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White Paper
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HP ProLiant DL360 Generation 3 Server High-Density Deployment

Table of Contents

Introduction

This white paper is a planning guide to expedite concentrated deployments of HP ProLiant DL360 Generation 3 servers in a single rack. This information is intended for field systems engineers, IT managers, installation technicians, and any personnel tasked with the installation and maintenance of the ProLiant DL360 G3 server. Use this white paper in conjunction with documents for the ProLiant DL360 G3 server and HP ProLiant branded rack deployment products as necessary.

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.

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.

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 fit a large number of density-optimized servers into existing server rooms and data centers. HP meets this need with the density-optimized line of HP ProLiant servers, such as the ProLiant DL360 G3 server. At a height of 1U each, up to 42 of these servers can fit in a single HP ProLiant branded 42U rack. This server has clear space saving benefits; its compressed size presents new challenges for rapid server deployment, cable management, and environmental considerations.

HP engineers have developed innovations in rapid high-volume deployment and improved cable management for large installations of these 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 HP ProLiant branded rack configurations, such as keyboard, video, and mouse infrastructure. The installation of a high-density system can place significant demands on utility power that, if not considered and managed appropriately, can result in downtime due to equipment failure, power main failure, or both. Power management becomes a critical element in an enterprise system handling large volumes of data and/or users where downtime costs can easily run into thousands of dollars per hour.

IMPORTANT: This document discusses the ProLiant DL360 G3 server primarily and the HP ProLiant branded 9000- and 10000-series racks and related rack options secondarily. This document does not discuss other servers, products or racks not manufactured by HP, although the ideas presented here may be applied to third party racks.

Note: This document discusses only HP components and solutions although the information and ideas presented herein may be applicable to third party hardware.

Glossary

Table 1. Glossary of Power Terms

Term	Description
High Voltage	180 - 264 VAC (200-240 VAC nominal) supplied to areas where load requirements are such that high voltage is more economical. Common in commercial applications in North America, numerous foreign countries also use this range as the AC appliance standard.
Inrush Current	A high, momentary current draw occurring when power is first applied to electrical systems. This current drain is not relative to the power-on requirements of equipment; it is due to the capacitive and inductive properties of components in the power supply.
Keyboard/ Video/Mouse	Keyboard/video/mouse (KVM) peripherals. A KVM switch is an accessory that switches a single KVM set between two or more server units.
Ground Leakage Current	Residual current flow through the grounding conductor; always undesirable. With data processing occurring at ever-increasing speeds, most IT equipment these days includes capacitors in the power circuits to filter radio frequency (RF) signals to ground. While effective at filtering RF, these components tend to allow a small amount of AC current to pass to the ground. Leakage current is additive, so that as more equipment is connected to the AC mains, the amount of leakage can increase.
Low Voltage	90 - 132 VAC (100-120 VAC nominal) supplied at utility outlets in homes and offices. This is the AC appliance standard used in North America, Latin America, and Japan.
Power Density	The amount (product) of amps and voltage provided to a system (VA). A 120-VAC 30-amp circuit will deliver a power density of 3600 VA while a 208-VAC 30-amp circuit (single-phase) will deliver a power density of 6240 VA.
Power Distribution Unit (PDU)	Rack-mounted component that connects directly to the building's AC power infrastructure. The PDU typically provides circuit-breaker protection for groups of AC outlets into which separate AC components of the rack are plugged. Some PDU designs offer primary/secondary switching.
Power Factor (Pf)	An efficiency rating that indicates the amount of watts actually consumed by a load from the volt-amperes delivered to it. The rating is expressed as either a decimal number between 0 and 1 or percentage of the formula of dividing watts by volt-amperes. A power factor of 1 indicates that a device receiving 1 VA is consuming 1 watt.
Power Service	Point at where electrical power enters a building or equipment room.

Table 1. Glossary of Power Terms

Term	Description
Volt-Ampere (VA)	A rating of apparent power (i.e., the amount of AC power that is available to or can be handled by utility equipment) measured with a volt meter and an ammeter. In single-phase systems VA = E × I, where E = volts, I = current in amperes. In three-phase systems VA = 1.73 × E × I.
Watt (W)	A rating of true power consumed by the product and measured with an input power meter. In single-phase systems W = E x I x pf, where E = volts, I = current in amperes, and pf = power factor.

ProLiant DL360 G3 Server Power Requirements

In the standard single-processor configuration, the ProLiant DL360 G3 server includes one 325-watt power supply that can operate off high or low voltage AC power. Single power supply units can be upgraded to a dual-power supply configuration with a redundant power supply option kit. The power supplies are hot-pluggable, allowing live removal and replacement.

The ProLiant DL360 G3 server uses an IEC C14-type AC plug that requires a power cable with an IEC C13 receptacle at one end. Power cord kits that are compatible with the physical and electrical requirements of the DL360 G3 server are available from HP and listed later in this document.

The ProLiant DL360 G3 server power specifications are provided in the following table using values derived from the product specification as well as the Power Calculator utility with a server in nominal and maximum configurations.

Table 2. ProLiant DL360 G3 Server Power Specifications

	Input Voltage					
	100	115	208	220	230	240
Power Supply Rated Output (W)	325	325	325	325	325	325
Nom. Input Wattage (W)	234	232	227	224	222	220
Max. Input Wattage (W)	338	336	329	326	324	321
Nom. Input Current Draw (A)	2.4	2.1	1.1	1.0	1.0	0.9
Max. Input Current Draw (A)	3.5	3.0	1.6	1.5	1.4	1.4
Nom. Input (Va)	238	237	231	228	227	225
Max. Input (Va)	345	343	336	332	330	328
Max. Thermal (Btu/Hr)	1154	1146	1123	1111	1104	1095
Efficiency (%)	72.1	72.6	74.1	74.9	75.4	76.0
Power Factor	0.98	0.98	0.98	0.98	0.98	0.98
Nom. Leakage Current (Ma)	0.31	0.36	0.65	0.69	0.72	0.75
Max. Leakage Current (Ma)	0.63	0.72	1.30	1.38	1.44	1.50
Nom Inrush Current (A) @ 2 Ms	30	30	30	30	30	30
Max Inrush Current (A) @ 2 Ms	60	60	60	60	60	60

NOTES:

Nom. = Nominal rating of a unit operating w/ one processor, 1HDD, up to 2 DIMMs, and no PCI cards.

Max. = Maximum rating of a fully loaded unit: 2 processors, 2HDD, 4 DIMMs, 1 PCI cards, and 2 power supplies.

These values are derived from a combination of product specifications and the Power Calculator configured as above in "Nom" and "Max."

Power Distribution Solutions

HP recommends using power distribution units (PDUs) in installations where a number of server units can place serious loading demands on the AC power bus. HP offers PDUs that provide safety and reliability to multi-server installations.

The PDUs described in this white paper offer 0U and 1U mounting options and feature circuit-breaker protection of equipment in groups.

Figure 1 shows a PDU using the 0U rack mounting option. This configuration may be preferable in a high-density installation requiring the maximum amount of vertical space for servers and other active components. The 0U configuration offers the following advantages:

- Saves vertical rack space for equipment requiring more operator/ maintenance accessibility.
- Easy access to power connections

Figure 2 shows a PDU using the 1U rack mounting option. This configuration may be preferable in installations where operator or maintenance accessibility to all components is key. The 1U configuration offers the following advantages:

- Easy access to all switches and circuit beakers.
- Easy viewing of circuit status LED.
- Easy access for service replacement or upgrade.

Figure 1. 0U Rack Mounting Option

Figure 2. 1U Rack Mounting Option

Modular PDU

The Modular PDU consists of a control core that connects to the power bus (or to a UPS) and four extension bars that distribute power to the equipment groups. The control core includes a 15A circuit breaker for each of the four C19-type extension bar outputs. Available in low- and high-voltage versions, the modular PDU comes with three types of extension bars to accommodate a variety of distribution requirements. The control core may be rack-mounted in a 0U or 1U configuration. The extension bars include both single-bar and double-bar mounting brackets for attachment to vertical rack supports. Several versions of Modular PDUs are available to meet a variety of electrical requirements as indicated in Table 3.
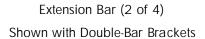
Figure 3. Modular PDU Components

Control Core   Extension Bar (2 of 4)

Shown with Double-Bar Brackets

Table 3. Modular PDU types

Name, PN	Voltage / Amperage	AC Bus Plug Type	Extension Bar Output Receptacle Type (Qty)
24A NA/JPN Low, 252663-D71	100-127/ 24	NEMA L5-30P	4 x NEMA 5-15R (8)
24A NA/JPN High, 252663-D72	200-240 / 24	NEMA L6-30P	4 x IEC 320 C13 (8)
32A International, 252663-B31	200-240 / 32	IEC 309 32A	4 x IEC 320 C13 (8)
40A World Wide, 252663-B21	200-240 / 40	Terminals for hardwiring	3 x IEC 320 C13 (8) 1 x IEC 320 C19 (4)
16A World Wide 252663-B24	200-240 / 16	1 x IEC 320 C20 (1)	1 x IEC 320 C19 (2)

Power/Jumper Cords

Although PDUs and servers are typically shipped with power cords, the physical and/or electrical requirements for a particular configuration may require different cords.

⚠️ **WARNING: Never cut or splice cords to accommodate a configuration. Personal injury or equipment damage could result in the use of improper power cords. The correct factory cord should always be used.**

Description	HP Part #	Description
PDU Y- Cable kit	310782-B21	This kit includes 1 Y-cable which 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) 142257-002 (8 ft) 142257-003 (10 ft) 142257-006 (4.5 ft) 142257-007 (4.5 ft) 15 each	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 6-, 8-, and 10-foot lengths. The ProLiant DL360 G3 server ships with one 10-ft IEC to IEC cable, part number 142257-003.

Console Management Systems

A KVM (keyboard, video, and mouse) console management system enables a single keyboard and video console to control multiple servers. An in-rack console management system may be used to manage a single rack of servers or groups of racks. The HP IP console switch products have 16 ports that can access up to 128 servers. The HP IP Consoling Solution combines analog and digital technology to provide flexible, centralized KVM control of data center servers. This solution provides enterprise customers with a significant reduction in cable volume, secure remote access, and high-performance server KVM access. Using the IP console viewer, users can access local KVM functions from any Windows® or Linux workstation by means of a 10/100 network connection. Alternatively, an off-rack console management system may also be used in the local vicinity of the servers it manages.

Table 4. Local/IP Console Management Options

Product Name	HP Part No.	Description
1x1x16 IP Console Switch	262585-B21	16-port KVM switch - provides access for 2 simultaneous user sessions (1 network session and 1 local session at a rack-mounted console)
3x1x16 IP Console Switch	262586-B21	16-port KVM switch - provides access for up to 4 simultaneous user sessions (3 network sessions and 1 local session at a rack-mounted console)

Table 4. Local/IP Console Management Options

Product Name	HP Part No.	Description
4Interface Adapters (8 per Pack)	262587-B21	Transitions traditional KVM cabling to CAT5 - one needed for each server (convenient 8-pack)
Interface Adapters (Single Pack)	262588-B21	Transitions traditional KVM cabling to CAT5 - one for each server
Expansion Module	262589-B21	Enables tiering of up to 8 servers per port on the IP console switch
CAT5 Cables 3FT (4 per Pack)	263474-B21	4-pack of 3-ft UTP CAT5 cables with RJ-45 connectors
CAT5 Cables 6FT (8 per Pack)	263474-B22	8-pack of 6-ft UTP CAT5 cables with RJ-45 connectors
CAT5 Cables 12FT (8 per Pack)	263474-B23	8-pack of 12-ft UTP CAT5 cables with RJ-45 connectors
CAT5 Cables 20FT (4 per Pack)	263474-B24	4-pack of 20-ft UTP CAT5 cables with RJ-45 connectors
CAT5 Cables 40FT (1 per Pack)	263474-B25	Single 40-ft UTP CAT5 cable with RJ-45 connectors
TFT5600 Rack-Mount Keyboard and Monitor	221546-001	1U integrated keyboard and monitor.
TFT5110R Flat Panel Monitor	281683-B21	1U rack-optimized monitor (keyboard not included).
Integrated Keyboard and Drawer	257054-001	1U Keyboard with Hot keys

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. The HP switchboxes mount behind the keyboard drawer and do not consume extra U-space in the rack. Using the TFT5600 RKM and an IP console switch will consume a total of 1U to accommodate up to 128 servers. One console switchbox can support up to 16 directly attached servers with no user blocking. Up to eight servers may be tiered or cascaded on each switch port using either a legacy Compaq KVM switch or an Expansion Module; however, only one user can access tiered switches or servers connected by Expansion Modules at any one time. Critical devices requiring frequent access should be attached directly to a switch port. Server accessibility should be assessed by the IT manager before deployment to determine the appropriate server density per console switch.

Table 5 outlines the number of devices that fully populate a 47U, 42U, or 36U rack with an in-rack local console.

Table 5. Device Configuration for an In-Rack Local IP Console

Device or Cable	47U Rack	42U Rack	36U Rack
ProLiant DL360/320 G3 servers	46	41	35
KVM IP Console Switches	1	1	1
Interface adapters	46	41	35
UTP CAT5 cables for KVM access	46	41	35
Expansion modules	4-16	3-16	3-16
TFT5600 RKM (integrated monitor/keyboard)	1	1	1

Each server deployed in a fully populated rack with an in-rack IP console management system requires the following accessories for successful deployment and operation (Figure 4):

- Interface adapter
- UTP CAT5 cable [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.

Figure 4. Remote Console Management System

Planning Rack Configurations

You must 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 and upgrade requirements, and installation requirements.

Weight Considerations

Due to the higher densities possible with today's DL servers and ProLiant Infrastructure products, it is now possible to configure a rack that can potentially present floor loading issues. This is even more important when several of these enclosures are positioned in the same row. The Rack/Site Installation Preparation Utility provides you with total rack weight information that should be used to verify the floor loading remains within design specifications.

Special Considerations For Compaq Branded Racks

Use the following considerations as guidelines for the ProLiant DL360 G3 server.

> **WARNING: Follow these guidelines to reduce the risk of personal injury or damage to the equipment:**
>
> - **Do not install a ProLiant DL360 G3 server into a rack until the rack has been placed in its final location.**
> - **Preinstall 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 771 kg (1,700 lbs). 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 G3 server in a Compaq branded 7000-series rack, replace the front door of the rack with the High Air Flow Rack-Door. Install the door 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 Compaq branded 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

The ProLiant DL360 G3 server design supports deployment in many environments. The server ships standard in a Universal Rack Rail that works in both round- and square-hole 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 to 787 mm (24 in to 31 in) 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 optional 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 HP ProLiant branded 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 HP ProLiant DL360 Generation 3 Setup and Installation Guide for complete installation instructions.

Telco Rack Solution

Many data centers use two post telecommunication (telco) racks. The ProLiant DL360 G3 server design supports deployment in telco racks. HP offers a telco rack kit designed to install ProLiant DL360 G3 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 server. Before deploying the servers into a telco rack, remove the standard server rails and replace them with the telco server rails included in the telco rack kit.

Online Calculators

HP provides online calculator utilities that simplify the process of determining power requirements and offer convenient "what if" calculations. These utilities, available online at no charge, offer several advantages over "scratch pad" methods using nameplate figures:

- Calculations are based on formulas using actual measurements of equipment running various exercise utilities.
- Calculations are based on active components exercised at 100% duty cycle, generally allowing headroom for typical installations.
- Air volume calculations based on measurements taken in equipment operating with an airflow chamber.
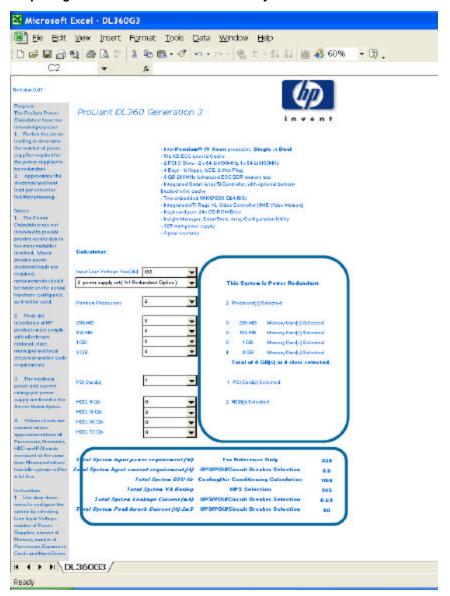
The "active answers" section of the HP webpage provides two types of online calculators:

- **Power Calculator** – Calculates the power requirements for a single DL360 G3 server
- Rack/Site Installation Preparation Utility – Calculates the power, vertical space, and air flow/cooling requirements for a complete rack of servers.

Power Calculator Utility

The Power Calculator utility (Figure 5) computes the power requirements for a single DL360 G3 server. Using drop-down menus, the user selects the number of CPUs, memory amount, hard drive type and amount, and PCI card compliment of the server. Each configuration change is re-calculated instantly, and a yellow warning message will be displayed if a particular parameter will not work or seriously impede performance.

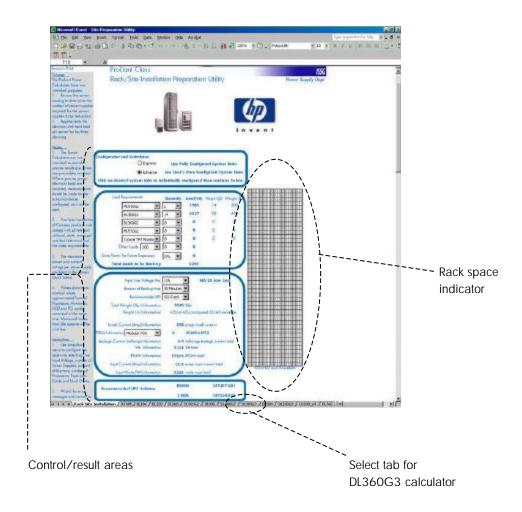**Figure 5. Opening Screen Of Power Calculator Utility**

The power calculator is convenient for small server system planning or for making minor additions to existing installations. For a more thorough analysis of a complete installation the Rack/Site Installation Preparation Utility is recommended.

Rack/Site
Preparation Utility

The Rack/Site Installation Preparation Utility will calculate all power, vertical rack space, and air flow requirements for a complete server installation. In addition, the Rack/Site Installation Preparation Utility includes sub-calculators for determining the power requirements of individual components.

The Rack/Site Preparation utility is accessed through the HP active answers web site. The user is presented with the main screen (Figure 6), which includes four control/result areas, individual calculator tabs, and a rack space indicator.

Figure 6. Opening Screen Of Rack/Site Installation Preparation Utility

Rack space indicator

Control/result areas

Select tab for DL360G3 calculator

To use the Rack/Site Installation Preparation Utility	Select either the **Express** or **Advanced** mode of calculation. Express calculation uses pre-set values for components and can be used for producing a quick estimate of system requirements. Advanced calculation requires user to configure individual components and is recommended for final installation planning. If **Express** mode is selected, proceed to step 5.

1. Select **DL360G3** tab at bottom of screen. The individual component configuration page is displayed (Figure 7). Starting with the line voltage, select the configuration parameters desired, scrolling down to ensure all appropriate parameters are chosen. Be aware of error messages indicating possible problems.

2. When component configuration is complete, click on the **Rack Site Installation** tab to return to the main calculator page (Figure 6).

Complete the **Load Requirements** and **Input Line Voltage** configuration areas. Each configuration change will be calculated instantly. The rack space indicator indicates the amount of vertical space used/available.

Figure 7. Opening Screen Of Individual Component Calculator

Power Configurations Examples

The high/low voltage and dual-power supply capabilities of the ProLiant DL360 G3 server makes it adaptable to a variety of power configurations. Each of the following examples suggests a method of power distribution for a group of servers mounted in a rack. These examples illustrate server power configurations only as well as ways to accomplish server management using iLO and KVM switching products and do not take into account such accessories as KVM switches and display monitors that are typically included in an installation.

Suggested Configurations

Table 6 is a Quick Reference table with suggested rack configurations for deploying ProLiant DL360 G3 servers. Examples of these configurations are further explained later in this section in Configurations A, B, and C.

Table 6. Suggested Rack Configurations Quick Reference

Configuration	A	B	C
Priority	Maximum Performance Density	Maximum Flexibility with Redundant Power	Traditionalist
Rack Size	42U	42U	42U
Server Count	42	35	24
Power Source	High Voltage	High Voltage	Low Voltage
PDU	4 x 40 Amp Modular PDU	4 x 40 Amp PDU	4 x 24 Amp PDU
KVM Switching	No local KVM Switching (iLO only)	IP Console Switch	IP Console Switch
Local Console	No Local Console	TFT5600RKM	TFT5600 RKM
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 6 x 16 Port Gigabit Ethernet Switch for data	2 x 24 Port 10/100 Ethernet Switch (22+2)** for iLO 1 x 48 Port Gigabit Ethernet Switch (44+4)* for data	2 x 24 Port 10/100 Ethernet Hub for iLO 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)   Single or Dual Power Supply

This configuration shows a "best practice" for a 42U rack with 42 servers in a high-voltage configuration summary (Table 7).

Table 7. Configuration A Summary

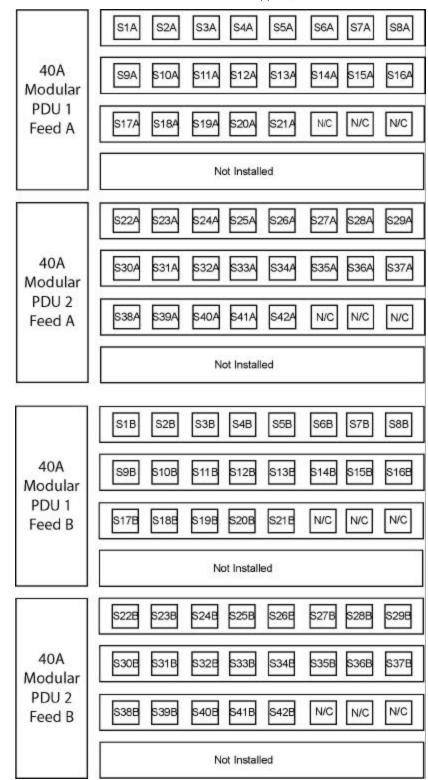| Configuration A Summary |
| --- |
| **Rack Contents** |
| **Rack** |
| HP ProLiant Model 10462 rack with 42U of mounting space |
| **Units** |
| 42 Servers with all fixed or all sliding rails with cable trays |
| 2 High-voltage 40 A Modular PDUs |
| **Internal Cables** |
| 42 Standard IEC-IEC jumper cords going to and from the servers to the Extension Bars mounted at the rear of the rack |
| **Cables External to Rack** |
| 42 (management) network cables from the Integrated Lights-Out 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 50,414 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 907.18 kg (2,000 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 (Figure 9). The network cables originating from each server connect to network switches outside this rack enclosure.

The use of the Double-Bar mounting brackets for the Modular PDU is highly recommended. This will allow the maximum number of outlets to mounted same side of the rack enclosure as the server power supply connection.

Note: No KVM switches are used in Configuration A. The Integrated Lights-Out Advanced Pack handles all of the local consoles. See Figure 9 for the Ethernet Cable Diagram.

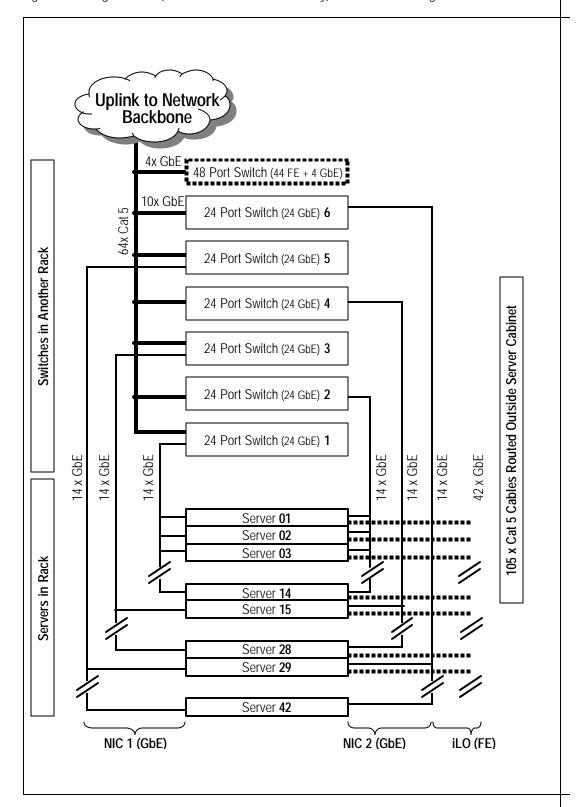**Figure 8. Configuration A (Maximum Performance Density) Power Cabling Diagram**

(42 ProLiant DL360 G3 Servers with Redundant Power Supplies)

Note: S1A= server 1 with power supply A and S1B= Server 1 with power supply B

One 40A Modular PDU connects to power feeds A and B to support 21 ProLiant DL360 G3 servers with redundant power supplies.

Figure 9. Configuration A (Maximum Performance Density) Ethernet Cable Diagram

Configuration B:
Maximum Flexibility

(35 servers, high-voltage)

Table 8. Configuration B Summary

Configuration B Summary

Rack Contents

Units

35 Servers with all fixed or all sliding rails with cable trays

2 X 40 A PDUs

2 x 48 Port Ethernet switches

2 x 24 Port Ethernet switches

1 IP Console KVM Switch

35 Interface Adapters

4 Expansion Modules

1 TFT5600RKM

Internal Cables

70 standard IEC-IEC jumper cords going to from the servers to the Extension Bars mounted at the rear of the rack

Cables External to Rack

35 (management) network cables from the Integrated Lights-Out Edition's RJ-45 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
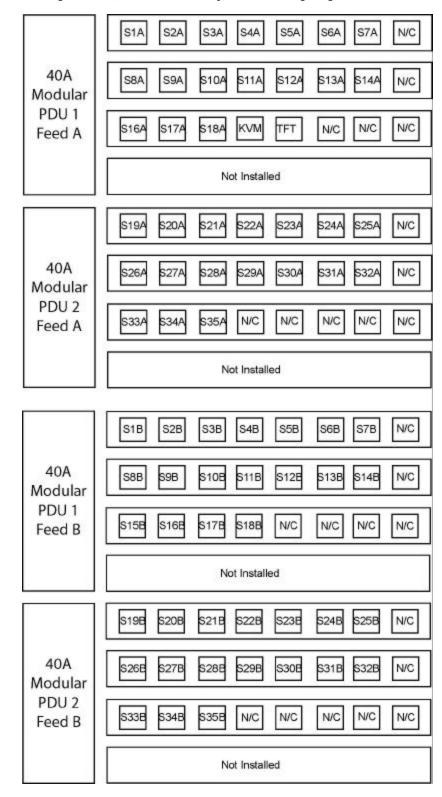
Site Utility Requirements (worst-case)

Power: 4 dedicated 200V - 240V 50A branch circuits (2 from each separate feed, assuming redundant power supply configuration).

Thermal: Up to 42,000 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 907.18 kg (2,000 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.

The use of the Double-Bar mounting brackets for the Modular PDU is highly recommended. This will allow the maximum number of outlets to be mounted on the same side of the rack enclosure as the server power supply connection.

Figure 10. Configuration B (Maximum Flexibility) Power Cabling Diagram

40A Modular PDU 1 Feed A								
	S1A	S2A	S3A	S4A	S5A	S6A	S7A	N/C
	S8A	S9A	S10A	S11A	S12A	S13A	S14A	N/C
	S16A	S17A	S18A	KVM	TFT	N/C	N/C	N/C
	Not Installed							

40A Modular PDU 2 Feed A								
	S19A	S20A	S21A	S22A	S23A	S24A	S25A	N/C
	S26A	S27A	S28A	S29A	S30A	S31A	S32A	N/C
	S33A	S34A	S35A	N/C	N/C	N/C	N/C	N/C
	Not Installed							

40A Modular PDU 1 Feed B								
	S1B	S2B	S3B	S4B	S5B	S6B	S7B	N/C
	S8B	S9B	S10B	S11B	S12B	S13B	S14B	N/C
	S15B	S16B	S17B	S18B	N/C	N/C	N/C	N/C
	Not Installed							

40A Modular PDU 2 Feed B								
	S19B	S20B	S21B	S22B	S23B	S24B	S25B	N/C
	S26B	S27B	S28B	S29B	S30B	S31B	S32B	N/C
	S33B	S34B	S35B	N/C	N/C	N/C	N/C	N/C
	Not Installed							

Note: S1A= server 1 with power supply A and S1B= Server 1 with power supply B

One 40A Modular PDU connects to power feeds A and B to support 17 or 18 ProLiant DL360 G3 server with redundant power   supplies.

Figure 11. Configuration B (Maximum Flexibility) KVM Switch Cabling Diagram
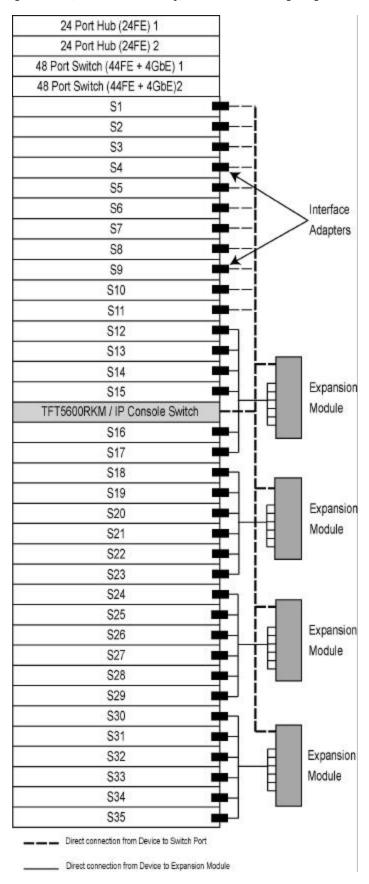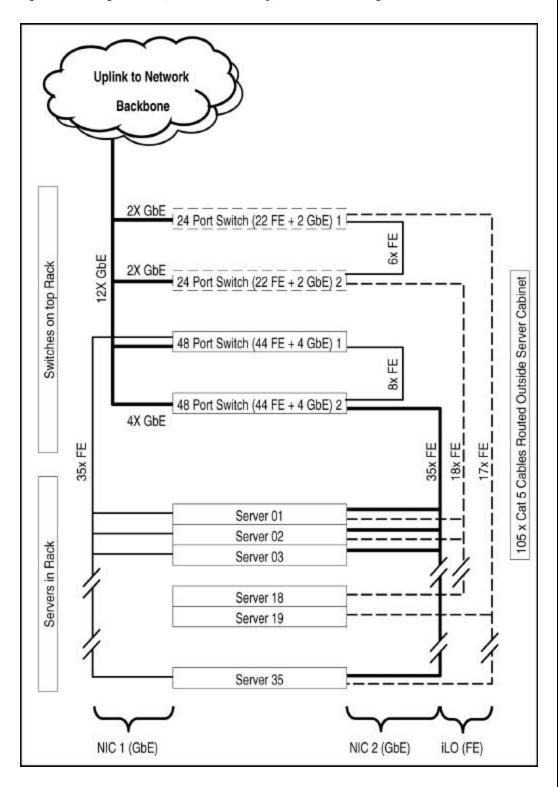
Figure 12. Configuration B (Maximum Flexibility) Ethernet Cable Diagram

Configuration C:
Traditionalist

24 servers, low-voltage

Table 9. Configuration C Summary

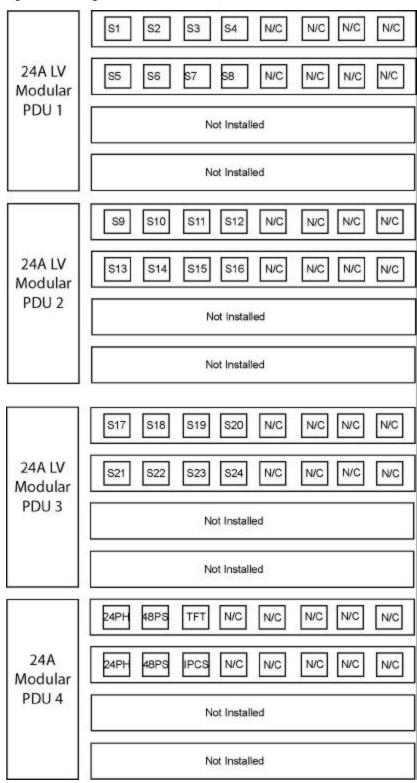| Configuration C Summary |
| --- |
| **Rack Contents**

Units

24 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

1 IP Console Switch

24 Interface Adapters

2 Expansion Modules

1 x 1U Keyboard/Monitor

Internal Cables

24 power cords going to 4 PDUs in the side panels (These cables are supplied with the servers.)

28 KVM cables going from switch to server, switch to switch and switch to 1U keyboard/monitor

24 (management) network cables from the Integrated Lights-Out Edition RJ-45 connector to two 24-port 10/100 Ethernet hubs

48 (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 100V - 120V 30A branch circuits.

Thermal: Up to 36,010 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 907.18 kg (2,000 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. |

The use of the Double-Bar mounting brackets for the Modular PDU is highly recommended. This will allow the maximum number of outlets to be mounted on the same side of the rack enclosure as the server power supply connection.

Figure 13. Configuration C (Traditionalist) Power Connections

Note: S1A= server 1 (single Power Supply); 24 24PH= 24 Port Ethernet Hub; 48PS= 48 Port Ethernet Switch; IPCS= IP Console Switch; TFT= TFT5600 1U Keyboard/Monitor

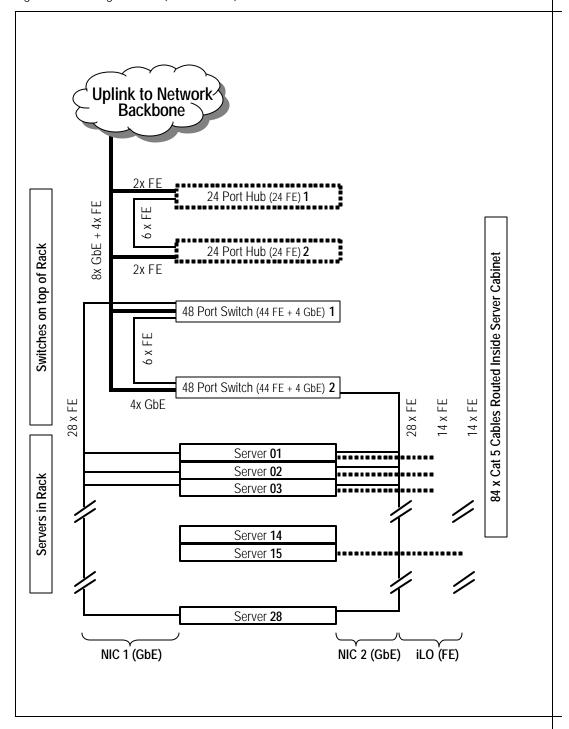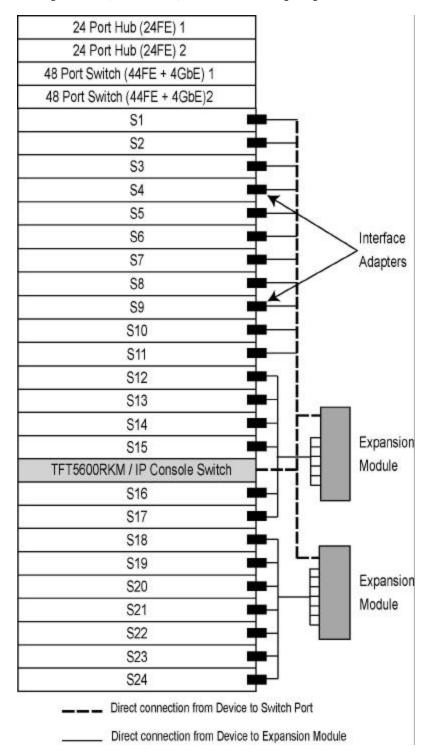Figure 14.   Configuration C (Traditionalist) Ethernet Cable

Figure 15.   Configuration C (Traditionalist) KVM Switch Cabling Diagram

Conclusion

The load requirements of high-density server installations can be significant. Careful planning using accurate calculations and providing overhead compensation for peripheral devices can greatly reduce the chances for downtime due to power problems.

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.

Reference Information and Glossary

Table 10 lists the sources referenced in this document.

Table 10. Sources of Information

Topic	Where to Find
Information focal point for the HP ProLiant DL360 G3 server	http://h18000.www1.hp.com/products/servers/platforms/index.html
Specifications, options, and a list of other HP products and options compatible with the ProLiant DL360 G3 server	*HP ProLiant DL360 Generation 3 QuickSpecs*
Installation and service guidelines for the ProLiant DL360 G3 server	www.compaq.com/support/servers/ProLiantDL360 Generation_3.html *HP ProLiant DL360 Generation 3 Server Setup and Installation Guide* *HP ProLiant DL360 Generation 3 Server Maintenance and Service Guide*
Installation of vertical-mount PDU brackets and Y-cables	Vertical-Mount PDU Brackets with High-Voltage Cables kit, P/N 166097-B21

Table 11 lists all the notational abbreviations used for optional components listed in the document.

Table 11. Notations for Optional Components

Notation	Description
1 x, 2 x, 4 x	Number of components, for example, 1 x 256 MB means one 256-MB DIMM
2.40 GHz	Intel® Xeon® 2.40-GHz processor
128 MB	128-MB DIMM
256 MB	256-MB DIMM
512 MB	512-MB DIMM
1 GB	1-GB DIMM
2 GB	2-GB 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

For More Information

Product information: 1-325-345-1518

Pre-sales: 1-325-282-6672

Post-sales: 1-325-652-6672

Business partner sales consulting: 1-325-888-5874

For more information on ProLiant servers visit www.hp.com/servers/proliant

For more information on HP 9000 and 10000 series racks and options visit www.hp.com/products/racks

Learn more about optional rack features at www.hp.com/products/rackoptions

Learn more about ProLiant server power protection and management at www.hp.com/products/ups

Feedback

Please direct comments and regarding this communication to the ISS Technology Communications Group at this internet address: TechCom@HP.com