BMC Installation Guide

Lenovo ThinkStation

Table of Contents

Overview

A Baseboard Management Controller (BMC) is a dedicated hardware controller for monitoring and controlling remotely located hardware. Although BMC began as a way for system administrators to effectively run servers in remote datacenters, it has proven a useful tool for any computer system that may not be easily accessible in day-to-day use. As more workstations, powerful desktops, and even densely populated minicomputers are moved into server rack locations and datacenters, BMC functionality continues to prove invaluable for monitoring and upkeep of any remotely located systems.

Remote Monitoring and Management: A BMC allows admins to keep an eye on important hardware parameters such as temperature, voltage, fan speed, and power consumption. This allows the ability to spot potential issues early and start troubleshooting before there is a system failure.

Out-of-Band Access: Users can access systems remotely via a BMC, even if the system's operating system is offline or unresponsive. This means administrators can view logs and sensors and control some of the system hardware components from anywhere, reducing both time to troubleshoot problems and overall downtime.

Intelligent Sensors and Alerts: A BMC has smart sensors that interact with and gather data from various hardware components. It can send real-time alerts and notifications, helping administrators address issues quickly, prevent system failures, and maintain optimal system performance.

Remote Console Access: A BMC provides a remote console virtual interface that lets administrators access and control the server as if they were physically present. This makes maintenance and troubleshooting easier and even allows for the remote installation of most operating systems.

In essence, a BMC allows users to interact with computer systems anywhere in the world as if the computer is in front of them, allowing administrators to manage, monitor, and troubleshoot systems from anywhere, at any time.

This document covers installation and basic setup of the Lenovo ThinkStation BMC PCIe add-in-card (AIC) in supported ThinkStation platforms.

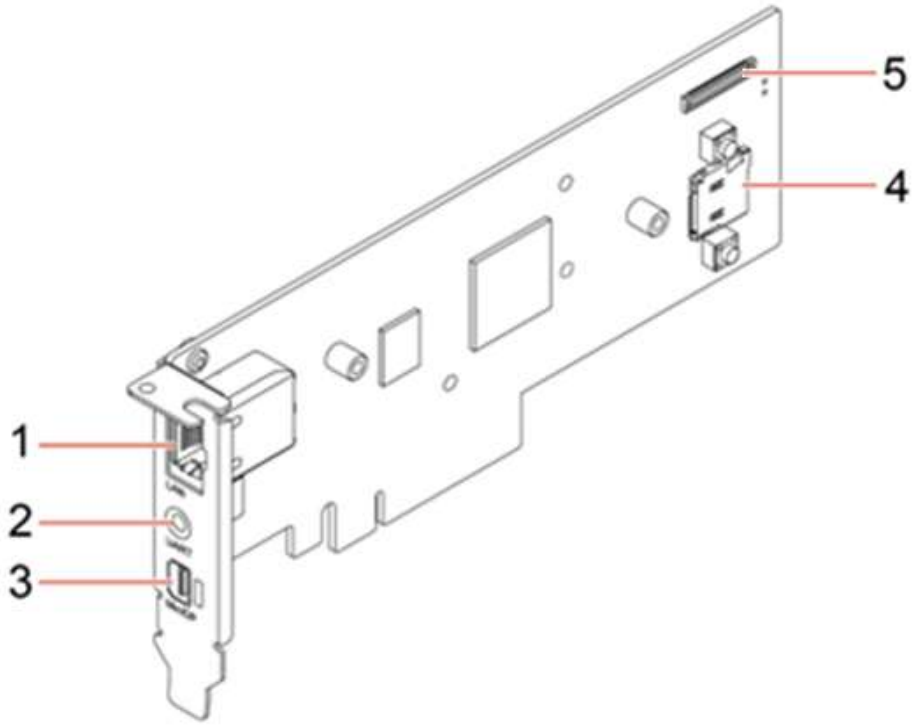
At the time of writing the following ThinkStation platforms support the Lenovo BMC AIC:

- P3 Ultra SFF
- P3 Ultra SFF Gen 2
- P5
- P7
- P8
- PX

Section 1 – BMC PCIe AIC Components

Below is an image of the Lenovo BMC AIC and its components.

Figure 1, BMC card with identified components



1	Ethernet/LAN connector
2	UART connector (non-functional)
3	Mini DisplayPort out connector
4	MicroSD slot
5	BMC Sideband Cable Port

NOTE: Image is shown with the Low Profile PCIe bracket specific to the P3 Ultra SFF version.

The BMC AIC Ethernet/LAN connector provides access to the remote interface of the host system. The P3 Ultra SFF Gen 1 also has an onboard, compatible 1GbE port that supports the Network Controller Sideband Interface (NC-SI) protocol. This means that both system network data and BMC traffic can be shared over this single network connection. However, due to a change in the onboard 1GbE adapter in the P3 Ultra Gen 2, the NC-SI protocol is not supported in this generation.

The UART connector is a 3.5mm serial port that, at the time of writing, is non-functional.

The Mini DisplayPort (mDP) out connector allows local users to view the computer display output normally even while remote users may have access and are controlling the system. If a standard system GPU, onboard or discrete, is being utilized simultaneously with the remote control of the system, users may experience issues with remote display output of the host system.

The MicroSD slot can be used for BMC firmware recovery or for storage of ISO images for remote OS installation.

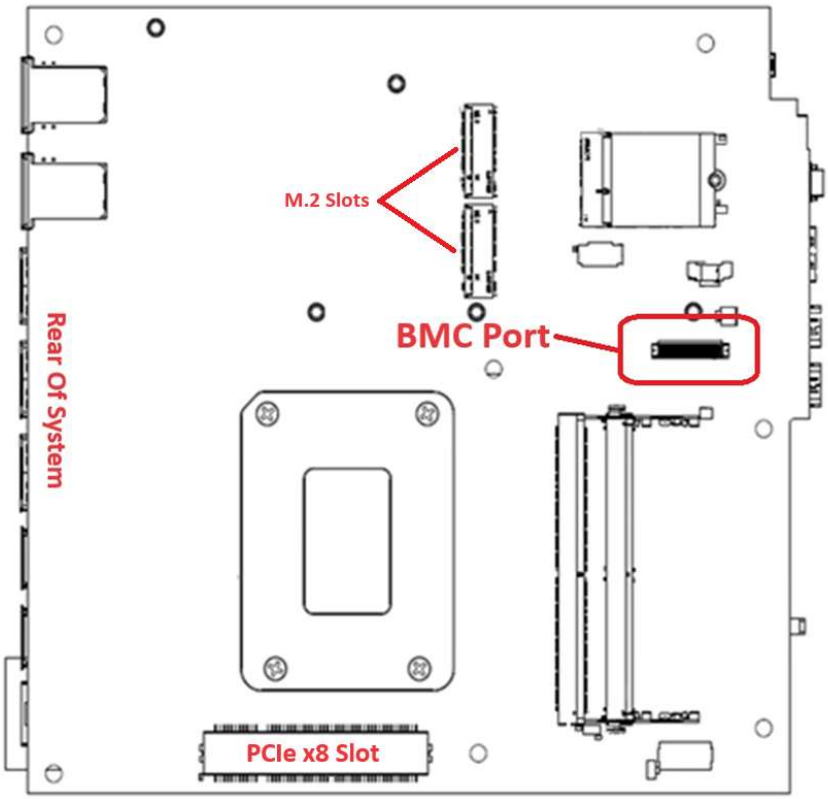
The BMC Sideband Cable Port is the secondary method of connecting the BMC AIC to the system board, in addition to the primary connection through the PCIe slot. Details on the connection of this cable are provided in Section 2.

Section 2 – P3 Ultra SFF BMC Card Installation

Installation of the BMC AIC in the P3 Ultra SFF must be installed in the PCIe x8 slot adjacent to the M.2 location. The BMC AIC can only be used in this PCIe slot due to the BMC sideband port location on motherboard near this slot. The Lenovo BMC AIC with a low profile PCIe bracket and the associated P3 Ultra SFF BMC sideband cable are necessary to complete the installation.

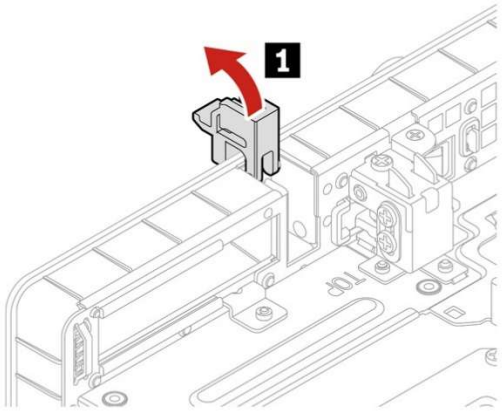
Before installing a Lenovo BMC AIC, update the BIOS and EC to the latest versions. To begin installation of the BMC AIC, power down the system, remove any connected devices and the power from the system. Then remove the cover and leave the system with the M.2 side facing up. See Figure 2 below for the location of the BMC port on the P3 Ultra SFF motherboard.

Figure 2, P3 Ultra SFF Motherboard BMC port location (M.2 SSD side)



On the rear of the system, lift the PCIe bracket retention flipper up out of the way (1) and remove the PCIe slot cover if it is still in place.

Figure 3, PCIe bracket retention flipper (M.2 SSD side)



Lower the BMC AIC into the system with the PCIe bracket tab extending into the space left open from the flipper. Then slide the BMC AIC sideways inserting it into the PCIe slot (2). Once the card is properly inserted and seated, lower the flipper down (3) locking the card into place.

Figure 4, BMC AIC insertion

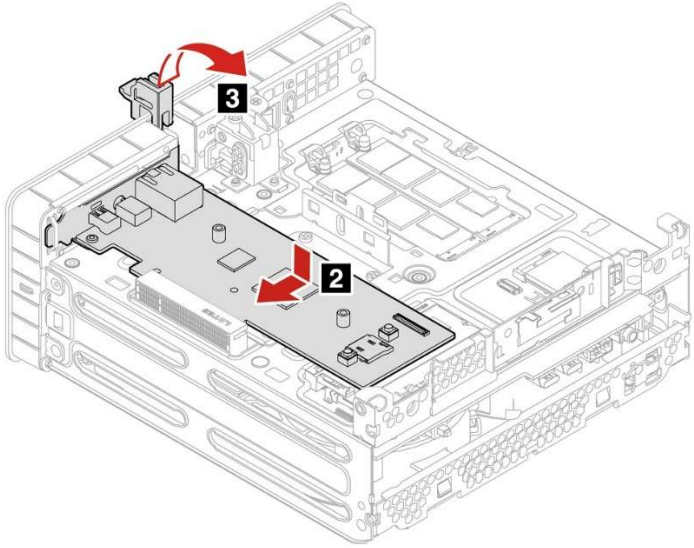
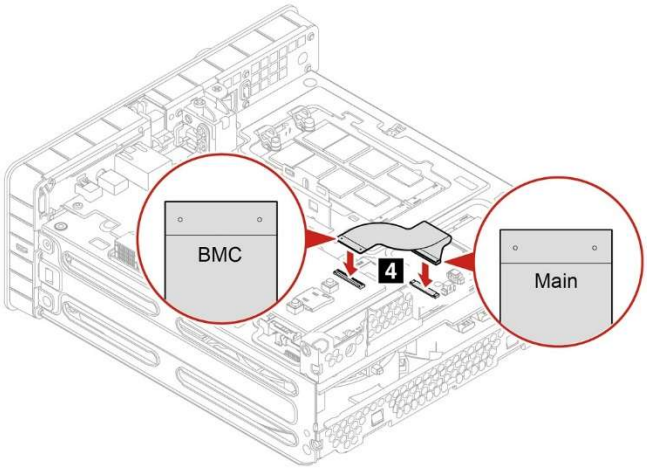


Figure 5, BMC AIC sideband cable installation



The sideband cable is labeled “Main” for the end that attaches to the motherboard and “BMC” for the end that attaches to the BMC AIC. To facilitate the installation of the BMC AIC, it is recommended to connect the “Main” end of the cable to the motherboard port first, install the BMC AIC into the PCIe slot, and then complete the cable installation by connecting the “BMC” end of the cable to the card.

To complete the installation, reassemble the system, connecting all of the peripherals, cables, and the monitor(s), and finally reattach power. It is recommended to add a network connection to access the BMC. For the P3 Ultra Gen 1 this can be either the BMC AIC Ethernet port or the onboard 1GbE port to facilitate remote access and configuration of the BMC. For the P3 Ultra SFF Gen 2 this must be the Ethernet port on the BMC AIC. For remote access, the selected Ethernet port must be connected to a network that is also accessible by any potential remote system. The system will need approximately 3 minutes for the BMC to initialize before it is able to power on and start the boot process.

NOTE: If the power button is pushed before the system has finished the BMC initialization, the white LED in the center of the power button will continue to flash 3 times then pause to indicate that BMC is still initializing. Once the process has completed the system will then proceed to boot.

NOTE: Every time the system power is removed and reattached, this initialization process will need to rerun and requires several minutes to complete.

Section 3 – P5/P7/P8/PX BMC AIC Installation

Installation Overview

Installation of the BMC AIC into the P5, P7, P8 and PX tower systems is very similar, with the location of the BMC port on the motherboard in roughly the same locations at the bottom center of the board. All four systems require both a BMC AIC and the associated BMC sideband cable and they typically each utilize the same BMC AIC and cable part number. See the table below for PCIe Slot information by system. The PX installation when using Slot 5 is covered later in this section and requires a different Sideband Cable. Figures 6-9 show each system motherboard, the location of the BMC ports, and the locations of the PCIe slot or slots reserved for the BMC AIC listed in red.

Table 1, BMC slot use by system

System	Supported BMC PCIe Slot
P5	Slot 5
P7	Sot 6
P8	Slot 7
PX - 1 CPU Configuration	Slot 8
PX - 2 CPU configuration	Slot 8 or Slot 5

BMC Port Location and Slot Use by System

Figure 6, P5 Motherboard BMC port location and BMC designated PCIe Slot 5

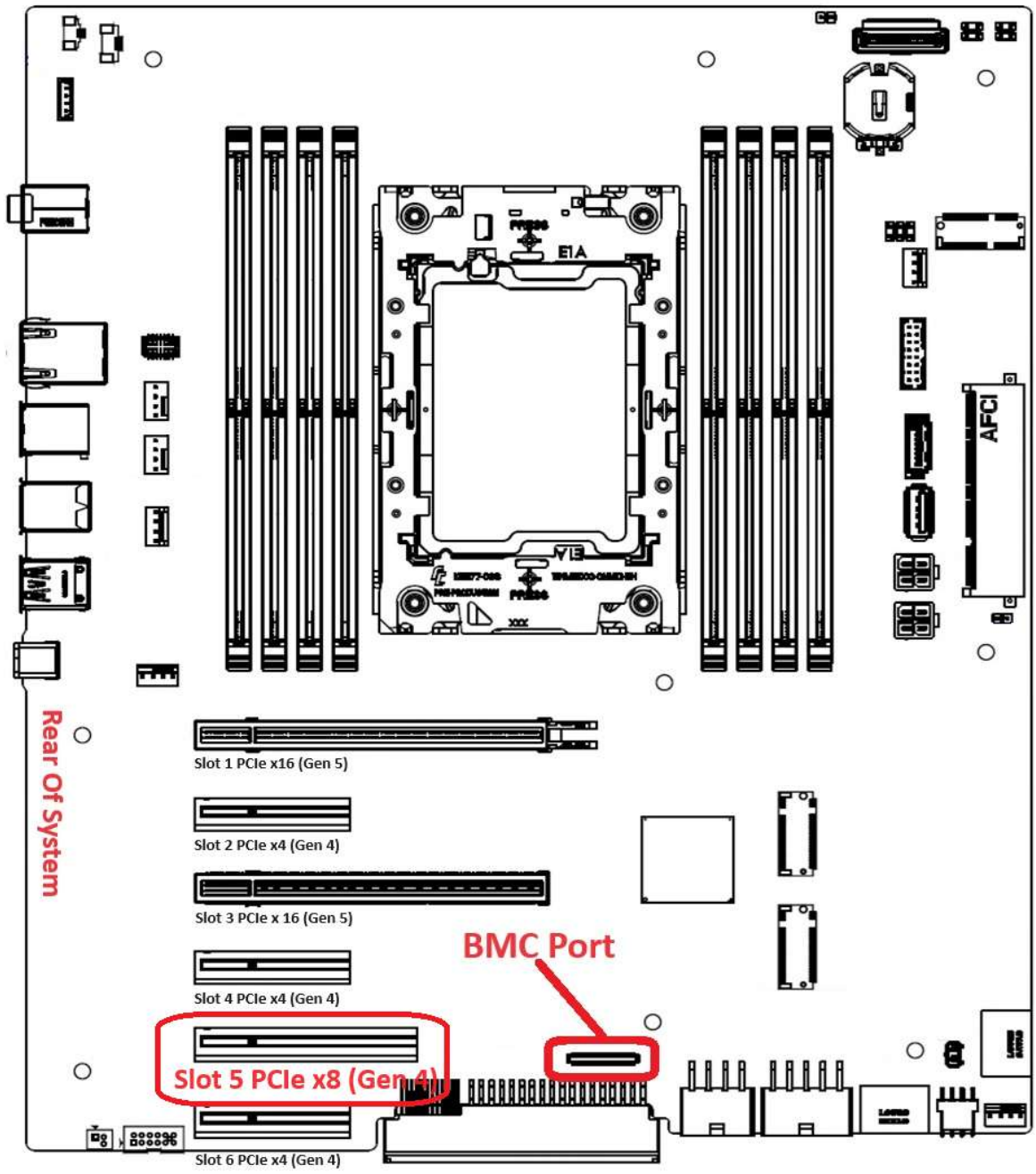


Figure 7, P7 Motherboard BMC port location and BMC designated PCIe Slot 6

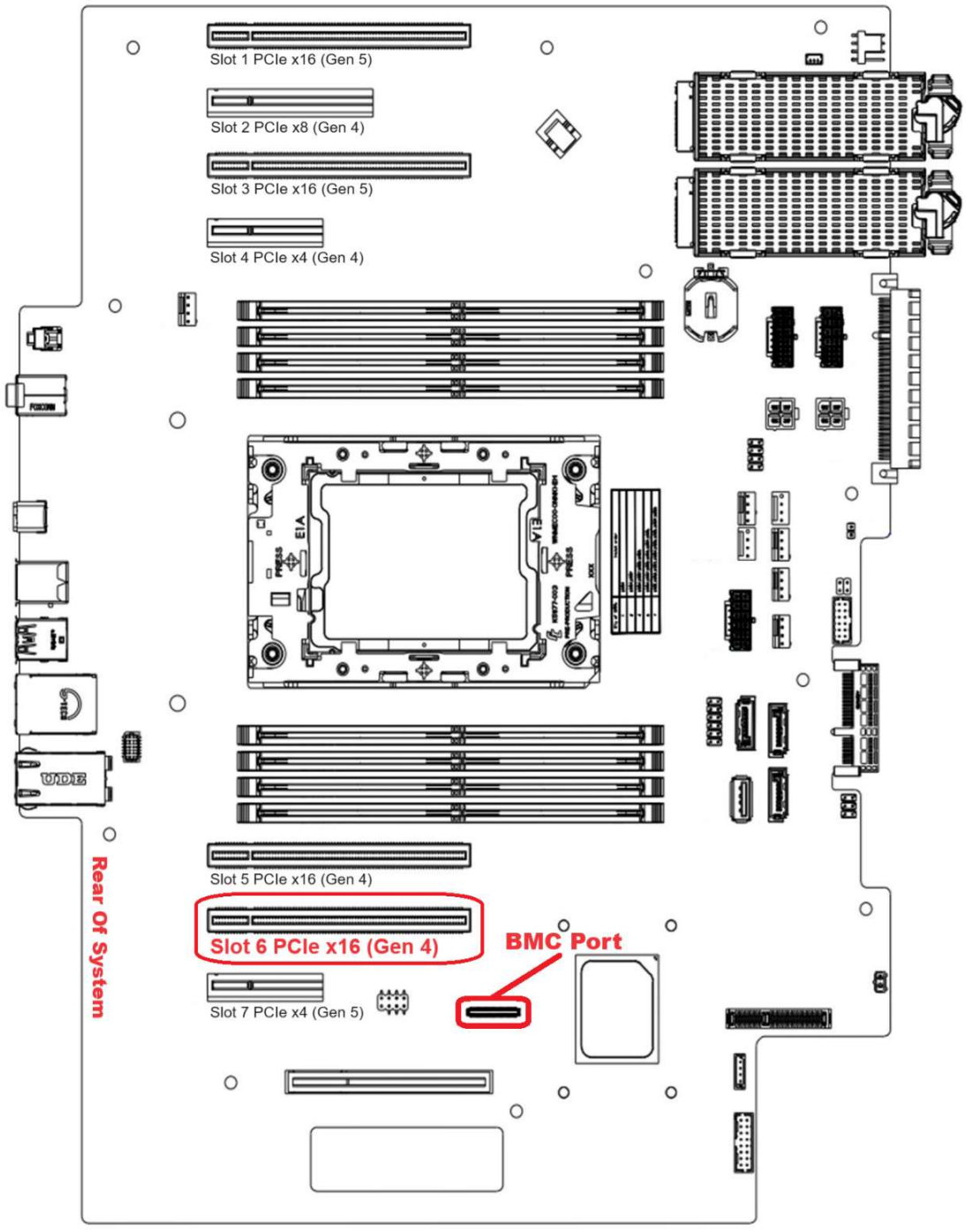


Figure 8, P8 Motherboard BMC port location and BMC designated PCIe Slot 7

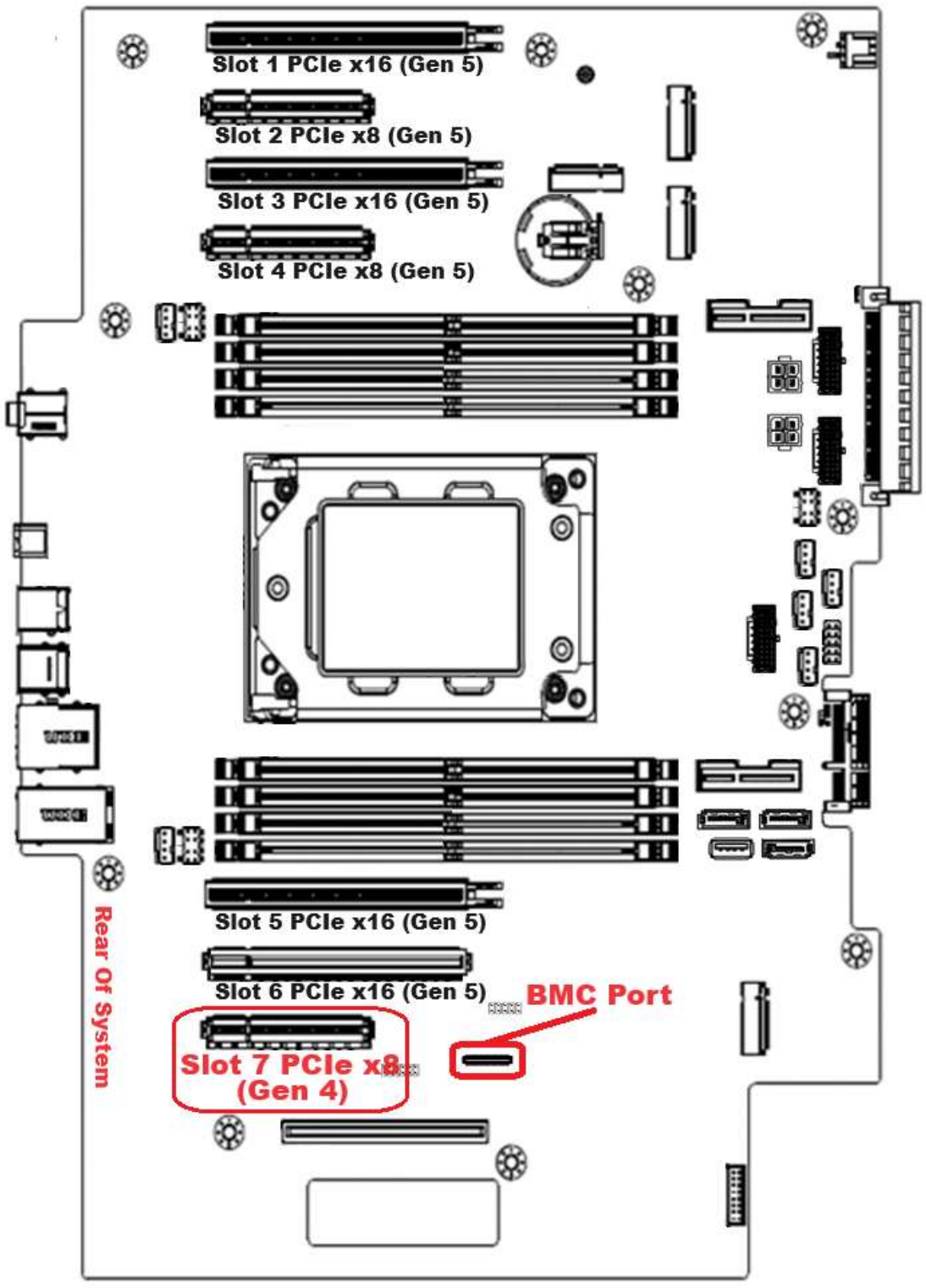
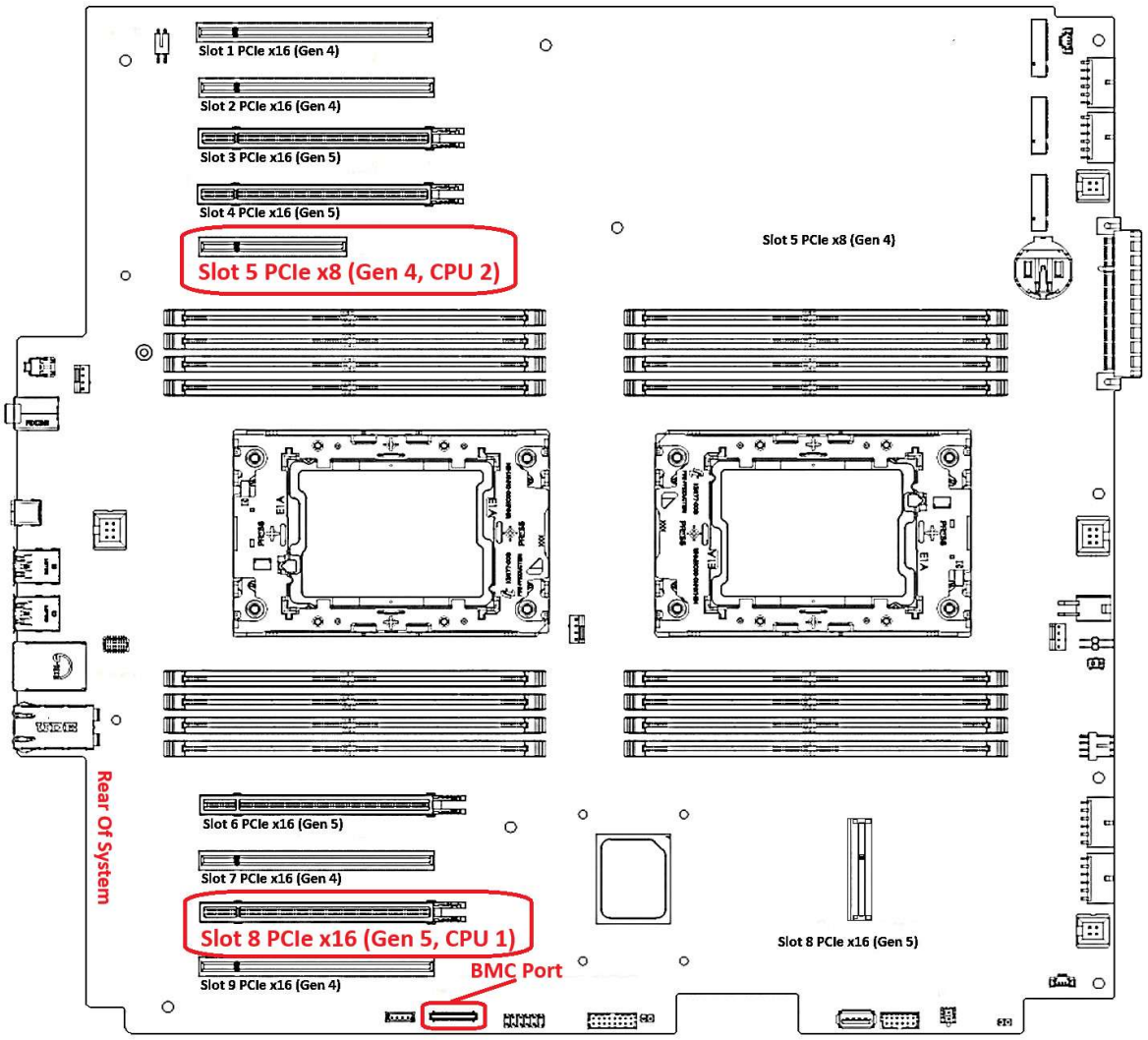


Figure 9, PX Motherboard BMC port location and BMC designated PCIe Slot 5 OR Slot 8

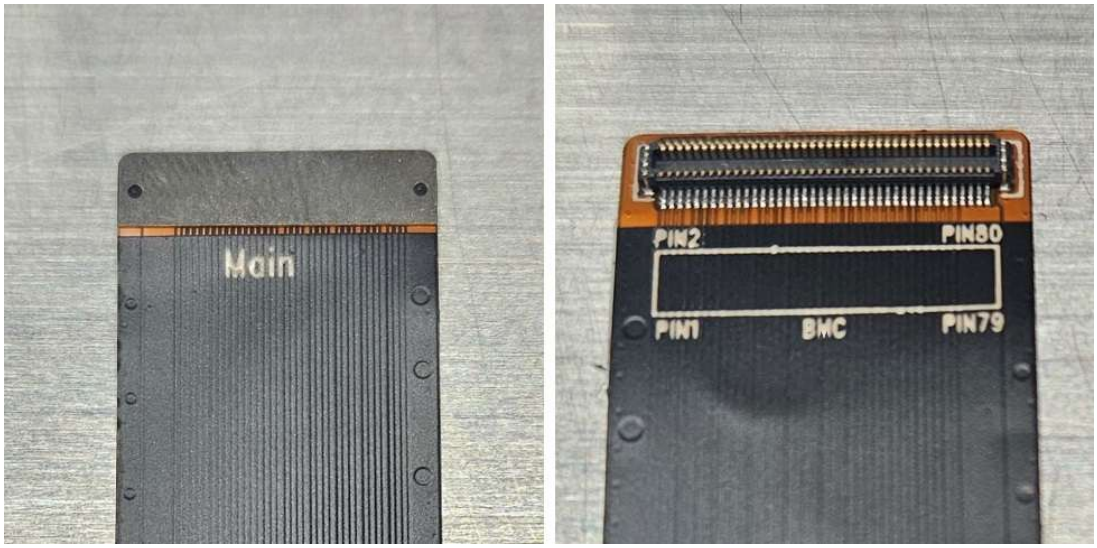


BMC AIC Installation for P5/P7/P8 and PX Slot 8

Before installing a Lenovo BMC AIC, update the BIOS and EC to the latest versions. To begin the installation of the BMC AIC, first power down the system, remove any connected devices and the power from the system, and then remove the cover. The following images demonstrate the installation of the BMC AIC into a P5 workstation but using the identified ports and slots from the previous images as a reference, the installation is virtually the same unless otherwise noted. Certain system components have been removed to better show the BMC AIC and sideband cable installation.

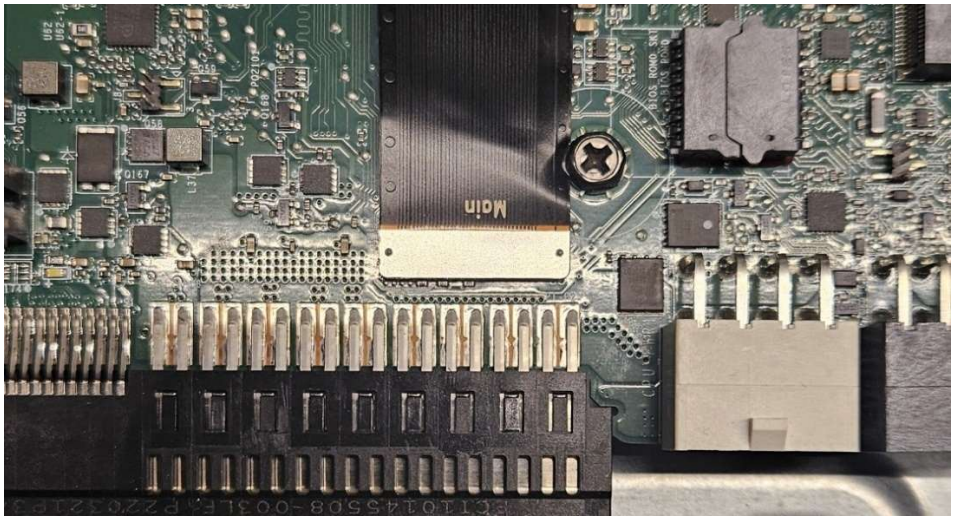
Check both ends of the supplied BMC sideband cable. One end of the sideband cable is labeled “Main” for the end that attaches to the BMC port on the motherboard and the other end is labeled “BMC” for the end that attaches to the BMC AIC.

Figure 10, Sideband cable identification



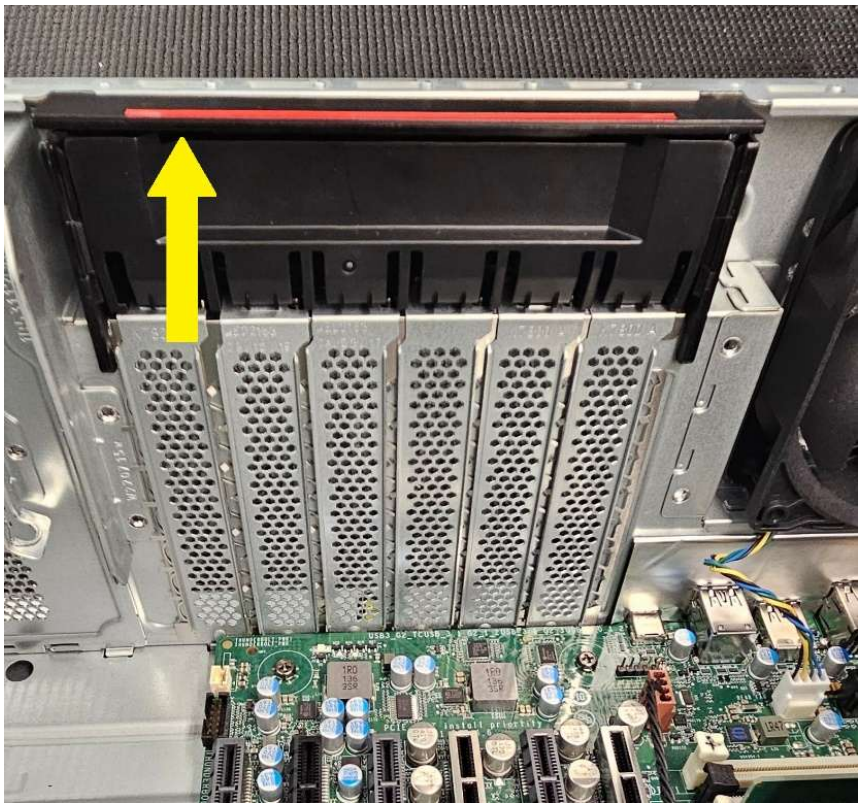
Locate the BMC port on the motherboard and plug the “Main” end of the cable into the motherboard and let the cable lie loose.

Figure 11, Sideband Cable plugged into the motherboard



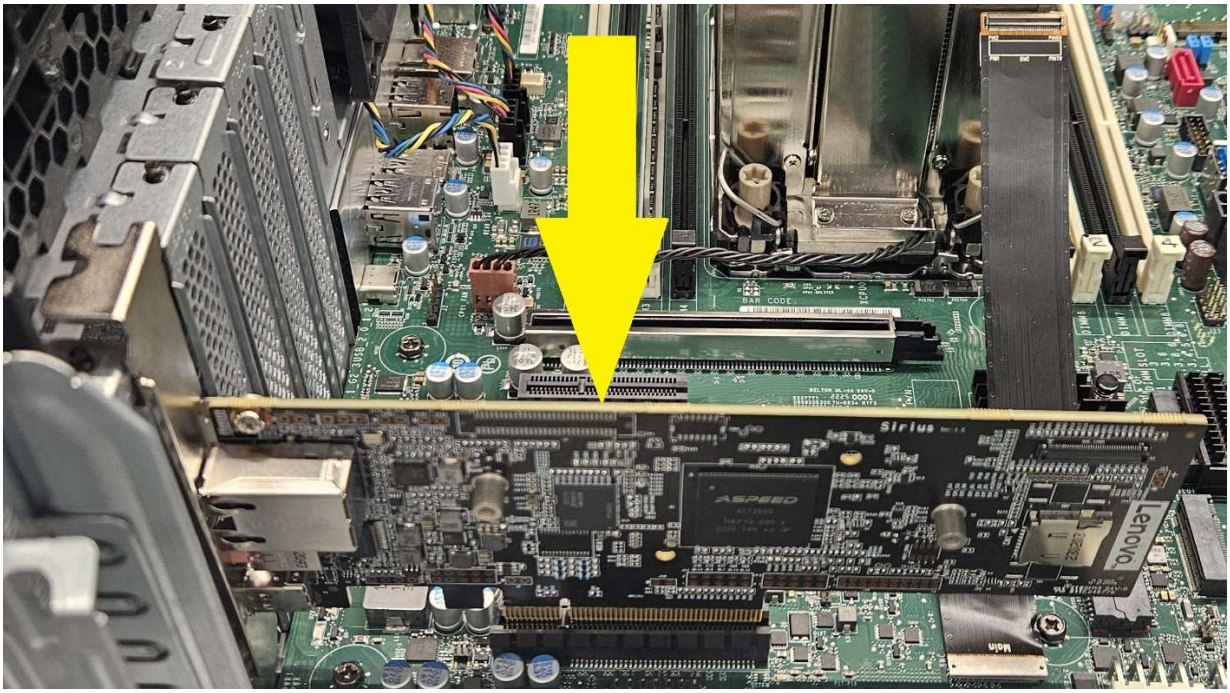
On the rear of the system, lift and turn the PCIe bracket retention handle up out of the way and remove the proper PCIe rear bracket cover if it is still in place.

Figure 12, PCIE bracket retention handle



Insert the BMC AIC into the appropriate slot for the system in use.

Figure 13, BMC AIC insertion



Lower the PCIe retention handle back into place to lock the BMC card into the slot. For the P5, P7, and P8 systems, gently curl the BMC Sideband cable over the top of the BMC card and plug the end into the Sideband cable port as shown below.

Figure 14, Sideband cable into the BMC card port in the P5, P7, and P8

For the PX system using Slot 8, the Sideband cable will rise straight up and curl over forwards to plug into the top of the BMC card as shown below.

Figure 15, Sideband cable into the BMC card port in Slot 8 on the PX

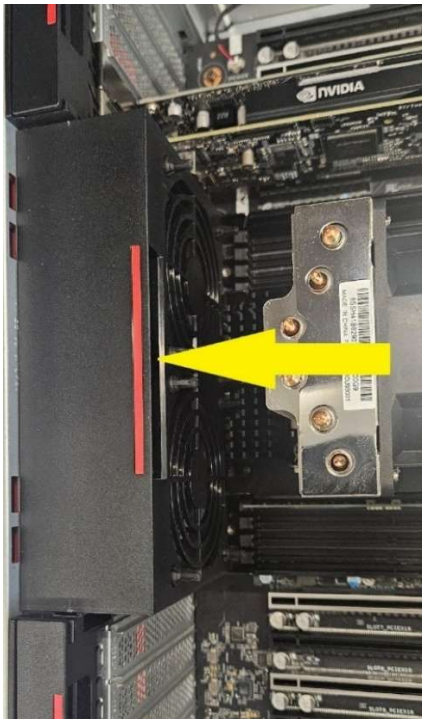
PX BMC AIC Installation for Slot 5

After the initial release of the BMC AIC, a longer sideband cable was introduced to allow PX users to install the BMC AIC into Slot 5 to maximize the number of dual-slot GPUs that can be utilized in the system. As the purpose is to maximize GPU configurations, the use of Slot 5 requires a dual CPU configuration. The installation is more complex for Slot 5 as it requires the removal of the memory channel ducts in order to run the Sideband cable under them.

Before installing a Lenovo BMC AIC, update the BIOS and EC to the latest versions. To begin the installation of the BMC AIC, first power down the system, remove any connected devices and AC power from the system, and then remove the cover. The following images in this section demonstrate the installation of the BMC AIC into Slot 5 in a PX workstation. Certain system components, including the CPUs, have been removed to better show the installation of the BMC AIC and sideband cable. However, the removal of these parts, if not specified in the following steps, is not required for the general installation process.

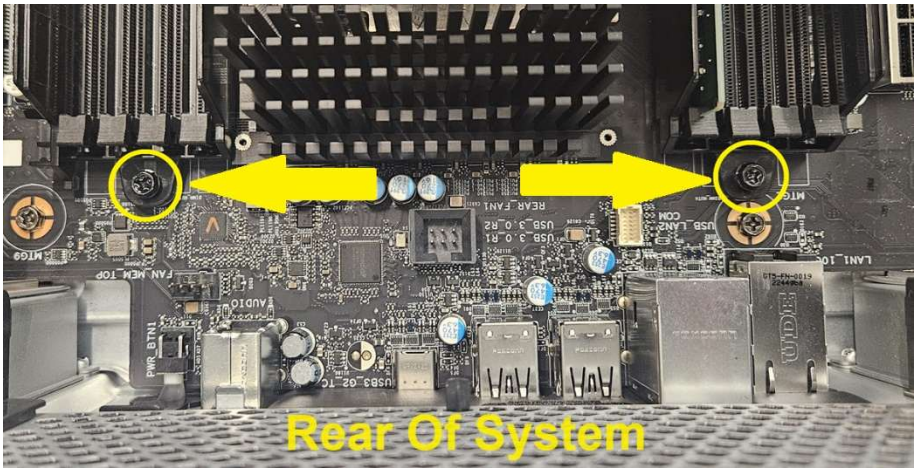
To install the sideband cable, the memory channel air ducts must be removed. There are two ducts, one above and one below the CPUs, and they are each secured to the motherboard by two screws, a single screw on either end. To remove the screws in the rear of the system, the rear chassis fan must be removed. Lift up under the front edge of the fan under the red line until the fan is fully removed from the system.

Figure 16, PX rear chassis fan



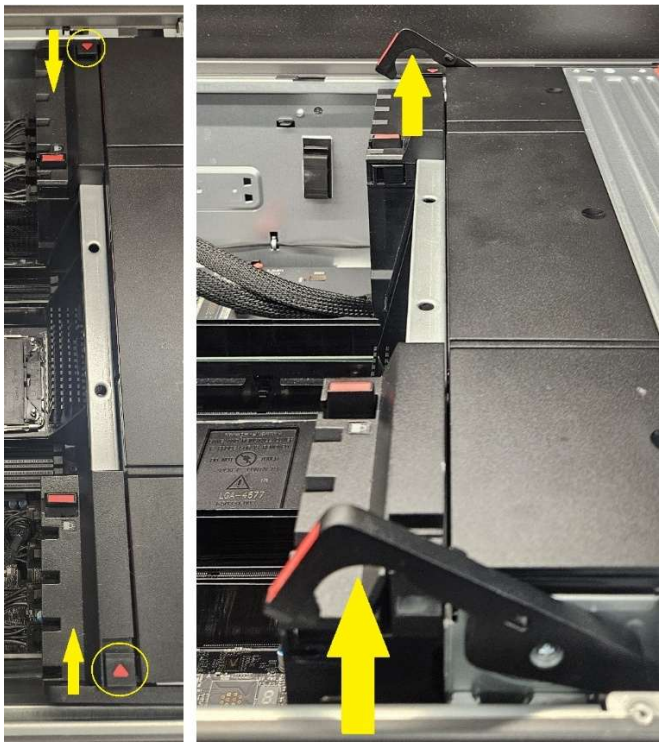
The rear screws for both air ducts are now accessible, remove them.

Figure 17, PX rear memory channel duct screws



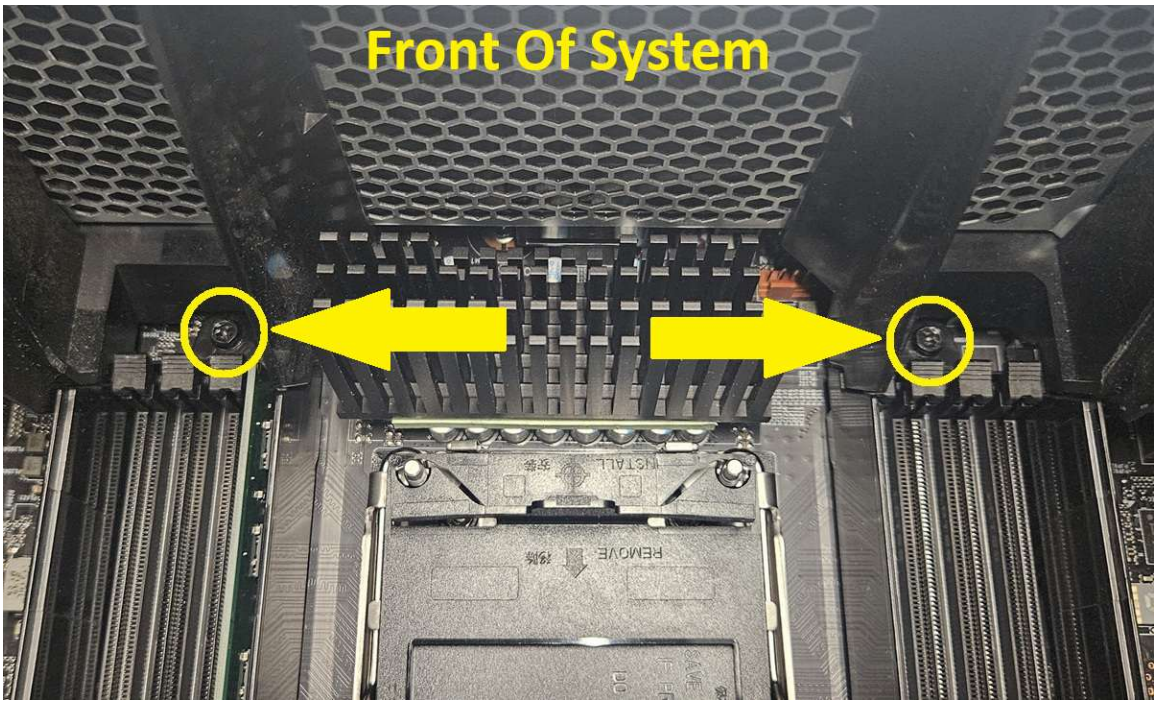
Next, the front fan assembly will need to be removed in order to access the front screws of the air ducts. Remove any PCIe cards that are being held in place with the front fan assembly. Also, disconnect any unused GPU cables from the grid on the front fan assembly. Push inward on the two rocker buttons on either end of the fan assembly, as shown below, to release the removal levers. Then pull up on both removal levers to lift the entire front fan assembly from the system.

Figures 18 and 19, Rocker buttons and removal levers



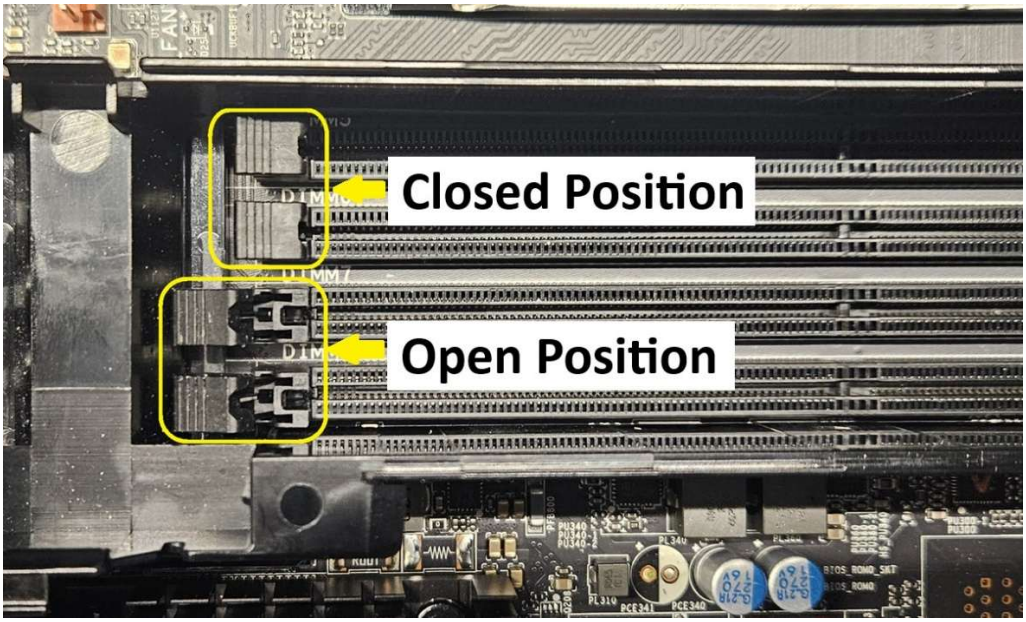
Locate and remove both of the front screws of the memory channel ducts.

Figure 20, Front of system air duct screws



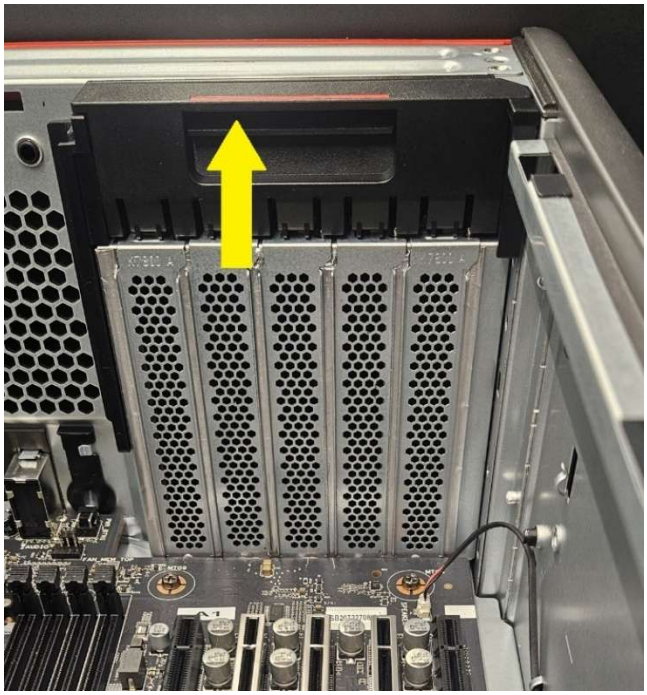
Make sure that all DIMM retention clips are in the closed position and lift the memory channel ducts up and out of the system.

Figure 21, DIMM retention clips



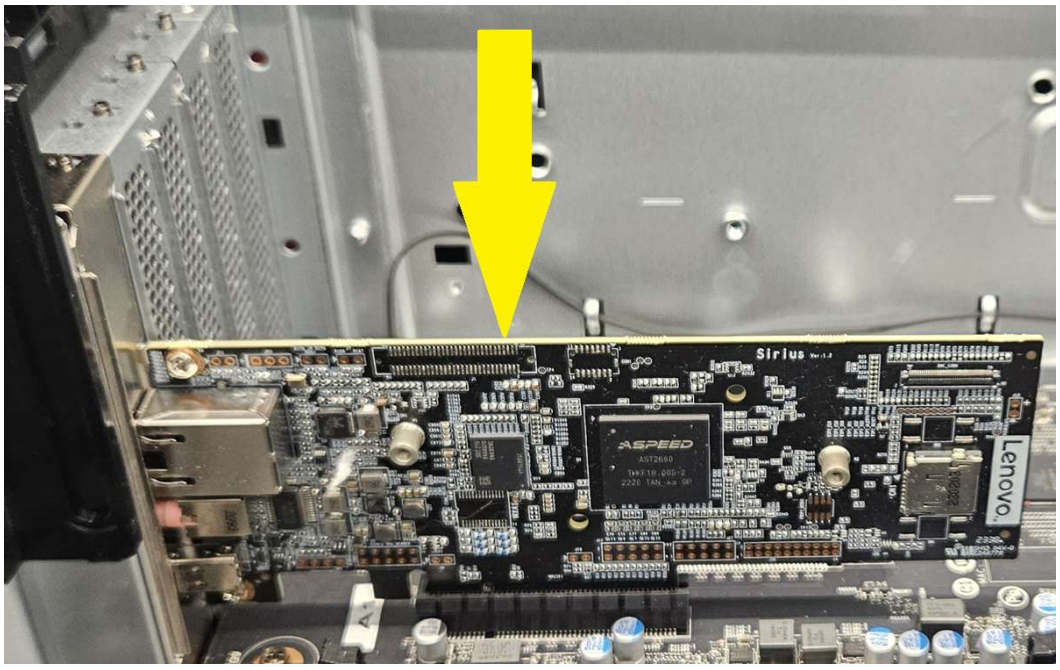
Using Figure 9, identify Slot 5 and the associated PCIe rear bracket opening. On the rear of the system, lift and turn the PCIe bracket retention handle up out of the way and remove the Slot 5 PCIe rear bracket cover if it is still in place.

Figure 22, PCIE bracket retention handle



Insert the BMC AIC into Slot 5.

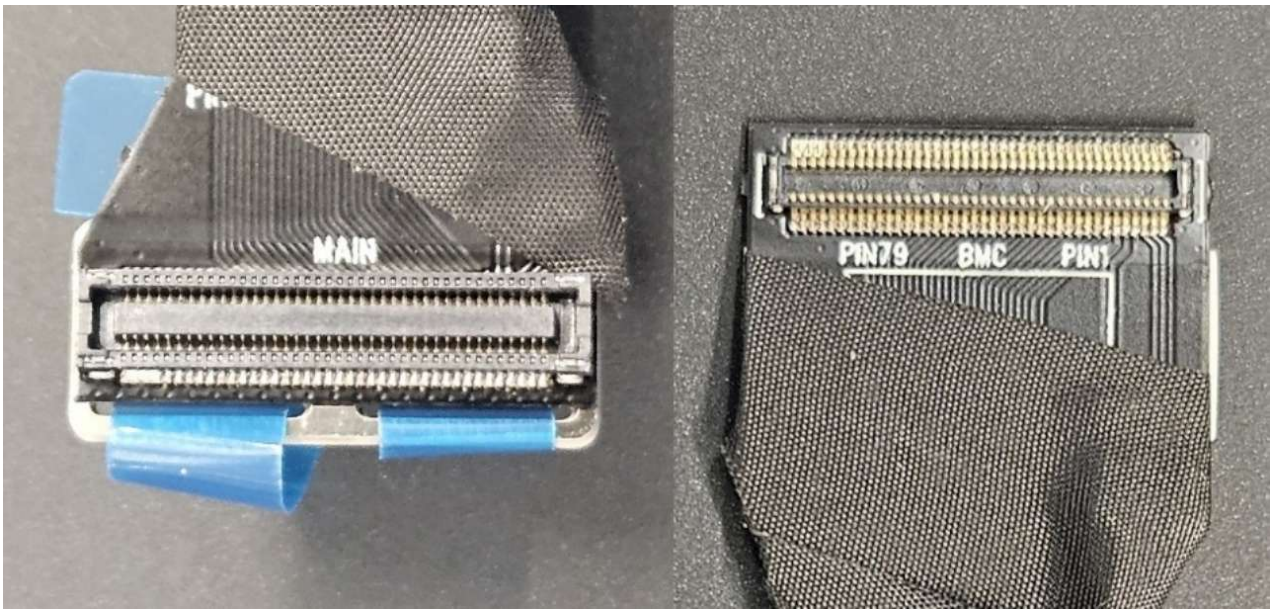
Figure 23, BMC AIC insertion



Lower the PCIe retention handle back into place to lock the BMC AIC into the slot.

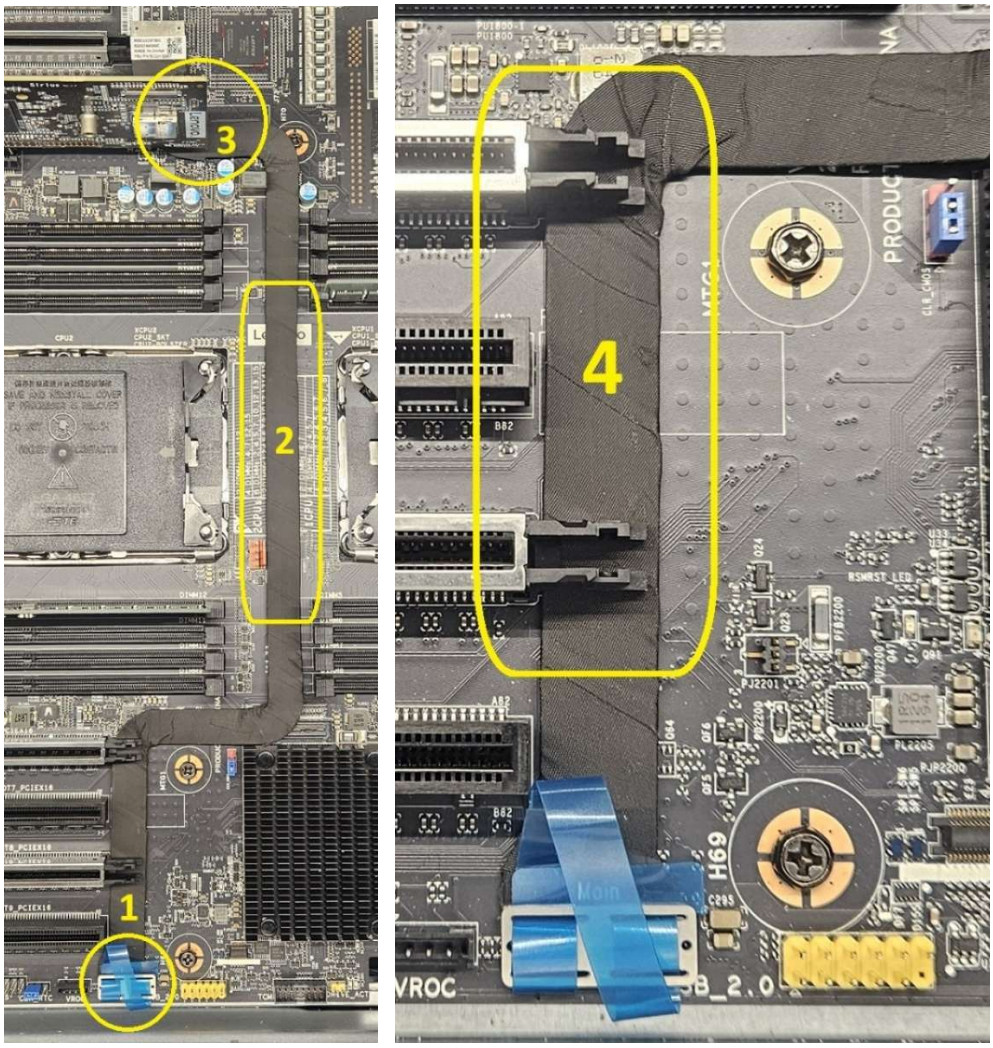
Check both ends of the supplied BMC sideband cable. One end of the sideband cable is labeled “Main” for the end that attaches to the BMC port on the motherboard. The other end is labeled “BMC” for the end that attaches to the BMC AIC.

Figure 24, Sideband cable ends identification



Next locate the BMC sideband port along the bottom edge of the system as seen in Figure 9. Lay the sideband ribbon cable with the end labeled “Main” starting from the sideband port (1), up through the middle of the system between the CPU sockets (2), and behind the BMC AIC in Slot 5 (3) as shown below in Figure 25. Note that the cable will need to be run under the ends of PCIe Slots 6 and 8 (4) in order to properly align with the BMC port

Figures 25 and 26, Sideband cable routing through the PX



Carefully insert the cable into the BMC port on the motherboard. When aligned properly it should fit and press into the slot easily. Do not exert excessive pressure or try to force the plug into the port. If it does not insert easily, realign the plug to the port and try again.

Lift the BMC end of the cable straight up and repeat the cable insertion process on the BMC AIC sideband cable port.

Figure 27, Sideband cable into the BMC card port in Slot 5 on the PX

Starting with the air ducts, reverse the previous steps to reinstall the air ducts, air duct screws, front fan assembly, and rear fan.

Completing the Installation

To complete the installation, replace the side cover and reassemble the system, connecting all of the peripherals, cables, and the monitor(s), and finally reattach power. It is recommended to add a network connection to the BMC AIC Ethernet port. For remote access, the BMC AIC Ethernet port must be connected to a network that is also accessible by any potential remote system. The system will need approximately 3 minutes for the BMC to initialize before it is able to power on and start the boot process. Normally the process will complete without issue or notification. If the power button is pushed at any time before the BMC AIC has completed initialization, the power button LED light will light up and the mini diagnostic display on the front of the system will show the progress of the initialization as seen in the Figure below. Once the process has completed the system will then proceed to boot.

NOTE: Every time the system power is removed and reconnected, this initialization process will need to rerun and requires several minutes to complete.

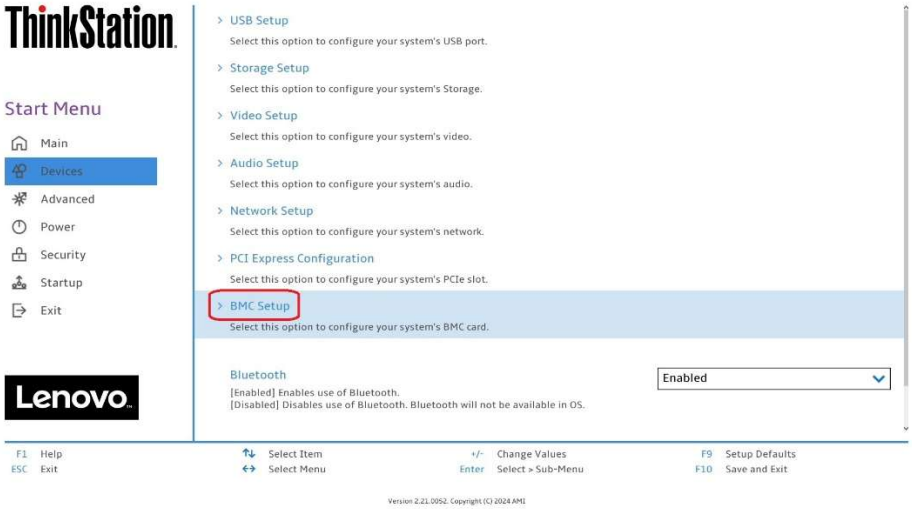
Figure 28, Diagnostic display

Section 4 – BMC AIC Setup

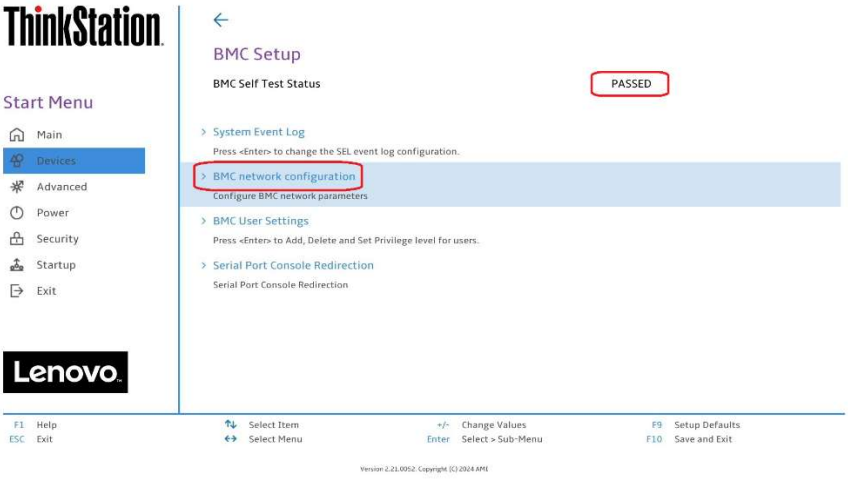
To configure the BMC settings, it is necessary to connect to the card remotely. This is typically done through a web GUI, but most settings can also be changed through other 3d party tools. All methods require the host and client systems to be connected to networks that are accessible to one another. This section will cover how to connect to the BMC AIC through the web GUI as well as how to then connect to the host system through the BMC remote control tool.

Once the BMC AIC has been installed and has fully initialized, the system is ready to boot. Verify that an active network cable has been plugged into the Ethernet port on the BMC AIC. Boot the system and press F1 when the POST screen is displayed to enter the BIOS setup. From the BIOS landing page click on “Devices”.

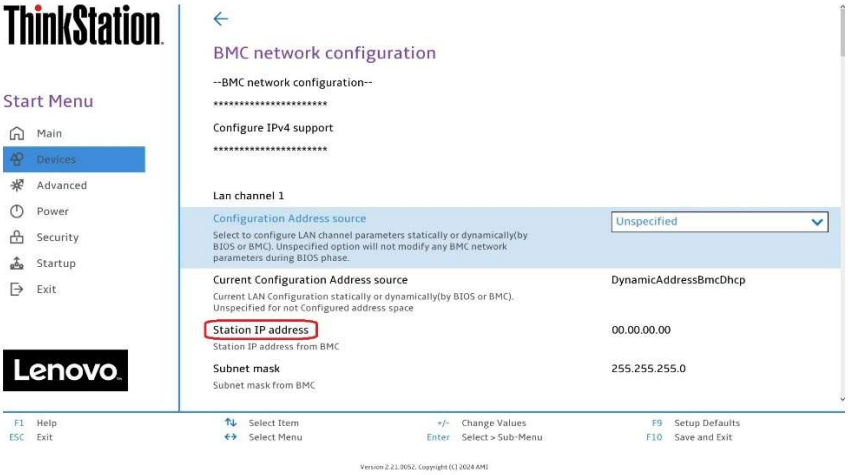
From the “Devices” page click on “BMC Setup”.



On the “BMC Setup” page, verify the “BMC Self Test Status” shows as “PASSED” and click on the “BMC network configuration” option. If the BMC shows “FAILED” it is recommended to power down the system and remove and reinstall the BMC AIC and cable to verify all components are installed and seated properly.



In the “BMC network configuration” section note the “Station IP address”.



Accessing the Web GUI:

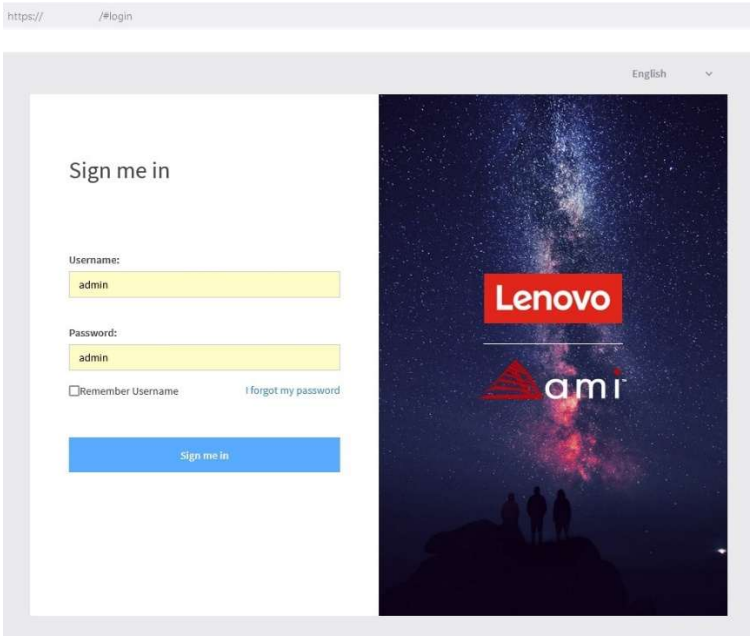
In a remote system, that has access to the same network of the host system, open a browser and type in the “Station IP address” in the following format:

https://xxx.xxx.xxx.xxx

It is necessary to use “https” to properly connect to the remote system interface.

Accept any warnings that appear until reaching the following login screen and log in with the default Username and Password. In a BMC AIC with FW level 1.00.15 the default login will be Username “admin” and Password “admin”. In a BMC AIC with FW level 1.00.17 the default login will be Username “admin” and Password “PASSW0RD!@” where the ‘o’ is a zero.

Figure 29, BMC login screen



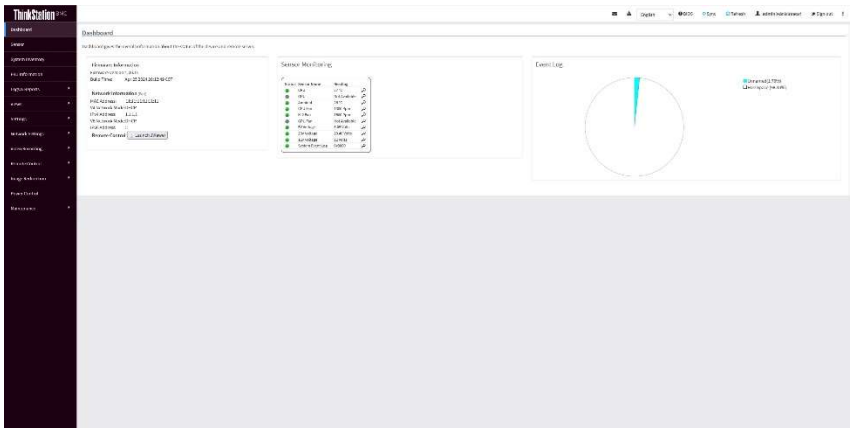
NOTE: Characters entered into the Password field are masked.

When clicking the “Sign me in” button, first time logins will be required to change the Password. Passwords must be 10-20 characters in length and contain characters from three of the following four categories:

- English uppercase characters A-Z
- English lowercase characters a-z
- Numerical digits 0-9
- Special characters (!, $, #, %, etc.)

When the password has successfully been changed, users will need to log in again with the new password. After a successful login users will be presented with the BMC Dashboard as seen in the Figure below.

Figure 30, BMC web GUI dashboard



From the landing page users have access to all of the settings, sensors, and features of the BMC.

Setting up the KVM/Remote Control:

One of the primary features of any BMC, is the ability for users to control the system remotely. The two easiest and most common methods for this with the Lenovo BMC AIC are by using the Remote KVM available through either the HTML 5 interface (H5Viewer) or through the Java application (JViewer).

H5Viewer simply requires an HTML 5 capable browser to remotely control a host system:

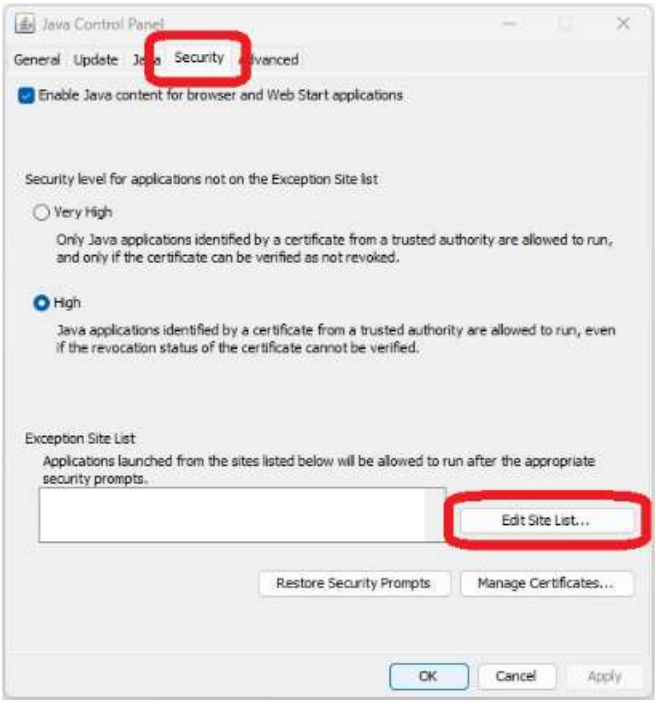
- Navigate from the Dashboard to “Remote Control” on the left-hand side
- From there open the “Remote Control” subsection
- Click on “Launch H5Viewer” and a separate window should open to start the remote-control function

If a new window does not automatically open, check for any browser notifications of blocked windows, grant access to the BMC web GUI IP address to allow it to

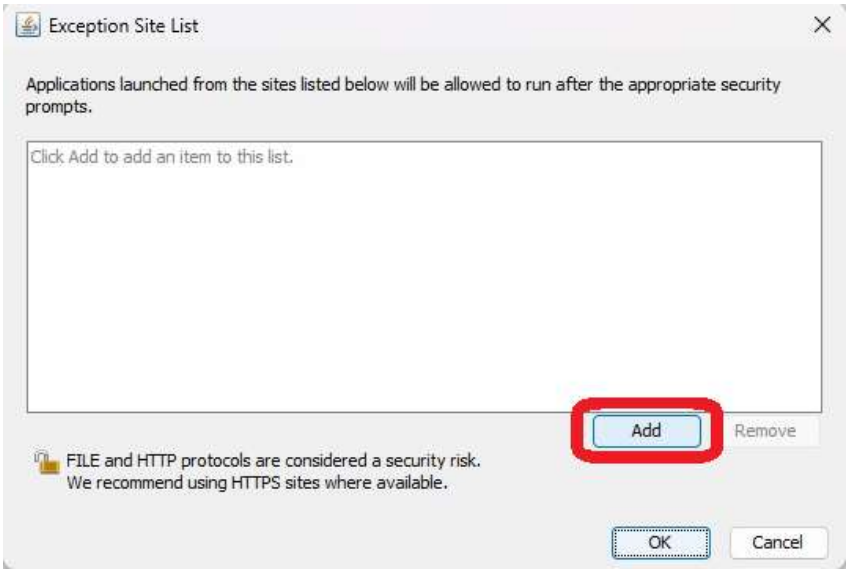
open new windows as needed, and click on “Launch H5Viewer” again to open the remote-control session.

JViewer requires the latest Java from Oracle to be installed on the remote system and some security configuration within the Java applet. For the sake of simplicity, Java for Windows will be used as an example.

- After installing or updating to the latest version of Java, browse to the Java directory and click on “Configure Java” to open the application
- Click on the “Security” tab and click on the “Edit Site List…” button



- In the “Exception Site List” window click on the “Add” button



- Type in the BMC IP address for the system that is to be accessed remotely in the following format and then click “OK”

  https://xxx.xxx.xxx.xxx

- Verify that the IP address entered now shows up in the “Exception Site List” window in the Security tab and click “OK”
- From the BMC Dashboard select to open “Remote Control” on the left-hand side and from there open the “Remote Control” subsection
- Click on “Launch JViewer” and a file will be downloaded
- Browse to the download location and click on the most recent “jviewer.jnlp” file

  NOTE: When running multiple instances of “JViewer”, from the same or different host systems, users may end up with multiple jviewer.jnlp files where every new instance gets appended with (x) where “x’ is the next progressing number.

- After double clicking on the correct “jviewer(x).jnlp” file a new window will open and, depending on the browser, there may be some security warnings that need to be accepted.

Although the H5Viewer and JViewer differ in appearance, they share many of the same settings and functions. Some examples of remote functionality are keystroke commands that can be sent to the host system, users can change resolution settings, and the host system can be reset, powered on, or powered off remotely. While using the remote control, users have access to the system at all times, from the boot process through the interactions with the OS. User experiences will differ based on the speed of the connection.

Refer to the Lenovo BMC User Guide for additional Remote-Control information and a complete list of BMC settings and functionality. The user guide can be found at https://support.lenovo.com/.

Access and changes to the BMC settings can also be made by additional third-party tools such as the various command line based Intelligent Platform Management Interface (IPMI) tools and the more recent HTTP based Redfish platform. As with those and any other third-party tools Lenovo does not recommend any one over another or offer support for them.

Section 5 – Considerations

General Considerations

- Before installing a Lenovo BMC AIC, users should update the BIOS and EC to the latest versions to ensure system compatibility with the BMC card.

- Discrete GPUs are unavailable in the P3 Ultra SFF when using a BMC card with a 125W CPU.

- The BMC card supports the remote installation of operating systems via image files. No other image file installations, such as peripheral firmware or BIOS updates, are currently supported and any attempt to use them may result in damage to the system.

- Windows is currently the only supported operating system.

Remote KVM Considerations

- In certain configurations using the Remote-Control function, while simultaneously using onboard and or discrete GPU output, users may experience unsatisfactory display functionality while in the Remote KVM window.

- Although subject to change with future firmware or driver updates, this is the current behavior:

    - By default, the discrete GPU, with an active monitor connected, will receive the priority for display at all times. This means that only a monitor that is connected to the discrete GPU, and powered on, will display the Lenovo POST screen and be able to access the BIOS. Additionally, in Windows the discrete GPU will display the login screen and show Display 1. The BMC Remote KVM will not be able to see or interact with the system during POST or access or interact with BIOS during boot. Also, as Display 2 in Windows, the Remote KVM will be unable to interact with the Windows Desktop.
    - If there are no active monitors connected to the discrete GPU, the system will default to giving display priority to the BMC in both the

preboot environment, and in the OS. In most cases simply turning off the locally attached monitor will be enough for the system to default to the BMC video output. However, in testing it has been observed that a limited number of monitors, even when turned off using the monitor power button, continue to send a signal that will cause the system to recognize it as an active display and the BMC video output will not receive priority.

- For the best Remote KVM experience, it is recommended to power off, or fully disconnect, any monitors connected to the discrete GPU. If a local monitor is required while using the Remote KVM, users should connect a monitor to the mDP on the BMC AIC prior to booting the system.

Revision History

Version	Date	Author	Changes/Updates
1.0	6/28/24	S Crowe	Initial launch release
1.1	7/24/24	S Crowe	Add info for P8 and PX
1.2	7/12/25	S Crowe	Additional Info