Interoperability

Grids, Clouds and Collaboratories

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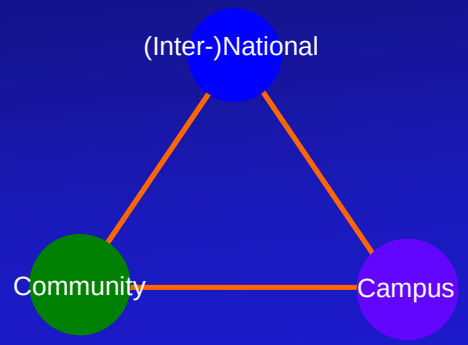
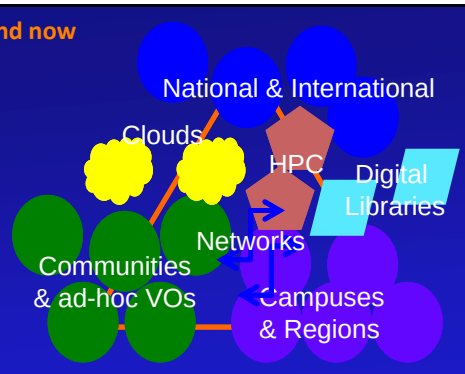
Executive Director Open Science Grid , Fermilab

Our (e.g. OSG's) Past – the 3 types of grids

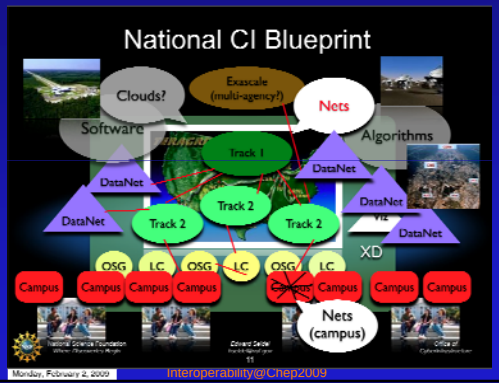


And now



the software is inevitably different & changing, with different external semantics.

National Science Foundation Landscape

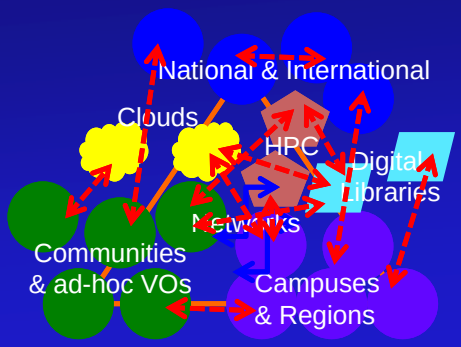


We must integrate & interface many more types of resource services

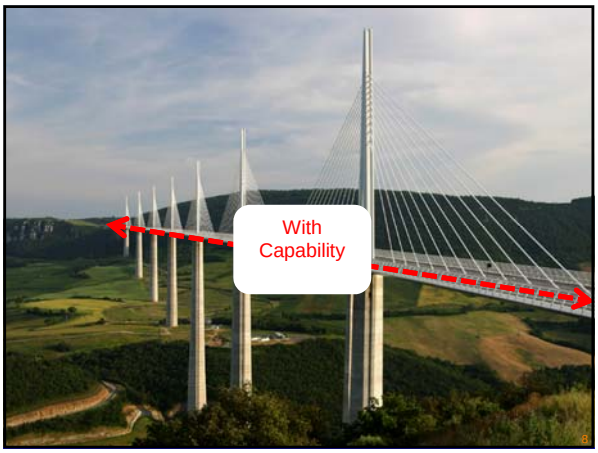
- Cross-campus infrastructures & community grids.
- Multi-organization grids & multi-site uniform clusters.
- Unique leadership class, peta-scale, exascale & the ubiquitous laptops
- Huge shared data repositories & large local data silos.
- Shared services & encapsulated virtual environments.
- Commercial & community clouds.

And these systems also overlap.

People work across them all



Bridges (aka gateways, adaptors, routers) connect the diverse resources layered on the network fabric.



Why include Collaboratories as well as Virtual Organizations ?

"center without walls, in which the nation's researchers can perform their research without regard to physical location, interacting with colleagues, ***accessing instrumentation, sharing data and computational resources, [and] accessing information in digital libraries***" (Wulf, 1989).

"a system which ***combines the interests of the scientific community at large with those of the computer science and engineering community*** to create integrated, tool-oriented computing and communication systems to support scientific collaboration" (Bly, 1998, p. 31).

experimental and empirical research environment in which scientists work and communicate with each other to design systems, participate in collaborative science***, and conduct experiments to evaluate and improve systems.***

".a new networked organizational form that *also includes social processes;* collaboration techniques; formal and informal communication; and ***agreement on norms, principles, values, and rules"*** (Cogburn, 2003, p. 86).

Goals remain - Supporting People to

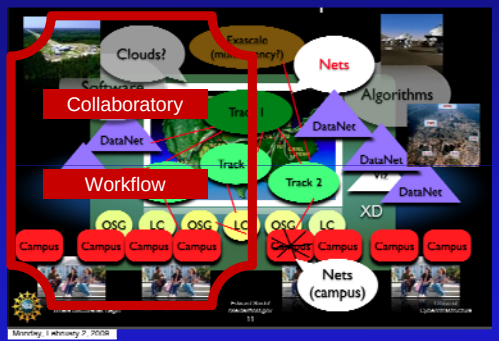
Do their own scholarship (research, science, education...)

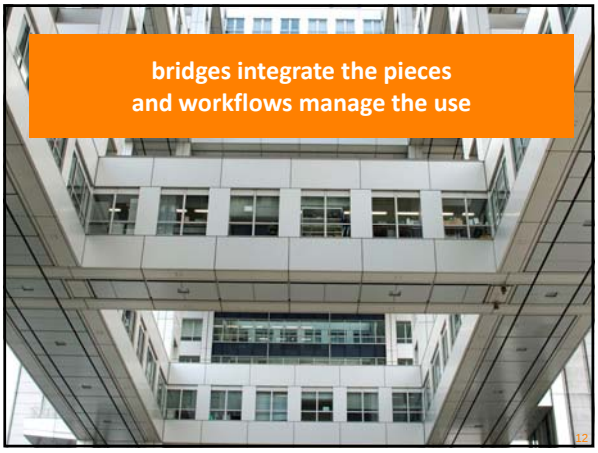
- Have local access to their local system using local methods.
- Access unique computing capabilities remote from their site.

and

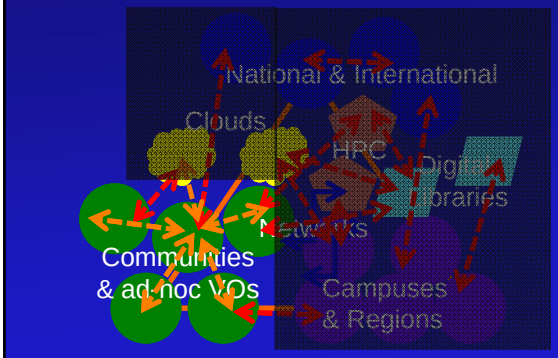
Collaborate with others - both ad-hoc and sustained

- Geographically and/or organizationally distributed.
- Use data from same or different intrument(s).
- Pool resources.
- Share and reuse their resources, software & services.
- Combine their knowledge.

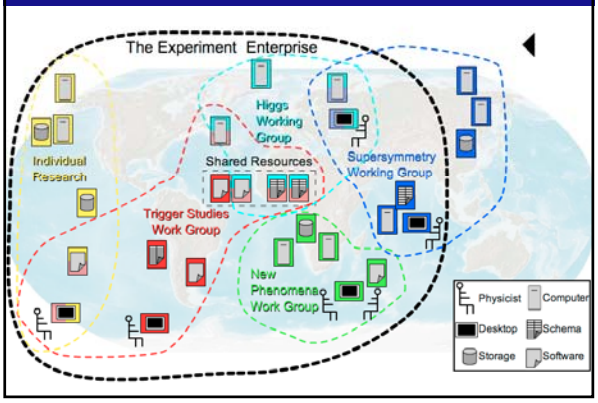


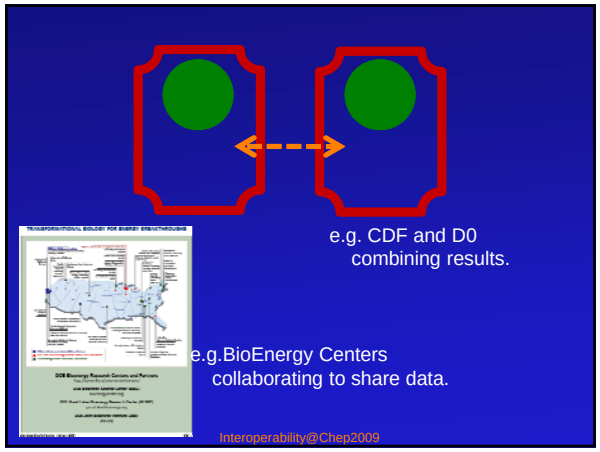


of course communities also work together



Our Original Vision





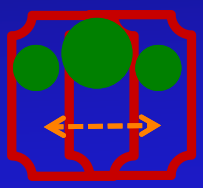
e.g. CDF and D0 combining results.

e.g.BioEnergy Centers collaborating to share data.

e.g.

Climate applications using both weather data and geophysical history.

Material scientists using data across X-ray, neutron and other probes



Bridge capabilities

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- Act as borders.

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- Allow each side to evolve independently.
- Apply and check for policy.

Bridge capabilities

be opened and closed

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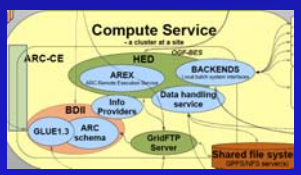
offer further discussion of boundary and interaction between the network and middleware layers?

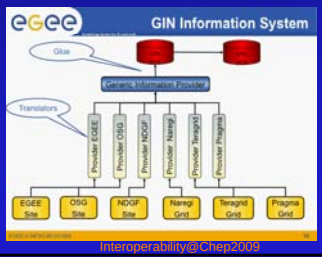
Some examples: jobs, information, management

- Advanced Resource Connector (ARC) Compute Element gateway
  - Multiplexing submissions from a variety of remote execution clients into a common queue and ARC submission framework.
  - Centralized data management across all ARC sites.



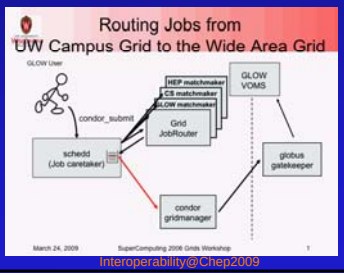
Information Service Adaptors

- Apply policy filters as well as translate
- Information can be injected at different stages in the flow.



Condor job router

– uploading jobs between different Security infrastructures .
- executing locally or remote as needed.



FermiGrid OSG-TeraGrid gateway
- Maintains state in "osg space" while dispatching work and data to TeraGrid.
- Will map users in VOs to TeraGrid allocation policies.
- Collects MDS4 into common pool with LDAP information.

End-point Identity (Shibboleth, Bridge-CAs) -X509
- Allow application of varying security policy

Virtual Machine/Cloud administration services

Experiment submit-agents

Portals and Hubs

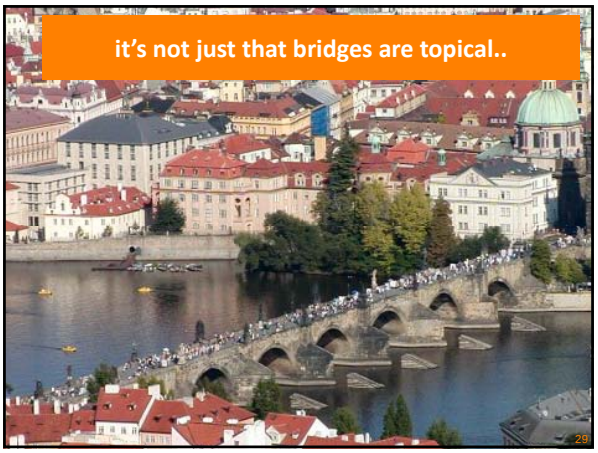
Human – Software Bridges?

Bridges are part of the interoperability solution

Integration to adapt to the most cost-effective computing, storage, software and services that are out there.

Agility to follow several cycles of technology buzz-words simultaneously, mix and match.

A natural place to handle inter-domain differences beyond APIs.


it’s not just that bridges are topical..
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