Tiered Storage Deployments with 24G SAS

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Agenda

- Enterprise Storage Market Update

- 24G SAS Enhancements

- Data Center Applications and Examples

- Storage Tiers Using 24G SAS
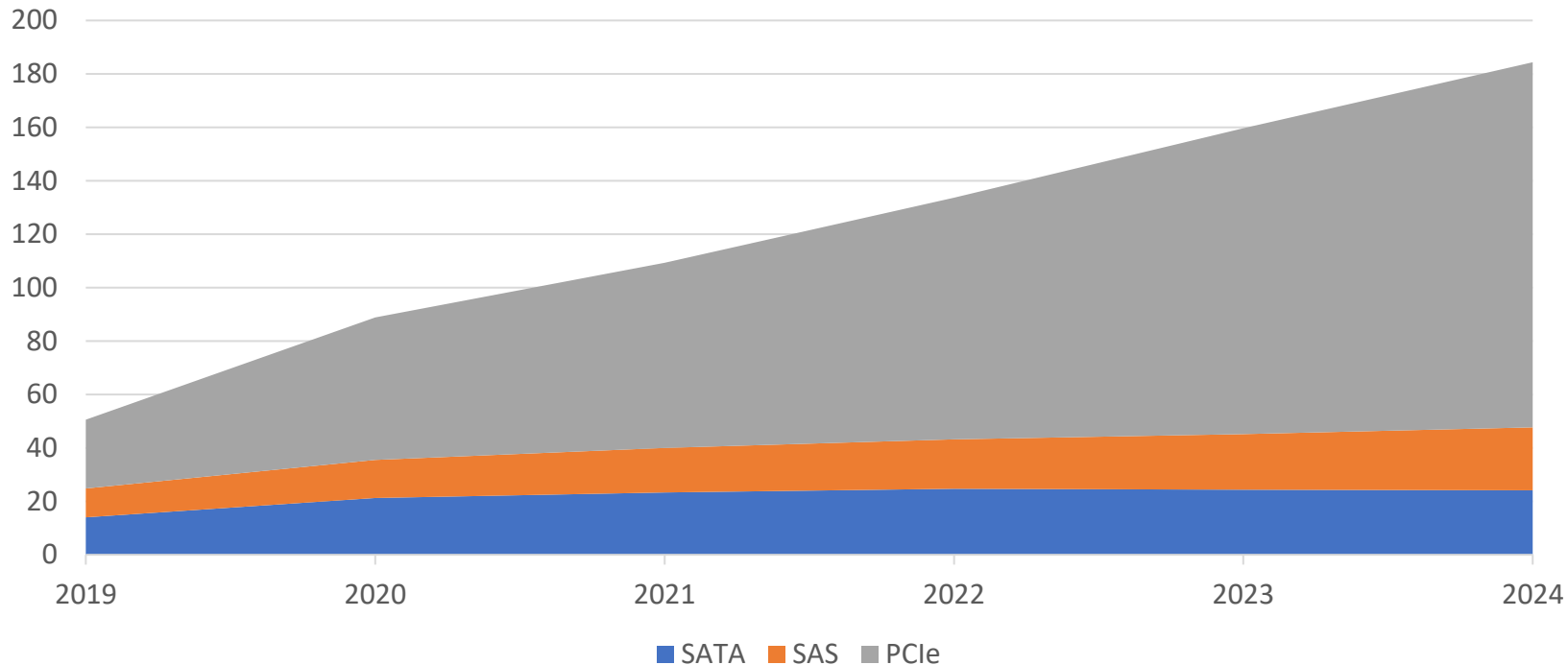
- Key Takeaways

All Enterprise Storage Exabytes (2019-2024)

SDC 20

SAS Connected Storage Continues Strong Growth

Legend: ■ SATA ■ SAS ■ PCIe ■ HDD (SAS/SATA)

Enterprise SSD Storage Exabytes (2019-2024)

Legend: SATA, SAS, PCIe
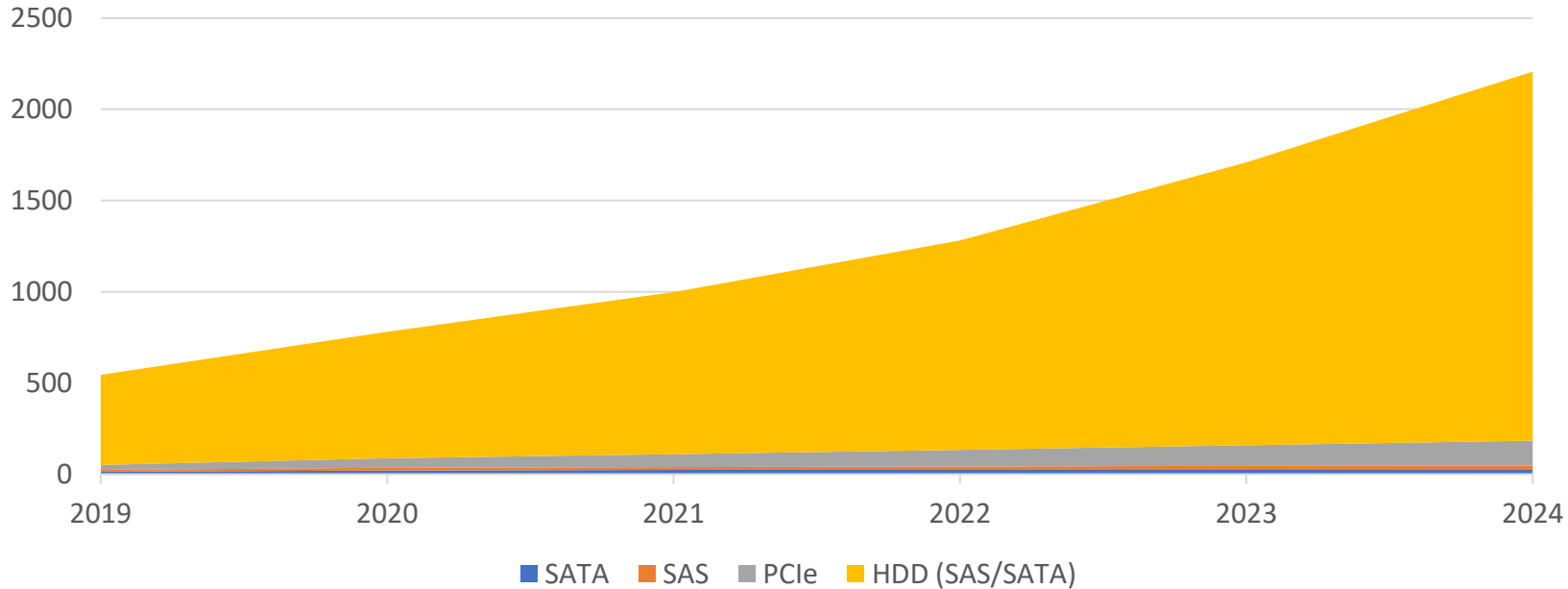
Source: TRENDFOCUS, August 2020
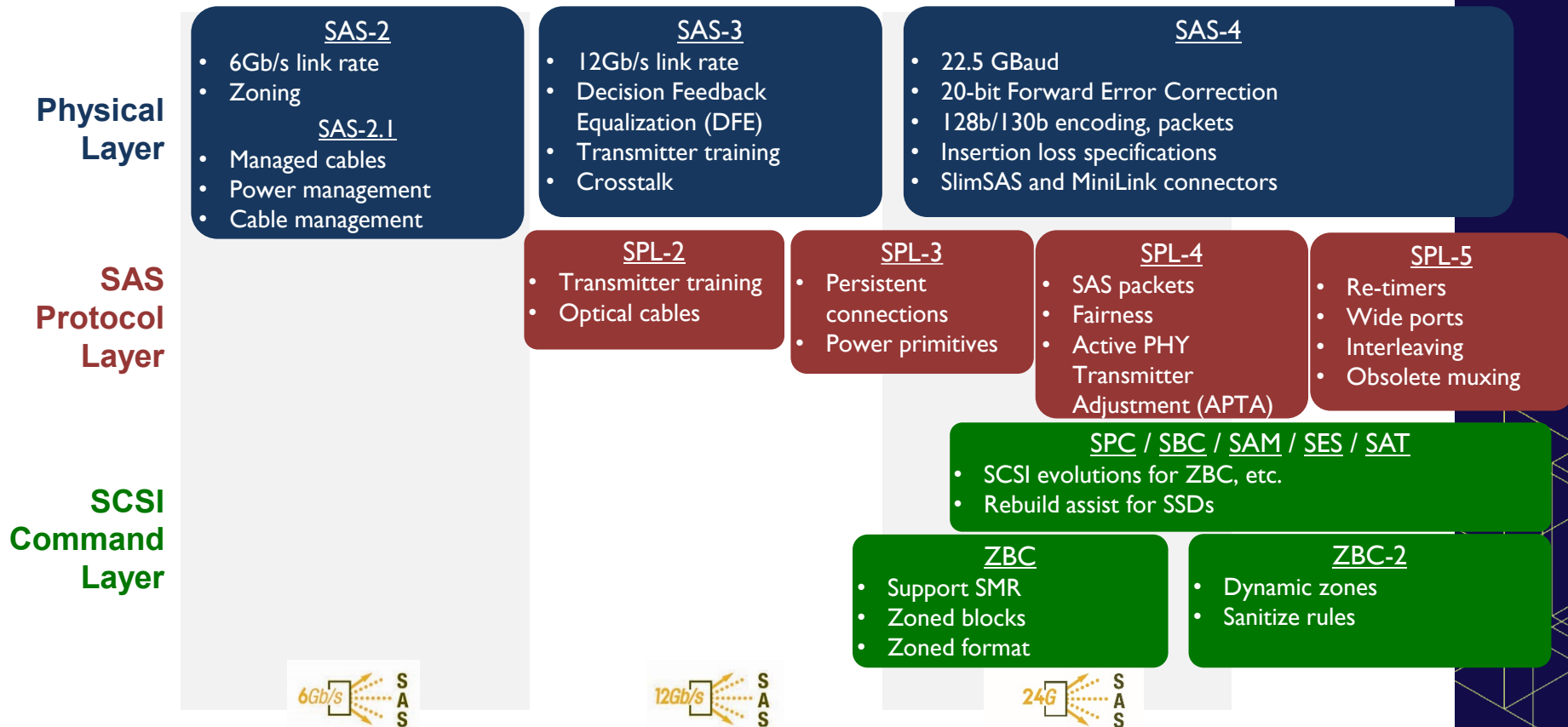(https://trendfocus.com/)

SAS Intersects New Media Innovations

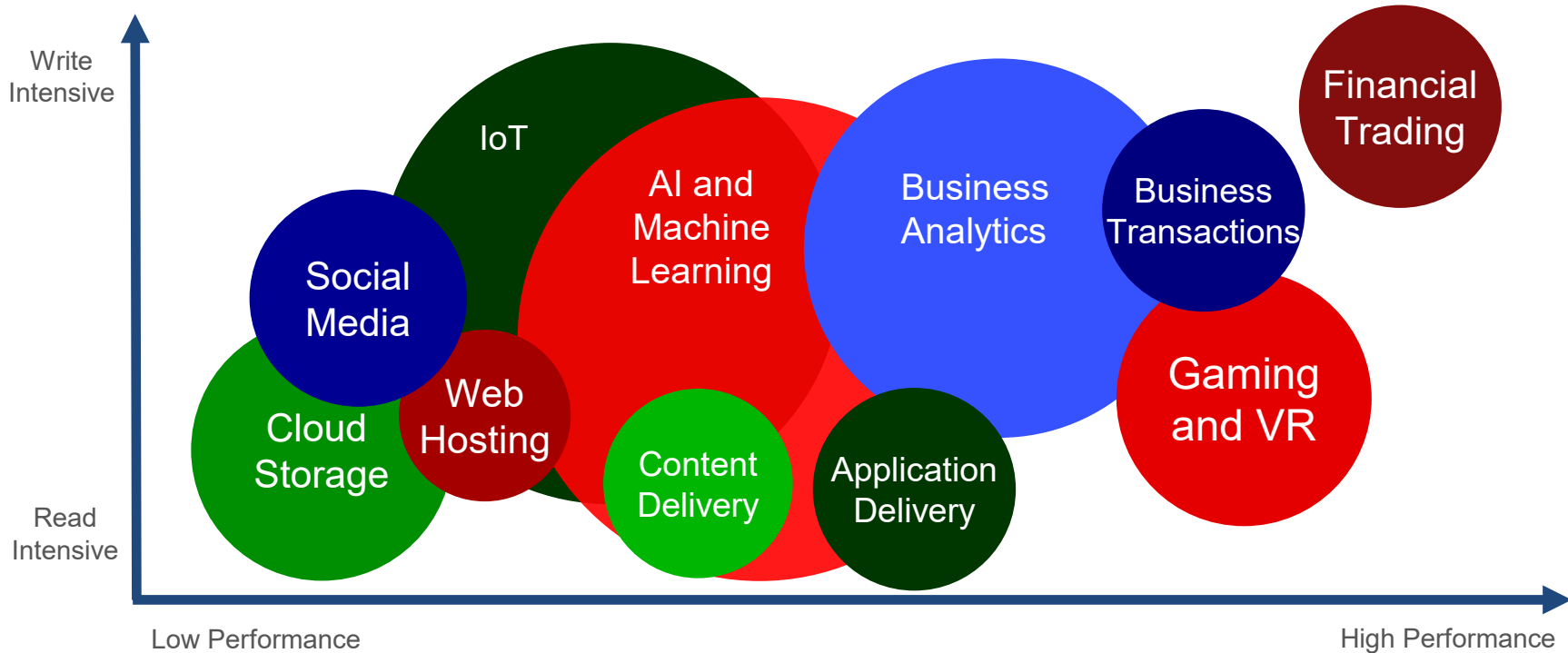## Storage media is ever-changing to increase IOPS and capacity and to provide lowest cost per GB

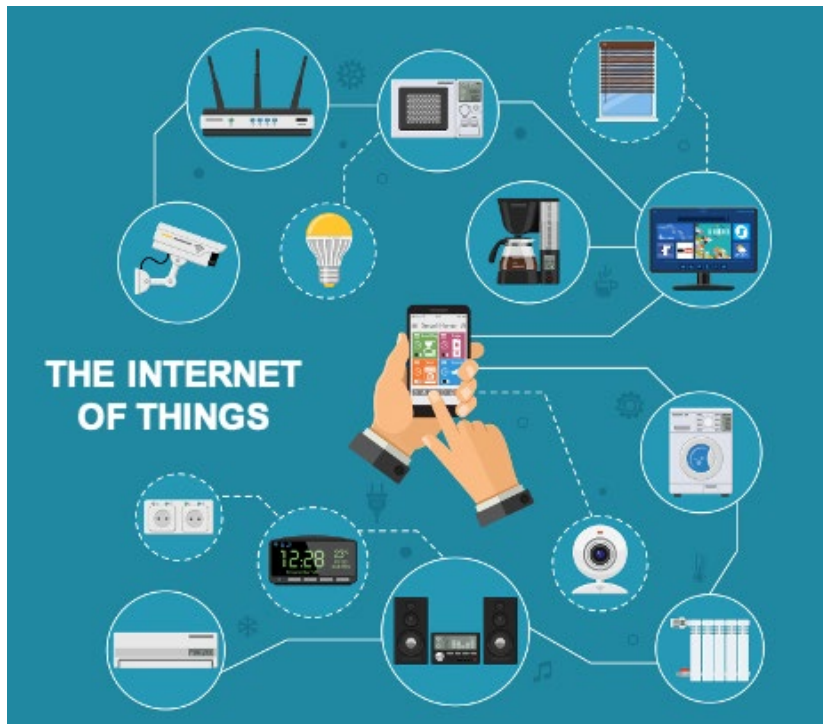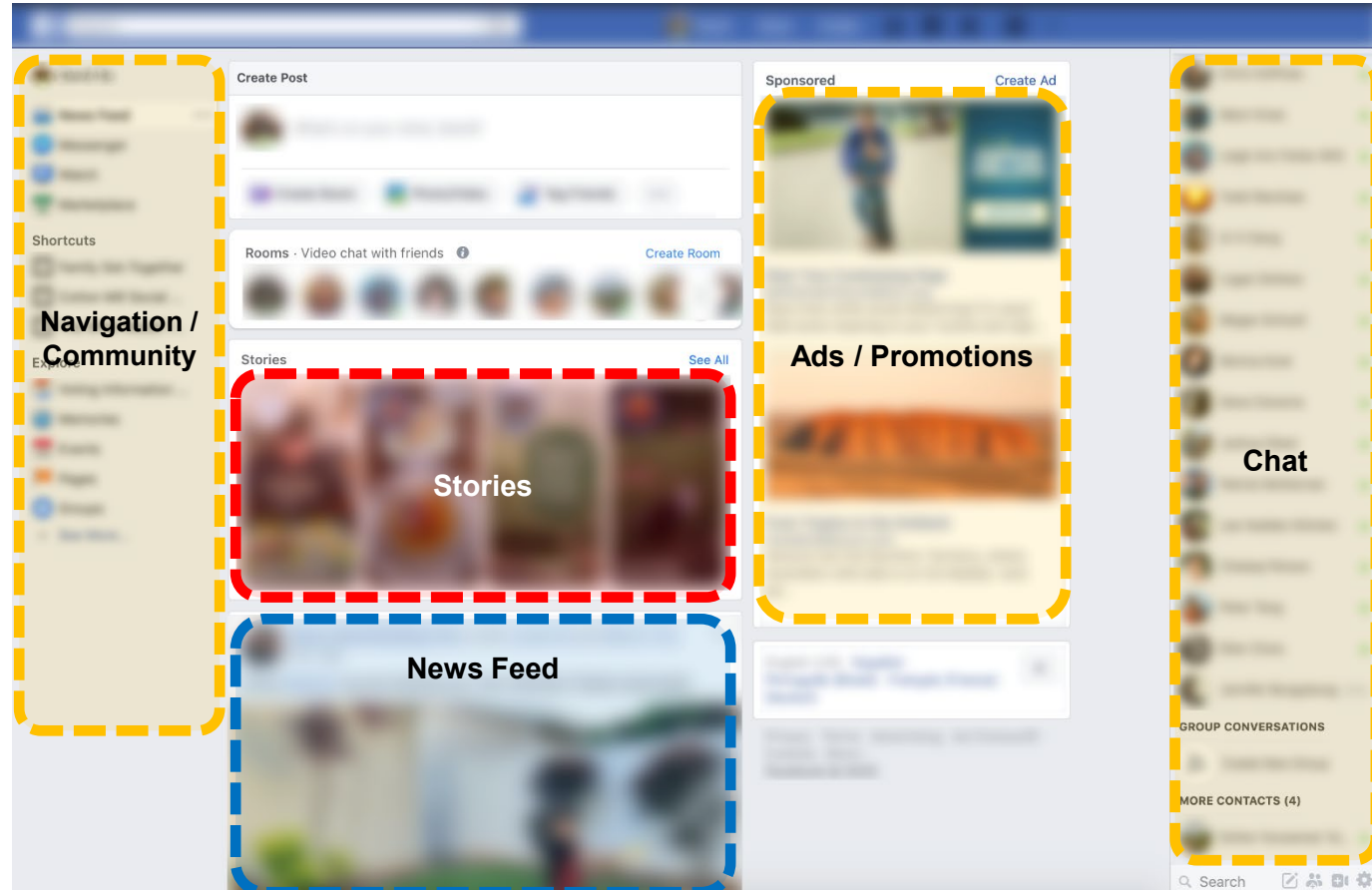| Innovation	Media	Focus	SAS's Role
MultiLink SAS™	HDD/SSD	Performance	Wide Device Connections
Storage Intelligence	SSD	Performance	Dedicated SSD Commands
TDMR (Two-Dimensional Magnetic Recording)	HDD	Faster Write Performance	HDD Connectivity
HAMR (Heat Assisted Magnetic Recording)	HDD	Capacity	HDD Connectivity
MAMR (Microwave Assisted Magnetic Recording)	HDD	Capacity	HDD Connectivity
SMR (Shingled Magnetic Recording)	HDD	Capacity	ZBC
HSMR (Hybrid Shingled Magnetic Recording)	HDD	Capacity	ZBC2
Multi-Actuator	HDD	Performance (IOPs/TB)	Multi LUN Connections
QLC (Quad-Level Cell) NAND	SSD	Capacity	ZBC

Specifications/Enhancements Timeline

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Physical Layer

SAS-2
- 6Gb/s link rate
- Zoning

SAS-2.1
- Managed cables
- Power management
- Cable management

SAS-3
- 12Gb/s link rate
- Decision Feedback Equalization (DFE)
- Transmitter training
- Crosstalk

SAS-4
- 22.5 GBaud
- 20-bit Forward Error Correction
- 128b/130b encoding, packets
- Insertion loss specifications
- SlimSAS and MiniLink connectors

SAS Protocol Layer

SPL-2
- Transmitter training
- Optical cables

SPL-3
- Persistent connections
- Power primitives

SPL-4
- SAS packets
- Fairness
- Active PHY Transmitter Adjustment (APTA)

SPL-5
- Re-timers
- Wide ports
- Interleaving
- Obsolete muxing

SCSI Command Layer

SPC / SBC / SAM / SES / SAT
- SCSI evolutions for ZBC, etc.
- Rebuild assist for SSDs

ZBC
- Support SMR
- Zoned blocks
- Zoned format

ZBC-2
- Dynamic zones
- Sanitize rules

6Gb/s SAS

12Gb/s SAS

24G SAS

Data Center Storage Applications

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Write Intensive

Read Intensive

Low Performance

High Performance

IoT

AI and Machine Learning

Business Analytics

Business Transactions

Financial Trading

Social Media

Web Hosting

Cloud Storage

Content Delivery

Application Delivery

Gaming and VR

Data Everywhere (and Every Way)

THE INTERNET OF THINGS

Social Media Example

Navigation / Community

Create Post

Rooms · Video chat with friends

Create Room

Stories

See All

Stories

News Feed

Sponsored

Create Ad

Ads / Promotions

Chat

GROUP CONVERSATIONS

MORE CONTACTS (4)

Search

Social Media Tiered Storage Example

	Function	HW Storage Support	Storage Cap/ Perf
Social Media Application	OS & Web Server	Mirrored Boot Volume	Low/ Low
	Database for User data	SAS HDD/SSD w/RAID	Medium/ High IOP
	Object Store	Lots of SATA devices	High/ Low
	Cache for Application & User Data	1 or 2 SSDs Lots of DDR	Low / High IOP

And what about analytics?
With a dataset of millions of users, what can we do??

Cloud Storage Architecture

Web Server

MemCache

DB Server

100% SAS Attach

Object Store

Analytics

Feeder
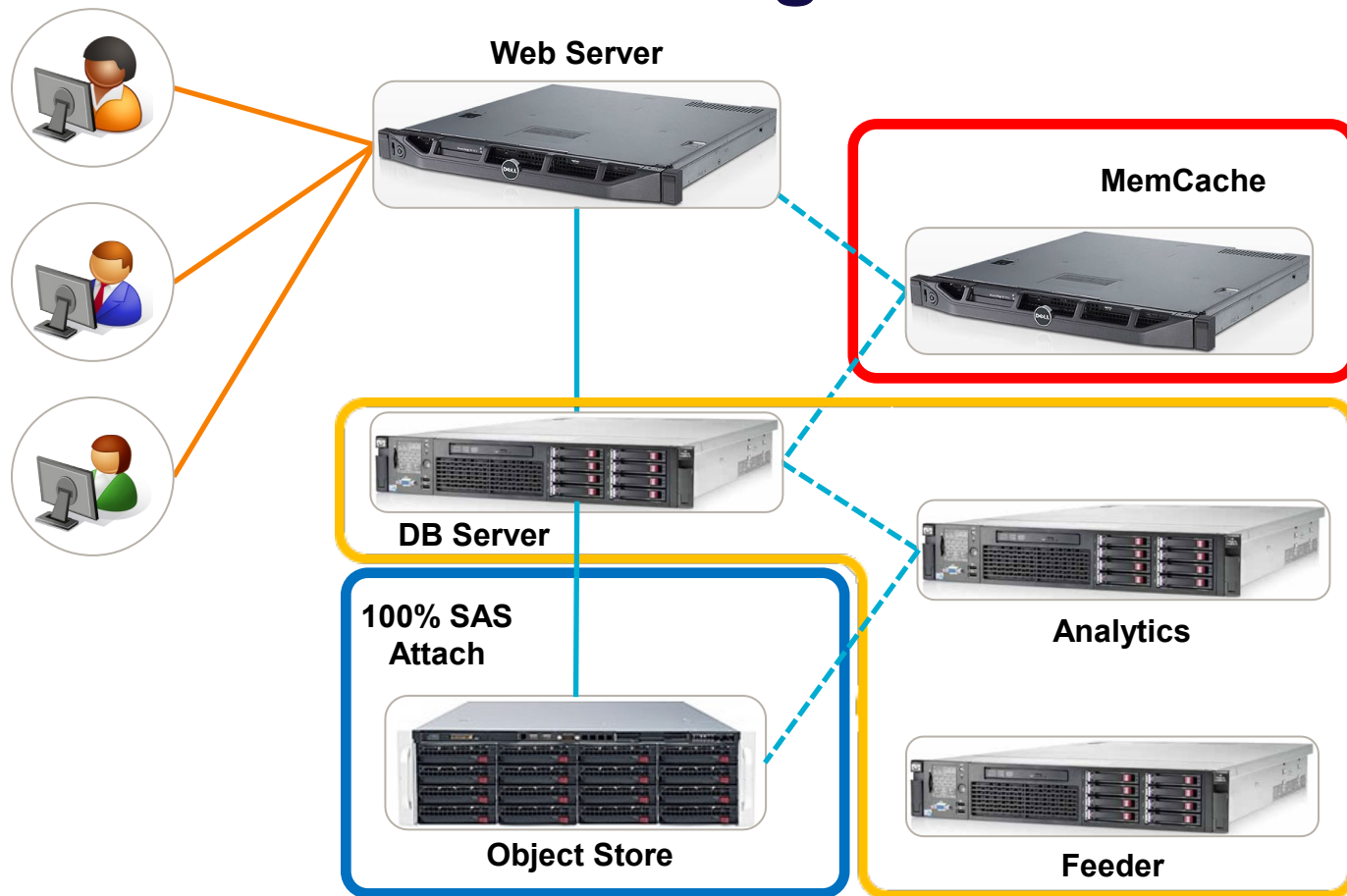
# Scalable, Flexible Storage – Hot Tier

SAS SSDs
SATA SSDs
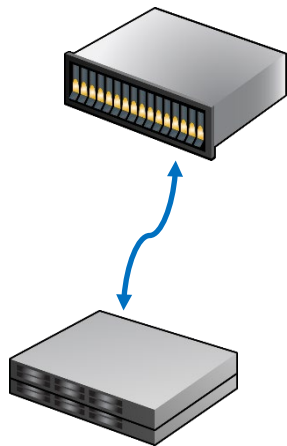
- Data center applications
  - Financial Trading
  - Gaming / VR
  - Business Transactions
  - AI and Machine Learning

- Storage requirements
  - Performance (IOPS)

- Features of 24G SAS that benefit this tier
  - Support for high-performance SAS and SATA SSDs
  - Cost-performance point ($ / IOPS)

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Scalable, Flexible Storage – Warm Tier

Cascaded JBODs (with SAS expanders) of Nearline SAS HDDs
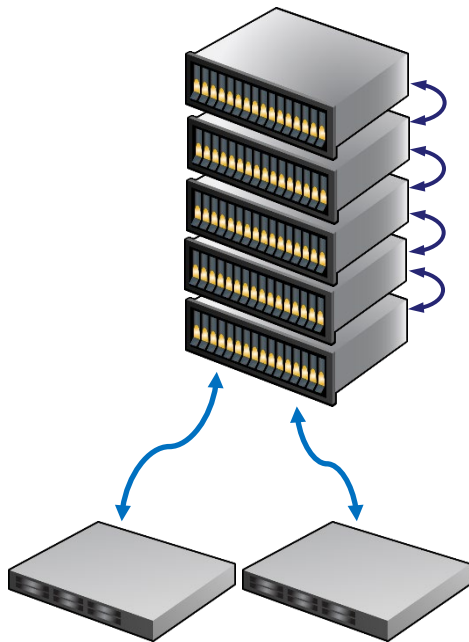
- Data center applications
  - IoT
  - Business Analytics
  - Social Media

- Storage requirements
  - Scalability
  - Balance of capacity, performance, and cost
  - Redundancy

- Features of 24G SAS that benefit this tier
  - Dynamic scaling up to 64K devices
  - Support for high-performance SAS HDDs
  - Reliability: Multi-path fail-over, RAID

# Scalable, Flexible Storage – Cold Tier

Cascaded JBODs (with SAS expanders) of SATA SMR HDDs
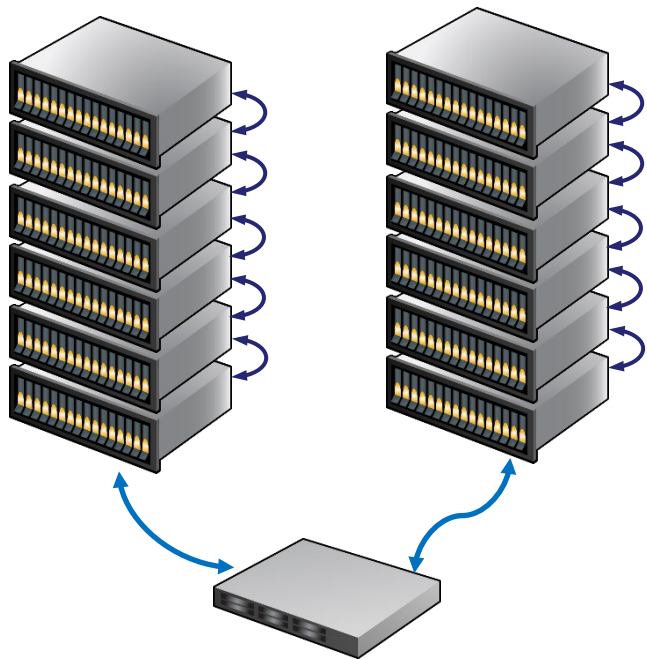
- Data center applications
  - Social Media
  - Cloud storage
  - IoT

- Storage requirements
  - Large-scale
  - Low power and low cost
  - High capacity ($/GB)

- Features of 24G SAS that benefit this tier
  - Flexibility to support SATA HDDs
  - Dynamic scaling up to 64K devices
  - Rack-level and data-center level reach

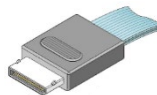# 24G SAS Ecosystem Readiness in 2020

- Ecosystem is on track for SAS-4 production readiness in 2020
  - SAS-4 analyzers have been sampling since last year
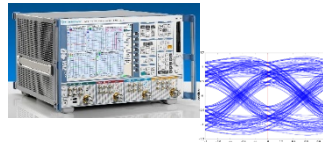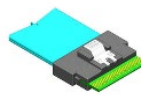
  - Cables and connectors: both existing and new form-factors ready for 24G SAS

    Mini SAS HD   SAS MiniLink   SlimSAS

  - SAS-4 controllers and expanders aligned with upcoming Gen4 platform launches
  - New HDD/SSD capabilities to intersect with 24G SAS ecosystem
    - MultiLink SSDs   − Multi-Actuator
    - Hybrid SMR   − HAMR / MAMR

Key Takeaways

- 24G SAS addresses the accelerating demand for storage

- SAS continues to innovate around the reliability of storage

- SAS architecture is optimized for scalable, flexible deployments, serviced by tiers of storage

- SAS is ubiquitous and is not going away anytime soon

- 24G SAS components are available today, with more to be announced

Thank You!

For more information about the SCSI Trade Association and 24G SAS, visit us at:

www.scsita.org

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