# Agilent's Key Technologies in Remote System Management

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## Abstract

*Agilent Technologies Boeblingen Verification Solutions is offering a variety of remote system management products. This paper will summarize the key technologies on which Agilents remote system management solutions are based. This includes the underlying standards, knowledge in remote management and diagnostics, as well as IP-based design of highly integrated systems on chip.*

## 1. Introduction

Agilent's remote system management solutions [1] are hardware based, operating system independent extensions which will be integrated into servers or communication systems for remote management. The term management includes all actions, which may be performed by a system administrator, like power on/off, shutdown, reset, updating of the BIOS, evaluation of system conditions like temperature, or making inputs at a console. The product portfolio includes system management cards (Remote Management Card, RMC) and an embedded Remote Management Chip (eRMC). Due to being based on common standards, the remote management solutions integrate easily into various system environments. Agilent's knowledge of system diagnostics gathered over decades empower them to perform sophisticated management tasks. All key functions have been integrated as a System on Chip (SoC) using state of the art IP-based design methods.

## 2. Remote Management and Diagnostics

System analysis and intelligent reasoning are some of Agilent's core competencies. The knowledge of reviewing system conditions has been integrated into the remote management products. Agilent's remote management solutions continuously monitor the system component's state. A sophisticated software evaluates components' data, obtained from detailed checks, and performs an intelligent reasoning to evaluate the system's health. In the case of deteriorating system conditions being detected, the administrator will be notified with a forecast in order to prevent the system from failure. Proactive alerts are typically raised by email, paging, or SNMP traps. Furthermore if a failure occurs (e.g. system is hanging), the remote management system will compute the most likely unit that may have caused the problem, in order to assist the administrator in recovering the system. Therefore the remote management systems are additionally equipped with VGA and console redirection functionality including screen and keyboard. Because of being independent from the systems processor, remote management may also be performed whilst the operating system is down, hanging, or power-off.

Agilent's advanced remote management solutions support system management by using the Internet. All functionality of the management solutions may be accessed via an integrated Web server. Possible communication channels are the LAN interface, one of the serial interfaces, the PCMCIA, or the PCI interface. The command set which is used for communication between managing client browser and server is typically in XML format.

The key technology, that formed the basis for Agilent's remote management solutions, stems from Agilent's diagnostics products. A complete PCI Exerciser and Analyzer [2] from Agilent's verification tools has been integrated into the remote management solutions. This allows monitoring of the health and load of the PCI bus with the precision of a measurement device.

## 3. The Intelligent Platform Management Standard

All interfaces for data acquirement rely on the Intelligent Platform Management standard. The Intelligent Platform Management Interface (IPMI, [3]) has become a widely accepted standard for system management. It is an extensible and scalable interface, which provides interoperability for system components to be managed. IPMI defines the hardware connections as well as a message based communication protocol. All interconnects in an IPMI system are based on the $I^2C$ standard [4].

The intelligence behind the platform management is provided by a Baseboard Management Controller (BMC). It manages the interface between system management

software and the platform management hardware. Furthermore it performs recovery control and event logging. Events are stored in a non-volatile memory, called System Event Log (SEL). The events logged in the SEL build a database for intelligent deduction by the management software. Sensors are spread over the entire system in order to gather system conditions. All sensors are connected to the BMC via $I^2C$ buses. Each sensor is logically assigned to Field Replaceable Units (FRU), which are observed by this sensor.

## 4. IP-Based Design

During development of the remote management solutions Agilent concentrated on its core competencies. ASICs, integrating all functionality needed for remote management, have been designed as Systems on Chip (SoC). Many components like an ARM710 processor [5] and others have been integrated as IP blocks from other vendors. The designers concentrated on the design of the primary PCI interface with analyzer and exerciser functionality and the development of the software needed for intelligent remote management. Following this approach, Agilent has demonstrated its competence in rapid state of the art design of ASICs with multi-million transistor count.

## 5. Outlook

Future remote management solutions will be developed to be compatible with upcoming PCI-x [6] and InfiniBand [7] systems. As previously done, basic knowledge will be leveraged from PCI-x and InfiniBand verification systems.

## 6. References


[1] Agilent Technologies Remote Management Solutions for PCI-based Systems, Technical Specification, Agilent Technologies, 2000.

[2] E2928A 32/64 bit 33/66MHz PCI Exerciser & Analyzer, Technical Specification, Agilent Technologies, 2000.

[3] Intelligent Platform Mangement Interface Specification, Version 1.0, Intel Corp., Hewlett-Packard Company, NEC Corp., Dell Computer Corp., November 15, 1999.

[4] The $I^2C$-Bus Specification, Version 2.1, Philips Semiconductors, January 2000.

[5] ARM710T Datasheet, ARM Ltd., July 1998.

[6] PCI-x Addendum to the PCI Local Bus Specification, Revision 1.0, PCI Special Interest Group, September 22, 1999.

[7] InfiniBand Architecture Specification, Version 0.9, InfiniBand Trade Association, March 31, 2000.