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Library of Congress Storage Architecture

Carl Watts

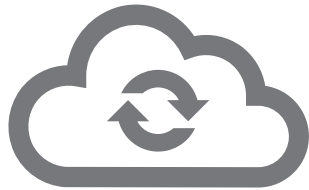
OCIO/ITSO/Operations & Maintenance



Overview

- Content Storage Environment Strategies
- Content Storage Environment Stats
- Content Storage Environment Projections
- Current Storage Architecture
- Unified Global Namespace (RIP) (a.k.a. CAL)
- Perpetual Migration Continues
- Converged Object Based Preservation Environment

Content Storage Environment Strategies

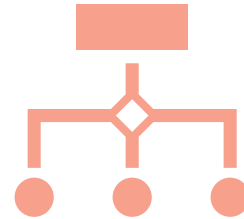


Preservation Deploying a 3:2:1 strategy

Three (3) copies of the data (2 tape copies and one cloud copy)

Two (2) technologies (Versity and AWS)

One (1) off premises copy (AWS Glacier)



Presentation Deploying a 2:2:1 strategy

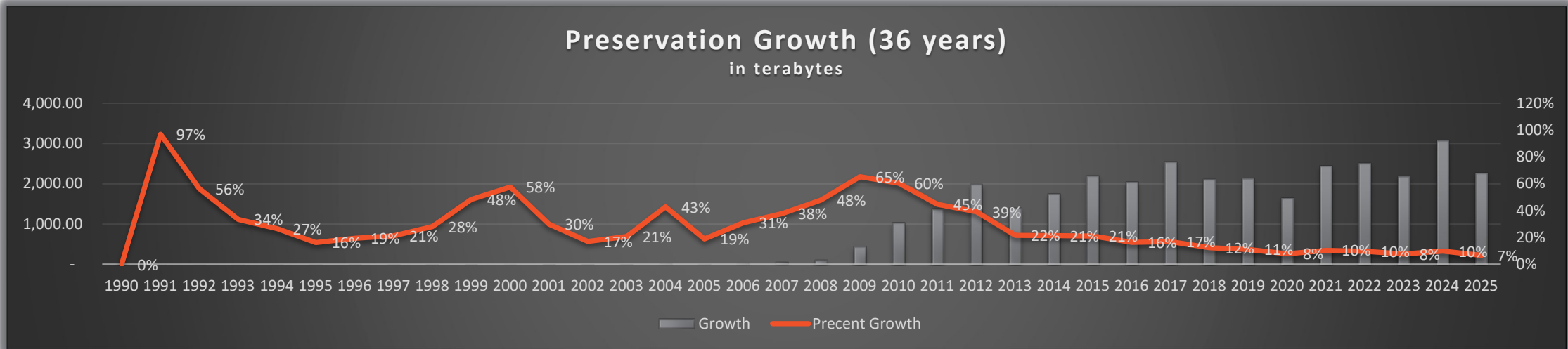
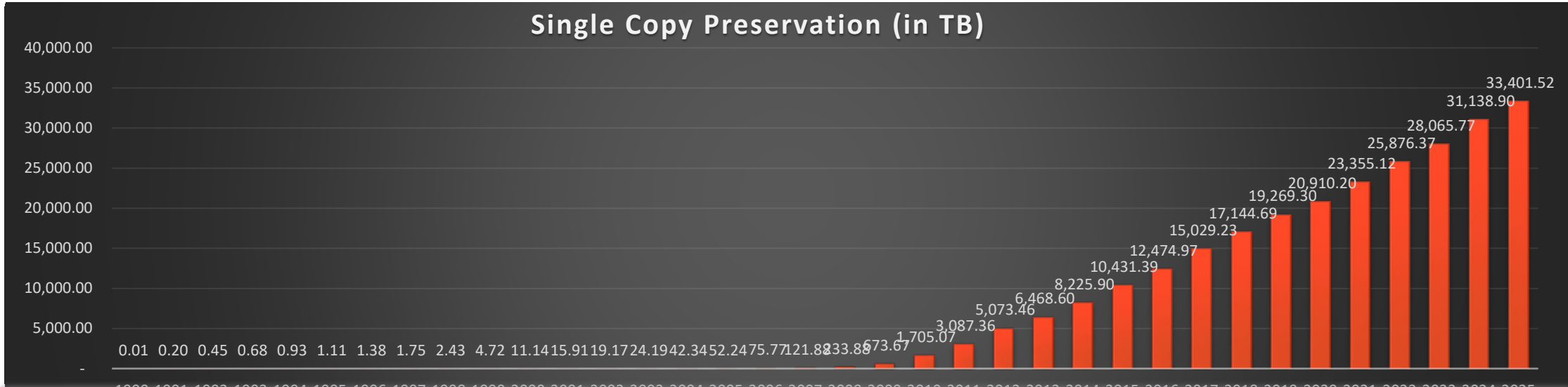
Two (2) copies of the data

Two (2) technologies (Spectrum Scale and AWS S3)

One (1) off premises copy (AWS S3 Intelligent Tiering)

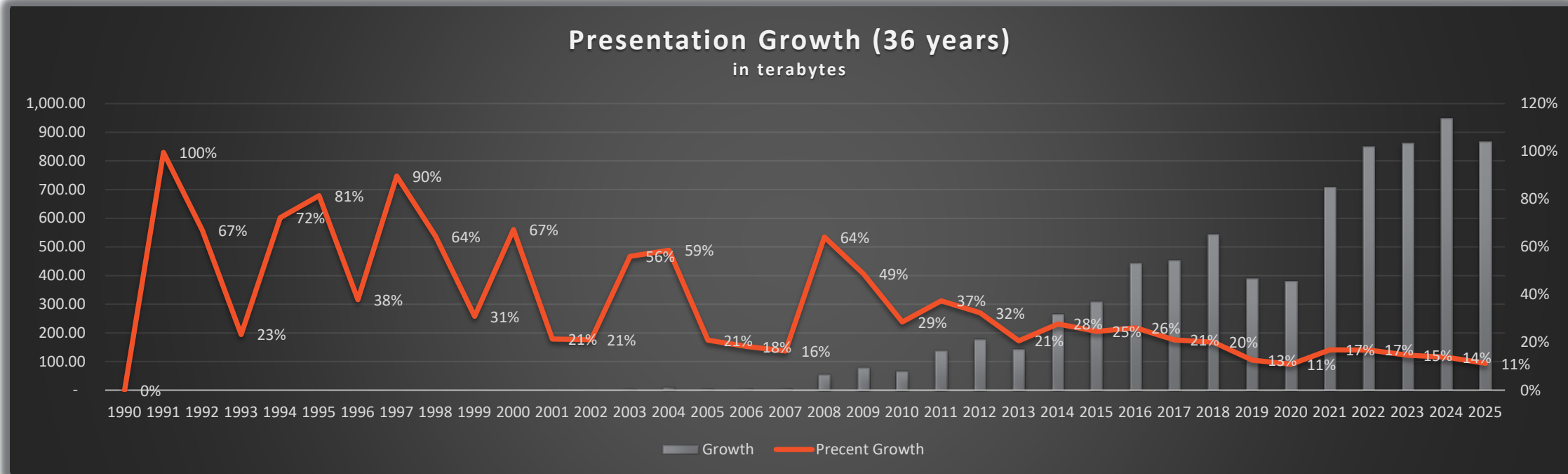
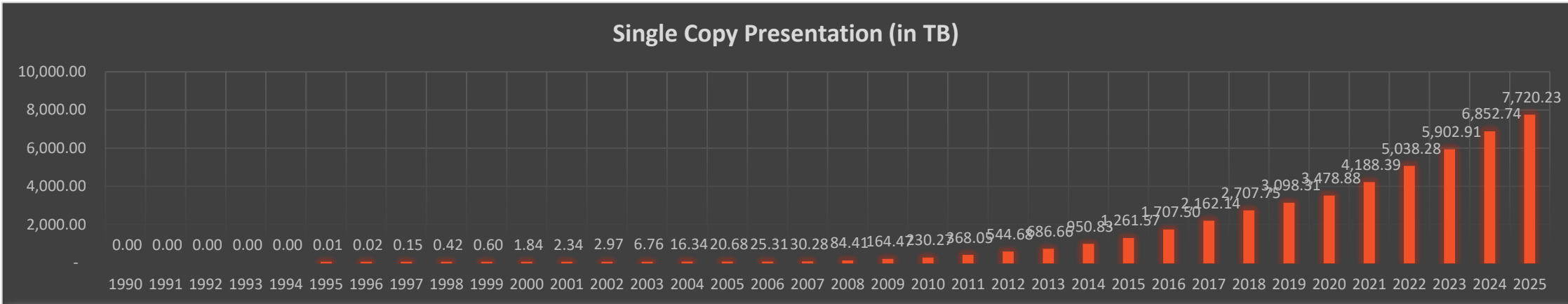
Content Storage Environment Statistics

- Preservation Single Copy 1.25B Objects (33.4PB) (7% Annual Growth)



Content Storage Environment Statistics

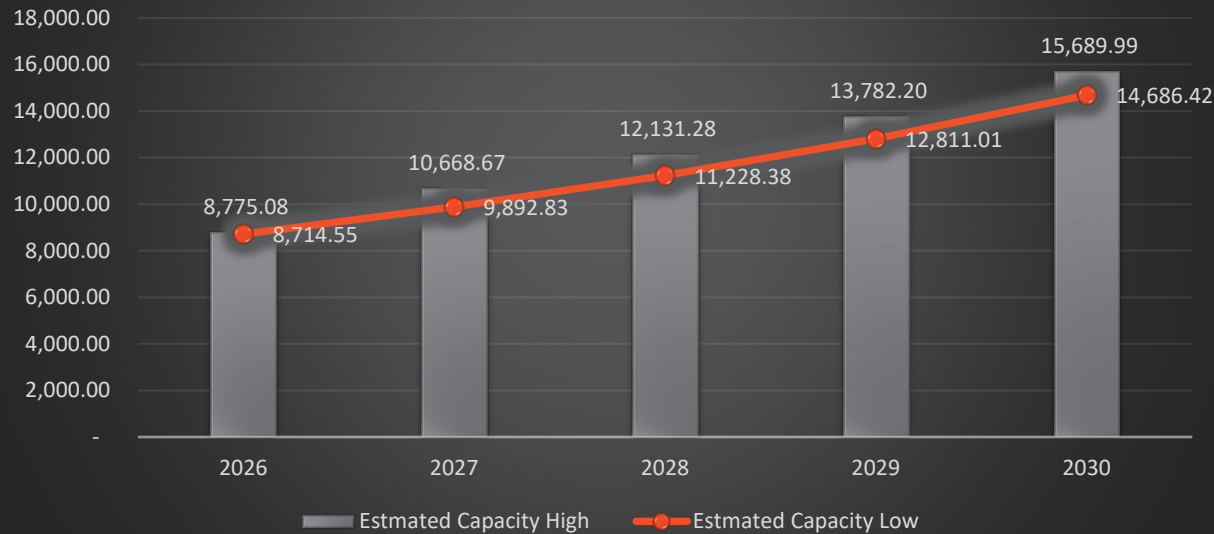
- Presentation Single Copy 300M Objects (7.7PB) (11% annual growth)



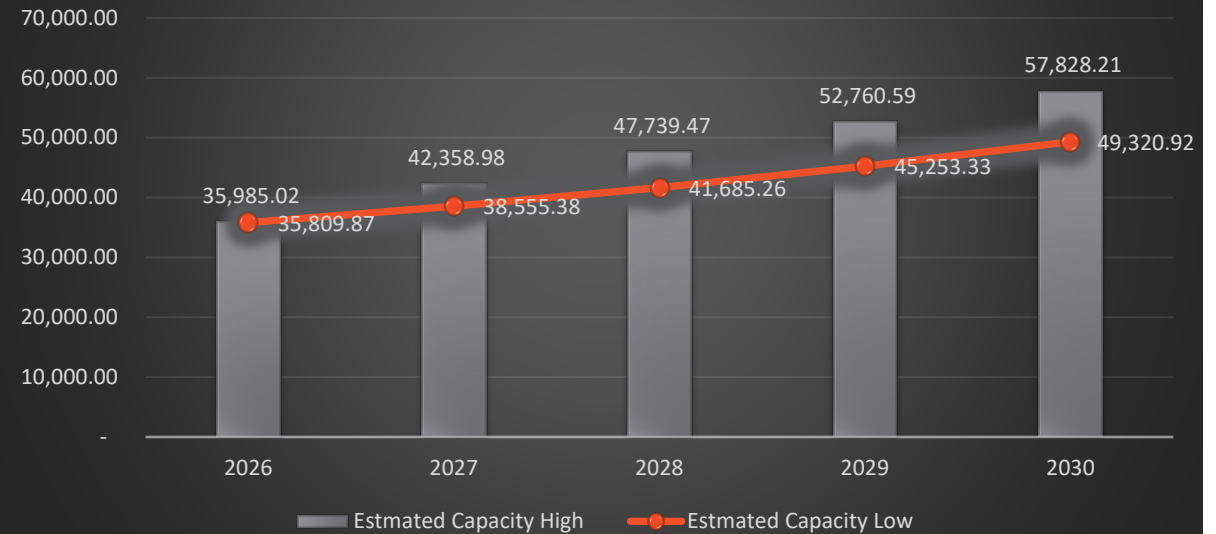
Content Storage Environment Projections

- Using a 10 growth average
 - Presentation 19%
 - Preservation 13%

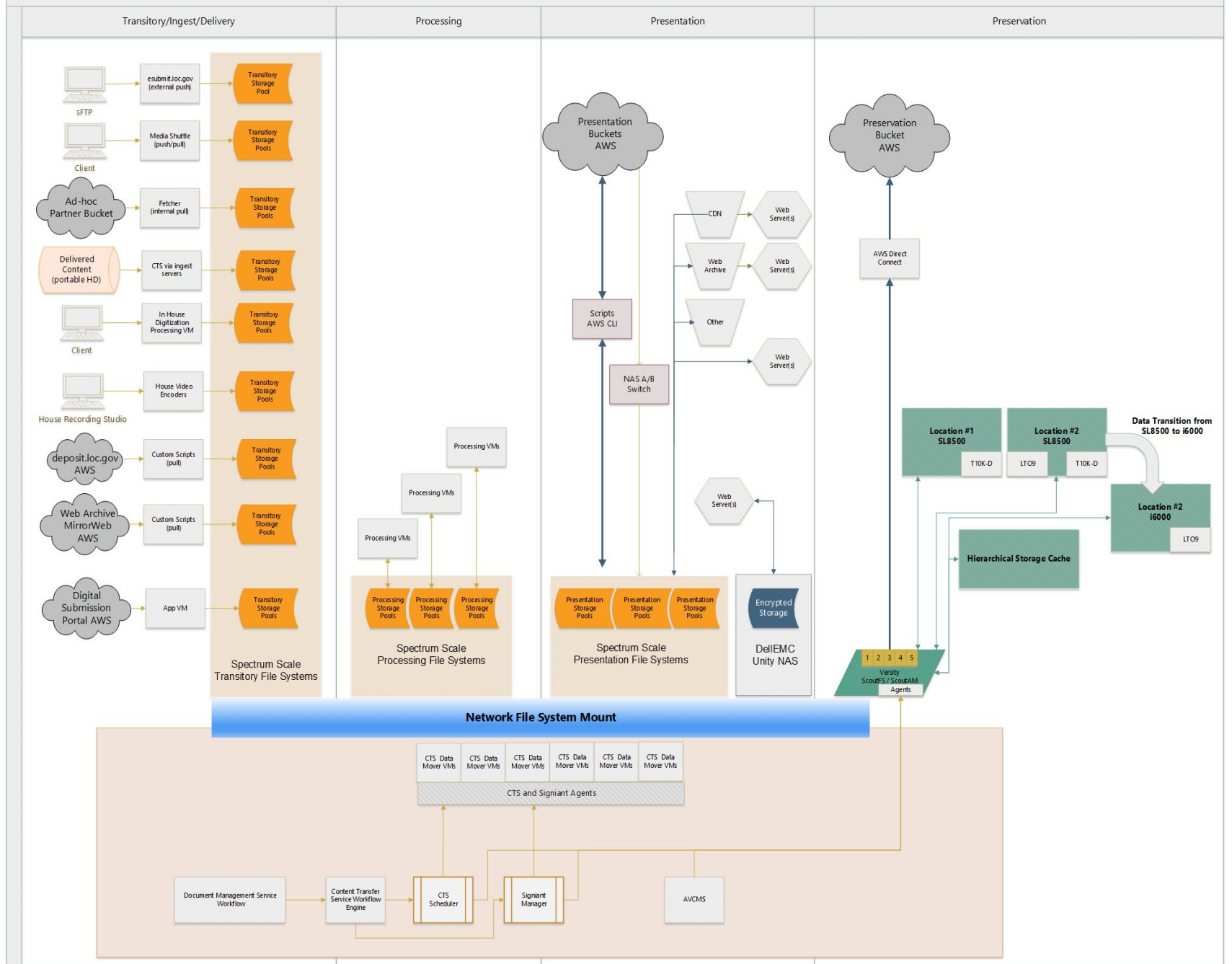
Presentation 5 Year Projected Growth (Single Copy)



Preservation 5 Year Projected Growth (Single Copy)



Current Storage Architecture



Unified Global Namespace Content Abstraction Layer

- No longer being researched (Why)
 - **Loss of control** of the backend when in-band data path is used
 - Location = Vendor
 - File or Object Name = Vendor
 - Database = Vendor
- A mix of legacy and vendor spaces may appear to be a single **Namespace**
- But what happens if/when these products are removed
 - Data migration for files/objects under product control
 - Migration from product to storage system
 - Some provide API's and scripts to move data
 - AWS migration could be costly
- So, how do we use this type of products:
 - We built an out-of-band A/B switch (MediaFlux)
 - Scan both internal and external storage
 - Provided fault / site tolerance

Perpetual Migration Continues

- Propagation of Preservation to AWS
 - Now in maintenance for this project (99.99% complete)
 - Daily and monthly transfer are handling differentials
 - Data verification is also continuing
- Upcoming Technology Change
 - Move to Converged Object Storage
 - OCIO Tape Archive Preservation System (OTAPS)
 - Migrate out of two (2) SL8500
 - Move off T10000D
 - Move off LTO9 in SL8500
 - Versity ScoutAM can read/write to S3
 - Issue: Can't perform object-restore in Glacier

Continuous Migration

From the 2017 Conference

From the 2012 Conference

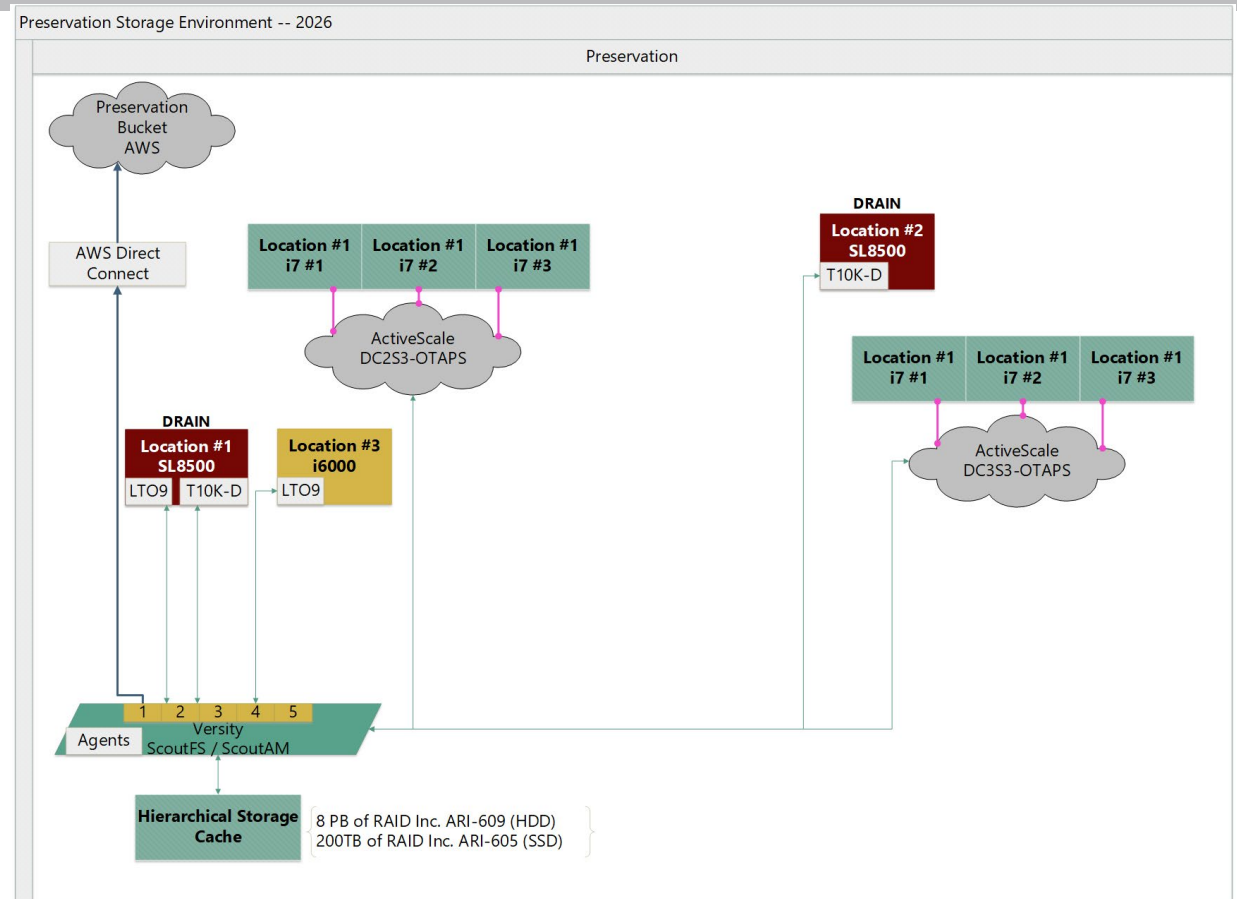


"Working on the cure for those suffering with digital Disposophobia"

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Converged Object Base Preservation Environment OCIO Tape Archive Preservation System (OTAPS)

- Product Selected
 - Integrator: Keeper Tech
 - System: Quantum ActiveScale with i7 tape libraries
 - Instituting RAIT, RAIL and Reed–Solomon ECC on media
 - Starting size is 40PB useable tape (Glacier) and 5PB (S3)



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Library of Congress Technology Refresh

Chris Barr

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Technology changes

- Dell Unity 600 primary storage fleet end of life in Jul 2026
- Cisco MDS SAN switch fabric end of life.
- Oracle SL8500 tape library end of life in Jul 2026.
- HPE Nimble HF storage platform end of life in 2028.
- Introduction of Quantum i6000 tape libraries and LTO9 for ScoutAM
- Refresh of ScoutAM servers. Introduction of RHEL9 and Cisco ACI environment.
- IBM StorageScale upgrade in Dec 2025 introduced CES/Ganesha stability improvements

Challenges

- Budgetary landscape
- Availability and cost of equipment due to AI demand
- Refresh of EOL Dell Unity storage with a managed service
- Introduction of 3rd party support to extend life of EOL tape libraries & SAN.
- Half of HPE Nimble HF fleet refreshed to Alletra last year. Remaining components to be refreshed in FY27.

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Thank you!

For More Information

Web: <https://digitalpreservation.gov/meetings/>

Points of Contact

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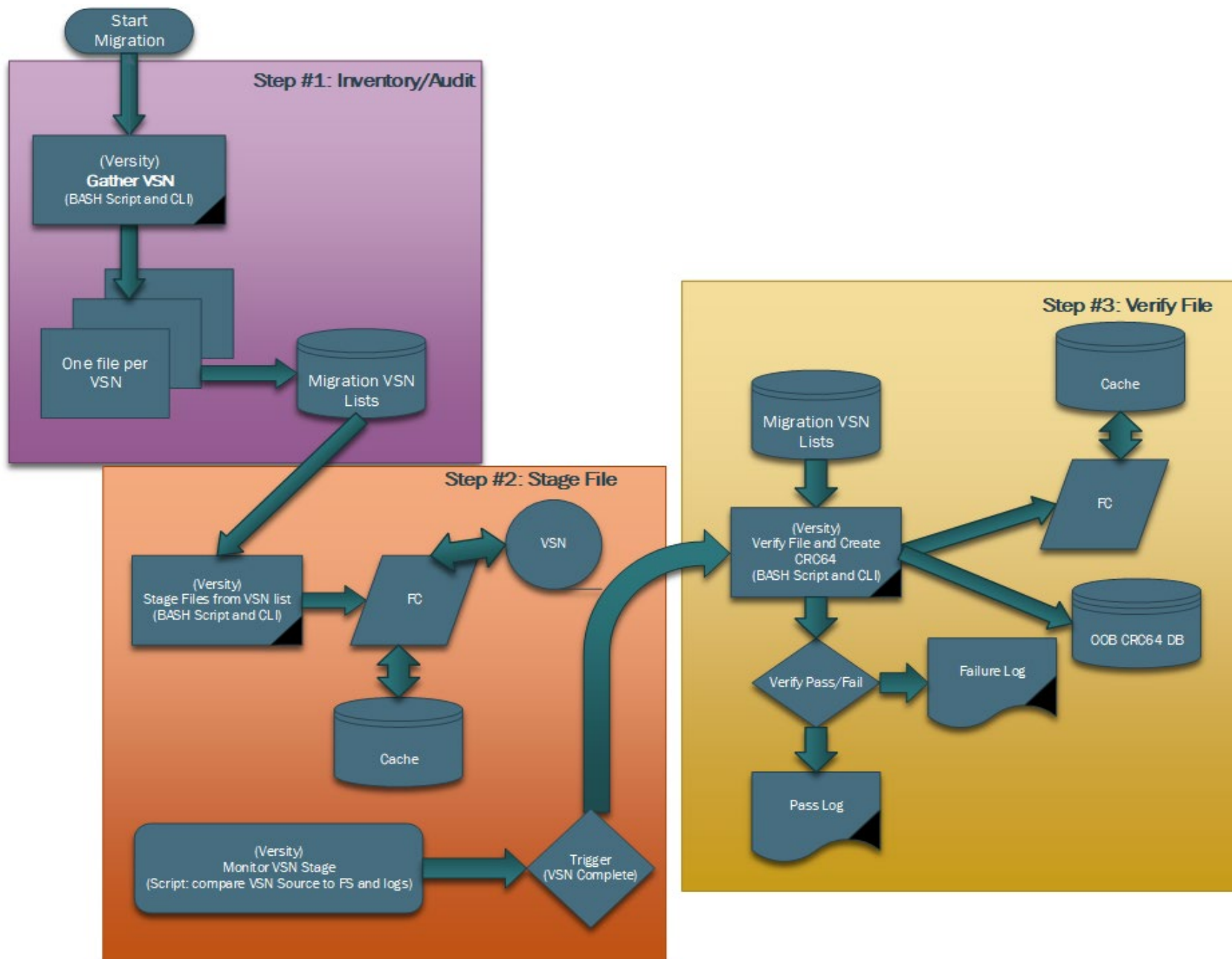
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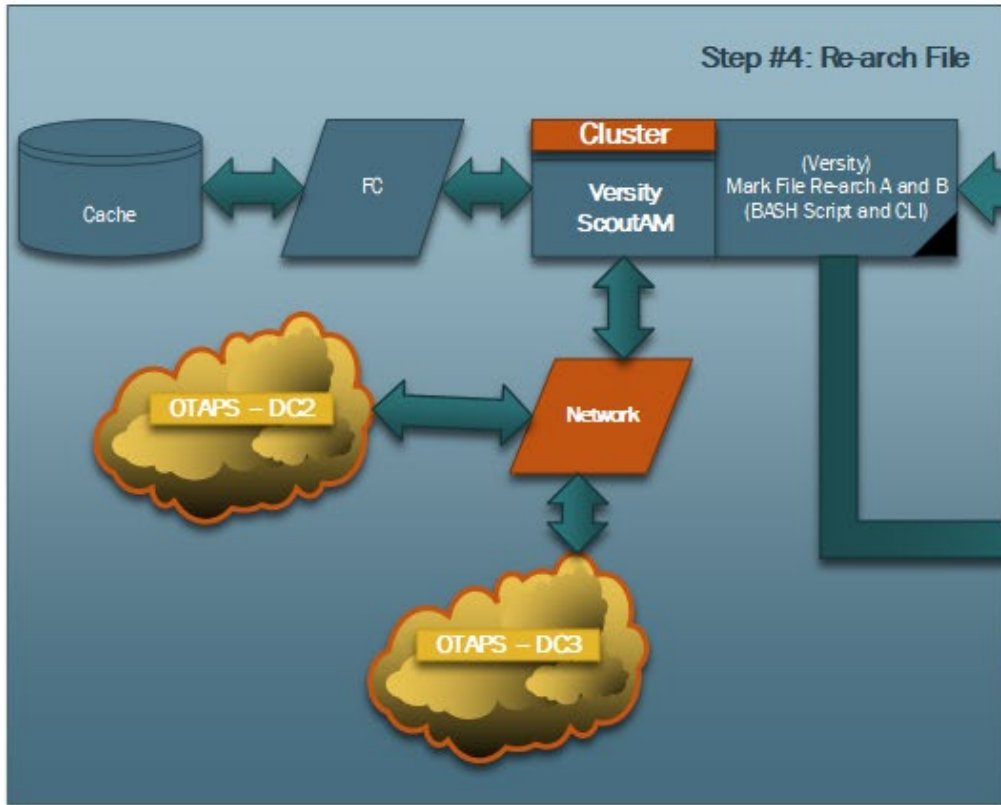
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Questions?

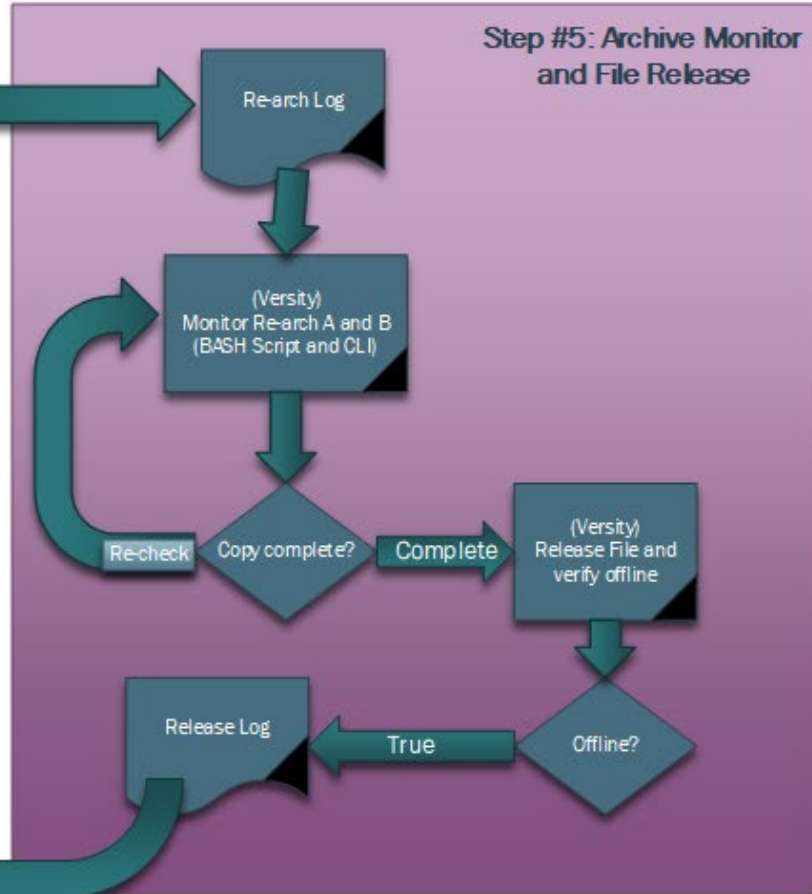
Migration Workflows



Migration Workflows



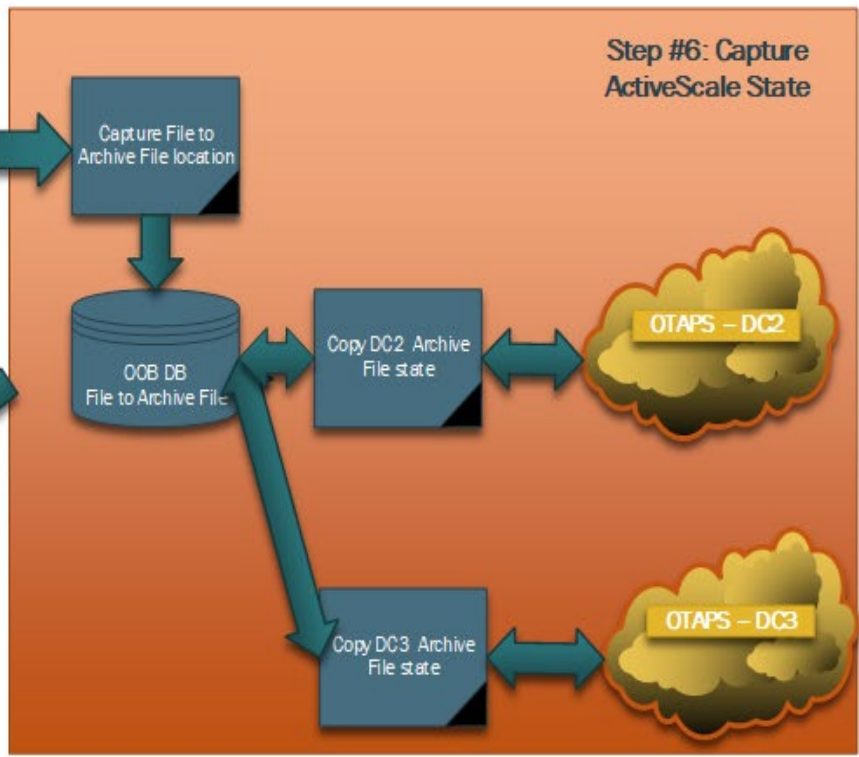
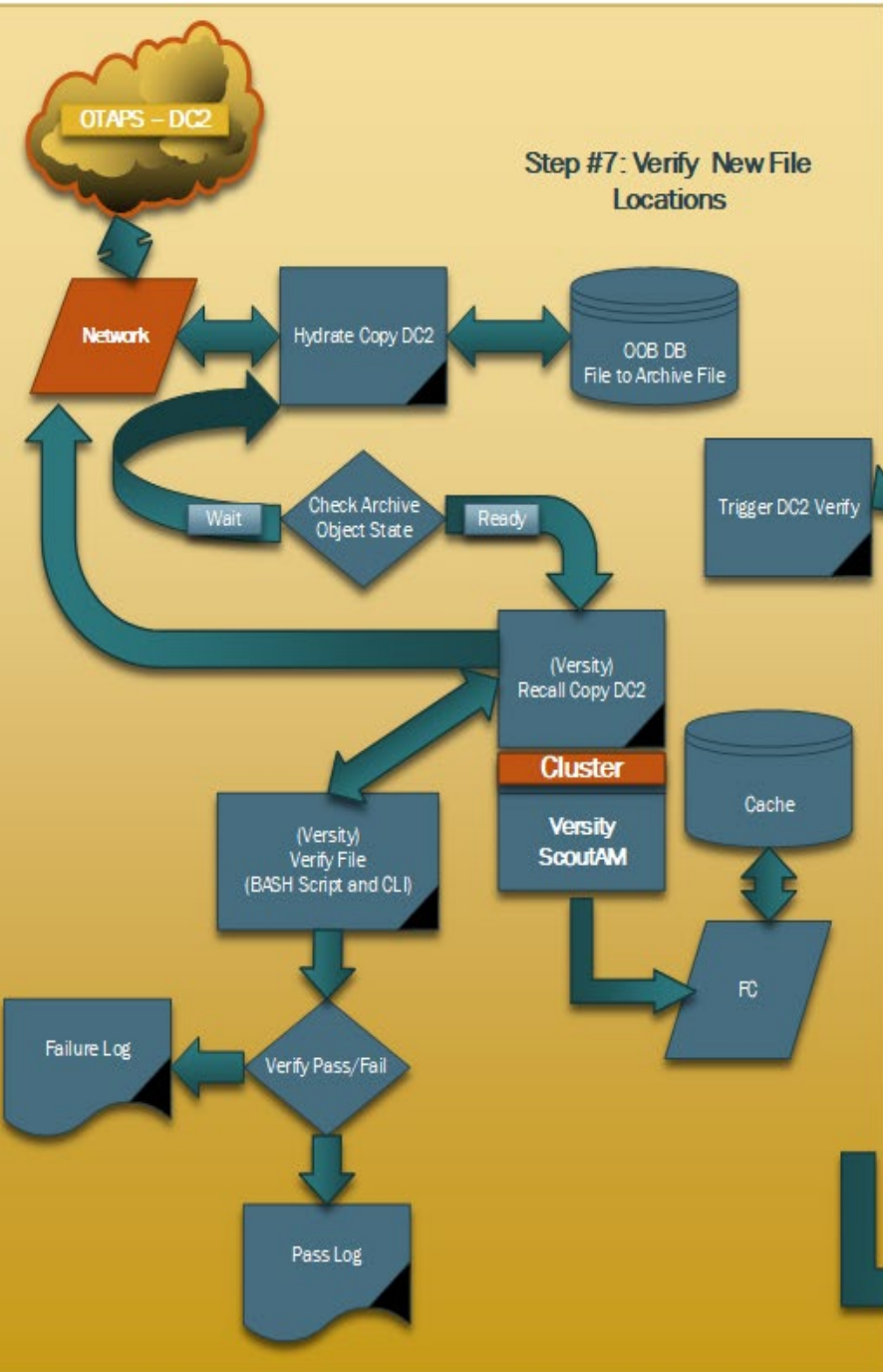
From Step #3



To Step #6

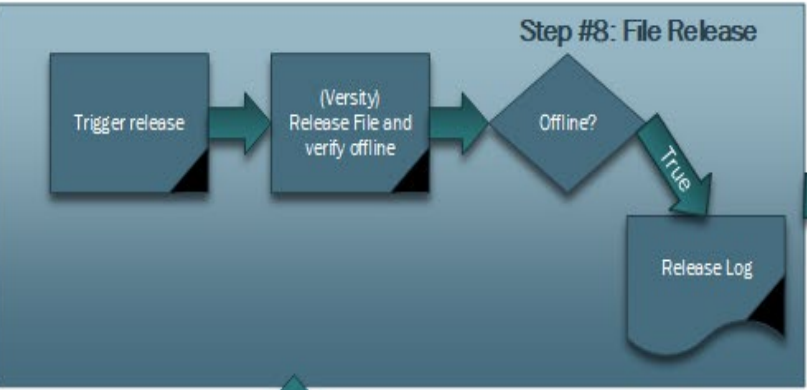
Migration Workflows

From Step #5

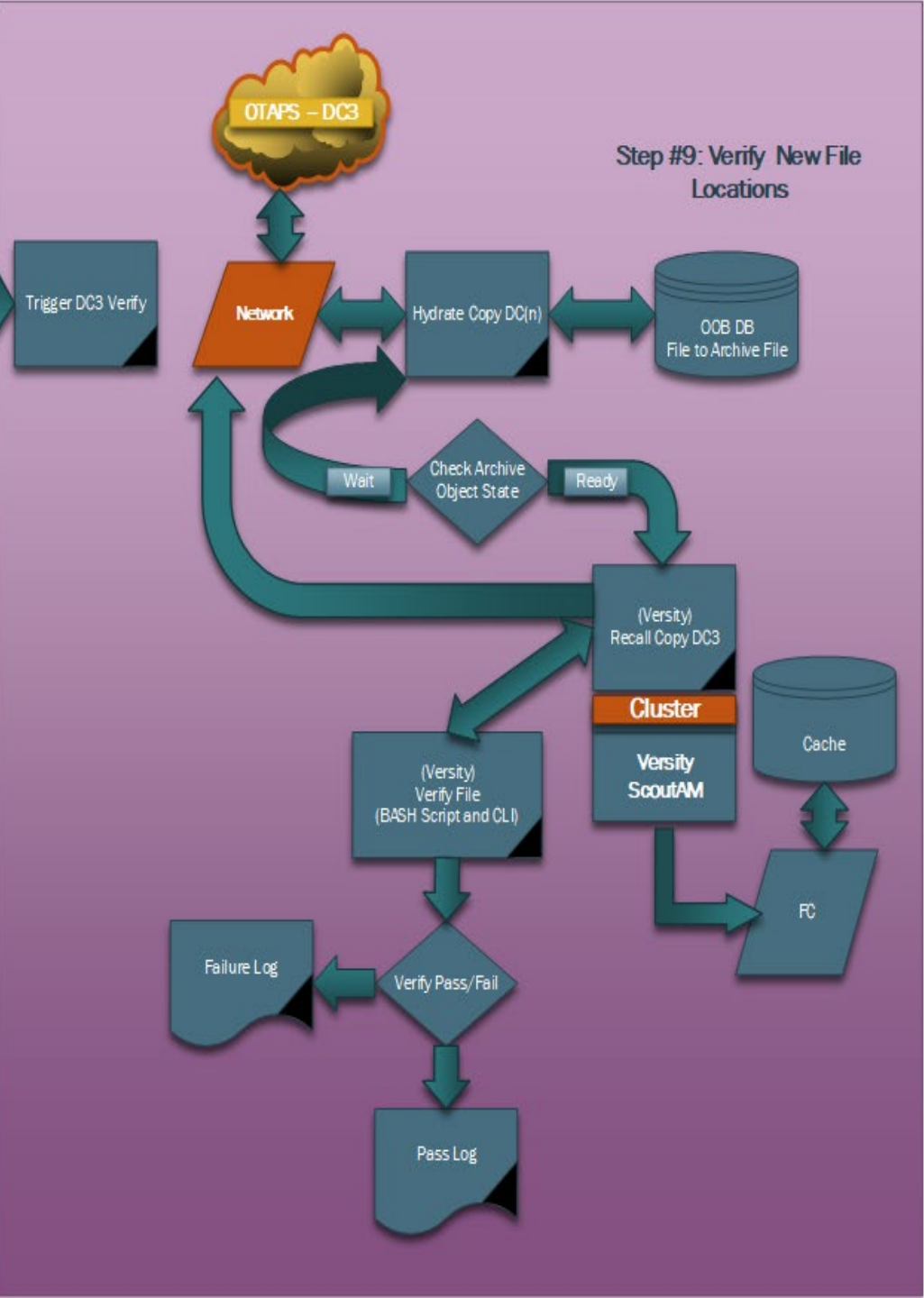


Migration Workflows

To Step #8



From Step #7



Migration Workflows