

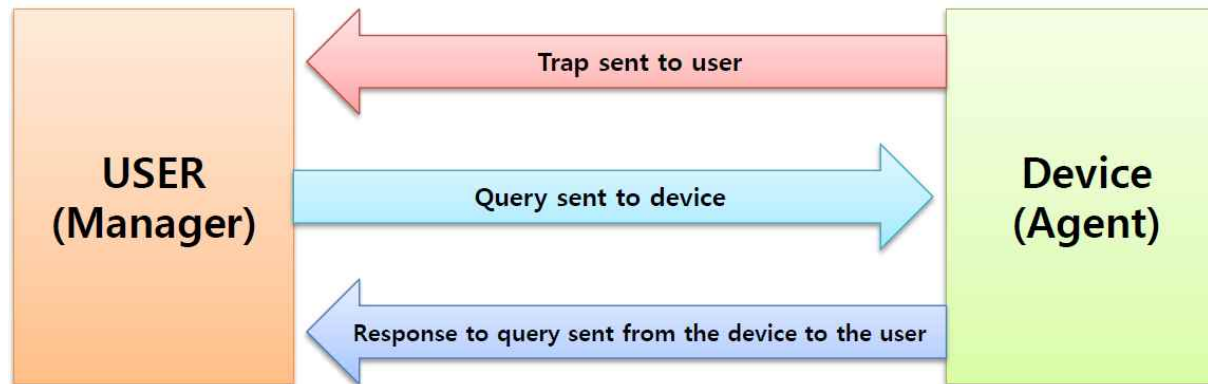
RAON EPICS integration of SNMP and its realization at early stage

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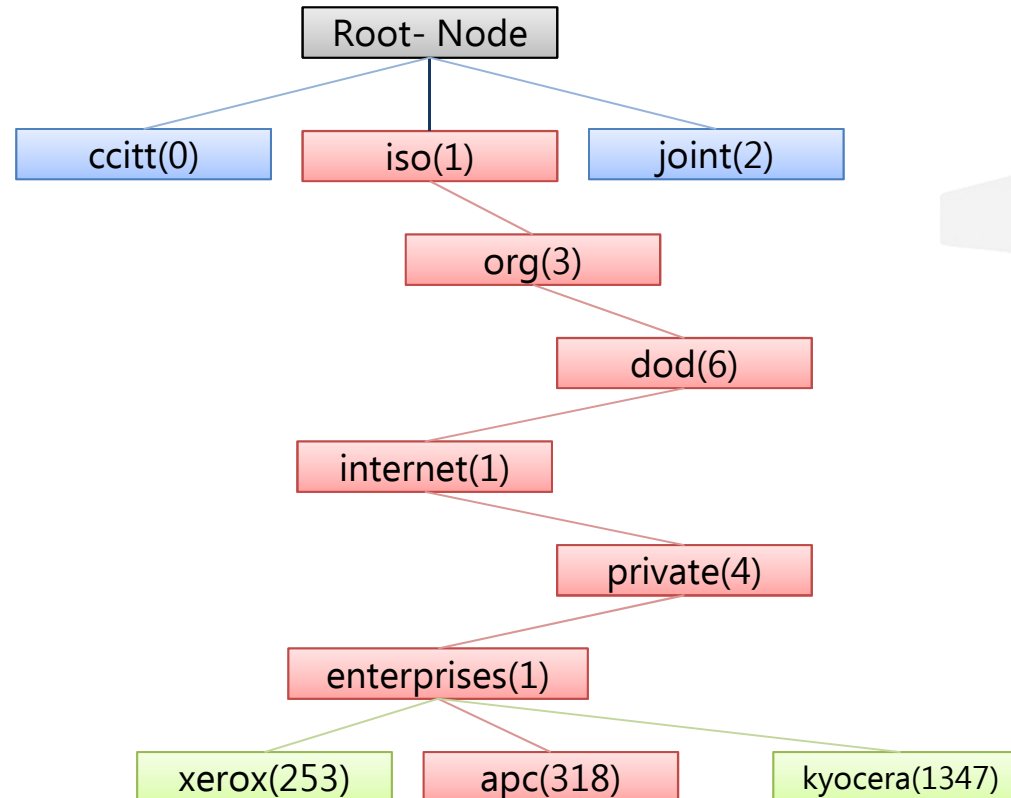
What is SNMP?

- Internet-standard protocol for managing and monitoring devices on IP networks.
- three versions of SNMP(v1/v2c/v3), and each version has different (encryption, authentication, and speed).
- Composed of Manager and Agent.



Management Information Base : MIB

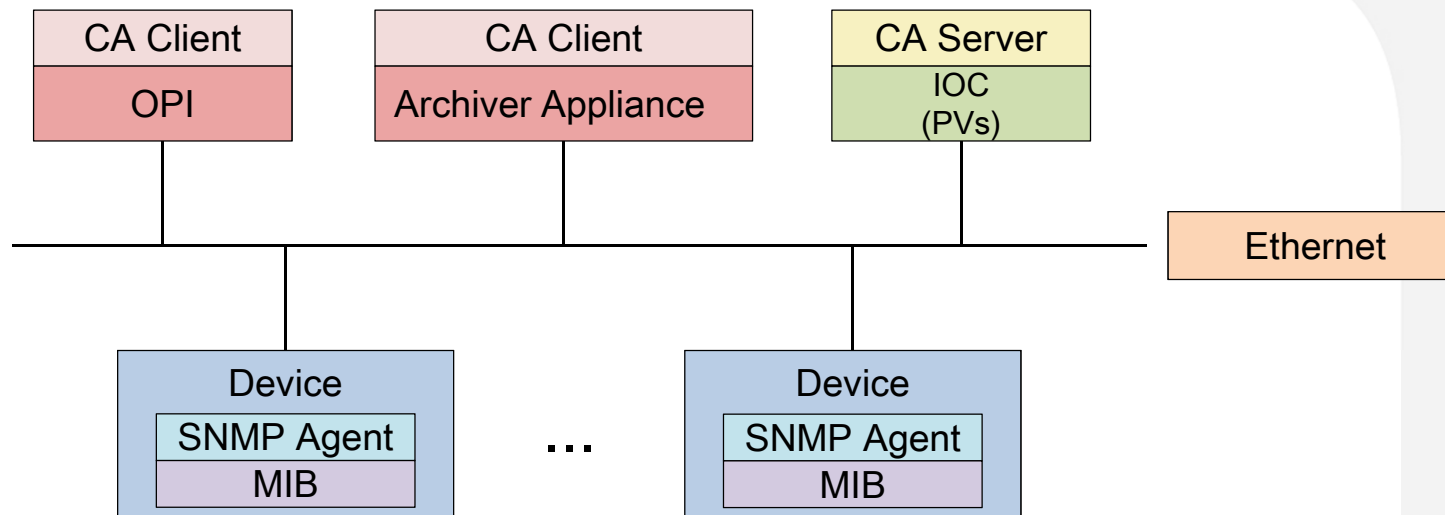
- Collection of the Object identifier (OID) that defines a managed object into a tree-like hierarchy.



- 1.3.6.1.4.1.318
- iso.org.dod.internet.private.enterprises.apc
- iso(1).org(3).dod(6).internet(1).private(4).enterprises(1).apc(318)

Why EPICS integration into SNMP?

- Accelerator control system is comprised of Ethernet-based devices.
- Essential to integrate Ethernet-based devices into EPICS.
- EPICS integration of Simple Network Management Protocol (SNMP).



devSNMP Module

- Developed by NSCL/FRIB.
- Support various record types (ai, ao, longin, longout, ...).
- Provide IOC shell commands.
- format of the INP/OUT fields :

@host community OIDname mask dataLength [set_type[special_flags]]

```
record(ai, "APC_Outlet1") {  
  field(DESC, "Outlet1 Status")  
  field(DTYP, "Snmp")  
  field(SCAN, ".2 second")  
  field(PREC, "3")  
  field(INP, "@10.1.5.123 public %(PO)sPDUOutletCtl.1 INTEGER: 100 i")  
}
```

Host community OID Name mask dataLength Set type

Software & Hardware

- **Software**
 - Debian Linux 7 Wheezy
 - Net-SNMP v5.4.3
 - EPICS v3.14.12.4
 - NSCL/FRIB devSNMP vRC8
 - CSS v3.2.13a
- **Hardware**
 - XEROX ApeosPort-IV C3375
 - KYOCERA FS-9530DN

Customized devSNMP Module

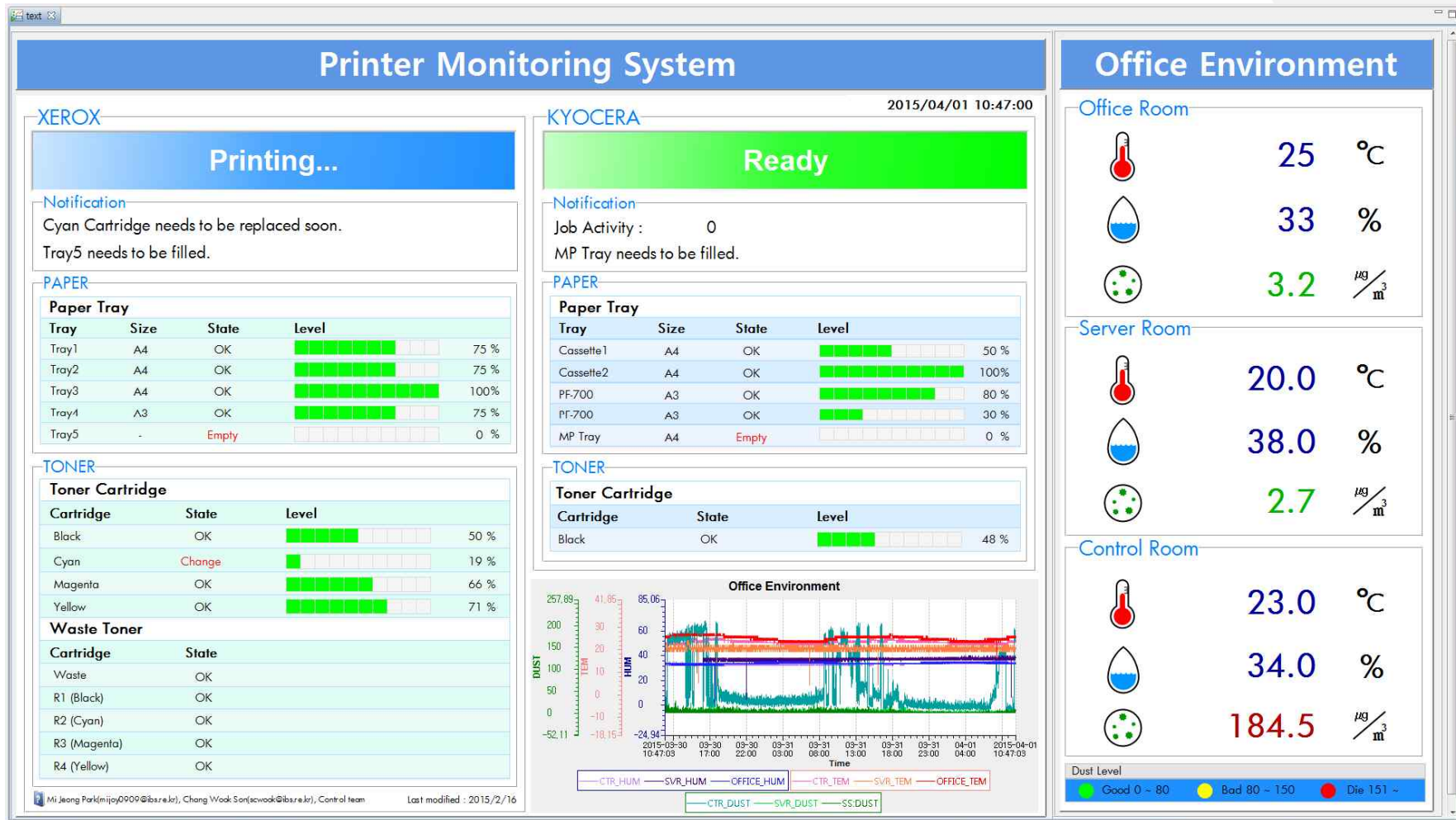
1. Created snmp, snmpstrRecord (Only SNMP string data type).

```
device(snmp, INST_IO, devSnmsoft, "SoftChannel")  
device(snmpstr, INST_IO, devSnmstrsoft, "SoftChannel")
```

2. Added Calc menu, MJP/SVAL/OVAL field.
3. Modified some codes.

```
record(snmp, "${USER}:xerox_toner_B") {  
  field(DESC, "xerox toner")  
  field(SCAN, "Passive")  
  field(DTYP, "SoftChannel")  
  field(OUT, "@%(XEROX) %(CM2) %(PR)prtMarkerSuppliesLevel.1.1 INTEGER: 100 ")  
  field(MJP, "Division") /* calc menu (Plus, Minus, Multiplication, Division) */  
  field(OVAL, "26000") /* the overall amount of black toner */  
  field(SVAL, "100") /* express as a percentage */  
}
```

Printer and Office T/H/D monitoring system UI



SNMP APIs + EPICS : S/W&H/W

- Develop customized system for RAON Control system.
- Apply to the APC Power Distribution Unit (PDU) and Wiener VME Crate.
- **Software**
 - Debian Linux 7 Wheezy
 - Net-SNMP v5.4.3
 - EPICS v3.14.12.4
 - CSS v3.2.13a
- **Hardware**
 - APC PDU 7921
 - Wiener VME64x 6023 Crate

SNMP APIs + EPICS : Features

- Uses Net-SNMP APIs :
Tutorial - Simple Async Application.
- Supports only two records :
 - snmp(float, integer, gauge)
 - snmpstr(string, BITS)
- Support SNMPv3(Read/Write).
- User can select the SNMP version for each record.
recommended : Read(SNMPv2) / Write(SNMPv3)
- Information of the SNMP Command is defined in each field(HOST, COMM, OIDS, AUTH, PRIV).

SNMP APIs + EPICS : Db file example

SNMPv2c

```
record(snmp, "${A}:${P}_Outlet1_R") {  
  field(DESC, "PDU outlet1 control")  
  field(DTYP, "SNMP Read")  
  field(SCAN, "5 second")  
  field(VERS, "SNMP_VERSION_2c")  
  field(HOST, "10.1.5.142")  
  field(COMM, "public")  
  field(OIDS, "${PO}sPDUOutletCtl.1")  
}
```

SNMPv3

```
record(snmp, "${A}:${P}_Outlet1_W") {  
  field(DESC, "PDU outlet1 control")  
  field(DTYP, "SNMP Write")  
  field(SCAN, "5 second")  
  field(VERS, "SNMP_VERSION_3")  
  field(AUTH, "PASSWORD")  
  field(PRIV, "PASSWORD")  
  field(HOST, "10.1.5.142")  
  field(COMM, "admin")  
  field(OIDS, "${PO}sPDUOutletCtl.1")  
}
```

- **VERS** : SNMP Version (SNMP_VERSION_2c or SNMP_VERSION_3)
- **HOST** : Host Name/IP of Network Device
- **COMM** : SNMP Community String(v2c) or UserName(v3)
- **OIDS** : OID Name
- **AUTH** : AuthKey (v3) – Strong authentication
- **PRIV** : Priv Key (v3) – Data encryption for privacy

UI for Power Distribution Unit

Device Monitoring System

APC PDU2 WIENER Crate3 2015/05/14 17:06:35

STATUS

P/S1 Status : OK ●

P/S2 Status : OK ●

P/S Alarm : ALL P/S OK ●

Power Watts : 0 V

Power Factor : 0 V

Line to Line Voltage : 0 V

Rating : 16 A

LOAD STATUS

Load : 1 Amps

OverLoad Threshold : 16 A

NearOverLoad Threshold : 12 A

LowLoad Threshold : 0 A

CONTROL PANEL

LOAD MANAGEMENT

OverLoad Threshold : 0 A

NearOverLoad Threshold : 0 A

LowLoad Threshold : 0 A

DEVICE MANAGEMENT

Line to Line Voltage : 0 V

Power Factor : 0 V

OUTLET STATUS

#	STATUS	Power On Delay	Power Off Delay	Reboot Duration
Outlet 1	ON	Immediate	Immediate	5 second
Outlet 2	ON	Immediate	Immediate	5 second
Outlet 3	ON	Immediate	Immediate	5 second
Outlet 4	ON	Immediate	Immediate	5 second
Outlet 5	ON	Immediate	Immediate	5 second
Outlet 6	ON	Immediate	Immediate	5 second
Outlet 7	ON	Immediate	Immediate	5 second
Outlet 8	OFF	Immediate	Immediate	5 second

OUTLET MANAGEMENT

ALL OUTLET CTRL MENU

#	STATUS	Power On Delay	Power Off Delay	Reboot Duration
Outlet 1	OPTION	0 second	0 second	0 second
Outlet 2	OPTION	0 second	0 second	0 second
Outlet 3	ON OFF	0 second	0 second	0 second
Outlet 4	Reboot OnWithDelay	0 second	0 second	0 second
Outlet 5	OffWithDelay RebootWithDelay	0 second	0 second	0 second
Outlet 6	OPTION	0 second	0 second	0 second
Outlet 7	OPTION	0 second	0 second	0 second
Outlet 8	OFF	0 second	0 second	0 second

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UI for VME Crate

Device Monitoring System

APC PDU2 WIENER Crate3
2015/04/14 09:43:17

CONTROL PANEL

* P/S On/Off

* System Reset

* Restart the device (reboots the cpu and reset all internal components)

POWER STATUS

Main Power : OK

Fan Fail : ●

P/S Status : OK

Over Heat : ●

SYS Fail : ●

FAN STATUS

Fan Temperature : 22 °C

Fan Nominal Speed : 2,000 RPM

#	1	2	3
Fan Speed	1740 RPM	1725 RPM	1672 RPM

OUTPUT STATUS

Channel	Name	Voltage	Current	Temp	Status
U0 ●	+5V0	5 V	0.13 A	OK	OK
U1 ●	+12V	11.99 V	0 A	OK	OK
U3 ●	+3V3	3.32 V	0.13 A	OK	OK
U5 ●	-12V	12 V	0 A	OK	OK

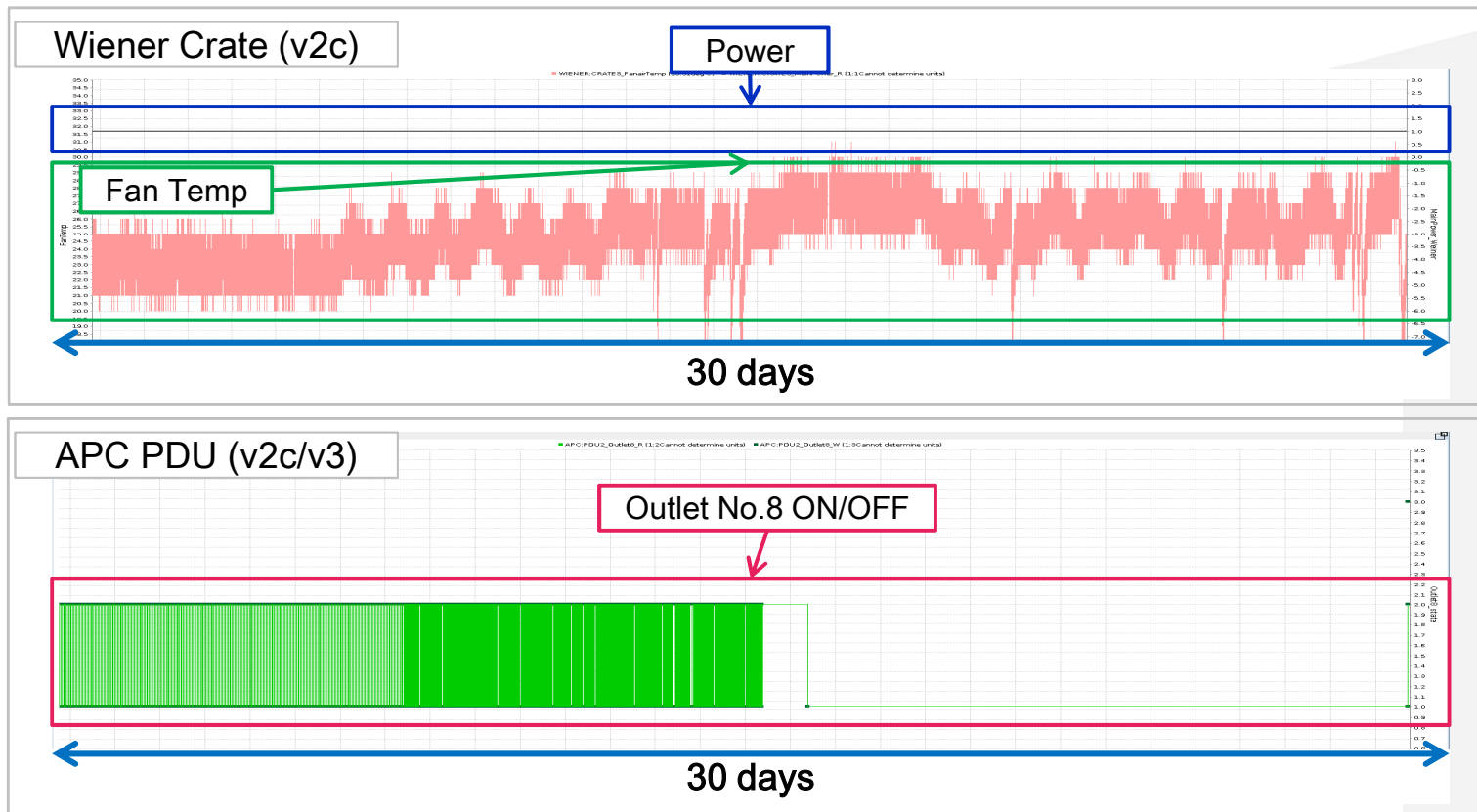
TEMPERATURE SENSORS

#	1	2	3	4	5	6	7	8
STATUS	OK	OK	OK	OK	OK	OK	OK	OK
Warning Threshold <small>(* 0...126 / DISABLE127) °C</small>	0 ▲▼ 45	0 ▲▼ 45	0 ▲▼ 45	0 ▲▼ 45	0 ▲▼ 45	0 ▲▼ 45	0 ▲▼ 45	0 ▲▼ 45
Failure Threshold <small>(* 0...126 / DISABLE127) °C</small>	0 ▲▼ 127	0 ▲▼ 127	0 ▲▼ 127	0 ▲▼ 127	0 ▲▼ 127	0 ▲▼ 127	0 ▲▼ 127	0 ▲▼ 127

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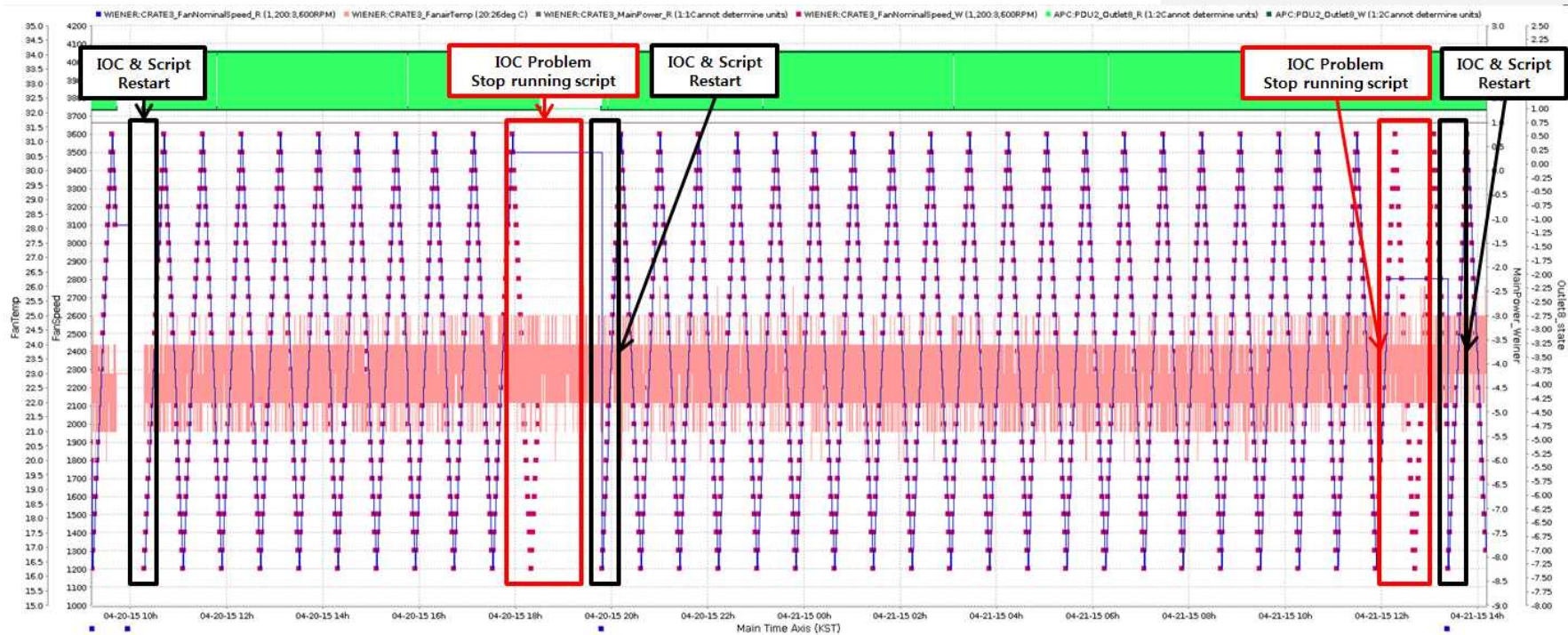
Stability Test : IOC Stability Test

- Purpose : for IOC and SNMPv3 stability
- Use bash script to change the PV value and archiver appliance



Stability Test : Wiener SNMPv3 Test

- Compare with APC PDU SNMPv3 is already approved in industry.
- Have fan tray PVs issue that doesn't change the value.
- Give the feedback to wiener.



Summary & Outlook

Summary

- ☑ Useful to expand its realm of network devices.
- ☑ Customized EPICS integration of SNMP using devSNMP and SNMP APIs for RAON and developing "SNMP" EPICS record
- ☑ Developed OPI by using CSS.
- ☑ Test its stability for IOC and SNMPv3 of Wiener.

Outlook

- ☐ Clean up codes.
- ☐ Support another SNMP data types.
- ☐ Apply to various network devices and more checking the stability.
- ☐ Able to apply SNMP to storage system and network switch issue monitoring.

Thank you for your attention!

If you have any question, call me anytime
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