



Introduction to Intelligent Platform Management Interface (IPMI)

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What is IPMI

- Started in 1998, IPMI is now at revision 2.0
- Is a standard accepted by DELL, IBM, SUN, INTEL and many others
- Goal 1: IPMI is a spec for monitoring and controlling the machine via special hardware, the Baseboard Management Controller, BMC
- Goal 2: Serial Over Lan (SOL). This is a method to redirect serial connections over an ethernet cable.

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The BMC

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Overview of IPMI

Major IPMI concepts:

- Sensors (example: Fans speed, CPU Temperature, voltage)
- Events (example: What the BMC should do when the CPU temperature reach 100 degrees? SNMP Traps)
- SDR (Sensor data repository, where the data are collected)
- SEL (System Event Log, a log of all critical situation)
- Session (Between the client and the BMC)

Security

- We can define *users*
- We can define *privileges*

The security depends on the version of the specification.

- Version 2.0: RMCP/RMCP+: based on RAKP messages (HMAC like protocol)
- Serial-Over-Lan is encrypted with RMCP+ only

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In Band, Out Of Band

IPMI defines two ways to access to the BMC:

- *In Band*: from the operating system running on the host computer
- *Out of Band*: from outside of the server through a network connection, serial connection, modem connection, without the host operating system loaded

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SOL: Serial-Over-Lan

With IPMI we are able to emulate the serial connection with the lan interface of the BMC.

- ⇒ No more serial cables
- ⇒ No more root password sent as clear text over the network
- ⇒ Only with RMCP+!

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Open Source client implementations

- **ipmitool (1.8.8)**
- ipmiutil (1.7.2)
- freeipmi (0.2.1) implements their in-band IPMI driver in userspace using iopl(2). No kernel modules!

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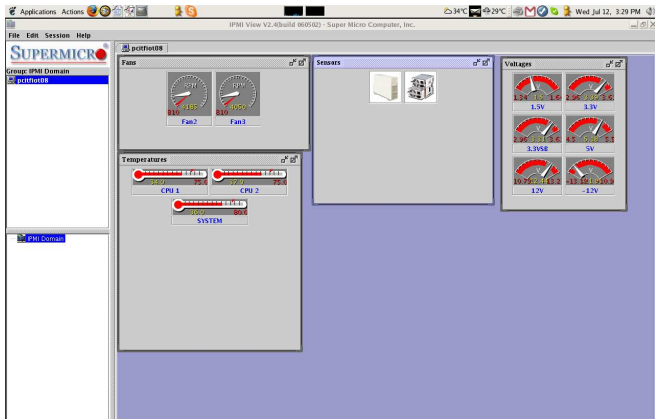
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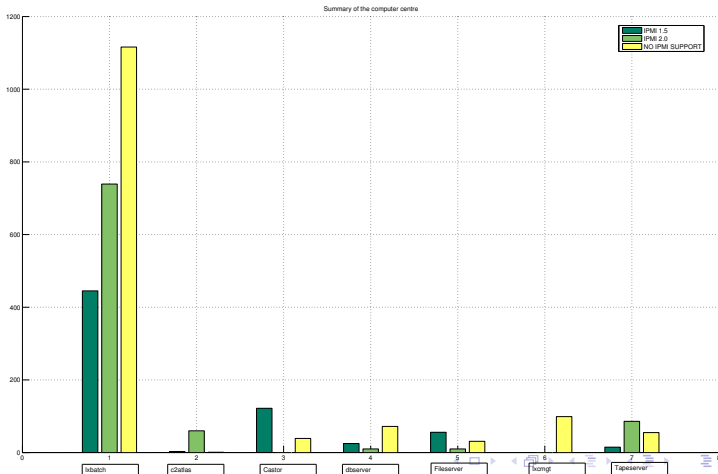
Closed Source client Implementations

- All vendors have a proprietary solutions for accessing the BMC





Overview on the 7 biggest clusters





And in numbers

Cluster Name	IPMI 1.5	IPMI 2.0	No IPMI Support	Total PCs
lxbatch	445	739	1116	2300
castor	122	0	39	161
tapeserver	15	86	55	156
dbserver	25	10	72	107
lxcgmt	0	0	99	99
fileserver	56	10	31	97
c2atlas	3	60	1	64

We Need IPMI 2.0 (Tested the SuperMicro BMC) for using SOL and RMCP+!.

In the following examples, `pcitadc05` is the client, and `pcitfiot08` is the *host* that supports IPMI via BMC.

BMC Info

From pcitadc05:

```
sh> ipmitool -I lan -H pcitfiot08 \  
      -U ADMIN -P 0czjTf bmc info
```

```
Device ID                : 32  
Device Revision          : 0  
Firmware Revision       : 2.3  
IPMI Version            : 2.0  
Manufacturer ID         : 5593  
Manufacturer Name       : Unknown (0x15d9)  
Product ID              : 4404 (0x1134)  
Device Available        : yes  
Provides Device SDRs   : no
```



Hardware sensors monitoring

From pcitadc05:

```
ipmitool -I lan -H pcitfiot08 \  
-U ADMIN -P 0czjTf sensor get "CPU 1"
```

Locating sensor record...

```
Sensor ID           : CPU 1 (0x0)  
Entity ID          : 7.1  
Sensor Type (Analog) : Temperature  
Sensor Reading     : 35 (+/- 0) degrees C  
Status             : ok  
Lower Non-Recoverable : na  
Lower Critical      : na  
Lower Non-Critical  : na  
Upper Non-Critical  : 76.000
```

Power cycle

No more need to leave the office for rebooting the machine!

Power cycle

```
sh> ipmitool -I lan -H pcitfiot09 \  
-U ADMIN -P 0czjTf power status  
Chassis Power is on  
sh> ipmitool -I lan -H pcitfiot09 \  
-U ADMIN -P 0czjTf power off  
Chassis Power Control: Down/Off  
sh> ipmitool -I lan -H pcitfiot09 \  
-U ADMIN -P 0czjTf power status  
Chassis Power is off  
sh> ipmitool -I lan -H pcitfiot09 \  
-U ADMIN -P 0czjTf power on  
Chassis Power Control: Up/On
```

Serial Over Lan

- At this moment Serial Over Lan is possible only with ipmicli-sm, a command-line interface patched for us by SuperMicro.
- The opensource tool we're using (ipmitool 1.8.8) has a bug, will be fixed in 1.8.9.

SOL Example

```
pcitadc05> ./ipmicli-sm 137.138.253.96
User Name: ADMIN
Password: *****
connect ok
ipmi>console
```

```
Scientific Linux CERN SLC release 4.3 (Beryllium)
```

```
pcitfiot08.cern.ch login:
```

Conclusions

IPMI is a powerful tool for monitoring and controlling a machine remotely, with a standard tool, ipmitool.

You can get all of my tests in my notes,

- <http://cern.ch/mascanc>