OPEN FORUM | OPEN STANDARDS

Using OGF Standards for Grid and HPC

Chris Smith, VP of Standards, Open Grid Forum

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Agenda

- Why Standardize?
- Current standards
  - Types of standards
  - Use cases
  - Specifications
  - Interoperability
- "Compute Grid" standards

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Why standardize?

- What is the value of implementing standards?
- For vendors
  - meet customer demand for interoperability
- For developers
  - leverage the expertise of other developers
  - offer a choice of tools and platforms in order to speed implementations
  - only need to support one integration interface
- For end-users
  - reduce the costs and risks of adopting grid technology
  - get insight into the best practices of the industry at large

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Why not standardize?

- Standards are not always appropriate
- A technology might be "too new"
  - you stifle innovation with standardization, which focuses on commonality
  - is "Cloud Computing" ready for standardization?
- A technology might be very niched
  - defacto standards will emerge in this case

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Types of standards

- **Information Schemas**
  - defines the information that is passed between clients and services, or between peer services
  - provides a single vocabulary used to describe resources and activities

- **Protocol Specifications**
  - defines the messages that pass between clients and services, and how the ordering of these messages effect a certain behaviour (i.e. operations)
  - the state of the interaction is as important as the messages passed

- **Application Programming Interfaces**
  - define programming language interfaces that expose desired service functionality within a client program
  - generally focused on users (clients) of services, rather than service providers

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Standard APIs vs Protocols

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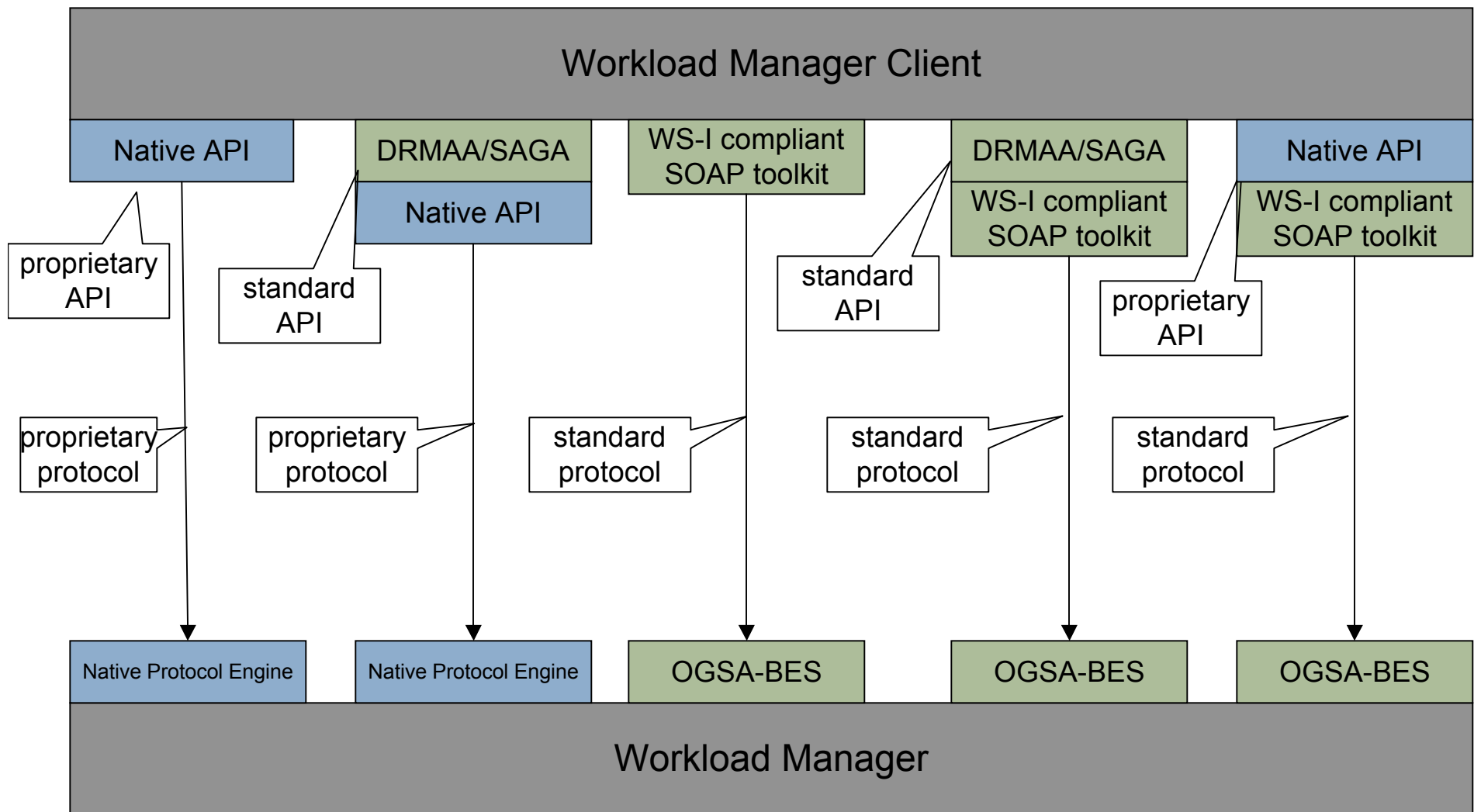
Where are we now?

- We have a sufficient body of specifications and profiles to implement various identified use cases in computing and data.

- Customer (user) value of standards is increased when they permit interoperability between packages/systems/vendors and when concepts can be transferred from one system to another.

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Use case driven

- High Performance Computing
  - Within an organization with shared file system – HPC Basic Profile
  - Multi-site/organization
- Data federation/data grids
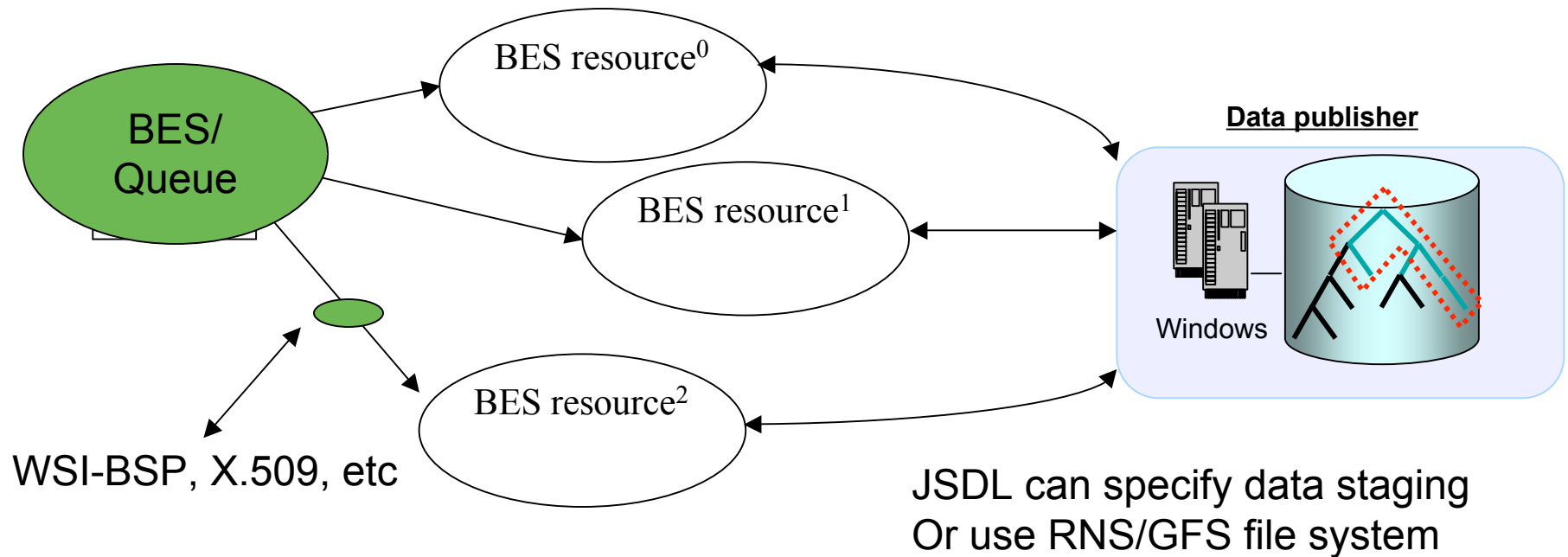 - Flat file data
  - Structured (relational)

Standards

- Security
  - WSI-BSP, WS-Security, WS-Trust, WS-Federation, WS-SecurityPolicy, WS-SecureNaming, WS-Secure Communication, others

- Infrastructure
  - WS-Addressing, Resource Namespace Services (RNS), WS-Naming

- Compute
  - JSDL, OGSA-BES, HPC Basic Profile

- Data
  - RNS, OGSA-Byte-IO, gridFTP, WS-DAI

- APIs
  - SAGA, DRMAA, GridRPC

http://www.ogf.org/gf/docs/?final

Simple HPC use case

BES resource[0]

BES/
Queue

BES resource[1]

Data publisher

Windows

BES resource[2]

WSI-BSP, X.509, etc

JSDL can specify data staging
Or use RNS/GFS file system

A simple "run" command can be implemented that generates a JSDL document describing the application to be run, its resource requirements, file inputs and outputs, etc. It interacts securely with a set of predefined BES resources using the OGSA Basic Security Profile 2.0, authenticating the client to the BES resources and the BES resources to the client.

Interop – it takes two

- One group or implementation inter-operating with itself is not particularly interesting
- Might be a need for interoperability within one infrastructure if multiple vendors solutions are deployed
- Not only must the services present the right interface (e.g. BES), it must also understand and use the same security infrastructure, etc – and not choke on the XML
  - in the world of SOAP based Web services, SOAP toolkit interoperability is often more difficult than basic spec interoperability

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Spec adoption

Project/Spec	WS-Naming	RNS	OGSA-BES	OGSA-ByteIO	WS-DAI	OGSA-BSP 2.0	JSDL	WSRF Basic Profile	HPC Basic Profile	SRM
Globus	yes		yes		yes		yes			
Unicore 6			yes	yes	will		yes	yes	yes	
Fujitsu USMT	will		yes	yes			yes	yes		
Microsoft CCS			yes				yes		yes	
Genesis II	yes	yes	yes	yes		will	yes	yes	yes	
UVA			yes				yes		yes	
OMII-UK			yes	yes			yes		yes	
GridSAM			yes				yes		yes	
Crown			yes				yes		yes	
Platform			yes				yes		yes	
OGSA-DAI				yes	yes					
NAREGI		may	may	may	yes		yes			
gFarm		yes								
gLite			yes				yes			

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Standards for "Compute Grid"

- It's often stated that "Compute Grids" are a solved problem, and thus ripe for standardization

- Both API and protocol specifications exist
  - API: DRMAA, SAGA
  - Protocol: HPC Basic Profile + OGSA-BES + JSDL

- Information Schema emerging in the form of the GLUE schema

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DRMAA

- Defines a generalized API for interacting with the job management capabilities of distributed resource management systems (DRMs) in order to facilitate integration of application programs.
  - currently there are standardized bindings for C and Java
  - non-standard bindings exist for Perl, Python and Ruby
- It's a very widely implemented specification
  - There are 8 separate implementations
  - Includes implementations for LSF, SGE, PBS (Torque and Pro), Condor and others
- http://www.ogf.org/documents/GFD.22.pdf
- See http://drmaa.org for in depth information

SAGA

- Provides a standardized interface across various middleware packages, easier to use than native interfaces.
- Differs from DRMAA in that it is more comprehensive and covers more application categories (it's more than just job management)
  - Functional API Packages include: Job Management, Name Spaces, File Management, Replica Management, Streams and Remote Procedure Call
  - API defined using an interface definition language in an OO fashion
- http://www.ogf.org/documents/GFD.90.pdf
- http://wiki.cct.lsu.edu/saga/space/start

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JSDL

- JSDL stands for Job Submission Description Language
  - describes the requirements of computational jobs for submission to Grids and other systems.
- A JSDL document describes job requirements
  - What to do, not how to do it
- JSDL does not define a submission interface or what the results of a submission look like
  - Or how resources are selected, or …
- JSDL 1.0 includes description of JSDL elements and XML Schema
  - http://www.gridforum.org/documents/GFD.56.pdf

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OGSA-BES

- The Basic Execution Service defines a Web Services interface for creating, monitoring and controlling things such as OS processes, service instances or parallel programs - what are called "Activities" in BES parlance

- BES defines an extensible state model for modeling the lifecycle of Activities
  - different implementations may support different sets of states and allowable transitions

- BES defines an extensible information model for the BES itself and for the Activities it manages
  - different implementations can provide extra properties on the BES container or Activities using XML extensibility
  - placeholder for GLUE schema once complete

- http://www.ogf.org/documents/GFD.108.pdf

HPC Basic Profile

- Defines how to combine other specifications (JSDL, OGSA-BES) to implement a particular use case scenario
  - The basic use case is batch job submission on cluster with shared file system
  - The HPC Profile purposefully reduces the scope of JSDL and BES in order to ensure base line interoperability by clarifying ambiguities
- Companies and organizations involved in developing the standard include
  - Platform Computing, Microsoft Corporation, University of Virginia, The Globus Alliance, Fujitsu, and many others
- http://www.ogf.org/documents/GFD.114.pdf
- Interoperability experience report has been published based on SC07 interoperability demo
  - http://www.ogf.org/documents/GFD.124.pdf

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HPC Profile Usage Scenarios
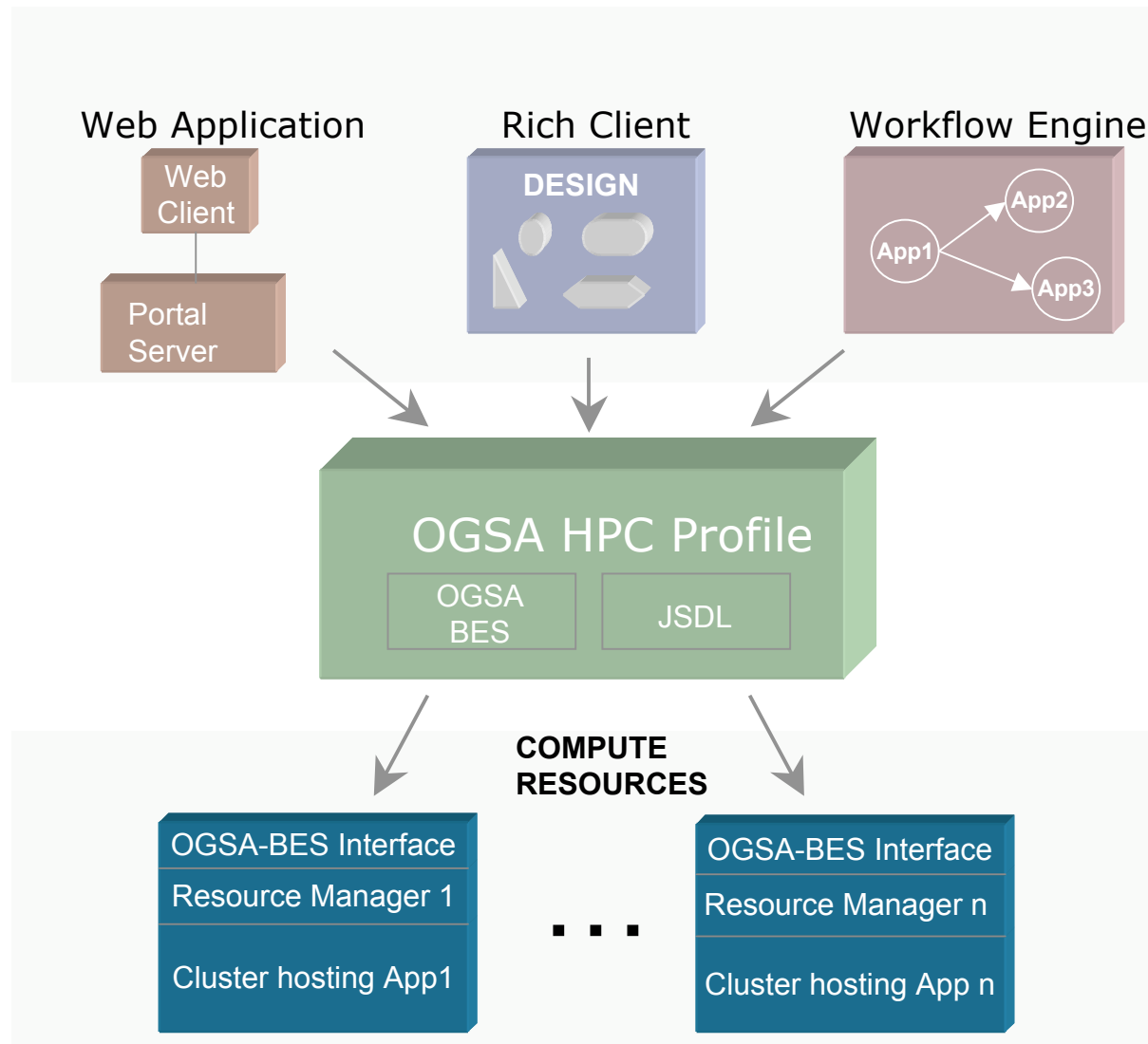
Conclusions

- Different types of specs address the needs of different people (API vs protocol)

- Today there exist a sufficient body of specifications to realize typical Grid & HPC use cases

- Implementation experience suggests that these specifications are ready for immediate adoption

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For more information

- http://www.ogf.org
- There will be an upcoming special issue of the journal "Concurrency and Computation: Practice and Experience" dedicated to practice and experience on activities related to the OGF
  - http://www.ogf.org/OGF_Special_Issue