



**How-to Guide
SAP NetWeaver '04**

How To... Load Balancing For Data Load Processing and Warehouse Management In BW

Version 1.10 – January 2005

**Applicable Releases:
SAP NetWeaver '04
For source system requirements see details in the
document**

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1 Scenario

You have an SAP BW system with several (application) servers. You would like to distribute the workload of the data loads and other data warehouse management activities in a way that fits your needs best. This could mean that you would like to have all processes distributed across all available servers or that you would like to have one dedicated server for these processes.

2 Introduction

SAP uses the terms instance and application server synonymously. In order to avoid misunderstandings we use the term instance for an SAP instance (application server) in this document. For a physical machine we use the term server. Some of the settings described in this document are done on an instance level, some on a server level. If you don't have several instances (of the same SAP system) on one server you don't have to draw this distinction between instance and server when reading this document.

There are a host of functions and settings in the area of load balancing provided by the basis system (Web Application Server). However, these have been designed primarily for SAP's ERP system. Customizing these features for optimal use with SAP BW requires further considerations. The challenges presented with data load processing originate from the fact that many fairly long running processes can be started almost simultaneously. The standard SAP load balancing approach takes the quality of the instances into consideration when distributing the load. This quality is evaluated in regular intervals (five minutes by default). Within one interval a lot of parallel processes may be started on the best instance, using a lot of work processes while the other instances are idle. An optimal distribution of BW OLAP workload or data load resource consumption cannot readily be achieved with this standard method.

Without adequate planning, and under heavy workload (peak) conditions, the risks can increase that hardware becomes a bottleneck; a limited number of servers can become saturated with processes consuming resources, and performance (and stability) can potentially suffer significantly. A successful load balancing approach optimally utilizes the hardware resources that have been allocated to the BW system. Note that this discussion assumes that an adequate sizing has been performed to properly size the SAP BW system (see SAP Service Marketplace alias "quicksizer" for more information).

This document describes load balancing approaches for typical SAP BW activities.

Commonly these activities process large amounts of data. Data (within one process) is split into packages and can thus be processed in parallel on one or across several servers or instances. On the other hand, several processes can run in parallel on one or on several servers or instances. This means that we can have parallel processing (and consequently achieve load balancing) both within one process and across processes.

In our examples we will use a system called AB5 as SAP BW system and a system called QB8 as an SAP source system of AB5. During data load processing, data is extracted from the source system and sent to the target SAP BW system. Other load processes involve the SAP BW system as source system, as well as the target system (for example, DataMarts, activation of data in ODS objects).

The instances and servers on AB5 are as follows, the server us7031 being the database server:

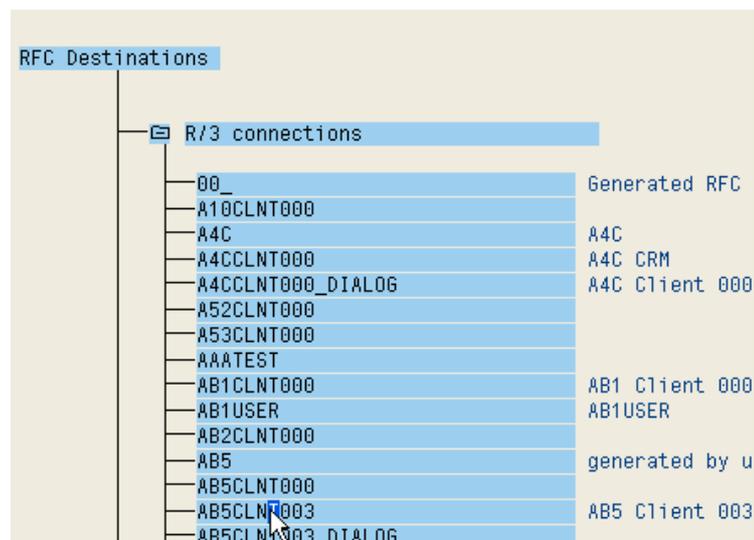
Server Names	Host name
1d9032_AB5_31	1d9032
1d9034_AB5_31	1d9034
us7031_AB5_31	us7031

3 The Step By Step Solution

3.1 Scenario 1: One Dedicated Server or Instance for Data Load Processing

You would like to have one instance dedicated to data load processing while the other instances are used for reporting or other processes (ie predictive analytics). The rationale for such a scenario might be that your organization must perform data loadings and reporting and analytics all at the same time. As a component of performance tuning strategy, you want to ensure that you fully exploit your available hardware resources, to separate these critical activities onto different servers, so that all servers can be optimized for their dedicated processes. Another reason for specifying one server as a data load server could be that you would like to minimize network traffic and overhead by focusing the data loads onto the database server. In this example, writing new data to the database during data load processing in the application doesn't require any additional network traffic.

1. In the source system (QB8 in our case) go to transaction SM59. Locate the connection that is used for transferring data to SAP BW (AB5 in our case). The typical naming convention is, for example, "AB5CLNT003", for the target SAP BW system AB5 with client 003 but the name could differ. AB5CLNT003_DIALOG is typically NOT the right destination. If there has been prior configuration work done with these RFC destinations, take those specifics into account. Double click the connection identifier in order to maintain it.
2. You can specify the target server in the field Target Host. The instance used is identified by the System Number.



RFC Destination AB5CLNT003

Remote logon Test connection Unicode Test

RFC destination AB5CLNT003

Connection type 3 R/3 connection ARFC

Description

AB5 Client 003 Open Hub Services

Technical settings Logon/Security Special Options

Load distrib. Yes No

Target host us7031 System Number 31

3.2 Scenario 2: Several Servers or Instances for Data Loading

You would like to distribute the work load over several servers or instances. The strategy is that you employ several or all servers may be to seek improved throughput or optimize data load processing.

This section describes the system behavior when data loads happen mainly in dialog work processes (typical for S-API ETL processing with SAP source systems through the use of tRFC). If you choose the option “Load to PSA and subsequently to data targets” in the InfoPackage, this section only applies for the first part of loading into the PSA. Loading to the InfoProviders will then take place in a background work process and the considerations of section 3.3.4 about distribution of jobs apply.

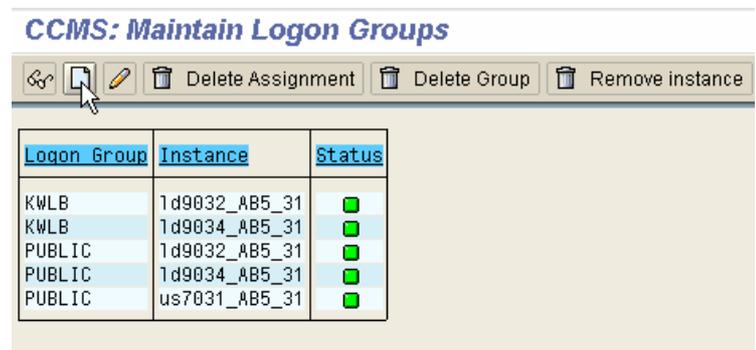
3.2.1 Several Source Systems

An easy but rigid approach to distribute the load can be done in a scenario with several SAP source systems for the same SAP BW system. In each source system you can specify a different target server (and instance) as described in section 3.1, e.g. In system QB8 specify us7031 as target server, in another source system QB7 specify ld9032 and in QB6 use ld9034.

3.2.2 Independent of the Number of Source Systems

The following approach uses a logon group in order to distribute the workload evenly across all instances in the logon group. Proper functioning of this feature is dependent upon the release version of the source system: Please check SAP OSS Note 593058 for details. If you already have a suitable logon group, you don't have to create a new one, but could adjust an existing one (enable external RFC as describe below). Bear in mind that this section is relevant to loading from AB5 to AB5 just the same (e.g. loading from an ODS object to an InfoCube in the same SAP BW system). In this case the settings for both source and target system are done in AB5.

1. In the SAP BW system in transaction SMLG press F8 or press the create button.

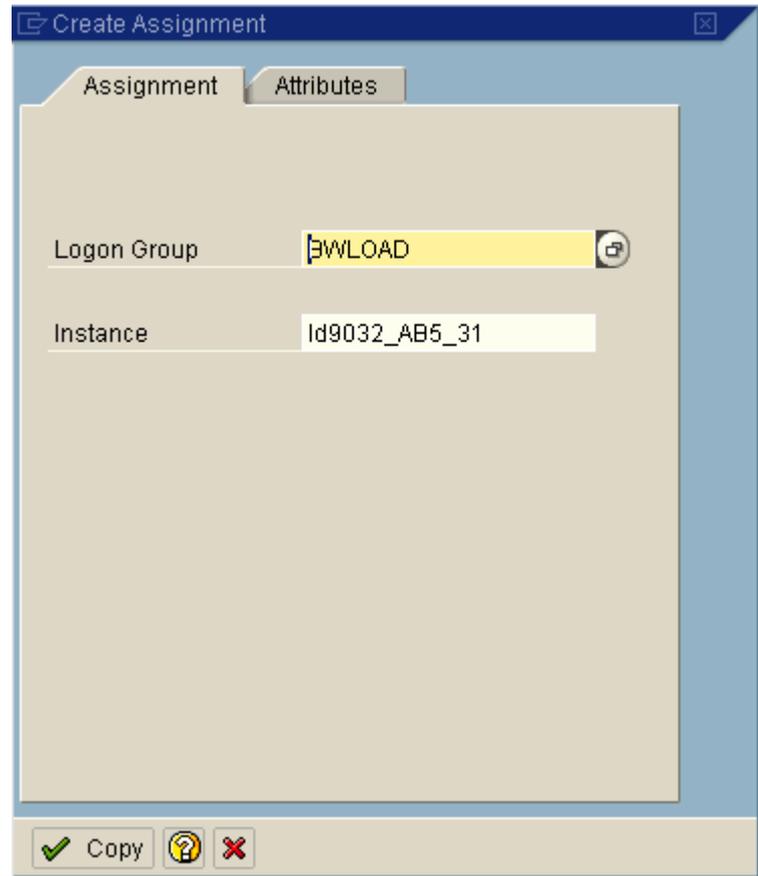


CCMS: Maintain Logon Groups

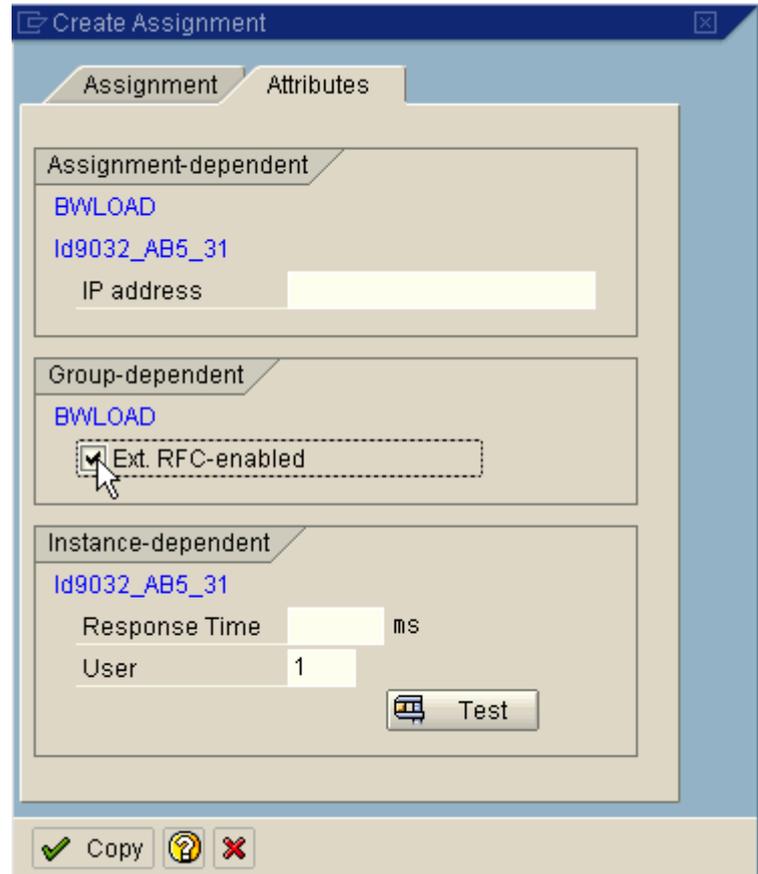
Buttons: Delete Assignment, Delete Group, Remove instance

Logon Group	Instance	Status
KWLB	ld9032_AB5_31	■
KWLB	ld9034_AB5_31	■
PUBLIC	ld9032_AB5_31	■
PUBLIC	ld9034_AB5_31	■
PUBLIC	us7031_AB5_31	■

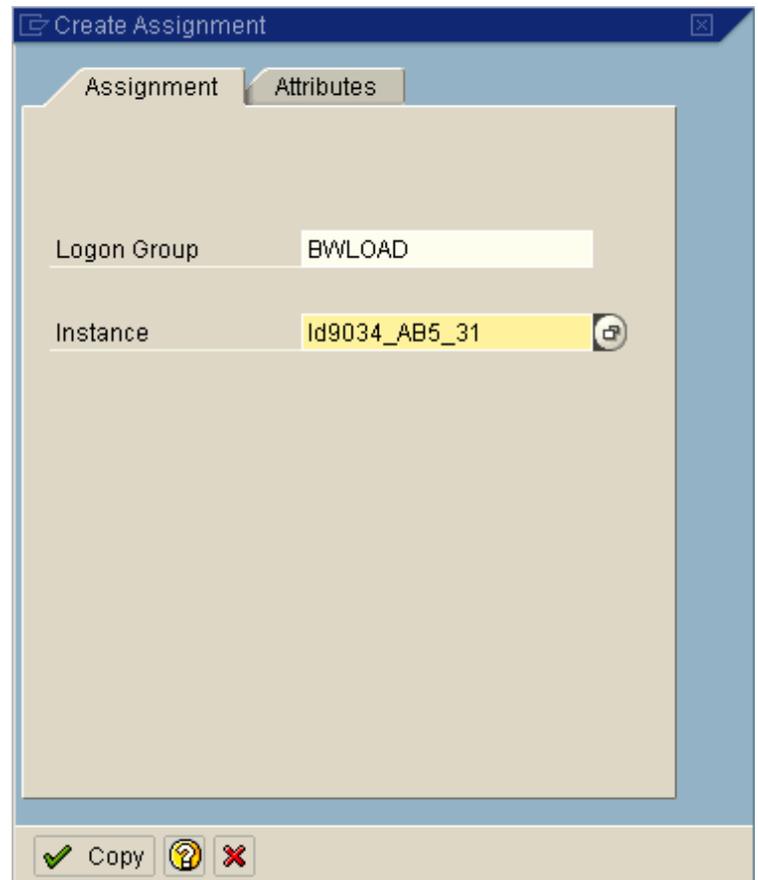
2. Enter a name (e.g. BWLOAD) and choose an instance that you would like to add to the logon group.



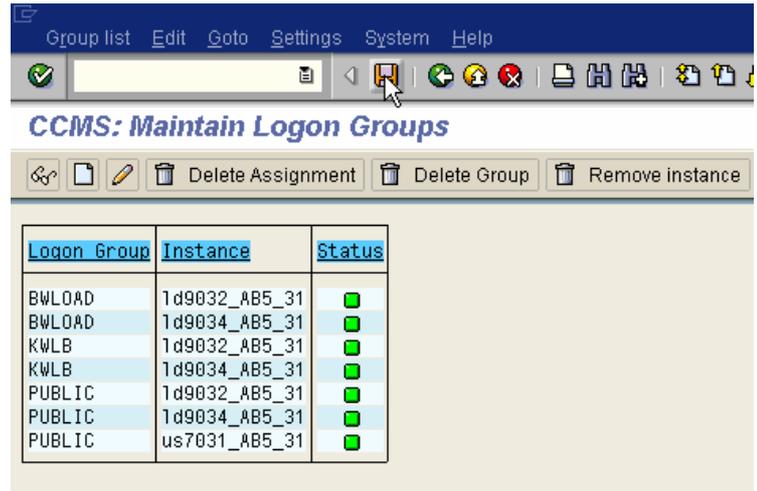
3. Switch to the Attributes tab and enable the group for external RFC then press Copy.



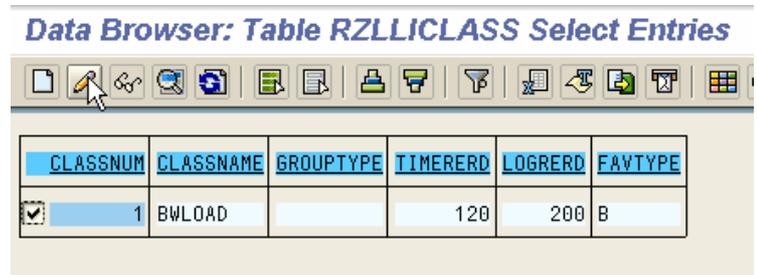
4. Press the Create button again to create another assignment of an instance to the logon group. Enter the same logon group name and a different instance name. Press Copy. Repeat this step for all instances you would like to add to the logon group.



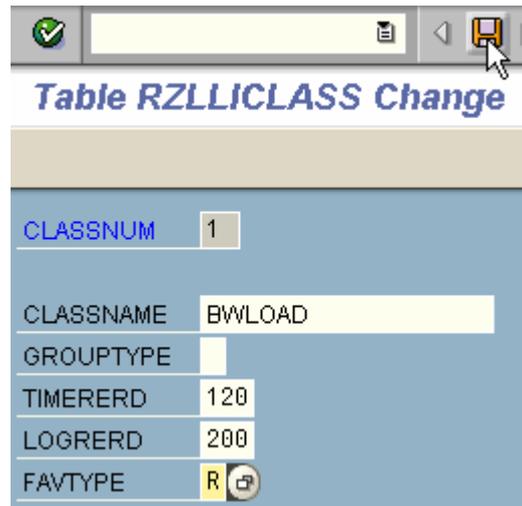
5. Press Save. Your screen should show one line for each instance assigned to your logon group.



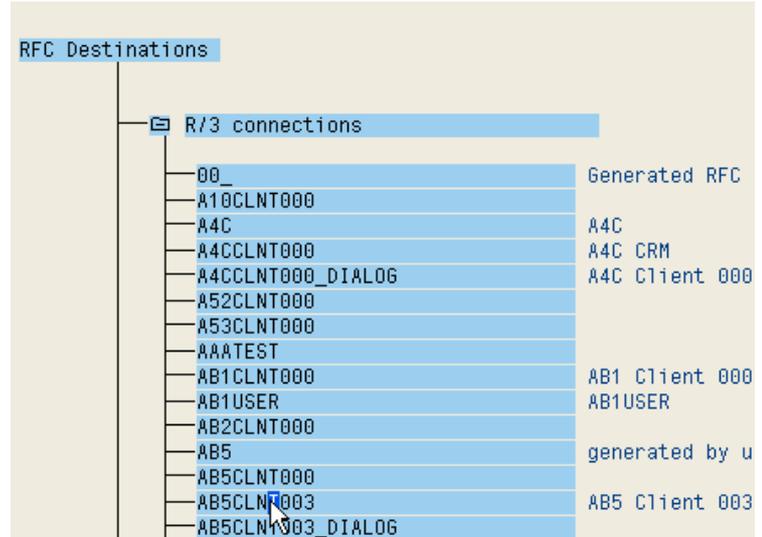
6. This step follows the recommendations given in SAP Note 593058. In transaction SE16 display the table contents of RZLLICLASS. Click on your logon group and press F6 or Change.



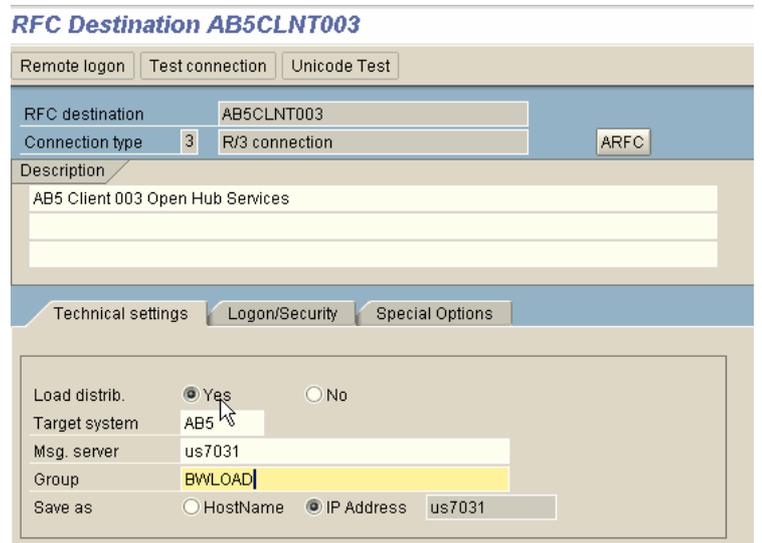
7. Change the value of the field Favorite Type, technical name "FAVTYPE", to "R" (round robin) and save your change.



8. Now go to the source system (QB8 in our case). In transaction SM59 in the source system locate the connection that is used for transferring data to SAP BW (AB5 in our case). The typical naming convention is, for example, "AB5CLNT003", for the target SAP BW system AB5 with client 003 but the name could differ. AB5CLNT003_DIALOG is typically NOT the right destination. If there has been prior configuration work done with these RFC destinations, take those specifics into account. Double click the connection identifier in order to maintain it.



9. Select the radio button for load distribution and press enter. In the newly revealed fields enter the target system name (ie AB5), the message server of the target system (ie us7031) and the logon group you have created before (ie BWLOAD). Save your settings.



10. When loading data (from QB8 to AB5) you now see a roughly even distribution of tasks running in data load processes across the specified instances (in transaction SM66).

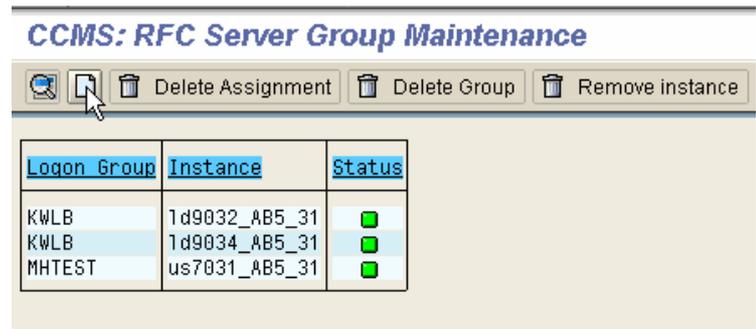
1d9032_AB5_31	0 DIA	15847	running	Yes	1	2 003	ALEREMOTE
1d9032_AB5_31	3 DIA	20619	running	Yes		184 003	ALEREMOTE
1d9032_AB5_31	4 DIA	20620	running	Yes		28 003	ALEREMOTE
1d9032_AB5_31	5 DIA	20621	running	Yes		141 003	ALEREMOTE
1d9034_AB5_31	0 DIA	30325	running	Yes	3	173 003	ALEREMOTE
1d9034_AB5_31	2 DIA	30322	running	Yes	4	14 003	ALEREMOTE
1d9034_AB5_31	3 DIA	30120	running	Yes	3	100 003	ALEREMOTE

3.3 Load balancing for Other Processes in BW

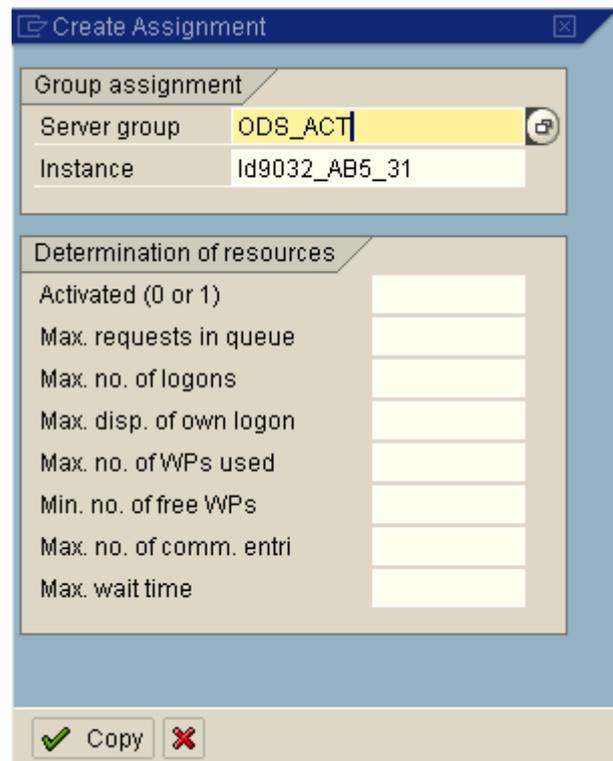
3.3.1 How to Create an RFC Server Group

These steps are not SAP BW specific, but rather functionality of the SAP basis (Web AS) system. For further information read the online documentation about creating RFC server groups.

1. In transaction RZ12 press F8 or press the create button.



2. Enter a name (e.g. ODS_ACT) and choose an instance you would like to add to the server group. Press Copy. You will be prompted about whether you would like to take over current quotas. You can do that or define your own quotas in the Determination of resources section in the same screen. For more information about these quotas refer to the online documentation and SAP OSS Note 74141.



- Repeat the previous step, entering the same server group name and a different instance name for all instances that you would like to add to this server group.

- Save your settings. Transaction RZ12 should look something like this after creating the server group. For each instance in the server group you see one line.

Logon Group	Instance	Status
KWLB	1d9032_AB5_31	■
KWLB	1d9034_AB5_31	■
MHTEST	us7031_AB5_31	■
ODS_ACT	1d9032_AB5_31	■
ODS_ACT	1d9034_AB5_31	■

3.3.2 Load Balancing for ODS Object Data Activation

ODS object data is first loaded to the activation queue. For this kind of loading the above load balancing considerations apply. After loading you activate the data. There are separate parameters for this activation process.

1. Run transaction RSCUSTA2. There you can specify the server group (defined above, e.g. ODS_ACT). The activation will then distribute the activation packages to the instances assigned to the server group.

Server Group	ODS_ACT
--------------	---------

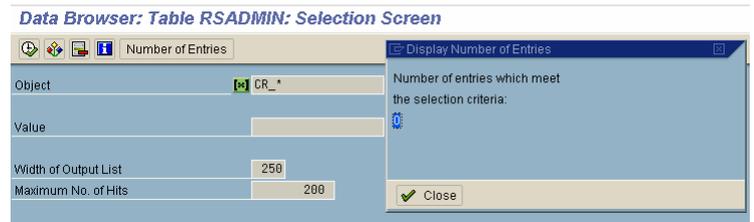
2. In addition, you can specify the approximate package size (the actual package may end up a little larger, though, depending on the key definition and the data). You can also specify the number of parallel packages (processes utilized in parallel), and the wait time which defines the duration the main process will wait for the parallel child processes (default 3600 is usually sufficient).

Maintenance View for ODS Fields (RSADMINA)	
No. of Par. Proc.	4
Min. No. Data Recs.	30000
Wait Time in Sec.	
Server Group	ODS_ACT

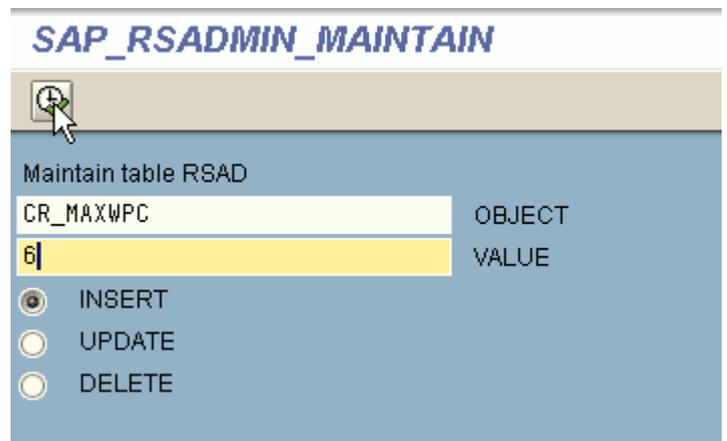
3.3.3 Load Balancing for the Change Run

Master data must be activated after data load is completed. All aggregates containing changed master data have to be adjusted. The process which activates newly loaded master data, and adjusts aggregates containing relevant navigational attributes and hierarchies, is called the change run. There are special parameters available for optimization of the change run. You can split the change run processes by InfoCube (one process is spawned for each InfoCube's aggregates). For more information on this please refer to SAP OSS Note 534630.

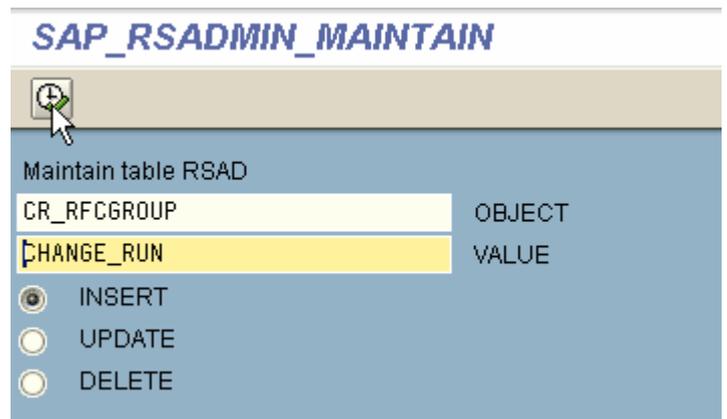
1. In transaction SE16 check whether the entries "CR_MAXWPC" or "CR_RFCGROUP" already exist in table RSADMIN.



2. In transaction SE38 run the report SAP_RSADMIN_MAINTAIN. Use the update function if the entries exist. In this example, let's assume that those entries don't exist, then insert the value for the parallel degree (6 in our example) as displayed.



3. For the server group insert the following values ("CHANGE_RUN" is the name of the server group in the example). You can use the same server group for the change run that is used for ODS activation, or use any other server group. Keep in mind that these server group names used here are for example purposes only.



3.3.4 Load Balancing with Process Chains

Process chains are a powerful tool offering graphical modelling and monitoring of BW operational activities, and thus enable you to automate BW administration. SAP best practices dictate that process chains be utilized as part of data load and warehouse management activities.

A start process triggers a process chain to commence, e.g. scheduled to run at a specific point in time. All other activities within the process chains are triggered by events inherently defined by the control flow built into the process chain design.

When an event is triggered, the system checks the SAP parameter `rdisp/btcname` on the current SAP instance and starts the event trigger program on the instance which is specified as the value of this parameter (default: Central Instance). After this the event scheduler tries to start the job immediately on this instance or in case all background work processes are occupied the job is converted to "time scheduled". For more information refer to SAP OSS Note 24092.

Background jobs scheduled to start at a specific time are handled in a different way. On each instance that has background work processes, a scheduler runs periodically (defined by the instance parameter `rdisp/btctime`, default 60 seconds). If there are jobs ready to run (as the time for execution has arrived), as long as there is no specific server defined in the the job properties, the scheduler picks up the jobs for the instance (if there are available background work processes).

Bear in mind that some processes within the process chains (like ODS object data activation, change run and data load processing) will utilize their own specific load balancing settings. Typically this kind of parallelization and load distribution is done in DIALOG work processes, whereas this section describes the background processes. The settings for background processes described below affect the entire system, also basis jobs that are not SAP BW specific. For this reason, any potential changes described below should only be implemented once all ramifications have been considered, not just the BW process chains aspects of the matter.

3.3.4.1 Manual Distribution of Process Chains

Since event triggered jobs run on the same instance as the event scheduler (if there are free background work processes) you can distribute the load by ensuring that the event scheduler runs on the same instance where the event is triggered. You can define the server for the process chain (for the start process, to be precise). The events are triggered on an instance on this server and the instance defined in `rdisp/btcname` (the current instance) will then be used to execute the tasks defined in the process chain. Since you can specify different servers for different process chains you can distribute the workload of the process chains manually onto the servers.

1. In the instance profile parameter maintenance change (or create) the parameter `rdisp/btcname` and set the value to the current instance. In this example screenshot we assume that the parameter has to be created in the instance profile and that the profile is maintained within the SAP system.

The screenshot shows the SAP parameter maintenance interface for profile 'AB5_D31_LD9032' Version '000005'. The parameter name is 'rdisp/btcname', its status is 'Active', and its sequence number is '3'. The parameter value is 'ld9032_AB5_31'. Below this, the 'Unsubstituted standard value' and 'Substituted standard value' are both set to 'us7031_AB5_31'.

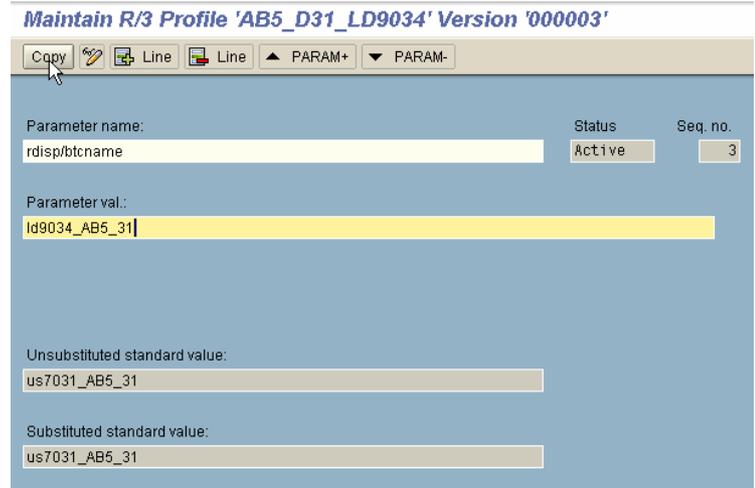
Parameter name:	Status	Seq. no.
rdisp/btcname	Active	3

Parameter val.: ld9032_AB5_31

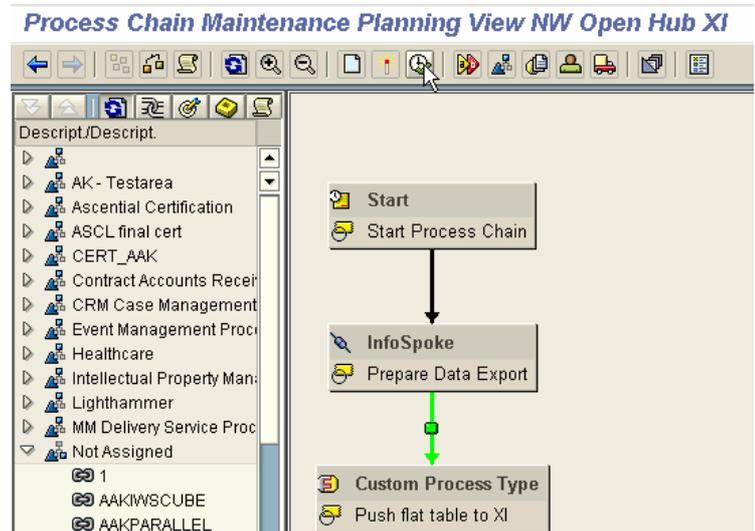
Unsubstituted standard value: us7031_AB5_31

Substituted standard value: us7031_AB5_31

- Repeat the last step for all instances you would like to use in this manner.



- In the process chain maintenance screen, when you activate and schedule your process chain, a dialog window will appear.



- In this dialog window you can define a target server for the start process of your process chain. You can define different servers for different process chains (potentially running at the same time). In this way you can manually configure distribution of the processes as a means of optimally utilizing available server resources.



3.3.4.2 Automatic Distribution

As an alternative to the manual distribution techniques previously described, you can distribute jobs across servers automatically. Event triggered jobs are automatically switched to time-based if no free background work processes are available on the instance when the event is triggered. You can use this feature in order to distribute the

jobs across servers. In this case you should not change the default for rdisp/btcname, but use the same value (e.g. the Central Instance) for all instances.

As described above, the instance that runs a time-based job is the first one with free background work processes that runs the scheduler. In order to get a fairly even distribution, the default of 60 seconds should be changed to 61, 62, 63, etc. That's because then there is no fixed relation between the start times of the scheduler on the instances. This is described in detail in SAP OSS Note 24092.

1. Check on all instances that the parameter rdisp/btcname is set to the same instance (e.g. the Central Instance). You can check this in the profile maintenance or in transaction TU02 (see screenshot). If it is not set, change this parameter on all instances.

Parameter Changes in SAPSYSTEM Id9032 31

Select Period Active parameters History of file Display: INIT<SID>.ORA

30.11.2004 10:34:50 AB5
History of Parameters

Parameter	Mod. date	
rdisp/btcname	10.05.04	us7031_AB5_31

2. In the instance profile, change the parameter rdisp/btctime.

Maintain R/3 Profile 'AB5_D31_LD9032' Version '000005'

Copy Line Line PARAM+ PARAM-

Parameter name: rdisp/btctime Status: Active Seq. no.: 3

Parameter val.: 61

Unsubstituted standard value: 60

Substituted standard value: 60

3. Repeat the last step for all instances; increase the value by 1 each time.

Maintain R/3 Profile 'AB5_DVEBMGS31_US7031' Version '000017'

Copy Line Line PARAM+ PARAM-

Parameter name: rdisp/btctime Status: Active Seq. no.: 3

Parameter val.: 62

Unsubstituted standard value: 60

Substituted standard value: 60

- Set the number of background work processes on the Central Instance to a low value. You may have defined different operation modes. If so, you have to adjust the number of background work processes in the relevant operation modes.

Maintain R/3 Profile 'AB5_DVEBMGS31_US7031'

30.11.2004 Active parameters

Parameter Name	Parameter value
rdisp/wp_no_dia	10
rdisp/wp_no_vb	2
rdisp/wp_no_vb2	0
rdisp/wp_no_enq	1
rdisp/wp_no_btc	2

- In the other instances adjust the number of background work processes so that you have sufficient processes system-wide.

Maintain R/3 Profile 'AB5_D31_LD9032' Version '000005'

30.11.2004 Active parameters

Parameter Name	Parameter value
rdisp/wp_no_dia	12
rdisp/wp_no_vb	2
rdisp/wp_no_vb2	0
rdisp/wp_no_enq	0
rdisp/wp_no_btc	7

- In this example, if jobs are now started by process chains, the first two will be assigned to the Central Instance (us7031_AB5_31) because of rdisp/btcname. Any subsequent jobs that don't find a free background work process on the Central Instance defined in rdisp/btcname will be converted to time scheduled. These jobs are distributed by the scheduling mechanism described above (rdisp/btctime).

Global Work Process Overview

CPU Debugging Long <-> short names Sele

Sort: Server

Server	No	Typ	PID	Status	Reaso	Se
1d9032_AB5_31	14	BTC	274	Complet		
1d9032_AB5_31	16	BTC	275	Complet		
1d9034_AB5_31	14	BTC	1849	stopped	CPIC	
1d9034_AB5_31	15	BTC	1850	stopped	CPIC	
us7031_AB5_31	13	BTC	5007	stopped	CPIC	
us7031_AB5_31	14	BTC	24306	running		

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