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!

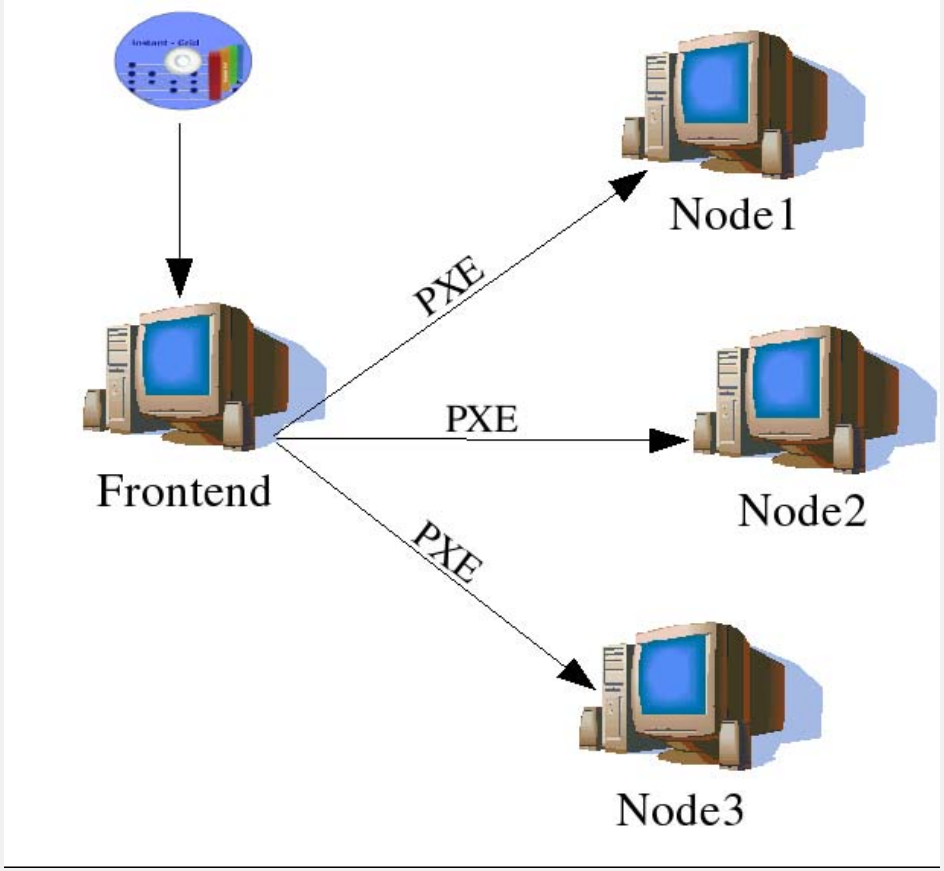
Reaching the Goals – Basic Features of Instant-Grid

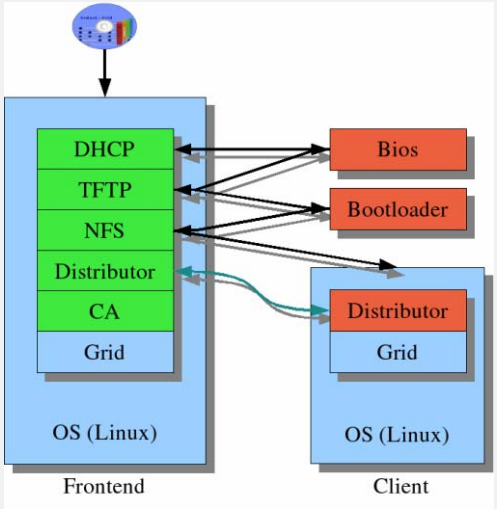
- Automatic configuration at the startup process
  - Network setup
  - Monitoring
  - Security
- Automated configuration at runtime
  - Dynamic discovery
  - User management
- Ready to use features and applications
  - Data management
  - Job management
  - Information service
  - Grid workflow
  - Grid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

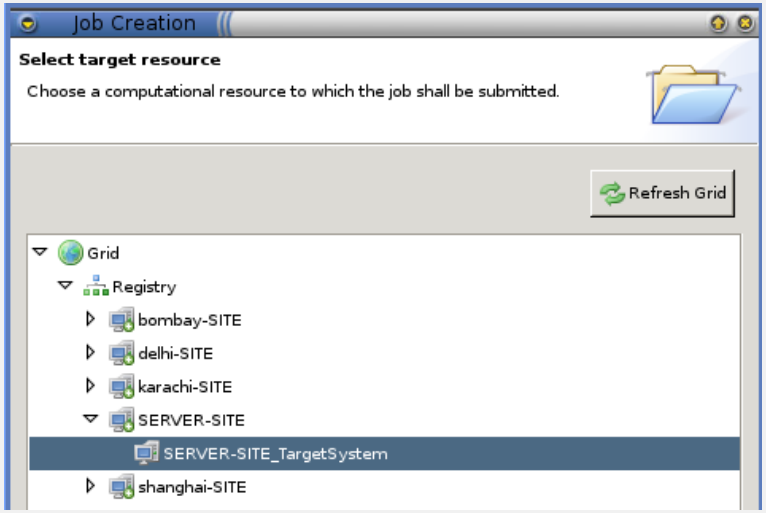
Automatic Configuration at the Startup Process (1)

- 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

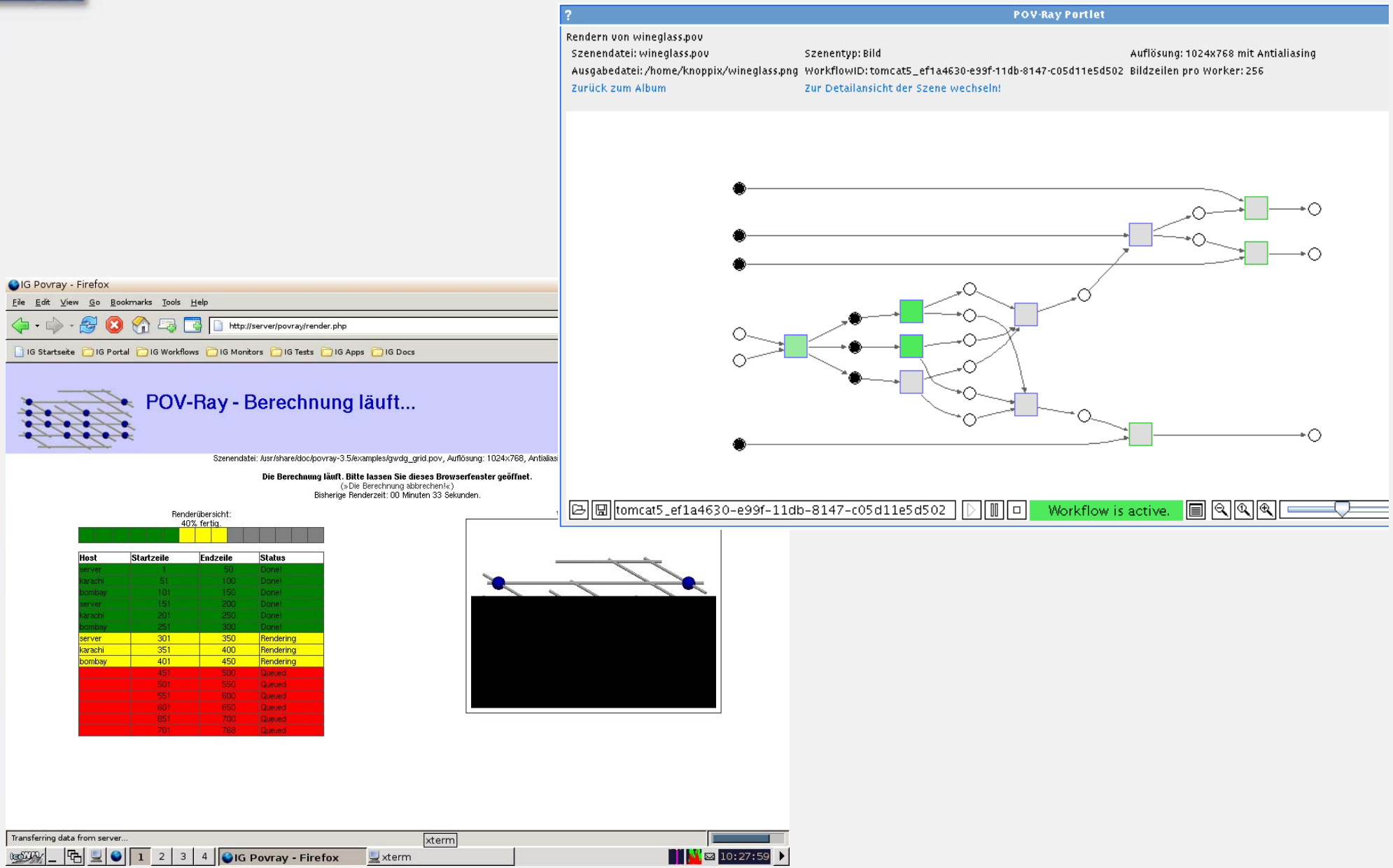
Basic Features: Monitoring with Ganglia

Gmond and gmetad are configured on all nodes dynamically

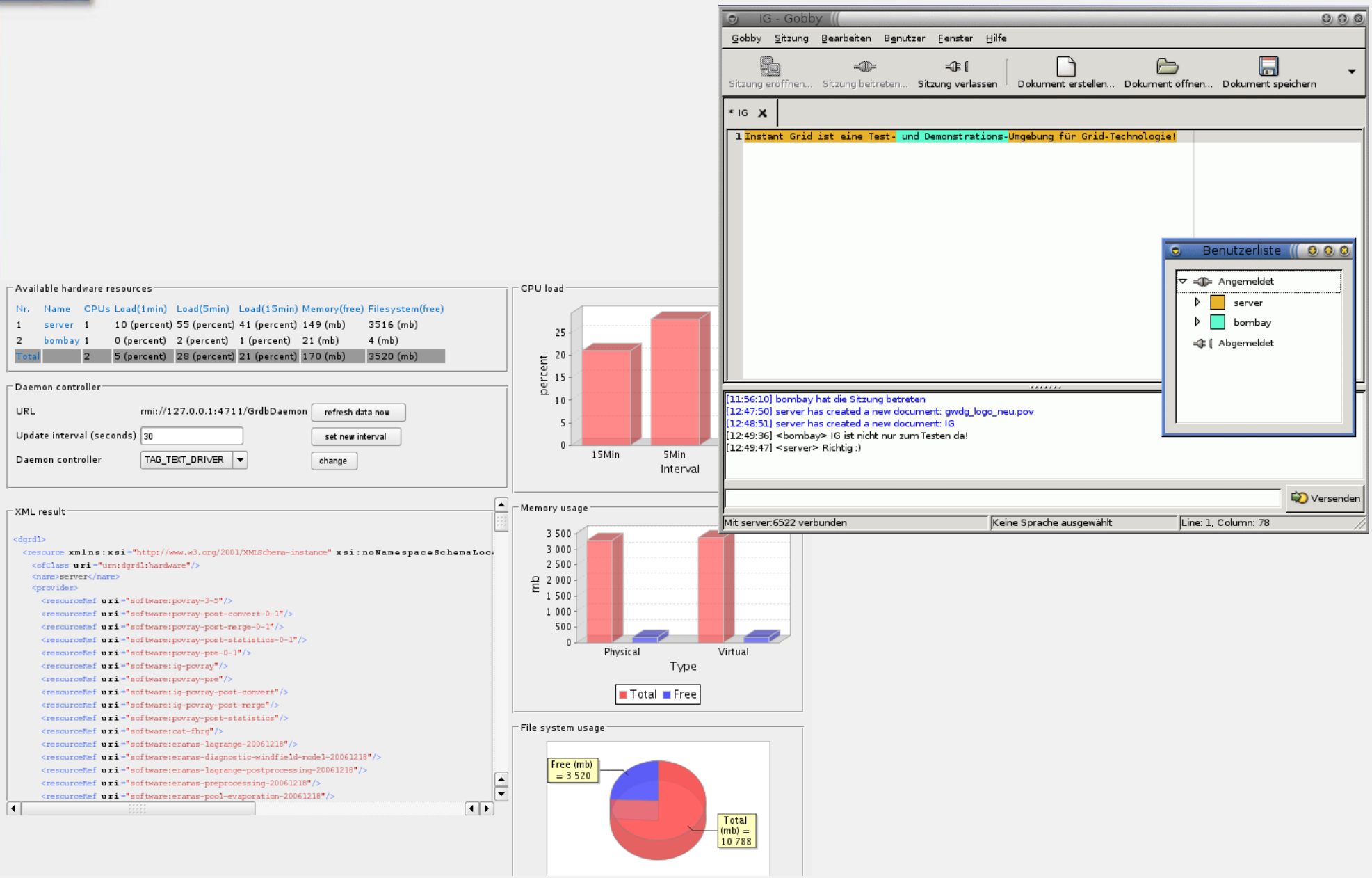
Ready to Use Features and Applications

- 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



Applications: Portal and Collaborative Editor



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 Built)

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

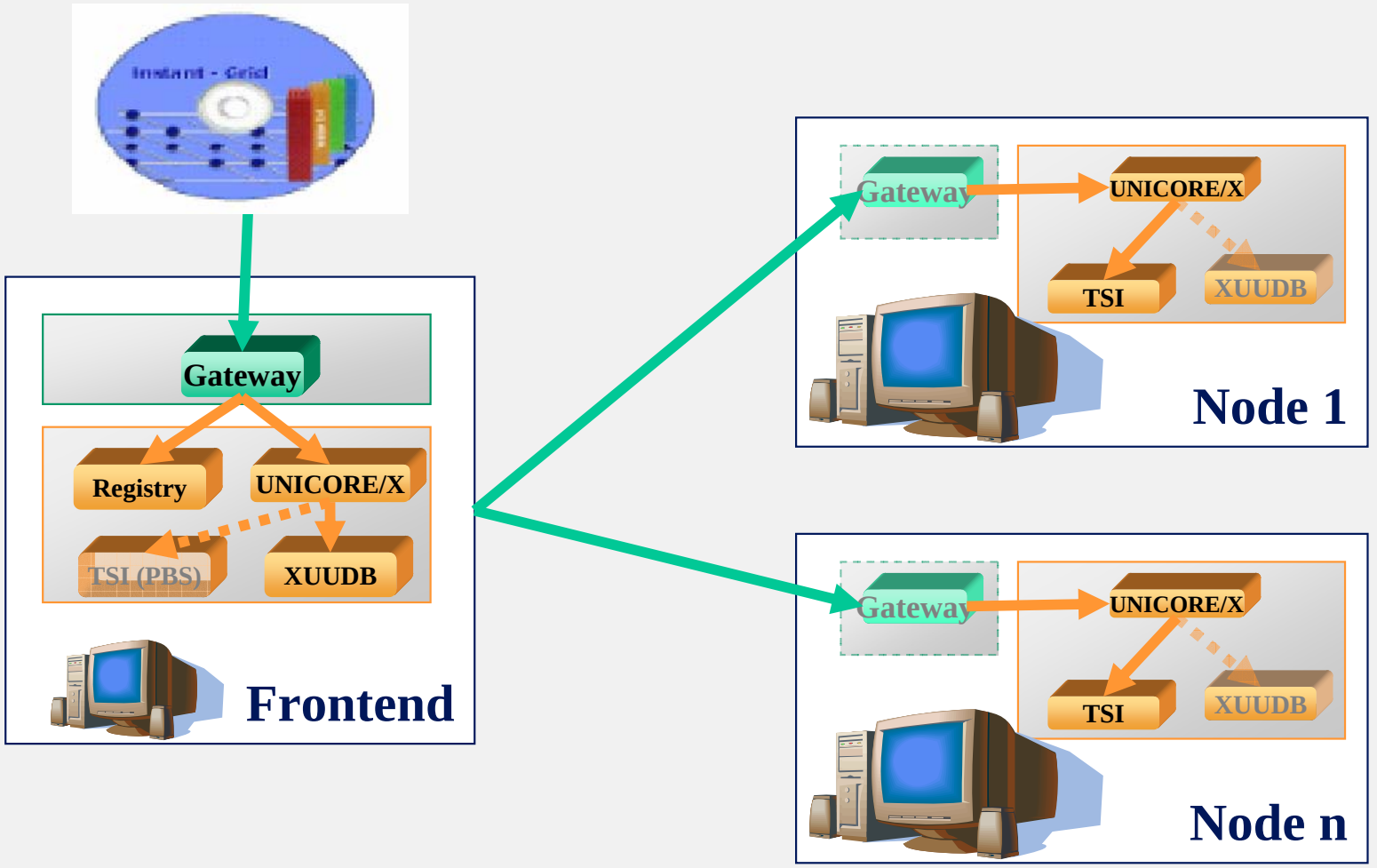
Services configured during the startup (on the frontend):

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

Services configured during the startup (on the clients):

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

New Feature: Dynamically Configured UNICORE6 Services On Every Nodes

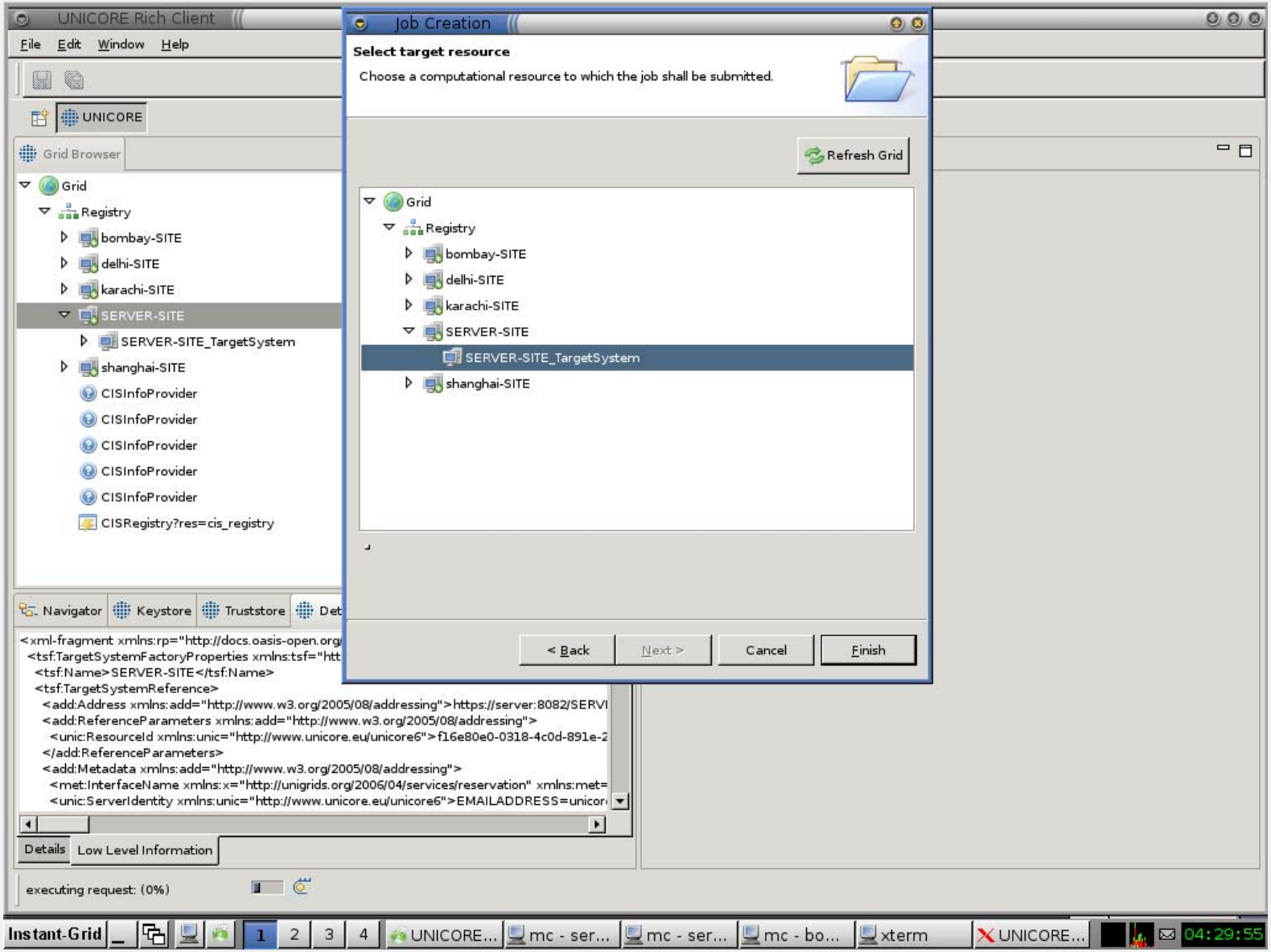


New Features: Security for UNICORE

UNICORE Security Environment of Instant-Grid

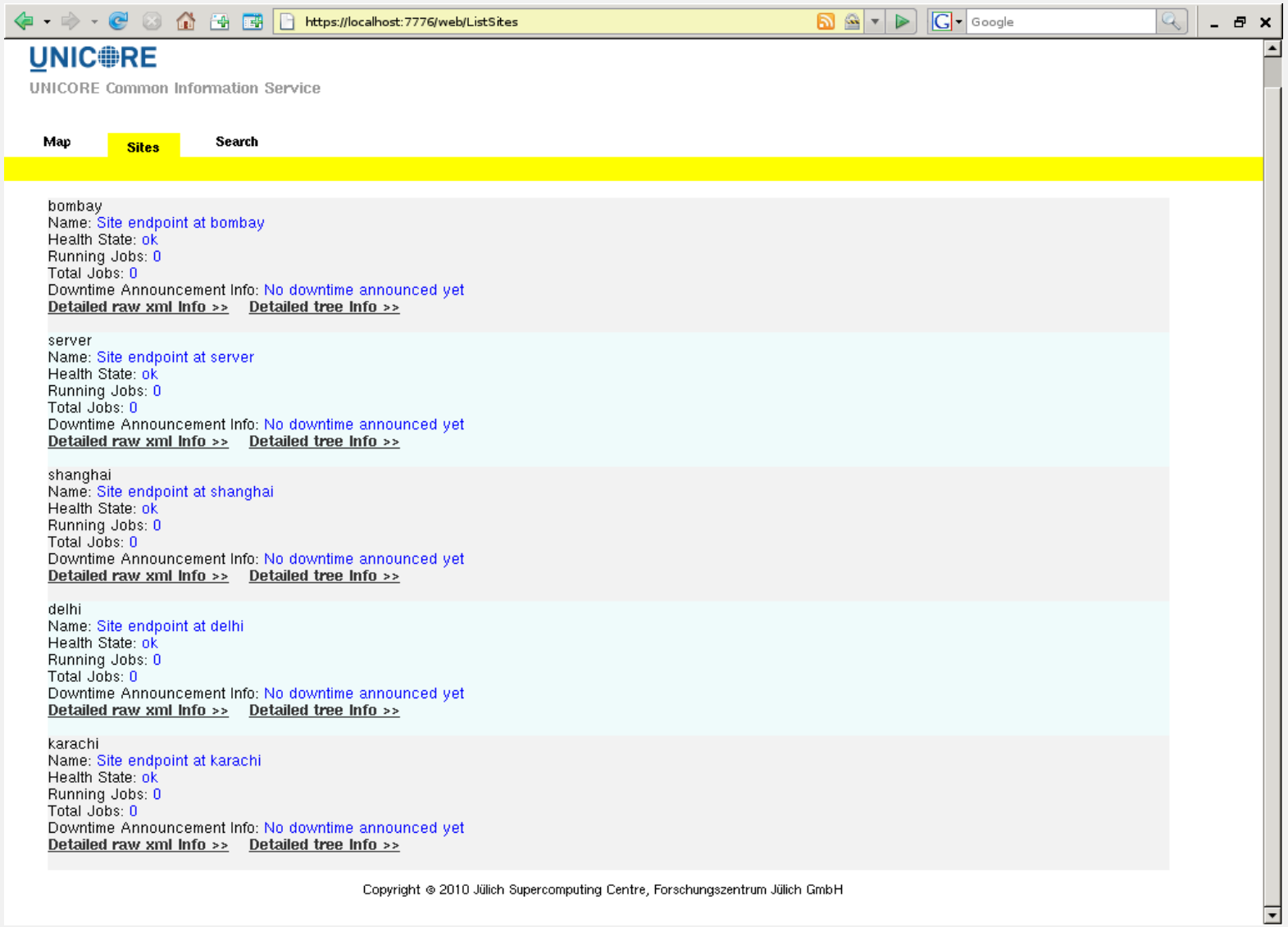
- Based on the X.509 Public Key Infrastructure
- Own Certificate Authority (CA) is initialized on the frontend
  - Issues user and server certificates
  - cacert.pem as a trusted certificate (in UNICORE components' truststore)
- Key- and trust-stores:
  - Created on demand (a new user account is required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

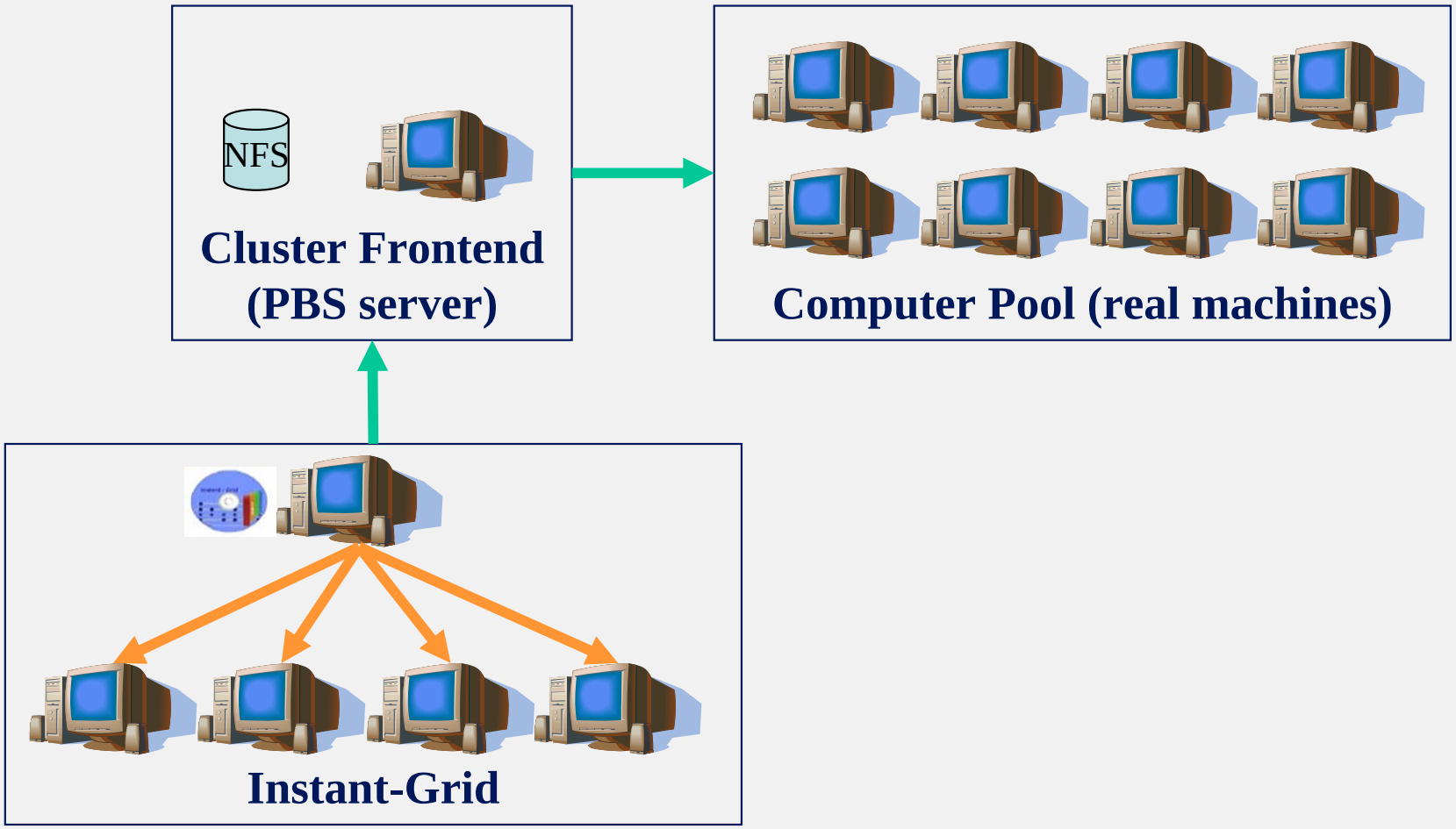
UNICORE Commandline Client with CIS extension

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