Incremental Scalability

Based on storage needs and deployment schedules, HPSS scales incrementally by adding computer, network and storage resources. A single HPSS namespace can scale from petabytes of data to exabytes of data, from millions of files to billions of files, and from a few file-creates per second to thousands of file-creates per second.


Incremental Scalability


Performance & Efficiency


Availability & Durability


Delivery & Support

About HPSS : HPSS RAIT Technology

What is HPSS RAIT?

HPSS RAIT (Redundant Array of Independent Tapes) is an HPSS software technology for striping data on tape with the added benefit of parity for redundancy. HPSS RAIT with single parity is similar to RAID-5 and HPSS RAIT with two parities is similar to RAID-6, except HPSS RAIT is used with tape. HPSS with RAIT still streams the tape drives at hardware speed, and stripe widths of up to 16 (data+parity) are available.

HPSS RAIT is transparent to the client using any of the existing HPSS client interfaces: FUSE, SwiftOnHPSS, FTP, Parallel FTP, HSI, HTAR, and other third-party HPSS client applications.

Why use HPSS RAIT?

HPSS RAIT offers two main advantages. First, RAIT allows data to flow to and from tape in a parallel manner. Parallel tape I/O allows single file transfers to exceed the native transfer rate of a single tape drive. At Oak Ridge National Laboratory (ORNL), large file I/O exceeds 1 GB/s with their 4+P HPSS RAIT stripe deployed on 250 MB/s tape technology. Thus, a 1 TB file can be written to tape in less than 17 minutes. Without parallel I/O, a 1 TB file might take over an hour to transfer using a single 250 MB/s tape drive.

Additionally, when compared to dual-copy tape, HPSS RAIT lowers redundant tape costs. At the lowest level, a 2+P HPSS RAIT will deliver up to 2x improvement in tape bandwidth and typically cuts the cost of redundant tape by 45%. Redundant tape costs are cut by 45%, rather than 50%, because typically 90% of the files by count only take 10% of the space in an HPSS repository, while 10% of the files by count take up 90% of the space. HPSS RAIT is intended for large files, so for greater recall efficiency, dual-copy tape is used to protect smaller files.

There are two basic methods of redundancy: making multiple copies (mirroring), and redundancy through error-correcting codes (such as Reed-Solomon). RAIT uses Reed-Solomon error-correcting codes which are less expensive than making multiple copies due to the lower tape, drive, space, and power requirements.

The Value of RAIT over Mirroring

There is a lower cost of fault tolerance with RAIT: fewer tape drives and cartridges are required. There are also faster mount times when compared with writing to a mirrored volume. For example, in the case of an 8 tape stripe and adding single failure redundancy: mirroring would require 8 additional tapes, resulting in a total of 16 tapes. RAIT, however, would only need 1 extra tape, resulting in a total of 9 tapes to accomplish the redundancy.

There is a high tolerance for tape loss within the HPSS RAIT stripe. RAIT reads and RAIT writes will continue even if there is a tape mount or tape media error. Automatic data recovery takes place during the RAIT read operation because HPSS can reconstruct the missing data using the parity and surviving data blocks.

What's Under the Hood of HPSS RAIT?

At the heart of HPSS RAIT is the HPSS RAIT engine. Client data will automatically flow through the HPSS RAIT engine for all HPSS RAIT transfers to and from tape.

Like HPSS' RAID counterparts, the HPSS RAIT parity rotates across all tapes in the RAIT stripe. Rotating the parity evens out the compressibility of the data on tape by ensuring an equal amount of data and parity are written to each tape cartridge.

Come meet with us!

2021 HUF - VIRTUAL
COVID-19 has disrupted the 2021 HPSS User Forum (HUF) and the Karlsruhe Institute of Technology (KIT) in Karlsruhe, Germany is no longer hosting the event. The 2021 HUF will be hosted online for six days spread across three weeks in October 2021 with no admission cost. This will be a great opportunity to hear from HPSS users, collaboration developers, testers, support folks and leadership (from IBM and DOE Labs) - Learn More. Please contact us if you are not a customer but would like to attend.

HPSS @ SC21
The 2021 international conference for high performance computing, networking, storage and analysis will be in St. Louis, MO from November 15th through 18th, 2021 - Learn More. As we do each year, we are scheduling and meeting with customers via IBM Single Client Briefings. Please contact your local IBM client executive or contact us to schedule a HPSS Single Client Briefing to meet with the IBM business and technical leaders of HPSS.

HPSS @ STS 2022
The 4th Annual Storage Technology Showcase is in the planning stage, but HPSS expects to support the event in March of 2022. Check out their web site - Learn More. We expect an update in early fall 2021.

HPSS @ MSST 2022
The 37th International Conference on Massive Storage Systems and Technology will be in Santa Clara, California in May of 2022 - Learn More. Please contact us if you would like to meet with the IBM business and technical leaders of HPSS at Santa Clara University.

What's New?

DOE Announces HPSS Milestone - Todd Heer, Deputy Program Lead, Advanced Simulation and Computing (ASC) Facilities, Operations, and User Support (FOUS), announced that DOE High Performance Storage Systems (HPSS) eclipse one exabyte in stored data.

Atos Press Release - Atos boosts Météo-France's data storage capacity to over 1 exabyte in 2025 to improve numerical modeling and climate predictions. Want to read more?

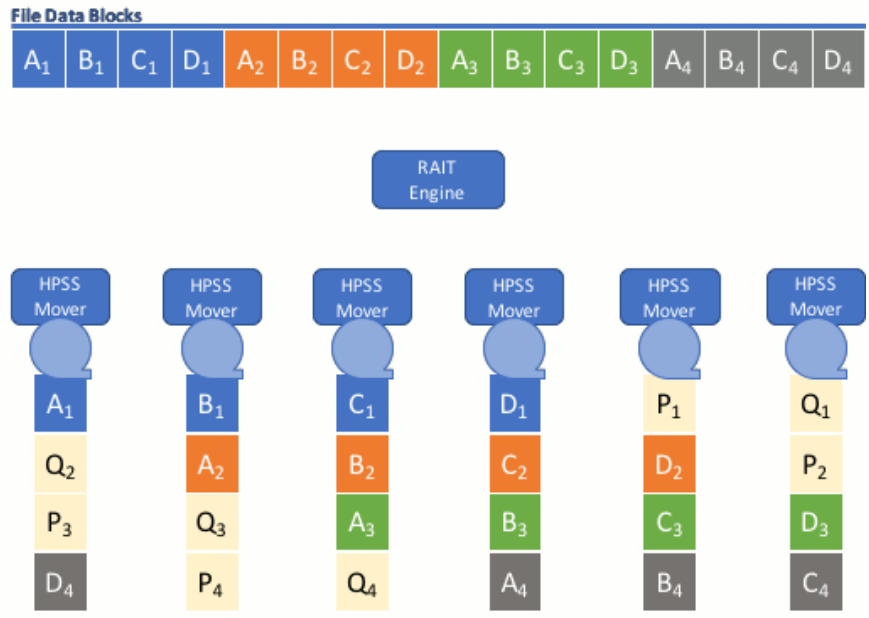
HPSS 9.2 Release - HPSS 9.2 was released on May 11th, 2021 and introduces eight new features and numerous minor updates.

HPSS 9.1 Release - HPSS 9.1 was released on September 24th, 2020 and introduces a few new

The figure below illustrates a single HPSS RAIT engine accepts four data blocks (A, B, C, and D) at a time from the client, generate the two parity blocks (P and Q), and send the six data blocks to tape in a parallel manner. Notice that the figure illustrates how the "File Data Block" is processed in four iterations, as follows:

1. A1, B1, C1, and D1 + P1 and Q1
2. A2, B2, C2, and D2 + P2 and Q2
3. A3, B3, C3, and D3 + P3 and Q3
4. A4, B4, C4, and D4 + P4 and Q4

The following illustration shows how data movement occurs:



HPSS RAIT Write Operations

HPSS RAIT Configuration Options and Features

- HPSS RAIT supports data stripe width of up to 15 and a parity stripe width of up to 7.
- You can control whether to mount the entire RAIT volume or only a minimal set of tapes for reading from a RAIT volume. For an 8 data/3 parity volume, this would cause 9 tapes to be mounted rather than 11 if the data is being verified against parity.
- Read verification allows users to verify that the data being read still matches the parity, with stripe-level data integrity.

Proven in the Field

ORNL:

- ORNL began using HPSS RAIT in January 2015, and are seeing faster tape mounts when compared to writing a mirror.
- ORNL was able to cut redundant tape cost-estimates by 75% with 4+Parity HPSS RAIT (tape stripe with rotating parity) and enjoy large file tape transfers beyond 1 GB/s.

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features.

HUF 2020 - The HPSS User Forum was hosted virtually at no cost in October 2020.

HPSS 9.1 Release - HPSS 9.1 was released on September 24th, 2020 and introduces a few new features.

HPSS 8.3 Release - HPSS 8.3 was released on March 31st, 2020 and introduces one new feature and many minor changes.

Capacity Leader - ECMWF (European Center for Medium-Range Weather Forecasts) has a single HPSS namespace with over 597 PB spanning over 403 million files.

File-Count Leader - LLNL (Lawrence Livermore National Laboratory) has a single HPSS namespace with over 66 PB spanning 1.571 billion files.

Older News - Want to read more?