



White Paper

# How Public Sector Organizations Benefit from Flash Storage

## Strategies That Boost Performance and Lower Costs

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### Executive Summary

Why is flash storage compelling? It is simpler than conventional storage. Instead of using a spinning disk and roving reading arm to store data, flash uses electricity to store data in addressable locations on a fixed, thin layer of oxide. Data is retained even when the power is off. There are no moving parts.

As a result, flash storage has been shown to consume as little as 20% of the power of a traditional spinning hard drive yet read as much as 100 times faster.

Flash storage costs more per gigabyte than conventional storage. However, used in combination with conventional storage, flash can reduce overall costs compared to using conventional storage alone.

Public sector organizations are combining flash and conventional storage to produce notable gains in performance and reductions in costs. This white paper examines leading strategies as demonstrated by several organizations. It also reviews the range of flash solutions that are proving useful for public sector organizations, including all-flash storage systems. The types of gains achieved overall include:

- Faster response time
- Increased data throughput
- More users accommodated per storage system
- Higher service levels in delivering services
- Savings by avoiding the need to purchase additional drives for performance
- Reduced power, space, and cooling costs

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## Why NetApp Flash Storage?

Nearly all public sector organizations face common IT challenges: data is increasing rapidly, budgets are tight, IT teams are overstretched, and fast performance is critical for meeting service levels.

Flash storage—and particularly NetApp® flash storage—addresses these challenges.

### Build on Value

Public sector organizations typically have more spending priorities than they have capital. When purchasing IT infrastructure, it's critical that they have entry-level choices that can scale and provide the best value over time.

The Info-Tech Research Group, an advisory company, kept this requirement in mind as it evaluated storage from seven leading vendors. Info-Tech named NetApp a “champion” and winner of “best overall value” for small to midrange storage. Vendors were rated for viability, strategy, reach, and channel; their products were rated for features, usability, affordability, and architecture. [See the complete Info-Tech report here.](#)

NetApp is the only company that received “exemplary” in seven out of the eight criteria and “good” or higher in all criteria. The report said that NetApp’s “introduction of Flash Pool brings flash performance to entry level systems...Advanced technologies and tools for thin provisioning, thin replication, thin snapshots, inline compression, deduplication, and efficient use of flash all help optimize disk utilization, as well as network bandwidth utilization.”

The last sentence in the preceding quote is a key reason why the best value in flash storage is a result of more than just the price per gigabyte of the storage devices. Some vendors in today’s marketplace offer flash storage at a lower initial price, but without the added capabilities discussed earlier; the “least expensive” choice at the start can turn out to be more expensive over time. The Info-Tech report named NetApp as champion because it “leads by introducing features from its high-end storage to its flagship small to mid-range product,” which is the NetApp FAS2200 line of storage systems.

### Keep It Simple

Another challenge is that public sector organizations typically have IT teams that are overstretched. They need IT solutions that deploy quickly and are simple to manage. That’s why NetApp storage systems such as the FAS2200 line have a new GUI-based System Setup utility: three simple screens enable a system to be up and running within minutes, nondisruptively. The systems feature automated management, requiring little human intervention. “Hot data” is cached automatically in real time according to usage frequency, and tools provide performance and diagnostic statistics to support smooth operation.

NetApp Flash Pool™ aggregates are also easy to scale: the NetApp Data ONTAP® operating system enables customers to easily and affordably upgrade to higher end systems and new capabilities or add storage capacity to their shared infrastructures with no downtime.

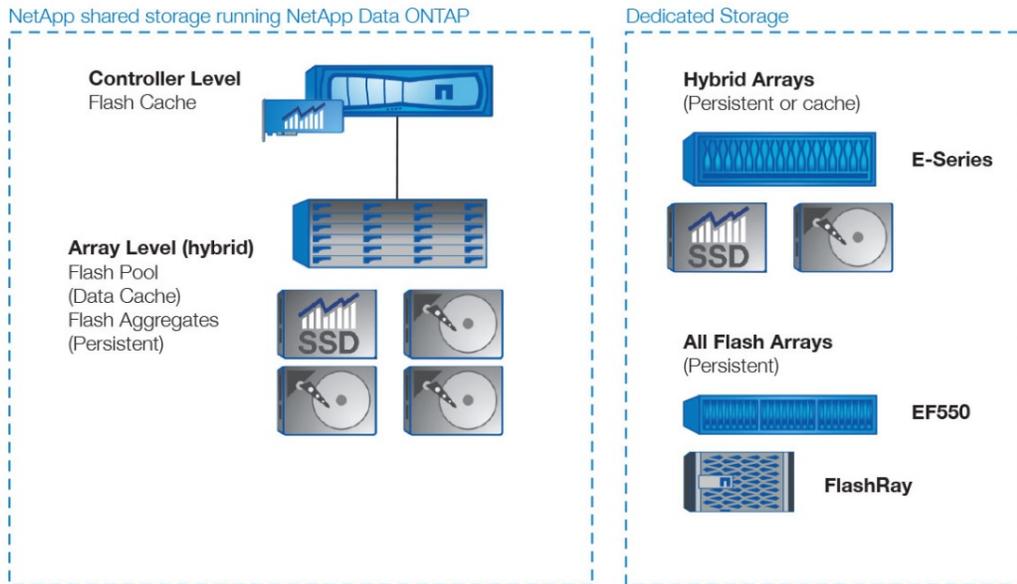
### Look for Reliability

Since 2009, NetApp has been a global leader in flash storage and now has over 75PB of flash memory deployed that accelerate more than 5EB of storage around the world. NetApp technical support is also global, enabling organizations to get the support they need wherever their operations may take them.

## Get Flexibility for the Right Fit

A variety of NetApp flash storage options enable public sector organizations to meet the needs of different workloads.

Figure 1): NetApp flash storage options for public sector organizations.



At the array level, NetApp Flash Pool, a Data ONTAP feature, provides a combination of performance and value that helps public sector organizations start right and stretch their dollars. NetApp Flash Pool lets an organization mix solid state disk (SSD) technology and hard disk drive (HDD) technology to create RAID-protected aggregates that accelerate reads and writes. The Flash Pool aggregate automatically copies hot data onto flash for faster performance, delivering SSD performance at HDD prices.

Flash Pool is available without additional software licensing. Implemented at the storage array level, it:

- Helps an organization respond to challenging service-level agreements (SLAs) while containing costs
- Provides RAID-protected SSD storage, important for write-intensive applications such as OLTP
- Delivers cache persistence through high-availability (HA) failover events
- Boosts the efficiency of a data storage environment
- Lets low-cost SATA disk drives be deployed as the primary HDD tier, to minimize cost, space, and power
- Works out of the box with default settings, making it easy to deploy and simple to manage

Flash Pool technology also seamlessly integrates with NetApp's industry-leading suite of nine storage efficiency technologies, further helping customers increase utilization and reduce power costs. NetApp is the only vendor offering this unique intelligent caching approach in the entry-level storage market, in its FAS2200 series systems.

NetApp Flash Cache™ is available in NetApp FAS3200 and FAS6200 series systems. FAS3200 systems can be flexibly configured with up to 2TB, and FAS6200 systems can be configured with up to 16TB of high-speed Flash Cache PCIe cards inside the controller, accelerating read-intensive workloads. This intelligent caching enables an organization to avoid the purchase of more hard disk drives or solid state drives. Flash Cache is deduplication aware, allowing more data to be cached.

Both FAS3200 series and FAS6200 series systems can also be configured with Flash Pool SSDs for workloads that need read and write acceleration. Combined with SATA HDDs, the result is SSD-like performance at HDD-like prices. If workloads require even higher performance, the systems can be configured with all-SSD disk shelves.

For a select yet growing number of applications, the true pain point is performance. Sometimes, simply scaling out disk drives or even utilizing hybrid flash solutions doesn't deliver the mission-critical submillisecond response times that are necessary. The all-flash NetApp EF540 and EF550 flash arrays are designed for these workloads. They can deliver more than 300,000 IOPS, submillisecond latency, and 6GBps throughput. When a NetApp all-flash array is substituted for traditional drives, it can also cut space utilization, power, and cooling by up to 95%.

The upcoming NetApp FlashRay™ product family, with general availability expected in 2014, will deliver rich scale-out and storage efficiency features to maximize the benefits of all-flash arrays. It will combine consistent, low-latency performance; high availability; and integrated data protection with enterprise storage efficiency features such as inline deduplication and compression.

## The Operational Impact of NetApp Flash Storage

Public sector organizations are using NetApp flash storage with several different strategies to achieve gains:

### Boost Performance for VDI, Virtual Server, and Cloud Environments

Many public sector organizations use virtualization and cloud services to increase agility while lowering costs. A number of organizations also are rolling out virtual desktops to enable workers to be productive from anywhere, on any device.

Virtual server, cloud, and virtual desktop environments all present a challenge, however. They scale successfully only when high storage input/output (I/O) is available to support them. Flash storage can play a critical role in making high storage I/O achievable and affordable.

The City of Ogden government, which serves 83,000 residents in Utah, delivered important gains with flash storage. It had a tight budget, yet wanted to give employees faster access to data. Virtual desktops were taking as long as 90 seconds to boot, so the city deployed a NetApp FAS2240 system with Flash Pool technology (SATA + SSD) to speed storage I/O.

Boot times dropped from 90 seconds to 15 seconds. Users now get fast and reliable access to data from mobile devices—whether it's finding a figure for a City Hall meeting or enabling a detective to retrieve a police record in the field.

“Using a NetApp platform with Flash Pool is like going from first gear on a mountain bike at an incline to a downhill finish,” says Andy Lefgren, manager, Ogden City. “Our virtual desktops are more responsive. NetApp makes it easier for us to help our end users perform their jobs.”

### Doubling Service Coverage Despite Budget Cuts

Another agency that faced a budget challenge is Iowa Workforce Development (IWD). It's part of the Iowa state government and has a critical mission: provide employment advice and services for the nearly 90,000 Iowans who are unemployed. The state's 5.7% unemployment rate includes 25% of the soldiers who have returned from active duty.

Budget cuts meant that IWD would have to close more than half of its 55 field offices. The agency wanted to make its services available digitally, through virtual desktops, instead of requiring field offices. Virtual desktops already served 30% of its staff, but the VDI program at that point was having storage-related performance and provisioning issues.

IWD replaced its prior storage with a NetApp V3160 storage system with Flash Cache. The increased IOPS provided by the storage system enabled the agency to roll out 500 virtual access points and support 1,500 virtual desktops. The access points can be found at public libraries, homeless shelters, the YMCA, human services organizations, and other sites.

The self-service desktops at each access point provide job service and resume development assistance, a job bank, skill testing tools, and other information. A little more than half of Iowa's counties had field offices before; now all 99 counties have access points for IWD services.

"The ability to deliver more services to more citizens across the state, especially those who are unemployed and searching for work, is an enormous success," says Gary Bateman, chief information officer at Iowa Workforce Development. "IWD has seen an average increase of 40% in the rate of services that the agency provides through the virtual access points every month."

In the prior VDI environment, the IT team used to get as many as 40 trouble tickets a day from employees who couldn't connect to their virtual desktops, largely due to storage performance issues. "Now, it's unusual to receive any tickets related to system availability," says Jean Foshier, information administrator at IWD. "NetApp has been pivotal to the success of our virtual desktop implementation."

## **Meeting User Expectations for Private Cloud Services**

At Bellevue College, the third-largest institute of higher education in Washington, a NetApp FAS6210 storage system with Flash Cache is improving the quality of private cloud services, which the college offers to more than 60,000 users. "We made it our goal to deliver private cloud services to students, faculty, and staff 24/7, with robust application performance," says Russ Beard, vice president of Information Resources at Bellevue College.

Using NetApp Flash Cache accelerated virtual machine performance by an average of 20% at Bellevue College, improving the overall performance of the college's private cloud. "NetApp Flash Cache gives us rapid read performance, so virtual machines are much more responsive for remote interactive sessions," says Edward Smith, network administrator at Bellevue College. "That's helping us meet our users' expectations of how cloud services should perform."

## **Boost Performance for Transaction Processing/Database Response**

Another key use case driving the adoption of flash storage in public sector organizations is the need to speed up database and transaction processing. Improving database response times was critical at the HR division of a large federal agency. The division serves hundreds of thousands of users through more than 300 applications, and data was hosted at three data centers on storage arrays from multiple vendors.

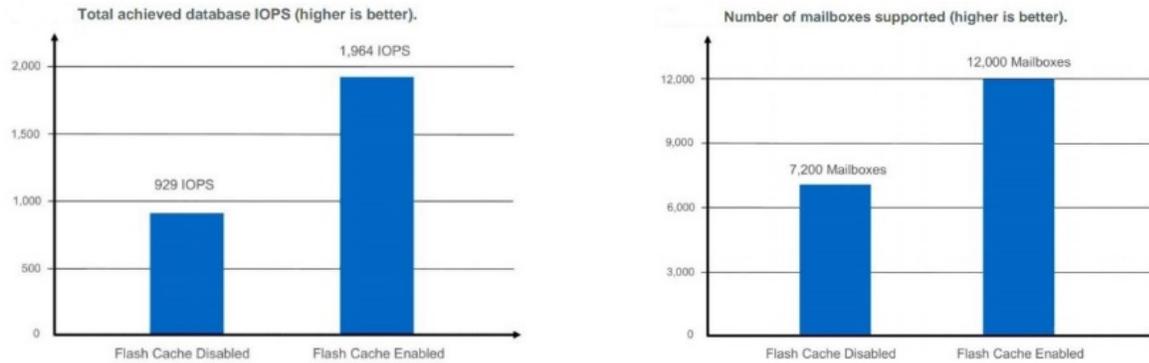
The agency wanted to enhance service levels, reduce costs, and scale for the future. It consolidated its HR environment at one data center and chose to standardize on NetApp storage. A key reason for the choice was NetApp's unified storage architecture. It can support all common NAS and SAN protocols from a single platform, eliminate geographic and application silos, and enable direct access to storage from multiple clients.

The new solution had an important challenge to solve: it needed to accommodate heavy, read-intensive database activity from tens of thousands of simultaneous users. As the volume of users increased, the conventional storage systems in the prior environment slowed, because each read request required their controller heads to move to pull data off drives.

To address this challenge, the agency deployed a wide array of NetApp storage systems, from entry-level FAS2040 systems up to FAS6290 systems that are clustered for high availability. Many of the systems combine NetApp Flash Cache and Flash Pool technologies.

NetApp Flash Cache makes sure that frequently accessed data and NetApp metadata are cached for fast access, while less frequently accessed data resides on cost-effective, high-capacity SATA drives. NetApp testing has shown that Flash Cache allows customers to increase the number of users of a database application such as e-mail by as much as 67% without adding disk drives (see Figure 2).

Figure 2) More users in a flash.



What difference can Flash Cache make? NetApp ran a test on a Microsoft® Exchange Server 2010 infrastructure. Turning Flash Cache on more than doubled IOPS (figure on left) and enabled 67% more users to be accommodated (figure on right). Source: NetApp TR-3867, “[Using Flash Cache for Exchange 2010.](#)”

NetApp Flash Pool technology accelerates write-intensive workloads (with the availability of overwrite caching) and is enabled for specific datasets, while Flash Cache provides system-wide acceleration. Flash Cache and Flash Pool may be deployed on the same storage system when appropriate, but caching for specific data volumes will be performed by one or the other technology. Response times have been significantly reduced.

## Accommodating Multiple Tenants

In addition, flash-based storage has enabled the federal agency to develop a more service-oriented enterprise platform. Its storage arrays now accommodate more tenants, or other operating units from the agency, than in the prior environment, yet they deliver the fast performance needed for I/O-intensive database transactions.

## Control Costs Despite Storage Growth

It’s easy to see that flash storage improves storage I/O performance. It’s less obvious why flash storage can also reduce costs and minimize the cost of growth.

The federal agency, for example, was able to save significantly compared to what it would have spent for additional SAS or SATA drives in order to overprovision and achieve the acceleration in performance that it gets from NetApp Flash Cache.

Boosting storage I/O also can make possible new cost-saving IT initiatives. Iowa Workforce Development was able to roll out virtual desktops across the state, expanding the reach of its employment services even though it had to close branch offices.

“By allowing us to eliminate dozens of brick and mortar offices across the state, NetApp is helping us save \$6.5 million annually,” says Iowa Workforce Development’s Bateman. “Thanks to NetApp, when pressured to do more with less, we were able to transform our virtualization and storage infrastructure into an invaluable asset that prevented us from having to lessen the workforce services we deliver to Iowa residents.”

Bellevue College uses Flash Cache in conjunction with high-capacity SATA drives to achieve cost-effective performance for its private cloud.

“Our virtual application servers are running on SATA and Flash Cache, and they’re performing very well,” says Beard. “Using SATA drives helps us keep storage costs manageable while still getting the capacity and

performance that we need. That's important, because as a public institution our budgets are governed by the state, and we don't have much leeway in raising funds for infrastructure costs.”

## **Boost Performance for High-Performance Computing**

High-performance computing (HPC) is becoming an increasingly important strategy for many public sector organizations. Interest is growing in all-flash storage systems such as the NetApp EF540 and EF550 because these systems can significantly accelerate HPC environments.

As mentioned previously in this paper, NetApp tests have shown that these arrays can exceed 300,000 IOPS while delivering submillisecond latency and 6Gbps throughput. This provides transactional performance equivalent to 1,000 traditional 15K SAS drives while decreasing space utilization, power, and cooling requirements by up to 95%, increasing the cost efficiency of HPC environments.

## **Enable Storage Processing on the Move**

NetApp flash storage serves another key need: It enables first responders and military teams to equip vehicles with storage systems and collect data such as video footage while on the move, despite shocks and bumps.

Vibrations can cause conventional spinning hard drives to fall out of alignment and run into issues, but an all-flash version of a system such as the NetApp FAS2200 series is able to keep operating.

NetApp flash storage systems also enable field teams to use NetApp SnapMirror® software to transmit data from vehicles back to data centers efficiently. The network compression and NetApp deduplication technologies in SnapMirror reduce bandwidth utilization and accelerate data transfers.

## **Exploring Flash: Next Steps**

In a world where data growth is accelerating, flash-based storage is enabling public sector organizations to boost storage performance while controlling costs. It's an important resource. To learn more, visit [www.netapp.com/flash](http://www.netapp.com/flash).

## Appendix: Results at Four Public Sector Organizations

### Iowa Workforce Development Saves \$6.5 Million Annually, Expands Services with 1,500+ Virtual Desktops on NetApp Storage

#### Customer

- Iowa Workforce Development
- Des Moines, Iowa
- [www.iowaworkforce.org](http://www.iowaworkforce.org)
- Industry: Government (state)

#### NetApp Partner

IP Pathways

[www.ippathways.com](http://www.ippathways.com)

#### Challenge

Contend with shrinking budgets while continuing to deliver diverse workforce services to Iowa citizens.

#### The Solution

Enable Iowa citizens to easily access workforce services through an efficient and a cost-effective virtual desktop solution, hosted on a NetApp V3160 storage system with NetApp Flash Cache.

#### Benefits

- Saved \$6.5 million annually in operating costs
- Deployed 1,500+ virtual desktops across Iowa in less than 6 months
- Implemented more than 2x the targeted number of virtual access points
- Reduced storage requirements by nearly 50% using NetApp deduplication
- Deployed 600 virtual desktops to support internal employees

“By allowing us to eliminate dozens of brick and mortar offices across the state, NetApp is helping us save \$6.5 million annually.”

Gary Bateman, Chief Information Officer, Iowa Workforce Development

### Bellevue College Enhances Private Cloud Services with NetApp

#### Customer

- Bellevue College
- Bellevue, Washington
- [www.bellevuecollege.edu](http://www.bellevuecollege.edu)
- Industry: Higher education

#### NetApp Partner

Bridge Data Solutions

[www.bridge-data.com](http://www.bridge-data.com)

## Challenges

- Deliver robust performance for applications running in private cloud
- Provide 24/7 availability for services and data
- Support upcoming digital asset management and virtual desktop initiatives
- Maximize performance and capacity while keeping costs down

## The Solution

Deploy NetApp FAS6210 storage system with Flash Cache and NetApp clustered Data ONTAP operating system for nondisruptive operations.

## Benefits

- Improve virtual machine performance by 20%, enhancing service quality
- Eliminate storage downtime, meeting expectations for 24/7 service availability
- Enable new and innovative educational opportunities
- Reclaim storage space with deduplication, reducing costs

“NetApp Flash Cache gives us rapid read performance, so virtual machines are much more responsive for remote interactive sessions. That’s helping us meet our users’ expectations of how cloud services should perform.”

Edward Smith, Network Administrator, Bellevue College

## Ogden City Speeds Access for Virtual Desktops and Databases with NetApp Flash Pool

### Customer

- Ogden City
- Ogden, Utah
- [www.ogdencity.com](http://www.ogdencity.com)
- Industry: Government (local)

### NetApp Partner

Solutions II  
[www.solutions-ii.com](http://www.solutions-ii.com)

## Challenges

- Enable users to access data faster and more reliably, especially from virtual desktops
- Eliminate slow system response when accessing information from Microsoft SQL Server® databases
- Address efficiency issues associated with the previous storage platform

## The Solution

Deploy a NetApp FAS2240 system that leverages different drives, Flash Pool technology (SATA + SSD), and deduplication to cost-efficiently meet varying performance and capacity needs.

## Benefits

- Sixfold faster virtual desktop boot times (90 seconds cut to 15)
- 85% reduction in SQL Server latency

- Fast, reliable access from mobile devices, enhancing government services
- Reduced administration time because data management is automated within Flash Pool SSDs: turn it on and walk away
- 98% smaller SQL Server backup windows (10 minutes to 10 seconds)
- 83% smaller VMware® drive and log file backups (2 minutes to 20 seconds)
- 60% reduction in storage requirements due to NetApp deduplication, reducing TCO

“Using a NetApp platform with Flash Pool is like going from first gear on a mountain bike at an incline to a downhill finish. Our virtual desktops and Microsoft SQL Server applications are more responsive, and middle-of-the-day SQL Server backups no longer impact application performance. NetApp makes it easier for us to help our end users perform their jobs.”

Andy Lefgren, Manager, Ogden City, Utah

## **Federal Agency Speeds Database Transactions with NetApp Flash Technology**

### **Customer**

- HR division at large agency
- Industry: Government (federal)

### **Challenges**

- Standardize and consolidate storage
- Improve database response times to boost user productivity
- Accommodate more tenants per storage system

### **The Solution**

Deploy NetApp Flash Pool and NetApp Flash Cache on NetApp storage systems.

### **Benefits**

- Significantly lower storage hardware costs by using NetApp flash technology instead of purchasing additional conventional drives to overprovision for performance
- Faster database response times
- Ability to accommodate a greater number of tenants (agency departments and groups) on storage arrays

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