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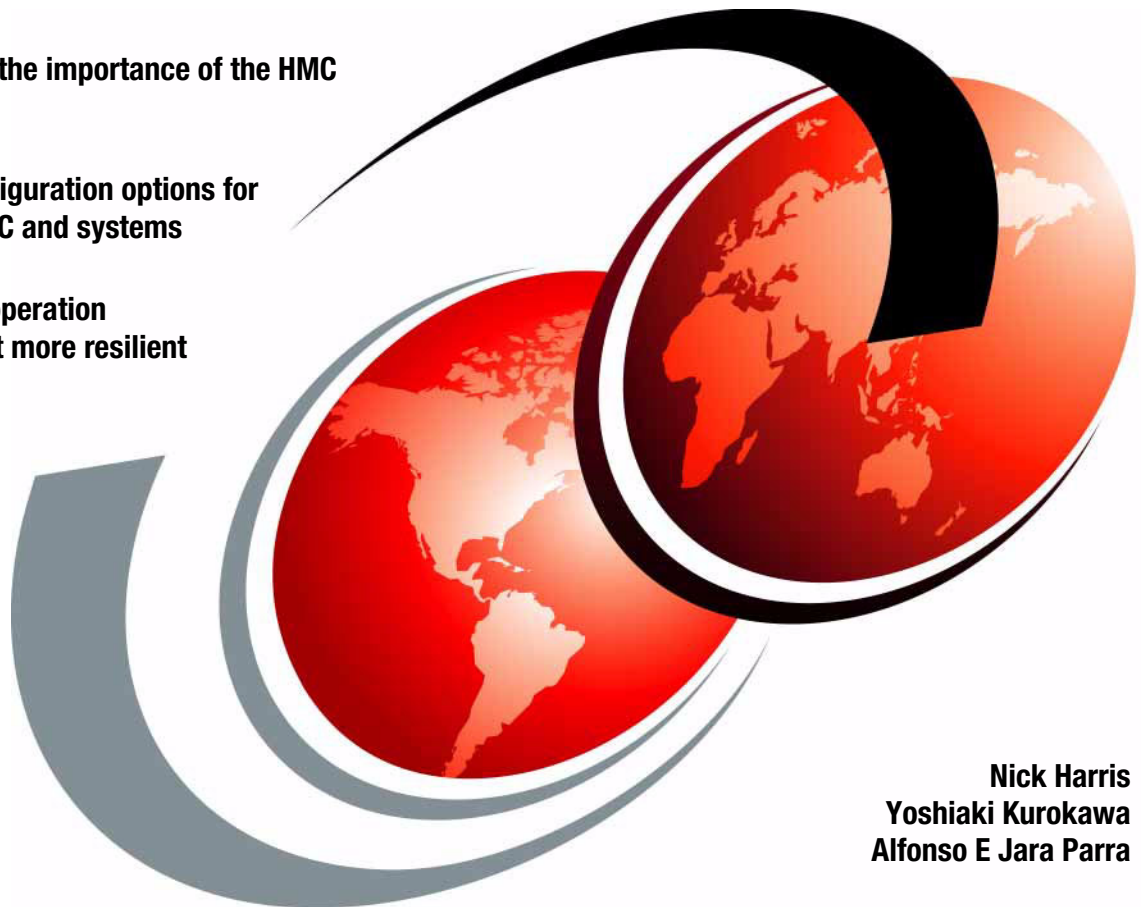
HMC Availability for System i5 and System p5

Understand the importance of the HMC

Review configuration options for multiple HMC and systems

Make your operation environment more resilient

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Redpaper

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HMC Availability for System i5 and System p5

August 2006

Note: Before using this information and the product it supports, read the information in "Notices" on page v.

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Contents

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Preface

This IBM® Redpaper proposes design considerations in the IBM System p5™ and IBM System i5™ environments to increase the availability of one of the most critical operational subsystems, the Hardware Management Console (HMC).

Every System p5 or System i5 environment can be managed by one or two HMCs. The HMC is required when the environment includes multiple logical partitions, Capacity Upgrade on Demand (CUoD), systems with 24-inch racks, and redundant service processors.

We make some general recommendations and provide diagrams and tips for best practices when designing high availability (HA) environments involving one or more HMCs.

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Introduction to HMC functions

IBM POWER5™ processors have represented a great advance for IBM System i and IBM System p high-end servers, enabling customers to use and share the same hardware for IBM i5/OS®, IBM AIX, and Linux platforms. These processors also have provided the most advanced processor, memory, and resources partitioning and virtualization capabilities available in these platforms.

This is part of the reason these systems are being used by many IBM customers to provide high-end high availability (HA) solutions for their applications and services. In this paper, we discuss the Hardware Management Console (HMC) and how to prevent system impacts through console unavailability.

In this first chapter, we cover the main HMC functions and why HMC represents such a critical resource for your environment.

1.1 Introduction to HMC availability

This paper explains design enhancements in the System p5 and System i5 environment architecture that increase the availability of one of the most critical subsystems in this environment, the HMC.

We offer general recommendations and provide diagrams and tips for best practices when designing high-availability environments that involve one or more HMCs.

You should have one properly configured and attached HMC in order to have access to all of the capabilities that are available in the production systems (System i5 and System p5). To improve the availability, we recommend attaching two HMCs to every System p5 or System i5 configuration. (If you have more than one System p5 or System i5 configuration, you can use one HMC to manage more than one system. The limit as of this paper's publication is 48 systems attached and 254 logical partitions (LPARs). In 1.5, "HMC connections to two managed systems" on page 14, we discuss the maximum number of managed systems attached to one HMC in real environments.)

Every System p5 or System i5 can be managed by one or two HMCs, and the connection scheme is quite different from one model to the other. (For some models, you can choose not to use an HMC, but environments that do not use HMC are beyond the scope of this paper.)

1.2 Why make your HMC more available

The Hardware Management Console is the only management point for your System p5 or System i5 environment that enables users to control the hardware, DLPAR capabilities, and support tasks.

The HMC is considered to be part of the server firmware, so it is one of the resources that contributes to the system stability and normal operations.

All System p5 and System i5 configurations are designed in a way that they can continue to provide service even if the HMC is lost, but you will lose some of the most advanced capabilities that make these systems among the best in the industry. Hence, we consider the HMC a critical resource in these environments, and therefore we consider that many application's availability relies on HMC high availability.

In the next sections we explain HMC functions and how losing these functions could affect normal System i5 and System p5 operations.

1.3 HMC functions

As mentioned earlier, using the HMC is the only way to manage some System p5 and System i5 capabilities. In this section we describe the capabilities provided by the HMC, how critical these services are and relate them to downtime. These grades of criticality and the allowable downtimes will determine the minimum acceptable downtime for the HMC in a non-HA environment.

> **Note:** To estimate the acceptable downtimes for each service, we classify the services as High, Medium, and Low Critical. Based on this distribution we assigned acceptable downtimes of minutes, hours, and days.

1.3.1 Partition management

Dynamic logical partitions (DLPAR) and Micro-Partitioning™ are components used by both System p5 and System i5 solutions. The HMC is mandatory for DLPAR operations, such as removing or adding devices, memory, or processors to any partition.

The following sections list the main functionalities related to partitioning that the HMC provides.

Power cycling

The HMC is the only point that allows the startup of an LPAR after a complete shutdown. It is also the only way to shut down an LPAR if you cannot access the operating system. For i5/OS, you should shut down from the HMC power function *only* in extreme circumstances.

Even though these power-cycling operations are infrequent, you might need to stop and restart a partition at any moment.

Critical: High
Acceptable downtime: Minutes

LPAR profile management

On the HMC, there are partition profiles that represent the permanent configuration of that partition. The HMC is used to permanently change the profile of the LPAR or DLPAR on an occasional basis. If you want to apply profile changes immediately, you must shut down the partition completely, then start the partition again with the changes. You could also use the dynamic reconfiguration capabilities and wait for a scheduled power cycle of the LPAR.

In both cases, this function relies on critical capabilities of the HMC: DLPAR or power cycling.

Critical: Low
Acceptable downtime: Days

DLPAR

DLPAR operations, such as processor, memory, or device reassignment, are common tasks in most of the production and test environments. Most of the time you will dynamically assign or remove resources on a daily basis, or when a problem appears part of the system and you must reconfigure the resources to keep providing service to your applications.

An HMC must be connected and running to enable dynamic assignment of resources.

Critical: Medium
Acceptable downtime: Hours

Remote DLPAR and scripting

This concept is linked to the previous section about DLPAR. An HMC is needed if you intend to use PLM (Partition Load Manager) for AIX and System p5 resource movement. For System i5, an HMC is needed for third-party resource management applications or if you use SSH-based scripting to make those changes (from i5/OS or Windows®).

The resource management application might detect a condition or have a planned event involving DLPAR resources and need to react. The HMC must be present to receive the commands from such an application, because these changes are directed to the HMC to be performed on the application's behalf.

Critical: High
Acceptable downtime: Minutes

1.3.2 HMC and FSP Service

HMC is the central management point for all hardware-related tasks in a System i5 and System p5. These tasks include IP assignment for the Bulk Power Complexes (BPCs) and the service processors (SPs, commonly called FSPs), as well as any maintenance action that requires IBM intervention.

DHCP

If the system has been configured to dynamically get IPs for FSPs, at least one HMC must be running its DHCP server services when the whole System i or System p platform starts up.

> **Note:** IBM System p 570, IBM System p 590, IBM System p 595, IBM System i 570, and IBM System i 595 do not allow the use of static IP addresses for the BPCs and the FSPs. In this case, the HMC must be used as a DHCP server.

If the system is configured for static IP addressing, the HMC DHCP services function is not needed. Where IP addresses are being provided by the HMC, the HMC only has to be available if the whole system must be restarted or if an FSP or BPC is replaced due to a failure.

In any other case, the BPCs and the FSPs will keep their IP addresses that were assigned during startup, thus will be able to keep working even if the DHCP server is down.

Critical: Very low
Acceptable downtime: Days

Service and maintenance actions

Typically, certain actions must be performed by an IBM representative, such as hardware replacement and customer setup actions that affect the machine environment (for example, firmware updates and upgrades).

These actions require the HMC because it is the main repository for hardware-related information and is the only way to perform certain actions. Some tasks can be performed with the operating systems running (such as Hot Plug tasks), or using the Advanced System Management Interface (ASMI). The HMC is needed to enable these operations and to keep track of any hardware changes that are made.

During a hardware problem requiring IBM intervention or during a firmware update or upgrade, the HMC must be available. These tasks are not part of a daily administration of these systems, but during a problem situation, they must be performed in the shortest time possible.

Critical: Medium
Acceptable downtime: Hours

Inventory Scout

Inventory Scout is a tool that surveys one or more systems for hardware and software information. The data gathered by Inventory Scout can be used by Web services such as the Microcode Discovery Service, which generates a report that indicates whether microcode installed on the system needs to be updated.

This information is gathered and kept in the HMC, and a copy is maintained by the partition operating system (OS). Each partition OS keeps information for the hardware assigned to this partition.

This service is not critical, mainly because each partition OS manages its own microcode levels.

Critical: Low
Acceptable downtime: Days

Service Focal Point

Traditional service strategies become more complicated in a partitioned environment. Each partition runs on its own, unaware that other partitions exist on the same system. If one partition reports an error for a shared resource, such as a managed system power supply, other active partitions report the same error. To enable service representatives to avoid long lists of repetitive call-home information, the HMC provides the Service Focal Point (SFP) application. SFP recognizes that these errors repeat, and filters them into one serviceable event for the service representative to review.

The Service Focal Point application is also the starting point for all service actions on HMC-attached systems. The service representative begins the repair action with the SFP application, selecting the Repair Serviceable Events view from the SFP graphical user interface (GUI). From here, the service representative selects a specific fault for repair from a list of open service events, initiating automated maintenance procedures that are designed especially for the System i5 and System p5 systems.

This function can became critical if there is a problem in the system, and an IBM representative must go to the customer site to solve it.

Critical: Medium
Acceptable downtime: Hours

Call Home

On servers equipped with an HMC (including the p5-595 and p5-590 servers), the Service Agent forwards the results of the diagnostic error log analysis to the Service Focal Point application running on the HMC. The Service Focal Point

consolidates and reports errors to IBM or to a user-designated system or pager. This service is the Call Home capability,

In an environment with more than one HMC (you can have two HMCs connected to a system, or there may be other HMCs in the same network connected to other systems), you can define one of some of them as Call Home systems, and all others will use them to report problems to IBM.

In any case, each system needs at least one HMC to gather and handle all of these errors.

Critical: Medium
Acceptable downtime: Hours

Error logging

In a System i5 or System p5 configuration, errors can be logged and managed in at least three places.

Each partition OS keeps track of the software and hardware errors that affect its service. You do not need an HMC to manage these errors.

ASMI shows and stores Service Processor errors. In this case HMC is the simplest way to read these error reports and is the best way to find possible solutions and take the appropriate Service Actions.

HMC itself stores all serviceable events reported by the LPARs or the hardware subsystems, enabling customers or IBM representatives to perform actions to solve problems.

Critical: Medium
Acceptable downtime: Hours

CoD

Capacity on Demand for System p5 and System i5 environments with DLPAR offers system managers the ability to activate processors and memory without rebooting partitions or other disruptions. CoD also gives managers the option to temporarily activate processors to meet intermittent performance needs and to activate additional capacity on a trial basis.

There are different types of CoD tasks:

► Retained Capacity Upgrade on Demand for the addition of permanent processor and memory system resources.

► Changed On/Off CoD to a post-pay, self-managed activation plan for temporary processor and memory resources.

- ▶ Reserve Capacity on Demand (Reserve CoD) configuration plan for "autonomic" temporary activation of pre-paid processor resources. This plan serves as an enhancement to the POWER4™ On/Off CoD plan.
- ▶ Trial CoD offering, modified to provide Web-based enablement option for one-time, no-cost trial (30 days) activation of processor and memory resources using activation codes.
- ▶ Capacity BackUp.

The HMC provides a series of CoD menus that enable the user to observe and manage their CoD configurations. These CoD menus are accessible through the Selected menu from the HMC menu bar.

For most of these tasks you must use HMC, but ASMI is available for IBM Service use in an emergency. There is one exception: Trial CoD can only be enabled using the HMC.

Critical: Low
Acceptable downtime: Days

FSP failover

In all System p5 and System i5 configurations, the Hypervisor is active, even in systems that have only a single partition. The Hypervisor communicates with both the HMC and the FSP; it can reset and reload FSP. It will automatically invoke a reset/reload of the FSP if an error is detected. An FSP reset/reload is not disruptive and does not affect system operation. FSP resets can be initiated by either the Hypervisor or the FSP itself. If the FSP does not respond to the Hypervisor and the reset/reload threshold is reached, the Hypervisor will initiate an orderly shutdown of the system.

In a properly configured i5-570, i5-595, p5-575, p5-590, or p5-595 with redundant Service Processors installed on the system, a firmware update enables redundant FSP failover. When it is installed, if the error threshold for the failing FSP is reached, the system will initiate a failover from one FSP to the backup.

An HMC is required to enable FSP failover.

Critical: Low
Acceptable downtime: Days

1.3.3 Operating system consoles

HMC offers the only way to get the system console for AIX and Linux. For i5/OS, an independent system console can be detected by the operating system.

i5/OS

The i5/OS console can be one of four types and is not a critical resource for most situations. The types of console are:

► HMC: A built-in 5250 emulator on the HMC Desktop can be configured as the i5/OS console. This is fast becoming the console of choice for i5/OS, but obviously requires an available HMC.

► Operations Console LAN: This console provides a GUI to the operating system via a LAN-connected PC.

► Operations Console direct attach: This console provides a GUI to the operating system via a serial-connected PC.

► Twinax console: By far the most popular in i5/OS partitions due to its heritage, this console is attached to an IOA in a particular slot in the system unit or expansion unit.

> **Note:** IOPless configuations have limitations on the use of Twinax consoles.

AIX and Linux

The console in UNIX systems is not a critical resource in most situations. In the most secure environments, superuser cannot remotely log into the system or transfer from another. In these cases, console sessions in the HMC become very critical for typical administrative tasks.

In other cases, TCP/IP and other user sessions are enough to perform most of the tasks.

Critical: Medium
Acceptable downtime: Hours

1.4 HMC connections to a single managed system

From the point of view of the HMC connection, we can create three different sets of System p5 or System i5 model arrangements. In each arrangement, we will descibe single HMC connections and dual HMC connection schemes.

Every HMC can have a second network adapter (not drawn in the diagrams) that allows connection with the LPARs and other HMCs' public network.

Both networks — private (to allow connectivity with the managed system) and public (customer provided, allows connectivity to the managed LPARs and any other HMC active in this environment) — are requisites in these environments.

In some special scenarios, a third network can be used for a second private network to any of the managed systems. In this case, you need a third Ethernet adapter configured and running in the HMC.

> **Important:** This connection scheme using one private and one open public network is required for i5-575, p5-575, p5-590, i5-595, and p5-595 servers. In these servers, the IPs for the BPCs and FSPs are provided by DHCP services that run in the HMC.
>
> In all other System i5 and System p5 systems, a customer can choose to use a private network to connect to the server or can define static IP addresses, or both. In this case, just one or two network cards might be needed.
>
> In all of these scenarios, IBM provides cables to connect the HMC to the system. The network to connect from the HMC to the LPARs and the other HMCs is provided by the customer.

Attaching two HMCs to the managed server is strongly recommended to reach an available environment. One HMC is not enough to keep an HA environment because the HMC would represent a critical single point of failure. Installation of more than two HMCs for a single system does not improve that system's overall availability. The system can be attached to one or two DHCP servers, but not three.

See 1.5, "HMC connections to two managed systems" on page 14 for information about sharing HMCs among several managed servers. Following this, in an environment with more than one System p5 or System i5 platforms, you will not need two HMCs per system (that is, four HMCs).

1.4.1 505, 510, 520, 550 systems and 570 with just one FSP

With these systems, we just have one FSP, with a single HMC connected directly to that FSP port. This creates an unavoidable single point of failure. If you lose the FSP, then you will lose the system; if you lose the HMC-to-FSP connection, you lose HMC functions.

Figure 1-1 on page 11 and Figure 1-2 on page 11 do not show a highly available environment from the point of view of the HMC connection to the system.
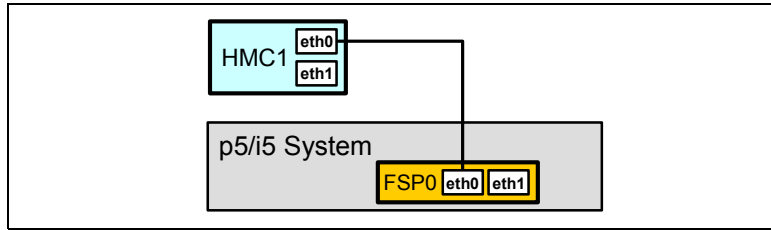
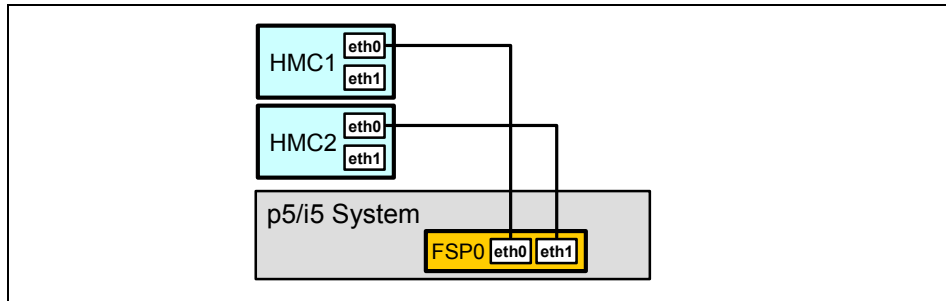*Figure 1-1   One HMC connected to a single FSP system*

Figure 1-2   Two HMCs connected to a single FSP system

1.4.2 570 with two FSPs

For a System i 570 with redundant FSP, the HMC is connected to each FSP through a customer-provided switch (Figure 1-3). Therefore, if we lose one FSP, or one of the connections to one HMC is broken, we still have access to the HMC services and the system will be up and running.
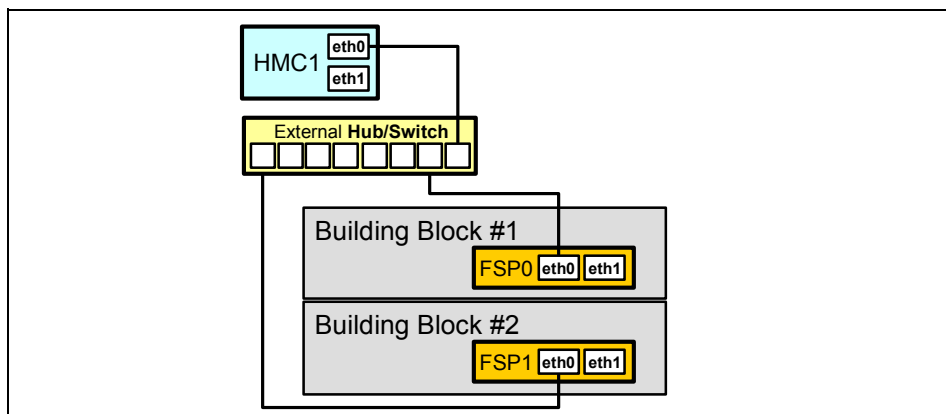

Figure 1-3   One HMC connected to a 570 with two FSPs

Figure 1-4 shows the simplest environment that provides HMC availability, with an HMC connection at every point. In this case, you can lose either an HMC, a switch, or an FSP without losing any of the HMC or system functions and services. (There is an exception: If you just define one HMC as a Call Home server, and you lose connection to this HMC, then you will not be able to connect to the IBM Support Center.)
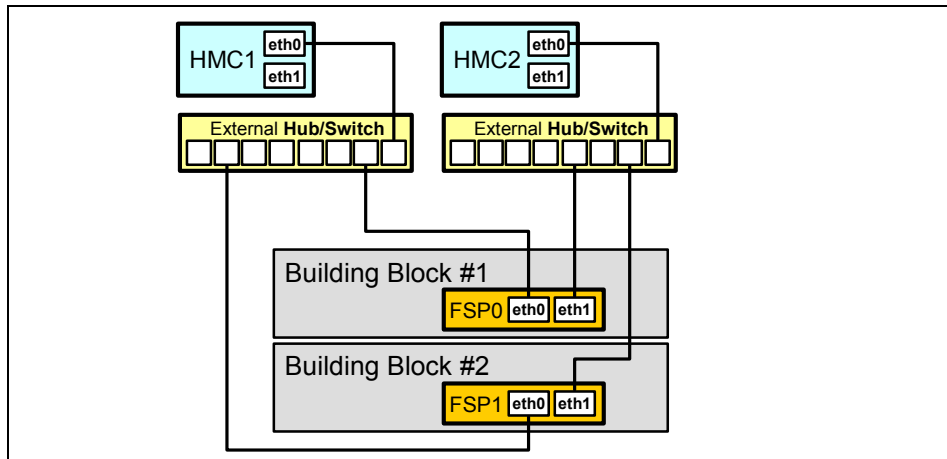

Figure 1-4   Two HMCs connected to a 570 with two FSPs

1.4.3 575, 590, and 595

These servers (p5-570, i5-570, p5-590, p5-595, and i5-595) represent an evolution beyond medium and small System p5 and System i5 solutions. Each of these models has two Bulk Power Controllers (BPC), and each BPC has an internal hub to allow connectivity to every hardware element in the environment (that is, in a single frame configuration, two FSPs and two BPAs per system).

In these systems, the HMCs are not connected directly to the FSP. They are connected to the first port in the internal hubs.

Figure 1-5 on page 13 through Figure 1-7 on page 14 show cabling best practices for one HMC, two HMCs, and two HMCs in a double-frame environment.
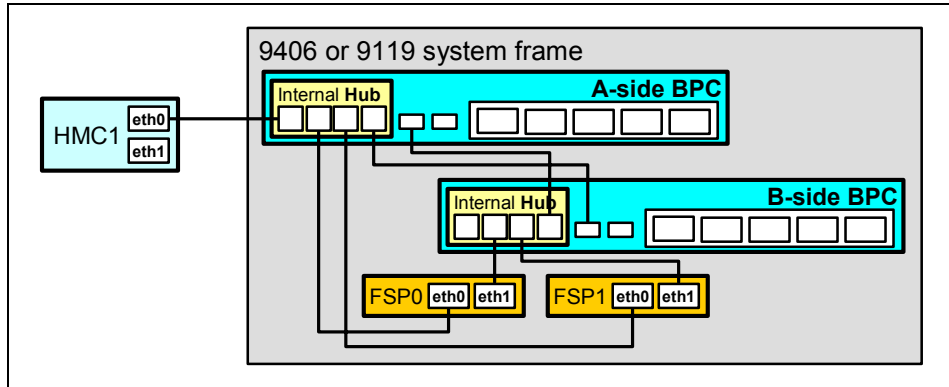
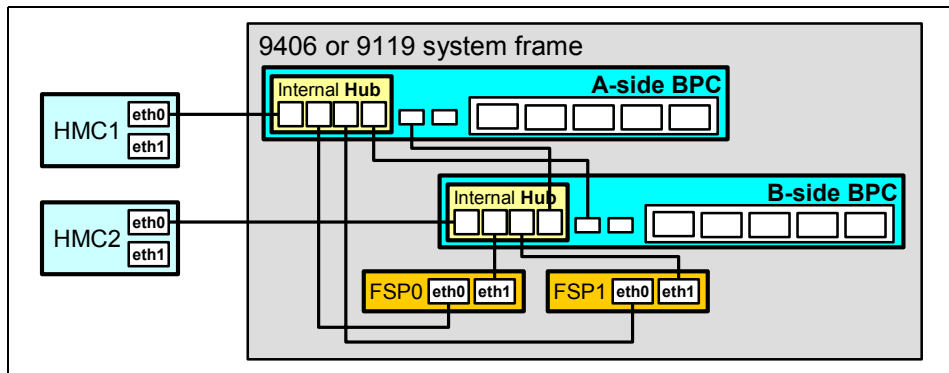*Figure 1-5   One HMC connected to a 575, 590, or 595 system (single frame)*

Figure 1-6   Two HMCs connected to a 575, 590, or 595 system (single frame)

For models p5-590 and p5-595, you can also add another frame with more I/O drawers to the server. Figure 1-7 on page 14 shows this connectivity scheme.

In this configuration, two more BPCs (also two internal hubs) are connected to the HMC to provide power and connectivity to the new IO drawers.
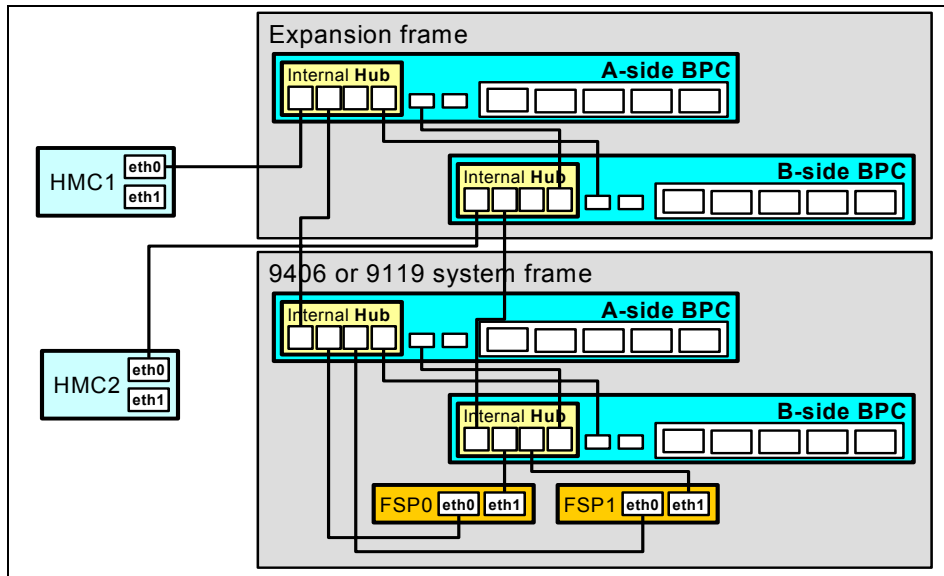
Figure 1-7   Two HMCs connected to a double-framed p5-595 or p5-590

1.5 HMC connections to two managed systems

In this section, we discuss the HMC connections to multiple systems. Considerations for connecting one or two HMCs to more than one managed system are similar to descriptions of connecting to just one system.

► Switches are customer provided.

► Each system can be managed by one or two HMCs.

► A public network to connect the HMC to the LPARs and the other HMCs is required.

► A private network to connect the HMC to the managed system is also a must.

► Each HMC can manage more than one system.

See Chapter 3, "HMC multi-system scenarios" on page 25 for more scenarios with several systems attached to one, two, or three HMCs.

1.5.1 505, 510, 520, 550 systems and 570 with just one FSP

Our first example has two systems and one HMC. A customer-provided external switch splits the connection from HMC1 across two switch ports. If the HMC, switch, or network fails, neither system will have access to HMC functions. If this

is a communications line failure (for example, from the switch to the first FSP, the HMC can still manage the second system.
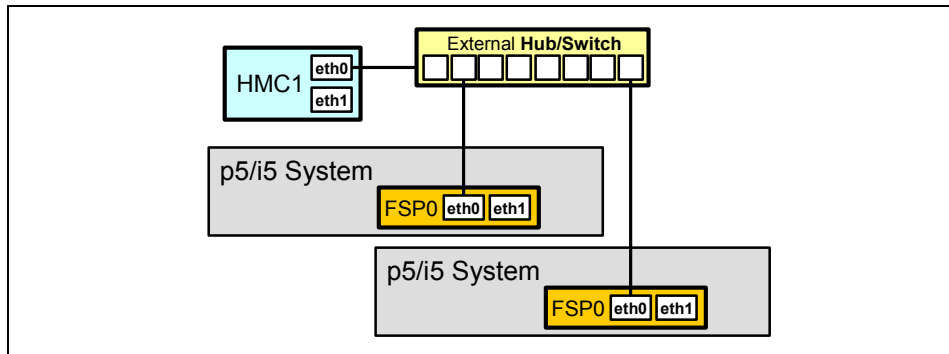

Figure 1-8   One HMC connected to two systems

When we introduce a second HMC and a second switch, availability improves dramatically. Either both HMCs or both networks would have to be unavailable for the systems to lose HMC function.
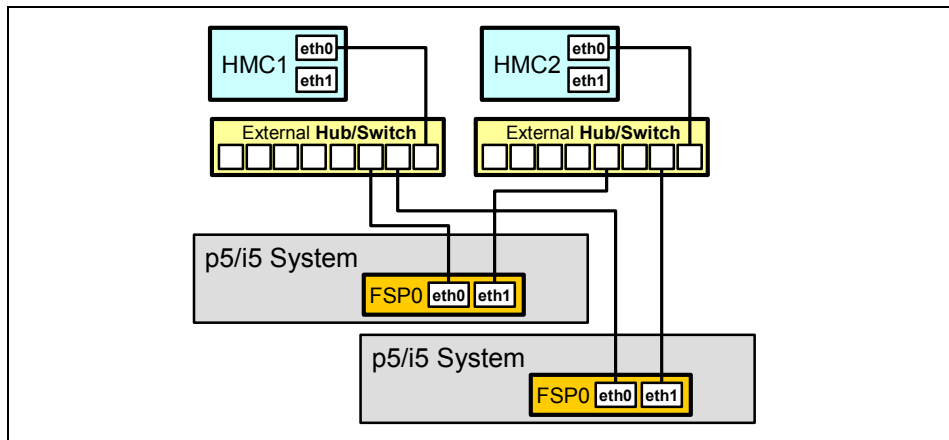

Figure 1-9   Two HMCs connected to two systems

1.5.2 570 with two FSPs

This example shows two System i 570s that have redundant FSPs and are attached to a single HMC, which represents a single point of failure. The connection for this situation involves the switch splitting the HMC connection across four service processors. Although this is a workable solution, it is not recommended.
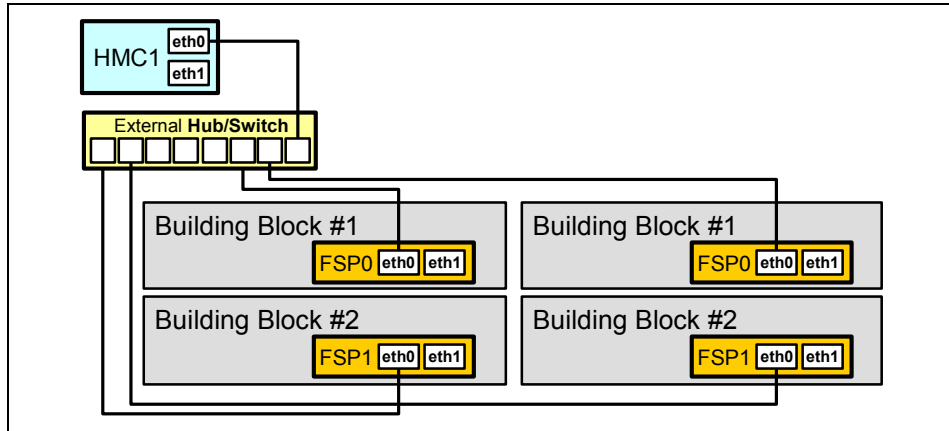
Figure 1-10   One HMC connected to two i5-570 systems with two FSPs each

Figure 1-11 shows two HMCs and two switches connected to two System p5-570s that have redundant FSPs. This is an ideal environment; in most failure circumstances, HMC services will still reach one or both System p5-570s.
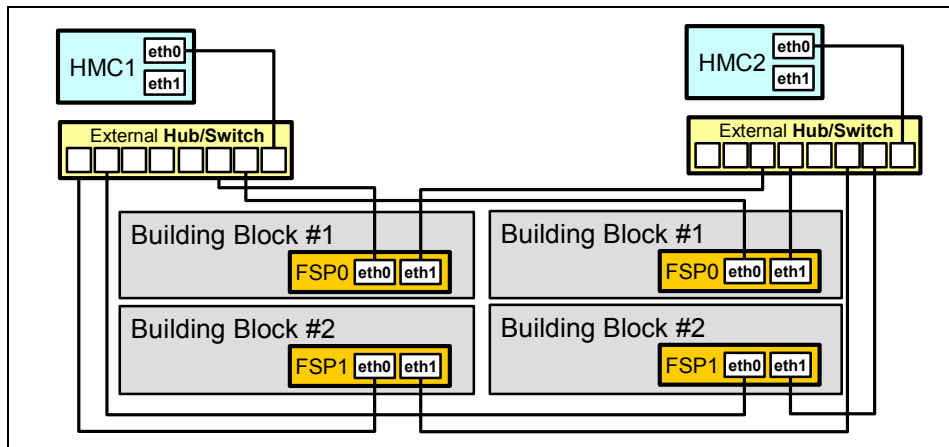

Figure 1-11   Two HMCs connected to two p5-570 systems with two FSPs each

1.5.3 575, 590, and 595

The larger models (p5-570, i5-570, p5-590, p5-595, and i5-595) offer the greatest challenge and should not be configured in an environment with only one HMC. But for completeness, we describe the scenario with a single HMC connected to a switch. This switch is then connected to both sides of each system or frame to be supported. The internal hub provides connections to the BPCs and FSPs.
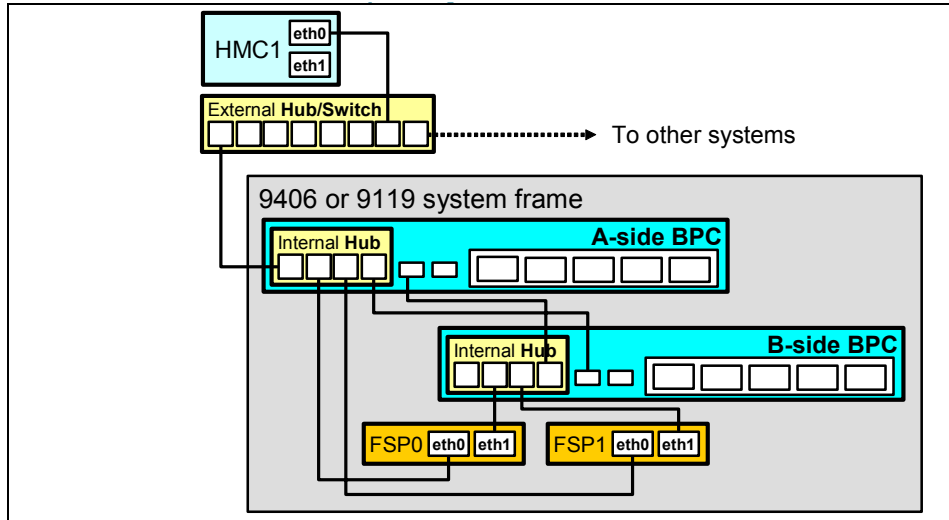
Figure 1-12   One HMC connected to more than one 575, 590, or 595

Figure 1-13 shows two HMCs and multiple switches that make dual connections to each of the managed systems. The two switches (and their HMCs) are connected to different internal hubs. The internal network provides access to the A and B side from each HMC.
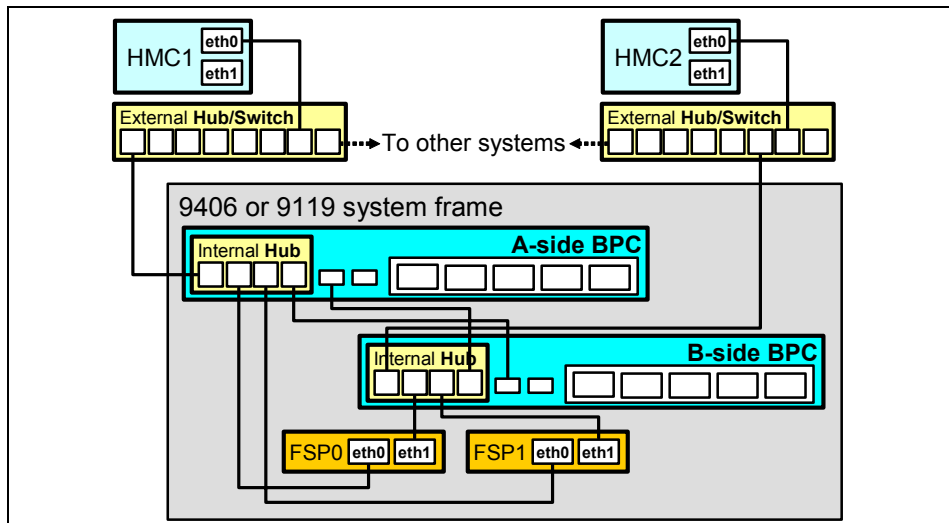

Figure 1-13   Two HMCs connected to more than one 575, 590, or 595

1.6 POWER5 models and characteristics

Table 1-1   Server model and FSP and BPC architecture at a glance

Model	FSP failover capable	IP addressing mode	Number of FSPs per system	Number of BPCs
IBM System p5 505 Express Rack-mount	No	Static IP / dynamic IP[a]	1	0
IBM System p5 520 Express Rack-mount / Desk side	No	Static IP / dynamic IP	1	0
IBM System i5 520	No	Static IP / dynamic IP	1	0
IBM System p5 550 Express Rack-mount / Desk side	No	Static IP / dynamic IP	1	0
IBM System p5 550Q Express Rack-mount / Desk side	No	Static IP / dynamic IP	1	0
IBM System i5 550	No	Static IP / dynamic IP	1	0
IBM System p5 570 Rack-mount	*Yes[b]*	Static IP / dynamic IP	1 or 2	0
IBM System i 5 570	*Yes*	Static IP / dynamic IP	1 or 2	0
IBM System p5 575 Frame-mount	No	Dynamic IP	1	2[c]
IBM System p5 590 Frame-mount	Yes	Dynamic IP	2	2 or 4[d]
IBM System i5 595	Yes	Dynamic IP	2	2 or 4[d]
IBM System p5 595 Frame-mount	Yes	Dynamic IP	2	2 or 4[d]

a. In these systems, customers can select IP addressing when installing the server. Dynamic addressing uses the HMC as a DHCP server, and static addressing requires that the customer set up the IPs.

b. To allow FSP failover, this system must have two FSPs installed and firmware level GA6 or above.

c. 575 is a rack-mounted machine. This rack must have two BPCs, but these BPCs can be used by more than one 575 if available.

d. These systems have two BPCs per frame. Two frames are needed to reach four BPCs.

High availability recognizes two kinds of servers in terms of FSP failover capabilities:

► Servers with FSP failover capability

  To allow FSP failover, the system must meet two main requisites:

  – The system must have two FSPs available.

  – Firmware level must be GA6 or above.

► Servers without FSP failover capability

Table 1-2   System p5 and System i5 models at a glance

Model	Processor	Clock rates (min/max)	System memory (std/max)	Internal storage (std/max)	Performance (rPerf range for pSeries and CPW for iSeries)[a]
IBM System p5 505 Express Rack-mount	One or two POWER5	1.50 GHz, 1.65 GHz	1 GB / 32 GB	73.4 GB / 600 GB	3.51 / 9.86
IBM System p5 520 Express Rack-mount / Desk side	Two POWER5+™	1.90 GHz	1 GB / 32 GB	73.4 GB / 16.8 TB (with optional I/O drawers)	11.16
IBM System i5 520		1.65 GHz	Up to 32 GB	Up to 19 TB	500 - 6000 CPW
IBM System p5 550 Express Rack-mount / Desk side	Two or four POWER5+	1.90 GHz	1 GB / 64 GB	73.4 GB / 31.2 TB (with optional I/O drawers)	11.16 / 22.28
IBM System p5 550Q Express Rack-mount / Desk side	Four or eight POWER5+	1.50 GHz	1 GB / 64 GB	73.4 GB / 31.2 TB (with optional I/O drawers)	18.20 / 34.46
IBM System i5 550	POWER5 1-way to 4-way	1.65 GHz	Up to 64 GB	38 TB	3300 - 12000 CPW

Model	Processor	Clock rates (min/max)	System memory (std/max)	Internal storage (std/max)	Performance (rPerf range for pSeries and CPW for iSeries)[a]
IBM System p5 570 Express Rack-mount	POWER5 2-way to 8-way	1.50 GHz	2 GB / 512 GB	73.4 GB / 46.8TB (with optional I/O drawers)	9.13 to 34.46
IBM System p5 570 Rack-mount	POWER5 2-way to 16-way	1.65 GHz / 1.90 GHz	2 GB / 512 GB	73.4 GB / 79.2 TB (with optional I/O drawers)	9.86 to 77.45
IBM System i5 570	POWER5 1-way to 16-way	1.65 GHz	Up to 512 GB	Up to 96 TB	3300 - 44700 CPW
IBM System p5 575 Frame-mount	POWER5 8-way or 16-way	1.90 GHz (8-way), 1.50 GHz (16-way)	1 GB / 256 GB	73.4 GB / 2.9 TB	56.67 (8-way), 87.3 (16-way)
IBM System p5 590 Frame-mount	POWER5 8-way to 32-way	1.65 GHz	8 GB / 1 TB	72.8 GB / 18.7 TB (using optional I/O drawers)	41.68 to 151.72
IBM System i5 595	POWER5 8-way to 64-way	1.65 GHz	Up to 2 TB	Up to 2 TB	24500 - 165000 CPW
IBM System p5 595 Frame-mount	POWER5 16-way to 64-way	1.65 GHz / 1.90 GHz	8 GB / 2 TB	72.8 GB / 28.1 TB (using optional I/O drawers)	80.86 to 306.21

a. The benchmarks and values shown herein were derived using particular, well-configured, development-level computer systems. Actual system performance might vary and is dependent on many factors including system hardware configuration and software design and configuration.

2

HMC-managed single-system scenarios

In this chapter, we focus on situations in which we manage one system (System p5 or System i5) using HMC. One system can be managed by up to two HMCs, so we make two scenarios, and discuss what happens and what should be considered in each:

► One HMC manages one system
► Two HMCs manage one system

As described previously, almost all System p5 and System i5 solutions have two ports for the HMC. In System p5 570, System i5 570, and smaller systems, the FSP has two ports. In System p5 575, System i5 575, and larger systems, the two BPCs in each side have one port in each internal hub. The only exceptions are the p5-570 and i5-570 with two FSPs. In this case, each FSP has two connecting ports, so there are four ports in total.

In this chapter, to simplify the figures, only two ports are drawn for each system.

2.1 Scenario 1: One HMC managing one system

This shows the simplest case: one HMC and one system. An HMC is connected to the FSP or BPC directly. You can locate an external customer-provided hub or switch between the HMC and the system. If the HMC is set to be a DHCP server, ensure that the HMC is up and running before powering on the managed system, including FSPs and BPCs.
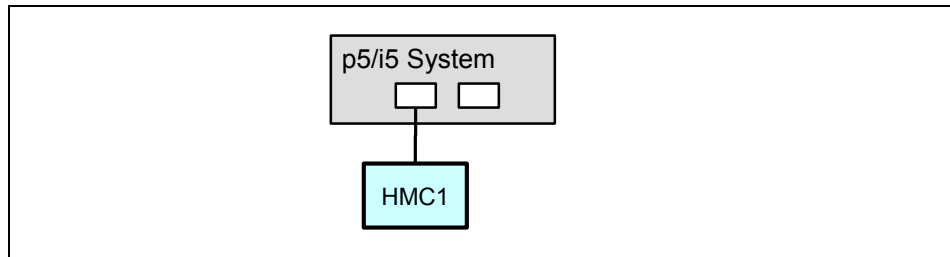

Figure 2-1   One system with one HMC

2.1.1 Case 1: Losing one system

If we lose one system in this situation, all operating systems running in each partition stop and all services are lost. Depending on the type of failure and application availability, you might need to restore system backup for each partition.

If one operating system running in one partition hangs this does not affect other partitions.
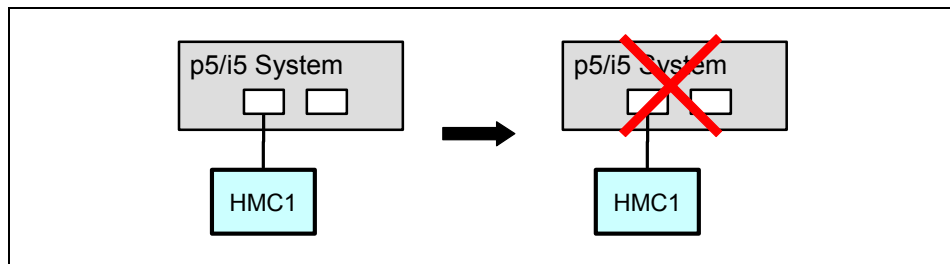

Figure 2-2   The case of one system failure

In a system without FSP failover capability, a failure of the FSP can sometimes result in an orderly shutdown of the system if the Hypervisor remains operational. For an environment where the availability of the application/system is critical, FSP failover capability is a requirement. All System p5-590, p5-595, and i5-595 systems with updated firmware have FSP failover capability. FSP failover is enabled from the HMC.

2.1.2 Case 2: Losing one HMC

In this situation, a breakdown occurs in the HMC or the HMC is disconnected. The operating systems are unaffected, but all functions that are performed by the HMC are lost. Some of these functions might be critical for system management. For example, in a critical environment, DLPAR operations might occur regularly; moving resources to adjust to workload changes, activating and shutting down partitions, and therefore losing the HMC could be critical for that operating environment.
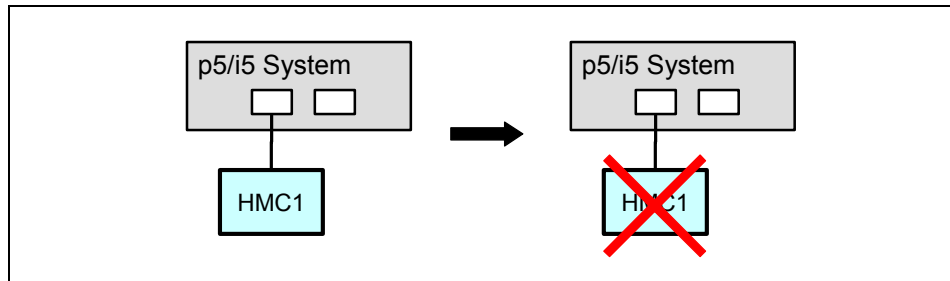

Figure 2-3   The case of one HMC failure

2.2 Scenario 2: Two HMCs managing one system

This case is considered to have HMC high availability. For high-end systems, we strongly recommend that you always have two HMCs for availability. With p5-570, i5-570, and smaller systems, IP addressing can be dynamic or static. To manage System p5-575, p5-590, p5-595, and i5-590, setting HMC as a DHCP server is a requirement that ensures that each HMC has an assigned IP address from a different IP address range.
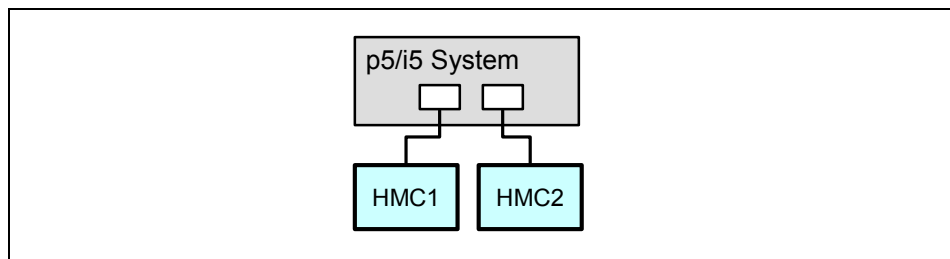

Figure 2-4   One system with two HMCs

No special installation procedure or configuration is needed to manage a system with two attached HMCs. They are installed in the normal manner, and both HMCs can be activated and ready to take management tasks at any time.

2.2.1 Case 1: Losing one system

In this case, the HMC availability configuration has no effect on system availability. As with a one-HMC environment, you lose all partitions and all services.
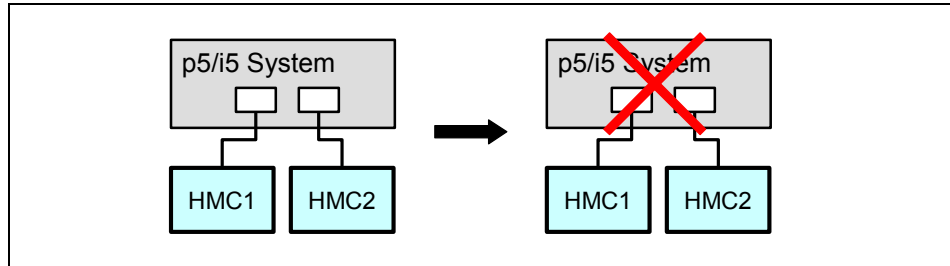

Figure 2-5   The case of one system failure

2.2.2 Case 2: Losing one HMC

In this case, you can still manage your system with the remaining HMC. You can recover the failed HMC while managing the systems from the second HMC.
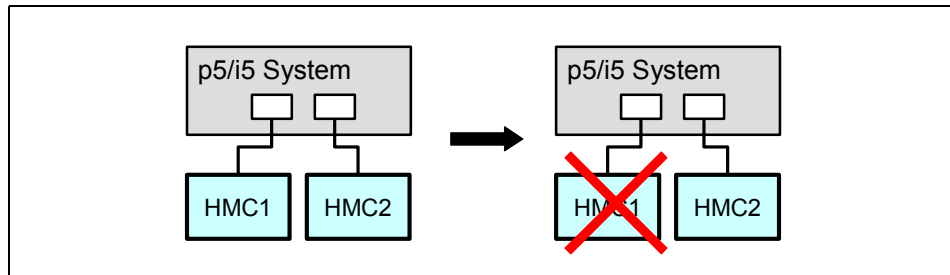

Figure 2-6   The case of one HMC failure

The main consideration in losing one of the two HMCs is how it was being used, because the two HMCs probably had different roles. If the failed HMC was considered the "primary" (the HMC normally in use by Operations), it might have been communicating with load-balancing applications, or i5/OS or PC applications running DLPAR. The remaining HMC must have communications established with those applications and any remote OS or scripting functions.

3

HMC multi-system scenarios

This chapter continues with the scenario theme and provides descriptions of environments involving several System p5 or System i5 managed systems and the HMCs attached to them. These scenarios show how HMC is involved in availability management.

25

3.1 General considerations

We do not show the public network interface for the HMCs in the following figures. As the path that HMCs use to synchronize between managing HMCs, this interface is needed to provide communication with other HMCs and the LPARs running in the managed system.

The public network interface is critical to provide DLPAR capabilities to the partitions and to ensure that the data is synchronized between all HMCs that manage a certain system. It also enables the use of one HMC to act as the Call Home server for all other HMCs in the same public network.

3.2 Particular considerations

In the following sections, we discuss particular considerations for each System i5 and System p5 model, and other special configurations.

3.2.1 505, 510, 520, 550 systems and 570 with just one FSP

The main characteristic for these servers is that they have only one FSP, and this results in a single point of failure in the system. Therefore, you will not be able to get a completely available environment for the HMC due to the FSP being the only connection point between the system and the HMC.

You can connect two HMCs to the same FSP (two ports are available for this connection), but keep in mind that an FSP failure ends the connection to the HMC, and shortly after the whole system will power off. (The first step during a normal FSP failover is to recover communication between the FSP and the Hypervisor. If this fails several times, the Hypervisor will shut down all LPARs and power off the system.)

In this scenario, the customer can choose to use static IP addressing or dynamic IP addressing (using the HMC as a DHCP server) to assign IP addresses to every hardware component.

3.2.2 570 with two FSPs

A customer can add a second FSP to a p5-570 or i5-570 system to provide higher reliability. In this case, there is a second independent HMC connection point. Using these two additional ports, you can connect two different HMCs to different FSPs, avoiding the previous single point of failure and providing higher availability for the HMC and its connections (because every element related to the HMC is completely redundant).

To assign IP addresses to the FSPs, the customer can choose to use static IP addressing (recommended) or use the HMC as a DHCP server.

3.2.3 575, 590, and 595

These are the most advanced System p5 and i5 products. In this scenario, all elements are redundant, which provides the highest availability. The HMC is not directly connected to an FSP Ethernet port; in these systems, each HMC (up to two) is connected to an Ethernet port in a special hub that connects all of the subsystems (BPCs, FSPs).

With this configuration, one HMC must be the DHCP server of the private network because no static IP address configuration is supported for the BPCs and the FSPs. We recommend using two HMCs to manage these systems, and use each HMC as a different DHCP server for the two defined private networks. Also, the public open network is important, and you are recommended to allow connection with the managed LPARs and any other HMC in the environment.

This special network configuration does not allow connection of a remote HMC to the system using a VPN.

3.2.4 Two-framed System p5 servers

System p5 590 and p5-595 systems can be configured with one or two frames. The main frame contains two Bulk Power Controllers (BPCs), two FSPs, CECs, and up to five I/O drawers. The second (expansion frame) has two BPCs and several I/O drawers.

In systems with two drawers, the HMC is connected to the HMC through the hubs located in the second frame. This means that the second frame must always be powered on and upgraded before the first frame.

If you power on the first frame before you power on the second (expansion) frame, some of the BPCs could power up with no IP assigned. This would prevent the HMC from accessing the BPCs.

3.2.5 Remote site installations

The main consideration when trying to enable HMC high availability between two remote sites concerns IP addressing.

One of the main functions of the HMC when using dynamic IP addressing is to provide the IP to the BPCs and the FSPs. This function works only when the HMC and the system are in the same private network (defined by the HMC DHCP server IP addressing range).

Locally, you can attach the system and the HMC to the same network segment (or VLAN) and the HMC will serve the IPs to the server, but this is valid only when all of the elements are in the same location.

When the server and the HMC are in different locations, the only way to ensure that all elements are in the same network is to use a VPN connection. However, VPN does not allow DHCP-served IP addresses to the BPCs and the FSPs.

In conclusion, the only way to remotely connect an HMC (with all functions enabled) to a system is using static IP addresses. This is not supported in p5-575, p5-590, p5-595, and i5-595 models.

3.2.6 One HMC managing two servers

Using just one HMC to manage, as shown in Figure 3-1, does not provide an available HMC environment, because losing this HMC would mean that no HMC service is available (Table 3-1).

Table 3-1   One HMC managing two local systems

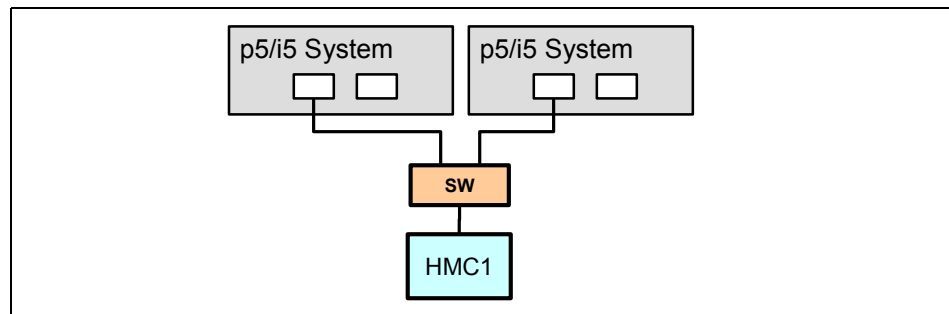| HMC high availability	No
IP addressing	Static or dynamic
FSP failover enabled	Only for i5-570 and p5-570 with two frames, p5-575, p5-590, and i5-595 and p5-595 systems. Check the HMC Web site for the correct firmware level: https://www.software.ibm.com/webapp/set2/sas/f/hmc/home.html
Scenario valid for	All systems

Figure 3-1   Network configuration: one HMC managing two servers in the same location

Two remote sites

Table 3-2 and Figure 3-2 show two remote sites managed by one HMC.

Table 3-2   One HMC with two remote sites

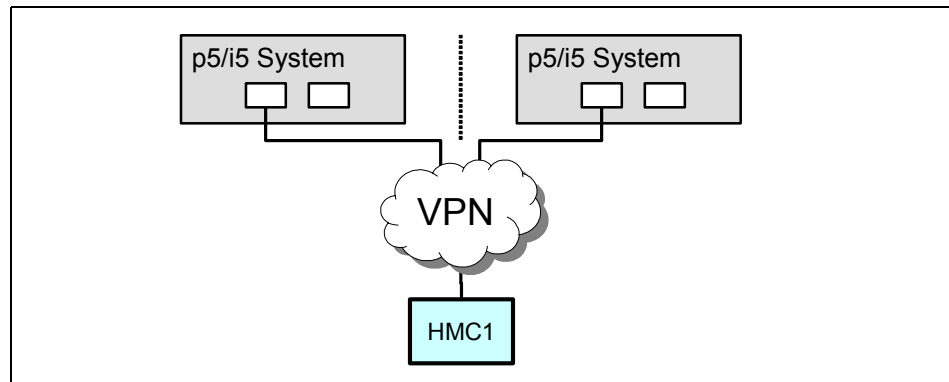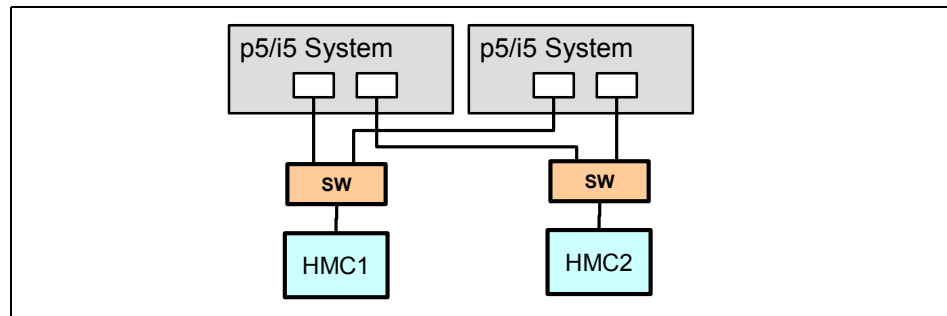| HMC high availability	No
IP addressing	Static
FSP failover enabled	Only for 570 with two frames, p5-575, p5-590, and 595 systems. Check the HMC Web site for the correct firmware level: `https://www.software.ibm.com/webapp/set2/sas/f/hmc/home.html`
Scenario valid for	p5-505, p5-510, i5-520, p5-520, i5-550, p5-550, i5-570 and p5-570

Figure 3-2   Network configuration: One HMC managing two servers in two remote locations

3.2.7 Two HMCs managing two servers

The following examples show two HMCs managing remote and local sites.

One local site

Table 3-3 and Figure 3-3 show two HMCs managing two local systems.

Table 3-3   Two HMC managing one local site

HMC high availability	Yes
IP addressing	Static or dynamic
FSP failover enabled	Only for p5-570 and i5-570 with two frames, p5-575, p5-590, i5-595, and p5-595 systems. Check the HMC Web site for the correct firmware level: https://www.software.ibm.com/webapp/set2/sas/f/hmc/home.html
Scenario valid for	All systems

Figure 3-3   Network configuration for two HMCs managing two local systems

Two remote sites

Table 3-4 and Figure 3-4 show two HMCs managing two remote systems.

Table 3-4   Remote site availability with two HMCs

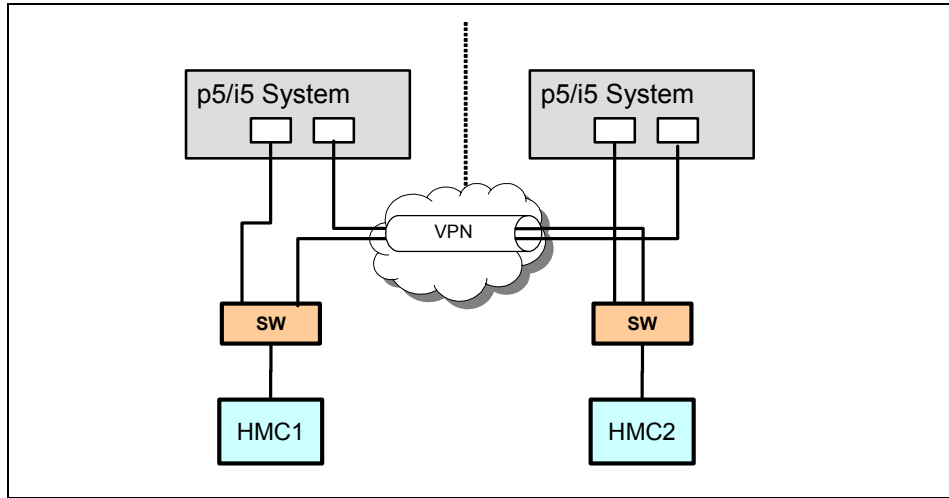| HMC high availability	Yes
IP addressing	Static
FSP failover enabled	Only for 570 with two frames, p5-575, p5-590, and 595 systems. Check the HMC Web site for the correct firmware level.
Scenario valid for	p5-505, p5-510, 520, 550, and 570

Figure 3-4   Network configuration: two HMCs managing two remote systems

3.2.8 Four HMCs managing two servers

If each system desires full redundancy, four HMCs will be required to manage two servers. This is especially important with model p5-575, p5-590, and 595 systems.

One local site

Table 3-5 and Figure 3-5 show the connections and availability for four HMCs managing two servers at one local site.

Table 3-5   Four HMCs managing two local systems

HMC high availability	Yes
IP addressing	Dynamic or static
FSP failover enabled	Only for 570 with two frames, p5-575, p5-590, and 595 systems. Check the HMC Web site for the correct firmware level.
Scenario valid for	All systems
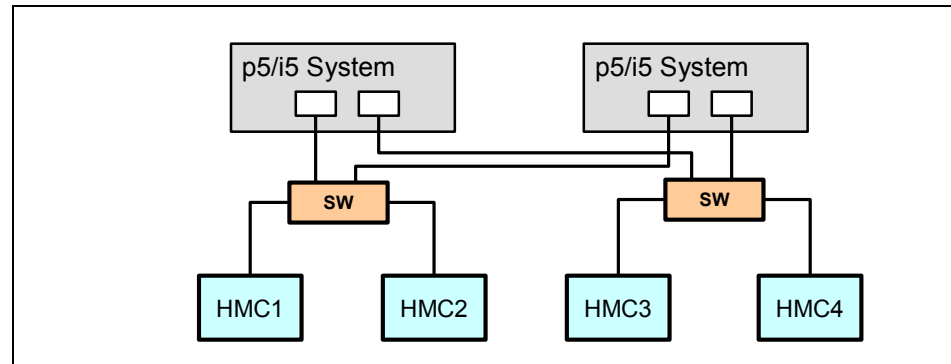
Figure 3-5   Network configuration for two HMCs each for two local systems

Two remote sites

Table 3-6 and Figure 3-6 show the connections and availability for four HMCs managing two remote systems.

Table 3-6   Four HMCs managing two remote systems

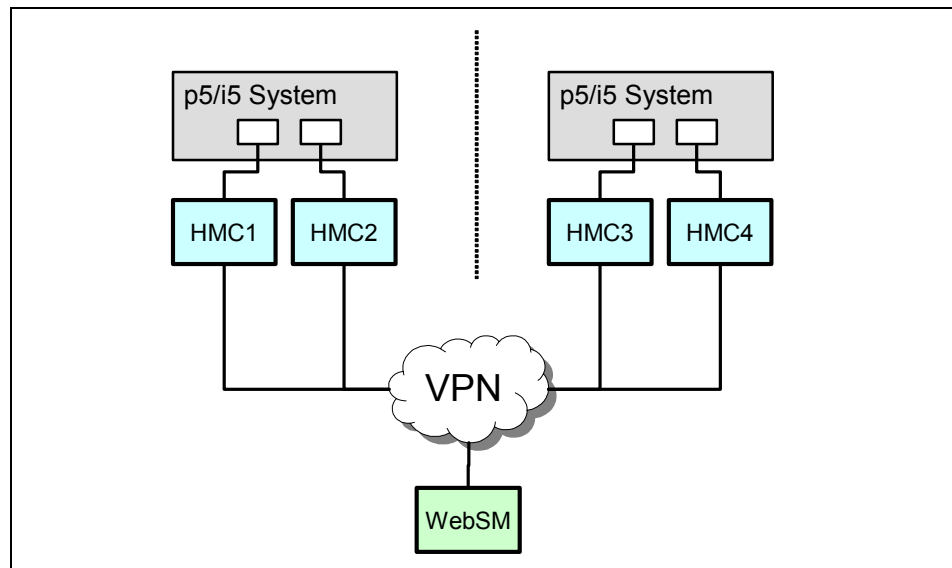| HMC high availability	Yes
IP addressing	Static
FSP failover enabled	Only for 570 with two frames, p5-575, p5-590, and 595 systems. Check HMC Web site for correct firmware level.
Scenario valid for	p5-505, p5-510, 520, 550, and 570

Figure 3-6   Network configuration: two HMCs each for two remote systems

3.2.9 Two HMCs managing several servers

The final scenario covers two HMCs managing any number of systems (up to the maximum allowed).

Table 3-7   Two HMCs managing multiple systems

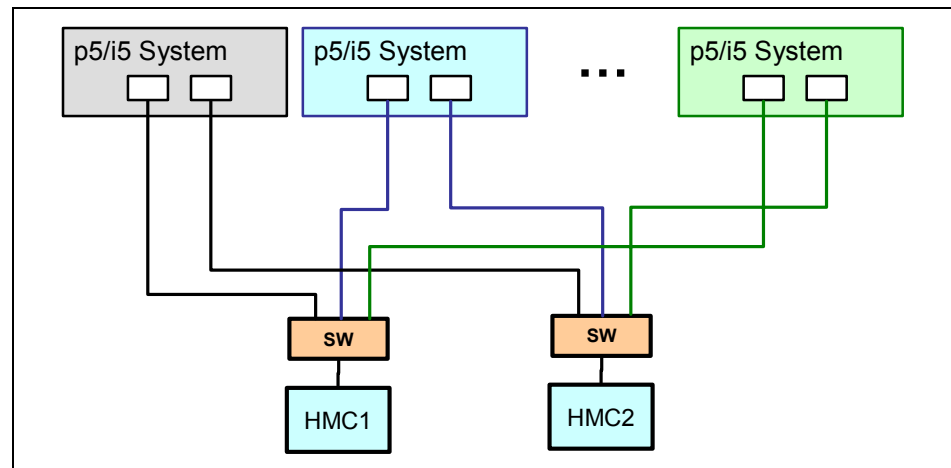| HMC high availability	Yes
IP addressing	Static or dynamic
FSP failover enabled	Only for 570 with two frames, p5-575, p5-590, and 595 servers, and firmware level higher than GA5.
Scenario valid for	All systems

Figure 3-7   Network configuration: two HMCs managing many systems

Related publications

The publications listed in this section are considered particularly suitable for a more detailed discussion of the topics covered in this Redpaper.

IBM Redbooks

For information about ordering these publications, see "How to get IBM Redbooks" on page 36. Note that some of the documents referenced here may be available in softcopy only.

► *Advanced POWER Virtualization on IBM System p5*, SG24-7940-01

  http://www.redbooks.ibm.com/redbooks/pdfs/sg247940.pdf

► *Logical Partitions on System i5: A Guide to Planning and Configuring LPAR with HMC on System i*, SG24-8000-01

  http://www.redbooks.ibm.com/redbooks/pdfs/sg248000.pdf

► *Hardware Management Console (HMC) Case Configuration Study for LPAR Management*, REDP-3999

  http://www.redbooks.ibm.com/redpapers/pdfs/redp3999.pdf

Other publications

These publications are also relevant as further information sources:

► *IBM POWER5 Processor-based Servers: A Highly Available Design for Business-Critical Applications*

  http://www.ibm.com/systems/p/hardware/whitepapers/power5_ras.pdf\

► *Redundant FSP Basics for 9117 and 9406 Model 570*

  http://w3.austin.ibm.com/:/projects/syspe/Redundant_FSP_Basics.pdf

Online resources

These Web sites and URLs are also relevant as further information sources:

► IBM eServer Hardware Information Center

  http://publib.boulder.ibm.com/infocenter/iseries/v1r2s/en_US/index.htm

- IBM eServer pSeries and AIX Information Center

  http://publib16.boulder.ibm.com/pseries/en_US/infocenter/base/

- IBM eServer iSeries Information Center

  http://publib.boulder.ibm.com/iseries/

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HMC Availability for System i5 and System p5

Redpaper

Understand the importance of the HMC

Review configuration options for multiple HMC and systems

Make your operation environment more resilient

This IBM Redpaper proposes design considerations in the IBM System p5 and IBM System i5 environment to increase the availability of one of the most critical operational subsystems, the Hardware Management Console (HMC).

Every System p5 or System i5 environment can be managed by one or two HMCs. In some cases certain models an HMC need not be installed.

We make some general recommendations and provide diagrams and tips for best practices when designing high-availability environments that involve one or more HMCs.