

ARC integration for CMS

Erik Edelmann², Laurence Field³, Jaime Frey⁴, Michael Grønager²,
Kalle Happonen¹, Daniel Johansson², Josva Kleist², Jukka Klem¹,
Jesper Koivumäki¹, Tomas Lindén¹, Antti Pirinen¹, Di Qing³

¹ Helsinki Institute of Physics

² Nordic Data Grid Facility

³ CERN

⁴ University of Wisconsin

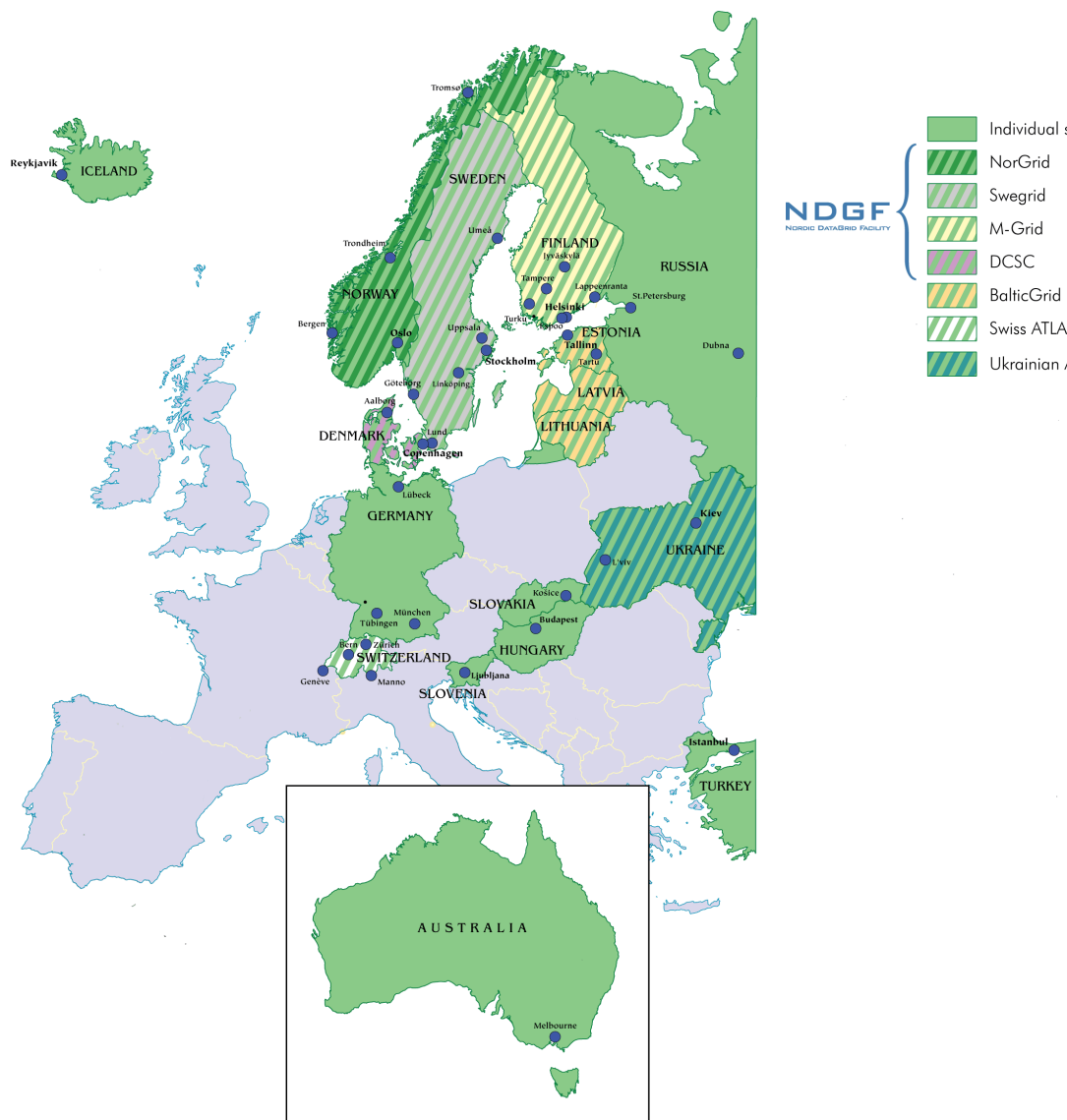
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3. Interoperability
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7. Summary

1. Advanced Resource Connector (ARC)



- The Nordugrid Advanced Resource Connector (ARC) middleware, main middleware in the Nordic countries
- NorduGrid up since 2002, now O(37000) cores.
- The Nordic Data Grid Facility (NDGF), the distributed Tier-1 computing facility uses ARC for LHC- and other VO:s.
- NDGF funded by Denmark, Finland, Norway and Sweden, mostly manpower, little hardware
- ARC development
 - NorduGrid collaboration
 - KnowARC, 6 M€ (EU)
- Released for major Linux distributions
- 64-bit support since at least 2005
- User Interface trivial to install



ARC deployment.

1. Advanced Resource Connector (ARC)

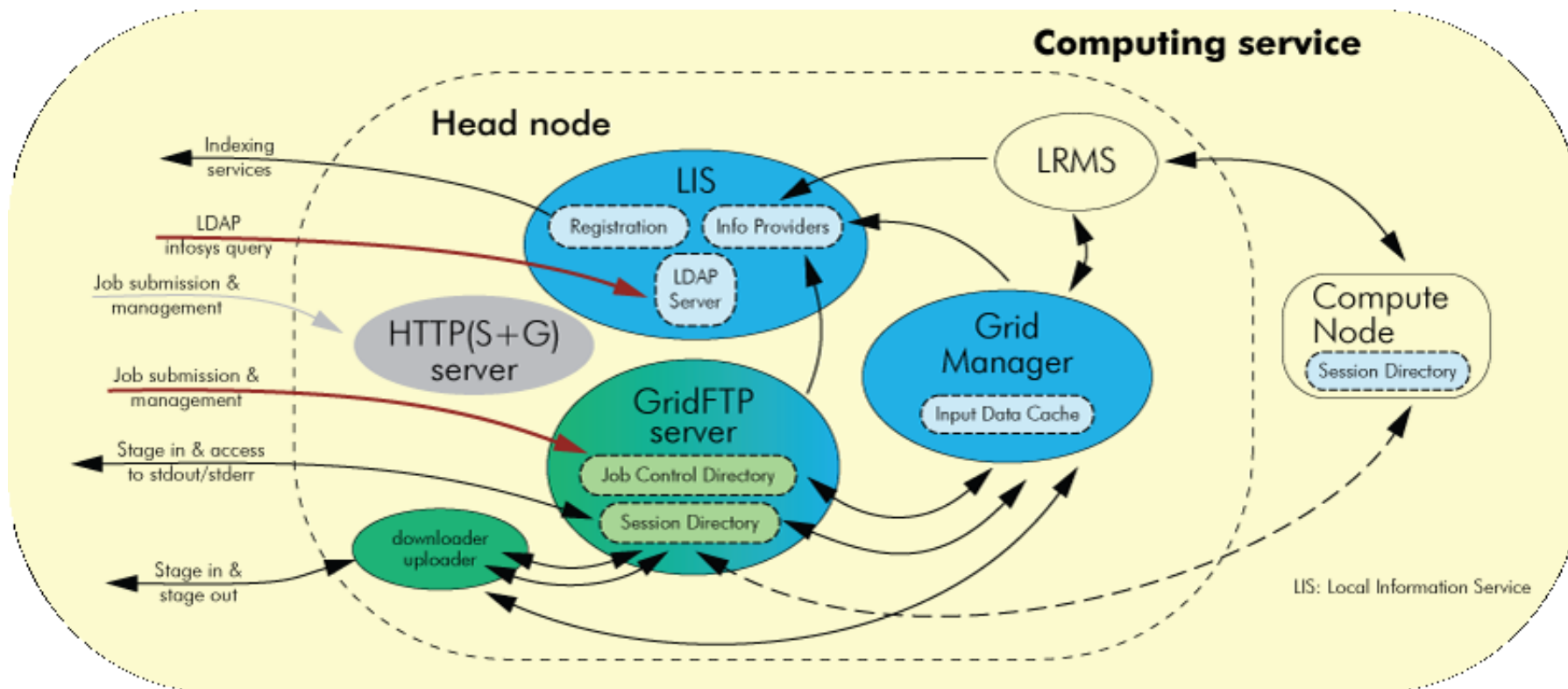


Figure 1: The ARC computing service.

Design features of ARC

- Brokering is in the UI to avoid scaling problems
- No middleware required on Worker Nodes since the GridManager usually handles the file I/O
- Jobs run only when the GridManager has transferred the input files, CPU efficiency can be higher than in the gLite model

Two ARC branches:

- Stable ARC 0.6x series
- Development series ARC1 by KnowARC

For more details on ARC see:

- NorduGrid website: <http://www.nordugrid.org>
- Budapest October 2008 ARC conference:
<http://indico.hep.lu.se/conferenceDisplay.py?confId=616>

Scaling features of ARC

- Several GridManager servers can be used on large sites for scaling
- Session directories can be served by several (NFS) servers
- Caching supported by GridManager to reduce file I/O

ARC and EGI

- ARC components have been selected to be part of Universal Middleware Distribution, <http://knowledge.eu-egi.eu/knowledge/index.php/UMD> for EGI, <http://web.eu-egi.eu/> together with gLite and UNICORE

2. ARC in Finland

- The Finnish grid infrastructure M-grid is built on ARC
- Future projects likely to use ARC
- Knowledge and support mostly available for ARC
- ALICE in Finland is part of Nordic Data Grid Facility (NDGF), the distributed Tier-1 resource, which uses ARC
- ALICE and CMS in Finland share the same CPU and disk hardware
- The CE:s used by the Finnish CMS Tier-2 are part of M-grid, so ARC was chosen for CMS

Goals:

- Enable CMS to run on ARC transparently with ProdAgent and CRAB
- Enable local users to use CMS tools natively with ARC

3. Interoperability

Difference between ARC, OSG and EGEE middlewares concerns mainly [1, 2]:

- job submission and description and information system

Service/component	ARC	OSG	EGEE
Job Submission	GridFTP	GRAM	GRAM/Condor
			GRAM*
Job Description	xRSL	JDL	JDL
Brokering	client	ReSS	WMS
Service Discovery	LDAP/BDII	LDAP/BDII	LDAP/BDII
Schema	ARC, GLUE v1.2	GLUE v1	GLUE v1.3
Storage Transfer	GridFTP	GridFTP	GridFTP
Storage Control	SRM	SRM	SRM
Security	GSI/VOMS	GSI/VOMS	GSI/VOMS

3. Interoperability

- User joins several grids
- Site joins several grids
- Application supports several grids (ProdAgent, CRAB)
- Gateway connects grids (NDGF gLite-ARC gateway)
- Middleware interoperability (WMS+Condor-G, glideinWMS+Condor-G)
- Standardized middleware API:s with interchangeable components (SRM protocol, implementations BeStMan, CASTOR, dCache, DPM, StoRM)

3. Interoperability

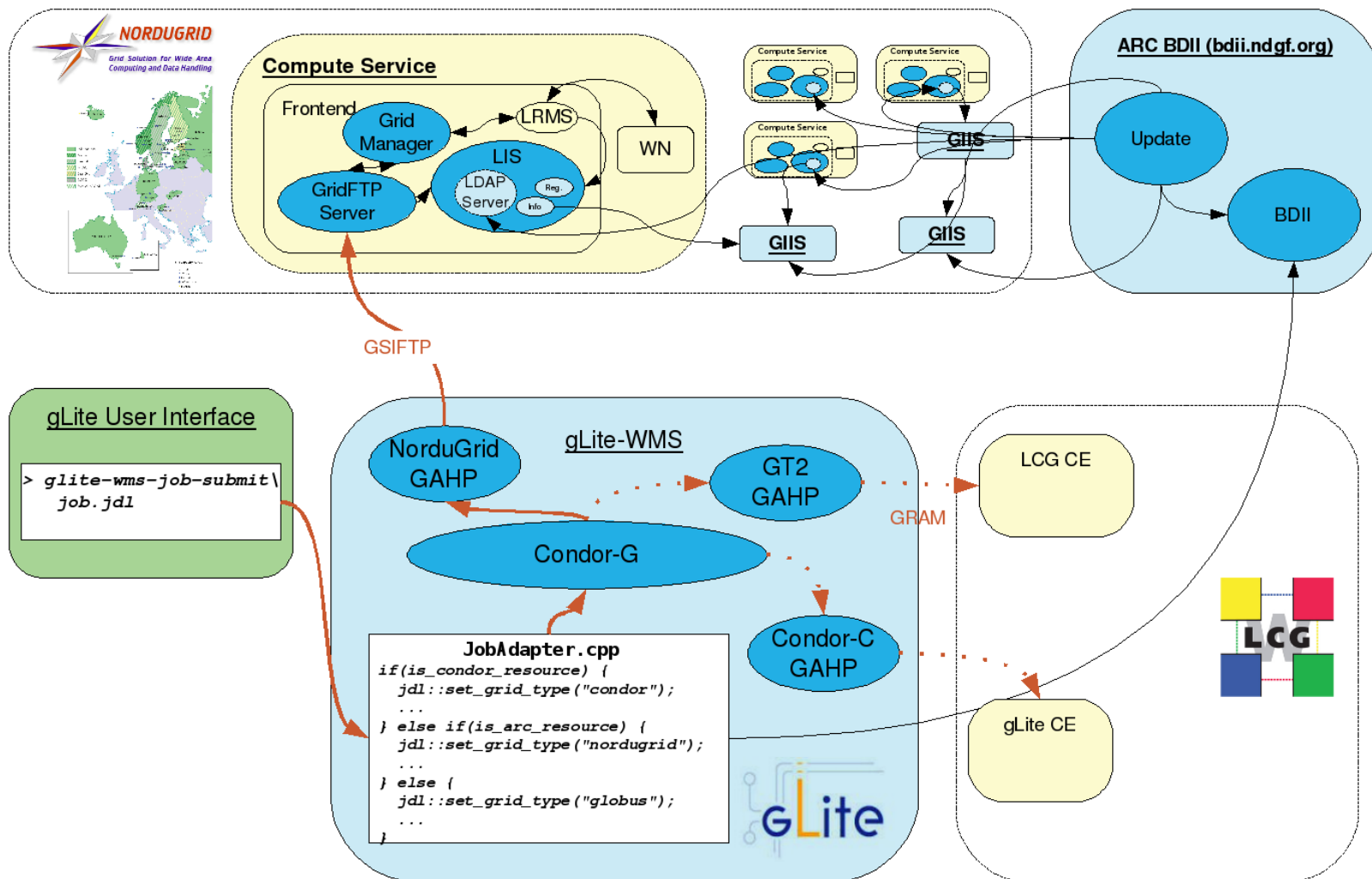


Figure 2: Submitting from gLite to ARC with Condor-G [1].

ProdAgent uses application level interoperability with plugins for different grids

- The ProdAgent ARC plugin uses ARC UI, no gLite dependency
- The ProdAgent ARC plugin is in production

CRAB submission is handled by gLite ARC interoperability

- The patched gLite WMS `arc-wms.cern.ch` can submit to ARC
- The ARC information system is translated into BDII by `bdii.ndgf.org`
- With the WMS submission any job can be run on ARC, provided that a gLite Runtime Environment (RE) is installed on the CE.
- The patch # 2397 to gLite WMS is being certified for deployment
- Once patch # 2397 is deployed all gLite WMS:s can do ARC submission
- The `glideinWMS` also uses Condor-G for ARC submission and this was demonstrated during CSA08

4. CMS applications

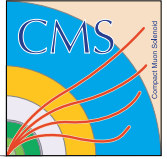


ARC CE	Jobs	Failed	Failure rate in %
ametisti	250	2	0,8
ametisti	500	2	0,4
ametisti	1000	2	0,2
sepeli	250	3	1,2
sepeli	1000	10	1,0
sepeli	2000	8	0,4

Example of CRAB job submission failure rate using arc-wms.cern.ch.

Service	Status	
CMSSW	OK	local manual installation https://twiki.cern.ch/twiki/bin/view/CMS/CMSSW_aptinstall
SRM(dCache)	OK	performance, xrootd issues, gsidcap? http://www.dcache.org/
PhEDEx	OK	Physics Experiment Data Exchange http://cmsdoc.cern.ch/cms/aprom/phedex/
Frontier	OK	Open source squid web cache http://frontier.cern.ch/squidstats/mrtgcms/hip/proxy-hit.
WLCG SAM	OK	WLCG Site Availabilty Monitoring
CMS SAM SRM	OK	CMS SRM Site Availabilty Monitoring https://twiki.cern.ch/twiki/bin/view/CMS/Dashboard
ProdAgent	OK	ARC plugin in production https://twiki.cern.ch/twiki/bin/view/CMS/ProdAgent
WLCG accounting	OK	Extract CMS SGAS information, inject into APEL

5. CMS and WLCG services



Service	Status	
CRAB		CMS Remote Analysis Builder http://cmsdoc.cern.ch/cms/ccs/wm/www/Crab/
	OK	gLite WMS to ARC submission, jobstatus needs to be improved
	OK	glideinWMS to ARC submission
	in progress	native CRAB ARC plugin, <i>jobsubmission possible</i>
CRABSERVER	pending	needs arc-wms configuration on all gLite WMS servers
JobRobot	OK	for site testing, monitoring
CMS SAM CE	in progress	CMS CE Site Availability Monitoring, tests VOMS roles
CMSSW	in progress	grid software installation jobs, tests VOMS roles

Problems

- Only arc-wms.cern.ch can presently submit to ARC resources. CRAB jobs submitted from other WMS servers abort.
- This problem will be solved by deployment of patch # 2397.
- VOMS problem on arc-wms.cern.ch is being debugged
- Only limited ARC jobstatus is passed through Condor-G to gLite WMS. Improvement needed to enhance jobsubmission, monitoring and debugging.
- The JobRobot jobs have a large abort rate, which needs to be understood
- Some submission problems are due to WMS configuration and dCache problems

Further work and development

- A native CRAB ARC plugin simplifies jobsubmission, ARC UI instead of gLite UI, gLite RE requirement can probably be removed
- Test CRABserver ARC submission
- Latest ARC can submit to CREAM CE:s. Test this for CRAB jobs
- Presently file I/O is done according to the CMS computing model so the ARC GridManager does not prestage the files
- Using ARC GridManager file handling might increase CPU efficiency and reliability for CE:s not on the same LAN as the "close" SE.
- Using GridManager for SE file I/O would enable file caching to decrease the file I/O bandwidth needs

7. Summary

- CMS can use ARC resources
- ProdAgent is using ARC resources
- CRAB jobs can be submitted with `arc-wms.cern.ch` and `glideinWMS`
- CRAB to ARC job failure rate is 1 % or less using `arc-wms.cern.ch`
- Native ARC CRAB plugin can submit jobs using ARC UI
- gLite WMS patch # 2397 deployment will enable ARC submission globally
- Detailed jobstatus information from ARC to gLite WMS needed
- Remaining CMS services are in progress (CMSSW installation jobs, CMS SAM CE tests)
- Performance might be improved by using more ARC GridManager features

References

- [1] *Interoperability Between ARC and the LCG/gLite Grid - a Status and Outlook* talk by Michael Grønager at 2nd Nordic Grid Neighbourhood Conference, <http://tinyurl.com/4cafsf>
- [2] *Interoperability between EGEE, NorduGrid and OSG via Cronus* talk by Sanjay Padhi at NorduGrid 2007 conference, <http://tinyurl.com/5xpymv>