Troubleshoot DIMM memory issues in UCS

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Introduction

This document describes how to troubleshoot memory modules related issues in Cisco Unified Computing System (UCS) solution. UCS uses Dual In-line Memory Module (DIMM) as RAM modules.

Prerequisites

Requirements

Cisco recommends that you have knowledge of Cisco Unified Computing System (Cisco UCS).

Components Used

This document is not restricted to specific software and hardware versions.

However, this document focus around

- Cisco UCS B-Series Blade Servers
- UCS Manager

The information in this document was created from the devices in a specific lab environment. All of
the devices used in this document started with a cleared (default) configuration. If your network is live, make sure that you understand the potential impact of any command.

**Troubleshoot Methodology**

This section covers main parts of UCS memory issues.

- Memory placement
- Troubleshoot DIMM's via UCSM and CLI
- Logs to check in tech support

**Terms and Acronyms**

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>DIMM</td>
<td>Dual In-line Memory Module</td>
</tr>
<tr>
<td>ECC</td>
<td>Error Correcting Code</td>
</tr>
<tr>
<td>LVDIMM</td>
<td>Low Voltage DIMM</td>
</tr>
<tr>
<td>MCA</td>
<td>Machine Check Architecture</td>
</tr>
<tr>
<td>MEMBIS</td>
<td>Memory Built-in Self Test</td>
</tr>
<tr>
<td>T</td>
<td></td>
</tr>
<tr>
<td>MRC</td>
<td>Memory Reference Code</td>
</tr>
<tr>
<td>POST</td>
<td>Power On Self Test</td>
</tr>
<tr>
<td>SPD</td>
<td>Serial Presence Detect</td>
</tr>
<tr>
<td>DDR</td>
<td>Double Data Rate</td>
</tr>
<tr>
<td>RAS</td>
<td>Reliability, Availability and Serviceability</td>
</tr>
</tbody>
</table>

**Memory Placement**

Memory placement is probably one of the most notable physical aspects of UCS solution. Typically the server comes with memory pre-populated with requested amount. However, when in doubt refer to hardware installation guide, which should be updated regularly as new hardware is introduced.

For memory population rules please refer to B-series technical specifications for the specific platform.

B-series technical specifications link:


**Memory Errors**

- DIMM Error
  - ECC (Error Correcting Code) Error
    - Multibit = Uncorrectable
      - POST it is mapped out by BIOS, OS does not see DIMM
      - Runtime usually causes OS reboot
    - Singlebit = Correctable
• OS continues to see memory, performance could degrade
  • Parity Error
  • SPD (Serial Presence Detect) Error
  • Configuration Error
    • Unpaired DIMMs
    • Mismatch errors
      • Not supported DIMMs
      • Not supported DIMM population
    • Identity unestablishable error
    • Check and update the catalog

**Correctable vs. Uncorrectable Errors**

Whether a particular error is correctable or uncorrectable depends on the strength of the ECC code employed within the memory system. Dedicated hardware is able to fix correctable errors when they occur with no impact on program execution.

The DIMMs with correctable error are not disabled and are available for the OS to use. The Total Memory and Effective Memory be the same (taking memory mirroring into account). These correctable errors reported in UCSM operability state as Degraded while overall operability Operable with correctable errors.

Uncorrectable errors generally cannot be fixed, and may make it impossible for the application or operating system to continue execution. The DIMMs with uncorrectable error is disabled and OS does not see that memory. UCSM operState change to ""Inoperable"" in this case.

**Troubleshooting DIMM’s via UCSM and CLI**

**To Check Errors from GUI**

<table>
<thead>
<tr>
<th>UCSM</th>
<th>Logs</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>DIMM Status</td>
<td>SEL</td>
<td>Comments</td>
</tr>
<tr>
<td>Operable</td>
<td>Check SEL log for DIMM related errors</td>
<td>A DIMM is installed and functional.</td>
</tr>
<tr>
<td>Operable</td>
<td>Check SEL for ECC errors</td>
<td>A correctable ECC DIMM error is detected during run time.</td>
</tr>
<tr>
<td>Removed</td>
<td>No logs</td>
<td>A DIMM is not installed or corrupted SPD data.</td>
</tr>
<tr>
<td>Disabled</td>
<td>Check SEL if another DIMM in failed in the same channel</td>
<td>Check and update capability catalog</td>
</tr>
<tr>
<td>Disabled</td>
<td>No logs</td>
<td>A DIMM may be healthy but disabled because configuration rule could not be maintained by a failed DIMM in the same channel. Failed to follow memory configuration rule because missing DIMMs.</td>
</tr>
<tr>
<td>Inoperable</td>
<td>Inoperable/R replacement required</td>
<td>UE ECC Error was detected.</td>
</tr>
<tr>
<td>Degraded</td>
<td>Check SEL for ECC errors</td>
<td>DIMM status and Operability changed due to ECC errors were detected before host rebooted. Uncorrectable ECC error was detected during run. DIMM remains available to OS, OS crashes and</td>
</tr>
</tbody>
</table>
required comes back up but still can use this DIMM. Error can occur again later. DIMM should be replaced in most situations.

In order to obtain statistics navigate to Equipment > Chassis > Server > Inventory > Memory and then Right click on memory and select show navigator.

**To Check Errors from CLI**

These commands are useful when troubleshooting errors from CLI.

```plaintext
scope server x/y -> show memory detail
scope server x/y -> show memory-array detail
scope server x/y -> scope memory-array x -> show stats history memory-array-env-stats detail
```

From memory array scope you can also get access to DIMM.

```plaintext
scope server X/Y > scope memory-array Z > scope DIMM N
```

From there then you can obtain per-DIMM statistics or reset the error counters.

```plaintext
UCS/chassis/server/memory-array/dimm # reset-errors
UCS /chassis/server/memory-array/dimm* # commit-buffer
UCS /chassis/server/memory-array/dimm # show stats memory-error-state
```

If you see a correctable error reported that matches the information above, the problem can be corrected by resetting the BMC instead of reseating or resetting the blade server. Use these Cisco UCS Manager CLI commands:

Resetting the BMC does not impact the OS running on the blade.

```plaintext
UCS/chassis/server/memory-array/dimm # reset-errors
UCS /chassis/server/memory-array/dimm* # commit-buffer
UCS /chassis/server/memory-array/dimm # show stats memory-error-state
```

For colusa servers:

```plaintext
UCS# scope chassis
UCS /chassis # scope server x
UCS /chassis/server # reset-ecc
```

With UCSM releases 3.1 and 2.2.7, the thresholds for memory corrected errors have been removed.

Therefore, memory modules (DIMM) shall no longer be reported as "Inoperable" or "Degraded" solely due to corrected memory errors.


Industry demands for greater capacity, greater bandwidth, and lower operating voltages lead to increased memory error rates. Traditionally, the industry has treated correctable errors in the same
way as uncorrectable errors, requiring the module to be replaced immediately upon alert. Given extensive research that correctable errors are not correlated with uncorrectable errors, and that correctable errors do not degrade system performance, the Cisco UCS team recommends against immediate replacement of modules with correctable errors. Customers who experience a Degraded memory alert for correctable errors should reset the memory error and resume operation. If you follow this recommendation, it avoids unnecessary server disruption. Future enhancements to error management are coming and helps distinguish among various types of correctable errors and identify the appropriate actions, if any, needed.

It is recommended to be minimum of version 2.1(3c) or 2.2(1b) which has enhancement with UCS memory error management

If the above troubleshooting did not help please raise a support request for assistance.

**Log Files to Check in Tech Support**

UCSM_X_TechSupport > sam_techsupportinfo

Provides information about DIMM and memory array.

Chassis/server tech support

For colusa servers:

```
UCS# scope chassis
UCS /chassis # scope server x
UCS /chassis/server # reset-ecc
```

Based on the platform/version, navigate to the files in tech support bundle

```
var/nuova/BIOS > RankMarginTest.txt
var/nuova/BIOS > MemoryHob.txt
var/nuova/BIOS > MrcOut_*_.txt
```

These files provide information about memory as seen from BIOS level.

Information there can be cross-referenced again DIMM states reporting tables shown above.

Example:

```
/var/nuova/BIOS/RankMarginTest.txt
```

- Useful for showing the test results from BIOS Training test
  MEMBIST

- Look for errors
• Look to see if any DIMMs are mapped out
• show DIMM specific information (Vendor/speed/PID)

For colusa servers:

UCS# scope chassis
UCS /chassis # scope server x
UCS /chassis/server # reset-ecc
The first column has two values:

DIMM locator (F2)
DIMM status (01)

Here is a brief description for each status:

0x00 // Not Installed (No DIMM)
0x01 // Installed (Working)
/// 0x02-0F (Reserved)
/// Failed
0x10 // Failed Training
0x11 // Failed Clock Training
/// 0x12-17 (Reserved)
0x18 // Failed MemBIST
/// 0x19-1F (Reserved)
/// Ignored
0x20 // Ignored (Disabled from debug console)
0x21 // Ignored (SPD Error reported by BMC)
0x22 // Ignored (Non-RDIMM)
0x23 // Ignored (Non-ECC)
0x24 // Ignored (Non-x4)
0x25 // Ignored (Other PDIMM in same LDIMM failed)
0x26 // Ignored (Other LDIMM in same channel failed)
0x27 // Ignored (Other channel in LockStep or Mirror failed)
0x28 // Ignored (Invalid PDIMM population)
0x29 // Ignored (PDIMM Organization Mismatch)

0x2A // Ignored (PDIMM Register Vendor Mismatch)

//// 0x2B-7F (Reserved)

var/nuova/BIOS > MemoryHob.txt

shows effective and failed memory installed on the server

For colusa servers:

UCS# scope chassis
UCS /chassis # scope server x
UCS /chassis/server # reset-ecc

18h - DIMM status is marked as failed when it fails in MemBist test. Replace with a known good
DIMM.

DIMM Status Description

00h Not Installed (No DIMM)

01h Installed (Working)

02h-0Fh Reserved

10h Failed (Training)

11h Failed (Clock training)

12h-17h Reserved

18h Failed (MemBIST)

19h-1Fh Reserved

20h Ignored (Disabled from debug console)

21h Ignored (SPD Error reported by BMC)

22h Ignored (Non-RDIMM)

23h Ignored (Non-ECC)

24h Ignored (Non-x4)

25h Ignored (Other PDIMM in same LDIMM failed)

26h Ignored (Other LDIMM in same channel failed)

27h Ignored (Other channel in LockStep or Mirror)

28h Ignored (Invalid memory population)
DIMM Blacklisting

In Cisco UCS Manager, the state of the Dual In-line Memory Module (DIMM) is based on SEL event records. When the BIOS encounters a noncorrectable memory error during memory test execution, the DIMM is marked as faulty. A faulty DIMM is a considered a nonfunctional device.

If you enable DIMM blacklisting, Cisco UCS Manager monitors the memory test execution messages and blacklists any DIMMs that encounter memory errors in the DIMM SPD data. To allow the host to map out any DIMMs that encounter uncorrectable ECC errors.

DIMM Blacklisting was introduced as an optional global policy in UCSM 2.2(2).

Server firmware must be 2.2(1)+ for B-series blades and 2.2(3)+ for C-series rack servers to properly implement this feature.

In UCSM 2.2(4), the DIMM Blacklisting enabled by default.

Open the tech support file …/var/log/DimmBL.log

Open the file /var/nuova/BIOS/MrcOut.txt if it is available

Find the DIMM Status table. Look for “DIMM Status:”

DIMM Blacklisted = 1E

Find the DIMM Status table. Look for “DIMM Status:”

DIMM Status:

  00 - Not Installed
  01 - Installed
  10 - Failed (Training failure)clear
  1E - Failed (DIMM Blacklisted by BMC)
  1F - Failed (SPD Error)
25 - Disabled (Other DIMM failed in same channel)

Example

DIMM Status:

|=======================|
| Memory | DIMM Status |
| Channel | 1 2 3 |
|=======================|
| A | 25 1F 25 |
| B | 01 01 01 |
| C | 1F 25 25 |
| D | 01 01 01 |
| E | 01 01 01 |
| F | 25 25 1E |
| G | 01 01 01 |
| H | 01 01 01 |
|=======================|

DIMM Status:

01 - Installed
1E - Failed (DIMM Blacklisted by BMC)
1F - Failed (SPD Error)
25 - Disabled (Other DIMM failed in same channel)

Methods to Clear DIMM Blacklisting Errors

UCSM GUI
UCSM CLI

UCS-B/chassis/server # reset-all-memory-errors

Related Information


Notable Bugs


Cisco Bug ID CSCvm88447 Reset ECC steps documentation missing for Standalone Colusa Servers