The UNICORE Grid Software Past, Present, and (a Glimpse on) the Future

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Overview

Past

History of UNICORE

Present

- What is UNICORE?
- From Project Results to Production Quality

Future

Unicore/GS



September 1996

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History – How it all began ...

- 2nd 6th September 1996: summer school in Jülich about "partial differential equations in numerics and applications"
- 3rd September 1996: round table with users, supercomputer centres, competence centres, vendors
 - discussion: "what prevents an efficient use of distributed supercomputers?"
 - results: propose solutions
- December 1996: UNICORE project idea submitted to BMBF
- Spring 1997: UNICORE project proposal developed and submitted to BMBF
- Ist of August 1997: start of the German UNICORE project
 - until 31st of December 1999
 - grant 01 IR 703



Uniform Interface to Computing Resources

- Goals
 - seamless, secure, intuitive
 - use of existing and future-oriented technologies
 - no change to existing procedures in the centers
 - prototype within two years
- Consortium (* without funding, ** joined later)
 - developers: Genias, Pallas
 - centers: Berlin (ZIB), Jülich (ZAM), Karlsruhe (RUKA), München (LRZ), Stuttgart (RUS)
 - competence center: Paderborn (PC²)
 - users: DWD, ECMWF*, debis, INPRO*, fecit*
 - vendors*: Hitachi**, HP**, IBM, NEC, SGI, SNI/Fujitsu, Sun**



Results

- well defined security architecture with X.509 certificates and extensible security mechanisms (sso)
- Intuitive usage via a graphical interface (AWT 1.1.5) and web browser (Netscape 4.05)
- central job supervisor based on Codine from Genias
- But
 - rudimental application specific support
 - no metacomputing support
 - only limited number of machines and batch subsystems supported
 - no complete product for production with support, involvement of vendors

UNICORE Plus

Goals

- continuation of UNICORE development until December 2002 towards a Grid infrastructure together with a computing portal
- hardening and maturing for operation in production
- integration of new functions
- support for more systems
- deployment at the participating sites
- Consortium
 - Jülich (FZJ, coordinator), Stuttgart (RUS), Berlin (ZIB), Munich (LRZ), Karlsruhe (RUKA), Paderborn (PC²), Dresden (TUD), DWD, Pallas, fecit
- Duration: 1st of January 2000 31st December 2002
 - grant 01 IR 001

UNIC RE Areas of Development

- Implementation Enhancements
 - replacement of applet by application
 - replacement of Codine by custom NJS
 - replacement of Jigsaw https server by UNICORE Gateway
- Data Management Enhancements
 - fast and secure file transfer, access to archives
- Extended Job Control
 - job chains, workflows, conditional execution (if-then-else)
- Application Specific Interfaces
 - custom build application interfaces, generalized plug-in toolkit
- Metacomputing
- Resource Modeling



12th of October 2005



UNIC

- A vertically integrated Grid middleware system
- Provides seamless, secure, and intuitive access to distributed resources and data
- Used in production and projects worldwide
- Features
 - intuitive GUI with single sign-on
 - X.509 certificates for AA and job/data signing
 - only one opened port in firewall required
 - workflow engine for complex multi-site/multi-step workflows
 - extensible application support with plug-ins

- matured job monitoring
- interactive access with UNICORE-SSH
- integrated secure data transfer
- resource management
- full control of resources remains
- production quality, ...



UNICORE Client

	Standard Output Standard Error Details AJO view
Preparation	This script was created and executed by Unicore
workflow-test [17:00:28 04/25/2005]	UNICORE - start of user output on stdout
🚰 import	
📰 script1	sp074 @ Mon Apr 25 17:00:20 DFT 2005
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- E script3	This script was created and executed by Unicore
– 🇖 file-transfer2	UNICORE - start of user output on stdout
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sfb <njs></njs>	Job Name: script3 EXECUTESCRIPTTASK 1114441228066 216
* A ZAM546 Test	Queue Date: Mon Apr 25 17:02:54 2005
DEISA_Cineca	Dispatch Time: Mon Apr 25 17:03:03 2005 Cmd: /tmnomfs/unicore/unicore/usnace 56b37dd8/TSI team file 2388172
CINECA SP4 «NJS»	Out: /tmpgpfs/unicore/unicore/outcome_56b37dd8/AA56b37e0d/AA56b37e15/AA56b37e13//stdout
우 <u>초</u> workflow-test [17:00:28 04/25/2005]	Err: /tmpgpfs/unicore/unicore/outcome_56b37dd8/AA56b37e0d/AA56b37e15/AA56b37e13//stderr
🗢 🚰 import	Ulass: tl Running Host: zabir001.idris.fr
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👁 🗖 file-transfer	Step System Time: 00:00:00.000000
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IDRIS ZAHIR <njs></njs>	
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SARA ASTER <njs></njs>	
DEISA_Idris	
DEISA_RZG	Save

hands on



UNICORE-SSH

Uses standard UNICORE security mechanisms to open a SSH connection through the standard SSH port



What is UNICORE and what is it not? A Google's perspective

www.umiccore.orgm www.common.net CRAY **INIC UNIC**®RE UNICORE itaru.s.kanazawa-u.ac.jp/unicore/ UNICORE (Uniform Interface to Computing Resources) offers a ready-to-run Grid system M OR including client and server software. UNICORE makes distributed computing and data sources available in a seamless and secure way in intranets and the internet 🔳 リロード 🔳 新規 🔳 編集 🔳 凍結 🔲 差分 🔳 添付 🔟 トップ 🗊 一覧 📄 単語検索 回 最終更新 🔳 バックアップ 🔳 へルさ Menu UNICORE UNICOREとは、グリッドミドルウェアです。クライアントは手元のパンコンにUNICORE Clientをインストールし、UNICOREサー UNICORE FrontPage バのGatewayにアクセスすることで、グリッド環境を利用することができます。 グリッド環境を提供する人は、デスクトップバソコンやサーバなどにUNICOREサーバのNJS・TSIをインストールし計算機資源と します。そして、Firewall上またはFirewallの外にGatewayを設置し、そこからクライアントにグリッド環境を提供します。 Tago Lab.- Kanazawa Univ. UNICORE ➤ UNICORE Forum e.V. Client enter New: The UNICORE 最新の5件 Gateway Firewall 2005-05-24 UNICORE FrontPage Client 4.1.5 (Windows) NJS NJS NJS www.unid 2000) Client 4.1.5 のインストー UNIC ル(Windows 2000) TSI TSI TSI ▶ Client 4.1.1 のインストー ル(RedHat 7.2) Client 3.6.6 Windows 2000/XP) UNICOREサーバのインストールと設定 Accueil Expertise Références インストール Associés Télécharger En prolongement de ses interventions de conseil, Unicore organise des EVENEMENTS axés sur des Retou problématiques communes à ses interlocuteurs

UNICORE Forum e.V.

- Founded by developers, leading European HPC centres, and supporting hardware vendors as a non-profit association
- Tasks
 - foster the distribution and use of UNICORE, organize workshops, support presentations at conferences, publish and maintain the specifications, coordinate further development, certify implementations and extensions







- Open Source under BSD license
- Supported by FZJ
 - integration of own results and from other projects
 - release management
 - problem tracking
 - CVS, mailing lists
 - documentation
 - assistance
- Viable basis for many projects
 - DEISA, VIOLA, UniGrids, D-Grid, NaReGI
- http://unicore.sourceforge.net



∇ UNICORE at SourceForge		
 Project page Download page CORE Client-side Client Server-side Gateway NJS UUDB TSI Job Modeling AJO OPTIONAL Client-side Client library Client library Client taide List All Jobs (LAJ) Plugin Loader Broker Unicore Broker EXPERIMENTAL 		
 Tracker page Mailing list page CVS page Project Statistics 		
✓ Installation		
Documentation		
▷ Links		

UNICORE at SourceForge

The UNICORE
Project page offers you the entry point to all features SourceForge provides for hosted projects. Selected pages which we think are most important in daily work are accessible via the menu to the left and briefly described below.

Selected p	ages	
Project pag	ge The entry point to all SourceForge features available for the UNICORE project.	
Download	page The root download page. The quick links to single packages are described below.	
Tracker pa	ge Trackers are used to submit and discuss bugs, support requests, patches and feature requests related to the UNICORE project. A separate page for each tracker catagory is accessible via this link. We encourage you to use trackers for comments, requests, etc. concerning this web site, too.	
Mailing list	page All mailing lists linked to this project including archives can be found here.	
CVS page	You want to get the latest development version of the source code? Then check the CVS page out.	
Ouick links	to software packages	
decribed and, component. Client	If existent, a link points to an in-depth description of the respective	
Gateway	The Gateway is the single entry point for all UNICORE connections into the USite.	
NJS	The Network Job Supervisor manages all jobs submitted to a UNICORE Vsite. The NJS package contains UNICORE's information service, the Incarnation Database (IDB).	
UUDB	User authorization is the job of the UNICORE User Database.	
TSI	The Target System Interface accepts incarnated job components from the NJS and passes them to the local resource management system for execution.	
AJO	The D Abstract Job Object class libary provides the foundation for job and workflow modeling and for the protocol between UNICORE clients and servers.	
Client library	The Arcon Java client library provides the means to integrate UNICORE client services in portals, applications, etc.	
Client plugins	The Client's plugin concept provides the means to integrate applications into a UNICORE Grid without source code modifications to the application. A large variety of plugins is already available.	
Unicore Broker	Maintained as a separate project, please visit http://uombroker.sourceforge.net/	

From Project Results to Production Usage



Production Usage at the John von Neumann Institute for Computing



- 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)







Cray XD1 (72+ CPUs)
IBM BlueGene/L (2048 CPUs, 5.7 TFlops)

OpenMolGRID Open Computing GRID for Molecular Science and Engineering

Workflow Automation & Speed-up

Automate, integrate, and speed-up drug discovery in pharmaceutical industry



UNICORE Client		
File Job Preparation Job Monitoring Settings Extension	s_ <u>H</u> elp	
	Standard Output Standard Error Details AJO view	
☐ Job Preparation ♥	This script was created and executed by Unicore UNICORE - start of user output on stdout Wed Sep 28 09:53:46 CEST 2005 Linux zam461 2.6.8-24.16-smp #1 SMP Thu Jun 2 12:09:57 UTC 2005 1686 1686 1386 GNU/Linux printenv grep GLOBUS GLOBUS_LOCATION=/opt/globus/gt2_4_3 GLOBUS_GRAM_MYJOB_CONTACT=URLx-nexus://zam461.zam.kfa-juelich.de:40188/ GLOBUS_GRAM_JOB_CONTACT=https://zam461.zam.kfa-juelich.de:40187/21951/1127894026/ UNICORE - end of user output on stdout	
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hands on	20 Forschungszentrum Jülich	



Consortium of Leading National Supercomputer Centres in Europe

Goal

- Ideploy and operate a persistent, production quality, distributed, heterogeneous, and multi-terascale supercomputing environment
- UNICORE is used as production Grid middleware





Workflow Application with UNICORE Global Data Management with GPFS







UNICORE Usage in other Projects



- UNICORE as basic middleware for research and development
- Development of UNICONDORE interoperability layer (UNICORE ↔ CONDOR)
- Access to about 3000 CPUs with approx. 17 TFlops peak in the NaReGI testbed



- UNICORE is used in the Core-D-Grid Infrastructure
- Development of tools for (even) easier installation and configuration of client and server components



- Broader vision of interoperability between different Grid middleware infrastructures needed
- Goals
 - develop next generation of UNICORE called Unicore/GS based on OGSA and compliant with WSRF
 - develop generic software components for visualization and steering, device monitoring and control, and access to distributed data and databases
 Research Center Jülich (project manager)
 - matured NJS functions are transformed into Atomic, Advanced, and Higher Level Services and Client Frameworks
 - actively influence upcoming Grid and Web Services standards









Uniform Access to Grid Services

Unicore/GS Architecture







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From Production UNICORE to Unicore/GS



Summary

- establishes a seamless access to Grid resources and data
- designed as a vertically integrated Grid Middleware
- provides matured workflow capabilities
- used in production at NIC and in the DEISA infrastructure
- available as Open Source from http://unicore.sourceforge.net
- used in research projects worldwide
- continuously enhanced by an international expert team of Grid developers
- currently transformed in the Web Services world towards OGSA and WSRF compliance