

A UNICORE-based Multi-Site and Multi-User Grid Environment for Demonstration, Education and Testing Purposes

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Outline

- Goals of Instant-Grid
- Instant-Grid Project
- Technical Concepts
- New Features – The UNICORE Edition
- Summary and Outlook

Goals of Instant-Grid

- Independent adhoc standalone and self-configured grid environment
- No previous grid knowledge required
- Utilization of computers located in a local network
- For developers:
 - Preinstalled grid tools, ready to use
 - Production independent testing
- For demonstration purposes:
 - Preinstalled grid applications
 - Fully configured services and user credentials, fully automated setup
- For education and teaching

Instant-Grid Project

- Originally based on Globus Toolkit 4
- Funded project phase from 2005 to 2007
- Further developments driven by the Instant-Grid community after 2007
- Instant-Grid with UNICORE in 2009
 - Easy deployable grid environment based on UNICORE 6 realizing the goals
 - Specific requirements of UNICORE 6
 - Interoperability test environment
- Join the community!

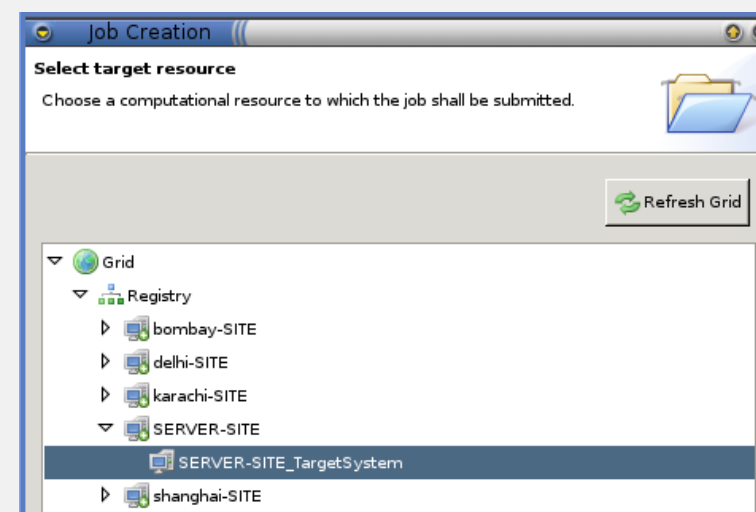
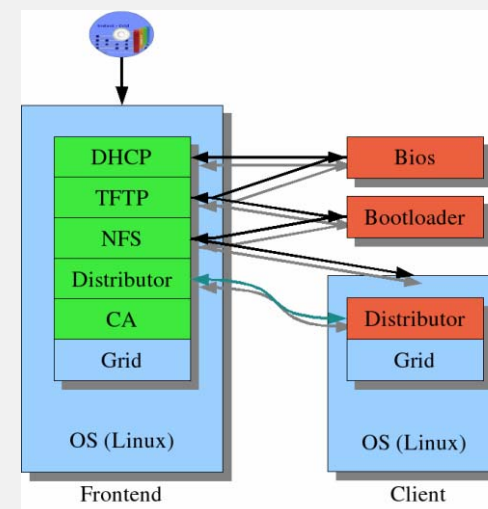
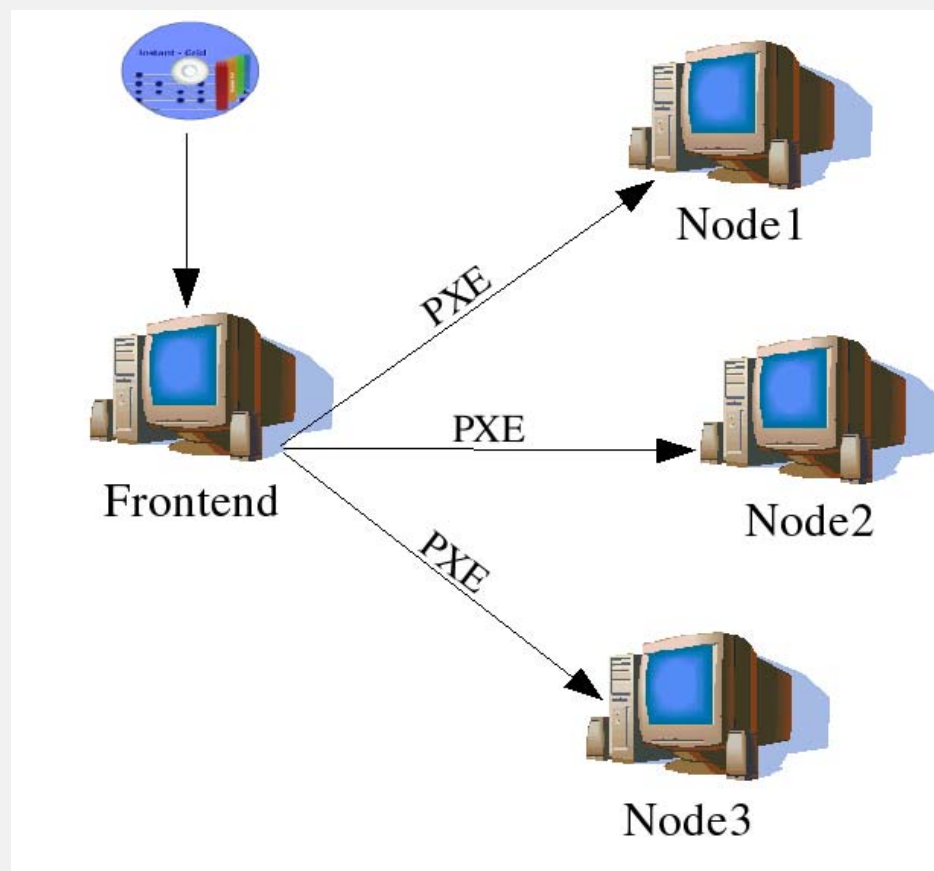
Reaching the Goals – Basic Features of Instant-Grid

- Automatic configuration at the startup process
 - Network setup
 - Monitoring
 - Security
- Automated configuration at runtime
 - Dynamic discovery
 - User management
- Ready to use features and applications
 - Data management
 - Job management
 - Information service
 - Grid workflow
 - Grid applications

Automatic Configuration at the Startup Process (1)

- Boot process from CD or USB (Server)
 - Network boot (PXE+DHCP+NFS) configured dynamically
- Network setup
 - Network services (DHCP+NAT+firewall+hostnames) configured dynamically
- Monitoring
 - Test tools
- Security
 - Certificate Authority initialized

Automatic Configuration at the Startup Process (2)



Automated Configuration at Runtime

- Dynamic discovery
 - Discover the changes of the resource and user pool
 - IPCOLLECTORD – checks status of the Instant-Grid clients and updates server configuration
 - Monitoring systems automatically run in the background
 - Cluster level: Ganglia
 - Grid level: Common Information Service (CIS)
- Automated management
 - Update mechanism for cluster and grid configuration
 - DISTRIBUTORD – distributes all configuration files

Basic Features: Monitoring with Ganglia



Gmond and gmetad are configured on all nodes dynamically

Ready to Use Features and Applications

- Internet connection or global grid connectivity is not required
- Preconfigured for demonstrations inside the local Instant-Grid implementation
- Several examples illustrate the broad area of possible grid applications
 - Distributed rendering with POV-Ray
 - Collaborative editing, chat and whiteboard functionalities
 - Workflow based environmental risk management
 - Framework for indexing text corpora
 - System to allocate laboratory resources to user

Applications: Rendering with POV-Ray



Szenendatei: /usr/share/doc/povray-3.5/examples/gwdg_grid.pov, Auflösung: 1024x768, Antialias

Die Berechnung läuft. Bitte lassen Sie dieses Browserfenster geöffnet.

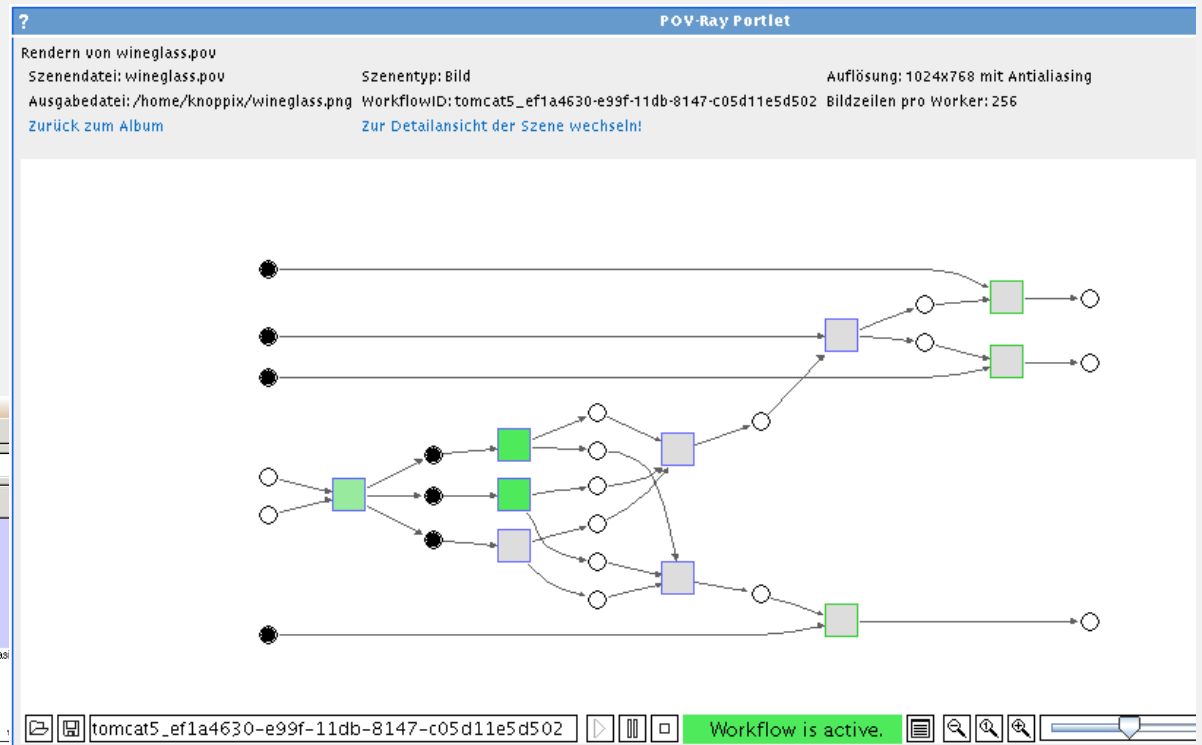
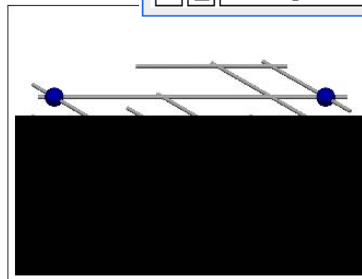
(-> Die Berechnung abbrechen!)

Bisherige Renderzeit: 00 Minuten 33 Sekunden.

Renderübersicht:

40% fertig

Host	Startzeile	Endzeile	Status
server	1	50	Done!
karachi	51	100	Done!
bombay	101	150	Done!
server	151	200	Done!
karachi	201	250	Done!
bombay	251	300	Done!
server	301	350	Rendering
karachi	351	400	Rendering
bombay	401	450	Rendering
	451	500	Queued
	501	550	Queued
	551	600	Queued
	601	650	Queued
	651	700	Queued
	701	768	Queued



Applications: Portal and Collaborative Editor

Available hardware resources

Nr.	Name	CPU	Load(1min)	Load(5min)	Load(15min)	Memory(free)	Filesystem(free)
1	server	1	10 (percent)	55 (percent)	41 (percent)	149 (mb)	3516 (mb)
2	bombay	1	0 (percent)	2 (percent)	1 (percent)	21 (mb)	4 (mb)
Total		2	5 (percent)	28 (percent)	21 (percent)	170 (mb)	3520 (mb)

Daemon controller

URL:

Update interval (seconds):

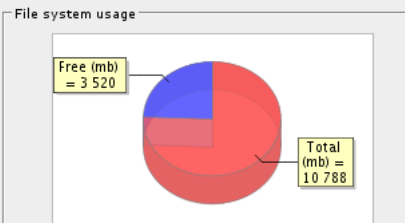
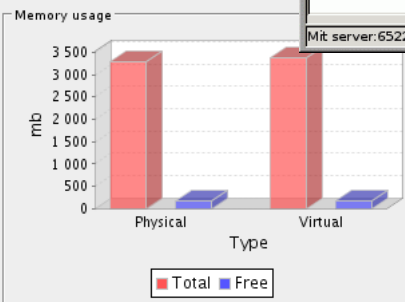
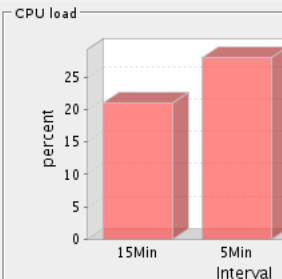
Daemon controller:

XML result

```

<dgrdl>
  <resource xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xsi:noNamespaceSchemaLocation="http://www.w3.org/2001/XMLSchema-instance">
    <ofClass uri="urn:dgrdl:hardware"/>
    <name>server</name>
    <provides>
      <resourceRef uri="software:povray-3-5"/>
      <resourceRef uri="software:povray-post-convert-0-1"/>
      <resourceRef uri="software:povray-post-merge-0-1"/>
      <resourceRef uri="software:povray-post-statistics-0-1"/>
      <resourceRef uri="software:povray-pre-0-1"/>
      <resourceRef uri="software:povray-pre"/>
      <resourceRef uri="software:ig-povray-post-convert"/>
      <resourceRef uri="software:ig-povray-post-merge"/>
      <resourceRef uri="software:povray-post-statistics"/>
      <resourceRef uri="software:cat-fhrig"/>
      <resourceRef uri="software:eraras-lagrange-20061218"/>
      <resourceRef uri="software:eraras-diagnostic-windfield-node1-20061218"/>
      <resourceRef uri="software:eraras-lagrange-postprocessing-20061218"/>
      <resourceRef uri="software:eraras-preprocessing-20061218"/>
      <resourceRef uri="software:eraras-pool-evaporation-20061218"/>
    </provides>
  </resource>
</dgrdl>

```



IG - Gobby

Gobby Sitzung Bearbeiten Benutzer Fenster Hilfe

Sitzung eröffnen... Sitzung betreten... Sitzung verlassen Dokument erstellen... Dokument öffnen... Dokument speichern

* IG X

1 Instant Grid ist eine Test- und Demonstrations-Umgebung für Grid-Technologie!

Benutzerliste

- Angemeldet
 - server
 - bombay
- Abgemeldet

[11:56:10] bombay hat die Sitzung betreten
 [12:47:50] server has created a new document: gwdg_logo_neu.pov
 [12:48:51] server has created a new document: IG
 [12:49:36] <bombay> IG ist nicht nur zum Testen da!
 [12:49:47] <server> Richtig :)

Versenden

Mit server: 6522 verbunden Keine Sprache ausgewählt Line: 1, Column: 78

New features of the UNICORE6 Edition

- Customization – Build and configure your own grid
 - Persistent setup
 - Easy, fast, local configuration
 - For end users
 - Image build (traditional remastering)
 - Time consuming
 - For us & for communities
- Dynamic configuration of UNICORE6 on every nodes
 - Services configured during the startup process
 - Security for UNICORE

New Features: Persistent Setup

- Pre-setup
 - After the hardware is configured and disks are mounted
 - Before services are started
 - Change of the service configurations (ssh key, ports, etc)
- Post-setup
 - After services are started
 - Installation of packages, adding users, etc
- How? Using the /clusterwork/sdaX/setup directories
 - Packages (.deb packages will be installed)
 - Filesystem (files will be copied recursively)
 - Scripts (scripts will be invoked by root)
- Changes in ramdisk only! (it costs RAM + not saved automatically)

New Features: Build Concept (Nightly Build)

reMastRR (remasterer)

- Original liveCD image extraction (cloop)
- Package build (deb for UNICORE6 Server, CIS, UCC, RichClient, PBS)
 - Repository
- Package install (chroot)
 - Legacy debian packages
 - Instant-Grid packages
- Image is compressed (cloop, 2 Gb)
- Live CD → setup takes place during the boot process

New Feature: Dynamically Configured UNICORE6 Services On Every Nodes

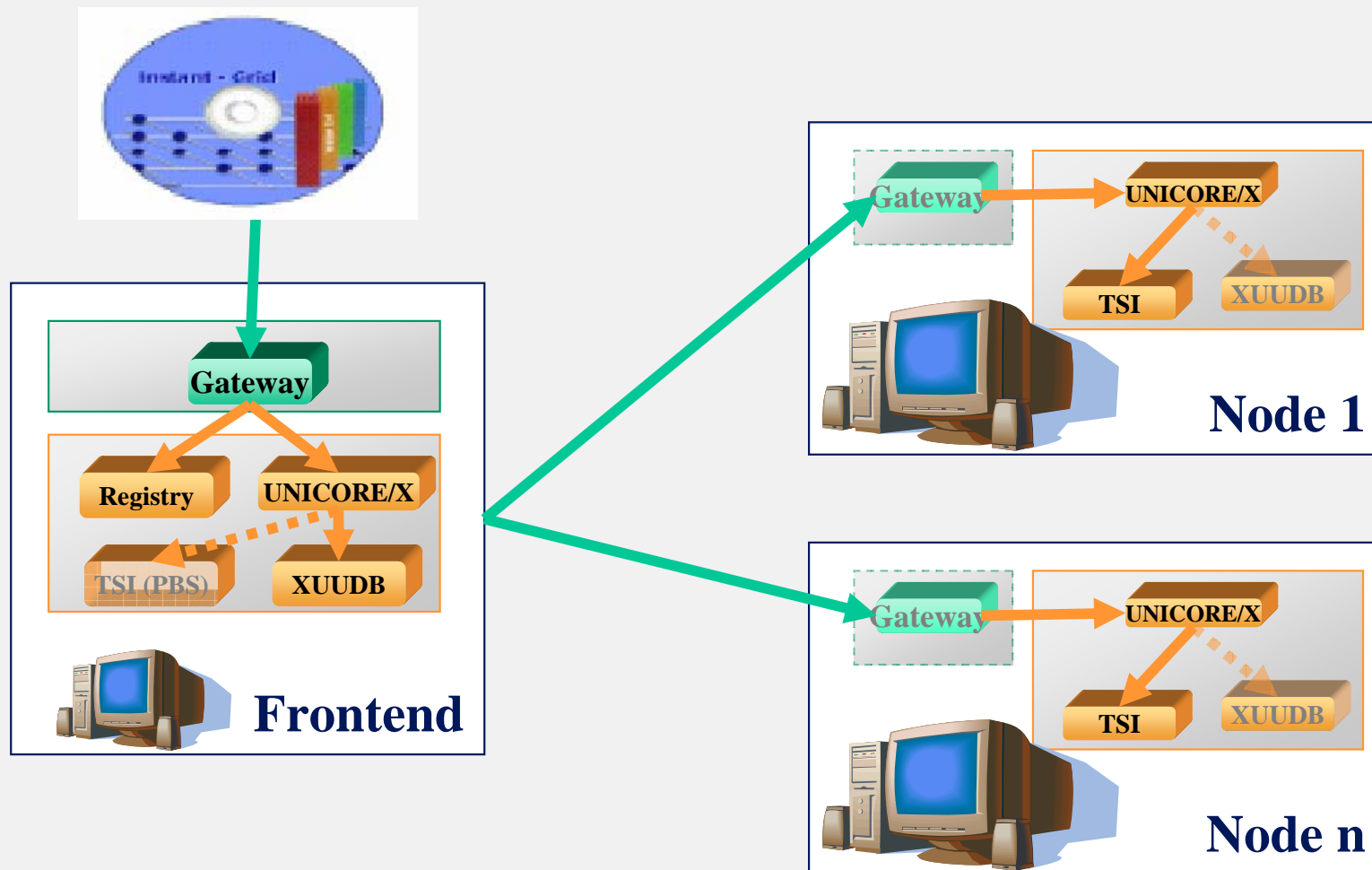
Services configured during the startup (on the frontend):

- Global-Registry
- Gateway
- UNICORE/X
- (Target System Interface for PBS: not yet)
- XUADB

Services configured during the startup (on the clients):

- UNICORE/X
- Target System Interface
- (XUADB, Gateway: will not be own services on the clients in the future)

New Feature: Dynamically Configured UNICORE6 Services On Every Nodes

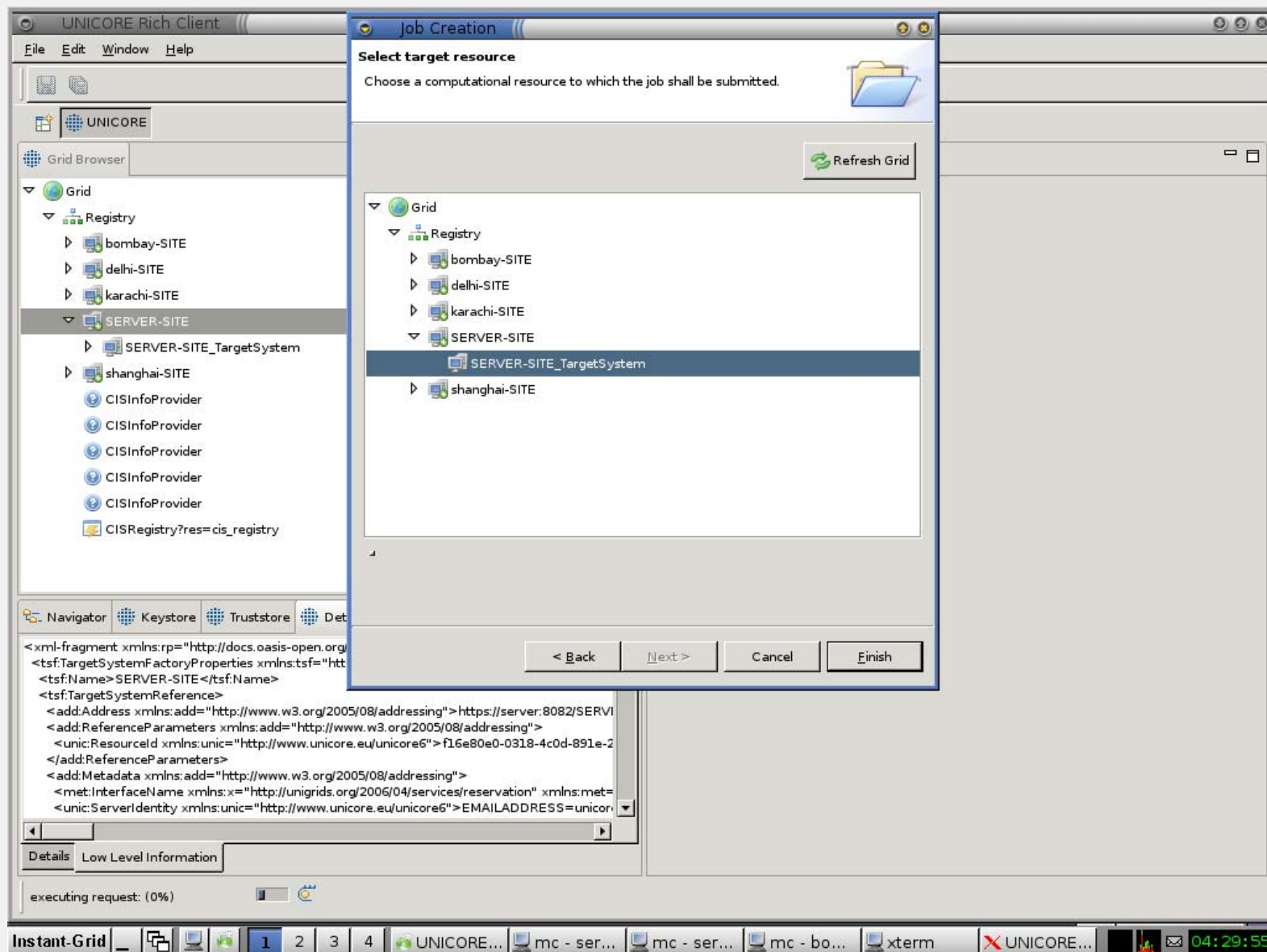


New Features: Security for UNICORE

UNICORE Security Environment of Instant-Grid

- Based on the X.509 Public Key Infrastructure
- Own Certificate Authority (CA) is initialized on the frontend
 - Issues user and server certificates
 - cacert.pem as a trusted certificate (in UNICORE components' truststore)
- Key- and trust-stores:
 - Created on demand (a new user account is required by a course user or a new host appears)
 - Keystore: private key (pkcs12 and jks)
 - Truststore: certificates identifying trusted other parties (jks)

New Features: UNICORE Rich Client



UNICORE Rich Client shows the available Instant-Grid sites

New Features: Common Information Service

UNICORE
UNICORE Common Information Service

Map Sites Search

bombay
Name: [Site endpoint at bombay](#)
Health State: **ok**
Running Jobs: 0
Total Jobs: 0
Downtime Announcement Info: **No downtime announced yet**
[Detailed raw xml Info >>](#) [Detailed tree Info >>](#)

server
Name: [Site endpoint at server](#)
Health State: **ok**
Running Jobs: 0
Total Jobs: 0
Downtime Announcement Info: **No downtime announced yet**
[Detailed raw xml Info >>](#) [Detailed tree Info >>](#)

shanghai
Name: [Site endpoint at shanghai](#)
Health State: **ok**
Running Jobs: 0
Total Jobs: 0
Downtime Announcement Info: **No downtime announced yet**
[Detailed raw xml Info >>](#) [Detailed tree Info >>](#)

delhi
Name: [Site endpoint at delhi](#)
Health State: **ok**
Running Jobs: 0
Total Jobs: 0
Downtime Announcement Info: **No downtime announced yet**
[Detailed raw xml Info >>](#) [Detailed tree Info >>](#)

karachi
Name: [Site endpoint at karachi](#)
Health State: **ok**
Running Jobs: 0
Total Jobs: 0
Downtime Announcement Info: **No downtime announced yet**
[Detailed raw xml Info >>](#) [Detailed tree Info >>](#)

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UNICORE CIS is configured to query the Instant-Grid Registry

New Features: Commandline Client (UCC)

```
server:3 04:34:20 .ucc # /usr/local/ucc-1.3.0/bin/ucc cis-showallcip
Number of information providers (CIPs) in CIS: 5
#####
1.    CIP URL: https://server:8082/SERVER-SITE/services/CISInfoProvider
2.    CIP URL: https://server:8082/bombay-SITE/services/CISInfoProvider
3.    CIP URL: https://server:8082/shanghai-SITE/services/CISInfoProvider
4.    CIP URL: https://server:8082/delhi-SITE/services/CISInfoProvider
5.    CIP URL: https://server:8082/karachi-SITE/services/CISInfoProvider
```

```
server:3 04:34:36 .ucc # /usr/local/ucc-1.3.0/bin/ucc list-sites
SERVER-SITE https://server:8082/SERVER-SITE/services/TargetSystemService?res=f16e80e0-0318-4c0d-891e-2e742dcc5cb4
delhi-SITE https://server:8082/delhi-SITE/services/TargetSystemService?res=20a144d8-aef1-4781-974e-273e76fbd885
karachi-SITE https://server:8082/karachi-SITE/services/TargetSystemService?res=3e18426a-3763-46e9-aa14-dba2a221dd10
```

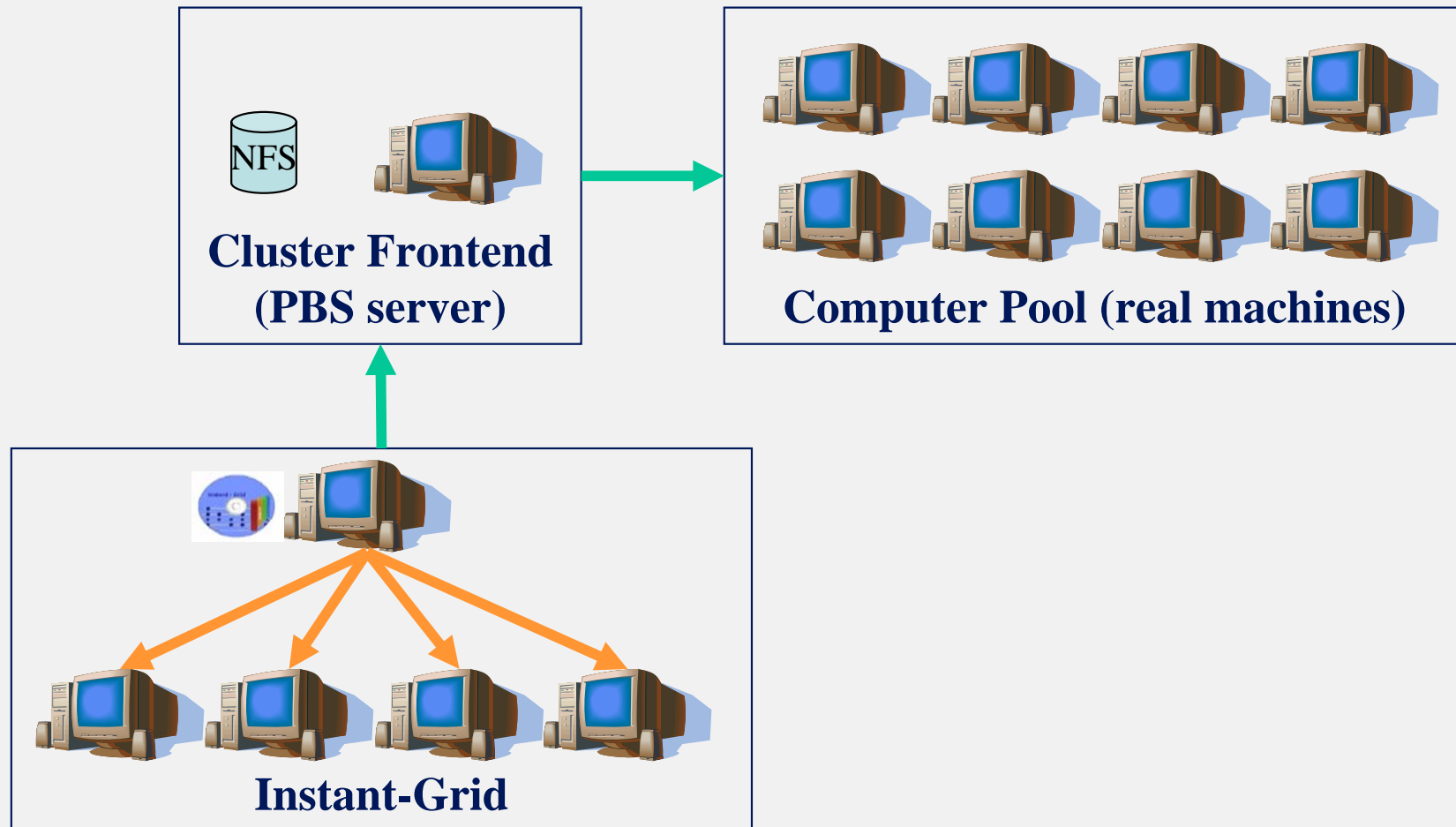
UNICORE Commandline Client with CIS extension

Instant-Grid Use Case: Practical Course (1)

Requirements of the practical course:

- Local trustful environment
- Multiple users
- Students can experiment grid systems at any time

Instant-Grid Use Case: Practical Course (2)



The setup of the practical course at the University of Göttingen

Comparision with UNICORE6 Test Environments

- UNICORE6 Testgrid
 - Limited resource consumption
 - Limited job duration
 - Remote (trust & outside of the domain)

- UNICORE6 Live CD
 - Designed for a single user
 - Single computer

Summary

Instant-Grid provides

- Multi-user configuration
- Automated, multi-hosts deployment of the UNICORE6 grid middleware
- Pre-configured local grid environment for the uninitiated
- Customizable, persistent setup
- All these features without permanent changes

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Link

<http://www.instant-grid.org>