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The Globus Toolkit and the OGSI – WSRF Evolution

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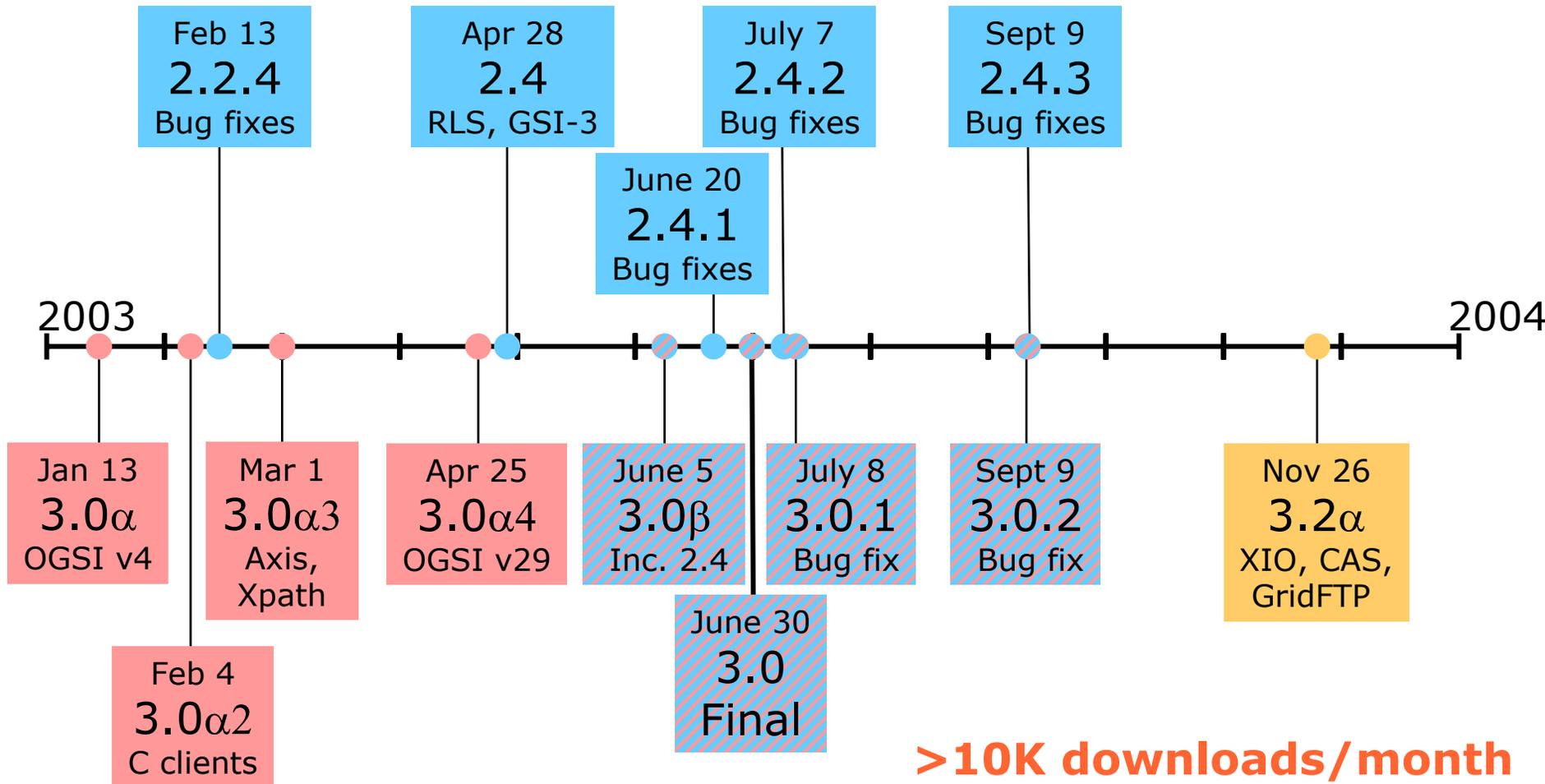


References

- Much of the content for this presentation was borrowed from the following presentations:
- Opening Keynote, GlobusWORLD 2004, January 20, 2004, "Bringing Grid & Web Services Together", Daniel Sabbah, Vice President of Strategy & Technology, IBM Software Group
 - ◆ <http://www.globusworld.org/program/slides/k1a.pps>
- Opening Keynote Addendum, GlobusWORLD 2004, January 20, 2004, "WS-Resource Framework: Globus Alliance Perspectives", Ian Foster
 - ◆ <http://www.globusworld.org/program/slides/k1b.pdf>
- Afternoon Keynote, GlobusWORLD 2004, January 21, 2004, "Globus and Grid: State of the Union", Ian Foster
 - ◆ <http://www.globusworld.org/program/slides/k4.pdf>



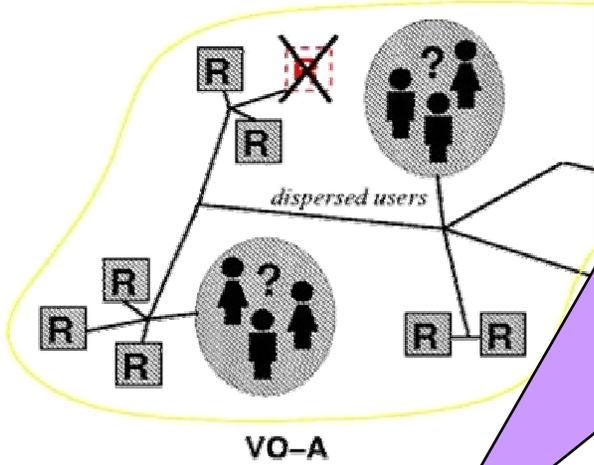
Baseline: Evolve 2.x, Introduce 3.0





Quick Review...
We all remember this slide...

“Resources for problem solving in dynamic ... virtual organizations”



Standards Matter!

In the Grid space, we must address how we describe, discover, and access resources. Monitor, manage, and coordinate, resources. Account and charge for resources.

Open, standard protocols enable interoperability, avoid product/vendor lock-in, enable innovation/competition on end points, enable ubiquity.

1. Enable integration of ...
2. Using general-purpose protocols & infrastructure
3. To achieve useful qualities of experience

“The Anatomy of the Grid”, Foster, Kesselman, Tuecke, 2001



Grid Services Standards

- Define a service-oriented architecture ...
 - ◆ the key to effective virtualization
 - ... to address vital “Grid” requirements
 - ◆ AKA utility, on-demand, system management, collaborative computing
 - ... building on Web services standards
 - ◆ extending those standards where needed
 - ◆ enabling ubiquity and thus a rich ecology of platform and solution providers
- The “Open Grid Services Architecture”

OGSI Quick Review

- The Open Grid Services Infrastructure (OGSI) Specification version 1.0
 - ◆ Released in July 2003
 - ◆ Defines a set of conventions and extensions on the use of Web Service Definition Language (WSDL) and XML Schema to enable stateful Web services.
 - ◆ It defines approaches for:
 - creating, naming, and managing the lifetime of instances of services.
 - declaring and inspecting service state data.
 - asynchronous notification of service state change.
 - representing and managing collections of service instances.
 - common handling of service invocation faults.



Globus Toolkit® 3.0

- Includes all pre-WS services and clients
- Complete Java implementation of OGSI v1.0
 - ◆ Rich, container-based implementation
 - ◆ Built on Apache Axis
- Globus “proprietary” services built on OGSI/WS
 - ◆ Managed Jobs (akin to GT2 GRAM)
 - ◆ Reliable File Transfer (RFT)
 - ◆ Index Services (akin to GT2 GIIS)
- Some services not yet WS-ified
 - ◆ GridFTP, Replica Location Services (RLS)

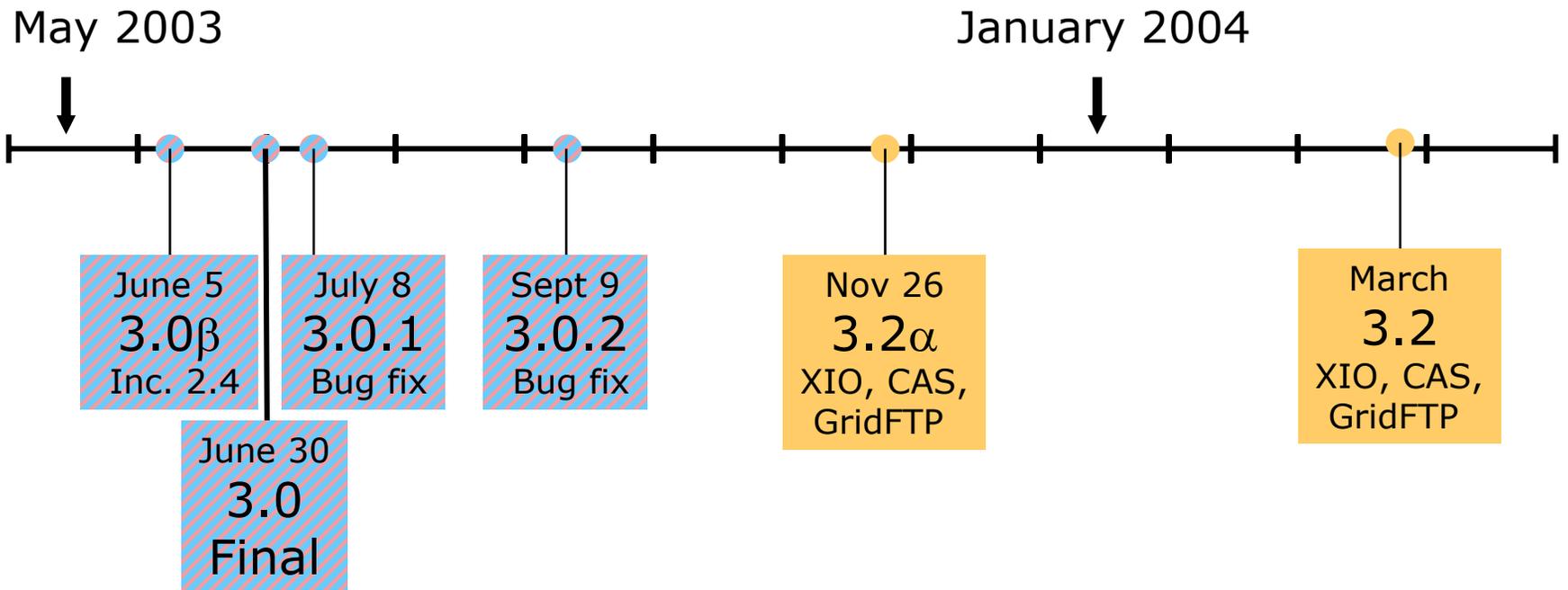


GT 3.2

- Many bug fixes
- Usability improvements
- New services
 - ◆ OGSI-based CAS
 - ◆ Registry based on OGSI ServiceGroup
- Improved GridFTP
- Improved RFT
 - ◆ Recursive copy, scalability
- Improved RLS
 - ◆ Hierarchical indexing
- Improved GRAM
 - ◆ Better fault tolerance, scalability
- OGSA Data Access & Integration: preview
- Optimized core
 - ◆ Reduced per service memory footprint
 - ◆ Some speed improvements
- eXtensible IO (XIO)
 - ◆ Transforms + transport
 - ◆ Globus IO targets XIO
 - ◆ Improved performance
 - ◆ Multiple transports
- Security
 - ◆ Java CRL support
 - ◆ Anonymous authentication
 - ◆ Lower memory footprint
 - ◆ Improved performance

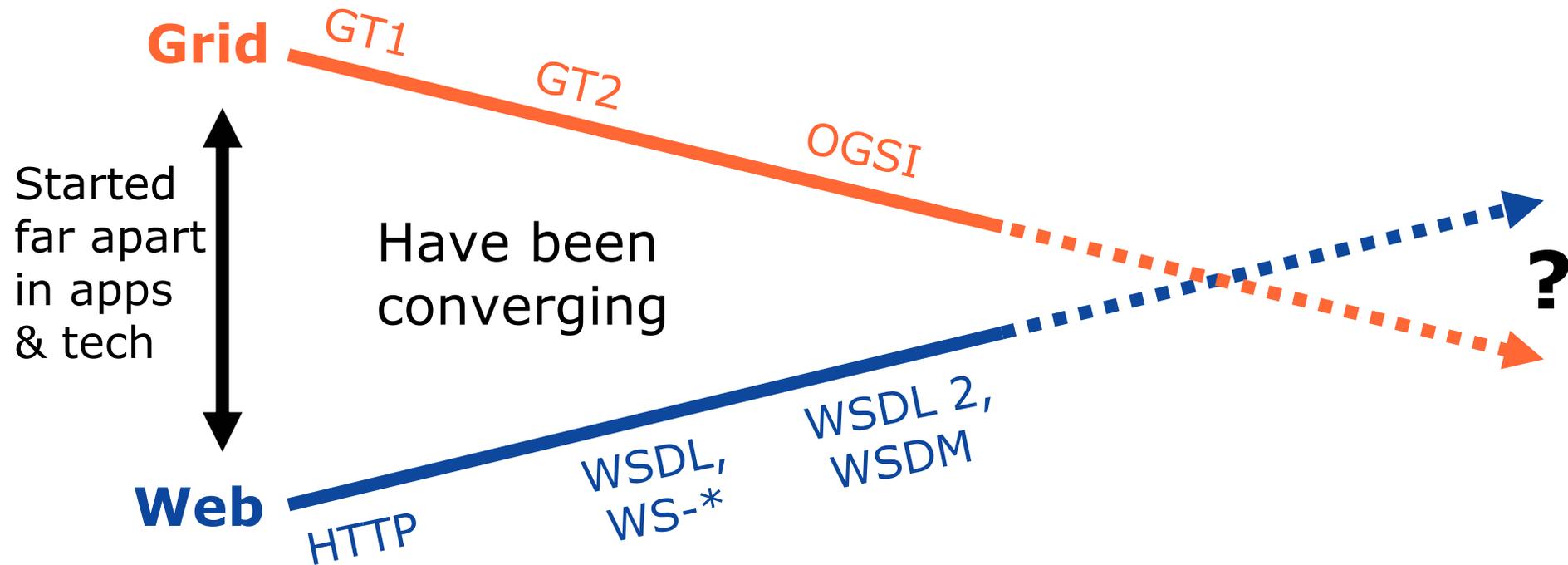


OGSI Globus Toolkit 3.0 Continues to Evolve





Grid and Web Services: Convergence?



However, despite enthusiasm for OGSI, adoption within Web community turned out to be problematic



Three Major Web Services Concerns about OGSi

- Too much stuff in one specification
 - ◆ Want to use parts but not all of OGSi.
 - ◆ Many feel that use of parts obligates use of all.
- Does not work well with existing Web services tooling
 - ◆ OGSi v1.0 uses XML Schema fairly aggressively.
 - ◆ xsd:any, attributes, etc.
 - ◆ “document-oriented” WSDL operations.
- Too “object oriented”
 - ◆ OGSi v1.0 models a stateful resource as a Web service that encapsulates the resource’s state.
 - ◆ Coupling identity and lifecycle of the service and resource state.
 - ◆ Web services purists argue that “Web services do not have state or instances.”
 - ◆ Some Web services implementations do not accommodate dynamic service creation and destruction.



WSRF Addresses These Concerns

- Too much stuff in one specification
 - ◆ WSRF partitions OGSI v1.0 functionality into a family of composable specifications.
- Does not work well with existing Web services tooling
 - ◆ WSRF tones down the usage of XML Schema somewhat.
- Too “object oriented”
 - ◆ WSRF re-articulates the underlying OGSI architecture to make an explicit distinction between the “service” and the stateful entities acted upon by that service.
 - ◆ WSRF calls these entities “resources,” and says that a service that acts upon resources through a conventional use of WS-Addressing exhibits the “implied resource pattern.”



The Motivators Behind WSRF

- Web services must often provide their users with the ability to access and manipulate state, i.e., data values that persist across, and evolve as a result of, Web service interactions.
- While Web services successfully implement applications that manage state today, it is desirable to define Web service conventions to enable the discovery of, introspection on, and interaction with stateful resources in standard and interoperable ways.
- WSRF defines these conventions and does so within the context of established Web services standards.



The Best of Both Worlds

Web Services & Grid Requirements

share access manage

**Applications on
demand**

**Resources
on demand**

**Secure and
universal access**

**Global
Accessibility**

**Business
integration**

**Vast resource
scalability**



Web Services



Grid Protocols

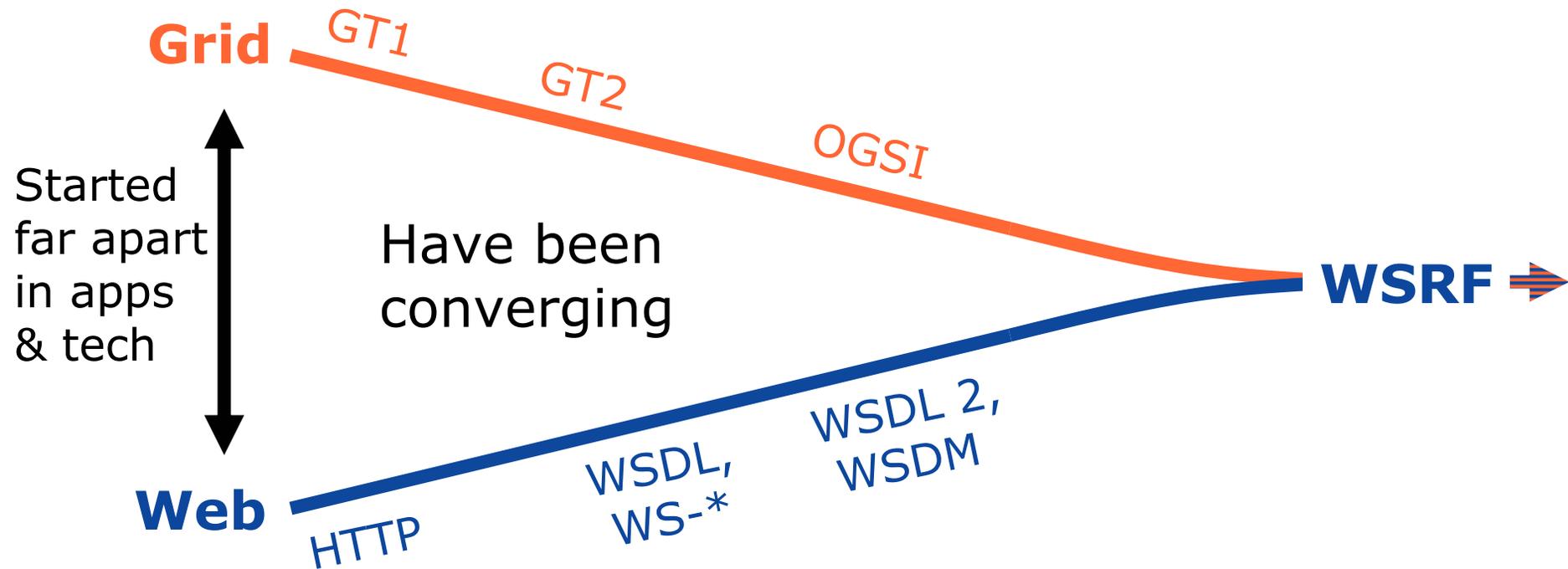


OGSI → WSRF, A Natural Evolution

- We were pivotal in moving the Grid community to Web services
 - ◆ Argument: ubiquity and resulting tools
- Identified state as a critical missing piece
 - ◆ Open Grid Services Infrastructure (OGSI)
- However, OGSI was developed largely outside of the Web services community
 - Pushback compromised goal of ubiquity
 - Engaged WS leaders to resolve problems
- Result is WSRF backed by major WS players



Grid and Web Services: Convergence: Yes!



The definition of WSRF means that Grid and Web communities can move forward on a common base



What exactly is the WS-Resource Framework?

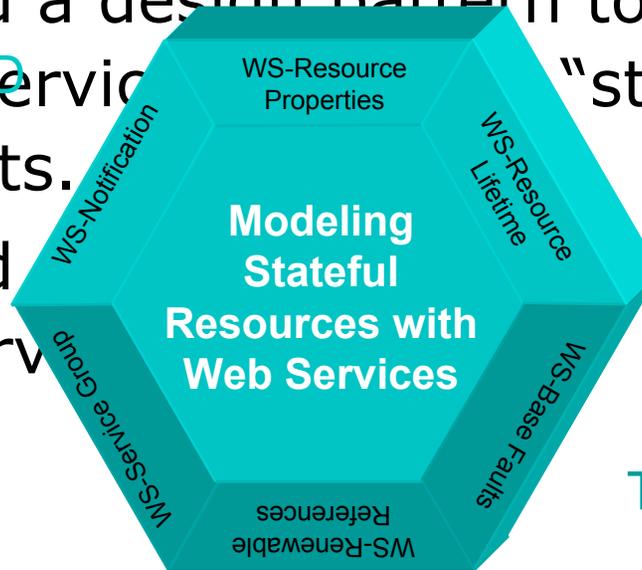
- The WS-Resource Framework (WSRF) is a set of six Web services specifications that define what is termed the *WS-Resource approach* to modeling and managing state in a Web services context.
- To date, drafts of three of these specifications have been released, along with an architecture document that motivates and describes the WS-Resource approach to modeling stateful resources with Web services.
- To be released soon are the other specifications, an overview document describing the relationship among the different specifications, and a document that compares the WS-Resource Framework with the Open Grid Services Infrastructure.



The GlobusWORLD Announcement

- A family of Web services specification proposals
 - ◆ Introduced a design pattern to specify how to use Web service components. **“stateful”**
 - ◆ Introduced publish-subscribe to Web services. **To be developed**

Introduced
At GlobusWORLD
2004



To be developed



What are the WS-Resource Framework specifications?

- WS-ResourceLifetime
- WS-ResourceProperties
- WS-Notification
- WS-RenewableReferences
- WS-ServiceGroup
- WS-BaseFaults



What are the WS-Resource Framework specifications?

- **WS-ResourceLifetime - Defined**
 - ◆ Both WSRF and OGSI define creation, identity assignment and destruction in nearly the same way.
 - ◆ Familiar Management Constructs WSRF & OGSI
 - Creation
 - Naming
 - Immediate Destruction
 - Scheduled Destruction
 - Determine Current Time
 - Determine Lifetime
 - ◆ New Management Construct in WSRF
 - Notify of Destruction



What are the WS-Resource Framework specifications?

- **WS-ResourceProperties - Defined**
 - ◆ Access the state of a stateful entry:
 - Determine type of state and what messages may be supported.
 - Issue read, modify and query requests against state components.
 - More granular and specific than OGSI operations.
 - ◆ Same approach as OGSI, different syntax.
 - ◆ Nearly identical to service data elements.



What are the WS-Resource Framework specifications?

- **WS-Notification - Defined**
 - ◆ Asynchronous notification of the state of individual resources.
 - ◆ OGSI – Notification portTypes
 - ◆ WSRF – Subscription against hierarchical topics.



What are the WS-Resource Framework specifications?

- **WS-RenewableReferences – Under Development**
 - ◆ Defines a mechanisms that can be used to renew an endpoint reference (target resource of addressing / policy scheme) that has become invalid.
 - ◆ When endpoint location or policy changes it may become necessary to renew a client copy of associated information regarding that resource.



What are the WS-Resource Framework specifications?

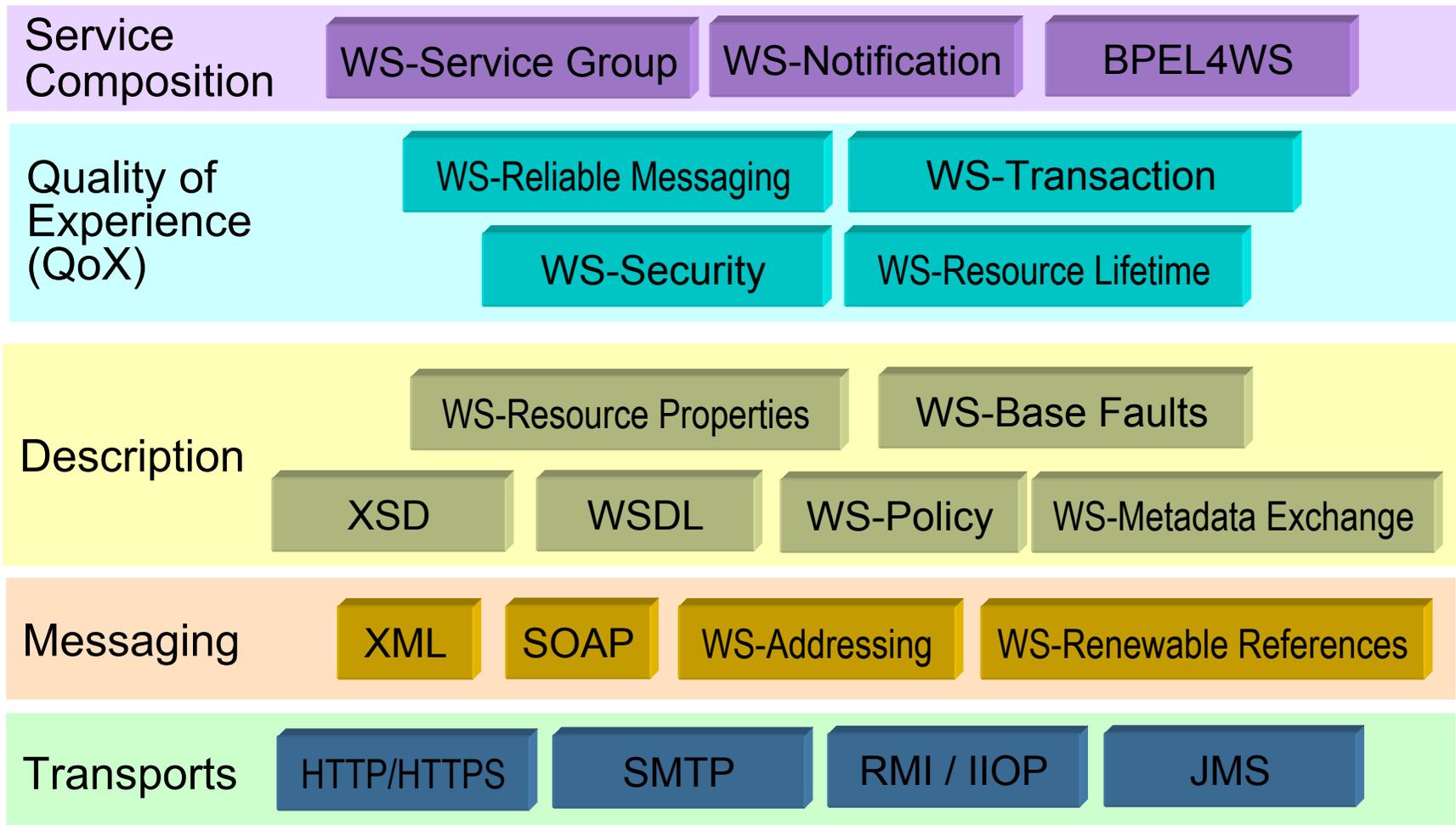
- **WS-ServiceGroup – Under Development**
 - ◆ Mechanism for creating a heterogeneous collection of services or entities.
 - ◆ Useful for building registries or collections of services or resources.
 - ◆ Similar to OSGI ServiceGroup portTypes
 - WSRF deprecates the OSGI “remove” operation.



What are the WS-Resource Framework specifications?

- **WS-BaseFaults – Under Development**
 - ◆ Defines a base fault XML type for use when returning faults in a Web services message exchange.
 - ◆ Simplifies problem determination by having a base set of information all fault messages contain.

WSRF & the Web Services Stack





From OGSI to WSRF: Refactoring and Evolution

OGSI	WSRF
Grid Service Reference	<i>WS-Addressing</i> Endpoint Reference
Grid Service Handle	<i>WS-Addressing</i> Endpoint Reference
HandleResolver portType	WS-RenewableReferences
Service data defn & access	WS-ResourceProperties
GridService lifetime mgmt	WS-ResourceLifeCycle
Notification portTypes	WS-Notification
Factory portType	Treated as a pattern
ServiceGroup portTypes	WS-ServiceGroup
Base fault type	WS-BaseFaults

Draft document at www.globus.org/wsrf



What does the definition of WSRF mean for OGSI-based systems?

- WSRF retains essentially all of OGSI concepts, and introduces only modest changes to OGSI messages and their associated semantics.
- Services implemented using OGSI-based tools, such as the Globus Toolkit's OGSI Core, are likely to require some changes to exploit WSRF-based tools, but the changes should be modest due to the similarities between WSRF and OGSI.
- Applications that use higher-level interfaces, such as the Globus Toolkit's GRAM or emerging standards such as OGSA DAI, will be only minorly effected by these changes.
- More generally, the fact that WSRF is based on mainstream Web services standards and has been embraced by major vendors means that we can expect to see rapid integration into commercial Web services products, enabling a much richer choice of products upon which WSRF compliant services can be built.

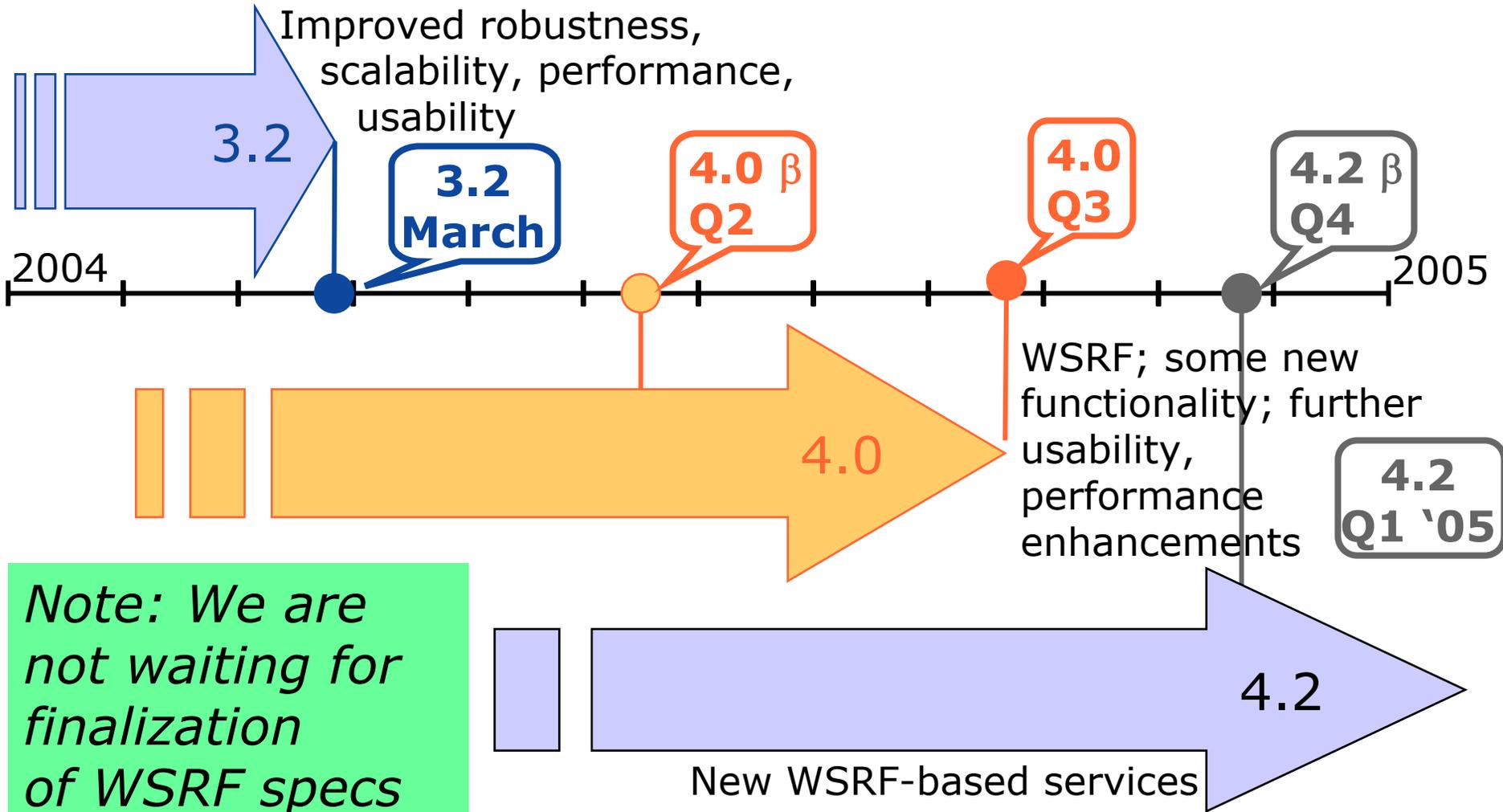


Priorities for 2004

- Stabilize the infrastructure around WSRF
 - ◆ Top priority!
 - Usability, performance, reliability, scalability, documentation, internationalization
- Bring to fruition new functionality in pipeline
 - ◆ Data access & integration, metadata mgmt
 - ◆ Enhanced GridFTP
 - ◆ Community scheduling framework
 - ◆ Monitoring & discovery frameworks
- Expand set of solution providers
- Expand engagement with corporate space



What This Means in Practice





GT 4.0 Practicalities

- GT 4.0 will implement draft WSRF specs
 - ◆ Based on initial standard submissions
 - ◆ Rev needed for final standards → but we will work very hard on backward compatibility
- Goal is to preserve OGSI client and service APIs as much as possible
 - ◆ No OGSI support: 4.0 WS components will **not** interoperate with 3.x WS components
- All pre-WS components will still be there
 - ◆ 4.0 pre-WS components will interoperate with 3.x pre-WS components



For Additional Information...

- <http://www.globus.org/wsrp/>

More specifically...

- <http://www.globus.org/wsrp/ModelingState.pdf>
- <http://www.globus.org/wsrp/WS-ResourceProperties.pdf>
- <http://www.globus.org/wsrp/WS-ResourceLifetime.pdf>
- <http://www.globus.org/wsrp/WS-Notification.pdf>
- <http://www.globus.org/wsrp/faq.asp>