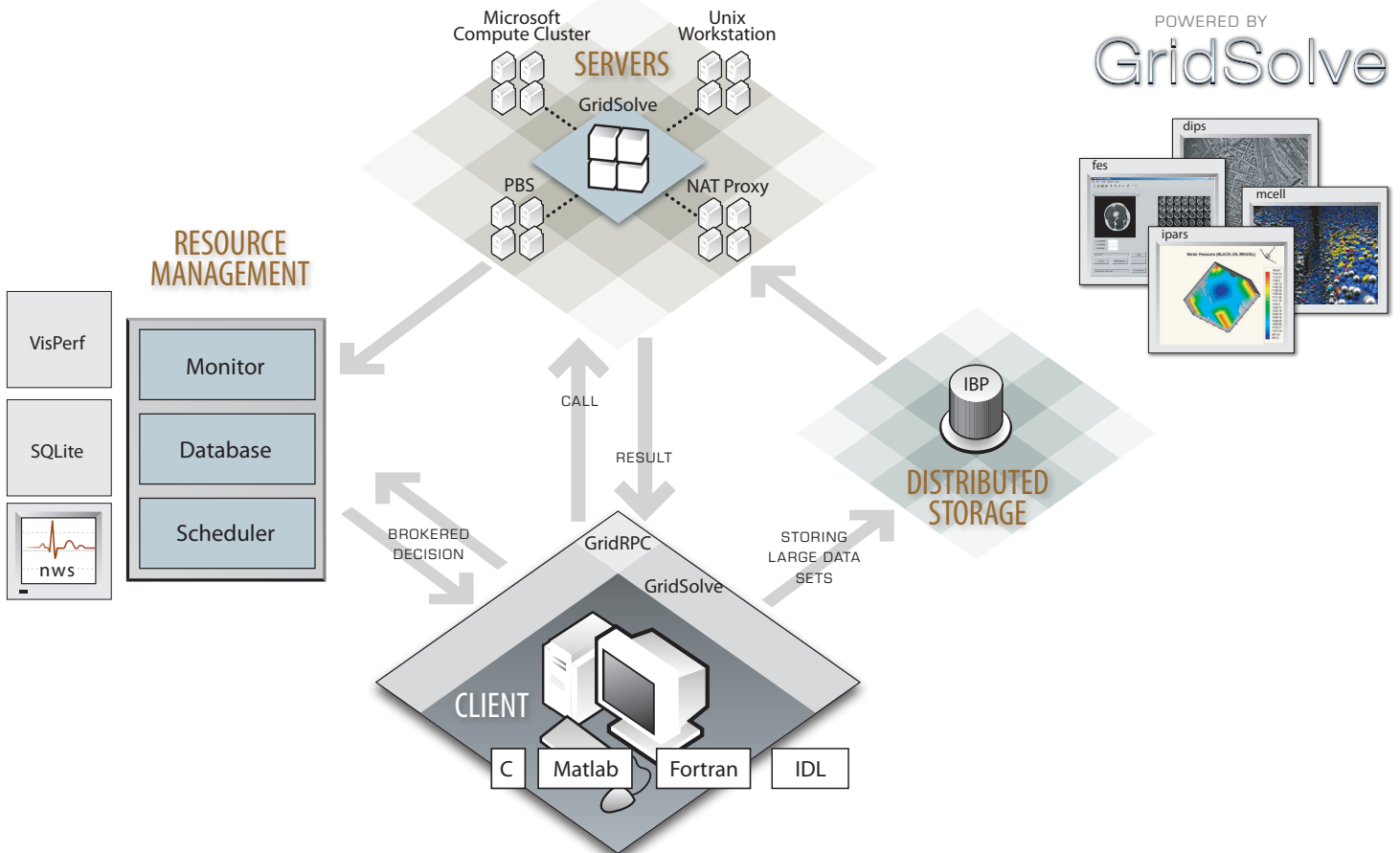


GridSolve investigates the use of distributed computational resources connected by computer networks to solve complex scientific problems. It is a remote procedure call (RPC)-based client/agent/server system that allows users to discover, access, and utilize remote software modules and hardware resources. GridSolve is the next generation of NetSolve. The main improvements are in three general areas: ease of use, interoperability, and scalability.



GridRPC

GridSolve is a system for Grid-enabling general purpose Problem Solving Environments (PSEs) and is part of the NSF Middleware Initiative (NMI).

In cooperation with the Global Grid Forum, GridRPC is an effort toward standardizing and implementing a Remote Procedure Call (RPC) mechanism for Grid computing. GridRPC unifies client access to existing Grid computing systems such as Ninj and GridSolve via a common API.

NATs

One of the major enhancements of GridSolve over NetSolve is the NAT-tolerant communication framework. Recently an increasing problem for users has been the extent to which NATs (Network Address Translators) interfere with the operation of grid computing systems and services. As beneficial as NATs may be in alleviating the demand for IP addresses, they pose many significant problems to developers of Grid applications. The GridSolve team has developed a new NAT-tolerant communications framework. An important aspect to making this new communications model work is the relay, which is a component that will allow servers to exist behind a NAT. To avoid problems related to potential duplication of IP addresses, the GridSolve components are identified by a globally unique identifier unrelated to the machine's IP address.

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GridSolve – the next generation of NetSolve – is a project that investigates the usage of distributed computational resources connected by computer networks to solve complex scientific problems efficiently. It is a remote procedure call (RPC)-based client/agent/server system that allows users to discover, access, and utilize remotely housed software modules, as well as the computational hardware needed to run these modules. The resources to be leveraged can be distributed by geographic location and/or ownership, and heterogeneous operating environments are supported.

Based on our experience developing NetSolve, we have identified several requirements that were not adequately addressed in the NetSolve system. These requirements, coupled with the requirements for the original NetSolve system, has formed the basis of GridSolve.

The overall goal is to address three general problems: ease of use, interoperability, and scalability. To improve the ease of use, we have streamlined the process of integrating user code into a GridSolve server. Interoperability encompasses several facets, including better handling of different network topologies including NATs and firewalls, better support for parallel libraries and parallel architectures, and better interaction with other Grid computing systems such as Globus and Ninf. Scalability in the context used here means ensuring that system performance does not degrade as a result of adding components to the GridSolve system.

The motivation for GridSolve is to create a grid-based software computing environment used routinely by a large user base to enhance scientific computing capabilities. In addition to the NetSolve features, GridSolve provides:

- NAT-tolerant communication framework
- Reconnect protocol
- Ease of problem integration using simplified IDLs
- Secure communication through SASL
- Drop and add problem capability

Although other research groups and organizations are investigating distributed and grid computing concepts, GridSolve's niche is providing access to complex collections of high-performance software that run on clusters of commodity components or supercomputers. Such access reduces the effort scientists normally exert to use these software resources.

GridSolve provides access to otherwise unavailable software and, in cases where the software is readily available, it can make the power of supercomputers accessible from low-end machines such as laptop computers. GridSolve is also designed to increase the accessibility of larger software systems like simulators and modeling software. GridSolve can also be used to extend the capabilities of problem solving environments (PSE), such as Matlab, by increasing the number and types of implemented algorithms available. The system also provides these environments with the ability to distribute GridSolve's computational tasks among multiple processors – a feat, for example, that is not possible with Matlab alone.

GridSolve/NetSolve have been employed by users in a variety of scientific domains ranging from image processing to nuclear engineering, microbiology, and sub-surface fluid modeling. The GridSolve project has also been part of larger collaborations with research groups from universities, government laboratories, and private research organizations.