter the COBOL Mapping Editor. The `PROCEDURE DIVISION` header might not be available if you are extracting from a copybook or part of the COBOL source.
2. It is very important to select the right COBOL data items describing the interface of the COBOL server correctly. This means the COBOL data items used as parameters must match in number and in sequence of formats (COBOL usage clause).
3. If your COBOL server contain `REDEFINES`, the first `REDEFINE` path is offered by default. Check manually whether this is the one you want. If not, correct it. You can select any other `REDEFINE` path.

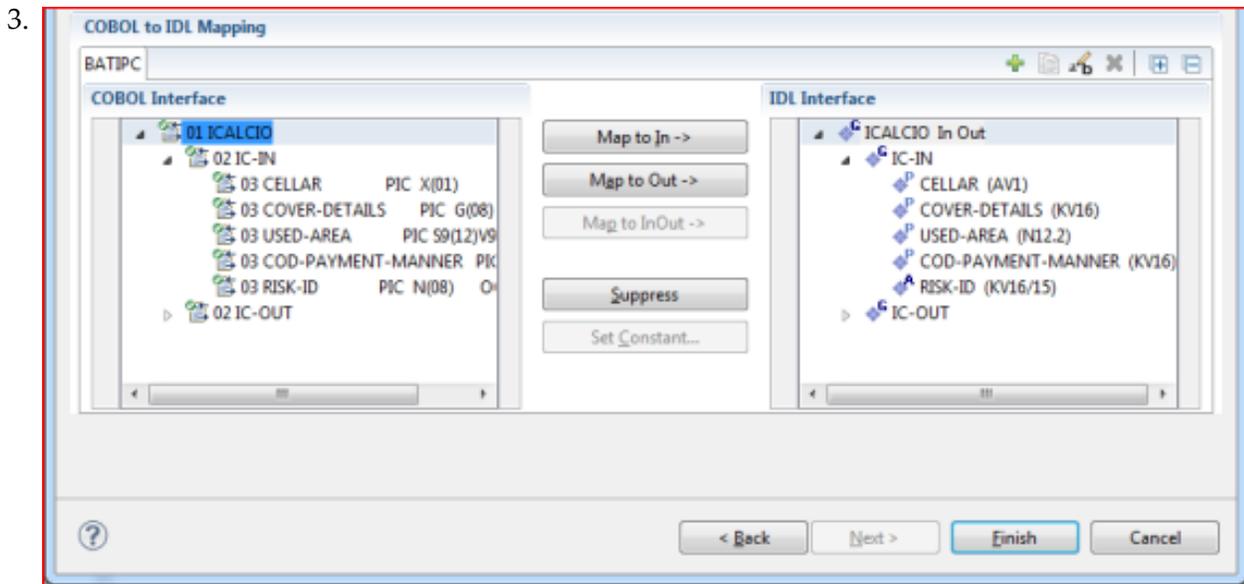
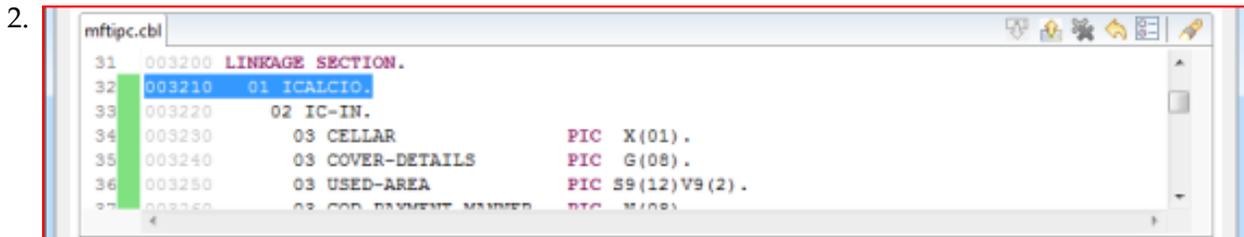
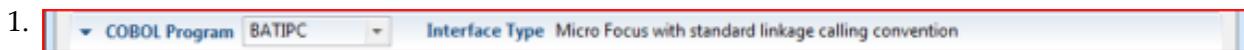
The user interface of the COBOL Mapping Editor is described below.

## Mapping Editor User Interface

This section assumes you have set the extraction settings as described above. The following areas of the COBOL Mapping Editor user interface are described here:

- [COBOL Program Selection](#)
- [COBOL Source View](#)
- [COBOL to IDL Mapping](#)

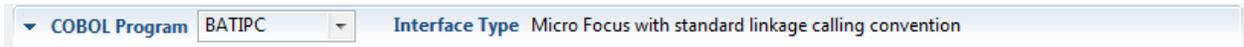
For COBOL server programs with standard call interface types, the user interface of the COBOL Mapping Editor looks like this:



1. **COBOL Program Selection.** Currently selected program with interface type
2. **COBOL Source View.** Contains all related sources for the currently selected COBOL program

3. **COBOL to IDL Mapping.** Tree view of your selected COBOL data items and mapping buttons with which you can map these items to your IDL interface

### COBOL Program Selection



The COBOL Program Selection displays the current selected COBOL program with its interface type. If you have extracted more than one COBOL program within the associated IDL file, you can switch to another COBOL program with its mapping by selecting the name in the combo box.

## COBOL Source View

```

31 003200 LINKAGE SECTION.
32 003210 01 ICALCIO.
33 003220 02 IC-IN.
34 003230 03 CELLAR          PIC X(01) .
35 003240 03 COVER-DETAILS  PIC G(08) .
36 003250 03 USED-AREA      PIC S9(12)V9(2) .
37 003260 03 COD-PAYMENT-MANNER PIC N(08) .

```

All COBOL data items contained in the LINKAGE and WORKING-STORAGE SECTION are offered in a text view. The text view contains all related sources (including copybooks) for the currently selected COBOL program. It is used for selecting data items and retrieving information from the original COBOL sources. The light green bar indicates that the data item is already contained in the COBOL Interface; a dark green bar indicates the data item is selectable and can be added to the COBOL Interface. This section can be collapsed. If you open the Editor with **Modify Interface** it is collapsed by default. The toolbar provides the following actions:

-  Add selected COBOL data item to COBOL Interface.
-  Remove selected COBOL data item from COBOL Interface.
-  Remove all COBOL data items from COBOL Interface.
-  Reset COBOL Interface to initial state.
-  Show dialog to modify COBOL Source Characteristics.
-  Show dialog to find text in Source.

The same functionality is also available from the context menu.

## COBOL to IDL Mapping

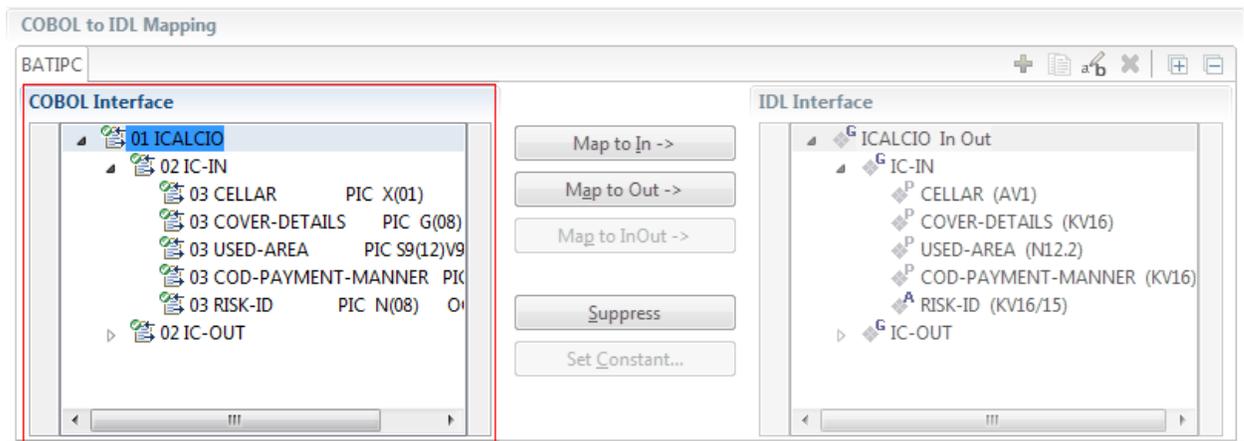
This section covers the following topics:

- [COBOL Interface](#)
- [Mapping Buttons](#)
- [IDL Interface](#)

### COBOL Interface

The **COBOL Interface** shows a tree view of your selected COBOL data items describing the interface of the COBOL server. A context menu is available for the COBOL data items, which provides mapping and other functions. On some COBOL data items, decision icons indicate where particular attention is needed, including mapping icons to visualize the COBOL data type and your current mapping.

The COBOL data item names are derived from the COBOL source from which they were extracted. If your COBOL interface contains parameters without a name, that is, the keyword `FILLER` is used, those COBOL data items are shown as `[FILLER]`. See [FILLER Pseudo-Parameter](#).



You can modify the COBOL interface using context menu or toolbar; decision and mapping icons provide additional information.

### Context Menu

The context menu on COBOL data items provides the following mapping and other functions, depending on the data item type, the COBOL level and the current mapping.

<b>Map to In   Out   InOut</b>	A suppressed COBOL data item becomes visible in the IDL interface. Used also to select another <code>REDEFINE</code> path.
<b>Suppress</b>	Suppress unneeded COBOL data items.
<b>Set Constant</b>	Set COBOL data items to constant.

**Remove from COBOL Interface** - Remove the data item from the COBOL interface. This also removes the mapped IDL parameter from all IDL interfaces for the current COBOL program. See [COBOL Program Selection](#).

See also [Mapping Editor IDL Interface Mapping Functions](#).

### Toolbar

The toolbar offers the following actions:

-  Create IDL Interface. Creates a new IDL interface based on the current COBOL interface: all IDL parameters are of IDL direction InOut; no IDL parameters are set to constant; for COBOL REDEFINE, the first REDEFINE path is mapped to IDL; FILLERS are suppressed according to your selection, see [Step 4: Define the Extraction Settings and Start Extraction](#).
-  Copy current IDL Interface. Creates a duplicate of the current IDL interface: all modifications such as IDL directions, suppress, selection of REDEFINE paths etc. are kept.
-  Remove current IDL Interface.
-  Rename current IDL Interface.
-  Expand the full tree.
-  Collapse the full tree.

See also [Map to Multiple IDL Interfaces](#).

### Decision Icons

The decision icons in the first column are set on COBOL data items where particular attention is needed:

-  This icon visualizes a COBOL REDEFINE. It is essential that you map the correct redefine path for your mapping to In, Out or InOut using the context menu. If you map a REDEFINE path, all other sibling REDEFINE paths are automatically set to "Suppress".

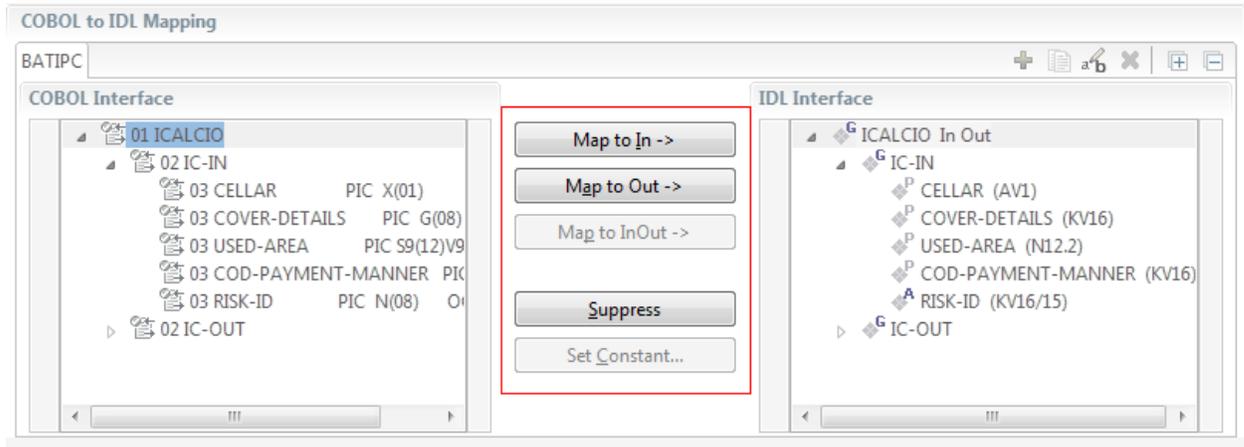
### Mapping Icons

The following mapping icons on the COBOL data items indicate your current IDL mapping:

-  Scalar parameter, mapped to In.
-  Scalar parameter, mapped to InOut.
-  Scalar parameter, mapped to Out.
-  Group parameter, here mapped to InOut.
-  REDEFINE parameter, here mapped to InOut.
-  Parameter set to Constant.

## Mapping Buttons

The following buttons are available:



### Map to In | Out | InOut ->

See *Map to In, Out, InOut*. A suppressed COBOL data item becomes visible in the IDL interface. Used also to select another REDEFINE path.

### Suppress

See *Suppress Unneeded COBOL Data Items*.

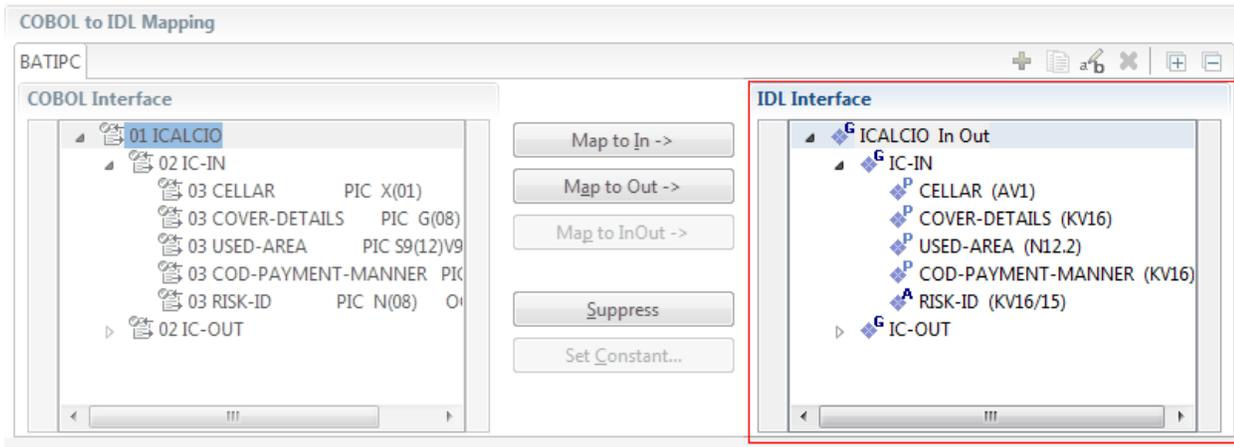
### Set Constant...

See *Set COBOL Data Items to Constants*.

## IDL Interface

If you have mapped the COBOL interface to multiple IDL interfaces, select the IDL interface by choosing the tabs. In the **IDL Interface** tree view, a context menu is also available with the following possibilities:

- Rename
- Remove from COBOL Interface. This also removes the mapped IDL parameter from all IDL interfaces for the current COBOL program. See *COBOL Program Selection* above.



## Mapping Editor IDL Interface Mapping Functions

This section covers the following topics:

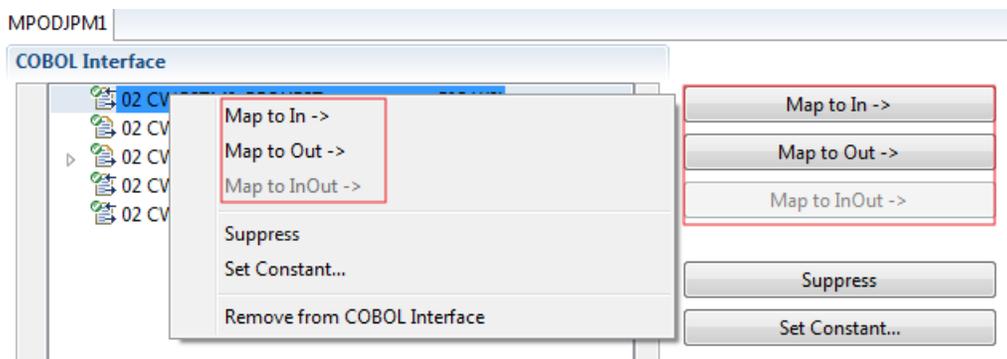
- Map to In, Out, InOut
- Map OCCURS DEPENDING ON
- Map to Multiple IDL Interfaces
- Select REDEFINE Paths
- Suppress Unneeded COBOL Data Items
- Set COBOL Data Items to Constants

### Map to In, Out, InOut

With the **Map to In**, **Map to Out**, **InOut** functions you make a COBOL data item visible as an IDL parameter in the IDL interface. With correct IDL directions you design the IDL interface by defining input and output parameters. COBOL programs have no parameter directions, so you need to set IDL directions manually.

#### > To provide IDL directions

- Go *step-by-step* through all *top-level* COBOL data items in the COBOL interface and use the **Map to In**, **Map to Out** and **InOut** functions available in the context menu of the COBOL interface and as mapping buttons to make the COBOL data items visible and provide IDL directions in the IDL interface:



#### Notes:

1. If a *top-level* COBOL *group* is mapped, the IDL direction is inherited by all subordinate COBOL data items and thus to the related IDL parameters in the IDL interface.
2. Subordinate COBOL data items can only be mapped to the same IDL direction as their *top-level* COBOL *group* data item.

3. With the inverse function **Suppress Unneeded COBOL Data Items** (see below) available in the context menu of the COBOL interface and as mapping button, a COBOL data item can be removed from the IDL interface.
4. IDL directions are described in the direction-attribute in `attribute-list` under *Software AG IDL Grammar* in the IDL Editor documentation.

If you are using an RPC server such as the z/OS (CICS | Batch), z/VSE (CICS | Batch), Micro Focus or BS2000/OSD RPC server, the amount of data to be transferred to/from the RPC client is reduced with correct IDL directions.

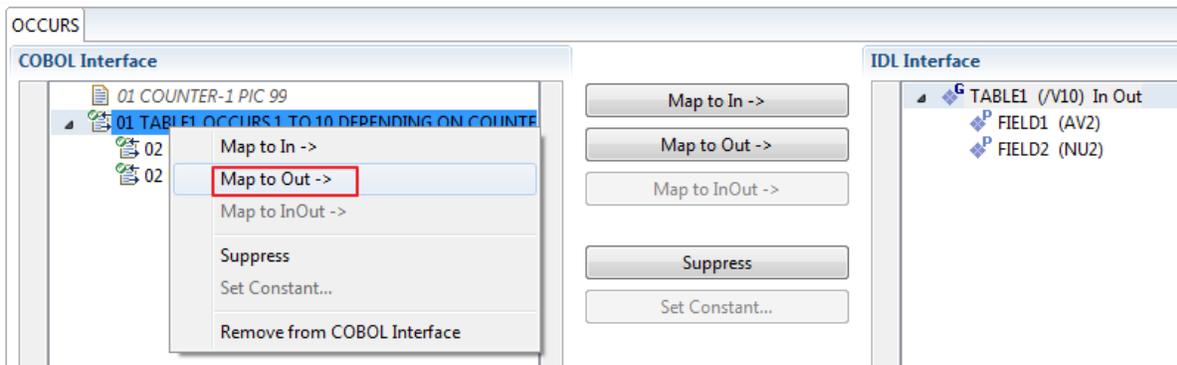
### Map OCCURS DEPENDING ON

With the **Map to In**, **Out**, **InOut** functions you can make the COBOL ODO subject (here COBOL data item TABLE) of a variable-sized COBOL table (see [COBOL Tables with Variable Size - DEPENDING ON Clause](#)) visible as an IDL unbounded group (with maximum). The ODO object (here COBOL data item COUNTER-1) is suppressed and therefore not part of the IDL interface. This is because the number of elements of the IDL unbounded group is already implicitly available. See the following example:

```
01 COUNTER-1 PIC 99.
01 TABLE OCCURS 1 TO 10 DEPENDING ON COUNTER-1
  02 FIELD1 PIC XX.
  02 FIELD2 PIC 99.
```

#### ➤ To map OCCURS DEPENDING ON

- 1 Add the COBOL ODO subject (here data item TABLE) and ODO object (here data item COUNTER-1) to the COBOL interface. It is important both data items are in the COBOL interface.
- 2 Use the **Map to In**, **Out** and **InOut** functions available in the context menu of the COBOL interface and as mapping buttons and apply IDL directions for the ODO subject (data item TABLE):

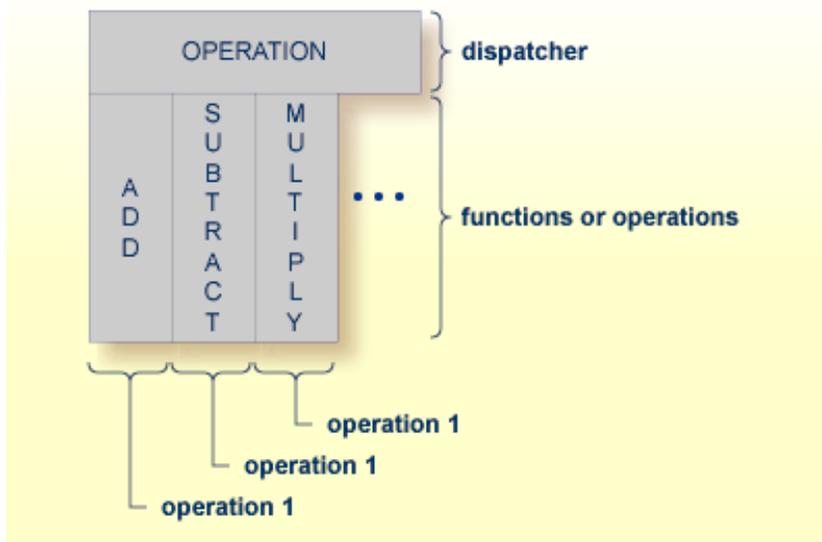


 **Notes:**

1. The ODO subject can be mapped to the IDL interface.
2. The ODO object is always suppressed, but is required to be part of the COBOL interface.
3. IDL directions are described in the direction-attribute in `attribute-list` under *Software AG IDL Grammar* in the IDL Editor documentation.

### Map to Multiple IDL Interfaces

Assume the COBOL server program provides multiple functions or operations, in the following example ADD, SUBTRACT, MULTIPLY. Some dispatcher front-end code executes the correct function, for example, depending on a *function-code* or *operation-code* parameter:



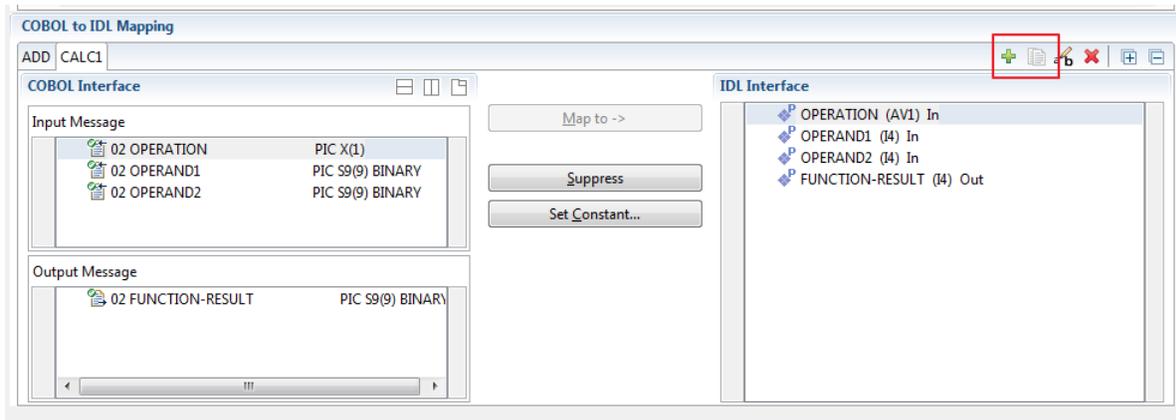
This example is described in more detail under [Example 1: COBOL Server with Multiple Functions](#).

If you have such a situation, a good approach is to expose each COBOL server program function separately as an IDL program. This gives advantages in further processing of the IDL and COBOL mapping files (SVM and CVM). For example:

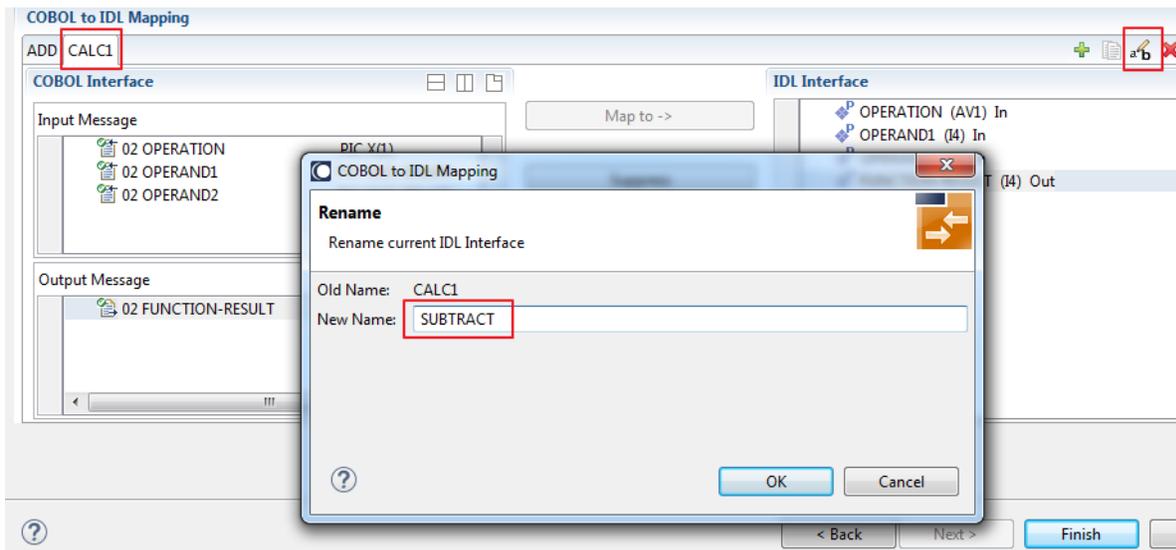
- If your target endpoint is a web service: instead having a Web service with a single operation, you get a web service with multiple operation, one operation for each COBOL function.
- If your target endpoint is Java or .NET: instead having a class with a single method, you get a class with multiple methods, one method for each COBOL function.

> To map a COBOL interface to multiple IDL interfaces

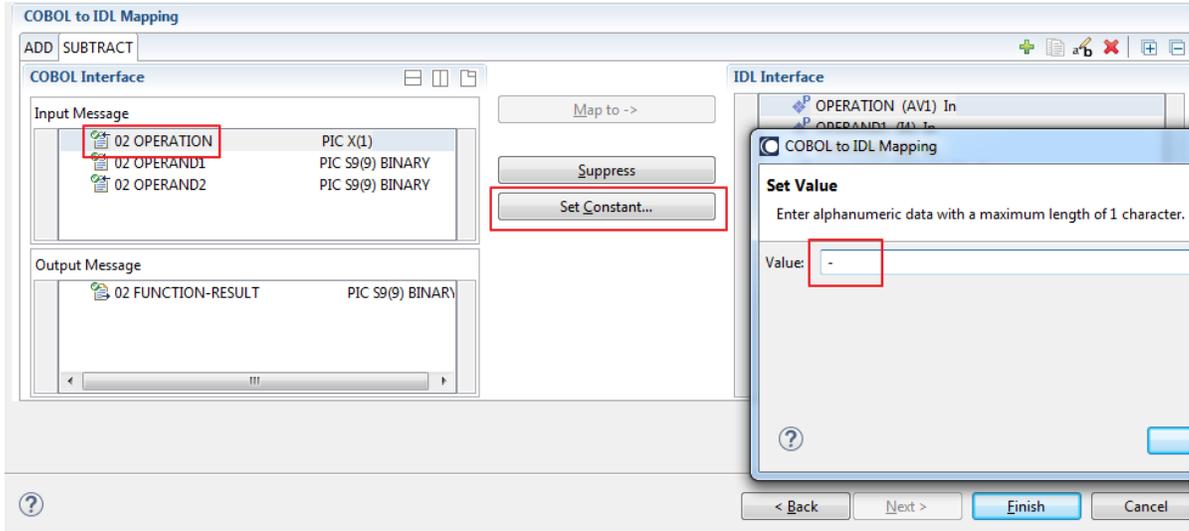
- 1 Select the tab with COBOL to IDL Mapping. For each function, define a separate IDL interface with the toolbar functions  or :



- 2 Give the IDL interfaces meaningful names with the toolbar function :



- 3 Define the required constant values to the *function-code* or *operation-code* parameter, see *Set COBOL Data Items to Constants* above:



For the delivered Example 1: COBOL Server with Multiple Functions:

- First, for step 1 above: Extract and define 3 separate IDL programs ADD, SUBTRACT, MULTIPLY.
- Second, for step 2 above: Rename them to suitable names, e.g. 'ADD', 'SUBTRACT', 'MULTIPLY'.
- Third, for step 3 above: Define the constants '+', '-' and '\*' to the parameter OPERATION respectively.
- After pressing **Finish**, the following IDL together with a server mapping file is created. See *Server Mapping Files for COBOL*.

```

library 'EXAMPLE' is

program 'ADD' is
define data parameter
  1 OPERAND1 (I4) In
  1 OPERAND2 (I4) In
  1 FUNCTION-RESULT (I4) Out
end-define

program 'SUBTRACT' is
define data parameter
  1 OPERAND1 (I4) In
  1 OPERAND2 (I4) In
  1 FUNCTION-RESULT (I4) Out
end-define

program 'MULTIPLY' is
define data parameter
  1 OPERAND1 (I4) In
  1 OPERAND2 (I4) In
  1 FUNCTION-RESULT (I4) Out
end-define

```

 **Notes:**

1. The following functions are offered to create further mappings from the COBOL interface, resulting in multiple IDL interfaces (IDL programs).

Icon	Function	Description
	Create IDL Interface	Creates a new IDL interface based on the current COBOL interface. All IDL parameters are of IDL direction InOut; no IDL parameters are set to constant; for COBOL REDEFINE, the first REDEFINE path is mapped to IDL; FILLERS are suppressed according to your selection, see <a href="#">Step 4: Define the Extraction Settings and Start Extraction</a> .
	Copy current IDL Interface	Creates a duplicate of current IDL interface. All modifications such as IDL directions, suppress, selection of REDEFINE paths etc. are kept.
	Rename current IDL Interface	The default name for the IDL interface is based on the COBOL program name plus appended number. With this function you can give the IDL interface a suitable name.
	Remove current IDL Interface	Deletes the current IDL interface.

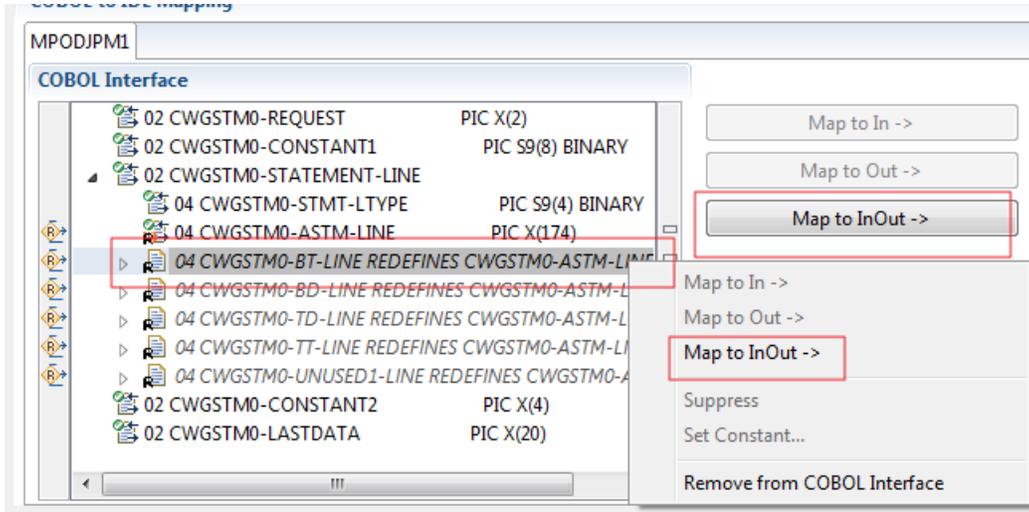
2. With the steps 1 thru 3 described here you can emulate the behavior of function Map to Operation of EntireX version 9.6 and earlier.

### Select REDEFINE Paths

For COBOL server programs containing COBOL REDEFINES, the correct REDEFINE path needs to be chosen for the IDL interface.

> **To select redefine paths**

- Use the **Map to In, Out** or **InOut** functions available in the context menu of the COBOL interface and as mapping buttons to make the COBOL REDEFINE path available in the IDL interface.



Begin with the COBOL REDEFINE defined at the highest level first. Work through all inner COBOL REDEFINE data items, going from higher levels to lower levels.

#### Notes:

1. Only one REDEFINE path of a COBOL REDEFINE can be mapped to the IDL interface. All COBOL REDEFINE siblings are suppressed.
2. If a REDEFINE path is actively mapped to the IDL interface, all COBOL REDEFINE siblings are suppressed.
3. You can suppress all REDEFINE paths of a COBOL REDEFINE. Simply suppress the active REDEFINE path, see *Suppress Unneeded COBOL Data Items* above.

### Suppress Unneeded COBOL Data Items

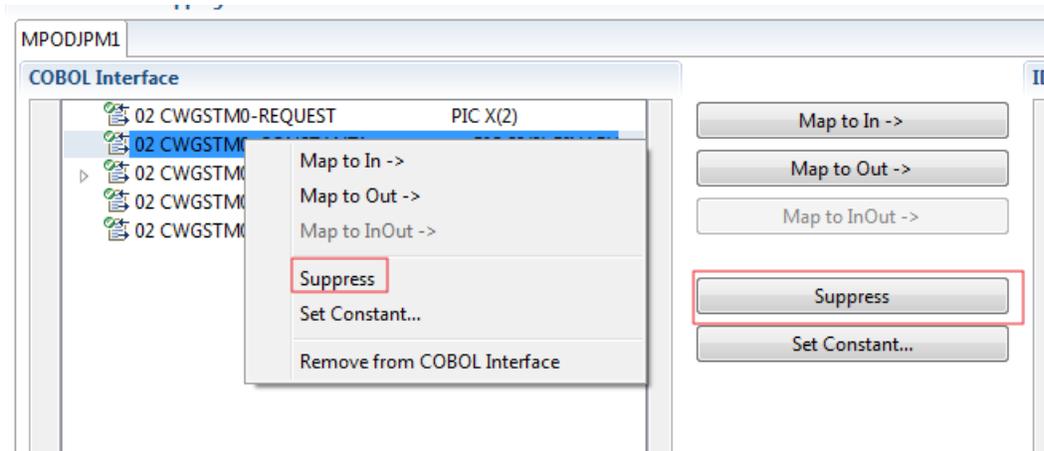
COBOL data items without any relevant information can be made invisible in the IDL interface. The IDL interface is simplified - it becomes shorter and tidier. This is useful, for example

- for FILLER data items
- if the RPC client or Adapter Service does not need an Out parameter
- if the RPC server or Adapter Service does not need an In parameter and a low value can be provided

If you are using an RPC server such as the z/OS (CICS | Batch), z/VSE (CICS | Batch), Micro Focus or BS2000/OSD RPC server, the amount of data to be transferred to/from the RPC client is also reduced.

### ➤ To suppress unneeded COBOL data items

- Use the **Suppress** function available in the context menu of the COBOL interface and as mapping button to make the COBOL data item invisible in the IDL interface:



#### Notes:

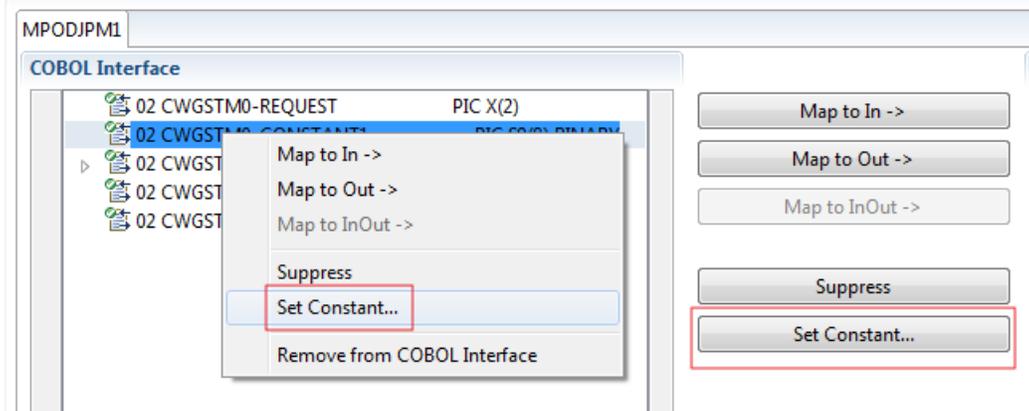
1. The COBOL data item is not part of the IDL interface. It is invisible for RPC clients or Adapter Service.
2. The RPC server or Adapter Service provides the COBOL data item to your COBOL server with low value, managing the offset to the next COBOL data item.
3. If a COBOL group is suppressed, all subordinate COBOL data items are suppressed as well.
4. With the inverse functions **Map to In**, **Out** or **InOut** (see above) available in the context menu of the COBOL interface and as mapping buttons, a COBOL data item is made visible in the IDL interface again.

### Set COBOL Data Items to Constants

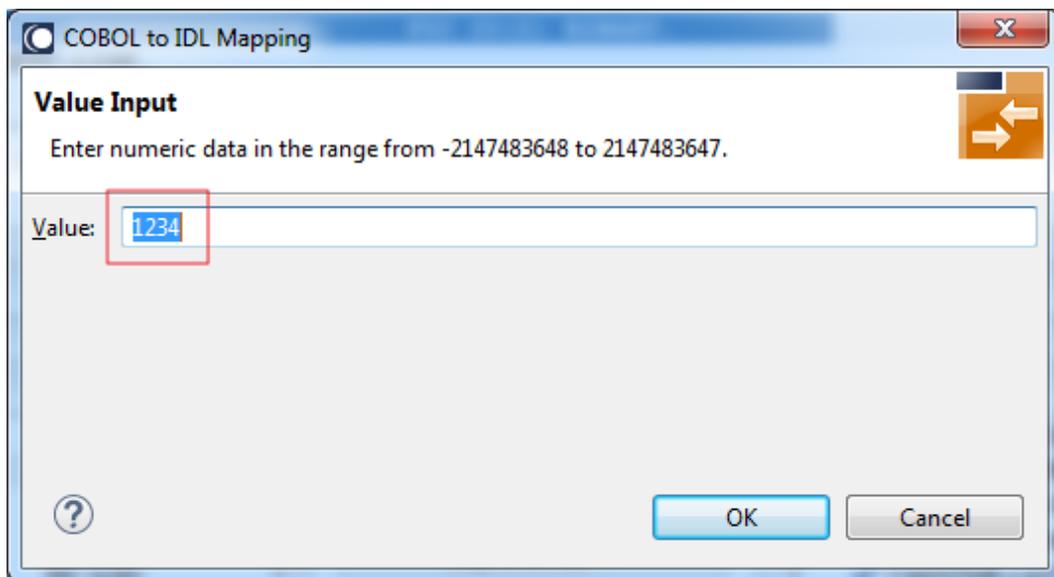
COBOL data items that always require fixed constant values on input to the COBOL server program can be made invisible in the IDL interface and initialized with the required constant values. This is useful for keeping the IDL interface short and tidy. RPC clients or Adapter Services are not bothered with IDL parameters that always contain constants, such as `RECORD-TYPES`. This function is often used in conjunction with **Map to Multiple IDL Interfaces** (see above).

### ➤ To set COBOL data items to constants

- 1 Use the **Set Constant** function available in the context menu of the COBOL interface and as mapping button to define a constant value for a COBOL data item:



- 2 You are prompted with a window to enter the constant value:



 **Notes:**

1. The COBOL data item is not part of the IDL interface. It is invisible for RPC clients or Adapter Services.
2. The RPC server or Adapter Service provides the defined constant in the COBOL data item to your COBOL server.
3. With the functions **Map to In**, **Out**, **InOut** (see above) available in the context menu of the COBOL interface and as mapping buttons, a COBOL data item can be made visible in the IDL interface again.

## Programming Techniques

- [Example 1: COBOL Server with Multiple Functions](#)

### Example 1: COBOL Server with Multiple Functions

Assume a COBOL server program has a FUNCTION or OPERATION code COBOL data item in its COBOL interface. The COBOL server program behaves differently depending on field values of this data item. See the following example where a COBOL programs implements a calculator with the functions ADD, SUBTRACT, MULTIPLY, etc. The execution of the different functions is controlled by the COBOL data item OPERATION:

```
. . .  
01 OPERATION                PIC X(1).  
01 OPERAND1                 PIC S9(9) BINARY.  
01 OPERAND2                 PIC S9(9) BINARY.  
01 FUNCTION-RESULT         PIC S9(9) BINARY.  
. . .  
MOVE 0 TO FUNCTION-RESULT.  
EVALUATE OPERATION  
    WHEN "+"  
        ADD OPERAND1 OPERAND2  
        GIVING FUNCTION-RESULT  
    WHEN "-"  
        SUBTRACT OPERAND2 FROM OPERAND1  
        GIVING FUNCTION-RESULT  
    WHEN "*"  
        MULTIPLY OPERAND1 BY OPERAND2  
        GIVING FUNCTION-RESULT  
    WHEN . . .  
  
END-EVALUATE.  
. . .
```

You can expose each COBOL server program function separately. The advantages or reasons for wanting this depend on the target endpoint. For example:

- **Web Service**

Instead having a Web service with a single operation, you want a web service with multiple operations, one operation for each COBOL function.

- **Java or .NET**

Instead having a class with a single method, you want a class with multiple methods, one method for each COBOL function.

- etc.

To do this you need to extract the COBOL server program as described under *Map to Multiple IDL Interfaces*.



# 15 IDL Extractor for COBOL Preferences

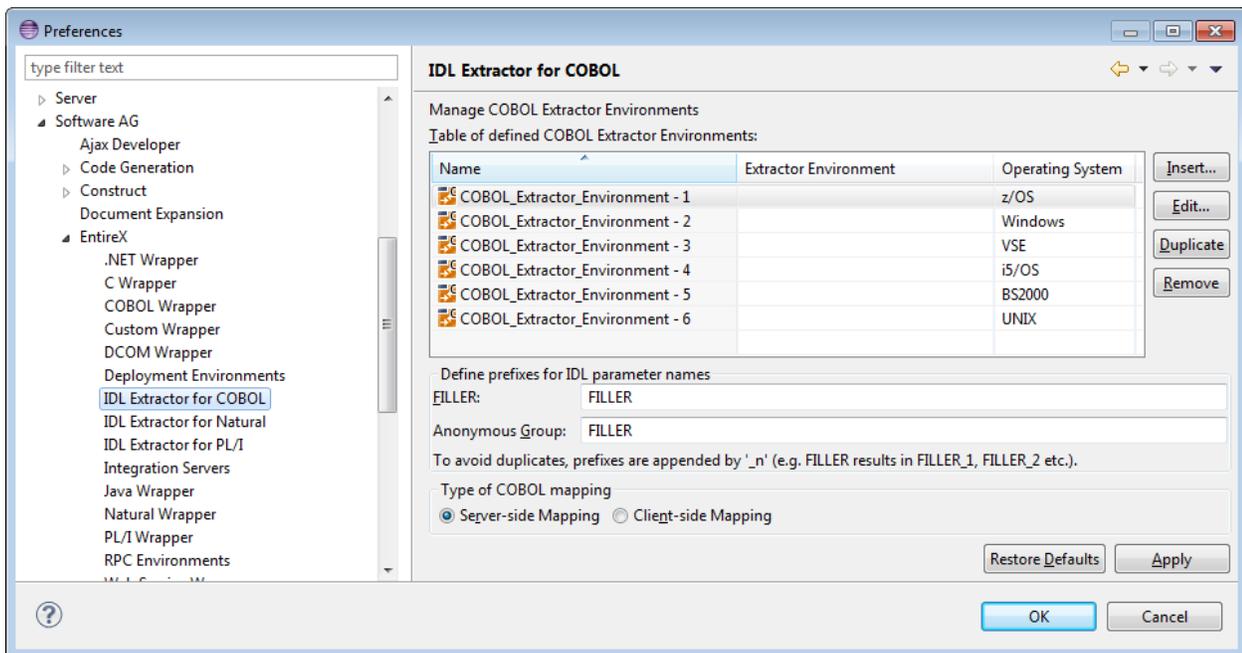
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- Create New Local Extractor Environment (z/OS, z/VSE, BS2000/OSD and IBM i) ..... 342
- Create New Local Extractor Environment for Micro Focus (UNIX and Windows) ..... 346
- Create New Remote Extractor Environment (z/OS) ..... 350
- Create New Remote Extractor Environment (BS2000/OSD) ..... 354

The IDL Extractor for COBOL preferences are used to manage COBOL extractor environments. A COBOL extractor environment provides defaults for the extraction and refers to COBOL programs and copybooks

- stored locally on the same machine where the EntireX Workbench is running, a so-called local COBOL extractor environment, or
- stored remotely on a host computer, a so-called remote COBOL extractor environment. The Extractor Service is required to access COBOL programs and copybooks remotely with a remote COBOL extractor environment. The Extractor Service is supported on operating systems z/OS and BS2000/OSD. See *Extractor Service* in the RPC Server documentation for Batch | IMS | BS2000/OSD.

COBOL extractor environments are offered in the IDL Extractor for COBOL wizard to reference the COBOL programs and copybooks and retrieve defaults for the IDL extraction. To create, edit, duplicate and remove COBOL extractor environments, open the **Preferences** page and use the buttons on the right.



The **Preferences** page contains further settings valid for all COBOL extractor environments:

- **Define prefixes for IDL parameter names**  
The defined prefixes are used for *FILLER Pseudo-Parameter*.
- **Type of COBOL mapping**  
Every EntireX Workbench (Eclipse) workspace is either in client-side mapping mode (generating EntireX Workbench server mapping files with extension .cvm) or server-side mapping mode (generating EntireX Workbench server mapping files with extension .svm). See *Server Mapping Files for COBOL* for an introduction. You can adjust the mode here, which will also set the mode

of the COBOL Wrapper to the same value. See *Generation Settings - Preferences* in the COBOL Wrapper documentation.

Server mapping files are generated automatically for RPC servers if required. See *When is a Server Mapping File Required? - IDL Extractor for COBOL* in the *EntireX Workbench* documentation.

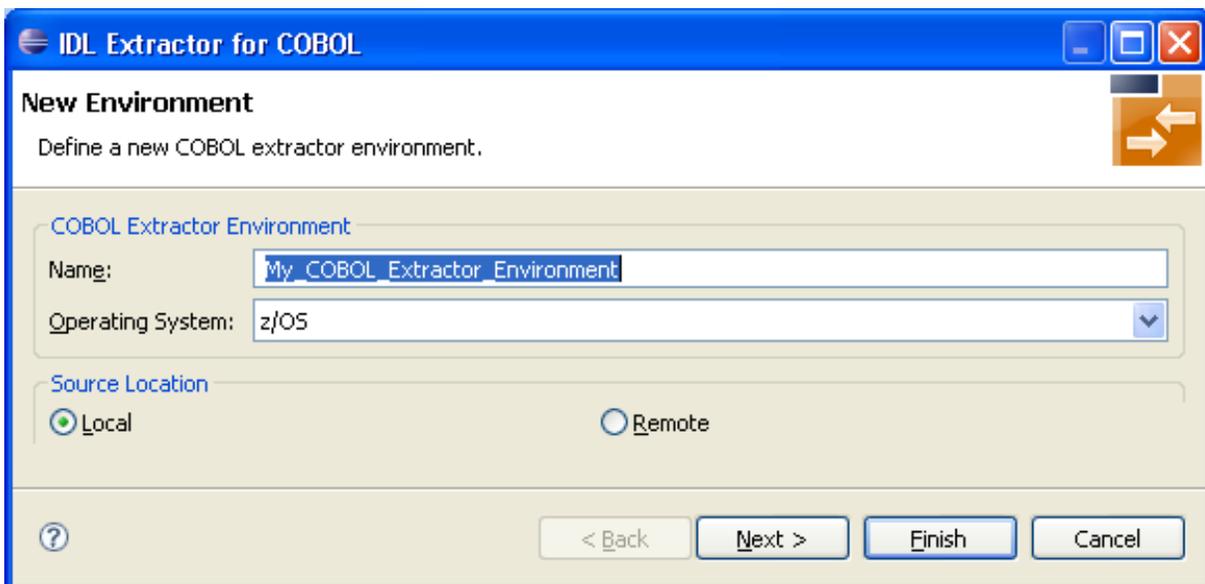
## Create New Local Extractor Environment (z/OS, z/VSE, BS2000/OSD and IBM i)

This section describes the four steps for creating a new local COBOL extractor environment to extract z/OS, z/VSE, BS2000/OSD or IBM i COBOL programs.

- [Step 1: Define the New Local Environment](#)
- [Step 2: Define the Default Settings](#)
- [Step 3: Define the Local Extractor Environment](#)
- [Step 4: Define the Local Copybook Locations](#)

### Step 1: Define the New Local Environment

On the New Environment page you can specify **Name** and **Operating system**.



The screenshot shows the 'New Environment' dialog box. The title bar reads 'IDL Extractor for COBOL'. The main title is 'New Environment' with the subtitle 'Define a new COBOL extractor environment.' Below this, there are two sections: 'COBOL Extractor Environment' and 'Source Location'. In the 'COBOL Extractor Environment' section, the 'Name' field contains 'My\_COBOL\_Extractor\_Environment' and the 'Operating System' dropdown is set to 'z/OS'. In the 'Source Location' section, the 'Local' radio button is selected, and the 'Remote' radio button is unselected. At the bottom of the dialog, there are four buttons: '< Back', 'Next >', 'Finish', and 'Cancel'.

#### » To define the new environment settings

- 1 Enter a unique **Name** for the COBOL extractor environment.
- 2 Select the **Operating system**.
- 3 Select "Local" for **Source Location**.

## Step 2: Define the Default Settings

The **Default Settings** page provides defaults for *Step 4: Define the Extraction Settings and Start Extraction* in *Using the IDL Extractor for COBOL - Overview*. You can set defaults for interface type and COBOL to IDL mapping.

**Default Settings**  
Define the default settings for the COBOL extractor environment.

**COBOL Extractor Environment**  
Name: My\_COBOL\_Extractor\_Environment

**COBOL Source Characteristics**  
Operating System: z/OS  
Interface Type: CICS with DFHCOMMAREA calling convention

**IMS MPP message interface (IMS Connect)**  
Transaction field length in COBOL source: \* 10  
 Ask for Transaction Name - specification at design time  
 Create IDL parameter for Transaction Name - specification at runtime

**IMS BMP with standard linkage calling convention**  
IMS PSB List:  Browse...

**CICS with Channel Container calling convention**  
Channel Name: EntireXChannel

**COBOL to IDL Mapping**  
Map alphanumeric fields (PICTURE X, A, G, N) to  
 Strings with variable length (Java, .NET, DCOM, C, Natural, SOAP, XML)  
 Strings with fixed length (COBOL, PL/I)  
 Map FILLER fields to IDL

? < Back Next > Finish Cancel

### ➤ To define the default extraction settings

- 1 Select the default **Interface Type**. See *Supported COBOL Interface Types*.
- 2 Depending on the interface type, additional information can be set. For interface type

- *CICS with Channel Container Calling Convention*, you can set the channel name.
- *IMS MPP Message Interface (IMS Connect)*, you can set defaults for the transaction name. Possible options are a constant transaction name defined during extraction process or an IDL parameter to be specified at runtime.
- *IMS BMP with Standard Linkage Calling Convention*, you can set the default for **IMS PSB List**.

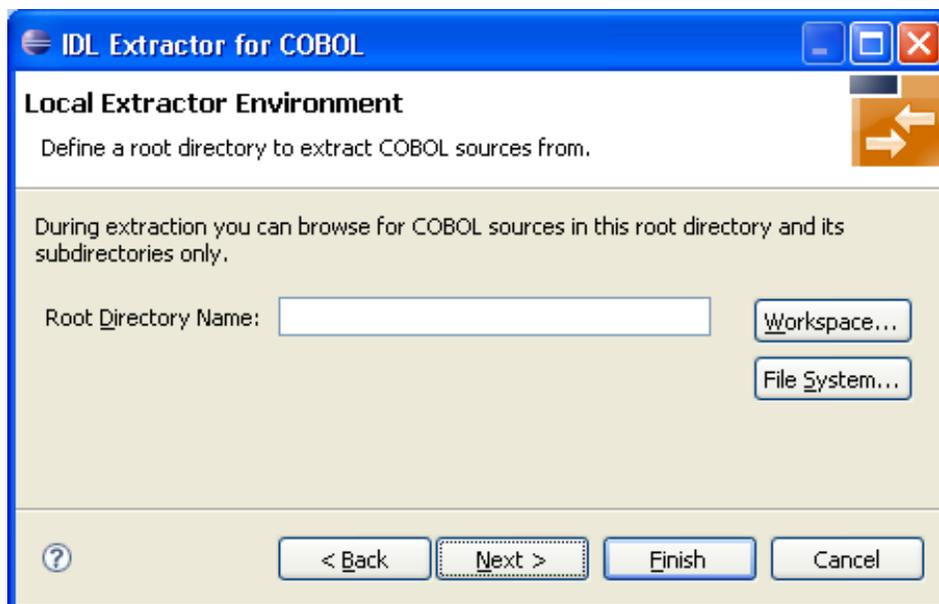
For more information refer to *Step 4: Define the Extraction Settings and Start Extraction*.

- 3 Specify a default value for **COBOL to IDL Mapping**. See *COBOL to IDL Mapping*.

Press **Next** and continue with *Step 3: Define the Local Extractor Environment* below.

### Step 3: Define the Local Extractor Environment

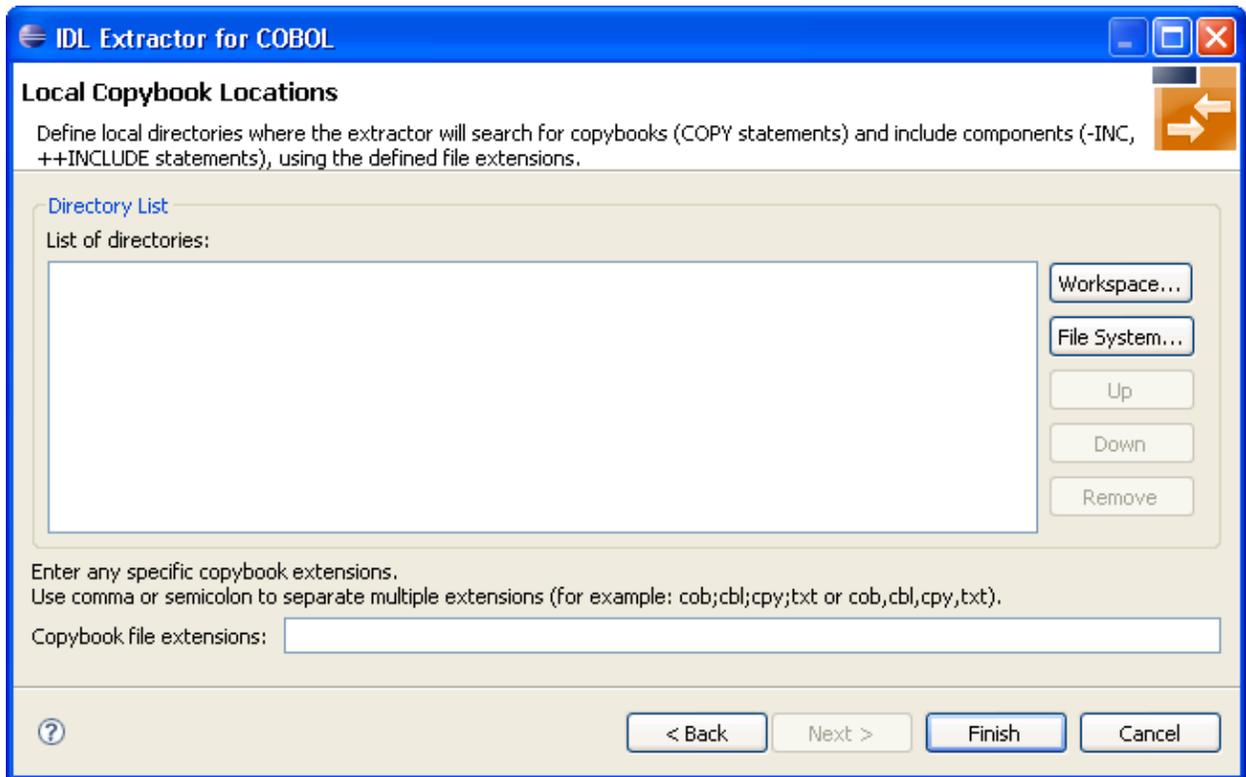
On the **Local Extractor Environment** page you can provide a default directory name for the COBOL programs:



1. Choose **Workspace...** or **File System...** to browse for a folder.
2. Choose **Next** and continue with *Step 4: Define the Local Copybook Locations* below.

## Step 4: Define the Local Copybook Locations

On the **Local Copybook Location** page you can add directories that will be used to resolve copybooks. Copybooks and members referenced with COPY statements, CA Librarian - INC statements and CA Panvalet ++INCLUDE statements will be searched for in the defined local directories:



The file extensions for copybooks can also be entered. If no extensions are specified, the IDL Extractor for COBOL wizard will try to locate copybooks without any file extensions.

Press **Workspace...** or **File System...** to browse for a folder.

Press **Finish**.

## Create New Local Extractor Environment for Micro Focus (UNIX and Windows)

---

This section describes the four steps for creating a new local COBOL extractor environment to extract Micro Focus COBOL programs.

- [Step 1: Define the New Local Environment](#)
- [Step 2: Define the Default Settings](#)
- [Step 3: Define the Local Extractor Environment](#)

- Step 4: Define the Local Copybook Locations

### Step 1: Define the New Local Environment

On the **New Environment** page you can specify the **Name** and **Operating system**. Only UNIX and Windows operating systems can be used for Micro Focus COBOL.

#### > To define the default extraction settings

- 1 Enter a unique name for the COBOL extractor environment.
- 2 Select the **Operating system** "UNIX" or "Windows".
- 3 Select "Local" for **Source location**.

## Step 2: Define the Default Settings

The **Default Settings** page provides defaults for *Step 4: Define the Extraction Settings and Start Extraction* in *Using the IDL Extractor for COBOL - Overview*.

You can set defaults for **Interface type**, **Compiler directives** and **COBOL to IDL Mapping**.

**IDL Extractor for COBOL**

**Default Settings**

Define the default settings for the COBOL extractor environment.

**COBOL Extractor Environment**

Name: My\_COBOL\_Extractor\_Environment

**COBOL Source Characteristics**

Operating System: Windows

Interface Type: Micro Focus with standard linkage calling convention

**Compiler Directives**

Meaning of PIC N without USAGE clause: DISPLAY-1 (DBCS)

Format of source code: Fixed (column 7 - 72)

TAB stop width: 8

**COBOL to IDL Mapping**

Map alphanumeric fields (PICTURE X, A, G, N) to

Strings with variable length (Java, .NET, DCOM, C, Natural, SOAP, XML)

Strings with fixed length (COBOL, PL/I)

< Back   Next >   Finish   Cancel

### > To define the default extraction settings

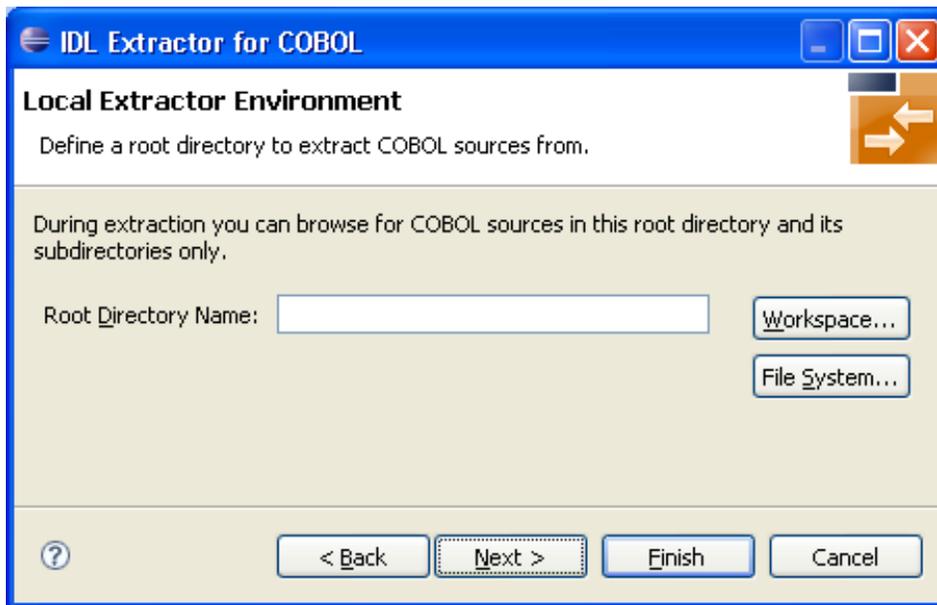
- 1 Refer to *Step 2: Define the Default Settings* for a local extractor environment for field descriptions. Select the default **Interface type**. See *Supported COBOL Interface Types*.
- 2 Select a value for **Meaning of PIC N without USAGE clause**. Select "NATIONAL" for IDL mapping to data type U, or "DISPLAY-1" (DBCS) for data type K. "DISPLAY-1" (DBCS) is the default, which is the same as Micro Focus compilers. See also *COBOL to IDL Mapping*.

- 3 Select the source code format. Use "Fixed" (default) or "Variable" to change the interpreted source code columns. Refer to your Micro Focus documentation for further information.
- 4 Enter the **TAB stop width**. Typical values are 4 or 8 (default).
- 5 Specify the default **COBOL to IDL Mapping**. See [COBOL to IDL Mapping](#).
- 6 Choose **Next** and continue with the [Step 3: Define the Local Extractor Environment](#) below.

Refer to [Step 2: Define the Default Settings](#) for a local extractor environment for field descriptions.

### Step 3: Define the Local Extractor Environment

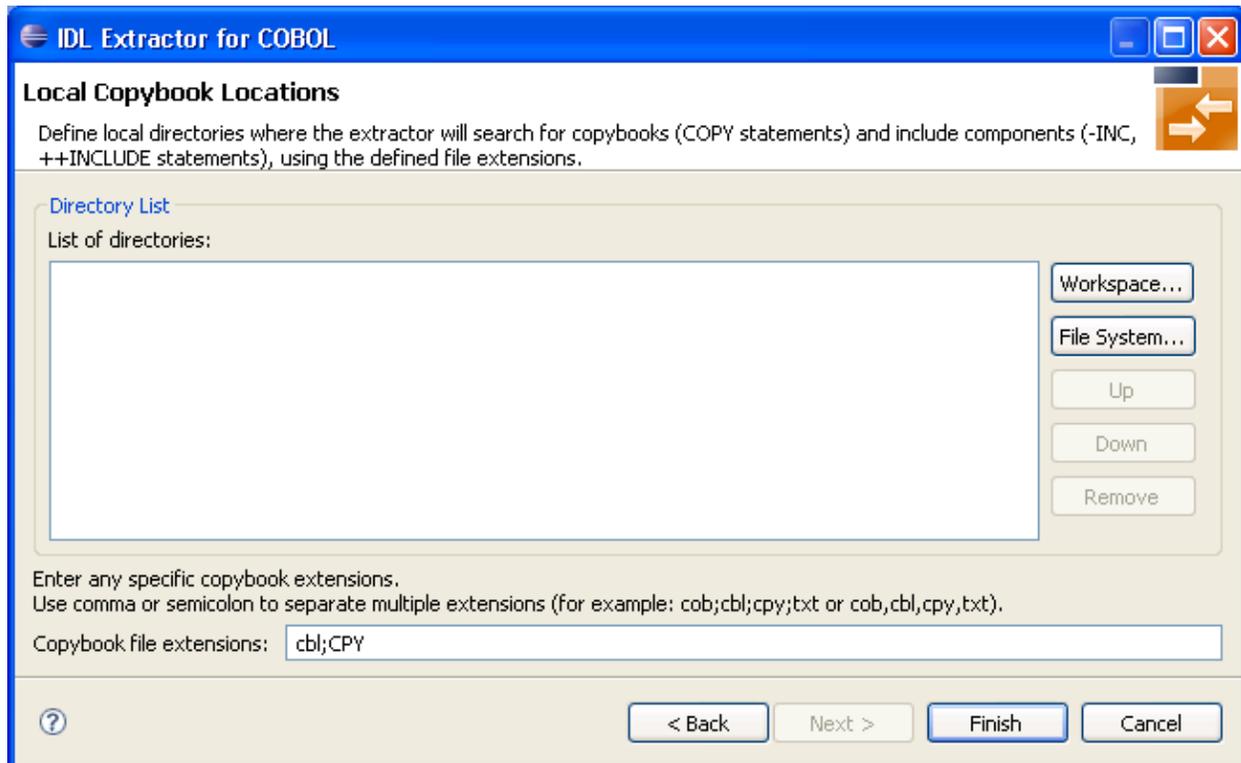
On the **Local Extractor Environment** page you can provide a default directory name for the COBOL programs:



1. Choose **Workspace...** or **File System...** to browse for a folder.
2. Choose **Next** and continue with [Step 4: Define the Local Copybook Locations](#) below.

## Step 4: Define the Local Copybook Locations

On the **Local Copybook Location** page you can add directories that will be used to resolve copybooks. Copybooks and members referenced with COPY statements, CA Librarian -INC statements and CA Panvalet ++INCLUDE statements will be searched for in the defined local directories:



The file extensions for copybooks can also be entered. If no extensions are specified, the IDL Extractor for COBOL wizard will try to locate copybooks without any file extensions.

Choose **Workspace...** or **File System...** to browse for a folder.

Choose **Finish**.

## Create New Remote Extractor Environment (z/OS)

This section describes the four steps for creating a new remote COBOL extractor environment to extract remotely z/OS COBOL programs stored in partitioned data sets or CA Librarian data sets.

- [Step 1: Define the New Remote Environment](#)
- [Step 2: Define the Default Settings](#)
- [Step 3: Define the Remote Extractor Environment](#)

- [Step 4: Define the Remote Copybook Locations](#)

### Step 1: Define the New Remote Environment

On the **New Environment** page you can specify **Name**, **Operating system** and the **Remote Source Location**.

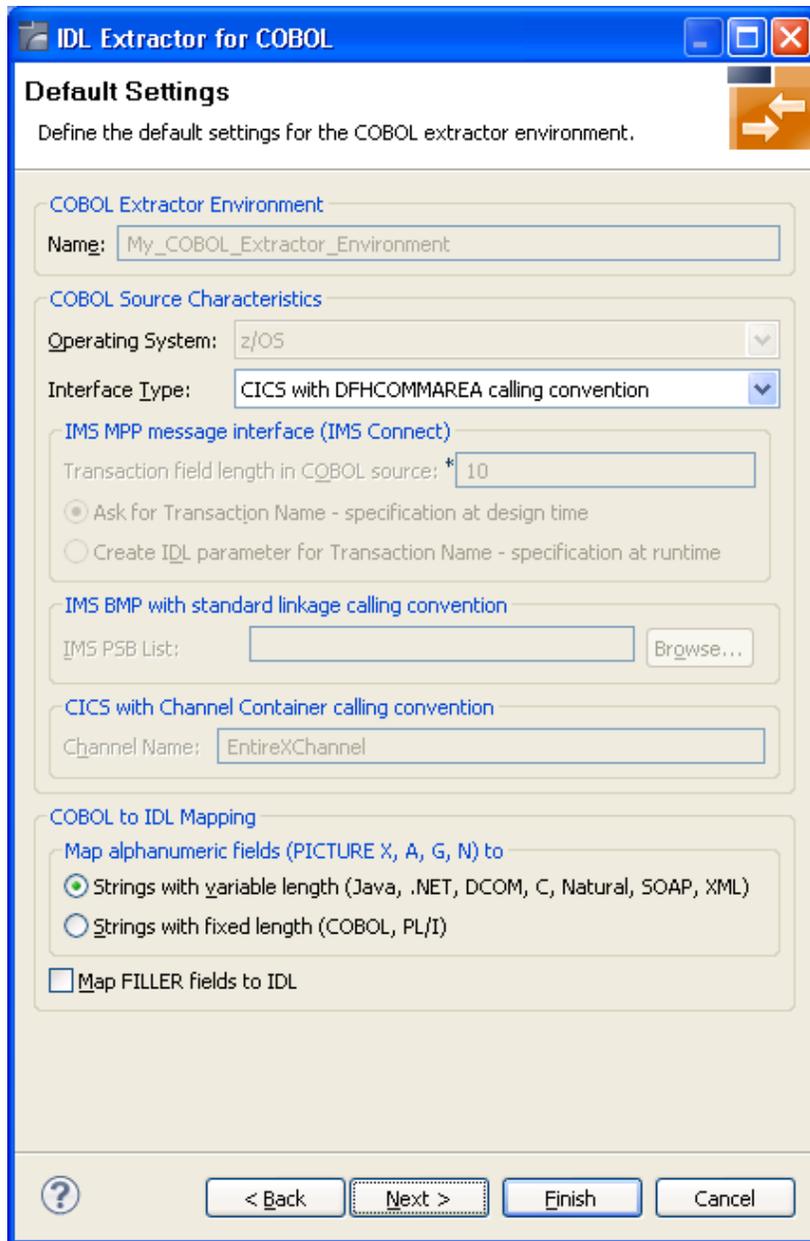
#### > To define the new environment settings

- 1 Enter a unique name for the COBOL extractor environment.
- 2 Select the **Operating system**.
- 3 Select "Remote" for **Source location**.

### Step 2: Define the Default Settings

The **Default Settings** page provides defaults for [Step 4: Define the Extraction Settings and Start Extraction](#) in [Using the IDL Extractor for COBOL - Overview](#).

You can set defaults for **Interface Type** and **COBOL to IDL Mapping**.



➤ **To define the default extraction settings**

- See *Step 2: Define the Default Settings* in section *Create New Local Extractor Environment (z/OS, z/VSE, BS2000/OSD and IBM i)*.

Press **Next** and continue with *Step 3: Define the Remote Extractor Environment* below.

### Step 3: Define the Remote Extractor Environment

The connection to the Extractor Service to browse for COBOL programs is defined on the **Remote Extractor Environment** page. See *Extractor Service*.

**Remote Extractor Environment**

Define an extractor service to extract remote COBOL sources from PDS or CA-Librarian datasets. Specify broker parameters and filter settings.

**Broker Parameters**

Broker ID: \*

Server Address: \*

Timeout (Seconds): 60

**EntireX Authentication**

User ID:

Password:

**RPC Server Authentication**

RPC User ID:

RPC Password:

**Filter Settings**

Use filter settings to restrict browsing with a dataset name (DSN), or high level qualifier (HLQ). Optionally, give member name.

Dataset Name or HLQ: \*

Member Name:

< Back   Next >   Finish   Cancel

#### > To define the remote extractor environment

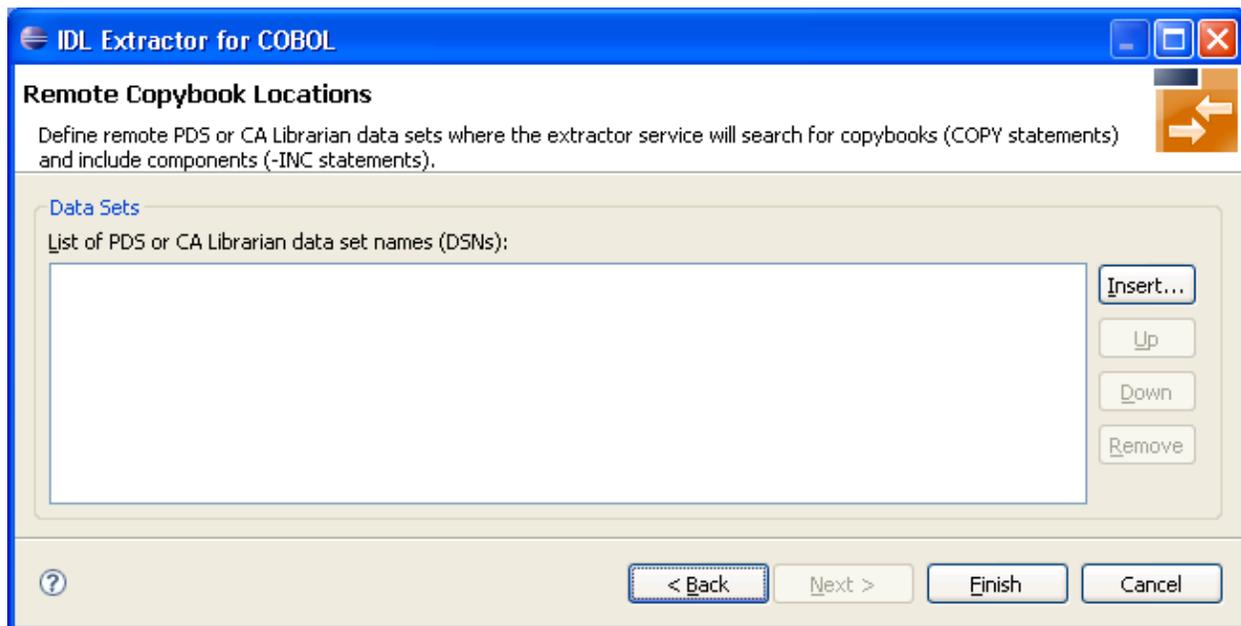
- 1 Under **Broker Parameters**, enter the required fields Broker ID and Server Address, which will have the default format brokerID@serverAddress. The last part (broker service) of the server address must always be "EXTRACTOR". The timeout value must be in the range 1-9999 seconds (default is 60).
- 2 The **EntireX Authentication** parameters describe the settings for the broker. See *Authentication of User*.
- 3 The **RPC Server Authentication** parameters describe the settings for the RPC server. See *Administering the Batch RPC Server* | *Administering the IMS RPC Server*.
- 4 A high-level qualifier is required in the **Data Set Name or HLQ** field. The extractor service will then offer only data sets with this high-level qualifier.

- 5 In the **Member Name** field you can provide a prefix for the partitioned data set or CA Librarian members. The extractor service will then offer only members beginning with this prefix.

Press **Next** and continue with [Step 4: Define the Remote Copybook Locations](#) below.

#### Step 4: Define the Remote Copybook Locations

On the **Remote Copybook Location** page you can add PDS or CA Librarian data sets that will be used to resolve copybooks. Copybooks and members referenced with COPY statements and CA Librarian -INC statements will be searched for in the defined remote data sets:



Press **Insert...** to add a new data set entry in the table. Use **Remove**, **Up** and **Down** to manage the data set list.

Press **Finish**.

## Create New Remote Extractor Environment (BS2000/OSD)

This section describes the four steps for creating a new remote COBOL extractor environment to extract remotely BS2000/OSD COBOL programs stored in LMS libraries.

- [Step 1: Define the New Remote Environment](#)
- [Step 2: Define the Default Settings](#)
- [Step 3: Define the Remote Extractor Environment](#)

- [Step 4: Define the Remote Copybook Locations](#)

### Step 1: Define the New Remote Environment

On the **New Environment** page you can specify **Name**, **Operating system** and the **Remote Source Location**.

The screenshot shows the 'New Environment' dialog box. The title bar reads 'IDL Extractor for COBOL'. The main title is 'New Environment' with the instruction 'Define a new COBOL extractor environment.' Below this, there are three sections: 'COBOL Extractor Environment' with a text field for 'Name' containing 'My\_COBOL\_Extractor\_Environment' and a dropdown for 'Operating System' set to 'B52000'; 'Source Location' with radio buttons for 'Local' and 'Remote' (selected); and a bottom bar with a help icon and buttons for '< Back', 'Next >', 'Finish', and 'Cancel'.

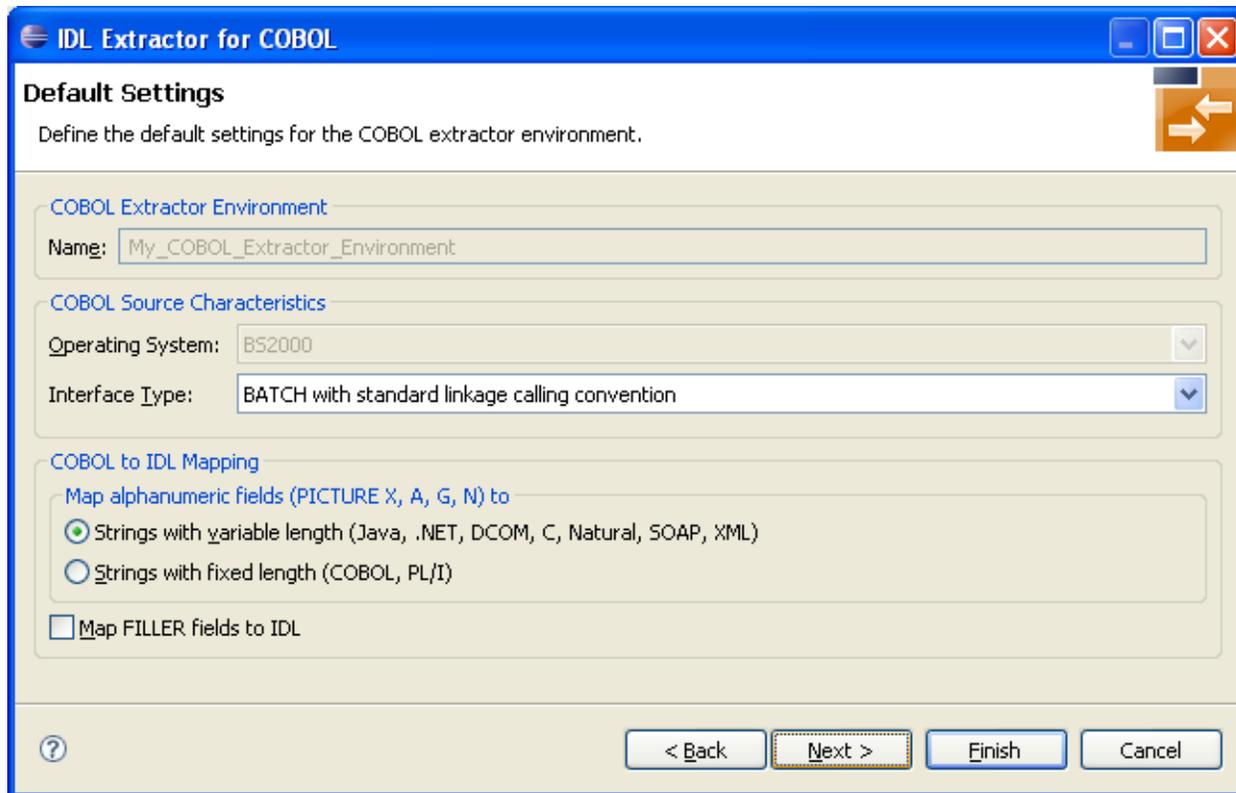
#### ➤ To define the new environment settings

- 1 Enter a unique name for the COBOL extractor environment.
- 2 Select the **Operating system**.
- 3 Select "Remote" for **Source location**.

### Step 2: Define the Default Settings

The **Default Settings** page provides defaults for [Step 4: Define the Extraction Settings and Start Extraction](#) in [Using the IDL Extractor for COBOL - Overview](#).

You can set defaults for **Interface Type** and **COBOL to IDL Mapping**.



### > To define the default extraction settings

- 1 Select the default **Interface Type**. See [Supported COBOL Interface Types](#).
- 2 Specify the default **COBOL to IDL Mapping**. See [COBOL to IDL Mapping](#).

Press **Next** and continue with [Step 3: Define the Remote Extractor Environment](#) below.

### Step 3: Define the Remote Extractor Environment

The connection to the Extractor Service to browse for COBOL programs is defined on the **Remote Extractor Environment** page. See *Extractor Service* in the BS2000/OSD Batch RPC Server documentation.

**Remote Extractor Environment**

Define an extractor service to extract remote COBOL sources from LMS libraries. Specify broker parameters and filter settings.

**Broker Parameters**

Broker ID: \*

Server Address: \*

Timeout (Seconds): 60

**EntireX Authentication**

User ID:

Password:

**RPC Server Authentication**

RPC User ID:

RPC Password:

**Filter Settings**

Use filter settings to restrict browsing with a LMS library name, or high level qualifier (HLQ). Optionally, give element (S) name.

LMS Library Name or HLQ: \*

Element (S) Name:

? < Back Next > Finish Cancel

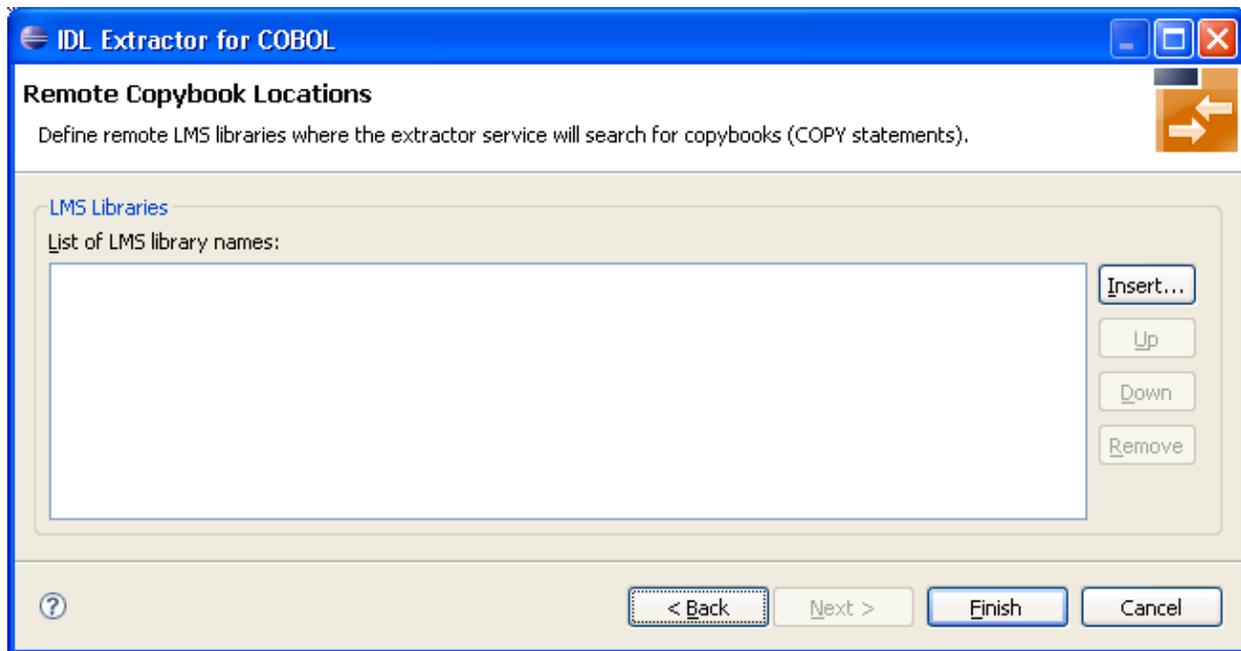
➤ **To define the remote extractor environment**

- 1 Under **Broker Parameters**, enter the required fields Broker ID and Server Address, which will have the default format brokerID@serverAddress. The last part (broker service) of the server address must always be "EXTRACTOR". The **Timeout** value must be in the range 1-9999 seconds (default is 60).
- 2 The **EntireX Authentication** parameters describe the settings for the broker. See *Authentication of User*.
- 3 The **RPC Server Authentication** parameters describe the settings for the RPC server. See *Configuring the RPC Server*.
- 4 A high-level qualifier can be entered in the **LMS Library Name or HLQ** field. The extractor service will then offer only LMS libraries with this high-level qualifier. You can use wildcard notation with asterisk to specify a range of values.
- 5 In the **Element Name** field you can provide a prefix for LMS library source elements. The extractor service will then offer only COBOL programs beginning with this prefix.

Press **Next** and continue with *Step 4: Define the Remote Copybook Locations* below.

#### Step 4: Define the Remote Copybook Locations

On the **Remote Copybook Location** page you can add directories that will be used to resolve copybooks. Copybooks referenced with `COPY` statements will be searched for in the defined remote LMS libraries:



Press **Insert...** to add a new data set entry in the table. Use **Remove**, **Up** and **Down** to manage the list of LMS libraries.

Press **Finish**.

# 16

## COBOL to IDL Mapping

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▪ COBOL Data Type to Software AG IDL Mapping .....	360
▪ User-decided Mapping .....	363
▪ DATA DIVISION Mapping .....	370
▪ PROCEDURE DIVISION Mapping .....	376
▪ Copybooks .....	377

This chapter describes how COBOL data items and related syntax are mapped to Software AG IDL by the IDL Extractor for COBOL using the *Extractor Wizard* and *Mapping Editor*.

See also *IDL Extraction per Interface Type* under *COBOL Mapping Editor* for guidelines on IDL extraction per interface type.

## COBOL Data Type to Software AG IDL Mapping

The IDL Extractor for COBOL maps the following subset of COBOL data types to Software AG IDL data types.

The following metasympols and informal terms are used for the IDL in the table below.

- The metasympols "[" and "]" surround optional lexical entities.
- The informal terms *n* and *m* are sequences of numeric characters, for example 123.

COBOL Data Type		Software AG IDL Data Type		Notes	
Alphabetic	PIC A( <i>n</i> )	An, AVn	Alphanumeric	1,2	
DBCS	PIC G( <i>n</i> )	Kn*2, KVn*2	Kanji	1,2,3	
DBCS	PIC N( <i>n</i> ) [USAGE] [IS] DISPLAY-1	Kn*2, KVn*2	Kanji	1,2,3	
Unicode or DBCS	PIC N( <i>n</i> )	Un, UVn or Kn*2, KVn*2	Unicode or Kanji	1,2,3,9	
Unicode	PIC N( <i>n</i> ) [USAGE] [IS] NATIONAL	Un, UVn	Unicode	1,2	
Alphanumeric	PIC X( <i>n</i> )	An, AVn	Alphanumeric	1,2	
Numeric	Zoned decimal	PIC 9( <i>n</i> )[V9( <i>m</i> )]	NUn[ , <i>m</i> ]	Unpacked decimal unsigned	2,4
	Zoned decimal	PIC S9( <i>n</i> )[V9( <i>m</i> )]	Nn[ , <i>m</i> ]	Unpacked decimal	2,4
	Packed decimal	PIC 9( <i>n</i> ) [V9( <i>m</i> )] COMP[UTATIONAL]-3	PUn[ , <i>m</i> ]	Packed decimal unsigned	2,4
	Packed decimal	PIC S9( <i>n</i> ) [V9( <i>m</i> )] COMP[UTATIONAL]-3	Pn[ , <i>m</i> ]	Packed decimal	2,4
	Packed decimal	PIC 9( <i>n</i> ) [V9( <i>m</i> )] PACKED-DECIMAL	PUn[ , <i>m</i> ]	Packed decimal unsigned	2,4
	Packed decimal	PIC S9( <i>n</i> ) [V9( <i>m</i> )] PACKED-DECIMAL	Pn[ , <i>m</i> ]	Packed decimal	2,4
	Binary	PIC [S]9( <i>n</i> ) BINARY (1<= <i>n</i> <=4)	I2	Integer (medium)	2,4,5,6,7
Binary	PIC [S]9( <i>n</i> ) BINARY (5<= <i>n</i> <=9)	I4	Integer (large)	2,4,5,6,7	

COBOL Data Type		Software AG IDL Data Type		Notes
Binary	PIC [S]9(n) COMP[UTATIONAL][-4] (1<=n<=4)	I2	Integer (medium)	2,4,5,6,7
Binary	PIC [S]9(n) COMP[UTATIONAL][-4] (5<=n<=9)	I4	Integer (large)	2,4,5,6,7
Binary	PIC [S]9(n) COMP-5 (1<=n<=4)	I2	Integer (medium)	2,4,6,7
Binary	PIC [S]9(n) COMP-5 (5<=n<=9)	I4	Integer (medium)	2,4,6,7
Floating point	COMP[UTATIONAL]-1	F4	Floating point (small)	8
Floating point	COMP[UTATIONAL]-2	F8	Floating point (large)	8
Alphanumeric-edited	Alphanumeric item containing "0" or "/"	A( <i>length of PIC</i> )	Alphanumeric	10
Numeric-edited	Numeric item containing "DB", "CR", "Z", "\$", ".", ",", "+", "-", "*", "B", "0" or "/"	A( <i>length of PIC</i> )	Alphanumeric	10

**Notes:**

1. Mapping to fixed-length or variable-length Software AG IDL data type is controlled in the extraction settings of the extraction wizard, see [Step 4: Define the Extraction Settings and Start Extraction](#).
2. Equivalent alternative forms of the PICTURE clause, e.g. XXX, AAA, NNN, GGG or 999 may also be used.
3. The length for IDL data type is given in bytes. For COBOL the length is in DBCS characters (2 bytes).
4. The character "P[(n)]" stands for a decimal scaling position, this character has no effect on the length of the generated data type. Only the data fraction will be mapped to the Software AG IDL:

```
01 GROUP1.
  10 FIELD1 PIC PPP9999.
```

will be mapped to IDL:

```
1 GROUP1
2 FIELD1 NU4
```

5. Behavior depends on the COBOL compiler settings:

- With COBOL 85 standard, the value range depends on the number of digits in the PICTURE clause. This differs from the value range of the IDL data type using the binary field size instead. If the parameter is of direction "In" your RPC client application has to ensure the integer value sent is within the allowed range. See *Software AG IDL Grammar* in the *IDL Editor* documentation.
- With *no* COBOL 85 standard, the value range of the COBOL data type reflects the binary field size, thus matches the IDL data type exactly. In this case, there are no restrictions regarding value ranges. For example:
  - with operating system z/OS and IBM compiler, see option TRUNC(BIN) in your COBOL compiler documentation
  - with operating systems UNIX and Windows and a Micro Focus compiler, see option NOTRUNC in your Micro Focus COBOL documentation.

6. For unsigned COBOL data types (without "S" in the PICTURE clause) the value range of the IDL data type differs:

- IDL allows negative values, COBOL does not.
- For I2, the maximum is 32767 for IDL instead of 65535 for COBOL.
- For I4, the maximum is 2147483647 for IDL instead of 4294967294 for COBOL.

7. Binaries with more than 9 digits in the PICTURE clause cannot be mapped to IDL. See the following table:

S9(10) thru S9(18)	Binary doubleword (8 bytes)	-9,223,372,036,854,775 thru +9,223,372,036,854,775
9(10) thru 9(18)	Binary doubleword (8 bytes)	0 thru 18,446,744,073,709,551

8. COMPUTATIONAL - 1 (4-byte, single precision) and COMPUTATIONAL - 2 items (8-byte, double precision) items are an IBM-specific extension. When floating-point data types are used, rounding errors can occur, so the values of senders and receivers might differ slightly.

9. If this form is extracted from a COBOL program originally written for Micro Focus COBOL and operating system UNIX or Windows, the mapping to the IDL data type depends on the setting in the IDL Extractor for COBOL Preferences. See **Meaning of PIC N without USAGE clause** within pane **Compiler Directives** of *Step 2: Define the Default Settings*. For all other COBOL program extractions, the mapping is always to IDL data type Un/Uvn.

10. COBOL alphanumeric/numeric edited items will force the generation of IDL data type A with an inline comment containing the original COBOL PICTURE clause. The CURRENCY SIGN clause in the SPECIAL-NAMES and the CURRENCY compiler option is not considered.

## User-decided Mapping

This section discusses the COBOL syntax relevant for extraction where user interactions drive the extraction process. Depending on the COBOL syntax and the COBOL server implementation, user interaction may be required to get correct extraction results. User interaction can also simplify or modernize the extracted IDL. The following syntax is covered:

- [Condition Names - Level-88 Data Items](#)
- [COBOL Data Items](#)
- [FILLER Pseudo-Parameter](#)
- [REDEFINES Clause](#)
- [COBOL Tables with Fixed Size](#)
- [VALUE Clause](#)

### Condition Names - Level-88 Data Items

See the following COBOL syntax:

```
88 condition_name VALUE [IS] 'literal_1'
88 condition_name VALUE [IS] 'literal_1' [THRU | THROUGH] 'literal_2'
88 condition_name VALUES [ARE] 'literal_1' [THRU | THROUGH] 'literal_2'
```

Semantically, level-88 condition names can be

#### ■ Enumeration Type Values

If your COBOL server requires the level-88 value to be provided on a call-by-call basis, that is, the value may change with every call, map the level-88 base variable to a simple IDL parameter with the desired direction In or InOut. RPC clients have to pass correct values, the same as defined by the level-88 condition names.

#### ■ Single Constant Values

If your COBOL server interface expects for your purpose always a constant value, map the level-88 condition names to a constant. For more information and COBOL examples, see Mapping Editor IDL Interface mapping function *Set COBOL Data Items to Constants* for interface type DFHCOMMAREA (In same as Out, In different to Out) | Large Buffer (In same as Out, In different to Out) | Channel Container | Batch | IMS BMP | Micro Focus | IMS Connect.

#### ■ Function or Operation Codes

If your COBOL server implements various functions or operations and the level-88 values are function or operation codes, map the COBOL interface to multiple IDL interfaces. For more information and COBOL examples see the Mapping Editor IDL Interface mapping function *Map to Multiple IDL Interfaces* for interface type DFHCOMMAREA (In same as Out, In different to Out) | Large Buffer (In same as Out, In different to Out) | Channel Container | Batch | IMS BMP | Micro Focus | IMS Connect.

If the mapping functions **Set COBOL Data Items to Constants** or **Map to Multiple IDL Interfaces** are used, a server mapping file is required to provide additional information. See *Server Mapping Files for COBOL*.

## COBOL Data Items

This section covers the following topics:

- [IDL Directions for COBOL Data Items](#)
- [IDL Parameter Names derived from COBOL Names](#)
- [COBOL Data Items Expecting Single Constant Values](#)
- [COBOL Data Items used as Function or Operation Codes](#)
- [Optional COBOL Group Data Items](#)
- [Unneeded COBOL Data Items](#)

### IDL Directions for COBOL Data Items

COBOL server programs do not contain parameter direction information (input, output). Therefore IDL directions (see `attribute-list` under *Software AG IDL Grammar* in the IDL Editor documentation) need to be added manually in the COBOL Mapping Editor. See *Map to In, Out, InOut* for interface type DFHCOMMAREA (In same as Out) | Large Buffer (In same as Out) | Batch | IMS BMP | Micro Focus.

### IDL Parameter Names derived from COBOL Names

Numbers in the first position of the parameter name are not allowed in Software AG IDL syntax (see *Software AG IDL Grammar* in the *IDL Editor* documentation). Thus COBOL names starting with a number are prefixed with the character "#" by default. For example:

```
01 1BSP  PIC XXX.
```

by default will be mapped to Software AG IDL:

```
01 #1BSP A(3).
```

If a parameter name is not specified, e.g.

```
01 GROUP1.  
 10 FIELD1 PIC XX.  
 10      PIC XX.  
 10 FIELD2 PIC S99.  
 10 FILLER PIC XX.  
 10 .  
 20 FIELD3 PIC S9(4) BINARY.  
 20 FIELD4 PIC S9(4) BINARY.
```

see [FILLER Pseudo-Parameter](#) above.

You can rename all IDL parameters in the *COBOL Mapping Editor*. See *IDL Interface* for interface type DFHCOMMAREA (In same as Out, In different to Out) | Large Buffer (In same as Out, In different to Out) | Channel Container | Batch | IMS BMP | Micro Focus | IMS Connect.

### **COBOL Data Items Expecting Single Constant Values**

If your COBOL server interface expects for your purpose always a constant value, use *Set COBOL Data Items to Constants* for interface type DFHCOMMAREA (In same as Out, In different to Out) | Large Buffer (In same as Out, In different to Out) | Channel Container | Batch | IMS BMP | Micro Focus | IMS Connect.

### **COBOL Data Items used as Function or Operation Codes**

If your COBOL server implements various functions or operations and the data items represent function or operation codes, map the COBOL interface to multiple IDL interfaces. For more information and COBOL examples see the Mapping Editor IDL Interface mapping function *Map to Multiple IDL Interfaces* for interface type DFHCOMMAREA (In same as Out, In different to Out) | Large Buffer (In same as Out, In different to Out) | Channel Container | Batch | IMS BMP | Micro Focus | IMS Connect.

### **Optional COBOL Group Data Items**

If your COBOL server interface produces dissimilar shapes of optional output, COBOL group data items can be mapped to multiple possible output (MPO). Criteria can be added under which circumstances COBOL groups are part of the returned data or not. This is done with Mapping Editor IDL Interface mapping function *Set Multiple Possible Output (MPO) Structures* for interface type DFHCOMMAREA (In same as Out, In different to Out) | Large Buffer (In same as Out, In different to Out) | Channel Container | IMS Connect.

See also example *COBOL Server Using Optional Output* for interface type DFHCOMMAREA (In same as Out, In different to Out) | Large Buffer (In same as Out, In different to Out) | Channel Container | IMS Connect.

### **Unneeded COBOL Data Items**

COBOL data items that are not needed in the IDL Interface but are required by the COBOL server can be suppressed. See *Suppress Unneeded COBOL Data Items* for interface type DFHCOMMAREA (In same as Out, In different to Out) | Large Buffer (In same as Out, In different to Out) | Channel Container | Batch | IMS BMP | Micro Focus | IMS Connect

## FILLER Pseudo-Parameter

In the check box **Map FILLER fields to IDL** of the COBOL to IDL in the extraction settings of the wizard (see [Step 4: Define the Extraction Settings and Start Extraction](#)) you can define whether COBOL FILLER pseudo-parameters should be part of the RPC client interface by default or not. By default they are not mapped to IDL. In the [COBOL Mapping Editor](#) you can change the mapping for a FILLER field individually, e.g. mapping required ones to IDL. If FILLER fields are mapped to IDL, they are made unique by appending a sequence number. You can set the prefix to be used in the [IDL Extractor for COBOL Preferences](#).

If the resulting names are not suitable, you can rename IDL field names in the Mapping Editor with the **Rename** function of the context menu. See the following example:

```
01 GROUP1.  
 10 FIELD1 PIC XX.  
 10 FILLER PIC XX.  
 10 FIELD2 PIC S99.  
 10 FILLER PIC XX.
```

This will be mapped to Software AG IDL:

```
1 GROUP1  
 2 FIELD1 (A2)  
 2 FILLER_1 (A2)  
 2 FIELD2 (N2.0)  
 2 FILLER_2 (A2)
```

If a group is named FILLER and the group has scalar fields, the group is always mapped to IDL, independent of the check box **Map FILLER fields to IDL**. For example:

```
01 GROUP1.  
 10 FIELD1 PIC XX.  
 10      PIC XX.  
 10 FIELD2 PIC S99.  
 10 FILLER PIC XX.  
 10 .  
 20 FIELD3 PIC S9(4) BINARY.  
 20 FIELD4 PIC S9(4) BINARY.
```

This will be mapped to Software AG IDL:

```

1 GROUP1
2 FIELD1 (A2)
2 FILLER_1 (A2)
2 FIELD2 (N2.0)
2 FILLER_2 (A2)
2 FILLER_3
3 FIELD3 (I2)
3 FIELD4 (I2)

```

## REDEFINES Clause

A redefinition is a second parameter layout of the same memory portion. In most modern programming languages, and also the Software AG IDL, this is not directly supported. The following possibilities are available to map COBOL REDEFINES:

1. You can select a single redefine path for IDL usage. In this case, the COBOL server requires predictable input and output structures. The redefine path can be determined at design time (extraction time). This is supported for all IDL directions that is, In, Out and InOut. For more information and COBOL examples, see Mapping Editor IDL Interface mapping function *Select REDEFINE Paths* for interface type DFHCOMMAREA (In same as Out, In different to Out) | Large Buffer (In same as Out, In different to Out) | Channel Container | Batch | IMS BMP | Micro Focus | IMS Connect.

If a REDEFINE path is selected, the mapping is as follows:

COBOL Syntax	Software AG IDL Syntax
1 <i>name_1</i> REDEFINES <i>name_2</i>	1 <i>name_1</i>
1 REDEFINES <i>name_2</i>	1 FILLER_ <i>n</i>
1 FILLER REDEFINES <i>name_2</i>	1 FILLER_ <i>n</i>

2. If the COBOL server supports more than one type of input (redefine paths) but uses predictable output structures, you can map the COBOL interface to multiple IDL interfaces. This is supported for IDL direction In only. In this case, the redefine path used is selected as described under 1 above. For more information and COBOL examples, see Mapping Editor IDL Interface mapping function *Map to Multiple IDL Interfaces* for interface type DFHCOMMAREA (In same as Out, In different to Out) | Large Buffer (In same as Out, In different to Out) | Channel Container | Batch | IMS BMP | Micro Focus | IMS Connect.
3. If the COBOL server produces more than one type of output (redefine paths) and implements the multiple possible output (MPO) concept, you can map the redefine to MPO. In this case the redefine path used is determined at runtime from a set of predefined redefine paths. The set of alternate redefine paths is determined during design time (extraction time). This is supported for IDL direction Out only. For more information and COBOL examples of the MPO concept, see Mapping Editor IDL Interface mapping function *Set Multiple Possible Output (MPO) Structures* for interface type DFHCOMMAREA (In same as Out, In different to Out) | Large Buffer (In same as Out, In different to Out) | Channel Container | IMS Connect.

If a REDEFINE is mapped to multiple possible output (MPO), the mapping is as follows:

COBOL Syntax	Software AG IDL Syntax
1 name_1 2 name_1_1 . . . . .	1 name_1 (/V1) 2 name_1_1 . . . . .
1 name_2 REDEFINES name_1 2 name_2_1 . . . . .	1 name_2 (/V1) 2 name_2_1 . . . . .
1 name_3 REDEFINES name_1 2 name_3_1 . . . . .	1 name_3 (/V1) 2 name_3_1 . . . . .

- If the COBOL server supports more than one type of input (redefine paths) and implements the multiple possible output (MPO) concept as well, you can combine extraction as described under 2 and 3 above.

In all cases the, COBOL REDEFINE requires a server mapping file to provide additional information. See *Server Mapping Files for COBOL*.

### COBOL Tables with Fixed Size

The following possibilities are available to map COBOL tables with fixed size:

- By default, fixed-size COBOL tables are converted automatically to fixed-size IDL groups (see *group-parameter-definition* under *Software AG IDL Grammar* in the IDL Editor documentation) with *fixed-bound-array* (see *array-definition* under *Software AG IDL Grammar* in the IDL Editor documentation). This is the usual way and is suitable for most situations. See the following syntax:

COBOL Syntax	Software AG IDL Syntax
1 name OCCURS n [TIMES] 2 name_1 . . . . .	1 name (/n) 2 name_1 . . . . .
1 name OCCURS n [TIMES] [ ASCENDING   DESCENDING [KEY] [IS] ↔ key_name ] 2 name_1 . . . . .	1 name (/n) 2 name_1 . . . . .

COBOL Syntax	Software AG IDL Syntax
<pre>1 name OCCURS n [TIMES] [ [ INDEXED [BY] index_name]   2 name_1 . .   . . .</pre>	<pre>1 name (/n)   2 name_1 . .   . . .</pre>

- In very rare situations, the COBOL server uses a fixed-size COBOL table in a variable-size manner. The number of elements in the table is determined by the size of the returned data. This is possible for message-oriented interface types if the message length can be determined by the COBOL server and its caller (Large Buffer, Channel Container, IMS Connect). The fixed-sized COBOL table must be the last parameter in the interface. For more information and COBOL examples see the Mapping Editor IDL Interface mapping function *Set Arrays (Fixed <-> Unbounded)* for interface type Large Buffer (In same as Out, In different to Out) | Channel Container | IMS Connect.

The following rules apply:

- The combination of phrases `ASCENDING` and `INDEXED BY` and phrases `DESCENDING` and `INDEXED BY` is meaningless for EntireX and therefore ignored by the IDL Extractor for COBOL.
- If the mapping function *Set Arrays (Fixed <-> Unbounded)* is used, a server mapping file is required to provide additional information. See *Server Mapping Files for COBOL*.

## VALUE Clause

The `VALUE` clause specifies the initial contents of a data item or the value(s) associated with a condition name. For condition names, see [Condition Names - Level-88 Data Items](#) above.

COBOL Syntax
<pre>1 name &lt;COBOL data type&gt; VALUE [IS] 'literal'</pre>

Initial values can be specified on data items in the Working-Storage Section. As an IBM extension, in the File and Linkage Sections, the `VALUE` clause is treated as a comment.

The IDL Extractor for COBOL ignores initial values of data items. The `DATA DIVISION` is parsed as without the `VALUE` clause. If you require the value on input to the COBOL server you specify to be a constant, see *Set COBOL Data Items to Constants* for interface type `DFHCOMMAREA` (In same as Out, In different to Out) | Large Buffer (In same as Out, In different to Out) | Channel Container | Batch | IMS BMP | Micro Focus | IMS Connect.

## DATA DIVISION Mapping

---

This section describes the COBOL syntax relevant for extracting the `DATA DIVISION`. No user decisions in the COBOL Mapping Editor are required or possible here.

- [BLANK WHEN ZERO Clause](#)
- [Continuation Lines](#)
- [DATE FORMAT Clause](#)
- [GLOBAL and EXTERNAL Clause](#)
- [JUSTIFIED Clause](#)
- [OBJECT REFERENCE Phrase](#)
- [POINTER Phrase](#)
- [PROCEDURE-POINTER Phrase](#)
- [RENAMES Clause - LEVEL 66 Data Items](#)
- [SIGN LEADING and TRAILING SEPARATE Clauses](#)
- [SYNCHRONIZED Clause](#)
- [COBOL Tables with Variable Size - DEPENDING ON Clause](#)
- [Unstructured Data Types - LEVEL 77 Data Items](#)
- [USAGE Clause on Group Level](#)
- [USAGE IS INDEX Clause](#)

### BLANK WHEN ZERO Clause

The `BLANK WHEN ZERO` clause specifies that an item contains nothing but spaces when its value is zero. The `BLANK WHEN ZERO` clause is not considered by the IDL Extractor for COBOL. The `DATA DIVISION` is parsed as without the `BLANK WHEN ZERO` clause. Because the `BLANK WHEN ZERO` clause only has an impact if the item is displayed, such a program can be mapped to IDL. The workaround for RPC clients is to imitate the `BLANK WHEN ZERO` clause.

### Continuation Lines

Continuation lines, starting with a hyphen in the indicator area, are supported.

### DATE FORMAT Clause

The `DATE FORMAT` clause is an IBM-specific extension. The `DATE FORMAT` clause specifies that a data item is a windowed or expanded date field.

The `DATE FORMAT` clause is not considered by the IDL Extractor for COBOL. The `DATA DIVISION` is parsed as without the `DATE FORMAT` clause. The semantic given by the `DATE FORMAT` clause has to be considered by RPC clients.

## GLOBAL and EXTERNAL Clause

The GLOBAL clause

- specifies that a data-name is available to every program contained within the program that declares it, as long as the contained program does not itself have a declaration for that name.
- is not considered by the IDL Extractor for COBOL. The DATA DIVISION is parsed as without the GLOBAL clause.

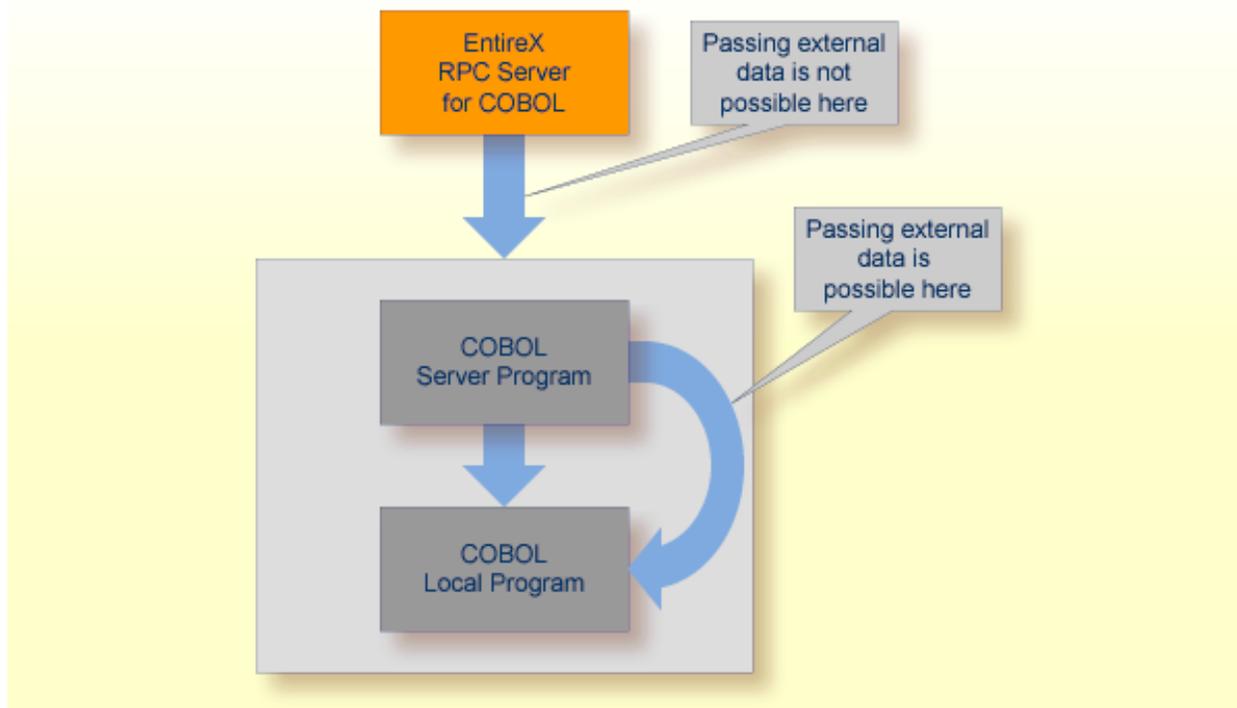
However, program parameters containing the GLOBAL clause can be mapped to IDL, which can make sense as long as the EXTERNAL DATA clause is used to pass parameters from the called COBOL server to further subprograms called.

The EXTERNAL clause

- can only be specified on data description entries that are in the Working-Storage section of a program.
- is not considered by the IDL Extractor for COBOL. The DATA DIVISION is parsed as without the EXTERNAL clause.



**Note:** EntireX RPC technology cannot pass data using EXTERNAL linkage from the RPC server to the COBOL server. However, program parameters containing the EXTERNAL clause can be mapped to IDL, which can make sense as long as the EXTERNAL DATA clause is used to pass parameters from the called COBOL server to further subprograms called.



### JUSTIFIED Clause

The IDL Extractor for COBOL ignores the JUSTIFIED clause. The DATA DIVISION is parsed as without the JUSTIFIED clause. The workaround for RPC clients is to imitate the JUSTIFIED clause.

### OBJECT REFERENCE Phrase

The OBJECT REFERENCE phrase is an IBM-specific extension. A program containing an OBJECT REFERENCE phrase cannot be mapped to IDL.

### POINTER Phrase

The POINTER phrase is an IBM-specific extension.

COBOL Syntax	Software AG IDL Syntax
1 <i>name</i> USAGE IS POINTER	none
1 <i>name</i> POINTER	none

The following rules apply:

- All pointers are mapped to "suppressed" in the Mapping Editor because the Software AG IDL does not support pointers.

- Offsets to following parameters are maintained by a server mapping file. See *Server Mapping Files for COBOL*. At runtime, the RPC server passes a null pointer to the COBOL server.

### PROCEDURE-POINTER Phrase

The `PROCEDURE-POINTER` phrase is an IBM-specific extension. A program containing a procedure-reference phrase cannot be mapped to IDL.

### RENAMES Clause - LEVEL 66 Data Items

Level-66 entries are ignored and cannot be used for mapping to IDL. The `DATA DIVISION` is parsed as without the level-66 entry.

### SIGN LEADING and TRAILING SEPARATE Clauses

The `SIGN LEADING` and `TRAILING SEPARATE` clauses are supported. Both require a server mapping file. See *Server Mapping Files for COBOL*.

### SYNCHRONIZED Clause

The synchronized clause aligns COBOL data items at word boundaries. The clause does not have any relevance for RPC clients and is not written into the IDL file but into the server mapping file. See *Server Mapping Files for COBOL*. At runtime, the RPC server aligns the data items accordingly.

### COBOL Tables with Variable Size - DEPENDING ON Clause

Variable size COBOL tables are converted to IDL unbounded groups (see `group-parameter-definition` under *Software AG IDL Grammar* in the IDL Editor documentation) with an unbounded array (see `array-definition` under *Software AG IDL Grammar* in the IDL Editor documentation) and maximum upper bound set. The lower-bound is always set to 1 in the IDL. See the following example:

```
01 COUNTER-1 PIC 99.
01 TABLE OCCURS 1 TO 10 DEPENDING ON COUNTER-1
   02 FIELD1 PIC XX.
   02 FIELD2 PIC 99.
```

The ODO subject (data item `TABLE`) will be mapped in the IDL to an unbounded group (with maximum). The ODO object (data item `COUNTER-1`) is not part of the IDL because the number of elements is implicitly available with the IDL unbounded group. See *Map OCCURS DEPENDING ON* for interface type `DFHCOMMAREA` (In same as Out, In different to Out) | Large Buffer (In same as Out, In different to Out) | Channel Container | Batch | IMS BMP | Micro Focus | IMS Connect.

```
01 TABLES (/V10)
  02 FIELD1 (A2)
  02 FIELD2 (NU2.0)
```

COBOL Syntax	Software AG IDL Syntax
1 <i>name</i> OCCURS <i>n</i> TO <i>m</i> [TIMES] DEPENDING [ON] <i>index</i> 2 <i>name_1</i> . . . . .	1 <i>name</i> (/Vm) 2 <i>name_1</i> . . . . .
1 <i>name</i> OCCURS <i>n</i> TO <i>m</i> [TIMES] DEPENDING [ON] <i>index</i> [ ASCENDING   ← DESCENDING [KEY] [IS] <i>key_name</i> ] 2 <i>name_1</i> . . . . .	1 <i>name</i> (/Vm) 2 <i>name_1</i> . . . . .
1 <i>name</i> OCCURS <i>n</i> TO <i>m</i> [TIMES] DEPENDING [ON] <i>index</i> [ INDEXED ← [BY] <i>index_name</i> ] 2 <i>name_1</i> . . . . .	1 <i>name</i> (/Vm) 2 <i>name_1</i> . . . . .

The following rules apply:

- The COBOL from value, *n* above, is semantically different from the IDL lower bound and means a lower-bound of elements which must not be crossed. It is the duty of the calling RPC client to take care of this and set the corresponding number of elements correctly. Do not send less than the COBOL lower bound.
- The combination of the phrases ASCENDING and INDEXED BY and phrases DESCENDING and INDEXED BY is meaningless for EntireX and therefore ignored by the IDL Extractor for COBOL.
- The COBOL clause OCCURS DEPENDING ON requires a server mapping file to provide additional information. See *Server Mapping Files for COBOL*.

### Unstructured Data Types - LEVEL 77 Data Items

COBOL level-77 data items are handled as COBOL data items on level 1. They are always mapped to IDL level 1.

### USAGE Clause on Group Level

A USAGE clause can be specified on group level, which defines the data type of subsequent groups or parameters. The USAGE clause on subsequent groups or parameters may not contradict a higher level definition. Therefore IDL data types may depend on USAGE clauses of parent groups if the COBOL data structure is defined as explained.

**USAGE IS INDEX Clause**

COBOL data items defined with `USAGE IS INDEX` are parsed as without `USAGE IS INDEX`. The `USAGE IS INDEX` clause is ignored.

## PROCEDURE DIVISION Mapping

---

This section discusses the syntax relevant for extraction of the `PROCEDURE DIVISION`:

- [PROCEDURE DIVISION Header](#)
- [BY VALUE Phrase](#)
- [RETURNING Phrase](#)

### PROCEDURE DIVISION Header

For Batch, IMS BMP and Micro Focus programs, the `PROCEDURE DIVISION` header is relevant for the COBOL InOut parameters. The parameters of the header are suggested as default COBOL InOut parameters.

For CICS DFHCOMMAREA programs, the `PROCEDURE DIVISION` header is of no interest, because the DFHCOMMAREA is the relevant information to get the COBOL InOut parameters from. If the DFHCOMMAREA is defined in the linkage section all parameters of the DFHCOMMAREA are suggested as default COBOL InOut parameters. If there is no DFHCOMMAREA, no suggestion is made.

For CICS Large Buffer, Channel Container and IMS MPP (IMS Connect) programs, parameters are not suggested; you select the parameters in the Mapping Editor manually.

However, you can always add, change and correct the suggested parameters if they are not the correct ones in the extraction wizard. See [Step 5: Select the COBOL Interface and Map to IDL Interface](#) in *Using the IDL Extractor for COBOL*.

### BY VALUE Phrase

The `BY VALUE` clause is an IBM-specific extension for COBOL batch programs. It is ignored by the IDL Extractor for COBOL. Directions are added in the Mapping Editor manually.

### RETURNING Phrase

The `RETURNING` phrase is an IBM-specific extension for COBOL batch programs. It is ignored by the IDL Extractor for COBOL. Handling is as without the phrase. No return value is transferred during execution time. If the `RETURNING` phrase is relevant for the interface, the COBOL program cannot be mapped to IDL.

## Copybooks

### Copybook Support

COPY statements are supported if nested copy statements do not recursively call the same source file.

If copybooks cannot be located, the following rules apply:

- In the case of a remote extraction, the copybook location (data set) is unknown.
- In the case of a local extraction, either the copybook location (directory) or the copybook extension is unknown.
- In both cases, the extraction wizard will appear with a dialog to browse for the copybook location (local directory or remote data set) and allows you to append your copybook extensions. Both will be saved in the preferences.

You can also predefine the following in the preferences:

- the copybook locations, see [Step 4: Define the Remote Copybook Locations](#) or [Step 4: Define the Local Copybook Locations](#) in *IDL Extractor for COBOL Preferences*.
- the copybook extensions for local extractions, see [Step 4: Define the Local Copybook Locations](#) in *IDL Extractor for COBOL Preferences*.

### Copybooks with REPLACE Option

COPY statements with the REPLACE option are supported. Beneath the REPLACE option, those copybooks are worked off like all other copybooks above. Example:

- a copybook ACPYBK with REPLACE option

```
01 WS-ZEUGNIS.
   :F: WS-AKTIONEN          PIC  9(01).
   :L:  :C:-NEU             VALUE 'N'.
   :L:  :C:-MOD             VALUE 'M'.
   :L:  :C:-INS             VALUE 'I'.
   :L:  :C:-WEG             VALUE 'W'.
   :L:  :C:-SIG             VALUE 'S'.
   :F: WS-NOTEN            PIC  X(03).
   :L:  SEHR-GUT            VALUE 100.
   :L:  GUT                 VALUE 95 THROUGH 99.
   :L:  BEFRIEDIGEND       VALUE 80 THROUGH 94.
   :L:  AUSREICHEND        VALUE 50 THROUGH 79.
   :L:  MANGELHAFT         VALUE 01 THROUGH 49.
   :L:  UNGENUEGEND        VALUE 0.
```

■ referencing the copybook above

```
COPY ACPYBK
REPLACING
  ==:F:== BY ==10==,
  ==:L:== BY ==88==,
  ==:C:== BY ==CMD==,
  95      BY 90,
  94      BY 89,
  WS-NOTEN BY WS-PROZENT,
  ==X(03)== BY ==9(03)==,
  ==9(01)== BY ==X(01)==.
```