# Status of Grid Interoperation Now (GIN) Interoperability Activities

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*e-Science 2007 Conference, Bangalore, India*

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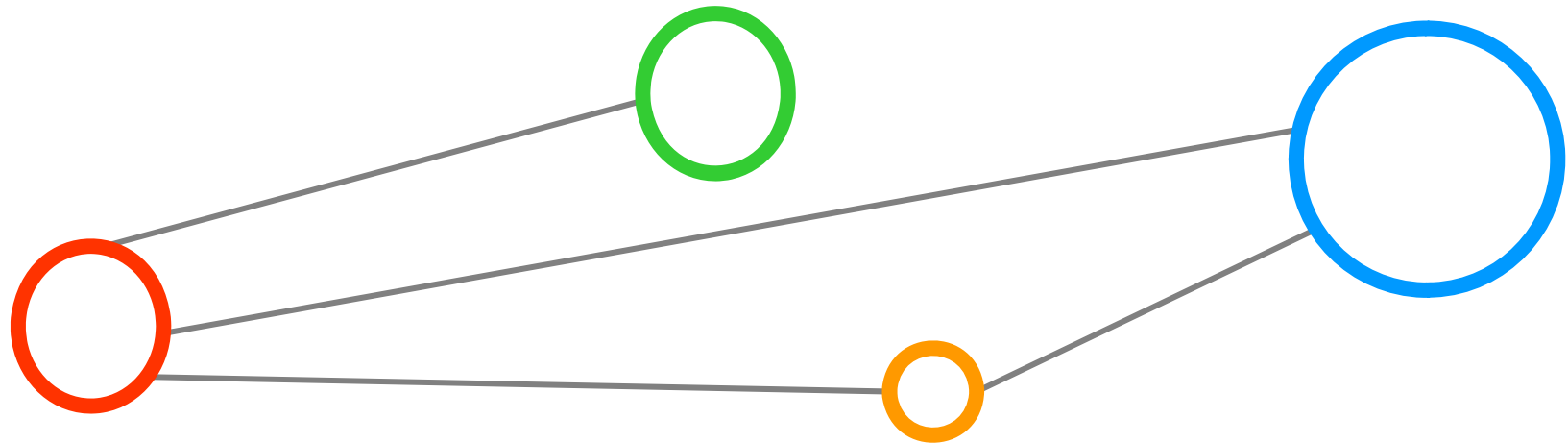
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# Outline

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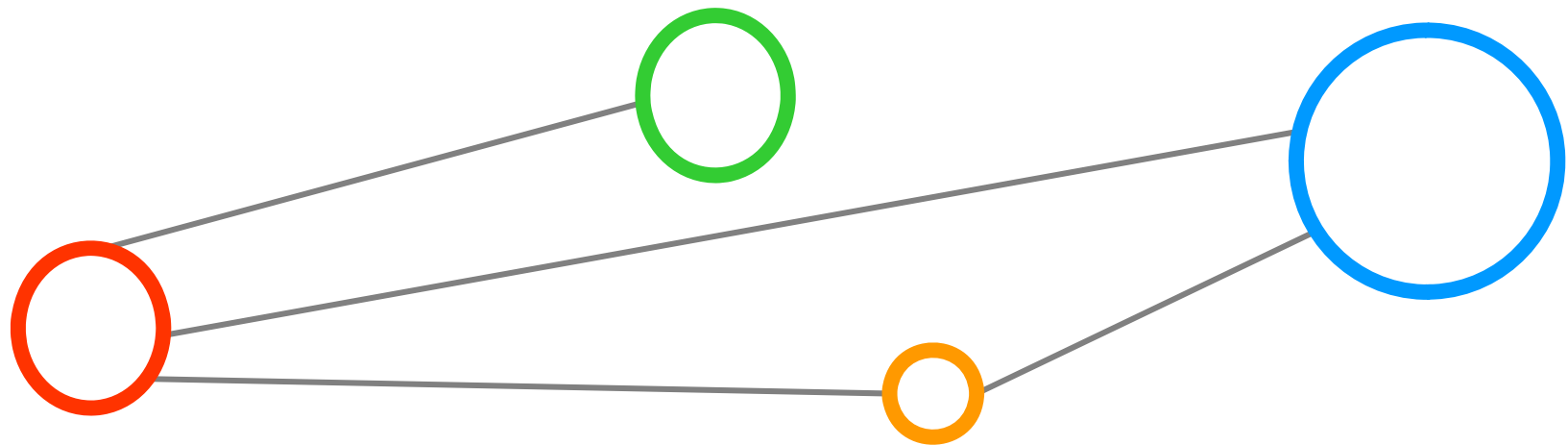
# Outline

- Motivation: Interdisciplinary e-Science & Interoperability
- Introduction: OGF GIN Group
  - Difference between Interoperation & Interoperability
- Overview of GIN Activities
  - Software Providers Meets GIN and Standards
  - SC06 and SC07 set of demonstrations
- Lessons Learned
  - SC Demos, OGF Experience Documents & Group Spin-offs
- Future Work & Conclusions
- References & Acknowledgements
- More Interoperability/Interoperation @e-Science 2007

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# Motivation

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# Motivation
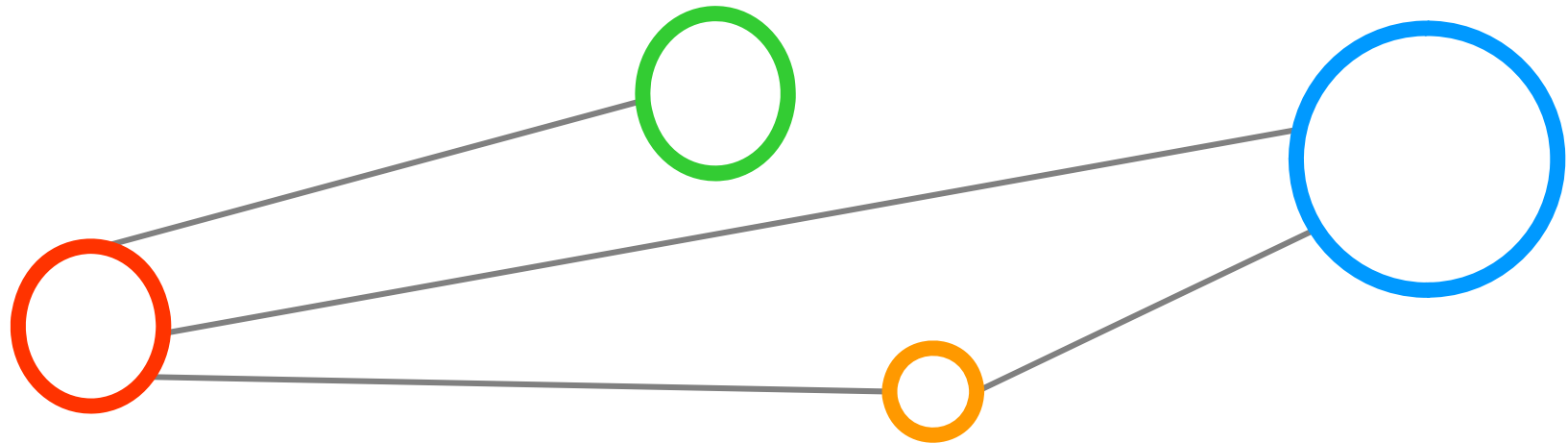
- Interdisciplinary e-Science is evolving…
  - Increasing complexity of Grid applications that embrace multiple physical models (i.e. multi-physics)
    - Usage of farming (embarrasingly parallel) in combination of usage of large scale supercomputers (massively parallel) in one scientific scenario
  - e-Scientists consider a larger range of scales (i.e. multi-scale)
    - Creating a steadily growing demand for compute power (and storage)
- Different 'types' of non-interoperable e-Infrastructures…
  - Often oriented towards specific types of computational resources
  - E.g. Enabling Grids for e-Science (EGEE) Infrastructure    EGEE [7]
    - Access to embarrassingly parallel computing systems
    - Suitable for farming applications (not high interconnectivity required)
  - E.g. Distributed European Infrastructure for Supercomputing Applícations (DEISA), TeraGrid Infrastructure    DEISA [3]    TeraGrid [6]
    - Access to massively parallel computing systems (i.e. supercomputers)
- e-Scientists can not use one client to access them

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# Introduction: OGF GIN

# Introduction: OGF GIN (1)

- Many production Grids have begun to offer production services to end-users in the past several years
    - E.g. EGEE, DEISA, D-Grid, NGS, TeraGrid, NAREGI, NGDF,…
    - Increasing number of (scientific) application projects that require access to a wide variety of resources in multiple e-Infrastructures
- The purpose of the Grid Interoperation Now (GIN) Community group of OGF is…
    <span>GIN-CG [5]</span>
    - …to manage and demonstrate a set of interoperation efforts among production Grids and e-Science infrastructures
        - E.g. Supercomputing 2006 and 2007 demonstrations of activities
    - …to provide lessons learned from production experience of certain standards to numerous OGF standardization groups
        - E.g. Job Submission Description Language (JSDL)   Anjomshoaa et al. [10]
    - … to point to areas where emerging standards have to be improved or are needed/missing at all
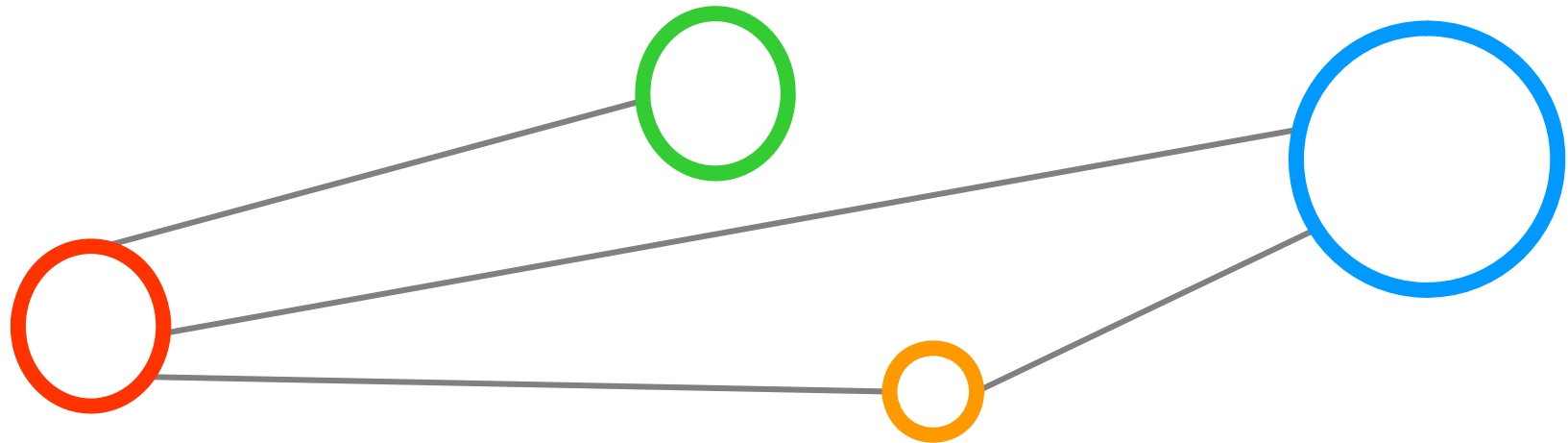        - E.g. GLUE Information schema   GLUE [23]

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# Introduction: OGF GIN (2)

- Why Grid INTEROPERATION Now (GIN) ?
  - We defined a difference between interoperability & interoperation
- Interoperation
  - Defined as what needs to be done to get production Grid and e-Science infrastructures to work together as a short-term solution
  - Use of much existing technologies and workarounds available
    - Often solutions that work with a specific technology version A and B
  - Not the perfect solution, but mostly the fastest one until standards are mature enough
- Interoperability
  - Defined as the native ability of Grids and Grid technologies to interact directly via common open standards in the near future
  - Within production e-Science infrastructures a rather long-term solution (but right solution able to sustain the interactions)
    - E.g. OGSA-Basic Execution Services (BES) an interesting standard, but not yet well adopted by Grid middleware providers  Foster et al. [11]
    - Solutions are sustained because technologies are compliant with interface

# Overview of GIN Activities

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# SW Providers meets GIN/OGF

- Event at the Open Grid Forum 21 Convention in Seattle
- Title: Software Providers Meets GIN and Standards
  - Attempted to discuss various topics that matter for production e-Infrastructures, middleware providers and standard groups
  - Panel Session held at OGF21 – "full room of the right people"
  - Many non GIN-members have stated much positive feedback about the session
    - E.g. Ravi Madduri (Globus Developer): "Best session ever had at an OGF"
- Panel Questions:
  - https://forge.gridforum.org/sf/wiki/do/viewPage/projects.gin/wiki/OGF21SoftwareForumPanelSession
- Participating Middleware Developers:
  - Globus, UNICORE, Condor, OMII-UK, GRIA, SRB/iRODS,…
- Participating Middleware Enhancers:
  - ARC, gLite, NAREGI, CROWN, VDT, OMII-Europe, …
- *Debriefing of this event at OGF22 in Cambridge*

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# SC06 and SC07 Demos

- OGF GIN organized a set of demonstrations between production Grids and e-Infrastructures
  - Supercomputing 2006 in Tampa, … USA
  - Supercomputing 2007 in Reno, NV, USA
    - http://forge.gridforum.org/sf/wiki/do/viewPage/projects.gin/wiki/GINSuperComputing2007
  - *We try to keep on doing this event…*
    *(early plans for Supercomputing 2008 in Austin, TX, USA)*
- Two approaches for demonstrations evolved
- (1) production
  - Using proprietary protocols and description languages for interactions
  - E.g. gLite proprietary Job Definition Language (JDL) & UNICORE 5 proprietary Abstract Job Description (AJO) interoperation for job submits

    gLite [2]

    UNICORE [1]
- (2) emerging standards
  - Using certain standards that are potentially mature enough to be used within real production e-Science Infrastructures in very near future
  - E.g. OGSA-BES, Usage Record Format (URF)

    R. Mach et al. [12]

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# SRB/SRM Island Interoperability

- **Storage Resource Broker (SRB)**
  - Manage sets of data, logical and physical file names, etc.

- **Storage Resource Manager (SRM) implementations**
  - Implementations of SRM interface specification, manage data
- **Goal: File transfer between SRB and SRM**
- **Approach: Using OGF's GridFTP specification as file transfer protocol**
  - The trick is to use a GridFTP server developed for SRB
  - Endow it with an 'SRM information system', and to pretend it is a so-called "Classic Storage Element."
  - This permits gLite tools, both the File Transfer Service (FTS) and the so-called lcg-utils, to transfer files between SRMs and SRBs
  - Basically no development effort was required

# gLite AMGA Metadata Catalogue

- gLite-AMGA metadata catalogue
  - Provides access to relational data(bases) on the Grid
  - Developed and used within the EGEE infrastructure

- WS-DAIR specification of OGF

  - WS – Database Access and Integration (DAI) Relational
  - Specification for standardized data(base) access

- Goal: Standardized data access for (different versions of) gLite AMGA Metadata catalogue

- Approach: Using OGF's WS-DAIR specification as standardized access to the gLite AMGA
  - Interoperation by implementation of a WS-DAIR compatible interface for AMGA

# DEISA & Australian Grid Interop

- Distributed European Infrastructure for Supercomputing Applications (DEISA)
  - Uses UNICORE 5 Grid middleware as access to supercomputers
  - Developed the DESHL UNICORE Command line interface
- Australian Grid
  - Uses Grid Resource Allocation Manager technology of Globus
- Goal: Enable a cross-Grid scientific application job submission based on NAMD molecular dynamics suite and outcome retrieval afterwards
- Approach: Using a common standard to create standardized job formats submitted to both Grids and retrieve outcome via standardized file transfer
  - DESHL uses OGF's Simple API for Grid Applications (SAGA)
  - Jobs in OGF's Job Submission and Description Langauge (JSDL)
  - File transfer via OGF's GridFTP specification

# Information Interoperation (1)

- **Berkeley Database Information Index (BDII)**

  <span style="background-color: yellow">BDII [20]</span>

  - Lightweight Directory Access Protocol (LDAP) - based

    <span style="background-color: yellow">RFC4511 [22]</span>

  - Information system capable of holding information

- **Grid Laboratory Uniform Environment (GLUE) 1.2**
  - Common information schema, used in e-Infrastructures
  - Version 2.0 is currently developed by the GLUE-WG of OGF

- **Goal: Translate information from all existing production Grid infrastructures in order to populate a single information resource about it**

- **Approach: Using the GLUE 1.2 specification as information schema for a BDII that contains information from 9 production Grid infrastructures**
  - EGEE, DEISA, OSG, NDGF, NAREGI, TeraGrid, Pragma, NGS, APAC

<span style="background-color: yellow">OSG [30]</span> <span style="background-color: yellow">NAREGI [31]</span> <span style="background-color: yellow">PRAGMA [32]</span> <span style="background-color: yellow">NGS [33]</span> <span style="background-color: yellow">APAC [4]</span>

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# Information Interoperation (2)

- Information was used to show the location of the computing centres in Google Earth that implies the current Grid landscape for the production Grids

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# gLite – UNICORE Interoperation

- Non Web services-based gLite Grid middleware   <span>gLite [2]</span>
  - Production middleware of the EGEE infrastructure
  - Used to access embarassingly parallel systems (pc pools, etc.)
- UNICORE 5   <span>UNICORE [1]</span>
  - Production middleware of the DEISA infrastructure
  - Used to access large massively parallel systems (supercomputer)
- Goal: Enable a job submission from gLite to UNICORE in order to get in EGEE access to DEISA supercomputers
- Approach: Using an interoperation tweaked gLite computing element that forwards jobs to the UNICORE Grid for their execution on supercomputers
  - Interoperation as a short-term achievement (no standards)
  - One specific version of gLite is interoperable with one specific version of UNICORE (if a version will change interoperation gone)

www.o   eGee Enabling Grids for E-sciencE

# gLite – UNICORE Interoperation

- Outcome of EGEE SA3 Activity: Security tweaks have realized this short-term solution for interoperation
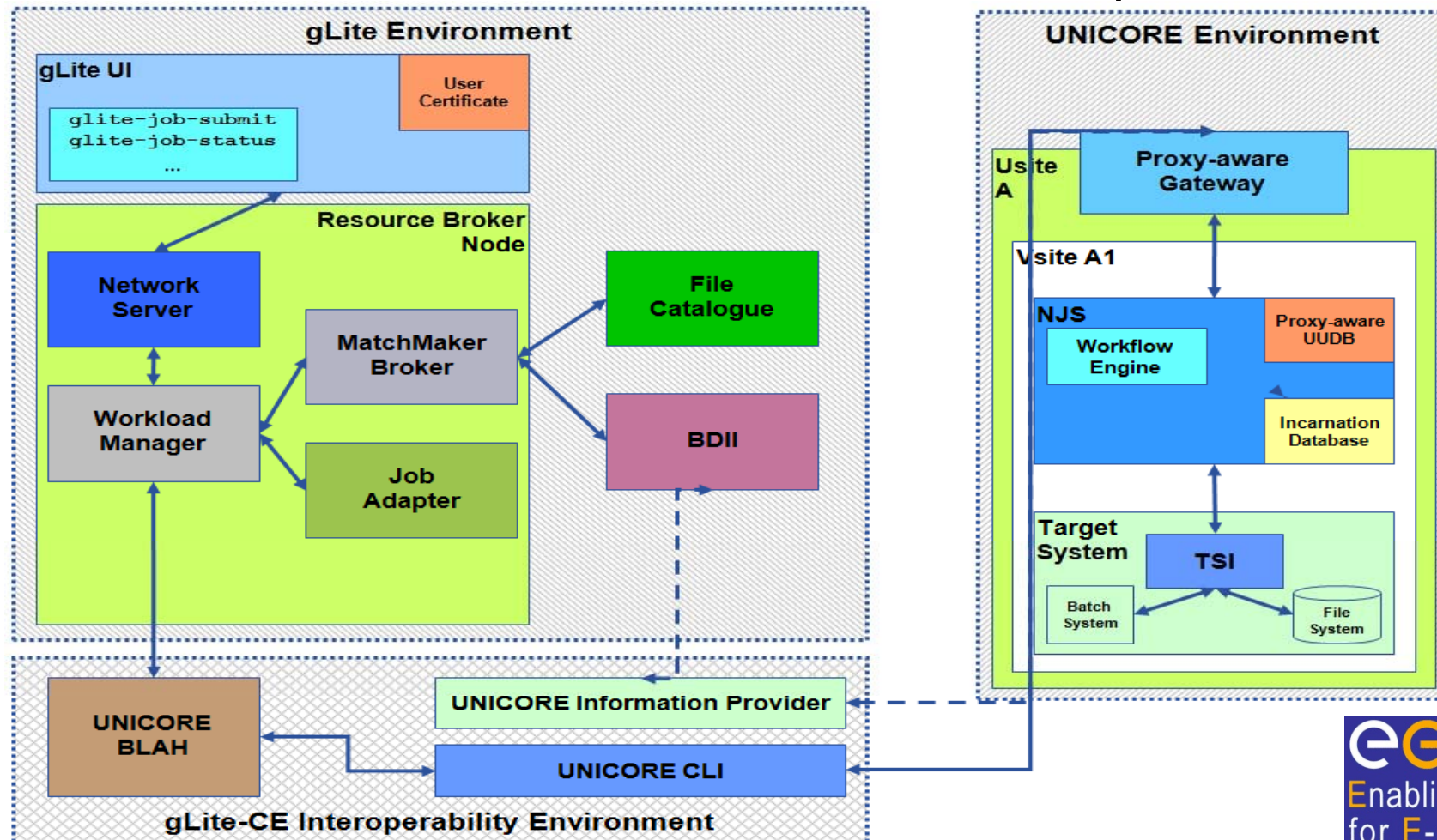
# gLite – UNICORE Interoperability

- Web services-enabled CREAM-BES of gLite middleware
  - CREAM is the access interface to a gLite computing element
  - In near future part of production gLite used in EGEE infrastructure
- Web serviced-based UNICORE 6
  - Extremely fast HPC-driven Grid middleware
  - In near future part of production middleware usable in DEISA
- Goal: Enable a sustainable cross-Grid job submission from gLite to UNICORE and vice versa
- Approach: Using a standardized job submission interface with a typical infrastructure security setup
  - OGSA – Basic Execution Services (BES) interface within UNICORE 6 and CREAM → CREAM - BES (gLite)
  - Virtual Organization Membership Service (VOMS) compliant with OASIS Security Assertion Markup Language (SAML)

VOMS  [26]

SAML  [27]

# gLite – UNICORE Interoperability

- Long-term Standard-based sustained interoperability between gLite and UNICORE
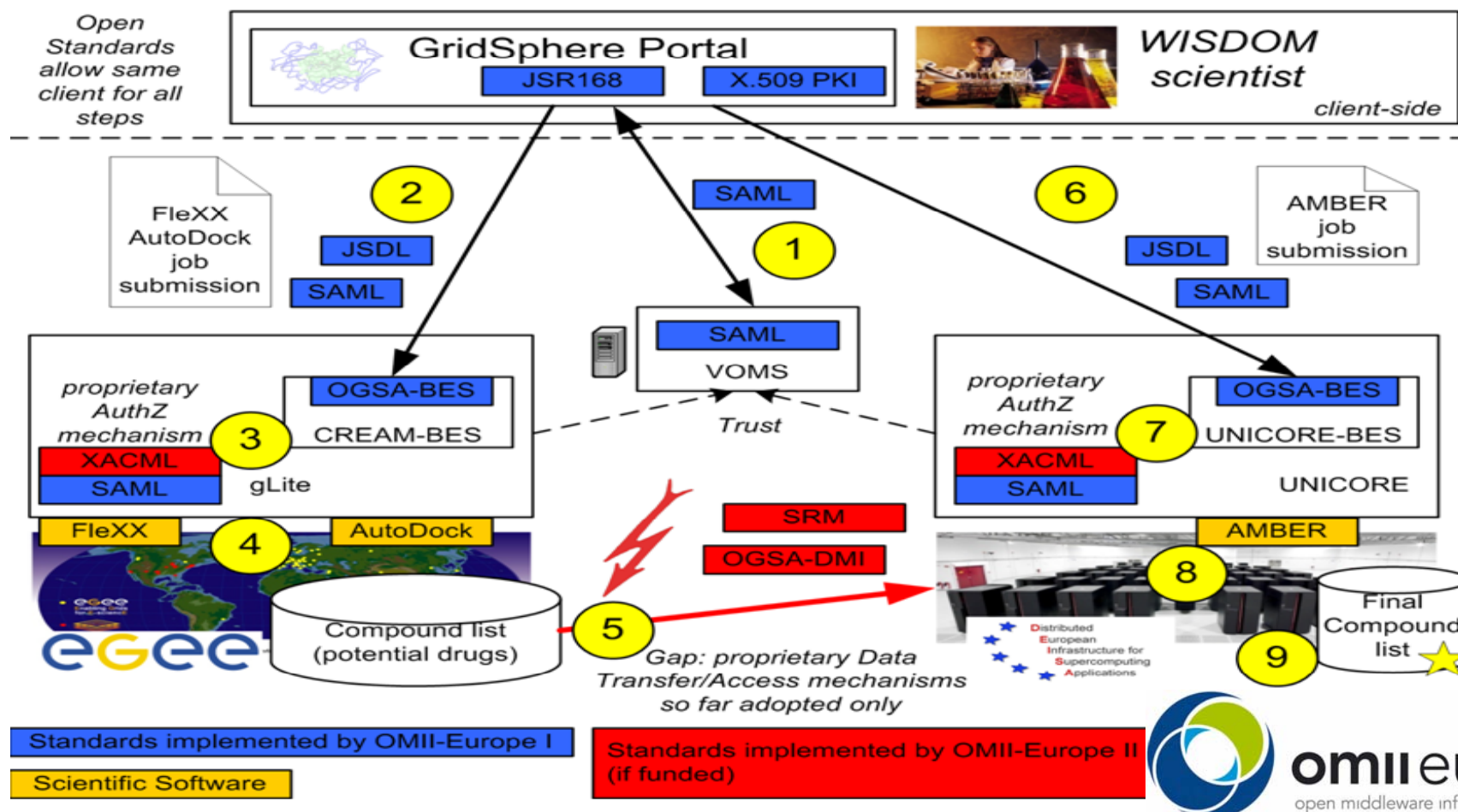
# GIN Portals

- **P-Grade Portals**  <span style="background-color:yellow">P-Grade [29]</span>
  - <u>P</u>arallel <u>G</u>rid <u>R</u>un-time and <u>A</u>pplication <u>D</u>evelopment <u>E</u>nvironment
  - Service rich graphical environment for development, execution and monitoring of data-driven Grid applications
- Used within national and international e-Infrastructure
  - UK NGS, HunGrid, Turkish Grid, etc.
  - International VOs like EGEE and SEE-Grid
- Goal: Enable access to different production Grid and e-Infrastructures using the same client
- Approach: Using the P-GRADE portal environment and develop adapters for it accessing different services within multiple Grids
  - Demonstration showed common end-users workflows
  - Using Grid Execution Management for Legacy Code Applications (GEMLCA)

<span style="background-color:yellow">GEMLCA [28]</span>

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# GIN Portals

- Outcome of P-Grade developer alliance
- Testing the port of applications      Link to Geoffrey's talk

# Usage Record Format Interop

- **Distributed Grid Accounting Systems (DGAS)**

  - Accounting System of gLite
- **Swedish Grid Accounting System (SGAS)**

  - Accounting System of SweGrid and Globus Tech Preview
- **Goal: Enable cross-Grid end-user usage records exchange between gLite-based and Globus-based Grids**
- **Approach: Using OGF's Usage Record Format (URF) and emerging OGF's OGSA – Resource Usage Service (RUS) specifications**

  - DGAS (gLite) and SGAS (Globus TechPreview) have been augmented with these standards within the OMII-Europe project
  - UNICORE 6 also adopts these standards in OMII-Europe
    - Aligned with this demo was a URF/OGSA-RUS-based monitoring application LLview (hence, UNICORE 6 should be also interoperable but not tested yet)

# Usage Record Format Interop

- Accounting could be an interesting new area of OGF in the next years…
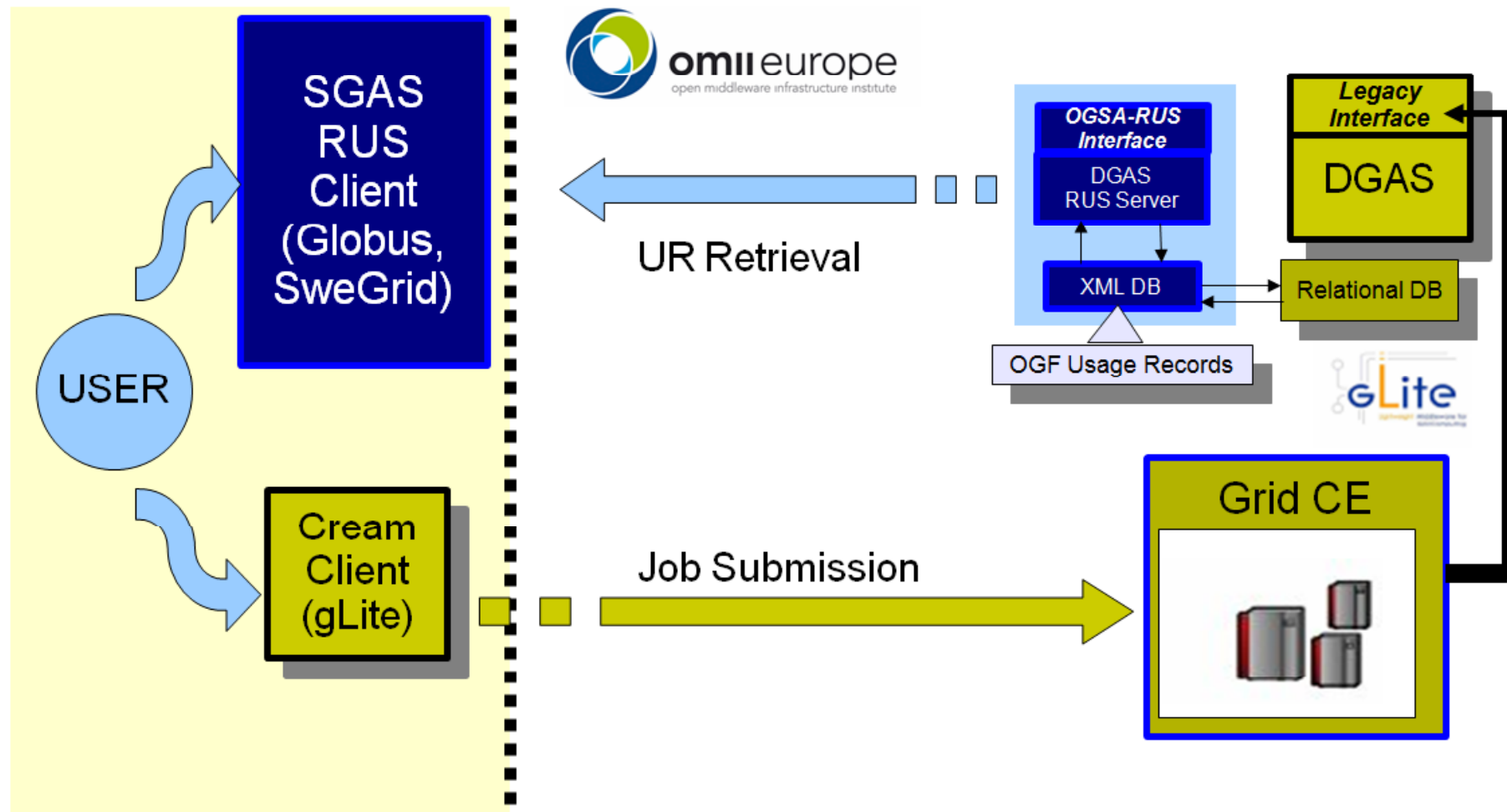
# GridFTP2 and other interops

- **GridFTP2 standard specification is emerging**
  - Implemented in dCache, Globus C and Java client libraries
- **Goal: Enable interoperable file transfers between these systems**
- **Approach: Using OGF's GridFTP2 specification**
  - Interoperation was shown by the NDGF at Supercomputing

I. Mandrichenko et al. [14]

- *Finally, other interoperations are evolving in numerous participating production Grid and e-Science infrastructures…*

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# Lessons Learned

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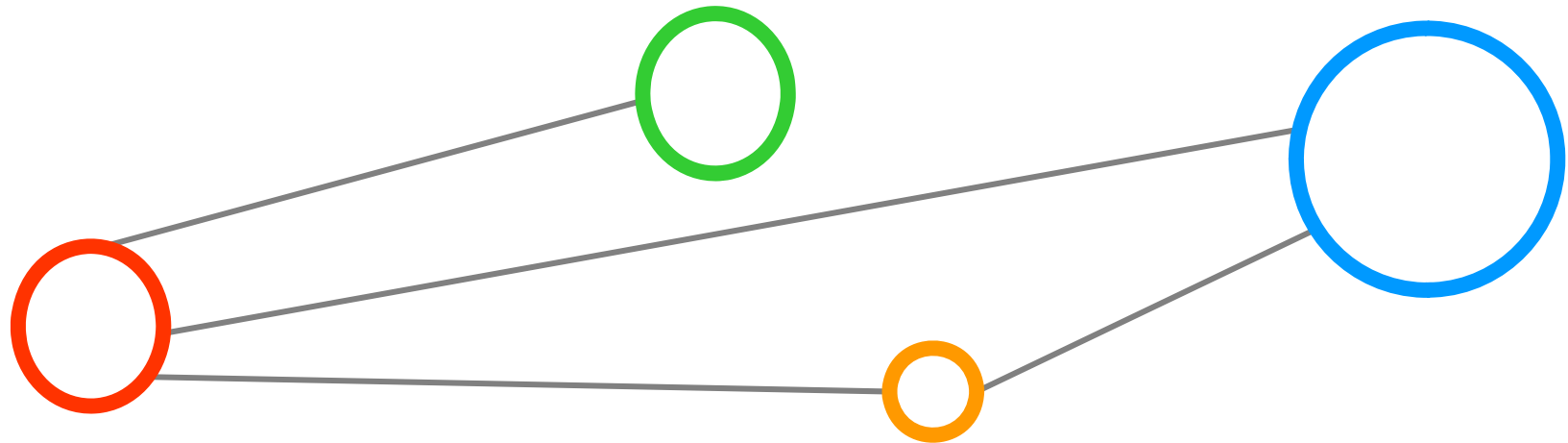
# Lessons Learned (1)

- Open Standards have to evolve faster and must take into account the experience from real production Grids
  - Feedback from developers that implement the standards in the sw provider stacks is important and must be considered
  - These stacks are finally used within these infrastructures
    - E.g. gLite in EGEE, UNICORE in DEISA, Globus in TeraGrid
  - Implementation of the standard should not start after standardization, but during standardization → deployment tests
    - Prove that the standard can be actually used later within production Grids

- Projects that develop interoperability components…
  - …via the integration of common open standards into middleware
  - They must try to get their implementations back into the major software providers stacks (gLite, Globus, UNICORE, OMII-UK,…)
  - Because these stacks are actually deployed later within the production Grid and e-Science infrastructures
    - E.g. Community development: Globus Alliance, UNICORE @SourceForge
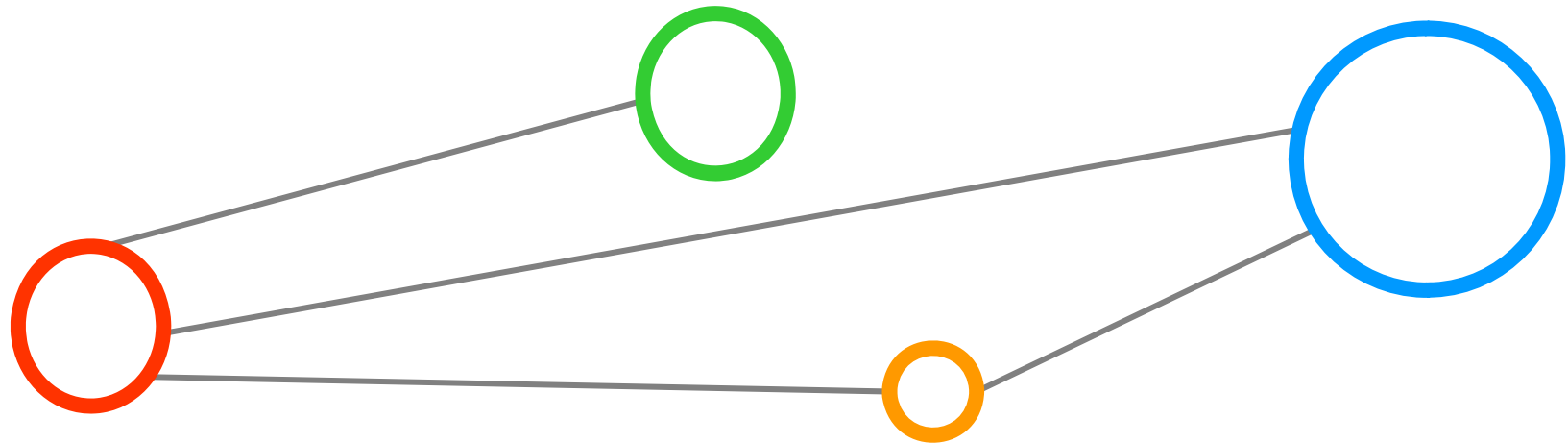
# Lessons Learned (2)

- (Different) Grid security issues are major showstoppers
  - All OGF standards must be more aligned with security setups!
  - Using OGF standards together with OGF security standards
    - E.g. High Performance Computing Profile (HPC-P) and Secure Channel
  - Using OGF standards together with other security standards
    - E.g. OGSA-BES together with OASIS SAML Security and WS-Security

- Focus on spin-off activities that deal with particular requirements (and problems) is needed
  - E.g. GIN demonstrations have shown an achievement of interoperability in terms of information…
    - But this requires and agreement on the information content and schema
    - Result: GLUE 2.0 is now an OGF working group and is standardizing this common schema for Grid computing
  - Other specific requirements may lead to spin-off activities:
    - E.g. problem of passing credentials through an OGSA-BES-based job submission for third party data staging (e.g. using GridFTP)
    - E.g. Worker Node Profile (Common Execution environment & variables)

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# OGF Experience Documents
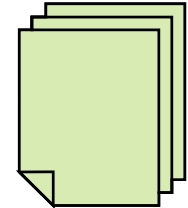
- Lessons learned from OGF GIN activities in OGF experience documents
- Collect information from various sources
  - GridForge, Wikis, Web sites, etc.
  - Center for all GIN information: http://www.ogf.org/gf/group_info/view.php?group=gin-cg
- Interviews
  - Small interviews with "ants" behind the scene
  - Detailed interviews & documents (detailed picture)
- Collect Sourcecode
  - Simple hacks, plug-ins, e.g. BDII – providers, etc.
  - Non-goal: Create repositories in parallel to official ones
- Provide feedback to OGF – WGs
  - OGSA – WG stated interest in GIN – INFO doc.

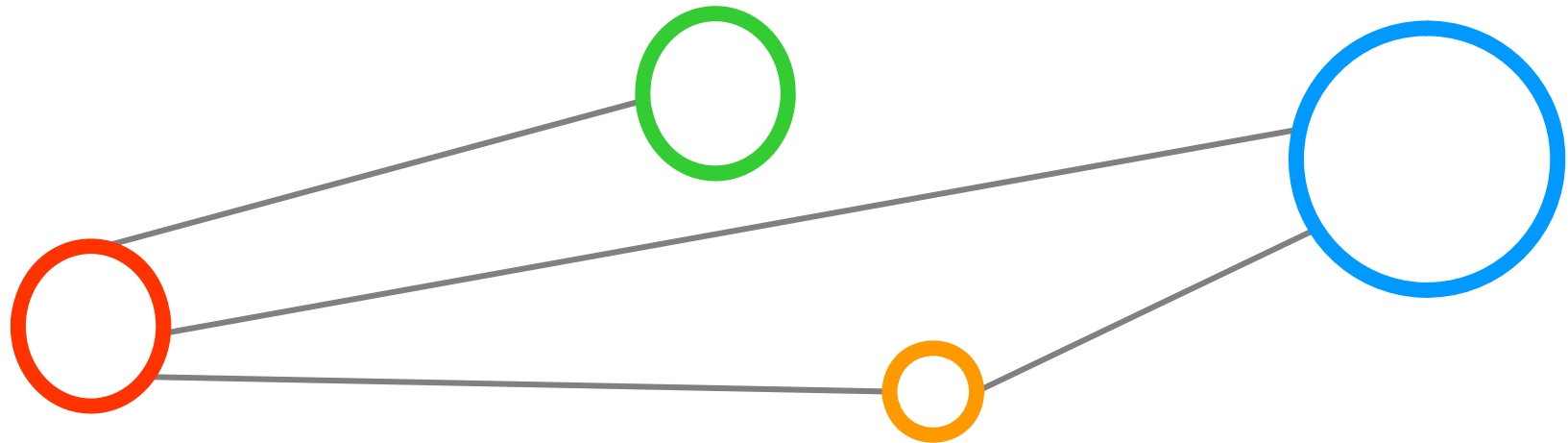www.ogf.org

# Future Work & Conclusions

# Future Work

- Follow up on specific spin-off activities
- Working on OGF experience documents
  - Provide lessons learned from production experience to OGF working groups
  - GIN will try to bring the production deployers closer to the standard developers for better experience exchange
- Sustain our interoperability/interoperation efforts/demos
  - Keep certain groups alive, even after project funding if possible
  - Early plans for Supercomputing 2008 next year
  - Which project will work on which interoperability → Synergies?
- Start with other areas gaining more and more interest within production Grids and e-Infrastructures
  - E.g. Accounting, e.g. OGSA-RUS-based interoperability
  - E.g. More real life e-Science applications interop. demonstrations (Such as OMII-Europe & WISDOM interoperability scenario)

WISDOM [24]

# Conclusions

- A lot of nice demonstrations at SC06 and SC07
  - We see how more and more standards find their way into the stacks of the middleware providers & production infrastructures
- Contributions to OGF GIN group
  - Members of world-wide e-Infrastructures and their experiences…
  - E.g. EGEE, DEISA, OMII-Europe, D-Grid, NGS, TeraGrid,...
  - Problem: If funding is stopped for these projects, less participation within the group and much less demonstrations / experience
    - Fund reduction will also have a major impact on OGF standard adoption
    - E.g. projects like OMII-Europe are all about supporting OGF in all areas, but may not continued to be funded by the European Commission currently
    - E.g. US funding agencies (e.g. NSF) have reduced funding for Grids
- Numerous interoperability scenarios come into existence
  - More and more e-Scientists require resources in multiple Grids
    - E.g. Supercomputing resources within DEISA combined with farming in EGEE
  - We need projects that support such activities and work directly with the e-Scientists to satisfy their interoperability requirements

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# References & Acknowledgements

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# References  (1)

[1] UNICORE Grid Middleware, http://www.unicore.eu

[2] gLite Grid Middleware, http://glite.web.cern.ch/glite/

[3] DEISA Project, http://www.deisa.org

[4] Australian Grid, Australian Partnership for Advanced Computing (APAC), http://www.apac.edu.au/

[5] OGF GIN Community Group, http://forge.ogf.org/sf/projects/gin

[6] TeraGrid Infrastructure, http://teragrid.org/

[7] EGEE Infrastructure, http://www.eu-egee.org

[8] Storage Resource Broker (SRB), http://www.sdsc.edu/srb/index.php/Main_Page

[9] Storage Resource Manager (SRM), http://sdm.lbl.gov/srm-wg/doc/SRM.v2.2.pdf

[10] A. Anjomshoaa et al., Job Submission Description Language (JSDL), http://www.gridforum.org/documents/GFD.56.pdf

[11] I. Foster et al., OGSA – Basic Execution Services (BES), http://www.ogf.org/documents/GFD.108.pdf

[12] R. Mach et al., Usage Record Format (URF), http://www.ogf.org/documents/GFD.98.pdf

[13] OMII-Europe project, http://www.omii-europe.org

[14] I. Mandrichenko, GridFTP2, http://www.ogf.org/documents/GFD.47.pdf

[15] gLite-AMGA, gLite Grid Metadata Catalogue, http://amga.web.cern.ch/amga/

[16] M. Antonioletti, WS-DAIR, http://www.ogf.org/documents/GFD.76.pdf

[17] DGAS, http://www.to.infn.it/grid/dgas/

[18] SGAS, http://www.sgas.se/

# References  (2)

[19] SAGA, http://forge.ogf.org/sf/projects/saga-core-wg

[20] Berkeley Database Information Index (BDII), https://twiki.cern.ch/twiki/bin/view/EGEE/BDII

[21] OGSA-RUS, http://forge.ogf.org/sf/projects/rus-wg

[22] RFC4511, Lightweight Directory Access Protocol (LDAP): The Protocol,http://tools.ietf.org/html/rfc4511

[23] GLUE, http://forge.ogf.org/sf/projects/glue-wg

[24] WISDOM Project, http://wisdom.eu-egee.fr/

[25] gLite File Transfer Service (FTS), http://www.gridpp.ac.uk/wiki/EGEE_File_Transfer_Service

[26] VOMS, https://twiki.cnaf.infn.it/cgi-bin/twiki/view/VOMS

[27] OASIS SAML, http://www.oasis-open.org/committees/security/

[28] GEMLCA, http://www.cpc.wmin.ac.uk/gemlca/

[29] P-Grade Portals, http://www.lpds.sztaki.hu/pgportal/index.php

[30] Open Science Grid (OSG), http://www.opensciencegrid.org/

[31] NAREGI, http://www.naregi.org/index_e.html

[32] PRAGMA, http://www.pragma-grid.net/

[33] NGS, http://www.grid-support.ac.uk/

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- Also we acknowledge all participating production Grid and e-Science infrastructures to provide their members with the opportunity to work within the GIN-CG

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  in the HELMHOLTZ association

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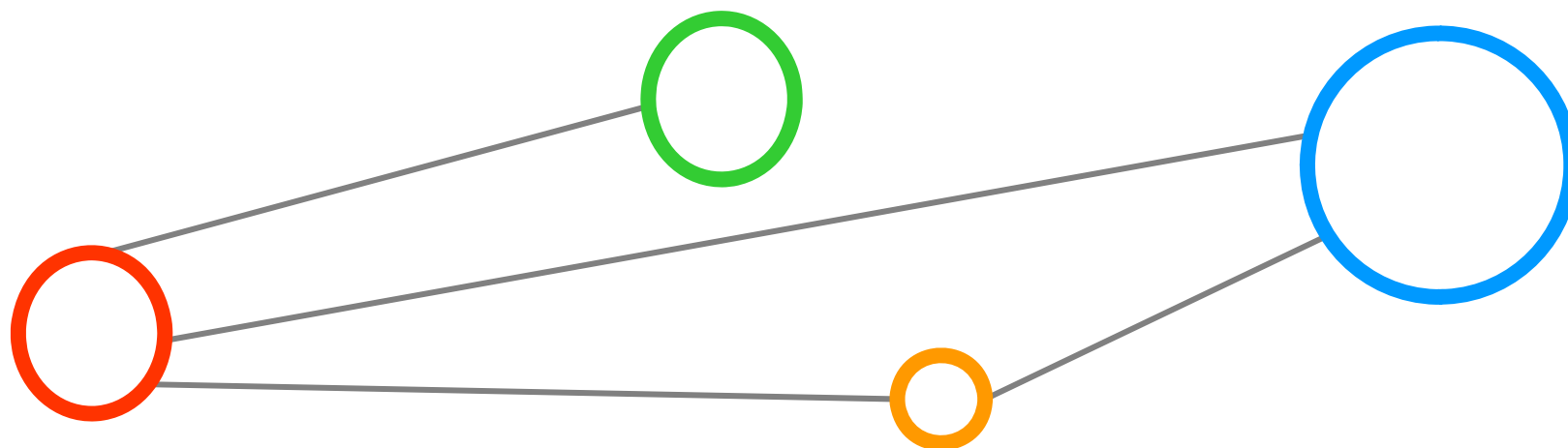
# IGIIW @ e-Science 2007

## Organized by OMII-Europe
## (Chair: Morris Riedel, GIN Secretary):

## International Grid Interoperability & Interoperation Workshop (IGIIW) 2007

in conjunction with

e-Science 2007, Bangalore, India

More Information, location & agenda:

http://www.omii-europe.org/OMII-Europe/igiiw2007.html

2 p.m. today - Room Chanakya B

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# EU – India Grid Interop.

## *Morris Riedel:*
## *„OMII-Europe – Interoperability scenarios of EU e-Infrastructures for Scientific Research"*
## EU India Grid Plenary Session Interoperability

in conjunction with

e-Science 2007, Bangalore, India

More Information, location & agenda:

http://www.euindiagrid.eu/events/eu-indiagrid-conference-1/draft-programme/view

14 December – 10:00 a.m.

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# END OF TALK

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