Developer Tutorial: Introducing the Cloud Data Management Interface – CDMI 1.1

SNIA – Cloud Storage Initiative
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Today’s Presenters

Alex McDonald  
SNIA CSI (Cloud Storage Initiative)  
Chair, NetApp

David Slik  
Co-Chair SNIA Cloud Technical Work Group  
Technical Director for Object Storage, NetApp
Introducing CDMI 1.1:
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“Follow Along” links
- Extensions: http://www.snia.org/tech_activities/publicreview/cdmi
- https://github.com/osaddon/cdmi
A Quick Review of CDMI

History of the standard

- Technical Working Group founded in 2009
  - Published TWG Charter and Use Cases

- CDMI Timeline:
  - 2010 - CDMI 1.0 Technical Architecture
  - 2011 - CDMI 1.0.1 Errata
  - 2012 - CDMI 1.0.2 Errata
  - 2013 - Adopted as ISO/IEC 17826
  - 2014 - CDMI 1.1.0 Technical Architecture
A Quick Review of CDMI
What is CDMI

❖ CDMI standardizes the following:
  ❖ How is data stored in the cloud
    ▶ Data objects, queues, metadata
  ❖ How is data stored in the cloud organized
    ▶ Containers, object IDs, query, snapshots
  ❖ How is data stored in the cloud transferred
    ▶ Client to cloud, cloud-to-cloud, exports, serialization, notifications
  ❖ How is data stored in the cloud secured
A Quick Review of CDMI
What is CDMI

- CDMI works with existing protocols:
  - File: NFS, CIFS, LTFS, etc.
  - Block: iSCSI, VMDKs, etc.
  - Object: S3, Swift, etc.

- CDMI fills many gaps in the above protocols
  - Unified storage management
  - Global and hierarchical namespaces
  - Query, notification and workflow
A Quick Review of CDMI
CDMI Adoption

- 22 publically announced CDMI servers
  - Major vendors (NetApp, DDN, etc)
  - Startup companies
  - Open source projects
- Widespread adoption in government
  - USA DoD, UK, Italy, etc.
- Supported in OpenStack Swift
To improve readability, the CDMI specification has been split into five parts:

- Preamble pp 1 – 25 25
- Basic Cloud Storage pp 27 – 41 15
- CDMI Core pp 42 – 108 67
- CDMI Advanced pp 109 – 235 127
- CDMI Annexes pp 235 – 256 22
Section 1 - Preamble

- References and Terms
- Provides an overview of cloud storage
- Provides an overview of the CDMI standard
- Defines the CDMI model for cloud storage and metadata
- Introduces general CDMI concepts:
  - Object Types, Object IDs, Time, use of HTTP, Security, Backwards Compatibility
Section 2 – Basic Cloud Storage

- Formerly “Non-CDMI” operations
- Defines basic RESTful operations for data objects and containers
- Compatible subset of CDMI, S3, Swift, etc.
  - Provides guidance for multi-protocol support
  - Also see the Header-based Metadata Extension
- Minimal baseline for cloud storage
Section 3 – CDMI Core

- Defines operations for CDMI Data Objects
- Defines operations for CDMI Containers
- Minimal baseline for CDMI-based systems
  - Containers optional
  - By ID only objects optional
  - Etc.
Section 4 – CDMI Advanced
- Defines operations for CDMI Domain Objects
- Defines operations for CDMI Queue Objects
- Defines operations for CDMI Capabilities
- Advanced Features of CDMI
  - Exports, Snapshots, Serialization, Metadata, Retention and Hold, Logging, Notifications, Query
Section 5 – CDMI Annexes

- Extensions to the CDMI standard implemented by at least one vendor
- Includes:
  - Summary Metadata for Bandwidth
  - Expiring ACLs
  - Group Storage System Metadata
  - Versioning
CDMI 1.1 Changes – Co-existence
Clarification- #904, #907, #918, #919, #931

- Clause 6 and 7 reworked
  - Clarifies that Non-CDMI operations represent basic RESTful HTTP operations that are consistent with most object storage protocols

- cdmi_authentication_methods
  - Text added explaining how S3, Keystone, etc work with CDMI
Copy and Move

- Copying data to an existing or new object has been clarified.
  - Behaviours are documented when fields in the source URI are omitted or specified
- Copying between and from queues have been clarified
  - Added `cdmi_copy_dataobject_from_queue`
- Domain move capability missing
CDMI 1.1 Changes – Container Fields
Clarification - #476

- childrenrange/children now optional on a container create
  - Eliminates an edge case where copying or deserializing a container could result in a large listing of children being returned

- Servers: No change required
- Clients: No longer depend on these fields being returned
CDMI 1.1 Changes – Container Fields
Clarification - #651

- Clarified contents of parentURI and parentID for root containers
  - Multiple vendors had chosen different approaches
  - Selected approach was “best compromise”

- Servers: Changes may be required
- Clients: Changes if depend on these fields
 Metadata updates, additions and deletions have been clarified in a new section: 16.6
  - Examples are already present in 1.0.2
  - Additional examples added

Mutability of storage and data system metadata
Default values of storage system metadata
The Location header must be an absolute URI

- A close reading of RFC 2616 should have already confirmed this for implementers.
CDMI 1.1 Changes – ACLs
Clarification - #812, #817, #890

- Clarified field results when ACL deny access to specific parts of objects
  - CDMI 1.0.2 approach was viewed as standard and intuitive, but needed to be specified normatively.
- Now indicates which status code to return
- Clarified that hex and string forms are allowed
- Servers: Changes may be required
- Clients: Changes if depend on these fields
CDMI 1.1 Changes – Retention and Hold Clarification - #894

- Additional examples added
CDMI 1.1 Changes – Scopes
New Functionality - #483, #508, #902

- CDMI Scopes have been enhanced to handle JSON arrays.
  - Required for querying against ACLs
- AND statements now use JSON arrays to avoid the use of duplicate keys
- Numeric query broken out

- Servers: Add new functionality if supported
- Clients: Changes required for numeric matching
CDMI 1.1 Changes – Queues

New Functionality - #515

- CDMI Queues now allow deletion by range
  - Allows idempotent deletes
- Servers: Add new functionality if supported
- Clients: No changes required
CDMI 1.1 Changes – Data Object Updates
New Functionality - #881

- Update range spec was unnecessarily restrictive
  - Now allows appends and sparse updates
- Servers: Add new functionality if supported
- Clients: No changes required
CDMI 1.1 Changes – Extensions
Multi-part MIME

- Allows the data object value to be sent as a separate MIME part, without requiring encoding
  - Improves efficiency of binary transfers
CDMI 1.1 Changes – Extensions
Domain Authentication Methods

- Allows a client to discover which authentication methods a server supports
- Allows an administrator to restrict which authentication methods are supported for a given domain
CDMI 1.1 Changes – Extensions
Group Storage System System Metadata

- Allows objects to have a specified “owner” that ACLs can refer to
- Allows broader compatibility with NFS and CIFS ACLs
CDMI 1.1 Changes – Extensions
Domain Summary Metadata

- Allows domain summaries to include information about bandwidth consumed
  - Network bytes
  - Reads & Writes
  - Public and Private (Internal) I/O
CDMI 1.1 Changes – Extensions

Expiring ACEs

- Allows ACEs to have an expiration time, when the ACE will no longer be evaluated as part of the ACL
  - Allows time-limited access
  - Allows content to become public after a period of time
Allows data objects to retain historical versions as changes are made

- Historical versions are accessed by ID
- Historical versions are enumerated as a tree
- Enables multi-writer conflict resolution
- Simplifies federation, distributed storage and disconnected operation
Guidance for CDMI 1.1 Adoption

- Review the CDMI 1.1 spec and errata, which is posted on the SNIA public review site
  - http://www.snia.org/tech_activities/publicreview
- Most vendors will be able to support 1.0.2 and 1.1 clients without changes.
  - Review error handling, data object update and container field behaviours
  - Consider adding support for Multi-part MIME
Come visit us at the Cloud Plugfests

Two closely coupled events are planned in December 2014:
- Virtual Cloud Plugfest Dec. 8-12, 2014
- Cloud Interoperability Demo Days Dec. 11-12, 2014 in London

For more details, see [http://www.cloudplugfest.org/](http://www.cloudplugfest.org/)

“Follow Along” links
- [https://github.com/osaddon/cdmi](https://github.com/osaddon/cdmi)
Introducing CDMI 1.1

Questions and Answers

Contact Info:

dslik@netapp.com
alexmc@netapp.com
After This Webcast

- This webcast and a copy of the slides will be posted to the SNIA Cloud Storage Initiative (CSI) website and available on-demand
  - http://www.snia.org/forum/csi/knowledge/webcasts

- A full Q&A from this webcast, including answers to questions we couldn't get to today, will be posted to the SNIA-CSI blog
  - http://www.sniacloud.com/
Conclusion

Thank You