19c ORACLE Database

Providing High Availability for SAP Resources starting with Oracle Clusterware 11g Release 2 up to Oracle Clusterware 19c

Important Things to Follow

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ORACLE

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OVERVIEW OF 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. 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

The current version of SAPCTL can be used starting with Oracle Clusterware 11g Release 2 and up to and including Oracle Clusterware 19c. Older versions of Oracle Clusterware are not supported with this version of SAPCTL.

This version contains a functionality to migrate VIP´s used for SAP to new types supported by Oracle Clusterware. You are required to migrate the type used for VIP`s for SAP before you upgrade to Oracle Clusterware 18c or Oracle Clusterware 19c as well as for all older supported releases before you apply the latest patch bundles or release upgrades (BP´s or RU´s). See Appendix 7 for instructions.

A new shell script is added to this version of SAPCTL, providing simplified modification to SAP instance profiles. You can use the script sapctl_config.sh to automatically maintain SAP instance profiles for SAP instance types ASCS, ERS, CENTRAL and PAS. See Appendix 8 for details.

An interface for SAP HA monitoring is implemented. Start and stop of SAP instances protected by SAPCTL can now be controlled by SAP monitoring tools, e.g. SAP MMC.

In addition to the critical SAP high availability components, namely the SAP Enqueue and SAP Replication Service, SAPCTL Version 10 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.

Oracle Exadata , Oracle SuperCluster and Oracle Database Appliance are certified to run SAP Central Services (SCS and ASCS instances and the ER instances) and SAPCTL supports these services when running on above mentioned Engineered Systems. For information on SAP on Oracle Exadata see SAP Note 1590515 and white paper “Using SAP NetWeaver with the Oracle Exadata Database Machine”, available here: http://scn.sap.com/community/oracle.

SAPCTL is available for the LINUX, Solaris and AIX operating system.

All SAP kernels starting with kernel version 7.00 are supported by SAPCTL.

As an additional option to simplify SAP monitoring of SAP ERS (enqueue replication) instances, SAPCTL supports an optional VIP for the SAP ERS instance. This VIP is always co-located with the SAP ERS instance. The VIP is optional and not required by placement decisions inside SAPCTL.

The new SAP Enqueue Service (ENSA2) is supported by SAPCTL. Decision on type of Enqueue Sevice is done during initial configuration. For ENSA2 the VIP for SAP ERS instance is mandatory.

Switching between old and new SAP Enqueue Service is possible. See Appendix 6 for instructions.

SAP SUPPORT FOR HIGH AVAILABILITY

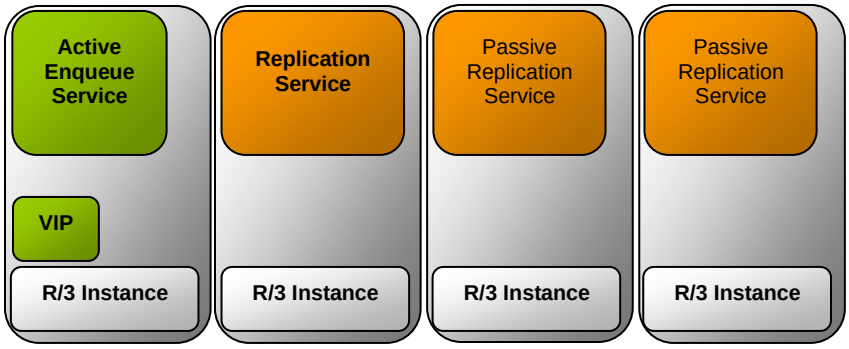
The SAP Enqueue Service provides distributed lock management for SAP application server instances. The SAP Enqueue Service must be available whenever an SAP installation uses more than one SAP instance. In order to support high availability, the Enqueue Service together with the Message Service builds 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

SAPCTL 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 always be 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.

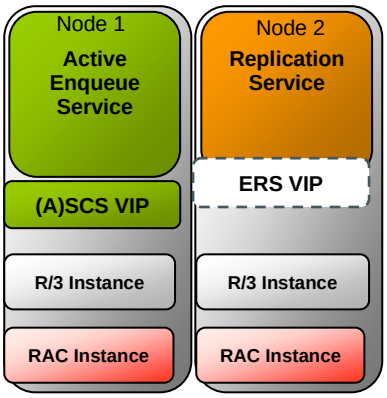
If you need to stop a running SAP Start Service, you can stop it with the Oracle Clusterware command crsctl.

SUPPORTED CONFIGURATIONS

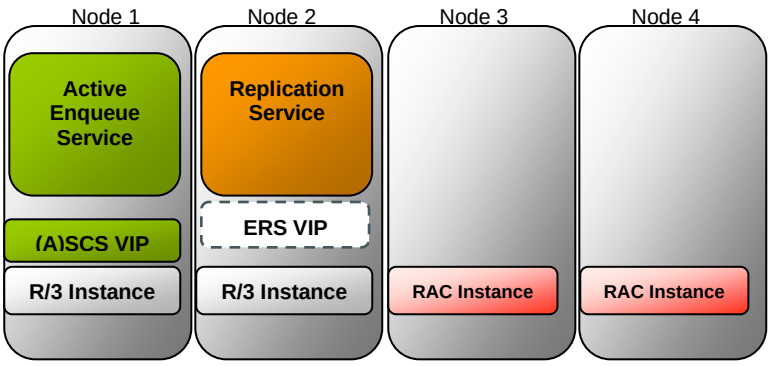
The Enqueue and Replication Services for ABAP and/or JAVA can run on any node that supports SAP R/3 or SAP WebAS which is limited to the following two configurations:

- All solutions require shared disk for the Oracle Cluster Registry (OCR) and voting disk device.
- All solutions assume that SAP runs in an Oracle Real Application Clusters (RAC) environment.
- Only the Oracle Clusterware of the Oracle RAC installation can be used i.e. a stand-alone Oracle Clusterware setup is not supported.

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.



Note: All four nodes in the example above forming one single cluster. It is not allowed to use only Oracle Clusterware together with sapctl without the Oracle RAC database installed.

Note: The optional ERS VIP for the SAP replication Service is not required for SAPCTL to function properly with the classic implementation of SAP standalone enqueue and replication (ENSA). The new implementation from SAP, known as ENSA2, will require the ERS VIP. For monitoring with SAP tools like MMC and connection for SAP Solution Manager or SAP LVM the ERS VIP is required as well.

INSTALLATION AND MANAGEMENT

You must install the Oracle Database software that you are using with your SAP installation under 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 consist of the following tasks:

- Appropriately configure the SAP application
- Register 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.

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). For example 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.

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 used 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. For instance, 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.

If the SAP HALIB interface script socc is to be used, put the path to saphascriptco.so and socc to the instance profile parameters service/halib and service/halib_cluster_connector.

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 for SAPCTL to function properly. So the hostname extension in the instance profile does not matter.

With this version of SAPCTL, an optional VIP for the Enqueue Replication Instance is supported. You may specify this VIP during creation of the resource for the Enqueue Replication instance. If you do so, it´s a good practice to use this hostname associated with the VIP as the extension to the instance profile.

Using the optional VIP for ERS simplifies SAP monitoring for SAP tools like MMC, Solution Manager or LVM.

If the SAP HALIB interface script socc is to be used, put the path to saphascriptco.so and socc to the instance profile parameters service/halib and service/halib_cluster_connector.

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

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

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.

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.

If the SAP HALIB interface script socc is to be used, put the path to saphascriptco.so and socc to the instance profile parameters service/halib and service/halib_cluster_connector.

INSTALLATION OF SAPCTL

The installation must be performed as user root.

Create the following directories:

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

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

```
# cd /usr/sap/sapctl
# 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/19/bin/crsctl  /usr/sap/sapctl/bin/crsctl
# ln –s /oracle/GRID/19/bin/crsctl.bin  /usr/sap/sapctl/bin/crsctl.bin
```

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

```
# cp –r /oracle/GRID/19/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.

UPRGADE FROM PREVIOUS VERSION

SAPCTL version is already version 6 or newer.

Replace the scripts in /usr/sap/sapctl/bin with the scripts deliverd with this version.

Change owner and group for all scripts in /usr/sap/sapctl/bin to <sid>adm:sapsys

```
# chown –R <sid>adm:sapsys /usr/sap/sapctl/bin
# chmod –R 775 /usr/sap/sapctl/bin
```

Start SAP resources with sapctl afterwards.

SAPCTL version is below version 6

Upgrade of CRS resources defined with versions before SAPCTL version 6 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.

Interface for SAP HALIB library

SAP provides a platform dependent library for vendor specific cluster solutions. This library is dynamically loaded by executable sapstartsrv during startup of the process. You must donwload the appropriate library for your platform / version from SAP service marketplace. SAPCTL provides a script “socc” (SAP Oracle Cluster Connector) which implements the functions required by SAP for interaction / monitoring with cluster solutions of different vendors. Script “socc” is platform independent.

Activation / load of the SAP halib is controlled with profile parameters in the instance profile. See Appendix 1 – Sample Profile Scripts for example. Also refer to SAP documentation for SAP high availability library for your platform.

Hint: Depending on your SAP kernel version, the SAP halib may require the script interface to reside in "/usr/local/bin/sap_cluster_connector". Create a symbolic link to "/usr/sap/sapctl/bin/socc" to adhere to the regulations.

```
# ln –s /usr/sap/sapctl/bin/socc   /usr/local/bin/sap_cluster_connector
```

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 'working 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.
- Set or Unset maintenance mode and suspend mode in sapctl for software maintenance operations performed on a SAP system without Clusterware interaction. No Check or failover is triggered if maintenance mode or suspend mode is active.

USAGE

sapctl <command> [<object>] -sapsid <SAP_SID> [options]

Command: start|stop|status|create|remove|relocate

Objects: abapvip|aersvip|javavip|jersvip|abapenq|javaenq|abaprep|javarep|abapall|javaall|asinstall|asinstvip|asinst|gwvip|gwinst|wdspvip|wdspinst|all|suspend|maintenance

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 FOR SAPCTL COMMAND

Object Type	Description
abapvip:	Refers to the VIP for the Enqueue Service of Web AS ABAP
aersvip:	Refers to the VIP for the Replication Service of Web AS ABAP

javavip:	Refers to the VIP for the Enqueue Service of Web AS JAVA
jersvip:	Refers to the VIP for the Replication 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.
maintenance:	Indicates maintenance mode for SAP system (set or unset depending on command)
suspend:	Indicates suspend mode for SAP system (set or unset depending on command)

COMMAND

Command	Description
start	Starts the resources associated with the object. Set maintenance or suspend mode.
stop	Stops the resources associated with the object. Unset maintenance or suspend mode.
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. See table COMMAND PARAMETERS for additional switches supported
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 resouces 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.
config	Switch between classical enqueue implementation (ENSA) and new implementation for standalone enqueue type (ENSA2) by use of parameter –enqtype. Without this parameter the SID of all protected SAP systems is displayed. Note that SAP profiles must be changed / configured as well if switch of enqueue type is planned.

COMMAND PARAMETERS

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>	-abapenq <EnqInst>
-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
-aersvip <IP Address>	A New IP Address for ERS ABAP (optional)
-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
-jersvip <IP Address>	A New IP Address for ERS JAVA (optional)
-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 of SAP Standalone Gateway
-gwvip <IP Address>	A New IP Address for SAP Standalone Gateway
-wdspinst <SAP Instance>	The Instance name of SAP WebDispatcher
-wdspvip <IP Address>	A New IP Address for SAP WebDispatcher
-to <node>	Tells the node where the resource should run after relocation
-nx <Network Number>	Network number in Oracle Clusterware. Default value is 2 if not specified
-enqtype <Number>	Use old (-enqtype=1) or new (-enqtype=2) Enqueue Service. Default value is 1 if not specified

RELOCATE PARAMETERS

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

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.

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/technetwork/database/database-technologies/clusterware/overview/index.html

And as a reminder - For details about configuring SAP with Oracle RAC refer to the white papers in key topics folder 'SAP on Oracle Real Application Clusters (RAC)' on the SAP Community Network at:

http://scn.sap.com/community/oracle .

General information for recommended HA-Setup by SAP is provided in SAP note “803018 – central note for NetWeaver04 High Availability capabilities”.

WORKING EXAMPLE

This working 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
IP address ERS ABAP	A new IP address that will be bound to the public network interface for Web AS ABAP ERS	140.86.242.66
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
IP address ERS JAVA	A new IP address that will be bound to the public network interface for Web AS JAVA ERS	140.86.242.67
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
sapctl version 10.0 Patch 0  Production Copyright 2019 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|suspend|mai
ntenance
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 –aersvip 140.86.242.66 –abapmsport 3601 –abapenq ASCS01 –abaprep ERS03 –
javavip 140.86.242.64 –jersvip 140.86.242.67 –javamsport 3902 –javaenq SCS02 –javarep ERS04        –
asinstvip 140.86.242.65 –asinst DVEBMGS00
sapctl version 10.0 Patch 0  Production Copyright 2019 Oracle.  All rights reserved
Creating SAP ABAP VIP
Creating SAP ABAP ERS VIP
Creating SAP ABAP Enqueue resource
Creating SAP ABAP Replication resource
Creating SAP JAVA VIP
Creating SAP JAVA ERS 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.

This virtual IP address is always placed on the same host as the ACSC01 instance.

The optional new virtual IP address **140.86.242.66** with the subnet **255.255.255.0** will be loaded onto the **eth0** network adapter. This optional virtual IP address is always placed on the same host as the ERS03 instance.

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.

This virtual IP address is always placed on the same host as the SCS02 instance.

The optional new virtual IP address **140.86.242.67** with the subnet **255.255.255.0** will be loaded onto the **eth0** network adapter. This optional virtual IP address is always placed on the same host as the ERS04 instance.

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 check which SAP Instances have been protected by Oracle Clusterware

```
[root@oracx2 bin]# sapctl config
sapctl version 10.0 Patch 0  Production Copyright 2019 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 10.0 Patch 0  Production Copyright 2019 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 10.0 Patch 0  Production Copyright 2019 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 10.0 Patch 0  Production Copyright 2019 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

```
[root@oracx2 bin]# sapctl stop abapenq -sapsid RAC
sapctl version 10.0 Patch 0  Production Copyright 2019 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 and also not stop the associated SAP sapstartsrv process.

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

```
[root@oracx2 bin]# sapctl start abapenq -sapsid RAC
sapctl version 10.0 Patch 0  Production Copyright 2019 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. Note that any already running associated VIP and the associated SAP sapstartsrv process will be relocated to the same node as the Enqueue service if required.

Relocate SAP resources to other hosting member

```
[root@oracx2 bin]# sapctl relocate –sapsid RAC –abaprep ERS03 –to oracw1
sapctl version 10.0 Patch 0  Production Copyright 2019 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 10.0 Patch 0  Production Copyright 2019 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 10.0 Patch 0  Production Copyright 2019 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.

Activate suspend mode for all SAP resources

```
[root@oracx2 bin]# sapctl  start suspend -sapsid RAC
sapctl version 10.0 Patch 0  Production Copyright 2019 Oracle.  All rights reserved
```

Note that the suspend mode works on all Oracle Clusterware resources associated with given SID. So the suspend mode is active then for all protected instances of a given SAP system. If the suspend mode is active, all CHECK operations for monitoring health of SAP resources are skipped, failed or stopped processes will not be detected then. No failover is triggered as long as suspend mode is set. Start and Stop actions triggered either by command line calls to sapctl or the SAP HALIB interface script socc will work normally. No change in SAP instance profiles is required for entering suspend mode for a SAP system.

Deactivate suspend mode for all SAP resources

```
[root@oracx2 bin]# sapctl  stop suspend -sapsid RAC
sapctl version 10.0 Patch 0  Production Copyright 2019 Oracle.  All rights reserved
```

Note that the suspend mode works on all Oracle Clusterware resources associated with given SID. Check functionality is resumed. SAP resources should be in consistent state before deactivating suspend mode to avoid unexpected failover.

Activate maintenance mode for all SAP resources

The primary usage pattern for using maintenance mode in sapctl is to enable SAP upgrade process SUM to run without interfering with Oracle Clusterware monitoring and controlling SAP resources. Note that the maintenance mode works on all Oracle Clusterware resources associated with given SID. So the maintenance mode is active then for all protected instances of a given SAP system. During maintenance mode no action is performed on any resource associated with given SID. This affects direct command line actions for starting and stopping of resources with sapctl command as well as actions triggered by SAP HALIB script interface socc. In maintenance mode calls to sapcontrol will not take place. You do not need to disable calls to SAP HALIB interface in the instance profiles of the SAP instance to bypass calls to SAP Oracle Clusterware Connector socc.

```
 [root@oracx2 bin]# sapctl  start maintenance -sapsid RAC
sapctl version 10.0 Patch 0  Production Copyright 2019 Oracle.  All rights reserved
```

Deactivate maintenance mode for all SAP resources

Note that the maintenance mode works on all Oracle Clusterware resources associated with given SID. The sapctl controlled maintenance mode can be switched on or off for single instance upgrade if upgrade process is done individually instance by instance or for complete period of SUM upgrade of the whole SAP system.

Before maintenance mode is deactivated, all instances and SAP startservice processes must be in same operating state as at the time when sapctl controlled maintenance mode was activated. Otherwise sapctl will detect changed state and probably initiate a failover of the affected instance.

Perform following step to deactivate maintenance mode:

```
[root@oracx2 bin]# sapctl  stop maintenance -sapsid RAC
sapctl version 10.0 Patch 0  Production Copyright 2019 Oracle.  All rights reserved
```

MAINTENANCE MODE SET BY SAP

The SAP controlled Maintenance Mode cannot be influenced via sapctl command line. It also differs in the scope of affected resources. Whereas the maintenance / suspend mode which can be set or unset by the user via sapctl command line calls works on all instances of a given SAP system, the SAP internally issued maintenance mode signaled to the Oracle Clusterware is set or unset individually for every single SAP instance.

The SAP controlled maintenance mode is used for SAP SUM operations (software updates by SAP Solution Manager) and planned restart operations of SAP instances and sapstartsrv service processes.

Note that this kind of maintenance operations is currently not available with all SAP kernels. Please check with SAP on availability of this feature. Details on supported SAP configurations and required SAP kernel version is published in SAP note 2464065 – Check of automatic maintenance mode for HA solutions.

APPENDIX 1 – SAMPLE PROFILE SCRIPTS

Note: In all examples given below 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
#-----------------------------------------------------------------------
# enque/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
#-----------------------------------------------------------------------
# SAP HA-Lib and Cluster Connector
#-----------------------------------------------------------------------
service/halib=/usr/sap/RAC/ASCS00/exe/saphascriptco.so
service/halib_cluster_connector=/usr/sap/sapctl/bin/socc
service/halib_debug_level=3
```

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
#-----------------------------------------------------------------------
# SAP HA-Lib and Cluster Connector
#-----------------------------------------------------------------------
service/halib=/usr/sap/RAC/ERS03/exe/saphascriptco.so
service/halib_cluster_connector=/usr/sap/sapctl/bin/socc
service/halib_debug_level=3
```

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
#-----------------------------------------------------------------------
# SAP HA-Lib and Cluster Connector
#-----------------------------------------------------------------------
service/halib=/usr/sap/RAC/SCS02/exe/saphascriptco.so
service/halib_cluster_connector=/usr/sap/sapctl/bin/socc
service/halib_debug_level=3
```

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.

```
enque/table_size=4096
enque/process_location=LOCAL
enque/server/internal_replication=true
enque/server/replication=true
enque/serverinst = 02
enque/enrep/keepalive_count=0
rdisp/msserv = 0
rdisp/msserv_internal = 3902
ms/standalone = 1
ms/server_port_0 = PROT=HTTP,PORT=81$$
#-----------------------------------------------------------------------
# SAP HA-Lib and Cluster Connector
#-----------------------------------------------------------------------
service/halib=/usr/sap/RAC/ERS04/exe/saphascriptco.so
service/halib_cluster_connector=/usr/sap/sapctl/bin/socc
service/halib_debug_level=3
```

Script: RAC_DVEBMGS10_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.

```
#-----------------------------------------------------------------------
# SAP HA-Lib and Cluster Connector
#-----------------------------------------------------------------------
service/halib=/usr/sap/RAC/DVEBMGS10/exe/saphascriptco.so
service/halib_cluster_connector=/usr/sap/sapctl/bin/socc
service/halib_debug_level=3
```

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 3 - 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.
- ./bin/socc — The SAP Oracle Cluster Connector. Interface script for SAP HA connector.
- /bin/sapctl_config.sh — This shell script is for automated maintenance of SAP instance profiles
- ./doc/sapctl.doc — This is a copy of this document.

APPENDIX 4 – 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>.aersvip
sap.<SID>.jersvip
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
sap.<SID>.maintenance
sap.<SID>.suspend
sap.<SID>.<NR>.maintenance

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
app.appviptypex2.type
ora.cluster_vip.type
ora.cluster_vip_net<x>.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 5 – 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.

Note: Replace used type **app.appvip.type** in this example by type **app.appviptype2x.type** if you already have migrates VIP type. See Appendix 7

```
#
# Template for creation of second cluster resource VIP for
# SAP instance types ASCS and SCS
#
# Settings used in this example which needs to be adapted 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:    kb1adm
#   <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/19/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 -unsupported"

/oracle/GRID/19/bin/crsctl setperm resource ora.net3.network -u user:kb1adm:r-x -unsupported
/oracle/GRID/19/bin/crsctl setperm resource ora.net3.network -u user:oracle:r-x -unsupported

#
# 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/19/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/19/bin/crsctl setperm resource sap.KB1.abapvip2 -u user:kb1adm:r-x
/oracle/GRID/19/bin/crsctl setperm resource sap.KB1.abapvip2 -u user:oracle:r-x

#
# JAVA :
/oracle/GRID/19/bin/crsctl add resource sap.KB1.javavip2 -type app.appvip.type -attr
"RESTART_ATTEMPTS=0,START_TIMEOUT=100,STOP_TIMEOUT=100,USR_ORA_VIP=i192.168.20.101,
START_DEPENDENCIES=hard(ora.net3.network) pullup(ora.net3.network)
attraction(sap.KB1.ERS21.javarep),STOP_DEPENDENCIES=hard(ora.net3.network)"

/oracle/GRID/19/bin/crsctl setperm resource sap.KB1.javavip2 -u user:kb1adm:r-x
/oracle/GRID/19/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.
#
/oracle/GRID/19/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)

APPENDIX 6 – SWITCHING SAP ENQUEUE SERVICE TYPE

SAP offers a new type of Enqueue service, called ENSA2. This new type requires changes in the resource attributes for the ABAP SCS and JAVA SCS instances and the SAP Start Service resources for these instances. In Oracle Clusterware, the placement strategy for the (A)SCS instances will change. In the old implementation the A(SCS) instances must be started on the node where the ERS instance runs. To achieve this, the associated CRS resources use an “attraction” attribute. So A(SCS) instance tries to follow ERS instance in case of failure.

With the new ENSA2 type this has changed. A(SCS) instances no longer need to follow ERS instances as the replication table is reconstructed now from ERS via network connection. Attach to existing shared memory held by ERS is no longer required. To reflect this, the associated CRS resources use a “dispersion” attribute. So A(SCS) instance tries to start on different host than ERS instance in case of failure.

The following example shows how to switch from old ENSA to new ENSA2. Run the command as user “root”:

```
[root@oracx2 bin]# sapctl config –sapsid RAC –enqtype 2
sapctl version 10.0 Patch 0  Production Copyright 2019 Oracle.  All rights reserved
Done
```

Switching back to old ENSA from new ENSA2 can be done by using enqtype 1 in the command. Example:

```
[root@oracx2 bin]# sapctl config –sapsid RAC –enqtype 1
sapctl version 9.0 Patch 0  Production Copyright 2017 Oracle.  All rights reserved
Done
```

Execution of the command may take some time.

Note that the SAP profiles must be changed as well. This change must be executed manually. See SAP documentation for instructions.

Configuration and other topics on ENSA2 can be found here:

https://help.sap.com/viewer/cff8531bc1d9416d91bb6781e628d4e0/1709%20001/en-US/902412f09e134f5bb875adb6db585c92.html

If multiple application VIP´s are used for SAP resources the attributes in parameter START_DEPENDENCIES must be changed. If ENSA2 is used, attribute “attraction” must be changed to attribute “dispersion”. Example for changing the attribute:

```
#  ABAP:
/oracle/GRID/19/bin/crsctl modify resource sap.KB1.abapvip2 -attr
" START_DEPENDENCIES=hard(ora.net3.network) pullup(ora.net3.network) dispersion(sap.KB1.ERS20.abaprep)"
#  JAVA:
/oracle/GRID/19/bin/crsctl modify resource sap.KB1.javavip2 -attr
" START_DEPENDENCIES=hard(ora.net3.network) pullup(ora.net3.network) dispersion(sap.KB1.ERS21.javarep)"
```

APPENDIX 7 – MIGRATE TYPE USED FOR SAP APPLICATION VIP

You are required to migrate the type used for VIP`s for SAP before you upgrade to Oracle Clusterware 18c or Oracle Clusterware 19c as well as for all older supported releases before you apply the latest patch bundles or release upgrades (BP´s or RU´s).

It is important that you perform this type migration of all VIP´s used by SAP as otherwise the Oracle Clusterware may not start correctly after node reboot or Clusterware shutdown.

You must stop the all SAP resources before you start the migration. Use sapctl stop all -sapsid <SID> for all SAP systems protected by sapctl. Also make sure that the VIP´s used for SAP are stopped. Use command crsctl to stop still running VIP´s.

Perform following command to execute type migration:

```
sapctl migrate_vip_type
```

After that, check that type of all SAP VIP`s has changed from app.appvip.type to app.appviptypex2.type.

Use command

```
crsctl status resource -w “(TYPE = app.appviptype2x.type)”
```

to list migrated resources.

APPENDIX 8 – SHELL SCRIPT FOR SAP INSTANCE PROFILE MAINTENANCE

A new shell script is added to this version of SAPCTL, providing simplified modification to SAP instance profiles. You can use the script sapctl_config.sh to automatically maintain SAP instance profiles for SAP instance types ASCS, ERS, CENTRAL and PAS.

The script sapctl_config.sh helps you adjusting your SAP instance profiles in a non-intrusive way

```
./sapctl_config.sh

sapctl_config (for this output)
sapctl_config <input filename> <option>
 options ASCS | ERS | CENTRAL | PAS
```

sapctl_config is non-intrusive and attempts to write into <input_filename>.sapctl.cfg for your personal review.

Covers: parameters according to Appendix 1 plus content from this SAP Note regarding "Start_Program".

After your personal review you may backup your initial SAP instance profiles and replace with the generated ones.

NB: If you refuse to overwrite existing files, it works in "append" mode.

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