

CMIS

Inventory Management System

PRODUCT DESCRIPTION

2017

Version 7.3

The network registration system for the telecommunications

VC4

VC4 B.V.

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1. Introduction

IMS is a powerful multi-user application that offers fast and user-friendly facilities for registering and managing a wide range of telecommunication networks and platforms.

This includes networks such as MPLS/IP, SDH, SONET, WDM/OTN, Fiber/FTTx, Ethernet, Mobile Core, Backhaul and RAN (2G, 3G, 4G), Microwave, xDSL, WIFI, Broadcasting, Subsea cable, VSAT, ATM, Voice, DCN and Synchronisation.

IMS can be used across the entire organisation. This means that the needs of the technical departments, sales through to senior management are all well catered for.

Main benefits of IMS:

- Complete and accurate asset overview, full life cycle of materials
- Platform and vendor independent
- End to end views of network services, cross platform
- Perform daily tasks faster and smarter resulting in shorter lead times in service delivery and fault handling
- Improvement of Service Level
- Accurate view of physical asset values representing depreciation and return on investment
- Integration with other systems, like NMS, CRM, Financial & Billing Systems, etc.
- Automatic discovery and synchronization of live network assets with NMS
- Optimized Network Capacity Management, saving CAPEX by avoiding unnecessary network spend.
- Pro-active network build initiated by threshold reporting
- Significant OPEX cost savings due to Leased Line invoice checks
- Can be used by complete organisation, including engineers, Customer Service, Management & Sales.
- Easy build of new equipment and connection types
- Less network outages due to Single Point of Failure calculations

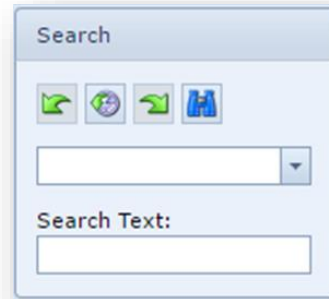
This document describes all functionalities of the IMS application from a high level.

Live demo of the IMS system may be requested via sales@vc4.nl

2. General functionality

2.1 Search functionality

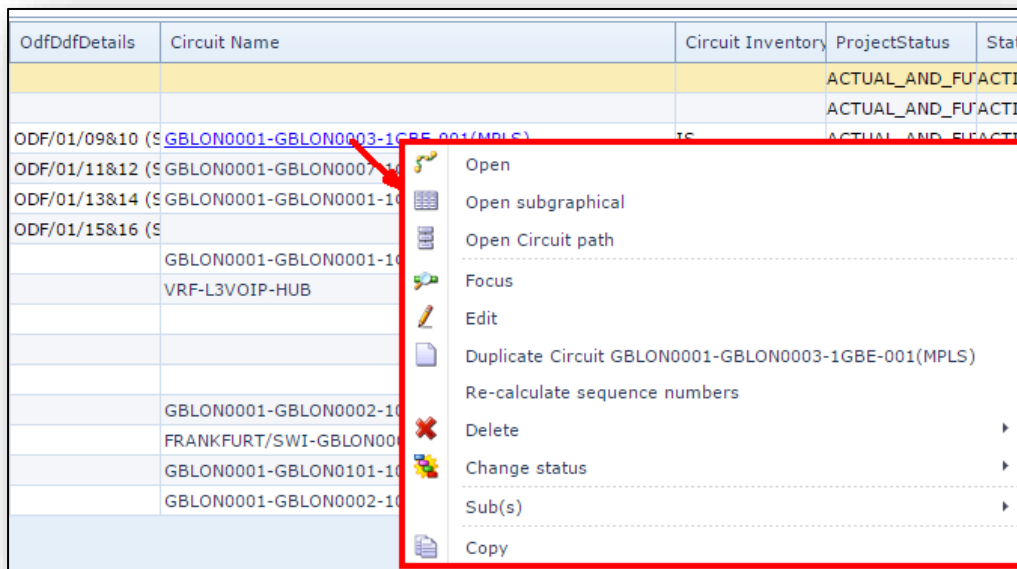
Search fields have been implemented throughout the system, so that all information stored can be found. Most are pull down fields, others are free text search fields, or both. Free text fields search with a “like” and over multiple fields.



After a search with multiple results, these results can be filtered to fine-tune the search.

2.2 Right mouse menus and double click option

Special Right Mouse Click Menus can be used to find information about a specific object.



On network items (such as circuit names, equipment names, locations) users can double click to find more details of the specific item.

2.3 Data export functionality

Every table (grid) in the different IMS screens can be exported to Excel or CSV via a right mouse option. Specific features, like Network Rings and Network Map support export to PDF.

Other export types are supported at the server side, such as XML and txt.

A full set of webservice API’s is also supported, so that external applications can extract information from the system.

2.4 Network Status

Network items such as connections, nodes, shelves and locations, always have a status in IMS. An explanation of each status is detailed below:

Status	Description	Explanation
PL	Planned	A planned item is planned/designed, but is not built in the network yet.
RFS	Ready for Service	An item with RFS status has been built in the actual network, but is not operational yet.
IS	In Service	The item is in use/operational
MI	To be Migrated	This status is applicable when the item is still in service, but will be migrated soon. After the migration is completed, the object status will be set to "In Service (IS)" again.
RFS	Ready for Cease	With this status, the network object is marked as still in use, but will be dismantled soon.
OOS	Out of Service	The network item is not in use anymore

Business and technology rules have been implemented in the IMS system. Before a status change is being executed, IMS will validate if the status change can be done.

Example: a connection cannot be set "in service", when the card or equipment related to the connection is still in "planned" or "ready for service" status.

Warehouse and Spares statuses

When equipment is in the IMS Warehouse and not in the network, the materials can have statuses related to the warehouse:

Status	Explanation
In Stock	The material is stored in a warehouse location.
Ordered	The material is being ordered at the equipment vendor and is not in a warehouse location yet.
To be returned	The material is dismantled/removed from the network and is on its way back to a warehouse location
Lay Out	The equipment is being prepared/packed to be picked up. It will leave the warehouse any moment.
Out Stock	Material is not in warehouse anymore.
Ready for Sale	The material is in warehouse and will not be used in network anymore. It will be sold.
Sold	The material has been sold to an external party.
Returned	Something is wrong with the material and is returned to vendor.
Defect	The material is defect and needs to be fixed or replaced.

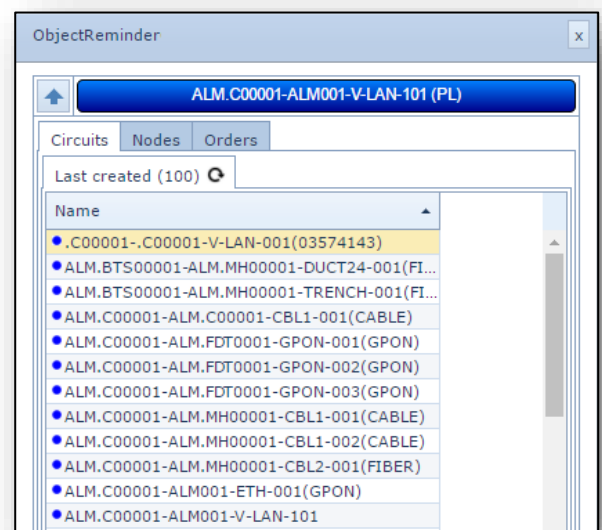
2.5 Object reminder

A user-friendly object reminder is available for the users to quickly find recent objects created and highlighted.

Objects can be set in focus to highlight the objects in the specific screen that is open.

Objects in focus can be related to other objects.

For example connection to port or layered into another connection.



2.6 History

All IMS user and interface activities and changes on the network are stored in the IMS database with related username, batch name or interface application name, date/time and description of the activities.

Those history records can be viewed per inventory object.

2.7 Business rules and validation checks

Many business rules and validation checks have been implemented. These rules and validation checks are technology specific, IMS specific or based on rules specific to the customer's organisation.

Some examples are:

- Check the status of its parent objects before changing the status;
- Check the port type (speed) with the connection type when connecting a connection to a port;
- Check related Leased Line (from other operator) when changing connection status to "Out of Service";
- Check if there is a SPOF (Single Point of Failure) in the connection when changing the connection status;
- Before changing the speed/bandwidth/type of a connection/service, check if the change can be done;
- Before changing a card (manually or via network reconciliation), check if change can be done.

2.8 Naming convention

IMS complies with the naming convention standards implemented by our customers.

Business rules will be implemented to ensure a correct naming convention for new objects.

Auto naming convention can be set for the different attributes, such as:

- Locations
- Active and passive equipment
- Connections and services
- Order numbers
- Trouble Ticket numbers
- Planned Work references

3. Locations

3.1 General information

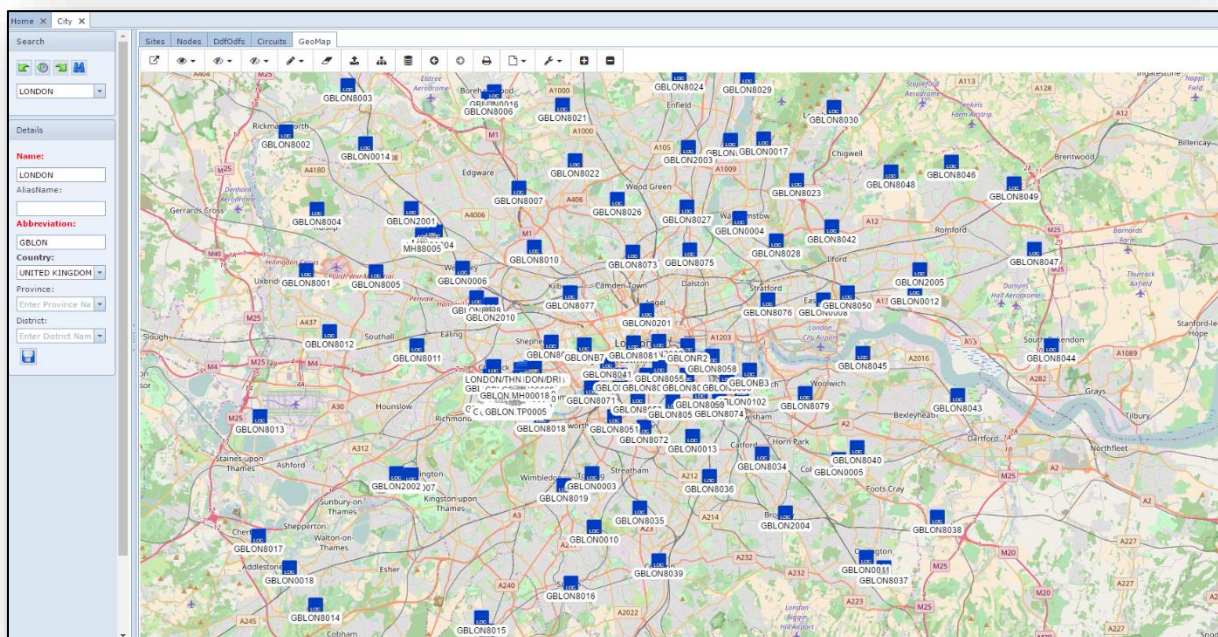
The following location types can be registered in IMS, in hierarchy:

- Countries
- Provinces/States/Regions
- Cities
- Buildings/Sites/other locations
- Rooms

A city must be related to a country and optionally to a province/state/region and/or a district.

One building can have several sub locations (rooms) related. Each location (like building, room) has a unique identifier in the IMS database.

Below example of the City form - Geo map in IMS:



3.2 Locations / sites

The sites/buildings and related rooms have related information like:

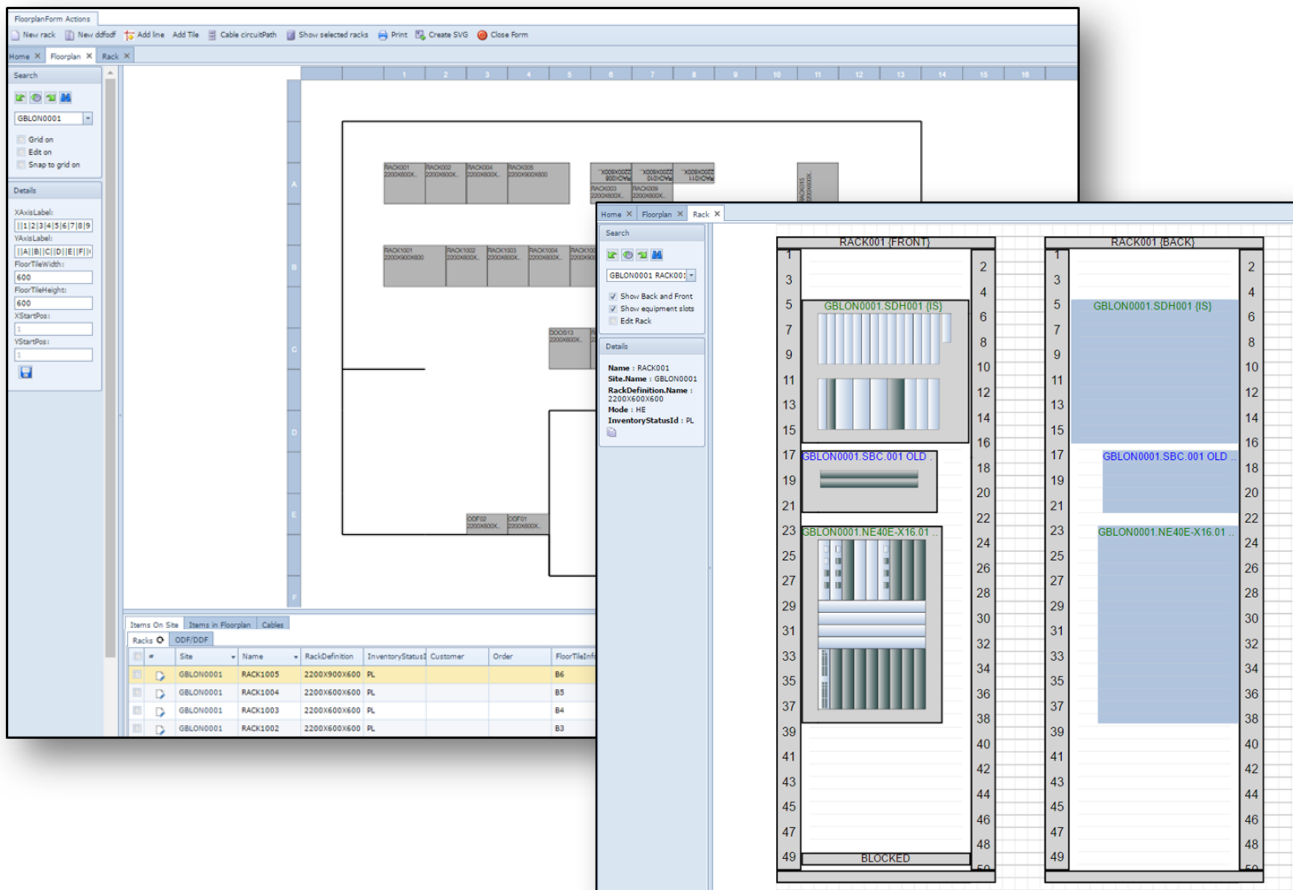
- General information, like
 - o Address details
 - o Room/floor name (in case of room location)
 - o Status
 - o Phone number
 - o Longitude/ Latitude
 - o Access Description
 - o Owner
 - o Contact person(s)
 - o General description
 - o Location type (list of types can be defined)
- Connections beginning or ending at a location
- Equipment installed
- DDF, ODF, Patch-Panels in the location
- Location alias names (different names for same location)
- Cabinets/Racks in the location
- Free/available ports in the location
- Geographical Maps (to view location in OpenStreet Maps, Google and/or Bing)

Special location naming convention rules can be implemented on request.

3.3 Floor Plan and Racks

The Floor Plan Management functionality supports the management of the sites. Via a graphical view of the site users can easily manage the floor space. It includes:

- Floor plan details, like
 - o Floortiles:
 - o Tile height
 - o Tile width
 - o Flexible labeling of the floortiles
 - o Racks/Cabinets
 - o Node/Power/DDF/ODF shelves in the rack/cabinet
 - o Walls, entrances
- Rotation of objects in floor plan
- Drag and drop functionality
- Zoom in/out



Example above (on the left) is a graphical layout of a location

On the right is a cabinet/rack opened from the floorplan with equipment placed at certain heights within the cabinet.

Rack types can be models by users with appropriate user permissions.

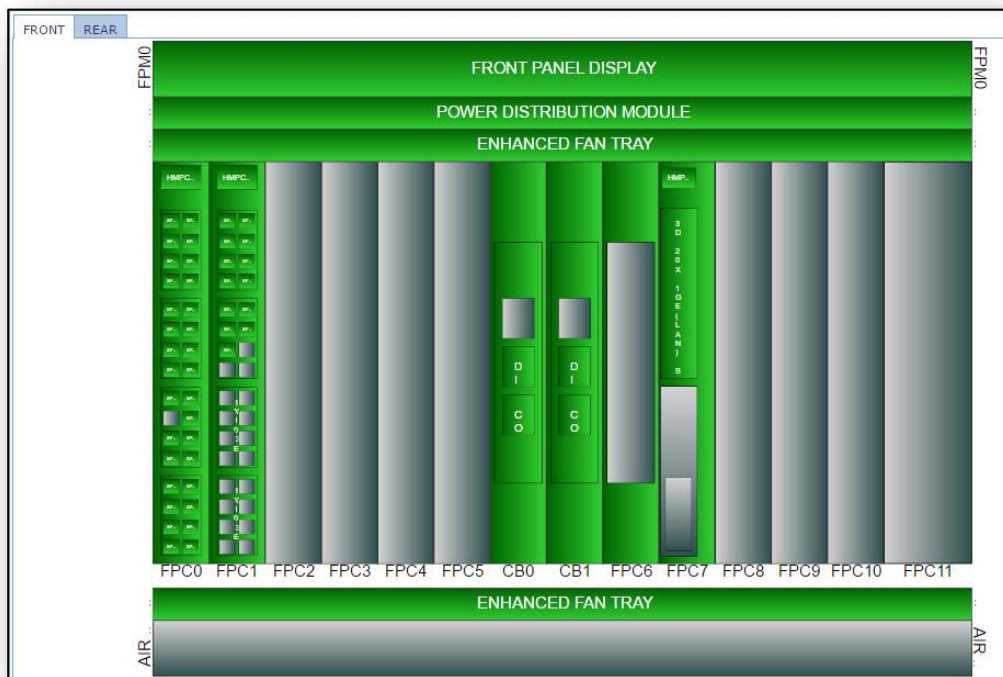
4. Equipment

4.1 Equipment types

VC4-IMS has the capability to model all different kinds of equipment, such as MPLS/IP, Ethernet, WDM/OTN, SDH, SONET, PDH, Voice/VoIP, Mobile 2G-3G-4G-5G RAN & Core, Microwave, FTTx/xPON, Broadcast, SubMarine, Satellite/vSAT, WiFi, SDN, Servers (physical and virtual) and many more.

IMS is vendor independent, so all types of all vendors can be created and modeled using the IMS GUI by users with appropriate permissions.

For each shelf/sub-shelf the front and back layout can be modeled in a graphical representation.



Other functions related to equipment type:

- Set up shelves
- Set up dimensions of equipment shelves
- Set up slots and slot dimensions
- Set up cards and cards per slot
- Set up card pluggables (FSPs/XFPs)
- Link an equipment type to a platform (such as MPLS, WDM)
- Link an equipment type to a management system (NMS/EMS).
- Set an icon, so that each type has a specific icon on the IMS Network Map.
- Relate equipment type picture
- Copy equipment type

4.2 Equipment

Equipment (network elements) with related information can be stored in IMS.

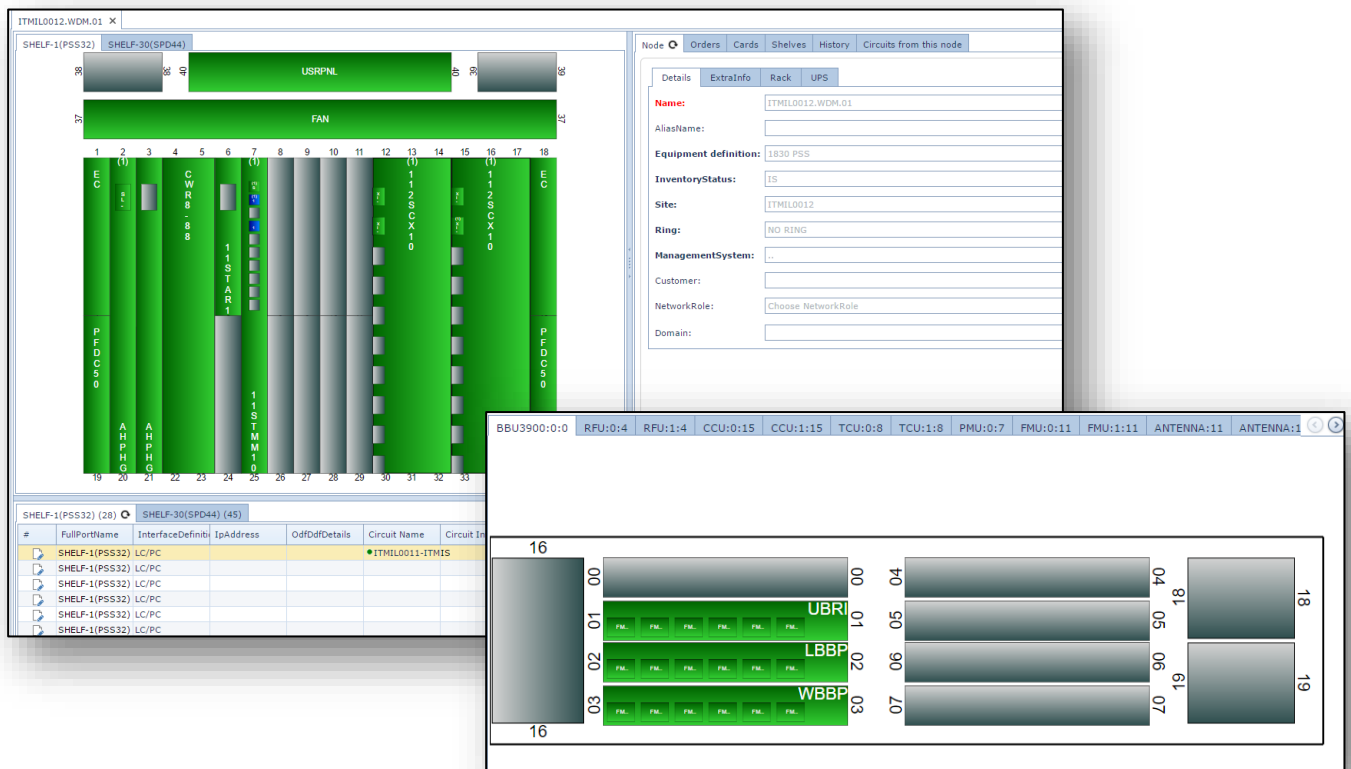
The following information can be stored.

4.2.1 General info

- Nodename
- Status
- Type of equipment
- Location where equipment has been installed
- Loopback address
- Management System
- Order details
- Hardware/Software version
- Serial number
- Barcode
- UPS info
- General comments
- Customized fields ([see customized fields and tabs](#))

4.2.2 Graphical layout

A graphical representation is given for the piece of equipment.



4.2.3 Physical and logical ports

In the equipment form, at the bottom of the screen all the ports, physical and logical, are visible.

The following info is available:

- Port name
- Interface
- IP address
- DDF/ODF position
- Circuitname (connection on port)
- Status of connection
- Status of port
- Type of port (bandwidth/speed)
- Uni / bi (directional)
- Comment
- Domain
- Reservation number
- Reserved by
- Reserved date
- Blocked yes/no

Equipment with specific functions can have additional port information.

Additional fields can be added using customized fields by admin users ([see customized fields and tabs](#)).

4.3 Cards

4.3.1 Card names and types

Cards will be visible in the slots. From the screen the cards can be opened to see more card details like:

- Card name
- Card code (if applicable)
- Parent card (if applicable)
- Serial number
- Barcode
- Status
- Software release
- Software revision
- Hardware version
- Protection card (yes/no)
- Date fields (like creation date, in service date)
- Extra info
- Order details

Each card type can have one or multiple card codes related.

Examples:

- Cisco card name "PA-4E1G/120", card code "73-2250-04"
- Ciena card name "CN-M6-FLEX" card code "B-966-0013-011"
- Nortel card name "8 X OC-3/12/STM-1/4 VT1.5/LO SFP", card code "NTK513DA"

Users with appropriate permissions can create, change and delete cards in the IMS system.

4.3.2 Ports with related information

All ports related to the cards will be shown in the equipment form, with information such as:

- Port name
- Interface
- IP address
- DDF/ODF position
- Circuitname (connection on port)
- Status of connection
- Status of port
- Type of port (bandwidth/speed)
- Uni / bi (directional)
- Comment
- Domain
- Reservation number
- Reserved by
- Reserved date
- Blocked yes/no

Users with appropriate permissions can create, change and delete ports on cards and equipment.

4.3.3 Card relations

Relations between cards can be made. For example, relation between front cards and back cards.

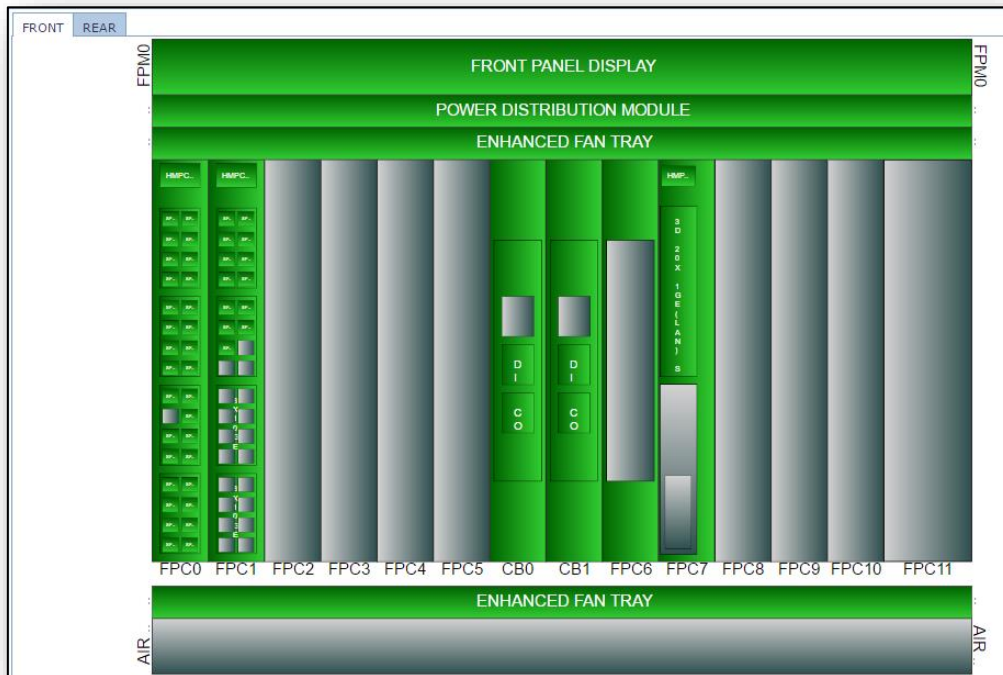
4.3.4 Card per slot

Business rules have been implemented to allow only certain cards in a specific slot. Users with the appropriate user permissions can add and change these business rules on “cards-per-slot”.

Also cards that occupies multiple slots can be handled.

4.3.5 Card in card

IMS supports the “card in card” model, where a carrier card has one or more sub-cards inserted. The carrier card will have sub-slots (graphical visual on the screen). Sub-cards in sub-slots are supported as well.



4.4 Node template

In many occasions a configuration of a node (cards in the equipment) will be like previous configurations. When creating a new piece of equipment IMS users can choose a template with cards already inserted in the correct slots. With the same functionality, a copy of an existing equipment can be done as well.

5. Distribution Frames

Distribution frames (like DDF, ODF, Patch Panels, Splice panels) can be registered in IMS.

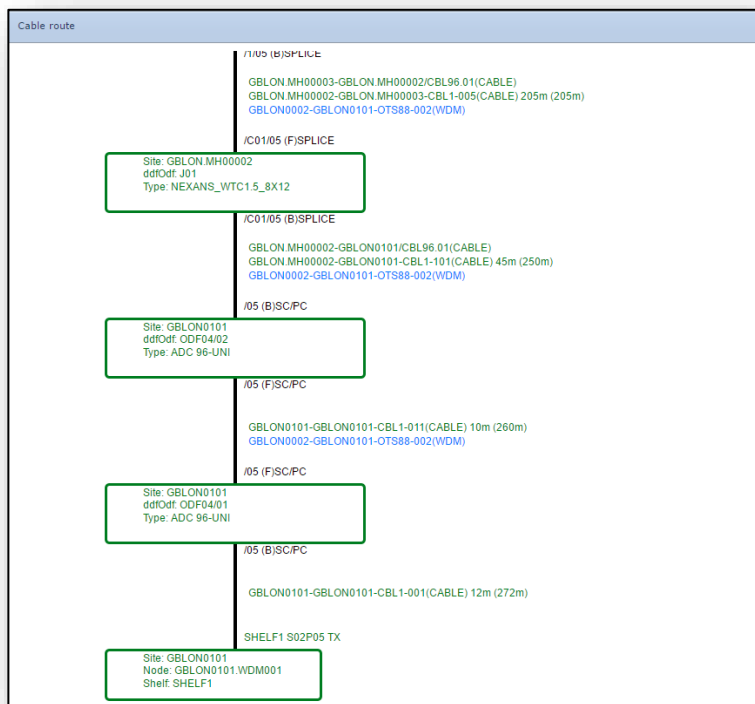
Cables (patches, jumpers) can be made between:

- Frame and equipment
(e.g. pre-wiring)
- Frame and Frame
- Frame and leased line

Cables can be layered into a main cable.

Splices can be registered and splice schemas can be viewed.

Graphical views can be drawn to show the end to end cable routes. Below an example of cable route starting on WDM equipment (lowest rectangle) towards an ODF and another ODF, routing further to fiber network (OSP).



IMS Product description

All types of frames can be modeled in IMS.

Users can create the digital and optical distribution frames with location as starting point. DDF/ODF shelves and patch panels can be positioned in a rack.

Each frame has a front and a back. Per frame position a connection/patch can be made to equipment (pre-wiring) or other frame.

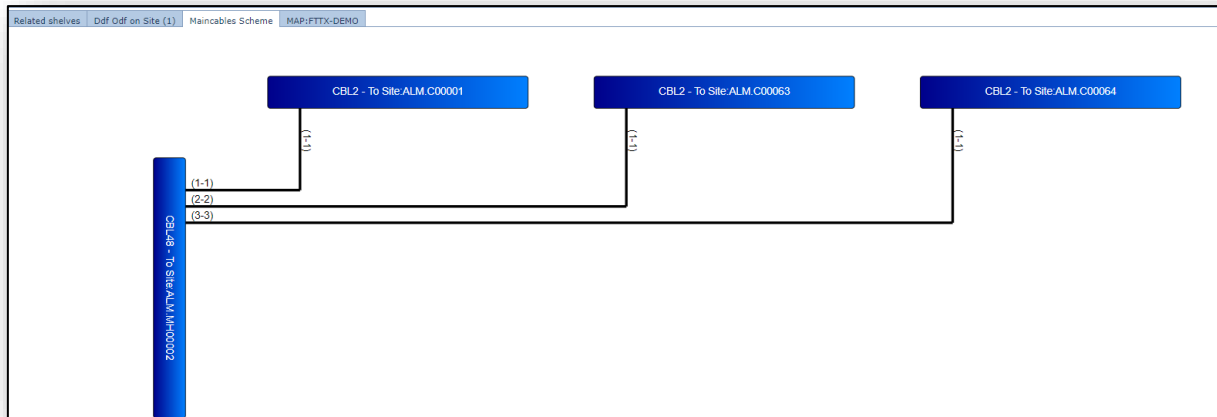
Below a screenshot of an ODF with its positions (filtered on back side positions).

#	FrontBack	FullName	MainCable	CableNumber	Channel/AsFullName	CH	Cable Back	CableSubCircuit	Comments	FullPath
b										
B	/C01/01	GBLON.MH0000	1	(T1-BLUE F1-BLUE)	GBLON.MH00002-GBLON101-CBL1-097(CABLE)		GBLON99004-GB			GBLON101.30.01 SHELFS 1/01(TX) <=> GBLON99005.OLT01
B	/C01/02	GBLON.MH0000	2	(T1-BLUE F2-ORANGE)	GBLON.MH00002-GBLON101-CBL1-098(CABLE)		GBLON99002-GBL			GBLON101.30.01 SHELFS 1/01(RX) <=> GBLON99005 ODF01
B	/C01/03	GBLON.MH0000	3	(T1-BLUE F3-GREEN)	GBLON.MH00002-GBLON101-CBL1-099(CABLE)					GBLON101 ODF04/01/01 (SC/PC) <=> GBLON99005 ODF01/0
B	/C01/04	GBLON.MH0000	4	(T1-BLUE F4-BROWN)	GBLON.MH00002-GBLON101-CBL1-100(CABLE)					GBLON101 ODF04/01/04 (SC/PC) <=> GBLON99005 ODF01/0
B	/C01/05	GBLON.MH0000	5	(T1-BLUE F5-SLATE)	GBLON.MH00002-GBLON101-CBL1-101(CABLE)					GBLON.MH00003 SBL1/05 (SPLICE) <=> GBLON101.WDM00
B	/C01/06	GBLON.MH0000	6	(T1-BLUE F6-WHITE)	GBLON.MH00002-GBLON101-CBL1-102(CABLE)					GBLON.MH00003 SBL1/06 (SPLICE) <=> GBLON101.WDM00
B	/C01/07	GBLON.MH0000	7	(T1-BLUE F7-RED)	GBLON.MH00002-GBLON101-CBL1-103(CABLE)					GBLON.MH00003 SBL1/07 (SPLICE) <=> GBLON101.WDM00
B	/C01/08	GBLON.MH0000	8	(T1-BLUE F8-BLACK)	GBLON.MH00002-GBLON101-CBL1-104(CABLE)					GBLON.MH00003 SBL1/08 (SPLICE) <=> GBLON101.WDM00
B	/C01/09		0							
B	/C01/10		0							
B	/C01/11		0							
B	/C01/12		0							
B	/C02/02		0							
B	/C02/01		0							
B	/C02/03		0							
B	/C02/04		0							
B	/C02/05		0							
B	/C02/06		0							
B	/C02/07		0							

Also splice schema (splices made within a splicebox) can be generated in the same way:

#	F	FullName	MainCable	C	C	Circuit	Circuit	Comments	FullPath
B	/T02/01	ALM.MH00001-ALM.MH00002-CBL48-001(FIBER)	1	ALM.MH00001-ALM.MH00002-CBL1-001(CABLE)	ALM.C00001-ALM.FDT0001-GPON-001(GPON)	ALM.C00001-ALM.FDT0001-GPON-001(GPON)			ALM.C00001 ODB.01/1 (LC/PC) <=> ALM.FDT0001
F	/T03/01	ALM.C00001-ALM.MH00001-CBL2-001(FIBER)	1	ALM.C00001-ALM.MH00001-CBL1-001(CABLE)	ALM.C00001-ALM.FDT0001-GPON-001(GPON)	ALM.C00001-ALM.FDT0001-GPON-001(GPON)			ALM.C00001 ODB.01/1 (LC/PC) <=> ALM.FDT0001
B	/T03/02	ALM.MH00001-ALM.MH00002-CBL48-001(FIBER)	2	ALM.MH00001-ALM.MH00002-CBL1-002(CABLE)					ALM.FDT0001 SPLT2 OUT02 <=> ALM.MH00001 J0
F	/T02/02	ALM.C00063-ALM.MH00001-CBL2-001(FIBER)	1	ALM.C00063-ALM.MH00001-CBL1-001(CABLE)					ALM.FDT0001 SPLT2 OUT02 <=> ALM.MH00001 J0
B	/T02/01	ALM.MH00001-ALM.MH00002-CBL48-001(FIBER)	3	ALM.MH00001-ALM.MH00002-CBL1-003(CABLE)					ALM.FDT0001 SPLT2 OUT03 <=> ALM.MH00001 J0
F	/T02/01	ALM.C00064-ALM.MH00001-CBL2-001(FIBER)	1	ALM.C00064-ALM.MH00001-CBL1-001(CABLE)					ALM.FDT0001 SPLT2 OUT03 <=> ALM.MH00001 J0
B	/T02/02	ALM.MH00001-ALM.MH00002-CBL48-001(FIBER)	4	ALM.MH00001-ALM.MH00002-CBL1-004(CABLE)					ALM.FDT0001 SPLT2 OUT03 <=> ALM.MH00001 J0
F	/T02/02	ALM.C00064-ALM.MH00001-CBL2-001(FIBER)	4	ALM.C00064-ALM.MH00001-CBL1-004(CABLE)					ALM.FDT0001 SPLT2 OUT03 <=> ALM.MH00001 J0
B	/T03/01	ALM.MH00001-ALM.MH00002-CBL48-001(FIBER)	5	ALM.MH00001-ALM.MH00002-CBL1-005(CABLE)					ALM.FDT0001 ALM.FDT0001-FEEDERDF-02/04 (L)
F	/T03/01	ALM.MH00001-ALM.MH00002-CBL48-001(FIBER)	5	ALM.MH00001-ALM.MH00002-CBL1-005(CABLE)					ALM.FDT0001 ALM.FDT0001-FEEDERDF-02/05 (L)
B	/T03/02	ALM.MH00001-ALM.MH00002-CBL48-001(FIBER)	6	ALM.MH00001-ALM.MH00002-CBL1-006(CABLE)					ALM.FDT0001 ALM.FDT0001-FEEDERDF-02/06 (L)
F	/T03/02	ALM.MH00001-ALM.MH00002-CBL48-001(FIBER)	6	ALM.MH00001-ALM.MH00002-CBL1-006(CABLE)					ALM.FDT0001 ALM.FDT0001-FEEDERDF-02/06 (L)
B	/T04/01	ALM.MH00001-ALM.MH00002-CBL48-001(FIBER)	7	ALM.MH00001-ALM.MH00002-CBL1-007(CABLE)					ALM.FDT0001 ALM.FDT0001-FEEDERDF-02/07 (L)
F	/T04/01	ALM.MH00001-ALM.MH00002-CBL48-001(FIBER)	7	ALM.MH00001-ALM.MH00002-CBL1-007(CABLE)					ALM.FDT0001 ALM.FDT0001-FEEDERDF-02/07 (L)
B	/T04/02	ALM.MH00001-ALM.MH00002-CBL48-001(FIBER)	8	ALM.MH00001-ALM.MH00002-CBL1-008(CABLE)					ALM.FDT0001 ALM.FDT0001-FEEDERDF-02/08 (L)
F	/T04/02	ALM.MH00001-ALM.MH00002-CBL48-001(FIBER)	8	ALM.MH00001-ALM.MH00002-CBL1-008(CABLE)					ALM.FDT0001 ALM.FDT0001-FEEDERDF-02/08 (L)
B	/T05/01	ALM.MH00001-ALM.MH00002-CBL48-001(FIBER)	9	ALM.MH00001-ALM.MH00002-CBL1-009(CABLE)					ALM.FDT0001 ALM.FDT0001-FEEDERDF-02/09 (L)
F	/T05/01	ALM.MH00001-ALM.MH00002-CBL48-001(FIBER)	9	ALM.MH00001-ALM.MH00002-CBL1-009(CABLE)					ALM.FDT0001 ALM.FDT0001-FEEDERDF-02/09 (L)
B	/T05/02	ALM.MH00001-ALM.MH00002-CBL48-001(FIBER)	10	ALM.MH00001-ALM.MH00002-CBL1-010(CABLE)					ALM.FDT0001 ALM.FDT0001-FEEDERDF-02/10 (L)
F	/T05/02	ALM.MH00001-ALM.MH00002-CBL48-001(FIBER)	10	ALM.MH00001-ALM.MH00002-CBL1-010(CABLE)					ALM.FDT0001 ALM.FDT0001-FEEDERDF-02/10 (L)
B	/T06/01	ALM.MH00001-ALM.MH00002-CBL48-001(FIBER)	11	ALM.MH00001-ALM.MH00002-CBL1-011(CABLE)					ALM.FDT0001 ALM.FDT0001-FEEDERDF-02/11 (L)
F	/T06/01	ALM.MH00001-ALM.MH00002-CBL48-001(FIBER)	11	ALM.MH00001-ALM.MH00002-CBL1-011(CABLE)					ALM.FDT0001 ALM.FDT0001-FEEDERDF-02/11 (L)
B	/T06/02	ALM.MH00001-ALM.MH00002-CBL48-001(FIBER)	12	ALM.MH00001-ALM.MH00002-CBL1-012(CABLE)					ALM.FDT0001 ALM.FDT0001-FEEDERDF-02/12 (L)
F	/T06/02	ALM.MH00001-ALM.MH00002-CBL48-001(FIBER)	12	ALM.MH00001-ALM.MH00002-CBL1-012(CABLE)					ALM.FDT0001 ALM.FDT0001-FEEDERDF-02/12 (L)

Schematic drawing of the splices can be viewed in a graphical way:



6. Connections

6.1 Connection types

Numerous kinds of connections can be stored on IMS. Some examples are shown below:

- Transport connections, like
 - o SDH
 - o SONET
 - o PDH
 - o WDM, OTN
 - o Cables, (Sub)Seacables
 - o Trenches, Ducts, Fiber cables, fibers
 - o GPON
 - o DSL
 - o Microwave
- Ethernet connections, like
 - o Carrier Ethernet, including:
 - o E-Lines (Ethernet service connecting two customer Ethernet ports over a WAN)
 - o E-LAN (a multipoint service connecting a set of customer endpoints, giving the appearance to the customer of a bridged Ethernet network connecting the sites)
 - o E-tree (a multipoint service connecting one or more roots and a set of leaves, but preventing inter-leaf communication)
 - o Metro Ethernet
 - o Ethernet over SDH/SONET
 - o Ethernet over MPLS
 - o Ethernet over Microwave
 - o GPON
- Data connections, like
 - o MPLS
 - o IP
 - o Frame Relay, ATM
- Voice like
 - o Customer voice connections
 - o Voice interconnects (to other telcos)
 - o Voice core and access links
 - o Signal links
 - o Voice routes
- Mobile
 - o Mobile Core 2G, 3G, 4G, 5G
 - o Mobile RAN 2G, 3G, 4G, 5G
 - o Mobile Backhaul
 - o National and international Interconnects
- Broadcast Network Connections, such as
 - o Trunks
 - o xGBE
 - o Source Routes
 - o VLANs
 - o Unicast
 - o Multicast
 - o ETS
 - o Services

- WiFi, WiMax connectivity
- Radio connections
 - o Microwave connections
 - o Sub connections
- Satellite/vSat connections
- Power connections
- DCN connections
- Synchronization connections

All connection rules (such as layering rules, sub-channel configurations, default data entry values, etc.) can be set up in the GUI of the system.

6.2 Connection speeds and types:

All circuit speeds/types can be modeled on IMS.

Examples:

- OTS, OMS, OTU, ODU0, ODU1, ODU2, ODU3, ODU4
- 2.5Gb, 10Gb, 100Gb, 400Gb, 480Gb, etc
- 10Mb, 100Mb, 1Gbe, 10Gbe
- STM1, STM4, STM16, STM64
- VC4, VC4-4C, VC4-16C, VC4-64C, VCgroup
- OC3, OC12, OC48, OC192
- STS1, STS3, STS12, STS48, STS192
- 45MB/VC3/T3
- 34Mb/VC3/E3
- 2Mb/VC12/E1
- 1.5Mb/VC11/T1
- 64k, 128k, 512k, etc.
- PVC, VCC, VPC
- VPN, VLAN, VRF, L2VPN, L3VPN, Service Tunnel, Pseudowires (PWE)
- VCG, E-Line, E-LAN, E-Tree
- GPON
- Radio/Microwave/RF
- Mesh Tunnels, Mesh Protection tunnels
- WIFI connections
- 2MHz, 5Hz, 20MHz, etc
- Power
- Trunks, xGBE, Source Routes, VLANs, Unicast, Multicast, ETS, Services etc.

6.3 General information related to connections:

Different kinds of information can be associated with each connection, such as:

- Connection name
- Location A-end
- Location Z-end
- Speed
- Status
- Customer/Platform
- Order information
- Product code/Service
- Platform
- Extra information
- Framing/Line coding
- Dates
- Protection settings
- etc

6.4 Layering

The complete network hierarchy can be modeled on IMS.

Examples:

- A physical ethernet connection will have V-LANs. A VLAN can have services (e.g. L2VPN, L3VPN) or other VLANs.
- A physical WDM connection will have OCH (optical channel) on a frequency and have ODUx connections that can carry other ODU connections or client connections (e.g. MPLS, SDH, etc)
- A physical SDH connection (STMx) can carry VC4x connections, which can have sub-connections (e.g. E1, E3).

IMS supports all technologies and all network layers up to and including customer services.

The user can easily click through this network hierarchy.

6.5 Ports

All ports related to a connection are visible on the connections screen. The following data is shown:

- Port name
- Card interface
- IP address
- DDF/ODF position connected to port (pre-wiring)
- Name of the connection that is connected to port
- Port status
- Port type
- Port speed
- Comment field
- Platform
- Reservation info

6.6 Protections

All different kinds of circuit protection mechanisms can be stored in IMS. Some examples being:

- MSP
- MSPRING / BLSR
- SNCP / UPSR
- Twin connections
- DNI
- 1+n card protection
- Mesh/ASON

6.7 Planning of connections

Connections can be planned in IMS before built in the actual network.

6.7.1 Manual planning

IMS allow users to manually assign the connections to specific channels and ports. Protections and specific settings to connections can be stored as well.

6.7.2 Automatic planning

The IMS Automatic Trail Engineering functionality allow network operators to automatically plan connections in IMS. This functionality is based on “least cost routing”. Rules to define the “costs” can be implemented based on customer requirements (for example shortest distance, least hops, least financial costs or combination).

If so required IMS can link this automatic planning with the workflow engine of IMS, so that workflows can be fully automated.

See also [Network Planning and Change Management](#).

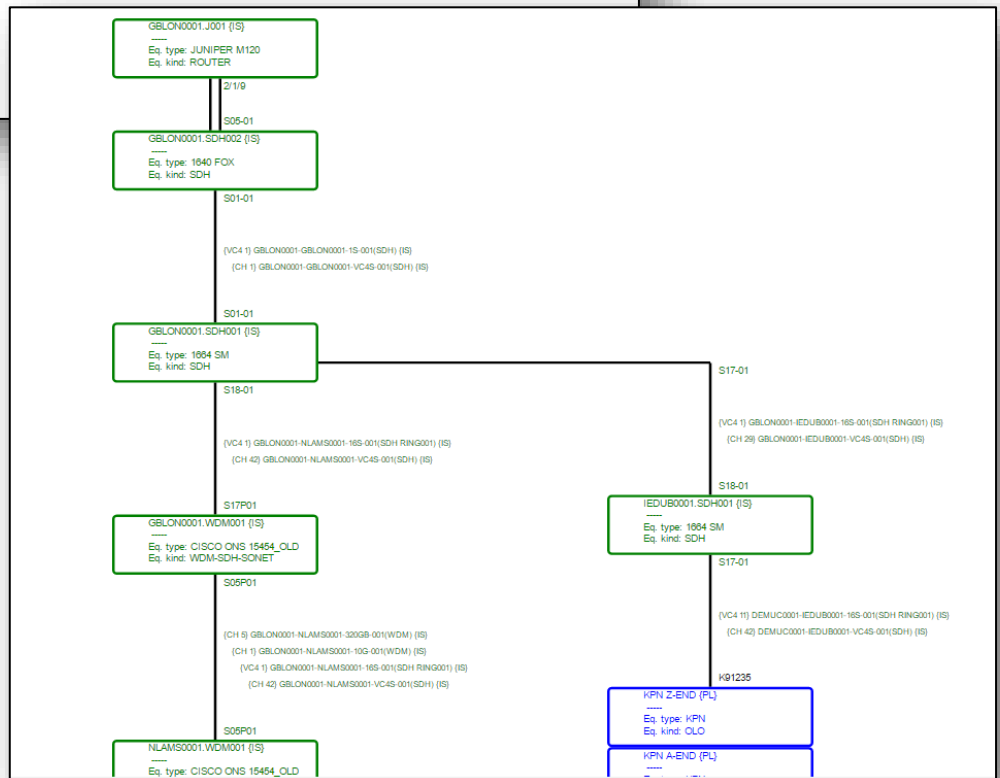
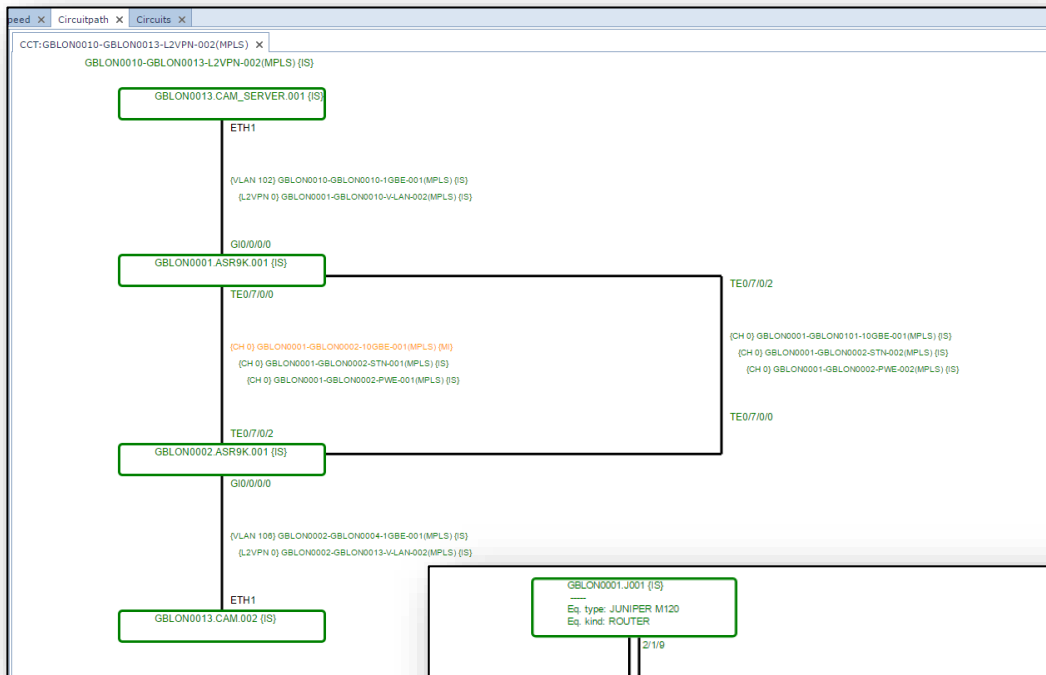
6.8 Test results

After connections or services have been tested, test results can be saved against the connection/service. If so required the testing process can be managed using the IMS Workflow, see chapter 19.

7. Graphical Circuit Path

A graphical overview can be drawn for each connection. This is done “on-the-fly”, calculated from the information held within the database. All details of the worker and protect route is given, including leased line details.

The user can decide what kind of information is visible on the screen like location details, card details, DDF/ODF information, etc.



8. GIS, Outside Plant and Network Map functionalities

The Network Map provide users with a graphical and geographical representation of the network.

Different kinds of network objects can be viewed in a map, such as

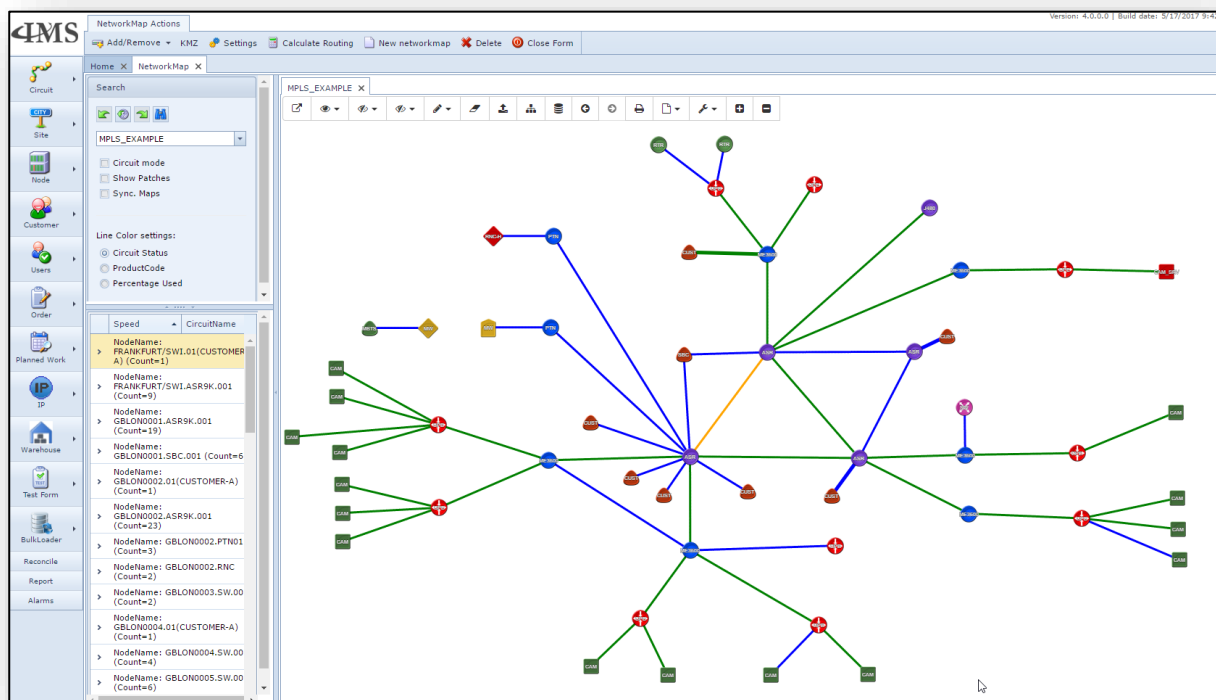
- Equipment
- DDF/ODF
- Manholes and splice-boxes (joints)
- Connections / services
- Link to other maps

8.1 Interactive map

Each object is an object from the database. IMS will draw the connectivity automatically based on the information stored in the database.

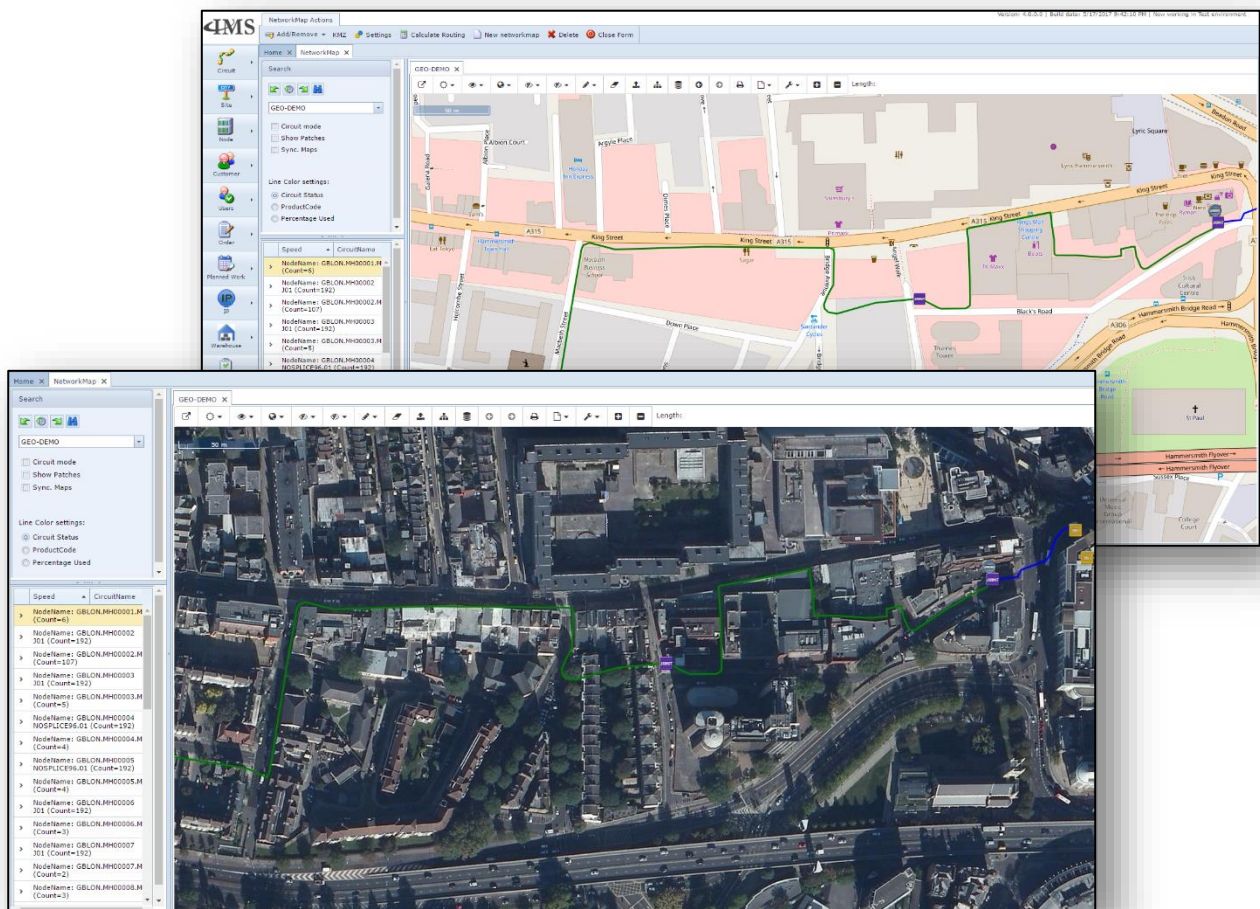
The Network Map is interactive, so that the objects can be opened directly from the map.

Example of Network Map, graphical:

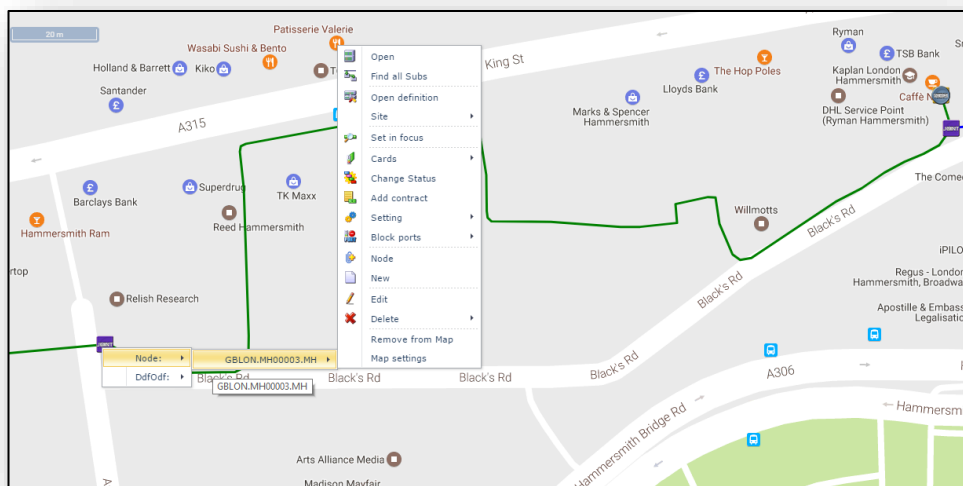


IMS Product description

Example Network Map, geographical.

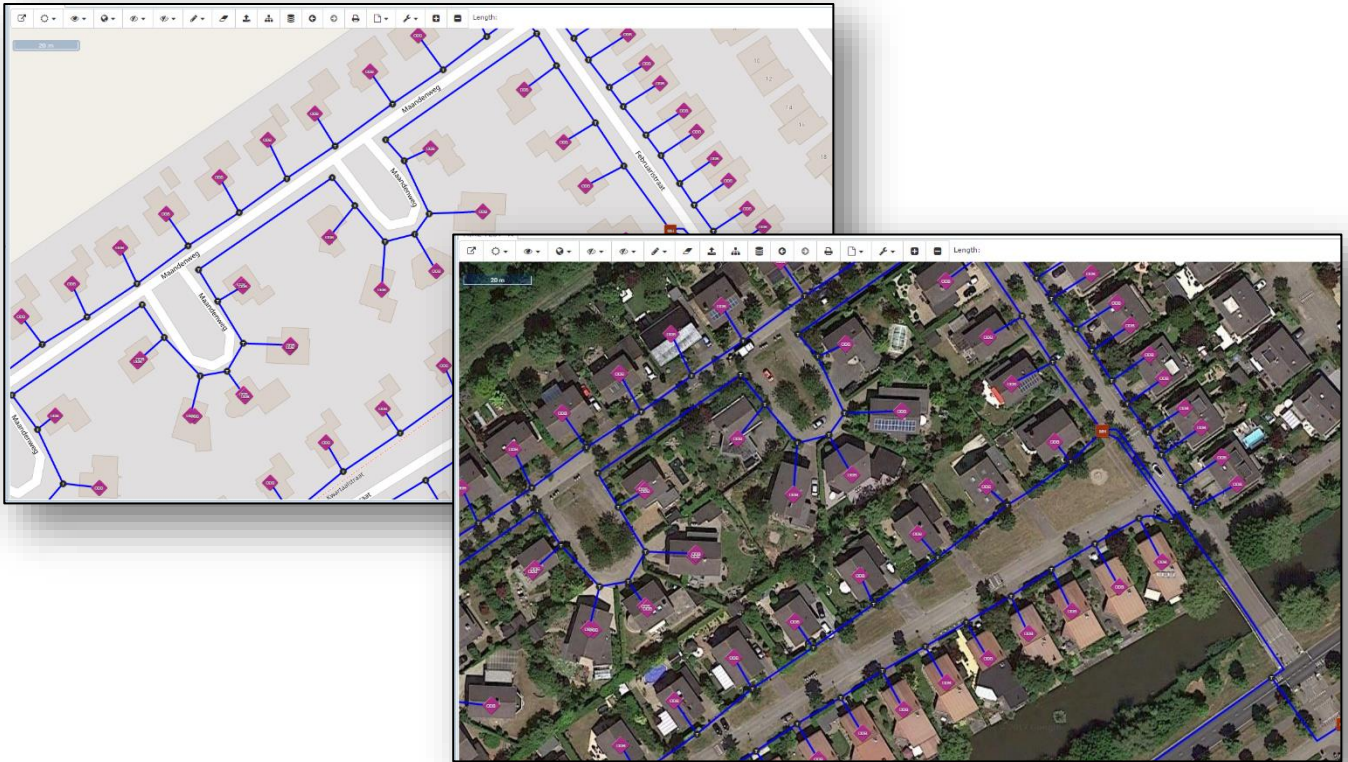


Right mouse menu is available on each object to find more details or to do certain actions:



8.2 Geographical background

VC4-IMS works with different GIS/geo background data providers, such as Openstreet Maps, Google and Bing.



Other type of layers can be supported as well.

8.3 Network Map functionalities

Below a short explanation of different functionalities and options in the Network Map:

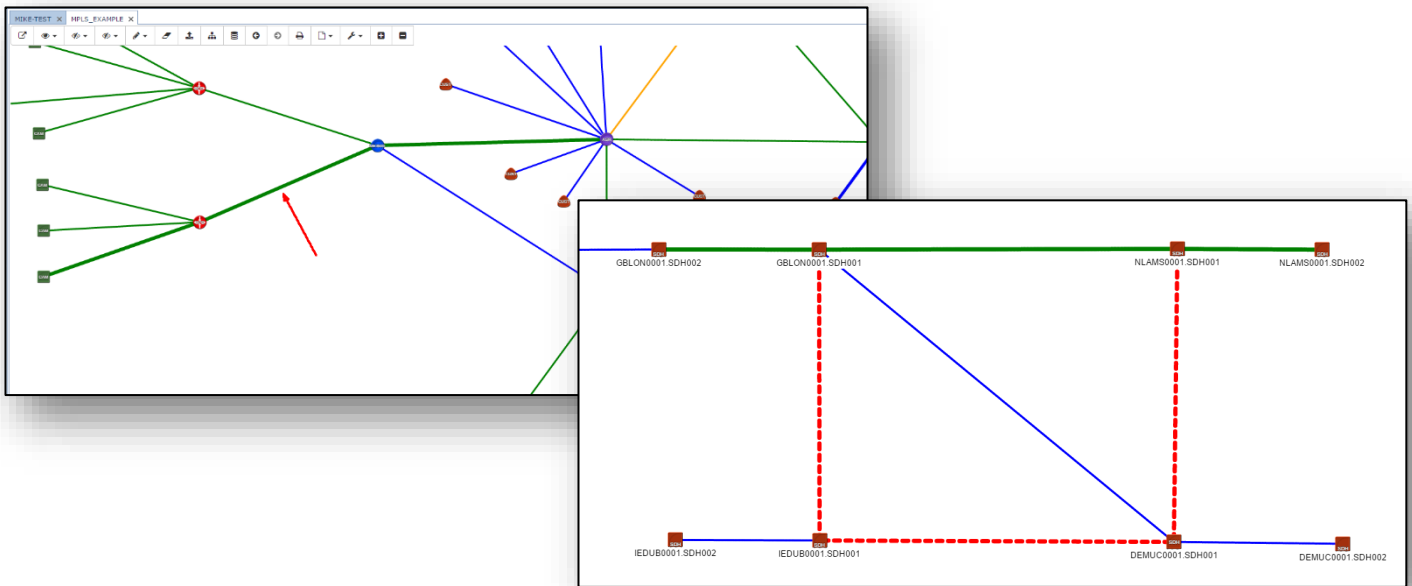
Connection types

A user can decide what types of connections needs to be drawn per Network Map.

For example, in a MPLS map, only show MPLS type of connections, in a fiber map, only fiber network connections, etc.

Highlighting connections

Connections can be highlighted in the map. This is done with a thick line.



All network connection layers can be highlighted. For example VLAN, L2VPN, 2MB, etc.

Work paths are highlighted in **green**, protection path with a thick **red and dotted** line.

Add objects

Objects are placed on the network map automatically when a user creates those objects using the Network Map.

Additionally, objects can be added to a network map using a menu option.

KMZ Export

Network Maps can be exported in KML/KMZ format.

Turn on/off objects

Users can make objects (per type) visible or invisible.

Multi-create functions

To help VC4-IMS users to quickly engineer new networks, the system has multiple functions to create multiple object in one action. Examples:

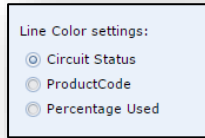
- Multi create sites including automatically retrieve address + latitude/longitude information.
- Multi create sites, and use templates for automatically implement equipment, ODF's, and/or spliceboxes.
- Multi create connections and auto connect to ports.
- Multi "patch" connections from one ODF/Splicebox to multiple ODFs. For example for FTTH usecase: to connect multiple households to one splicebox in a manhole)
- Create in multiple sites new equipment/DDF's/ODF's

Auto routing

VC4-IMS has auto routing capabilities for automatically finding the optimum route through the network.

Line color settings

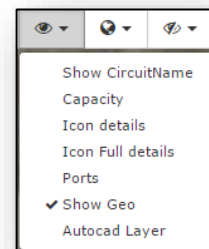
The colors of the lines (connections) on the network Map can have different functions:



- Status of the connection (blue is planned, green is in service, purple is “ready for service”, etc).
- Type of connection (product code). Users can set a color per type of connection/product.
- Used capacity. IMS calculates the used capacity and show green (enough capacity available), yellow (medium full) or red (full or almost full).

Show additional information

With tick-boxes within the menu, users may switch on/off additional information on the screen like:

**All lines**

In case there are multiple connections between two nodes, the IMS user can decide to see it as one line or see it as separate connections

Navigation

The map can be moved, zoomed in and out in normal graphical view, but also in geographical view.

Objects

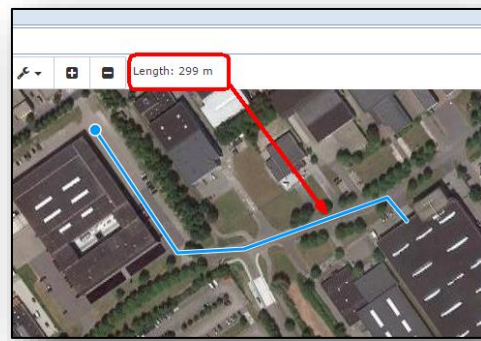
Once a user has appropriate user permissions, the user can add, move/position and delete objects.

Free draw

Users can draw a new connection from starting node +port towards a second node. IMS will show automatically the available ports. In case of fiber trench, the geo route can be drawn directly on the map.

Measure distance

Users can measure the distance within a map using point and click functionality.



8.4 Outside Plant

The physical inventory, Outside Plant (OSP), can be planned and maintained within the VC4-IMS application.

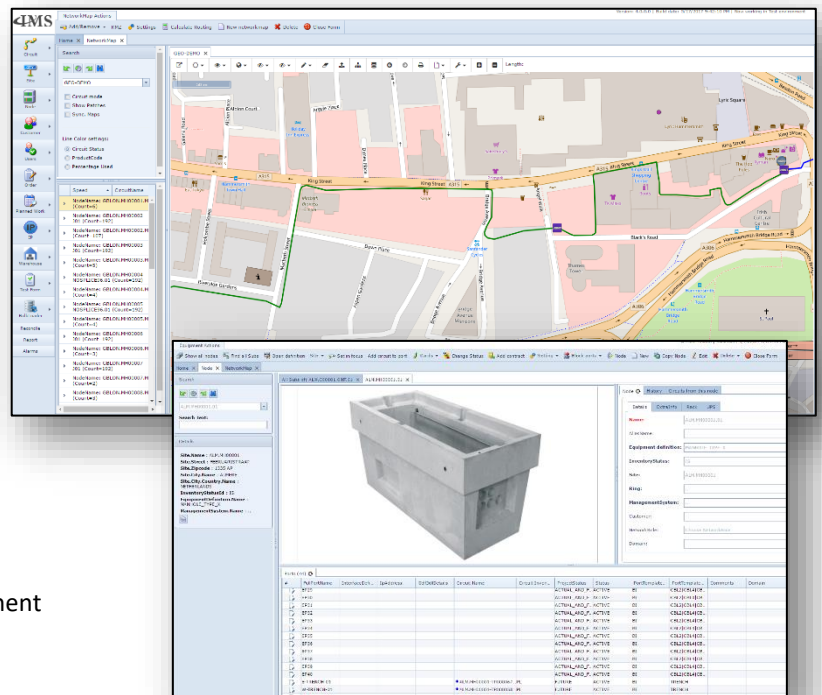
Typically, the OSP functionality is used for fiber & copper network registration, Mobile RAN (2G, 3G, 4G, 5G), Microwave/Radio networks, WiFi, Wimax and Subsea cables.

Since VC4-IMS also manages the active and logical networks (with the relation to the physical network), the logical connections and services can be seen in a geographical view. This unique combination makes it possible to perform different analysis to reduce network outages (Single Point of Failure calculations) and improve the sales activities.

8.4.1 OSP objects

Examples of OSP objects that can be registered:

- Trenches
- Ducts
- Fiber and copper cables
- Fiber and copper connections
- Manholes/Handholes locations
- Cable entries (building, manhole, BTS site)
- Poles
- DDF/ODF's
- Spliceboxes / enclosures
- Cassettes within spliceboxes
- Splitters
- Any other passive equipment/component
- Active equipment, such as:
 - o OLT, ONT/ONU
 - o Mobile RAN (2G/3G/4G), Core
 - o Transmission, MPLS/IP
 - o Microwave
 - o WiFi
 - o Microwave
 - o etc



8.4.2 GIS Functionalities

The following main functionalities around OSP/GIS are built in the system:

- Network planning (locations, active and passive equipment, connections/services)
- Network change management
- Fault handling
- Capacity management
- Sales support (sell close to network)
- Switch between geo-background and graphical view
- Easy fiber/copper cable trench routing on the map (street level)
- Auto routing over fiber/copper/logical layers
- Registering the z-positions of cable routes (depth, height)
- Single Point of Failure checks (e.g. worker and protection path configured in same fiber cable)
- Planned Work impact analysis (which services go down due to fiber cut)
- KML export
- Splicing schemas
- Full asset management of fiber/copper networks
- Graphical and geographical end-to-end paths
- Full point-to-point FTTx & PON network support
- Reporting
- [Network Map functionalities](#) as listed in paragraph 8.3

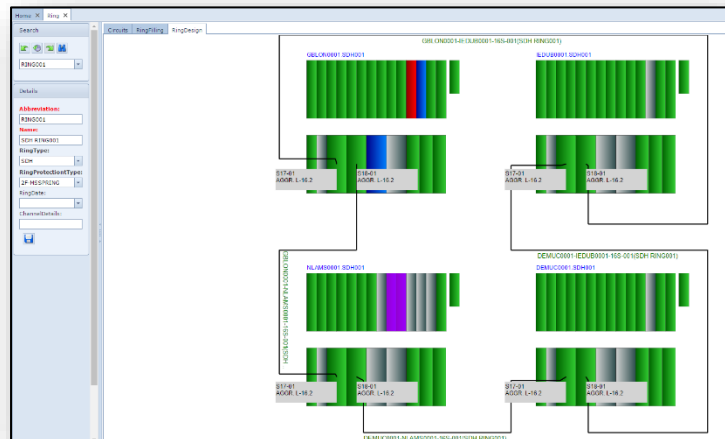
The screenshot displays the IMS software interface with three main components:

- Equipment Details (Top Left):** Shows details for a '2 x 32 Splitter' (ALM_FDT0001). The details include:
 - Site Name: ALM_FDT0001
 - Site Street: SEIZOENWAD
 - Site Zipcode: 3220
 - Site City Name: AALSJEE
 - Site City Country Name: NETHERLANDS
 - InventoryStatusID: FL
 - EquipmentDefinitionName: FOT
 - ManagementSystemName: ...
 - BuildDate: 1/26/2017 10:23:19 AM
- Equipment Table (Top Middle):** A table listing various equipment items:

#	FullPortName	Interfacedef.	Ipaddress	Id@details	Circuit name	Circuit driver	ProjectStatus	Status	PortTemplate	PortTemplate
1	SPLT3 IN01			ALM_FDT0001-F	ALM_FDT0001-ALM_FDT0001-GPON-001(GPON)	PL	FUTURE	ACTIVE	B1	GPON
2	SPLT3 IN02			ALM_FDT0001-F	ALM_FDT0001-ALM_FDT0001-GPON-001(GPON)	PL	FUTURE	ACTIVE	B1	GPON
3	SPLT3 OUT01			ALM_FDT0001-F	ALM_FDT0001-ALM_FDT0001-GPON-001(GPON)	PL	FUTURE	ACTIVE	B1	GPON
4	SPLT3 OUT02			ALM_FDT0001-F	ALM_FDT0001-ALM_FDT0001-GPON-001(GPON)	PL	FUTURE	ACTIVE	B1	GPON
5	SPLT3 OUT03			ALM_FDT0001-F	ALM_FDT0001-ALM_FDT0001-GPON-001(GPON)	PL	FUTURE	ACTIVE	B1	GPON
6	SPLT3 OUT04			ALM_FDT0001-F	ALM_FDT0001-ALM_FDT0001-GPON-001(GPON)	PL	FUTURE	ACTIVE	B1	GPON
- Network Map (Bottom Left):** A geographical map showing a network layout with nodes and connections overlaid on a street grid. Labels on the map include 'Manslootweg', 'Kortlandweg', and 'Kortlandweg'. Nodes are represented by pink diamond shapes.
- Cable Route Diagram (Right):** A vertical flow diagram showing the path of a cable route between sites:
 - Site: ALM_FDT0001 (Node: ALM_FDT0001, Sheet: SPLT3) - SPLT3 OUT01
 - ALM_FDT0001-ALM_FDT0001-CBL1-001(CABLE) 5m (5m)
 - ALM_C00069-ALM_FDT0001-GPON-001(GPON)
 - /01 (B)LC
 - Site: ALM_FDT0001 (Sheet: SPLT3) - FEEDER-ODF-93
 - Type: FEEDER-ODF-48P
 - /01 (F)LC
 - ALM_FDT0001-ALM_MH00002-CBL48-001(FIBER)
 - ALM_FDT0001-ALM_MH00002-CBL1-001(CABLE) 10m (15m)
 - ALM_C00069-ALM_FDT0001-GPON-001(GPON)
 - /01 (F)NO-SPLICE
 - Site: ALM_MH00002 (Sheet: NOSPLICE48_0001) - NOSPLICE-48
 - Type: NO-SPLICE-48
 - /01 (B)NO-SPLICE
 - ALM_MH00002-TP000097-CBL48-001(FIBER)
 - ALM_MH00002-TP000097-CBL1-001(CABLE) 0m (15m)
 - ALM_C00069-ALM_FDT0001-GPON-001(GPON)
 - /T01/01 (B)SPLICE
 - Site: TP000097 (Sheet: J000001) - GCO2-FD6-24TRAYX2POS
 - Type: GCO2-FD6-24TRAYX2POS
 - /T01/01 (F)SPLICE
 - ALM_C00069-TP000097-CBL2-001(FIBER)
 - ALM_C00069-TP000097-CBL1-001(CABLE) 0m (15m)
 - ALM_C00069-ALM_FDT0001-GPON-001(GPON)
 - /1 (B)LC/PC
 - Site: ALM_C00069 (Sheet: ODB_01) - ODB2
 - Type: ODB2
 - /1 (F)LC/PC

9. Network Rings

Some networks, like WDM, Ethernet, SDH, SONET, can be built in a ring structure. In IMS you can create rings for these networks. Per ring the ring name, abbreviation, protection mechanism and in service date can be stored.



10. Customers

10.1 Customer information

Customer details are stored in the customer form. Customer data can be registered via the IMS Graphical User interface (GUI) or imported/linked via interface to a CRM application. The following information can be registered:

- Customer abbreviation
- Customer full name
- Customer related information, like
 - Customer address
 - Customer contact persons
- Customer connections/services
- Customer locations
- Customer equipment
- Customer orders
- Planned Works impacted to customer
- Trouble tickets impacted to customer
- Customer Contract and SLA information

These items can be opened directly from the customer page.

#	Name	InventorySta.	Speed	Nam.	Customer	Order Name	Product Name	ServiceParts	Vendor	CreateUser	CreateDate	Del
1	AMR001A-AMR002A-10G-001(VC4)	PL	10G		VC4	TRAINING_TEA	ETHERNET	ETHERNET	UNKNOWN	TEAM3	6/13/2016	
2	AMSTERDAM/AI-MILANO/MI-2MB-001(VC4)	PL	2MB		VC4	ITALY_POC	SDH	SDH	ALU	ADMIN	3/10/2016	
3	AMSTERDAM/AI-MILANO/MI-2MB-002(VC4)	PL	2MB		VC4	ITALY_POC	CITY2CITY-2MB	SDH	ALU	ADMIN	3/9/2016	
4	FRANKFURT/SWI-GBLON001-10GBE-001(VC4)	PL	10GBE		VC4	ITALY_POC	ETHERNET	ETHERNET	CISCO	INSSUPPORT	4/21/2016	
5	GBLON001-GBLON001-1GBE-002(VC4)	IS	1GBE		VC4	PROJECT1234	CITY2CITY-1GB	LEASED LINE	JUNIPER	TEAM2	9/2/2014	9/2/2014
6	GBLON001-GBLON001-1GBE-003(VC4)	PL	1GBE		VC4	ITALY_POC	ETHERNET	ETHERNET	CISCO	INSSUPPORT	4/21/2016	
7	MILANO/MI-PARIS/TH2-VC45-001(VC4)	PL	VC45		VC4	ITALY_POC	SDH SECTION	SDH	UNKNOWN	ADMIN	3/10/2016	

11. Leased Lines and Interconnects

11.1 Leased Lines

A complete or part of a network connection can be leased via another telecom provider (so called "leased line").



Any leased lines can be registered and managed in the IMS application.

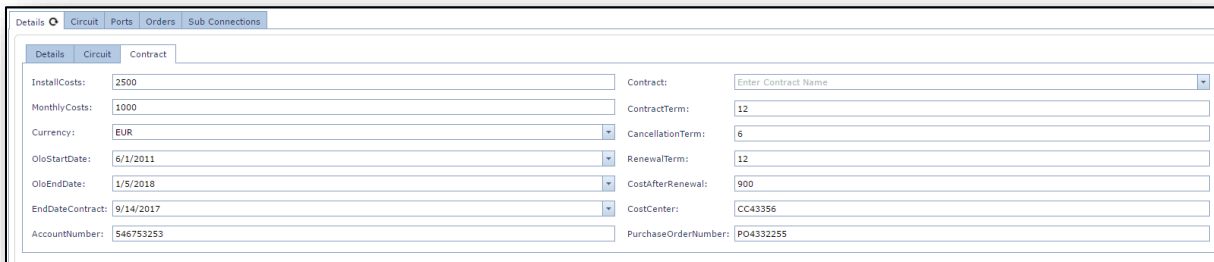
Information captured and managed

- General Attributes of the leased line, such as:
 - Name
 - Bandwidth
 - Bandwidth up
 - Bandwidth down
 - Supplier
 - Product (service name) of supplier
 - Status
 - Type (e.g. leased line, interconnect, telephone line)
 - Distance
 - Ratio (overbooking)
 - Creation date
 - Protocol
 - Demarcation point
 - protection information
 - Order and cease number
 - additional extra information (customizable by IMS Admin users).

- Vendor and SLA (Service Level Agreement) information:
 - Agreed Order lead times
 - Agreed Fault repair time
 - Agreed to be on-site
 - Main time to repair
 - Contact persons + details
 - Connections bought from operator
 - Product names
 - Special Arrangements
 - Escalation procedure

In case IMS workflow and IMS trouble ticket functionality are being used the agreed SLA's can be checked with the actual SLA's.

- Leased Line Contract information:
 - Contract number
 - Start date contract
 - End date contract
 - Related End date customer contract
 - PO number
 - Account number
 - Internal cost center number
 - Installation costs (+currency)
 - Monthly costs (+currency)
 - Contract term
 - Extension term
 - Costs related to extension



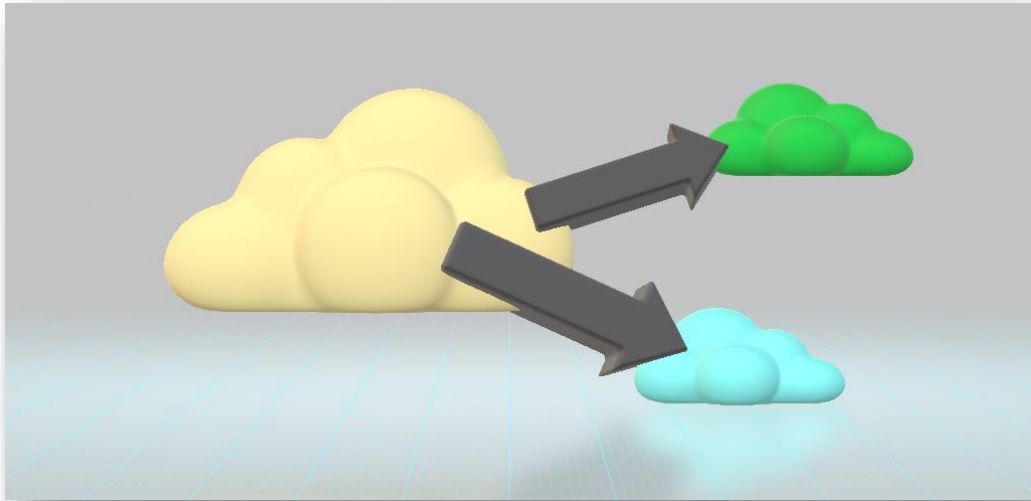
Details		Contract	
InstallCosts:	2500	Contract:	Enter Contract Name
MonthlyCosts:	1000	ContractTerm:	12
Currency:	EUR	CancellationTerm:	6
OloStartDate:	6/1/2011	RenewalTerm:	12
OloEndDate:	1/5/2018	CostAfterRenewal:	900
EndDateContract:	9/14/2017	CostCenter:	CC43356
AccountNumber:	546753253	PurchaseOrderNumber:	PO4332255

Automatic invoice check can be performed to audit the invoices from the leased line provider(s).

11.2 Interconnects

An interconnect in IMS is a connection that connects your network with another operator, for example a 10Gbe or 1Gbe towards another operator delivering your service to the end-customer.

Other examples are: STMx/OCx interconnect delivering VC4/E3/E1 or STS3/1, T3,T1 circuits to end customers or Voice interconnects.



Interconnects to other networks can be managed from one page.

IMS gives a quick overview of all interconnects or just the interconnect to a specific network or telecom provider, including the available capacity per interconnect.

Information captured and managed

- the interconnect name
- status of the interconnect
- name of the domain the interconnect belongs to
- product code/service related to the interconnect
- name of the interconnect used by the other service provider
- used/occupied capacity in the interconnect
- name of the service provider of the other end of the interconnect
- A-end and Z-end, node + port details of the interconnect

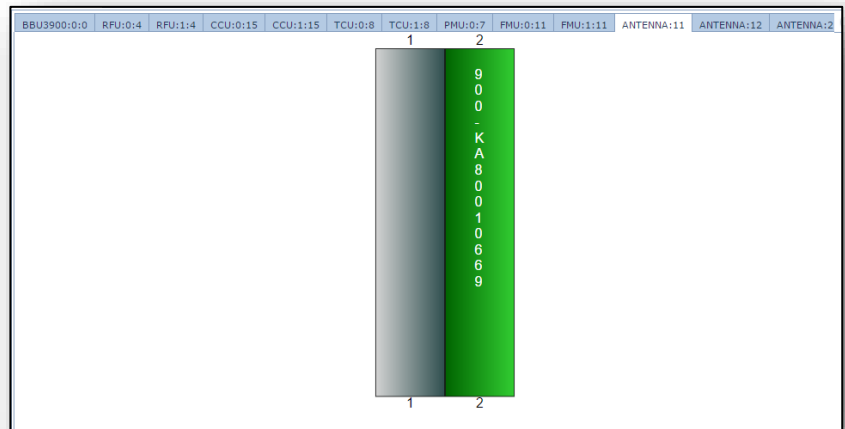
12. Base station, Cell, RF & Antenna details

For Mobile 2G, 3G, 4G, MW and WIFI networks physical and logical parameters can be stored against the base stations.

Antennas are modeled as sub-shelves of the BTS.

When an interface is built towards the NMS/EMS, IMS data will be automatically synchronized every night.

Specific forms have been created to manage the planning of the parameters.



Below some example screenshots for Mobile BTS's (2G, 3G and 4G) parameters. VC4-IMS supports multiple future situations. Differences are highlighted in orange color.

Order Name	Node Name	Site Name	InventorySta	Sector Inven...	In Service D...	Sector Num...	DeviceNumber	Shelf Name	Azimuth	MechTilt	MechTiltUpDo...	AntennaBotto...	RadiationCen...	PoleNumber	InServiceDate
DEMO-RF3	4807.MBTS.1	4807	IS	IS	6/27/2016	1	11	ANTENNA:11		8DOWN		25	1.312	16/30/2016	
DEMO-RF3	4807.MBTS.1	4807	IS	IS	6/27/2016	1	12	ANTENNA:12		12DOWN		25	1.312	16/30/2016	
DEMO-RF3	4807.MBTS.1	4807	IS	IS	6/27/2016	2	21	ANTENNA:21	120	8DOWN		25	1.312	2	
DEMO-RF3	4807.MBTS.1	4807	IS	IS	6/27/2016	2	22	ANTENNA:22	120	12DOWN		25	1.312	2	
DEMO-RF3	4807.MBTS.1	4807	IS	IS	6/27/2016	3	32	ANTENNA:32	240	12DOWN		25	1.312	3	
DEMO-RF3	4807.MBTS.1	4807	IS	IS	6/27/2016	3	32	ANTENNA:32	240	4DOWN		25	1.312	3	
DEMO-RF3	4807.MBTS.1	4807	IS	IS	6/27/2016	3	31	ANTENNA:31	240	8DOWN		25	1.312	3	
DEMO-RF3<1	4807.MBTS.1	4807	PL	IS	6/27/2016	1	11	ANTENNA:11		9DOWN		25	1.312	16/30/2016	
DEMO-RF3<1	4807.MBTS.1	4807	PL	IS	6/27/2016	1	12	ANTENNA:12		12DOWN		25	1.312	16/30/2016	
DEMO-RF3<1	4807.MBTS.1	4807	PL	IS	6/27/2016	2	21	ANTENNA:21	120	8DOWN		25	1.312	2	
DEMO-RF3<1	4807.MBTS.1	4807	PL	IS	6/27/2016	2	22	ANTENNA:22	120	12DOWN		25	1.312	2	
DEMO-RF3<1	4807.MBTS.1	4807	PL	IS	6/27/2016	3	31	ANTENNA:31	240	8DOWN		25	1.312	3	

Above screenshot of antenna details.
Below Cell details.

Order Name	Node Name	Site Name	Sector	CarrierNumb...	InventorySta	CreateDate	InServiceDate	CellId	Name	Technology	Lac	Rac	Sac	Tac	Pci
DEMO-RF1	4807.MBTS.1	4807	1	01S	6/27/2016	6/27/2016	24427	4807_G_1_18F01	DCS1800		1032				
DEMO-RF2	4807.MBTS.1	4807	1	2IS	6/28/2016	7/5/2016	56137	4807_U_1_21F21	UMTS2100		1532		2	56137	
DEMO-RF3	4807.MBTS.1	4807	1	11S	6/28/2016	7/5/2016	36137	4807_U_1_21F11	UMTS2100		1532		2	36137	
DEMO-RF3	4807.MBTS.1	4807	1	11S	6/28/2016	7/5/2016	32844	4807_U_1_09F11	UMTS900		1532		2	32844	
DEMO-RF3	4807.MBTS.1	4807	1	01S	6/28/2016	7/5/2016	21	4807_L_1_09F01	LTE900						
DEMO-RF3	4807.MBTS.1	4807	1	01S	6/28/2016	7/5/2016	3	4807_L_1_18F01	LTE1800						
DEMO-RF4	4807.MBTS.1	4807	1	2PL	7/1/2016		56137	4807_U_1_21F21	UMTS2100		1532		2	56137	
DEMO-RF-1	4807.MBTS.1	4807	1	0PL	10/31/2016		65534	4807_G_1_18F01	DCS1800						
DEMO-RF-1	4807.MBTS.1	4807	1	0PL	11/8/2016		100	4807_L_1_26F01	LTE2600						
DEMO-RF-1	4807.MBTS.1	4807	1	0PL	11/8/2016		20	4807_L_1_18F01	LTE1800						
DEMO-RF-1	4807.MBTS.1	4807	2	01S	6/27/2016	6/27/2016	24428	4807_G_1_18F02	DCS1800		1032				
DEMO-RF3	4807.MBTS.1	4807	2	11S	6/30/2016	6/30/2016	32845	4807_U_1_09F12	UMTS900		1532		2	32845	
DEMO-RF3	4807.MBTS.1	4807	2	11S	6/30/2016	6/30/2016	36138	4807_U_1_21F12	UMTS2100		1532		2	36138	
DEMO-RF3	4807.MBTS.1	4807	2	21S	6/30/2016	6/30/2016	56138	4807_U_1_21F22	UMTS2100		1532		2	56138	
DEMO-RF3	4807.MBTS.1	4807	2	01S	6/30/2016	6/30/2016	22	4807_L_1_09F02	LTE900						
DEMO-RF3	4807.MBTS.1	4807	2	01S	6/30/2016	6/30/2016	10	4807_L_1_18F02	LTE1800						
DEFAULT	4807.MBTS.1	4807	2	0PL	11/9/2016		100	4807_L_1_26F02	LTE2600						
DEMO-RF-1	4807.MBTS.1	4807	3	01S	6/27/2016	6/27/2016	24429	4807_G_1_18F03	DCS1800		1032				
DEMO-RF3	4807.MBTS.1	4807	3	11S	6/30/2016	6/30/2016	32846	4807_U_1_09F13	UMTS900		1532		2	32846	
DEMO-RF3	4807.MBTS.1	4807	3	11S	6/30/2016	6/30/2016	36139	4807_U_1_21F13	UMTS2100		1532		2	36139	
DEMO-RF3	4807.MBTS.1	4807	3	21S	6/30/2016	6/30/2016	56139	4807_U_1_21F23	UMTS2100		1532		2	56139	
DEMO-RF3	4807.MBTS.1	4807	3	01S	6/30/2016	6/30/2016	23	4807_L_1_09F03	LTE900						
DEMO-RF3	4807.MBTS.1	4807	3	01S	6/30/2016	6/30/2016	11	4807_L_1_18F03	LTE1800						
DEMO-RF3	4807.MBTS.1	4807	3	2PL	8/12/2017		65535	4807_U_1_21F23	UMTS2100						

Via network reconcile, all actual parameters can be viewed in the IMS Node form, see example screenshot

NODENAME	PARENT_RNC	SECTOR	NODETYPE	CELL_NAME	CELL_ID	SAC	LAC	RAC	SCRAMBLING_CODE	MAX_TX_POWER_DE	UARFCNDOWNLINK	UARFCNUPLINK
4807.MBTS.1	4310.MC.5	1	UMTS900	4807_U_1_09F11	32844	32844	1532	2	85	43	3087	2862
4807.MBTS.1	4310.MC.5	1	UMTS2100	4807_U_1_21F21	36137	36137	1532	2	85	46	10811	9861
4807.MBTS.1	4310.MC.5	1	UMTS2100	4807_U_1_21F11	36137	36137	1532	2	85	43	10836	9886
4807.MBTS.1	4310.MC.5	2	UMTS2100	4807_U_1_21F22	36138	36138	1532	2	471	46	10811	9861
4807.MBTS.1	4310.MC.5	2	UMTS900	4807_U_1_09F12	32845	32845	1532	2	471	43	3087	2862
4807.MBTS.1	4310.MC.5	2	UMTS2100	4807_U_1_21F12	36138	36138	1532	2	471	43	10836	9886
4807.MBTS.1	4310.MC.5	3	UMTS2100	4807_U_1_21F23	36139	36139	1532	2	384	46	10811	9861
4807.MBTS.1	4310.MC.5	3	UMTS900	4807_U_1_09F13	32846	32846	1532	2	384	43	3087	2862
4807.MBTS.1	4310.MC.5	3	UMTS2100	4807_U_1_21F13	36139	36139	1532	2	384	43	10836	9886

below. The data will be grouped in different tab pages.

13. Vendors and contracts

All equipment and Leased Line vendors can be managed in IMS.

Equipment vendors:

IMS is vendor independent, so all equipment types of all vendors can be managed.

Per vendor information can be stored such as:

- Description
- Equipment types
- SLA on site
- SLA MTTR (main time to repair)
- Website/link
- Special arrangements
- Escalation description
- Contacts with contact details
- Maintenance Contracts

When IMS Workflow, IMS Trouble Tickets and/or IMS Warehouse are being used, the system can support the management of the performance and SLA's of your vendors.

Leased Line vendors:

Also all Leased Line vendors can be managed when Leased Lines are used in your network.

Per vendor information can be stored such as:

- Leased Line Products
- Leased lines of this vendor/provider
- Description
- SLA on site
- SLA MTTR (mean time to repair)
- Website/link
- Special arrangements
- Escalation description
- Contacts with contact details

When IMS Leased Lines, IMS Workflow and/or IMS Trouble Tickets are being used the system can support the management of the performance and SLA's of your Leased Lines vendors.

14. Platforms

IMS Network Planning and Inventory Solution is platform independent. This means all network platforms can be registered, such as (but not limited to):

- MPLS / IP
- MPLS-TP
- WDM
- OTN
- SDH
- SONET
- Ethernet
- Mobile Core 2G, 3G, 4G
- Mobile RAN 2G, 3G, 4G
- Microwave
- Broadcast networks
- PDH
- ATM / Frame Relay
- Subsea
- Satellite
- Synchronization
- DCN
- IT networks

A network item can be linked to a platform name. Related items can be viewed and opened via the platform form. For each platform relevant information can be stored, such as:

- Equipment
- Connections
- IP range.

15. Domains

In IMS a domain refers to a group of network items, which is separated from another domain.

Examples where network domains are often used:

- IP management
- V-LAN management
- Voice networks

After creating the domain name, this name can be related to network items, such as:

- Equipment
- Ports
- Connections
- IP addresses

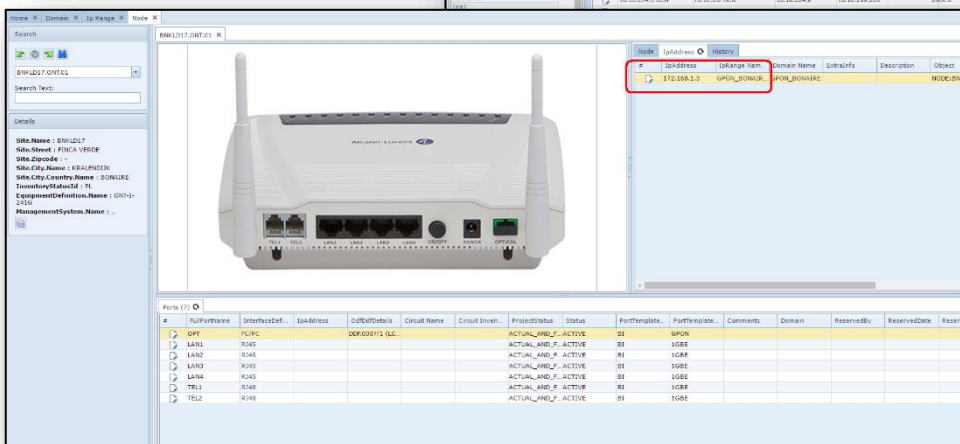
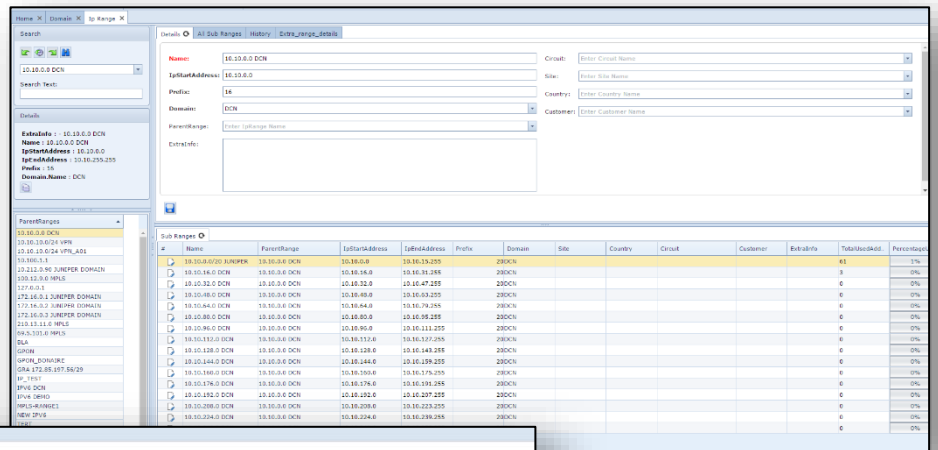
16. IP Management

IMS is designed to help telecom administrators automate the task of maintaining data about the assignment of IP addresses on a network. IMS manages the process of identifying in-use IP addresses and IP addresses that are not or no longer assigned to any device.

IMS eliminates IP conflicts by using network domains. Within one domain an IP address must be unique.

It fully supports both IPv4 as well as IPv6.

As a first IP address ranges need to be created. The system allows the creation of subnets, and sub of subnets (multiple layers).



IP addresses can be related to network items, like equipment (loopback address), ports, cards and connections (like VLAN's).

17. Network Planning and Change Management

Network Planners can use IMS to plan new or change network before it is built in the actual network.

Every network item, such as location, equipment, shelf, card and connection has a status to identify in which phase in the delivery or planning process it is, see also: [network status](#).

IMS Network Planning can be used seamlessly with IMS Workflow (see IMS Workflow), so that planners follow the right process. In case IMS Workflow is not used, IMS can be linked to another workflow/order management system if so desired.

All kinds of handy tools have been built in to help the planner to plan their network in IMS, such as:

- Automatic Trail Engineering
- Equipment templates
- Duplicate circuit
- Copy routing
- Ring and network overviews
- Available routes from node

17.1 Manual and Automated Planning

IMS allow users to manually create, change or delete network items and circuit routes.

The Automatic Trail Engineering functionality allow network operators to automatically plan connections in IMS. This functionality is based on “least cost routing”. Rules to define the “costs” can be implemented based on customer requirements (for example shortest distance, least hops, least financial costs or combination).

If so required IMS can link this automatic planning with the workflow engine of IMS, so that workflows can be fully automated.

17.2 Change Management

Network Planners can plan new network in IMS such as new equipment, new cards, new connections, etc. Also existing networks may be subject for change. Those changes can be planned on forehand so that all departments (like NOC, Customer services) are aware of these changes.

After changes have been implemented successfully, status can be changed to “In service” again. Old information, such as old routing and port info, will be stored in the IMS history.

The following changes can be managed:

- Different network statuses used in the change management process; (see also: [network status](#))
- Migration (MI) status for connections which will be subject to change;
- Future ports for ports that are currently occupied and will become available in the future;
- Actual and future situations of connection and equipment/ports;
- Actual and future situations on timeslot/channel level;
- Capacity Management on actual network and future network;
- Graphical Circuit Path for actual and future routing;
- Planned dates for changes;
- Change Management business and validation rules.

18. Capacity Management

In the IMS Graphical User Interface (GUI) users can see used and available slots, ports, channels on the physical and logical network (equipment and connections).

Below example of the node form where users can see used and available slots and ports in one screen.

The screenshot displays the node form for ITMIL0012.WDM.01. The main area shows a rack diagram with slots and ports. A details panel on the right provides information such as Name, AliasName, Equipment definition (1830 PSS), InventoryStatus (IS), Site (ITMIL0012), Ring (NO RING), ManagementSystem, Customer, NetworkRole (Choose NetworkRole), and Domain. Below the diagram is a table listing port configurations with columns for #, FullPortName, Interf..., IpAddress, OdfDdfOctets, Circuit Name, ProjectStatus, Status, Po., PortTemplate Speed, Comments, Domain, ReservedBy, and Reserve.

#	FullPortName	Interf...	IpAddress	OdfDdfOctets	Circuit Name	ProjectStatus	Status	Po.	PortTemplate Speed	Comments	Domain	ReservedBy	Reserve
	SHELF-1(PSS32) 4/CLS7	LC/PC				ACTUAL_AND_FUTURE	ACTIVE	BI	OTSS8 OTS44 OTS1 O				
	SHELF-1(PSS32) 4/CLS8	LC/PC				ACTUAL_AND_FUTURE	ACTIVE	BI	8 OTS44 OTS1 O				
	SHELF-1(PSS32) 6/L1	LC/PC				ACTUAL_AND_FUTURE	ACTIVE	BI	OTSS8 OTS44 OTS1 O				
	SHELF-1(PSS32) 7/L1	LC/PC				ACTUAL_AND_FUTURE	ACTIVE	BI	OTSS8 OTS44 OTS1 O				
	SHELF-1(PSS32) 7/C1	LC/PC				ACTUAL_AND_FUTURE	ACTIVE	BI	OTSS8 OTS44 OTS1 O				
	SHELF-1(PSS32) 7/C2	LC/PC				ACTUAL_AND_FUTURE	ACTIVE	BI	OTSS8 OTS44 OTS1 O				
	SHELF-1(PSS32) 7/C4	LC/PC				ACTUAL_AND_FUTURE	ACTIVE	BI	OTSS8 OTS44 OTS1 O				
	SHELF-1(PSS32) 12/L1	LC/PC				ACTUAL_AND_FUTURE	ACTIVE	BI	OTSS8 OTS44 OTS1 O				
	SHELF-1(PSS32) 12/C1	LC/PC				ACTUAL_AND_FUTURE	ACTIVE	BI	10G 64S 10GBE OTS1				
	SHELF-1(PSS32) 12/C2	LC/PC				ACTUAL_AND_FUTURE	ACTIVE	BI	10G 64S 10GBE OTS1				
	SHELF-1(PSS32) 15/L1	LC/PC				ACTUAL_AND_FUTURE	ACTIVE	BI	OTSS8 OTS44 OTS1 O				
	SHELF-1(PSS32) 15/C1	LC/PC				ACTUAL_AND_FUTURE	ACTIVE	BI	10G 64S 10GBE OTS1				

Example part of capacity report:

SPEED	LOCATION_A	CITY_B	LOCATION_B	CIRCUITNAME	TOTALCHANNELS	USEDCHANNELS	FREECHANNELS	PERCENTAGE_USED
64S	LONDON/THN	PARIS	PARIS/TH2	PARIS/TH2_64SM_0001	64	0	0	0%
1S	GBLON001	LONDON	GBLONR7	GBLON001-GBLONR7-1S-003(SDH)	1	0	0	0%
1S	GBLON001	LONDON	GBLONR1	GBLON001-GBLONR1-1S-002(SDH)	1	0	0	0%
16S	GBLON001	LONDON	GBLON002	GBLON001-GBLON002-16S-001(SDH)	17	1	16	5.88%
16S	GBLON001	DUBLIN	IEDUB001	GBLON001-IEDUB001-16S-001(SDH RING001)	17	1	16	5.88%
16S	GBLON002	LONDON	GBLON0101	GBLON002-GBLON0101-16S-001(SDH)	17	0	0	0%
OTS88	GBLON002	LONDON	GBLON0101	GBLON002-GBLON0101-OTS88-001(WDM)	88	1	87	1.14%
OTS44	GBLON002	LONDON	GBLON0101	GBLON002-GBLON0101-OTS44-001(WDM)	44	3	41	6.82%

IMS Product description

The port capacity in a location can be found in the locations form, tab pages “free ports on location” and “used ports on location”.

#	Node Name	Node Equip	Shelf Name	Name	Interface Car	OpDfdDetails	ProjectStatus	Status	Comments	Domain	ReservedBy	ReservedDate	ReservedDur
1	GBLON0001.3001	JUNIPER M120	FRONT	3/0/0			ACTUAL_AND_FUTURE	ACTIVE		MPLS			
2	GBLON0001.7750.01	7750 SR-12		1/1/1	LC/PC		ACTUAL_AND_FUTURE	ACTIVE		DCN			
3	GBLON0001.7750.01	7750 SR-12		1/1/2	LC/PC		ACTUAL_AND_FUTURE	ACTIVE					
4	GBLON0001.7750.01	7750 SR-12		1/1/3	LC/PC		ACTUAL_AND_FUTURE	ACTIVE	S				
5	GBLON0001.7750.01	7750 SR-12		1/1/4	LC/PC		ACTUAL_AND_FUTURE	ACTIVE					
6	GBLON0001.7750.01	7750 SR-12		1/1/12	LC/PC		ACTUAL_AND_FUTURE	ACTIVE					
7	GBLON0001.7750.01	7750 SR-12		1/1/13	LC/PC		ACTUAL_AND_FUTURE	ACTIVE					
8	GBLON0001.7750.01	7750 SR-12		1/1/14	LC/PC		ACTUAL_AND_FUTURE	ACTIVE					
9	GBLON0001.7750.01	7750 SR-12		1/1/15	LC/PC		ACTUAL_AND_FUTURE	ACTIVE					
10	GBLON0001.7750.01	7750 SR-12		1/1/16	LC/PC		ACTUAL_AND_FUTURE	ACTIVE					
11	GBLON0001.7750.01	7750 SR-12		1/1/17	LC/PC		ACTUAL_AND_FUTURE	ACTIVE					
12	GBLON0001.7750.01	7750 SR-12		1/1/18	LC/PC		ACTUAL_AND_FUTURE	ACTIVE					
13	GBLON0001.7750.01	7750 SR-12		1/1/19	LC/PC		ACTUAL_AND_FUTURE	ACTIVE					
14	GBLON0001.7750.01	7750 SR-12		1/1/10	LC/PC		ACTUAL_AND_FUTURE	ACTIVE					
15	GBLON0001.7750.01	7750 SR-12		1/1/11	LC/PC		ACTUAL_AND_FUTURE	ACTIVE					
16	GBLON0001.7750.01	7750 SR-12		2/1/1	LC/PC		ACTUAL_AND_FUTURE	ACTIVE					
17	GBLON0001.7750.01	7750 SR-12		2/1/2	LC/PC		ACTUAL_AND_FUTURE	ACTIVE					
18	GBLON0001.7750.01	7750 SR-12		2/1/3	LC/PC		ACTUAL_AND_FUTURE	ACTIVE					
19	GBLON0001.ASR9K.001	ASR-9010		G10/0/0/6	LC/PC	ODF/01/15016	ACTUAL_AND_FUTURE	ACTIVE					
20	GBLON0001.M901	RW-7216-2000	IDU				SFP1	ACTIVE					
21	GBLON0001.ASR9K.001	ASR-9010		G10/1/0/2	LC/PC		ACTIVE	ACTIVE					
22	GBLON0001.ASR9K.001	ASR-9010		G10/1/0/4	LC/PC		ACTIVE	ACTIVE					
23	GBLON0001.SBC.001	SBC_SHELF	OLD				S1P01	ACTIVE					
24	GBLON0001.SBC.001	SBC_SHELF					S1P02	ACTIVE					
25	GBLON0001.SBC.001	SBC_SHELF					S1P03	ACTIVE					
26	GBLON0001.SBC.001	SBC_SHELF					S1P04	ACTIVE					
27	GBLON0001.SBC.001	SBC_SHELF	OLD				S2P01	ACTIVE					
28	GBLON0001.SBC.001	SBC_SHELF					S2P02	ACTIVE					
29	GBLON0001.SBC.001	SBC_SHELF					S2P03	ACTIVE					
30	GBLON0001.SBC.001	SBC_SHELF					S2P04	ACTIVE					
31	GBLON0001.SBC.001	SBC_SHELF	ACHE_SBC.01				S0P0	ACTIVE					
32	GBLON0001.SBC.001	SBC_SHELF	ACHE_SBC.02				S0P0	ACTIVE					

Example of capacity in IP ranges

#	Name	ParentRange	IpStartAddress	IpEndAddress	Prefix	Domain	Site	Country	Circuit	Customer	ExtraInfo	TotalUsedAd	PercentageU...
1	100.0.192.1/28	JUNIPER PARENT	100.0.192.0	100.0.192.15	28	JUNIPER						3	21%
2	100.41.204.130/26	JUNIPER PARENT	100.41.204.128	100.41.204.191	26	JUNIPER						2	3%
3	100.41.204.194/26	JUNIPER PARENT	100.41.204.192	100.41.204.255	26	JUNIPER						2	3%
4	100.50.0.2/30	JUNIPER PARENT	100.50.0.0	100.50.0.3	30	JUNIPER						1	50%
5	100.50.0.6/30	JUNIPER PARENT	100.50.0.4	100.50.0.7	30	JUNIPER						1	50%
6	100.65.115.97/28	JUNIPER PARENT	100.65.115.96	100.65.115.111	28	JUNIPER						1	7%
7	100.65.115.113/28	JUNIPER PARENT	100.65.115.112	100.65.115.127	28	JUNIPER						1	7%
8	100.65.118.97/28	JUNIPER PARENT	100.65.118.96	100.65.118.111	28	JUNIPER						1	7%
9	100.65.118.113/28	JUNIPER PARENT	100.65.118.112	100.65.118.127	28	JUNIPER						1	7%
10	100.65.123.2/27	JUNIPER PARENT	100.65.123.0	100.65.123.31	27	JUNIPER						2	7%
11	100.65.123.34/27	JUNIPER PARENT	100.65.123.32	100.65.123.63	27	JUNIPER						2	7%
12	100.65.123.66/27	JUNIPER PARENT	100.65.123.64	100.65.123.95	27	JUNIPER						2	7%
13	100.65.123.98/27	JUNIPER PARENT	100.65.123.96	100.65.123.111	27	JUNIPER						2	7%
14	100.65.123.113/27	JUNIPER PARENT	100.65.123.112	100.65.123.141	27	JUNIPER						2	7%
15	100.65.123.144/27	JUNIPER PARENT	100.65.123.143	100.65.123.171	27	JUNIPER						2	7%
16	100.65.123.174/27	JUNIPER PARENT	100.65.123.173	100.65.123.201	27	JUNIPER						2	7%
17	100.65.123.204/27	JUNIPER PARENT	100.65.123.203	100.65.123.231	27	JUNIPER						2	7%
18	100.65.123.234/27	JUNIPER PARENT	100.65.123.233	100.65.123.261	27	JUNIPER						2	7%
19	100.65.123.264/27	JUNIPER PARENT	100.65.123.263	100.65.123.291	27	JUNIPER						2	7%
20	100.65.123.294/27	JUNIPER PARENT	100.65.123.293	100.65.123.321	27	JUNIPER						2	7%
21	100.65.123.324/27	JUNIPER PARENT	100.65.123.323	100.65.123.351	27	JUNIPER						2	7%
22	100.65.123.354/27	JUNIPER PARENT	100.65.123.353	100.65.123.381	27	JUNIPER						2	7%
23	100.65.123.384/27	JUNIPER PARENT	100.65.123.383	100.65.123.411	27	JUNIPER						2	7%
24	100.65.123.414/27	JUNIPER PARENT	100.65.123.413	100.65.123.441	27	JUNIPER						2	7%
25	100.65.123.444/27	JUNIPER PARENT	100.65.123.443	100.65.123.471	27	JUNIPER						2	7%
26	100.65.123.474/27	JUNIPER PARENT	100.65.123.473	100.65.123.501	27	JUNIPER						2	7%
27	100.65.123.504/27	JUNIPER PARENT	100.65.123.503	100.65.123.531	27	JUNIPER						2	7%
28	100.65.123.534/27	JUNIPER PARENT	100.65.123.533	100.65.123.561	27	JUNIPER						2	7%
29	100.65.123.564/27	JUNIPER PARENT	100.65.123.563	100.65.123.591	27	JUNIPER						2	7%
30	100.65.123.594/27	JUNIPER PARENT	100.65.123.593	100.65.123.621	27	JUNIPER						2	7%
31	100.65.123.624/27	JUNIPER PARENT	100.65.123.623	100.65.123.651	27	JUNIPER						2	7%
32	100.65.123.654/27	JUNIPER PARENT	100.65.123.653	100.65.123.681	27	JUNIPER						2	7%
33	100.65.123.684/27	JUNIPER PARENT	100.65.123.683	100.65.123.711	27	JUNIPER						2	7%
34	100.65.123.714/27	JUNIPER PARENT	100.65.123.713	100.65.123.741	27	JUNIPER						2	7%
35	100.65.123.744/27	JUNIPER PARENT	100.65.123.743	100.65.123.771	27	JUNIPER						2	7%
36	100.65.123.774/27	JUNIPER PARENT	100.65.123.773	100.65.123.801	27	JUNIPER						2	7%
37	100.65.123.804/27	JUNIPER PARENT	100.65.123.803	100.65.123.831	27	JUNIPER						2	7%
38	100.65.123.834/27	JUNIPER PARENT	100.65.123.833	100.65.123.861	27	JUNIPER						2	7%
39	100.65.123.864/27	JUNIPER PARENT	100.65.123.863	100.65.123.891	27	JUNIPER						2	7%
40	100.65.123.894/27	JUNIPER PARENT	100.65.123.893	100.65.123.921	27	JUNIPER						2	7%
41	100.65.123.924/27	JUNIPER PARENT	100.65.123.923	100.65.123.951	27	JUNIPER						2	7%
42	100.65.123.954/27	JUNIPER PARENT	100.65.123.953	100.65.123.981	27	JUNIPER						2	7%
43	100.65.123.984/27	JUNIPER PARENT	100.65.123.983	100.65.123.1011	27	JUNIPER						2	7%
44	100.65.123.1014/27	JUNIPER PARENT	100.65.123.1013	100.65.123.1041	27	JUNIPER						2	7%
45	100.65.123.1044/27	JUNIPER PARENT	100.65.123.1043	100.65.123.1071	27	JUNIPER						2	7%
46	100.65.123.1074/27	JUNIPER PARENT	100.65.123.1073	100.65.123.1101	27	JUNIPER						2	7%
47	100.65.123.1104/27	JUNIPER PARENT	100.65.123.1103	100.65.123.1131	27	JUNIPER						2	7%
48	100.65.123.1134/27	JUNIPER PARENT	100.65.123.1133	100.65.123.1161	27	JUNIPER						2	7%
49	100.65.123.1164/27	JUNIPER PARENT	100.65.123.1163	100.65.123.1191	27	JUNIPER						2	7%
50	100.65.123.1194/27	JUNIPER PARENT	100.65.123.1193	100.65.123.1221	27	JUNIPER						2	7%
51	100.65.123.1224/27	JUNIPER PARENT	100.65.123.1223	100.65.123.1251	27	JUNIPER						2	7%
52	100.65.123.1254/27	JUNIPER PARENT	100.65.123.1253	100.65.123.1281	27	JUNIPER						2	7%
53	100.65.123.1284/27	JUNIPER PARENT	100.65.123.1283	100.65.123.1311	27	JUNIPER						2	7%
54	100.65.123.1314/27	JUNIPER PARENT	100.65.123.1313	100.65.123.1341	27	JUNIPER						2	7%
55	100.65.123.1344/27	JUNIPER PARENT	100.65.123.1343	100.65.123.1371	27	JUNIPER						2	7%
56	100.65.123.1374/27												

19. Workflow Management

Workflow management is keeping track the tasks within your organisation.

This workflow management is an integrated module IMS. Every process can be created easily by users who have the correct permissions. It is not mandatory to use this functionality, IMS can also be integrated with other Workflow systems.

The IMS order management functionality supports:

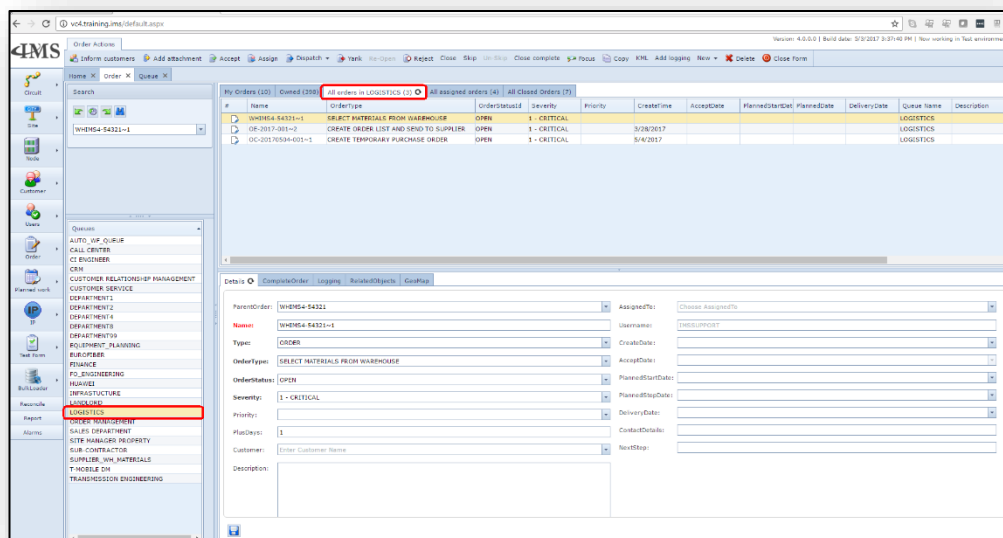
- Flexible Process creation and adjustment
- Order queues
- Main and sub tasks
- Serial and parallel work streams
- Automatic tasks to queues
- Ability to accept or reject tasks
- Automatic Order Lead time management
- Report functionality
- Direct links to network items in inventory, like connections, equipment, etc.

Workflow functionality can also be used to automate certain tasks, like:

- Automatically create circuitname(s)
- Automatically relate circuit to port on equipment
- Automatically design circuit through network
- Automatically create sub interface on IP/MPLS router/switch
- Automatically relate IP address to port
- Set all related network items to "In Service"
- Automatically add card in equipment
- Auto provisioning of connections in Network

19.1 Order queues

Each department using the IMS workflow functionality will have its own order queue. A queue is a central order box where new orders are coming in and users (employees of the specific department) can pick up an order.



19.2 Order type

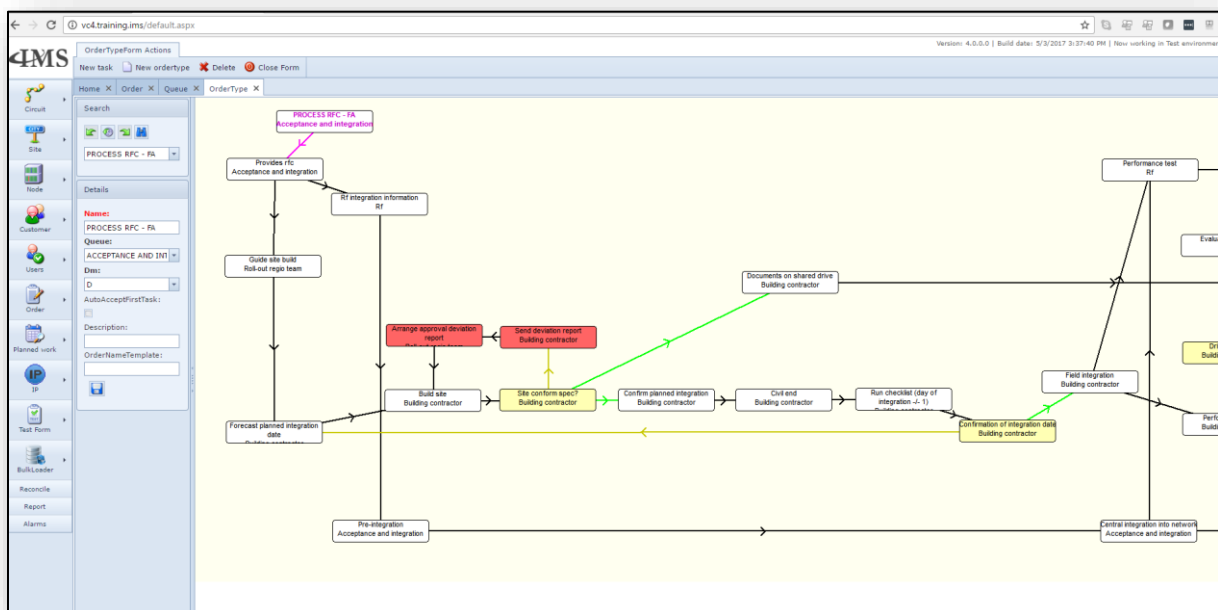
For each process in the company (order type) a workflow can be created. For example “create new 1GBE MPLS connection”, “migrate 10GBE connection”, “build new equipment”, “cease leased line”, etc.

Users with the correct user permissions can create, modify and delete order types.

Below an example of different tasks in a process.

#	ID	Name	TaskSort	PlusDays	Queue	TaskDone	Description	HoursWork	Queue	AutoWorkFlow	AutoWorkflowRelated
358	PROVIDES RFC	ACCEPTANCE AND INTEGRATION	1		1			1			
359	GUIDE SITE BUILD		2		1			1			
360	FORECAST PLANNED INTEGRATION DATE		3		5			1			
361	RF INTEGRATION INFORMATION		4		1			1			
362	PRE-INTEGRATION		5		1			1			
363	BUILD SITE		6		1			1			
364	SITE CONFORM SPEC?		7		1			1			
365	SEND DEVIATION REPORT		8		1			1			
366	ARRANGE APPROVAL DEVIATION REPORT		9		1			1			
367	DOCUMENTS ON SHARED DRIVE		10		1			1			
368	CONFIRM PLANNED INTEGRATION		11		1			1			
369	CIVIL END		12		1			1			
370	RUN CHECKLIST (DAY OF INTEGRATION -1)		13		1			1			
371	CONFIRMATION OF INTEGRATION DATE		14		1			1			
372	FIELD INTEGRATION		15		1			1			
373	CENTRAL INTEGRATION INTO NETWORK		16		1			1			
374	PERFORM DRIVE TEST		17		1			1			
375	DRIVE TEST OK?		18		1			1			
376	48 HRS STABILITY TEST		19		1			1			
377	STABILITY TEST OK?		20		1			1			
378	PUNCH EXTRA ITEMS		21		1			1			
379	EVALUATE DRIVE TEST		22		1			1			

The workflow can be seen graphical as well.



Workflow (including fields) may be adjusted any time. Open orders will not be changed, only new orders will follow adjusted process and related fields.

19.3 Order fields and attachments

Each process / order type will need to have its own kind of information.

For example:

To create a new connection, engineers need to know:

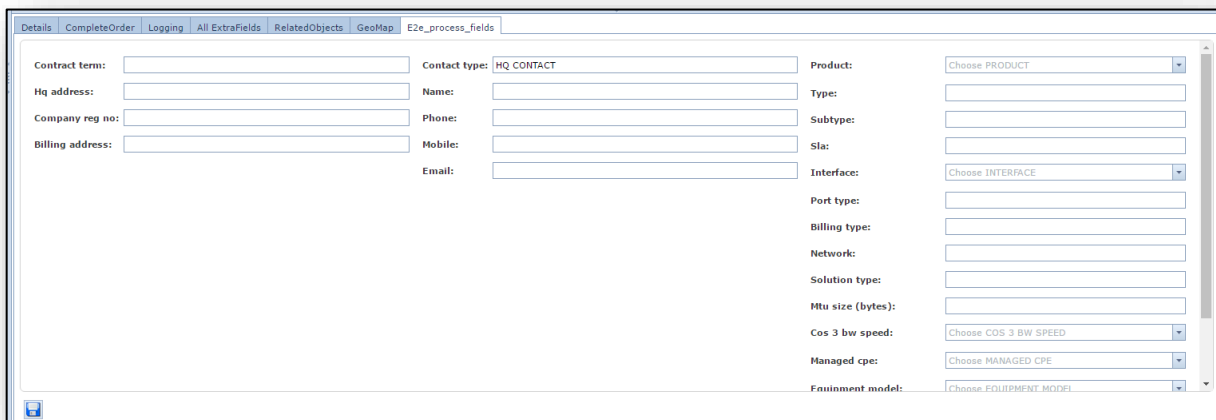
- Location FROM
- Location TO
- Bandwidth
- Number of connections
- etc.

For other kind of processes other information will be necessary.

To avoid mistakes in running orders functionality is available to define which information field is mandatory before closing a task and which field may be edited by a department.

Users with the correct user permissions can create this kind of fields and may define the business rules.

Example of order fields in a running order:



The screenshot shows a web application interface with a tabbed menu at the top containing: Details, CompleteOrder, Logging, All ExtraFields, RelatedObjects, GeoMap, and E2e_process_fields (which is the active tab). The form contains the following fields:

- Contract term:
- Hq address:
- Company reg no:
- Billing address:
- Contact type:
- Name:
- Phone:
- Mobile:
- Email:
- Product:
- Type:
- Subtype:
- Sl:
- Interface:
- Port type:
- Billing type:
- Network:
- Solution type:
- Mtu size (bytes):
- Cos 3 bw speed:
- Managed cpe:
- Equipment model:

To each running order one or multiple attachments can be linked.

Those attachments will be stored on the IMS application server or any other file directory on Clients premises.

19.4 Order Reports

All kind of KPI reports relating to order management are available and can be created.

Examples are:

- Department Lead time reports
- Number of orders per order type - per month - per department
- Closed orders per order type - per month - per department
- Current open orders - per department

20. Trouble Tickets

20.1 General

The Trouble Ticket functionality in IMS manages and maintains lists of problems in the active network(s). This functionality helps the organization, e.g. Customer Support Center and Network Operations Center (NOC) departments, to create, update and resolve reported customer issues and issues identified by the NOC.

A ticket can be created either, automatically via an interface to an alarm management system or manually by an IMS user.

Each ticket has a unique number in the system and contains information about the actual problem, actions performed by departments trying to solve the problem and general information, like status, severity, etc.

20.2 Impact calculation

With the Trouble Ticket functionality fully integrated in the IMS application, impact assessment can be performed directly for each network problem.

IMS will calculate the (customer) services and customers impacted. The impacted customers, connections and services, equipment and cards are all related on the trouble ticket.

Any active trouble tickets pertaining to a specific customer are directly visible from the Customer form within IMS.

20.3 Fault Management

The process to solve a network problem can be managed within the Workflow/Order Management.

For each process type, like

- Replace defect card
- Solve cable cut
- etc.

A process can be created with related responsible departments. Also, the standard lead-times can be registered, so that the Network, Customer and Vendor SLA's can be managed.

The complete Workflow functionality has been explained in chapter "Workflow Management".

21. Planned Works impact analysis

Before Planned Work is carried out on the network, IMS can determine the impact of the Planned Work with regards to the customer services.

If so desired, IMS users can inform impacted customers via email. These emails can be sent from the IMS application using predefined Planned Work email templates.

21.1 General Planned Work info

In IMS a Planned Work order can be registered under a Planned Work reference with the following related information:

- Planned Work Reference number
- Planned Work engineer
- Planned Work Category
- Type of Planned Work, like
 - o Normal
 - o Emergency Planned Work
 - o Third Party Notification
- Status
- Description
- Begin date
- End date
- Expiry date
- Start time
- End time
- Outage time
- Related Trouble Ticket numbers
- Customer informed [yes/no]

21.2 Planned Work analysis

Planned Work engineers can import one or multiple network item(s) that are impacted by the Planned Work, for example:

- Equipment
- Card
- Connection
- Fiber/Copper cable, Duct/Span
- Leased Line
- Location

IMS will calculate all sub-connections and customer services running over the impacted network items. The system can calculate whenever the sub-connections and customer services will have a protection switch or will go completely down.

21.3 Planned Work Email Notification

After the impact has been determined, customers can be informed via email functionality in IMS. Responsible departments can create pre-defined email templates for different types of Planned Work. This tool is multi-language.

22. Single Point of Failure calculation

A Single Point of Failure, (SPOF), is a part of a network which, if it fails, will stop one or multiple (customer) services from working. They are undesirable in any network whose goal is high availability.

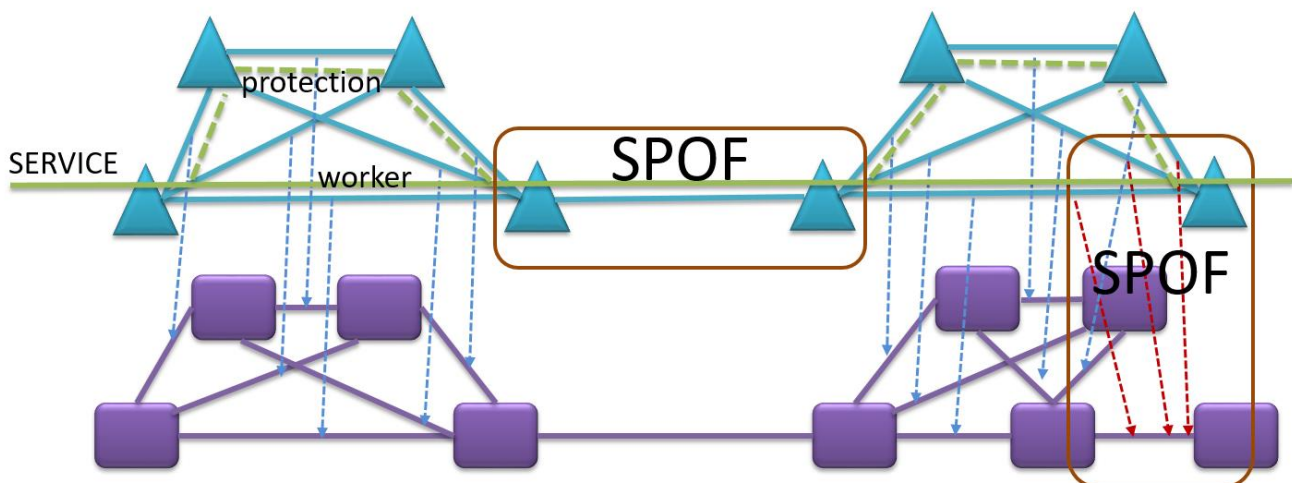
The assessment of a potentially single location of failure identifies the critical components of a complex network that would provoke a total (customer) service failure in case of malfunction. Highly reliable networks may not rely on any such individual component.

Below two schematic examples.

Scenario 1:

A service (green line) is running over a network (blue network). The service is protected on the left and right (dotted green line). In the middle, there is no protection. This is a SPOF.

The blue network is transported over the purple network. On the right, the worker and protection path run over a single link in the purple network. This is also a SPOF, because when the last purple line breaks, the service goes down.



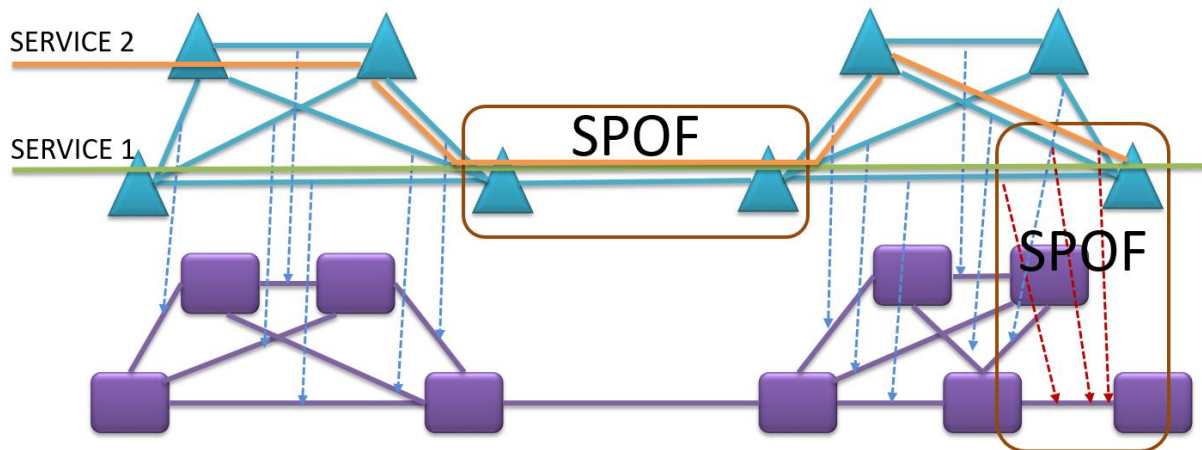
Scenario 2:

An operator sold to a customer two (2) single connections but those connections should be a protection of each other.

The two services (the green service and the orange line) run over a network (blue network). The two services should both take a unique route.

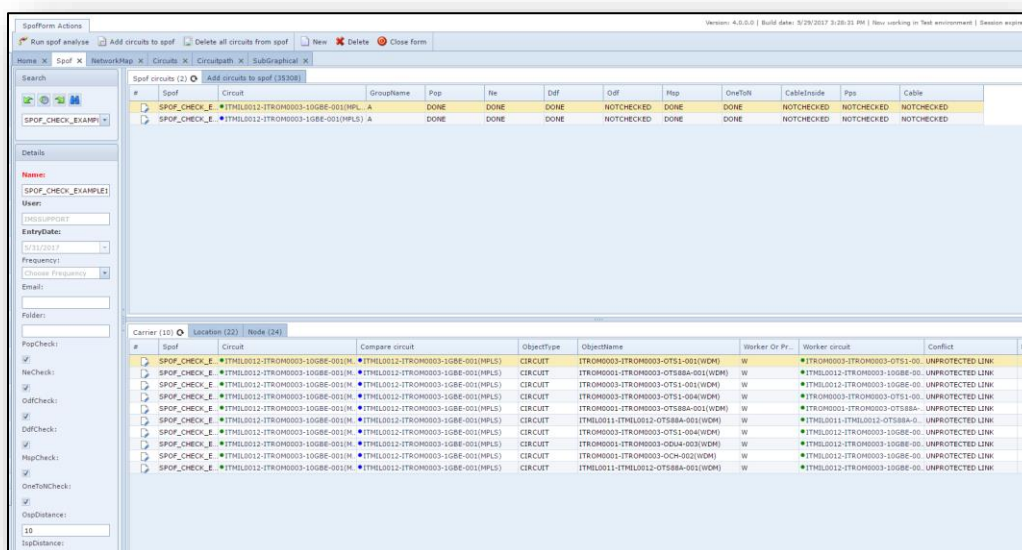
In the middle, the two connections run via the same path. This is a SPOF.

The blue network is transported over the purple network. On the right, the path of the orange and green service run over a single link in the purple network. This is also a SPOF, because when the last purple line breaks, both services go down.



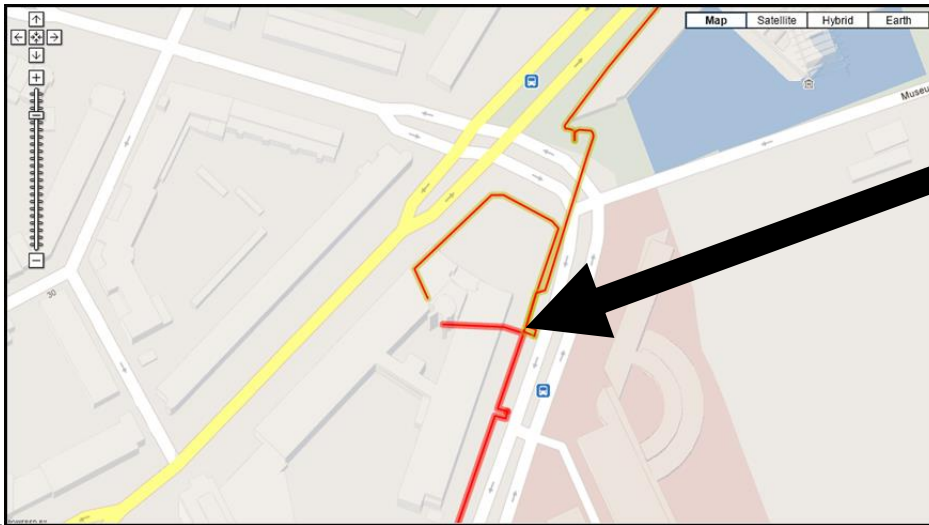
The IMS SPOF functionality performs such assessments. Since IMS understands the protection schemes and the relation between the different networks, IMS will highlight SPOF's after calculating the network topologies and the customer services.

Screenshot from SPOF analysis in IMS:



IMS Product description

Below a screenshot of an example SPOF in IMS Network Map. Two fiber cables are starting from different entries from the building, but are then going to the same manhole on the right near the building, then the fiber routes continue their own routes again, one going up, one going down.



23. Warehouse Management

The IMS Warehouse functionality primarily aims to control the movement and storage of materials within a warehouse and process the associated transactions, including receiving, put away and picking. It also directs and optimizes stock put away based on real-time information about the status of bin utilization.

IMS Warehouse management involves the receipt, storage and movement of goods, to a final network or customer location.

The power of real-time data in the warehouse minimizes the time spent on every task, while providing cross checks for accuracy at every step.

Benefits include:

- Improves overall warehouse efficiency, reducing labor costs
- Reduces inventory stocking level requirements
- Increases shipping accuracy
- Enables efficient and accurate material tracking
- Decreases the volume and cost of warehouse space

Each stock/warehouse and spares location has a unique name in the IMS database. IMS sees a difference between a warehouse and a spares location. This is because network materials used for spares in the fault-handling process may not be used by the service delivery process and vice versa.

23.1 Materials

A material is a piece of equipment (e.g. equipment shelf/chassis, card, DDF/ODF/Patch panel, etc.).

Each material has information related to it, like:

- Name: name of the material
- Description: description of the material
- Supplier: supplier of the material
- Vendor Code: vendor code of the material
- Version: version of the piece of equipment
- Price: price of the material to buy this piece of equipment
- Status: Once a material is being ordered at the supplier, the material gets a status. The different statuses are listed below.

Status	Explanation
In Stock	The material is stored in the warehouse and is not yet planned to go in the network yet.
Ordered	The material is being ordered at the equipment vendor.
Reserved	The material is in the warehouse and is reserved (for a project) to go into the actual network soon.
In Stock	The material is stored in the warehouse and is not yet planned to go in the network yet.
Laid Out	The equipment is being packed to be picked up. It will leave the warehouse any moment.
Out Stock	Material is not in warehouse anymore.
Ready for Sale	The material is in warehouse and will not be used in network anymore. It will be sold.
Sold	The material has been sold to an external party.
Returned	Something is wrong with the material and is returned to vendor.
Defect	The material is defect and needs to be fixed or replaced.

- Status date: date of last status change
- PO number: number of purchase order
- Order number: order number in service delivery process
- Row/Rack/board: exact location of material in the warehouse location
- Requester: name of the person who requested the material in IMS application
- Remark: extra comment field

Barcode

At any time during the life-cycle of the material (e.g. in warehouse or in network) users can add a barcode to the material.

A barcode reader can be linked to the user machine, so that the barcode is transferred into the barcode field in IMS.

23.2 Material list

The materials that can be ordered at suppliers and materials that are in stored in the warehouses are defined in the so called “material list”.

The screenshot shows the 'Inventory Item' details for material 'B1-TRIB 51.1 35974'. The form includes the following fields:

- Name: B1-TRIB 51.1 35974
- Material Class: Choose MaterialClass
- Vendor: ALU EQUIPMENT
- Price: 50
- Currency: EUR
- SerialNumberRequired: YES
- Supplier:
- Deliverable: YES
- MinQuantity: 5
- EndOfSale: 12/14/2016
- EndOfService: 1/19/2017
- DefaultMaintenanceCycle: 12
- ReplacedBy: Enter MaterialType Vendor Name
- DepreciationDays: 0
- Description: B1-TRIB 51.1 35974

IMS users (with appropriate user permissions) can add/edit or delete the items in the material list.

Additional to the standard fields related to a material, the following fields are linked to a material type that can be ordered:

- Deliverable: is this material (still) deliverable at the supplier.
- Serial No. Mandatory: is the serial number field mandatory to be filled in when working with this material.

23.3 Material template

A Material Template can be used in case the same group of different kind of materials is often being ordered. The template groups the materials together so that the group of materials can be ordered with one click instead of many.

23.4 Order list

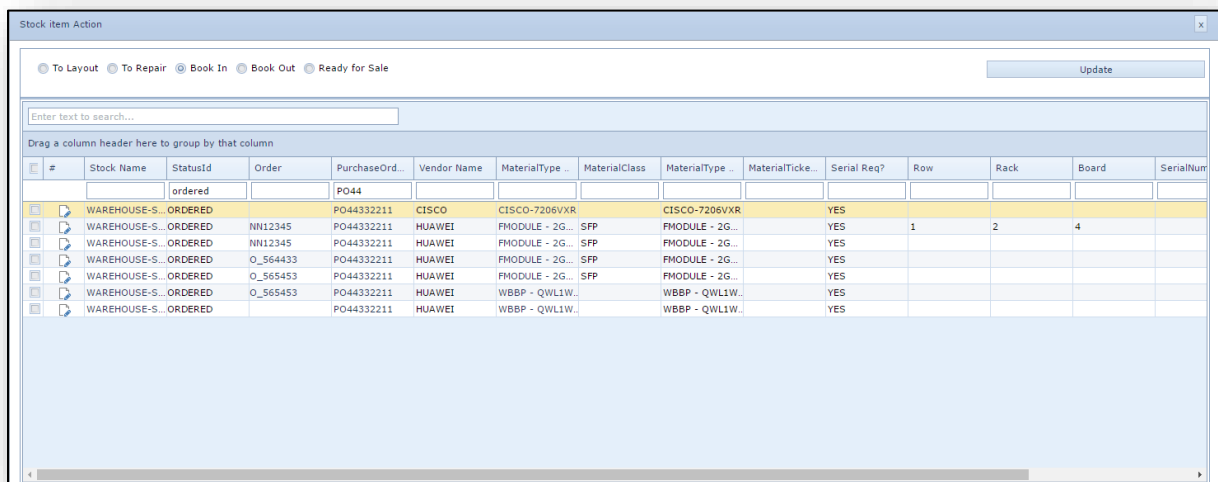
After a PO number is available (through IMS or through Financial System), equipment can be ordered at the supplier.

To select the equipment to be ordered the order list form can be used.

After materials have been selected, the order list must be committed.

23.5 Material actions

Ordered materials that are delivered by the supplier can be booked in / placed into the warehouse.



In the same form, users can also:

- Book out materials: Materials that are being picked up to leave the warehouse
- Send materials to repair: Defect materials can be sent to equipment vendor to have them repaired or Replaced.
- Ready for Sale: Mark equipment “ready for sale” if materials are not going to be reused and to be sold to third party.

23.6 Reserve equipment

In case equipment is needed for a service delivery order, the specific materials can be reserved from the warehouse for a project/order.

23.7 Materials ready to be picked up

After materials have been reserved, one or more materials can be selected that are ready to be picked up. Those materials will get status “Lay out”.

23.8 Book out Materials

When the materials are being picked up at the warehouse the logistics employee must “book out” the material from the warehouse.

Next to the normal process of booking out materials, materials can also be booked out without a material reservation.

23.9 Cable Management

Cables are handled a little bit differently in the warehouse functionality compared to equipment.

23.9.1 Cable types

Different types of cables can be registered.

Per cable type the following information can be related:

- Supplier: Name of the supplier of the cable
- Vendor code: Code that is used when ordering the cables
- Cable type: type of cable, e.g. Multi-mode, Single-Mode, Coaxial
- Connector type A: Type of connector on one end of the cable.
(e.g. BNC, RJ45, E2000, FC/PC, SC/PC, etc.)
- Connector type Z: Type of connector on other end of the cable.
(e.g. BNC, RJ45, E2000, FC/PC, SC/PC, etc.)
- Duplex type: Type of duplex (if applicable)
- Length: Length of the cable
- Price per piece: Cost of one cable
- Minimum quantity: Minimum stock level. In case quantity of cables in warehouse go below this amount, warnings will be send to logistics department to order new cables of that type.

23.9.2 Other actions around cables

The cables can be ordered like other materials under a PO number.

Cables can be booked in/out, similar as other materials.

23.10 Warehouse to Network Inventory

Network items can be moved from warehouse to the network inventory (service delivery process).

New node/equipment:

When registering new (to be) installed equipment in the inventory a pull-down field becomes selectable and will generate a list of material of the equipment type currently in stock in the warehouse.

New/change card:

Right mouse clicking a node slot allows the selection of a card in stock in the Warehouse.

23.11 Network Inventory to Warehouse

Network items can be moved from Network Inventory to the Warehouse (decommission process).

Dismantle equipment:

Dismantle or removing node/shelf/card or other material can be by “moving” the node back into stock in the Warehouse.

Replace equipment:

In the Fault Handling process, defect materials can be replaced/swapped.

This is normally done using the Spares Warehouse location.

See also chapter 24 - Spares Management.

23.12 Reports

All different kind of reports available related to warehouse. Examples are:

- Lead time equipment supplier
- Stock levels per site
- Stock levels per equipment type
- Stock levels per cable type
- Automatic warnings when stock level drops below threshold value

Next to the standard reports, users can also create customized reports. If so desired reports can be sent to email once or every period of time.

24. Spares Management

With the Warehouse functionality spare materials can be managed as well.

IMS supports:

- Spare Management locations (sites)
- Equipment list (node, cards) per vendor
- Management of spare equipment per location
- Ordering spare equipment at vendor
- Monitoring of spare equipment deliveries from vendor
- Easy swap of materials in case of defect materials
- Automatic Reports, see chapter “Reports”.

See also chapter 23 for the full warehouse functionality.

25. Reports

IMS supports different kinds of reports:

- Predefined reports
- Customized reports using Report Query form
- Scheduled reports sent via email
- SQL based reports in SQL Report form

Reports can be created using all data in the IMS database, examples are

- Connection capacity reports;
- Port capacity reports;
- Data quality reports;
- Trend reports;
- Workflow Order / Process / Lead time reports;
- Trouble Ticket and Network Availability reports;
- Planned Work reports;
- SLA (Service Level Agreement) KPI reports;
- Inventory / Asset reports;
- User activity
- and more.

The reports are managed in two different report forms, Report Query form and SQL Report form.

Report Query Form

Via this form users can use preconfigured reports that have been tailored for your organization.

Users may create and customize reports so that personal or department report requirements are fulfilled. These personal reports can be saved and scheduled if so desired.

SQL Report Form

Via this form users can use preconfigured reports that have been tailored for your organization.

Users may create their own SQL reports using SQL statements. These reports can be saved and scheduled (sent via email) if so desired.

All reports can be exported to excel.

IMS Product description

The screenshot displays the IMS Version 3.7.6 Presentation Environment. The main window is divided into several sections:

- Queries:** A list of queries on the left, with 'TROUBLE TICKETS' selected.
- Query information:** Details for the selected query, including the query name 'Trouble tickets - cards', owner 'Admin', and a 'Query name' field.
- SQL Editor:** A window showing the following SQL query:


```

      1 SELECT CARD, CARDNAME, COUNT, CARD, NROFTROUBLETICKETS, RELATED
      2 FROM
      3 SELECT NF, CARDNAME, CARD
      4 FROM ORDERRELATE O, NODECARDFILLING NF
      5 WHERE SOORT = 'FAULT'
      6 AND OBJECTTYPE = 'CARD'
      7 AND NF.ID = OBJECTID
      8 AND NF.CARDTYPE IS NULL
      9 UNION ALL
      10 SELECT NF, CARDTYPE, CARD
      11 FROM ORDERRELATE O, NODECARDFILLING NF
      12 WHERE SOORT = 'FAULT'
      13 AND OBJECTTYPE = 'CARD'
      
```
- Results:** A table showing the output of the query, with 9 records. The columns are Cardname and Nrooftroubletickets related.

Cardname	Nrooftroubletickets related
N1TP04BF	8
SFP STM111.1	4
AMU MAIN CARD	4
N1TP03BF	4
FS ADAPTER 2204C/480C	4
NTK378A	2
STM16 (PORT)	1
731775-02	
NTK5130A	
- Data Grids:** Two overlapping spreadsheets showing detailed data. The top grid has columns for CARDNAME, CARDTYPE, USED, PWR, and VTTM (MIN). The bottom grid has columns for CARDTYPE #, CARDTYPE #, USED, PWR, and VTTM (MIN).

26. Bulk changes

When there is need for uploading a large amount of data of the same kind (e.g. new connections, connection routing, new equipment, etc.) this uploading can be done via the “bulkloader” in IMS.

From a MS Excel (in structured format) the data can be copied into the bulkloader form.

IMS will import the data with the same business rules as implemented in the GUI.

27. Flexible fields and tabs

Within minutes IMS Admin users can create extra tab pages and fields. There is no need for a new IMS version, these actions can be done in existing Graphical User Interface (GUI).

Tab parameters:

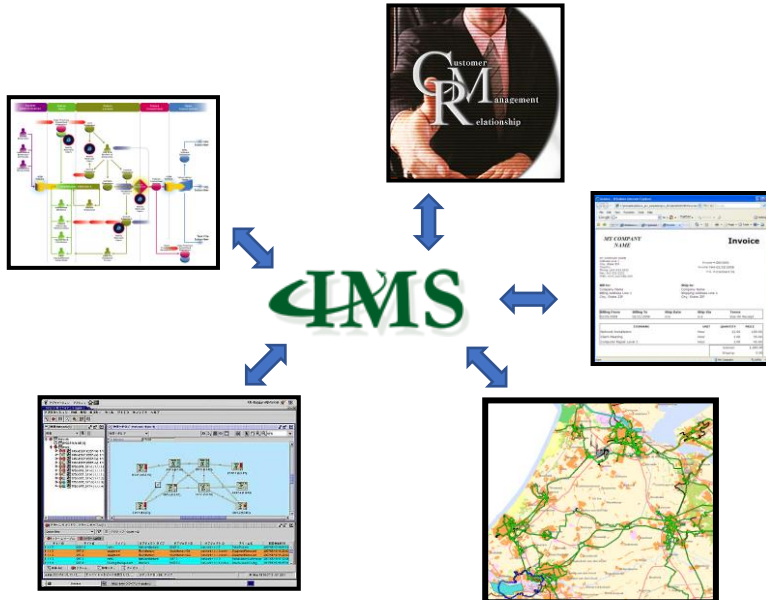
- In which form this new tab needs to be implemented
- Tab name
- Link to which table in the database

Field parameters:

- Name of field
- Field type (e.g. text, numeric, date, formula)
- Condition tab/field is shown (e.g. when speed = "2MB" or node type ="Cisco 7206VXR")
- Position of field in tab page
- Field dimension in tab page
- Combobox dropdown values (optional)
- Standard value
- Empty value allowed?

28. Interfaces to other systems

IMS supports multiple types of interfaces to other systems and software applications. This chapter describes what types of interface are supported and high-level how these interfaces work.



Typical types of applications IMS interfaces with are:

- Network Management Systems
- Alarm Management Systems
- CRM systems
- Workflow / Order management systems
- GIS systems
- Billing systems

Interfaces to customer owned applications can be created as well.

28.1 Network Management System Interfaces

This paragraph provides information regarding interfaces to the Network Management Systems (NMS), Element Management Systems (EMS) and directly to the Network Elements (NEs)/Equipment.

28.1.1 Types of Interfaces

VC4-IMS supports multiple types of NMS/EMS and NE interfaces. Some examples:

- CORBA (Common Object Request Broker Architecture)
- RESTful based interfaces
- MTOSI
- TL1
- Interfaces based on XML (Extensible Markup Language)
- SNMP
- CLI/Telnet/SSH;
- Flat files (txt, csv);
- Vendor Proprietary interfaces;
- Database to database interfaces.

28.1.2 Network Reconciliation and Auto Discovery

The most common purpose of an interface to a NMS, EMS or NEs is Network Reconciliation and Auto Discovery. IMS will take a snapshot of the NMS/EMS and NE data and compare this data with the data in the IMS database.

This is normally performed once day, however this could to run more or less frequent.

Reconcile Process

Below steps describes the reconcile process:

1. Each night IMS collects data from NMS/EMS and/or NE's.
2. The network data will be stored in the IMS Reconcile table in the database
3. Each element (e.g. equipment, connection) has a unique link ID to NMS/EMS/NE.
4. Connections running over multiple platforms can have different NMS/EMS/NE ID's, so IMS knows exactly which part of connections should be synchronized.
5. IMS will query/compare the data in "reconcile" table with the "normal" IMS.

Two options in case of differences between NMS – IMS:

- 1) Auto-discovery IMS corrects data automatically in IMS database.
- 2) IMS shows the difference in the reconcile form.

The frequency of the reconciliation process can be set by the IMS Admin user (e.g. daily at a specific time, weekly).

Auto-discovery

Some information IMS can correct the data in IMS database automatically.

Examples are:

- New equipment in actual network, but not yet in IMS
- New connections in actual network, but not yet in IMS
- New inserted cards in actual network, but not yet in IMS
- Serial numbers not (correct) in IMS database
- Software/Hardware versions
- Etc.

Customer may decide which objects will be automatically discovered or reported as a mismatch.

IMS Reconcile form

Some information cannot be corrected automatically.

A Network engineer must check first whether IMS is correct or NMS is correct.

The differences between NMS and IMS will be shown in the IMS Reconcile form.

Examples are:

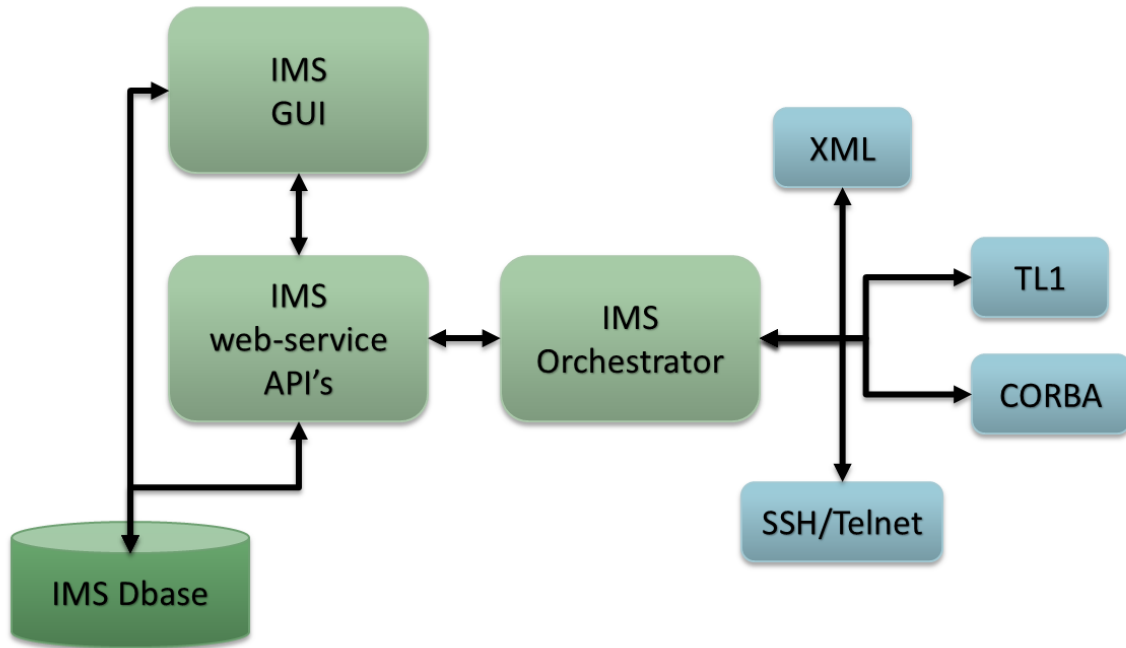
- Equipment type differences
- Connections with a different routing
- Connections on different ports
- Card differences
- Cards that are deleted in NMS, but still “in service” in IMS

Users can correct these kinds of discrepancies using the IMS GUI.

28.1.3 Auto provisioning from IMS into NMS/EMS or NE

VC4-IMS can also be integrated to the network to do auto-provisioning. That means the services will be planned in IMS first, then IMS pushes the information to the NMS/EMS or NE's to build the services in the network.

Below a schematic overview.



28.1.4 Service Fulfillment

The IMS workflow can be used to automate the processes around auto provisioning to automate the Service Fulfillment.

Each type of service can have its own process (customizable by users with correct permissions), so that the workflow process can be used to decompose standard services into smaller steps and automate actions that follow a fixed rule.

See chapter 19 for more information related to IMS Workflow.

28.2 BSS/OSS interfaces

External BSS/OSS systems can be linked to VC4-IMS using different kind of interfaces, such as:

- Web-service API's
- TMF RESTful Inventory
- SNMP
- Database to database interfaces;
- Flat files (txt, csv);
- Proprietary interfaces

28.2.1 Alarm Management System Interfaces

In case an Alarm Management System, such as IBM Tivoli/Netcool, HP TeMIP, Centina vSure, is being used by the operator an interface can be created to receive and maybe correlate the alarms coming from NMS/EMS or NE's.

A simple interface could be to push the inventory data from IMS to the Alarm Management system.

A more comprehensive interface is a webservice interface between the two systems. In case of an (filtered) alarm in the NMS/EMS/NE the Alarm Management sends requests to IMS. IMS creates a Trouble Ticket automatically and performs impact analysis to identify the impacted services and customers. IMS will send the information back to the Alarm Management System.

28.2.2 Customer Resource Management System (CRM) Interfaces

When a CRM system is being used, the customer data in this CRM system will be the master. Once an interface is created between the two systems, IMS can make use of this customer data. This customer information can then be linked to inventory objects.

Normally this is a simple interface to extract data from the CRM and synchronize it with IMS. Optionally the CRM system can also read from the IMS database, using the IMS web-service interface or using a simple database view.

A CRM can also start the workflow in IMS, once a customer wants a new service or a change.

28.2.3 Interface between IMS and Financial Systems

To keep all the company's assets and its related financial values up to date, it is most important to keep the network inventory, warehouse and financial systems in sync. This may sound easy, but it is not always the case. Since many people, and so many of the employees of your company, follow the path of least resistance, procedures may not be followed all the time and assets get lost.

When the financial system is not properly linked to the inventory and warehouse system, there is no asset control and multiple site surveys will be necessary to get a view of the current assets.

How to control the assets:

- Build interfaces to all the different network vendors (NMS/EMS/NE's) to synchronize the actual active network assets in VC4-IMS. This will guarantee 100% correct asset view of all active components. Since VC4-IMS manages the active **and** passive equipment and the relations between them, network reconciliation and automatic discovery will also support to control the passive equipment.
- Manage the materials in the warehouse using VC4-IMS warehouse functionality (see chapter 23)
- Build an interface to the financial system (such as Oracle Finance/ERP, or any other financial system). Often materials have different names in network, inventory and ordering. VC4-IMS can handle multiple names for the same item to overcome this problem.
- In case there is no standard naming convention in place: introduce proper naming convention for locations and equipment.
- Make use of serial numbers and/or own barcode system or combination. Serial numbers are often used for active equipment, so that this information can be retrieved from NMS/EMS/NE without the need of pulling cards out of the equipment (and causing service interruption).
- Daily reconcile the financial system with the VC4-IMS application.
- Run data quality checks to keep also passive equipment inventory up to date.

28.2.4 Interfaces to other types of applications and databases

Most other types of OSS/BSS interfaces are customized interfaces. Examples are interfaces to existing Workflow systems, Trouble Tickets, Billing systems, GIS systems, etc.

Each company is different and uses different systems and procedures. So, what an interface to VC4-IMS needs to do, will also vary per organization. That is why our experienced team will be available to discuss with your organization how to build the most efficient interface to optimize the data flow.

28.3 IMS Webservice API's

External systems can interface with IMS using the web-service API's.

With the IMS web-service interface any external system can:

- Read IMS data
- Create IMS data
- Edit IMS data
- Delete IMS data

Examples of existing API's are, but not limited to:

- Create country
- Delete country
- Retrieve country data
- Create city
- Delete city
- Retrieve city data
- Create new customer
- Delete customer
- Retrieve customer data
- Create Location
- Delete Location
- Retrieve location data
- Create node
- Delete node
- Change status of node
- Retrieve node data
- Add shelf in node
- Delete shelf from node
- Change shelf status
- Retrieve shelf data
- Add card in node
- Remove card from node
- Change card status
- Retrieve card data
- Change status of connection
- Relate connection to port
- Remove connection from port
- Relate connection to bearer connection
- Remove connection from bearer connection
- Retrieve connection data
- Retrieve bearer connection data
- Create new OLO connection
- Change status of OLO connection
- Relate OLO connection to location
- Remove OLO connection from location
- Relate OLO connection to connection
- Remove OLO connection to connection
- Retrieve OLO connection data
- Create Order / Initiate Workflow (Service Fulfillment)
- Edit Order
- Create Trouble Ticket and start IMS fault impact analysis

29. User-groups and permissions

In IMS a single user belongs to a so-called user group.

A user group is a group of users focused on the use of one or more particular functionalities.

IMS has a method of assigning permissions/access rights to these specific groups of users.

29.1 Users and User groups in IMS

A user group is used to group multiple users with same user permissions.

Per user group permissions can be set per IMS screen and per part of screen.

These groups are managed within the Menu Permissions form.

Examples of User groups:

- Read-only
- Equipment build
- Connection build
- Site Management
- Administrator

The IMS admin user can create/change these user groups.

One user may belong to one or more user-groups.

29.2 Database domains

Global and/or larger telecom providers might have the need to have different database domains. For example, a separated database domain per country or island.

VC4 can create such database domains, so that the organisation can have one single network planning and inventory system but with different IMS database schemas.

30. IMS Architecture

30.1 Database and application

Application

The VC4-IMS software is a web-based application and can be opened using most common web browsers. There is no need for additional client installation, a web browser is enough.

Database

IMS runs on an Oracle database. Oracle 12 is recommended, but older versions are also supported.

30.2 High Availability

The IMS solution can be built in a high available environment.

Prerequisites for High Availability

- 1) Redundant hardware and software at both the primary and data replication sites.
- 2) Provide identical hardware and software configurations at each site.

30.2.1 Architecture

This paragraph describes the architecture that is needed in an IMS environment with high availability.

Server locations

In a normal availability environment, one server location is enough to install the IMS servers.

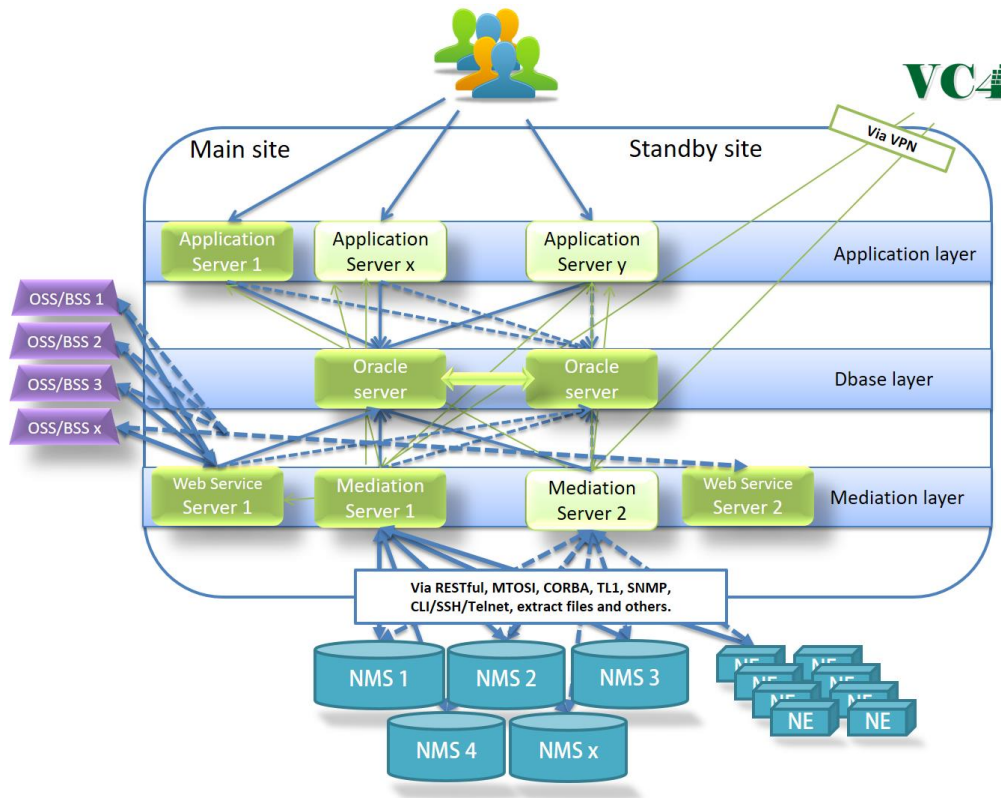
High availability:

Two different server locations will be needed to guarantee high availability.

One location will be the primary site. The other location the backup or Disaster Recovery (DR) site.

Connectivity

On the next page, a schematic drawing of the connectivity.



Oracle Servers

The main Oracle database server must be installed on the primary site. The backup Oracle server must be installed on the DR site.

In High Available IMS environment Oracle RAC may be used or Oracle DataGuard software to protect the data.

Application Servers

IMS users run the IMS application on the Application (web) servers or on user machines in case of client-server users.

The Application server will connect to the active Oracle server.

In a high available IMS environment minimum quantity of application servers is two.

Mediation servers

When network reconciliation towards NMS/EMS and/or NE's, one or more Mediation Servers need to be implemented.

One server can manage between 5-10 NMS/EMS/NE interfaces. A second server is needed for redundancy purposes or in case of larger number of interfaces.

WebService servers

For OSS/BSS interfaces (like interfaces to CRM, Billing, Alarm Management, Performance Management) a separate server needs to be implemented.

30.3 VPN

To be able to provide maintenance on the application and database VPN access will be needed from VC4 office to the IMS Environment.

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