



High Performance Storage System



Extreme-Scale Hierarchical Storage Management (HSM) Software

HPSS is disk and tape storage software designed to manage and access exabytes of data at high data rates. Files can be on disk, disk protected by tape, disk space-managed by tape, or stored directly to tape. For files on tape, an option determines if files are recalled to disk or accessed directly from tape. Standalone, HPSS presents its own file system directly to the user. When coupled with Spectrum Scale, users interact with Spectrum Scale, and HPSS provides space management and disaster recovery services to one or more Spectrum Scale file systems.

Cluster Architecture for Extreme Scalability

HPSS has a cluster design that combines the power of multiple computers, disk storage units, tape libraries, and tape drives, into a single, integrated storage system. HPSS is capable of managing billions of files, exabytes of data, and extreme data transfer rates. No matter how large, the storage system always appears to its clients as a single storage service with a unified common name space.

Migration Services

IBM offers a service to migrate TSM, SAM-FS, DMF, and DXUL files to HPSS. IBM has experience migrating large tape data stores, with or without physically copying the tapes.

End-to-End Data Integrity

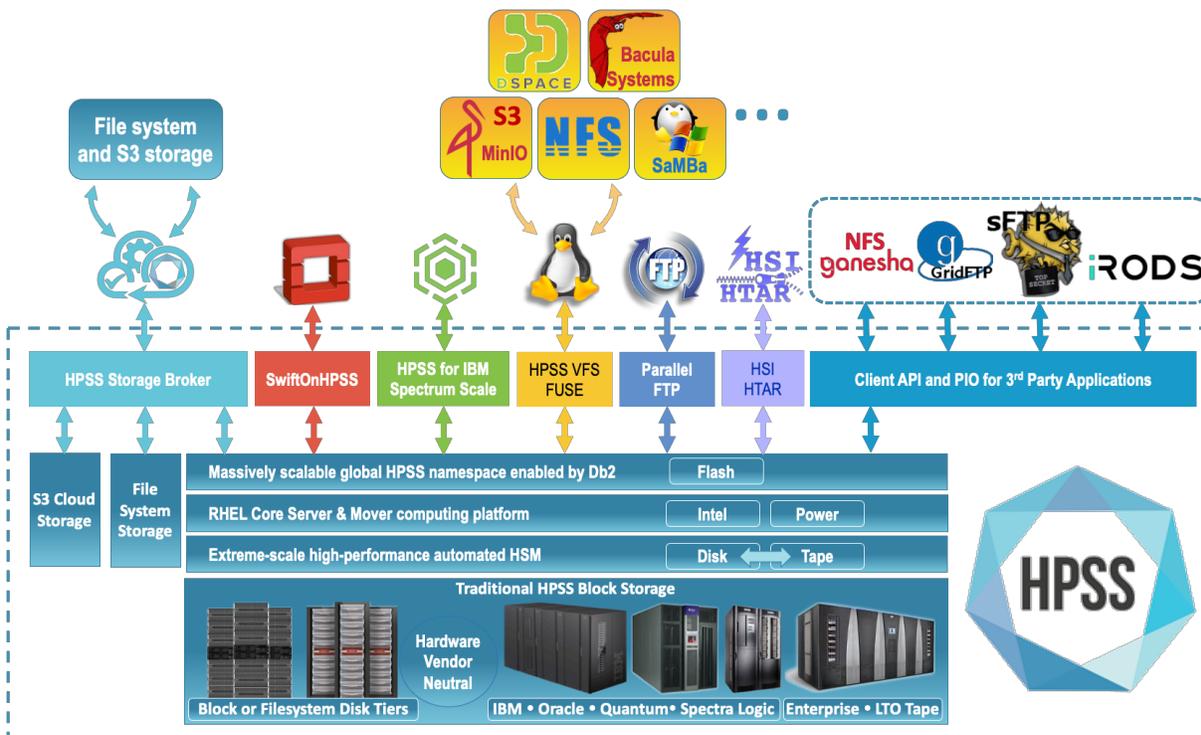
HPSS leverages SCSI T10 Logical Block Protection technology of modern tape drives and file checksums to ensure that your files are accurately written to tape. High-speed re-validation of data on tape is accomplished without recalling files back to disk.

High Data Rate

HPSS enables disks and tapes to be striped to create files that can be accessed using parallel I/O operations. A single instance of HPSS is capable of concurrently accessing hundreds of tapes for extremely high aggregate data transfers. HPSS provides automatic aggregation of small files when writing to tape, which increases tape performance and conserves tape space.

HPSS Native RAIT

A Redundant Array of Independent Tapes (RAIT) software feature for HPSS is available. One or more tape parity configurations can be defined to cut the cost of tape redundancy by 50% or more. RAIT has the same performance benefits as tape striping.



Publicly disclosed HPSS sites

The following organizations have reported data stores ranging from one petabyte to over 567 petabytes in a single HPSS namespace:

- Argonne National Lab (ANL)
- Australian University of Tasmania Research Data Management System (UTAS)
- Boeing
- Brookhaven National Lab (BNL)
- European Center for Medium-Range Weather Forecasts (ECMWF)
- French Atomic Energy Commission (CEA-DAM)
- French National Institute of Nuclear Physics (IN2P3)
- French National Meteorological Service (Météo-France)
- French National Space Center (CNES)
- German Climate Research Center (DKRZ)
- German University of Stuttgart (HLRS)
- German Karlsruhe Institute of Technology (KIT)
- German Max Planck Computing and Data Facility (MPCDF)
- German Weather Center (DWD)
- Indian Institute of Tropical Meteorology (IITM)
- Indiana University (IU)
- India's National Centre for Medium Range Weather Forecasting (NCMRWF)
- Japanese Aerospace Exploration Agency (JAXA)
- Japanese High Energy Accelerator Research Organization (KEK)
- Lawrence Berkeley National Lab (LBNL)
- Lawrence Livermore National Lab (LLNL)
- Los Alamos National Lab (LANL)
- NASA Atmospheric Science Data Center (NASA ASDC)
- NASA Langley Research Center (NASA LaRC)
- NOAA National Center for Atmospheric Research (NOAA NCAR)
- NOAA National Centers for Environmental Information (NOAA NCEI)
- NOAA National Centers for Environmental Prediction (NOAA NCEP)
- NOAA Comprehensive Large Array-data Stewardship System (NOAA CLASS)
- Oak Ridge National Lab (ORNL)
- Pacific Northwest National Lab (PNNL)
- Purdue University
- SciNet, Canada's largest supercomputer center
- Shared Services Canada (SSC)
- Stanford Linear Accelerator Center (SLAC)
- Sandia National Lab (SNL)
- United Kingdom Meteorological Office (UKMO)

www.hpss-collaboration.org

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Transfer interfaces

HPSS Application Programming Interface: The most powerful interface in terms of control, performance, and functionality. HPSS API is the foundation of every HPSS interface, and customers have ported open source applications including NFS-Ganesha, Globus GridFTP, iRODS, and SFTP to directly interact with HPSS.

Parallel File Transfer Protocol: The high performance Parallel FTP (PFTP) interface moves files in and out of HPSS at high data rates. Standard FTP and high-performance parallel FTP commands are both supported.

HSI & HTAR: The Hierarchical Storage Interface (HSI) provides a familiar UNIX shell-style interface for managing and transferring files. HTAR is a high-performance utility for transferring groups of files between file systems and HPSS.

HPSS Virtual File System (VFS) Interface: Linux applications benefit from a near-POSIX standard read-write file system interface. This interface enables HPSS to be mounted as a Linux file system in user space (FUSE). Customers are using HPSS VFS with Open SSL, OpenStack, SaMBa, NFS, DSpace and Bacula.

OpenStack Swift Object Storage Interface: SwiftOnHPSS for OpenStack Swift is an S3 interface for HPSS that supports automatic class of service (COS) selection, automatic HPSS end-to-end data integrity support with OpenStack Swift md5 object checksums, and shared access of Swift objects by other HPSS interfaces – <https://github.com/openstack/swiftonhpss>.

Spectrum Scale for HPSS Interface: Intended for HPC use, HPSS can be coupled with Spectrum Scale (previously named GPFS) to automatically: copy files from Spectrum Scale to HPSS; purge Spectrum Scale files that are not being used when space thresholds are reached; recall files from HPSS when accessed by Spectrum Scale users; and save a point-in-time snapshot of Spectrum Scale.

HPSS Storage Broker: HPSS Storage Broker is used to store, protect, and error correct project datasets across a wide variety of archive storage including public and private S3 object stores, file systems and HPSS.

System Integrity

IBM Db2 Protected Metadata: All metadata is stored in and protected by an IBM Db2 database enabling very rapid restart and failure recovery.

HPSS High Availability: HA-HPSS optionally leverages redundant hardware, the Db2 log shipping feature, and failover scripts to minimize HPSS downtime.

Equipment Supported

The full suite of HPSS software runs on Intel and Power computers using Red Hat Enterprise Linux. Tape libraries from IBM, Oracle, Quantum and Spectra Logic are supported, as are all-current IBM, HP and Oracle tape drives for the HPSS tape tiers. HPSS supports IBM Spectrum Scale, and most enterprise HDD and SSD local attached or network attached storage units for the HPSS disk cache tiers.

How HPSS is Offered

HPSS is licensed and supported by IBM under an agreement between IBM and the Department of Energy. HPSS is sold, installed and supported as a service offering of IBM Global Business Services. IBM also offers system engineering services, custom feature development services, and migration services. For U.S. Government organizations, HPSS is listed on NASA's SEWP government-wide acquisition web site, <http://swep.nasa.gov>.

HPSS is developed by an ongoing collaboration of five national laboratories of the United States Department of Energy and IBM. This collaboration has been working together since 1992, through seven major releases.