



NAS Performance...At What Cost?

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Management Summary

You need to buy more network-attached storage to satisfy the demands of the next important application. Or, you need to buy a new NAS system to improve the performance of an existing application. At some point during the evaluation, you will ask the very important question, "How fast is it?"

The most accurate way to predict how a storage system will perform in a customer's environment requires that the equipment be brought in house and the applications data be loaded onto the new storage device. This is time consuming and impractical for most customers.

Many vendors have produced their own benchmarks to answer the question "How fast is it?" Independent vendor benchmarks have unique test scenarios making it difficult, if not impossible, to compare the performance of two different vendors' solutions; in effect, you are comparing "apples" to "oranges". (It is not well known that the original expression to denote evaluating dissimilar objects was comparing "apples" to "oysters".) Standardized benchmarks tests are necessary to compare competing storage solutions. These vendor-agnostic benchmarks provide storage evaluators with one benchmark to compare the performance of two different vendors' systems. But what is the cost to gain better performance? Each storage system is composed of various hardware and software components and priced differently. It is difficult to compare the cost of performance for two very different storage subsystems. An additional metric is required to allow IT to compare cost of performance for each system. This price/performance metric can be called dollars per operations (\$/OPS).

Standard Performance Evaluation Council

Standard benchmarks have been developed by organizations, such as the Standard Performance Evaluation Corporation (SPEC), that allow customers to more easily compare performance of one vendor's solution against another. The Standard Performance Evaluation Corporation has published several different benchmarks, such as benchmarks for CPUs, mail servers, graphics applications, web services, and network file servers. SPEC is a non-profit organization, whose members include a variety of participants, including hardware and software vendors (such as Apple Computer, BEA Systems, EMC, HP, and Oracle) and many universities (such as California Institute of Technology, John Hopkins University, Penn State, and the University of Stuttgart). These members have designed benchmarks that allow IT evaluators to compare different mail servers, for example, to determine which systems are 'faster' than others. The rules for these benchmarks and the performance of several different NAS systems are published on the SPEC website (www.spec.org).

One of the SPEC benchmarks measures the performance of a network file system or NAS system. This benchmark, called the *SPEC Server File System*, or *SPECsfs*, simulates many clients accessing a NAS system using NFS protocol. The results of this benchmark document the maximum number of operations per second attained and the measured response time. With this standardized SPECsfs benchmark, IT can now compare perfor

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mance of several different NAS systems under comparable load conditions. However, each vendor's NAS solution may consist of different hardware and software configurations, such as the number of file systems and disk drives that were used to achieve the reported performance. This difference can result in a wide spectrum of costs across the various tested solutions. *SPECsfs* rules require that vendors specify the hardware and software configuration that was used to run the benchmark. However, vendors are not required to list the cost of the solution.

Storage Performance Council

In 1998, a similar organization was founded to develop benchmarks specifically for storage systems. This organization, called the *Storage Performance Council*, or *SPC*, developed its first benchmark called *SPC-1*, which measures random I/O performance of large, complex storage systems that traditionally reside in a SAN. Other benchmarks are under development. In fact, a second benchmark, *SPC-2*, was recently announced that measures the performance of large sequential data move, which typifies video-on-demand applications. The benchmarks' rules and results are available at www.storageperformance.org.

The SPC report contains an important metric that is not available in the SPEC. This metric, called the SPC-1 Price-Performance, is calculated by dividing the number of I/Os per second (IOPS) by the cost of the system. Vendors are required to specify the list cost of the system and the cost for three years of maintenance. Buyer beware! Vendors are also allowed to apply *reasonable* discounts to the specified list pricing and this discounted price, not the list price, is typically used in the calculation.

The SPC-1 Price-Performance number gives storage evaluators an easy way to compare the cost of performance across different SAN storage systems today. Customers evaluating NAS solutions will discover that the SPC has yet to deliver a NAS benchmark, although they have announced plans to deliver one in the future.

Calculating NAS Price Performance

Customers evaluating NAS storage systems can use the *SPECsfs* benchmark with one important addition. They need to calculate the cost of performance using a dollars-per-IOPS metric. The cost for the system must include the following.

- *Pricing for all hardware and software components for the NAS solution* - This must include the cost of the disks, controllers, firmware and

Exanet

Exanet has produced several models of Network Attached Storage Systems, under the trade name *ExaStore*, which deliver high performance. For example, the two-node EX200FC cluster sustained 143,880 *SPECsfs* operations with an overall response time of 1.47 milliseconds. Similar impressive results were achieved for the four- and six-node cluster systems showing linear scalability of performance while maintaining low response time.

However, Exanet has taken the results of the *SPECsfs* to the next level. Using their list pricing, they have calculated the cost of performance – it is \$2.35 per OPS for the EX200FC. We urge other NAS vendors to produce similar calculations to allow customers to compare storage systems more easily.

software. We recommend that list pricing be used to eliminate the ambiguity of *reasonable* pricing.

- *Pricing for the cost of maintenance* - This must include the maintenance costs for all hardware and software components. We recommend that the cost to maintain the system for three years be used, since some vendors have warranty periods that differ by months or years.

Then the dollars/IOPS can be calculated to determine the best price performance solution.

Conclusion

Some vendors have backed performance claims with proprietary benchmark testing. These findings do not allow customers to compare different vendors' solutions easily.

Vendor-agnostic benchmarks, such as the *SPECsfs* benchmark, helps cut through some of the vendor hype. It allows customers to determine how a disk system will perform within a pre-determined environment. As such, it is the only one that customers should use to evaluate storage systems. Unfortunately, some standardized benchmarks, such as *SPECsfs*, do not include the cost parameters. Until the Storage Performance Evaluation Council requires pricing to be included, customers need to work with their vendors to calculate the cost per performance to ensure that they get the best performance - at the best price.



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