ARC’s view on the European (Grid) Middleware Initiative: role, objectives and migration plans

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Nordunet Conference,
17th September 2009, Copenhagen
Outline

- The Advanced Resource Connector
  - a highly efficient production middleware
  - with lots of promising new developments...
- The European Middleware, the way ARC would like to see it
- What can ARC offer for EMI/UMD/EGI?
- Conclusion

*thanks to Oxana Smirnova for the numerous nice slides*
ARC Today

- Reliable, efficient and easy-to-handle open source middleware, in production since 2002
- Best suits high-throughput distributed computing
- Totally independent, very portable code base
  - GSI-based

- Clear separation of cluster and grid layer
  - No grid layer on the nodes (unless required by users)
  - Powerful input/output grid data handling by the front-end
    - Dramatically increases CPU utilization
    - Automatically allows for data caching
  - ARC frontend: all grid related operations
  - ARC infosys: efficient, reliable, distributed, dynamic

- Resource discovery and brokering encapsulated in the client
  - No single point of failure, ARC clients act as “agents”
  - Redundancy, mobility, scalability
  - Based on a powerful client API, ARCLIB
Why our users like ARC

- Best suited for **shared community** resources:
  - **Perfectly portable** (RedHat &Co, Debian &Co)
  - Has interfaces to **most major batch systems**
    - Any new batch system can easily be plugged in
  - **Minimal intrusiveness**, minimal footprint
  - Orders of magnitude **simpler** installation and maintenance (comparing to other solutions)
    - Suits a 1-CPU “site” and a 3000+ cores Top500 monster
  - **Very low Grid failure rate**, transparent downtime handling
  - Versatile, **portable CLI**: ~14 MB in size, needs no root privileges
    - Does everything from SRM storage listing to brokering

⇒ **Saves customers’ time and taxpayers’ money**
Disclaimer: information shown here is incomplete and was collected by Oxana Smirnova in half an hour by asking people around and googling

- Biophysics
- Biochemistry
- Computational chemistry
- Quantum chemistry
  - GAMESS
- Molecular dynamics
  - GAUSSIAN, DALTON, MOLDEN
- Bioinformatics
  - Taverna
  - BLAST, HMMER
  - eQTL
- Language studies
- Solid state physics
- Computational physics
- Mathematical crystallography
- Informatics, mathematical logic clause solving
- Automatic malware comparison
- Medical imaging
- Simulation of avalanche dynamics
- HEP
  - ATLAS, IceCube, CMS, ALICE, LHCb tested
- CO2 sequestration
- Other materials sciences
ARC performance: NDGF in ATLAS production

ATLAS VO CPU–time per Tier1 in 2008

- Europe
- Asia
- America

Kit, PIC, IN2P3, INFN, NDGF, NITI, RAL, ASGC, TRIUMF, BNL
ARC performance: NDGF in ATLAS production

99% efficiency
Continous improvements triggered by production

- Support for LFC file transfers
- Dynamic transfer lists
- Faster job processing/throughput
- Grid-Manager scalability → job processing slaves
- Fair-share for job processing
- Distributed cache (Nordugrid wide) → Virtual T2
- Cache-aware job brokering

*The results of the community-requested rapid developments are injected into production ARC releases (0.8.x)*
New developments or... if it ain’t broken, why fix?

It is started because ....

Remember, Grid is about resource sharing

When different applications need to use different infrastructures, standards must be in place

When we started in 2002, there were no standards

Today, we need to add standard interfaces to the existing services

If everybody does it, we’ll have the interoperable Grid of our dreams
HED ing towards a better ARC

- Standard WS interfaces
- Better modularity
- Extensibility
- Self-sufficient core components
  - No 3rd party dependencies
- Portability
- Re-designed security
- User-friendly
- Developer-friendly
Fruits of the non-intrusive development

- **A-REX**
  - The flagship HED service implementing a Computing Element (CE)
  - JSDL/BES/GLUE2 with ARC extensions
  - Available as part of the 0.8 production ARC release
  - Based on the good-old Grid-Manager
  - Comes with all the production-triggered improvements
Fruits of the non-intrusive development

- **Libarcclient** (including libarcdata2) and **arc** util
  - Implemented in C++ but comes with Python and JAVA wrappers
  - Modular, plugin-based
    - with powerful **existing** plugins for pre-WS ARC, gLite, Unicore services, variety of brokering algorithms
  - Backward compatible with previous ARC servers
  - Available on Windows, MAC–OSXGrid
Fruits of the non-intrusive development

Chelonia distributed storage solution implemented within HED
- Global namespace
- Supports collections and sub-collection to any depth
- Automatic replication

A-Hash: a replicated database to store metadata;
Librarian: handles
- metadata and hierarchy of collections and files
- the location of replicas
- health data of the Shepherd services

Bartender: high-level interface for the users and for other services
Shepherd: manages storage services, and provides a simple interface for storing files on storage nodes

Watch online www.youtube.com/watch?v=NEUWzGHHGhc
or see the demo live at EGEE09 in Barcelona
Fruits of the non-intrusive development

- **ISIS**
  - P2P information system backbone
  - stores service registrations
  - WS interface to insert/query registration info
  - a new generation ARC service implemented within HED

- **Security services**
  - Charon
  - FruitFly
  - Shibbridge
European middleware landscape: Today
European middleware landscape: possible future without EMI
Harmonization takes us to a better future

Only if it is done the right way:

- Can’t keep everything
- Remove unnecessary obstacles
- Quick hacks are not the solution

Roundabout built with EU funds
European middleware landscape: Tomorrow
How can ARC contribute to European middleware?

- **Convergence process:**
  - Interoperability experience with gLite, Unicore
  - Standardization background (GLUE, PGI, ...)
  - Ready-to-use development framework (HED)
  - Commitment to perform the agreed changes within the ARC software stack

- **EMI distribution:**
  - Easy-to-deploy components
    - Minimal & reasonable set of external dependencies
    - Distributed through **standard channels**
  - Userfriendly components (easy-to-use clients)
  - Components with low operational & maintenance cost
  - Components available on multiple platforms
    - major Linuxes, Windows, MAC, Solaris
  - Highly efficient & reliable services
How can ARC contribute to European middleware?

**Inventory** of the proposed ARC components:

- **Computing:**
  - *Grid-Manager, A-REX, libarcclient, ng*, *arc*, JURA
- **Data:**
  - *Classic SE, libarcdatal, ng* *data*, *arc* *data*, Chelonia
- **Info:**
  - *Infoserver, Infoindex, ALIS, ISIS, libarcclient, Grid Monitor*
- **Security:**
  - *HED security, arcproxy*
- **Internal:**
  - *HED*

Please note:

- Several *components* on the list are target for phase out
- There are components which we consider as the basis for a new commonly developed EMI component
- All ARC components are open for harmonization-related development
Summary

- ARC is a well-respected middleware, proven to be in many aspects superior to other analogous products
  - Deployed by a number of national infrastructures
  - Actively developed
  - Coordinated by NorduGrid (repositories, releases, issue tracking, documentation, support etc)
- ARC considers EGI/UMI/EMI as THE opportunity to achieve convergence of the middleware stacks
  - Standard-based interoperability of components
- ARC is prepared for the challenges posed by EMI/UMD
  - Strong commitments for the needed HARMONIZATION work
  - Wealth of experience concerning interop. and harmonization
  - Available framework to carry out the necessary modifications
  - Can offer components which will bring added value to an European middleware distribution
Further information on ARC

- **Wealth of information on**
  - www.nordugrid.org and www.knowarc.eu

- **The original ARC “white paper”:**

- **An update containing information about new components:**
  - “ARC middleware: evolution towards standards-based interoperability”, to appear in CHEP09 proceedings

- **Code:**
  - svn.nordugrid.org -> arc0 and arc1 directories of the nordugrid repository
  - download.nordugrid.org -> official source and binary packages, external software

- **The community:**
  - Check out, sing up for the nordugrid-discuss mailing list
  - Attend some of the Technical Meetings or Conferences