The Open Cloud Computing Interface for Interoperability Across Clouds

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Key Points

- There is a wide range of distributed computing application scenarios
  - These apps can have different requirements, but there are many required technical capabilities in common
- How do we support these required capabilities with *IT as a Service*?
  - How do we map the necessary common *technical capabilities* into economically self-sustaining *business models*?
  - How do we achieve *portability* and *interoperability*?
    - Within a private enterprise, among federated sites, and among public providers
- This must be achieved in an *open, non-proprietary* manner!
  - *Open Cloud Computing Interface*
- Stakeholders must coordinate to bring stability to the marketplace!
  - Stakeholder contribution of *time, money & people* in *open forums* can produce ROI
- *Let's Begin – with the rapidly evolving landscape ...*

Vast Array of Application Scenarios Are Driving Evolution

- Integrated Physical and Computational Systems
- Dynamic Data-Driven Application Systems (DDDAS)
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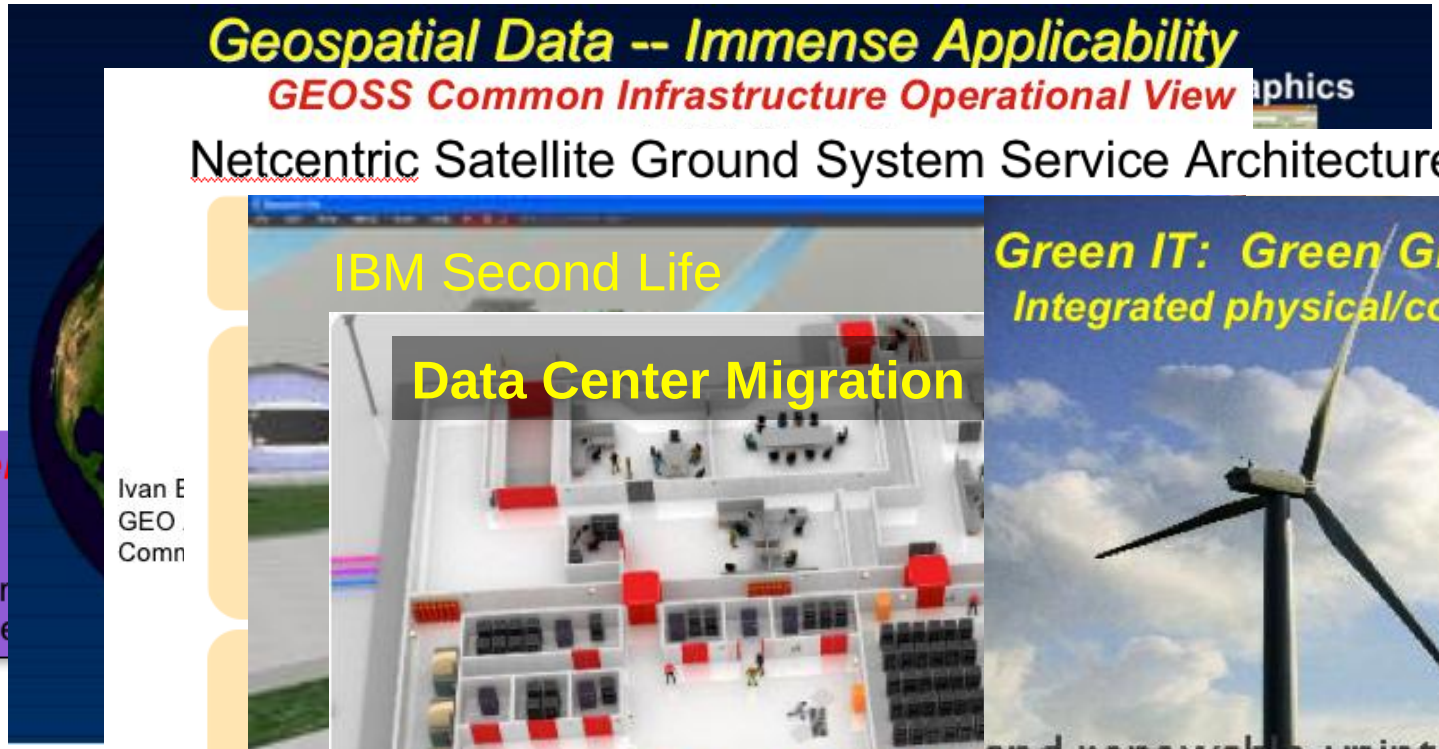
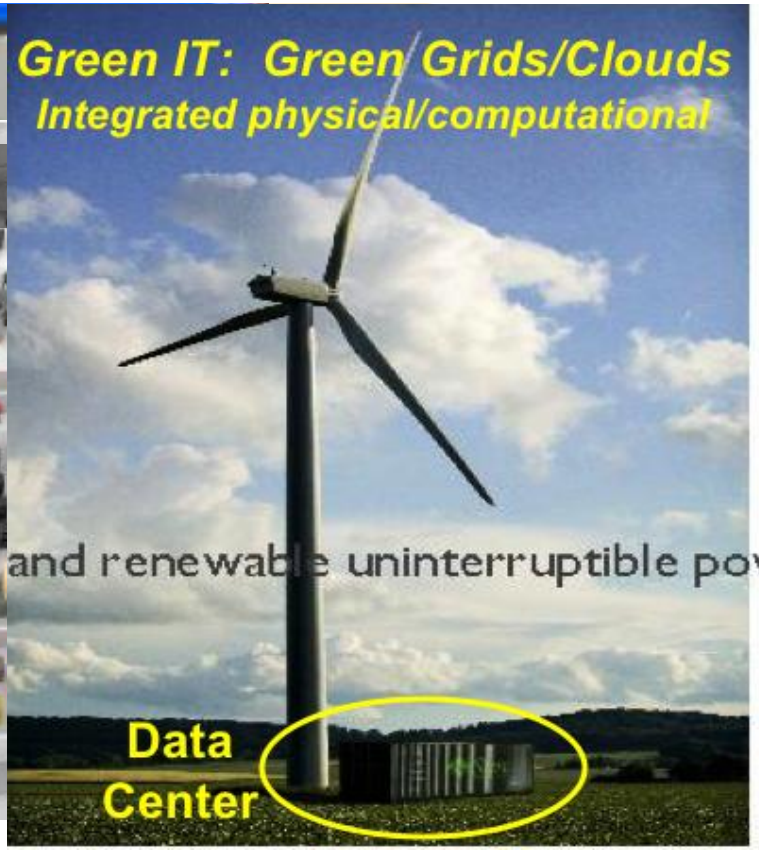




Cloud Computing -- What is it?

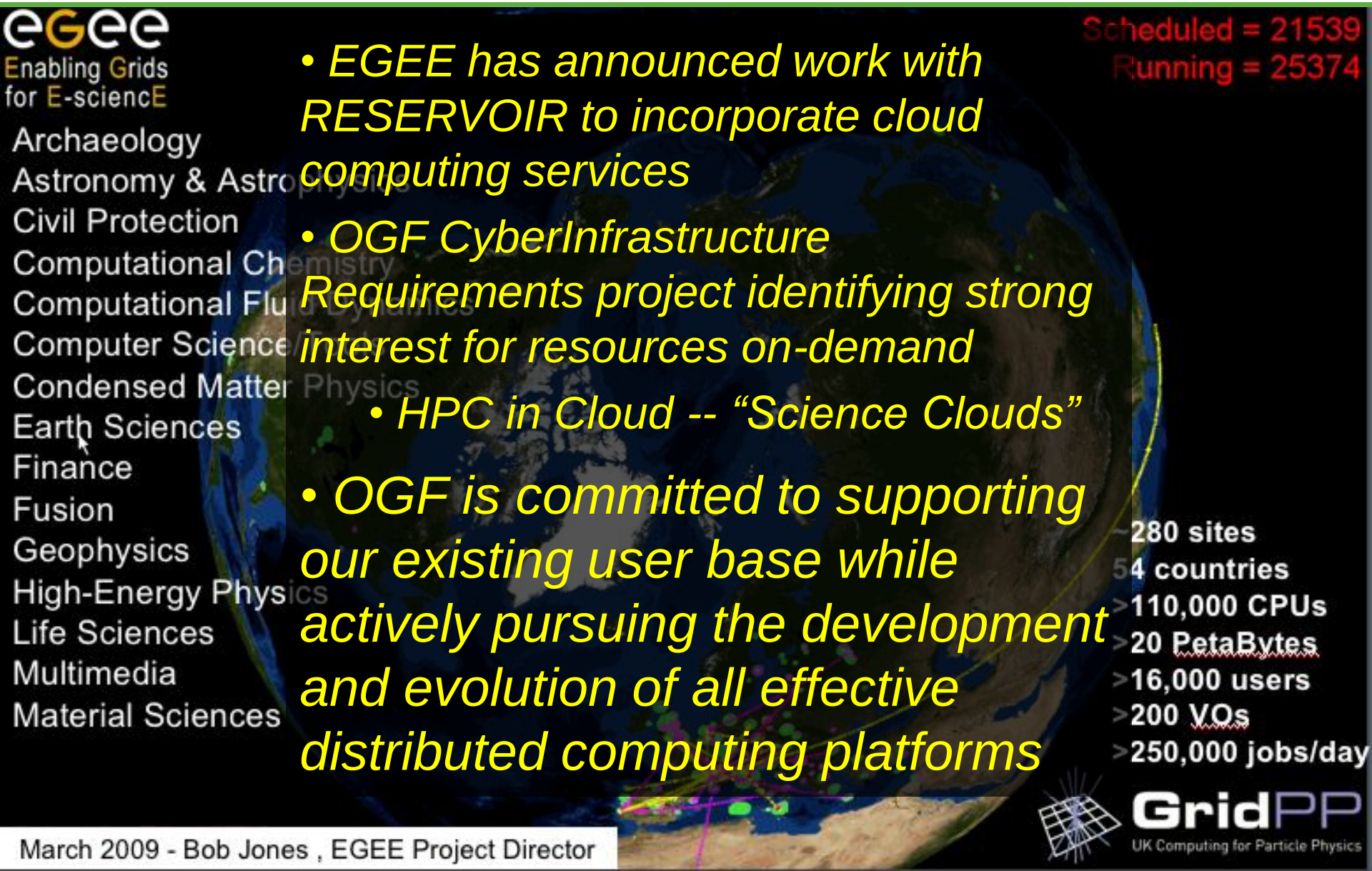
- A broad term used to denote *abstraction* and *virtualization* at any of several different system layers
  - "Outsourcing" of hardware, system environment, or services
  - Things just run "in the cloud", i.e., somebody else's data center
- Generally from a single provider through a very simple API
  - Simple API eases adoption at the cost of insight and control
  - Effective business model for provider to "sell" virtualized, back-end data center resources

Application Level	• *Software as a Service (SaaS)* • Build an application from pre-defined services • Example: Salesforce.com
Platform Level	• *Platform as a Service (PaaS)* • Acquire a set of hosting environments • Example: Google App Engine (Python)
Infrastructure Level	• *Infrastructure as a Service (IaaS)* • Acquire a set of machines you can login to • Example: Amazon EC2

How Do Grids and Clouds Relate?

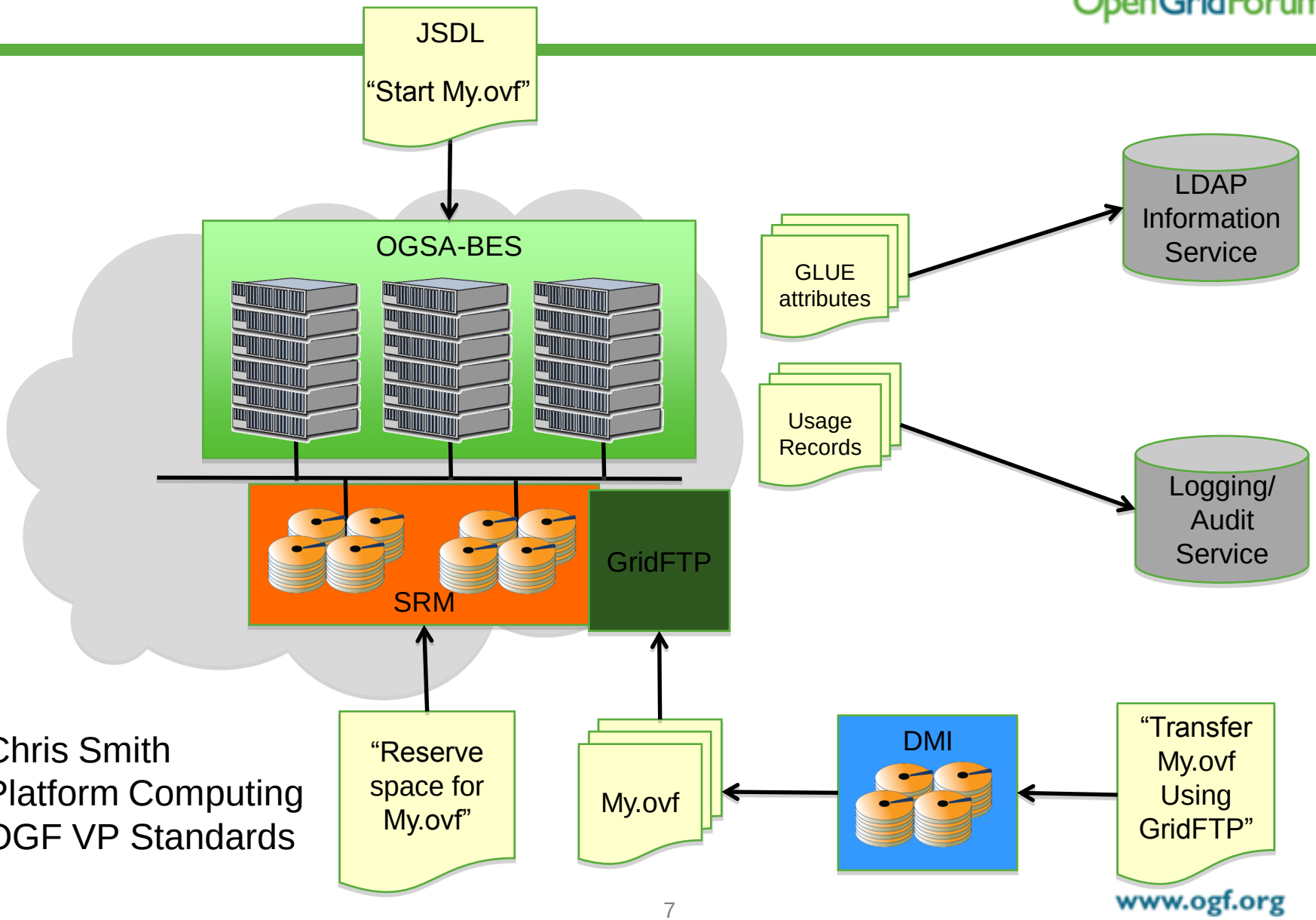
- Opinions vary … but …
- Grids came out of "big science" and the desire to collaborate in a *federated environment*
  - Managed sharing of resources
- Clouds came out of industry and the desire to dynamically provision resources *in the cloud*
  - Simple APIs for using abstracted or virtualized resources
  - Economies of scale in the data center
  - Aka, utility computing, internet computing, …
- "Grids are an access model; Clouds are a business model"
  - Chris Smith, Platform Computing, OGF VP Standards
- Distributed applications need and can use capabilities being developed under both rubrics of *grid* and *cloud*
  - There is no real *grid vs. cloud dichotomy*

An Evolving Infrastructure



- *EGEE has announced work with RESERVOIR to incorporate cloud computing services*
- *OGF CyberInfrastructure Requirements project identifying strong interest for resources on-demand*
  - *HPC in Cloud -- "Science Clouds"*
- *OGF is committed to supporting our existing user base while actively pursuing the development and evolution of all effective distributed computing platforms*

A Possible Way to Access Cloud Services



Chris Smith
Platform Computing
OGF VP Standards

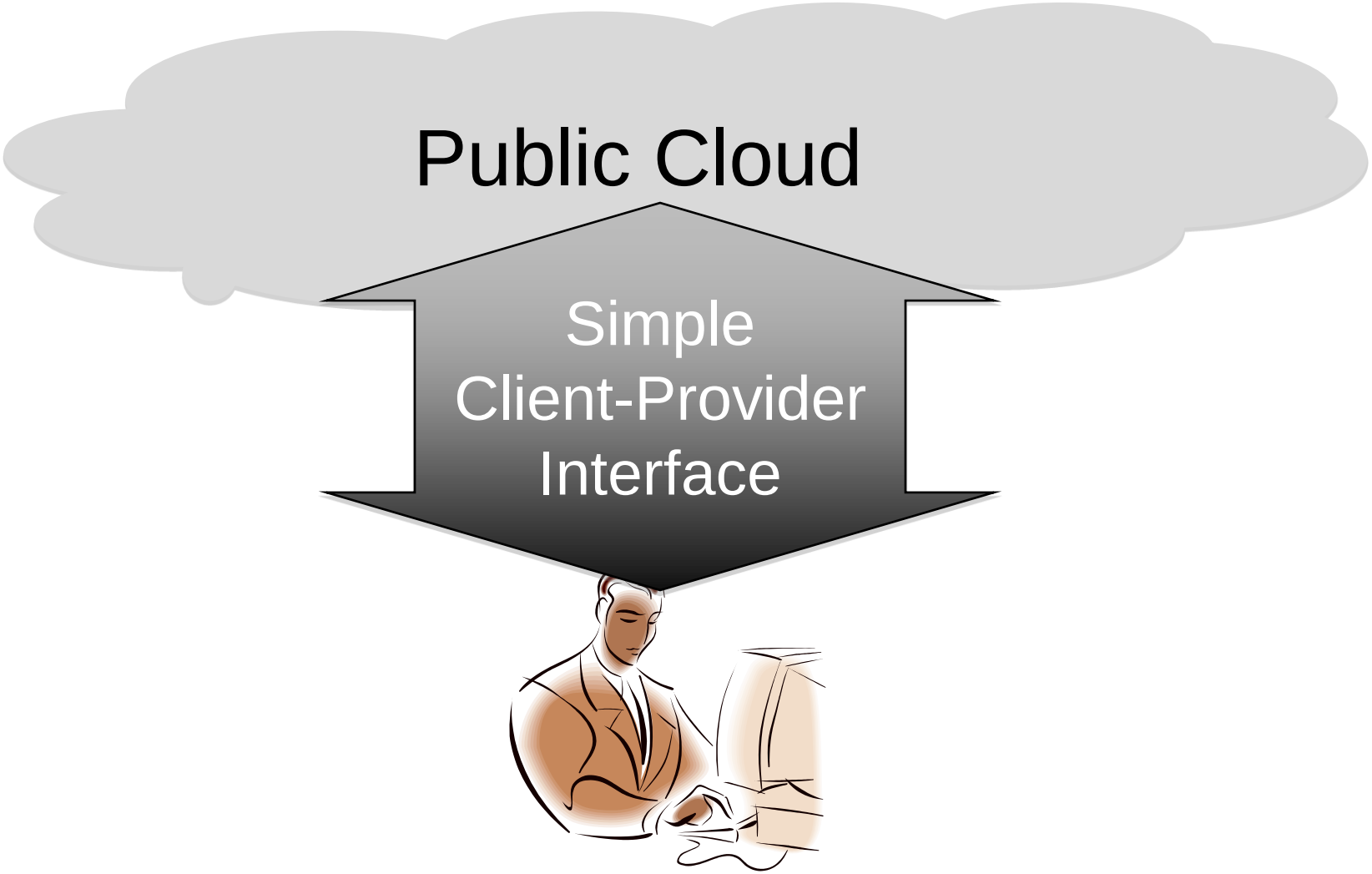
Referenced Standards

- Web Services Agreement Specification (WS-Agreement)
  - http://www.ogf.org/documents/GFD.107.pdf
- GLUE Schema
  - http://www.ogf.org/documents/GFD.147.pdf
- Lightweight Directory Access Protocol (LDAP)
  - http://tools.ietf.org/html/rfc4510
- Storage Resource Manager Interface (SRM)
  - http://www.ogf.org/documents/GFD.129.pdf
- Data Movement Interface (DMI)
  - http://www.ogf.org/documents/GFD.134.pdf
- GridFTP
  - http://www.ogf.org/documents/GFD.20.pdf
- Open Virtualization Format Specification (OVF)
  - http://www.dmtf.org/standards/published_documents/DSP0243_1.0.0.pdf
- Job Submission Description Language (JSDL)
  - http://www.ogf.org/documents/GFD.136.pdf
- Basic Execution Service (BES)
  - http://www.ogf.org/documents/GFD.108.pdf
- Usage Record (UR)
  - http://www.ogf.org/documents/GFD.98.pdf

No Shortage of Challenges

- Data access and interoperability
  - Must be done at the application domain level, by the domain users
- Security
  - Different models will expose different security threats
- Reliability
  - Managing redundancy, live migration, etc., across the infrastructure
- Frameworks
  - How to manage sets of resources, e.g., VMs and VOs?
- Performance management
  - What job mix needs to be supported, e.g., e-commerce, HPC, transactional, database, data streaming?
- Costing models
  - How to compare your own infrastructure costs with a cloud providers?

Deployment Models Blur the Boundaries of Grids and Clouds



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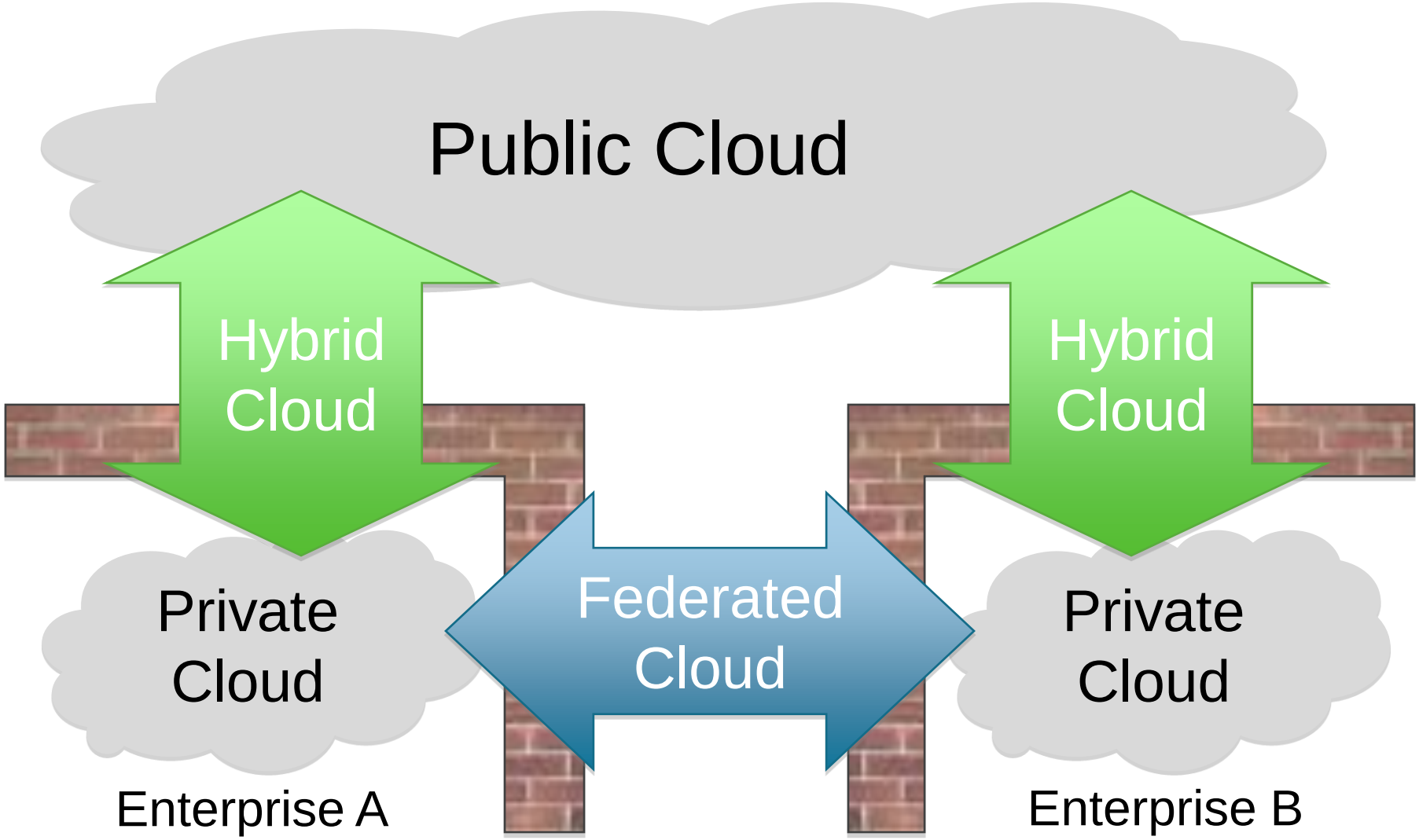
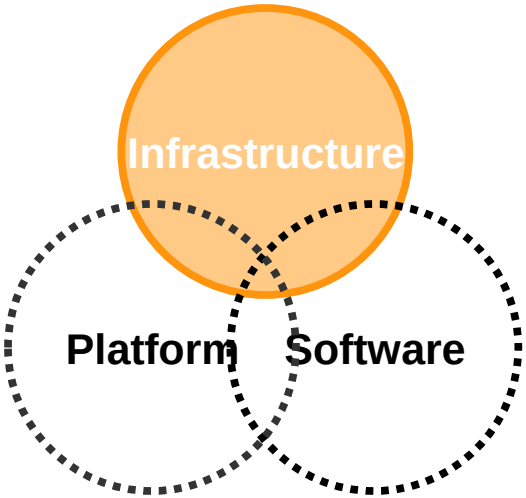


Public vs. Private Cloud Issues

- Cost & Cost Predictability
- Users expect to monitor & manage "their" infrastructure
  - Will a public cloud provider expose enough information for a client to troubleshoot when something goes wrong?
- Security & Privacy
  - You can store encrypted data in a clouds, but can you compute on it?
- Regulation
  - Physical location of data
  - Long-term audit trails (15-20 years)
- Individual vs. Corporate Requirements
  - Corporate use of public clouds may entail legal & contracting overheads
  - Ease of use and quick provisioning may tempt individuals to ignore corporate procedures
  - Trade-off between quick results and longer term risk exposure
- Internal IT departments may want to offer their own "seed cloud”
- *Interoperability & portability* between private and public clouds

Need for Cloud Interoperability

- Requirements:
  - ***Interoperability*** – ability to let different system interoperate (Hybrid & Federated Clouds)
  - ***Portability*** – ability to move services and port them as easy as possible
  - ***Integration*** – wire up cloud computing with legacy resources
- Need for IaaS interoperability lead to ***OCCI***
  - WG chairs represent the whole cloud community
  - Academia
    - Andy Edmonds (SLA@SOI - Intel)
  - Industry
    - Thijs Metsch (RESERVOIR - Sun Microsystems)
  - End-Users
    - Sam Johnston (Australian Online Solutions)
  - Service Providers
    - Alexis Richardson (RabbitMQ & CohesiveFT)



OCCI
Open Cloud Computing Interface

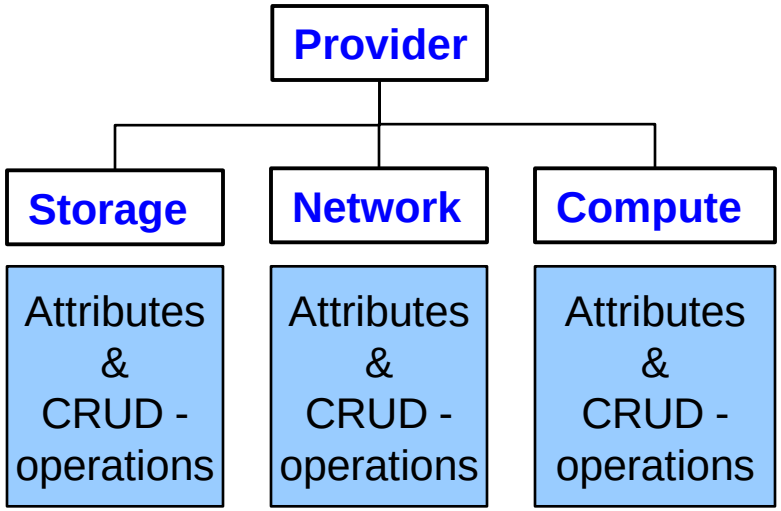
Open Process = Open Standard

- The Open Grid Forum has an established open process where *anybody* can join and collaborate
  - Great momentum with many individuals and companies joining
  - Many people blogging & tweeting about OCCI
- Very aggressive timeline to be one of the first Cloud APIs
  - ***OGF 25*** – BoF session and creation of the group (100 Attendees)
  - ***OGF 26*** – First presentations at a OGF meeting in Chapel Hill
  - ***OGF 27*** – Presentation of first API ready to implement
  - ***OGF 28*** – Start working on extensions to the API

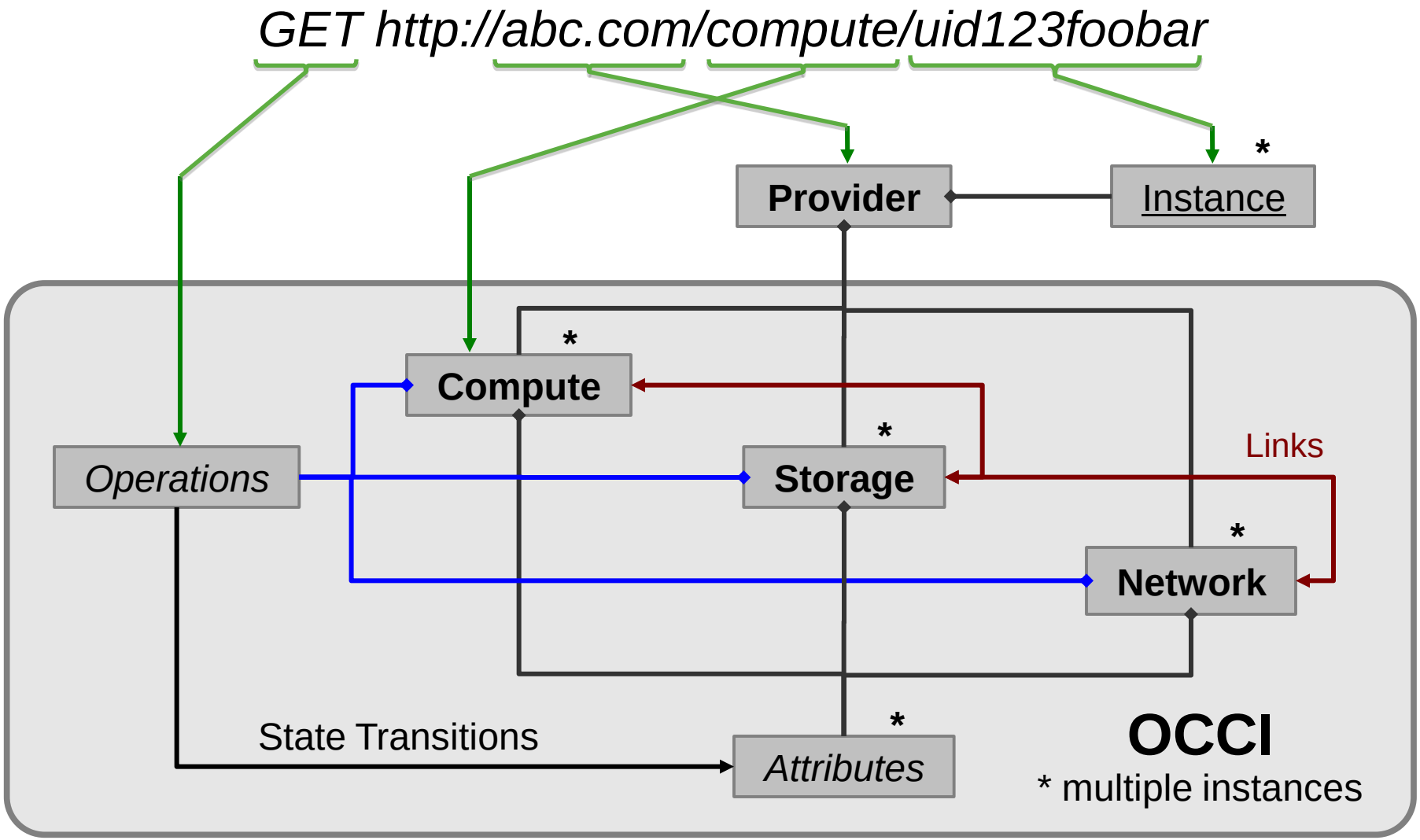
Focused on IaaS Cloud API

- Goal was the creation of a simple and RESTful API
  - Simple means ~15 commands
  - ***Slim -- very extensible!***
- Requirements and Use Case documents also underway
- OCCI collaborating with:
  - DMTF: Work Registry
  - SNIA: Cloud storage joint mtgs.
  - SCRM: Cloud Coordination
    - ➔ ***cloud-standards.org***
- Interest has been huge
  - 160 members on mailing list
  - Four providers and two projects to implement standard
- ***Come work w/ OCCI !***

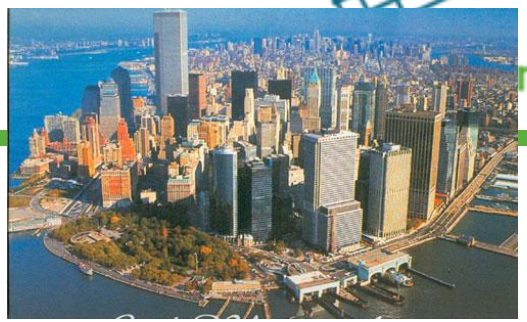
http://www.occi-wg.org



The Open Cloud Computing Interface



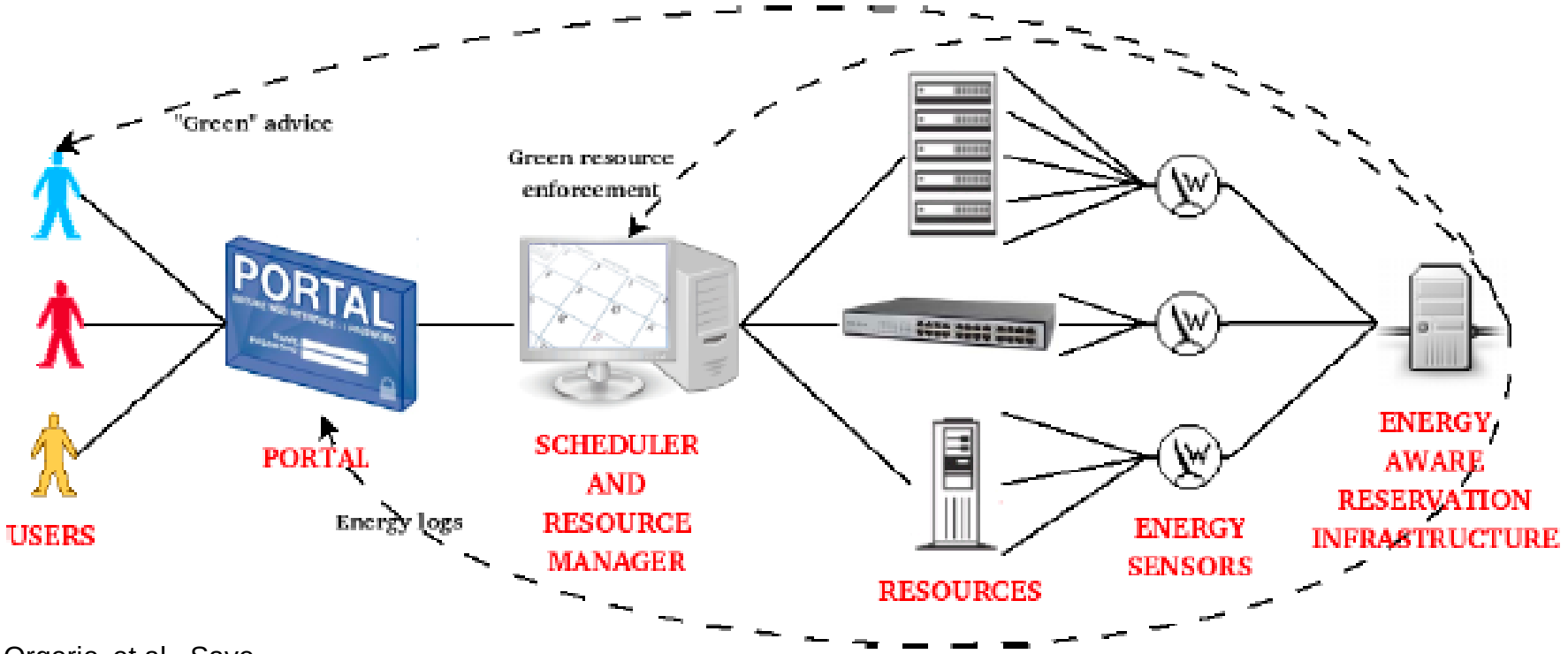
Green IT/Grids/Clouds



- Energy becoming defining issue for Data Centers
  - Beyond cost: location feasibility
- Energy Management Architectures are Sensor & Control Systems
  - Environmental Monitoring
  - Decision Making
  - Enacting Responses
- Control Mechanisms include:
  - Scheduling
  - Voltage-Frequency Scaling
  - Powering racks up-down
  - VM placement & migration
- Clouds can be used to enforce energy policy
  - By abstracting the infrastructure, clouds can transparently manage workload on the back-end
    - Consolidate jobs on servers
    - Move work to where the green power is
- Several projects underway
  - Reservoir (EU), OpenNebula (EU), GreenNet (INRIA), GreenLight (NSF), Low Carbon ICT (UK)

More data centers are just not possible in NYC or London

An Energy Management Architecture



Orgerie, et al., Save Watts in your Grid: Green Strategies for Energy-Aware Framework in Large Scale Distributed Systems. 14th IEEE ICPDS, Dec. 2008.

- CO2 Working Group Starting
  - Reporting interface between physical infrastructure management and workload management

What Must Standards Organizations Do to Achieve Portability and Interoperability?

- ***Drive Progress***
- Build Critical Mass of Key Stakeholders
  - Continual polling and coordination across the community
- Forge agreement on:
  - Clear Goals
  - Clear Schedule (“time-box” the process)
  - Clear Responsibilities
  - Proper Provisioning of the Effort
- Major Stakeholders Must Contribute:
  - Time, Money & ***People***
  - Technical staff must engage to do the real technical work
  - The more people "invested", the more your agenda addressed!
  - Cannot be a “marketing” organization
- Deliver ROI to the Stakeholders
  - ***Targeted Projects on Key Issues***

Upcoming OGF Events!

- OGF-27
  - Banff, Alberta, Canada, Oct 12-16, 2009
  - With IEEE Grid 2009 & Cybera/CANARIE Natl Summit
  - Combined “Grid to Cloud” & “HPC in Cloud” Workshops

- OGF-28
  - Munich, Germany
  - March 8-12, 2010

Take-Home Message

- Wide spectrum of applications can use the capabilities being developed under the rubrics of *grid* and *cloud*
- OGF will energetically pursue -- in collaboration with the broader community -- all useful distributed computing technologies of interest to our stakeholders
- *OCCI will facilitate interoperability among public, private, hybrid and federated clouds*
  - *But this is only part of the puzzle*
- ***We must coordinate and collaborate to make the whole thing work***
  - ***SCRM -> cloud-standards.org !***

Thank You

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