Applications Driving 24G SAS

24G SAS increases performance with double the effective speed and optimizations for SSD and SMR.

Executive Summary

SAS, or Serial Attached SCSI, has been in use for more than 10 years, starting with 3.0 Gb/s SAS in 2004 and then doubling in effective bandwidth with the release of each new generation. The newest speed bump is the 24G SAS; end-user products using 24G SAS are anticipated in late 2020. In addition to effectively doubling the effective bandwidth from the current 12Gb/s SAS, the 24G SAS has optimizations for both SSD and HDD. The technology will be backwards compatible, adding to the preexisting tried-and-true SAS ecosystems. The end result is unmatched by other storage fabrics: highly scalable, highly flexible technology with tested manageability that optimizes use of the storage devices released today. 24G SAS will be the protocol of choice for all-flash deployments as well as tiered or cached systems with both HDD and SSD components.

Applications

The new SPL-4 protocol will be optimized for SSDs, delivering more efficiency and lower latencies, while still supporting various SMR commands, including SMR zone block commands, for dense HDDs. This makes it an ideal choice for use in tiered and cached solutions with both SSDs and highly dense SMR HDDs. Optimizations specifically for SSDs and the ability to support thousands of devices will make SAS continue to be the protocol of choice for all-flash arrays. The broad range of devices that 24G SAS is optimized for make it ideal for almost every application.

24G SAS technology can satisfy the performance, scalability and capacity required by today's big data, analytics and other related applications.

Enterprise and cloud applications including traditional databases, NoSQL databases, Hadoop and others can take advantage of tiered storage, and SAS technology can be deployed across multiple tiers. SAS supports SSDs with different endurance and performance levels as well as hard disk drives (HDDs) that often fill the role of low-cost capacity storage. Data used for fast-moving transactions, big data analytics and long-term, low-cost archive can all live on storage connected via SAS.

Industry Impact

24G SAS will be joining a vast, tested, and robust SAS ecosystem that has been trusted by the industry for over 10 years. Backwards compatibility, ease of installation, 24G speed, and enhancements for SSD and SMR will convince most in the industry to continue with SAS solutions while waiting for newer protocols to finish maturing.

24G SAS Overview

24G SAS relies on the upcoming SAS Protocol Layer (SPL-4) protocol and the upcoming (SAS-4) physical layer.

Just like its predecessors, 24G SAS will be compatible with SATA devices and has backward compatibility with the previous two SAS generations: 12Gb/s SAS and 6 Gb/s SAS. Major advancements present in the new 24G SAS allow similar channel lengths and cable types to be used while ensuring SAS Reliability, Availability and Serviceability (RAS) requirements are achieved.

Chief among these advancements are a more efficient 128b/130b encoding scheme and 20-bit forward error correction (FEC). The new encoding scheme provides better link efficiency at higher speeds. FEC allows for correction of transmission errors at the receiver, furthering the robustness of SAS interconnects in the 24G SAS ecosystem. It should be noted that the previously used 8b/10b encoding scheme can be used on the same physical link, ensuring backwards capability with earlier devices.

24G SAS has some valuable new features and enhancements. At the physical layer, a SAS-4 Adaptive PHY Training Algorithm (APTA) enables it to operate optimally even if the temperature or operating voltage changes. At the protocol layer, Serial Management Protocol (SMP) prioritization, power management, service capabilities, and arbitration fairness for connection requests have undergone enhancements.

24G SAS has optimizations for both HDD and SSD. Shingled Magnetic Recording (SMR) zone block commands enable effective management of the newest, most dense HDDs. A group of Storage Intelligence features allows SSD applications to manipulate write streams to reduce garbage collection and write amplification. Storage intelligence also gives better control over background housekeeping tasks. With better management of writes, SSD performance will be improved and lifetime extended.

Lane Count and Performance

Each lane of 24G SAS has 19.2 Gbps bandwidth, doubling the bandwidth from 12Gb/s SAS. A SAS device typically uses 2 or 4 SAS lanes for each drive. Over 1,000 SAS devices can connect to the processor via the same RAID controller or HBA. For comparison, PCIe 4.0 storage solutions have a maximum bandwidth for a single lane of 15.8 Gbps, which is slower than SAS. NVMe devices directly attached to the PCIe bus have a scalability limitation due to the memory and management required by the local system memory mapped technology.

SAS gives more speed per lane, and has more flexibility, allowing one SAS device to take advantage of all the bandwidth offered and allow thousands of SAS devices to connect using the same SAS lanes.

24G SAS, like previous generations, supports **MultiLink SAS™** using wide-port connections, such as x2, x4 and higher to the drive.
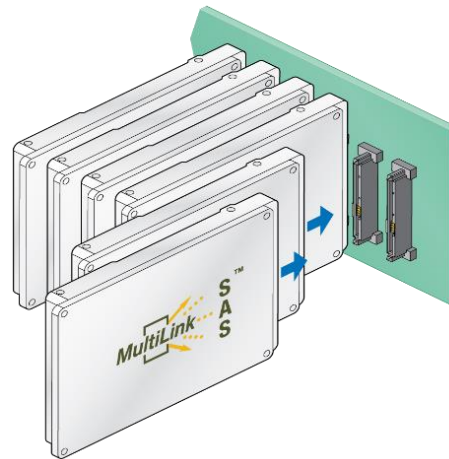
SAS has a complete, established ecosystem including the internal components as well as internal and external cabling and connectors.

Refer to SAS Benefits paper available here: https://www.demartek.com/Demartek_SAS_Benefits_2017-07.html on the Demartek website.

Summary and Conclusion

SAS is the most mature protocol that offers fast 24G speeds and is the only such protocol with optimizations for SSDs and HDDs, making it continue to be the ideal solution for almost all datacenter applications.

Leveraging its strong storage legacy, SAS continues to innovate with a roadmap that extends beyond 24G SAS, making it a sustainable storage platform that supports future storage needs.

The most current version of this report is available at
https://www.demartek.com/Demartek_SAS_Applications_24G_2018-07.html on the Demartek website.

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