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

POV-Ray - Berechnung läuft...

Workflow: povray_for_universe

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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

Node 1

Node n
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 CIS is configured to query the Instant-Grid Registry.
UNICORE Commandline Client with CIS extension

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-2e742dce5cb4
karachi-SITE https://server:8082/karachi-SITE/services/TargetSystemService?res=3e18426a-37f3-46e9-a14c-dba2a221dd10
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
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