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Document Number: DSP0264
Version: 0.0.09
Date: 2011-09-07

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Cloud Infrastructure Management Interface - Common Information Model (CIMI-CIM)

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A CIM Representation of the CIMI model

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Document Type: Specification

Document Status: Work In Progress

Document Language: en-US

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47 Abstract

48 This document is a deliverable from the DMTF Cloud Management Working Group. It defines a CIM
49 representation, in MOF, for the Cloud Infrastructure Management Interface [CIMI] logical model see the
50 CIMI specification [CIMI] for more information.

51 *Note to reader: The CIMI specification can currently be found on the DMTF Work In Progress*
52 *portal:*

53 <http://dmf.org/standards/wip>

54 *When these specifications become standards, they will be located at an official URI per DMTF*
55 *publication processes.*

56 Acknowledgments

57 TBD

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78 1 Scope

79 This document makes use of the common meta-model used by CIM, the Common Information Model to
80 describe the CIMI logical model. This is defined in DSP004, **CIM Infrastructure Specification 2.6**

81 2 References

82 The following referenced documents are indispensable for the application of this document. For dated
83 references, only the edition cited applies. For undated references, the latest edition of the referenced
84 document (including any amendments) applies:

85 **DMTF DSP0004, CIM Infrastructure Specification 2.6,**
86 http://www.dmtf.org/standards/published_documents/DSP0004_2.6.pdf

87 **DMTF 0XXX DSP CIMI Cloud Infrastructure Management Interface**

88 *Note to reader: This CIMI specifications can currently be found on the DMTF Work In Progress*
89 *portal:*

90 <http://dmf.org/standards/wip>

91 *When these specifications become standards, they will be located at an official URI per DMTF*
92 *publication processes.*

93

94 3 Terms and Definitions

95 3.1 CIM (Common Information Model)

96 CIM (Common Information Model) defined by DSP0004 as:

- 97 1. The name of the meta-model used to define schemas (e.g., the CIM schema or extension
98 schemas).
- 99 2. The name of the schema published by the DMTF (i.e., the CIM schema).

100

101 This specification describes the translation between the CIM meta-model and CIMI Entities.

102

103 3.2 CIM Schema

104 The schema published by the DMTF that defines the Common Information Model. It is divided into a core
105 model and a common model. Extension schemas are defined outside of the DMTF and are not
106 considered part of the CIM schema.

107

108 3.3 MOF (Managed Object Format)

109 The management information is described in a language based on ISO/IEC 14750:1999 called the
110 Managed Object Format (MOF). In this document, the term "MOF specification" refers to a collection of
111 management information described in a way that conforms to the MOF syntax. A complete description of
112 the MOF syntax is provided in ANNEX A of DSP0004 "CIM Infrastructure Specification 2.6"

113 ...

114 **4 CIMI CIM/MOF Meta-model Translation**

115 In order to address as many potential client communities as possible, CIMI allows entities to be accessed
116 and managed via multiple protocols.

117 Heterogenous service implementations may leverage different operating systems, language, platforms
118 and other technologies. In order to provide consistency and interoperability, the CIMI specifications
119 defines translations of the model to additional meta-models such as CIM MOF, and others.

120 **4.1 CIM/MOF Formal Model**

121 This section makes use of the common meta-model used by CIM, the Common Information Model. This
122 is defined in DSP004, "CIM Infrastructure Specification 2.6"

123 The definition of CIMI entities is represented according to the metamodel and described in the MOF
124 format. This provides a way to formally describe the model for entities in a manner which is independent
125 of the access protocol used. It also provides a degree of consistency between managing CIMI resources
126 and key cloud foundation resources such as storage, virtual machines, hardware, and operating systems
127 which follow DMTF Standards.

128 Service providers using CIM SHOULD maintain consistency with the formal definition of the CIMI model
129 as expressed in the CIM meta-model and MOF formats.

130

131 **4.2 Formal CIMI Model Definition in CIM MOF.**

132 CIM and MOF provide a common meta-model and a language, respectively, for describing classes and
133 associations between those classes that represent the entities in a management domain and the
134 relationships between those entities. CIM makes no assumptions about how the classes are implemented
135 (is implementation-independent) or if they represent abstract or concrete entities.

136 **4.2.1 Translation Rules**

137 *Note to reader: In the future, this section will include rules that an implementer can use to translate*
138 *between the MOF representation and the appropriate CIMI model representation for a given protocol.*

139 **4.2.2 CIMI Class Definitions and their MOF representation**

140 The CIMI entities are described formally in MOF corresponding to CIM Version 2.6.0

141 The CIMI classes are defined in a schema with the prefix CIMI and derived from a common root class
142 CIMI_BaseElement, which does not derive from any DMTF standard CIM schema class. Although some
143 of the CIMI classes correspond to existing CIM classes, for example CIMI_Job, no attempt has been
144 made to derive from them at this point.

145 *Note to reader: The MOF files can currently be found on the DMTF Work In Progress portal:*

146 <http://dmf.org/standards/wip>

147 *When these specifications become standards, they will be located at an official URI per DMTF*
148 *publication processes.*

149 **4.2.3 Commonly Used Qualifiers**

150 The CIMI Model takes advantage of the CIM qualifiers feature in order to simplify the model. The
151 following qualifiers are used to simplify representation of the relationships between the cloud managed
152 entities.

153 The definitions of these qualifiers are listed below for reader convenience. The authoritative descriptions
154 and definitions are found in DSP0004.

155 4.2.3.1 Description

156 The Description qualifier describes a named element. The Description qualifier takes string values.

157 Example:

```
158 Description (  
159     "Represents the entry point into the cloud defined by the Cloud "  
160     "Infrastructure Management Interface Model. The Cloud Entry Point implements "  
161     "a catalog "  
162     "of entities such as Systems, System Templates, Machines, "  
163     "Machine Templates, etc. that can be queried and browsed by the "  
164     "Cloud Consumer" )]
```

165 4.2.3.2 Required

166 The defined element with which the Required qualifier is associated is required by implementations.
167 Other elements are considered optional.

168 4.2.3.3 Version

169 The Version qualifier provides the version information of the object, which increments when changes are
170 made to the object.

171

172 Example:

```
173 [Version ( "0.0.1" )]
```

174

175 4.2.3.4 Reference

176 A *Reference* qualifier applies to class properties and denotes that the property is a reference to an
177 instance or a collection of instances of a class. A property qualified as a Reference represents a one-way
178 association. It simplifies the model because it provides an alternative to defining an explicit association
179 class.

180 The qualifier type is string and it should be applied to properties of type string. The value of the qualifier
181 should be a valid name of the referenced class as show in the example below:

182 Example:

```
183 [Reference("CIMI_ReferredEntity")] string ref;
```

184 A property qualified as Reference can be an array, in which case the Min and Max qualifiers can be used
185 to define the cardinality constraints of the association (if any).

186 4.2.3.5 Indication

187 This qualifier indicates that the class is defining an indication. Indications are not required to have keys.
188 The Indication qualifier takes boolean values.

189 NOTE: The Indication qualifier is used in CIMI-CIM to ensure backwards compatibility with existing
190 CIMv2 implementations. While existing implementations may not yet support the Structure qualifier, the
191 use of the Indications qualifier signals that keys are not required.

192 4.2.3.6 Structure

193 CIMI-CIM defines a new custom qualifier named "Structure". Use of the Structure qualifier indicates that
194 a definition is a structure rather than a class. For an example, see section 5.3.2.

195

196 4.3 Attribute Types in Metadata

197 The CIMI model uses standard CIM types in the MOF files. For the purpose of serialization of such meta
 198 data over the wire for the CIMI protocol, these data types can be considered as equivalent according to
 199 the table below. When providers emit metadata describing the model, which originates from MOF, the
 200 following type conversions should be used:

201

Model Schema	CMWG
datetime	DateTimeUTC
uint8	Integer
sint8	Integer
uint16	Integer
sint16	Integer
uint32	Integer
sint32	Integer
uint64	Integer
sint64	Integer
string	String
boolean	Boolean
real32	N/A
real64	N/A
reference	URI

202

203 5 CIMI CIM MOF Representation Examples

204 The following sections shows examples of CIMI entities represented as CIM classes through the use of
 205 the CIM meta-model expressed as MOF.

206 The normative CIM meta-model representations are published by the DMTF at the URI below. The
 207 representations are published in MOF, XSD and other formats.

208 *Note to reader: The URIs listed in the examples may not work due to the Work In Progress*
 209 *status of this document. The files can currently be found on the DMTF Work In Progress portal:*

210 <http://dmf.org/standards/wip>

211 *When these specifications become standards, they will be located at an official URI per DMTF*
 212 *publication processes.*

213 The following non-normative copies of the MOF files are provided for illustration. Where any differences
 214 occur between the published MOF files and the copies below, the published MOF files shall be
 215 considered authoritative.

216 5.1 CIMI_CloudEntryPoint

217 Defined in: CIMI_CloudEntryPoint.mof

```

218 [Version ( "0.0.1" ),
219     UMLPackagePath ( "CIMI::Core::CoreElements" ),
220     Description (
221         "Represents the entry point into the cloud defined by the Cloud "
222         "Infrastructure Management Interface Model. The Cloud Entry Point implements a
223 catalog "
224         "of entities such as Systems, System Templates, Machines, "
225         "Machine Templates, etc. that can be queried and browsed by the "
226         "Cloud Consumer" )]
227 class CIMI_CloudEntryPoint : CIMI_BaseElement {
228
229     [Description (
230         "A reference to the System Template Collection of this "
231         "CloudEntry Point." ),
232         Reference ( "CIMI_SystemTemplateCollection" )]
233     string systemTemplates;
234
235     [Description (
236         "A reference to the System Collection of this Cloud Entry Point."
237         ),
238         Reference ( "CIMI_SystemCollection" )]
239     string systems;
240
241     [Description (
242         "A reference to the Machine Template Collection of this "
243         "Cloud Entry Point." ),
244         Reference ( "CIMI_MachineTemplateCollection" )]
245     string machineTemplates;
246
247     [Description (
248         "A reference to the Machine Configuration Collection of "
249         "this Cloud Entry Point." ),
250         Reference ( "CIMI_MachineConfigurationCollection" )]
251     string machineConfigs;
252
253     [Description (
254         "A reference to the Machine Image Collection of this "
255         "Cloud Entry Point." ),
256         Reference ( "CIMI_MachineImageCollection" )]
257     string machineImages;
258
259     [Description (
260         "A reference to the Machine Admin Collection of this "
261         "Cloud Entry Point." ),
262         Reference ( "CIMI_MachineAdminCollection" )]
263     string machineAdmins;
264
265     [Description (
266         "A reference to the Machine Collection of this Cloud Entry Point."
267         ),
268         Reference ( "CIMI_MachineCollection" )]
269     string machines;

```

```

270
271     [Description (
272         "A reference to the Volume Template Collection of this "
273         "Cloud Entry Point." ),
274         Reference ( "CIMI_VolumeTemplateCollection" ) ]
275 string volumeTemplates;
276
277     [Description (
278         "A reference to the Volume Configuration Collection of "
279         "this Cloud Entry Point." ),
280         Reference ( "CIMI_VolumeConfigurationCollection" ) ]
281 string volumeConfigs;
282
283     [Description (
284         "A reference to the Volume Image Collection of this Cloud "
285         "Entry Point." ),
286         Reference ( "CIMI_VolumeImageCollection" ) ]
287 string volumeImages;
288
289     [Description (
290         "A reference to the Volume Collection of this Cloud Entry Point."
291         ),
292         Reference ( "CIMI_VolumeCollection" ) ]
293 string volumes;
294
295     [Description (
296         "A reference to the Network Template Collection of this "
297         "Cloud Entry Point." ),
298         Reference ( "CIMI_NetworkTemplateCollection" ) ]
299 string networkTemplates;
300
301     [Description (
302         "A reference to the Network Configuration Collection of "
303         "this Cloud Entry Point." ),
304         Reference ( "CIMI_NetworkConfigurationCollection" ) ]
305 string networkConfigs;
306
307     [Description (
308         "A reference to the Network Collection of this Cloud Entry Point."
309         ),
310         Reference ( "CIMI_NetworkCollection" ) ]
311 string networks;
312
313     [Description (
314         "A reference to the VSP Template Collection of this Cloud" ),
315         Reference ( "CIMI_VSPTemplateCollection" ) ]
316 string vspTemplates;
317
318     [Description (
319         "A reference to the VSP Configuration Collection of this "
320         "Cloud Entry Point." ),
321         Reference ( "CIMI_VSPConfigurationCollection" ) ]
322 string vspConfigs;
323
324     [Description (
325         "A reference to the VSP Collection of this Cloud Entry Point."
326         ),
327         Reference ( "CIMI_VSPCollection" ) ]
328 string vsps;
329
330     [Description (
331         "A reference to the Meter Template Collection of this "
332         "Cloud Entry Point." ),

```

```

333     Reference ( "CIMI_MeterTemplateCollection" )]
334 string meterTemplates;
335
336     [Description (
337         "A reference to the Meter Collection of this Cloud Entry Point."
338     ),
339     Reference ( "CIMI_MeterCollection" )]
340 string meters;
341
342     [Description (
343         "A reference to the Event Log Collection of this Cloud Entry Point."
344     ),
345     Reference ( "CIMI_EventLogCollection" )]
346 string eventLogs;
347
348     [Description (
349         "A reference to the Event Collection of this Cloud Entry Point"
350     ),
351     Reference ( "CIMI_EventCollection" )]
352 string events;
353
354     [Description (
355         "This value is Provider specific and is the minimum "
356         "amount of time a Job will be retained by the system "
357         "after the completion of the Job." )]
358 uint32 jobTime;
359
360
361 };
362

```

363 5.2 CIMI_Machine

364 Defined in: CIMI_Machine.mof

```

365 [Version ( "0.0.1" ),
366     UMLPackagePath ( "CIMII::Core::CoreElements" ),
367     Description ( "A running instance of a machine" )]
368 class CIMI_Machine : CIMI_BaseElement {
369
370     [Description (
371         "Indicates the operational status of the entity" ),
372     ValueMap { "Started", "Stopped", "Sleeping", "Hibernated" }]
373 string status;
374
375     [Required, Description (
376         "The size of the CPU allocated to this Machine to be "
377         "used. This should adhere to the standard unit of "
378         "measurement. For example, a Machine with 4 unit worth of "
379         "CPU would allow the processes in the Machine to use up "
380         "to 4 units worth of CPU (and be charged thereof). When "
381         "this value is increased, it implies that the Machine is "
382         "allocated more CPU to use, and vice versa when the value "
383         "is decreased." ),
384     EmbeddedInstance ( "CIMI_CPUType" )]
385 string cpu;
386
387     [Required, Description (
388         "The size of the memory (RAM) allocated to this Machine. "
389         "When this value is increased, it implies that the "
390         "Machine is allocated more RAM, and vice versa when the "
391         "value is decreased." ),
392     EmbeddedInstance ( "CIMI_Size" )]
393 string memory;

```

```

394
395     [Description (
396         "The list of disks (local storages) that are part of the "
397         "Machine. Adding an element to this list creates a disk." ),
398         EmbeddedInstance ( "CIMI_DiskInstance" )]
399     string disks[];
400
401     [Description (
402         "The list of networked volumes that are attached to this "
403         "Machine. Adding a Volume to this list means that the "
404         "Machine has some access to the data on the Volume. "
405         "Removing a Volume from this list means that the Machine "
406         "no longer has access to the data on the Volume." ),
407         EmbeddedInstance ( "CIMI_VolumeInterface" )]
408     string volumeInterfaces[];
409
410     [Required, Description (
411         "A list of sub-entities that define the network "
412         "interfaces on this Machine." ),
413         EmbeddedInstance ( "CIMI_NetworkInterface" )]
414     string networkInterfaces[];
415
416     [Description (
417         "A list of references to Meters monitored for this Machine."
418         ),
419         Reference ( "CIMI_Meter" )]
420     string meters[];
421
422
423     [Description ( "Start the machine" )]
424     uint32 start(
425 );
426
427     [Description ( "Stop the machine" )]
428     uint32 stop(
429 );
430
431 };
432
433

```

434 5.3 Common Elements

435 The Cloud Infrastructure Management Interface classes are defined in a schema with the prefix CIMI and
436 derived from a common root class CIMI_BaseElement, which does not derive from any DMTF standard
437 CIM schema class.. In order to facilitate this translation, a set of common structures is defined which are
438 reused in the CIM meta-model expression of CIMI.

439 5.3.1 CIMI_BaseElement

440 Defined in: CIMI_BaseElement.mof

```

441 [Abstract, Version ( "0.0.1" ),
442     UMLPackagePath ( "CIMI::Core::CoreElements" ),
443     Description ( "Common properties for all CMWG classes" )]
444 class CIMI_BaseElement {
445
446     [Key, Description (
447         "The unique identifier of this entity; assigned upon "
448         "entity creation. This attribute value is immutable, and "
449         "should be unique in the providers cloud." )]
450     string uri;
451

```

```

452     [Description (
453         "The human readable name of this entity; assigned by the "
454         "creator as a part of the entity creation input." )]
455     string name;
456
457     [Description (
458         "The human readable description of this entity; assigned "
459         "by the creator as a part of the entity creation input." )]
460     string description;
461
462     [Description (
463         "The timestamp when this entity was created. The format "
464         "should be unambiguous, and the value is immutable" )]
465     datetime created;
466
467
468 };
469

```

470 5.3.2 Structures

471 CIMI-CIM defines a set of common structures for use in the CIMI Model. These are indicated by the use
 472 of the Structure qualifier, which indicates that the definition is a structure rather than a class.

473 An example is the definition of the CIMI_PropertyBagElement:

474 Defined in: CIMI_PropertyBagElement.mof

```

475
476 [Indication, Version ( "0.0.1" ),
477     UMLPackagePath ( "CIMI::Core::Structures" ),
478     Description (
479         "A list of name/value pairs, some of which may control one or "
480         "more aspects this entity. Properties may also serve as an "
481         "extension point, allowing consumers and providers to record "
482         "configuration and control information for features and "
483         "capabilities beyond those defined by this specification. "
484         "Individual properties may be either mutable or immutable and, "
485         "if mutable, writeable or read-only, depending upon the nature "
486         "of the property and the underlying cloud implementation." ),
487     Structure]
488 class CIMI_PropertyBagElement {
489
490     [Required, Description ( "The property name" )]
491     string propName;
492
493     [Required, Description ( "The property Value" )]
494     string propValue;
495
496
497 };language

```

498

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 506 [mework_v015.doc](http://members.dmtf.org/apps/org/workgroup/cmwg/download.php/56339/Cloud%20Management%20Framework_v015.doc)

507

Change History			
:0.0.7	08/26/11	JoshCo	Initial Draft
0.0.8	08/28/11	Doug	Misc some cleanup
0.0.9	08/30/11	JoshCo	Updated MOFs and editorial cleanup

508