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PRODUCT
GUIDE

Unify OpenScape Fault Management

Unify OpenScape Fault Management V13, Layer 2 Manager Plugin

User Guide
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1 Preface

This chapter discusses the following aspects:

- Purpose and Audience of this guide
- The terminology uses in this guide
- Organization of this guide
- Conventions used in this guide

1.1 Purpose

This user guide describes the Layer 2 Manager plugin for OpenScape FM

1.2 Audience

This guide is written for end users, who like to know how the Layer 2 Manager Plugin for the OpenScape FM can be used. The reader should be familiar with the usage of the OpenScape FM. A detailed description of this program can be found in the *OpenScape FM Desktop User Guide*.

1.3 Terminology

- **Server** means the OpenScape FM server. The server on which the OpenScape FM with the Layer 2 Manager Plugin has been installed.
- **Client** means the OpenScape FM client. Generally this is a web browser in which the OpenScape FM has been started by entering an URL.
- **Layer-2** means the network access layer of the internet protocol family. This corresponds to OSI Layer 1 and 2 (Physical and Data Link layer).
- **Switch** means an Ethernet switch, as it is used in IP based networks.
- **Bridge** means an Ethernet bridge for IP based networks. Bridges nowadays a rarely used. Within the Layer 2 Managers they are handled like switches. Both terms are used synonymic within this guide.
- **Router** means an IP layer 3 router.
- **Host** means an end point within an IP net. An IP system which does not forward IP packets on layer 2 or layer 3.
- **IP node** is used synonym to Host. It also means an arbitrary device with at least one IP address, which has no forwarding function.

- **Port** means a physical interface of an Ethernet switch to connect a network component.
- **Interface** means a physical interface of an IP node or Host, which can be uniquely identified through an MAC address.
- **MAC Address** means a so called Media-Access-Control-Address. It is also called Ethernet ID. Each interface within an Ethernet based network topology has a worldwide unique MAC address, which will be used to generate paths and to address objects within the Layer 2 plane.

1.4 Organization of this Guide

This guide is organized as follows:

- *Chapter 2, "Introduction"* contains an introduction about the functions of the Layer 2 Manager Plugin.
- *Chapter 3, "First Steps"* contains information about the installation and licencing of the Layer 2 Manager Plugin.
- *Chapter 4, "Working with the Layer 2 Manager Plugin"* describes the handling and configuration of the Layer 2 Manager Plugin.
- *Appendix A, "Rights"* contains the list of the user rights that may be granted for the Layer 2 Manager Plugin.
- *Appendix B, "Required Hardware"* contains a list of hardware requirements for the Layer 2 Manager Plugin.
- *Appendix C, "Requirements"* contains a list of additional requirements that have to be fulfilled to use the Layer 2 Manager Plugin.

1.5 Conventions Used within this Guide

The following font conventions are used within this guide:

Bold Font: Indicates that a word is a new word or an important term.

Example: **Bridge-MIB**.

Bold Computer Font: Indicates data that has to be entered by the user.

Example: **`Java`**.

Computer Font: Indicates computer output (including UNIX prompts) or explicit directory or file names.

Example: `Prompt%.`

Italics: Indicates a reference to another guide or to another chapter within this guide.

Example: *Documentation for the OpenScape FM.*

Italics are also used for emphasis.

Example: *All* users are effected.

2 Introduction

The OpenScape Fault Management, or short OpenScape FM, is the standard network management platform for Unify telecommunication networks. As such it is has grown to an important tool for service technicians to perform management, error analysis and error recovery activities.

The OpenScape FM provides extensive support for traditional, circuit-switched telecommunication networks and it integrates the new OpenScape Voice (VoIP) Technology. The IP Manager provides base functionality for the management of VoIP based communication. It discovers and displays the logical connections of the Layer 3 network topology and sub components of IP devices like HTTP-servers, SNMP-agents and interfaces.

In some situations, however, the knowledge about the physical connections involved in a communication process can be helpfull. This knowledge provides the means for a rapid error analysis and error recovery and is therefor of great importance.

The knowledge will be delivered by the Layer 2 Manager Plugin for the OpenScape FM which extends the network‘s layer 3 structure discovered and displayed by the OpenScape FM by a view from the perspective of the network access layer (OSI layer 1-2).

An incremental procedure is used to generate the layer 2 topology. The procedure for the incremental build of the model of the physical network topology determines the connections between the switches. It will then attach the endpoint interfaces to switch ports or LAN segments.
The generated layer 2 model forms a representation of the real world topology, as seen from the perspective of the network access layer.

A necessary prerequisite for the generation of a layer 2 model is the access to the data describing the spanning tree and the address forwarding tables within the switches (see *Appendix C, “Requirements”)*. This data will also be provided by standard SNMP-MIBs and therefore the procedure can be used within heterogenous, ethernet based networks.

Many methods currently established on the market will usually only represent a static snapshot of the layer 2 topology. The Layer 2 Manager Plugin uses incremental techniques. The model state will continuously be adjusted to the reality. E. g. data, which has become available through the discovery of a new SNMP agent, will be integrated into the model during runtime.

The implemented layer 2 procedure has therefore the ability to make decisions based on an incomplete model (for example when yet not all switches have been discovered).

Separate views will be generated to visualize the layer 2 model data. The topmost view of the Layer 2 Manager Plugin will be represented by a ‚Layer 2 Topology‘ object placed within the Root submap. The view directly below this object will display all components that participate in the data transmission as seen in the layer 2 topology view. The layer 2 topology view will contain all discovered switches, bridges, routers and multi-homed hosts. It will also display LAN segments that are connected to more than one switch.

The objects displayed within the layer 2 topology view can be structured using the topology manager. The layer 2 topology can therefore be adopted by the user to the geographical and organizational conditions of the enterprise.

For every component within the layer 2 topology view (bridge, switch, router or host), a so called Proximity View can be opened. Within the Proximity View the component and all it‘s direct neighbors will be initially displayed. These are all components which may be reached with a single step. The visibility of the neighbor relations may

be expanded in steps. Successively all components which may be reached in two steps, three steps ... , will be added to the view.
The expansion can be done for all components within the Proximity View, or for a specific component.

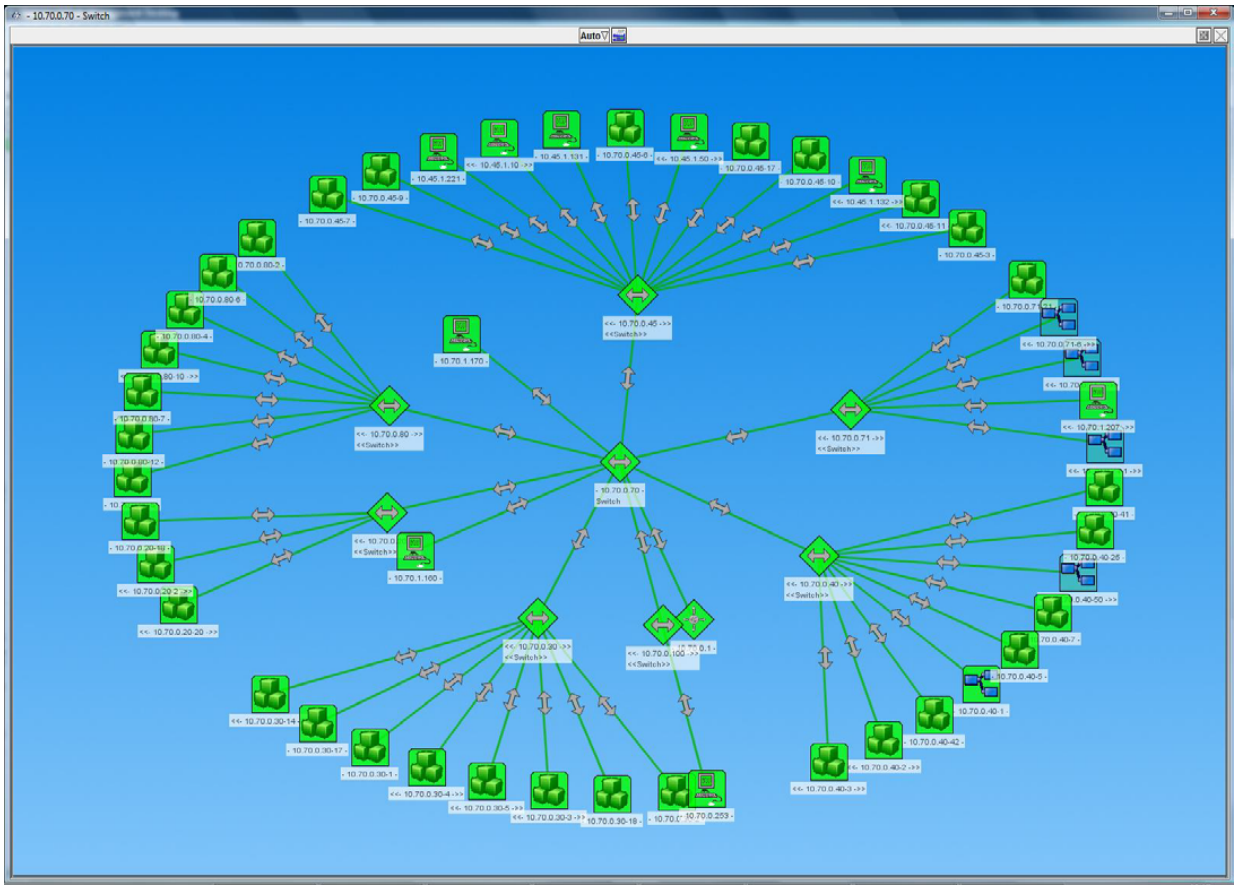

Figure 1 Example Topology using a Star Layout

If more than one IP node can be reached using the same port, they will be placed under the same LAN segment.

Besides the representation of the layer 2 topology, the Plugin provides some analysing functions. By entering a MAC address, it is possible to find the switch port through which the respective interface is connected and to which component it belongs. The list of the known MAC addresses can be displayed to enter a selection.

In addition the possible layer 2 paths between two IP nodes, considering VLANs, can be displayed. IP nodes of different VLANs will not be connected within the path, even if a physical connection would exist. Only a connection within the layer 3 allows a connecting path between such nodes.

3 First Steps

3.1 Installation of the Layer 2 Plugin

The Layer 2 Plugin will be installed automatically when the OpenScape FM is installed.

3.2 Initialization of the Layer 2 Plugin

The Layer 2 Plugin will be initialized automatically during the installation. The sub menu **Layer 2 Manager** will then be added to the menu **IP Manager** within the main menu. A new object which represents the Layer 2 Manager Plugin will be added to the hierarchy. This object has the path **Root->System->Plugins->IP Manager**. The menu of this object contains the same menu entries that can be found in the Layer 2 Manager sub menu.

The sub menu **Layer 2 Manager** contains the menu entries **Show Layer-2 Paths...**, **Show Switch Ports...**, **Repoll** and **MAC Addresses...** . A description of these menu entries can be found in *Chapter 4, “Working with the Layer 2 Manager Plugin”*.

3.3 Licencing

The licencing of the Layer 2 Manager is part of the OpenScape FM licence.

4 Working with the Layer 2 Manager Plugin

4.1 Layer 2 Topology

During the initialization of the Layer 2 Manager Plugin, the container **Layer 2 Topology** will be added to the root submap. The identified switches and bridges will be displayed within the view of the **Layer 2 Topology** container. In the following, the terms switch and bridge will be used synonymic within this text.

In addition, the view of the **Layer 2 Topology** container will contain all systems which are connected to more than one bridge or switch (e. g. routers).

The Layer 2 Topology view encloses all components which are part of the communication process as seen from a layer 2 standpoint. This includes LAN segments which are connected to more than one switch.

The Layer 2 Manager tries to identify VLANs and their interfaces by scanning the Q-BRIDGE MIB and CISCO-VTP MIB. The VLAN information will be shown within the label of the respective interfaces. By using the menu item **Show VLAN-IDs ...** from the interface‘s pull down menu, the list of IDs will be displayed. The information will be used while calculating Layer 2 paths.

The objects, which are displayed within this view, may be arranged into subnets by using the topology manager. This makes it possible to build a customer specific view, which represents the organizational or geographical structure.

All discovered switches will be displayed directly within the **Layer 2 Topology** submap. Connection symbols between the systems will represent the physical connections which were discovered by the Layer 2 Manager.

A double click on a switch or the selection of the menu entry **Open->Submap** will open the Proximity View. This will display the switch and all IP nodes that may be reached directly through the various switch ports. If more than one IP node can be reached using the same port (e.g. if they are connected to a hub), then a LAN segment object will be created, which contains these IP nodes. Two different types of segments will be distinguished:

A known segment for which the IP nodes are known and represented by the OpenScape FM.

And an empty segment for which no IP nodes are known yet.

Within the submap of a known LAN segment, the IP nodes of this segment are displayed.
On the submap of an empty segment, the segment itself and the corresponding switch are displayed.
The label of a LAN segment includes the port which is used by the segment to communicate with the switch (“-Port-<port_number> -“).

The viewing range within the Proximity View can be expanded or reduced in steps. If the viewing range is expanded, IP nodes which are in a greater distance will be displayed. The distance between a node and the switch is defined by the minimum number of steps (‚hops‘) which are necessary to reach the IP node from the switch. More about the Proximity View can be found in *Section 4.1.1, “The Proximity View”*.

The submap of a connection contains the IP interfaces (ports) which are used for communication. The colour of the connection represents the status of the connection. This status is the accumulated compound status of the port and interface objects within the connections submap.

IP nodes which cannot be assigned to a switch will be placed within a container called ‚**Orphan**'.

4.1.1 The Proximity View

The selection of the menu entry **Open->Proximity View** or a double click on an IP node within the Layer 2 Topology will open up the **Proximity View**.

The Proximity View will be indicated by a special background image (grey color gradient). In addition the title of the submap will be enclosed into two ‚-' symbols (e. g. „- *grisu.materna.de* -").

The Proximity View can be used to analyze which systems can be reached from an IP node or switch. The Proximity View displays IP nodes and the physical connections between these nodes. That way it is possible to see which IP nodes are attached to which switches and ports at a single glance. This gives an overview which provides the information which switches will be used when one IP node communicates with another. The visibility range within the partial network displayed within the Proximity View can be set generally (for all displayed IP nodes) or specifically (for a specific IP node).

The representation of the Proximity View can be modified by using the context menu **Layout**. Here the visibility range within the displayed partial network can be enlarged or reduced in steps. Also the layout in which the IP nodes will be displayed can be selected within the same context menu.

Using the menu entry **Layout->Expand**, the visibility range within the displayed partial network will be expanded by one step each. Initially only the IP nodes will be displayed, that can be reached from the selected IP node within a single step. When the layout gets expanded, all IP nodes and LAN segments will be added that could be reached with one additional step.

IP nodes or switches for which the visibility range can be expanded (which therefore have at least one undisplayed connection), will be displayed as reference symbols (their icon labels will be enclosed by << and >>). For these objects specific dependencies can be displayed.

If the visibility range should be reduced within the displayed partial network, then the menu entry **Layout->Collapse** can be selected. The objects with the greatest distance will be removed from the view.

Both menu entries can be activated for a single IP node (context menu by right clicking on an symbol) or for the whole submap (context menu by right clicking on the background).

The currently selected layout algorithm can be updated by selecting the menu entry **Layout->Redo**.

These layout algorithms are also provided for other submap types within the OpenScape FM.

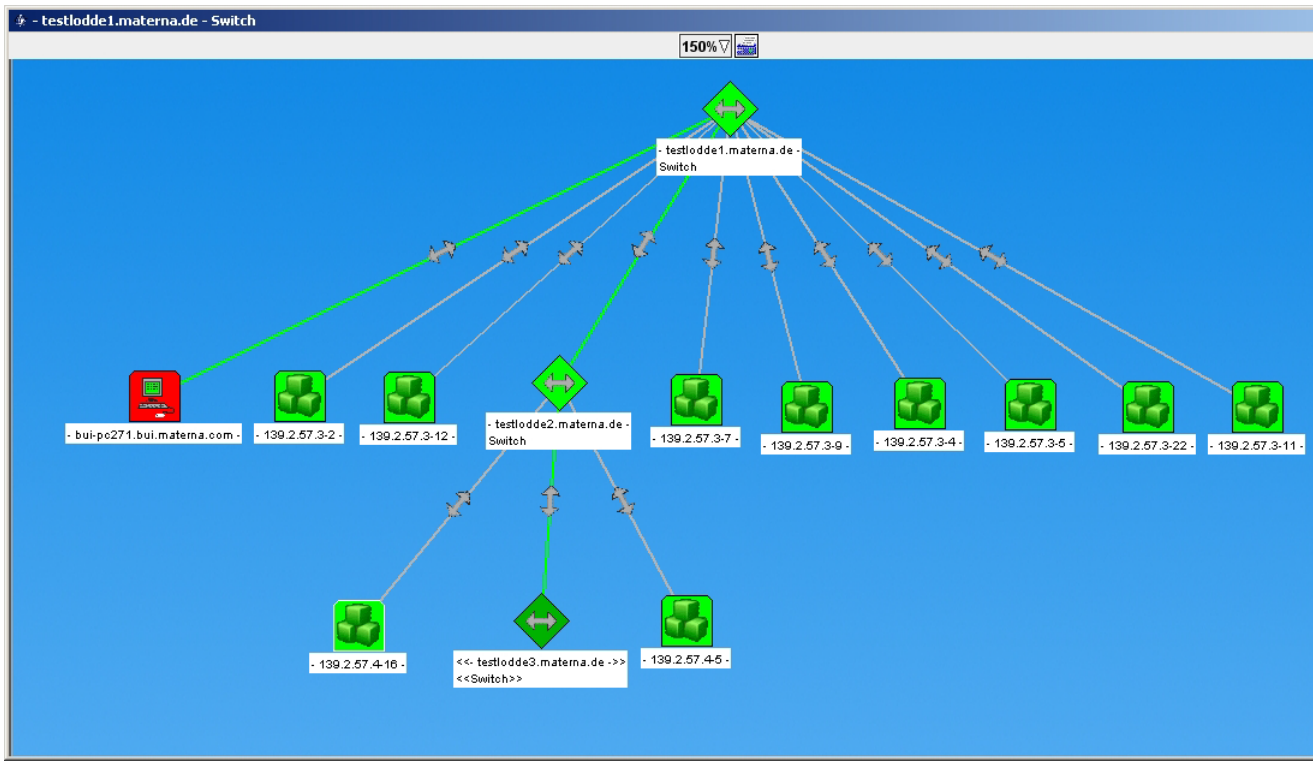

Figure 2 Example Layer 2 Topology - Tree Layout

Layer 2 Connections will be displayed by the following symbol:

If at least one interface with a specific VLAN-ID is found on the view of a connection, then the following symbol will be used:

4.1.2 Updating the Topology

Updates of the Layer 2 Topology representation are performed automatically within the defined interval. This interval can be configured within the Plugin. In addition to the automatic updates, manual updates can be activated. This can be done by selecting the menu entry **IP Manager->Layer 2 Manager->Repoll** from within the main menu.

The repoll rate of the topology model itself is dependant on the polling intervals configured within the respective switches.

4.1.3 Changing to IP Manager Submap

To switch to the classical view of an IP node, the menu item **Open->IP Node Submap** can be used. This view displays sub components like HTTP-servers, SNMP-agents or interfaces.

By selecting an object‘s context menu entry **Open->Proximity View** for an IP node or interface, a switch back to the Proximity View of an object can be performed.

4.2 Layer 2 Route

The Layer 2 Manager provides the option to determine the physical path between two network components on Layer 2 level. When paths are considered, VLANs will be treated as separate networks. The algorithm will use the VLAN IDs to identify which ports may be used for the next step.

The route finding feature can be accessed...

- by using the main menu entry **IP Manager->Layer 2 Manager->Show Layer-2 Paths...** and the entry of two IP addresses,
- by using a direct selection from within the context menu of the desired start and end IP node through the entries **Layer 2->Layer-2-Route Start** and **Layer 2->Layer-2-Route End**.

In both cases, an identical window opens which mainly consist of a table that displays the IP nodes, switches and interfaces along the possible paths between the two selected objects.

Within the table each row corresponds to one step that has to be done by a package on its way from the start to the end IP node. Each IP node, switch and interface that has to be passed is listed separately.

If e.g. the computers CMP1 and CMP2 are connected by switch IF and a path between them should be displayed, the list would contain in the following order:

- the computer CMP1
- the sending interface of computer CMP1
- the receiving interface of switch IF
- the interface IF
- the sending interface of switch IF
- the receiving interface of computer CMP2
- the computer CMP2

The table contains the following columns:

- **Path/Distance**: Here the path number and the position within the respective path are displayed.
  The path number shows to which of the discovered paths the table entry belongs. The distance in ascending order shows the sequence in which the packages have to pass the objects for the respective path.
- **Element:** The label of the object.

- **Physical Address:** The MAC address of the interface is displayed here.
- **Interface Index:** The index of the interface is displayed in this column. For switch ports this is identical to the port number.
- **VLAN IDs:** If the respective object is located within a VLAN, the VLAN‘s ID will be displayed here.

The button **Close** in the lower part of the window closes the window.

4.2.1 Displaying Layer 2 Route (Main Menu)

To display the routes from one IP address to another, the menu entry Display **Show Layer-2 Paths...** from the main menu **IP Manager->Layer 2 Manager** can be selected. This will open up a dialogue in which the source IP address (field **Source IP**) and the source IP address (field **Target IP**) can be entered. On pressing the button **Ok** the window described in *Section 4.2, “Layer 2 Route”* will be opened for the entered IP addresses.

4.2.2 Displaying Layer 2 Route (IP Node)

Within the context menu of an IP node, the menu entry **Layer-2 Path Start** can be selected to mark this IP node as the source node for a Layer 2 routing calculation. The target IP node can be marked respectively by selecting the context menu entry **Layer-2 Path End** of this node.
If this process should be aborted without displaying a route, the context menu entry **Layer-2 Path Cancel** can be used.

The menu entries **Layer-2 Path End** and **Layer-2 Path Cancel** are available for all IP nodes, if the menu entry **Layer-2 Path Start** has been selected before.

After the selection of the menu entry **Layer-2 Path End**, the window described in *Section 4.2, “Layer 2 Route”* will be opened.

4.3 Showing Known MAC Addresses

The Layer 2 Manager offers a function to display all MAC addresses that are known by the OpenScape FM. This feature can be invoked by using the main menu entry **IP Manager->Layer-2 Manager->MAC Addresses...**.

The displayed list contains one known MAC address per row, which is displayed in the column **ID**. The column **IP Address** shows the IP address corresponding to the MAC.

If the object to which the MAC belongs is displayed within the OpenScape FM, the objects name will be displayed in the column **Node**.

The column **Source** displays the name of the object that provided the knowledge about the MAC. Possible sources are the Interface table of the object‘s SNMP MIB -II or ARP cache entries of routers/switches. Both sources are checked during discoveries. In addition MAC addresses can be provided by technology specific actions.

The column **Update** displays the time when the respective entry was updated the last time.

4.4 Showing Switch Ports

The Layer 2 Manager offers the function to display the switch or port through which the interface is connected that belongs to a given MAC address. This feature can be accessed as follows:

1. Selecting the main menu entry **IP Manager->Layer-2 Manager->Show Switch Ports...**.
   This will open up a dialogue in which a MAC address can be entered. The button **Cancel** will close this dialogue. The button **Ok** will open the window ‚Showing Switch Ports“.
2. For a known IP node, the menu entry **Show Switch Ports...** can be selected directly within the context menu of the IP node. In this case the entry of the MAC address is unnecessary and the window ‚Show Switch Ports‘ will open up instantly.
3. The MAC address can be selected from the list of known MAC addresses. This list can be opened by selecting the main menu entry **IP Manager->Layer-2 Manager->MAC Addresses...** . If at least one MAC address is selected within the list, pressing the button **Show Switch Ports...** will display the list of switches and ports connected to the selected addresses.

The window **’Show Switch Ports’** contains a table with the following columns:

- **Switch Port:** The port numbers. There may be more than one row for a port number, if more than one node is attached to the same port.
- **Switch Interface:** The description of the switch interfaces. The background color will correspond to the status of the switch interface.
- **Switch:** The symbol labels of the switch objects.
- **Switch MAC Address:** The MAC address of the switch.
- **Host:** The symbol labels of the connected host objects.
- **Host Interface:** The host interfaces. The background color will correspond to the status of the host interface.
- **Host MAC Address:** The MAC address of the connected host object.

The button **Close** closes the window.

4.5 Showing Switch Ports with Forwarding Entries

To help in the debugging process to find possible sources of networking problems, a function exists that lists all switches for which a selected IP address is known. The function can be started by selecting the entry **IP Manager->Layer 2 Manager->Forwarding Entries** from the context menu of the respective IP node.

A list will be displayed that contains one row per matching switch. The switch ports that have sent/received data to/from the IP node are identified by the columns **Switch**, **Switch MAC-Address**, **Switch Interface** and **Switch Port**.

The object for which the list was created is identified by the columns **Host**, **Host MAC-Address** and **Host Interface**.

The column **Located** displays whether the connection to the IP node was through other switches (entry is `false`) or if the OpenScape FM assumes that the IP node is connected directly to the switch (entry is `true`). In the latter case the IP node appears on the submap of the respective switch within the Layer-2 topology.

A Rights

The plugin's access rights are integrated into the general access management (*see OpenScape FM Desktop User Guide*).

The description of the individual rights can be found within the tooltipps for the corresponding right symbols (tree or submap).

The names of the rights for this plugin begin with the plugin designation *Layer2Manager*.

B Required Hardware

B.1 Hardware

- OpenScape FM Server and Client.
  A detailed description about the required hardware can be found in the *OpenScape FM Desktop User Guide*.

Required Hardware

Hardware

C Requirements

The Layer 2 Manager supports IP based networks, which are build using the ethernet infrastructure.

To allow the creation of a correctly build Layer 2 Topology model, the network components of the managed net have to support the following SNMP-MIBs (access to the SNMP agents has to be provided by an Administrator).

- MIB-2 (mib-2, RFC 1213)
- BRIDGE-MIB (dot1dBridge, RFC 1493)
- Q-BRIDGE-MIB (qBridgeMIB, RFC 2674)
- Cisco VTP (if Cisco components are used)

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