omii europe

open middleware infrastructure institute

# Basics of Grid Middleware – 2 (with an introduction to OMII-Europe)

Mike Mineter
NeSC-TOE

# Contents

- **Convergence of Web Services and Grids**
- **Current state of production grids**
- **(Some of the) emerging standards**
- **Response of the OMII-Europe project**

**Acknowledgement: many of these slides are reused from presentations created by the NeSC-TOE team for NGS courses**

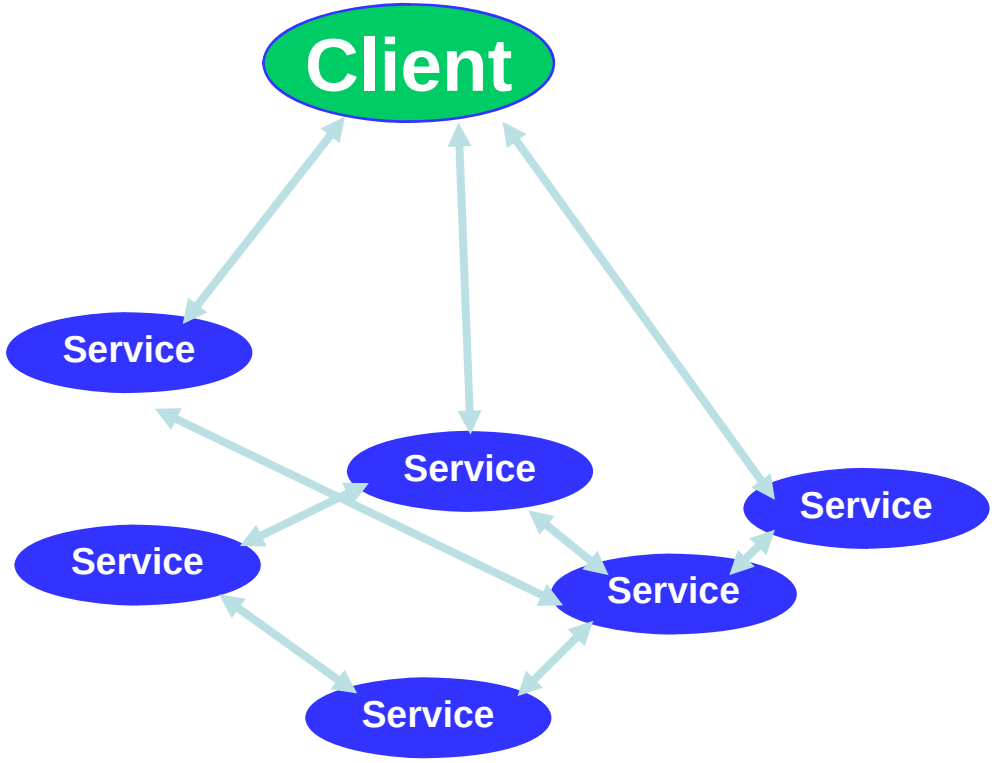
# Goal of talk

- **To explore the**
  - Multiple grids and diverse middleware in production use
  - Emerging standards

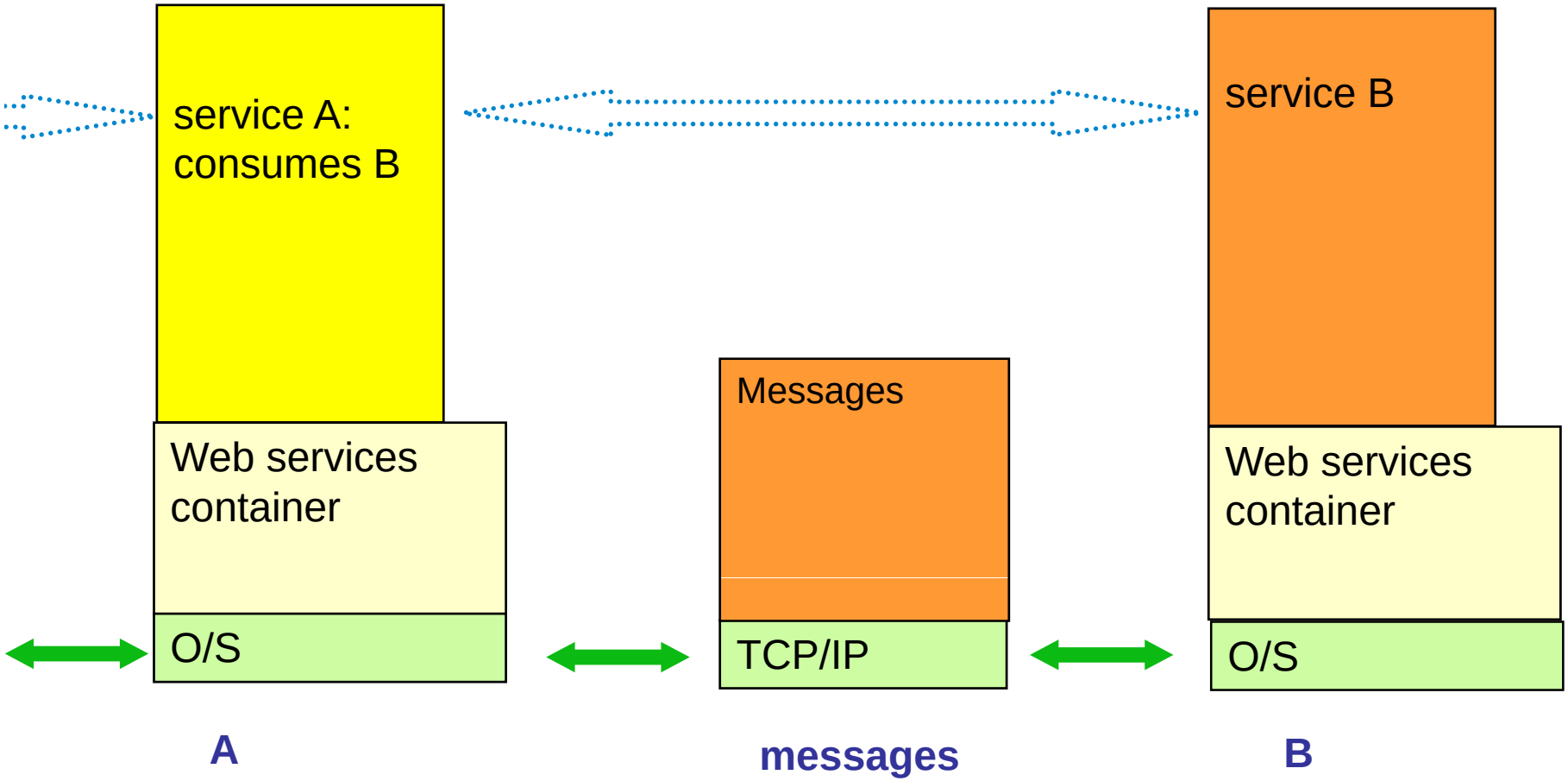
- **…. and the OMII-Europe response**
  - building bridges between grids

# Service orientation – software components that are…

- **Accessible across a network**
- **Loosely coupled, defined by the messages they receive / send**
- **Service description that can be used to create client software**
- **Based on standards (for which tools do / could exist)**
- **Developed in anticipation of new uses**



# Using service B from service A



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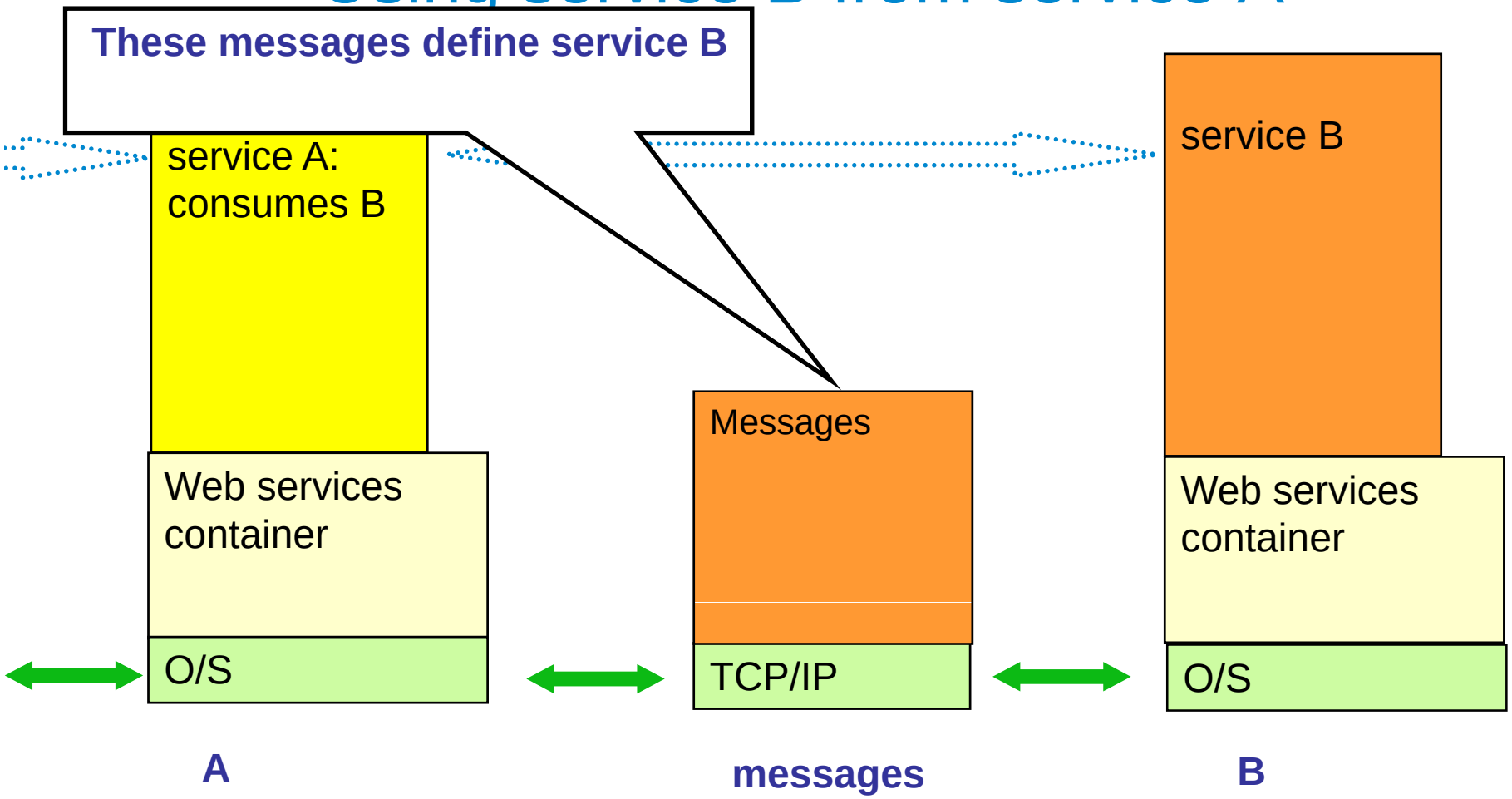
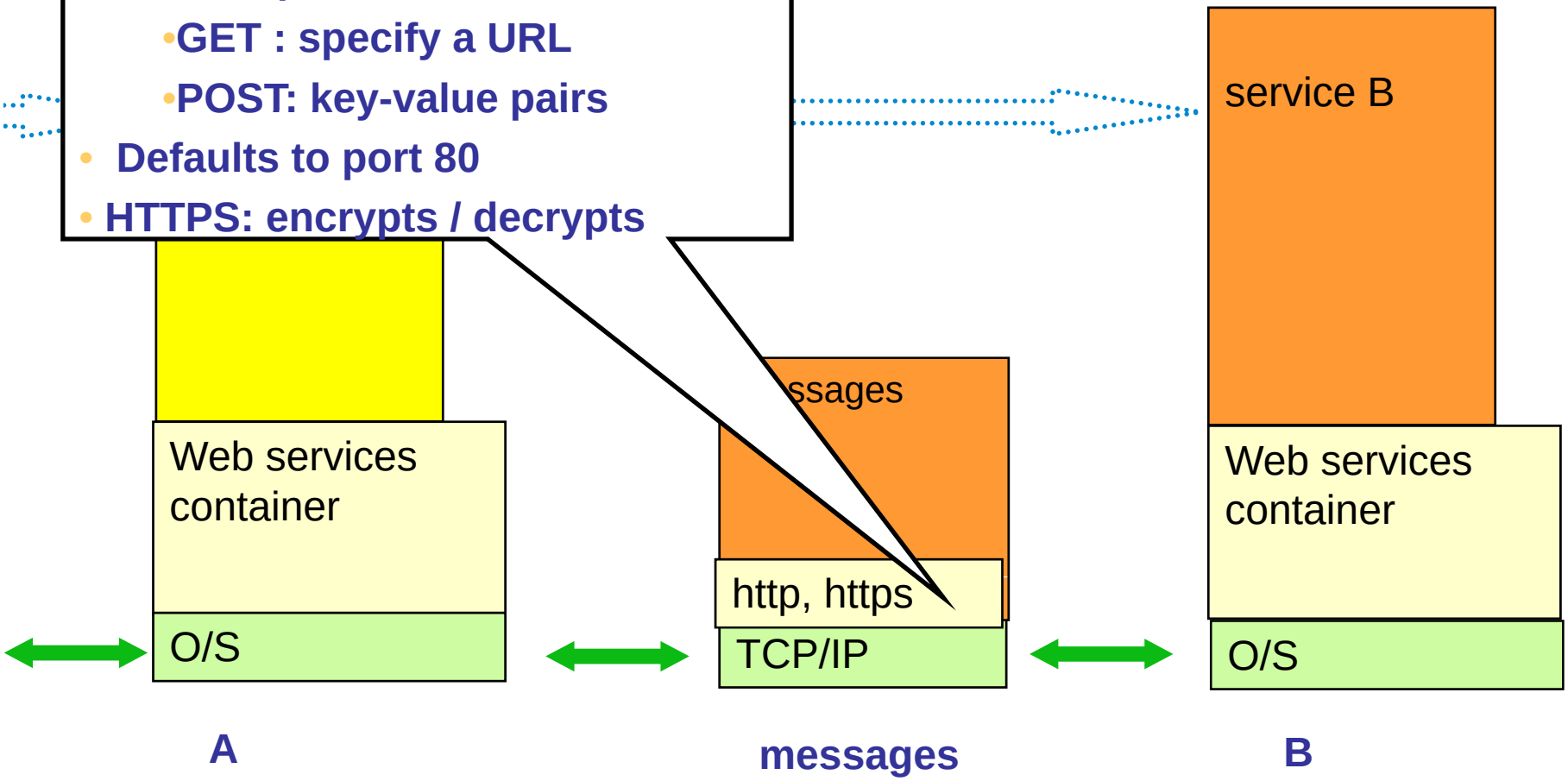


# B from service A

- Commonly used for WS - original purpose: carry HTML
- HTTP request methods
  - GET : specify a URL
  - POST: key-value pairs
- Defaults to port 80
- HTTPS: encrypts / decrypts

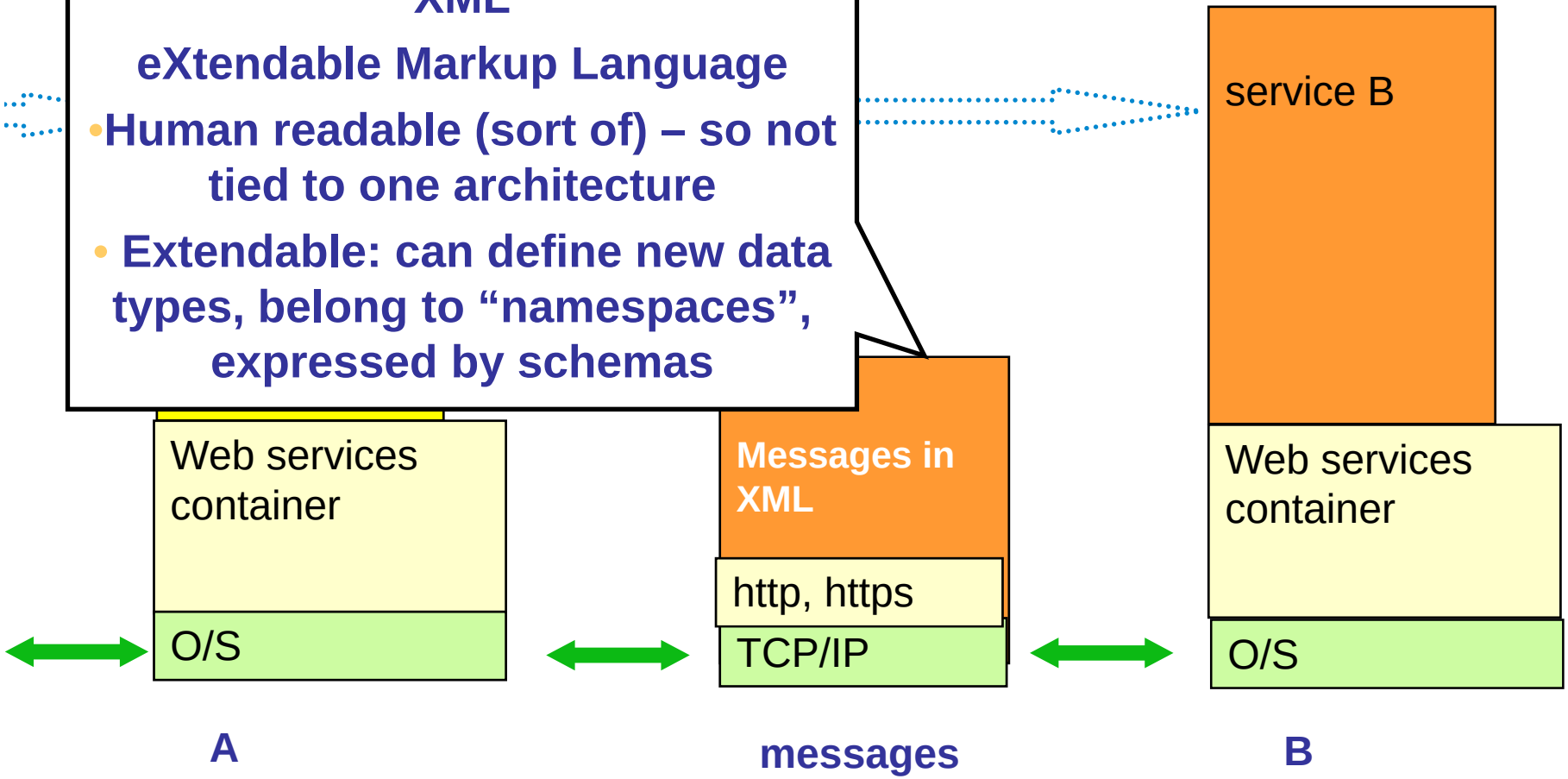


# Using service B from service A

**XML**

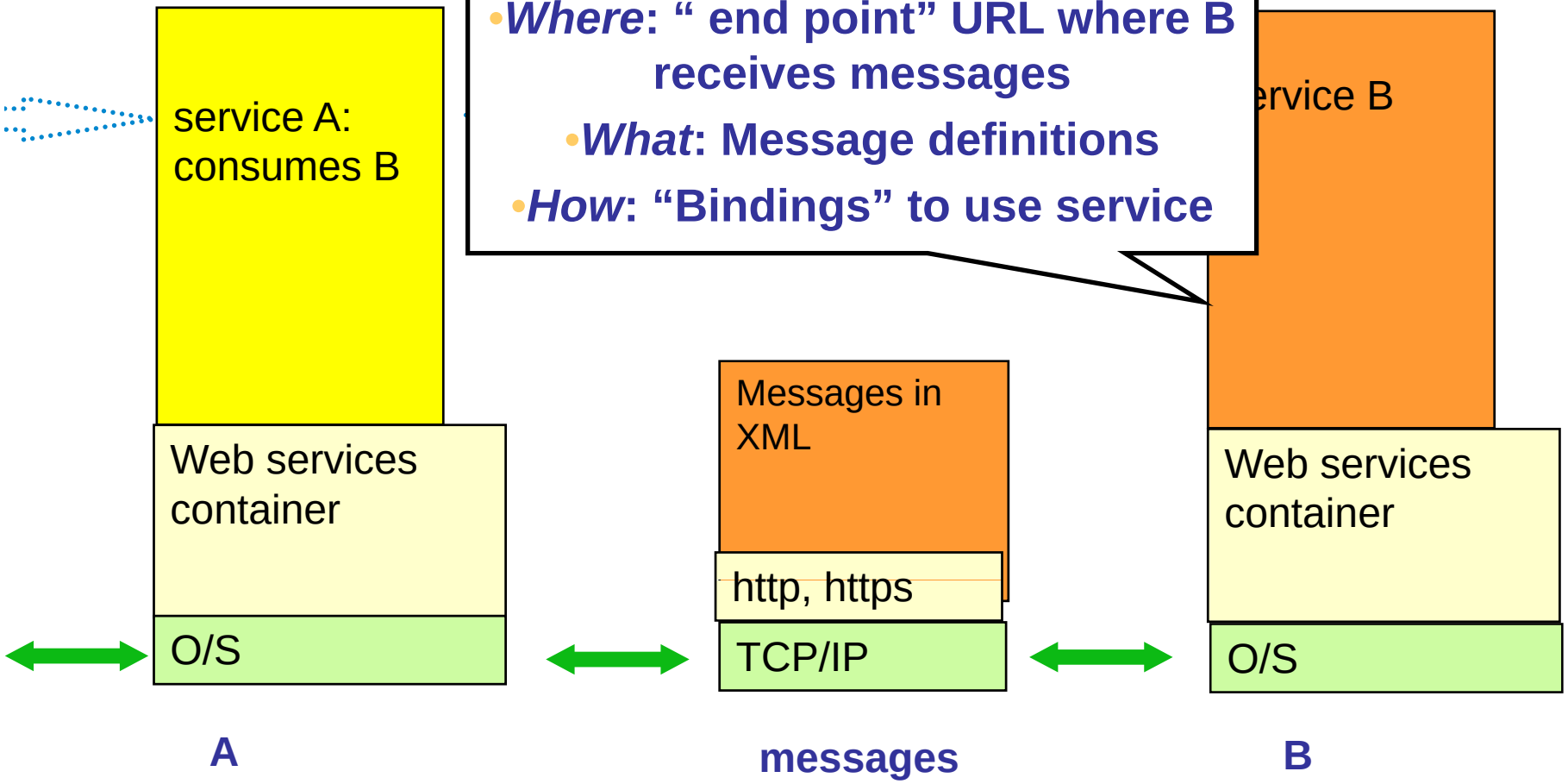
**eXtendable Markup Language**

- **Human readable (sort of) – so not tied to one architecture**
- **Extendable: can define new data types, belong to "namespaces", expressed by schemas**



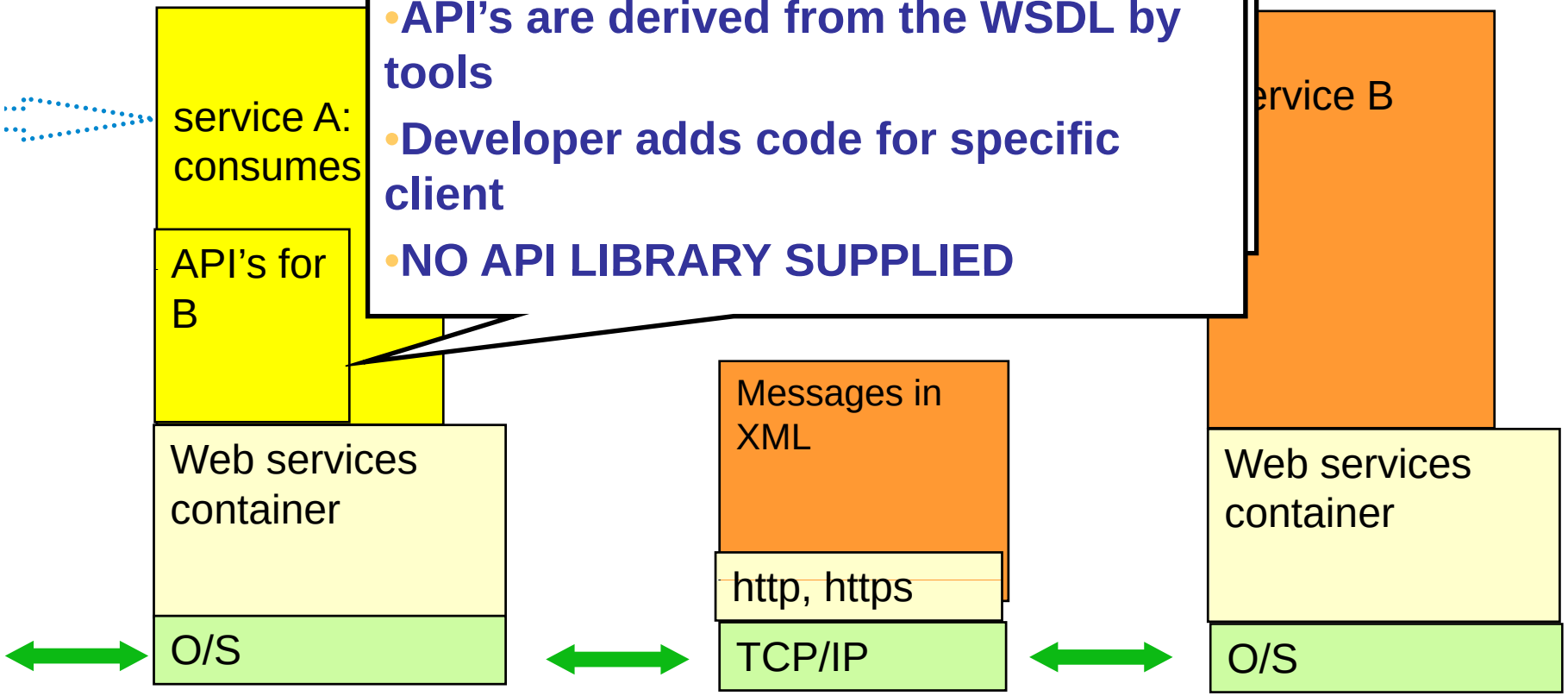
**Service B is described by WSDL, "Web Service Description Language". Includes:**

- ***Where*: " end point" URL where B receives messages**
- ***What*: Message definitions**
- ***How*: "Bindings" to use service**

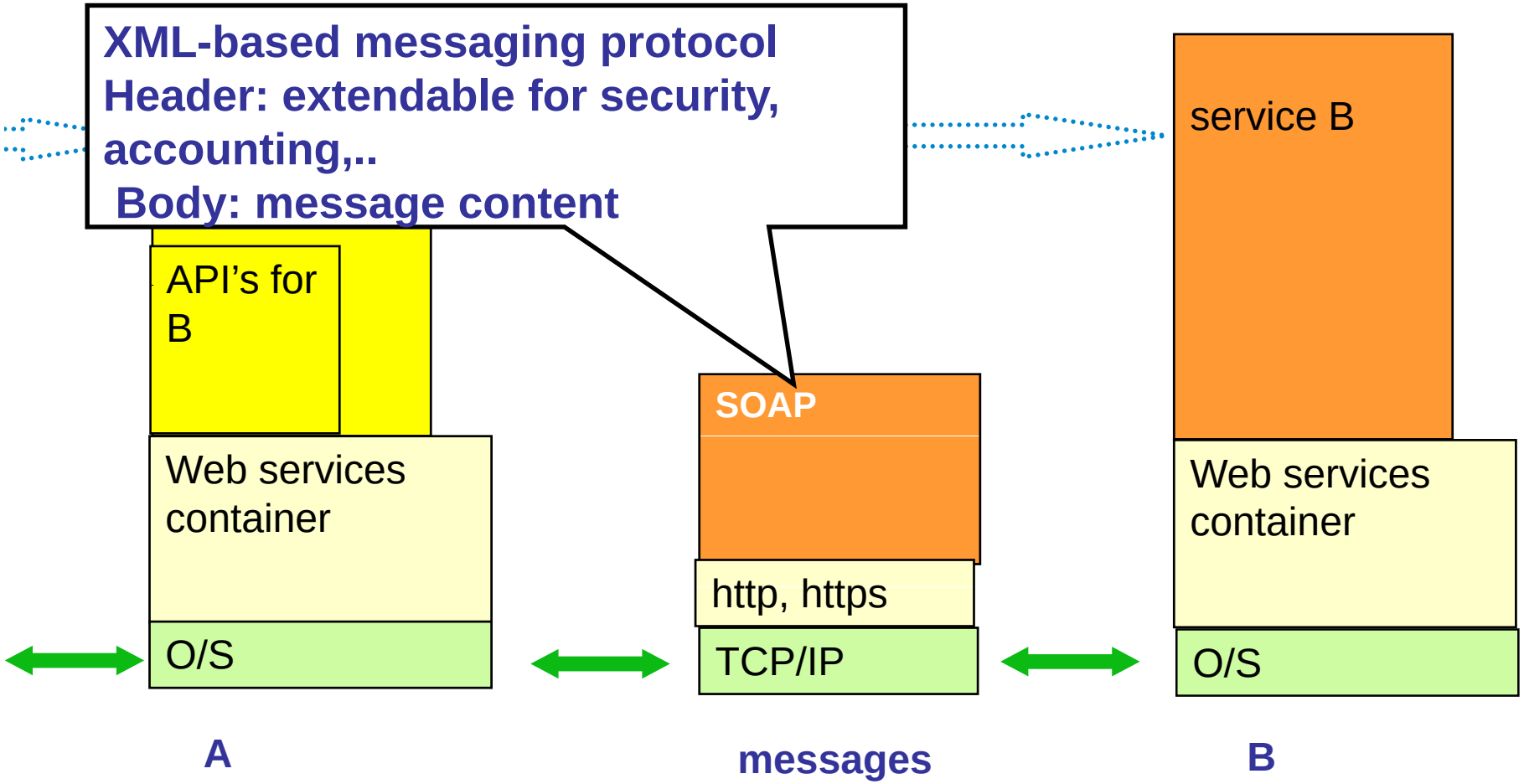


**Service B is described by WSDL, "Web Service Description Language". Includes:**

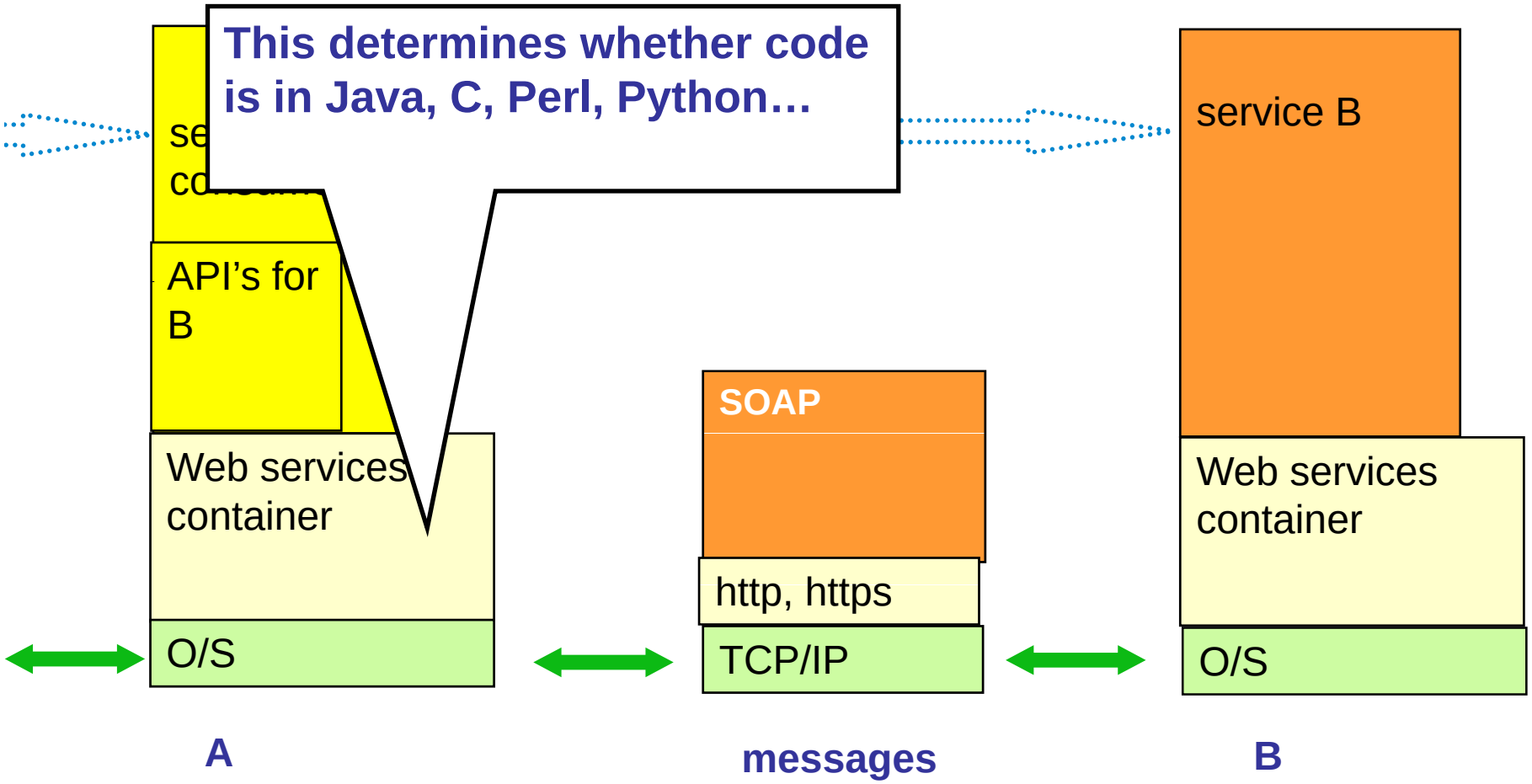
- **API's are derived from the WSDL by tools**
- **Developer adds code for specific client**
- **NO API LIBRARY SUPPLIED**



# SOAP

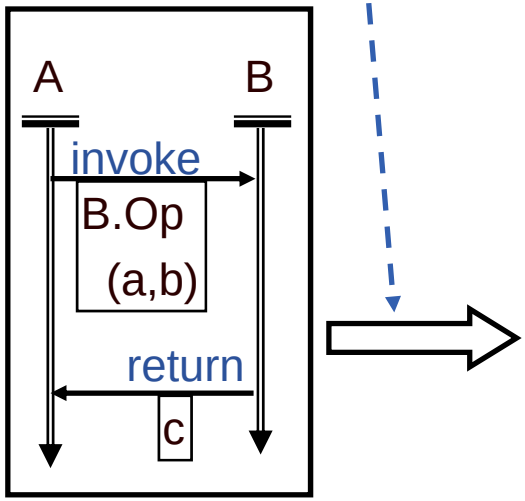

XML-based messaging protocol
Header: extendable for security, accounting,..
Body: message content
API's for B
Web services container
O/S
SOAP
http, https
TCP/IP
service B
Web services container
O/S
A
messages
B

# Code languages

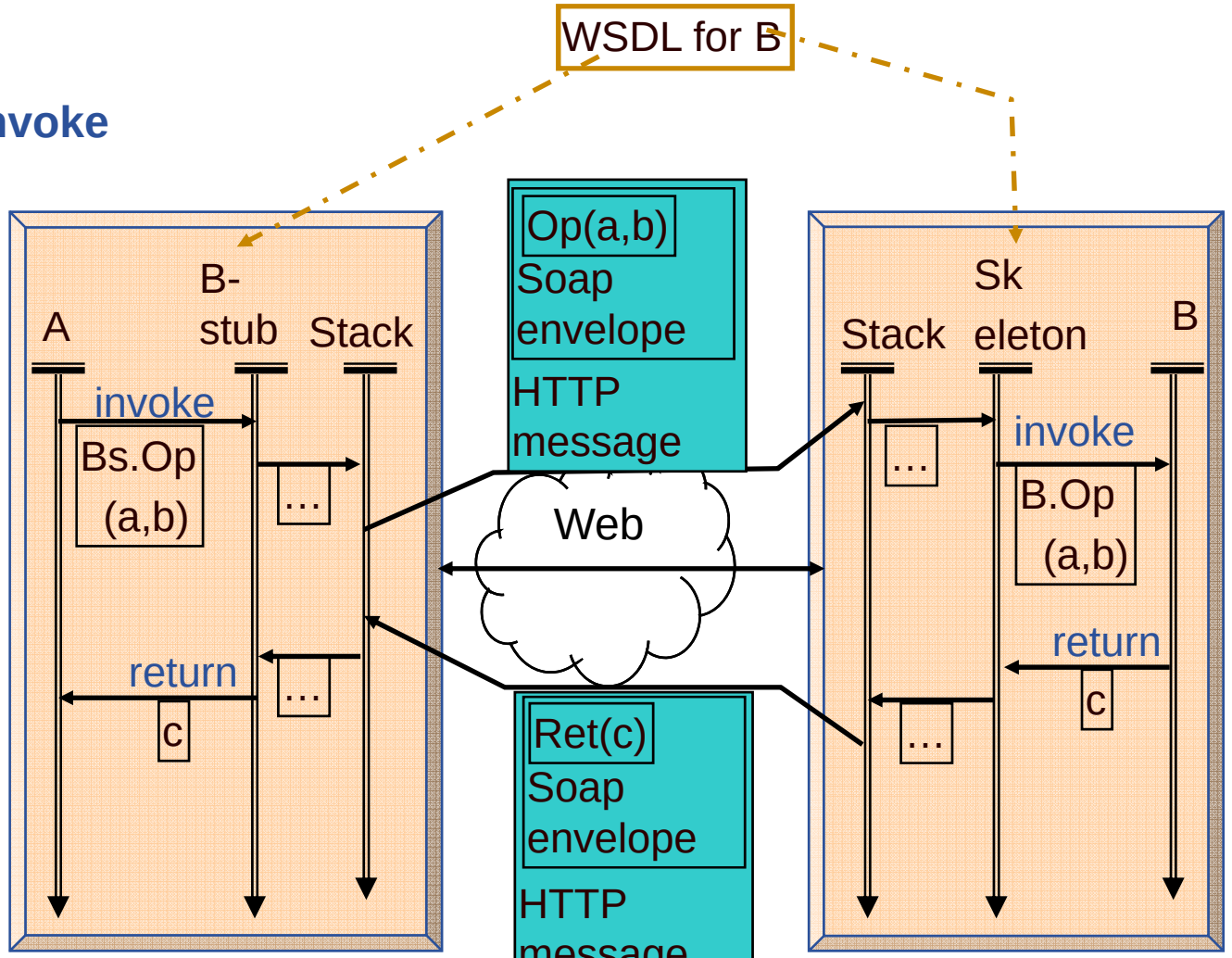


# (JAVA) Web Services

**Insert the web into the invoke and into the return**




**Java program with 2 classes**




**Consumes B (client)**

**Provides B (server)**

# (JAVA) Web Services

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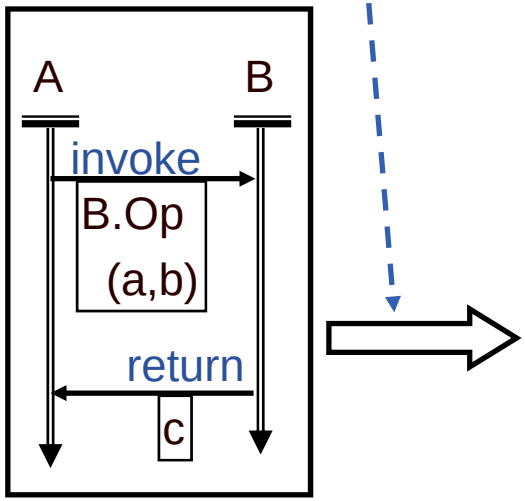


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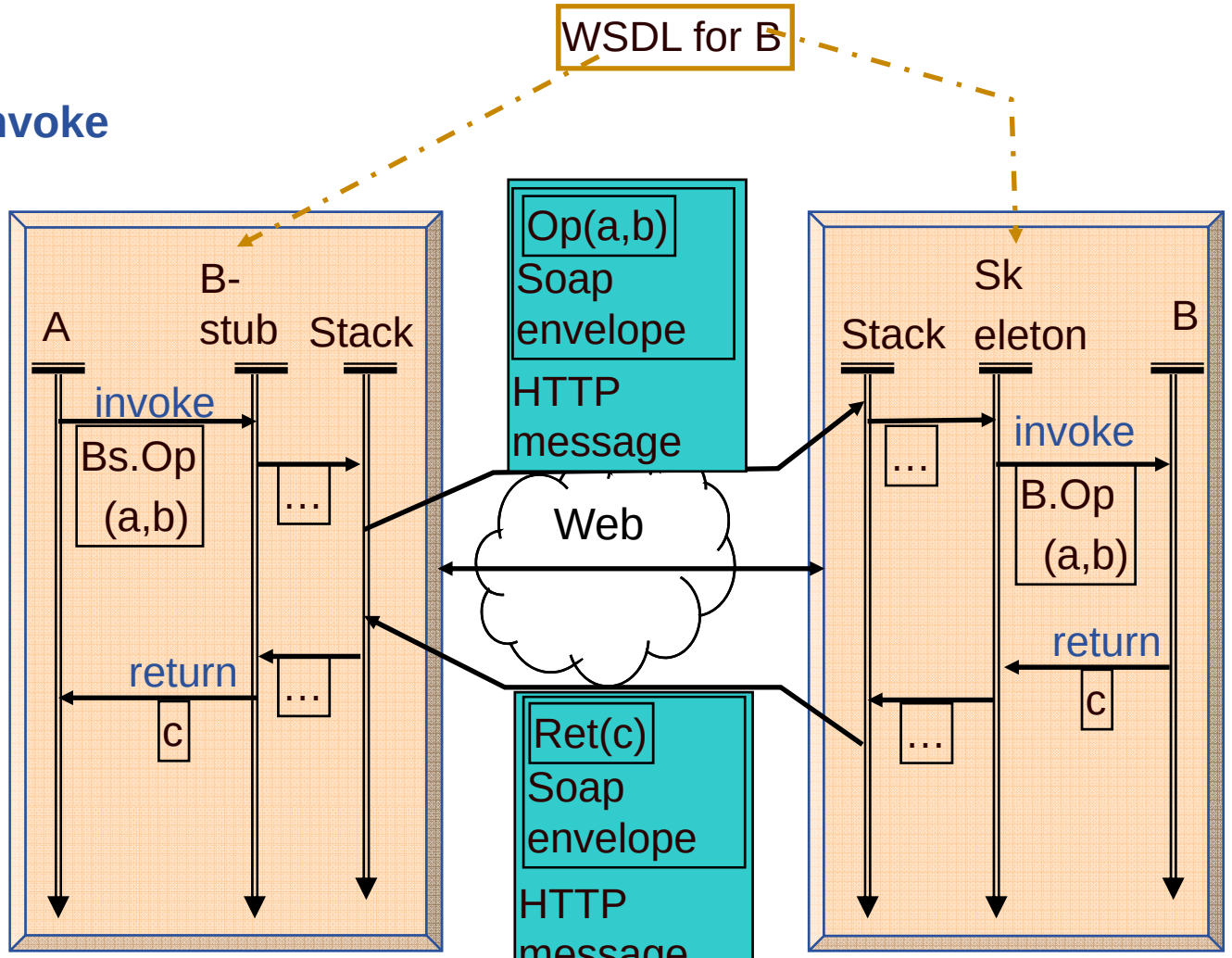
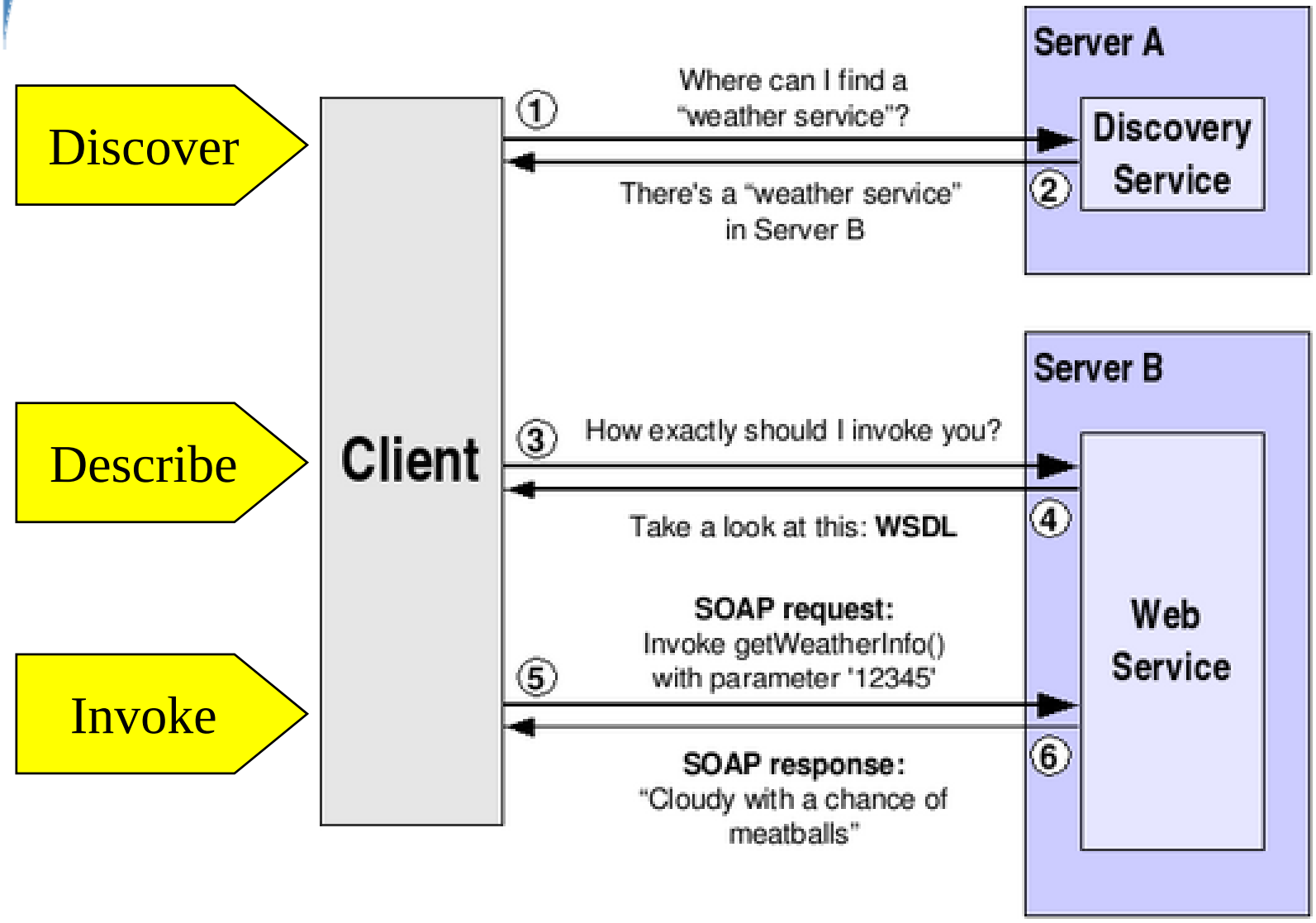



**Consumes B (client)**

**Provides B (server)**

# Real Web Service Invocation

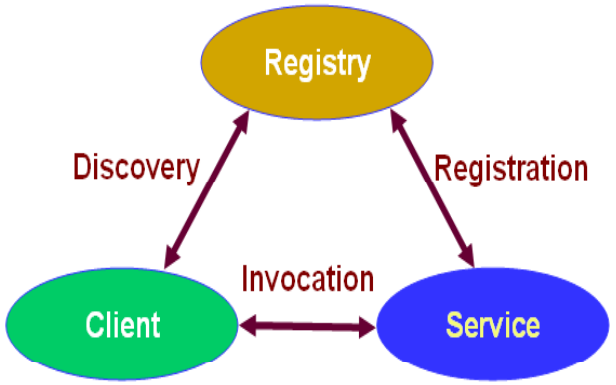


# WS-I core of Web Services

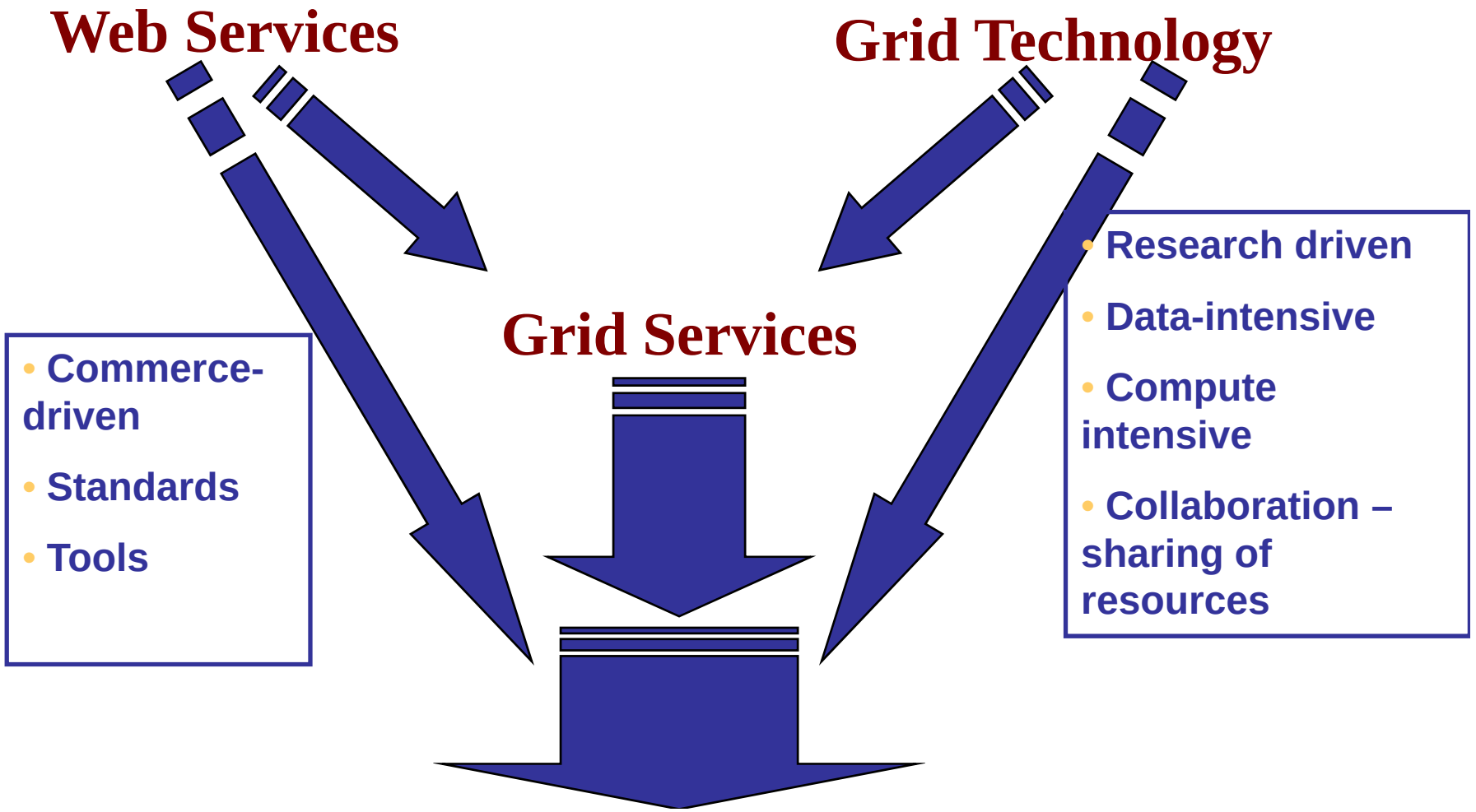
- WS-I (Interoperability) delivers practical guidance, best practices and resources for developing interoperable Web services solutions.
- http://www.ws-i.org/

Open standards:

- SOAP: protocol for message passing
- Web Service Description Language: to describe services
- UDDI: Universal Description, Discovery and Integration
- WS-Security: incorporates security



# October 2001 View




## Open Grid Services Architecture

omii europe
open middleware infrastructure institute

EU project: RIO31844-OMII-EUROPE

# 2007 View

## Web Services

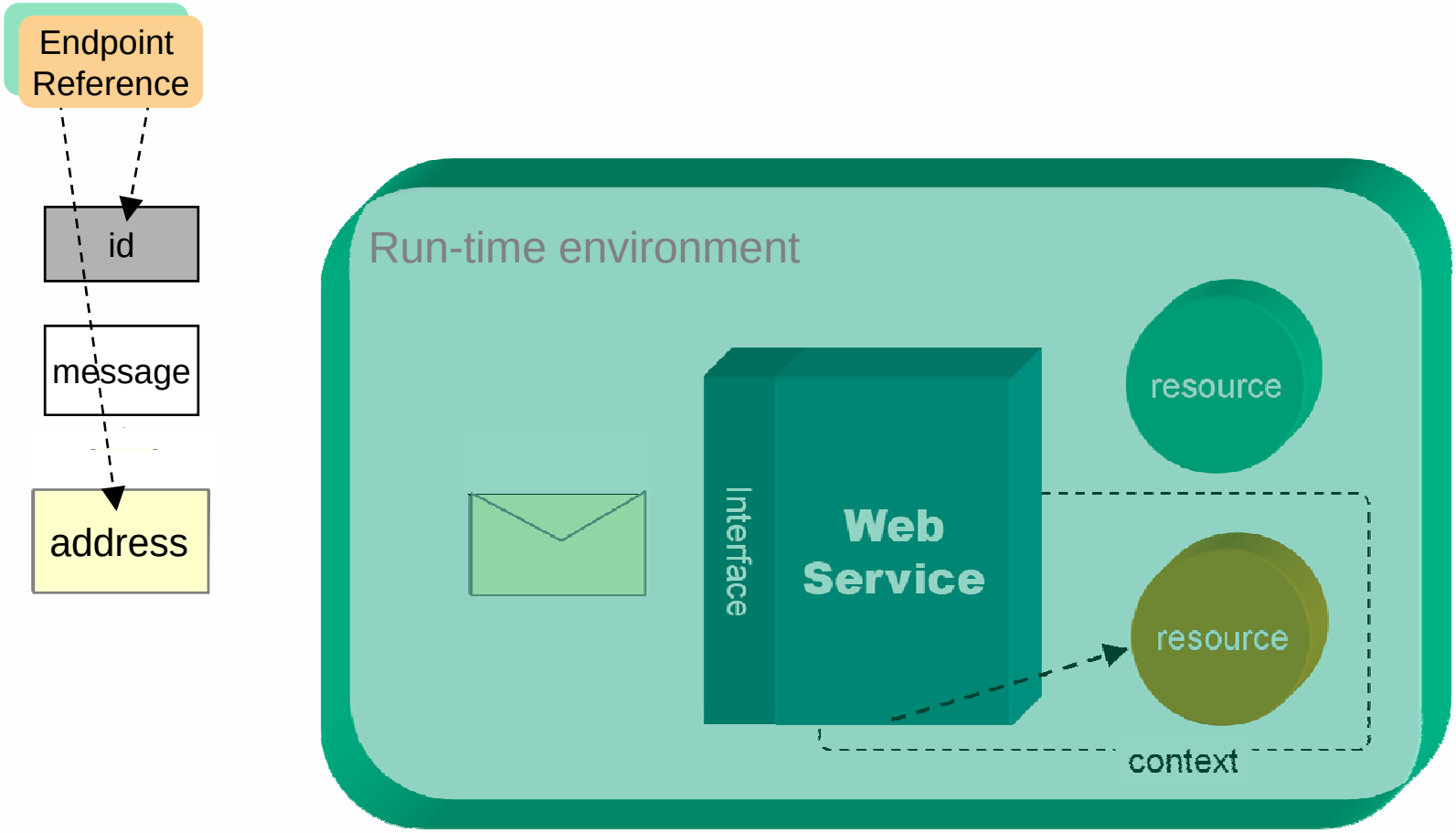
- Basis for defining standards for different services
- For services on grids:
  - **Need to manage state – interact with resources**
  - **Need to be notified of change of state**

**WSRF – Web Services Resource Framework**

**WS-Notification**

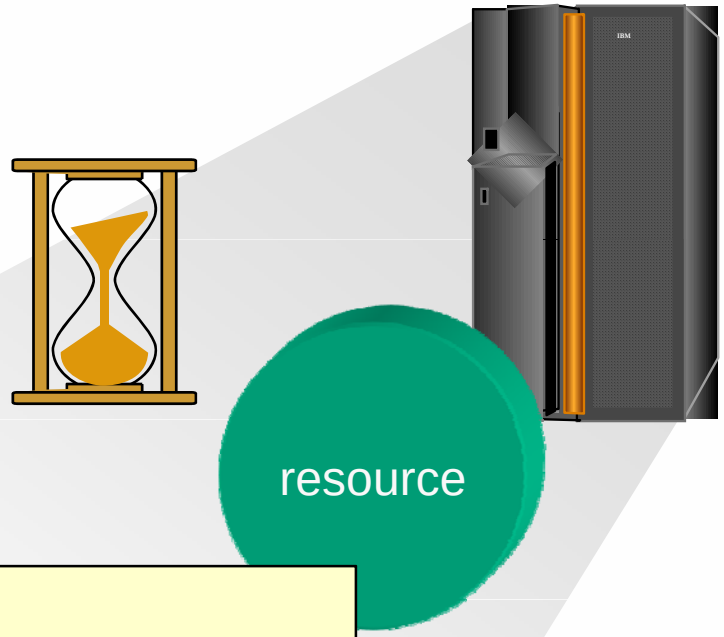
# The WS-Resource framework model

## *Using a Web service to access a WS-Resource*



# The WS-Resource framework model

- **WS-Resource Properties**
  - **Resource state and metadata "Projected" as an XML document**
  - **Query and Set operations**
- **WS-Resource LifeTime**
  - **Explicit destruction or "Soft state" time-to-live**
  - **Provides for cleanup of resource instances**

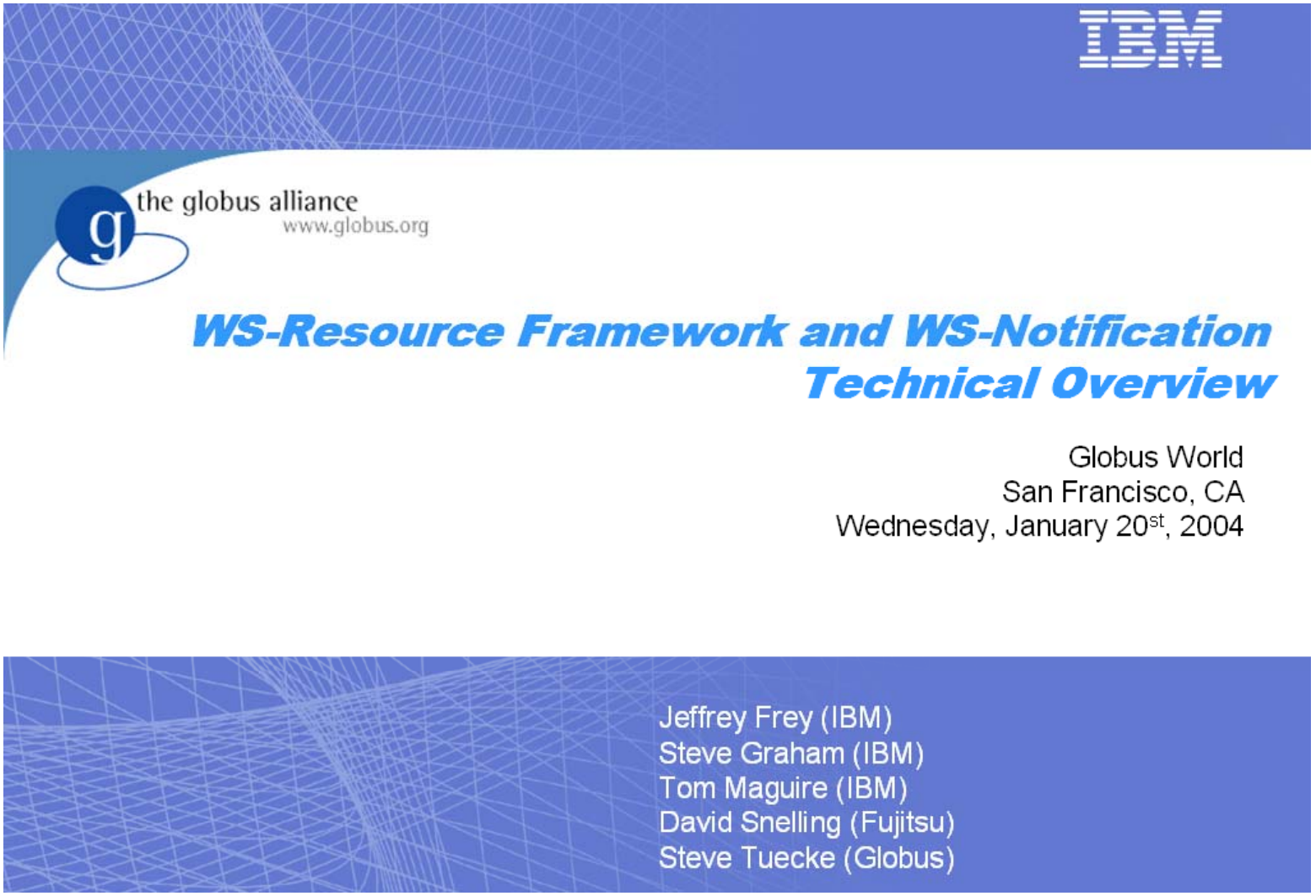



```
<ProcessorProperties>
    <ProcID>5A34C1DE03</ProcID>
    <ProcArchitecture>Power6.2</ProcArchitecture>
    <ProcSpeedMIPS>400</ProcSpeed>
    <ProcCacheMB>256<ProcCache>
    <ProcRunning>1</ProcRunning>

</ProcessorProperties>
```

# Acknowledgements: some slides are from

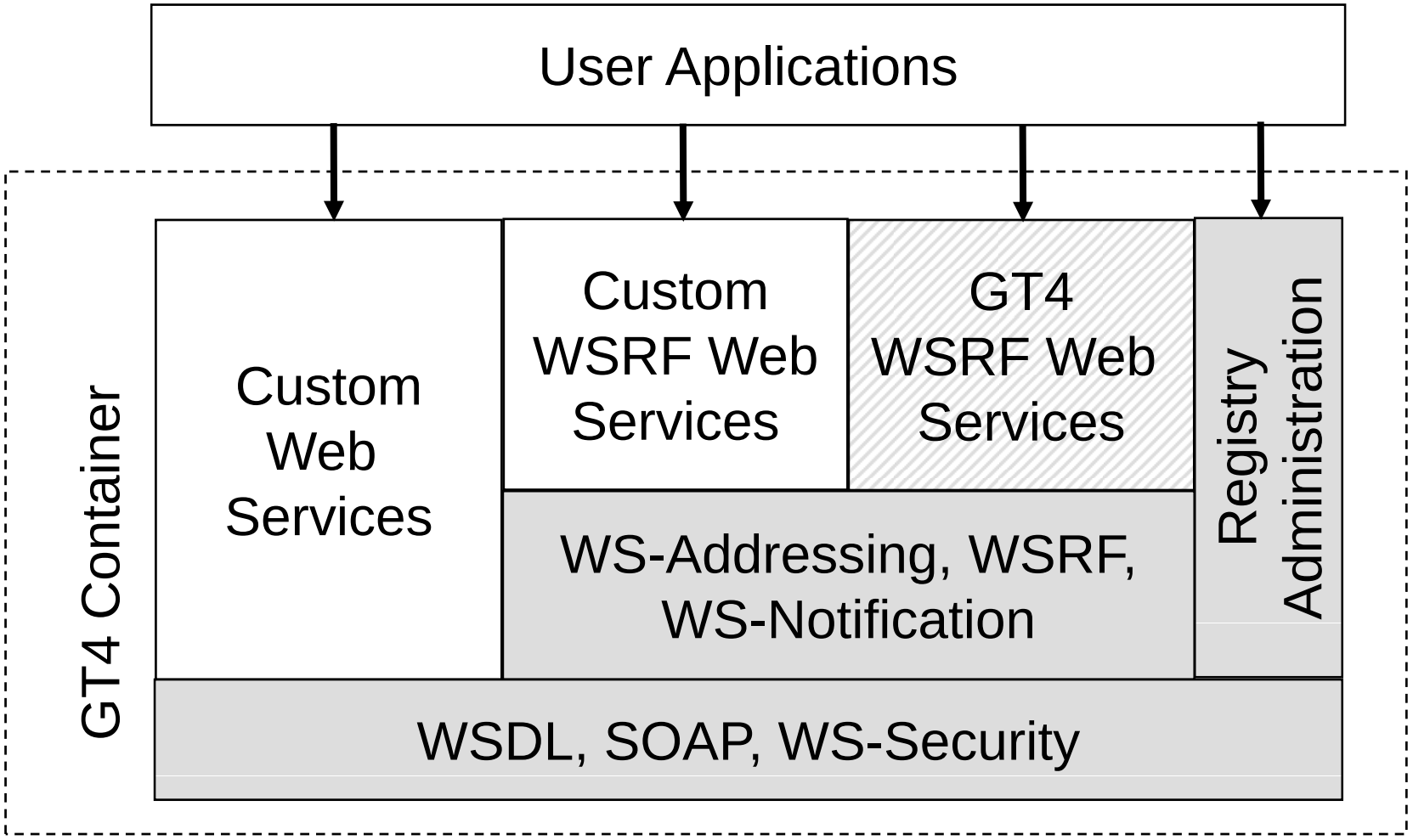
**http://www.nesc.ac.uk/action/esi/contribution.cfm?Title=385**



- **Among middleware that uses WSRF/ WS-N:**
  - Globus Toolkit 4
  - UNICORE

the globus alliance
www.globus.org

# Globus Toolkit 4 Web Services Core




**Thanks to J. Schopf, ANL**

# „Grid driving HPC“

- **Supporting the Perspective:**
  ***“Driving HPC in the pan-European ecosystem“***
  - Leadership capability computing (tier-0) → “Supercomputers”
  - Entry-level capability computing (tier-1) → “Clusters”
  - Farming-based capacity computing (tier-2) → “PC pools, farms”
- **Partnership for Advanced Computing in Europe (PACE)**
  - Towards multi-core petascale Supercomputing Grids
  - Near Future: Multi-core-based supercomputers (‘e.g. 80 cpus on a chip’)
    - **Up to 1 Mil. CPUs at 1 site for each supercomputer**
    - **Grid: 1 Mil * n CPUs**

**Thanks to M. Riedel, FZJ**



EU project: RIO31844-OMII-EUROPE

# Standards-based UNICORE 6 Development

- **WSRF-compliant and OGSA-based UNICORE 6**
  - Standards: WSRF 1.2 final, WS-I, JSDL 1.0, XACML 1.0, OGSA ByteIO
  - Modern software stack: Java 5, XFire SOAP Stack, XMLBeans, Jetty, …
- **Joint development effort under leadership of FZJ**

CINECA Consorzio Interuniversitario icm intel FUJITSU Forschungszentrum Jülich in der Helmholtz-Gemeinschaft

- **Beta version released in April 2007**
- **6.0 final release, July/August 2007, rc already available**
  - UNICORE Atomic Services (UAS), workflows, compliant with UNICORE 5 TSIs, Intel GPE 1.4, UCC
- **6.1 release, Q4-2007**
  - Extended workflow support, portals, Intel GPE 1.5
  - support for VOMS and OGSA-BES (out of OMII-Europe)

**Thanks to M. Riedel, FZJ**

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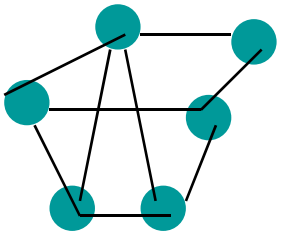
- **Current state of production grids**
- **(Some of the) emerging standards**
- **Response of the OMII-Europe project**

# Grid Islands



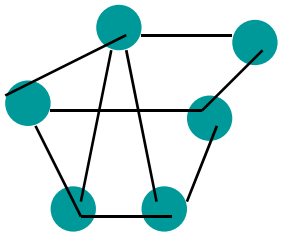
**UNICORE**

**Isolate:**

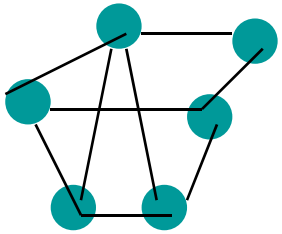
**Data**

**Computers**

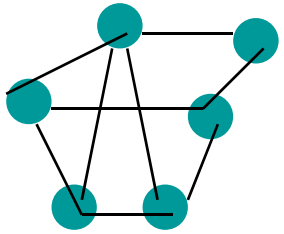
**Expertise**



**CROWN**

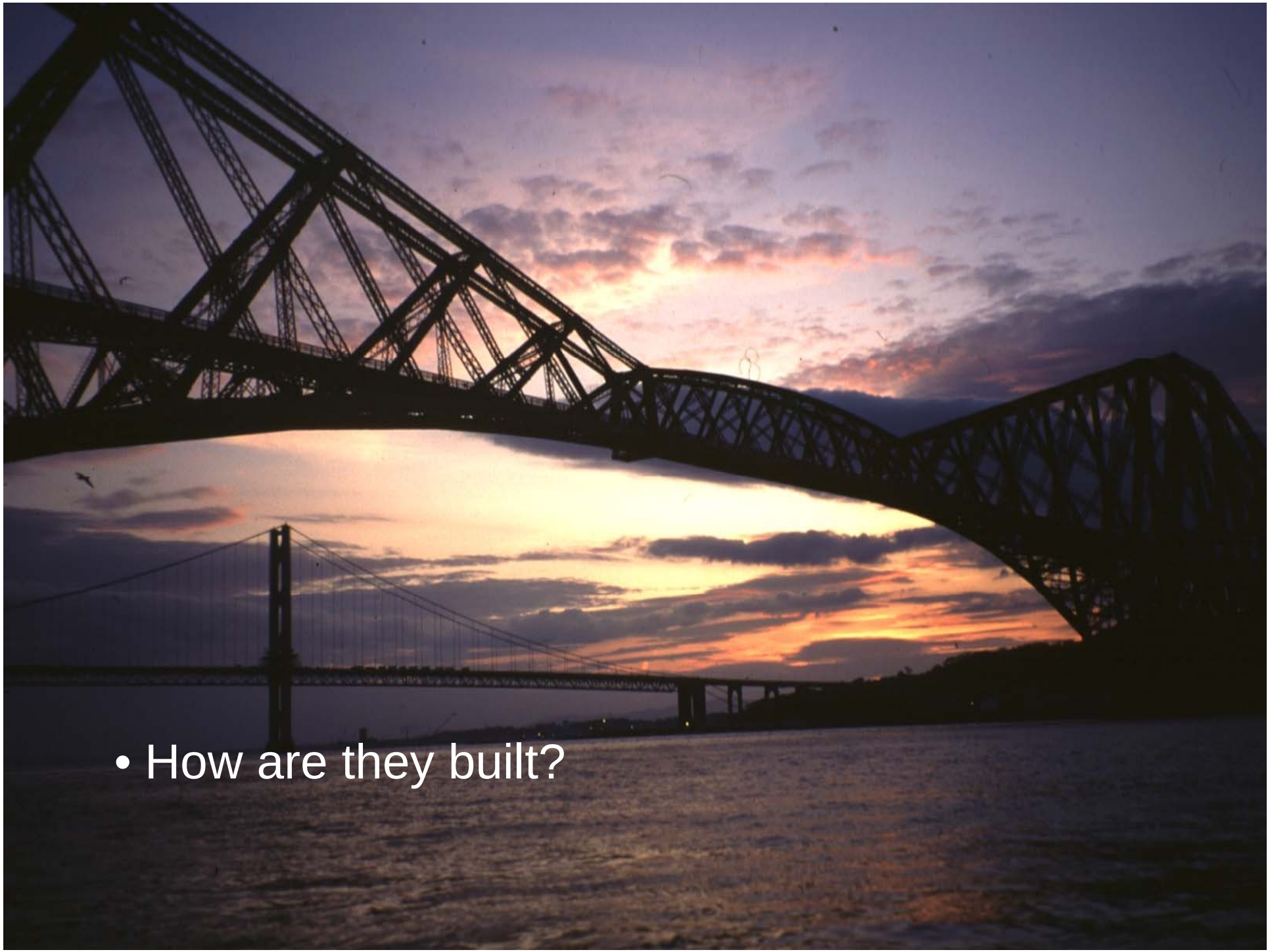


**gLite**



**Globus Toolkit 4**


Bridges in infrastructure...
• What do they enable?


• How are they built?


•How easy are they to use?

# Overview of OMII-Europe

- **Bridge-building with OMII-Europe**
  - **What do these bridges enable?**
  - **How are they built?**
  - **How easy are they to use?**
  - **When will they be ready to use?**
    - Most release dates after ~September. Project is only just 1 year old!
    - Happy Birthday to us!

# Contents

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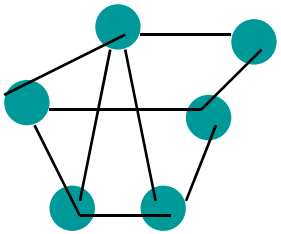
# Grid Islands



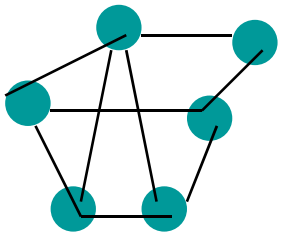
**UNICORE**

**Isolate:**

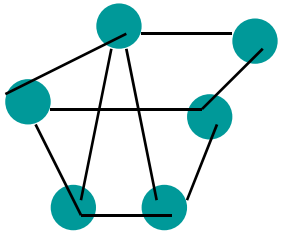
**Data**

**Computers**

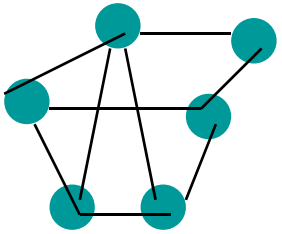
**Expertise**



**CROWN**

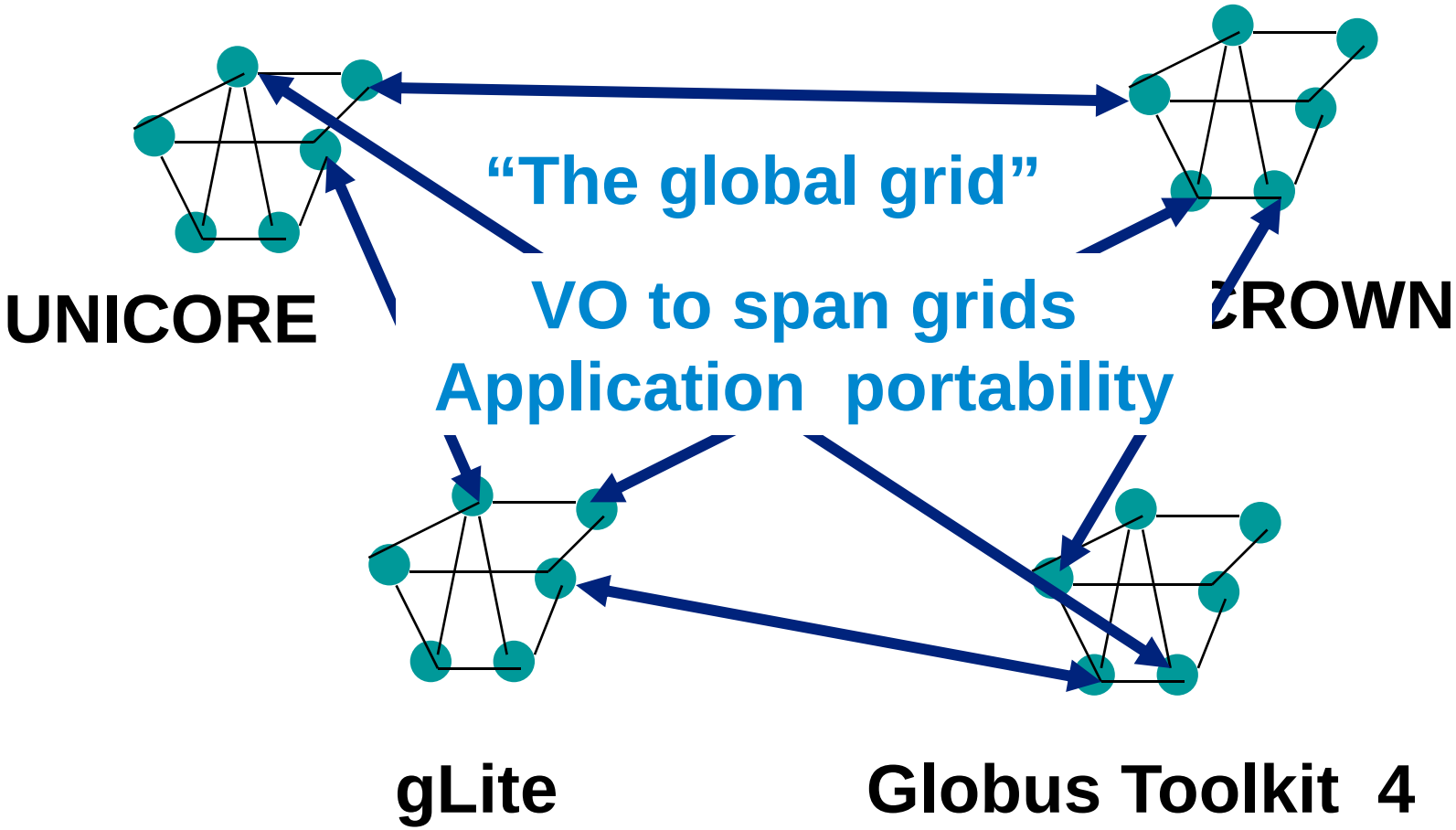


**gLite**

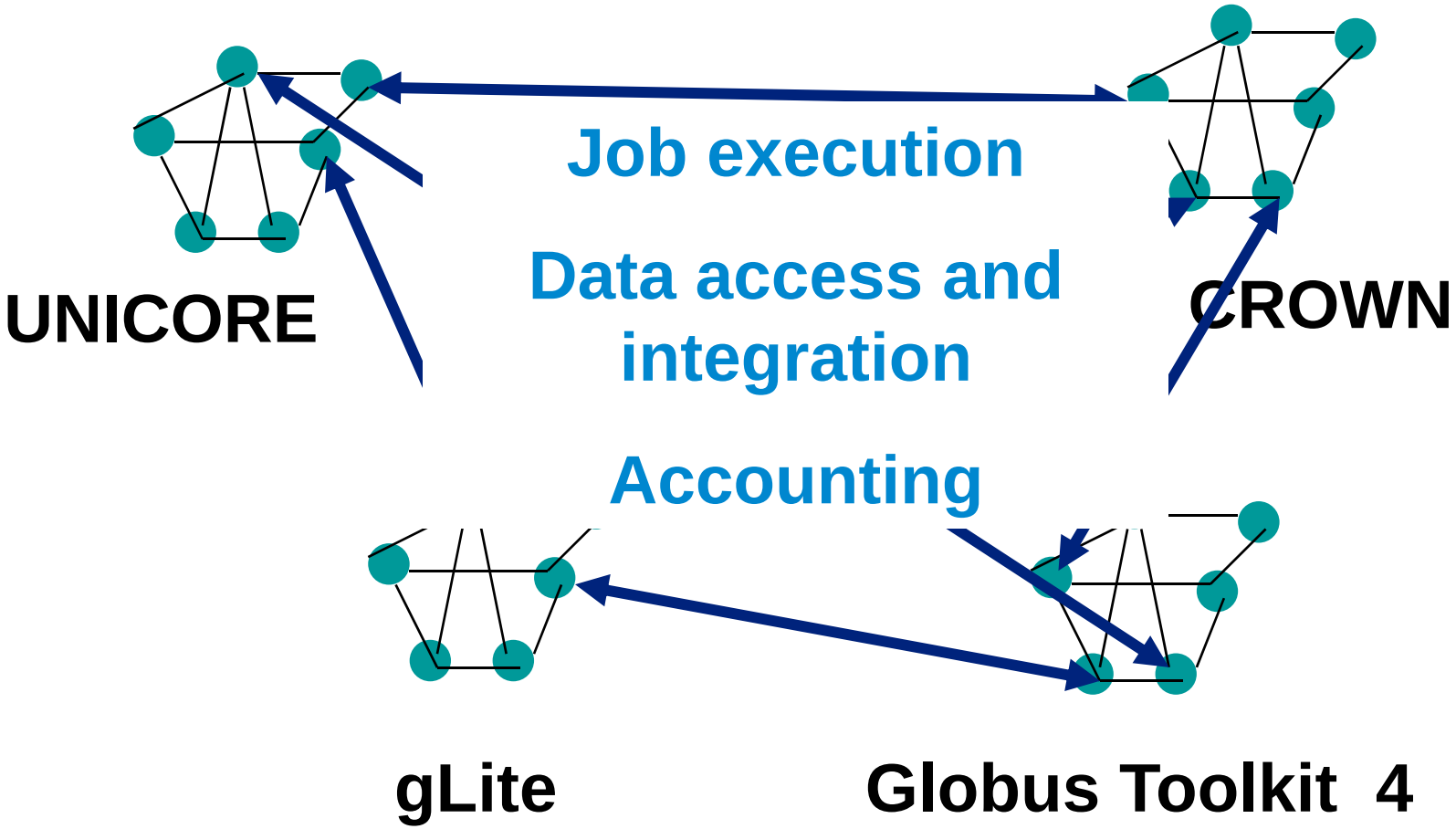


**Globus Toolkit 4**

# OMII-Europe vision: to enable…



# Bridges – for interoperability – initially….



# Bridges – How are they built?

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**Components based on standards:**

**OGSA Basic Execution Service**

**OGSA Data Access & Integration Services**

**OGSA Resource Usage Service**

**OGSA: Open Grid Services Architecture**

# OMII-Europe components

- **Basic Execution Service**
  - Execution of job described in JSDL: "Job Submission Description Language"
  - E.g. OGSA-BES interface being developed for EGEE Compute Elements.

# Hello World in JSDL

London e-Science Centre

Imperial College London

```
<?xml version="1.0" encoding="UTF-8"?>
<jsdl:JobDefinition
   xmlns:jsdl="http://schemas.ggf.org/2005/11/jsdl"
   xmlns:jsdl-posix=
          "http://schemas.ggf.org/jsdl/2005/11/jsdl-posix">
<jsdl:JobDescription>
   <jsdl:Application>
      <jsdl-posix:POSIXApplication>
         <jsdl-posix:Executable>
            /bin/echo
         <jsdl-posix:Executable>
         <jsdl-posix:Argument>hello</jsdl-posix:Argument>
         <jsdl-posix:Argument>world</jsdl-posix:Argument>
      </jsdl-posix:POSIXApplication>
   </jsdl:Application>
 </jsdl:JobDescription>
</jsdl:JobDefinition>
```

**Reused with permission – slide from Stephen McGough**

# OMII-Europe components

- **Basic Execution Service**
- **Data Access and Integration**
  - Expose data to grid users
  - “Activities” support computation close to data
  - OMII-Europe porting OGSA-DAI to gLite, UNICORE, CROWN
- **Resource Usage Service**
  - Gather accounting data from diverse resources on different grids

# Bridges – How are they built?

# VOMS in OMII-Europe

- **VOMS: to manage VO membership as basis for Authorisation**
  - Used by gLite: communicate VO attributes in proxy extensions
    - **Permits delegation**

- **In OMII-Europe: also will communicate in "Security Assertion Markup Language (SAML)"**
  - standard from OASIS

# Components – How easy are they to use?

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# Evaluation Infrastructures

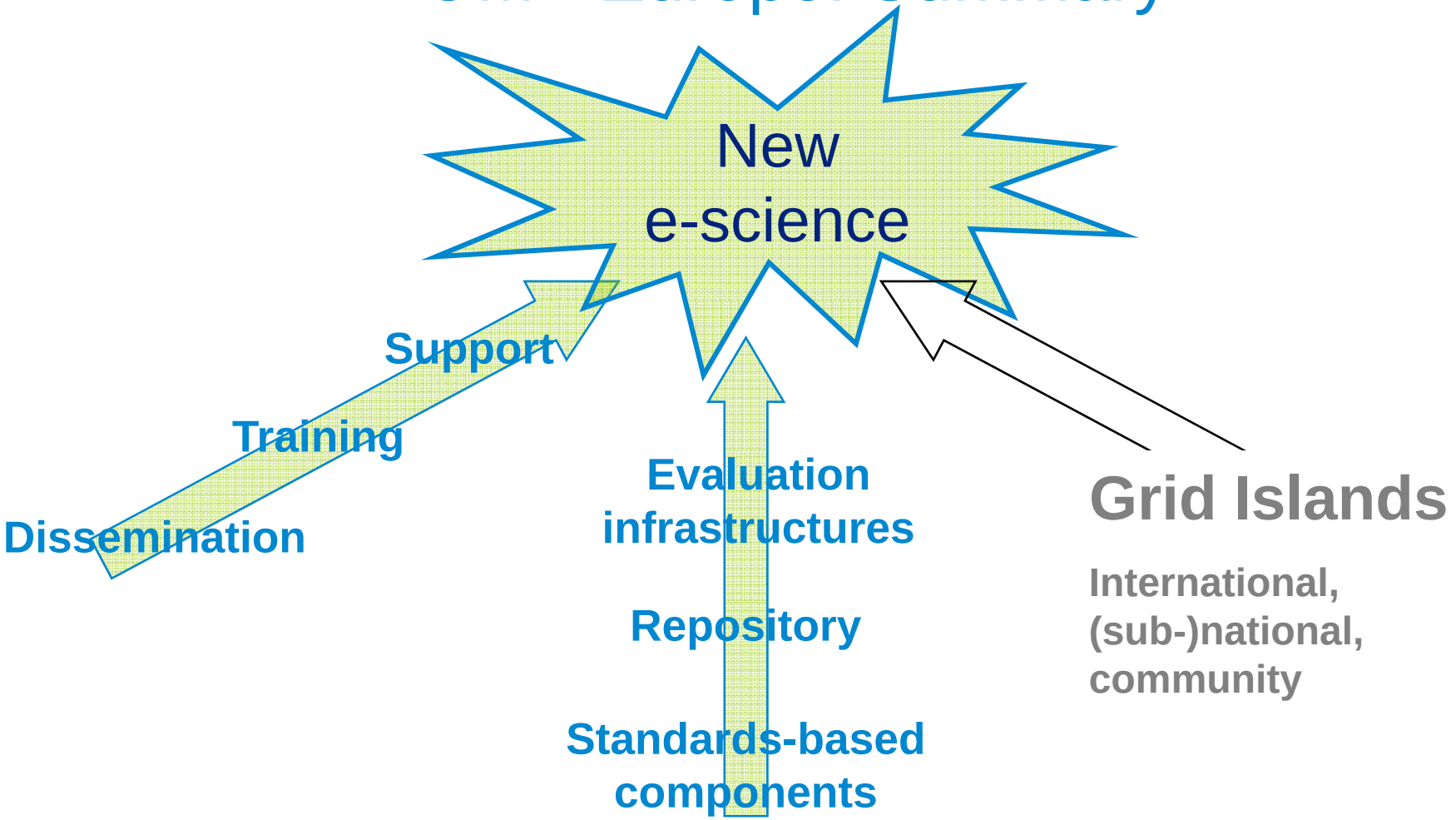
- **Ready for you to try different middleware**
- **New OMII-Europe components will be installed on these**
- **http://support.omii-europe.org**

| Middleware | Site |
|---|---|
| Globus Toolkit 4.0.3 | Edinburgh |
| UNICORE 5, UNICORE 6 | FZJ |
| gLite 3.0 (EGEE) | PSNC |
| gLite 3.1 (EGEE) | INFN |
| OMII-UK Release 3.2 | SOTON |
| CROWN Grid | BU and TU |

# What will OMII-Europe deliver?

- **Repository of open-source, quality assured software services for EGEE, Globus, UNICORE and CROWNgrid**
  - Objective: Some services bundled with major grid distributions
  - Initial integration work with EGEE, UNICORE and Globus
- **Evaluation infrastructure to “test” services**
- **User support and training**

# OMII-Europe: Summary



# Further Information

- **WS-I**
  - http://en.wikipedia.org/wiki/WS-I_Basic_Profile
  - http://en.wikipedia.org/wiki/WS-Security
- **Globus Toolkit:**
  - Tutorial later today….
  - http://www.globus.org/wsrf/
  - http://gdp.globus.org/gt4-tutorial/
  - http://dev.globus.org/wiki/Outreach/Materials
- **UNICORE**
  - Tutorial tomorrow….
  - www.unicore.eu

# Thank you!

**http://omii-europe.org**