

# Oracle Clusterware 18c Technical Overview

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## Introduction

Oracle Clusterware enables the clustering of otherwise independent servers so that they co-operate as a single system. As a cluster, these servers provide the integrated foundation to enable high availability and scalability for Oracle Real Application Cluster (RAC) databases and user applications.

The cluster of servers is coordinated via the Oracle Clusterware, with cluster resources made available as required in support of the high availability requirements of the Oracle RAC databases and applications running on the cluster, on one or more of the clustered servers, or nodes. Introduced in Oracle 10g Release 1, Oracle Clusterware has evolved and broadened its capabilities to meet the demand for a more versatile and more capable infrastructure, while automating much of the co-ordination of events and actions behind the scenes.

Oracle Clusterware 12c Release 2 provided new features and enhancements aimed at reducing the effective cost of ownership, especially with regards to larger cluster estates. The introduction of Oracle Clusterware 18c continues that enrichment, focusing primarily on ease of use and the reduction of operating effort.

Oracle Clusterware 18c introduces the following features & enhancements:

» **Cluster Domain architectures enhancements:**

- » *Conversions*,
  - from Standalone Cluster to Member Cluster, and
  - from one storage access configuration to another for Database Member Clusters.
- » *Oracle ACFS Remote Service*: enable Oracle ACFS file systems on local Member Clusters utilizing remotely hosted ASM storage services on the Domain Services Cluster.
- » *Single network support for Application Member Clusters*.

» **Shared SCAN** – the optional election of SCAN VIP's on one cluster to act as the SCAN VIP's for other clusters, reducing the number of IP addresses required by using a single SCAN VIP setup for multiple clusters.

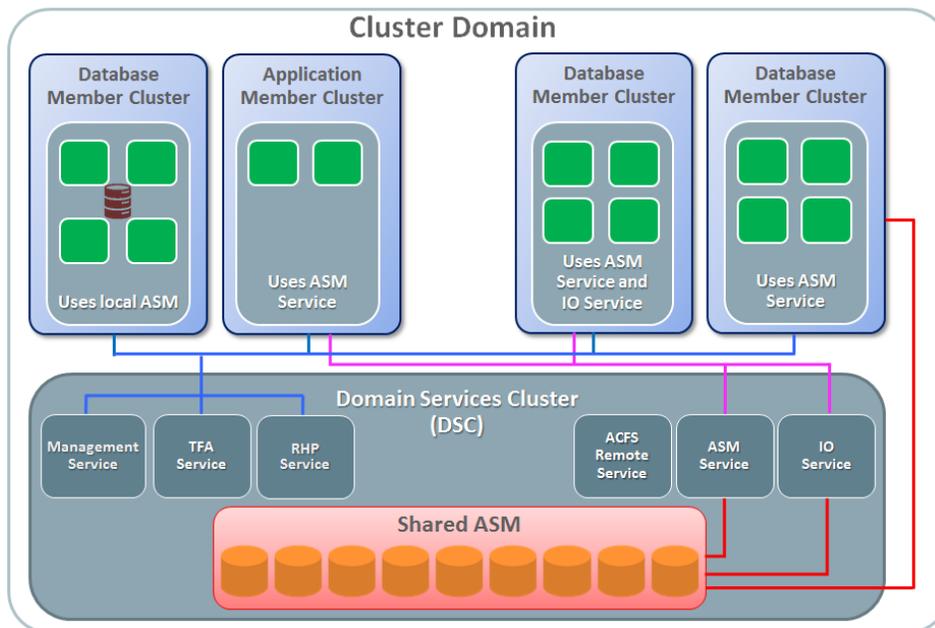
» **Node VIP-less Clusters** – optionally, deploy new clusters without Node VIP's, thus freeing up cluster resources and reducing the number of IP addresses required.

» **Cross-Cluster Dependency Proxies** – support for Clusterware resource dependencies that span clusters.



## Cluster Domains

The Cluster Domain architecture was introduced in Oracle Clusterware 12c Release 2 as an optional deployment model enabling simpler, easier deployments, reduced storage management effort and performance gains for I/O operations, especially useful when managing a larger estate of Oracle Clusters. Oracle Clusterware 18c builds on this architecture by adding support for Oracle ACFS file systems mounted locally on Member Clusters though they are utilizing remote ASM storage, and providing support for converting existing Standalone Clusters to Member Clusters.



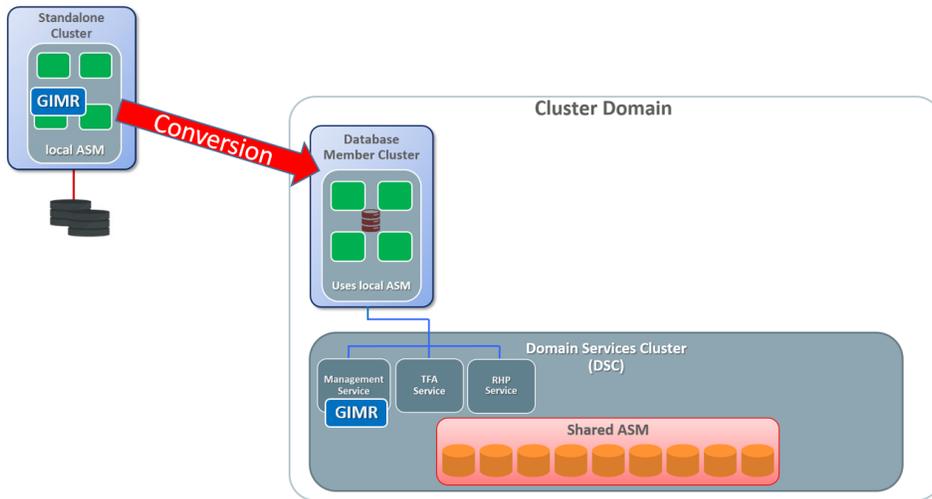
**Figure 1: Cluster Domain Architecture**

### Conversions

When the Cluster Domains were introduced in Oracle Database 12c Release 2 it was presumed that adoption of the new architecture would be for new deployments only, thus requiring support only via the Oracle Universal Installer (OUI). Now, as they are being adopted, the demand for conversions has been addressed with new functionality added in Oracle Database 18c.

### Convert from Standalone Cluster to Member Cluster

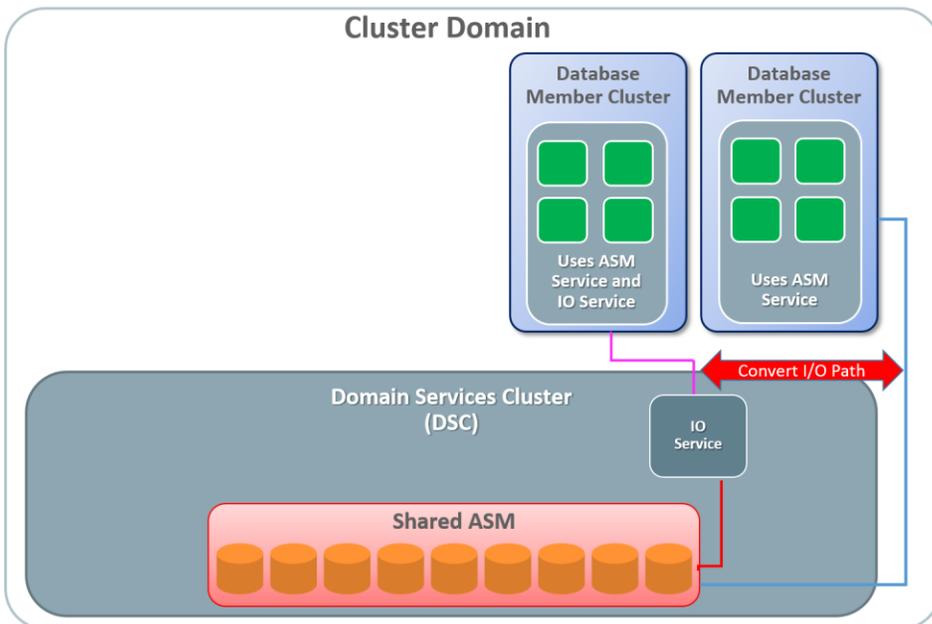
With Oracle Clusterware 18c the first of the conversion capabilities has been introduced, whereby a Standalone Cluster can be converted to a Member Cluster with local ASM. The conversion effectively removes the requirement for a local Grid Infrastructure Management Repository (GIMR), thus freeing up local shared storage, and moving it to the Domain Services Cluster by subscribing to the Cluster Domain's Management Service.



**Figure 2: Convert Standalone Cluster (local GIMR) to Database Member Cluster (GIMR offloaded to DSC)**

**Storage Access Conversion for Database Member Clusters**

New with Oracle Clusterware 18c is the ability to convert the storage access methods for established Database Member clusters with using remote ASM-managed storage. This conversion allows for the Database Member Clusters to convert from using the IOService on the Domain Services Cluster (DSC) to accessing the storage directly, or the reverse.



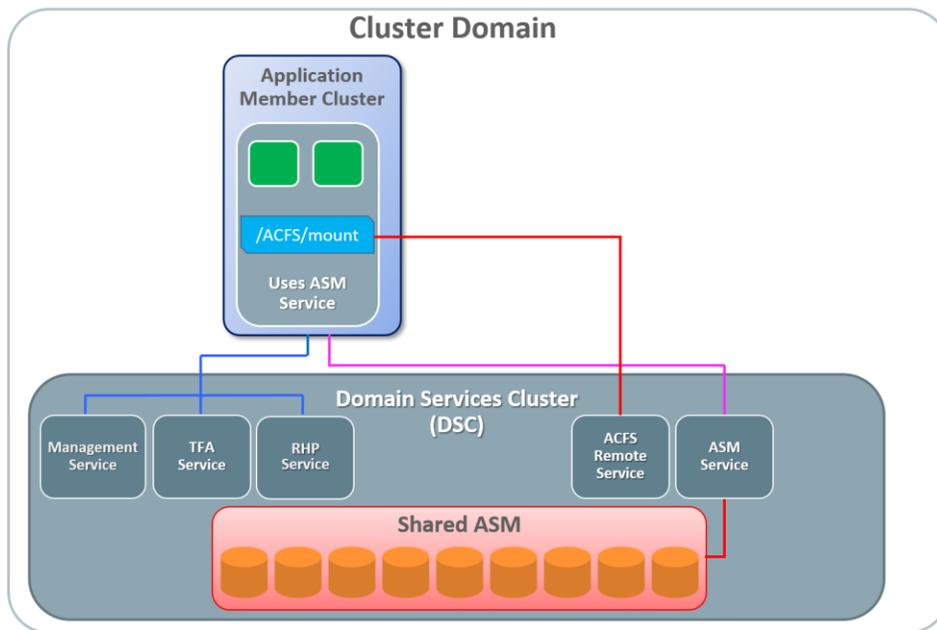
**Figure 4: Storage Access Conversion for Database Member Clusters using Remote ASM**

This capability further enhances the flexibility and adaptability of the Cluster Domain, without requiring significant downtime. The conversion will still require that the underlying infrastructure be changed to support the new access paths, which will require a short outage on the Database Member Cluster.

### Oracle ACFS Remote Service

Oracle ACFS 18c introduces support for native Oracle ACFS functionality on database member clusters and application member clusters. Oracle Member Clusters with no local shared file system can leverage all Oracle ACFS feature and functionality through the Oracle ACFS Remote Service hosted on the Domain Services Cluster.

In using this service, the Member Clusters can now have shared local storage, though it is using remote storage, without having to manage NFS mounts. The Oracle ACFS file system can be used for flat files, logs, trace files, extracts and even database files.

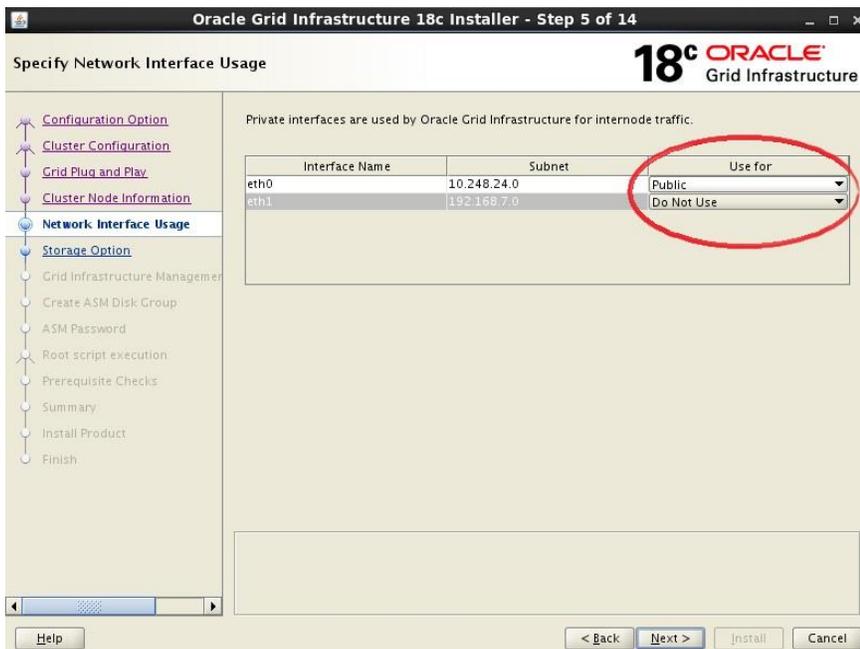


**Figure 3: Oracle ACFS Remote file system as mounted on Application Member Cluster**

### Single Network Support for Application Member Clusters

For Application Member Clusters there will no longer be a requirement for a dedicated private network for the Cluster Interconnect. During deployment, if there is an option to provide the private network information, but if this is left blank (the default), then all Cluster Interconnect traffic will be routed across the public network. This will significantly ease the deployment of Application Member Clusters.

Specify that the interconnect traffic should use the Public Network during deployment:



**Figure 6: Select only the Public Network during Application Member Cluster deployment**

Interconnect traffic for Application Member Clusters is limited to cluster health and membership messages. There is no Cache Fusion traffic. Thus, enabling the use of a single network (i.e. the Public network) for Application Member Clusters is a relatively simple enhancement. However, this is not the case for clusters that host RAC databases, where Cache Fusion makes up a considerable percentage of the traffic across the interconnect network. The performance and responsiveness of RAC databases depend upon the isolation of the Cache Fusion traffic and its reliability. In addition, by using a private interconnect network, there is not the requirement to encrypt that Cache Fusion traffic. This is not necessary for the interconnect traffic for Application Member Clusters.

## Shared SCAN

Shared SCAN has been introduced primarily to reduce the number of IP-addresses required during cluster deployments. With a Shared SCAN VIP configured on one cluster (called the 'Shared SCAN Cluster'), existing and new 18c and newer clusters can be configured to utilize this single SCAN VIP setup, rather than having them configured for each of these clusters (called 'Shared SCAN clients').

The Shared SCAN is setup exactly as a local SCAN is setup; in other words, an existing SCAN setup can be utilized as a Shared SCAN. What differs is how the connections are routed through this Shared SCAN to the Shared SCAN clients. The key difference is the location of the SCAN Listeners; with a local SCAN setup, they are configured on the nodes of the local cluster, but with a Shared SCAN they are configured on the Shared SCAN Cluster.

Database clients (users) connect via a Shared SCAN VIP to the respective SCAN Listener on the Shared SCAN Cluster. The SCAN Listener on the Shared SCAN Cluster would then redirect new connections to the registered endpoints of the service/database on the Shared SCAN client.

#### What is SCAN?

Single Client Access Name (SCAN) is a feature used in Oracle Real Application Clusters (RAC) environments that provides a single name for clients to access any Oracle Database running in a cluster. It was introduced in Oracle 11g Release 2 in order to insulate users from cluster node changes (i.e. adding or removing nodes).

RAC Databases register with the SCAN LISTENERS (remote\_listener), allowing the SCAN LISTENERS to redirect user connections to specific databases according to their connect string.

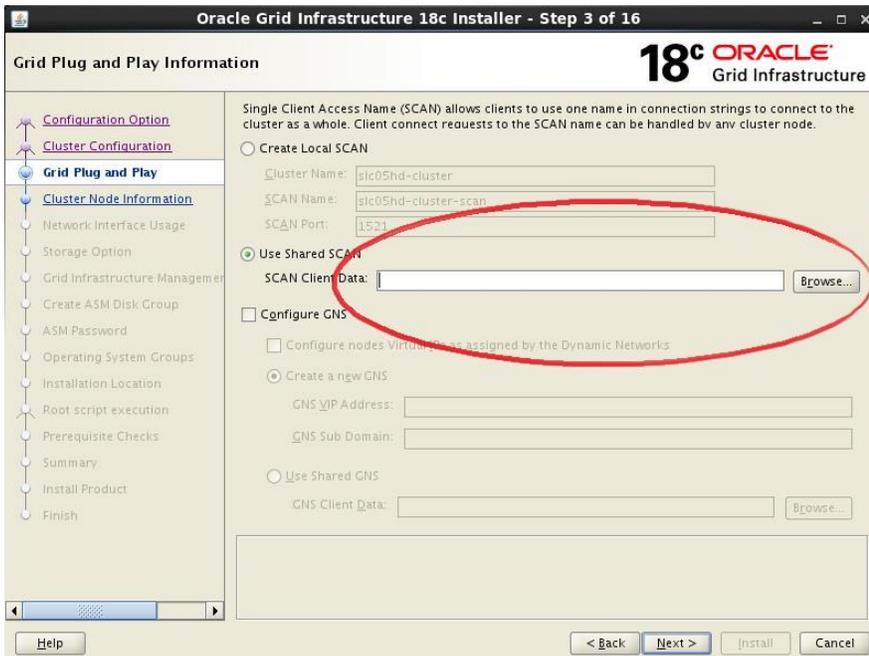
For more information about SCAN, see:

[Oracle Single Client Access Name whitepaper](#)

Configuring Clusters to Utilize a Shared SCAN:

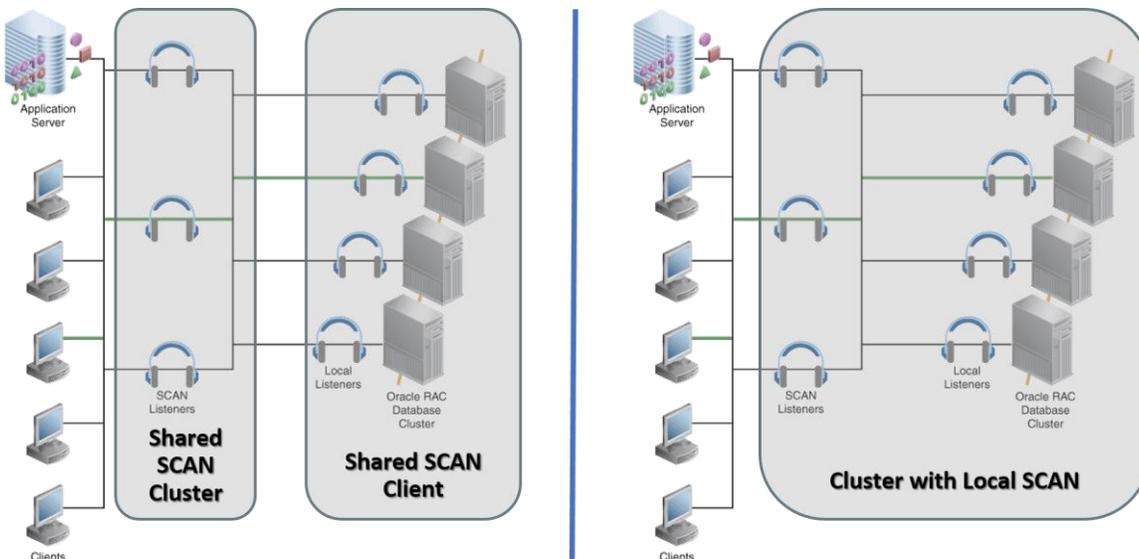
- » Setup Resources on Shared SCAN Cluster (for each of the Shared SCAN clients) – issued manually:
  - Create SCAN Listener and ONS configurations for the new Shared SCAN client:
    - `srvctl add scan_listener -clientcluster <cluster_name>`
    - `srvctl add ons -clientcluster <cluster_name>`
  - Note: There will be a SCAN Listener created for each Shared SCAN client. (For instance, if there are 6 database clusters configured to use a Shared SCAN Cluster, then there will be 6 SCAN Listeners configured on that Shared SCAN Cluster.)
  - Create the credential file(s) for the Shared SCAN client:
    - `srvctl export scan_listener -clientcluster <cluster_name> -clientdata <filename>`
    - `srvctl export ons -clientcluster <cluster_name> -clientdata <filename>`
  - Note: A single credential file can be designated for both the ONS and SCAN Listener. Also, if the Shared SCAN is configured on a Domain Services Cluster (DSC), then the SCAN Listener and ONS credentials will be included in the credential file for the Database Member Cluster that is being configured.
- » Setup Resources and Connectivity on the Shared SCAN client – manually with these commands, or via OUI:
  - Copy the credential file(s) from the Shared SCAN Cluster to the Shared SCAN client
  - Create the local resources and save connectivity information for databases on the Shared SCAN client:
    - `srvctl add scan -clientdata <filename>`
    - `srvctl add scan_listener -clientdata <filename>`
    - `srvctl add ons -clientdata <filename>`

Simpler still, specify the Shared SCAN credential file during deployment:



**Figure 7: Enter File Name for the SCAN/ONS Credential File**

Database clients (users) would connect to a specific database on a Shared SCAN client as they would to a database on a cluster with locally configured SCAN. Their connection string would specify the SCAN Name, the port and the service, exactly as they do with a local SCAN configuration. Note that it is the port and the service that differentiates the SCAN Listeners on the Shared SCAN Cluster.



**Figure 8: Database User Connections with Shared SCAN and Local SCAN**

Shared SCAN implementations will still require three IP-addresses, exactly as a locally configured SCAN. Deploying more than three SCAN VIP's is not required. And, the Shared SCAN Client must belong to the same network sub-net as does the Shared SCAN Cluster with which it registers. Note also that for Cluster Domain implementations, the Shared SCAN will be hosted on the Domain Services Cluster.

## Node VIP-less Clusters

Node VIP's have long been used to provide HA connectivity for database clients, but have no place in clusters that are not hosting Oracle databases. Such clusters, often referred to 'application clusters', rely on application VIP's for to provide fault tolerant connectivity to the applications or processes on the cluster nodes.

With the introduction of Cluster Domains in Oracle 12c Release 2, Application Member Clusters were the first instance of deployments that did not include Node VIP's.

Now, with Oracle Clusterware 18c, Standalone Clusters without Node VIP's are an option during the deployment. The default is still to configure Node VIP's, as this preserves backwards compatibility (plus clusters upgraded from previous versions will, of course, have Node VIP's). This deployment option would be recommended for clusters that do not host databases or for non-production deployments (in which failure management is not as critical as it might be for production systems).

During deployment, simply do not specify the virtual hostname:

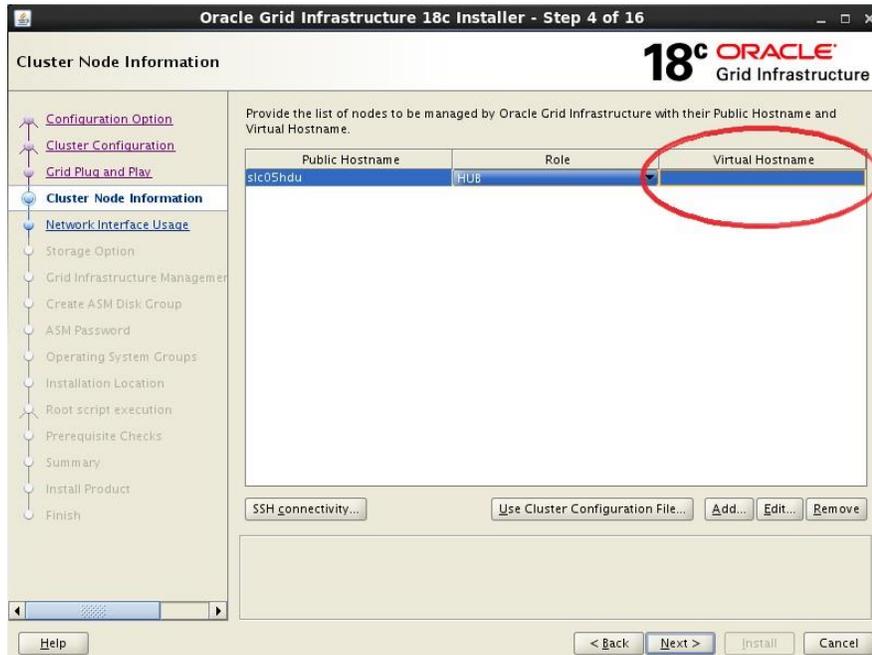
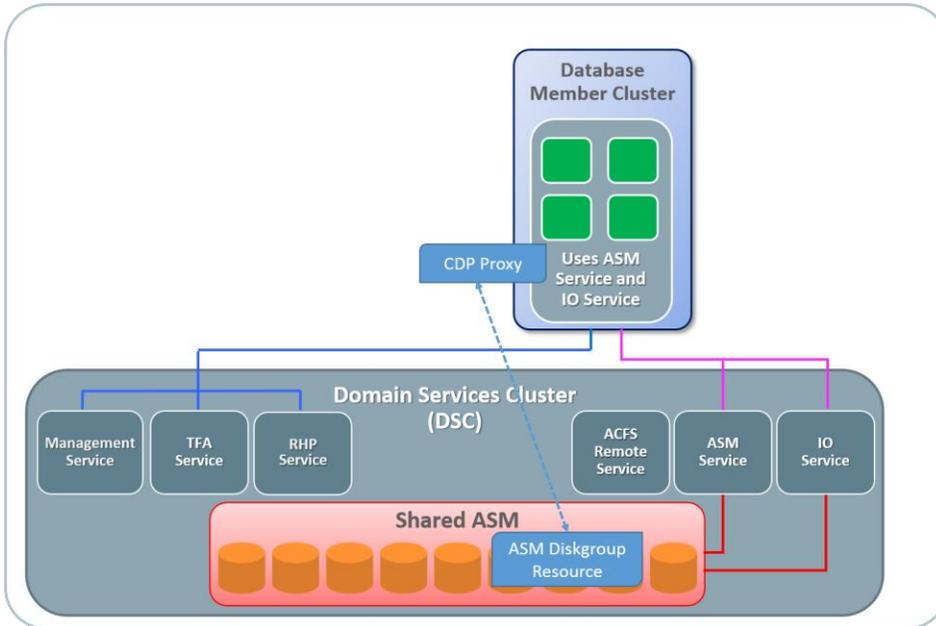


Figure 9: For Node VIP-less Deployments, omit the Virtual Hostname

## Cross-Cluster Dependency Proxies

Cross-Cluster Dependency Proxies were created to allow Clusterware resource dependency management to extend beyond the domain of a single cluster. This means that resources on one cluster may have dependencies upon the resources on other clusters.

The default deployment in Oracle Clusterware 18c applies to Cluster Domains and the Database Member Clusters that access the ASM-managed storage on the Domain Services Cluster. The databases on the Database Member Cluster are dependent upon the availability and accessibility of the ASM diskgroups on which their database data files are stored. This dependency is mapped using the Cross-Domain Protocol (CDP).



**Figure 10: Cross-Cluster Dependency Proxy setup for Database Member Clusters**

In addition, users may implement CDP for other uses. An example of this might be for an Application Member Cluster and its dependency upon the availability of a remotely hosted database. By creating a proxy for the remote database service, the startup of the Application Member Cluster could ensure that that remote database is also started.

CDP may also be used to monitor the status of entities in remote clusters. An example of this would be a monitoring process to keep track of which VM's in a remote cluster are active, allowing local processes to act on this information without having to establish connectivity to that remote entity.





## Summary

Oracle Clusterware 12c Release 2 introduced improvements in manageability and deployment, better mitigation and control for failure scenarios for Oracle clusters. Oracle Clusterware 18c continues that trend by promoting ease of use and the further reduction in operating effort.

Enhancements have been made to the Cluster Domain architecture. Introduced with Oracle Clusterware 12c Release 2, Cluster Domains is aimed at providing simplified, easier and faster management and deployment of multi-cluster infrastructures is key for larger cluster installations. New capabilities have been introduced in Oracle Clusterware 18c to further encourage new and established customers to adopt this innovative cluster architecture

In addition, key new Oracle Clusterware features allow for the reduction of the number of IP-addresses during deployment of new clusters, for database and non-database clusters, and the ability to manage Clusterware resource dependencies across clusters.

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