

The Cumulus Project: Build a Scientific Cloud for a Data Center

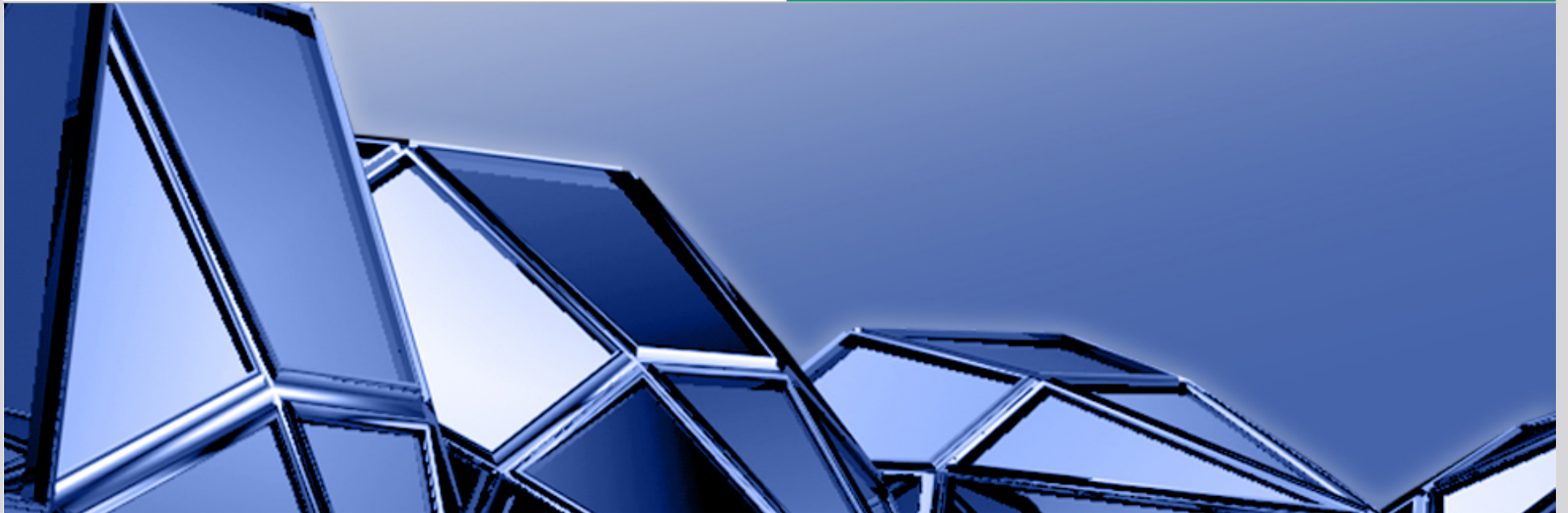
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Forschungszentrum Karlsruhe
in der Helmholtz-Gemeinschaft



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Cloud Motivation



Grid Computing, Cloud Computing

Search Trends

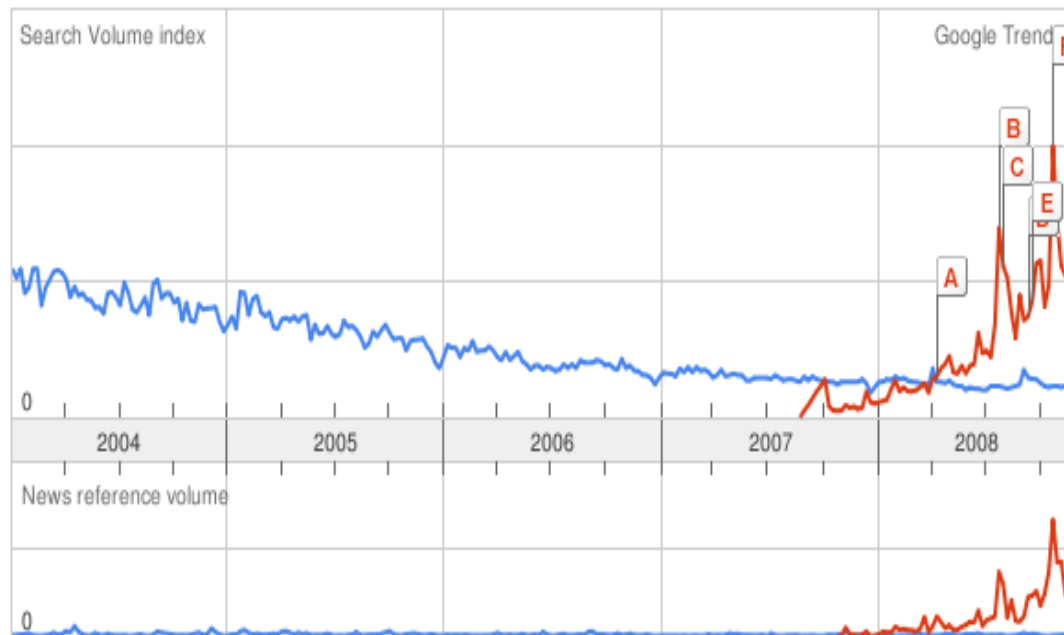
Tip: Use commas to compare multiple search terms.

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All regions

● grid computing ● cloud computing



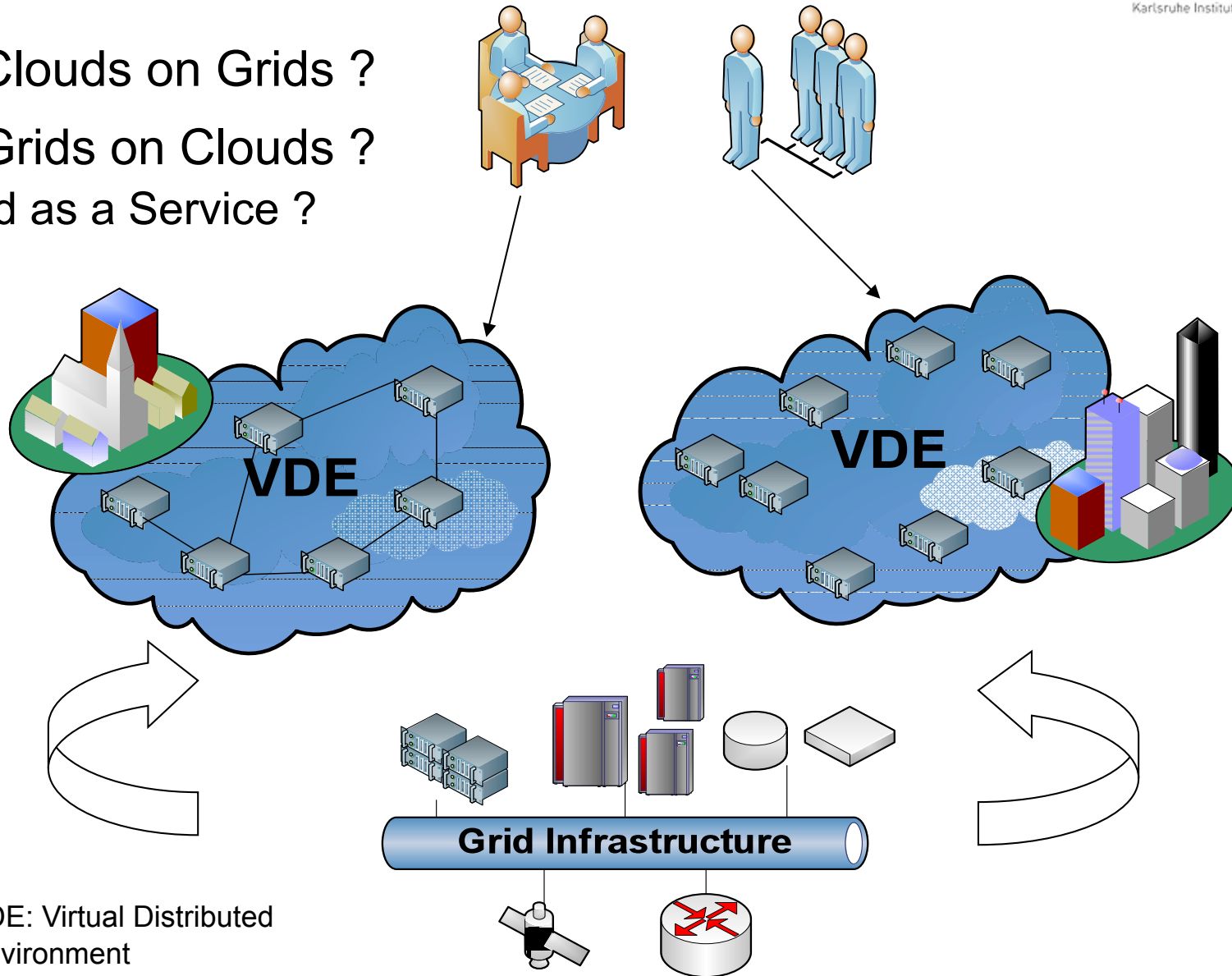
- A [Google and Salesforce.com in cloud computing deal](#)
Siliconrepublic.com - Apr 14 2008
- B [Yahoo, Intel and HP form cloud computing labs](#)
Reseller News - Jul 29 2008
- C [How Cloud Computing Is Changing The World](#)
Pittsburgh Channel.com - Aug 4 2008
- D [Citrix Unveils Cloud Computing Strategy and Product Line](#)
Business Wire (press release) - Sep 15 2008
- E [IBM launches four new cloud computing centers](#)
InfoWorld - Sep 24 2008
- F [Cloud Computing Expo: Swiss Post First to the Cloud](#)
Sys-Con - Oct 28 2008

Clouds vs. Grids: A Comparison

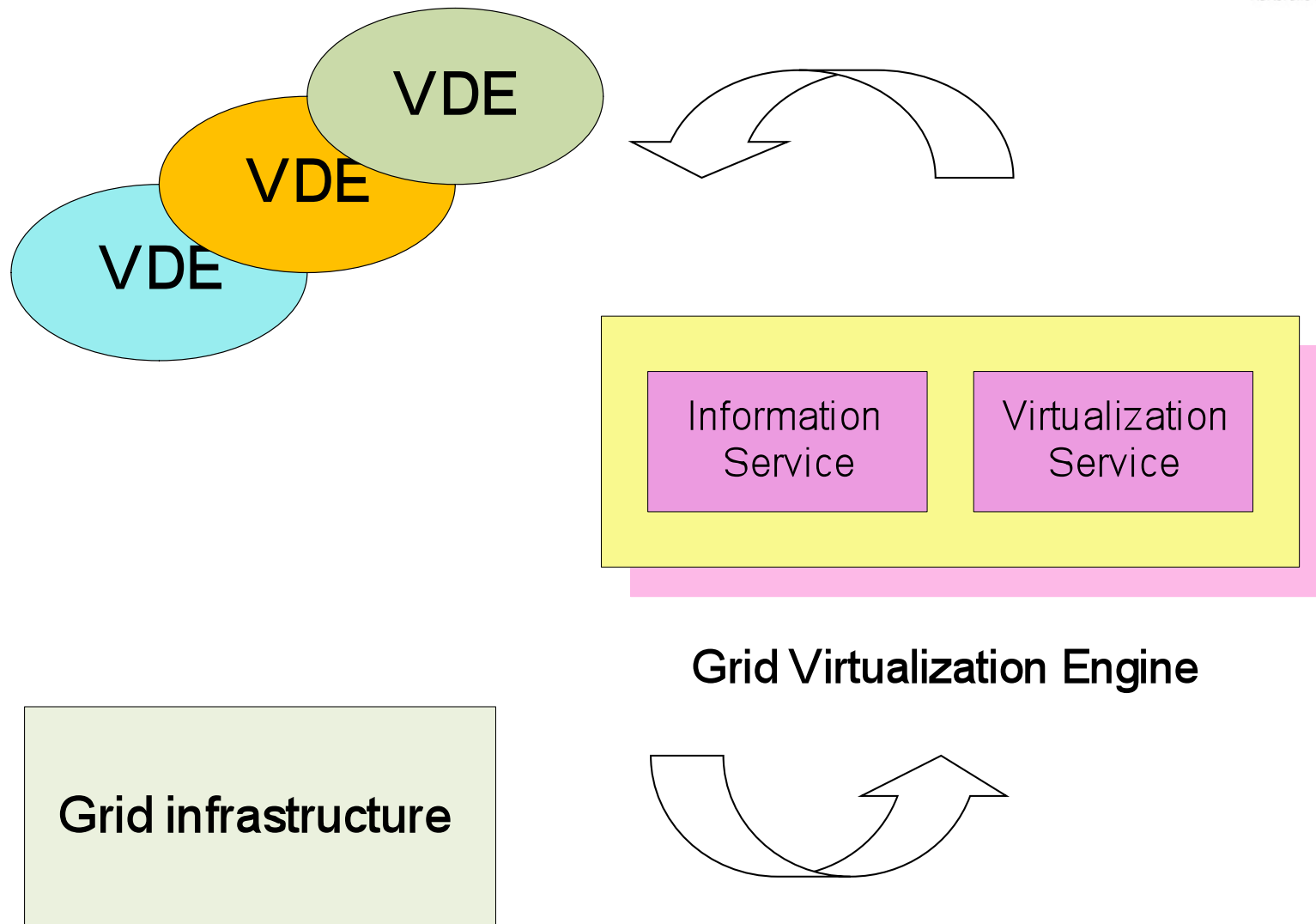
	Cloud Computing	Grid Computing
Objective	Provide desired computing platform via network enabled services	Resource sharing Job execution
Infrastructure	One or few data centers, heterogeneous/homogeneous resource under central control, Industry and Business	Geographically distributed, heterogeneous resource, no central control, VO Research and academic organization
Middleware	Proprietary, several reference implementations exist (e.g. Amazon)	Well developed, maintained and documented
Application	Suited for generic applications	Special application domains like High Energy Physics
User interface	Easy to use/deploy, no complex user interface required	Difficult use and deployment Need new user interface, e.g., commands, APIs, SDKs, services ...
Business Model	Commercial: Pay-as-you-go	Publicly funded: Use for free
Enabling technology	Virtualization, SaaS, Web 2.0, Web service, ...	HPC, Grid infrastructure, middleware, ...
QoS	Possible	Little support
On-demand provisioning	Yes	No

Agenda

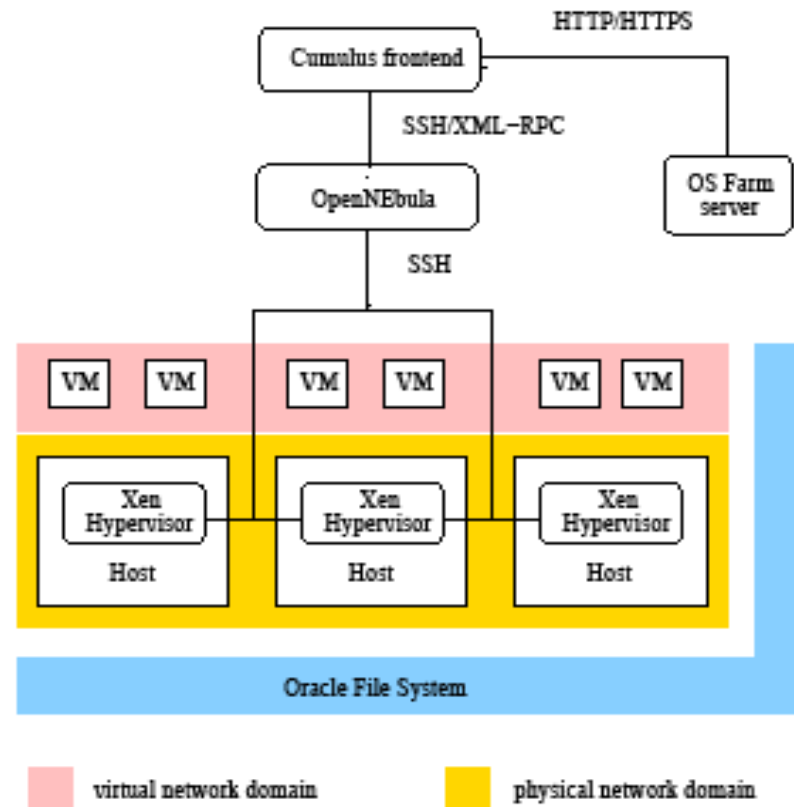
- Build Clouds on Grids ?
- Build Grids on Clouds ?
 - Grid as a Service ?



Virtual Distributed Environment



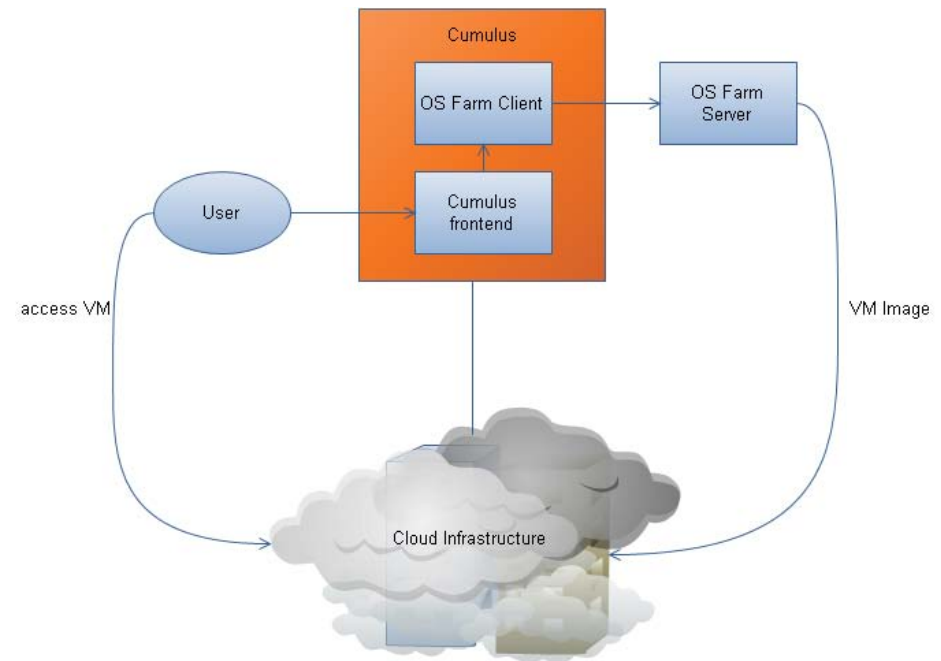
Cumulus: A Cloud Computing Prototype



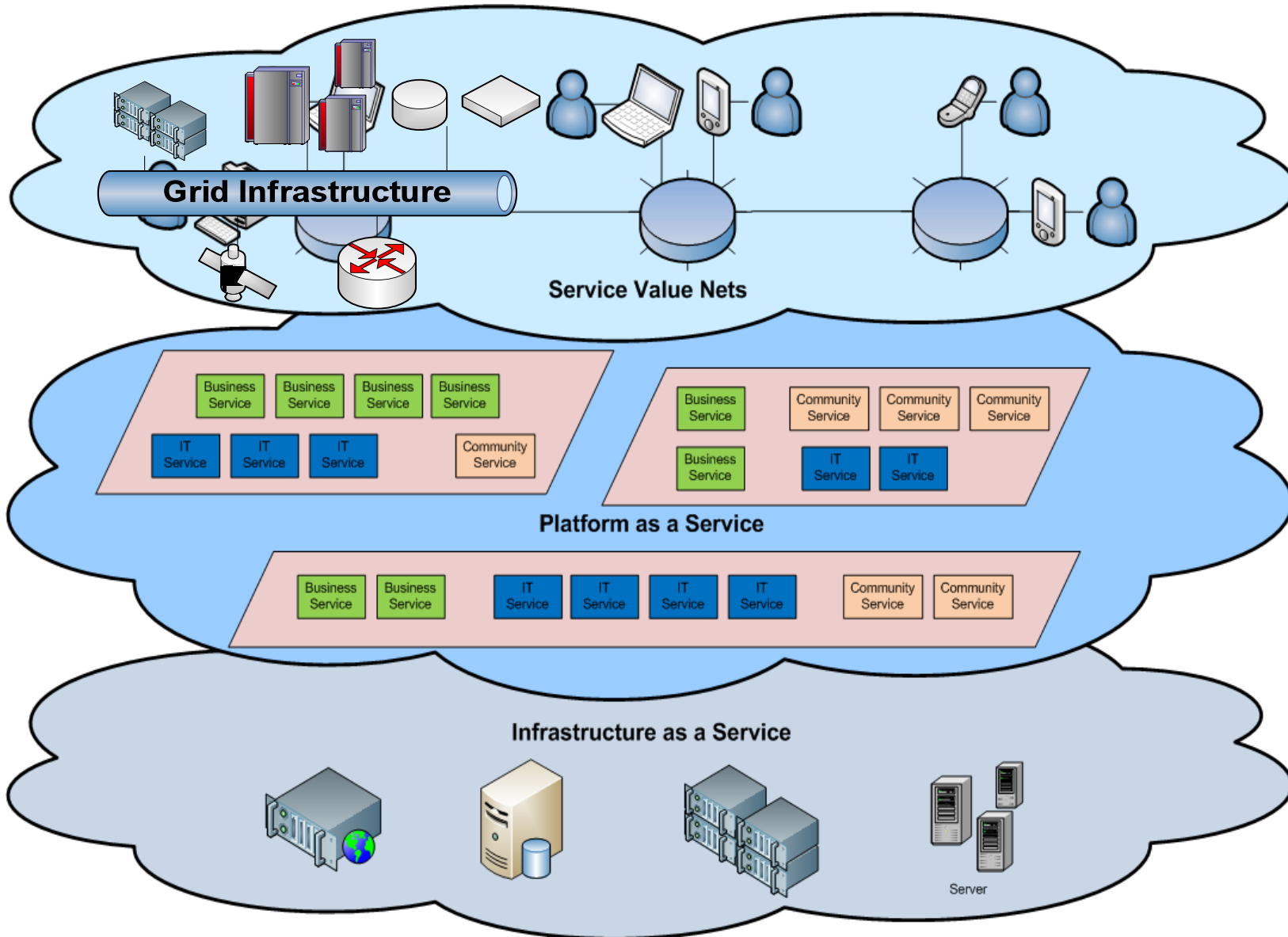
- Presented at CCA08 in Chicago last year
 - Also tried GT4 Virtual Workspace / Nimbus as an alternative to OpenNEbula

OS Farm as a Platform Provisioning Tool

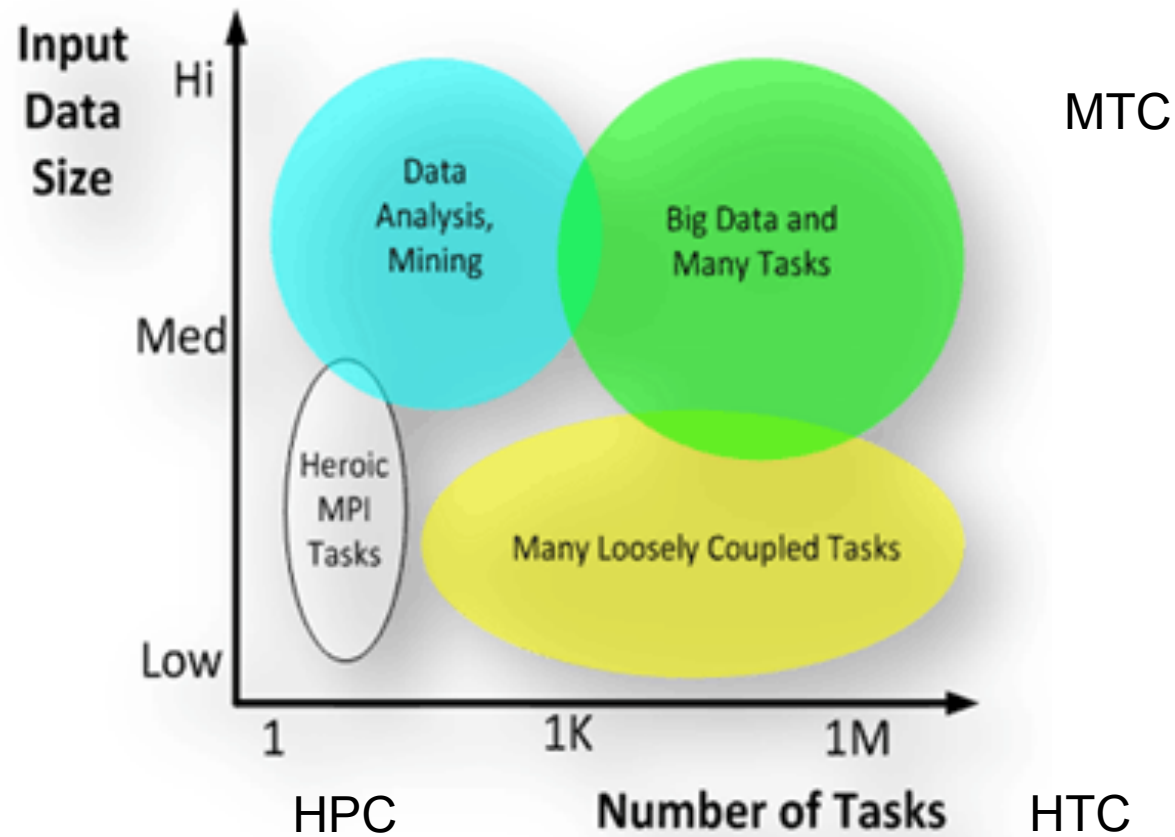
- OS Farm is a development at CERN OpenLab
- OS Farm is a server to generate VM images
- Can accept HTTP requirements, or via *wget*:
 - *Wget http://www.fzk.de/osfarm/create?name=&transfer=http&class=slc_old&arch=i386&filetype=.tar&group=core&group=base*
- A Java client is embedded in the **Cumulus** frontend to invoke the OS Farm service dynamically.
- OS Farm development has been canceled in favor of CernVM



Build Grids on Clouds (Grid as a Service) ?

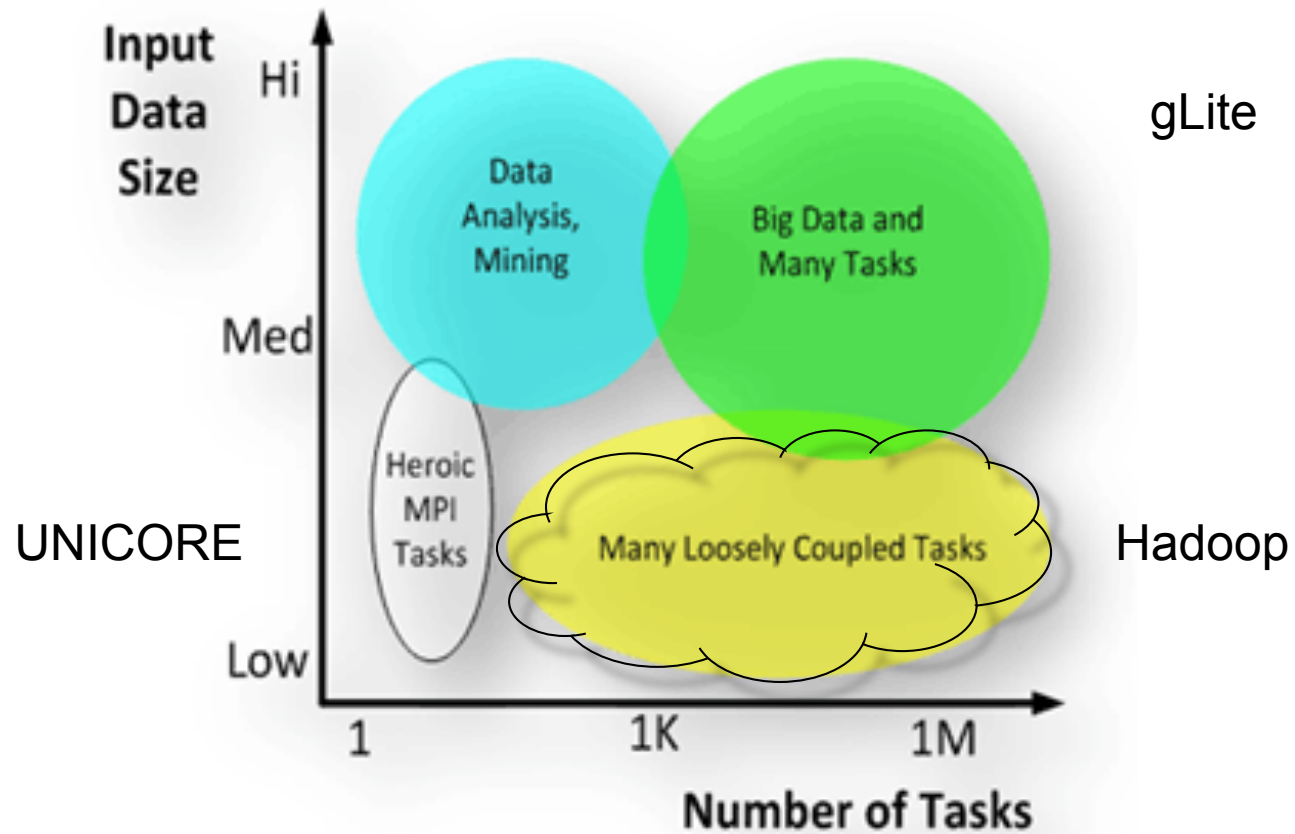


HPC vs. HTC vs. MTC (Many Task Computing)

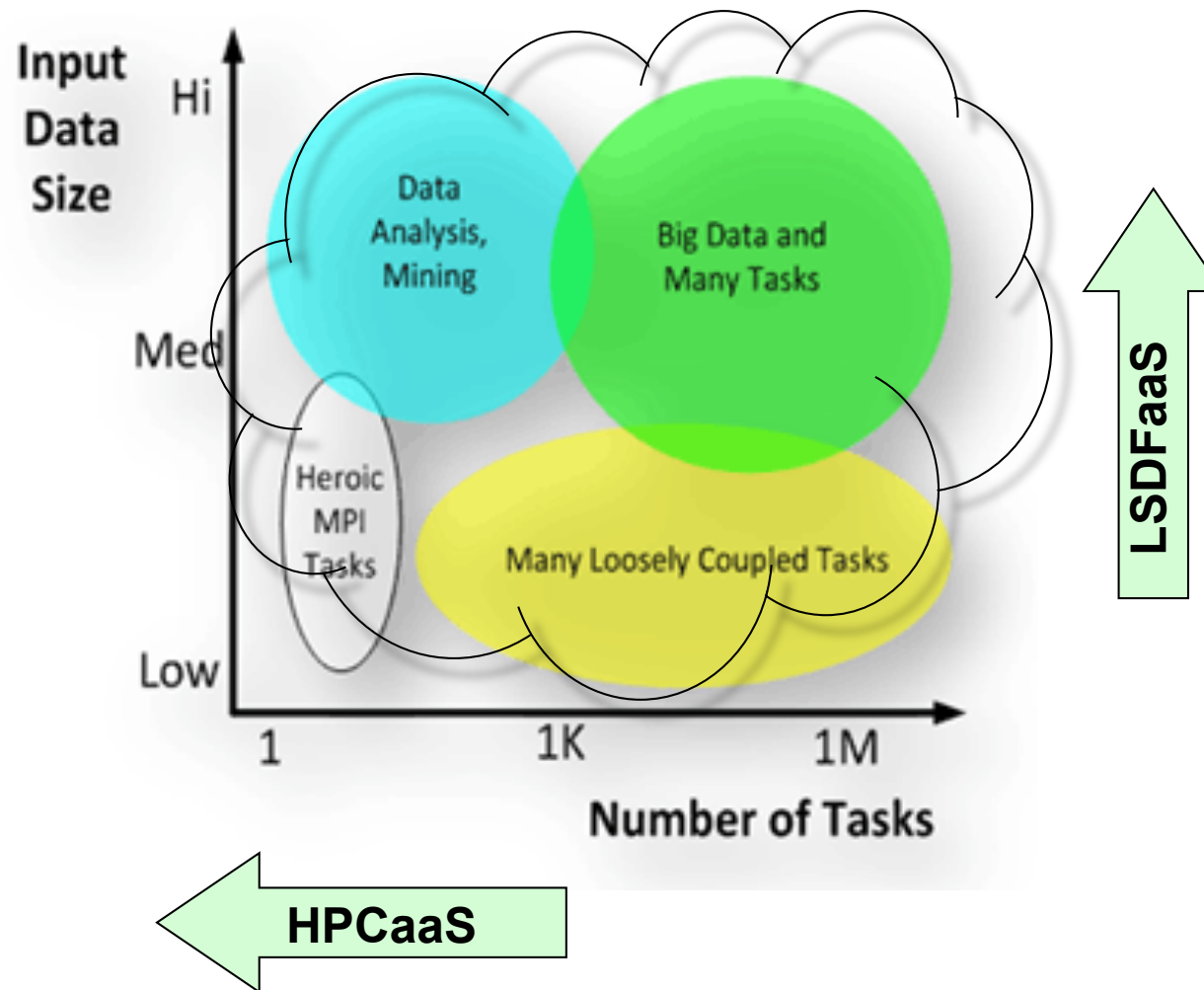


Source: I.Foster

The Grid and Cloud Space



Extension of the Cloud Space

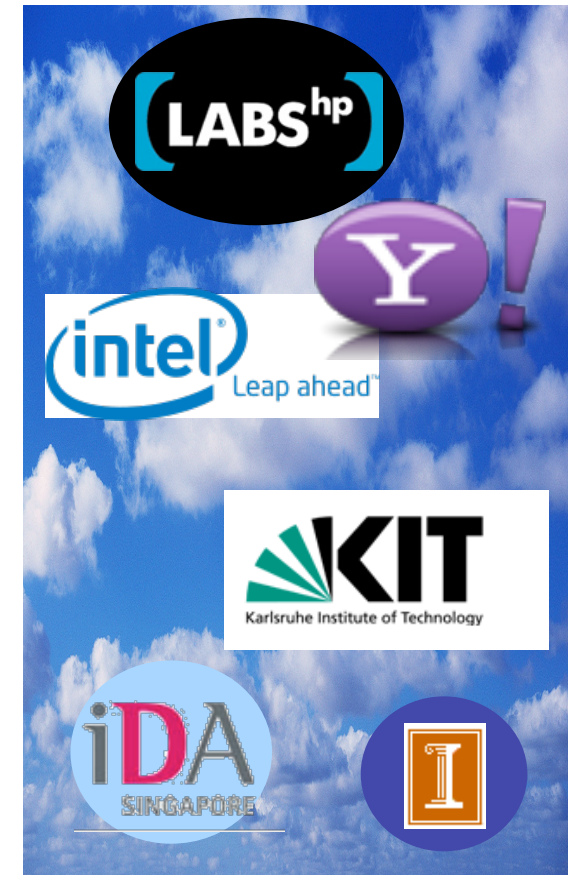


OpenCirrus Cloud Computing Research Testbed

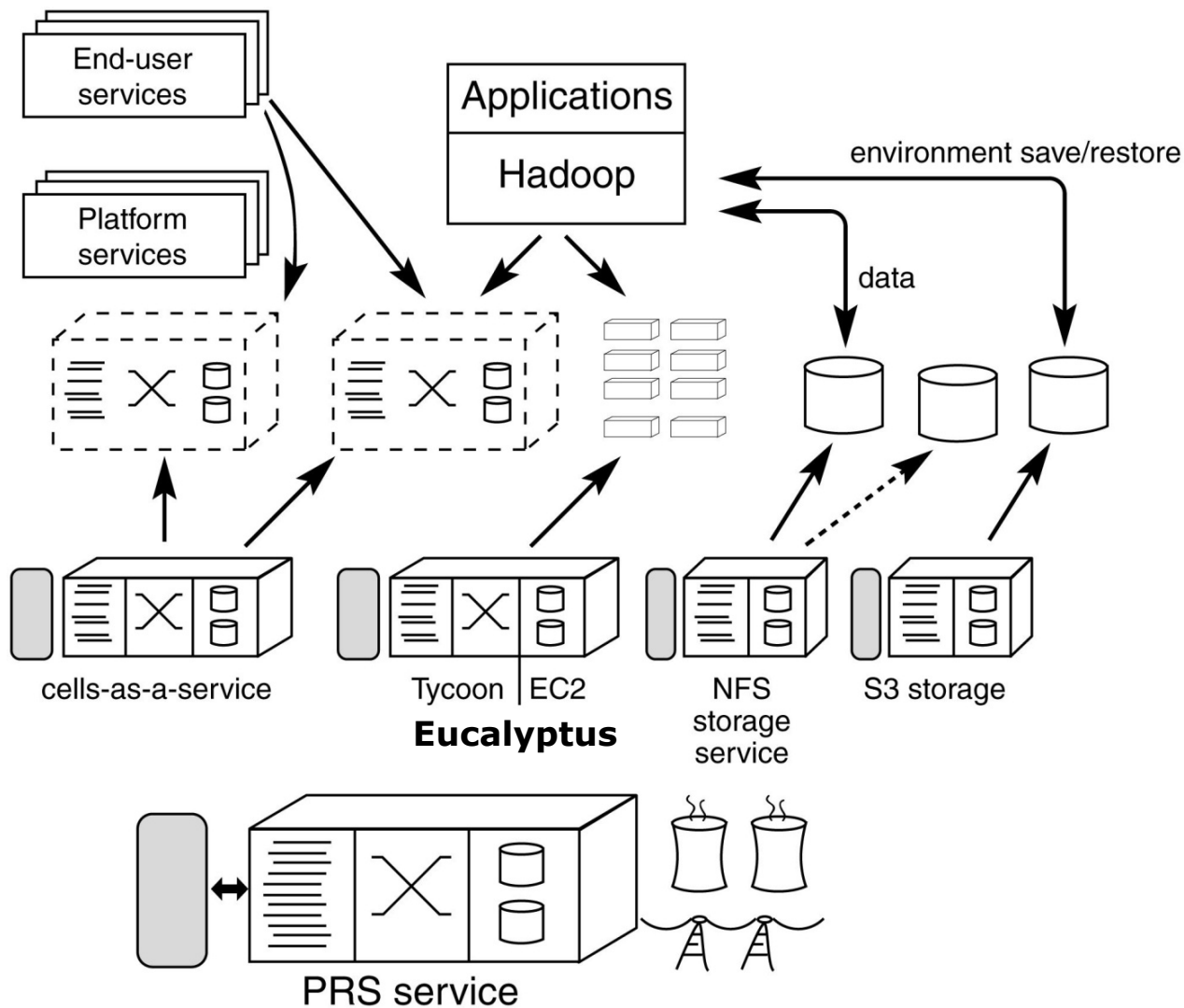
<http://cloudtestbed.com>



- An open, internet-scale global testbed for cloud computing research
 - a tool for collaborative research
 - focus: data center management & cloud services
- Resources:
 - Multi-continent, multi-datacenter, cloud computing system
 - “Centers of Excellence” around the globe
 - each with 100–400+ nodes and up to ~2PB storage
 - and running a suite of cloud services
- Structure: a loose federation
 - Sponsors: HP Labs, Intel Research, Yahoo!
 - Partners: UIUC, Singapore IDA, KIT, NSF
 - Members: System and application development
- Great opportunity for Cloud R&D



Open Cirrus™ Blueprint



Cloud Application Services

Virtual Resource Sets

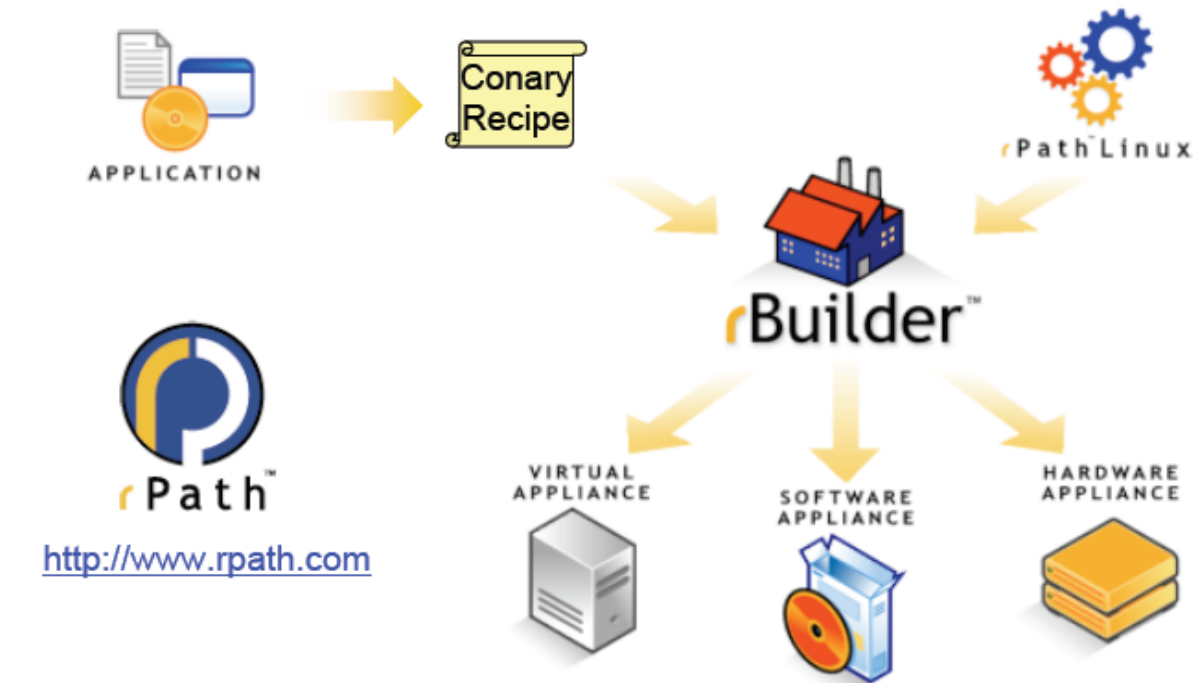
Cloud Infrastructure Services

**IT-Infrastructure Layer
(Physical Resource Sets)**

Management of Platforms

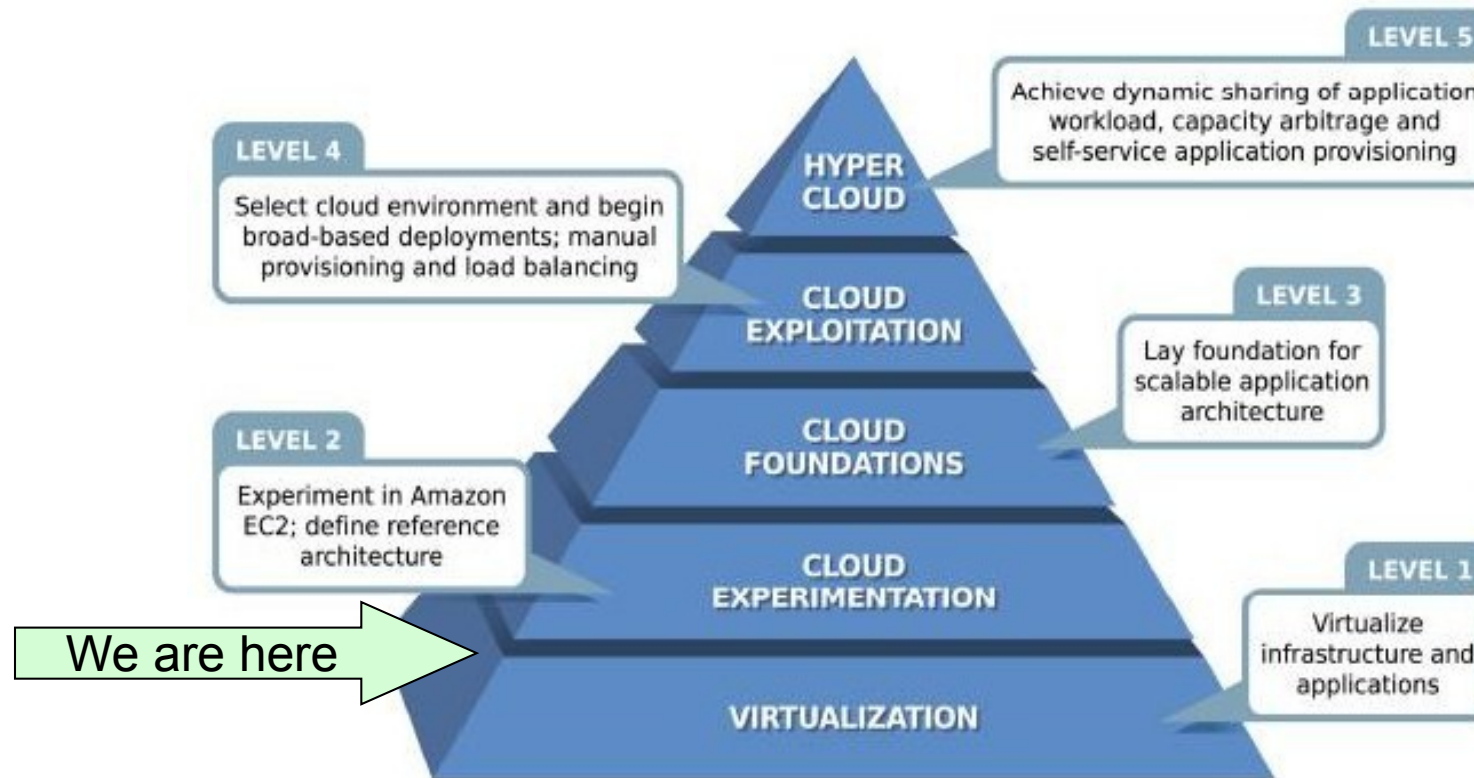
CernVM
Software Appliance

From Application to Appliance



- Dynamic Generation of Appliances and Templates, see <http://cernvm.cern.ch/>
- Proposal: Integration of CernVM with Eucalyptus for dynamic PaaS

The Way to Cloud Nirvana



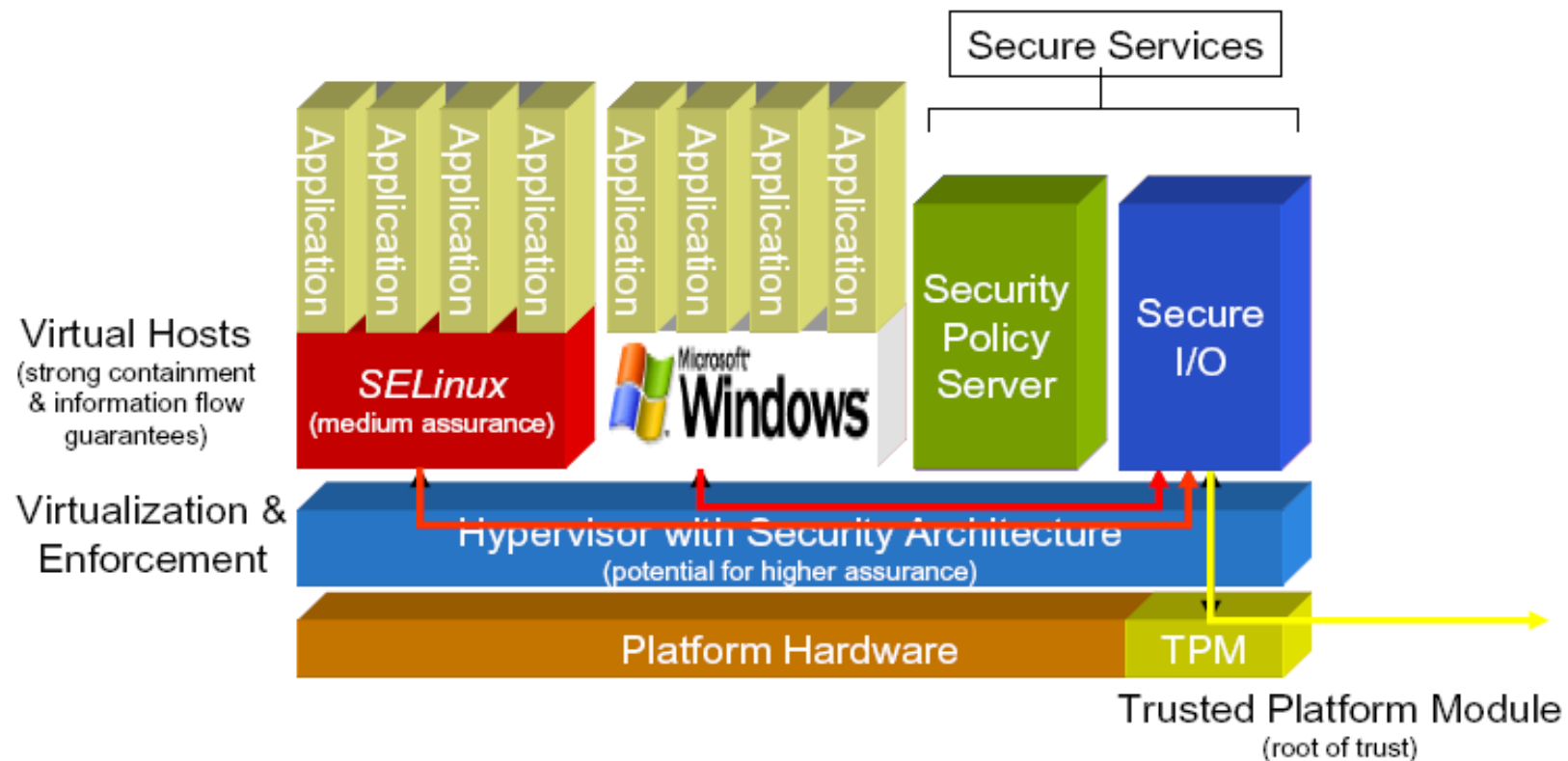
Source: rpath

■ Roadmap for Cloud Services at SCC

- Virtualization: Deployment of Eucalyptus 1.4 (EC2, S3)
- Access the Services with OpenID
- Will range from Infrastructure Services to elastic Applications
- Implement Grid as a Service (GaaS)

Cloud Security: A possible Solution

Hypervisor Security Architecture complements OSES with strong isolation, controlled sharing, & verifiable / attestable environments



Source: IBM

Summary

- It seems problematic to build Clouds on Grids
 - Inherit Grid complexity (Distributed resources)
 - Expensive
 - No business model
- It looks promising to build Grids on Clouds
 - Fully automated operations (Centralized resources)
 - Economy of scale
 - Business models lead to efficient use of resources
- Actual development
 - An average cloud data center is much larger than the largest grid infrastructure
 - From an economic point of view it looks promising to leverage those resources and implement the legacy Grid interfaces in the cloud
 - Move from manufacture towards industrialization of IT-Services

Thank you for your attention!

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