Introduction to Intelligent Platform Management Interface (IPMI)

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14th July 2006
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)
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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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With IPMI we are able to emulate the serial connection with the lan interface of the BMC.
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⇒ No more root password sent as clear text over the network
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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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Closed Source client Implementations

- All vendors have a proprietary solutions for accessing the BMC
Overview on the 7 biggest clusters
And in numbers

<table>
<thead>
<tr>
<th>Cluster Name</th>
<th>IPMI 1.5</th>
<th>IPMI 2.0</th>
<th>No IPMI Support</th>
<th>Total PCs</th>
</tr>
</thead>
<tbody>
<tr>
<td>lxbatch</td>
<td>445</td>
<td>739</td>
<td>1116</td>
<td>2300</td>
</tr>
<tr>
<td>castor</td>
<td>122</td>
<td>0</td>
<td>39</td>
<td>161</td>
</tr>
<tr>
<td>tapeserver</td>
<td>15</td>
<td>86</td>
<td>55</td>
<td>156</td>
</tr>
<tr>
<td>dbserver</td>
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<td>10</td>
<td>72</td>
<td>107</td>
</tr>
<tr>
<td>lxcgmt</td>
<td>0</td>
<td>0</td>
<td>99</td>
<td>99</td>
</tr>
<tr>
<td>fileserver</td>
<td>56</td>
<td>10</td>
<td>31</td>
<td>97</td>
</tr>
<tr>
<td>c2atlas</td>
<td>3</td>
<td>60</td>
<td>1</td>
<td>64</td>
</tr>
</tbody>
</table>

We Need IPMI 2.0 (Tested the SuperMicro BMC) for using SOL and RMCP+.!
In the following examples, pcitad05 is the client, and pcitfiot08 is the *host* that supports IPMI via BMC.
BMC Info

From pcitadc05:

```sh
sh> ipmitool -I lan -H pcitfiot08 \
    -U ADMIN -P OczjTf 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

Additional Device Support:
- Sensor Device
- SDR Repository Device
- SEL Device
- FRU Inventory Device
- IPMB Event Receiver
- IPMB Event Generator
- Bridge
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
Upper Critical : 78.000
Upper Non-Recoverable : 80.000
```

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Introduction to Intelligent Platform Management Interface (IPMI)
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