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
```
Why EPICS integration into SNMP?

- Accelerator control system is comprised of Ethernet-based devices.
- Essential to integrate Ethernet-based devices into EPICS.
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]]
  ```

```plaintext
record(ai, "APC_Outlet1") {
  field(DSC, "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")
}
```
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, devSnmpSoft, "SoftChannel")
   device(snmpstr, INST_IO, devSnmpstrSoft, "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(DSC, "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(DSC, "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
UI for VME Crate
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 date 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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