

Natural Roll Server Operation

This document covers the following topics:

- Roll Server System Requirements
- Formatting the Roll File
- Starting the Roll Server
- Roll Server Messages, Condition Codes and Abend Codes
- Return Codes and Reason Codes of the Roll Server Request
- Operating the Roll Server
- Roll Server Performance Tuning
- Roll Server User Exits

See also *Natural Roll Server Functionality*.

Roll Server System Requirements

This section describes the Roll Server system requirements.

- APF Authorization
- System Linkage Index
- Virtual Storage
- CF Structure
- XCF Signalling Paths

APF Authorization

Link the module `NATRSM vr` (vr =version, release number) to an Authorized Program Facility (APF) library, specifying `IEWL` parameter `AC(1)`. Refer to *Installation Procedure for Natural under z/OS*.

System Linkage Index

As the Roll Server reserves one system linkage index (System LX), check whether there is a high enough value of `NSYSLX` in member `IEASYSxx` of library `SYS1.PARMLIB`.

When the Roll Server terminates, its address space ID is no longer available because a System LX has been used. It becomes available again with the next IPL.

To avoid this, deactivate the Roll Server with the DEAL operator command and restart it afterwards.

Once a System LX has been reserved, it is reused with every restart of the Roll Server until the next IPL.

Virtual Storage

Storage	Size
ECSA	84 bytes
Private program storage	30 KB above
Fixed subpool storage (incl. ELSQA):	10 KB below, 50 KB above
LRB directory	32+(64*number of LRB slots)
100 slots per roll file	4 KB above
Every additional roll file	30 KB above
Working storage	depending on load, about 1 MB above

CF Structure

The space required is calculated using the following formula:

$$24 \text{ KB} + (\text{RFN} + 1) * 1 \text{ KB} + (\text{RFS} + 8) * 160 \text{ bytes}$$

where RFN denotes the number of roll files and RFS denotes the total number of roll-file slots in all roll files.

Example:

- There are five roll files with 1000 slots each.

$$24 \text{ KB} + 6 \text{ KB} + 5008 * 160 \text{ bytes} = 24 \text{ KB} + 6 \text{ KB} + 783 \text{ KB} = 813 \text{ KB}$$

- The CF structure should thus be defined with 820 KB:

```
STRUCTURE NAME(NATROLLS) SIZE(820) PREFLIST(CF1)
```

XCF Signalling Paths

In a z/OS Parallel Sysplex environment, the Roll Servers communicate via the XCF Signalling Services. As the default XCF group name, the leftmost eight bytes of the CF structure name are used.

If you want to specify your own XCF groupname, use the NATRSU24 user exit. For more information on this user exit, see *NATRSU24 User Exit*.

Formatting the Roll File

To format the roll file, proceed as follows:

1. Allocate it as a physical, sequential dataset with a fixed-record format.
2. Format it using module NATRSRFI.

During formatting, the roll file is converted to BDAM format with a device-dependent block size.

Note:

If you plan to use an existing roll file of a previous version, it is sufficient to execute the NATRSRFI RESET function.

To format, enter the following parameter string under the DD name RFIPARMS, or as PARM on the JCL EXEC statement:

```
function,dd-name,slot-size,number-of-slots
```

All parameters are positional; they are explained in the table below:

Parameter	Description	
<i>function</i>	FORMAT	Format the roll file.
	RESET	All roll file slots are reset (marked as free). You can only use this parameter value if the roll file has already been formatted. The only other parameter allowed is <i>dd-name</i> .
	LIST	Print a list of session-IDs contained in the roll file and their last activity. The only other parameter allowed is <i>dd-name</i> .
<i>dd-name</i>	The name of the DD statement under which the roll file has been specified.	
<i>slot-size</i>	The size of a roll file slot in bytes. This size is rounded to the next higher multiple of the block size used. It is recommended to initially use a slot size equal to the size of the Natural thread. Then look at the Roll Server statistics. They also show the largest occurrence of a thread size. Use this value to reduce the slot size, if necessary.	
<i>number-of-slots</i>	The number of roll file slots to be allocated. This number is the maximum number of concurrently active users. This parameter is optional. If omitted, the entire roll file, as allocated, will be formatted.	

To calculate the required disk space in cylinders for a roll file (SPACE parameter of the DD statement), use the following formula:

$$\text{number-of-cylinders} = \text{ceiling} (\text{number-of-slots} * \text{slot-size} / 30 * \text{block-size})$$

or in tracks

number-of-tracks = ceiling (number-of-slots * slot-size / 2*block-size)

The block size used is:

23476 for 3380 DASD

27998 for 3390 DASD

22928 for 9345 DASD

In addition, space is needed for the roll file directory header (40 bytes) and one directory entry for each roll file slot (24 bytes). Thus, one additional block is needed for roughly 976 slots on 3380, 1164 slots on 3390, or 953 slots on 9345 DASD.

NATRSRFI Output

If a DD statement with ddname RFIPRINT is specified, NATRSRFI directs its output to this dataset. When RFIPRINT is omitted, output is written to JESMSG LG using the WTO macro (ROU TDCE=11). Note that RFIPRINT must be specified for the LIST function.

NATRSRFI Conditon and Abend Codes:

The following condition codes are used:

0	Normal completion.
4	Number of slots formatted is less than requested.
20	Parameter error.

The following user abend codes are used:

Abend Code	Cause
U0100	Open for RFIPARMS or RFIPRINT failed.
U0101	Open for roll file failed.

Example 1:

```
//FBRUNRFI JOB (FB,218),FB,CLASS=K,MSGCLASS=X,NOTIFY=FB
//FORMAT EXEC PGM=NATRSRFI
//STEPLIB DD DISP=SHR,DSN=NATURAL.NATvr.LOAD
//RF1 DD DISP=SHR,DSN=FB.SYSF.ROLLF1
//RF2 DD DISP=SHR,DSN=FB.SYSF.ROLLF2
//RFIPARMS DD *
FORMAT,RF1,200000,1000
FORMAT,RF2,200000
```

where *vr*s = version, release, system maintenance level.

Excerpt from resulting JESMSG LG:

```

+FBRUNRFI: FORMAT,RF1,200000,1000
+FBRUNRFI: RF1: FB.SYSF.ROLLF1
+FBRUNRFI:      Creation date: 2001/06/13 Volume: ADA002(3390)
IEC031I D37-04,IFG0554P,FBRUNRFI,FORMAT,RF1,305B,ADA002,FB.SYSF.ROLLF1
+FBRUNRFI: Not enough space for 1000 slots.
+FBRUNRFI:      60 Blocks written. Block size is 27998.
+FBRUNRFI:      1 Directory block.
+FBRUNRFI:      8 Blocks per slot. Slot size is 223984.
+FBRUNRFI:      7 Slots initialized. Roll file version vrs.
+FBRUNRFI:      3 Blocks unused.
+FBRUNRFI: FORMAT,RF2,200000
+FBRUNRFI: RF2: FB.SYSF.ROLLF2
+FBRUNRFI:      Creation date: 2001/06/08 Volume: USRF08(3380)
IEC031I D37-04,IFG0554P,FBRUNRFI,FORMAT,RF2,020F,USRF08,FB.SYSF.ROLLF2
+FBRUNRFI:      60 Blocks written. Block size is 23476.
+FBRUNRFI:      1 Directory block.
+FBRUNRFI:      9 Blocks per slot. Slot size is 211284.
+FBRUNRFI:      6 Slots initialized. Roll file version vrs.
+FBRUNRFI:      5 Blocks unused.

```

Example 2:

```

//FBRUNRFI JOB  (FB,218),FB,CLASS=K,MSGCLASS=X,NOTIFY=FB
//FORMAT EXEC PGM=NATRSRFI,PARM='FORMAT,RF1,200000'
//STEPLIB DD  DISP=SHR,DSN=NATURAL.NATvr.LOAD
//RF1 DD  DISP=SHR,DSN=FB.SYSF.ROLLF1
//RFIPRINT DD  SYSOUT=X

```

Resulting RFIPRINT:

```

Natural Roll Server - Roll File Utility Version
vrs
FORMAT,RF1,200000
RF1: FB.SYSF.ROLLF1
Creation date: YYYY/MM/DD Volume: ADA002(3390)
60 Blocks written. Block size is 27998.
1 Directory block.
8 Blocks per slot. Slot size is 223984.
7 Slots initialized. Roll file version vrs.
3 Blocks unused.

```

Notes Concerning the Formatting or Resetting of Roll Files

- You can format or reset several roll files at once by specifying several parameter lines in RFIPARMS.
- You cannot format or reset a roll file while the roll server is active.
- When the roll file is formatted in a z/OS Parallel Sysplex environment, the roll server Coupling Facility structure must also be cleared using the SETXCF operator command, for example:

```
SETXCF FORCE,STR,STRNAME=NATROLL1
```

Starting the Roll Server

You start the Roll Server either as a batch job or as a started task by executing module NATRSMvr. The roll file(s) must be defined as DD statements with *ddname* ROLLF1 to ROLLF5.

On the JCL EXEC statement, specify as PARM the following parameters:

subsystem-id, number-of-roll-files, number-of-LRB-slots, LRB-slot-size, CF-structure-name, low-water-mark, high-water-mark, non-activity-time, timeout-check-time, message-case

All parameters are positional and must be separated by a comma. They are explained in the table below:

Parameter	Possible Values	Default	Comment
<i>subsystem-id</i>	4-byte non-blank string	NATv	The specified value must match the value of the Natural profile parameter SUBSID (<i>v</i> = version number). Note: With Natural under CICS, refer to the ROLLSRV parameter in the NCMDIR macro for setting the appropriate subsystem ID.
<i>number-of-roll-files</i>	0 - 5	1	In a z/OS non-Parallel Sysplex system, the Roll Server can operate without a roll file, using only the in-storage Local Roll Buffer.
<i>number-of-LRB-slots</i>	1 - 32767	none	The number of LRB slots multiplied by the slot size must not exceed 2 GB. The same number of LRB slots is assigned for each LRB, i.e. for each roll file used. The total number of LRB slots is calculated by the formula: <i>number-of-roll-files * number-of-LRB-slots</i>
<i>LRB-slot-size</i>	any numeric value	roll file slot size	Value in number of bytes. This parameter must be specified if no roll file is used. If roll files are used, this parameter is ignored and the roll file slot size is used instead.
<i>CF-structure-name</i>	any valid structure name	none	If you specify less than 16 characters, blanks are appended. Only specify this parameter if you use the Coupling Facility (with z/OS Parallel Sysplex).
<i>low-water-mark</i>	1 - 9	7	Specifies the low water mark in steps of ten percent of the number of LRB slots. This parameter is ignored in a z/OS Parallel Sysplex environment.

Parameter	Possible Values	Default	Comment
<i>high-water-mark</i>	1 - 10	8	Analogous to low-water-mark parameter. Value "10" means that the staging task will never be activated. It is only recommended to specify "10" if the LRB is large enough to serve all simultaneously active Natural sessions. This parameter is ignored in a z/OS Parallel Sysplex environment.
<i>non-activity-time</i>	1 - 999999	none	Number of hours a session can be inactive before it is deleted from the roll file. If this time is exceeded, the session is deleted during the next scheduled timeout check. If this parameter is omitted, no timeout check will be executed. This parameter can be changed using operator command TIMEOUT, see below.
<i>timeout-check-time</i>	0000 - 2359	none	The time of day that the timeout check is to be run. Sessions will be deleted if they have been inactive longer than the non-activity time specified by the preceding parameter. If this parameter is omitted, no timeout check will be scheduled. This parameter can be changed using operator command TIMEOUT, see below.
<i>message-case</i>	UCTRAN or blank	blank	Specify UCTRAN if the Roll Server is to issue all its messages in upper case.

Note:

The Local Roll Buffer resides in a Memory Object "above the bar". Use the MEMLIMIT parameter on the EXEC statement to ensure enough memory can be allocated "above the bar".

Examples for Starting the Roll Server as a Batch Job

```
// EXEC PGM=NATRSMvr,PARM='NAvr,,1000'  
//ROLLF1 DD DSN=SYSF.ROLLFILE
```

The subsystem ID is *NAvr*, one roll file is used (default), and the Local Roll Buffer has 1000 slots. The slot size used is identical with the roll file's slot size. The low water mark is 70% (default), the high water mark is 80% (default).

```
// EXEC PGM=NATRSMvr, PARM=' ,5,1000,150000,NATROLL1', MEMLIMIT=800M
//ROLLF1 DD DSN=DASD1.ROLLFILE
//ROLLF2 DD DSN=DASD2.ROLLFILE
//ROLLF3 DD DSN=DASD3.ROLLFILE
//ROLLF4 DD DSN=DASD4.ROLLFILE
//ROLLF5 DD DSN=DASD5.ROLLFILE
```

The subsystem ID is NATv (default), five roll files are used, and each of the five Local Roll Buffers has 1000 slots. The LRB slot size is 150000 bytes. The roll file directory resides in the Coupling Facility structure NATROLL1. Low and high water marks are ignored, because every thread is written to the roll file (see *Natural Roll Server Functionality*). Since this job is intended for z/OS, the MEMLIMIT option specifies 800 Megabytes for the Local Roll Buffers.

Note:

The Roll Server will not start in the following cases:

- Another Roll Server is running with the same *subsystem-id*.
- Another Roll Server is accessing a roll file specified in its JCL
- A roll file has been reformatted without resetting the CF structure, using the SETXCF FORCE command.

Roll Server Messages, Condition Codes and Abend Codes

The Roll Server writes informational and error messages to JESMSG LG using the WTO macro (ROUTCDE=11). The messages are preceded by a message identifier and the Roll Server's job name, for example:

```
RSM0019 FBRSMvrs: Roll Server Version vrs is active
```

The messages are explained in the section *Roll Server Messages* in the *Messages and Codes* documentation.

Condition Codes of the Roll Server Started Task

The following condition codes are used:

0	Normal completion
12	Wrong parameter input
16	Runtime error
20	Abend has occurred
>100	Initialization error

User Abend Codes

When an unexpected return code is issued by an XCF or XES Service Call, an abend with a dump is forced. Register 14 of the abend register contains the reason code. To find a description of the reason, refer to *Programming: Sysplex Services Reference* (IBM documentation). If the error was not environment-specific, send the dump to Software AG support.

The following user abend codes are used:

Abend Code	Cause
U0200	IXLCONN failed
U0201	IXLFORCE failed
U0202	IXLLIST failed
U0203	IXLDISC failed
U0204	IXCLEAVE failed
U0301	IXLLIST failed
U0302	IXCMGO failed
U0401	IXLLIST failed
U0501	IXLLIST failed

Return Codes and Reason Codes of the Roll Server Request

These are codes that Natural may receive from the Roll Server's PC services routines. They are reported by the respective teleprocessing interfaces (Natural CICS or Natural IMS interface). For a list of these codes, refer to the *Return Codes and Reason Codes of the Roll Server Request* in the *Messages and Codes* documentation.

Operating the Roll Server

The following commands can be passed to the Roll Server via the MODIFY operator command:

Command	Description
DEAL	<p>The Roll Server is stopped, but the address space is not terminated. The roll file directory and all modified LRB slots are written to the roll file. In a de-allocated status, the Roll Server can be restarted with new parameters and the old address space ID. The roll files can be reformatted in de-allocated status. If you do that, however, currently active Natural sessions are no longer restartable.</p> <p>Statistics are written to JESMSG LG using the WTO macro (ROUTCDE=11). Statistics include information about roll-out and roll-in activity, as well as roll file I/O.</p>
DIAGNOSE	<p>Debugging function, only to be used at Software AG's advice.</p> <p>This command does not have any function. Its intended future use is in connection with special Zaps to aid in diagnosing specific customer problems, as the need arises.</p>
SNAP	<p>Debugging function. The Roll Server's address space is dumped to SYSUDUMP.</p>

Command	Description	
START , <i>parmstring</i>	Reactivates the Roll Server with the specified parameters. You can only use this command in deactivated status.	
STATS	Write Roll Server statistics to JESMSG LG using the WTO macro (ROUTCDE=11). Statistics include information about roll-out and roll-in activity, as well as roll file I/O.	
TERM	Stops the Roll Server. The roll file directory and all modified LRB slots are written to the roll file and the address space is terminated. The address space ID is no longer available until the next IPL. Statistics are written to JESMSG LG using the WTO macro (ROUTCDE=11). Statistics include information about roll-out and roll-in activity, as well as roll file I/O.	
TIMEOUT	NAT <i>nnn</i>	Specifies or replaces the non-activity time parameter.
	TOC <i>hhmm</i>	Specifies or replaces the time of day of the timeout check.
	OFF	Disables timeout checking.
	ON	Reinstates timeout checking.
	NOW	Starts an immediate timeout check. Normal timeout check scheduling (if specified) remains in effect.
	? (or no specification)	Displays current timeout settings. The question mark (?) is optional and can be omitted.
TRSTART	Debugging function, only to be used at Software AG's advice. Activates the Trace Task. If the General Trace Facility (GTF) is started and enabled for user records of Type 200, trace records are written to the GTF.	
TRSTOP	Deactivates the Trace Task.	

Roll Server Performance Tuning

As a general rule for Roll Server performance tuning, give the Roll Server a higher dispatching priority than the address spaces where Natural runs.

To find out where the weaknesses in performance are, analyze the system performance using the *Natural Subsystems and Roll Server Information* function of the SYSTP utility.

When looking at Roll-Server Statistics, keep an eye especially on the following values:

- The number of direct writes.

"Direct write" means that the Natural thread that was received was written to the roll file directly.

There are two possible reasons:

1. No LRB slot available. Increase the LRB.
 2. The compressed thread was larger than a single LRB slot. Increase the LRB slot size.
- The number of direct reads.

"Direct read" means that the requested thread was no longer in the LRB and had to be read directly from the roll file.

If the ratio of direct reads to the total number of reads is very high in a single z/OS system, the LRB is too small (increase it).

If the ratio of direct reads to the total number of reads is very high in a z/OS Parallel Sysplex environment, this may also mean that there are many inter-system activities, which in turn means that a Natural session changes z/OS images quite frequently during its lifetime.

- The number of staging waits (in a single z/OS environment).

A "staging wait" is a situation where a write request had to wait until the Staging Task had written the LRB slot to the roll file. If the ratio of staging waits to the total number of write requests is very high, this indicates that the high and low water marks are set inappropriately or that there is a bottleneck on the roll file device/roll file channel.

Based on experience with stress tests, the following is recommended:

If the ratio of maximal number of active users to number of LRB slots is very small, increase the high water mark. If not, decrease the high water mark.

The difference between high water mark and low water mark should not be larger than three (30%).

Ideally, if the number of LRB slots is definitely larger than the maximum number of concurrent users, the high water mark should be set to 10.

Roll Server User Exits

The roll server has two user exits.

- NATRSU14
- NATRSU24

Sample source modules are delivered for these.

NATRSU14 User Exit

Specifies the roll file number to be used.

Entry calling conventions:

- Register 1 addresses the parameter list that is described by the following DSECT:

```

PLIST      DSECT
PLRSVER    DS CL4    Roll server version (= 'vrs')
PLNRF      DS H      Number of roll files
PLUID      DS CL16   Userid
PLTSNUM1   DS H      Total number of slots Roll file 1
PLUSNUM1   DS H      Number of slots in use Roll file 1
PLTSNUM2   DS H      Total number of slots Roll file 2
PLUSNUM2   DS H      Number of slots in use Roll file 2
PLTSNUM3   DS H      Total number of slots Roll file 3
PLUSNUM3   DS H      Number of slots in use Roll file 3
PLTSNUM4   DS H      Total number of slots Roll file 4
PLUSNUM4   DS H      Number of slots in use Roll file 4
PLTSNUM5   DS H      Total number of slots Roll file 5
PLUSNUM5   DS H      Number of slots in use Roll file 5
PLISTL EQU *-PLIST

```

vrs stands for the current Natural version, release and system maintenance level.

- Register 13 points to a 36-fullword save area.
- Register 14 contains the return address.
- Register 15 contains the entry address of NATRSU14.

Return calling convention:

- Register 15 contains the number of the roll file in binary format.

Note:

If access registers are modified within this user exit, these access registers must be saved and restored on return. This user exit is called in primary addressing mode with PSW Key 8. Since it runs in cross-memory mode, no SVC except SVC 13 may be used.

NATRSU24 User Exit

Specifies the XCF group name to be used.

Entry calling conventions:

- Register 1 points to an 8-byte area in which the group name must be generated.
- Register 13 points to an 18-fullword save area.
- Register 14 contains the return address.
- Register 15 contains the entry address of NATRSU24.

As a group name default, the Roll Server will use the leftmost 8 bytes of the CF structure name.

This user exit is called in primary mode, PSW Key 8 and in task mode.