Evolution of the WLCG Information Infrastructure

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Resources used by the LHC experiments

- WLCG includes more than 170 GRID sites
- Relies on EGI, OSG and Nordic (NeIC) infrastructures
- Apart of classical GRID sites , more and more resources are provided by public clouds and HPCs
- Fraction of resources provided opportunistically is steadily increasing
- New compute and storage architectures

Evolving from a quite static set of resources to a very dynamic and more heterogeneous set

Challenges

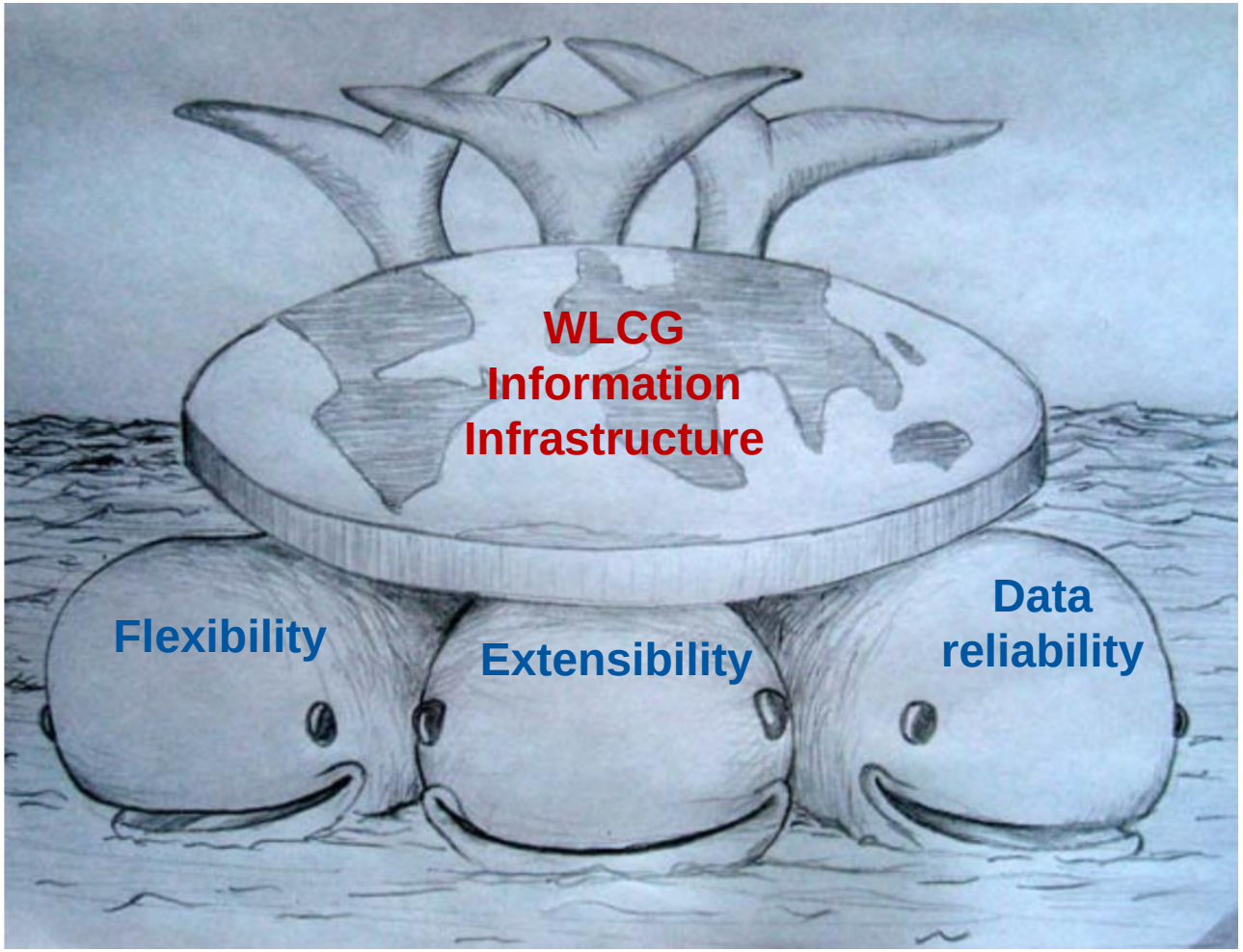
- Need to react/adapt quickly to the technology evolution, changes in the procurement modes and computing models of the experiments.
- Need for integration of new heterogeneous resources
- Less control on the resource providers, therefore can not expect to enforce everywhere solutions like BDII. Rather foresee lightweight approach.
- Data reliability is often an issue. Data coming from multiple sources easily becomes contradictory. For every use case and data type need to define a canonical info source and make sure that it provides correct data
- Resource optimization becomes extremely important. Information system should be able to host data required for resource optimization. Examples: QoS for storage, network matrix, etc…

The goal is to address all those problems once for all experiments

What can help

- WLCG (including experiment operations) has a central operational model. Allows to reduce the complexity of the Information System which has been designed for a fully distributed operational model (BDII).
- Experiments mainly rely on static and semi-static data. This can simplify implementation of the primary info providers.
- Build on the experience we have accumulated so far. Development of the Computing Resources Information Catalogue (CRIC) has been inspired by the success of the ATLAS Grid Information System (AGIS).
- Common solutions shared by the experiments, correspondingly common data models and interfaces. Rucio is a good example.

How WLCG Information Infrastructure should evolve



Data reliability

- Why information systems developed by the LHC experiments (AGIS, DIRAC…) are more successful in providing reliable data ?
  - Data is validated by its constant use
  - Faulty info can be changed in place, without waiting for correction at the primary source and propagating through the complete chain
  - Well defined content required for the experiment operations

These principles should be taken on board while evolving WLCG information infrastructure

Current WLCG Information Infrastructure

- Currently consists of multiple central components:
  - BDII for static and dynamic data describing distributed services
  - GocDB and OSG repository. Mostly static information. Service endpoints, downtime information, information about support units
  - REBUS for WLCG MoU info: pledges and federation topology
- LHC VOs have developed their own ISs in order to add experiment specific information and cope with various info sources

New components

- **Primary data sources** for service level information.
- **Central topology and configuration service** which collects and validates data from all kind of primary sources. Provides possibility to correct data by authorized users. Provides common set of UIs and APIs for all interested clients. Sends notifications in case of spotted inconsistencies or/and errors
- Both should be compatible in terms of data structures for service description

Primary data sources for service level information

Current

For static and dynamic information

Service BDII -> Site BDII -> Top level BDII
GLUE schema and ldap protocol

BDII usage is limited to the EGI classical GRID sites.
Not used for the OSG sites, Cloud and HPC resources

New

Focus on static and semi-static information

Lightweight format for the description of storage and compute resources:
Storage Resource Reporting **SRR**
Compute Resource Reporting **CRR**

We want to start with **minimal, clean, consolidated data sets** which can be easily provided for any kind of resources
Easy to extend if required (flexibility and extensibility)
Both **CRR** and **SRR** have been developed following GLUE2 experience

SRR and CRR implementation and deployment

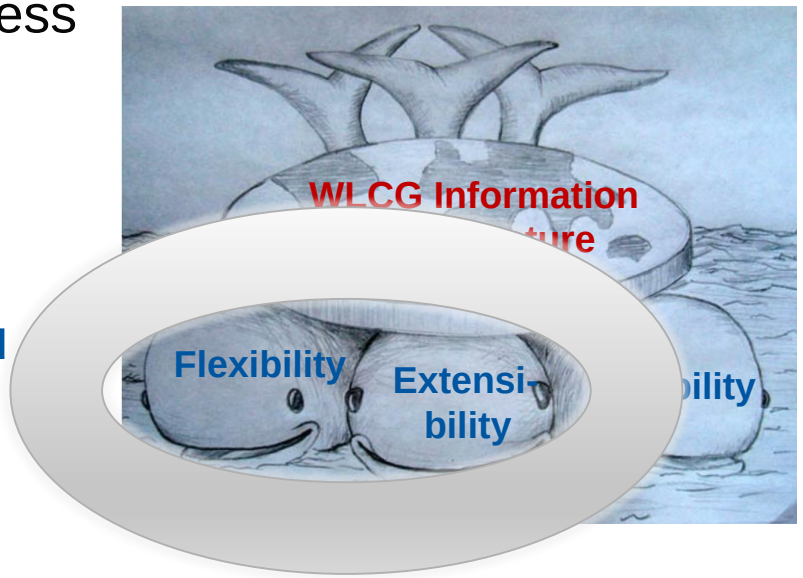
- SRR and CRR should be published in a form of json files accessed via http protocol. Corresponding URLs recorded in the central system like GocDB and/or CRIC.
- JSONs are testable against a version controlled JSON schema
- Work with all storage middleware providers in order to enable SRR generated by storage services. All of them put in place first SRR prototype. More details.
- DPM is the most advanced one. DPM Upgrade Task Force has been setup to upgrade sites to the release supporting SRR. More than 30% of the DPM sites used by the LHC experiments have already enabled SRR.
- WLCG dCache Upgrade Task Force has been setup to upgrade WLCG dCache sites to the release supporting SRR.
- CRR format has been agreed by the WLCG IS Evolution Task Force. Implementation of CRR by the pioneer sites is ongoing. Was prototyped not only for classical batch resources, but also for cloud resources (vac & vcycle)

Central Topology and Configuration Service

- Computing Resources Information Catalogue (CRIC) is a high level information system aiming to describe the topology of the WLCG infrastructure and other resources used by the LHC experiments (HPC, clouds, etc…) and experiment-specific configuration required to exploit these resources according to the experiments Computing models.
- **Share what is common, customize what is specific**
- Inspired by ATLAS Grid Information System (AGIS). Evolving AGIS towards common global solution.
- Functionality is addressing the needs of the particular experiments and/or WLCG central operations
- CRIC should become a central entry point for all kinds of WLCG topology and configuration information

Lego bricks like approach

- Plugin based -> straightforward customization to address various experiment requirements and implementation of the dedicated experiment instances
- Shared building blocks -> common look and feel and optimized development process
- Flexibility in terms of
  - **primary information sources,**
  - **applied authentication authorization methods,**
  - **utilization of Permissions, Roles and Groups at various level,**
  - **customized UIs and APIs**
  - …



- CRIC design principles allow to extend the system in order to follow technology evolution and changes in the experiment computing models and applications.

CRIC structure

WLCG CRIC
Extension of CORE CRIC to support LHCb and ALICE and WLCG central operations tasks

CMS CRIC
To describe CMS - specific configuration required to use provided resources

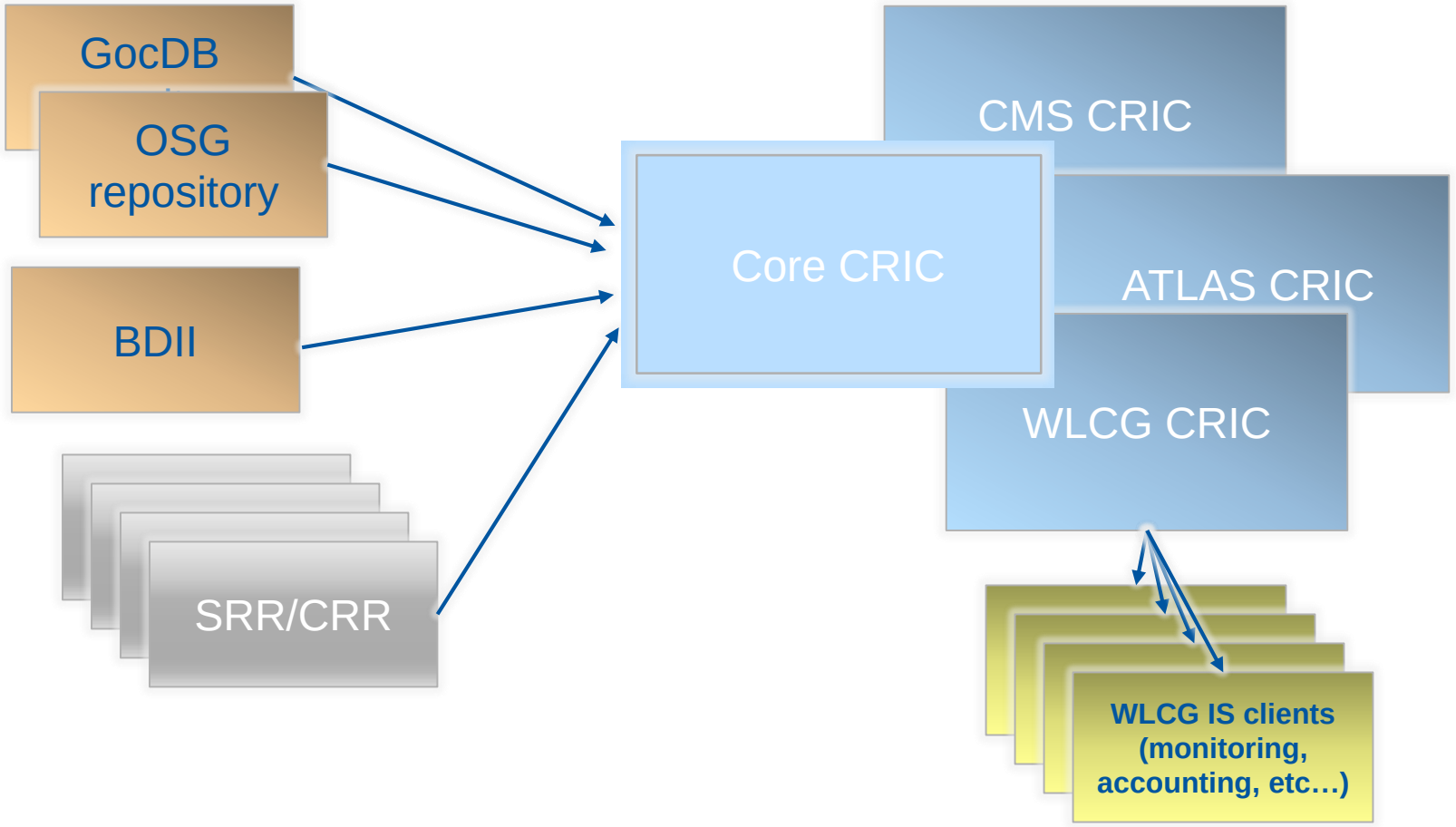
CORE CRIC
To describe resources provided to the LHC experiments

DOMA CRIC
To provide additional configuration required for TPC tests

Every CRIC instance contains CORE part and one of the blue plugins

ATLAS CRIC
To describe ATLAS-specific configuration required to use provided resources

Data flow


GocDB
OSG repository
BDII
SRR/CRR
Core CRIC
CMS CRIC
ATLAS CRIC
WLCG CRIC
WLCG IS clients (monitoring, accounting, etc…)

Conclusions

- WLCG information infrastructure is evolving in order to follow technology evolution and respond the needs of the LHC experiments and various procurement modes…
- Two directions of work : lightweight primary information sources for the distributed services and central topology and configuration system. Good progress done in both directions
- We aim to provide a flexible and extensible infrastructure which can be quickly adopted for ever-changing environment