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Dell Fluid File System Solutions

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Agenda

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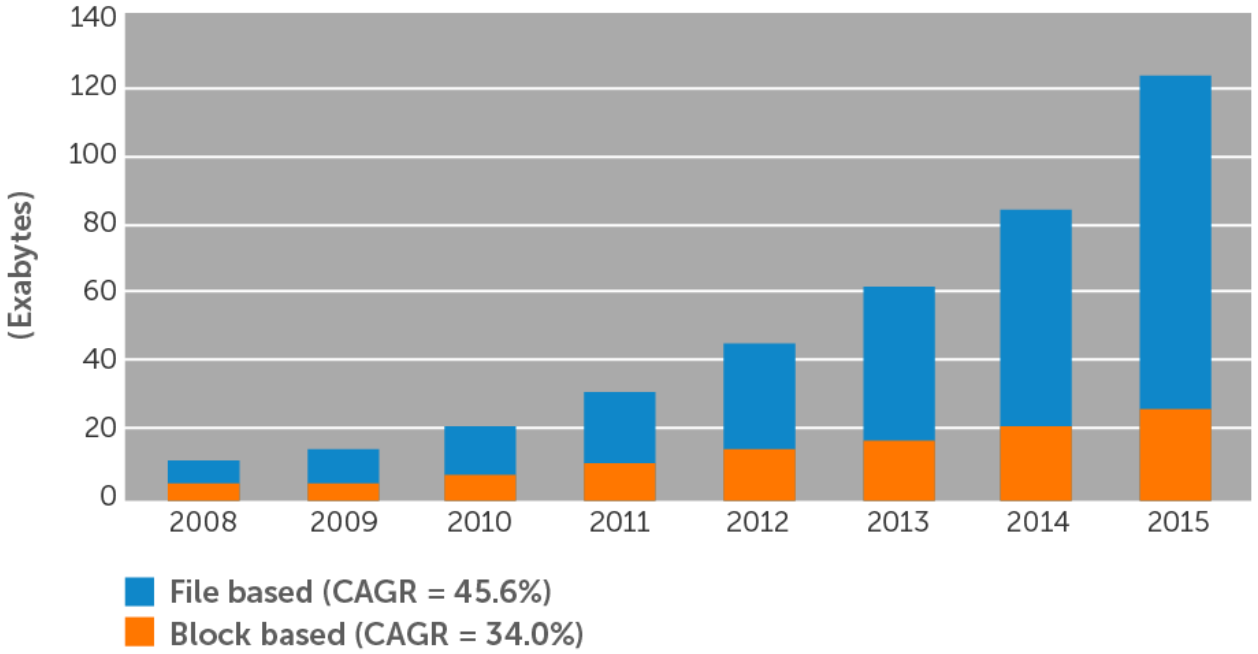
- What's driving the growth of unstructured data?
- Traditional file solutions on the market today
- Dell Fluid File System – what's different?
- Examples of FluidFS use cases
- Dell FluidFS product portfolio

Continued growth of unstructured data is one of the most critical drivers of storage

Worldwide File – Based Versus Block – Based Storage Capacity Shipments, 2008 - 2015



IDC Worldwide File – Based Storage 2011 – 2015 Forecast:
Foundation Solutions for Content Delivery, Archiving, and Big Data
Dec 2011 – Document 231910

Is the relentless growth of unstructured file data causing you pain?

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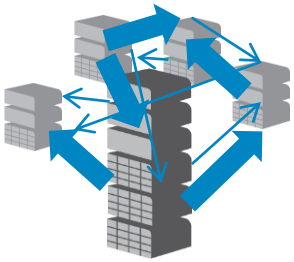
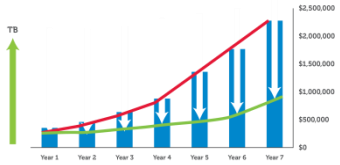
Data silos prevent access to business information

Complexity of data migration, backup, and data recovery



Deploying more storage increases CAPEX and OPEX



Scalability limitations of traditional file systems

How do you manage file data today?

Each approach has its **advantages**…

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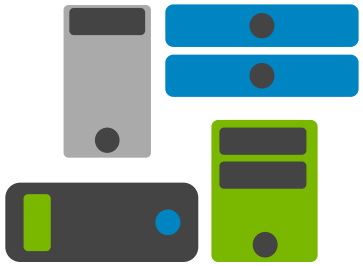
File servers

- Simple and affordable
- Single protocol
- Add per project

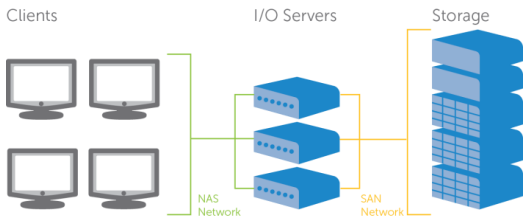
Traditional NAS

- Simple to manage
- Enterprise-class
- Multiple connectivity protocols

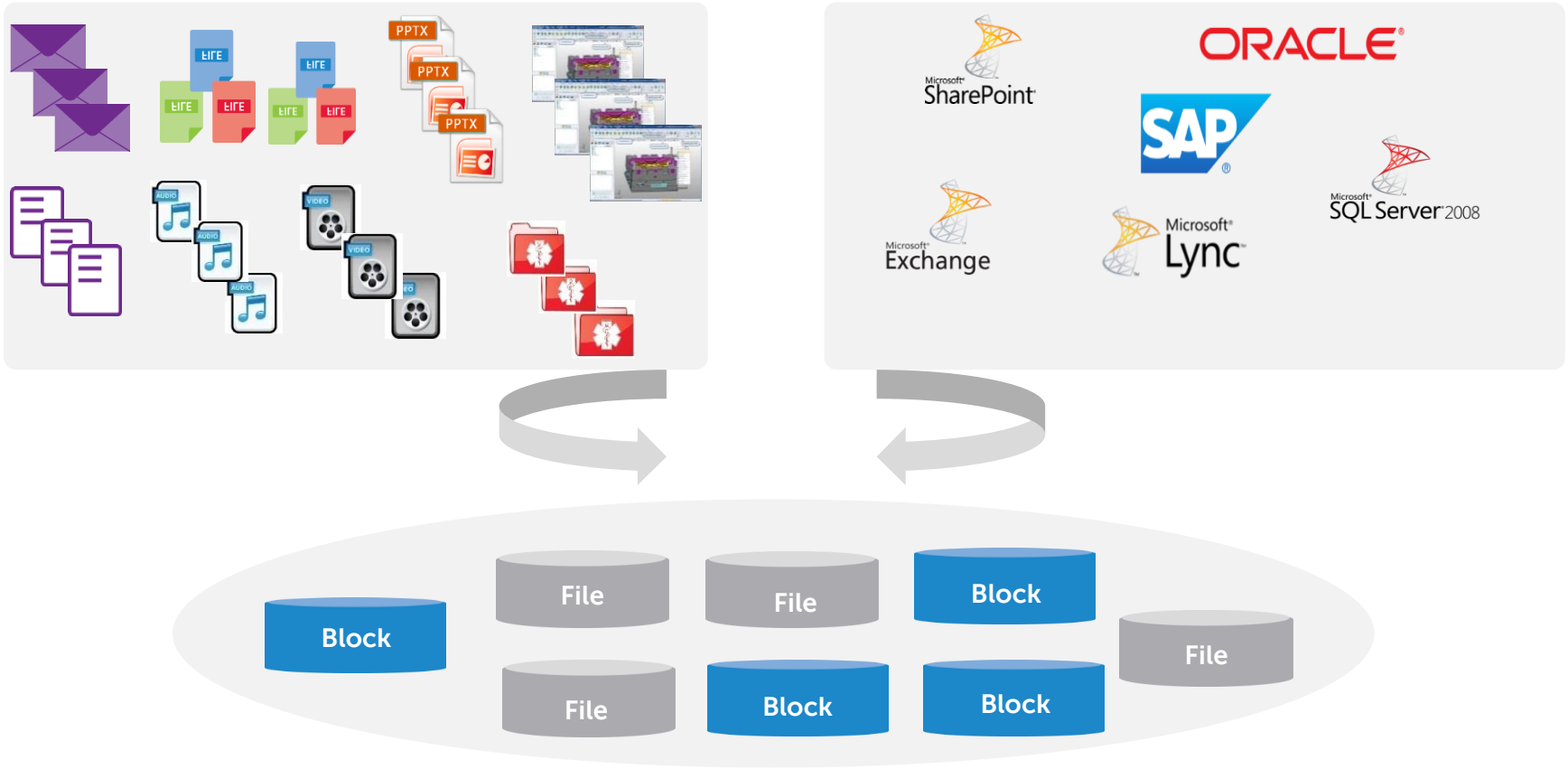


Clustered file systems

- Highly scalable
- Great for HPC, oil & gas, simulation, EDA, etc.

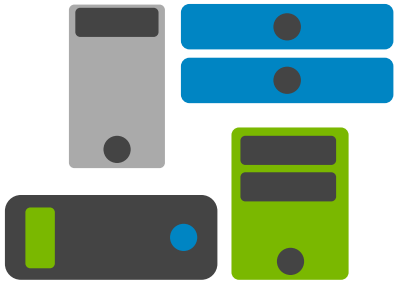


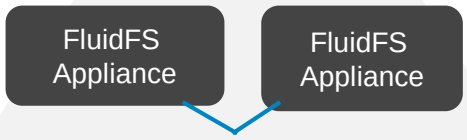
One approach: **Unify file and block in a single pool**

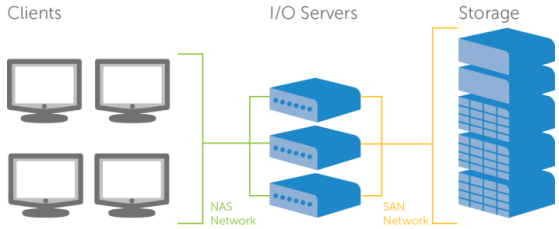


Although this approach overcomes some shortcomings, limitations persist

Dell's design architecture: starting with the best features

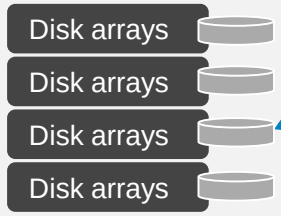






Traditional NAS

- Simple
- Standards Based
- Enterprise-Class
- Monolithic



Dell FluidFS

Clustered File Systems

- Scalable
- Complex
- Proprietary
- HPC Focused

Scale-out architecture for unified file and block storage

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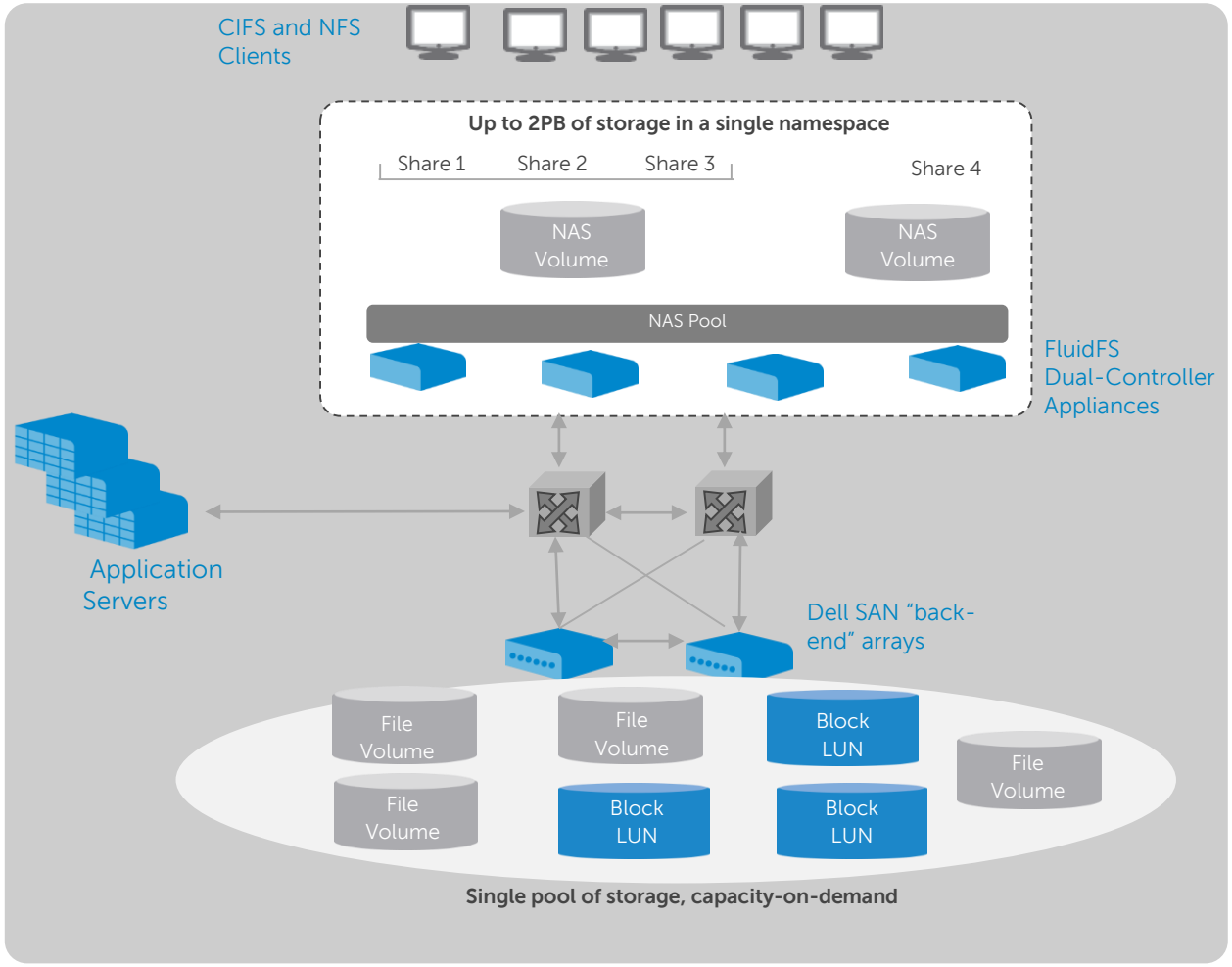


- Scale-out architecture supports a single namespace across up to four dual-controller appliances
- Capacity expands up to 2PB manageable space so data does not need to be shared or siloed into individual file sets
- Designed with no limit to storage space or file system
- Load-balancing continually optimizes performance across client ports and controllers
- Non-disruptive capacity and performance scale-out without forklift upgrades
- Linear file OPS and throughput scalability
- No architectural limitations of traditional NAS or file servers
- Single scalable namespace up to 2PB for easy administration
- Shared infrastructure for block and file enables highest efficiencies and cost savings
- Optimized data placement on high performance SSDs and HDDs
- Policy-driven post-process dedupe and compression

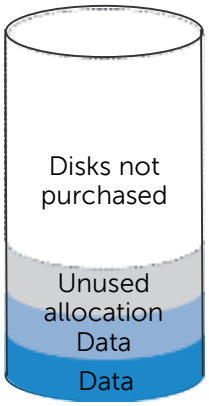
Fluid File System Appliances: Built for High Availability

- Purpose-built Dell appliance for Compellent and EqualLogic platforms
  - Two redundant, active-active, hot-swappable controllers per 2U appliance for high availability
  - Midplane between controller pairs with 40Gb bandwidth for cache mirroring
- Integrated backup battery protects cache contents
- Redundant, hot-swappable fans and power supplies
- Internal hard drive for local boot with flash for configuration backup
- Dedicated, redundant interconnect network

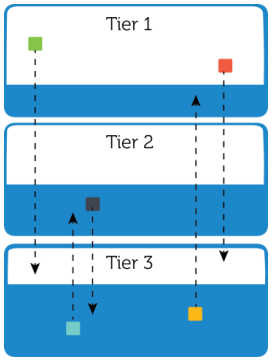
Redundant hardware and
active-active architecture deliver high availability
without introducing idle resources

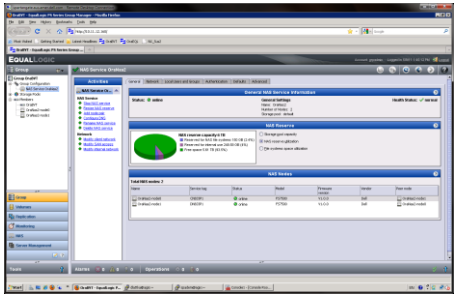
Efficiencies of unified storage

- **Single storage platform**
  - Avoids overhead and complexity of separate block and file solutions
  - Lowers TCO



- **SAN efficiencies extended to NAS**
  - Compellent Automated Tiered Storage cuts overall storage costs by up to 80%
  - Single virtualized pool of capacity eliminates the need to carve separate spindles for file
  - Thin Provisioning enables over-allocation of NAS capacity, but only consumes space when data is written
  - Peer scale



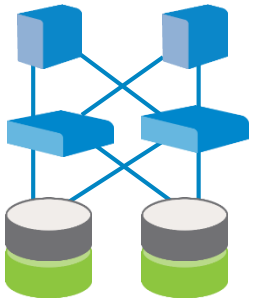


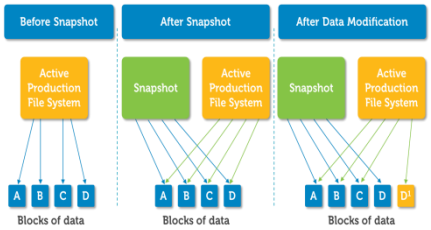
- **Unified management**
  - A single management interface for file and block storage

- **All-inclusive software licensing**
  - Ensures best TCO for the unified platform

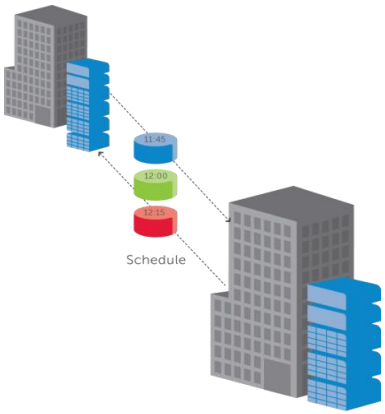
Built-in resiliency and data protection

- **HA architecture**
  - Active/active controller pairs
  - Automatic controller failover and failback
  - No single point of failure
  - All critical components are redundant





- **Snapshots and replication**
  - Redirect-on-write snapshots
  - Thin volume cloning
  - Multiple online recovery points
  - End user self-service recovery
  - Snapshots are replicated and available on the remote site



- **NDMP**
  - Backup based on continuous snapshots
  - Supported by most enterprise backup sw vendors
  - Backup streams load-balanced among nodes

- **ICAP antivirus**
  - FluidFS can verify the files read from CIFS clients are virus-free

How can you **use FluidFS** in your environment? Let's look at some examples

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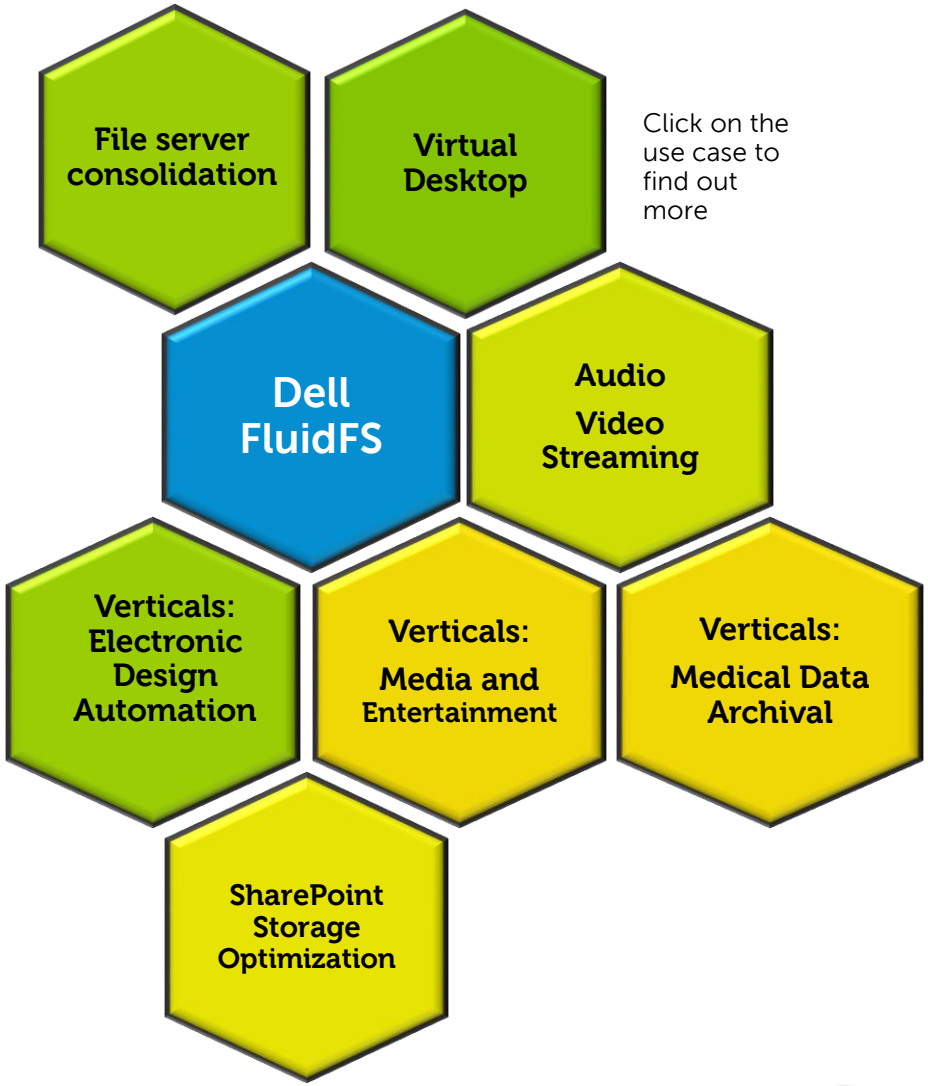
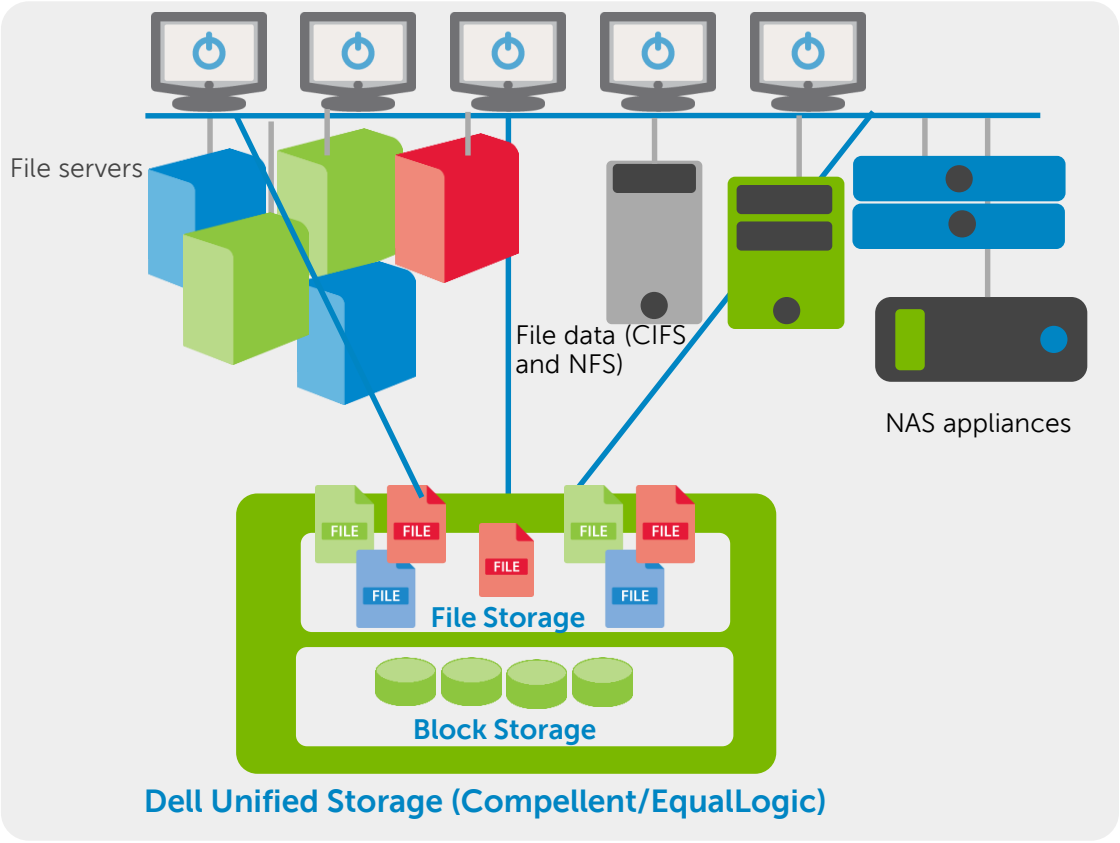
Applications which take advantage of advanced file system and unified storage

- General file share consolidation
- Vertical industry-specific file workloads
- File-intensive apps
- Apps where efficiencies are maximized when block and file storage are used



FluidFS Use Cases:
File Server Consolidation for File Shares and Home Directories

- Easy scale-out of capacity and performance reduces costs and drives efficiencies
- Benefits of automated tiering extended to NAS from back-end SAN storage
- Ability to add additional storage on-demand with no downtime
- Centralized management and streamlined backup



- **Challenge:** 1) Environments with a sprawl of CIFS and NFS file servers and legacy NAS devices; 2) Silos of storage limit access to business information; 3) Complex data migration, backup and management; 4) Limited scalability.
- **Solution**: File servers and traditional NAS devices are consolidated on a single Dell FluidFS storage platform.

FluidFS Use Cases:
Media and Entertainment

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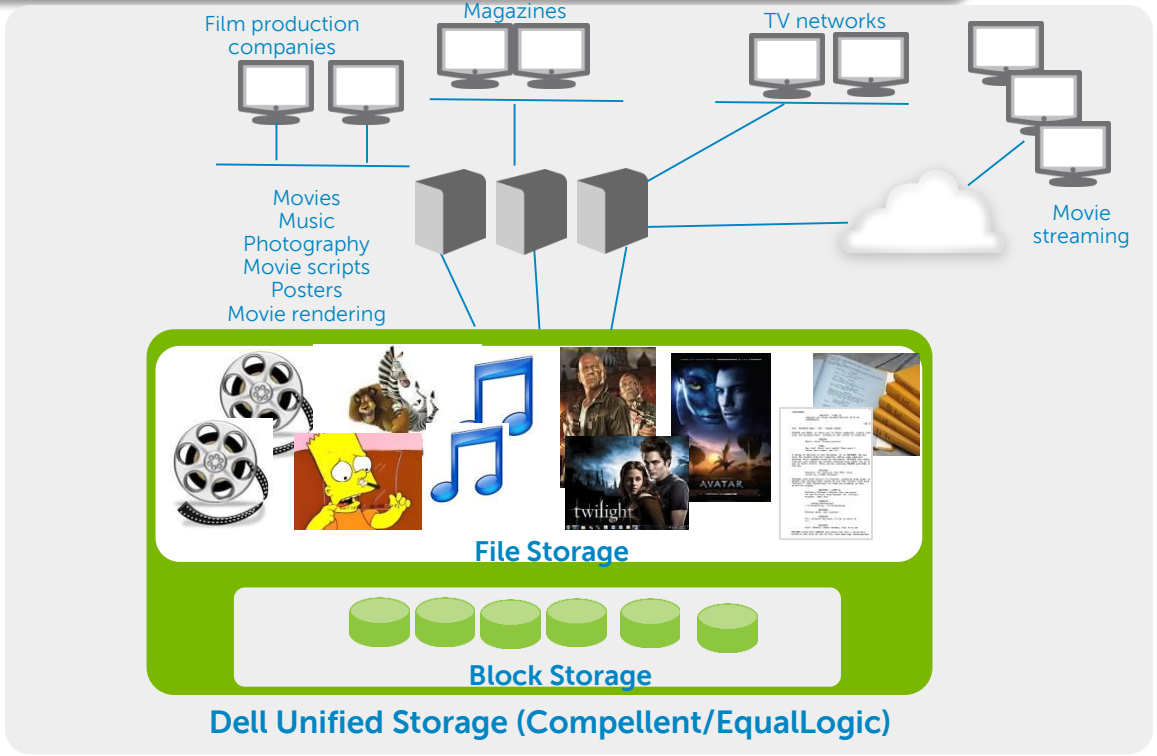
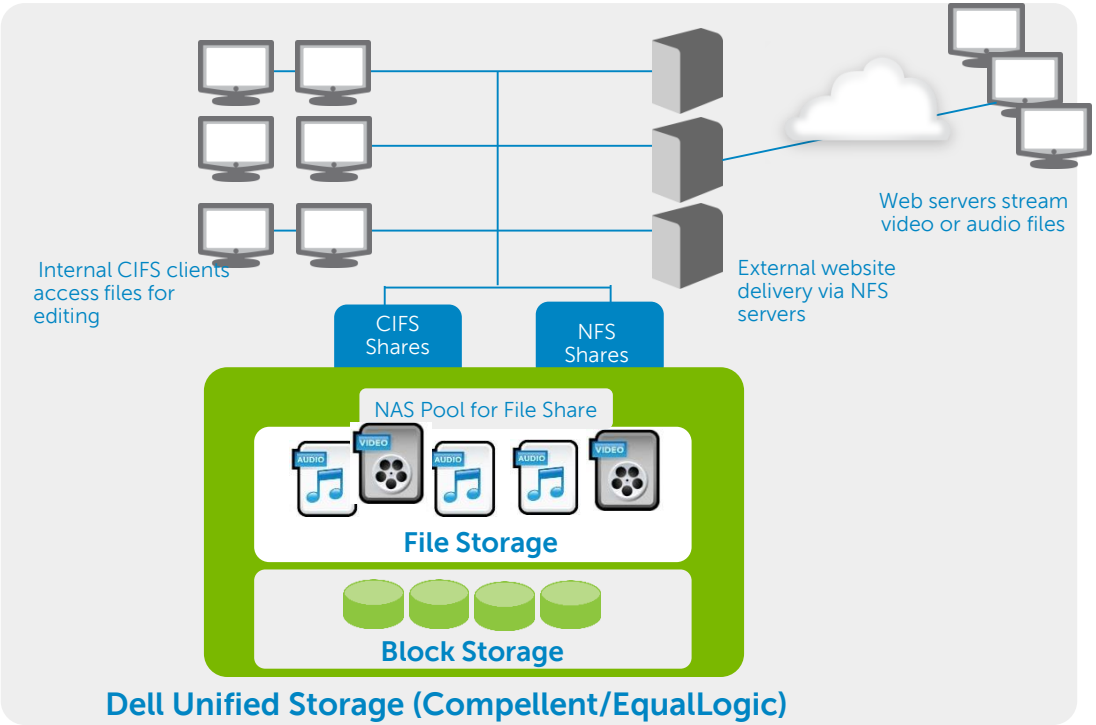
- A single, scalable file system enables easy, concurrent access to any type of digital asset
- Accelerated media production processes
- Up to 2PB of data in a single volume
- Cost reductions from increased storage utilization



- **Challenge:** Digital assets stored on multiple storage systems are hard to access and share. The rapidly growing libraries of media files need to serve different distribution channels, media formats and consumption models.
- **Solution:** Local media storage systems are consolidated onto a Dell FluidFS storage, giving concurrent access to a single, scalable file system, accelerating media production processes.

FluidFS Use Cases:
Audio/Video Streaming

- Non-disruptive file growth with a scale-out solution
- Single large repository to manage all media assets
- Multiprotocol NFS and CIFS access to files
- A single namespace exposes the same source data to both NAS client protocols.



- **Challenge:** Large volumes of audio and video files, now on numerous file servers, need to be accessed by internal CIFS clients and shared to external NFS servers for streaming. Access to files is difficult, backup is complex, licensing costs are rising.
- **Solution:** File servers are consolidated onto a multiprotocol Dell FluidFS storage, allowing for easy access by clients.

FluidFS Use Cases:
Medical Data Archival

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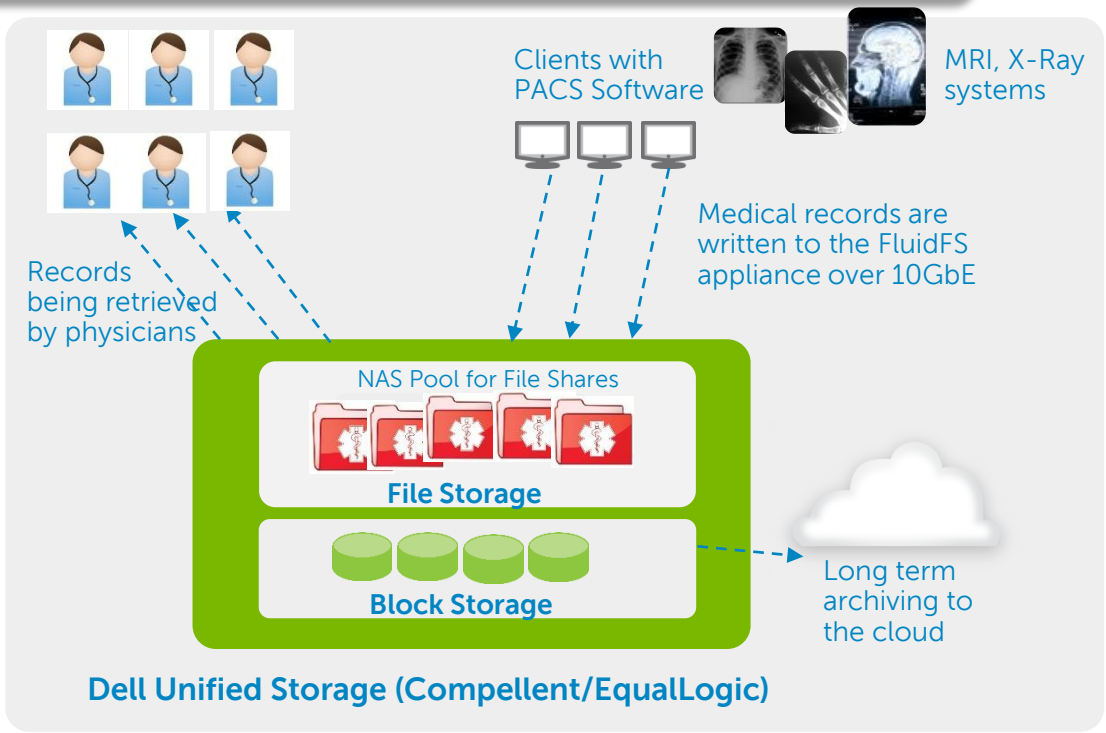
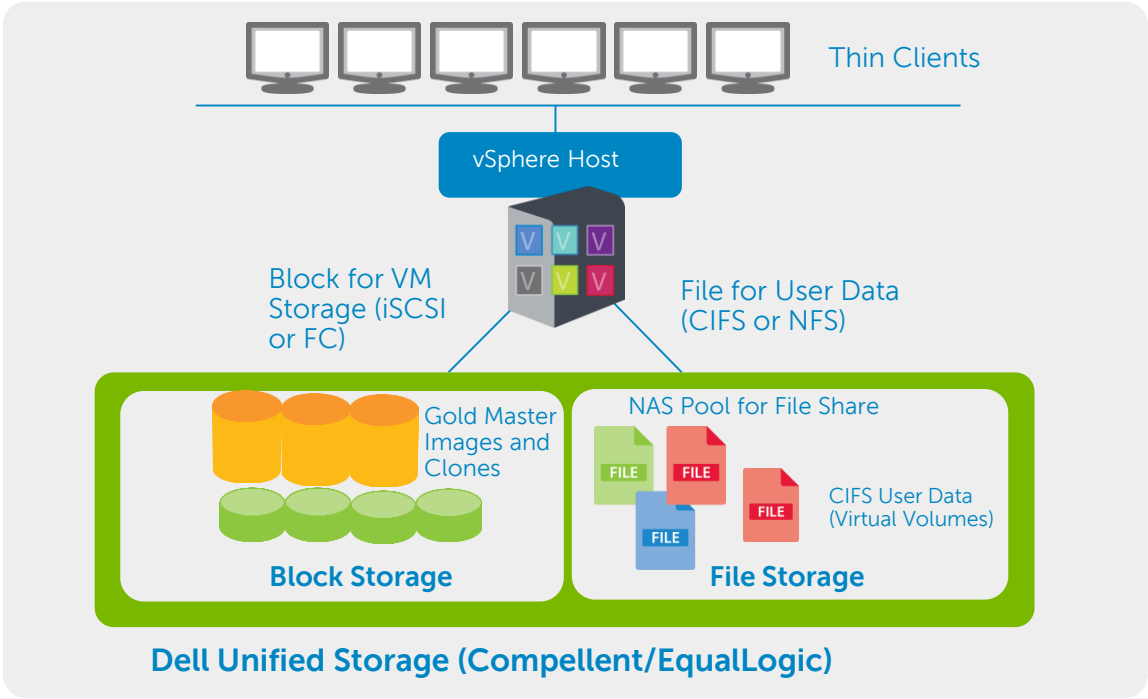
- Scale-out performance for medical record storage and retrieval
- Fast retrieval of records by physicians
- Single namespace up to 2PB simplifies management
- HA architecture guarantees business continuity
- Multi-protocol access for NFS and CIFS clients



- **Challenge**: Primary PACS cache and long-term image archiving for a hospital radiology department overflow with digital patient records. Writing new records takes time, resulting in slow retrieval by doctors and system downtimes.
- **Solution**: Servers running PACS software write millions of patient records at high speeds into the Dell FluidFS storage. Records are now easily and reliably accessible to doctors from their workstations.

FluidFS Use Cases:
Virtual Desktop

- Multiprotocol CIFS and NFS support enables file access from within individual desktop VMs
- Centralized granular data protection
- Single shared pool of storage resources to manage
- Better VM performance Improves end-user productivity



- **Challenge**: When user data is stored alongside OS and apps, the desktop VM size grows over time leading to additional capacity requirements, slow data access, high latency, inefficient backup and a degraded user experience.
- **Solution**: User data is separated from desktop VMs by placing VMs on block storage for high performance and user data on file storage for optimal availability and more granular backups.

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In summary

- New technology Implemented across all primary storage platforms
- Shared capabilities across the portfolio
- Innovations enable a new customer experience with
  - Scale out designs without rigid architecture limitations
  - Maximized operational efficiencies
  - Built-in resilience
- 100% Dell IP