

Deploying HP consoling solutions

best practices



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Abstract

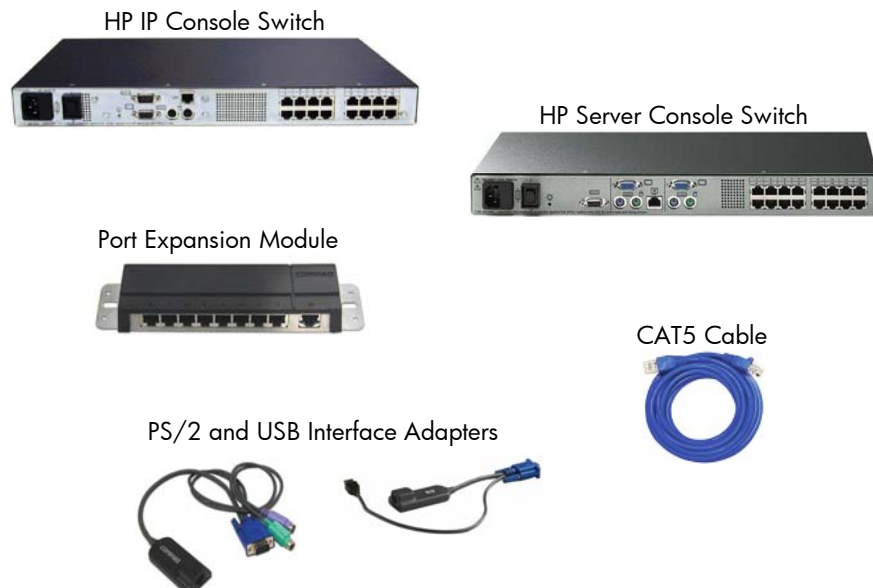
This paper describes the best methods to properly deploy an HP IP consoling solution to deliver maximum functionality at minimum cost. An HP IP consoling solution may include one or more IP Console Switches, expansion modules, interface adapters, cables, and software. These components are designed to work together to address such datacenter problems as space constraints, management of heterogeneous systems, unpleasant working environments, and cable clutter.

Introduction

Managing a server system can become an important challenge as the number of servers increases. Hewlett-Packard offers a variety of solutions (Figure 1) for managing a server system through one or more consoles. Consoling solutions provided by HP include the following:

- HP IP Console Switch
- HP Server Console Switch
- Interface adapters for keyboards/video monitors/mice (KVMs)
- Port Expansion Module
- CAT5 cable

Figure 1. HP Consoling Components



HP console switches and accessories

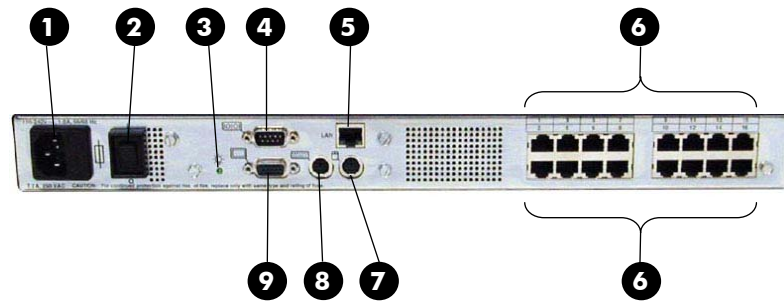
HP offers two types of console switches: the HP IP Console Switch and the HP Server Console Switch. These switches allow control of multiple servers through one or more KVM consoles for efficient server management. The use of CAT5 or better cables instead of conventional KVM cables significantly reduces cable clutter. Also, deploying accessories such as expansion modules can substantially increase the capacity of each switch.

HP IP Console Switch

The HP IP Console switch (Figure 2) is a rack-mountable digital KVM switch that offers local console and secure remote IP KVM console functionality to directly access up to 16 servers. Key features include:

- Local/remote user support – one local and up to three remote users (using a single IP address) per switch
- SNMP compatible – Can provide predefined traps to Insight Manager.
- RILOE, RILOE II, and iLO compatible
- Heterogeneous support with mixed server brands
- Investment protection – backward-compatible with earlier Compaq Server Console switches
- Scalable from standard 16-port functionality:
 - To 128 servers using optional 8-port expansion modules
 - To 256 servers using additional, cascaded console switches
- Hot-pluggable RJ-45 ports using proprietary protocol to transfer KVM information
- No requirement to install software on connected servers – Supports multiple operating systems and heterogeneous environments on systems with PS/2 or USB keyboard and mouse and a standard VGA connector.

Figure 2. HP IP Console Switch connections, control, and indicators



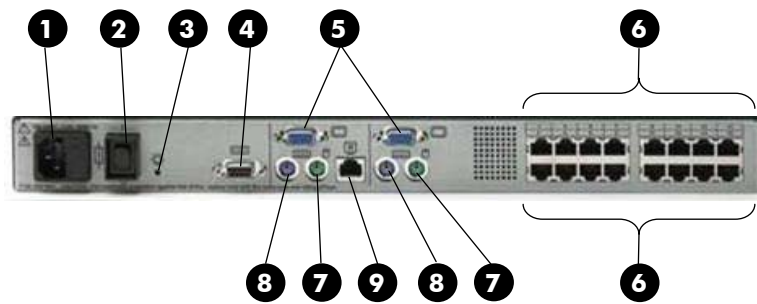
Item	Description
1	AC input power connector (100 – 240 VAC)
2	Power On/Off switch
3	Status LED
4	Serial port (DB-9)
5	LAN connector for up to three remote users (RJ-45)
6	Server KVM ports (RJ-45). (Not used for LAN connection.)
7	Mouse connector (PS/2)
8	Keyboard connector (PS/2)
9	Video monitor connector (DB-15)

HP Server Console Switch

The HP Server Console switch (Figure 3) is a rack-mountable KVM switch that is available in 8- or 16-port versions. Key features include:

- Multiple user support – one or two local users per switch (depending on model)
- Heterogeneous support with mixed server brands and operating systems
- Investment protection – backward-compatible with earlier Compaq switches
- Scalable:
 - Up to 128 servers using optional 8-port expansion modules
 - Up to 256 servers using additional, cascaded 16-port console switches
- Hot-pluggable RJ-45 ports using proprietary protocol to transmit KVM information
- No requirement to install software on connected servers – multiple operating systems supported with standard KVM connections

Figure 3. HP Server Console Switch connections, control, and indicators (2 x 16 model shown)



Item	Description
1	AC input power connector (100 – 240 VAC)
2	Power On/Off switch
3	Status LED
4	Firmware upgrade serial port (DB-9)
5	Video monitor connector (DB-15)
6	Server KVM ports (RJ-45). (NOT used for LAN connection.)
7	Mouse connector (PS/2)
8	Keyboard connector (PS/2)
9	Cascaded switch input port (RJ-45) (NOT used for LAN connection.)

The HP Server Console Switch comes in the following models: a 1x8 (one local user x eight ports), and a 2x16 (two local users x sixteen ports). The 2x16 model supports two concurrent console sessions to two different servers.

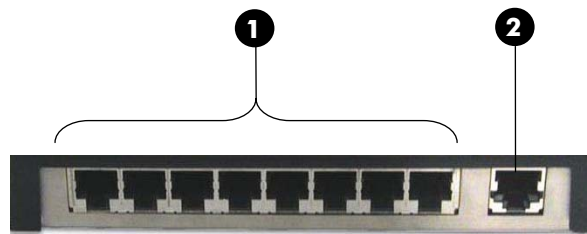
Port Expansion Module

The 8-port expansion module (Figure 4) is an accessory that connects to a single port on an HP Console Switch, thereby increasing the functionality of each individual switch port to a total of 8 ports.

NOTE

Access to servers connected to a port expansion module is limited to one at a time. Users should anticipate the possibility of restricted (blocked) console access to servers sharing a common switch port through the expansion module.

Figure 4. Port expansion module connectors



Item	Description
1	Server / KVM connectors (RJ-45)
2	Console Switch input connector (RJ-45)

The port expansion module incorporates a unique clip mounting system for snap-in installation on the rear rails of a standard rack. The port expansion module can also be attached to a rack with Velcro.

Interface adapters

An interface adapter (Figure 5) transforms standard KVM signals into a format suitable for transmission over a single UTP CAT5 cable for connection to the switch. Two types of adapters are available:

- PS/2-to-RJ-45 – Converts PS/2 keyboard and mouse signals and analog video signals
- USB-to-RJ-45 – Converts USB keyboard and mouse signals and analog video signals

Figure 5. Interface adapters



The USB adapter will only work with computers and servers that support USB keyboard functionality at the BIOS level. The USB adapter is necessary for server lines that do not have PS2 connections available.

NOTE:

Interface adapters should NOT be used to tier an HP Server Console Switch, but they must be used to tier a legacy Compaq Server Console Switch.

Each interface adapter has a unique, factory-assigned, electronic identification number (EID) that a switch uses to recognize and manage the attached device. The interface adapter also stores a user-configured server name (up to 16 characters). If a server is to be relocated, HP suggests that the interface adapter *remain attached to the server*. When the server and interface adapter are reconnected to an HP Console Switch, the server name and port connection will be seamlessly presented in the OSD of the new switch. This feature makes cable reconfiguration virtually automatic and alleviates the need to update port and server name information. The interface adapter also has a "keep alive" function that enables users to disconnect the CAT5 cable without losing mouse and keyboard functionality. This function allows users to reconfigure switch-to-server connections without having to power down the server and then reboot the OS to regain mouse or keyboard functionality.

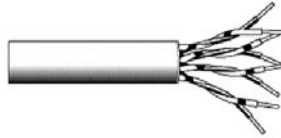
NOTE

HP interface adapters are exclusively configured for use with the HP IP Console Switch and HP Server Console Switch. They are not compatible with other KVM devices. The HP IP Console Switch or HP Server Console Switch will not recognize third-party adapters.

CAT5 cabling

For KVM connections with HP console servers, HP recommends the use of UTP CAT5 or better cable. CAT5 cable uses an industry standard specification that contains four pairs of twisted copper wires (Figure 6).

Figure 6. UTP CAT5 cable



Each wire pair is twisted to prevent electromagnetic interference (crosstalk) caused by electrical signals traveling in adjacent wire pairs. In normal network communication, only two of the four pairs are used. The HP IP Console Switch transport protocol uses all four pairs to send the signal data. Failure to install UTP CAT5 or better cable will reduce switch performance or render it non-functional. CAT5 quality can be verified using a cable tester to verify signal quality and wire pin-out configuration. Cables not meeting at least the CAT5 specification should not be used for KVM cabling.

UTP CAT5 cable is recommended for 10Base-T and 100Base-T network connections (100 mbps recommended). CAT5 cables are available from HP in standard lengths of 3, 6, 12, 20, and 40 feet. To reduce cable clutter or the need to coil extra footage, customers can fabricate their own CAT5 cables to custom lengths for connecting devices to the HP IP Console Switch. Users must take care when routing cables and consider these important factors in cable routing plans: signal degradation (attenuation) and electromagnetic interference (crosstalk).

For optimal screen resolution of 1280×1024, customers should limit the cable length between the switch and the attached server to 15 meters (50 feet). Longer cable will limit the screen resolution: A maximum resolution of 800×600 pixels is possible at 30 meters (100 feet). Table 1 shows the limitations of CAT5 cable in transferring video information.

Table 1. Video signal limitations of CAT5 cable

Screen resolution	Maximum cable length
800 x 600 @ 85 Hz	100 ft
1024 x 768 @ 85 Hz	75 ft
1280 x 1024 @ 85 Hz	50 ft
1600 x 1200 @ 85 Hz	10 ft

Designing a KVM solution

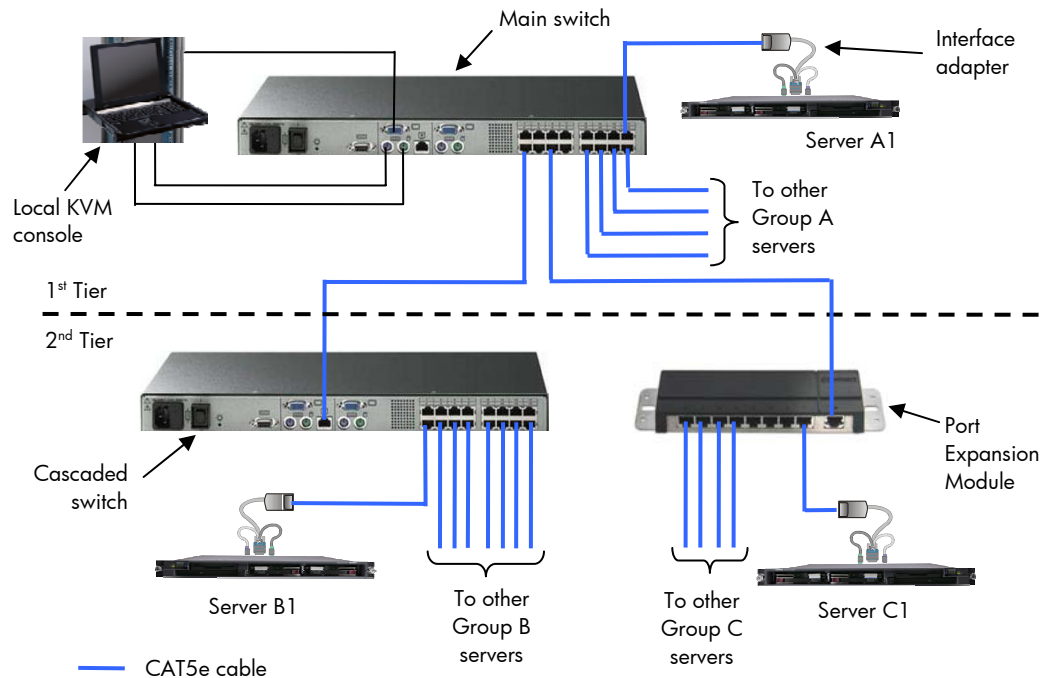
Implementation of an efficient multi-server system requires a server management plan. Functional aspects of server management to be considered include:

- Number of servers to be managed
- Type of KVM access required per server: local, remote, or both
- Access priority: KVM access to servers through cascading switches may be restricted/blocked
- Remote or integrated Lights-Out functionality

Console switch scalability and tiering

Switch architecture limits the number of devices that can connect directly to the switch. To increase server handling capacity, HP console switches can be cascaded and can be used with port expansion modules. Tiering increases switch capacity but can restrict server access. In Figure 7, three groups of servers are managed by a local KVM console connected to the main switch. Group A servers are connected directly to the main switch while groups B and C are tiered through a console switch and port expansion module respectively.

Figure 7. Tiering with HP Server Console Switches



Only two tiers of expansion are allowed. Each port of the main switch can handle only one server transaction at a time, so mission-critical servers that require priority access by a KVM console should be connected directly to the first (top) tier switch (such as Server A1 in Figure 7). All servers in Group B (controlled through the cascaded switch) in effect share a single port of the first tier (main) switch and compete for access by the local KVM console of the first tier switch. All servers in Group C (connected to the expansion box) also share a single port of the main switch.

Console switches and expansion modules should be tiered using the following hierarchy:

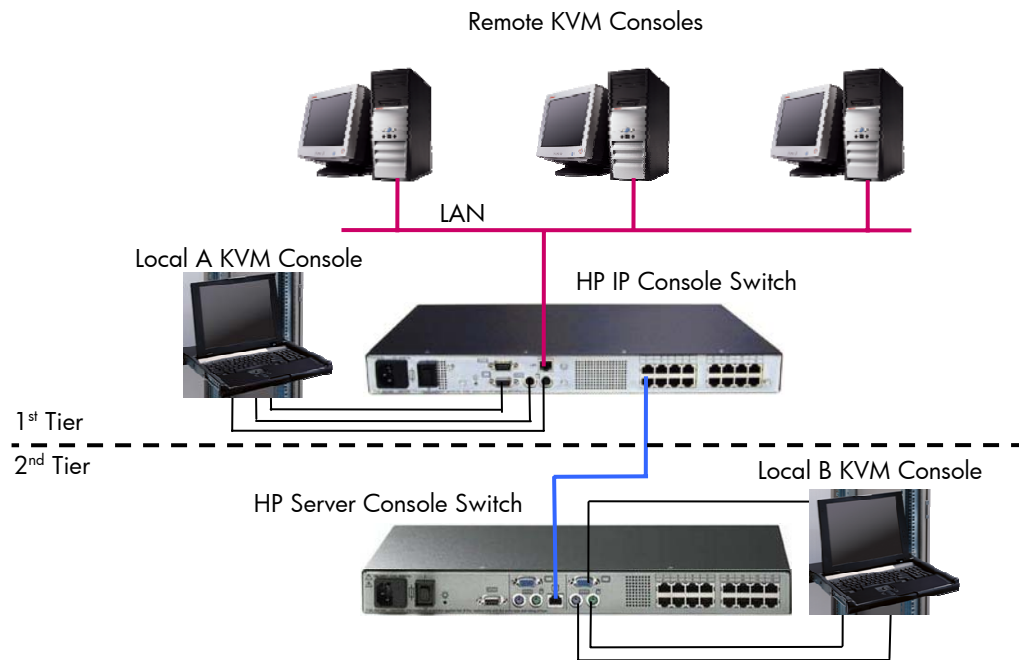
- HP IP Console Switch – first tier only (requires upgrade to firmware version 2.1.5 for compatibility with HP Server Console Switch)
- HP Server Console Switch – first or second tier
- Expansion Module – second tier only
- Compaq Server Console Switch – second tier (requires upgrade with Softpaq version 2.1.0 or later for compatibility with HP IP Console Switch)

Server management

The HP IP Console Switch and the HP Server Console Switch each provide connections for a local KVM console using standard keyboard, video monitor, and mouse connections. The HP IP Console Switch also provides an Ethernet port allowing up to three workstations to operate as remote KVM consoles over a LAN or the Internet.

Figure 8 shows an example of a two-tiered system with local and remote KVM consoles attached to an HP IP Console Switch at the first tier and a local KVM console attached to an HP Server Console Switch on the second tier (server connections are not shown). The Local A and three Remote KVM Consoles have access to all servers in the system, while the Local B KVM Console has access to the servers connected to its HP Server Console Switch.

Figure 8. System using remote and local KVM console management



The following sections describe the merits and considerations of using remote and local KVM consoles.

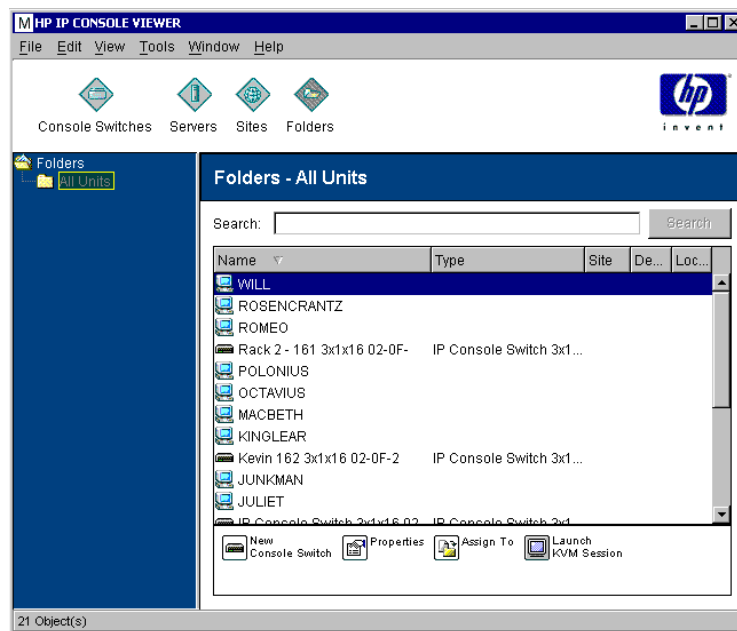
Remote KVM Console

A PC or workstation can function as a remote (in-band) KVM console by connecting to the HP IP Console Switch through a network interface. The remote KVM console will run HP IP Console Viewer, an application that allows configuration and control of the remote servers and offers the following advantages:

- Convenience – An IT administrator does not need to be at the server site to manage the server.
- Economical – A workstation can multitask as a KVM console without the need for additional KVM components.

The IP Console Viewer (Figure 9) is a Java applet that installs on Microsoft® Windows® or Linux® workstations operating as remote KVM consoles.

Figure 9. HP IP Console Viewer applet screen



Features of the HP IP Console Viewer applet include:

- Multiple security levels
- Operates across firewalls and VPNs
- No software to install on managed servers
- Secure SSL data transferred across network
- Customizable server information (location, site, names)
- Customizable views
- Sort on multiple fields
- Scan mode

When accessing the IP Console Switch with a remote KVM console, the performance and bandwidth utilization will vary depending on several factors such as type of connection (LAN or internet); network utilization; the type and amount of hardware used for switching and routing; and, most importantly, the video resolution and color depth.

Since it is difficult to accurately predict KVM performance over a network, the following guidelines should be considered:

- A single remote KVM session requires little bandwidth since only screen changes, mouse movement, and keystrokes are transferred.
- A clean network test with two servers, two clients, and an IP Console switch yielded a maximum average bandwidth utilization of 503 KB/s down and 12.9 KB/s up measured on the client. Video resolution on the server was set to 1024×768 High Color (16 bit). The KVM was kept constantly busy opening and closing windows and applications on the server at a high pace. Normal administrative functions resulted in bandwidth usage dropping to under 300 KB/s down. Using standard KVM/IP settings (256 colors) lowers bandwidth significantly and improves responsiveness.

Local KVM console

The local (out-of-band) KVM console attaches directly to the console switch using standard (PS/2 and video) cables. The local KVM console uses the On Screen Display (OSD) application included in the firmware for the console switch and offers the following advantages:

- Security – Generally, only an IT administrator has access to a local KVM console. Additionally, production and development servers can be locked so that remote access requires authorization.
- Failover strategy – Since local KVM consoles work out-of-band from LANs, they are not affected by network issues such as a network failure, security issue, or bandwidth problems (performance degradation from high traffic)
- No additional software required – Local KVM consoles can use the OSD application that resides in the firmware of the console switch.

The OSD application is accessed by the local KVM console. The OSD dialog box (Figure 10) allows the user to view, configure, and control attached servers. To access the OSD firmware, press **Print Screen** on the local keyboard. (If the OSD does not start, the user can also press the **Ctrl** key twice). Use the mouse pointer, Tab, or Arrow keys and press **Enter** to execute desired commands. Use the Arrow keys and press **Enter** to move between server consoles.

Figure 10. On Screen Display application screen



Integrating HP KVM and HP Lights-Out technology

HP Lights-Out technology provides a function similar to the HP IP Console Switch but with significant differences. With HP Lights-Out technology, an autonomous management processor residing in the server unit and running off auxiliary power provides a user with remote KVM control of server functions. There are two key methods of obtaining Lights-Out functionality for an HP ProLiant server:

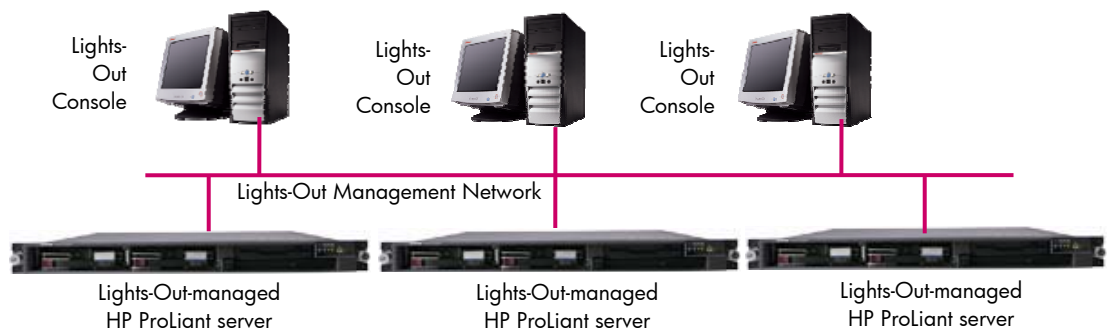
- HP Remote Insight Lights Out Edition (RILOE) or Remote Insight Lights Out Edition II (RILOE II) – A PCI card that delivers full remote server management including a graphical remote console.
- HP Integrated Lights-Out (iLO) – An embedded management processor delivered as standard with many HP ProLiant servers and supporting one of two operating modes: standard or advanced.

iLO Standard functionality supports remote console access when the OS is in text mode. Basic system management functions include remotely powering on and off a host server, updating iLO firmware, accessing SNMP alerts, and accessing server diagnostics such as the Integrated Management Log and server status.

iLO Advanced functionality is acquired by licensing the optional HP ProLiant Essentials Integrated Lights-Out Advanced Pack. Advanced functionality offers sophisticated virtual administration features for full control of servers in dynamic data center and remote locations. Features include a graphical remote console for servers with a graphical OS, integration with Windows Terminal Services for enhanced graphical performance while the OS is operating, virtual media support to use standard floppy and CD media anywhere on the network, and directory services support to simplify management of multiple iLO devices.

For more information on Lights-Out technology, refer to the Remote Management technology papers available at this URL: www.hp.com/servers/technology

Figure 11 shows how Lights-Out enabled servers can be accessed directly across the management network.

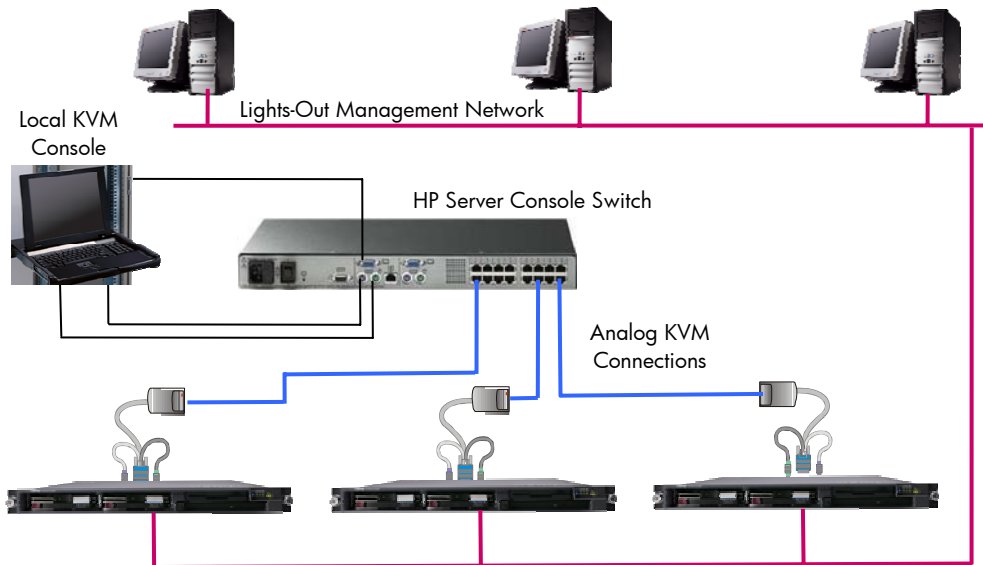


For maximum security implementations, HP recommends isolating the Lights-Out management network from any data networks accessible by system users and granting management network access only to administrators. This recommendation also applies when using an HP IP Console solution.

HP Server Console Switches and HP Lights-Out technology

HP Server Console Switches can provide local KVM access to servers in a datacenter working in conjunction with an iLO or RiLOE II solution to provide remote access. Using the RiLOE II board or the iLO with the iLO Advanced Pack, the administrator can manage the servers remotely. However, when physical access is required, the HP Server Console switch can provide local console access.

Figure 11. Integrated system using Lights-Out technology with HP Server Console Switch



The following points should be taken into consideration when using the HP Server Console Switch as a local console to a server with a RiLOE II or iLO interface:

- If a RiLOE is installed, the interface adapter should be attached to the video and keyboard ports.
- Users cannot access the RiLOE II or iLO-managed server with the normal KVM or local console while a RiLOE II or iLO session is active.
- The RiLOE II/iLO connection has highest priority and will terminate local sessions and IP console viewer sessions.

HP IP Console Switches and Lights-Out technology

The HP IP Console Switch, RiLOE II, and iLO with Advanced Pack all allow remote-console control of a managed server, but they implement the functions differently. Selecting a management solution for a particular environment should involve the following considerations:

- The HP IP Console Switch consolidates remote console connections. A single HP IP Console Switch can manage up to 256 servers from a single Ethernet connection and IP Address.
- The HP IP Console Switch provides a consistently fast remote console experience for all operating systems and all servers.
- The HP IP Console Switch supports heterogeneous environments. Since there is no need for hardware on the server (except the standard keyboard, mouse, and VGA ports), the HP IP Console Switch can support servers such as the ProLiant DL145 that do not have iLO installed, HP Integrity, and systems from other vendors.

- The HP IP Console Switch has a local console port that enables direct access, without an IP connection, within the datacenter.
- RiLOE/iLO supports virtual power control. A system administrator can remotely power-off and power-on a server through RiLOE/iLO to perform a cold-boot of a failed server.
- RiLOE/iLO supports integration with HP Insight Manager and ProLiant management agents.
- RiLOE/iLO supports virtual media. This allows the CD, diskette drive, or image file in an administrator's local system to be used by a remote server as its own media device for POST, boot, or runtime functions.

A heterogeneous data center may use various servers from different vendors or a mix of HP servers, including some of which support RiLOE II/iLO and some that do not. In such an environment, a customer could use the HP IP Console to provide remote KVM access to all the servers while using iLO Standard functionality to provide Virtual Power on those servers that support it. HP Consoling solutions provide the flexibility the customer needs to address all aspects of remote management.

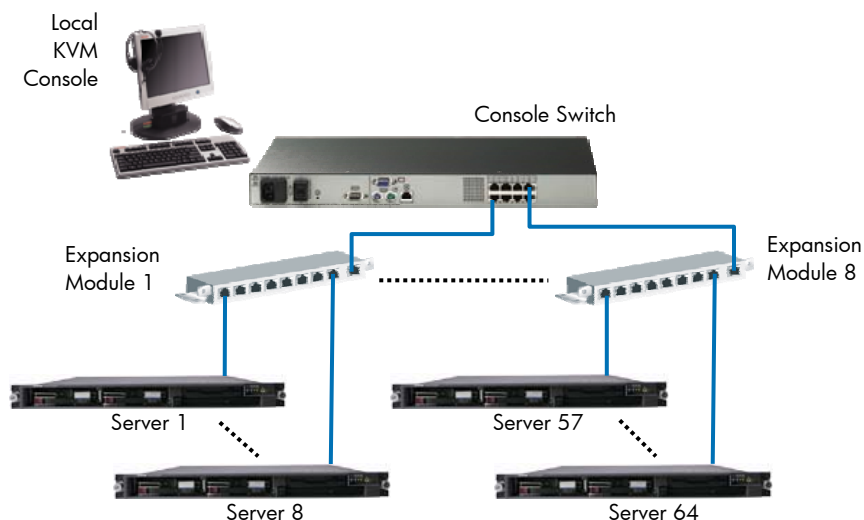
System configuration examples

Figures 12 through 14 illustrate the scalability of HP console switches for three different requirements.

Small size solution (64-server maximum)

Figure 12 shows a solution for a relatively small system supporting up to 64 servers. In this example, one 8-port HP Server Console Switch is tiered with eight 8-port Expansion Modules, each supporting eight servers. All servers are managed through a single local KVM console attached to the console switch.

Figure 12. Small size solution (up to 64 servers)



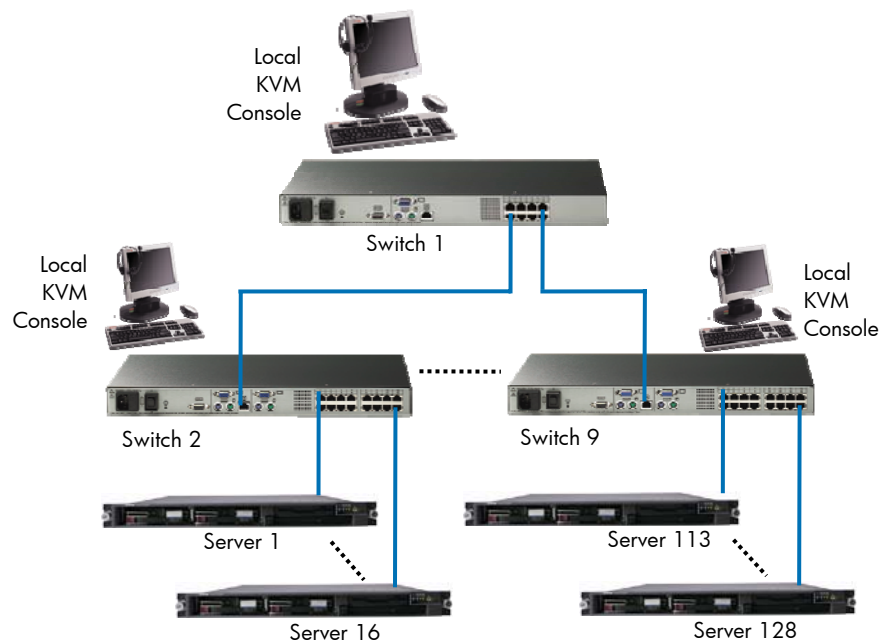
The requirements for this system are as follows:

- Local access only through a single KVM console
- One 0x1x8 HP Server Console Switch
- Up to eight 8-port Expansion Modules
- Up to 64 interface adapters
- Up to 64 CAT5 cables

Mid-size solution (128-server maximum)

Figure 13 shows a solution for a mid-sized system supporting up to 128 servers. In this example, an HP Server Console Switch supports eight tiered console switches. Each tiered switch supports 16 servers. The Local KVM Console for switch 1 can access all 128 servers, while the other Local KVM Consoles can access only the servers attached to their own switch.

Figure 13. Mid-size solution (up to 128 servers)



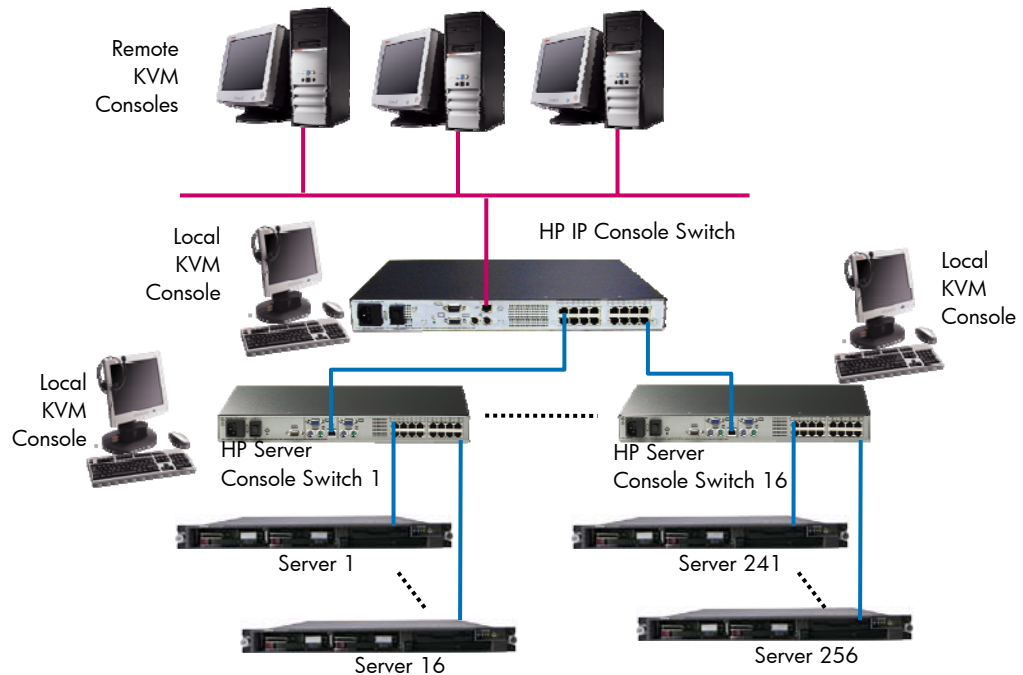
The requirements for this system are as follows:

- Local access only through each KVM console
- One 0x1x8 HP Server Console Switch (p/n 336044-B21)
- Up to eight 0x2x16 HP Server Console Switches (p/n 336044-B21)
- Up to 128 interface adapters
- Up to 128 CAT5 cables

Enterprise solution (256 servers)

Figure 14 shows a solution for an enterprise system supporting up to 256 servers. In this example, one HP IP Console Switch serves 16 cascaded HP Server Console Switches that each handle 16 servers. All servers can be managed by any one of three remote KVM consoles or by the local KVM console connected to the HP IP Console Switch. The local KVM console attached to a HP Server Console Switch can directly manage the 16 servers attached to its switch.

Figure 14. Enterprise solution (up to 256 servers)



The requirements for this system are as follows:

- Local or remote access through multiple KVM consoles
- One 3x1x16 HP IP Console Switch
- Up to sixteen 0x2x16 HP Server Console Switches (p/n 336044-B21)
- Up to 256 interface adapters
- Up to 256 CAT5 cables

Implementation best practices

Operational guidelines

Equipment layout and security

In enterprise systems consisting of multiple racks of servers, HP recommends mounting a cascaded (second tier) 2x16 HP Server Console Switch in each rack to allow local KVM console access and access from a remote KVM console through a first-tier HP IP Console switch.

To ensure an optimum video screen resolution of 1280 x 1024, console switches should be placed so that the CAT5 cables connecting to the servers do not exceed 50 feet in length.

The connection between the IP Console Viewer software and the IP Console Switch is a secure connection. The switch administrator uses IP Console Viewer to set up access for each individual user and to grant each user access to the servers for which he or she is responsible.

Since local KVM consoles are often unattended, the following security measures should be taken:

- The screen saver should be enabled so that the local console is automatically disconnected from a server after a specified period of inactivity.
- A password should be used to lock the local KVM console when it is not in use.

Energy mode

HP recommends not using energy saving modes for either the switch OSD or the target servers for the following reasons:

- Little energy will be saved – CRTs are not attached to the servers and the TFT screens typically used in the racks are generally in the closed and stored position.
- Performance – The delay in bringing up a server from energy saving mode may easily be interpreted by the user as a system problem.

Mouse tuning

Mouse synchronization is required when using the remote KVM console capability of the HP IP Console Switch. To synchronize the mouse pointers for a remote session with a server, the following mouse settings must be used on the server:

- Windows 2000: Mouse speed = 50 percent, Acceleration = None
- Windows NT4: Speed = Slider adjusted to the far left for zero acceleration
- Windows XP: Speed = 50 percent, Enhanced pointer precision = Deselected

After setting the mouse properties, the administrator should click on the mouse synchronization button in the IP Console Viewer.

Integrating with a legacy infrastructure

The HP IP Console Switch and the HP Server Console Switch are compatible with existing Compaq server console switches with the following caveats:

- Legacy Compaq console switches must be upgraded with firmware version 2.1.0 or later to be recognized by the IP Console Switch.
- The HP IP Console Switch must have firmware version 2.1.5 to integrate with the HP Server Console Switch.
- The HP IP Console Switch is not compatible with the Compaq PCI KVM card or legacy HP console switches.

Conclusion

HP consoling solutions and HP Lights-Out technology offer IT administrators flexibility in managing data centers of all sizes using local or remote access.

For more information

For more information on HP ProLiant servers and solutions, access the HP website at:
www.hp.com/servers/proliant

Call to action

To help us better understand and meet your needs for ISS technology information, please send comments about this paper to: techCom@HP.com

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