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OCM之家

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海量数据学院首席讲师，院长兼总经理，Oracle ACE ，中国OCM之家（OCMH）发起人，同时创办了Oracle慕课联盟（OMOOCU），用互联网+的形式推广线上免费课程。获得Oracle 10g 11g 12c OCM认证。从业10年以上，资深Oracle数据库专家，51CTO认证讲师，在数据库领域有丰富的经验。拥有Oracle数据库，SQL Server数据库，RHCE，F5，Cisco等十余种相关技术认证。曾任职于北京神州泰岳软件股份有限公司、北京电信发展有限公司，云和恩墨的恩墨学院教学总监。负责运维全国各省客户的海量数据库，负责高可用数据库的部署实施、故障处理、性能优化，教育培训等工作。现任海量数据学院首席讲师兼院长，为多家大中型企业和多所国家211工程高等学校，提供过Oracle相关课程培训以及技术分享活动。讲课富有亲和力和感染力，擅长理论联系实际，通过华丽的操作将枯燥的技术展现出来，使学员理解技术在真实生产中的应用。至今培养OCP和OCM数千人，培训经验丰富，致力于推广和分享ORACLE技术。 技术博客地址：http://www.dbstyle.net

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—— Section 4 Grid Infrastructure and Real Application Clusters

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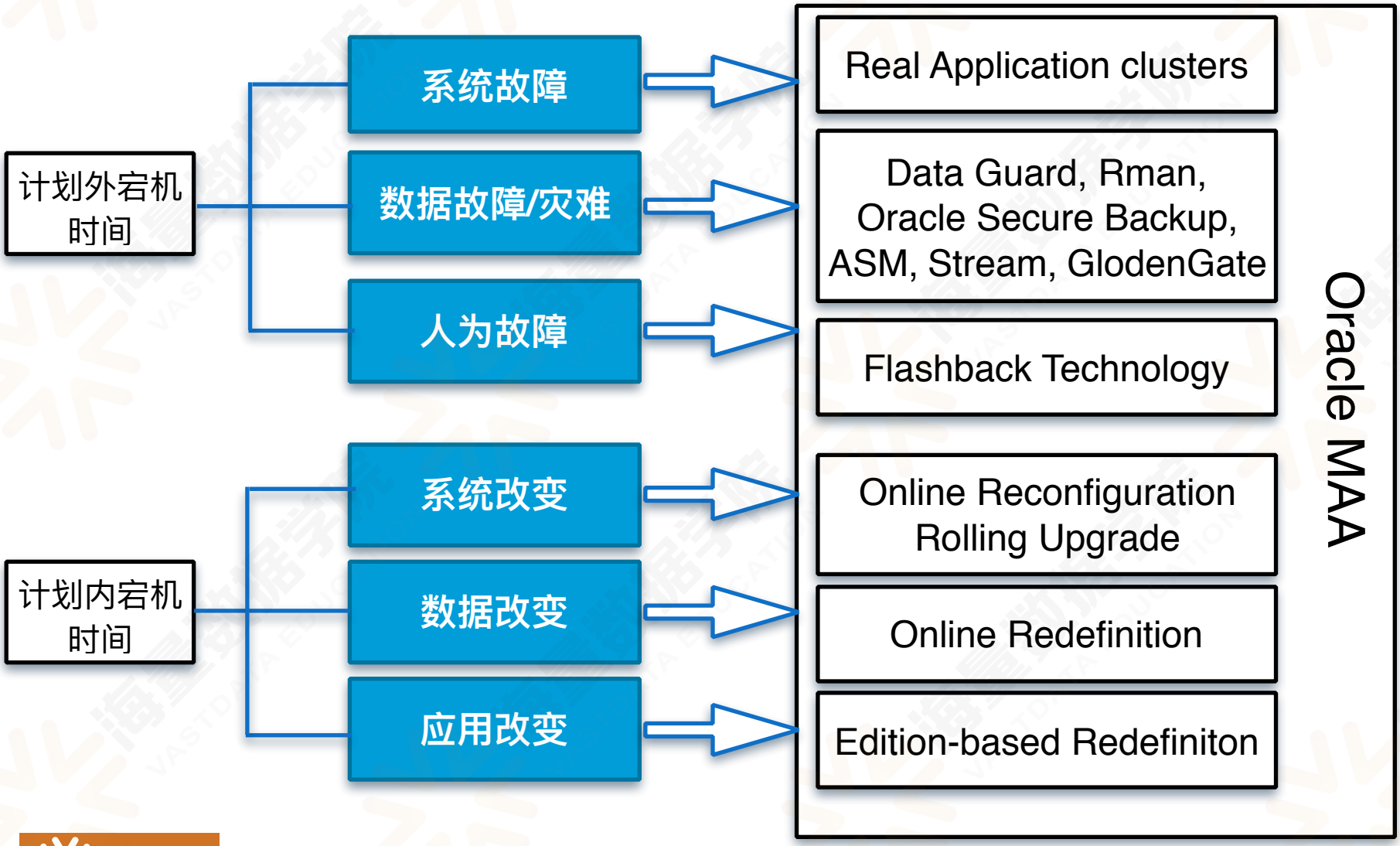
Examination time

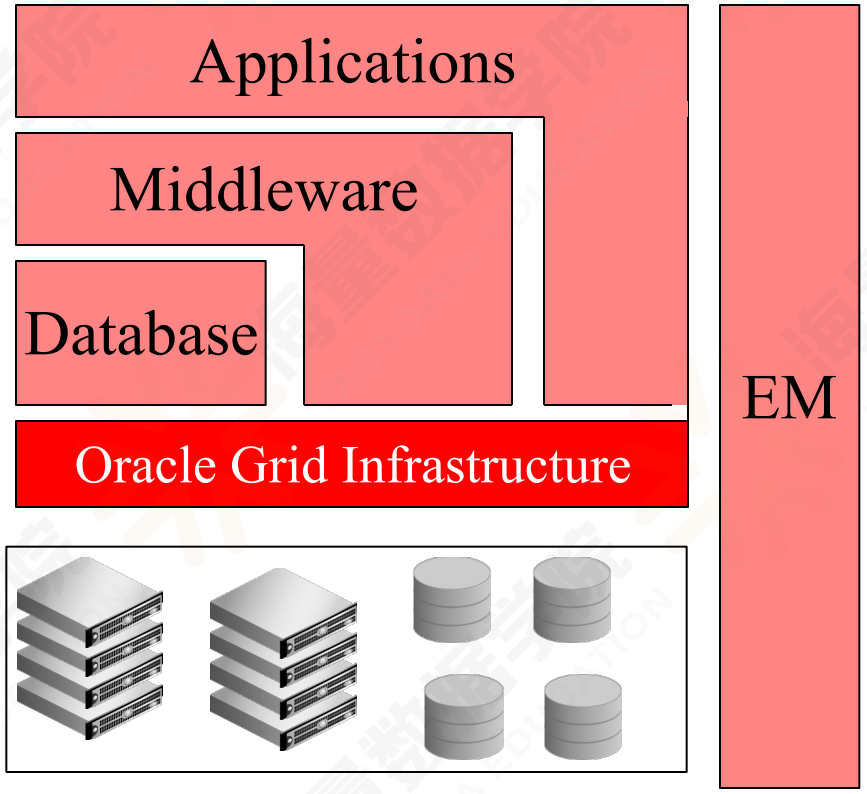
1. General Database and Network Administration, and Backup Strategy	120 min
2. Data and Performance Management	90 min
3. Data Guard	90 min
4. Grid Infrastructure and Real Application Clusters	90 min

Oracle MAA 架构

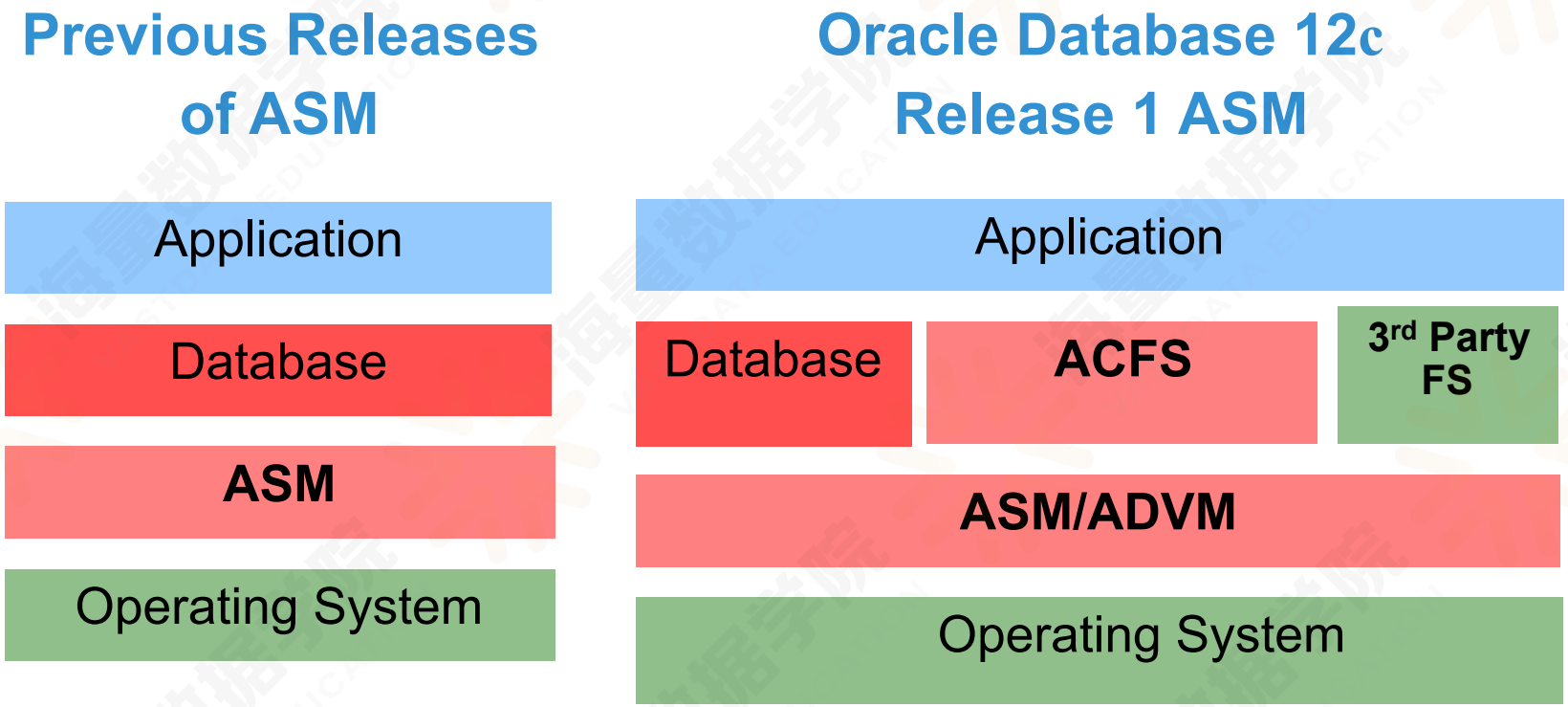


Oracle Grid Infrastructure

- 标准化的基础结构软件
- 排除使用第三方解决方案的需要
- 包括:
  - Automatic Storage Management (ASM)
  - ASM Cluster File System (ACFS)
  - ACFS Snapshots
  - Oracle Clusterware
  - Oracle Restart



Automatic Storage Management Technology Stack



Oracle Grid Infrastructure and Oracle Database Installation: System Requirements

- Memory requirements:
  - 1 GB for the database instance with Database Control
  - 1.5 GB for the ASM instance and Oracle Restart
- Disk space requirements:
  - 3 GB of swap space (based on 2GB RAM)
  - 1 GB of disk space in the `/tmp` directory
  - Between 1.5 GB and 3.8 GB for the Oracle software
  - 1.7 GB for the preconfigured database (optional)
  - 2.4 GB for the fast recovery area (optional)
- Operating system (see documentation)

Preparing the Operating System

Create the required operating system groups and users:

- Groups:
  - `oinstall`
  - `dba`
  - Optional groups (for separation of duty across multiple users):
    - `oper`
    - `asmdba`
    - `asmoper`
    - `asmadmin`
- Users:
  - Software owner, usually oracle
  - Can create multiple users for multiple product installations

11.2

Setting Environment Variables

Oracle environment variables:

- ORACLE_BASE: Base of the Oracle directory structure. Recommendation is to set this before installation.
- ORACLE_HOME: The environment in which Oracle products run. Not required before installation if ORACLE_BASE is set.
- ORACLE_SID: Not required before installation, but useful after for ease of interaction with a particular instance.
- NLS_LANG: Optional environment variable that controls language, territory, and client character set settings

Checking the System Requirements

- Adequate temporary space
- 64-bit versus 32-bit issues
- Correct operating system (OS)
- OS patch level
- System packages
- System and kernel parameters
- X Server permissions
- Sufficient swapping
- ORACLE_HOME status

Defining Ownership of OS Devices for ASM

- The operating system devices that are being used for ASM disks need to be owned by the Grid Infrastructure user and the OSASM group.
- For Oracle ASMLib drivers:

```
# /etc/init.d/oracleasm configure
..
Default user to own the driver interface []: grid
Default group to own the driver interface []: asmadmin
..
```

Installation Scenario

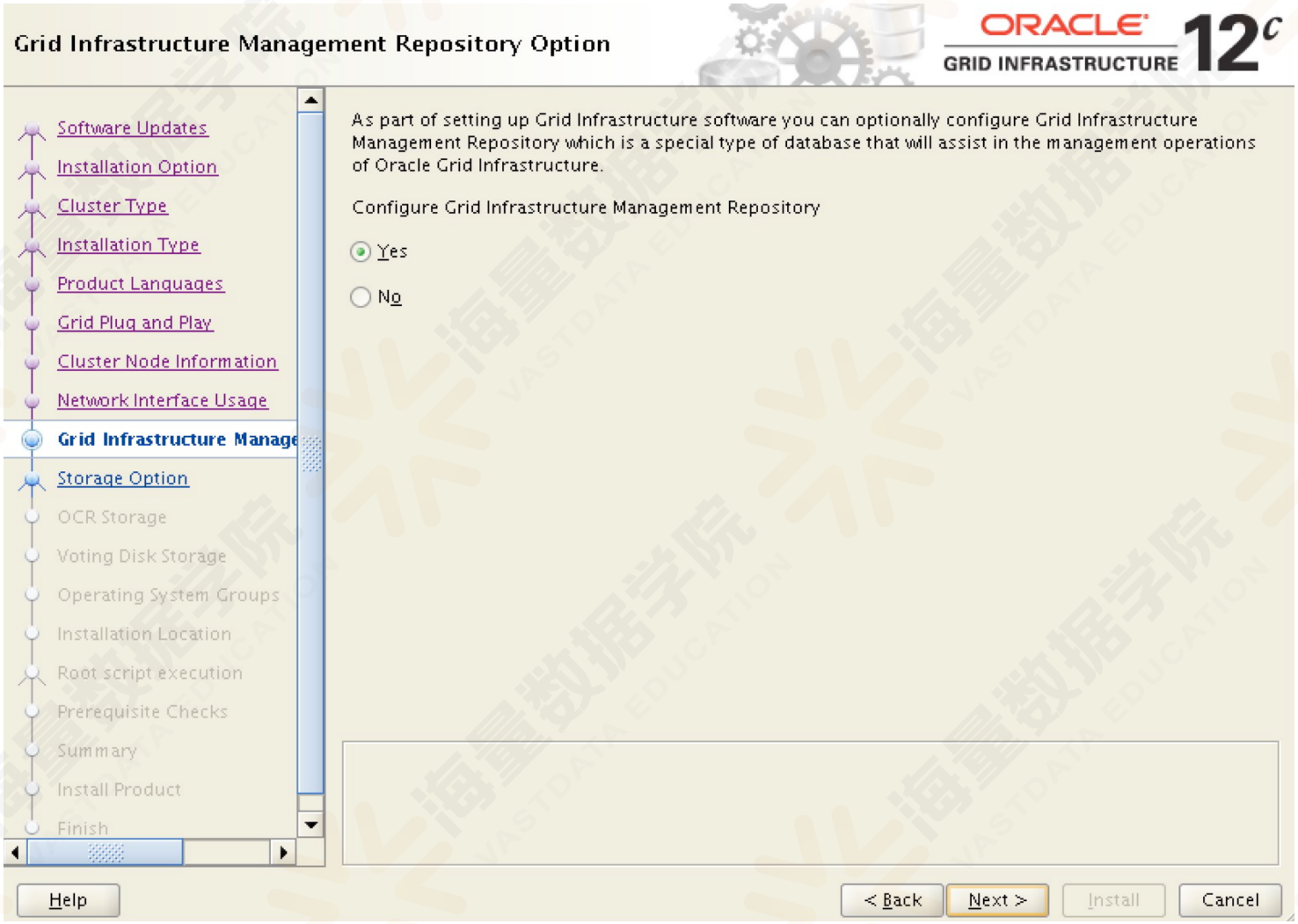
The installation scenario being presented in this course is divided into one part:

- Part One: Install Oracle Grid Infrastructure for a Cluster (Lesson 1)

MGMTDB: Grid Infrastructure Management Repository

- MGMTDB is new database instance which is used for storing Cluster Health Monitor (CHM) data.
- In 11g this was being stored in berkley database but starting Oracle database 12c it is configured as Oracle Database Instance.
- In 11g, .bdb files were stored in $GRID_HOME/crf/db/hostname and used to take up lot of space (>100G) due to bug in 11.2.0.2
- During 12c Grid infrastructure installation, there is option to configure Grid Infrastructure Management Repository.

MGMTDB: Grid Infrastructure Management Repository



MGMTDB: Grid Infrastructure Management Repository

If you choose YES, then you will see instance -MGMTDB running on one of the node on your cluster.

```
[grid@host03 ~]$ ps -ef|grep mdb_smon
grid      33471      1  0 20:53 ?        00:00:00 mdb_smon_-MGMTD
```

This is a Oracle single instance which is being managed by Grid Infrastructure and fails over to surviving node if existing node crashes.You can identify the current master using below command

```
[grid@host03 ~]$ oclumon manage -get MASTER

Master = host03
```

MGMTDB: Grid Infrastructure Management Repository

This DB instance can be managed using srvctl commands. Current master can also be identified using status command

```
[grid@host03 ~]$ srvctl status mgmtdb
Database is enabled
Instance -MGMTDB is running on node host03
```

MGMTDB: Grid Infrastructure Management Repository

We can look at mgmtdb config using

```
[grid@host03 ~]$ srvctl config mgmtdb
Database unique name: _mgmtdb
Database name:
Oracle home: <CRS home>
Oracle user: grid
Spfile: +DGDATA/_MGMTDB/PARAMETERFILE/spfile.268.898151007
Password file:
Domain:
Start options: open
Stop options: immediate
Database role: PRIMARY
Management policy: AUTOMATIC
Type: Management
PDB name: cluster01
PDB service: cluster01
Cluster name: cluster01
Database instance: -MGMTDB
```

MGMTDB: Grid Infrastructure Management Repository

Replace config with start/stop to start/stop database.

Databases files for repository database are stored in same location as OCR/Voting disk

```
[grid@host03 ~]$ export ORACLE_SID=-MGMTDB
[grid@host03 ~]$ sqlplus / as sysdba

SQL> select file_name from dba_data_files union select member
file_name from V$logfile;

FILE_NAME
--------------------------------------------------------------------------------
+DGDATA/_MGMTDB/DATAFILE/sysaux.257.898150833
+DGDATA/_MGMTDB/DATAFILE/system.258.898150855
+DGDATA/_MGMTDB/DATAFILE/undotbs1.259.898150879
+DGDATA/_MGMTDB/ONLINELOG/group_1.261.898150917
+DGDATA/_MGMTDB/ONLINELOG/group_2.262.898150917
+DGDATA/_MGMTDB/ONLINELOG/group_3.263.898150917

6 rows selected.
```

MGMTDB: Grid Infrastructure Management Repository

We can verify the same using oclumon command

```
[grid@host03 ~]$ oclumon manage -get reppath

CHM Repository Path = +DGDATA/_MGMTDB/
FD9B43BF6A646F8CE043B6A9E80A2815/DATAFILE/sysmgmtdata.269.898151125
```

MGMTDB: Grid Infrastructure Management Repository

Since this is stored at same location as Voting disk, if you have opted for configuring Management database, you will need to use voting disk with size >5G (3.2G+ is being used by MGMTDB). During GI Installation ,I had tried adding voting disk of 2G but it failed saying that it is of insufficient size. Error did not indicate that its needed for Management repository but now I think this is because of repository sharing same location as OCR/Voting disk.

Default (also Minimum) size for CHM repository is **2048 M** . We can increase respository size by issuing following command

```
[grid@host03 ~]$ oclumon manage -repos changerepossize 4000
The Cluster Health Monitor repository was successfully resized.The
new retention is 266160 seconds.
```

MGMTDB: Grid Infrastructure Management Repository

This command internally runs resize command on datafile and we can see that it changed datafile size from 2G to 4G

```
[grid@host03 ~]$ oclumon manage -get reppath

CHM Repository Path = +DGDATA/_MGMTDB/
FD9B43BF6A646F8CE043B6A9E80A2815/DATAFILE/sysmgmtdata.269.898151125
```

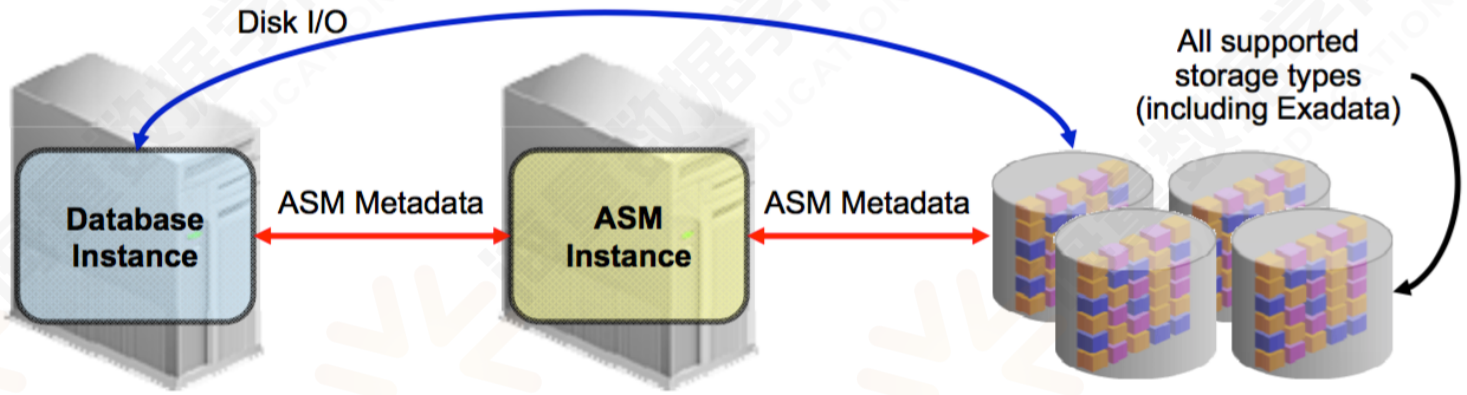
Flex ASM: Overview

In previous versions, ASM clients can access ASM only by using an ASM instance on the same host.

- Resources are consumed by ASM on every database server.
- If an ASM instance fails, its clients must fail.

With Flex ASM, ASM clients can use a network connection to access ASM.

- Resources are saved because ASM is not required on every database server.
- If an ASM instance fails, its clients can connect to another instance.



Flex ASM Instance Changes

ASM instances are no longer required to run on every node in a cluster.

Administrators specify the cardinality for ASM.

- Cardinality sets the number of instances across the cluster.
- The default is 3.

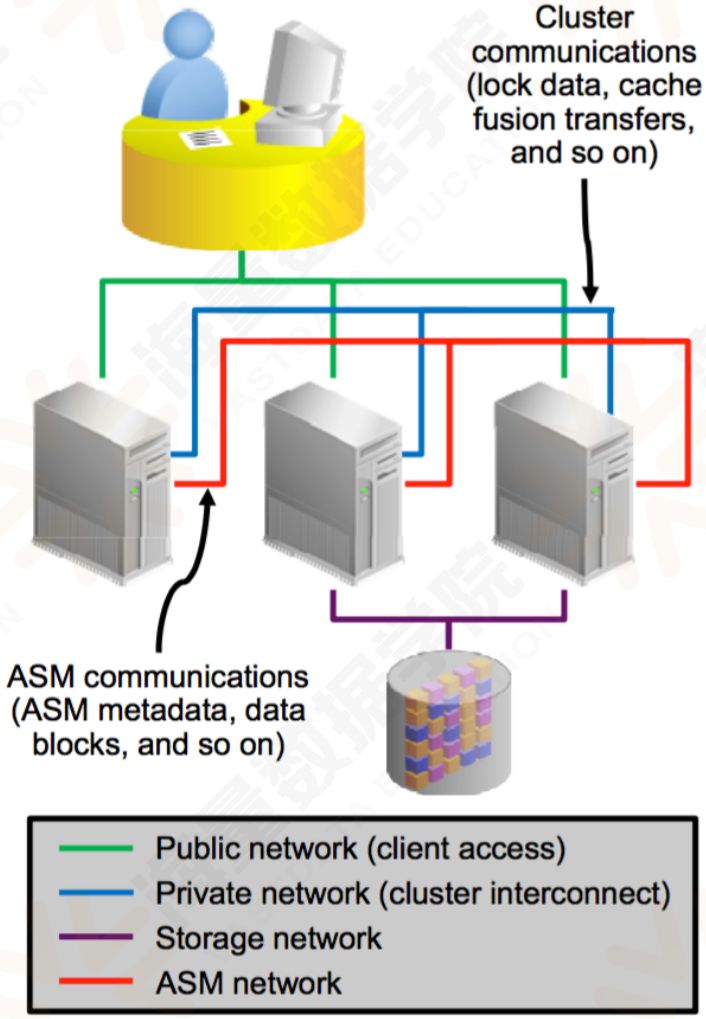
All disk groups are mounted by all ASM instances.

ASM Network

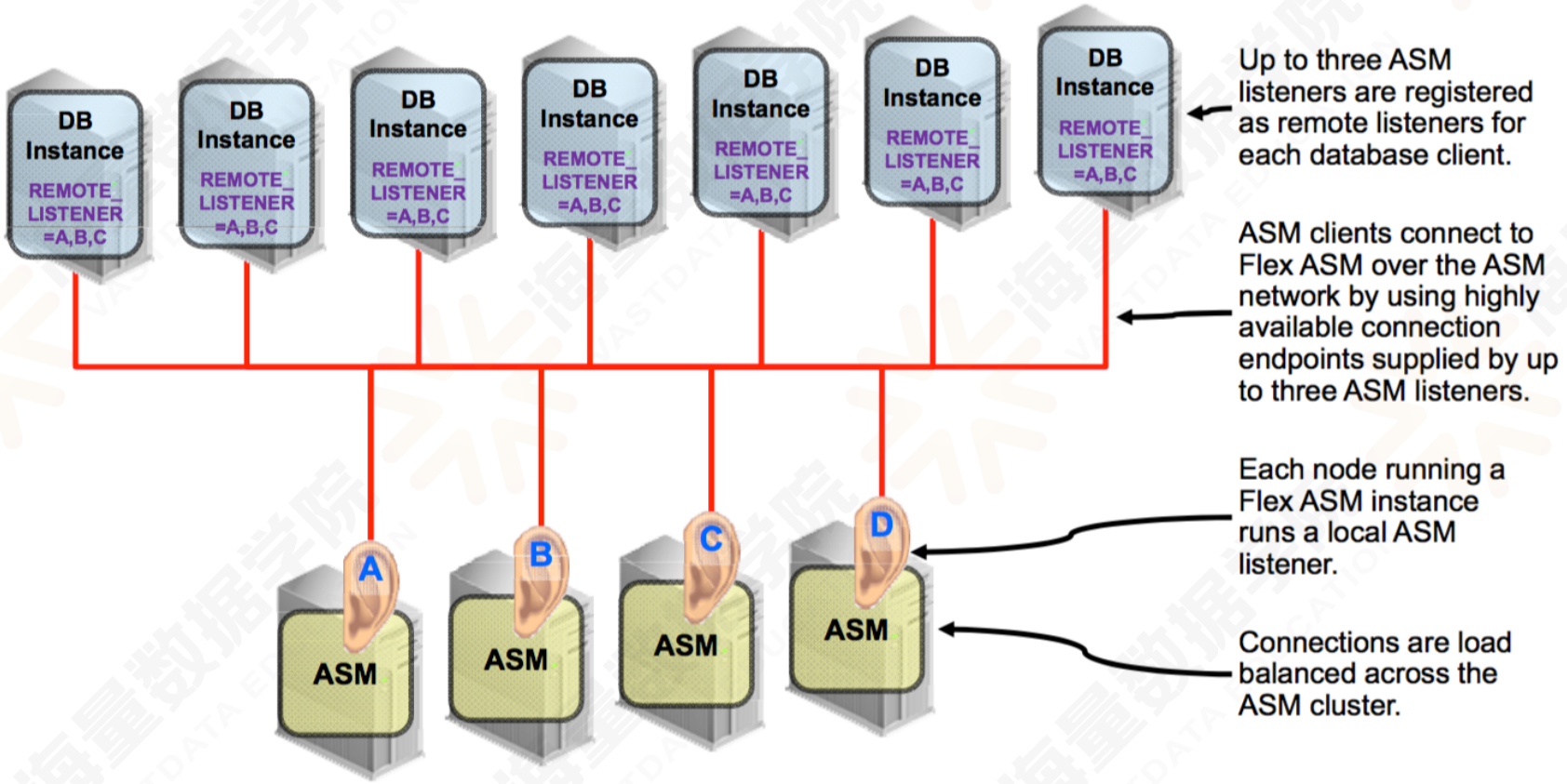
In previous versions, Oracle Clusterware requires:

- A public network for client application access
- One or more private networks for inter-node communication within the cluster

Flex ASM adds the ASM network, which is used for communication between ASM and ASM clients.



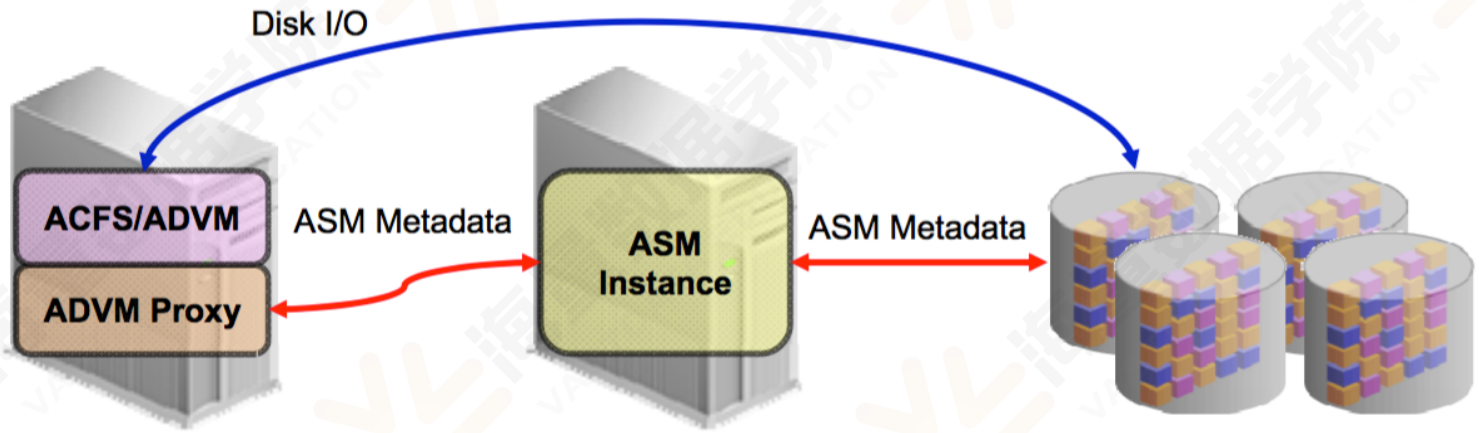
ASM Listeners



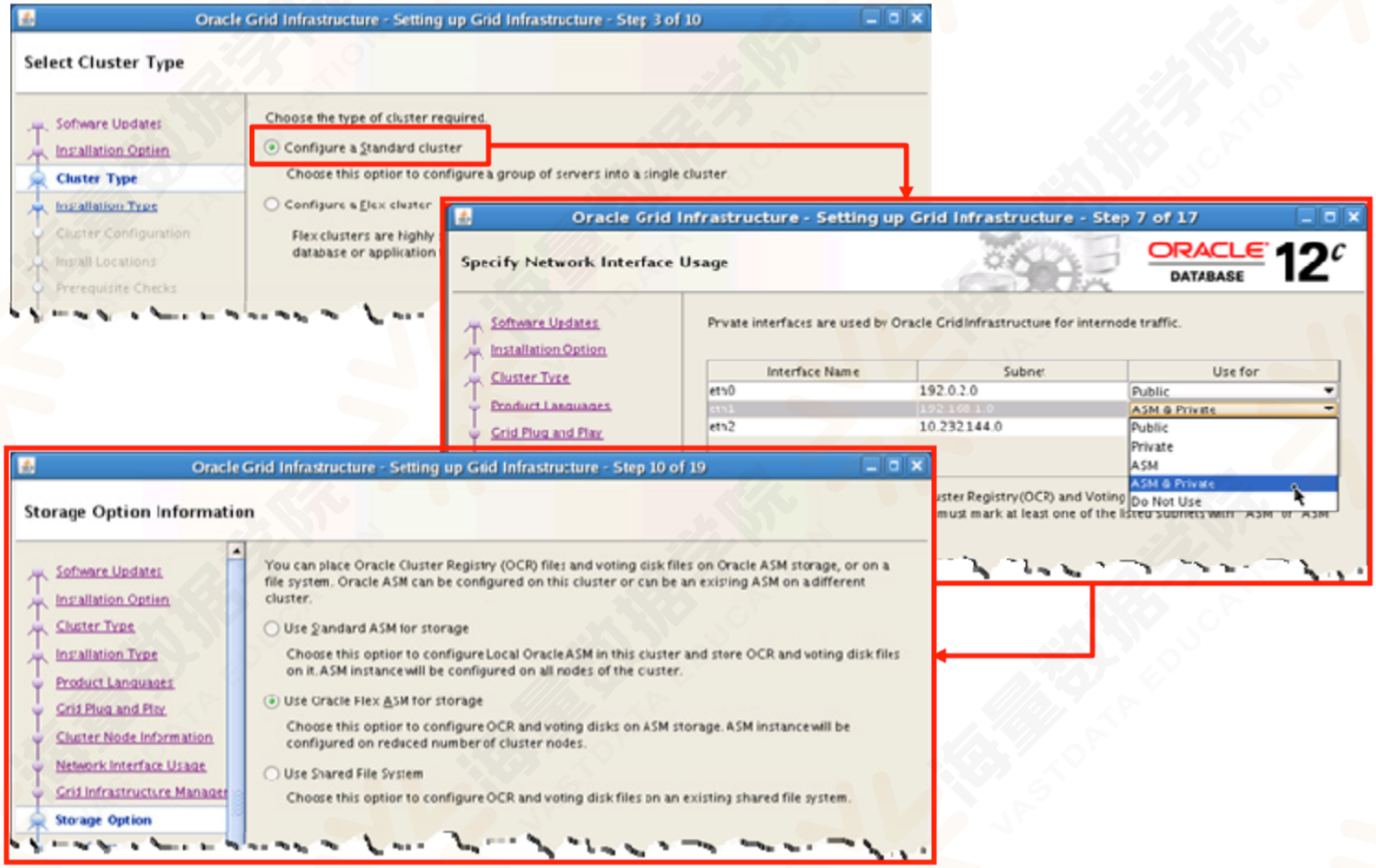
ADVM Proxy

The ADVM Proxy is a special Oracle instance.

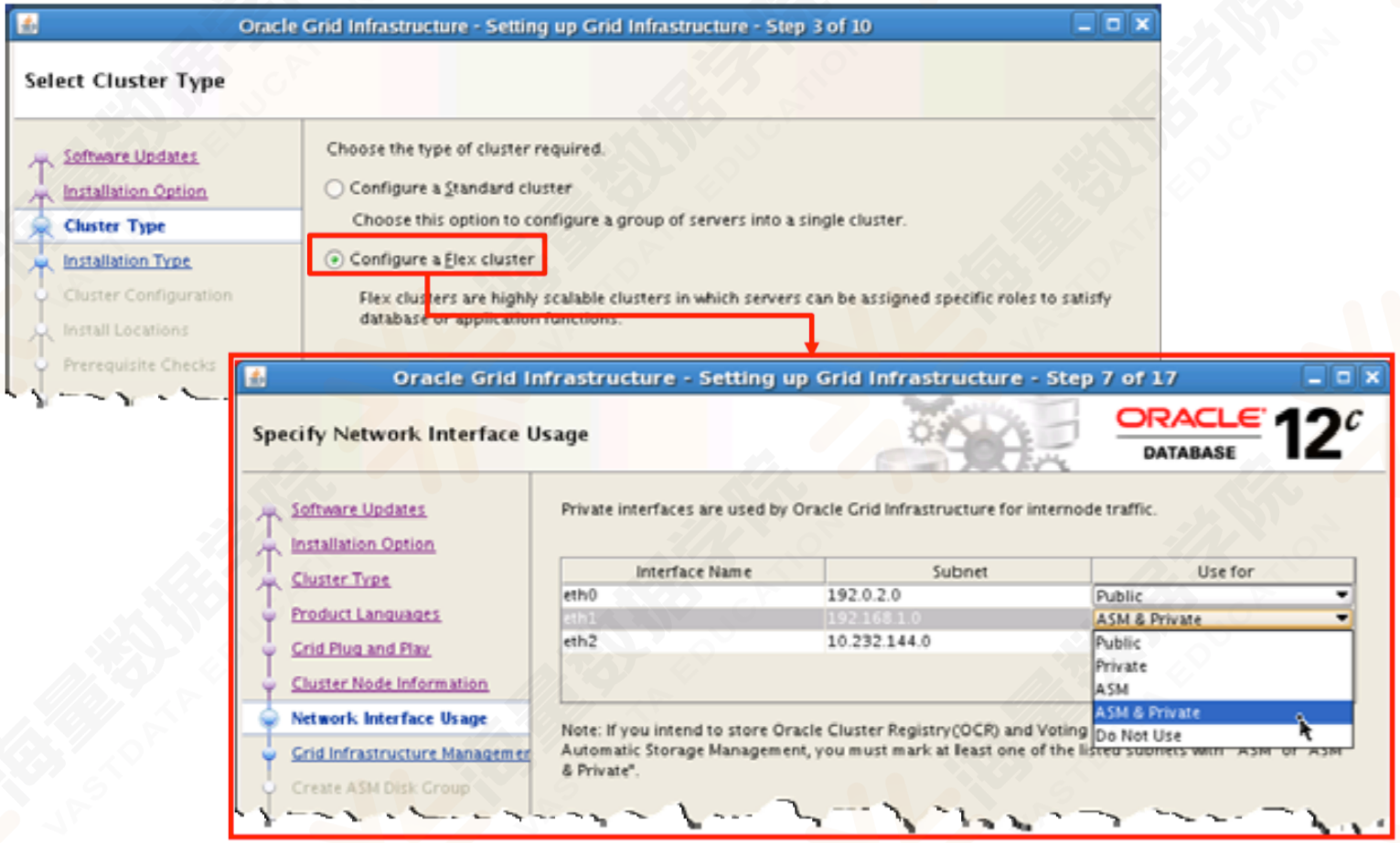
- It enables ADVM to connect to Flex ASM.
- It is required to run on the same node as ADVM and ACFS.
- By default, it is configured on every node in a standard cluster or every Hub Node in a Flex Cluster.
- It can be shut down when ACFS is not running.



Configuring Flex ASM on a Standard Cluster



Configuring Flex ASM on a Flex Cluster



Managing Flex ASM Instances

Flex ASM is designed to require minimal monitoring and ongoing management.

The primary concern is that instances are up and running.

```
$ srvctl status asm -detail
ASM is running on c00n03,c00n02,c00n01
ASM is enabled.
$ srvctl status asm -proxy -detail
ADVM Proxy is running on c00n04,c00n03,c00n02,c00n01
ADVM Proxy is enabled.
```

No Flex ASM–specific instance parameters are required.

Default settings will effectively support most situations.

ASM and ADVM Proxy instances use automatic memory management.

- Minimum default setting: `MEMORY_TARGET=1076M`

Stopping, Starting, and Relocating Flex ASM Instances

ASM instances:

```
$ srvctl status asm -detail
ASM is running on c00n03,c00n02,c00n01
ASM is enabled.
$ srvctl stop asm -node c00n03 -f
$ srvctl start asm -node c00n04
$ srvctl status asm -detail
ASM is running on c00n04,c00n02,c00n01
ASM is enabled.
$ srvctl relocate asm -currentnode c00n04 -targetnode c00n03 $ srvctl status
asm -detail
ASM is running on c00n03,c00n02,c00n01
ASM is enabled.
```

ADVM Proxy instances:

```
$ srvctl stop asm -proxy -node c00n03
$ srvctl start asm -proxy -node c00n04
```

Setting the Number of Flex ASM Instances

```
$ srvctl config asm
ASM home: <CRS home>
Password file: +DATA/orapwASM
ASM listener: LISTENER
ASM instance count: 3
Cluster ASM listener: ASMNET1LSNR_ASM
$ srvctl modify asm -count 4 $ srvctl config asm
ASM home: <CRS home> Password file: +DATA/orapwASM ASM listener:
LISTENER

ASM instance count: 4
Cluster ASM listener: ASMNET1LSNR_ASM
```

Monitoring Flex ASM Connections

```
SQL> select distinct i.instance_name asm_instance_name,
  2  c.instance_name client_instance_name, c.db_name, c.status
  3  from gv$instance i, gv$asm_client c
  4  where i.inst_id=c.inst_id;

ASM_INSTANCE_NAME    CLIENT_INSTANCE_NAME DB_NAME  STATUS
-------------------- -------------------- -------- ------------
+ASM1                +APX1                +APX     CONNECTED
+ASM1                +ASM1                +ASM     CONNECTED
+ASM1                orcl_2               orcl     CONNECTED
+ASM1                orcl_5               orcl     CONNECTED
+ASM1                orcl_7               oral     CONNECTED
+ASM2                +APX2                +APX     CONNECTED
+ASM2                +ASM2                +ASM     CONNECTED
+ASM2                orcl_1               orcl     CONNECTED
+ASM2                orcl_4               oral     CONNECTED
+ASM3                +APX3                +APX     CONNECTED
+ASM3                +ASM3                +ASM     CONNECTED
+ASM3                orcl_3               orcl     CONNECTED
+ASM3                orcl_6               orcl     CONNECTED
+ASM3                orcl_8               orcl     CONNECTED
```

Relocating an ASM Client

Clients are automatically relocated to another instance if an ASM instance fails.

- Clients reconnect and the connection is load balanced to an available instance.

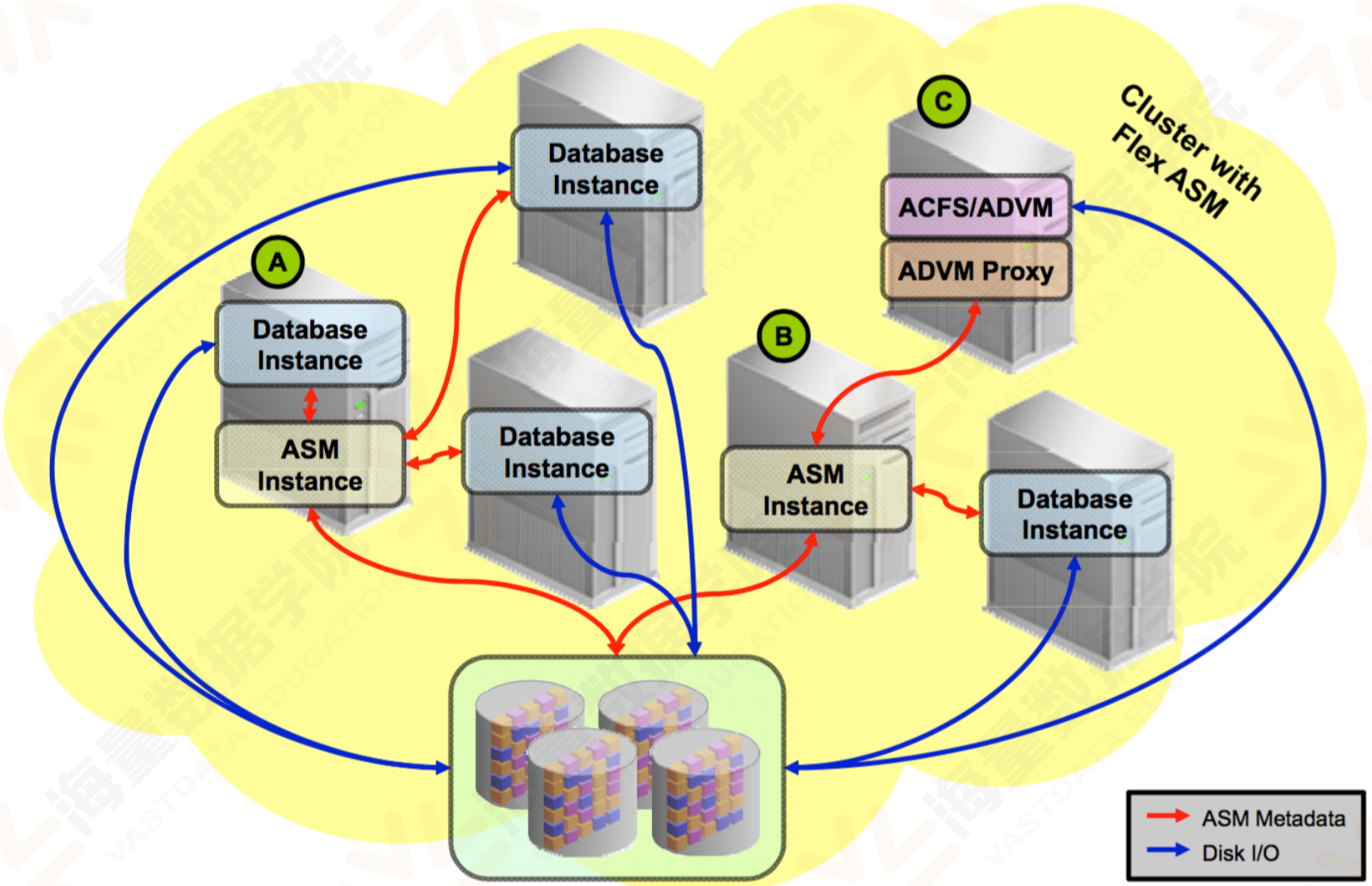
Clients can be manually relocated using the `ALTER SYSTEM RELOCATE CLIENT` command.

- The command syntax is:

```
SQL> ALTER SYSTEM RELOCATE CLIENT '<instance_name>:<db_name>';
```

  - Query `GV$ASM_CLIENT` to determine `instance_name` and `db_name`.
- This is useful for manually adjusting the workload balance between instances.

Flex ASM Deployment: Example



Flex ASM and Flex Clusters

Flex Clusters require Flex ASM.

- Standard ASM is not supported on a Flex Cluster.

Flex ASM does not require a Flex Cluster.

- Flex ASM can run on a standard cluster servicing clients across the cluster.
- Flex ASM can run on the Hub Nodes of a Flex Cluster servicing clients across the Hub Nodes of the Flex Cluster.

The benefits of Flex ASM apply regardless of cluster type:

- Smaller ASM resource footprint
- Protection from ASM failure

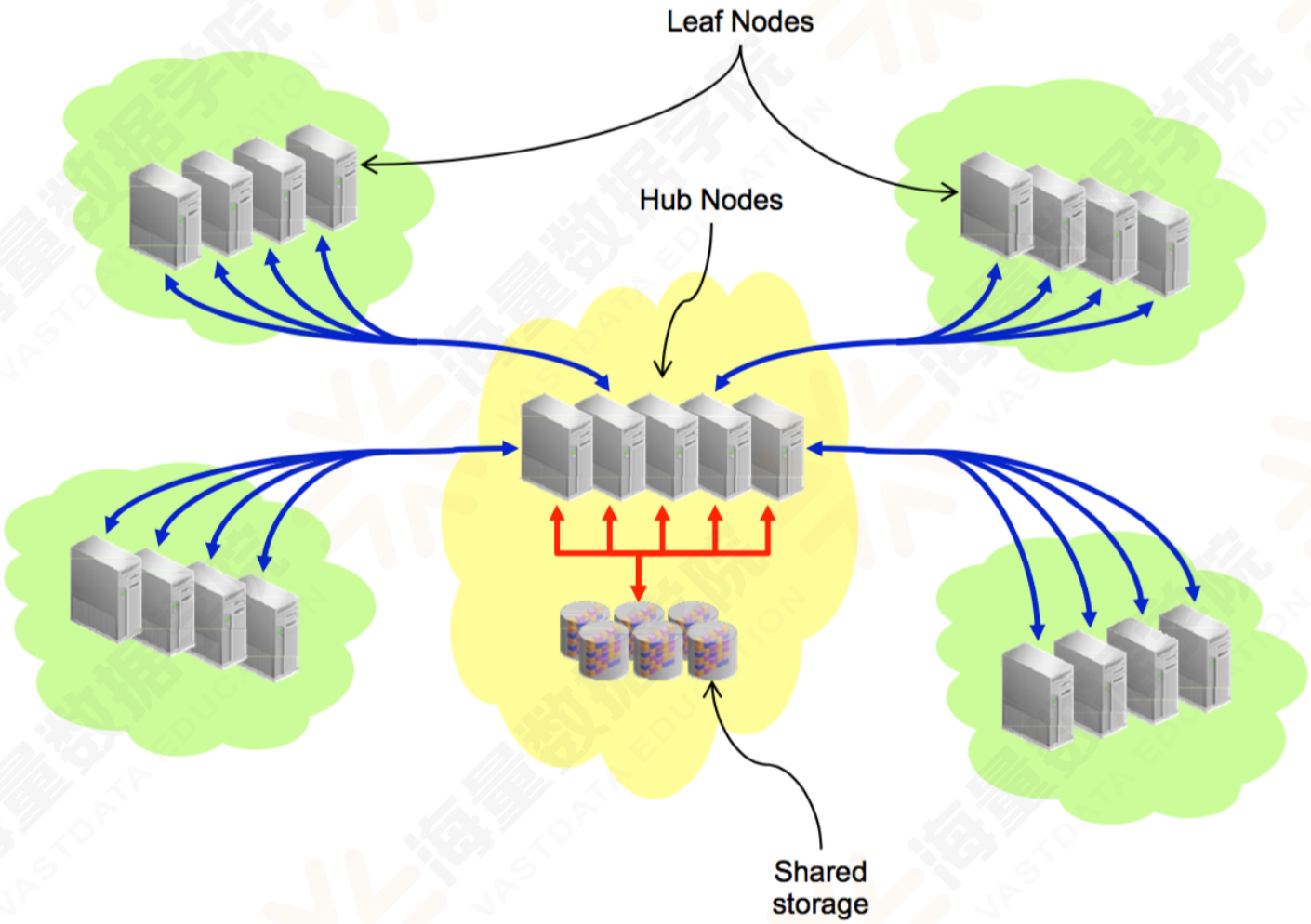
Flex Clusters: Overview

In previous releases, most large clusters contain between 32 and 64 nodes.

With Oracle Clusterware 12c, Flex Clusters are designed to scale up to 2000 nodes. Use cases include:

- Large pools of highly available application resources
- Multiple databases and applications running in one cluster

Flex Cluster Architecture

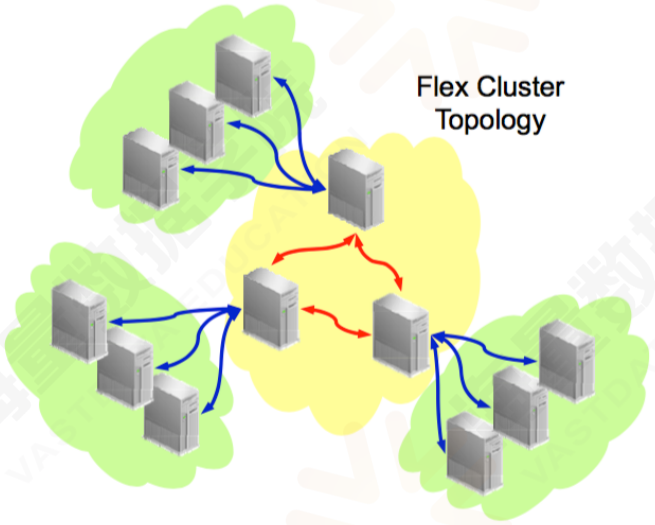


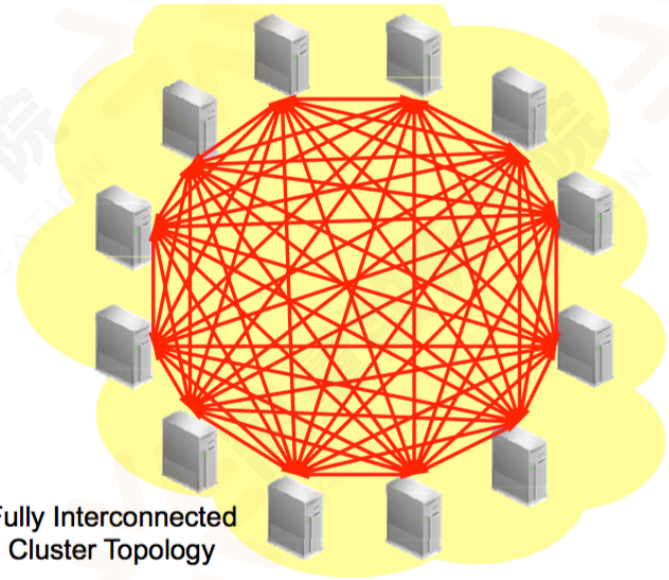
Flex Cluster Scalability

The Flex Cluster hub-and-spoke topology segments the cluster into more manageable groups of nodes.

Only the Hub Nodes require direct access to the OCR and voting disks.

Fewer interactions are required between nodes.





Leaf Node Characteristics

Leaf Nodes:

Are more loosely coupled to the cluster than Hub Nodes

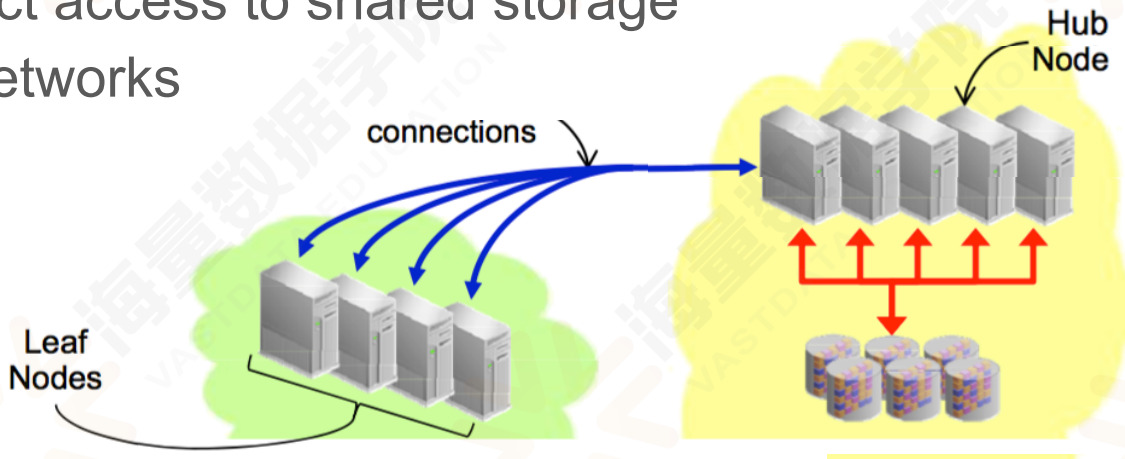
Automatically discover the Hub Nodes at startup

Connect to the cluster through a Hub Node

- Failure of the Hub Node or network failure results in eviction of associated Leaf Nodes.
- Functioning Leaf Nodes can be brought back into the cluster.

Do not require direct access to shared storage

Are on the same networks as the Hub Nodes



Grid Naming Service and Flex Clusters

Clients on Leaf Nodes use GNS to locate Hub Node services.

- The GNS server location is stored in the cluster profile.
- Leaf Node services issue DNS queries to GNS.
  - Particularly during Leaf Node startup

A fixed GNS VIP is required on one of the Hub Nodes.

- So Leaf Node clients have a reliable, well-known location to contact.

DNS forwarding is not required for Flex Clusters.

- But it can be implemented to better integrate GNS with DNS.

Cluster Mode: Overview

Oracle Clusterware 12c introduces a new cluster mode setting to enable Flex Cluster functionality.

- Users must explicitly enable Flex Cluster functionality.

The default cluster mode setting disables Flex Cluster functionality.

- Users who do not implement Flex Clusters are not exposed to the new code.
- Performance and stability of standard clusters is not impacted by Flex Cluster functionality.

Configuring the Cluster Mode

- Showing the current cluster mode:

```
$ crsctl get cluster mode status
```

- Converting from a standard cluster to a Flex Cluster:
  1. Ensure that GNS is configured with a fixed VIP:

```
# srvctl add gns -i <Fixed GNS VIP address> -d <cluster domain>
```

  2. Enable Flex ASM in the cluster using ASMCA
  3. Set the cluster mode:

```
# crsctl set cluster mode flex
```

  4. Stop Oracle Clusterware on each node:

```
# crsctl stop crs
```

  5. Start Oracle Clusterware on each node:

```
# crsctl start crs
```

Configuring the Node Role

- Showing the current node role:

```
$ crsctl get node role status -node <hostname>
```

```
$ crsctl get node role status -node c00n02
Node 'c00n02' active role is 'hub'
```

- Setting the node role:

```
# crsctl set node role { hub | leaf | auto } -node <hostname>
```

```
# crsctl set node role leaf -node c00n02
# crsctl get node role config -node c00n02
Node 'c00n02' configured role is 'leaf'
# crsctl get node role status -node c00n02
Node 'c00n02' active role is 'hub'
```

Configuring the Hub Size

- Showing the current hub size:

```
$ crsctl get cluster hubsize
CRS-4950: Current hubsize parameter value is 32
```

- Setting the hub size:

```
# crsctl set cluster hubsize <number>
```

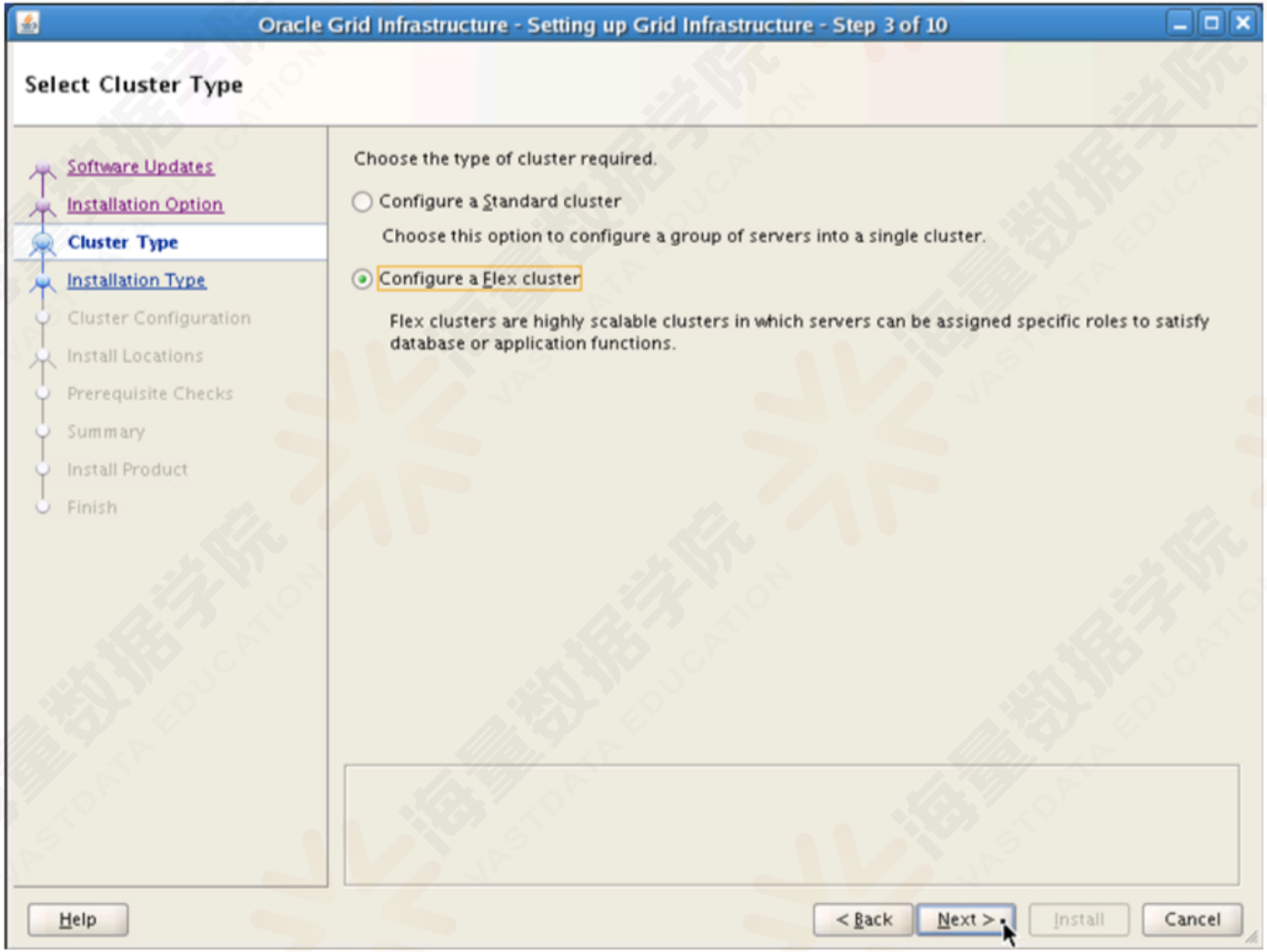
```
# crsctl set cluster hubsize 16
# crsctl get cluster hubsize
CRS-4950: Current hubsize parameter value is 16
```

Configuring Miss Count for Leaf Nodes

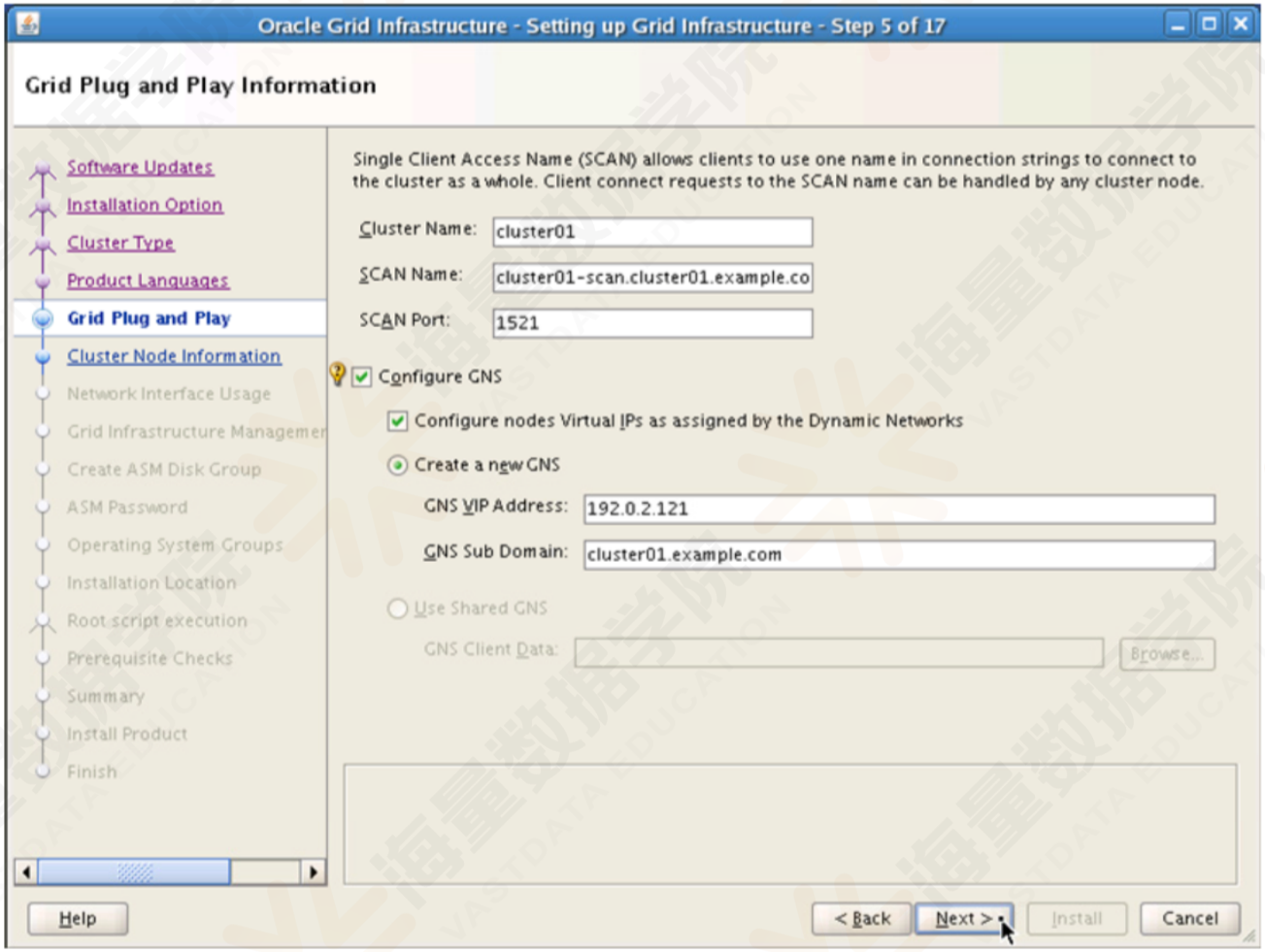
- Viewing and setting `leafmisscount`:

```
# crsctl get css leafmisscount
CRS-4678: Successful get leafmisscount 30 for Cluster Synchronization
Services.
# crsctl set css leafmisscount 45
CRS-4684: Successful set of parameter leafmisscount to 45 for Cluster
Synchronization Services.
# crsctl get css leafmisscount
CRS-4678: Successful get leafmisscount 45 for Cluster Synchronization
Services.
```

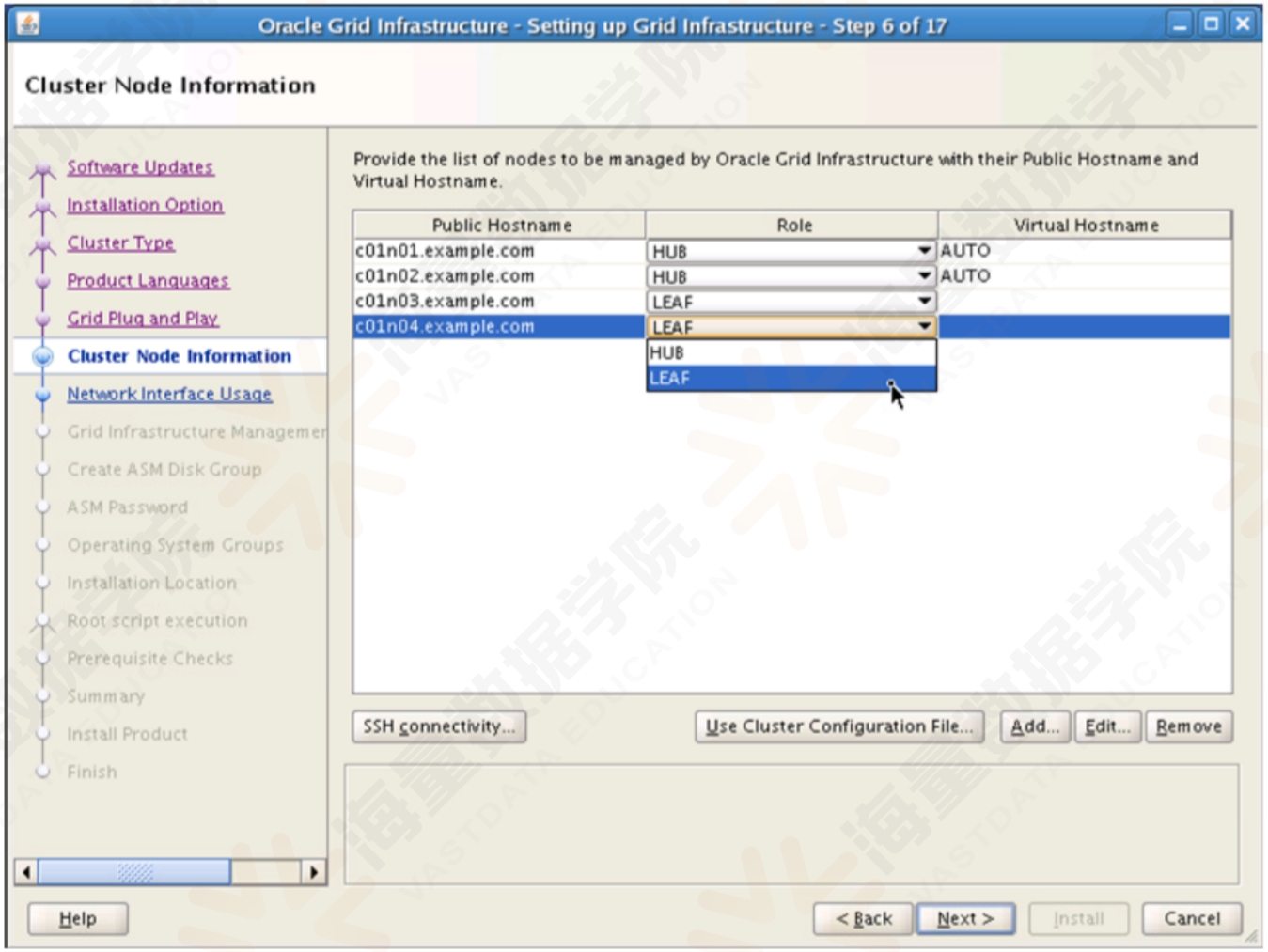
Configuring a Flex Cluster with OUI: Selecting the Cluster Type



Configuring a Flex Cluster with OUI: Configuring GNS



Configuring a Flex Cluster with OUI: Selecting the Node Type



Flex Clusters and Node Failure

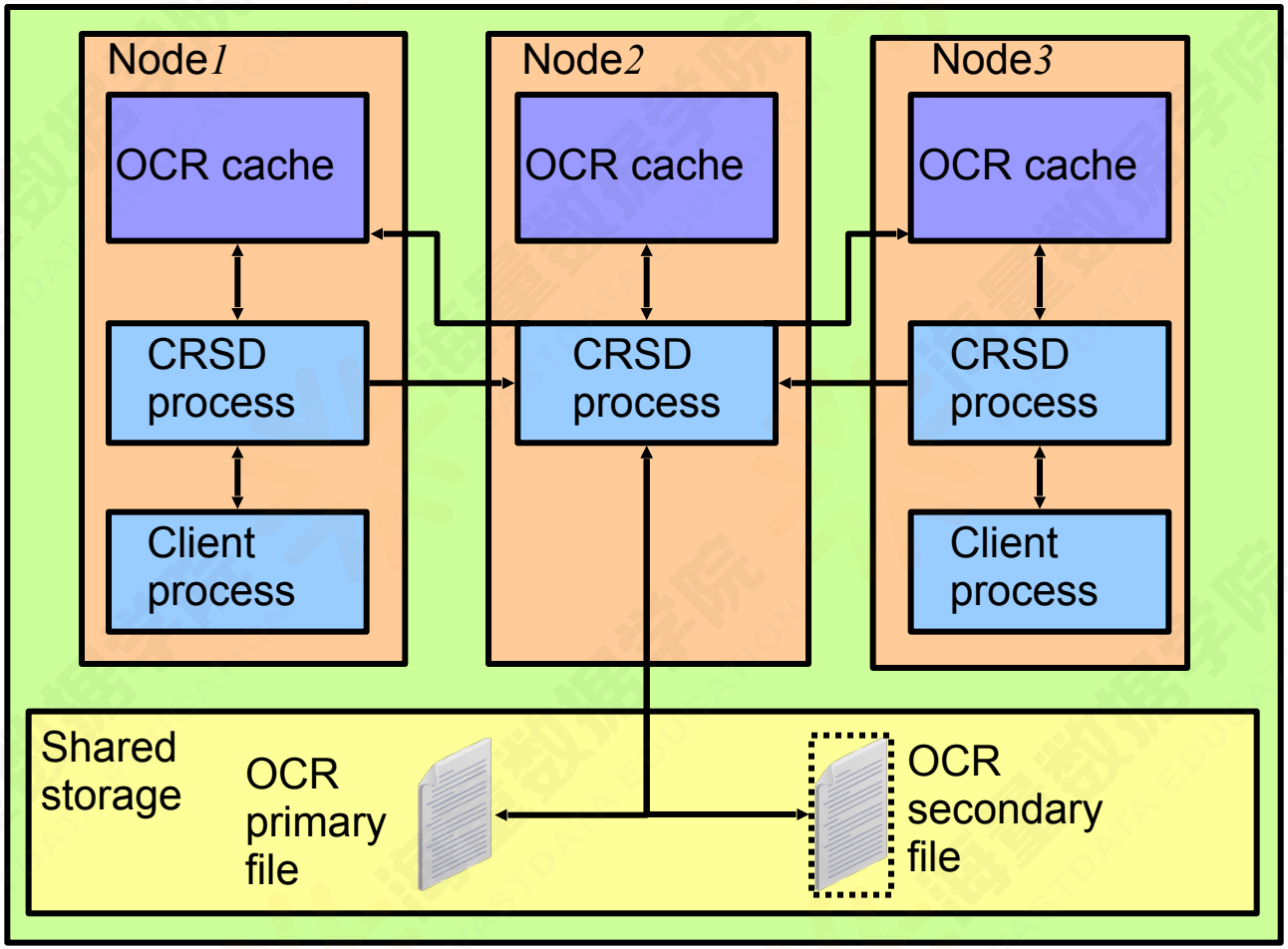
- Nodes that are evicted from the cluster do not require a restart; only a cluster software restart.
- If a Hub Node fails:
  - The node is evicted from the cluster.
    - Services are relocated to other Hub Nodes if possible.
  - Corresponding Leaf Nodes are also evicted from the cluster.
    - Services are relocated to other Leaf Nodes if possible.
- If a Leaf Node fails:
  - The node is evicted from the cluster.
    - Services are relocated to another Leaf Node where possible.
  - The impact of the failure is contained where possible.

Sizing Shared Storage

Minimum sizing for Oracle Clusterware configuration files using External, Normal, or High redundancy:

Redundancy	Minimum # of Disks	OCR Files	Voting Disk Files	Total
External	1	280 MB	280 MB	560 MB
Normal	3	560 MB	840 MB	1.4 GB
High	5	840 MB	1.4 GB	2.3 GB

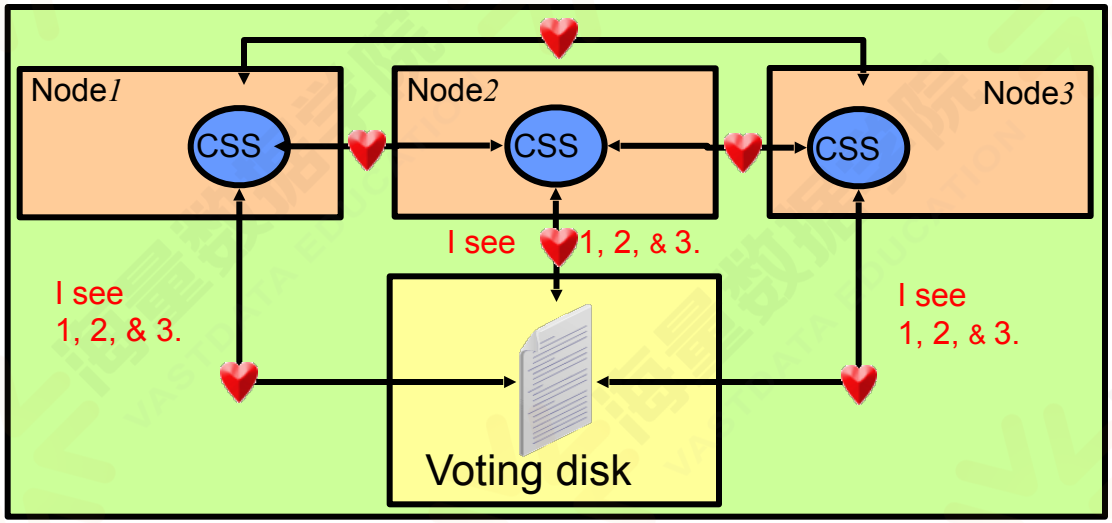
Oracle Clusterware Repository (OCR)



Managing Voting Disks in ASM

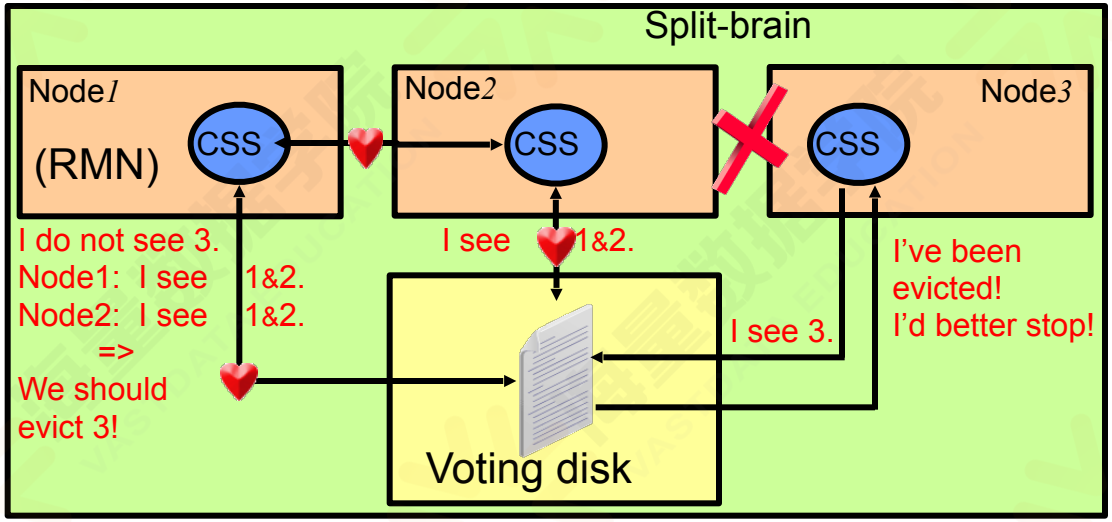
- 每个节点必须要能够访问半数以上的仲裁盘；否则，节点将会被驱逐出集群。
- 仲裁盘可以存储在ASM磁盘组中。
  - 它不是常规的ASM文件。
  - ASM不可用时，集群也可以知道仲裁盘的位置。
- 仲裁盘的数量通过ASM磁盘组的冗余设置来决定。
  - external 冗余的磁盘组，使用一个仲裁盘
  - normal 冗余的磁盘组，使用三个仲裁盘
  - high 冗余的磁盘组，使用五个仲裁盘
- 每个仲裁盘都要有一个单独的失败组。
- 仲裁盘的管理使用 crsctl 工具。

CSS Voting Disk Function



Nodes can see each other.

Node3 can no longer communicate through private interconnect. Others no longer see its heartbeats and evict that node by using the voting disk.



Policy-Based Cluster Management Enhancements: Overview

In previous releases:

- A cluster can be logically divided into server pools
  - The server pools collectively define a policy.
  - All nodes are assumed to be equal.
- "Quality of Service Management" uses a different policy
  - Potential for overlap, confusion, and inconsistency

With Oracle Clusterware 12*c*, policy-based cluster management is enhanced to provide:

- Extended server attributes to govern node placement
- A library of policy definitions with an easy way of switching between policies
- Unification of policies for Oracle Clusterware and "Quality of Service Management"

Server Pools

Server pools:

- Are logical divisions of a cluster into pools of servers/nodes
- Distribute a uniform workload over several servers in the cluster
- Are allocated to host databases or other resources
- Are managed using the `crsctl` and `srvctl` commands
- Support parent/child relationships among server pools
  - Top-level pools are mutually exclusive.
- Include two built-in server pools at Oracle Clusterware installation:
  - `FREE`: For servers that are not assigned to other pools
  - `GENERIC`: For administrator-managed fixed configuration and for databases prior to 11*g* Release 2

Server Pools and Policy-Based Management

- With policy-based management, administrators specify the server pool in which the servers run.
  - A DBA uses `srvctl` to create a server pool for servers hosting a database or database service.
  - A clusterware administrator uses `crsctl` to create a server pool to host applications and other nondatabase uses.
- Server pools provide resource isolation to prevent applications running in one pool from accessing resources running in another pool.
- Oracle Clusterware provides fine-grained role separation between server pools.
  - This maintains required role separation in organizations that have clustered environments managed by separate groups.

Server Pool Attributes

Attribute	Description
ACL	Access Control List that defines privileges for the server pool
ACTIVE_SERVERS	List of servers currently assigned to a server pool
EXCLUSIVE_POOLS	Governs whether servers can be shared among other pools
IMPORTANCE	Relative importance of server pool ranging from 0 (lowest) to 1000
MAX_SIZE	Maximum number of servers a server pool can contain
MIN_SIZE	Minimum number of servers a server pool can contain
NAME	The name of the server pool
PARENT_POOLS	Specifies parent pools when creating nested server pools
SERVER_CATEGORY	The name of a registered server category, used as part of server categorization
SERVER_NAMES	List of servers that may be associated with a server pool

Server Pool Attribute Considerations

- You can use `srvctl` or `crsctl` to create server pools for databases and other applications.
  - If you use `crsctl` to create server pools, you can use the entire set of server pool attributes.
  - If you use `srvctl` to create a server pool, you can use only a subset of the server pool attributes:
    - `category`
    - `importance`
    - `min`
    - `max`
    - `serverpool`
    - `servers`
- Use `srvctl` to create server pools that host Oracle databases.
- Use `crsctl` to create server pools that host nondatabase resources such as middle tiers and applications.

GENERIC and FREE Server Pools

- When upgrading Clusterware, all nodes are placed in the GENERIC pool to ensure compatibility with earlier releases.
- The GENERIC server pool stores any server that is not in a top-level server pool and is not policy managed.
  - Servers hosting non-policy-managed applications are statically assigned to the GENERIC server pool.
- FREE server pool attributes are restricted, as follows:
  - SERVER_NAMES, MIN_SIZE, and MAX_SIZE cannot be edited by the user.
  - IMPORTANCE and ACL can be edited by the user.
- Configuration attributes of the GENERIC server pool cannot be edited.

Assignment of Servers to Server Pools

Assume that there are no servers in a cluster, all server pools are empty, and server pools are defined as follows:

NAME	IMPORTANCE	MIN_SIZE	MAX_SIZE	PARENT_POOLS	EXCLUSIVE_POOLS
sp1	1	1	10		
sp2	3	1	6		
sp3	2	1	2		
sp2_1	2	1	5	sp2	s123
sp2_2	1	1	5	sp2	s123

1. Clusterware assigns `host01` to `sp2` because `sp2` has the highest `IMPORTANCE` and its `MIN_SIZE` value has not yet been met.
2. Clusterware assigns `host01 to sp2_1` but cannot assign `host01` to `sp2_2` because `sp2_1` is configured to be exclusive with `sp2_2`.

Creating Server Pools with `srvctl` and `crsctl`

Use the `crsctl` utility or the `srvctl` utility to create additional server pools.

- Specifying attributes on the command line:

```
$ crsctl add serverpool SP1 -attr "MIN_SIZE=2,
MAX_SIZE=5, IMPORTANCE=3"
```

```
$ srvctl add srvpool -serverpool SP1 -min 2 -max 5
-importance 3 -servers "server1,server2"
```

- Specifying attributes using a text file to supply them:

```
$ crsctl add serverpool SP1 -file
/usr/local/bin/SP1_attributes.txt
```

Managing Server Pools with `srvctl` and `crsctl`

Use the `crsctl` utility or the `srvctl` utility to delete and modify server pools.

- To delete server pools:

```
$ crsctl delete serverpool SP1
```

```
$ srvctl remove srvpool -g SP1
```

- To modify server pools:

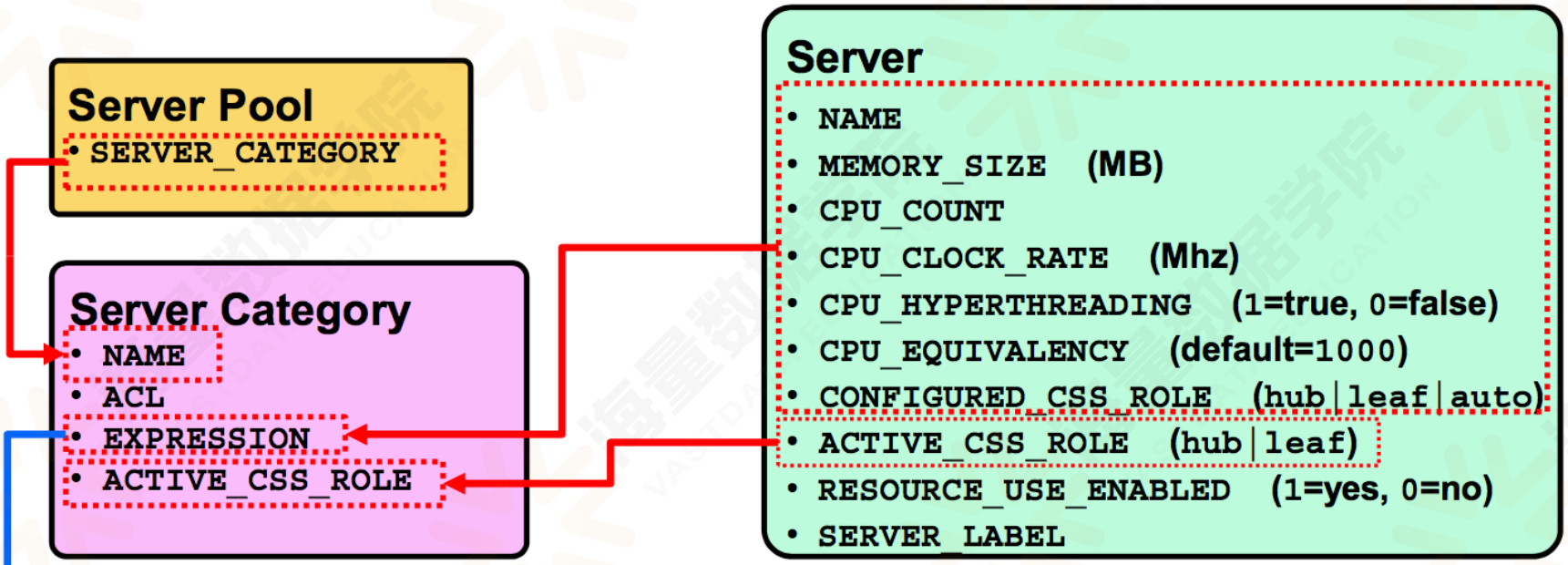
```
$ crsctl modify serverpool SP2 -attr "MIN_SIZE=4,
MAX_SIZE=8, IMPORTANCE=7"
```

```
$ srvctl modify srvpool -serverpool SP2 -min 4
-max 8 -importance 7
```

Server Categorization: Overview

- In previous releases, server pools were restricted to a set of basic attributes characterizing servers as belonging to a given pool.
- There was no way to distinguish between types of servers.
  - All servers were considered to be equal in relation to their processors, physical memory, and other characteristics.
- Server categorization enables you to organize servers into particular categories, using attributes such as processor types, memory, and other distinguishing system features.

Server Categorization



Server Category EXPRESSION Format:

```
<expr> ::= (<simple>|<expr> [<comp> <simple>|<expr>])
<simple> ::= (<attrName> <operator> <value>)
<comp> ::= "AND" | "OR"
<operator> ::= "=" | ">" | "<" | "!=" | "co" | "nc"
```

Contains

Does Not Contain

Examples:

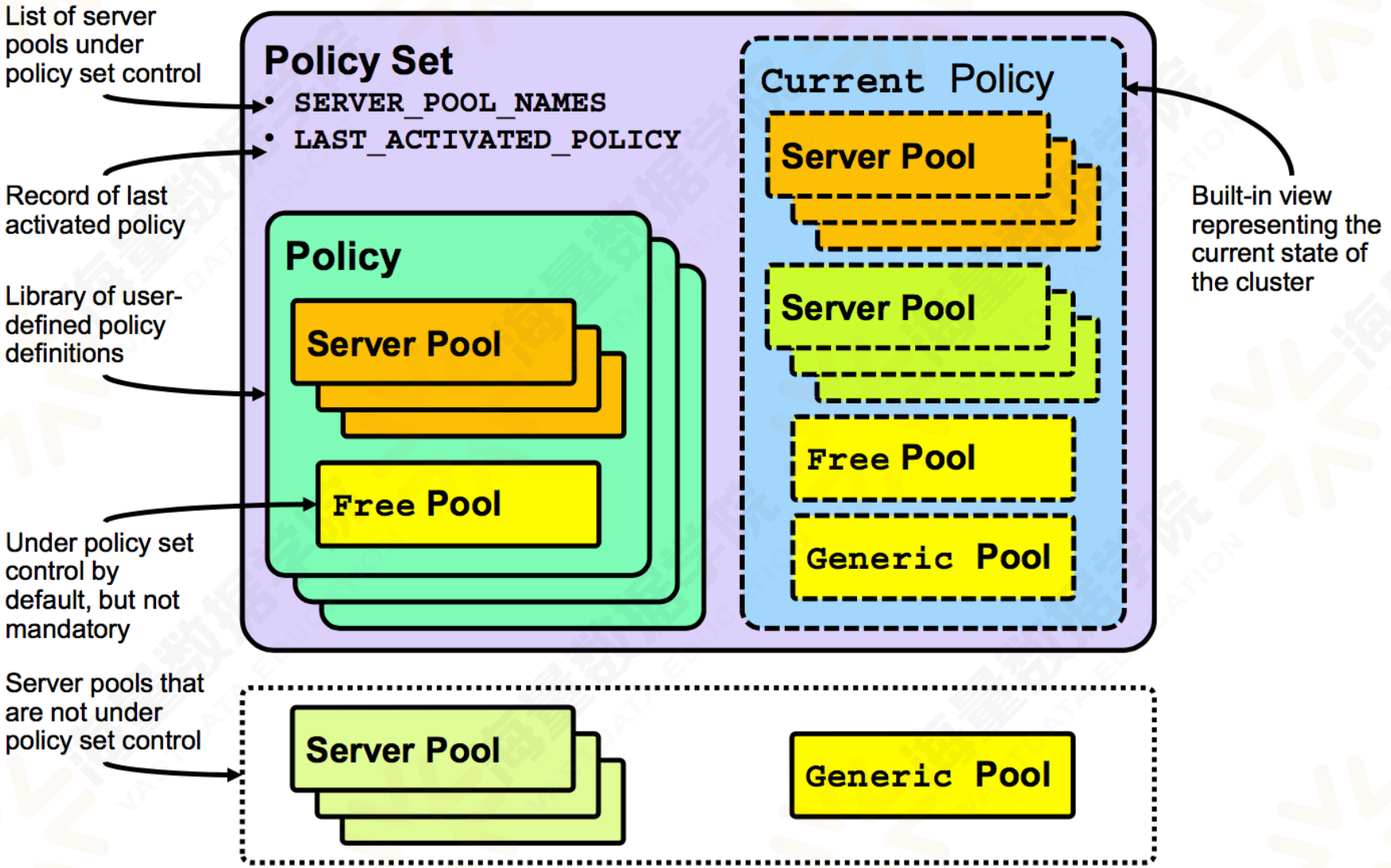
```
((NAME co 'test') OR (CPU_CLOCK_RATE < 2500))
((CPU_COUNT > 4) AND (MEMORY_SIZE > 8000))
```

Administering Server Categorization: Server Attributes

- Most server attributes are automatically discovered by Oracle Clusterware.
- Example: Viewing attribute settings

```
$ crsctl status server host01 -f
NAME=host01
MEMORY_SIZE=4006
CPU_COUNT=1
CPU_CLOCK_RATE=2857
CPU_HYPERTHREADING=0
CPU_EQUIVALENCY=1000
DEPLOYMENT=other
CONFIGURED_CSS_ROLE=hub
RESOURCE_USE_ENABLED=1
SERVER_LABEL=UNAVAILABLE
PHYSICAL_HOSTNAME=UNAVAILABLE
STATE=ONLINE
ACTIVE_POOLS=Free
STATE_DETAILS=
ACTIVE_CSS_ROLE=hub
```

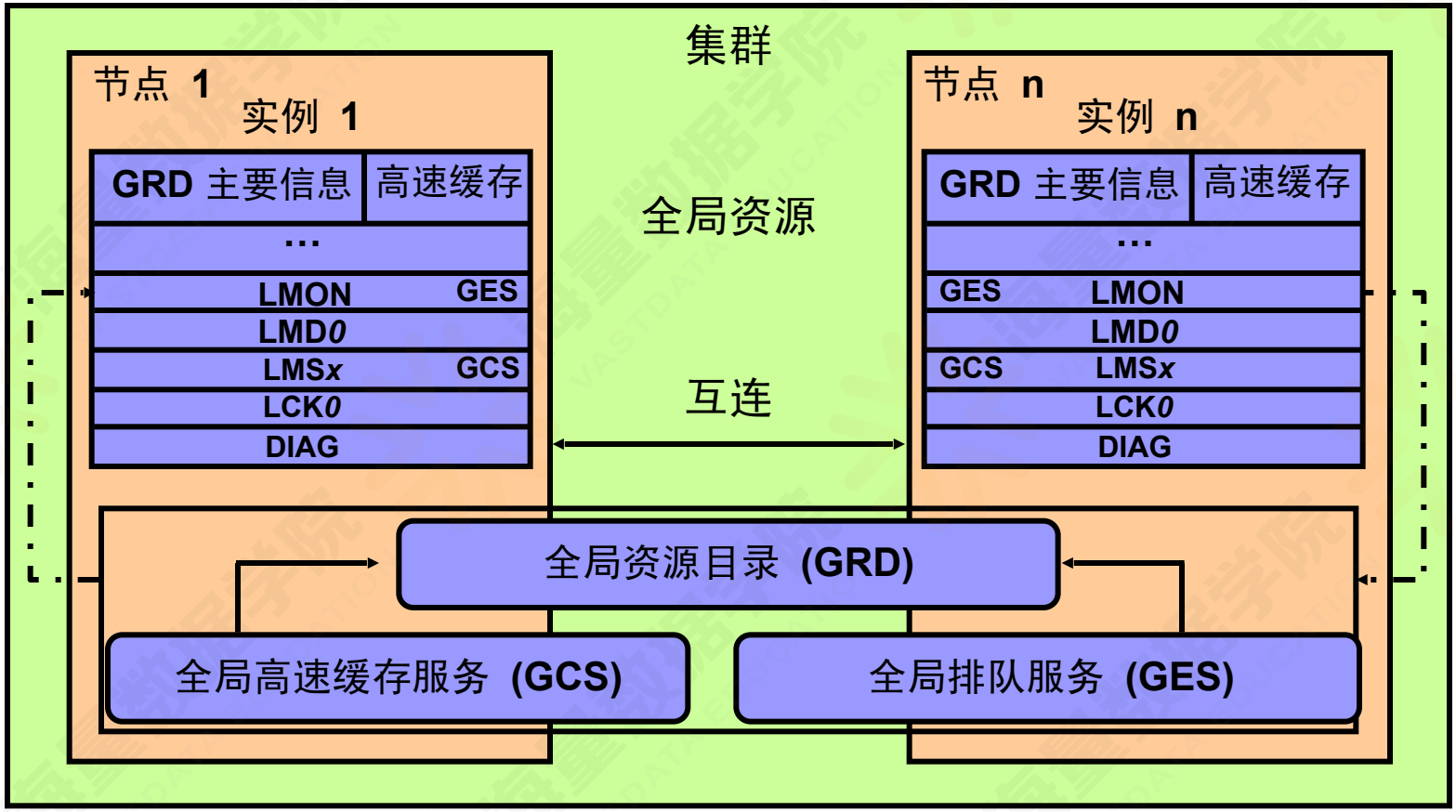
Policy Set: Overview



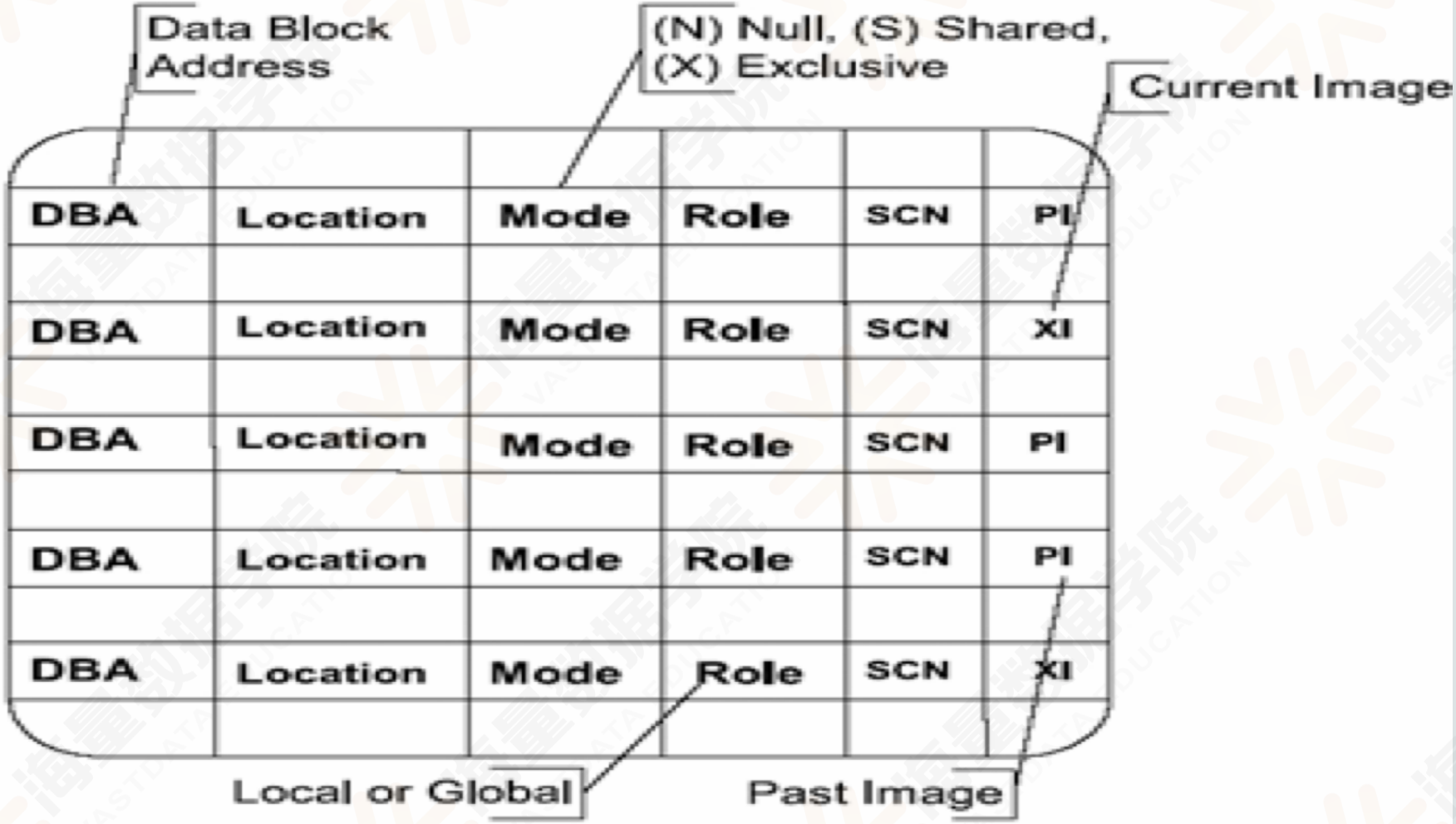
Viewing the Policy Set

```
$ crsctl status policyset
ACL=owner:grid:rwx,pgrp:oinstall:rwx,other::r-x
LAST_ACTIVATED_POLICY=
SERVER_POOL_NAMES=Free
POLICY
  NAME=Current
  DESCRIPTION=This policy is built-in and managed automatically to
reflect current configuration
  SERVERPOOL
    NAME=Free
    ACTIVE_SERVERS=host01 host02
    EXCLUSIVE_POOLS=
    IMPORTANCE=0
    MAX_SIZE=-1
    MIN_SIZE=0
    PARENT_POOLS=
    SERVER_CATEGORY=
    SERVER_NAMES=
...
```

全局资源协调



Global Resource Directory



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