Quantum

WHITE PAPER

QUANTUM'S XCELLIS SCALE-OUT NAS

Industry-leading IP Performance for 4K, 8K and Beyond

CONTENTS

INTRODUCTION

As media professionals reach for the tools they need to create content at ever-high resolution and more formats for broader consumption, older infrastructure needs to adapt quickly and cost effectively or be left behind.

As creative organizations rise to meet the current challenges of combined ease of use while delivering high-performance 4K, 8K and even 16K on the horizon, they are drawn by the convenience of feature-rich Network-Attached Storage (NAS), but may feel pushed by performance requirements to Storage Area Networks (SAN) to meet performance needs.

Quantum StorNext® file system is well known for its industry-leading performance and flexibility to scale. Powered by StorNext, Quantum's new Xcellis® Scale-out NAS is the only solution that delivers both enterprise-class features and best-of-breed cost-effective scaling of performance and capacity.

AUDIENCE

This paper is intended for business and technical readers in content creation, and covers the need for a new approach to infrastructure for creative workflows, Xcellis Scale-out NAS architecture, recent performance testing and comparison vs. several well-known alternatives.

HOW TRADITIONAL INFRASTRUCTURE IS FAILING IN CREATIVE WORKFLOWS

With tens of thousands of users in content creation around the world, Quantum understands the micro and macro trends driving creative professionals as they meet new challenges. Increasingly, all but the largest sites want to move away from the overhead of building and maintaining environments that require high-performance systems to connect directly to Fibre Channel SANs; the move to IP-based workflows is one of the top trends in the industry today.

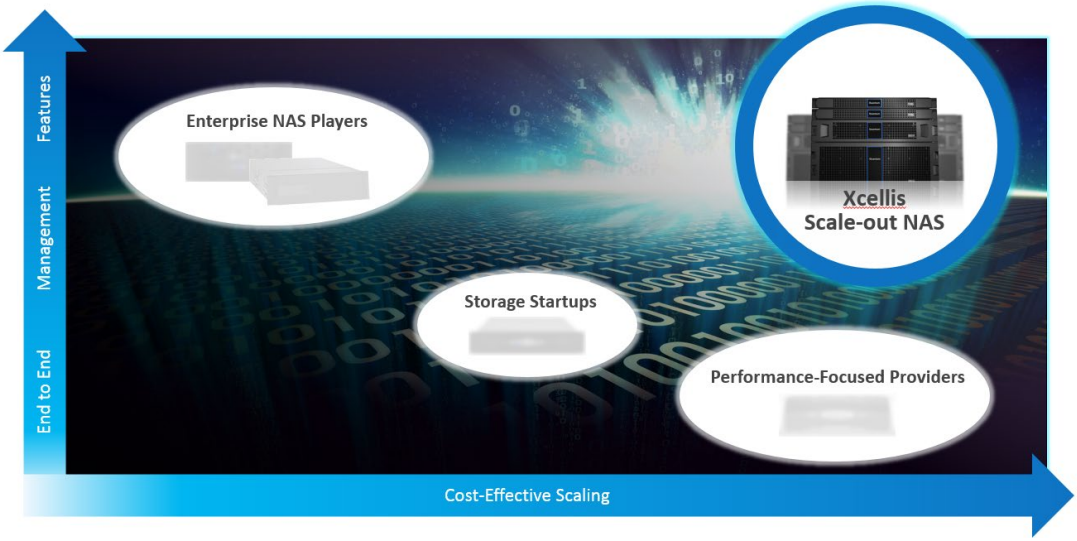
As they look to implement or expand existing NAS infrastructure to support 4K and other high-performance creative workflows, however, several potential problems become evident.

- Enterprise and traditional scale-out NAS offerings have great feature support, but do not scale performance OR capacity cost effectively.
- Performance-focused vendors offer solutions that scale performance and capacity cost effectively, but lack much-needed features.
- Start-ups solve a specific problem or set of problems well, but lack the resources to deliver a complete, reliable solution—typically having big gaps in features and either performance or capacity scaling.

XCELLIS SCALE-OUT NAS OVERVIEW

Xcellis Scale-out NAS combines over two decades of Quantum experience in shared file systems and data tiering to deliver the industry's only IP solution that has enterprise-class features[1] with massive performance and capacity capabilities that also scale cost effectively.

Built on StorNext, Xcellis Scale-out NAS combines a unified view of all data under management, integrated data tiering for archive, collaboration, distribution and protection across local or remote file, object or public cloud. Xcellis Scale-out NAS appliances starting at under $25k are fully scalable to 100s of petabytes of capacity and multiple streams of uncompressed 4, 8 or even 16K per client.



[1] For details on Xcellis Scale-out NAS feature set: https://www.quantum.com/en/products/scale-out-storage/xcellis-scale-out-nas/

Xcellis Scale-out Architecture and Core Capabilities

The scale-out 'node' includes the shared file system and its dedicated metadata management hardware, front-end 'NAS heads' that support scaling of IP performance and connectivity, and user data storage. Unlike traditional scale-out products, Xcellis' NAS heads and storage can scale either together in set configurations, or independently, allowing Quantum customers to add only what they need—performance or capacity. In comparison to approaches that force you to overspend on either storage or compute by expanding both at once, Xcellis allows scaling of performance and capacity independently. This makes Xcellis far more cost effective and customizable.

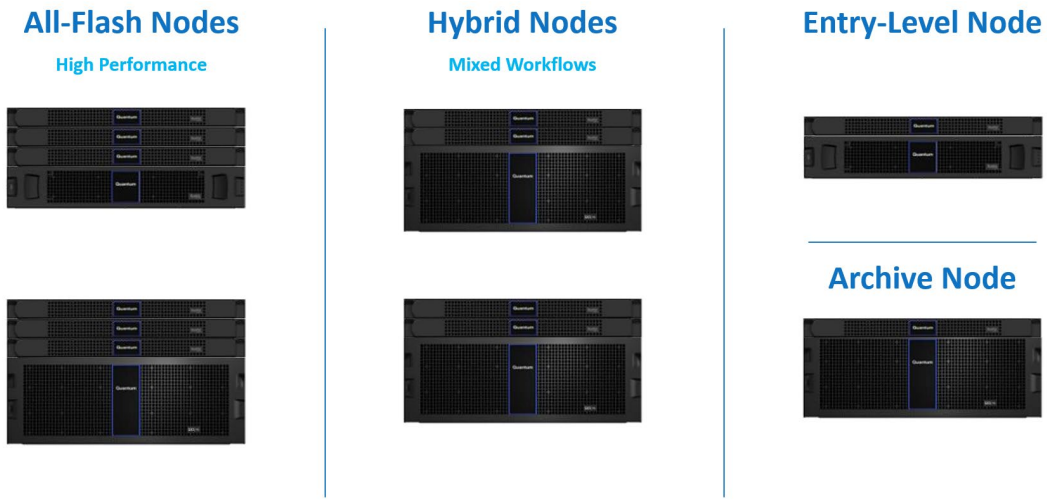
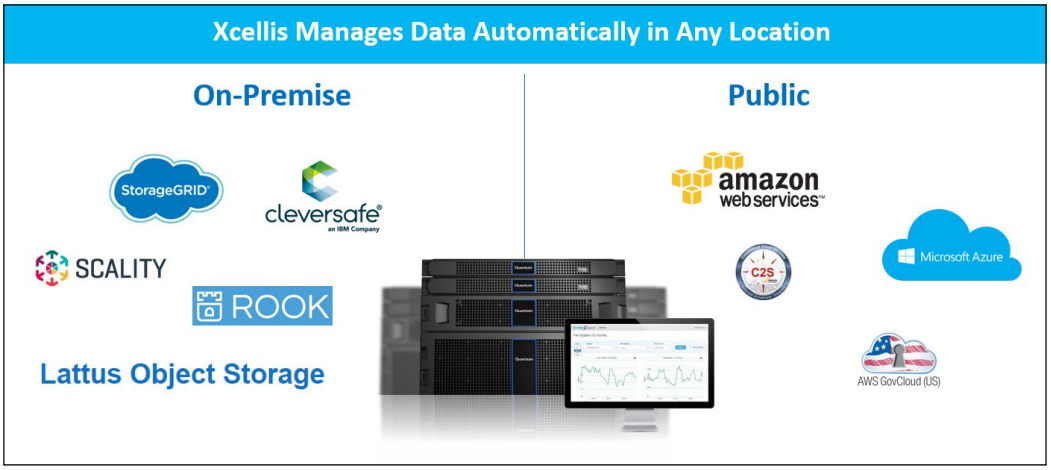
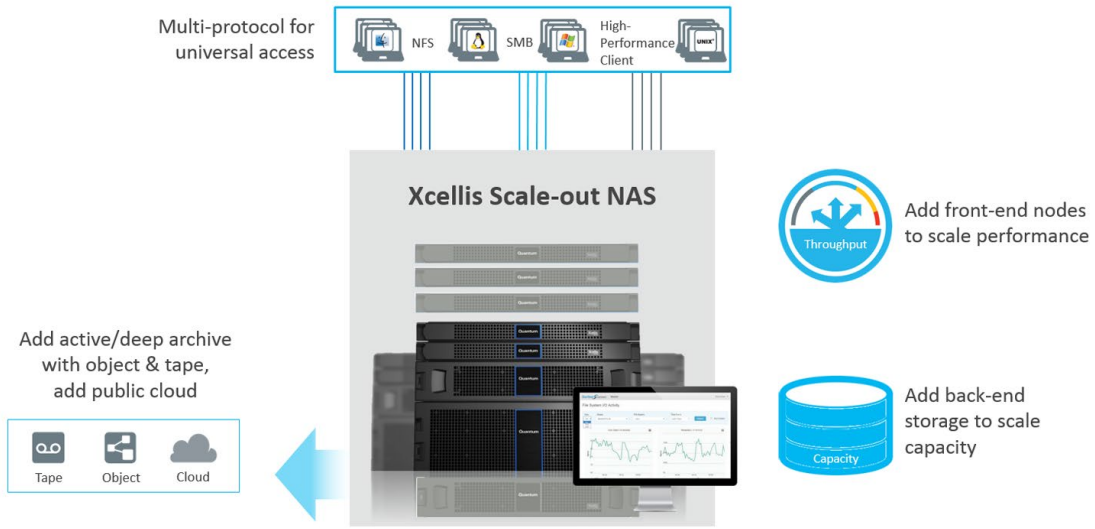


Figure 1: Xcellis Scale-out NAS – Sample Node Types

Another key component of Xcellis Scale-out NAS cost-effective scaling capabilities is the integration of tiering in the core file system. Not only do all users, applications and administrators have shared view of—and concurrent access to—all data under management in an Xcellis Scale-out NAS, this shared view extends to multiple, less-expensive tiers of storage. Xcellis Scale-out NAS capacity can be cost-effectively expanded with on-site or off-site object storage, tape or public cloud.



For organizations that want an infrastructure that can grow with them over the long term, a single Xcellis Scale-out node can expand front-end performance to hundreds of GB/s and almost 2 PB of capacity. Multiple nodes cluster behind a single shared file system view to scale both performance and capacity well beyond modern workflow requirements.



Today an Xcellis Scale-out NAS can manage up to 10 billion files and has a theoretical peak capacity of 512 LUNs and 18 exabytes.

Universal Connectivity

Xcellis Scale-out NAS offers multiple connectivity options to meet a range of performance and configuration requirements.

- **SMB/NFS[2]:** Direct connectivity with Server Message Block (SMB) and Network File System (NFS) clients over Ethernet for organizations that want to use IP-based workflows and avoid the potential expense and complexity of Fibre Channel connectivity. Xcellis delivers industry-leading performance for SMB and NFS connections. For those workflows with even higher performance requirements, there are several additional options.
- **DLC:** Distributed LAN Client (DLC) connectivity, which provides the extremely high-performance connectivity over Ethernet, greater than 99% of theoretical line rate. DLC is particularly useful for HPC rendering projects where a large data set is broken into segments and processed by multiple servers. DLC can provide nearly two-and-a-half times the throughput of NFS on the same network[3].
- **Fibre Channel:** For the highest level of performance, Xcellis Scale-out NAS supports direct file system participation with a native client over Fibre Channel. This approach bypasses the front-end Xcellis Scale-out NAS heads, connecting directly to back-end storage for data transfers.
- **NVMeOF:** Quantum is now offering a reference architecture for NVMeOF. Thanks to a partnership with Excelero, Quantum Xcellis Scale-out NAS now enables a single client to achieve even faster than Fibre Channel speeds with IP connectivity.

[2] Xcellis Scale-out NAS Supports SMB 1 (CIFS), SMB 2, SMB 3, NFS v3, NFS v4, Active Directory, OpenLDAP, RESTful API.
[3] DLC can be implemented two ways: 1) control data and data on the same single connection, or 2) control data on one connection and data on a second connection.

PERFORMANCE TESTING RESULTS

Performance testing is always a sensitive topic because, of course, without on-site testing with the infrastructure, data and applications of the individual site, it is difficult to know how performance will manifest in each organization's workflow. System-level testing can be a very good proxy for ranking various approaches and vendors relative to each other.

Methodology

Configurations Tested

For this series of performance tests, Quantum's lab configuration was a single Xcellis Scale-out NAS with 4.4 TB SSD for metadata (12x 400 GB SSD) and 172 TB HDD for data (96x 1.8 TB 10k RPM HDD) and 40 GbE front-end connectivity.

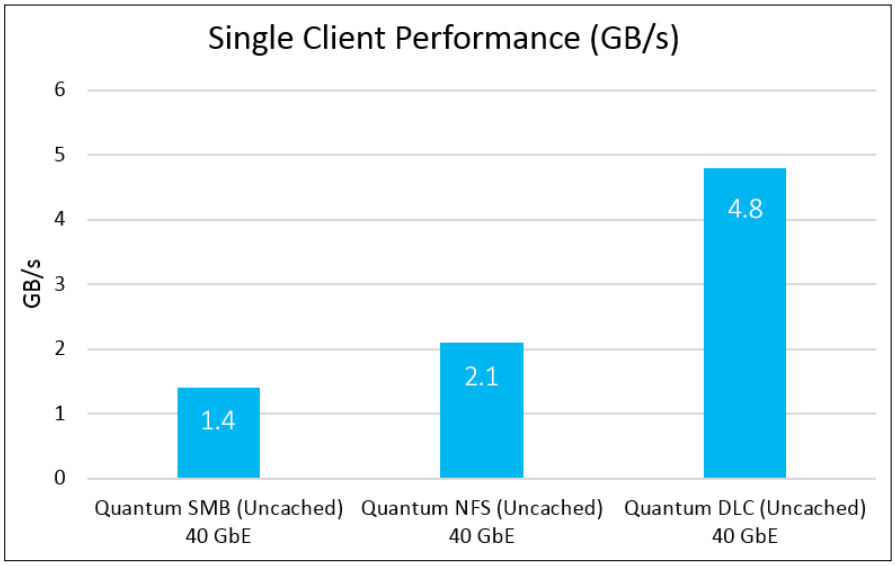
References to source data for configurations for competing results shown below are given in footnotes for each competitive reference made.

Why 'Cached' is a No-Go in Media

Please note these results—and all Quantum results in this paper, unless otherwise noted—are uncached. This is important because most 'marketing' numbers from benchmarks given by most vendors are cached #s—the performance reading or writing data to system cache rather than to tier 1 HDD or even SSD. While cached #s are a strong metric for small-file workflows, they are almost meaningless for creative workflows where streaming file sizes exceed system-level cache in almost all instances. Note that while the Xcellis Scale-out NAS can handily outperform most competing cached numbers with its uncached results, in this paper for performance comparisons, competing uncached numbers are used where available.

Results

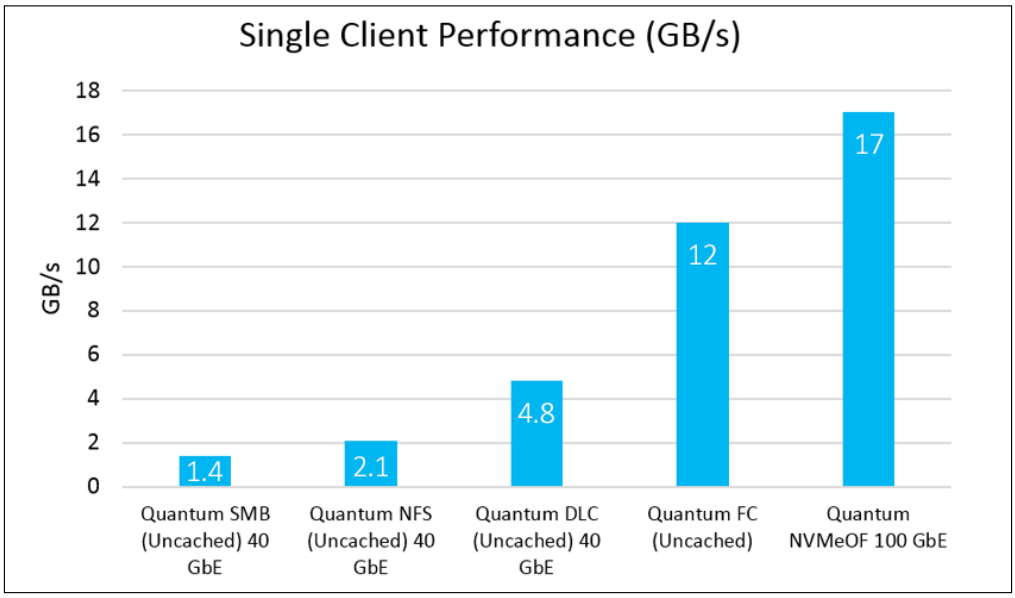
Per-client performance for Xcellis Scale-out NAS is very strong and supports the bandwidth requirements for any workflow up to and including 8K.



As mentioned above, unlike other NAS providers in the content creation market, with Xcellis Scale-out NAS, Quantum customers have the choice of connectivity options beyond standard IP-based NFS and SMB.

For a single client accessing a single Xcellis Scale-out NAS over FC—where the data path between client and storage is directly over FC—peak performance through the file system was recorded as 12 GB/s.

For a single client accessing a single Xcellis Scale-out NAS over two 100-GbE connections—where the data path between client and storage is direct to NVMe storage presented by NVMesh as block-level devices. From the client side, a driver is installed to read these devices over 100G Ethernet. Peak performance through the file system was recorded at a whopping 17 GB/s.



The bottom line is that Xcellis Scale-out NAS has very strong performance vs. both traditional offerings and start-up in the NAS arena, and this performance leadership translates directly into several customer benefits including lower cost and complexity and future-proof infrastructure.

With significantly more performance per client/port, it is not unusual to see Xcellis Scale-out NAS infrastructure deliver the same performance as a Qumulo or Isilon system using 1/3rd or even 1/10th the number of network ports.

Xcellis Scale-out NAS vs. The Competition

We chose to compare Xcellis performance relative to two other providers—Dell/EMC Isilon and Qumulo—because they target creative workflows and represent 'traditional scale-out NAS' and 'start-ups'.

What we found is that, even using their strongest published performance numbers—all flash, cached, 40 GbE, etc.—Xcellis Scale-out NAS came out ahead.

Some other interesting things we found were that:

1. Very few NAS providers want to highlight their SMB performance #s—some won't publish them at all, preferring to highlight their NFS results. Quantum's ability to deliver SMB results, which are close to competitors' cached NFS #s, begs the question of whether this discrepancy in competing systems is a fundamental architectural limitation or a lack of focus.
2. While it is easy in these times of mass marketing and bold claims to dismiss vendor claims of 2x, 3x or more performance superiority, the fact is that even small core system and protocol performance advantages can translate directly into significantly lower cost of complexity of management for the customer.

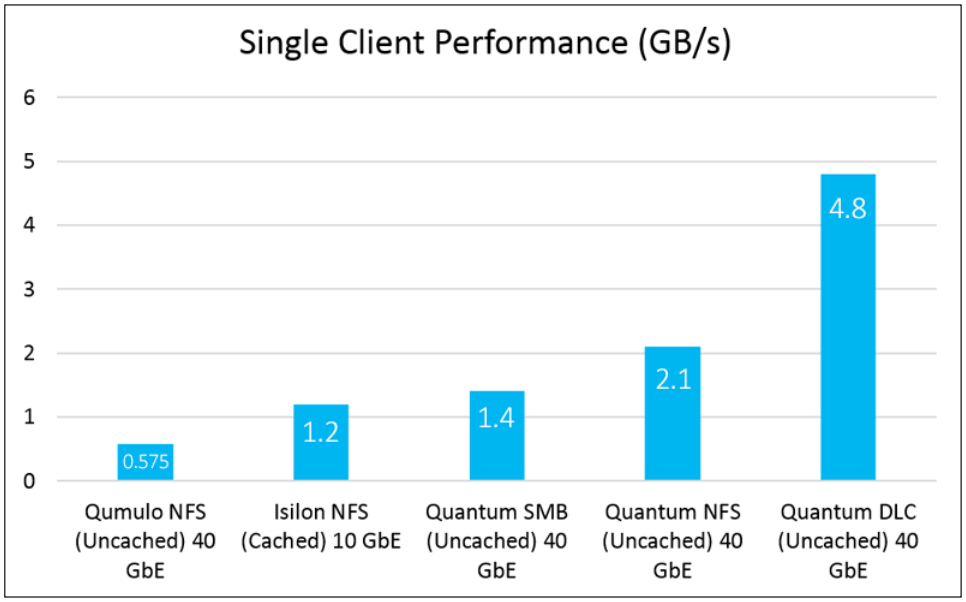
NFS vs. SMB Reported Results

While Isilon reports their SMB performance is "about half[4]" their NFS performance and Qumulo does not even publish their SMB results[5], we note that Xcellis Scale-out NAS delivers similar—sometimes even greater—SMB performance vs. NFS. This performance focus highlights Quantum's development commitment to media and entertainment workflows, which often are very dependent on SMB performance. This balanced performance across interfaces shows the strength and maturity of the backing StorNext file system and highlights the amount of work required to ensure maximum performance through multiple protocols.

Quantum vs. Qumulo and Isilon

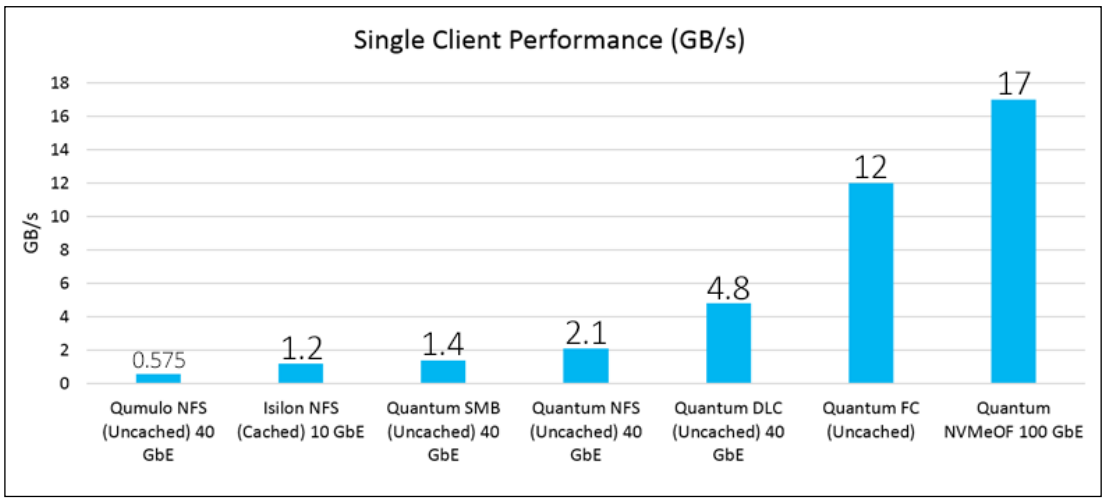
Using the most recent numbers we could find for Isilon's[6] and Qumulo's performance in publicly available documents[7], we found that Xcellis Scale-out NAS consistently outperformed the fastest solutions from both providers—the Dell/EMC Isilon F800 and QF2 on HP4200 Apollo Gen9.

As you can see from the single-stream comparison below, standard NFS and SMB on Xcellis Scale-out NAS is almost 2x the competition, and DLC over Ethernet is about 3.5x faster.



[4] https://www.youtube.com/watch?v=YipaVnPu92s
[5] http://discover.qumulo.com/rs/268-GVP-131/images/Qumulo-HPE-WP.pdf
[6] https://www.emc.com/collateral/white-papers/f800-h600-performance-wp.pdf
[7] https://public.tableau.com/profile/qumulo#!/vizhome/ClusterPerformance/PerformanceSingleTestModel

Of course, for those systems in the environment needing even more performance—multiple streams of uncompressed 4, 8 or even 16K, for example—only Xcellis Scale-out NAS has the 10+ GB/s performance-per-client support with a choice of NVMeOF on 100 GbE or an FC client.



Increased Performance Translates Directly to Lower Cost & Complexity

It is not hard to take the relative performance of systems and see—side by side—how much gear is needed to produce a desired level of performance for a given workflow. For example, comparing a modest-sized Xcellis Scale-out NAS node with a top-performing Qumulo configuration, you can quickly see it would take 2 to 6x the number of network ports and **>1.5 to 2x the rack units worth of gear for a Qumulo** to drive—in this case—12.4 GB/s. Smaller and larger configurations show similar deltas. Obviously, this means that the Qumulo route not only has higher complexity to configure and manage in terms of infrastructure, but that **the cost of data center space for the Qumulo approach—heating, cooling, racks, etc.—is considerably higher.**

Hardware Needed to Deliver 12.4 GB/s Total Performance		
Attribute	**Quantum Scale-out NAS**	**Qumulo HP4200 Apollo Gen9**
Rack Units (cached)	N/A	14U (1,945 MB/s per node)
Rack Units (uncached)	9U 4.8 GB/s per node *(including dedicated metadata array)*	18U (704 MB/s per node)
HDDs (cached config)	N/A	126
SSDs (cached config)	N/A	63
HDDs (uncached config)	96 *(data) + (12 metadata)*	162
SSDs (uncached config)	N/A	81
Customer Infrastructure (cached)	N/A	12 x 40 GbE ports into the customer network
Customer Infrastructure (uncached)	6 x 40-GbE ports into the customer network	36 x 40-GbE ports into the customer network

CONCLUSION

Quantum solutions power the most demanding workflows in content creation around the world. Decades of direct exposure to the creative teams solving the toughest problems have pushed Quantum's technology portfolio again and again. As a result, Quantum can deliver the Xcellis Scale-out NAS with balanced, high performance, an enterprise-class feature set, and the ability to cost-effectively scale performance and capacity.

As your creative endeavors push the envelope on performance or capacity, replacing or augmenting your current storage infrastructure with Xcellis Scale-out NAS can provide you with a flexible high-performing storage platform that can evolve over time with your ever-changing needs while providing the ability to leverage technological advancements.

For more information and updated results as they become available, contact Quantum[8], or see the Xcellis Scale-out NAS page[9].

[8] https://www.quantum.com/en/company/contact-us/
[9] https://www.quantum.com/products/scale-out-storage/nas/index.aspx

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ABOUT QUANTUM

Quantum is a leading expert in scale-out tiered storage, archive and data protection. The company's StorNext® platform powers modern high-performance workflows, enabling seamless, real-time collaboration and keeping content readily accessible for future use and re-monetization. More than 100,000 customers have trusted Quantum to address their most demanding content workflow needs, including top studios, major broadcasters and cutting-edge content creators. With Quantum, customers have the end-to-end storage platform they need to manage assets from ingest through finishing and into delivery and long-term preservation. See how at **www.quantum.com/customerstories**.

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