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# 24G SAS Opens the Way to the Latest High-Performance Applications

Rick Kutcipal

President, SCSI Trade Association  
Product Planning, Broadcom

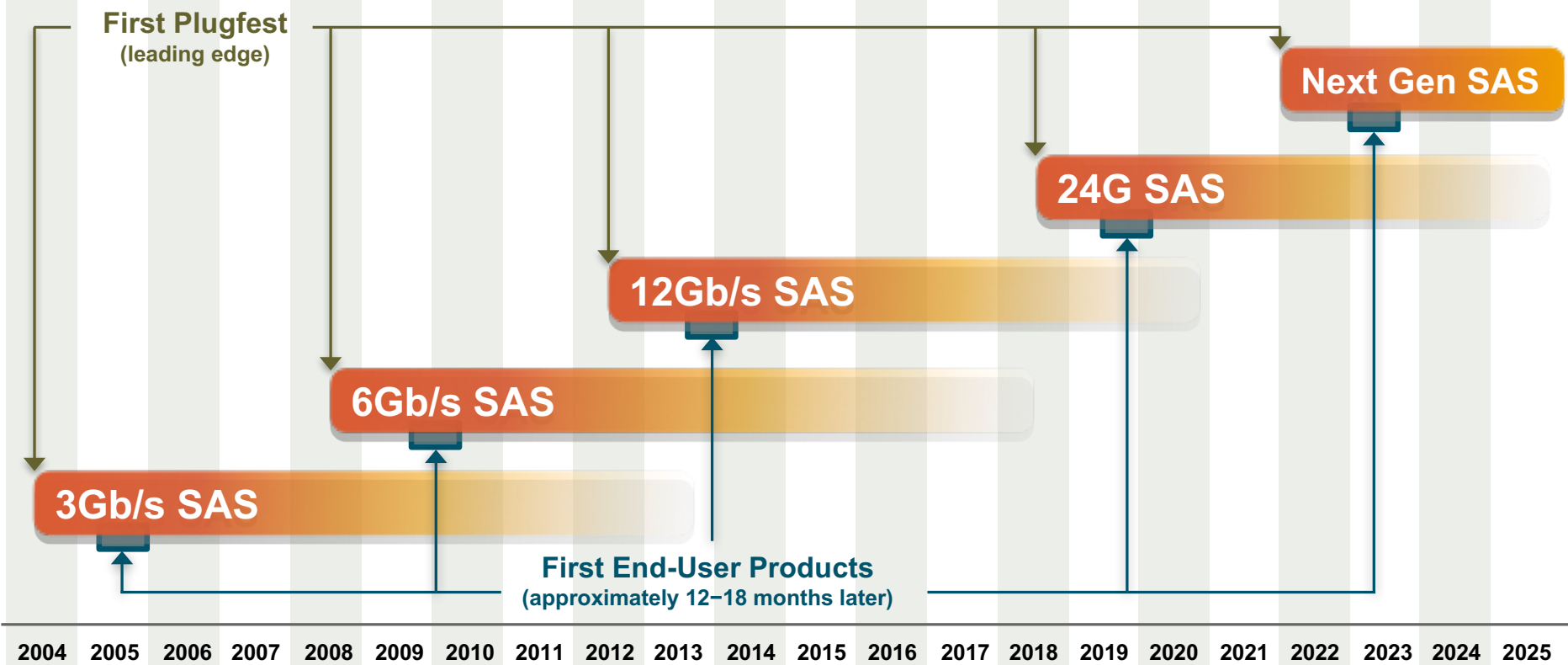


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## Today's Panel

- **SAS Continues to Thrive**  
*Don Jeanette, Vice President at TRENDFOCUS, NAND/SSD Market Research*
- **Expanding on a Vibrant, Mature Storage Ecosystem**  
*Jeremiah Tussey, Sr. Product Marketing Manager (Alliances), Scalable Storage Business Unit, Microsemi Corporation*
- **Applications Drive 24Gb/s SAS**  
*Dennis Martin, Founder and President, Demartek*
- **Designing Your Data Center with 24G SAS and Flash**  
*Kevin Marks, Principal Engineer, Dell*

# SAS Technology Roadmap





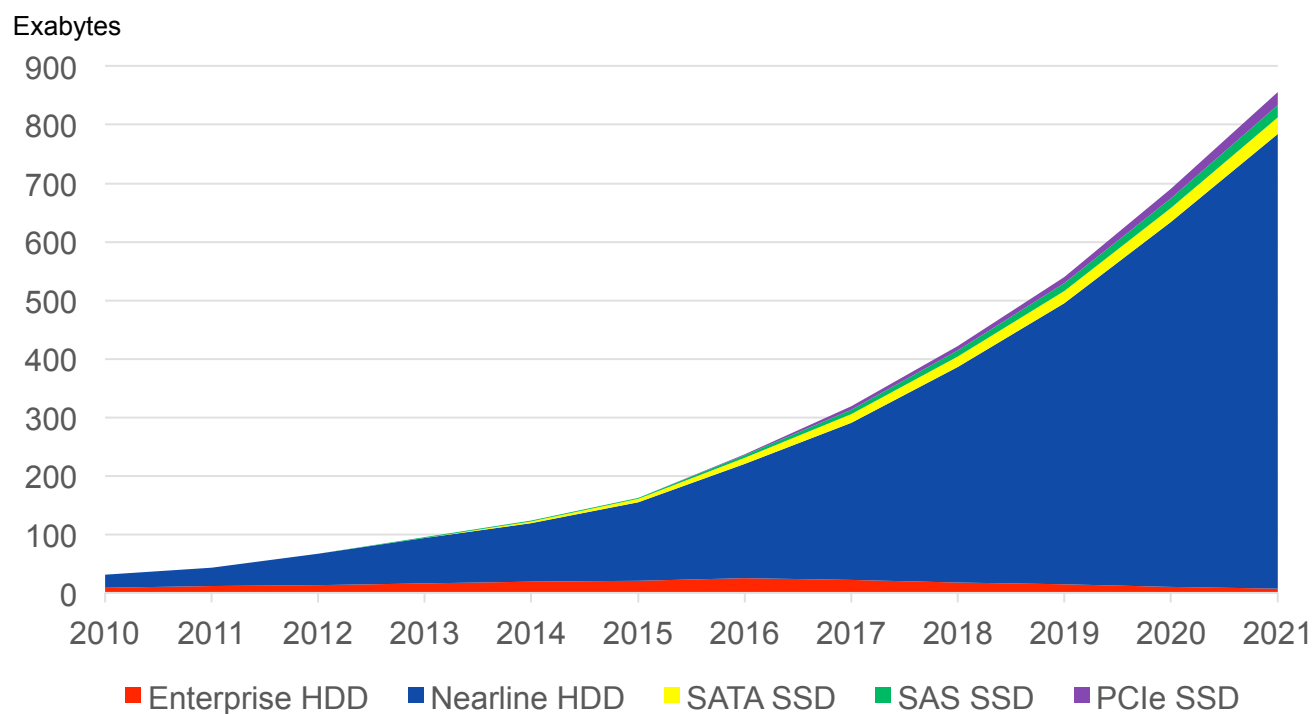
# SAS Continues to Thrive

Don Jeanette  
Vice President  
TRENDFOCUS



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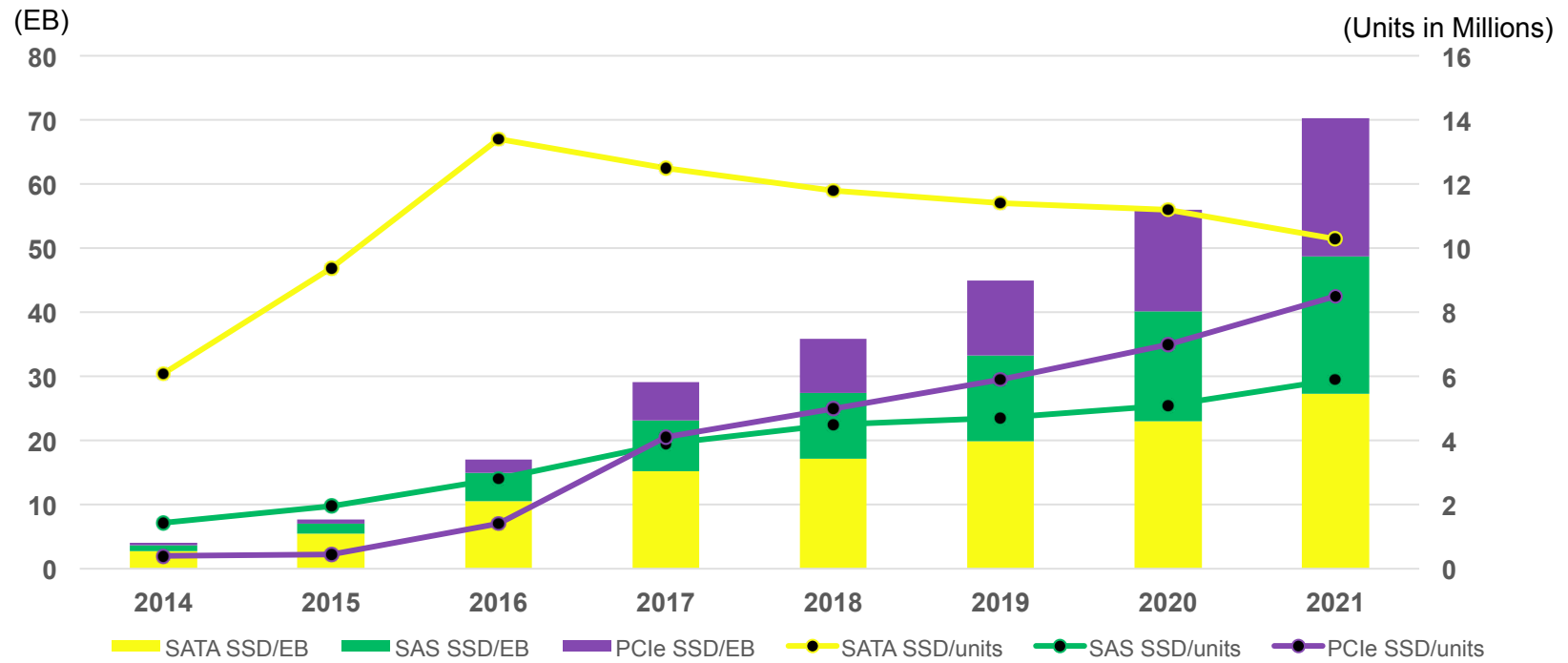
## eHDD/eSSD Storage Capacity Shipped



- Nearline HDDs, both SATA and SAS, will be the dominant storage devices for bit growth over the coming years, ensuring SAS a long and healthy life!
- SAS as one of the key protocols represents, in some way, almost all capacity shipped when combining HDD & SSD volumes



# The Promise Land of SSDs (with SAS)





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## Can't We All Just Get Along???

- SAS, including 24G SAS, remains more than relevant
- Things to consider
  - Markets served
  - Resources & Competencies
  - Competing Technologies
  - Supplier Strategies
  - Price Points



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# 24G SAS Will Have All the Support System Designers Need

**Jeremiah Tussey**

Alliances Manager, Product Marketing – Scalable Storage BU, Microsemi Corporation

*SCSI Trade Association (BoD – Secretary)*





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## System Designers need integration assistance...

- What to do with existing storage infrastructure and investment?
- How to cope with increasing capacity demand?
- What if more infrastructure will be deployed over time?
- How robust will my data be with future SAS generations?
- What improvements will there be to ensure reliable data and consistent performance?
- What level of performance is required to efficiently aggregate storage?
- Will there be the a variety of products in the next generation?



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## How Proven SAS Technology works for you...

- Backwards Compatibility
  - Leverage existing ecosystem (tools, test equipment)
  - Support for two generations of backward compatibility
    - SAS-4 delivers great value when aggregating lower speed SAS/SATA drives
    - SAS/SATA (HDD+SSD) majority of all drives shipped per year thru 2021\*

- Preserve and Enhance SAS Value Proposition

- Reliability – Robust Error Handling and Availability
- Scalability – Scalable to 1,000s of Devices, Multiple Connectivity Options!
- Flexibility – SAS Infrastructure Supports SAS/SATA Devices, and More!
- Serviceability – Surprise Add/Remove Media & Cables (De Facto Standard!)
- Manageability – Storage Management Built into Standard (Platform/Enclosure Mgmt), Cable Mgmt





# Reliability



- Robust Error Handling
  - i. Pull a drive
  - ii. CRC error
  - iii. Reset
  - iv. Adding another JBOD
- Enables Incomparable Availability
  - supporting multi-host environments
  - redundant failover mechanisms
  - multiple and independent data access points to the infrastructure
- Proven Over 3 Generations of SAS
- Mechanisms In Place Within The Protocol To Protect



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## Innovative 24G SAS Technology



- Physical Layer Enhancements
  - 2.4 GB/s effective **single-lane** bandwidth (22.5 Gbaud rate)
  - 20-Bit Forward Error Correction (FEC) enhances industry-standard encoding (128b/130b) up to 30dB channels
  - Leveraging OIF-CEI and IEEE
  - SAS-4 transmitter training algorithm (continuous adaptation)
- Protocol and Block Level Enhancements
  - Fairness enhancements – performance consistency across topologies
  - Storage Intelligence and Persistent Connections – SSD efficiency
  - Zoned Block Commands (ZBC) – SMR and future HDD technologies
  - SMP priorities – higher priority for management-class traffic
  - Enhanced buffering/aggregation mechanisms



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# What products will support 24G SAS



- Cables
- Storage Enclosures
  - SAS Expanders
- Servers
  - HBAs
  - RAID Controllers
- Storage Media
  - SSDs/HDDs (SAS)
- Analyzers
- Test Equipment
- Plugfests
- Testing Services



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# 4K Video, Real-Time Analytics, and AI Applications Drive 24G SAS

Dennis Martin





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## About Demartek

- Industry Analysis and ISO 17025 accredited test lab
- Lab includes enterprise servers, networking & storage (6/12Gb SAS, 10/25/40/100GbE, 8/16/32GFC)
- We prefer to run real-world applications to test servers and storage solutions (databases, Hadoop, etc.)
- Demartek is an EPA-recognized test lab for ENERGY STAR Data Center Storage testing
- Website: [www.demartek.com/TestLab](http://www.demartek.com/TestLab)



Full Report



Short Report



Video Report



Infographic



Commentary



Speaking

# Storage Interface Comparison



- Free reference page on demartek.com
  - [www.demartek.com/Demartek\\_Interface\\_Comparison.html](http://www.demartek.com/Demartek_Interface_Comparison.html)
  - Search for “**storage interface comparison**” in your favorite search engine
- Popular page – includes interactive PDF for download
- Provides comparison of storage interfaces
  - FC, FCoE, IB, iSCSI, NVMe, PCIe, SAS, SATA, Thunderbolt, USB
  - Transfer rates, encoding schemes, history, roadmaps, cabling, connectors
- ***We’re not a product vendor – we use these technologies in our lab***





## What do these have in common?

- 4K Video
- Real-time Analytics
- AI Applications



## 4K Video

- UHD, DCI 4K standard: 4096 x 2160  $\approx$  8.8M pixels
  - Used in theaters and by the movie studios
- UHD-1 or UHDTV: 3840 x 2160  $\approx$  8.3M pixels
  - Used in consumer devices
  - 4x 1080p (1920 x 1080  $\approx$  2.1M pixels)
  - 9x 720p (1280 x 720  $\approx$  0.9M pixels)
- 4K TV broadcasting expected by 2019 or 2020 in USA
  - ATSC 3.0 specification, early trials in 2017



# Storage Requirements for Video?

## Data rates (MB/s) for video editing

- 4 – 444 depending on resolution, etc.\*
- Per video editing station

SAS has the bandwidth for the storage back-end to support many video editing stations

## Multiple cameras or video streams

- Number of cameras
- Number of hours of recording (per camera)
- Frames per second (fps)
- Resolution (4K, 1080p, 720p, etc.)
- Compression used (Codec)
- Length of time data is to be stored
- Number of backup copies

\* Source: Avid

[http://avid.force.com/pkb/articles/en\\_US/White\\_Paper/DNxHR-Codec-Bandwidth-Specifications](http://avid.force.com/pkb/articles/en_US/White_Paper/DNxHR-Codec-Bandwidth-Specifications)

Imagine a video surveillance system:  
100 cameras, 720p, 15 fps, 24 hours



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# Real-time Analytics

- Reminder: 1440 minutes/day and 86,400 seconds/day
- A few sources of data:
  - Internet of Things (IoT) sensors, cameras, etc.
  - IT infrastructure event logs (servers, network, storage, security, etc.)
  - Payment transactions
  - Smart buildings, cars, cities
  - Medical procedures, studies
- Ingest, extract and process in real-time requires:
  - Fast storage access and processing power near the data source
- SAS infrastructure supports this today



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# Artificial Intelligence (AI) Applications

- AI and machine learning are hungry for massive amounts of data in order to make predictions and other analysis
    - Free dashcam example
    - MyShake example
  - The nature of storage needs to adapt
    - Faster
    - More metadata
    - Policy-based management
- } SAS supports this today



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## What do these have in common?

- 4K Video
  - Real-time Analytics
  - AI Applications
- } • Huge amounts of data
- Need fast access to storage



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## 24G SAS

- Takes advantage of the faster PCIe 4.0 bus
- Backward compatible with the full SAS ecosystem
- Already supported:
  - Scales to thousands of devices
  - Dual-ported drives
  - Hot swap
  - Multi-path I/O (MPIO)
  - Broad O.S. and hypervisor support
  - Management infrastructure



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# Designing Your HyperConverged Data Center with 24G SAS and Flash

Kevin Marks

Technologist, Distinguished Engineer

DellEMC | Server Solution Office of the CTO





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# The Shift to Hyper-Converged



Then



Hyper-converged



Now

# Driving the HCI Shift





## How 24G SAS Enables the HCI Shift

**SPEED** - Doubles the bandwidth from previous generation and is well matched to Gen4 PCIe

- HCI requires lots of IO bandwidth, HCI has lots of local IO

**RELIABILITY** – Adds active transmitter training and Forward Error Correction (FEC)

- HCI platforms have complex signal channels and need help to maintain cost

**LATENCY** – Add persistent connections and enhances Edge/Buffering for devices (SATA)

- HCI requires low latency, especially for any type of SSD caching devices



## And this is on top of

**SCALABILITY**- Maintains same device counts and reach

- While HCI generally does not have large SAS domains, it allows for JBOD expansion if needed

**MANAGEMENT** – Maintains the same management layer including enclosure management

- HCI solutions can reuse the years of management/enclosure APIs/code

**EXCEPTION HANDLING** - Maintains the same exception handling/hotplug support

- HCI solutions can reuse the years of development in exception handling and hotplug support

**SECURITY** - Maintains the same security use cases via TCG

- Many HCI platforms have building support for TCG security solutions



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# Thanks

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