Audit Control Environment

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ACE Motivation

- Many archives use digests to monitor the integrity of their data.
- Most cannot assert their digests have not been tampered with.
- Should be lightweight
  - No Public/Private key infrastructure
- Must be able to be audited by any party
  - Auditor has no prior relationship with archive or depositor
  - Audit based only publically available information
ACE Concept

- Issue a small token that can be stored alongside an object to be preserved.
- The token secures the digest of the object.
- The token is cryptographically linked to an external witness value.
- Witness value is a single number/digest produced daily.
  - Easy to secure.
  - Small amount of data (several dozen KB/yr)
Components

• ACE Integrity Management Service
  - Issues tokens
  - Generates witness values
  - Provides token proof values

• ACE Audit Manager
  - Resides at archive, local auditor
  - Monitors files based on archive policy
  - Registers files, requests tokens, stores audit trails
  - Open Source / BSD license
All Components Auditable

• Local Audit
  – Provide a local audit of storage
  – ACE is local, but independent of the archive system

• IMS Audit
  – Prove that the keeper of round summaries isn’t acting malicious

• External Auditor
  – Prove to any outside party that any stored object is valid.
  – Financial, legal audit. Provide object along with proof
What can we prove?

• Witness to token validation shows
  – Object is intact if its digest matches the token
  – IMS and AM have not been compromised

• The file’s state can be linked to a 24 hour time window.
  – Token links to witness which covers 1 day.
How can it be used?

• Tokens can be created for items still at producer
  – Witness links file creation to point in time
• Proof can be provided during data distribution
  – 3rd party trusted distributor
• Facilitate secure transfer of digests and objects
Chronopolis Deployment

- Three sites
  - UMD, SDSC, NCAR
  - Differing hardware (linux/sun/filesystem/SAM QFS)
- 20+Tb monitored, 5+ million files
- UMD complete audit in a little over a week
- Bottleneck was underlying storage system
Additional Information

• http://adapt.umiacs.umd.edu/ace
  - Papers, results, etc..
  - Audit Manager, release and source

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