ARC “NOX” AND THE ROADMAP
TO THE UNIFIED EUROPEAN MIDDLEWARE

GRID- 2010, Dubna, July 2 2010

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Outlook

- Usage of ARC in NDGF and ATLAS
- Overview of the latest ARC release
- Future of European middleware development and ARC
NDGF Facility - end 2009

All resources belong to local providers
NDGF “cloud” in ATLAS

2010-04-01 22:00:00 – 2010-04-30 02:59:59

- 99% efficiency
- Very few errors
- Includes sites from far away

99% efficiency
ATLAS storage in NDGF - data

Used disk space for NDGF-T1_DATADISK

Costability disk usage evolution at NDGF-T1_DATADISK acc. to DQ2
ATLAS storage in NDGF - MC

Used disk space for NDGF-T1_MCDISK

Custodality disk usage evolution at NDGF-T1_MCDISK acc. to dq2

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ATLAS production in the Nordic “cloud”, 2009

ND - year

- activated
- assigned
- holding
- running
- transferring
- finished (12hrs)
- failed (12hrs)
- waiting

Range from Mon Jun 1 00:00:00 2009 UTC to Mon May 31 00:00:00 2010 UTC
Generated by TRIUMF-LCG2 (times in UTC)
All this is using “traditional” ARC
ARC has changed a lot meanwhile

- Code base restructured
  - New SVN repository ("arc1") – base for ARC Nox releases
  - Still a lot of code in "arc0", gradual transition

- Architecture changes
  - Main principles are the same
  - Increased modularity: single service hosting layer, HED
  - Globus/GSI is not needed (separate plugin), standard HTTP(s) instead

- Some new components (see later)

- True portability
  - Windows, Mac, Solaris
  - C++ and language bindings for Python and Java (in progress)

- We are in Linux distributions
  - Packages available in Debian (also Ubuntu), Fedora (EPEL -> RedHat, CEntOS)

- Interoperability improvements
  - Adherence to standards
  - Many are not practically useful: trying to fix them via OGF PGI- WG
 ARC Releases

- Latest production ARC release: 0.8.2.2
  - Bugfix release on the 0.8.2
  - Significantly changed information system internals
  - Contains both "traditional" and selected Nox components (optional)
  - Came out in June 2010
  - http://wiki.nordugrid.org/index.php/ARC_v0.8.2

- Latest technology preview ARC release: nox-1.1.0
  - Concise distribution of the new components from arc1 tree
  - Not recommended for production deployment
  - Came out in May 2010
- Same philosophy
  - compute, info, data areas
- Everything is in HED
  - HED is a Web Service container
  - Handles all external interfaces
  - Built-in modularity
  - Flexible security
Two solutions available as an ARC CE:

1) "Traditional" pre Web Service CE
   - Proprietary interface via GridFTP plugin
   - Grid Manager behind (data staging, cache, LRMS interface, RTE, etc.)
   - Resource and job info published via LDAP

2) A-REX, or Web Service CE – introduced in Nox
   - Standard compliant WS interface (extended BES, JSDL, GLUE)
   - The "same" Grid Manager behind but benefits from the HED
   - Some extra features: e.g. RTE deployment (Janitor)
   - Resource and job info published via WS-RF and BES

Deployment: possible to mix the two, run several GMs
   - Deploy A-REX with a GridFTP plugin interface
   - Multiple Grid Managers can run behind single interface
   - Available in ARC 0.8.x
   - Migration guide: wiki.nordugrid.org/index.php/Gm_to_arex_migration
ARC has no own logging/bookkeeping service
But there are modules that can publish information to 3rd party services (currently SGAS)
The ARC Computing Elements come with accounting "modules"
- Prepare usage record for Grid jobs
- Submit records to SGAS logging database

Two modules are available:
- JURA: collects records of A-REX and logs to SGAS server
- Urlogger: collects records of Grid Manager and logs to SGAS 3 server
"Traditional" LDAP-based solution, inspired by MDS

- **Local infosys ("GRIS")**
  - ARC release 0.8.0 introduced BDII into ARC replacing Globus LDAP backend
  - Version 0.8.2 moved to BDII version 5

- **Index service ("EGIIS")**
  - ARC release 0.8.0 introduced a replacement for Globus GIIS backend
  - Reimplementation of the infoindex slapd wrapper in v0.8.2
  - Ready for roll-out
New WS-based solution for Nox

- **LIDI - the local information system**
  - WSRF interface via HED
  - Every service describes itself through the LIDI interface
  - A-REX LIDI: GLUE2 compliant

- **ISIS - information indexing service**
  - WS-interface
  - Peer-to-peer infosys backbone
  - Sort of service registry
"Traditional" ARC has no own storage solution, but is interoperable with 3rd party SRM storages, especially dCache

Nox comes with Chelonia

- Self-healing flexible storage cloud system
- User friendly interface: FUSE mounting
  - Automatic restoration of number of replicas if storage components fall out
- Set of services

- Watch it on youtube: www.youtube.com/watch?v=NEUWzGHHGhc
- Or try it out:
  - part of Nox release, also available in 0.8.2
Data area (2/3)

- Libarcdata library and arc* client tools
  - Simple CLI to move files around, supports many protocols

- Data capabilities of Grid Manager/ A-REX
  - Staging (uploaders/downloaders)
    - fair-share system for transfers which splits transfer slots evenly between users or VOMS VOs/roles/groups
    - intelligent retry strategy for failed data transfers with exponential back-off for temporary errors
    - dynamic output files
    - multiple Grid Managers (or A-REXes) can be run under one GridFTP server to improve throughput
    - the SRM port/protocol ambiguity problem is solved by caching SRM information
- **Cache**
  - Grid Manager can use "remote" caches managed by another GM on the same site
  - added authentication caching so continuous permission checking at source is not needed
  - caches can be cleanly drained before taken offline
  - added ability to specify a lifetime for cache files
  - optimizations in the cleaning tool

- **BUT:**
  - There is a strong need for a new data handling system
  - Expert group is developing a new architecture
"Traditional" ARC: GSI
In Nox, all security is handled by HED
- Capability to support almost "everything" (TLS, SAML, GSI, VOMS, MyProxy, ...)

Quite straightforward integration with 3rd party services
- First steps taken with ARGUS

arcproxy command line interface
- Creates all kinds of proxy certificates
- Complete re-implementation, available even on MS Windows

Plus a large zoo of proof-of-concept services and clients developed (or re-implemented) for Nox
- Charon, FruitFly, ARC-VOMS, etc...
"Client" area

- arc* commands introduced in Nox
  - MS Windows, Mac OS, Linuxes
- "Traditional" standalone client package
  - Still the fastest way to Grid
  - Available for many Linux platforms
- and there is finally a graphical client: ArcJobTool
  - Written in Python
  - Utilizes libarclient features
  - Has a Web portal incarnation
  - Code: sourceforge.net/projects/laportal/
  - Movie: www.youtube.com/watch?v=eXgwpip8L6k
Interoperability

- **Dream:**
  - offer standards-based interoperability with other popular middlewares: gLite, Unicore, Globus, etc

- **Reality:**
  - Standards are not suitable for production needs
  - Support for existing standards varies a lot among middlewares
    - When implemented it comes with "dialects" and own extensions

- **Involvement in ongoing standardization**
  - OGF is the main forum
  - Interoperability demos with "hello grid" based on BES, JSDL, ...
  - OGF tutorials
  - Production Grid Infrastructures Working Group (PGI) effort to define a better standard

- **Nox modularity makes interoperability easier**
- EGEE paved way to EGI
  - A common infrastructure needs a Unified Middleware Distribution – UMD
  - However, Europeans today use gLite, Globus, UNICORE and ARC
  - Unifying all these is a huge challenge

- European Middleware Initiative (EMI) aims at finding convergence between ARC, gLite and UNICORE
  - Define common interfaces
  - Develop common solutions where possible
  - Harmonise components, get rid of redundant ones
  - Produce bundled releases, candidates for UMD inclusion
  - Includes dCache, too
EMI “Day 0” release will include all the components that are used today in production infrastructures

“Traditional” components will be gradually phased out
- Grid Manager to be replaced with A-REX
- Old ng* clients and library to be replaced with new arc* clients and library
- Information system – yet to be defined by the EMI, definitely Glue2 based
- Storage solution: common EMI effort, lead by dCache
- We also would like to get rid of Globus and GSI completely
  • Strong desire to rely on industry standards, especially in security

Not all Nox components are embraced by EMI (yet)
- Will be maintained and developed by ARC community
Community around ARC

- Headquarters in Scandinavia (NorduGrid), but contributors and users everywhere
  - Ukrainian Academic Grid powered by ARC – the largest national Grid
  - Last two NorduGrid conferences in Hungary and Slovenia

- An Open Source development community
  - Mail forum, technical workshops, conferences
  - SVN, build system, Bugzilla, user support, etc...
  - Just write to nordugrid-support@nordugrid.org if you want to contribute or having problems

- Healthy mixture of developers, sysadmins and (extra)ordinary users
  - Academic environment, lots of volunteer work
  - Crazy but good-natured people

- Patchy funding from national, regional and EU projects
  - "Old": NGN, EU KnowARC, NDGF, NGIn, ...
  - "New": EU EMI, EU EGI-InSPIRE, EU EDGI, EU IGE, new NDGF
  - Projects come and go, NorduGrid community stays
Instead of summary: challenges

- Deliver future releases in sync with EMI
- Improve systematic testing – with help from EMI
- Implement common EMI interfaces
- Carry out EMI security integration
- Re-engineer the data staging
- Improve configuration of Nox components
- Finalize the prototypes, preview components
- Phase out all “traditional” components, get rid of the old SVN tree
- Find answers for new architecture approaches (clouds, pilot/agent jobs etc)
- Continue porting and Linux inclusion work
- Improve documentation and distribution channels
- One day celebrate ARC-1.0 😊