Hardware Events Alerting on Dell Servers IPMI PET Applied

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Who Am I?

- System Administrator
  zongheng.com, 20+ million visits per day
  173.com, new project
- Casual C/Perl Programmer

NO WARRANTY

Although I struggled to verify and to clarify,
I might miss something,
You might get it wrong.

Misery Stories

- high temporature
- 2010-09-09 Cable error [1]
- 2011-08-19 mss2 Uncorrectable ECC
- 2011-08-25 gw67 Fan redundance lost
- 2011-10-18 squid13 Battery failed [2]
- 2011-10-27 f2 HDD1 fault [3]

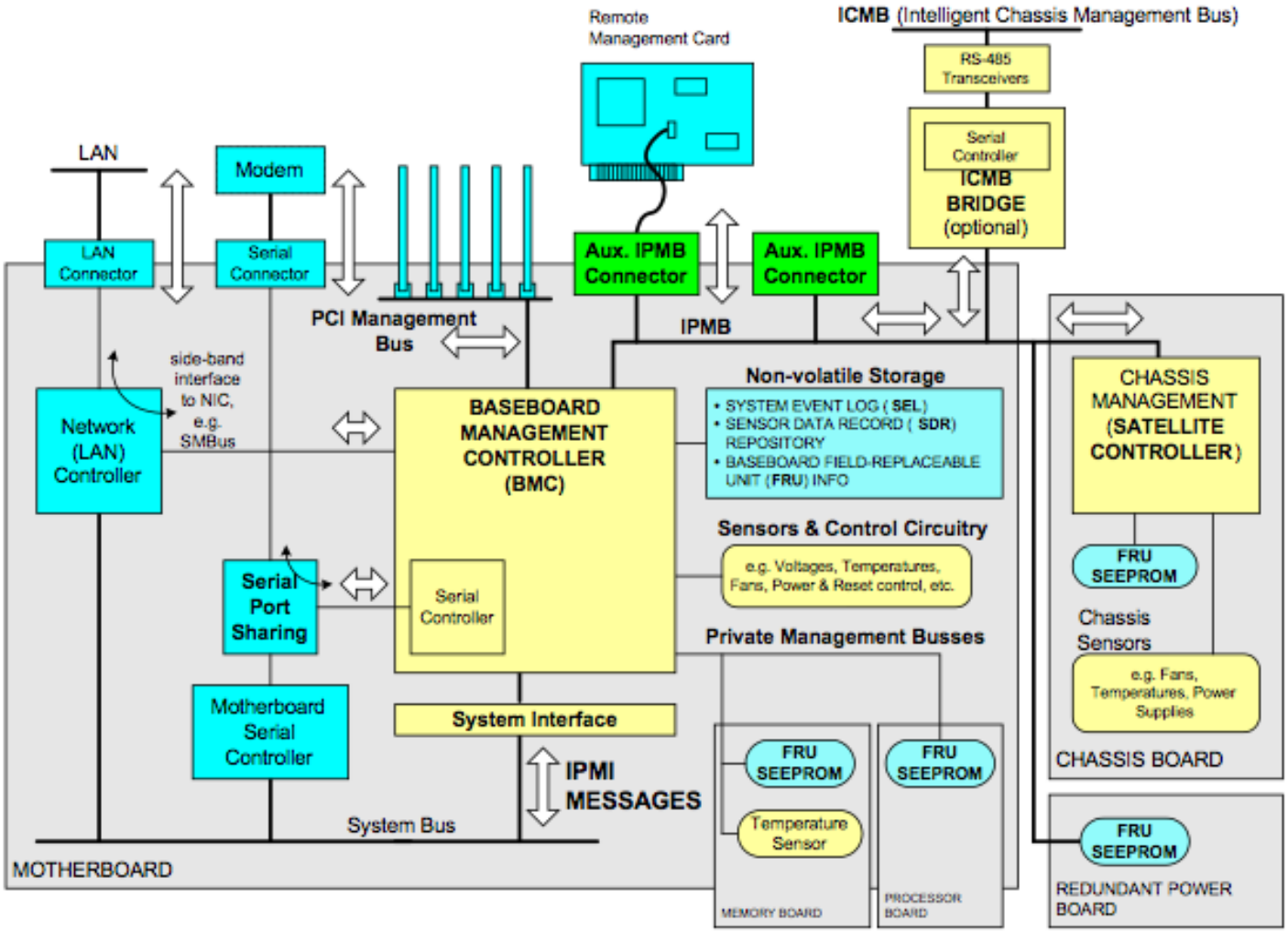
[1] Not sure, apparently VD degraded.
[2] noisy
[3] Maybe PERC 6/i 6.0.2 firmware bug.

The GOAL - Real Time Alerting

insert overview picture

Hardware Events 101 - IPMI Block Diagram [4]

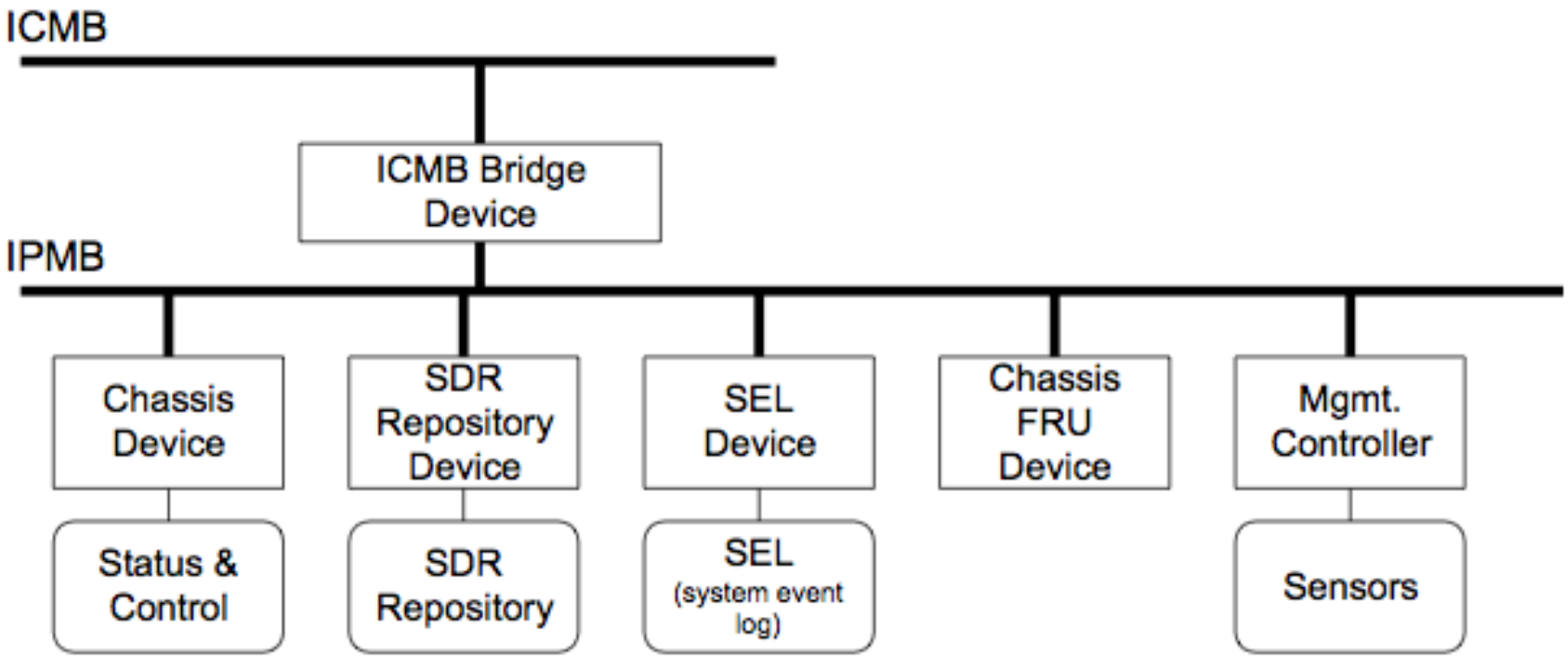
Figure 1-2, IPMI Block Diagram



[4] Figure 1-2 IPMI BLock Diagram, IPMIv2r1

Hardware Events 101 - Logical Devices [5]

Figure 2-2, ICMB Logical Devices

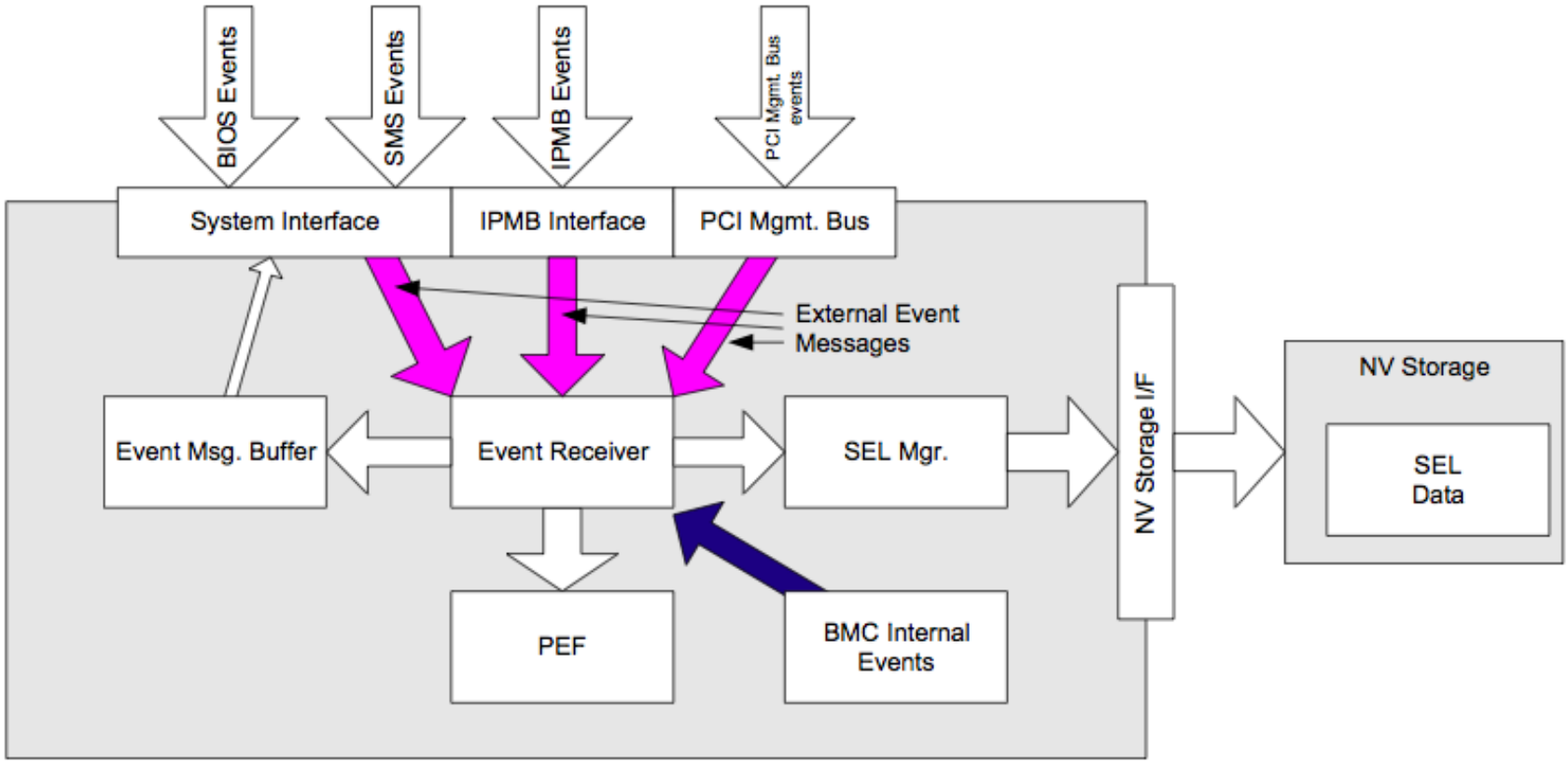


[5] Figure 2-2 ICMB Logical Devices, ICMBv1r13

Hardware Events 101 - Event Message Reception [6]

The Event Message generator (the device generating an Event Message) notifies the system of the event by sending an Event Request Message to the Event Receiver Device.

Table 16-1, Event Message Reception



[6] Table 16-1 Event Message Reception, IPMIv2r1

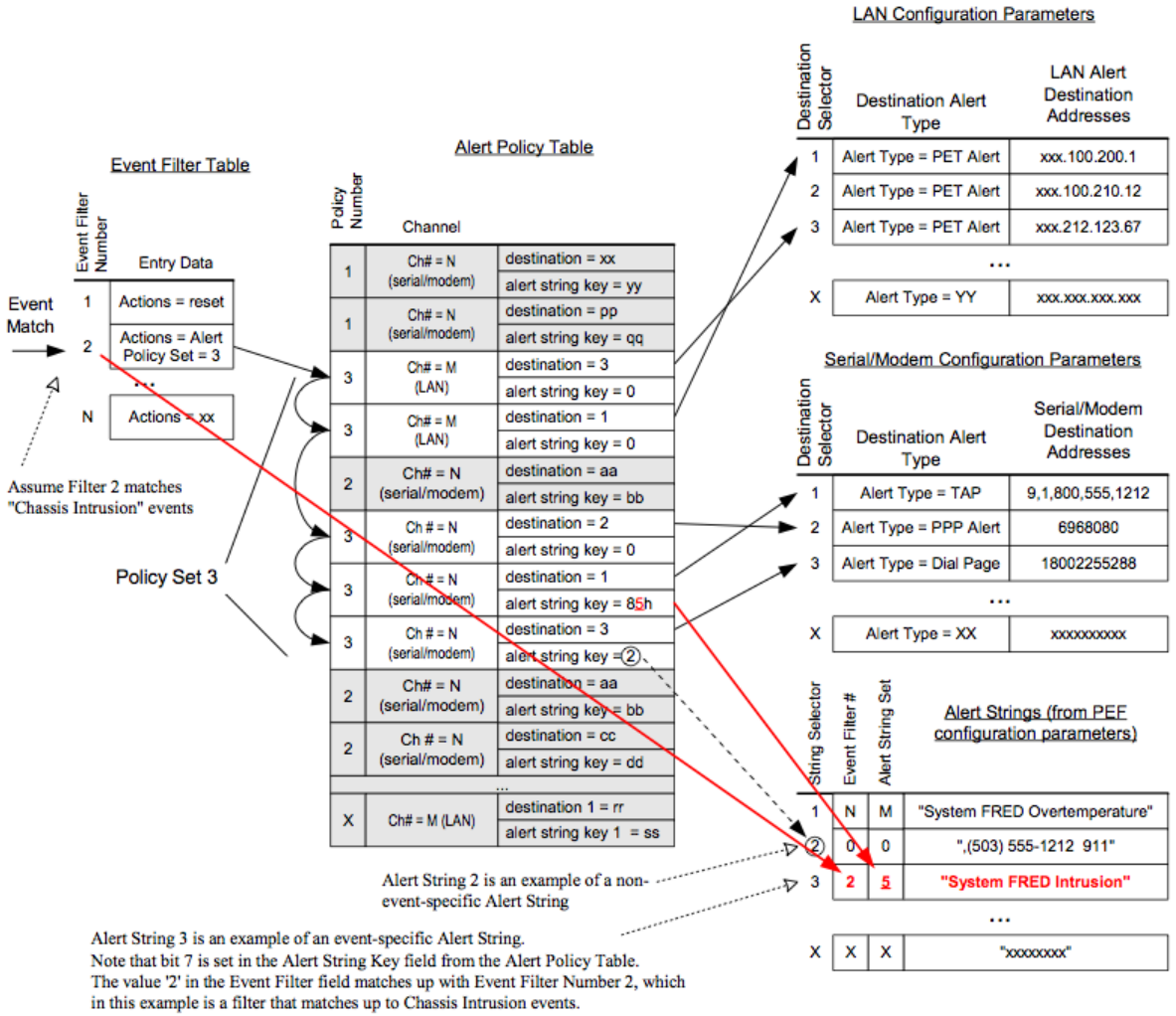
Hardware Events 101 - Platform Event Filtering

Platform Event Filtering (PEF) provides a regular mechanism for configuring the BMC to take selected actions on event messages that it receives or has internally generated. These actions include operations such as system power- off, system reset, as well as triggering the generation of an Alert.

Event filtering is independent of Event Logging.

Hardware Events 101 - Alert Processing Example [7]

Figure 17-2, Event Filter, Alert Policy, and Alert Destination, & String Relationships



[7] Figure 17-2 Event Filter, Alert Policy, and Alert Destination, String Relationships

The Crude Way - cronly SEL diff

```
# cronly SEL diff
1 * * * * /usr/sbin/cronsel.sh

#!/bin/bash
# cronsel.sh - fetch SEL entries out-band and alert differences
set -e
cd /var/seldiff
while read HOST USER PASS
do
  ipmitool -I lan -H $HOST -U $USER -f $PASS sel list > $HOST.new
  diff -Nu $HOST.save $HOST.new > $HOST.diff
  if test -s $HOST.diff; then
    mail -s "$HOST seldiff" zongheng@pwrd.com < $HOST.diff
  fi
  mv -f $HOST.new $HOST.save
done < sel.conf
```

The Simple Way - ipmievd(8) + syslog filter

- ipmitool event daemon, one process per host
- The 'open' interface does not work? Polling over LAN.
- In-band w/ central syslog server
- Out-band

```
# ipmievd -I lan -H HOST -u USER -f PASS sel

# syslog entry in /var/log/messages
Oct 31 01:53:20 z7 ipmievd: Physical Security sensor - General Chassis
intrusion
```

The Complex Way - PET + snmptrapd(8)

- Configure PET on every host[8], BMC or iDRAC
- One snmptrapd as receiver

[8] HPC support is appreciated.

What Messes It Up?

- Dell bmc/drac tools & manuals swamp
  DRAC - racadm

  BMC - ?
- traphandle logic line, e.g. [9]

```
<UNKNOWN>
UDP: [172.23.252.107]:32768
DISMAN-EVENT-MIB::sysUpTimeInstance 60:5:11:46.26
SNMPv2-MIB::snmpTrapOID.0 DELL-ASF-MIB::asfTrapCaseIntrusion
DELL-ASF-MIB::asfPetEvts.1 "44 45 4C 4C 50 00 10 59 80 43 B2 C0 4F 33 33 58
00 42 19 EE AB 64 FF FF 20 20 00 41 73 18 00 80
01 FF 00 00 00 00 00 19 00 00 02 A2 01 00 C1 "
SNMP-COMMUNITY-MIB::snmpTrapAddress.0 172.23.252.107
SNMP-COMMUNITY-MIB::snmpTrapCommunity.0 "public"
SNMPv2-MIB::snmpTrapEnterprise.0 DELL-ASF-MIB::asfPetEvts
```

- PET octet string decoding

[9] Assume DELL-ASF-MIB installed.

Lost In Vendor Manuals?

Vendor Manuals

1950/R610/R710 Hardware Owner's Manual
DRAC5/iDRAC6 Manual
BMC <Ctrl-E>
OpenManage
...

Standards

IPMIv2.0

Open Source IPMI Software Matrix

	ipmitool	**ipmiutil**	**freeipmi**	**OpenIPMI**
Key Strength	buttom-up IPMI coverage	top-down IPMI user fucntions	IPMI conformance	Linux driver
Target Market	sa,dev,OEM	sa,dev,OEM	sa,HPC[10]	kernel,openhpi
License	BSD	BSD	GPL	GPL,LGPL
LED	Yes	Yes	Yes	No
Embedded Shell	ipmitool shell	No	No	ipmish
Discovery	No	idiscover	ipmi-detect	rmcp_ping
Configuration save/restore	No	config	bmc-config pet-config [11]	No
Event Daemon	ipmievd	ipmiutil_evt	No	No
First Release	06 Nov 2003	24 Oct 2001	13 Nov 2006	10 May 2002

[10] hostrange support is really helpful on large clusters.

[11] Aid exploring configuration differences.

Tools Into The Rescue - freeipmi

- bmc-config, pef-config

```
# bmc-config --checkout -f bmc.config.txt
# pef-config --checkout -f pef.config.txt
# ipmitool lan set 1 ipaddr 172.23.252.107
# ipmitool lan set 1 defgw ipaddr 172.23.252.254
racadm config -g cfgIpmiLan -o cfgIpmiLanEnable 1
racadm config -g cfgIpmiLan -o cfgIpmiLanAlertEnable 1
racadm config -g cfgIpmiPef -i 5 -o cfgIpmiPefAction 1
racadm config -g cfgIpmiPet -i 1 -o cfgIpmiPetAlertEnable 1
racadm config -g cfgIpmiPet -i 1 -o cfgIpmiPetAlertDestIpAddr 172.23.252.253
# bmc-config --diff -f bmc.config.txt
# pef-config --diff -f pef.config.txt
```

- bmc-device

```
# bmc-device --platform-event="41 04 05 73 6f assertion 80 01 ff"
```

- ipmi-pet

```
# ipmi-pet -v --interpret-oem-data --no-sensor-type-output \
--no-header-output --comma-separated-output 356224 \
44 45 4c 4c 50 00 10 59 80 43 b2 c0 4f 33 33 58 \
00 02 19 e8 7e 26 ff ff 20 20 04 20 73 18 00 80 \
01 ff 00 00 00 00 00 19 00 00 02 a2 01 00 c1
Oct-10-2011,20:49:46,Intrusion,Ok,Deassertion Event,General
Chassis Intrusion ; Intrusion while system On
```

Config Exploration

	factory	custom
Lan_Channel		
Volatile_Access_Mode	Disabled	Always_Available
Volatile_Enable_Pef_Alerting	No	Yes
Non_Volatile_Access_Mode	Disabled	Always_Available
Non_Volatile_Enable_Pef_Alerting	No	Yes
Lan_Conf		
IP_Address	192.168.0.120	172.23.252.107
Default_Gateway_IP_Address	192.168.0.1	172.23.252.254
Lan_Alert_Destination_1		
Alert_IP_Address	0.0.0.0	172.23.252.253
Alert_Policy_1		
Policy_Enabled	No	Yes
Event_Filter_9 [12]		

[12] Looks like racadm effectively disables PEF rules on R610 ..

Sample PET SNMP Payload Decoding

Acutally two traps per event, since the cookie field differs.

```
306d                                    SEQUENCE len=109
0201 00                                     version-1(0)
0406 70 75 62 6c 69 63                      community: public
a460                                        TrapPDU(context constructed 4)
0609 2b 06 01 04 01 98 6f 01 01                 enterprise: .1.3.6.1.4.1.3183.1.1
4004 ac 17 fc 6b                                agent-addr: 172.23.252.107
0201 06                                         generic   : enterprise-specific(6)
0203 05 6f 00                                   specific  : 356096
4304 1f 02 b3 22                                timestamp : 520270626
303f                                            SEQUENCE len=63
303d                                                SEQUENCE len=61
060a 2b 06 01 04 01 98 6f 01 01 01                      OID: .1.3.6.1.4.1.3183.1.1.1
042f 44 45 ... c1                                     VALUE: the 47-octet value
```

Sample PET Octet String Decoding

```
44 45 4C 4C 50 00 10 59 80 43 B2 C0 4F 33 33 58 // dmidecode grep UUID
00 02  // cookie
19 E8 7E 26 // timestamp, Mon Oct 10 20:50:46 CST 2011
FF FF  // UTC offset, unspecified
20 // Trap Source Type, IPMI
20 // Event Source Type, IPMI
04 // Event Severity, OK
20 // Sensor Device, I2C address of controller
73 // Sensor Number, Intrusion (0x73), ipmitool sensor -v grep 73
18 // Entity 24=System chassis
00 // Entity instance, unspecified
80 01 FF 00 00 00 00 00  // Event Data
19 // language code, English
00 00 02 A2 // Manufacturer ID, Dell
01 00 // System ID
C1 // OEM Custom, none
```

snmptrapd(8) Explained

- subagent shipped with net-snmp
- TRAP/INFORM receiver on udp/162
- log to syslog, and
- invoke handler(integration hook)
  external program, e.g. traptoemail

  Perl subroutine, NetSNMP::TrapReceiver(3)
- with permission
  authCommunity log,execute public

Put Them Together

demo

Acknowledgements

Zhangxiaoyi helps a lot on Dell servers.
Albert Chu helps with expertise on IPMI.

References

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[2] Intelligent Chassis Management Bus Bridge Specification v1.0
http://download.intel.com/design/servers/ipmi/ICMB_1013.pdf

[3] Platform Event Trap Format Specification ftp://download.intel.com/design/servers/ipmi/pet100.pdf

[4] Dell DRAC http://en.wikipedia.org/wiki/Dell_DRAC

[5] Dell Remote Access Controllers Manuals http://support.dell.com/support/edocs/software/smdrac3/

[6] Remote Management with the Baseboard Management Controller in Eighth-Generation Dell PowerEdge Servers http://www.dell.com/downloads/global/power/ps4q04-20040110-Zhuo.pdf

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http://www.dell.com/downloads/global/power/ps4q04-20040204-Murphy.pdf

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http://www.dell.com/downloads/global/power/ps1q07-20060359-Khobragade.pdf

[9] Dell PowerEdge R610 Systems Hardware Owners Manual
http://support.dell.com/support/edocs/systems/per610/en/HOM/pdf/hom_en.pdf

[10] A Comparison of common IPMI Software open-source projects
http://ipmiutil.sourceforge.net/docs/ipmisw-compare.htm

Thanks!