SCSI Standards and Technology Update

Rick Kutcipal, President, SCSI Trade Association
Greg McSorley, Vice President, SCSI Trade Association

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Abstract

- SCSI Standards and Technology Update

SCSI continues to be the backbone of enterprise storage deployments and continues to rapidly evolve by adding new features, capabilities, and performance enhancements. This presentation includes an up-to-the-minute recap of the latest additions to the SAS standard and roadmaps, the status of 12Gb/s SAS deployment, advanced connectivity solutions, MultiLink SAS™, and 24Gb/s SAS development. Presenters will also provide updates on new SCSI features such as Storage Intelligence and Zoned Block Commands (ZBC) for shingled magnetic recording.

SCSI Standards and Technology Update

- 12Gb/s SAS
- New SCSI Features
- Advanced Connectivity
- MultiLink SAS™ and U.2
- 24Gb/s SAS

SAS Spans the Storage Spectrum

SNIA Global Education

SAS Fabrics	Direct Attach Storage	External Storage	HDD/SSD

- SAS Expanders
- SAS Switches
- Port Multiplexers

*ROC = RAID on a Chip
HBA = Host Bus Adapter

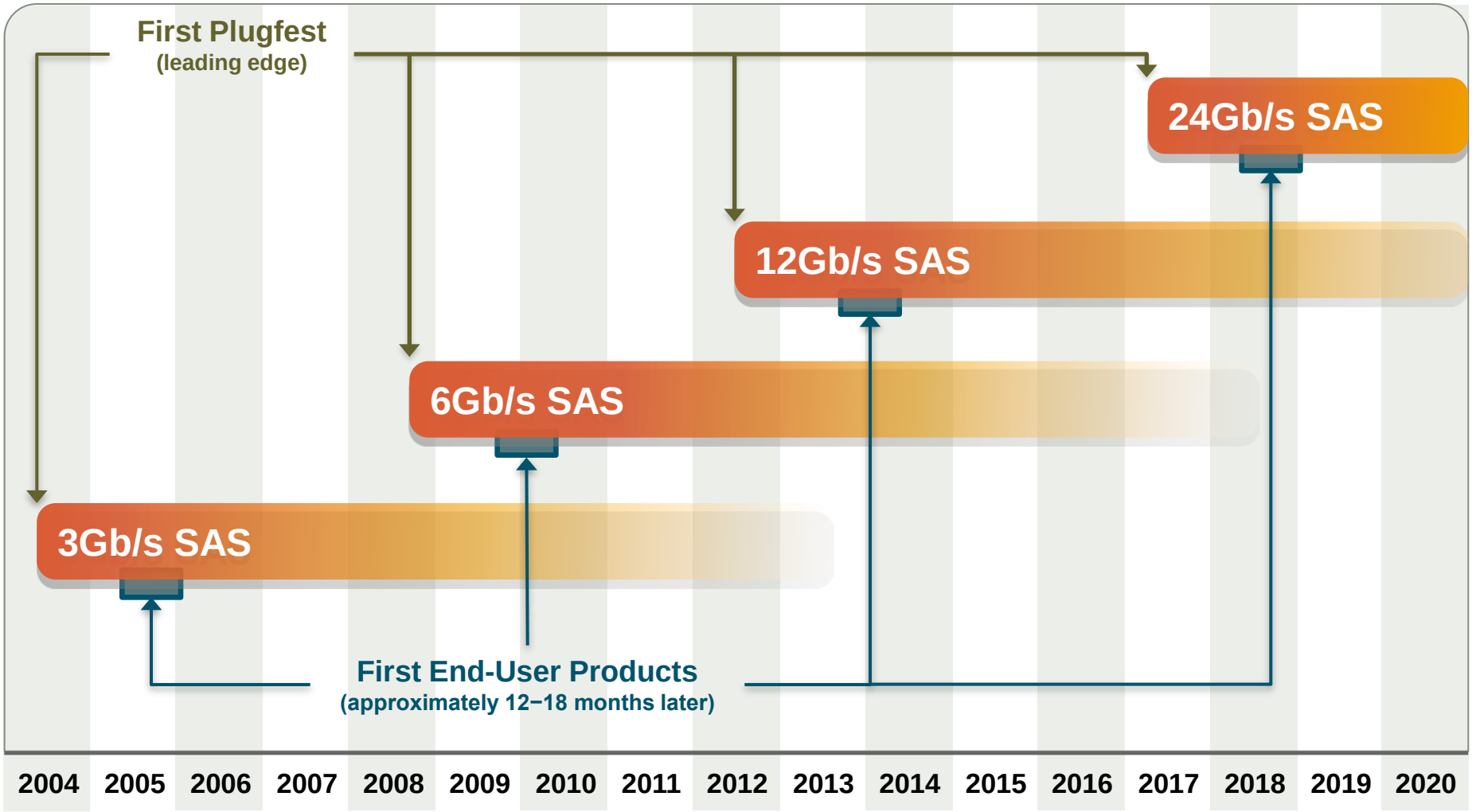
- Controllers/ROCs/HBAs*
- SDS HBAs
- Expanders
- Storage Blades

- NAS/SAN Heads
- Native SAS Connect
- Controllers/ROCs/HBAs*
- Expanders
- SAS/SATA Bridges

- SAS SSDs
- SATA SSDs
- SAS HDDs
- SATA HDDs
- Near-Line SAS HDDs

SAS is the Universal Storage Interface

SAS Technology Roadmap



Source: SCSI Trade Association – Aug 2015

12Gb/s SAS (Protocol Layer)

- 12Gb/s SAS Enabled the Intel Grantley Server Processor Launch
  - Consists of SPL-2/3 and SAS-3
- SPL-2 Published 3/2013
  - Transmitter Training
  - Enhanced Power Control
- SPL-3 Published 11/2014
  - Persistent Connections
  - Expander Forced Normal Completion of Connections

Largely SSD Enhancements

Shingled Magnetic Recording

Available Today

- Drive Managed
  - Drive autonomously hides all SMR issues
  - Workloads can affect performance
- Host Managed
  - New device type
  - Extensions to ATA and SCSI command sets (ZAC & ZBC)
  - Sequential writes are required
- Host Aware
  - Superset of Drive Managed and Host Managed
  - Extensions to ATA and SCSI command sets (ZAC & ZBC)
  - Sequential writes are preferred

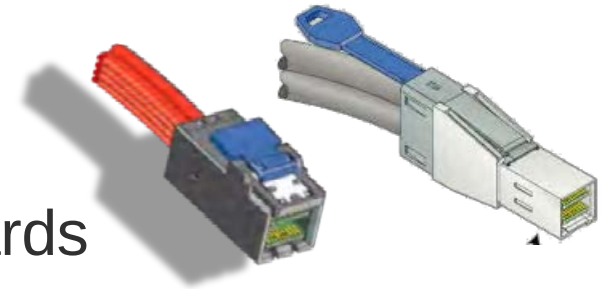
ZBC & ZAC Expected to Be Complete by the End of 2015

12Gb/s SAS (PHY Layer)

- SAS-2.1 Published 11/2011
  - Managed connectivity
  - Converged high-density connectivity – Mini-SAS HD
    - SFF-8644 (external connector)
    - SFF-8643 (internal connector)
  - Active copper support
  - Optical support
- SAS-3 Published 10/2014
  - 12 Gb/s SAS interface
  - Transmitter training
  - x4 backplane connector
  - Optical Mini-SAS HD connector

SAS Advanced Connectivity Objectives

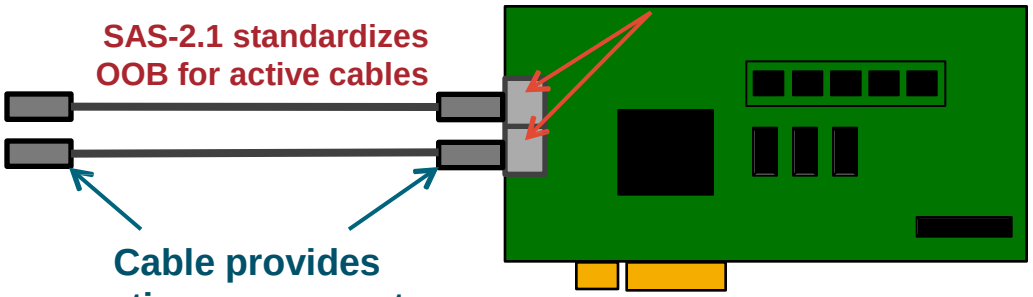
- Simplify Cable & Connector Options
  - 2X density improvement
- Provide Managed Connectivity Standards
  - Active copper solution to 20m
  - Optical solution to 100m
- Supports 6Gb/s,12Gb/s & 24 Gb/s SAS Deployments



Internal similar to external

Passive, Active Copper, and Optical use same connector

Supply power here for active cabling

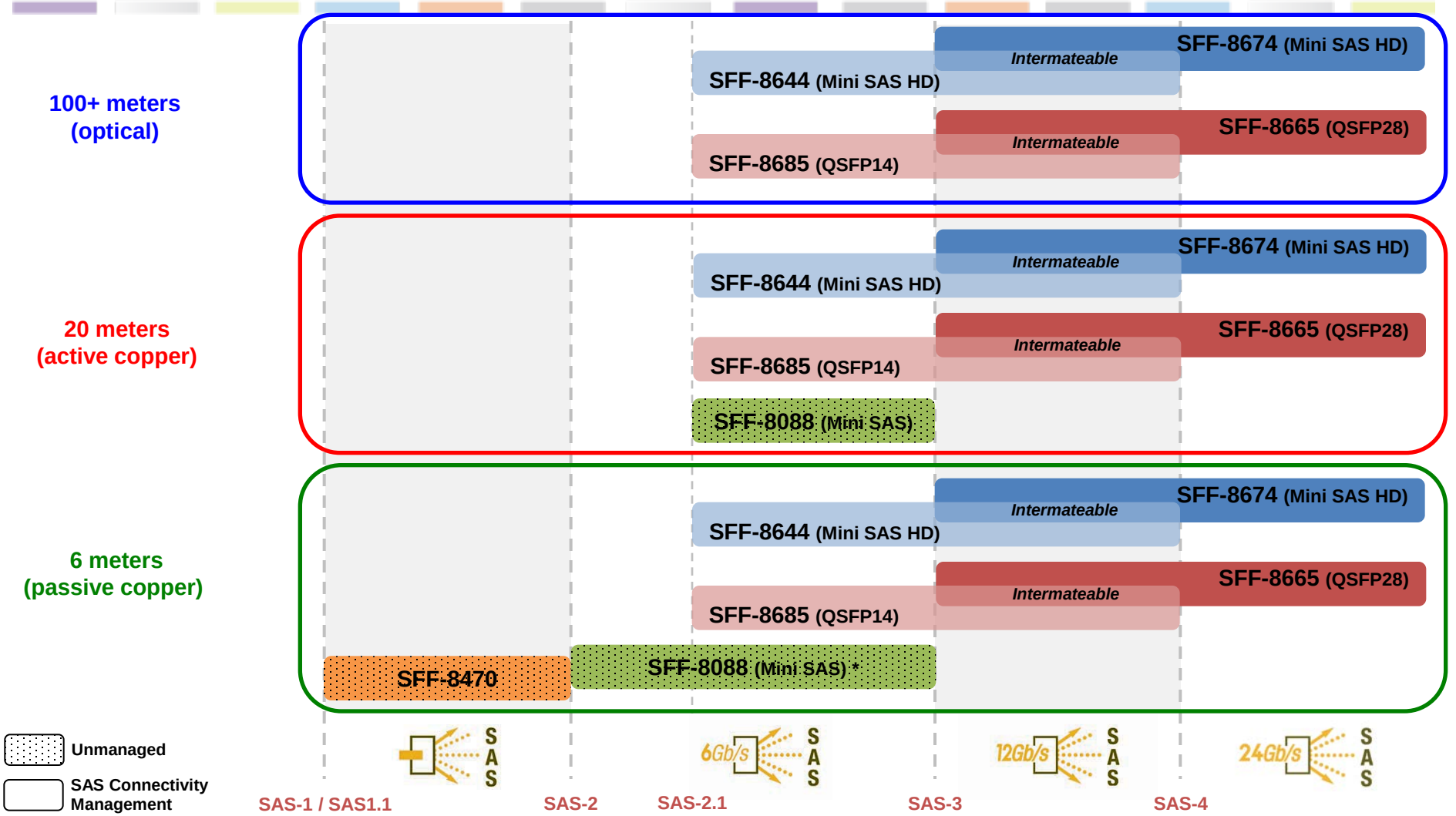


Mini-SAS HD connectors courtesy:
Project T10/2125-D Revision 04
17 September 2009, ANSI SAS-2.1

Advanced Connectivity: Managed Cables

- New in SAS-2.1, Fully Deployed in SAS-3
- OOB (Out of Band) Method of Controlling the Interface
- EEPROM (or microprocessor) in the Cable End Communicates Via I^2C to the System
- Enables Support For Passive Cu, Active Cu & Active Optical Cables From a Single HBA

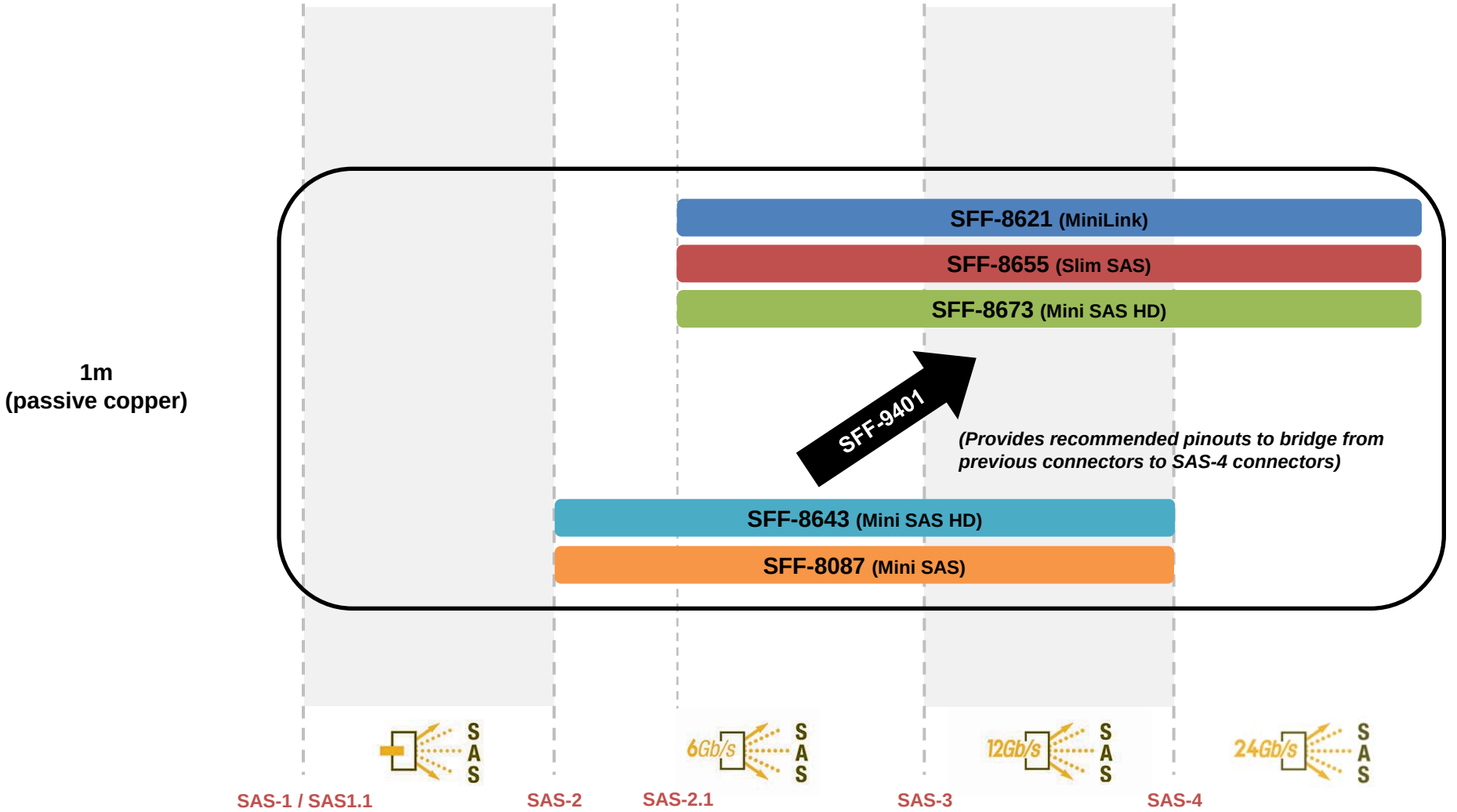
SAS External Cabling Solutions



* SFF-8088 passive copper up to 10m

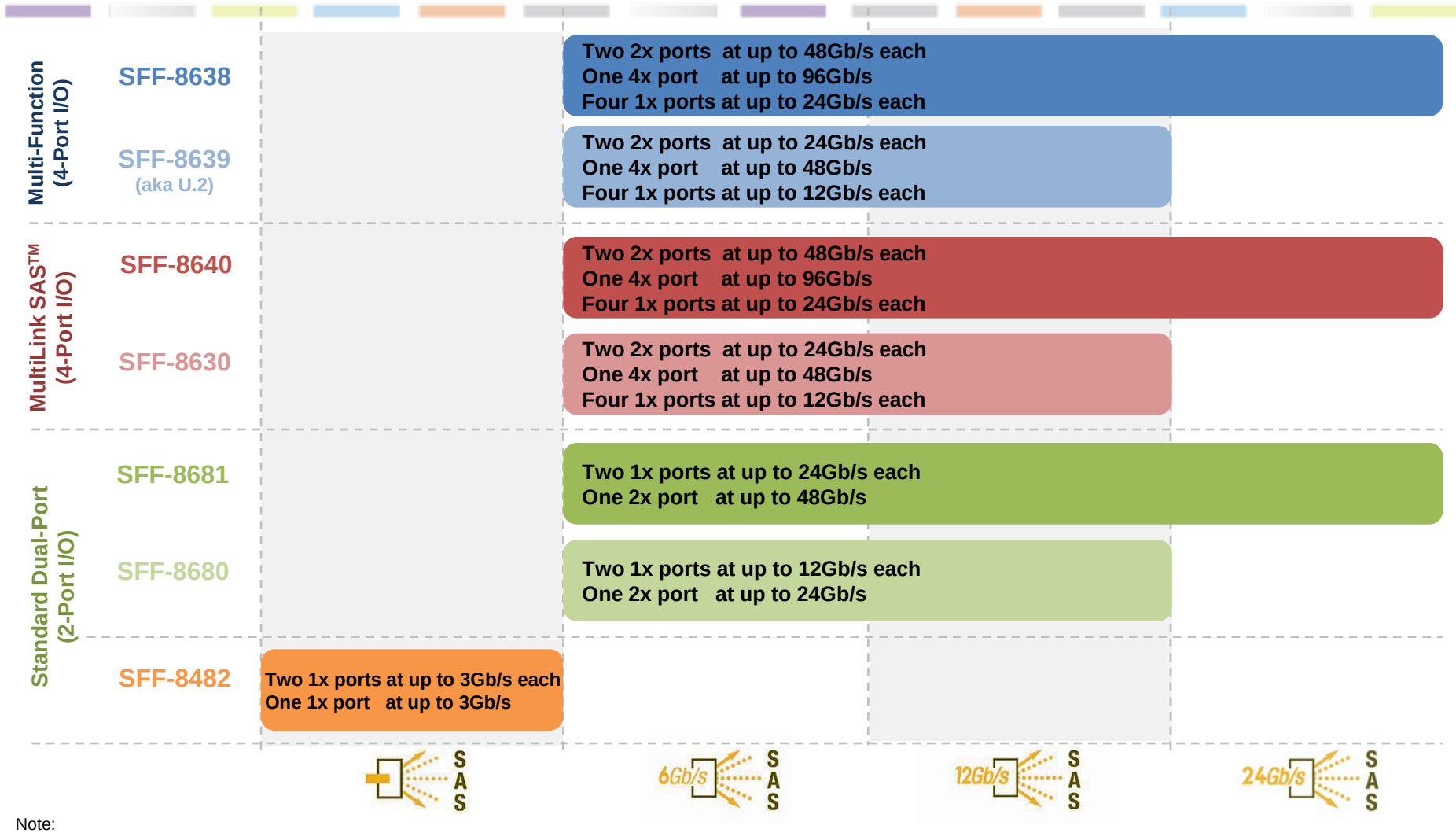
Source: SCSI Trade Association – Aug 2015

SAS Internal Cabling Solutions



Source: SCSI Trade Association – Aug 2015

SAS Device to Mid-Plane Interconnects



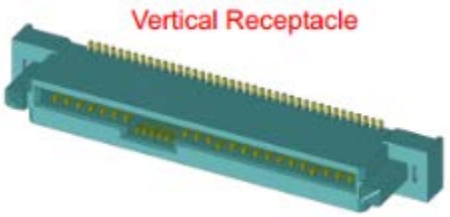
Note:
Data rates shown will double when full-duplexed.

Source: SCSI Trade Association – Aug 2015

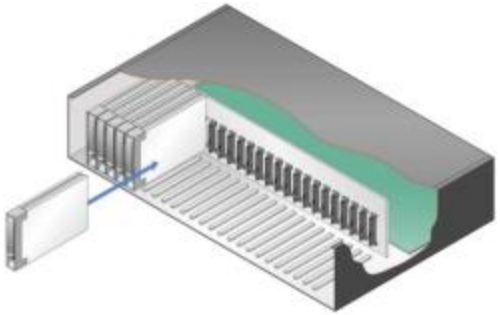
U.2 Components (formerly Express Bay)

25W Power

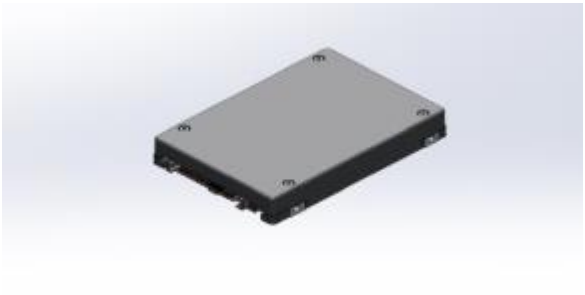
Cooling



Multifunction Connector

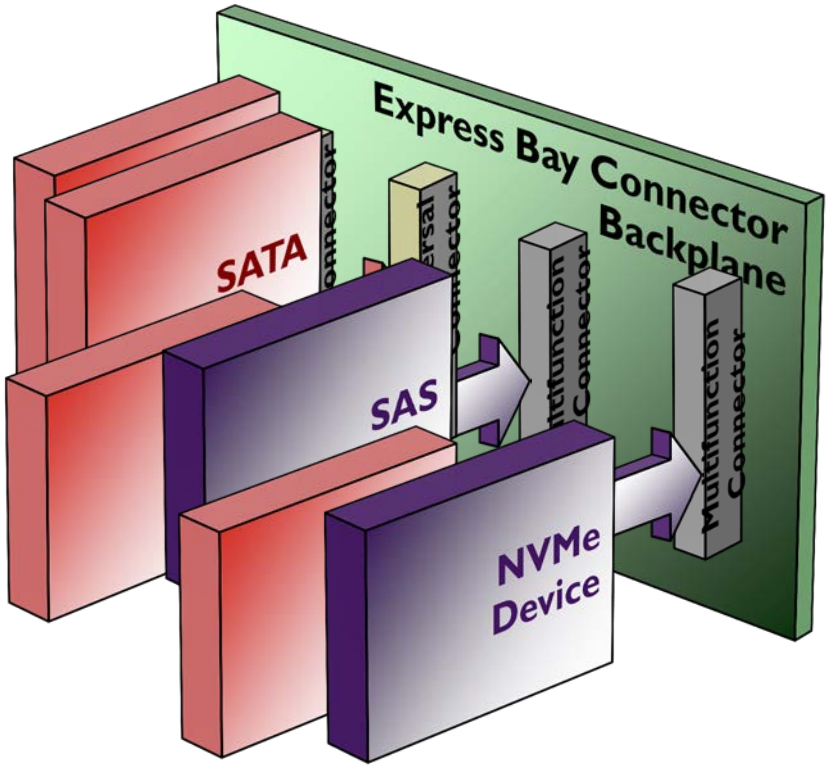


Accessibility / Serviceability



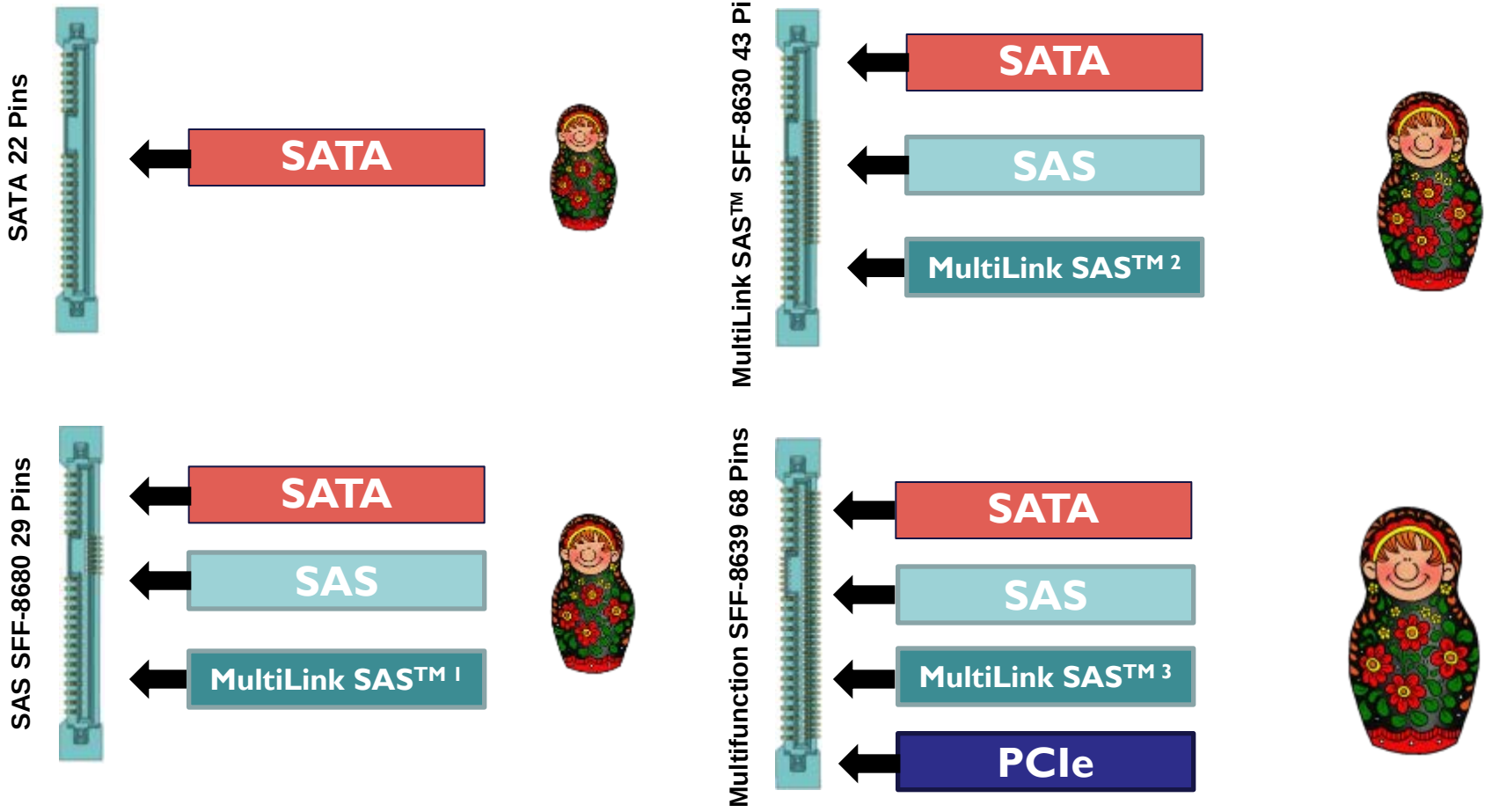
Traditional Drive Form Factor

U.2



- U.2
  - Up to 25 Watts
    - For both SAS and PCIe
  - SFF-8639 connector
  - PCI-SIG electrical specification
- Objectives
  - Preserve the enterprise storage experience for PCIe storage
  - Meet SSD performance demands
  - Serviceable, hot-pluggable Express Bay opens up new possibilities …

SAS Connector Compatibility



[1] Max two links operational

[2] Four links operational

[3] Two or four links operational depending on host provisioning

U.2 Summary

- Preserves the Enterprise Storage Experience for PCI Express Storage
- Meets SSD Performance Demands with PCIe, SAS, or SATA
- Serviceable, Accessible Bay Offers Configurability

24Gb/s SAS Objectives

- Double the Effective Bandwidth of 12Gb/s SAS
- Backwards Compatibility
  - Support for two generations of backward compatibility
  - Leverage existing ecosystem (tools, test equipment)
- Preserve the Existing SAS Value Proposition
  - **Reliability** – Robust Error Handling
  - **Scalability** – Scalable to 1,000s of Devices
  - **Flexibility** – SAS Infrastructure Supports SAS & SATA Devices
  - **Serviceability** – Surprise Add/Remove Media & Cables
  - **Manageability** – Storage Management Built into the Standard
- Align with a 2019 Platform Launch

24Gb/s SAS Characteristics

- 22.5 Gbaud
- Efficient Encoding – 128b/130b
- 20 Bit Forward Error Correction
  - Targeting a 30dB channel
- Protocol & Block Level Enhancements
  - SMP priorities
  - Storage Intelligence
  - Zone Block commands
- In Flight
  - Channel model (leveraging OIF-CEI & IEEE)
  - SAS-4 transmitter training algorithm (continuous adaptation)
  - Fairness enhancements

Summary

- SCSI Standards Continue to Evolve & Adapt
- New Features for Performance & Efficiency Being Added
- Proven Stable Protocol
- Follow T10 Activities (www.T10.org)
  - Standards updates
  - Meeting schedules
  - Discussions
- Stay Up-To-Date with the SCSI Trade Association (http://www.scsita.org)
  - Press releases
  - Articles

Attribution & Feedback

The SNIA Education Committee thanks the following Individuals for their contributions to this Tutorial.

Authorship History

Rick Kutcipal
Greg McSorley

Updates:

Additional Contributors

*Please send any questions or comments regarding this SNIA Tutorial to **tracktutorials@snia.org***