



omii europe
open middleware infrastructure institute



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PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the consortium (including the Commission Services)	
CO	Confidential, only for members of the consortium (including the Commission Services)	

Document Control Sheet

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Executive Summary

The NA2.3 milestone of the NA2 activity is a directory of world-wide Grid initiatives that is to be published on the website. The purpose of this milestone is to provide potential users an unbiased repository of worldwide grid initiatives that presents general information about the grid initiative, the main features of the current middleware used and the relevant e-infrastructures. Additionally, this document contains links to related sites for a reader interested in getting more information. This directory contains two lists - Middleware and E-Infrastructures - which will enable potential users to compare the key features and attributes of each grid initiative before making a choice.

This document is also made available on the OMII-Europe project website (<http://omii-europe.org>).

1. Middleware

OMII-Europe is an EU project which has been established to source key software components for Grid applications and to ensure that these components can interoperate across heterogeneous Grid middleware platforms. Three grid middleware platforms are chosen as the primary focus of OMII-Europe. These are gLite, Globus, and UNICORE. Additionally, OMII-Europe also works closely with OMII-UK and engages with the project's Chinese partners in relation to the CROWN platform.

The following table presents a comparison of the middleware platforms. In order to provide an unbiased repository of worldwide grid initiatives, some middleware platforms external to OMII-Europe have been included too. The details of each middleware can be found in Appendix A.

Table 1 A comparison of the properties of the middleware platforms

Name	Status	Version	Release Date	Web Service Based	Open Source	O/S	Main Function
Within OMII-Europe							
gLite	Active	3.1	06/2007	Yes	Yes	Scientific Linux 4	Job management; Data management; Job event tracking; Information and Monitoring; Service discovery; Security; Workload management;
Globus	Active	4.0.6	01/2008	Yes	Yes	For C components: Unix(Linux); For Java-only portions: any system;	Resource monitoring; Discovery; Management; Security; File management;
UNICORE	Active	6.0.1	11/2007	Yes	Yes	Unix, Windows	Job preparation; Job management; Job monitoring; Data management; Application support; Automation of work; Interactive access;
CROWN	Active	2.5	05/2006	Yes	Yes	Linux, Windows	Resource describing and publishing; Automatic service discovering and interoperating;
OMII-UK Distribution	Active	3.4.2	11/2007	Yes	Yes	Client: Linux, Apple OSX, Windows XP SP2 (client only); Server: Linux, Apple OSX;	Job submission and monitoring service; Workflow services; Data access and integration service; UDDI registry service; Reliable messaging;

Name	Status	Version	Release Date	Web Service Based	Open Source	O/S	Main Function
External to OMII-Europe							
NorduGrid middleware (ARC)	Active	v0.6.1	10/2007	Yes	Yes	Debian, Fefora, Mandrake, Redhat, SuSE	Information services; Resource discovery and monitoring; Job submission and management;
GRIA	Active	5.2	12/2007	Yes	Yes	Client: any system which is capable of running Java5.0 (1.5.0) or later; Server: Linux, Windows XP;	Management of billing accounts; Resource allocations; Data storage; Job execution;

2. E-Infrastructure

2.1 A general comparison of e-Infrastructures

A growing number of e-infrastructures have deployed one or more of the middleware distributions supported by OMII-Europe, including EGEE, NGS, Teragrid, CROWNgrid, and D-Grid. The following table presents a comparison of the key features of some e-Infrastructures. The details of each e-Infrastructure can be found in Appendix B.

Table 2 A brief comparison of some e-infrastructures

Name	Site	Status	CPU	Storage	Public/Private	Level
EGEE	240	Operational; EGEE II is under construction	41,000	5 Petabytes (5 million Gigabytes)	Public	EU
NGS	4 core sites and 6 partner sites	Operational; NGS2 is now in production	512	162TB	Public	UK
TeraGrid	11	Operational	104,632	More than 30 Petabytes	Public	US
CROWNgrid	89	Operational	235	67.5TB	Public	CN
D-Grid	9	Operational	5,534	Unknown	Public	DE


Appendix A

A.1 Middleware Details (Inside OMI-Europe)

A.1.1 gLite



Name	gLite
Middleware Logo	
Organisation	EGEE project
Organisation Logo	
License	EGEE Software License http://public.eu-egee.org/license/license2.html
Status	Active
Current Version	3.1
Date of Last Release	June 2007
Web Service	Web Service Based
Source Type	Open Source
Home Page	http://glite.web.cern.ch/glite/
Download	http://glite.web.cern.ch/glite/packages/R3.1
Client/Server O/S	Scientific Linux 4
Function	Job management, data management, accounting, job event tracking, information and monitoring, service discovery, security, workload management
Description	gLite is the next generation middleware for grid computing. Born from the collaborative efforts of more than 80 people in 12 different academic and industrial research centres as part of the EGEE Project, gLite provides a bleeding-edge, best-of-breed framework for building grid applications.

A.1.2 Globus

Name	Globus
Middleware Logo	
Organisation	The Globus alliance
Organisation Logo	
License	Apache Public License, Public License – version 3, Third Party Licenses http://www.globus.org/toolkit/legal/4.0
Status	Active
Current Version	4.0.6



Date of Last Release	January 2008
Web Service	Web Service Based
Source Type	Open Source
Homepage	http://www.globus.org/toolkit/
Download	http://www.globus.org/toolkit/downloads/4.0.6
Client/Server O/S	For C components: Unix(Linux); For Java-only portions: any system;
Function	Resource monitoring, discovery, management, security, file management
Description	<p>The open source Globus Toolkit is a fundamental enabling technology for the "Grid," letting people share computing power, databases, and other tools securely online across corporate, institutional, and geographic boundaries without sacrificing local autonomy. The toolkit includes software services and libraries for resource monitoring, discovery, and management, plus security and file management. In addition to being a central part of science and engineering projects that total nearly a half-billion dollars internationally, the Globus Toolkit is a substrate on which leading IT companies are building significant commercial Grid products.</p> <p>The toolkit includes software for security, information infrastructure, resource management, data management, communication, fault detection, and portability. It is packaged as a set of components that can be used either independently or together to develop applications. Every organisation has unique modes of operation, and collaboration between multiple organisations is hindered by incompatibility of resources such as data archives, computers, and networks. The Globus Toolkit was conceived to remove obstacles that prevent seamless collaboration. Its core services, interfaces and protocols allow users to access remote resources as if they were located within their own machine room while simultaneously preserving local control over who can use resources and when.</p> <p>The Globus Toolkit has grown through an open-source strategy similar to the Linux operating system's, and distinct from proprietary attempts at resource-sharing software. This encourages broader, more rapid adoption and leads to greater technical innovation, as the open-source community provides continual enhancements to the product.</p> <p>Essential background is contained in the papers "Anatomy of the Grid" by Foster, Kesselman and Tuecke and "Physiology of the Grid" by Foster, Kesselman, Nick and Tuecke.</p>

A.1.3 UNICORE



Name	UNICORE
Middleware Logo	
Organisation	UNICORE project
Organisation Logo	
License	BCD License
Status	Active
Current Version	UNICORE6 (6.0.1)
Date of Last Release	November 2007
Web Service	Web Service Based
Source Type	Open Source
Home Page	http://www.unicore.eu
Download	http://www.unicore.eu/download/unicore6
Client/Server O/S	Unix, Windows
Function	Job preparation, job management, job monitoring, data management, application support, automation of work, interactive access

Description	UNICORE (Uniform Interface to Computing Resources) offers a ready-to-run Grid system including client and server software. UNICORE makes distributed computing and data resources available in a seamless and secure way in intranets and the internet.
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A.1.4 CROWN

Name	CROWN
Middleware Logo	
Organisation	CROWN, China
Organisation Logo	
License	Freely Available
Status	Active
Current Version	2.5
Date of Last Release	May 2006
Web Service	Web Service Based
Source Type	Open Source
Home Page	http://www.crown.org.cn/en/
Download	http://www.crown.org.cn/en/download/download.jsp
Client/Server O/S	Linux, Windows
Function	Service management, e.g. resource describing and publishing, automatic service discovering and interoperating
Description	CROWN, short for China Research and Development environment Over Wide-area Network, is a grid test bed to facilitate scientific activities in different disciplines. It is a middleware being produced by a number of institutions in China.



A.1.5 OMII-UK Distribution

Name	OMII-UK Distribution
Middleware Logo	
Organisation	OMII-UK
Organisation Logo	
License	BCD License
Status	Active
Current Version	3.4.2
Date of Last Release	November 2007
Web Service	Web Service Based

Source Type	Open Source
Home Page	http://www.omii.ac.uk/
Download	http://www.omii.ac.uk/downloads/
Client/Server O/S	Client: Linux distributions, Windows XP SP2 (client only) and Apple OSX; Server: Linux distributions and Apple OSX;
Function	Job submission and monitoring service, workflow services, data access and intergration service, UDDI registry service, reliable messaging
Description	OMII-UK offers a sustained, well-engineered, interoperable, documented and supported set of easily-used integrated middleware services, components and tools. Users of the OMII-UK software distributions can be assured of quality software through open publication of its software development process, software grading and full test results for all software. The OMII-UK intends to lead the evolution of Grid Middleware through an open consultative process with major software vendors and major UK, EU and US projects.

A.2 Middleware Details (Outside OMII-Europe)

A.2.1 NorduGrid middleware (ARC)

Name	The NorduGrid middleware (or Advanced Resource Connector, ARC)
Middleware Logo	
Organisation	The NorduGrid Collaboration
Organisation Logo	
License	GPL License http://www.nordugrid.org/middleware/license.html
Status	Active
Current Version	v0.6.1
Date of Last Release	October 2007
Web Service	Web Service Based
Source Type	Open Source
Home Page	http://www.nordugrid.org/
Download	http://ftp.nordugrid.org/download/
Client/Server O/S	Debian, Fefora, Mandrake, Redhat, SuSE
Function	Information services, resource discovery and monitoring, job submission and management, brokering and data management and resource management
Description	<p>The NorduGrid middleware (or Advanced Resource Connector, ARC) is an open source software solution distributed under the GPL license, enabling production quality computational and data Grids.</p> <p>ARC provides a reliable implementation of the fundamental Grid services, such as information services, resource discovery and monitoring, job submission and management, brokering and data management and resource management. Most of these services are provided through the security layer of the GSI. The middleware builds upon standard Open Source solutions like the OpenLDAP, OpenSSL, SASL and Globus Toolkit libraries.</p> <p>ARC is designed to be a scalable, non-intrusive and portable solution. The development is user- and application-driven, with the main requirements being those of performance, stability, usability and portability. The middleware can be</p>

	built on any platform where the external software packages (like GT libraries) are available.
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A.2.2 GRIA

Name	GRIA (Grid Resources for Industrial Applications)
Middleware Logo	
Organisation	University of Southampton IT Innovation Centre
Organisation Logo	
License	LGPL http://www.gria.org/termsandconditions.php
Status	Active
Current Version	5.2
Date of Last Release	December 2007
Web Service	Web Service Based
Source Type	Open Source
Home Page	http://www.gria.org
Download	http://www.gria.org/downloads/download-page
Client/Server O/S	Client: any system which is capable of running Java 5.0 (1.5.0) or later; Server: Linux, Windows XP;
Function	Management of billing accounts, resource allocations, data storage, job execution, relational database access and distributed workflows
Description	<p>GRIA is Grid middleware which enables use of the Grid in a secure, interoperable and flexible manner.</p> <p>GRIA makes use of business models, processes and semantics to allow resource owners and users to discover each other and negotiate terms for access to high-value resources.</p> <p>GRIA implements an overall business process to find, procure and utilise resources capable of carrying out high-value, expert-assisted computations.</p> <p>By focusing on business processes and the associated semantics, GRIA enables users to provision for their computational needs more cost effectively, and develop new business models for some of their services.</p> <p>Services from different providers can be combined together to create applications using a simple and easy-to-use API.</p>

Appendix B


B.1 E-Infrastructure Details

B.1.1 EGEE


Abbreviation	EGEE
Name	Enabling Grids for E-science
Logo	
Site	240
Status	Operational; EGEE II is under construction
CPU	41,000
Storage	5 Petabytes (5 million Gigabytes)
Public/Private	Public
Level	EU
Home Page	http://www.eu-egee.org/
Applications	<p>HPE Applications: ALICE, ATLAS, CMS, LHCb, Babar, CDF, D0, ZEUS;</p> <p>Biomedical Applications: WISDOM, GATE, GPS@, CDSS, Docking Platform for Tropical Diseases, gPTM3D, SiMRI3D, Xmipp_MLrefine, GridGRAMM, GROCK;</p> <p>Digital libraries: GRACE;</p> <p>Computational Chemistry: CHARON, CompChem;</p> <p>Earth Science applications;</p> <p>Geophysics Applications: Geocluster;</p> <p>Astrophysics Applications: MAGIC, ESA Planck mission, ANTARES, The NEMO Project;</p> <p>Fusion Applications: ITER Project;</p> <p>Financial Applications: Egrid Project;</p> <p>http://public.eu-egee.org/applications/</p>
Description	<p>The Enabling Grids for E-science project brings together scientists and engineers from more than 240 institutions in 45 countries world-wide to provide a seamless Grid infrastructure for e-Science that is available to scientists 24 hours-a-day. Conceived from the start as a four-year project, the second two-year phase started on 1 April 2006, and is funded by the European Commission.</p> <p>Expanding from originally two scientific fields, high energy physics and life sciences, EGEE now integrates applications from many other scientific fields, ranging from geology to computational chemistry. Generally, the EGEE Grid infrastructure is ideal for any scientific research especially where the time and resources needed for running the applications are considered impractical when</p>

	<p>using traditional IT infrastructures.</p> <p>The EGEE Grid consists of 41,000 CPU available to users 24 hours a day, 7 days a week, in addition to about 5 PB disk (5 million Gigabytes) + tape MSS of storage, and maintains 100,000 concurrent jobs. Having such resources available changes the way scientific research takes place. The end use depends on the users' needs: large storage capacity, the bandwidth that the infrastructure provides, or the sheer computing power available.</p>
Process of accessing	http://www.eu-egge.org/feedback_folder/registration/

B.1.2 NGS


Abbreviation	NGS
Name	National Grid Service
Logo	
Site	4 core sites and 6 partner sites
Status	Operational; NGS2 is now in production
CPU	512
Storage	162TB
Public/Private	Public
Level	UK
Home Page	http://www.grid-support.ac.uk/
Applications	Amber, DL_POLY, Gromacs, NAMD, Fftw, ncbiBlast, Vasp, Grace, Rasmol, Exonerate, Emboss, Fasta, Siesta, Gaussian. http://www.grid-support.ac.uk/content/view/167/92/
Description	The UK National Grid Service (NGS) is the core UK academic research grid and it is intended for the production use of computational and data grid resources.
Process of accessing	http://www.ngs.ac.uk/access.html

B.1.3 Teragrid


Abbreviation	TereGrid
Name	TereGrid
Logo	
Site	11
Status	Operational;
CPU	104,632
Storage	more than 15 petabytes (quadrillions of bytes)
Public/Private	Public
Level	US

Home Page	http://www.teragrid.org/index.php
Applications	<p>ccp4, ESMF, gmp, gsl, LAMMPS, MFIX, MPQC, OpenSees, SAS, SuperLU, Titanium;</p> <p>Astronomy, Astrophysics, and Cosmology: enzo, SExtractor, WRF;</p> <p>Chemical Engineering: APBS, CHARMM (Harvard Version), DL_POLY, DOCK, FIDAP, Gambit, GAMESS, Gaussian 03, Gaussian 98, Gromacs, MOLCAS, Molden, MOLPRO, NBO, NWChem, Qchem, VASP, WIEN2k;</p> <p>Computational Biology: AMBER, BLAST, CPMD, DOCK, FastDNAML, Gaussian 03, mpiBLAST, Parallel Genesis, Paup, PMEMD, rasmol, TurboBlast, WU BLAST;</p> <p>Computational Chemistry: ABINIT, ADF, AMBER, BLAST, CHARMM (Harvard Version), CPMD, DL_POLY, GAMESS, Gaussian 03, Gaussian 98, Gromacs, LAMMPS, MOLCAS, Molden, MOLPRO, MPQC, NAMD, NBO, NCO, NWChem, PMEMD, Qchem, VASP, vmd, WIEN2k;</p> <p>Computational Fluid Dynamics: FIDAP, Fluent, Gambit, GASP, Gridgen, MFIX;</p> <p>Computational Structural/Solid Mechanics: Abaqus, Ansys, I-DEAS 10NX, LS-DYNA, MSC.Marc, MSC.Mentat, MSC/Nastran, MSC/Patran, OpenSees, PRO/Engineer;</p> <p>Knowledge Discovery/Machine Learning: AVS/Express;</p> <p>Materials Science: ADF, CHARMM (Harvard Version), GAMESS, Gaussian 03, Gaussian 98, NBO, Qchem, VASP;</p> <p>http://hpcsoftware.teragrid.org/Software/user/index.php</p>
Description	<p>TeraGrid is an open scientific discovery infrastructure combining leadership class resources at nine partner sites to create an integrated, persistent computational resource.</p> <p>Using high-performance network connections, the TeraGrid integrates high-performance computers, data resources and tools, and high-end experimental facilities around the US. These integrated resources include more than 102 teraflops of computing capability and more than 15 petabytes (quadrillions of bytes) of online and archival data storage with rapid access and retrieval over high-performance networks. Through the TeraGrid, researchers can access over 100 discipline-specific databases. With this combination of resources, the TeraGrid is the world's largest, most comprehensive distributed cyberinfrastructure for open scientific research.</p> <p>TeraGrid is coordinated through the Grid Infrastructure Group (GIG) at the University of Chicago, working in partnership with the Resource Provider sites: Indiana University, Oak Ridge National Laboratory, National Center for Supercomputing Applications, Pittsburgh Supercomputing Center, Purdue University, San Diego Supercomputer Center, Texas Advanced Computing Center, University of Chicago/Argonne National Laboratory, and the National Center for Atmospheric Research.</p>
Process of accessing	http://www.teragrid.org/userinfo/access/index.php

B.1.4 CROWNgrid

Abbreviation	CROWNgrid
Name	China Research and Development environment Over Wide-area Network
Logo	
Site	89
Status	Operational
CPU	235
Storage	67.5TB
Public/Private	Public
Level	CN
Home Page	http://www.crown.org.cn/en/
Applications	BlastWS, DSSRetrieval, AREM, UDMGrid, Phrap, ensacan http://www.crown.org.cn/en/app/app_center.jsp
Description	CROWN, short for China Research and Development environment Over Wide-area Network, is a grid testbed to facilitate scientific activities in different disciplines. As we planned, the whole CROWN platform consists of 3 parts. Firstly, many resources (including computers, clusters and some storage devices) should be connected via a nation-wide network infrastructure to build the CROWN architecture. Secondly, series of grid middleware and auxiliary tools should be provided to meet the common requirements of different scientific activities in all kinds of areas. Finally, a number of typical applications should be put in use over the fabric and middleware to demonstrate the feasibility and robustness of CROWN
Process of accessing	http://www.crown.org.cn/en/faq/faq.jsp#u2

B.1.5 D-Grid

Abbreviation	D-Grid
Name	D-Grid
Logo	
Site	9
Status	Operational
CPU	5,534
Storage	Unknown
Public/Private	Public
Level	DE
Home Page	http://www.d-grid.de/
Applications	Astrophysical Applications: NIRVANA, AMIGA, NBODY6++, DYNAMO , GADGET , GEO600 , CACTUS, ASTROMATCH , CLUSTERFINDER, VIRTUAL TELESCOPE, MILLENNIUM QUERY, MILL. POSTPROCESSING, SED CLASSIFICATION, STELLA, PLANET, FRINGE, PROC, CACTUS MONITORING, GALAXY MERGERS;

	<p>Engineering Applications: foundry technologies, metal forming technologies, groundwater flow and transport, turbine simulation and fluid-structure interaction;</p> <p>As well as Climate research applications, Particle physics applications, Biomedical research applications, and Humanities applications.</p>
Description	<p>The D-Grid project is funded by BMBF. The purpose of the D-Grid project is to design, build and operate a network of distributed integrated and virtualised high-performance resources and related services in Germany which allow processing of large amounts of scientific data and information.</p> <p>D-Grid currently consists of a grid infrastructure project and 6 community projects in the areas of high-energy physics, astrophysics, medicine and life sciences, earth sciences (e.g. climate), engineering sciences, and libraries.</p> <p>UNICORE, Globus, gLite are provided for the core D-Grid grid service. 9 Partners provide compute resources and the grid middleware, including Forschungszentrum Jülich (FZJ/ZAM), Forschungszentrum Karlsruhe (FZK/IWR), Leibniz Rechenzentrum München (LRZ), Garching Computing Centre of the Max Planck Society (RZG), RWTH Aachen (RWTH/RZ), Paderborn Center for Parallel Computing (PC2), TU Dresden (TUD/ZIH), Fachhochschule Bonn-Rhein-Sieg (VIOLA), Fraunhofer SCAI (VIOLA) .</p>
Process of accessing	<p>https://www.d-grid.de/index.php?id=208&L=1</p>