



IBM Spectrum Storage

Software Defined Data Protection

**IBM Spectrum Protect™ with
IBM Spectrum Scale™**

Version 6.6

Agenda

▶ Introduction Spectrum Protect and Spectrum Scale

Why Spectrum Protect with Spectrum Scale

Configuration options

Positioning and Advantages

IBM Spectrum Storage™ Family

Securely ‘unboxing’ storage to revolutionize data economics

Family of Storage Management and Optimization Software

Control

Protect

Archive

Virtualize

Accelerate

Scale



IBM Spectrum Control™	Analytics-driven data management to reduce costs by up to 50 percent
IBM Spectrum Protect™	Optimized data protection to reduce backup costs by up to 38 percent
IBM Spectrum Archive™	Fast data retention that reduces TCO for active archive data by up to 90%
IBM Spectrum Virtualize™	Virtualization of mixed environments stores up to 5x more data
IBM Spectrum Accelerate™	Enterprise storage for cloud deployed in minutes instead of months
IBM Spectrum Scale™	High-performance, highly scalable storage for files, objects & analytics

IBM Spectrum Protect™ – IBM Tivoli® Storage Manager (TSM)

Comprehensive backup and recovery suite for physical, virtual and cloud environments

On Premises

Physical / Virtual

Hybrid

- ✓ Backup
- ✓ Recovery
- ✓ Archive
- ✓ DR
- ✓ BaaS / DRaaS
- ✓ Object Storage

Services

✓ Incremental forever	✓ Replication	✓ D2D	✓ NAS
✓ Deduplication everywhere	✓ Snapshots	✓ D2D2T	✓ LAN / SAN
✓ Compression	✓ Encryption	✓ D2D2C	✓ WAN

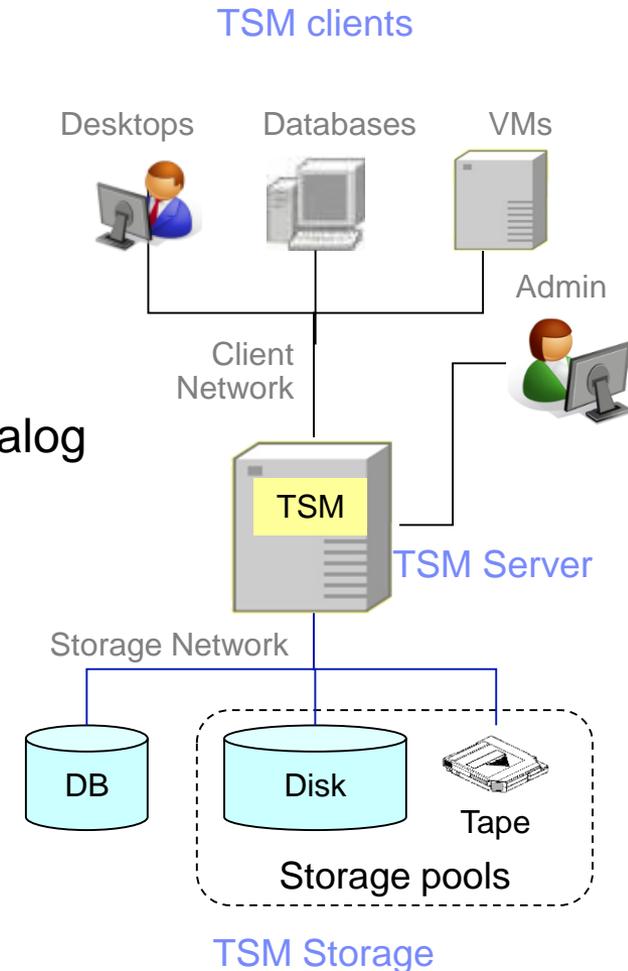
Heterogeneous storage

Cloud Storage

Over 20 years experience protecting some of the world's largest data centers, over 20,000 active clients

Spectrum Protect Architecture

- Spectrum Protect has client – server architecture
 - Backup Client selects and backs up the data
 - Backup Server catalogs data and stores it in storage pools
- Spectrum Protect server has internal database as catalog
- Storage pools can be on a variety of storage media
 - Flash, disk, NAS, optical and tape
 - Storage pool tiering allows automated migration
 - Includes transparent migration between the pools
- Spectrum Protect server provides embedded tools for central management, monitoring and reporting



IBM Spectrum Storage Family

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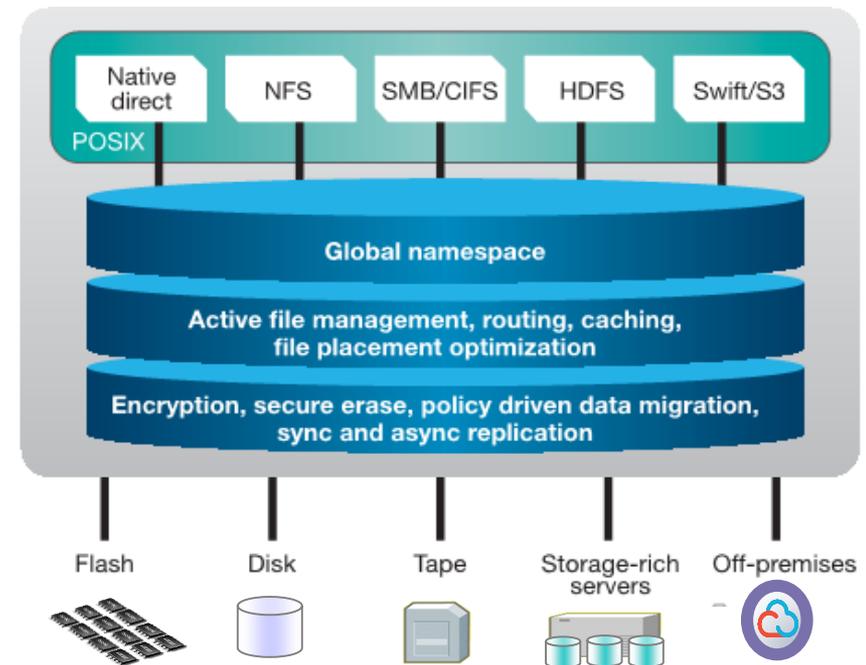


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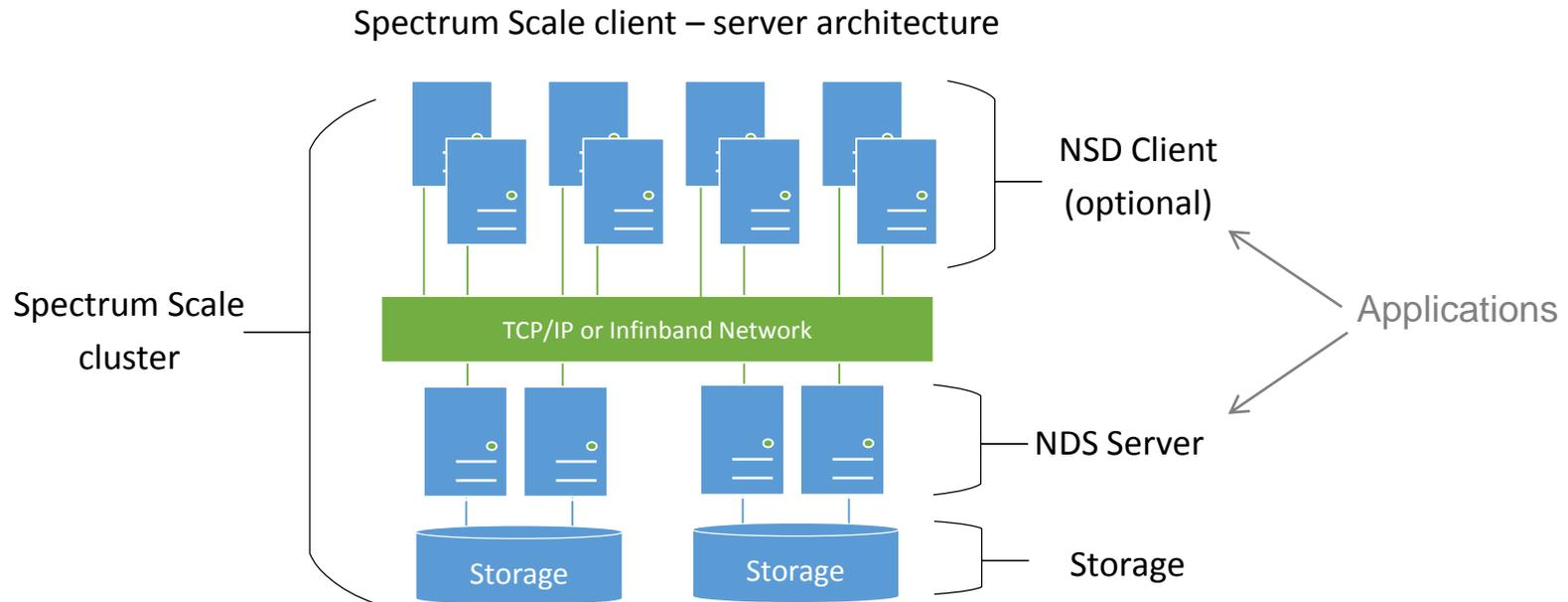
IBM Spectrum Scale™

Scale out file system with comprehensive storage services

- **Global name space**
Unified file and object storage
- **Intuitive user interface**
Graphical user interface
- **Data life cycle management**
Tiering, encryption and compression
- **Global collaboration**
Anywhere, any time access
- **Built in data protection**
Replication, Backup and Native RAID
- **Unmatched scalability**
400 GB/sec real cluster throughput



Spectrum Scale Architecture



- Storage cluster consists of NSD server and clients (optional)
 - Spectrum Scale can also be established without clients, application can run on NSD server
- NSD servers manage the disks (NSD) and provide file system access
- NSD clients access file systems directly through NSD server

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Introduction Spectrum Protect and Spectrum Scale

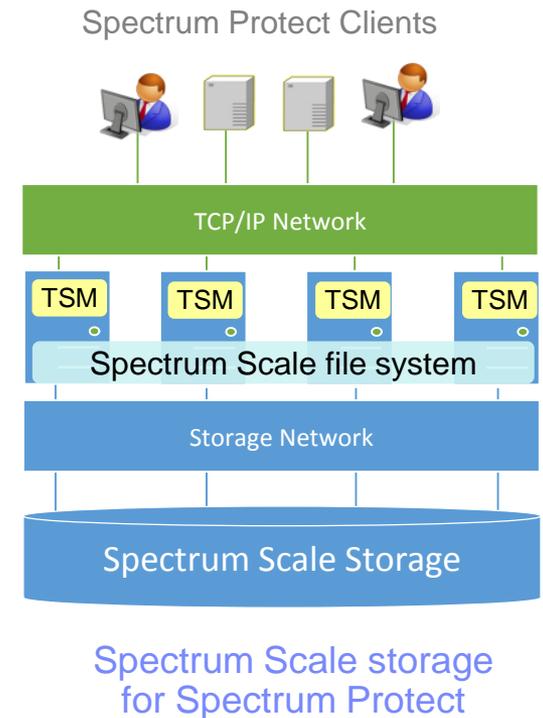
▶ **Why Spectrum Protect with Spectrum Scale**

Configuration options

Positioning and Advantages

Spectrum Protect on Spectrum Scale - Overview

- **Multiple** Spectrum Protect (TSM) instances store DB and storage pools in a Spectrum Scale file system (GPFS)
 - Spectrum Scale provides global name space for all Spectrum Protect instances
 - Instances share all file system resources
- Spectrum Protect instances run on cluster nodes accessing the file system and disk directly
- Spectrum Scale file systems balances the workload and capacity for all TSM instances on disk
- Provides standardized, scalable and easy to use storage infrastructure for the multiple instances

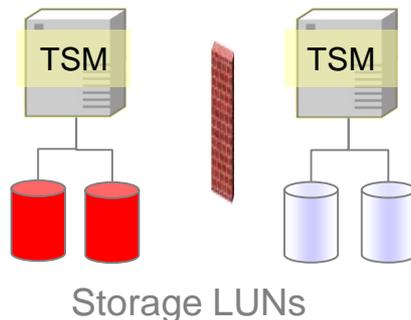


Solution positioning

Without Spectrum Scale

- Each backup server has its own isolated file system
- Each backup server is tightly coupled to LUNs
- Storage islands appear with underutilized capacity
- Capacity and performance management is challenging
- Scaling and performance may impact apps and users

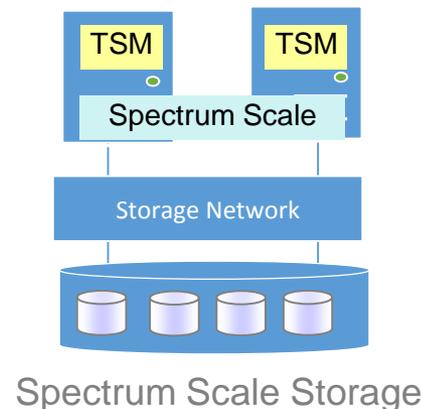
Spectrum Protect Instance



With Spectrum Scale

- Scale capacity seamlessly and transparently to apps or users under the shared file system global namespace
- File system replication is included
- Build your infrastructure using commodity storage, i.e. no vendor lock in.
- Central administration of all storage

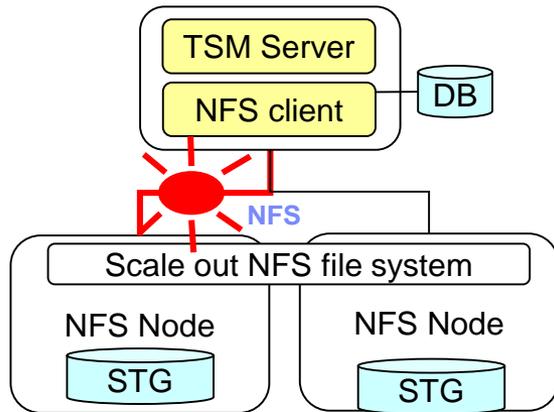
Spectrum Protect Instance



Spectrum Scale does not have the NFS bottleneck

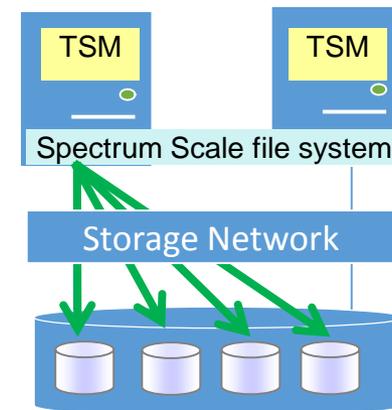
When Spectrum Protect performs I/O to NFS server it is bound to a **single** node

- Because a NFS session is point-to-point
- I/O Performance on single volume is limited by one NFS server



With Spectrum Scale, Spectrum Protect performs I/O to **all** disk in parallel

- I/O performance on a single volume is done to all disk in parallel



Key Values for Spectrum Protect with Spectrum Scale

Better storage utilization – multiple TSM server share the same storage

Better operational efficiency with one storage for all TSM server

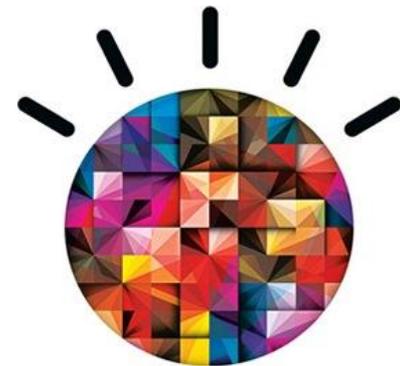
Seamless scalability of storage capacity and performance

Highly scalable performance with parallel striping across all disks

Flexible disaster protection – asynchronous, synchronous or Native RAID

Cost efficiency by utilizing standard infrastructure components

High availability in clustered file system



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Introduction to Spectrum Protect and Spectrum Scale

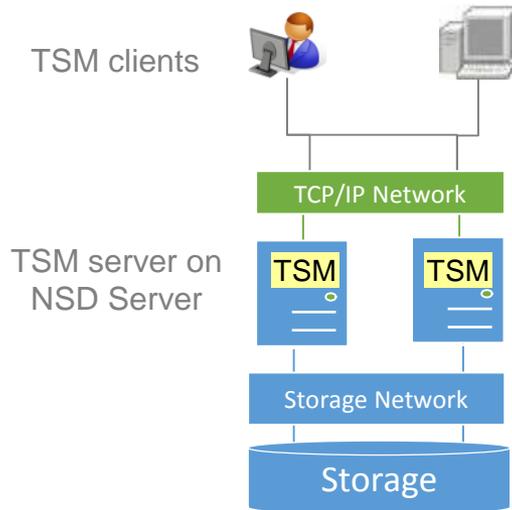
Why Spectrum Protect with Spectrum Scale

▶ **Configuration options**

Positioning and Advantages

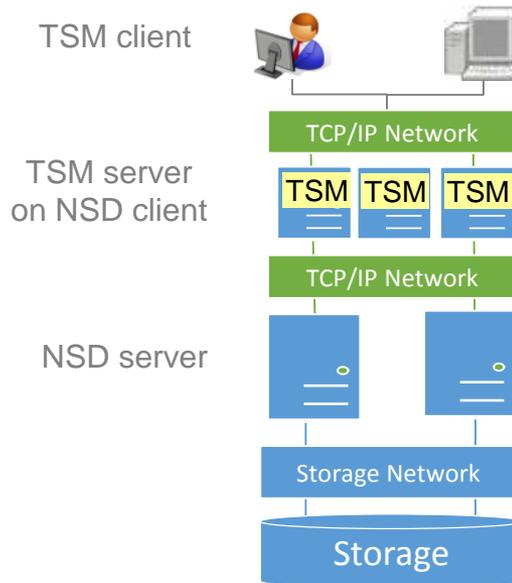
Deployment options

On NSD server



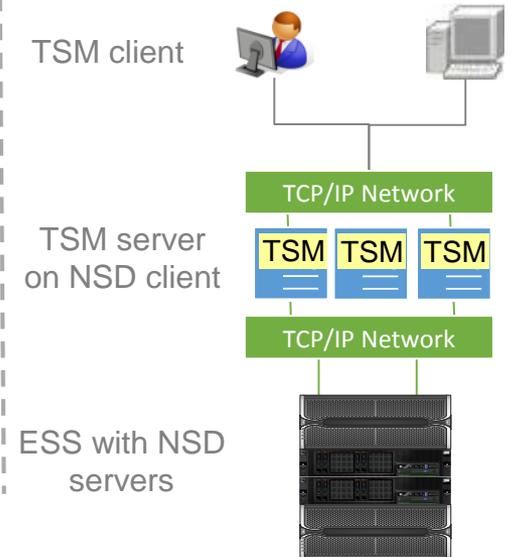
- TSM server on NSD servers
- Direct SAN storage access
- Requires less infrastructure
- If Spectrum Scale is used just by TSM only

On NSD client



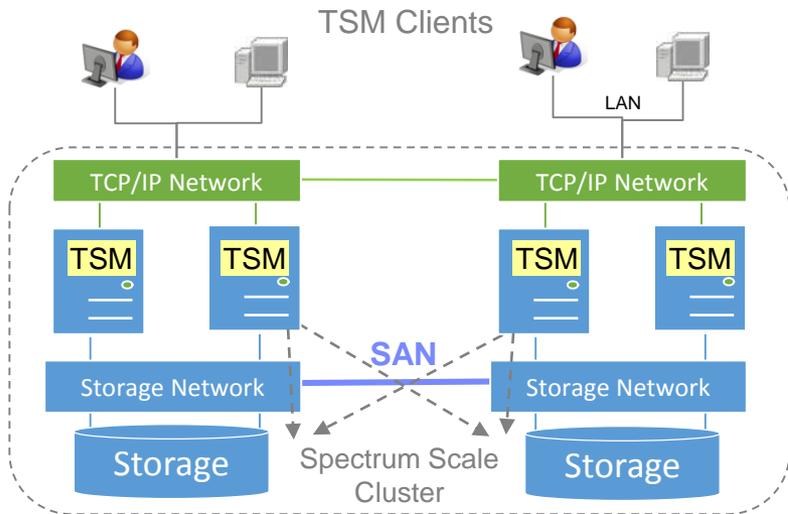
- TSM runs on client connected to Scale / ESS NSD server
- SAN or LAN access from TSM server to Scale/ ESS server
- Requires more infrastructure
- If Spectrum Scale is used by multiple applications

With Elastic Storage Server



Synchronous replication with Spectrum Scale and ESS

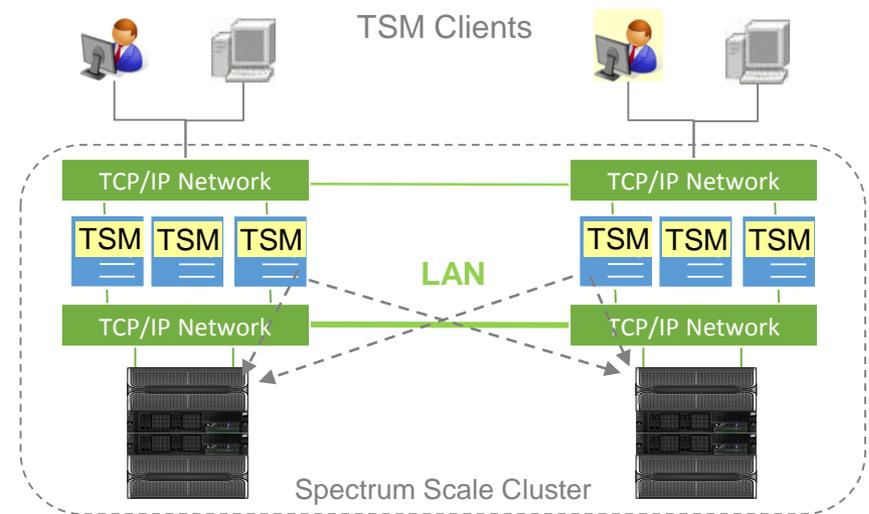
Spectrum Protect on NSD servers



Synchronous mirror over **SAN**

Spectrum Scale server on both sites have access to all storage system via SAN

Spectrum Protect with ESS



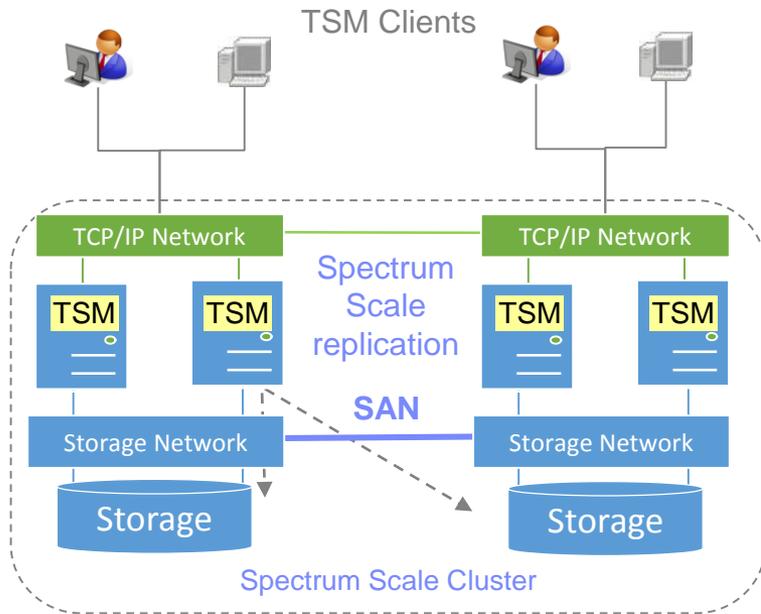
Synchronous mirror over **LAN**

Scale clients on both sites have access to all ESS systems via LAN

One Spectrum Scale cluster across sites
 One Spectrum Protect instance is active at one site

Replication options for Spectrum Scale and Spectrum Protect

Spectrum Scale synchronous replication

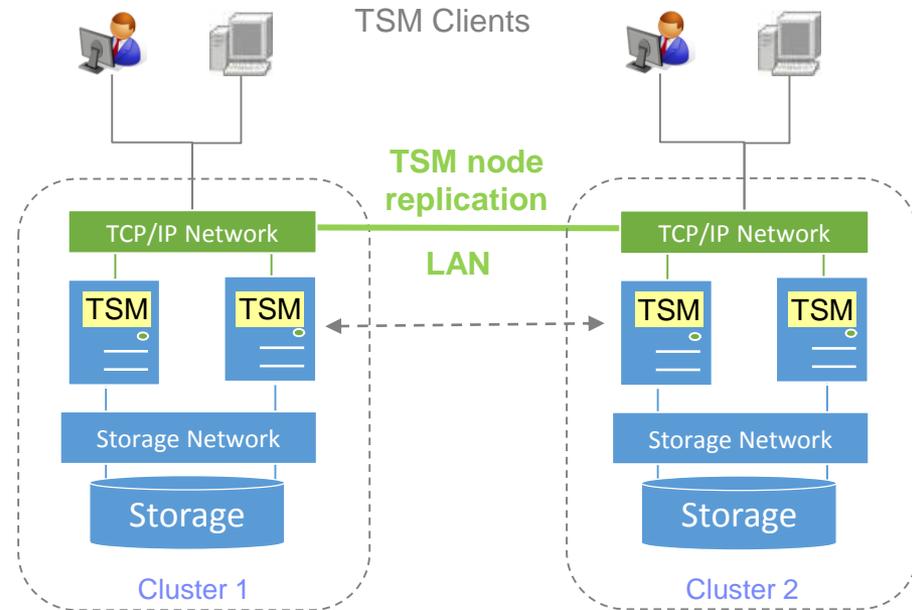


Synchronous replication via LAN or SAN

One cluster with active instances in both sites

Made for high availability and workload balancing

Spectrum Protect node replication



Asynchronous replication by TSM via LAN

Two independent clusters with TSM instances

Made for disaster recovery

Agenda

Introduction to Spectrum Protect and Spectrum Scale

Why Spectrum Protect with Spectrum Scale

Spectrum Protect on Spectrum Scale deployment options

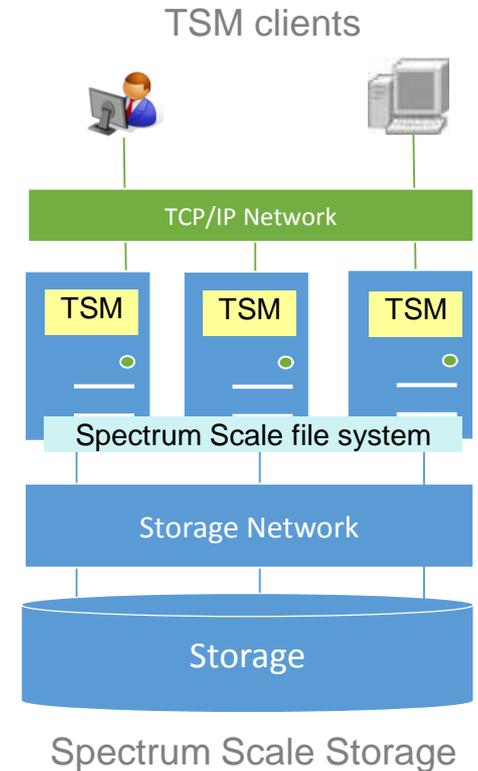
▶ **Positioning and advantages**

Better operational efficiency

- **Single point of management**
 - Storage resources for all Spectrum Protect instances are centrally managed

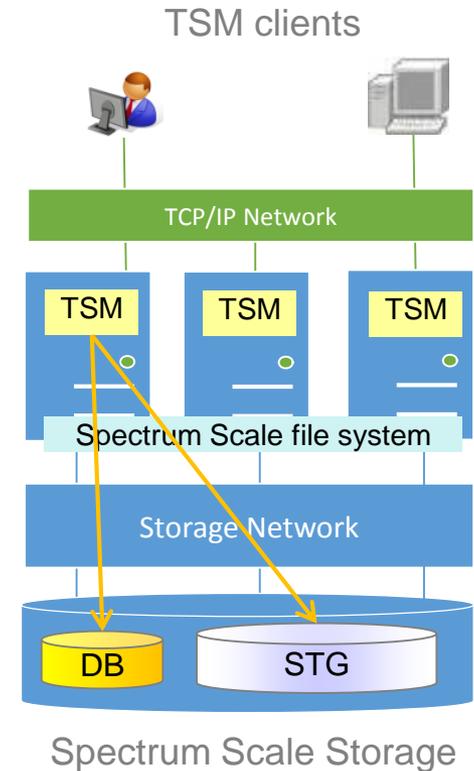
- **Always-on**
 - Adding storage capacity is transparent to Spectrum Protect instances
 - Spectrum Scale can be design highly resilient

- **Transparent resource balancing**
 - Instances requiring more resources can benefit from instances requiring less



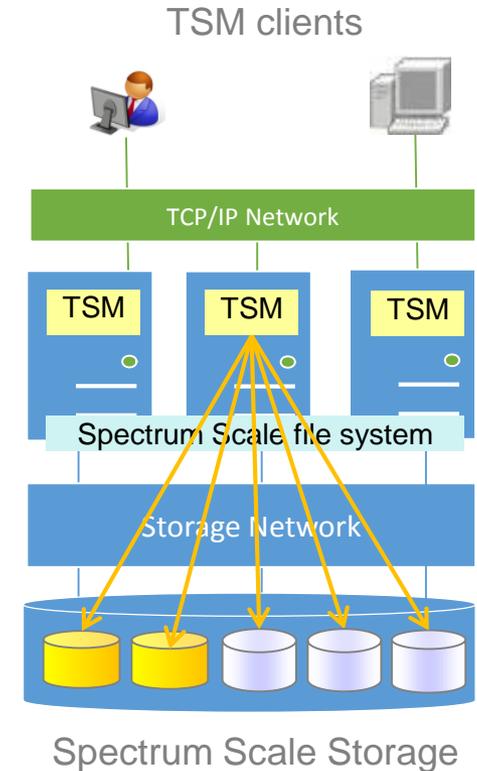
Lower cost

- No extra storage resources for DB required
 - All Spectrum Protect instances store DB and storage pools in one Spectrum Scale cluster
- Better storage utilization
 - Storage capacity is provided to all Spectrum Protect instances in global namespace
- No extra infrastructure required
 - Multiple Spectrum Protect instances can run on one Spectrum Scale node
- Use and reuse standard Infrastructure



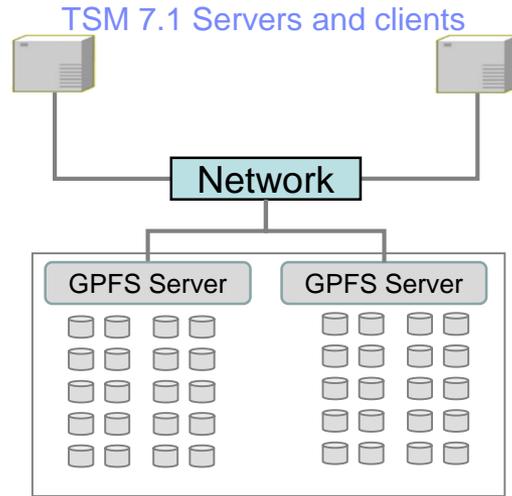
Scaling parallel performance

- **Direct access to Spectrum Scale storage**
 - Spectrum Protect stores directly in Spectrum Scale storage, no overhead for conversion of files to blocks (like with NFS)
- **Parallel usage of all available disk**
 - Spectrum Protect writes in parallel to all disk
 - No dedicated connection or session between TSM server and GPFS storage (no NFS bottleneck)
- **Fine tuning for DB and storage pools file systems**
 - Variable file system block size allow to adopt specific workloads
- **Efficient caching for data and metadata in**
 - Spectrum Scale cache improves sequential storage pool workloads

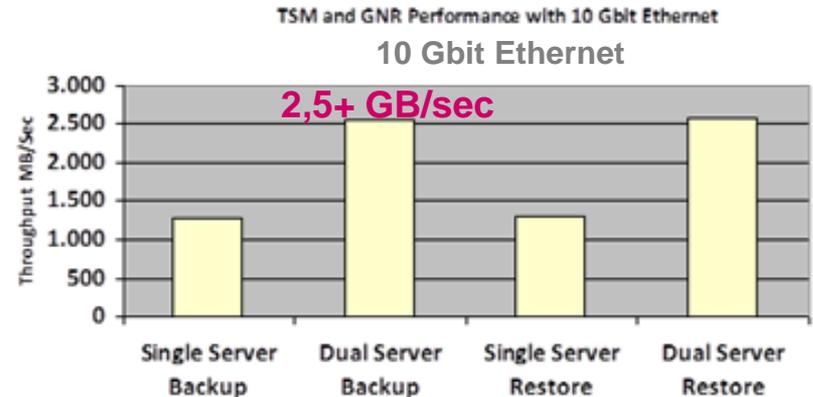
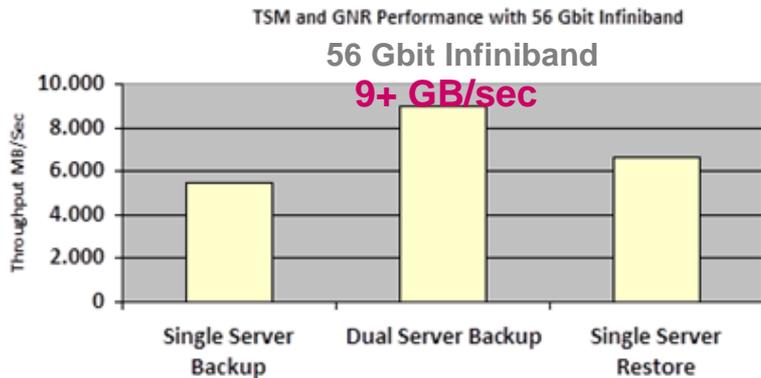
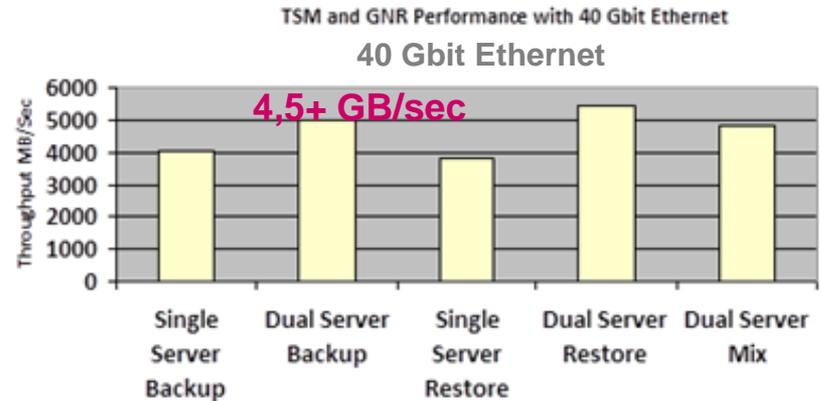


How fast can a backup with Spectrum Protect on Spectrum Scale be?

Test setup



GPFS Native RAID system with NL-SAS disk



Positioning Spectrum Protect with Spectrum Scale

Multiple Spectrum Protect servers on Spectrum Scale can benefit from

- Global name space provided within high available cluster
- More flexibility with synchronous replication across sites
- Better cost efficiency
- Better performance
- Ease of use



Thank You

Links

- **IBM Spectrum Storage home:**
<http://www-03.ibm.com/systems/uk/storage/spectrum/>
- **IBM Spectrum Scale Home Page**
<http://www-03.ibm.com/systems/storage/spectrum/scale/overview.html>
- **Spectrum Scale Knowledge Center:**
http://www-01.ibm.com/support/knowledgecenter/STXKQY_4.2.0/ibmspectrumscale42_welcome.html?lang=en
- **IBM Spectrum Scale Wiki**
[http://www.ibm.com/developerworks/wikis/display/hpccentral/General+Parallel+File+System+\(GPFS\)](http://www.ibm.com/developerworks/wikis/display/hpccentral/General+Parallel+File+System+(GPFS))
- **Spectrum Scale Redbook:**
<http://www.redbooks.ibm.com/abstracts/sg248254.html?Open>
- **ESS home page**
<http://www-03.ibm.com/systems/uk/storage/spectrum/ess/>
- **ESS knowledge center including Native RAID**
http://www-01.ibm.com/support/knowledgecenter/SSYSP8_3.5.0/sts35_welcome.html?cp=SSYSP8_3.5.0%2F0&lang=en
- **TSM Blueprints**
<https://ibm.biz/TivoliStorageManagerBlueprints>
- **Edision Group whitepaper:**
<http://www.theedison.com/index.php/library-edison/221-ibm-spectrum-scale-outperforms-emc-isilon-as-a-backup-target>

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MHz / GHz only measures microprocessor internal clock speed; many factors may affect application performance. When referring to storage capacity, GB stands for one billion bytes; accessible capacity may be less. Maximum internal hard disk drive capacities assume the replacement of any standard hard disk drives and the population of all hard disk drive bays with the largest currently supported drives available from IBM.

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Disclaimer – Performance and Capacity

Performance is based on measurements and projections using standard benchmarks in a controlled environment. The actual throughput or performance that any user will experience will vary depending upon many factors, including considerations such as the amount of multiprogramming in the user's job stream, the I/O configuration, the storage configuration, and the workload processed. Therefore, no assurance can be given that an individual user will achieve results similar to those stated here.

There are many ways to set up a filesystem, the figures shown are for a filesystem implemented with parameters for "maximum performance" (typically 16MB blocksize). If more efficient space utilisation is required for small files (e.g. 512KB blocksize) then the achievable performance will be affected.

Throughput figures (MB/sec) are based on benchmarks using the IOR benchmark and the ESS set up with 8+2P data protection and a combined Data+Metadata storage pool. Where actual results for a model/storage combination are not available, figures are estimates which have been scaled from real benchmarks. IOR tests were performed using Infiniband interconnect and RDMA, figures for other network interconnects may vary significantly.

IOPS figures are "uncached, raw" IOPS tested using the gfsperf benchmark.

The Separate capacity columns assume 7% to 10% of the filesystem capacity is set aside and dedicated for Metadata (MD), this is a typical figure but can vary depending on filesystem requirements (e.g. a very large number of files may require >7%). The figure shown is approximately 2%-3% usable MD with 3-way replication assumed. The combined Data+MD figure provides an indication of maximum filesystem capacity, a combined MD+Data is the default way in which most filesystems work. Separated MD and Data pools provide better performance, total capacity is seen as reduced because the whole of the MD space is assigned explicitly and is seen as separate- this is the recommended way to set up a GPFS filesystem. The ESS default is to use separate MD and Data pools- 7% (GUI) or 10% (ESS scripts) is a typical MD capacity (approx 2% actual, 3-way or 4-way replicated).

These calculations take into account the equivalent of 2 spares worth of disk space per Declustered Array (DA) which is the default and can be changed.

These calculations also take into account GNR overheads (checksums) etc.

These calculations assume all vdisks are of the same RAID type, although mixing is allowed in practice.

This does not take into account any GPFS file system level replication which will reduce the net usable space appropriately.