



Document Identifier: DSPIS-0005

Date: 2017-012-01

Version: 0.2a

Data Center Equipment Schema Readme

Information for Work-in-Progress version:

IMPORTANT: This document is not a standard. It does not necessarily reflect the views of the DMTF or its members. Because this document is a Work in Progress, this document may still change, perhaps profoundly and without notice. This document is available for public review and comment until superseded.

Provide any comments through the DMTF Feedback Portal: <http://www.dmtf.org/standards/feedback>

Document Class: Informative

Document Status: Work-in-Progress

Document Language: en-US

Copyright Notice

Copyright © 2017 Distributed Management Task Force, Inc. (DMTF). All rights reserved.

DMTF is a not-for-profit association of industry members dedicated to promoting enterprise and systems management and interoperability. Members and non-members may reproduce DMTF specifications and documents, provided that correct attribution is given. As DMTF specifications may be revised from time to time, the particular version and release date should always be noted.

Implementation of certain elements of this standard or proposed standard may be subject to third party patent rights, including provisional patent rights (herein "patent rights"). DMTF makes no representations to users of the standard as to the existence of such rights, and is not responsible to recognize, disclose, or identify any or all such third party patent right, owners or claimants, nor for any incomplete or inaccurate identification or disclosure of such rights, owners or claimants. DMTF shall have no liability to any party, in any manner or circumstance, under any legal theory whatsoever, for failure to recognize, disclose, or identify any such third party patent rights, or for such party's reliance on the standard or incorporation thereof in its product, protocols or testing procedures. DMTF shall have no liability to any party implementing such standard, whether such implementation is foreseeable or not, nor to any patent owner or claimant, and shall have no liability or responsibility for costs or losses incurred if a standard is withdrawn or modified after publication, and shall be indemnified and held harmless by any party implementing the standard from any and all claims of infringement by a patent owner for such implementations.

For information about patents held by third-parties which have notified the DMTF that, in their opinion, such patent may relate to or impact implementations of DMTF standards, visit <http://www.dmtf.org/about/policies/disclosures.php>.

This document's normative language is English. Translation into other languages is permitted.

1. Domains	7
2. Specific Equipment Collections	7
3. Power Equipment Sensor Types	12
3.1. Generator	12
3.2. PDU (Power Distribution Unit) - RackPDU	12
3.3. Rectifier	13
3.4. Transformer	13
3.5. UPS	13
3.6. VFD	14
4. Cooling Equipment Sensor Types	14
4.1. Air Handling Unit	15
4.2. Chiller	15
4.3. CRAC (Computer Room Air Conditioner)	16
4.4. CRAH (Computer Room Air Handler)	16

Foreword

IMPORTANT: These documents are not final. They do not necessarily reflect the views of the DMTF or its members. Because these documents are a Work in Progress, these documents may still change, perhaps profoundly and without notice. These documents are available for public review and comment until superseded.

The following files are part of the Redfish Data Center Equipment Schema development effort:

- README-IS-0005.pdf - Redfish Data Center Equipment Schema Readme (for Work in Progress release)
- Overview-IS-0005.pdf - Overview of Redfish DCIM modeling concepts (for Work in Progress release)

Redfish Work in Progress Schemas

The following new schema files are released as Work In Progress documents.

Schema File	Version	Date	Description
AirHandlingUnit_v1	0.2.0a	2017-12-01	Work in Progress release.
AirHandlingUnitCollection_v1	0.2.0a	2017-12-01	Work in Progress release.
Alarm_v1	0.2.0a	2017-12-01	Work in Progress release.
AlarmCollection_v1	0.2.0a	2017-12-01	Work in Progress release.
AlarmRegistry_v1	0.2.0a	2017-12-01	Work in Progress release.
CRAC_v1	0.2.0a	2017-12-01	Work in Progress release.
CRACCollection_v1	0.2.0a	2017-12-01	Work in Progress release.
CRAH_v1	0.2.0a	2017-12-01	Work in Progress release.
CRAHCollection_v1	1.0.0a	2017-8-22	Work in Progress release.
Chiller_v1	0.2.0a	2017-12-01	Work in Progress release.
ChillerCollection_v1	0.2.0a	2017-12-01	Work in Progress release.
CoolingTower_v1	0.2.0a	2017-12-01	Work in Progress release.
CoolingTowerCollection_v1	0.2.0a	2017-12-01	Work in Progress release.
DCIMCooling_v1	0.2.0a	2017-12-01	Work in Progress release.
DCIMCoolingCollection_v1	0.2.0a	2017-12-01	Work in Progress release.
DCIMPower_v1	0.2.0a	2017-12-01	Work in Progress release.
DCIMPowerCollection_v1	0.2.0a	2017-12-01	Work in Progress release.
Generator_v1	0.1.0a	2017-8-22	Work in Progress release.
GeneratorCollection_v1	0.2.0a	2017-12-01	Work in Progress release.

Schema File	Version	Date	Description
PDU_v1	0.2.0a	2017-12-01	Work in Progress release.
PDUCollection_v1	0.2.0a	2017-12-01	Work in Progress release.
PowerMeter_v1	0.2.0a	2017-12-01	Work in Progress release.
PowerMeterCollection_v1	0.2.0a	2017-12-01	Work in Progress release.
RackPDU_v1	0.2.0a	2017-12-01	Work in Progress release.
RackPDUCollection_v1	0.2.0a	2017-12-01	Work in Progress release.
Rectifier_v1	0.2.0a	2017-12-01	Work in Progress release.
RectifierCollection_v1	0.2.0a	2017-12-01	Work in Progress release.
Sensor_v1	0.2.0a	2017-12-01	Work in Progress release.
SensorCollection_v1	0.2.0a	2017-12-01	Work in Progress release.
CRAC_v1	0.2.0a	2017-12-01	Work in Progress release.
CRACCollection_v1	0.2.0a	2017-12-01	Work in Progress release.
ServiceRoot_v1	0.2.0a	2017-12-01	Work in Progress release.
SwitchGear_v1	0.2.0a	2017-12-01	Work in Progress release.
SwitchGearCollection_v1	0.2.0a	2017-12-01	Work in Progress release.
TransferSwitch_v1	0.2.0a	2017-12-01	Work in Progress release.
TransferSwitchCollection_v1	0.2.0a	2017-12-01	Work in Progress release.
Transformer_v1	0.2.0a	2017-12-01	Work in Progress release.
TransformerCollection_v1	0.2.0a	2017-12-01	Work in Progress release.
UPS_v1	0.2.0a	2017-12-01	Work in Progress release.
UPSCollection_v1	0.2.0a	2017-12-01	Work in Progress release.
VFD_v1	0.2.0a	2017-12-01	Work in Progress release.
VFDCollection_v1	0.2.0a	2017-12-01	Work in Progress release.

Equipment Modeling Methodology

The Work In Progress (WIP) data center power and cooling equipment data models are based on an initial collection of the kinds of inventory, status, metric and sensor properties each type of equipment is often instrumented with. Further refinement was started in the WIP schemas by creating a sensor abstraction with a related collection so that there could be flexibility in representing equipment with more or less sensors and still achieve a level of interoperable consistency in the API representation.

Additionally, the concept of one or more power and cooling "domains" (or "zones") was introduced to reflect real world installations and organization of this kind of equipment. The following is a more detailed description of the modeling methodology used in this WIP release.

1. Domains

Within a data center there may be one or more power or cooling domains with each domain consisting of the equipment providing service to the portion of the data center designated as a domain.

The Redfish DCIM modeling approach establishes a Power Domain collection and a Cooling Domain collection subordinate to the Redfish Service Root.

- Domain Collections located in Service Root and referenced from Service Root document.
- Organize data center facility equipment into 2 domains
 - Power – Name proposal “DCIMPower”
 - Cooling – Name proposal “DCIMCooling”
- Each Domain Collection consists of 1 or more members, with a domain member representing the group of equipment in the domain being instrumented and information/metrics at the domain level.
- A domain member consists of a document with references to collections of specific equipment types and properties representing information and domain level metrics.

2. Specific Equipment Collections

An equipment collection consists 0 or more members, with an equipment collection member representing a specific piece of equipment.

The following data definition design pattern applies to each data center facilities equipment type:

- Represented as a CSDL/JSON entity in schema - named after the equipment type.
- Top level properties.
 - Equipment inventory information
 - Status
 - Metrics
 - Unique equipment properties and actions
- One Sensor Collection for all equipment and sub-component Sensors
 - Represented in one collection referenced as top level navigation property
- Specific equipment top level Sensors
 - Represented in SensorType arrays, an array for each SensorType
- SetPoints and Deadbands
 - Represented in SetPoint array of references to Sensor collection members with SetPoint and Deadband properties
- Alarms
 - All Alarms represented in subordinate Alarms collection
 - Triggered Alarms represented in array of references to Alarms collection members

- Equipment sub-components are represented as 1 or more members of top level array property.
 - Each sub-component is represented as a property of object type with the top level properties
 - Component inventory information
 - Status
 - Metrics
 - SensorType arrays, one array for each SensorType in the sub-component
 - Unique component properties and actions

Equipment Inventory Modeling

Equipment inventory information is represented by a consistent set of top level properties in the equipment entity schema.

Every DCIM (and other Redfish IT equipment schema) equipment schema includes the common inventory properties.

Equipment Location Modeling

Equipment location is represented by the PhysicalLocation top level property in the equipment entity schema.

Every DCIM equipment schema includes the PhysicalLocation property.

The PhysicalLocation property is a common Redfish property of type Resource.Location object.

The Resource.Location object has properties supporting international addresses and other types of location information.

Sensor Modeling and Types

All sensors are modeled in a common way with a `SensorType` property differentiating between different kinds of sensors.

Sensors of various types are represented in the equipment schema as individual members of a `Sensors` Collection subordinate to each equipment model entity.

Array properties of specific sensor types are located:

- As top level properties in equipment entity schema
- Within sub-component definitions.

`SensorType` enumeration values:

- Temperature
- Humidity
- Amperage
- ACVoltage
- DCVoltage
- Frequency
- Pressure
- LiquidLevel
- Rotational
- AirFlow
- LiquidFlow
- Barometric
- Altitude

Typical Power and Cooling Equipment and Sub-Component Specific Sensors

The following information are the types of sensors typically found on various types of power and cooling equipment. All sensor types are accounted for in the common sensor model. Standards based requirements for specific sensors for a particular type of equipment are expected to be defined in a subsequent equipment specific Interoperability Profile. For more information on Interoperability Profiles see DMTF Redfish Publications DSP0272 (Redfish Interoperability Profile Specification) and DSP8013 (Redfish Interoperability Profile Bundle).

3. Power Equipment Sensor Types

Sensors types for Redfish data model aligned power equipment schema.

3.1. Generator

- Fuel Level
- Oil Level
- Temperature
- AC Output Sub-Component Sensors
 - Frequency
 - RMS Voltage (L-L)
 - RMS Voltage (L-G)
 - RMS Current
 - Output Ground Current
 - Battery Voltage

3.2. PDU (Power Distribution Unit) - RackPDU

- Temperature
- Humidity
- AC Input Sub-Component (1-n) Sensors
 - RMS Voltage
 - RMS Current
 - Frequency

- AC Output Sub-Component (1-n) Sensors
 - RMS Voltage
 - RMS Current
 - Frequency

3.3. Rectifier

- Temperature
- AC Input Sub-Component (n) Sensors
 - RMS Voltage
 - RMS Current
 - Frequency
- DC Bus (n)
 - DC Voltage
- Rectifier (n)
 - DC Current
 - Temperature

3.4. Transformer

- Temperature
- Ambient Temperature
- Humidity
- Pressure
- Liquid Level
- AC Input
 - RMS Voltage
 - RMS Current
 - Frequency
- AC Output
 - RMS Voltage
 - RMS Current
 - Frequency

3.5. UPS

- AC Utility Input
 - RMS Voltage (L-L) Phase A-B
 - RMS Voltage (L-L) Phase B-C
 - RMS Voltage (L-L) Phase C-A
 - RMS Current
 - Frequency

- Ambient Temperature
 - Humidity
- AC Static Bypass Input
 - RMS Voltage (L-N)
 - RMS Voltage (L-L)
 - RMS Current
 - Frequency
- AC Maintenance Bypass Input
 - RMS Voltage (L-N)
 - RMS Voltage (L-L)
 - RMS Current
 - Frequency
- DC Bus
 - Voltage
 - DC Current
- Battery Sub-Component (1-n)
 - Temperature
- AC Output
 - RMS Voltage (L-N)
 - RMS Voltage (L-L)
 - RMS Current
 - Frequency

3.6. VFD

- Speed
- AC Input
 - RMS Current
 - RMS Voltage (L-L)
- AC Output
 - Frequency
 - RMS Voltage (L-L)
 - RMS Current
- DC Bus
 - DC Voltage

4. Cooling Equipment Sensor Types

Sensors types for Redfish data model aligned cooling equipment schema.

4.1. Air Handling Unit

- Supply Air Temperature
- Return Air Temperature
- Relative Humidity
- RA Relative Humidity
- Supply Fan Speed
- Exhaust Fan Speed
- Supply Water Temperature
- Return Water Temperature
- Chilled Water Valve Opening
- Differential Water Pressure
- Outside Air Temperature
- Outside Air Relative Humidity
- Outside Air Damper Position
- Exhaust Air Damper Position
- Return Air Damper Position
- Mixing Air Damper
- Reheat Coil Discharge Temperature

4.2. Chiller

- Chilled Water Return Temperature
- Chilled Water Supply Temperature
- Cold Water Return from Chiller
- Cold Water Supply to Chiller
- Compressor Discharge Temperature
- Compressor Discharge Pressure
- Compressor Suction Pressure
- Compressor Suction Temperature
- Evaporator Entering Water Temp
- Evaporator Leaving Water Temp
- Evaporator Saturated Refrigerant Temperature
- Evaporator Refrigerant Pressure
- Condenser Saturated Refrigerant Temperature
- Condenser Refrigerant Pressure
- Chilled Water Flow
- Cold Water Flow
- Chilled Water Valve Position
- Cold Water Valve Position
- Chilled Water Pump Speed
- Cold Water Pump Speed

- Make Up Chilled Water
- Compressor Oil Temperature
- Compressor Oil Pressure
- Compressor Phase AB Voltage
- Compressor Phase BC Voltage
- Compressor Phase CA Voltage
- Compressor Line 1 Current
- Compressor Line 2 Current
- Compressor Line 3 Current
- Compressor Line 1 Current RLA
- Compressor Line 2 Current RLA
- Compressor Line 3 Current RLA

4.3. CRAC (Computer Room Air Conditioner)

- Supply Air Temperature
- Return Air Temperature
- Relative Humidity
- Unit Fan Speed
- Condensor Fan Speed
- Compressor Discharge Temperature
- Compressor Discharge Pressure
- Compressor Suction Pressure
- Compressor Suction Temperature
- Outside Air Humidity
- Outside Air Temperature

4.4. CRAH (Computer Room Air Handler)

- Supply Air Temperature
- Return Air Temperature
- Relative Humidity
- Unit Fan Speed
- Supply Water Temperature
- Return Water Temperature
- Differential Water Pressure
- Outside Air Humidity
- Outside Air Temperature