BMC and BIOS communication

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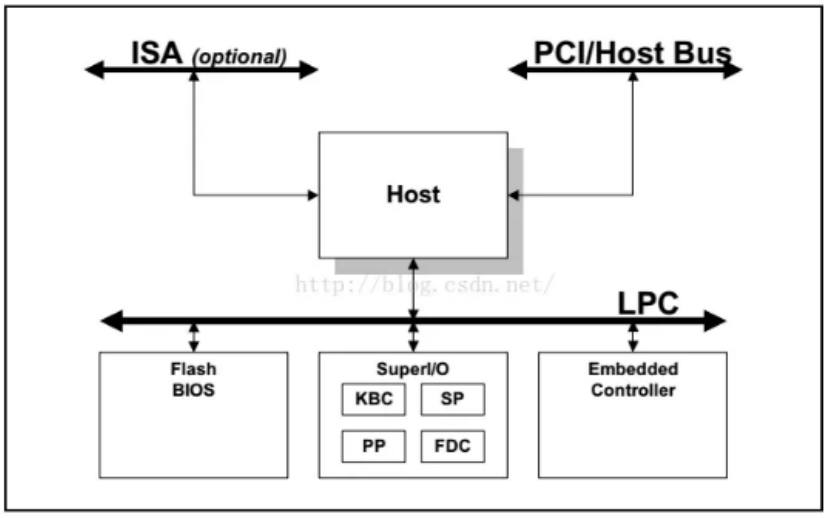
1. LPC

LPC (Low Pin Count) is a 33MHz 4-bit parallel bus protocol based on Intel standards, used to replace the previous ISA bus protocol. LPC changes the address/data separation decoding of ISA BUS to a decoding method similar to PCI's address/data signal line sharing, which greatly reduces the number of signal lines and simplifies the motherboard circuit involvement.

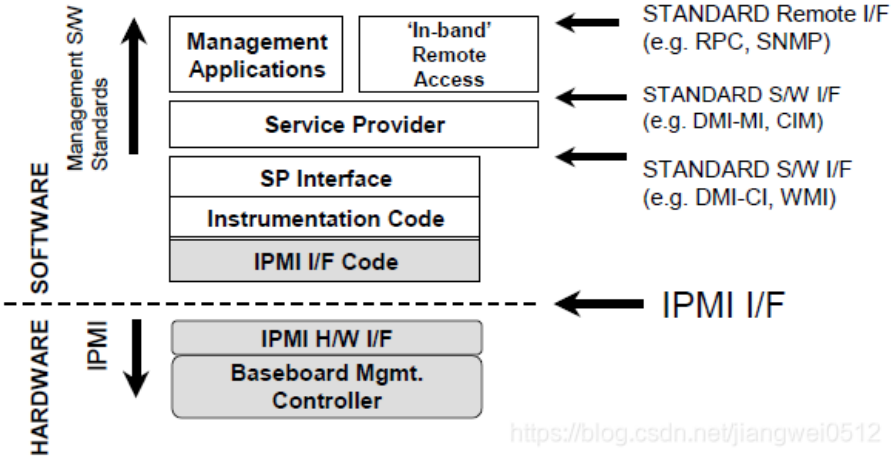


The communication between BMC and BIOS is mainly connected through the LPC bus. The LPC controller of AST2500 and the LPC controller of PCH are connected together. The LPC of the bridge is the master and the BMC is the slave. In this way, BIOS can access the registers of the device under the LPC of the BMC through the address of the LPC bus domain, so that communication can be achieved.

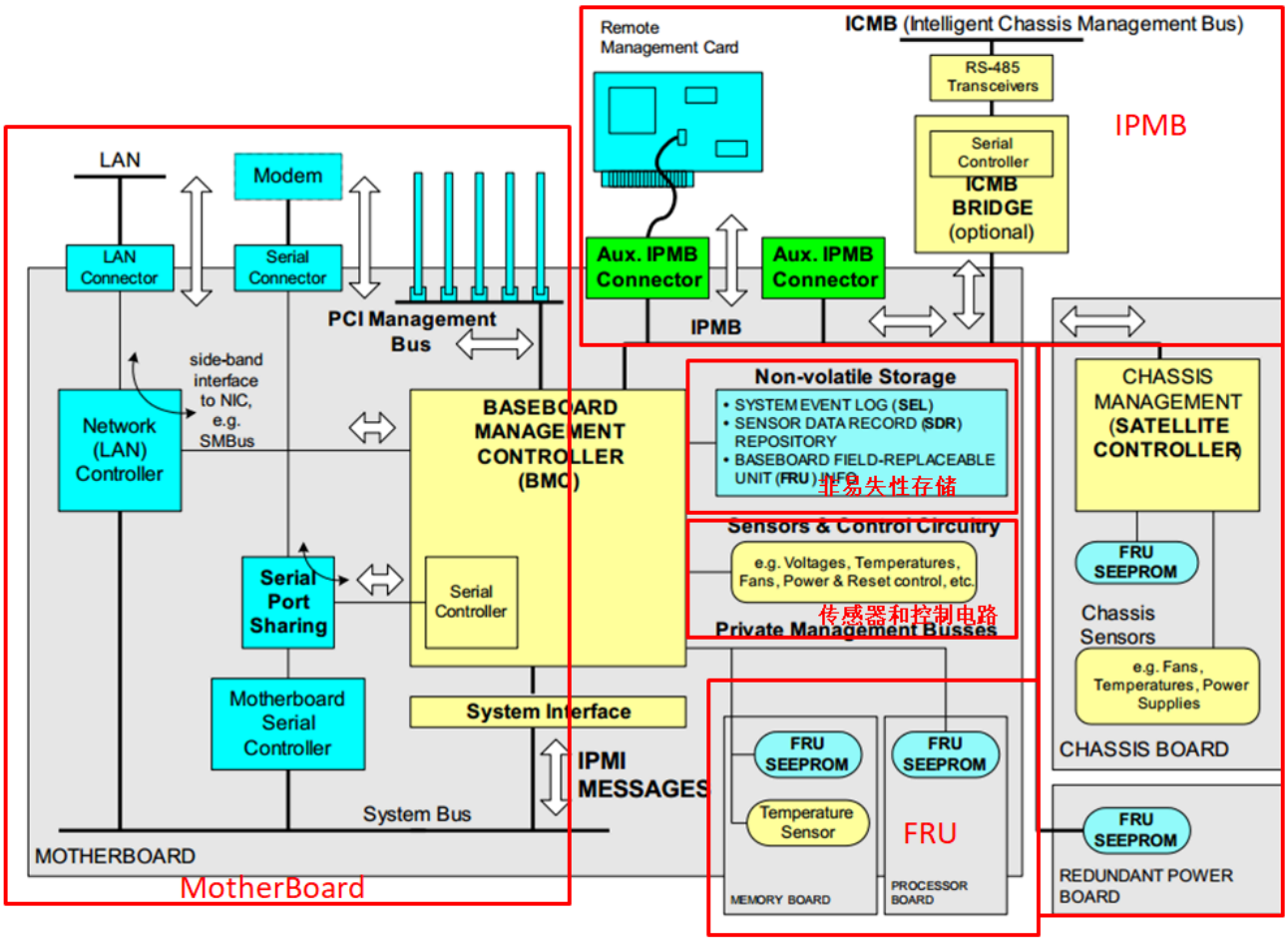
2. IPMI

Introduction to IPMI

Intelligent Platform Management Interface is a set of computer interface specifications for out-of-band management. IPMI runs on a separate piece of hardware connected to the motherboard or server, which is the baseboard management controller (BMC). BMC is a core part of IPMI and belongs to the IPMI hardware architecture. BMC manages the interface between the platform hardware and the system management software. BMC receives reports from sensors within the system and acts on those reports.



The various hardware modules related to IPMI are shown in the figure below:



MotherBoard: including CPU, PCH and other main components

IPMB: Intelligent Platform Management Bus, is an I2C-based serial bus used for communication between BMC and "satellite" controllers, on which IPMI commands are transmitted.

Non-volatile Storage: Non-volatile storage, Unix-like system running BMC

Sensors & Control Circuitry: Sensors and control circuits, obtaining information and controlling the environment

FRU: Field Replaceable Unit: Field replaceable units, such as memory, CPU and other replaceable hardware

IPMI Protocol

IPMI Messages

IPMI message transmission uses a request/response protocol, and IPMI request messages are usually called commands. The use of the request/response protocol facilitates the transmission of IPMI messages in different transports, which allows multiple master operations on the bus (such as IPMB), allows message interleaving, and allows multiple management controllers to communicate messages directly on the bus.

IPMI commands are functionally grouped using a field called the Network Function Code (Net-Fn), with command sets for sensors, events, chassis commands, and other commands.

The network function code combines commands into a function command set. The NetFn allocation table is:

值（十六进制）	名称	说明
00,01	机箱	用于普通的机箱功能命令字，如上/下电
02,03	桥接	用于桥接消息，当本设备作为桥接设备时才会用到
04,05	传感器/事件	用于传感器和事件消息
06,07	应用消息	用于应用消息，具体内容与执行的命令对象相关
08,09	固件	Firmware相关消息，比如在线升级
0A,0B	存储	用于访问非易失存储器的消息，比如EEPROM
0C,0D	传输	用于访问接口的消息，比如配置Serial或LAN接口的属性
2C,2D	组扩展	该命令字用于其它协议通信，其中数据位的第一字节标明协议的类型
2E,2F	OEM扩展	用于IANA命令，数据的前三个字节必须为IANA Enterprise Number
30-3F	生产厂家自定义	用于生产厂家自定义命令

System Interface

IPMI provides three standard interfaces to send IPMI messages to BMC. In order to support various microcontrollers, IPMI provides a series of system interfaces. The system interface is connected to the system bus that can be driven by the host processor. The current IPMI system interface can be I/O mapped or memory mapped. Any system bus that allows the host processor to access the specified I/O or memory location and meets the timing specifications can be used. PCI, LPC, or a proprietary bus other than the baseboard chipset. The IPMI system interface includes:

Keyboard Controller Style (KCS):

System Management Interface Chip (SMIC):

Block Transfer (BT):

SMBus System Interface (SSIF):

IPMI guides the communication between BMC and various interfaces through the "channel model", channel number allocation:

Channel Number	Type／Protocol	Description
0	primary IPMB	Channel 0 is used to communicate with the main IPMB. IPMI messages use the IPMB protocol.
1-Bh	Implementation-specific	Channels 1-7 are assigned to different types of communication media and IPMI message protocols (e.g. IPMB)
Ch-Dh	-	
Eh	Present I/F	Eh is used to identify the channel from which the message is received.

Fh	System Interface	Channel F is assigned to route messages to the i system interface

3. Communication between BIOS and BMC

BIOS mainly uses KCS and BT channels to communicate with BMC, and generally uses KCS channel. BMC cannot actively communicate with BIOS. BIOS will send IPMI commands to BMC. If BMC successfully receives the commands, it will return information to BIOS. BIOS is the active party, and BMC is the responding party.

KCS (Keyboard Controller Style) and BT (Block Transfer): KCS is usually the preferred communication method, and BT with block transfer is more efficient when transferring large amounts of data.

KCS interface - BMC request message format :

Figure 9-, KCS Interface/BMC Request Message Format

Byte 1	Byte 2	Byte 3:N
NetFn/LUN	Cmd	Data

KCS interface-response message format:

Figure 9-, KCS Interface/BMC Response Message Format

Byte 1	Byte 2	Byte 3	Byte 4:N
NetFn/LUN	Cmd	Completion Code	Data

BT request message format:

Figure 11-, BT Interface/BMC Request Message Format

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5:N
Length	NetFn/LUN	Seq	Cmd	Data

BMC response message format:

Figure 11-, BT Interface/BMC Response Message Format

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5:N	Byte 6:N
Length	NetFn/LUN	Seq	Cmd	Completion Code	Data