

FutureGrid Services I

FutureGrid Tutorial at PPAM 2011

Torun Poland

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- OpenStack
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- Image Generation
- Interoperability Activities
- Getting an Account
- Portal

- **Second Slide Set**

- HPC
- Mapreduce
- Eucalyptus

Overview of Existing Services

Categories

- PaaS: Platform as a Service
 - Delivery of a computing platform and solution stack
- IaaS: Infrastructure as a Service
 - Deliver a compute infrastructure as a service
- Grid:
 - Deliver services to support the creation of virtual organizations contributing resources
- HPCC: High Performance Computing Cluster
 - Traditional high performance computing cluster environment
- Other Services
 - Other services useful for the users as part of the FG service offerings

Selected List of Services Offered

FutureGrid



User

PaaS

Hadoop
(Twister)
(Sphere/Sector)

IaaS

Nimbus
Eucalyptus
ViNE
(OpenStack)
(OpenNebula)

Grid

Genesis II
Unicore
SAGA
(Globus)

HPCC

MPI
OpenMP
ScaleMP
(XD Stack)

Others

Portal
Inca
Ganglia
(Exper. Manag./Pegasus
(Rain)

Services Offered

1. ViNe can be installed on the other resources via Nimbus
2. Access to the resource is requested through the portal
3. Pegasus available via Nimbus and Eucalyptus images

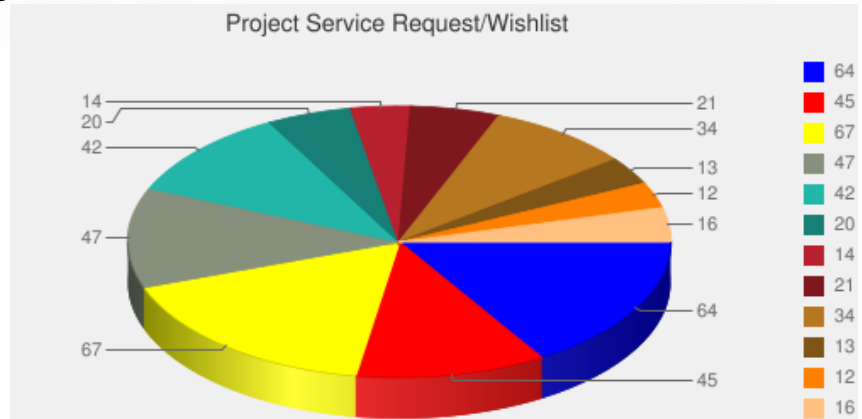
	India	Sierra	Hotel	Foxtrot	Alamo	Xray	Bravo
myHadoop	✓	✓			✓		
Nimbus		✓	✓	✓	✓		
Eucalyptus	✓	✓					
ViNe ¹	<input checked="" type="checkbox"/>	✓	<input checked="" type="checkbox"/>	✓	<input checked="" type="checkbox"/>		
Genesis II	✓	✓			✓	✓	
Unicore	✓	✓				✓	
MPI	✓	✓	✓	✓	✓	✓	✓
OpenMP						✓	
ScaleMP	✓						
Ganglia	✓		✓				
Pegasus ³	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		
Inca	✓	✓	✓	✓	✓	✓	
Portal ²	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
PAPI						✓	
Vampir							

Which Services should we install?

- We look at statistics on what users request
- We look at interesting projects as part of the project description
- We look for projects which we intend to integrate with: e.g. XD TAS, XD XSEDE
- We leverage experience from the community

User demand influences service deployment

- Based on User input we focused on
 - Nimbus (53%)
 - Eucalyptus (51%)
 - Hadoop (37%)
 - HPC (36%)



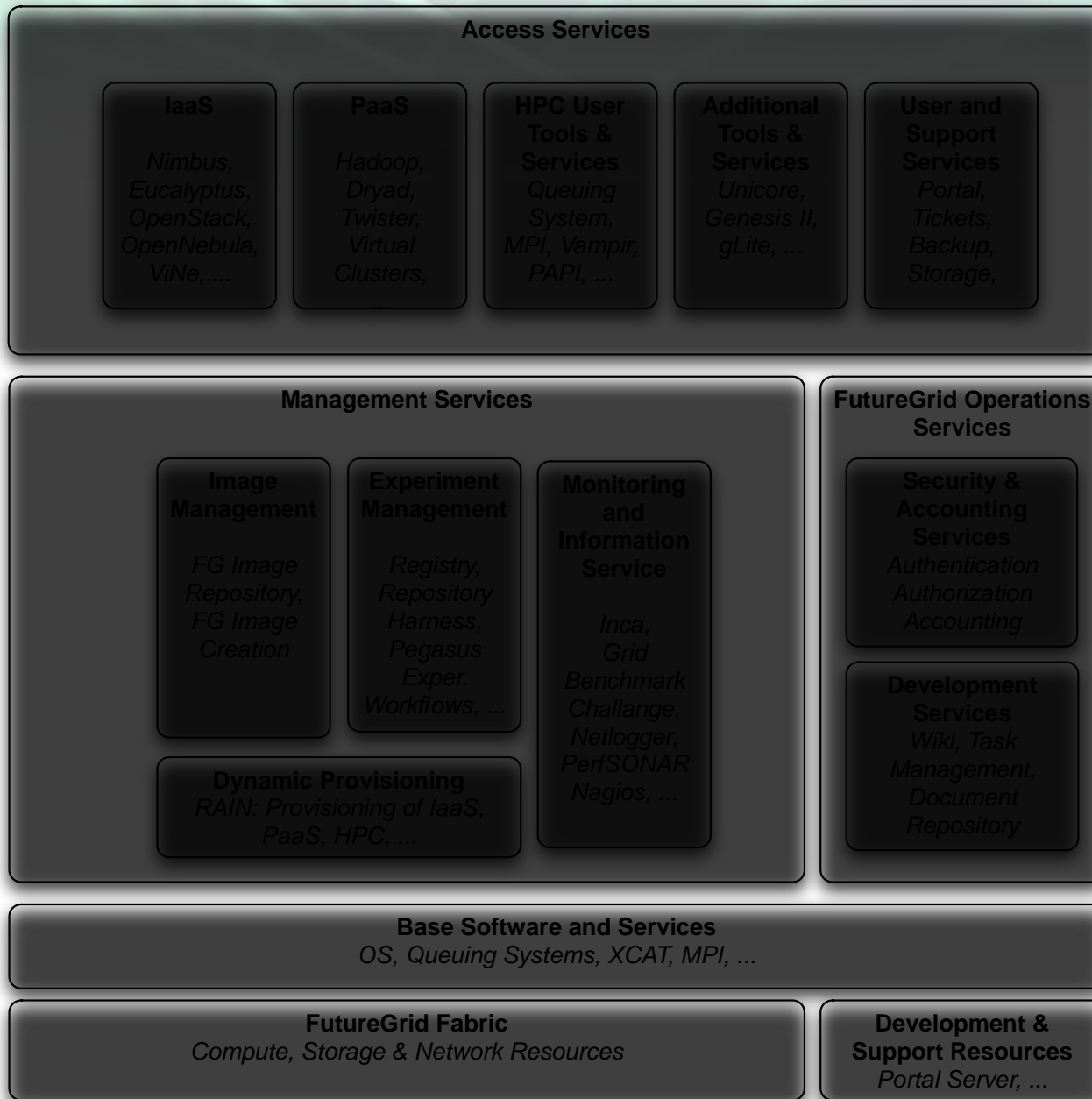
- Eucalyptus: 64(50.8%)
- High Performance Computing Environment: 45(35.7%)
- Nimbus: 67(53.2%)
- Hadoop: 47(37.3%)
- MapReduce: 42(33.3%)
- Twister: 20(15.9%)
- OpenNebula: 14(11.1%)
- Genesis II: 21(16.7%)
- Common TeraGrid Software Stack: 34(27%)
- Unicore 6: 13(10.3%)
- gLite: 12(9.5%)
- OpenStack: 16(12.7%)

** Note: We will improve the way we gather statistics in order to avoid inaccuracy during the information gathering at project and user registration time.*

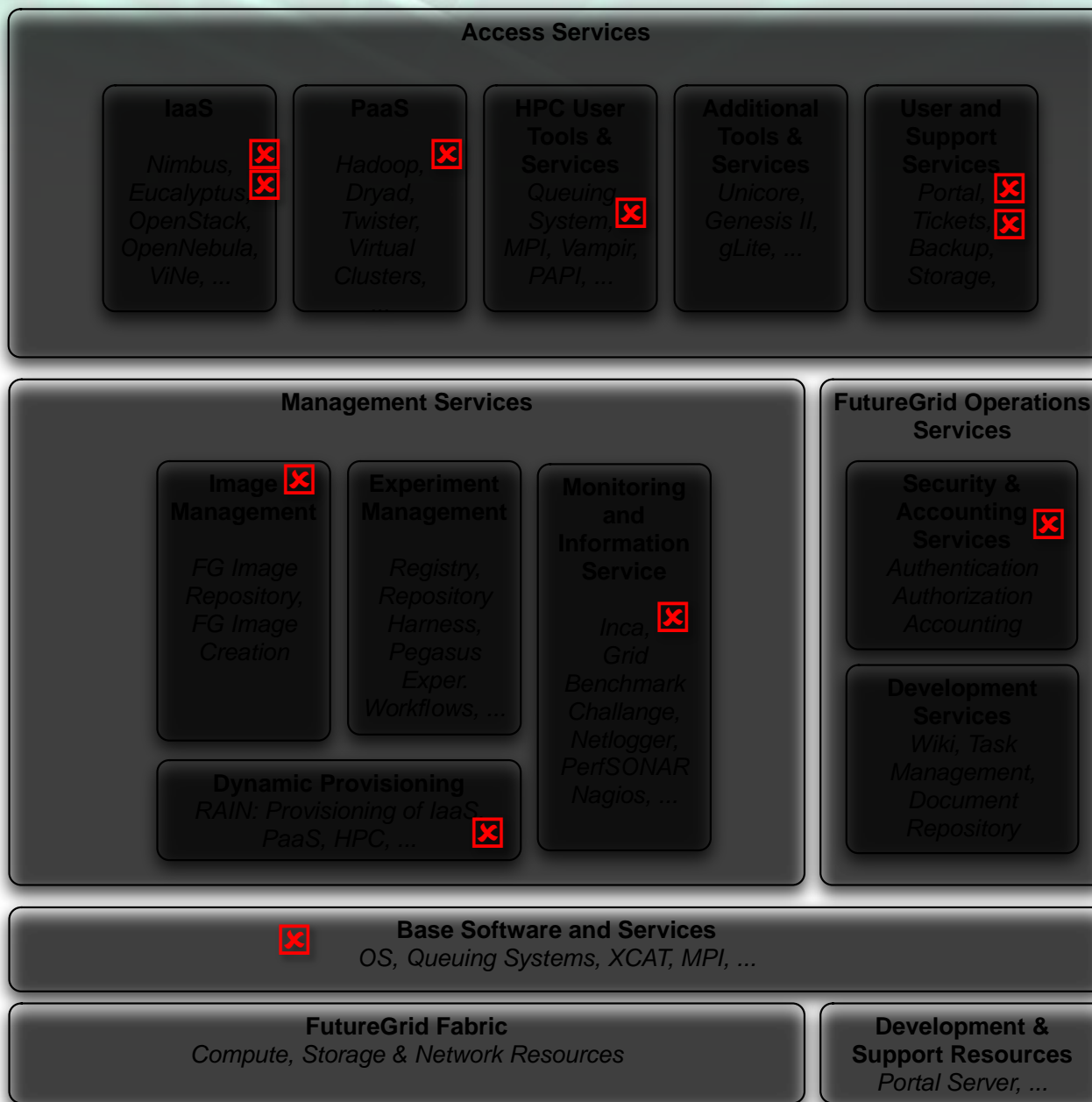
Software Architecture



Software Architecture



Next we present selected Services



Cloud Computing with Nimbus on FutureGrid

TeraGrid'11 tutorial, Salt Lake City, UT

Kate Keahey

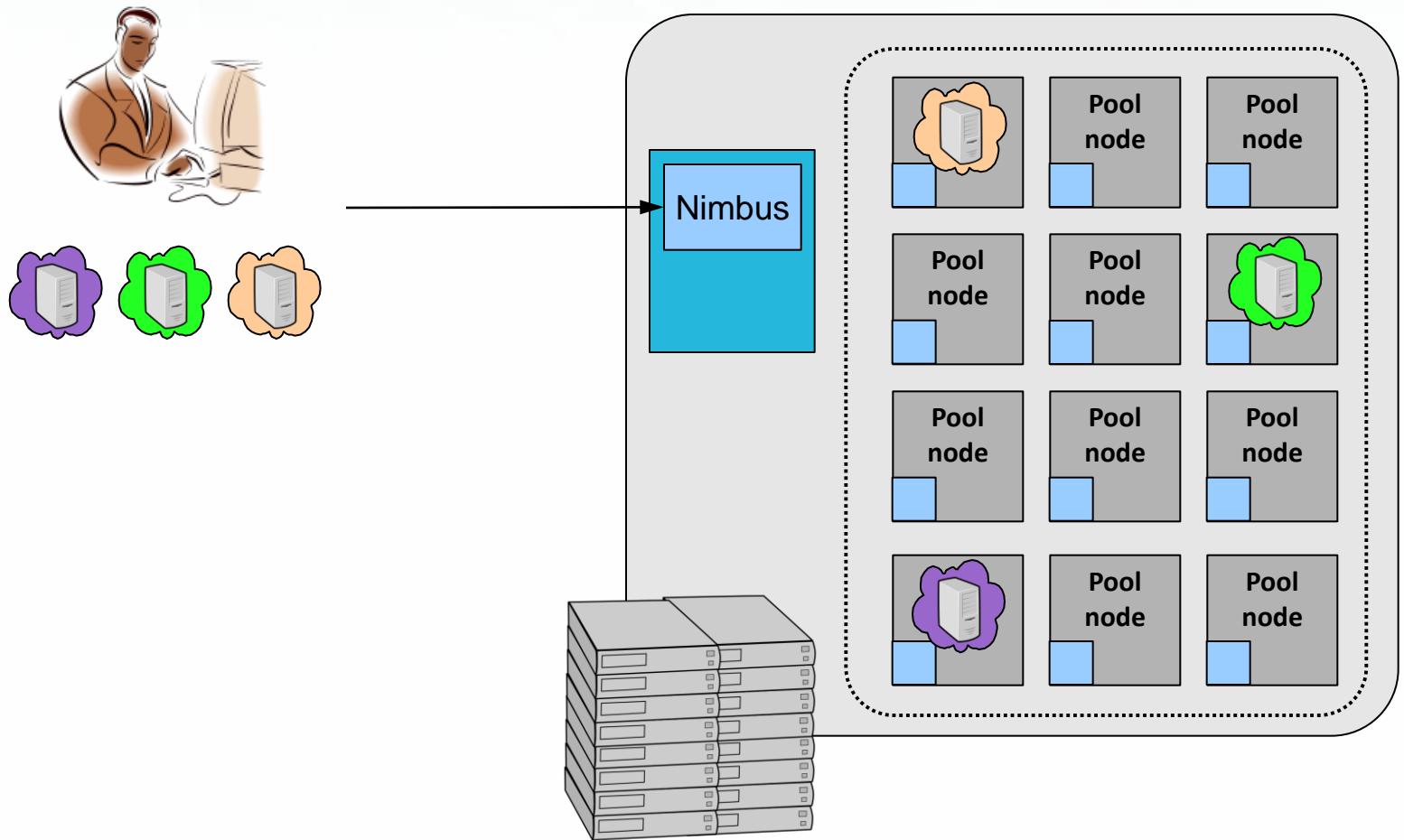
keahey@mcs.anl.gov

Argonne National Laboratory

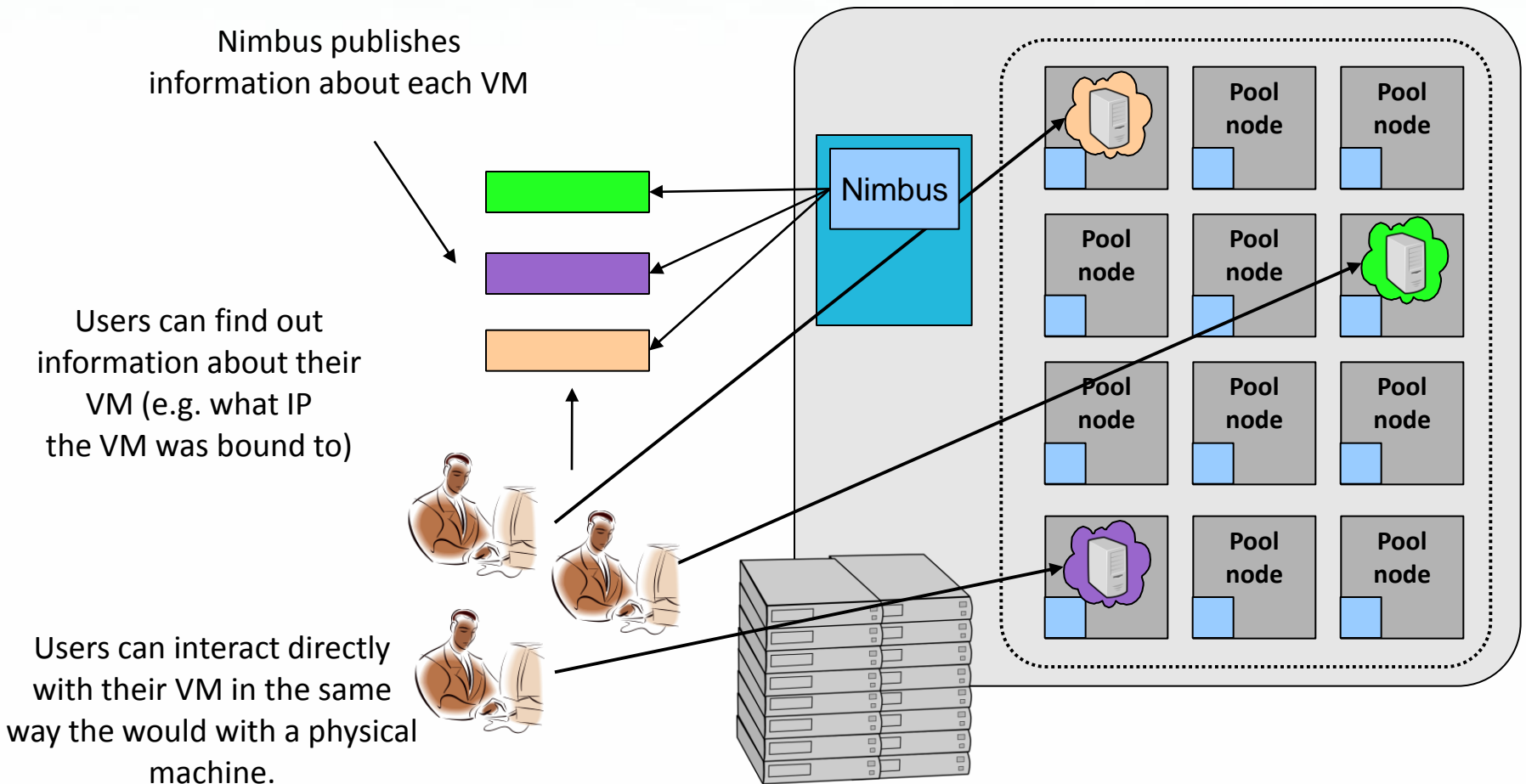
Computation Institute, University of Chicago

Nimbus Infrastructure

IaaS: How it Works



IaaS: How it Works



Nimbus on FutureGrid

- **Hotel** (University of Chicago) -- Xen
41 nodes, 328 cores
- **Foxtrot** (University of Florida) -- Xen
26 nodes, 208 cores
- **Sierra** (SDSC) -- Xen
18 nodes, 144 cores
- **Alamo** (TACC) -- KVM
15 nodes, 120 cores

FutureGrid: Getting Started

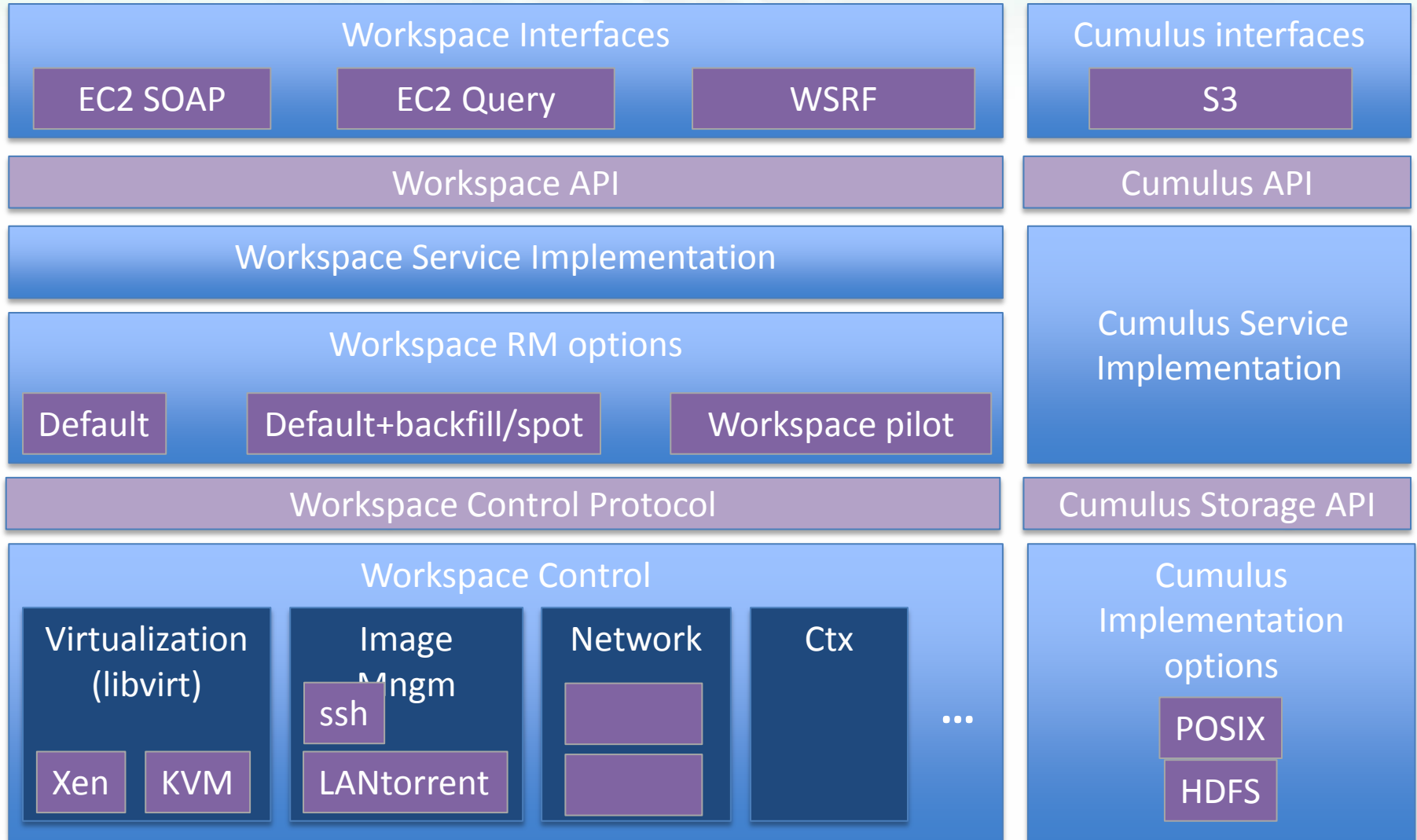
- To get a FutureGrid account:
 - Sign up for portal account:
<https://portal.futuregrid.org/user/register>
 - Once approved, apply for HPC account:
<https://portal.futuregrid.org/request-hpc-account>
 - Your Nimbus credentials will be in your home directory
- Follow the tutorial at:
<https://portal.futuregrid.org/tutorials/nimbus>
- or Nimbus quickstart at
http://www.nimbusproject.org/docs/2.7/clouds/cloud_quickstart.html

FutureGrid: VM Images

```
[bresnaha@login1 nimbus-cloud-client-018]$ ./bin/cloud-client.sh -conf\  
~/nimbus/hotel.conf -list
```

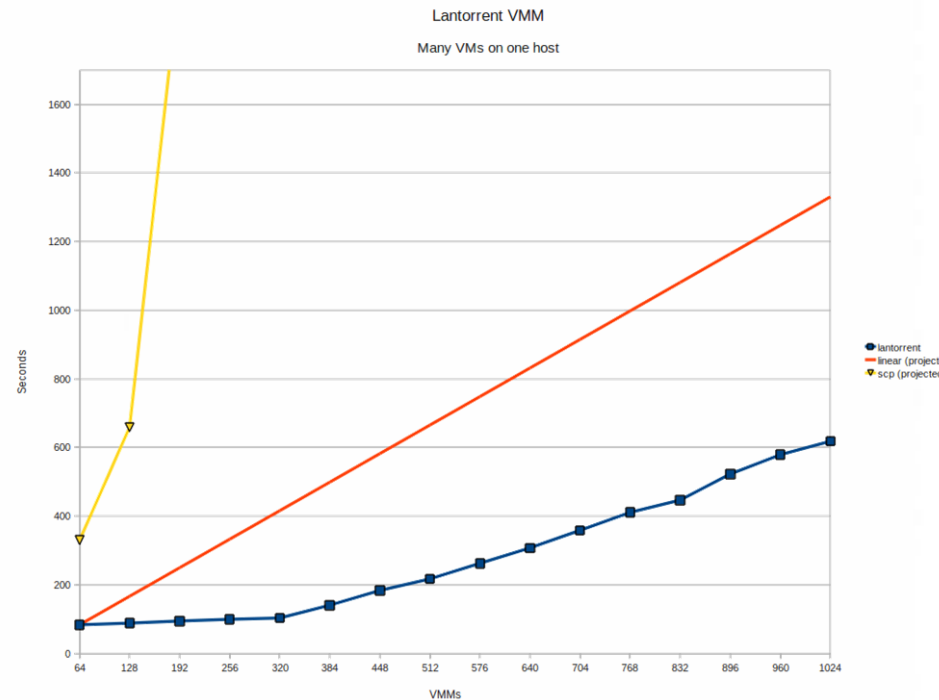
```
[Image] 'base-cluster-cc12.gz'           Read only  
Modified: Jan 13 2011 @ 14:17      Size: 535592810 bytes (~510 MB)  
[Image] 'centos-5.5-x64.gz'           Read only  
Modified: Jan 13 2011 @ 14:17      Size: 253383115 bytes (~241 MB)  
[Image] 'debian-lenny.gz'            Read only  
Modified: Jan 13 2011 @ 14:19      Size: 1132582530 bytes (~1080 MB)  
[Image] 'debian-tutorial.gz'         Read only  
Modified: Nov 23 2010 @ 20:43      Size: 299347090 bytes (~285 MB)  
[Image] 'grid-appliance-jaunty-amd64.gz' Read only  
Modified: Jan 13 2011 @ 14:20      Size: 440428997 bytes (~420 MB)  
[Image] 'grid-appliance-jaunty-hadoop-amd64.gz' Read only  
Modified: Jan 13 2011 @ 14:21      Size: 507862950 bytes (~484 MB)  
[Image] 'grid-appliance-mpi-jaunty-amd64.gz' Read only  
Modified: Feb 18 2011 @ 13:32      Size: 428580708 bytes (~408 MB)  
[Image] 'hello-cloud'               Read only  
Modified: Jan 13 2011 @ 14:15      Size: 576716800 bytes (~550 MB)
```

Nimbus Infrastructure: a Highly-Configurable IaaS Architecture



LANTorrent: Fast Image Deployment

- **Challenge:** make image deployment faster
- Moving images is the main component of VM deployment
- LANTorrent: the BitTorrent principle on a LAN
- Streaming
- Minimizes congestion at the switch
- Detecting and eliminating duplicate transfers
- **Bottom line:** a thousand VMs in 10 minutes on Magellan
- Nimbus release 2.6, see www.scienceclouds.org/blog



Preliminary data using the Magellan resource
At Argonne National Laboratory

Nimbus Platform

Nimbus Platform: Working with Hybrid Clouds

Creating Common Context

Allow users to build turnkey dynamic virtual clusters

Nimbus Elastic Provisioning

interoperability automatic scaling
HA provisioning policies



private clouds
(e.g., FNAL)



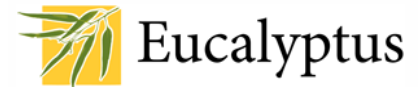
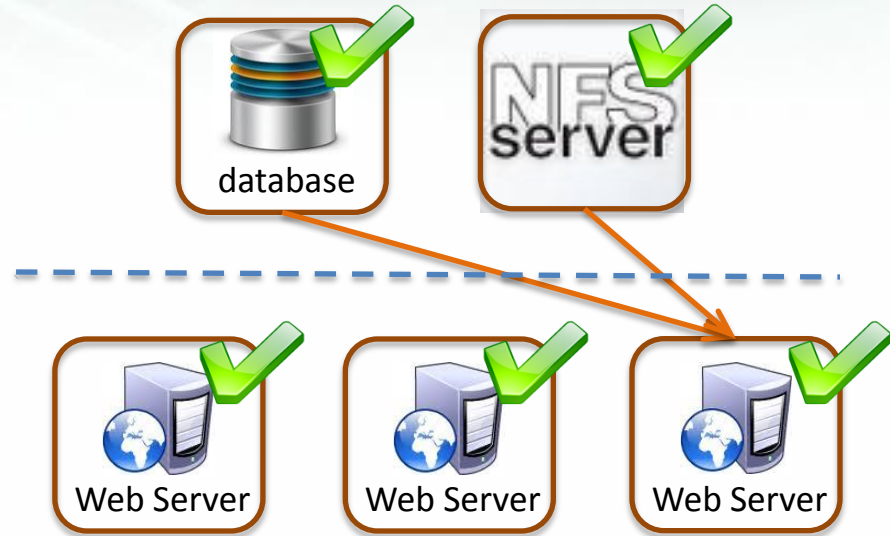
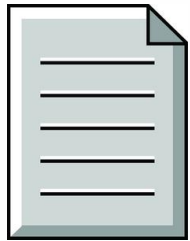
community clouds
(e.g., FutureGrid)



public clouds
(e.g., EC2)

Cloudinit.d

Launch plan

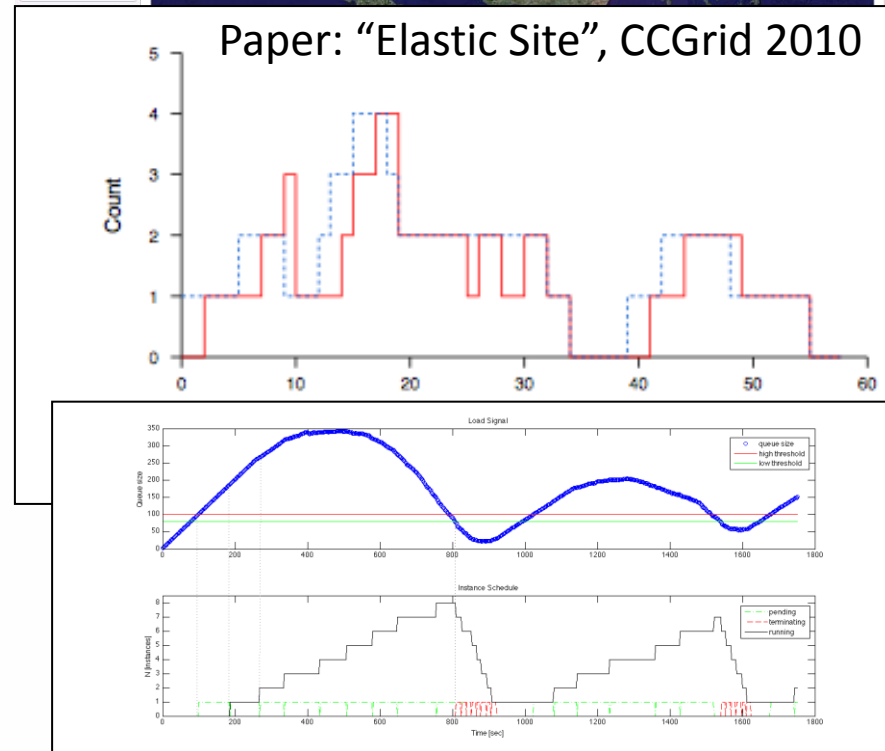


- ...and test-based monitoring and repair

Paper at TeraGrid'11

Elastic Scaling Tools: Towards “Bottomless Resources”

- Early efforts:
 - 2008: The ALICE proof-of-concept
 - 2009: ElasticSite prototype
 - 2009: OOI pilot
- **Challenge:** a generic HA Service Model
 - React to sensor information
 - Queue: the workload sensor
 - Scale to demand
 - Across different cloud providers
 - Use contextualization to integrate machines into the network
 - Customizable
 - Routinely 100s of nodes on EC2
- **Coming out later this year**



FutureGrid Case Studies

Sky Computing

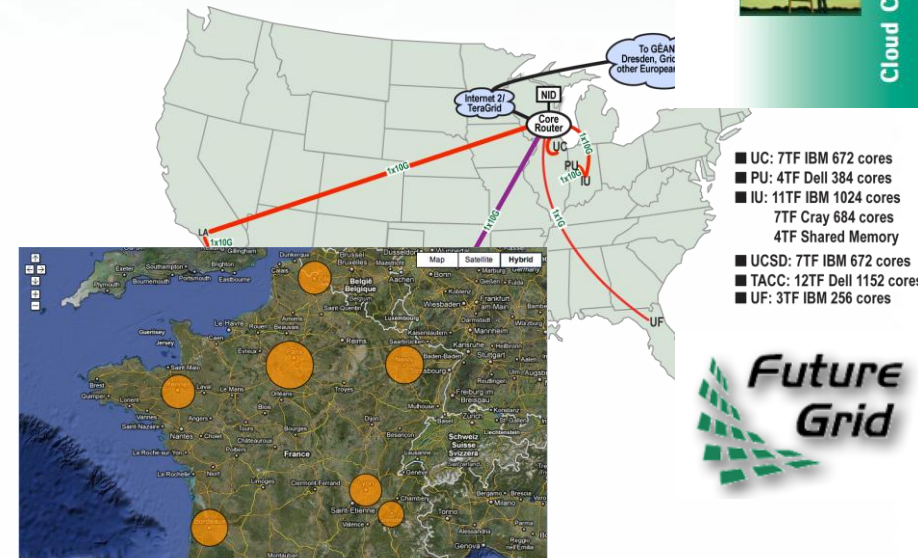
Work by Pierre Riteau et al,
University of Rennes 1



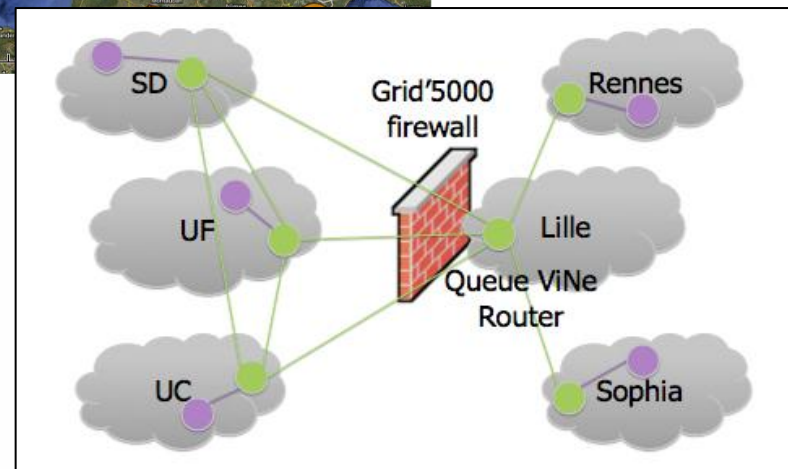
Cloud Computing

“Sky Computing”

IEEE Internet Computing, September 2009



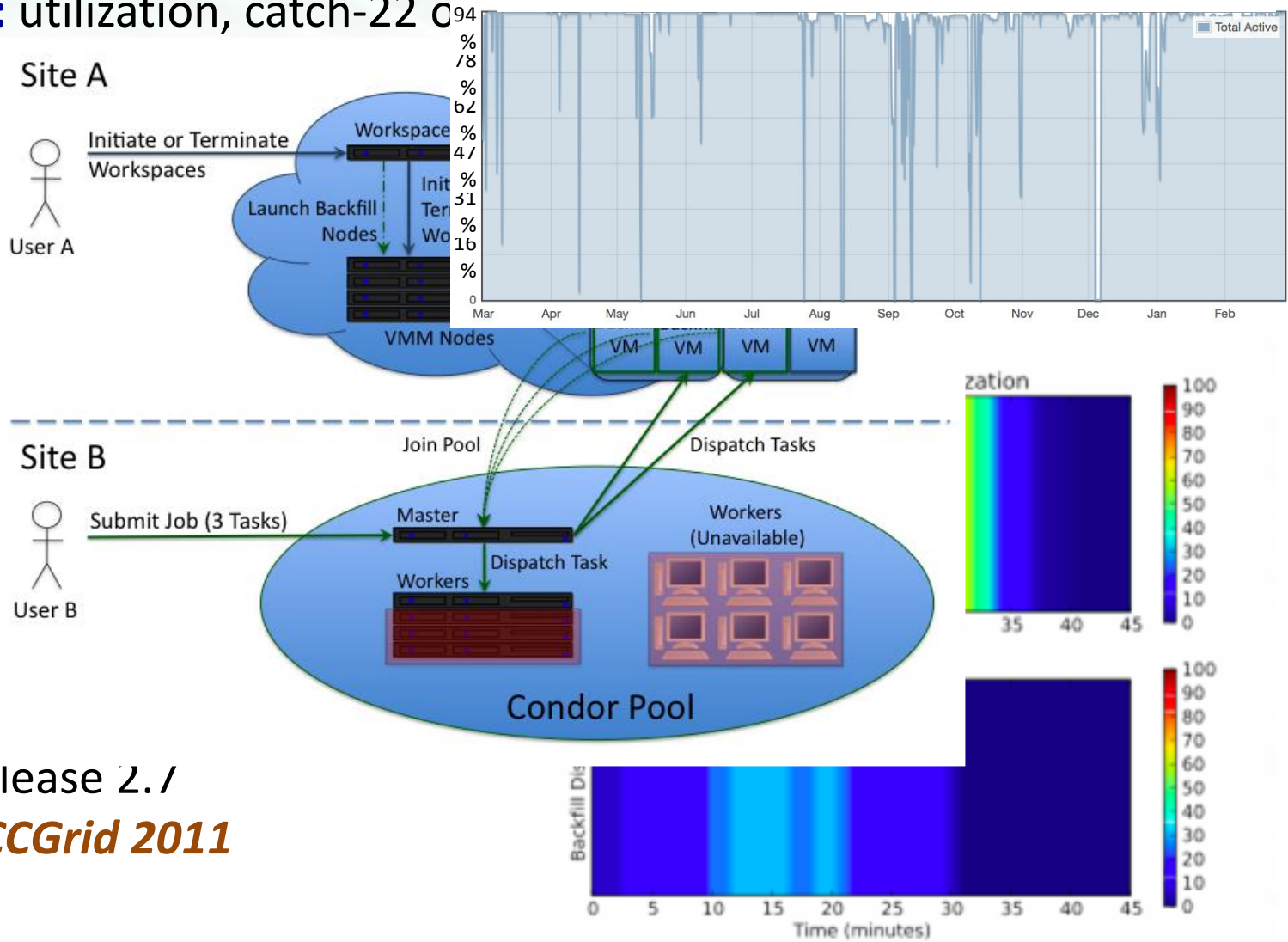
- Sky Computing = a Federation of Clouds
- Approach:
 - Combine resources obtained in multiple Nimbus clouds in FutureGrid and Grid' 5000
 - Combine Context Broker, ViNe, fast image deployment
 - Deployed a virtual cluster of over 1000 cores on Grid5000 and FutureGrid – largest ever of this type
- Grid'5000 Large Scale Deployment Challenge award
- Demonstrated at OGF 29 06/10
- TeraGrid '10 poster
- More at: www.isgtw.org/?pi



Backfill: Lower the Cost of Your Cloud

1 March 2010 through 28 February 2011

- **Challenge:** utilization, catch-22 of on-demand
- **Solution:**
 - Backfill
- **Bottom line:** utilization
- Who decides when to run?
- Spot pricing
- Open Source contributions
- Preparing for production in Chicago
- Nimbus release 2.7
- *Paper @ CCGrid 2011*



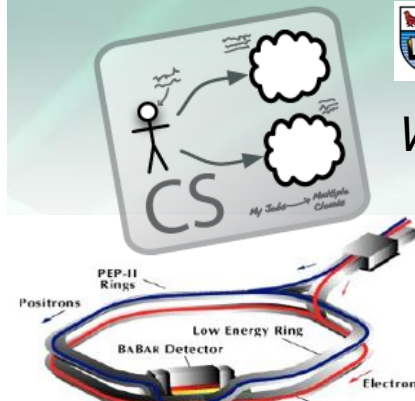


BABAR

™ and © Helvex, All Rights Reserved

Canadian Efforts

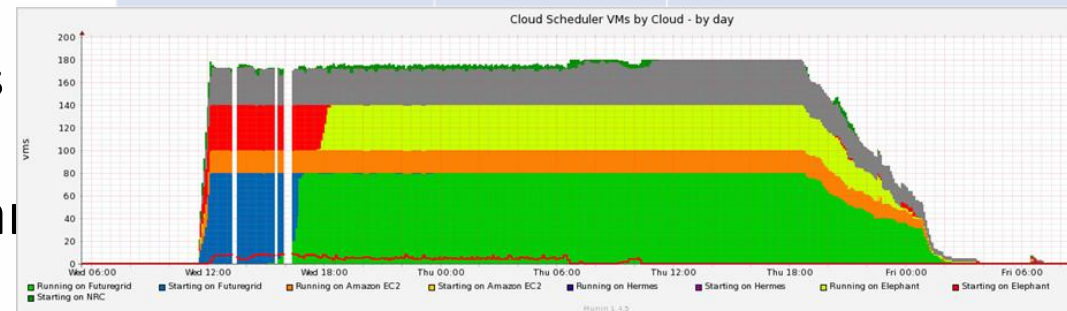
- BarBar Experiment at SLAC in Stanford, CA
- Using clouds to simulating electron-positron collisions in their detector
- Exploring virtualization as a vehicle for data preservation
- Approach:
 - Appliance preparation and management
 - Distributed Nimbus clouds
 - Cloud Scheduler
- Running production BaBar workloads



Work by the UVIC team



Resource	Cores	Notes
FutureGrid @Argonne Lab	100 Cores Allocated	Resources allocation to support BaBar
Elephant Cluster @Uvic	88 Cores	Experimental cloud cluster hosts (xrootd for cloud)
NRC Cloud in Ottawa	68 Cores	Hosts VM image repository (repoman)
Amazon EC2	Proportional to \$	Grant funding from Amazon
Hermes Cluster @Uvic	Variable (280 max)	Occasional Backfill access



The Nimbus Team

- Project lead: Kate Keahey, ANL&UC
- Committers:
 - Tim Freeman - University of Chicago
 - Ian Gable - University of Victoria
 - David LaBissoniere - University of Chicago
 - John Bresnahan - Argonne National Laboratory
 - Patrick Armstrong - University of Victoria
 - Pierre Riteau - University of Rennes 1, IRISA
- Github Contributors:
 - *Tim Freeman, David LaBissoniere, John Bresnahan, Pierre Riteau, Alex Clemesha, Paulo Gomez, Patrick Armstrong, Matt Vliet, Ian Gable, Paul Marshall, Adam Bishop*
- *And many others*
 - See <http://www.nimbusproject.org/about/people/>

Parting Thoughts

- Many challenges left in exploring infrastructure clouds
- FutureGrid offers an instrument that allows you to explore them:
 - Multiple distributed clouds
 - The opportunity to experiment with cloud software
 - Paradigm exploration for domain sciences
- Nimbus provides tools to explore them
- Come and work with us on FutureGrid!



www.nimbusproject.com

**Let's make cloud computing for
science happen.**

OpenStack

- Why OpenStack?
 - Users want to avoid being locked into a single solution.
 - Has large backing by many industrial partners with contributing efforts (more than 60 companies)
 - Is open source
 - Provides flexibility in deployment

What is OpenStack?

- Originated at NASA to provide a compute cloud infrastructure
- Contains currently three subprojects
 - OpenStack Compute (VM & Networks)
 - OpenStack Image Service (Image Management)
 - OpenStack Object Store (Storage)
- Supports multiple hypervisors
 - Xen, KVM, ESXi, Hyper-V

OpenStack Plans on FG

- Currently we are installing OpenStack on FG and have test instances running
- It will be available to the general users before the end of the year.
- Also expect to have a professional version of Eucalyptus
- Currently Nimbus best supported VM manager on FutureGrid

Virtual Appliances on FutureGrid

Renato Figueiredo (University of Florida)

renato@acis.ufl.edu



Overview

- Traditional ways of delivering hands-on training and education in parallel/distributed computing have non-trivial dependences on the environment
 - Difficult to replicate same environment on different resources (e.g. HPC clusters, desktops)
 - Difficult to cope with changes in the environment (e.g. software upgrades)
- Virtualization technologies remove key software dependences through a layer of indirection

Overview

- FutureGrid enables new approaches to education and training and opportunities to engage in outreach
 - Cloud, virtualization and dynamic provisioning – environment can adapt to the user, rather than expect user to adapt to the environment
 - Availability of plentiful resources to run appliances, the ability for users to create and share appliances, and the variety of VM management systems,
- Leverage unique capabilities of the infrastructure:
 - Reduce barriers to entry and engage new users
 - Use of encapsulated environments (“appliances”) as a primary delivery mechanism of education/training modules – promoting reuse, replication, and sharing
 - Hands-on tutorials on introductory, intermediate, and advanced topics

What is an appliance?

- Hardware/software appliances
 - TV receiver + computer + hard disk + Linux + user interface



- Computer + network interfaces + FreeBSD + user interface



What is a virtual appliance?

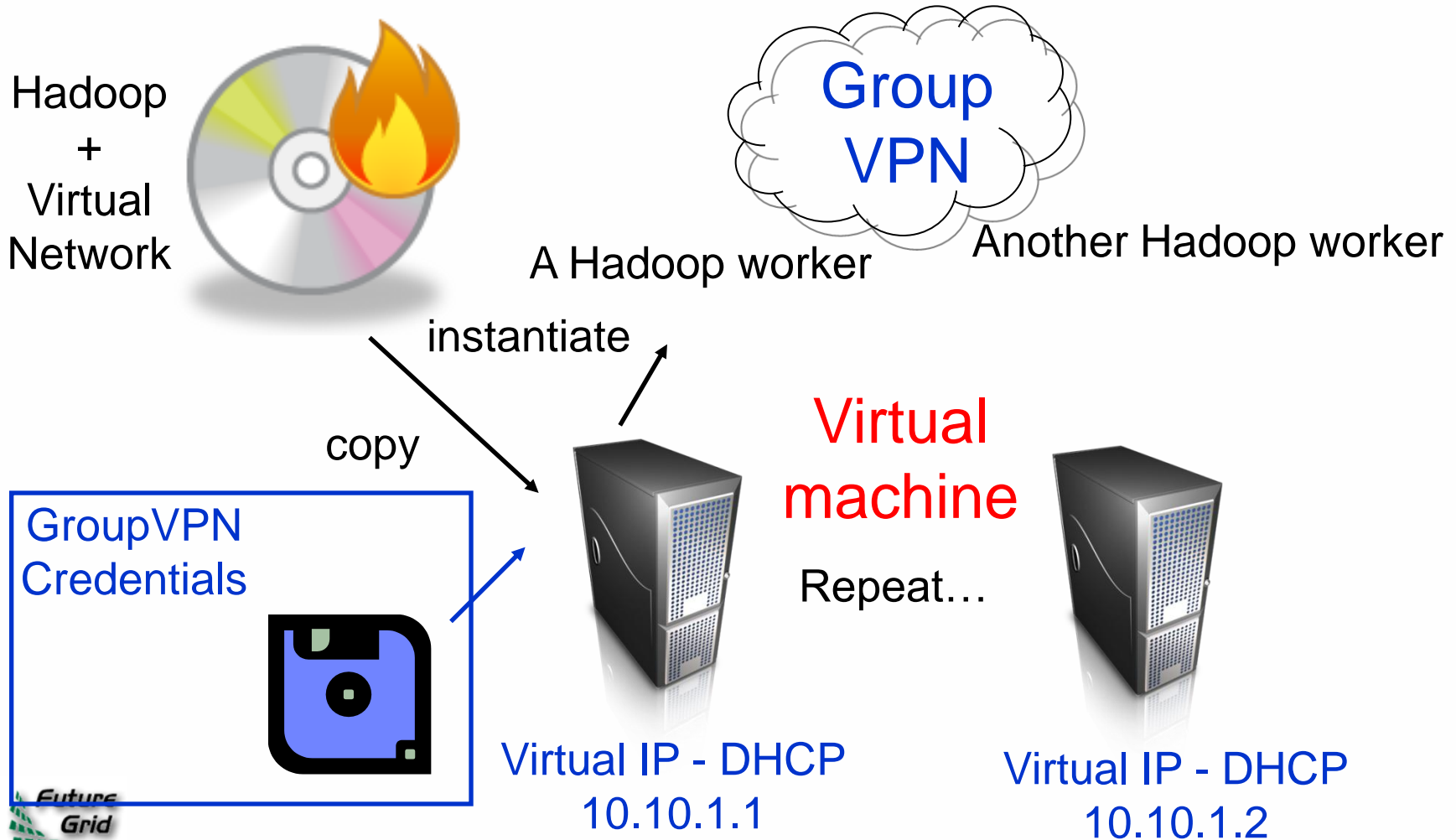
- An appliance that packages software and configuration needed for a particular purpose into a virtual machine “image”
- The virtual appliance has no hardware – just software and configuration
- The image is a (big) file
- It can be *instantiated* on hardware

Educational virtual appliances

- A flexible, extensible platform for *hands-on, lab-oriented* education on FutureGrid
- Support *clustering* of resources
 - Virtual machines + social/virtual networking to create sandboxed modules
 - *Virtual “Grid” appliances*: self-contained, pre-packaged execution environments
 - *Group VPNs*: simple management of virtual clusters by students and educators

Virtual appliance clusters

- Same image, different VPNs



Tutorials - examples

- <http://portal.futuregrid.org/tutorials>
- Introduction to FG IaaS Cloud resources
 - Nimbus and Eucalyptus
 - Within minutes, deploy a virtual machine on FG resources and log into it interactively
 - Using OpenStack – nested virtualization, a sandbox IaaS environment within Nimbus
- Introduction to FG HPC resources
 - Job scheduling, Torque, MPI
- Introduction to Map/Reduce frameworks
 - Using virtual machines with Hadoop, Twister
 - Deploying on physical machines/HPC (MyHadoop)

Virtual appliance – tutorials

- Deploying a single appliance
 - Nimbus, Eucalyptus, or user's own desktop
 - VMware, Virtualbox
 - Automatically connects to a shared “playground” resource pool with other appliances
 - Can execute Condor, MPI, and Hadoop tasks
- Deploying private virtual clusters
 - Separate IP address space – e.g. for a class, or student group
- Customizing appliances for your own activity

Virtual appliance 101

- `cloud-client.sh --conf alamo.conf --run --name grid-appliance-2.04.29.gz --hours 24`
- `ssh root@129.114.x.y`
- `su griduser`
- `cd ~/examples/montepi`
- `gcc montepi.c -o montepi -lm -m32`
- `condor_submit submit_montepi_vanilla`
- `condor_status, condor_q`



Dynamic Provisioning & RAIN on FutureGrid

Gregor von Laszewski



Classical Dynamic Provisioning



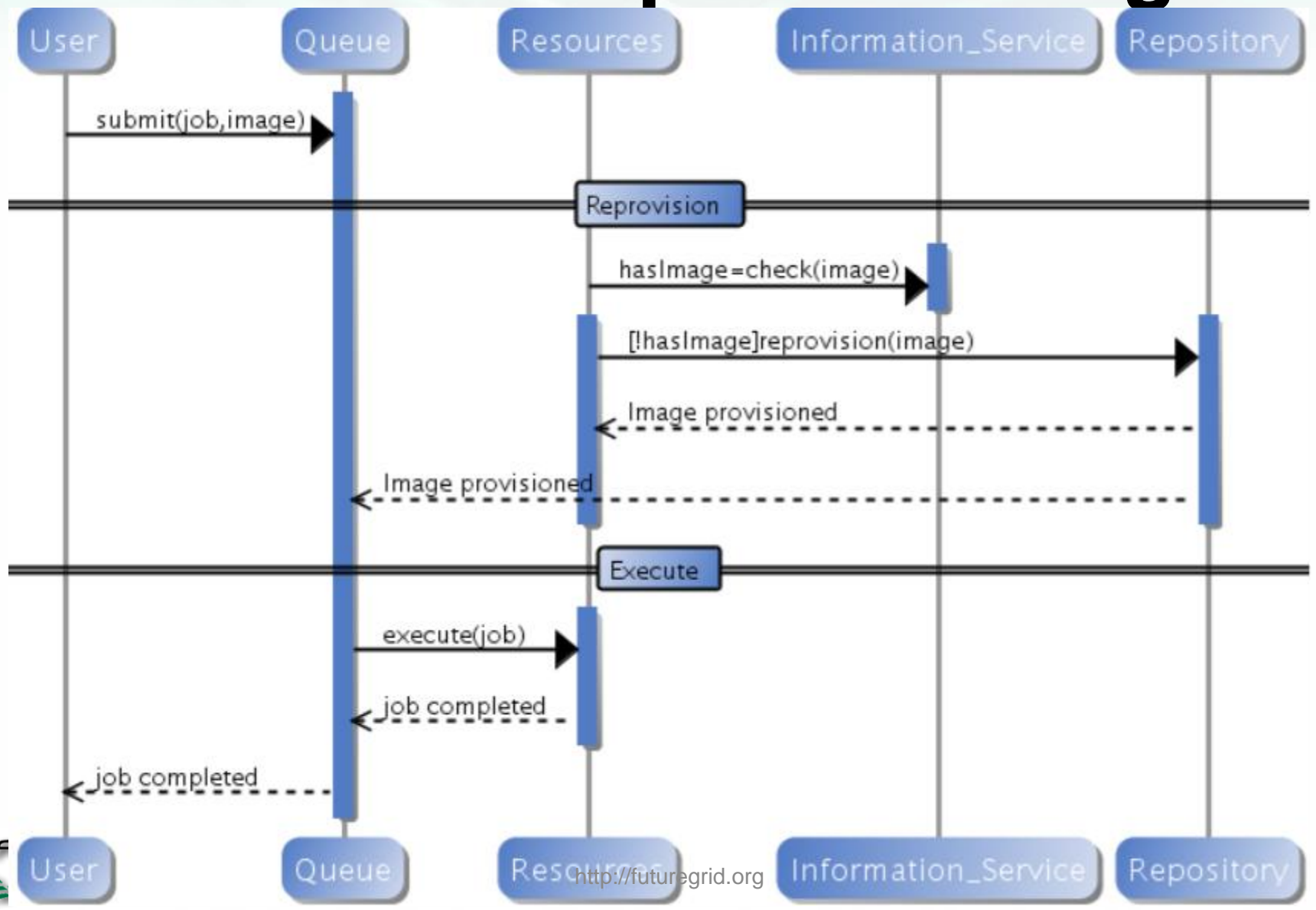
- Dynamically
 - partition a set of resources
 - allocate the resources to users
 - define the environment that the resource use
 - assign them based on user request
- Deallocate the resources so they can be dynamically allocated again

Use Cases of Dynamic Provisioning

Technology
Preview

- **Static provisioning:**
 - Resources in a cluster may be statically reassigned based on the anticipated user requirements, part of an HPC or cloud service. It is still dynamic, but control is with the administrator. (Note some call this also dynamic provisioning.)
- **Automatic Dynamic provisioning:**
 - Replace the administrator with intelligent scheduler.
- **Queue-based dynamic provisioning:**
 - provisioning of images is time consuming, group jobs using a similar environment and reuse the image. User just sees queue.
- **Deployment:**
 - dynamic provisioning features are provided by a combination of using XCAT and Moab

Generic Reprovisioning



Dynamic Provisioning Examples

Technology
Preview

- Give me a virtual cluster with 30 nodes based on Xen
- Give me 15 KVM nodes each in Chicago and Texas linked to Azure and Grid5000
- Give me a Eucalyptus environment with 10 nodes
- Give 32 MPI nodes running on first Linux and then Windows
- Give me a Hadoop environment with 160 nodes
- Give me a 1000 BLAST instances linked to Grid5000
- Run my application on Hadoop, Dryad, Amazon and Azure ... and compare the performance

From Dynamic Provisioning to “RAIN”



- In FG dynamic provisioning goes beyond the services offered by common scheduling tools that provide such features.
 - Dynamic provisioning in FutureGrid means more than just providing an image
 - adapts the image at runtime and provides besides IaaS, both PaaS and SaaS
 - We call this “raining” an environment
- Rain = Runtime Adaptable INsertion Configurator
 - Users want to “rain” an HPC, a Cloud environment, or a virtual network onto our resources with little effort.
 - Command line tools supporting this task.
 - Integrated into Portal
- Example “rain” a Hadoop environment defined by a user on a cluster.
 - `fg-hadoop -n 8 -app myHadoopApp.jar ...`
 - Users and administrators do not have to set up the Hadoop environment as it is being done for them

FG RAIN Commands

- `fg-rain -h hostfile -iaas nimbus -image img`
- `fg-rain -h hostfile -paas hadoop ...`
- `fg-rain -h hostfile -paas dryad ...`
- `fg-rain -h hostfile -gaas gLite ...`

- `fg-rain -h hostfile -image img`

- `fg-rain -virtual-cluster -16 nodes -2 core`

- Additional Authorization is required to use `fg-rain` without virtualization.

Rain in FutureGrid

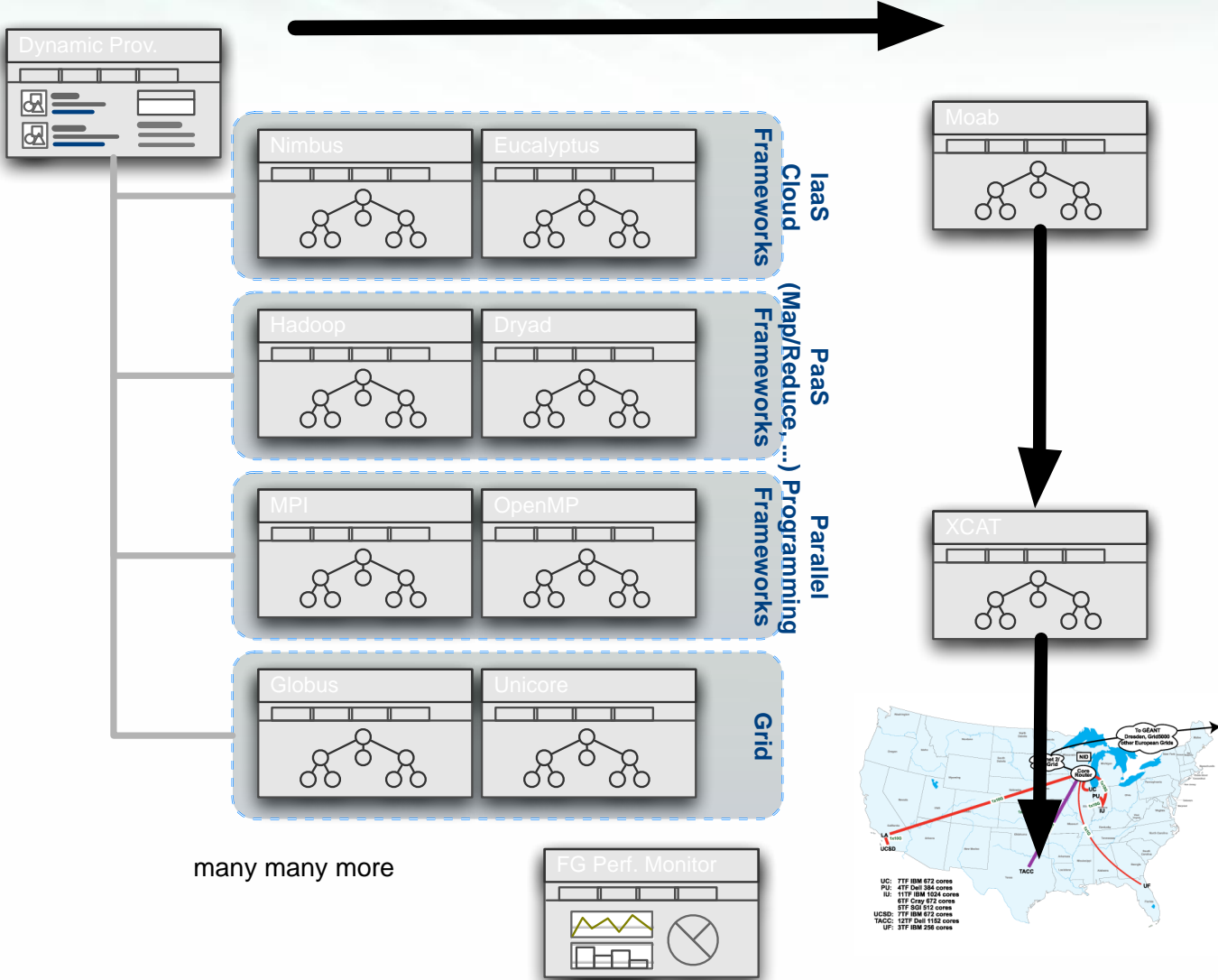


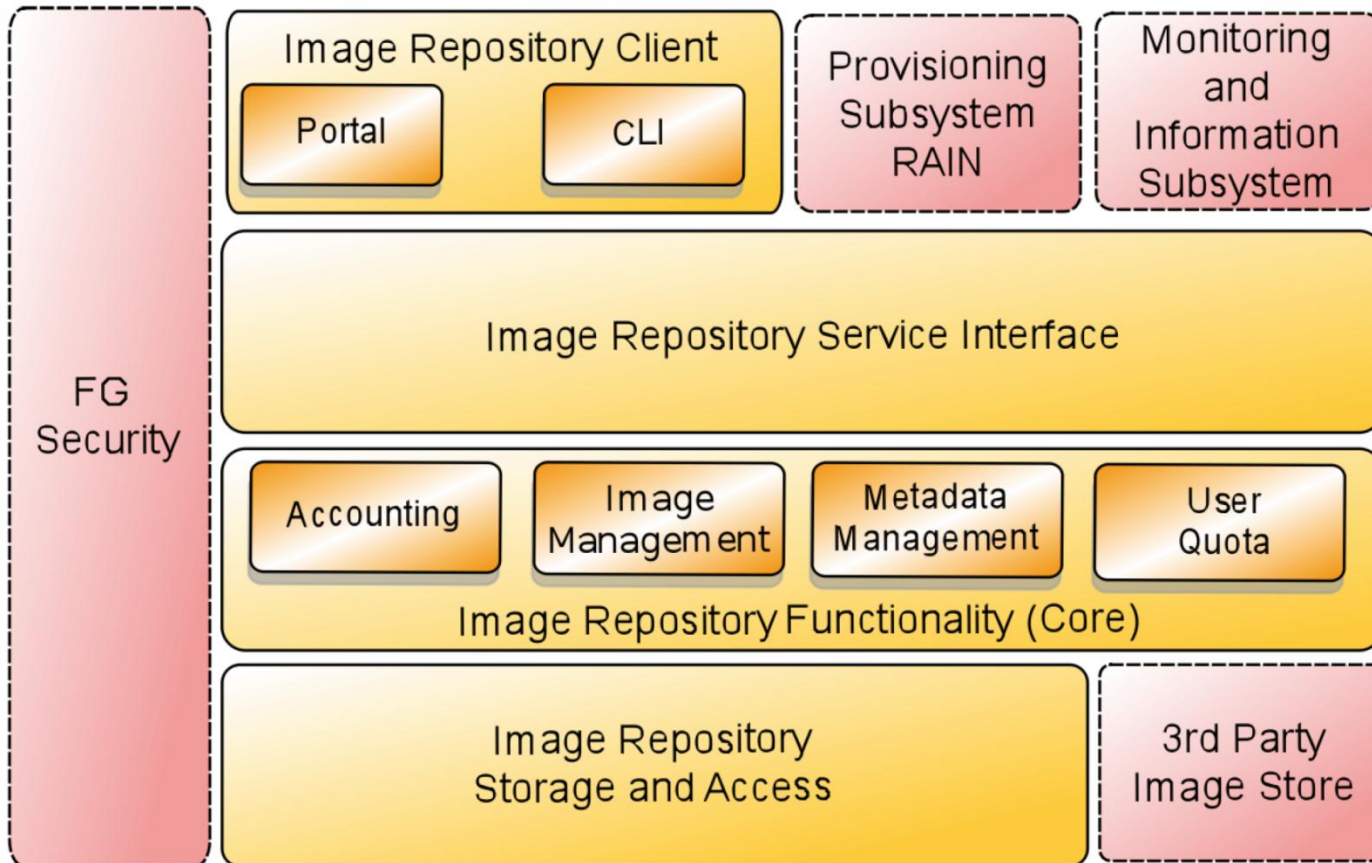
Image Generation and Management on FutureGrid

Javier Diaz
Gregor von Laszewski

FG Image Repository I

- Service to query, store, and update images through a unique and common interface
 - Can distinguish image types for different purposes (IaaS, HPC...)
- Maintains data related with the usage to assist performance monitoring and accounting
- Special features
 - Users can request images that fulfill their requirements. If there is not such image in the repository, it can be generated
 - Store basic images and the description of how to generate new ones

FG Image Repository II



Management Motivation

- The goal is to create and maintain platforms in custom FG VMs that can be retrieved, deployed, and provisioned on demand.
- A unified Image Management system to create and maintain VM and bare-metal images.
- Integrate images through a repository to instantiate services on demand with RAIN.
- Essentially enables the rapid development and deployment of Platform services on FutureGrid infrastructure.

What happens internally?

- Generate a Centos image with several packages
 - `fg-image-generate -o centos -v 5.6 -a x86_64 -s emacs, openmpi -u javi`
 - **> returns image: centosjavi3058834494.tgz**
- Deploy the image for HPC (xCAT)
 - `./fg-image-register -x im1r -m india -s india -t /N/scratch/ -i centosjavi3058834494.tgz -u jdiaz`
- Submit a job with that image
 - `qsub -l os=centosjavi3058834494 testjob.sh`



Subscriptions

→ [Subscribe](#)

Who's online

There are currently 2 users and 1 guest online.

Online users



Who's new



RAIN - FutureGrid Image Generation

Choose OS

OS:

Version:

Arch:

Choose Software Stacks/Packages

Available packages

[SAGA on FutureGrid](#)
[SciDB on FutureGrid](#)
[latex](#)
[Hadoop on FutureGrid](#)

Description

Package name: Hadoop on FutureGrid
 This package is ...

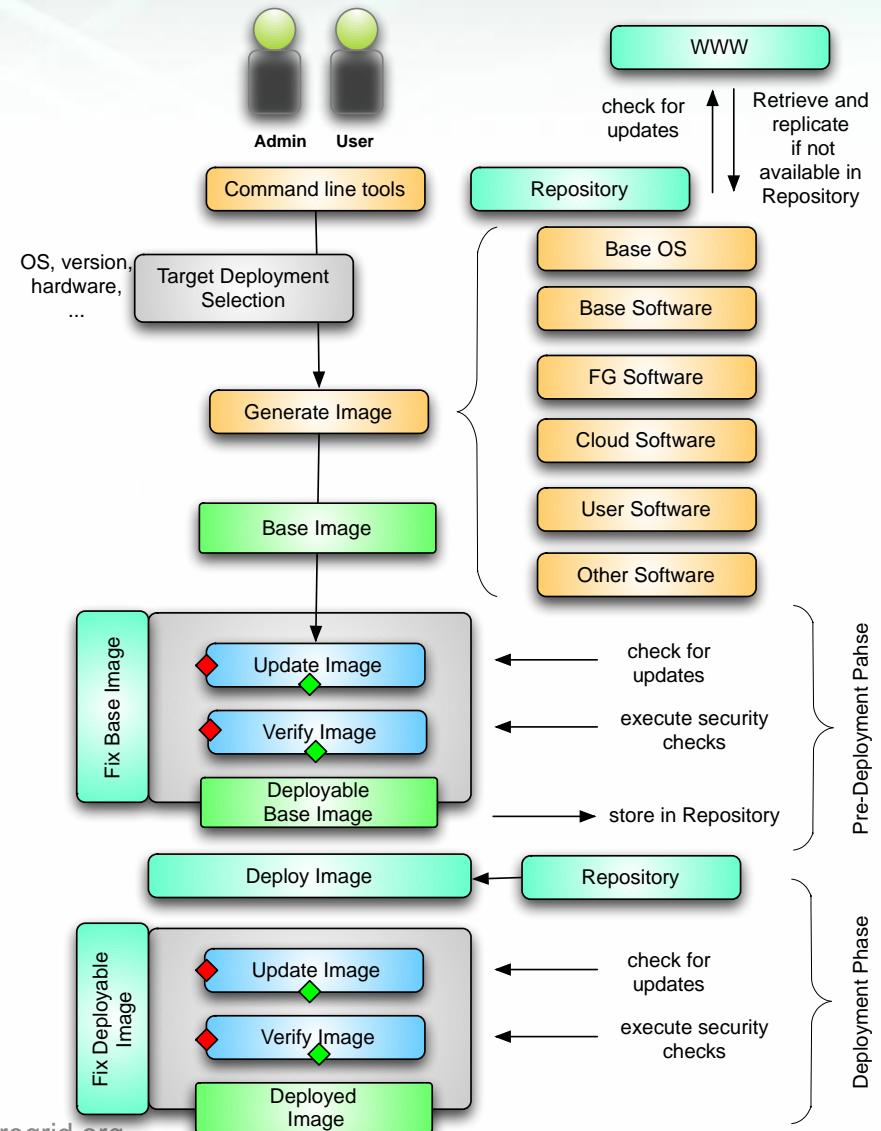
Selected packages

emacs

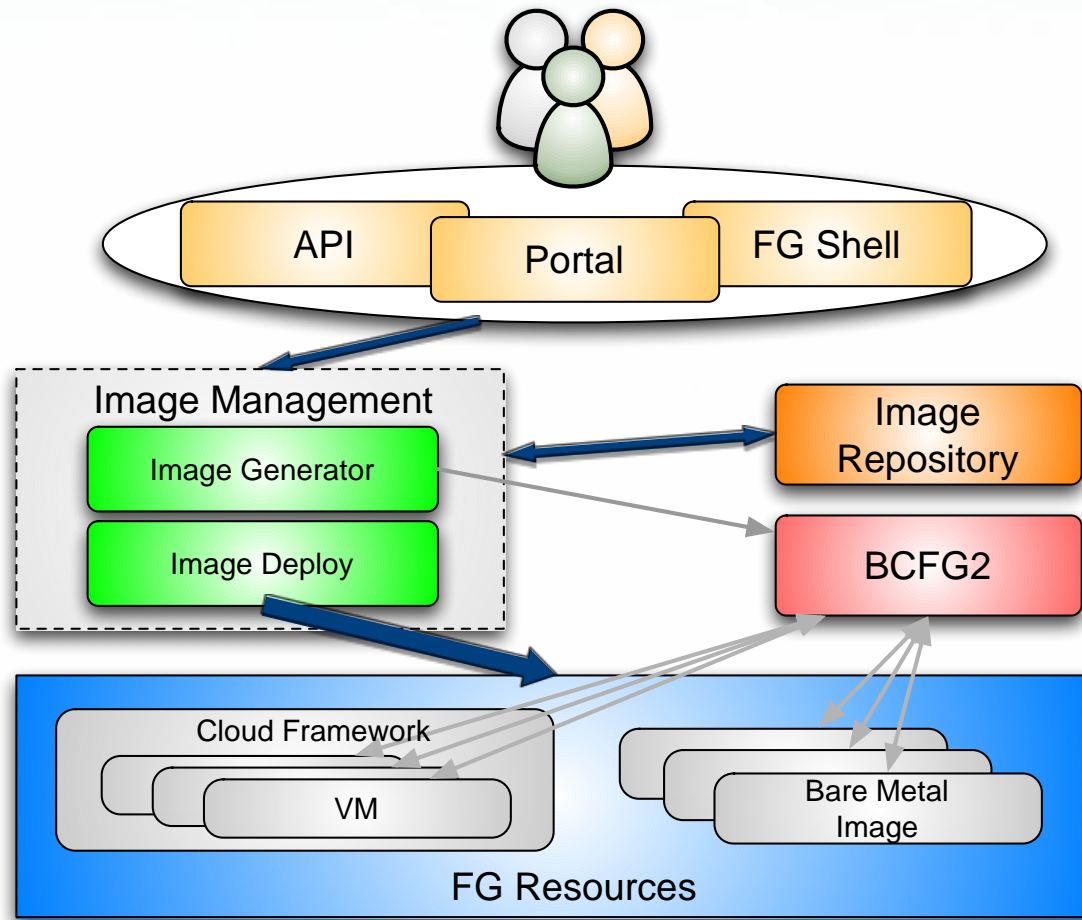


Image Generation

- Users who want to create a new FG image specify the following:
 - OS type
 - OS version
 - Architecture
 - Kernel
 - Software Packages
- Image is generated, then deployed to specified target.
- Deployed image gets continuously scanned, verified, and updated.
- Images are now available for use on the target deployed system.



Deployment View



Implementation

- Image Generator
 - alpha available for authorized users
 - Allows generation of Debian & Ubuntu, YUM for RHEL5, CentOS, & Fedora images.
 - Simple CLI
 - Later incorporate a web service to support the FG Portal.
 - Deployment to Eucalyptus & Bare metal now, Nimbus and others later.
- Image Management
 - Currently operating with an experimental BCFG2 server.
 - Image Generator auto-creates new user groups for software stacks.
 - Supporting RedHat and Ubuntu repo mirrors.
 - Scalability experiments of BCFG2 to be tested, but previous work shows scalability to thousands of VMs without problems

Interoperability

Andrew Grimshaw

Interfacing with OGF

- Deployments
 - Genesis II
 - Unicore
 - Globus
 - SAGA
- Some thoughts
 - How can FG get OCCl from a community effort?
 - Is FG useful for OGF community?
 - What other features are desired for OGF community?

Current Efforts

- Interoperability
- Domain Sciences – Applications
- Computer Science
- Computer system testing and evaluation

Grid interoperability testing

Requirements

- Provide a *persistent* set of standards-compliant implementations of grid services that clients can test against
- Provide a place where grid application developers can experiment with different standard grid middleware stacks without needing to become experts in installation and configuration
- Job management (OGSA-BES/JSDL, HPC-Basic Profile, HPC File Staging Extensions, JSDL Parameter Sweep, JSDL SPMD, PSDL Posix)
- Resource Name-space Service (RNS),
Byte-IO

Usecases

- Interoperability tests/demonstrations between different middleware stacks
- Development of client application tools (e.g., SAGA) that require configured, operational backends
- Develop new grid applications and test the suitability of different implementations in terms of both functional and non-functional characteristics

Implementation

- UNICORE 6
 - OGSA-BES, JSDL (Posix, SPMD)
 - HPC Basic Profile, HPC File Staging
- Genesis II
 - OGSA-BES, JSDL (Posix, SPMD, parameter sweep)
 - HPC Basic Profile, HPC File Staging
 - RNS, ByteIO
- *EGEE/g-lite*
- *SMOA*
 - *OGSA-BES, JSDL (Posix, SPMD)*
 - *HPC Basic Profile*

Deployment

- UNICORE 6
 - Xray
 - Sierra
 - India
- Genesis II
 - Xray
 - Sierra
 - India
 - Eucalyptus (India, Sierra)

Domain Sciences

Requirements

- Provide a place where grid application developers can experiment with different standard grid middleware stacks without needing to become experts in installation and configuration

Usecases

- Develop new grid applications and test the suitability of different implementations in terms of both functional and non-functional characteristics

Applications

- *Global Sensitivity Analysis in Non-premixed Counterflow Flames*
- *A 3D Parallel Adaptive Mesh Renement Method for Fluid Structure Interaction: A Computational Tool for the Analysis of a Bio-Inspired Autonomous Underwater Vehicle*
- *Design space exploration with the M5 simulator*
- *Ecotype Simulation of Microbial Metagenomes*
- *Genetic Analysis of Metapopulation Processes in the Silene-Microbotryum Host-Pathogen System*
- *Hunting the Higgs with Matrix Element Methods*
- *Identification of eukaryotic genes derived from mitochondria using evolutionary analysis*
- *Identifying key genetic interactions in Type II diabetes*
- *Using Molecular Simulations to Calculate Free Energy*

Test-bed

Use as an experimental facility

- Cloud bursting work
 - Eucalyptus
 - Amazon
- Replicated files & directories
- Automatic application configuration and deployment

Grid Test-bed

Requirements

- Systems of sufficient scale to test realistically
- Sufficient bandwidth to stress communication layer
- Non-production environment so production users not impacted when a component fails under test
- Multiple sites, with high latency and bandwidth
- Cloud interface without bandwidth or CPU charges

Usecases

- XSEDE testing
 - XSEDE architecture is based on same standards, same mechanisms used here will be used for XSEDE testing
- Quality attribute testing, particularly under load and at extremes.
 - Load (e.g., job rate, number of jobs i/o rate)
 - Performance
 - Availability
- New application execution
 - Resources to entice
- New platforms (e.g., Cray, Cloud)

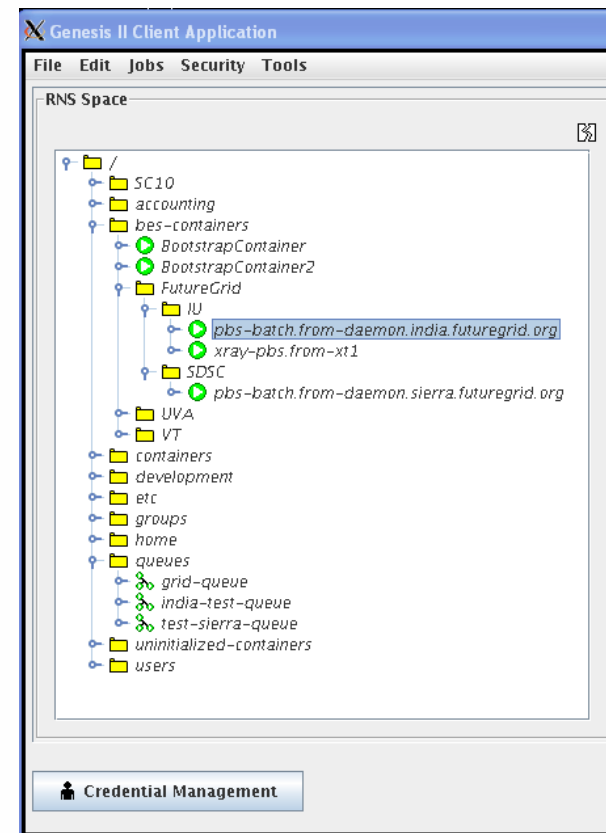
Extend XCG onto FutureGrid

(XCG- Cross Campus Grid)

Design

- Genesis II containers on head nodes of compute resources
- Test queues that send the containers jobs
- Test scripts that generate thousands of jobs, jobs with significant I/O demands
- Logging tools to capture errors and root cause
- Custom OGSA-BES container that understands EC2 cloud interface, and “cloud-bursts”

Image



Getting Access to FutureGrid

Gregor von Laszewski

Portal Account, Projects, and System Accounts

- The main entry point to get access to the systems and services is the FutureGrid Portal.
- We distinguish the portal account from system and service accounts.
 - You may have multiple system accounts and may have to apply for them separately, e.g. Eucalyptus, Nimbus
 - Why several accounts:
 - Some services may not be important for you, so you will not need an account for all of them.
 - In future we may change this and have only one application step for all system services.
 - Some services may not be easily integratable in a general authentication framework

Get access

Project Lead

1. Create a portal account
2. Create a project
3. Add project members

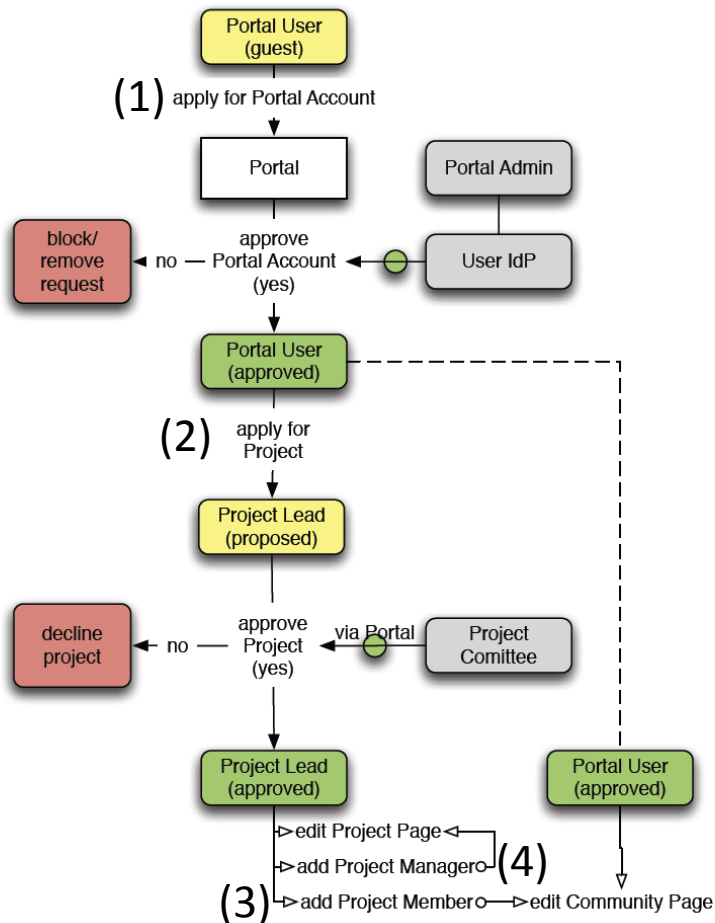
Project Member

1. Create a portal account
2. Ask your project lead to add you to the project

Once the project you participate in is approved

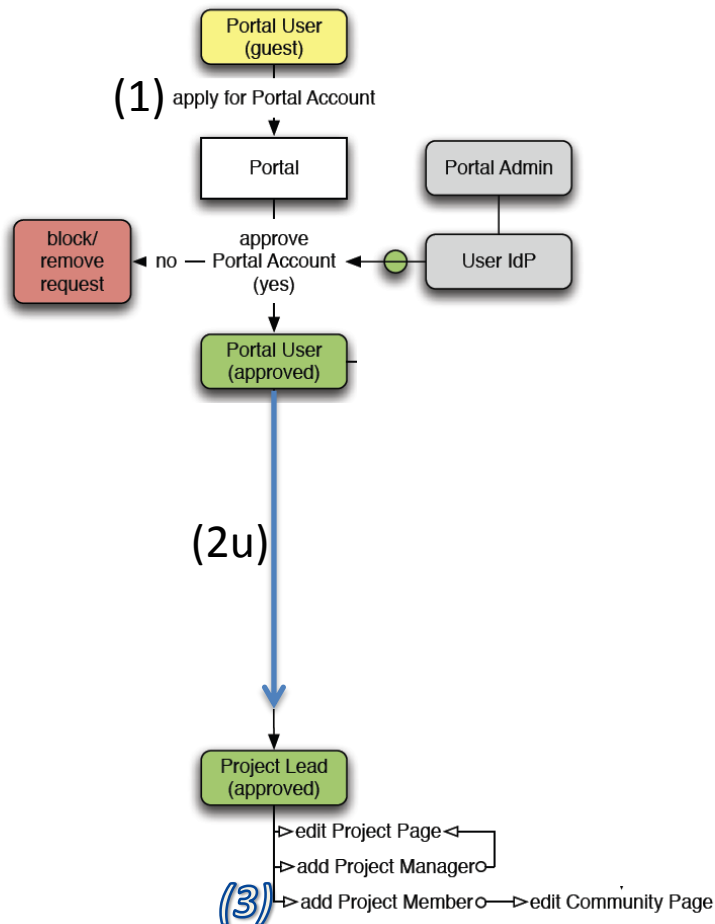
1. Apply for an HPC & Nimbus account
 - You will need an ssh key
2. Apply for a Eucalyptus Account

The Process: A new Project




- **(1) get a portal account**
 - *portal account is approved*
- **(2) propose a project**
 - *project is approved*
- **(3) ask your partners for their portal account names and add them to your projects as members**
 - *No further approval needed*
- **(4) if you need an additional person being able to add members designate him as project manager (currently there can only be one).**
 - *No further approval needed*
- **You are in charge who is added or not!**
 - Similar model as in Web 2.0 Cloud services, e.g. sourceforge

The Process: Join A Project



- **(1) get a portal account**
 - *portal account is approved*
- **Skip steps (2) – (4)**
- **(2u) Communicate with your project lead which project to join and give him your portal account name**
- *Next step done by project lead*
 - **(3)** *The project lead will add you to the project*
- **You are responsible to make sure the project lead adds you!**
 - Similar model as in Web 2.0 Cloud services, e.g. sourceforge

Apply for a Portal Account



FutureGrid Portal

[About](#) [User Support](#) [Projects](#) [News](#) [Log In](#)

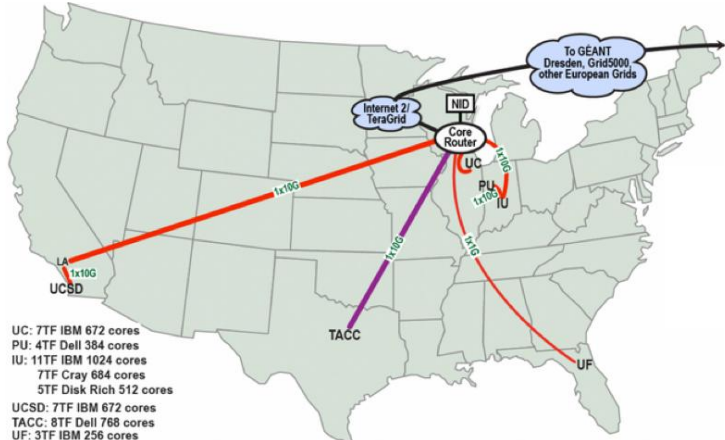
Home Page

FutureGrid is a distributed, high-performance test-bed that allows scientists to collaboratively develop and test innovative approaches to parallel, grid, and cloud computing.

The test-bed is composed of a set of distributed high-performance computing resources connected by a high-speed network (with adjustable performance via a network impairment device). Users can access the HPC resources as traditional batch clusters, a computational grid, or as highly configurable cloud resources where users can deploy their own virtual machines

The flexibility in configuration of FutureGrid resources enables its use across a variety of [research and education](#) projects. To learn more about how to join FutureGrid, visit the "Getting Started" page.

The FutureGrid project is funded by the National Science Foundation (NSF) and is led by Indiana University with University of Chicago, University of Florida, San Diego Supercomputing Center, Texas Advanced Computing Center, University of Virginia, University of Tennessee, University of Southern California, Dresden, Purdue University, and Grid 5000 as partner sites.



UC: 7TF IBM 672 cores
PU: 4TF Dell 384 cores
IU: 11TF IBM 1024 cores
7TF Cray 684 cores
5TF Disk Rich 512 cores
UCSD: 7TF IBM 672 cores
TACC: 8TF Dell 768 cores
UF: 3TF IBM 256 cores

News

- [Joining the Development Team](#)
- [CLOUD 2011: Analysis of Virtualization Technologies for High Performance Computing Environments](#)
- [CCGrid2011: FutureGrid Tutorial](#)
- [FutureGrid Staff Presents Poster at CReSIS Advisory Board Meeting](#)
- [Director Fox Presents at CReSIS Advisory Board Meeting](#)

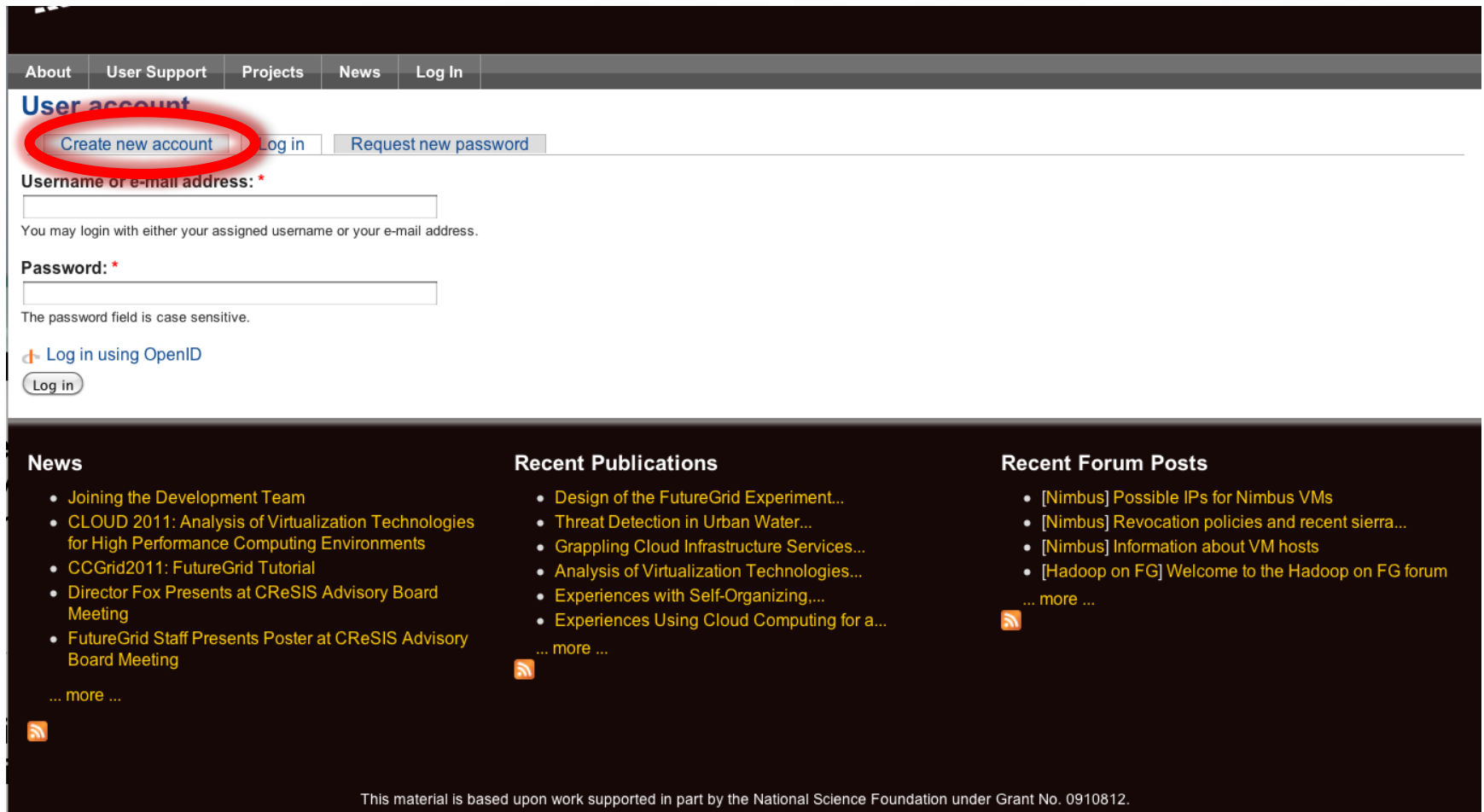
Recent Publications

- [Design of the FutureGrid Experiment...](#)
- [Experiences with Self-Organizing...](#)
- [Experiences Using Cloud Computing for a...](#)
- [Threat Detection in Urban Water...](#)
- [Grappling Cloud Infrastructure Services...](#)
- [Analysis of Virtualization Technologies...](#)
- [... more ...](#)

Recent Forum Posts

- [\[Nimbus\] Possible IPs for Nimbus VMs](#)
- [\[Nimbus\] Revocation policies and recent sierra...](#)
- [\[Nimbus\] Information about VM hosts](#)
- [\[Hadoop on FG\] Welcome to the Hadoop on FG forum](#)
- [... more ...](#)

Apply for a Portal Account



The screenshot shows the 'User account' section of the FutureGrid portal. At the top, there is a navigation bar with links for 'About', 'User Support', 'Projects', 'News', and 'Log In'. Below this, the 'User account' section contains three buttons: 'Create new account' (highlighted with a red circle), 'Log in', and 'Request new password'. There are two input fields: one for 'Username or e-mail address' and one for 'Password'. Below the password field, there is a note that the password field is case sensitive. There is also a link for 'Log in using OpenID' and a 'Log in' button. At the bottom of the page, there are three columns of content: 'News', 'Recent Publications', and 'Recent Forum Posts'. Each column has a list of items and a 'more' link. There are also RSS feed icons for each column.

About User Support Projects News Log In

User account

[Create new account](#) [Log in](#) [Request new password](#)

Username or e-mail address: *

You may login with either your assigned username or your e-mail address.

Password: *

The password field is case sensitive.

[Log in using OpenID](#)

[Log in](#)

News

- [Joining the Development Team](#)
- [CLOUD 2011: Analysis of Virtualization Technologies for High Performance Computing Environments](#)
- [CCGrid2011: FutureGrid Tutorial](#)
- [Director Fox Presents at CReSIS Advisory Board Meeting](#)
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... more ...

Recent Publications

- [Design of the FutureGrid Experiment...](#)
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- [Grappling Cloud Infrastructure Services...](#)
- [Analysis of Virtualization Technologies...](#)
- [Experiences with Self-Organizing....](#)
- [Experiences Using Cloud Computing for a...](#)

... more ...

Recent Forum Posts

- [\[Nimbus\] Possible IPs for Nimbus VMs](#)
- [\[Nimbus\] Revocation policies and recent sierra...](#)
- [\[Nimbus\] Information about VM hosts](#)
- [\[Hadoop on FG\] Welcome to the Hadoop on FG forum](#)

... more ...

This material is based upon work supported in part by the National Science Foundation under Grant No. 0910812.

Apply for a Portal Account

User account

Please Fill Out.

Create new account

Log in

Request new password

1. Please fill in all the fields. Fields that have a "*" are required.
2. If possible, please use the email address from your organization, '.edu' for example. This could help speed up the verification process. Using emails from such as gmail, yahoo, hotmail may delay your account approval, or even get your application declined.
3. The minimum password length is 8.
4. Read the User Agreement form and check 'I Agree with these terms' to proceed.
5. Type the characters shown in the Captcha image into the textbox located near the end of the page.
6. Click 'Create new account' button to submit your account request. Then you should be able to log into the portal, but with very limited access until your account is approved.

Account information

Username: *

Spaces are allowed; punctuation is not allowed; capital letters, hyphens, and underscores.

E-mail address: *

A valid e-mail address for the system will be sent to this address. This e-mail address is not made public and will only be used if you wish to receive a new password or wish to receive certain news or notifications by e-mail.

Password: *

Confirm password: *

Please choose a password for your account, it must be at least 8 characters.

Contact

Firstname: *

Lastname: *

Chose a strong password

Apply for a Portal Account

The content of this field is kept private and will not be shown publicly.

Department / Organizational Unit / Division / Lab: *

This is your institution name, department, or similar. Examples are Computer Science Department, Mathematics and Computer Science Division.

University / Government Organization / Company : *

The name of your University, Government Organization, or Company. Examples are Indiana University, Argonne National Laboratory, Google, Open Science Grid. Please do not use abbreviations.

Institutional Role: *

Undergraduate Student

Select the institutional role that best identifies you in your organization. The content of this field is kept private and will not be shown publicly.

Adviser's Contact Information:

[edit](#)

For students, please put your advisor's contact information, which includes student ID, partner ID, phone number, email, URL, address, etc., otherwise your application may get delayed or even declined. The content of this field is kept private and will not be shown publicly.

Institution Address: *

[edit](#)

Institution Country: *

URL:

Please Fill Out.

Use proper department and university

Specify advisor or supervisors contact

Use the postal address, use proper capitalization

Apply for a Portal Account

Citizenship: *

UNITED STATES;US

The content of this field is kept private and will not be shown publicly.

Please Fill Out.

FG User Agreement

FutureGrid User Responsibility Agreement v 3.2

This form is based on "TeraGrid User Responsibility Agreement" but is modified to fit FutureGrid requirements. An updated form may be required once FutureGrid is more tightly integrated with TeraGrid.

Report your citizenship

Introduction

FutureGrid has legal and other obligations to protect shared resources as well as the intellectual property of users. Users share this responsibility by observing the rules of acceptable use that are outlined in this document.

READ THE RESPONSIBILITY AGREEMENT

FutureGrid resources include hardware, software, network connections, and storage. Each resource is finite and shared by the entire research community. Responsible conduct on the part of each user is essential to ensure equitable and secure access for all. Failure to use FutureGrid resources properly may result in the penalties outlined in section 5, including those imposed by FutureGrid, civil, and/or criminal penalties. Each time an application for FutureGrid resources is submitted, the Acceptance Statement, must be agreed upon. To simplify the process you can do this electronically. In case of questions, please send mail to help@futuregrid.org.

I agree with these terms.

AGREE IF YOU DO. IF NOT CONTACT FG.

5 S 5 b F

You may not be able to use it.

What code is in the image?: *

Enter the characters shown in the image.

[Create new account](#)

Apply for an HPC and Nimbus account

- Login into the portal
- Simple go to
 - Accounts-> HPC&Nimbus
- (1) add you ssh keys
- (3) make sure you are in a valid project
- (2) wait for up to 3 business days
 - No accounts will be granted on Weekends
 - Friday 5pm EST – Monday 9 am EST

The screenshot shows the FutureGrid Portal interface. The navigation menu includes: About, User Support, Projects, Accounts, Developer, Admin, Experts, News, Log Out, Editor. The 'Accounts' menu is expanded, and 'HPC & Nimbus' is highlighted with a red circle. Below the navigation, there are sections for 'Subscriptions', 'Who's online', 'Online users', 'Who's new', and 'My Projects Summary'. The 'My Projects Summary' section contains two tables: 'Projects I lead' and 'Projects I manage'. The 'Projects I lead' table has columns for Project Id, Title, and Project Status. The 'Projects I manage' table also has columns for Project Id, Title, and Project Status. The URL at the bottom of the page is <https://portal.futuregrid.org/request-hpc-account>.

Generating an SSH key pair

- For Mac or Linux users
 - `ssh-keygen -t rsa -C yourname@hostname`
 - Copy the contents of `~/.ssh/id_rsa.pub` to the web form
- For Windows users, this is more difficult
 - Download [*putty.exe*](#) and [*puttygen.exe*](#)
 - Puttygen is used to generate an SSH key pair
 - Run puttygen and click “Generate”
 - The public portion of your key is in the box labeled “SSH key for pasting into OpenSSH authorized_keys file”

Check your Account Status


eGrid Portal

Accounts | Develop | Admin | Experts | News | Log Out | Editor | Search this site: _____

My Portal Account

Revisions | Track | Grant

Profile Picture | Contact

 Gregor von Laszewski
Community Grids Laboratory
Indiana University
Pervasive Technology Institute
2719 East 10th Street
Bloomington, Indiana 47408
+1 (234) 567 9065
laszewski@gmail.com
gregor
edit

My FutureGrid HPC Accounts Status

User: Gregor von Laszewski

Steps	Portal Account	⇒	Project Affiliation	⇒	SSH Key Submission	⇒	HPC Account Request	⇒
Status	OK		OK		OK		PENDING	

Actions

Note: Once your FG resource account is created, you can [modify\(add, revoke, etc\)](#) your ssh keys directly through the [portal](#) and they will be **effective immediately**.

Useful links

- [Go To My Account](#)
- [Edit My Portal Account Information](#)
- [Edit My Contact Information](#)
- [Edit My Expertise Information](#) (FG Experts are required to fill this out). It is optional for all others
- [Upload a Portrait](#)
- [Bookmarks](#)

- Goto:
 - Accounts-My Portal Account
- Check if the account status bar is green
 - Errors will indicate an issue or a task that requires waiting
- Since you are already here:
 - Upload a portrait
 - Check if you have other things that need updating
 - Add ssh keys if needed

Eucalyptus Account Creation

- **YOU MUST BE IN A VALID FG PROJECT OR YOUR REQUEST GETS DENIED**
- Use the Eucalyptus Web Interfaces at
<https://eucalyptus.india.futuregrid.org:8443/>
- On the Login page click on Apply for account.
- On the next page that pops up fill out ALL the Mandatory AND optional fields of the form.
- Once complete click on signup and the Eucalyptus administrator will be notified of the account request.
- You will get an email once the account has been approved.
- Click on the link provided in the email to confirm and complete the account creation process

Portal

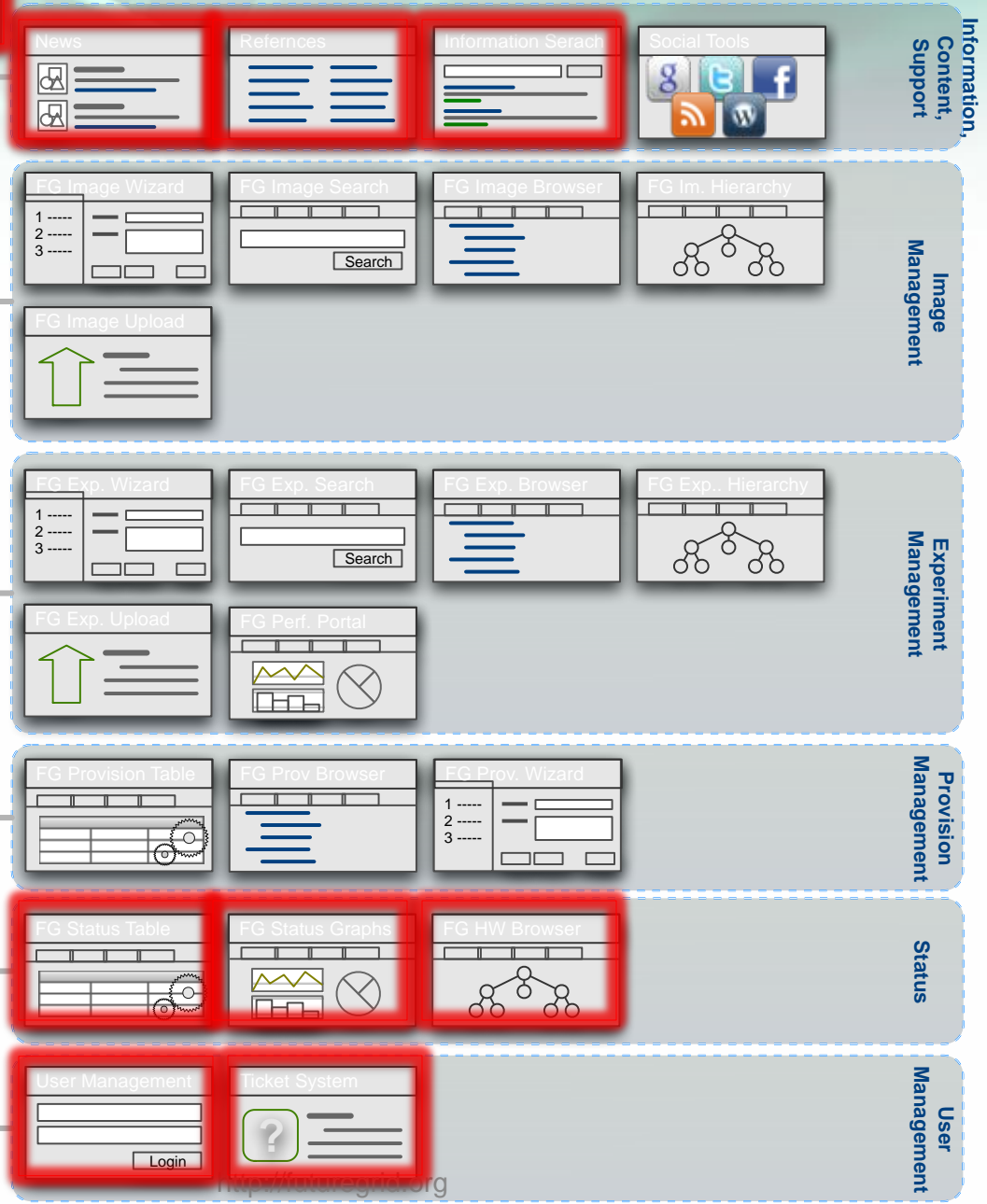
Gregor von Laszewski

FG Portal

- Coordination of Projects and users
 - Project management
 - Membership
 - Results
 - User Management
 - Contact Information
 - Keys, OpenID
- Coordination of Information
 - Manuals, tutorials, FAQ, Help
 - Status
 - Resources, outages, usage, ...
- Coordination of the Community
 - Information exchange: Forum, comments, community pages
 - Feedback: rating, polls
- Focus on support of additional FG processes through the Portal

The screenshot displays the FutureGrid Portal interface. At the top, there is a navigation bar with links for About, News, User Information, Community, Projects, Accounts, Developer, Admin, Experts, Log Out, Editor, and a search box. Below this is a 'Subscriptions' section with a 'Subscribe' button. The main content area is titled 'Home Page' and includes a 'View' button and a 'Grant' button. The 'Who's online' section indicates 3 users and 4 guests are online. The 'Online users' list includes gcf, gregor, and admin. The 'Who's new' section lists smits.smiling, khaled, Fedo, Rayray, and libobitt. The main text describes FutureGrid as a distributed, high-performance test-bed for collaborative development and testing of innovative approaches to parallel, grid, and cloud computing. It mentions that the test-bed is composed of distributed high-performance computing resources connected by a high-speed network. A map of the United States shows various sites: UCSD, TACC, UC, and UF. A legend lists the resources: UC: 77F IBM 672 cores, FIU: 417F Dell 364 cores, IU: 117F IBM 1624 cores, UT: Cray 184 cores, STC: Dell R610 512 cores, UCSD: 77F IBM 672 cores, TACC: 87F Dell 788 cores, UF: 317F IBM 226 cores. The 'News' section lists articles like 'Joining the Development Team' and 'FG @ TeraGrid11 and OGF'. The 'Recent Publications' section lists articles like 'Experiences with Self-Organizing...' and 'Experiences Using Cloud Computing for a...'. The 'Recent Forum Posts' section lists posts like '[Community] Please use the forum for general...' and '[Nimbus] Cluster initialization stop in: Waiting...'. The bottom of the page features a 'Future Grid' logo.

Portal Subsystem



Information Services

- What is happening on the system?
 - System administrator
 - User
 - Project Management & Funding agency
- Remember FG is not just an HPC queue!
 - Which software is used?
 - Which images are used?
 - Which FG services are used (Nimbus, Eucalyptus, ...?)
 - Is the performance we expect reached?
 - What happens on the network

Simple Overview

Machine Partition Information *

Resource	HPC	Eucalyptus	Nimbus	
IU-INDIA (1416 cores)	58.8% (832 cores)	28.2% (400 cores)		<p>HPC(58.8%) Eucalyptus(28.2%) Misc(12.4%) Mgmt(0.6%)</p>
IU-XRAY (664 cores)	100% (664 cores)			<p>HPC(100%)</p>
TACC-ALAMO (656 cores)	100% (656 cores)			<p>HPC(100%)</p>
UC-HOTEL (672 cores)	50% (336 cores)		50% (336 cores)	<p>HPC(50%) Nimbus(50%)</p>
UCSD-SIERRA (672 cores)	46.4% (312 cores)	17.9% (120 cores)	23.8% (160 cores)	<p>HPC(46.4%) Nimbus(23.8%) Eucalyptus(17.9%) Mgmt(6%) Misc(6%)</p>
UFL-FOXTROT (256 cores)			96.9% (248 cores)	<p>Nimbus(96.9%) Mgmt(3.1%)</p>

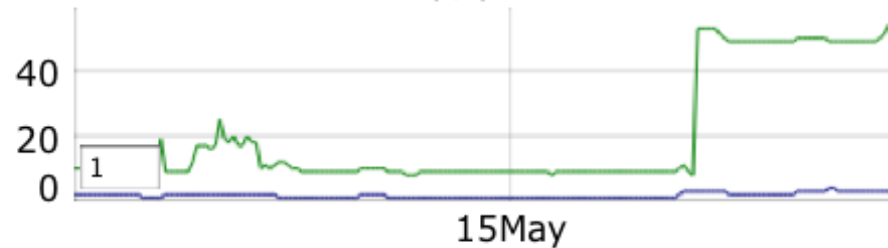
*A small percentage of nodes may be unavailable or used for management

Eucalyptus

This graph shows the number of currently running VMs within the Eucalyptus deployment on each machine.

Running VMs

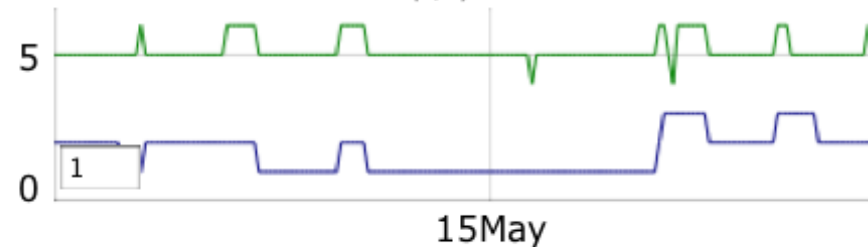
x-axis = Timestamp, y-axis = Count



This graph shows the number of users currently running VMs within the Eucalyptus deployment on each machine.

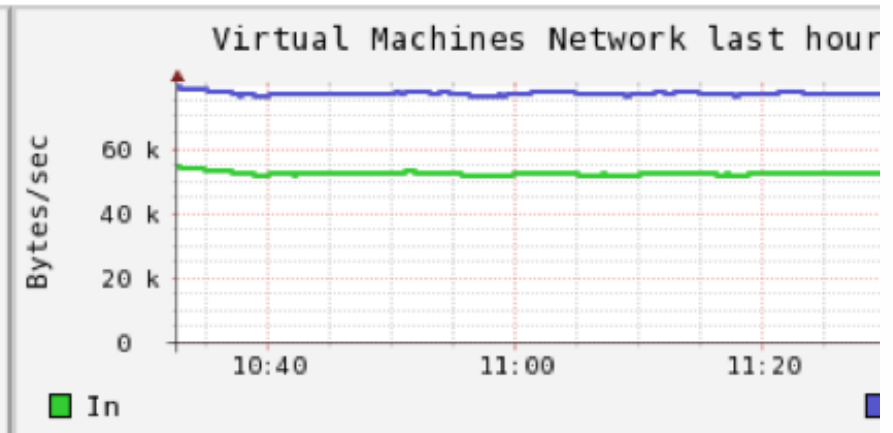
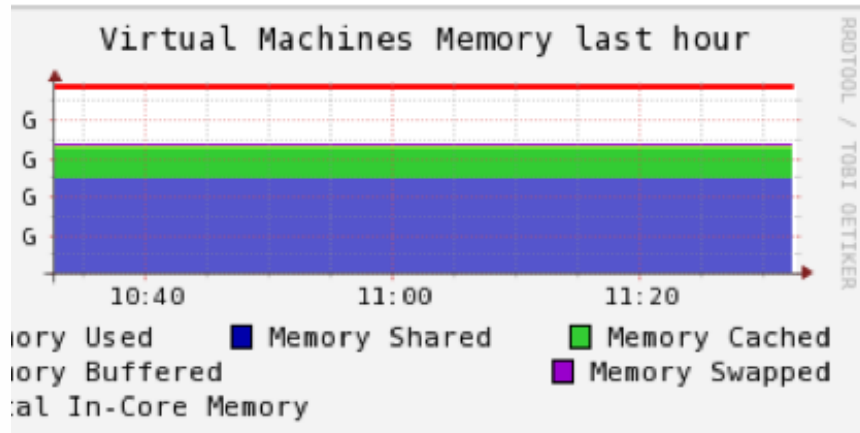
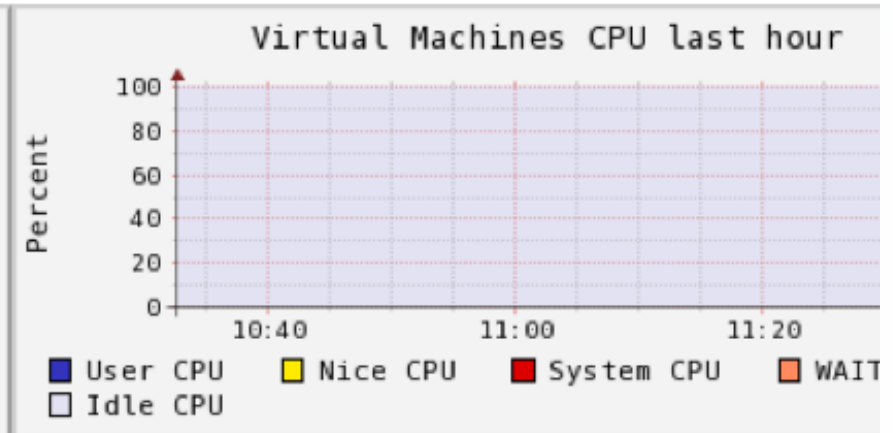
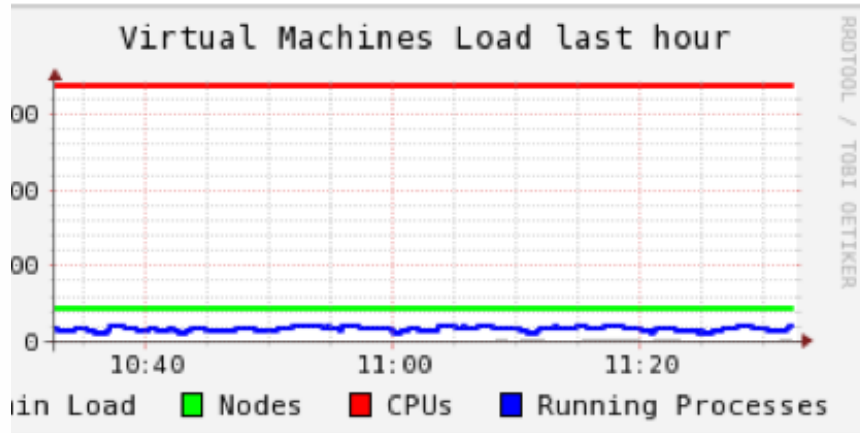
Users

x-axis = Timestamp, y-axis = Count



Ganglia

On India



Forums

Announcements				
✉	User A forum for FG staff to post important information to FG users. This includes information about system status and other important activities.	1	1	23 weeks 5 days ago by gregor
FG User Services Forum				
✉	Community This forum is managed by the FG community and allows posting of questions and answers by all of the FG users and staff members. It is a public forum to which all authenticated users have access to.	20	21	2 days 10 hours ago by gregor
✉	Education This Forum is related to discussion to prepare educational materials for FutureGrid, HPC, Cloud, and Grid Computing	6 1 new	8	2 weeks 5 days ago by mcanonic
✉	HPC For general an public HPC discussions	2	3	21 weeks 6 days ago by gregor
✉	Eucalyptus Eucalyptus related discussions	7	10	14 weeks 3 days ago by archit
✉	Eucalyptus Ops			20 weeks 4 days ago

My Ticket System

FutureGrid tickets

My tickets

Submit a ticket

Your tickets are listed below. Click on a ticket title to expand the details for that ticket.

Please note, there may be some delay before a ticket appears in this view. Recently submitted tickets may not display immediately.

Show entries

Search:

ID	Created	Subject	Status	Last updated
303	Wed Jul 13 11:47:17 2011	Eucalyptus account	resolved	Wed Jul 13 12:02:46 2011
300	Wed Jul 06 16:09:23 2011	Machine with fixed IP address to access XD data	new	Wed Jul 06 16:09:24 2011
287	Sun Jun 26 03:26:01 2011	test	resolved	Mon Jul 04 16:18:33 2011
283	Fri Jun 24 09:23:15 2011	Portal account request stalled	resolved	Sun Jun 26 03:43:07 2011
279	Tue Jun 21 16:08:55 2011	python version 2.71 india and sierra	new	Tue Jun 21 16:08:55 2011
278	Tue Jun 21 13:38:46 2011	xemacs	new	Tue Jun 21 13:38:46 2011
265	Wed Jun 08 09:42:06 2011	URGENT	resolved	Wed Jun 08 11:49:27 2011
251	Thu May 26 11:05:24 2011	FG account	resolved	Thu Jun 02 09:40:22 2011
250	Thu May 26 11:02:03 2011	FG portal account	resolved	Thu Jun 02 09:40:50 2011
249	Thu May 26 10:59:43 2011	FG account	resolved	Thu Jun 02 09:41:17 2011

Showing 1 to 10 of 11 entries

[First](#) [Previous](#) [1](#) [2](#) [Next](#) [Last](#)



My Ticket Queue

edit	Yes	Tutorials	Page		Renato Figueiredo	07/15/2011 - 20:24
edit	Yes	Connecting VMs in private networks via ViNe overlay	Community Page		Mauricio Tsugawa	07/15/2011 - 15:34
edit	Yes	Accessing FutureGrid	Page		Gregor von Laszewski	07/15/2011 - 11:18
edit	Yes	Help and Support	Page		Gregor von Laszewski	07/15/2011 - 09:32
edit	Yes	Manage My Portal Account	Page	YES	Gregor von Laszewski	07/15/2011 - 09:16
edit	Yes	Status	Page	YES	Gregor von Laszewski	07/14/2011 - 13:09
edit	Yes	Host List Manager	Page		Warren Smith	07/12/2011 - 12:03
edit	Yes	Contact	Page		Gregor von Laszewski	07/12/2011 - 12:01
edit	Yes	Overview	Page		Gregor von Laszewski	07/12/2011 - 12:00
edit	Yes	Jobs	Page		Gregor von Laszewski	07/12/2011 - 11:59
edit	Yes	Nimbus Services	Page		Gregor von Laszewski	07/12/2011 - 11:59
edit	Yes	India	Page		Gregor von Laszewski	07/12/2011 - 11:58

My Projects

My Projects

Project Id	Title	Project Status	Lead	Manager	Members	Supporting Experts
edit 124	Tutorial: CCGrid2011	approved	Gregor von Laszewski	Andrew Younge	Aaron Vose, Javier Diaz Montes, Cui Lin, Bhanu Rekepalli, Atsuhiko Goto, Marc Frincu, Eshwar Peadamallu, Jesus Montes, Raul Gracia, Alberto Sanchez, Daniel Zinn, Bruno Schulze	Andrew Younge, Fugang Wang
edit 82	FG General Software Development	approved	Gregor von Laszewski	Gregor von Laszewski	Andrew Younge, Mauricio Tsugawa, Bingjing Zhang, Jens-S. Vöckler, Archit Kulshrestha, John Bresnahan, Stephen Mock, Patrick Hurley, Gregory Pike, Matthew Hanlon, Warren Smith, Gregor von Laszewski, Javier Diaz Montes, Michael Lewis, Anh Huy Bui, Joseph Makar, Fugang Wang, meng han	
edit 2	Deploy OpenNebula on FutureGrid	approved	Gregor von Laszewski	Javier Diaz Montes	Javier Diaz Montes	Javier Diaz Montes

Projects I am Member of

Projects I'm a member of

Project Id	Title	Project Status	Lead	Manager	Members	Supporting Experts
89	Support multiple dimensional index in HDFS on the FutureGrid platform	approved	Abhijeet Kodgire	Abhijeet Kodgire	Gregor von Laszewski, Lizhe Wang	Gregor von Laszewski, Lizhe Wang
86	Parallel Analysis of EEG Data with Hadoop on FutureGrid	approved	Rewati Ovalekar	Rewati Ovalekar	Geoffrey Fox, Gregor von Laszewski, Lizhe Wang	
84	Development of an Index File System to Support Geoscience Data with Hadoop	approved	Sonali Karwa	Sonali Karwa	Geoffrey Fox, Gregor von Laszewski, Lizhe Wang	
83	OpenStack on FutureGrid	approved	Archit Kulshrestha	Archit Kulshrestha	Gregory Pike, Gregor von Laszewski	
82	FG General Software Development	approved	Gregor von Laszewski	Gregor von Laszewski	Andrew Younge, Mauricio Tsugawa, Bingjing Zhang, Jens-S. Vöckler, Archit Kulshrestha, John Bresnahan, Stephen Mock, Patrick Hurley, Gregory Pike, Matthew Hanlon, Warren Smith, Gregor von Laszewski, Javier Diaz Montes, Michael Lewis, Anh Huy Bui, Joseph Makar, Fugang Wang, meng han	

Projects I Support

Projects I'm supporting as an expert

[Edit] [Export]	Project	Title	Project Status	Lead	Manager	Members	Supporting Experts
	133	Supply Chain Network Simulator Using Cloud Computing	approved	Manuel Rossetti	Manuel Rossetti		Gregor von Laszewski, Yuduo Zhou
	91	Integrated Information Services (IIS) Testing	approved	John-Paul Navarro	John-Paul Navarro	Aaron Diestelkamp	Lizhe Wang, Gregor von Laszewski
	89	Support multiple dimensional index in HDFS on the FutureGrid platform	approved	Abhijeet Kodgire	Abhijeet Kodgire	Gregor von Laszewski, Lizhe Wang	Gregor von Laszewski, Lizhe Wang
	62	Evaluation of using XD TAS (Technology Auditing Service) in FutureGrid	approved	Chang-Da Lu	Chang-Da Lu		Gregor von Laszewski, Lizhe Wang
	10	TeraGrid XD TIS(Technology Insertion Service) Technology Evaluation Laboratory	approved	John Lockman	John Lockman	Peter Enstrom, Victor Hazlewood, Daniel LaPine	Lizhe Wang, Gregor von Laszewski

My References

My Publications

Title	Authors	Citation Key	URL	Year of Publication	Type of Publication	Type of Work
Analysis of Virtualization Technologies for High Performance Computing Environments	Younge, Andrew J., Robert Henschel, James Brown, Gregor von Laszewski, Judy Qiu, and Geoffrey C. Fox	[fg-1015]		2011	Conference Paper	Paper
Towards Generic FutureGrid Image Management	von Laszewski, Gregor, Javier Diaz, Fugang Wang, Andrew J. Younge, Archit Kulshrestha, and Geoffrey Fox	[fg-1155]	URL	2011	Conference Proceedings	
Grappling Cloud Infrastructure Services with a Generic Image Repository	Diaz, Javier, Andrew J. Younge, Gregor von Laszewski, Fugang Wang, and Geoffrey C. Fox	[fg-1014]	URL	2011	Conference Paper	White Paper
FutureGrid User Manual	von Laszewski, Gregor, and others	[fg-1050]	URL	2011	Miscellaneous	Manual
FutureGrid Software: Portal Development	von Laszewski, Gregor, and Fugang Wang	[fg-1060]	URL	2011	Report	Report
FutureGrid Software: Image Repository REST API	von Laszewski, Gregor, and Javier Diaz	[fg-1061]	URL	2011	Miscellaneous	Notes/Draft




















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Yes	Accessing FutureGrid	User Manual	Gregor	von Laszewski	07/15/2011 - 11:18
Yes	Help and Support	User Manual	Gregor	von Laszewski	07/15/2011 - 09:32
Yes	fg-image-deploy	User Manual	Gregor	von Laszewski	07/12/2011 - 12:51
Yes	Foxtrot	User Manual	Gregor	von Laszewski	07/12/2011 - 12:50
Yes	Developers Manual	Developers Manual	Gregor	von Laszewski	07/12/2011 - 12:50
Yes	User Manual	User Manual	Gregor	von Laszewski	07/12/2011 - 12:49
Yes	Overview (Phase I)	User Manual	Gregor	von Laszewski	07/12/2011 - 12:47
Yes	FG-Image-Generate	User Manual	Gregor	von Laszewski	07/12/2011 - 12:42
Yes	Overview	User Manual	Gregor	von Laszewski	07/12/2011 - 12:00
Yes	Project Management on FutureGrid	Developers Manual	Gregor	von Laszewski	06/06/2011 - 10:02
Yes	fg-hadoop	User Manual	Gregor	von Laszewski	04/27/2011 - 14:18
Yes	Source Code Development Rules	Developers Manual	Gregor	von Laszewski	04/27/2011 - 14:02
Yes	Editorial Processes	Developers Manual	Gregor	von Laszewski	04/27/2011 - 13:55

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edit Yes	Accessing FutureGrid	Page		Gregor von Laszewski	07/15/2011 - 11:18
edit Yes	Help and Support	Page		Gregor von Laszewski	07/15/2011 - 09:32
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edit Yes	Status	Page	YES	Gregor von Laszewski	07/14/2011 - 13:09
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