

Server Management Requirements and Implications on Server Motherboard Design

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Today server vendors increase value and differentiate their products with manageability features. Hardware management in combination with remote access capabilities have become a powerful tool for server users. This article determines typical forms of server deployments and shows how server management features ease server operation and maintenance. While server management features move toward standard and will become commodity, motherboard vendors are increasingly asked to embed such features. Agilent Technologies offers a portfolio of remote management solutions. The article introduces Agilent Technologies' portfolio and explains how such solutions integrate into server motherboards.

Computers have changed everyday life, as they have become integral part of workplaces, like telecommunication devices, and multimedia applications. But also all infrastructure which serves computer networks, workplace environments, telecommunication networks, and multimedia services are based on computers. If a computer provides services to other computers, it is generally called server. Servers distinguish from other computers in providing services to many other systems. Thus when a server goes out of operation this is much more dramatic as it affects many other systems. In real life this means; a company cannot produce any more; the cash registers of a supermarket don't work; the phone system of a city is down; or an internet service provider is out of operation. All these server failures have one fact in common, they can become very expensive and can even ruin a company. As servers have become a basis of existence many efforts are invested to keep them operational. As the overall number of servers is steadily increasing concepts are needed for observation and maintenance. The demands for such concepts differ depending on the type of server deployment.

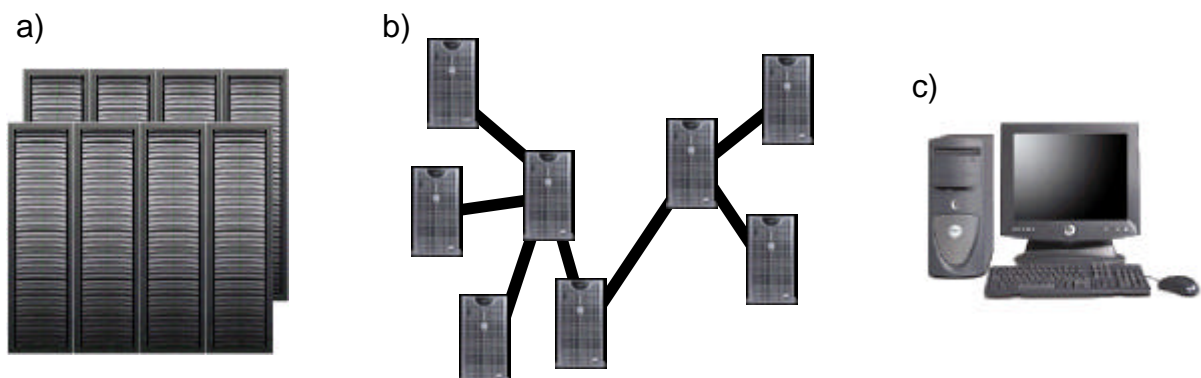


Figure 1: Typical Server Deployments: (a) Computing Data Center Environment, (b) Branch Office Environment, and (c) Small Office / Home Office (SOHO).

Many servers are typically concentrated in a computing data center. Multiple servers are mounted in a rack and multiple racks can be stored in a room. Computing data centers typically suffer from staffing shortages as they have to be observed 24 hours a day for 7 days a week. Dense systems complicate installation and cabling of servers. Further large numbers of servers are hard to manage and it is hard to localize failures. Bigger companies typically have multiple sites. Their use of computers typically requires to have servers at multiple locations. Such a deployment is called branch office environment. Typically an IT department is centralized versus servers are located at multiple sites. This increases costs of server maintenance as personnel has to travel around. Long distances cause late failure detection and make server recovery inefficient.

Small offices or home offices (SOHO environments) often require only a single server. Due to cost reductions servers may be leased and IT service is out sourced. Very often no backup system is available. SOHO environments often use a dial-up network. Similar to branch office environments server maintenance in SOHO environments is expensive and failures are detected late. Also server recovery times are long and are dominated by delivery times of spare parts.

Notification and Remote Management Features

Because of the importance of servers their reliability is essential and features which increase reliability drive purchase decisions. Such features are notification functions, support for remote failure analysis, remote server control and management, and remote system operation.

Ideally notification functions pro actively notify an administrator to prevent the server from a failure. Severe damage can be avoided in sending a notification if there is an indication that something will go wrong. Such a notification can be an E-mail to an administrator, a pager call to maintenance staff, and also SNMP traps to management software. Since it isn't always possible to prevent a system from a failure it is important that such notifications can also be send after a failure occurred. Therefore out-of-band infrastructure is needed to send such notifications.

Remote failure analysis features are needed for fast and efficient problem isolation. Upon a notification it must be possible to view remotely an event log and current system and sensor status. This must also be possible after a server failure. Furthermore it should be possible to perform tests and execute diagnostics tools from a remote location.

Remote server control and management features help for fast and efficient server recovery after operating system hang. Remote hardware management includes power on / off, server reset, and BIOS modifications.

Server recovery after breakdown as well as server initialization can be done fast and efficiently with remote system operation features which allow to view the server screen and remotely use keyboard and mouse. This enables remote server maintenance while the operating system is running. Further applications and even an operation system can be installed from a remote location.

Remote Server Management Solutions

Besides the numerous software based network and system management tools available on the market, Agilent Technologies has an unique family of hardware based solutions providing extensive remote capabilities even if the server hardware is broken. The portfolio extends from high end baseboard management controllers to accessory

cards. The solutions are independent subsystems which monitor and control the server in any state. All solutions come with hardware, firmware, and with additional software, if needed. The firmware is open for customization and allows to adapt the solutions to server specific requirements.





High End Baseboard Management Controllers	Embedded Remote Management Chips	Embedded Remote Management Cards	Accessory Cards
			
eRMC Base 1.5	eRMC 2.0	RMC Plus family	RMC 2.0

Table 1: Agilent Technologies' Portfolio of Remote Server Management Solutions at a Glance. (See also at <http://www.agilent.com/find/rmc>)

Agilent Technologies' remote server management solutions are based on the Intelligent Platform Management standard IPMI version 1.5. As independent out-of-band subsystem they run on standby power even when the server is turned off. This way they can power on and off and reset a server in any state. Agilent Technologies remote server management solutions monitor system sensors like e.g. temperatures, fans, and voltages. A system event log is used to store events and make them visible

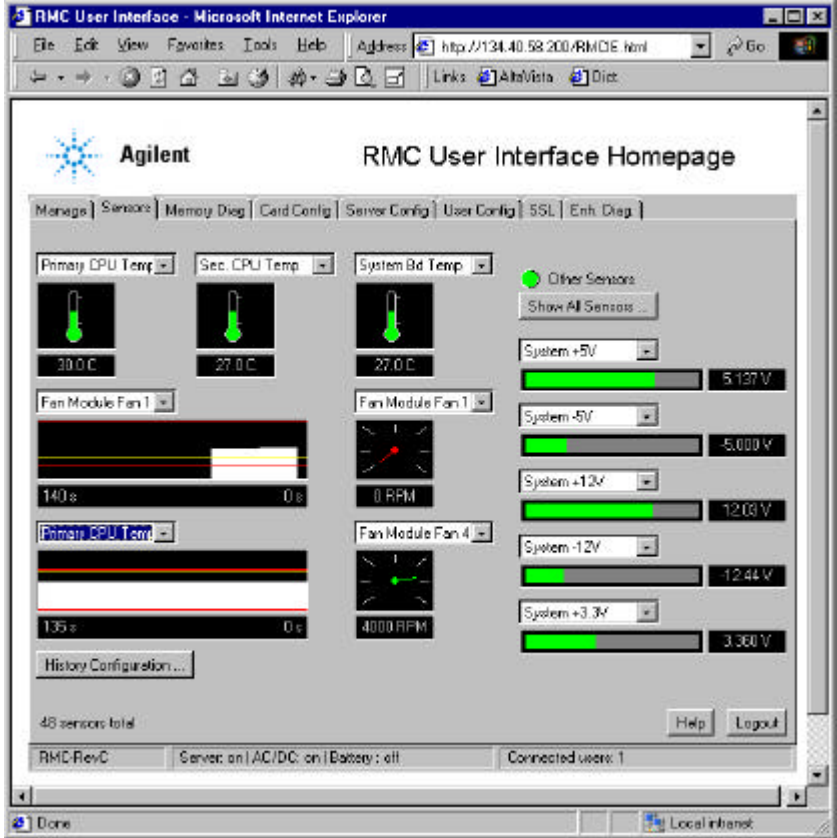


Figure 2: Example Screen of Agilent Technologies' Remote Server Management Products User Interface. It Illustrates a Selection of Server Sensors.

to a remote administrator. Upon critical events notifications can be send via network or phone, if a modem is connected. Remote access is key for Agilent Technologies' solutions. Therefore access via network or modem is provided. All solutions provide a graphical user interface, which can be accessed with a standard Web browser. Figure 2 shows an example screen of the user interface.

As remote server management features hook deep into the server architecture, remote management solutions have to be considered during the design phase of a server motherboard. Either such a solution becomes part of the motherboard or the motherboard has to provide the necessary infrastructure like a connector to the essential signals. In the following it is shown how Agilent Technologies remote server management solutions influence motherboard design.

High End Baseboard Management Controllers

Agilent Technologies' high end baseboard management controller eRMC Base 1.5 can be directly embedded on a motherboard. It requires external memory for operation. On the motherboard it can connect to I/O lines, I²C sensors, and intelligent IPMI devices. Further it has internal analog/digital converters (ADC) for voltage measurements and can directly control fans. As in-band interface to the operating system a low pin count (LPC) bus is used in keyboard controller style (KCS). Remote access can be accomplished via a serial port or in using the system network interface chip (NIC). Thus for LAN access the motherboard has to be equipped with a NIC that has two interfaces; one to the main system (which is usually PCI) and an I²C interface to the eRMC Base 1.5.

As the I²C connection between eRMC Base 1.5 and the NIC is of limited performance the network protocols are limited. As specified by IPMI version 1.5 baseboard management controllers support the highly efficient IPMI protocol over LAN. To implement a Web based user interface Agilent Technologies provides an external server software, which translates this network protocol into a graphical user interface.

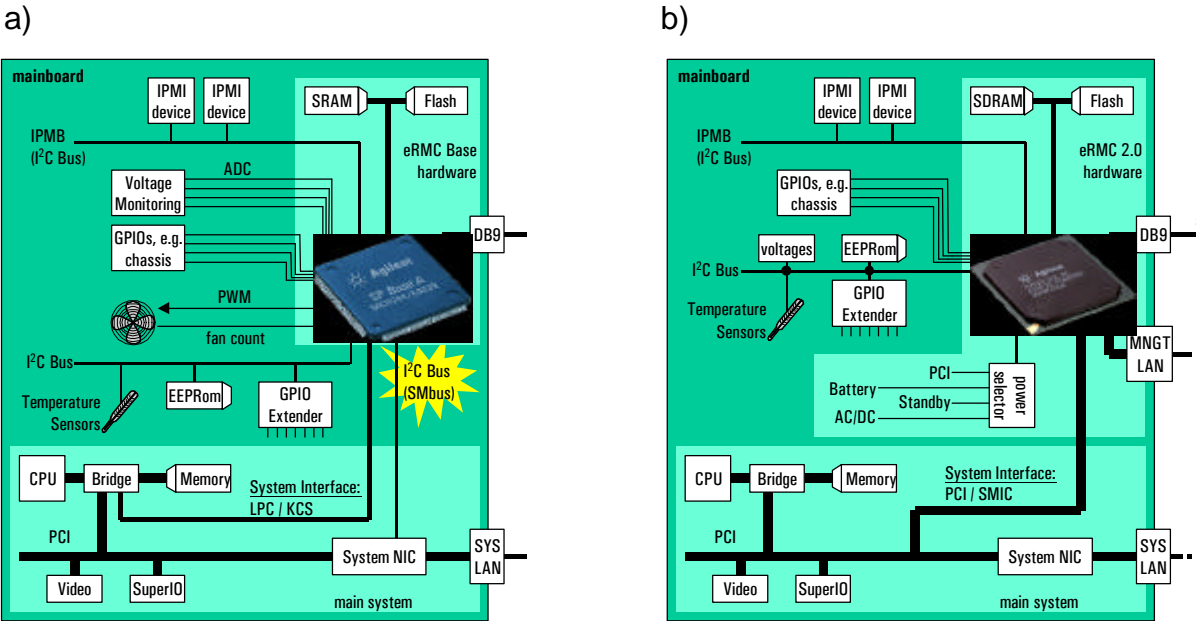


Figure 3: Typical Motherboard Designs with eRMC Base 1.5 (a) and with eRMC 2.0 (b).

Embedded Remote Management Chips

For servers with higher remote management requirements an embedded remote management chip like Agilent Technologies' eRMC 2.0 is recommended. As it is more feature rich as a baseboard management controller, it comes with an integrated LAN interface and an embedded Web server. It supports a large variety of network protocols and doesn't necessarily need external software. For communication with the server and the operating system it uses an integrated PCI interface. This way the eRMC 2.0 can get hardware level control over the keyboard, mouse, and video.

On the basis of the eRMC 2.0 chip Agilent Technologies offers also a variety of PCI cards. Based on the integration level of such cards two groups of cards can be distinguished; embedded cards and accessory cards.

Remote Management Accessory Cards

Accessory cards require an IPMI compliant baseboard management controller (like the eRMC Base 1.5) on a server motherboard. This baseboard management controller is customized to the specific sensors and switches on a motherboard. As interface between the accessory card and the baseboard management controller an Intelligent Platform Management Bus (IPMB) is used. This way the accessory card can be independent from a specific motherboard and provide high-end remote management features over a complete server family. Figure 4 shows such a system with Agilent Technologies' RMC 2.0 accessory card.

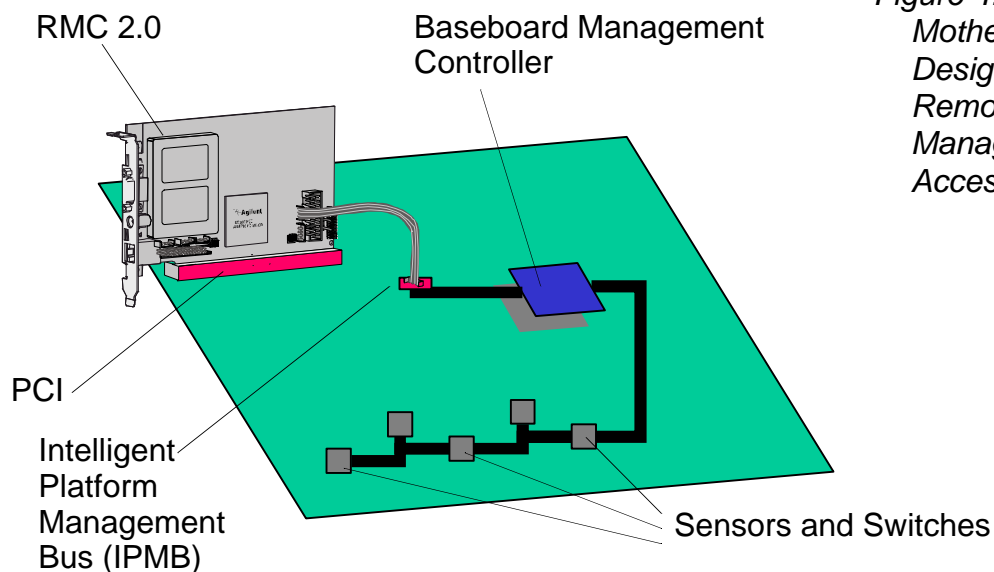


Figure 4: Typical Motherboard Design with a Remote Management Accessory Card.

Embedded Remote Management Cards

Motherboards without integrated baseboard management controller can be remotely managed with an embedded remote management card. Therefore all necessary sensors and switches have to be accessible via a connector. Agilent Technologies offers several embedded remote management cards; the RMC Plus family. To minimize integration efforts Agilent Technologies has defined a connector of necessary sideband signals for motherboard management. This proprietary connector is called Agilent Management Connector (AMC). The specification is freely available from Agilent Technologies. It ensures core features like power on / off and reset but is also open for server specific manageability features. Such server specific manageability features may require tailoring of the embedded card's firmware.

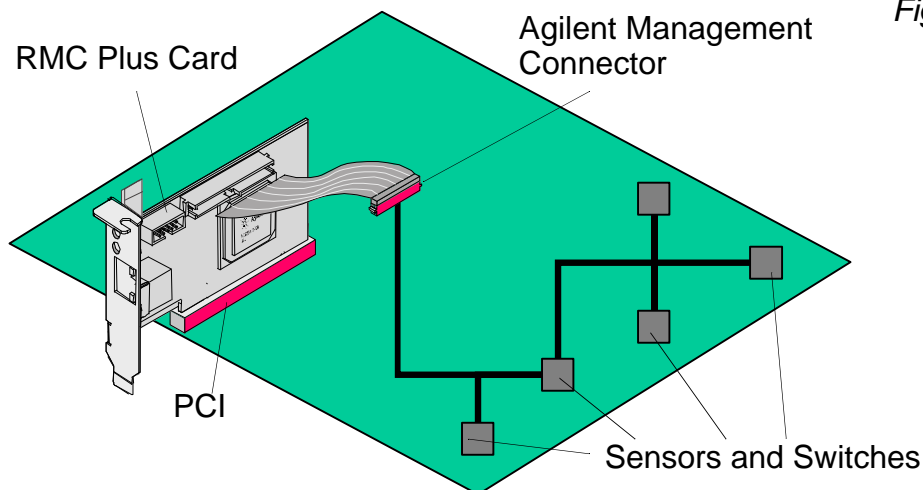


Figure 5: Typical Motherboard Design with an Embedded Remote Access Card.

Outlook

Agilent Technologies started to distribute its remote management solutions to motherboard vendors. March, 5th Agilent Technologies will introduce its first distribution partner in Taiwan. This will not only provide local support, but also make Agilent Technologies' solution portfolio globally available to Taiwan server motherboard vendors. As known for, Agilent Technologies as an independent solution provider will focus on developing next generation technologies and will set new standards.

For more information please refer to Agilent Technologies' remote server management solutions Web site at <http://www.agilent.com/find/rmc>