Huawei G5500 Server

1.0.0

White Paper

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1 Product Overview

1.1 Overview

Rapid advancements in applied computing, such as artificial intelligence (AI), high-performance computing (HPC), and big data analytics, mean growing demand for computing power. As we reach the limit of Moore's law, memory and power consumption become the limiting factor to facing this challenge. A viable solution is heterogeneous computing, which allows for flexible combinations of CPU, GPU, FPGA, and ASIC processors and multiplies computing performance and energy efficiency exponentially.

Nowadays, deep learning algorithms are developing rapidly in the AI field. Typical examples are that AlphaGo defeats the world's No.1 Go player and the face recognition accuracy offered by visual computing outperforms human eyes. With the help of heterogeneous computing in data training and reasoning, outstanding achievements are also recorded in the fields such as financial, auxiliary clinical treatment, automatic driving, and public security.

Huawei FusionServer G5500 (G5500 for short) is a heterogeneous computing server dedicated for AI, HPC, cloud computing, and big data processing. It has been optimized to adapt to service scenarios such as HPC as well as data training and inference for deep learning. It supports heterogeneous processors including CPU, GPU, and FPGA and applies both to enterprise and public cloud deployments.

The G5500 is a 4U modular server that features excellent computing performance, flexible orchestration, high-performance large-capacity built-in storage, and easy maintenance.

Market positioning of the G5500 is as follows:

- A flexibly orchestratable, high-performance, and easy-to-maintain basic hardware platform for AI training and cloud services in Internet and data center scenarios
- A high-bandwidth AI deep learning inference hardware platform for safe city video analytics
- A high-performance hardware platform for HPC applications

Figure 1-1 shows the G5500 appearance.

Figure 1-1 G5500 appearance

1.2 Product Features

Excellent heterogeneous computing capabilities

- Supports NVIDIA GPU and Intel CPU thermal design power (TDP)
- Supports configuration of two CPUs and 24 DIMMs to address applications requiring high memory capacity, for example, large-scale neural network model training.

Flexibly orchestratable for performance optimization in HPC or AI scenarios

- Supports GPU topology orchestration with one-click configuration.
- Supports configuration of single or dual nodes as well as different topologies.

Industry-leading storage performance and capacity

- Supports RAID 1 configuration for the disk on which the OS is installed.
- Provides built-in NVMe disks that support a maximum bandwidth of 24 GB/s for AI training and HPC high-performance storage.
- Provides built-in 80 TB large-capacity RAID 6 permanent storage, significantly reducing the cost of external NAS storage devices.

Modular, future-ready architecture

- Supports GPU and CPU decoupling and independent evolution to protect customer investment.
- Adopts a modular design that helps improve the maintenance efficiency while reducing the maintenance cost and service interruption time.
- Uses chassis that support evolution of CPU and GPU power consumption and heat dissipation technologies in the coming 3 to 5 years and high-speed backplanes that support PCIe Gen3/Gen4.

Redundancy design and high reliability

- Uses a passive busbar backplane design that supports high current, which is more secure and stable.
- Supports redundant fan modules and PSUs as well as RAID configuration for storage, preventing data loss and service interruption.

2 System Architecture

2.1 Logical Architecture

Logically, the G5500 is comprised of six modules: general-purpose computing module (x86), heterogeneous computing module (GPU/FPGA), I/O module, chassis management module, fan module, and PSU.

The general-purpose computing module, heterogeneous computing module, and I/O module logically comprise a unified compute node through the backplane high-speed service bus (PCIe). The compute node supports two form factors, full-width and half-width. In the full-width configuration, a chassis can house a single node; in the half-width configuration, a chassis can house two nodes. The I/O module provides external ports through a standard PCIe card, and the compute node provides external ports through the management module (MM) by way of LAN on motherboard (LOM).

All modules communicate through the backplane management bus. In addition to modules, the management module also manages nodes, fans, and PSUs of the entire chassis.

- **Figure 2-1** shows the logical system architecture.

Figure 2-1 Logical architecture of the G5500
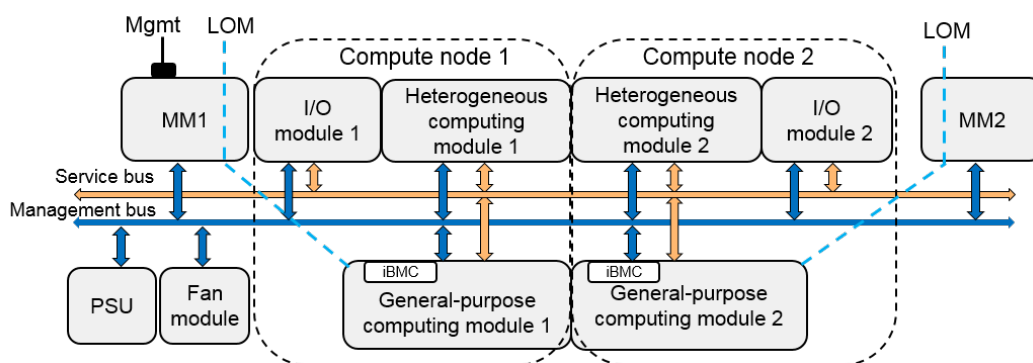
The G5500 supports multiple configuration and logical topologies. The full-width configuration supports the cascaded and balanced topologies. Topologies can be configured using the management software to quickly adapt to different service scenarios to achieve the optimal performance. The half-width configuration supports the deep learning inference topology.

- **Figure 2-2** shows the full-width node cascaded topology. The ratio of CPUs to GPUs is 1:8. This topology supports P2P between GPUDirect[TM] RDMA and eight GPUs for large-scale deep learning.

Figure 2-2 Full-width node cascaded topology
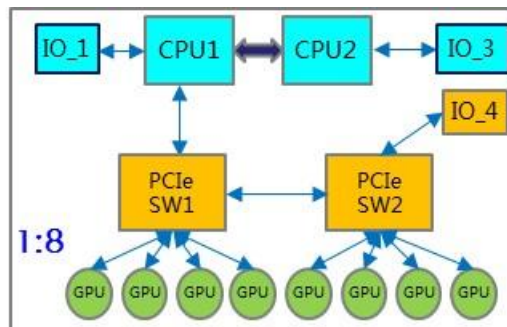
- **Figure 2-3** shows the full-width node balanced topology. The ratio of CPUs to GPUs is 1:4. This topology supports P2P between GPUDirect[TM] RDMA and four GPUs for small- and medium-scale deep learning.

Figure 2-3 Full-width node balanced topology
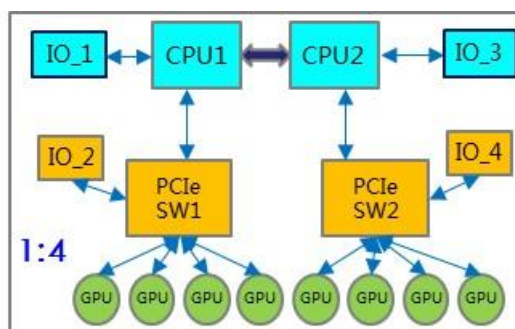
- **Figure 2-4** shows the half-width node deep learning inference topology. The half-width configuration supports a maximum of 16 half-height half-length P4 GPGPU cards. The ratio of CPUs to GPUs is 1:8. This configuration applies to the deep learning inference scenario.

Figure 2-4 Half-width node deep learning inference topology
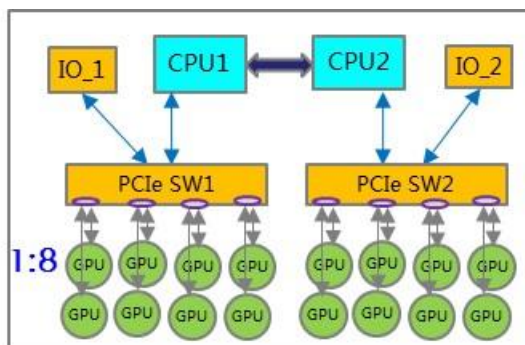
2.2 Server Design

The design used by the G5500 has the following features:

- The server is 4U high and can be installed in a standard 19-inch cabinet. Two types of compute nodes, full-width and half-width, are supported. A chassis can house one full-width compute node or two half-width compute nodes.

- The server adopts the full modular design. Components including fans, PSUs, I/O modules, chassis management modules, general-purpose computing modules, and heterogeneous computing modules are hot-swappable and can be maintained without being removed.

- The PSUs share a 12 V DC bus and support N+N redundancy.

- Fans are configured as fan trays in N+1 redundancy mode to improve the heat dissipation efficiency and reliability and tolerate single failures of fans.

Figure 2-5 shows the system architecture of the G5500.

Figure 2-5 System architecture of the G5500
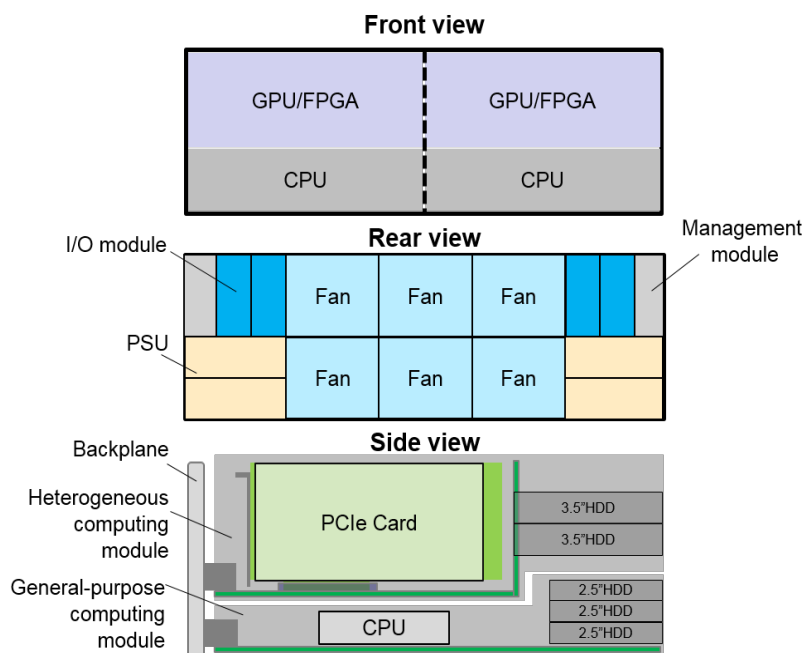
📖**NOTE**

- To make full use of space and prevent heterogeneous modules from being violently removed, the heterogeneous computing modules in the upper slots and the general-purpose computing modules in the lower slots are staggered. To maintain these modules, you need to follow the specified sequence.

- During installation, install the heterogeneous computing modules in the upper slots and then the general-purpose computing modules in the lower slots.

- During removal, remove the general-purpose computing modules in the lower slots and then the heterogeneous computing modules in the upper slots.

2.3 Heat Dissipation Design

- Front-to-rear ventilation: The system draws in air from the front of the chassis, delivers the cool air to the hard disks, processors, and dual in-line memory modules (DIMMs), and then discharges warm air through the rear of the chassis.

- Independent air channel for CPUs and GPUs: CPUs and GPUs are separately located in the upper and lower slots. An independent air channel is equipped for each channel, helping to achieve the optimal heat dissipation effect.

- Heat dissipation for PSUs: PSUs are located on both sides at the rear of the chassis. An independent air channel is reserved on either chassis side to enable cooling of PSUs by using built-in fans.

- Heat dissipation for the management module and I/O module: The two modules are located in the upper part at the rear of the chassis. Cooling of the two modules is implemented through the returned air of built-in fans.

- Optimized heat dissipation design:
    - High pressure counter-rotating fans improve the air volume by 10% compared with ordinary fans.
    - Refined ventilation channels place the focus of heat dissipation on thermosensitive components.
    - Scientific layout of temperature sensors enables complete coverage of hot spots and accurate fan speed adjustment.
    - The panel honeycomb design achieves a porosity rate of up to 66%, which is 10% higher than the square hole design.
    - The PID algorithm enables smooth and efficient fan speed adjustment, allowing the system to operate at a temperature below 35℃ (95℉) in the long term.

Figure 2-6 Ventilation channels (front view)
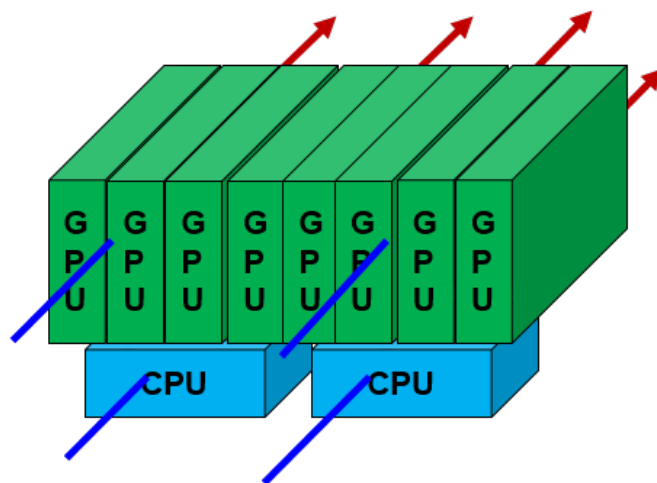
Figure 2-7 Ventilation channels (top view)
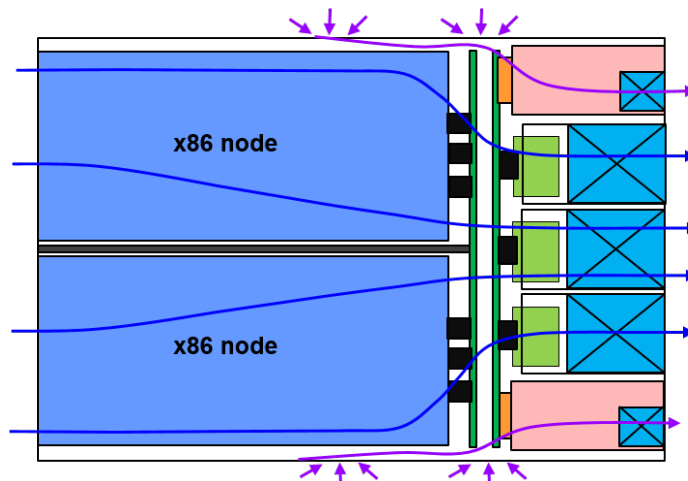
2.4 Management System

- The system uses a dual-layer architecture that comprises the Integrated Baseboard Management Controller (iBMC) and the Hyper Management Module (HMM). The iBMC on each compute node manages the node through the Intelligent Platform Management Interface (IPMI), KVM, or virtual DVD-ROM drive. The HMM manages fan modules, PSUs, and chassis assets.

- Ports of the iBMC and HMM are converged through the built-in switch of the chassis management module. Users can access the HMM and iBMC over a GE port to carry out chassis and node management.

- The HMM adjusts speeds and manages alarms of all fan modules through the I^2C bus centrally. It sends management commands to fan modules, which then deliver pulse-width modulation (PWM) signals to fans.

- The HMM determines proper fan speeds based on the temperature of temperature-sensitive components on each board and the ambient temperature, and then sends the speed adjustment command to the fan modules.

- The HMM manages each two PSUs through one I^{2}C bus. It detects the operating status and PWROK status of the PSUs by using GPIO pins and reports alarms when detecting an exception. It supports query of the output power and service status of PSUs as well as reporting of power alarms.

  Figure 2-8 shows the management system of the G5500.

Figure 2-8 Management system of the G5500
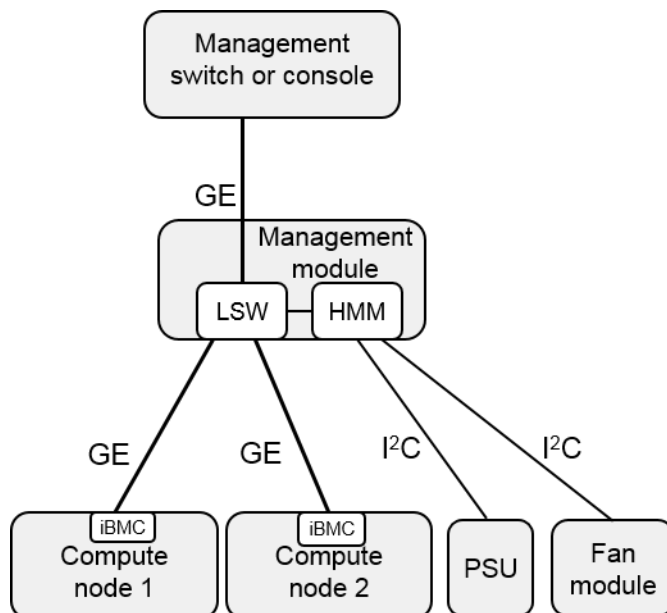
3 Hardware Description

3.1 Module List

The G5500 adopts a modular design. **Table 3-1** describes the modules of the G5500.

Table 3-1 List of modules

Model	Type	Description
G5500	4U chassis	Chassis used by the G5500.
MM510	Chassis management module	Module used by the G5500 for chassis management.
EX500	I/O module	I/O module of the G5500, which supports two half-height half-length PCIe cards.
G560	Full-width general-purpose computing module	G560: supporting Intel$^®$Xeon$^®$ E5-2600 V4 CPUs
G530	Half-width general-purpose computing module	G530 V2: supporting Intel$^®$Xeon$^®$ Scalable CPUs

Mode l	Type	Description
GP6xx	Full-width heterogeneous computing module (for G560)	xx: the maximum number of heterogeneous computing modules supported
GP3xx	Half-width heterogeneous computing module (for G530 V2)	GP608: full-width, supporting 8 full-height full-length dual-slot PCIe cards. GP316: half-width, supporting 16 half-height half-length single-slot PCIe cards

📖**NOTE**

Both the general-purpose computing modules and heterogeneous computing modules do not support mixed configuration of full-width and half-width nodes.

3.2 Appearance

Front Panel

- **Figure 3-1** shows the front panel of the G5500 equipped with a full-width node.

Figure 3-1 Front panel of the G5500 equipped with a full-width node
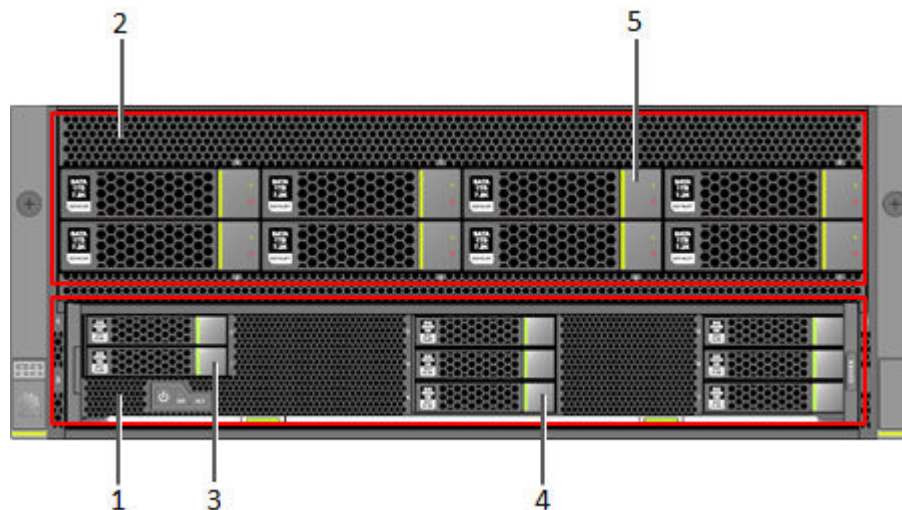
1	General-purpose computing module 1	2	Heterogeneous computing module 1
3	2.5-inch SAS/SATA hard disk	4	2.5-inch NVMe SSD
5	3.5-inch SAS/SATA hard disk	-	-

- **Figure 3-2** shows the front panel of the G5500 equipped with half-width nodes.

Figure 3-2 Front panel of the G5500 equipped with half-width nodes
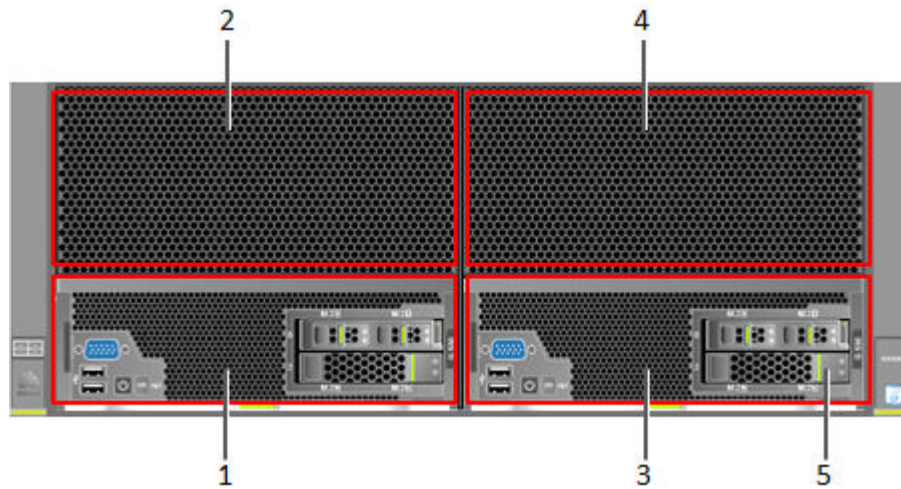
1	General-purpose computing module 1	2	Heterogeneous computing module 1
3	General-purpose computing module 2	4	Heterogeneous computing module 2
5	2.5-inch SAS/SATA hard disk or NVMe SSD	-	-

Rear Panel

- The rear panel of the G5500 consists of chassis management modules, I/O modules, fan modules, and PSUs, as shown in **Figure 3-3**.

Figure 3-3 Rear panel of the G5500
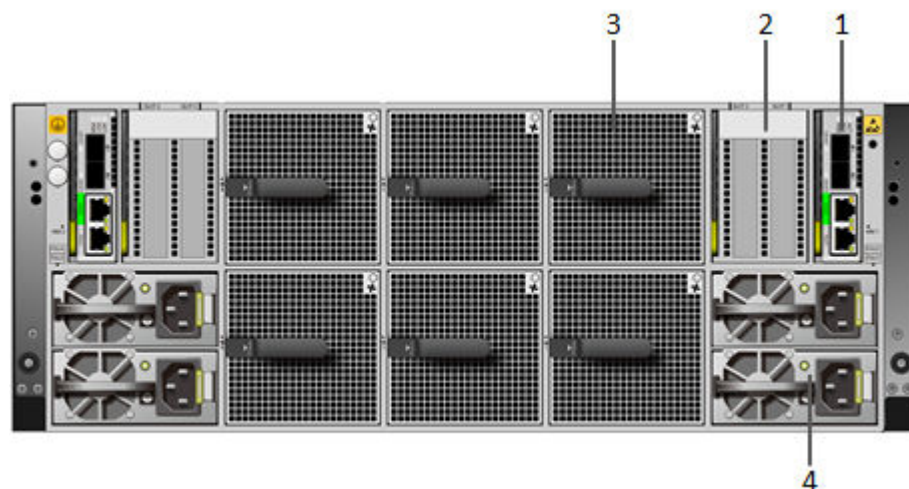
1	Chassis management module	2	I/O module
3	Fan module	4	PSU

3.3 Compute Nodes

The G5500 is comprised of general-purpose computing nodes and heterogeneous computing nodes.

- **Figure 3-4** shows a full-width general-purpose computing node G560.

Figure 3-4 G560 appearance

- **Figure 3-4** shows a full-width heterogeneous computing node GP608.

Figure 3-5 GP608 appearance

- **Figure 3-6** shows a half-width general-purpose computing node G530 V2.

Figure 3-6 G530 V2 appearance

● **Figure 3-4** shows a half-width heterogeneous computing node GP316.

Figure 3-7 GP316 appearance

📖**NOTE**

● For details about full-width compute nodes, see the *Huawei G5500 Server G560 Compute Node White Paper*.

● For details about half-width compute nodes, see the *Huawei G5500 Server G530 Compute Node White Paper*.

3.4 I/O Modules

The G5500 provides two I/O modules at the rear of its chassis. Each I/O module provides two extended half-height half-width PCIe x16 slots. One chassis supports four PCIe slots in total.

● **Figure 3-8** shows an I/O module.

Figure 3-8 Appearance of an I/O module
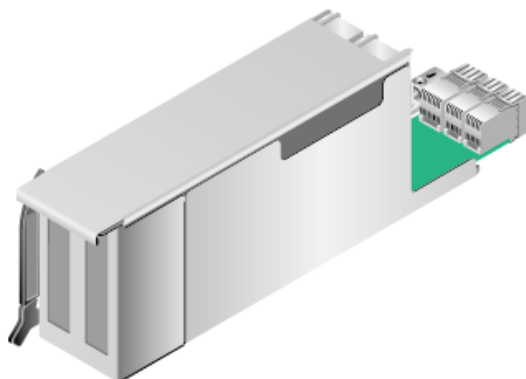
● Each I/O module has two PCIe slots, as shown in **Figure 3-9**.

Figure 3-9 Positions of PCIe slots
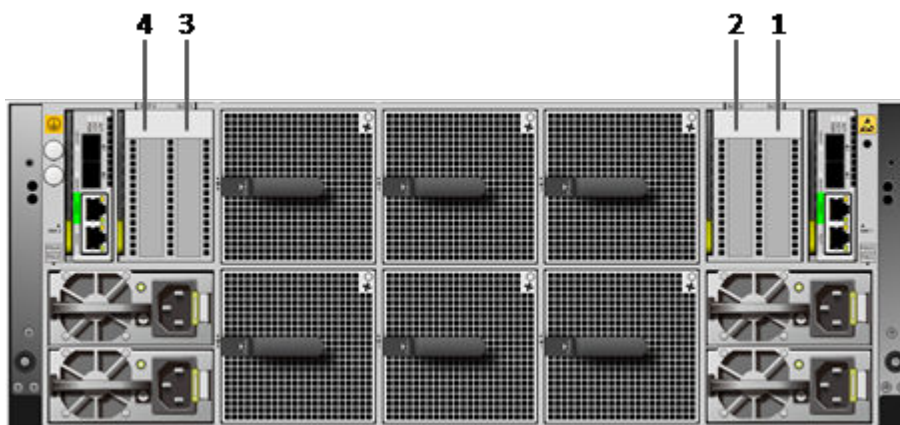
1	SLOT1	2	SLOT2
3	SLOT3	4	SLOT4

● **Table 3-2** lists the mapping between PCIe slots and compute nodes.

Table 3-2 Mapping between PCIe slots and compute nodes

PCIe Slot	Connected Compute Node (Full-Width)	Connected Compute Node (Half-width)
Slot 1	Compute node 1	Compute node 1
Slot 2	Compute node 1	Compute node 1
Slot 3	Compute node 1	Compute node 2
Slot 4	Compute node 1	Compute node 2

● **Table 3-3** lists the technical specifications of PCIe slots.

Table 3-3 Technical specifications of PCIe slots

Item	Specifications	Description
Dimensions (H x L)	68.90 mm × 167.65 mm (2.71 in. x 6.6 in.)	Half-height half-length
Maximum power consumption	50 W	Single slot

For details about available PCIe card options, see the *Huawei Server Compatibility List*.

3.5 Chassis Management Modules

The MM510, chassis management module of the G5500, manages the fans, PSUs, and assets of the chassis. In addition, it converges the management ports of compute nodes and provides unified management ports externally.

Figure 3-10 shows the positions of chassis management modules.

Figure 3-10 Positions of chassis management modules
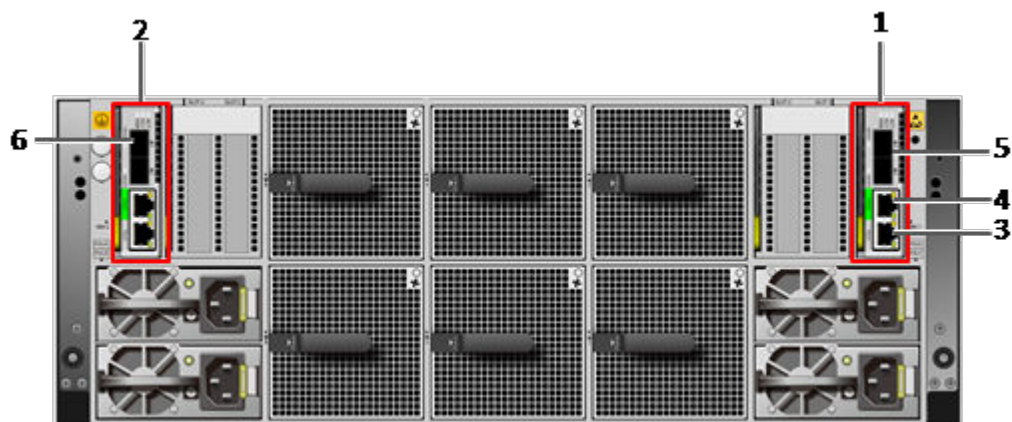
1	Management module 1 (MM1), mandatory	2	Management module 2 (MM2), optional
3	1000BASE-T management port	4	Serial port
5	LOM port from compute node 1	6	LOM port from compute node 2

The main functions and configuration principles of the chassis management module are as follows:

● MM1: Mandatory. It supports the management port convergence function. It provides two LOM ports from compute node 1.

● MM2: Optional. It does not support the management port convergence function. It provides two LOM ports from compute node 2.

● It is recommended that a chassis management module be configured in the MM2 slot only when half-width compute node 2 is configured and LOM ports need to be provided.

Figure 3-11 shows a chassis management module.

Figure 3-11 Appearance of a chassis management module
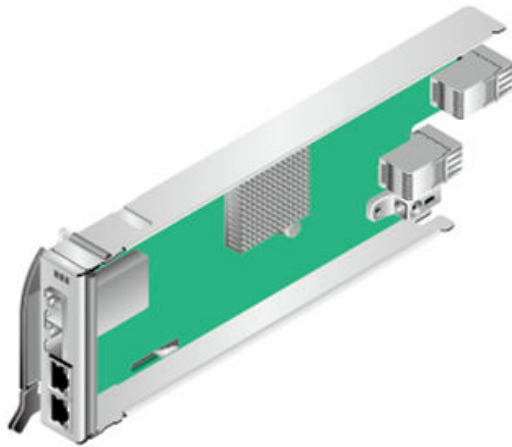
Figure 3-12 shows the panel of the chassis management module.

Figure 3-12 Panel of the chassis management module
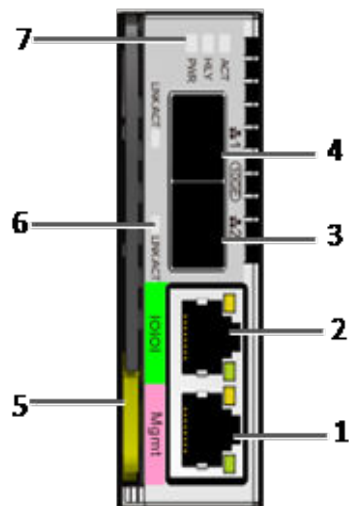
1	1000BASE-T management port	2	Serial port
3	10GE optical port 2 (LOM)	4	10GE optical port 1 (LOM)
5	Ejector lever	6	10GE port indicator

7	Management module indicator	-	-

NOTE

- The LOM network interface card (NIC) of the compute node provides external ports through the management module. Replacing the management module affects the LOM function.
- The LOM function is supported from the Xeon Scalable series.

3.6 Fan Modules

The G5500 is equipped with six hot-swappable fan modules. It adopts a design that provides front-to-back ventilation channels to accelerate air flows.

Figure 3-13 shows a fan module.

Figure 3-13 Appearance of a fan module
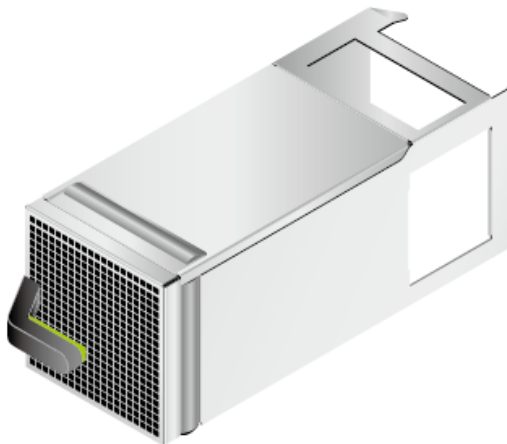
Table 3-4 describes the indicators on a fan module.

Table 3-4 Indicators on a fan module

Name	Color	State	Description
Operating status indicator	Red or green	Off	There is no power supply.
		Blinking red at 0.5 Hz	The fan module has an alarm.
		Blinking green at 0.5 Hz	The fan module is communicating with the management module properly.
		Blinking green at 4 Hz	The fan module is not communicating with the management module properly.

3.7 PSUs

The G5500 is equipped with four power supply units (PSUs), which support both AC input and high-voltage DC input.

The input voltage and output power of the PSUs are as follows:

- AC input: 200 V AC to 240 V AC, 2200 W
- AC input: 100 V AC to 120 V AC, 1200 W
- High-voltage DC input: 240 V DC, 2200 W

The output voltage of the PSUs is 12 V DC.

Figure 3-14 shows a PSU.

Figure 3-14 Appearance of a 2200 W PSU
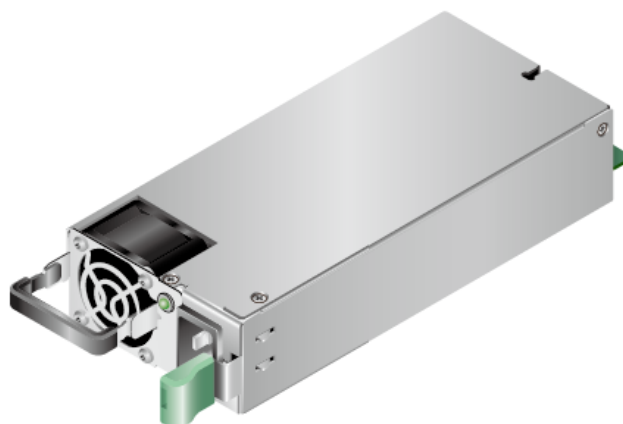
The PSU has a handle, an AC power input socket, an operating status indicator, and a latch, as shown in **Figure 3-15**.

Figure 3-15 PSU panel
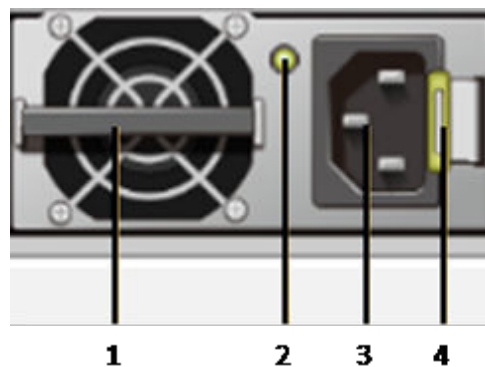
1	Handle	2	Indicator

3	C20 power socket	4	Latch

Table 3-5 describes the indicator on an AC PSU.

Table 3-5 Indicator on an AC PSU

Name	Color	State	Description
PSU status indicator	Green/ Orange	Off	There is no power supply, or the PSU is faulty.
		Green	The PSU is operating properly.
		Orange	Power protection is enabled and no output power is supplied.

□NOTE

If the input current of the 2200 W power supply exceeds 10 A, a 16 A power cable and terminal are required.

4 Security Management

4.1 TPM

Compute nodes support security solutions based on the Trusted Platform Module (TPM).

TPM is a security chip that complies with the Trusted Computing Group (TCG) TPM specification. The TPM is a hardware-based system security function module. TPM 2.0 provides functions such as data encryption, password protection, authentication, and internal resource protection.

A TPM is installed on a compute node and connected to the compute node over a port. To ensure data security at the hardware level, users are allowed to access a compute node with the TPM only after authorization and authentication and in the specified way.

4.2 Management Module

Security management of the management module consists of hyper management module (HMM) command-line based hierarchical protection, remote Secure Shell (SSH) logins, and Simple Network Management Protocol (SNMP) encrypted authentication.

Command Line-based Hierarchical Protection

When a user logs in to an HMM through an Ethernet port, the HMM authenticates the user to ensure security. Only the user that passes the authentication can log in to the HMM to perform configuration and maintenance.

The HMM uses a hierarchical protection mode for commands. Commands are classified into the following three levels in ascending order: monitoring level, configuration level, and management level. Similarly, login users are also classified into three levels: common user, operator, and administrator. Users can use only the commands of the levels that are equal to or lower than their own levels. This mechanism effectively controls the authority of login users.

Remote SSH Login

The HMM supports Secure Shell (SSH). SSH provides authentication for user logins and helps defend against various attacks on a non-secure network. The HMM also supports Secure File Transfer Protocol (SFTP), which provides encryption protection for file transfer.

SNMP Encrypted Authentication

The HMM supports SNMPv3 and SNMPv3 Trap encrypted authentications. If the HMM is managed by a network management system through the SNMP protocol, the HMM uses the encrypted authentication mode offered by the user-based security model (USM) to ensure security.

The SNMP version can be SNMPv3 or SNMPv3 Trap. Both versions support the MD5 or SHA authentication modes and the DES or AES encryption modes. The MD5 authentication mode is used by default, which is not secure and easy to be cracked. Therefore, the SHA algorithm is recommended.

📖**NOTE**

The HMM also supports the SNMPv1, SNMPv2c, FTP, and Telnet protocols, which are disabled by default for security purposes. If you need to use these functions, contact Huawei technical support.

5 Management Features

The G5500 provides the HMM+iBMC dual-layer management architecture:

- Independent node management

  The G5500 uses new-generation Huawei proprietary iBMC intelligent management system to implement remote server management. The iBMC complies with IPMI 2.0 and Redfish specifications and provides highly reliable hardware monitoring and management.

- Out-of-band aggregation management

  The G5500 uses the HMM to manage fans, PSUs, and assets in each chassis. The HMM is not directly accessible by users. Its GUI is incorporated on the iBMC. Users can access the iBMC over the GE port on MM1.

5.1 iBMC Features

5.2 HMM Features

5.1 iBMC Features

The iBMC provides the following features:

- KVM and text console redirection
- Remote virtual media
- IPMI V2.0
- SNMPv3
- Redfish 1.0.
- Common information model (CIM)
- Login using a web browser
- Black box

Table 5-1 describes the iBMC features.

Table 5-1 iBMC features

Feature	Description
Support for multiple management ports	Supports integration with any standard management system using the following interfaces: ● IPMI 2.0 ● CLI ● HTTPS ● SNMPv3 ● Web ● Redfish 1.0
Node fault detection	Detects hardware faults and accurately locates faults to the component level.
Node alarm management	Supports alarm management and reports alarms using the SNMP Trap, Simple Mail Transfer Protocol (SMTP), Event, SMTP or syslog service to ensure 24/7 continuous operation.
Integrated virtual KVM	Provides remote maintenance measures to improve the troubleshooting efficiency. A maximum resolution of 1280 x 1024 is supported.
Integrated virtual media	Virtualizes local media devices or images to media devices on a remote server, which simplifies OS installation. A maximum transmission rate of 8 MB/s is supported.
WebUI	Provides a user-friendly GUI that helps simplify users' configuration and query operations. The iBMC WebUI supports the following browsers: ● Internet Explorer 9.0/10.0/11.0 ● Mozilla Firefox 26.0/39.0 ● Chrome 21.0/44.0 ● Safari 8.0 ● JRE 1.7.0 U40 ● JRE 1.8.0 U45
Fault reproduction	Reproduces faults to facilitate fault diagnosis.
Screen snapshot and screen video	Allows you to view screenshots and videos without login, which facilitates routine preventive maintenance inspection (PMI).
Domain Name Service (DNS)/Active Directory (AD)	Provides the DNS and AD services, which significantly simplify network and configuration management.
Dual-image backup	Starts software from a backup image if the software fails.
IPv6	Supports IPv6 to ensure sufficiency of IP addresses.

5.2 HMM Features

The HMM provides the following features:

- IPMI V2.0
- Support for Redfish management ports
- Login over CLI
- Out-of-band aggregation management
- Heat dissipation and power management

Table 5-2 describes the HMM features.

Table 5-2 HMM features

Feature	Description
Server management port	Supports integration with any standard management system using the following interfaces: - IPMI 2.0 - CLI - Redfish
HMM hot swap	Supports replacement of a failed HMM without powering off the system to quickly restore the HMM back to normal operation.
Chassis asset management	Supports intelligent asset management.
Out-of-band aggregation management	Integrates the out-of-band management of all server nodes in the chassis, which helps reduce cabling in the management network and shorten the maintenance time.

6 Technical Specifications

6.1 Chassis Specifications

Chassis Parameters

Table 6-1 provides the G5500 technical specifications.

Table 6-1 G5500 technical specifications

Item	Description
Form factor	4U modular server
Compute node	Supports one full-width node or two half-width nodes.
I/O module	Provides two I/O modules, which support a maximum of PCIe x16 slots
Chassis management module	Provides a 1000BASE-T management port for external connection and two 10GE LOM ports for compute nodes through MM1.
PSU	Provides four 2200 W PSUs, which can work in N+N redundancy mode.
Fan module	Provides six fans, which can work in N+1 redundancy mode.
Dimensions (W x D x H)	447 mm x 790 mm x 175 mm (17.6 in. x 31.1 in. x 6.89 in.)

Item	Description
Weight	● Net weight: 20 kg (44.1 lb) ● Fully-configured: 70 kg (154.35 lb) ● Packaging materials: 9.1 kg (20.07 lb)

6.2 Node Specifications

Table 6-2 provides the models and specifications of G5500 server nodes.

Table 6-2 Hardware list

Type	Model	Specifications
Full-width configuration	G560	● Two Intel®Xeon® E5-2600 v4 processors ● A maximum of 24 DDR4 DIMMs ● Six 2.5-inch NVMe SSDs ● Two 2.5-inch SAS/SATA hard disks
	GP608	● A maximum of eight full-height dual-slot GPU cards ● Eight 3.5-inch SAS/SATA hard disks
Half-width configuration	G530 V2	● Two Intel® Xeon® Scalable processors ● A maximum of 24 DDR4 DIMMs ● Two 2.5-inch SAS/SATA hard disks or NVMe SSDs
	GP316	A maximum of 16 half-height half-length standard PCIe cards

6.3 Power Supply and Power Specifications

The G5500 provides four PSU slots. Table 6-3 provides the power supply and power specifications.

Table 6-3 Power supply and power specifications

Power Type	Power Input	Maximum Output Power	Power Cable
2200 W power supply	● 200 V AC to 240 V AC, 50/60 Hz ● 240 V DC	Single module: 2200 W 2+2 backup: 4400 W 1+1 backup: 2200 W	16 A power cables complying with IEC320 C19 and IEC320 C20

Power Type	Power Input	Maximum Output Power	Power Cable
	● 100 V AC to 120 V AC, 50/60 Hz	Single module: 1200 W 2+2 backup: 2400 W 1+1 backup: 1200 W	

6.4 Environmental Specifications

Table 6-4 provides the G5500 environmental specifications.

Table 6-4 Environmental specifications

Item	Description
Temperature	● Operating temperature: 5°C to 35°C (41°F to 95°F) ● Storage temperature: -40°C to +65℃ (-40°F to +149°F) ● Temperature change rate: < 20°C/h (36°F/h)
Humidity	● Operating humidity: 8% to 90% RH (non-condensing) ● Storage humidity: 5% to 95% RH (non-condensing) ● Humidity change rate: < 20% RH/h
Altitude	● ≤ 3048 m (9999.88 ft). For altitudes above 900 m (2952.72 ft), the operating temperature decreases by 1°C (1.8°F) every 300 m (984.24 ft). ● HDDs are not supported when the altitude is higher than 3000 m (9842.4 ft).
Acoustic noise	Noise emissions are measured in accordance with ISO 7999 (ECMA 74) and declared in accordance with ISO 9296 (ECMA 109). The data listed in the following is the declared A-weighted sound power levels (LWAd) and declared average bystander position A-weighted sound pressure levels (LpAm) when the server is operating in a 23°C (73.4°F) ambient environment: Idle: ● LWAd: 6.2 Bels ● LpAm: 45 dBA NOTE The actual sound levels generated when the server is operating vary depending on the server configuration, workload, and ambient temperature.
Vibration	● One cyclical sweep in each axial direction at the rate of 0.1 oct/min, a total of three axial directions ● 5 Hz to 10 Hz: 5 mm (0.2 in., peak-to-peak value) ● 10 Hz to 100 Hz: 1 m/s2

Item	Description
Shock	Half sine wave, peak acceleration of 2 g (g-force), 11 ms, 3 times for each surface, a total of three axial directions
Corrosive gaseous contaminant	● Copper corrosion rate test requirements: The corrosion product thickness growth rate is lower than 300 Å/month (meeting G1 requirements of the ANSI/ISA-71.04-2013 standard on gaseous corrosion). ● Silver corrosion rate test requirements: The corrosion product thickness growth rate is lower than 200 Å/month.
Particle contaminant	● In compliance with ISO 14664-1 Class 8 requirements A professional organization is required to monitor particle contaminants in the equipment room. ● No explosive, conductive, magnetic conductive, and corrosive dust

7 Warranty

According to the *Huawei Warranty Policy for Servers & Storage Products* (*Warranty Policy* for short), Huawei provides a three-year warranty for the server, a one-year warranty for DVD-ROM drives and batteries, and a three-month warranty for software media.

The *Warranty Policy* stipulates warranty terms and conditions, including the available services, response time, terms of service, and disclaimer.

The warranty terms and conditions may vary by country, and some services and/or parts may not be available in all countries. For more information about warranty services in your country, contact Huawei technical support or the local Huawei representative office.

Table 7-1 describes the warranty service response time.

Table 7-1 Response time

Service	Response Time	Description	Remarks
Help desk	24/7	Available 24 hours a day, 7 days a week (00:00 to 24:00, Monday to Sunday)	None
Remote troubleshooting	24/7	Available 24 hours a day, 7 days a week (00:00 to 24:00, Monday to Sunday)	The response time is the period between the end of a customer's service request and beginning of the response by the technical support to offer troubleshooting services.

Service	Response Time		Description	Remarks
Online technical support	24/7		Huawei enterprise support website (http://e.huawei.com): available 24 hours a day, 7 days a week (00:00 to 24:00, Monday to Sunday)	None
Licensing of software updates	24/7		Available 9 hours a day, 5 days a week (09:00 to 18:00, Monday to Friday), excluding official holidays	The repaired or replacement parts will be shipped within 45 calendar days after Huawei receives the defective parts.
Return for repair	Outside China	9/5 hours, shipment within 45 calendar days	Available 9 hours a day, 5 days a week (09:00 to 18:00, Monday to Friday), excluding official holidays	The repaired or replacement parts will be shipped within 45 calendar days after Huawei receives the defective parts.
	In China	10×5×NBD	Available 10 hours a day, 5 days a week (08:00 to 18:00, Monday to Friday), excluding official holidays. Arrival: NBD	1. Service requests submitted after 15:30 will be handled the next business day. 2. The response time starts when a remote decision is made to appoint an onsite engineer.

Table 7-2 describes the warranty services provided by Huawei.

Table 7-2 Warranty services

Service	Description
Help Desk	Huawei provides 24-hour after-sales technical support (such as handling requests for troubleshooting and hardware repair), receives and handles customer inquiries, complaints, and suggestions through a dedicated hotline.

Service	Description
Remote troubleshooting	After receiving a service request for rectifying a network or system fault, Huawei engineers will analyze and handle the fault remotely and proceed to rectify it in the shortest possible time. There are two methods for remote troubleshooting: telephone support and remote access.
Online technical support	Huawei enterprise support website (http://e.huawei.com) provides product and technical materials, such as product manuals, configuration guides, networking case study, and maintenance experience collections. Registered users can access the website and download required documents.
Licensing of software updates	To ensure that the devices operate stably, Huawei provides software patches whenever necessary
Return for repair	Huawei provides repair or replacement services for customers within the promised time to meet customer needs for spare parts. You can return defective parts to the designated Huawei site after submitting a service request. For servers used in China, Huawei provides a three-year warranty for parts replacement and repair as well as a 10-hour-a-day, 5-day-a-week NBD support program. Huawei provides a three-year warranty for parts replacement and repair for the servers used outside China. Huawei provides a 9-hour-a-day, 5-day-a-week support program. Service requests will be handled the next business day. Huawei delivers the repaired or new parts within 45 calendar days after receiving the defective parts.

8 Standards and Certifications

8.1 Certifications

For details about the certifications, see the *Huawei Server Certification Map & Certifications*.

8.2 Standards and Protocols

Table 8-1 lists the standards and protocols the G5500 complies with.

Table 8-1 Standards and protocols the G5500 complies with

Category	Standard/Protocol	Description
Standards	IEEE 802.1P	QoS
	IEEE 802.1Q	VLAN
	IEEE 802.1D	Bridge/Spanning Tree
	IEEE 802.3	Ethernet
	IEEE 802.3u	Fast Ethernet (FE)
	IEEE 802.3x	Flow control
	IEEE 802.3z	Gigabit Ethernet
	IEEE 1149.1-2001	IEEE standard test access port and boundary-scan architecture
	IEC 812	Procedure for Failure Mode and Effects Analysis (FMEA)
	IEC 863	Reliability, maintainability and availability predictions

Category	Standard/Protocol	Description
	IEC 60297	Chassis compliance
	IEC 60950	Safety
	IEC 60825-1/2/6	Safety
	IEC 60215	Safety
	IEC 61000	EMC standards
	UL60950	Safety (North America)
	EN60950	Safety (Europe)
	ECMA TR/70	Environmental protection
	GR-929	Reliability
	Telcordia SR-332	Reliability
	ETS	European Telecommunications Standards
Protocol	IP	Internet Protocol
	ARP	Address Resolution Protocol
	ICMP	Internet Control Message Protocol
	IGMP	Internet Group Management Protocol
	SNMP	Simple Network Management Protocol
	TELNET	Remote Terminal Protocol
	HTTP	Hypertext Transfer Protocol
	TFTP	Trivial File Transfer Protocol
	FTP	File Transfer Protocol
	IPMI	Intelligent Platform Management Interface

A Acronyms and Abbreviations

A	
AC	Alternating Current
AES NI	Advanced Encryption Standard New Instruction Set
AI	Artificial Intelligence
ARP	Address Resolution Protocol
ASIC	Application-Specific Integrated Circuits
AVX	Advanced Vector Extensions
B	
BBU	Backup Battery Unit
BMC	Baseboard Management Controller
C	
CD	Calendar Day
CIM	Common Information Model
CLI	Command-line Interface
D	
DC	Direct Current
DDR4	Double Data Rate 4
DEMT	Dynamic Energy Management Technology
DIMM	Dual In-line Memory Module
DVD	Digital Video Disc
E	
ECC	Error Checking and Correcting

A	
ECMA	European Computer Manufacturers Association
EDB	Execute Disable Bit
EN	European Efficiency
ETS	European Telecommunications Standards
F	
FC	Fiber Channel
FPGA	Field-Programmable Gate Array
FTP	File Transfer Protocol
G	
GE	Gigabit Ethernet
GPIO	General Purpose Input/Output
GPU	Graphics Processing Unit
H	
HDD	Hard Disk Drive
HMM	Hyper Management Module
HPC	High-performance Computing
HTTP	Hypertext Transfer Protocol
HTTPS	Hypertext Transfer Protocol Secure
HVDC	High Voltage Direct Current
I	
ICMP	Internet Control Message Protocol
IDC	Internet Data Center
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
iBMC	Integrated Baseboard Management Controller
IO	Input/Output
IOPS	Input/Output Operations per Second
IP	Internet Protocol
IPC	Intelligent Power Capability
IPMB	Intelligent Platform Management Bus

A	
IPMI	Intelligent Platform Management Interface
K	
KVM	Keyboard Video and Mouse
L	
LC	Lucent Connector
LDIMM	Load Reduced DIMM
LED	Light Emitting Diode
LOM	LAN on motherboard
M	
MAC	Media Access Control
N	
NBD	Next Business Day
NC-SI	Network Controller Sideband Interface
NVMe	Non-Volatile Memory Express
O	
OS	Operating system
P	
P2P	Peer to Peer
PCIe	Peripheral Component Interconnect Express
PHY	Physical Layer
PID	Proportional–Integral–Derivative
PMBUS	Power Management Bus
POK	Power OK
PWM	Pulse-width Modulation
Q	
QPI	QuickPath Interconnect
R	
RAID	Redundant Array of Independent Disks
RDIMM	Registered Dual In-line Memory Module
RDMA	Remote Direct Memory Access

A	
RJ45	Registered Jack 45
S	
SAS	Serial Attached Small Computer System Interface
SATA	Serial Advanced Technology Attachment
SGMII	Serial Gigabit Media Independent Interface
SMTP	Simple Mail Transfer Protocol
SM_CLP	Server Management Command Line Protocol
SNMP	Simple Network Management Protocol
SSD	Solid-state Drive
T	
TACH	Tachometer signal
TBT	Turbo Boost Technology
TCG	Trusted Computing Group
TDP	Thermal Design Power
Telnet	Telecommunication Network Protocol
TXT	Trusted Execution Technology
TFTP	Trivial File Transfer Protocol
TPM	Trusted Platform Module
U	
UEFI	Unified Extensible Firmware Interface
UID	Unit Identification Light
UL	Underwriter Laboratories Inc.
UPI	UltraPath Interconnect
USB	Universal Serial Bus
V	
VGA	Video Graphics Array
VRD	Voltage Regulator-Down