A European Grid Technology

http://www.unicore.eu

Achim Streit

Jülich Supercomputing Centre (JSC)
History Lesson

- **UNiform Interface to COmputing Resources**
  - seamless, secure, and intuitive
- Initial development started in two German projects funded by the German ministry of education and research (BMBF)
  - 08/1997 – 12/1999: UNICORE project
    - Results: well defined security architecture with X.509 certificates, intuitive GUI, central job supervisor based on Codine from Genias
    - Results: implementation enhancements (e.g. replacement of Codine by custom NJS), extended job control (workflows), application specific interfaces (plugins)
- Continuous development since 2002 in several EU projects
- Open Source community development since Summer 2004

http://www.unicore.eu
More than a decade of German and European research & development and infrastructure projects

Any many others, e.g.

http://www.unicore.eu
UNICORE – Grid driving HPC

- Used in
  - DEISA (European Distributed Supercomputing Infrastructure)
  - National German Supercomputing Center NIC
  - Gauss Center for Supercomputing (Alliance of the three German HPC centers)
  - PRACE (European PetaFlop HPC Infrastructure) – starting-up
  - But also in non-HPC-focused infrastructures (i.e. D-Grid)

- Taking up major requirements from i.e.
  - HPC users
  - HPC user support teams
  - HPC operations teams

http://www.unicore.eu
UNICORE 6 – www.unicore.eu

- Open source (BSD license)
  - Open developer community on SourceForge
  - Contribution with your own developments easily possible

- Design principles
  - Standards: OGSA-conform, WS-RF compliant
  - Open, extensible, interoperable
  - End-to-End, seamless, secure and intuitive
  - Strong security (X.509, proxy and VO support)
  - Excellent workflow and application support
  - Easy to use clients (graphical, commandline, portal)
  - Easy installation and configuration
  - Support for many operating and batch systems
  - 100% Java 5
UNICORE 6 Architecture

Portal client, e.g. GridSphere

command-line client

Eclipse-based client

GPE application client

Gateway

UNICORE Atomic Services

OGSA

Gateway

UNICORE Atomic Services

OGSA

Service Registry

Target System Interface

Local RMS (e.g. Torque, LL, LSF, etc.)

scientific clients and applications

authentication

emerging standard interfaces

Grid services hosting

job incarnation & authorization

parallel scientific jobs of multiple end-users on target systems

http://www.unicore.eu
Standards in **UNICORE 6**

- **Security**
  - Full **X.509** certificates as base line, **XACML** based access control
  - Support for **SAML**-based VOMS & **X.509** proxies in development
- **Information system, monitoring, accounting**
  - **GLUE 2.0** information service in development (strong interaction with the GLUE WG)
  - **OGSA-RUS** for accounting in development (incl. **UR** for storing)
- **Job management**
  - **OGSA-BES, HPC-P**: creation, monitoring and control of jobs
  - job definition compliant with **JSDL** (+ JSDL HPC ext.)
  - **DRMAA** communication to local resource manager for job scheduling
- **Data management**
  - Fully **OGSA-ByteIO** compliant for site-to-site transfers
  - Web-Services (**WS-RF 1.2, SOAP, WS-I**) stack!
UNICORE 6 Architecture: Focus on Workflow

- Portal client, e.g. GridSphere
- command-line client
- Eclipse-based client

Gateway

Service Registry
UNICORE hosting env.

UNICORE Workflow Engine

UNICORE Tracing Service
UNICORE hosting env.

UNICORE Service Orchestrator

Resource Information Service
UNICORE hosting env.

UNICORE Atomic Services
OGSA-*

XNJS + TSI
UNICORE hosting env.

Local RMS (e.g. Torque, LL, LSF, etc.)

Local RMS (e.g. Torque, LL, LSF, etc.)

UNICORE Atomic Services
OGSA-*

XNJS + TSI
UNICORE hosting env.

Gateway

Authentication

Workflow execution

Brokering and job management

Job execution and data storage

Parallel scientific jobs of multiple end-users on target systems

Scientific clients and applications

http://www.unicore.eu
UNICORE 6 Status

- **6.0** released August 10, 2007
  - Web services / WS-RF core
  - Basic services (registry, jobs, files)
  - XNJS job execution management engine
  - Graphical GPE Application client
  - Flexible security framework using X.509, SAML, XACML
  - Standards: WS-RF 1.2, JSDL 1.0, OGSA ByteIO
  - Extensible Command-line client and scripting tools

- **6.0.1** released December 23, 2007
  - Fast https-based file transfer, bug fixes

- **6.1** released March 20, 2008
  - Enhanced workflow support
  - Rich client based on Eclipse
  - Interoperability components

http://www.unicore.eu
Using UNICORE 6

GPE Application Client

Rich Client for Workflows (based on Eclipse)

UCC command-line client

Programming API

soon to be released

http://www.unicore.eu
Rich Client based on Eclipse
GPE Application Client
UCC – Commandline Client
Accessing UCC through emacs

--- date.u  All
[ucc run] Registry PING
Do
[ucc run] Output goes to
[ucc run] Output goes to
[ucc run] Synchronous process
[ucc run] Adding Job id
[ucc run] Read job from </user/home/robreu/unicore/ucc_samples/date.u>
[ucc run] Job started.
RUNNING
SUCCESSFUL exit code: 0
[ucc run] Exporting Uspace file 'stdout' to '/tmp/eca14fd-c9c7-4115-a17e-37f1ba25fb62.stdout'
/tmp/eca14fd-c9c7-4115-a17e-37f1ba25fb62.stdout
[ucc run] Exporting Uspace file 'stderr' to '/tmp/eca14fd-c9c7-4115-a17e-37f1ba25fb62.stderr'
/tmp/eca14fd-c9c7-4115-a17e-37f1ba25fb62.stderr

--- UCC finished at 2008-03-27T13:08:59+0100

-u:xx ucco* Bot (21.33) (ucc output)----13:10 0.22 Mail-----------------
Quit
Seamless installation of server components

tar.gz based installer is also available
... and the UNICORE services even run under Windows XP
UNICORE in use
some examples
Core D-Grid sites committing parts of their existing resources to D-Grid
  - Approx. 700 CPUs
  - Approx. 1 PByte of storage
  - UNICORE is installed and used

Additional Sites received extra money from the BMBF for buying compute clusters and data storage
  - Approx. 2000 CPUs
  - Approx. 2 PByte of storage
  - UNICORE (as well as Globus and gLite) is installed as soon as systems are in place
Consortium of leading national HPC centers in Europe
Deploy and operate a persistent, production quality, distributed, heterogeneous HPC environment
UNICORE as Grid Middleware
On top of DEISA’s core services:
- Dedicated network
- Shared file system
- Common production environment at all sites
Used e.g. for workflow applications

IDRIS – CNRS (Paris, France), FZJ (Jülich, Germany), RZG (Garching, Germany), CINECA (Bologna, Italy), EPCC (Edinburgh, UK), CSC (Helsinki, Finland), SARA (Amsterdam, NL), HLRS (Stuttgart, Germany), BSC (Barcelona, Spain), LRZ (Munich, Germany), ECMWF (Reading, UK)
Interoperability and Usability of Grid Infrastructures

- Provide key software components for building e-infrastructures
- Initial focus on providing common interfaces and integration of major Grid software infrastructures
  - OGSA-DAI, VOMS, GridSphere, OGSA-BES, OGSA-RUS
  - UNICORE, gLite, Globus Toolkit, CROWN
- Infrastructure Integration (e.g. Secure Job Submissions)

http://www.unicore.eu
Provide an integrated Grid solution for workflow-centric, complex applications with a focus on data, semantics and knowledge

- Provide decision support services for risk assessment, toxicity prediction, and drug design
- End user focus
  - ease of use
  - domain specific tools
  - “hidden Grid”
- Based on UNICORE 6

http://www.unicore.eu
Usage in the National German HPC center NIC

- About 450 users in 200 research projects
  - ¼ of them uses UNICORE
- Access via UNICORE to
  - IBM p690 eSeries Cluster (1312 CPUs, 8.9 TFlops)
  - JUBL (16384 CPUs, 45.8 TFlops)
  - SoftComp Cluster (264 CPUs, 1 TFlops)
  - JUGGLE (176 cores, 845 GFLops)
  - Cray XD1 (120 CPUs + FPGAs, 528 GFlops)

http://www.unicore.eu
UNICORE

join the developer community, software, source code, documentation, tutorials, mailing lists, community links, and more:

http://www.unicore.eu