

Storage Resource Management Grid Middleware Unifies Usage of Grid Storage, Saves Human Resources, and Reduces Error Rates Greatly

Storage Resource Managers (SRMs) are middleware components whose function is to provide dynamic space allocation and file management on shared storage components on the Grid. They complement Compute Resource Managers in providing storage allocation and dynamic management of files and storage resources for execution of Grid jobs.

The SRM functional specification effort was initiated by the Scientific Data Management Group (SDM) at LBNL and supported by the DOE SciADC middleware program. Because the SDM group is also participating to deploy SRMs in two of the National Collaboratory projects, Earth System Grid and especially Particle Physics Data Grid, SRM has developed into an internationally coordinated effort between several DoE laboratories including LBNL, Fermilab and TJNAF, as well as European institutions including CERN and RAL in the UK. This coordinated effort has resulted in the adaptation of the standard specification, and the development of multiple SRM middleware components that inter-operate. This approach is particularly essential for providing Grid access to complex Mass Storage Systems (MSSs), and is now deployed in multiple institutions around the world. SRMs were even developed for legacy MSS systems (e.g. at NCAR) which enables them to be accessed from the Grid.

SRMs have been used in production by several facilities including BNL, NERSC, Fermilab, CERN, and JTNAF. Some are being used for access to files or for storing files in remote systems, and some are used for intensive data movement between storage systems. For example, The BNL to NERSC setup using SRMs that access HPSS, takes advantage of robustness features of the SRMs. They use the Berkeley-SRMs to move about 10,000 files per month (about 1 GB each) in an automated fashion. This arrangement, called a DataMover, is also being used by the Earth Systems Grid to move robustly a large volume of simulation production data from NERSC to NCAR, as well as ORNL to NCAR. The benefits are great reduction in the error rates, for 1% to 0.02% in the STAR project, and essentially eliminating the human effort previously required.

The dream of having multiple, diverse, storage system interoperate was fulfilled by this effort, thanks in great part to goodwill and commitment of the international participants. The SRM standard is now widely adopted by various international efforts, including several HENP experiments, including STAR, ATLAS, and CMS, as well as other efforts, such as NorduGrid. SRMs are also being used by several Grid Collaboratory projects, most notably by the Earth Systems Grid and the Particle Physics Data Grid for production use. Although the SRM specification has become a de-facto standard, there is an ongoing effort to standardize this functional specification through the Global Grid Forum (GGF).