webMethods EntireX

EntireX z/OS Batch RPC Server

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webMethods EntireX

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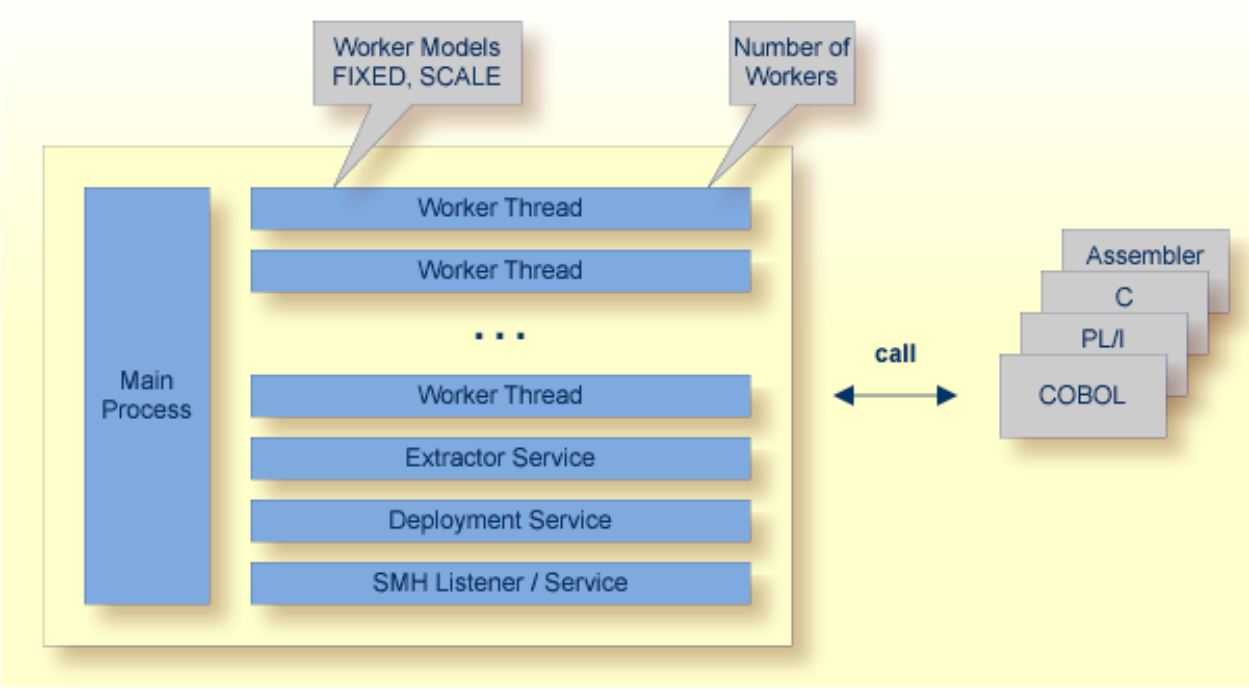
Table of Contents

1 Introduction to the Batch RPC Server

The EntireX z/OS Batch RPC Server allows standard RPC clients to communicate with RPC servers on the operating system z/OS running in batch mode. It supports the programming languages COBOL, PL/I and C.

Worker Models



RPC requests are worked off inside the RPC server in worker threads, which are controlled by a main thread. Every RPC request occupies during its processing a worker thread. If you are using RPC conversations, each RPC conversation requires its own thread during the lifetime of the conversation. The Batch RPC Server provides two worker models:

- `FIXED`
  The *fixed* model creates a fixed number of worker threads. The number of worker threads does not increase or decrease during the lifetime of an RPC server instance.
- `SCALE`
  The *scale* model creates worker threads depending on the incoming load of RPC requests.

  A maximum number (`thru` value of the `workermodel` parameter) of worker threads created can be set to restrict the system load. The minimum number (`from` value of the `workermodel` parameter), allows you to define a certain number of threads - not used by the currently executing RPC request - to wait for new RPC client requests to process. In this way the RPC server is ready to handle many RPC client requests arriving at the same time.

See parameter `workermodel` under ***Configuring the RPC Server***.

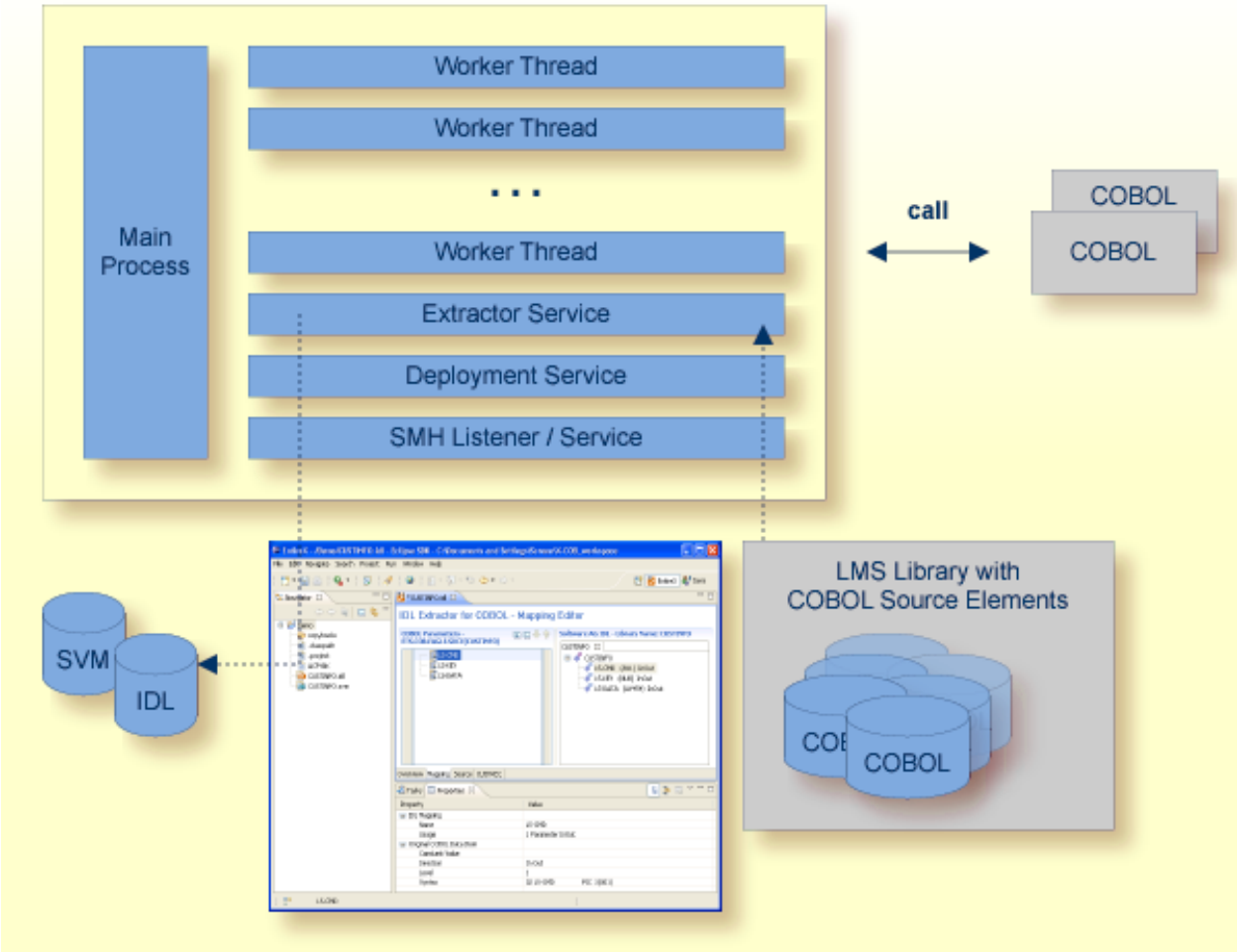
Inbuilt Services

Batch RPC Server provides several services for ease-of-use:

- Extractor Service
- Deployment Service
- SMH Listener Service

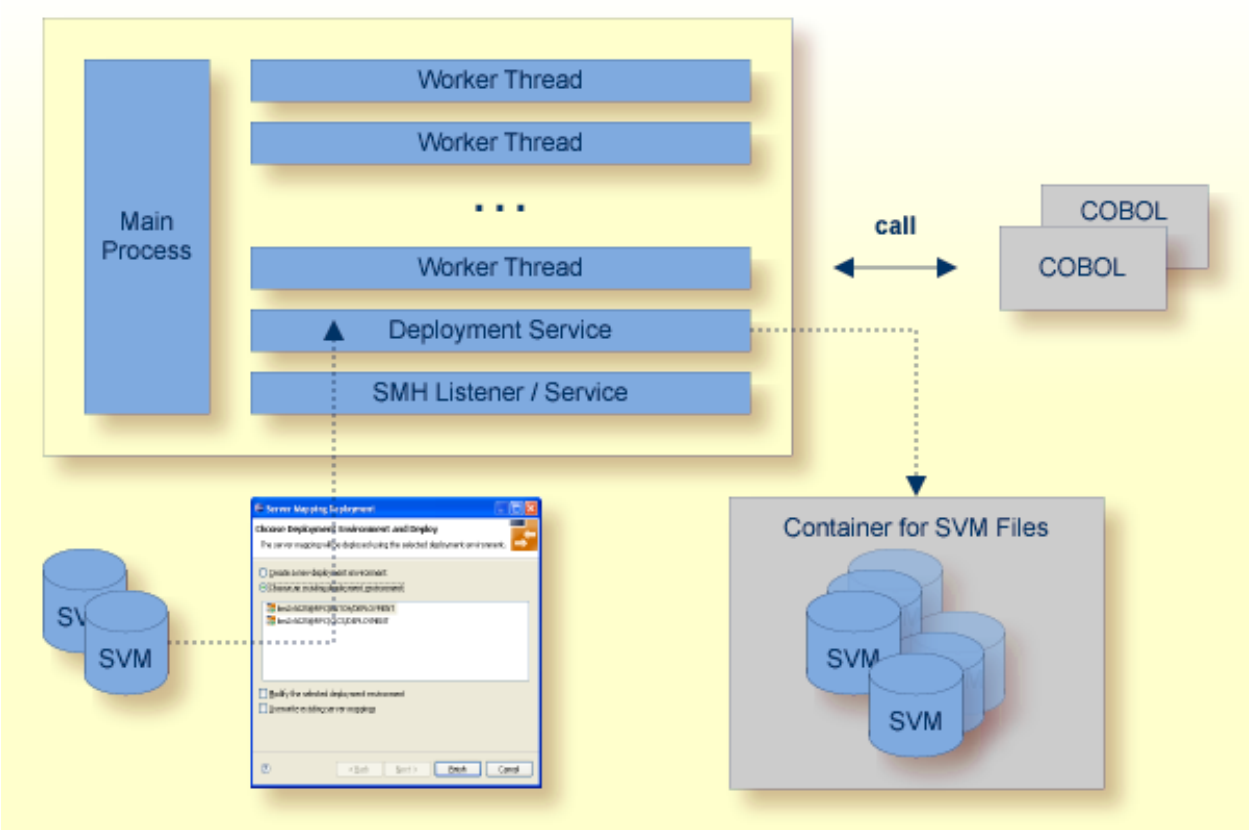
Extractor Service

The Extractor Service is a prerequisite for remote extractions with the *IDL Extractor for COBOL* and *IDL Extractor for PL/I*. See ***Extractor Service*** for more information.



Deployment Service

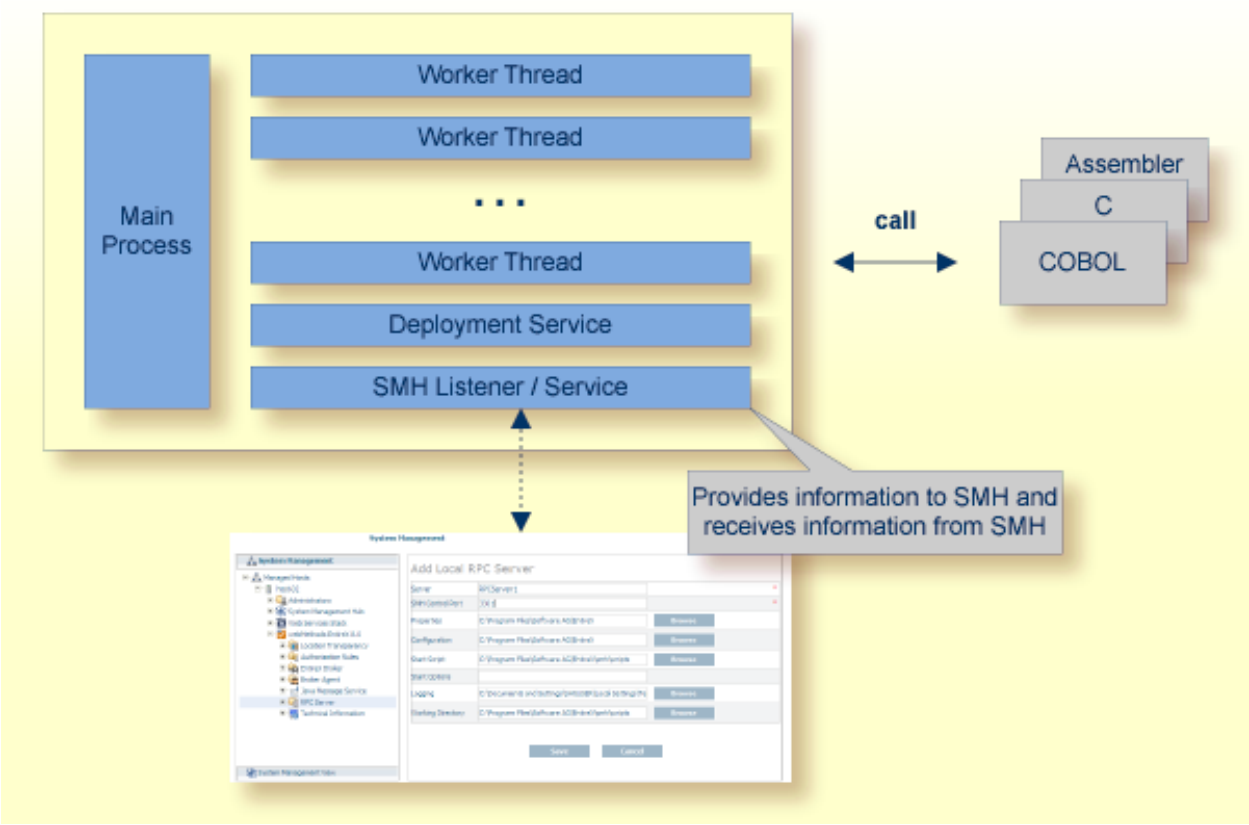
The Deployment Service allows you to deploy server mapping files (SVM files) interactively using the Deployment Wizard (see *Server Mapping Deployment*). On the RPC server side, the SVM files are stored in a VSAM file as the container. See ***Deployment Service*** for configuration information.



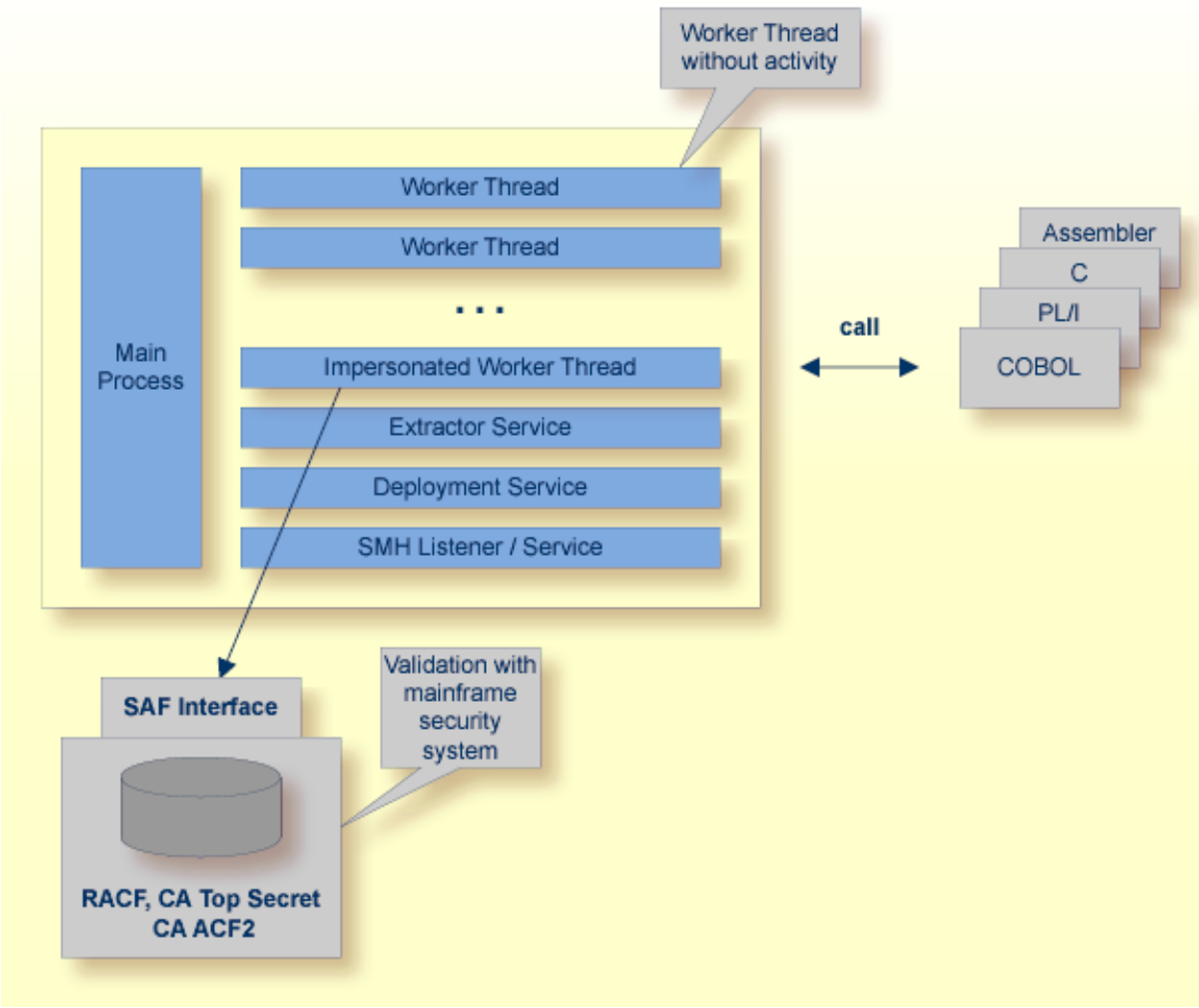
SMH Listener Service

With the SMH Listener Service you use the System Management Hub to monitor the RPC server. See *Administering the EntireX RPC Servers using System Management Hub* in the UNIX and Windows administration documentation.

The SMH Service is switched on if the parameter `smhport` is set. See parameter `smhport` under *Configuring the RPC Server*.


Main Process
Worker Thread
Worker Thread
Worker Thread
Deployment Service
SMH Listener / Service
call
Assembler
C
COBOL
Provides information to SMH and receives information from SMH
Add Local RPC Server

Impersonation



The Batch RPC Server can be configured to execute the RPC request impersonated under the RPC client user ID. This means that for the request execution, the worker thread gets the identity of the RPC client. This is necessary when accessing (security) protected data sets, for example with the *Extractor Service*. The way authentication is carried out can be controlled by the RPC parameter `impersonation`.

- For `impersonation` value `AUTO`, the Batch RPC Server does not validate RPC passwords, so you have to make sure the RPC client is correctly authenticated, either by using a secure EntireX Broker (validation must be against the correct mainframe security repository where z/OS user IDs are defined) or with your own security implementation.

- For `impersonation` value `YES`, the Batch RPC Server uses the RPC user ID and password supplied by the RPC client for authentication and impersonation of the client. This means that the RPC server validates the password.

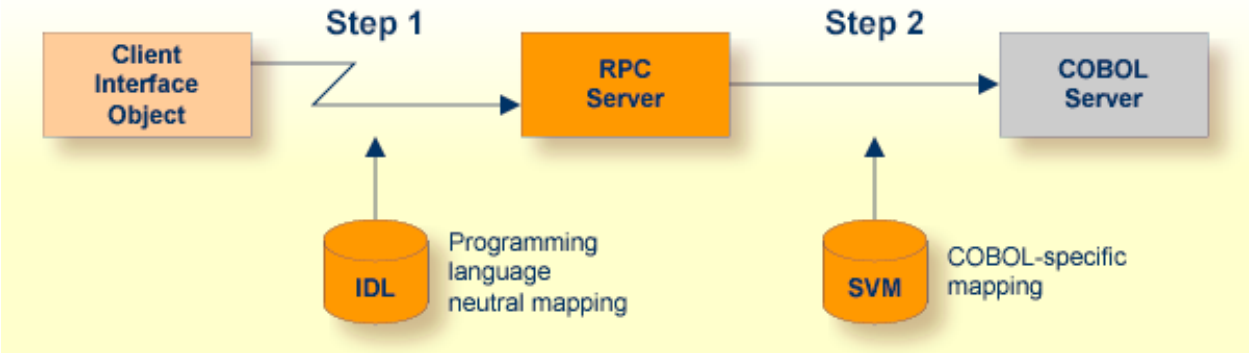
The picture above shows the configuration `impersonation=yes`.

The lifetime of an impersonated task starts when an open request for an RPC conversation or a non-conversational RPC request is received. It ends when the RPC conversation stops (after a commit operation or timeout) or when the non-conversational RPC request has been performed.

Usage of SVM Files

There are many situations where the Batch RPC Server requires a server mapping file to correctly support special COBOL syntax such as `JUSTIFIED`, `SYNCHRONIZE` and `OCCURS DEPENDING ON` clauses, `LEVEL-88` fields, etc. the .

SVM files contain COBOL-specific mapping information that is not included in the IDL file and therefore *not* sent by an EntireX RPC client to the RPC server. See also ***When is an SVM File Required?*** under ***SVM Files***.



The RPC server marshalls the data in a two-step process: the RPC request coming from the RPC client (Step 1) is completed with COBOL-specific mapping information taken from the SVM file (Step 2). In this way the COBOL server can be called as expected.

The SVM files are retrieved as a result of the *IDL Extractor for COBOL* extraction process and the *COBOL Wrapper* if a COBOL server is generated.

You can customize the usage of the SVM file using parameter `svm`. See ***Configuring the RPC Server***.

Note: SVM files are used for COBOL only.

2 Administering the Batch RPC Server

The EntireX z/OS Batch RPC Server allows standard RPC clients to communicate with RPC servers on the operating system z/OS running in batch mode. It supports the programming languages COBOL, PL/I and C.

Customizing the RPC Server

The following elements are used for setting up the Batch RPC Server:

- Configuration File
- IBM LE Runtime Options
- Started Task JCL

Configuration File

The name of the delivered example configuration file is `CONFIG` (see source library EXP960.SRCE). The configuration file contains the configuration for the Batch RPC Server. The following settings are important:

- connection information such as broker ID, server address (class, name, service)
- location and usage of server mapping files (SVMs)
- scalability parameters
- trace settings
- etc.

The configuration file is specified as a DD definition with a user-defined DD name in the started task JCL. The DD name is passed to the RPC server with the following server startup argument:

```
CFG=DD:ddname
```

Example using the DD name `CONFIG`:

```
CFG=DD:CONFIG
```

For more information see ***Configuring the RPC Server***.

IBM LE Runtime Options

Depending on the feature the Batch RPC Server needs to support (see table below) additional runtime options for IBM's Language Environment need to be set. For a full description of LE runtime options, see **z/OS V1R4.0 Lang Env Prog Guide**.

Feature	LE Runtime Options	Description
Trap abends of called RPC server programs	`ABTERMENC(RETCODE)` (1)	Required to also trap the LE abends within a server program.
Level of information if called RPC server program terminates by unhandled condition	`TERMTHDACT(UADUMP)` (1)	Forces a U4039 system dump for abends not trapped by the server.
SSL/TLS connections	`POSIX(ON)`	If not specified, TCP or NET connections are supported.
Call RPC server programs with AMODE 24 as well	`ALL31(OFF),STACK(,,BELOW)`	If not specified, AMODE 31 is supported.

Note: (1) Set internally by the Batch RPC Server and cannot be changed.

There are various ways to specify LE runtime options, for example during installation; using JCL; using `CSECT CEEUOPT` (for application-specific LE runtime options) linked to the RPC Server; etc. We recommend you use the IBM standard approach with `CEEOPTS DD` statement in the started task JCL. See *Started Task JCL* for this purpose. Add the following lines to your started task JCL:

```
//...
//CEEOPTS  DD *
ALL31(OFF),STACK(,,BELOW)
/*
//..
```

The example above uses an in-stream data set to configure `ALL31(OFF),STACK(,,BELOW)` to allow calling of 24-bit and 31-bit programs and configure `RPTOPTS(ON)` to list all used LE runtime options to `SYSOUT`.

Started Task JCL

The name of the started task is `EXPSRVB` (see EntireX job library EXX960.JOBS). The started task contains the following:

- the target server libraries of the called COBOL or PL/I server
- the configuration file used; see *Configuration File*
- LE runtime options used; see *IBM LE Runtime Options*
- etc.

Configuring the RPC Server

The following rules apply:

- In the configuration file:
  - Comments must be on a separate line.
  - Comment lines can begin with '*', '/' and ';'.
  - Empty lines are ignored.
  - Headings in square brackets [<topic>] are ignored.
  - Keywords are not case-sensitive.
- Underscored letters in a parameter indicate the minimum number of letters that can be used for an abbreviated command.

  For example, in `brokerid=localhost`, `brok` is the minimum number of letters that can be used as an abbreviation, i.e. the commands/parameters `broker=localhost` and `brok=localhost` are equivalents.

Parameter	Default	Values	Req/ Opt
`brokerid`	`localhost`	Broker ID used by the server. See *Using the Broker ID in Applications* in the RPC Programming documentation. Example: `brokerid=myhost.com:1971`	R
`ceeoptions`		Allows you to change IBM's LE runtime options. This parameter is deprecated. See ***IBM LE Runtime Options*** for how to set the LE runtime options.	O
`class`	`RPC`	Server class part of the server address used by the server. The server address must be defined as a service in the broker attribute file (see *Service-specific Attributes* (`DEFAULTS=SERVICE`) under *Broker Attributes* in the platform-independent administration documentation). Case-sensitive, up to 32 characters. Corresponds to `CLASS`. Example: `class=MyRPC`	R
`codepage`	no codepage transferred	Depending on the internationalization approach, the codepage (locale string) where incoming data is provided to the COBOL server. Conversely, the COBOL server must provide outgoing data in the	O

Parameter	Default	Values	Req/ Opt
		given codepage, otherwise unpredictable results occur. See *What is the Best Internationalization Approach to use?* under *Internationalization with EntireX* for information on which internationalization approach requires a codepage (locale string). By default, no codepage is transferred to the broker. For the most popular internationalization approach, *ICU Conversion* under *Introduction to Internationalization*, the correct codepage (locale string) must be provided. This means it must: ■ follow the rules described under *Locale String Mapping* in the internationalization documentation ■ be a codepage supported by the broker ■ be the codepage used in your environment for file and terminal IO, otherwise unpredictable results may occur. Example: `codepage=ibm-273`	

`compresslevel`	`N`	Enforce compression when data is transferred between broker and server. See *Data Compression in EntireX Broker* in the general administration documentation.
		
		`compresslevel= 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8| 9 | Y | N`
		
		`0-9` 0=no compression
		9=max. compression
		`N` No compression.
		`Y` Compression level 6.
		
		Example:
		`compresslevel=6`
			O

`deployment`	`NO`	Activates the deployment service, see ***Deployment Service***. Required to use the deployment wizard. See *Server Mapping Deployment Wizard* in the COBOL Wrapper documentation. `YES` Activates the deployment service. The RPC server registers the deployment service in the broker.	O

Parameter	Default	Values	Req/ Opt
		NO The deployment service is deactivated. The RPC server does not register the deployment service in the broker. Example: deployment=yes	
encryptionlevel	0	Enforce encryption when data is transferred between client and server. Requires EntireX Security. See ENCRYPTION-LEVEL under *Broker ACI Fields*. 0 Encryption is enforced. 1 Encryption is enforced between server and broker kernel. 2 Encryption is enforced between server and broker kernel, and also between client and broker. Example: encryptionlevel=2	O
etblnk	BROKER	Define the broker stub to be used. See *Administering Broker Stubs* in the z/OS administration documentation for available stubs. Example: etblnk=broker	O
extractor	NO	The extractor service is a prerequisite for remote extractions. See ***Extractor Service***. extractor=YES|NO Example: extractor=yes	O
impersonation	NO	Defines if RPC requests are executed under the user ID of the RPC client. Depending on settings, different levels of checks are done prior to RPC server execution. See also ***Impersonation***. impersonation= NO | YES | AUTO [, sameuser | , anyuser] NO: The RPC request is executed anonymously, which means the user ID of the RPC client is not used. RPC requests are executed under the user ID of the RPC server.	O

<table>
<tr><th>Parameter</th><th>Default</th><th colspan="3">Values</th><th>Req/ Opt</th></tr>
<tr><td></td><td></td><td>YES</td><td colspan="2">The RPC request runs impersonated under the supplied RPC client user ID. The Batch RPC Server validates the RPC client user ID/password pair against the mainframe security repository.</td><td></td></tr>
<tr><td></td><td></td><td>AUTO</td><td colspan="2">Same as option YES above, except that no password validation is performed, that is, the client is treated as already authenticated. For this setting, make sure the RPC client is correctly authenticated; use either
■ a secure broker (validation must be against the correct mainframe security repository where the user IDs are defined) and option sameuser
or
■ your own security implementation (option anyuser is supported for compatibility reasons if you need different broker and server user IDs - the customer-written security implementation must validate the RPC client using the RPC client user ID)</td><td></td></tr>
<tr><td></td><td></td><td></td><td>sameuser</td><td>The Batch RPC Server checks whether the broker client user ID matches the RPC client user ID. This is the default if AUTO is used.</td><td></td></tr>
<tr><td></td><td></td><td></td><td>anyuser</td><td>The RPC client user ID is used for impersonation. The broker client user ID is ignored.</td><td></td></tr>
<tr><td></td><td></td><td colspan="3">Note:

1. EntireX supports two user ID/password pairs: a broker client user ID/password pair and an</td><td></td></tr>
</table>

Parameter	Default	Values	Req/ Opt
		(optional) *RPC user ID/password* pair sent from RPC clients to the RPC server. 2. With EntireX Security, the *broker client user ID/password* pair is checked. The *RPC user ID/password* pair is designed to be checked by the target RPC server. Thus it is possible to use different user IDs in the broker and target RPC server. 3. RPC clients send the (optional) *RPC user ID/password* pair in the same way as specifying the Natural user ID/password pair for a Natural RPC Server. See for example *Using Natural Security* in the respective section of the documentation. 4. If the RPC client does not specify the optional *RPC user ID/password pair*, the *broker client user ID* is inherited to the *RPC user ID* and thus used for impersonation by the Batch RPC Server. Example: `impersonation=auto,anyuser` Using impersonation requires additional installation steps. See *Using z/OS Privileged Services* in the z/OS installation documentation.	
`library`	no default	`library = search-logic [- library] where search-logic is one of FIX(dllname) | PREFIX(prefix) | PREFIX()` This parameter applies to programming language C only. Do not set if other programming languages for RPC server are used. `FIX(dllname)` The IDL library name coming from the RPC client is ignored, thus long IDL library names can be used. You have to define the DLL names for all client interface objects and RPC servers. `PREFIX(prefix)` The IDL library name coming from the RPC client is used to form the DLL name. As `prefix` you can define any character. If an RPC client sends, for example, `"SYSTEM"` as the IDL	O

Parameter	Default	Values	Req/ Opt
		library name and "D" is defined as *prefix*, the DLL name derived is "DSYSTEM". This configuration restricts the IDL library names to max. 7 characters. PREFIX() The IDL library name coming from the RPC client is used as DLL name. This configuration restricts the IDL library names to max. 8 characters. Example PREFIX configuration (this configuration matches the standard names produced by the C Wrapper): library=PREFIX(D)-PREFIX() Example FIX configuration: library=FIX(MYSTUBS)-FIX(MYRPCS)	
logon	YES	Execute broker functions LOGON/LOGOFF in worker threads. Must match the setting of the broker attribute AUTOLOGON. Reliable RPC requires logon set to YES. See *Reliable RPC*. NO No logon/logoff functions are executed. YES Logon/logoff functions are executed. Example: logon=no	O
marshalling	COBOL	The Batch RPC Server can be configured to support either COBOL, PL/I or C. See also ***Locating and Calling the Target Server***. marshalling=(LANGUAGE=COBOL|PLI [flavor=ENTERPRISE | MVS] | C) COBOL Server supports COBOL. The COBOL servers are called directly without a server interface object. So-called server mapping (SVM) files are used to call the COBOL server correctly if one is available. See *Server Mapping Deployment*. PLI Server supports PL/I Server compiled with IBM's PL/I. In z/OS load modules	O

Parameter	Default	Values		Req/ Opt
			produced by newer IBM PL/I compilers and linkers, the flavor can be detected automatically, thus `flavor` can be omitted.	
			`ENTERPRISE` Enterprise compiler z/OS. This is the default if PL/I is used. See prerequisites for z/OS.	
			`MVS` Server supports PL/I Server compiled with older IBM compiler PL/I MVS & VM V1R1 and above. See prerequisites for z/OS.	
		`C`	Server supports C. The modules are called using a server interface object built with the *C Wrapper*.	
`password`	no default	Password for broker logon. Case-sensitive, up to 32 characters. For more information see broker ACI control block field `PASSWORD`. Example: `password=MyPwd`		O
`restartcycles`	15	Number of restart attempts if the broker is not available. This can be used to keep the Batch RPC Server running while the broker is down for a short time. A restart cycle will be repeated at an interval which is calculated as follows: `timeout` + `ETB_TIMEOUT` + 60 seconds where `timeout` is the RPC server parameter (see this table), and `ETB_TIMEOUT` is the environment variable (see *Environment Variables in EntireX* in the general administration documentation)		O

Parameter	Default	Values	Req/ Opt
		When the number of cycles is reached and a connection to the broker is not possible, the RPC server stops. Example: `restartcycles=30`	

return_code	NO	Enable application-specific errors.
		`return_code=(NO|YES)`
		
		`NO` No tests of COBOL special register `RETURN-CODE` for application-provided error.
		`YES` After execution of the RPC server, tests COBOL special register `RETURN_CODE` for application provided error. See ***Aborting RPC Server Customer Code and Returning Error to RPC Client***.
		
		Example:
		`return_code=yes`
			O

runoption	no default	This parameter is for special purposes. It provides the Batch RPC Server with additional information. The runoptions are normally set to meet the platform's requirements. Set this parameter only if a support representive provides you with an option and asks you to do so. The parameter can be defined multiple times. Example: `runoption=<option>` `runoption=<option>`	O
servername	SRV1	Server name part of the server address used by the server. The server address must be defined as a service in the broker attribute file. See *Service-specific Attributes* (`DEFAULTS=SERVICE`) under *Broker Attributes* in the platform-independent administration documentation. Case-sensitive, up to 32 characters. Corresponds to `SERVER` of the broker attribute file. Example: `servername=mySrv`	R
service	CALLNAT	Service part of the server address used by the server. The server address must be defined as a service in the broker attribute file. See *Service-specific Attributes* (`DEFAULTS=SERVICE`) under *Broker Attributes* in the platform-independent administration documentation.	R

Parameter	Default	Values	Req/ Opt
		Case-sensitive, up to 32 characters. Corresponds to `SERVICE` attribute of the broker attribute file. Example: `service=MYSERVICE`	
`smhport`	0	The port where the server listens for commands from the System Management Hub (SMH). If this port is 0 (default), no port is used and management by the SMH is disabled. Example: `smhport=3001`	O
`ssl_file`	no default	Set the SSL parameters. See ***Using SSL or TLS with the RPC Server*** for examples and more information.	O

`svm`	`ERXSVM`	Usage and location of SVM files. If no `svm` parameter is given, the RPC server tries to open the SVM container using DD name `ERXSVM`. If this DD name is not available, no server mappings are used. For more information see ***SVM Files***.
		
		`svm = no| ddname`
		
		`no` No SVM files are used.
		`ddname` DD name of the SVM file container in the started task JCL of the Batch RPC Server.
		
		Example:
		`svm=MYSVM`
		
		For the example above, define the DD name `MYSVM` in the started task JCL of the Batch RPC Server (see ***Started Task JCL***) as
		
		`//MYSVM DD DISP=SHR,DSN=<svm.cluster>`
			O

`timeout`	60	Timeout in seconds, used by the server to wait for broker requests. See broker ACI control block field `WAIT` for more information. Also influences `restartcycles`. Example: `timeout=300`	O
`tracedestination`	`DD:ERXTRACE`	The name of the destination file for trace output. `tracedestination=DD:`*`ddname`*, where *`ddname`* is the name of the trace file.	O

Parameter	Default	Values	Req/ Opt

		Example:
		`tracedestination=DD:MYTRACE`
		
		The DD name `MYSVM` must be defined in the started task of the Batch RPC Server (see ***Started Task JCL***):
		
		`//MYTRACE DD DISP=SHR,DSN=<rpctrace-file>`	

`tracelevel`	`None`	Trace level for the server. See also ***Activating Tracing for the RPC Server***.
		
		`tracelevel = None | Standard | Advanced ↩ | Support`
		
		`None` No trace output.
		`Standard` For minimal trace output.
		`Advanced` For detailed trace output.
		`Support` This trace level is for support diagnostics and should only be switched on when requested by Software AG support.
		
		Example:
		`tracelevel=standard`
			O

`traceoption`	`None`	Additional trace option if trace is active. `None` No additional trace options. `STUBLOG` If `tracelevel` is `Advanced` or `Support`, the trace additionally activates the broker stub log. `NOTRUNC` Normally if a data buffer larger than 8 KB is traced, the buffer trace is truncated. Set this option to write the full amount of data without truncation. **Note:** This can increase the amount of trace output data dramatically if you transfer large data buffers. Example: `traceoption=(STUBLOG,NOTRUNC)`	O

Parameter	Default	Values	Req/ Opt
userid	ERX-SRV	Used to identify the server to the broker. See broker ACI control block field USER-ID. Case-sensitive, up to 32 characters. Example: userid=MyUid	R
workermodel	SCALE,1,3,slowshrink	The Batch RPC Server can be configured to ■ adjust the number of worker threads to the current number of client requests: workermodel=(SCALE,*from*,*thru* [,slowshrink ↩ | fastshrink]) ■ use a fixed number of worker threads: workermodel=(FIXED,*number*) **FIXED**: A fixed *number* of worker threads is used by the Batch RPC Server. **SCALE**: The number of worker threads is adjusted to the current number of client requests. With the *from* value, the minimum number of active worker threads can be set. The *thru* value restricts the maximum number of worker threads. **slowshrink**: The RPC server stops all worker threads not used in the time specified by the timeout parameter, except for the number of workers specified as minimum value. This is the default if SCALE is used. **fastshrink**: The RPC server stops worker threads immediately as soon as it has finished its conversation, except for the number of	O

Parameter	Default	Values	Req/ Opt
		workers specified as minimum value. Example: `workermodel=(SCALE,2,5)`	

Locating and Calling the Target Server

The IDL library and IDL program names that come from RPC client are used to locate the RPC server. See `library-definition` and `program-definition` under *Software AG IDL Grammar* in the *IDL Editor* documentation. This two-level concept (library and program) has to be mapped to the Batch RPC Server environment. Different mechanisms are used depending on the language:

- COBOL
- PL/I
- C
- Assembler (IBM 370)

COBOL

The approach used to derive the z/OS module name for the RPC server depends on whether so-called server mapping files are used or not. See ***Usage of SVM Files*** for an introduction.

- If SVM files are used, the IDL library and IDL program names are used to form a key to locate the SVM entry in the SVM container. If an SVM entry is found, the z/OS module name of the RPC server is derived from the SVM entry. In this case the IDL program name can be different to the z/OS module name if it is renamed during wrapping process (see *Customize Automatically Generated Server Names*) or during the extraction process in the COBOL Mapping Editor (see *The Software AG IDL Tree Pane*).
- If no SVM files are used at all, the IDL program name is used as the z/OS module name of the RPC server (the IDL library name is ignored).

To use the Batch RPC Server with COBOL

1 Make sure that all z/OS modules called as RPC servers

- are compiled with IBM's Language Environment (see **z/OS V1R4.0 Lang Env Prog Guide** for more information)
- use COBOL calling conventions
- can be called dynamically ("fetched") from any Language Environment program

- are accessible through the Batch RPC Server started task JCL `STEPLIB` concatenation. See *Started Task JCL*.

2 Configure the parameter `marshalling` for COBOL, for example:

```
mashalling=COBOL
```

3 Configure the parameter `svm` depending on whether SVM files are used or not.

See also *Scenario I: Calling an Existing COBOL Server* or *Scenario II: Writing a New COBOL Server*.

PL/I

There is a simple mechanism to derive the RPC server z/OS module name:

- The IDL program name is used as the z/OS module name.
- The IDL library name is not used.

To use the Batch RPC Server with PL/I

1 Make sure that all z/OS modules called as RPC servers

- are compiled with IBM's Language Environment (see **z/OS V1R4.0 Lang Env Prog Guide** for more information)
- use PL/I calling conventions
- can be called dynamically ("fetched") from any Language Environment program
- are accessible through the Batch RPC Server started task JCL `STEPLIB` concatenation. See *Started Task JCL*.

2 Configure the parameter `marshalling` for PL/I, for example `marshalling=PLI`.

See also *Scenario III: Calling an Existing PL/I Server* or *Scenario IV: Writing a New PL/I Server*.

C

The approaches needed to derive the dynamic-link libraries (DLLs) names for the RPC server are more complex for C, for the following reasons:

- the limitation of 8 characters per (physical) member (DLL name in PDSE)
- the maximum length of 128 characters per IDL library name (see *Rules for Coding Library, Library Alias, Program, Program Alias and Structure Names* under *Software AG IDL File* in the IDL Editor documentation).

Either you restrict yourself in short IDL library names (up to 8 characters) and use the flexible `PREFIX` configuration, or, if you need independence from the IDL library length and names, use the `FIX` configuration. The parameter *`library`* is used for this purpose.

To use the Batch RPC Server with C

1. Make sure all dynamic-link libraries (DLLs) called as RPC servers and client interface objects are accessible through the Batch RPC Server started task JCL `STEPLIB` concatenation. See *Started Task JCL* under *Administering the Batch RPC Server*.
2. Configure the parameter `marshalling` for C, for example `marshalling=C`.
3. Configure the parameter *`library`* either with the `FIX` configuration or `PREFIX` configuration, depending on how you have built your DLLs. See *Using the C Wrapper for the Server Side (z/OS, UNIX, Windows, BS2000/OSD, IBM i)*.

See also ***Scenario V: Writing a New C Server***.

Assembler (IBM 370)

There is a simple mechanism to derive the RPC server z/OS module name:

- The IDL program name is used as the z/OS module name
- The IDL library name is not used.

To use the Batch RPC Server with Assembler

- Make sure all z/OS modules called as RPC Servers
  - are accessible through the Batch RPC Server started task JCL `STEPLIB` concatenation. See *Started Task JCL* under *Administering the Batch RPC Server*.
  - Use PL/I or COBOL calling conventions. Configure the parameter `marshalling` for PL/I or COBOL.

See also ***Scenario VI: Writing a New Assembler Server***.

Using SSL or TLS with the RPC Server

The Batch RPC Server supports certificates stored in RACF as keyrings. There are two ways of specifying the RACF keyring and other SSL or TLS parameters, depending on the complexity of the parameters:

- as part of the Broker ID for short parameters, the simplest way
- using the SSL file, a text file containing more complex parameters.

As an alternative, you can use for this purpose IBM's Application Transparent Transport Layer Security (AT-TLS), where the establishment of the SSL or TLS connection is pushed down the stack into the TCP layer.

This section convers the following topics:

For more information, see *SSL or TLS and Certificates with EntireX*.

Specifying the SSL or TLS Parameters as Part of the Broker ID

To specify the SSL or TLS parameters as part of the Broker ID

1 In the ***Started Task JCL*** set the LE runtime option `POSIX(ON)`, see ***IBM LE Runtime Options***.

2 Add the RACF keyring `<user-id>/<ring-name>` and other SSL or TLS parameters to the server parameter `brokerid` in the ***Configuration File***. SSL or TLS parameters are separated by ampersand (&).

Example with *Transport-method-style Broker ID*:

```
ETB024:1609:SSL?TRUST_STORE=<user-id>/<ring-name>&VERIFY_SERVER=N
```

Example with *URL-style Broker ID*:

```
ssl://localhost:2010?TRUST_STORE=<user-id>/<ring-name>&VERIFY_SERVER=N
```

3 Make sure the target the Batch RPC Server connects to is prepared for SSL/TLS connections as well. See the following sections:

- *Running Broker with SSL or TLS Transport* in the respective section of the administration documentation

- *Settting up and Administering the Broker SSL Agent* in the UNIX and Windows administration documentation
- Direct RPC in the EntireX Adapter documentation under *webMethods* > *Mainframe Integration* on the **Software AG Product Documentation** website

Specifying the SSL or TLS Parameters in a Separate File

To specify the SSL or TLS parameters in the SSL file

1 In the ***Started Task JCL*** set the LE runtime option `POSIX(ON)`, see ***IBM LE Runtime Options***.

2 Define a so-called SSL file in text format (for example as a PDS member) with the RACF keyring `<user-id>/<ring-name>` and other SSL or TLS parameters.

Example:

```
TRUST_STORE=<user-id>/<ring-name>
VERIFY_SERVER=N
```

Note: Each line in the SSL file must be terminated with hexadecimal zero.

3 In the ***Configuration File***, define a `DDNAME` to be used in the ***Started Task JCL*** to enable the Batch RPC Server to access the SSL file defined in Step 2 above.

Example:

```
...
SS_FILE=DD:MYSSL
...
```

4 Add a DD statement to the ***Started Task JCL*** using the `DDNAME` defined in Step 3 above to point to the SSL file defined in Step 2 above.

Example:

```
//...
//MYSSL    DD DISP=SHR,DSN=<high-level-qualifier>.MYPDS(SSLFILE)
//...
```

5 In the ***Configuration File*** define the server parameter `brokerid` for SSL or TLS connections.

Example with *Transport-method-style Broker ID*:

```
ETB024:1609:SSL
```

Example with *URL-style Broker ID*:

```
ssl://localhost:2010
```

6 Make sure the target the Batch RPC Server connects to is prepared for SSL/TLS connections as well. See the following sections:

- *Running Broker with SSL or TLS Transport* in the respective section of the administration documentation
- *Settting up and Administering the Broker SSL Agent* in the UNIX and Windows administration documentation
- Direct RPC in the EntireX Adapter documentation under *webMethods* > *Mainframe Integration* on the **Software AG Product Documentation** website

Using IBM's Application Transparent Transport Layer Security (AT-TLS)

To set up SSL or TLS with AT-TLS

1 Set up the Batch RPC Server for a TCP/IP connection.

2 Configure the rules for the AT-TLS policy agent the Batch RPC Server matches, for example by using the job name and remote port number the Batch RPC Server connects to. Used certificates are also defined with those rules. Refer to your IBM documentation for further information.

3 Make sure the target the Batch RPC Server connects to is prepared for SSL/TLS connections as well. See the following sections:

- *Running Broker with SSL or TLS Transport* in the respective section of the administration documentation
- *Settting up and Administering the Broker SSL Agent* in the UNIX and Windows administration documentation
- Direct RPC in the EntireX Adapter documentation under *webMethods* > *Mainframe Integration* on the **Software AG Product Documentation** website

Starting the RPC Server

To start the Batch RPC Server

1 Modify the member `EXPSRVB` (see EntireX job library EXX960.JOBS) according to your system requirements and copy the started task JCL to your system `PROCLIB` concatenation. See ***Started Task JCL***.

2 Modify the server parameters ***Configuration File*** according to your system requirement. For details, see ***Configuring the RPC Server***.

3 Start the task manually with

```
/s EXPSRVB
```

Or:

Add the task to your system automation tool(s)

Stopping the RPC Server

To stop the Batch RPC Server

- Use the operator command `STOP`. Examples:

```
/p EXPSRVB
/f EXPSRVB,STOP
```

Or:

Add the `STOP` command to your system automation tool(s).

Or:

Use the System Management Hub; this method ensures that the deregistration from the Broker is correct. See *Broker Administration using System Management Hub* in the UNIX and Windows administration documentation.

Activating Tracing for the RPC Server

To switch on tracing for Batch RPC Server

1 Set the parameters `tracelevel` and `tracedestination`.

2 Dynamically change the trace level with the operator command

```
F EXPSRVB,TRACELEVEL=tracelevel,
```

for valid *tracelevel* values, see `tracelevel`.

The `TRACELEVEL` command without any value will report the currently active trace options, for example:

```
F EXPSRVB,TRACELEVEL
```

might reply with the operator message

```
Tracelevel=0 TraceFile=DD:ERXTRACE
```

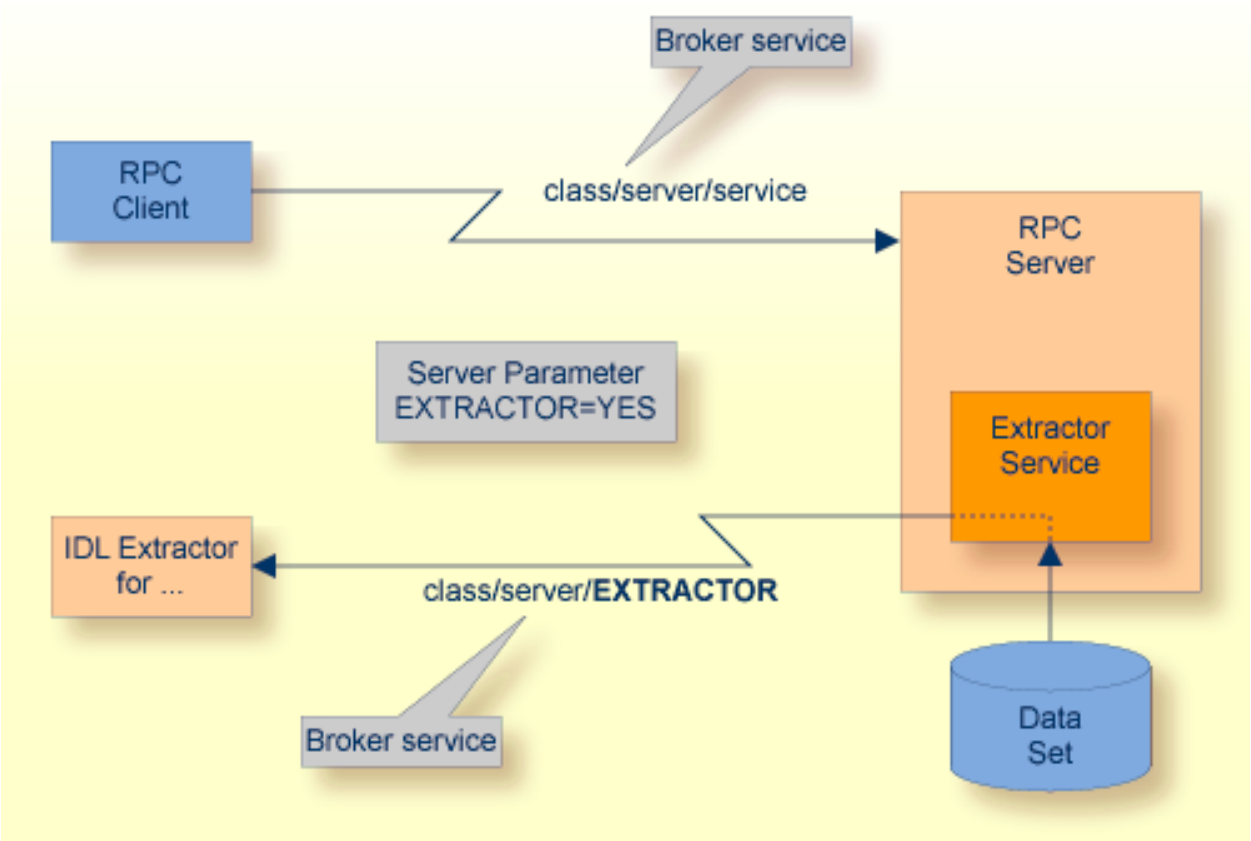
To evaluate the return codes, see *Component Return Codes in EntireX* under *Error Messages and Codes*.

3 Extractor Service

Introduction

The extractor service

- provides access to PDS data sets and CA Librarian DA master files defined within the z/OS catalog
- provides access to security-protected data sets (protected e.g. by RACF, CA ACF2, CA Top Secret)
- is a built-in service of the RPC server, which can be enabled/disabled by RPC server configuration settings
- depending on the platform where the broker is running, usage can be restricted to certain users or group of users, using EntireX Security; see *Authorization of Client and Server* under *Overview of EntireX Security* in the EntireX Security documentation.



Scope

The extractor service is a prerequisite for the

- **IDL Extractor for COBOL**
  used together with a remote extractor environment, see *Step 2: Select a COBOL Extractor Environment or Create a New One* in the IDL Extractor for COBOL documentation.
- **IDL Extractor for PL/I**
  used together with an RPC environment, see *RPC Environment Manager* in the IDL Extractor for PL/I documentation

The extractor service uses the same class and server names as defined for the RPC server, and "EXTRACTOR" as the service name, resulting in *class*/*server*/EXTRACTOR as the broker service. Please note "EXTRACTOR" is a service name reserved by Software AG. See SERVICE under *Broker Attributes* in the platform-independent administration documentation.

CA Librarian Support

- Supported Features:
  - Traditional CA Librarian DA master files are supported.
  - Extraction from multiple CA Librarian data sets is possible.
  - CA Librarian archive levels (history) are supported for the COBOL (main) source where the extraction starts.
  - Security RACROUTE is supported.
  - PDS data sets and CA Librarian data sets can be mixed, that is:
    - the COBOL source can reside in a PDS, and some copybooks in CA Librarian, and others in PDS
    - the COBOL source can reside in CA Librarian, and some copybooks in PDS and others in CA Librarian
    - -INC and COBOL COPY statements can be mixed in one source

Enabling the Extractor Service

To enable the extractor service

1 Set the Batch RPC Server parameter `extractor=yes`. See `extractor` under ***Configuring the RPC Server***.

2 Define in the broker attribute file, under the RPC service, an additional broker service with "`EXTRACTOR`" as the service name and values for class and server identical to those used for the RPC service. For example, if your RPC service is named

```
CLASS = RPC    SERVER = SRV1    SERVICE = CALLNAT
```

the extractor service requires the following additional service definition in the Broker attribute file:

```
CLASS = RPC    SERVER = SRV1    SERVICE = EXTRACTOR
```

3 Optional. If you need to restrict the use of the extractor service to a selected group of users, use EntireX Security and define security rules for the *`class`*`/`*`server`*`/EXTRACTOR` broker service. The service name `EXTRACTOR` is a constant.

- For a z/OS broker, see *Resource Profiles in EntireX Security* in the EntireX Security documentation.
- For a UNIX or Windows broker, see *Administering Authorization Rules using System Management Hub* in the UNIX and Windows administration documentation.
- Not applicable to a BS2000/OSD broker.

4 Optional. Use the `impersonation` feature of the Batch RPC Server to enable access to security-protected data sets (protected e.g. by RACF, CA ACF2, CA Top Secret). See `impersonation` under ***Configuring the RPC Server***.

Disabling the Extractor Service

To disable the extractor service

- Set the Batch RPC Server parameter `extractor=no`. See `extractor` under ***Configuring the RPC Server***. The Batch RPC Server will not register the extractor service in the broker.

Restrictions

The following restrictions apply to CA Librarian:

- Filtering with programmer and type, as is done by the CA Librarian ELIPS (Extended Librarian Interactive Productivity Services) application, is not supported.
- CA Librarian Wide Record Master Files (PDS/E - PO) are not supported.
- CA Librarian MCD Security is not supprted
- CA Librarian member passwords (NOBYPP installations) are not supported
- The optional syntax elements `seq1`, `seq2` and `ARC` of the CA Librarian `-INC module-name[,seq1[,seq2][,ARC={date | Lx | -y}]]` statement are not supported. Therefore CA Librarian archive levels (history) are not supported for COBOL copybooks. It is always the most recent member (last update) that is delivered by the extractor service.

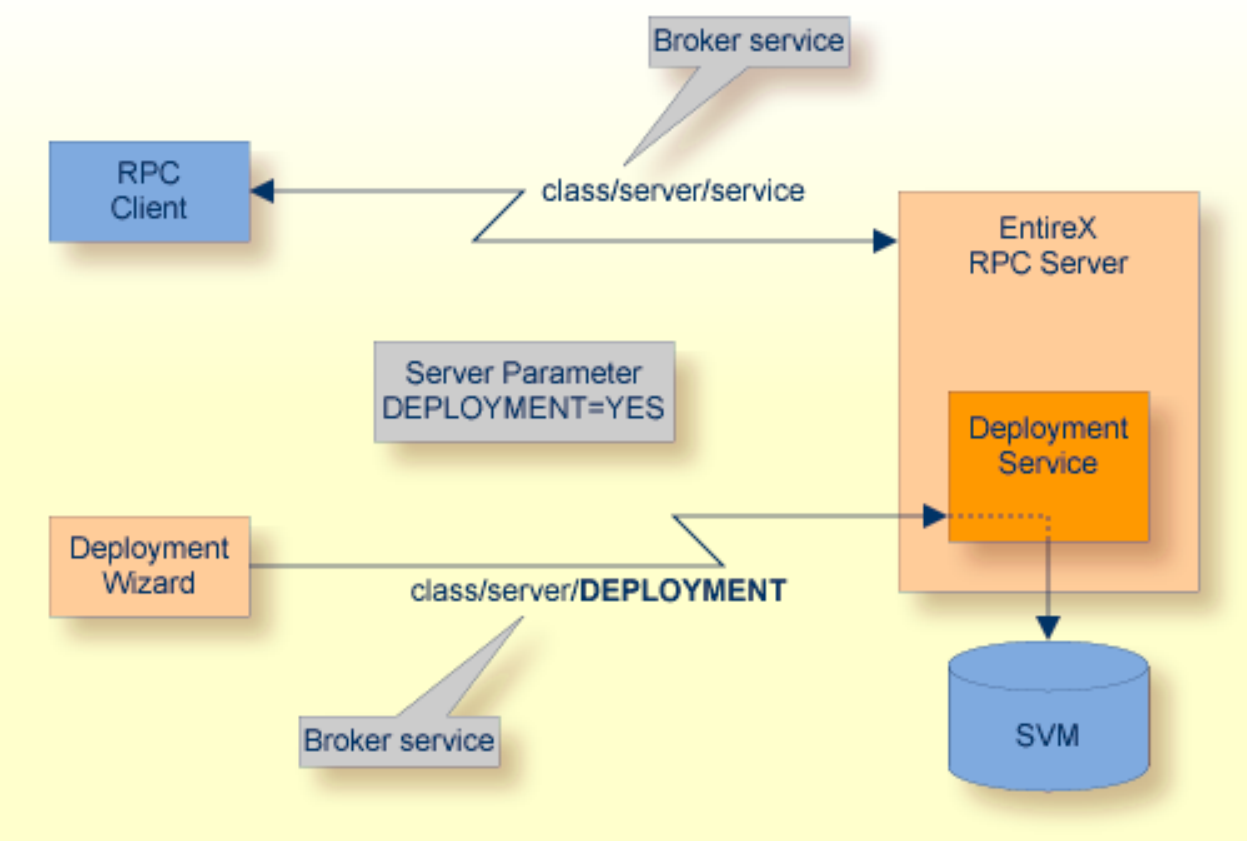
No access is provided to other data sets (e.g. CA Panvalet) or to data sets not defined in the z/OS catalog (e.g. defined in VTOC only).

4 Deployment Service

Introduction

The deployment service

- is the (server-side) counterpart to the deployment wizard; see *Server Mapping Deployment Wizard*.
- is a built-in service of the EntireX RPC server, which can be enabled/disabled by EntireX RPC server configuration settings
- usage can be restricted to certain users or group of users, using EntireX Security; see *Authorization of Client and Server* under *Overview of EntireX Security* in the EntireX Security documentation.



Scope

The deployment service is used for the

- IDL Extractor for COBOL to deploy SVM files with the deployment wizard;
- COBOL Wrapper for server generation to deploy SVM files with the deployment wizard.

See *Server Mapping Deployment Wizard*.

The deployment service uses the same class and server names as defined for the EntireX RPC server, and `DEPLOYMENT` as the service name, resulting in *`class`*`/`*`server`*`/DEPLOYMENT` as the broker service. Please note `DEPLOYMENT` is a service name reserved by Software AG. See broker attribute `SERVICE`.

Enabling the Deployment Service

To enable the deployment service

1 For a Batch RPC Server, the server mapping file VSAM (container) must be installed and configured. See *Install the SVM File for a Batch RPC Server (Optional)* under *Installing the EntireX RPC Servers under z/OS* in the z/OS installation documentation in the z/OS installation documentation.

2 Set the RPC server parameter `deployment=yes`. See `deployment` under ***Configuring the RPC Server***.

3 Define in the broker attribute file, under the RPC service, an additional broker service with `DEPLOYMENT` as the service name and values for class and server identical to those used for the RPC service. For example, if your RPC service is named

```
CLASS = RPC     SERVER = SRV1     SERVICE = CALLNAT
```

the deployment service requires the following additional service definition in the broker attribute file:

```
CLASS = RPC     SERVER = SRV1     SERVICE = DEPLOYMENT
```

4 Optional. If you need to restrict the use of the deployment service to a selected group of users, use EntireX Security and define security rules for the *`class`*`/`*`server`*`/DEPLOYMENT` broker service. The service name `DEPLOYMENT` is a constant.

- For a z/OS broker, see *Resource Profiles in EntireX Security* in the EntireX Security documentation.

- For a UNIX or Windows broker, see *Administering Authorization Rules using System Management Hub* in the UNIX and Windows administration documentation.
- Not applicable to a BS2000/OSD or z/VSE broker.

Disabling the Deployment Service

To disable the deployment service

- Set the Batch RPC Server parameter `deployment=no`. See `deployment` under ***Configuring the RPC Server***.

  The Batch RPC Server will not register the deployment service in the broker.

5 Handling SVM Files

A server mapping file (SVM) enables the RPC server to correctly support special COBOL syntax such as `REDEFINE`s, `JUSTIFIED`, `SYNCHRONIZE` and `OCCURS DEPENDING ON` clauses, `LEVEL-88` fields, etc. If one of these elements is used, the EntireX Workbench automatically extracts an SVM file in addition to the IDL (interface definition language), or an SVM file is generated by the COBOL Wrapper for a server skeleton. The SVM file is used at runtime to marshal and unmarshal the RPC data stream.

SVM Files in the EntireX Workbench

In the *EntireX Workbench*, an SVM file has to relate to an appropriate IDL file. Therefore, you always have to keep the IDL file and the SVM file together in the same folder.

If there is an SVM file and a corresponding IDL file,

- at least one of the IDL programs in the corresponding IDL file requires server-mapping information to correctly call the target server. For those IDL programs, there is an SVM entry (line) in the Workbench SVM file.
- deployment of the SVM file to the RPC server is mandatory, see *Server Mapping Deployment*.

If there is an IDL file but no corresponding SVM file,

- there is no IDL program that requires server mapping information.

SVM Files in the RPC Server

Under z/OS, SVM entries of the EntireX Workbench SVM files are stored as records within one VSAM file (containing all SVM entries from all Workbench SVM files). The unique key of the VSAM file consists of the first 255 bytes of the record: for the type (1 byte), for the IDL library (127 bytes) and for the IDL program (127 bytes). The CICS, Batch and IMS RPC servers use a VSAM file as the container.

If *one* server requires an SVM file, you need to provide this to the RPC server:

- Development environments: to allow the deployment of new SVM files, enable the deployment service. See ***Enabling the Deployment Service***.
- Production environments: provide SVM files to the RPC server. See configuration parameter `svm`.

If *no* server requires an SVM file, you can execute the RPC server without SVM files:

- Development environments: you can disable the deployment service. See ***Disabling the Deployment Service***.

- Production environments: there is no need to provide SVM files to the RPC server. See configuration parameter `svm`.

Source Control of SVM Files

Because SVM entries within an SVM file contain text data only, a Workbench SVM file is text-based (although it is not intended for human consumption). Therefore, you can include it in your source control management together with the IDL file and the COBOL source(s) as a triplet that should always be kept in sync.

Change Management of SVM Files

Under z/OS, change management for a VSAM file (SVM container) is similar to change management for a database. The complete VSAM file can be backed up at any time, for example by using IDCAMS. All updates to the VSAM file done after a backup must be kept.

All Workbench SVM files added since the last backup should be available.

Compare SVM Files

For SVM files in the *EntireX Workbench* format, you can use a third party file/text compare tool to check if two files are identical.

The SVM entries (corresponding to lines in a Workbench SVM file) contain a creation timestamp at offset 276 (decimal) in the format *YYYYMMDDHHIISST*. The precision is 1/10 of a second.

List Deployed SVM Files

Use IDCAMS:

```
//EXXPRINT JOB (,,,999),ENTIREX,NOTIFY=&SYSUID,MSGLEVEL=(1,1),
//             CLASS=K,MSGCLASS=X,REGION=0M
//*-------------------------------------------------------------*
//* PRINT CONTENTS OF AN SVM VSAM CLUSTER                       *
//*-------------------------------------------------------------*
//SVMPRINT EXEC PGM=IDCAMS
//SYSPRINT DD SYSOUT=*
//IN       DD DISP=SHR,DSN=ETS.SVM.KSDS
//OUT      DD SYSOUT=*
```

```
//SYSIN    DD *
  PRINT  -
    INFILE(IN) -
    DUMP | HEX | CHAR -
    OUTFILE(OUT)
/*
//
```

Use `DUMP` or `CHAR` format to print the SVM records of the VSAM file.

Check if an SVM File Revision has been Deployed

SVM entries (corresponding to lines in Workbench SVM files) contain a creation timestamp at offset 276 (decimal) in the format *`YYYYMMDDHHIISST`*. Precision is 1/10 of a second. The creation timestamp can be checked.

The timestamp can be found on the same offset in the records in the VSAM file (SVM container).

Access Control: Secure SVM File Deployment

For deployment with the *Server Mapping Deployment Wizard*, use EntireX Security if the broker is running on platforms z/OS, UNIX , Windows or z/VSE. See ***Enabling the Deployment Service***.

For IBM deployment tool `IDCAMS`, use RACF to secure deployment.

Ensure that Deployed SVM Files are not Overwritten

For IDCAMS, use the `NOREPLACE` option to disallow overwriting of duplicate SVM records in the VSAM file (container). See *Server Mapping Deployment using FTP and IDCAMS*.

When is an SVM File Required?

For the IDL Extractor for COBOL

Interface Type	COBOL Syntax	COBOL Mapping Editor	SVM Required	More Information
CICS with DFHCOMMAREA Calling Convention and `IN` different to `OUT`	all		yes	*CICS with `DFHCOMMAREA` Calling Convention* under *Introduction to the IDL Extractor for COBOL* | *CICS `DFHCOMMAREA`* under *COBOL Parameter Selection*
CICS Channel Container Calling Convention	all		yes	*CICS with Channel Container Calling Convention*
CICS with DFHCOMMAREA Large Buffer Interface	all		yes	*CICS with `DFHCOMMAREA` Large Buffer Interface*
IMS MPP Message Interface (IMS Connect)	all		yes	*IMS MPP Message Interface (IMS Connect)*
IMS BMP with Standard Linkage Calling Convention	all		yes	*IMS BMP with Standard Linkage Calling Convention*
Micro Focus with Standard Linkage Calling Convention	`BINARY` clause		yes	*Micro Focus with Standard Linkage Calling Convention*
all	`OCCURS DEPENDING ON` clause		yes	*Tables with Variable Size - `DEPENDING ON` Clause* under *COBOL to IDL Mapping* in the IDL Extractor for COBOL documentation
all	`REDEFINES` clause		yes	*`REDEFINE` Clause*
all	`TRAILING [SEPARATE]` clause		yes	*`SIGN LEADING` and `TRAILING SEPARATE` Clause*
all	`LEADING [SEPARATE]` clause		yes	*`SIGN LEADING` and `TRAILING SEPARATE` Clause*
all	`ALIGNED RIGHT` attribute		yes	
all	all	Rename of program	yes	*The Software AG IDL Tree Pane* under *Mapping Editor User Interface* in the IDL Extractor for COBOL documentation

Interface Type	COBOL Syntax	COBOL Mapping Editor	SVM Required	More Information
all	all	Map to operation	yes	*Context Menu* under *The COBOL Parameters Pane*
all	all	Map to constant	yes	*Context Menu*
all	all	Suppress	yes	*Context Menu*
other combinations			no	

For the COBOL Wrapper

This depends on the interface type chosen and the IDL type:

Interface Type	IDL Type	COBOL Wrapper	SVM Required	More Information
CICS with DFHCOMMAREA Large Buffer Interface	all		yes	*CICS with DFHCOMMAREA Large Buffer Interface* under *COBOL Server Interface Types*
CICS with Channel Container Calling Convention	all		yes	*CICS with Channel Container Calling Convention*
IMS BMP with Standard Linkage Calling Convention	all		yes	*IMS BMP with Standard Linkage Calling Convention*
Micro Focus	I2 or I4		yes	*Micro Focus with Standard Linkage Calling Convention* | *IDL Data Types* under *Software AG IDL File* in the IDL Editor documentation
all	IDL unbounded array		yes	`array-definition` under *Software AG IDL Grammar* in the IDL Editor documentation
all	IDL unbounded group		yes	`group-parameter-definition` under *Software AG IDL Grammar* in the *IDL Editor* documentation
all	all	IDL program name is not a valid COBOL name and is therefore adapted, or the COBOL program name is customized	yes	*Customize Automatically Generated Server Names*
other combinations			no	

Is There a Way to Smoothly Introduce SVM Files?

All EntireX RPC servers can be executed without SVM files. There is no need to install the SVM container (see *SVM Files in the RPC Server*) as long as you do not use features that require SVM files (see *When is an SVM File Required?*). You can also call COBOL servers generated or extracted with previous versions of EntireX mixed with a COBOL server that requires SVM files. All EntireX RPC servers are backward compatible.

6 Scenarios and Programmer Information

COBOL Scenarios

Scenario I: Calling an Existing COBOL Server

To call an existing COBOL server

1 Use the *IDL Extractor for COBOL* to extract the Software AG IDL and, depending on the complexity of the extraction, also an SVM file.

2 Build an EntireX RPC client using any EntireX wrapper. See *EntireX Wrappers*. For a quick test you can:

- use the IDL Tester; 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*

See *Client and Server Examples for z/OS Batch* for COBOL RPC Server examples.

Scenario II: Writing a New COBOL Server

To write a new COBOL server

1 Use the *COBOL Wrapper* to generate a COBOL server skeleton and, depending on the complexity of the extraction, also an SVM file. Write your COBOL server and proceed as described under *Using the COBOL Wrapper for the Server Side*.

2 Build an EntireX RPC client using any EntireX wrapper. See *EntireX Wrappers*. For a quick test you can:

- use the IDL Tester; 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*

See *Client and Server Examples for z/OS Batch* for COBOL RPC Server examples.

PL/I Scenarios

Scenario III: Calling an Existing PL/I Server

To call an existing PL/I server

1 Use the *IDL Extractor for PL/I* to extract the Software AG IDL.

2 Build an EntireX RPC client using any EntireX wrapper. See *EntireX Wrappers*. For a quick test you can:

- use the IDL Tester; 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*

See *Client and Server Examples for z/OS Batch* for PL/I RPC Server examples.

Scenario IV: Writing a New PL/I Server

To write a new PL/I server

1 Use the *PL/I Wrapper* to generate a PL/I server skeleton. Write your PL/I server and proceed as described under *Using the PL/I Wrapper for the Server Side*.

2 Build an EntireX RPC client using any EntireX wrapper. See *EntireX Wrappers*. For a quick test you can:

- use the IDL Tester; 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*

See *Client and Server Examples for z/OS Batch* for PL/I RPC Server examples.

C Scenarios

Scenario V: Writing a New C Server

To write a new C server

1 Use the *C Wrapper* to generate a C server skeleton and a C server interface object. Write your C server and proceed as described under *Using the C Wrapper for the Server Side (z/OS, UNIX, Windows, BS2000/OSD, IBM i)*.

2 Build an EntireX RPC client using any EntireX wrapper. See *EntireX Wrappers*. For a quick test you can:

- use the IDL Tester; 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*

Assembler Scenarios

Scenario VI: Writing a New Assembler Server

To write a new Assembler (IBM 370) server

1 Build an RPC server in Assembler. Here are some hints:

- The RPC server is dynamically callable (no pre-initialization required).
- The parameter interface is either compatible with the COBOL or PL/I calling convention (IDL level parameter will be passed in the address list). Configure the parameter `marshalling` accordingly for COBOL or PL/I.
- The alignment of integer or float data types is considered. The HASM Assembler aligns integer or float data types to appropiate boundaries. For example:

```
...
      MyLabel   DSECT
      MyField1  DS   H                      I2
      MyField2  DS   F                      I4
      MyField3  DS   E                      F4
      MyField4  DS   L                      F8
```

- The Batch RPC Server will not align these data types by default.
- To force alignment by definition in your IDL file (see the aligned attribute within the `attribute-list`) before generating your RPC client. For information on whether your client supports the aligned attribute, see *Mapping the `aligned` Attribute* in the respective Wrapper documentation.

2 Build an EntireX RPC client using any EntireX wrapper. See *EntireX Wrappers*. For a quick test you can:

- use the IDL Tester; 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*

Aborting RPC Server Customer Code and Returning Error to RPC Client

Using RETURN-CODE Special Register (COBOL only)

The `RETURN-CODE` special register (an IBM extension to the COBOL programming language) is used by your RPC server to report an error.

Upon return, the value contained in the `RETURN-CODE` special register is detected by the Batch RPC Server and sent back to the RPC client instead of the application's data.

For IBM compilers the `RETURN-CODE` special register has the implicit definition:

```
RETURN-CODE GLOBAL PICTURE S9(4) USAGE BINARY VALUE ZERO
```

Special registers are reserved words that name storage areas generated by the compiler. Their primary use is to store information produced through specific COBOL features. Each such storage area has a fixed name, and must not be defined within the program. See your compiler documentation for more information.

The following rules apply to application error codes:

- The value range for application errors is 1-9999. No other values are allowed.

- On the RPC client side, the error is prefixed with the error class 1002 “Application User Error” and presented as error 1002*nnnn*.
- No application data is sent back to the RPC client in case of an error.
- It is not possible to return an error text to the RPC client.

Example

```
. . .
        IF error occurred THEN
               MOVE <error-number> TO RETURN-CODE
               GO TO MAIN-EXIT
        END-IF.
        . . .

   MAIN-EXIT.
       EXIT PROGRAM.
END PROGRAM RETCODE.
```

Note: To enable this feature, configure the Batch RPC Server with `return_code=yes`.