

# TECHNOLOGY BRIEF

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## Compaq Remote Insight Board/PCI: Hardware and Software Architecture

*This brief describes hardware and software technology implemented in the Remote Insight Board/PCI. First, it gives a very brief overview of the functions of the Remote Insight Board/PCI. Then it describes the Remote Insight Board/PCI hardware. Specific hardware features are described in some detail, such as the embedded network interface controller and PC Card modem for connectivity. The two components that comprise the key hardware for text-based communication, the video controller and the video-capture ASIC, are described. Finally, the brief explains how the sophisticated software architecture of the Remote Insight Board/PCI incorporates both PPP and TCP/IP stacks to provide seamless connectivity for any remote management activity. This includes a web-based browser menu, graphical console functions, Compaq Insight Manager Agents (SNMP and web-based), and a virtual network connection that provides standard network functions between the remote management PC and the managed server.*

*This technology brief assumes that the reader is familiar with the features and functions of the previous Remote Insight Board. If not, refer to the related white paper, Remote Insight Board/PCI Product Overview, document number ECG042/0798, or the Remote Insight Board/PCI User Guide, part number 294024-001.*

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**Compaq Remote Insight Board/PCI: Hardware and Software  
Architecture**

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ECG072/0798

**BOARD FUNCTIONALITY**

The Compaq Remote Insight Board/PCI is a remote management tool useful for servers in a distributed enterprise, whether it is across the globe or it is a local operation with multiple computers in a data center. It is available even when the host operating system (OS) is not functional or the host server is down. Through its remote console and remote reset functions, the Remote Insight Board/PCI provides access to and control over the managed server at all times, regardless of server location, administrator location, or server condition. The Remote Insight Board/PCI captures critical management information through its integration with Compaq Insight Manager, and its storage of reset sequences, failure sequences, critical events, and errors for later replay. It provides immediate alerting via alphanumeric paging for Compaq Insight Manager and other critical alerts.

**HARDWARE ARCHITECTURE**

The Remote Insight Board/PCI is a PCI-based, stand-alone computer that is installed in a server to provide remote management of that server. It incorporates its own microprocessor, memory, video controller, battery backup, network interface controller (NIC), and modem (Figure 1).

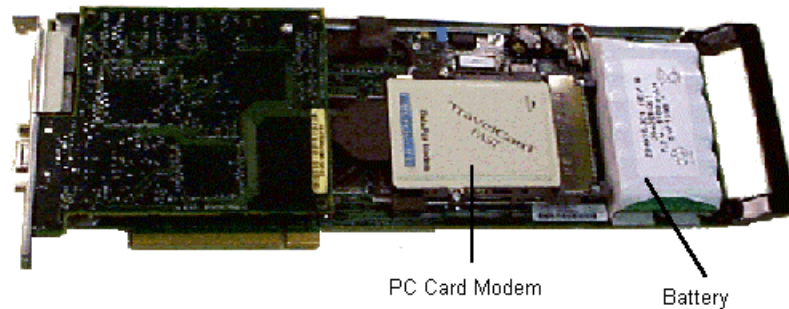


Figure 1: Remote Insight Board/PCI. The modem and battery are identified in this photo.

The Remote Insight Board/PCI is the third-generation server management board from Compaq. Its predecessors are the original Server Manager/R board and the Remote Insight Board. Table 1 compares key hardware features of the Remote Insight Board/PCI to features of the previous Remote Insight Board (EISA-based).

Table 1: Hardware components of the current and previous Remote Insight Boards

Component	Remote Insight/PCI	Remote Insight
Processor	33 MHz (Intel i960RP)	16 MHz (Intel 386EX)
On-board (RAM) Memory	8 MB	1 MB
Video (RAM) Memory	2 MB	512 KB
Modem	33.6 Kb/s (replaceable PC Card)	14.4 Kb/s
Network Interface Controller	10/100 Base-T Ethernet	None
Battery	Nickel Metal Hydride	Nickel/Cadmium

## TECHNOLOGY BRIEF *(cont.)*

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In addition to a more powerful processor and more memory, the Remote Insight Board/PCI brings these important enhancements:

- Transition from an EISA- to a PCI-based board that can take advantage of the high-speed and high-bandwidth PCI bus
- Embedded 10/100 Base-T Ethernet NIC that supports network access
- PC card slot for modem connectivity that provides future flexibility as communication technologies evolve

### PCI-Based Architecture

Most enterprise servers today use the PCI local bus for I/O because it provides greater bandwidth and speed than ISA or EISA bus architectures, as shown in Table 2 below.

Table 2: Differences between ISA, EISA, and PCI bus architectures

	ISA	EISA	PCI <sup>1</sup>
<b>Bus Width</b>	16-bit	32-bit	32-bit
<b>Bus Speed</b>	8.33 MHz	8.33 MHz	33 MHz
<b>Maximum bandwidth</b>	16.6 MB/sec	33.3 MB/sec	133.3 MB/sec

Because the functions of the Remote Insight Board/PCI must be available even in the event of a server power loss, the Remote Insight Board/PCI has the ability to completely isolate itself from the host PCI bus and the host power supply. The Remote Insight Board/PCI uses electrical switches to isolate the PCI bus and to control the power and clock signals on the PCI bus. It then seamlessly transfers to its own clock and battery power when the server powers down. The administrator can have full confidence that the Remote Insight Board/PCI is available, regardless of the condition of the server.

### Embedded NIC

The Remote Insight Board/PCI contains an embedded, auto-sensing, 10/100 Base-T Ethernet NIC. Therefore, the administrator can manage servers using a management LAN rather than using an asynchronous dial-up connection. In a data center environment, this results in two possible benefits:

- Reduces the number of phone lines required
- Provides an extra level of security

If an administrator desires to access the managed server *only* through the network, no additional phone lines are needed for the server. However, the Remote Insight Board/PCI does support connections through the NIC and the modem simultaneously.

The use of a NIC can provide an extra level of security for companies that require user authentication in addition to passwords and dial-back procedures. The administrator can establish the company's standard security protocols on a remote access server (for example, a modem bank), dial into this remote access server through an asynchronous connection, and then connect to the NIC in the managed server behind this security gateway.

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<sup>1</sup> The PCI specification also defines a 64-bit, 66-MHz bus, which gives a maximum total bandwidth of 533 MB/s. However, 64-bit, 66-MHz PCI is just now coming into use. For compatibility with all Compaq servers containing PCI slots, the Remote Insight Board/PCI uses a 32-bit architecture.

LAN: Local Area Network.  
Commonly refers to Ethernet network.

The Remote Insight Board/PCI cannot send paging alerts to the administrator if the board has only network access. If the administrator configures the Remote Insight Board/PCI for paging, a phone line is required. SNMP traps, however, can be delivered through the network and Compaq Insight Manager.

### **PC Card Modem**

Because communication technology is changing so rapidly, Compaq designed the Remote Insight Board/PCI to adapt easily to future changes. An industry-standard PCMCIA connector has been added to the Remote Insight Board/PCI to accommodate a removable PCMCIA (PC Card) modem.

The Remote Insight Board/PCI ships in three possible configurations: NIC only, NIC and modem, or NIC and serial port. The Remote Insight Board/PCI with the modem configuration uses a 33.6 Kb/s card. As higher-speed modems become available, future PC Card upgrades can extend the customer's investment in the Remote Insight Board/PCI.

### **PC Card Serial Port**

The PCMCIA connector can also accommodate an optional serial port PC Card that is configured to accept an external modem. The serial port provides flexibility for the administrator to connect to a more secure modem, terminal server, null modem, or modem-sharing device. The serial port PC Card contains a full 16550 UART for high-speed serial connections.

### **Dual Access**

The NIC and the modem can be active simultaneously if the administrator only needs standard remote console or remote reset functions. If an administrator normally uses the embedded NIC to manage servers, but the network is down, the administrator can transfer to modem access. The administrator may also desire different techniques for managing servers from different management PCs. For example, the administrator may wish to access the managed server through the LAN during the day, but access the managed server through the modem of a different management PC during non-business hours.

If the administrator needs the graphic remote console function, only a single connection is supported: either the modem or the NIC connection, but not both simultaneously. Also, if an administrator uses the same management PC to make both the modem and network connection, routing changes will have to be made in the managed server before using the graphical remote console function. The routing procedure is explained in *the Remote Insight Board/PCI User Guide*.

### **Video Control Hardware Assists Text-Based Communication**

The primary function of the Remote Insight Board/PCI is to provide continuous management capabilities for remote servers when the OS is not functioning. Using the text-based communication tools allows the administrator to

- Gain control over the server reset process.
- Access the system configuration utilities, perform diagnostics, review past reset and failure sequences, and give interactive keyboard commands during the reset process.
- Gain control over a text-based OS such as Novell NetWare or SCO UnixWare.

PCMCIA:  
Personal Computer  
Memory Card  
International Association

UART:  
Universal Asynchronous  
Receiver/Transmitter

ASIC: Application-Specific Integrated Circuit

Two main components comprise the hardware for text-based communication: an on-board video controller and a video-capture ASIC. The video controller generates the server video signal to the monitor. This enables other on-board hardware to monitor and capture the video sequences efficiently. The video-capture ASIC, designed by Compaq, performs both video capture and compression. It uses essentially the same circuitry as that used in Integrated Remote Console, a proven hardware technology used in Compaq servers since the Compaq ProLiant 2500 Server.<sup>2</sup>

**Advantages of On-Board Video and Video-Capture ASIC**

Compaq’s implementation of the video control in the Remote Insight Board/PCI provides two distinct advantages:

- Embedding the video controller and video-capture ASIC onto the board frees the host PCI bus for other activity.
- Compressing the video data allows higher video sampling rates and requires fewer memory resources.

Embedding the video controller and video-capture ASIC onto the Remote Insight Board/PCI reduces the demand for system bus cycles. The video-capture ASIC can capture the video data directly from the local video stream without interrupting the video controller and using extra bus cycles (Figure 2). This reduces the load on the host PCI bus, since none of the remote control video captures affect the host PCI bus after the video signal goes to the video controller on the Remote Insight Board/PCI.

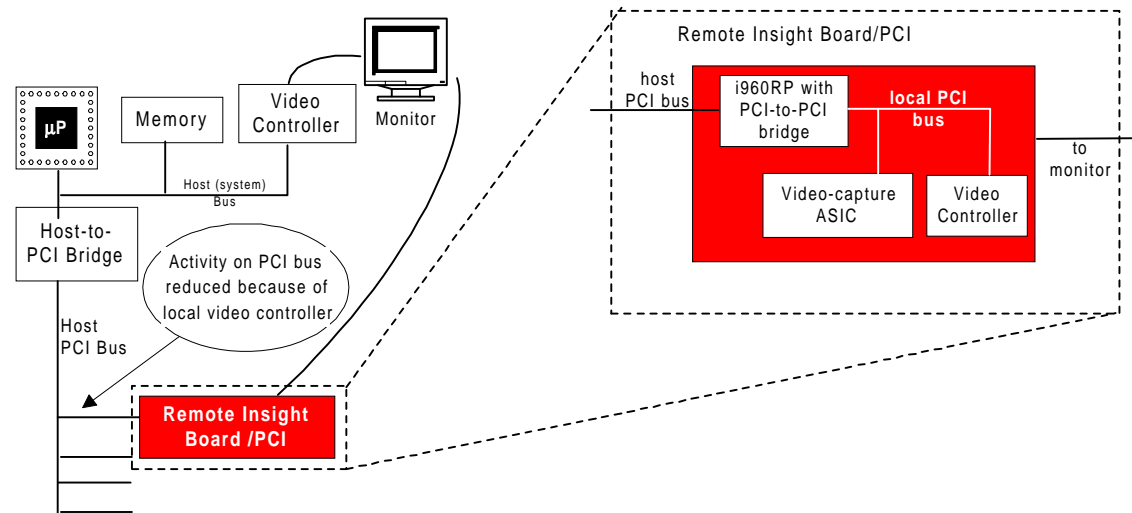


Figure 2: The Remote Insight Board/PCI is located on the host PCI bus. Because of its internal video control and local PCI bus, the Remote Insight Board/PCI can capture video without creating traffic on the host PCI bus.

The video-capture ASIC performs real-time video monitoring and compression. It identifies the original operation the OS is performing in each video cycle and then encodes and compresses the data needed to reconstruct that operation. The operations include scrolling the server console screen, clearing the screen, and drawing text. After the operation is identified, the video-capture ASIC encodes and compresses the data needed to reconstruct that operation. Since the video-capture ASIC is local to the board, a faster sample rate can be used, allowing more information to

<sup>2</sup> For more information, see the technology brief *Remote Server Management with Integrated Remote Console*, document number ECG582A/1096.

be captured and less information to be lost during video compression. Because the video information is compressed, it requires fewer resources than video stored without compression.

Another possible solution would be to take video snapshots and copy the entire video frame into the board's memory. However, this would require continually reading the host video buffer to obtain snapshots of the current screen. Without using local video-capture and compression, host bandwidth resources would be used continually by these video capture cycles. The Remote Insight Board/PCI eliminates excess video cycle traffic on the primary PCI bus, freeing that bus for other system cycles.

### SOFTWARE ARCHITECTURE

The Remote Insight Board/PCI has a complex software architecture that provides SNMP communication with Compaq Insight Manager, gives access to the browser-based Remote Insight menu, and allows use of external software programs to control graphical operating systems like Microsoft Windows NT.

The software architecture includes the following key components:

- Resident PPP and TCP/IP stacks
- HTML server
- SNMP agents
- Shared memory interface (SMIF)
- OS-specific Remote Insight driver (called CPQRIB, CPQRLNLM, or crid, depending on the OS used on the server)
- Windows NT WAN driver (RIBWAN)

### Interaction with Compaq Insight Manager

Remote Insight Board/PCI is fully integrated with Compaq Insight Manager.<sup>3</sup> While the OS on the managed server is functional, the administrator can easily access Compaq Insight Manager to obtain SNMP alerts and to monitor hardware subsystems within the server.

In general, when the management PC connects to the Remote Insight Board/PCI through the modem, the PPP stack is used for communication. When the management PC connects to the Remote Insight Board/PCI through the NIC, the TCP/IP stack is used.

*SNMP: Simple Network Management Protocol*

*PPP: Point-to-Point Protocol*

*TCP/IP: Transmission Control Protocol/Internet Protocol*

*HTML: HyperText Markup Language*

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<sup>3</sup> For more information on Compaq Insight Manager, see the white paper *Compaq Insight Manager*, document number ECG027/0798.

SNMP requests are sent from the management PC through the PPP or TCP/IP connection of the Remote Insight Board/PCI. The requests are then passed to the managed server through the SNMP stack, to the SMIF, and then to the Remote Insight driver, as shown in Figure 3. The SMIF is the common memory area that the Remote Insight Board/PCI uses to communicate to the server's OS through the Remote Insight driver. The Remote Insight driver is added onto the server OS when the Remote Insight Board/PCI is installed. The Remote Insight driver communicates to the SNMP stack on the managed server. Responses from Compaq Insight Manager agents on the managed server are sent back along the same path to the management PC.

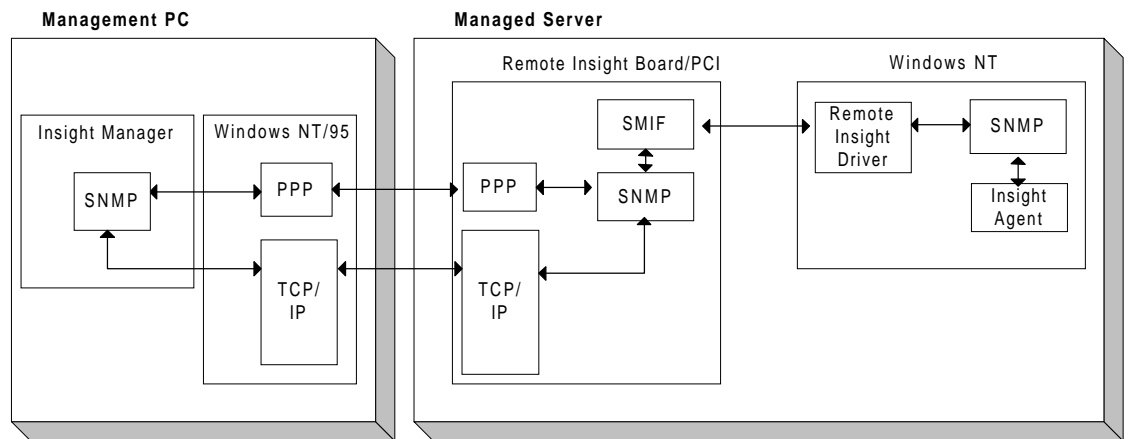


Figure 3: Compaq Insight Manager uses the embedded PPP or TCP/IP stacks in the Remote Insight Board/PCI to pass SNMP information between the management PC and the managed server.

## Graphical Console Access

With the Remote Insight Board/PCI, the administrator can also control a graphical OS like Windows NT. To do this, the Remote Insight Board/PCI leverages software utilities specifically designed to provide a graphical remote console, such as Compaq Carbon Copy or Symantec pcANYWHERE.

## Leveraging Existing Graphical Software Solutions

In existing software programs such as Carbon Copy, software video drivers that read the graphical screen draw functions of Windows NT are implemented at the OS level. Identifying and encoding these graphical screen draw functions requires a much greater level of detail than those for a text-based video screen do. These video drivers greatly reduce the amount of information sent across a phone line or network connection.

While designing the Remote Insight Board/PCI, Compaq considered customers' current solutions. Many existing third-party programs enable graphical remote console operations. Compaq's research showed that many customers were devoted to these programs and did not want to give them up. The Compaq design leverages these solutions to protect the customer investment in software and personnel training.



**Implementation of Graphical Communication**

The Remote Insight Board/PCI creates a *virtual LAN* (an IP connection), between the management PC and the managed server. To accomplish this, PPP or TCP/IP information is passed through the modem, serial port, or NIC of the Remote Insight Board/PCI. TCP/IP information must be converted into a PPP packet. A WAN connection is created between Windows NT's RAS server, and the Remote Insight Board/PCI's shared memory interface (SMIF) by the RIBWAN driver. The RIBWAN driver is added to the server OS during the Remote Insight Board/PCI installation process. The WAN connection communicates between the Remote Insight Board/PCI and the host server (Windows NT RAS) for graphical console functions or web-based agents (Figure 4). The Windows NT operating system perceives the connection to the Remote Insight Board/PCI as a WAN connection, and allows network information to pass through, creating the virtual LAN. For security and performance reasons, Compaq recommends disabling RAS IP forwarding.

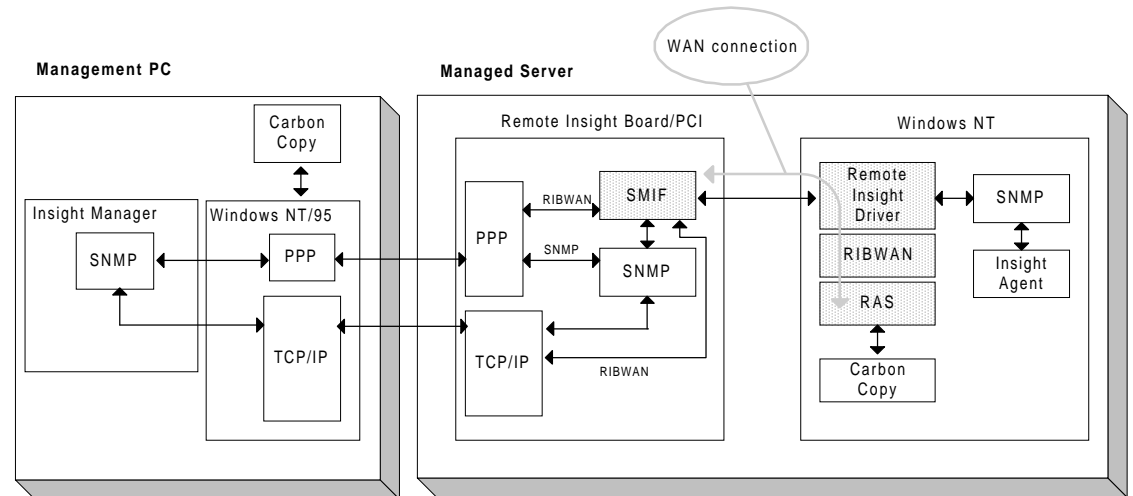


Figure 4: WAN connection is established between Windows NT RAS and the Remote Insight Board/PCI. This provides a virtual LAN connection between the management PC and the managed server.

Implementing this virtual LAN through the board permits the administrator to perform standard network functions over the PPP connection, such as transferring files and mounting drive volumes remotely. The PPP connection also gives the administrator simultaneous, multiple access points to Insight Manager agents, FTP/Telnet, and other standard utilities.

**Browser Access**

The Remote Insight Board/PCI uses a web-based browser to access the main menu (Figure 5). Because web-based browsers are ubiquitous and easy-to-use, the need for a text-based menu no longer exists. Using the browser allows familiar hypertext navigation of graphical pages by mouse rather than by keyboard commands.

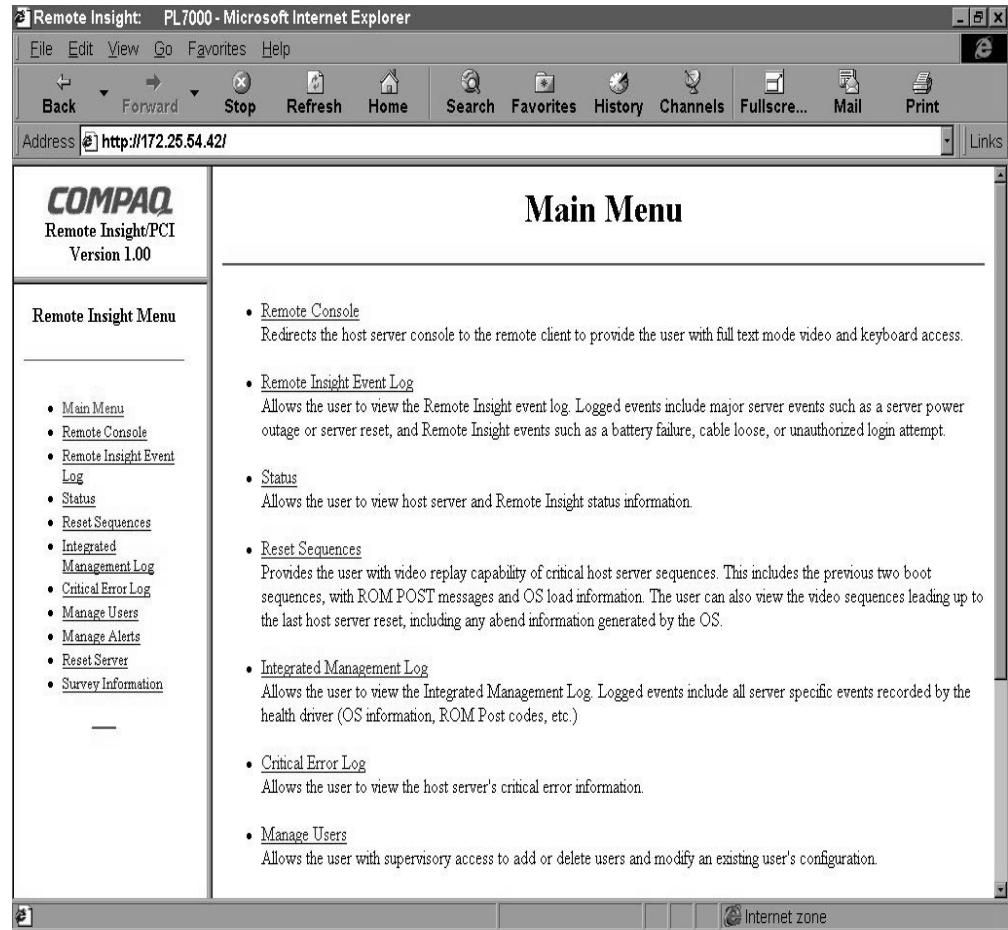


Figure 5: The Remote Insight Board/PCI main menu is HTML code that is embedded onto the board and can be called up by the administrator using any standard web browser.

### Implementation of Web Browser Technology

The Remote Insight Board/PCI uses two basic components of web technology: HTML and Java code.

When most people see the term “web-based,” they think of the Internet, a corporate intranet, or the World Wide Web. In each of these cases, the web browser uses a look-up table to correlate the URL of a server to the actual IP address of that server.

In the same way, the Remote Insight Board/PCI acts as a web server, providing web pages rather than a text-based utility to access the functions of the Remote Insight Board/PCI. The administrator enters the default IP address of the Remote Insight Board/PCI (192.168.0.13). The web browser connects directly to the board through either the PPP or TCP/IP connection and accesses the HTML server without going through the SMIF (Figure 6). The administrator browses through the HTML pages to perform these functions: view event log and status information, replay reset and failure sequences, reset the server, and modify user login and alerting configurations. The administrator can also access web-based SNMP agents through the HTML browser.

URL: Uniform Resource Locator

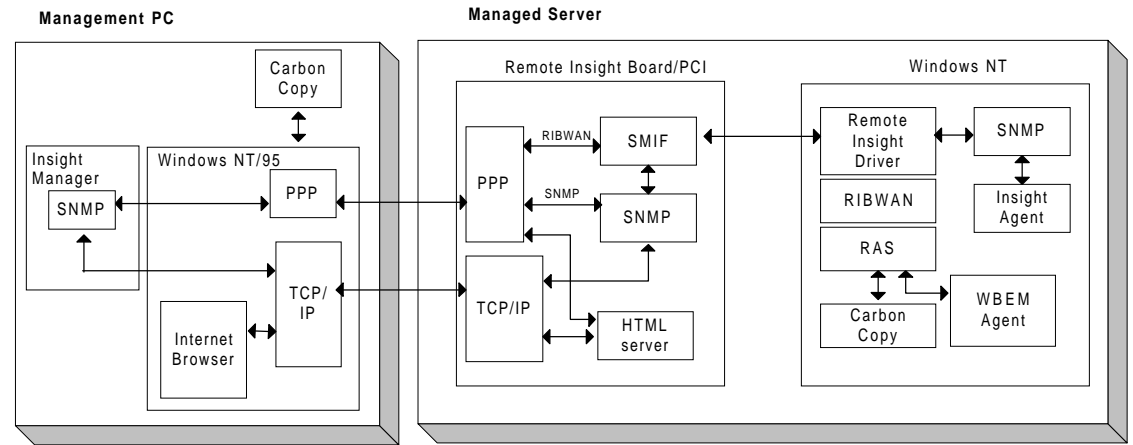


Figure 6: HTML code does not pass through the SMIF. It is accessed directly through the PPP or TCP/IP stack.

The web pages are *all* local to the Remote Insight Board/PCI. When the administrator accesses the Remote Insight Board/PCI through the browser, the board in essence becomes a web server, displaying its own web pages to the administrator. There is no connection to the World Wide Web or Internet; the administrator cannot jump from a Remote Insight web page to the World Wide Web. This provides the type of secure connection that administrators need for managing servers.

Java is the standard programming language used in browser technology. It is supported by all the major web browsers in existence today, such as Microsoft Internet Explorer 4.0x and Netscape Navigator 4.05. Compaq used generic Java code to make the remote console application compatible with browser technology. When a user requests a remote console session, the Remote Insight Board/PCI downloads a Java applet (40 KB of code) to the remote web browser to activate the session. For best performance if using Microsoft Internet Explorer 4.0x, Compaq recommends installing Service Pack 1.

## CONCLUSION

The Compaq Remote Insight Board/PCI delivers proven expertise for remote management in a PCI-based board. This third-generation server management board integrates hardware and software technologies to provide seamless remote access to and control over managed servers. The architecture of the Remote Insight Board/PCI is designed to leverage important industry-standard technologies such as the high-bandwidth PCI bus, PC Cards, and web browsers. Remote Insight Board/PCI gives the system administrator a powerful tool to manage servers in remote locations or servers in mission-critical environments.