

Natural Development Server

Natural Development Server for z/VSE (SMARTS/Com-plete)

Version 2021Oct

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This document applies to Natural Development Server Version 2021Oct 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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Table of Contents

Preface	vii
1 About this Documentation	1
Document Conventions	2
Online Information and Support	2
Data Protection	3
2 Introducing Natural Development Server	5
Purpose of Natural Development Server	6
Remote Development Functions	6
3 Development Server File	9
Purpose of the Development Server File	10
Relations between FDIC and the Development Server File	10
Unique Development Server File	10
4 Natural Development Server on Mainframes	13
Development Server Concept	14
Front-End Stub NATRDEVS	15
Front-End	16
Transaction Processors	16
Gateway Module	17
Server Monitor	17
Product Interaction	17
5 Prerequisites	19
General Prerequisites for NDV Installation	20
Prerequisites for NDV under SMARTS/Complete on z/VSE	21
Prerequisites/Restrictions for NDV CICS Adapter	21
6 Operating the Natural Development Server	23
Starting the Natural Development Server	24
Terminating the Natural Development Server	24
Monitoring the Natural Development Server	25
Runtime Trace Facility	26
Trace Filter	27
7 Monitor Client NATMOPI	29
Introduction	30
Command Interface Syntax	30
Command Options Available	30
Monitor Commands	31
Directory Commands	31
Command Examples	32
8 HTML Monitor Client	33
Introduction	34
Prerequisites for HTML Monitor Client	34
Server List	34
Server Monitor	36
9 SPoD-Specific Limitations and Considerations	39

Limitations	40
Performance Considerations	49
CICS-Specific Limitations when Using the NDV CICS Adapter	54
Natural Documentation and Online Help	54
10 Natural Development Server Frequently Asked Questions	55
Are there any differences between NDV under SMARTS and NDV under Com-plete?	56
Natural Development Server starts and terminates immediately	56
Which dataset should I analyze to get error information?	56
Trace output shows: Cannot load Natural front-end	57
Trace output shows: Transport initialization failed, EDC8115I address already in use	57
Trace output shows: Error at: Template runtime connect	58
Definitions required in Natural Security	58
I do not get a NAT0954 even if I specify DU=OFF	59
Map Environment fails with a NAT3048	59
Map Environment fails with Stub RCnn	59
Special characters are not translated correctly	61
Characters are not displayed correctly in the terminal emulation of Natural Studio	62
How do I find out which hexadecimal value must be specified for TABAA1/TABAA2?	63
The modifications of TABAA1/TABAA2 do not apply to sources listed in the remote debugger	63
Accessing work files	64
Are there any Natural profile parameter settings required for NDV?	64
Sporadically I get a NAT7660 with socket code 0	64
NAT9915 GETMAIN for thread storage failed	64
The NDV server consumes a lot of CPU time even if only a few clients are using it	65
I get a NAT0873 internal error at user authentication for Map Environment	65
The server fails to start with return code 4 and in the error log I find 'Transport initialization failed'	65
Listing mainframe objects in a view needs a long time	66
11 Natural Development Server CICS Adapter	67
12 Introducing the Natural Development Server CICS Adapter	69
Purpose of the Natural Development Server CICS Adapter	70
Remote Development Functions	70
CICS Support	70
Product Interaction	71
13 Installing the Natural Development Server CICS Adapter under SMARTS on z/VSE	73
Prerequisites	74
Installation Procedure	74
14 Configuring the Natural Development Server CICS Adapter	77

Configuration File	78
Configuration Parameters	78
NDV CICS Adapter User Exits	82
15 NDV CICS Adapter Frequently Asked Questions	89
Under which CICS user ID does the NDV transaction run within the CICS region?	90
I receive a NAT9940 (NAT9939) starting my NDV server.	90

Preface

This documentation applies to Natural Development Server (product code NDV) under SMARTS/Complete on z/VSE.

SMARTS is an acronym for “Software AG Multi-Architecture Runtime System”. It constitutes a runtime layer that allows POSIX-like applications to run on mainframe operating systems. Software AG products communicate with the operating system through the SMARTS layer.

Natural Development Server for z/VSE is released together with Natural for Mainframes. It has the same version number as Natural for Mainframes.

For information on changes, enhancements or new features in this version of Natural Development Server, see the *Release Notes* in the corresponding Natural for Mainframes documentation.

Introducing Natural Development Server	Describes purpose and functionality of Natural Development Server which is used in conjunction with NaturalONE or Natural for Windows (as a client) in a Natural Single Point of Development (SPoD) environment.
Development Server File	Describes purpose and use of the Natural Development Server file, a central dictionary file that is structurally identical to the Natural system file FDIC.
Natural Development Server on Mainframes	Describes concept and architecture of Natural Development Server.
Prerequisites	Describes prerequisites that apply when you install Natural Development Server on a mainframe computer.
Operating the Natural Development Server	How to operate Natural Development Server.
Monitor Client NATMOPI	Describes the Monitor Client NATMOPI, a character-based command interface for monitoring the various types of servers that are provided in a mainframe Natural environment.
HTML Monitor Client	Describes the HTML Monitor Client, a monitor interface that supports any web browser as a user interface for monitoring the various types of servers that are provided in a mainframe Natural environment.
SPoD-Specific Limitations and Considerations	Describes the limitations which are due to the different capabilities of the graphical user interface available on the local site and the character-based user interface that exists on the remote site. In addition, this document includes hints which are important for the efficient use of the remote development facilities.
Natural Development Server Frequently Asked Questions	Contains frequently asked questions concerning Natural Development Server.

Natural Development Server CICS Adapter	Describes the optional Natural Development Server CICS Adapter, which is required if you want to use Natural Development Server in a CICS environment.
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Related Documentation

- Natural Single Point of Development documentation
- NaturalONE documentation
- Natural for Windows documentation
- Natural for Mainframes documentation

1 About this Documentation

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

Document Conventions

Convention	Description
Bold	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 (...).

Online Information and Support

Software AG Documentation Website

You can find documentation on the Software AG Documentation website at <https://documentation.softwareag.com>.

Software AG Empower Product Support Website

If you do not yet have an account for Empower, send an email to empower@softwareag.com with your name, company, and company email address and request an account.

Once you have an account, you can open Support Incidents online via the eService section of Empower at <https://empower.softwareag.com/>.

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To get information about fixes and to read early warnings, technical papers, and knowledge base articles, go to the [Knowledge Center](#).

If you have any questions, you can find a local or toll-free number for your country in our Global Support Contact Directory at https://empower.softwareag.com/public_directory.aspx and give us a call.

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You can find documentation and other technical information on the Software AG Tech Community website at <https://techcommunity.softwareag.com>. You can:

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- Access articles, code samples, demos, and tutorials.
- Use the online discussion forums, moderated by Software AG professionals, to ask questions, discuss best practices, and learn how other customers are using Software AG technology.
- Link to external websites that discuss open standards and web technology.

Data Protection

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.

2 Introducing Natural Development Server

- Purpose of Natural Development Server 6
- Remote Development Functions 6

This chapter describes the purpose and the functions of Natural Development Server (product code NDV) which are used in conjunction with NaturalONE or Natural for Windows (as client) in a Natural Single Point of Development (SPoD) environment.

Purpose of Natural Development Server

Natural Development Server enables you to use NaturalONE or the Natural Studio development environment provided by Natural for Windows to develop and test Natural applications in a remote Natural mainframe environment running under the operating system z/VSE.

For more information on NaturalONE and remote development, see

- NaturalONE documentation (describes the SPoD client side; how to manage offloaded Natural objects in the Eclipse workspace, and also how to modify them directly on a development server).
- Natural Single Point of Development documentation (general information).

For more information on Natural Studio and remote development, see

- Natural for Windows documentation or Help system (describes the SPoD client side; how to manage Natural objects directly on a development server).
- Natural Single Point of Development documentation (general information).

With Natural version 9 on Mainframe, Unix and Linux, NaturalONE and the Natural Development Server are integrated into Natural. The Natural editors (program editor, data editor and map editor) are disabled. As NaturalONE and Natural Development Server licenses are integrated with Natural, they can be activated with the Natural (NAT) license key. This does not apply to Natural for Windows.

Remote Development Functions

- [Establishing a Connection between Client and Server](#)

- [Using the Remote Development Functionality](#)

Establishing a Connection between Client and Server

A connection to an active development server can be established by mapping it in the client (that is, in NaturalONE or Natural Studio). A dialog will be shown for setting up the connection in which you have to specify the following information:

Server

Host name	The host name defines the remote node name where the server is running (or the IP address of the server).
Server port	The server port defines the TCP/IP port number for the development server.
Environment name	The environment name can be used to give the addressed server a logical (descriptive) name. If this box is left blank, a default name will be created automatically.

Startup

Session parameters	<p>If dynamic parameters are required for your development server, specify them in this text box. Otherwise, leave this text box blank.</p> <p>Note: Specifying a parameter string in this text box causes the profile specification of the NDV configuration parameter <code>DEFAULT_PROFILE</code> to be overwritten. For more information on how to configure a Natural Development Server for SMARTS on z/VSE, see <i>Single Point of Development > Natural Development Server for z/VSE > Natural Development Server for z/VSE (SMARTS/Com-plete) > Configuring the Natural Development Server</i>.</p>
User ID	Your user ID is automatically provided.
Password	If Natural Security is installed on the development server, specify the required password in this text box. Otherwise, leave this text box blank.

These settings are transferred to the selected Natural Development Server and evaluated to create an exclusive Natural session that is responsible for executing all development requests for that environment. Once you have successfully mapped a development server, the Natural objects of the connected remote development environment are shown in NaturalONE or Natural Studio.

Using the Remote Development Functionality

You can use the entire functionality of NaturalONE or Natural Studio to create, edit, stow or execute Natural objects on the remote Natural environment. You can map to multiple environments from one NaturalONE or Natural Studio. Each mapped environment owns a Natural session on the Natural Development Server, even if you map multiple environments on the same server.

When you are working with NaturalONE, it is recommended that you work in the so-called "local mode". In local mode, the sources are no longer stored or modified directly on the development

server. The central place for keeping the sources is now the Eclipse workspace which is connected to a version control system.

3 Development Server File

- Purpose of the Development Server File 10
- Relations between FDIC and the Development Server File 10
- Unique Development Server File 10

This chapter describes purpose and use of the Natural Development Server file, a central dictionary file that is structurally identical to the Natural system file `FDIC`.

Purpose of the Development Server File

As Natural stores its data in system files, Natural Development Server stores its data in the system file that is assigned to the Natural parameter `FDIC`, a logical system file which is called the “development server file”.

The development server file is used as a central dictionary file for storing Natural applications and the links to objects making up an application. It also holds object locking information. This information is not bound to certain groups of application developers, but has an impact on the entire application development of an enterprise. Therefore, this file should be available only once, to ensure that the application definitions and locking states are kept consistent.



Note: If a Predict Program object having an implementation pointer completely filled with a Natural member name, library name, user system file number and user system file database id, this documentation is deleted when the Natural member is deleted in an NDV environment. The switch "**Delete documentation with deletion of Natural member**" is by default initialized with "Y", i.e. deleting the existing documentation. If you want to keep the documentation set this new switch to "N".

Relations between FDIC and the Development Server File

The development server file layout corresponds to the file layout of the Natural system file `FDIC` used by Predict. This means that the central dictionary file can also be used to hold Predict data, but Predict is not a prerequisite for using the development server file. This enables you to use your existing application documentation in the application definitions of the remote development environment.

Unique Development Server File

It is of vital importance that the various remote development environments that can be mapped use a common and unique development server file.

Non-compliance with this requirement may give rise to inconsistencies in object locking and in the applications existing in the application workspace.

NTDYNP Macro

To prevent the `FDIC` parameter from being overwritten when a Natural Development Server is mapped, you are strongly recommended to prevent the `NTDYNP` macro from being used to specify `FDIC` as a dynamic parameter.

Under Natural Security

In a Natural Development Server that is protected by Natural Security, the use of another `FDIC` file in the application workspace is prevented if the application security profiles are activated. See also *Application Protection* in the *Natural Security* documentation.

4 Natural Development Server on Mainframes

- Development Server Concept 14
- Front-End Stub NATRDEVS 15
- Front-End 16
- Transaction Processors 16
- Gateway Module 17
- Server Monitor 17
- Product Interaction 17

This chapter describes the concept and the architecture of the Natural Development Server (product code NDV) which is designed for use under SMARTS or Com-plete on z/VSE.

In addition, an optional Natural Development Server CICS Adapter is available that enables Natural Development Servers for z/OS or SMARTS/VSE to be used with a CICS TP monitor.

Development Server Concept

A Natural Development Server is a multi-user, multi-tasking application. It can host Natural sessions for multiple users and execute their requests concurrently.

The concept is based on the “serverized” Natural runtime system. Its architecture comprises a server front-end stub (development server stub NATRDEVS) that uses the Natural front-end to dispatch Natural sessions and to execute functionality within these sessions.

The Natural remote development server architecture basically consists of:

- **Front-end stub**

The stub NATRDEVS is launched to initialize a Natural Development Server. It listens for incoming transactions and dispatches the appropriate Natural session for executing the transaction.

- **Front-end**

The front-end is called (together with the Natural runtime system) by the front-end stub for session initialization/termination, request execution and session roll-in/roll-out.

- **Gateway module**

The module NATGWSTG provides for interaction between the Natural runtime system and the front-end stub. NATGWSTG is already included in the Natural nucleus and is called by the Natural runtime system to exchange the necessary request data.

- **Transaction processors**

Transaction processors are called by the front-end stub. The application logic of each individual transaction is implemented within a transaction processor.

- **Natural Driver**

Natural is driven by the Natural Com-plete interface NCF-SERV.

- **Server monitor**

A monitor task allows the administrator to control the server activities, to cancel particular user sessions or to terminate the entire server, etc.

Front-End Stub NATRDEVS

The multi-user, multi-tasking, front-end stub NATRDEVS is launched to initialize a Natural Development Server.

- [Stub Description](#)
- [Natural System Variables Used](#)
- [Natural I/O Handling](#)

Stub Description

The task executing the server initialization (TMain) basically is the main listener which waits for incoming requests from the remote development client (Natural Studio). It owns a session directory to manage multiple clients (users) and their corresponding remote Natural sessions. TMain has the task to accept all incoming requests and to dispatch them to other subtasks (TWork). The process is as follows:

- First, a **Map Environment** command issued by the user on the client side (in the **Tools** menu of Natural Studio) connects to TMain to establish a connection.
- Next, TMain inserts the client into its session directory, attaches a new TWork subtask and passes the connection to TWork.
- TWork processes the request (indeed initializes a new Natural session if the client sends a CONNECT request) and replies to the client.
- After the reply, TWork listens on that connection for successive requests of that particular client. TWork remains active until the user on the client (Natural Studio) side switches the focus to a different environment (the local or a different mapped environment).
- If the user activates the environment again, TMain launches a new TWork subtask that resumes the existing Natural session from the previous TWork.

That is, each client owns one subtask TWork on the Natural Development Server and multiple remote Natural sessions (one for each mapped environment). This subtask remains active as long as the mapped environment on Natural Studio is the currently active environment. Each remote Natural session remains active until the user disconnects/unmaps the corresponding environment on the client side. Consequently, a Natural session can be executed under different subtasks if the user switches among multiple environments.

Natural System Variables Used

Within a Natural Development Server session, the following Natural system variables are used:

- *TPSYS contains SERVSTUB,
- *DEVICE contains VIDEO,
- *SERVER-TYPE contains DEVELOP.

Natural I/O Handling

The Natural runtime system allows I/O execution in the same way as in an online environment:

- A Natural Development Server intercepts the I/O and sends the 3270 data stream to Natural Studio.
- Natural Studio internally starts a terminal emulation window and passes the 3270 stream to that window.
- After I/O execution, the I/O data is sent back to the server.
- The front-end stub invokes the front-end to continue processing after I/O.

Front-End

The Natural front-end required for a Natural Development Server is the Natural Complete driver NCFNUC that is delivered with the corresponding Natural Version for Mainframes.

The Natural front-end required for executing the Natural sessions under control of CICS is the Natural remote front-end NATCSRFE that is delivered with the Natural Development Server. For further information, refer to [Introducing the Natural Development Server CICS Adapter](#) in the *Natural Development Server CICS Adapter* documentation.

Transaction Processors

The transaction processors are Natural programs in the library SYSLIB that process transactions (for example, "save source", "get library list") requested by the remote development client. The transaction processors are invoked by the front-end stub.

Gateway Module

The gateway module `NATGWSTG` is already included in the Natural nucleus.

For CICS support, the Natural Development Server distribution medium in addition contains the remote gateway modules `NATSRGND/NATLRGND`. These modules are responsible for transmitting the NDV-relevant data between a Natural Development Server and the Natural session running in CICS.

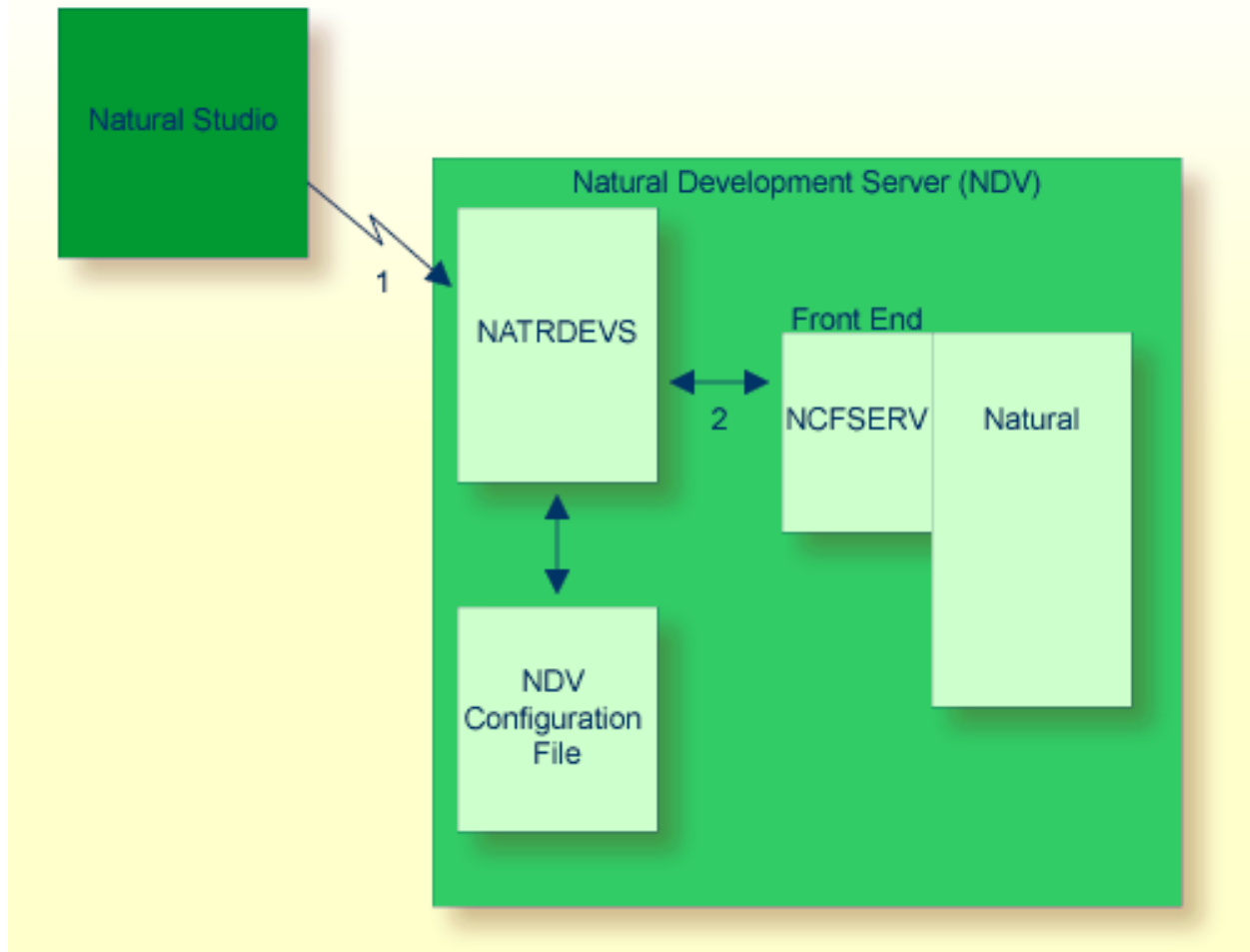
For more information, refer to the Natural Development Server CICS Adapter documentation.

Server Monitor

To enable the administrator to monitor the status of the Natural Development Server, a monitor task is provided which is initialized automatically at server startup. Using the **monitor commands**, the administrator can control the server activities, cancel particular user sessions, terminate the entire server, etc. See *Operating the Development Server*.

Product Interaction

The following figure illustrates the interaction of Natural Studio used as a remote development client with a Natural Development Server.



1. Natural Studio (the client) sends a remote development request to the Natural Development Server (NDV) using the port number specified with the NDV configuration parameter `PORT_NUMBER`.
2. The Natural Development Server dispatches the Natural session using the Natural front-end you have specified with the NDV configuration parameter `FRONTEND_NAME` (`NCFSERV` in this example).

5 Prerequisites

- General Prerequisites for NDV Installation 20
- Prerequisites for NDV under SMARTS/Com-plete on z/VSE 21
- Prerequisites/Restrictions for NDV CICS Adapter 21

This chapter describes the prerequisites that apply when you install a Natural Development Server (product code NDV) on a mainframe computer.

General Prerequisites for NDV Installation

- The currently applicable version of Natural for Mainframes must be installed; refer to Empower at <https://empower.softwareag.com/>.



Important: Any user-written exits not written in Natural and used within a Natural Development Server environment must be reentrant and thread-safe (capable to run in a multi-tasking environment).

- If you are using Predict and you have to migrate to a Predict version specified under *Natural and Other Software AG Products* in the current *Natural Release Notes for Mainframes*, you are strongly recommended to migrate to the newer Predict version *before* you install the Natural Development Server.



Important: If you do not migrate to a Predict version specified under *Natural and Other Software AG Products* in the current *Natural Release Notes for Mainframes* before starting the Natural Development Server installation, you will have to define a new Natural system file FNAT and a new Development Server File (FDIC). The current version of Natural for Mainframes and the desired additional products must have been loaded on the Natural system file FNAT before you start the installation of the Natural Development Server.

- To use other Software AG products in conjunction with the Natural Development Server, refer to the section *Software AG Product Versions Required with Natural* in the current *Natural Release Notes for Mainframes* for the required version.
- The Software AG Editor must be installed. You are recommended to set the size of the editor buffer pool to 1024 KB.

If you are using System Maintenance Aid (SMA), the necessary modules are linked when the SMA parameter SAG-EDITOR is set to Y (Yes). This is the default.

If you are installing without SMA, see *Installation for z/VSE, Installing Software AG Editor*.

- The prerequisites for the operation of a remote development client must be fulfilled in addition. Natural for Windows or NaturalONE must have been installed on the PC client. For information on the applicable version of Natural for Windows, refer to Empower at <https://empower.softwareag.com/>.
- Natural Development Server Version 9.1 is compatible with all supported versions of Natural for Mainframes, Natural for Windows and NaturalONE.



Note: For information about plug-ins and add-on products available, refer to Empower at <https://empower.softwareag.com/> and the section *Natural and Other Software AG Products* in the current *Natural Release Notes for Mainframes*.

Prerequisites for NDV under SMARTS/Com-plete on z/VSE

In addition to the [general prerequisites](#) described above, the following operating-system-specific prerequisites apply:

- z/VSE must be installed.

Version as specified under *Operating/Teleprocessing Systems Required* in the current *Natural Release Notes for Mainframes*.

- SMARTS must be installed (product code APS).
- The Natural Com-plete/SMARTS Interface must be installed (product code NCF).
- To prevent the formation of endless loops in user programs running under NDV, specify a reasonable value for the CPU time limit in the SMARTS parameter `THREAD-GROUP`.
- As a prerequisite for using the client impersonation feature (parameter `SECURITY_MODE`), Natural Security must be installed.

For more information on how to configure a Natural Development Server for SMARTS on z/VSE, see [Single Point of Development > Natural Development Server for z/VSE > Natural Development Server for z/VSE \(SMARTS/Com-plete\) > Configuring the Natural Development Server](#).

Prerequisites/Restrictions for NDV CICS Adapter

The Natural Development Server must have been installed under SMARTS or Com-plete on z/VSE.

In addition, the following prerequisites and restrictions apply to the Natural Development Server CICS Adapter:

- CICS must be installed.

Version as specified under *Operating/Teleprocessing Systems Required* in the current *Natural Release Notes for Mainframes*.

- CICS TCP/IP and the CICS listener must be enabled. Refer to *CICS TCP/IP Socket Interface Guide*.
- The current version of Natural for Mainframes and the corresponding Natural CICS Interface must be installed.

- Natural must not be used with the Natural profile parameter `ADAMODE` (Adabas Interface Mode) set to 0; this settings would cause an excessive number of Adabas user queue elements (UQE) per Natural session.

With the NDV CICS Adapter, it is recommended to use `ADAMODE=1` or `ADAMODE=2`. If you have to use `ADAMODE=0` or `ADAMODE=3`, then it is recommended to use the configuration parameters `RFE_CICS_TA_INIT_TOUT` and `RFE_CICS_KEEP_TA` in the Natural Development Server configuration file.

6 Operating the Natural Development Server

- Starting the Natural Development Server 24
- Terminating the Natural Development Server 24
- Monitoring the Natural Development Server 25
- Runtime Trace Facility 26
- Trace Filter 27

This chapter describes how to operate a Natural Development Server in a SMARTS on z/VSE environment.

Starting the Natural Development Server

A prerequisite is a running SMARTS address space that is configured to run the Natural Development Server (see *Development Server Installation*).

Start the Natural Development Server with the SMARTS console command

```
<msg-id> NATRDEVS <server-id>
```

- where

msg-id is the message identifier assigned to the SMARTS partition,

server-id is the name of your Natural Development Server.

Example:

```
141 NATRDEVS NDVS1
```



Note: If you qualify the Natural Development Server datasets by *server-id*, the server ID is restricted to a maximum length of 6 characters.

Alternatively, you can automatically start Natural Development Servers during SMARTS initialization by using the SMARTS SYSPARM parameter STARTUPPGM. In the SMARTS SYSPARM file specify:

```
STARTUPPGM='NATRDEVS <server-id>'
```

Example:

```
STARTUPPGM='NATRDEVS NDVS1'
```

Terminating the Natural Development Server

The Natural Development Server can be terminated from within the [Monitor Client NATMOPI](#), see [Monitor Commands](#).

Active Natural Sessions are canceled by issuing `cancel session` commands. If, at the time of the Natural Development server shutdown, no Natural session is active on that Natural Development server, then no `cancel session` command is issued.

Natural Development server only uses the `cancel session` command for sessions that are currently executing a Natural session (e.g. using **Run As/Debug As**) or using the **Natural Command Console for Mainframes**. It is only required for active Natural sessions that are not sitting on a terminal I/O. They must either be sitting on a wait inside Natural or looping.

Monitoring the Natural Development Server

To enable the administrator to monitor the status of the Natural Development Server, a monitor task is provided which is initialized automatically at server startup. Using the monitor commands described below, the administrator can control the server activities, cancel particular user sessions, terminate the entire server, etc.

- [Monitor Communication](#)
- [Monitor Commands](#)

Monitor Communication

To communicate with the monitor, you can use the monitor client `NATMOPI`; see [Monitor Client NATMOPI](#). Or you can use the HTML Monitor Client that supports standard web browser; see [HTML Monitor Client](#).

Monitor Commands

The Natural Development Server supports the following monitor commands:

Monitor Command	Action
<code>ping</code>	Verifies whether the server is active. The server responds and sends the string <code>I'm still up</code>
<code>terminate</code>	Terminates the server.
<code>abort</code>	Terminates the server immediately without releasing any resources.
<code>set configvariable value</code>	With the <code>set</code> command, you can modify server configuration settings. For example, to modify <code>TRACE_LEVEL</code> : <code>set TRACE_LEVEL 31+30+15</code>
<code>list sessions</code>	Returns a list of active Natural sessions within the server. For each session, the server returns information about the user who owns the session, the session initialization time, the last activity time and an internal session identifier (<code>session-id</code>).
<code>cancel session session-id</code>	Cancels a specific Natural session within the Natural Development Server. To obtain the session ID, use the monitor command <code>list sessions</code> .

Monitor Command	Action
cleanup	Cancel sessions that are inactive longer than specified in configuration parameter SESSION_TIMEOUT. For more information on how to configure a Natural Development Server for SMARTS on z/VSE, see Single Point of Development > Natural Development Server for z/VSE > Natural Development Server for z/VSE (SMARTS/Complete) > Configuring the Natural Development Server.
help	Returns help information about the monitor commands supported.

Runtime Trace Facility

For debugging purposes, the server code has a built-in trace facility which can be switched on, if desired.

- [Trace Medium](#)
- [Trace Configuration](#)
- [Trace Level](#)

Trace Medium

A remote development server writes its runtime trace to the logical system file SYSOUT of the FSI0 task.

Trace Configuration

The trace is configured by a [trace level](#) which defines the details of the trace. Once a trace is switched on, it can be restricted to particular clients or client requests by specifying a [trace filter](#), see also NDV configuration parameter TRACE_FILTER.

Every Natural session is provided with a 32-bit trace status word (TSW) which defines the trace level for this session. The value of the TSW is set in the NDV configuration parameter TRACE_LEVEL. A value of zero means that the trace is switched off.

For more information on how to configure a Natural Development Server for SMARTS on z/VSE, see Single Point of Development > Natural Development Server for z/VSE > Natural Development Server for z/VSE (SMARTS/Complete) > Configuring the Natural Development Server.

Trace Level

Each bit of the TSW is responsible for certain trace information. Starting with the rightmost bit:

Bit 31	Trace main events (server initialization/termination, client request/result).
Bit 30	Detailed functions (session allocation, rollin/rollout calls, detailed request processing).
Bit 29	Dump internal storage areas.
Bit 28	Session directory access.
Bit 27	Dump request/reply PAL buffer.
Bit 26	Free.
Bit 25	Dump I/O buffer.
Bit 24	Free.
Bit 23	Request processing main events.
Bit 22	Request processing detailed functions.
Bit 21	Remote debugger main events.
Bit 20	Remote debugger detailed functions.
Bit 19-16	Free.
Bit 15	Trace error situations only.
Bit 14	Apply trace filter definitions.
Bit 13	Trace start and termination of the server only.
Bit 12	Trace start and termination of the client sessions only. Even if bit 13 is set.
Bit 11-08	Free.
Bit 07-01	Free.
Bit 00	Reserved for trace-level extension.

Trace Filter

It is possible to restrict the trace by a logical filter in order to reduce the volume of the server trace output.

- The filter can be set with the configuration parameter `TRACE_FILTER`.
- The filter may consist of multiple `keyword=filtervalue` assignments separated by spaces.
- To activate the filter definition, the trace bit 14 in the trace status word (see [Trace Level](#)) must be set.

The filter keyword is:

Client	Filters the trace output by specific clients.
--------	---

The following rules apply:

- If a keyword is defined multiple times, the values are cumulated.
- The value must be enclosed in braces and can be a list of filter values separated by spaces.
- The values are not case sensitive.
- Asterisk notation is possible.

Example:

```
TRACE_FILTER="Client=(KSP P*)"
```

Each request of the user ID `KSP` and each request of the user IDs starting with a `P` are traced.

7 Monitor Client NATMOPI

■ Introduction	30
■ Command Interface Syntax	30
■ Command Options Available	30
■ Monitor Commands	31
■ Directory Commands	31
■ Command Examples	32

Introduction

The Monitor Client NATMOPI is a character-based command interface for monitoring the various types of servers that are provided in a mainframe Natural environment. Each of these servers has its own set of monitor commands which is described in the corresponding server documentation. In addition, a set of directory commands is available which can be used independent of the server type. One NATMOPI can be used to monitor different server types.

Command Interface Syntax

Basically the syntax of the command interface consists of a list of options where each option can/must have a value. For example:

```
-s <server-id> -c help
```

where `-s` and `-c` are options and `<server-id>` and `help` are the option values.

It is possible to specify multiple options, but each option can have only one value assigned.

The command options available are listed below.

Command Options Available

Words enclosed in `<>` are user supplied values.

Command Option	Action
<code>-s <server-id></code>	Specify a server ID for sending a monitor command . If the server ID is not unique in the server directory, NATMOPI prompts the user to select a server.
<code>-c <monitor command></code>	Specify a monitor command to be sent to the server ID defined with the <code>-s</code> option
<code>-d <directory command></code>	Specify a directory command to be executed.
<code>-a</code>	Suppress prompting for ambiguous server ID. Process all servers which apply to the specified server ID.
<code>-h</code>	Print NATMOPI help.

Monitor Commands

These are commands that are sent to a server for execution. The monitor commands available depend on the type of server, however, each server is able to support at least the commands `ping`, `terminate` and `help`.

For further commands, refer to [Operating the Natural Development Server](#) where the corresponding **server commands** are described.

Directory Commands

Directory commands are not executed by a server, but directly by the monitor client NATMOPI.

You can use the directory commands to browse through the existing server entries and to remove stuck entries.

The following directory commands are available. Words enclosed in `<>` are user supplied values and words enclosed in `[]` are optional.

Directory Command	Action
<code>ls [<server-id>]</code>	List all servers from the server directory that apply to the specified server ID. The server list is in short form.
<code>ll [<server-id>]</code>	Same as <code>ls</code> , but the server list contains extended server information.
<code>rs [<server-id>]</code>	Remove server entries from server directory. Note: If you remove the entry of an active server, you will lose the ability to monitor this server process.
<code>cl [<server-id>]</code>	Clean up server directory. This command pings the specified server. If the server does not respond, its entry will be removed from the directory.
<code>ds</code>	Dump the content of the server directory.
<code>lm</code>	List pending IPC messages.

Command Examples

Example: Ping a Server in Different Environments

Server in z/VSE (SMARTS/Complete):

- System operator:

```
(vse-replid) NATMOPI -sServerName -cPING
```

- Com-plete online command:

```
NATMOPI -sServerName -cPING
```

Further Command Examples:

<code>natmopi -dls</code>	List all servers registered in the directory in short format.
<code>natmopi -dcl TST -ls TST</code>	Clean up all servers with ID TST* (ping server and remove it, if it does not respond), and list all servers with ID TST* after cleanup.
<code>natmopi -sSRV1 -cping -sSRV2 ↵ -sSRV3 -cterminate</code>	Send command ping to SRV1. Send command terminate to SRV2 and SRV3.
<code>natmopi -cterminate -sSRV1 ↵ -cping -sSRV2 -sSRV3</code>	Is equivalent to the previous example. That is, NATMOPI sends the command following the -s option to the server. If no -c option follows the -s option, the first -c option from the command line will be used.
<code>natmopi -sSRV1 -cterminate -a</code>	Send command terminate to SRV1. If SRV1 is ambiguous in the server directory, send the command to all SRV1 servers without prompting for selection.

8 HTML Monitor Client

- Introduction 34
- Prerequisites for HTML Monitor Client 34
- Server List 34
- Server Monitor 36

Introduction

The HTML Monitor Client is a monitor interface that supports any web browser as a user interface for monitoring the various types of servers that are provided in a mainframe Natural environment. Each of these servers has its own set of monitor details which are described in the corresponding server documentation. The HTML Monitor Client enables you to list all existing servers and to select a server for monitoring.

Prerequisites for HTML Monitor Client

To run the HTML Monitor Client, any server must host an HTTP Monitor Server. The HTTP Monitor Server is a subtask that can run in any Natural Development Server address space and is configured with the NDV configuration parameter `HTPMON_PORT` and `HTPMON_ADMIN_PSW`. An HTTP Monitor Server is accessible through a TCP/IP port number and can monitor all servers running on the current node (for SMARTS: running within the current SMARTS). Although it is not necessary, you can run multiple HTTP Monitor Servers on one node. But each one needs an exclusive port number.

Server List

Open your web browser and connect the HTTP Monitor Server using the following URL:
`http://nodename:port`, where *nodename* is the name of the host on which the Natural Development Server hosting the monitor is running. And *port* is the port number the administrator has assigned as the monitor port in the NDV configuration file.

Example

Natural Server List					
<input type="button" value="Refresh"/>					
	Server ID	Pid	Started	Config Parameters	Session Parameters
NDV <input type="button" value="Select"/>	DAEFNDV1	2	2017/08/22 07:46:53	PORT_NUMBER = 7201 FRONTEND_OPTIONS = 01 FRONTEND_NAME = NATNDV82 TRACE_LEVEL = 0 HTPMON_PORT = 7202	Version:NAT8206 ADANAME=ADALNKR DBCLOSE=ON ET=OFF ETID=OFF MAXCL=0 ZIIP=OFF Connection = SOC:daef:7201 Security = No
NDV <input type="button" value="Select"/>	DAEFNDV3	3	2017/08/22 07:46:54	PORT_NUMBER = 7318 FRONTEND_OPTIONS = 01 FRONTEND_NAME = NATNDV82 TRACE_LEVEL = 0 HTPMON_PORT = 7316	Version:NAT8206 ADANAME=ADALNKR CFICU=ON CP=IBM01140 DBCLOSE=ON ET=OFF ETID=OFF MAXCL=0 ZIIP=OFF Connection = SOC:daef:7318 Security = No
NDV <input type="button" value="Select"/>	DAEFNDV5	4	2017/08/22 07:46:56	PORT_NUMBER = 7307 FRONTEND_OPTIONS = 01 THREAD_NUMBER = 5 THREAD_SIZE = 1500 FRONTEND_NAME = NATNDV42 TRACE_LEVEL = 0 HTPMON_PORT = 7317	Version:NAT4207 Connection = SOC:daef:7307 Security = No

The server list consists of green and red entries. The red ones represent potentially dead server entries which can be deleted from the server directory by choosing the attached **Remove** button. The **Remove** button appears only for the red entries. “Potentially dead” means, that the HTTP Monitor Server “pinged” the server while assembling the server list, but the server did not answer within a 10 seconds timeout. Thus, even if you find a server entry marked red, it still might be active but could not respond to the ping. Choosing the **Remove** button does not terminate such a server but removes its reference in the monitor directory. Hence, it cannot be reached by the monitor anymore.

Choosing the **Select** button opens a window for monitoring the selected server.

Server Monitor

Example:



With the buttons, you can perform the labeled monitor commands.

The selection box allows you to modify the server configuration parameters. If you select a parameter for modification, it has a predefined value. This predefined value does not reflect the setting of the server. It is just a sample value.

If you choose the **ListSess** button, a list of all Natural sessions appears in the window, for example:

Monitor server QADS4782 44

Reply for server pid 44:

	UserId	SessionId	InitTime	LastActivity	St
1	CF	D2ECEC17EFD90D46	02 07:24:01	02 10:19:32	I
2	QFSTEST	D2ECCDCEC74B4142	02 05:08:31	02 05:40:08	I
3	QFSTEST	D2ECCDB50A4CC242	02 05:08:04	02 05:18:10	I
4	QFSTEST	D2ECB50CA40AFF43	02 03:17:45	02 03:23:08	I
5	QFSUSER	D2ECBF3C8AEC6344	02 04:03:20	02 04:41:43	I
6	QFSUSER	D2ECBBFC020A4B43	02 03:48:47	02 03:52:22	I
7	QFTEST	D2ECEB1DB7DA7C43	02 07:19:39	02 07:23:36	I
8	STARGATE	D2EC53BA2E7B8A46	01 20:02:21	01 20:02:23	

You can cancel sessions by selecting the session ID in the **SessionId** column and choosing the **CancelSession** button.

ListSess shows currently connected sessions. Connected sessions are either permanent connections to Natural Studio or temporary connections to NaturalONE. In case of NaturalONE, a connected session is a session that currently executes a Natural session (for example using **Run As/Debug As**), waits on an I/O screen or uses the **Natural Command Console for Mainframes**.

In conjunction with Security Caching the following buttons are available:

ListClients - to display the clients that are logged in

CancelClient - to delete a client and force a new password prompt

9 SPoD-Specific Limitations and Considerations

- Limitations 40
- Performance Considerations 49
- CICS-Specific Limitations when Using the NDV CICS Adapter 54
- Natural Documentation and Online Help 54

When you are working with Natural Single Point of Development, you will encounter a few limitations which are due to the different capabilities of the graphical user interface available on the local site and the character-based user interface that exists on the remote site. In addition, this document includes hints which are important for the efficient use of the remote development facilities.

Editor Features With SPoD

You can use Natural's Single Point of Development with different versions of Natural on a variety of platforms. Depending on the server environment you are using together with Natural for Windows (client), the editors offer different features. For further information, refer to the section *Editor Features With SPoD* in the *Natural for Windows Editors* documentation.

Limitations

- Execution of Programs Calling CICS-Related 3GL Programs
- LE370 3GL Programs
- Execution of Programs Accessing DL/I Databases
- Execution of Programs Accessing DB2 Databases
- Back-End Program
- System Commands
- Profile Parameters
- Terminal Commands
- Moving/Copying Error Messages
- LIST DDM, EDIT DDM
- Maps Containing GUI Elements
- Field Sensitive Maps
- Resources
- Dialogs
- Natural ISPF Macros and Recordings
- SYSLIB/SYSLIBS
- Allow Lower Case Input in Program Editor of Natural Studio
- Terminal Emulation
- Dependencies between XRef Evaluation and Predict

- [Remote Debugging](#)

Execution of Programs Calling CICS-Related 3GL Programs

The Natural Development Server CICS Adapter must be used to execute programs calling 3GL programs which in turn use CICS-specific information or issue CICS-specific calls (CICS EXEC ...).

LE370 3GL Programs

The execution of LE370 3GL programs is not supported by the Natural Development Server under SMARTS on z/VSE.

Execution of Programs Accessing DL/I Databases

To execute programs accessing DL/I databases, the Natural Development Server CICS Adapter must be used.

Execution of Programs Accessing DB2 Databases

Access to DB2 databases is not supported by the Natural Development Server under SMARTS on z/VSE.

Back-End Program

If a back-end program has been specified (for example, by means of the Natural profile parameter PROGRAM), it is not invoked if the Natural session is executing on a Natural Development Server.

System Commands

- [System Command SYSDDM](#)
- [System Commands Unavailable for Remote Development](#)
- [System Commands Entered Directly on the Development Server](#)

System Command SYSDDM

The system command SYSDDM is not available, since the DDMs are listed in the tree view under the node DDM, and because all functions of the utility SYSDDM are available by using Natural Studio's context menu or menu bar.

System Commands Unavailable for Remote Development

The following system commands are not available, since their use would make no sense with a graphical user interface:

- EDT
- HELLO
- MAINMENU

System Commands Entered Directly on the Development Server

All system commands which are not entered in the user interface of Natural Studio are executed directly by the Development Server without control of Natural Studio. As a result, the character-based representation of the corresponding command appears in the terminal emulation window. This is the case when the `STACK TOP COMMAND` mechanism is used or when a system command is directly entered inside the terminal emulation window.

During the mapping phase any `STACK` commands entered in the text box **Session Parameters** are processed within Natural Studio and the corresponding Natural Studio windows are used.

It is even possible to invoke the mainframe editors. However, this may lead to inconsistencies (see also *Object Locking* in the Natural for Windows documentation). Therefore, you are strongly recommended to use only Natural Studio's GUI editors.

The commands `HELLO` and `MAINMENU` do not cause a screen output on the development server side, since this would not make any sense in the SPoD environment. Instead of the menu-driven user interface, the dialogs provided in Natural Studio are used.

Profile Parameters

CP Parameter

The Natural profile parameter setting `CP=AUTO` is not supported in a SPoD environment. (`AUTO` means that the code page name from the user terminal is taken, if available.)

Terminal Commands

Using terminal commands in a SPoD environment is only possible within the terminal emulation window. Entering terminal commands in the command line of Natural Studio is not possible.

Moving/Copying Error Messages

Moving and copying of error messages is different in remote and local environments:

- When error messages are moved or copied within the remote environment or are moved or copied from the local to the remote environment or vice versa: the error messages involved are merged, that is,
 - error messages which already exist in the target environment are replaced,
 - messages which do not exist in the source library are kept in the target library,
 - messages which do not exist in the target library are added.
- When error messages are moved or copied within the local environment, the messages involved are handled on file level, that is,
 - all error messages (that is, files) of a language are deleted and
 - the file from the source library is created anew in the target library.

LIST DDM, EDIT DDM

In contrast with a pure Natural mainframe environment, that is, without remote development from Natural Studio, the command `EDIT DDM` is available also from a user library. This means that it is not necessary to expand the DDM node in the tree view to be able to edit a specific DDM. However, when Natural Security is used, the use of the commands `LIST DDM` and `EDIT DDM` can be restricted only via the security profile of the mainframe Natural utility `SYSDDM`.

Maps Containing GUI Elements

Maps containing GUI elements can be moved or copied from the local environment to a remote environment. However, the GUI elements are not displayed when the map is being tested or executed on the remote environment.

Field Sensitive Maps

For these maps, the consistency check for a map field is made as soon as the user input has been entered. Field sensitive maps can be moved or copied from the local environment to a remote environment. However, a field sensitive map cannot be tested or executed on a remote mainframe environment.

Resources

On the mainframe, objects of type resource can be handled (displayed, copied, deleted, etc.). See *Using Non-Natural Files - Resources* in the *Natural Programming Guide*.

By default, resources are not handled by Natural Development Server for performance reasons; that is, resources are normally *not* displayed.

If you want Natural Development Server to handle resources, use the user exit NDV-UX03 (source: NDV-SX03), which allows you to enable/disable the display of resources in Natural Studio for all or certain users only.

The server behaves in the following way: If the user exit exists and the flag DISPLAY-RESOURCES contained therein is set (Y), the server checks in the Library Statistical Record whether the number of resources is greater than 0. If so, the library is searched also for resources.

Dialogs

Dialogs can be stored on the mainframe. Therefore it is possible to move or copy dialogs from the local environment to a remote environment. Private resource files of a dialog will not be moved or copied together with the dialog. It is also possible to list dialogs in a remote environment. New dialogs cannot be created and dialogs cannot be edited in a remote environment.

Natural ISPF Macros and Recordings

As the object types Natural ISPF Macro and Recording available with Natural for Mainframes cannot be processed by Natural Studio, they will not be displayed in the tree view of the library work space. If a library consists only of such object types, the library will be displayed nevertheless in the tree view, but without any subnodes.

If a library containing such object types is deleted, then the objects of these two specific object types will not be deleted and the library will continue to be displayed in the tree view.

Objects of the types Natural ISPF Macro and Natural ISPF Recording cannot be linked to an application.

SYSLIB/SYSLIBS

The restricted libraries SYSLIB/SYSLIBS of the server are not shown in Natural Studio's tree view, because a logon to these libraries is not possible. These libraries can be modified only by using a Natural utility such as SYSMAIN or the Object Handler.

Allow Lower Case Input in Program Editor of Natural Studio

Natural Studio's program editor is case-sensitive, that is, lower case input will be included in the program source in lower case. The compiler on the Natural Development Server, however, expects upper case code in its normal setting. This issue can be fixed by setting the compiler option `LOWSRCE=ON`. But this setting will have specific side effects which should be noticed. Refer to the `CMPO` profile parameter in the Natural *Parameter Reference*.

Terminal Emulation

The terminal emulation supports 3270 Model 2 screens. The support of 3270 Model 3, 4 and 5 screens is planned for one of the next versions of Natural Single Point of Development.

Dependencies between XRef Evaluation and Predict

If you are using dynamic language assigned when calling other objects such as `INPUT USING MAP 'MAP1&'`, the connection between caller and called object cannot be retrieved by using XRef Evaluation.

Natural on the mainframe supports case-sensitive calls to other objects such as `PERFORM SUBROUTINE`. With the current version of SPoD, this may lead to strange results when, in XRef Evaluation, trees are expanded and it is not possible to request case-sensitive calls with the filter dialog.

Remote Debugging

When the remote debugging facility was implemented, the goal was not to provide any new functions, but to support the existing essential debugging functions under the Natural Development Server. These functions are:

- Stepmode
- Breakpoints
- Watchpoints
- Display and modification of variables and their contents during a break.

Generally, it was intended to provide for compatibility between the debug functionality that exists in a Natural on mainframes and a Natural on PC. Hence, the current state of development constitutes the lowest possible common denominator. Especially the debug statistics as supported on mainframes are not yet supported in a remote debug environment.

Which Differences Exist in Debugging in a Mainframe Environment and in Natural Studio?

The following tables provide an overview of differences that exist between Natural debugging in a mainframe environment and debugging in Natural Studio.

Explanation of the table headings:

MF	Describes debugging functionality available or not available in a mainframe Natural environment.
SPoD	Describes debugging functionality available or not available in a Natural Single Point of Development environment using Natural Studio as a development client and a mainframe Natural Development Server.
PC	Describes debugging functionality available or not available in Natural Studio (stand alone).

■ Restarting a Debug Process

MF	The restart function is not supported.
SPoD	The restart function is not supported.
PC	Debug on PC offers a special restart function which is not available for remote debugging on mainframe.

■ EXIT from Debugger

MF	System command RUN: leave the Natural Debugger. The program execution continues.
	System command STOP: both debugging and execution are terminated.
SPoD	Stop command in Debug menu: debug mode terminates, program execution stops.
PC	Stop command in Debug menu: debug mode terminates, program execution stops.

■ STEP OVER

MF	Syntax of STEP SKIPSUBLEVEL is used instead of STEP OVER.
SPoD	STEP OVER is applicable for called objects on a different level (CALLNAT, etc). It is not applicable for internal subroutines.
PC	STEP OVER is supported for any called objects and, in addition, for internal subroutines.

■ Set Next Statement (Natural Studio Context Menu Command)

MF	Not applicable.
SPoD	Not supported.
PC	Supported. Allows you to continue the execution at a chosen line.

■ System Variables: Display/Modify

MF	System variables can be displayed, but cannot be modified.
SPoD	System variables can be displayed, but cannot be modified.
PC	System variables can be displayed and modified.

■ Display of Binary Variables

MF	Either alphanumeric or hexadecimal display of binary variables can be selected. In alphanumeric display, binary variables with lengths ranging from 1 to 4 are interpreted and displayed as numerical values. Binary variables with lengths > 4 are displayed in alphanumeric representation.
SPoD	Binary variables are always represented as hexadecimal values.
PC	Binary variables are always represented as hexadecimal values.

■ Modify Dynamic Variables

MF	During the debug process, the content of a dynamic variable can be modified in the given length. Modification of length of dynamic variable during debug is not supported.
SPoD	Content of dynamic variable can be modified in given length.
PC	Both content and length of dynamic variable can be modified during the debug process.

■ Maximum Length when Displaying Variable Values

MF	Displays full content of variable; long variables are displayed in chunks of maximally 256 bytes. If Unicode is used: max. 256 bytes = 128 characters.
SPoD	Displays maximally 253 bytes. If Unicode is used: max. 252 bytes = 126 characters.
PC	Displays maximally 253 characters.

■ Maximum Length of Watchpoint Variables

MF	Maximally 253 bytes. If Unicode is used: max. 252 bytes = 126 characters.
SPoD	Maximally 253 bytes. If Unicode is used: max. 252 bytes = 126 characters.
PC	Maximally 253 characters.

■ **Watchpoint: Display of Break Line**

MF	After the watchpoint has been registered, the Debugger marks the preceding (already executed) statement.
SPoD	After the watchpoint has been registered, the Debugger stops at the current position in the program. This is the statement to be executed next.
PC	After the watchpoint has been registered, the Debugger stops at the current position in the program. This is the statement to be executed next.

■ **Several Watchpoint Breaks per Line of Program**

MF	Multiple breaks on the same line may arise for the same watchpoint variable (because of different watchpoint operators). The hit counter is incremented accordingly.
SPoD	Multiple breaks on the same line may arise for the same watchpoint variable (because of different watchpoint operators). The hit counter is incremented accordingly.
PC	Several watchpoint definitions for the same variable result in a maximum of one break per line, hit counts of all watchpoint definitions are incremented.

■ **Breakpoint Definition**

MF	Breakpoints can only be defined for programs which are found in the current library or in any steplib.
SPoD	Breakpoints can only be defined for programs which are found in the current library or in any steplib.
PC	Breakpoints for programs can be defined in any library (not necessarily in the current library or steplib).

■ **Breakpoints BEG and END**

MF	The symbolic breakpoints <code>BEG</code> and <code>END</code> (first and last executed statement) are supported.
SPoD	Breakpoints <code>BP - BEG</code> and <code>BP - END</code> are not supported.
PC	Breakpoints <code>BP - BEG</code> and <code>BP - END</code> are not supported.

■ Debugging of Programs which are Called through the Stack

MF	Stacked programs can be debugged when any breakpoint or watchpoint has been defined, but they cannot be entered automatically in step mode.
SPoD	Programs on stack can be entered in step mode.
PC	Programs on stack can be entered in step mode.

■ Edit/Stow a Program during Debug

MF	A NAT0932 (program version) error appears if during the debug process the debugged program was stowed and loaded into the buffer pool.
SPoD	A NAT0932 (program version) error appears if during the debug process the debugged program was stowed and loaded into the buffer pool.
PC	Change and stow of program during debug is possible.

■ Call Stack

MF	The debug command <code>OBJCHAIN</code> displays a list of active programs and their levels.
SPoD	The current program and its level are displayed in the call stack window.
PC	All active programs and their levels are displayed in the call stack window.

Performance Considerations

Progress Information

The working situation displayed in the library workspace of Natural Studio is based on the representation of the entire user system files.

The tree view window opens when the user connects to the Natural Development Server. For this, the entire system file has to be analyzed and the corresponding information has to be transferred from the Natural Development Server to the Natural Studio client. In the case of very large system files, the build-up of the tree view window can be very time consuming. Status information displayed in the status bar keeps the user informed about the progress of the screen build-up operation. This is to avoid the impression that the connection to the Natural Development Server might be interrupted.



Tip: Switch on the status bar using the **View > Status Bar** function of the menu bar. Make sure that the transfer rate of your network is 100 Mbit/s at minimum.

Filter Definition

Another possibility to reduce the amount of data read while mapping the environment is to supply filter definitions on system file or library level.



Tip: In the context menu of a system file and library node it is possible to apply filter definitions. Using these definitions on the client side, you can limit the number of libraries/objects displayed in the tree view.

Refresh Options

In the default configuration of Natural Studio, all operations which result in a modification of the system file, for example, moving or copying objects, but also a `SAVE` or `STOW` command, will cause the tree view window contents to be refreshed, which can be a very time consuming process in the case of very large system files.



Tip: By default, the **Refresh** function is set to **Full automatic refresh**. Change the automatic refresh function by choosing **Optimized automatic refresh** or **No automatic refresh** in the context menu.

Since the tree view of the application workspace displays only the objects that are linked to the application, the build-up of its tree view screen is consequently considerably faster, which is another advantage of using the application workspace.

Object Lists on Mainframes

In mainframe environments, libraries may contain a huge number of objects. Expanding such a library in a tree node in the NaturalONE Server view or in the Natural Studio views can take a long time.



Tip: Install the hyperdescriptor as described in *NaturalONE in a Nutshell > Performance Aspects* in the NaturalONE documentation. The hyperdescriptor is also used by Natural Studio. It can significantly improve the database access required for reading object names the Natural system file.

Library Statistical Record

In a Natural Single Point of Development environment, either local Natural libraries are accessed or Natural Studio requests the library statistical data from the remote development server. In the local environment, the data are stored persistently in the FILEDIR structure of the library. In the case of a mainframe development server, Natural objects are stored in system files in the database and the requested statistical data of a library are not stored permanently.

In order to reduce the number of Adabas calls and to improve the performance, a statistical record has been introduced.

The program `NDVCSTAR` is provided to initialize a complete system file, a range of libraries or a single library on a system file with the [Library Statistical Records](#), see [Initialization of Library Statistical Records](#).

- [Concept](#)
- [Data Consistency](#)
- [Restrictions](#)
- [Initialization of Library Statistical Records](#)

Concept

In a Natural Single Point of Development environment, a library statistical record is created and maintained for every library of the `FUSER` or `FNAT` system file. This statistical record resides on the same system file where the library resides and contains the following information for every library:

- Total number of objects
- Total number of all sources
- Total number of all cataloged objects
- Total number of objects for every object type
- Accumulated size of all sources
- Accumulated size of all cataloged objects
- Accumulated size of sources for every object type
- Accumulated size of all cataloged objects for every object type

Supported object types:

- Program
- Map
- GDA
- LDA
- PDA
- Subroutine
- Helproutine
- Subprogram
- Copycode (source only)
- Text (source only)
- Command Processor
- Dialog (source only)
- Class

- Error Message (source only)
- Function
- Adapter
- Resource

When Natural Studio requests the statistics for a library the first time, the library statistical record is created and saved in the appropriate system file. Once the library statistical record has been built, all requests from Natural Studio will be satisfied by reading and sending the contents of the statistical record instead of rebuilding the complete library statistics.

When the user initiates an explicit refresh for a library, the statistical record is rebuilt completely.

Data Consistency

The library statistical record of a mainframe development server is supported only in a Single Point of Development environment. The statistical record is always up to date if all system file modifications are initiated in this environment.

All commands or operations triggered by Natural Studio which will modify the system files (add new object or copy, move, delete, rename object, etc.) will update the library statistical record on the development server.

In addition, the library statistical record is regenerated if an object list for the whole library is requested or the statistical record for a given object type is updated if an object list for this type is requested.

To ensure consistency of the data in the library statistical records of your `FNAT` and `FUSER` system files, you are strongly recommended to make changes on the same `FNAT` and `FUSER` system file used in a Single Point of Development environment exclusively in that environment.



Caution: When working with Natural Studio, care must be taken to start all commands or utilities from within Natural Studio. It is not admissible to issue system commands in the terminal emulation window, for example, at a `MORE` prompt or in a command line. In such a case, the library statistical data might become inconsistent. The same is true if you start a server application that directly changes the `FNAT` or `FUSER` system file.

Such inconsistencies may be resolved after the next regeneration (implicit rebuild via get object list or explicit refresh) of the library statistical record is forced.

Restrictions

Statistical records cannot be used for read-only system files. In this case, the old behavior is used.

Initialization of Library Statistical Records

In order to initialize the Library Statistical Records of a complete system file, a range of libraries or a single library on a system file you can invoke the program NDVCSTAR.

The following options are provided:

Option	Meaning	Default value	
Library name range	Possible values:	*	
	blank or * (asterisk)		All libraries.
	<i>value</i> >		All libraries with names greater than or equal to <i>value</i> .
	<i>value</i> <		All libraries with names less than or equal to <i>value</i> .
DBID, FNR	The database ID (DBID) and file number (FNR) of the system file where the Natural libraries are stored. If no values (or 0) are specified, the current FUSER or FNAT system file is used.	0, 0	
Password, Cipher	The password and cipher code of the Adabas file where the Natural libraries are stored.	None	
Update existing records	Specifies whether existing Library Statistical Records are to be processed. Possible values:	N	
	Y (yes)		Regenerate existing Library Statistical Records.
	N (no)		Skip existing Library Statistical Records.
Display library names	Specifies whether a processing message of the library currently processed is to be displayed. Possible values:	1	
	Y (yes)		Display processing messages.
	N (no)		Display only error messages.

➤ To invoke the program NDVCSTAR

- At a NEXT/MORE prompt or in a Natural command line, enter NDVCSTAR and press ENTER.

➤ To execute the program NDVCSTAR in batch mode

- Enter NDVCSTAR followed by the desired options.

Examples:

```
NDVCSTAR *,1,47,,N,Y
```

On the system file with DB=D=1, FNR=47, this command creates, for all libraries that do not yet have a Library Statistical Record, a new one. Any existing library statistical records are skipped. For every library found, a processing message is displayed.

```
NDVCSTAR ABC*,,,,Y,Y
```

This command creates or regenerates the library statistical record on the current FUSER system file for all libraries that start with ABC. For every library found, a processing message is displayed.

CICS-Specific Limitations when Using the NDV CICS Adapter

This topic is discussed in the Natural Operations for Mainframes documentation. Refer to *Natural as a Server under CICS*.

Natural Documentation and Online Help

The following restrictions apply to the Natural documentation and the Windows-based online help when you are using a Natural Development Server (NDV) for remote development:

- The online help currently available with Natural Studio contains only the Natural for Windows documentation and the SPoD client documentation.
- Therefore this online help may describe Natural features which are not or not yet supported on the mainframe platform.
- Natural features that are available only on mainframes are missing.
- Particularly in the sections dealing with the Natural programming language, minor but important differences due to hardware platforms, operating systems, TP monitors, etc. may exist.

We ask you to refer to the Natural for Mainframes documentation set for full details.

10 Natural Development Server Frequently Asked Questions

▪ Are there any differences between NDV under SMARTS and NDV under Com-plete?	56
▪ Natural Development Server starts and terminates immediately	56
▪ Which dataset should I analyze to get error information?	56
▪ Trace output shows: Cannot load Natural front-end	57
▪ Trace output shows: Transport initialization failed, EDC8115I address already in use	57
▪ Trace output shows: Error at: Template runtime connect	58
▪ Definitions required in Natural Security	58
▪ I do not get a NAT0954 even if I specify DU=OFF	59
▪ Map Environment fails with a NAT3048	59
▪ Map Environment fails with Stub RCnn	59
▪ Special characters are not translated correctly	61
▪ Characters are not displayed correctly in the terminal emulation of Natural Studio	62
▪ How do I find out which hexadecimal value must be specified for TABA1/TABA2?	63
▪ The modifications of TABA1/TABA2 do not apply to sources listed in the remote debugger	63
▪ Accessing work files	64
▪ Are there any Natural profile parameter settings required for NDV?	64
▪ Sporadically I get a NAT7660 with socket code 0	64
▪ NAT9915 GETMAIN for thread storage failed	64
▪ The NDV server consumes a lot of CPU time even if only a few clients are using it	65
▪ I get a NAT0873 internal error at user authentication for Map Environment	65
▪ The server fails to start with return code 4 and in the error log I find 'Transport initialization failed'	65
▪ Listing mainframe objects in a view needs a long time	66

This chapter contains frequently asked questions concerning the Natural Development Server (NDV) under SMARTS or Com-plete on z/VSE.

Are there any differences between NDV under SMARTS and NDV under Com-plete?

No. Installation, configuration, operation and behavior are identical in both environments.

Natural Development Server starts and terminates immediately

At server initialization, the Natural Development Server

- allocates central control blocks,
- opens the datasets STGTRACE, STGSTDO, STGSTDE, STGCONFIG,
- obtains the configuration file,
- loads the Natural front-end,
- initializes the first Natural session and
- launches the TCP/IP listener task.

If one of these steps fails, the server will not be able to continue and will terminate immediately.

Analyze the trace output (STGTRACE) or the error output (STGSTDE) to find out the problem.

STGTRACE, STGSTDO, STGSTDE are synonyms for *serveridE*, *serverid0* and *serveridT*.

Which dataset should I analyze to get error information?

STGSTDE	<p>Contains only error output. Each record consists of 2-4 lines, depending on whether it is a Natural error, a system error or an NDV stub error.</p> <ul style="list-style-type: none">■ Natural Error<ol style="list-style-type: none">1. DayOfMonth Time TaskId UserId2. TaskId NDV Error: error classification3. Natural FrontEnd error or Natural runtime error4. Natural error text■ System Error
---------	--

	<ol style="list-style-type: none"> 1. DayOfMonth Time TaskId UserId 2. TaskId NDV Error: error classification 3. TaskId Sys Error: System error text <ul style="list-style-type: none"> ■ NDV Stub Error <ol style="list-style-type: none"> 1. DayOfMonth Time TaskId UserId 2. TaskId NDV Error: error classification
STGTRACE	<p>Contains NDV trace information and error information.</p> <p>Each trace record contains DayOfMonth Time TaskId trace information text.</p> <p>The string PrintError in the trace information text prefixes errors.</p>
STGSTO	Content of the configuration file allocated to STGCONFIG.
SYSOUT	Messages from LE runtime system.

Trace output shows: Cannot load Natural front-end ...

The Natural front-end specified by the NDV configuration parameter `FRONTEND_NAME` was not found in the load library concatenation. See *Single Point of Development > Natural Development Server for z/VSE > Natural Development Server for z/VSE (SMARTS/Com-plete) > Configuring the Natural Development Server*.

Trace output shows: Transport initialization failed, EDC8115I address already in use

The TCP/IP port number specified by the NDV configuration parameter `PORT_NUMBER` is already in use by another process. See *Single Point of Development > Natural Development Server for z/VSE > Natural Development Server for z/VSE (SMARTS/Com-plete) > Configuring the Natural Development Server*.

Trace output shows: Error at: Template runtime connect

When a Natural Development Server initializes, it starts a Natural session using the session parameter(s) defined by the NDV configuration parameter `SESSION_PARAMETER`. The profile definition of the NDV configuration parameter `DEFAULT_PROFILE` is appended. For more information on how to configure a Natural Development Server for SMARTS on z/VSE, see *Single Point of Development > Natural Development Server for z/VSE > Natural Development Server for z/VSE (SMARTS/Complete) > Configuring the Natural Development Server*.

If the initialization of the template session fails, the server terminates immediately. The original error can be found below the message `Error at:Template runtime connect`.

Typical error situations could be:

- No Natural buffer pool defined.
- Natural system file `FNAT` not accessible.
- Natural profile parameter `ITERM=ON` (Session Termination in Case of Initialization Error).
- NDV initial user ID not defined.

Definitions required in Natural Security

- Each client must be defined in Natural Security (NSC) if the Transition Period Logon flag in NSC is set to `NO`. Otherwise, your **Map Environment** attempt fails with a NAT0873 error.
- You must define an NDV initial user ID (default ID is `STARGATE`) unless you run with Natural profile parameter `AUTO=OFF` (no automatic logon).
- Each user must have either a default library or a private library. Otherwise, your **Map Environment** attempt will fail with a NAT1699 error.
- You must not specify a startup program that executes an I/O statement or stacks a `LOGON`, `LOGOFF` or `RETURN` command, because the program is executed whenever you change the focus to that library within the tree view.
- If you add a new user, you must specify a password for this user. Otherwise, his/her **Map Environment** attempt will fail with a NAT0838 error.

I do not get a NAT0954 even if I specify DU=OFF

The IBM Language Environment (LE) runtime option `TRAP` must be set to `TRAP(ON,NOSPIE)`.

Map Environment fails with a NAT3048

Specify session parameter `ETID=' '`. If you are using Natural Security, clear the ETID (Adabas User Identification) definition for that user.

Map Environment fails with Stub RCnn

Stub return codes are raised by the NDV front-end stub, if it detects a logical processing error when dispatching the NDV request. The NDV trace output contains detailed information about the reason for the error.

The following stub return codes are possible:

Code	Meaning, Reason, Action
1	Error during session reconnect (for future use).
2	Cannot create new session directory entry or subtask. When Natural Studio executes a Map Environment command, the Natural Development Server allocates an entry in its session directory and creates a new subtask. If one of these actions fails, the Stub RC 2 is raised.
3	Cannot initialize new session. This error occurs if a storage allocation for internal NDV control buffers fails due to a lack of virtual memory above 16 MB. Reason: Virtual memory above 16 MB too small. Action: Increase the virtual memory above 16 MB, decrease the number of physical storage threads, distribute the clients to several Natural Development Servers.
4	Session execution failed. Internal error. Natural Studio uses an invalid session identifier to process a request. Reason:

Code	Meaning, Reason, Action
	<ul style="list-style-type: none"> ■ When a Map Environment command is issued, the session ID already exists. ■ The Natural session with the specified ID is not initialized. <p>Action:</p> <p>Locate the defective session ID in the server trace file and cancel it using the monitor task, or restart your Natural Studio session.</p>
5	<p>I/O execution not allowed.</p> <p>In some situations, a Natural I/O is prohibited at the Natural Development Server.</p> <p>Reason:</p> <ul style="list-style-type: none"> ■ I/O execution during LOGON request. ■ I/O execution while a transaction processor is executing. <p>Action:</p> <p>Locate the I/O buffer in the server trace file to find out which I/O should be processed. Check for any startup program specified for the library you want to logon to.</p>
6	<p>Not applicable.</p>
7	<p>Error during I/O execution.</p> <p>The Natural Development Server cannot finish a terminal I/O.</p> <p>Reason:</p> <ul style="list-style-type: none"> ■ Virtual memory above 16 MB too small. ■ I/O reply buffer sent by Natural Studio is invalid. <p>Action:</p> <p>Increase the virtual memory above 16 MB. If the I/O reply buffer is invalid, contact Software AG support.</p>
8	<p>Protocol element missing.</p> <p>Internal error, contact Software AG support.</p>
9	<p>NDV not installed on Natural system file.</p> <p>Natural Development Server cannot execute the Natural module TRPRO located on library SYSLIB.</p> <p>Reason:</p> <ul style="list-style-type: none"> ■ The NDV modules were not loaded on the system file FNAT. <p>Action:</p> <p>Use the Natural utility INPL to load the NDV modules.</p>
10	<p>LOGON command required.</p>

Code	Meaning, Reason, Action
	<p>If you execute a program on the Natural Development Server that executes a LOGOFF (or a RETURN when no SETUP record is available), the logon library is undefined.</p> <p>In an online environment, the Natural Security logon screen is displayed in this situation. Under NDV, the Natural session rejects all requests except a LOGON command. This applies only if Natural Security is installed. You can issue a LOGON command either via the command line or by clicking on any library in your tree view.</p>

Special characters are not translated correctly

The ASCII-to-EBCDIC translation for NDV uses the Natural translation tables TABA1/TABA2. These tables are automatically or manually adapted at the customer's site.

Automatic Adaptation of Translation Tables

Automatic adaptation of the Natural translation tables TABA1/TABA2 takes place if the following Natural profile parameters are set:

- CFICU=ON and
- CP=*value*

where *value* can be any value except OFF or AUTO.

For further information on possible settings, see the corresponding profile parameter descriptions in the Natural *Parameter Reference* documentation.

At session initialization (when you map to the NDV server) Natural automatically adapts its conversion tables TABA1/TABA2 according to the CP parameter definition and the code page used at the client. To verify if the conversion tables have been adapted, set NDV TRACE_LEVEL=31, connect to the NDV host via Natural Studio, and review the NDV trace file.

Each Map Environment starts with:

```
11 07:58:02 00000003 Got new connection
```

some lines down you find:

```
11 07:58:02 00000005 Client codepage: windows-1252
11 07:58:02 00000005 Client operation = 18
```

and again some lines down you find:

```
11 07:58:03 00000005 TABA1/TABA2 adapted according CP definitions
```

which indicates that the table has been adapted.

Manual Adaptation of Translation Tables

The translate tables can be modified as follows:

1. Modify source member `NTTABA1/NTTABA2` on the Natural distribution library. Reassemble `NATCONFIG` and relink the Natural nucleus.
2. Specify the Natural session parameter `TABA1/TABA2`.

Manual adaptation requires setting `CP=OFF`. It also requires that `TERMINAL_EMULATION=WEBIO` be off. As a result, you cannot use the statements `REQUEST DOCUMENT` and `PARSE`.

Automatic and manual adaptation are mutually exclusive. If the automatic adaptation is effective, any `TABA1/TABA2` definitions are discarded. You can use either the automatic or the manual update but not a mix of both.

Do not use Natural Studio session parameters as an approach to permanently implementing these changes. You run the risk that different clients may use different translations, and this could corrupt source code the clients share. It is better to maintain the translation centrally. You can do this in two different ways:

1. Maintain the Natural parameter module, or
2. Use the NDV configuration parameter `SESSION_PARAMETER`.

This affects the SPoD users only.

Characters are not displayed correctly in the terminal emulation of Natural Studio

In Natural Studio, see also Tools / Options / Workspace / Terminal emulation setting in Natural Studio. The default (Latin) may not be the correct choice. For instance, in the US, you probably want to select "United States".

A simple Natural program on the mainframe can reveal the EBCDIC representation of a character which is not converting correctly:

```
#A(A1) = '{'
WRITE #A(EM=H)
END
```

If none of the available code pages applies to your needs, it is possible to adapt one of the N3270_USER 3270 translation tables in the etc directory. Details are in the *Natural for Windows* product documentation.

The web-site <http://www.tachyonsoft.com/uc0000.htm> is a good resource for finding valid EBCDIC and ASCII values for a given character (glyph) in various code pages.

How do I find out which hexadecimal value must be specified for TABA1/TABA2?

Run the following program on your Natural for Windows locally.

```
#A(A1) = '{'
WRITE #A(EM=H)
END
```

Output is 7B.

Run the program on a mainframe (edit the program with the Natural mainframe editor). Output is 75, assuming that you use a German EBCDIC table. If you use a US EBCDIC table, the output will be C0.

Start your Natural Development Server session with TABA1=(75,7B) and TABA2=(7B,75).

The modifications of TABA1/TABA2 do not apply to sources listed in the remote debugger

Specify the NDV configuration parameter `DBG_CODEPAGE=USER`.

For more information on how to configure a Natural Development Server for SMARTS on z/VSE, see Single Point of Development > Natural Development Server for z/VSE > Natural Development Server for z/VSE (SMARTS/Com-plete) > Configuring the Natural Development Server.

Accessing work files

This topic is discussed in the *Natural Operations for Mainframes* documentation.

Are there any Natural profile parameter settings required for NDV?

The following Natural profile parameter values are required for NDV:

- `ETID=OFF` is required to allow multiple Natural sessions for each client.
- `DBCLOSE=ON` is required to remove database resources immediately after session termination rather than to keep them until they are removed due to a timeout.
- `ITERM=OFF` is required to continue with the Natural Development Server initialization, even if session initialization errors occur.
- `AUTO=ON/AUTO=OFF` (Automatic Logon) has a different behavior under Natural Single Point of Development. In an online Natural environment, this parameter controls whether you are prompted for your user ID and password or whether your user ID is treated to be a trusted user ID from the TP environment. With Natural Single Point of Development, you must always specify your user ID and password in the Map Environment dialog.

Sporadically I get a NAT7660 with socket code 0

The reason for this error is a queue overflow for incoming TCP/IP requests that results in an `IPN214W` error in the TCP/IP `SYSLST` output. The SMARTS `SYSPARM` parameter `CDI_DRIVER=('TCP/IP', PAACSOCK, MINQ= nn, MAXQ= nn)` defines the minimum and/or maximum number of requests that can be queued by TCP/IP.

Increase the value of `MINQ` and ensure that `MAXQ` is greater than or equal to `MINQ`.

NAT9915 GETMAIN for thread storage failed

The Natural front-end cannot allocate the Natural thread. Increase the SMARTS `SYSPARM` parameter `THSIZEABOVE`. (The NDV configuration parameter `THREAD_SIZE` is obsolete under `z/VSE`.)

The NDV server consumes a lot of CPU time even if only a few clients are using it

If you run your NDV server without a CPU time limit on session level, a Natural program might run into an endless loop. Issue a server command `list sessions` and examine whether any of the listed sessions has the status code "IO" (under the column header `St.` in the list output). The character `I` means that the client owns an initialized session, and the `O` flags mean that the client occupies a thread and is currently executing.

If a second `list sessions` command results in an "IO" for the same client with an unaltered Last Activity, it is probably a stuck or looping client. You can try to cancel the session using a `CANCEL SESSION` server command. If the cancelation fails, a restart of the NDV server is required.

If the `list sessions` function does not show a stuck or looping client, cancel the NDV server by using the `DUMP` option, and consult Software AG support.

You can define a CPU time limit for NDV servers under SMARTS on VSE with the SMARTS configuration parameter `THREAD-GROUP.THREAD-GROUP=(DEFAULT,($DEFAULT,252,6,3,,N)` defines a maximum CPU time limit of 3 seconds.

I get a NAT0873 internal error at user authentication for Map Environment

Please check the NDV trace file for the message `ExtMsg:Security system not activated (SYSPARM SECSYS)`. This message indicates that SMARTS cannot invoke the external security system specified by the `SYSPARM` parameter `SECSYS`.

The server fails to start with return code 4 and in the error log I find 'Transport initialization failed'

Probably the TCP/IP environment is in error. See the system error message after the error log entry and ask your system programmer(s) for assistance.

Listing mainframe objects in a view needs a long time

Opening a node in the **Natural Server** view or in the Natural Studio views in a mainframe environment can take a long time if a huge number of objects are contained in a library. See [Object Lists on Mainframes](#) in *SPoD-Specific Limitations and Considerations*.

11 Natural Development Server CICS Adapter

The following topics apply if you want to use the Natural Development Server in a CICS TP monitor environment:

Introducing the Natural Development Server CICS Adapter	Describes the purpose and the functions of the Natural Development Server CICS Adapter.
Installing the NDV CICS Adapter under SMARTS on z/VSE	How to configure the CICS connection for a Natural Development Server running under SMARTS on z/VSE.
Configuring the Natural Development Server CICS Adapter	How to configure the CICS connection for a Natural Development Server running on z/OS in batch mode.
NDV CICS Adapter Frequently Asked Questions	Contains frequently asked questions concerning the Natural Development Server CICS Adapter.

See also *SPoD-Specific Limitations and Considerations* for information on CICS-related topics.

12 Introducing the Natural Development Server CICS Adapter

- Purpose of the Natural Development Server CICS Adapter 70
- Remote Development Functions 70
- CICS Support 70
- Product Interaction 71

This chapter describes the purpose and the functions of the Natural Development Server (NDV) CICS Adapter.

Purpose of the Natural Development Server CICS Adapter

The Natural Development Server CICS Adapter is designed for a Natural Single Point of Development context where it enables the use of a Natural Development Server (product code NDV), running under SMARTS or Com-plete on z/VSE within a CICS TP monitor environment.

See also:

- Natural Single Point of Development
- Natural Development Server under SMARTS on z/VSE

Remote Development Functions

The Natural Development Server CICS Adapter enables you to execute a Natural Single Point of Development session within CICS.

In the **Tools** menu, Natural Studio offers you a command named **Map Environment**. This command enables you to open a Natural session on a remote development server.

If you configure the remote development server for use in conjunction with the Natural Development Server CICS Adapter, this Natural session is not hosted by the remote development server, but it is dispatched remotely within a specified CICS region.

CICS Support

The CICS support is not implemented within the front-end stub `NATRDEVS`. For dispatching the Natural sessions in CICS, the development server continues to run in batch mode or under SMARTS. But it uses the remote front-end `NATCSRFE` that is delivered with the Natural Development Server to dispatch the Natural sessions in CICS. That is, depending on the installed front-end, a development server dispatches the sessions locally (`NCFNUC` for SMARTS) or remotely (`NATCSRFE` for CICS).

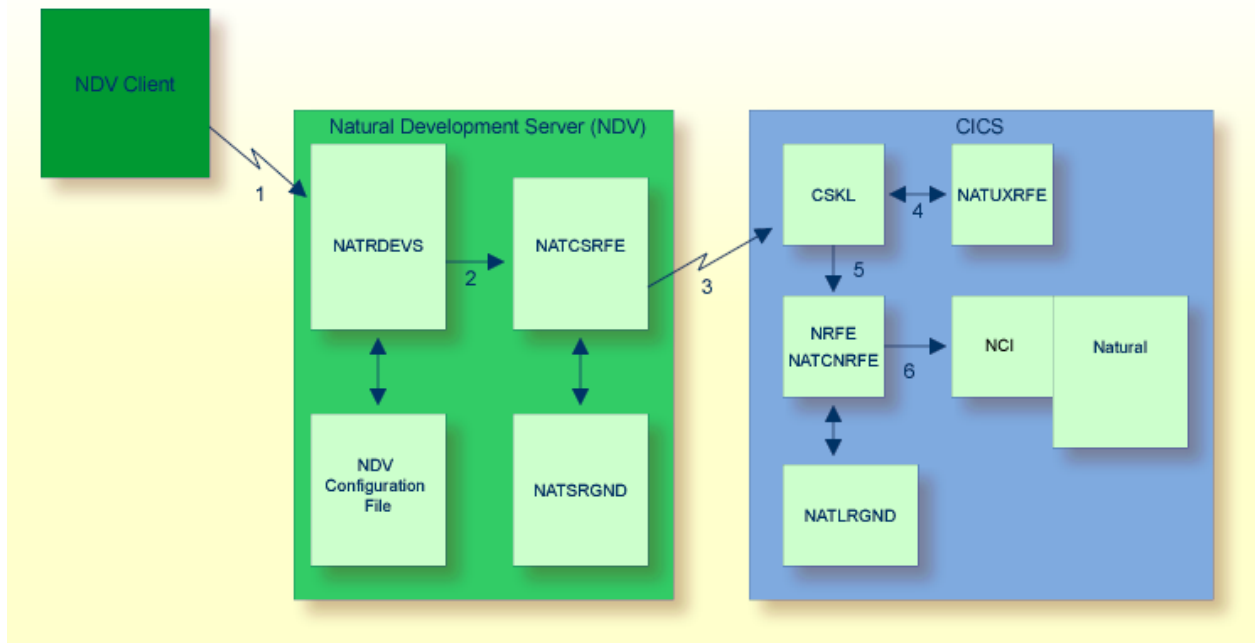
`NATCSRFE` in turn accepts the Natural request from `NATRDEVS` and transfers it to a configured CICS environment using the CICS Socket Interface. Within the CICS environment, a CICS Natural transaction is launched that processes the Natural request and returns the result. Thus it is not necessary to execute the entire development server under CICS. Only small working units (Natural requests such as "save source" or "get library list") are transferred to CICS for execution.

The Natural Development Server CICS Adapter comprises the following components:

NATCSRFE	The remote front-end called by the Natural Development Server to dispatch a Natural request. It is loaded into the development server address space.
NATCNRFE	The counterpart of NATCSRFE. NATCNRFE runs in the CICS address space. It is started by the IBM-provided standard listener of the CICS Socket Interface (refer also to <i>TCP/IP V3R1 for MVS: CICS TCP/IP Socket Interface Guide</i> and <i>TCP/IP for z/VSE V1R5 IBM Program Setup and Supplementary Information</i>).
NATSRGND/NATLRGND	Transmits the NDV-relevant data between Natural Development Server and the Natural session running in CICS. NATSRGND must be loaded into the Natural Development Server address space and NATLRGND into the CICS address space.
NATUXRFE	This user exit obtains the client credentials from the Natural Development Server and authenticates then with a CICS VERIFY PASSWORD request. If the request succeeds, the CICS listener launches the NDV transaction under the client account (impersonation).

Product Interaction

The following figure illustrates the interaction between Natural Studio as a remote development client, the Natural Development Server and the CICS environment involved.



1. Natural Studio sends the remote development request to the Natural Development Server using the port number specified with the Natural Development Server configuration variable `PORT_NUMBER`.
2. The Natural Development Server dispatches the Natural session using the Natural front-end you have specified with the Natural Development Server configuration variable `FRONTEND_NAME`. Specify `NATCSRFE` in order to use the Natural Development Server CICS Adapter.
3. `NATCSRFE` transmits the request to the host/port specified with the Natural Development Server configuration variable `RFE_CICS_TA_HOST / RFE_CICS_TA_PORT`. You must configure the CICS-supplied standard listener `EZAL` to listen at this port.
4. If the Natural Development Server is configured to perform remote impersonation (`SECURITY_MODE=IMPERSONATE/IMPERSONATE_REMOTE`), `NATXRFE` is called to authenticate the client. If the authentication succeeds, `CSKL` launches the CICS transaction `NRFE` under the account of the client (impersonated).
5. `CSKL` launches the CICS transaction you have specified with the Natural Development Server configuration parameter `RFE_CICS_TA_NAME` (`NRFE` in this example). This transaction must be defined to use the program `NATCNRFE`.
6. `NATCNRFE` finally dispatches the Natural session using the Natural CICS front-end you have specified with the Natural Development Server configuration parameter `RFE_CICS_FE_NAME`.
7. The Natural Development Server will use Internet Protocol IPv6 if available. If an IPv6 connection to the CICS adapter is not possible, IPv4 will be used.

13

Installing the Natural Development Server CICS Adapter under SMARTS on z/VSE

- Prerequisites 74
- Installation Procedure 74

This chapter describes how to install the CICS connection for a Natural Development Server (NDV) running under SMARTS on z/VSE.

Prerequisites

For details, refer to the section [Prerequisites](#).

Installation Procedure

To install the Natural Development Server CICS Adapter, perform the following steps:

Step 1: Customize CICS

(Job I005, Step 8405)

The Natural Development Server sublibrary must be defined in the CICS Libdef search chain.

Customize the standard listener EZAL of the CICS socket interface using the CICS transaction EZAC, DISPLAY, LISTENER and, on the second screen, define NATUXRFE in the SECEXIT field of EZAL.

The definition of SECEXIT=NATUXRFE is mandatory when the NDV server is started with impersonation (parameter SECURITY_MODE).

As of z/VSE Version 4.1, the CICS *task related user exit* must be active (transaction EZAT).

Start the standard listener using the CICS transaction EZA0.

The following CICS resource definitions are required:

1. Define the CICS transaction for the remote front-end. This transaction name is an arbitrary name which must be defined in the NDV configuration parameter RFE_CICS_TA_NAME. This document uses the transaction name NRFE.

```
DEFINE TRANSACTION(NRFE) GROUP(ndvgroup)
    PROGRAM(NATCNRFE)
    TWSIZE(128)
    RESTART(NO)
    TASKDATAKEY(USER)
    TASKDATALOC(ANY)
```

2. Define the programs NATCNRFE, NATLRGW0 and NATUXRFE:

```
DEFINE PROGRAM(NATCNRFE) GROUP(ndvgroup)
LANGUAGE(C) DATALOCATION(ANY) EXECCKEY(USER)
```

```
DEFINE PROGRAM(NATLRGW0) GROUP(ndvgroup)
LANGUAGE(C) DATALOCATION(ANY) EXECCKEY(USER)
```

```
DEFINE PROGRAM(NATUXRFE) GROUP(ndvgroup)
LANGUAGE(C) DATALOCATION(ANY) EXECCKEY(USER)
```

NATUXRFE must be defined with EXECCKEY(CICS) because the transaction CSKL is defined with TASKDATAKEY(CICS) and the program NATUXRFE is part of the calling chain initiated by CSKL. This also applies if another transaction defined with TASKDATAKEY(CICS) is used to invoke NATUXRFE.

In addition, when using the CICS open transaction environment (OTE), set the following parameters for NATCNRFE and NATUXRFE:

```
API(OPENAPI)
CONCURRENCY(THREADSAFE)
```

This is required, for example, if the parameter OTE=YES is set for the configuration macro EZACICD with TYPE=CICS for the CICS region, or if the parameter is set with the transaction EZAC,ALTER,CICS.

The values of API, CONCURRENCY and EXECCKEY for NATCNRFE must be the same as for the environment-dependent nucleus of Natural because Natural is called by NATCNRFE using standard linkage conventions (direct branch using a BASR instruction) instead of an EXEC CICS LINK command.

You need not adapt the program definition of NATLRGW0 for the CICS OTE.

Step 2: Link the object modules into the NDV load library

(Job I054, Step 8420)

The NDV object modules must be linked with the necessary runtime extensions of your CICS installations into executable load modules.

Step 3: Customize the Development Server

In order to dispatch the NDV Natural sessions in CICS, you must adapt the configuration file of your development server running under SMARTS on z/VSE. For this purpose, one sample JCL member (SMAI009 Step 8410) is available.

Refer to [Configuring the Natural Development Server CICS Adapter](#) and to Single Point of Development > Natural Development Server for z/VSE > Natural Development Server for z/VSE (SMARTS/Com-plete) > Configuring the Natural Development Server.

14

Configuring the Natural Development Server CICS Adapter

■ Configuration File	78
■ Configuration Parameters	78
■ NDV CICS Adapter User Exits	82

This chapter describes how to configure the CICS connection for a Natural Development Server (product code NDV) running on z/OS or under SMARTS on z/VSE.

Configuration File

After the installation of the NDV CICS Adapter is complete, the configuration of the NDV CICS Adapter has to be done in the Natural Development Server configuration file of the corresponding Natural Development Server.

To enable the CICS Adapter, specify the remote front-end module in the NDV configuration parameter `FRONTEND_NAME` (`FRONTEND_NAME=NATCSRFE`).

Configuration Parameters

The following CICS-relevant configuration parameters exist:

- `RFE_CICS_TA_NAME`
- `RFE_CICS_FE_NAME`
- `RFE_CICS_TA_HOST`
- `RFE_CICS_TA_PORT`
- `RFE_CICS_TA_INIT_TOUT`
- `RFE_CICS_KEEP_TA`
- `RFE_CICS_TRACE`

RFE_CICS_TA_NAME

This configuration parameter specifies the CICS transaction to be used for starting the remote front-end in CICS. This transaction must be defined in CICS and must refer to the program `NATCNRFE`. See also [Installing the NDV CICS Adapter under SMARTS on z/VSE](#).



Note: At logon, this transaction name can be overridden by the user in order to switch to a different CICS transaction on a mainframe. See *Dynamically Changing the CICS Transaction Name when Starting a Session* in the section *Accessing a Remote Development Environment* in the *NaturalONE* documentation.

Default Value	none
Example	RFE_CICS_TA_NAME=NRFE

RFE_CICS_FE_NAME

This configuration parameter specifies the Natural CICS nucleus you have installed with the applicable Natural for Mainframes installation under CICS. This program must be defined in CICS. For further information, see Empower at <https://empower.softwareag.com/>.

Default Value	none
Example	RFE_CICS_FE_NAME=NCIvrNUC

See also the Natural *Installation for Mainframes* documentation, *Installing the Natural CICS Interface, Customize CICS*.

RFE_CICS_TA_HOST

This configuration parameter specifies the TCP/IP address of the host the desired CICS is running. This parameter can be omitted if the development server and CICS are running on the same TCP/IP node.

Default Value	The host address of the development server.
Example	RFE_CICS_TA_HOST=node1 or RFE_CICS_TA_HOST=157.189.160.55

RFE_CICS_TA_PORT

This configuration parameter specifies the TCP/IP port of the CICS supplied listener.

You can acquire this port number using the CICS supplied transaction EZAC. The CICS command `EZAC DISPLAY LISTENER` shows the definitions of the CICS standard listener.



Note: This port number is not used in Natural Studio to map to a remote development server. This port number (and the RFE_CICS_TA_HOST definition) is used internally by the development server to communicate with the CICS region.

Possible Values	1 - 65535
Default Value	none
Example	RFE_CICS_TA_PORT=3010

RFE_CICS_TA_INIT_TOUT

If Natural Studio sends a request to a Natural Development Server that is configured to use the CICS remote front-end, the remote front-end launches a CICS transaction (NRFE) for processing the request. The CICS transaction in turn listens to the TCP/IP to receive the data from the development server required for processing the request.

This configuration parameter specifies the timeout value (in seconds) a launched transaction waits until the expected request data arrive from the development server. If this timeout expires, the request aborts with a NAT9940 error.

Default Value	5
Example	RFE_CICS_TA_INIT_TOUT=20



Note: Do not define a value below 5.

RFE_CICS_KEEP_TA

For each request sent by Natural Studio, the Natural Development Server opens a TCP/IP connection to the CICS region and launches a CICS transaction (NRFE) for processing the request. With `RFE_CICS_KEEP_TA=YES`, the CICS transaction remains active for processing further requests of the same client. This saves the overhead for creating the TCP/IP connection and transaction initialization for successive requests, but consumes more resources within the CICS region due to waiting transactions.

The transaction wait time (for successive requests) is limited by `RFE_CICS_TA_INIT_TOUT`. That is, if the time slice between two successive requests exceeds the time specified by `RFE_CICS_TA_INIT_TOUT`, the CICS transaction and the TCP/IP connection is terminated independent of the `RFE_CICS_KEEP_TA` definition.

`RFE_CICS_TA_INIT_TOUT=5` is a reasonable value to reuse transactions for multiple requests initiated by a single action in Natural Studio and to save CICS resources if Natural Studio waits for the next action of the user.

Default Value	None
Example	RFE_CICS_KEEP_TA=YES

RFE_CICS_TRACE

This configuration parameter specifies the trace level for the remote front-end.

The trace level is similar to the trace implemented for the development server. It is a bit string where each bit is responsible for a certain trace information:

Bit 31	Trace main events (transaction initialization/termination, request processing).
Bit 30	Detailed functions.
Bit 29	Dump internal storage areas.
Bit 27	Dump buffer header exchanged between development server and CICS.
Bit 26	Dump entire buffer exchanged between development server and CICS.
Bit 25	Dump the Natural Development Server relevant buffer only (remote gateway buffer).
Bit 23	Trace error situations only.
Bit 07	Activate trace in the development server region.
Bit 06	Activate trace in the CICS region.
Bit 00	Reserved for trace-level extension.

The trace destination is the data set defined for STDOUT.

Default Value	0
Example	RFE_CICS_TRACE=31+27+7 Dump main events and buffer header in the CICS region (Bits 31 + 27 + 7).

The following is a sample development server configuration file using the Natural Development Server CICS Adapter:

```
# the development server parameter
SESSION_PARAMETER=PROFILE=(NDV,10,930)
FRONTEND_NAME=NATCSRFE           # use the CICS Adapter front-end
PORT_NUMBER=4711                 # the port number used by Natural Studio

# the CICS Adapter parameter
RFE_CICS_TA_NAME=NRFE           # the CICS transaction for remote front-end
RFE_CICS_TA_PORT=3010           # the port of the CICS listener
                                # no RFE_CICS_TA_HOST is defined. This requires
                                # that CICS runs on the same node as the
                                # development server.
RFE_CICS_FE_NAME=NCI41NUC       # the name of the installed Natural CICS nucleus
RFE_CICS_TA_INIT_TOUT=20        # transaction timeout is 20 seconds
```

NDV CICS Adapter User Exits

- [User Exit NRFEUX01](#)

User Exit NRFEUX01

Many customer environments have 3-GL front-ends in their Natural for CICS installation which get control before Natural for CICS gets active in order to prepare the CICS environment for Natural for CICS.

With the NDV CICS Adapter, such a 3-GL front-end is not called.

A user-exit NRFEUX01 is called by the NDV CICS Adapter before Natural for CICS is invoked. Any functionality necessary to prepare the CICS environment for Natural for CICS can be implemented in that exit.

The exit is called before session initialization, before roll-in, after roll-out and after session termination. Special attention must be paid if the exit maintains any resources related to the task number. Under the Natural Development Server, the CICS task number can change during the lifetime of a Natural session. These resources must be saved at roll-out indexed by the session ID. At roll-in these resources must be obtained using the session ID and reallocated under the current task number. The session ID is a unique identifier of a Natural session. This identifier is passed to the exit.

The user exit NRFEUX01 is called by NATNRFE with EXEC CICS LINK. The exit must return with EXEC CICS RETURN. This exit has the following COMAREA layout:

Name	Format	In/Out	Description
Eye	CL8	I	Eyecatcher NATRFE01. The exit should abort if the first six bytes of the eyecatcher do not match. The 01 suffix may increase if the area is expanded at the end. So the exit should accept any number between 01 and 99.
SID	XL8	I	Unique session identifier. A Natural session under Natural Development Server does not necessarily run under one task. The task number may change at each roll-out/roll-in sequence. The only unique identifier of a session is the SID.
EVNT	XL1	I	Current event. Session start (x'00'), end (x'01'), roll-in (x'02'), roll-out (x'03').
	XL3		Unused.
RC	F	O	The return code of the exit (not equal to 0 means session abort).
ETXTL	F	O	Length of the following error text.

Name	Format	In/Out	Description
			A maximum of 80 characters is transmitted to the client. Any longer text is truncated.
ETXT	A	O	Error text to be returned to the client. This area is allocated by the exit and released by NATCNRFE.
SPRML	F	I/O	Length of following session parameter.
SPRM	A	I/O	Session parameter can be modified by the exit. If the length is not appropriate, the exit can release the memory space pointed by SPRM and allocate a larger space.
UID	CL8	I	The user ID of the NDV client.

To install the user exit, implement the program NRFEUX01 and define it to CICS.

Sample User Exit:

```

* =====
* NDV CICS Adapter sample user exit NRFEUX01
* At each invocation this sample writes a line to the CICS log.
* If the user-ID is KSP1, it appends the session parameter with the
* string SPRMFORKSP1.
* If the user-ID is KSP2, it aborts the session with an error message.
* =====
NRFEUX01 DFHEIENT CODEREG=(11),DATAREG=(13),EIBREG=(12)
NRFEUX01 AMODE 31
NRFEUX01 RMODE ANY
          EXEC CICS GETMAIN SET(10) FLENGTH(WK#L)
          CLC   EIBRESP,DFHRESP(NORMAL)
          BNE   RFEM0101          bif error, issue message
          USING WORK,RA
          EXEC CICS ADDRESS COMMAREA(9)
          C     R9,=XL4'FF000000'
          BE    RFEM0102          bif no commarea, issue message
* -----
* Validate input parameter
* -----
          USING COMA,R9
          CLC   CA#EYE,=C'NATRFE'
          BNE   RFEM0103          bif unknown area, issue message
          CLI   CA#EYEV,C'0'
          BL    RFEM0103          bif unknown area, issue message
          CLI   CA#EYEV,C'9'
          BH    RFEM0103          bif unknown area, issue message
          CLI   CA#EYEV+1,C'0'
          BL    RFEM0103          bif unknown area, issue message
          CLI   CA#EYEV+1,C'9'
          BH    RFEM0103          bif unknown area, issue message
          SLR   RF,RF

```

```

ST      RF,CA#RC                set good return code
*
*      -----
*      Perform action depending the given event
*      -----
SLR     R1,R1
ICM     R1,B'0001',CA#EVENT
SLL     R1,2                    *4
C       R1,MAXEVENT
BH      RFEM0104                unknown event, issue message
B       RFEX0020(R1)
RFEX0020 DS  0H
B       RFEX0100                Session start
B       RFEX0200                Session end
B       RFEX0300                Session rollin
B       RFEX0400                Session rollout
MAXEVENT DC  A(*-4-RFEX0020)

RFEX0100 DS  0H
*
*      -----
*      Session start. Allocate resources for that user/SID
*      -----
CLC     CA#USID,=CL8'KSP1'
BNE     RFEX0150
*
*      -----
*      Append given session parameter with TSTPRMS
*      -----
LA      R1,L'TSTPRMS            my param len
A       R1,CA#PARML             + existing param len
LA      R1,1(,R1)               + one delimiter blank
ST      R1,WK#PARML
EXEC    CICS GETMAIN SET(4) FLENGTH(WK#PARML)
ST      R4,WK#PARM
ICM     R1,B'1111',CA#PARML
BZ      RFEX0105                bif no existing parms
L       R0,WK#PARM
L       R2,CA#PARM
LR      R3,R1
MVCL   R0,R2                    move existing parms
LR      R4,R0
MVI     0(R4),C' '              delimit with one blank
LA      R4,1(,R4)
RFEX0105 DS  0H
MVC     0(L'TSTPRMS,R4),TSTPRMS append with TSTPRMS

ICM     R2,B'1111',CA#PARM
BZ      RFEX0110                bif no memory allocated
EXEC    CICS FREEMAIN DATAPOINTER(2)
RFEX0110 DS  0H
MVC     CA#PARM,WK#PARM         return new memory
MVC     CA#PARML,WK#PARML       return new length
RFEX0150 DS  0H
CLC     CA#USID,=CL8'KSP2'

```

```

BNE RFEF0180
*
* -----
*
* Abort this session
* -----
*
LA R1,L'ATXT
ST R1,WK#PARML
EXEC CICS GETMAIN SET(1) FLENGTH(WK#PARML)
ST R1,WK#PARM
MVC 0(L'ATXT,R1),ATXT
LA R1,4
ST R1,CA#RC
RFEF0180 DS 0H
B RFEF1000

RFEF0200 DS 0H
*
* -----
*
* Session end. Deallocate resources for that user/SID
* -----
*
B RFEF1000

RFEF0300 DS 0H
*
* -----
*
* Session rollin. Obtain resources by SID and index by task,
* Task has possibly changed.
* -----
*
B RFEF1000
RFEF0400 DS 0H
*
* -----
*
* Session rollout. Index resources by SID, task may change.
* -----
*
B RFEF1000

RFEF1000 DS 0H
MVI WK#TEXT1,C' '
MVC WK#TEXT1+1(L'WK#TEXT1-1),WK#TEXT1

LA R1,WK#TEXT1
MVC 0(8,R1),=C'RFEUX01 '
LA R1,8(,R1)

MVC 0(L'CA#SID,R1),CA#SID
LA R1,L'CA#SID(,R1)
MVI 0(R1),C' '
LA R1,1(,R1)

MVC 0(L'CA#USID,R1),CA#USID
LA R1,L'CA#USID(,R1)
MVI 0(R1),C' '
LA R1,1(,R1)

SLR R2,R2
ICM R2,B'0001',CA#EVENT

```

```

SLL  R2,3                *8
LA   R2,EVNT(R2)
MVC  0(L'EVNT,R1),0(R2)

EXEC CICS WRITEQ TD QUEUE(=C'CSSL') FROM(WK#TEXT1),          +
      LENGTH(L'WK#TEXT1)
B    RFEX9000

TST  DC  C'NREFUX01 Was active'

* -----
* Home section
* -----
RFEX9000 DS  0H
      LTR  RA,RA
      BZ   RFEX9010          bif no work area aquired
      EXEC CICS FREEMAIN DATAPOINTER(10)
RFEX9010 DS  0H
      EXEC CICS RETURN

RFEM0101 DS  0H
      EXEC CICS WRITEQ TD QUEUE(=C'CSSL') FROM(MSG1) LENGTH(L'MSG1)
      B    RFEM9000
RFEM0102 DS  0H
      EXEC CICS WRITEQ TD QUEUE(=C'CSSL') FROM(MSG2) LENGTH(L'MSG2)
      B    RFEM9000
RFEM0103 DS  0H
      EXEC CICS WRITEQ TD QUEUE(=C'CSSL') FROM(MSG3) LENGTH(L'MSG3)
      B    RFEM9000
RFEM0104 DS  0H
      EXEC CICS WRITEQ TD QUEUE(=C'CSSL') FROM(MSG4) LENGTH(L'MSG4)
      B    RFEM9000
RFEM9000 DS  0H
      B    RFEX9000

* =====
* Constants
* =====
MSG1  DC  C'RFEUX01 Getmain failed'
MSG2  DC  C'RFEUX01 Cannot address commarea'
MSG3  DC  C'RFEUX01 COMMAREA layout not supported'
MSG4  DC  C'RFEUX01 COMMAREA event not supported'
EVNT  DS  0CL8
      DC  CL8'START'
      DC  CL8'FIN'
      DC  CL8'ROLLIN'
      DC  CL8'ROLLOUT'
TSTPRMS DC C'SPRMFORKSP1'
ATXT  DC  C'KSP2 aborted by my exit'
      LTORG

```

```

* =====
* DSECTs
* =====
COMA      DSECT
CA#EYE   DS      CL6           'NATRFE'
CA#EYEV  DS      CL2           > x'FOF1'
CA#SID   DS      CL8           the unique session identifier
CA#EVENT DS      XL1           the session event
EV_START EQU     0             Session start
EV_END   EQU     1             Session end
EV_ROLIN EQU     2             Session rollin
EV_ROLOU EQU     3             Session rollout
          DS      XL3
CA#RC    DS      F             Exit return code
CA#ETXTL DS      F             Error text len
CA#ETXT  DS      A             Error text
CA#PARML DS      F             Profile parameter len
CA#PARM  DS      A             Profile Parameter
CA#USID  DS      CL8           The Natural user ID
WORK     DSECT
WK#TEXT1 DS      CL80
WK#PARM  DS      F
WK#PARML DS      F
WK#L     EQU     *-WORK
*
R0       EQU     0
R1       EQU     1
R2       EQU     2
R3       EQU     3
R4       EQU     4
R5       EQU     5
R6       EQU     6
R7       EQU     7
R8       EQU     8
R9       EQU     9
RA       EQU     10
RB       EQU     11
RC       EQU     12
RD       EQU     13
RE       EQU     14
RF       EQU     15
          END ←

```


15 NDV CICS Adapter Frequently Asked Questions

- Under which CICS user ID does the NDV transaction run within the CICS region? 90
- I receive a NAT9940 (NAT9939) starting my NDV server. 90

This chapter contains frequently asked questions concerning the Natural Development Server CICS Adapter under z/VSE.

Under which CICS user ID does the NDV transaction run within the CICS region?

The NDV transaction (the NDV Natural session) runs under the CICS default user ID specified in the CICS system initialization parameter `DFLTUSER`.

This is the same user ID as your CICS standard listener (`CSKL`) uses.

I receive a NAT9940 (NAT9939) starting my NDV server.

The NAT9940 message in fact should be a NAT9939 message. This will be corrected with Patch Level 01 (NDV212PL01). The NAT9939 message indicates an error in the communication between the NDV server environment and the CICS environment. The general layout of the message is a text describing the error which may be followed by a condition code (CC), if applicable.

The most important NAT9939 errors are listed below. Many errors not listed here are internal errors.

- **ConfigError: ...missing or invalid**

A mandatory configuration variable for the Natural Development Server CICS Adapter is not defined in the NDV configuration file.

- **Cannot bind Socket**

The port specified with `RFE_CICS_TA_PORT` is not in a listen state on the node specified with `RFE_CICS_TA_HOST`. Probably the CICS TCP/IP standard listener is configured to use a different port or the listener is not running.

- **Timeout at connection establishment**

The CICS transaction launched by the NDV server did not respond within the time specified in `RFE_CICS_TA_INIT_TOUT`. Examine CICS message log for potential messages regarding this transaction.

- **Partner closed connection**

Unexpected abort of the connection by either of the partners (NDV server or CICS transaction). Examine CICS message log and NDV server trace for preceding error messages regarding this request. If you are using TCP/IP V1.5.C under z/VSE, apply TCP/IP fix ZP15C204.

- **Invalid reply on connection establishment.**

The CICS transaction launched by the NDV server did not initialize correctly. Examine CICS message log for potential messages regarding this transaction. Possible reason: The transaction defined with `RFE_CICS_TA_NAME` is not defined correctly within CICS.

■ Cannot load NDV Remote Gateway DLL

The remote gateway DLL NATSRGND/NATLRGND cannot be loaded within the NDV server/CICS region. Possible reason: Module cannot be found on load library concatenation or CICS PPT entry missing.

■ Cannot load NCI front-end

The Natural CICS front-end specified with RFE_CICS_FE_NAME cannot be loaded. Examine CICS message log error messages regarding this program. Possible reason: Module cannot be found on load library concatenation or CICS PPT entry missing.

