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IBM's Grid Medical Archive Solution

IBM Systems and Technology Group
Healthcare and Life Sciences Solutions

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The Elevator pitch – what is GMAS?

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GMAS is an open, highly scalable, fixed content archive solution, designed for multi-site healthcare institutions, that is easy to manage, affordable and highly resilient, supporting multiple applications and multiple tiers of storage.

- **open**
- **highly scalable**
- **fixed content**
- **multi-site healthcare institutions**
- **easy to manage**
- **affordable**
- **highly resilient and available**
- **multiple applications**
- **multiple tiers of storage**

Presentation Agenda

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- Data Archive Requirements
- IBM GMAS Overview
- IBM GMAS Benefits
- IBM GMAS Technical Overview
- IBM GMAS Use Cases
- In Summary
- Q&A

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Data Archive Requirements

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Two types of data requiring different strategies

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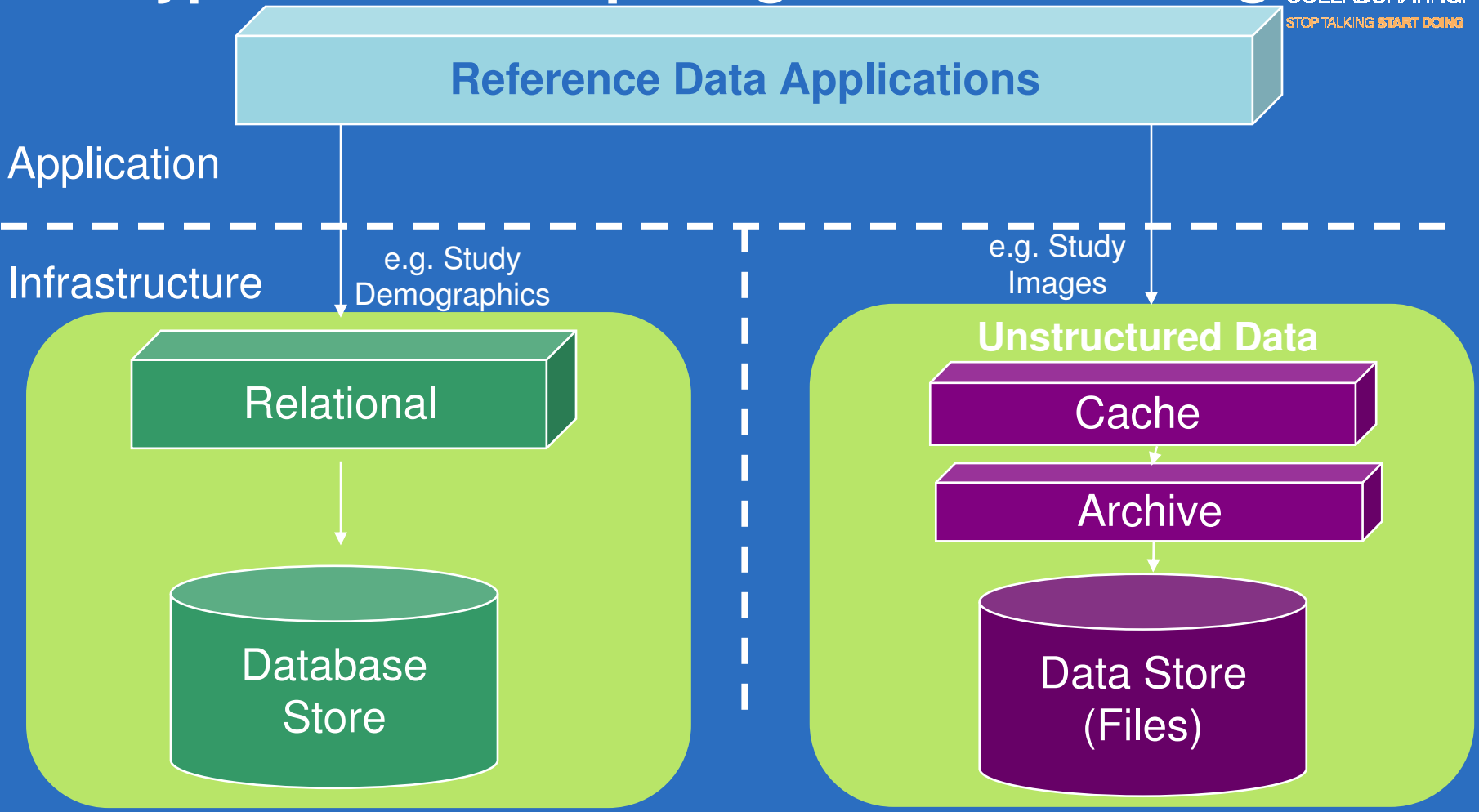

Significantly different functional and non-functional requirements between Relational and Unstructured Data. GMAS is a solution for Unstructured Data.

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Requirements summary for healthcare reference data archiving

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- *Massive and growing data volumes*
- *Information Lifecycle Management*
- *Common Enterprise Storage System*
- *Protect Patient Data and Records*
- *Data Outlives Hardware and Media*
- *Eliminate of Storage Silos and Vendor Lock-in*
- *Critical nature of application reliability*
- *Address all cost components*

Any archive solution chosen should address each of these key requirements

The Costs of Storing and Archiving Data

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Gartner Group divides the burdened cost of archival storage cost into 6 areas:

- **Purchase Cost (20%)** – Capital Acquisition Costs

- **Downtime (20%)** – Costs to restore normal operations
- **Backup/Restore (30%)** – Manual, Error Prone Processes
- **Environmentals (14%)** – Space, Power, Cooling, etc.
- **Administration (13%)** – Storage Silos require dedicated support
- **Hardware Management (3%)** – Resources across application silos

80% of an archive's cost is operations and maintenance!

Source: Gartner Research

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Introducing IBM's GMAS

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What is IBM's GMAS?

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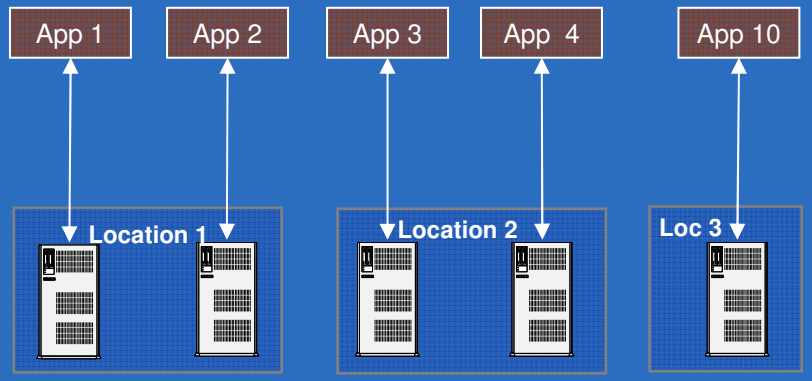
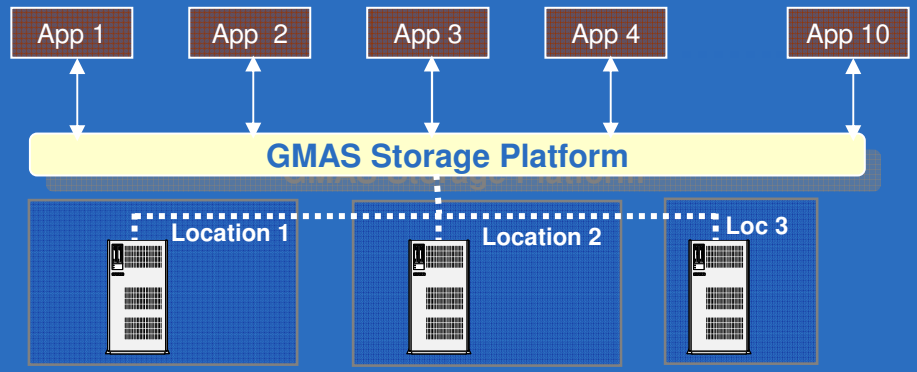
GMAS is a storage solution that intelligently manages the interaction between applications and storage resources via client business rules

Before GMAS



After GMAS



"Siloed" infrastructure:

- Difficulty sharing resources across applications
- Requires application downtime for maintenance
- Manual administration, upgrades & conversions
- Inherently vulnerable to storage failures

"Virtualized" infrastructure:

- Collapses silos into a single shareable storage pool across applications
- Enables maintenance, support & data conversion without application downtime
- Automates upgrades, conversions & administration
- No single point of failure

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IBM GMAS Key Features

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GMAS protects data and simplifies the delivery and operation of reference data storage systems

1. **Protects Data for Life:**
   - Digital signatures, Proactive Checking, No Data Loss
2. **Enterprise Solution:**
   - All sites (LAN/WAN), All applications
   - All Storage Tiers and Competitive Storage
3. **Improves Availability and Uptime of Applications:**
   - Real time failover, automated rebuild, self healing
   - No downtime, changes transparent to applications
4. **Automates Storage Administration:**
   - ILM, Data Replication
   - Upgrades & Data Migrations
   - Less than 10% of an FTE to manage

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How GMAS Works: Storing and Protecting Data

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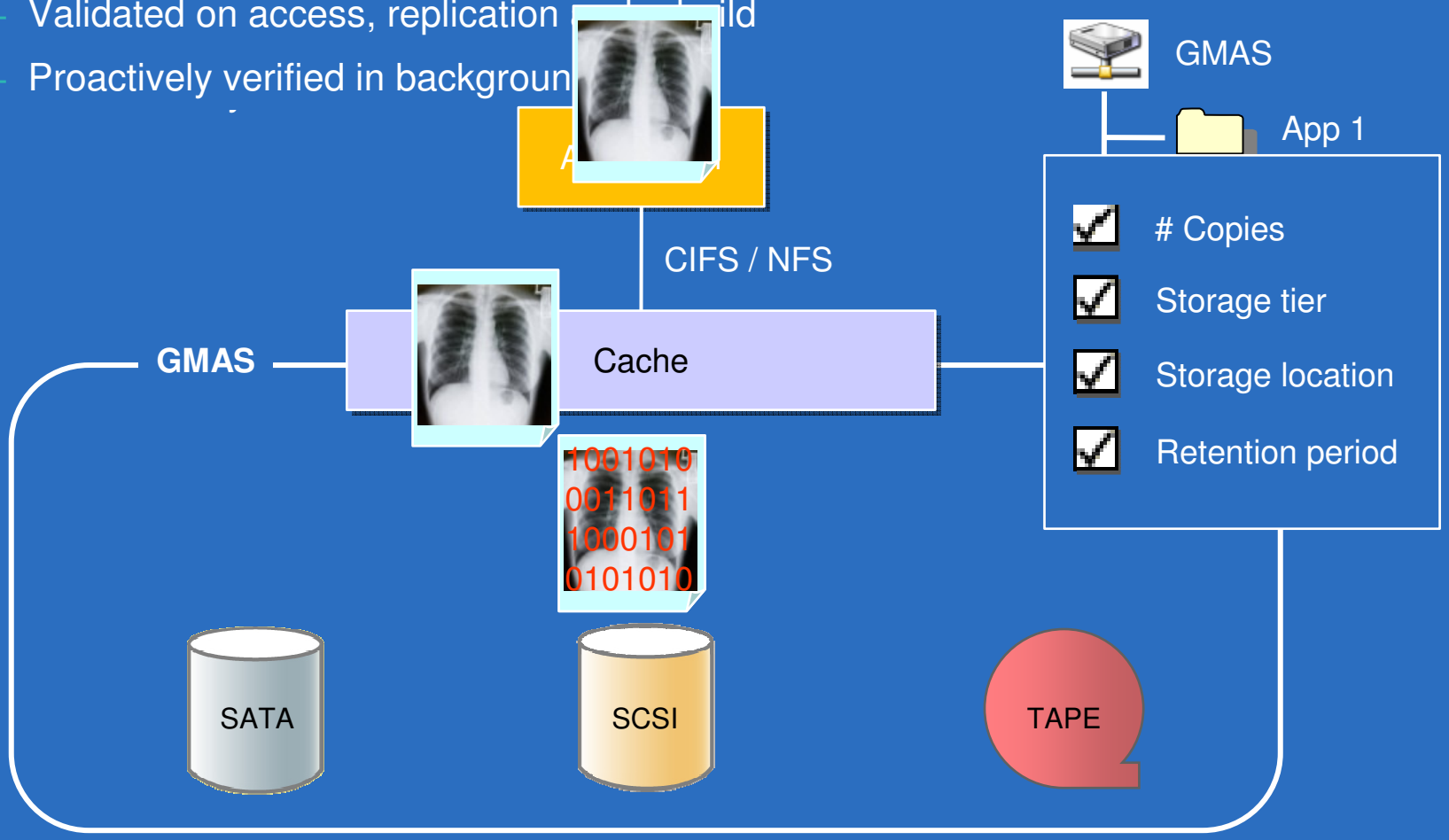
Transparent Actions Performed by IBM GMAS

- Data is protected with digital fingerprint
  - Validated on access, replication and rebuild
  - Proactively verified in background



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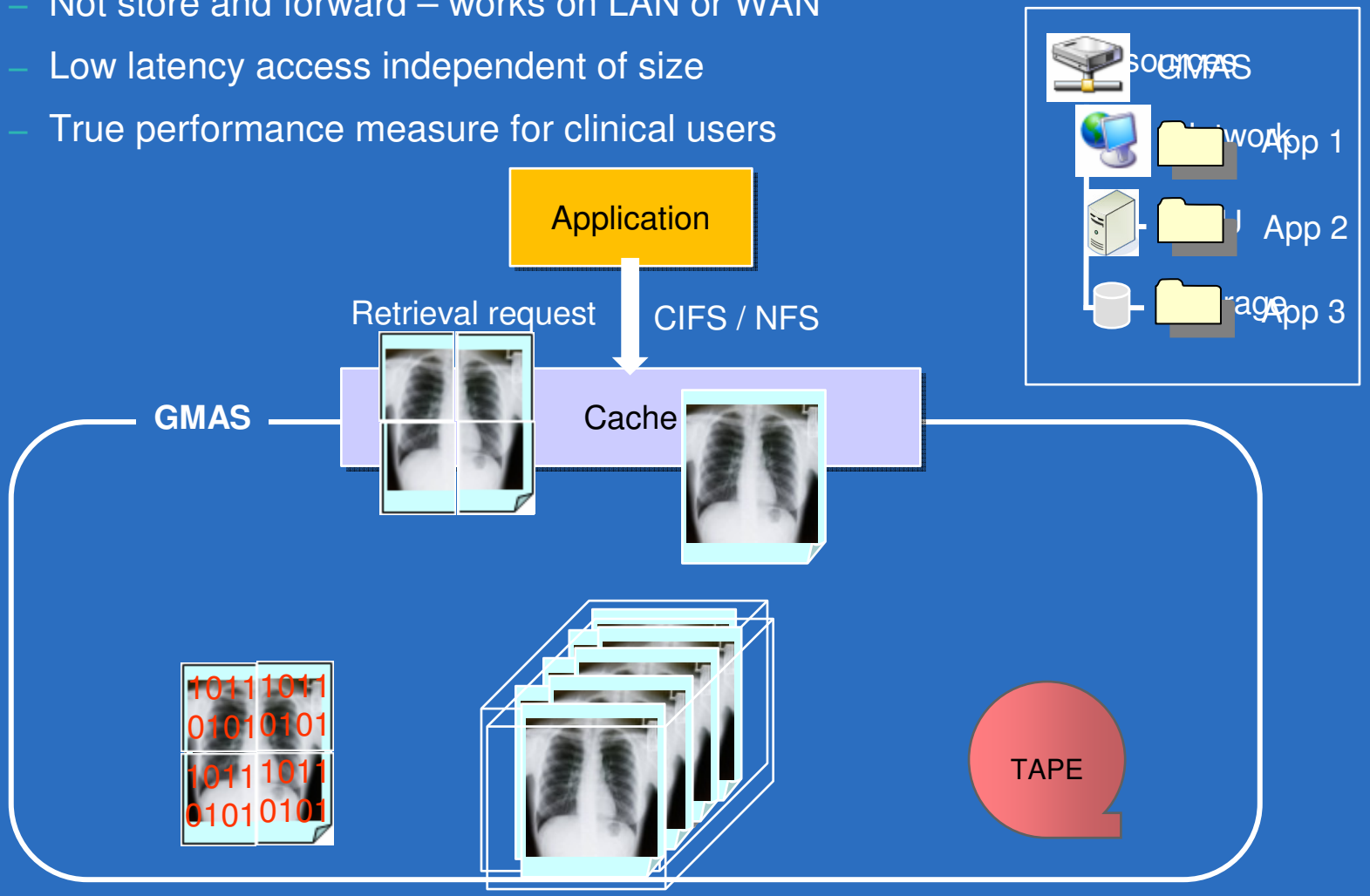
How GMAS Works: Data Retrieval

- Stream based transport
  - Not store and forward – works on LAN or WAN
  - Low latency access independent of size
  - True performance measure for clinical users



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Solution Features and Benefits

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How GMAS addresses HCLS Data Storage Challenges

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Gartner Group divides the burdened cost of archival storage cost into 6 areas over a 3 years:

- **Purchase Cost (20%)** – Capital Acquisition Costs
- **Downtime (20%)** – Costs to restore normal operations
- **Backup/Restore (30%)** – Manual, Error Prone Processes
- **Environmentals (14%)** – Space, Power, Cooling, etc.
- **Administration (13%)** – Storage Silos require dedicated support
- **Hardware Management (3%)** – Resources across application silos

GMAS Addresses each of these data challenges!

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Source: Gartner Research, 2007

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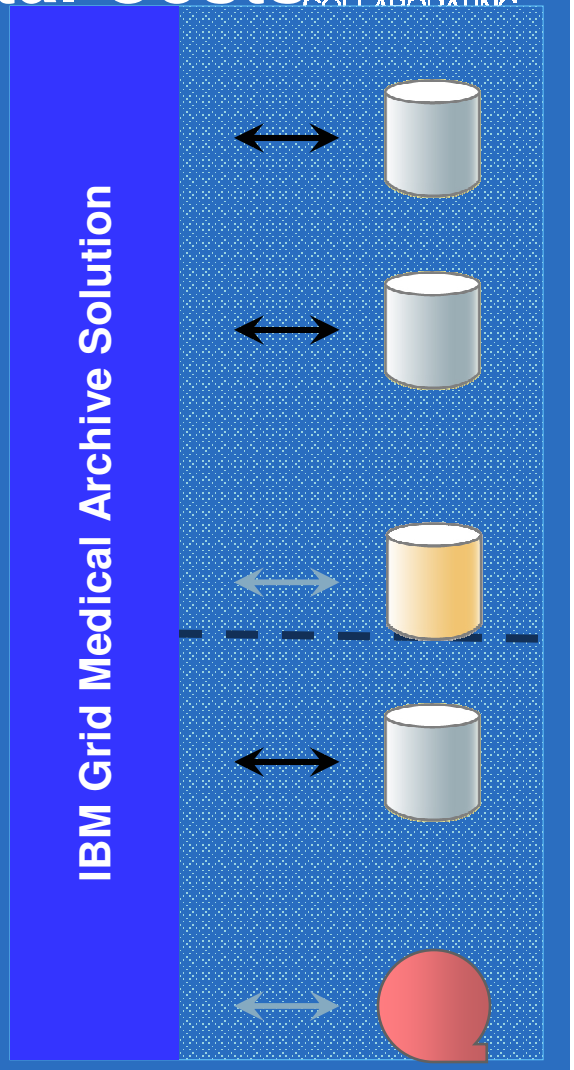
Reduces Purchase and Environmental Costs

- Multi-Site, Multi-Application & Multi-Vendor
  - LAN/WAN: Centralized or Distributed
  - All enterprise fixed content applications
  - Heterogeneous/multi-vendor technologies
- Multi-Tier Support via Archive Node
  - Reduces cost of storage
  - Integrated with IBM Tivoli Storage Manager: 150+ devices supported: Centera, Tape, DVD, UDO
  - Automated ILM: Location, Copies & Aging
- Provides Future Flexibility
  - Freedom to choose right hardware at right time
  - Vendor and media agnostic
  - Eliminates vendor lock-in



Lowers Administrative and Hardware Management Costs

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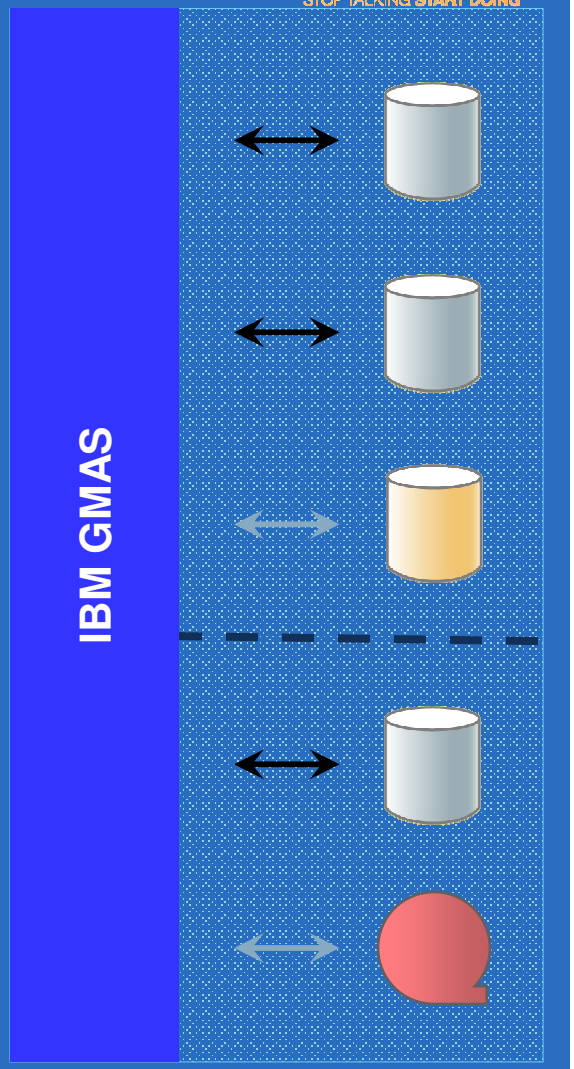
- Add Capacity on Demand
  - Seamlessly add capacity
  - Use best available technologies
  - Associate resources to the pool, not the application
- Eliminate Manual Media Migration
  - Data outlives hardware/media
  - Manual media migration costs ~$10,000/TB
  - GMAS automates technology refresh
  - Data verified during migration
  - No impact on clinical operation



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Lowers Administrative and Hardware Management Costs

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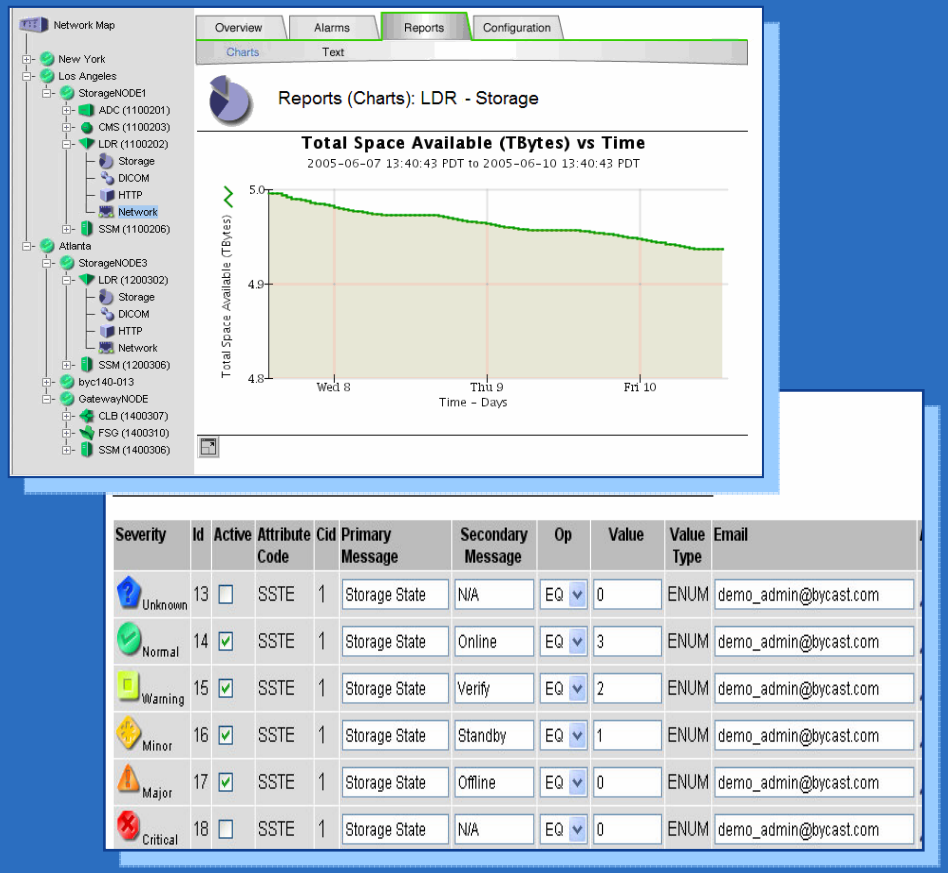

Severity	Id	Active	Attribute Code	Cid	Primary Message	Secondary Message	Op	Value	Value Type	Email
Unknown	13	☐	SSTE	1	Storage State	N/A	EQ	0	ENUM	demo_admin@bycast.com
Normal	14	☑	SSTE	1	Storage State	Online	EQ	3	ENUM	demo_admin@bycast.com
Warning	15	☑	SSTE	1	Storage State	Verify	EQ	2	ENUM	demo_admin@bycast.com
Minor	16	☑	SSTE	1	Storage State	Standby	EQ	1	ENUM	demo_admin@bycast.com
Major	17	☑	SSTE	1	Storage State	Offline	EQ	0	ENUM	demo_admin@bycast.com
Critical	18	☐	SSTE	1	Storage State	N/A	EQ	0	ENUM	demo_admin@bycast.com

- Storage Management: Less than 10% of an FTE
- Centralized web-based administration
  - Proactive monitoring
  - Fault detection & alerts
  - Enterprise wide view of storage resources
- Proactive planning
  - Real time metrics measure resource utilization
  - Real time and historical reports determine trends

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Eliminates Application Downtime and Error Prone Manual Backup and Restore

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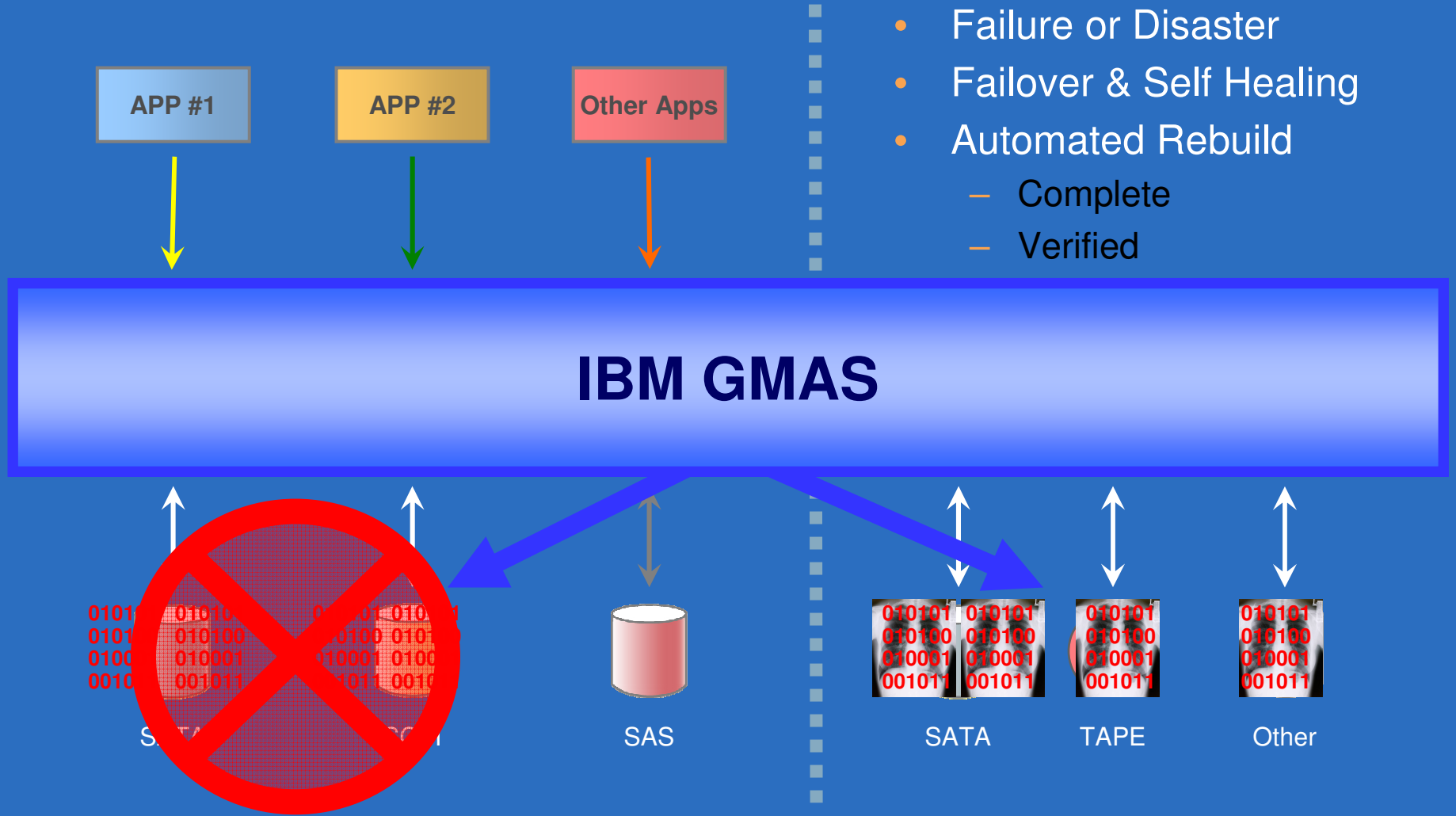
- Failure or Disaster
- Failover & Self Healing
- Automated Rebuild
  - Complete
  - Verified



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In Summary: GMAS Lowers Both Storage Acquisition and Operational Costs

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Requirement	GMAS Benefits
Acquisition Costs	✓ Multiple tiers aligns cost of storage with value – TRUE ILM ✓ Flexible: Change footprint and hardware as needs evolve
Environmental Costs	✓ Freedom to choose the right hardware/media/technology: SAN, DAS, Tape, MAID, … ✓ Easy to leverage higher density storage systems as they evolve
Administration Costs	✓ Automates storage management functions: hardware refresh, recovery… ✓ Single management system reduces management costs ~ 10% FTE for management
Downtime	✓ Inherent high-availability of architecture reduces downtime ✓ Continuous operation in the presence of faults
Hardware Management	✓ Eliminates silos and allow for use of heterogeneous HW environment ✓ Automated data migration on to replacement media
Backup & Restore	✓ Eliminates back-up with grid architecture and built-in redundancy ✓ Automated rebuild in the event of disaster/storage failures

Challenge

- Massive, fast growing archive: 20TB/yr with 630TB archive by 2010
- Increased data access by eliminating downtime and delivering automated DR protection
- Provide Business Continuity by automating backup and eliminating manual error prone processes

Solution:

- IBM GMAS using SATA
- Grid spans 2 data centers and 8 hospitals
- GMAS to support all enterprise applications – GE, McKesson, Allscripts
- Implementation: "flawless, on-time and on-budget"

Business Benefits:

- **100% uptime: grid split across 2 sites without interruption**
- **Management < 10% FTE: traditional storage with backup required 1+ FTE**
- **Physicians satisfied and silent: fast performance & reliable data access**
- **50% reduction in storage costs**
- **Long-term platform: expand with right media to optimize price / performance ratio**
- **Last manual media migration has been performed**

"Providing our patients with the best possible healthcare, while controlling costs, is a top priority for Iowa Health System"

-- Jim Mormann, CIO, Iowa Health System

Proven with Leading PACS Vendors

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Partner	Product	Validation	Interface
SIEMENS	Magic	Certified - Customers: Health Alliance	Custom RCP
	syngo Imaging	Certified	Custom NFS
	syngo KinetDX	Certified	CIFS
	Sorian EDM	Certified	CIFS
AGFA	Impax/Heartlabs	Certified	CIFS, NFS
	Impax Data Center	Certified	NFS
GE Healthcare	Centricity with Enterprise Archive	Certified	CIFS
	Cardiolink	Certified	CIFS
PHILIPS	EasyAccess	Certified	CIFS
	Xcelera	Certification Pending	CIFS
McKESSON	Horizon Medical Imaging	Certified	CIFS
	Horizon Patient Folder	Certified	CIFS
CERNER All Together	ProVision / MMF	Certified	NFS
FUJIFILM	Synapse ProSolv	Certified Certification Pending	CIFS FTP
EPMedSystems	EPMed systems	Certification Required	NFS
delmar Reynolds	Delmar Reynolds	Certifiication Required	NFS
eRAD PACS Your workflow solution	eRAD PACS	Certified	NFS

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Technical Overview

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Grid Medical Archive Solution

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- GMAS IS:
  - GMAS Software
  - IBM X Series servers
  - IBM Storage
  - IBM Services
- HW & SW & Services are offered in pre-designed and Pre-built bundles
- Customers and Business Partners do not have to design and build a Grid solution from scratch

GMAS SW Components & Data Flow

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ARCHIVE NODE

- Manages Near-Line storage. Sends data to Tivoli Storage Manager.
- 100s of devices supported including tape & UDO.
- We provided TSM (or DR550) or can use existing customer TSM environment.
- Can be SCSI/SAN attached IBM or non-IBM storage.
- Must always be at least two storage nodes in Grid.
- We have standard IBM SAS and SAN attached options, but custom installs can use existing IBM and non-IBM storage.

GATEWAY NODE

- Redundant or Clustered NFS or CIFS interface to GMAS Grid.
- Mounts like a NAS device for medical applications.
- 500GB Cache for data in and out of the Grid
- Alarms, Email sent when problems detected within Grid.
- Reports generated on Grid usage.

Archival Media

Spinning Media

IBM DS4000
IBM EXP3000

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Grid Medical Archive Solution

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GMAS is offered in:

- Single Site Solutions
  (redundancy & ILM at single site)
- Single Site + DR Solutions
  (redundancy & ILM across two sites)
- Multi-Site Solutions
  (redundancy & ILM across multiple sites)

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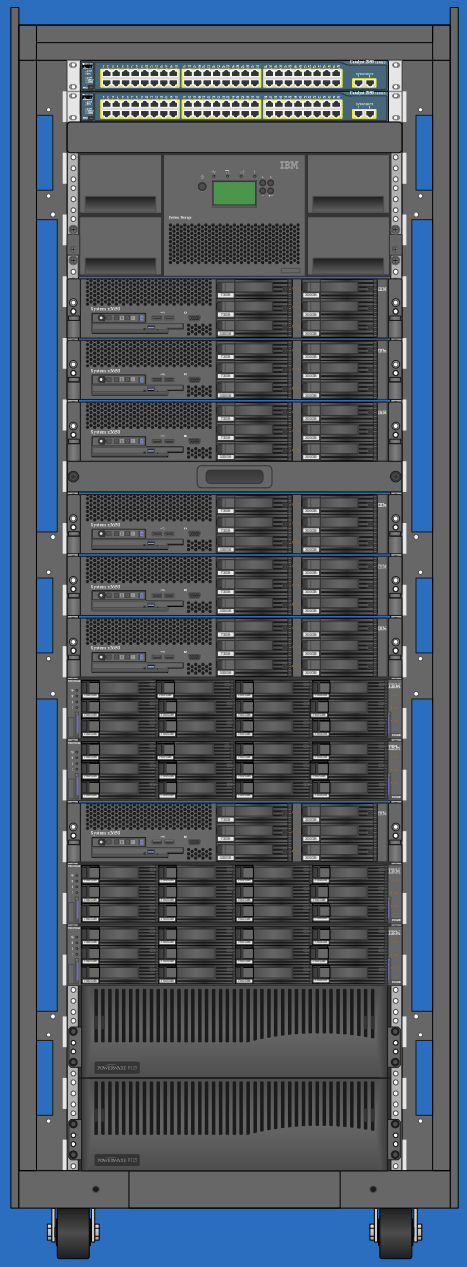
Single Site



- Base: (2) 24 Port LAN Switches
- Option: 38TB LTO Library
- Option: TSM Server
- Option: ARCHIVE
- Option: HA GATEWAY
- Base: GATEWAY
- Base: GATEWAY/ADMIN
- Base: CTL#1/STG
- Base: 6TB SATA STORAGE
- Option: 6TB SATA STORAGE
- Base: CTL#2/STG
- Base: 6TB SATA STORAGE
- Option: 6TB SATA STORAGE
- Option: (2) 4.5 KVA UPS
- Base: 36U Rack & Console

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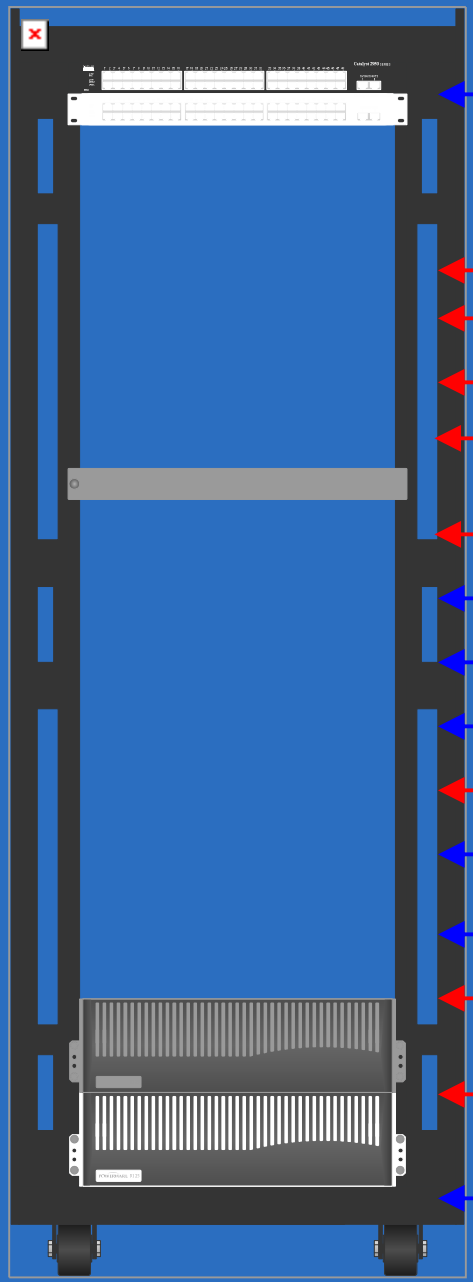
Multi Site



Base: (2) 24 Port LAN Switches

Option: STG

Option: 6TB SATA

Option: 6TB SATA

Option: HA or RED GWY

Option: HA or RED GWY

Option: HA or RED GWY

Base: GWY

Base: CTL#1/STG

Base: 6TB SATA

Option: 6TB SATA

Base: CTL#2/STG

Base: 6TB SATA

Option: 6TB SATA

Option: (2) 4.5 KVA UPS

Base: 36U Rack & Console

Option: STG

Option: 6TB SATA

Option: 6TB SATA

Option: HA or RED GWY

Option: HA or RED GWY

Base: GWY/ADM

Option: CTL#4/STG

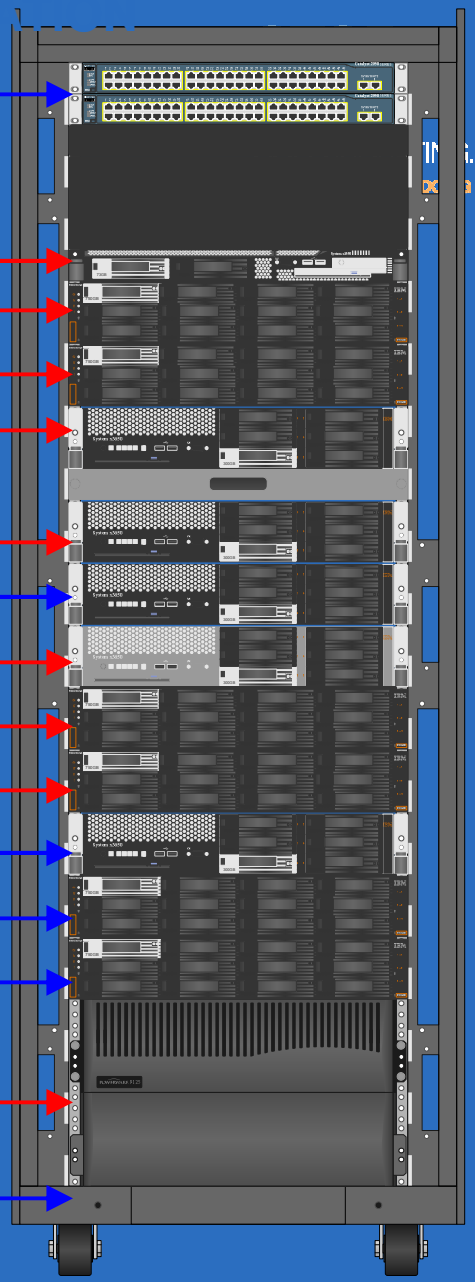
Option: 6TB SATA

Option: 6TB SATA

Base: CTL#3/STG

Base: 6TB SATA

Base: 6TB SATA



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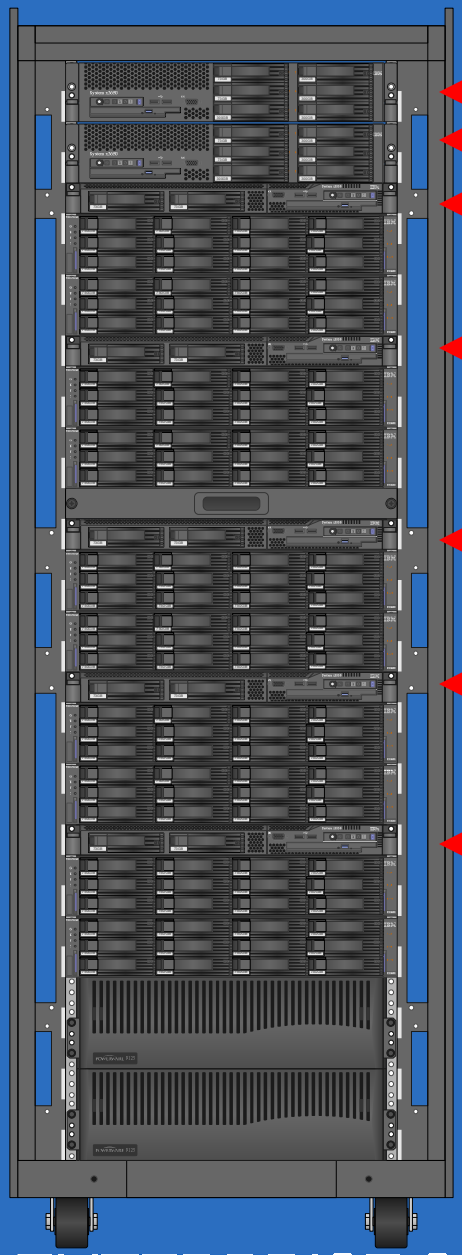
Expansion Rack



Option: Gateway

Option: Gateway

Option: 12TB STG

Option: 12TB STG

Option: 12TB STG

Option: 12TB STG

Option: 12TB STG

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Expansion Rack can be added to any site configuration adding Storage Nodes and if needed additional Gateway Nodes

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TS3200 Archive Node

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TS3200 (2) LTO4, 48 Slots, 38TB usable

TSM Server (FC connected to TS3200)

Archive Node

The TS3200 Archive Node can be added to any configuration. Many Archive Nodes can exist in larger Grids.

Note GMAS requires one copy of data to remain in the LTO library, but an additional copy of data can be made within TSM for secure offsite storage.

The basic TS3200 Archive Node configuration requires 8U of rack space.

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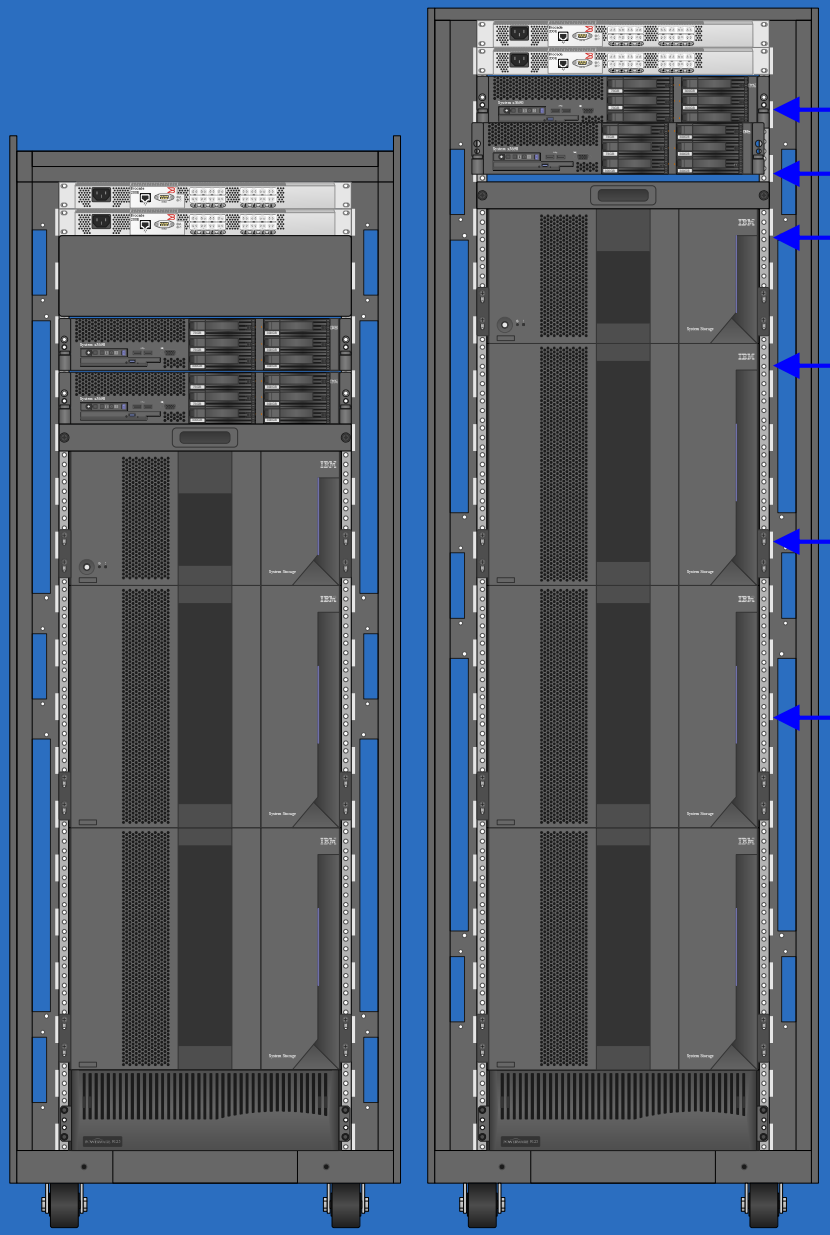
TS3310 Archive Node



- SAN Switches for LTO drive connectivity
- TSM Server (FC connected to TS3200)
- Archive Node
- TS3310 Base Library
  (2) LTO4 Drives
  (30) slots, 24TB usable
- TS3310 Expansion Library
  (0-4) LTO4 Drives
  (90) Additional slots, 72TB usable
- One to two additional 9U expansions.
  Total of 169TB in 36U rack
  Total of 243TB in 42U rack

The TS3310 Archive Node can be added to any configuration. Many Archive Nodes can exist in larger Grids.

Note GMAS requires one copy of data to remain in the LTO library, but an additional copy of data can be made within TSM for secure offsite storage.

For larger storage configurations the TS3500 should be considered.

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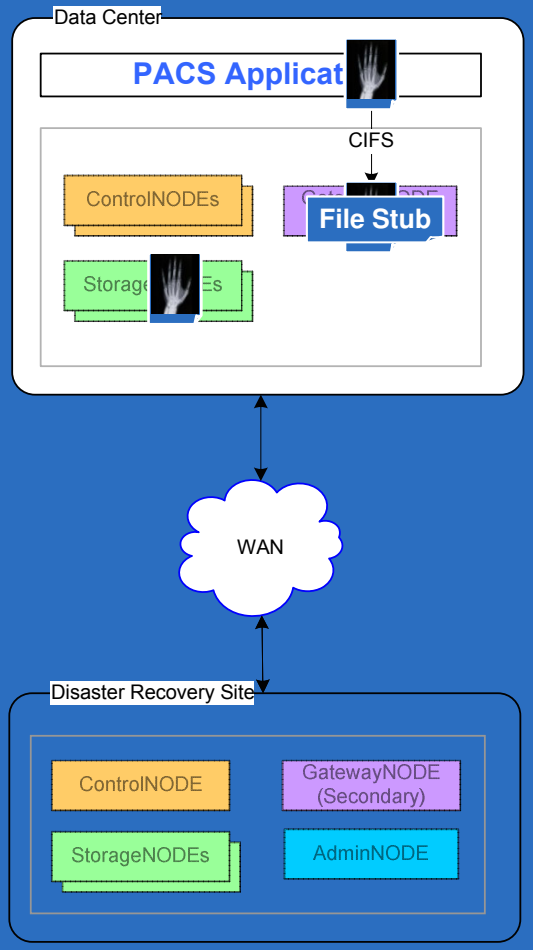
Technical Use Cases

Note: ***These use cases provide insight into GMAS activities that are transparent to applications & end-users. Storage & retrieval services simply operate as requested. Although not required for management, storage administrators have full visibility.***

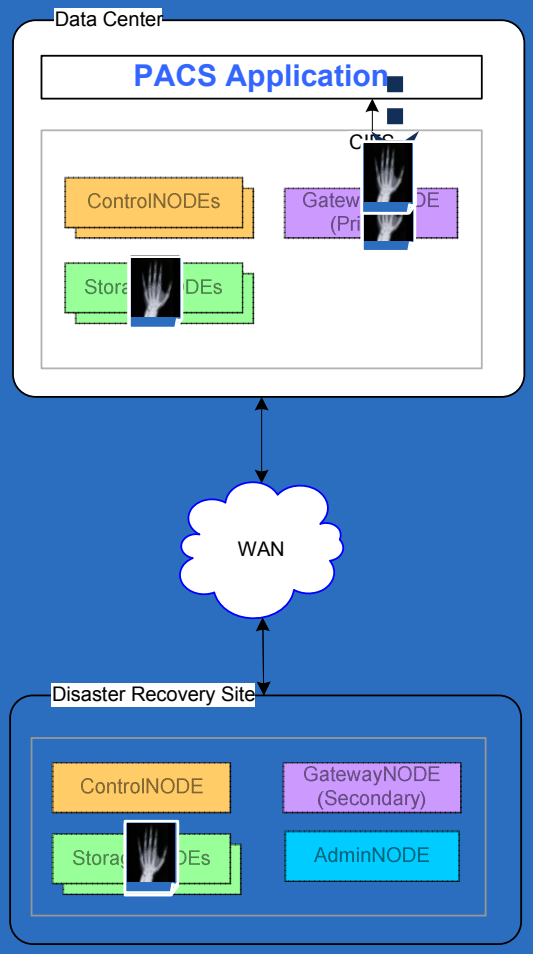
Automated Information Lifecycle Management
Storing Studies



1. PACS stores study to Gateway Node
2. Study is streamed to Storage Node
   - Cached copy remains on Gateway Node while file stubs are replicated
3. Study is replicated to Disaster Recovery Site
4. Cached copy is purged, based on activity.

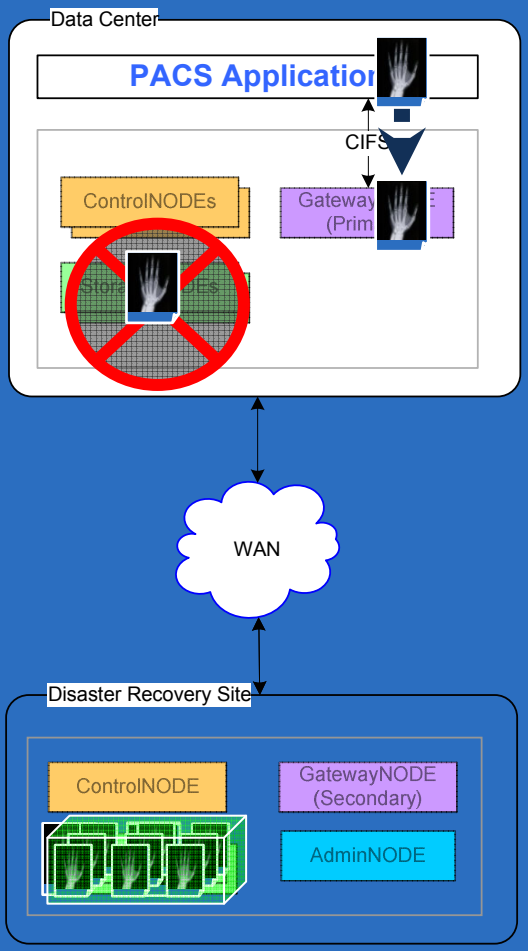
Grid is Content-Aware

Retrieving Studies



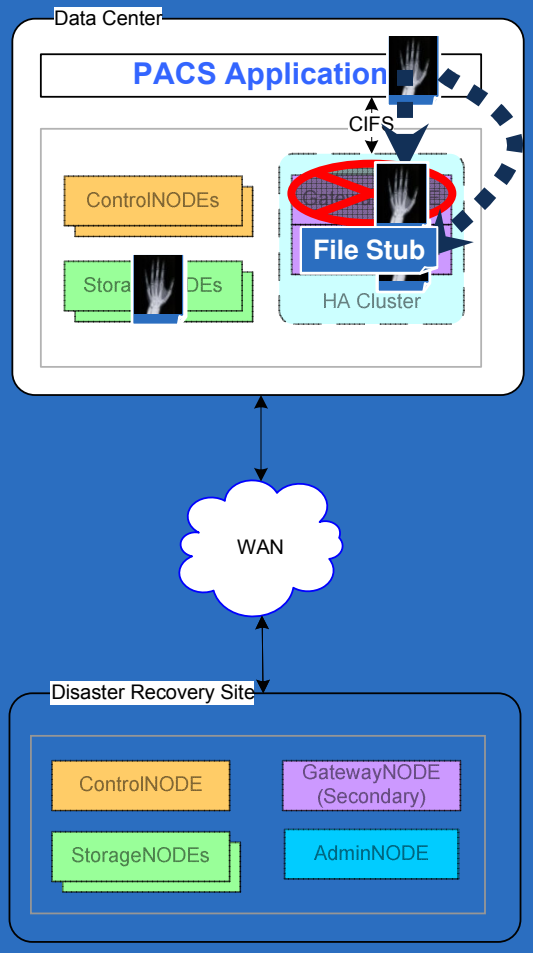
1. PACS requests study from Gateway Node
2. If cache “hit”, study is instantly retrieved by PACS
3. If cache “miss”, study is retrieved from Storage node
   - Cached in Gateway Node
4. If faster retrieval, study streamed from Disaster Recovery Site
   - Cached in Gateway Node

Automated Restore
Storage Failure



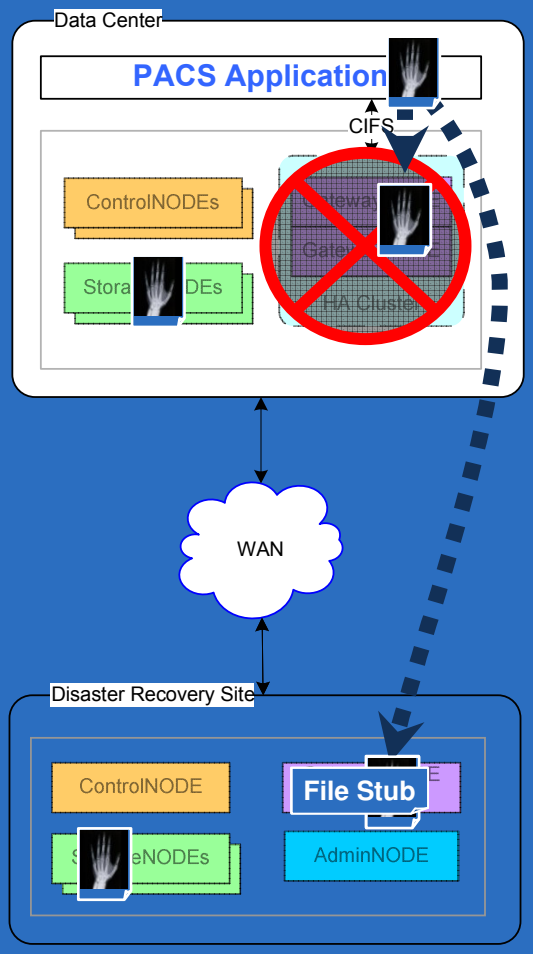
1. Data Center Storage Node(s) fail
2. PACS retrieves directly from Gateway Node cache (if available)
3. Otherwise, study streamed from Disaster Recovery Site
4. New studies stored at Disaster Recovery Site
5. Number of copies is maintained by ILM policy
6. On restoration, GMAS automatically rebuilds storage and redistributes any new data
7. Studies submitted during storage failure are available for fast access – even after Gateway Node cached copy is purged.

Continuous Clinical Operations
Gateway Failure



1. Data Center primary Gateway Node fails
2. Automated failover to secondary Gateway Node in High-Availability Cluster (no affect on PACS)
3. Data stored at Data Center, file system synchronized at Disaster Recovery Site
4. ILM policy automatically replicates study to Disaster Recovery Site
5. Retrieval of new & prior studies available from Data Center
6. On restoration of Gateway Node, file system automatically synchronizes
7. PACS retrieval of studies are made from Data Center storage – even those stored during Gateway Node failure.

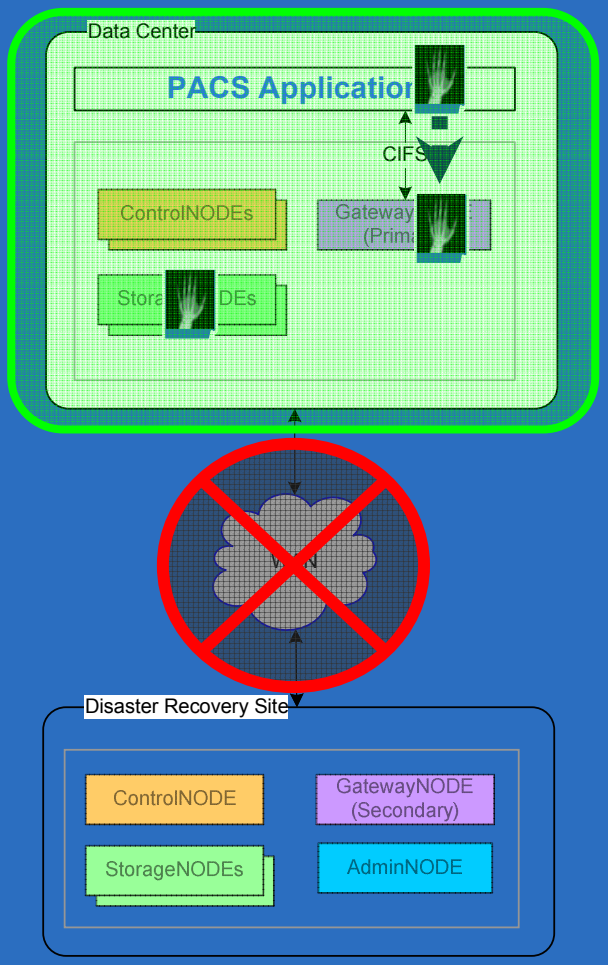
Continuous Clinical Operations
Gateway Cluster Failure



1. Data Center Gateway Cluster fails
2. PACS fails over to store on secondary Gateway Node at Disaster Recovery Site
3. ILM policy automatically replicates study to Data Center
4. Retrieval of new & prior studies available from Disaster Recovery Site
5. On restoration of Gateway Cluster, file system automatically synchronizes
6. PACS retrieval of studies are made from Data Center storage – even those stored during Gateway Cluster failure.

Automated Recovery

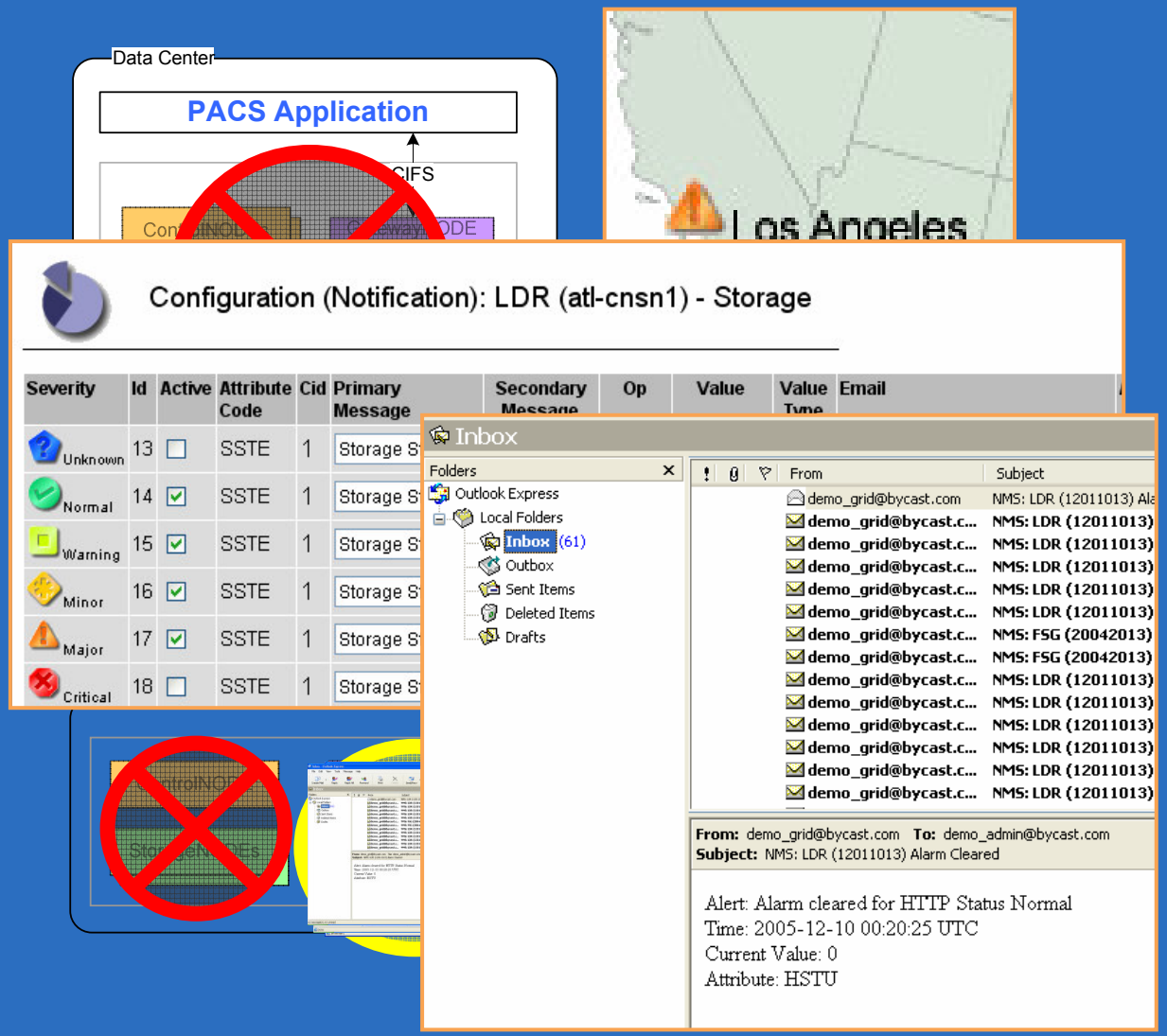
Failure – Islanded Operations



1. Disconnect from Disaster Recovery Site due to network failure
1. Store and retrieve operations are not impacted
2. Additional copies are made at Data Center when data stored
3. Data is retrieved from Gateway Node cache or Data Center Storage Node
4. Network is restored
5. GMAS automatically distributes data to enforce ILM business policy.

Proactive Alerts
Fault Notification

STOP HESITATING. START COLLABORATING.
STOP TALKING START DOING



1. GMAS can detect a multitude of faults
2. Admin Node provides auto-notification of faults
3. Configurable alarms and alerts
4. Alarms and alerts are received via email.

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STOP
HESITATING.
START
COLLABORATING.
STOP TALKING START DOING

In Summary

ENTERPRISE SCALABILITY
START VIRTUALIZING. START AUTOMATING. START SIMPLIFYING.

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Why GMAS?

STOP HESITATING. START COLLABORATING.
STOP TALKING START DOING

1. Enterprise Platform for all fixed content data
2. Improves Application, Uptime & Performance
3. Protects Data for Life
4. Automates Storage Administration
5. Cost effective for Small, Medium & Large Organizations
6. Provides many levels of Online and Nearline storage
7. Applicable to single site 1TB applications and 100 site Petabyte applications

ENTERPRISE SCALABILITY
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ENTERPRISE SCALABILITY

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Thank You and Questions

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