

INTEL® OPTANE™ DC PERSISTENT MEMORY (DCPMM) -Bios settings

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OBJECTIVES

Upon completion of this course, participants will be able to:

- Use Intel BIOS to configure Intel Optane DC persistent memory (DCPMM)
- Know where to find the DCPMM configuration settings in BIOS
- Feel confident in their ability to setup and configure DCPMM in an Intel server





CONFIGURING DCPMM MODES AND OPTIONS

VIEWING AND CONFIGURING INDIVIDUAL DCPMMS

MONITORING DCPMM HEALTH AND UPDATING FIRMWARE

SECURITY OPTIONS

CREATING GOALS, REGIONS, AND NAMESPACES

SUMMARY

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CONFIGURING MODES FOR DCPMM USING INTEL BIOS



VIEWING MEMORY INFORMATION

Memory Size

Memory Speed

Volatile Memory Mode

Here is a screen shot of the **Memory Configuration** screen, and as you can see there is a lot of information and settings here, including Memory Size, Memory Speed, Volatile Memory Mode and DIMM Information. Another option from this screen is to select Memory **RAS and Performance Configuration**. We will explore those options on the next slide.

DIMM Information

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Memory Configuration Configure memory RAS Total DDR4 Memory 384 GB (Reliability, Availability, 3024GB-0GB-3024GB DCPMM and Serviceability) and view Effective Memory 390351 MB current memory performance ADDDC Current Configuration information and settings. Current Memory Speed 2666 MT/s Memory Operating Speed Selection <Auto> IMC Interleaving <Auto> Page Policy <Auto> Volatile Memory Mode <Auto> DCPMM Error Injection <Disabled> Publish ARS capability <Auto> ARS on Boot <Auto> Average Power Budget (in [570] SMB Clock Frequency <Auto> Snoopy mode for 2LM <Enabled> <Enabled> Snoopy mode for AD NVM Performance Setting <BW Optimized> <Option 1> CR FastGo Configuration CR Latch System Shutdown <Disabled> State CR QoS <Disable - Disable CR QoS feature> Thermal Throttling <Auto> **Thresholds** Offset Attempt Fast Boot <Auto> Attempt Fast Cold Boot <Auto> Enable power cycle policy <Enabled> MRC Promote Warnings <Enabled> <Enabled> Promote Warnings Halt on mem Training Error <Enabled> Thermal Monitor <Enabled> lemory RAS and Performance Configuration **DIMM Information** CPU1_DIMM_A1 32GB Installed&Operational CPU1_DIMM_A2 DCPMM 2526B-2526B-06B CPU1_DIMM_B1 32GB Installed&Operational CPU1_DIMM_B2 DCPMM 2526B-2526B-06B CPU1_DIMM_C1 32GB Installed&Operational CPU1_DIMM_C2 DCPMM 252GB-252GB-0GB CPU1_DIMM_D1 32GB Installed&Operational 6

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CONFIGURING RAS AND PERFORMANCE OPTIONS

Memory RAS and Performance Configuration

Here is a screen shot of the **Memory RAS and Performance Configuration** screen. RAS stands for Reliability, Accessibility and Serviceability. From here you can enable or disable Sparing, NUMA Optimization, Patrol Scrub, Cloaking and setting the Correctable Error Threshold.

Capabilities

Memory Mirroring Possible Memory Rank Sparing Possible Memory ADDDC Possible ADDDC Sparing NUMA Optimized Sub_NUMA Cluster Patrol Scrub Correctable Error Threshold Cloaking

110
NO
YES
<enabled></enabled>
<enabled></enabled>
<disabled></disabled>
<enabled></enabled>
<10>
<disabled></disabled>

ULG

Enable/Disable Adaptive Double Device Data Correction Sparing.

	F10=Save Changes and Exit	F9=Reset to Defaults
†↓=Move Highlight	<enter>=Select Entry</enter>	Esc=Exit
		poration



NAVIGATING TO THE MAIN DCPMM SETUP SCREENS



DCPMM MEMORY CONFIGURATION IN INTEL BIOS

This is the main **DCPMM Memory Configuration** screen in the Intel BIOS. You will get a count of detected DIMMS as well as a quick check on their health. From this screen you can access DIMM specific info, Regions, Namespaces, Capacity readings, Diagnostics, and Preferences. On the next slide we will look at what is available when clicking on the **DIMMs** link.





VIEWING INDIVIDUAL DCPMM DIMM INFORMATION



In the previous screen **DCPMM Memory Configuration**, when you select **DIMMs**, you are presented with the screen above on the left, and from there, you can click on a specific DIMM module to get information about that DIMM which is presented on the screen to the right. From this screen, aside from getting a lot of information about the DIMM like the handle number, the health, the capacity, and the firmware version, you can prob deeper into the health of the DIMM, you can update the firmware, and you can configure security and data policy on the DIMM. Clicking on Show More Details will display even more information about the DIMM as we will see in the next slide.



VIEWING MORE DIMM INFORMATION PART 1

In the **DC Persistent Memory Module** screen, when you select **Show More Details** you are presented with the screen to the right (plus the screen on the next slide). As you can see there is a wealth of information about the DIMM including the serial number, the manufacturing date, the channel position, and the controller revision, just to name a few.

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	DC Persistent Memory Module	
Show more details +		t Show or hide additiona details about the DIMM
Serial number Part number Socket Memory controller ID Vendor ID Device ID Subsystem vendor ID Subsystem device ID Device locator Subsystem revision ID Interface format code Manufacturing info valid Manufacturing date Manufacturing location Memory type Memory back label	0x00000C43 NMA1XBD2566QS 0x0 0x0 0x8089 0x5141 0x8089 0x97A CPU1_DIMM_A2 0x18 0x0301 (Non-Energy Backed Byte Addressable) [1] 18-37 0xA2 Logical Non-Volatile Device NODE 1	details about the pinn
Data width label [b] Total width [b] Speed [MHz] Channel ID Channel position Revision ID Form factor	64 72 2666 0x0000 [1] 0x0 <dimm> 0x9009</dimm>	
Controller revision ID Is new Memory capacity App Direct capacity Unconfigured capacity Inaccessible capacity Reserved capacity Peak power budget ImWI Avg power budget ImWI Max average power budget ImWI Package sparing capable Package sparing enabled Package spares available	B0 (0×0020) [0] 0 B 252.0 GiB 0 B 465.2 MiB 0 B [20000] [15000] [18000] [1] [1] [1]	
Configuration status SKU violation	<valid> [0]</valid>	



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VIEWING MORE DIMM INFORMATION PART 2

This is the rest of the information that is displayed when **Show More Details** has been selected from the **DC Persistent Memory Module** screen. I won't tire you by reading all the items on this screen but as you can see, there is a LOT of information.

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Show more details +	[X]	T Show or hide additional		
(Information continued from last slide)				
ARS status	<completed></completed>			
Uverwrite DIMM status	<not started=""></not>			
Last shutdown time	Tue Jan 28 01:34:14 UIC 2020			
rirst fast refresh	101			
Viral pulley endule	101			
Latched Last shutdown status	PMTC 1211/DDRT 1 211 Pouge Loss			
Lateneu Last Shatubwi Status	(PII), PM Warm Reset Received.			
	Controller's FW State Flush			
	Complete, Write Data Flush			
	Complete, PM Idle R			
Unlatched Last shutdown status	PMIC 12U/DDRT 1.2V Power Loss			
	(PLI), PM Warm Reset Received,			
	Controller's FW State Flush			
	Complete, Write Data Flush			
0 11 11111	Complete, PM Idle K			
Security capabilities	Encryption, Erase			
Root status	Success			
ATT DRAM enabled	215			
Error injection enabled	<0>			
Boot status	Success			
AIT DRAM enabled	<1>			
Error injection enabled	<0>			
Media temperature injection	<0>			
enabled				
Software triggers enabled	<0>			
Software triggers enabled	None			
Poison error injections counter	[0]			
Poison error clear counter	[0]			
Media temperature injections	[0]			
counter				
Software triggers counter	[0]			
Master Passphrase Enabled	[0]			
Monitor health				
Undate firmware				
Configure securitu				
Configure data policy				
View DIMMs				
Back to main menu				

MONITORING DCPMM HEALTH

In the previous screen **DC Persistent Memory** Module, when you select Monitor Health, you are presented with the screen to the right, and from there you can see the values for various sensors as well as how many times the thresholds have been exceeded or not met on things like the temperature of the Media on the DIMM or the controller temperature. You also can get a reading here of how much "life" is left in the DIMM expressed as a percentage. There is also information on the Power On time, Up time, Power cycles and Firmware error counts. Finally, at the bottom of the screen you can set non-critical thresholds. Be sure to Apply Changes if you update any settings.

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Monitor Health

Value
Sensor Type Value
Non-critical threshold Critical lower threshold
Critical upper threshold Fatal threshold
Alarm enabled state

<Controller temperature> <41 C> [98] [99] [99] [102] <Normal> <0>

<38 C>

[82]

[83]

[83]

[85]

<0>

<Normal>

<Health> <Healthu>

Sensor Type Value Non-critical threshold

Sensor Type

Critical lower threshold Critical upper threshold Fatal threshold State Alarm enabled state

Sensor Tupe Value Non-critical threshold State Alarm enabled state

Sensor Type Value

Sensor Type Value

Sensor Tupe Value

Sensor Type Value

Sensor Type Value Sensor Type

Value

<FW error count> $\langle 0 \rangle$ <Unlatched dirty shutdown count>

Modify non-critical thresholds

Controller temperature [C] [98] Media temperature [C] [82] [50] Percentage remaining [7]



<Percentage remaining> <100 % [50] <Normal> $\langle 0 \rangle$

<Media temperature>

<Latched dirty shutdown count> <0>

<Power on time> <25652918 S>

<Up time> <16112 S>

<Power cycles> <86>

< 0 >

UPDATING DCPMM FIRMWARE

In the previous screen **DC Persistent Memory Module**, when you select **Update Firmware**, the screen to the right is what you are presented with. You can specify a file containing the new firmware code and then select **Update**.

Specify the firmware image to load on system restart and select Update. Warning! Modifying the settings of a san unusable configuration. Current firmware version: 01.02 Selected firmware version: None File: ■ Staged firmware version: N/A ▶ Update	the DIMM on the next single DIMM may result in 2.00.5346	Please provide file path relative to the root directory of the device containing the new firmware For example: "\firmware\newFirmware.bin"
Current firmware version: 01.02 Selected firmware version: None File: Staged firmware version: N/A Update	2.00.5346	"\firmware\newFirmware.bin"
Selected firmware version: None File: Staged firmware version: N/A		
Staged firmware version: N/A		
> Update		
 Back to DIMM details View DIMMs Back to main menu 		
F10=Save	Changes and Exit	F9=Reset to Defaults

CONFIGURING DCPMM SECURITY

In the previous screen **DC** Persistent Memory Module, when you select **Configure Security**, the screen to the right is what you are presented with. If you select to set a password, it is stored and automatically applied to unlock DCPMMs before the operating system starts running, but the secure erase action still requires the passphrase. Secure erase is used to erase the encrypted data on the DIMM. Freeze lock is used to lock the security settings of the DIMM.

Specify the security Warning! Modifying th	settings on the DIMM. ne settings of a single DIMM may result in
State:	<disabled></disabled>
Enable security Secure erase Freeze lock • Back to DIMM details • View DIMMs • Back to main menu	Please type in your new password

SETTINGS IN BIOS FOR APP DIRECT

To use DCPMM in App Direct mode, several steps need to be performed, including creating a **goal** which identifies how much memory to use, creating **regions** which are a group of one or more DCPMMs, and create **namespaces** which define a contiguously addressed range of non-volatile memory conceptually similar to a hard disk partition. From the **DCPMM Memory Configuration** BIOS screen you can do all of these steps. Note that creating a goal is part of the creating namespaces process. Also note that from this screen you can get to an option for running diagnostics on the DCPMM which we will look at later in this presentation.



CREATING DCPMM GOALS IN BIOS



Creating a goal is a two-step process. The first step is to select **Create Goal Config** from the **Regions** screen. Once you do that you will be presented with the screen on the right side of this slide. When creating a goal, there are several options. One option is to select if the goal is for the entire platform (which is the default) or if you want to create a goal for one socket on the platform. Another option is determining if the memory will be standard App Direct which is interleaved or if the memory will be App Direct non-interleaved. Once you have made your selections, the second and final step is to click on **Create Goal Config** in the **Create Goal Config** screen. A reboot is required.



VIEWING DCPMM REGION SETTING IN BIOS

Regions			Region	
Current configuration Megion ID 1 Persistent memory type: App Direct Capacity: 1.4 TiB Free capacity: 1.4 TiB Persistent memory type: App Direct Capacity: 1.4 TiB Persistent memory type: App Direct Capacity: 1.4 TiB Persistent memory type: App Direct Capacity: 1.4 TiB Free capacity: 1.4 TiB Pree capacity: 1.4 TiB Memory allocation goal configuration DIMM ID 0x0001 MemorySize: 0 B New: A reboot is required for the memory allocation goal to processed by the BIOS. DIMM ID 0x0011 MemorySize: MemorySize: 0 B	Uiew region details.	View settings. Region ID: DIMM ID: ISet ID: Persistent memory type: Capacity: Free capacity: Health: Socket ID: Mack to Regions menu Back to main menu	0x0001 0x0001, 0x0011, 0x0021, 0x0101, 0x0111, 0x0121 0x51AE7F48F7F92CCC App Direct 1.4 TiB 1.4 TiB Healthy 0x0000	View and configure regions.
F10=Save Changes and Exit ↑↓=Move Highlight <enter>=Select Entry Comunight (c) 2006-2019. Intel Com</enter>	F9=Reset to Defaults Esc=Exit moration	1↓=Move Highlight Co	F10=Save Changes and Exit F9 <enter>=Select Entry Es pyright (c) 2006-2019, Intel Corporati</enter>	D=Reset to Defaults sc=Exit ion

To view region settings, select a region from the **Regions** screen and when you press Enter you will see a screen similar to the one on the right side of this slide, showing the Region ID, the DIMMs that are part of that region, the persistent memory type (standard interleaved or non-interleaved), the capacity, the health and the socket the region is tied to.



CREATING DCPMM NAMESPACE SETTING IN BIOS

From the **DCPMM Memory Configuration** BIOS screen you can also select to create a namespace. The screen on the right is what is displayed and allows options for giving the namespace a name or label, associating it with a region, and assigning a size to the namespace.

Create Namespace			
Create a namespace. Name Region ID Mode Capacity input Units Capacity	<pre></pre>	Name of namespace	
 Create namespace Back to Namespaces 			
▶ Back to main menu			
t∔=Move Highlight	F10=Save Changes and Exit <enter>=Select Entry</enter>	F9=Reset to Defaults Esc=Exit	
	-Comunight (c) 2006-2019, Intel Corn	noration	



RUNNING DIAGNOSTICS ON DCPMM

From the **DCPMM Memory Configuration** BIOS screen you can select **Diagnostics** which will allow you to run diagnostics on individual DIMMs or all of them, as well as validating the configuration parameters, and checking the firmware and security settings.

	Diagnostics	
Choose diagnostics type Quick diagnostics DIMM ID 0x0001 DIMM ID 0x0011 DIMM ID 0x0011 DIMM ID 0x0021 DIMM ID 0x0101 DIMM ID 0x0111 DIMM ID 0x0121 DIMM ID 0x1001 DIMM ID 0x1011 DIMM ID 0x1011 DIMM ID 0x1101 DIMM ID 0x1111 DIMM ID 0x1121 Config diagnostics	: (X) (X) (X) (X) (X) (X) (X) (X)	f Execute selected diagnostic tests.
FW diagnostics Security diagnostics	[X] [X]	
Execute tests		1
†↓=Move Highlight	F10=Save Changes and Exit <enter>=Select Entry —Copyright (c) 2006-2019, Intel Com</enter>	F9=Reset to Defaults Esc=Exit rporation



SUMMARY

- The Intel BIOS is a powerful tool for configuring and diagnosing Intel[®] Optane[™] DC persistent memory modules (DCPMMs)
- BIOS can configure the DCPMMs for Memory Mode or App Direct Mode
- In BIOS, you can configure Goals, Regions, and Namespaces required for App Direct operations
- BIOS has a health check option for DCPMM modules



