inteliPhy

# Digital IT Infrastructure Twin (Digital Twin) Software

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## General requirements

R-1 The Digital Twin Software shall have a scalable system architecture. There shall be no technical limit on the number of objects managed by the Digital Twin Software.

R-2 The Digital Twin Software shall have a Client-Server Architecture:

- Digital Twin Software Server which contains a digital representation of the IT infrastructure
- Digital Twin Software Clients which provide a graphical user interface (GUI) for access to the Digital Twin Software Server

R-3 The Digital Twin Software Server shall support multiple simultaneous client sessions.

R-4 The Digital Twin Software shall be capable of supporting multiple sites.

R-5 The Digital Twin Software shall support the Microsoft SQL as external database and PostgreSQL as internal or external database management system.

R-6 The Digital Twin Software shall display the network in a hierarchical tree structure and as geographical network maps.

R-7 The Digital Twin Software shall be capable of importing and displaying drawings and maps for accurate representation of geographies and building floor plans. As a minimum, Portable Graphics Format (png) files shall be supported.

R-8 The Digital Twin Software shall provide copy-paste and drag-and-drop capabilities for populating floorplans and maps with database objects. It shall be possible to define the position of objects by dragging them to the appropriate position on the map / floorplan.

R-9 Database Objects that are placed onto a floorplan shall be fully functional so that the administration of objects is possible directly from the floorplan using context menus.

R-10 The Digital Twin Software shall not be limited in the registration of users or assets.

R-11 The Digital Twin Software shall allow the listing of any information (e.g. manufacturer, article number, model number, name/custom label, mounting type, physical dimensions, weight, data port specifications, CPU, RAM, …) on any asset. It shall allow the attachment of files relevant to the asset, e.g. maintenance proofs or pictures.

R-12 The Digital Twin Software shall at least allow the creation of places, buildings, floors, data centers and rooms. Rooms and data centers shall optionally have elevated floors. It shall be possible to create sub-hierarchies with places to create an 8- or higher-tiered hierarchy.

R-13 The floorplan and 3D view shall have the possibility to overlay the floor tiles with a ruler of definable step size, and to export resulting graphics to png. The ruler should also be displayed in the row view.

R-14 The Digital Twin Software shall provide graphical representation of rack layouts with front, rear and side views of rack.

R-15 The Digital Twin Software shall provide the possibility to display buildings, floors, data centers, rooms, racks and equipment in 2D and 3D views.

R-16 The Digital Twin Software shall model the network down to the individual port, cable and fiber level.

R-17 The Digital Twin Software shall be able to model any type of network, in particular also the power network.

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| R-18 | The Digital Twin Software shall be able to make network connections in several ways, among them drag-and-drop. |
| R-19 | The Digital Twin Software shall be able to represent splice connections and window-cuts. |
| R-20 | The Digital Twin Software shall be able to export an inventory at any level of the infrastructure with equipment, article number and quantities. |
| R-21 | The Digital Twin Software shall be able to place Objects on a GIS map, with the accurate longitude, latitude and altitude automatically retrieved. |
| R-22 | The Digital Twin Software shall be able to create network connections between different sites using ducts and subducts on a GIS map. |
| R-23 | The Digital Twin Software shall be able to switch the visibility of Ducts, Subducts, Buildings, Places and Manholes on and off. |
| R-24 | The Digital Twin Software shall be able to import ducts to the GIS map using KML files. |
| R-25 | The Digital Twin Software shall allow the choice of different GIS tile providers, including a custom choice. |
| R-26 | The Digital Twin Software shall be capable of visualizing connections in the network end-to-end i.e. with all intermediate installation cables, patch cables and patch panels. |
| R-27 | The Digital Twin Software shall be capable of visualizing all connections that terminate on a selected device. |
| R-28 | The Digital Twin Software shall be capable of visualizing and naming user-defined port-to-port connections. |
| R-29 | The Digital Twin Software shall additionally provide the possibility to display cable paths in 2D and 3D. |
| R-30 | It shall be possible to draw ducts in buildings and on the GIS map, visible in 2D, 3D and on a GIS map. It shall be possible to route subducts in ducts. It shall be possible to route cables in subducts and ducts. Microducts shall be represented by cable models. |
| R-31 | The Digital Twin Software shall be capable of creating synoptically network drawings showing devices and their connecting cables but omitting geographical data such as buildings, rooms or racks. |
| R-32 | The Digital Twin Software shall be delivered with a complete library of object models, which is regularly extended. |
| R-33 | It shall be possible to import additional models into the library. It shall also be possible to attach documents to models, e.g. fillable maintenance checklists, that are downloadable from any instantiation of that model. |
| R-34 | A built-in model editor shall be available that permits the creation of new models from within the Client GUI. |
| R-35 | The Digital Twin Software shall be able to select favorite models in both the model selector and the model editor. |
| R-36 | It shall be possible to augment model types with custom fields such as asset tags, MAC, IP or URL addresses, port names, color codes, units etc. Custom fields shall be available in queries and reports. |
| R-37 | The Digital Twin Software shall provide mass import functions to populate the database. |
| R-38 | The Digital Twin Software shall provide means to perform a tokenized search of any object in the database. |
| R-39 | The Digital Twin Software shall provide the possibility to create reports on almost any aspect of the database. Among many options, this may include power capacity availability. Reports shall be freely configurable from within the Client GUI. It shall be possible to export the reports. |

R-40 The Digital Twin Software shall allow the user to create automated reports to be sent in user-defined intervals to user-defined recipients.

R-41 The Digital Twin Software shall be capable of creating graphical charts based on reports. The charts shall be freely configurable. As a minimum pie charts, line charts, bar charts and dial charts shall be available.

R-42 The Digital Twin Software shall be capable of monitoring values by polling or setting event traps and sending email alerts in case certain events or specified conditions (e.g. excessive power consumption in a rack) occur.

R-43 The Digital Twin Software shall be capable of controlling devices by setting values using SNMP.

R-44 The Digital Twin Software should be able to send emails from a Microsoft Office 365 mail server or alternatively any generic SMTP server with basic authentication.

R-45 The Software shall be capable of monitoring the infrastructure elements and environmental parameters of the data center, their logging and mapping, and the continuous processing of the measured data.

R-46 The Digital Twin Software shall be capable of generating cable labels according to freely configurable numbering schemes. It shall be possible to export the cable labels to a labeling printer.

R-47 The Digital Twin Software shall provide work order capabilities that include:

- Plan and generate work orders from within the Client GUI
- Send work orders to installation personnel by email
- Work orders shall contain individual tasks and bill of materials required to execute the work order
- Time planning of work orders (GANTT chart)
- It shall be possible to create dependencies between work orders, e.g. a work order to install a server in a rack is dependent on the completion of another work order to install this rack.

R-48 The Digital Twin Software shall provide for management of assets and organizations. It shall be possible to create links between assets / organizations and network objects, e.g. to identify the owner of a device or software application being installed on a device.

R-49 The Digital Twin Software shall have a capacity management function that provides means to search for free capacity in the infrastructure based on rack space.

R-50 The Digital Twin Software shall have a warehouse management function allowing to place objects in warehouse locations and remove objects from a warehouse to install it in the IT infrastructure. Comprehensive warehouse reports shall be available.

R-51 The Digital Twin Software shall provide configurable multiple user access levels that are based on specific locations, access to objects and the capability to perform operations on these objects.

R-52 The Digital Twin Software shall be capable to connect to external user directories using the LDAP and LDAPs protocol. It shall support UPN Suffixes.

R-53 The Digital Twin Software shall support the mapping of LDAP groups.

R-54 The Digital Twin Software shall allow multi-factor authentication (MFA).

R-55 The Digital Twin Software shall keep a system log (audit trail), where all changes to the IT infrastructure are recorded.

R-56 The Digital Twin Software shall be capable of collecting values from SNMP-enabled devices (PDUs, cooling, battery, sensors, active equipment) and associating such values with database objects. The SNMP values shall be collected on a regular basis and stored. The collection intervals shall be configurable. For numerical values,

average, maximum and minimum values for certain time periods (day / week / month) shall be calculated.

R-57 The Digital Twin Software shall allow the setting of alerts, generated via custom infrastructure queries or SNMP traps. An alerts overview shall show all affected objects of an alarm. Affected objects can directly be opened in all available other views, e.g. 3D view. Alarms are also shown in the Quick Details, 2D and 3D views, and on the GIS map.

R-58 The Digital Twin Software shall allow the creation of user-defined dashboards and the sharing of such dashboards among users.

R-59 The Digital Twin Software shall generate customizable reports on key performance indicators (KPIs), such as Data Center Space Efficiency (DCSE), Fiber, Copper and Power Port Utilization, Power Usage Effectiveness (PUE), Rack Power Utilization (RPU), Rack Space Utilization, Rack Weight Utilization for sustainability management.

R-60 The Digital Twin Software shall allow to display the KPIs in customized dashboards, lists, graphs, in 2D and 3D.

R-61 The Digital Twin Software shall allow the integration with third-party software.

R-62 The Digital Twin Software shall be deployable in less than 15 minutes.

R-63 The Digital Twin Software shall be intuitive and easy to use, and a 2-day training should be sufficient to work with the software on a daily basis.

R-64 The Digital Twin Software shall provide the option to guide new users through the software with a welcome tour.

R-65 The Digital Twin Software shall make tutorial videos available to the users.

R-66 The Digital Twin Software shall give all users the opportunity to personalize their application view.

# Digital Twin Software Client Requirements

R-67 The Digital Twin Software Client shall enable full-featured remote access capabilities to the Digital Twin Software including electronic work orders, database access and related functions from any device with a modern web browser, including but not limited to panel PCs, tablets (Android/iOS), and desktop PCs.

R-68 The Digital Twin Software Client shall have an easy-to-use Graphical User Interface (GUI). The GUI shall be customizable with various tabs, views and interfaces on a per-user basis.

R-69 The Digital Twin Software Client GUI shall operate in a Web Browser without requiring installation of additional software on the client machine.

R-70 Communication between the Digital Twin Software Server and the Digital Twin Software Client shall be encrypted using the HTTPS protocol.

R-71 The Digital Twin Software Client shall allow for flexible enlargement of the window size.

# Automated Infrastructure Management (AIM) Requirements

The Digital Twin Software shall support the following AIM functions:

R-72 Read connectivity status from Intelligent Patch Panels and display the port status (connected / disconnected) on the Digital Twin Software Client.

R-73 Recognize cable connections between Intelligent Patch Panel ports and update the digital representation on the Digital Twin Software Server.

R-74 Continuously supervise the connectivity status on Intelligent Patch Panels and generate alarms in the case of unallowed changes. Alarms shall be displayed in the Digital Twin Software Client GUI and shall be notified by email.

R-75 Display work orders on Intelligent Patch Panels by activating LEDs on patch panel ports where the work order mandates a change (connection / disconnection)

R-76 Reconcile differences between the cabling as it is sensed by the Intelligent Patch Panels and the cabling as it is documented in the Digital Twin Software

# Advanced Asset Management

R-77 The Digital Twin Software shall be able to create labels that uniquely identify assets. Assets are tagged by adhering the created labels to the assets.

R-78 The Digital Twin Software shall have a mobile application capable of registering tagged assets in the software and afterwards displaying all information stored in the software about the registered assets.

R-79 The Digital Twin Software shall be able to create audits of the whole or parts of the infrastructure and perform them offline without internet connection. It should allow the user to take notes, add pictures and/or a voice message. The audit should report on matched, unmatched, misplaced and unknown assets.

R-80 The Digital Twin Software shall allow the scanning of any QR- or barcode to identify an asset (e.g. a cable) and display it in its available views (e.g. end-to-end connectivity).

Alternative descriptions of Digital IT Infrastructure Twin:

- Data Center Monitoring and IT registration system
- Data Center Infrastructure Management (DCIM)
- Cable Management System (CMS)