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Information technology — Cloud Data Management Interface (CDMI) Version 2.0.0

Technologies de l'information — Interface de management des données du nuage informatique (CDMI) Version 2.0.0

Reference number
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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of document should be noted (see www.iso.org/directives or www.iec.ch/members_experts/refdocs).

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This document was prepared by SNIA (as Cloud Data Management Interface (CDMI™), Version 2.0.0) and drafted in accordance with its editorial rules. It was adopted, under the JTC 1 PAS procedure, by Joint Technical Committee ISO/IEC JTC 1, Information technology.

This third edition cancels and replaces the second edition (ISO/IEC 17826:2016), which has been technically revised.

The main changes are as follows:

— Specification changes:

  — no longer a reliance on X-CDMI-SPECIFICATION-VERSION header, as per IETF guidelines;

  — support for PATCH HTTP verb, in addition of PUT, for resource updates;

  — use of /cdmi/v2.0.0/ root URI in examples;

  — new format for query parameters in URIs;

  — exports section has been re-written;

  — versioning examples have been updated;

  — audit and logging clauses have been removed (due to no vendor implementations);

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- Bibliography section has been re-written;
- RFC references have been updated;
- HTTPS is used instead of HTTP in examples;
- references updated from CIFS to SMB;
- document formatting cleanup.

- Incorporated Extensions into Specification:
  - Encrypted Object extension;
  - Delegated Access Control extension;
  - JSON Transfer Encoding extension.
- Incorporated Extensions into Annex A:
  - summary metadata for bandwidth;
  - expiring access control entries;
  - group storage system metadata;
  - header-based metadata;
  - immediate query.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html and www.iec.ch/national-committees.

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Table of Contents:

I CDMI Preamble 1

Clause 1: Scope 3

Clause 2: Normative references 4

Clause 3: Terms, acronyms, and definitions 6

Clause 4: Conventions 11
4.1 Interface format . . . 11
4.2 Typographical conventions . . . 12
4.3 Request and response body requirements . . . 13
4.4 Key Word requirements . . . 14

Clause 5: Overview of Cloud Storage 15
5.1 Overview . . . 15
5.2 Reference model for cloud storage interfaces . . . 18
5.3 Cloud data management interface . . . 19
5.4 Security . . . 23
5.5 Required HTTP support . . . 25
5.6 Time representations . . . 28
5.7 Backwards compatibility . . . 29
5.8 Object references . . . 30

II Basic Cloud Storage 32

Clause 6: Data Object Resource Operations using HTTP 33
6.1 Overview . . . 33
6.2 Create a data object using HTTP . . . 34
6.3 Read a data object using HTTP . . . 36
6.4 Update a data object using HTTP . . . 39
6.5 Delete a data object using HTTP . . . 41

Clause 7: Container Object Resource Operations using HTTP 43
7.1 Overview . . . 43
7.2 Create a container object using HTTP . . . 44
7.3 Read a container object using HTTP . . . 46
7.4 Update a container object using HTTP . . . 47
7.5 Delete a container object using HTTP . . . 48
7.6 Create (POST) a new data object using HTTP . . . 50

III CDMI Core 52

Clause 8: Data Object Resource Operations using CDMI 53
8.1 Overview . . . 53
8.2 Data object details . . . 54
8.3 Create a data object using CDMI . . . 56
8.4 Read a data object using CDMI . . . 67
8.5 Update a data object using CDMI . . . 76
8.6 Delete a data object using CDMI . . . 85

Clause 9: Container Object Resource Operations using CDMI 87
9.1 Overview . . . 87
9.2 Container object details . . . 88
9.3 Create a container object using CDMI . . . 90
9.4 Read a container object using CDMI . . . 97
9.5 Update a container object using CDMI . . . 102

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9.6 Delete a container object using CDMI . . . 107
9.7 Create (POST) a new data object using CDMI . . . 109
9.8 Create (POST) a new queue object using CDMI . . . 119

IV CDMI Advanced 125

Clause 10: Domain object resource operations using CDMI 126
10.1 Overview . . . 126
10.2 Domain object details . . . 128
10.3 Domain object summaries . . . 131
10.4 Domain object membership . . . 134
10.5 Create a domain object using CDMI . . . 137
10.6 Read a domain object using CDMI . . . 141
10.7 Update a domain object using CDMI . . . 145
10.8 Delete a domain object using CDMI . . . 149

Clause 11: Queue object resource operations using CDMI 151
11.1 Overview . . . 151
11.2 Queue object details . . . 152
11.3 Create a queue object using CDMI . . . 155
11.4 Read a queue object using CDMI . . . 161
11.5 Update a queue object using CDMI . . . 168
11.6 Delete a queue object using CDMI . . . 172
11.7 Enqueue a new queue object value using CDMI . . . 174
11.8 Delete a queue object value using CDMI . . . 180

Clause 12: Capability object resource operations using CDMI 182
12.1 Overview . . . 182
12.2 Capability object details . . . 183
12.3 Read a capabilities object using CDMI . . . 199

Clause 13: Exported protocols 204
13.1 Overview . . . 204
13.2 Container object export details . . . 205
13.3 NFS exported protocol . . . 208
13.4 SMB exported protocol . . . 210
13.5 iSCSI exported protocol . . . 211
13.6 WebDAV exported protocol . . . 212
13.7 OCCI exported protocol . . . 213

Clause 14: CDMI snapshots 215
14.1 Overview . . . 215
14.2 Creating a snapshot . . . 216
14.3 Deleting a snapshot . . . 217

Clause 15: Serialization/deserialization 218
15.1 Overview . . . 218
15.2 Canonical format . . . 219
15.3 Exporting serialized data . . . 221
15.4 Importing serialized data . . . 222

Clause 16: Metadata 223
16.1 Overview . . . 223
16.2 Support for storage system metadata . . . 224
16.3 Support for data system metadata . . . 226
16.4 Support for provided data system metadata . . . 234
16.5 Support for user metadata . . . 236
16.6 Metadata update operations . . . 237

Clause 17: Access control 238
17.1 Overview . . . 238
17.2 Access control flow . . . 239

Clause 18: Retention and hold management 251
18.1 Overview . . . 251
18.2 Retention management disciplines . . . 252
18.3 CDMI retention . . . 253
18.4 CDMI hold . . . 255
18.5 CDMI auto-deletion . . . 258

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18.6 Retention security considerations . . . 259

Clause 19: Scope specification **260**
19.1 Overview . . . 260
19.2 Examples . . . 261
19.3 Query matching expressions . . . 263

Clause 20: Results specification **266**
20.1 Overview . . . 266
20.2 Examples . . . 267

Clause 21: Notification queues **268**
21.1 Overview . . . 268
21.2 Metadata . . . 269

Clause 22: Query queues **273**
22.1 Overview . . . 273
22.2 Extending CDMI query . . . 275

Clause 23: Encrypted objects **276**
23.1 Overview . . . 276
23.2 Encryption operations . . . 277
23.3 Example uses of encrypted objects . . . 280
23.4 KMS integration . . . 281
23.5 CMS format . . . 282
23.6 JOSE format . . . 283
23.7 Signature/digest verification . . . 284
23.8 Error handling . . . 285

Clause 24: Delegated access control **286**
24.1 Overview . . . 286
24.2 Delegated access control (DAC) . . . 288
24.3 Delegated access control message exchange . . . 290
24.4 Client header passthrough . . . 292
24.5 DAC request . . . 293
24.6 Packaged DAC request . . . 295
24.7 DAC response . . . 296
24.8 Packaged DAC response . . . 297
24.9 Error handling . . . 299
24.10 Examples . . . 300

Clause 25: Data object versions **311**
25.1 Overview . . . 311
25.2 Traversing version-enabled data objects . . . 313
25.3 Concurrent updates and version-enabled data objects . . . 314
25.4 Capabilities for version-enabled data objects . . . 316
25.5 Updates triggering version creation . . . 317
25.6 Operations on version-enabled data objects . . . 318
25.7 Operations on data object versions . . . 319
25.8 Query of data object versions . . . 320
25.9 Version-enabled data object serialization . . . 321

V CDMI Annexes **323**

Clause 26: Extensions **324**
26.1 Overview . . . 324
26.2 Summary metadata for bandwidth . . . 325
26.3 Expiring access control entries (ACEs) . . . 327
26.4 Group storage system metadata . . . 328
26.5 Header-based metadata . . . 329
26.6 Immediate query . . . 337

VI References **340**

Bibliography **341**

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List of Figures

Fig. 1: Existing data storage interface standards . . . 16
Fig. 2: Storage interfaces for object storage client data . . . 16
Fig. 3: Cloud storage reference model . . . 18
Fig. 4: CDMI object model . . . 20
Fig. 5: Object transitions between named and ID-only . . . 21
Fig. 6: CDMI URI Components . . . 26

Fig. 7: Hierarchy of domains . . . 126

Fig. 8: Hierarchy of capabilities . . . 183

Fig. 9: CDMI and OCCI in an integrated cloud computing environment . . . 213

Fig. 10: Snapshot container structure . . . 215

Fig. 11: Access control flow . . . 239

Fig. 12: Object retention . . . 253
Fig. 13: Object hold . . . 255
Fig. 14: Object hold on object with retention . . . 255
Fig. 15: Object with multiple holds . . . 256

Fig. 16: Encrypted object state transistions . . . 277

Fig. 17: Non-delegated (ACL-based) access control data flow . . . 286
Fig. 18: Delegated access control data flow example for non-encrypted object . . . 290
Fig. 19: Delegated access control data flow example for encrypted object . . . 291

Fig. 20: Updates to a non-version-enabled data object . . . 311
Fig. 21: Updates to a version-enabled data object . . . 312
Fig. 22: Linkages between a version-enabled data object and data object versions . . . 313
Fig. 23: Overlapping concurrent updates . . . 314
Fig. 24: Linkages for overlapping updates . . . 314
Fig. 25: Nested concurrent updates . . . 315
Fig. 26: Linkages for nested updates . . . 315
Fig. 27: Version to `capabilityURI` relationships . . . 316

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List of Tables

Table 1: Overview of this document . . . 2

Table 2: Interface format . . . 11
Table 3: Key word requirements . . . 14

Table 4: Types of resources in the CDMI object model . . . 20
Table 5: Creation/consumption of storage system metadata . . . 21
Table 6: Object ID format . . . 22
Table 7: Relative URIs resolved against root URIs . . . 27

Table 8: Capabilities - Create a CDMI data object using HTTP . . . 34
Table 9: Request headers - Create a CDMI data object using HTTP . . . 34
Table 10: HTTP status codes - Create a data object using HTTP . . . 35
Table 11: Capabilities - Read a CDMI data object using HTTP . . . 36
Table 12: Request header - Read a CDMI data object using HTTP . . . 36
Table 13: Response headers - Read a CDMI Data Object using HTTP . . . 37
Table 14: HTTP status codes - Read a CDMI data object using HTTP . . . 37
Table 15: Capabilities - Update a CDMI data object using HTTP . . . 39
Table 16: Request headers - Update a CDMI data object using HTTP . . . 39
Table 17: Response header - Update a CDMI data object using HTTP . . . 40
Table 18: HTTP status codes - Update a CDMI data object using HTTP . . . 40
Table 19: Capabilities - Delete a CDMI data object using HTTP . . . 41
Table 20: HTTP status codes - Delete a CDMI data object using HTTP . . . 41

Table 21: Capabilities - Create a CDMI container object using HTTP . . . 44
Table 22: HTTP status codes - Create a container object using HTTP . . . 44
Table 23: Capabilities - Delete a CDMI container object using HTTP . . . 48
Table 24: HTTP status codes - Delete a CDMI container object using HTTP . . . 49
Table 25: Capabilities - Create a CDMI data object using HTTP POST . . . 50
Table 26: Request header - Create a new data object using HTTP . . . 50
Table 27: Response header - Create a new data object using HTTP . . . 51
Table 28: HTTP status codes - Create a new data object using HTTP . . . 51

Table 29: Capabilities - Create a CDMI data object using CDMI . . . 57
Table 30: Request headers - Create a CDMI data object using CDMI . . . 57
Table 31: Request message body - Create a data object using CDMI . . . 58
Table 32: Response headers - Create a data object using CDMI . . . 61
Table 33: Response message body - Create a data object using CDMI . . . 61
Table 34: HTTP status codes - Create a data object using CDMI . . . 62
Table 35: Capabilities - Read a CDMI data object using CDMI . . . 67
Table 36: Request headers - Read a CDMI data object using CDMI . . . 67
Table 37: Response headers - Read a CDMI data object using CDMI . . . 68
Table 38: Response message body - Read a CDMI data object using CDMI . . . 68
Table 39: HTTP status codes - Read a CDMI data object using CDMI . . . 70
Table 40: Capabilities - Update a CDMI data object using CDMI . . . 76
Table 41: Request headers - Update a CDMI data object using CDMI . . . 77
Table 42: Request message body - Update a CDMI data object using CDMI . . . 77
Table 43: Response header - Update a CDMI data object using CDMI . . . 80
Table 44: HTTP status codes - Update a CDMI data object using CDMI . . . 80
Table 45: Capabilities - Delete a CDMI data object using CDMI . . . 85
Table 46: HTTP status codes - Delete a CDMI data object using CDMI . . . 85

Table 47: Container metadata . . . 89
Table 48: Capabilities - Create a CDMI container object using CDMI . . . 91
Table 49: Request headers - Create a container object using CDMI . . . 91
Table 50: Request message body - Create a container object using CDMI . . . 91
Table 51: Response headers - Create a container object using CDMI . . . 93
Table 52: Response message body - Create a container object using CDMI . . . 93

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Table 53: HTTP status codes - Create a CDMI container object using CDMI . . . 94
Table 54: Capabilities - Read a CDMI Container Object using CDMI . . . 97
Table 55: Request headers - Read a container object using CDMI . . . 97
Table 56: Response headers - Read a container object using CDMI . . . 98
Table 57: Response message body - Read a container object using CDMI . . . 98
Table 58: HTTP status codes - Read a container object using CDMI . . . 99
Table 59: Capabilities - Update a CDMI container object using CDMI . . . 103
Table 60: Request headers - Update a container object using CDMI . . . 103
Table 61: Request message body - Update a container object using CDMI . . . 103
Table 62: Response header - Update a container object using CDMI . . . 105
Table 63: HTTP status codes - Update a container object using CDMI . . . 105
Table 64: Capabilities - Delete a CDMI container object using CDMI . . . 107
Table 65: HTTP status codes - Delete a container object using CDMI . . . 108
Table 66: Capabilities - Create a CDMI data object using CDMI . . . 110
Table 67: Request headers - Create a new data object Using CDMI . . . 111
Table 68: Request message body - Create a new data object Using CDMI . . . 111
Table 69: Response headers - Create a new data object using CDMI . . . 115
Table 70: Response message body - Create a new data object using CDMI . . . 115
Table 71: HTTP status codes - Create a new data object using CDMI . . . 116
Table 72: Capabilities - Create a CDMI Queue object using CDMI . . . 120
Table 73: Request headers - Create a new queue object using CDMI . . . 120
Table 74: Request message body - Create a new queue object using CDMI . . . 121
Table 75: Response headers - Create a new queue object using CDMI . . . 122
Table 76: Response message body - Create a new queue object using CDMI . . . 122
Table 77: HTTP status codes - Create a new queue object using CDMI . . . 123

Table 78: Required metadata for a domain object . . . 129
Table 79: Contents of domain summary objects . . . 132
Table 80: Required settings for domain member user objects . . . 134
Table 81: Required settings for domain member delegation objects . . . 135
Table 82: Capabilities - Create a CDMI domain object using CDMI . . . 137
Table 83: Request headers - Create a domain object using CDMI . . . 137
Table 84: Request message body - Create a domain object using CDMI . . . 138
Table 85: Response headers - Create a domain object using CDMI . . . 139
Table 86: Response message body - Create a domain object using CDMI . . . 139
Table 87: HTTP status codes - Create a domain object using CDMI . . . 140
Table 88: Capabilities - Read a CDMI domain object using CDMI . . . 141
Table 89: Request headers - Read a domain object using CDMI . . . 141
Table 90: Response headers - Read a domain object using CDMI . . . 142
Table 91: Response message body - Read a domain object using CDMI . . . 142
Table 92: HTTP status codes - Read a domain object using CDMI . . . 143
Table 93: Capabilities - Update a CDMI domain object using CDMI . . . 145
Table 94: Request headers - Update a domain object using CDMI . . . 145
Table 95: Request message body - Update a domain object using CDMI . . . 146
Table 96: Response header - Update a domain object using CDMI . . . 147
Table 97: HTTP status codes - Update a domain object using CDMI . . . 147
Table 98: Capabilities - Delete a CDMI domain object using CDMI . . . 149
Table 99: HTTP status codes - Delete a domain object using CDMI . . . 150

Table 100: Capabilities - Create a CDMI queue object using CDMI . . . 155
Table 101: Request headers - Create a queue object Using CDMI . . . 156
Table 102: Request message body - Create a queue object using CDMI . . . 156
Table 103: Response headers - Create a queue object Using CDMI . . . 158
Table 104: Response message body - Create a queue object using CDMI . . . 158
Table 105: HTTP status codes - Create a queue object using CDMI . . . 159
Table 106: Capabilities - Read a CDMI queue object using CDMI . . . 161
Table 107: Request headers - Read a queue object using CDMI . . . 162
Table 108: Response headers - Read a queue object using CDMI . . . 162
Table 109: Response message body - Read a queue object using CDMI . . . 162
Table 110: HTTP status codes - Read a queue object using CDMI . . . 165
Table 111: Capabilities - Update a queue object using CDMI . . . 168
Table 112: Request headers - Update a queue object Using CDMI . . . 168
Table 113: Request message body - Update a queue object Using CDMI . . . 168
Table 114: Response header - Update a queue object Using CDMI . . . 170
Table 115: HTTP status codes - Update a queue object using CDMI . . . 170
Table 116: Capabilities - Delete a queue object using CDMI . . . 172
Table 117: HTTP status codes - Delete a queue object Using CDMI . . . 173
Table 118: Capabilities - Enqueue a new queue object value using CDMI . . . 174
Table 119: Request headers - Enqueue a new queue object value using CDMI . . . 174
Table 120: Request message body - Enqueue a new queue object value using CDMI . . . 175

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Table 121: HTTP status codes - Enqueue a new queue object value Using CDMI . . . 177
Table 122: Capabilities - Delete a queue object value using CDMI . . . 180
Table 123: HTTP status codes - Delete a queue object value using CDMI . . . 181

Table 124: System-wide capabilities . . . 185
Table 125: Capabilities for storage system metadata . . . 189
Table 126: Capabilities for data system metadata . . . 190
Table 127: Capabilities for data objects . . . 193
Table 128: Capabilities for container objects . . . 194
Table 129: Capabilities for domain objects . . . 196
Table 130: Capabilities for queue objects . . . 198
Table 131: Capabilities - Read a capabilities object using CDMI . . . 199
Table 132: Request headers - Read a capabilities object using CDMI . . . 199
Table 133: Response headers - Read a capabilities object Using CDMI . . . 200
Table 134: Response message body - Read a capabilities object using CDMI . . . 200
Table 135: HTTP status codes - Read a capabilities object using CDMI . . . 201

Table 136: Elements of the NFS protocol export structure . . . 208
Table 137: Elements of the SMB protocol export structure . . . 210
Table 138: Elements of the iSCSI protocol export structure . . . 211
Table 139: Elements of the WebDAV protocol export structure . . . 212

Table 140: Serialization import behaviour . . . 222

Table 141: Storage system metadata . . . 224
Table 142: Data system metadata . . . 226
Table 143: Provided values of data system metadata . . . 234

Table 144: ACE types . . . 241
Table 145: Who identifiers . . . 241
Table 146: ACE flags . . . 241
Table 147: ACE masks bits . . . 243
Table 148: ACE bit mask/string . . . 249

Table 149: Query matching expressions . . . 263

Table 150: Required metadata for a notification queue . . . 269
Table 151: Notification status metadata . . . 272

Table 152: Required metadata for a query queue . . . 273
Table 153: Query status metadata . . . 274

Table 154: Access modes for DAC . . . 288
Table 155: DAC request . . . 293
Table 156: Packaged DAC request . . . 295
Table 157: DAC response . . . 296
Table 158: Packaged DAC response . . . 297

Table 159: Version-enabled data object metadata items . . . 313

Table 161: Response headers - Inspect a data object using HTTP . . . 330
Table 162: HTTP status codes - Inspect a data object using HTTP . . . 331
Table 163: Request headers - Create a container object using HTTP . . . 333
Table 164: Response Headers - Inspect a container object using HTTP . . . 334
Table 165: HTTP status codes - Inspect a container object using HTTP . . . 334
Table 167: Required metadata for a query queue . . . 338

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Part I

CDMI Preamble

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This Cloud Data Management Interface (CDMI™) International Standard is intended for application developers who are implementing or using cloud storage. It documents how to access cloud storage and to manage the data stored there.

This document is organized as follows:

Table 1: Overview of this document

Clause 1	Scope	Defines the scope of this document
Clause 2	Normative references	Lists the normative references for this document
Clause 3	Terms	Provides terminology used in this document
Clause 4	Conventions	Describes the conventions used in presenting the interfaces and the typographical conventions used in this document
Clause 5	Overview of Cloud Storage	Provides a brief overview of cloud storage and details the philosophy behind this International Standard as a model for the operations
Clause 6	Data Object Resource Operations using HTTP	Provides the normative standard of data object resource operations using HTTP
Clause 7	Container Object Resource Operations using HTTP	Provides the normative standard of container object resource operations using HTTP
Clause 8	Data Object Resource Operations using CDMI	Provides the normative standard of data object resource operations using CDMI
Clause 9	Container Object Resource Operations using CDMI	Provides the normative standard of container object resource operations using CDMI
Clause 10	Domain Object Resource Operations using CDMI	Provides the normative standard of domain object resource operations using CDMI
Clause 11	Queue Object Resource Operations using CDMI	Provides the normative standard of queue object resource operations using CDMI
Clause 12	Capability Object Resource Operations using CDMI	Provides the normative standard of capability object resource operations using CDMI
Clause 13	Exported Protocols	Discusses how virtual machines in the cloud computing environment can use the exported protocols from CDMI containers
Clause 14	Snapshots	Discusses how snapshots are accessed under CDMI containers
Clause 15	Serialization/ Deserialization	Discusses serialization and deserialization, including import and export of serialized data under CDMI
Clause 16	Metadata	Provides the normative standard of the metadata used in the interface
Clause 18	Retention and Hold Management	Describes the optional retention management disciplines to be implemented into the system management functions
Clause 19	Scope Specification	Describes the structure of the scope specification for JSON objects
Clause 20	Results Specification	Provides a standardized mechanism to define subsets of CDMI object contents
Clause 21	Notification Queues	Describes how CDMI clients can efficiently discover what changes have occurred to the system
Clause 22	Query Queues	Describes how CDMI clients can efficiently discover what content matches a given set of metadata query criteria or full-content search criteria
Clause 23	Encrypted Objects	Describes how to work with transparently encrypted objects
Clause 24	Delegated Access Control	Describes how to delegate access control to external systems
Clause 25	Data Object Versions	Describes how to work with versioned data objects
Clause 26	Extensions	Provides informative vendor extensions. Each extension is added to the standard when at least two vendors implement the extension.

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Clause 1

Scope

This CDMI™ International Standard specifies the interface to access cloud storage and to manage the data stored therein. This International Standard applies to developers who are implementing or using cloud storage.

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Clause 2

Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

The provisions of the referenced specifications other than ISO/IEC, IEC, ISO, and ITU documents, as identified in this clause, are valid within the context of this International Standard. The reference to such a specification within this International Standard does not give it any further status within ISO/IEC. In particular, it does not give the referenced specifications the status of an International Standard.

ISO 3166:2013, *Codes for the representation of names of countries and their subdivisions (Parts 1, 2 and 3)* - see [35][36][37]

ISO 4217:2015, *Codes for the representation of currencies and funds* - see [38]

ISO 8601:2019, *Data elements and interchange formats – Information interchange – Representation of dates and times* - see [32][33]

ISO/IEC 9594-8:2017, *Information technology – Open Systems Interconnection – The Directory: Public-key and attribute certificate frameworks* - see [43]

ISO 14721:2012, *Space data and information transfer systems – Open archival information system (OAIS) – Reference model* - see [34]

ISO/IEC 14776-414:2009, *SCSI Architecture Model - 4 (SAM-4)* - see [29]

ISO/IEC 17788:2014, *Information technology – Cloud computing – Overview and vocabulary* - see [31]

ISO/IEC 20648, *TLS specification for storage systems* - see [39]

ISO/IEC 27040:2015, *Information technology – Security techniques – Storage security* - see [30]

ISO/IEC Directives, Part 2, Rules for the structure and drafting of International Standards, 6th edition, 2011* - see [28]

IEEE 1003.1-2017, *IEEE Standard for Information Technology–Portable Operating System Interface (POSIX(R)) Base Specifications, Issue 7* - see [41]

RFC 1867, *Form-based File Upload in HTML* - see [20]

RFC 2045, *Multipurpose Internet Mail Extensions (MIME) Part One: Format of Internet Message Bodies* - see [9]

RFC 2046, *Multipurpose Internet Mail Extensions (MIME) Part Two: Media Types* - see [10]

RFC 2119, *Key Words for Use in RFCs to Indicate Requirement Levels* - see [3]

RFC 2578, *Structure of Management Information Version 2 (SMIv2)* - see [21]

RFC 2616, *Hypertext Transfer Protocol – HTTP/1.1* - see [23]

RFC 2617, *HTTP Authentication: Basic and Digest Access Authentication* - see [8]

RFC 3280, *Internet X.509 Public Key Infrastructure Certificate and Certificate Revocation List (CRL) Profile* - see [13]

RFC 3530, *Network File System (NFS) Version 4 Protocol* - see [1]

RFC 7143, *Internet Small Computer System Interface (iSCSI) Protocol (Consolidated)* - see [4]

RFC 3986, *Uniform Resource Identifier (URI): Generic Syntax* - see [2]

RFC 4627, *The Application/JSON Media Type for JavaScript Object Notation (JSON)* - see [5]

RFC 4648, *The Base16, Base32, and Base64 Data Encodings* - see [19]

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RFC 4918, *HTTP Extensions for Web Distributed Authoring and Versioning (WebDAV)* - see [6]

RFC 5246, *The Transport Layer Security (TLS) Protocol Version 1.2* - see [25]

RFC 6068, *The 'mailto' URI Scheme* - see [27]

RFC 5652, *Cryptographic Message Syntac (CMS)* - see [12]

RFC 6208, *Cloud Data Management Interface (CDMI) Media Types* - see [26]

RFC 6839, *Additional Media Type Structured Syntax Suffixes* - see [11]

RFC 7515, *JSON Web Signatures* - see [17]

RFC 7516, *JSON Web Encryption* - see [18]

RFC 7518, *JSON Web Algorithms* - see [15]

RFC 8446, *The Transport Layer Security (TLS) Protocol Version 1.3* - see [24]

SNIA TLS, *TLS Specification for Storage Systems, version 1.1.0* - see [42]

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Clause 3

Terms, acronyms, and definitions

For the purposes of this document, the terms and definitions given in Rec. ITU-T Y.3500 | ISO/IEC 17788:2014 and the following apply.

3.1

Access Control List (ACL)
a persistent list, commonly composed of Access Control Entries (ACEs), that enumerates the rights of principals (users and groups) to access resources

3.2

API
Application Programming Interface

3.3

CDMI™
Cloud Data Management Interface

3.4

CDMI capabilities
an object that describes what operations are supported for a given cloud or cloud object

The mimetype for this object is `application/cdmi-capability`.

3.5

CDMI container
an object that stores zero or more children objects and associated metadata

The mimetype for this object is `application/cdmi-container`.

3.6

CDMI data object
an object that stores an array of bytes (value) and associated metadata

The mimetype for this object is `application/cdmi-object`.

3.7

CDMI domain
an object that stores zero or more children domains and associated metadata describing object administrative ownership

The mimetype for this object is `application/cdmi-domain`.

3.8

CDMI object
one of CDMI capabilities, CDMI container, CDMI data object, CDMI domain, or CDMI queue

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3.9

CDMI queue
an object that stores a first-in, first-out set of values and associated metadata

The mimetype for this object is `application/cdmi-queue`.

3.10

CIFS
Common Internet File System (See SMB)

3.11

cloud storage
See Data storage as a Service

3.12

CRC
cyclic redundancy check

3.13

current data object version
the most recent version of a version-enabled data object

3.14

data object version
either the current data object version or an historical data object version

3.15

Data Storage as a Service (DSaaS)
delivery of appropriately configured virtual storage and related data services over a network, based on a request for a given service level

3.16

delegated access control (DAC)
the process of delegating an access control decision to a third party

3.17

delegated access control provider (DAC provider)
a third-party system that is capable of making access control decisions

3.18

delegated access control request (DAC request)
a request made to a DAC provider for an access control decision

3.19

delegated access control response (DAC response)
a response from a DAC provider indicating the result of a request for an access control decision

3.20

domain
a shared user authorization database that contains users, groups, and their security policies and associated accounting information

Each CDMI object belongs to a single domain, and each domain provides user mapping and accounting information.

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3.21

eventual consistency
a behavior of transactional systems that does not provide immediate consistency guarantees to provide enhanced system availability and tolerance to network partitioning

3.22

FC
Fibre Channel

3.23

FCoE
Fibre Channel over Ethernet

3.24

historical data object version
a non-current state of a version-enabled data object

3.25

HTTP
HyperText Transfer Protocol

3.26

Infrastructure as a Service (IaaS)
delivery over a network of an appropriately configured virtual computing environment, based on a request for a given service level

Typically, IaaS is either self-provisioned or provisionless and is billed based on consumption.

3.27

intermediary CDMI server
a CDMI server that is capable of forwarding DAC requests and responses

3.28

iSCSI
Internet Small Computer Systems Interface (see RFC 7143 [4])

3.29

JOSE
JavaScript Object Signing and Encryption

3.30

JWA
JSON Web Algorithm

3.31

JWE
JSON Web Encryption

3.32

JWS
JSON Web Signing

3.33

JSON
JavaScript Object Notation

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3.34

LDAP
Lightweight Directory Access Protocol

3.35

LUN
Logical Unit Number (see *ISO/IEC 14776-414*)

3.36

metadata
data about other data (see [34])

3.37

MIME
Multipurpose Internet Mail Extensions (see RFC 2045 [9])

3.38

NFS
Network File System (see RFC 3530 [1])

3.39

object
an entity that has an object ID, has a unique URI, and contains state

Types of CDMI objects include data objects, container objects, capability objects, domain objects, and queue objects.

3.40

object identifier
a globally-unique value assigned at creation time to identify an object

3.41

OCCI
Open Cloud Computing Interface (see [40])

3.42

Platform as a Service (PaaS)
delivery over a network of a virtualized programming environment, consisting of an application deployment stack based on a virtual computing environment

Typically, PaaS is based on IaaS, is either self-provisioned or provisionless, and is billed based on consumption.

3.43

POSIX
Portable Operating System Interface (see *IEEE Std 1003.1*)

3.44

private cloud
delivery of SaaS, PaaS, IaaS, and/or DaaS to a restricted set of customers, usually within a single organization

Private clouds are created due to issues of trust.

3.45

public cloud
delivery of SaaS, PaaS, IaaS, and/or DaaS to, in principle, a relatively unrestricted set of customers

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3.46

Representational State Transfer (REST)
a specific set of principles for defining, addressing, and interacting with resources addressable by URIs (see [7])

3.47

RPO
recovery point objective

3.48

RTO
recovery time objective

3.49

service level
performance targets for a service

3.50

Server Message Block
A network file system access protocol designed primarily used by Windows clients to communicate file access requests to Windows servers. (Also see CIFS)

3.51

SNMP
Simple Network Management Protocol

3.52

Software as a Service (SaaS)
delivery over a network, on demand, of the use of an application

technology that allocates the physical capacity of a volume or file system as applications write data, rather than pre-allocating all the physical capacity at the time of provisioning.

3.53

Uniform Resource Identifier (URI)
compact sequence of characters that identifies an abstract or physical resource (see RFC 3986 [2])

3.54

version-enabled data object
a CDMI data object with versioning enabled

3.55

virtualization
presentation of resources as if they are physical, when in fact, they are decoupled from the underlying physical resources

3.56

WebDAV
Web Distributed Authoring and Versioning (see RFC 4918 [6])

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