Journeying Into New Storage Worlds To Meet Notre Dame's Expanding Storage Needs

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- Founded in 1842 by Rev. Edward Sorin, C.S.C.
- Located in Notre Dame, IN near South Bend
- ~12,290 students, ~8,450 undergraduates

OIT at Notre Dame

The **Office of Information Technologies** (OIT) is the central team that supports enterprise-wide computing on campus. It provides the products and services that students/faculty/staff use every day to complete tasks related to their studies or jobs.

- **Vision:** Serve as Notre Dame's trusted technology partner.
- **Mission:** Develop innovative technology solutions and provide reliable technology services in support of Notre Dame’s students, faculty and staff.

Notre Dame ranks 6th in Computerworld’s Best Places to Work in IT 2016

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Business Missions Needing Storage Solutions

- Researchers at Notre Dame advance human understanding through research, scholarship, and creative endeavor in order to be a repository for knowledge and a powerful means for doing good in the world.
- "A great Catholic university for the 21st century, one of the preeminent research institutions in the world."
  – *Rev. John I. Jenkins, C.S.C., President*
- More research results in more data.
- Right storage solution at the right price – accessible, reliable, speed

Brief Storage Journey

- ~12 years ago, started with a NetApp cluster with about 8 TB of storage
- Used for user file systems – SMB/CIFS protocol
- Added filesystems for servers – NFS protocol
- Added email servers - FC protocol
- Added Oracle databases - NFS protocol
- Added SQL databases - iSCSI protocol
- Switched to Exchange for email - iSCSI protocol

Brief Storage Journey

- We grew to 6 production filers; 2 test filers; 4 filers for snapvault and backup destinations
- Started adding Flash Cache to NetApps in 2010
- Started adding SSDs to our NetApps in 2012
- Grew to ~1.8 PB of usable storage space

Brief Storage Journey

- NetApp was a Swiss army knife solution for our storage needs
- We had NetApp - so that's what we used to supply storage
- Same storage cost regardless of the value of data

Data Growth Drivers

- Videos – sports, research, lectures
- Photos
- Research data
- Server virtualization -> VMware
- End user storage needs are growing at about 50% per year
- Database growth – and multiple copies
- Data center data - data for applications and servers
- New research building opening now - Fall 2016
- New Digital Media Center to come on line fall of 2017

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Why Change Our Storage Strategy?

- Data was growing too fast
- Our budgets could not keep up with the demands
- $7+ million over 5 years for NetApp purchases and maintenance

Our Storage Strategy

- Lower 5 year TCO (non-labor) for storage by at least 20% over previous 5 years
  - Map capabilities of storage to core needs of the enterprise
  - Storage cost should be appropriate to the value of what is being stored
  - Options to provide good enough service to be the tier
- Define SLAs for major data types/categories
  - End-user / Departmental / Database / Server / Data protection (backups)
- Shift emphasis from CapEx storage spend to OpEx storage spend over the next 5 years
  - do not buy for peaks, but rather for steady state
  - specifically target cloud-integrated storage solutions
- Lower storage delivery timeframes to less than 1 week
- Create and define storage tiers and costs for storage services and publish costs and decision matrix to help storage consumers make informed decisions
- Create a culture of vendor accountability and build partnerships

Implementing Our Storage Strategy

- Moving away from general purpose storage to purpose specific storage, with heavy emphasis on cloud
- Started by moving backups to the cloud -
  - AWS VTL
  - AWS storage gateway
  - Veritas NetBackup cloud storage in AWS S3
  - Panzura
  - Back to AWS storage gateways
- Google Drive
- Box

Implementing Our Storage Strategy

- Dternity and Dternity Media Cloud for archiving
  - Fighting Irish Media (FIM)
  - University Archives
- Migrating 80% of central IT services to AWS – Cloud First
- VMware - getting storage that tightly integrates with VMWare
- Databases – plans for migrating to AWS
- User file systems - moving to Avere – AWS S3-IA backend
- Black Pearl for CatDV integrated archiving

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Lessons Learned During the Journey

What worked well

- Detailed requirements list
- POC – very important
- Work with vendors to work through issues that arise
- Getting more features than sticking with NetApp

What could improve

- Asking too much from storage solution
- We keep coming up with needs that don’t have “perfect” solutions yet
- No single solution fits anymore
- Pull the plug – don’t just keep going, regardless

Challenges

- We need to be careful not to be stretched too thin by having too many different storage solutions
- Still have the same # of people to run the systems
- Losing data – because of many places to store data

Food for Thought

Help

Creativity

Patience

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