

Schneider Electric

StruxureWare Data Center Operation v8.0

Data Center Infrastructure Management System Specification

THIS GUIDE SPECIFICATION IS WRITTEN IN ACCORDANCE WITH THE CONSTRUCTION SPECIFICATIONS INSTITUTE (CSI) MASTERFORMAT. THIS SECTION MUST BE CAREFULLY REVIEWED AND EDITED BY THE ARCHITECT OR THE ENGINEER TO MEET THE REQUIREMENTS OF THE PROJECT. COORDINATE THIS SECTION WITH OTHER SPECIFICATION SECTIONS IN THE PROJECT MANUAL AND WITH THE DRAWINGS.

WHERE REFERENCE IS MADE THROUGHOUT THIS SECTION TO "PROVIDE", "INSTALL", "SUBMIT", ETC., IT SHALL MEAN THAT THE CONTRACTOR, SUBCONTRACTOR, OR CONTRACTOR OF LOWER TIER SHALL "PROVIDE", "INSTALL", "SUBMIT", ETC., UNLESS OTHERWISE INDICATED.

THIS SECTION IS WRITTEN TO INCLUDE THE 2004 MASTERFORMAT AND THE 1995 MASTERFORMAT VERSIONS. WHERE APPLICABLE, THESE ITEMS ARE BRACKETED AND, IN EACH CASE, UNLESS OTHERWISE INDICATED, THE FIRST CHOICE APPLIES TO THE 2004 MASTERFORMAT AND THE SECOND CHOICE APPLIES TO THE 1995 MASTERFORMAT.

SECTION [26 62 00]

DATA CENTER INFRASTRUCTURE MANAGEMENT SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions, [Division 01 - GENERAL REQUIREMENTS] [Division 1 - GENERAL REQUIREMENTS], and other applicable specification sections in the Project Manual apply to the work specified in this Section.

1.2 SUMMARY

- A. **Scope:** This specification describes the operation and functionality of a Data Center Infrastructure Management system (DCIM) hereafter referred to as the DCIM. The DCIM software shall be delivered to the owner as an ISO image. The DCIM shall be installed on a physical server or as a virtual appliance or as part of a cluster setup of up to 4 servers to provide redundancy and load-balancing. The recommended minimum server configuration for each server or virtual guest is:

< 10,000 racks

- CPU: 4 CPU cores as a minimum, 8 CPU cores are recommended
- Memory: 16GB RAM

> 10,000 racks across 200 rooms with 30 concurrent users

- CPU: 8 CPU cores
- Memory: 32GB RAM

> 20,000 racks across 400 rooms with 30 concurrent users

- CPU: 16 CPU cores
- Memory: 64GB RAM

The following applies to all solution sizes:

- Storage speed minimum 170 MB/s
- 1 Gbps network connection between cluster nodes
- 10 Mbps low latency (<100ms) network connection to Disaster Recovery node

DCIM shall depend on other monitoring systems such as StruxureWare Data Center Expert for real-time data collection. The DCIM system shall be on the same LAN as the StruxureWare Data Center Expert.

- B. **Section Includes:** This specification shall describe how DCIM provides insights and drives performance throughout the data center, including data center assets and physical infrastructure. DCIM shall enable the monitoring and collection of low-level infrastructure data to enable intelligent analysis by individuals with domain expertise (e.g., operations, capacity planners and facilities planners), as well as a holistic analysis of the overall infrastructure. DCIM shall enable the integration of information technology (IT) and facility management disciplines to centralize monitoring, management and intelligent capacity planning of a data center's critical systems.
- C. The DCIM shall operate in conjunction with an existing network infrastructure to provide system management of the systems described above.

1.3 APPROVED PRODUCTS

The Data Center Infrastructure Management system (DCIM) shall be StruxureWare Data Center Operation, designed by Schneider Electric. Substitutions shall only be permitted subject to 2.1, below.

1.4 SYSTEM DESCRIPTION

A. Design Requirements:

1. All material and equipment used shall be standard components, regularly manufactured, available and not custom designed especially for this project. The data center infrastructure system, including the DCIM, shall previously be thoroughly tested as a system, and proven in actual use prior to installation on this project.
2. The DCIM shall be installed on a physical server, or as a virtual appliance, with a specified HTTP or HTTPS connection to access the user interface (DCIM client), and standard TCP protocol connections for communications with the monitoring system.
3. The DCIM system-level redundancy and load-balancing shall be provided using a server-level cluster setup. Up to 2 servers can be setup in a cluster to gain performance improvements.
4. The DCIM shall enable vendor-neutral inventory management with real-time device failures and data shown within a data center physical layout. Graphical floor layout and rack elevation view shall be supported.
5. The DCIM tool shall provide location-based drill-down views providing a structured overview of data center locations, from a global to local view down to single assets.
6. A Power Usage Effectiveness (PUE) dashboard will provide information on daily energy use.
7. Inventory report provides structured information on all rack-mount devices, organized by device type, age, manufacturer, and properties for quick overview of all current devices within a particular data center.
8. The DCIM tool shall have a search capability to allow data center operations to quickly locate a piece of equipment in the rack layout and floor layout.
9. The DCIM tool shall provide public web services API to allow third-party applications to access the inventory database, alarms and events, capacity and cooling analysis data, and PUE information.
10. The DCIM shall provide provisions to predict the optimal location for physical infrastructure and rack-based IT equipment based on the availability and requirements of physical infrastructure capacity and user defined requirements such as redundancy, network, and business use grouping.
11. The DCIM shall provide provisions to reduce stranded capacity and enable informed decision making and planning by proactively analyzing the impact of future moves, adds, changes before they occur, ensuring that the physical infrastructure provides the required space, power, and cooling capacity for current and future needs.
12. The DCIM shall be capable of hosting additional add-on modules that allow a user to perform energy efficiency and energy cost management, inventory management, power and cooling capacity management, change management, IT optimization, IT power capping, server access (software Keyboard Video Mouse or KVM), dynamic cooling control and mobile data center management.

13. The DCIM shall provide read-only smart phone applications to get a high level status of the data center operations and KPI.
14. The DCIM shall be capable of integrating with additional plug-ins that supports Cisco UCS Manager, HP OneView, HP uCMDB Asset Management, ServiceNow Asset Management, RF Code Centerscape, Vigilent dynamic cooling control, BMC Remedy ticketing system, Microsoft System Center Virtual Machine Manager 2008, HP uCMDB, and VMware vCenter For the most updated information about supported version, please see the DCIM Support webpage.

B. System Characteristics:

1. The DCIM shall be deployed on the following physical server and system requirements:
 - a. The DCIM software shall be delivered as an ISO image or an installer file for installations on Redhat v7.x
 - b. The server should have a minimum of 4 multi-core CPUs, 16GB RAM, and 100 GB hard disk storage. Depending on the size of managed data centers, more CPU, memory and hard disk space may be required.
 - c. LAN (10/100/1000 base T) network ports.
 - d. USB ports for installation and upgrades.
 - e. CentOS 7 or RHEL 7 as the server operating system.
 - f. DCIM PostgreSQL database 9.1 as the internal database.
 - g. JBoss Application Server 5.1 as the Java application server.
 - h. Monitor / keyboard port for field service diagnostic purposes only.
2. The DCIM shall meet the following virtual appliance requirements:
 - a. The virtual appliance shall be delivered as an ISO image with the CentOS 7 OS or as an installer file for the RHEL 7 OS.
 - b. The virtual hypervisor shall be supported on VMware, Microsoft Hyper-V, and Redhat KVM.
 - c. The virtual guest shall have a minimum of 4 multi-core CPUs, 16GB RAM, and 100 GB hard disk storage allocated to it.
 - d. Will support LAN network adapters.
3. The DCIM client workstation shall have the following requirements if running the desktop client:
 - a. CPU: 2 GHz Intel Core 2 Duo (or equivalent), hard disk: 500 MB free hard disk space for installation, memory (RAM): 4 GB and display: 1024x768 screen resolution with 16 million colors. These are the absolute minimum requirements for running StruxureWare Data Center Operation but for larger setups, better specifications are recommended.
 - b. Microsoft® Windows 7 or Microsoft® Windows 8 or Microsoft® Windows 8.1 or Microsoft® Windows 10 (Recommended 32-bit), Linux or Mac OS.
 - c. Browser: Internet Explorer 11, Chrome (latest version), and Firefox (latest version).
 - d. Java™ Plug-in (JRE) version 1.6.0_22 or higher.
 - e. You must have local administration rights on the client computer during installation of the desktop client.
4. The Web Browser UI can be used on any device with a supported web browser - some functionality may be restricted in very small screens like smart phones etc.
5. The owner will supply the following information to facilitate system implementation:
 - a. Network configuration settings (IP addresses, subnet mask) necessary for the DCIM to reside on the owner's public or private network.
 - b. E-mail addresses and SMTP settings for e-mail notification.
 - c. Open the following ports in the firewall for DCIM server and client communication - Port 80 for HTTP, Port 443 for HTTP using SSL.
 - d. Provide details of the monitoring system, the BMC Remedy ticketing server, the VMware vCenter server, the BMC cards for Server Access and the Microsoft System Center Virtual Machine Manager.
6. High availability requirements

- a. Ability to support one or more disaster recovery server in remote locations for resuming operation in the event of a disaster. The disaster recovery server should always keep an up-to-date copy of the production server database and can become the primary server in the case of the primary server failure.
- b. Ability to support one hot stand-by servers in the same location for real-time failover and load balancing. This is sometimes called server clustering support. In the case of a primary server failure, one clustering server will take over immediately.

C. **Management System Vendor Responsibilities**

1. Provide the software as an ISO image or installer file.
2. Provide system installation, configuration and operator orientation by factory employed Field Service Engineer depending on the services purchased.
3. Provide 7 x 24 technical telephone support for ANZ, EMEA, LAM and NAM and 8 x 5 technical telephone support for APJ and GCN regions through a toll free number per the Software Support Contract.
1. Provide upgrades as per Software Support Contract.

1.2 **SUBMITTALS**

A. **Proposal Submittals:**

1. As bid system bill of materials
2. Product brochures
3. Product guide specifications
4. High-level system architecture diagram
5. Installation information, including requirements

B. **Delivery Submittals:**

1. Online help available at <http://dcimsupport.apc.com> for the installation, configuration and troubleshooting of the DCIM, which shall be translated from English into the following languages:
 1. Japanese
 2. Simplified Chinese
 3. Traditional Chinese
 4. Russian
 5. French
 6. Italian
 7. German
 8. Korean
 9. Brazilian Portuguese
 10. Spanish

1.3 **QUALITY ASSURANCE**

A. **Qualifications:**

1. **Software Designer Qualifications:** The software designer shall be a firm engaged in the development of data center infrastructure management systems whose products have been in satisfactory use in similar service for a minimum of 5 years.
2. **Installer Qualifications:** Installer shall be a firm that shall have a minimum of five years of successful installation experience with projects utilizing data center infrastructure management systems similar in type and scope to that required of this Project.

- B. **Pre-Installation Conference:** Conduct pre-installation conference in accordance with [Section 01 31 19 - PROJECT MEETINGS] [Section 01200 - PROJECT MEETINGS]. Prior to commencing the installation, meet at the Project site to review the material selections, installation procedures, and coordination with other trades. Pre-installation conference shall include, but shall not be limited to, the Installer, and any trade that requires coordination with the work. Date and time of the pre-installation conference shall be acceptable to the Owner and the Architect/Engineer.

1.4 **DELIVERY, STORAGE, AND HANDLING**

Deliver materials to the Project site in supplier's or manufacturer's original wrappings and containers, labeled with supplier's or manufacturer's name, material or product brand name, and lot number, if any.

1.5 WARRANTY

- A. **General:** See [Section 01 77 00 - CLOSEOUT PROCEDURES] [Section 01770 - CLOSEOUT PROCEDURES].
- B. **Additional Owner Rights:** The warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to and run concurrent with other warranties made by the Contractor under requirements of the Contract Documents.

1.6 MAINTENANCE

- A. A complete offering of software support contracts and licenses for the DCIM shall be available from the manufacturer, and shall be required to provide ongoing technical support and allow future software updates. Contract work shall be performed by factory-trained service personnel.

PART 2 - COMPONENTS

2.1 MANUFACTURERS

- A. **Basis of Design:** Product specified is “StruxureWare Data Center Operation” as designed by Schneider Electric. Items specified are to establish a standard of quality for design, function, materials, and appearance. Equivalent products by other manufacturers are not acceptable. The Architect/Engineer will be the sole judge of the basis of what is equivalent.

2.2 MODES OF OPERATION

- A. **System Overview:** The DCIM shall be a centralized server appliance that is accessed remotely from client workstations/servers/tablets via a HTTP or HTTPS connection. No client-based services shall be used as a substitute. StruxureWare Data Center Operation, StruxureWare Data Center Operation for Colocation, Data Center Operation: Capacity, Data Center Operation: Change, Data Center Operation: IT Optimize, Data Center Operation: IT Power Control, Data Center Operation: Server Access, Data Center Operation: Cooling Optimize, Data Center Operation: Energy Cost, Data Center Operation: Energy Efficiency, Data Center Operation: Insight, and Data Center Operation: Vizor modules shall be offered by the DCIM. Microsoft System Center Virtual Machine Manager, VMware vCenter, ServiceNow Asset Management, RF Code Centerscape, HP uCMDB, HP OneView and BMC Remedy integration shall be supported. A Web Services Open API guide shall be made available by the DCIM vendor.
- B. The DCIM desktop client must support the following:
 - a. Microsoft® Windows 7 or Microsoft® Windows 8 or Microsoft® Windows 8.1 or Microsoft® Windows 10 (Recommended 32-bit) or Linux or Mac OS.
 - b. Browser: Internet Explorer 11, Chrome (Latest version), and Firefox (Latest version).
 - c. Java™ Plug-in (JRE) version 1.6.0_22 or higher.

The DCIM web client must support the following:

- a. Internet Explorer 11, Chrome (latest version), Firefox (latest version)
- C. The DCIM read-only Data Center Operation: Vizor smart phone application must be supported on the following platforms:
 - a. Apple iOS.
 - b. Android OS
- D. **StruxureWare Data Center Operation:** The DCIM software shall provide the methodology to create visual view of the data center floor layout, and the racks view and the equipment within, and manage network connectivity. Both AC (Alternate Current) and DC (Direct Current) equipment is supported. This module shall also map the alarms to the appropriate device on the floor layout. The DCIM software shall support the following capabilities -

1. Floor Layout

- A. The DCIM tool will have the capability to add locations and rooms of different types to the data center model to represent the actual physical enterprise infrastructure.
- B. The DCIM tool will have the capability to configure a bird's eye view of the room layout to ensure the layout in the data center model accurately represents the real-world physical environment of the room. This includes any physical attributes of the room such as size, shape, walls, doors, windows and walkways.
- C. The DCIM tool will have the capability to see multiple rooms in a layout pane at the same time allowing a user to compare or drag equipment between them – for modeling.

- D. The DCIM tool will have the capability to export the complete or filtered data center inventory into a delimited file (.csv file).
- E. The DCIM tool will have the capability to render the floor layout in both 2D and 3D view.
- F. Ability to import an AutoCad (.dwg) floor drawing and display the floor layout. Each layer can be toggled on or off. Rooms can be created based on wall detection on the AutoCad drawing.
- G. Ability to export the Floor Layout to AutoCAD format (.dwg). Each overlay and the information in the overlay must be stored in individual layers.
- H. Ability to export the Floor Layout to the following picture formats: BMP, JPG, PNG and SVG.
- I. Ability to export the Rack View to the following picture formats: BMP, JPG, PNG and SVG.
- J. Ability to copy/paste equipment on the floor, such as racks, PDUs, UPS and cooling units as well as equipment in the racks, such as servers and patch panels. You can copy/paste individual pieces of equipment or multiple items, such as a rack and its contents.

2. Multi-tenant Data Center Support

- A. Ability to create cages and auto-detect cage area in square meters or square footage.
- B. Ability to create cages automatically from AutoCAD drawing through cage selection and wall detection.
- C. Ability to assign customer to data center asset including rack mounted equipments, racks, cages, etc.
- D. Cages, racks and servers are color coded based on sales status (closed, reserved, internal, and open).
- E. Ability to assign Contracted Power value to each cage, rack or server.
- F. Ability to add power receptacles to each cage.
- G. Show a legend on the floor view with information about how many racks are open, closed, reserved and internal.
- H. Show a legend on the floor view with information about how much space is open, closed, reserved and internal.
- I. Show a legend on the floor view with information about total room area, sellable space and space efficiency.
- J. Provide a web client where tenants can log on and only see their assigned rooms, cages or racks.

3. Rack elevation View

- A. The DCIM tool will identify how much weight has been placed in a rack / room compared to the predefined load bearing capability settings of the rack.
- B. Illustrate the weight of the equipment added to the rack in the rack layout compared to the maximum equipment loading capability of the rack.

- C. Visualize status of network ports on equipment (used vs. not used).
- D. Visualize network cables.

4. Network Management

- A. The DCIM tool will be able to model the configured network connections and allows a user to setup new network routes between the configured equipment.
- B. Network port properties will have the capability to be imported from a product catalog and/or will be user configurable.
- C. Ability to configure network routes for selected network equipment in the layout, for example between a server and a switch or a switch and a switch. A route is defined as a connection from a piece of equipment (communication endpoint, such as a server or layer 2/3 network gear, such as a switch) to the first piece of equipment that is a communication endpoint or layer 2/3 network gear.
- D. Ability to configure cable types and color code each cable type.
- E. Ability to configure properties on a cable, such as length, bar code etc.

5. Product Catalog

- A. The DCIM tool will be able to provide a product catalog that contains up-to-date floor and rack mounted data center equipment.
- B. The DCIM tool will be able to allow a user to add floor and rack-mountable equipment to a rack, server room, electrical room or store room.
- C. Ability to create an inventory bundle that combines multiple pieces of equipment in one building block.

6. Dashboard Key Performance Indicator (KPI) View

- A. Provide a map view to monitor the data center operations in a quick overview, including any alarms in different locations and rooms.
- B. From the map overview, one can drill down to locations > rooms > racks > servers for details or troubleshooting.
- C. Display capacity KPIs for each data center in the map view. The KPIs should include the status of the Power, Cooling, U-space and Network utilization.
- D. Power is represented as the percentage of the available load (kW) that is utilized by the IT equipment in the location or room.
- E. Cooling is represented as the percentage of the available load (kW) that is utilized by the IT equipment in the location or room.
- F. U-space is represented as the percentage of the available U-positions (U-pos) that is populated with equipment in the location or room.
- G. Network is represented as the percentage of the available Network ports (ports) that is utilized by networking equipment in the location or room.

- E. **Data Center Operation: Capacity:** The DCIM software shall provide capabilities to perform capacity planning, perform power and cooling analysis as per the following details:

1. Capacity Planning

The DCIM software will provide provisions to recommend the best location for a server in the rack layout, utilizing available space, cooling, network and power capacity to optimize capacity utilization and avoid stranded capacity:

- A. Impact simulation: Generates a list of equipment that would be impacted if the selected piece of equipment, e.g. a UPS or cooling unit, was to fail.

- B. Measured Load: Display measured load data for UPS and racks in the floor layout that identify how much of each UPS or rack's maximum kW power is in use. This requires communication to power monitoring devices or servers.
- C. Measured Load: Display measured Amps on breakers and rack PDUs.
- D. Measured Load: Displayed measured load data for cages in the floor layout that identify how much of a cage's contracted power is in use. This requires communication to power monitoring devices or servers.
- E. Power Capacity: Ability to assign planned capacity for each rack and illustrates rack capacity consumption compared to the planned recommended values for that rack. Provide information such as remaining power, the amount exceeding the recommended capacity.
- F. Power Path: Ability to model power connections between the equipment supplying and delivering power and the equipment requiring power. This includes power path from switchgear, UPS, main PDU with modular circuit breaker mapping, rack RPDU and to individual servers.
- G. Power Path: Ability to export the power path to a comma separated file.
- H. Power Path: Ability to visualize the configured power path in a graphical diagram. The diagram is exportable in the following file formats: JPG, SVG, PNG and BMP.
- I. Rack U Space: Ability to monitor and display rack U space utilization of each rack.

2. Power Analysis

Ability to detect the following list of configuration issues regarding data center power configuration and provide recommended actions:

- A. Connection has not been configured between PDU and power supply: A power connection is missing in the data center model from this PDU to the power supply from which it should receive power.
- B. Equipment connected to this PDU draws more power than is supported by the power supply breaker: The breaker does not provide sufficient power to cover the power requirements of the equipment connected to that PDU.
- C. Equipment is connected to a rack PDU outside this rack: The power connection setup for this equipment is not optimum as it is setup to be supplied by a rack PDU that is not positioned in the same rack as the equipment.
- D. Rack is without rack PDU or a rack PDU is not powered: The rack is without rack PDUs or its rack PDUs are not connected to a PDU, remote distribution panel (RDP) or power panel.
- E. The breaker configuration does not support rack's estimated load: The equipment in the rack draws more power than the breaker supports. In case of 3 phase equipment, the problem shall be indicated even if only one of the phases is overloaded.
- F. The input voltage setting required by the equipment is not available in current rack: In the data center model, the server's input voltage requirement cannot be supplied by the rack PDU in the rack.
- G. The measured load exceeds the estimated load per phase designed for the rack: Connected devices in the rack use more power than the estimated load per phase in the rack shall be indicated in the data center model.
- H. The measured load exceeds the total estimated load configured for the rack: Connected devices in the rack that use more power than the total estimated load in the rack shall be indicated in the data center model.
- I. The measured load of the UPS exceeds the total estimated load of the connected equipment: Devices connected to the UPS use more power than design capacity or they have not been assigned to the correct UPS in the data center model layout to correctly represent the physical infrastructure. In case of 3 phase equipment, the problem shall be indicated even if the measured value is only too high for one of the phases.
- J. The phase configuration for the connected server is not supported by the rack PDU: The phase connection configured for this server is not valid. This message will occur if a power connection had been configured to this server but subsequently changes have been made to the phase configuration.

- K. The Rack PDU output voltage setting does not match the output voltage of the connected PDU / Power Panel: The power connection is invalid because the voltage required by the rack PDU is not available from the power distribution component.
- L. The server must be supplied from the same phase from both distribution units: The redundancy setup requires identical phase distribution setup for A and B feed.
- M. The UPS in the layout does not supply enough power to match the configured load of connected equipment in the layout: The load of the equipment connected to the UPS is higher than the load that the UPS can supply. In case of 3 phase equipment, the problem shall be indicated even if only one of the phases is overloaded.

3. Cooling Analysis

- A. The DCIM software shall be able to calculate cooling performance of data centers in real-time with CFD-like simulation, provide calculated inlet and exhaust temperatures per rack plus capture index (percentage of heat captured by cooling devices) per rack.
- B. Ability to present the calculation results visually in the floor layout.
- C. Ability to alarm cooling configuration issues and provide recommended actions. For example, a room has no perforated tiles for the Computer Room Air Conditioning (CRAC) unit airflow (one or more CRACs have been added to the floor but no perforated tiles have been added), or there is no perforated tile airflow (one or more perforated tiles have been added to the room but no CRACs have been provided to supply any airflow).
- D. 2D plenum airflow and pressure view: Provide a 2D under-floor plenum view that shows airflow vectors and Cubic Feet per Minute (CFM) based on the height of the raised floor, the placement and type of perforated tiles and cooling devices. When a cooling unit or a perforated tile is moved around, the flow vectors and airflow CFMs shall update instantly.
- E. 3D temperature and airflow view: Provide a 3D view showing max/average inlet/return temperature and airflow above the raised floor. Calculate velocity vector and temperature in real-time (seconds) to allow customers to try what-if scenarios. Ability to slide the temperature and velocity plane in all three dimensions.
- F. Ability to simulate failure of one or more cooling units and examine impacts to IT equipment.
- G. Ability to map temperature sensors to rack elevation or anywhere in the data center 3D space and draw the 3D measured temperature map based on the measured data.

4. Integration with 3rd Party Software

In addition to the below mentioned integrations, several other integration are available to more 3rd party systems. For the most updated list of integrations, please check DCIM Support web site which will list all the integrations with details about the what data can be integrated, supported versions etc.

- A. The DCIM software shall support integration with Cisco UCS manager to retrieve real-time power measurement data for blade servers and display them. In addition, it should support automatic power capping Cisco UCS chassis based on rack PDU breaker setting to safe guard rack PDU breakers.
- B. The DCIM software shall support integration with VMware vCenter and Microsoft System Center Operations Manager (SCOM), Virtual Machine manager to retrieve virtual machine information and map them to physical servers.
- C. The DCIM software shall support integration with HP Universal Configuration Management Database (uCMDB), pushing IT asset data such as network, server devices and properties to the DCIM software.
- D. Ability to support two-way data exchange between the DCIM software and a broad range of systems, such as CMDBs, asset management systems, and building

management systems using Extract, transform and load (ETL). Based on the ETL system, it is possible to develop custom solutions, integrating DCIM with a broad range of data sources.

- F. **Data Center Operation: Energy Efficiency:** The DCIM shall provide the following functionality from the data center Energy Efficiency point of view:
1. The DCIM tool will provide current and historical Power Usage Effectiveness (PUE) values and full insight into current and historical energy efficiency.
 2. It will present how much power is devoted to driving the installed IT-equipment compared with the total facility consumption.
 3. Identify efficiency losses and enables improved PUE at the subsystem level.
 4. Provide insight into energy losses and cost of energy at the subsystem level, providing details of which subsystem draws the most costs.
 5. The DCIM tool will have a web-based dashboard view which includes efficiency data on current and historical PUE, as well as detailed subsystem cost analysis.
 6. The DCIM tool will provide a report on current and historical PUE values.
 7. The DCIM tool will provide energy efficiency analysis, PUE and DCiE (Data Center infrastructure Efficiency) reporting.
- G. **Data Center Operation: Change:** The DCIM shall provide the following change management functionality to keep track of additions, movements, maintenance or deletions in a data center:
1. The DCIM tool will enable operators to gain control over the data center environment by implementing organized moves, adds, and change work processes by providing an automated workflow system that can develop and assign work orders, reserve space, track status, and provide a historical audit trail.
 2. Ability to assign deadline and person to each work order.
 3. Ability to create multiple tasks and track task status for each work order.
 4. Ability to track completion date for a work order and provide information about work orders that are completed after the deadline.
 5. Ability to create work order templates that can be used for recurring work types like maintenance activities or standard procedure for installation of a certain type of server.
 6. Support workflow management that will allow for easy implementation and tracking of organized moves, additions, and changes.
 7. Support device catalogs of floor and rack-mountable equipment.
 8. Support audit trail reporting that would show asset moves, additions, and changes by date/time, owner, and work orders.
 9. Support high-level single "glass pane" report of changes done to the data center in specified time period.
 10. Ability to integrate with BMC Remedy server to import Remedy tickets and associate them with internal work orders. Update Remedy ticket status when work order status changes or finishes.
- H. **Data Center Operation: IT Optimize**
Data Center Operation: IT Optimize provides insight into the IT layer of the data center through integration with external IT systems. The integration is handled by the IT Optimize server through either:
- IPMI (discover equipment with Base Management Controllers)
 - SSH (discoveries on Linux)
 - SNMP (discoveries on Linux)
 - VMware (discoveries on ESXi/VMware guest)

- WMI (discoveries on Windows)

IT Optimize monitors IT asset utilization and power consumption to help identify servers associated with over-provisioning, underutilization, and imbalanced power and cooling throughout the data center. You can save unnecessary power by identifying and consolidating or retiring these servers. The system uses the actual power draw rather than nameplate values to obtain improved accuracy.

1. Configuration

You can configure the IT Optimize server communication to external systems such as Cisco UCS Manager, Data Center Operation: IT Power Control powered by Intel, or VMware vSphere® in System Setup>External System Configuration.

2. Discovery of IT Optimize server subnets

When the IT Optimize server communication has been configured, you can configure discovery of the assets on various network subnets on the IT Optimize server. The discovery enables the system to scan the defined IP range and monitor changes in power and CPU utilization on the servers. To work with the values in the StruxureWare Data Center Operation layout, the only remaining step is to associate the discovered IT assets with servers in the data center layout.

3. Association of discovered IT assets

You can associate a discovered asset with the server representing it in the data center layout by dragging it from the Unassociated Devices pane on top of the corresponding server in the rack layout. You can also associate multiple assets in Associating live data from an external system to the layout in one operation by using the multi-associate option.

When you have associated an asset, it disappears from the list of unassociated devices and you can see the power and or CPU utilization data displayed in the layout.

4. Monitoring power and CPU utilization

When the system has been configured to retrieve data from the external systems and the devices have been discovered and associated with assets in the data center layout, power and CPU utilization values from these systems show in the IT Utilization and Power overlays when you hover over a server in the layout.

I. **Data Center Operation: IT Power Control:**

1. Data Center Operation: IT Power Control is powered by Intel® Data Center Manager (DCM) and provides insight into the IT layer of the data center. The data retrieval is handled by the IT Power Control module through IPMI or SSH. You can retrieve and monitor power and temperature data from Intel DCM in StruxureWare Data Center Operation.
2. Support rack-level power capping functionality powered by Intel DCM for increasing power usage accuracy and delay physical equipment investment. Power capping allows you to limit how much power your IT equipment can use and helps you free UPS capacity.
3. Ability to support different rack-level power capping strategy including: Simultaneous server peak (sum of all server peak loads), historic rack peak, Rack peak sharing (20% of rack peak value), and manual input.

J. **Data Center Operation: Server Access**

Data Center Operation: Server Access provides software KVM (vKVM) access to servers through a Base Management Card (BMC) or to the server's operating system via the RDP, SSH or VNC protocols. Access through a BMC card allows access to the complete lifecycle of the server including power on/off and BIOS access. The remote console access and power control access is achieved through integration with external IT systems. The integration is handled by the IT Optimize and Server Access server using IPMI.

1. Configuration

You can configure the Server Access server communication in System Setup -> External System Configuration.

2. Discovery of Server Access server subnets

When the Server Access server communication has been configured, you can configure discovery of the assets on various network subnets on the IT Optimize and Server Access server. The discovery enables the system to scan the defined IP range and find servers with a supported BMC installed. To use remote console or use the power controls in the StruxureWare Data Center Operation layout, the only remaining step is to associate the discovered servers with servers in the data center layout.

3. Association of discovered servers

You can associate a discovered server with the server representing it in the data center layout by dragging it from the Unassociated Devices pane on top of the corresponding server in the rack layout. You can also associate multiple servers from an external system to the layout in one operation by using the multi-associate option.

When you have associated a server, it disappears from the list of unassociated devices and you can configure the remote console access from the Server Access page in the server's property page and once configured, you can access the functionality from the right-click menu on the server in the rack view, the equipment browser, the navigation tree and the discovered devices window.

4. User rights.

Users can be granted or denied access to the Server Access functionality via the User Rights and Authentication dialog. Here you can enable or disable the access by checking or clearing the Server Access and Power Cycle checkbox.

5. Once a server is Server Access enabled, an icon on the server in the rack view indicates the power state of the server. There are three different states: Powered On, Powered Off and Unknown. Only servers with a BMC can have their power state detected – servers without a BMC will always be Unknown. The power state is updated during the polling configured in the External System Configuration. In the server's tooltip and on the server's Server Access property page you can see when the power state was last updated.

6. With Server Access enabled, you can choose to enable/disable the Remote Console, Operating System and the Power Control independently of each other.

K. **Data Center Operation: Cooling Optimize**

Data Center Operation: Cooling Optimize provides dynamic cooling of the data center through integration with an external cooling control system.

You can use Cooling Optimize to automatically maintain the temperature in the data center within user-configurable set points. The temperature set points can be configured for multiple locations throughout the data center.

1. Configuration

You can configure the Cooling Optimize server communication in System Setup -> External System Configuration.

2. Discovery of Cooling Optimize sensors

When the Cooling Optimize communication has been configured, you can view the sensors and cooling units monitored and controlled by the Cooling Optimize server in the unassociated devices view. From this view, the sensors and cooling units can be associated with equipment in the model.

3. Association of sensors and cooling units

You can associate sensors and cooling units with the assets representing them in the data center layout by dragging each from the Unassociated Devices pane on top of the corresponding asset in the floor view or in the rack layout. You can also associate multiple assets from an external system to the layout in one operation by using the multi-associate option.

When you have associated a sensor, it disappears from the list of unassociated devices and you can configure the high and low set points. You can also see the measured temperature in the tooltip by over the sensor (rack) or viewing the rack in the rack view with the Cooling Optimize overlay active.

When you have associated a cooling unit, it disappears from the list of unassociated devices and you can view sensor information (such as return air temperature, discharge air temperature etc.) in the tooltip when mousing over the cooling unit. You can also override the Cooling Optimize server's control of the unit.

4. In the Cooling Optimize overlay, you can see the influence that a selected cooling unit has on the temperature throughout the data center. You can also see what influence the cooling units have on a selected temperature sensor. The influence is visualized with shades of blue for cooling influence and shades of red for heat influence.
- L. **Data Center Operation: Insight:** The DCIM software shall support a report design tool that has the ability to:
1. Configure and design custom reports in addition to the standard built-in reports.
 2. Define new data sources including other JDBC, Web Services, XML or Text-based databases for data integration.
 3. Define customized report layout and provide a comprehensive list of report elements for users to choose: Text, Label, Image, Table, List, Chart, etc.
 4. Support customized equation and calculation.
 5. Save a finished report design as a template for other users to use.
 6. Output reports to the following formats: HTML, Word Doc, PowerPoint PPT, PDF, POSTSCRIPT or Excel file.
- M. **Data Center Operation: VIZOR:**
1. Shall support Apple iOS (iPhone, iPad, iPod Touch, etc) and Android devices.
 2. Ability to access the complete data center assets from a mobile device.
 3. Ability to scan barcode and audit equipments and racks from a mobile device.
 4. Ability to view capacity utilization summary on a mobile device.
 5. Ability to view the KPI dashboard on a mobile device.
- N. **Standard Reports:** The DCIM software shall be able to support the following standard report templates out-of-box:
1. **Audit Trail report:** The DCIM software shall generate an Audit Trail report that lists actions recorded in the application, whether those actions were in response to work orders, or changes made to the data center model. The audit trail also provides information about user login/logout.
 2. **Capacity History:** The DCIM software shall generate a capacity history report that shows the capacity change history for one or more data centers over a user-specified period of time. Allow users to choose data from various capacity categories including power, cooling, space, network and energy efficiency, etc.
 3. **Contiguous Free U-Space:** provides information about contiguous free u-space per rack.
 4. **Cooling Optimize Benchmark:** provides an overview of the energy usage during two configurable time periods. This can be used to verify the energy savings by installing Cooling Optimize by comparing energy usage before and after the installation. The energy savings are also converted into cost savings and annual greenhouse gas reduction.
 5. **Customer Inventory Report:** report all customer inventory (server, rack DPU, racks, cages, PDUs, etc) for one or multiple customer accounts. Customer names and accounts can be selected at the time of report generation.
 6. **Energy Cost:** The DCIM tool will provide an Energy Usage Report, which shows energy consumed within the data center by the kWh and cost per kWh, detailed to the rack level. The report will include data based on the filter selections of time period, Rooms, Organization, the entered kWh price, the entered overhead factor or Power Usage Effectiveness (PUE). The calculations are based on measured load values, if the IT devices have been setup to report live measured data. Otherwise, the estimated load value will be used.

7. Executive Power: provides a summary of total capacity, free capacity, measured peak, failover load, and power sold/all coated data in a report format. The report is sorted by data center sites and rooms.
 8. Executive Space: provides space usage stats in terms of total, sold, open, reserved, etc square footage and rack counts information. It is sorted by data center sites and then data center rooms.
 9. Inventory: The DCIM software shall generate an Inventory report that lists the contents of the filtered item or items of the entire inventory.
 10. Network Summary: The DCIM software shall generate a network report that lists the usage of network ports on each server and network devices. It shall also present all network routes in the data center.
 11. Panel Schedule: The DCIM software shall generate a report showing the configuration of the breaker panels including breakers and a selection of power consumers or measurements in either Amps or kW.
 12. Panel Schedule Customer: The DCIM software shall generate a report showing the configuration of the breaker panels including breakers, power consumers and customer.
 13. Rack U-Space: The DCIM software shall generate a rack space report that displays the amount of available positions in specified racks for equipment that takes up one or more U positions.
 14. Server Energy Cost: The DCIM software shall generate a report with information about the cost per server based on power usage.
 15. Server Power Consumption: A Server Power Consumption report can be generated to identify the servers with the highest average power usage. You can use this list to evaluate likely server candidates for upgrades, load sharing, or retirement.
 16. Server Utilization report: A Server Utilization report can be generated to identify performance indicators on power cost, server utilization and retirement candidates.
 17. Temperature Compliance: provides a graphical representation of Cooling Optimize sensors and how they are aligned with a configurable low and high threshold. The report also provides information about how many hours during the selected period sensors have been above or below the predefined thresholds.
 18. Underutilized Servers: An Underutilized Servers report can be generated to identify non-utilized and underutilized servers in the data center.
 19. Work Order Details: The DCIM software shall generate a work order detail report that shows all the tasks associated with the work order and the status of each task.
 20. Work Order List: The DCIM software shall generate a work order list report that shows work order number, deadline, status, priority, summary and assignee information for user selected work order number ranges.
 21. Work Order Project: The DCIM software shall generate a report showing all the work orders with a specified project code. The information shown per work order is: Order number, Summary, Needed by, Comments, Assignee, Status and priority.
- O. **StruxureWare Portal:** The DCIM software shall support high-level KPI dashboard via a web interface:

1. Provide a dashboard that displays key performance indicators (KPIs) of managed data centers, through the use of portlets.
2. Ability to modify the dashboard with different themes, data sources, graph types and portlets.
3. Several pre-configured portlets are available for users to choose from including, but not limited to: Total UPS load, Used UPS load, Measure A/B-feed peak and average, Total cooling capacity, Used cooling capacity, Total network ports, Used network ports, Total/Used/Available U-space, Ambient and Inlet temperature, Energy Efficiency PUE/DCiE number and trends.
4. The dashboard needs to be accessible via a Web page.

2.3 Data Center Infrastructure Management System Security

- A. **Authentication and Encryption:** The communication between the client and the DCIM shall be secured via a Secure Sockets Layer (SSL) 168-bit Triple-DES (Data Encryption Standard) encoded connection.
- B. **OpenLDAP and Active Directory:** The DCIM shall have Open Lightweight Directory Access Protocol and Active Directory support.
- C. The log in to the user interface of DCIM shall use Secure Socket Layer (SSL) or Secure Socket Handling (SSH) authenticate. The web launch to devices shall occur through a HTTP or HTTPS connection. To increase security, the HTTP or HTTPS connection and the HTTP or HTTPS port shall be user configurable for each device, through the DCIM user Interface.
- D. The DCIM shall allow the user to create user accounts ranging from Administrator Access to View Only Access. The DCIM shall have no specified limit to the number of user accounts that can be created. Each of these accounts shall have their own unique login user name and password. An administrator shall have full read/write access to all the DCIM's functionality. The access other users can be, limited to specific rooms, specific features, as well as provide view only access. The "Read Only" access user shall not be allowed to change the DCIM configuration.
- E. The Tenant Portal web access shall allow configuration of access for non-DCO users, that are configured as tenants (customers) in a colocation environment. The tenant's access shall be restricted to the equipment that is assigned to the tenant via the 'Customer' property on the equipment.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. **Verification of Conditions:** Examine areas and conditions under which the work is to be installed, and notify the Contractor in writing, with a copy to the Owner and the Architect/Engineer, of any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected.
 - 1. Beginning of the work shall indicate acceptance of the areas and conditions as satisfactory by the Installer.

3.2 INSTALLATION

- A. **General:** Preparation and installation shall be in accordance with reviewed product data, final shop drawings, manufacturer's written recommendations, and as indicated on the Drawings.
- B. **Factory-Assisted Start-Up:** If a factory assisted DCIM installation and start-up is requested, factory-trained service personnel shall perform the following inspections, test procedures, and on-site training:
 - 1. **Installation:**
 - a. Installation to the physical server.
 - 2. **Mechanical Inspection:**
 - a. Check the network connections to the DCIM.
 - b. Check the network connections to all managed/monitored devices.
 - c. Ensure the DCIM is powered and verify power to the optional DCIM Hub (if installed).
 - 3. **Functional Inspection:**
 - a. Ensuring owner can log in to the DCIM.
 - b. Ensure any additional license keys are installed on the DCIM.
 - c. Verify the configuration of the various modules.
 - d. Ensure the owner's defined users are added in the DCIM.
 - 4. **On-Site Operational Training:** During the factory-assisted installation, operational training for site personnel shall include log in to the user interface, navigation through the menu options, device discovery, generation of reports, creation of groups, creation of users, and setting up alarm notification.

3.3 FIELD QUALITY CONTROL

- A. **General:** See [Section 01 45 23 - INSPECTING AND TESTING SERVICES] [Section 01410 - INSPECTING AND TESTING SERVICES].
- B. **Manufacturer Field Service:**
 - 1. **Worldwide Service:** The DCIM manufacturer shall have a worldwide service organization available, consisting of factory-trained field service personnel to perform start-up, preventative maintenance, and service of the DCIM system and power equipment. The service organization shall offer 24 hours a day, 7 days a week, 365 days a year service support, according to the Statement of Work for the specified region.
 - 2. **Updates and Bugfixes:** Software patches and updates shall be available on regular basis delivered to the Owner via apc.com website, if software maintenance contracts are included in the purchase.

3.4 MAINTENANCE CONTRACTS

- A. **A complete offering of Software Support Contracts** for the DCIM shall be available. All DCIM systems under this software support contract shall be entitled to Technical Phone Support, all Software Updates, Feature Enhancements, and development of Multi-Vendor device support during the duration of this contract.
- B. **A Statement of work for the Software Support Contracts** shall be made available for the DCIM detailing vendor responsibilities and customer responsibilities.

3.5 DEMONSTRATION

- A. **General:** Provide the services of a factory-authorized service representative of the manufacturer to provide start-up service and to demonstrate and train the Owner's personnel.

- B. **DCIM Training Workshop:** A DCIM training workshop shall be available from the DCIM manufacturer. The training workshop shall include, but shall not be limited to, a combination of lecture and practical instruction with hands-on laboratory sessions. The training workshop shall include a combination of lecture and practical instruction with hands-on laboratory sessions. The service training workshop shall include instruction DCIM operational theory, configuration and operation, report generation, and troubleshooting.

END OF SECTION