DataDirect™ NETWORKS
INFORMATION IN MOTION™

GridScaler™

Overview

Vic Cornell

Application Support Consultant

DDN | Designed for Big Data & Cloud

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Massively Scalable Storage Technology

HyperScale, High Performance Platform

- DDN's Massively Scalable SFA™:S/W Engine on Enhanced H/W Platforms
- Over 1TB/s In Only 25 Systems, Millions of IOPS

Cloud Storage & Computing Infrastructure

Peer to Peer Cloud Infrastructure

- DDN's WOS™ Cloud-Based Data Delivery
- 55 Billion Objects Per Day, 100+ Locations

Big Data Processing for Actionable Insight

Big Data Processing System

- DDN's SFA In-Storage Processing™
- Nanosecond Latency, 16 Virtual Machines

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DDN GridScaler

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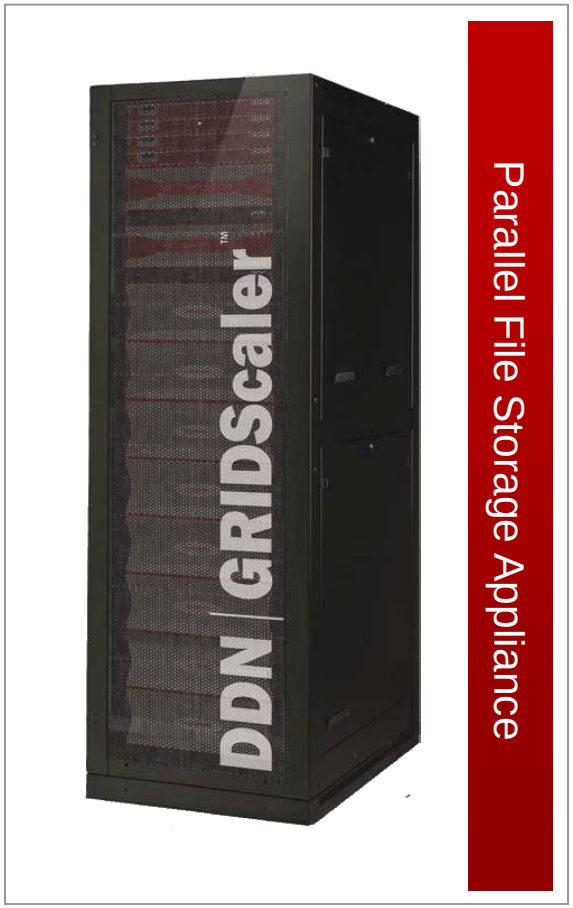
Massively Scalable Parallel File Storage Appliance

- Easy to deploy, All-in-One appliance based on IBM GPFS technology
- Scalable building block architecture
  - 200GB/sec+ and 100,000s of IOPS
- Feature-Rich, Enterprise Grade with High Availability with no single point of failure
- DDN also provide the DirectMon centralized configuration and monitoring solution



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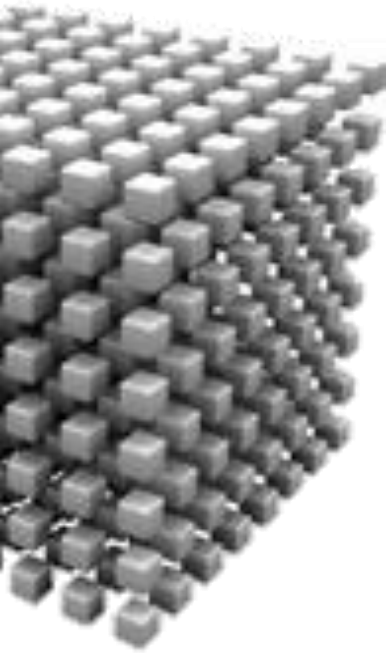
Parallel File Storage | Why?



- NAS Isn't Good at Highly Concurrent Access
  - Locking Engines Not Designed For Massive Parallelism
  - Locking Is Often File Level, Not Granular
- NAS is Point to Point Technology
  - One Server ⇔ One client
  - If your server isn't big enough – then your storage isn't fast enough.
  - Some NAS systems forward requests – but multi hop doesn't scale well.
- NAS Protocols can't support RDMA Access
  - No Support For Native InfiniBand, the leading HPC protocol.

Parallel File Systems Are Designed By HPC Engineers & For HPC Research

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GridScaler-At a Glance

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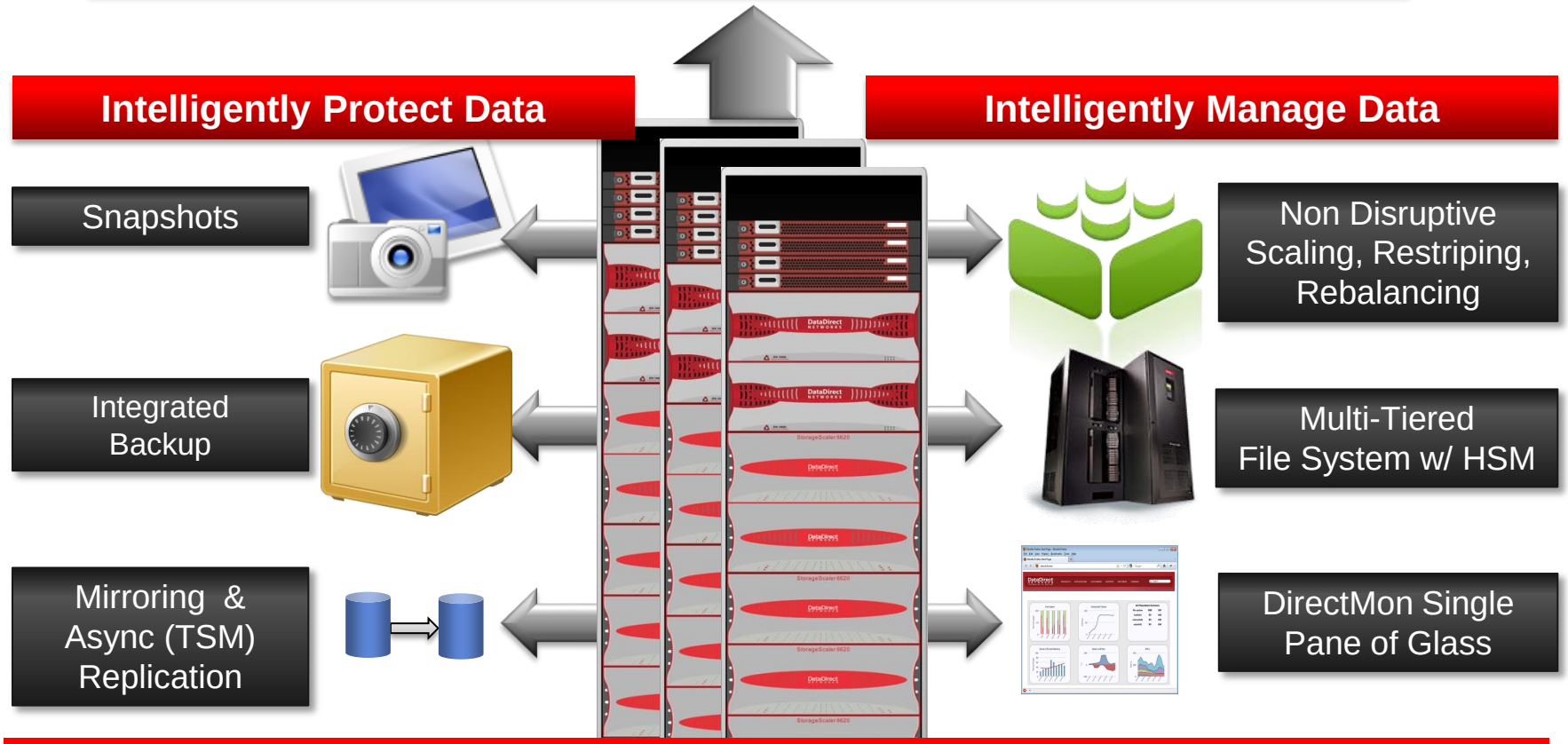
InfiniBand™ | **Fibre Channel** | **1Gb / 10Gb**

10s to 1000s of Linux & Windows Clients

100s – 1000s of NFS Clients



Multi-Petabyte, Scalable Parallel Storage System

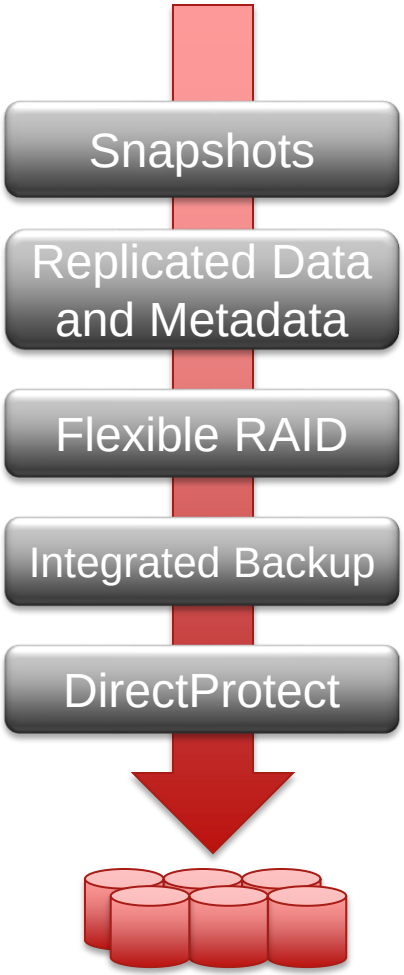
No-Compromise Scale Out Performance & Data Protection

100s of GB/s of Performance, Linear Performance Scaling & Leading Data Center Efficiency

Peace of Mind – DDN and GPFS

Data Protection at multiple levels

- GPFS Snapshots protect against accidental deletion, corruption or viruses
- GPFS Synchronously replicates data and metadata to add reliability
- DDN Flexible RAID configurations provide parity protection against disk failures
- Integrated backup (with Tivoli Storage Manager) uses the GPFS policy engine to efficiently backup changed data
- DDN DirectProtect to automatically detect and correct silent data corruption



Data Protection At Multiple Levels

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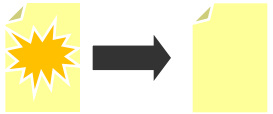
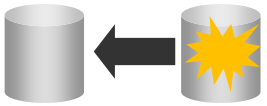
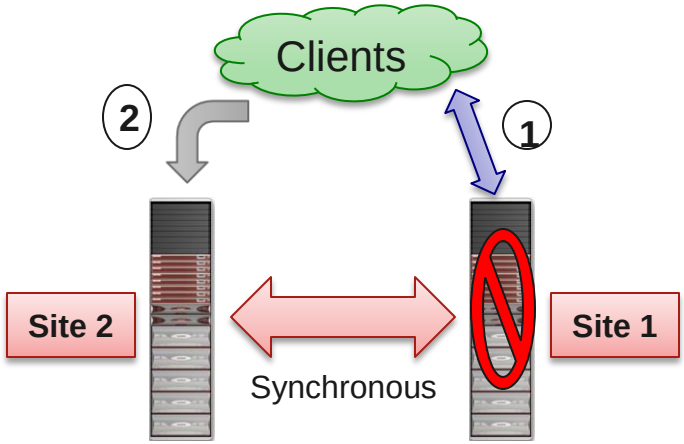
Enterprise Grade Features

Snapshots – read only point in time view of the file system





- Up to 256 Snapshots per file system with easy restores
- Space efficient – minimizes space consumed by only storing changes
- Reduce backup windows by backing up from snapshots



Replication

- Replicate Data and Metadata for added Reliability
- Reduce latency as clients can access site closest to them
- Failover to surviving site without disruption of service

Defragmentation Tools

- Built in parallel defragmentation tools maximize storage utilization.
- Dramatically reduce seek times and accelerates applications response times.

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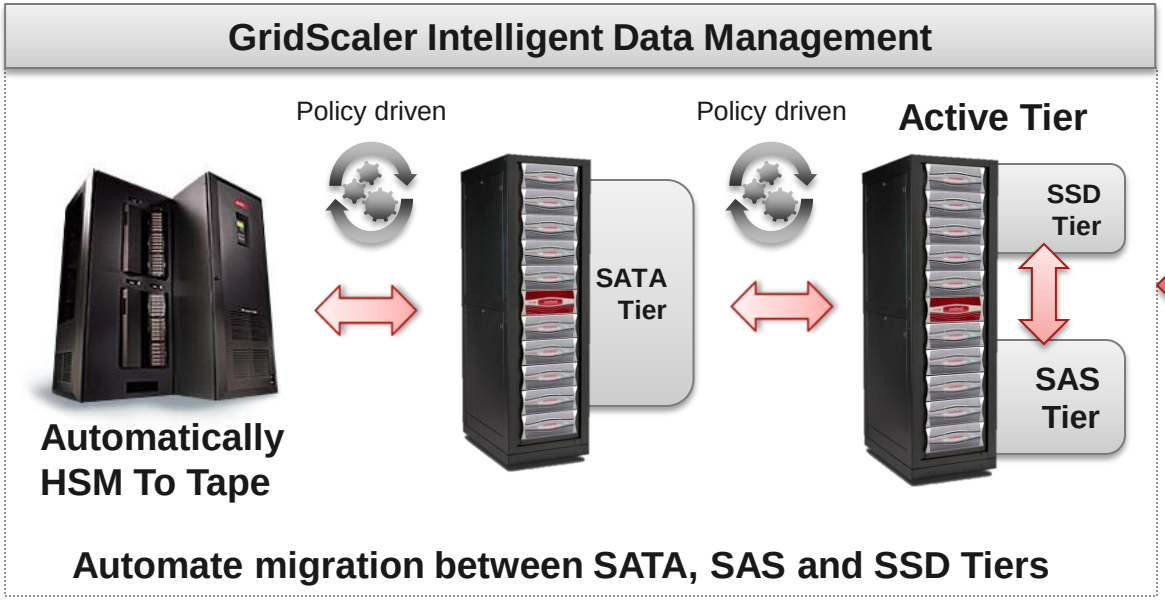
Manage Data Intelligently

- GridScaler has built in HSM and Information Lifecycle Management
  - Build tiers of SSD, SATA and SAS to optimize storage utilization
  - Automatically migrate data between different tiers of storage based on policies
  - Seamless integration with Tivoli Storage Manager (TSM) to migrate data to and from Tape

- Online/Nearline/Archive/Backup – all data are “instantly” visible from a single name-space and managed from a single point.



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GRIDScaler Architecture

- **Scalability**
  - Up to 8192 nodes in a single cluster
  - Multiple client networks supported (IB, GigE, 10GigE)
  - Nodes can be added/removed while system is on-line
  - Data can be restriped/rebalanced as nodes are added/removed
  - Process 1 Billion files in SC'07 (Billion File Challenge)

- **Capacity**
  - Large number of disks/LUNs supported in a single file system
  - Up to 256 simultaneously mounted file systems
  - Up to 2 billion files in a single file system
  - Up to 500 million files in a single directory
  - No Disk/LUN size limitation

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Architecture (contd.)

- **Performance**
  - Wide striping
  - Supports large file system block sizes
  - Parallel access to files from multiple nodes
  - Efficient deep pre-fetching: read ahead, write behind
  - Highly multithreaded daemon
  - Parallel defragmentation
  - Scales with storage (up to 130GB/s observed to a single file)

- **Availability**
  - Journaling to quickly recover from node failure
  - Built-in heartbeat feature to detect node, disk or connectivity failure
  - Primary and secondary servers for redundant operation
  - RAID1 for data mirroring
  - NFS server failover (using cNFS)

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Architecture (contd.)

- **Advanced Features**
  - Snapshots (up to 256)
  - Quotas (users, groups, file sets)
  - Multi-cluster support
    - Share user data across different GridScaler clusters over WAN
    - Eliminates the need to have multiple copies of the data and allows for collaboration between locations which need to share data
    - Administer the data independently from the compute resources
  - ILM (storage pools, file sets, policy-based migration)

- **Licensing**
  - GPFS licensed on a per-socket (CPU) basis – not per core
  - Licenses are priced differently for clients and servers
  - Linux – both client and server license supported
  - Windows – client license only

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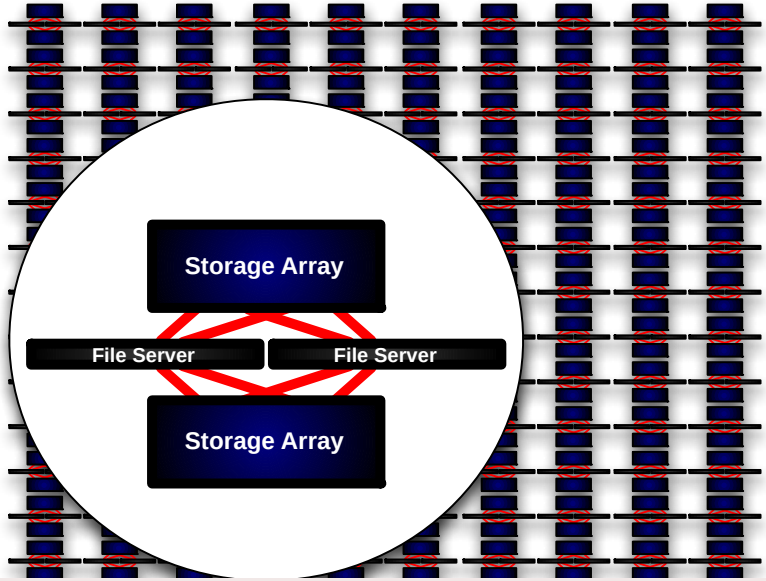
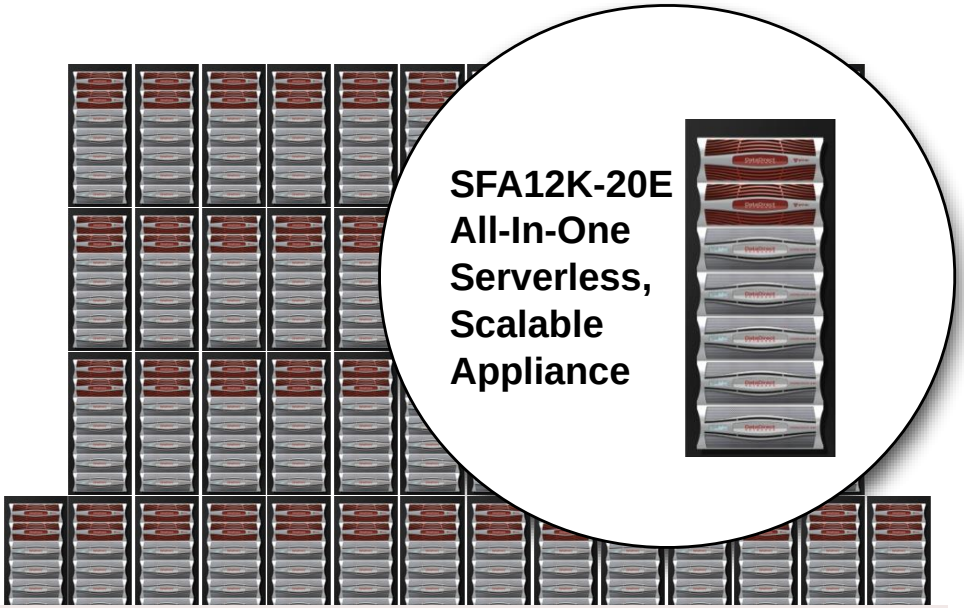
The TB/s Challenge

Requirements in HPC, Web and Big Data Computing Are Approaching TB/s





250 Storage Arrays (5x More) 500 Storage Controllers (5x More)	**50 Storage Arrays (80% Less)** 100 Storage Controllers (80% Less)
250 File System Servers 500 InfiniBand HBAs 4000 InfiniBand Cables	**ZERO File System Servers** ZERO InfiniBand HBAs ZERO InfiniBand Cables
250 File Server Licenses (1.5x More)	**100 File Server Licenses (60% Less)**

**Compared To Engenio e5400*

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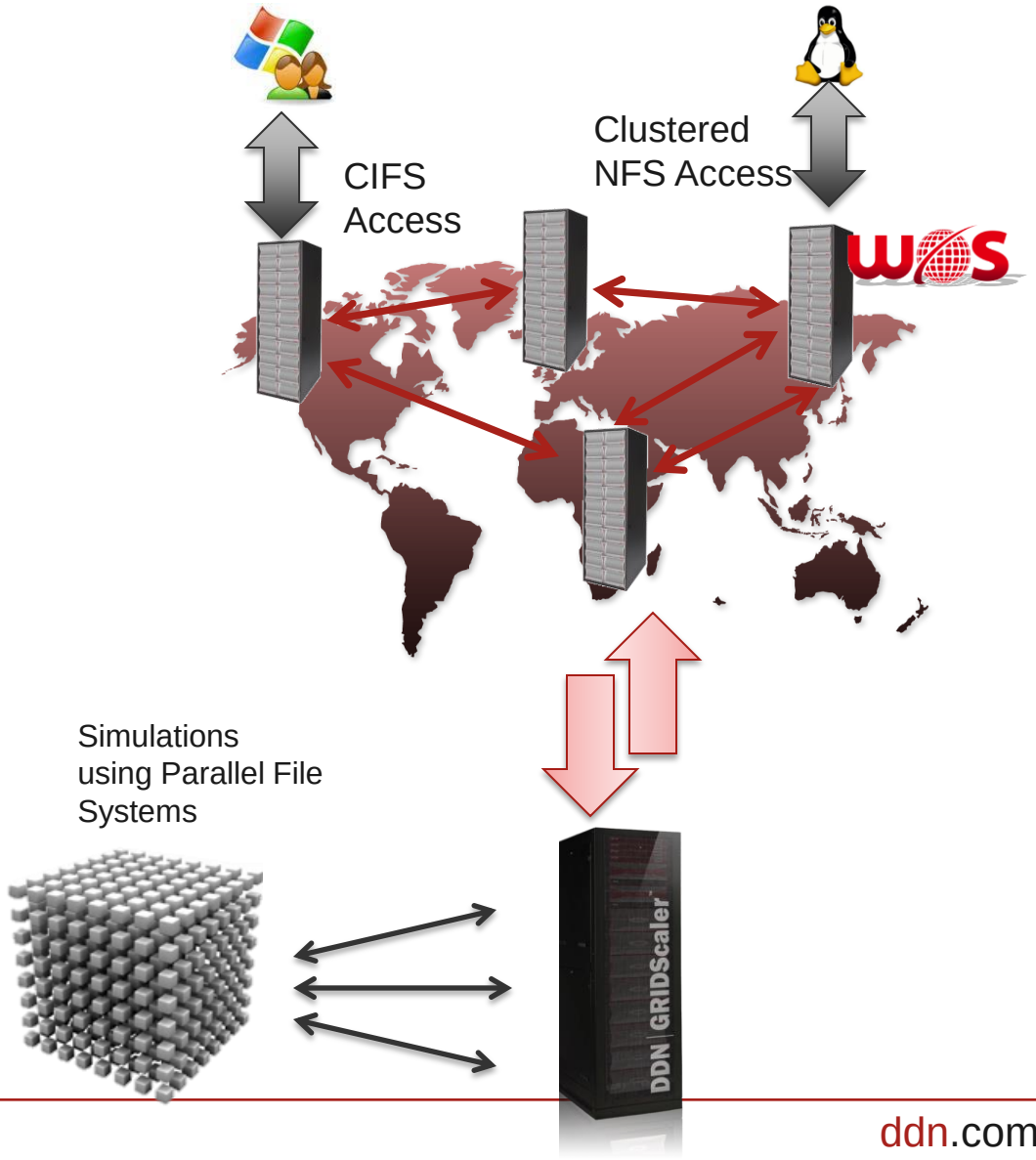
Integration with Web Object Scaler

- Built for collaboration
- Simulate on GRIDscaler and distribute using WOS
- Ingest using WOS access (NFS and CIFS) and simulate on GRIDscaler
- Back up files safely to the WOS cloud for disaster recovery



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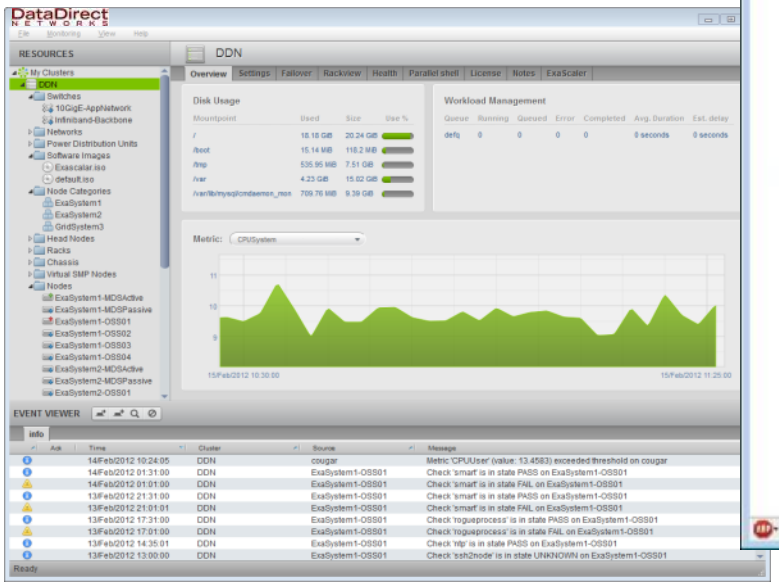
DirectMon™

A centralized monitoring solution for the datacenter with a top-down support for both

GridScaler file system & SFA Storage Arrays



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