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Published Since 1993 Report #TCG2006105 December 10, 2006

EMC NQM Brings Prioritization to CLARiiON Storage Performance

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Management Summary

Priorities. Individuals, communities, and organizations all have them. **Whether articulated or not, priorities exist because we want to make the most of our time, energy, and resources.** These are finite and valuable commodities, and we want to focus them on what matters most (to us). Otherwise, the default position is simply to react to whichever person or issue is present and clamoring the loudest at the moment. This is known as the tyranny of the urgent, or in the computer world, interrupt-driven. While it produces *busyness*, it does not ensure important *business* is addressed. Only priorities do that.

EMC's *Navisphere Quality of Service Manager* (*NQM*) brings prioritization of performance resources in CLARiiON storage arrays – at the application level. It offers a storage QoS capability that:

- Monitors performance for each application,
- Prioritizes applications according to policies set by the business, *and*
- Allocates system resources dynamically and automatically to meet service-level requirements, even for specific performance targets

As such, NQM is a valuable tool for the tricky task of performance management. When users experience problems with application performance, it can help administrators find and alleviate the problem (i.e., the bottleneck). NQM also makes it easier to manage CLARiiON arrays more precisely in shared environments, ultimately facilitating a higher degree of storage consolidation – and its inherent benefits of higher utilization and lower total cost of ownership.

NQM allows users to define I/O classes by LUNs, metaLUNs, I/O size, and I/O type. It measures and monitors the performance of these classes in terms of bandwidth (MBs per second), throughput (I/Os per second), and response time (milliseconds). Finally, it allocates performance resources automatically according to policies that either limit performance of I/O classes or boost performance to meet specific targets.

Read on for details.

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Storage QoS

Imagine a perfectly-maintained highway that feeds into a single tollbooth, where each car must stop to pay an attendant. Traffic flow would be limited by this tollbooth. In fact, it would not matter whether the highway had one lane versus four lanes, or a speed limit of 45 versus 75 MPH, because only the tollbooth (i.e., the bottleneck) matters. If you want to speed up a system, you have to alleviate the bottleneck.

So, imagine a second tollbooth is installed to let traffic flow through more quickly, but only vehicles carrying a special pass can use it. These priority vehicles would move through more quickly than the rest of the cars. The result is two classes or qualities of service for highway traffic – regular and expedited. Such a system allocates a scarce resource (flow through a toll area) among multiple users (vehicles on the highway) according to established priorities and policies (regular and expedited vehicles).

Storage QoS Defined

This same principle applies to storage quality of service (QoS) in computing environments. **Storage QoS technologies dynamically allocate the performance resources of a storage system among multiple servers according to business priorities.** The goal is to enable applications to receive the service levels they need. For instance, if an OLTP[1] application and file server store data the same storage array, QoS could give priority access to OLTP since it is more sensitive to response time. After all, customers do not want to wait for their orders to process!

More specifically, storage QoS technologies have the ability to:

1. Monitor performance for each application,
2. Prioritize applications according to policies set by the business, *and*
3. Allocate system resources dynamically and automatically according to policies to meet service-level requirements, even for specific performance targets

These three capabilities together are necessary for true storage QoS. While many useful storage performance management tools available today, not all can be categorized as QoS. For instance, there are software tools that measure performance at the port or array level. This is useful for system management, but it is not enough for managing application performance, which must be measured and controlled at the volume or LUN level. There are also tools that move data non-disruptively within or between storage systems to balance performance, mitigate hot spots (i.e., overused sections of the array), take advantage of tiered storage, and facilitate server and storage upgrades. This is a great capability for data management, but it is not storage QoS, per se. QoS implies that the system can detect potential performance deficiencies and immediately allocate resources to compensate – without delay or human intervention. Data migration does not meet this threshold because it is a time-consuming and often manually-initiated process.

Rationale for Storage QoS

The rationale for QoS is enabling storage consolidation. Consolidation means deploying larger, shared systems in order to increase resource utilization, simplify management, and lower costs. It takes advantage of economies of scale. QoS enables *a higher degree of storage consolidation*, because it makes it easier to share storage systems while maintaining service level requirements for applications. Through prioritization and policies, QoS lets enterprises get more out of finite storage resources, as well as quickly diagnose performance problems when they occur.

EMC NQM

EMC *Navisphere Quality of Service Manager* (*NQM*) is a storage QoS tool for EMC *CLARiiON* storage arrays. It measures and monitors performance at the application level and allocates resources dynamically-based on policies to meet service-level requirements.

[1] Online transaction processing

Like the horsepower rating of a car engine, CLARiiON performance resources are fixed and finite. Since most enterprises deploy their CLARiiON arrays in multi-application environments, NQM policies allow the performance resources to be controlled and directed according to business priorities, rather than on an undifferentiated, first-come-first serve basis. Once a policy is running, NQM constantly and dynamically allocates system resources to enforce it – without moving the data.[2] As such, it meets the criteria for storage QoS.

How It Works

NQM manages performance around "building blocks" of data called *I/O classes*. Users define I/O classes according to application profiles (or any other meaningful grouping), using one or more of the following characteristics.

- ***LUNs or metaLUNs*** (i.e., LUN groups),
- ***I/O size*** – such as > 2 MBs, or
- ***I/O type*** – reads, writes, or both

For instance, the LUNs associated with an e-mail application could be in one I/O class, and those associated with testing and development could be in another.

NQM measures and monitors the performance of each I/O class according to the following metrics.

- ***Bandwidth*** (MBs per second),
- ***Throughput*** (I/Os per second), and
- ***Response time*** (milliseconds)

It displays the metrics in real-time and reports historical performance logs for up to seven days. These logs can be exported as .csv files for long-term performance trending.

Users may create and schedule policies based on I/O classes and performance metrics. A single policy controls all I/O requests coming into the CLARiiON array, so NQM enforces one policy at a time. However, users may create up to 10 policies and scheduled them to run at different times.

[2] The mechanism is employs is adjusting the queue depth for LUNs and metaLUNs.

One type of policy establishes a performance target for an I/O class, such as a throughput of 1,500 I/Os per second[3] for an OLTP application. It allows a top-priority application to have the consistent performance it needs. Another type of policy establishes a performance limit, such as limiting a file server consuming no more than 30 MBS/second of bandwidth. This prevents secondary applications from over-consuming resources at the expense of priority applications.

Pricing

NQM is a software option for EMC's *Navisphere Management Suite* and is sold separately. The list price is $9,000 to $30,000 per array, depending on the model (and irrespective of capacity). NQM supports the following CLARiiON arrays when running *FLARE 24* (operating system) or higher: *CX300*, *CX500*, *CX700*, *UltraScale CX3-20*, *CX3-40*, and *CX3-80*.

Use Cases

Enterprises can employ NQM in numerous ways, as illustrated by the following examples.

Find the Bottleneck

When users complain about the performance of an application, such as e-mail, it is up to the administrators to find the root cause of the problem. Since performance is a function of the end-to-end computing and data path – which includes the application software, server, network, and storage – they must go on a search to figure out where the bottleneck is. With its ability to monitor application performance, NQM can help locate the bottleneck. Administrators may determine immediately if the problem is with the storage system. If not, NQM will have narrowed and shortened the search. If the bottleneck is there, NQM could establish or modify a policy to correct the performance deficiency at the application level.

Transact by Day, Back Up by Night, Etc.

Some enterprises will use NQM to run

[3] Measured at the array.

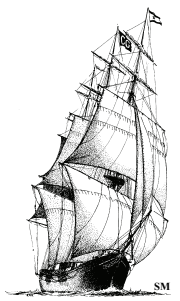
different policies according to the time of day or day of week. For instance, an enterprise might want to prioritize an OLTP application during business hours but give the backup system more performance during the nightly backup window. NQM could enforce different polices based on a schedule, e.g., favor transactions by day and backups by night. This same concept also applies to cyclical or seasonal events, such as quarter-end reporting.

Leverage Tiered Storage

Many people associate tiered storage with different types of disk drives, such as Fibre Channel and ATA, or different network connections, such as Fibre Channel and iSCSI (IP), but it can be associated with performance policies too. For less-critical Windows servers, an enterprise might provision LUNs on ATA drives, limit performance consumption using NQM policies, and connect to servers over iSCSI. This would leave the lion's share of system resources for priority Unix applications hosted on Fibre Channel drives and connected over a Fibre Channel SAN. The result is tiered storage with more granular control over the service levels delivered.[4]

Conclusion

The primary benefit of NQM is to enhance these benefits of storage consolidation by partitioning a CLARiiON array more efficiently among multiple applications. If traditional consolidation shares storage capacity and host port connections, NQM goes a step further to allocate performance resources according to business and application priorities. It offers storage QoS, which helps deliver the right service levels to applications at a lower overall cost. **Investment in NQM is worth considering, especially if consolidation and performance management are significant factors in your CLARiiON storage environment.**



[4] See **The Clipper Group Explorer** dated November 17, 2006, entitled *Practical Steps Toward Information Lifecycle Management* and available at http://www.clipper.com/research/TCG2006100.pdf.

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