Channel Access Security

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Material copied from the IOC Application Developer's Guide

Marty Kraimer, Janet Anderson, Andrew Johnson (APS) and others

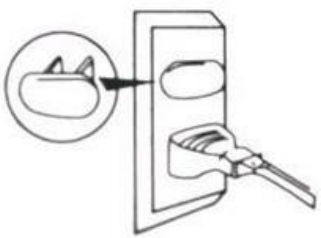
"Security"?

Not like this

- Fend off malicious hackers, evildoers, long-haired troublemakers

More like this

- Prevent casual users from making mistakes
- Help operators follow procedures



http://asset3.cbsistatic.com/cnwk.1d/i/ne/p/2008/FortKnox_550x338.jpg
http://i01.i.aliimg.com/img/pb/216/247/491/491247216_377.jpg

Function and Scope

Control reading and/or writing of EPICS records via Channel Access

- **Almost never used to limit reading**

Criteria:

- **Who, which user?**
  - **Control system engineer may always access everything**
  - **Beam Line Staff may always access most things**
  - **Beam Line Users cannot write certain things**
- **Where, which machine?**
  - **Full access from Beam Line Control Room OPIs**
  - **No write access from anywhere else**
- **When, in which system state?**
  - **Read-only while experiment is running, while automation is enabled, …**
  - **Writable when experiment idle, manual control enabled, …**

Limitations

… Via Channel Access

- Nothing is encrypted
- IOC console (*dbpf*, …) not affected

Who?

- $USER

From Where?

- Host name, easy to fake

Specification Summary

- **Content included in database and access security file**
  - **Groups**
  - **A record belongs to one ASG (access security group)**
  - **ASG contains:**
    - **Multiple rules** (read or write)
      - **Groups of users** (which user)
      - **Groups of hostnames** (which machine)
      - **Optionally qualified by the value of PVs** (which state)
    - **Rules give statements like:**
      - Operators may write any property of PVs in this group from any OPI in the control room in any system state
      - Maintenance personnel may write values of PVs in this group from any maintenance OPI when the system state is *maintenance*

EPICS DB

- **Record**
  - **Assigned to access security group**
  - **`field(ASG, "LIMITED")`**
  - **Default ASG is** *DEFAULT*
- **Fields have** *Access Security Level* **property**
  - **Most in ASL1**
  - **Some are ASL0**
  - **Nobody can remember. See *.dbd**

Access Security File

- UAG(<name>) { <user> [, <user> ...] }
- ...
- HAG(<name>) { <host> [, <host> ...] }
- ...
- ASG(<name>) {
  [INP<index>(<pvname>) ...]
  RULE(<level>,NONE |READ|WRITE [,NOTRAPWRITE | TRAPWRITE]) {
  [UAG(<name> [,<name> ...])]
  [HAG(<name> [,<name> ...])]
  CALC(<calculation>)
  }
  ...
  }
  ...

RULE(<level>, <what>,[<trap option>])

- **<level> is 0 or 1.**
  - **The dbd file assigns each field an access security level. Level 1 fields are typically related to record behavior and configuration. Level 0 fields are related to value.**
    - **Example: For the AI record,** VAL **is level 0, all the rest are level 1**
  - **Rules for level 1 also grant access to level 0**
  - **Example: Everybody can write** VAL **(level 0), but restrict other fields:**

```
ASG(WRITE_SOME)
{
    RULE(1, READ)
    RULE(0, WRITE)
    RULE(1, WRITE)
    {
        UAG(x_users)
        HAG(x_hosts)
    }
}
```

- **<what> is NONE, READ, or WRITE**
  - **Plus an optional** *TRAPWRITE*, **which will cause invocation of a** *trap write listener*, **i.e. custom C code that may be added to the IOC. This can be used to log write access by user and host, it doesn't otherwise affect access security.**

Default Implicit Behavior

- **If no access security file is loaded, all users from anywhere may read and write all fields of all records anytime**
- **The previously mentioned *DEFAULT* ASG has no effect**

Equivalent Explicit Default Configuration

- **Create file *simple.acf* with the following content:**

```
ASG(DEFAULT)
{
        RULE(1, READ)
        RULE(1, WRITE)
}
```

  - **Add the following line to your st.cmd:**

```
asSetFilename("path_to_the_file/simple.acf")
```

- **Result:**
  - ✓ **Since, by default, records belong to the ASG named *DEFAULT***
    - ✓ **full *read*/*write* to all records is allowed**
  - ✓ **Functionally equivalent to doing nothing**
  - ✓ **But now, the *asprules* and *asdbdump* commands show something**
- **Caveat:**
  - **If the AS config file does not exist or contains a syntax error, *all access is prohibited!***
  - **Use the *ascheck* utility on the host before loading a file into the IOC**

Read-Only

- **Group that allows read, but no write:**

```
ASG(READONLY)
{
  RULE(1, READ)
  # Nothing in here about WRITE…
}
```

- **To have any effect, set the ASG field of at least one record to *READONLY***
  - **You can change ASG fields at runtime**
  - **… via Channel Access, unless AS prohibits it…**
- ***caput* will show that the old and new values stay the same**
- **Display tools (*edm, CSS BOY*, ..) will indicate read-only access via cursor or disabled widgets**

Limit Write to Users and Hosts

- Limit write access to
  - members of a user access group UAG
  - while on a computer in the host access group HAG

```
UAG(x_users) { ubuntu }
HAG(x_hosts) { ubuntu }
ASG(X_TEAM)
{
  RULE(1, READ)
  RULE(1, WRITE)
  {
     UAG(x_users)
     HAG(x_hosts)
  }
}
```

- Caveats:

  The CA *client library* sends the user and host names to the server. Especially the host name can be tricky:

  - It's *not* the client's IP address
  - It's the result of the *hostname* command, which might be *myhost* or *some.site.myhost*, might differ from DNS name
  - The *casr* command on the IOC can sometimes help to show who and from where is connecting via CA, and the *asdbdump* command shows who they pretend to be

Limit Access by System State

- **Limit write access to times where some set of variables meets some criteria**
  - ```
    ASG(MODE)
    {
      INPA(accelerator_mode)              # accelerator_mode
    is normal pv
      RULE(1, READ)
      RULE(1, WRITE)
      {
       CALC(A < 5)
      }
    }
    ```
- **This is based on the same code as the *CALC* record**
  - **PVs may be assigned to inputs *A* through *L***
  - **The computation should result in 0 or 1, the latter allowing access**
    ```

SNS Beamline Example

- **DEFAULT**
  - Anybody can read
  - Special list of experts can always write
  - Normal users cannot write in certain modes
- **ALWAYS**
  - Anybody can always read and write
  - Use for “STOP”, “ABORT” type PVs
- **EXPERT**
  - Anybody can read
  - Only special list of experts can write

Additional Security Measures

- Place IOCs in private network
  - No ‘telnet’ to their console
  - No Channel Access from malicious clients
  - Outside access (ssh, NXClient, …) controlled the usual way
- Add Channel Access Gateway to other networks
  - Gateway also has access security
  - Make it read-only

And that's all I have to say about that!