

Providing High Availability for SAP Resources with Oracle Clusterware 11 Release 2

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Providing High Availability for SAP Resources

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Providing High Availability for SAP Resources

Providing High Availability is an essential component in the world of business continuity

This paper explains how to use Oracle Clusterware to enable high availability for SAP resources

OVERVIEW OF HIGH AVAILABILITY FOR SAP RESOURCES

Oracle Clusterware can provide high availability for SAP resources just as it does for Oracle resources. Oracle has created an Oracle Clusterware tool, SAP Control (SAPCTL), to enable you to easily manage SAP high availability resources.

SAPCTL provides an easy-to-use interface to administer the resources, scripts, and dependencies of Oracle Clusterware and SAP high availability components. SAPCTL consolidates the functionality of the Oracle command-line tools by enabling you to easily manage the SAP Enqueue Service for ABAP and JAVA, the SAP Replication Service for ABAP and JAVA, and the additional virtual IP addresses used by the SAP Enqueue Service for ABAP and/or JAVA.

NEW FUNCTIONALITY

In addition to the critical SAP high availability components, namely the SAP Enqueue and SAP Replication Service, SAPCTL Version 6 provides an interface for the protection of arbitrary number of SAP application instances.

The SAP Central Instance (CI) or SAP application instances (DV) are possible candidates to run under SAPCTL supervision.

The SAPCTL tool supports SAP Standalone Gateway (GW) and SAP WebDispatcher (W) as independent SAP instances as well.

For all supported SAP instance types, SAPCTL in addition monitors the associated SAP Start Service (sapstartsrv daemon process) with an always co-located CRS resource. The SAP Start Service process is started automatically by SAPCTL if the SAP instance gets started on a cluster node or relocated to another node in the cluster. There is no need to bring up all SAP Start Processes on system boot by **sapinit** procedure as this task is performed by SAPCTL after startup of Oracle Clusterware.

Multiple networks for the application VIPs are supported. All defined application VIPs for a SAP instance are always co-located on the same node in the cluster. If an instance must be relocated to another node, all application VIPs for the SAP instance are relocated to this node as well. Configuration of additional application VIPs is not done automatically during resource creation and need to be defined by manual steps. Templates are provided together with the SAPCTL scripts. See appendix 4 for more information.

If SAP executables are located on an Oracle ACFS filesystem, this is detected by SAPCTL and the resource dependencies are automatically created.

The Oracle Exadata Database Machine is certified to run SAP Central Services (SCS and ASCS instances and the ER instances) and SAPCTL supports these services when running on Oracle Exadata. For information on SAP components and configuration for Oracle Exadata Database Machine see SAP note 1590515 and white paper "Using SAP NetWeaver with the Oracle Exadata Database Machine", available here: <http://www.sdn.sap.com/irj/sdn/ora>.

SAPCTL is available for the LINUX, Solaris and AIX operating system. Oracle Clusterware 11g Release 2 is required for this version of SAPCTL. All SAP kernels starting with kernel version 7.00 are supported by SAPCTL.

SAP SUPPORT FOR HIGH AVAILABILITY

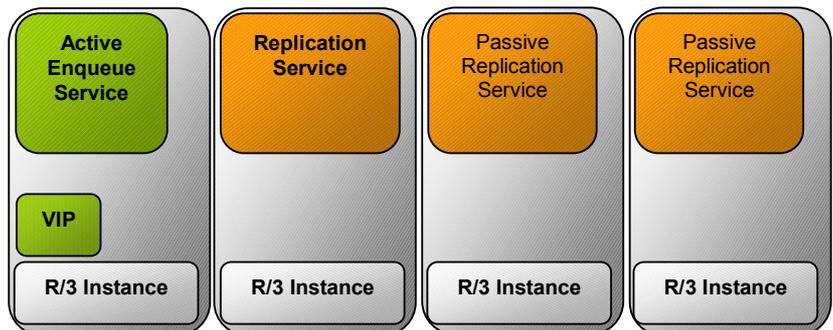
The SAP Enqueue Service provides distributed lock management for SAP application server instances. The SAP Enqueue Service must be available whenever an SAP installation uses more than one SAP instance. In order to support High Availability, the Enqueue Service together with the Message Service builds up the “Standalone Enqueue Service” (ASCS) for SAP WebAS ABAP. In case of SAP WebAS JAVA, the Enqueue Service together with the Message Service forms the “Central Services Instance” (SCS). This SCS instance is always required for the JAVA stack of SAP.

SAP uses an active/passive approach to enable high availability for the respective Enqueue Service. There is exactly one Enqueue Service for application type ABAP and one for application type JAVA running in the SAP system. The SAP system comprises multiple application instances on different nodes. One or more SAP Replication Services run on the node on which the active Enqueue Service for ABAP and/or JAVA falls over in the event of a failure or planned outage.

The term ‘service’ is used to signify the SAP process that provides either Enqueue or Replication

The nodes that host these services are termed the ‘Enqueue Server’ and the ‘Replication Server’

Each Replication Service of type ABAP or JAVA maintains a copy of the Enqueue Service’s lock table; this copy is kept in a shared memory segment during runtime. The node that supports the Enqueue Service for ABAP and/or JAVA also hosts an additional virtual IP address (VIP) for communication. Whenever the active node fails or is shut down, the VIP and Enqueue Services fail over to the next node. The available node supports the Replication Service of type ABAP and/or JAVA.



SAP Enqueue and Replication Server Nodes

ORACLE CLUSTERWARE

Oracle Clusterware, formerly known as Cluster Ready Services (CRS), is an integrated cluster management solution that enables linking multiple servers so that they function as a single system. While continuing to be required for Oracle RAC databases, Oracle Clusterware can also support non-Oracle applications.

OVERVIEW OF THE SAPCTL IMPLEMENTATION

This solution uses Oracle Clusterware to enable high availability for the SAP Enqueue Service. The implementation uses Oracle Clusterware modeling features so that each managed entity is represented as a resource. SAPCTL implements unique Oracle Clusterware resources, one each for the Enqueue Service of type ABAP or JAVA, the Replication Service for ABAP or JAVA, and the unique VIP resources for both types of Enqueues Service. For all additional SAP Application Instances of type CI, GW or DV, a pair of Oracle Clusterware resources for the instance itself and the accompanying unique VIP is used respectively.

The management policy for the Enqueue Service and VIP are configured so that the two are co-located, while the policy for the Replication Service resource ensures that it is never running on the same node as the associated Enqueue Service. The failover policy for the Enqueue Service resource guarantees that upon failure, the Enqueue Service is restarted on the node that is currently hosting the belonging Replication Service, if any. The Replication Service will be subsequently relocated to a different node if one is available. This applies to both the ABAP and JAVA application server type of SAP WebAS.

All resources for SAP Application Instances of type CI or DV have a co-located VIP resource assigned. The failover policy for this set of resources is to relocate the application service together with the associated VIP to an available node in the cluster in case of any error. There is no restart attempt by default.

For all types of supported SAP Instances, e.g. ASCS, ERS, CI or DV, an additional resource for the SAP Start Service is defined in CRS. Every SAP Instance has a dependency on the associated SAP Start Service and is always co-located if the SAP instance is running. The SAP Start Service for an SAP Instance should be always running on one node in the cluster, so the SAPCTL command line interface does not provide a function to start or stop the SAP Start Service.

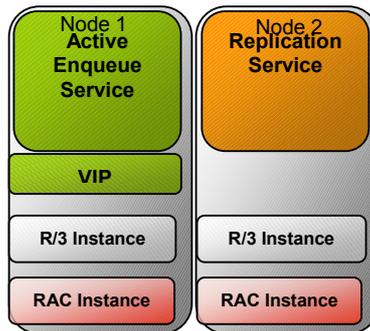
If you need to stop a running SAP Start Service, you can stop it by Oracle Clusterware command `crsctl`.

SUPPORTED CONFIGURATIONS

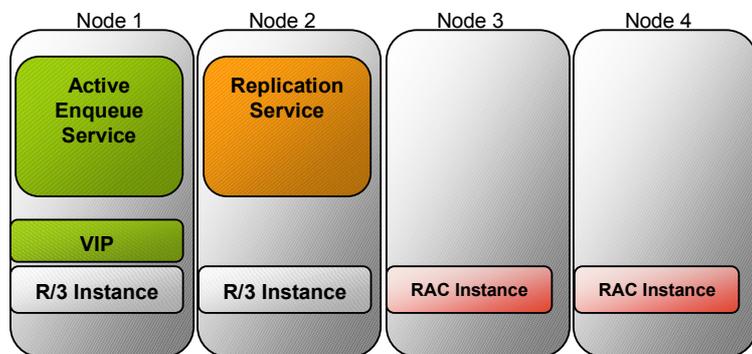
The Enqueue and Replication Services for ABAP and/or JAVA can run on any node that supports SAP R/3 or SAP WebAS which is limited to the following two configurations:

- All solutions require shared disk for the Oracle Cluster Registry (OCR) and voting disk device.
- All solutions assume that SAP runs in an Oracle RAC environment.

Co-location of Enqueue and Replication Services with the Oracle database. For example, a two-node Linux cluster running Oracle RAC and R/3 in a co-located configuration.



Co-location of Enqueue and Replication Services in the same Oracle RAC environment as the Oracle database. For example, a four-node Linux cluster running Oracle RAC on two nodes and R/3 on two nodes of the same cluster.



INSTALLATION AND MANAGEMENT

You must install the Oracle Database software that you are using with your SAP installation in the operating system user oracle and primary group oinstall. In addition, the users <sid>adm from SAP as well as the Oracle Clusterware owner (oracle) must belong to the dba group. For more information about groups and users for SAP environments, refer to the SAP documentation.

REQUIREMENTS FOR RUNNING SAPCTL

Before running SAPCTL, your environment must meet the following conditions:

- You must run 'create' and 'remove' commands as the 'root' user.
- You must run 'start' and 'stop' commands as 'sapuser', this is the software owner of your SAP installation.
- You may run 'status' command as any user.

These requirements describe the default Oracle permission scheme. You can, however, modify the permission scheme with the crsctl setperm command.

OVERVIEW OF INSTALLATION AND CONFIGURATION

The procedures for installing this solution comprise the following tasks:

- Appropriately configuring the SAP application
- Registering the SAP Enqueue and Replication Services with the Oracle Clusterware.

CONFIGURING SAP

The configuration changes that you need to make to enable SAPCTL are not automated.

A few minor modifications to your existing configuration, namely the generation of profiles for use with virtual hostnames is required.

The use of startsap / stopsap scripts is no longer supported with this version of SAPCTL. Instead, the SAP Start Service sapstartsrv is used to start, stop and monitor the SAP instances. The sapstartsrv service for every instance must be up and running on one node in the cluster to allow SAP Tools monitoring of SAP Instances. The SAP Start Service sapstartsrv should not run simultaneously on multiple nodes, especially if the SAP installation in the cluster is on a shared cluster filesystem. This is the default for Oracle RAC installations with SAP.

With the introduction of Oracle Clusterware resources for SAP Start Services, SAPCTL will automatically bring up the SAP Start Service if you start the SAP Instance by SAPCTL command.

Please note that the use of sapstart services requires unique instance numbers for all SAP instances. It is no longer possible to use the same number twice. Therefore you probably need to change the instance numbers for all replication instances (ABAP or JAVA). E.g. ASCS01 and ERS03 is a valid combination, whereas ASCS01 and ERS01 is not allowed.

Also note that using an Oracle RAC database requires additional profile changes. The configuration steps for this are documented in the white paper 'Configuration of SAP NetWeaver for Oracle 11g Release 2 Real Application Clusters Unix and Linux'.

USER PROFILE SID<ADM>

The home directory for the SAP user sid<adm> contains profile scripts for the c-shell and the Bourne or bash shell that are commonly used in UNIX environments. There are four sets of scripts and the script sets have the following purposes:

- For the environment of the SAP application.
- To ensure that the Oracle database uses the required environment settings.
- For the SAP Java virtual machine.
- For SAP APO, an SAP tool that requires a specialized environment setup.

The appropriate script set is called during the execution of .login (csh) or .profile (sh). A common attribute of these scripts is the hostname used as the last portion of the script name. Because Oracle Clusterware can start the SAP Enqueue Service and the SAP Enqueue Replication Service on all of the hosts in the cluster with arbitrary hostnames, you must duplicate these scripts with as many different names as there are hosts in the cluster. You must do this on all hosts that are eligible for running the respective programs.

The important requirement of SAP for Oracle RAC is to have the Oracle RAC database's home directory reside on a shared cluster file system.

If the home directory is on a cluster file system, then create links with the different hostnames in the cluster to the various profile scripts. In the following example, SAP software has initially been installed on node1 of a four-node cluster. Node2, node3, and node4 are the other cluster members.

```
# su - sid<adm>
# for TYPENAME in "sapenv sapsrc dbenv dbsrc"
do
    for NODENAME in "node2 node3 node4"
    do
        ln .$TYPENAME_node1.sh .$TYPENAME_$NODENAME.sh
        ln .$TYPENAME_node1.csh .$TYPENAME_$NODENAME.csh
    done
done
```

In case of a .j2ee or .apo profile script, create the appropriate links in the same manner if these SAP applications are also controlled by Oracle Clusterware. Further discussion of this topic is outside of the scope of this white paper.

USER PROFILE ORA<SID>

For administrative purposes, a special Oracle database user is created by SAP. This user is known as ora<sid> in SAP installations. The user ora<sid> is the Oracle software owner for the database belonging to the SAP system. For this user account, the same changes to the profiles as for an SAP user account <sid>adm are required. Refer to the previous section, 'USER PROFILE <SID>ADM' for more information about the required changes.

INSTANCE PROFILE: CENTRAL SERVICES INSTANCE (ASCS, SCS), ENQUEUE AND MESSAGE SERVICE FOR ABAP AND JAVA

See Appendix 1 for the changes that are required to these profiles:

You must adapt the profiles for use by the standalone enqueue to the virtual node in the cluster on which the service runs. The virtual node name is part of the filename. Therefore, you must create a copy of the files with the appropriate name.

The virtual hostname must resolve to the VIP IP address associated with the SAP instance (ASCS, SCS, DVEBMGS, etc.) by either /etc/hosts resolution or DNS lookup. E.g., if the virtual hostname for ABAP Standalone Enqueue is sap_abapvip, this hostname must resolve to the IP address you specify during creation of Oracle Clusterware resources in -abapvip parameter of sapctl create command. Same applies to the -javavip and all -asinstvip parameters.

The directory holding the instance profile and the start commands should reside on a shared cluster file system. The default path is /usr/sap/<SID>/SYS/profile. An example of the parameter changes for a standalone Enqueue Service for ABAP and JAVA on a cluster protected by Oracle Clusterware is available in Appendix 1.

INSTANCE PROFILE: ENQUEUE REPLICATION INSTANCE (ERS)

See Appendix 1 for the changes that are required to these profiles:

The Enqueue Replication instance has an instance and a start profile similar to any other SAP instance. The required modifications to these profiles are the same as those that this paper described for the standalone enqueue instance.

The Enqueue Replication instance does not require a VIP. So the hostname extension in the instance profile does not matter. Nevertheless it's a good practice to use the same virtual hostname as the associated Enqueue instance.

See Appendix 1 for examples.

INSTANCE PROFILE: CENTRAL INSTANCE (CI) OR APPLICATION SERVER INSTANCES (DV)

The SAP application server instances, either configured as a dialog or dialog and update instances, are also eligible to be under the protection of Oracle Clusterware.

See Appendix 1 for the changes that are required to these profiles

In case of the ABAP application stack, it is still required to configure a Central instance (CI) even if the central services like message and enqueue service are part of the standalone ASCS instance type. Beside of the SAP Central Instance, it is possible to have additional SAP server instances (type DV) protected by SAPCTL. To configure additional Oracle Clusterware resources for the SAP server instances, run the sapctl create command once for every additional SAP server instance.

An example of a SAP Central Instance (CI) with failover capabilities on an Oracle CRS cluster is available in Appendix 1. Note that the instance name of a SAP central instance is DVEBMGS.

The Central Instance and all instances of type DV all have a unique VIP associated, if protected by Oracle Clusterware and running in the cluster.

For the relationship between virtual hostname to use and IP addresses for the VIPs the same rules as with SAP Central Services Instances (ASCS, SCS) apply. All virtual hostnames must resolve by either DNS or /etc/host lookup to the IP address given during SAPCTL resource creation.

INSTALLATION OF SAPCTL

The installation must be performed as user root.

Create the following directories:

```
# mkdir /usr/sap/sapctl/bin
# mkdir /usr/sap/sapctl/log
# mkdir /usr/sap/sapctl/perl
```

Untar the SAPCTL scripts to directory /usr/sap/sapctl/bin

```
# cd /usr/sap/sapctl/bin
# tar -xvf sapctl.tar .
```

In directory /usr/sap/sapctl/bin, create 2 symbolic links to CRS executables installed in your CRS installation.

```
# ln -s /oracle/GRID/11202/bin/crsctl /usr/sap/sapctl/bin/crsctl
# ln -s /oracle/GRID/11202/bin/crsctl /usr/sap/sapctl/bin/crsctl
```

Recursively copy the perl subdirectory from your CRS installation to directory /usr/sap/sapctl/perl

```
# cp -r /oracle/GRID/11202/perl/* /usr/sap/sapctl/perl
```

Recursively change ownership and permission for sapctl subdirectories

```
# chown -r <sid>adm:sapsys /usr/sap/sapctl
# chmod -r 775 /usr/sap/sapctl
```

With these permissions all users with primary group sapsys have permission to use SAPCTL. You can use this setup for multiple SAP installations / multiple SID's.

UPGRADE FROM PREVIOUS VERSION

Delete all scripts installed from older versions of SAPCTL installed in directory /usr/sap/<SID>/SYS/exe/run. The names of the script files are:

- sapctl
- sapctl.pl
- sapwrap
- crssapactions.pl

Upgrade of CRS resources defined with older versions of SAPCTL is not possible. You must delete already defined CRS resources for SAP before you proceed with (re-) registering with Oracle Clusterware. Use command

```
# /usr/sap/sapctl/bin/sapctl remove all -sapsid <SID>
```

to delete the resources. Repeat this for all SAP systems protected by SAPCTL. After that, continue with registration as shown below.

REGISTERING WITH ORACLE CLUSTERWARE

Registration with Oracle Clusterware, as well as the subsequent management of the resources, is done by using SAPCTL. An overview of SAPCTL functionality follows and a 'Worked Example' appears later in this paper.

MANAGEMENT INTERFACE

The management of the Enqueue and Replication Service as well as the VIP resource should be done using SAPCTL. This command line interface can manage any number of the installations on an Oracle Clusterware managed environment.

FUNCTIONALITY

A 'worked example' using SAPCTL appears later in this paper

SAPCTL performs the following:

- Creates and removes the Oracle Clusterware configuration of the SAP high availability subsystem.
- Starts the SAP high availability subsystem that is wrapped with Oracle Clusterware as a whole as well as its individual components.
- Stops the SAP high availability subsystem that is protected by the Oracle Clusterware as a whole as well as its individual components.
- Queries the state (status) of the SAP high availability subsystem as a whole as well as that of the components that comprise it.
- Relocates a resource to other hosting members on demand.

USAGE

```
sapctl <command> [<object>] -sapsid <SAP_SID> [options]
    Command: start|stop|status|create|remove|relocate
    Objects: abapvip|javavip|abapenq|javaenq|
             abaprep|javarep|abapall|javaall|
             asinstall|asinstvip|asinst|
             gwvip|gwinst|wdspvip|wdspinst|all
```

NOTE:

Create and remove commands work on all objects only.

For detailed help about each command and object and its options use:

```
sapctl <command> -h
```

<Objects>

abapvip: Refers to the VIP for the Enqueue Service of Web AS ABAP

javavip: Refers to the VIP for the Enqueue Service of Web AS JAVA

asinstvip: Refers to the VIP for SAP Web AS instances (type CI, DV)

abapenq: Refers to the Enqueue Service of Web AS ABAP

javaenq: Refers to the Enqueue Service of Web AS JAVA

abaprep: Refers to the Replication Service for Web AS ABAP

javarep: Refers to the Replication Service for Web AS JAVA

asinst: Refers to the SAP Web AS instances (type CI, DV)

abapall: Includes all resources associated with the Web AS ABAP

javaall: Includes all resources associated with the Web AS JAVA

asinstall: Include all resources associated with the SAP Web AS instances (type CI, DV)

gwvip: Refers to the VIP for SAP Standalone Gateway instances (Type GW)

gwinst: Refers to the SAP Standalone Gateway instance

wdspvip: Refers to the VIP for SAP WebDispatcher instances

wdspinst: Refers to the SAP WebDispatcher

all: Includes all of the resources associated with the solution for the specified SAP SID.

<Commands>

- start

Starts the resources associated with the object.

- stop

Stops the resources associated with the object.

- status

Displays the current state or status of resources that are associated with the object. This includes the processed output of the resource state as reported by “crsctl status resource <resource_name>”

- create

Creates the Oracle Clusterware resources for the SAP high availability subsystem. This command is only supported for a single object 'all' and must be run as the 'root' user because this operation must create a VIP resource. The following parameter switches are supported:

Parameter	Description
-sapsid	The SID for the SAP instance
-if <adapter name>	The name of the public network adapter
-nm <netmask>	The network mask for the public network interface
-net <network address>	The network address for the public network
-nodes <node1, ... ,node(n)>	List of nodes in the cluster acting as hosting members
-abapenq <EnqInst>	The Enqueue Service identifier for Web AS ABAP
-abaprep <RepInst>	The Replication Service identifier for Web AS ABAP
-abapvip <IP Address>	A New IP Address for Web AS ABAP
-abapmsport <Portnumber>	The portnumber of ABAP message server
-javaenq <EnqInst>	The Enqueue Service identifier for Web AS JAVA
-javarep <RepInst>	The Replication Service identifier for Web AS JAVA
-javavip <IP Address>	A New IP Address for Web AS JAVA
-javamsport <Portnumber>	The portnumber of JAVA message server
-asinst <SAP Instance>	The Instance name of SAP Central instance
-asinstvip <IP Address>	A New IP Address for SAP Central Instance
-gwinst <SAP Instance>	The Instance name od SAP Standalone Gateway
-gwwip <IP Address>	A New IP Address for SAP Standalone Gateway
-wdspinst <SAP Instance>	The Instance name od SAP WebDispatcher
-wdspvip <IP Address>	A New IP Address for SAP WebDispatcher

The VIP resource will be created as being owned by the 'root' user, while other resources are created as being owned by the SAP user. All of the generated Oracle Clusterware action scripts are owned by the SAP user.

- remove

Removes the Oracle Clusterware resources and Oracle Clusterware action scripts for the SAP high availability subsystem. This operand is only supported for a single object 'all' and must be run as the 'root' user because this operation must delete a VIP resource. The remove command deletes Oracle Clusterware type definitions for SAP resources as well if no other SAP system has dependencies on this type. E.g. if you have SAP system <SID1> and <SID2> protected by SAPCTL, the type definition for SAP resources will only be deleted if the last SAP system is removed from SAPCTL protection.

- relocate

Relocate a running resource to other host from the list of valid hosting members. VIP resources are not allowed to be relocated, as VIP resources have dependent resources defined. If a resource with dependency to a VIP is specified, then the associated VIP resource gets relocated as well.

Parameter	Description
-abaprep <Instance name>	Name of the AB AP Replication instance.
-javarep <Instance name>	Name of the JAVA Replication instance.
-abapenq <Instance name>	Name of the AB AP Replication instance. The VIP resource for ABAP is relocated as well.
-javapenq <Instance name>	Name of the JAVA Replication instance. The VIP resource for JAVA is relocated as well.
-asinst <Instance name>	Name of the CI or DV instance. The VIP resource for the instance is relocated as well.
-gwinst <Instance name>	Name of the Standalone Gateway instance. The VIP resource for the instance is relocated as well.
-wdspinst <Instance name>	Name of the WebDispatcher instance. The VIP resource for the instance is relocated as well.
-to <node>	Tells the node where the resource should run after relocation.

CONCLUSION

This paper has shown how to use Oracle Clusterware to enable protection of both the SAP Enqueue Service and the SAP Replication Service.

Oracle Clusterware can protect SAP installation types SAP Web AS ABAP, SAP Web AS JAVA or both.

Oracle Clusterware provides an easy way to protect SAP Services from failure. More information about Oracle Clusterware can be found at:

<http://www.oracle.com/technology/products/database/clustering>

And as a reminder - For details about configuring SAP with Oracle RAC refer to the white paper 'Configuration of SAP NetWeaver for Oracle Grid Infrastructure 11.2 with Oracle Real Application Clusters 11g Release 2' in key topics folder 'SAP on Oracle Real Application Clusters (RAC)' on the SAP SDN website at:

<http://sdn.sap.com/irj/sdn/ora> .

WORKED EXAMPLE

This worked example assumes that you have completed the following steps.

- Oracle Clusterware is installed.
- Oracle RAC is installed.
- You have installed SAP and the SAPCTL package

You need to know the following information about your SAP installation:

Required Information	Description	Typical Example
SAP_SID	The name of the SAP Instance containing the SAP services that require protection	RAC
interface	The name of the public network interface	eth0
netmask	The IP network Netmask	255.255.255.0
network address	The address of the network	140.86.242.0
hosting_members	The list of nodes that are capable of running the SAP services	sapnode1,sapnode2
abap_enqueue	The name of the SAP enqueue service of Web AS ABAP	ASCS01
abap_replication	The name of the SAP replication service of Web AS ABAP	ERS03
abap_msport	The portnumber of message server for ABAP (SAP profile parameter rdisp/msserv)	3601
IP address ABAP	A new IP address that will be bound to the public network interface for Web AS ABAP	140.86.242.63
java_enqueue	The name of the SAP enqueue service of Web AS JAVA	SCS02
abap_replication	The name of the SAP replication service of Web AS ABAP	ERS04
java_msport	The portnumber of message server for JAVA (SAP profile parameter j2ee/ms/port)	3902
IP address JAVA	A new IP address that will be bound to the public network interface for Web AS JAVA	140.86.242.64
Instance name	The name of the SAP instance of type CI or DV	DVEBMGS00
IP address Instance	A new IP address that will be bound to the public network interface for SAP instance	140.86.242.65

The SAPCTL utility

```
[root@oracx2 bin]# sapctl
Production Copyright 2010 Oracle. All rights reserved
USAGE:
sapctl <command> [<object>] -sapsid <SAP_SID> [options]
    command : start|stop|status|create|remove|relocate
    objects  : abapvip|javavip|abapenq|javaenq|abaprep|javarep
              |abapall|javaall|asinstall|asinstvip|asinst|all
NOTE:
Create and remove commands work on all objects only
For detailed help on each command and object and its options use:
sapctl <command> -h
```

Enable Oracle Clusterware Protection for your SAP resources

```
[root@oracx2 bin]# sapctl create -sapsid RAC -if eth0
-nm 255.255.255.0 -net 140.86.242.0
-nodes oracx1,oracx2,oracw1,oracw2
-abapvip 140.86.242.63 -abapmsport 3601 -abapenq ASCS01 -abaprep ERS03
-javavip 140.86.242.64 -javamsport 3902 -javaenq SCS02 -javarep ERS04
-asinstvip 140.86.242.65 -asinst DVEBMGS00
Production Copyright 2010 Oracle. All rights reserved
Creating SAP ABAP VIP
Creating SAP ABAP Enqueue resource
Creating SAP ABAP Replication resource
Creating SAP JAVA VIP
Creating SAP JAVA Enqueue resource
Creating SAP JAVA Replication resource
Creating SAP INST VIP for DVEBMGS00
Creating SAP INST resource for DVEBMGS00
Done
```

In this case, the SAP Central Services for ABAP and JAVA of the SAP system **RAC** is going to be protected:

The SAP enqueue service for Web AS ABAP called **ASCS01** and the Replication service called **ERS03** will be allowed to run on separate nodes from the following node list "**oracx1 oracx2 oracw1 oracw2**". A new virtual IP address **140.86.242.63** with a subnet of **255.255.255.0** will be loaded onto the **eth0** network adapter. Network adapter **eth0** has associated network (-net parameter) **140.86.242.0**.

The SAP enqueue service for Web AS JAVA called **SCS02** and the Replication service called **ERS04** will be allowed to run on separate nodes from the following node list "**oracx1 oracx2 oracw1 oracw2**". A new virtual IP address **140.86.242.64** with a subnet of **255.255.255.0** will be loaded onto the **eth0** network adapter. Network adapter **eth0** has associated network (-net parameter) **140.86.242.0**.

The SAP Central Instance called **DVEBMGS00** is allowed to run on separate nodes from the following node list "**oracx1 oracx2 oracw1 oracw2**". A new virtual IP address **140.86.242.65** with a subnet of **255.255.255.0** will be loaded onto the **eth0** network adapter.

Network adapter **eth0** has associated network (-net parameter) **140.86.242.0**.

The script does not automatically start these resources.

To see which SAP Instances have been protected by Oracle Clusterware

```
[root@oracx2 bin]# sapctl config
Production Copyright 2010 Oracle. All rights reserved
SAP SIDs protected by the Oracle Clusterware are :
RAC
```

In this case only one SAP Instance called 'RAC' is being protected by Oracle Clusterware.

Check the Status of the Oracle Clusterware Protected SAP resources

```
[root@oracx2 bin]# sapctl status all -sapsid RAC
sapctl version 6.0 Patch 2 Production Copyright 2011 Oracle. All
rights reserved
SAP ABAP Enqueue service is OFFLINE
SAP JAVA Enqueue service is OFFLINE
SAP ABAP Replication service is OFFLINE
SAP JAVA Replication service is OFFLINE
SAP instance DVEBMGS00 is OFFLINE
```

To check the status of the Oracle Clusterware resources that protect the SAP services use the status command. Please note that the status of all defined SAP instances is reported. The status of associated VIPs and the SAP Start Services for the SAP instances will not be displayed.

Start the Oracle Clusterware Protected SAP resources

```
[root@oracx2 bin]# sapctl start all -sapsid RAC
sapctl version 6.0 Patch 2 Production Copyright 2011 Oracle. All
rights reserved
Starting SAP ABAP Enqueue service
Starting SAP JAVA Enqueue service
Starting SAP ABAP Replication service
Starting SAP JAVA Replication service
Starting SAP instance DVEBMGS00
SAP ABAP Enqueue service is ONLINE on oracx1
SAP JAVA Enqueue service is ONLINE on oracx1
SAP ABAP Replication service is ONLINE on oracx2
SAP JAVA Replication service is ONLINE on oracx2
SAP instance DVEBMGS00 is ONLINE on oracx1
Done
```

Notice that you can use this command to start either the enqueue or replication services. However you should start the enqueue service first.

Check the Status after the start

```
[root@oracx2 bin]# sapctl status all -sapsid RAC
sapctl version 6.0 Patch 2 Production Copyright 2011 Oracle. All
rights reserved
SAP ABAP Enqueue service is ONLINE on oracx1
SAP JAVA Enqueue service is ONLINE on oracx1
SAP ABAP Replication service is ONLINE on oracx2
SAP JAVA Replication service is ONLINE on oracx2
SAP instance DVEBMGS00 is ONLINE on oracx1
```

The resource may take a short while to start. Therefore, some resources may indicate that they are OFFLINE while they are being started.

Stop the Enqueue Service for Web AS ABAP (and associated VIP)

```
[root@oracx2 bin]# sapctl stop abapenq -sapsid RAC
sapctl version 6.0 Patch 2 Production Copyright 2011 Oracle. All
rights reserved
Stopping SAP ABAP Enqueue service
```

```
SAP ABAP Enqueue service is OFFLINE
Done
```

You can use the stop command to stop the Enqueue service. Note that this will not stop the associated VIP.

Start the Enqueue Service for Web AS ABAP (and associated VIP)

```
[root@oracx2 bin]# sapctl start abapenq -sapsid RAC
sapctl version 6.0 Patch 2 Production Copyright 2011 Oracle. All
rights reserved
Starting SAP ABAP Enqueue service
SAP ABAP Enqueue service is ONLINE on oracx2
Done
```

You can use the start command to start the Enqueue service. This will also start the associated VIP. Notice that the Enqueue service now runs on the node that hosted the Replication service before.

Relocate SAP resources to other hosting member

```
[root@oracx2 bin]# sapctl relocate -sapsid RAC -abaprep ERS03 -to
oracw1
sapctl version 6.0 Patch 2 Production Copyright 2011 Oracle. All
rights reserved
Stopping SAP ABAP replication service
Relocating SAP ABAP Replication Service to node oracw1
Done
```

You can use the relocate command to move SAP resources to other hosting members. You cannot relocate any VIP resource with this command. Valid SAP resources are the Enqueue service, the Replication service or any SAP instance of type CI or DV.

Stop all of the Oracle Clusterware managed SAP resources

```
[root@oracx2 bin]# sapctl stop all -sapsid RAC
sapctl version 6.0 Patch 2 Production Copyright 2011 Oracle. All
rights reserved
Stopping SAP instance for DVEBMGS00
Stopping SAP JAVA Replication service
Stopping SAP ABAP Replication service
Stopping SAP JAVA Enqueue service
Stopping SAP ABAP Enqueue service
SAP ABAP Enqueue service is OFFLINE
SAP JAVA Enqueue service is OFFLINE
SAP ABAP Replication service is OFFLINE
SAP JAVA Replication service is OFFLINE
SAP instance DVEBMGS00 is OFFLINE
Done
```

You can choose to not stop all of the Oracle Clusterware resources by replacing all with either 'enqueue' or 'replication' but you should stop the replication service first.

Remove Oracle Clusterware protection for SAP resources

```
[root@oracx2 bin]# sapctl remove all -sapsid RAC
sapctl version 6.0 Patch 2 Production Copyright 2011 Oracle. All
rights reserved
Removing resource SAP ABAP Enqueue service
Removing resource SAP ABAP VIP
Removing resource SAP JAVA Enqueue service
Removing resource SAP JAVA VIP
Removing resource SAP ABAP Replication service
Removing resource SAP JAVA Replication service
Removing resource SAP instance DVEBMGS00
Removing resource SAP instance VIP for DVEBMGS00
Done
```

Note you cannot remove clusterware protection for a single resource. You must remove protection for all of the resources within an SAP instance in a single operation. This command must be run as the 'root' user.

APPENDIX 1 – SAMPLE PROFILE SCRIPTS

Note: In all examples given here only the required entries for SAP Standalone Enqueue and Enqueue Replication are shown.

The following is an example of the profile scripts for a standalone Enqueue Service for the SAP Web AS ABAP on a cluster. The virtual hostname of the cluster nodes hosting the ASCS instance is sap_abapvip in this example.

Script: DEFAULT.PFL

```
-----  
# rdisp/mshost must resolve to the IP address given as -abapvip  
# parameter in sapctl create command  
-----  
rdisp/mshost = sap_abapvip  
rdisp/msserv = sapmsRAC  
rdisp/msserv internal = 3901  
enque/process_location = REMOTESA  
-----  
# enqueue/serverhost must resolve to the IP address given as -abapvip  
# parameter in sapctl create command  
-----  
enque/serverhost = sap_abapvip  
enque/serverinst = 01  
-----  
# SAP Central Service Instance for J2EE  
-----  
# j2ee/scs/host must resolve to the IP address given as -javavip  
# parameter in sapctl create command  
-----  
j2ee/scs/host = sap_javavip  
j2ee/scs/system = 02  
j2ee/ms/port = 3902
```

Script: RAC_ASCS01_sap_abapvip

The following is an example of the profile scripts for a standalone Enqueue Service for the SAP Web AS ABAP on a cluster. The virtual hostname of the cluster nodes hosting the ASCS instance is sap_abapvip in this example.

```
enque/table_size=4096  
enque/process_location=LOCAL  
enque/server/internal_replication=true  
enque/server/replication=true
```

Script: RAC_ERS03_sap_abapvip

The following is an example of the profile scripts for a standalone Replication Service for SAP Web AS ABAP on a cluster.

```
enque/table_size=4096  
enque/process_location=LOCAL  
enque/server/internal_replication=true  
enque/server/replication=true  
enque/enrep/keepalive_count=0
```

Script: RAC_SCS02_sap_javavip

The following is an example of the profile scripts for a standalone Enqueue Service for the SAP Web AS JAVA on a cluster. The virtual hostname of the cluster nodes hosting the SCS instance is sap_javavip in this example.

```
enque/table_size=4096  
enque/process_location=LOCAL  
enque/server/internal_replication=true  
enque/server/replication=true  
enque/enrep/keepalive_count=0
```

Script: RAC_ERS04_sap_javavip

The following is an example of the profile scripts for a standalone Replication Service for SAP Web AS JAVA on a two-node cluster.

```
enqueue/table size=4096
enqueue/process_location=LOCAL
enqueue/server/internal_replication=true
enqueue/server/replication=true
enqueue/serverinst = 02
enqueue/enrep/keepalive_count=0
rdisp/msserv = 0
rdisp/msserv_internal = 3902
ms/standalone = 1
ms/server_port_0 = PROT=HTTP,PORT=81$$
```

Script: RAC_DVEBMGS00_sap_instvip

The following is an example of the profile scripts for a SAP Central Instance on a cluster. The virtual hostname of the cluster nodes hosting the instance is sap_instvip in this example.

```
#-----
# No changes required here. All required parameters are in DEFAULT.PFL
#-----
```

APPENDIX 2 – TROUBLESHOOTING AND LOG FILES

The troubleshooting content in this section assumes that you are familiar with the Oracle Clusterware and SAP R/3 commands. You can troubleshoot SAPCTL by examining the log files as described in this section.

The following is the log of the actions that SAPCTL performs. You should also check to see which commands were executed. If you cannot resolve your problem, then examine this log file to determine why resource actions do not perform as expected:

`/usr/sap/sapctl/log/sapctl.log`

You can also examine the content of the CRSD log file:

`${ORA_CRS_HOME}/log/<hostname>/crsd/crsd.log`

A detailed log output from actions performed by SAPCTL per node for every SAP SID is in directory:

`${ORA_CRS_HOME}/log/<hostname>/agent/crsd/scriptagent_<sidadm>`

APPENDIX 2 - SAPCTL BILL OF MATERIALS

This section describes the SAPCTL bill of materials (BOM). The un-compressed tar file contains the following items:

- `./bin/sapctl` – This is a Perl-based SAPCTL management utility implementation.
- `./bin/crssapactions.pl` – The action script called by CRS to start, stop and monitor all defined SAP resources.
- `./doc/sapctl.doc` – This is a copy of this document.

APPENDIX 3 – CRS RESOURCES AND TYPES

The SAPCTL create command creates all CRS resources and type definition for SAP instances. Every SAP instance type has specialized CRS resource type. Below is the list with all resources and types used by SAPCTL. Depending on the SAP instance types protected by SAPCTL you may find only a subset in an actual installation.

List of CRS resources used by SAPCTL

```
sap.<SID>.ASCS<NR>.startsrv
sap.<SID>.ASCS<NR>.abapenq
sap.<SID>.SCS<NR>.startsrv
sap.<SID>.SCS<NR>.javaenq
sap.<SID>.ERS<NR>.startsrv
sap.<SID>.ERS<NR>.abaprep
sap.<SID>.abapvip
sap.<SID>.javavip
sap.<SID>.DVEBMGS<NR>.startsrv
sap.<SID>.DVEBMGS<NR>.sapinst
sap.<SID>.DVEBMGS<NR>.instvip
sap.<SID>.DV<NR>.startsrv
sap.<SID>.DV<NR>.sapinst
sap.<SID>.DV<NR>.instvip
sap.<SID>.G<NR>.startsrv
sap.<SID>.G<NR>.sapgw
sap.<SID>.G<NR>.gwvip
sap.<SID>.W<NR>.startsrv
sap.<SID>.G<NR>.gwinst
sap.<SID>.G<NR>.gwvip
ora.net<x>.network
```

For detailed information of all resource attributes use CRS command “`crsctl status resource <resource_name> -f`”.

List of CRS Types used for SAPCTL

For implementation of the CRS resources defined for SAP, some specific resource types will get defined by sapctl during resource creation.

```
sap.abapenq.type
sap.abaprep.type
sap.javaenq.type
sap.javarep.type
sap.startsrv.type
ora.network.type
cluster_resource
app.appvip.type
```

For detailed information of resource types use CRS command
“**crsctl status type <type_name> -f**”

Serverpool used for SAPCTL

If not already existing; sapctl will create a serverpool resource in CRS repository.

SAP_SP_<SID>

Information on nodes defined for the Serverpool can be obtained by CRS command
“**crsctl status serverpool <serverpool_name> -f**”.

APPENDIX 4 – MULTIPLE APPLICATION VIP’S FOR SAP RESOURCES

The Oracle Clusterware Framework supports multiple application VIPs on different networks for SAP application resources. If a SAP resource has a dependency on multiple application VIPs, these VIPs are always co-located on the same host. Configuration of additional application VIPs is not supported by SAPCTL create command, so the required modifications must be done manually.

The following example script shows how to set up a second application VIP for SAP ASCS and SCS resource. You can use this script as template.

```
#
# Template for creation of second cluster resource VIP for
# SAP instance types ASCS and SCS
#
# Settings used in this example which needs to be adopted to your needs:
#
# ABAP Central services Instance ASCS:      ASCS10
# ABAP Replication Instance:                ERS20
# JAVA Central Services Instance SCS:       SCS11
# JAVA Replication Instance:                ERS21
# <sid>adm user for this installation:       kbladm
# <SID> for this installation:                KB1
# Netmask for second network:                255.255.255.0
# Subnet used for 2nd VIP resources:         192.168.20.0
#
# 1. Create additional network resource "ora.net3.network"
#    for the VIP's on the second network.
#    Chance ACL permissions of resource "ora.net3.network" to allow
#    user <sid>adm and user oracle to operate on this resource
#
/oracle/GRID/11202/bin/crsctl add resource ora.net3.network -type
ora.network.type -attr "USR ORA IF=eth1, USR ORA NETMASK=255.255.255.0,
USR_ORA_SUBNET=192.168.20.0"
/oracle/GRID/11202/bin/crsctl setperm resource ora.net3.network -u user:kbladm:r-
x
/oracle/GRID/11202/bin/crsctl setperm resource ora.net3.network -u user:oracle:r-
x
#
# 2. Create application VIP for ASCS and/or SCS instance on the second network.
#    Chance ACL permissions of resources "sap.<SID>.[abapvip2|javavip2]" to allow
#    user <sid>adm and user oracle to operate on this resource
#
# ABAP:
/oracle/GRID/11202/bin/crsctl add resource sap.KB1.abapvip2 -type app.appvip.type
-attr
"RESTART ATTEMPTS=0,START TIMEOUT=100,STOP TIMEOUT=100,USR ORA VIP=192.168.20.100
, START_DEPENDENCIES=hard(ora.net3.network) pullup(ora.net3.network)
attraction(sap.KB1.ERS20.abaprep),STOP_DEPENDENCIES=hard(ora.net3.network)"
/oracle/GRID/11202/bin/crsctl setperm resource sap.KB1.abapvip2 -u user:kbladm:r-
x
/oracle/GRID/11202/bin/crsctl setperm resource sap.KB1.abapvip2 -u user:oracle:r-
x
#
# JAVA :
/oracle/GRID/11202/bin/crsctl add resource sap.KB1.javavip2 -type app.appvip.type
-attr
"RESTART ATTEMPTS=0,START TIMEOUT=100,STOP TIMEOUT=100,USR ORA VIP=i192.168.20.10
1, START_DEPENDENCIES=hard(ora.net3.network) pullup(ora.net3.network)
attraction(sap.KB1.ERS21.javarep),STOP_DEPENDENCIES=hard(ora.net3.network)"
```

```

/oracle/GRID/11202/bin/crsctl setperm resource sap.KB1.javavip2 -u user:kbladm:r-
x
/oracle/GRID/11202/bin/crsctl setperm resource sap.KB1.javavip2 -u user:oracle:r-
x

# 3. Modify resource for ASCS and/or SCS instance, adding start dependency on
both application VIP's on backend and frontend network.
# Note the single quotation mark for attribute START DEPENDENCIES, required if
there is a list.
#
# ABAP:
/oracle/GRID/11202/bin/crsctl modify resource sap.KB1.ASCS10.abapenq -attr
"START_DEPENDENCIES='hard(sap.KB1.abapvip,sap.KB1.abapvip2,sap.KB1.ASCS10.startsr
v) pullup(sap.KB1.abapvip,sap.KB1.abapvip2,sap.KB1.ASCS10.startsrv)
attraction(sap.KB1.ERS20.abaprep)'"

#
# JAVA:
/oracle/GRID/11202/bin/crsctl modify resource sap.KB1.SCS11.javaenq -attr
"START_DEPENDENCIES='hard(sap.KB1.javavip,sap.KB1.javavip2,sap.KB1.SCS11.startsrv
) pullup(sap.KB1.javavip,sap.KB1.javavip2,sap.KB1.SCS11.startsrv)
attraction(sap.KB1.ERS21.javarep)'"

```

(Note that there are no CR/LF in the command lines shown)



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