Intel® Remote Management Module 4

Technical Product Specification

Revision 1.3

June, 2012

Enterprise Platforms and Services Division – Marketing

Revision History

Date	Revision Number	Modifications
January 2011	1.0	Initial release.
December 2011	1.1	Updated for EPSD Platforms Based on Intel® Xeon® Processor E5-4600/2600/2400/1600/1400 Product Families.
	1.2	Update for new speed POR.
June 2012	1.3	Corrected description of NIC.

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1.   Introduction

This Technical Product Specification (TPS) provides details about the architecture and feature set of the Intel® Remote Management Module 4 (Intel® RMM4). This document does not replace the Intel® RMM4 User's Guide, but provides enhanced information to assist with understanding and learning more about specific features of the board.

1.1   Chapter Outline

- Chapter 1 – Introduction

- Chapter 2 – RMM4 Overview

- Chapter 3 – Hardware Architecture

- Chapter 4 – Advanced Features

- Glossary

2.   RMM4 Overview

Intel® Remote Management Model 4 (RMM4) includes two components, Intel® Remote Management Module 4 Lite (RMM4 Lite) and Intel® Dedicated Server Management NIC (DMN). RMM4 Lite is the key that can enable advance features of server onboard Integrated BMC (ServerEngines* Pilot III Baseboard Management Controller). DMN can provide a dedicated management LAN interface with an Ethernet network controller. This DMN is only for Integrated BMC management communication and cannot be shared with OS.

RMM4 has two kinds of packages:

- RMM4 Lite edition
  - This package only includes RMM4 Lite model and has no DMN. User can access Integrated BMC advanced features from onboard BMC-shared NIC (Integrated BMC channel 1 and/or BMC channel 2)

- RMM4 full edition
  - This package contains RMM4 Lite and DMN. User can access Integrated BMC advanced features from Intel® Dedicated Server Management NIC (Integrated BMC channel 3) and onboard BMC-shared NIC (Integrated BMC channel 1 and/or BMC channel 2)

Table 1. RMM4 and RMM4 Lite Properties

Modules	BMC Basic Features	BMC Advanced Features	Onboard BMC-shared NIC (BMC channel 1 or 2)	DMN (BMC channel 3)
RMM4 Lite edition	Yes	Yes	Yes	No
RMM4 full edition	Yes	Yes	Yes	Yes

2.1   RMM4 Board Layout

2.1.1   RMM4 Pictures

Figure 1. Intel® RMM4 Lite Picture

Figure 2. Intel® Dedicated Server Management NIC Picture

2.1.2   RMM4 Connector and Component Layout

2.1.2.1   RMM4 Lite
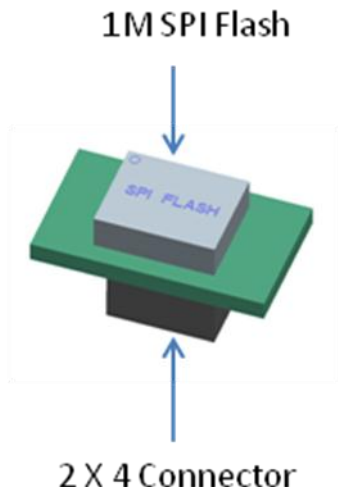
Figure 3. RMM4 Lite Connector and Component Layout
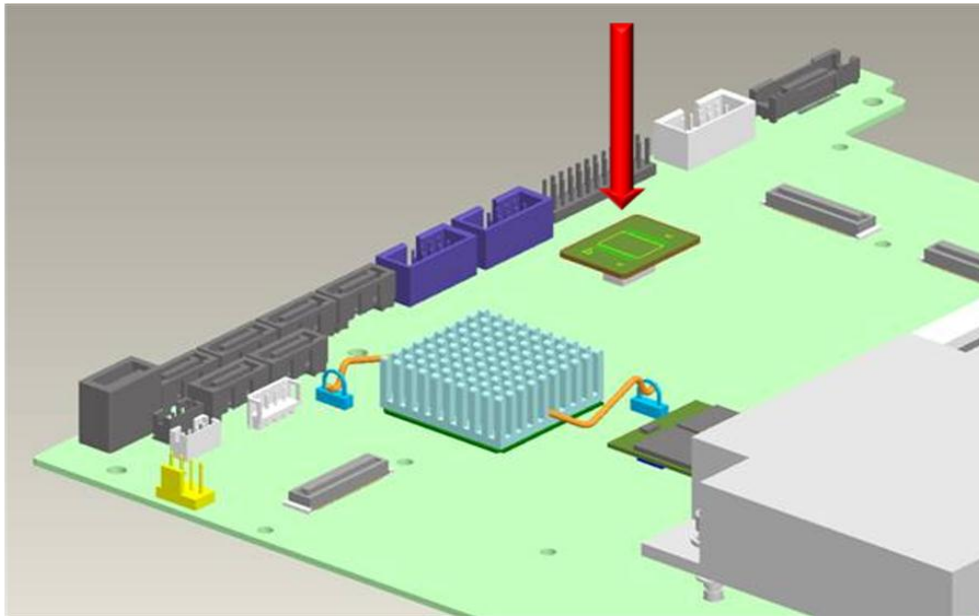
Figure 4. Populate RMM4 Lite

2.1.2.2   Dedicated Management NIC
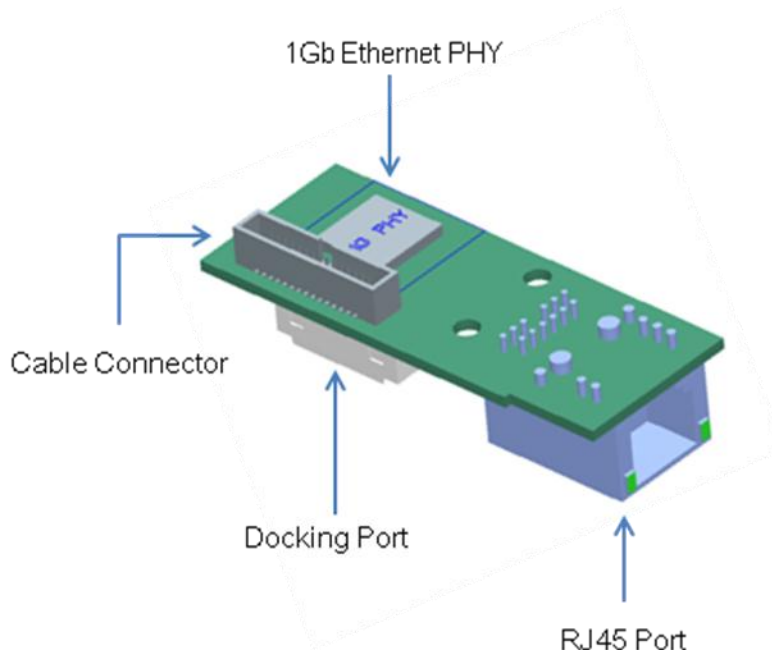
Figure 5. Components of Dedicated Management NIC Module
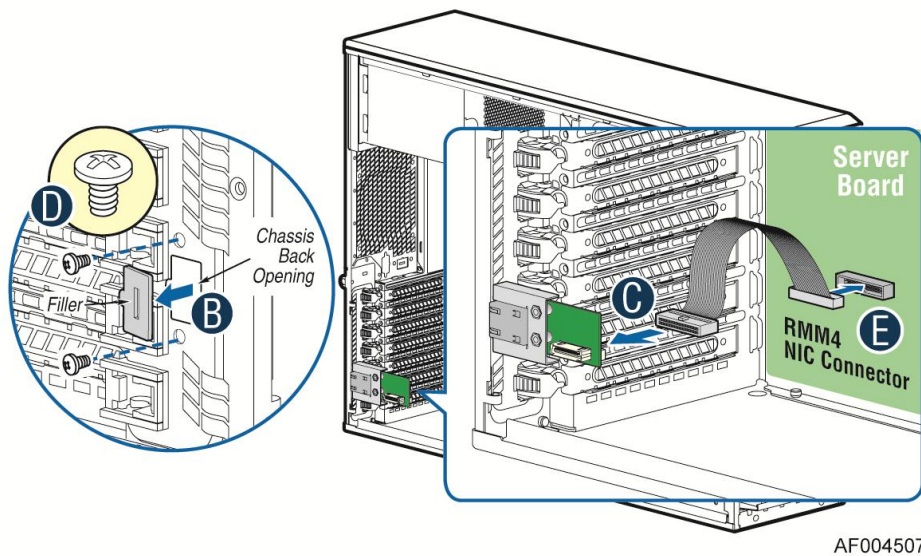
Figure 6. Mount Dedicated Management NIC Module to Pedestal Chassis
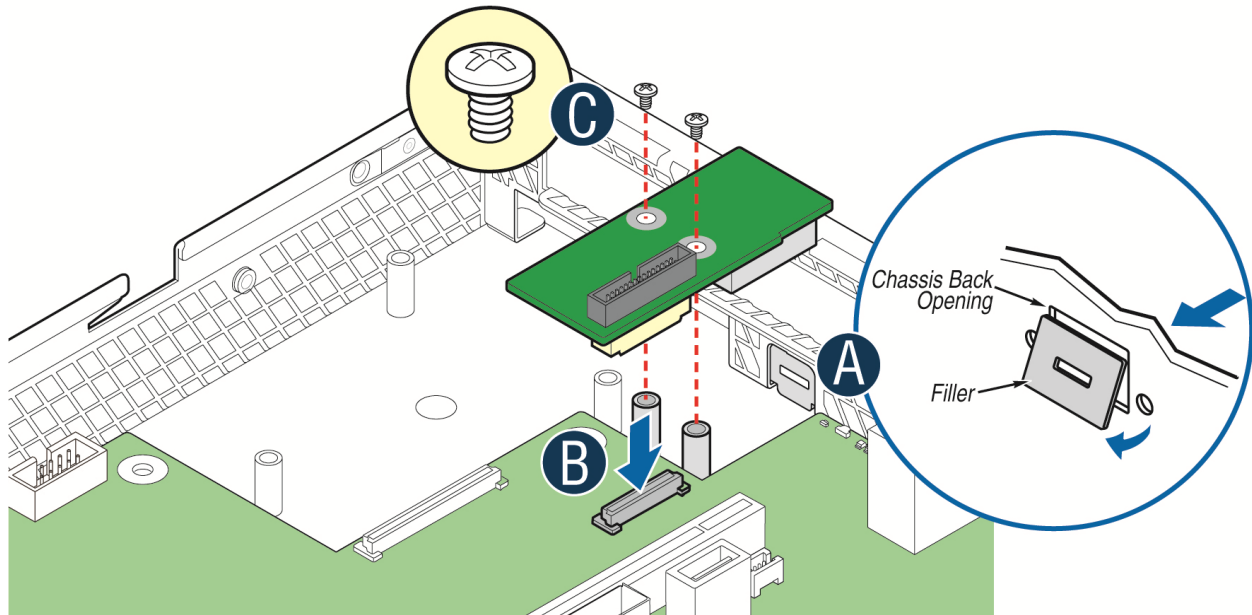
AF004137

Figure 7. Mount Dedicated Management NIC Module to Rack Chassis

2.1.3   RMM4 Mechanical Drawings

2.1.3.1   RMM4 Lite
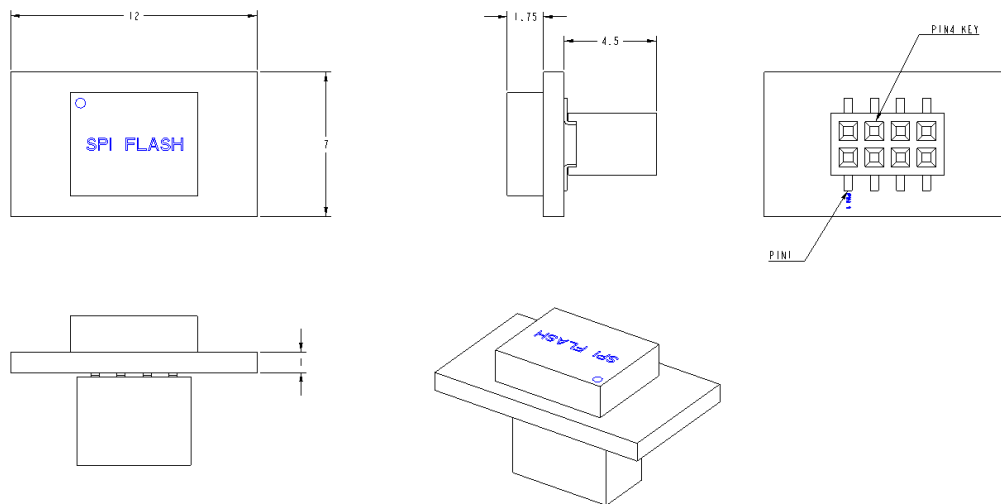
Figure 8. RMM4 Lite Mechanical Drawings

2.1.3.2   RMM4 Dedicated NIC
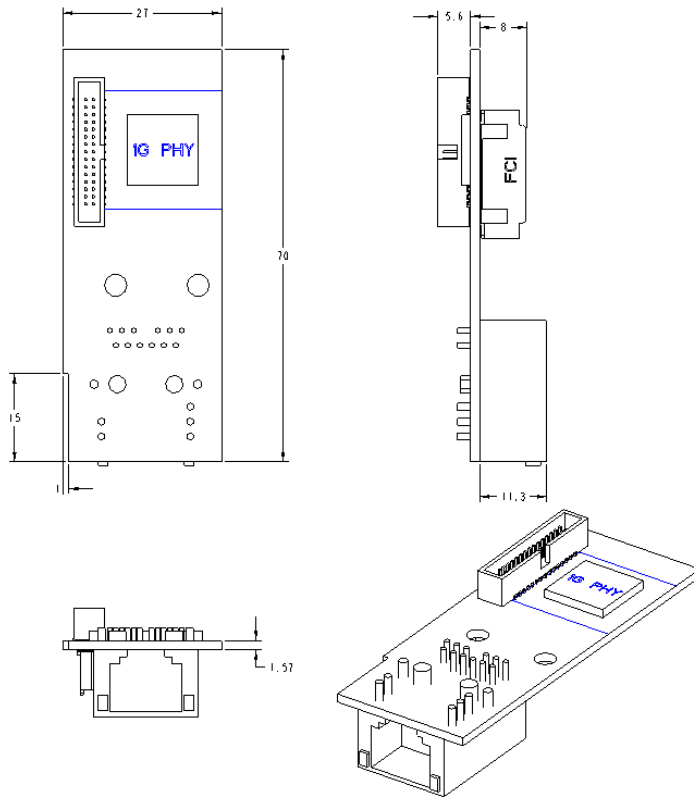
Figure 9. Dedicated Management NIC Mechanical Drawings

3.   Hardware Architecture

3.1   Integrated BMC Board Architecture

Intel® RMM4 utilizes the on-board ServerEngines* Pilot III Integrated Baseboard Management Controller (Integrated BMC). The Integrated BMC board architecture is displayed below:
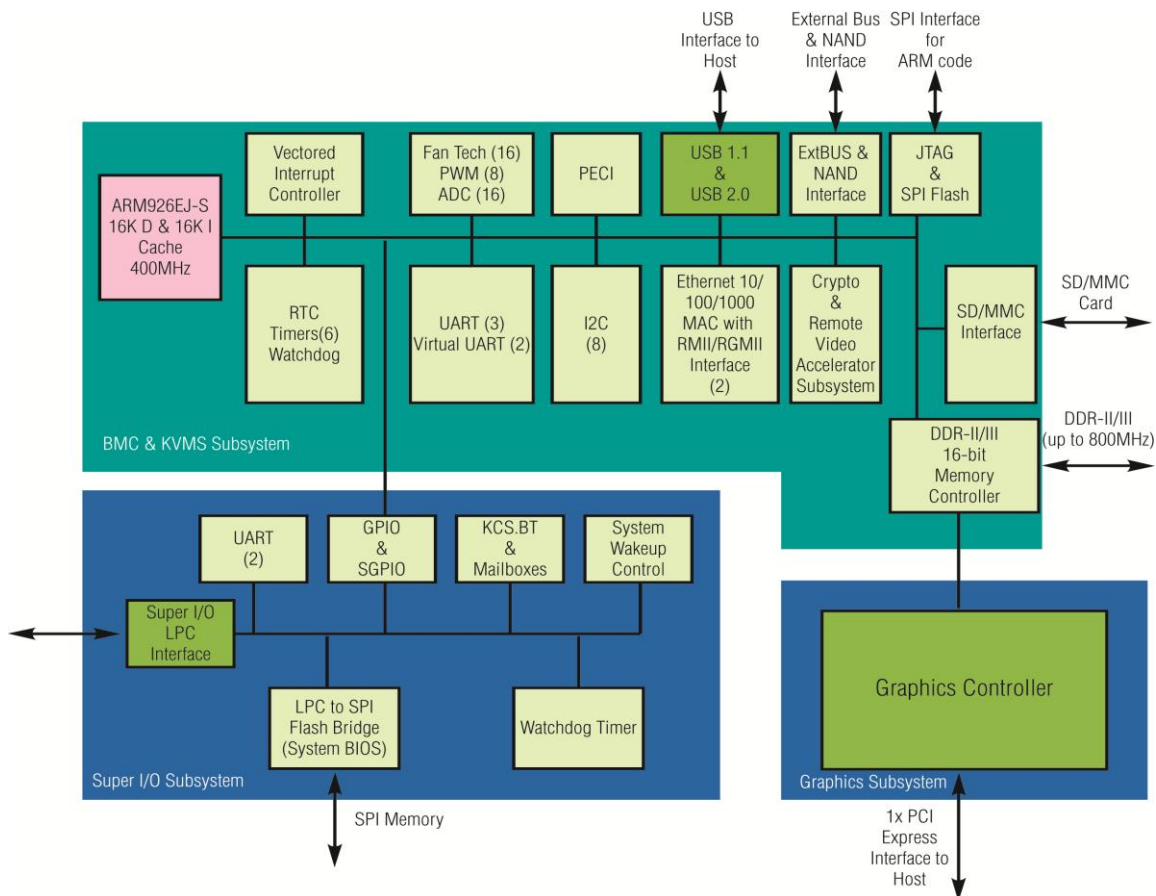
Figure 10. Integrated BMC Board Architecture

3.2   Integrated BMC Feature Set

At the center of the server management subsystem is the ServerEngines* Pilot III Integrated Baseboard Management Controller. Pilot III is a highly Integrated dual (controller and flash) chip solution. This device provides support for many platform functions including system video capabilities, legacy Super I/O functions, Heceta* hardware monitoring functions, and also provides an ARM* 926-EJ 400MHz microcontroller to host the embedded server management firmware stack.

Integrated BMC utilizes main host interfaces: LPC, PCI Express, SMBus* to ME and USB.

The LPC interface to the host is used for SIO and BMC communication. The LPC Bus interface provides IPMI Compliant KCS and BT interfaces The PCI Express interface is mainly used for the graphics controller interface to communicate with the host. The graphics controller is a VGA-compliant controller with 2D hardware acceleration and full bus master support.

The BMC functionality is implemented with an Integrated ARM9 processor. BMC and the host processor communicate through KCS3, KCS4, KCS5, BT, SMIC or Mailboxes. The software can use more than one interface to communicate with BMC. The host accesses these interfaces through the LPC interface.

BMC contains the following modules:

- Eight PWM Control and Sixteen Fan TACH Monitors

- Voltage Level Monitor and Temperature Monitor

- Platform Environment Control Interface (PECI)

- USB Devices

- Ethernet 10/100/1000 Port A and Port B

- Three UART Interfaces (UART3-5)

- Eight I2C Interfaces

- Real-Time Clock (RTC)

- Three Multi-Purpose Timers

- Interrupt Controller

- PS2 Controller (through the USB interface)

- LPC ROM Interface

- SPI Flash Interface

- Two Watchdog Timers

The host processor interfaces with the SIO blocks through the LPC interface. The SIO subsystem contains the following modules:

- LPC Host Interface

- Serial Port 1 (SP1) and Serial Port 2 (SP2)

- System Wake-up Control

- General-Purpose I/O (GPIO)

- Watchdog Timer

- Five KCS Interfaces (KCS1-5)

- BT Interface

- SMIC Interface

- Mailbox Interface

- Real-Time Clock (RTC)

- SPI Interface

- TAP Interface

Integrated BMC includes a VGA-compliant graphics controller with hardware acceleration for BLIT and 2D graphics. The graphics controller operates completely independent of the BMC; however it can be disabled by the BMC.

The graphics controller supports the following features:

- Integrated Matrox* graphics core

- 2D hardware graphics acceleration

- DDR3 memory interface 16bit up to 800Mbps and support up to 1GB of memory

- High-speed Integrated 24-bit RAMDAC

- Single-lane PCI Express host interface

Remote KVMS supports the following features:

- USB 2.0 interface for remote storage such as CD/DVD ROM and floppy

- USB 1.1 interface for PS2-to-USB bridging, remote keyboard and mouse

- Hardware-based video compression and redirection logic

- Supports both text and graphics redirection

- Hardware-assisted video redirection using the Frame Processing Engine

- Direct interface to the Integrated graphics controller registers and frame buffer

- Hardware-based encryption engine

3.3   RMM4 Block Diagram
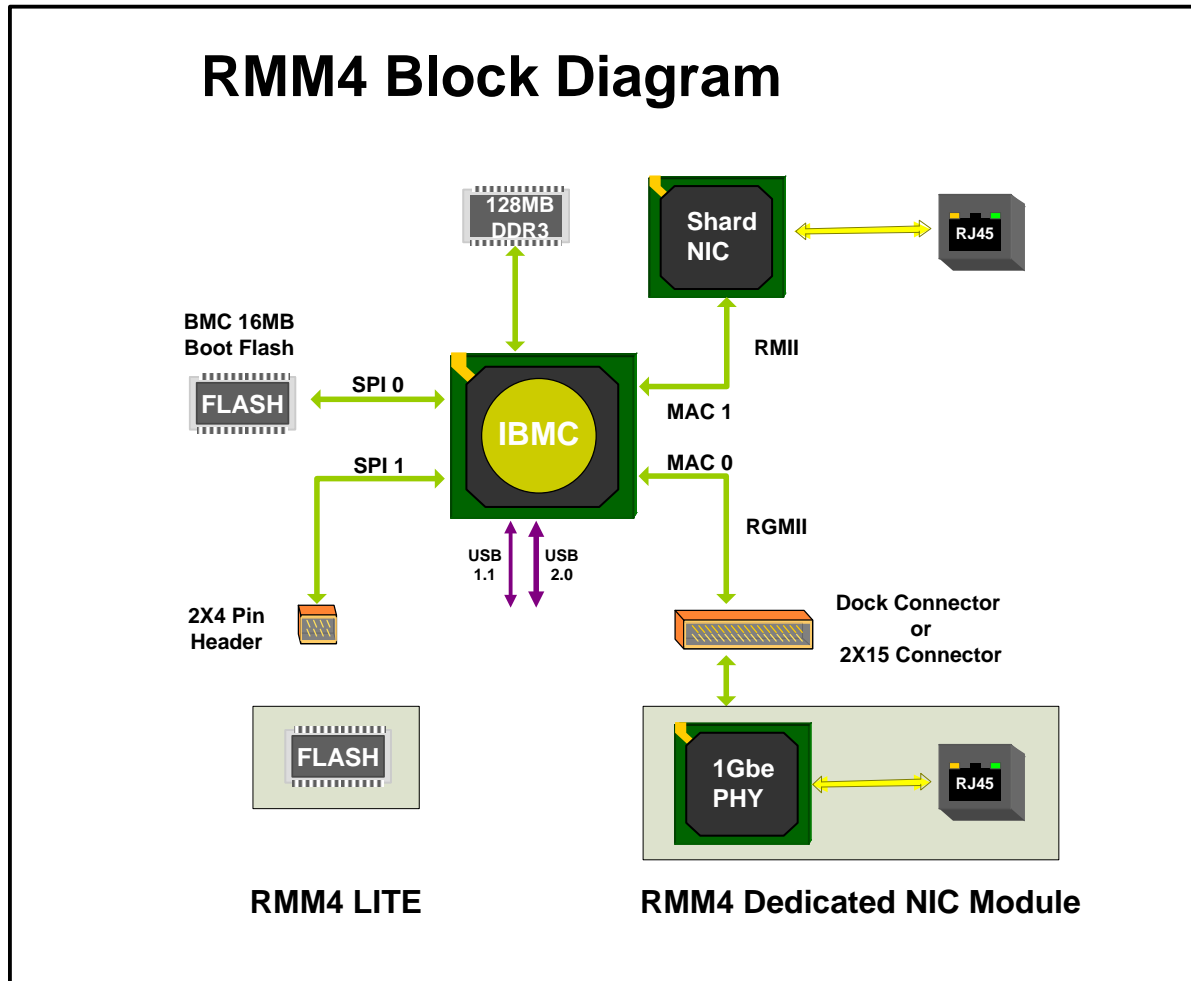
Figure 11. RMM4 Block Diagram

3.3.1   USB 2.0 (high-speed) Interface

A USB 2.0 (high-speed) interface supports the following:

- Virtual keyboard
- Virtual mouse
- Intel® RMM4 - Virtual Media

3.3.2   RMII and RGMII Interface

The Reduced Media Independent Interface (RMII) and Reduced Gigabit Media Independent Interface (RGMII) are standard for communication between an Ethernet MAC (Media Access Controller) device and an Ethernet PHY (Physical layer interface) device. Integrated BMC has a RMII link to onboard shred NIC PHY and has a RGMII link to the Intel® Dedicated Server Management NIC PHY for data and control.

3.3.3   128-MB DDR3 System Memory

The ServerEngines* Pilot III Baseboard Management Controller uses 128-MB DDR3 memory. This memory supports running the embedded Linux operating system and all other embedded firmware.

3.3.4   16-MB Flash

The embedded firmware includes the advanced features is stored in a 16-MB flash chip. This is attached to the SPI0 of Integrated BMC.

3.3.5   RMM4 Lite 1-MB Flash

RMM4 Lite is key to enable the advanced features of ServerEngines* Pilot III Baseboard Management Controller. RMM4 Lite has 1-MB Flash that connects to Integrated BMC SPI1.

3.4   Electrical Specification

3.4.1   RMM4 Lite Pin-outs

Table 2. RMM4 Lite Pin-outs

Pin	Signal Description	Pin	Signal Description
1	DI	2	VCC
3	CLK	4	KEY
5	GND	6	DO
7	GND	8	CS_N

3.4.1.1   Dedicated Management NIC

Table 3. DMN Docking Port (J1L1) Pin-outs

Pin	Signal Description	Pin	Signal Description
1	3V3_AUX	2	MDIO
3	3V3_AUX	4	MDC
5	GND	6	TXD_0
7	GND	8	TXD_1
9	GND	10	TXD_2
11	GND	12	TXD_3
13	GND	14	TX_CTL
15	GND	16	RX_CTL
17	GND	18	RXD_0
19	GND	20	RXD_1
21	GND	22	RXD_2
23	GND	24	RXD_3
25	GND	26	TX_CLK
27	GND	28	RX_CLK
29	GND	30	PRESENT
31	Reserved	32	Reserved
33	Reserved	34	Reserved
35	Reserved	36	Reserved
37	Reserved	38	Reserved
39	Reserved	40	Reserved

Table 4. DMN Cable Connector (J1A1) Pin-outs

Pin	Signal Description	Pin	Signal Description
1	3V3_AUX	2	MDIO
3	3V3_AUX	4	MDC
5	GND	6	TXD_0
7	GND	8	TXD_1
9	GND	10	TXD_2
11	GND	12	TXD_3
13	GND	14	TX_CTL
15	GND	16	RX_CTL
17	GND	18	RXD_0
19	GND	20	RXD_1
21	GND	22	RXD_2
23	GND	24	RXD_3
25	GND	26	TX_CLK
27	GND	28	RX_CLK
29	GND	30	PRESENT

3.5   Dedicated Management NIC Functionality

The following tables describe the Dedicated Management NIC LED Status indicators.

Note that the maximum network interface speed will be platform dependent. Please check your specific *Intel® Server Board Technical Product Specification* (TPS) for details.

Table 5. Dedicated Management NIC LED Status on S1200BTL

LED	Color	Condition	Functionality
Dedicated Management NIC Speed	Amber	On	1Gbps mode
	Green	On	100Mbps mode
		Off	10Mbps mode
Dedicated Management NIC Activity	Green	On	LAN link and no access
	Green	Blink	LAN access
		Off	Idle

Table 6. Dedicated Management NIC LED Status on EPSD Platforms Based on Intel® Xeon® Processor E5-4600/2600/2400/1600/1400 Product Families

LED	Color	Condition	Functionality
Dedicated Management NIC Speed	Green	On	1Gbps mode
	Amber	On	100Mbps mode
		Off	10Mbps mode
Dedicated Management NIC Activity	Green	On	LAN link and no access
	Green	Blink	LAN access
		Off	Idle

3.5.1   Dedicated Management NIC MAC Address

The Dedicated Management NIC MAC Address is derived from the main boards MAC Address and is also dependent upon the number of NIC that are built onto the main board.

For Intel® S1200BTL each server board has four MAC addresses assigned to it at the Intel factory. The printed MAC address is assigned to NIC1 on the server board.

- NIC 1 MAC address (for OS usage)

- NIC 2 MAC address = NIC 1 MAC address + 1 (for OS usage)

- BMC LAN channel 1 MAC address = NIC1 MAC address + 2

- BMC LAN channel 3 (DMN) MAC address = NIC1 MAC address + 3

For EPSD Platforms Based on Intel® Xeon® Processor E5 4600/2600/2400/1600 Product Families each server board has either five or seven MAC addresses assigned to it at the Intel factory. The printed MAC address is assigned to NIC1 on the server board.

If the platform has two NIC built into the main board then there will be five MAC addresses assigned as follows:

- NIC 1 MAC address (for OS usage)

- NIC 2 MAC address = NIC 1 MAC address + 1 (for OS usage)

- BMC LAN channel 1 MAC address = NIC1 MAC address + 2

- BMC LAN channel 2 MAC address = NIC1 MAC address + 3

- BMC LAN channel 3 (DMN) MAC address = NIC1 MAC address + 4

If the platform has four NIC built into the main board then there will be seven MAC addresses assigned as follows:

- NIC 1 MAC address (for OS usage)

- NIC 2 MAC address = NIC 1 MAC address + 1 (for OS usage)

- NIC 3 MAC address = NIC 1 MAC address + 2 (for OS usage)

- NIC 4 MAC address = NIC 1 MAC address + 3 (for OS usage)

- BMC LAN channel 1 MAC address = NIC1 MAC address + 4

- BMC LAN channel 2 MAC address = NIC1 MAC address + 5

- BMC LAN channel 3 (DMN) MAC address = NIC1 MAC address + 6

4.   Advanced Features

4.1   Enabling Advanced Management Features

The Advanced management features are to be delivered as part of the Integrated BMC FW image. The Integrated BMC's baseboard SPI flash contains code/data for both the Basic and Advanced features. An optional add-in card Intel® RMM4 Lite is used as the activation mechanism. When the BMC FW initializes, it attempts to access the Intel® RMM4 Lite. If the attempt to access Intel® RMM4 Lite is successful, then the BMC activates the advanced features that include KVM over LAN and Remote Media redirection.

Table 7. Integrated BMC Basic and Advanced Features

Feature	Basic	Advanced
IPMI 2.0 Feature Support	X	X
In-circuit BMC Firmware Update	X	X
FRB 2	X	X
Chassis Intrusion Detection	X	X
Fan Redundancy Monitoring	X	X
Hot-Swap Fan Support	X	X
Acoustic Management	X	X
Diagnostic Beep Code Support	X	X
Power State Retention	X	X
ARP/DHCP Support	X	X
PECI Thermal Management Support	X	X
E-mail Alerting	X	X
Embedded Web Server	X	X
SSH Support	X	X
KVM over LAN		X
Remote Media Redirection		X
Local Directory Access Protocol (LDAP)	X	X
Intel® Intelligent Power Node Manager Support	X	X
SMASH CLP	X	X

Advanced manageability features are supported over all NIC ports enabled for server manageability. This includes baseboard BMC-shared NICs as well as the LAN channel provided by the optional Intel® Dedicated Server Management NIC add-in card.

4.2   Keyboard, Video, Mouse (KVM) Redirection

The Integrated BMC firmware supports keyboard, video, and mouse redirection (KVM) over LAN. This feature is available remotely from the embedded web server as a Java applet. This feature is only enabled when the Intel® RMM4 Lite is present. The client system must have a Java Runtime Environment (JRE) version 6 or later to run the KVM or media redirection applets.

The Integrated BMC supports an embedded KVM application (Remote Console) that can be launched from the embedded web server from a remote console. USB1.1 or USB 2.0 based mouse and keyboard redirection are supported. It is also possible to use the KVM-redirection (KVM-r) session concurrently with media-redirection (media-r). This feature allows a user to interactively use the keyboard, video, and mouse (KVM) functions of the remote server as if the user were physically at the managed server.

The KVM-redirection feature automatically senses video resolution for best possible screen capture and provides high-performance mouse tracking and synchronization. It allows remote viewing and configuration in pre-boot POST and BIOS setup, once BIOS has initialized video.

Other attributes of this feature include:

 ▪ Encryption of the redirected screen, keyboard, and mouse

 ▪ Compression of the redirected screen

4.2.1   Remote Console

The Remote Console is the redirected screen, keyboard and mouse of the remote host system. To use the Remote Console window of your managed host system, the browser must include a Java* Runtime Environment plug-in. If the browser has no Java support, such as with a small handheld device, the user can maintain the remote host system using the administration forms displayed by the browser.

The Remote Console window is a Java Applet that establishes TCP connections to the Integrated BMC. The protocol that is run over these connections is a unique KVM protocol and not HTTP or HTTPS. This protocol uses ports #7578 for KVM, #5120 for CDROM media redirection, and #5123 for Floppy/USB media redirection (both supporting encryption).

4.2.2   Performance

The remote display accurately represents the local display. The feature adapts to changes to the video resolution of the local display and continues to work smoothly when the system transitions from graphics to text or vice-versa. The responsiveness may be slightly delayed depending on the bandwidth and latency of the network.

 Enabling KVM and/or media encryption will degrade performance. Enabling video compression provides the fastest response while disabling compression provides better video quality.

For the best possible KVM performance, a 2Mb/sec link or higher is recommended.

The redirection of KVM over IP is performed in parallel with the local KVM without affecting the local KVM operation.

4.2.3   Security

The KVM redirection feature supports multiple encryption algorithms, including RC4 and AES. The actual algorithm that is used is negotiated with the client based on the client's capabilities.

4.2.4   Availability

The remote KVM session is available even when the server is powered-off (in stand-by mode). No re-start of the remote KVM session shall be required during a server reset or power on/off. An Integrated BMC reset (for example, due to an Integrated BMC Watchdog initiated reset or an Integrated BMC reset after an Integrated BMC FW update) will require the session to be re-established.

KVM sessions persist across system reset, but not across an AC power loss.

4.2.5   Timeout

The remote KVM session will automatically timeout after a configurable amount of time (30 minutes is the default).

Remote KVM activation does not disable the local system keyboard, video, or mouse.

4.2.6   Usage

As the server is powered up, the remote KVM session displays the complete BIOS boot process. The user is able to interact with the BIOS setup, change and save settings as well as enter and interact with option ROM configuration screens.

At least two concurrent remote KVM sessions are supported. It is possible for at least two different users to connect to same server and start remote KVM sessions.

4.3   Media Redirection

The embedded web server provides a Java applet to enable remote media redirection. This may be used in conjunction with the remote KVM feature, or as a standalone applet.

The media redirection feature is intended to allow system administrators or users to mount a remote IDE or USB CD-ROM, floppy drive, or a USB flash disk as a remote device to the server. Once mounted, the remote device appears just like a local device to the server, allowing system administrators or users to install software (including operating systems), copy files, update BIOS, and so on, or boot the server from this device.

The following capabilities are supported:

- The operation of remotely mounted devices is independent of the local devices on the server. Both remote and local devices are useable in parallel.

- Either IDE (CD-ROM, floppy) or USB devices can be mounted as a remote device to the server.

- It is possible to boot all supported operating systems from the remotely mounted device and to boot from disk IMAGE (*.IMG) and CD-ROM or DVD-ROM ISO files. See the Tested/supported Operating System List for more information.

- Media redirection shall support redirection for a minimum of two virtual devices concurrently with any combination of devices. As an example, a user could redirect two CD or two USB devices.

- The media redirection feature supports multiple encryption algorithms, including RC4 and AES. The actual algorithm that is used is negotiated with the client based on the client's capabilities.

- A remote media session is maintained even when the server is powered-off (in standby mode). No restart of the remote media session is required during a server reset or power on/off. Integrated BMC reset will require the session to be re-established

- The mounted device is visible to (and useable by) managed system's OS and BIOS in both pre-boot and post-boot states.

- The mounted device shows up in the BIOS boot order and it is possible to change the BIOS boot order to boot from this remote device.

- It is possible to install an operating system on a bare metal server (no OS present) using the remotely mounted device. This may also require the use of KVM-r to configure the OS during install.

USB storage devices will appear as floppy disks over media redirection. This allows for the installation of device drivers during OS installation.

If either a virtual IDE or virtual floppy device is remotely attached during system boot, both the virtual IDE and virtual floppy are presented as bootable devices. It is not possible to present only a single-mounted device type to the system BIOS.

4.3.1 Availability

The default inactivity timeout is 30 minutes and is not user-configurable.

Media redirection sessions persist across system reset but not across an AC power loss or BMC reset.

4.4 Network Port Usage

The KVM and media redirection features use the following TCP ports:

- 5120 – CD Redirection

- 5123 – FD Redirection

- 5124 – CD Redirection (Secure)

- 5127 – FD Redirection (Secure)

- 7578 – Video Redirection

- 7582 – Video Redirection (Secure)

Glossary

Word/Acronym	Definition
ARP	Address resolution protocol
BMC	Baseboard Management Controller
CLI	Command line interface
DDC	Display Data Channel
DHCP	Dynamic Host Configuration Protocol
DVC	Dambrackas Video Compression
DVO	Dynamic Visual Output
FPGA	Field Programmable Gate Array
ICMP	Internet Control Message Protocol
Intel® RMM4	Intel® Remote Management Module 4
Intel® RMM4 Lite	Intel® Remote Management Module 4 Lite
Intel® DMN	Intel® Dedicated Server Management NIC
IPMI	Intelligent Platform Management Interface
ITE	Information Technology Equipment
KVM	Keyboard, video and mouse
MAC	Media Access Controller
OOB	Out-Of-Band- No operating system interaction on Server
PBDE	Polybrominated Biphenyls Diphenyl Ethers
RMII	Reduced Media Independent Interface
RGMII	Reduced Giga bit Media Independent Interface
RTC	Real-Time Clock
TCP/IP	Transmission Control Protocol/Internet Protocol
TPS	Technical Product Specification
UART	Universal asynchronous receiver transmitter
UDP	User Datagram Protocol