Natural SQL Gateway Server

This section covers the following topics:

Natural SQL Gateway Server Concept

This section describes the concept and the structure of the server for the Natural SQL Gateway.

This server is necessary if the Natural SQL Gateway runs within a TP environment. For additional information, see *Product Structure* in the section *Introduction to Natural SQL Gateway*.

A Natural SQL Gateway server is a multi-user, multi-tasking application. The server is responsible for maintaining the persistent connection to the JDBC server for each client, because a client running in a TP environment cannot cope with persistent JDBC connections. The client opens a so called SQL session at the Natural SQL Gateway server. This is done implicitly with the SQL `CONNECT` statement. This session represents the client from the JDBC server point of view and keeps the persistent connection. The client is loosely coupled to this session just by maintaining a session identifier. The session remains until the client disconnects with the SQL `DISCONNECT` statement.

The Natural SQL Gateway server can host SQL sessions for multiple users and execute their requests concurrently.

To enable the administrator to monitor the status of the Natural SQL Gateway server, a monitor task is provided which is initialized automatically at server startup. Using the monitor commands, the administrator is able to control the server activities, cancel particular user sessions, terminate the entire server, etc. For further information, see *Monitoring the Natural SQL Gateway Server* in the section *Operating the SQL Gateway Server*.

Installing the Natural SQL Gateway Server under z/OS

This document describes how to install a server for the Natural SQL Gateway (product code NSB) under the operating system z/OS.

The installation of the Natural SQL Gateway server is performed by installation jobs. The sample jobs are contained in the dataset `NSB`*`vrs`*`.JOBS` and are prefixed with `NSB`, or generated by System Maintenance Aid (SMA).

The following topics are covered:

- Prerequisites
- Content of the NSB Server Distribution Tape
- Installation Procedure

Prerequisites

For details, refer to *Prerequisites* in the section *Installing Natural SQL Gateway*.

Content of the NSB Server Distribution Tape

The installation tape contains the datasets listed in the table below. The sequence of the datasets and the number of library blocks needed are shown in the *Report of Tape Creation* which accompanies the installation tape.

Dataset Name	**Contents**
`NSB`*`vrs`*`.OBJS`	Contains the object modules of the server.
`NSB`*`vrs`*`.JOBS`	Example installation jobs.

The notation *vrs* in dataset names represents the version, release and system maintenance level of the product.

Installation Procedure

Step 1: Allocate the Natural SQL Gateway server LOAD library

(Job I008, Step 9510)

Step 2: Create a Natural SQL Gateway server configuration file and sample Clist

(Job I009 / Step 9510, 9520, 9530)

Step 9510 creates the `NSBCONFG` sample member for the batch server.

Step 9520 creates a Clist sample member to ping and terminate a Natural SQL Gateway server.

Step 9530 creates a sample member with a batch job to ping and terminate a Natural SQL Gateway server.

The following parameters of the configuration file have to be defined. See *Configuring the Natural SQL Gateway Server*. For the other parameters, the default values may be used:

`FRONTEND_NAME`	Specify the name of the Natural SQL Gateway 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 NSB load library

(Job I054, Step 9510)

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

See sample job `NSBI054` on dataset `NSB`*`vrs`*`.JOBS`.

Step 4: Create server startup JCL

(Job I200, Step 9515)

Described in the section *Configuring the Natural SQL Gateway Server*. See sample member `NSBSTART` on dataset `NSB`*`vrs`*`.JOBS`.

Step 9515 creates a startup procedure for the batch server.

Sample:

```
//         PROC SRV=SAGNSB
//NSB      EXEC PGM=NATRNSV,
// REGION=4000K,TIME=1440,PARM='POSIX(ON),TRAP(ON,NOSPIE)/&SRV'
//STEPLIB  DD   DISP=SHR,DSN=NSBvrs.LOAD
//         DD   DISP=SHR,DSN=SMA.LOAD
//SYSUDUMP DD   SYSOUT=X
//CEEDUMP  DD   SYSOUT=X
//CMPRINT  DD   SYSOUT=X
//STGCONFG DD   DISP=SHR,
//              DSN=NSB.CONFIG(&SRV)
//STGTRACE DD   SYSOUT=X
//STGSTDO  DD   SYSOUT=X
//STGSTDE  DD   SYSOUT=X
//SYSOUT   DD   SYSOUT=X
```

Note:
The Natural SQL Gateway 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.

Configuring the Natural SQL Gateway Server

This document describes how to configure a Natural SQL Gateway server.

The following topics are covered:

- Configuration Requirements
- Natural SQL Gateway Server Configuration File
- Natural SQL Gateway Server Configuration Parameters
- Natural SQL Gateway Server Configuration File Example

- Natural SQL Gateway Server Datasets

Configuration Requirements

A Natural SQL Gateway server requires the following z/OS language environment parameter configuration:

Parameter	Definition
`POSIX(ON)`	Enables a Natural SQL Gateway server to access the POSIX functionality of z/OS. If you start a Natural SQL Gateway server server with `POSIX(OFF)`, it terminates immediately with a user abend U4093 and the system message EDC5167. IBM supplies the default value `OFF`.
`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 value `TRACE`.
`ENVAR(TZ=...)`	The `ENVAR` option enables you to set UNIX environment variables. The only environment variable applicable for the Natural SQL Gateway server is `TZ` (time zone). This variable allows you to adjust the timestamp within the Natural SQL Gateway server’s trace file to your local time. Example: `ENVAR(TZ=CET-1DST) CET` - 1 hour daylight saving time

To set the z/OS language environment parameters, you have the following options:

- Use the `PARM` parameter specified in the `EXEC` card of the Natural SQL Gateway 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 SQL Gateway server load module.

- As of z/OS Version 1.8, you can define the DD card for `CEEOPTS` to specify your LE options in a dataset.

Natural SQL Gateway Server Configuration File

A configuration file is allocated to the name `<`*`serverid`*`>C` (for example, `NSBS1C`) or `STGCONFG` alternatively.

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 *Natural SQL Gateway Server Configuration File Example* shown below.

Natural SQL Gateway Server Configuration Parameters

The following Natural SQL Gateway server configuration parameters are available:

- FRONTEND_NAME
- HANDLE_ABEND
- HOST_NAME
- HTPMON_ADMIN_PSW
- HTPMON_PORT
- PORT_NUMBER
- TRACE_FILTER
- TRACE_LEVEL

FRONTEND_NAME

This configuration parameter specifies the name of the CXX server front-end to be used to communicate with the JDBC server. The front-end resides on the CXX load library.

Value	Explanation
frontend-name	Name of the CXX front-end to be used. Maximum length: 8 characters. The default value is `CXXNSERV`.

Example:

```
FRONTEND_NAME=CXXNSERV
```

HANDLE_ABEND

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
```

or

```
HANDLE_ABEND=NO
```

HOST_NAME

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

Value	Explanation
host-name	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 (for example, Terminate Server) performed by the HTML Monitor Client.

Value	Explanation
character-string	The password (any character string) 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 Natural SQL Gateway 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	The password to be entered at the HTML Monitor Client for some monitor activities. No default value is provided.

Example:

```
HTPMON_PORT=3141
```

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
```

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=(XYZ P*)"
```

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

See *Trace Filter* in the section *Operating the Natural Gateway Server*.

TRACE_LEVEL

Value	Explanation
`trace-level`	See *Trace Level* in the section *Operating the Natural Gateway Server*.
`0`	This is the default value.

Example:

```
TRACE_LEVEL=0x00000011
```

or alternatively

```
TRACE_LEVEL=31+27
```

The setting in the example switches on the TSW bits 31 and 27; see *Trace Level* in the section *Operating the Natural Gateway Server*.

Natural SQL Gateway Server Configuration File Example

For z/OS:

```
# This is a comment
FRONTEND_NAME=CXXNSERV       # and another comment
PORT_NUMBER=4811
TRACE_LEVEL=31+27
```

Natural SQL Gateway Server Datasets

The Natural SQL Gateway server requires the following datasets:

Dataset Name	Purpose
STGCONFG	Defines the server configuration file.
STGTRACE	The server trace output.
STGSTDO	The stdo dataset.
STGSTDE	The stde error output.

Alternatively, you can qualify each dataset name by the server ID.

Dataset Name	Purpose
NSBS1C	Defines the server configuration file for the server NSBS1.
NSBS1T	The server trace output for the server NSBS1.
NSBS1O	The stdo dataset for the server NSBS1.
NSBS1E	The stde error output for the server NSBS1.

Operating the Natural SQL Gateway Server

The following topics are covered below:

- Starting the Natural SQL Gateway Server
- Monitoring the Natural SQL Gateway Server
- Runtime Trace Facility

Starting the Natural SQL Gateway Server

Under z/OS:

The Natural SQL Gateway server can be started as a "started task":

```
//NSBSRV  PROC
//SRV      EXEC PGM=NATRNSV,REGION=4000K,TIME=1440,
// PARM=('POSIX(ON)/NSBSRV1')
//STEPLIB  DD DISP=SHR,DSN=NSBvrs.LOAD
//CMPRINT  DD SYSOUT=X
//STGCONFG DD DISP=SHR,DSN=NSBvrs.CONFIG(SRV1)
//STGTRACE DD SYSOUT=X
//STGSTDO  DD SYSOUT=X
//STGSTDE  DD SYSOUT=X
```

- where NSB is the product code and *vrs* is the version, release, system maintenance level number of the Natural SQL Gateway server.

Note:
`PARM=('POSIX(ON)/NSBSRV1') - POSIX(ON)` is required for a proper LE370 initialization, and `NSBSRV1` 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.

Monitoring the Natural SQL Gateway Server

To enable the administrator to monitor the status of the Natural SQL Gateway server, a monitor task is provided which is initialized automatically at server startup. Using the monitor commands described below, the administrator is able to perform functions such as 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

- Use the monitor client `NATMOPI`.

  See *Monitor Client NATMOPI*.

  Or:
  Use the HTML Monitor Client that supports a standard web browser.

  See *HTML Monitor Client*.

  Or:
  Under z/OS, 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 Natural SQL Gateway server running under the job *`jobname`*.

Monitor Commands

The Natural SQL Gateway server supports the following monitor commands:

Command Name	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` *`configvariable value`*	With the set command, you can modify server configuration settings. For example, to modify `TRACE_LEVEL`: `set TRACE_LEVEL 0x00000012`
`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 (*`session-id`*).
`cancel session` *`session-id`*	Cancels a specific Natural session within the Natural SQL Gateway server. To obtain the session ID, use the monitor command `list sessions`.
`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 Filter

Trace Medium

Under z/OS, the Natural SQL Gateway server writes its runtime trace to the logical system file `STGTRACE`.

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 Natural SQL Gateway server configuration parameter `TRACE_FILTER`.

Every 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 Natural SQL Gateway server configuration parameter `TRACE_LEVEL`. A value of zero (0) 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:

Trace Bit	Trace Information
31	Trace main events (server initialization/termination, client request/result).
30	Detailed functions (session allocation, rollin/rollout calls, detailed request processing).
29	Dump internal storage areas.
28	Session directory access.
27	Dump send/reply buffer.
26	Dump send/reply buffer short. Only the first 64 bytes are dumped.
25 - 16	Free.
15	Trace error situations only.
14	Apply trace filter definitions.
13 - 08	Free.
07 - 01	Free.
00	Reserved for trace-level extension.

Trace Filter

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

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

The filter keyword is:

`Client`	Filters the trace output by specific clients.

The following rules apply:

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

Example:

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

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

Monitor Client NATMOPI

This section covers the following topics:

- Introduction
- Command Interface Syntax
- Command Options Available
- Monitor Commands
- Directory Commands
- Command Examples

Introduction

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

Command Interface Syntax

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

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

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

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

The command options available are listed below.

Command Options Available

Words enclosed in <> are user supplied values.

Command Option	Action
`-s` *`<server-id>`*	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.
`-c` *`<monitor command>`*	Specify a monitor command to be sent to the server ID defined with the `-s` option
`-d` *`<directory command>`*	Specify a directory command to be executed.
`-a`	Suppress prompting for ambiguous server ID. Process all servers which apply to the specified server ID.
`-h`	Print `NATMOPI` help.

Monitor Commands

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

For further commands, refer to *Operating the Natural SQL Gateway Server* where the corresponding server commands are described.

Directory Commands

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

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

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

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

Command Examples

Example: Ping a Server in Different Environments

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 Natural SQL Gateway product code (NSB) and *vr* is the two-digit version number.

- Execute `NATMOPI` in TSO (Command):

  ```
  NATMOPI -sServerName -cPING
  ```

  The NSB 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 -cterminat`	Send command `ping` to `SRV1`. Send command `terminate` to `SRV2` and `SRV3`.
`natmopi -cterminate -sSRV1 -cping -sSRV2 -sSRV`	Is equivalent to the previous example. That is, `NATMOPI` sends the command following the `-s` option to the server. If no `-c` option follows the `-s` option, the first `-c` option from the command line will be used.
`natmopi -sSRV1 -cterminate -a`	Send command `terminate` to `SRV1`. If `SRV1` is ambiguous in the server directory, send the command to all `SRV1` servers without prompting for selection.

HTML Monitor Client

This section covers the following topics:

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

Introduction

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

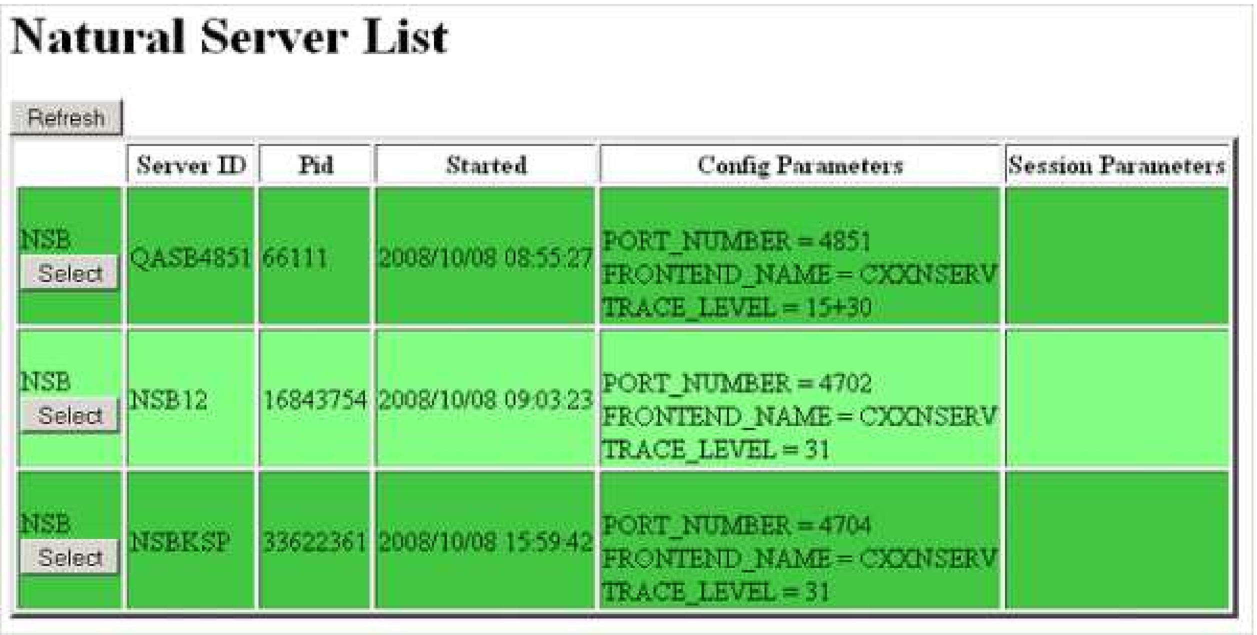
Prerequisites for HTML Monitor Client

To run the HTML Monitor Client, any server must host an HTTP Monitor Server. The HTTP Monitor Server is a subtask that can run in any Natural SQL Gateway server address space and is configured with the 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 SQL Gateway server hosting the monitor is running. And *`port`* is the port number the administrator has assigned as the monitor port in the configuration file.

Example:



Natural Server List

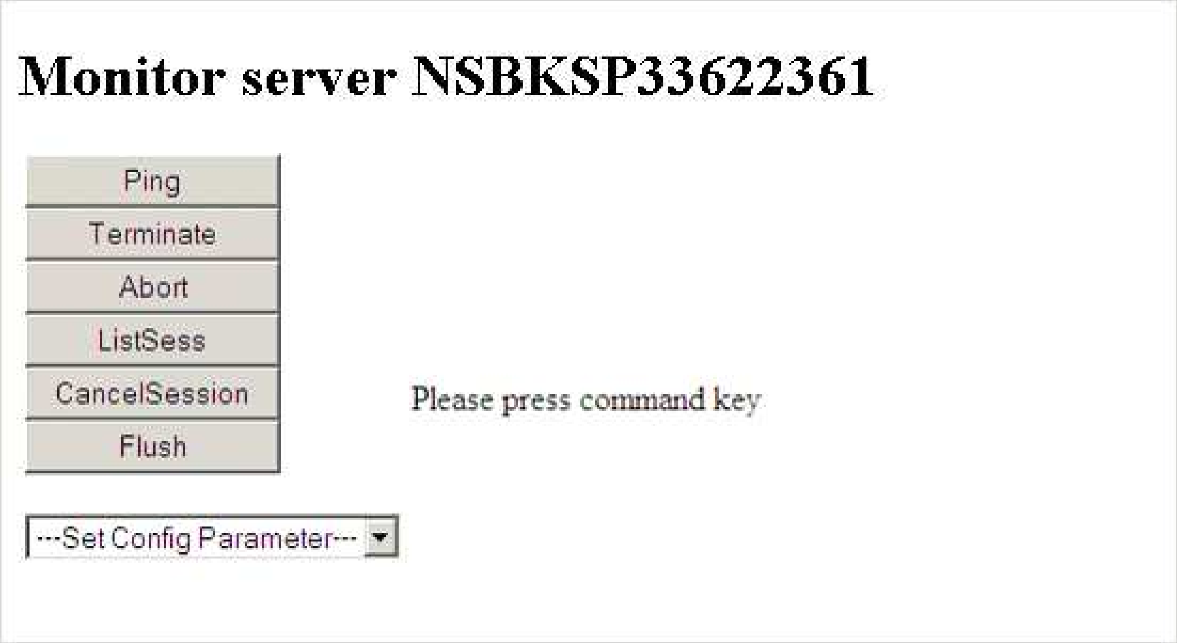
	Server ID	Pid	Started	Config Parameters	Session Parameters
NSB Select	QASB4851	66111	2008/10/08 08:55:27	PORT_NUMBER = 4851 FRONTEND_NAME = CXXNSERV TRACE_LEVEL = 15+30	
NSB Select	NSB12	16843754	2008/10/08 09:03:23	PORT_NUMBER = 4702 FRONTEND_NAME = CXXNSERV TRACE_LEVEL = 31	
NSB Select	NSBKSP	33622361	2008/10/08 15:59:42	PORT_NUMBER = 4704 FRONTEND_NAME = CXXNSERV TRACE_LEVEL = 31	

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

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

Server Monitor

Example:



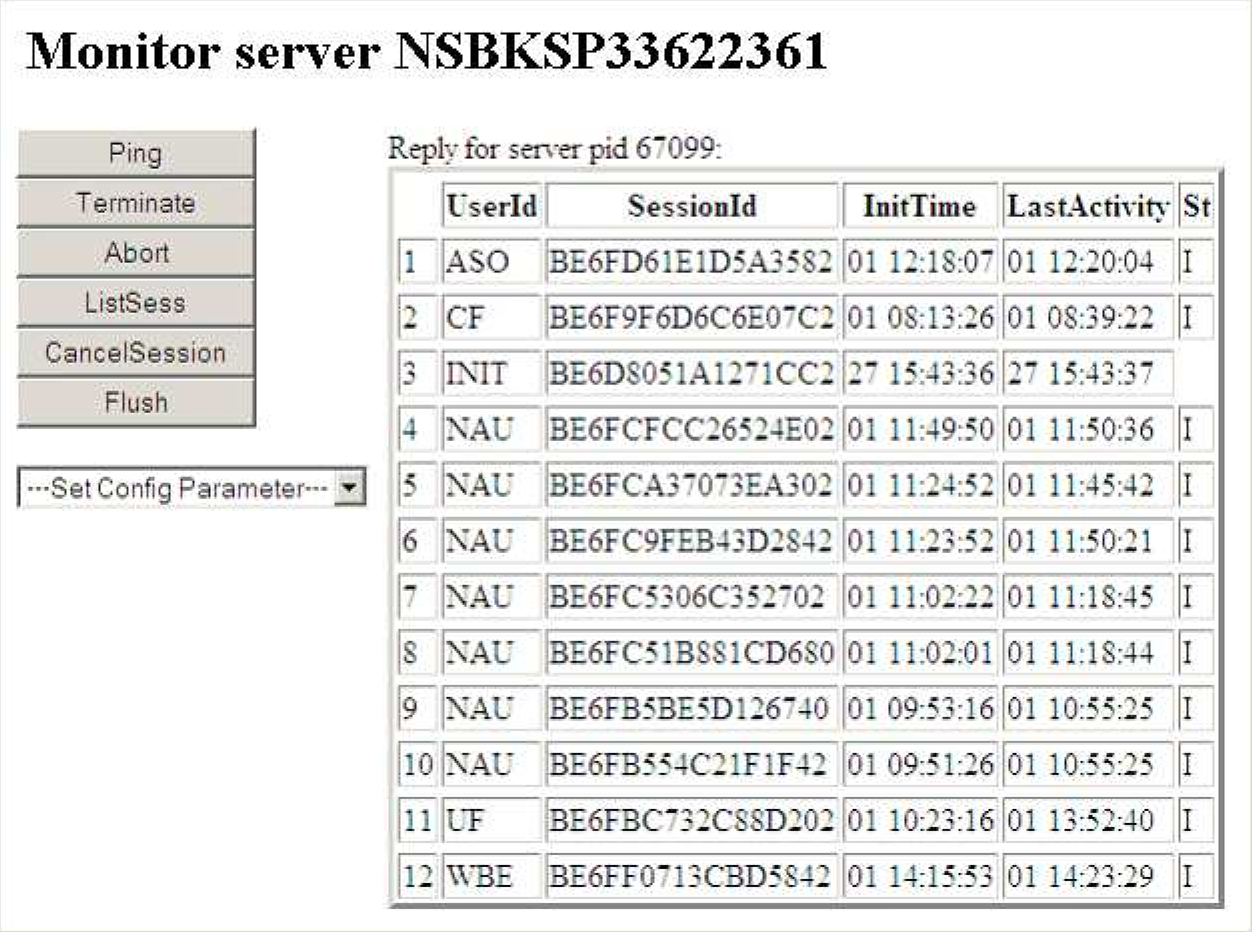
Monitor server NSBKSP33622361

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 NSBKSP33622361

Reply for server pid 67099:

	UserId	SessionId	InitTime	LastActivity	St
1	ASO	BE6FD61E1D5A3582	01 12:18:07	01 12:20:04	I
2	CF	BE6F9F6D6C6E07C2	01 08:13:26	01 08:39:22	I
3	INIT	BE6D8051A1271CC2	27 15:43:36	27 15:43:37	
4	NAU	BE6FCFCC26524E02	01 11:49:50	01 11:50:36	I
5	NAU	BE6FCA37073EA302	01 11:24:52	01 11:45:42	I
6	NAU	BE6FC9FEB43D2842	01 11:23:52	01 11:50:21	I
7	NAU	BE6FC5306C352702	01 11:02:22	01 11:18:45	I
8	NAU	BE6FC51B881CD680	01 11:02:01	01 11:18:44	I
9	NAU	BE6FB5BE5D126740	01 09:53:16	01 10:55:25	I
10	NAU	BE6FB554C21F1F42	01 09:51:26	01 10:55:25	I
11	UF	BE6FBC732C88D202	01 10:23:16	01 13:52:40	I
12	WBE	BE6FF0713CBD5842	01 14:15:53	01 14:23:29	I

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