# JDisc Discovery 5.0

# Networking Add-On

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# 1 Introduction

JDisc Discovery's Networking Add-On extends JDisc Discovery's discovery with network management features, including:

1. Network Topology Discovery
   JDisc Discovery's discovery determines the network (layer 3) and segmentation (layer 2) topology. Network topology (layer 3) describes how routers connect networks and Segmentation topology (layer 2) describes how switches connect to other switches and devices within a sub-network.
2. Router and Switch Configuration Backup
   JDisc Discovery's discovery collects configuration files from Cisco routers, switches, and firewalls and from HP ProCurve switches. The predefined set of configuration commands for Cisco and HP ProCurve devices helps you to start quickly without extra configuration steps. Of course, you can add extra configuration commands as you need them.
   JDisc Discovery keeps a history of configuration files and provides a comparison feature to spot the differences between revisions.
3. Enhanced Router and Switch Discovery
   The Networking Add-On augments JDisc Discovery's discovery to also discover modules of many interconnect devices.
4. VLAN Discovery
   With the Networking Add-On, JDisc Discovery detects VLANs and their associated switch ports for many network switches.
5. WLAN Discovery

   JDisc Discovery's WLAN discovery identifies WLANs and access points in the proximity of Windows and Mac OS X computers. WLANs, access points and WLAN clients are also displayed in segmentation topology maps.

# 2 Network Topology

The network topology section provides some background information on network topology and the OSI networking model before explaining how JDisc Discovery determines the network and segmentation topology.

## 2.1 Background

A network topology defines interconnections between devices on a computer network. Topologies can be logical or physical. Logical topologies explain the data flow within the network whereas the physical topology describes the actual cable connections between elements.

The OSI layer sub-divides a communication system into seven layers:

1. Physical Layer
2. Data Link Layer
3. Network Layer
4. Transport Layer
5. Session Layer
6. Presentation Layer
7. Application Layer

Each layer provides specific services for the higher level layers and makes use of the lower level layers.

### 2.1.1 Data Link Layer

The data link layer and the network layer are the most important.

According to Wikipedia, the data link layer '*provides the functional and procedural means to transfer data between network entities and to detect and possibly correct errors that may occur in the Physical Layer* '. Switches and bridges operate on network layer two.

Switches connect devices within a network and prevent collisions among devices within one network. In most networks, switches are connected to other switches to either provide redundant communication paths or to connect more devices to the network.

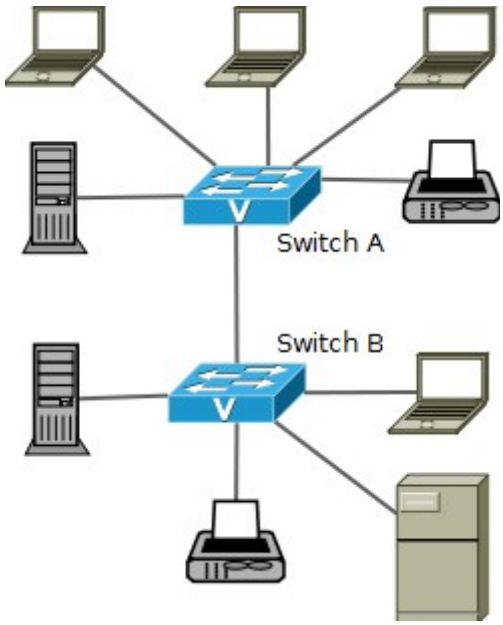


Diagram: Two switches connecting devices

The above diagram shows two switches connecting PCs, laptops, printers, and servers within a network. Each device is connected to one switch port.

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Switches operate on the OSI layer 2 and connect devices within a network.

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## 2.1.2 Network Layer

Wikipedia defines the network layer as a layer that '*provides functional and procedural means of transferring variable length data sequences from a source to a destination via one or more networks, while maintaining the quality of service requested by the Transport Layer. The Network Layer performs network routing functions, and might also perform fragmentation and reassembly, and report delivery errors. Routers operate at this layer* '.

The following diagram illustrates how two routers connect three networks. Since routers work on layer 3, we call this the *layer three* or *network topology*.

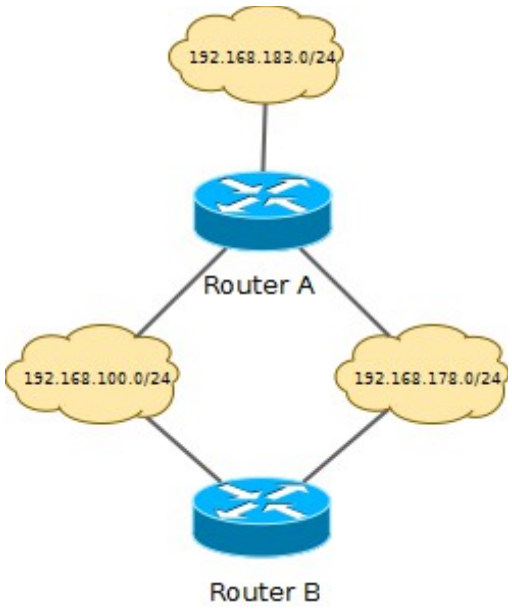


Diagram: Routers connecting IP networks

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Routers operate on the OSI layer 3 and connect different networks.

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## 2.2 Network Topology Discovery

This section explains how JDisc Discovery discovers the network topology and what to consider to achieve good results.

### 2.2.1 Interface Status

The status of a network interface is described by the two status values below:

1. Administrative Status:
   When a network administrator enables a network interface, it is considered administratively 'up'. Otherwise, it is considered administratively 'down'.
2. Operational Status:
   The operational status indicates whether a network interface is connected to an active devices. When the operational status is 'down', either no device is connected or the connected device is switched off.

### 2.2.2 Requirements

SNMP read access to all routers and switches is absolutely important. Moreover, JDisc Discovery queries variables of three SNMP MIBs (CISCO CDP, MIB LLDP MIB and the Bridge-MIB) when discovering routers and switches.

Routers and switches exchange link neighbor information via CDP (Cisco Discovery Protocol) or LLDP (Link Layer Discovery Protocol). JDisc Discovery can use CDP and LLDP information to create interconnections between routers and switches. Please note: The completeness of the segmentation topology is depending on the support of the CDP or LLDP protocols of all switches within a sub-network.

In addition to CDP and LLDP, JDisc Discovery queries the MAC forwarding tables from switches to create the segmentation topology when CDP or LLDP are not available. LLDP, CDP and port forwarding can be enabled globally and for individual devices.

The connections between switches and endpoint devices (all device other than routers or switches) are based on the address forwarding tables (exposed by the Bridge-MIB) of each switch port. Switches store the sender MAC addresses of link layer packets received on each switch port in a cache. Unfortunately switches discard address forwarding information of devices that do no longer send link layer packets for a certain time period (default is 5 minutes). Therefore, JDisc Discovery keeps the switch port connections until either the device has been connected to another switch port or another device is connected to a switch port.

You can schedule JDisc Discovery's discovery to regularly collect segment topology data for each sub-network (default is 15 minutes).

1. Unmanaged switches cannot be mapped in the segmentation topology. Such switches are even invisible to the network discovery and have a negative impact on the accuracy of the segmentation topology.
2. Switches and routers must support Cisco's CDP MIB, the LLDP MIB or the Bridge-MIB. If not, JDisc Discovery cannot determine the interconnections between routers and switches.
3. Make sure CDP or LLDP are enabled on your routers and switches if you enable those protocols in the topology settings.
4. Switches must support the Bridge-MIB (RFC 1493) to create the mapping of end-point devices to switch ports.
5. When a switch port is operational down, it is not possible to detect if no device is connected or if a previously connected devices has been turned off. In this case, JDisc Discovery keeps the last connection.

### 2.2.3 Topology Configuration

There is nothing in particular to configure for the network topology discovery. Whenever JDisc Discovery detects a switch, then it reads the port forwarding, CDP and LLDP information (if available). Based on this information, JDisc Discovery detects the network topology.

### 2.2.4 Topology Pitfalls

Although topology information is available via CDP, LLDP and mac forwarding information, the result might not always be perfect. There are several reasons for this. Especially, when you mix devices from multiple vendors supporting different protocols.

So let's suppose we have three switches (Switch A, Switch B and Switch C). Switch A, Port 1 is connected to Switch B, Port 1. Switch B, Port 2 is connected to Switch C, Port 1.

Switch A and C have CDP configured, Switch B does not support CDP.

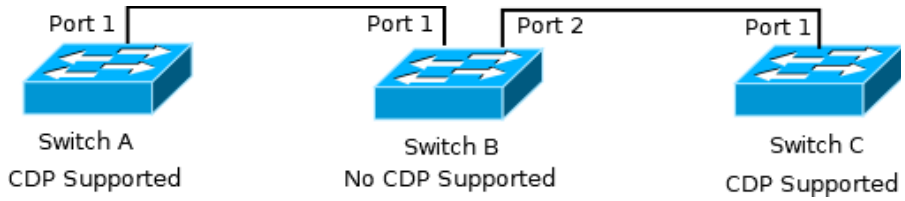



Figure: Simply Switch Topology

Since Switch B does not reply to CDP requests, Switch A thinks that it is directly connected to Switch C. When JDisc Discovery reads CDP information from Switches A and C, then it gets incomplete information that those two switches are directly connected. Switch B is not visible because it is not supporting CDP.

In combination with LLDP, it might even be more complex. LLDP and CDP information might provide different connections due to supported or not supported protocols on the switches.

Whenever you know, that CDP or LLDP information for a switch is incomplete or not correct, then you can disable CDP or LLDP for individual switches using the context menu *Manage* > *Disable Discovery Protocols*.

## 2.3 Review MAC Forwarding, CDP And LLDP Information

JDisc Discovery stores the mac forwarding, CDP and LLDP information in its database. Each switch can display the stored information within its device properties.

### 2.3.1 MAC Forwarding Table

Each switch maintains a set of mac addresses that visible on a switch port. When there is exactly one network interface attached to the switch port, then the set includes exactly one mac address. When there are multiple devices visible from the switch port (e.g. because the port is connected to another switch which contains the actual devices), then it might contain multiple mac addresses.

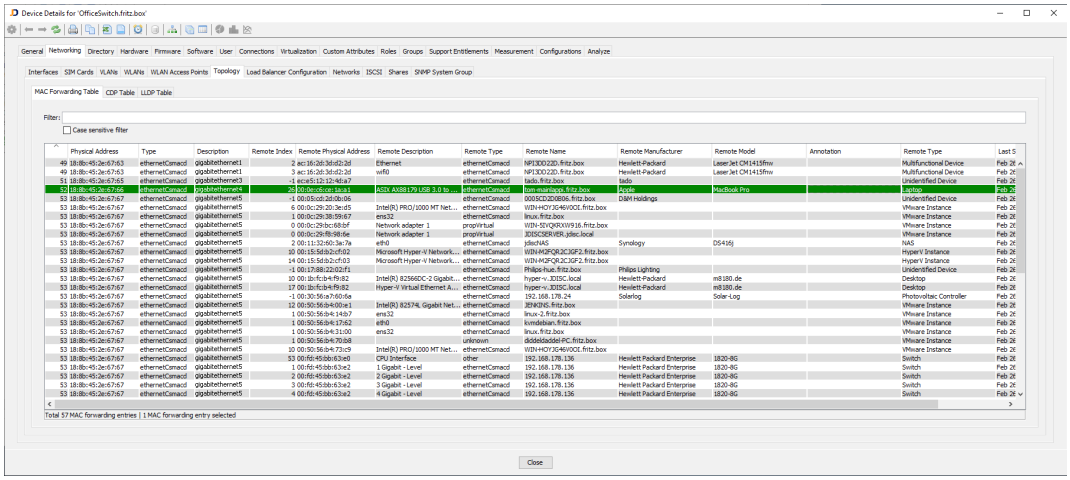


Figure: Port Forwarding Table

The port forwarding table contains information about the local switch interface and information about the remote mac address. When the device that belongs to the remote mac address has been scanned correctly, then the report also displays information about the remote device.

### 2.3.2 CDP Table

CDP (Cisco Discovery Protocol) is a Cisco proprietary protocol that is used by Cisco switches to determine the switch to switch connections. But there are also other vendors that licensed this protocol.

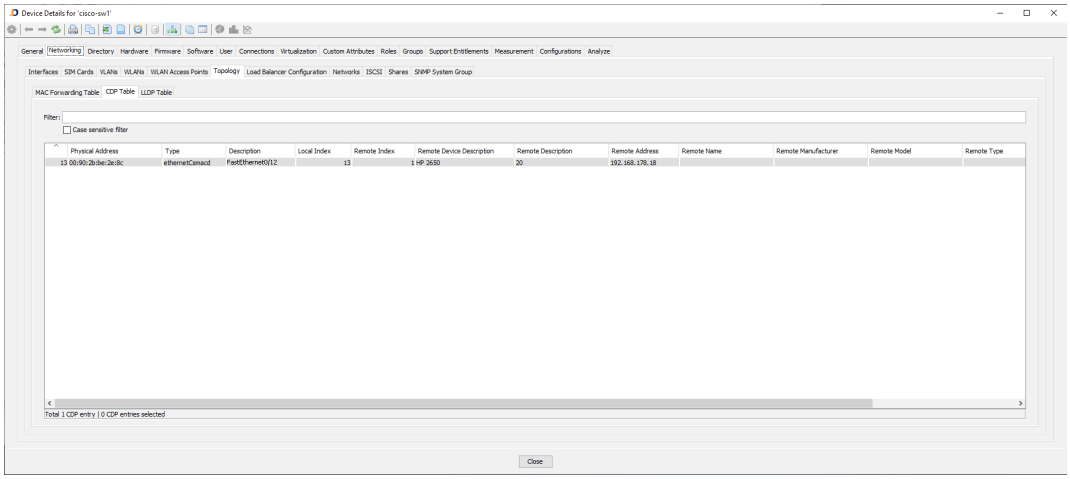


Figure: CDP Table

### 2.3.3 LLDP Table

The purpose of the LLDP (Link Layer Discovery Protocol) is similar to the CDP protocol: Detect switch to switch connections. However this is an open standard and no proprietary protocol. So many vendors support this protocol.

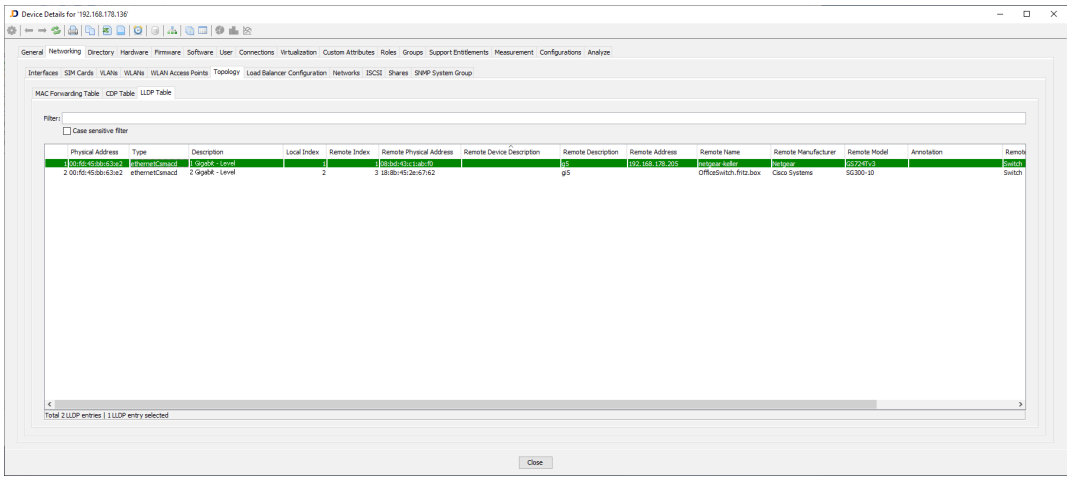


Figure: LLDP Table

## 2.4 Network Topology Views

JDisc Discovery stores topology information in its database and provides graphical and report based topology views.

### 2.4.1 Graphical Representation

JDisc Discovery can create network maps that visualize the network topology. Two different kinds of networks maps exist:

1. Network maps that display how routers connect networks (Layer 3 map).
2. Segment maps that display how devices are connected to each other within a network (Layer 2 map).

Objects in a map can have actions associated with its icon. Select an object in a map and open the context menu to review available actions.

Maps can be exported as JPG image. You can use the *File » Save as JPG...* or click the camera icon to save the map as image.

Save the current map layout either with with *File » Save* or click the disc icon. Saved maps are available from *Maps » Topology Maps*.

Use the magnifying glass icons ( and ) to zoom the map in or out.

Use the enlarge and the shrink button to enlarge or shrink the canvas.

When a map is created, JDisc Discovery automatically creates a layout. The layout depends on the selected algorithm and the network topology. JDisc Discovery Offers five different layout algorithms.

The *Filters* menu allows removing devices of a specific device types from the map. You can also use the *Remove* context menu to remove selected devices from a map.

### 2.4.1.1 Network Maps (Layer 3 Maps)

Open the IP4 network report from *Networking » IPv4 Networks.* Select networks to include into the network map, open the context menu and select *Network Topology*.

The following figure shows a network topology consisting of 5 networks and 2 routers connecting the networks.

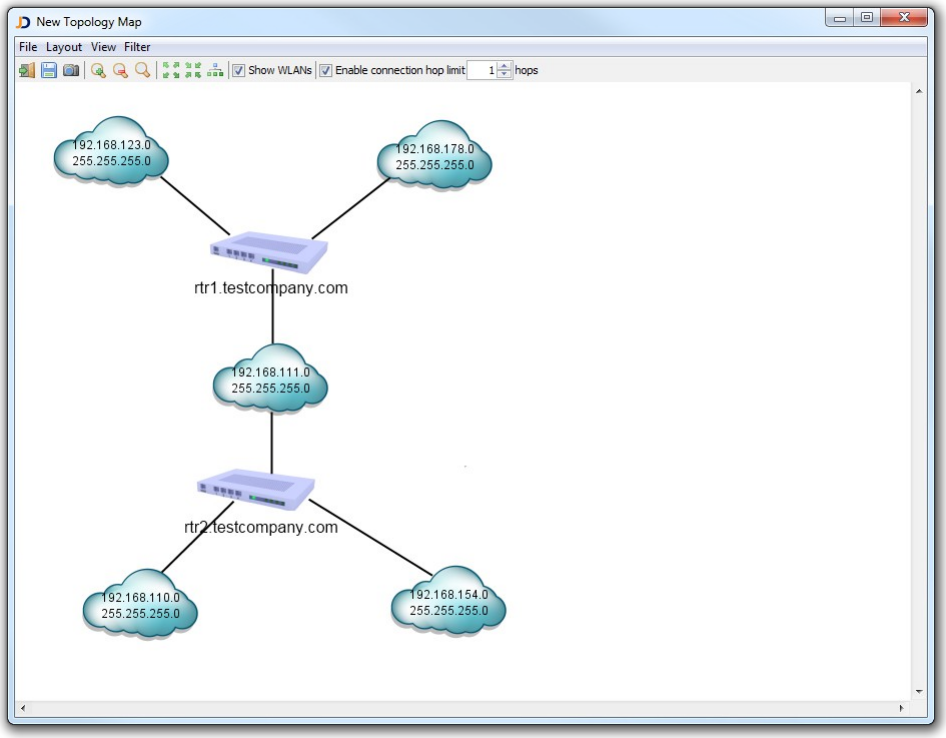



Figure: Network topology

When you double-click a network the segment topology map of the selected network opens. The segment topology map is associated to its network map. When you save a segment map the associated network map is also saved. All layout changes are stored in the database.

### 2.4.1.2 Segment Maps (Layer 2 Maps)

Segment maps (also called layer 2 maps) display how devices are connected to each other. You can open segment maps in three different ways:

1. Double-click a network in a network map. This opens the network's segment

topology map.

2. Open the IP4 networks report (*Networking » IPv4 Networks*) and select a network. Open the context menu and select *Segment Topology » All Devices* or *Segment Topology » Network Devices Only*. The all devices options opens a map including all devices having topology connections. The network devices only options opens a map that only includes routers and switches having topology connections.

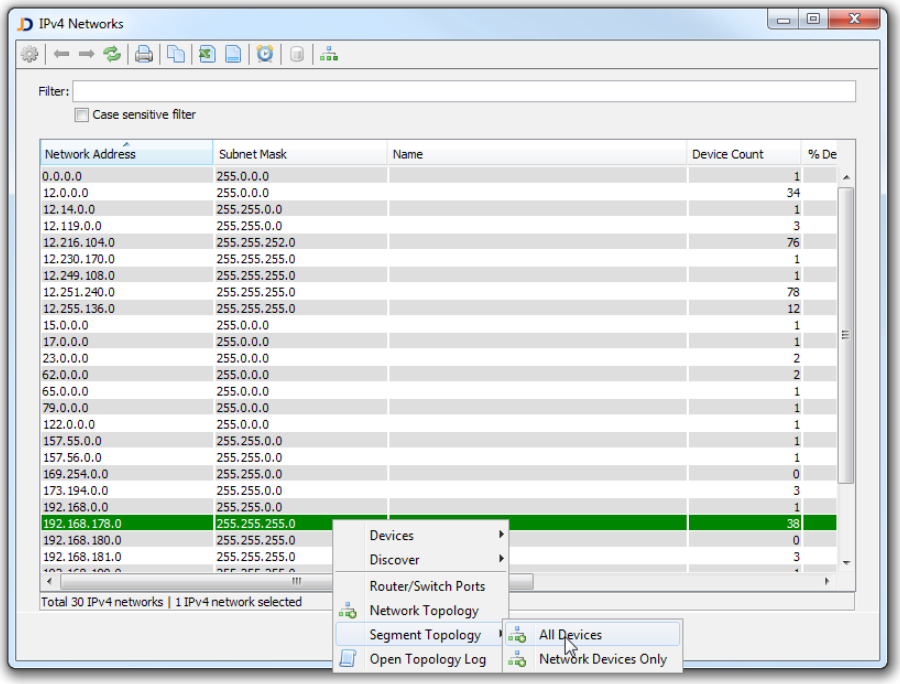



Figure: Open  a network topology map

3. Open a segment topology map from a device report. Select one or multiple devices (so called *root devices*), open the context menu and select *Create Topology Map.*

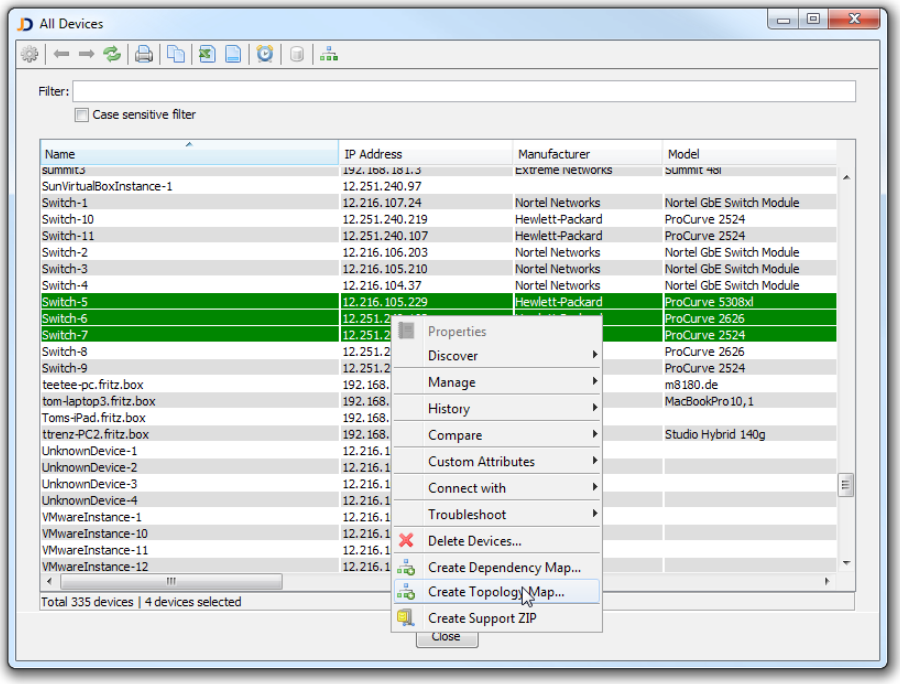



Figure: Open a topology map based on selected root devices

A new segment topology map appears displaying the selected root devices and all directly connected devices. Root devices are highlighted with blue background. You can increase the hop count to display more devices that are indirectly connected to the root devices.

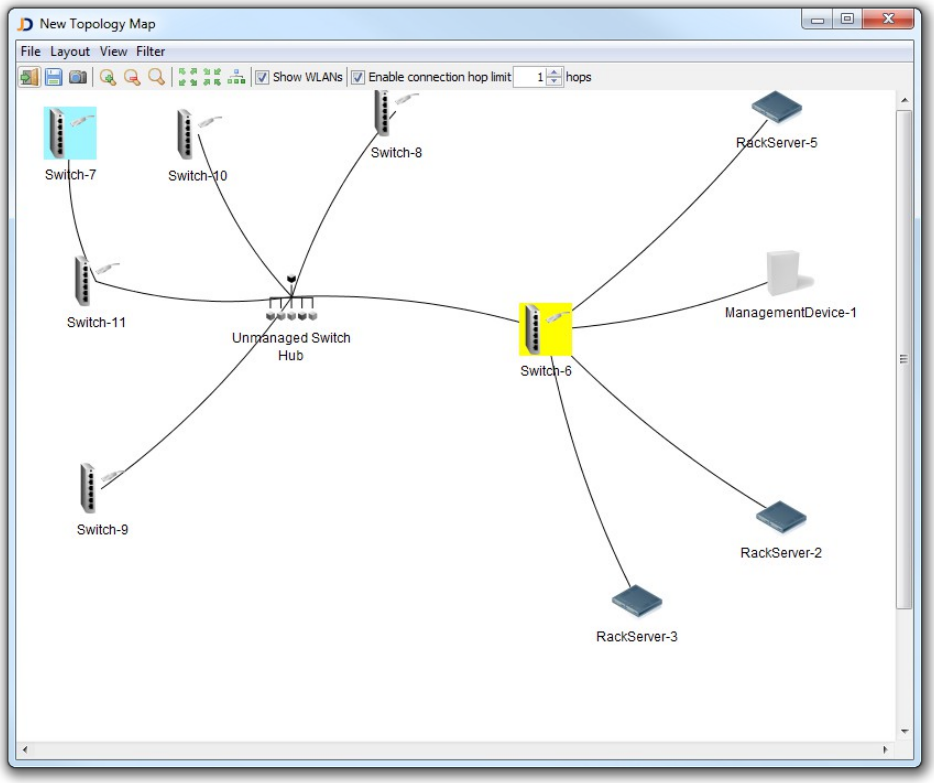



Figure: Segment Topology based on root devices

### 2.4.2 Topology Reports

In addition the network and segment maps, the Networking Add-On augments JDisc Discovery with several new reports and menus. This section explains the new menu items.

#### 2.4.2.1 Enhanced Interfaces Report

The device interface report contains a second table displaying devices that are connected to selected interfaces. You can select one or more interfaces to view what devices are connect to selected interfaces.

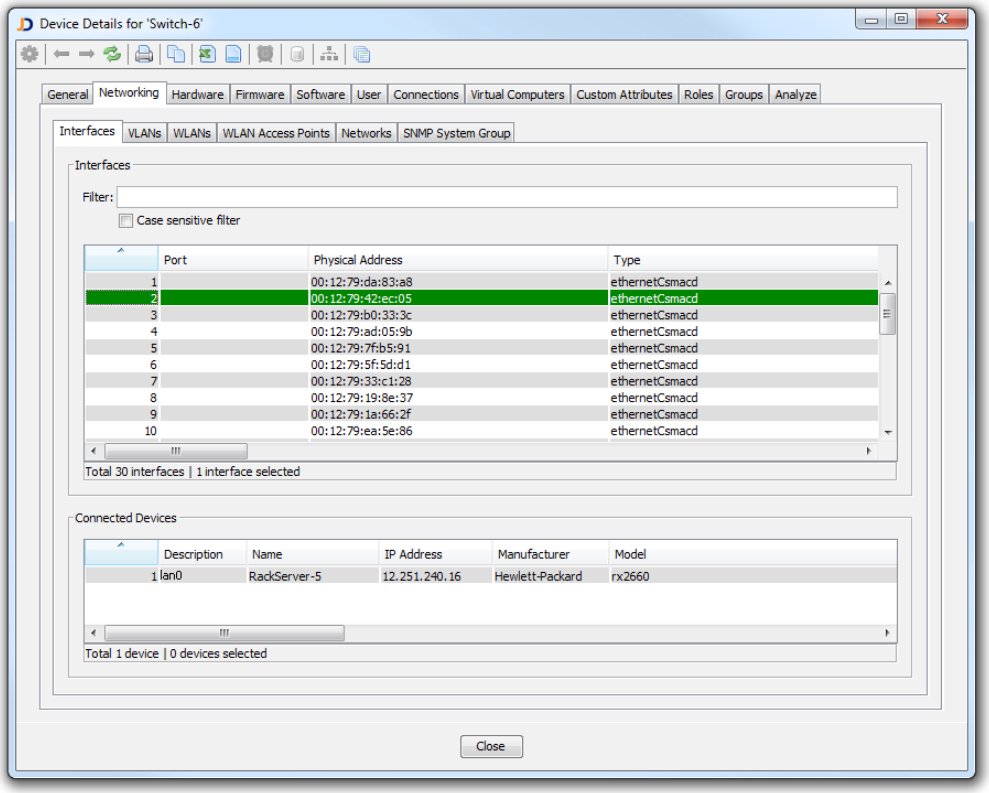



Figure: Enhanced Interface Report

### 2.4.2.2 Routing Device Report

The routing devices report displays all routing devices. Select *Networking » Topology » Routing Devices*.

### 2.4.2.3 Router/Switch Ports Report

The Router/Switch Ports report displays all routers and switches including the number of available and used ports. When the operational status is down, either a connected device is turned off or the port is enabled, but not device is connected. It is not possible to determine the correct state. Therefore JDisc Discovery introduces two more port states:

1. Potentially used:
   A port is *potentially used* when the administrative status is up, the operational status is down and the topology discovery has detected a device connected to that port in one of the previous runs. JDisc Discovery assumes the device is still connected, but turned off. The aging mechanism will delete this device connection automatically when the device is not turned on for a specified interval.
2. Potentially free:
   A port is *potentially free* when the administrative status is up, the operational status is down and the topology has not detected any device connected to this port in one of the previous runs.

#### 2.4.2.4 Custom Reports

Network topology information is also available for use with custom reports. The figure below illustrates the new topology fields in the Networking sub-tree.

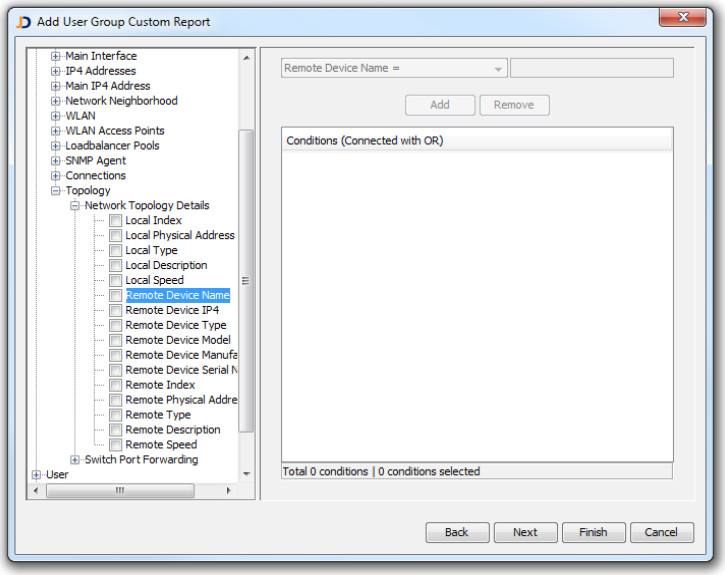



Figure: Custom reports displaying topology information

### 2.4.2.5 Saved Maps

*Maps » Topology Maps* displays all saved topology maps. Open a saved map using a double-click on the map's name.

# 3 Configuration Backup

JDisc Discovery already collects files, system command and custom script output. The Networking Add-On extends JDisc Discovery's remote login and data collection capabilities to include Cisco and HP networking devices. JDisc Discovery supports these products:

- Cisco devices running IOS
- Cisco PIX and ASA firewalls
- HP ProCurve switches

The set of supported devices will be extended in future releases.

## 3.1 Configuration

This section explains how to enable configuration file collection for network devices. As for Unix computers, JDisc Discovery logs on to devices using telnet or SSH[1] and executes commands to retrieve configuration files.

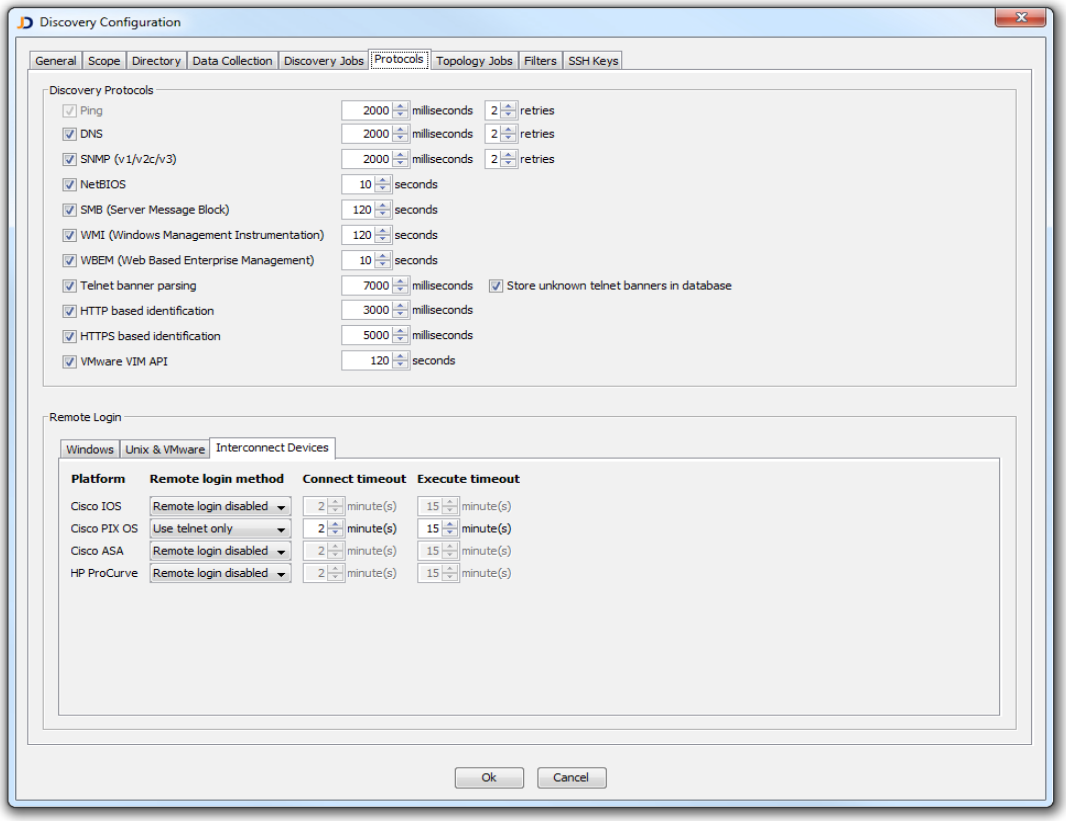
Device must have been identified via SNMP to determine what commands to execute. If SNMP read access has failed, JDisc Discovery cannot collect configuration files even if access credentials for Telnet or SSH have been provided.

To collect configuration files of networking devices SNMP read access is required.

1 Note that SSH1 is not supported!

### 3.1.1 Enable Remote Login

Open the *Discovery Configuration* dialog from *Discovery » Configuration* and select the *Protocols* tab. Click *Interconnect Devices* next to the *Clients & Servers* tab.




Enable remote login for interconnect devices

Choose the remote login method and timeouts for the desired platform as appropriate and click *Ok* to save the configuration.

### 3.1.2 Provide Access Credentials

To collect configuration information, JDisc Discovery needs access credentials to log on to interconnect devices, such as routers or switches. Open the discovery configuration dialog with *Discovery » Configuration* and select the *Accounts* tab from within the *Scope* tab.

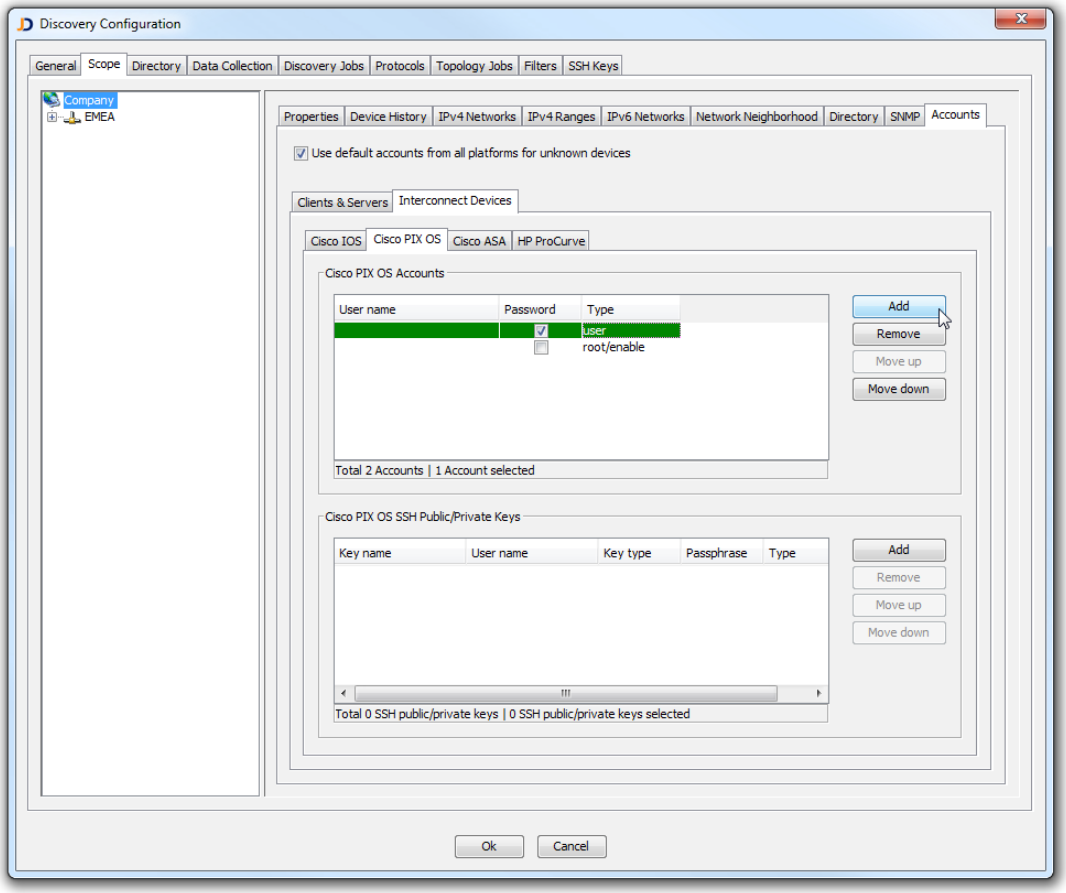



Figure: Enter default accounts for interconnect devices

JDisc Discovery only uses the non-privileged user account to log on to interconnect devices. The enable user account is only used when switch to enable mode is needed.

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When an interconnect device only use password authentication, leave the login field empty.

If an interconnect device does not have a enable password, add an empty enable account without login and password. Otherwise, JDisc Discovery does not switch to enable mode.

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### 3.1.3 Configure File Collection

JDisc Discovery comes with a predefined set of file collections for supported interconnect devices. Open the *Discovery Configuration* dialog from *Discovery » Configuration* and select the *File Collection* sub-tab within the *Data Collection* tab.

Check or uncheck the check box to enable or disable the desired file collection. Click *Add* to add new data collections.

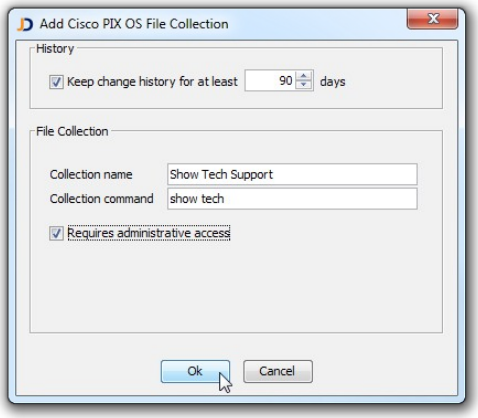


Figure: Add a new file collection for Cisco IOS devices

JDisc Discovery captures and collects the command output when the device is discovered the next time. You can view the result of the new file collection as any other custom attribute. Refer to the discovery manual for more information about custom attributes.

# 4 VLAN Discovery

JDisc Discovery's Networking Add-On identifies the VLAN configuration of the most popular switches. For Cisco Switches, JDisc Discovery reads private Cisco MIB information and the Bridge-mib for all other switch manufacturers. VLAN information can be displayed globally or for each switch individually.

## 4.1 Concepts

VLANs partition layer 2 networks into multiple collision domains or help to create multiple layer 3 networks on a single switch.

Static VLANs consists of a fixed switch port configuration all belonging to the same VLAN. Tagged VLANs embed VLAN membership information (tags) into network packets which are used by switches to forward network packets to the designated ports.

VLANs are identified by ids and administrators can assign friendly names to VLANs (for instance 'Test Environment' for VLAN id 10) when configuring their switches. Assigning consistent friendly names for each VLAN on the network greatly simplifies the administration and troubleshooting. Unfortunately VLAN friendly names are not always assigned consistently over the network.

In order to cover both cases, JDisc Discovery lets the administrators define how to identify VLANs:

- Identify a VLAN based on the VLAN tag id only
- Identify a VLAN based on the VLAN tag id and the friendly name

You can choose this option in the *Data Collection » Networking* tab

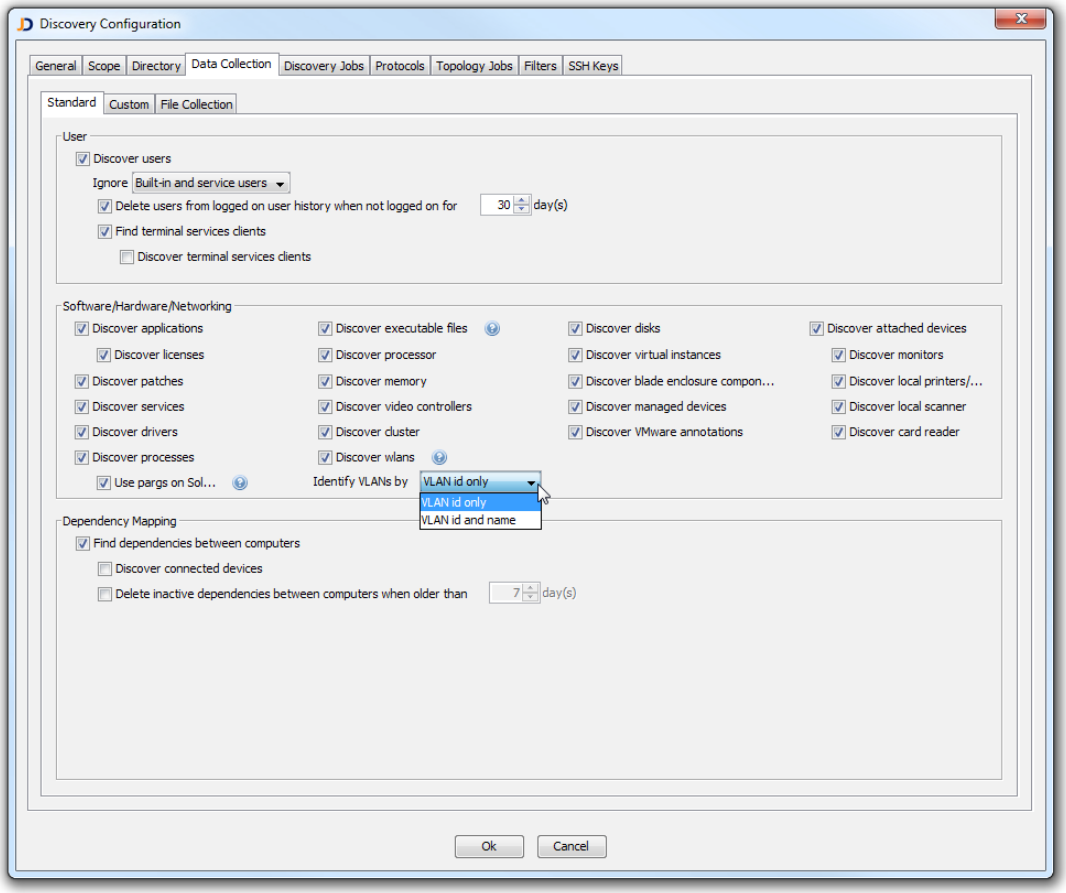


Fig: Configuration of the VLAN Identification

## 4.2 Device VLAN Information

The *Device Details » Interfaces* report displays VLAN membership information of each switch interface.

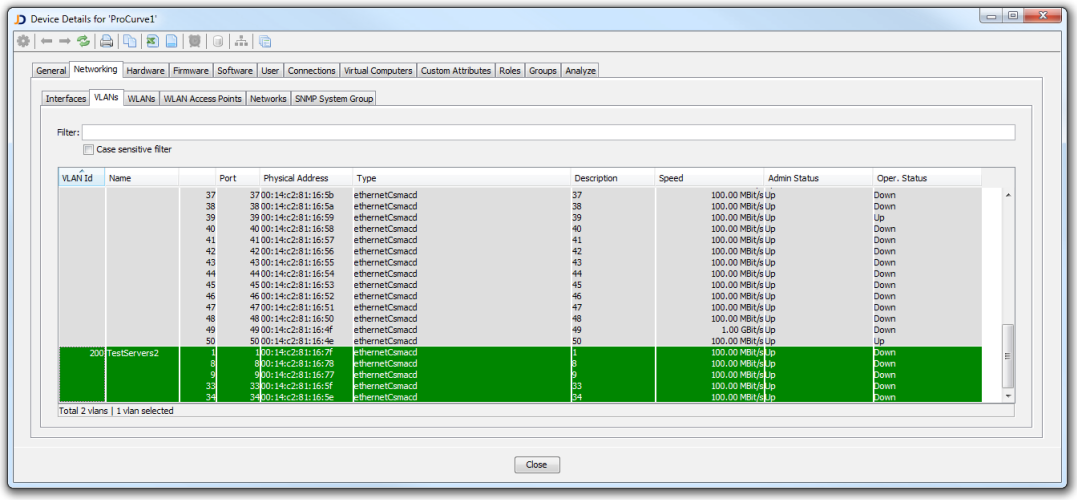


Figure: Device VLAN Report

The device VLAN report lists all VLANs and the corresponding ports.

## 4.3 VLAN Report

The *VLANs* reports displays VLANs along with the number of switches that are member of the VLAN. Select *Networking » VLANs* to display the *VLANs* report.

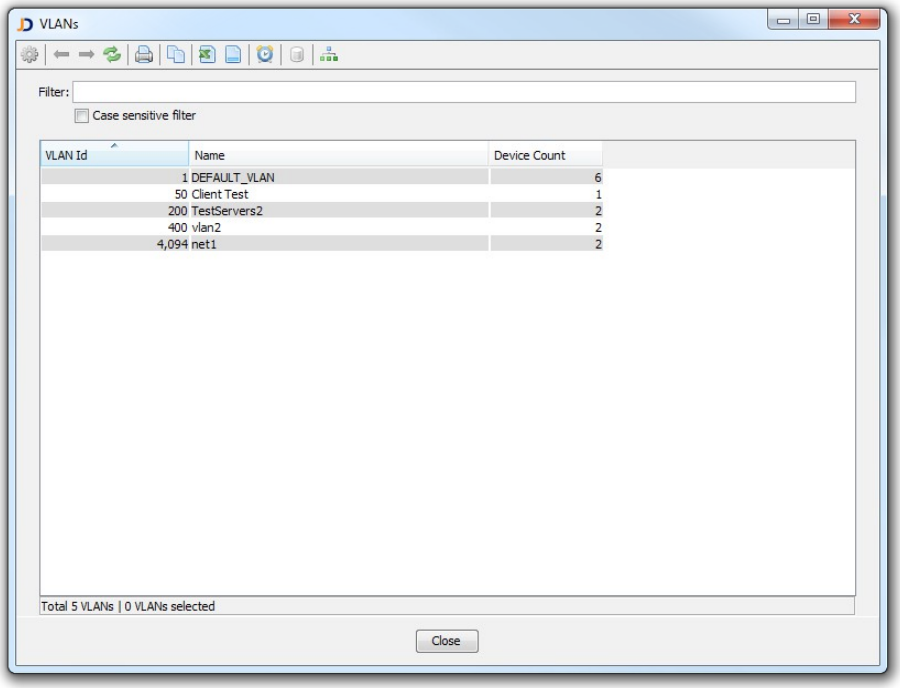


Figure: VLANs Report

Double-click a VLAN to open a new VLAN Switch Port report displaying all switch ports that belong to the selected VLAN.

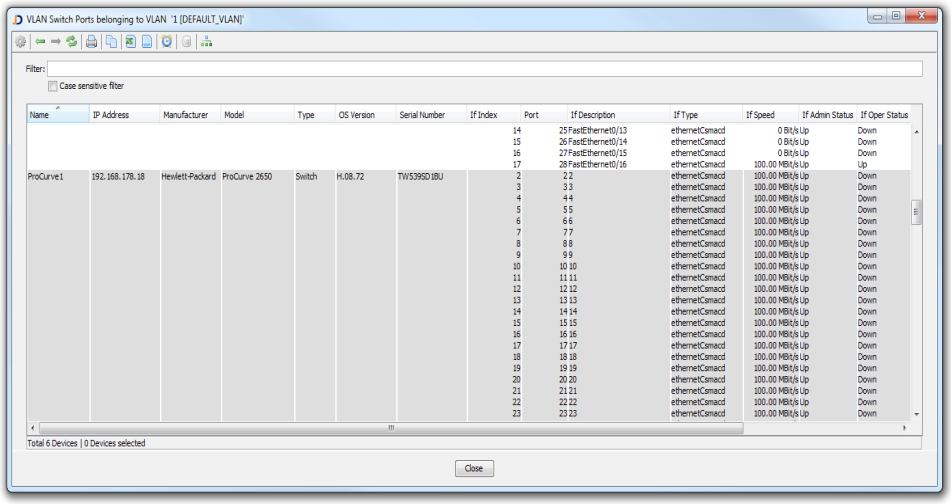


Figure: VLAN Switch Port Report

## 4.4 VLANs In Custom Reports

To create custom reports that display switch port VLAN membership, select and add the VLAN attribute from *Interfaces*.

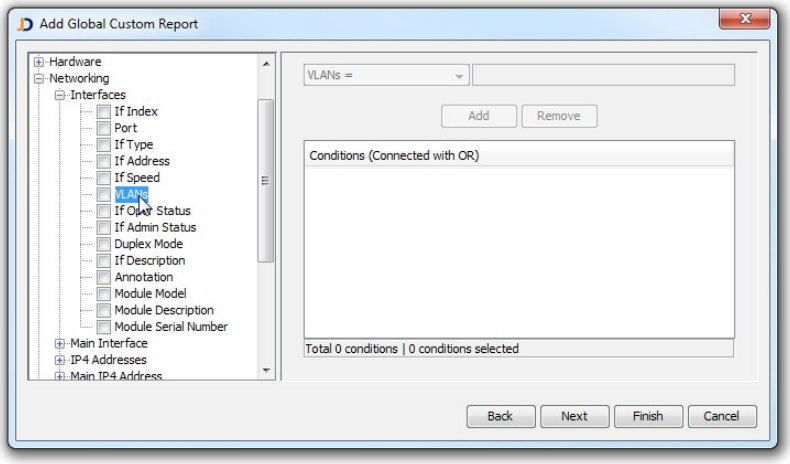


Figure: VLAN Membership Custom Reports

# 5 WLAN Discovery

## 5.1 Wireless LAN Discovery

JDisc Discovery's wireless network discovery utilizes Windows and Mac OS X computers having IEEE 802.11 compatible network adapters as discovery probe to capture WLANs within range.

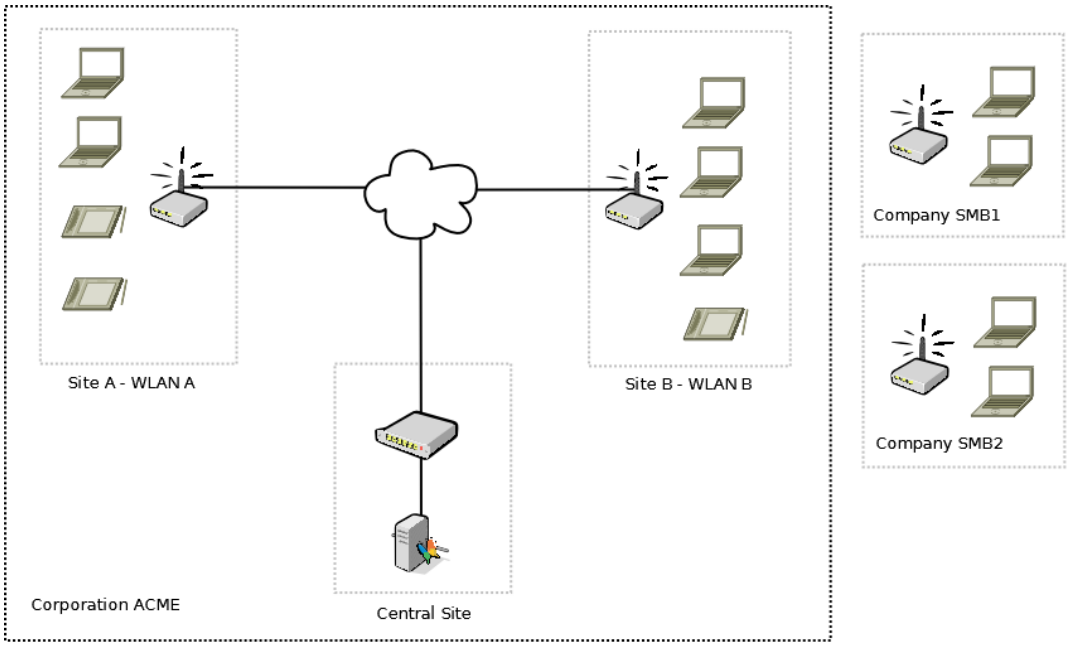


Fig: WLAN discovery

The above figure illustrates how the two WLANs A and B are discovered from the central site when the Windows computers in site A and B are being discovered. The WLANs and access points of company SMB1 and SMB2 might also show up in the discovery results depending on the signal strength even though these do not belong to corporation ACME.

JDisc Discovery's wireless network discovery detects for each Windows or Mac OS X computer having a IEEE 802.11 compatible network adapter:

- Wireless networks within range
- Wireless network access points serving the WLANs in range
- Active WLAN connection

The remote login protocol for Windows and Mac OS X must be enabled to discover WLAN information.

## 5.2 Configuring WLAN Discovery

The configuration of the WLAN discovery is accessible from *Data Collection » Networking.*

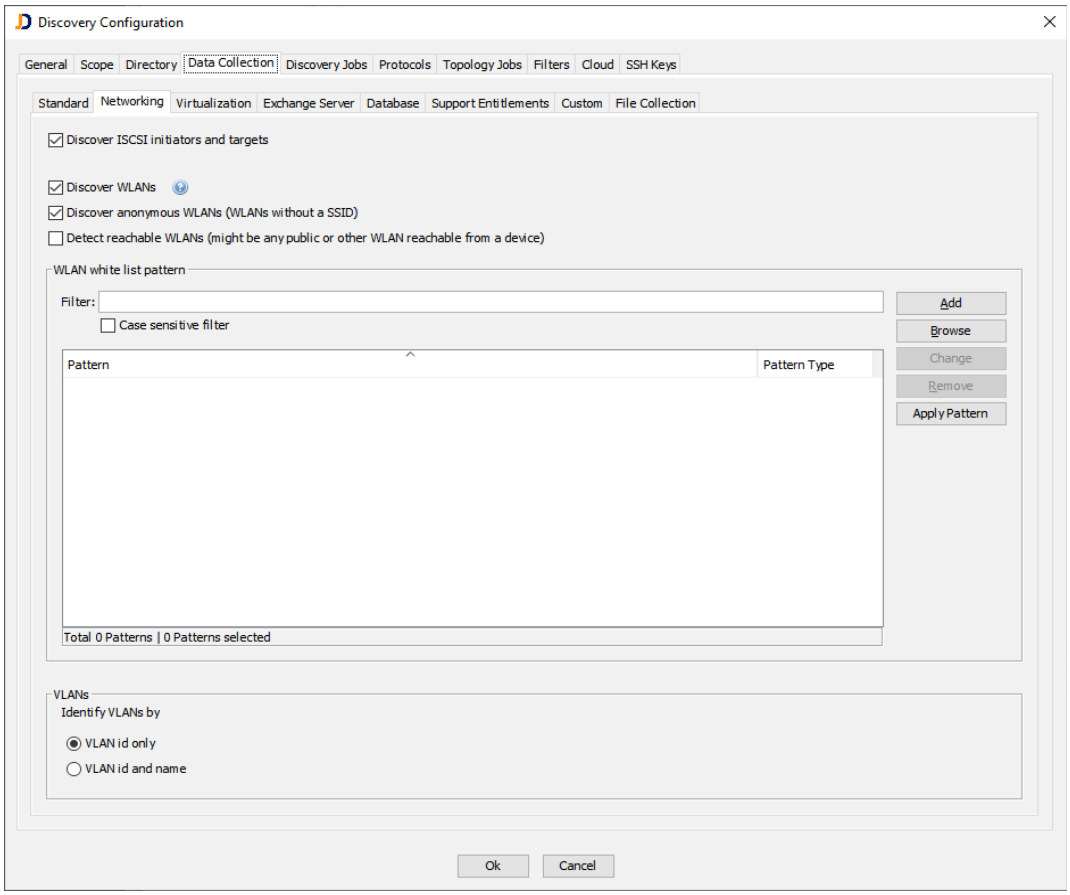


Fig: WLAN Configuration

The discovery of WLANs can be completely turned off by the checkbox *Discover WLANs.* If there are anonymous WLANs (WLANs without a SSID) in the network then the discovery of these can be turned off by the second checkbox *Discover anonymous WLANs*.

The option *Detect reachable WLANs (might be any public or other WLAN reachable from a device)* determines whether all reachable WLANs should be detected. This

option is disabled by default and only adds WLANs which a device is connected to.

Control the set of WLANs that get into your database with a whitelist. WLANs only get added to the JDisc Discovery's database if an entry in the white list matches the WLAN's SSID. An empty whitelist adds all discovered WLANs to the database.

### 5.2.1 Add An Entry To The Whitelist

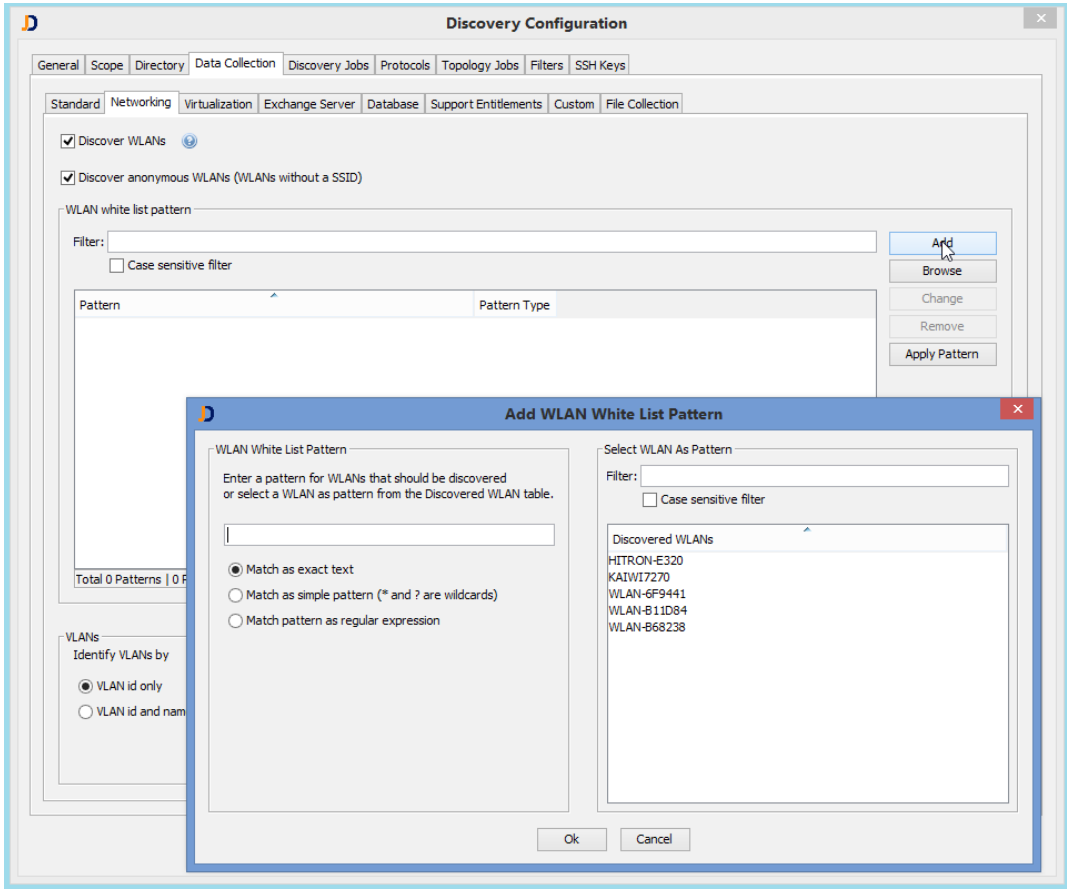


Fig: Add an entry to the WLAN whitelist

Enter a pattern into the text field on the left. A pattern can be:

- a simple text which matches exactly one WLAN SSID
- a text with * and ? as wildcards
- or a regular expression (defined like in the Java programming language)

For convenience there is a list with already discovered WLAN SSIDs. Select an item in the list in order to copy the content to the filter field.

The *Browse* opens the list of already discovered WLANs.

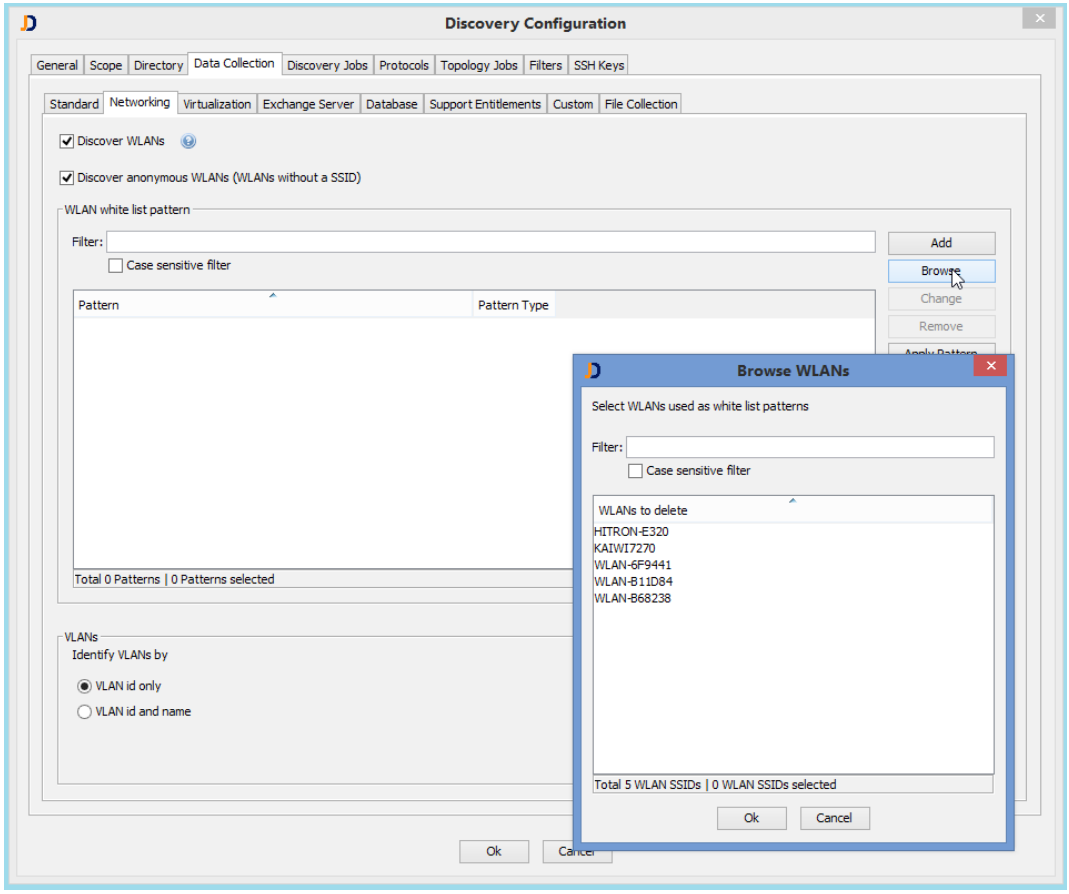


Fig: Browse already discovered WLANs

Select one or more entries in order to add them to the whitelist.

Use the *Change* or *Remove* buttons to change or remove entries from the whitelist.

### 5.2.2 Cleanup Already Discovered WLANs

If there are many unwanted WLANs in the JDisc Discovery's database, they can be cleaned up with the new white list.

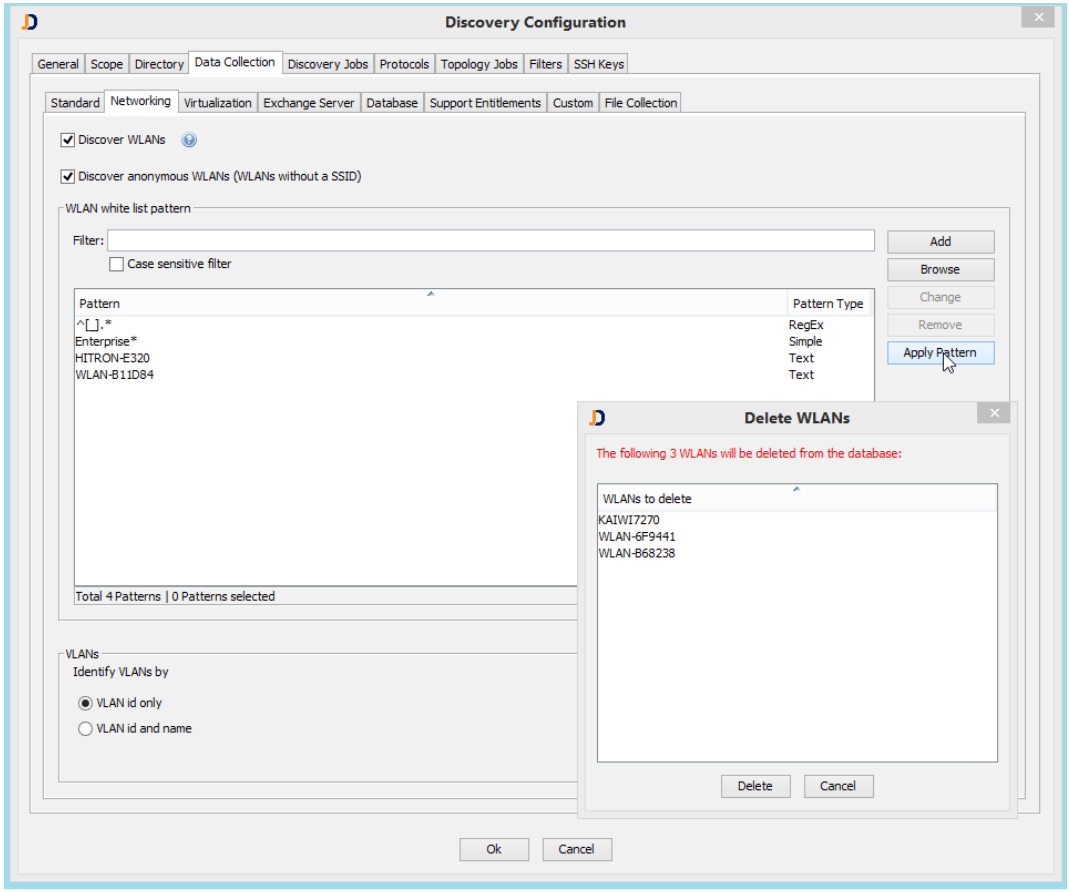


Fig: Cleanup unwanted WLANs

After pressing the *Apply Pattern* button a list pops up with WLAN SSIDs that do not match any of the whitelist entries. There might be empty lines in case there are anonymous WLANs in the database. Review the list of WLANs that are to be deleted. Applying the filter also deletes WLAN accesspoints connected to the shown SSIDs if they have no IP address.

## 5.3 WLANs Report

The WLANs overview report displays wireless networks within the range of discovered Windows computers and statistical information including

- Average signal quality of Windows and Mac OS X computers within range

- Average connection speed of computers having a WLAN connection

The WLAN overview report is accessible from *Networking » WLAN » WLANs.*

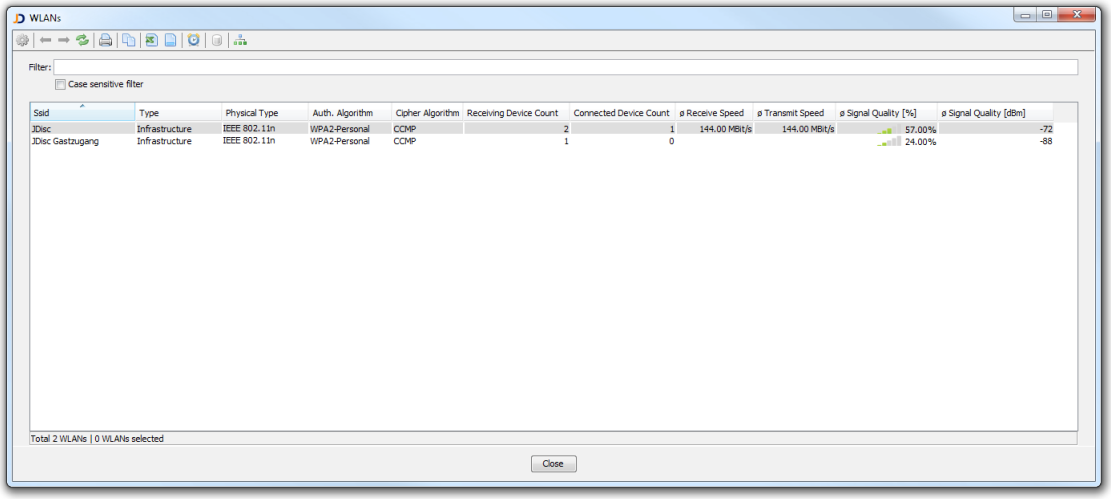


Fig: WLAN overview report

## 5.4 WLAN Device Details Reports

When you have opened a Windows or Mac OS X computers' *Device Details* dialog, select the *Networking » WLANs* and *WLANs Access Points* tabs to view

- Wireless networks within range including the signal quality
- Wireless network access points serving the WLANs in range including the signal quality and channel numbers
- The active WLAN connection including the connection speed

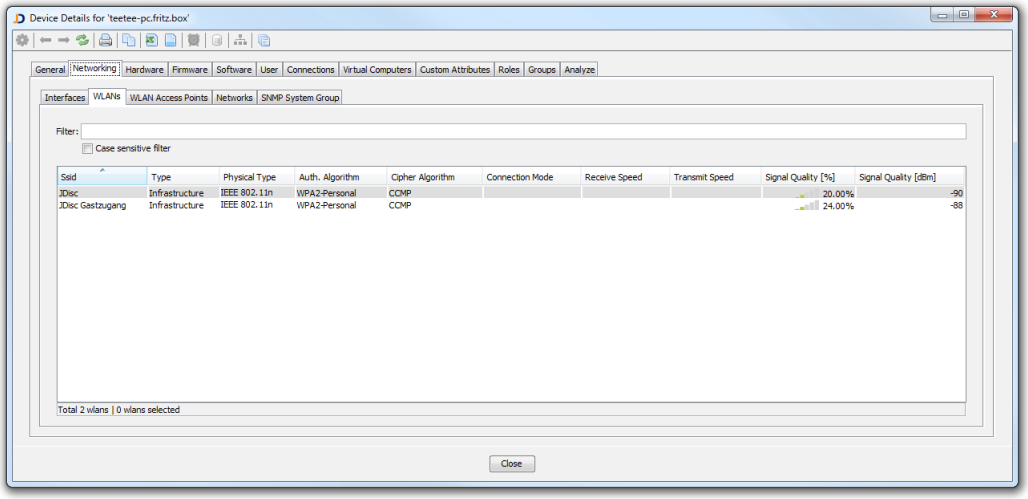

Fig: Device details WLAN report

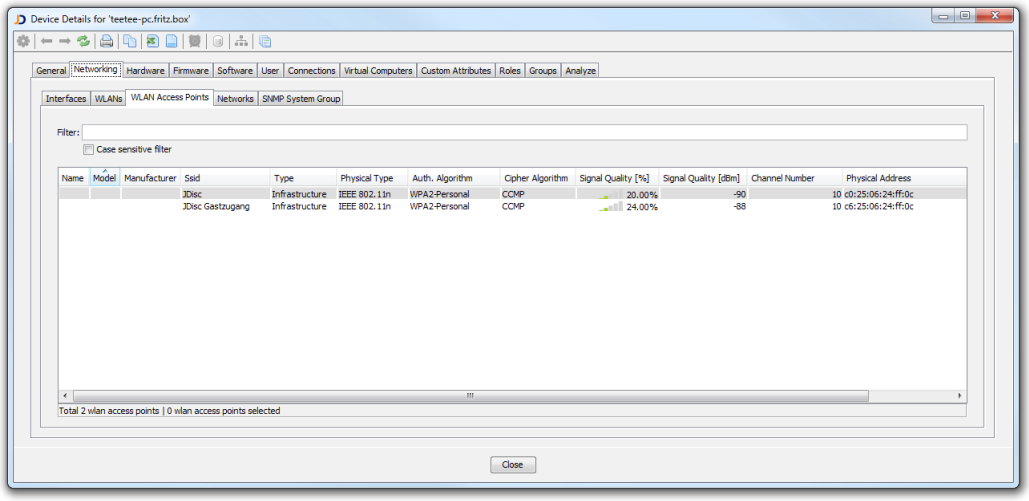


Fig: Device details WLAN access points report

## 5.5 Displaying WLANs In Topology Maps

JDisc Discovery's topology maps also display WLANs indicated by a cloud icon (☁) when WLAN clients are connected the WLAN through an access point. WLAN cloud icons are annotated by the WLAN's SSID.

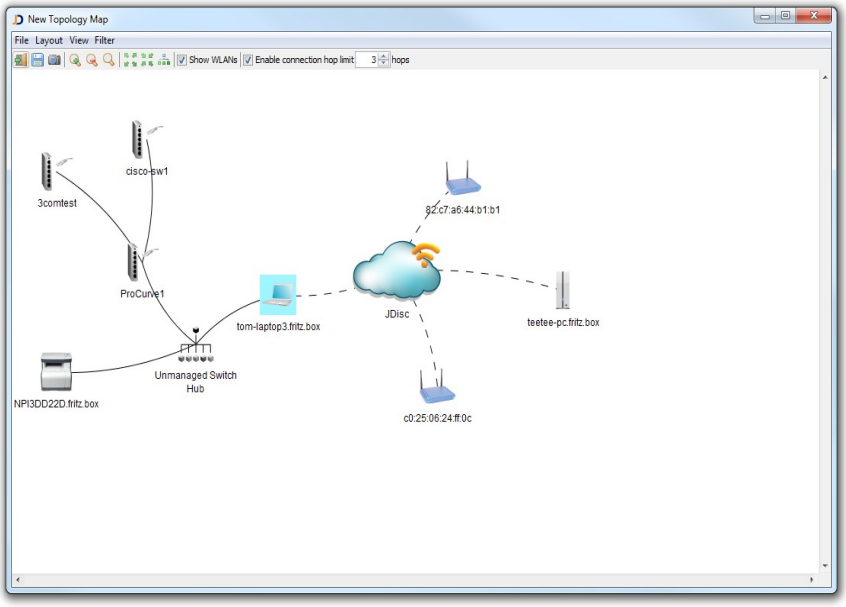


Fig: A WLAN in a topology map

The figure above shows the WLAN 'JDisc' and two connected devices (tom-laptop3.fritz.box and teetee-pc.fritz.box). In addition to that two access points serving the 'JDisc' WLAN are also displayed. 'tom-laptop3.fritz.box' is multi-homed and connected to the 'JDisc' WLAN and to the Ethernet network by an unmanaged switch.

When you select the link between the notebook 'tom-laptop3.fritz.box' and the WLAN cloud will highlight the connection to the access point to which 'tom-laptop3.fritz.box' is connected. Selecting the connection between the access point and the 'JDisc' WLAN will highlight all connections to all clients connected to the access point.

# 6 Enhanced Discovery

The Networking Add-On enhances JDisc Discovery's discovery to collect installed modules of routers and switches.

JDisc Discovery uses the SNMP Entity MIB to collect installed modules. The *Hardware » Modules* tab of the *Device Details* dialog displays installed module.

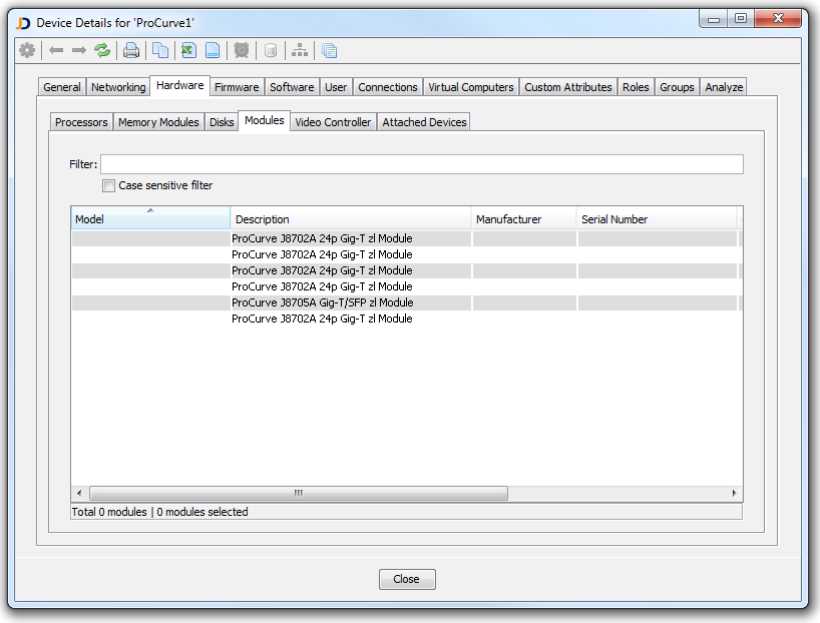


Figure: Modules of a HP ProCurve Switch

# 7 Open Source

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All license files can be found in the installation directory 'Licenses'.

- This product includes software developed by the Apache Foundation (http://www.apache.org). These are 'Axis', 'Commons Collections', 'Commons Net', 'CXF', 'log4j', and 'POI', 'Drools', 'log4j'.
- This product includes the 'SBLIM' WBEM implementation (http://sourceforge.net/projects/sblim/files/sblim-cim-client2/)
- This product includes icons from 'FAMFAMFAM' icon gallery 'SILK' (http://www.famfamfam.com/lab/icons/silk).
- This product includes Kai Toedter's 'Jcalendar' (http://www.toedter.com/en/jcalendar/index.html).
- This product includes the JUNG layout library (http://jung.sourceforge.net).
- This product includes the COLT numeric library (http://acs.lbl.gov/~hoschek/colt).
- This product uses the Postgres database (http://www.postgresql.org).
- This product uses SNMP4J (http://www.snmp4j.org).
- This product uses the Ganymed SSH library (http://www.ganymed.ethz.ch/ssh2).
- This product uses the drools rule engine (http://jboss.org/drools).
- This product uses the janino compiler (http://www.janino.net).
- This product uses Jyhton (http://www.jython.org/Project).
- The product calls the dmidecode binary (http://www.nongnu.org/dmidecode).
  Find the source code in the 'sources' directory.
- This product uses icons from 'Crystal Clear' (http://commons.wikimedia.org/wiki/Crystal_Clear).
- This product uses the 'PUTTY' ssh client.
- This product uses the dom4j library (http://dom4j.sourceforge.net/dom4j-1.6.1).
- This product uses the Jaxen library (http://jaxen.org/)

- This product uses the Jcalendar library (http://toedter.com/jcalendar/).
- This product uses the Jdom library (http://www.jdom.org/).
- This product uses the saxpath library (http://www.saxpath.org/).
- This product uses the miglayout library (http://www.miglayout.com/).
- This product uses the taskdialog library (https://code.google.com/p/oxbow/).
- This product uses the vijava library (http://vijava.sourceforge.net/).
- This product uses the dnsjava library (http://www.dnsjava.org/).
- This product uses the trove library (http://trove.starlight-systems.com/).