



## NSF Fact Sheet

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### NSF Middleware Initiative

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**Background.** "Middleware" is the software that makes many forms of collaborative computing, including grid computing, possible. By connecting two or more otherwise separate applications across the Internet, middleware allows those applications to access diverse resources. Middleware enables a robust set of advanced network services that allow scientists and researchers to collaborate with their colleagues and effectively share instruments, computing resources, laboratories and data.

NSF established the NSF Middleware Initiative (NMI) in 2001 to define, develop and support an integrated national middleware infrastructure. NMI activities will facilitate sharing of scientific resources such as telescopes, supercomputing systems and linear accelerators, as well as common resources such as databases, directories and calendars. One important emphasis is to explore ways in which grid computing can be integrated with enterprise computing on university campuses.

*NSF Middleware Initiative: <http://www.nsf-middleware.org/>*

**GRIDS Center and EDIT Consortium.** In September 2001, NSF launched NMI with awards totaling almost \$12 million. These three-year awards formed the Grid Research Integration Deployment and Support (GRIDS) Center and the Enterprise and Desktop Integration Technologies (EDIT) consortium. The GRIDS Center and EDIT Consortium, working closely with the NSF Partnerships for Advanced Computational Infrastructure and private industry, are defining, developing, deploying and supporting an integrated national middleware infrastructure for 21st Century science and engineering applications.

The GRIDS team includes participants from the Information Sciences Institute (ISI) at the University of Southern California, the University of Chicago, the National Center for Supercomputing Applications (NCSA) at the

University of Illinois at Urbana-Champaign, the San Diego Supercomputer Center (SDSC) at the University of California at San Diego, and the University of Wisconsin at Madison. The EDIT Consortium consists of participants from Internet2, EDUCAUSE and the Southeastern Universities Research Association (SURA). In 2003, NSF made new awards to continue and expand the activities of the GRIDS Center and EDIT Consortium. Other 2003 awards extend NMI's efforts in production-quality middleware to grid portals and integration of scientific instrumentation. The Open Grids Computing Environment (OGCE) consortium, which includes participants from Indiana University, the University of Michigan, NCSA, the Texas Advanced Computing Center at the University of Texas at Austin and the University of Chicago, will focus on simplifying the development of "grid portals," Web-based user interfaces to applications that may access a broad array of resources and services on the grid. Indiana University also leads a project to develop standard grid middleware architecture for access and integration of scientific instruments.

*GRIDS Center: <http://www.grids-center.org/>*

*EDIT Consortium: <http://www.nmi-edit.org/>*

**NMI Releases.** The GRIDS Center and EDIT Consortium have thus far issued three releases of production-quality open-source and open-standards middleware tools. Available free to the public from the NMI web site, the components—developed at universities and national laboratories—are designed to support or fill functions needed by the research and education community in such areas as user authentication and authorization, resource identification and allocation, job management, and scheduling. NMI tools and procedures also ensure that the middleware is deployable and supportable on a wide variety of systems, including production environments at campus and laboratories.

The NMI releases address security and policy concerns of resource owners and users; are flexible enough to deal with many resource types and sharing modes; scale to large numbers of resources, participants and program components; and operate efficiently when dealing with large amounts of data and computational power. The NMI teams also provide support and training to ensure the success of early adopters and new user communities.

**NMI Integration Testbed.** NSF has also funded the NMI Integration Testbed, consisting of eight universities that coordinate closely to deploy and evaluate NMI middleware in production environments. The NMI Integration Testbed includes the University of Alabama at Birmingham, the University of Alabama in Huntsville, the University of Florida, Florida State University, Georgia State University, the University of Michigan, the Texas Advanced Computing Center (University of Texas at Austin) and the University of Virginia. Managed by Southeastern Universities Research Association (SURA), the testbed sites use and evaluate software, services and architectures that

facilitate access to distributed electronic resources for faculty and campus projects. Their efforts gauge the middleware's practicality, emphasizing factors such as performance, ease of use, robustness and technical support. *NMI Integration Testbed: <http://www.nsf-middleware.org/testbed/>*

**Expanding the Middleware Portfolio.** In 2002 and 2003, NSF also made awards that focus on experimental applications of new middleware capabilities as well as near-term additions to the portfolio of middleware services of the NMI releases. These NMI awards include efforts to develop collaboration tools, scalable video services, essential software libraries for grid-based parallel computing, generalized grid-based application environments and tools for grid-based databases. The goal for these awards is to develop middleware standards and services that will eventually be integrated into the production NMI releases. One of these awards, for example, led to the new H.350 standard for videoconferencing middleware recently adopted by the International Telecommunications Union.

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