To STaaS or not to STaaS?
Strategic Directions for Today's IT Infrastructure

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Introduction

Storage based on a subscription service has been available on the public cloud for quite some time. While inherently flexible, its costs are notoriously unpredictable due to additional fees for items such as egress, usage, threshold-crossing pricing increments, and protection safeguards across zones and regions. In comparison, on-premise storage based on a subscription model offers the same flexibility as public cloud storage, but without the uncertainty of unforeseen charges.

This white paper discusses the differences between on-premise Storage as a Service (STaaS) solutions compared to public cloud storage. It unpacks why a formal Total Cost of Ownership (TCO) comparison is critical to answering whether "To STaaS or not to STaaS." The TCO of four IBM STaaS performance tiers are compared to the traditional purchase of a similar IBM FlashSystem. CIOview understands that the amount of storage required is the main factor potential buyers use to determine the size of a storage technology purchase. Therefore, the nuances of traditional storage purchases, including different configurations to achieve a required usable storage benchmark, are explored.

This white paper primarily focuses on IBM's STaaS offering. Included are examples of estimated TCO (Total Cost of Ownership) costs for the current range of IBM STaaS offerings compared to a traditional purchase, by varying growth rates and time periods. STaaS offers several additional benefits beyond the scope of a traditional TCO that are equally crucial in seeing the full picture. The competitive landscape in the quickly evolving world of STaaS is touched on briefly. Finally, critical STaaS findings are exposed, the competitive STaaS landscape discussed, and a set of final thoughts presented.

To STaaS or Not to STaaS

Why On-Premise STaaS?

Many organizations have taken a cloud-centric approach with their IT resources only to discover that the public cloud is not a singular solution. As portions of the technology infrastructure grow in complexity and legacy applications that pre-date the cloud still provide essential value, a more nuanced approach to the role of the cloud is emerging. The public cloud is flexible but it is costly. In contrast, on-premise infrastructures exhibit lower costs that are more predictable, but are less able to respond to changing business needs.

"Public Cloud STaaS is notoriously unpredictable from a cost perspective."

There is tremendous pressure on the data storage function to be an inherently more flexible resource, with the ability to expand and contract as business demands change. This translates into replicating the benefits of public cloud storage, while at the same time somehow combining what has been the traditional value of on-premise storage: fixed costs, knowable budget, and control of the technology being used.

While a hybrid model may seem obvious, the challenge remains of discerning what the public cloud to on-premise infrastructure balance should be. In the case of storage, while a movement away from a CapEx model to a OpEx/subscription commitment is intuitively appealing, without a formal TCO analysis, there is no way to know how a storage subscription model may or may not fit within an organization's plan for a more business-rational hybrid world.

Why not STaaS?

Beyond the much-needed TCO analysis, there is the argument that by adopting STaaS you are giving up control of your storage architecture and direction. On the other hand, one could argue as long as the STaaS vendor meets your service level agreement (SLA) in terms of access protocol, capacity, IOPS, bandwidth, latency, data resiliency, etc., is there really an issue? Furthermore, unlike the public cloud where there is a substantial cost to repatriating workloads, any shift away from on-premise STaaS in the future is a much less complex and costly endeavor.

"On-premise STaaS provides many of the same features as cloud STaaS, but without the possibility of unforeseen charges."

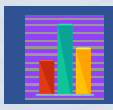
STaaS or Buy?

In the STaaS decision-making process, a third option may be considered: a traditional storage purchase. When should you buy storage, and when is STaaS the better option? In general, a purchase might make more financial sense when:

- Performance requirements are modest and required usable capacity is less than 100TB
- Performance requirements are extremely high
- Growth is limited
- Hardware discount rate is high
- Flexibility is not valued
- Excess IT resources are present

However, you will never know for sure unless you undertake a comprehensive comparison of the TCO of STaaS and the TCO of a purchase. A TCO comparison also provides the necessary context for assessing the less obvious benefits of STaaS. In order to generate the data used to evaluate the intricacies of costs related to on-premise STaaS and a purchase option, we have utilized TCOgo! for STaaS, a web-based tool that serves this very purpose.

The TCO of STaaS



Key STaaS TCO Variables

- Initial usable capacity
- Storage growth rate
- Facilities costs
- Performance level required
- Length of the subscription/investment period

Key Storage Purchase TCO Variables

General Cost Factors

- Annual corporate tax rate
- Cost of capital
- Capital equipment threshold
- Depreciation method
- Depreciation schedule
- Project timeframe
- Expected average rate of inflation

Personnel Cost Factors

- Country
- Region/state
- Industry
- Hours of operation
- Salaries & benefits
- Expected annual increase in IT salaries

Facilities Cost Factors

- Rent per square foot or square meter
- Raised floor
- Price per kWh
- Carbon emitted
- Power usage effectiveness factor
- Expected annual increase in rent
- Array hours of operation

Hardware & Software Cost Factors

- Required amount of storage
- Annual storage growth rate
- Annual server growth rate
- Additional required sites
- Compression/deduplication rate
- Drive/module configuration
- Workload type/details/characteristics
- Host/server connections
- Performance requirements
- Performance bottleneck identifier
- Performance safeguard implementation
- Expected annual rate of hardware price decline
- Expected annual rate of software price decline
- Vendor discounts/promotions
- Support/warranty contract length

System Settings Cost Factors

- RAID setting and parity
- File format overhead
- Storage set-aside
- Array capacity cut-off point
- Threads and concurrency

Amount of Storage and Performance

The table below shows the TCO of buying a storage system versus choosing a STaaS option. It shows the TCO at three different storage points (300TB, 400TB and 500TB), and displays the results as a range based on calculations for four different performance levels. All TCO calculations include: hardware, software, support, personnel, facilities, services, and a conservative cost associated with downtime.

Initial Usable Storage	Buy	STaaS
300TB	$0.4M-$2.7M	$0.4M-$1.6M
400TB	$0.5M-$3.3M	$0.5M-$2.0M
500TB	$0.5M-$4.5M	$0.6M-$2.4M

Assumptions include: capacity purchased upfront, compression ratio of 3:1, 3-year analysis period, 25% annual storage growth, maximum capacity utilization rate of 75% (not applicable to STaaS). All list prices.

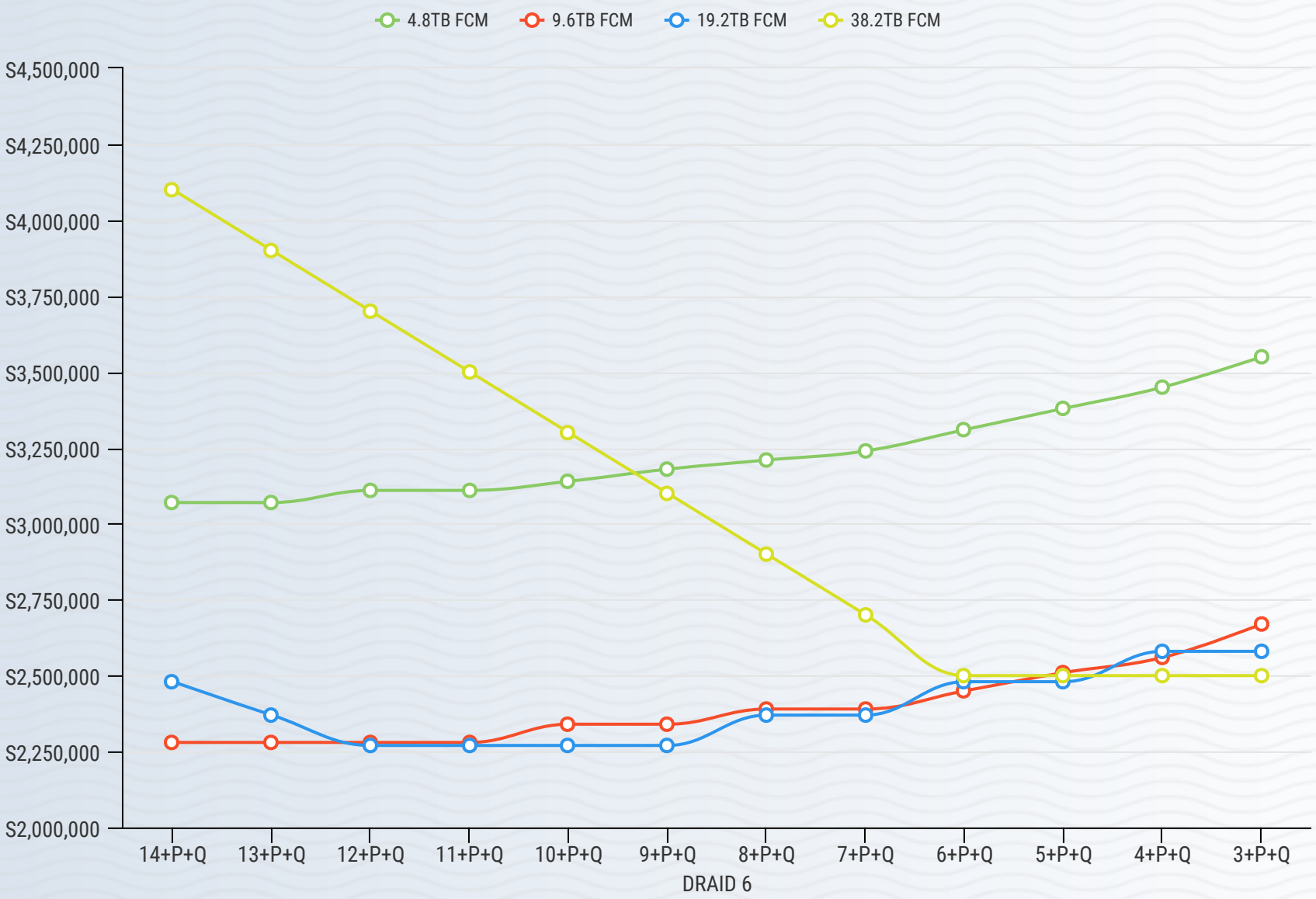
As Table 1 illustrates, in the case of buying capacity-focused storage (the first number in the ranges), the cost difference between a purchase and STaaS is never appreciably more. In contrast, if your workloads require a very high level of performance (the second number in the ranges), then the difference between a STaaS solution and a purchase could be as much as $2 million depending upon the configuration, although a discount on a traditional purchase would narrow the savings gap.

Drive Type, Capacity and RAID

One way to potentially reduce your purchase costs is to find the optimal drive to give you the lowest TCO. Part of this effort requires running TCO scenarios for each drive type and capacity, considering compression/deduplication possibilities, and deciding on the performance threshold. Then you need to consider what RAID level and parity size makes a good trade-off regarding the increased chance of downtime or impaired performance due to a failed drive. This is a particularly important decision given the rebuild times that are now common for 30+TB drives. So with that all said, what is the TCO impact of different drive capacities and DRAID options? And finally, is it really worth the time and effort to complete this sort of analysis?

Chart 1 provides an assessment of the TCO impact of the different drive options and DRAID possibilities.

Chart 1: TCO for different Drive Size and Parity



Assumptions include: capacity purchased upfront, initial usable capacity of 250TB, compression ratio of 3:1, 3-year analysis period, annual storage growth of 25%, maximum capacity utilization rate of 75%. List prices.

The first question to be answered is whether it's worth doing a drive/parity analysis? For most companies, a possible savings of $1.8 million would be considered well worth this effort. In this example, the savings can be achieved by choosing a 9.6TB FCM versus a 38.2TB FCM and selecting a 14+P+Q DRAID 6.

There are significant TCO trade-offs when selecting a particular drive size and parity group. While larger parity groups are commonly associated with higher levels of downtime, with DRAID 6 a two drive failure becomes much less likely than an adapter card going bad, and the rebuild times for even the largest capacity drives are bearable given DRAID's collective restoration capabilities.

Annual Growth

Until now, 25% annual growth was set as the default value, but what if storage growth is much lower or higher? Using 300TB of usable capacity as an example, in the case of a high performance scenario you can see how the attractiveness of STaaS compares to a purchase when the growth rate assumption is changed (Table 2).

Table 2: 300TB of STaaS (Extreme Tier) by Growth Rate

Annual Growth	10%	25%	40%	55%
Buy	$2.0M	$2.6M	$3.4M	$4.2M
STaaS	$1.3M	$1.6M	$1.9M	$2.2M
STaaS Savings	$0.7M	$1.0M	$1.5M	$2.0M

Assumptions include: capacity purchased upfront, compression ratio of 3:1, 3-year analysis period, maximum capacity utilization rate of 75% (not applicable to STaaS), DRAID 6 and 10+P+Q, STaaS Extreme tier, FlashSystem 9500 with FCM. List prices.

For those companies in need of high performance and at the same time experiencing high annual storage growth rates, STaaS has a significant TCO advantage over a purchase. However, these differences may be attenuated depending on the discount structure that you are able to negotiate.

Time Period

The investment time frame for a purchase vs. STaaS comparison is a key factor because of the growing wave of companies in the planning stages of a move to a hybrid cloud environment. As a result, some companies are looking at a 2-year horizon while others are in need of a 1-year analysis. For non-profit or government agencies, a longer time frame may be more valid.

Table 3: 300TB of STaaS (Capacity Tier) by Time Period

Time Period	1 Year	2 Years	3 Years	4 Years	5 Years
Buy	$216K	$283K	$393K	$522K	$677K
STaaS	$138K	$248K	$385K	$555K	$740K
STaaS Savings	$78K	$35K	$8K	-$32K	$-63K

Assumptions include: capacity purchased upfront, compression ratio of 3:1, 25% annual storage growth of 25%, maximum utilization rate 75% (not applicable to STaaS), DRAID 6, 9+P+Q and 14+P+Q (NL-SAS). STaaS Capacity tier, FlashSystem 5200 with Flash & NL-SAS. List prices.

Table 3 shows that not all TCO cases result in the favor of STaaS savings. However, these are hard costs and additional STaaS benefits should be included in the savings calculation. This example shows a TCO advantage over a purchase when the investment time horizon is short. By looking at TCO examples where some of the key variables such as growth rate and analysis period are isolated, it helps to bring into focus the issues that are key to a rational storage decision.

In Table 2 and Table 3 many variables were consistent by design. However, variables should be adjusted based upon specific configurations. For example, more compression and higher capacity utilization could be an option, with the FlashSystem 9500 configuration in Table 2 compared to the FlashSystem 5200 comparison in Table 3. If changing variables such as these is needed then how do you know what the ripple effects will be? Using TCOgo! for STaaS allows you to change the underlying array design assumptions and immediately see the TCO impact. TCOgo! also includes a methodology for the following additional STaaS benefits.

STaaS Additional Benefits

What is not captured in a traditional TCO model is the elastic nature of STaaS and the associated business benefits that can be derived. STaaS also frees up storage management resources by offering a break-fix outsourced model, and the addition of AI in the storage capacity management process all but eliminates the time needed for capacity planning. Just as it is crucial to have a robust TCO model for comparison purposes, it is equally important to isolate the business benefits of STaaS and have a solid methodology to place a financial value on each one.

Capital Savings

As the economy weakens and interest rates increase, the capital savings generated by a subscription model become more valuable. Capital savings are your capital expenditure (hardware and software) multiplied by the weighted cost of capital. To get your weighted cost of capital and calculate capital savings you need to know: the risk free return (usually the T-bill rate), market cap, beta and your expected return (typically 8%). This allows you to calculate your company's equity-linked cost of capital. To calculate your debt-linked cost of capital you need to know: corporate tax rate, amount of company debt and the average cost of company debt. Add together your debt and equity linked cost of capital and you have your company's weighted cost of capital.

Personnel Savings

A STaaS subscription includes hardware maintenance, firmware updates and break/fix operations performed by IBM. Such a service can reduce employee burnout and is particularly valuable for companies that are in a tight job market. CIOview estimates that STaaS typically saves up to 30% of storage personnel resources, freeing them up for more value-added activities. To calculate your annual savings, you need to know the number of employees involved in operational issues, average salary plus benefits, and the average employee time spent on operational issues. The total savings are simply your annual savings times the number of years that you are considering for a STaaS contract.

Seasonal Savings

The temporary need for additional storage capacity is common. To determine your STaaS seasonal savings you need to know: the percentage of usable capacity required for seasonal demands, number of seasonal events per year, and the length in days of the average event. Then take the cost to acquire additional capacity to a traditional system, minus the STaaS cost to expand temporarily to meet each seasonal need for your analysis period, and you will have calculated savings. This calculation is complex when billable capacity is changing through time, and the cost to increase capacity of a traditional storage system is usually non-linear. However, modeling shows the savings can be significant and should not be overlooked.

Capacity Planning Savings

Capacity planning typically involves creating a series of complex spreadsheets which have to be updated and shared on a continual basis. Time taken to accomplish this can be multiplied by the full salary and benefits of the individual(s) responsible. Sixty five percent of these savings will typically be used in higher value work and can be counted financially. These savings are deflated by a 35% factor only because capacity planning is often done in the form of extra work as opposed to operational activities, which are almost always constrained to the work day.

Service/Contractor Savings

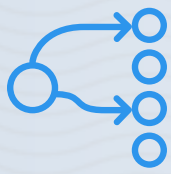
CIOview estimates the cost of contract labor or support services is commonly 12% of hardware and software costs. This can be reduced by 50% or more. Therefore, to calculate your additional savings, you would take the cost to purchase hardware and software for your subscription period, then multiply this figure by 12% and attribute the potential reduction in professional services/contractors. This is an estimate of your annual expenditure on outside contractors. This figure is then multiplied by the number of years of your STaaS contract. You may also choose to figure in fees and expenses associated with hiring a storage consultant including time spent searching, interviewing, or paying an outside agency. All told, this may increase savings by an additional 15-25% in this category.

Time to Market Savings

The time it takes to launch a new business immediately impacts the revenue and profits of most companies. Increasingly, this time is judged to be critical as businesses continue to try and adjust to rapidly changing consumer tastes, shifts in demand caused by economic and geopolitical events, as well as the breaking down of supplier relationships. To calculate the savings associated with improving your company's time to market you need to know: average time to launch a new business initiative, improvement with STaaS (potentially 50%), and average length of a new business cycle. This yields an extension of the business life cycle attributable to STaaS. Using your corporate ROI hurdle (typically 30%) and the cost of an average new business cycle gives you the minimum benefits. The minimum benefit multiplied by the number of new business initiatives during your investment time frame provides you with estimated STaaS savings.

Refresh/Procurement Savings

A recent study by the International Data Group found the average technology purchase involves 15.5 people across 5.8 different functions. Procurement times, effort and costs are reduced when companies use a subscription model and annual storage refresh costs can be eliminated entirely. The savings associated with reduced procurement and refresh activities should be based on: number of people involved in the typical IT procurement process, average FTE cost (salary plus benefits), and days spent on procurement by average FTE time saved. This provides you with your procurement costs for a purchase and you should subtract the same calculation for STaaS. The refresh costs only apply if you typically do not purchase all of your storage upfront. If you would add storage annually then you would make the same calculation multiplied by the number of years. However, you would not have to subtract anything for STaaS in this case. Suppose you are using a conservative financial methodology. In that case, you may wish to consider multiplying the savings by 65% for what social scientists believe is the amount of time saved which is then generally used in a productive fashion.



Over Provisioning

Buying all capacity upfront is a common strategy in the storage world. The benefits include: having sufficient capacity if growth is higher than expected and ensuring sufficient capacity to avoid performance problems. Normally, there is a cost to having excess capacity in the form of a pre-paid capital expenditure, data center space, and the opportunity cost of having purchased an item whose cost will fall every year. A subscription model has none of these issues.

STaaS Competitive Landscape

IBM's STaaS is certainly not the only on-premise storage subscription option. Offerings are available from Dell Technologies, Pure Storage, Hewlett Packard Enterprise, NetApp, Hitachi and a number of smaller companies. There are notable differences between products in terms of transparency, professional services, software sophistication, and flexibility of plans.

Table 4 below shows a summary comparison of solutions that are or potentially will be competitive to IBM STaaS in the future. The results shown are the total subscription cost over three years for each offering. The analysis is based on a compression ratio of 2:1. It also assumes 25% storage growth annually. Any number in bold indicates a minimum storage subscription influenced the result.

This scenario was run for 50, 100, 250, 500, and 1000 terabytes of usable/effective storage, as most companies are interested in knowing how much actual data storage will be available to them. Although it is tempting, you cannot simply compare a solution based on the marketing name alone. Dell's "Capacity Optimized" solution competes with IBM's "Balanced" tier, rather than IBM's "Capacity" tier. IBM's "Premium" tier best matches Pure's "Ultra'' tier rather than its offering named "Premium". Currently, the level of performance from IBM's "Extreme" tier is much higher than anything Dell and Pure offer.

Table 4: Storage as a Service Subscription Costs by Usable/Effective TB

Vendor	Performance Tier	50 TB Usable	100 TB Usable	250 TB Usable	500 TB Usable	1000 TB Usable
IBM	Capacity	**$0.160M**	**$0.160M**	$0.284M	$0.500M	$0.914M
IBM	Balanced	**$0.408M**	$0.408M	$0.703M	$1.249M	$2.317M
IBM	Premium	**$0.297M**	$0.426M	$0.914M	$1.693M	$3.381M
IBM	Extreme	$0.413M	$0.821M	$1.764M	$3.265M	$6.524M
Dell	Capacity Optimized	**$0.133M**	$0.190M	$0.461M	$0.879M	$1.670M
Dell	Balanced	**$0.193M**	$0.276M	$0.670M	$1.272M	$2.452M
Dell	Performance Optimized	**$0.585M**	**$0.585M**	$1.029M	$1.928M	$3.687M
Pure	Capacity	**$0.228M**	**$0.228M**	**$0.237M**	$0.379M	$0.566M
Pure	Performance	**$0.116M**	$0.167M	$0.408M	$0.759M	$1.390M
Pure	Premium	**$0.168M**	$0.242M	$0.589M	$1.088M	$2.001M
Pure	Ultra	**$0.330M**	$0.477M	$1.159M	$2.140M	$3.939M

Assumptions include: subscription cost only (including installation), 25% annual growth rate, **compression ratio of 2:1**, 3-year contract length. List Prices as of 7/22. Bold numbers indicate the TB minimum impacted the result.

Upon first glance, IBM's STaaS appears to be more expensive. However this is not really the case, and it is important to understand why not. Combining the costs presented in Table 4 with some key metrics in Table 5 below provides a starting assessment of the economics of each offering.

Using published IOPS per TB figures (Table 5), and attributing them to each individual configuration example in Table 4, the total initial IOPS of all IBM STaaS examples can be calculated. The total initial IOPS for all 20 hypothetical IBM configurations adds up to 7,178,250 IOPS, and the total cost of all 20 example IBM configurations for three years would be approximately $26,601,000. Dividing the total cost by the total initial IOPS shows an average of $3.71 per initial IOPS (IOPS were adjusted for compression applicable for the capacity tier).

By the same logic, Dell has an average cost of $4.34 per initial IOPS, and Pure is $4.50. The performance numbers were controlled for the minimum storage when applicable. In this analysis of 55 configurations, Dell is 17% more expensive than IBM, and Pure is 22% more expensive on average than IBM. Similar results should be seen when considering the average IOPS of each configuration over three years or the final available IOPS of each configuration at the end of the analysis. However, the initial IOPS comparison seemed most intuitive.

This example shows STaaS product comparisons that seem simple are ultimately more complex than one would suspect. As a result, without a true STaaS Competition TCO tool that allows easy changes to the key service attributes and factors such as downtime, there is no practical way to determine which storage subscription service is the most financially appealing.

"In this analysis of 55 configurations, on average Dell is 17% more expensive than IBM, and Pure is 22% more expensive than IBM."

Table 5: Key STaaS Solution Metrics

Vendor	Performance Tier	IOPS per TB	Min. TB	Max Comp.	Read GB/s	Write GB/s	Availability Estimate
IBM	Capacity	60-140	100	3:1	19	6	99.999%
IBM	Balanced	600	100	3:1	35	10	99.999%
IBM	Premium	2250	50	3:1	45	12	99.999%
IBM	Extreme	4500	25	3:1	45	12	99.999%
Dell	Capacity Optimized	700	50	3:1	12.5 *250TB	2 *250TB	99.99%
Dell	Balanced	1100	50	3:1	20 *250TB	3 *250TB	99.99%
Dell	Performance Optimized	1800	100	3:1	25 *250TB	5 *250 TB	99.99%
Pure	Capacity	110	200	2:1	9	3	99.99%
Pure	Performance	330	50	2:1	18	6	99.99%
Pure	Premium	1100	50	2:1	18	6	99.99%
Pure	Ultra	2200	50	2:1	18	6	99.99%

Among the key metrics that stand out in Table 5 are IBM's throughput numbers. If one was adjusting for throughput results one would expect to get a similar outcome to the cost adjustment obtained for IOPS. IBM's estimated availability is stronger than its peers and compares very favorably with public cloud storage solutions. This bodes well for IBM STaaS when downtime models are included in a TCO analysis.

Final Thoughts

Moving to a storage subscription model is a significant shift in philosophy for many organizations. To make the right decision consider the following:

- STaaS Total Cost of Ownership (TCO) comparisons between cloud and traditional storage purchase are a worthwhile exercise. This is the only surefire way to take out the cultural bias towards either approach.

- Simple variables will have a dramatic impact on comparisons between STaaS and other storage solutions. IBM STaaS often compares favorably to a traditional storage purchase, but a comprehensive TCO analysis is useful to identify specific trends or make general conclusions.

- Recognizing the TCO of a purchase will be highly influenced by many factors including but not limited to: initial capacity, storage growth, drive capacity and type, DRAID and parity selected, as well as your investment/subscription time horizon.

- Document the additional savings associated with STaaS. While not strictly part of a TCO analysis, these benefits provide another level of insight into the difference between a purchase and a subscription model.

- Robust analysis tools are required to create an apples-to-apples comparison when evaluating STaaS offerings from competitive vendors, to a traditional storage purchase, or a cloud storage solution.

- The marketing names of STaaS solutions/tiers may not align in vendor-to-vendor comparisons.

About CIOview

CIOview is the choice of IT managers worldwide who need exacting financial metrics for evaluating complex IT solutions. CIOview's software helps senior managers make and document complex purchase decisions, ensuring technology purchases are aligned with business goals. CIOview's flagship product lines, TCOgo! and TCOnow!, are used by thousands of companies and organizations in more than fifty countries.

CIOview's founders are industry thought-leaders in the area of financial impact of technology, and have dedicated their research to that topic. When CIOview's founders stretched spreadsheet technology to its limit, they began looking for a more effective approach, and TCOnow! was born. Now, CIOview develops and markets its fourth generation of business value technology tools, the most powerful and flexible available anywhere.

About TCOgo! for STaaS

Comparing the TCO of IBM's STaaS to a conventional storage purchase is a complex task. For IBM and its Business Partners, TCOgo! for STaaS is available as a web-based TCO solution. Built upon CIOview's extensive technology data collection, TCOgo! allows for a custom comparison between an IBM STaaS solution and an IBM FlashSystem purchase. TCOgo! not only includes a traditional TCO comparison, but also additional STaaS benefits with customizable models. Results are shown graphically and a PDF is automatically generated for your convenience.

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