International Collaboration to Extend and Advance Grid Education

Edinburgh e-Science TOE

Training Outreach and Education

Wider Context
NGS Future Developments

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Information Society

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National e-Science Centre

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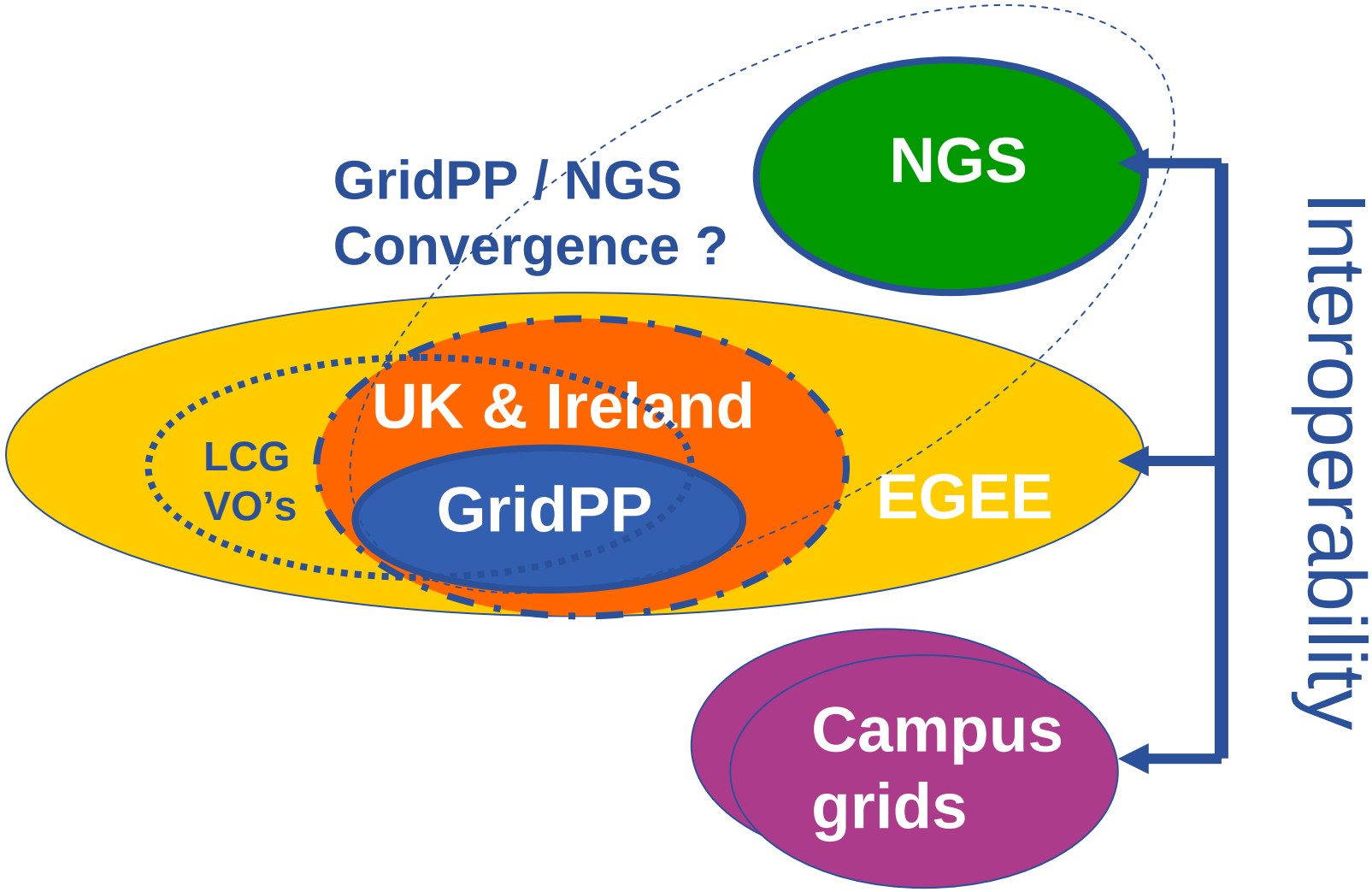
NGS – The Future



NGS – Resource Brokering

Inclusion of EGEE Resource Broker

- **(This is NOT the SRB!!!)**
- **Current NGS middleware comprises toolkits inviting development of higher level services**
- **On the current NGS we have**
  - GRAM to submit jobs
  - Information service – resources available, state of queues…
- **The RB will take the work out of deciding where to run a job**
  - Submit job to the grid, not a specified “compute element”
- **Challenge delaying RB deployment:**
  - RB is tightly coupled to rest of EGEE middleware

Virtual Organization Membership Service

Before VOMS

- User is authorised as a member of a single VO
- All VO members have same rights
- Gridmapfiles are updated by VO management software: map the user's DN to a local account
- grid-proxy-init

VOMS

- User can be in multiple VOs
  - Aggregate rights
- VO can have groups
  - Different rights for each
    - Different groups of experimentalists
    - …
  - Nested groups
- VO has roles
  - Assigned to specific purposes
    - E,g. system admin
    - When assume this role
- Proxy certificate carries the additional attributes
- voms-proxy-init

NGS – The Future

- **Middleware recently deployed**
  - Portal v2 https://portal.ngs.ac.uk
  - INCA monitoring: http://inca.grid-support.ac.uk/
- **Being deployed**
  - VOMS http://wiki.ngs.ac.uk/index.php?title=VOMS
  - GridSAM –job submission and monitoring service http://wiki.ngs.ac.uk/index.php?title=GridSAM
- **Under development**
  - Shibboleth integration http://www.jisc.ac.uk/whatwedo/programmes/programme_middleware/
- **Under observation**
  - middleware from EGEE http://www.glite.org
  - OMII-UK middleware http://www.omii.ac.uk/
  - GT4 http://www.globus.org/toolkit/
- **Long-term possibilities include**
  - NextGrid http://www.nextgrid.org/

Grid-Related Standards

General Standards Bodies

W3C – World-Wide Web Consortium

- Industry non-profit organisations individuals.
- Best known for **fundamental web standards**

DMTF: Distributed Management Task Force

- Industry
- management standards and integration technology.
- Best known for standards that address **system management** in enterprise and Internet environments

OASIS: Organization for the Advancement of Structured Information Standards

- Vendors users academics governments; Organizations individuals industry groups
- Best known for **e-business** standards that address real world business requirements

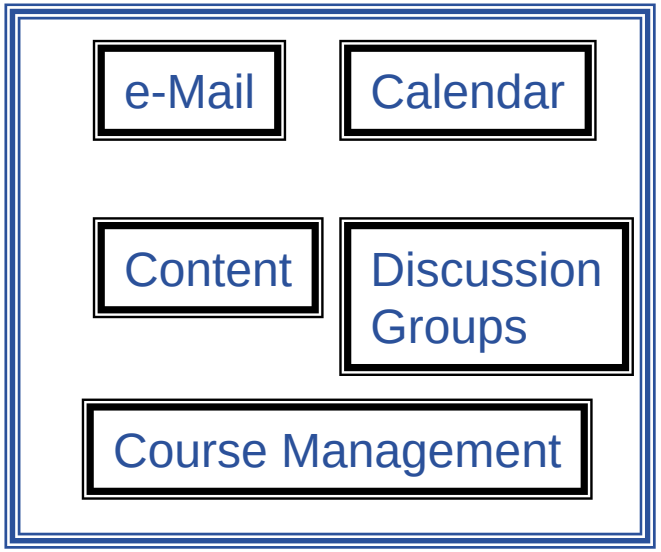
OGF : Open Grid Forum

GGF : Global Grid Forum → OGF : Open Grid Forum

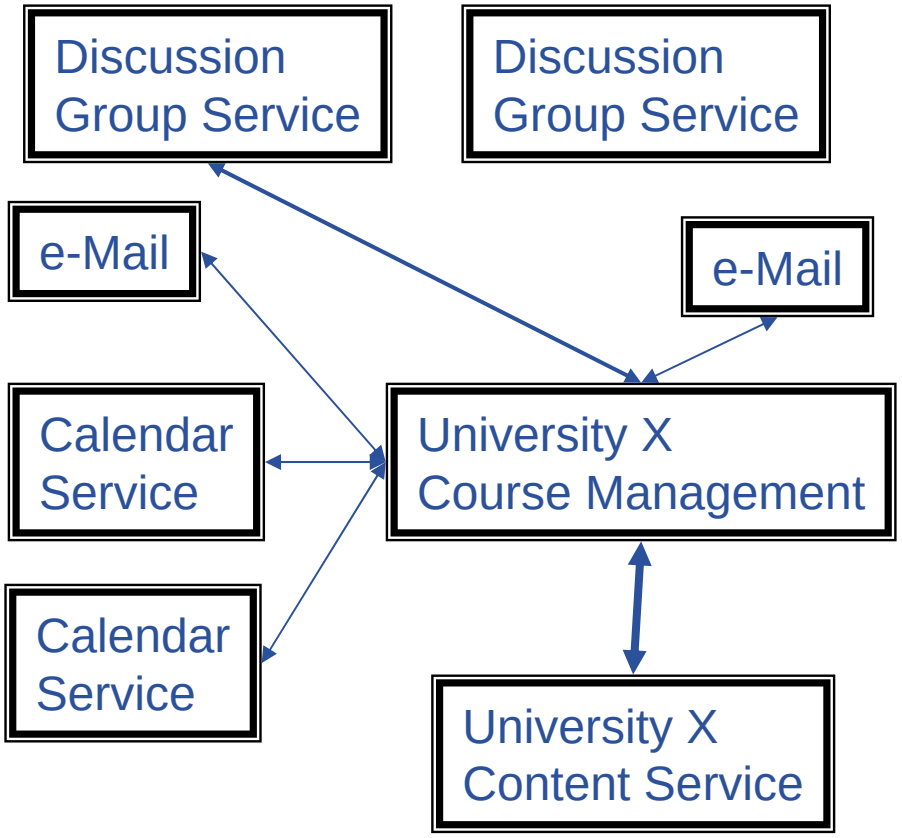
- **International community leading the global standardization effort for grid computing.**
- **Founded in 2000**
- **Members include**
  - users, developers, and vendors.
  - Industry, academics, research laboratories
- **Best known for standards and architectures for Grids, including:**
  - OGSA (Open Grids Services Architecture)
  - GridFTP
  - ByteIO
  - JSDL, BES (Basic Execution Service)
  - HPCP (High Performance Computing Profile)
  - …

Service Orientation

University X
Staff/Student Support System



Bundled collection of Proprietary Web-based Applications –
Lock-in
Jack-of-all-Trades

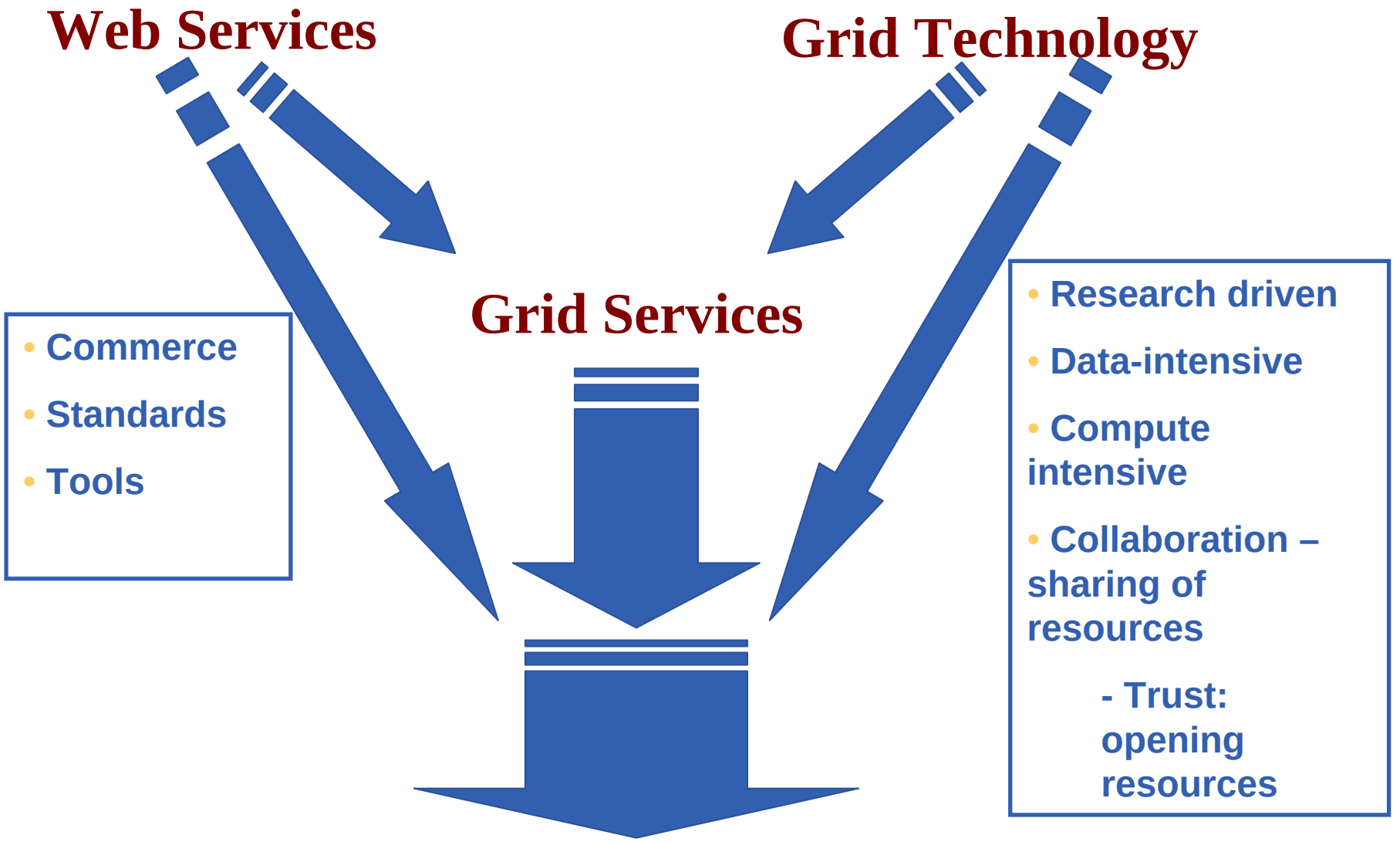


Loosely coupled collection of Services
Core competency focus

Web Services

- **Web Services are software components that are..**
  - **Accessible across a network**
  - **Defined by the messages they receive / send**
  - **Loosely coupled**
    - Web services framework supports
      Autonomous Evolution
      - *So can change service implementation without changing interfaces*
      - *Can evolve interface with forward & **backward compatibility***
  - **Interoperable: each service has a description that is accessible and can be used to create software to invoke that service - WSDL**
- **… and based on standards**
  - **Built on (extensions of) standards made ubiquitous by the Web: http(s), XML, … and for which tools are therefore built.**
  - **Developed in anticipation of new uses**
  - **central - XML SOAP WSDL**
- **Briefly - A service is a software system designed to support interoperable machine-to-machine interaction over a network**

Grid Services



GRIDS + WS = Grid Services

Exploit commonality

- **Efficiency of common solution to common problems**
  - Interaction across Organisational Boundaries
  - Interaction across globally distributed network of components
  - Interaction within a changing environment
  - Interoperability is required due to heterogeneity

Integrate Differences

- **Service Abstraction vs Virtual Computer Abstraction**
  - **Construct the Virtual Computer components as services**
  - **Retro-fit web-services wrappers**
- **Organisational independence vs co-operative VOs**
  - **VO and authorisation/authentication services**

Persistence

Web Services

- **Short-lived Interactions**
- **Call-return interaction**

Grids

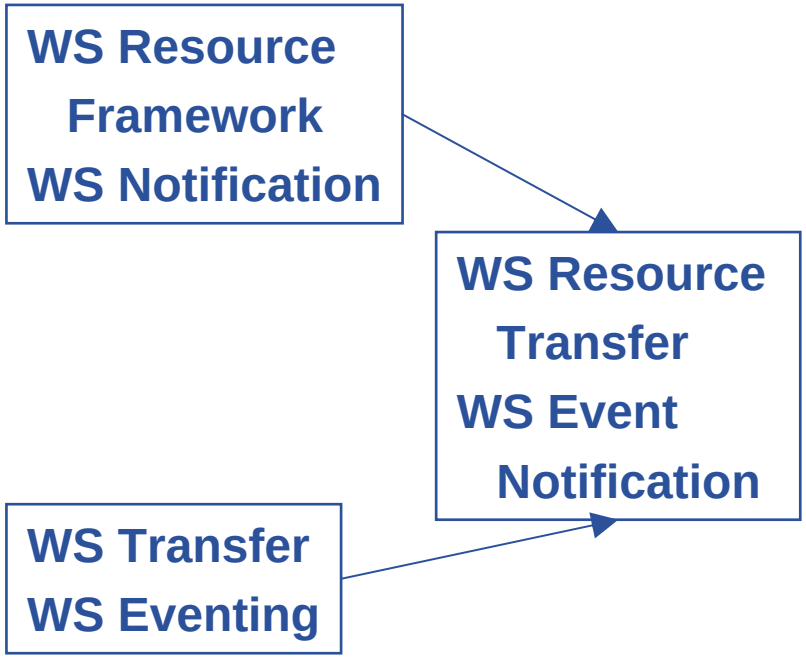
- **Persistence –**
  - Infrastructure
  - Computation
  - Data
  - People
- **also, Event-driven interactions**

Need to add to basic web services the notion of persistency

STATEFUL SERVICES

Resources and Event-driven Interaction

- **Resource**
  - Existence
    - creation
    - identifier
    - deletion
    - lifetime
  - Resource Properties – state elements
    - XML representation
    - get
    - put
    - partial get
    - partial put
- **Event Driven**
  - Subscribe to a topic
    - itself a resource
  - Notify a topic-relevant event



OGSA – Conceptual View

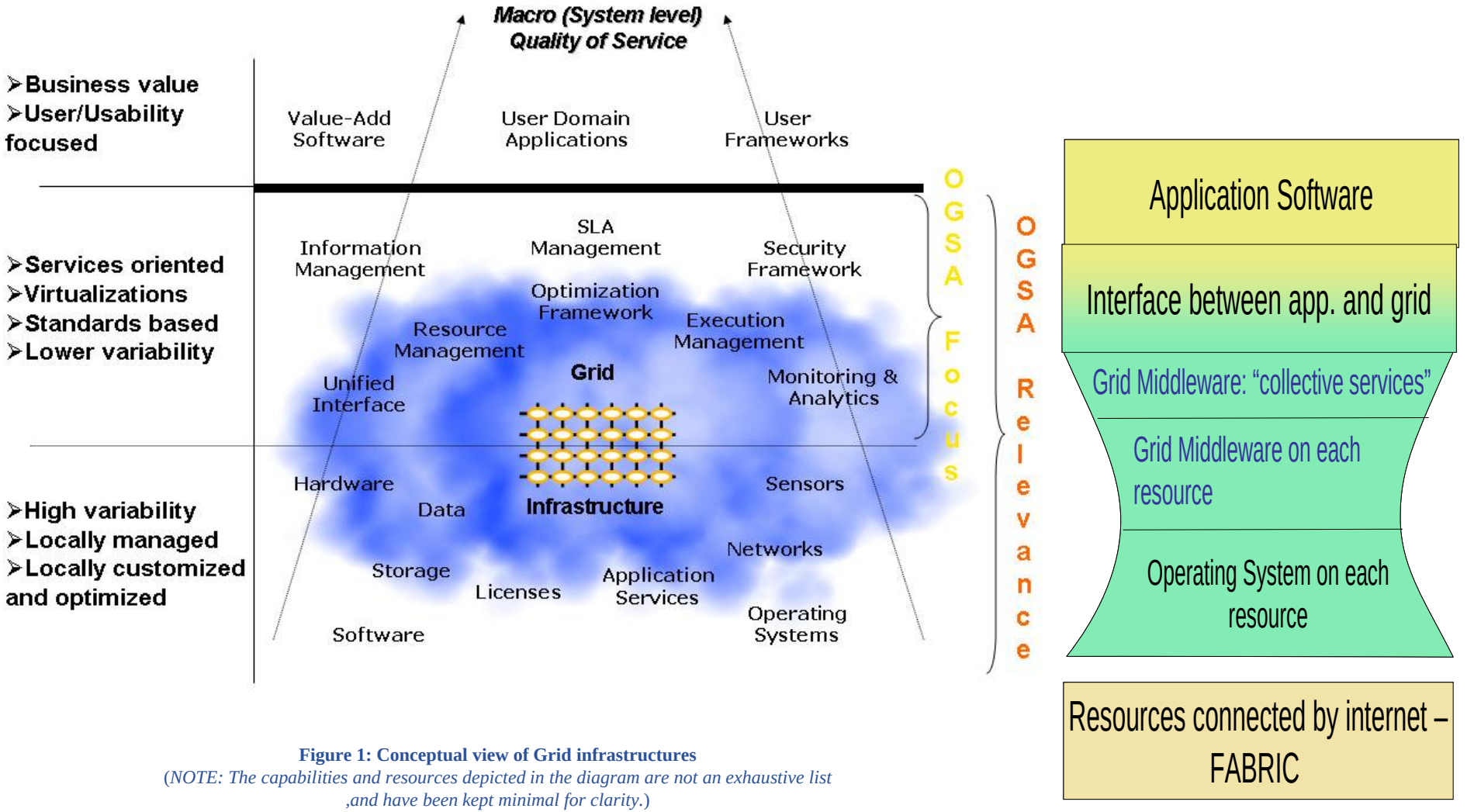


Figure 1: Conceptual view of Grid infrastructures
(NOTE: The capabilities and resources depicted in the diagram are not an exhaustive list ,and have been kept minimal for clarity.)

OGSA - Basis

- **Aim is to establish standard functionality domains and associated standard specifications**
- **Infrastructure Services – Base Profiles**
  - **Resources**
    - *WS-Addressing*
    - *WSRF*
    - *WS-Notification*

    Alternative

    - *WS-Resource Transfer*
    - *WS-Event-Notification*
    - ***WS-I Basic Profile***
      - XML
      - SOAP
      - WSDL
  - **Secure Channel**
    - *WS-Security; XML-signature; WS-I Basic Security Security Assertion Mark-up Language (SAML)*
  - **Anonymous Channel**
    - *WS-I Basic Security*

Projects / Organisations
that we think you should know about

Projects / Organisations

	Middle-ware	Production Infrastructure	Training	Education
• **OMII-Europe**	**X**		**X**	
• **OMII-UK**	**X**			
• **EGEE**	**X**	**X**	**X**	
• Globus	X			
• Condor	X			
….				
• **ICEAGE**				**X**
• **NextGRID**	**X**			

Projects / Organisations

	Training	Education
• OMII-Europe	X	
• OMII-UK		
• EGEE	X	
• ICEAGE		X

Edinburgh e-Science TOE:

Training

Outreach

Education

(Formerly known as the "NeSC Training Team")

TOE activities

- **European**
  - Leads ICEAGE
  - Lead training for: EGEE, OMII-Europe
- **In UK (~1 FTE)**
  - Lead training for NGS >> 200 people trained over 2 years
- **Increasing emphasis on "Enabling, Facilitating" part of our mission statement**
  - Bootstrapping training – e.g.
    - Build VOs' ability to train selves
    - Support other training groups – e.g. training CA for NGS
    - Regional grids, university middleware teams
    - Training the Trainers
  - As courses are proven
    - support others in their delivery
    - build next level courses

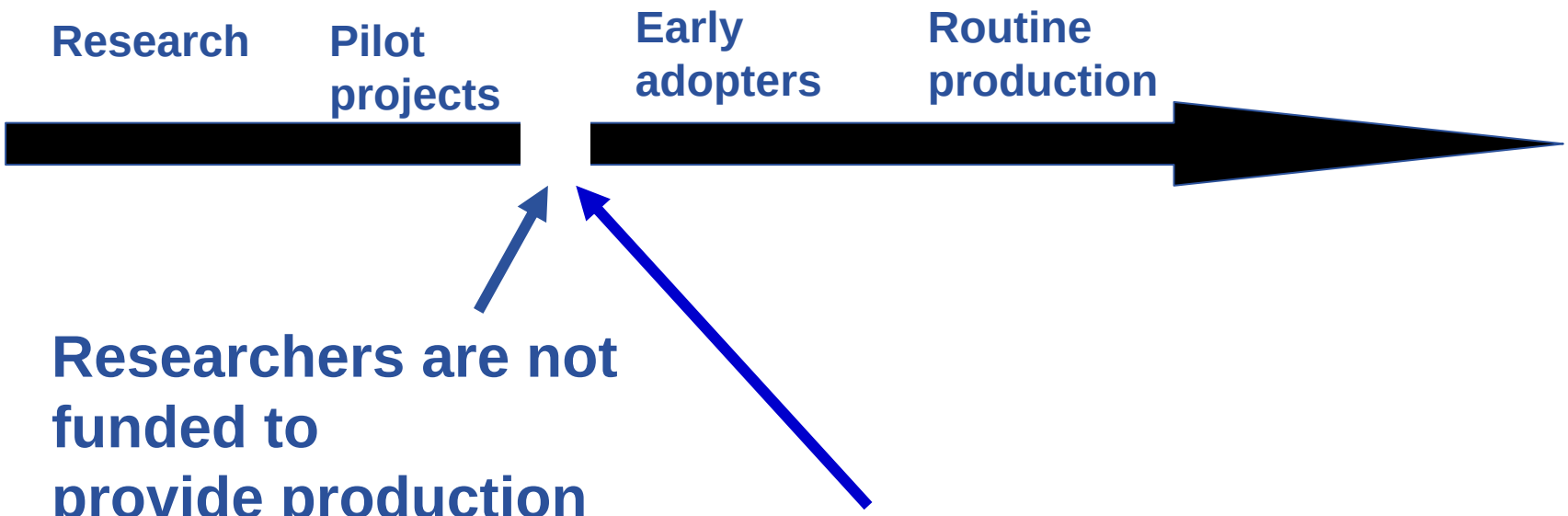
Open Middleware Infrastructure Institute - Europe

- **The OMII-Europe vision is**
  - to harvest open-source, Web-Services-based, Grid software components from across Europe and
  - to supply these Grid services in a form that will enable them to interoperate across the platforms:
    - gLite
    - UNICORE
    - Globus .
- **EU project - 16 partners from Europe, the USA and China**
- **Focussing on 5 basic service-level components, and associated standards**
  - Basic Execution Service supporting JSDL
  - Data Integration Service, OGSA DAI
  - Virtual Organisation Management Service, VOMS
  - Accounting Service, based on forthcoming RUS OGF specification
  - Portal capability, GridSphere
- **Focus on the user experience**
  - impartial broker; interoperability; quality assurance
- **Re-engineering rather than developing new technology**
  - where necessary porting components to new platforms

Open Middleware Infrastructure Institute - UK

- **Mission –**
  - To be a leading provider of reliable interoperable and open-source Grid middleware components services and tools to support advanced Grid enabled solutions in academia and industry.
- **Partners –**
  - University of Southampton (2004)
  - OGSA-DAI team at Edinburgh
  - myGrid team at Manchester
- **Activities -**
  - Providing a software repository of Grid components and tools from e-science projects
  - re-engineering software, hardening it and providing support for components sourced from the community
  - A managed programme to contract the development of “missing” software components necessary in grid middleware
  - Providingan integrated grid middleware release of the sourced software components

OMII-UK – Building e-Research



Researchers are not funded to provide production quality software for others to use

OMII-UK exists to help bridge this gap!

EGEE – international e-infrastructure

International Collaboration to Extend and Advance Grid Education

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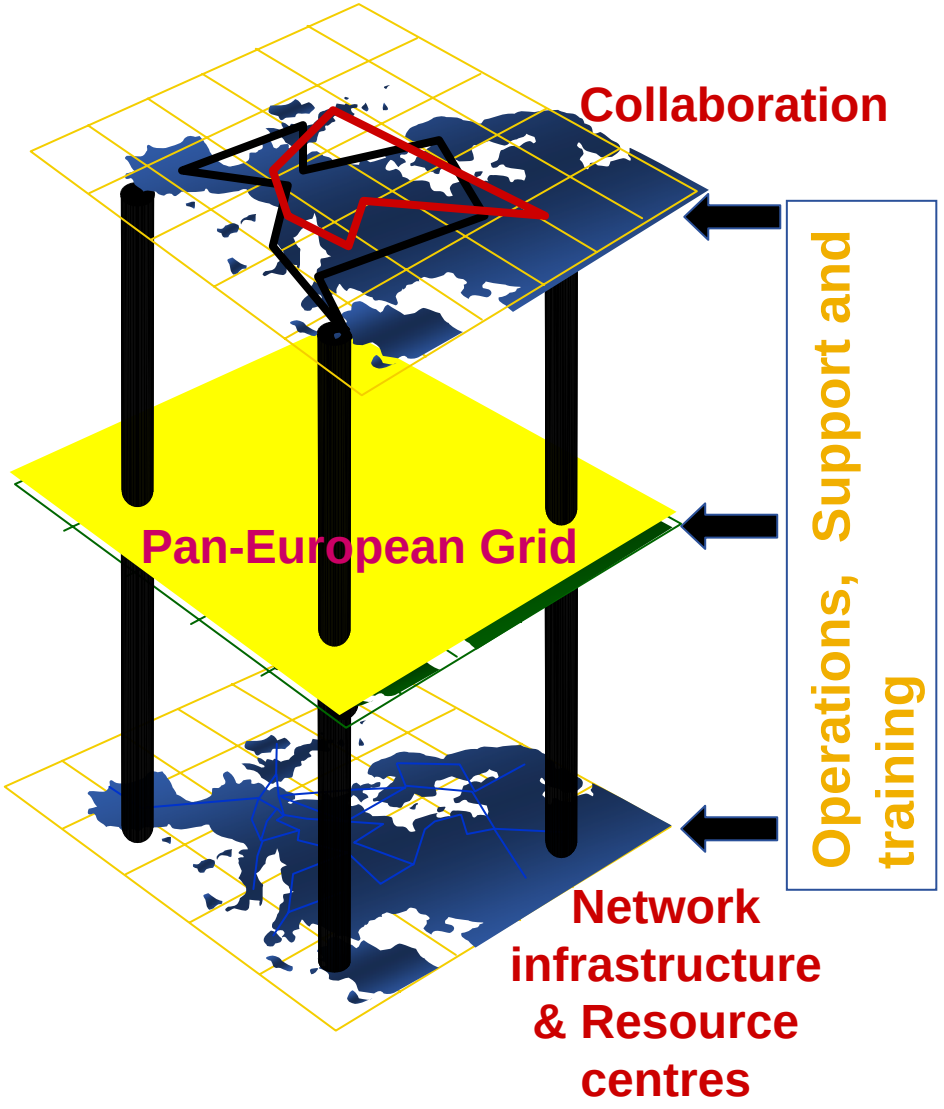
Training Outreach and Education

- **Build, deploy and operate a consistent, robust a large scale production grid service that**
  - Links with and build on national, regional and international initiatives
- **Improve and maintain the middleware in order to deliver a reliable service to users**
- **Attract new users from research and industry and ensure training and support for them**



EGEE – In the first 2 years

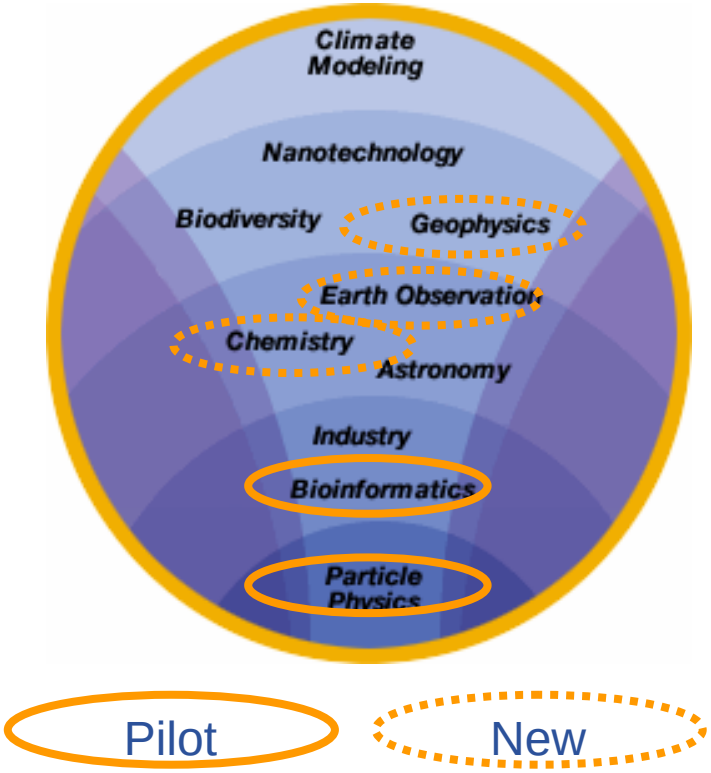
International Collaboration to Extend and Advance Grid Education

Edinburgh e-Science TOE Training Outreach and Education

- **Established production quality sustained Grid services**
  - 3000 users from at least 5 disciplines
  - Goal was to integrate 50 sites into a common infrastructure → currently 180
  - offer 5 Petabytes (10^{15}) storage

- **Demonstrated a viable general process to bring other scientific communities on board**

- **Secured a second phase from April 2006**



NextGRID Project

- 11M€ EU FP6 project; 3 years starting September 2004.
- 22 partners, some industrial, some academic.
- Developing Architecture for Next Generation Grids.
- Research and exploration project: A 5-10 year lookout.

www.nextgrid.org

NextGRID – Challenges & Experiments

- **Key focus areas:**
  - Service Level Agreements
  - Workflows (across domains)
  - Security
  - Data
- **Challenges are manifested in NextGRID reference applications from WP7:**
  - Financial modelling (Implied Volatility, Derivatives Pricing)
  - Digital media production (On-demand video rendering)
- **Key components being developed and evaluated.**

- **Mission**

  Stimulate and support advances in grid education throughout Europe

- **Goals**
  - Achieve rapid growth in effective advanced grid education
  - Make best use of worldwide capacity for advanced grid education
  - Deliver a stimulating programme of educational events
    - Including international summer schools
  - Broaden engagement in an advanced grid education
    - both geographically and across disciplines

Iceage – Activities

- **Forum**
  - International panel of experts to develop curricula, policies & strategies, ontologies
- **Support, Outreach, Induction & Training services**
  - Attracting & Training the Trainers
  - Persuading Universities to adopt Grid Computing Curricula
  - E-Learning, repository & course scheduling & announcement
- **Summer Schools**
  - General
  - Specialised – S/W engineering Bio-informatics …
- **T-Infrastructure**
  - A training grid - very different from a production grid
    - *response time vs throughput*
    - *lightweight CA*
    - *middleware agility*
    - *safe and effective play-ground*

Concluding Remarks

Continued Learning

- **Training Material –**
  - EGEE digital library
    - http://egee.lib.ed.ac.uk/
- **Educational Material**
  - ICEAGE Digital Library
    - http://baillie.lib.ed.ac.uk/
- **Finding Someone who knows / can teach it**
  - ICEAGE Experts Registry
- **Finding courses**
  - ICEAGE HE programme registry
  - Various events programmes – EGEE / NeSC / NGS / …

Service-Orientation

- **Service-oriented Middleware**
  - to enable
    - inter-operability
    - mix-and-match
- **Service-oriented Organisations**
    - TOE
    - NGS
    - NW-GRID
  - If you want something new or something doesn't work for you
    - ASK – it might change
- **Service-oriented Research**
  - grids enable this

Devil's Advocate

The killer argument for not bothering with grids

- **It's easier just to use my own cluster**

The killer argument for not bothering with commercial airlines

- **It's easier just to buy my own jet**

The killer argument for not bothering with scheduled train services

- **It's easier just to run my own train**

The killer argument for not bothering with public roads

- **It's easier just to build my own roads**

Works for some VIPs

Works for one V-VIP

Works for nobody - you can't build a road to everywhere you might want to go

FUNDAMENTAL INFRASTRUCTURE MUST BE SHARED

So, why Bother Trying to Use Grids?

- **Orchestration of services**
  - *Can be heterogeneous*
  - *Are owned by different organisations*
  - *geographically distributed*
    - Data
    - Instruments
    - Applications

- **Processor Power**
  - if your peak need is much higher than your average need

- **Collaboration**
  - if you want to jointly develop and use applications

The End

That's ALL Folks