Troubleshoot DIMM memory issues in UCS

Contents

Introduction

This document describes how to troubleshoot memory modules related issues in Cisco Unified Computing System (UCS) solution. UCS usesDual 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

DIMM	Dual In-line Memory Module
ECC	Error Correcting Code
LVDIMM	Low Voltage DIMM
MCA	Machine Check Architecture
MEMBIST	Memory Built-in Self Test
MRC	Memory Reference Code
POST	Power On Self Test
SPD	Serial Presence Detect
DDR	Double Data Rate
RAS	Reliability, Availability and Serviceability

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:

http://www.cisco.com/c/en/us/products/servers-unified-computing/ucs-b-series-blade-servers/datasheet-listing.html

Memory Errors

- DIMM Error Multibit = UncorrectablePOST it is mapped out by BIOS, OS does not see DIMMRuntime usually causes OS rebootSinglebit = CorrectableOS continues to see the DIMM
    - ECC(Error Correcting Code) Error
    - Parity Error
    - SPD (Serial Presence Detect) Error

- Configuration Error Not supported DIMMsNot supported DIMM population
    - Unpaired DIMMs
    - Mismatch errors
- 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

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

```
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.

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.

```
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.

```
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:

UCS# scope chassis
UCS /chassis # scope server x
UCS /chassis/server # reset-ecc
```
With UCS releases 2.27, and 3.1 and above, the thresholds for memory corrected errors has been removed.

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

As per whitepaper http://www.cisco.com/c/dam/en/us/products/collateral/servers-unified-computing/ucs-manager/whitepaper-c11-736116.pdf

Industry demands for greater capacity, greater bandwidth, and lower operating voltages lead to increased memoryerror 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)

29h Ignored (Organization mismatch)

2Ah Ignored (Register vendor mismatch)

2Bh- 7Fh Reserved

80h Ignored (Workaround -Looping)

81h Ignored (Stuck I2C bus)

82h – FFh Reserved

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

- **http://www.cisco.com/c/en/us/td/docs/unified_computing/ucs/ts/guide_old_FM/TS_Server.html**
- **http://www.cisco.com/c/en/us/td/docs/unified_computing/ucs/sw/gui/config/guide/2-2/b_UCSM_GUI_Configuration_Guide_2_2/configuring_server_related_policies.html#concept_2069B1145AAB47638CF9AFBB12198CEF**
- **https://www.cisco.com/c/dam/en/us/support/docs/servers-unified-computing/ucs-b-series-blade-servers/CiscoUCSEnhancedMemoryErrorManagementTechNoteFeb42015.pdf**
- **http://www.cisco.com/c/en/us/td/docs/unified_computing/ucs/ts/guide_old_FM/TS_Server.html#wp1073848**
- **http://www.cisco.com/c/en/us/support/docs/field-notices/636/fn63651.html**

Notable Bugs

Cisco Bug ID CSCug93076 B200M3-DDR voltage regulator may have excessive noise under light load

Cisco Bug ID CSCup07488 IPMI DIMM fault sensor is setting Dimm Degraded with no error count.

Cisco Bug ID CSCud22620 Improved accuracy at identifying Degraded DIMMs

Cisco Bug ID CSCuw44524 C460M4, B260M4 or B460M4 IVB clear CMOS can cause memory UECC Error

Cisco Bug ID CSCur19705 ECC/UECC Errors observed on B200M3

Cisco Bug ID [CSCvm88447](#)Reset ECC steps documentation missing for Standalone Colusa Servers