COMPAQ

White Paper

Contents

ProLiant DL360 G2 Server High-Density Deployment

Abstract: *This white paper is a planning guide to expedite concentrated deployments of several ProLiant™ DL360 Generation 2 (G2) servers in a single rack. Use this white paper in conjunction with documents for the ProLiant DL360 G2 server and Compaq rack deployment products as necessary. This paper is written for Field Systems Engineers (FSEs) and customers (IT managers, system managers, account managers, and installers).*

Executive Summary

Many business enterprises and service providers implement a distributed architecture for their infrastructure, remote client access, and web applications. In these cases, individual applications are loaded on multiple machines creating the need to tightly fit a large number of density optimized servers into existing server rooms and data centers. Compaq meets this need with the density-optimized line of ProLiant servers, such as the ProLiant DL360 G2 server. At a height of 1U each, up to 42 ProLiant DL360 G2 servers can fit in a single Compaq 42U rack. This server has clear space saving benefits; its compressed size presents new challenges for rapid server deployment, cable management and environmental considerations.

Compaq engineers have developed innovations in rapid high-volume deployment and improved cable management for large installations of ProLiant DL360 G2 servers. This white paper introduces planning, power and thermal considerations, server and rack requirements and installation configurations. It also outlines the products associated with high-volume deployment in Compaq rack configurations, such as keyboard, video, and mouse infrastructure.

IMPORTANT: This document discusses the ProLiant DL360 G2 server primarily and the Compaq 7000-, 9000- and 10000-series racks and related Compaq rack options secondarily. This document does not discuss other Compaq servers, products or racks not manufactured by Compaq, although the ideas presented here may be applied to third party racks.

Help us improve our technical communication. Let us know what you think about the technical information in this document. Your feedback is valuable and will help us structure future communications. Please send your comments to: serverdocumentation@compaq.com.

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ProLiant DL360 G2 Server High-Density Deployment
White Paper prepared by Industry Standard Servers

First Edition (July 2002)
Document Number 1713-0702A-WWEN

Symbols in Text

The following symbols can be found in the text of this document:

WARNING: Text set off in this manner indicates that failure to follow directions in the warning could result in bodily harm or loss of life.

CAUTION: Text set off in this manner indicates that failure to follow directions could result in damage to equipment or loss of information.

IMPORTANT: Text set off in this manner presents clarifying information or specific instructions.

Note: Text set off in this manner presents commentary, sidelights, or interesting points of information.

Symbols on Equipment

The following symbols are located on equipment in areas where hazardous conditions might exist.

This symbol in conjunction with any of the following symbols indicates the presence of a potential hazard. The potential for injury exists if warnings are not observed. Consult the documentation included with the server for specific details.

This symbol indicates the presence of hazardous energy circuits or electrical shock hazards. Refer all service to qualified personnel.

WARNING: To reduce the risk of injury from electrical shock hazards, do not open this enclosure. Refer all maintenance, upgrades, and service to qualified personnel.

This symbol indicates the presence of electrical shock hazards. The area contains no user or field serviceable parts. Do not open for any reason.

WARNING: To reduce the risk of injury from electrical shock hazards, do not open this enclosure.

This symbol on a RJ-45 receptacle indicates a Network Interface Connection.

WARNING: To reduce the risk of electrical shock, fire, or damage to the equipment, do not plug telephone or telecommunications connectors into this receptacle.

This symbol indicates the presence of a hot surface or hot component. If this surface is contacted, the potential for injury exists.

WARNING: To reduce the risk of injury from a hot component, allow the surface to cool before touching.

Server Warnings

Adhere to the following guidelines when servicing or installing a ProLiant DL360 G2 server:

WARNING: To reduce the risk of electrical shock or damage to the equipment:

- Unplug the power cord from the system.

- Do not disable the power cord grounding plug. The grounding plug is an important safety feature.

- Plug the power cord into a grounded (earthed) electrical outlet that is easily accessible at all times.

CAUTION: To properly ventilate the system, provide at least 7.6 cm (3 inches) of clearance at the front and back of the computer.

CAUTION: The system is designed to be electrically grounded. To ensure proper operation, plug the AC power cord only into a properly grounded (earthed) AC outlet.

Rack Warnings

WARNING: To reduce the risk of personal injury or damage to the equipment:

- Do not attempt to move or relocate an equipment rack populated with servers. A fully populated rack can weigh as much as 771 kg (1,700 lb). The rack might become unstable and cause serious personal injury or equipment damage.

- Before installing the servers, extend the leveling jacks to the floor and rest the full weight of the rack on the leveling jacks. Either install the stabilizer kit or couple multiple racks together for stability.

- Always load the heaviest item first and load the rack from the bottom to the top. Loading in this manner makes the rack "bottom-heavy" and helps prevent the rack from becoming unstable.

- Extend only one ProLiant DL360 G2 server at a time. A rack might become unstable if more than one server is fully extended for any reason.

CAUTION: Do not overload the AC supply branch circuit that provides power to the rack.

Where to Find Information

This white paper is divided into sections that address important aspects of planning and installing a high-volume deployment of ProLiant DL360 G2 servers in Compaq racks. Table 1 describes the information each section discusses.

Table 1. Where to Find Information

Section	Description	Where to Find
Introduction	Explains the purpose and scope of this white paper and provides a glossary of terms.	Page 6
Understanding Power, Thermal, Weight and Console Management Considerations	Lists important information about the ProLiant DL360 G2 server, Compaq racks, PDUs, and related options to help choose a rack configuration as well as discusses console management options.	Page 9
Power Distribution Units	Discusses specific PDU and power cord choices.	Page 14
Suggested Rack Configurations	Provides three configurations representing maximum performance density, maximum flexibility, and traditional environmental schemes.	Page 22
Installation Procedures	Describes preparation and brief installation procedures that are common to various ProLiant configurations.	Page 34

Introduction

The dense ProLiant DL360 G2 server was designed to meet the challenges associated with deploying a high concentration of servers in a single rack. Customers should evaluate their environments, power distribution, console, cable, and thermal management choices well in advance to ensure efficient deployments.

All discussions of power requirements for ProLiant DL360 G2 servers are based on the input power of the server. This document uses the maximum rated power supply input of 308 W for calculation purposes. However, de-rating the input power might be effective to help:

- Minimize the number of PDUs required for each rack.

- Match the rack current requirements with the existing circuit breaker capacity.

- Match the rack cooling requirements with the existing facility cooling capability.

IMPORTANT: In this document, de-rating the input power budget means using less than the maximum rated input power values for the power supply. **Make sure the de-rated power budget satisfies all the installation requirements, including future upgrade plans.**

Refer to the *Compaq ProLiant DL360 G2 Server QuickSpecs* for detailed specifications and options for the ProLiant DL360 G2 server.

References

Table 2 lists the sources referenced in this document.

Table 2. Sources of Information

Topic	Where to Find
Information focal point for the Compaq ProLiant DL360 G2 server	www.compaq.com/proliant
Specifications, options, and a list of other Compaq products and options compatible with the ProLiant DL360 G2 server	*Compaq ProLiant DL360 G2 QuickSpecs*
Installation and service guidelines for the ProLiant DL360 G2 server	www.compaq.com/support/servers/ProLiantDL360 G2.html *Compaq ProLiant DL360 G2 Setup and Installation Guide*, P/N 233832-001 *Compaq ProLiant DL360 G2 Maintenance and Service Guide*, P/N 233831-001
Installation of vertical-mount PDU brackets and Y-cables	Vertical-Mount PDU Brackets with High-Voltage Cables kit, P/N 166097-B21

Table 3 lists all the notational abbreviations used for optional components listed in the document.

Table 3. Notations for Optional Components

Notation	Description
1 x, 2 x, 4 x	Number of components, for example, 1 x 128 MB means one 128-MB DIMM
1.40 GHz	Intel Pentium III 1.40-GHz processor
128 MB	128-MB DIMM
256 MB	256-MB DIMM
512 MB	512-MB DIMM
HDD	Hard disk drive
GB	Gigabyte
SA5300	Smart Array 5300 Controller option (64-bit PCI card)
iLO	Integrated Lights-Out, a management ASIC
iLO Advanced Pack	An optional license to unlock the advanced features of Integrated Lights-Out (i.e. Virtual Graphic Console and Virtual Floppy)
FE	Fast Ethernet or 10/100 Mbs
GbE	Gigabit Ethernet or 10/100/1000 Mbs

Glossary

1U – A rack unit (1U) is 4.45 cm or 1.75 inches in vertical dimension. The height of a device (also known as form factor) can be expressed in rack units (Us). The ProLiant DL360 G2 server is a 1U server.

1U Integrated Keyboard/Mouse/TFT – The TFT5600 RKM (rack-mount keyboard and monitor) is a 1U integrated keyboard and monitor. Its full 15-inch TFT active matrix display provides flicker-free, quality display at viewing angles up to 120 degrees horizontally and 105 degrees vertically.

Flat Panel Display (FPD) – A TFT5010R (15-inch) flat panel monitor provides a large image size and exceptional screen performance in a space-saving 2U size that enables the monitor to be neatly tucked away when not in use.

High-voltage – AC line voltage of 200 V to 240 V. With higher voltage levels, a server can use a lower current and still meet its power requirements. It is recommended to use a high-voltage source to support high-volume deployments of ProLiant servers in a rack.

Integrated Lights-Out – The Integrated Lights-Out (iLO) is an intelligent microprocessor for remote administration and is embedded on the system board of some new density optimized ProLiant servers. To access the functionality, an IT administrator would connect a standard network cable to the dedicated Integrated Lights-Out management port. This port can be connected to a corporate intranet, the Internet (via VPN technology), or a separate management network. No additional software is needed to run this advanced management. An administrator accesses the console via a standard browser from anywhere, any time.

In-Rack Keyboard – The 1U Rack Keyboard Drawer and the Internal Keyboard with Trackball are designed to work together to save room in space-constrained, rack-mount environments. The 1U Keyboard Drawer requires only half the rack depth and provides enough space behind it to mount a Server Console Switch.

Keyboard/Video/Mouse (KVM) – KVM refers to a keyboard cable, a video cable, a mouse cable, or a switch. Some parts lists might refer to KVM switches as Server Console Switches.

Local Console –A local console system interacts with a server using a set of KVM devices and can be in-rack or off-rack. In this document, **in-rack** local console refers to a flat panel display and a keyboard/trackball in the same rack as the servers. **Off-rack** local console refers to any combination of a display, a keyboard, and a pointing device located outside of the rack. A local console system does not use a network connection to interact with the server.

Low-Voltage – AC line voltage of 100 V to 120 V.

N.A. – North America, including U.S., Canada, and Mexico.

Network Interface Controllers (NICs) – Controllers that are embedded on the system board of the ProLiant DL360 G2 server.

Power Distribution Unit (PDU) – A PDU is a high-voltage or low-voltage device that is equipped with circuit breakers that help prevent electrical surges and external equipment malfunction by providing over current and surge protection for connected devices. Refer to the "Power Distribution Units" section of this document for more information.

Remote Console – A remote console is a server console system that uses a network connection to interact with the server. This system enables any computer with appropriate software and network access to control a server from anywhere across the globe. Use the remote-console system when managing a large number of servers because it eliminates the congestion of KVM cabling.

Remote Insight Lights-Out Edition – The Remote Insight Lights-Out Edition is designed to provide remote access and control of ProLiant server products from anywhere on the network with a standard web browser. Consequently, customers can deploy a server in a true "headless" fashion with a minimum of only three cables per server: one power cord for the server, one network cable for the LAN connection, and one network cable for the Remote Insight Lights-Out Edition management LAN connection.

Server Console Switch – A device that enables multiple servers in a rack to be accessed and managed by a single keyboard, mouse, and monitor. These switches are also known as KVM switches.

Sliding Rail – A tool-free racking system designed for Compaq and third-party racks that support in-rack serviceability for ProLiant servers. Customers with this option could slide the server entirely out of the rack to remove the top access panel without removing any of the cabling from the rear of the server.

UID LED and Switch – The blue Unit Identification (UID) LED recognizes when the ProLiant server requires service. A UID switch toggles both the front and rear UID LEDs simultaneously.

Wake on LAN (WOL) – An option that enables a remote (re)start of the server.

Understanding Power, Thermal, Weight and Console Management Considerations

Power, thermal, and weight are the most important considerations for optimizing a hardware installation in high-volume server environments. The type of console management system used in a server environment is determined by the rack deployment.

Table 4 provides server parameters necessary to calculate the power, thermal, and weight requirements for any number of ProLiant DL360 G2 servers. Console management considerations are discussed in detail later in this section.

Table 4. ProLiant DL360 G2 Server Parameters

Server Dimensions H x W x D	
1.65 x 16.75 x 25 in/4.19 x 42.55 x 63.5 cm	
Server Weights	
Minimum configuration: 1 x processor, 2 x 128-MB DIMM, 1 x CD-ROM drive, 1 x diskette assembly, 0 x HDD, power supply	26 lb/11.81 kg
Maximum configuration: 2 x processor, 4x DIMMs, 2 x HDDs, 2 x SA5300, 1 x CD-ROM drive, 1 x diskette assembly, power supply	30.6 lb/13.9 kg
Component Weights	
CD/diskette drive assembly	0.34 kg (0.75 lb)
DIMM	0.04 kg (00.1 lb)
HDD	0.86 kg (1.9 lb)
SA5300	0.45 kg (1.0 lb)

continued

Table 4. ProLiant DL360 G2 Server Parameters *(continued)*

Component Weights *(continued)*		
Maximum system measured input AC power		
	90 V	257 W
	220 V	248 W
Maximum power supply rated input current		
	120 V	3.56 A
	240 V	1.78 A
Maximum system measured input current		
	90 V	2.86 A
	240 V	1.13 A
System Thermal Dissipation (per hour)		
	115 V	1,050 BTUs
	240 V	1,050 BTUs
Relative Humidity (non-condensing)		
	Operating	10 to 90%
	Non-operating	5 to 95%

The SA5302 option is a PCI card available from Compaq. Any third-party PCI cards used in the ProLiant DL360 G2 server must comply with the industry-standard PCI specifications for dimension, weight, power, and thermal requirements.

Power and Thermal Budgeting

Note: In this document, de-rating the input power budget means not using the maximum rated input power values for the power supply. **It is strongly recommended the installation planner ensures the de-rated power budget satisfies all the installation requirements, including future upgrade plans.**

All ProLiant DL360 G2 power requirement discussions in this document are based on the input power of the server, since this number has direct impact in planning for the PDU selection and the facility power source. Use one of the following methods during the facility power distribution planning to account for the ProLiant DL360 G2 input power.

1. Use the maximum rated input power of 308 W.

2. Use the Power Calculator Utility (provided in Active Answers) to configure your system as it will be used; providing all the relevant power and cooling parameters needed to plan an installation. For more information on the Power Calculator Utility, refer to our website located at:

    www.activeanswers.compaq.com/aaconfigurator/PowerCalc/DL360G2.xls

3. Use the de-rated input power, which can be calculated by adding the power budgets of installed optional components from the rated input power.

4. Use the allocated input power, which can be calculated by dividing the maximum power of a PDU by the number of servers. This calculated power should be at least 250 W to support all the optional components initially released with the ProLiant DL360 G2.

The power budgets of optional components referred to (in the following sections) were derived from the system input power of a set of selectively measured server configurations. The configurations measured range from a basic low-end configuration to a fully populated high-end configuration. Since the input power values for a ProLiant DL360 G2 server in an installation might vary depending on the software applications, the information provided in this section should be used as a guideline only.

The ProLiant DL360 G2 server power supply is designed to support future upgrades of processors, DIMMs, and hard disk drives. As such, the power supply **output power** is rated at 200 W. Considering the power supply efficiency of 65% (including the Power Factor Correction); the power supply **input power** is rated at 308 W. This input power value may be used in planning for the power source implementation and facility cooling requirements. In some cases the input power requirement for each ProLiant DL360 G2 server might be desired to be lower than 308 W. For example,

- To minimize the number of PDUs, that is, the number of facility power feed lines, required for each rack.

- To match the rack current requirements with the existing facility branch circuit breakers.

- To match the rack power and cooling requirements with the existing facility power and cooling limitations.

Table 5 demonstrates how significant reduction in input current and thermal dissipation can be realized, if a deployment plan can limit each ProLiant DL360 G2 configuration over the useful lifetime of a rack configuration.

Table 5. De-rated Current and Thermal Dissipation for Reduced Input Power Assumptions

	De-Rated		Fully Rated
Input Power	**120 W**	**250 W**	**308 W**
Input Current @110 V AC	1.09 A	2.27 A	2.80 A
Input Current @208 V AC	0.57 A	1.20 A	1.48 A
Thermal Dissipation	409 BTUs/hour	852 BTUs/hour	1050 BTUs/hour

The de-rated input power values of 120 W and 250 W can be correlated with the measured input power values for the minimum and maximum configurations for ProLiant DL360 G2 servers. However, the de-rated input power value must be high enough to account for any future upgrades for a deployment plan.

As stated earlier, the power supply is designed to support future processor and hard drive upgrades. When installing 42 servers, the number of PDUs to be installed will depend on the support for the input current requirement. Carefully de-rating the input power may very well satisfy deployment needs and also reduce the number of PDUs per rack. Reducing the number of PDUs has a direct impact on the deployment time and maintenance of an installation.

Input Current and Thermal Dissipation Calculations

The input power is the key in deriving the input current and thermal dissipation. For a given input power, the input current will vary depending on the input voltage level.

The relationship among the current, the voltage and the power for the power supply input is as follows:

> **Input Current = Input Power / Input Voltage**

For example,

> *Input Current = 100 W /110 V = 0.91 A*
> *Input Current = 100 W /208 V = 0.48 A*

The input power of a server depends on the operational state of the system. For example, during the initial power up, a server consumes more power due to the hard disk drives spin-ups. It should be noted that in the ProLiant DL360 G2, the two hard disk drives spin-up one after the other. Therefore, the peak input power requirement changes significantly when the first drive is added, but not as much when the second drive is added. After the initial power up, the input power varies depending on the operating system and the application software running on the server. During standby, only the auxiliary portion of the power supply is consuming power to support operations of a very limited part of the system, for example, the Remote Insight Lights-Out Edition option, NICs, and so on.

The thermal dissipation can be calculated from the input power as follows:

> **Thermal Dissipation = Input Power * 3.41**

For example,

> *Thermal Dissipation = 100 W * 3.41 = 341 BTUs/hour*
> *Thermal Dissipation = 292 W * 3.41 = 996 BTUs/hour*

The easiest way to calculate the thermal dissipation for the entire rack is to add the input power requirements for all the servers and other units populated in a rack, and then multiply the total input power by 3.41.

Measured Input Power

Table 6 lists the measured input power of ProLiant DL360 G2 with varying subsystem components, to illustrate the effects of adding or removing optional components. Table 7 lists each subsystem component's input power derived from Table 6. A few test programs were run to exercise various parts of the system. Also, the current and power were measured on the input side of the power supply. The "peak" and "typical" input power values were measured during power up and idle/normal operations, respectively.

Table 6. Measured Input Power for Selected Server Configurations

Configuration Number	ProLiant DL360 G2 Configuration	Power Input Typical / Peak
1	1 x 1.4 GHz, 2 x 128 MB, 1 x 18.2 GB (base-line)	146 W / 153 W
2	2 x 1.4 GHz, 2 x 128 MB, 2 x 18.2 GB	189 W / 196 W
3	2 x 1.4 GHz, 4 x 1 GB, 2 x 18.2 GB	195 W / 205 W
4	2 x 1.4 GHz, 4 x 1 GB, 2 x 72.8 GB, 2 x 5302	244 W / 257 W

Note: Peak power of a fully configured ProLiant DL360 G2 server (Configuration 4 was measured to be only about 83% of its rated peak input power).

Table 7. Measured Input Power for Optional Subsystem Components

Sub-system Components	Power Input Typical / Peak
Intel Pentium® III 1.40 GHz Processor	23 W / 26 W
128-MB DIMM	1 W / 3 W
256-MB DIMM	1 W / 3 W
512-MB DIMM	1 W / 4 W
1-GB DIMM	2 W / 5 W
18.2-GB HDD	16 W / 38 W
36.4-GB HDD	16 W / 38 W
72.8-GB HDD	16 W / 38 W
SA5302	9 W / 16 W

Note: DIMM and HDD input power can vary depending on the component and drive manufacturer.

Input Power Budget De-rating

If a deployment plan limits the future expansion beyond certain configurations options, which may be added in the future, then adjustments can be made to the expected input current and thermal requirements of the servers.

- To de-rate the input power, start with the minimum configuration (Configuration 1 from Table 6). Add the typical power of the components included in the desired system configuration to calculate the de-rated power budget. Typical input powers for various components are listed in Table 7.

Example

Assuming the desired server configuration is as follows; use Table 8 to calculate the de-rated power budget using the typical power from Tables 6 and 7.

Processors: 2 x 1.40 GHz

Memory: 4 x 128 MB

Storage: 2 x 18.2 GB

Smart Array Controller 5302: 1 x SA5302

Table 8. Example De-rating Worksheet

	Maximum Rated Input Power (in watts) for the base configuration	Typical Power	146 W
1.	Add the typical power for the second processor.	23 W	
2.	Add the typical power for the additional memory.	2 W	
3.	Add the typical power for the second HDD.	16 W	

continued

Table 8. Example De-rating Worksheet *(continued)*

	Maximum Rated Input Power (in watts) for the base configuration	Typical Power	146 W
4.	Add the typical power for the PCI card	9 W	
5.	Calculate the total power Typical power for the desired configuration (in watts)	196 W	
6.	Calculate the thermal dissipation. Thermal dissipation for the desired configuration (in BTUs)	196 W $\times$ 3.41 668 BTUs/hour	

Therefore, the new power budget for this configuration is **196 W** (compared to the rated 308 W), and the thermal dissipation is approximately **668 BTUs/hour** (compared to the rated 1050 BTUs/hour).

The rated input power for the ProLiant DL360 G2 power supply is 308 W. Therefore, the power budget for a maximum configuration is **308 W** and the thermal dissipation will be approximately (308*3.41=) **1050 BTUs/hour**.

This de-rated input power budget significantly reduces the power and thermal requirements for highly populated racks. This also reduces the number of PDUs for certain configurations, which lowers cost and decreases deployment time. Costs for the facility electrical plumbing, data center floor ventilation, and facility air conditioning installation can be reduced.

IMPORTANT: It is strongly recommended to verify that the de-rated power budget satisfies all the installation requirements, including future upgrade plans.

Input Power Budget Allocation

This section explains how to allocate the input power budget for each server. This method can be used when a PDU is to support a known number of ProLiant DL360 G2 servers. It is important to verify that the calculated power budget allocation will be sufficient to support the worst-case server configurations that are to be deployed.

The allocated input power for each server is calculated by multiplying the allocated input current for each server with the line voltage.

> *Allocated Input Power = Allocated Input Current * Input Line Voltage*

Example

Assume a high voltage PDU rated at 24 A is to support 21 servers. Each server can be allocated 1.143 A. If the line voltage is assumed to be at 208 V, then the allocated input power budget for each server will be (1.143*208) = 238 W.

Since the input power budget of 238 W exceeds the fully configured system measured input power of 195 W (as shown in Table 6), 21 ProLiant DL360 G2 servers can be supported by a 24 A high-voltage PDU. That means, only two of these PDUs are needed to support 42 servers in a 42U rack.

Power Distribution Units

Designed for use in high-volume rack deployments, Compaq offers several PDU models ranging from 16 – 24A, supporting both high-voltage and low-voltage applications. Compaq PDUs are equipped with circuit breakers to provide short circuit and over current protection.

The Modular PDUs (with up to 32 outlets) provide easy accessibility, increased outlet count, and flexibility; therefore, allowing you to mount the units in different locations within the rack. All mounting hardware, including both the 0U and 1U mounting brackets are included in the Modular PDU kit (no additional mounting brackets need to be purchased).

Legacy Single Input 0U/1U PDUs range from 16A - 40A and offer up to 12 outlets. The 0U mounting brackets are included in the PDU kit (1U mounting brackets need to be purchased separately, 215852-B21).

The Dual Input PDU, equipped with two input ends and a built-in AC transfer switch, is a fault-tolerant solution that automatically switches over to a secondary input source when the first (primary) source becomes unavailable. The Dual Input PDUs ship with both 0U and 1U mounting brackets (no additional mounting brackets need to be purchased). Table 9 lists PDU options. For more information, refer to the website located at:

www.compaq.com/ups

Table 9. Compaq PDUs

Part Number	Availability	Input Voltage	Current Rating	Maximum Servers per PDU	Input Connectors and Cord	Output Connectors	Output Breakers	Dimensions	Weight
Modular PDUs (Up to 32 outlets, 0U/1U mounting) *New!*									
252663-D71[3]	North America, Japan	Low	24 A	8	NEMA L5-30P 12-ft cord	32 × NEMA 5-15R	4 × 15 A	5.03 × 25.15 × 48.97 cm 1.98 × 9.9 × 19.28 in	5.4 kg 12 lb
252663-D72[3]	North America, Japan	High	24 A	16	NEMA L6-30P 12-ft cord	32 × IEC 320-C13	4 × 15 A	5.03 × 25.15 × 48.97 cm 1.98 × 9.9 × 19.28 in	3.6 kg 8 lb
252663-B31[3]	International	High	32 A	21	NEMA L6-30P 12-ft cord	32 × IEC 320-C13	4 × 15 A	5.03 × 25.15 × 48.97 cm 1.98 × 9.9 × 19.28 in	5.4 kg 12 lb
252663-B21[2,3]	Worldwide	High	40 A	27	NEMA L6-30P 12-ft cord	32 × IEC 320-C13 4 × IEC 320-C19	4 × 15 A	5.03 × 25.15 × 48.97 cm 1.98 × 9.9 × 19.28 in	5.4 kg 12 lb
Single Input PDUs (Up to 12 outlets, 0U/1U mounting)									
207590-B21[4]	Worldwide	High	16 A	10	IEC 320 C-20	12 × IEC 320-C13	2 × 10 A	4.27 × 20.32 × 43.18 cm 1.62 × 8.0 × 17.00 in	3.15 kg 7 lb
207590-D71[4]	North America, Japan	Low	24 A	8	NEMA L5-30P 12-ft cord	12 × NEMA 5-15	4 × 15 A	4.27 × 20.32 × 43.18 cm 1.62 × 8.0 × 17.00 in	4.5 kg 11 lb
207590-B31[4]	International	High	32 A	21	IEC 309-32A 12-ft cord	12 × IEC 320-C13	4 × 10 A	4.27 × 20.32 × 43.18 cm 1.62 × 8.0 × 17.00 in	4.5 kg 11 lb
207590-D72[4]	North America, Japan	High	24 A	16	NEMA L6-30P 2 × 12-ft cord	12 × IEC 320-C13	4 × 10 A	4.27 × 20.32 × 43.18 cm 1.62 × 8.0 × 17.00 in	4.5 kg 11 lb
207590-B23[2]	North America	High	40 A	27	Field wiring	12 x IEC 320-C13	2 x 10 A; 3 x 15 A	4.27 × 20.32 × 43.18 cm 1.62 × 8.0 × 17.00 in	6.4 kg 14 lb

continued

Table 9. Compaq PDUs *(continued)*

Dual Input / Transfer Switch PDUs (12 outlets, 0U/1U mounting)								
191186-001[1]	North America	High	24 A	16	NEMA L6-30P 2 × 12-ft cord	12 × IEC 320-C13	4 × 10 A	4.37 × 30.48 × 43.18 cm 1.72 × 12.0 × 17.00 in	9.1 kg 20 lb
191186-B31[1]	International	High	30 A	20	IEC 309-32A 12-ft cord	12 × IEC 320-C13	4 × 10 A	4.37 × 30.48 × 43.18 cm 1.72 × 12.0 × 17.00 in	9.1 kg 20 lb
Note 1: This PDU supports power from two different sources. If one power source fails, the PDU uses the alternate source.								
Note 2: This PDU must be hard-wired to the power source by a certified electrician.								
Note 3: This PDU is using the maximum rated power supply input and not the de-rated values.								
Note 4: This PDU family is scheduled to be discontinued on December 31, 2002.								

Figuring Type and Number of PDUs

The type and number of PDUs required to power a full rack of servers depends on each server's power requirement, the number of servers deployed in the rack, and the available power for the servers.

Compaq PDUs support both high-voltage and low-voltage applications. The input current rating for a ProLiant DL360 G2 server is either 1.48 A at 200 to 240 volts or 2.80 A at 100 to 120 volts. To determine the number of servers supported by a PDU, divide the PDU's current rating by the server's total input current rating.

IMPORTANT: The examples shown in the following sections use the maximum rating of the power supply. They are for reference only.

Example

One high-voltage PDU (P/N 252663-D72) has a current rating of 24 A. The server has a total input current rating of 1.48 A at 208 volts.

24 A (PDU current rating) / 1.48 A (server total input current rating) = 16

This PDU can support a maximum of 16 servers at full server input current ratings.

Example

One low-voltage PDU (P/N 252663-D71) has a current rating of 24 A. The server has a total input current rating of 2.80 A at 110 volts.

24 A (PDU current rating) / 2.80 A (server total input current rating) = 8

This PDU can support a maximum of 8 servers at full server input current ratings.

For more information on PDUs, refer to the website located at:

www.compaq.com/ups

Selecting Server Power Cords

The appropriate server power cord to use depends on the cable management system installed in the rack. Generally, the sliding rail cable management system requires a power cord that is 1.8 m (6 ft) in length. This length provides enough slack for the power cord to route through the cable management arm.

Power Cords

The ProLiant DL360 G2 server ships with an IEC-IEC power cord (PN 142257-002) used for rack mounting with high voltage Power Distribution Units (PDUs). For low voltage, stand-alone deployments or installation without a rack, country-specific power cord options are available.

U.S. & Japan models will ship with two power cords - IEC-IEC and country-specific cord:

- Power cord, US, IEC320-C13 to IEC320-C14, 10 A 250 V, Straight (10 ft / 2.5 meter) (PN 142257-002)

- Power cord, US, IEC320-C13 to NEMA 5–15P, 15 A 125 V, Straight (10 ft / 3 meter) (PN 103541-001)

High-Voltage Y-Cables

The Vertical-Mount PDU Bracket with a High-Voltage Cables kit includes 11 Y-cables, each of which is 3.0 m (10 ft) long. The single-cord PDU section is 1.8 m (6 ft) long, and the dual-cord server section is 1.3 m (4 ft) long. See Table 9 for part numbers.

Note: You do not need the Vertical-Mount PDU Bracket to mount any of the PDUs listed in Table 9; however, the Y-cables shipped with this kit may be used with the PDUs.

Y-cables have a single-cord section with an IEC connector that connects to the PDU, a dividing joint in the center, and a dual-cord section with IEC connectors that connect to the servers. One Y-cable supplies power from the PDU to two ProLiant DL360 G2 servers in the standard configuration.

⚠ **CAUTION:** When installing server power cords into the PDUs, ensure that the load is balanced among the output circuit breakers. Do not exceed the ratings of the circuit breakers.

Table 10. Compaq High-Voltage Power Cables

Description	Compaq Part #	Description
Vertical-Mount PDU Bracket with High-voltage Cables kit	166097-B21	This kit includes two sets of PDU brackets and 11 Y-cables. Each cable is 10-ft long with a 6-ft section on the single-side and 4-ft sections on the dual-side.
10A IEC-to-IEC Cables kit	142257-001 (6 ft)	The IEC-to-IEC cables can be used either as individual power cords for the server or to extend the length of the high-voltage Y-cables. The cables are available in six-, eight-, and ten-foot lengths. The ProLiant DL360 G2 Server ships with one 10-ft IEC to IEC cable, part number 142257-003.
	142257-002 (8 ft)	
	142257-003(10 ft)	
	142257-006(4.5ft)	
	142257-007(4.5ft) kit of 15 cables	

Console Management Systems

A console management system enables a single keyboard and video console to control multiple servers. Install an in-rack console management system in the same rack with the servers it manages. Install an off-rack console management system in the local vicinity of the rack of servers it manages. Use a remote console management system to manage a rack of servers from any other system connected to the same network.

Table 11 lists options for configuring console management systems.

Table 11. Local Console Management Options

Product Name	Compaq Part No.	Description
Server Console Switch 1 x 8-port (100-230 V AC)	400337-001	N.A.
TFT5600 Rack-Mount Keyboard and Monitor	221546-001	1U integrated keyboard and monitor.
TFT5010R Flat Panel Monitor	217248-XXX	2U rack-optimized monitor (Keyboard not included).
1U Keyboard with Hot Keys and Trackball	158649-XXX	1U Form Factor
CPU-to-Switchbox Cable	110936-B25[1]	
Note 1: Use 6-ft cables for sliding rails.		

In-Rack Local Consoles

With an in-rack local console, all equipment, servers, switchboxes, keyboards, keyboard drawers, and video displays are installed together in the same rack. One console switchbox can support up to eight pieces of equipment.

Each server deployed in a fully populated rack with an in-rack local console management system requires the following accessories for successful deployment and operation:

* KVM server to console cables [1.8 m (6 ft) cables for sliding rail solutions].

* Universal Rack Rail (the quick deploy rail kit that ships standard with the server and comes with a cable management solution), or the option Sliding Rail Kit (with cable management solution), or optional telco rack solution.

Off-Rack Local Consoles

When an off-rack local console is used, certain components such as console switchboxes, keyboards, and video displays do not populate space in the rack, but are located in close proximity to the rack. Because of this, the rack can be fully populated with servers. Cable lengths for connecting servers to an off-rack local console vary in length depending on the location of the console.

Each server deployed in a fully populated rack with an off-rack console management system requires the following accessories for successful deployment and operation:

* KVM server to console cables.

* Given the thickness of the KVM cables, it is recommended to keep the console management system within the rack, especially in highly concentrated server deployments.

Remote Console Management

The new Integrated Lights-Out (iLO), the next generation of Compaq's Lights-Out technology, simplifies the life-cycle ownership of ProLiant servers. In the future, customers will receive the robust Lights-Out capabilities built into more ProLiant servers.

ILO includes an intelligent microprocessor and can be accessed via a new, dedicated Lights-Out port on the rear bezel of the server. This port can be connected to a corporate intranet, the Internet (via VPN technology), or a separate management network. Accessed via a standard browser from

anywhere, the Integrated Lights-Out capabilities will not require any unique software applications to use. ILO provides essential server management and diagnostics features combined with basic Lights-Out capabilities standard on the server. The essential features of iLO are referred to as iLO Standard. ILO Standard features include:

- Simplified setup

- Text-based console (for access to server boot sequences)

- Text-mode operating system console

- Remote power on/off

- Detailed server status, logs, virtual indicators, and diagnostics

- Automatic server recovery

The sophisticated virtual administration features of iLO can be easily accessed with a license key available with the Integrated Lights-Out Advanced option kit. The iLO Advanced feature suite include Virtual Graphical Console and Virtual Floppy Drive that provide significant cost savings by removing the time it takes to be physically present in front of the server for routine access and maintenance. The graphical remote console is accessible from anywhere on the network via a standard Microsoft Internet Explorer browser and is available during all server states (setup, boot, OS, and halted). The break-through Virtual Floppy enables remote deployment, remote application installation, and remote upgrade of servers thereby allowing customers to save time and money in their deployment, management, upgrade, and troubleshooting efforts. The Integrated Lights-Out functionality will extend to include Virtual CD that will be available as a free upgrade to iLO Advanced customers.

Each server deployed in a fully populated rack with a remote console management system requires the following accessories for successful deployment and operation:

- Integrated Lights-Out Advanced Pack

- An RJ-45 cable for the Integrated Lights-Out management port

Planning Rack Configurations

Consider several important factors when planning a rack configuration:

- The number of servers deployed in the rack

- The number of other devices such as keyboard drawers, video displays, and console switchboxes that support the servers

- The number of PDUs and their orientation

- The type of rack

- The rack management system

- The console management system

- The remote management system

- Network interface scheme

All of these factors influence floor support requirements, future service, as well as upgrade and installation requirements.

Table 12 lists the weight and power specifications for Compaq racks and rack option products. To calculate floor support requirements for a particular rack configuration, add the weight measurements to calculate the total weight of a rack fully populated with ProLiant DL360 G2 servers.

IMPORTANT: Populate a rack with ProLiant DL360 G2 servers and other rack option products only after the rack is in or very near its final position. Do not transport a fully populated rack.

Table 12. Compaq Rack and Related Options Weight (and power if applicable)

Option	Note	Weight	Power
Compaq Rack 10642 (42U)	Without the side panels	114.84 kg/253 lb	
Compaq Rack 9142 (42U)	Without the side panels	114.84 kg/253 lb	
Compaq Rack 9136 (36U)	Without the side panels	75 kg/165 lb	
Compaq Rack 7142 (42U)	Without the side panels	114.84 kg/253 lb	
High-voltage Power Y-cable	10 ft	0.45 kg/1 lb	
Keyboard/Video/Mouse molded cable	6 ft	0.64 kg/1.42 lb	
High-voltage 16 A PDU		4.99 kg/11 lb	
High-voltage 24 A PDU		4.99 kg/11 lb	
Low-voltage 24 A PDU		4.99 kg 11 lb	
Keyboard/trackball	With sliding tray	7.26 kg/16 lb	
TFT5010R Flat Panel Monitor	With sliding tray	22 kg/48.5 lb	45 W
TFT5600 Rack-mount keyboard and monitor	With sliding tray	6.25 kg/13.75 lb	50 W
Server Console Switch	1 x 8 port (100-230 V AC)	2.38 kg/5.25 lb	100 W

Compaq Rack Builder Online

Compaq Rack Builder Online is a tool that assists in planning and configuring new racks. It provides users with a powerful web-based tool for configuring one or many racks with Compaq components. Using either a simple guided interface or a "build it yourself" mode for advanced users, rack configurations are created using a complete and current database that includes all Compaq rack-mountable products. To access Compaq Rack Builder Online, visit the Compaq website:

www.compaq.com/rackbuilder

Special Considerations for Compaq Racks

Use the following considerations as guidelines for the ProLiant DL360 G2 server.

> ⚠ **WARNING:** Follow these guidelines to reduce the risk of personal injury or damage to the equipment:
>
> - Do not install a ProLiant DL360 G2 server into a rack until the rack has been placed in its final location.
>
> - Pre-install slide rails, PDUs, power cords, and cables into the rack in a build room or other location before moving the rack to its final location.
>
> - Extend the leveling jacks to the floor and rest the full weight of the rack on the jacks before installing any servers. The casters are not designed to support the full weight of a populated rack.
>
> - Do not move a rack populated with servers. A fully populated rack can weigh up to 1,800 pounds. Moving a populated rack can cause the rack to become unstable, resulting in serious personal injury or equipment damage.

To effectively cool the ProLiant DL360 G2 server in a 7000-series rack, replace the front door of the rack with the High Air Flow Rack-Door. Insert before deploying the servers in the rack.

Use the Rack Extension kit (P/N 154392-B21) to alleviate any space problems for cable bundles at the rear of 7000-series racks.

Rack Management Systems

To determine the best rack management solution, consider the service and upgrade demands of the servers deployed in the rack.

Universal Rack Rails

Because not all customers use Compaq racks, the ProLiant DL360 G2 server design supports deployment in many environments, Compaq ships standard a Universal Rack Rail that works in both Compaq and third-party rack cabinets. This kit includes variable length rack rails that are compatible with a variety of third-party racks depths and will work with either round or square holes. The Universal Rack Rail can be installed in racks that are 610 mm (24 inches) to 787 mm (31 inches) deep.

Sliding Rack Rails

The Sliding Rack Rails and cable management solution are conducive to in-rack servicing and provide convenient access to the server cables and connectors. With this solution, a server can be powered down and serviced without disconnecting the server cables or removing the server from the rack.

The Sliding Rack Rails and cable management solution use the same adjustable depth rack rail mechanism for either square or round hole racks. Therefore, they are designed for Compaq or third-party racks. The sliding rack rails compress and snap securely in place in the rack without screws or nuts.

A steel-cable pulley operates as the cable management solution and attaches directly onto the rear of the rack rail. It secures and routes the power, network, KVM cords, and cables along the rear of the rack. When a server is extended from the front of the rack for servicing, the steel cable from the cable pulley extends as well. This not only prevents the cables from sagging and tangling, but it also enables proper air ventilation through the rack while enabling the servers to be fully extended without disconnecting any of the server cables.

Refer to the *Compaq ProLiant DL360 G2 Setup and Installation Guide* for complete installation instructions.

Telco Rack Solution

Many data centers use two post telecommunication (telco) racks. The ProLiant DL360 G2 server design supports deployment in telco racks. Compaq offers a telco rack kit designed to install ProLiant DL360 G2 servers in telco racks. This kit includes rack rails and screws that are compatible with a variety of telco racks. The telco rack kit includes replacement server rails designed to fit on the ProLiant DL360 G2 server. Before deploying ProLiant DL360 G2 servers into a telco rack, remove the standard server rails and replace them with the telco server rails included in the telco rack kit.

IMPORTANT: Always install the Compaq telco rack kit when deploying a ProLiant DL360 G2 server in a telco rack.

Suggested Rack Configurations

Table 13 is a Quick Reference table with suggested rack configurations for deploying Compaq DL360 G2 servers. Examples of these configurations are further explained later in this section in Configurations A, B, and C.

Table 13. Suggested Rack Configurations Quick Reference

Configuration	A	B	C
Priority	Maximum Performance Density	Maximum Flexibility	Traditionalist
Rack Size	42U	42U	42U
Server Count	42	35	28
Power Source	High Voltage	High Voltage	Low Voltage
Rack Level Power (De-Rated)	8,300 W + switch power	6,860 W + switch power	5,488 W + switch power
PDU	2 x 40 Amp Modular PDU	2 x 24 Amp Dual Input PDU	4 x 24 Amp PDU
KVM	No local KVM Console (iLO only)	4 x 8 port KVM switch	4 x 8 port KVM switch
Lights-Out Management	iLO Advanced	iLO Advanced	iLO Standard or iLO Advanced
IP Connections	1 x 48 Port 10/100 Ethernet Switch (44+4)* for iLO	2 x 24 Port 10/100 Ethernet Switch (22+2)** for iLO	2 x 24 Port 10/100 Ethernet Hub for iLO
	6 x 16 Port Gigabit Ethernet Switch for data	1 x 48 Port Gigabit Ethernet Switch (44+4)* for data	2 x 48 Port Gigabit Ethernet Switch (44+4)* for data

*   44 10/100 ports plus 4 Gigabit uplink ports
**   22 10/100 ports plus 2 Gigabit uplink ports

Configuration A: Maximum Performance Density (42 Servers, High-Voltage)

This configuration shows a "best practice" for a 42U rack with 42 servers in a high-voltage facility where a deployment plan can accommodate the de-rating of each ProLiant DL360 G2 server. The "Power and Thermal Budgeting" section explains power budgeting methods and measured power for different base-line configurations and subsystem components. The following calculation verifies supporting 42 servers with 2x40 A high voltage PDUs:

Since there are 2 PDUs supporting 42 servers, each PDU needs to support 21 servers. A 40 A high-voltage PDU supporting 21 servers can allocate each server with maximum current of (40/21=) 1.905 A @ 208 V. Therefore, the allocated maximum input power for each server will be:

$$1.905 \text{ A} * 208 \text{ V} = \underline{396 \text{ W}}$$

Since the maximum input power per server is 308 W, 308 W will be used to calculate the maximum thermal dissipation per server. It will be:

$$308 \text{ W} * 3.41 = 1050 \text{ BTUs/hour}$$

For 42 servers, the total thermal dissipation will be (1050*42=) 44,112 BTUs/hour.

In the "Measured Input Power" section of this document, a fully configured system was measured to consume lower than 250 W (Table 6, Server Configuration 4). If each de-rated server configuration input power is lower than 238 W, then 42 servers can be supported via this configuration summary.

Table 14. Configuration A Summary

Configuration A Summary
Rack Contents
Units
42 servers with all fixed or all sliding rails with cable trays
2 high voltage 40 A Modular PDUs
Internal Cables
42 standard power cords going to 2 PDUs in the side panels
Cables External to Rack
42 (management) network cables from the Integrated Lights-Out's RJ45 connector to external 48 port Ethernet switches with 44 10/100 ports and 4 Gigabit ports
84 (data) network cables from the on-board 10/100/1000 NICs' RJ-45 connectors to six external 24 port Gigabit Ethernet switches, assuming use of two LAN connections per server
2 high voltage input power cords hardwired from the PDUs to facility AC power feeds
Site Utility Requirements (worst-case)
Power: 2 dedicated 200 V-240 V 50 A branch circuits.
Thermal: up to 34,100 BTUs/hour [This number is a worst-case. The actual BTUs/hour will depend on the OS/application software running and the server hardware configurations.]
Weight: up to 1,665 lb (with sliding-rails) [The network cables are not accounted for since most implementations route the network cables to the ceiling-hung cable rails outside of the rack.]

The optional Integrated Lights-Out Advanced Pack is recommended for all console management (local and remote) for this configuration. The network cables originating from each ProLiant DL360 G2 server connect to network switches outside this rack enclosure.
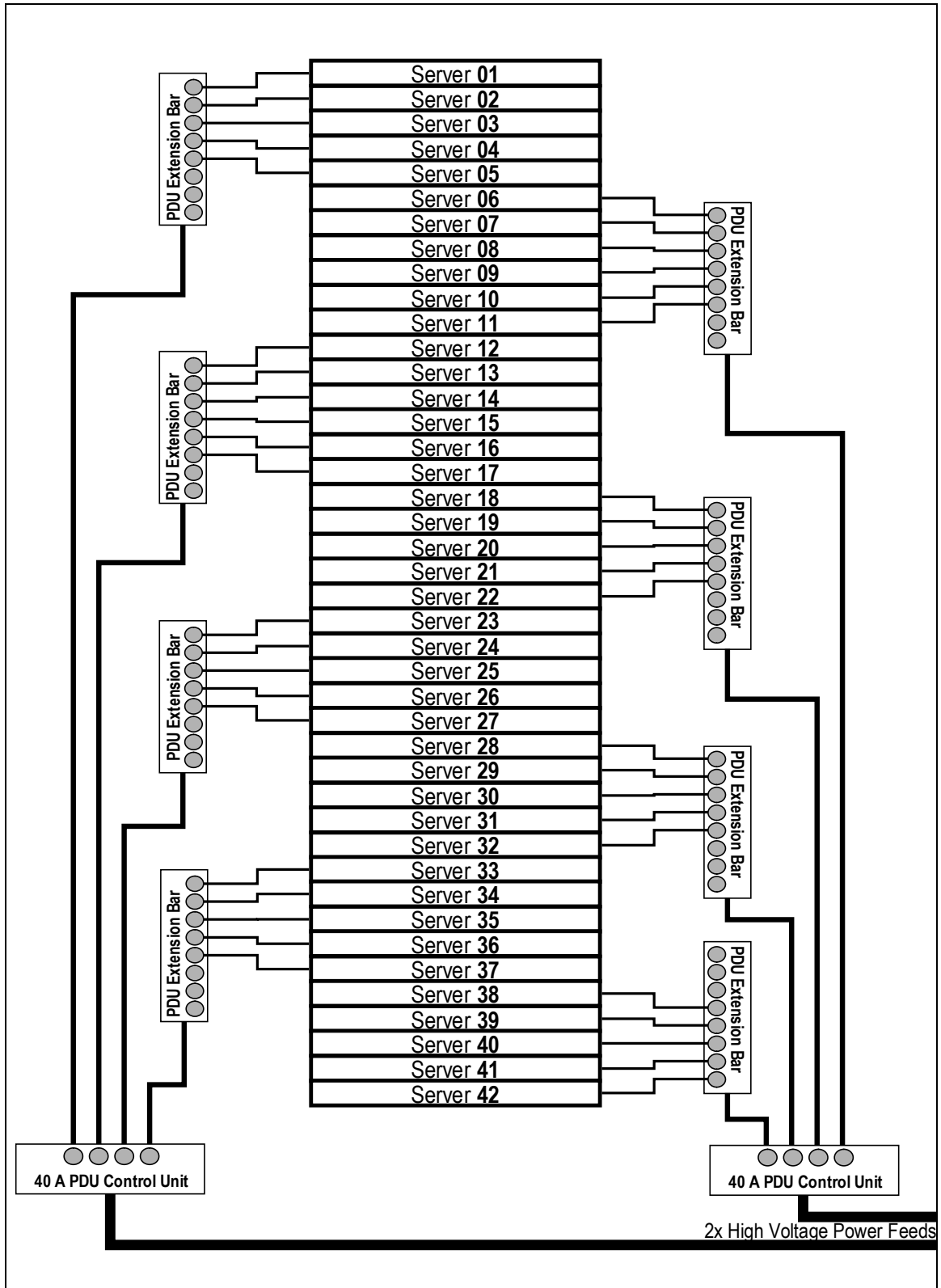
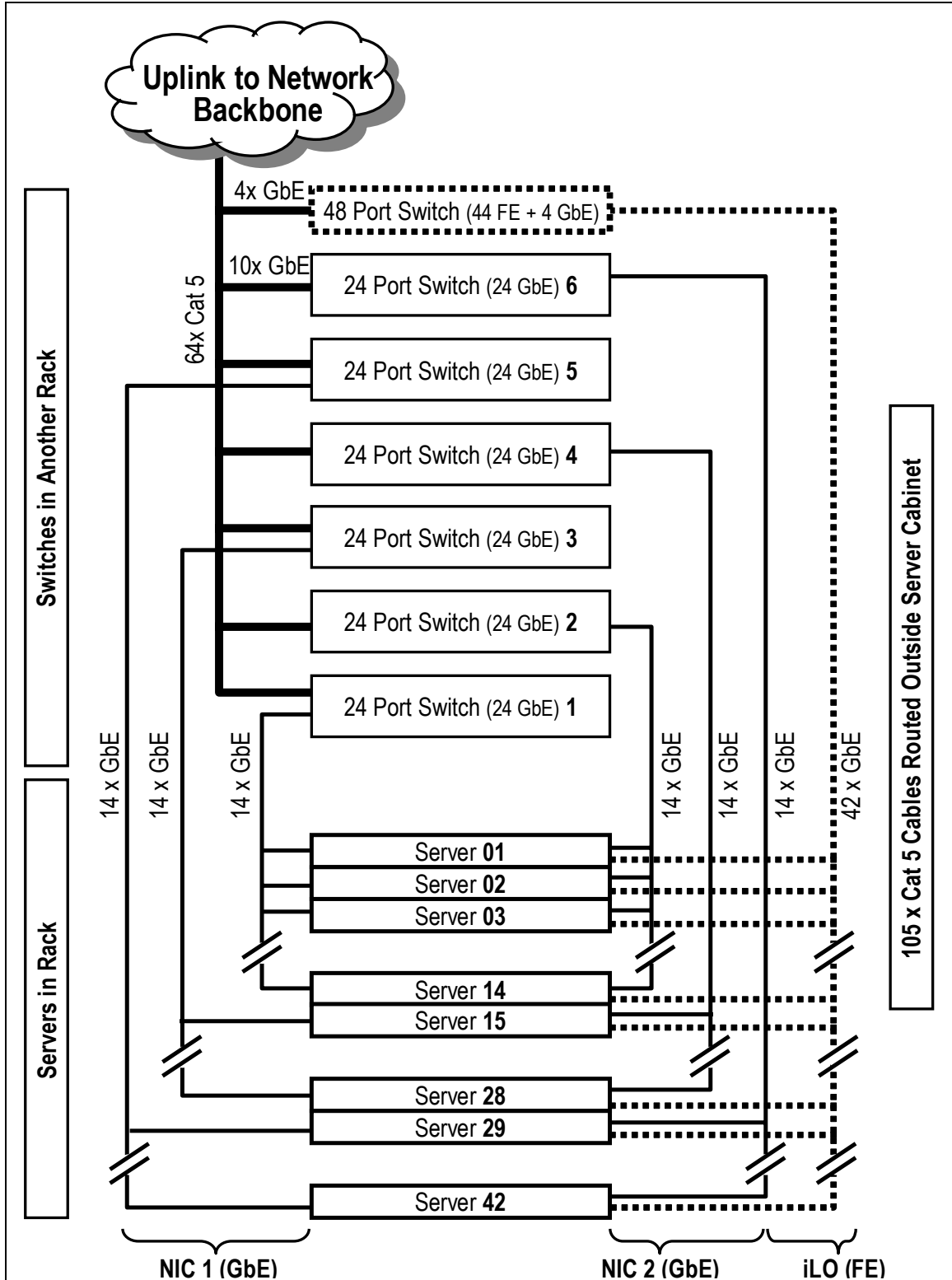**Figure 1.   Configuration A (Maximum Performance Density) Power Diagram**

Figure 2.   Configuration A (Maximum Performance Density) Ethernet Cable Diagram

Note: There are no KVM Switches used in Configuration A. The Integrated Lights-Out Advanced Pack handles all of the local consoles. See Figure 2 for the Ethernet Cable Diagram.

Configuration B: Maximum Flexibility (35 Servers, High-Voltage)

The following calculation verifies supporting 35 servers (de-rated Power Budget) with 24 A high-voltage PDUs:

Since there are 2 PDUs supporting 35 servers, 4 KVM switches, 4 Ethernet switches, and (1) 1U Keyboard/Monitor, each PDU needs to support up to 22 devices. A 24 A high-voltage PDU supporting 19 servers can allocate each server with maximum current of (24/19=) 1.26 A. Assuming 208 V, the allocated maximum input power for each server will be:

$$1.26 \text{ A} * 208 \text{ V} = \underline{263 \text{ W}}$$

The maximum thermal dissipation per server will be:

$$263 \text{ W} * 3.41 = 897 \text{ BTUs/hour}$$

For 35 servers, the total thermal dissipation will be (897*35=) 31,395 <u>BTUs/hour</u>.

In the "Measured Input Power" section of this document, a fully configured system was measured to consume lower than 250 W (Table 6, Server Configuration 4). If each de-rated server configuration input power is lower than 263 W, then 35 servers can be supported via this configuration summary.

Table 15. Configuration B Summary

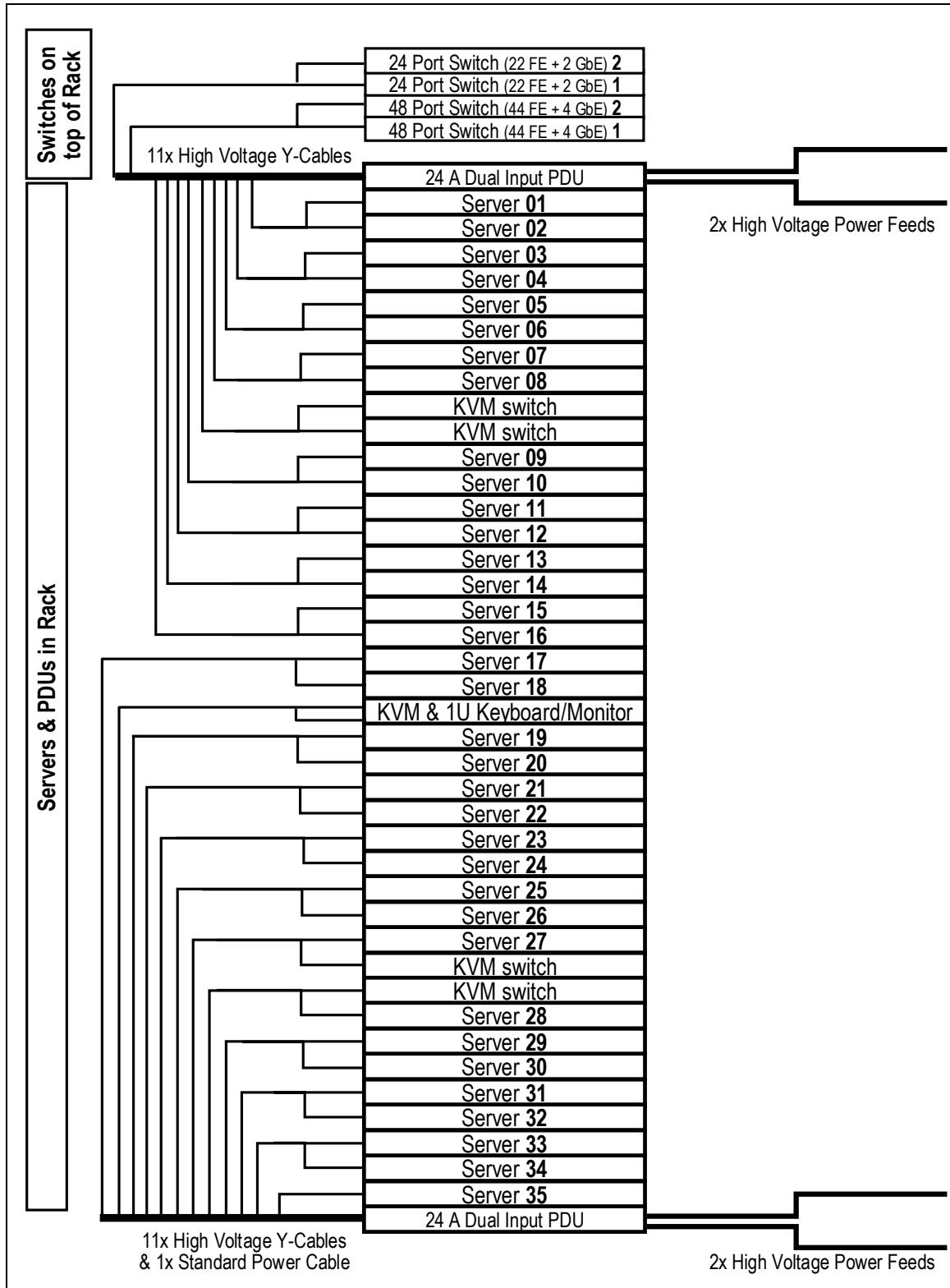| Configuration B Summary |
|---|
| **Rack Contents** |
| **Units** |
| 35 servers with all fixed or all sliding rails with cable trays |
| 2 X 24 A Dual Input PDUs |
| 2 x 48 port Ethernet switches |
| 2 x 24 port Ethernet switches |
| 4 KVM switches |
| 1 x 1U Keyboard/Monitor |
| **Internal Cables** |
| 35 power cords going to 2 PDUs |
| 40 KVM cables going from switch to server, switch to switch and switch to 1U Keyboard/Monitor |
| **Cables External to Rack** |
| 35 (management) network cables from the Integrated Lights-Out Edition's RJ45 connector to two external 24 port Ethernet switches, each with 22 10/100 ports and 2 Gigabit ports |
| 70 (data) network cables from the on-board 10/100/1000 NICs' RJ-45 connectors to external 48 port Ethernet switches with 44 10/100 ports and 4 Gigabit ports, assuming use of two LAN connections per server |
| 4 high voltage input power cords connecting from the PDUs to the facility AC power feeds |
| **Site Utility Requirements (worst-case)** |
| **Power:** 4 dedicated 200 V-240 V 30 A branch circuits (2 from each separate feed). |
| **Thermal:** up to 31,395 BTUs/hour [This number is a worst-case. The actual BTUs/hour will depend on the OS/application software running and the server hardware configurations.] |
| **Weight:** up to 1,690 lb [The network cables are not accounted for since most implementations route the network cables to the ceiling-hung cable rails outside of the rack.] |

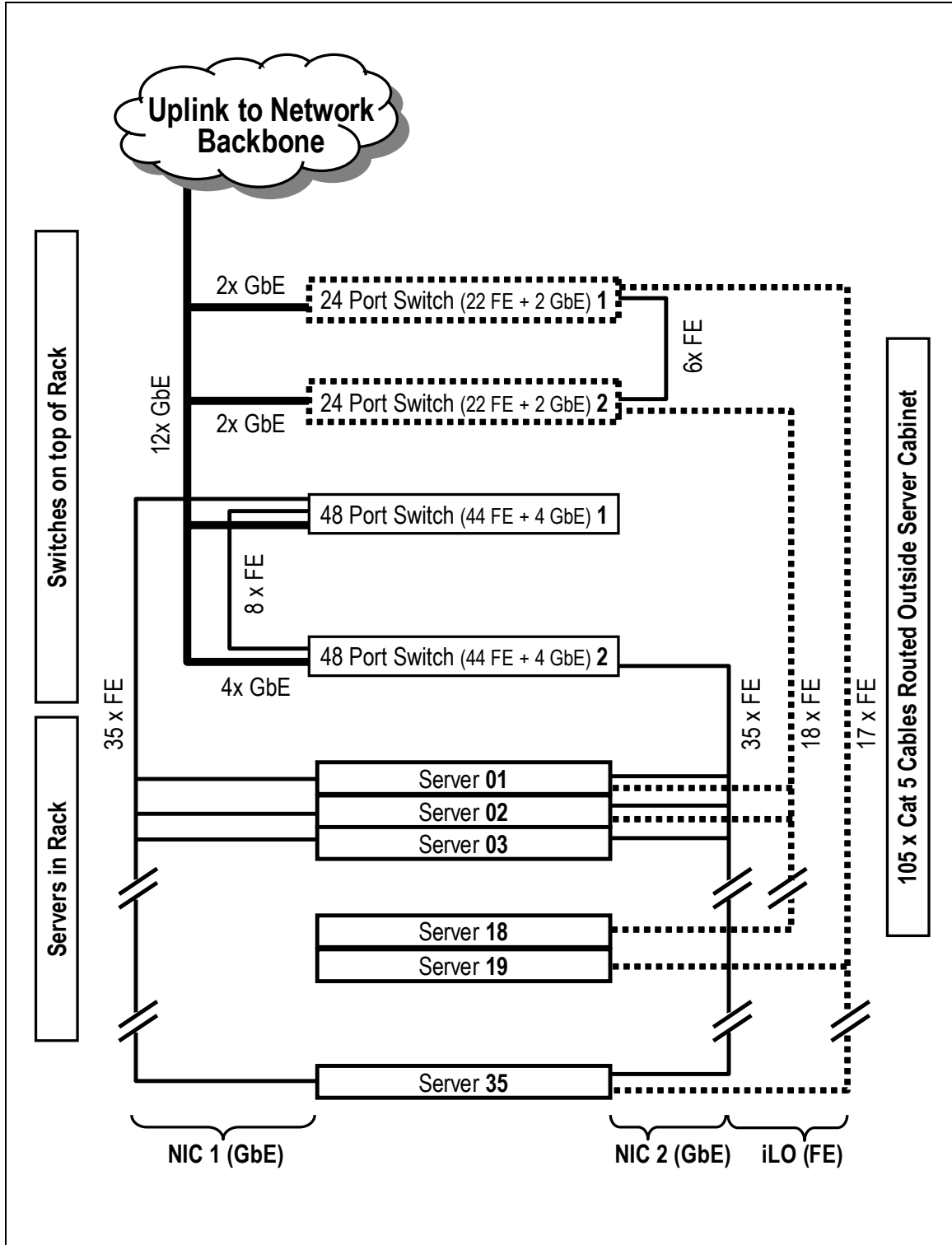**Figure 3.   Configuration B (Maximum Flexibility) Power Diagram**

Figure 4.   Configuration B (Maximum Flexibility) Ethernet Cable Diagram
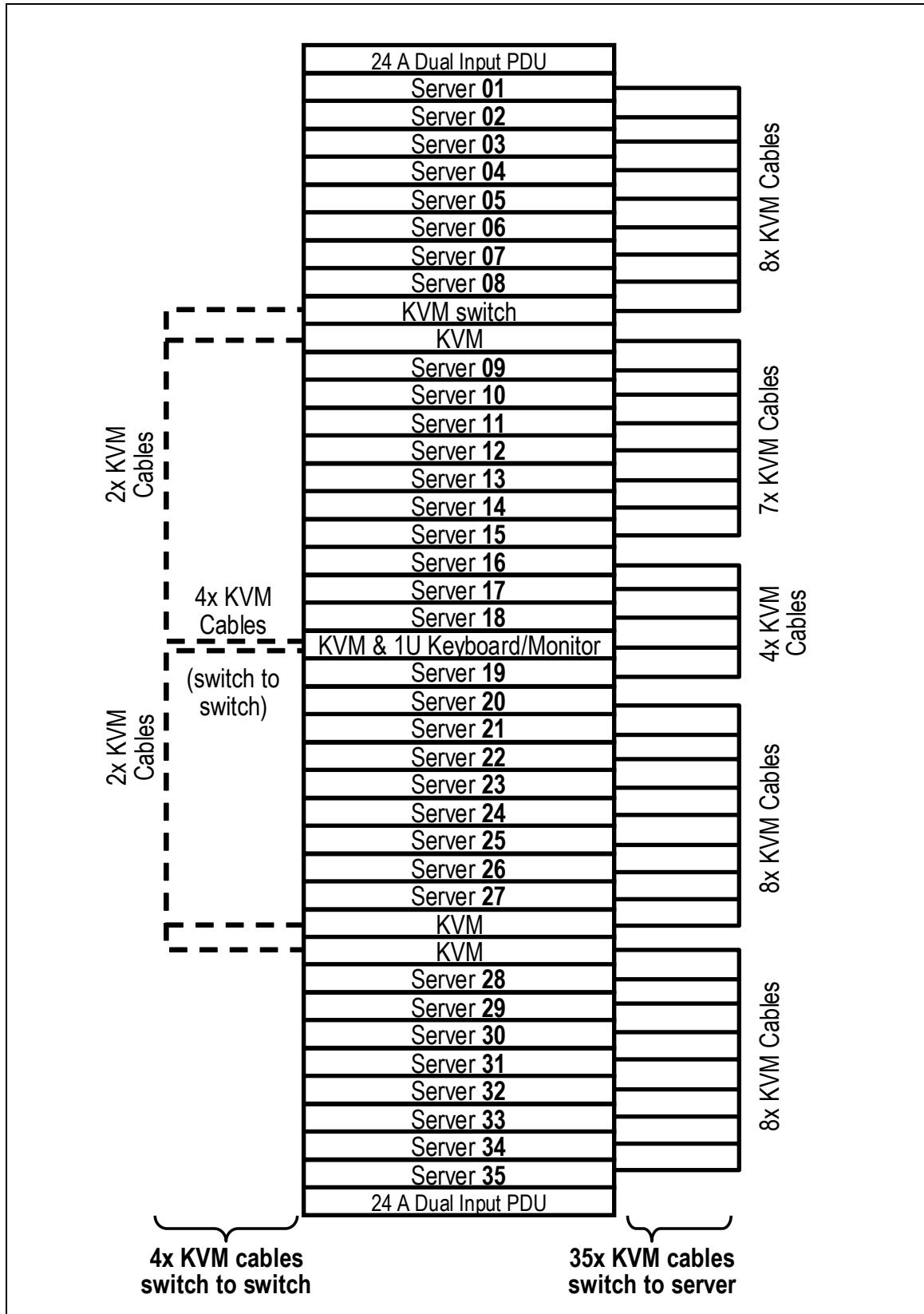
Figure 5.   Configuration B (Maximum Flexibility) KVM Diagram

Configuration C: Traditionalist (28 Servers, Low-Voltage)

The following calculation verifies supporting 28 servers (de-rated Power Budget) with 24 A low-voltage PDUs:

Since there are 4 PDUs supporting 28 servers, 4 KVM switches, 2 Ethernet switches, 2 Ethernet hubs and (1) 1U Keyboard/Monitor, each PDU needs to support up to 18 devices. A 24 A low-voltage PDU supporting 8 servers can allocate each server with maximum current of (24/8=) 3.0 A. Assuming 110 V, the allocated maximum input power for each server will be:

$$3.0 \text{ A} * 110 \text{ V} = \underline{330 \text{ W}}$$

The maximum thermal dissipation per server will be:

$$330 \text{ W} * 3.41 = 1{,}125 \text{ BTUs/hour}$$

For 28 servers, the total thermal dissipation will be (1,125*28=) <u>31,508 BTUs/hour</u>.

In the "Measured Input Power" section of this document, a fully configured system was measured to consume lower than 250 W (Table 6, Server Configuration 4). If each de-rated server configuration input power is lower than 330 W, then 28 servers can be supported via this configuration summary.

Table 16. Configuration C Summary

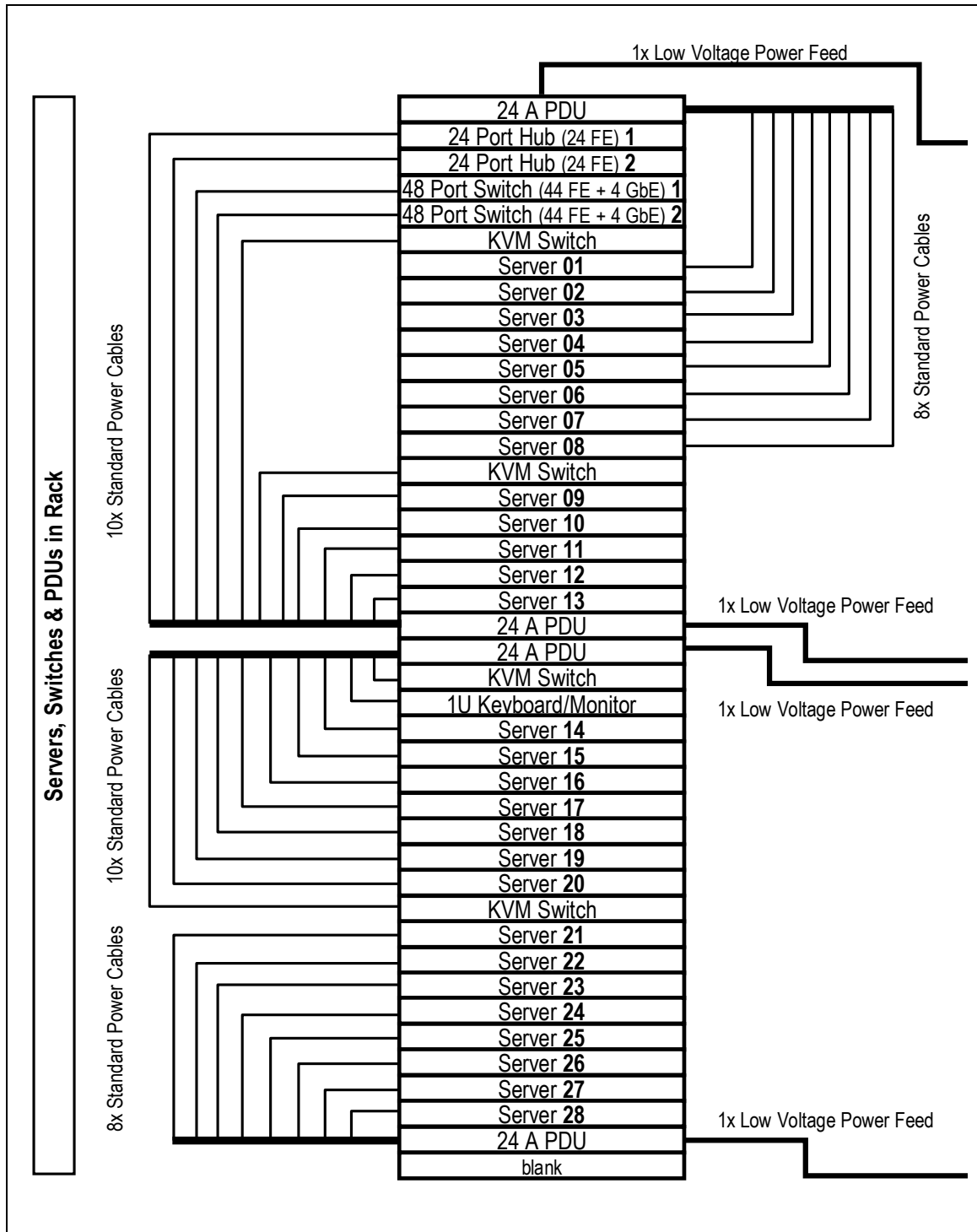| Configuration C Summary |
|---|
| **Rack Contents** |
| **Units** |
| 28 servers with all fixed or all sliding rails with cable trays |
| 4 low voltage 24 A 0U/1U PDUs |
| 2 x 48 port Ethernet switches |
| 2 x 24 port Ethernet hubs |
| 4 KVM switches |
| 1 x 1U Keyboard/Monitor |
| **Internal Cables** |
| 36 power cords going to 4 PDUs in the side panels [These cables are supplied with the servers.] |
| 32 KVM cables going from switch to server, switch to switch and switch to 1U Keyboard/Monitor |
| 28 (management) network cables from the Integrated Lights-Out Edition's RJ45 connector to two 24 port 10/100 Ethernet hubs |
| 56 (data) network cables from the on-board 10/100/1000 NICs' RJ-45 connectors to two 48 port Ethernet switches each with 44 10/100T ports and 4 gigabit ports, assuming use of two LAN connections per server |
| **Cables External to Rack** |
| 4 low voltage input power cords connecting from the PDUs to facility AC power feeds |
| **Site Utility Requirements (worst-case)** |
| **Power:** 4 dedicated 100 V-120 V 30 A branch circuits. |
| **Thermal:** up to <u>31,508 </u>BTUs/hour [This number is a worst-case. The actual BTUs/hour will depend on the OS/application software running and the server hardware configurations.] |
| **Weight:** up to 1,690 lb [The network cables are not accounted for since most implementations route the network cables to the ceiling-hung cable rails outside of the rack.] |

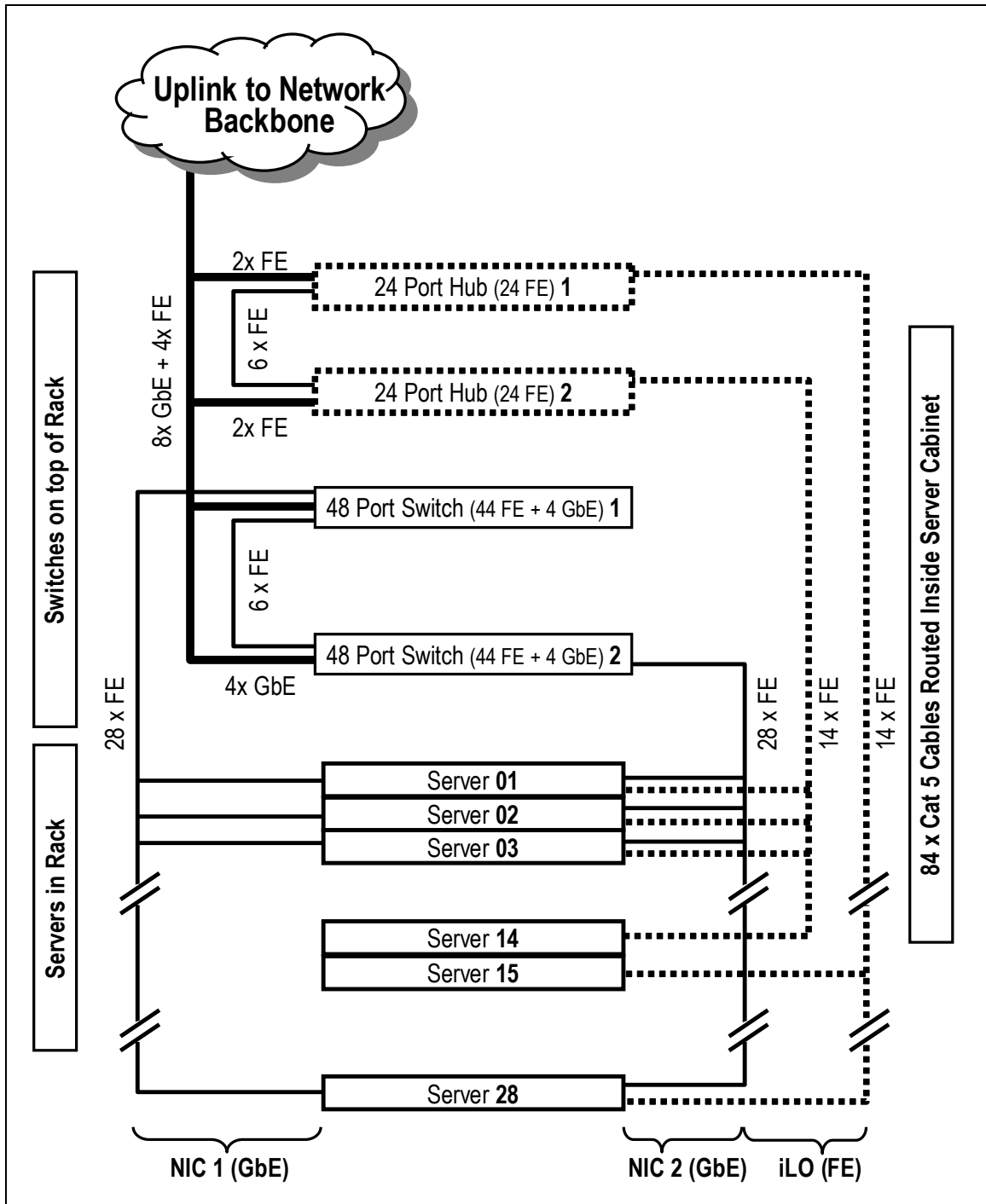**Figure 6.   Configuration C (Traditionalist) Power Diagram**

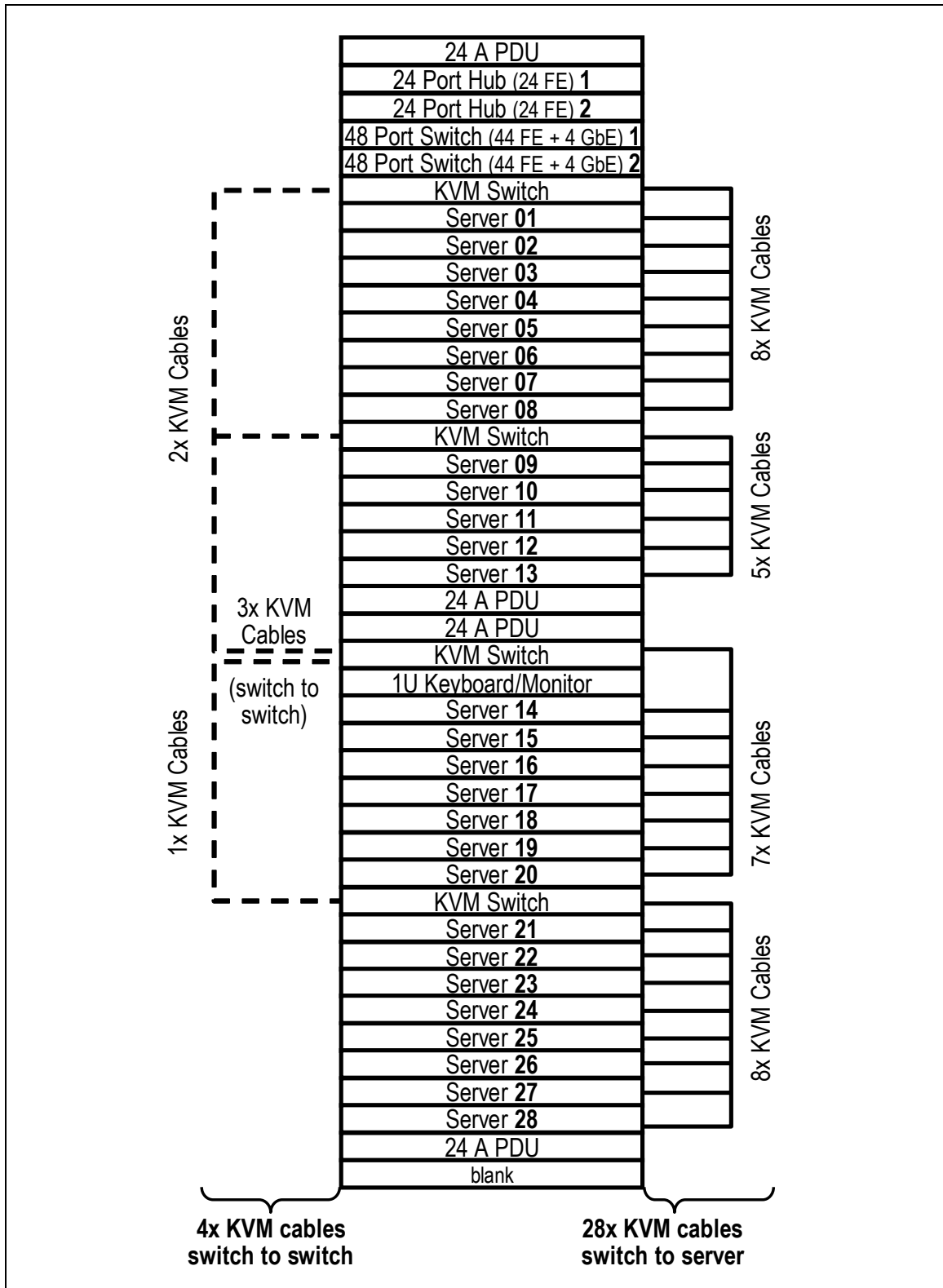**Figure 7. Configuration C (Traditionalist) Ethernet Cable Diagram**

Figure 8.   Configuration C (Traditionalist) KVM Diagram

Installation Procedures

Note: Take necessary precautions for all procedures.

This section describes the preparation and brief installation procedures that are common to various configurations described in the previous section.

1. Server Preparation

2. Rack Preparation

3. Installing PDUs

4. Installing the Rack Rails

5. Installing a Server in a Rack

6. Connecting Cables

7. Completing the Installation

Execute Steps 2 through 7 in order, especially when multiple racks are connected together or when a rack is populated in a separate room and relocated to its final position. Step 1 can be done any time before Step 5.

Server Preparation

This section briefly describes the preparation necessary for the ProLiant DL360 G2 server. Refer to the *Compaq ProLiant DL360 G2 Setup and Installation Guide* and accompanying documentation for details.

The ProLiant DL360 G2 server comes standard with Universal Rack Rails as a fast deployment solution for fixed rack rail kits. If the application does not require in-rack servicing, then the factory-equipped fixed-rails may be used for installation.

The sliding rails and the cable management solution option allows the server to be extended fully from the rack, temporarily locked in place for servicing, and without removing the cables from the server. It also provides better access to the rear cabling connections. If customers choose to use the sliding rail and cable management solution option, then replace the factory-mounted fixed server rails with the optional sliding server rails on the server. Then install the optional cable tray to the rear of the server chassis per the instructions that come with the option.

Prior to installing a ProLiant DL360 G2 server in a rack, install all the necessary optional components inside the server, such as the PCI option cards, additional processor, and additional DIMMs.

Rack Preparation

Most of the discussions in this section will focus around Compaq 42U racks. The rack selection criteria and recommendations are beyond the scope of this document. A bustle or an extension kit might be required if the installation will end up with several cables for all ProLiant DL360 G2 servers, for example, KVM cables. For complete details on rack installation, refer to the set up and install guides for the respective rack models.

Installing Power Distribution Units

PDU installation varies depending on the rack configuration, the number of servers deployed in the rack, the selected type of PDU, as well as the voltage and current rating for each PDU. For information on Modular or Dual Input PDUs, refer to the information located on the website at:

www.compaq.com/ups

Routing Power Cords

Use the following general procedures to route server power cords in 36U, 42U, and 47U racks.

IMPORTANT: When installing server power cords into the PDUs, ensure that the load is balanced among the output circuit breakers.

Power Cords

To route and connect power cords:

IMPORTANT: Route and connect the power cord to the PDU after the server is installed.

1. Connect the power cord to the server first and route it through the cable management system with the other server cables.

2. Route the power cord inside the rear rack support to the PDU.

IMPORTANT: In 7000-series racks, route the power cables from the servers to the PDUs through the gap in the rear of the rack rail.

High-Voltage Y-Cables

To route high-voltage Y-cables:

1. Connect the single-cord section of the Y-cable to the PDU installed on the same side as the cable management tray.

2. Align the Y-joint with the rear rack support and center it between the rack rails of the two servers that the Y-cable supports.

3. Use two plastic tie wraps to secure the Y-joint to the rack support.

4. After installing the servers, connect the cables to the servers and route them through the cable management system with the other server cables.

Installing the Rack Rails

The following procedure describes how to install the standard rack rails onto the rack. The rails are designed to snap in place without screws or nuts.

1. Remove the server rails from the left and right standard rails.

2. Insert the rails into the rack holes.

3. Insert the server into the rack.

4. Install the cable management arm.

5. Cable and power up the server.

Repeat the procedure for any subsequent rack rails. For detailed instructions on installing standard rack rails, refer to the *Compaq ProLiant DL360 G2 Server Setup and Installation Guide* and to the *Compaq ProLiant DL360 G2 Hardware Configuration and Installation Poster*.

> ⚠ **CAUTION:** Always install servers from the bottom of the rack to the top. Installing servers in this manner provides more stability for the rack and reduces the risk of the rack tipping over.

> **IMPORTANT:** Before installing the rack rails for the standard rack rails and cable management arm, remove the server rails from the slide rail assembly. See the "Server Preparation" section in this document for more information.

> **IMPORTANT:** Install a ProLiant DL360 G2 server in every U-space from the bottom to the top for maximum density.

Installing a Server in a Rack

Install ProLiant DL360 G2 servers in the rack from the bottom to the top. Tighten the thumbscrews on the front of each server to secure the server to the rack. Attach the cable management arm to the rear of the server and to the rear of the rack.

> ⚠ **WARNING:** To reduce the risk of serious personal injury, fire, or damage to the equipment:
>
> - Extend the leveling jacks to the floor and rest the full weight of the rack on the leveling jacks.
>
> - Install either the stabilizer kit or couple multiple racks together for stability.
>
> - Load the heaviest item first and load the rack from the bottom to the top. Loading the rack in this manner makes the rack "bottom-heavy" and helps prevent the rack from becoming unstable.
>
> - Do not overload the AC supply branch circuit that provides power to the rack.
>
> - Extend only one ProLiant DL360 G2 server at a time. A rack might become unstable if more than one server is fully extended for any reason.

Connecting Cables

This section discusses connecting and routing cables with different cable management solutions and different console management solutions.

1. Connect the cables to each device installed in the rack, working from the bottom to the top.

2. Connect the cables to the bottom piece of equipment.

3. Bundle the cables and route them through the cable management solution.

4. Connect the cables to the console switchbox.

5. Connect the power cord to the PDU. Do not connect the PDU to any power source until all equipment is fully deployed in the rack.

Refer to *Compaq ProLiant DL360 G2 Server Setup and Installation Guide* for the recommended order for connecting cables.

When the cables are properly connected and routed through the cable management arm, the rear door of the rack closes easily over the cables. If the rear door does not close easily, additional space might be required. Install the rack extension or the bustle kit to provide more space for the cables at the rear of the rack.

⚠ **WARNING:** To reduce the risk of electrical shock or damage to the equipment:

- Unplug the power cord from the system.

- Do not disable the power-cord-grounding plug. The grounding plug is an important safety feature.

- Plug the power cord into a grounded (earthed) electrical outlet that is easily accessible at all times.

- Do not route the power cord where it can be walked on or pinched by items placed against it. Pay particular attention to the plug, electrical outlet, and the point where the cord extends from the server.

IMPORTANT: In 7000-series racks, route the power cables from the servers to the PDUs through the gap in the rear of the rack rail.

Integrated Lights-Out for Remote Console Management

The remote console management system uses a CAT5 cable connected to the RJ-45 connector in the Integrated Lights-Out management port. Route this cable according to the instructions in the *Compaq ProLiant DL360 G2 Server Setup and Installation Guide*. Connect the CAT5 cable to the network data line outlet.

Completing the Installation

To complete the installation:

1. Install side panels on the outsides of the end racks.

2. Install the front and rear doors.

3. Connect the PDUs to the power source.

4. Power up the servers.