

Natural

Natural Web I/O Interface

Version 9.1.2

April 2023

Dieses Dokument gilt für Natural ab Version 9.1.2.

Hierin enthaltene Beschreibungen unterliegen Änderungen und Ergänzungen, die in nachfolgenden Release Notes oder Neuausgaben bekanntgegeben werden.

Copyright © 1979-2023 Software AG, Darmstadt, Deutschland und/oder Software AG USA, Inc., Reston, VA, USA, und/oder ihre Tochtergesellschaften und/oder ihre Lizenzgeber.

Der Name Software AG und die Namen der Software AG Produkte sind Marken der Software AG und/oder Software AG USA Inc., einer ihrer Tochtergesellschaften oder ihrer Lizenzgeber. Namen anderer Gesellschaften oder Produkte können Marken ihrer jeweiligen Schutzrechtsinhaber sein.

Nähere Informationen zu den Patenten und Marken der Software AG und ihrer Tochtergesellschaften befinden sich unter <http://documentation.softwareag.com/legal/>.

Diese Software kann Teile von Software-Produkten Dritter enthalten. Urheberrechtshinweise, Lizenzbestimmungen sowie zusätzliche Rechte und Einschränkungen dieser Drittprodukte können dem Abschnitt "License Texts, Copyright Notices and Disclaimers of Third Party Products" entnommen werden. Diese Dokumente enthalten den von den betreffenden Lizenzgebern oder den Lizenzen wörtlich vorgegebenen Wortlaut und werden daher in der jeweiligen Ursprungssprache wiedergegeben. Für einzelne, spezifische Lizenzbeschränkungen von Drittprodukten siehe PART E der Legal Notices, abrufbar unter dem Abschnitt "License Terms and Conditions for Use of Software AG Products / Copyrights and Trademark Notices of Software AG Products". Diese Dokumente sind Teil der Produktdokumentation, die unter <http://softwareag.com/licenses> oder im Verzeichnis der lizenzierten Produkte zu finden ist.

Die Nutzung dieser Software unterliegt den Lizenzbedingungen der Software AG. Diese Bedingungen sind Bestandteil der Produktdokumentation und befinden sich unter <http://softwareag.com/licenses> und/oder im Wurzelverzeichnis des lizenzierten Produkts.

Dokument-ID: NATMF-NNATWEBIO-912-20230424

Table of Contents

Preface	vii
1 About this Documentation	1
Dokumentationskonventionen	2
Online-Informationen und Support	2
Datenschutz	3
I Introduction	5
2 Introduction	7
What is the Natural Web I/O Interface?	8
Components of the Natural Web I/O Interface	8
Executing a Natural Application in a Web Browser	9
Client-Server Compatibility	10
Terminology	10
Differences in a SPoD Development Environment	11
Restrictions When Using the Natural Web I/O Interface with Natural Applications	11
Differences between the Natural Web I/O Interface Client and Terminal Emulation	13
II Introducing the Natural Web I/O Interface Server CICS Adapter	15
3 Introducing the Natural Web I/O Interface Server CICS Adapter	17
Purpose of the Natural Web I/O Interface Server CICS Adapter	18
CICS Support	18
Product Interaction	19
III Introducing the Natural Web I/O Interface Server IMS Adapter	21
4 Introducing the Natural Web I/O Interface Server IMS Adapter	23
Purpose of the Natural Web I/O Interface Server IMS Adapter	24
IMS TM Support	24
Product Interaction	25
IV Installing and Configuring the Natural Web I/O Interface Server	27
5 Natural Web I/O Interface Server Concept and Structure	29
Web I/O Interface Server Concept	30
Front-End Stub NATRNWO	30
Front-End	31
Server Monitor	32
6 Prerequisites	33
General Prerequisites for Web I/O Interface Server Installation	34
Prerequisites for the Web I/O Interface Server for z/OS	34
7 Installing the Natural Web I/O Interface Server under z/OS	35
Prerequisites	36
Content of the Web I/O Interface Server Distribution Medium	36
Installation Procedure	36
8 Configuring the Natural Web I/O Interface Server	41
Configuration Requirements for z/OS	42
Web I/O Interface Server Configuration File for z/OS	49

Web I/O Interface Server Configuration Parameters	49
Web I/O Interface Server Configuration File Example	61
Web I/O Interface Server Data Sets for z/OS	61
Web I/O Interface Server User Exits	61
9 Installing the Natural Web I/O Interface Server CICS Adapter under z/OS	63
Prerequisites	64
Installation Procedure	64
10 Configuring the Natural Web I/O Interface Server CICS Adapter	69
Configuration File	70
Configuration Parameters	70
11 Installing the Natural Web I/O Interface Server IMS Adapter	75
Prerequisites	76
Example Jobs	76
Installation Procedure	76
12 Configuring the Natural Web I/O Interface Server IMS Adapter	81
Configuration File	82
Configuration Parameters	82
V Installing the Natural Web I/O Interface Client	85
13 Prerequisites	87
Servlet Container	88
Natural for Mainframes	88
Natural for UNIX	88
Natural for Windows	89
Browser Prerequisites	89
14 Installing the Natural Web I/O Interface Client on Apache Tomcat	91
Installation Steps	92
Installation Verification	93
15 Migrating the Natural Web I/O Interface Client from IIS to Apache Tomcat	95
Before You Install the Natural Web I/O Interface Client	96
Installing the Natural Web I/O Interface Client on Apache Tomcat	97
Configuring the Natural Web I/O Interface Client on Apache Tomcat	97
VI Configuring the Client	101
16 About the Logon Page	103
Starting a Natural Application from the Logon Page	104
Examples of Logon Pages	104
Dynamically Changing the CICS Transaction Name when Starting a Session	105
Specifying a Password in the Logon Page	106
Changing the Password in the Logon Page	106
Browser Restrictions	107
17 Natural Client Session Configuration	109
General Information	110
Name and Location of the Configuration File	110
18 Natural Client Configuration Tool	111

Invoking the Configuration Tool	112
Session Configuration	113
Logging Configuration	121
Logon Page	121
Logout	121
19 Natural Web I/O Style Sheets	123
Name and Location of the Style Sheets	124
Editing the Style Sheets	124
Modifying the Position of the Main Output and of the PF Keys	124
Modifying the Font Size	126
Modifying the Font Type	127
Defining Underlined and Blinking Text	128
Defining Italic Text	128
Defining Bold Text	129
Defining Different Styles for Output Fields	129
Modifying the Natural Windows	130
Modifying the Message Line	131
Modifying the Background Color	131
Modifying the Color Attributes	131
Modifying the Style of the PF Key Buttons	132
JavaScript and XSLT Files	133
20 Starting a Natural Application with a URL	135
21 Configuring Container-Managed Security	137
General Information	138
Name and Location of the Configuration File	138
Activating Security	138
Defining Security Constraints	139
Defining Roles	139
Selecting the Authentication Method	140
Configuring the UserDatabaseRealm	140
22 Configuring SSL	141
General Information	142
Creating Your Own Trust File	142
Defining SSL Usage in the Configuration File	143
23 Logging	145
General Information	146
Name and Location of the Configuration File	146
Invoking the Logging Configuration Page	146
Overview of Options for the Output File	148
VII Operating and Monitoring the Natural Web I/O Interface Server	149
24 Operating the Natural Web I/O Interface Server	151
Starting the Natural Web I/O Interface Server	152
Terminating the Natural Web I/O Interface Server	153
Monitoring the Natural Web I/O Interface Server	153
Runtime Trace Facility	154

Trace Filter	156
25 Monitor Client NATMOPI	157
Introduction	158
Command Interface Syntax	158
Command Options Available	158
Monitor Commands	159
Directory Commands	159
Command Examples	159
26 HTML Monitor Client	163
Introduction	164
Prerequisites for HTML Monitor Client	164
Server List	164
Server Monitor	166
Index	169

Preface

This documentation is organized under the following headings:

Introduction	What is the Natural Web I/O Interface?
Introducing the Natural Web I/O Interface Server CICS Adapter	Special information which applies if you want to use the Natural Web I/O Interface server in a CICS environment under z/OS.
Introducing the Natural Web I/O Interface Server IMS Adapter	Special information which applies if you want to use the Natural Web I/O Interface server in an IMS TM environment under z/OS.
Installing and Configuring the Natural Web I/O Interface Server	How to install and configure the Natural Web I/O Interface server in a mainframe environment.
Installing the Natural Web I/O Interface Client	How to install the Natural Web I/O Interface client on an application server or in a servlet container so that it can be used with the Natural Web I/O Interface server.
Configuring the Client	How to define the information that is to appear in the logon page.
Operating and Monitoring the Natural Web I/O Interface Server	How to operate the Natural Web I/O Interface server in a mainframe environment, and how to monitor it using the Monitor Client NATMOPI or the HTML Monitor Client.



Note: This documentation only explains how to install the Natural Web I/O Interface server in a mainframe environment. For information on how to install it in a UNIX or Windows environment, see the Natural documentation for the appropriate platform.

1 About this Documentation

▪ Dokumentationskonventionen	2
▪ Online-Informationen und Support	2
▪ Datenschutz	3

Dokumentationskonventionen

Konvention	Beschreibung
Fettschrift	>Kennzeichnet Elemente auf einem Bildschirm.
Nichtproportionale Schrift	Kennzeichnet Namen und Orte von Diensten im Format <i>Ordner.Unterordner.Dienst</i> , Programmierschnittstellen (APIs), Namen von Klassen, Methoden und Properties in Java.
<i>Kursivschrift</i>	Kennzeichnet: Variablen, für die Sie situations- oder umgebungsspezifische Werte angeben müssen. Neue Begriffe, wenn sie erstmals im Text auftreten. Verweise auf andere Dokumentationsquellen.
Nichtproportionale Schrift	Kennzeichnet: Text, den Sie eingeben müssen. Meldungen, die vom System angezeigt werden. Programmcode.
{ }	Zeigt eine Reihe von Auswahlmöglichkeiten an, von denen Sie eine auswählen müssen. Geben Sie nur die innerhalb der geschweiften Klammern vorhandenen Informationen ein. Geben Sie nicht die Klammersymbole { } ein.
	Trennt zwei sich gegenseitig ausschließende Auswahlmöglichkeiten in einer Syntaxzeile voneinander ab. Geben Sie eine der Auswahlmöglichkeiten ein. Geben Sie nicht das Symbol ein.
[]	Zeigt eine oder mehrere Optionen an. Geben Sie nur die innerhalb der eckigen Klammern vorhandenen Informationen ein. Geben Sie nicht die Klammersymbole [] ein.
...	Zeigt an, dass Sie mehrere Auswahlmöglichkeiten desselben Typs eingeben können. Geben Sie nur die Informationen ein. Geben Sie nicht die drei Auslassungspunkte (...) ein.

Online-Informationen und Support

Produktdokumentation

Sie finden die Produktdokumentation auf unserer Dokumentationswebsite unter <https://documentation.softwareag.com>.

Zusätzlich können Sie auch über <https://www.softwareag.cloud> auf die Dokumentation für die Cloud-Produkte zugreifen. Navigieren Sie zum gewünschten Produkt und gehen Sie dann, je nach Produkt, zu „Developer Center“, „User Center“ oder „Documentation“.

Produktschulungen

Sie finden hilfreiches Produktschulungsmaterial auf unserem Lernportal unter <https://knowledge.softwareag.com>.

Tech Community

Auf der Website unserer Tech Community unter <https://techcommunity.softwareag.com> können Sie mit Experten der Software AG zusammenarbeiten. Von hier aus können Sie zum Beispiel:

- Unsere umfangreiche Wissensdatenbank durchsuchen.
- In unseren Diskussionsforen Fragen stellen und Antworten finden.
- Die neuesten Nachrichten und Ankündigungen der Software AG lesen.
- Unsere Communities erkunden.
- Unsere öffentlichen Repositories auf GitHub and Docker unter <https://github.com/softwareag> und <https://hub.docker.com/publishers/softwareag> besuchen und weitere Ressourcen der Software AG entdecken.

Produktsupport

Support für die Produkte der Software AG steht lizenzierten Kunden über unser Empower-Portal unter <https://empower.softwareag.com> zur Verfügung. Für viele Dienstleistungen auf diesem Portal benötigen Sie ein Konto. Wenn Sie noch keines haben, dann können Sie es unter <https://empower.softwareag.com/register> beantragen. Sobald Sie ein Konto haben, können Sie zum Beispiel:

- Produkte, Aktualisierungen und Programmkorrekturen herunterladen.
- Das Knowledge Center nach technischen Informationen und Tipps durchsuchen.
- Frühwarnungen und kritische Alarmer abonnieren.
- Supportfälle öffnen und aktualisieren.
- Anfragen für neue Produktmerkmale einreichen.

Datenschutz

Die Produkte der Software AG stellen Funktionen zur Verarbeitung von personenbezogenen Daten gemäß der Datenschutz-Grundverordnung (DSGVO) der Europäischen Union zur Verfügung. Gegebenenfalls sind in der betreffenden Systemverwaltungsdokumentation entsprechende Schritte dokumentiert.

I Introduction

2 Introduction

- What is the Natural Web I/O Interface? 8
- Components of the Natural Web I/O Interface 8
- Executing a Natural Application in a Web Browser 9
- Client-Server Compatibility 10
- Terminology 10
- Differences in a SPoD Development Environment 11
- Restrictions When Using the Natural Web I/O Interface with Natural Applications 11
- Differences between the Natural Web I/O Interface Client and Terminal Emulation 13

This chapter describes the purpose and the functions of the Natural Web I/O Interface.



Note: This introduction mainly describes how the Natural Web I/O Interface works in a runtime (production) environment. The section *Differences in a SPoD Development Environment* briefly explains the special version that is used in a SPoD development environment.

What is the Natural Web I/O Interface?

The Natural Web I/O Interface is used to execute Natural applications in a web browser. It fully supports the following:

- The display and input of Unicode characters. See *Unicode Input/Output Handling in Natural Applications* in the *Unicode and Code Page Support* documentation.
- Rich internet applications developed with Natural for Ajax.

Components of the Natural Web I/O Interface

The Natural Web I/O Interface consists of a server and a client.

Server

The Natural Web I/O Interface server enables you to use a browser as the I/O device for Natural applications. The server does the user authentication, creates the Natural session and handles the I/O between Natural and the client. The Natural Web I/O Interface server is installed on the same machine as the Natural application.

Client

The client handles the communication between the user's web browser and the Natural Web I/O Interface server. It converts the output from the Natural application to web pages, and returns the user input to Natural.

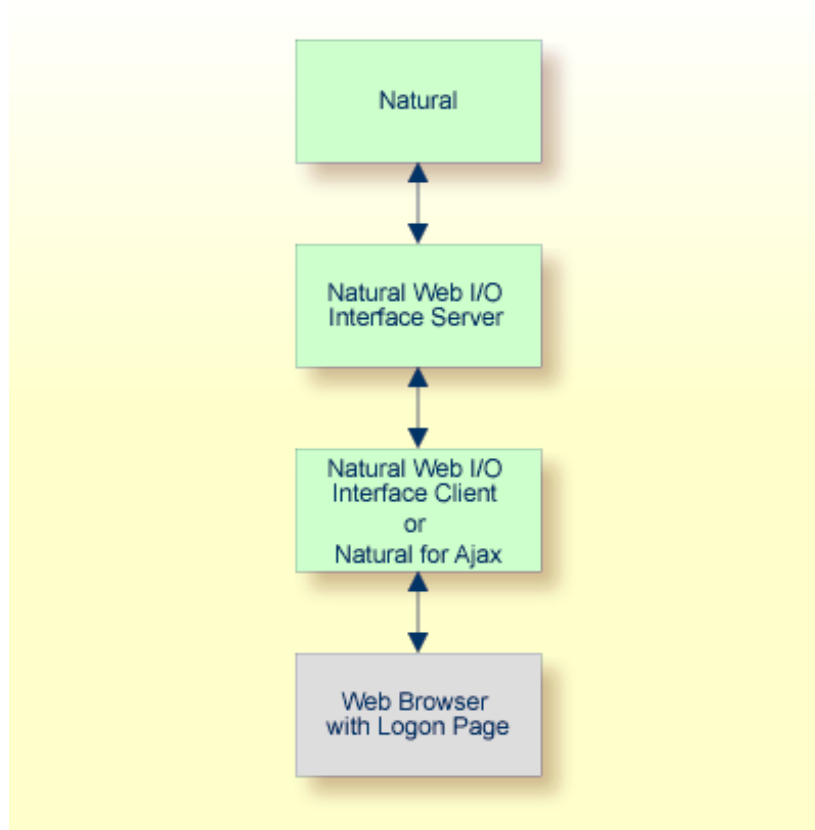
Two types of client are supported:

- Natural Web I/O Interface client for displaying character-based applications in the web browser. Maps with GUI controls are not supported in this case.
- Natural for Ajax for displaying rich internet applications in the web browser. For further information on this type of client, see the Natural for Ajax documentation.

The client is installed on a web/application server. This can be done on any machine in the network.


Executing a Natural Application in a Web Browser

The Natural Web I/O Interface receives data from a Natural application and delivers web pages to the user's web browser. This is illustrated in the following graphic:



The communication steps for executing a Natural application in the web browser are:

1. The user enters the address (URL) of a logon page in the web browser. The client then displays the logon page in the web browser.

 **Note:** For information on how to invoke and configure the logon page, see [Configuring the Client](#).

2. The user enters all required information for starting a Natural application into the logon page. This information is sent to the client.
3. The client asks the Natural Web I/O Interface server to start the requested Natural application for this user.
4. The Natural Web I/O Interface server checks the supplied user ID and password, creates a Natural session for the user and starts the Natural application.

5. The Natural application returns the first application screen which is then transferred via the Natural Web I/O Interface server to the client and finally as a web page to the web browser.

Different web browsers are supported. Note that cookies and JavaScript must be enabled in the web browser. For a list of the currently supported web browsers, see the browser prerequisites for the type of client that you are using.

Client-Server Compatibility

The following rules apply:

- The Natural Web I/O Interface server can work with any client that has the same or a higher protocol version.

If the server detects that the client is using a version that is lower than the server version, the server replies that the client is too old and the connection is closed.

- The client can work with any server that has the same or a lower protocol version.

If the client detects that the server is using a version that is lower than the client version, the client switches to the server version. However, new client functionality is not supported in this case.

- The Natural Web I/O Interface server must have the same protocol version as the Natural process that is started by the server. If Natural detects that the server is using a different protocol version, an error message is sent to the user and the connection is closed.

Terminology

On the different Natural platforms for which the Natural Web I/O Interface is supported, different techniques are used for implementing the server part of the Natural Web I/O Interface. On Natural for UNIX, it is implemented as a daemon. On Natural for Windows, it is implemented as a service. On the mainframe, it is implemented as a server. In this documentation, the general term “server” is therefore used for all different kinds of implementation.

Differences in a SPoD Development Environment

The previous sections of this introduction have described how the Natural Web I/O Interface works in a runtime (production) environment. This section briefly explains the differences in a SPoD development environment.

A special version of the Natural Web I/O Interface is used when working in a remote development environment with Natural for Windows (SPoD). In this case, the Natural Web I/O Interface is an integrated component which does not require a separate installation. The server is part of the Natural Development Server (NDV), and the client is part of Natural Studio. Other than in the runtime environment, the screen is not displayed in a browser but in a normal window. Rich GUI pages created by Natural for Ajax are not supported in the development environment.

It is important that I/O via the Natural Web I/O Interface has been enabled on the Natural host. Otherwise, the Natural Web I/O Interface cannot be invoked. See also *Unicode Input/Output Handling in Natural Applications* in the *Unicode and Code Page Support* documentation.

Restrictions When Using the Natural Web I/O Interface with Natural Applications

There are several restrictions when using the Natural Web I/O Interface with Natural applications on UNIX, mainframe or Windows hosts.



Note: The term “application” refers to application software. It does not refer to system software or software for development.

The following restrictions apply:

- **GUI controls**

GUI controls are not supported: dialogs, buttons, radio buttons, list boxes, list views, check boxes etc. The Natural Web I/O Interface only supports Natural applications developed without GUI controls.

- **File transfer**

File transfer (for example, with the `DOWNLOAD` statement) is not supported by the Natural Web I/O Interface.

- **Runtime errors**

This restriction applies to older Natural versions on UNIX and Windows. As of version 6.3.3, this restriction no longer applies.

Runtime errors in Natural applications are not handled by the Natural Web I/O Interface. This leads to a loss of the session. Bypass: use the Natural system variable *ERROR-TA to handle the error. Sample Natural error transaction:

```
DEFINE DATA
LOCAL
1 ERR_INFO
  2 ERR_NR(N5)
  2 ERR_LINE(N4)
  2 ERR_STAT(A1)
  2 ERR_PNAM(A8)
  2 ERR_LEVEL(N2)
END-DEFINE
INPUT ERR_INFO
DISPLAY ERR_INFO
TERMINATE
END
```

■ **Terminal commands**

Terminal commands are not supported. They do not work when entered in the Natural Web I/O Interface client.

■ **Natural system variable *INIT-ID**

When using the Natural Web I/O Interface client with Natural applications on UNIX, mainframe or Windows hosts, the Natural system variable *INIT-ID will not be filled with a value for the terminal type. On UNIX and Windows, it will contain the value "notty". On mainframes, it will contain a session ID that is unique on that server.

The following restrictions apply to Natural on UNIX and Windows hosts (the mainframe does not have these restrictions):

■ **Return to the Natural main screen**

You must not use Natural applications that return to the Natural main screen as this leads to wrong screen display and a loss of the session.

■ **Natural editors and utilities**

You must not use Natural utilities such as SYSMAIN or SYSDDM and editors such as the program editor as this leads to wrong screen display and a loss of the session.

■ **Natural system commands**

You must not use any Natural system command such as CATALL, FIND, GLOBALS, HELP, KEY, LIST, RETURN, SCAN, SETUP or XREF as this leads to wrong screen display and a loss of the session.

Differences between the Natural Web I/O Interface Client and Terminal Emulation

The Natural Web I/O Interface client runs as an HTML terminal emulator inside a browser control. The look and feel of the Natural Web I/O Interface client display is quite similar to that of the regular terminal (emulation), but there are some differences due to browser functionality:

- A double-click with the mouse pointer on any field simulates the `ENTER` key.
- It is not possible to position the cursor outside the range of input and output fields.
- The cursor can be moved with the left and right arrow keys within one input field. It is also possible to jump from one input field to another using the left, right, up and down arrow keys.
- The insert mode can be switched on and off using the `INSERT` key.
- For Unicode character sets (type `U`; for example, Chinese), one character may require more space than an ordinary alphanumeric character, because the Unicode character representation is proportional. The application design must take this into account, because Natural is based on characters with fixed width. For input fields it is possible to scroll within the field, but for output fields there may not be sufficient space to display the Unicode characters. The display length for a field can be controlled by the session parameter `DL`.
- Type-ahead mode is not supported.
- Paste in overwrite mode is not supported.
- Key schemes are fixed; keys such as the right `CTRL` key and the `ENTER` key on the numeric pad are no longer definable.
- Screen update is slower since the complete screen is sent rather than updates.
- The blink attribute is not supported in Internet Explorer.
- The keys `PF1` through `PF12` are simulated by the key combinations `F1` through `F12`.
- The keys `PF13` through `PF24` are simulated by the key combinations `SHIFT+F1` through `SHIFT+F12`.
- The keys `PF25` through `PF36` are simulated by the key combinations `CTRL+F1` through `CTRL+F12`.
- The keys `PF37` through `PF48` are simulated by the key combinations `ALT+F1` through `ALT+F12`.
- The program attention keys (`PA1`, `PA2` and `PA3`) are simulated by the key combinations `CTRL+SHIFT+F1`, `CTRL+SHIFT+F2`, `CTRL+SHIFT+F3`.
- The clear key is simulated by `CTRL+SHIFT+F4`.

IBM Mainframes Only

- The terminal screen size is controlled by the Natural profile parameter `TMODEL`. The default setting `TMODEL=0` means 24 lines and 80 columns.
- There is no `ATTN` (attention interrupt) key, no `RESET` key and no `EEOF` (erase end of file) key.

VT Only

- The I/O occurs in block mode. Therefore, the Natural program will only react when a function key is pressed.

II Introducing the Natural Web I/O Interface Server CICS Adapter

3 Introducing the Natural Web I/O Interface Server CICS

Adapter

- Purpose of the Natural Web I/O Interface Server CICS Adapter 18
- CICS Support 18
- Product Interaction 19

This chapter describes the purpose and the functions of the Natural Web I/O Interface Server CICS Adapter.

Purpose of the Natural Web I/O Interface Server CICS Adapter

The Natural Web I/O Interface Server CICS Adapter is designed for a mainframe Natural context where it enables the use of a Natural Web I/O Interface server, running under z/OS in batch mode within a CICS TP monitor environment.

CICS Support

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

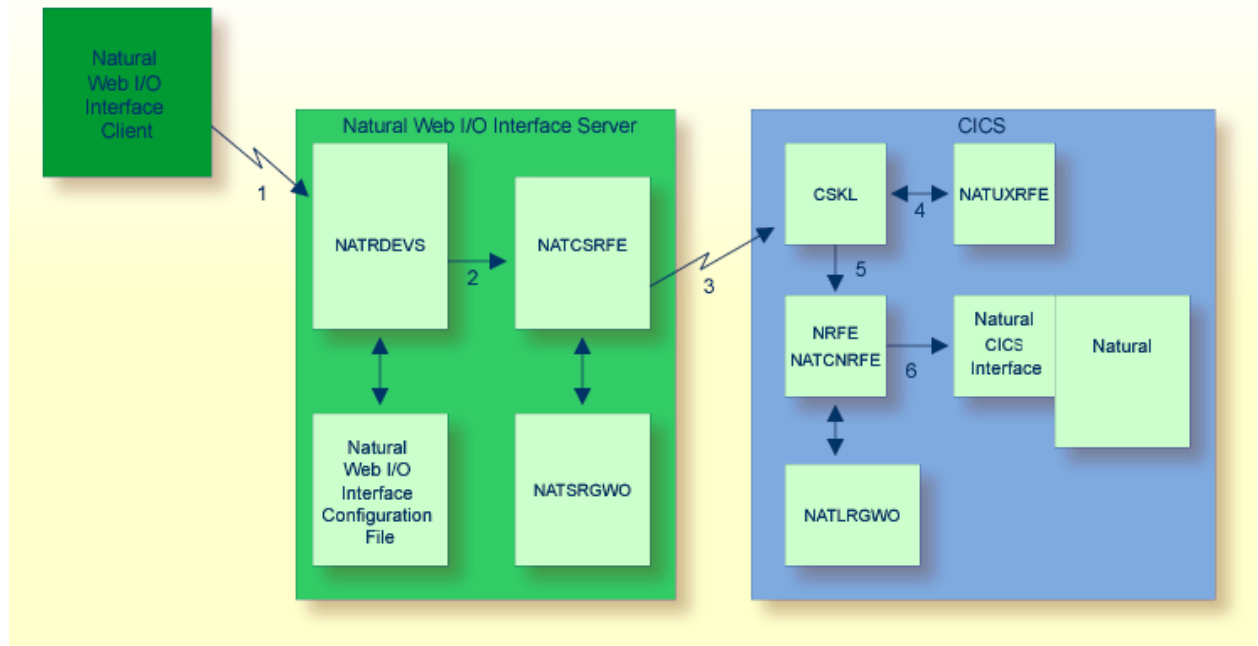
NATCSRFE in turn accepts the Natural request from NATRNWO and transfers it to a configured CICS environment using the CICS Socket Interface. Within the CICS environment, a CICS Natural transaction is launched that processes the Natural request and returns the result. Thus it is not necessary to execute the entire Web I/O Interface server under CICS. Only if Natural is requested to run the Natural application, control is transferred to CICS for execution.

The Natural Web I/O Interface Server CICS Adapter comprises the following components:

NATCSRFE	The remote front-end called by the Natural Web I/O Interface server to dispatch a Natural request. It is loaded into the Web I/O Interface server's 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>).
NATSRGWO/NATLRGWO	Transmits the data relevant for Natural Web I/O Interface server between Natural Web I/O Interface server and the Natural session running in CICS. NATSRGWO must be loaded into the Natural Web I/O Interface server's address space and NATLRGWO into the CICS address space.
NATUXRFE	This user exit obtains the client credentials from the Natural Web I/O Interface server and authenticates then with a CICS VERIFY PASSWORD request. If the request succeeds, the CICS listener launches the NWO transaction under the client account (impersonation).

Product Interaction

The following figure illustrates the interaction between the Natural Web I/O Interface server and the CICS environment involved.



1. The Web I/O Interface (NWO) client sends a request to the Natural Web I/O Interface server using the port number specified with the Natural Web I/O Interface server configuration variable `PORT_NUMBER`.
2. The Natural Web I/O Interface server dispatches the Natural session using the Natural front-end you have specified with the Natural Web I/O Interface server configuration variable `FRONTEND_NAME`. Specify `NATCSRFE` in order to use the Natural Web I/O Interface Server CICS Adapter.
3. `NATCSRFE` transmits the request to the host/port specified with the Natural Web I/O Interface server configuration variable `RFE_CICS_TA_HOST / RFE_CICS_TA_PORT`. You must configure the CICS-supplied standard listener `CSKL` to listen at this port.
4. If the Natural Web I/O Interface server is configured to perform remote impersonation (`SECURITY_MODE=IMPERSONATE/IMPERSONATE_REMOTE`), `NATUXRFE` 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 Web I/O Interface 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 Web I/O Interface server configuration parameter `RFE_CICS_FE_NAME`.

III

Introducing the Natural Web I/O Interface Server IMS

Adapter

4 Introducing the Natural Web I/O Interface Server IMS Adapter

- Purpose of the Natural Web I/O Interface Server IMS Adapter 24
- IMS TM Support 24
- Product Interaction 25

This chapter describes the purpose and the functions of the Natural Web I/O Interface Server IMS Adapter.

Purpose of the Natural Web I/O Interface Server IMS Adapter

The Natural Web I/O Interface Server IMS Adapter is designed for a mainframe Natural context where it enables the use of a Natural Web I/O Interface server running under z/OS in batch mode within an IMS TM environment.

IMS TM Support

The IMS TM support is not implemented within the front-end stub NATRNWO. For dispatching the Natural sessions in IMS TM, the Web I/O Interface server continues to run in batch mode. But it uses the remote front-end NATISRFE that is delivered with the Natural Web I/O Interface server to dispatch the Natural sessions in IMS TM. That is, depending on the installed front-end, a server dispatches the sessions locally (NATMVS for batch mode) or remotely (NATISRFE for IMS TM).

NATISRFE in turn accepts the Natural request from NATRNWO and transfers it to a configured IMS TM environment using the IMS installation provided BPM listener. The IMS listener launches in a dedicated MPP region a non conversational Natural transaction that processes the Natural request and returns the result. Thus it is not necessary to execute the entire Natural Web I/O Interface server under IMS TM. Only small working units (Natural requests such as “save source” or “get library list”) are transferred to IMS TM for execution.

The Natural Web I/O Interface Server IMS Adapter comprises the following components:

NATISRFE	The remote front-end called by the Natural Web I/O Interface server to dispatch a Natural request. It is loaded into the Web I/O Interface server's address space.
NATINRFE	The counterpart of NATISRFE. NATINRFE runs in an MPP region. It is launched by the IBM-provided IMS Listener (refer also to z/OS Communications Server IP IMS Socket Guide).
NATSRGWO/NATLRGWO	Transmits the data relevant for Natural Web I/O Interface server between Natural Web I/O Interface server and the Natural session running in IMS TM. NATSRGWO must be loaded into the Natural Web I/O Interface server's address space, and NATLRGWO into the MPP region.


Product Interaction

The following description explains the interaction between the Natural Web I/O Interface server and the IMS TM environment involved.

1. The Web I/O Interface (NWO) client sends a request to the Natural Web I/O Interface server using the port number specified with the Natural Web I/O Interface server configuration variable `PORT_NUMBER`.
2. The Natural Web I/O Interface server dispatches the Natural session using the Natural front-end you have specified with the Natural Web I/O Interface server configuration variable `FRONTEND_NAME`. Specify `NATISRFE` in order to use the Natural Web I/O Interface Server IMS Adapter.
3. `NATISRFE` transmits the request to the host/port specified with the Natural Web I/O Interface server configuration variable `RFE_IMS_TA_HOST / RFE_IMS_TA_PORT`. You must configure the IBM provided BMP Listener to listen at this port.
4. The BMP Listener launches the IMS TM transaction you have specified with the Natural Web I/O Interface server configuration parameter `RFE_IMS_TA_NAME`. This transaction must be specified in the configuration of the IMS Listener.
5. The server transaction first retrieves the transaction initialization message. `TIM` contains the necessary information to do the `TAKESOCKET` and passes it to `NATINRFE`. `NATINRFE` does the `TAKESOCKET` and establishes the TCP/IP conversation with `NATISRFE`.
6. `NATINRFE` finally dispatches the Natural IMS front-end, which establishes a Natural server session.

IV Installing and Configuring the Natural Web I/O Interface Server

The Natural Web I/O Interface server is available on z/OS.

 **Note:** 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.

This part covers the following topics:

[Natural Web I/O Interface Server Concept and Structure](#)

[Prerequisites](#)

[Installing the Natural Web I/O Interface Server under z/OS](#)

[Configuring the Natural Web I/O Interface Server](#)

Natural Web I/O Interface Server CICS Adapter

The following topics apply in addition if you want to use the Natural Web I/O Interface server in a CICS environment under z/OS:

[Installing the Natural Web I/O Interface Server CICS Adapter under z/OS](#)

[Configuring the Natural Web I/O Interface Server CICS Adapter](#)

Natural Web I/O Interface Server IMS Adapter

The following topics apply in addition if you want to use the Natural Web I/O Interface server in an IMS TM environment under z/OS:

[Installing the Natural Web I/O Interface Server IMS Adapter](#)

[Configuring the Natural Web I/O Interface Server IMS Adapter](#)

Notation *vrs* or *vr*

When used in this documentation, the notation *vrs* or *vr* represents the relevant product version (see also *Version* in the *Glossary*).

5

Natural Web I/O Interface Server Concept and Structure

- Web I/O Interface Server Concept 30
- Front-End Stub NATRNWO 30
- Front-End 31
- Server Monitor 32

This chapter describes the concept and the structure of the server for the Natural Web I/O Interface which is designed for use on z/OS.

Web I/O Interface Server Concept

A Natural Web I/O Interface server is a multi-user, multi-tasking application. It can host Natural sessions for multiple users and execute their applications concurrently.

The concept is based on the “serverized” Natural runtime system. Its architecture comprises a server front-end stub (Web I/O Interface server stub NATRNWO) that uses the Natural front-end to dispatch Natural sessions and to execute applications within these sessions.

The Natural Web I/O Interface server architecture basically consists of:

- **Front-end stub**

The stub NATRNWO is launched to initialize a Natural Web I/O Interface server. It listens for incoming connection requests and launches a Natural session for executing the application.

- **Front-end**

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

- **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 NATRNWO

The multi-user, multi-tasking, front-end stub NATRNWO is launched to initialize a Natural Web I/O Interface server.

The following topics are covered below:

- [Stub Description](#)

- **Natural System Variables Used**

Stub Description

The task executing the server initialization (`TMain`) basically is the main listener which waits for incoming requests from the Web I/O Interface client. 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 server connection issued by the user on the client side (the Login button of the Web I/O Interface client) 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` initializes a new Natural session and starts the specified Natural application program.
- While the application performs I/O requests, `TWork` intercepts the I/O data and passes them to the Web I/O Interface client for processing the I/O. The I/O reply is sent back to the server and the server continues the application.
- If the application terminates (reaches the `NEXT` mode), `TWork` terminates the Natural session and drops the connection to the Web I/O Interface client.

That is, each client owns one subtask `TWork` on the Natural Web I/O Interface server. This subtask runs a Natural session (and within the Natural session, a Natural application) and remains active as long as the application is running.

Natural System Variables Used

Within a Natural Web I/O Interface server session, the following Natural system variables are used:

- `*TPSYS` contains `SERVSTUB`,
- `*DEVICE` contains `BROWSER`,
- `*SERVER-TYPE` contains `WEBIO`.

Front-End

Under z/OS, the Natural front-end required for a Natural Web I/O Interface server is a Natural batch front-end driver, which should be LE enabled. See sample installation jobs for details.

Under z/OS, 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.

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 Web I/O Interface server. For more information, refer to the *Natural Web I/O Interface Server CICS Adapter* documentation.

Server Monitor

To enable the administrator to monitor the status of the Natural Web I/O Interface 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 Web I/O Interface Server](#).

6 Prerequisites

- General Prerequisites for Web I/O Interface Server Installation 34
- Prerequisites for the Web I/O Interface Server for z/OS 34

This chapter describes the prerequisites that apply when you install a Natural Web I/O Interface server on a mainframe computer.

General Prerequisites for Web I/O Interface Server Installation

The following general prerequisites apply:

- The currently applicable version of Natural for Mainframes must be installed.
- The International Components for Unicode for Software AG (ICS) must be installed with the Web I/O Interface server; see *International Components for Unicode for Software AG* in the *Unicode and Code Page Support* documentation.



Note: For further information, refer to the products and versions specified under *Software AG Product Versions Supported by Natural* in the current *Natural Release Notes*.

Prerequisites for the Web I/O Interface Server for z/OS

In addition to the general prerequisites described above, the following operating-system-specific prerequisites apply:

- z/OS must be installed.
- To prevent the formation of endless loops in user programs running under the Web I/O Interface, specify a reasonable value for Natural profile parameter MT (maximum CPU time).

7 Installing the Natural Web I/O Interface Server under z/OS

- Prerequisites 36
- Content of the Web I/O Interface Server Distribution Medium 36
- Installation Procedure 36

This chapter describes how to install a server for the Natural Web I/O Interface (product code NWO) under the operating system z/OS.

The installation of the Web I/O Interface server is performed by installation jobs. The sample jobs are contained in the data set `NW0vrs.JOBS` (where *vrs* represents the relevant product version) and are prefixed with `NW0`, or generated by System Maintenance Aid (SMA).

Notation *vrs* or *vr*

When used in this documentation, the notation *vrs* or *vr* represents the relevant product version (see also *Version* in the *Glossary*).

Prerequisites

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

Content of the Web I/O Interface Server Distribution Medium

The installation medium contains the data sets listed in the table below. The sequence of the data sets and the number of library blocks needed are shown in the *Software AG Product Delivery Report*, which accompanies the installation medium.

Data Set Name	Contents
<code>NW0vrs.OBJS</code>	Contains the object modules of the server.
<code>NW0vrs.JOBS</code>	Example installation jobs.

Installation Procedure

Step 1: Allocate the Web I/O Interface Server LOAD library

(Job I008, Step 9410)

Step 2: Create a Web I/O Interface Server configuration file and sample Clist

(Job I009 / Step 9410, 9420, 9430)

Step 9410 creates a sample `NWOCONFIG` for the batch server.

Step 9420 creates a sample `Clist` to ping and terminate a Web I/O Interface server.

Step 9430 creates a sample batch job to ping and terminate a Web I/O Interface server.

The following parameters of the configuration file have to be defined. See [Configuring the Natural Web I/O Interface Server](#). For the other parameters, the default values may be used:

FRONTEND_NAME	Specify the name of the Web I/O Interface server front-end module you will generate in one of the following steps.
PORT_NUMBER	Specify the TCP/IP port number under which the server can be connected.

Step 3: Link the object modules into the NWO load library

(Job I054, Step 9410)

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



Note: The module `NATCNRF` applies to two different products, the Natural Web I/O Interface Server (NWO) and the Natural Development Server (NDV). So if you have already installed NDV, the module `NATCNRF` might already be there. However, it does not matter if you re-install `NATCNRF` with NWO because the resulting module from either installation is the same.

See sample job `NWOI054` on data set `NWOvrs.JOBS`.

Step 4: Create the Natural parameter module and NWO server front-end module

(Job I060, Steps 9410, 9420, 9430)

- Job I060, Step 9410 starts the batch program `IEBUPDATE` to store the parameter module `NWOPARM`.
- Job I060, Step 9420 assembles and links the parameter module `NWOPARM`.
- Job I060, Step 9430 links the NWO server front-end module.

The reentrant `ADALINK` module `ADALNKR` must be used.



Note: If you have Natural subproducts for IBM database access installed, for example, Natural for DB2, Natural for DL/I, Natural for VSAM, you need to adjust the link job to include `ATTRCSS` from `SYS1.CSSLIB` in order to enable the use of `SYNCPPOINT/ROLLBACK` functionalities.

Step 5: Create server startup JCL

(Job I200, Step 9415)

Described in the section [Configuring the Natural Web I/O Interface Server](#). See sample member `NWOSTART` on data set `NW0vrs.JOBS`.

Step 9415 creates a startup procedure for the batch server.

Sample:

```
//          PROC SRV=SAGNWO
//NWO      EXEC PGM=NATRWO ,
// REGION=4000K,TIME=1440,PARM=' POSIX(ON),TRAP(ON,NOSPIE)/&SRV '
//STEPLIB DD  DISP=SHR,DSN=NW0vrs.LOAD
//          DD  DISP=SHR,DSN=SAGLIB.SMALOAD
//SYSUDUMP DD  SYSOUT=X
//CEEDUMP DD  SYSOUT=X
//CMPRINT DD  SYSOUT=X
//STGCONFIG DD  DISP=SHR,
//          DSN=NW0.CONFIG(&SRV)
//STGTRACE DD  SYSOUT=X
//STGSTDO DD  SYSOUT=X
//STGSTDE DD  SYSOUT=X
//SYSOUT   DD  SYSOUT=X
```



Note: The Web I/O Interface server account must be defined in the z/OS UNIX System Services (OE segment). If the server account is not defined, the server ends with U4093 and system message CEE5101C in the trace file.

Step 6: Web I/O Interface clients must be defined to Natural Security

If Natural Security (NSC) is installed:

- The Web I/O Interface initial user ID (default ID is `STARGATE`) must be defined in Natural Security with a valid default library. Refer also to Web I/O Interface server configuration parameter `INITIAL_USERID`. Alternatively, you can define the Natural profile parameter `AUTO=OFF` (automatic logon) for the Web I/O Interface.
- Each client user ID must be defined in Natural Security.

If the Web I/O Interface initial user ID is not defined, the Web I/O Interface server initialization aborts with a NAT0856.

If a Web I/O Interface client is not defined, the server connection returns an NSC error.

If you connect to the server from a Web I/O Interface client, make sure that the user who is defined in Natural Security has a default library or a private library defined. Otherwise, error message NAT0815 will occur.

Step 7: Web I/O Interface clients must be defined to the server host

If you configure the Web I/O Interface server to use an external security system (see Web I/O Interface server configuration parameter [SECURITY_MODE](#)), the Web I/O Interface clients must be defined to the external security system.

8

Configuring the Natural Web I/O Interface Server

- Configuration Requirements for z/OS 42
- Web I/O Interface Server Configuration File for z/OS 49
- Web I/O Interface Server Configuration Parameters 49
- Web I/O Interface Server Configuration File Example 61
- Web I/O Interface Server Data Sets for z/OS 61
- Web I/O Interface Server User Exits 61

This chapter describes how to configure a Natural Web I/O Interface server.

Configuration Requirements for z/OS

The following topics are covered:

- [Language Environment Parameter Settings](#)
- [External Security Configuration](#)
- [SSL Support](#)

Language Environment Parameter Settings

A Natural Web I/O Interface server requires the following z/OS language environment parameter configuration:

Parameter	Definition				
POSIX(ON)	Enables a Natural Web I/O Interface server to access the POSIX functionality of z/OS. If you start a Natural Web I/O Interface server server with POSIX(OFF), it terminates immediately with a user abend U4093 and the system message EDC5167. IBM supplies the default "OFF".				
TRAP(ON,NOSPIE)	<p>Defines the abend handling of the LE/370 environment:</p> <table border="1"> <tr> <td>ON</td> <td>Enables the Language Environment condition handler.</td> </tr> <tr> <td>NOSPIE</td> <td>Specifies that the Language Environment will handle program interrupts and abends via an ESTAE, that is, the Natural abend handler will receive control to handle program interrupts and abends.</td> </tr> </table> <p>If you do not specify TRAP(ON,NOSPIE), the Natural abend handling does not work properly. IBM supplies the default (ON,SPIE).</p>	ON	Enables the Language Environment condition handler.	NOSPIE	Specifies that the Language Environment will handle program interrupts and abends via an ESTAE, that is, the Natural abend handler will receive control to handle program interrupts and abends.
ON	Enables the Language Environment condition handler.				
NOSPIE	Specifies that the Language Environment will handle program interrupts and abends via an ESTAE, that is, the Natural abend handler will receive control to handle program interrupts and abends.				
TERMTHDACT(UADUMP)	Defines the level of information that is produced in case of an abend. The option UADUMP generates a Language Environment CEEDUMP and system dump of the user address space. The CEEDUMP does not contain the Natural relevant storage areas. IBM supplies the default (TRACE).				
ENVAR(TZ=...)	<p>The ENVAR option enables you to set UNIX environment variables. The only environment variable applicable for the Natural Web I/O Interface server is TZ (time zone). This variable allows you to adjust the timestamp within the Natural Web I/O Interface server's trace file to your local time.</p> <p>Example:</p>				

Parameter	Definition
	ENVAR(TZ=CET-1DST) CET - 1 hour daylight saving time

You can set the z/OS language environment parameters:

- With the `PARM` parameter specified in the `EXEC` card of the Natural Web I/O Interface server startup job. The length of the options is limited by the maximum length of the `PARM` parameter.
- Assemble an LE/370 runtime option module `CEEUOPT` and link it to the Natural Web I/O Interface server load module.

External Security Configuration

If you configure the Web I/O Interface server to impersonate the Web I/O Interface clients in the server (Web I/O Interface server configuration parameter `SECURITY_MODE=IMPERSONATE` or `IMPERSONATE_LOCAL`), the Web I/O Interface server must run “program-controlled”. Under RACF, the following definitions are required for the Web I/O Interface server:

- The resource `BPX.SERVER` must be defined and the Web I/O Interface server account must have `READ` access to this resource.
- The `LOAD` data sets defined in the Web I/O Interface server startup job definition must be defined to the program class `"**"`.

```
ralt program ** addmem('natural load library') uacc(read)
ralt program ** addmem('NWO load library'//NOPADCHK) uacc(read)
ralt program ** addmem('user load library'//NOPADCHK) uacc(read)
```

- `SETR WHEN(PROGRAM) REFRESH`

Additionally, each client connecting to the server must be defined in RACF and must be granted to use the z/OS Unix System Services.

SSL Support

- [SSL over AT-TLS](#)
- [Maintenance of Certificates under z/OS](#)
- [Using RACF Key Rings](#)
- [Using Key Databases](#)
- [How to configure TCP/IP for AT-TLS?](#)
- [How to Verify AT-TLS Configuration?](#)
- [Frequently Asked Questions](#)

- [Generation of a Natural Web I/O Interface Server Certificate](#)

SSL over AT-TLS

SSL support for the Natural Web I/O Interface server is based on the z/OS Communication Server component AT-TLS (Application Transparent-Transport Layer Security).

AT-TLS provides TLS/SSL encryption as a configurable service for sockets applications. It is realized as an additional layer on top of the TCP/IP protocol stack, which exploits the SSL functionality in nearly or even fully transparent mode to sockets applications. AT-TLS offers three modes of operation. See *z/OS Communications Server, IP Programmer's Guide and Reference*, Version 1, Release 9, Chapter 15, IBM manual SC31-8787-09.

These modes are:

■ Basic

The sockets application runs without modification in transparent mode, unaware of performing encrypted communication via AT-TLS. Thus legacy applications can run in secured mode without source code modification.

■ Aware

The application is aware of running in secured mode and is able to query TLS status information.

■ Controlling

The sockets application is aware of AT-TLS and controls the use of AT-TLS encryption services itself. This means, the application is able to switch between secured and non secured communication.

Natural Web I/O Interface server uses the Basic mode for its SSL implementation. That is, a server configured as SSL server rejects requests from non-secured clients.

Maintenance of Certificates under z/OS

Certificates, which are to be used with AT-TLS, can be maintained in two ways under z/OS. They are stored either in RACF key rings or in key databases, which are located in the z/OS UNIX file system. Which of these proceedings actually applies is defined in the AT-TLS Policy Agent Configuration file for the z/OS TCP/IP stack, which is used by the Natural HTTPS client.

IBM delivers a set of commonly used CA root certificates with each z/OS system delivery. If key rings are going to be used to hold server certificates, those root certificates must be manually imported into the key rings by the system administrator. If IBM delivers newer replacements for expired root certificates, all affected key rings have to be updated accordingly.

Unlike key rings, key databases contain the current set of root certificates automatically after they have been newly created. However, the need for maintaining always the latest set of root certificates applies to the key database alternative as well.

Using RACF Key Rings

In RACF, digital certificates are stored in so-called key rings. The RACF command `RACDCERT` is used to create and maintain key rings and certificates, which are contained in those key rings.

See *z/OS Security Server RACF Security Administrator's Guide*, IBM manual SA22-7683-11, and *z/OS Security Server RACF Command Language Reference*, IBM manual SA22-7687-11.

Using Key Databases

Alternatively to RACF, certificates can be kept in key databases, which reside in the z/OS UNIX services file system. For the creation and maintenance of key databases, the `GSKKYMANT` utility has to be used.

See *z/OS Cryptographic Services PKI Services Guide and Reference*, IBM manual SA22-7693-10.

How to configure TCP/IP for AT-TLS?

Proceed as follows:

1. In the TCP/IP configuration file, set the option `TTLS` in the `TCPCONFIG` statement.
2. Configure and start the AT-TLS Policy Agent. This agent is called by TCP/IP on each new TCP connection to check if the connection is SSL.
3. Create the Policy Agent file containing the AT-TLS rules. The Policy Agent file contains the rules to stipulate which connection is SSL.

See also *z/OS Communications Server: IP Configuration Guide*, Chapter 18 *Application Transparent Transport Layer Security (AT-TLS) data protection*.

The Sample Policy Agent file defines the server with the job name starting with `NWODEV` and listening at port 4843 to use SSL.

The sample expects the certificate database on the HFS file `/u/admin/CERT.kdb`.

```
TTLSRule                               ConnRule01~1
{
  LocalAddrSetRef                       addr1
  RemoteAddrSetRef                      addr1
  LocalPortRangeRef                     portR1
  RemotePortRangeRef                    portR2
  Jobname                                NWODEV*
  Direction                              Inbound
  Priority                                255
```

```

    TTLSGroupActionRef      gAct1~NW0_Server
    TTLSEnvironmentActionRef eAct1~NW0_Server
    TTLSConnectionActionRef cAct1~NW0_Server
}
TTLSGroupAction           gAct1~NW0_Server
{
    TTLSEnabled            0n
}
TTLSEnvironmentAction     eAct1~NW0_Server
{
    HandshakeRole          Server
    EnvironmentUserInstance 0
    TTLSKeyringParmsRef    keyR1
}
TTLSConnectionAction      cAct1~NW0_Server
{
    HandshakeRole          Server
    TTLSCipherParmsRef     cipher1~AT-TLS__Silver
    TTLSConnectionAdvancedParmsRef cAdv1~NW0_Server
}
TTLSConnectionAdvancedParms cAdv1~NW0_Server
{
    CertificateLabel       NDV_TEST_CERT
}
TTLSKeyringParms         keyR1
{
    Keyring                 /u/admin/CERT.kdb
    KeyringStashFile        /u/admin/CERT.sth
}
TTLSCipherParms          cipher1~AT-TLS__Silver
{
    V3CipherSuites         TLS_RSA_WITH_DES_CBC_SHA
    V3CipherSuites         TLS_RSA_WITH_3DES_EDE_CBC_SHA
    V3CipherSuites         TLS_RSA_WITH_AES_128_CBC_SHA
}
IpAddrSet                 addr1
{
    Prefix                  0.0.0.0/0
}
PortRange                 portR1
{
    Port                    4843
}
PortRange                 portR2
{
    Port                    1024-65535
}

```

How to Verify AT-TLS Configuration?

Check Policy-Agent job output JESMSG LG for:

```
EZZ8771I PAGENT CONFIG POLICY PROCESSING COMPLETE FOR <your TCP/IP address space>: ←
TTLS
```

This message indicates a successful initialization.

Check Policy-Agent job output JESMSG LG for:

```
EZZ8438I PAGENT POLICY DEFINITIONS CONTAIN ERRORS FOR <your TCP/IP address space>: ←
TTLS
```

This message indicates errors in the configuration file. Check the *syslog.log* file for further information.

Does the configuration rule cover the server?

Try to connect the server and check *syslog.log* for:

```
EZD1281I TTLS Map CONNID: 00018BED LOCAL: 10.20.91.61..4843 REMOTE: ←
10.20.160.47..4889 JOBNAME: NWODEVvr USERID: NWOSRV TYPE: InBound STATUS: Enabled ←
RULE: ConnRule01~1 ACTIONS: gAct1 eAct1~NWO_Server cAct1~NWO_Server
```

The above entry indicates that the connection to Port 4843 is SSL enabled.

Frequently Asked Questions

Is there more information about problem determination?

See also *z/OS V1R8.0 Comm Svr: IP Diagnosis Guide: 3.23, Chapter 29 Diagnosing Application Transparent Transport Layer Security (AT-TLS)*

How to switch on P-agent trace?

See *Comm Svr: IP Configuration Reference, Chapter 20 Syslog daemon and Comm Svr: IP Configuration Guide, Chapter 1.5.1 Configuring the syslog daemon (syslogd)*

Error at connection establishment

Find return code RC and corresponding GSK_ function name in P-agent trace.

See *System SSL Programming* and locate the RC in Chapter 12.1 *SSL Function Return Codes*.

Sample trace with `trace=255`:

```
EZD1281I TTLS Map CONNID: 00002909 LOCAL: 10.20.91.61..1751 REMOTE: ←
10.20.91.117..443 JOBNAME: KSP USERID: KSP TYPE: OutBound STATUS: A
EZD1283I TTLS Event GRPID: 00000003 ENVID: 00000000 CONNID: 00002909 RC: 0 ←
Connection Init
EZD1282I TTLS Start GRPID: 00000003 ENVID: 00000002 CONNID: 00002909 Initial ←
Handshake ACTIONS: gAct1 eAct1 AllUsersAsClient HS-Client
EZD1284I TTLS Flow GRPID: 00000003 ENVID: 00000002 CONNID: 00002909 RC: 0 Call ←
GSK_SECURE_SOCKET_OPEN - 7EE4F718
EZD1284I TTLS Flow GRPID: 00000003 ENVID: 00000002 CONNID: 00002909 RC: 0 Set ←
GSK_SESSION_TYPE - CLIENT
EZD1284I TTLS Flow GRPID: 00000003 ENVID: 00000002 CONNID: 00002909 RC: 0 Set ←
GSK_V3_CIPHER_SPECS - 090A2F
EZD1284I TTLS Flow GRPID: 00000003 ENVID: 00000002 CONNID: 00002909 RC: 0 Set ←
GSK_FD - 00002909
EZD1284I TTLS Flow GRPID: 00000003 ENVID: 00000002 CONNID: 00002909 RC: 0 Set ←
GSK_USER_DATA - 7EEE9B50
EZD1284I TTLS Flow GRPID: 00000003 ENVID: 00000002 CONNID: 00002909 RC: 435 Call ←
GSK_SECURE_SOCKET_INIT - 7EE4F718
EZD1283I TTLS Event GRPID: 00000003 ENVID: 00000002 CONNID: 00002909 RC: 435 ←
Initial Handshake 00000000 7EEE8118
EZD1286I TTLS Error GRPID: 00000003 ENVID: 00000002 CONNID: 00002909 JOBNAME: KSP ←
USERID: KSP RULE: ConnRule01 RC: 435 Initial Handshake
EZD1283I TTLS Event GRPID: 00000003 ENVID: 00000002 CONNID: 00002909 RC: 0 ←
Connection Close 00000000 7EEE8118 ←
```

Generation of a Natural Web I/O Interface Server Certificate

Under z/OS, SSL certificates can be produced with the UNIX System Services utility GSKKYPAN. The following steps have to be executed for the production of a new certificate, which is to be used for the SSL secured communication between Natural Web I/O Interface client and server:

1. Start a shell session out of TSO or connect via telnet to the z/OS UNIX shell.
2. Start GSKKYPAN.
3. Create a new – or open an existing key database.
4. Create a self-signed certificate, for example, of type “User or server certificate with 2048-bit RSA key”.
5. Export the certificate to a (HFS) file. Choose Base64 ASN.1 DER as export format.

This generated file can now be copied to the Natural Web I/O Interface client(s) using FTP with ASCII transfer format. On the client side, the received file should be stored with the file name suffix .CER. The certificate can now be used by the Natural Web I/O Interface client.

If certificates are kept in a RACF key ring, the generated certificate has to be imported into the appropriate key ring using the RADCERT command.

Certificates, which are produced on a different platform, for example, on a Windows PC, can be imported into a RACF key ring or into a key database as well.

Detailed information about the use of the GSKKYMANT utility can be found in the IBM Communications server documentation, e.g in the following manuals:

z/OS Communications Server IP Configuration Guide Version 1 Release 2 (IBM manual SC31-8775-01

or

z/OS Communications Server Cryptographic Services System Secure Sockets Layer Programming (IBM manual SC24-5901-04).

For the generation of certificates under Windows, a free downloadable utility named Ikeyman is available on several websites. Ikeyman is an IBM product as well and maps the functionality of GSKKYMANT to the Windows platform.

Web I/O Interface Server Configuration File for z/OS

A configuration file is allocated to the name `<serverid>C` (for example, NWOS1C) or STGCONFG alternatively.

The configuration file is a text file located on a data set or on an HFS file under z/OS.

The configuration file contains the server configuration parameters in the form of a *keyword=value* syntax. In addition, it may contain comments whose beginning is marked with a hash symbol (#).

See also the [Web I/O Interface Server Configuration File Example](#) shown below.

Web I/O Interface Server Configuration Parameters

The following Web I/O Interface server configuration parameters are available:

- COMPATIBILITY_MODE
- FORCE_IPV4
- FRONTEND_NAME
- FRONTEND_OPTIONS
- FRONTEND_PARAMETER
- HANDLE_ABEND
- HOST_NAME
- HTPMON_ADMIN_PSW
- HTPMON_PORT
- HOST_NAME
- IGNORE_PRESENT_SERVER
- INITIAL_USERID
- KEEP_TCB

- O4I
- PASSWORD_MIXEDCASE
- PORT_NUMBER
- SECURITY_MODE
- SESSION_PARAMETER
- SESSION_TIMEOUT
- THREAD_NUMBER
- THREAD_SIZE
- TRACE_FILTER
- TRACE_LEVEL
- UPPERCASE_SYSTEMMESSAGES

COMPATIBILITY_MODE

The current version of NWO presumes to run with the most recent version of Natural. An error NAT7729 NWO and Natural version do not agree is issued when running with older Natural versions. This is because NWO must negotiate a subset of functionality with the client at a time when the involved Natural version is not already known.

If you want to run NWO with a previous version of Natural, you can set this parameter to YES. It is recommended that you leave this parameter at its default value if you intend to run your NWO with the most recent version of Natural, because in this case COMPATIBILITY_MODE=YES would unnecessarily limit the functionality.

Value	Explanation
YES	Accept also older versions of Natural. Results in a limitation of the functionality documented with the most recent version.
NO	Presume to run with the most recent version of Natural. This is the default value.

Example:

```
COMPATIBILITY_MODE=YES
```

FORCE_IPV4

This parameter is only available with Natural Web I/O Interface Version 8.3 or above.

This parameter allows you to enforce the use of communication method IPV4.

Value	Explanation
YES	Enforce the use of communication method IPV4.
NO	First try communication method IPV6. If this fails give an error message and use communication method IPV4. This is the default value.

FRONTEND_NAME

This configuration parameter specifies the name of the Natural front-end to be used to start a Natural session. The front-end resides on a PDS member.

Value	Explanation
<i>frontend-name</i>	Natural front-end to be used. Maximum length: 8 characters.

No default value is provided.

Example:

```
FRONTEND_NAME=NAT vrsSV
```

FRONTEND_OPTIONS

The values of this configuration parameter may be used to specify additional options for the Natural front-end.

Value	Explanation
01	Do not use the Roll Server. This is the default value.
02	Clean up roll file at server termination.
04	Write GTF trace.
08	Write ETRACE.
10	Front-end automatic termination.
20	Write console information.

You may combine the above options as desired in that you add their values and set the result as shown in the example below.

Example:

```
FRONTEND_OPTIONS=07
```

The setting in this example enables the Options 01, 02 and 04.

FRONTEND_PARAMETER

This optional configuration parameter contains additional Natural front-end parameters as specified in the Startup Parameter Area.

Value	Explanation
<i>parameter-name</i>	<p>You can define multiple parameters. Each parameter specification is a pair of 8-character strings, the first containing the parameter keyword and the second the parameter value, for example:</p> <pre>FRONTEND_PARAMETER = 'MSGCLASSX '</pre>

No default value is provided.

For further information, refer to the section *Natural in Batch Mode* in the *Natural Operations for Mainframe* documentation.

Example:

```
FRONTEND_PARAMETER='MSGCLASSX      '
```

The setting in this example specifies that the default output class for `CMPRINT` is "X".

HANDLE_ABEND

If an abend occurs in the server processing outside the Natural processing the abend is not trapped by the Natural abend handling. For this reason the NWO server has its own abend recovery.

It is recommended that you leave this parameter on its default value in order to limit the impact of an abend to a single user. If you set the value of this parameter to `NO`, any abend in the server processing terminates the complete server processing. That is, it affects all users running on that server.

Value	Explanation
YES	Trap abends in the server processing, write a snap dump and abort the affected user. This is the default value.
NO	Suspend the server abend handling.

Example:

```
HANDLE_ABEND=NO
```

HOST_NAME

This optional configuration parameter is necessary only if the server host supports multiple TCP/IP stacks.

Value	Explanation
<i>host-name</i>	If HOST_NAME is specified, the server listens on the particular stack specified by HOST_NAME, otherwise the server listens on all stacks.

No default value is provided.

Example:

```
HOST_NAME=node1
```

or

```
HOST_NAME=157.189.160.55
```

HTPMON_ADMIN_PSW

This configuration parameter defines the password required for some monitor activities (e.g. Terminate Server) performed by the HTML Monitor Client.

Value	Explanation
any character string	The password to be entered at the HTML Monitor Client for some monitor activities.

No default value is provided.

Example:

```
HTPMON_ADMIN_PSW=GHAU129B
```

HTPMON_PORT

A Web I/O Interface server can be configured to host an HTTP monitor task which serves the HTML Monitor Client running in a web browser. It is not required to run this monitor task on each server. A single task allows you to monitor all servers running at one node.

This configuration parameter defines the TCP/IP port number under which the server monitor task can be connected from a web browser.

Value	Explanation
1 - 65535	TCP/IP port number.

No default value is provided.

Example:

```
HTPMON_PORT=3141
```

HOST_NAME

This configuration parameter defines the host name of the Web I/O Interface server.

IGNORE_PRESENT_SERVER

This configuration parameter applies in conjunction with the Web I/O Interface server CICS Adapter.

A Web I/O Interface (NWO) server allocates a so-called "server environment" which contains the server dependent common resources.

This environment is unique for each NWO server and relates to the server name. If an NWO server with Web I/O Interface Server CICS Adapter ends abnormally, it might leave a stuck NWO server environment within the CICS region. This causes that a restart of the server fails with error message NAT9913.

If you start an NWO server with `IGNORE_PRESENT_SERVER=YES`, it might damage an already running server which is using the same server name and the same CICS region.

Value	Explanation
YES	Terminate existing CICS server environment.
NO	Abort server initialization if a CICS server environment already exist. This is the default value.

Example:

```
IGNORE_PRESENT_SERVER=YES
```

INITIAL_USERID

At server initialization, the Natural Web I/O Interface server creates a temporary Natural session to obtain the properties of the installed Natural environment.

This configuration parameter specifies the user ID to be used for this Natural session.

Value	Explanation
<i>userid</i>	The specified value must not exceed 8 characters, otherwise it is truncated.
STARGATE	This is the default value.

Example:

```
INITIAL_USERID=NWOINITU
```

See also *Web I/O Interface clients must be defined to Natural Security* in the operating-system-specific Natural Web I/O Interface server *Installation* section.

KEEP_TCB

By default, the remote Natural session of a mapped environment terminates its TCB whenever you switch the focus within Natural Studio to a different mapped environment. If you toggle the focus back, the remote session is dispatched using a different TCB.

The maximum number of active TCBs is equal to the number of connected clients.

The configuration parameter `KEEP_TCB` specifies whether the remote Natural session should use the same TCB during its entire lifetime. This is required if you use Adabas and the Adabas parameter `ADANAME` is set to `ADAUSER` or if you want to access DB2. It could also be required if you access 3GL programs which need to be executed under the same TCB for successive calls.

Value	Explanation
YES	The remote Natural session uses the same TCB during its entire lifetime.
NO	This is the default value.

Example:

```
KEEP_TCB=YES
```

04I



Note: This parameter is only available with Natural Web I/O Interface Version 8.3 or above.

This parameter allows you to collect server data for Optimize for Infrastructure.

Value	Explanation
YES	Collect server data for Optimize for Infrastructure.
NO	Do not collect server data for Optimize for Infrastructure. This is the default.

Example:

```
04I=YES
```

PASSWORD_MIXEDCASE

This parameter allows you to define whether passwords specified in the connection dialog are translated into upper case or not.

This parameter does only apply with SECURITY_MODE=IMPERSONATE, IMPERSONATE_LOCAL or IMPERSONATE_REMOTE.

Value	Explanation
YES	Passwords remain in mixed case.
NO	Passwords are translated into upper case. This is the default.

Example:

```
PASSWORD_MIXEDCASE=YES
```

PORT_NUMBER

This configuration parameter defines the TCP/IP port number under which the server can be connected.

Value	Explanation
1 - 65535	TCP/IP port number.

No default value is provided.

Example:


```
PORT_NUMBER=3140
```

SECURITY_MODE

The Natural Web I/O Interface server offers a security concept that also covers the operating system resources. The client credentials are validated at the operating-system-depending security system and the client request is executed under the client's account data.

Using the `SECURITY_MODE` parameter, you can specify at which rank (in batch mode z/OS or under CICS) you want to impersonate the activities of a Web I/O Interface client.

Value	Explanation
IMPERSONATE_LOCAL	Impersonation is done within the Natural Web I/O Interface server environment. If the session is dispatched in a remote TP environment (e.g. in CICS using the NWO CICS Adapter), it is still executed anonymous. The client must be defined in the security system of the Web I/O Interface server. It is not required to define the client in a remote TP environment. See also External Security Configuration .
IMPERSONATE_REMOTE	No impersonation is done within the Natural Web I/O Interface server environment. If the session is dispatched in a remote TP environment, the client is impersonated. The client must be defined in the security system of the remote TP environment. See also Web I/O Interface server security exit NATUXRFE and the section Product Interaction in the <i>Web I/O Interface Server CICS Adapter</i> documentation. Note: Please verify the correct installation of NATUXRFE. A Map Environment attempt with a valid user ID and an invalid password should fail with a NAT0873 error.
IMPERSONATE	Impersonation is done within the Natural Web I/O Interface server environment and in a remote TP environment. The client must be defined in the security system of the Natural Web I/O Interface server and in the remote TP environment.

No default value is provided.

Example:

```
SECURITY_MODE=IMPERSONATE
```

SESSION_PARAMETER

This optional configuration parameter defines session parameters that precede the parameter string specified in the connection dialog of the Natural Web I/O Interface client.

Value	Explanation
<i>parameter-string</i>	This string may extend across several lines. A + sign at the end of a string line denotes that another line follows.

No default value is provided.

Example 1:

```
SESSION_PARAMETER='NUCNAME=NATNUCvr' +
'PROFILE=(NWOPARM,18006,48),ADAMODE=0,' +
'BPI=(TYPE=NAT,SIZE=6044),BPI=(TYPE=EDIT,SIZE=2048)', +
'BPI=(TYPE=SORT,SIZE=1024)'
```

Example 2:

```
SESSION_PARAMETER=FNAT=(10,930)
```

The setting in the second example defines that every session on this Natural Web I/O Interface server is started with the session parameter FNAT=(10,930) appended to the user-specified parameters or the definitions in the configuration parameter DEFAULT_PROFILE.

SESSION_TIMEOUT

Cancel inactive sessions when the SESSION_TIMEOUT parameter is met. Check for sessions inactive longer than *n* minutes once a day at HH:MM (24 hours) or every *n* minutes.

The server will not start if an invalid SESSION_TIMEOUT parameter is given.

Value	Explanation
hh:mm,n <numeric value greater than 0> or m <numeric value greater than 0>,n <numeric value>0>	If format is hh:mm, check once a day at hh:mm for sessions more than <i>n</i> minutes inactive. or If format is a numeric value, check every <i>m</i> minutes for sessions more than <i>n</i> minutes inactive.

Examples:

```
SESSION_TIMEOUT=19:30,480
```

Every day at 19:30 cancel sessions more than 480 minutes inactive.

```
SESSION_TIMEOUT=360,480
```

Every 360 minutes cancel sessions more than 480 minutes inactive.

THREAD_NUMBER

This configuration parameter specifies the number of physical storage threads to be allocated by the Natural front-end, that is, the number of sessions that can be executed in parallel.



Note: This parameter is obsolete when the Natural Web I/O Interface Server CICS Adapter or Natural Web I/O Interface Server IMS Adapter is used.

Value	Explanation
<i>thread-number</i>	Number of physical storage threads to be allocated. Note: This number does not limit the number of sessions within the server, but the number of sessions which can be in execution status concurrently. The number of sessions is limited by the size of the Natural swap medium.
3	This is the default value.

Example:

```
THREAD_NUMBER=5
```

THREAD_SIZE

This configuration parameter specifies the size of each physical storage thread which contains the Natural session data at execution time.



Note: This parameter is obsolete when the Natural Web I/O Interface Server CICS Adapter or Natural Web I/O Interface Server IMS Adapter is used.

Value	Explanation
<i>thread-size</i>	Size (in KB) of each physical storage thread.
500	This is the default value.

Example:

```
THREAD_SIZE=800
```

TRACE_FILTER

This optional configuration parameter enables you to restrict the trace by a logical filter in order to reduce the volume of the server trace output, for 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.

See [Trace Filter](#) in the section *Operating the Natural Web I/O Interface Server*.

TRACE_LEVEL

Value	Explanation
<i>trace-level</i>	See Trace Level in the section <i>Operating the Natural Web I/O Interface Server</i> .
0	This is the default value.

Example:

```
TRACE_LEVEL=0x00000011
```

or alternatively

```
TRACE_LEVEL=31+27
```

The setting in the example switches on [Bits 31 and 27](#).

UPPERCASE_SYSTEMMESSAGES

This configuration parameter is used to enable or disable the translation of all NWO error messages and trace outputs to uppercase. This feature is for customers who are using character sets with no lowercase characters defined.

Value	Explanation
YES	Enable uppercase translation.
NO	Disable uppercase translation. This is the default value.

Web I/O Interface Server Configuration File Example

```
# This is a comment
SESSION_PARAMETER=profile=(stgqa,10,930) fuser=(10,32) CFICU=ON
THREAD_NUMBER=2
THREAD_SIZE=700
FRONTEND_NAME=NATOSvrL      # and another comment
PORT_NUMBER=4811
```

Where *vr* is the current product version and release number.

Web I/O Interface Server Data Sets for z/OS

The Natural Web I/O Interface server requires the following data sets:

STGCONFG	Defines the server configuration file.
STGTRACE	The server trace output.
STGSTDO	The stdo data set.
STGSTDE	The stde error output.

Alternately, you can qualify each data set name by the server ID.

NWOS1C	Defines the server configuration file for the server NWOS1.
NWOS1T	The server trace output for the server NWOS1.
NWOS1O	The stdo data set for the server NWOS1.
NWOS1E	The stde error output for the server NWOS1.

Web I/O Interface Server User Exits

The Natural Web I/O Interface server offers the following user exit:

User Exit NSECUX01

This user exit is applicable only when the parameter `SECURITY_MODE` is set to `IMPERSONATE_LOCAL` or `IMPERSONATE`.

This user exit allows you to adapt the user ID used for the RACF login. It is useful if the RACF user IDs and the user IDs used in Natural differ according to a standardized rule. For example, each RACF user ID is the corresponding Natural user ID preceded by two dollar signs (\$\$).

If the exit (the load module `NSECUX01`) is found in the NWO load library concatenation, it is called using standard linkage conventions (direct branch using a `BASR` instruction) before the user is validated against RACF.

The following parameters are passed to the exit:

Name	Format	In/Out	Description
sUId	CL64	I/O	User ID to be modified for RACF login.

The exit is called using standard linkage conventions.

Sample user exit implemented in C:

```
#include <string.h>
#include <stdio.h>

# pragma linkage (NSECUX01, FETCHABLE)

void NSECUX01(char sUId[64])
{
    char sUIdTemp[64];

    printf("Uex got usid:%s\n", sUId);
    strcpy(sUIdTemp, sUId);
    sprintf(sUId, "$$%s", sUIdTemp);
    printf("Uex ret usid:%s\n", sUId);
    return;
}
```

The exit above extends each user ID by two preceding dollar signs (\$\$) when it is used for RACF login.

9 Installing the Natural Web I/O Interface Server CICS Adapter under z/OS

- Prerequisites 64
- Installation Procedure 64

This chapter describes how to install the CICS connection for a Natural Web I/O Interface server (product code NWO) running under z/OS in batch mode.

Prerequisites

For details, refer to the section *Prerequisites*.

Installation Procedure

To install the Natural Web I/O Interface Server CICS Adapter, perform the following steps:

Step 1: Customize CICS

(Job I005, Steps 9405, 9406, 9410, 9411)

The Natural Web I/O Interface server load library must be defined in the CICS `DFHRPL` concatenation.

The CICS TCP/IP environment can be customized using the configuration macro `EZACICD` in the `EZACONFG` configuration data set or the configuration transaction `EZAC`. This section describes the usage of the transaction `EZAC`.

Customize the standard listener `CSKL` of the CICS socket interface using the CICS transaction `EZAC, ALTER, LISTENER` and, on the second screen, define `NATUXRFE` in the `SECEXIT`.

For impersonation with pass phrases an enhanced listener is required. Customize an existing enhanced listener or define a new one using the CICS transaction `EZAC, DEFINE, LISTENER` with `TRANID` `CSEL` (or another name of your choice) and `FORMAT` `ENHANCED`. Customize this enhanced listener by altering the settings on the second screen as follows:

```
CSTRANid    ===> NRFE
CSSTTYPe    ===> KC
CSDELAY      ===> 000000
MSGLENgth   ===> 000
PEEKDATA     ===> NO
MSGFORMat   ===> EBCDIC
USEREXIT     ===> NATUXRFE
GETTID       ===> NO
USERID       ===>
```

The definition of `SECEXIT=NATUXRFE` is mandatory when an enhanced listener is used or when the Natural Web I/O Interface server is started with impersonation (parameter `SECURITY_MODE`).

Start the listener using the CICS transaction `EZA0`.

Specify `AF=INET6` if IPv6 (Internet Protocol Version 6) is to be used.

 **Note:** Using IPv6 is only possible with Natural Web I/O Interface Server Version 8.3.2 or above

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 NWO configuration parameter `RFE_CICS_TA_NAME`. This document uses the transaction name `NRFE`.

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

2. Define the programs `NATCNRFE`, `NATLRGWO` and `NATUXRFE`:

```
DEFINE PROGRAM(NATCNRFE) GROUP(NWOgroup)
LANGUAGE(C) DATALOCATION(ANY) EXECKEY(USER)
```

```
DEFINE PROGRAM(NATLRGWO) GROUP(NWOgroup)
LANGUAGE(C) DATALOCATION(ANY) EXECKEY(USER)
```

```
DEFINE PROGRAM(NATUXRFE) GROUP(NWOgroup)
LANGUAGE(LLE370) DATALOCATION(ANY) EXECKEY(CICS)
```

`NATUXRFE` must be defined with `EXECKEY(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(REQUIRED)
```

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 `EXECKEY` 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.

3. For DB2 access, a DB2 plan name must be defined. If you have not specified a DB2 plan name for pool threads in the DB2CONN resource definition, the transaction specified in RFE_CICS_TA_NAME and its associated DB2 plan name must be defined to CICS with a DB2TRAN and/or DB2ENTRY resource definition.



Note: The dynamic plan selection provided by the Natural for DB2 interface must not be used.

4. For DB2 access, the authorization ID under which the NWO CICS transaction is accessing DB2 must have the necessary privileges for DB2 access. The authorization ID to be used is specified in the DB2ENTRY resource definition. If you choose the USERID option, the user ID of the CICS system will be used because the NWO CICS transactions are running under the user ID of the CICS system.

The sample JCL containing the following members defines all necessary CICS entries:

- NWOCNF

Step 2: Create member for CICS server

- Job I009, Step 9411, create member NWOCNFC for CICS server

Step 3: Link the object modules into the NWO load library

(Job I054, Step 8420)

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

See sample job NW0I054 on data set NW0vrs.JOBS.

Step 4: Create startup procedure

- Job I200, Step 9416, create startup procedure for CICS server

Step 5: Customize the Natural Web I/O Interface Server

In order to dispatch the NWO Natural sessions in CICS, you must adapt the configuration file of your Natural Web I/O Interface server running under z/OS in batch mode. For this purpose, two sample JCL members (NW0I009C and NW0CONF0) are available.

Refer to [Configuring the Natural Web I/O Interface Server CICS Adapter](#) and to [Configuring the Natural Web I/O Interface Server](#).

10 Configuring the Natural Web I/O Interface Server CICS

Adapter

▪ Configuration File	70
▪ Configuration Parameters	70

This chapter describes how to configure the CICS connection for a Natural Web I/O Interface server (product code NWO) running on z/OS.

Configuration File

After the installation of the Natural Web I/O Interface Server CICS Adapter is complete, the configuration of the Natural Web I/O Interface Server CICS Adapter has to be done in the configuration file of the corresponding Natural Web I/O Interface server.

To enable the CICS Adapter, specify the remote front-end module in the NWO 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 Natural Web I/O Interface Server CICS Adapter under z/OS](#).



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 the section *Dynamically Changing the CICS Transaction Name when Starting a Session* in the client documentation for the Natural Web I/O Interface server.

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.

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 Web I/O Interface server and CICS are running on the same TCP/IP node.

Default Value	The host address of the 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 the Web I/O Interface client to connect to a Web I/O Interface server. This port number (and the `RFE_CICS_TA_HOST` definition) is used internally by the Web I/O Interface 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 the Web I/O Interface client sends a request to a Natural Web I/O Interface 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 Web I/O Interface 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 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, the Natural Web I/O Interface 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	NO
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 Web I/O Interface 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 Web I/O Interface server and CICS.
Bit 26	Dump entire buffer exchanged between Web I/O Interface server and CICS.
Bit 25	Dump the Natural Web I/O Interface server relevant buffer only (remote gateway buffer).
Bit 23	Trace error situations only.
Bit 07	Activate trace in the Web I/O Interface 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 server configuration file using the Natural Web I/O Interface Server CICS Adapter:

```
# The Web I/O Interface Server parameter.
SESSION_PARAMETER=PROFILE=(NWO,10,930)
FRONTEND_NAME=NATCSRFE           # Use the CICS Adapter front-end.
PORT_NUMBER=4711                 # The port number used by the Web I/O Interface Client.

# 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 server.
RFE_CICS_FE_NAME=NCIvrNUC       # The name of the installed Natural CICS nucleus.
RFE_CICS_TA_INIT_TOUT=20        # Transaction timeout is 20 seconds.
```



Note: The server parameters `THREAD_NUMBER` and `THREAD_SIZE` are obsolete when the Natural Web I/O Interface Server CICS Adapter is used.

11 Installing the Natural Web I/O Interface Server IMS Adapter

- Prerequisites 76
- Example Jobs 76
- Installation Procedure 76

This chapter describes how to install the IMS TM connection for a Natural Web I/O Interface server (abbreviated: “NWO server”) running under z/OS in batch mode.

Notation *vrs* or *vr*:

When used in this document, the notation *vrs* or *vr* represents the relevant product version (see also Version in the *Glossary*).

Prerequisites

For details, refer to the section *Prerequisites*.

Example Jobs

The example installation jobs are contained in the `NW0vrs.JOBS` data set and are prefixed with the product code. The data set is provided on the installation medium for Natural Web I/O Interface.

Installation Procedure

Perform the following steps:

Step 1: Customize the IMS Listener

See *z/OS Communications Server IP IMS Socket Guide* for the description of

- how to set up and operate the IMS Listener,
- how to use the IMS TCP/IP control statements.



Note: The port number of the IMS Listener is to be used later on in the NWO configuration parameter `RFE_IMS_TA_PORT`.

Step 2: Install the Server Transaction

It is assumed that the Natural IMS TM Interface is already installed. Thus, this step describes the additional steps which are necessary to create the Natural Web I/O Interface server environment.

Step 2.1: Adapt the Transaction Code Table

(Job I055, Steps 2555, 2556)

- In the NTIMSPT macro of the Natural parameter module, add the following entry:

```
NTIMSPT TRAN=NAT vrsAD ,TYPE=SFE ,           X
        ENVPID=ENVNW000 ,                   X
        PSB=NII vrsAD
```

- Assemble and link the parameter module.

Step 2.2: Adapt the Environment Parameters

(Job I055, Steps 2580, 2581)

- In the NTIMSPE macro of the Natural parameter module, add a new entry:

```
NTIMSPE ENTRYNM=ENVNW000 ,                 X
        THBELOW=OFF ,                       X
        THSIZE=1536000      (1500K)
```

- Assemble and link the parameter module.

Step 2.3: Relink the Natural IMS TM Interface Module

(Job I055, Step 2582)

Relink the Natural IMS TM interface module NII vrsIF.

Step 2.4: Natural IMS TM Parameter Module

(Job I080, Steps 2500, 2510)

- Build the Natural IMS TM parameter module.
- Assemble and link the Natural IMS TM parameter module.

Step 2.5: Link the Server Front-End

(Job I080, Step 2586)

Link the server front-end.

Ensure that the name of the server front-end matches the value specified with the PSB keyword subparameter of the NTIMSPT macro in installation step 2.1 above.

Step 3: Customize IMS TM

- Define the PSB for the server transaction.

As a minimum requirement you need a TP PCB. In order to access DL/I databases from the server transactions, the specific DB PCBs have to be added.

Define the application of the server transaction in the stage1 input. The transaction is a single mode, single segment non-conversational transaction.

Example:

```
APPLCTN PSB=NII vrsAD,PGMTYPE=TP,SCHDTYP=PARALLEL
TRANSACT CODE=NAT vrsAD,MODE=SNGL, X
MSGTYPE=(SNGLSEG, NONRESPONSE,4)
```

- Adapt the MPP region.

In the JCL of the MPP region, add the SYSTPCD DD statement.

See *z/OS Communications Server IP IMS Socket Guide* for the description on how to configure TCPIP.DATA.

- Concatenate the data set containing the NWO load library to the STEPLIB DD statement.

Before starting the Natural Web I/O Interface Server IMS Adapter installation, set the SMA parameter NWO-SRV-IMS to Y (yes).

To install the Natural Web I/O Interface Server IMS Adapter, perform the following steps:

Step 4: Create Member for NWO Server

(Job I009, Step 9412)

- Create member `NWOCONFI` for the NWO server.

Step 5: Link the Object Modules into the NWO Load Library

(Job I054, Step 9440)



Notes:

1. The module `NATINRFE` applies to two different products: the Natural Development Server (NDV) and the Natural Web I/O Interface (NWO server). So if you have already installed NDV, the module `NATINRFE` might already be there. However, it does not matter if you reinstall `NATINRFE` with NWO because the resulting module from either installation is the same.
2. The module `NATISRFE` (referenced in config via `FRONTEND_NAME=NATISRFE`) has already been linked in the prior steps of batch installation.

Step 6: Create Startup Procedure

(Job I200, Step 9417)

- Create the startup procedure for the NWO server.

Step 7: Customize the Natural Web I/O Interface Server

In order to dispatch the NWO Natural sessions in IMS, you must adapt the configuration file of your development server running under z/OS in batch mode. For this purpose, two sample JCL members (`NWOI009I` and `NWOCONFI`) are available.

Refer to [Configuring the Natural Development Server IMS Adapter](#) and to [Configuring the Natural Web I/O Interface Server](#).

12 Configuring the Natural Web I/O Interface Server IMS

Adapter

■ Configuration File	82
■ Configuration Parameters	82

This chapter describes how to configure the IMS TM connection for a Natural Web I/O Interface server (product code NWO) running on z/OS.

Configuration File

After the installation of the Natural Web I/O Interface Server IMS Adapter is complete, the configuration of the Natural Web I/O Interface Server IMS Adapter has to be done in the configuration file of the corresponding Natural Web I/O Interface server.

To enable the Natural Web I/O Interface Server IMS Adapter, specify the remote front-end module in the NWO configuration parameter `FRONTEND_NAME`:

```
FRONTEND_NAME=NATISRFE.
```

Configuration Parameters

The following IMS-relevant configuration parameters exist:

- `RFE_IMS_TA_NAME`
- `RFE_IMS_TA_HOST`
- `RFE_IMS_TA_PORT`
- `RFE_IMS_TRACE`

RFE_IMS_TA_NAME

This configuration parameter specifies the IMS transaction to be used for starting the remote front-end in IMS TM. This transaction must be defined in IMS TM and must refer to the program NATINRFE. See also *Installing the Natural Web I/O Interface Server IMS Adapter under z/OS*.

Default Value	none
Example	RFE_IMS_TA_NAME=NATvrsAD

RFE_IMS_TA_HOST

This configuration parameter specifies the TCP/IP address of the host the desired IMS TM is running. This parameter can be omitted if the Web I/O Interface server and IMS TM are running on the same TCP/IP node.

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

RFE_IMS_TA_PORT

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



Note: This port number is not used in the Web I/O Interface client to connect to a Web I/O Interface server. This port number (and the RFE_IMS_TA_HOST definition) is used internally by the Web I/O Interface server to communicate with the IMS region.

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

RFE_IMS_TRACE

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

The trace level is similar to the trace implemented for the Web I/O Interface 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 Web I/O Interface server and IMS TM.
Bit 26	Dump entire buffer exchanged between Web I/O Interface server and IMS TM.
Bit 25	Dump the Natural Web I/O Interface server relevant buffer only (remote gateway buffer).
Bit 23	Trace error situations only.
Bit 07	Activate trace in the Web I/O Interface server region.
Bit 06	Activate trace in the IMS MPP region.
Bit 00	Reserved for trace-level extension.

The trace destination is the data set defined for STDOUT.

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

The following is a sample server configuration file using the Natural Web I/O Interface Server IMS Adapter:

```
# The Web I/O Interface Server parameter.
SESSION_PARAMETER=PROFILE=(NWO,10,930)
FRONTEND_NAME=NATISRFE           # Use the IMS Adapter front-end.
PORT_NUMBER=4711                 # The port number used by the Web I/O Interface Client.

# The IMS Adapter parameter.
RFE_IMS_TA_NAME=NATvrsAD        # The IMS transaction for the remote front-end.
RFE_IMS_TA_PORT=3020            # The port of the IMS listener.
                                # No RFE_IMS_TA_HOST is defined. This requires
                                # that IMS runs on the same node as the server.
```



Note: The server parameters `THREAD_NUMBER` and `THREAD_SIZE` are obsolete when the Natural Web I/O Interface Server IMS Adapter is used.

V

Installing the Natural Web I/O Interface Client

This part explains how to install the Natural Web I/O Interface client on Tomcat so that it can be used with the server part of the Natural Web I/O Interface that is running in a Natural for Mainframes, Natural for UNIX or Natural for Windows runtime environment.

The following topics are covered:

Prerequisites

[Installing the Natural Web I/O Interface Client on Apache Tomcat](#)

[Migrating the Natural Web I/O Interface Client from IIS to Apache Tomcat](#)

13 Prerequisites

▪ Servlet Container	88
▪ Natural for Mainframes	88
▪ Natural for UNIX	88
▪ Natural for Windows	89
▪ Browser Prerequisites	89

Servlet Container

The following servlet container is supported. The servlet container is not delivered with the Natural Web I/O Interface. It can be obtained from the location indicated below, according to its license terms.

- Apache Tomcat 7, 8 and 9 (see <http://tomcat.apache.org/>).

Natural for Mainframes

If you want to use the Natural Web I/O Interface client with Natural for Mainframes, the following must be installed:

- Natural for Mainframes Version 8.2.5 or above, and
- the Natural Web I/O Interface server.

For detailed information, see:

- the *Installation* documentation for the different operating systems which is provided for Natural for Mainframes;
- the section *Installing and Configuring the Natural Web I/O Interface Server* in the version of this *Natural Web I/O Interface* documentation which is provided for Natural for Mainframes.

Natural for UNIX

If you want to use the Natural Web I/O Interface client with Natural for UNIX, the following must be installed:

- Natural for UNIX Version 9.1.2 or above, and
- the Natural Web I/O Interface server and daemon.

For detailed information, see:

- the *Installation* documentation which is provided for Natural for UNIX;
- the section *Installing and Configuring the Natural Web I/O Interface Server* in the version of this *Natural Web I/O Interface* documentation which is provided for Natural for UNIX.

Natural for Windows

If you want to use the Natural Web I/O Interface client with Natural for Windows, the following must be installed:

- Natural for Windows Version 9.1.2 or above, and
- the Natural Web I/O Interface server and service.

For detailed information, see:

- the *Installation* documentation which is provided for Natural for Windows;
- the section *Installing and Configuring the Natural Web I/O Interface Server* in the version of this *Natural Web I/O Interface* documentation which is provided for Natural for Windows.

Browser Prerequisites

Supported browsers in this version are:

Internet Explorer 11

Microsoft Edge

Mozilla Firefox Extended Support Release 68 and 70 ⁽¹⁾

Google Chrome ⁽²⁾

Notes:

⁽¹⁾ Only the Extended Support Releases of Mozilla Firefox are explicitly supported. Due to frequent upgrades of the Mozilla Firefox consumer release, the compatibility of Natural Web I/O Interface client with future versions of Mozilla Firefox cannot be fully guaranteed. Possible incompatibilities will be removed during the regular maintenance process of Natural Web I/O Interface client.

⁽²⁾ The Google Chrome support is based on Google Chrome Version 74. Due to frequent version upgrades of Google Chrome, compatibility of Natural Web I/O Interface client with future versions of Google Chrome cannot be fully guaranteed. Possible incompatibilities will be removed during the regular maintenance process of Natural Web I/O Interface client.



Important: Cookies and JavaScript must be enabled in the browser.

14 Installing the Natural Web I/O Interface Client on Apache

Tomcat

- Installation Steps 92
- Installation Verification 93

If you want to use the Natural Web I/O Interface client with Apache Tomcat, you must proceed as described in this chapter.

Installation Steps

The Natural Web I/O Interface client is installed using the Tomcat Manager.

The following is assumed:

- `<install-dir>` is the path to Software AG's main installation directory. By default, this is `C:\SoftwareAG` on Windows and `/opt/softwareag` on UNIX.
- `<host>` is the name of the machine on which Apache Tomcat is installed.
- `<port>` is the name of the port where Apache Tomcat is installed. In a default installation, this is port 8080.
- `<tomcat>` is the path to the directory in which Apache Tomcat is installed.

The following topics are covered below:

- [First-time Installation](#)
- [Update Installation](#)

First-time Installation

➤ To install the Natural Web I/O Interface client

- 1 Natural for Windows and UNIX: Copy the complete contents of the `<install-dir>/natural/INSTALL/nwoclient/<nnnn>/tomcat` directory to a directory of your choice on your hard disk.

Or:

Download the Natural Web I/O Interface client for Apache Tomcat from Empower (<https://empower.softwareag.com/>) and unzip the contents to a directory of your choice on your hard disk.

- 2 Make sure that Apache Tomcat is running.
- 3 Open your web browser and enter the following URL:

```
http://<host>:<port>/manager/html
```

This opens the Tomcat Manager.

- 4 Deploy the web application file `natuniweb.war`:

- Under **Select WAR file to upload** select the path to the file `natuniweb.war`.

- Choose **Deploy**.
- 5 In the Tomcat Manager, look for the application **Natural Web I/O Interface Client** and choose **Reload**.

Update Installation

➤ To update the Natural Web I/O Interface client

- 1 Natural for Windows and UNIX: Copy the complete contents of the `<install-dir>/natural/INSTALL/nwoclient/<nnnn>/tomcat` directory to a directory of your choice on your hard disk.

Or:

Download the Natural Web I/O Interface client for Apache Tomcat from Empower (<https://empower.softwareag.com/>) and unzip the contents to a directory of your choice on your hard disk.

- 2 Shut down Apache Tomcat.
 - 3 Create a backup copy of your `sessions.xml` file, which is located in `<tomcat>/webapps/natuniweb/WEB-INF`.
 - 4 Start Apache Tomcat.
 - 5 Open your web browser and enter the following URL:


```
http://<host>:<port>/manager/html
```
- This opens the Tomcat Manager.
- 6 Select `natuniweb.war` in the list of installed applications.
 - 7 Choose **Undeploy**.
 - 8 Deploy the new version of the Natural Web I/O Interface client as in a first-time installation.
 - 9 Restore the `sessions.xml` file that you have backed up previously.

Installation Verification

It is assumed that `http://<host>:<port>` is the URL of your application server.

➤ To verify the installation

- Enter the following URL in your web browser:

```
http://<host>:<port>/natuniweb/natural.jsp
```

For example:

```
http://myhost:8080/natuniweb/natural.jsp
```

The Natural Web I/O Interface client is now started in your browser. The entries which appear in the resulting logon page depend on the settings in your configuration file. For further information, see [Configuring the Client](#).

15 Migrating the Natural Web I/O Interface Client from IIS to Apache Tomcat

- Before You Install the Natural Web I/O Interface Client 96
- Installing the Natural Web I/O Interface Client on Apache Tomcat 97
- Configuring the Natural Web I/O Interface Client on Apache Tomcat 97

Microsoft Internet Information Services (IIS) is no longer supported. If you are currently using the Natural Web I/O Interface client on IIS, you have to move to Apache Tomcat.



Note: JBoss Application Server and Oracle GlassFish Server are also no longer supported. If you are currently using one of these application servers, you also have to move to Apache Tomcat. In this case, however, you can reuse your previous settings (that is, the URL for logon page and the configuration file *sessions.xml*).

The most simple solution is to migrate the Natural Web I/O Interface client from IIS to Apache Tomcat. Therefore, this chapter gives IIS administrators a quick introduction to a Tomcat installation and describes the migration steps.

Before You Install the Natural Web I/O Interface Client

If Apache Tomcat is not yet installed, proceed as described in the topics below:

- [Installing Tomcat](#)
- [Installing Java](#)
- [Starting the Tomcat Server](#)

Installing Tomcat

Go to <http://tomcat.apache.org/> and download Tomcat as a zip file.

For Microsoft Windows users: download either the 32-bit or the 64-bit Windows zip file.

Unzip the downloaded zip file to a directory of your choice.

Installing Java

Tomcat is based on Java. Therefore, you have to make sure that a Java Runtime Environment (JRE) or a Java Development Kit (JDK) is installed. The version of the Java runtime should be at least Java 6 update 24. This is the minimum version that is required for the Natural Web I/O Interface client on Tomcat.

You can download the Java JRE or JDK from the Oracle website at <http://www.oracle.com/technetwork/java/javase/downloads/index.html>.

If Java is installed on your system, make sure that the environment variable `JAVA_HOME` is set to the Java home directory.

Starting the Tomcat Server

When Tomcat and the appropriate Java version have been installed, you can start Tomcat.

To start Tomcat, execute the *startup.bat* file from the *bin* directory of your Tomcat installation. To check whether Tomcat is running, enter the following URL:

```
http://localhost:8080
```

This should display Tomcat's default home page.

Installing the Natural Web I/O Interface Client on Apache Tomcat

When Apache Tomcat has been installed, install the Natural Web I/O Interface client as described in [Installing the Natural Web I/O Interface Client on Apache Tomcat](#).

Configuring the Natural Web I/O Interface Client on Apache Tomcat

When the Natural Web I/O Interface client has been installed, proceed as described in the topics below:

- [Invoking the Logon Page](#)
- [Changing the Tomcat HTTP Port](#)
- [Using the Settings from Your IIS Configuration File](#)
- [Using the Configuration Tool](#)
- [Protecting the Configuration Tool Against Unauthorized Access](#)
- [Displaying the Logon Page by Default](#)

Invoking the Logon Page

Enter the following URL to invoke the logon page (this is different from the URL that was used with IIS):

```
http://localhost:8080/natuniweb/natural.jsp
```

Changing the Tomcat HTTP Port

IIS usually runs on the default port 80. If you want Tomcat to work with the same port, edit the file *server.xml* which is located in Tomcat's *conf* subdirectory and then search for the following text:

```
<Connector port="8080" protocol="HTTP/1.1"
```

Change the port number so that it looks as follows:

```
<Connector port="80" protocol="HTTP/1.1"
```

Using the Settings from Your IIS Configuration File

With Tomcat, you can reuse the *settings.xml* configuration file of IIS, but you have to rename the file to *sessions.xml*. Proceed as follows:

1. Copy the *settings.xml* file from your IIS installation to the following directory of your Tomcat installation:

```
webapps/natuniweb/WEB-INF
```

2. Either rename the *sessions.xml* file which comes with the Natural Web I/O Interface client installation on Tomcat (for example, to *sessions-original.xml*) or delete it.
3. Rename the *settings.xml* file to *sessions.xml*.

Using the Configuration Tool

When the Natural Web I/O Interface client runs on Tomcat, it is no longer necessary to edit the configuration file manually. Instead, you can use the configuration tool. Using this tool has the advantage that it is not possible for you to create invalid XML code and thus damage the XML file. See [Using the Configuration Tool](#) for further information.

The IIS-specific entries in the renamed configuration file will be ignored. These are:

```
natural_parameter visible  
theme  
screen top  
screen left  
screen size  
screen pfkeypos
```

You can still edit the configuration file manually. However, this is no longer recommended.

Protecting the Configuration Tool Against Unauthorized Access

It is possible to protect the configuration tool against unauthorized access. See [Configuring Container-Managed Security](#) for detailed information.

For detailed information on the necessary realm configuration for Tomcat, see <http://tomcat.apache.org/tomcat-6.0-doc/realm-howto.html>.

Displaying the Logon Page by Default

When you enter the URL `http://localhost:8080/natuniweb`, Tomcat shows the default page of the Natural Web I/O Interface client which allows you to access either the **logon page** or the **configuration tool** of the Natural Web I/O Interface client.



Note: If you have defined a different port (for example, 80), make sure to use that port number in the URL.

This behavior is different from IIS which displays the logon page by default. If you also want Tomcat to display the logon page by default, edit the file `web.xml` which is located in Tomcat's `webapps\natuniweb\WEB-INF` directory and search for the following entry:

```
<welcome-file-list>
  <welcome-file>
    index.html
  </welcome-file>
</welcome-file-list>
```

Change the name of the welcome file to `natural.jsp` as shown in the following example:

```
<welcome-file-list>
  <welcome-file>
    natural.jsp
  </welcome-file>
</welcome-file-list>
```

VI

Configuring the Client

This part explains how to configure the Natural Web I/O Interface client so that it can be used in a Natural runtime environment. The following topics are covered:

[About the Logon Page](#)

[Natural Client Session Configuration](#)

[Natural Client Configuration Tool](#)

[Natural Web I/O Style Sheets](#)

[Starting a Natural Application with a URL](#)

[Configuring Container-Managed Security](#)

[Configuring SSL](#)

[Logging](#)

16

About the Logon Page

▪ Starting a Natural Application from the Logon Page	104
▪ Examples of Logon Pages	104
▪ Dynamically Changing the CICS Transaction Name when Starting a Session	105
▪ Specifying a Password in the Logon Page	106
▪ Changing the Password in the Logon Page	106
▪ Browser Restrictions	107

Starting a Natural Application from the Logon Page

When you start the Natural Web I/O Interface client in the browser, a logon page appears. The entries in this logon page depend on the settings in your configuration file (see [Natural Client Session Configuration](#)).

In order to start a Natural application from the logon page, you enter the following URL inside your browser:

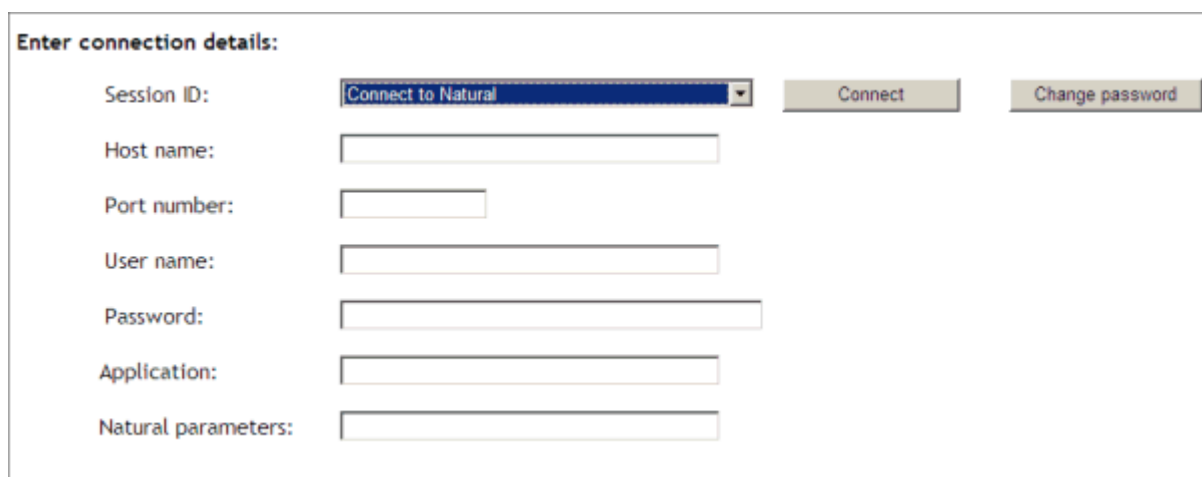
```
http://<host>:<port>/natuniweb/natural.jsp
```

where *<host>* and *<port>* are the host name and port number of your application server.

Examples of Logon Pages

For each session definition that has been configured in the configuration file, an entry appears on the logon page. If the user selects the corresponding entry, only those parameters that were not preconfigured in the configuration file need to be specified in the logon page in order to start the application. Usually, you will preconfigure all connection parameters except user name and password.

The following example shows part of a logon page which results from a configuration file in which no special entries are defined for a session:



The screenshot shows a web form titled "Enter connection details:". It contains the following elements:

- Session ID:** A dropdown menu with "Connect to Natural" selected.
- Host name:** A text input field.
- Port number:** A text input field.
- User name:** A text input field.
- Password:** A text input field.
- Application:** A text input field.
- Natural parameters:** A text input field.
- Buttons:** "Connect" and "Change password" buttons are located to the right of the Session ID dropdown.

The following example shows part of a logon page which results from a configuration file in which many settings are already predefined (including user ID and password):

Enter connection details:

Session ID:

To log on to a session, you have to specify all required information in the logon page (for example, you select a session from the corresponding drop-down list box). When you choose the **Connect** button, the screen for the selected session appears.

Dynamically Changing the CICS Transaction Name when Starting a Session

The following description applies if you want to switch to a different CICS transaction on a mainframe.

You specify the CICS transaction name in the same text box in which you also specify the dynamic parameters for the Natural environment. So that the CICS transaction name can be evaluated, it is important that you specify it before any Natural parameters, using the following syntax:

```
<TA_NAME=name>
```

where *name* can be 1 to 4 characters long. This must be the name of an existing CICS transaction which applies to a CICS Adapter. It will override the transaction name which is currently defined in the configuration file for the CICS Adapter on the Natural Web I/O Interface server (NWO). Ask your administrator for further information.

Make sure to put the entire definition in angle brackets. When this definition is followed by a Natural parameter, insert a blank before the Natural parameter. Example:

```
<TA_NAME=NA82> STACK=(LOGON SYSCP)
```

If the specified CICS transaction name cannot be found, an error message occurs and the session cannot be started.



Note: The above definition for the CICS transaction name can also be specified in the [configuration tool](#), in the same place where you also specify the Natural parameters, and together with the [URL parameter](#) natparam.

Specifying a Password in the Logon Page

The following information applies when the field for entering a password appears on the logon page. This field does not appear when a password has already been defined in the configuration file.

Under Windows and UNIX, you always have to enter the operating system password, even if Natural Security is active.

On the mainframe, this is different: When Natural Security is not active, you have to enter the operating system password. When Natural Security is active, you have to enter the Natural Security password.

Changing the Password in the Logon Page

Currently, this functionality is only available for Natural for UNIX and Natural for Windows.

The following information applies when the fields for entering a user ID and a password appear on the logon page. These fields do not appear when user ID and password have already been defined in the configuration file; in this case, it is not possible to change the password in the logon page.

When your password has expired, you are automatically asked for a new password. When you try to log on with your current password, an error message appears and input fields for changing the password are shown.

> To change the password

- 1 Choose the **Change password** button in the logon page.

The name of this button changes to **Don't change password** and the following two input fields are shown in the logon page:

- **New password**
- **Repeat new password**

- 2 Enter your user ID and your current password as usual.
- 3 Enter the new password in the two input fields.
- 4 Choose the **Connect** button to change the password.

Or:

If you do not want to change your password, choose the **Don't change password** button. The two input fields will then disappear.

Browser Restrictions

The browser's "Back" and "Forward" buttons do not work with the Natural Web I/O Interface client and should therefore not be used.

If you want to run two Natural sessions in parallel, you have to start a new instance of the browser (for example, by choosing the corresponding icon in the Quick Launch toolbar of Windows). You must not use the browser's "New Window" function. This would result in one session running in two browsers, which is not allowed.

17 Natural Client Session Configuration

- General Information 110
- Name and Location of the Configuration File 110

General Information

The configuration file is an XML file which is required to define the sessions that can be invoked from the logon page.

To edit the configuration file, you use the configuration tool. Using this tool has the advantage that it is not possible for you to create invalid XML code and thus damage the XML file. See [Natural Client Configuration Tool](#) for further information.

Name and Location of the Configuration File

The name of the configuration file is *sessions.xml*. It can be found in the *WEB-INF* directory.

`<tomcat-install-dir>/webapps/natuniweb/WEB-INF`

18 Natural Client Configuration Tool

▪ Invoking the Configuration Tool	112
▪ Session Configuration	113
▪ Logging Configuration	121
▪ Logon Page	121
▪ Logout	121

Invoking the Configuration Tool

The Natural Web I/O Interface client offers a configuration tool. The configuration tool is used to create the session configurations which are then available in the logon page. It can also be used for logging purposes in case of problems; however, this should only be done when requested by Software AG support.

The configuration tool is automatically installed when you install the Natural Web I/O Interface client.

➤ To invoke the configuration tool

- Enter the following URL in your browser:

```
http://<host>:<port>/natuniweb/conf_index.jsp
```

where *<host>* and *<port>* are the host name and port number of your application server.



Note: You might wish to protect the configuration tool against unauthorized access. See [Configuring Container-Managed Security](#) for information on how to restrict the access to sensitive areas of the application server environment. If you have restricted access to the configuration tool, an authentication dialog appears. The appearance of this dialog depends on the authentication model you have chosen.

The configuration tool appears.

The screenshot shows the web interface for the Natural Web I/O Interface Client Configuration Tool. The header features the Software AG logo and the title "Natural Web I/O Interface Client Configuration Tool". The main content area is divided into two columns. The left column contains a navigation menu with links for Home, Session Configuration, Logging Configuration, Natural Web I/O Interface Logon, and Logout. The right column is titled "Configuration Tool Management" and contains four sections: "Session Configuration" (manage sessions), "Logging Configuration" (define log levels), "Natural Web I/O Interface Client Logon" (connect to server), and "Logout" (close session). Below this is a section titled "Natural Online Resources" with sub-sections for "Natural Information" (use the development environment) and "Developer Community" (stay connected with peers).

The configuration tool has two frames.

The home page of the configuration tool is initially shown in the right frame. It provides brief descriptions for the links provided in the left frame. It also provides links to several Software AG pages on the web.

When you have invoked a function (for example, when you are currently viewing the session configuration), you can always choose the **Home** link in the left frame to return to the home page of the configuration tool.

The functions that are invoked by the other links in the left frame are described below.

Session Configuration

This section explains how to manage the content of the configuration file for the sessions. It covers the following topics:

- [Invoking the Session Configuration Page](#)
- [Global Settings](#)
- [Adding a New Session](#)
- [Editing a Session](#)
- [Overview of Session Options](#)
- [Duplicating a Session](#)
- [Deleting a Session](#)
- [Adding a New User](#)
- [Saving the Configuration](#)

Invoking the Session Configuration Page

The content of the configuration file for the sessions is managed using the **Session Configuration** page.

➤ To invoke the Session Configuration page

- In the frame on the left, choose the **Session Configuration** link.

The **Session Configuration** page appears in the right frame. It shows the global settings and lists all sessions and users that are currently defined. For a session, some of the configuration file information is shown. Example:

Session Configuration

Global Settings

Last activity timeout (n seconds):

Trace directory:

SSL trust file path:

SSL trust file password:

Sessions

Session ID	Host Name	Port Number	Application	Natural Parameters	Edit	Duplicate	Delete
Connect to Natural					Edit	Duplicate	Delete
localtestserver	localhost	6640			Edit	Duplicate	Delete

Users

User ID	Edit	Duplicate	Delete
user1	Edit	Duplicate	Delete

Global Settings

The global settings apply for all defined sessions. You can define the following global settings in the configuration file:

Option	Description
Last activity timeout (n seconds)	The number of seconds that the client waits for the next user activity. When the defined number of seconds has been reached without user activity, the session is closed. The default is 3600 seconds.
Trace directory	<p>Optional. Location of a different trace directory.</p> <p>When a different trace directory is not defined, the trace files are written to the default trace directory. By default, the trace files are written to the directory which has been set by the Java property <code>java.io.tmpdir</code>. On Windows, this is normally the environment variable <code>TMP</code> for the user who started the application server. On UNIX, this is normally <code>/tmp</code> or <code>/var/tmp</code>.</p> <p>You can also set this property in the start script for the application server.</p>

Option	Description
	Tracing can be enabled individually for each session (see Overview of Session Options below). However, it should only be enabled when requested by Software AG support.
SSL trust file path	Optional. The path to your trust file. See Configuring SSL for further information.
SSL trust file password	If your trust file is password-protected, you have to specify the appropriate password. When you do not specify the password for a password-protected trust file, the trust file cannot be opened and it is thus not possible to open an SSL session. When your trust file is not password-protected, you should not specify a password.

Adding a New Session

You can add a new session to the configuration file.

➤ To add a new session

- 1 Choose the **Add New Session** button.

The **Edit Session** page appears.

- 2 Specify all required information as described below in the section [Overview of Session Options](#).
- 3 Choose the **OK** button to return to the **Session Configuration** page.

The new session is not yet available in the configuration file.

- 4 Choose the **Save Configuration** button to write the new session to the configuration file.

Editing a Session

You can edit any existing session in the configuration file.

➤ To edit a session

- 1 Choose the **Edit** link that is shown next to the session that you want to edit.

The **Edit Session** page appears.

- 2 Specify all required information as described below in the section [Overview of Session Options](#).
- 3 Choose the **OK** button to return to the **Session Configuration** page.

The modifications are not yet available in the configuration file.

- 4 Choose the **Save Configuration** button to write the modifications to the configuration file.

Overview of Session Options

The **Edit Session** page appears when you

- **add** a new session, or
- **edit** an existing session.

Example:

Edit Session

Session ID:	<input type="text"/>
Type:	Undefined <input type="button" value="v"/>
Host name:	<input type="text"/>
Port number:	<input type="text"/>
Use SSL	<input type="radio"/> Yes <input checked="" type="radio"/> No
User name:	<input type="text"/>
User name in upper case:	<input type="radio"/> Yes <input checked="" type="radio"/> No
Password:	<input type="text"/>
Application:	<input type="text"/>
Natural parameters:	<input type="text"/>
Double-click behavior:	Enter <input type="button" value="v"/>
Screen rows:	<input type="text" value="24"/>
Screen columns:	<input type="text" value="80"/>
Show function key numbers:	<input type="radio"/> Yes <input checked="" type="radio"/> No
Check for numeric input:	<input checked="" type="radio"/> Yes <input type="radio"/> No
Trace:	<input type="radio"/> Yes <input checked="" type="radio"/> No
Timeout (in seconds):	<input type="text" value="60"/>
Filler character:	<input type="text"/>

The **Edit Session** page provides the following options:

Option	Description
Session ID	Mandatory. A session name of your choice. On the logon page, the session name is provided in a drop-down list box.
Type	<p>The platform on which user ID and password are authenticated. You can select the required setting from the drop-down list box.</p> <ul style="list-style-type: none"> ■ Undefined Default. User ID and password can have a maximum of 32 characters. See also the description for Natural for Windows or UNIX below. ■ Natural for Mainframes User ID and password can have a maximum of 8 characters. ■ Natural for Mainframes with Natural Security User ID and password can have a maximum of 8 characters. The user ID must comply with the Natural naming conventions for library names. ■ Natural for Windows or UNIX User ID and password can have a maximum of 32 characters. When a domain is required, you have to specify it together with the user ID (in the form "<i>domain\user-ID</i>").
Host name	The name or TCP/IP address of the server on which Natural and the Natural Web I/O Interface server are running. When this is specified, the corresponding field does not appear on the logon page.
Port number	The TCP/IP port number on which the Natural Web I/O Interface server is listening. When this is specified, the corresponding field does not appear on the logon page.
Use SSL	<p>If set to Yes, a secure connection is established between the Natural Web I/O Interface client on the application server and the Natural Web I/O Interface server.</p> <p>Important: If you want to use SSL with Natural for Mainframes, one of the corresponding mainframe types must be selected; the type must not be Undefined or Natural for Windows or UNIX. The other way around, if you want to use SSL with Natural for Windows or UNIX, you must not select one of the mainframe types; the type may also be Undefined in this case.</p>
User name	Optional. A valid user ID for the current machine. When this is specified, the corresponding field does not appear on the logon page.
User name in upper case	If selected, the input field for the user ID is in upper-case mode.
Password	<p>Optional. A valid password for the above user ID.</p> <p>Under Windows and UNIX, this is always the operating system password of the user, even if Natural Security is active.</p> <p>On the mainframe, this is different: When Natural Security is not active, this is the operating system password of the user. When Natural Security is active, this is the Natural Security password.</p>

Option	Description
	When a password is specified, the corresponding field does not appear on the logon page. The configuration tool saves the password in encrypted form.
Application	<ul style="list-style-type: none"> ■ Natural for Mainframes The name of the Natural program or a command sequence that starts your application as you would enter it on the NEXT prompt. Example: <code>TEST01 data1,data2</code> ■ Natural for UNIX The name of the UNIX shell script for starting the Natural application (a file similar to <i>nwo.sh</i>). ■ Natural for Windows The name of the Windows command file (<i>.bat</i>) for starting the Natural application. <p>When this is specified, the corresponding field does not appear on the logon page.</p>
Natural parameters	<p>Optional. Parameters for starting the Natural application. This can be stack parameters, a parameter file/module or other Natural-specific information.</p> <ul style="list-style-type: none"> ■ Natural for Mainframes Used to pass dynamic Natural profile parameters to the session, for example: <code>SYSPARM=(MYPARMS) STACK=(LOGON MYAPPL)</code> <p>Note: It is recommended to specify the Natural program that starts the application with the option Application instead of passing it with the profile parameter <code>STACK</code>.</p> <ul style="list-style-type: none"> ■ Natural for UNIX and Natural for Windows Used when the above shell script (UNIX) or command file (Windows) uses the parameter <code>\$5</code> after "natural", for example: <code>PARM=MYPARM STACK=(LOGON MYLIB;MENU)</code>
Double-click behavior	<p>The key that is to be simulated when double-clicking an output field. By default, this is the ENTER key.</p> <p>It is possible to disable the double-click behavior, or to define a function key (PF1 through PF12).</p> <p>You can select the required setting from the drop-down list box.</p> <p>Tip: When context-sensitive help has been defined for the output fields, it may be useful to define PF1. The help function will then be invoked when the user double-clicks an output field.</p>
Screen rows	<p>The number of rows in the output window. Possible values: minimum 24, no upper limit. Default: 24.</p> <p>Not used by Natural for Mainframes which uses the profile parameter <code>TMODEL</code> instead.</p>
Screen columns	<p>The number of columns in the output window. Possible values: minimum 80, no upper limit. Default: 80.</p>

Option	Description
	Not used by Natural for Mainframes which uses the profile parameter <code>TMODEL</code> instead.
Show function key numbers	If set to Yes , the PF key numbers are shown next to the PF keys.
Trace	Should only be set to Yes when requested by Software AG support.
Check for numeric input	<p>If set to Yes (default), numeric input fields are validated. In this case, only the following characters are allowed in numeric input fields (in addition to the numbers "0" through "9"):</p> <p><i>blank</i> + (plus) - (minus) _ (underscore) , (comma) . (period) ? (question mark)</p> <p>If set to No, numeric input fields are not validated.</p>
Timeout (in seconds)	The number of seconds that the client waits for a response after an updated page was sent to the Natural session. When the defined number of seconds has been reached without response, the session is closed. The default is 60 seconds. Normally, you need not change this value.
Filler character	Optional. The filler character that is to be removed from the input fields. An application can define, for example, an underscore (<code>_</code>) as the filler character. Trailing filler characters will be removed from the input fields, and leading filler characters will be replaced with blanks.

Duplicating a Session

You can add a copy of any existing session to the configuration file.

➤ To duplicate a session

- 1 Choose the **Duplicate** link that is shown next to the session that you want to duplicate.

A new entry is shown at the bottom of the list of sessions. Its name is "Copy of *session-ID*". The duplicated session is not yet available in the configuration file.

- 2 **Edit** and save the duplicated session as described above.

Deleting a Session

You can delete any existing session from the configuration file.

➤ To delete a session

- 1 Choose the **Delete** link that is shown next to the session that you want to delete.

The session is deleted from the list of sessions. It is not yet deleted in the configuration file.

- 2 Choose the **Save Configuration** button to delete the session from the configuration file.

Adding a New User

You can predefine Natural users and their passwords in the configuration file.

When a Natural page is opened with a URL that specifies a user in the URL parameter `natuser`, the specified user is matched against the list of users in the configuration file. When the specified user is defined in the configuration file, the corresponding password is used to authenticate the user when the Natural session is started. See also [Starting a Natural Application with a URL](#).

Example - when the following URL is used, the password defined for "user1" is used:

`http://myhost:8080/natuniweb/natural.jsp?natuser=user1...`

➤ To add a new user

- 1 Choose the **Add New User** button.

The **Edit User** page appears.

- 2 Specify a user name and password
- 3 Choose the **OK** button to return to the **Session Configuration** page.

The new user is not yet available in the configuration file.

- 4 Choose the **Save Configuration** button to write the new user to the configuration file.



Note: You edit, duplicate and delete a user in the same way as a session (see the corresponding descriptions above).

Saving the Configuration

When you choose the **Save Configuration** button, all of your changes are written to the configuration file. The server picks up the new settings automatically the next time it reads data from the configuration file.



Caution: If you do not choose the **Save Configuration** button but log out instead or leave the configuration tool by entering another URL, the new settings are not written to the configuration file.

Logging Configuration

The content of the configuration file for logging is managed using the **Logging Configuration** page. See the section [Logging](#) for detailed information.

Logon Page

The configuration tool provides the following link in the left frame:

- **Natural Web I/O Interface Logon**

This link opens the logon page in the right frame.

The logon page uses the current settings in the configuration file. When you select a session from the drop-down list box, you can check whether the connection details are shown as desired. If not, you can go back to the session configuration and modify the settings of the corresponding session.

See also [About the Logon Page](#).

Logout

When the configuration tool is protected against unauthorized access and you log out of the configuration tool, you make sure that no other user can change the client configuration when you leave your PC unattended for a while.

➤ **To log out**

- In the frame on the left, choose the **Logout** link.

When the configuration tool is protected against unauthorized access, the authentication dialog is shown again.

When it is not protected, the home page is shown again.

19 Natural Web I/O Style Sheets

▪ Name and Location of the Style Sheets	124
▪ Editing the Style Sheets	124
▪ Modifying the Position of the Main Output and of the PF Keys	124
▪ Modifying the Font Size	126
▪ Modifying the Font Type	127
▪ Defining Underlined and Blinking Text	128
▪ Defining Italic Text	128
▪ Defining Bold Text	129
▪ Defining Different Styles for Output Fields	129
▪ Modifying the Natural Windows	130
▪ Modifying the Message Line	131
▪ Modifying the Background Color	131
▪ Modifying the Color Attributes	131
▪ Modifying the Style of the PF Key Buttons	132
▪ JavaScript and XSLT Files	133

Name and Location of the Style Sheets

Several aspects on a page (such as font, font style or color) are controlled by a style sheet (CSS file).

The Natural Web I/O Interface client is delivered with the style sheet `3270.css`, which is located in:

`../natuniapp.ear/natuniweb.war/resources`



Note: For more information on style sheets, see <http://www.w3.org/Style/CSS/>.

Editing the Style Sheets

It is recommended that you have a basic understanding of CSS files.

You can edit the predefined style sheets or create your own style sheets.

It is recommended that you work with backup copies. When a problem occurs with your style sheet, you can thus always revert to the original state.

To see your changes in the browser, you have to

1. delete the browser's cache, and
2. restart the session.

Modifying the Position of the Main Output and of the PF Keys

Applies when only the named PF keys are displayed. This feature cannot be used when all PF keys are displayed, since they are always displayed at the same position. See also [Overview of Session Options](#).

The following elements are available:

Element Name	Description
<code>.mainlayer</code>	Controls the position of the main output in the output window. Used for languages that are written from left-to-right (LTR).
<code>.mainlayer_rtl</code>	Controls the position of the main output in the output window. Used for languages that are written from right-to-left (RTL).
<code>.pfkeydiv</code>	Controls the position of the PF keys in the output window. Used for languages that are written from left-to-right (LTR).

Element Name	Description
.pfkeydiv_rtl	Controls the position of the PF keys in the output window. Used for languages that are written from right-to-left (RTL).

The *_rtl elements are only used if Natural sends the web I/O screen with a right-to-left flag (SET CONTROL 'VON'). In the browser, the screen elements are then shown on the right side (instead of the left side).

For web I/O in applications where only the left-to-right orientation is used, the *_rtl elements are not required.

If the PF keys are to appear at the bottom, define the elements as shown in the following example:

```

/* Defines the main screen position */
.mainlayer {
    top: 5px;
    left: 0px;
    height: 550px;
}

/* Defines the main screen position for right-to-left */
.mainlayer_rtl{
    top: 5px;
    right: 30px;
    height: 550px;
}

/* Defines the PF keys screen position */
.pfkeydiv {
    height: 70px;
    left: 0px;
    top: 580px;
    width: 100%;
}

/* Defines the PF keys screen position for right-to-left */
.pfkeydiv_rtl {
    height: 70px;
    right: 30px;
    top: 580px;
    width: 100%;
}

```

Modifying the Font Size

Depending on the screen resolution, one of the following style sheets for defining the font size is used in addition to the default style sheet:

- *model2.css*
- *model3.css*
- *model4.css*
- *model5.css*

These style sheets are located in the *tmodels* subdirectory of the *resources* directory in which all style sheets are located.

Depending on what comes closest to the standard 3270 screen model, the corresponding style sheet from the *tmodels* subdirectory is automatically used. It is selected according to the following criteria:

Standard 3270 Screen Model	Criteria	Style Sheet
Model 2 (80x24)	30 rows or less.	<i>model2.css</i>
Model 3 (80x32)	Between 31 and 40 rows.	<i>model3.css</i>
Model 4 (80x43)	41 rows or more.	<i>model4.css</i>
Model 5 (132x27)	30 rows or less, and more than 100 columns.	<i>model5.css</i>

The font sizes in the above style sheets can be adjusted. Example for *model4.css*:

```
body {  
    font-size: 10px;  
}
```

The default font sizes for the above 3270 screen models are:

Standard 3270 Screen Model	Default Font Size
Model 2	16px
Model 3	14px
Model 4	10px
Model 5	12px

Modifying the Font Type

As a rule, you should only use monospace fonts such as Courier New or Lucida Console. With these fonts, all characters have the same width. Otherwise, when using variable-width fonts, the output will appear deformed.

If you want to define a different font type, you should define the same font type for the body, the output fields and the input fields as shown in the following example:

```
body {
  background-color: #F3F5F0;
  font-family: Lucida Console;
}

.OutputField {
  white-space:pre;
  border-width:0;
  font-family: Lucida Console;
  font-size: 100%;
}

.InputField {
  background-color: white;
  font-family: Lucida Console;
  border-width: 1px;
  font-size: 100%;
  border-color: #A7A9AB;
}
```

Use the CSS at-rule `@font-face` to specify a custom font with which to display text.

For example, Arabic fonts to be used with `InputFields` for the presentation of "Arabic-Indic numerals" instead of "European numerals":

```
@font-face {
  font-family: CustomFont;
  src: url( CustomFont.woff );
}
```

Defining Underlined and Blinking Text

The following elements are available:

Element Name	Description
.natTextDecoUnderline	Defines underlined text.
.natTextDecoBlinking	Defines blinking text.
.natTextDecoNormal	Defines normal text (no underline, no blinking).

Example:

```
/* Text decoration */
.natTextDecoUnderline { text-decoration:underline; }
.natTextDecoBlinking {text-decoration:blink; }
.natTextDecoNormal {text-decoration:normal;}
```

Blinking text is not supported by the Internet Explorer.

Defining Italic Text

The following elements are available:

Element Name	Description
.natFontStyleItalic	Defines italic text.
.natFontStyleNormal	Defines normal text (no italics).

Example:

```
/* font style */
.natFontStyleItalic {font-style:italic;}
.natFontStyleNormal {font-style:normal;}
```


Defining Bold Text

The following elements are available:

Element Name	Description
<code>.natFontWeightBold</code>	Defines bold text.
<code>.natFontWeightNormal</code>	Defines normal text (not bold).

```
/* Font weight */
.natFontWeightBold {font-weight:bolder;}
.natFontWeightNormal {font-weight:normal;}
```

When you define bold text (`{font-weight:bolder;}`) for the default font Courier New, your text always has the same width as with normal text (`{font-weight:normal;}`).

However, when you define bold text for Courier or Lucida Console, the bold text will be wider than the normal text and your output may thus appear deformed. It is therefore recommended that you switch off bold text for Courier and Lucida Console:

```
.natFontWeightBold {font-weight:normal;}
```

Defining Different Styles for Output Fields

The following elements are available:

Element Name	Description
<code>.FieldVariableBased</code>	Defines the style for output fields that are based on a variable.
<code>.FieldLiteralBased</code>	Defines the style for output fields that are based on a literal.

Example:

```
.FieldVariableBased {
  /* font-style:italic; */
}

.FieldLiteralBased {
  /* font-style:normal; */
}
```



Note: In the above example, as well as in the standard CSS files delivered by Software AG, the variable-based output fields are defined as italic, but are commented out.

Modifying the Natural Windows

The following elements are available:

Element Name	Description
.naturalwindow	Controls the rendering of the Natural windows.
.wintitle	Controls the rendering of the titles of the Natural windows.

Example:

```
.naturalwindow {
  border-style: solid;
  border-width: 1px;
  border-color: white;
  background-color: black;
}

.wintitle {
  left: 0px;
  top: 1px;
  height: 17px;
  width: 100%;
  color: black;
  font-size: 100%;
  font-weight: bold;
  background-color: white;
  text-align: center;
  font-family: Verdana;
  border-bottom-style: solid;
  border-bottom-width: 2px;
}
```



Note: In a mainframe environment, you have to set the Natural profile parameter `WEBIO` accordingly to enable this feature. See *WEBIO - Web I/O Interface Screen Rendering* in the *Parameter Reference* which is provided with Natural for Mainframes.

Modifying the Message Line

The rendering of the message line is controlled by the `.MessageLine` element.

Example:

```
.MessageLine {  
  color: blue;  
}
```



Note: In a mainframe environment, you have to set the Natural profile parameter `WEBIO` accordingly to enable this feature. See *WEBIO - Web I/O Interface Screen Rendering in the Parameter Reference* which is provided with Natural for Mainframes.

Modifying the Background Color

The background color is defined in the `body` element.

Example:

```
body {  
  background-color: #F3F5F0;  
  font-family: Lucida Console;  
}
```

Modifying the Color Attributes

You can define different colors for all Natural color attributes. These are:

- Red
- Green
- Blue
- Yellow
- White
- Black
- Pink
- Turquoise
- Transparent

You can define these color attributes for input fields and output fields, and for normal output and reverse video.

The following examples show how to define the color attribute “Red”.

Define the color for a normal output field:

```
.natOutputRed {color: darkred;}
```

Define the foreground and background colors for an output field with reverse video:

```
.reverseOutputRed {background-color: darkred; color:#F3F5F0;}
```

Define the color for a normal input field:

```
.natInputRed {color: darkred;}
```

Define the foreground and background colors for an input field with reverse video:

```
.reverseInputRed {background-color: darkred; color:#F3F5F0;}
```

Modifying the Style of the PF Key Buttons

The following elements are available:

Element Name	Description
.PFButton	Controls the style for normal rendering.
.PFButton:hover	Controls the style that is used when the mouse hovers over a PF key button.

Example:

```
.PFButton {
  text-align: center;
  width: 90px;
  border-style: ridge;
  border-width: 3px;
  padding: 2px;
  text-decoration: none;
  font-family: Verdana;
  font-size: 12px;
  height: 22px;
}

.PFButton:hover {
  color: #FFFF00;
  background-color: #222222;
}
```



Note: In a mainframe environment, you have to set the Natural profile parameter `WEBIO` accordingly to enable this feature. See *WEBIO - Web I/O Interface Screen Rendering* in the *Parameter Reference* which is provided with Natural for Mainframes.

JavaScript and XSLT Files

In addition to the CSS files described above, the Natural Web I/O Interface client uses XSLT files with specific names for the conversion of the Natural Web I/O Interface screens from the internal XML format to HTML. The following elements are affected:

- Input text is placed into the HTML element `<input>`.
- Output text is placed into the HTML element `<input>` (with attribute `readonly="readonly"`).
- A message line is placed into the HTML element ``.
- PF keys are embedded in an XML island and then rendered with JavaScript.
- Window elements are embedded in an XML island and then rendered with JavaScript.



Note: The JavaScript file which is part of the above conversion is *natunicript.js*. It is located in the *scripts* directory which can be found in the `<installdir>/natuniweb` directory.

The name of the default XSLT file is:

- *transuni.xsl* for all supported browsers.

The default XSLT file can be found in the following directory:

`<installdir>/natuniweb/web-INF`

The XSLT file is only read once when the server is started.



Important: It is recommended that you do not change the above JavaScript file *natunicript.js*. Software AG may change or correct the original JavaScript functionality in new versions or service packs of the product.

You can copy your own JavaScript file into the *scripts* directory which can be found in the `<installdir>/natuniweb` directory.

In this case, the file must have the following name:

- *usernatunicript.js* for all supported browsers.

If this user file can be found when the server is started, it is read additionally to the JavaScript file *natunicript.js*. Define your new functionality in this JavaScript file. Add the required XSL elements to the file *usertransuni.xsl* to call the new functions. If this user file can be found when the server is started, it is read instead of the default XSLT file.

When you make changes to this file, you have to restart the server so that your changes become effective.

20

Starting a Natural Application with a URL

The connection parameters available in the configuration file for the session and on the logon page can also be specified as URL parameters of the logon page URL. This allows bookmarking the startup URL of a Natural application or starting an application by clicking a hyperlink in a document.

The URL parameters overrule the definitions in the configuration file, with the exception described in the table below.

The following URL parameters are available for the logon page:

URL Parameter	Corresponding Option in the Session Configuration
<code>natsession</code>	Session ID
<code>natserver</code>	Host name
<code>natport</code>	Port number
<code>natuser</code>	User name
<code>natprog</code>	Application
<code>natparam</code>	Natural parameters
<code>natparamext</code>	Natural parameters The URL parameter <code>natparamext</code> extends an existing Natural parameter definition in the configuration file. The extension works in the following way: the Natural parameters defined in the configuration file come first. Then, the Natural parameters defined in the URL parameter <code>natparamext</code> are added, separated by a space character. If you want to overrule the definition in the configuration file, use the URL parameter <code>natparam</code> instead.
<code>nattimeout</code>	Timeout (n seconds)



Important: All parameter values must be URL-encoded.

Example: In order to start the Natural program `dump`, while your application server is running on `myhost:8080` and your Natural Web I/O Interface server is running on `myserver1:4811`, you can use the following URL:

`http://myhost:8080/natuniweb/natural.jsp?natserver=myserver1&natport=4811&natprog=dump&natuser=my-username`

21

Configuring Container-Managed Security

▪ General Information	138
▪ Name and Location of the Configuration File	138
▪ Activating Security	138
▪ Defining Security Constraints	139
▪ Defining Roles	139
▪ Selecting the Authentication Method	140
▪ Configuring the UserDatabaseRealm	140

General Information

The Natural Web I/O Interface client comes as a Java EE-based application. For the ease of installation, the access to this application is by default not secured. You might, however, wish to restrict the access to certain parts of the application to certain users. An important example is the **configuration tool**, which enables you to modify the Natural session definitions and the logging configuration of the Natural Web I/O Interface client. Another example is the Natural logon page.

This section does not cover the concepts of JAAS-based security in full extent. It provides, however, sufficient information to activate the preconfigured security settings of the Natural Web I/O Interface client and to adapt them to your requirements.

Name and Location of the Configuration File

Security is configured in the file *web.xml*. This file is located in the following directory:

```
<tomcat-install-dir>/webapps/natuniweb/WEB-INF
```

Activating Security

Great care must be taken when editing and changing the configuration file *web.xml*. After a change, the application server must be restarted.

Edit the file *web.xml* and look for the section that is commented with "Uncomment the next lines to add security constraints and roles.". Uncomment this section by removing the comment marks shown in boldface below:

```
<!-- Uncomment the next lines to add security constraints and roles. -->
<!--
<security-constraint>
  <web-resource-collection>
    <web-resource-name>Configuration Tool</web-resource-name>
    <url-pattern>/conf_index.jsp</url-pattern>
    <url-pattern>/faces/*</url-pattern>
  </web-resource-collection>
  ...
<security-role>
  <description>Administrator</description>
  <role-name>nwoadmin</role-name>
</security-role>
-->
```

Defining Security Constraints

The security constraints defined by default are just examples. A `<security-constraint>` element contains a number of `<web-resource-collection>` elements combined with an `<auth-constraint>` element. The `<auth-constraint>` element contains a `<role-name>`. The whole `<security-constraint>` element describes which roles have access to the specified resources.

Example - the following definition specifies that only users in the role "nwoadmin" have access to the configuration tool:

```
<security-constraint>
  <web-resource-collection>
    <web-resource-name>Configuration Tool</web-resource-name>
    <url-pattern>/conf_index.jsp</url-pattern>
    <url-pattern>/faces/*</url-pattern>
  </web-resource-collection>
  <auth-constraint>
    <role-name>nwoadmin</role-name>
  </auth-constraint>
</security-constraint>
```

In the following section, you will see where and how the roles are defined.

Defining Roles

A few lines below in the file *web.xml*, there is a section `<security-role>`. Here, the roles that can be used in `<security-constraint>` elements are defined. You can define additional roles as needed. The assignment of users to roles is done outside this file and will often be done in a user management that is already established at your site.

Example:

```
<security-role>
  <description>Administrator</description>
  <role-name>nwoadmin</role-name>
</security-role>
```

Selecting the Authentication Method

In the file *web.xml*, there is a section `<login-config>`. The only element that should possibly be adapted here is `<auth-method>`. You can choose between the authentication methods "FORM" and "BASIC". Form-based authentication displays a specific page on which users who try to access a restricted resource can authenticate themselves. Basic authentication advises the web browser to retrieve the user credentials with its own dialog box.

Example:

```
<login-config>
  <auth-method>FORM</auth-method>
  ...
</login-config>
```

Configuring the UserDatabaseRealm

In the *tomcat-users.xml* file (which is located in the *conf* directory), specify the role "nwoadmin" for any desired user name and password. For example:

```
<user username="pepe" password="pepe123" roles="nwoadmin"/>
```

For detailed information on the necessary realm configuration for Tomcat, see <http://tomcat.apache.org/tomcat-6.0-doc/realm-howto.html#UserDatabaseRealm>.

22

Configuring SSL

- General Information 142
- Creating Your Own Trust File 142
- Defining SSL Usage in the Configuration File 143

General Information

Trust files are used for a secure connection between the Natural Web I/O Interface server and the Natural Web I/O Interface client. Server authentication cannot be switched off. A trust file is always required.

A trust file contains the certificates that you trust. These can be certificates of a CA (Certificate Authority) such as VeriSign, or self-signed certificates.

For information on the steps that are required on the Natural Web I/O Interface server and how to generate a self-signed certificate which needs to be imported to the client, see [SSL Support](#).

To establish a secure connection, you have to proceed as described in the topics below.

Creating Your Own Trust File

To create your own trust file, you can use, for example, Sun's keytool utility which can be found in the *bin* directory of the Java Runtime Environment (JRE). Here are some helpful examples:

- Create an empty, password-protected trust file:

```
keytool -genkey -alias foo -keystore truststore.jks -storepass "your-password"  
keytool -delete -alias foo -keystore truststore.jks
```

- Import a certificate:

```
keytool -import -alias "name-for-ca" -keystore truststore.jks -storepass ←  
"your-password" -file server.cert.crt
```

You should use a meaningful name for the alias.

- List the certificates in a trust file:

```
keytool -list -v -keystore truststore.jks
```

- Delete a certificate from a trust file:

```
keytool -delete -alias "name-for-ca" -keystore truststore.jks
```

When you modify the trust file or its password, you have to restart the application server so that your modification takes effect.

Defining SSL Usage in the Configuration File

Invoke the [configuration tool](#) and proceed as follows:

1. In the global settings for all defined sessions, define the **SSL trust file path** and, if required, the **SSL trust file password**. See also [Global Settings](#) in *Natural Client Configuration Tool*.

With the server authentication, the Natural Web I/O Interface client checks whether the certificate of the Natural Web I/O Interface server is known. If it is not known, the connection is rejected.

When a trust file is not defined in the configuration tool, the Natural Web I/O Interface client tries to read the file *calist* from the *lib/security* directory of the Java Runtime Environment (JRE). The default password for this file is "changeit".

2. Define a session and set the session option **Use SSL** to **Yes**. See also [Overview of Session Options](#) in *Natural Client Configuration Tool*.

23 Logging

- General Information 146
- Name and Location of the Configuration File 146
- Invoking the Logging Configuration Page 146
- Overview of Options for the Output File 148

General Information

The Natural Web I/O Interface client uses the Java Logging API. In case of problems with the Natural Web I/O Interface client, you can enable logging and thus write the logging information to an output file. This should only be done when requested by Software AG support.

You configure logging using the [configuration tool](#).



Note: Some logging information is also written to the console, regardless of the settings in the configuration file. The console shows the information which is normally provided by the logging levels SEVERE, WARNING and INFO.

Name and Location of the Configuration File

The name of the configuration file is *natlogger.xml*, which is located in:

`<application-server-install-dir>server/default/deploy/naturalunicode.rar/log`

Invoking the Logging Configuration Page

The content of the configuration file *natlogger.xml* is managed using the **Logging Configuration** page of the [configuration tool](#).

➤ **To invoke the Logging Configuration page**

- 1 In the frame on the left, choose the **Logging Configuration** link.

The **Logging Configuration** page appears in the right frame. Example:

Logging Configuration

Specify the output log file characteristics.

- "/" : The local pathname separator
- "%t": The system temporary directory
- "%h": The value of the "user.home" system property
- "%g": The generation number to distinguish rotated logs
- "%u": A unique number to resolve conflicts
- "%%": Translates to a single percent sign "%"

File pattern name:

File type:

File size (in Kbytes; 0=unlimited):

Number of files:

File enabled: Yes No

Append mode: Yes No

Specify log levels for individual modules. The available settings are:

- SEVERE: Events that interfere with normal program execution
- WARNING: Warnings, including exceptions
- INFO: Messages related to server configuration or server status, excluding errors
- CONFIG: Messages related to server configuration
- FINE: Minimal verbosity
- FINER: Moderate verbosity
- FINEST: Maximum verbosity

Communication:

Resource adapter:

Session beans:

Message beans:

Configuration file:

Logging:

Utilities:

Natural Web I/O Interface pages:

- Specify the characteristics of the output file as described below in the section [Overview of Options for the Output File](#).
- Specify the log levels for individual modules by selecting the log level from the corresponding drop-down list box.

A brief description for each log level is provided on the **Logging Configuration** page.

- Choose the **Save Configuration** button to write the modifications to the configuration file.



Caution: When you do not choose the **Save Configuration** button but log out instead or leave the configuration tool by entering another URL, your modifications are not written to the configuration file.

Overview of Options for the Output File

The following options are provided for specifying the characteristics of the output file:

Option	Description
File pattern name	<p>The pattern for generating the output file name. Default: "%h/nwolog%g.log".</p> <p>The default value means that an output file with the name <i>nwolog<number>.log</i> will be created in the home directory of the user who has started the application server.</p> <p>For detailed information on how to specify the pattern, see the Java API documentation.</p>
File type	<p>The format of the output file. Select one of the following entries from the drop-down list box:</p> <ul style="list-style-type: none"> ■ Text format Output in simple text format (default). ■ XML format Output in XML format. <p>The corresponding formatter class is then used.</p>
File size	<p>The maximum number of bytes that is to be written to an output file. Zero (0) means that there is no limit. Default: "0".</p>
Number of files	<p>The number of output files to be used. This value must be at least "1". Default: "10".</p>
File enabled	<p>If set to Yes (default), the file handler is enabled. If set to No, the file handler is disabled.</p>
Append mode	<p>If set to Yes, the logging information is appended to the existing output file. If set to No (default), the logging information is written to a new output file.</p>

VII Operating and Monitoring the Natural Web I/O Interface

Server

This part covers the following topics:

[Operating the Natural Web I/O Interface Server](#)

[Monitor Client NATMOPI](#)

[HTML Monitor Client](#)

Notation *vrs* or *vr*

When used in this documentation, the notation *vrs* or *vr* represents the relevant product version (see also *Version* in the *Glossary*).

24

Operating the Natural Web I/O Interface Server

- Starting the Natural Web I/O Interface Server 152
- Terminating the Natural Web I/O Interface Server 153
- Monitoring the Natural Web I/O Interface Server 153
- Runtime Trace Facility 154
- Trace Filter 156

This chapter describes how to operate a Natural Web I/O Interface server. Unless otherwise noted, the information below applies to all operating systems.

Starting the Natural Web I/O Interface Server

The Web I/O Interface server can be started as a “started task”:

```
//NWOSRV  PROC
//KSPSRV  EXEC PGM=NATRNWO,REGION=4000K,TIME=1440,
// PARM=('POSIX(ON)/NWOSRV1')
//STEPLIB DD DISP=SHR,DSN=NWOvrs.LOAD
//        DD DISP=SHR,DSN=NATvrs.LOAD
//CMPRINT DD SYSOUT=X
//STGCONFIG DD DISP=SHR,DSN=NWOvrs.CONFIG(SRV1)
//STGTRACE DD SYSOUT=X
//STGSTDO  DD SYSOUT=X
//STGSTDE  DD SYSOUT=X
```

where *vrs* represents the relevant product version of NWO or Natural.



Note: PARM=('POSIX(ON)/NWOSRV1') - POSIX(ON) is required for a proper LE370 initialization, and NWOSRV1 is the name of the server for the communication with the monitor client.

The name of the started task must be defined under RACF and the z/OS UNIX System Services.



Note: If you qualify the Natural Web I/O Interface server data sets by *server-id*, the server ID is restricted to a maximum length of 6 characters.

Alternatively you can automatically start Natural Web I/O Interface servers during SMARTS initialization by using the SMARTS SYSPARM parameter STARTUPPGM. In the SMARTS SYSPARM file specify:

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

Example:

```
STARTUPPGM='NATRNWO NWOS1'
```

Terminating the Natural Web I/O Interface Server

The Natural Web I/O Interface server can be terminated from within the Monitor Client `NATMOPI`, see [Monitor Commands](#) below.

Monitoring the Natural Web I/O Interface Server

To enable the administrator to monitor the status of the Natural Web I/O Interface 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.

The following topics are covered below:

- [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*.

You can alternatively use the operator command `MODIFY` to execute the monitor commands described below in the section *Monitor Commands*. The output of the executed monitor command will be written to the system log.

Example:

```
F jobname,APPL=ping
```

sends the command `ping` to the Web I/O Interface server running under the job `jobname`.

Monitor Commands

The Natural Web I/O Interface server supports the following monitor commands:

Monitor Command	Action
ping	Verifies whether the server is active. The server responds and sends the string I'm still up
terminate	Terminates the server.
abort	Terminates the server immediately without releasing any resources.
set <i>configvariable value</i>	With the set command, you can modify server configuration settings. For example, to modify TRACE_LEVEL: set TRACE_LEVEL 31+30+15
list sessions	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 (<i>session-id</i>).
cancel session <i>session-id</i>	Cancels a specific Natural session within the Natural Web I/O Interface server. To obtain the session ID, use the monitor command <code>list sessions</code> . Canceling active batch server sessions in Natural requires authorized services provided by the Authorized Services Manager (ASM). If the ASM is not started, those sessions cannot be canceled.
cleanup	Cancel sessions that are inactive longer than specified in configuration parameter <code>SESSION_TIMEOUT</code> .
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.

The following topics are covered below:

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

- [Trace Level](#)

Trace Medium

The Natural Web I/O Interface server writes its runtime trace to the logical system file `YSOUT` of the `FSIO` 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 Web I/O Interface server 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 Web I/O Interface server configuration parameter `TRACE_LEVEL`. A value of zero means that the trace is switched off.

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 send/reply buffer.
Bit 26	Dump send/reply buffer short. Only the first 64 bytes are dumped.
Bit 25	Dump I/O buffer.
Bit 24	Dump I/O buffer short. Only the first 64 bytes are dumped.
Bit 23	Call back gateway event.
Bit 22-17	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 11-01	Free.
Bit 00	Reserved for trace-level extension.



Note: Using trace levels 12 and 13 is only possible with Natural Web I/O Interface Server Version 8.3.2.

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.

25 Monitor Client NATMOPI

■ Introduction	158
■ Command Interface Syntax	158
■ Command Options Available	158
■ Monitor Commands	159
■ Directory Commands	159
■ Command Examples	159

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 $\langle \rangle$ 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 Web I/O Interface 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 $\langle \rangle$ are user supplied values and words enclosed in `[]` are optional.

Directory Command	Action
<code>ls [<i><server-id></i>]</code>	List all servers from the server directory that apply to the specified server ID. The server list is in short form.
<code>ll [<i><server-id></i>]</code>	Same as <code>ls</code> , but the server list contains extended server information.
<code>rs [<i><server-id></i>]</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 [<i><server-id></i>]</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/OS (SMARTS/Com-plete), output in STDOUT:

- System operator:

```
/F complete-jobname,NATMOPI -sServerName -cPING
```

■ Com-plete online command:

```
NATMOPI -sServerName -cPING
```

Server in z/OS (started task or batch mode):

■ Execute NATMOPI in batch job:

```
NATMOPI,PARM=(' -sServerName -cPING')
```

Sample job:

```
//SAGMOPI JOB SAG,CLASS=K,MSGCLASS=X
//NATEX EXEC PGM=NATMOPI,REGION=3000K,
// PARM=(' -Sname -CPING')
//* PARM=(' -H')
//STEPLIB DD DISP=SHR,DSN=NATURAL.XXXvr.LE.LOAD
// DD DISP=SHR,DSN=CEE.SCEERUN
//SYSOUT DD SYSOUT=X
//SYSPRINT DD SYSOUT=X
//*
```

Where *XXX* is the Web I/O Interface server product code (NWO) and *vr* is the two-digit product version.

■ Execute NATMOPI in TSO (Command):

```
NATMOPI -sServerName -cPING
```

The NWO load library must be included in the steplib of TSO.

Further Command Examples:

natmopi -dls	List all servers registered in the directory in short format.
natmopi -dcl TST -ls TST	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.
natmopi -sSRV1 -cping -sSRV2 ↵ -sSRV3 -cterminate	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 <code>-s</code> option to the server. If no <code>-c</code> option follows the <code>-s</code> option, the first <code>-c</code> option from the command line will be used.
<code>natmopi -sSRV1 -cterminate -a</code>	Send command <code>terminate</code> to SRV1. If SRV1 is ambiguous in the server directory, send the command to all SRV1 servers without prompting for selection.

26 HTML Monitor Client

- Introduction 164
- Prerequisites for HTML Monitor Client 164
- Server List 164
- Server Monitor 166

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 commands 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 Web I/O Interface server address space. It is configured with the NWO server 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
NWO <input type="button" value="Select"/>	QAWO4841	197	2017/08/27 20:04:19	PORT_NUMBER = 4841 FRONTEND_OPTIONS = 0X01 FRONTEND_NAME = NATCSRFE TRACE_LEVEL = 30+31+15+13+12	Version:NAT8206 TMODEL=2 SORT=(EXT=OFF) DBGAT=(ACTIVE=OFF,TRACE=00000097) RCA=(NATATDBG) RCALIAS=(NATATDBG,NCIAD833) Connection = SOC:daef:4841 Security = No
NWO <input type="button" value="Select"/>	QAWO4842	198	2017/08/27 20:04:29	PORT_NUMBER = 4842 FRONTEND_OPTIONS = 0X01 FRONTEND_NAME = NATBAT82 TRACE_LEVEL = 31+30+15+12	Version:NAT8206 NUCNAME=QA82NRE TMODEL=2 IM=F SORT=(EXT=OFF) DBGAT= (ACTIVE=OFF,TRACE=00000097) ZIIP=OFF RCA=SAGICU RCA=ICSDT54X CFICU=(ON,DATFILE=ICSDT54X)RCA=(NATATDBG) RCALIAS=(NATATDBG,NATAD834) Connection = SOC:daef:4842 Security = No
NWO <input type="button" value="Select"/>	QAWO4843	199	2017/08/27 20:04:37	PORT_NUMBER = 4843 FRONTEND_OPTIONS = 0X01 FRONTEND_NAME = NATISRFE TRACE_LEVEL = 15+30	Version:NAT8206 TMODEL=2 SORT=(EXT=OFF) Connection = SOC:daef:4843 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

Monitor server QAWO4842 198

Ping

Terminate

Abort

ListSess

CancelSession

Configuration

Flush

Cleanup

Please press command key

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 QAWO4842 198

Ping

Terminate

Abort

ListSess

CancelSession

Configuration

Flush

Cleanup

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	QFTTEST	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.

Index

A

application
start with URL, 135

C

configuration tool, 111

D

differences
Natural Web I/O Interface, 13

L

logging, 145
logon page
Natural Web I/O Interface, 103

R

restrictions
Natural Web I/O Interface, 11

S

SSL, 141

T

trust files, 141

U

URL to start application, 135

W

Web I/O Interface (see set up client)
configuration tool, 111
differences, 13
logon page, 103
restrictions, 11
