

# Virtualized CUDB Virtual Machine Recovery

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## OPERATING INSTRUCTION

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# 1 Introduction to Virtual Machine Recovery

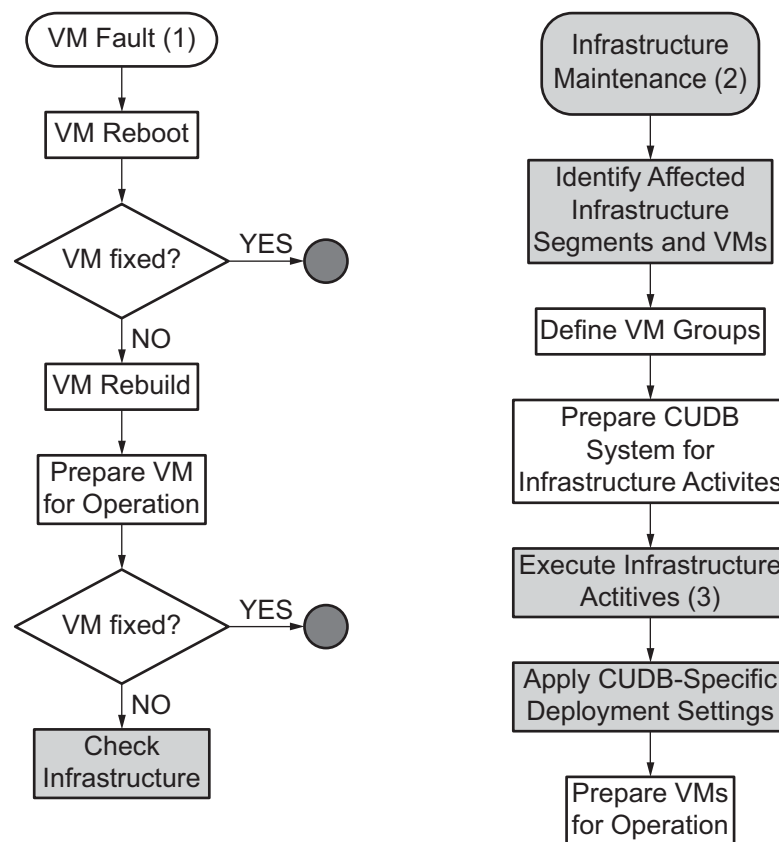
This document describes how to recover a Virtual Machine (VM) in an Ericsson Centralized User Data Base (CUDB) node deployed on a cloud infrastructure.

## 1.1 Description

This Operating Instruction (OPI) describes how to recover a VM in a virtualized CUDB node. Specifically, it describes the following procedures:

- Manually recovering the VM by means of rebooting or rebuilding it.
- Preparing the CUDB node and system to gracefully handle and recover from a planned infrastructure maintenance activity.

The major steps of the recovery procedures listed above are shown in Figure 1.



(1) Where reboot is recommended in CUDB procedures, or after other procedures have been exhausted.

(2) Triggered by VM faults, or other reasons.

(3) Aligned with VM grouping.

Cloud Infrastructure Level

*Figure 1 VM Recovery Procedures*

## 1.2 Target Groups

This document is intended for system administrators operating CUDB systems. For some of the actions described in the document, cloud administration role is also required. The cloud administrator is the cloud service provider who delivers the cloud service and executes required actions on the cloud infrastructure.

### 1.3 Revision Information

**Rev. A** Initial release.



**Rev. B** Editorial changes only.

## 1.4 Typographic Conventions

Typographic conventions can be found in the following document:

- *Typographic Conventions*







## 2 Reboot and Rebuild the VM

If a VM is having issues and all applicable CUDB recovery procedures outlined in *CUDB Troubleshooting Guide*, Reference [1] have been performed, but the VM still did not recover, it can be rebooted from the cloud infrastructure (see Section 2.1 on page 5). If rebooting does not solve the issue, or if the VM must be reinstalled, the VM can also be rebuilt (see Section 2.2 on page 6).

### 2.1 Reboot the VM

Perform the following steps to reboot the VM from the cloud infrastructure.

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#### Warning!

Any custom data not saved in the `/local` or `/local2` folders will be lost after rebooting.

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In case of using Cloud Execution Environment (CEE), follow the below steps to reboot the VM:

1. Login to the Atlas Dashboard.
2. Select the appropriate project in the **Current Project** field, then select **Project** in the **View** field.
3. Choose the **Instances** category.
4. Identify the VM to reboot.
5. In the **Actions** column of the identified VM, select the action **Soft Reboot Instance** to use graceful shutdown, or the action **Hard Reboot Instance** to use non-graceful shutdown. Refer to the “Openstack End User Guide” or the “Atlas Dashboard End User Guide” documents of the CEE Customer Product Information (CPI) for more details.
6. While the reboot process is ongoing, the **Status** column of the instance will show `REBOOT`. Once it becomes `ACTIVE`, the processes in the VM will begin to start up.
7. If the issue still persists after the VM has fully started up, rebuild the VM by performing the steps of Section 2.2 on page 6.

Refer to the “Atlas Dashboard End User Guide” document in the CEE documentation for more information on how to reboot VMs if using CEE. In case



of using a different cloud solution, refer to the solution-specific documentation for more information.

## 2.2 Rebuild the VM

VMs are rebuilt during node installation to ensure the automatic recovery of the SC\_2\_1 System Controller (SC), or when any VM is reinstalled.

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### Warning!

All data on the VM will be lost when it is about to be reinstalled.

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In case of using CEE, follow the steps below to rebuild the affected VM:

1. Login to the Atlas Dashboard.
2. Select the appropriate project in the **Current Project** field, then select **Project** in the **View** field.
3. Choose the **Instances** category.
4. Identify the VM to rebuild.
5. In the **Actions** column of the identified VM, select the action **Rebuild Instance**.
6. In the **Rebuild Instance** window, choose the **Payload** image option from the **Select Image** drop-down box to allow the VM to boot from network.
7. Once the image is chosen, select **Rebuild**.
8. While the rebuild process is ongoing, the **Status** column of the instance will show **REBUILD**. Once it becomes **ACTIVE**, the processes in the VM will begin to start up.
9. Depending on the type of the VM, perform the applicable steps below to prepare the recovered VM for operation:

- If the rebuilt VM is an SC, wait until the synchronization between the SCs is completed. Use the following command to check the synchronization status:

```
cat /proc/drbd
```

Once the synchronization is finished, any custom `crontab` jobs and their definitions (or similar tasks) which are not deployed by default in CUDB will be lost. If necessary, redeploy them after the procedure is completed.



- If the rebuilt VM belongs to a DSG, and replication issues are detected after all the processes in the VM started up, perform a combined unit data backup and restore as described in the “Performing Combined Unit Data Backup and Restore” section of *CUDB Backup and Restore Procedures*, Reference [2].
- If the rebuilt VM belongs to a PLDB, execute the following command after the Network Databases (NDBs) are started, and the database cluster server connections are OK:

```
cudbPrepareStore --pl
```

Refer to the “Atlas Dashboard End User Guide” document in the CEE documentation for more information on how to rebuild VMs if using CEE. In case of using a different cloud solution, refer to the solution-specific documentation for more information.





## 3 Actions for Planned Infrastructure Maintenance Activities

This section describes how to prepare the CUDB node and system to gracefully handle and recover from a planned maintenance activity on the infrastructure level. The major steps of this procedure are as follows:

1. Identifying all affected VMs (see Section 3.1 on page 9).
2. Preparing the affected VMs for recovery (see Section 3.2 on page 11 and Section 3.3 on page 14).
3. Performing post-maintenance cloud administration actions (see Section 3.4 on page 16).
4. Preparing the recovered VMs for operation (see Section 3.5 on page 17).

### 3.1 Identify All Affected VMs

An infrastructure segment can host one or several VMs. If a maintenance activity on the infrastructure level is planned, find out which infrastructure segment is affected to identify which VMs must be prepared for it. In most cases, the affected infrastructure segment is known ahead, and based on that information, the cloud administrator can easily identify all affected VMs. However, it can happen that an unexpected failure in the infrastructure occurs, and the specific infrastructure segment has yet to be identified, based on the VMs with faults in their behavior.

#### 3.1.1 Identify Affected Infrastructure Segment

If the infrastructure segment has not yet been identified, it can be identified by the infrastructure position of the faulty VMs. To do so, provide the VM instance name(s), the VM instance Universally Unique Identifier(s) (UUIDs), or both to the cloud administrator. This information can be gathered as follows:

- The **instance name** can be obtained from the cloud infrastructure.
- The **instance UUID** can be obtained either from the CUDB system, if an alarm was raised for that VM (from the alarm description), or from the cloud infrastructure.

In case of using CEE, identify the instance name, the instance UUID, or both as described below:

- ☐ The **instance name** of the VM can be obtained from the **Instances** page of the Atlas Dashboard. Its format is `<tenant>_<nameOfFailingVirtualMac`



*hine>*. For example, the SC\_2\_1 VM instance name of the CUDB\_VNF01 tenant would be CUDB\_VNF01\_SC\_2\_1.

- ☐ The **instance UUID** of the VM can be obtained from the Atlas Dashboard by choosing the instance name identified above, and checking the ID value under the **Information** section of the **Overview** tab.

Once one or both of the above data is available, contact the cloud administrator, and provide them the VM instance name(s), instance UUID(s), or both.

### 3.1.2 Cloud Administration Actions to Identify Infrastructure Position

After obtaining the VM(s) instance name, instance UUID, or both (as described in Section 3.1.1 on page 9), cloud administrators must identify the infrastructure position. Depending on the user interface used, perform the applicable procedure described below.

In case of using the Atlas Dashboard GUI, identify the VM infrastructure position with the following steps:

1. Login to the Atlas Dashboard.
2. Choose the **Instances** category, and search for the instance using the provided instance name.
3. Look for the compute host name, which is located left to the name of the provided instance name in the **Host** column. Ignore the `.domain.tld` suffix.

In case of using OpenStack command line tools, perform the following steps in a Cloud Infrastructure Controller (CIC):

1. Execute the below command to show the details of the specific VM:

```
nova show <instance_UUID>
```

2. Check the command output for the infrastructure position. The information is stated under the `OS-EXT-SRV-ATTR:host` field. Ignore the `.domain.tld` suffix.

In case of using a cloud solution other than CEE, refer to the solution-specific documentation for more information on how to identify the infrastructure position.

### 3.1.3 Cloud Administration Actions to Identify Affected VMs

The cloud administrator can identify the affected VMs on the cloud infrastructure level from the cloud infrastructure segment. To do so, identify which VMs the infrastructure segment hosts.



In case of using CEE, follow the steps below to identify the VMs hosted by the specific infrastructure segment:

1. Login to the Atlas Dashboard.
2. Choose the **Compute Environment** category, and search for the identified compute host.
3. Choose the identified compute host to see the related details.
4. Check the instances running on the selected compute host. This information can be found under the **Instances** view of the opened compute host details.
5. Provide the instance names to the requesting tenants.

In case of using a cloud solution other than CEE, refer to the solution-specific documentation for more information on how to identify the affected VMs.

## 3.2

### Preparations for PLDB or DSG VM Recovery

Perform the following steps to prepare for the VM recovery in case of Processing Layer Database (PLDB) or DSG VMs:

1. Establish an SSH session towards the target CUDB node with the following command:

```
ssh root@<CUDB_Node_OAM_VIP_Address>
```

This session is established to the first or second SC (that is, either to SC\_2\_1 or SC\_2\_2). Refer to “CUDB Users and Passwords”, Reference [4] for more information on the default `root` password.

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#### Warning!

If the failing VM is a master DS Unit replica, then perform the VM recovery in low traffic periods. This is because the following procedure results in a cluster mastership change that can cause traffic loss, or even data loss.

Also, make sure that provisioning traffic is stopped before starting the VM recovery.

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2. Identify the mastership of the affected VMs as described in Section 3.2.1 on page 11.
  3. Disable AMC as described in Section 3.2.2 on page 13.
  4. Perform the mastership change as described in Section 3.2.3 on page 13.



### 3.2.1 Identify Mastership

Depending on whether the affected VM is a DS or a PLDB, perform the applicable procedure below to identify their mastership.

#### Checking if the DS VM is a Master

If the VM belongs to a DSG, execute a planned mastership change procedure if it hosts the DSG master. Perform the following steps to do so:

1. Identify the DS VM number in the `/cluster/etc/cluster.conf` LDE file. For example, if the IP of the DS VM is `10.22.0.7`, then take note of the last octet, and look for the following two lines of the `cluster.conf` file:

```
node 7 payload PL_2_7  
  
host all 10.22.0.7 DS1_0
```

2. Check the `dsGroupId` attribute of the specific instance of the `CudbLocalDs` class in the configuration model. Refer to the “Object Model Modification Procedure” section of *CUDB Node Configuration Data Model Description*, Reference [3] for more information on how to check an attribute.
3. Use the following command to check if the master replica of the DSG with the specific `dsGroupId` is hosted on the affected VM:

```
cudbSystemStatus -R
```

4. If the DS VM is a master, then disable AMC and execute a planned mastership change procedure as described in Section 3.2.2 on page 13 and Section 3.2.3 on page 13.

#### Checking if the PLDB VM is a Master

If the VM belongs to the PLDB, execute a planned mastership change procedure if it hosts the PLDB master. Perform the following steps to do so:

1. Identify the PLDB VM number in the `/cluster/etc/cluster.conf` LDE file. For example, if the IP of the PLDB VM is `10.22.0.3`, then take note of the last octet, and look for the following two lines of the `cluster.conf` file:

```
node 3 payload PL_2_3  
  
host all 10.22.0.3 PL0
```

2. Use the following command to check if the affected PLDB VM is a master or not:

```
cudbSystemStatus -R
```





3. If the PLDB VM is a master, then disable AMC and execute a planned mastership change procedure as described in Section 3.2.2 on page 13 and Section 3.2.3 on page 13.

### 3.2.2 Disable AMC

If AMC must be disabled, then follow the below steps:

1. Check if AMC is enabled. To do so, check the value of the `enabled` attribute of the `CudbAutomaticMasterChange` class in the configuration model. Refer to the “Object Model Modification Procedure” section of *CUDB Node Configuration Data Model Description*, Reference [3] for more information on how to check an attribute.
2. If AMC is disabled, no further actions are needed. If it is enabled (that is, the value of the `enabled` attribute is `true`), then disable it on all CUDB nodes by setting the value of the `enabled` attribute to `false`. Refer to the “Object Model Modification Procedure” section of *CUDB Node Configuration Data Model Description*, Reference [3] for more information on how to modify the object model, and how to apply the changes with the `applyConfig` administrative operation.

### 3.2.3 Perform Mastership Change

Follow the below steps to perform a mastership change:

1. Login to the SC of the node where the master replica is to be hosted with the following command:

```
ssh root@<CUDB_Node_OAM_VIP_Address>
```

Refer to “CUDB Users and Passwords”, Reference [4] for more information on the default `root` password.

2. Execute one of the below commands depending on the type of the mastership change:

- In case of a DSG mastership change, execute the following command:

```
cudbDsgMastershipChange -d <DSG_number>
```

- In case of PLDB mastership change, execute the following command:

```
cudbDsgMastershipChange --pl
```

3. Check that the system has executed the planned mastership change without faults. Use the following command to do so:

```
cudbSystemStatus -R
```

**Note:** If the replication status is not correct, stop the procedure, and contact the next level of maintenance support.



Refer to *CUDB Node Commands and Parameters*, Reference [5] for more information on the `cudbDsgMastershipChange` command, and to the “Changing DSG or PLDB Mastership Manually” section of *CUDB System Administrator Guide*, Reference [6] for more information on performing a manual mastership change.

## 3.3 Recovery of Multiple VMs in Parallel

This section describes how to recover multiple VMs in parallel on a virtualized CUDB node.

### 3.3.1 VM Groups

Because of the virtualized CUDB node infrastructure deployment on host aggregates, multiple VMs can be affected by an infrastructure maintenance. An affected infrastructure segment (that is, “compute host”) can host either one SC, or one or several payload VMs for one CUDB node.

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#### Do!

Because of the deployment rules described above, VMs of another virtualized CUDB node can be hosted on the same infrastructure segment, and can therefore also be affected. Take special care while identifying the affected VMs, and execute the recovery steps of Section 3.3.2 on page 15 on all affected virtualized CUDB nodes.

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In the CUDB system, VMs are categorized into three distinct groups: SC, PLDB, and DSG. These groups can be further divided into groups of even-numbered and odd-numbered VMs. Considering the deployment of a typical virtualized CUDB node and the applied anti-affinity policies, the affected infrastructure segment is likely to host one of the following groups of VMs:

- SC\_2\_1
- SC\_2\_2
- Odd-numbered PLDB and odd-numbered DSG VMs.
- Even-numbered PLDB and even-numbered DSG VMs.



**Note:** The type of VMs in the last two groups can vary depending on the infrastructure availability during the deployment, but the redundancy over the infrastructure must be satisfied because of the applied anti-affinity policies. This means the following:

- The same infrastructure segment cannot host both VMs of the same DSG.
- The PLDB VMs must be evenly distributed. In other words, the majority of the PLDB VMs cannot be hosted by one infrastructure segment.

In case of a failure in multiple infrastructure segments (that is, more than one group of VMs of the above four groups must be recovered), consider the following rules for recovery:

- Do not execute recovery in parallel for different VM groups. Instead, recover one VM group at a time, with the priority as listed above.
- If the affected VMs belong to the same group, they can be recovered in parallel. To do so, perform the recovery in the following order:
  - First, recover fully one SC.
  - Continue with the parallel recovery of the odd-numbered PLDB and DSG VMs.
  - Then, continue with the parallel recovery of the even-numbered PLDB and DSG VMs.

### 3.3.2

### Execute Parallel Recovery

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#### Warning!

During VM recovery, always follow the order of groups exactly as listed in Section 3.3.1 on page 14. Deviations from the defined order can result in a major node outage.

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Perform the following steps to recover multiple VMs belonging either to the same or a different VM group:

1. Identify all affected VMs inside the node to group them. Follow the steps of Section 3.1 on page 9 to do so.



**Note:** To ensure that the traffic handling capacity is enough during the recovery procedure, the number of VMs to replace in parallel should not exceed the configured value of the `redundancyLevel` attribute of the `CudbLdapAccess` class (refer to the “Class `CudbLdapAccess`” section of *CUDB Node Configuration Data Model Description*, Reference [3]). If this condition cannot be fulfilled (that is, the amount of VMs to recover is larger than the value of the `redundancyLevel` attribute), then it is recommended to perform the recovery only for the same number of VMs in parallel at a single time as the value of the `redundancyLevel` attribute. However, if recovery is performed during a low traffic period or in a maintenance window (when the degraded traffic handling capacity could still be enough), recovery may be executed in parallel for more VMs, than the value of the `redundancyLevel` attribute.

2. Prepare for the recovery of all VMs as described in Section 3.2 on page 11.

**Note:** Enabling and disabling Automatic Mastership Change (AMC) is a system-wide change, and must be performed only once.

3. In case of recovering SC group(s) or PLDB group(s), force the applications to move their primary connections to another CUDB node. This applies in case primary connections are established, or if the SC or PLDB VMs are affected.
4. Execute the recovery of the VMs exactly in the order as specified in Section 3.3.1 on page 14, skipping any group which has no affected VMs.
5. If all recoveries have been finished, and more VMs were recovered than the value of the `redundancyLevel` attribute, then perform a rolling restart of the LDAP Front Ends (FEs) with the `cudbLdapFeRestart` command.

## 3.4 Cloud Administration Actions After Infrastructure Maintenance

Once the VMs have been prepared as described in Section 3.2 on page 11, the infrastructure maintenance activities can be performed.

In case the infrastructure maintenance activities include the re-deployment of any infrastructure segment (for example in case when server replacement is performed), the cloud administrator must check if any applicable CUDB-specific deployment preparations must be executed on the affected infrastructure segment(s) (such as verifying that the ARP spoofing protection is turned off).

In case of using CEE, the cloud administrator must execute the following steps to verify that the ARP spoofing protection is turned off:

1. Execute the following command on each infrastructure segment (that is, “compute host”):

```
grep prevent_arp_spoofing /etc/neutron/plugins/ml2/ml2_conf.ini
```



2. In case the parameter is set to `True`, the ARP spoofing protection is on. Turn it off by setting the `prevent_arp_spoofing` parameter to `False` in `/etc/neutron/plugins/ml2/ml2_conf.ini` on all compute nodes. Then, execute the following command:

```
service neutron-plugin-openvswitch-agent restart
```

## 3.5 Prepare the VMs for Operation

This section describes how to prepare the VMs for operation after the infrastructure maintenance activities have been performed.

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### Do!

Before continuing with the steps of Section 3.5.1 on page 17 or Section 3.5.2 on page 18, verify with the cloud administrator that the applicable CUDB-specific deployment preparations of Section 3.4 on page 16 have been executed.

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**Note:** If the VM did not join the cluster automatically after the infrastructure maintenance has been performed, refer to the Release Notes to check if any manual action is needed for the recovery of the network connectivity of the VMs. Some actions can involve cloud administration.

### 3.5.1 Prepare SC VM

**Note:** When recovering the SC, the *SAF, LOTC Disk Replication Consistency Failed*, Reference [7] alarm might appear. At the same time, if the infrastructure maintenance activities are taking more than 20 minutes to complete, then the *SAF, LOTC Disk Replication Communication Failed*, Reference [8] alarm might also appear. These alarms are expected during the VM recovery procedure on the SC, and should be automatically cleared when all recovery steps are executed. Refer to the corresponding alarm OPI for more information on these alarms.

If the VM to recover is an SC, then perform the following steps once the infrastructure maintenance has been finished:

1. Login to the other SC with the following command:

```
ssh root@<CUDB_Node_OAM_VIP_Address>
```

Refer to “CUDB Users and Passwords”, Reference [4] for more information on the default `root` password.

2. During the first boot, the new SC also synchronizes its replicated disk storage system with another SC. This process can take up to one hour, depending on the disk storage system size and network bandwidth. Use the following command to check the synchronization status:



```
cat /proc/drbd
```

3. Redeploy the `Crontab` jobs and their definitions, or similar tasks that are not deployed by default in CUDB on the recovered SC.

### 3.5.2 Prepare PLDB or DSG VM

Depending on the type of VM, perform the applicable steps below to prepare the recovered PLDB or DSG VM for operation:

- ☐ In case the recovered VM belongs to a DSG, and replication is not recovered, then refer to the “Performing Combined Unit Data Backup and Restore” section of *CUDB Backup and Restore Procedures*, Reference [2].
- ☐ In case the recovered VM belongs to a PLDB group, execute the following command after the Network Databases (NDBs) are started, and the database cluster server connections are OK:

```
cudbPrepareStore --pl
```

- ☐ In case the recovered VM is a PLDB or DSG VM, and AMC was manually disabled because of the steps of Section 3.2.2 on page 13 (or because of another emergency recovery procedure), then re-enable AMC by setting the value of the `enabled` attribute of the `CudbAutomaticMasterChange` class to `true`. Refer to the “Object Model Modification Procedure” section of *CUDB Node Configuration Data Model Description*, Reference [3] for more information on how to modify the object model, and how to apply the changes with the `applyConfig` administrative operation.



## Glossary

For the terms, definitions, acronyms and abbreviations used in this document, refer to *CUDB Glossary of Terms and Acronyms*, Reference [9].







## Reference List

### **CUDB Documents**

- [1] *CUDB Troubleshooting Guide*
- [2] *CUDB Backup and Restore Procedures*
- [3] *CUDB Node Configuration Data Model Description*
- [4] *CUDB Users and Passwords*, 3/00651-HDA 104 03/10
- [5] *CUDB Node Commands and Parameters*
- [6] *CUDB System Administrator Guide*
- [7] *SAF, LOTC Disk Replication Consistency Failed*
- [8] *SAF, LOTC Disk Replication Communication Failed*
- [9] *CUDB Glossary of Terms and Acronyms*