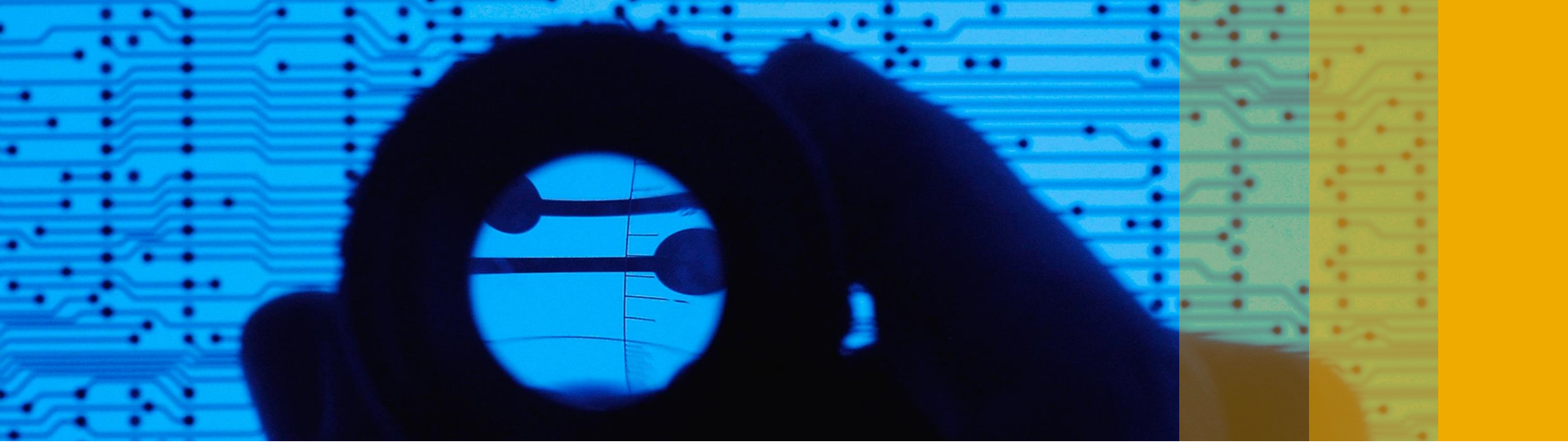

Week 2: Memory Management and Gateway Service

Unit 1: Fundamentals of Memory Management

SAP Run Simple

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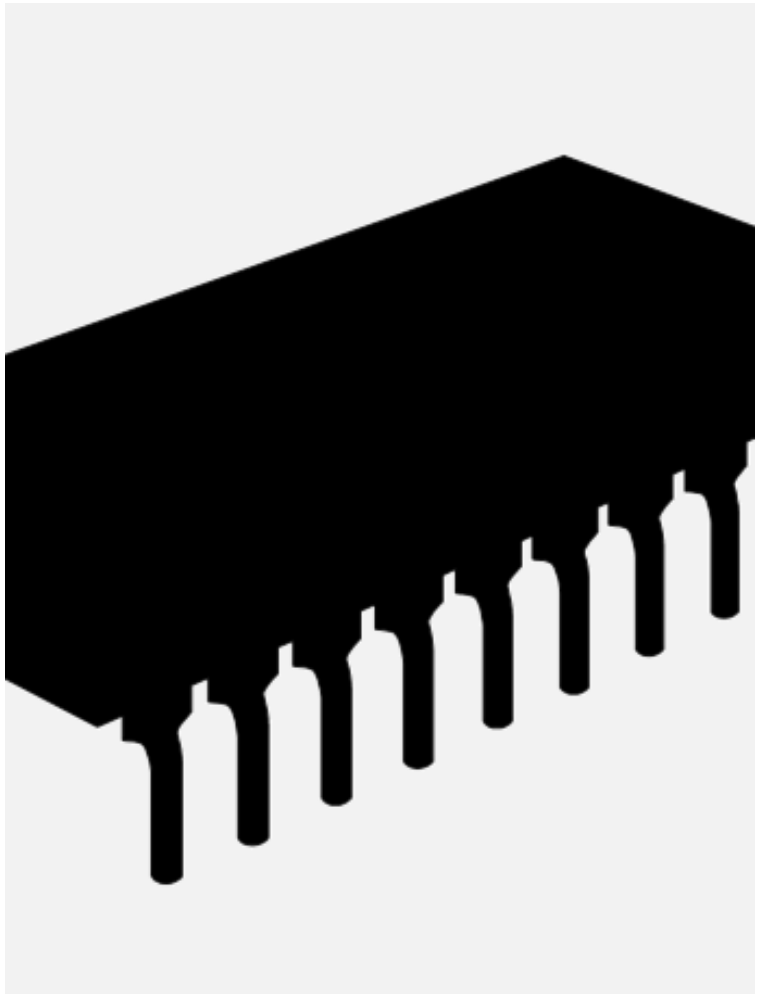
Fundamentals of Memory Management

Memory types

An application runs in a work process where an ABAP program is normally executed. The process requires memory to do this, which is allocated to the process by the memory management system.

The different SAP memory types are:

- Extended memory
- Private memory (heap memory)
- Paging memory

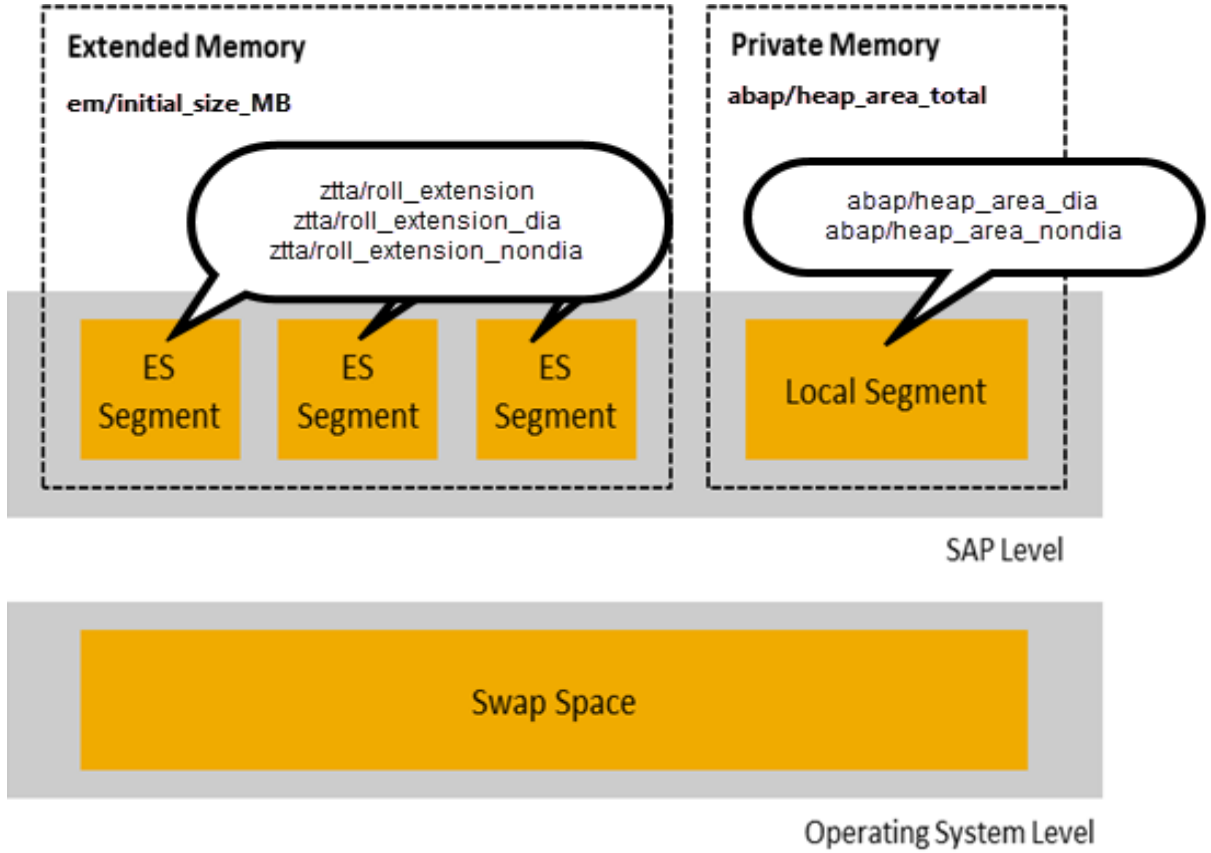


Fundamentals of Memory Management

Features (1)

The order in which the work process is assigned the memory type depends on the work process type (either dialog or non-dialog), and the underlying operating system.

By default, dialog work processes allocate extended memory first, while non-dialog ones heap.

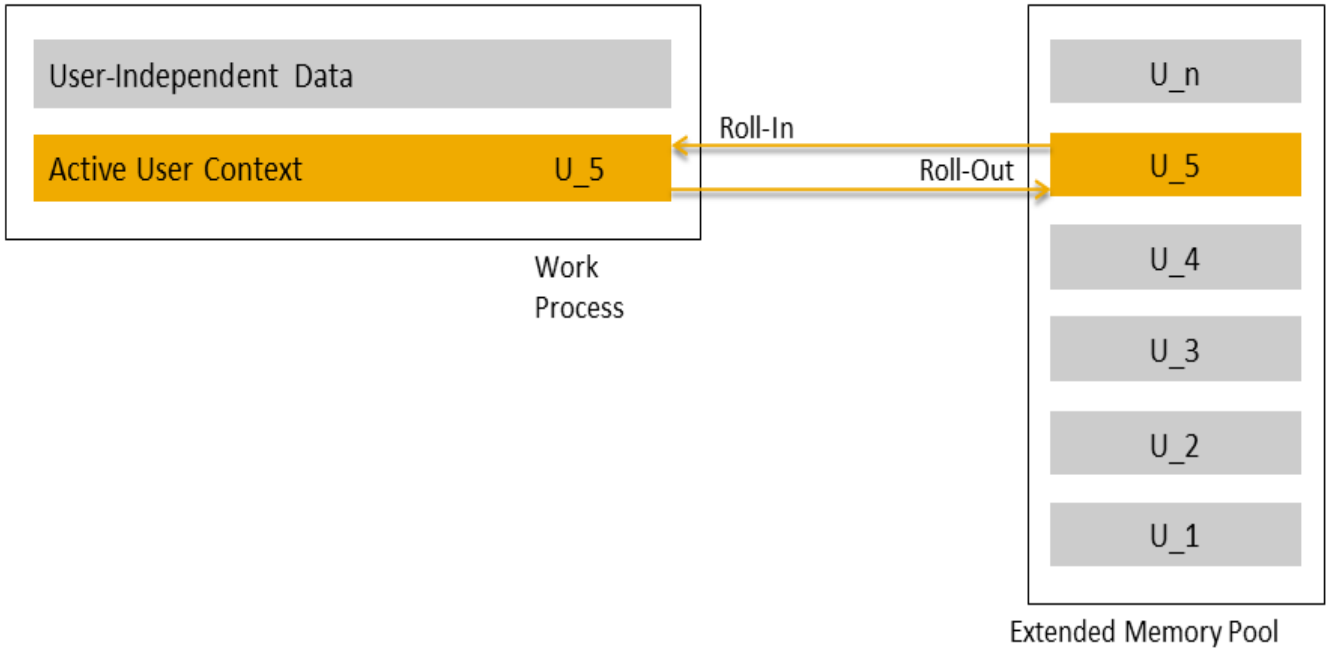


Fundamentals of Memory Management

Features (2)

User Context

The memory used exclusively by a work process stores session-specific data that must be kept for longer than the duration of a work step. This data is automatically made available to the process at the start of a dialog step (rolled in) and saved at the end of the dialog step (rolled out).



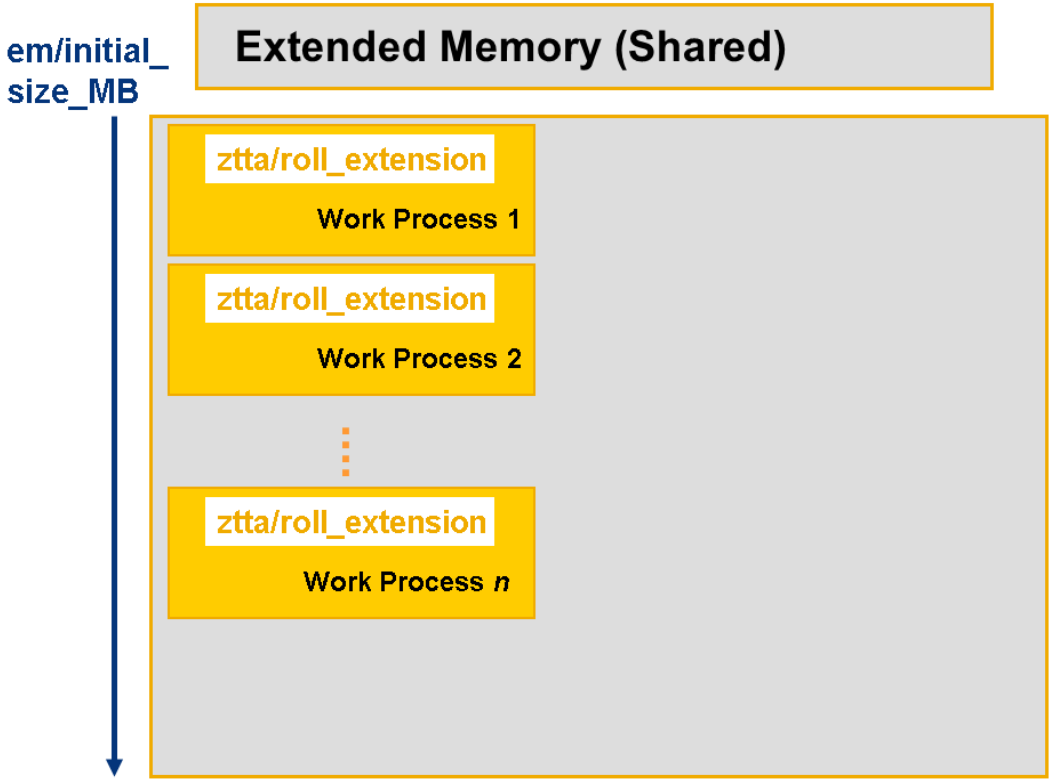
Fundamentals of Memory Management

Extended memory

Extended memory is the core of the memory management system. Each work process has a part reserved in its virtual address space for extended memory.

You can adjust the size of extended memory using the profile parameter em/initial_size_MB, on AIX platform using EM/TOTAL_SIZE_MB. On Windows, it can be extended automatically up to em/max_size_MB.

ztta/roll_extension(_dia|_nondia) defines the quota for extended memory per user context.
On Windows either ztta/roll_extension or em/address_space_MB – whichever is lower – will be the limit.



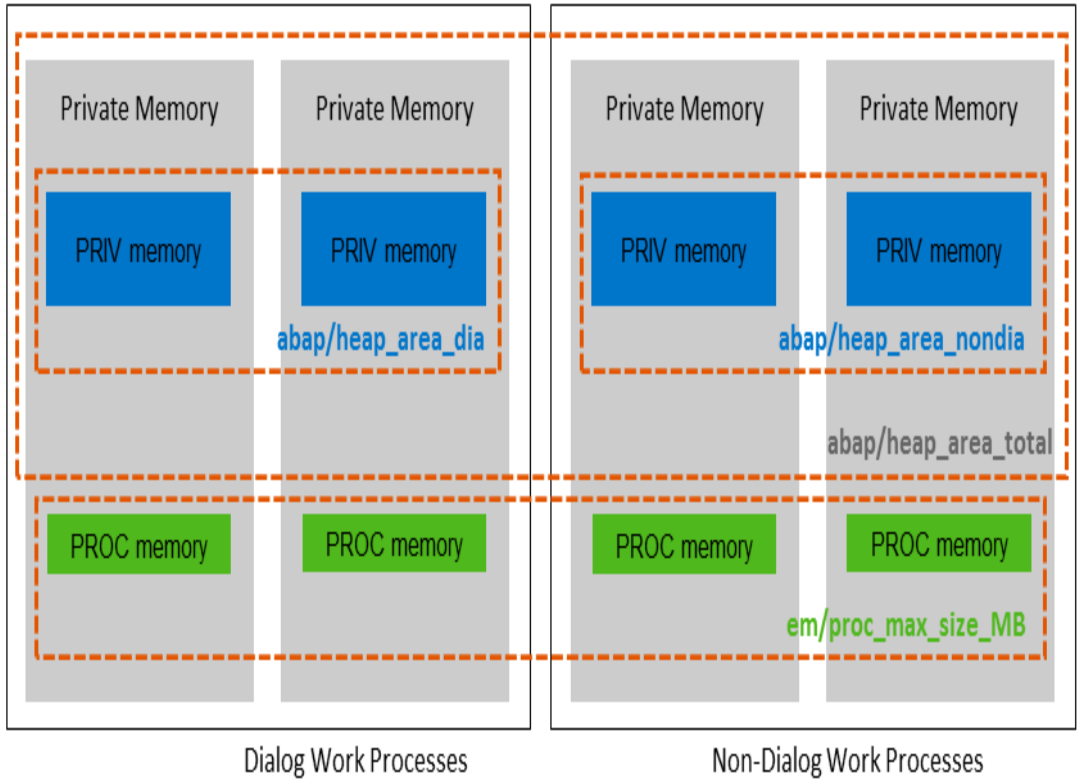
Fundamentals of Memory Management

Private memory (1)

If the extended memory is fully occupied, or the limit for the work process has been exceeded, the dialog work process allocates private memory. This is known as heap memory because it is specific to the process, and the user context can no longer be processed by a different work process.

The other work process types (background, update, and spool work processes, a.k.a. non-dialog work processes) are assigned private memory directly.

Private memory (heap memory) in turn differentiates between PRIV-memory and PROC-memory.



Fundamentals of Memory Management

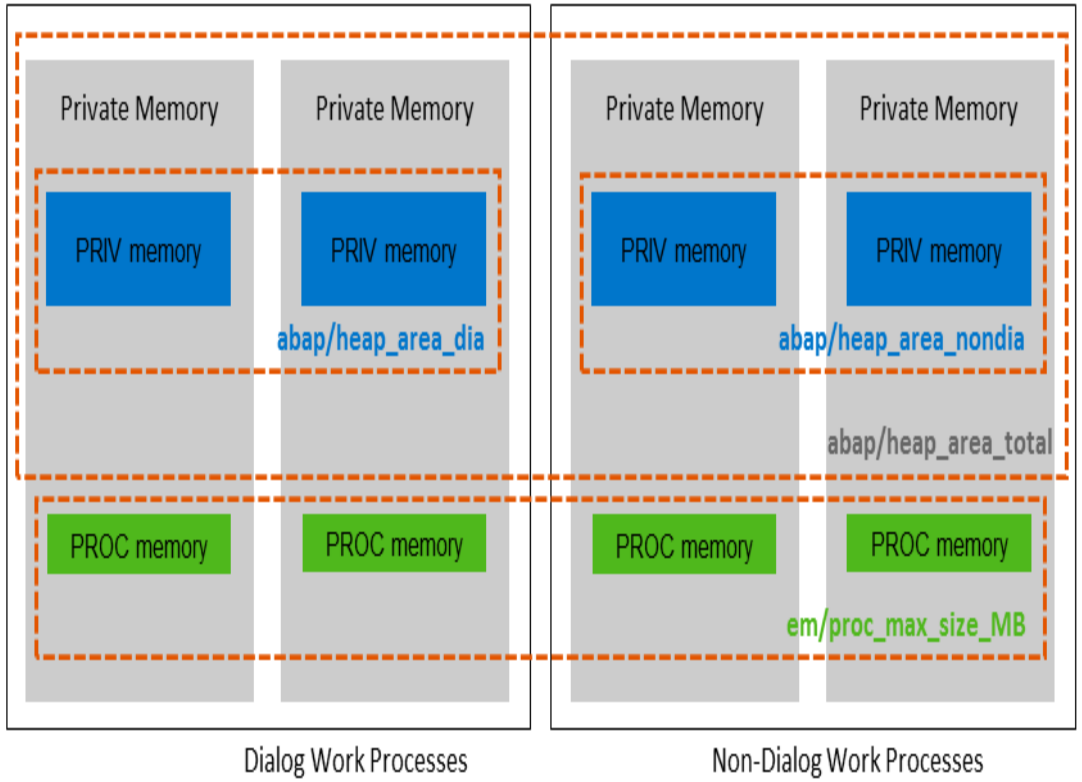
Private memory (2)

PRIV-memory

The work process is run in PRIV mode when private memory is assigned.

Private memory cannot be used by other work processes. After releasing the assigned memory, the operating system still considers the virtual memory as being occupied by the allocating work process.

When the amount of heap memory defined by abap/heaplimit is exceeded, a work process is restarted after completing a transaction step and releases the resources on operating system level. It is strongly recommended not to change the default value of abap/heaplimit.



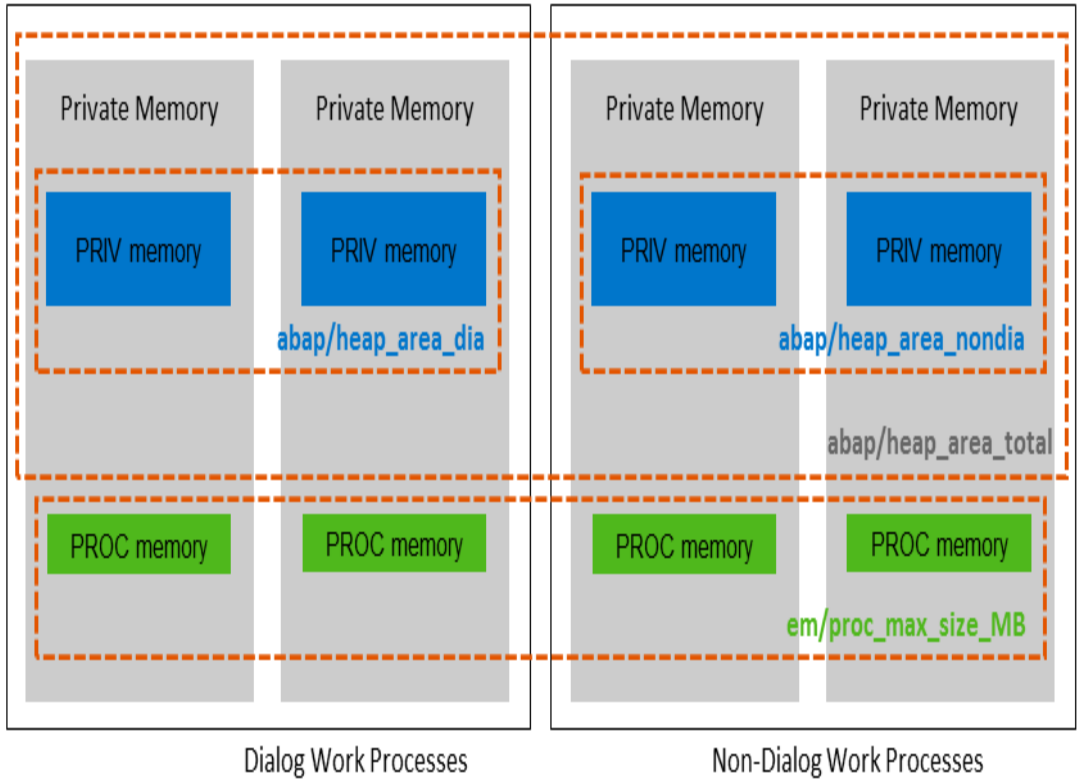
Fundamentals of Memory Management

Private memory (3)

The SAP system offers a mechanism that lets you terminate non-active dialog work processes in PRIV mode.

The mechanism works as follows: In PRIV mode, a maximum number (n) of dialog work processes can run without any time restrictions. To determine this number (n), set the value of the profile parameter rdisp/wppriv_max_no.

If more than (n) dialog work processes are active and the time span set in parameter rdisp/max_priv_time has elapsed, the transaction for the PRIV process that has spent the longest possible time in PRIV mode is reset.



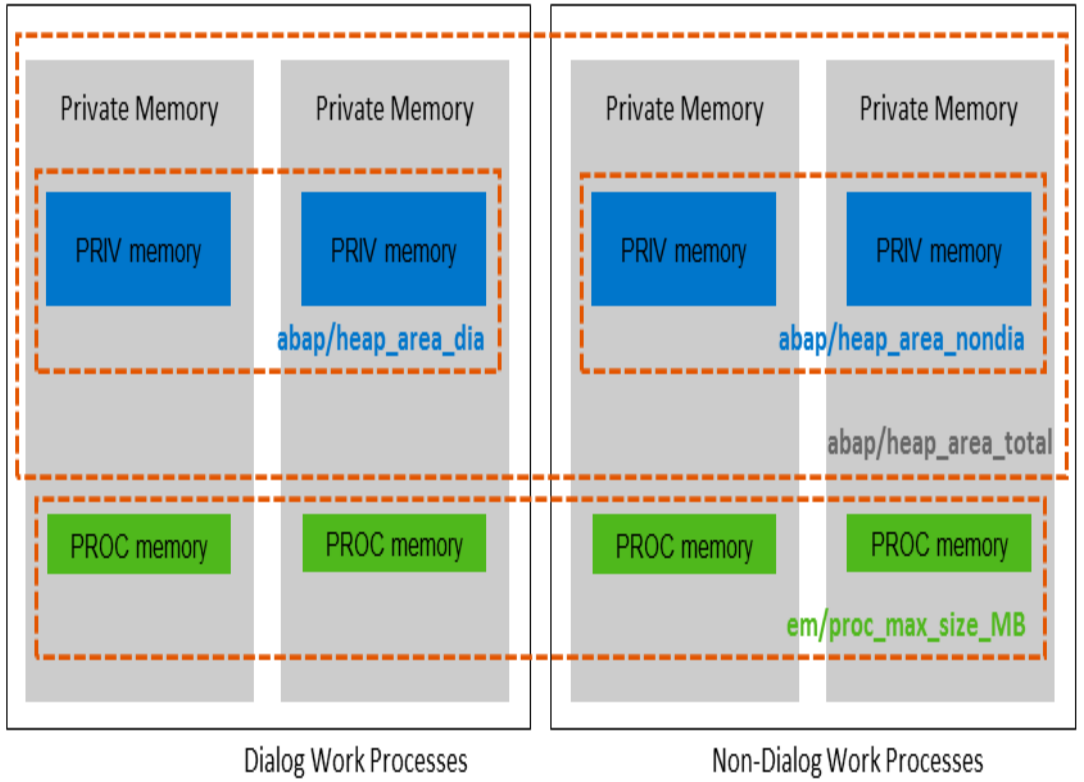
Fundamentals of Memory Management

Private memory (4)

PROC-memory

This is used for data that is not bound to a specific user context, for example temporary, heap buffer areas. In contrast to PRIV memory, allocation of PROC memory does not lead to an exclusive reservation of the process for a specific user context.

em/proc_max_size_MB specifies the maximum size of the PROC heap memory that can be allocated by all work processes in total, and em/proc_max_wpsize_MB the maximum allocation per work process.



Fundamentals of Memory Management

Paging memory

Paging memory functions as memory for ABAP extracts and exports. It is divided into two parts:

- Paging buffer (in memory) is set by rdisp/PG_SHM
- Paging file (on file system) is set by rdisp/PG_MAXFS

By default, the paging buffer is set by a formula depending on physical memory, and the paging file is set to the size of the paging buffer. The formula is optimal for normal usage.

Fundamentals of Memory Management

Parameters

An instance is controlled by its profile parameters. Profile parameters enable you (amongst other things) to set up your memory management system to get maximum benefit from it.

Certain parameters may restrict individual work processes, and quotas may limit resources used by all work processes.

Many of the SAP memory management profile parameters are calculated by formulas to simplify administration and to ensure that parameters are consistent.

See also:

SAP Note 2085980 – New features in memory management as of Kernel Release 7.40

Parameter Name	System Default Value(Unsubstituted Form)	Comment
rsdb/tbi_buffer_area_MB	(((($(rtbb/buffer_length) * 1024 + $(zcsa/table_buffer_ar	Size of the table buffer in MB
ES/SHM_MAX_SHARED_SEGS	(($(em/global_area_MB) + $(abap/shared_objects_size_MB) + $	Max segemnts used for shared contexts
rdisp/max_websocket_connections	($(rdisp/tm_max_no) / 2)	Size of the WebSocket table
rdisp/wp_max_no	($(rdisp/wp_no_dia) + $(rdisp/wp_no_vb) + $(rdisp/wp_no_vb2	Maximum number of startable work processes
rdisp/configurable_wp_no	(max($(rdisp/wp_max_no) - 5, $(rdisp/wp_no_dia) + $(rdisp/	Maximum number of configurable workprocesses
rdisp/max_comm_entries	(max(1000, $(rdisp/tm_max_no) * 1.5))	Maximum number of communication entries
abap/programs	($(abap/buffersize)/4)	Directory size of the ABAP program buffer
EM/TOTAL_SIZE_MB	($(em/initial_size_MB))	Quota for maximum consumption of extended memory on that server
em/address_space_MB		Space reserved for user context in work processes
mpi/max_pipes	($(icm/max_conn) * 2)	Maximum number of memory pipes (MPI)
wdisp/HTTP/max_pooled_con	($(icm/max_conn))	Maximum number of Web Dispatcher HTTP connections to a backend server
wdisp/HTTPS/max_pooled_con		Maximum number of Web Dispatcher HTTPS connections to a backend server
abap/heap_area_total	($(PHYS_MEMSIZE) * 1024 * 1024)	limit of heap on Appl.Server
rdisp/wp_ca_blk_no	($(rdisp/elem_per_queue)*3)	Maximum number of communication blocks
rdisp/PG_MAXFS	($(rdisp/PG_SHM))	Maximum size of SAP paging file
gw/max_conn	($(rdisp/tm_max_no)*2)	Maximum number of active connections
rsdb/ntab/sntabsize	($(rsdb/ntab/ftabsize) * 0.1)	data area size for Short NTAB buffer
rsdb/ntab/irbdsize	($(rsdb/ntab/ftabsize) * 0.2)	data area size for Initial records buffer
rsts/ccc/cache07	($(rsts/ccc/cachesize) * 0.1)	Size of cache for long multibyte characters
rtbb/max_tables	($(zcsa/db_max_buftab) * 0.1)	Directory entries in single key buffer (partial buffer)
rsdb/ntab/entrycount	($(zcsa/db_max_buftab))	number of nametabentries administrated
rtbb/buffer_length	($(zcsa/table_buffer_area) * 0.1 / 1024)	Size of single key buffer (partial buffer)
em/blocksize_KB	(ceil($(em/initial_size_MB) * 1024 / 100000 / 4096) * 4096)	Block size for extended memory
rdisp/wpdbug_max_no	(max(1, $(rdisp/wp_no_dia)/2))	Max. number of work processes in SAP debug mode
rsdb/cua/max_objects	(max(2000,$(rsdb/cua/buffersize) / 4))	Maximum number of objects in CUA Buffer
rsdb/obj/max_objects	(max(2000,$(rsdb/obj/buffersize) / 4))	Maximum number of objects in export / import buffer
zcsa/db_max_buftab	(max(20000,$(zcsa/table_buffer_area) / (5 * 1024)))	Directory entries in generic key buffer (table buffer)
ES/SHM_SEG_SIZE	(max(4096, 1024 * ceil(max($(rsdb/tbi_buffer_area_MB), $(aba	Segment size in MBytes
rsdb/obj/buffersize	(max(4096,$(PHYS_MEMSIZE)*1024 * 0.01))	Size of export/import buffer [kB]
em/global_area_MB	(min($(em/initial_size_MB) * 0.05, 32000))	Size of the extended global memory area (EG) im MB
ssl/server_cache_size	(min($(icm/max_conn) * 4, 100000))	Size of the server side SSL session cache
mpi/total_size_MB	(min(0.06 * $(icm/max_conn) + 50, 2000))	Total memory size in MB used for MPI
rdisp/PG_SHM	(min(1000+40*max(5,floor(($(PHYS_MEMSIZE)-128)/20)),256000))	Size of paging buffer
abap/shared_objects_size_MB	(min(20000, $(em/initial_size_MB)*0.02))	Size of Shared Objects Memory in MB
rdisp/max_amc_receiver_entries	(min(32000,$(rdisp/tm_max_no)*2))	Size of the AMC receiver table
gw/max_sockets	(min(32768,max(2048,$(gw/max_sys)+$(rdisp/max_gateways)+500)	max number of sockets for gateway
zcsa/table_buffer_area	(min(3333333333, (max(30000000,($(em/initial_size_MB) * 1024	Size of generic key buffer (table buffer)
em/initial_size_MB	(min(512000, $(PHYS_MEMSIZE) * 0.7))	Initial size of extended memory pool
em/max_size_MB	(min(512000, $(PHYS_MEMSIZE) * 1.5))	Maximum size of extended memory pool
rsdb/ntab/ftabsize	(min(800000, ($(rsdb/ntab/entrycount))))	data area size for field description buffer
abap/buffersize	(min(ceil($(em/initial_size_MB)*1024*0.2/4096)*4096, ceil(sq	Program Buffer Size

Fundamentals of Memory Management

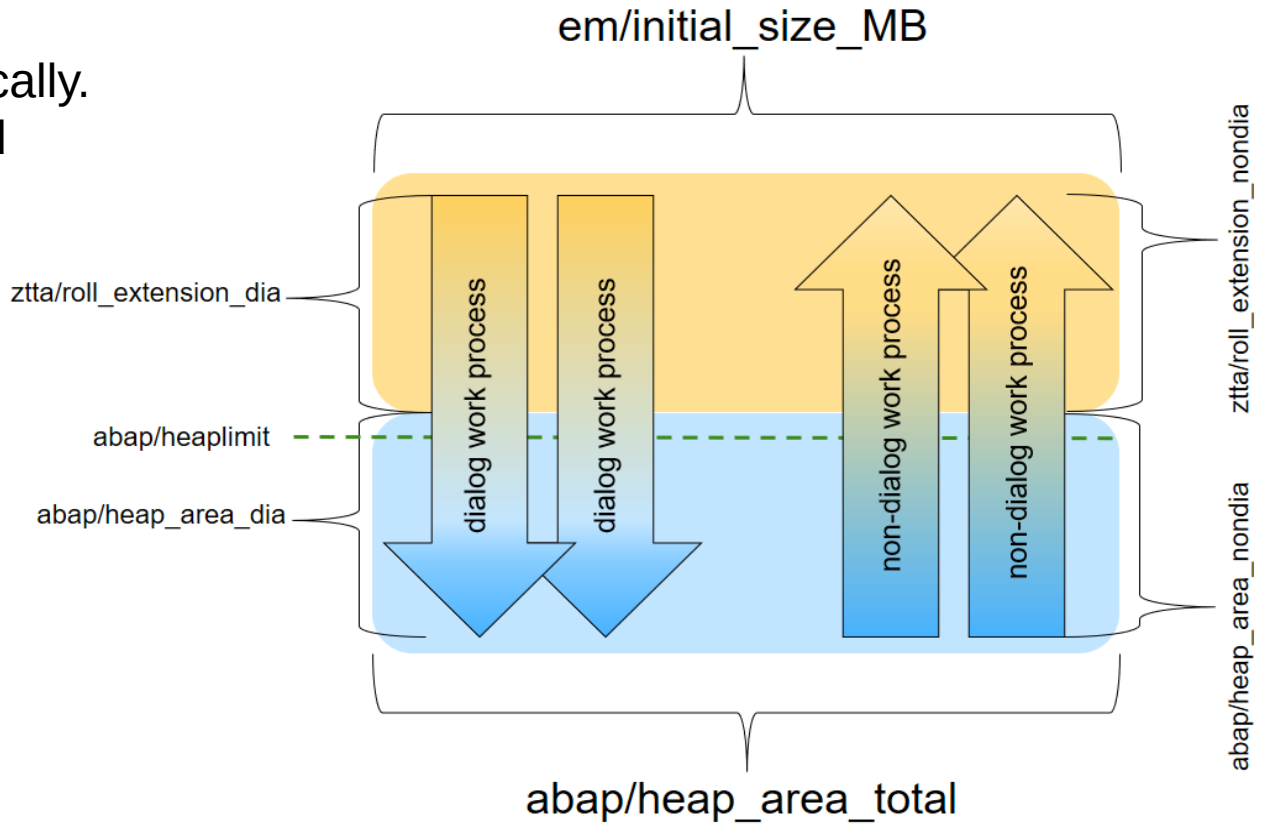
Most important profile parameters (1)

PHYS_MEMSIZE

- Available main memory for the SAP instance.
  With PHYS_MEMSIZE, all memory management parameters are calculated and adjusted automatically.
  At least extended global memory (for the ITS) and page should be checked.

Controlling Memory Management

- abap/heaplimit: Work process restart

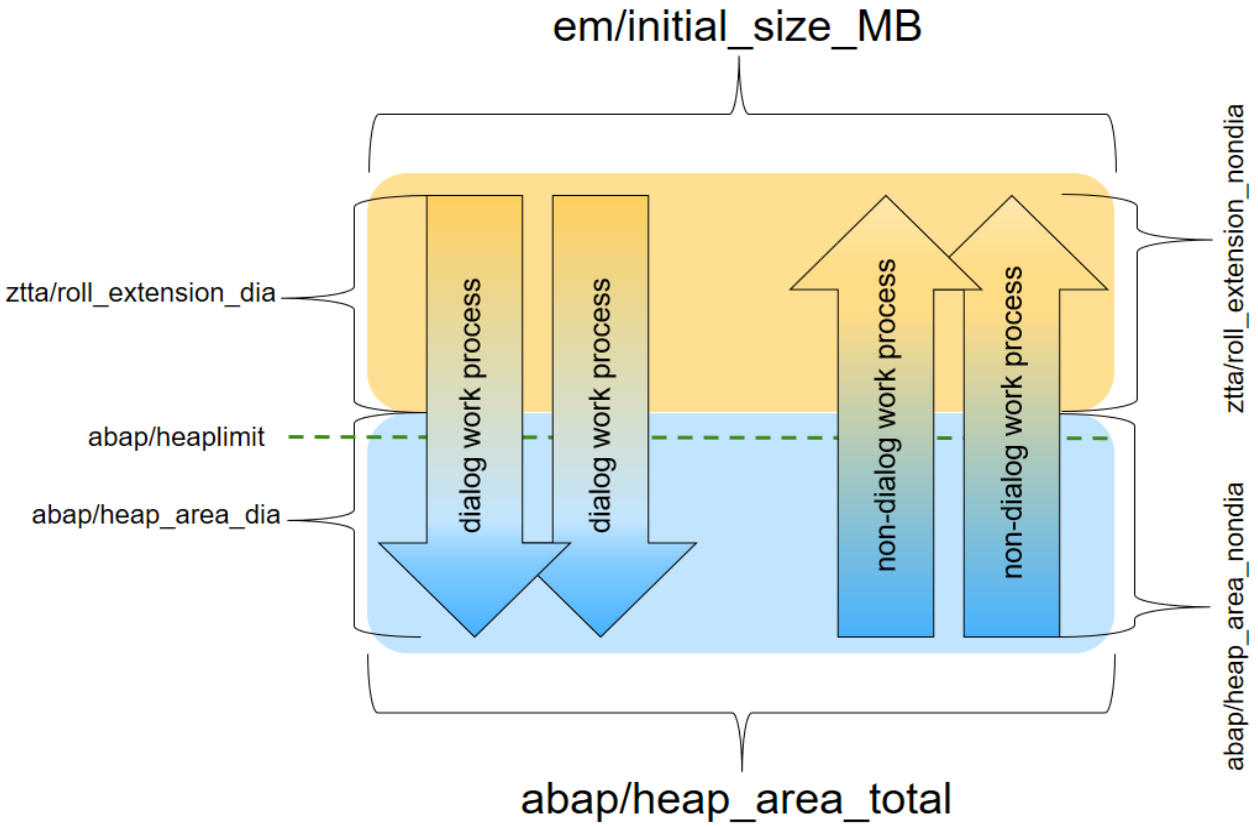


Fundamentals of Memory Management

Most important profile parameters (2)

Memory Management Resources for One Work Process

- ztta/roll_extension_dia: EM limit for dialog work processes
- abap/heap_area_dia: Heap memory limit for dialog work processes
- abap/heap_area_nondia: Heap memory limit for non-dialog work processes
- ztta/roll_extension_nondia: EM limit for non-dialog work processes

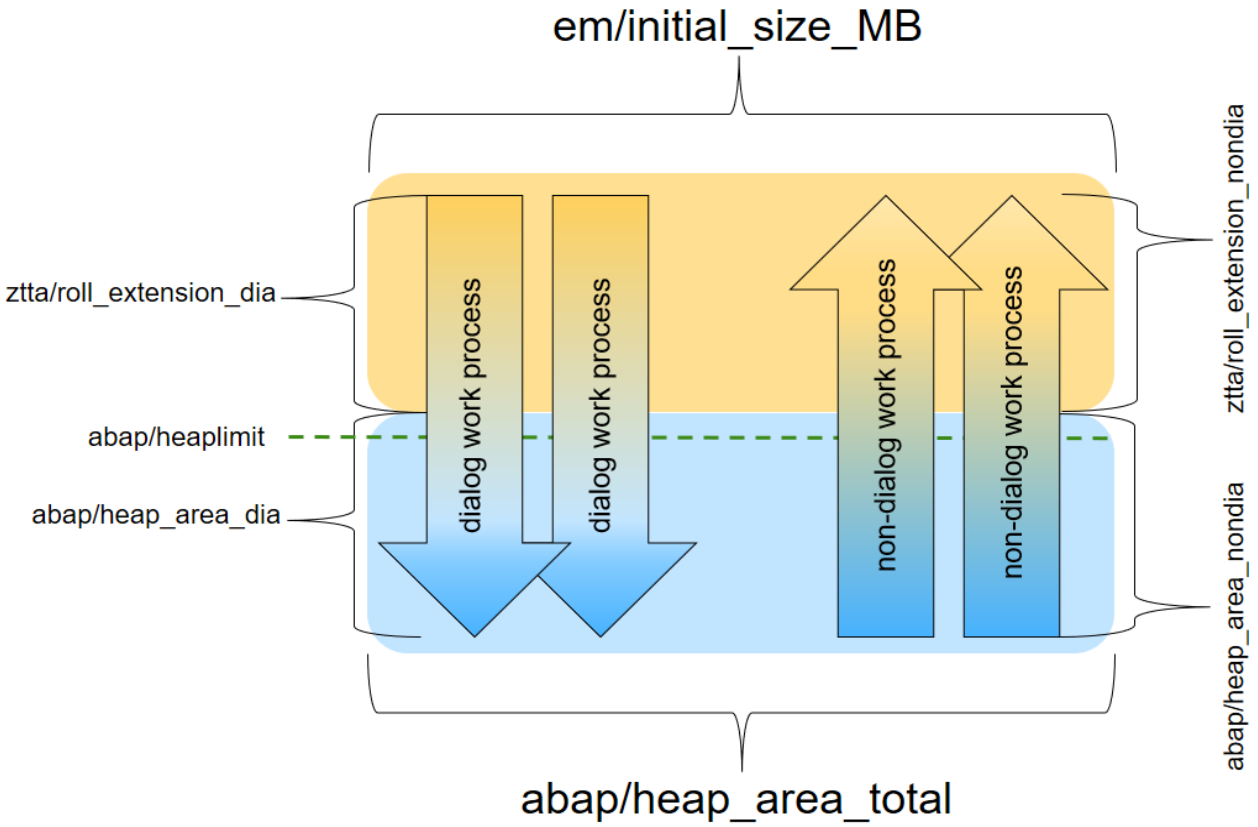


Fundamentals of Memory Management

Most important profile parameters (3)

Memory Management Limitations of Entire System

- abap/heap_area_total: Heap memory limit for all work processes together
- em/initial_size_MB: Extended memory pool size
- em/proc_max_size_MB: Maximum amount of PROC memory that can be allocated to all work processes



Fundamentals of Memory Management

Platform-specific description of memory management (1)

AIX

- ES/TABLE = SHM_SEGS | UNIX_STD
  The default value SHM_SEGS switches to the alternative implementation of the extended memory. With SHM_SEGS, the allocation sequence for non-dialog work processes is the same as for dialog work processes (first extended memory, then heap).
- EM/TOTAL_SIZE_MB
  Defines the extended memory pool size on AIX

Fundamentals of Memory Management

Platform-specific description of memory management (2)

Linux

- es/implementation = std | map
  With the default std variant, the memory management of an SAP system on Linux is the same as on standard UNIX systems. This means that all user contexts are displayed in the address space at the same time.

Fundamentals of Memory Management

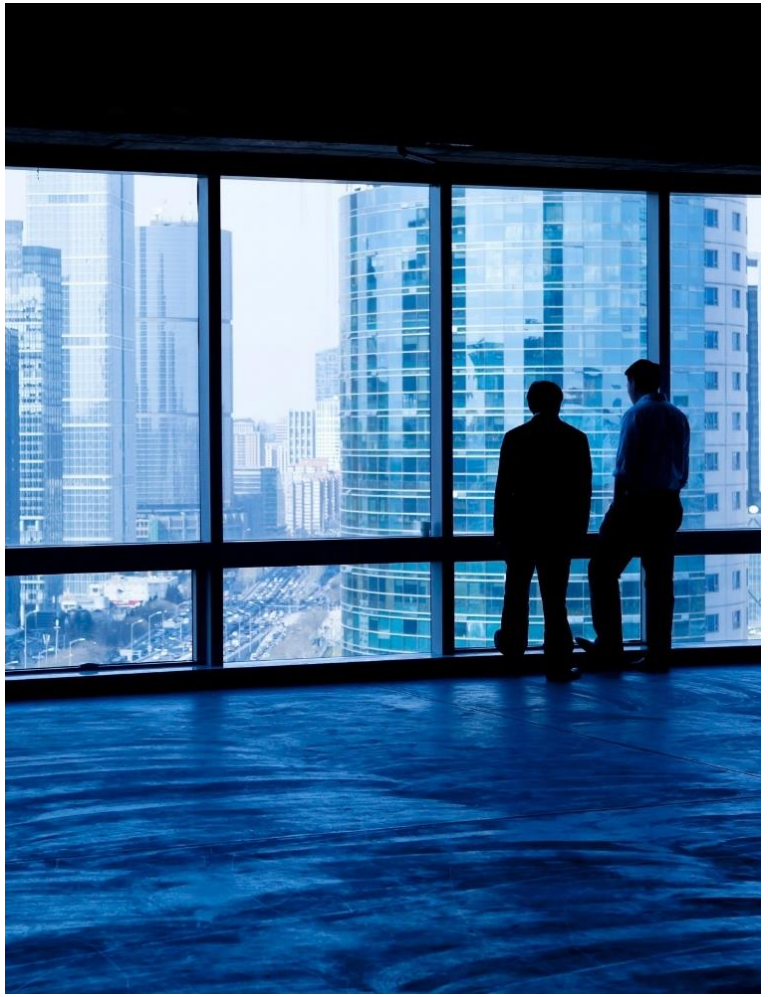
Platform-specific description of memory management (3)

Windows

- em/address_space_MB
  Space reserved for user context + extended global memory (EG) in work processes
- em/max_size_MB
  Maximum size of extended memory pool

Sequence for allocating extended memory for work processes:

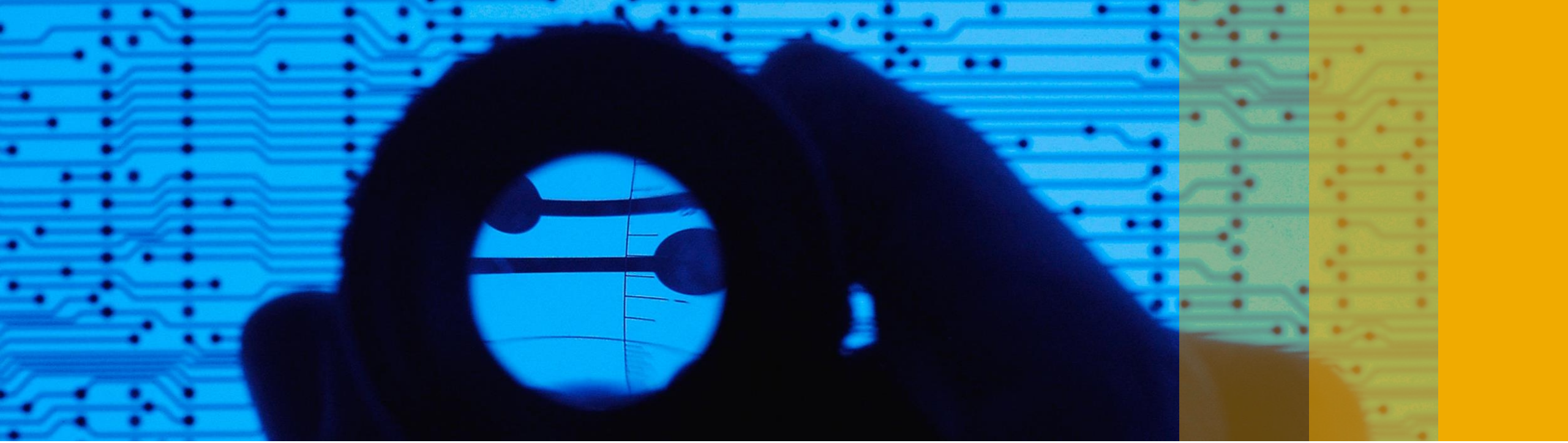
- min {em/address_space_MB, ztta/roll_extension_dia} for dialog work processes
- min {em/address_space_MB, ztta/roll_extension_nondia} for non-dialog work processes



Thank you.

Contact information:

open@sap.com



Week 2: Memory Management and Gateway Service

Unit 2: Memory Management Configuration

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Memory Management Configuration

The operating system

Resources

- Various operating systems:
  - Windows
  - UNIX: Linux, AIX, Oracle Solaris, HP-UX
- Used by:
  - operating system
  - SAP
  - 3rd party applications (e.g. database)
- Memory on operating system level:
  - physical memory (RAM)
  - paging file (Swap space)
- RAM + Swap = virtual memory

Memory Management Configuration

User-specific memory

Operating system memory for <sid>adm

- Determine it by:
  - sh -c 'ulimit -a' or csh -c limit
  - SAP tool: memlimits -v off
- In command output refer to:
  - data size, stack size (requirements vary per operating system)
  - Maximum heap size per process

```
tslhost:tsladm 72> sh -c "ulimit -a"
core file size          (blocks, -c) 0
data seg size           (kbytes, -d) unlimited
scheduling priority             (-e) 0
file size               (blocks, -f) unlimited
pending signals                 (-i) 31428
max locked memory       (kbytes, -l) 64
max memory size         (kbytes, -m) unlimited
open files                      (-n) 65536
pipe size            (512 bytes, -p) 8
POSIX message queues     (bytes, -q) 819200
real-time priority              (-r) 0
stack size              (kbytes, -s) 8192
cpu time               (seconds, -t) unlimited
max user processes              (-u) 31428
virtual memory          (kbytes, -v) unlimited
file locks                      (-x) unlimited
```

```
tslhost:tsladm 73> memlimits -v off
SAP R/3 address space configuration test tool V3.2 (
=================================================

+-------------------------------------------------
|                          Result
+-------------------------------------------------
Maximum heap size per process.........:  4096 MB
    measurement limited to 4096 MB
    this value is probably limited by swap space
Total available swap space............:  4096 MB
    measurement limited to 4096 MB
    main memory size x 3 recommended , minimum 1 GB
```

See also:

SAP Note 1704753 – Inst.Systems Based on NetWeaver on UNIX
SAP Note 1827960 – Adjusting operating system limits for SAP instances

Memory Management Configuration

Instance-specific memory

Memory requirement of SAP instance

- Determine it by:
  - sappfpar check pf=<instance profile>
- At the bottom of command output:
  - Total, minimum requirement
  - Total, worst case requirement
    Shared Memory (SHM) + Extended Memory (EM) total + Heap total
  - Errors detected (e.g. segment size)
- What to consider:
  - Total, worst case requirement must fit in RAM+Swap
  - Errors detected must be 0 ---> change configuration if there are any

```
tslhost:tsladm 78> sappfpar check pf=TSL_DVEBMGS00_tslhost


================================================================================
==   Checking profile:     /sapmnt/TSL/profile/TSL_DVEBMGS00_tslhost
================================================================================


Shared memory resource requirements estimated
================================================================
Total Nr of shared segments required.....:         33
System-imposed number of shared memories.:        100
Shared memory segment size required min..:  606327808 ( 578.2 MB)
Currently available maximum segment size.: 21474836480 (20480.0 MB)

Swap space requirements estimated
================================================
Shared memory.....................: 1609.1 MB
..in pool 10  115.8 MB,   97% used
..in pool 40  151.1 MB,   97% used
..not in pool: 1336.4 MB
Processes.........................:  153.7 MB
Extended Memory ..................: 2763.0 MB
------------------------------------------------
Total, minimum requirement.......: 4525.8 MB
Process local heaps, worst case..: 3814.7 MB
Total, worst case requirement....: 8340.5 MB

Errors detected..................:    0
Warnings detected................:    0
```

Memory Management Configuration

ZAMM (1)

Zero Administration Memory Management

- One parameter:
  - PHYS_MEMSIZE
  - % of RAM or absolute value in MB, default 100% RAM
  - other memory parameters are automatically derived from it, platform dependently, by best practices formulas
- Change if:
  - further SAP instances are planned on same host
  - you want to adjust the resource requirement of an SAP instance

Profile parameter	Default value	Unit	OS platforms
PHYS_MEMSIZE	Main memory (RAM) of the ABAP application server	MB	All
em/initial_size_MB	(min(512000, $(PHYS_MEMSIZE) * 0.7))	MB	All except for AIX
em/initial_size_MB	($(EM/TOTAL_SIZE_MB))	MB	AIX
EM/TOTAL_SIZE_MB	($(PHYS_MEMSIZE) * 0.7)	MB	AIX
EM/TOTAL_SIZE_MB	($(em/initial_size_MB))	MB	All except for AIX
em/blocksize_KB	(ceil($(em/initial_size_MB) * 1024 / 100000 / 4096) * 4096)	KB	All
em/global_area_MB	min($(em/initial_size_MB) * 0.05, 32000)		
em/max_size_MB	($(em/initial_size_MB))		for
em/max_size_MB	(min(512000, $(PHYS_MEMSIZE) * 1.5))		
em/address_space_MB	4096		
em/address_space_MB	($(em/initial_size_MB))		
rdisp/PG_SHM	(min(1000+40*max(5,floor(($(PHYS_MEMSIZE)-128)/20)),20000))	8 KB	All
rdisp/PG_MAXFS	($(rdisp/PG_SHM))	8 KB	All
ES/SHM_PROC_SEG_COUNT	16	integer	AIX, IBM I
ES/SHM_PROC_SEG_COUNT	3	integer	All except for AIX, IBM I
ES/SHM_MAX_SHARED_SEGS	1	integer	IBM z/OS (= OS390)
ES/SHM_MAX_SHARED_SEGS	(($(em/global_area_MB) + $(abap/shared_objects_size_MB) + $(rtbb/buffer_length)/1024 + $(zcsa/table_buffer_area)/1024/1024) / $(ES/SHM_SEG_SIZE) + 1)	integer	All except for IBM z/OS
ES/SHM_MAX_PRIV_SEGS	(max(1, 16 - $(ES/SHM_MAX_SHARED_SEGS)))	integer	AIX, IBM I
ES/SHM_MAX_PRIV_SEGS	2	integer	All except for AIX, IBM I
abap/heaplimit	150000000	Bytes	All
abap/buffersize	(ceil($(em/initial_size_MB)*1024*0.15/4096) * 4096)	KB	All
abap/programs	($(abap/buffersize)/4)	integer	All
abap/heap_area_dia	2000000000	byte	All
abap/heap_area_nondia	0	byte	Windows
abap/heap_area_nondia	2000000000	byte	All except for Windows
abap/heap_area_total	($(PHYS_MEMSIZE) * 1024 * 1024)	Bytes	Windows
abap/heap_area_total	(max($(PHYS_MEMSIZE)*1024*1024 * 0.1, $(abap/heap_area_dia) * 2))	Bytes	All except for Windows
abap/shared_objects_size_MB	(min(4000, $(em/initial_size_MB)*0.02))	MB	AIX, IBM I
abap/shared_objects_size_MB	(min(20000, $(em/initial_size_MB)*0.02))	MB	All except for AIX, IBM I

Profile parameter	Default value
PHYS_MEMSIZE	Main memory (RAM) of the ABAP application server
em/initial_size_MB	(min(512000, $(PHYS_MEMSIZE) * 0.7))

Memory Management Configuration

ZAMM (2)

Zero Administration Memory Management

- Offers a good basic settings which may need to be adjusted.
- To check old values that are still set against new calculated ones, use

  sappfpar check_formula pf=<profile>

- and decide which is more suitable for the SAP instance.
- See also:
  - SAP Note 88416 – Zero administration memory management for the ABAP server
  - SAP Note 2085980 – New features in memory management as of Kernel Release 7.40

```
tslhost:tsladm 87> sappfpar check_formula pf=/sapmnt/TSL/profile/TSL_DVEBMGS00_tslhost

================================================================================
==   Checking profile:     /sapmnt/TSL/profile/TSL_DVEBMGS00_tslhost
================================================================================

Parameter changes if default formulas would be used:
abap/buffersize: 150000 --> 569344
abap/heap_area_total: 10000000 --> 4000000000
abap/programs: 37500 --> 142336
em/global_area_MB: 250 --> 138
ipc/shm_psize_40: 162000000 --> 209715200
rdisp/PG_MAXFS: 10000 --> 8600
rdisp/PG_SHM: 10000 --> 8600
```

Memory Management Configuration

Issues

Typical issues:

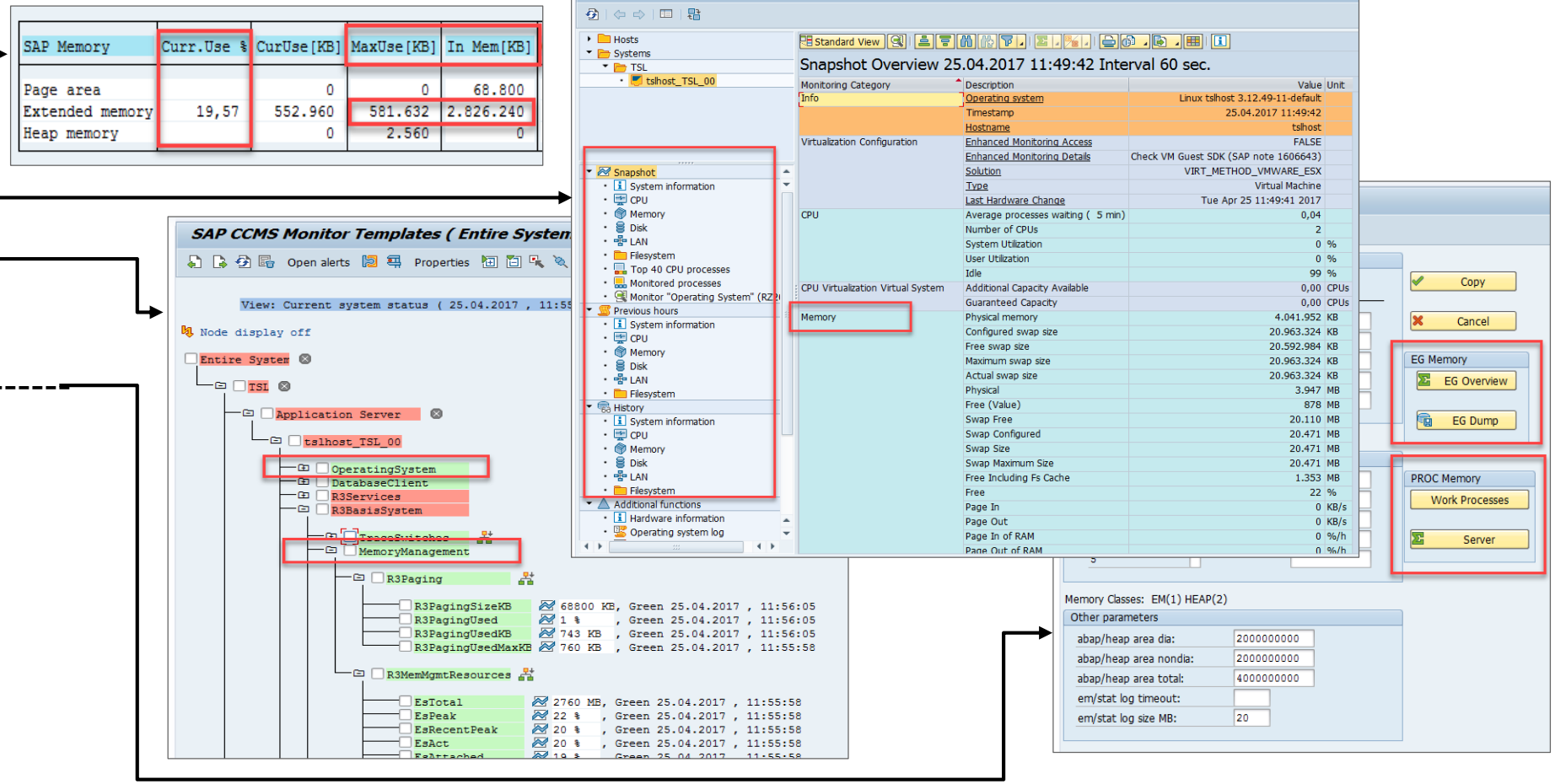
- Work process-specific memory limits reached (dump)
- Instance-specific memory limits reached (dump)
- Operating system memory fully utilized or user-specific operating system limits reached (crash, dump)

Memory Management Configuration

Tools

Monitoring tools

- ABAP:
  - ST02
  - ST06
  - RZ20
  - SM50 / SM66 (PRIV)
  - RSMEMORY
- Operating system:
  - top
  - ps aux
  - Windows task manager
  - ...



Memory Management Configuration

Dumps

Typical memory dumps (ST22)

- SYSTEM_MEMORY_ERROR
- SYSTEM_NO_MEMORY
- SYSTEM_NO_ROLL
- SYSTEM_NO_SHM_MEMORY
- SYSTEM_NO_TASK_STORAGE
- SYSTEM_SHM_NO_ROLL
- ...
- TSV_TNEW_BLOCKS_NO_ROLL_MEMORY
- TSV_TNEW_OCCURS_NO_ROLL_MEMORY
- TSV_TNEW_PAGE_ALLOC_FAILED
- ...
- LOAD_NO_ROLL

Memory Management Configuration

Dumps (2)

Typical memory dumps (ST22)

Special case:

- *NO_ROLL* dumps

They point to EM shortage.

Background:

Starting with SAP NetWeaver 7.4, all data that was stored in the classic ROLL area in earlier releases will be stored in the extended memory together with the other data contained in the ABAP user context, to simplify configuration.

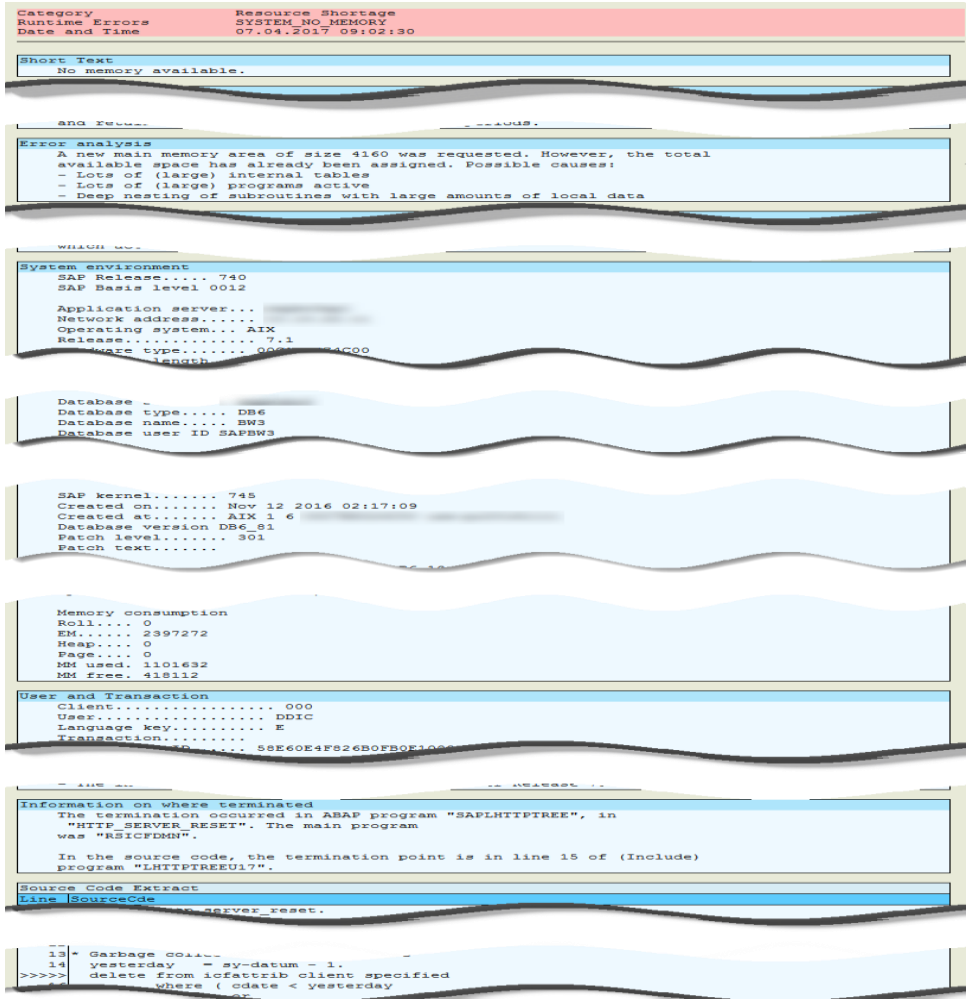
Memory Management Configuration

Analysis

Dump analysis (ST22)

Most important parts:

- Runtime errors, i.e. the name of dump
- Short text
- Error analysis
- System environment,
  such as SAP release, SP level, OS,
  SAP kernel and patch, database
- **Memory consumption,**
  such as EM, Heap, MM used, MM free
- Work process number (dev_wXX)
- User and transaction
- Information on where terminated
- Source code extract (ABAP)



Memory Management Configuration

Best practices

Memory consumption – EM, Heap:

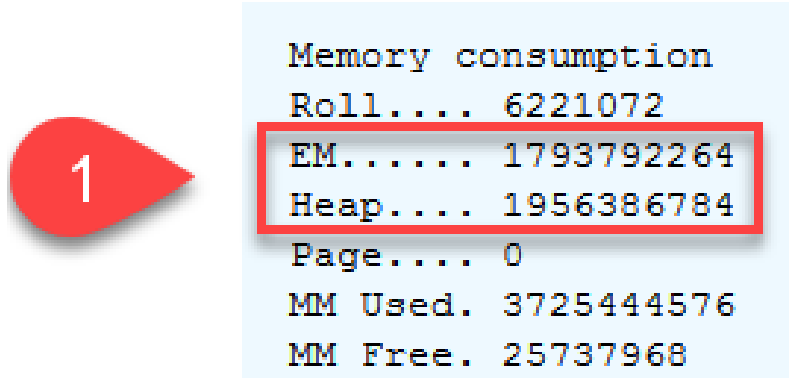
1. Corresponds to (or very close to) process-specific limits
   EM: ztta/roll_extension
   Heap: abap/heap_area_(dia|nondia)
2. Different from process-specific limits

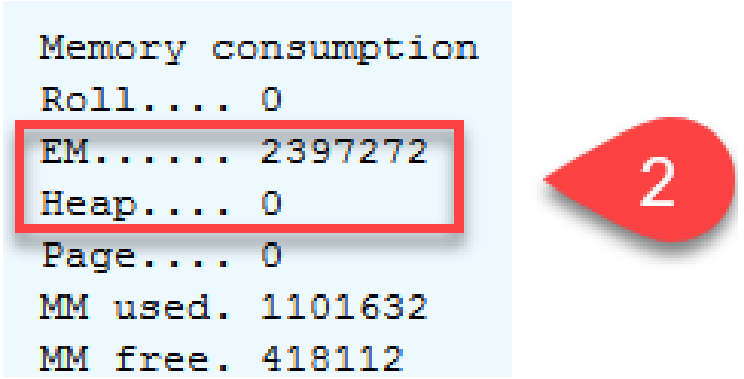
How to react:

1. Involve the application specialists (refer to “Transaction”, “Information on where terminated”, “Source code extract” in dump) so they verify why so much memory is being used; restrict selection criteria of report if possible
2. Review work process trace (see “Work process number” in dump) for details, either instance or operating system limits reached

See also:

– SAP Memory Management System

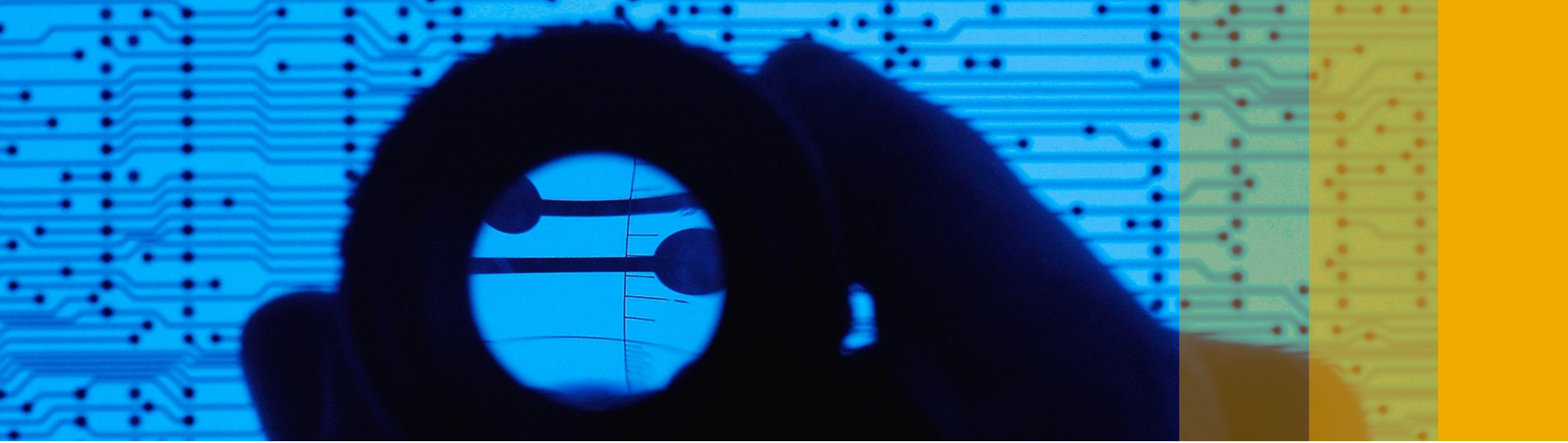




Thank you.

Contact information:

open@sap.com



Week 2: Memory Management and Gateway Service

Unit 3: Fundamentals of SAP Gateway

SAP Run Simple

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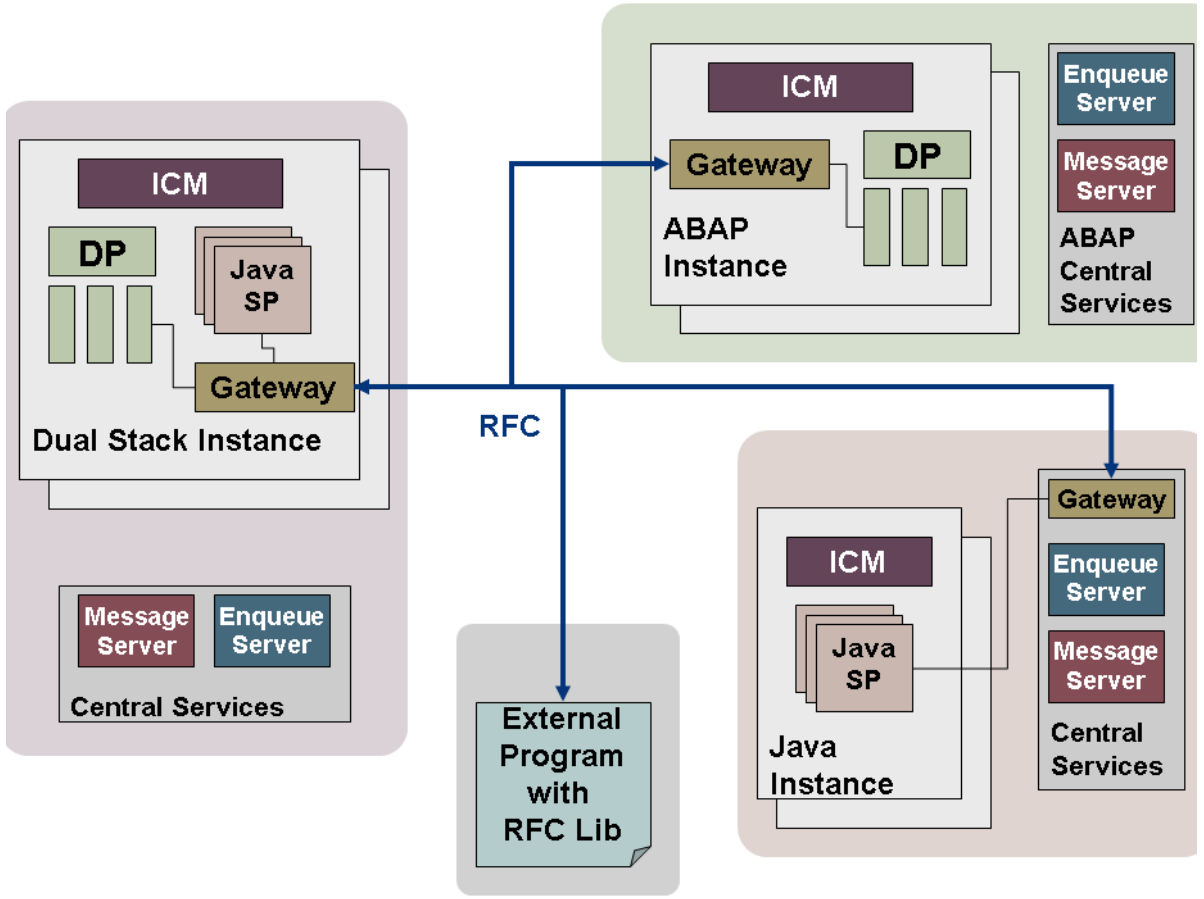
Fundamentals of SAP Gateway

Usage (1)

- The gateway carries out RFC services within the SAP world, which are based on TCP/IP. These services enable SAP systems and external programs to communicate with one another.
- RFC services can be used either in the ABAP program or for the external programs using the interfaces.
- RFC can be used between processes of an instance or a system, or between systems.

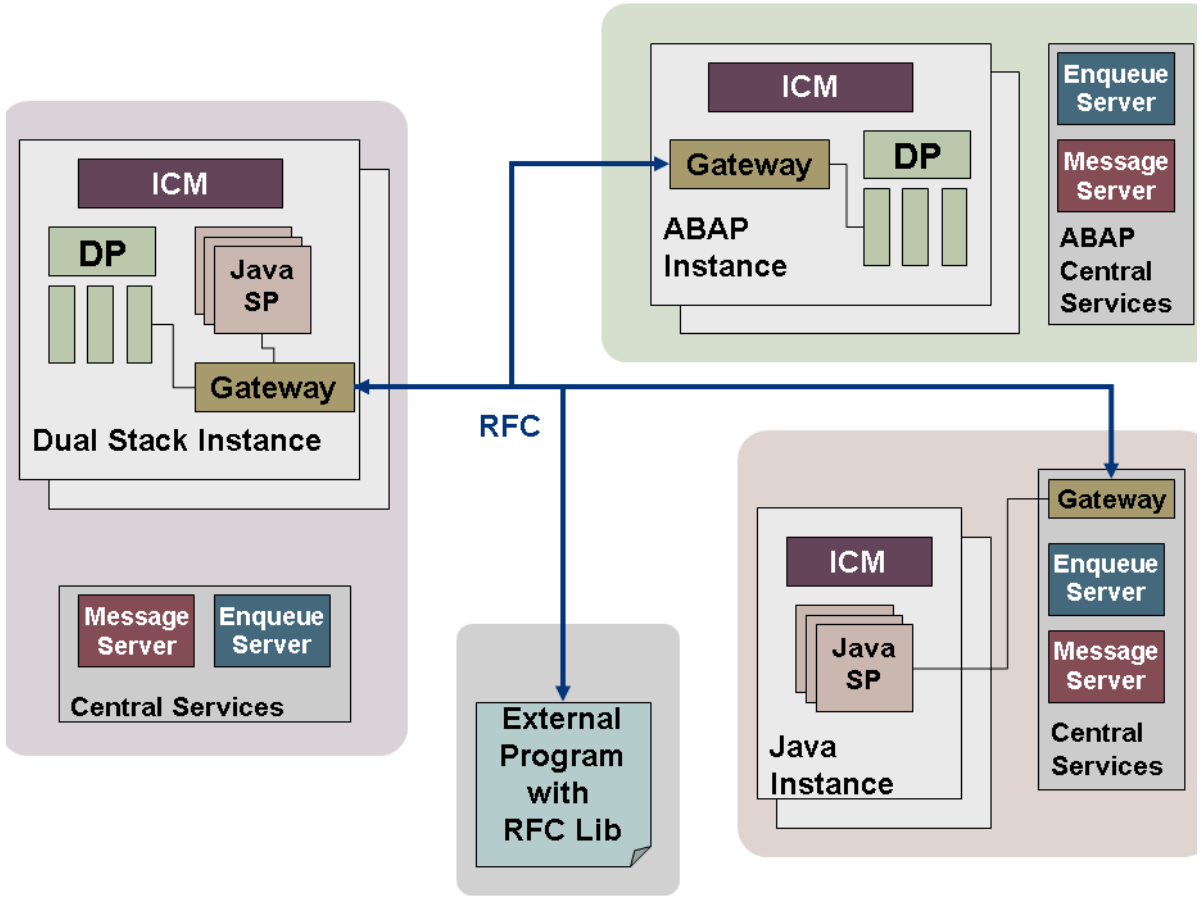


Fundamentals of SAP Gateway

Usage (2)

The following figure shows three different SAP systems. Here you can see the differences between the installation types ABAP-only, Java-only, and dual stack:

- For ABAP systems, each instance contains a gateway that is started and monitored by the ABAP dispatcher.
- For systems with an ASCS instance, it is possible to configure a gateway on the ASCS instance. By default, it is not configured.
- For Java systems, one gateway is enough for the whole system, because the instances communicate with each other and not using the RFC. The gateway is used for RFC/JCo connections to other systems.



Fundamentals of SAP Gateway

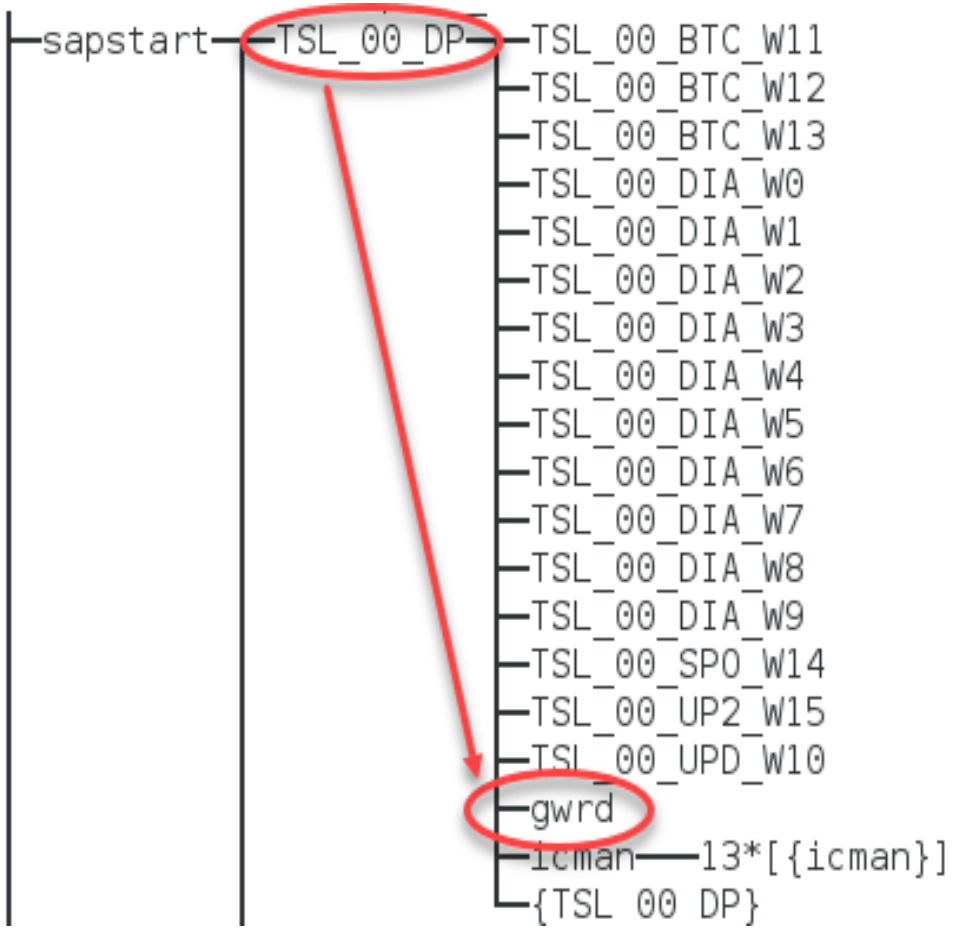
Architecture of the gateway (1)

Gateway Processes

- The SAP Gateway is made up of:
  - Gateway read process (usual name: gateway)
  - Gateway monitor

Gateway Read Process

- Gateway read is started by the dispatcher and checked by it periodically.
- The gateway reader receives all RFC requests and hands them over to a DIA WP; the processing takes place there.

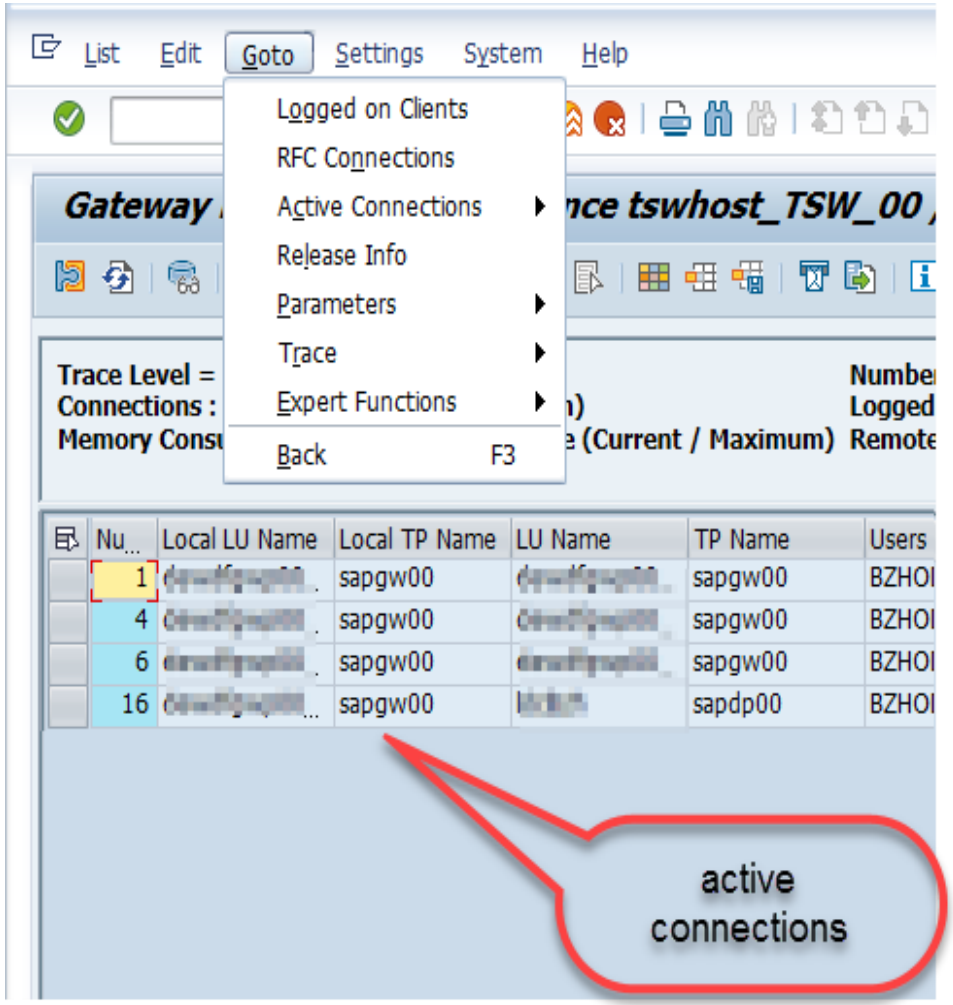


Fundamentals of SAP Gateway

Architecture of the gateway (2)

Gateway Monitor

- The gateway monitor (transaction SMGW) is used to analyze and administer the gateway. When you start it, you initially get a list of active connections.
- You can call up all the other monitor functions via a menu. These are among others:
  - Display Logged-On Clients
  - Display and Control Existing Connections
  - Display Gateway Release Information
  - Display Parameters and Attributes of the Gateway
  - Change Gateway Parameters
  - Activate Traces
  - Expert Functions



Fundamentals of SAP Gateway

Architecture of the gateway (3)

Gateway Monitor

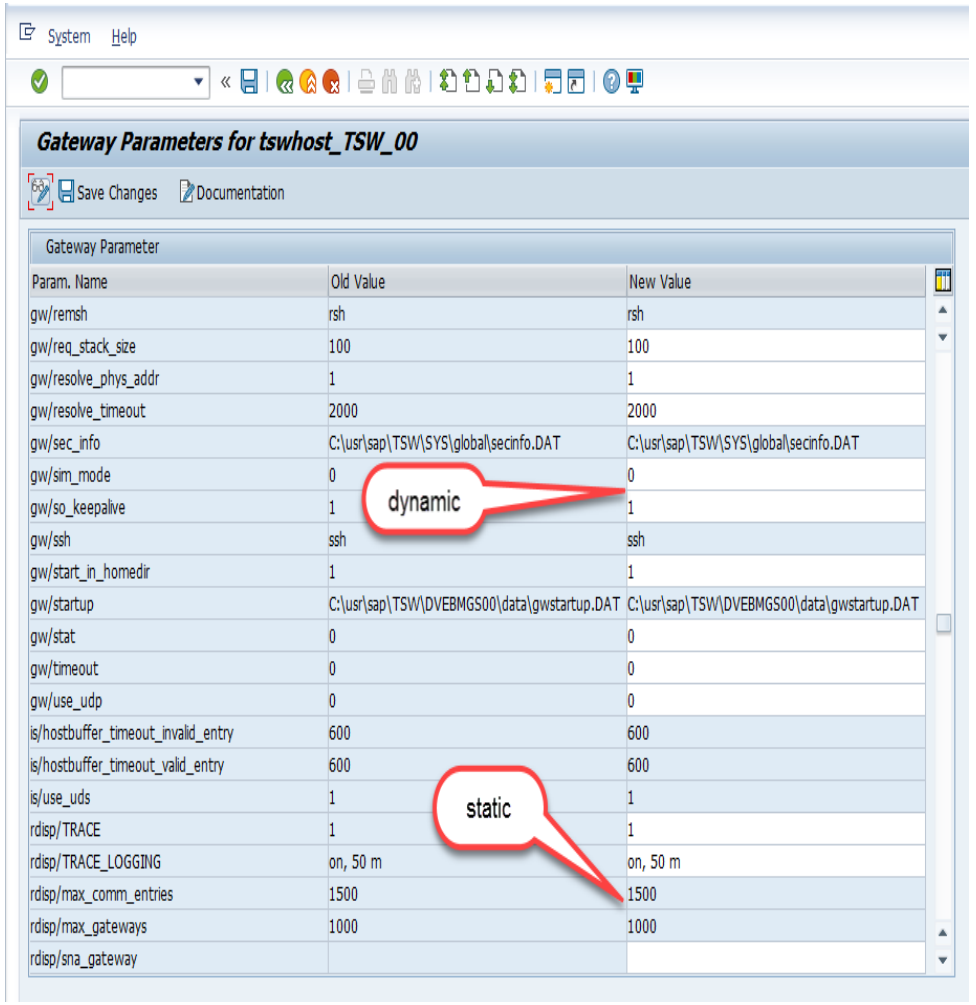
- You can also monitor the gateway at operating system level. Use program gwmon.
- It has a reduced set of functionality compared to SMGW.

```
Gateway monitor, connected to tswhost / sapgw00
Main menue
------------------------------------------------
  1 : display connection table
  2 : display work process table
  3 : display client table
  4 : display remote gw table
  5 : connection attributes
  6 : statistics
  7 : gateway parameters and attributes
  8 : gateway release info
  9 : security information
 10 : expert functions
  + : increase gateway trace
  - : decrease gateway trace
  q - quit
-->
```

Fundamentals of SAP Gateway

Configuring the gateway

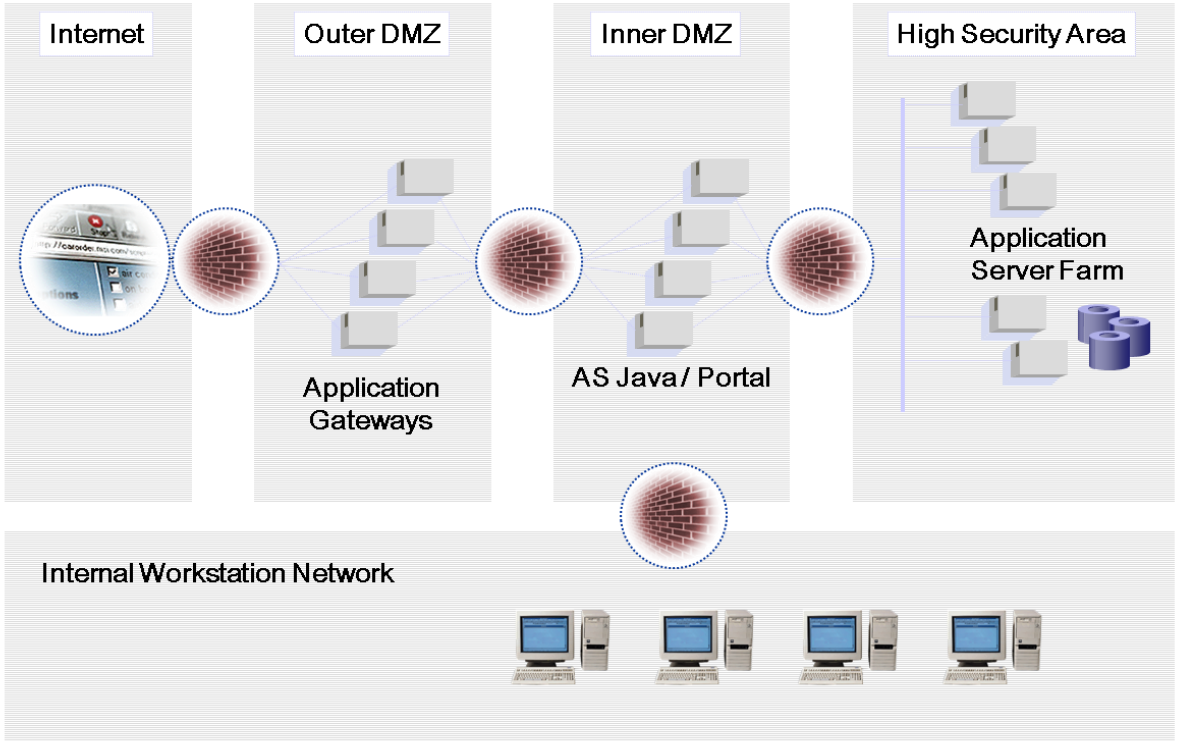
- The installation of a gateway for TCP/IP connections within an instance of an SAP system is standard.
- As with all SAP programs, the gateway can be controlled by parameters.
- The gateway reads the parameters from the SAP profile like every other process.
- Changes to static parameter values (blue rows) only take effect when you restart the system. Dynamic parameter values (white rows), on the other hand, can be changed during runtime.



Fundamentals of SAP Gateway

Security settings in the gateway (1)

- SAP Gateway is an interface between the application server and other SAP systems or programs. Application servers and database hosts are in the same network segment. This network is secured from external access through a demilitarized zone (DMZ).
- RFC communication via the SAP Gateway to remote systems / programs via the Internet is in principle unsecure if no further actions are taken.



Fundamentals of SAP Gateway

Security settings in the gateway (2)

System administrators have several options to configure external communication of the gateway to make it more secure:

- Configuring support of Secure Network Communication (SNC) components
- Configuring network-based access control lists (ACL)
- Configuring the startup of connections between the gateway and external programs to make them more secure
  - Logging-based configuration
  - Restrictive configuration (secure configuration)

Fundamentals of SAP Gateway

SNC support (1)

Configuring support of SNC components

- The parameter snc/enable specifies whether the system incl. the gateway is to support SNC. snc/enable = 0 → no SNC connections are accepted.
- The gateway checks whether connections to non-SNC programs are permitted. snc/permit_insecure_start = 1 → connections to non-SNC programs are permitted.

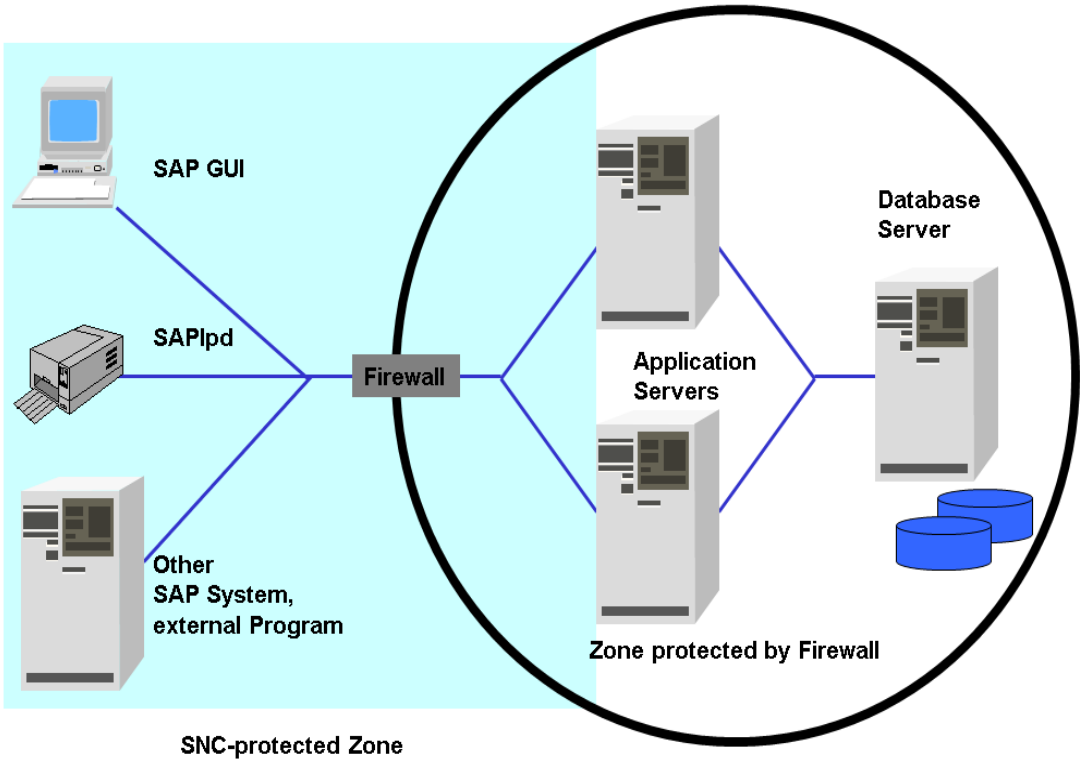
SNC-enabled port: 48XX

Non-SNC port: 33XX

Please note: Establishing an SNC-protected connection is time-consuming, and it will therefore have an impact on performance.

See also:

Recommendations regarding SNC configuration

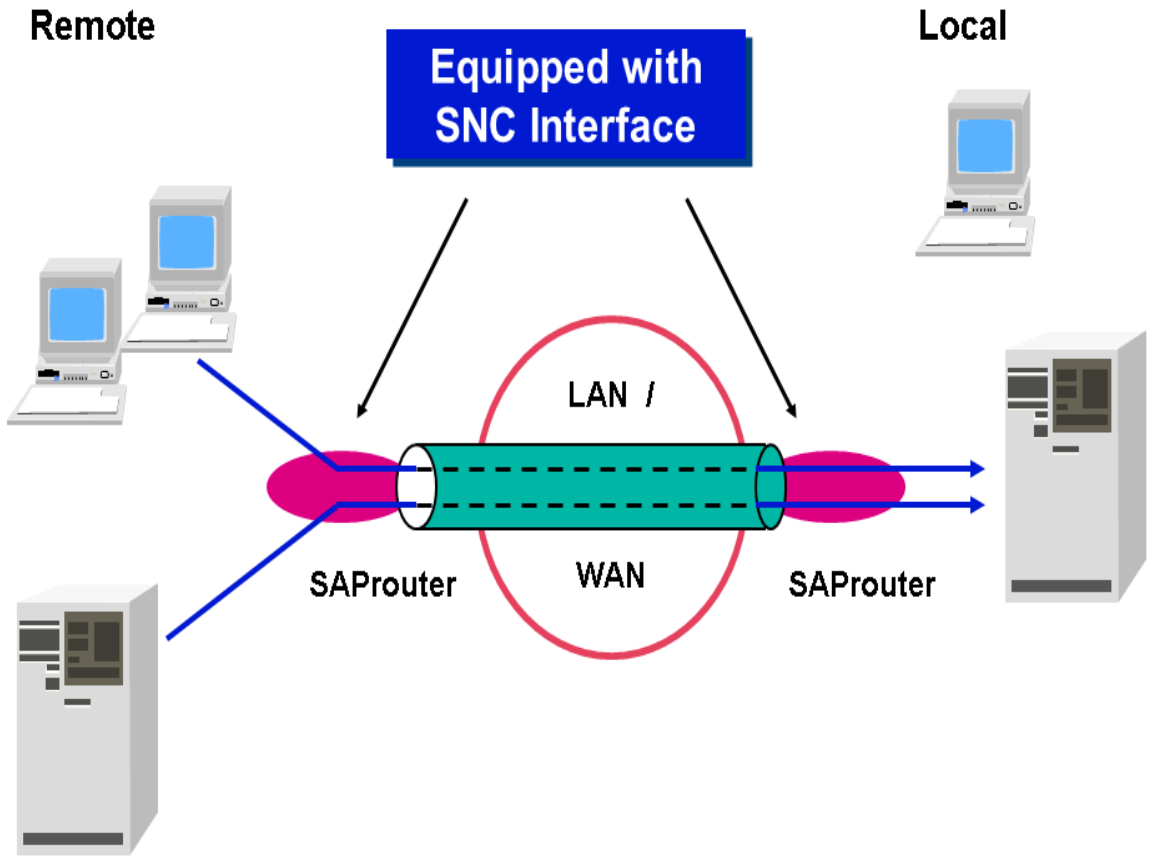


Fundamentals of SAP Gateway

SNC support (2)

Configuring support of SNC components

As an alternative to SNC support, you can also secure communication between SAP Gateways of different SAP systems by using SAP routers. They take on the SNC encryption and SNC encoding tasks.



See also:

Configuring SNC: SAProuter → SAProuter

Fundamentals of SAP Gateway

Secure configuration (1)

Configuring connections between the gateway and external programs to make them more secure

To ensure the SAP Gateway operates more securely, be especially aware of interaction with external programs. You can configure the gateway to ensure that undesirable external programs cannot be run.

There are two ways to do this:

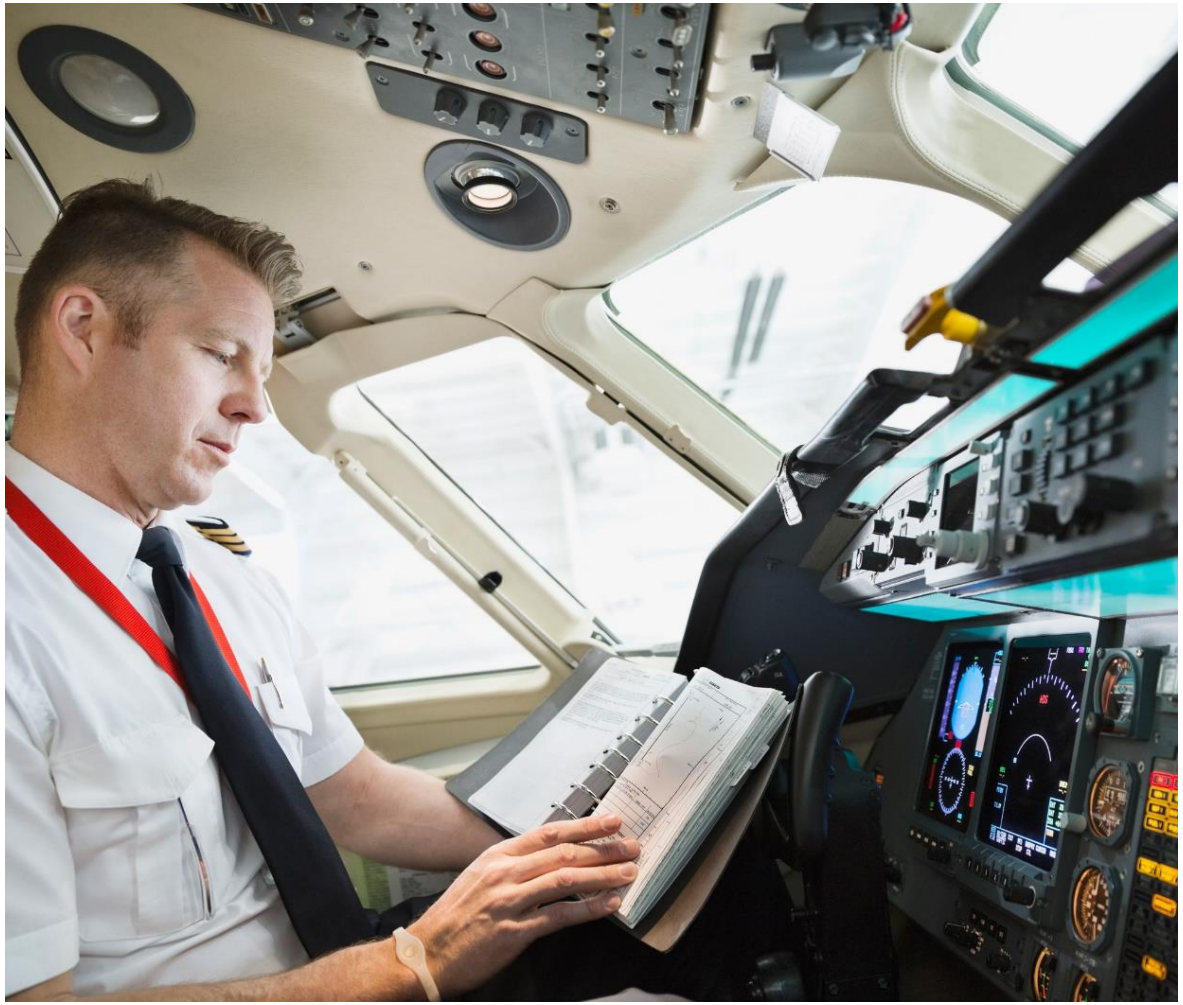
- Logging-based configuration
- Restrictive configuration (secure configuration)

Fundamentals of SAP Gateway

Secure configuration (2)

Logging-based configuration

To ensure SAP programs required for system operation are not blocked by a configuration that is too restrictive, you should configure the security files to enable all connections, and monitor the gateway using gateway logging. This way, you get an overview of which programs are to be allowed, and can then edit the secinfo and reginfo configuration files accordingly.



See also:

Setting Up Gateway Logging

Fundamentals of SAP Gateway

Secure configuration (3)

Restrictive configuration (secure configuration)

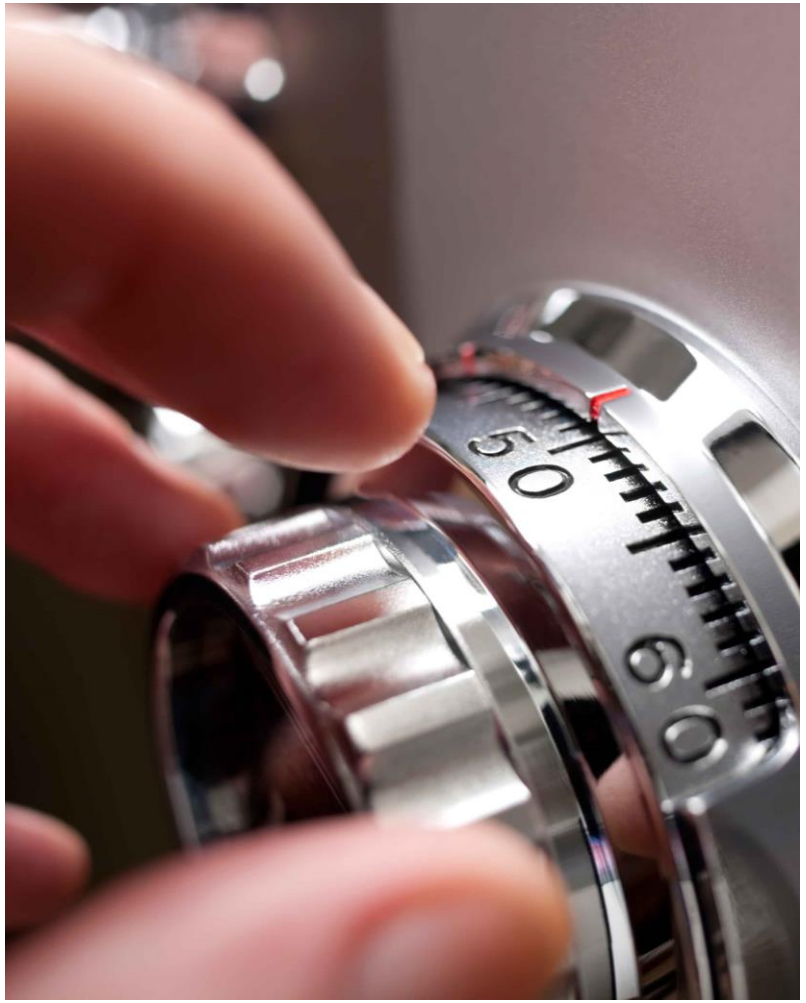
You configure the gateway so that initially only system-internal programs can be started and registered. After that, you can add programs you want to allow to the secinfo and reginfo configuration files.

To set up the recommended secure SAP Gateway configuration, proceed as follows:

- Check if parameter gw/acl_mode = 1 (default) is set
- Check the secinfo and reginfo files
- Extend these files as required

See also:

- SAP Note 1850230 - GW: "Registration of tp <program ID> not allowed"
- SAP Note 2145145 - User is not authorized to start an external program



Thank you.

Contact information:

open@sap.com

Week 2: Memory Management and Gateway Service

Unit 4: SAP Gateway Security Configuration

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SAP Gateway Security Configuration

Tips

General tips for reginfo and secinfo

- The first line of the reginfo / secinfo file should be “#VERSION=2”
- The first letter of the rule can be either P (for Permit) or D (for Deny)
- Each line must be a complete rule, i.e. you cannot break the rule into two or more lines
- The gateway will apply the rules in the same order as they appear in the file, and only the first matching rule will be used
  except for registered programs: all ACCESS info of all lines will be used if the TP name matches
- Each instance should have its own security files, with their own rules, as the rules are applied by the gateway process of the local instance; however a central file can be used as well
- The keyword “local” means “the local server”; the keyword “internal” means “all servers that are part of this SAP system”

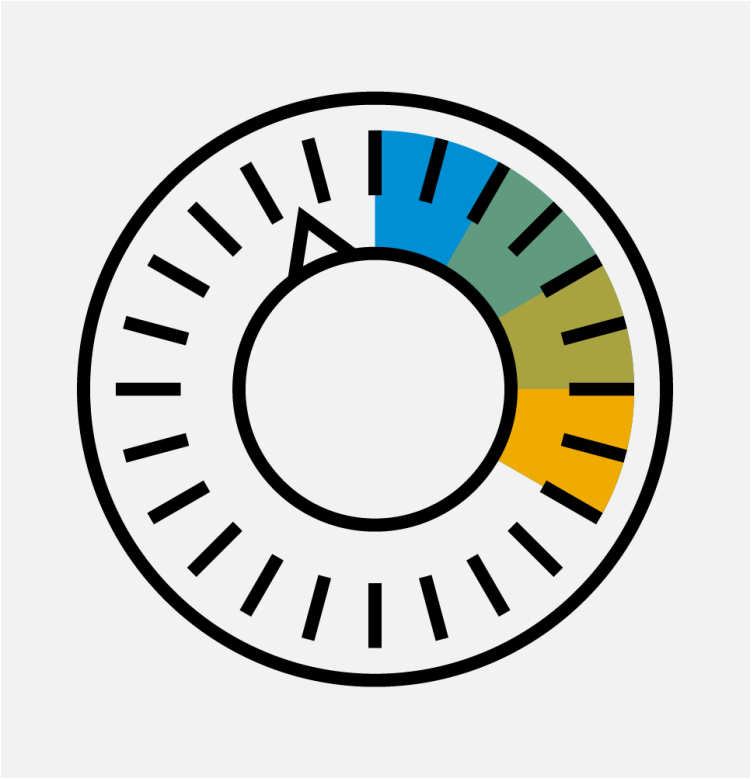
See also: SAP Note 1408081 - Basic settings for reg_info and sec_info

SAP Gateway Security Configuration

ACLs

reginfo and secinfo

- The reginfo file has rules related to the registration of external programs (systems) to the local SAP instance
- The secinfo file has rules related to the start of programs by the local SAP instance



Default location/name:

- gw/sec_info = $(DIR_DATA)/secinfo
- gw/reg_info = $(DIR_DATA)/reginfo

When the gateway is started, it reads both security files.

You can make dynamic changes by changing, adding, or deleting entries in the reginfo / secinfo file. Then the file can be immediately activated by reloading the security files.

SAP Gateway Security Configuration

reginfo (1)

General reginfo rule definition

- P (permit) / D (denied)
- TP=<program name>
- HOST=<comma separated list of hosts that can register the program>
- ACCESS=<comma separated list of hosts that can communicate with the program>
- CANCEL=<comma separated list of hosts that can cancel this registration>

Usually:

- ACCESS is a list with at least all SAP servers from this SAP system; this can be replaced by the keyword “internal”
- CANCEL is a list with all SAP servers from this system, or the keyword “internal”, and also the same servers as in HOST

Example

```
#VERSION=2
P TP=cpict4 HOST=10.18.210.140
D TP=* HOST=10.18.210.140
P TP=cpict2 ACCESS=ld8060,localhost CANCEL=ld8060,localhost
P TP=cpict4
P TP=* USER=* HOST=internal
```

SAP Gateway Security Configuration

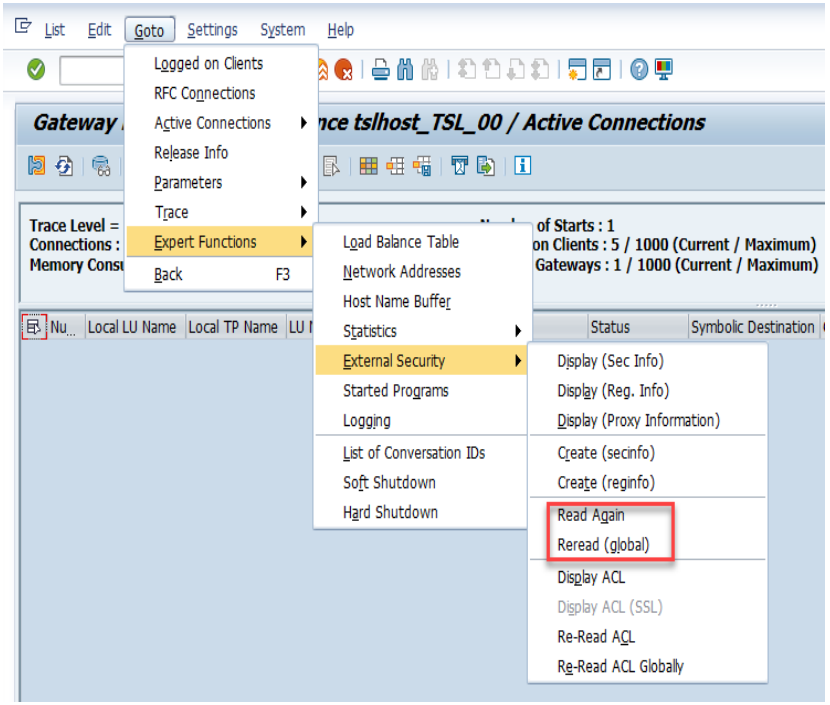
reginfo (2)

Changes to the reginfo rules

- Changes are not immediately effective, even after having reloaded the file (transaction SMGW, menu Goto → Expert functions → External security → Maintain ACL Files, then Goto → Reread); after reloading, de-register all existing registrations of the affected program, and re-register it again
- For a standalone gateway installation, you can reload the security files (reginfo and secinfo) without having to restart the gateway or the ASCS instance:

  gwmon pf=<path to instance profile>

  there access “m” Menu → “9” security information → “4” refresh sec.



See also (videos included):

- SAP KBA 1850230 - GW: "Registration of tp <program ID> not allowed”
- SAP KBA 2075799 - ERROR: Error (Msg EGW 748 not found)

SAP Gateway Security Configuration

secinfo

General secinfo rule definition

- P (permit) / D (denied)
- TP=<program name>
- USER=<username that is allowed to start the program>
- HOST=<comma separated list of hosts the program can be started on>
- USER-HOST=<comma separated list of hosts the users can start the program from>

See also (video included):

- SAP KBA 2145145 - User is not authorized to start an external program

Example

```
#VERSION=2
D HOST=* USER=* TP=/bin/sap/cpict4
P HOST=* USER=* TP=/bin/sap/cpict*
P TP=hugo HOST=local USER=*
P TP=* USER=* USER-HOST=internal HOST=internal
```

SAP Gateway Security Configuration

Additional ACLs (1)

Additional Access Control Lists

General gw/acl_file definition

- Format: <permit | deny> <ip-address[/mask]> [trclevel] [# comment]
- Controls which IP addresses are allowed to open a TCP/IP connection to this gateway
- The rules are checked sequentially from the “top down”; the first relevant rule determines the result (“first match”)
- Applied before the reginfo rules
- ip-address: IPv4 decimal, '.' separated: e.g. 10.11.12.13
  IPv6 hexadecimal, ':' separated. '::' is supported
- mask : if specified, it must be a subnetwork prefix mask
- trclevel: with which ACL hits (matches of addresses based on the subnetwork mask) are written to the relevant trace file

Default location/file: empty

Example

```
permit 10.1.2.0/24          # permit client network

permit 192.168.7.0/24       # permit server network

permit 10.0.0.0/8 1         # screening rule

                            # (learning mode, trace-level 1)

permit 2001:db8::1428:57ab # permit IPv6 host

deny   0.0.0.0/0            # deny the rest
```

SAP Gateway Security Configuration

Additional ACLs (2)

Additional Access Control Lists

General gw/prxy_info definition:

- P (permit) / D (denied)
- SOURCE = <list of host names and port separated by comma where TCP/IP connection is allowed from>
- DEST = <list of host names and port separated by comma where TCP/IP connection is allowed to>

Default location/file:

- $(DIR_DATA)/prxyinfo

Example

```
P SOURCE=saphosta DEST=saphostb

D SOURCE=saphosta:3300 DEST=saphostb

D SOURCE=10.18.54.56 DEST=10.18.55.*

P SOURCE=*.sap.com DEST=*.sap.com

P SOURCE=*.sap.com,*sap.corp DEST=*
```

SAP Gateway Security Configuration

Simulation

Simulation Mode

- gw/sim_mode = 0 | 1
- Applies to the registration action only
- If activated (value is 1): after the external program was registered, the ACCESS and CANCEL options will be followed as defined in the rule, if a rule exists

See also:

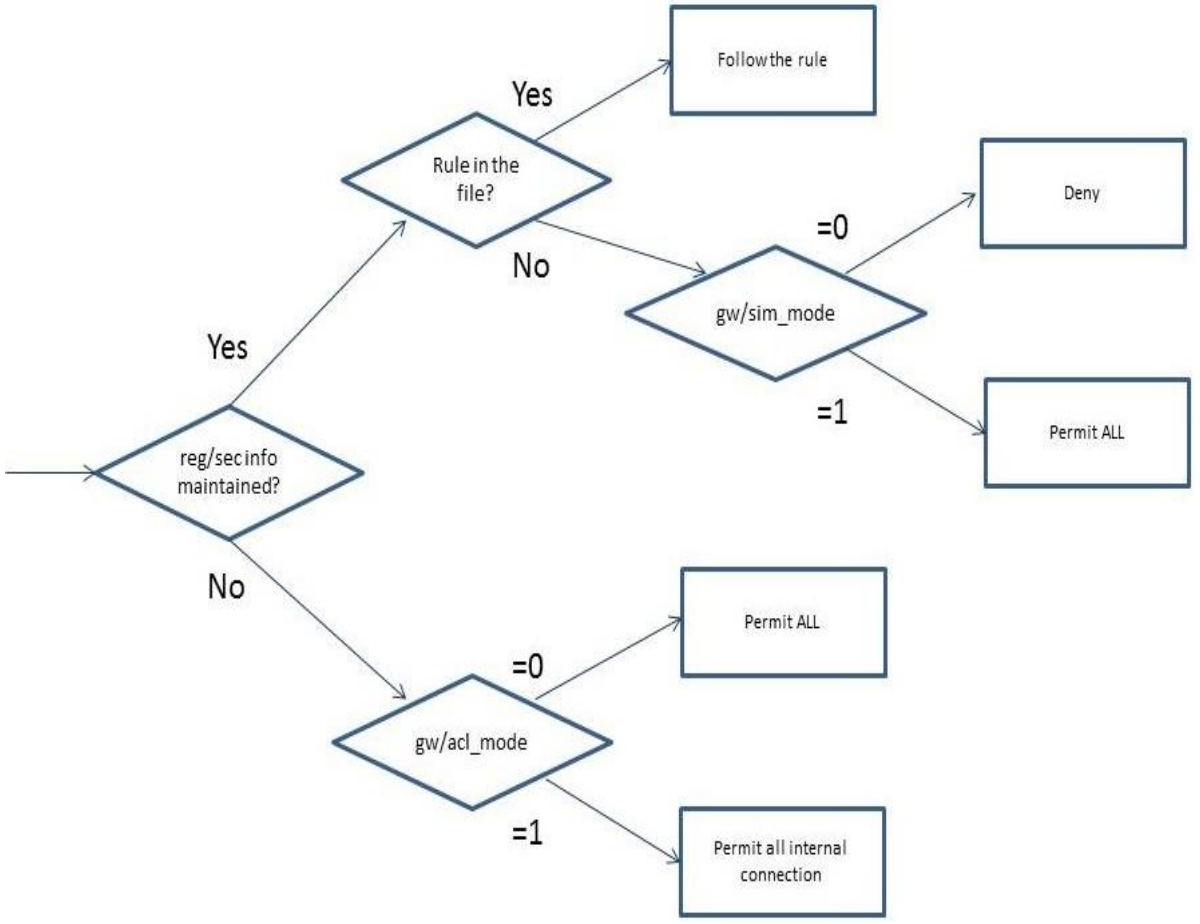
SAP Note 1689663 - GW: Simulation mode for reg, sec, and prxy_info

SAP Gateway Security Configuration

Parameters

Gateway behavior vs. gateway parameters

- gw/acl_mode = 0 | 1
  The parameter defines the behavior of the gateway if no ACL file (gw/sec_info, gw/reg_info) exists.
  If the above ACL files are maintained, the value of this parameter is irrelevant.
- gw/sim_mode = 0 | 1
  Activates/Deactivates the simulation mode



SAP Gateway Security Configuration

Logging (1)

Gateway logging

For standalone gateway (ASCS)

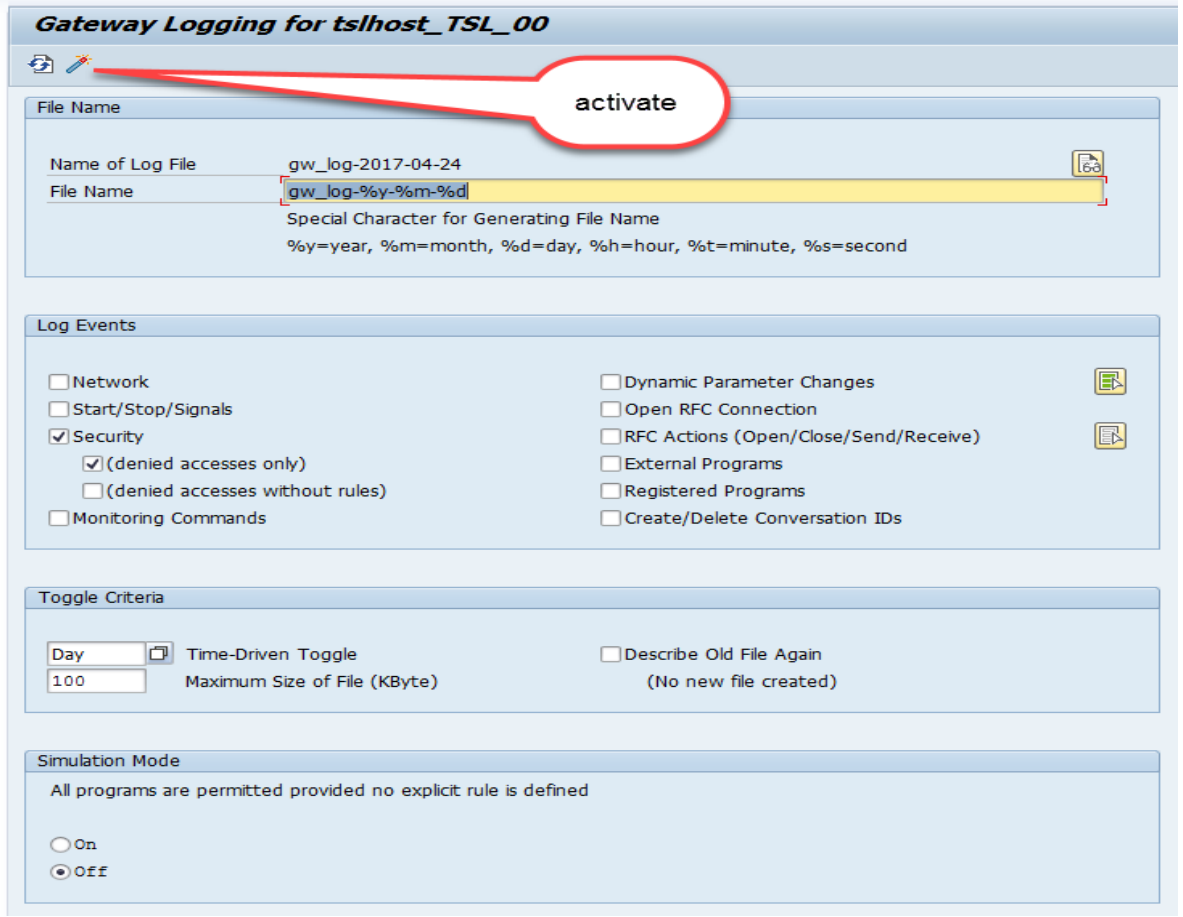
- Activate it by gw/logging= LOGFILE=<name> ACTION=[TERSMPXVCO] [MAXSIZEKB=n] [SWITCHTF=t] [FILEWRAP=on]

For ABAP:

- Start it from SMGW → Goto → Expert Functions → Logging
- Define File Name, Log Events, Toggle Criteria, Simulation Mode (switch on/off simulation mode)
- Activate logging by “magic wand”

See also:

- SAP Note 910919 - Setting up Gateway logging
- Setting Up Gateway Logging (Help portal)



SAP Gateway Security Configuration

Logging (2)

Gateway logging

Log file example:

- default name: gw_log-yyyy-mm-dd
- accepted / denied records
- for reginfo / secinfo

```
S Wed Oct 10 2007 11:07:38:196 reginfo accepted server: TP=name, HOST=ldxxx.fqn.dom.ain (ip.ad.dr.ess)
S Wed Oct 10 2007 11:08:14:974 reginfo accepted server: TP=IGS.WDFxxx, HOST=wdfxxx.fqn.dom.ain (ip.ad.dr.ess)
S Wed Oct 10 2007 11:08:20:103 secinfo accepted: USER=rehm, USER-HOST=ldxxx.fqn.dom.ain (ip.ad.dr.ess), HOST=ldxxx.fqn.dom.ain (ip.ad.dr.ess), TP=/usr/sap/BIN/SYS/exe/run/tp
S Wed Oct 10 2007 11:09:00:497 secinfo accepted: USER=rehm, USER-HOST=ldxxx.fqn.dom.ain (ip.ad.dr.ess), HOST=ldxxx.fqn.dom.ain (ip.ad.dr.ess), TP=/usr/sap/BIN/SYS/exe/run/tp
S Wed Oct 10 2007 11:09:19:974 reginfo accepted server: TP=IGS.WDFxxx, HOST=wdfxxx.fqn.dom.ain (ip.ad.dr.ess)
S Wed Oct 10 2007 11:10:24:975 reginfo accepted server: TP=IGS.WDFxxx, HOST=wdfxxx.xxx.xxx.xxx (ip.ad.dr.ess)
S Wed Oct 10 2007 11:11:04:780 secinfo accepted: USER=UNAME, USER-HOST=ldxxx.fqn.dom.ain (ip.ad.dr.ess), HOST=ldxxx.fqn.dom.ain (ldxxx) (ip.ad.dr.ess), TP=/usr/sap/BIN/SYS/exe/run/tp
S Wed Oct 10 2007 11:11:29:976 reginfo accepted server: TP=IGS.WDFxxx, HOST=wdfxxx.fqn.dom.ain (ip.ad.dr.ess)
S Wed Oct 10 2007 11:11:34:347 secinfo accepted: USER=UNAME, USER-HOST=ldxxx.fqn.dom.ain (ip.ad.dr.ess), HOST=ldxxx.fqn.dom.ain (%%SAPGUI%%) (ip.ad.dr.ess), TP=gnetx.exe
S Wed Oct 10 2007 11:11:55:536 secinfo accepted: USER=UNAME, USER-HOST=ldxxx.fqn.dom.ain (ip.ad.dr.ess), HOST=ldxxx.fqn.dom.ain (ldxxx) (ip.ad.dr.ess), TP=sapxpg
S Wed Oct 10 2007 11:12:06:166 secinfo accepted: USER=UNAME, USER-HOST=ldxxx.fqn.dom.ain (ip.ad.dr.ess), HOST=ldxxx.fqn.dom.ain (ldxxx) (ip.ad.dr.ess), TP=sapxpg
S Wed Oct 10 2007 11:12:34:977 reginfo accepted server: TP=IGS.WDFxxx, HOST=wdfxxx.fqn.dom.ain (ip.ad.dr.ess)
S Wed Oct 10 2007 11:13:39:977 reginfo accepted server: TP=IGS.WDFxxx, HOST=wdfxxx.fqn.dom.ain (ip.ad.dr.ess)
S Wed Oct 10 2007 11:13:40:177 secinfo denied: USER=uname, USER-HOST=ldxxx.fqn.dom.ain (ip.ad.dr.ess), HOST=ldxxx.fqn.dom.ain (ip.ad.dr.ess), TP=/priv/uname/p4/bas/CGK/workU/_out/name
S Wed Oct 10 2007 11:13:40:277 reginfo denied server: TP=name, HOST= ldxxx.fqn.dom.ain (ip.ad.dr.ess)
```

SAP Gateway Security Configuration

Additional features

Additional security features

- Deactivated: gw/reg_no_conn_info = 0
- Activated: gw/reg_no_conn_info = 1 | 64 | 65 | 128 | 129 | 192 | 193

Decimal Value	Security feature to be activated (Note Number - Short Text)
1	SAP Note 1298433 - Bypassing security in reginfo & secinfo
64	SAP Note 1697971 - GW: Enhancement when starting external programs
128	SAP Note 1848930 - GW: Strong gw/prxy_info check

You can activate the features by summarizing the “Decimal Values” associated with “Security feature to be activated”. Example:

- Value 1 activates the security feature of SAP Note 1298433
- Value 64 activates the security feature of SAP Note 1697971
- Value 65 (=64+1) will activate both of the above features
- and so on...
- Value 193 (=128+64+1) activates all the three features available as of kernel 7.4

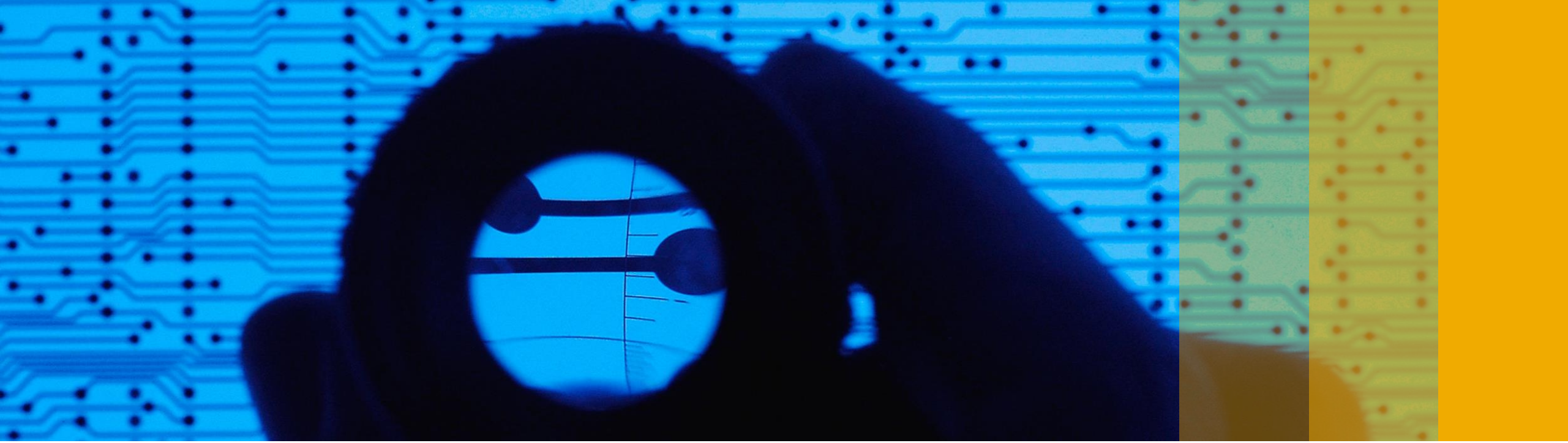
See also:

- SAP Note 1444282 - gw/reg_no_conn_info settings
- SAP Note 2269642 - GW: Validity of parameter gw/reg_no_conn_info

Thank you.

Contact information:

open@sap.com



Week 2: Memory Management and Gateway Service

Unit 5: RFC Interface Scenarios

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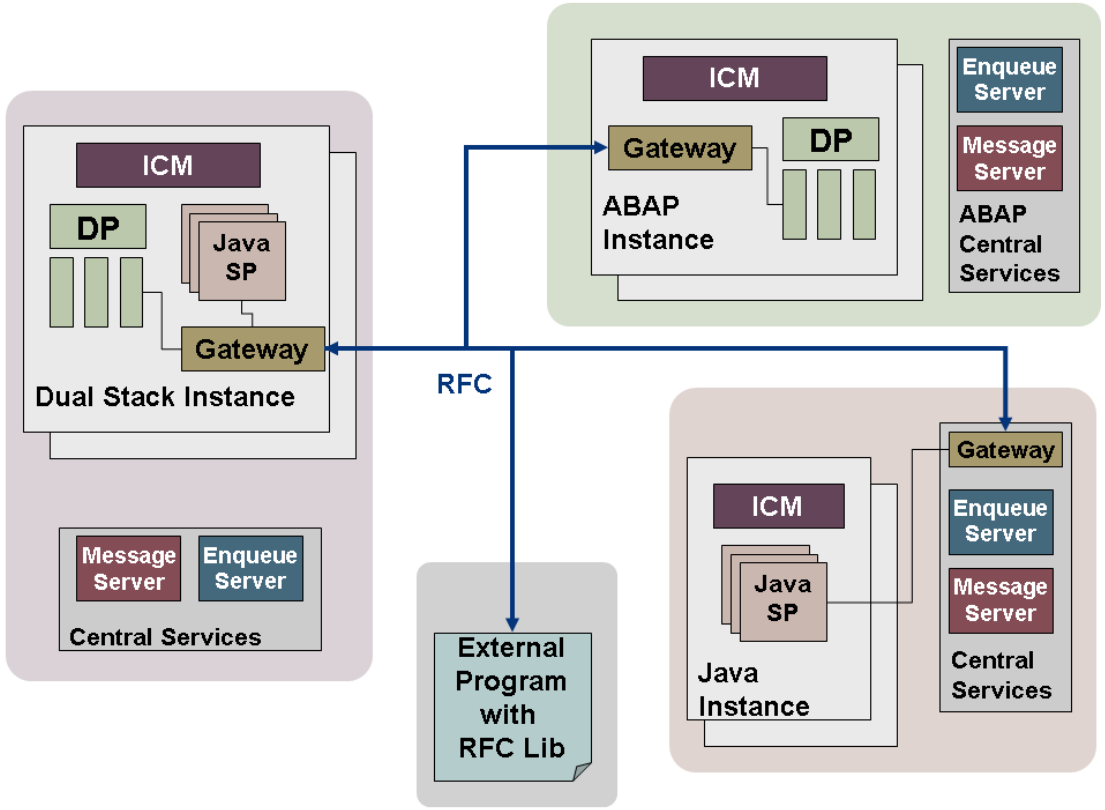
RFC Interface Scenarios

RFC fundamentals

RFC connection fundamentals

- client: where the RFC call is initiated from
- server: where the RFC call is processed
- “leading” gateway: the local gateway of the client by default, unless specified otherwise in SM59 at “Gateway Options”
- CA block: communication block, required for all requests with associated data
- streaming: CPIC streaming is used for the RFC data transfer; this is a performance optimization rdisp/cpicStreaming (on), available only for kernel >= 7.4



RFC Interface Scenarios

sRFC, aRFC

Synchronous RFC (sRFC) on ABAP level

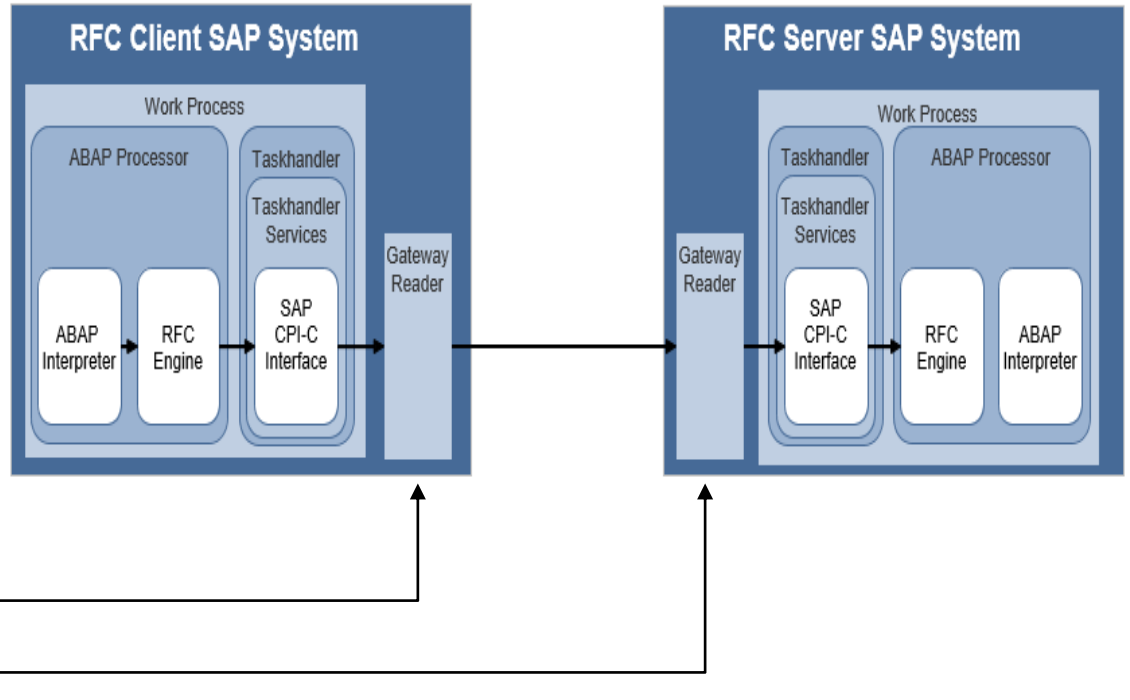
- wait for the answer of server at client side
- synchronizing package when target taskhandler received the CA block (= one round trip per CA block)

Asynchronous RFC (aRFC) on ABAP level

- don’t wait for the answer of server at client side

Possible scenarios

- "leading" gateway in aRFC on the client side
- "leading" gateway in aRFC on the server side



RFC Interface Scenarios

Synchronization

Synchronization points in RFC communication

Taskhandler point of view when sRFC:

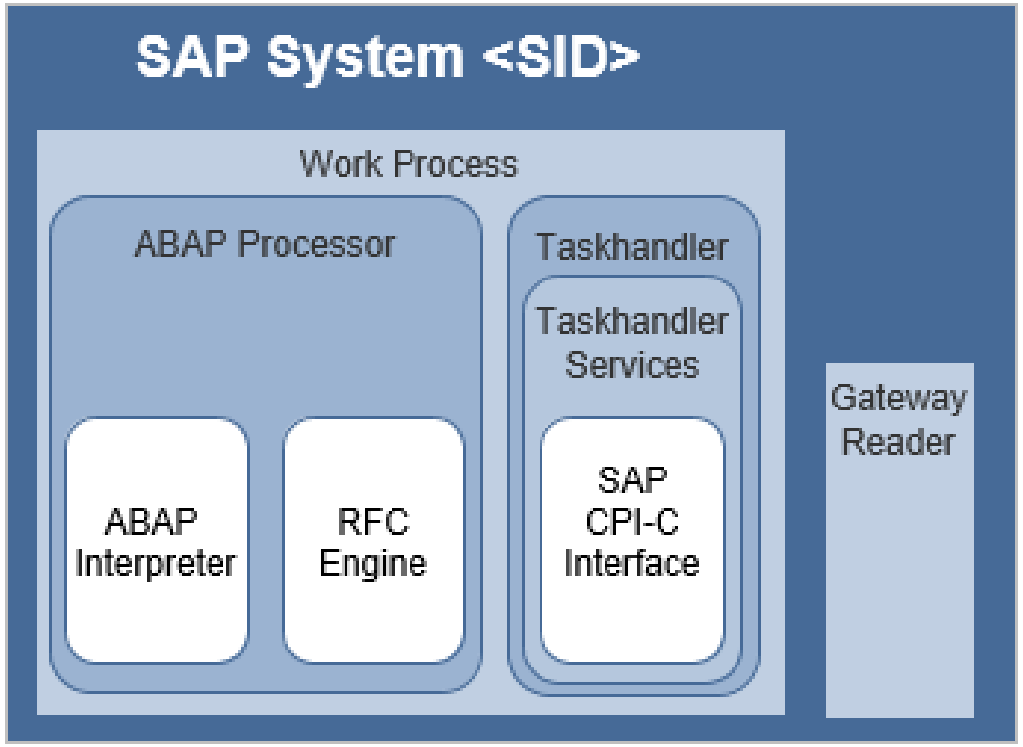
- always sync packages between "leading" gateway and server taskhandler for each CA block

Taskhandler point of view when aRFC:

- for kernel < 7.4: sync package inserted after every 5 packages
- for kernel >= 7.4: sync package inserted after rdisp/max_async_send packages (default value: 20)

Gateway point of view:

- “leading” gateway sync when buffer limit is reached
  for kernel < 7.4: gw/req_stack_size (default value: 30)
  for kernel >= 7.4: gw/req_stack_size (default value: 100)



RFC Interface Scenarios

Performance

Connection speed <v> on network with round-trip time <t>

Synchronous RFC (sRFC)

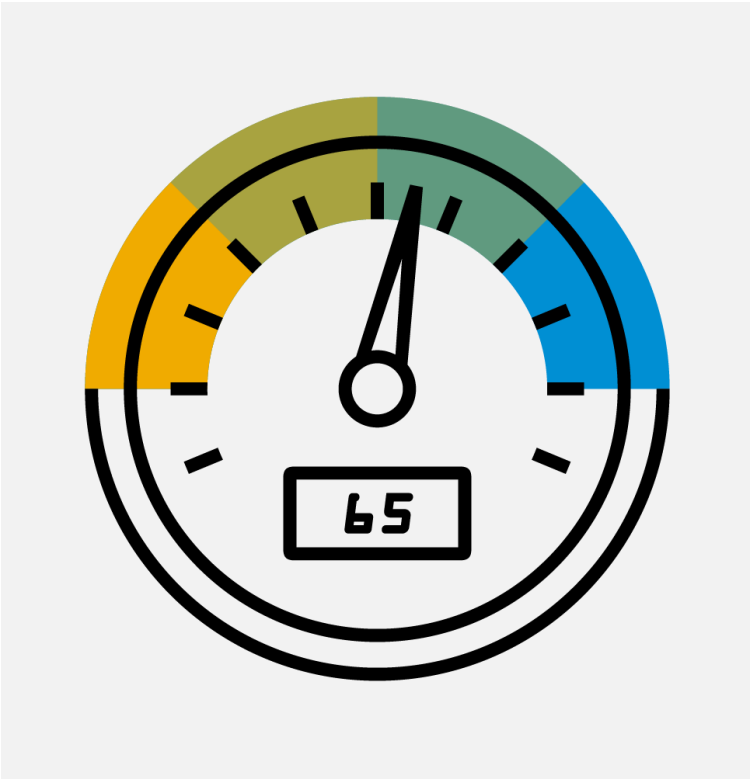
- one round trip per CA block: 1block/<t> = 1<v>

Asynchronous RFC (aRFC)

- “leading” gateway on the client end: 1block/<t> = 1<v> (like sRFC)
- “leading” gateway on the server end:
  - for kernel < 7.4: every 5 packages, therefore
    5 * <v> = 5<v> (versus 1<v> when leading GW on client end)
  - for kernel >= 7.4: rdisp/max_async_send packages, therefore
    20 * <v> = 20<v> (versus 1<v> when leading GW on client end)

Above applies only to mass data transfer in **one** direction.

What it means? With **default** settings, the streaming is 4 times faster, and with proper configuration it can be improved further.



RFC Interface Scenarios

RFC lifetime

Lifetime of an RFC connection

- There is no timeout for RFC.
- The RFC session remains active as long as:
  - the (ABAP) client session exists
  - the server session is explicitly closed

The RFC session is closed by:

- terminating the report (the transaction), e.g. cancel via SM50, SM04, SMGW, ...
- calling the RFC_CONNECTION_CLOSE function module

Every application is responsible for the administration of its RFC calls and the respective RFC contexts.

RFC Interface Scenarios

"On Hold" RFC

Observations in SAP system:

- sessions in SM50 with status "On Hold" "RFC response"
- sessions in SM04 with last request a long time ago

What does it point to?

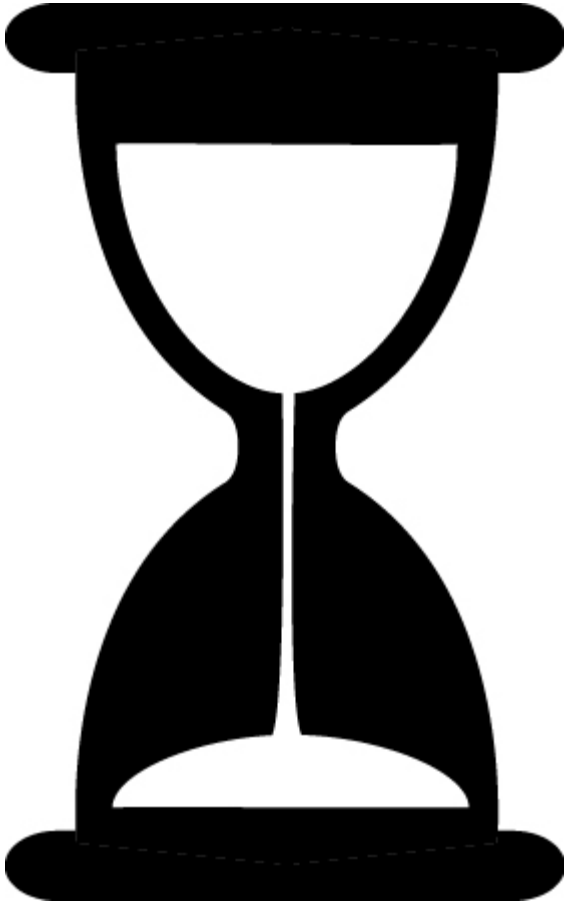
a) the client has been waiting for a server response for a long time

b) a non-dialog process cannot be rolled out during the RFC communication and always displays the status "On Hold" "RFC response"

c) the communication changes so fast that other conversation IDs are connected to it

Is this really a problem situation?

- a) the server needs further analysis
- b) and c) does not constitute an error

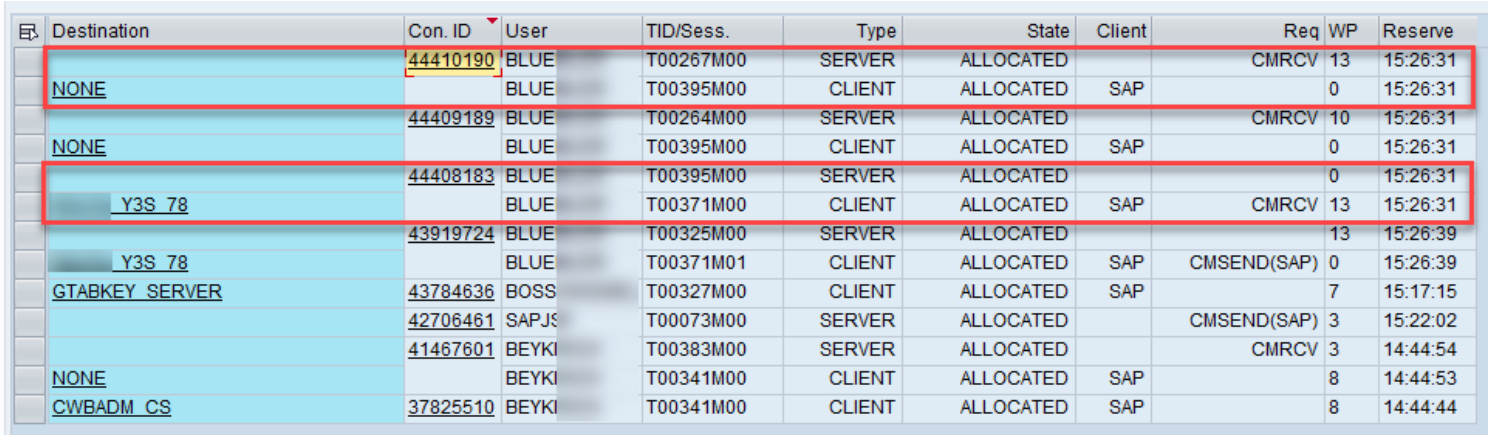


RFC Interface Scenarios

Information (1)

How to find relevant information?

- SM51
  - Highlight instance
  - Menu path Goto →
    Information →
    Communication →
    RFC connection
  - Sort by “ConvID”
    (appears only at RFC client side)
    See relations



Destination	Con. ID	User	TID/Sess.	Type	State	Client	Req	WP	Reserve
	44410190	BLUE	T00267M00	SERVER	ALLOCATED		CMRCV	13	15:26:31
NONE		BLUE	T00395M00	CLIENT	ALLOCATED	SAP		0	15:26:31
	44409189	BLUE	T00264M00	SERVER	ALLOCATED		CMRCV	10	15:26:31
NONE		BLUE	T00395M00	CLIENT	ALLOCATED	SAP		0	15:26:31
	44408183	BLUE	T00395M00	SERVER	ALLOCATED			0	15:26:31
Y3S_78		BLUE	T00371M00	CLIENT	ALLOCATED	SAP	CMRCV	13	15:26:31
	43919724	BLUE	T00325M00	SERVER	ALLOCATED			13	15:26:39
Y3S_78		BLUE	T00371M01	CLIENT	ALLOCATED	SAP	CMSEND(SAP)	0	15:26:39
GTABKEY_SERVER	43784636	BOSS	T00327M00	CLIENT	ALLOCATED	SAP		7	15:17:15
	42706461	SAPJS	T00073M00	SERVER	ALLOCATED		CMSEND(SAP)	3	15:22:02
	41467601	BEYKI	T00383M00	SERVER	ALLOCATED		CMRCV	3	14:44:54
NONE		BEYKI	T00341M00	CLIENT	ALLOCATED	SAP		8	14:44:53
CWBADM_CS	37825510	BEYKI	T00341M00	CLIENT	ALLOCATED	SAP		8	14:44:44

RFC Interface Scenarios

Information (2)

How to find relevant information?

- SM04
  - Select the user session
  - Menu User → Technical information
  - modeinfo[n].cpic_no
    is the number of RFCs spawned by this context

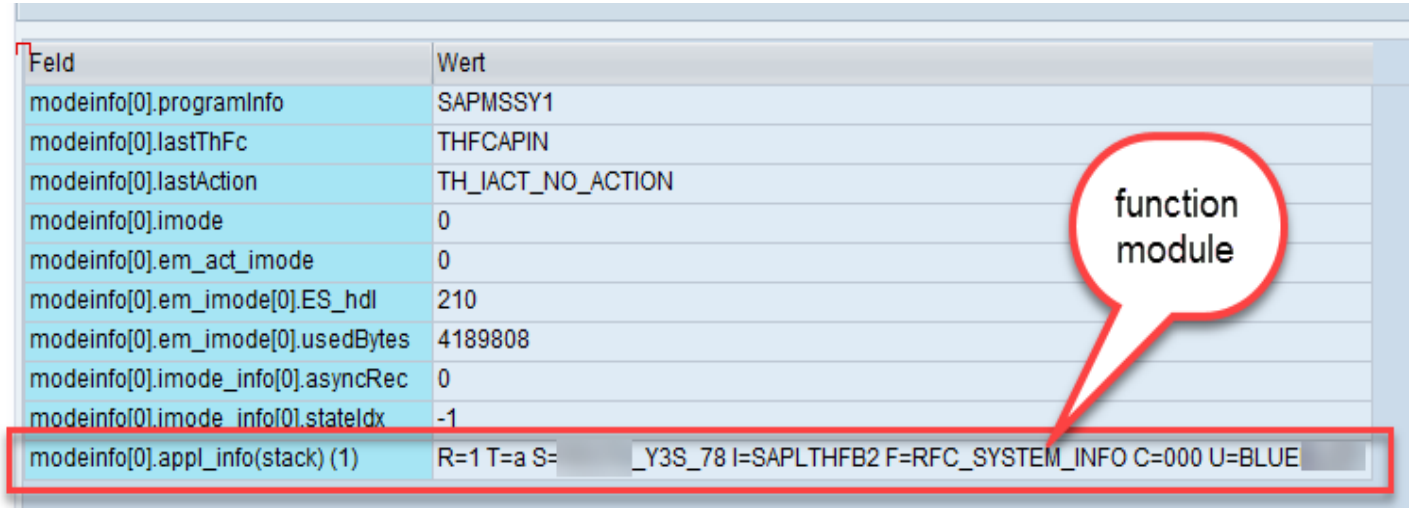
Field	Value
modeinfo[0].em_state	DP_EM_DETACHED
modeinfo[0].eg_state	DP_EM_NO_CONTEXT
modeinfo[0].spa_state	DP_SPA_INITIALIZED
modeinfo[0].enq_state	x0 = NORMAL_ENQ_STATE
modeinfo[0].act_enq_info	0
modeinfo[0].stat_trans_id	5706F04960314E5AE10000000A420F63
modeinfo[0].cpic_no	1
modeinfo[0].conv_id	45042639
modeinfo[0].type	SERVER
modeinfo[0].async_receive	x0 =
modeinfo[0].dest	
modeinfo[0].loc_queue_act_size	0
modeinfo[0].loc_queue_act_appc_size	0
modeinfo[0].type	x41 = NORMAL REM_SERV_NO_CONV
modeinfo[0].last_wp	13
modeinfo[0].diatime	Thu Apr 7 15:34:45 2016

RFC Interface Scenarios

Information (3)

How to find relevant information?

- SM04
  - Select the user session
  - Menu User → Technical information
  - modeinfo[n].appl_info(stack) (m)
    Incl. the name of function module currently executed
    Only for kernel >= 7.4

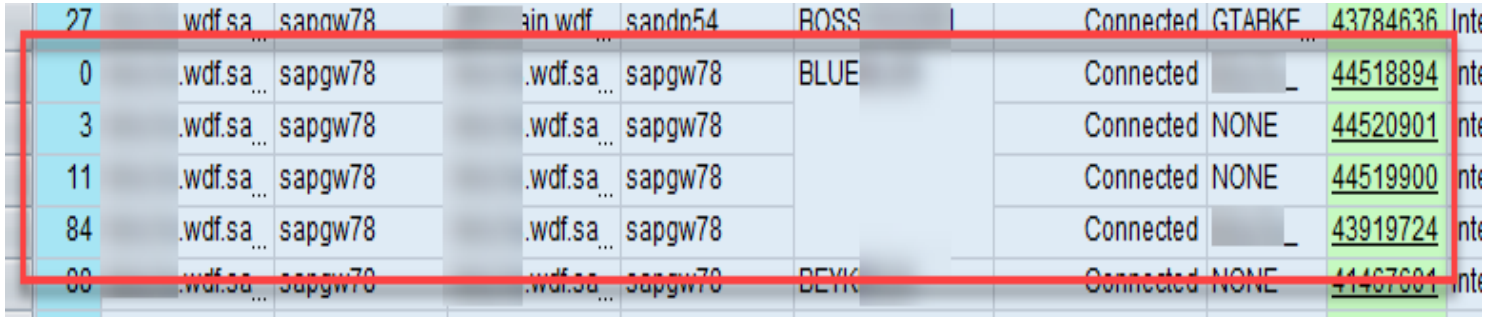


RFC Interface Scenarios

Information (4)

How to find relevant information?

- SMGW
  – Sort by “Users”



27	wdf.sa...	sapgw78	ain.wdf...	sapdp54	BOSS	Connected	GTABKF...	43784636	Inte
0	.wdf.sa...	sapgw78	.wdf.sa...	sapgw78	BLUE	Connected	_	44518894	nte
3	.wdf.sa...	sapgw78	.wdf.sa...	sapgw78		Connected	NONE	44520901	nte
11	.wdf.sa...	sapgw78	.wdf.sa...	sapgw78		Connected	NONE	44519900	nte
84	.wdf.sa...	sapgw78	.wdf.sa...	sapgw78		Connected	_	43919724	nte
88	.wdf.sa...	sapgw78	.wdf.sa...	sapgw78	BEYK	Connected	NONE	44467681	nte

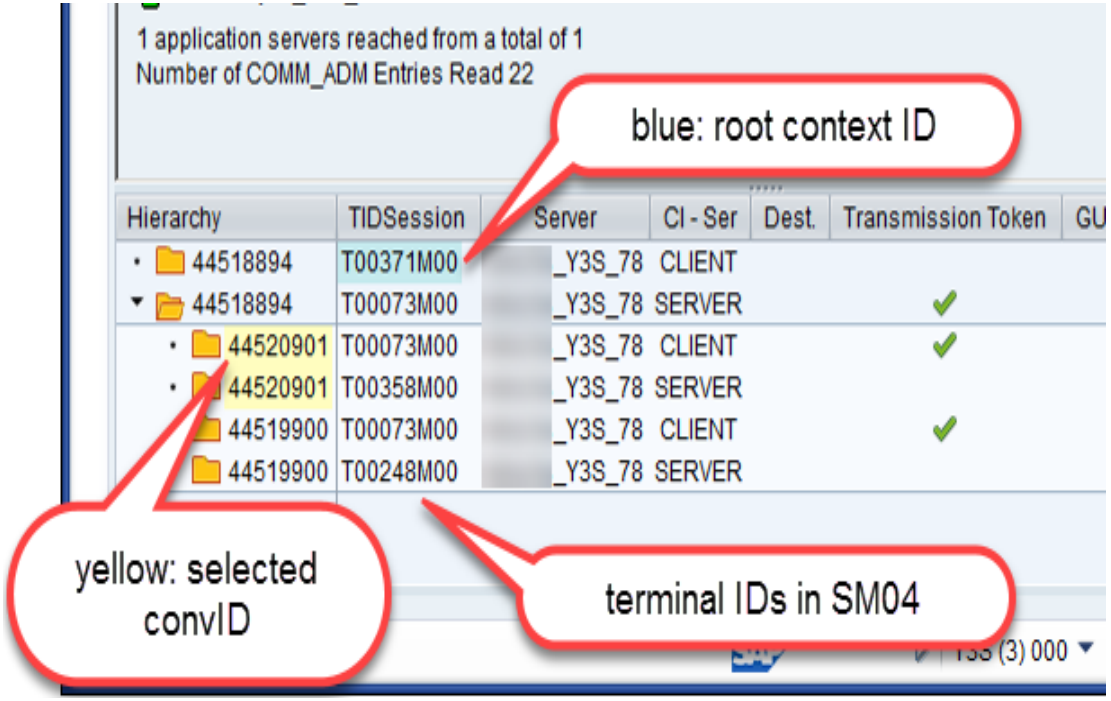
RFC Interface Scenarios

Information (5)

How to find relevant information?

- SM5A, the all-in-one solution
  - Enter the conversation ID
  - Execute the transaction to get RFC Chain Analysis

- See also:
  - SAP KBA 2180934 - Analysis of Workprocess in "On Hold" RFC, or Stopped CPIC status
  - SAP Note 981914 - Using report RSMON000_ANALYSE_CONVID(_ALV), transaction SM5A



Thank you.

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