

A grayscale photograph of a modern office interior. On the left, there's a glass-walled office space with a potted plant. On the right, a meeting room is visible with a large table and several black office chairs. The floor is made of light-colored wooden planks. A large blue rectangular box is overlaid in the center, containing the title text.

DESIGNING INFRASTRUCTURE FOR “ANY-K”

André Gignac, Senior Solutions Architect

Quantum

16K

- Technology changes all the time
- Moore's Law holds true
- It is never ending
- However there is hope

- Breaking it down
 - Resolution
 - CODEC
 - Frame Rate
 - Host
 - Connectivity
 - Storage
- Make smart decisions about tech

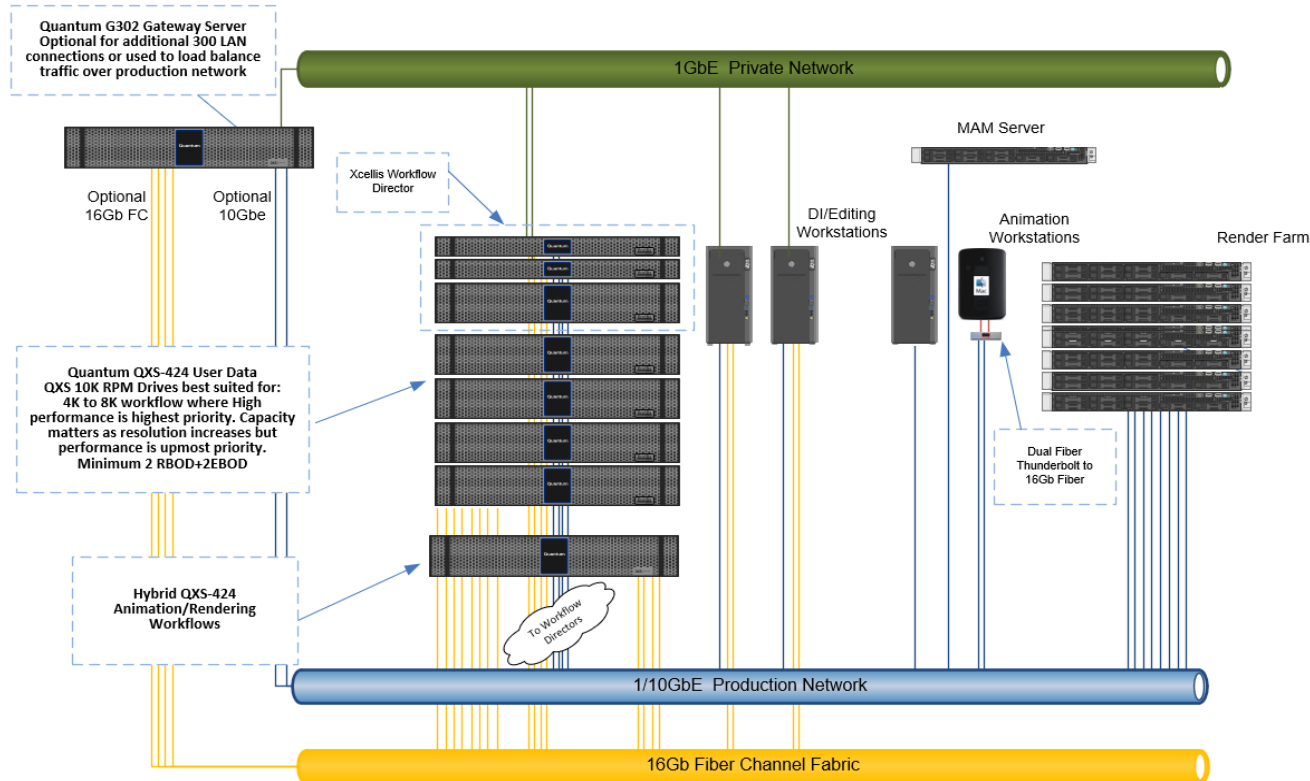
A grayscale photograph of chess pieces on a board, with a blue rectangular overlay on the right side containing the text 'TYPICAL WORKFLOWS'.

TYPICAL WORKFLOWS

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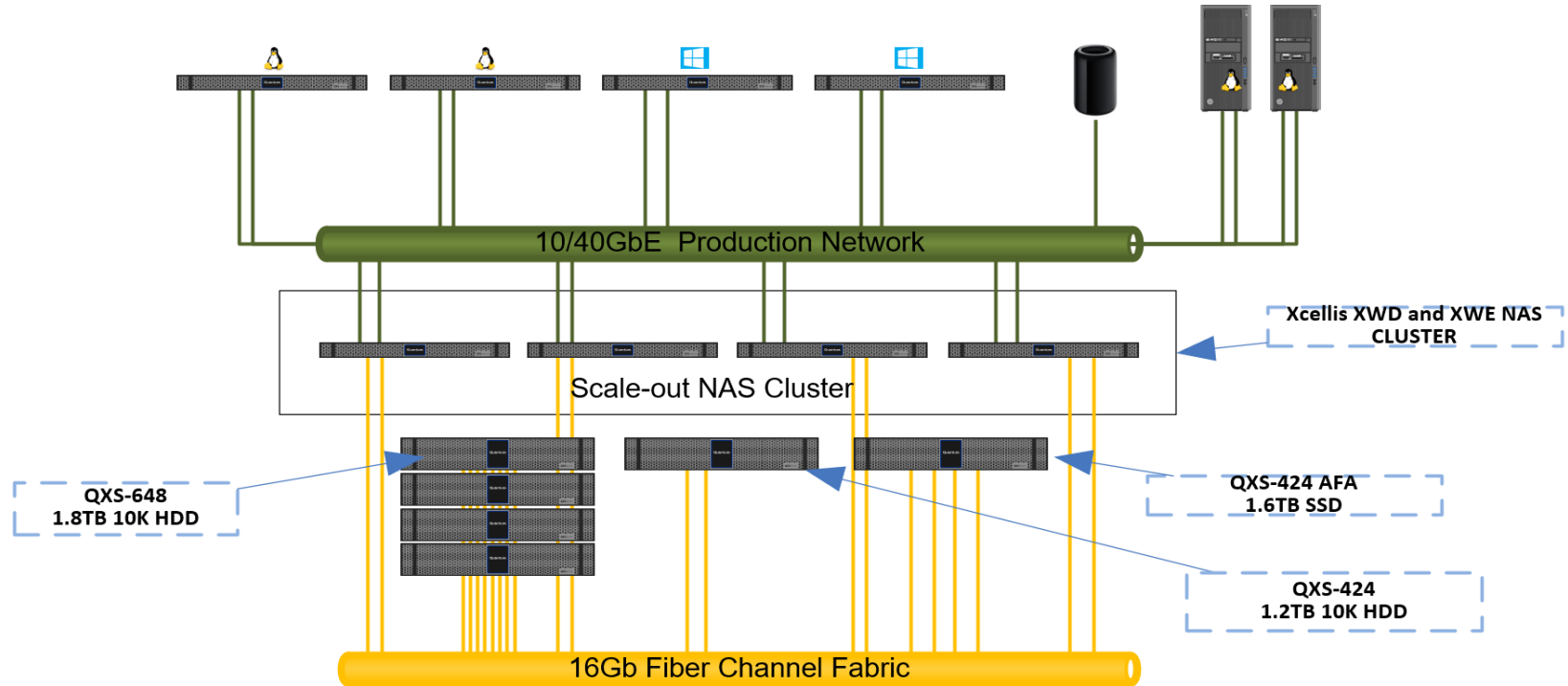
Traditional Architecture for M&E Workflow - SAN

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Traditional Architecture for M&E Workflow - NAS

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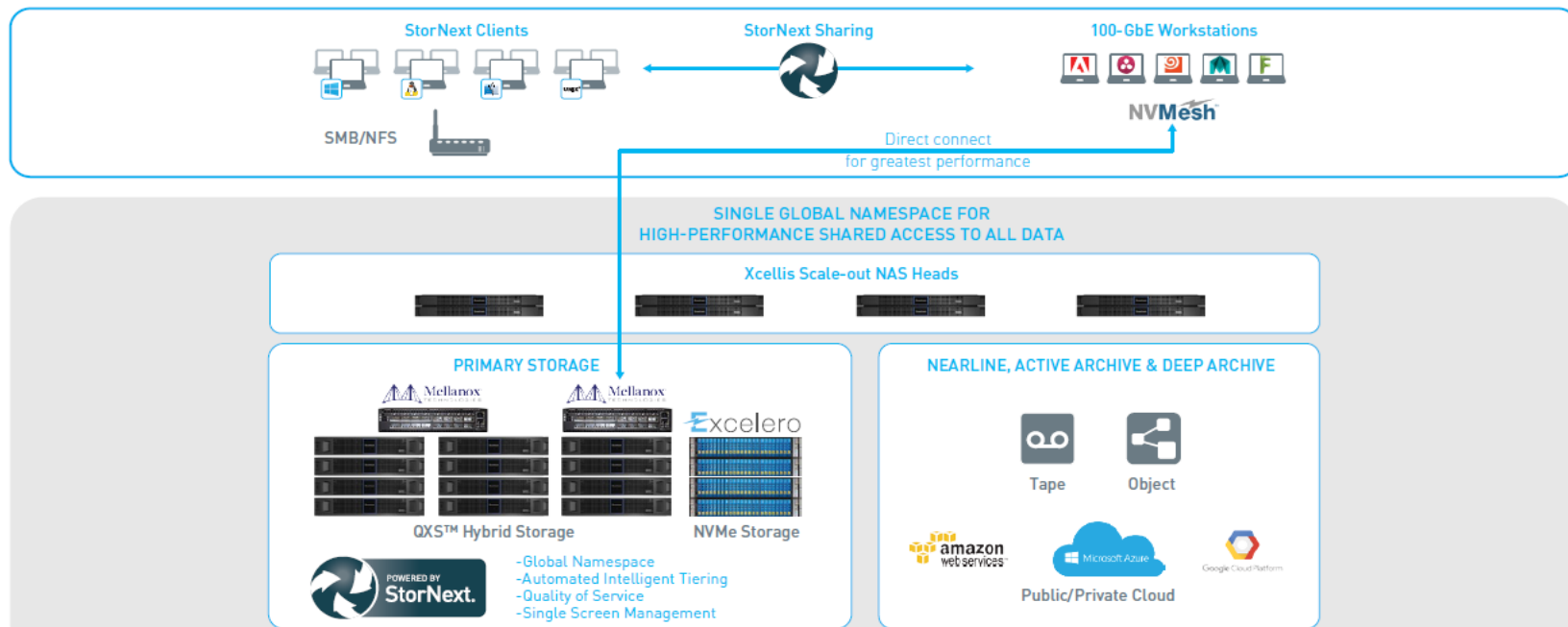


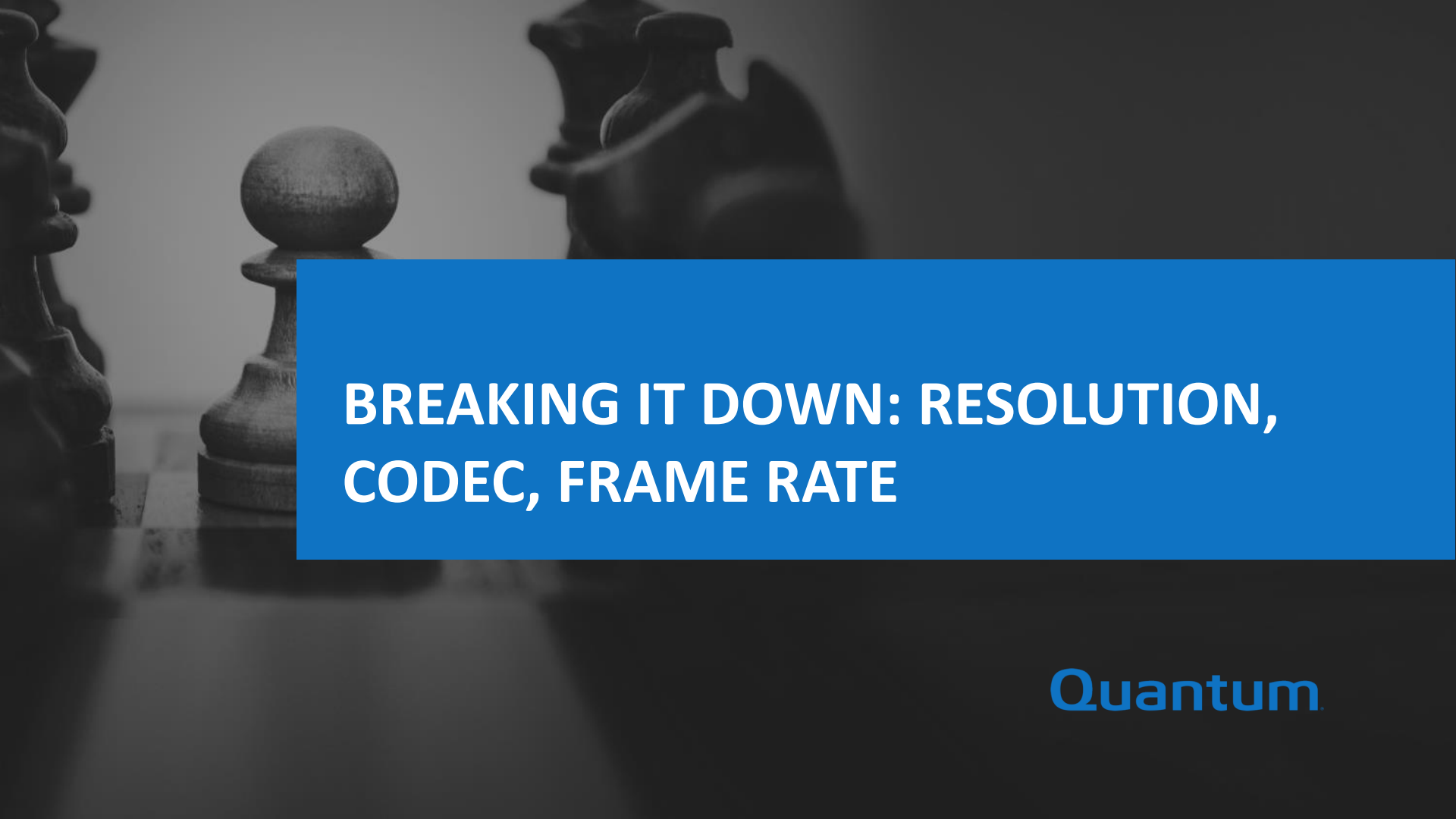
100GbE Reference Architecture

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Figure 1. High-Performance All-IP Workflows with NVMe

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A grayscale background image of chess pieces on a board. A blue rectangular box is overlaid on the right side of the image, containing white text.

BREAKING IT DOWN: RESOLUTION, CODEC, FRAME RATE

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8K UHD

7680 x 4320 16-bit @ 60fps

12 GB/s, 12.9 TB/hr

The 4K Family

- Approx. 4X the horizontal resolution of HD
- 3840x2160, 4096x2160 most common
- 4096x3072, 4096x3112 variants
- All “4K”

4K DCI

(4096 x 2160) 10-bit @ 24fps

849 MB/s, 3.1 TB/hr

4K UHD

3840 x 2160 10-bit @ 60fps

2 GB/s, 7.2 TB/hr

Cinema 4K

2K

(2048 x 1080) 10-bit @ 24 fps

212 MB/s, 764 GB/hr

High-Definition (Full HD)

1920 x 1080 10-bit @ 30fps

248 MB/s, 896 GB/hr

Standard Definition

720 x 480

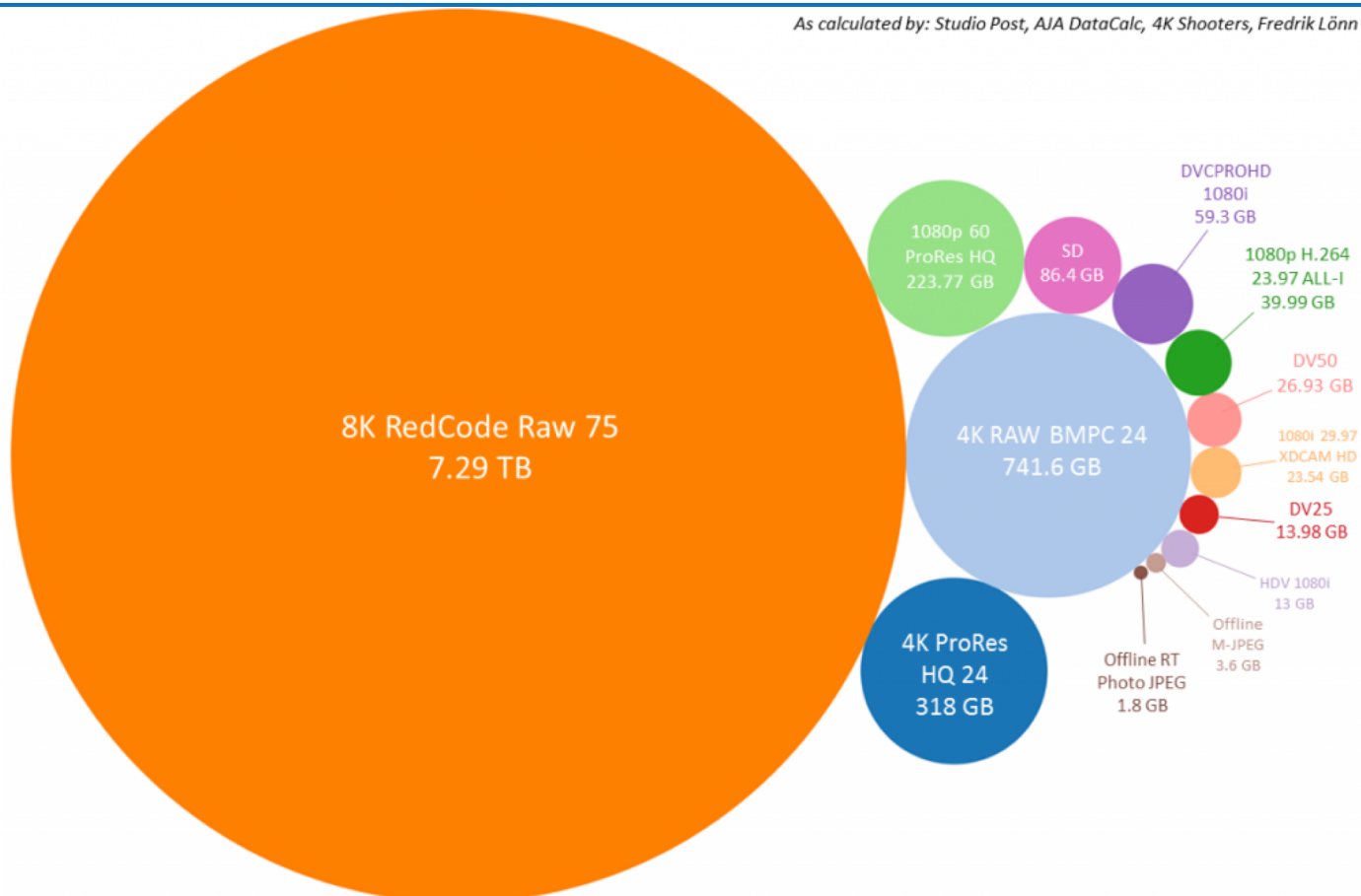
10-bit @ 29.97fps

27 MB/s, 94 GB/hr

Resolution CODEC and Data Size Per Hour

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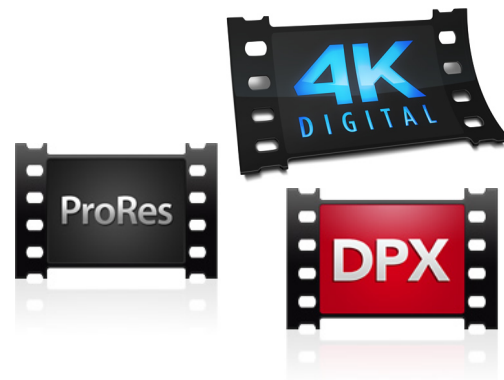
As calculated by: Studio Post, AJA DataCalc, 4K Shooters, Fredrik Lönn



Frame Rate

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4K Format	Resolution (W x H)	Frame Rate (fps)	Data Rates (MB/s)	Storage Capacity (GB/Hr)
UHD ProRes 422 HQ	3840 X 2160	30	111	400
		60	221	796
UHD ProRes 4444 XQ	3840 X 2160	30	249	896
UHD (10 bit)	3840 x 2160	24	807	2,905
		60	1990	7,164
4K Full App (10 bit)	4096 x 3112	24	1224	4,406
UHD (16 bit)	3840 x 2160	60	3190	11,484



☆ AJA

TIME 1 Secs ▾

CODEC

10bit RGB

RESOLUTION

4K-2160

60

AUDIO

0 ch

32.0 KHz

8 bit

DATA SIZE

2.12 GB

☆ AJA

TIME 1 Secs ▾

CODEC

10bit YUV

RESOLUTION

4K-2160

60

AUDIO

0 ch

32.0 KHz

8 bit

DATA SIZE

1.42 GB

☆ AJA

TIME 1 Secs ▾

CODEC

16bit RGB

RESOLUTION

4K-2160

60

AUDIO

0 ch

32.0 KHz

8 bit

DATA SIZE

3.19 GB

A grayscale photograph of chess pieces on a board, with a blue rectangular overlay on the right side containing white text.

BREAKING IT DOWN: HOST, CONNECTIVITY

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How Operating Systems Differ for Hosts (Clients)

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- Linux is the optimal performer
 - More efficient HBA drivers
 - Lowest OS overhead
 - Choose the hardware
- Windows drivers have more CPU overhead, less efficient
 - Windows is 15% less efficient than Linux
 - Choose the hardware
- 40-60% less efficient in multi-client environments than either
 - macOS is overly aggressive with I/O requests
 - Limited by the Thunderbolt Bus



- InfiniBand
 - 56Gb invented the QSFP form factor (quad cable)
 - Very low latency, very little adoption
- Fibre Channel
 - 32 or 128Gb Options
 - 32Gb FC runs on a single piece of duplex fiber with LC-LC connectors
 - Lowest latency option
- Ethernet
 - 10Gb Ethernet is the old standby; available in Cu, TwinAx, or LC-LC Optical
 - 40Gb Ethernet sounds fast but it is really 4x 10Gb (QSFP, four cables or a special copper cable)
 - 25Gb Ethernet is the new standard, it uses standard fiber with LC-LC connectors
 - 100Gb Ethernet is the latest standard, built off the 25Gb technology but uses QSFP
 - Can be used for standard traffic or iSCSI
 - Packetized network will have higher latency than others



A grayscale photograph of chess pieces on a board, with a blue rectangular overlay in the center containing the title text.

BREAKING IT DOWN: STORAGE

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Types of storage



Common types

- Workflow
- Tier 0
- Tier 1 Primary
- Tier 2 Near-line
- Object
- Tape – LTO
- Cloud



WORKFLOW STORAGE



HYBRID/ STORAGE



OBJECT STORAGE



TAPE STORAGE



CLOUD STORAGE

Applying the Right Technology at the Right Time

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**Workflow-
driven**

ACQUIRE / INGEST

PROCESS / ANALYZE

RETAIN / MONETIZE

**Tier-
aware**

PRIMARY



SECONDARY



ARCHIVE



CLOUD



The Right Drive for the Job

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Matching Drive Type to Stream Count Requirements

➤ LFF HDDs

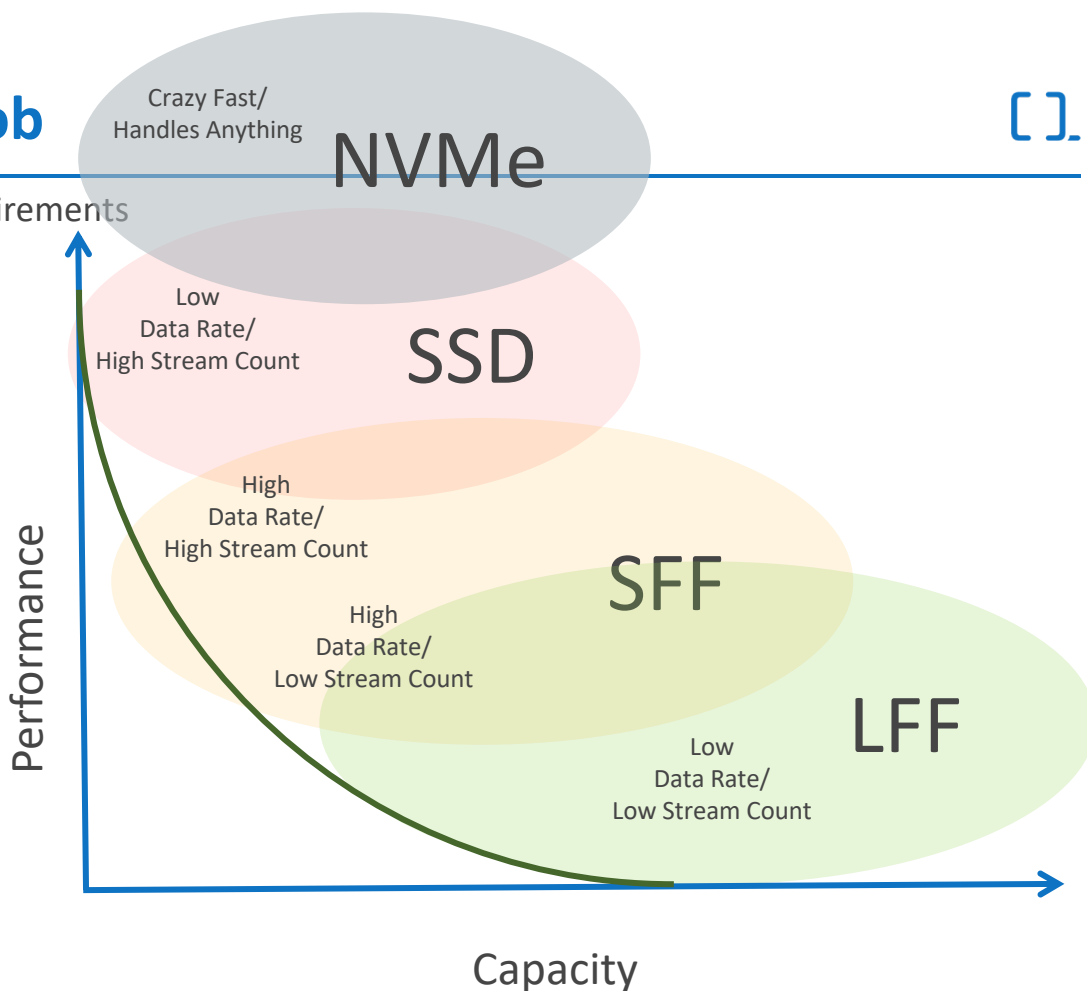
- High-capacity
- Low performance (7.2K RPM)
- Affordable

➤ SFF HDDs

- Low capacity
- High performance (10K RPM)
- Higher priced

➤ SFF Solid State Drives (SSDs)

- Lowest capacity
- Highest performance
- Highest price



Market Trends you Should Know

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Figure 96. Cloud vs. Local Archive Storage

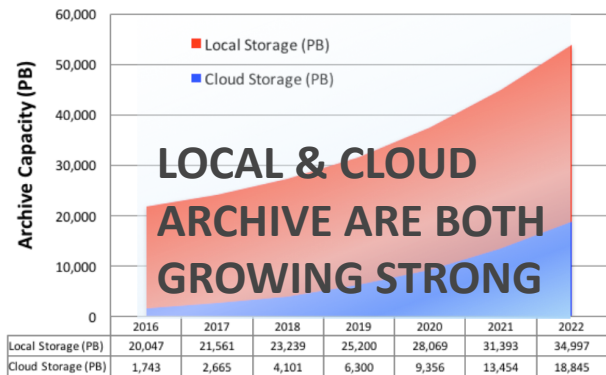


Figure 93. Total Annual Digital Storage Demand Projections for Archiving and Digital Content Conversion & Preservation



90. Percentage of Digital Long-Term Archives on Various Media

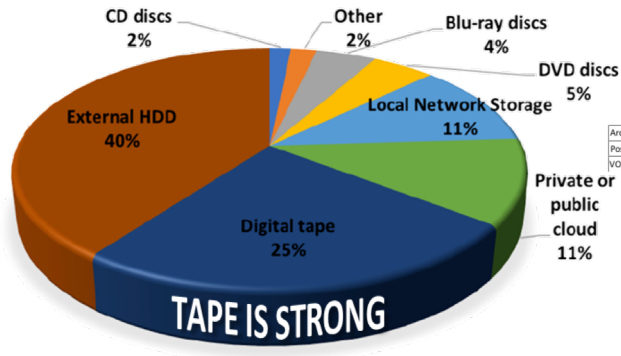


Figure 99. Media and Entertainment Object Storage Capacity Projections

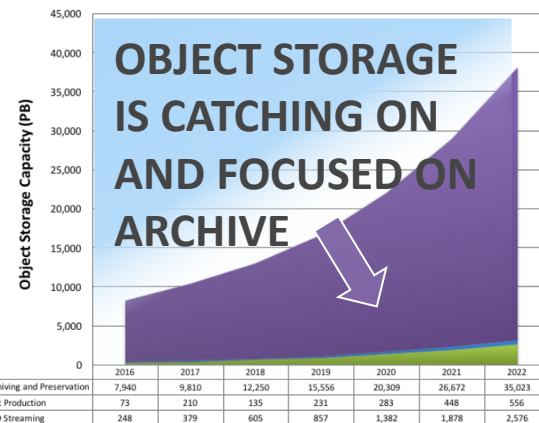
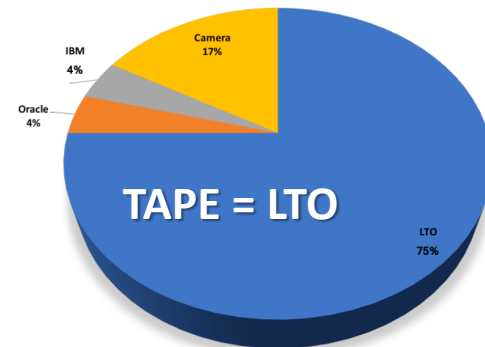
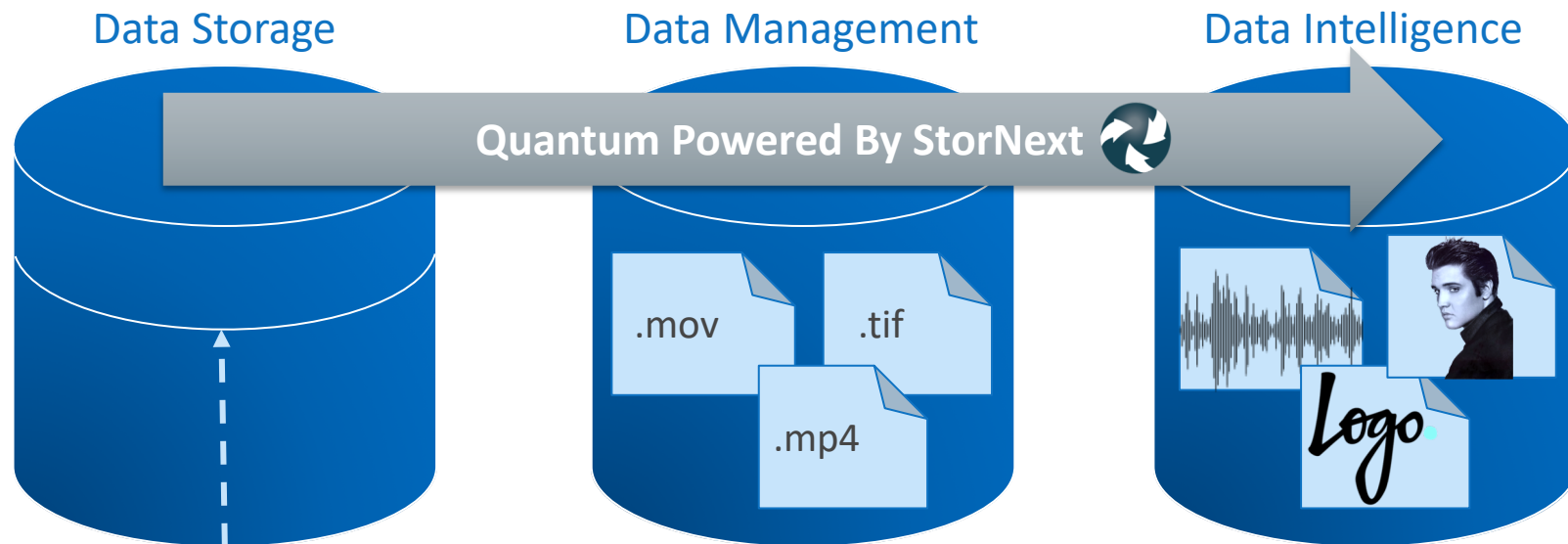


Figure 91. Percentage of Tape Formats Used in Digital Archiving



Key Market Trends: Data Intelligence

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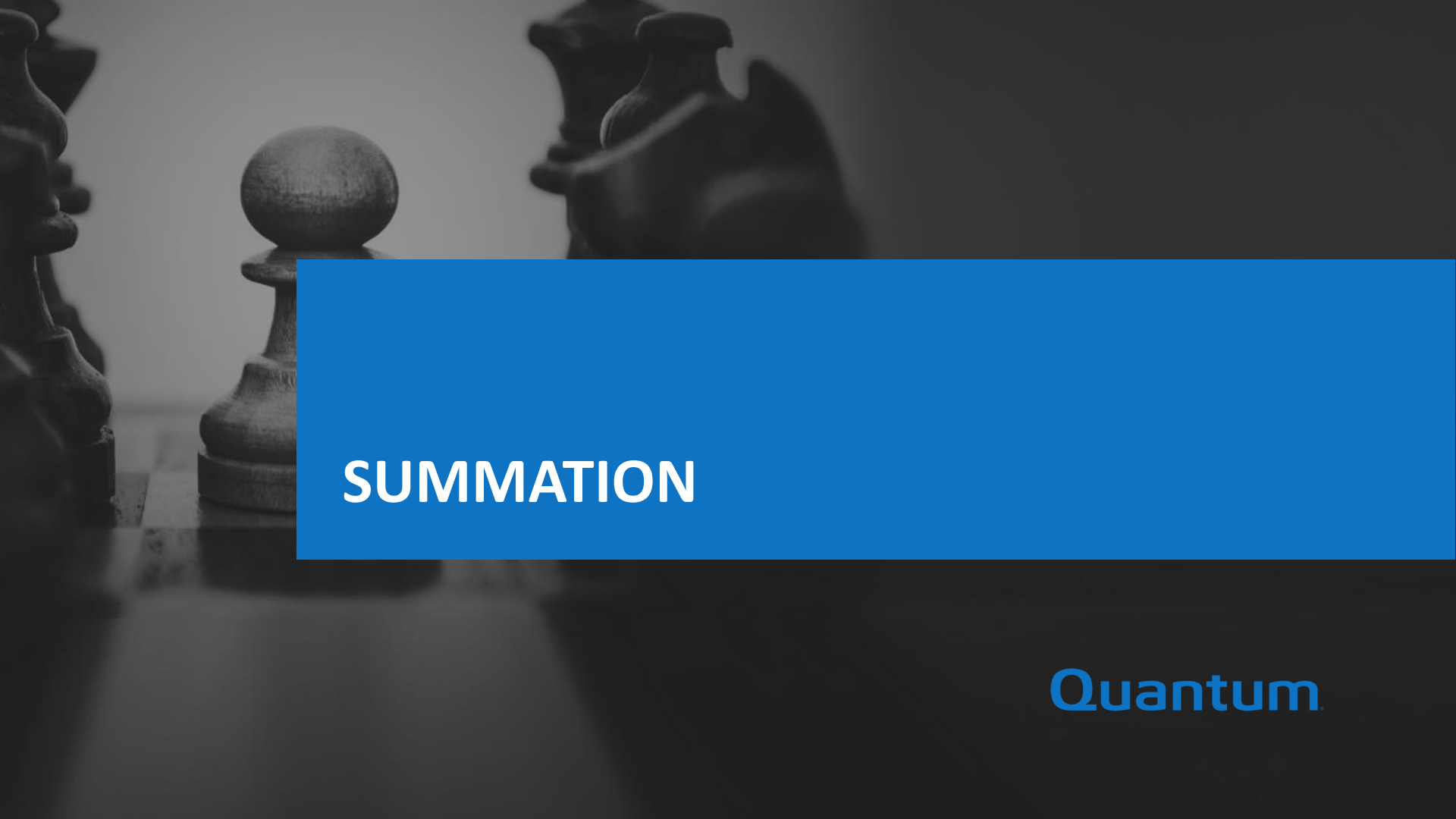
Creating more intelligent storage solutions that help maximize the value of content

Integration is a key to success

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- NVMe is the future
- SSDs are not going away
- Spinning disk is not going away
- Fibre Channel is no going away
- Budgets for storage are not increasing
- Costs are coming down

A black and white photograph of chess pieces on a board, with a blue rectangular overlay on the right side containing the word 'SUMMATION' in white capital letters.

SUMMATION

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➤ Plan!

- Technology will change
- Storage infrastructure will grow
- Build a foundation with connectivity and storage

➤ Latest doesn't equal greatest

- Storage technology is in the middle ages
- Foundation is the key to any great building

➤ Ecosystem

- Make sure all components are tested to work together

➤ What to use and when - Primary

- 4K = typical solution was FC, however, easily achievable with the right Scale-out NAS
- 8K = FC or 100GbE solution
 - Scale-out NAS will be tough, but compressed media at 8K, very viable solution
- 16k & Beyond = NVMe-oE. This is the new shiny toy! With our partnership with Excelero, we can provide 16K uncompressed.

➤ What to use and when - Archive

- Fastest Access / High Recall Rate = Object storage
 - Cost effective at scale, protected, disk-based, on-prem cloud without latency & cost of OPEX off-prem cloud
- Fast Access / Medium Recall Rate = LTO Tape Library
 - Cheapest, most cost effective and reliable way to store media. All major cloud providers use LTO as the backend.
- Slow Access / Low Recall Rate = Cloud
 - Cost effective at scale, protected, can have high cost when data is needed quickly

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