A unified Information System for WLCG and beyond

Alexey Anisenkov (BINP)

on behalf of CRIC team

CHEP 2018, Bulgaria, 10 July 2018
Distributed Computing Environment (WLCG)

- LHC Experiments rely on huge heterogeneous distributed environment
  - variety of Computing Resources involved (GRID, Clouds, HPC)
  - variety of Infrastructures and middleware providers

- Each community uses and describes Resources in its own way
- **Computing Models** are similar but still have different implementation
WLCG Information landscape

Components of the WLCG Information System

- GOCDB
- OIM
- Open LDAP BDII
- REBUS

WLCG information consumers

- Rucio
- PanDA
- Phedex
- GlideinWMS
- HammerCloud

Other sources

And many others...
Current limitations of the WLCG Information System

- Multiple sources of information. Data is sometime contradictory or incomplete. Debugging is complicated. No central place where data can be validated
- Integration of new type of resources is not straightforward
- Complex objects like storage services with variety of access protocols and storage shares is not properly described

No high-level information middleware which completely covers Experiments use-cases and describes resource as VOs need

Currently every experiment has to solve all those problems on its own
Solution: a unified Information system

High level information system aiming to describe the topology of the WLCG infrastructure (resources provided by the WLCG sites) and experiment-specific configuration required to exploit this infrastructure according to the experiments Computing models.

CRIC is a framework providing a centralized (and flexible) way to describe which resources LHC experiments are using and also how they use them:

- Clear distinction between resources provided by (Sites) and resources used by (Experiments)
- Experiment independent, but still experiment-oriented
- Plugin based approach allows customization to address various experiment requirements and implementation of the dedicated experiment instances
- Shared building blocks to optimize development process and to ensure common look and feel. Think about it in terms of lego bricks
- Flexibility to address technology evolution and changes in the experiment computing models and applications. Lego bricks again!

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CRIC Architecture: plugin based

- Modular architecture is based on the Django framework, implementing different apps for CORE (provided by) and experiment (used by) parts.
- Data are exposed via REST API which is configurable by filters and different presets (views).
- Bootstrap, jQuery, Web services and many other modern tools and technologies are used.
Authorization and Authentication (A&A)

- CRIC supports enhanced Access controls and user Group management
- Several Authentication methods are enabled
- Flexible utilisation of Permissions, Roles and Groups at various levels
- Fine grain A&A on the level of a single CRIC object
- Ability to bootstrap User info from whatever external source (CERN user DB, Experiment DBs, config files, e-groups, etc)

Each Experiment configures own Data access policies!
Example of A&A use-cases for different experiments

- **CMS** is planning to use CRIC not only to define access rights for CRIC objects, but also to define/expose user privileges for other **CMS applications** (CRAB, Phedex, etc...). Relies on CERN SSO and local authentication.

- **ATLAS** uses a simpler concept based on user’s DNs coming from VOMS.

Experiment decides what elements should be used out of the CRIC box to implement own policies and follow own workflow.

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Logging functionality - track the changes

➢ CRIC provides an advanced logging functionality to monitor, administer and troubleshoot the system
➢ Logging is performed at the object level (a given object or any other object related to it)
➢ Full list of changes (including old values) is provided through build-in table view.
➢ You can check who, when and how interacted with an object.
CRIC introduces unified description of Service Resources in particular to target and resolve the complexity of SE definition.

- Link together all protocols, activities, closeness metrics, space tokens, other experiment specifics belong to same Storage into unified Resource
- Multiple protocols concept
- Connect associated CE to default SE for given activity
- Integration of new SE technologies (e.g. ObjectStores) within the experiments

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Experiment specific concepts. CMS Facility example

- Facility is a **CMS specific** concept
- An aggregation of set of sites and services in a CMS administrative domain

<table>
<thead>
<tr>
<th>CMS Facility KIT</th>
<th>Authorization Groups</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Main Parameters</strong></td>
<td><strong>Executive(s)</strong></td>
</tr>
<tr>
<td>Facility Name</td>
<td>e-groups:: - empty list -</td>
</tr>
</tbody>
</table>
| Full Facility Name | users:: cms.kit.exec
| Location | users:: cms.kit.exec |
| Web Page | users:: cms.kit.exec
| Timezone | users:: cms.kit.exec |
| RC site (GOCDB/OIM) | users:: cms.kit.exec |
| Last modification time | users:: cms.kit.exec |

<table>
<thead>
<tr>
<th><strong>Resources</strong></th>
<th><strong>Backup Squid(s)</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>CMS Site(s)</td>
<td>This facility isn't hosting any backup squids.</td>
</tr>
<tr>
<td>Compute Unit(s)</td>
<td>Frontier(s)</td>
</tr>
<tr>
<td>Storage Unit(s)</td>
<td>This facility isn't hosting any frontiers.</td>
</tr>
</tbody>
</table>

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General details and links to other objects.

- Facility is linked to a GocDB/OIM site
- (which is an experiment independent concept defined in CORE part of CRIC)
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Facility is linked to a GocDB/OIM site (which is an experiment independent concept defined in CORE part of CRIC).

### Per-Facility authorization groups

mapped to users and CERN e-groups.

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**CMS Facility KIT**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Facility Name</td>
<td>KIT</td>
</tr>
<tr>
<td>Full Facility Name</td>
<td>Karlsruhe</td>
</tr>
<tr>
<td>Location</td>
<td>1 Vliet of the Konrad-Heiden (4.900), Germany</td>
</tr>
<tr>
<td>Web Page</td>
<td><a href="http://www.t1.de">http://www.t1.de</a></td>
</tr>
<tr>
<td>Timezone</td>
<td>Europe/Berlin</td>
</tr>
<tr>
<td>RC site (GOCDB/OIM)</td>
<td>FZK-LCG2</td>
</tr>
</tbody>
</table>

**Last modification time**

- **2018-06-20 13:45:34**

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**Resources**

**CMS Site(s)**

- **T1_DE_KIT**
  - SU(s): T1_DE_KIT_Buffer, T1_DE_KIT_Disk, T1_DE_KIT_MSS, T2_DE_DESY
  - CU(s): CU_T1_DE_KIT (T1_DE_KIT)

**Compute Unit(s)**

- CU_T1_DE_KIT

**Storage Unit(s)**

- T1_DE_KIT_Buffer
- T1_DE_KIT_Disk
- T1_DE_KIT_MSS

**Backup Squid(s)**

- This facility isn't hosting any backup squids.

**Frontier(s)**

- This facility isn't hosting any frontiers.
**General details and links to other objects.**

Facility is linked to a GocDB/OIM site (which is an experiment independent concept defined in CORE part of CRIC)

**Per-Facility authorization groups** mapped to users and CERN e-groups.

**Aggregation of Experiment specific objects** like Sites, Compute and Storage units ...
Experiment specific concepts. CMS Facility example

- General details and links to other objects.
  - Facility is linked to a GocDB/OIM site (which is an experiment independent concept defined in CORE part of CRIC)

- Per-Facility authorization groups mapped to users and CERN e-groups.

- Track the history of changes for given object

- Aggregation of Experiment specific objects like Sites, Compute and Storage units...
Experiment-specific concepts. Computing resource example

➢ Experiments use different systems to submit jobs in the grid

➢ **CMS** is submitting Pilots through **GlideinWMS**. Currently GlideinWMS configuration is described in the XML files hosted by Github. This configuration has been imported into CRIC.

➢ **ATLAS** is submitting Pilots through AutoPilotFactories (APF), ARC ControlTower (aCT), and now Harvester.
  ○ These frameworks require config files which describe the Computing Elements (and batch system underlying)
  ○ These configs are auto-generated from AGIS, exploiting the resource description in "core", and in the future will come from **CRIC**
Status and plans

➢ CMS CRIC instance is ready for validation by the CMS community
➢ Ongoing implementation of CRIC instance for WLCG central operations. It represents CORE part with sites and services used by all 4 LHC experiments

Next steps:

➢ Porting REBUS functionality into CRIC
➢ Extending CMS CRIC functionality following CMS feedback
➢ Migrating AGIS to ATLAS CRIC
Conclusions

➢ All LHC experiments are sharing common computing infrastructure. CRIC offers a common framework describing this infrastructure, but also an advanced functionality to describe all necessary experiment-specific configuration. The way the system is designed each experiment can independently describe it’s world and still coexist with the others under the same roof.

➢ First CRIC version mainly focused on the CMS-required functionality is ready for validation. We need you to start using CMS CRIC and provide us with use cases you think need improvement and error-proofing!

➢ Check CRIC at http://cms-cric-qa-01.cern.ch