Security in iRODS

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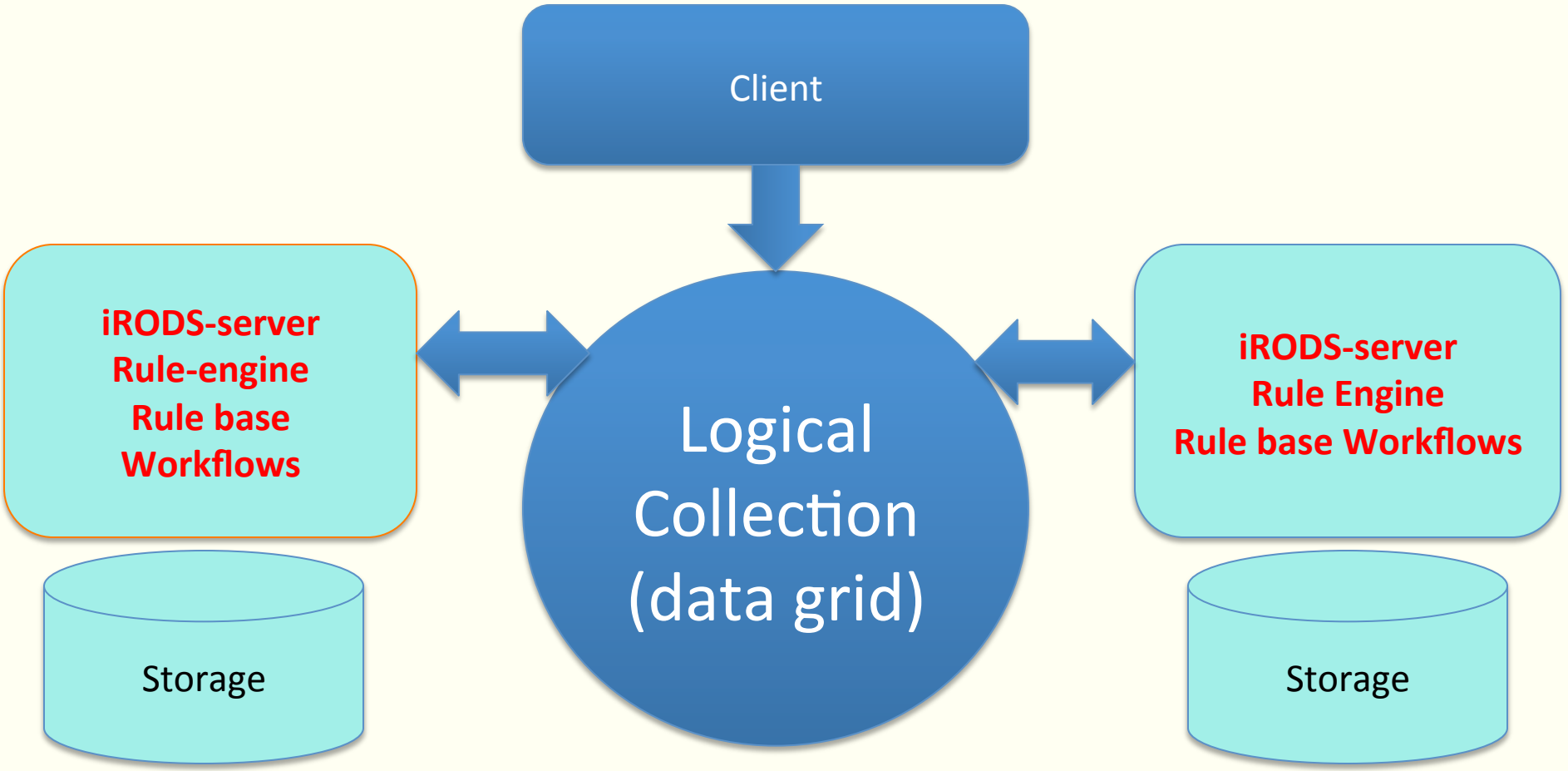
Topics

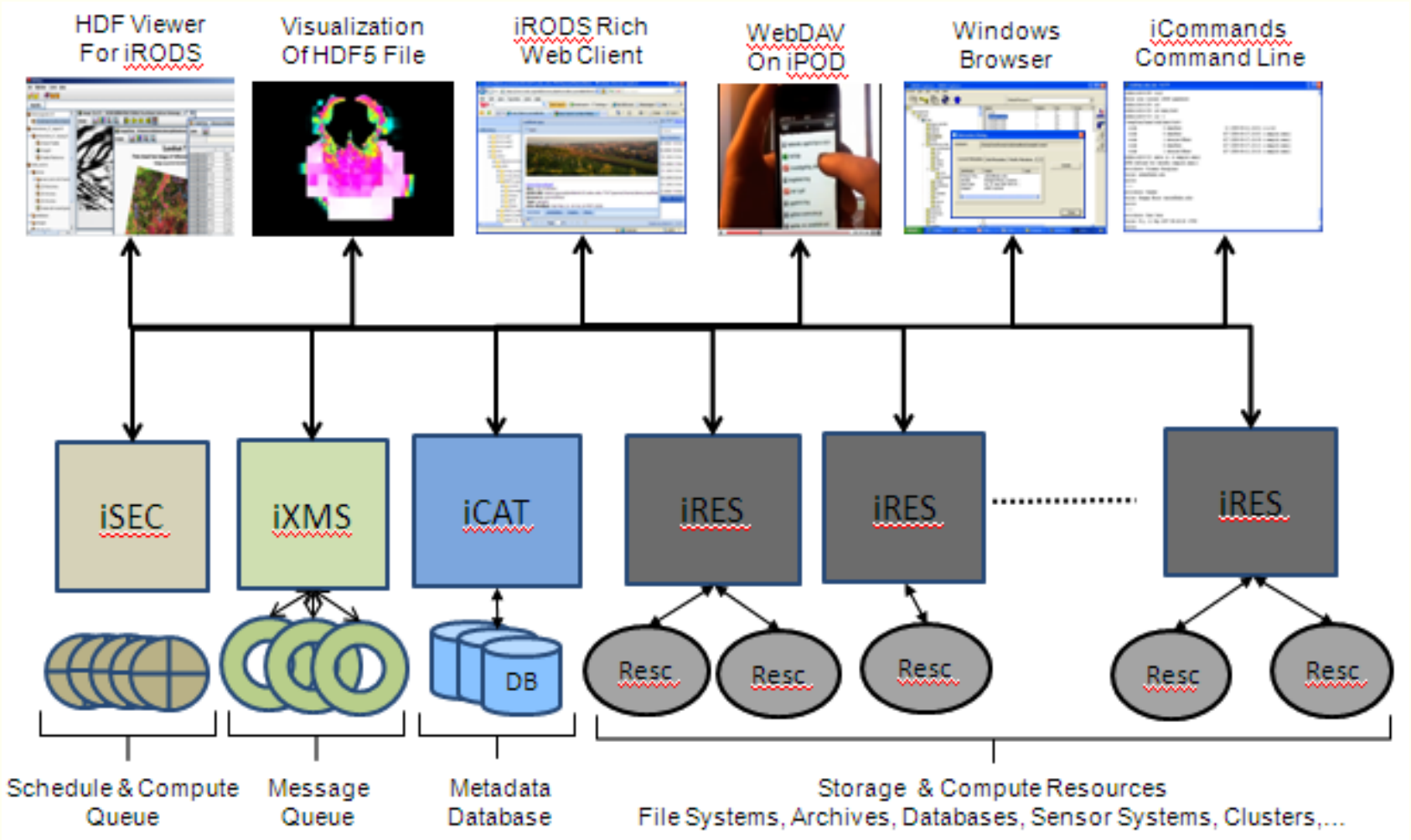
- **Identity management**
- **Authentication**
  - Generic Security Service API - GSSAPI
  - Pluggable Authentication Modules
- **Authorization**
  - Access controls
  - Policy constraints
- **Audit**
- **Vulnerability assessments**

Identity Management



Create Logical Name for each user
Store data under iRODS data grid name

iRODS User Identity Stored in iCAT



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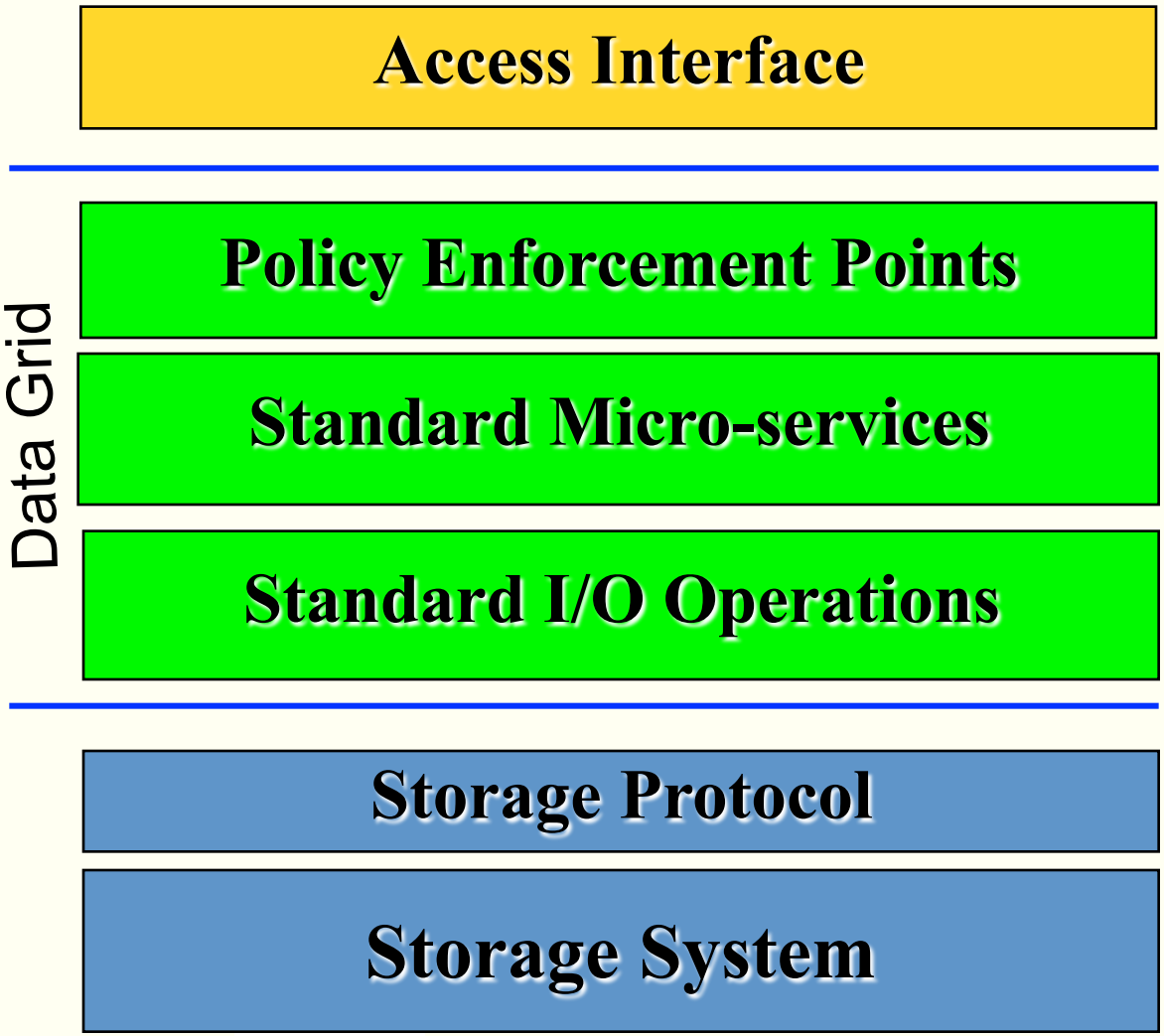
Access Virtualization



Map from the actions requested by the client to multiple policy enforcement points.

Map from policy to standard micro-services.

Map from micro-services to standard Posix I/O operations.

Map standard I/O operations to the protocol supported by the storage system

Identity Management

- **3.1 - ARCS maintained identity in an external certificate authority**
  - When iRODS received a certificate, would create an iRODS logical name to match the certificate
- **3.2 - Pluggable Authentication Modules**
  - Use LDAP to implement the identity management
  - User names are maintained in LDAP server
  - iRODS uses SSL and OpenSSL libraries to exchange information with LDAP

Authentication

- **iRODS data grid 3.1 – GSSAPI**
  - Challenge response – iRODS manages a password for each user
  - Kerberos – certificate authority manages password
  - GSI – certificate authority manages password
  - UK ASPiS system (Architecture for a Shibboleth-Protected iRODS System, UK E-Science)
    - Added attributes to the REI structure for user identification
    - Added rules and micro-services to control access
    - Installed policies at the policy enforcement points for acSetRescSchemeForCreate, acPreprocForDataObjOpen, and acDataDeletePolicy

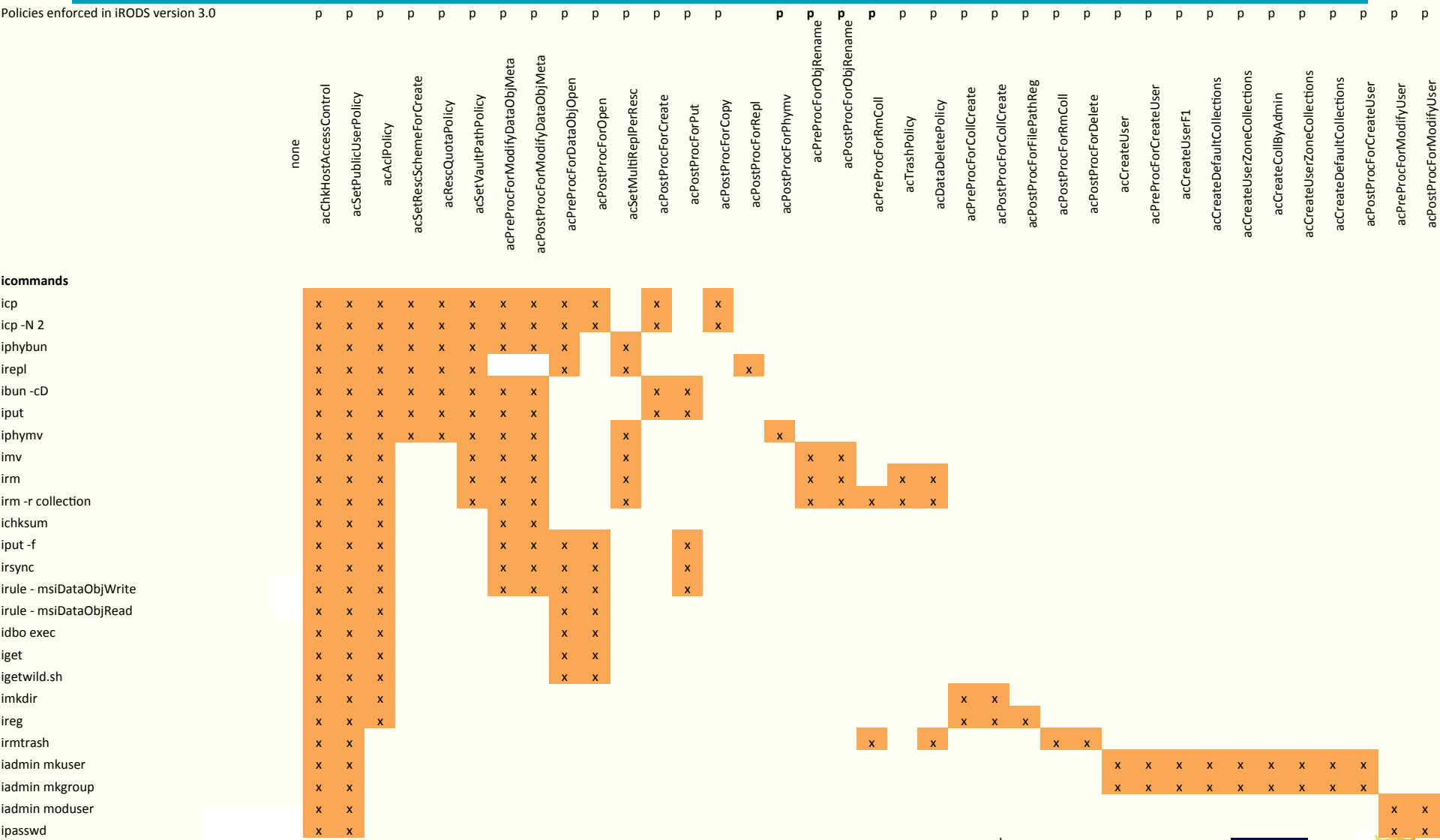
PAM Authentication – iRODS 3.2

- **For additional security, when using PAM (system passwords), 'iinit' will create a separate iRODS password that is then used for the other i-commands (stored in the .irodsA file).**
  - The generated iRODS passwords will be valid for 2 weeks (or other defined period) and can be renewed during that period via another 'iinit' command.
- **Since system passwords are being transferred (and iRODS passwords back), the session for the 'iinit' protocol needs to be encrypted.**
  - This is done via SSL and the OpenSSL libraries. As such, your iRODS server needs to have a proper X.509 certificate for SSL to use. You can use either a self-signed certificate (best for testing) or a certificate from a trusted CA.
- **There is a new iadmin sub-command, 'rpp' (remove PAM-derived Password) for the admin to remove these generated passwords for a specified user if needed**

Authorization

- **Access controls are maintained for each file for users and groups**
  - DATA_ACCESS_DATA_ID
  - DATA_ACCESS_TYPE
  - DATA_ACCESS_USER_ID
  - USER_ID
  - USER_GROUP_ID
- **Each access is processed at policy enforcement points**
  - acChkHostAccessControl
  - acSetPublicUserPolicy
  - acAclPolicy (additional checks for admin in the data grid)

Policy Constraints on Actions



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Audit Trails

- **Micro-services for parsing audit trails**
  - msiGetAuditTrailInfoByActionID
  - msiGetAuditTrailInfoByKeywords
  - msiGetAuditTrailInfoByObjectID
  - msiGetAuditTrailInfoByTimeStamp
  - msiGetAuditTrailInfoByUserID
- **Turn on audit trail in iRODS/server/icat/src/icatMidLevelRoutines.c**

Example Action IDs for Audit

- **Located in iRODS/server/icat/include/icatDefines.h**
  - ACCESS_GRANTED 1000
  - REGISTER_DATA_OBJ 2010
  - REGISTER_DATA_REPLICA 2011
  - REGISTER_RESOURCE 2030
  - DELETE_USER_RE 2040
  - REGISTER_ZONE 2064
  - MOD_USER_NAME 2070
  - MOD_USER_PASSWORD 2076
  - ADD_AVU_METADATA 2110
  - RENAME_COLLECTION 2131

Example Audit Rule

```
myTestRule {
#Parse audit trails for specific audit action
#  2040  - delete user
  msiGetAuditTrailInfoByActionID(*Id,*Buf,*Status);
  writeBytesBuf("stdout",*Buf);
}
INPUT *Id="2040"
OUTPUT ruleExecOut
```

Vulnerability Assessments

- **Collaboration with Dr. Barton Miller, University of Wisconsin**
  - Built on experience with Storage Resource Broker
  - Analyses were used to improve security of code
- **Question: When vulnerabilities are identified:**
  - Immediately publish?
  - Generate patch for current version and then publish?
  - Include patch in next release and then publish?
  - Retrofit patches to prior versions and then publish?

Conclusion

- **iRODS is middleware and depends upon the security of the underlying operating systems**
  - Users authenticate to iRODS
  - iRODS authenticates to each server / storage system
  - iRODS checks access controls for each file
  - iRODS checks policies that can impose additional controls on actions
- **Assessment policies can check collection properties**
  - Integrity needs to be validated independently of ingestion
  - Audit trails can be parsed to verify compliance over time