DataDirect Networks
Lustre User Group 2009

DDN = HPC

- **DDN provides more bandwidth to the top500 list than all other vendors combined!**
- **8 out of Top10 systems choose DDN**
- **50 out of Top100 and more**
- **5 systems over 120GB/s**
  - top end = 3 x faster than rivals
- **Mix of applications:**
  - Government/University
  - Defense/Intelligence
  - Oil Exploration
  - Product Design
  - Archival, Backup

Rank	Site	Computer
1	DOE/NNSA/LANL United States	Roadrunner - BladeCenter QS22/LS21 Cluster, PowerXCell 8i 3.2 Opteron DC 1.8 GHz , Voltaire Infiniband IBM
2	Oak Ridge National Laboratory United States	Jaguar - Cray XT5 QC 2.3 GHz Cray Inc.
3	NASA/Ames Research Center/NAS United States	Pleiades - SGI Altix ICE 8200EX, Xeon QC 3.0/2.66 GHz SGI
4	DOE/NNSA/LLNL United States	BlueGene/L - eServer Blue Gene Solution IBM
5	Argonne National Laboratory United States	Blue Gene/P Solution IBM
6	Texas Advanced Computing Center/Univ. of Texas United States	Ranger - SunBlade x6420, Opteron QC 2.3 Ghz, Infiniband Sun Microsystems
7	NERSC/LBNL United States	Franklin - Cray XT4 QuadCore 2.3 GHz Cray Inc.
8	Oak Ridge National Laboratory United States	Jaguar - Cray XT4 QuadCore 2.1 GHz Cray Inc.
9	NNSA/Sandia National Laboratories United States	Red Storm - Sandia/ Cray Red Storm, XT3/4, 2.4/2.2 GHz Cray Inc.
10	Shanghai Supercomputer Center China	Dawning 5000A - Dawning 5000A, QC Opteron 1.9 Ghz, Infiniband, HPC 2008 Dawning

EXTREME STORAGE

Petascale Storage Blueprint

DataDirect N E T W O R K S

- **World's First PFlop System Without Accelerators**
- **240GB/s Site-Wide File System: "Spider"**
  - ~2x the other fastest at that time: CEA & LLNL – Update… LLNL is catching up!
- **Uses 48 x S2A9900 Storage Systems**
  - DDR IB-Connected Arrays
  - Over 13.4K HDDs, 10PB Usable
- **Enables Site-Wide Scalable File System with High QoS**
  - One file system for all clusters
  - Supports 98,400 CPUs
- **Selection based on extensive storage bakeoff vs. Competition**
  - Storage Energy Consumption
  - Selected on Mixed I/O Capabilities More So than Sequential

ornl OAK RIDGE NATIONAL LABORATORY

DataDirect N E T W O R K S lustre

Thank You

- **Close Partnership for Leadership Class I/O**
- **Major Lustre Changes to Enable Full Bandwidth**
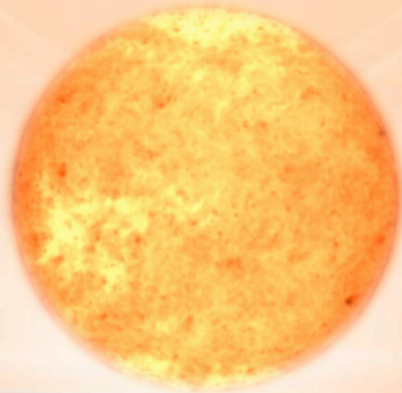- **Many Lessons Learned From Petascale Multi-Core I/O Effects**

DDN HPC I/O
Vision

EXTREME STORAGE

2009-2010

The Storage Horizon

- **Data Patterns Are Evolving**
  - Petascale Information Processing
  - Cloud Storage Is Changing Dynamics
  - The Digital Content Explosion Continues
- **2009 = Disk Drive Revolution**
  - SSDs are Disrupting a 30-Year Industry
  - Economics of performance have shifted
  - New disks must be utilized differently
- **SW enablement of Storage is Key**
  - Smarter SW will enable data service
  - Smart SW = simplicity @ scale
  - Smarter data protection is required in a PetaByte (PB) world
- **Green = Packaging + Mgmt + Smart Data Reduction**

DDN: Application Focused
Performance & Capacity Optimized

DataDirect NETWORKS

Performance
World's fastest NAS & SAN Storage Deployments
World's fastest HPC Storage Deployments
World's fastest Backup Storage Deployments

Capacity
Leading Single System Capacity
Vertical & Horizontal Optimized for Scale
Industry Leading Storage Density
Leading Online Storage Energy Efficiency + MAID

Simplicity
2009 = Full Product Line Refresh
One StorageOS Across Multiple Platforms
Built for Embedded File & Backup Storage Applications
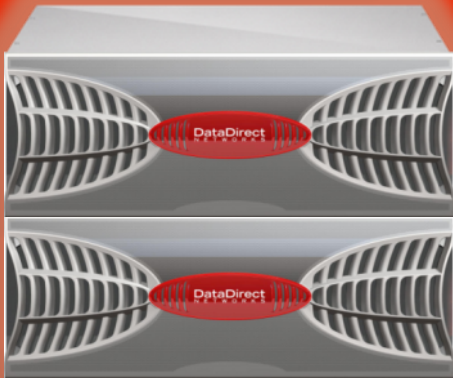
…Roadmap to SFA…

DataDirect
N E T W O R K S

After 10 years and over 200 petabytes of Extreme S2A Storage deployed, S2A concepts, going forward, will be ported to the next-generation

Storage Fusion Architecture

This combination will deliver a marriage of scalability, storage performance protection, bandwidth & IOPS in an integrated data storage system.

Introducing

DDN's Storage Fusion Architecture

Introducing SFA
Formal Announcement June '09

DataDirect NETWORKS

- Designed to Deliver Truly Balanced I/O
  - SFA will deliver unrivaled throughput and IOPS
    - Designed for massively threaded HPC systems
    - Industry leading IOPS & Throughput - disk, cache & SSD
- Simplifying Storage
  - SFA will be DDNs first product to embed file systems and storage services
  - Effort underway to unify management
- Enterprise Roadmap
  - Rapid path to enhanced data integrity, management, backup, etc.

Multi-Platform Architecture

DataDirect NETWORKS™

Storage Array

BLOCK STORAGE TARGET

FIBRE CHANNEL INFINIBAND iSCSI

Clustered Filer

DDN FILE STORAGE [LUSTRE, NAS, VTL, ETC]

BLOCK STORAGE TARGET

Open Appliance

CUSTOMER APPLICATIONS

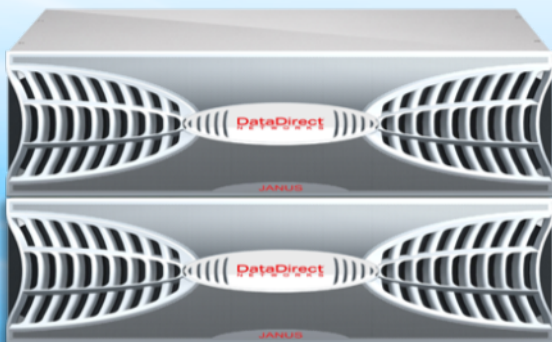**STORAGE SERVER VIRTUALIZATION**

BLOCK STORAGE TARGET

Flexible Deployment Options: 3 System Modalities

Multi-Platform Architecture
Single OS Across All Hardware

DataDirect
N E T W O R K S

High End Systems
SFA10000, SFA11000

Mid-Range, Modular
S2A6620, SFA6720

MULTI-PLATFORM HW SUPPORT

BLOCK STORAGE TARGET	DDN FILE STORAGE	CUSTOMER APPLICATIONS

STORAGE FUSION ARCHITECTURE OS

The SFA10000

	SFA10K
General Availability	Q3 2009
Hosted Applications & Application Resources	8 Cores 16GB FS Cache
File Storage Ports	QDR IB, 10GbE
Host Port Options	16 x FC8 8 x QDR IB
Throughput (block)	10GB/s
IOPs (block)	1M (cache) 300,000 (disk)
Max Spindles	1,200 (600/rack)

6x20 Product Family

	S2A6620R2
General Availability	Q2 2009
Storage Cache	12GB
Hosted Applications & Application Resources	n/a
Application Ports	n/a
Host Port Options	4 x FC8 8 x 1Gb, 4 x 10Gb iSCSI (Q3) 4 x DDR IB (Q3)
Throughput (block)	2GB/s
IOPs (block)	350K (cache), 30K (disk)
Max Spindles	120 (60 drives per 4U)

Key Enhancements

- **Elimination of Needless SCSI Layers For Full-Performance**
- **End-End Data Integrity**
- **System Robustness & Drive Rebuild Acceleration**
- **Proper, Transparent Utilization of Solid State Technology**
- **Tracking Storage Performance with Moore's Law**
  - Finally – Technologies Can Track Linearly

Thank you again, and stay tuned!