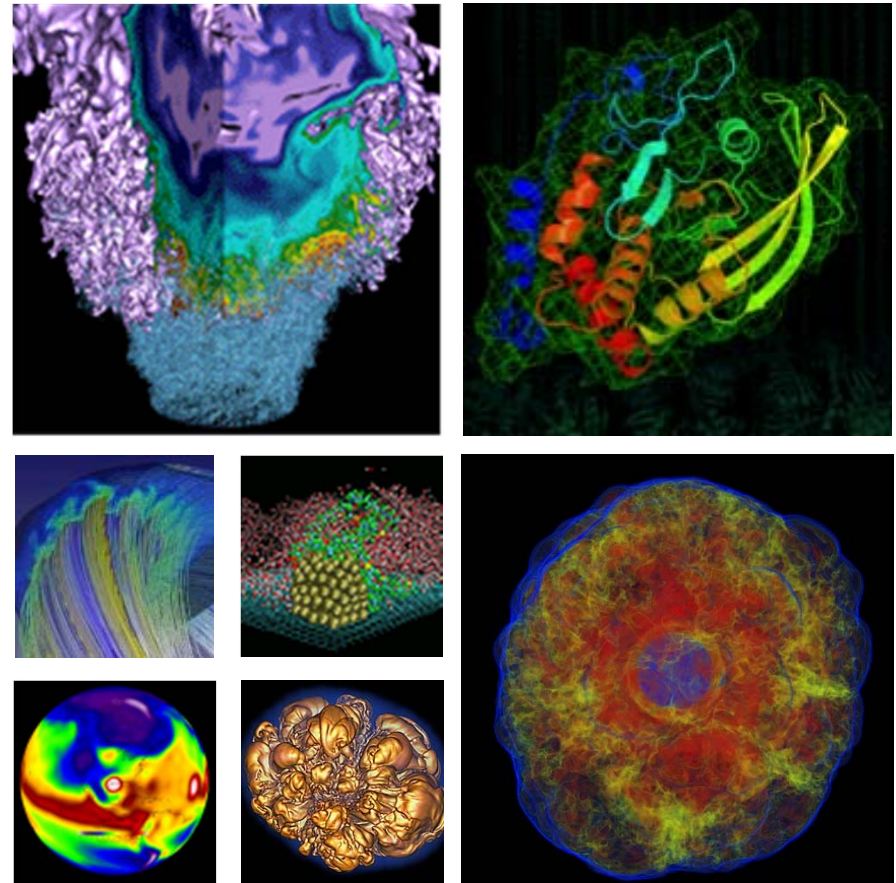# Migrating Archives at Scale

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Designing Storage Architectures
for Digital Collections
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Agenda

- **Metadata transformations**
  - New or redundant hardware is critical
  - Backups, backups, backups – metadata checkpoints
  - Process or luck ultimately determine success

- **Data migrations**
  - Accomplish early and accomplish often
  - Complete as soon as possible

- **Move to our new Computational Research and Theory (CRT) building**
  - Migrating our file systems and archive to our new facility

New or redundant hardware is crucial

- **Test metadata transformations at scale (e.g. copy of production system unavailable to users)**
  - Each large storage system, with its own distinct set of metadata, had unique issues

- **Purposefully inject error conditions**
  - What if a script fails halfway through its processing?
  - What are we going to do if we have inconsistent metadata?

- **Enables a site to quickly recover primary hardware**

- **Allows time to test before releasing to new users**
  - Try to mimic user intensive workloads
  - Let internal staff test before production users

Backups, at key points in process

- **Full, self-contained backup before you begin**
  - Serves as your fallback in the event of process failure

- **Full, self-contained backup before you use the newly transformed system**
  - Enables fault detection

Develop a process, avoid relying on luck

- **Determine rate of processing to help estimate completion**
  - Sometimes this is difficult, but it is important especially if you haven't executed at scale

- **Online conversions or migrations are superior**

- **Have and practice a reversion plan**
  - No matter how unlikely

- **Validation before returning to production**

Adopt new technology and use it!

- **Contains operational cost**
  - Media budget stays in check
- **Don't delay in migrating old data to new type**
  - Ensures you can read old data
  - Enables cycling of old media

Early adoption of new tape formats enabled us to reduce our total # of tapes by 10,000 while growing by 18 PBs of data.
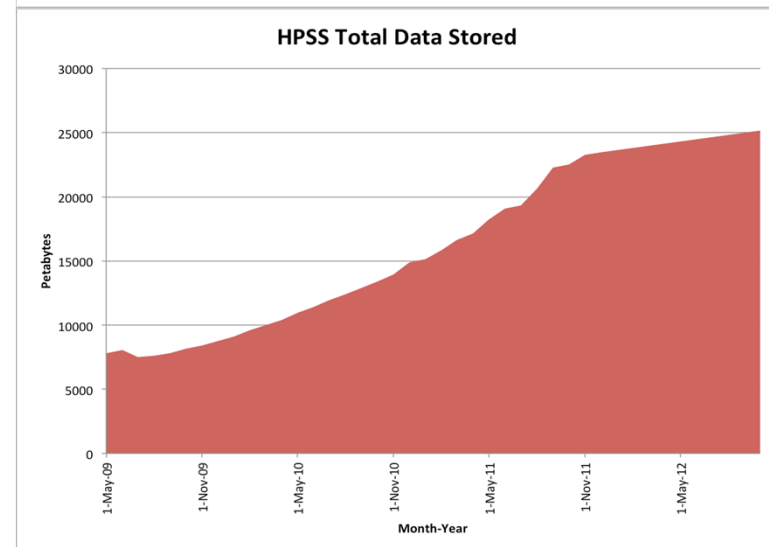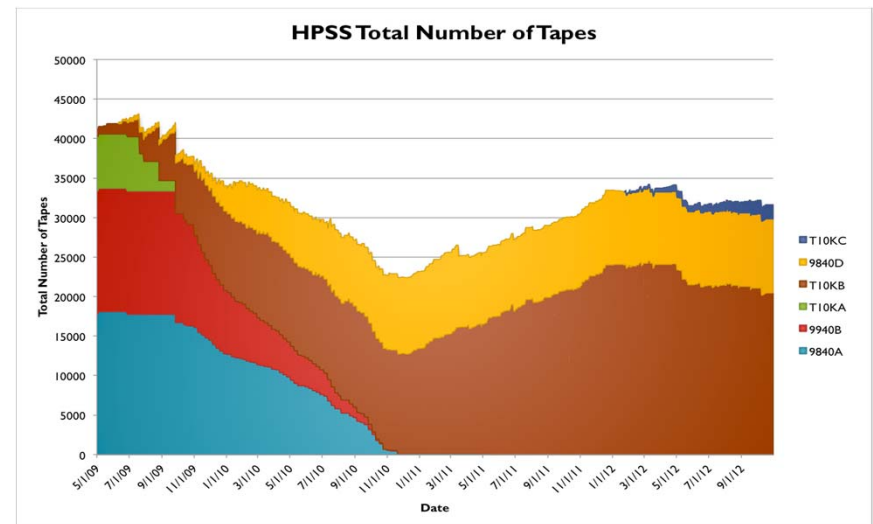
How we plan to move to a new facility

- **Archive and backup system moves will happen last**
  - Once the dust settles in the new facility
  - Consider whether we require new environmentally managed tape room
  - Offer primary and secondary copy of user data at two distinct sites
- **File systems**
  - Opportunity for setting up new file systems
    - New configurations
    - Leave history encoded in metadata (versions, problems)
    - Read every file because it's a COPY operation
  - Smaller file systems will use replication features in GPFS
  - Larger file systems using new shift utility (developed by P. Kolano, NASA Ames) to copy data
    - Transfer protocol is highly parallel and tunable
    - Data integrity features (checksum)
    - Persistent capability (retries)
    - Namespace traversal optimized

Summary

- **Develop a process and rehearse**
  - Introduce errors, try to revert to previous system

- **Extra hardware is critical to success**
  - Practice at scale if possible

- **Be an early adopter of new technology**
  - Contains operational expenditures with exponential growth

- **Copying data from old to new format or systems**
  - Helps eliminate metadata history

Thank you.