



INTEL® OPTANE™ DC PERSISTENT MEMORY (DCPMM) – DIAGNOSTICS

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OBJECTIVES

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

- Use IPMCTL as a tool to configure and read DCPMMs configurations
- Diagnose the health of DCPMMs
- Discover the firmware version on each DCPMM
- Understand what sensors are available on DCPMMs
- Validate the configuration of the DCPMMs

AGENDA

DCPMM DIMM Module Information
What version Intel® Optane™ DC persistent memory Mgmt SW is installed?
Display help for IPMCTL commands using namespaces as an example
What are the total DCPMM memory resources and what is the current configured Mode?
What is the health of each Intel® Optane™ DC persistent memory?
What is the DIMM Topology & Population?
What is the total amount of memory currently mapped to each socket?
Which DIMM's make up each Persistent Memory Region?
Which firmware version is loaded on Intel® Optane™ DC persistent memory?
What sensors are available on the Intel® Optane™ DC persistent memory modules?
Is the current DCPMM configuration valid?
How to run diagnostics on a specific DCPMM - for instance DIMM ID 0x0001?

DETERMINING IPMCTL VERSION

Module Information	Command Example
What version Intel® Optane™ DC persistent memory Mgmt SW is installed?	ipmctl version

```
FS0:\> ipmctl version
Intel(R) Optane(TM) DC Persistent Memory Command Line Interface Version 1.0.0.34
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Intel(R) Optane(TM) DC Persistent Memory Driver API Version 01.00
```

DISPLAYING HELP FOR IPMCTL COMMANDS - EX. NAMESPACES

Module Information	Command Example
Display help for namespace management commands (show, create, delete)	<code>ipmctl show -h -namespace</code> <code>ipmctl create -h -namespace</code> <code>ipmctl delete -h -namespace</code>

```
FS0:\> ipmctl show -h -namespace
Show information about one or more namespaces.
    show [-help|-h] [-all|-a] [-display|-d (Attributes)] [-units|-u (BIMBiMiBiGBiGiBiTiB)] -namespace [(NamespaceIDs)] [-region (RegionIDs)]
```

```
FS0:\> ipmctl create -h -namespace
Provision capacity on one or more DIMMs into regions
    create [-help|-h] [-force|-f] [-units|-u (BIMBiMiBiGBiGiBiTiB)] [-dimmm [(DimmIDs)]] -goal [-socket (SocketIDs)] [MemoryMode=(0|1)] [PersistentMemoryType=(AppDirect|AppDirectNotInterleaved)] [Reserved=(0|1)] [NamespaceLabelVersion=(1.1|1.2)]
Create a new namespace from a persistent memory region
    create [-help|-h] [-force|-f] [-units|-u (BIMBiMiBiGBiGiBiTiB)] -namespace -region (RegionID) [Capacity=(GiB)] [Name=(string)] [Mode=(None|Sector)]
```

```
FS0:\> ipmctl delete -h -namespace
Delete one or more existing namespaces.
    delete [-help|-h] [-force|-f] -namespace [(NamespaceIDs)]
```

TOTAL DCPMM SIZE AND CONFIGURATION MODE

Module Information	Command Example
What are the total DCPMM memory resources and what is the current configured Mode?	<code>ipmctl show -memoryresources</code>

Reading from a system
configured in Memory Mode:

```
[root@B7R19Z2S1 ~]# ipmctl show -memoryresources  
Capacity=3029.4 GiB  
MemoryCapacity=3024.0 GiB  
AppDirectCapacity=0.0 GiB  
UnconfiguredCapacity=0.0 GiB  
InaccessibleCapacity=5.4 GiB  
ReservedCapacity=0.0 GiB
```

Reading from a system
configured in App Direct Mode:

```
[root@B7R19Z2S1 ~]# ipmctl show -memoryresources  
Capacity=3029.4 GiB  
MemoryCapacity=0.0 GiB  
AppDirectCapacity=3024.0 GiB  
UnconfiguredCapacity=0.0 GiB  
InaccessibleCapacity=5.4 GiB  
ReservedCapacity=0.0 GiB
```


DETERMINING THE HEALTH OF DCPMM DIMMS

Module Information	Command Example
What is the health of each Intel® Optane™ DC persistent memory?	<code>ipmctl show -sensor health</code>

```
FS0:\> ipmctl show -sensor health
DimmID | Type   | CurrentValue | CurrentState
=====
0x0001 | Health | Healthy      | Normal
0x0011 | Health | Healthy      | Normal
0x0021 | Health | Healthy      | Normal
0x0101 | Health | Healthy      | Normal
0x0111 | Health | Healthy      | Normal
0x0121 | Health | Healthy      | Normal
0x1001 | Health | Healthy      | Normal
0x1011 | Health | Healthy      | Normal
0x1021 | Health | Healthy      | Normal
0x1101 | Health | Healthy      | Normal
0x1111 | Health | Healthy      | Normal
0x1121 | Health | Healthy      | Normal
```


DISPLAY THE TOPOLOGY OF MEMORY IN THE SYSTEM

Module Information	Command Example
What is the DIMM Topology & Population?	ipmctl show -topology

```
FS0:\> ipmctl show -topology
DimmID | MemoryType | Capacity | PhysicalID | DeviceLocator
=====
0x0001 | Logical Non-Volatile Device | 252.4 GiB | 0x0028 | CPU1_DIMM_A2
0x0011 | Logical Non-Volatile Device | 252.4 GiB | 0x002C | CPU1_DIMM_B2
0x0021 | Logical Non-Volatile Device | 252.4 GiB | 0x0030 | CPU1_DIMM_C2
0x0101 | Logical Non-Volatile Device | 252.4 GiB | 0x0036 | CPU1_DIMM_D2
0x0111 | Logical Non-Volatile Device | 252.4 GiB | 0x003A | CPU1_DIMM_E2
0x0121 | Logical Non-Volatile Device | 252.4 GiB | 0x003E | CPU1_DIMM_F2
0x1001 | Logical Non-Volatile Device | 252.4 GiB | 0x0044 | CPU2_DIMM_A2
0x1011 | Logical Non-Volatile Device | 252.4 GiB | 0x0048 | CPU2_DIMM_B2
0x1021 | Logical Non-Volatile Device | 252.4 GiB | 0x004C | CPU2_DIMM_C2
0x1101 | Logical Non-Volatile Device | 252.4 GiB | 0x0052 | CPU2_DIMM_D2
0x1111 | Logical Non-Volatile Device | 252.4 GiB | 0x0056 | CPU2_DIMM_E2
0x1121 | Logical Non-Volatile Device | 252.4 GiB | 0x005A | CPU2_DIMM_F2
N/A | DDR4 | 32.0 GiB | 0x0026 | CPU1_DIMM_A1
N/A | DDR4 | 32.0 GiB | 0x002A | CPU1_DIMM_B1
N/A | DDR4 | 32.0 GiB | 0x002E | CPU1_DIMM_C1
N/A | DDR4 | 32.0 GiB | 0x0034 | CPU1_DIMM_D1
N/A | DDR4 | 32.0 GiB | 0x0038 | CPU1_DIMM_E1
N/A | DDR4 | 32.0 GiB | 0x003C | CPU1_DIMM_F1
N/A | DDR4 | 32.0 GiB | 0x0042 | CPU2_DIMM_A1
N/A | DDR4 | 32.0 GiB | 0x0046 | CPU2_DIMM_B1
N/A | DDR4 | 32.0 GiB | 0x004A | CPU2_DIMM_C1
N/A | DDR4 | 32.0 GiB | 0x0050 | CPU2_DIMM_D1
N/A | DDR4 | 32.0 GiB | 0x0054 | CPU2_DIMM_E1
N/A | DDR4 | 32.0 GiB | 0x0058 | CPU2_DIMM_F1
```

DETERMINING THE TOTAL AMOUNT OF MEMORY MAPPED TO SOCKETS

Module Information	Command Example
What is the total amount of memory currently mapped to each socket?	<code>ipmctl show -socket</code>

```
FS0:\> ipmctl show -socket
SocketID | MappedMemoryLimit | TotalMappedMemory
=====
0x0000   | 4.5 TiB             | 1.6 TiB
0x0001   | 4.5 TiB             | 1.6 TiB
```


DETERMINING WHICH DIMMS ARE MAPPED TO WHICH SOCKET

Module Information	Command Example
Which DIMM's make up each Persistent Memory Region?	ipmctl show -a -region

```
FS0:\> ipmctl show -a -region
---RegionID=0x0001---
  SocketID=0x0000
  PersistentMemoryType=AppDirect
  Capacity=1.4 TiB
  FreeCapacity=1.4 TiB
  HealthState=Healthy
  DimmID=0x0001, 0x0011, 0x0021, 0x0101, 0x0111, 0x0121
  ISetID=0x51AE7F48F7F92CCC
---RegionID=0x0002---
  SocketID=0x0001
  PersistentMemoryType=AppDirect
  Capacity=1.4 TiB
  FreeCapacity=1.4 TiB
  HealthState=Healthy
  DimmID=0x1001, 0x1011, 0x1021, 0x1101, 0x1111, 0x1121
  ISetID=0x6D647F48C2E62CCC
```

Note: No result will be returned if the configuration of the DCPMMs is 100% Memory Mode since regions are not used in that configuration.

DETERMINING WHAT FIRMWARE IS LOADED ON THE DCPMMS

Module Information	Command Example
Which firmware version is loaded on Intel® Optane™ DC persistent memory?	ipmctl show -firmware ipmctl show -dimm

```
FS0:\> ipmctl show -firmware
DimmID | ActiveFWVersion | StagedFWVersion
=====
0x0001 | 01.02.00.5346   | N/A
0x0011 | 01.02.00.5346   | N/A
0x0021 | 01.02.00.5346   | N/A
0x0101 | 01.02.00.5346   | N/A
0x0111 | 01.02.00.5346   | N/A
0x0121 | 01.02.00.5346   | N/A
0x1001 | 01.02.00.5346   | N/A
0x1011 | 01.02.00.5346   | N/A
0x1021 | 01.02.00.5346   | N/A
0x1101 | 01.02.00.5346   | N/A
0x1111 | 01.02.00.5346   | N/A
0x1121 | 01.02.00.5346   | N/A
```

```
FS0:\> ipmctl show -dimm
DimmID | Capacity | LockState | HealthState | FWVersion
=====
0x0001 | 252.4 GiB | Disabled | Healthy | 01.02.00.5346
0x0011 | 252.4 GiB | Disabled | Healthy | 01.02.00.5346
0x0021 | 252.4 GiB | Disabled | Healthy | 01.02.00.5346
0x0101 | 252.4 GiB | Disabled | Healthy | 01.02.00.5346
0x0111 | 252.4 GiB | Disabled | Healthy | 01.02.00.5346
0x0121 | 252.4 GiB | Disabled | Healthy | 01.02.00.5346
0x1001 | 252.4 GiB | Disabled | Healthy | 01.02.00.5346
0x1011 | 252.4 GiB | Disabled | Healthy | 01.02.00.5346
0x1021 | 252.4 GiB | Disabled | Healthy | 01.02.00.5346
0x1101 | 252.4 GiB | Disabled | Healthy | 01.02.00.5346
0x1111 | 252.4 GiB | Disabled | Healthy | 01.02.00.5346
0x1121 | 252.4 GiB | Disabled | Healthy | 01.02.00.5346
```


READING DCPMM SENSORS

Module Information	Command Example
What sensors are available on each Intel® Optane™ DC persistent memory modules?	ipmctl show -sensor

```
FS0:\> ipmctl show -sensor -dimm 0x0001
DimmID | Type | CurrentValue | CurrentState
=====
0x0001 | Health | Healthy | Normal
0x0001 | MediaTemperature | 40C | Normal
0x0001 | ControllerTemperature | 41C | Normal
0x0001 | PercentageRemaining | 100% | Normal
0x0001 | LatchedDirtyShutdownCount | 0 | Normal
0x0001 | PowerOnTime | 32559378s | Normal
0x0001 | UpTime | 5873s | Normal
0x0001 | PowerCycles | 106 | Normal
0x0001 | FwErrorCount | 5 | Normal
0x0001 | UnlatchedDirtyShutdownCount | 0 | Normal
```

READING DCPMM SENSORS

Module Information	Command Example
What is the temperature of each Intel® Optane™ DC persistent memory module?	<code>ipmctl show -sensor MediaTemperature</code> <code>ipmctl show -sensor ControllerTemperature</code>

Media Temperature Readings:

```
FS0:\> ipmctl show -sensor MediaTemperature
DimmID | Type                | CurrentValue | CurrentState
=====|=====|=====|=====
0x0001 | MediaTemperature    | 40C          | Normal
0x0011 | MediaTemperature    | 37C          | Normal
0x0021 | MediaTemperature    | 37C          | Normal
0x0101 | MediaTemperature    | 41C          | Normal
0x0111 | MediaTemperature    | 40C          | Normal
0x0121 | MediaTemperature    | 39C          | Normal
0x1001 | MediaTemperature    | 40C          | Normal
0x1011 | MediaTemperature    | 40C          | Normal
0x1021 | MediaTemperature    | 39C          | Normal
0x1101 | MediaTemperature    | 38C          | Normal
0x1111 | MediaTemperature    | 37C          | Normal
0x1121 | MediaTemperature    | 37C          | Normal
```

Controller Temperature Readings:

```
FS0:\> ipmctl show -sensor ControllerTemperature
DimmID | Type                | CurrentValue | CurrentState
=====|=====|=====|=====
0x0001 | ControllerTemperature | 41C          | Normal
0x0011 | ControllerTemperature | 40C          | Normal
0x0021 | ControllerTemperature | 40C          | Normal
0x0101 | ControllerTemperature | 45C          | Normal
0x0111 | ControllerTemperature | 45C          | Normal
0x0121 | ControllerTemperature | 39C          | Normal
0x1001 | ControllerTemperature | 42C          | Normal
0x1011 | ControllerTemperature | 42C          | Normal
0x1021 | ControllerTemperature | 44C          | Normal
0x1101 | ControllerTemperature | 40C          | Normal
0x1111 | ControllerTemperature | 40C          | Normal
0x1121 | ControllerTemperature | 39C          | Normal
```


VALIDATING DCPMM CONFIGURATION STATUS

Module Information	Command Example
Is the current DCPMM configuration valid?	<code>ipmctl show -d configurationstatus -dimm</code>

```
FS0:\> ipmctl show -d configurationstatus -dimm
---DimmID=0x0001---
    ConfigurationStatus=Valid
---DimmID=0x0011---
    ConfigurationStatus=Valid
---DimmID=0x0021---
    ConfigurationStatus=Valid
---DimmID=0x0101---
    ConfigurationStatus=Valid
---DimmID=0x0111---
    ConfigurationStatus=Valid
---DimmID=0x0121---
    ConfigurationStatus=Valid
---DimmID=0x1001---
```

RUNNING DIAGNOSTICS ON DCPMM DIMMS

Module Information	Command Example
How to run diagnostics on a specific DCPMM - for instance DIMM ID 0x0001?	<code>ipmctl start -diagnostic -dimm 0x0001</code>

```
FS0:\> ipmctl start -diagnostic -dimm 0x0001
---Diagnostic=Quick
State=Ok
Message=The quick health check succeeded.
---Diagnostic=Config
State=Ok
Message=The platform configuration check succeeded.
---Diagnostic=Security
State=Ok
Message=The security check succeeded.
---Diagnostic=FW
State=Ok
Message=The firmware consistency and settings check succeeded.
```


REVIEW OF IPMCTL COMMANDS

Module Information	Command Example
What version Intel® Optane™ DC persistent memory Mgmt SW is installed?	<code>ipmctl version</code>
Display help for IPMCTL commands using namespaces as an example	<code>ipmctl show -h -namespace</code> <code>ipmctl create -h -namespace</code> <code>ipmctl delete -h -namespace</code>
What are the total DCPMM memory resources and what is the current configured Mode?	<code>ipmctl show -memoryresources</code>
What is the health of each Intel® Optane™ DC persistent memory?	<code>ipmctl show -sensor health</code>
What is the DIMM Topology & Population?	<code>ipmctl show -topology</code>
What is the total amount of memory currently mapped to each socket?	<code>ipmctl show -socket</code>
Which DIMM's make up each Persistent Memory Region?	<code>ipmctl show -a -region</code>
Which firmware version is loaded on Intel® Optane™ DC persistent memory?	<code>ipmctl show -firmware</code> <code>ipmctl show -dimm</code>
What sensors are available on the Intel® Optane™ DC persistent memory modules?	<code>ipmctl show -sensor</code>
Is the current DCPMM configuration valid?	<code>ipmctl show -d configurationstatus -dimm</code>
How to run diagnostics on a specific DCPMM - for instance DIMM ID 0x0001?	<code>ipmctl start -diagnostic -dimm 0x0001</code>

For more information on using ipmctl please visit:
<https://docs.pmem.io/ipmctl-user-guide/>

SUMMARY

- IPMCTL is a powerful tool used to configure and read DCPMMs settings
- IPMCTL can be used to diagnose a problem with DCPMMs by validating setting
- IPMCTL is useful for checking the health of DCPMMs as well as reading sensor settings

For more information on using ipmctl please visit:
<https://docs.pmem.io/ipmctl-user-guide/>

