User Guide

Taylors Falls Reference Design for Intel® Xeon® D Processors

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1 Introduction

The Taylors Falls Reference Design for Intel® Xeon® D processors provides key information regarding the platform, network resources, CPU, and memory available for software development and deployment. It details the Best-Known Methods (BKM) and the benefits of following the BKMs. It also refers to the DPDK Performance reports and settings that are to be followed in the Taylors Falls platform.

This document is part of the Network Transformation Experience Kits.

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Document Revision History

Revision	Date	Description
001	May 2022	Initial release.
002	December 2022	Revised the document for public release to Intel® Network Builders.

1.1 Terminology

Table 1. Terminology

Abbreviation	Description
BKM	Best-Known Method
BKC	Best-Known Configuration
BMC	Board Management Controller
CPLD	Custom Programmable Logic Device
DPDK	Data Plane Development Kit
MAC	Media Access Control
SSH	Secure Shell Host

1.2 Reference Documentation

Table 2. Reference Documents

Reference	Source
Quick Start Guide Edge Server SAF61011	www.edge-core.com Document Reference # E072021-CS-R0115020000xxxxA
Network and Edge Reference System Architectures on a Single Server Quick Start Guide	https://networkbuilders.intel.com/solutionslibrary/network-and-edge-reference-system-architectures-single-server-quick-start-guide

2 Getting Started

2.1 Connecting to Console

The console connectivity is configured with serial connection: 115200 bps, 8 characters, No parity, One stop bit, 8 data bits, and No Flow Control.

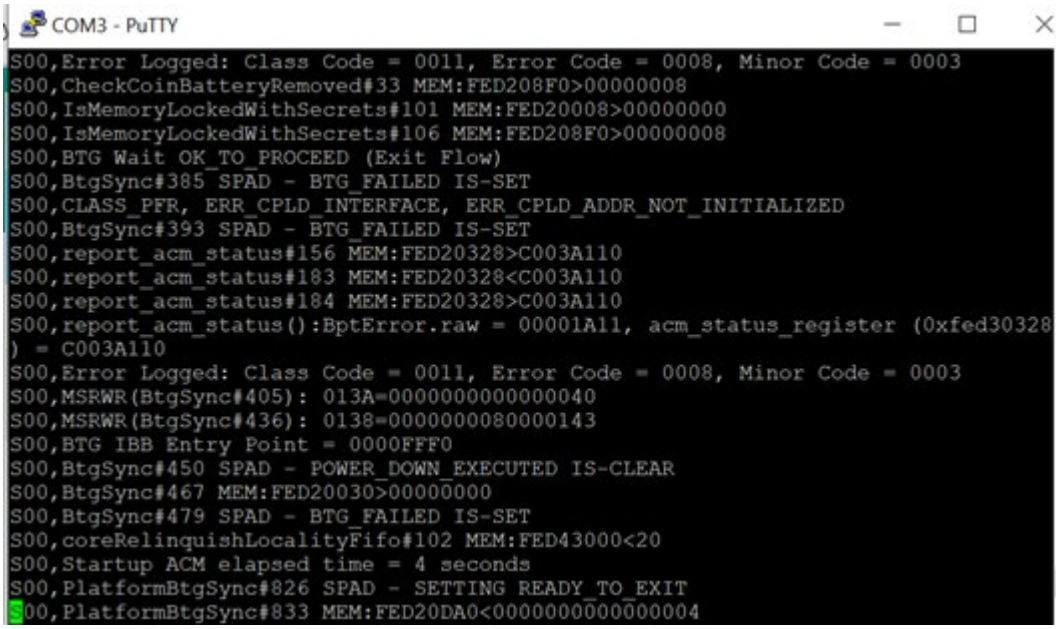


Figure 1 COM3 - PuTTY

The following steps describe the process for console connectivity:

1. Look for the word “console” engraved on the front panel.
2. One end of the patch cable shown in the image below is connected to console RJ45. The other end (not shown) is connected to a USB port on your laptop with COM3 PuTTY.

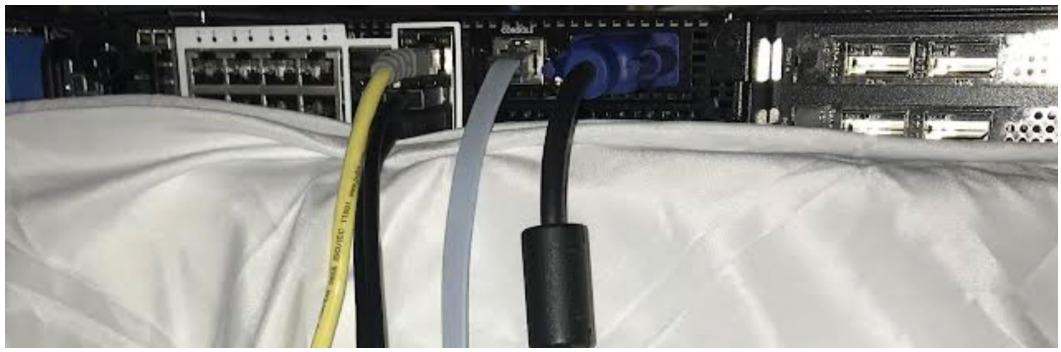


Figure 2 Patch Cable Connected to Console RJ45

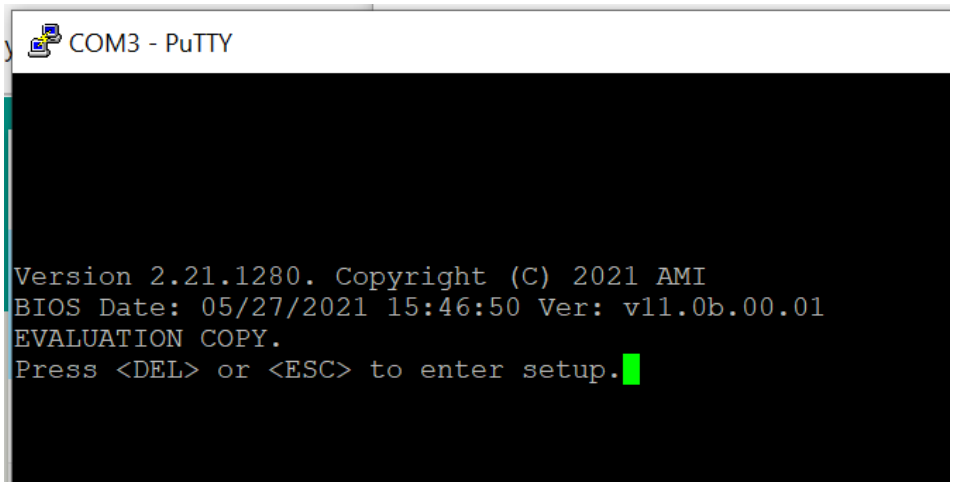
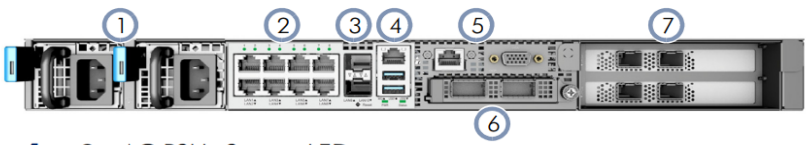


Figure 3 VGA Screen – 1

3. Wait for some time for the message to appear on the VGA screen.

Figure 4 VGA Screen – 2

4. Press **Delete** or **ESC** to set up the system. In addition to console connectivity shown in the figure with marking 5, another RJ45 interface is marked with 4. This is for the Board Management Controller (BMC). This interface is referred to as the Management Port; it is situated just above two USB ports.



1. 2 x AC PSUs System LEDs
2. 8 x 1G RJ-45 PoE ports
3. 2 x 25G SFP28 ports
4. 1000BASE-T RJ-45 Management port, 2 x USB ports
5. Console, VGA ports

Figure 5 Console Connectivity

2.2 Connecting to Server Management – BMC

The Server Management Connectivity (Port) to BMC is located in the center of the server. It is located above the two USB connections - BMC (Channel 1) RJ45. This is the BMC connection. In Figure 6, a yellow color patch cable is connected to the management port – it is used for only connecting to BMC and not to the host OS.

Note: Do not use Management Port for SSH to the operating system. It should be solely used for BMC control and configuration.

2.2.1 Setting Network for BMC

In Figure 6, the yellow patch cable has one end connected to the platform's Management Port Interface and the other end to the switch/router of the local network.

Figure 6 Setting Network for BMC

The following steps show how to set up the network for BMC.

1. Go to **Server Management** tab and select **BMC Network Configuration** sub-menu.

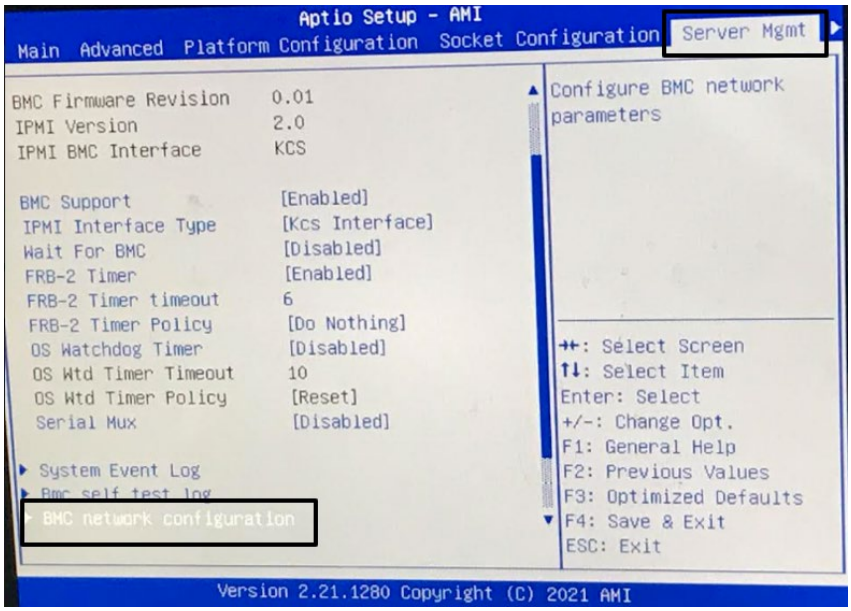


Figure 7 BMC Network Configuration Menu

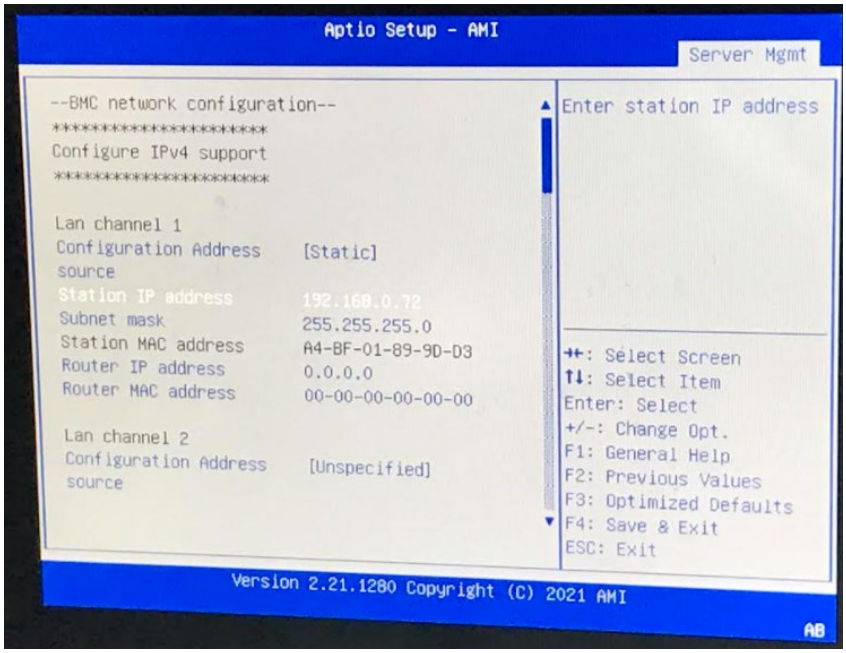


Figure 8 Static IP Address Details

The screen in Figure 9 appears displaying the range for addresses in the router.

Note: The above BMC static address should fall outside that range.

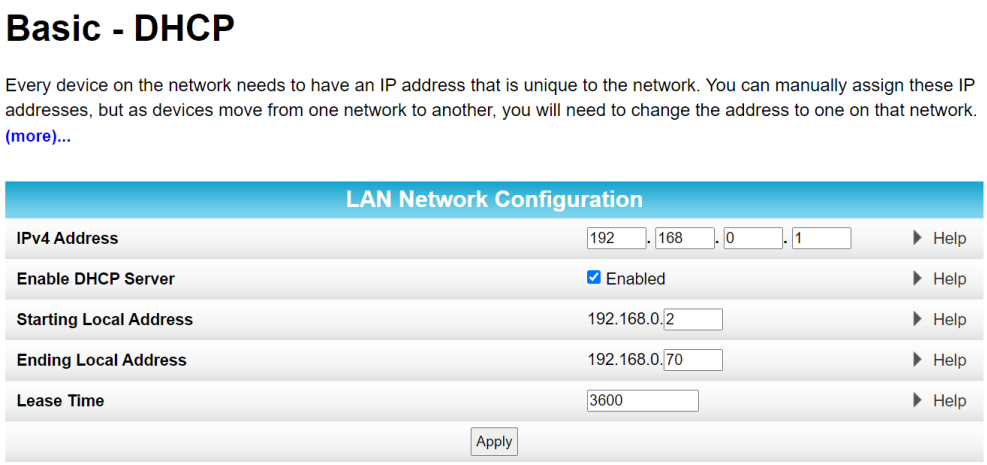


Figure 9 LAN Network Configuration Details

2. Make sure you can ping the Server Management Port as shown in Figure 10.

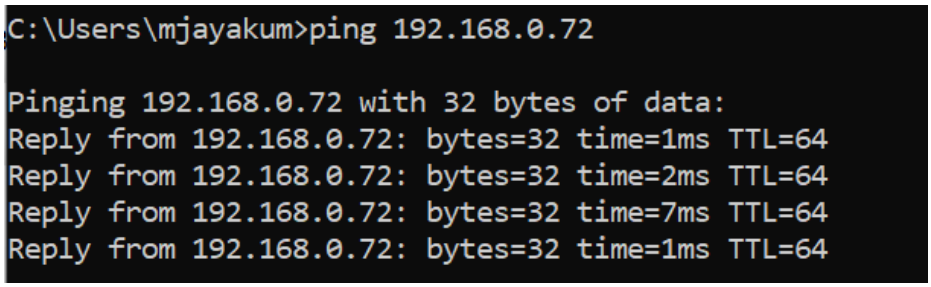


Figure 10 Server Management Port

2.3 Connecting to OpenBMC GUI

3. Enter the BMC using the web URL https://192.168.0.72 and enter the login details

Note: Use the user/password written on the box. For initial systems shipped, contact your Intel representative for the login credentials.

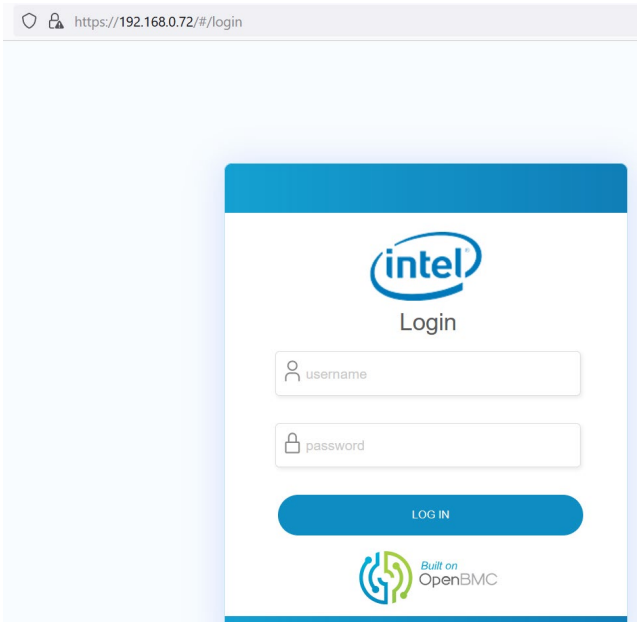


Figure 11 OpenBMC Login Page

The following screenshots are self-explanatory to perform server management tasks.

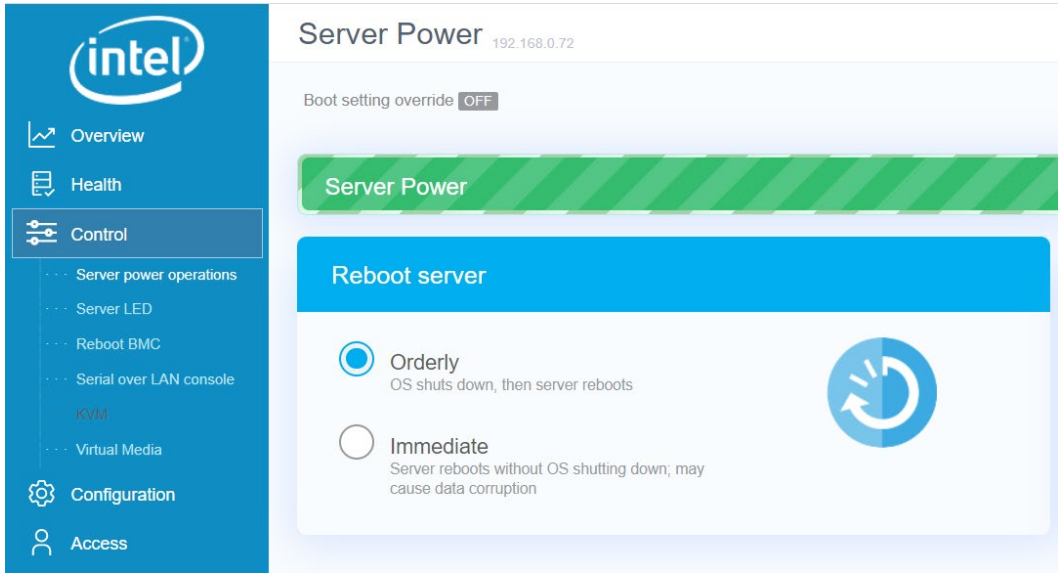


Figure 12 OpenBMC – Control Tab

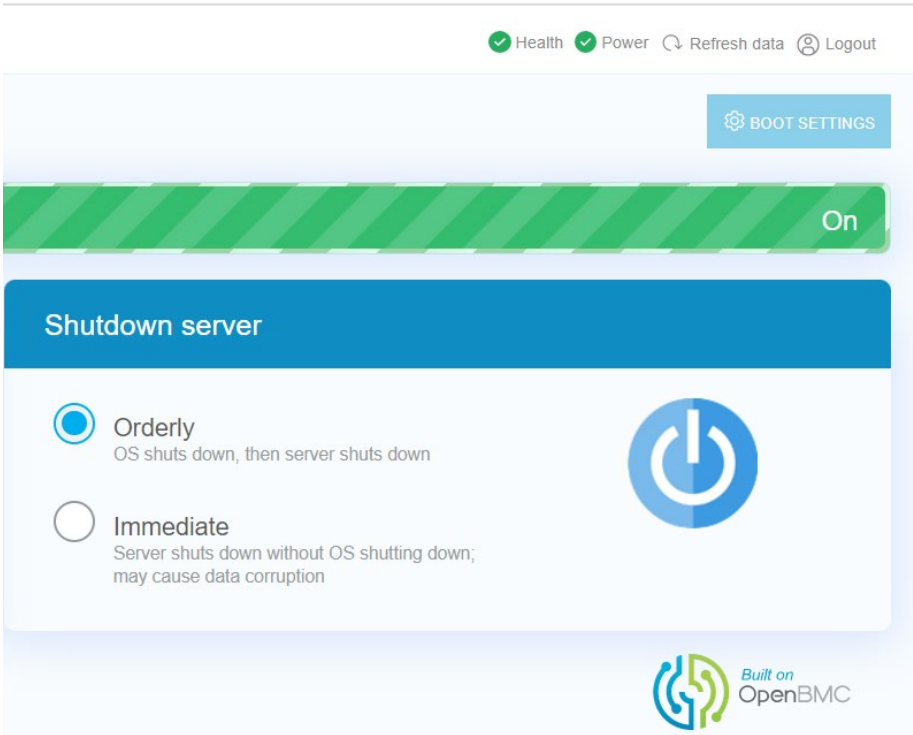


Figure 13 Shutdown Server Option

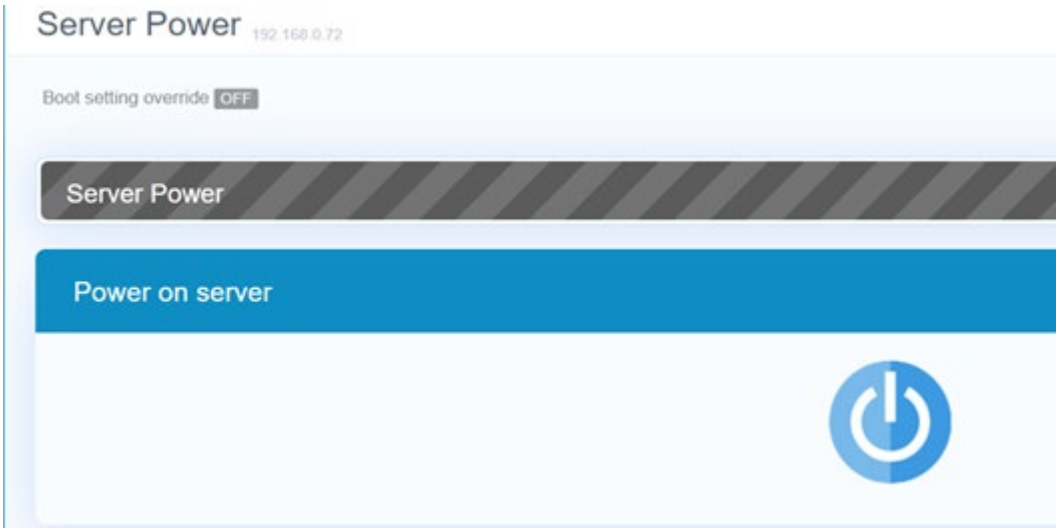


Figure 14 Setup Up Server Power Option

Firmware is one of the key components in managing initial boot and monitoring the platform during normal operation. Ensuring that the system is equipped with the latest available version is key to maintaining an optimally performant system. OpenBMC provides an easy to use interface to allow the upgrade of firmware on the Taylor Falls platform.

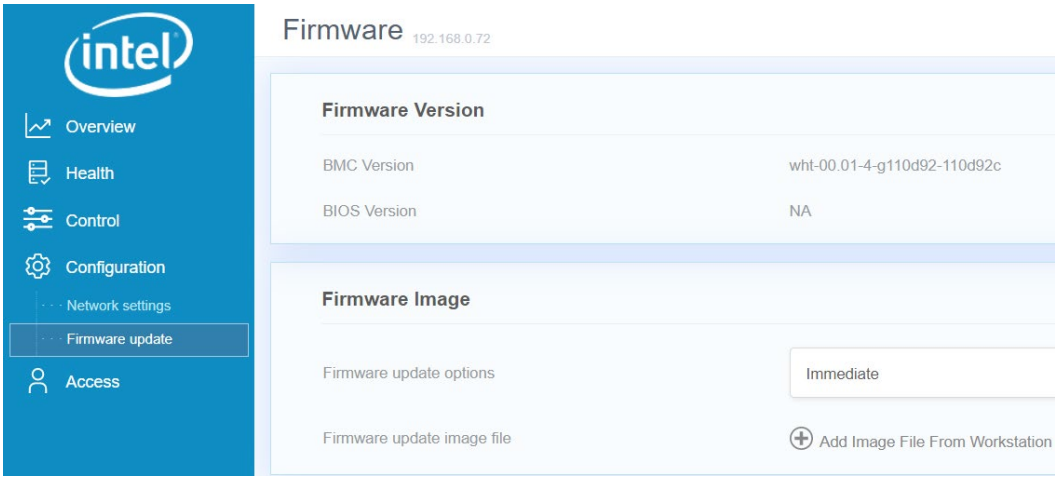


Figure 15 Firmware Update Option

Similarly, the OpenBMC provides extensive detail on users on the system, as well as details on their privileges.

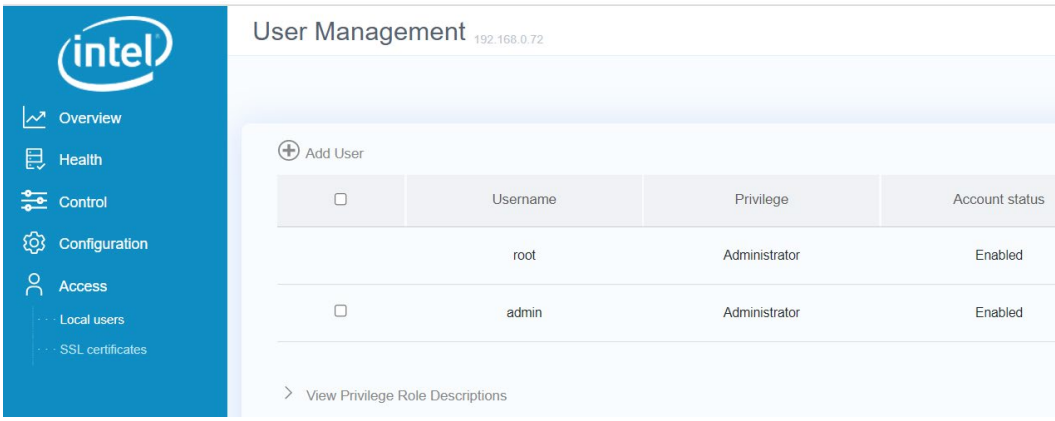


Figure 16 User Management Update Option

Figure 17 shows an overview of the system information on the latest firmware version, MAC addresses of connected networking devices, available IP addresses, and details on the baseboard management controller.

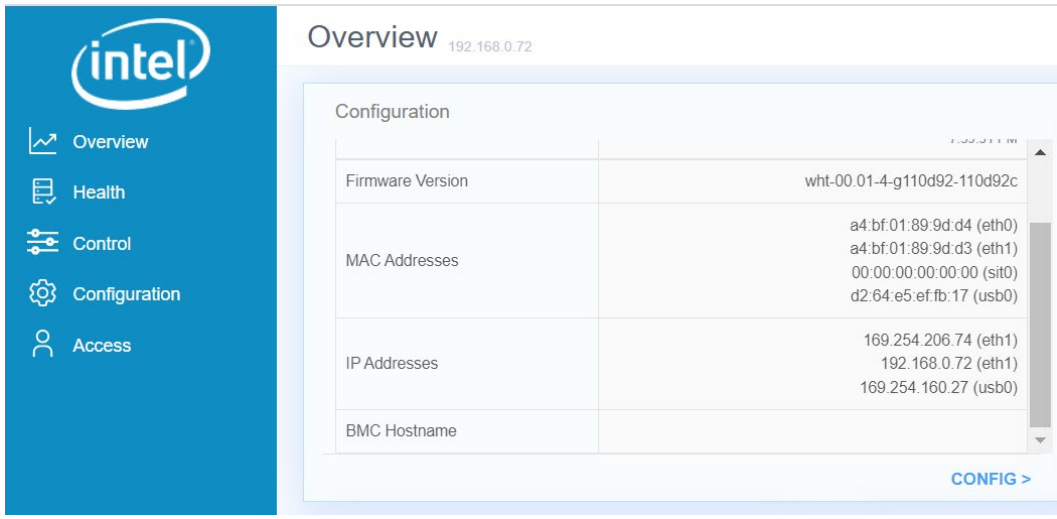


Figure 17 System Detail Overview Page

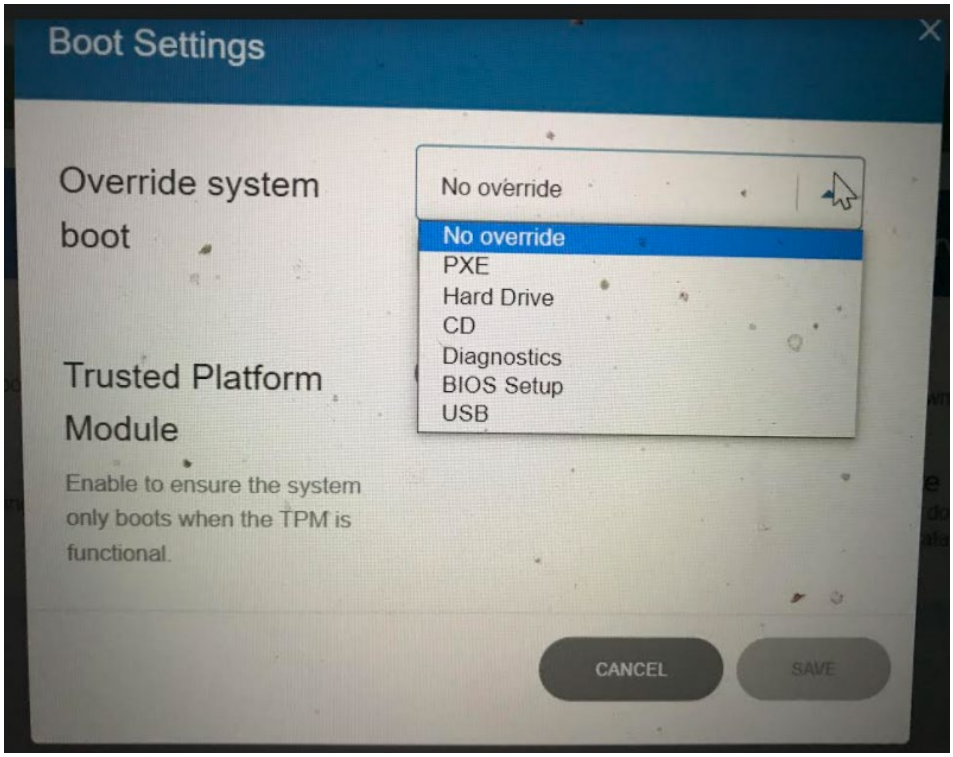


Figure 18 Boot Settings

3 Best Practices

3.1 BIOS Setting for Virtualization and Performance

This section details the steps to set the BIOS for optimized platform settings and SSH to operating system settings.

The following tabs are displayed on the BIOS setup screen:

- Main
- Advanced
- Platform Configuration
- Socket Configuration

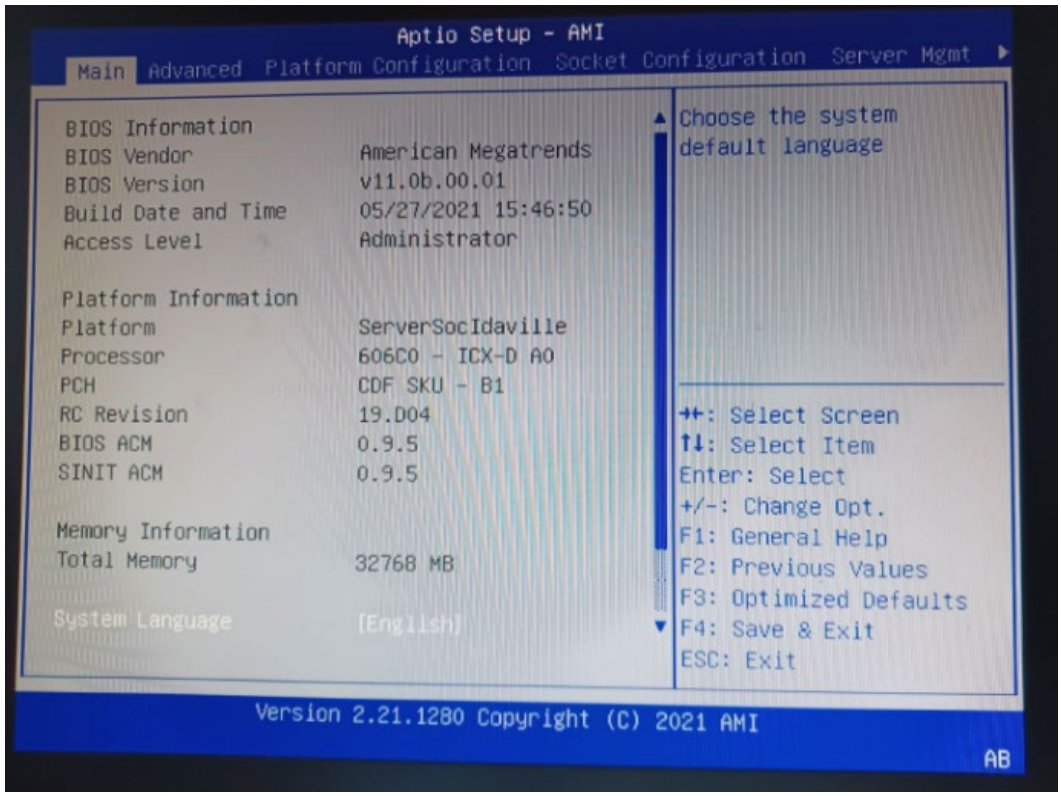


Figure 19 BIOS Settings

1. For virtualization to function properly, in the system setup, **Enable** VT-d. By default, it comes disabled.
2. For virtualization, Enable SR-IOV set up if it is disabled.

Note: Go through all the BIOS settings to suit your performance requirement.

It is important to set the system at performance mode instead of power optimization mode in case you do not want packet drops. This is achieved by setting sleep states, C-states, frequency governor, P-states, and turbo appropriately.

Note: It is assumed that you are familiar with DPDK data plane performance optimization settings.

1. Refer to the Intel Ethernet's Performance Report with DPDK 22.03 and apply the settings mentioned in the DPDK Performance Report to set the optimizations.
2. Add all optimizations as per the requirement. The DPDK Performance Report has setting optimizations options – ISOLCPU, nohz, no rcu_cb as shown in Figure 20, for example.

Item	Description
BIOS	CPU Power and Performance Policy <Performance> CPU C-state Disabled CPU P-state Disabled Turbo Boost Disabled
Boot settings	default_hugepagesz=1G hugepagesz=1G hugepages=16 intel_iommu=on iommu=pt isolcpus=1-21,28-48 nohz_full=1-21,28-48 rcu_nocbs=1-21,28-48
DPDK Settings	CC=gcc meson -Dlibdir=lib -Dexamples=l3fwd -Dc_args=-DRTE_LIBRTE_I40E_16BYTE_RX_DESC --default-library=static x86_64-native-linuxapp-gcc
Command line	dpdk-l3fwd -l 5-8 -n 6 -w 0000:18:00.0 -w 0000:18:00.1 -w 0000:18:00.2 -w 0000:18:00.3 -- -p 0xf --config '(0,0,5),(1,0,6),(2,0,7),(3,0,8)' --tx-queue-size 2048 --rx-queue-size 2048

Figure 20 Optimization Options

Note: For full optimization, refer to the DPDK Performance Report and perform each step.

3. Press **F4** to save and continue to the operating system.

3.2 Use the BKC (Best-Known Configuration) Software Components

Use only the BKC platform configuration and BKC software components. Use the matching BKC specific to your application usage. Insist on this and contact your Intel platform provider for the BKC configuration and components.

3.3 Run Basic Performance Tests First

Before running your application, run the basic performance tests as detailed in the Performance Report.

It is understandable that you may be eager to run your application right away on the platform. However, it has been proven that taking the right approach reduces your time to market greatly.

First, run the basic performance tests as provided in the Performance Report. It is the BKC configuration and that is the software stack that has been verified and the performance numbers are published. After the test is performed, a report is generated with exact performance numbers; this helps to set the platform for correct tuning.

If you skip the above step and go to your application directly, it is not confirmed that the platform and BKC settings are optimum. The application runs directly on a non-optimized system; there is no benchmark to compare.

It is strongly recommended to follow the right approach of running the performance tests with a proven software stack as shown in the Intel Ethernet's Performance Report with DPDK 22.03

4 SSH to Host Operating System

Now let us look how to SSH to the host operating system. Since the Management Port is used for BMC accesses only, for SSH to the operating system, in this writeup, a USB Ethernet dongle is used as shown in Figure 21.

```
usb@2:3          enp0s30u3          network          Ethernet interface
```

Figure 21 shows a USB ethernet dongle. You can also use any of the other 8 x 1G ports

Figure 21 USB Ethernet Dongle

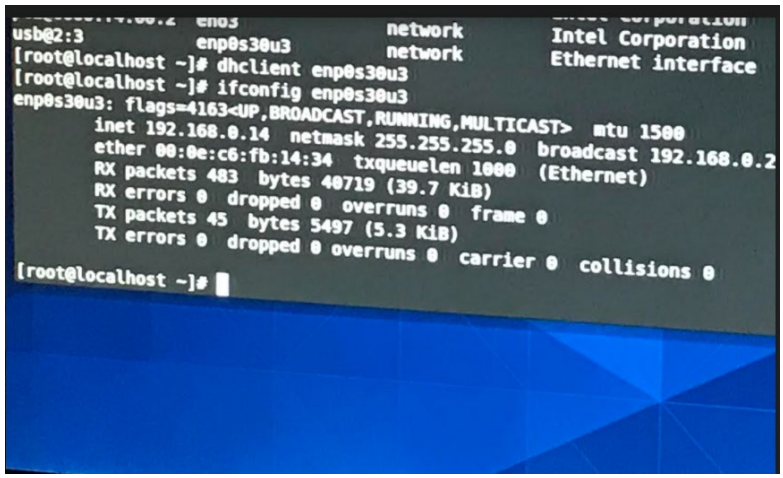


Figure 22 CentOS

For the CentOS operating system installed, enter the username provided by your Intel representative. This may vary from system to system. Please consult your system provider for login information.

4.1 CPU Configuration Details

1. How many cores are in the system?

There are 20 cores shown in the first screenshot for the command "cat /proc/cpuinfo".

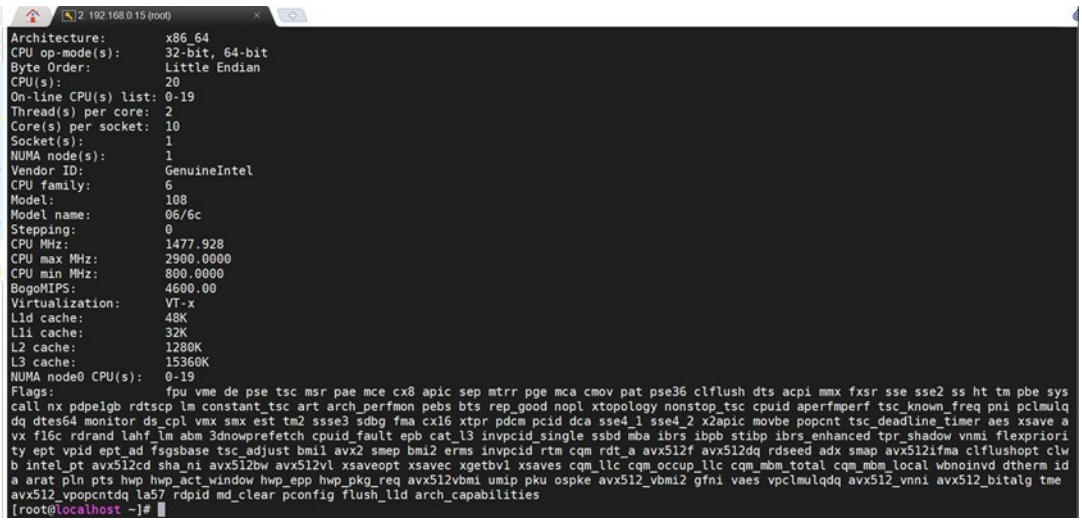


Figure 23 Number of Cores

2. How much memory comes with the system?

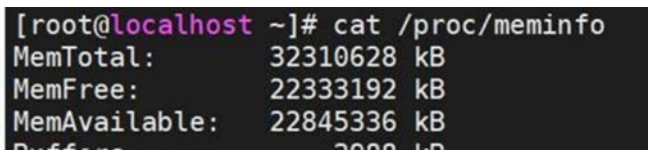


Figure 24 Memory Details

3. What is the Network Infrastructure?

```
lshw -C net -businfo
```

```
[root@localhost ~]# sudo -i
[root@localhost ~]# lshw -C net -businfo
Bus info          Device            Class          Description
=========================================================
pci@0000:02:00.0  enp2s0f0          network        I350 Gigabit Network Connection
pci@0000:02:00.1  enp2s0f1          network        I350 Gigabit Network Connection
pci@0000:02:00.2  enp2s0f2          network        I350 Gigabit Network Connection
pci@0000:02:00.3  enp2s0f3          network        I350 Gigabit Network Connection
pci@0000:03:00.0  enp3s0f0          network        I350 Gigabit Network Connection
pci@0000:03:00.1  enp3s0f1          network        I350 Gigabit Network Connection
pci@0000:03:00.2  enp3s0f2          network        I350 Gigabit Network Connection
pci@0000:03:00.3  enp3s0f3          network        I350 Gigabit Network Connection
pci@0000:06:00.0  eno1              network        I210 Gigabit Network Connection
pci@0000:15:00.0  ens6f0            network        Ethernet Controller E810-C for QSFP
pci@0000:15:00.1  ens6f1            network        Ethernet Controller E810-C for QSFP
pci@0000:17:00.0  ens83f0           network        Ethernet Controller E810-C for QSFP
pci@0000:17:00.1  ens83f1           network        Ethernet Controller E810-C for QSFP
pci@0000:f4:00.0  eno2              network        Intel Corporation
pci@0000:f4:00.2  eno3              network        Intel Corporation
usb@2:3           enp0s30u3         network        Ethernet interface
[root@localhost ~]#
```

Figure 25 Network Infrastructure Details

4. IP Link Show

```
[root@localhost ~]# ip link show
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN mode
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
2: enp2s0f0: <NO-CARRIER,BROADCAST,MULTICAST,UP> mtu 1500 qdisc mq state
    link/ether a4:bf:01:89:9d:c9 brd ff:ff:ff:ff:ff:ff
3: enp2s0f1: <NO-CARRIER,BROADCAST,MULTICAST,UP> mtu 1500 qdisc mq state
    link/ether a4:bf:01:89:9d:ca brd ff:ff:ff:ff:ff:ff
4: enp2s0f2: <NO-CARRIER,BROADCAST,MULTICAST,UP> mtu 1500 qdisc mq state
    link/ether a4:bf:01:89:9d:cb brd ff:ff:ff:ff:ff:ff
5: enp2s0f3: <NO-CARRIER,BROADCAST,MULTICAST,UP> mtu 1500 qdisc mq state
    link/ether a4:bf:01:89:9d:cc brd ff:ff:ff:ff:ff:ff
6: enp3s0f0: <NO-CARRIER,BROADCAST,MULTICAST,UP> mtu 1500 qdisc mq state
    link/ether a4:bf:01:89:9d:cd brd ff:ff:ff:ff:ff:ff
7: enp3s0f1: <NO-CARRIER,BROADCAST,MULTICAST,UP> mtu 1500 qdisc mq state
    link/ether a4:bf:01:89:9d:ce brd ff:ff:ff:ff:ff:ff
8: enp3s0f2: <NO-CARRIER,BROADCAST,MULTICAST,UP> mtu 1500 qdisc mq state
    link/ether a4:bf:01:89:9d:cf brd ff:ff:ff:ff:ff:ff
9: enp3s0f3: <NO-CARRIER,BROADCAST,MULTICAST,UP> mtu 1500 qdisc mq state
    link/ether a4:bf:01:89:9d:d0 brd ff:ff:ff:ff:ff:ff
10: eno1: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc mq state UP mo
    link/ether a4:bf:01:89:9d:c8 brd ff:ff:ff:ff:ff:ff
```

Figure 26 IP Link Details – 1

```
11: enp0s30u3u1: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state
    link/ether ee:fb:31:1a:96:8f brd ff:ff:ff:ff:ff:ff
12: enp0s30u3: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP
    link/ether 00:0e:c6:fb:14:34 brd ff:ff:ff:ff:ff:ff
13: ens6f0: <NO-CARRIER,BROADCAST,MULTICAST,UP> mtu 1500 qdisc mq state DOWN mode
    link/ether b4:96:91:a4:00:a8 brd ff:ff:ff:ff:ff:ff
14: ens6f1: <NO-CARRIER,BROADCAST,MULTICAST,UP> mtu 1500 qdisc mq state DOWN mode
    link/ether b4:96:91:a4:00:a9 brd ff:ff:ff:ff:ff:ff
15: ens83f0: <NO-CARRIER,BROADCAST,MULTICAST,UP> mtu 1500 qdisc mq state DOWN mod
    link/ether b4:96:91:a4:02:c8 brd ff:ff:ff:ff:ff:ff
16: ens83f1: <NO-CARRIER,BROADCAST,MULTICAST,UP> mtu 1500 qdisc mq state DOWN mod
    link/ether b4:96:91:a4:02:c9 brd ff:ff:ff:ff:ff:ff
17: eno2: <NO-CARRIER,BROADCAST,MULTICAST,UP> mtu 1500 qdisc mq state DOWN mode D
    link/ether a4:bf:01:89:9d:d1 brd ff:ff:ff:ff:ff:ff
18: eno3: <NO-CARRIER,BROADCAST,MULTICAST,UP> mtu 1500 qdisc mq state DOWN mode D
    link/ether a4:bf:01:89:9d:d2 brd ff:ff:ff:ff:ff:ff
19: virbr0: <NO-CARRIER,BROADCAST,MULTICAST,UP> mtu 1500 qdisc noqueue state DOWN
    link/ether 52:54:00:42:90:26 brd ff:ff:ff:ff:ff:ff
20: virbr0-nic: <BROADCAST,MULTICAST> mtu 1500 qdisc fq_codel master virbr0 state
    link/ether 52:54:00:42:90:26 brd ff:ff:ff:ff:ff:ff
[root@localhost ~]#
```

Figure 27 IP Link Details – 2

Let us look one by one and associate the above ports as shown in the following section and the functionality they provide.

4.1.1 8 x 1G RJ-45 PoE Ports

The server has eight RJ45 8 x 1G RJ-45 PoE Ports on left side – as show in Figure 28. The I350 Gigabit network connection is marked as LAN 1 – LAN 8 shown as: bus:device:function as 02:00.0 – 02:00.3 with names enp2s0f0 to enp2s0f3 and bus:device:function as 03:00.0 – 03:00.3 with names enp3s0f1 to enp3s0f3.

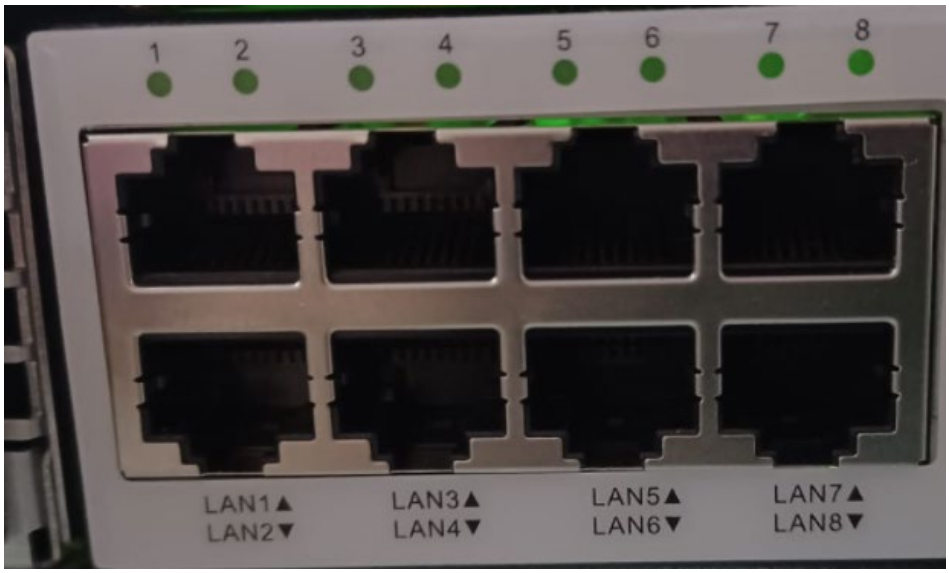


Figure 28 Ports on the Server

```
pci@0000:02:00.0  enp2s0f0          network        I350 Gigabit Network Connection
pci@0000:02:00.1  enp2s0f1          network        I350 Gigabit Network Connection
pci@0000:02:00.2  enp2s0f2          network        I350 Gigabit Network Connection
pci@0000:02:00.3  enp2s0f3          network        I350 Gigabit Network Connection
pci@0000:03:00.0  enp3s0f0          network        I350 Gigabit Network Connection
pci@0000:03:00.1  enp3s0f1          network        I350 Gigabit Network Connection
pci@0000:03:00.2  enp3s0f2          network        I350 Gigabit Network Connection
pci@0000:03:00.3  enp3s0f3          network        I350 Gigabit Network Connection
```

Figure 29 Port Details

4.1.2 2 x SFP Ports – eno2 and eno3 – SoC Integrated I/F

```
[root@localhost ~]#
[root@localhost ~]# #****************************************
[root@localhost ~]# # identify eno2
[root@localhost ~]# # ****************************************
[root@localhost ~]# ethtool --identify eno2
```

LAN9 is eno2 as identified by blinking of LED with the command:

```
ethtool --identify eno2
```

Figure 30 LAN9 – eno2

Likewise, you can identify LAN10 = eno3 as shown in the following screenshot.

```
[root@localhost ~]# # ****************************************
[root@localhost ~]# # identify eno3
[root@localhost ~]# # ****************************************
[root@localhost ~]# ethtool --identify eno3
```

Figure 31 LAN10 – eno3

4.2 Server Management Port

eno1 is the server management port, as shown in Figure 32.

```
pci@0000:06:00.0  eno1              network        I210 Gigabit Network Connection

10: eno1: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc mq state UP mo
    link/ether a4:bf:01:89:9d:c8 brd ff:ff:ff:ff:ff:ff
```

Figure 32 Server Management Port – eno1

4.3 SSH to OS Host

The USB dongle is shown in Figure 33.

```
[root@localhost ~]#
[root@localhost ~]# ifconfig enp0s30u3
enp0s30u3: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 192.168.0.14  netmask 255.255.255.0  broadcast 192.168.0.255
        ether 00:0e:c6:fb:14:34  txqueuelen 1000  (Ethernet)
        RX packets 9547  bytes 12196257 (11.6 MiB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 4417  bytes 356021 (347.6 KiB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0
```

Figure 33 USB Dongle

1. Use one of the 8 x 1G ports also for SSH into the system. Here we are showing a USB dongle so that you can use the 8 x 1G ports for your application.
2. First, do dhclient enp0s30u3 (or any other port you are planning to use SSH) to get an IP address assigned.
3. Run the DPDK performance tests on your system to ensure that your system is tuned properly. Then, start developing and run your application.

Appendix A Programming Platform Components

This appendix describes instructions for programming platform components.

A.1 Offline Program (Using Download Cable)

1. Sdsd Connect to the header between BMC and FPGA.
2. In Intel® Quartus® select the image and then start the program.

A.1.1 Online Program

1. Connect Taylor Falls with Ethernet cable (Front port).
2. Set PFR Provision mode in BIOS then save & exit BIOS.
3. HOTKEY ctrl + u + 1 to switch console to BMC.
4. Set IP in BMC, then using browser type the IP address you set.
5. In browser using account: *root* password: *0penBmc* to login.
6. Select the configuration page then upload the FPGA image. BMC starts the program CPLD.

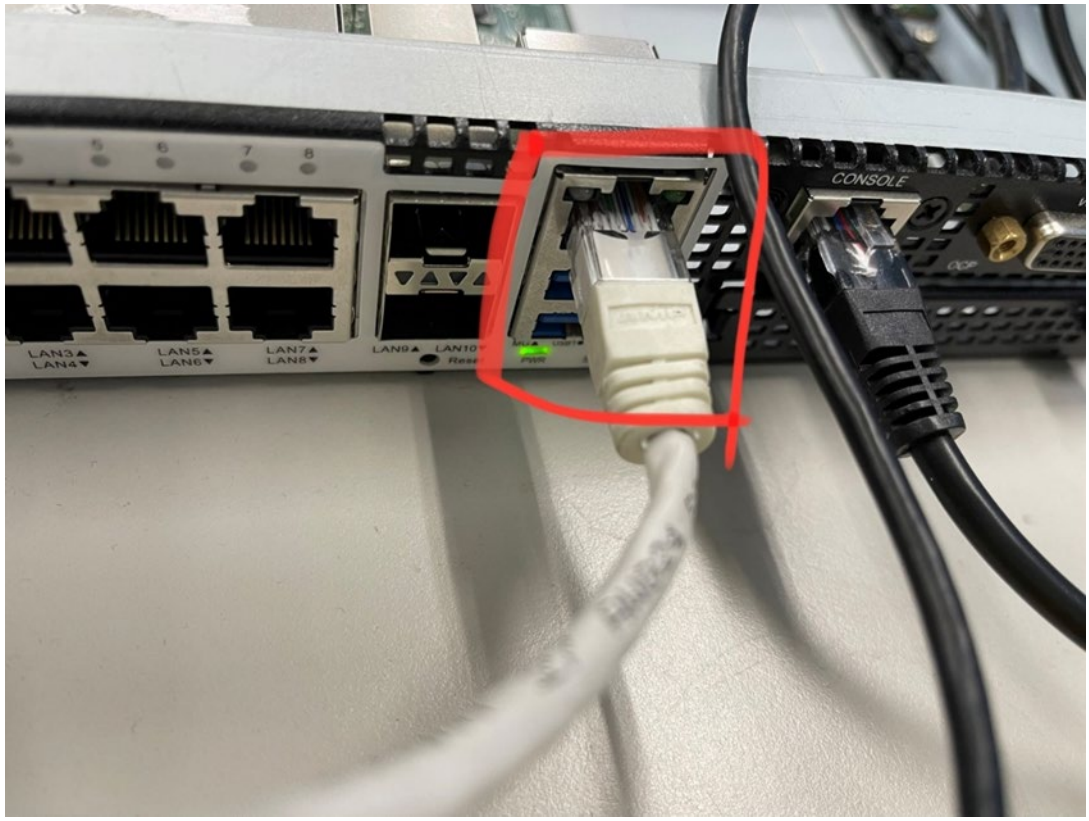


Figure 34 Front Port Location

Appendix B BKC Software Components

Note: Following is the BKC for the same generation processor but for another platform. It is provided here for you to benefit from the information you can gather from this platform.

Subject: 2022 WW06 IDAVILLE ICX-D LCC PC BKC RELEASE ANNOUNCEMENT REPORT (PC BKC#L22)

For the latest BKC Revision, contact your Intel representative.

B.1 Executive Summary

1. LCC PC BKC #L22 cycle started with PRQ Production fused silicon – RLBP, RLBT, RLBU, RLBV, RLC3, RLC5, RLC6, and RLC7 on Brighton City Internal & External RP boards.
2. This is the Platform PC BKC Release with full validation coverage on RHEL 8.4 with kernel 4.18, Windows Server RS5.
3. Ingredient changes from BKC# L21 are:
   - **IFWI** 2021.53.2.01 **(BIOS** 21.D40**)**
   - **CPK_Linux** 1.7.19
   - **CPK_RDMA** 1.7.73
   - **Chipset** 10.1.18950.8298-server
   - **CPK_ESXi** 1.6.6
4. This release has different IFWIs for QS/PRQ and ES samples (Production signed IFWI to be used on production fused QS/PRQ units & Debug signed IFWI to be used on ES1 and ES2 units).
5. Full validation is performed with DAM disabled Production signed IFWI.
6. PC stability is performed on RHEL operating system and DPMO is achieved for WMR, S5 & G3.
7. BKC does not support Fedora as it is not POR.
8. Windows operating image in this BKC does not contain CPK_Win driver injected in it, as we are observing BSOD while installing Windows Server operating system. You must install CPK_Win driver manually after installing the operating system.

Performance varies by use, configuration and other factors. Learn more at www.Intel.com/PerformanceIndex.

Performance results are based on testing as of dates shown in configurations and may not reflect all publicly available updates. See backup for configuration details. No product or component can be absolutely secure.

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1222/DN/WIT/PDF 730006-002US