UNICORE

CROWN

OpenGridForum
OPEN FORUM | OPEN STANDARDS

the globus alliance

gLite
Lightweight Middleware for Grid Computing

omii europe
open middleware infrastructure institute

Are Web Services the Answer to Interoperability?

The OMII – Europe View & Lessons learned

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EGEE 2007 Conference, Budapest, 5th October 2007

HELMHOLTZ ASSOCIATION

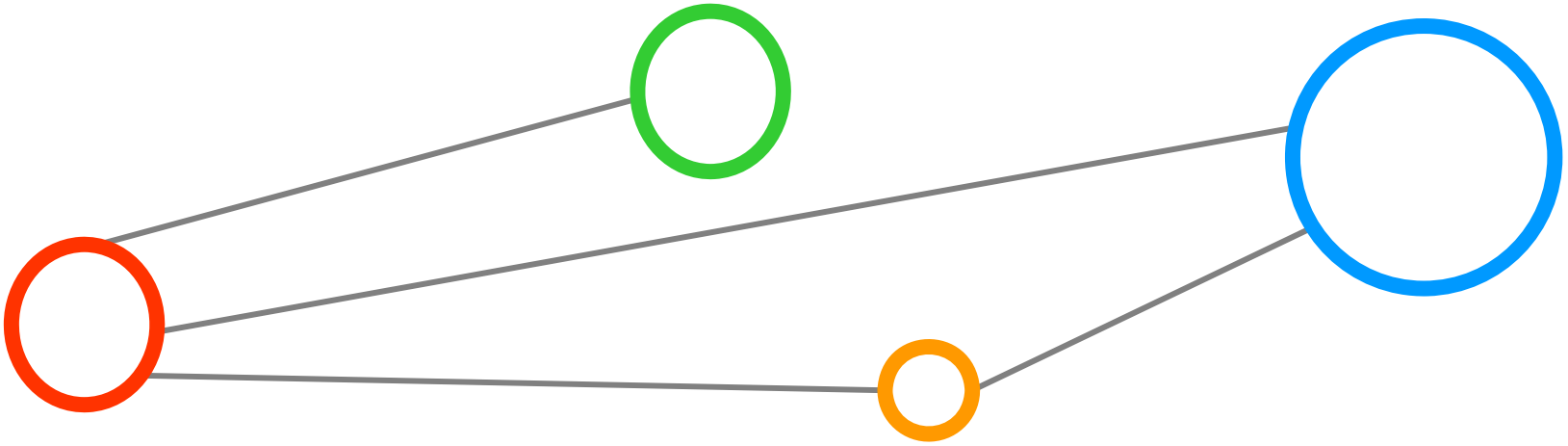
Information Society Technologies

Forschungszentrum Jülich
in der Helmholtz-Gemeinschaft

Outline

- **Clarification: Web Services**
- **Motivation: Grid Islands**
- **Examples of Interoperation**
- **Future: Interoperability Highway**
- **The OMII – Europe View**
- **Lessons Learned from Interoperability**
- **Panel Discussion Topics**
- **Conclusions**
- **References & IGIIW & Acknowledgements**

Clarification: Web Services (what we mean by Web Services)

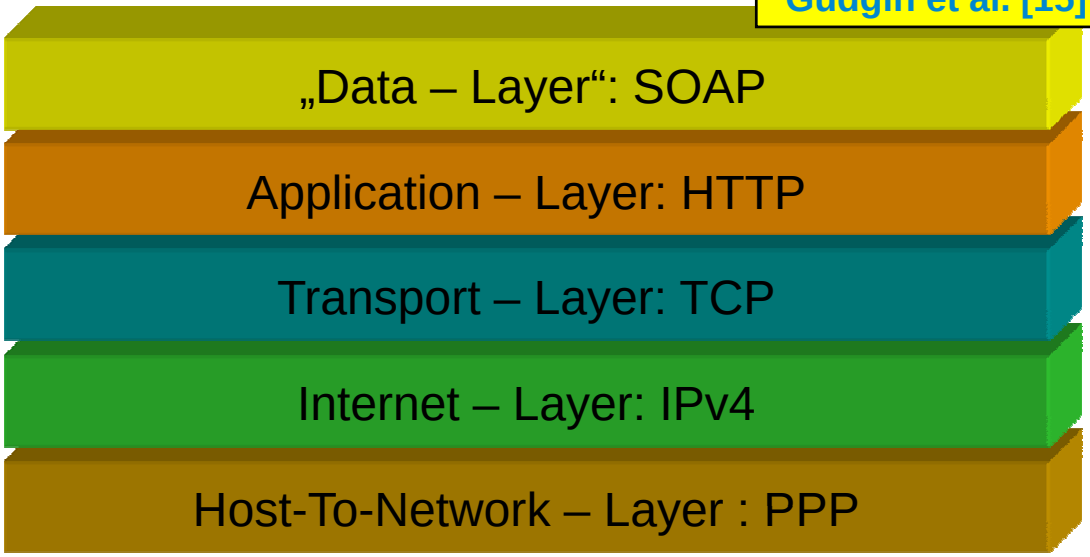


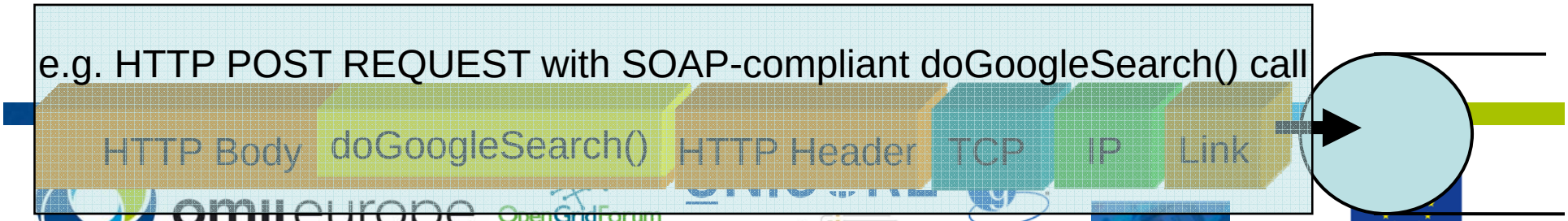
Web Services in a Nutshell (1)

- **Using WSDL description** Christensen et al. [16]
  for XML elements of doGoogleSearch()

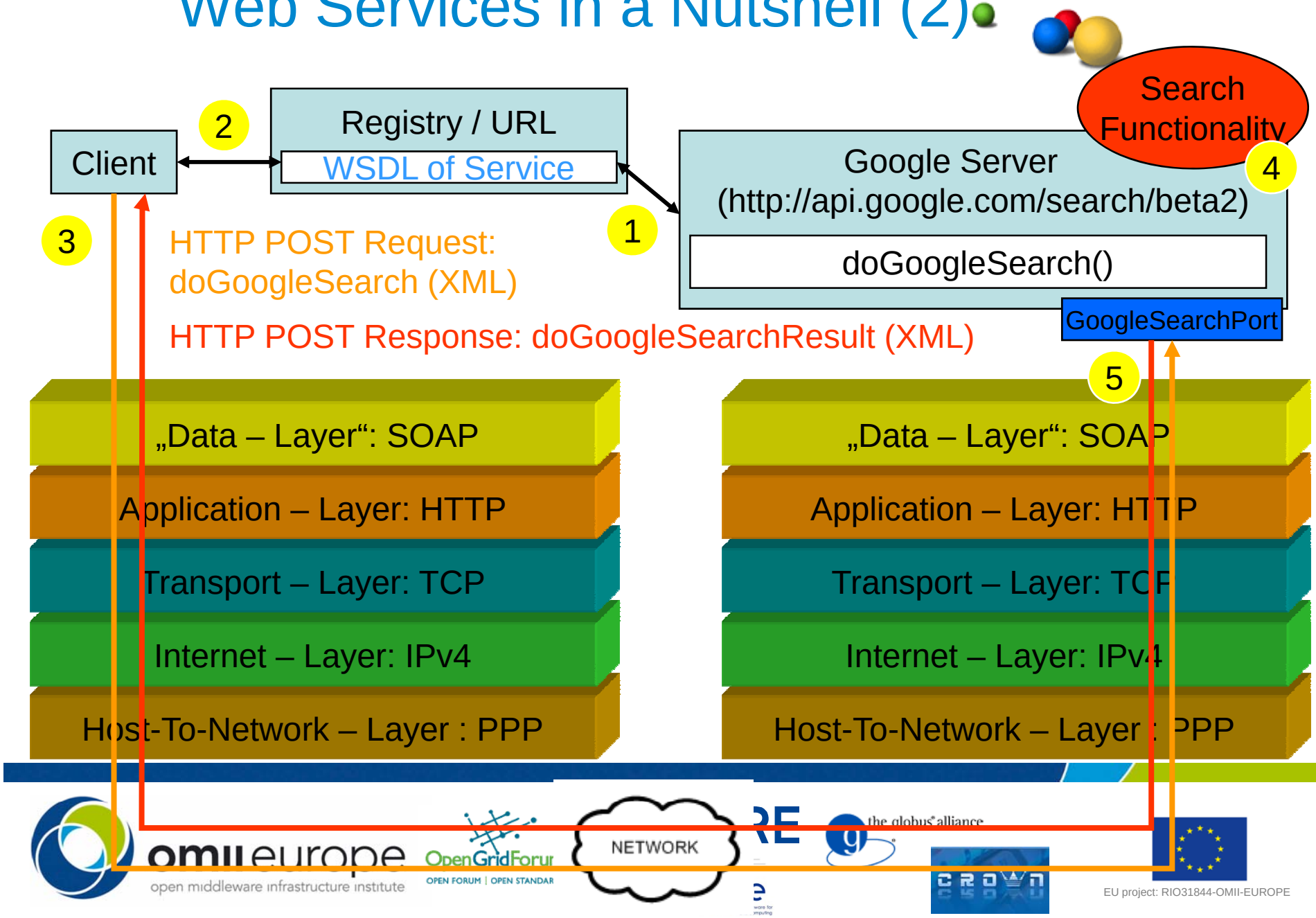
```
<soap>
<soap:header>
http://api.google.com/
search/beta2
</soap:header>
<soap:body>
doGoogleSearch( key = ‚Grid‘ )
</soap:body>
</soap>
```

Gudgin et al. [15]

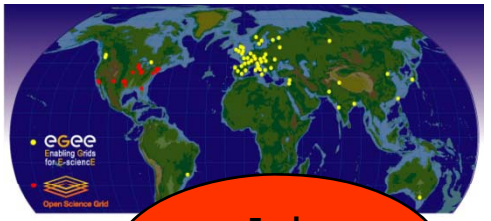




Web Services in a Nutshell (2)



Web Services in a Nutshell (3)



Job Execution

Client

2

Registry / URL

WSDL of Service

Foster et al. [7]

OGSA-BES-enabled Computing Element (e.g. CREAM-BES)

4

createActivity()

OGSA - BES - Port

3

HTTP POST Request: createActivity (XML → JSDL)

1

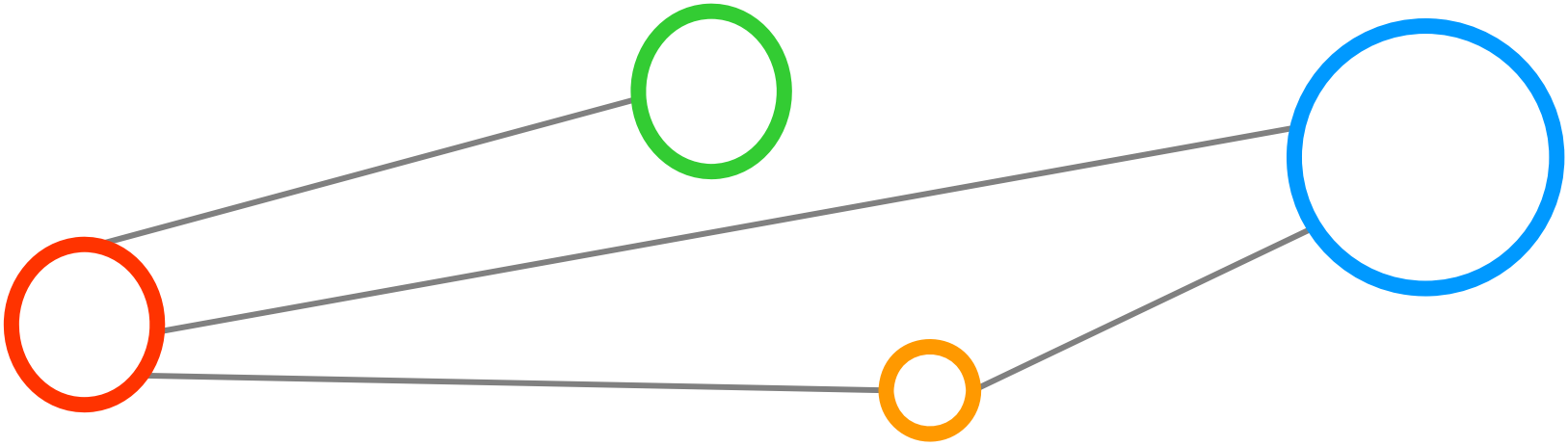
Anjomshoaa et al. [17]

HTTP POST Response: createActivityResult (XML)

5

„Data – Layer“: SOAP	„Data – Layer“: SOAP
Application – Layer: HTTP	Application – Layer: HTTP
Transport – Layer: TCP	Transport – Layer: TCP
Internet – Layer: IPv4	Internet – Layer: IPv4
Host-To-Network – Layer : PPP	Host-To-Network – Layer : PPP

Motivation: Grid Islands (focus on EC e-Infrastructures)



A guide to European flagship e-Infrastructure projects

EC e-Infrastructures [14]

Knowledge is the **most valuable commodity in today's economy** and e-Infrastructures can be understood as the highways for creating and disseminating this k knowledge widely available throughout society. **So what exactly are eInfrastructures?**

'e-Infrastructure' is the short term for *Electronic Research Infrastructures*.

These are collections of ICT based resources and services used by the worldwide research and education community to conduct collaborative projects and generate

These ICT based resources consist of telecommunication links, computers, storage systems, instruments, software and related computer technology. Importantly organisations operating in different locations in the world.

European eInfrastructures are structured into the following elements:

- Connectivity (Géant2): high-speed internet backbone connecting research and education institutes.
- Cluster grids (EGEE-II): clusters of computers around the world that are connected on the above Géant network to maximse their full power.
- Supercomputer Grid (DEISA): Supercomputers linked together, also on the Geant2 network, to run groundbreaking applications not possible on just one.
- Middleware (OMII Europe): A 'software' that allows you to use and easily access these above distributed EGEE and DEISA grid infrastructures.

Together these elements form the eInfrastructures that create 'Global virtual research communities' that exchange and generate new knowledge.

Whereas 20 years ago the problems that researchers faced in just exchanging information led to the WWW, the need to exchange knowledge in powerful wa resources for collaborative research.

Just as the web led to new dramatic changes, so do these eInfrastructures allow new research, discoveries and working methods that were otherwise impossible.

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Grid Islands: DEISA and EGEE

- **DEISA Grid (Supercomputing/HPC community)**
  - Uses non WS-based UNICORE 5 in production
  - No Virtual Organization Membership Service (VOMS)
  - Suitable for massively parallel scientific jobs (MPI, …)
- **EGEE Grid (mainly HEP community + others)**
  - Uses non WS-based gLite in production
  - Proxy-based X.509 security, but VOMS support
  - Suitable for embarrassingly parallel scientific jobs
- **Both Grids are currently not technical interoperable**
  - Scientists cannot use one middleware to access both
  - UNICORE 5 and gLite are currently not interoperable

Distributed European Infrastructure for Supercomputing Applications

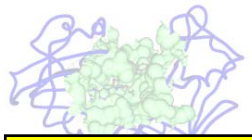
DEISA [3]

EGEE [4]

UNICORE gLite

Cross-Grid use case example (Why do we need interoperability?)

- **WISDOM (Wide In Silicio Docking on Malaria)**
  - WISDOM aims at developing new drugs for Malaria
  - WISDOM uses EGEE for large scale in silicio docking
    - **A computational method for prediction of whether one molecule will bind to another**
    - **using AutoDock and FlexX software**
  - AutoDock and FlexX are software provided via gLite in EGEE
  - Output is a list of chemical compounds (potential drugs)
- **Refine best compound list via molecular dynamics(MD)**
  - Fast MD computations use highly scalable AMBER in DEISA
    - **AMBER (Assisted Model Building with Energy Refinement) 9**
- **Goal: Accelerate drug discovery using EGEE + DEISA**



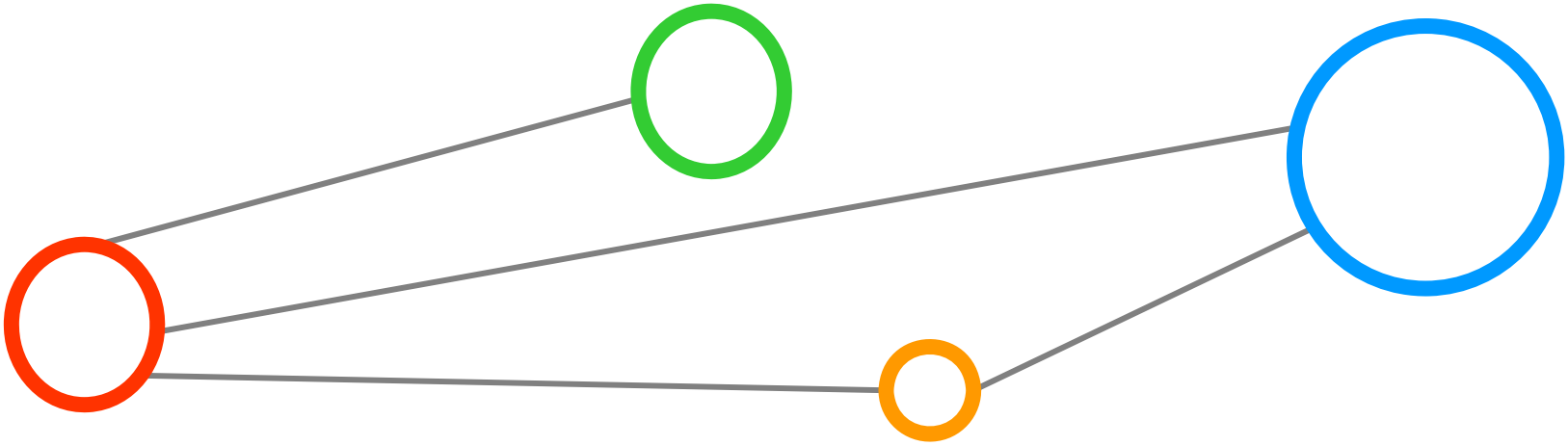
WISDOM [1]

Different strategies to solve Grid islands

- **Interoperation (aka „short-term achievement“)**
  - Work performed in OGF Grid Interoperation Now group (GIN-CG)
  - Bilateral efforts in many other projects, e.g. EGEE and DEISA
  - What needs to be done to get interacting production Grids
  - Hacks, workarounds, short-term achievements, adapters, …
  - Commonly found in production Grid interoperations
- **Interoperability (aka „long-term achievement“)**
  - Work performed in OMII – Europe
  - Native standards support from middlewares (no hacks)
  - Many interoperable components work together to achieve a goal
  - Interoperability through open standards from OGF, OASIS, …

Rather vague definition of terms… („GIN way of definition“)

Examples of Interoperation



Link to talk Erwin Laure: OGF/GIN Status and perspectives

Grid Interoperation Now (GIN) Community Group

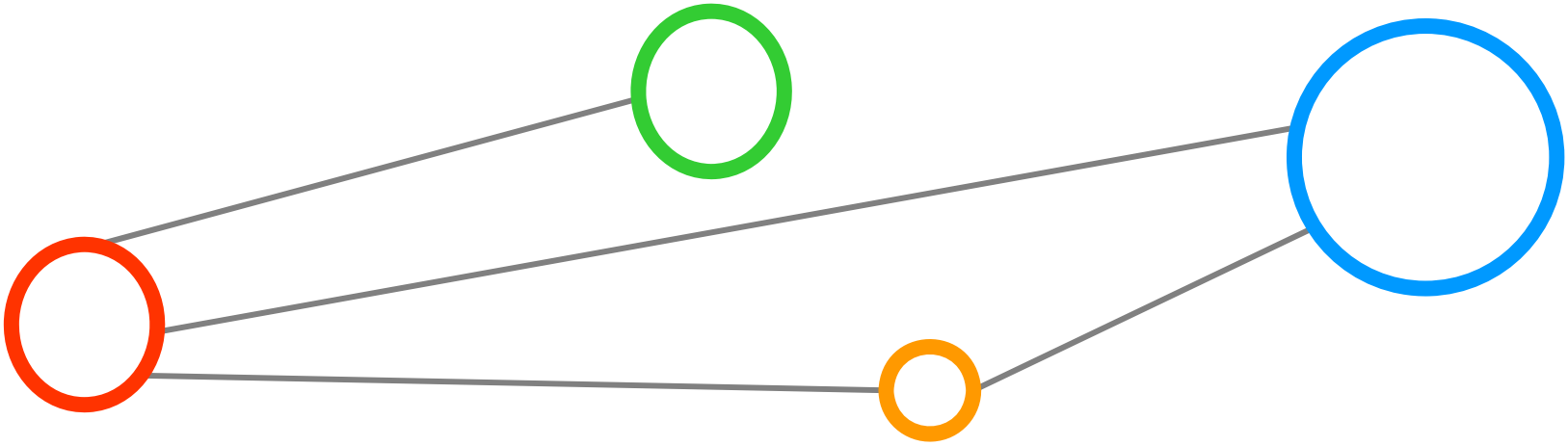
GIN-CG [5]

- **GIN goals**
  - What needs to be done to get different Grids talking together
  - Short-term achievements, using what is available today
- **GIN in 2006…**
  - Many interoperability demonstrations at Supercomputing 2006
  - Data area: Interoperation between different data islands
    - **Storage Resource Broker (SRB) & Storage Resource Manager (SRM)**
  - Info area: Interoperation of information services and models
- **GIN in 2007 (also OMII-Europe participates)…**
  - Two kinds of demos: Production and Future Production
  - Many demonstrations planned for SC2007: Participate!

Interoperations within projects

- **EC EGEE & US OSG** OSG [18]
  - Interoperation scenario for scientific job submissions & data transfer
- **EGEE Phase II (EGEE-II)**
  gLite and UNICORE 5 interoperation development
  - Submit job from gLite to UNICORE (and monitor its execution)
  - Goal: interoperation on a technical level between DEISA (HPC) and EGEE (HEP+ some others)
  - Sustainability of interoperation via interoperability through standards
- **KnowARC** KnowARC [6]
  - Interoperation scenario for scientific job submissions
  - Submit job from ARC to gLite and fetch its outcome

Future: Interoperability Highway (with Web Services)



Future: Interoperability Highway (WS-based)

End-users via clients & portals

GOAL: Transparency of Grids for end-users

Emerging Open Standards

OpenGridForum — OPEN FORUM | OPEN STANDARDS

OASIS *others*

„Interoperability highway“ based on open standards

Grid Middlewares

UNICORE

gLite — Lightweight Middleware for Grid Computing

the globus alliance

CROWN

others

Grid Resources

UNICORE [19] **gLite [20]** **GT [21]** **CROWN [22]**

Standard Compliance & Interoperability

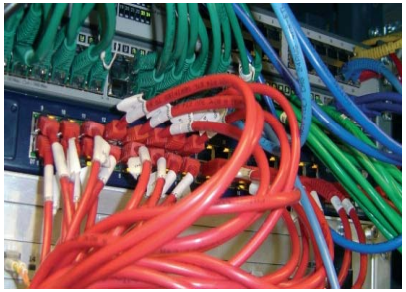
- **Both are <u>different</u> targets, but towards same direction**
  - Standard Compliance is a prerequisite for interoperability
  - Standard Compliance does not implies interoperability
    - **Interoperability is much more than standard compliance**
- **Interoperability: use components together “scenario”**
  - e.g. job submission via information service based on model (GLUE)

GLUE [23]

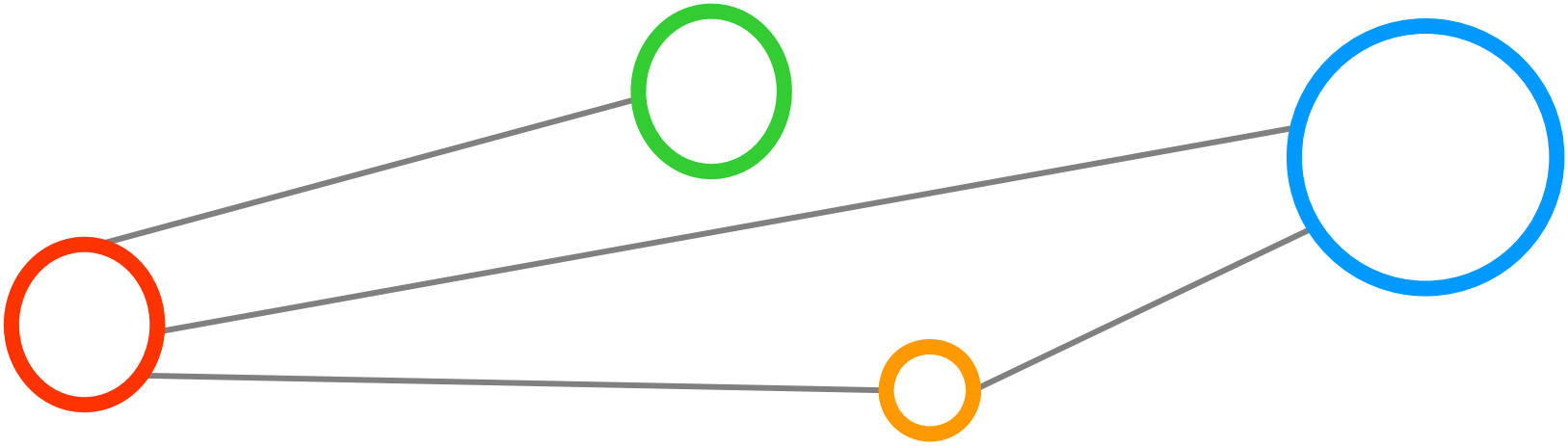
- **One well-known example: OGSA - Basic Execution Services (OGSA-BES)**

Foster et al. [7]

  - In real deployments is not the ‘vanilla OGSA-BES interface’ available
  - Same exact “client” works not directly with gLite & UNICORE
    - **E.g. different security models: X.509 Proxies vs. full X.509 certificates**
  - Different WS-* infrastructures (WS-I & WS-RF), soon WS-Transfer?


The OMII-Europe View



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CROWN

EU project: RIO31844-OMII-EUROPE

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OMII-Europe [8]

114 person years over 2 years, 5 million Euro, 4 major Grid infrastructures

University of Southampton UK **(coordinator)**	University of Chicago **USA**
Fujitsu Laboratories Europe **UK**	NCSA, University of Illinois **USA**
Forschungszentrum Juelich **Germany**	University of Southern California **Los Angeles USA**
Kungl Tekniska Högskolan **Sweden**	University of Wisconsin-Madison **USA**
Istituto Nazionale di Fisica Nucleare **Italy**	Beihang University **China**
Poznan Supercomputing & Networking Center **Poland**	China Institute of Computing Technology **Beijing China**
University of Edinburgh **UK**	Computer Network Information Centre **Beijing China**
CERN, European Organisation for Nuclear Research **Switzerland**	Tsinghua University **China**

OMII-UK

UNICORE

Security

VOMS

GridSphere

OGSA-DAI

gLite

Globus

MyProxy

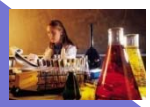
Condor

CROWN

CROWN

EU project: RIO31844-OMII-EUROPE

Benefits



USERS

OMII-Europe Repository

Evaluation Infrastructure

OMII-Europe Components

Developments:

VOMS,
OGSA-BES,
OGSA-DAI,
OGSA-RUS,
GridSphere

Interoperability Tests: Integrate and use OMII-Europe components with each other:

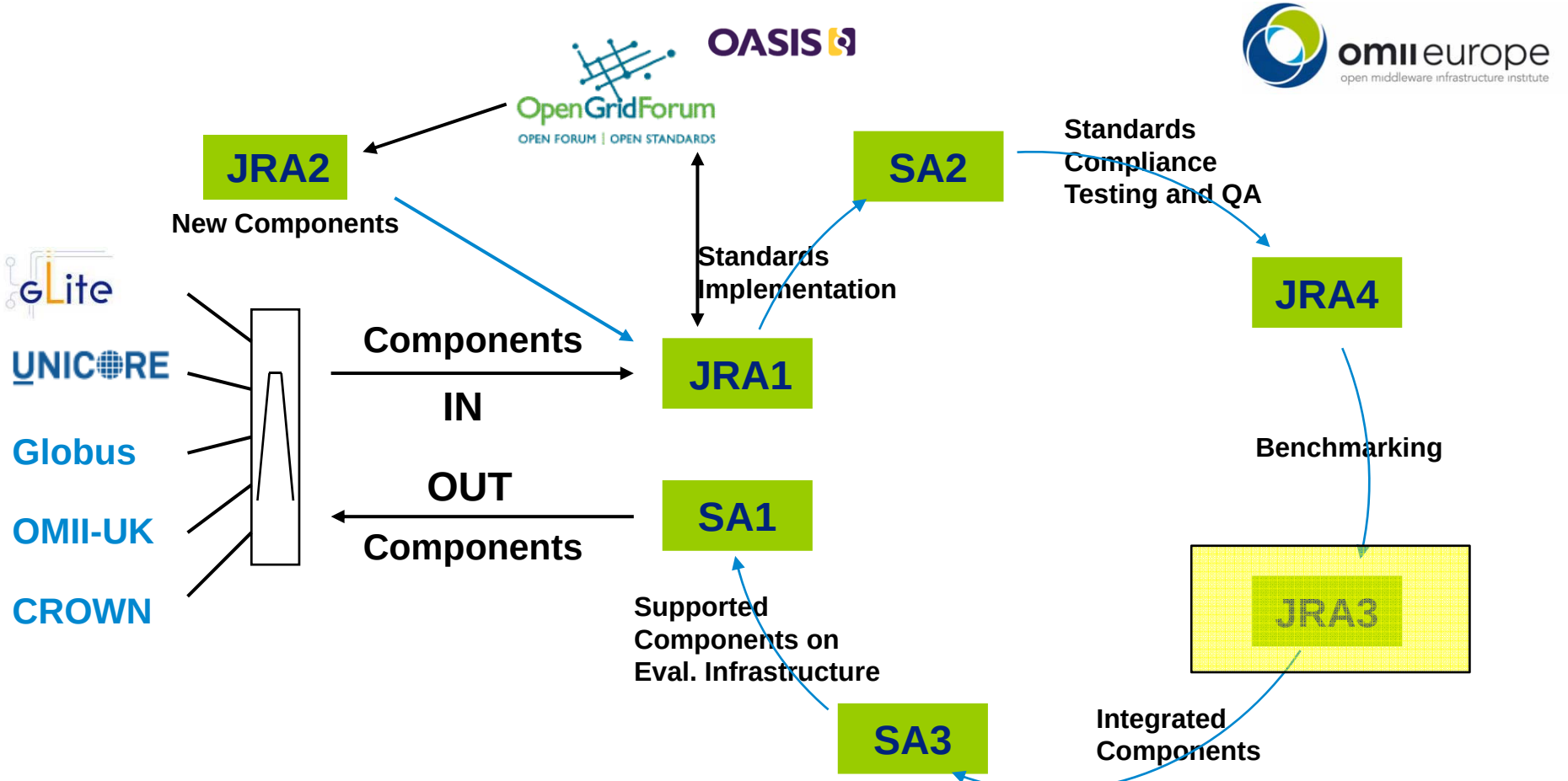
e.g. VOMS & OGSA-BES & GridSphere

building the "interoperability highway…"

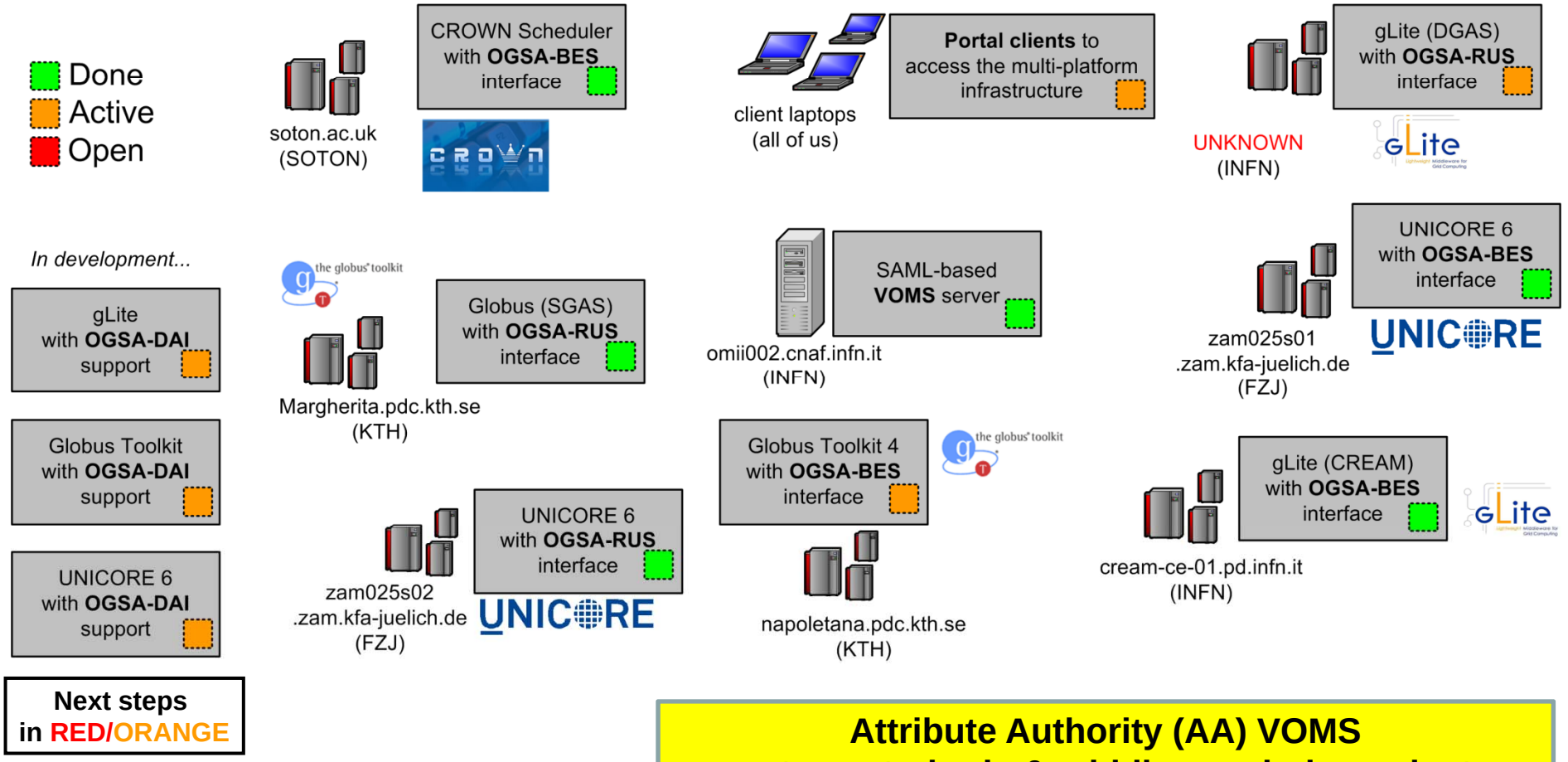
Quality Assuranc &
Compliance Testing of Grid middleware

e.g. Compliance with one specific specification: e.g. OGSA-BES

The Virtuous Cycle - Technology transfer with grid infrastructure projects and standards organisations



The OMII-Europe View (1)



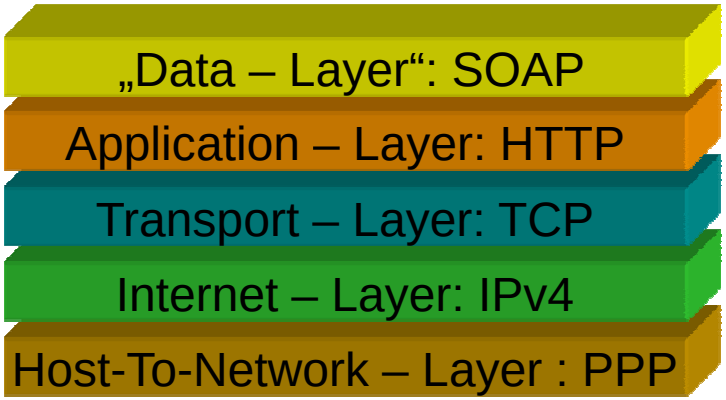
EU project: RIO31844-OMII-EUROPE

The OMII-Europe View (2)

Cantor et al. [9]

- **OASIS Security Assertion Markup Language (SAML)**
  - SAML signed assertions can contain trustful information
  - New WS-based VOMS is SAML compliant
  - VOMS releases (user) attributes as signed SAML assertions
    - **Attributes contain roles and Virtual Organization/Project membership**
- **SAML-based interoperability: UNICORE 6 and VOMS**
  - New WS-based VOMS is interoperable with UNICORE 6
  - VOMS can act as a Attribute Authority (AA) for UNICORE 6
- **Working interoperability between gLite and UNICORE 6**
  - Scenario with job submission including VOMS assertions
- **Important cornerstone of the "Interoperability Highway"**

Interoperability approach with Web Services (1)



- **JRA3-T2: Integration of components in OMII – Europe**
  - OGSA-BES, OGSA-RUS, OGSA-DAI, VOMS, GridSphere
  - Middleware: UNICORE, gLite, Globus Toolkits, and CROWN

Done
Active
Open

soton.ac.uk
(SOTON)

CROWN Scheduler with **OGSA-BES** interface

client laptops
(all of us)

Portal clients to access the multi-platform infrastructure

UNKNOWN
(INFN)

gLite (DGAS) with **OGSA-RUS** interface

In development...

gLite with **OGSA-DAI** support

Globus Toolkit with **OGSA-DAI** support

UNICORE 6 with **OGSA-DAI** support

Margherita.pdc.kth.se
(KTH)

Globus (SGAS) with **OGSA-RUS** interface

omii002.cnaf.infn.it
(INFN)

SAML-based **VOMS** server

zam025s01
.zam.kfa-juelich.de
(FZJ)

UNICORE 6 with **OGSA-BES** interface

zam025s02
.zam.kfa-juelich.de
(FZJ)

UNICORE 6 with **OGSA-RUS** interface

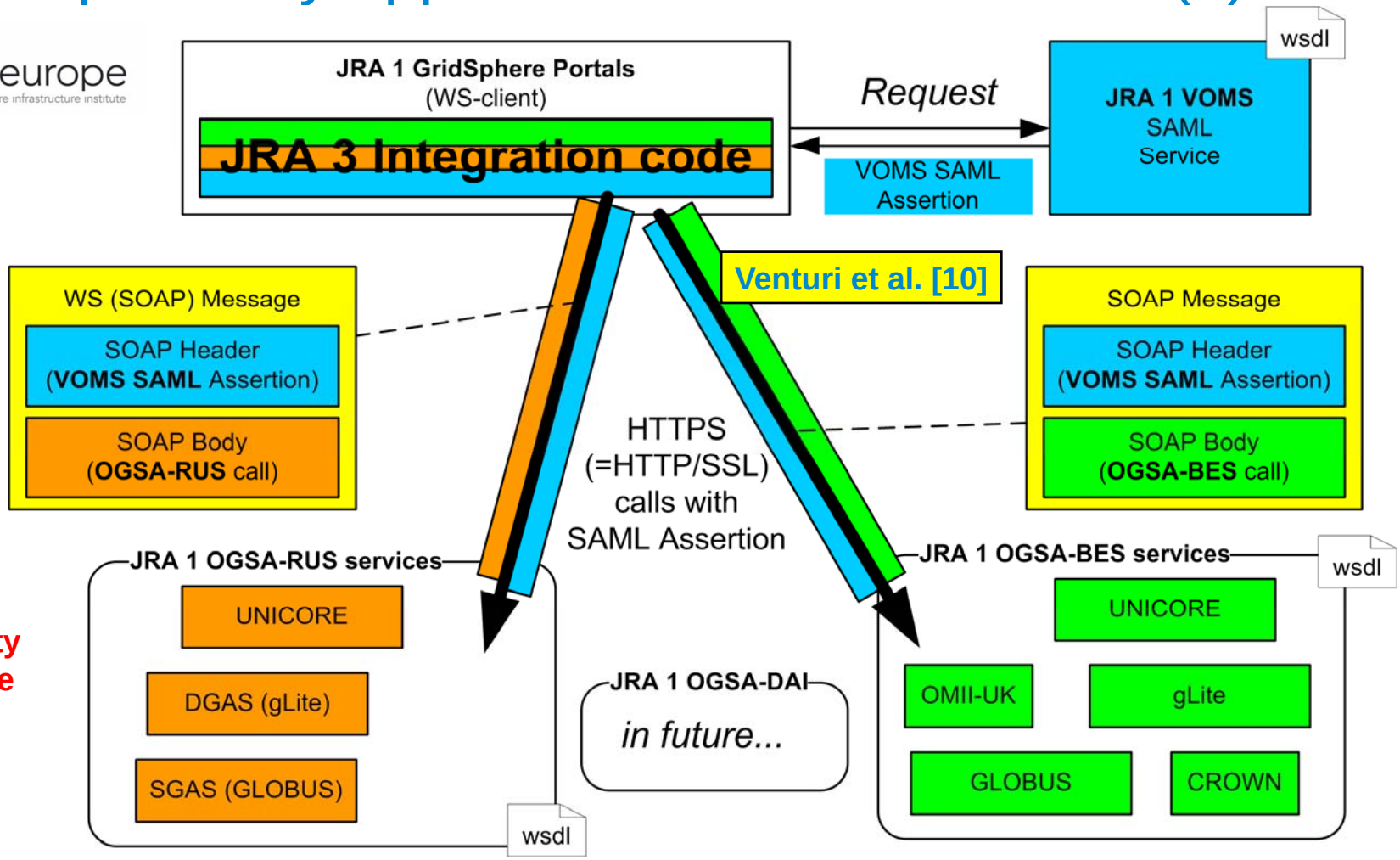
Globus Toolkit 4 with **OGSA-BES** interface

na
(KTH)

gLite (CREAM) with **OGSA-BES** interface

Goal: Test interoperability before they go Into production EC e-Infrastructures

Interoperability appraoch with Web Services (2)



JRA 3:

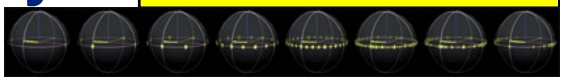
Interoperability by using more than one technology!

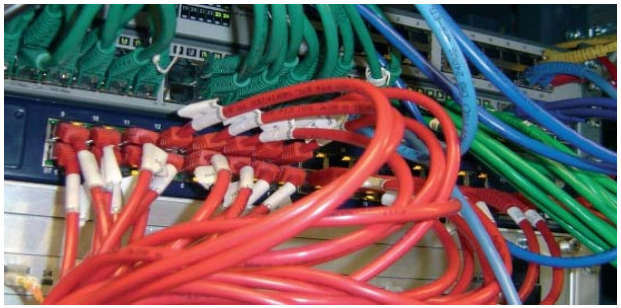
Another approach is used with proxies that carry SAML assertions („double delegation“)

(Test) Interoperability Scenarios

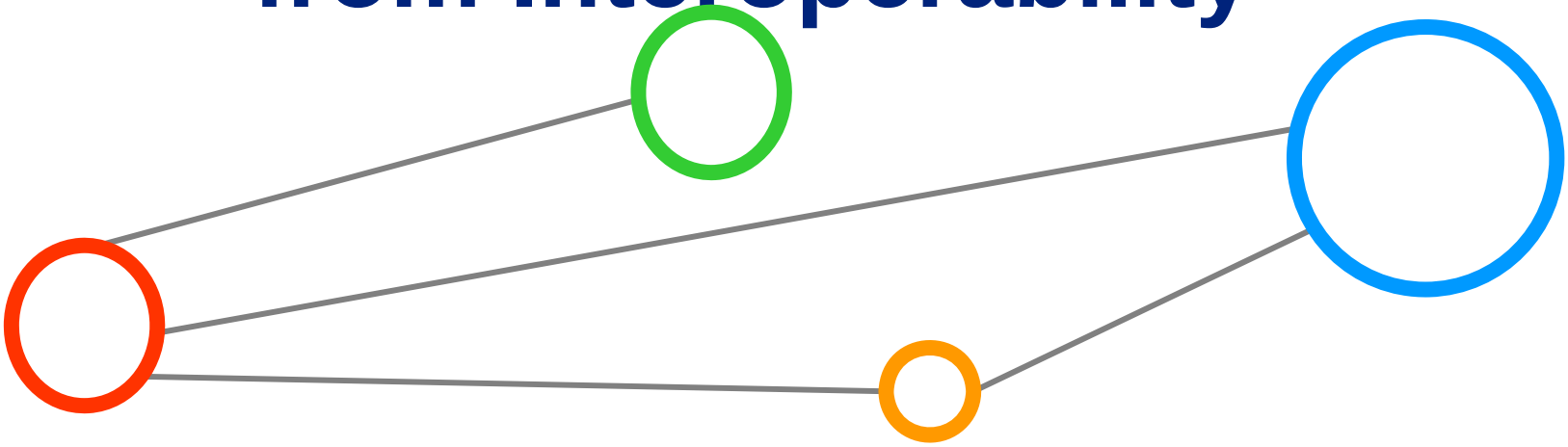
- **Towards e-Infrastructure interoperability**
  - Using components together in real use cases
  - OGSA-BES&VOMS jobs for gLite, UNICORE, Globus, CROWN
  - OGSA-BES&VOMS-based job submit using information models
  - OGSA-DAI managed data used during OGSA-BES job submits
  - OGSA-RUS example application LLview on top of all middlewares
  - Others…
- **Phases updates during the second year, new component versions**
  - E.g. OGSA-DAI integration into the multi-platform infrastructure
- **Participation in Supercomputing 2007 Demonstrations**
  - E.g. Improved OGSA-BES endpoints interoperability, etc.

DEISA DECI IQCS [2]





Lessons Learned from Interoperability



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Lessons Learned from Interoperability (1)

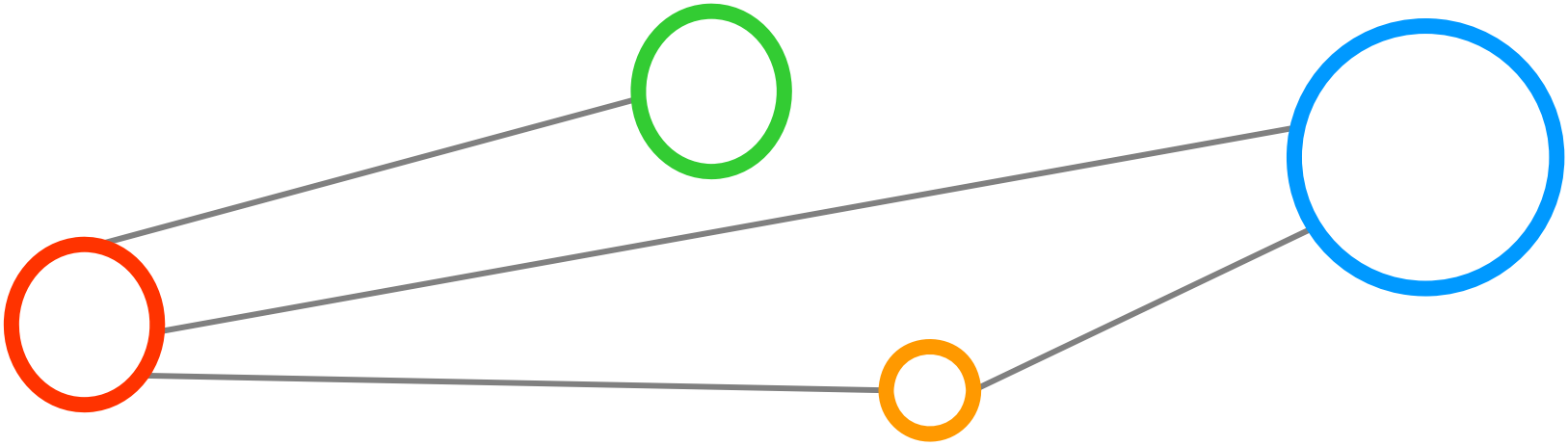
- **Missing components/functionality in Grid platforms**
  - UNICORE not relies on Info-Service, but demand for gLite
- **(Emerging) Standard specifications in different versions**
  - e.g. OGSA-BES v.26 (SC 2006), v.34 public comment, and 1.0 now
- **Different technologies for WS-* infrastructures adopted**
  - OGSI, WS-RF, WS-I, WS-ResourceTransfer, → what's next?
  - E.g. GetResourceProperty operation of WS-I endpoint fails
  - UNICORE & Globus Toolkit are WS-RF compliant, gLite more WS-I
- **Different versions of the WS-* infrastructures**
  - UNICORE uses recent WS-Addressing, Globus uses old version
  - UNICORE is WS-RF 1.2 compliant, Globus uses WS-RF 1.0

Changes in GT4.1!

Lessons Learned from Interoperability (2)

- **Challenges in security are major show stoppers**
  - Standards specification compliance is only a precondition
- **Absence of a widely accepted common security profile**
  - OMII-EU (JRA3T1: Common Security Profile) works on that
  - Several specifications of OGF (Secure Channel etc.) used
  - Only several specifications of OASIS (SAML etc.) are used
  - Only several specifications of IETF (X.509 etc.) are used
- **Different strategies and adoption status in Middlewares**
  - E.g. Delegation Mechanisms are extremely different
  - Proxies: Globus, gLite – Only initial support by UNICORE
  - Explicit Trust Delegation: UNICORE – Not by gLite & Globus

Panel Discussion Topics



Panel Discussions Topics…

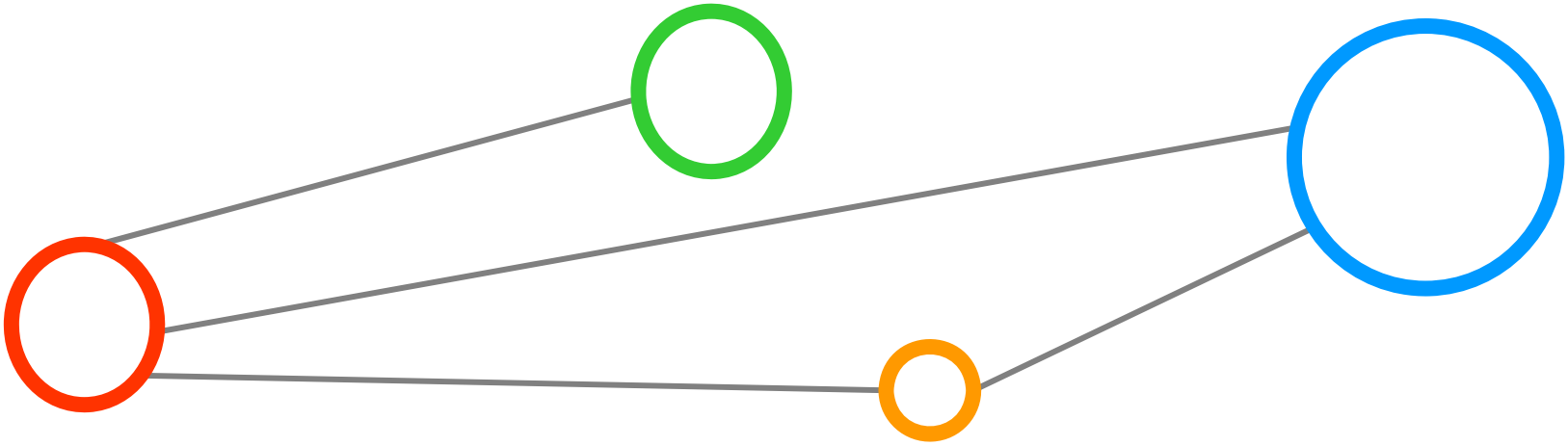
- **OMII – Europe works with CROWN**
  - OGSA-BES Metascheduler is used, more next year
  - Open for interoperability collaborations via standards…
- **EU – China Grid**
  - Uses which stack: CROWN, GOS, CGSP, ….
  - Adoption of which standards?
  - Potentials of demonstrating interoperability efforts in GIN?
- **EU – India Grid**
  - GARUDA dependency…
  - Adoption of which standards, whic middleware is used?
  - Potentials of demonstrating interoperability efforts in GIN?

CROWN [13]

EU China Grid [11]

EU India Grid [12]

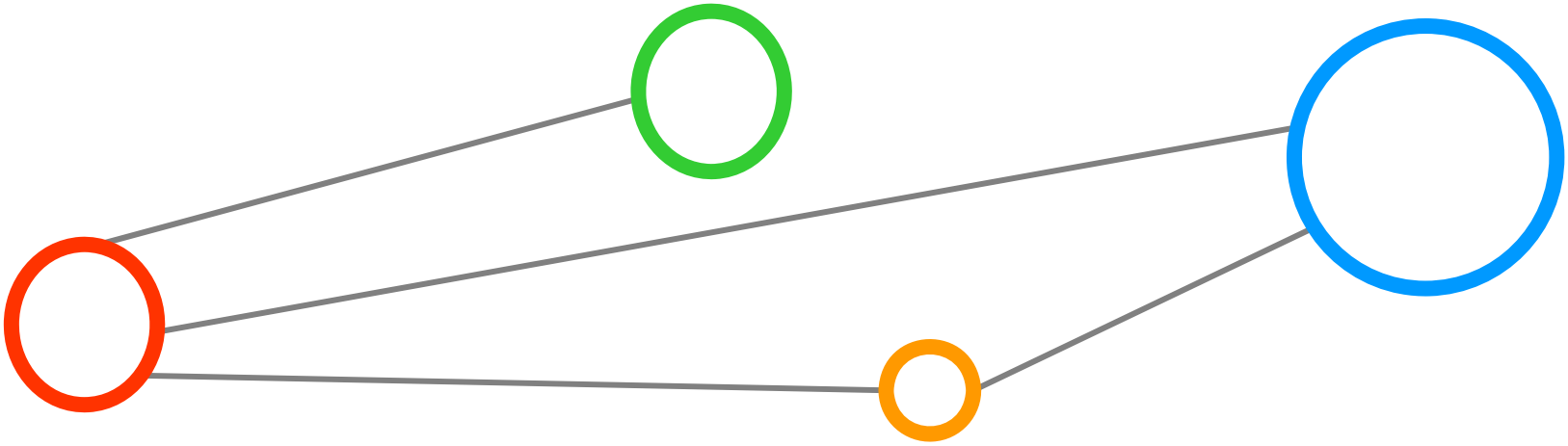
Conclusions



Summary

- **Standard compliance (via ETICS, Metronome, etc.)**
  - One Component follow specification X (e.g. OGSA-BES v.1.0)
- **Interoperation (work performed in OGF GIN-CG group)**
  - What needs to be done to get interacting production Grids
  - Hacks, workarounds, short-term achievements, adapters
- **Interoperability (work performed in OMII – Europe)**
  - Many components work together to achieve a goal (a real scenario)
  - Native standards support from middlewares (no hacks)
  - OMII-Europe II will focus on data interoperability issues (if funded)
- **Continuing work in the open standards working groups!**
  - „Interoperability highway…“ realize the „true global Grid with WS-*“

References



References

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