

BMC 使用及其配置方法分享

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BMC 介绍

- 1. 定义
 - BMC(Baseboard Manage Controller) 基板管理控制器。主要作用是用来管理主板上的各种硬件资源，如CPU, MEMORY, PCIe等。
- 2. 主要功能
 - 硬件监控：监测系统温度、电压、风扇速度、电源状态等关键参数。
 - 远程管理：允许管理员通过网络接口在任何时间、任何地点访问并管理设备，即使操作系统不运行或宕机也能进行操作，这种功能被称为带外管理（Out-of-Band Management）。
 - 故障报警：当检测到系统异常时，BMC能够发送警告通知给管理员。
 - 远程控制：支持远程开关机、重启、操作系统重装、固件更新等操作。
 - IPMI兼容：大部分BMC都支持 Intelligent Platform Management Interface (IPMI) 协议，这是一个开放标准，用于实现系统硬件健康状况的远程监控和管理。

BMC
(Baseboard Management Controller)

基板管理控制器

BMC 介绍

- 服务器从加电那一刻所有的部件都归BMC管理，BMC是一个独立的系统，它不依赖与系统上的任何其他硬件，也不依赖于BIOS和操作系统。服务器os系统和BMC可以各自单独重启互不影响。一般插拔电源时bmc会重启。
- 但BMC是可以和BIOS和OS来进行交互的，这都是为了起到一个更好的平台管理作用。
- 通过BMC，我们可以远程控制包括服务器的开机，关机和重装系统等待。
- BMC功能是服务器独立有的，个人PC一般不具备该功能。
- BMC和BIOS也是互补相关的，但是有些服务器可以通过bios来进行bmc的一些网络配置。

BMC 介绍

- BMC的架构

BMC 的结构分为芯片和固件

BMC 芯片，目前主要是台湾的Aspeed，目前为全球第一大服务器BMC芯片供应商。近2年开始有国产的芯片，如龙芯、飞腾、申威等。

。Aspeed（信骅技术）成立于2004年，是一家总部为位于台湾新竹的IC设计公司。Aspeed在2016年收购了Boardcom旗下的Emulex Pilot远程服务器管理芯片业务，目前为全球第一大服务器BMC芯片供应商。

The logo for ASPEED, featuring the word "ASPEED" in a bold, italicized, sans-serif font. The "A" is red, and the rest of the letters are blue.

BMC固件主要是采用ami公司的固件。



AMI（安迈）公司成立于1985年，总部位于美国，目前是世界上最大的BIOS固件供应商。AMI的MegaRAC系列BMC远程管理固件解决方案被广泛的应用于Aspeed系列BMC芯片中。

BMC 芯片与CPU和网络的连接

- 与CPU的连接

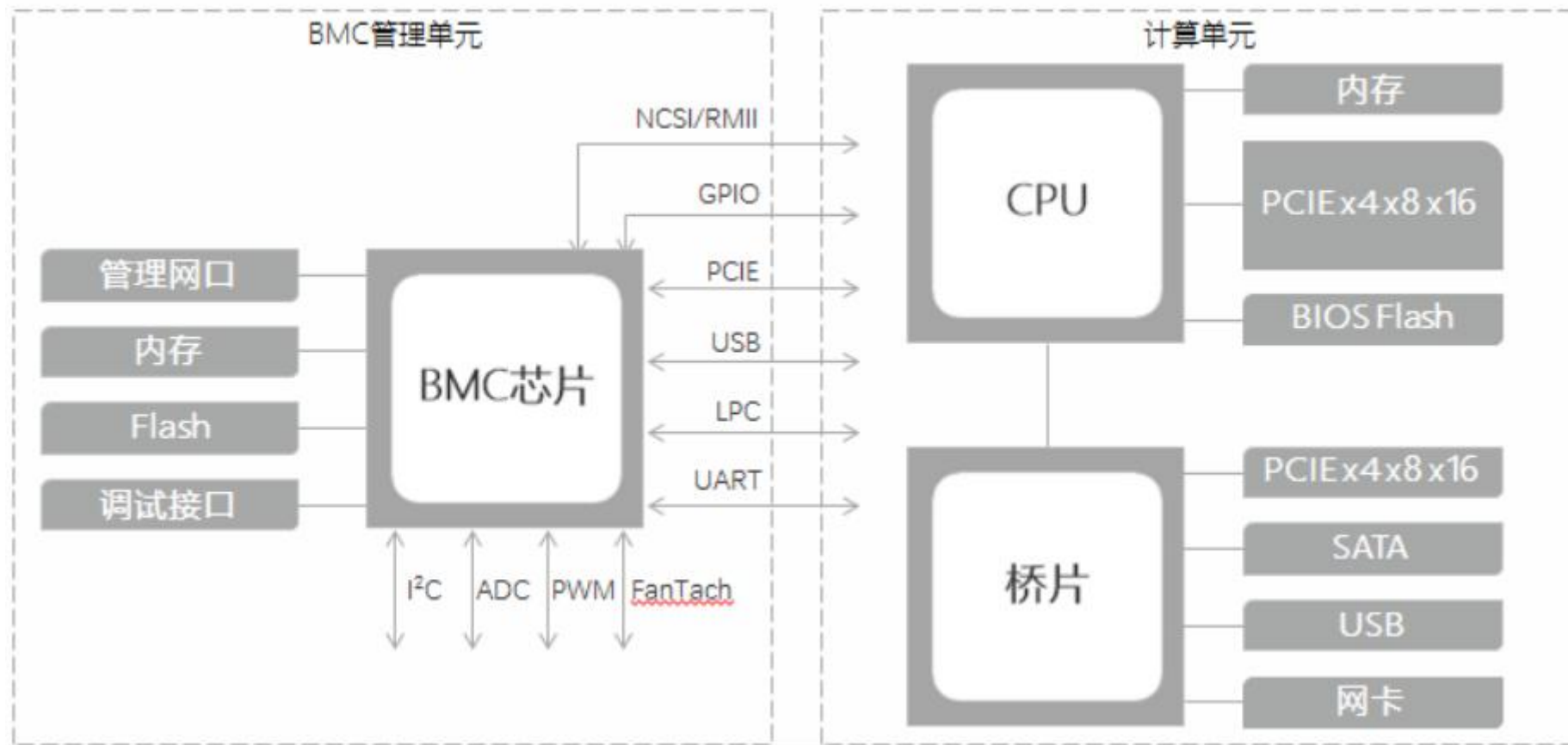
- I2C总线:

- 功能: BMC通常通过I2C (Inter-Integrated Circuit) 总线与CPU连接。这是一种低速的双向串行通信协议, 适合于传感器和其他小型设备。
 - 作用: BMC可以通过I2C读取CPU的状态信息 (如温度、负载) 和传递控制命令。

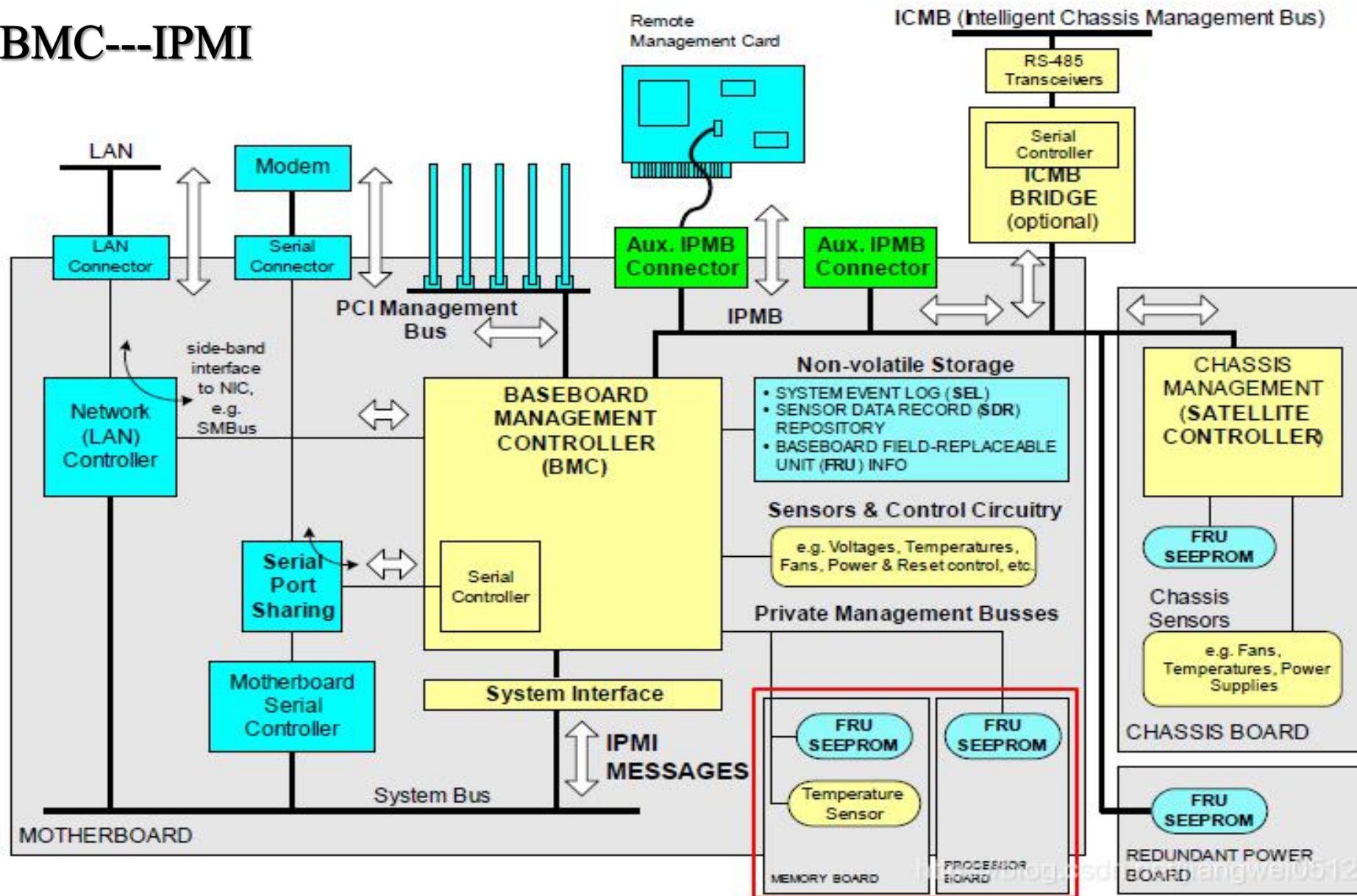
- 网络的连接

- 1. NC-SI (Network Controller Sideband Interface) NC-SI 是一种常见的标准, 用于在BMC和网卡之间进行通信。它是由DMTF (Distributed Management Task Force) 定义的, 用于通过网卡的侧带接口实现管理通信。
 - RMII (Reduced Media Independent Interface)
在某些系统中, BMC和网卡之间的通信可以通过RMII接口实现。RMII是一种用于网络设备之间通信的物理层接口。通过RMII, BMC可以访问网卡的数据链路层, 并利用此通道发送和接收数据包, 尤其是管理数据。
 - 共享网络端口 (Shared Network Port)
 - 专用管理端口 (Dedicated Management Port)
 - IPMI over LAN

BMC



BMC---IPMI



左图显示了IPMI系统中的各组成元素，IPMI系统的核心是一块BMC(Baseboard Management Controller)的控制板，BMC实现了IPMI协议中的大部分功能。而且BMC并不依赖服务器的CPU、BIOS或者操作系统来工作，是一个单独在系统内运行的无代理管理子系统。BMC能够提供自主监控、事件记录、日志提取，并作为网关在系统管理软件和IPMB(Intelligent Platform Management Bus)、ICMB(Intelligent Chassis Management Bus)之间提供服务。

BMC--- 常见使用

← → ↻ ▲ 不安全 | https://10.12.250.20/page/mainmenu.html

⏪ ☆ ⚙ □ 👤 重新启动

work linux-社区网站 oa_office Bug_Email linux_kernel 网络学习 Linux学习 编程学习 linux系统管理 linux_softwae 汇编 ai 个人 已导入 科技

The screenshot displays the Intel Integrated BMC Web Console interface. The main content area shows the 'Summary' page with the following information:

- System Information** (Left sidebar): System Information, System Components, CPU Information, DIMM Information, NIC Information, NVMe Information, Storage Information, Current Users.
- Summary** (Main content):
 - KCS Policy Control Mode is Provisioning. This setting is intended for BMC provisioning and is considered insecure.**
 - Summary**
 - Host Power Status : Host is currently ON
 - Advanced Management Key : Activated
 - Device (BMC) Available : Yes
 - BIOS ID : SE5C7411.86B.8118.D04.2206151341
 - BMC FW Rev : egs-1.40-0-g95ab74-c2bd0000
 - BMC Firmware Build Time : Dec 22 2022 01:37:59 UTC
 - Backup BMC FW Rev : egs-1.13-0-0000
 - CPLD FW Rev : DNP_v3p4
 - Mgmt Engine (ME) FW Rev : 06.00.03.162.0
 - Baseboard Serial Number : BQDP21300022
 - Overall System Health :
- Web Session Timeout** (Bottom): 30 Minutes

An 'About' popup window is open on the right side of the console, titled 'Integrated BMC Firmware'. It contains the following text:

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Open Source Software Licenses
This Software includes open source software components. A list of open source software components used by this Software, the associated licenses and copyright holders may be downloaded using a link provided on the product firmware update page on <https://downloadcenter.intel.com>

Open Source Software Archive
A BMC Open Source Archive containing all open source software source code used in the Software may be downloaded using a link provided on [https://downloadcenter.intel.com](#)

BMC

← → ↻ ⚠ 不安全 | https://10.12.250.60/#/overview/server

🔍 ☆ 🏠 👤 重新启动即可更新 ⋮

work linux-社区网站 oa_office Bug_Email linux_kernel 网络学习 Linux学习 编程学习 linux系统管理 linux_softwae 汇编 ai 个人 已导入 科技 »

CETC华诚金锐

当前用户: root 退出登录

切换语言



HCJR052109020206
BMC IP地址 10.12.250.60

服务器信息 >
Error

服务器电源 >
Running

上次数据更新于
{{ dataService.last_updated | localeDate | translate }}

刷新



服务器概览

HCJR052109020206

服务器信息

| | |
|---------------------|-------------------------------|
| 型号 | 制造商 |
| L10SW1000317 | HCJR |
| 序列号 | 固件版本 |
| HCJR052109020206 | KL4.36.32.S.054.211116.D.Test |
| HMCODE版本号 | SROM版本号 |
| 6fb29bd | 6.0.0.6 |
| CPLD版本 | |
| CPLD: 0210 | |
| Hardware: 0000.0200 | |

查看 7 高优先级日志

BMC时间
not available

启动 服务器LED 关闭

编辑网络配置 >

传感器读数



服务器健康



服务器控制



服务器配置



用户

BMC信息

BMC

System | Server Health

System Information

System Components

CPU Information

DIMM Information

NIC Information

NVMe Information

Storage Information

Current Users

System | Server Health

Sensor Readings

Event Log

System | Server Health | Configuration

Email Alert

IPv4 Network

IPv6 Network

VLAN

NTP Settings

Advanced System Management Key

SSL Certification

Users

Security Settings

Sensor Customization

BMC Firmware Update

BIOS/IFWI Firmware Update

CPLD Update

Syslog Server Configuration

Thermal Customization

System | Server Health | Configuration | Remote Control

Alert Em

SMTP s

Enable

SMTP S

SMTP S

Sender E

Select t

Temp

Fan F

PSU

Proce

Unco

Check

Alert De

System | Server Health | Configuration | Remote Control

KVM

Press the button to launch the KVM

Start

KVM

Server Power Control

Launch SOL

Virtual Front Panel

BMC

System Server Health Configuration Remote Control **Virtual Media**

Local Image
Launch the operation window of local image o

Local Image
Web ISO

Launch Window to Mount Local Image

System Server Health Configuration Remote Control Virtual Media **Server Diagnostics**

System Diagnostics
Log files should be sent to the system manufacturer for analysis.

System Diagnostics
POST Codes
System Defaults

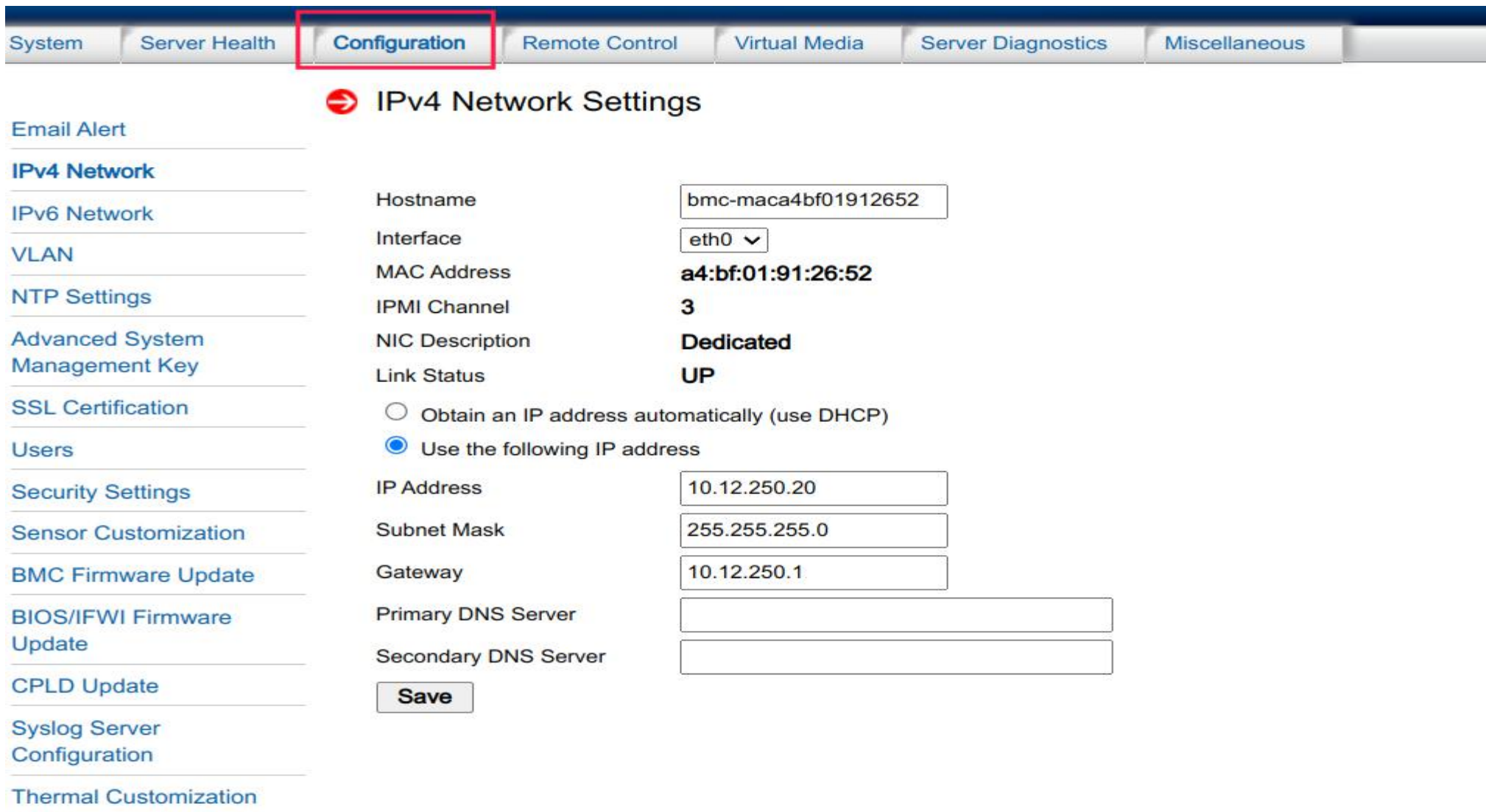
System Debug Log

System Server Health Configuration Remote Control Virtual Media Server Diagnostics **Miscellaneous**

List of Policies

NM Configuration
Power Statistics

BMC--- 常见的操作

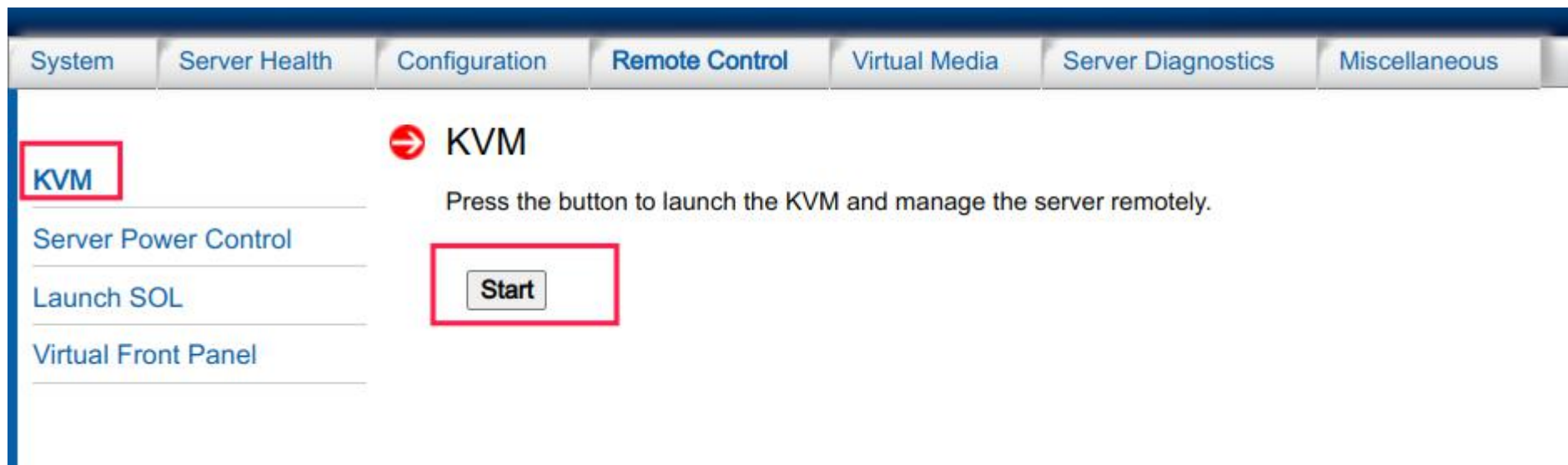


The screenshot shows the BMC Configuration page with the 'Configuration' tab selected. The 'IPv4 Network Settings' section is active, displaying various network parameters and their values. A 'Save' button is visible at the bottom of the settings area.

| Setting | Value |
|---|----------------------------------|
| Hostname | bmc-maca4bf01912652 |
| Interface | eth0 |
| MAC Address | a4:bf:01:91:26:52 |
| IPMI Channel | 3 |
| NIC Description | Dedicated |
| Link Status | UP |
| Obtain an IP address automatically (use DHCP) | <input type="radio"/> |
| Use the following IP address | <input checked="" type="radio"/> |
| IP Address | 10.12.250.20 |
| Subnet Mask | 255.255.255.0 |
| Gateway | 10.12.250.1 |
| Primary DNS Server | |
| Secondary DNS Server | |

Save

BMC--- 启动kvm显示



The screenshot shows the BMC Remote Control interface. The top navigation bar includes tabs for System, Server Health, Configuration, Remote Control, Virtual Media, Server Diagnostics, and Miscellaneous. The Remote Control tab is active. On the left sidebar, the KVM option is highlighted with a red box. The main content area shows a red arrow icon next to the text 'KVM'. Below this, there is a text instruction: 'Press the button to launch the KVM and manage the server remotely.' A 'Start' button is displayed below the text and is also highlighted with a red box. The sidebar contains the following menu items: KVM, Server Power Control, Launch SOL, and Virtual Front Panel.

System Server Health Configuration **Remote Control** Virtual Media Server Diagnostics Miscellaneous

KVM

Server Power Control

Launch SOL

Virtual Front Panel

→ KVM

Press the button to launch the KVM and manage the server remotely.

Start

BMC --- kvm 远程桌面处理

The screenshot displays the Intel Integrated BMC Web Console interface. At the top, the Intel logo and the text "Integrated BMC Web Console" are visible. Below this, a navigation bar includes tabs for "System", "Server Health", "Configuration", "Remote Control", "Virtual Media", "Server Diagnostics", and "Miscellaneous". On the right side of the navigation bar, there are links for "Logout", "Refresh", and a help icon.

The main content area shows a KVM remote desktop session. On the left side of the session, there is a sidebar menu with the following items: "KVM", "Server Power Control", "Launch SOL", and "Virtual Front Panel". The desktop environment itself has a dark blue background with a green aurora-like pattern. Several icons are visible on the desktop:

- A computer icon labeled "计算机" (Computer).
- A trash can icon labeled "回收站" (Recycle Bin).
- A home folder icon labeled "主目录" (Home Directory).
- A PDF file icon labeled "统信UOS操...9:32.pdf" (UOS Operation...9:32.pdf).
- Another PDF file icon labeled "统信UOS操" (UOS Operation).

BMC --- 串口log及登陆

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当前



上海华诚金锐信息技术有限公司

HCJR052109020206

BMC IP地址 10.12.250.60

服务器信息 >

⊗ Error

服务器电源 >

✔ Running

上次数据更新于

{{ dataService.last_updated | localeD:



服务器概览



服务器健康



服务器控制



服务器配置



用户

```
XhcClearBiosOwnership: called to clear BIOS ownership
XhcClearBiosOwnership: called to clear BIOS ownership
PINTC: "sw64,irq-num" fallback to 8
PINTC: "sw64,ver" fallback to 1
pci 0000:00:00.0: ignoring class 0x060000 (doesn't match header type 01)
pci 0001:0a:00.0: ignoring class 0x060000 (doesn't match header type 01)
pci 0002:0c:00.0: ignoring class 0x060000 (doesn't match header type 01)
pci 0003:0e:00.0: ignoring class 0x060000 (doesn't match header type 01)
pci 0004:10:00.0: ignoring class 0x060000 (doesn't match header type 01)
pci 0005:12:00.0: ignoring class 0x060000 (doesn't match header type 01)
pci 0006:14:00.0: ignoring class 0x060000 (doesn't match header type 01)
pci 0007:16:00.0: ignoring class 0x060000 (doesn't match header type 01)
pci 0008:18:00.0: ignoring class 0x060000 (doesn't match header type 01)
pci 0009:1a:00.0: ignoring class 0x060000 (doesn't match header type 01)
pci 000a:1c:00.0: ignoring class 0x060000 (doesn't match header type 01)
pci 000b:1e:00.0: ignoring class 0x060000 (doesn't match header type 01)
ipmi_si dmi-ipmi-si.0: IRQ index 0 not found
Jan  1 08:00:11 swhost-193 kernel: [ 11.880000] ipmi_si dmi-ipmi-si.0: IRQ index 0 not found

UOS Server 20 1070e swhost-193 ttyS0
swhost-193 login: root
密码:
警告: 您的密码将在 3 天后过期。
上次登录: Thu Oct 24 16:56:11 from 10.255.10.59
Welcome to UOS Server 20
```

cmdline: 添加启动参数 console=ttyS0,115200

BMC --- 电源操作

HCJR052109020206

BMC IP地址 10.12.250.60

服务器信息 >

 Error

服务器电源 >

 Running

上次数据更新于

{{ dataService.last_u

服务器电源操作

当前状态

上一次进行电源操作 Aug 24, 2024 3:

HCJR052109020206 - 10.12.250.60

 R

选择一项电源操作

 热重启

不断电情况下进行系统复位操作

 有序关机

有序 - 操作系统关闭, 然后服务器关闭

 立即关机

立即 - 服务器在没有关闭操作系统的情况下关闭; 可能会导致数据损坏

BMC---系统日志

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当前用户



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HCJR052109020206

BMC IP地址 10.12.250.60

服务器信息 >

⊗ Error

服务器电源 >

✔ Running

上次数据更新于

{{ dataService.last_updated | localeDate



服务器概览



服务器健康



服务器控制



服务器配置



用户

过滤日志

🔍 × [过滤日志](#)

按严重程度过滤

[所有](#) [高](#) [中](#) [低](#)

按日期范围过滤 (MM/DD/YYYY)

年/月/日 📅 - 年/月/日 📅

按日志状态过滤

所有日志 ▼

2100 条日志被选择

🗑️ 删除

📄 导出

| | | | | | | | |
|-------------------------------------|-------|-----|---|-----------|------------|--|---|
| <input checked="" type="checkbox"/> | #2418 | 已解决 | 高 | EMERGENCY | CPU0_power | {{ event.Timestamp localeDate : (tmz == 'UTC') translate}} | ▼ |
|-------------------------------------|-------|-----|---|-----------|------------|--|---|

| | | | | | | | |
|-------------------------------------|-------|-----|---|----------|------------|--|---|
| <input checked="" type="checkbox"/> | #2417 | 已解决 | 高 | CRITICAL | CPU0_power | {{ event.Timestamp localeDate : (tmz == 'UTC') translate}} | ▼ |
|-------------------------------------|-------|-----|---|----------|------------|--|---|

BMC IP 配置

- 方法一

BIOS界面配置

昆仑固件设置工具 - 版本4.00.0024

| 主页 | 高级 | 安全维护 | 启动 | 服务器管理 | 保存 & 退出 |
|-------------------|----|-----------------------------|----|-------------------|---------|
| BMC自测状态 | | 已通过 | | 启用 / 关闭与BMC通信的接口. | |
| BMC 设备 ID | | 28 | | | |
| BMC 设备版本 | | 2 | | | |
| BMC 固件版本 | | KL1.33.32.245.g700e15200.21 | | | |
| IPMI 版本 | | 1116 | | | |
| | | 2.0 | | | |
| BMC 支持 | | [启用] | | | |
| 等待 BMC | | [0] | | | |
| ▶ BMC 自测日志 | | | | | |
| ▶ BMC 网络配置 | | | | | |
| ▶ BMC 用户设置 | | | | | |

++ : 选择屏幕
↑↓ : 选择选项
F1 : 一般帮助
F10 : 保存 & 退出
+/- : 改变数值
ESC : 退出
Enter: 选择

昆仑固件设置工具 - 版本4.00.0024

服务器管理

--BMC 网络配置--

配置 IPV4 支持

专用网络管理信道

| | |
|----------------|---------------------|
| 配置地址源 | [设置静态IP] |
| 站 IP 地址 | 10.12.250.60 |
| 子网掩码 | 255.255.255.0 |
| 站 MAC 地址 | A8-3F-A1-A0-13-C9 |
| 路由 IP 地址 | 10.12.250.1 |

输入站 IP 地址.

++ : 选择屏幕
↑↓ : 选择选项
F1 : 一般帮助
F10 : 保存 & 退出
+/- : 改变数值
ESC : 退出
Enter: 选择

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BMC IP 配置

- 方法二:
- BMC界面配置IP
 - 将笔记本电脑网口和服务器BMC网口用网线直连。
 - 用tcpdump抓去协商时候的包，可以看出现有的bmc网口的默认ip(注意先打卡tcpdump，然后插网线)
 - 采用默认ip登陆bmc管理页面(注意是https的协议)

The screenshot displays the BMC configuration page for server HCJR052109020206. The browser address bar shows the URL: `https://10.12.250.60/?ip-address=false#/configuration/network`. The page header includes the CETC logo and the server ID. The main content area is divided into two sections: '常用设置' (Common Settings) and 'IPV4设置' (IPV4 Settings). In the '常用设置' section, the '主机名' (Host Name) is HCJR052109020206, the '网络接口' (Network Interface) is eth1, the 'MAC地址' (MAC Address) is a8:3f:a1:a0:13:c9, and the '默认网关' (Default Gateway) is 10.12.250.1. In the 'IPV4设置' section, the '分配静态IP地址' (Assign static IP address) option is selected. The 'IPV4地址' (IPV4 Address) is 10.12.250.60 and the '网络掩码前缀长度' (Network mask prefix length) is 24. The sidebar on the left contains navigation icons for '服务器概览', '服务器健康', '服务器控制', '服务器配置', and '用户'.

BMC IP 配置

- 方法三---ipmitool工具配置

先用ipmitool 查看本机对应的bmc地址。

```
[root@swhost-193 ~]# ipmitool lan print
Set in Progress          : Set Complete
Auth Type Support       : MD5
Auth Type Enable        : Callback : MD5
                          : User      : MD5
                          : Operator : MD5
                          : Admin    : MD5
                          : OEM      : MD5
IP Address Source       : Static Address
IP Address               : 10.12.250.60
Subnet Mask              : 255.255.255.0
MAC Address              : a8:3f:a1:a0:13:c9
Default Gateway IP      : 10.12.250.1
802.1q VLAN ID         : Disabled
RMCP+ Cipher Suites     : 3,17
Cipher Suite Priv Max   : Not Available
Bad Password Threshold  : Not Available
```

BMC IP 配置

- 方法三---IPMI 设置BMC网络IP
 - 查看BMC网络信息（通常配置通道1, 第一个网卡）：`ipmitool lan print 1`
 - 设置BMC使用IP地址：`ipmitool lan set 1 ipaddr 172.16.21.98`
 - 设置BMC使用子网掩码：`ipmitool lan set 1 netmask 255.255.255.0`
 - 设置BMC使用网关：`ipmitool lan set 1 defgw ipaddr 172.16.21.205`

BMC常见问题

- BMC 密码忘记

BMC密码忘记，可以用指令进行重置。

//bmc 密码修改

a) 先列出bmc的用户名

```
[root@localhost ~]# ipmitool user list 1
```

| ID | Name | Callin | Link | Auth | IPMI Msg | Channel Priv | Limit |
|----|-------|--------|------|------|---------------|--------------|-------|
| 1 | | true | true | true | NO ACCESS | | |
| 2 | uos | true | true | true | ADMINISTRATOR | | |
| 3 | fwupd | true | true | true | NO ACCESS | | |
| 4 | | true | true | true | NO ACCESS | | |
| 5 | | true | true | true | NO ACCESS | | |
| 6 | | true | true | true | NO ACCESS | | |
| 7 | | true | true | true | NO ACCESS | | |
| 8 | | true | true | true | NO ACCESS | | |
| 9 | | true | true | true | NO ACCESS | | |

b) 密码修改

```
ipmitool user set password <user_id> <new_password>
```

```
[root@localhost ~]# ipmitool user set password 2 .kernel1
```

```
Set User Password command successful (user 2)
```

其中，是要重置密码的用户ID，通常是"2"（Super Administrator）或"3"（Operator）。是新的BMC密码，根据要求可以设置为任意强度的密码。在命令执行完成后，等待一段时间，直到BMC密码重置成功。//重新刷新下登陆页面。

BMC常见问题

- BMC 设备硬件是不是正常启动了
 - `ls /sys/devices/platform`

```
[root@serverhost99 ~]# ls /sys/devices/platform
dmi-ipmi-si.0      efivars.0          GHES.3  HYG00030:00  kgdboc   pcspkr   power   serial8250
efi-framebuffer.0 'Fixed MDIO bus.0' GHES.4  ipmi bmc.0   microcode PNP0C0C:00 rtc-efi.0 uevent
[root@serverhost99 ~]#
```

- 或者看dmesg中查询BMC，有相关的提示，就表示有。
- BMC 串口sol怎么使用
 - bios中要使能
 - 在cmdline中添加 `console=ttyS0,115200`

IPMI驱动

- 内核中IPMI驱动是分层实现的，最底层分别实现了基于Smbus、LPC的自动检测、事物处理、结果读取和清除的操作，并用这些函数初始化了抽象的system interface的对应的函数，从而屏蔽了底层硬件接口的区别。更上层的设备抽象和协议实现都是直接和抽象的system interface直接交互的。

```
meihp@meihaipeng:~/work/project/4-19e/kernel/drivers/char/ipmi$ ls
bt-bmc.c      ipmi_kcs_sm.c  ipmi_si_hardcode.c  ipmi_si_pci.c      ipmi_ssif.c      kcs_bmc.h
ipmi_bt_sm.c ipmi_msghandler.c ipmi_si_hotmod.c    ipmi_si_platform.c ipmi_watchdog.c  kcs_bmc_npcm7xx.c
ipmi_devintf.c ipmi_povernv.c ipmi_si_intf.c      ipmi_si_port_io.c  Kconfig          Makefile
ipmi_dmi.c    ipmi_poweroff.c ipmi_si_mem_io.c    ipmi_si_sm.h       kcs_bmc_aspeed.c
ipmi_dmi.h    ipmi_si.h      ipmi_si_parisc.c    ipmi_smic_sm.c     kcs_bmc.c
```

IPMI驱动

```
Makefile .../ipmi x ipmi_si.h ipmi_si_hardcode.c ipmi_si_pci.c ipmi_si_platform.c ipmi_si_i <C
drivers > char > ipmi > Makefile
6 ipmi_si-y := ipmi_si_intf.o ipmi_kcs_sm.o ipmi_smic_sm.o ipmi_bt_sm.o \
7   ipmi_si_hotmod.o ipmi_si_hardcode.o ipmi_si_platform.o \
8   ipmi_si_port_io.o ipmi_si_mem_io.o
9 ifdef CONFIG_PCI
10 ipmi_si-y += ipmi_si_pci.o
11 endif
12 ifdef CONFIG_PARISC
13 ipmi_si-y += ipmi_si_parisc.o
14 endif
15
16 obj-$(CONFIG_IPMI_HANDLER) += ipmi_msghandler.o
17 obj-$(CONFIG_IPMI_DEVICE_INTERFACE) += ipmi_devintf.o
18 obj-$(CONFIG_IPMI_SI) += ipmi_si.o
19 obj-$(CONFIG_IPMI_DMI_DECODE) += ipmi_dmi.o
20 obj-$(CONFIG_IPMI_SSIF) += ipmi_ssif.o
21 obj-$(CONFIG_IPMI_POWERNV) += ipmi_powernv.o
22 obj-$(CONFIG_IPMI_WATCHDOG) += ipmi_watchdog.o
23 obj-$(CONFIG_IPMI_POWEROFF) += ipmi_poweroff.o
24 obj-$(CONFIG_IPMI_KCS_BMC) += kcs_bmc.o
25 obj-$(CONFIG_ASPEED_BT_IPMI_BMC) += bt-bmc.o
26 obj-$(CONFIG_ASPEED_KCS_IPMI_BMC) += kcs_bmc_aspeed.o
27 obj-$(CONFIG_NPCM7XX_KCS_IPMI_BMC) += kcs_bmc_npcm7xx.o
~
```

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```
[root@localhost ~]# lsmod | grep ipmi
ipmi_si                262144  0
ipmi_ssif              262144  0
ipmi_devintf          262144  0
ipmi_msghandler       262144  3 ipmi_devintf,ipmi_si,ipmi_ssif
```

IPMI驱动

`ipmi_msghandler` - This is the central piece of software for the IPMI system. It handles all messages, message timing, and responses. The IPMI users tie into this, and the IPMI physical interfaces (called System Management Interfaces, or SMIs) also tie in here. This provides the kernelland interface for IPMI, but does not provide an interface for use by application processes. --- `ipmi_msghandler.ko`: 内核用它来实现IPMI协议规范，实现各种消息的处理和回调；

`ipmi_devintf` - This provides a userland IOCTL interface for the IPMI driver, each open file for this device ties in to the message handler as an IPMI user. --- 实现设备节点 `/dev/ipmi0` ；

`ipmi_si` - A driver for various system interfaces. This supports KCS, SMIC, and BT interfaces. Unless you have an SMBus interface or your own custom interface, you probably need to use this. ---屏蔽了不同系统接口的驱动，支持 KCS/SMIC/BT，除非host 和BMC之间使用Smbus或者其他定制化的接口，否则都需要这一标准驱动；定义了 probe BMC的三种方法：ACPI/SMBIOS (DMI) /PCI (class type)；

`ipmi_ssif` - A driver for accessing BMCs on the SMBus. It uses the I2C kernel driver's SMBus interfaces to send and receive IPMI messages over the SMBus. ---在更早的内核版本里对应的名字就是 `ipmi_smbus.ko`，支持通过Smbus 接口发送、接受信息，实现对 IPMI management controller基于Smbus直接访问的接口驱动；