

The European UNICORE 6 Grid Middleware

The UNICORE Grid system provides a seamless, secure and intuitive access to distributed Grid resources such as supercomputers, clusters, and large server farms. In recent years, UNICORE 5 is used as a well-tested Grid middleware in scientific production Grids (e.g. DEISA, D-Grid) and for business use cases (e.g. T-Systems, Philips Research). In addition, UNICORE serves as a solid basis in many European and international research projects that use existing UNICORE components to implement advanced features, higher-level services, and support for scientific and business applications from a growing range of domains.

More recently, the new Web services-based UNICORE 6 has become available in beta state. It is based on common open standards that have emerged

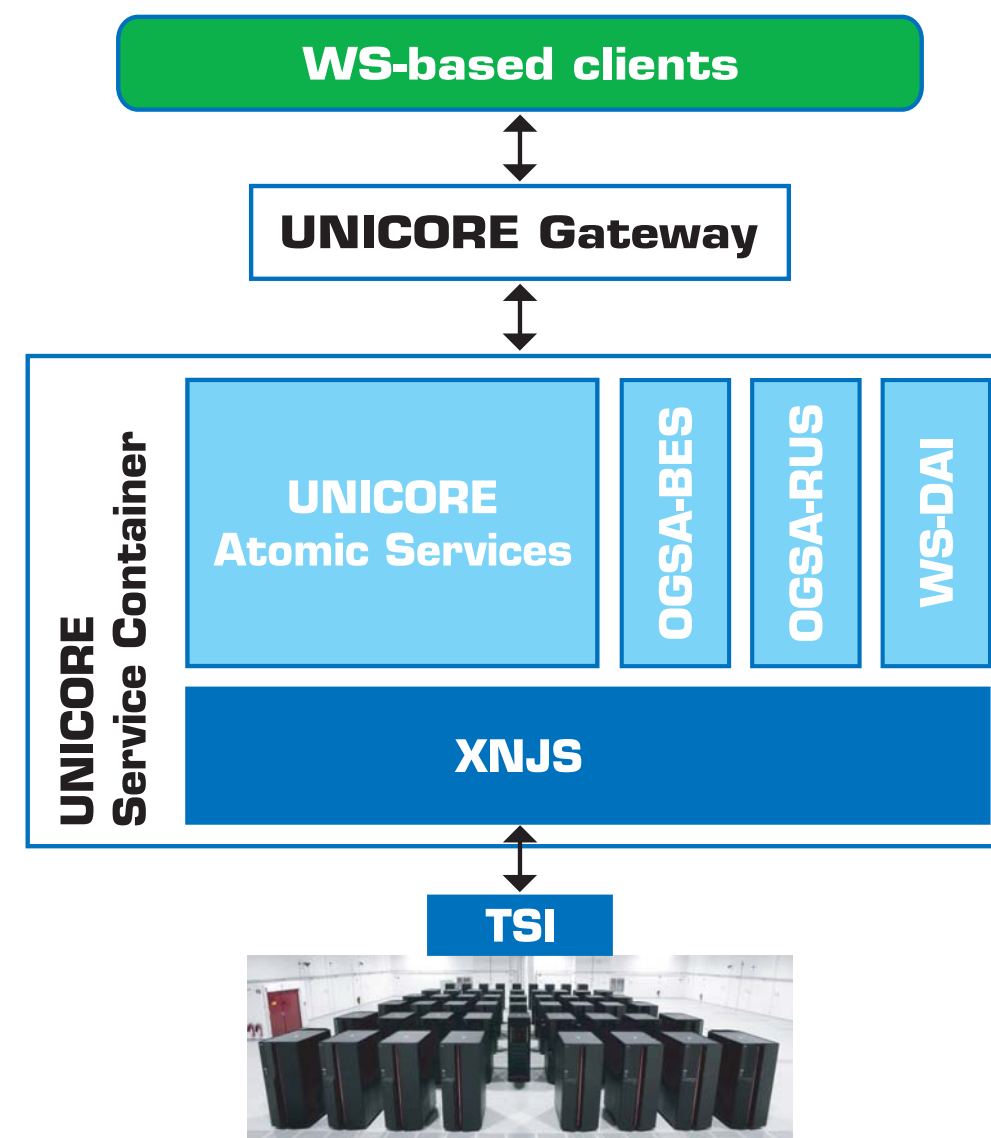
from various standardization bodies such as OASIS (Organization for the Advancement of Structured Information Standards) and OGF (Open Grid Forum).

Web and Grid Services

At the time of writing, the technologies and techniques of the Grid community follow an approach of Service Oriented Architectures (SOAs). A well-known set of service-oriented OGF standards are based on the Open Grid Services Architecture (OGSA) that emphasizes the use of so-called Grid services. In the last years, the Web services technology is used to implement these concepts of Grid services that lead initially to the Open Grid Services Infrastructure (OGSI). OGSI introduced the concepts of so-called stateful Web services that expose and manage the state (e.g. computational job status) of various kinds of Grid resources, including lifecycle management. More recently, specifications of the Web community have become increasingly important and thus the Web Services Resource Framework (WS-RF) was accepted in April 2006 as an official OASIS standard to re-factor the concepts of OGSI to exploit new Web service standards (e.g. Web Services Addressing).

UNICORE 6 Architecture

The rapid adoption of OGSA and WS-RF concepts within Grid technologies allows for an extension of UNICORE concepts through the use of common open standards. The Figure below illustrates the architecture of the new UNICORE 6 Grid middleware and its Web services-based interfaces that are conform to OGSA concepts. Among other additional interfaces, the UNICORE Atomic Services (UAS) are the main interfaces that allow for the exploitation of the core functionality by Web services-based clients. This core functionality includes job submission and control, file and data transfer as well as storage management.



In more detail, UNICORE 6 provides a Service Container that is able to host WS-RF compliant Grid services. Authenticated end-user requests from different Web services-based clients – e.g. command line, portal, API or the GPE UNICORE Client from Intel – pass the UNICORE Gateway and initiate operations of services deployed within the UNICORE Service Container.

The UAS consists of several WS-RF standards compliant stateful Web services. First and foremost, the Target System Service (TSS) provides access to a stateful resource that models a physical computational Grid resource like a supercomputer. It exposes various pieces of information, e.g. details about the total numbers of CPUs, memory, etc. and preinstalled applications on the Grid-enabled resource. Through the TSS Grid jobs described in the OGF standard Job Submission Description Language (JSDL) are submitted to the UNICORE site. The jobs are controlled with the Job Management Service (JMS). To support data staging of JSDL jobs, the Storage Management Service (SMS) is used to access storages within Grid infrastructures. The transfer itself is realized by the File Transfer Service (FTS), which offers different solutions based on open OGF standards like e.g. Random ByteIO (RbyteIO) and Streamable ByteIO (SbyteIO).

These WS-RF compliant services expose the functionality of UNICORE 6 via common open standards. The function of the new Network Job Supervisor (XNJS) as the execution backend is to control and manage the state and persistency of jobs. Hence, one of the major tasks of the XNJS is to parse JSDL documents and turn the rather

abstract job descriptions to site-specific commands by using an enhanced Incarnation DataBase (IDB). Authorization is done by using the enhanced UNICORE User Data Base (UUDB) in conjunction with extensible Access Control Markup Language (XACML) policy validations. Then all commands are forwarded to the UNICORE Target System Interface (TSI) which is directly connected to the already existing batch sub-system (e.g. LoadLeveler, Torque, LSF) running on the supercomputer.

Additional Service Interfaces

The UNICORE 6 architecture provides extensibility towards additional services being deployed in the UNICORE Service Container. These services realize additional functionalities such as the OGF standard Web services Data Base Access and Integration Service (WS-DAI) used for the access to relational or XML-based databases. In addition, the

OMII-Europe project (see Inside Vol. 4 No. 2, autumn 2006) currently augments the UNICORE 6 Grid technology with other useful emerging OGF standards via services such as the OGSA-Resource Usage Service (RUS) and OGSA-Basic Execution Services (BES).

Summary

The new Web services enabled UNICORE 6.0 offers significant improvements in terms of usability for end-users, performance, extensibility for developers, interoperability with other Grid middleware, as well as open standards compliance. On top of the UNICORE Atomic Services, an integra-

tion of scientific applications via other high-level services can easily be realized and deployed. Therefore

UNICORE 6.0 is well suited to be used in the future European Supercomputing infrastructure. To foster ongoing developments and the uptake in various European and international infrastructures and R&D projects, UNICORE 6 is available as open source under BSD license from SourceForge. Main contributors to UNICORE are: Fujitsu Labs of Europe, Intel, ICM Warsaw, CINECA Bologna, the University of Manchester, and Forschungszentrum Jülich.

More information and lightweight UNICORE 6 installation packages are available at <http://www.unicore.eu>

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