



Reliable Industrial Networking with SCALANCE

SIPEC Event

Instructions and Tips for Presentation / Labs

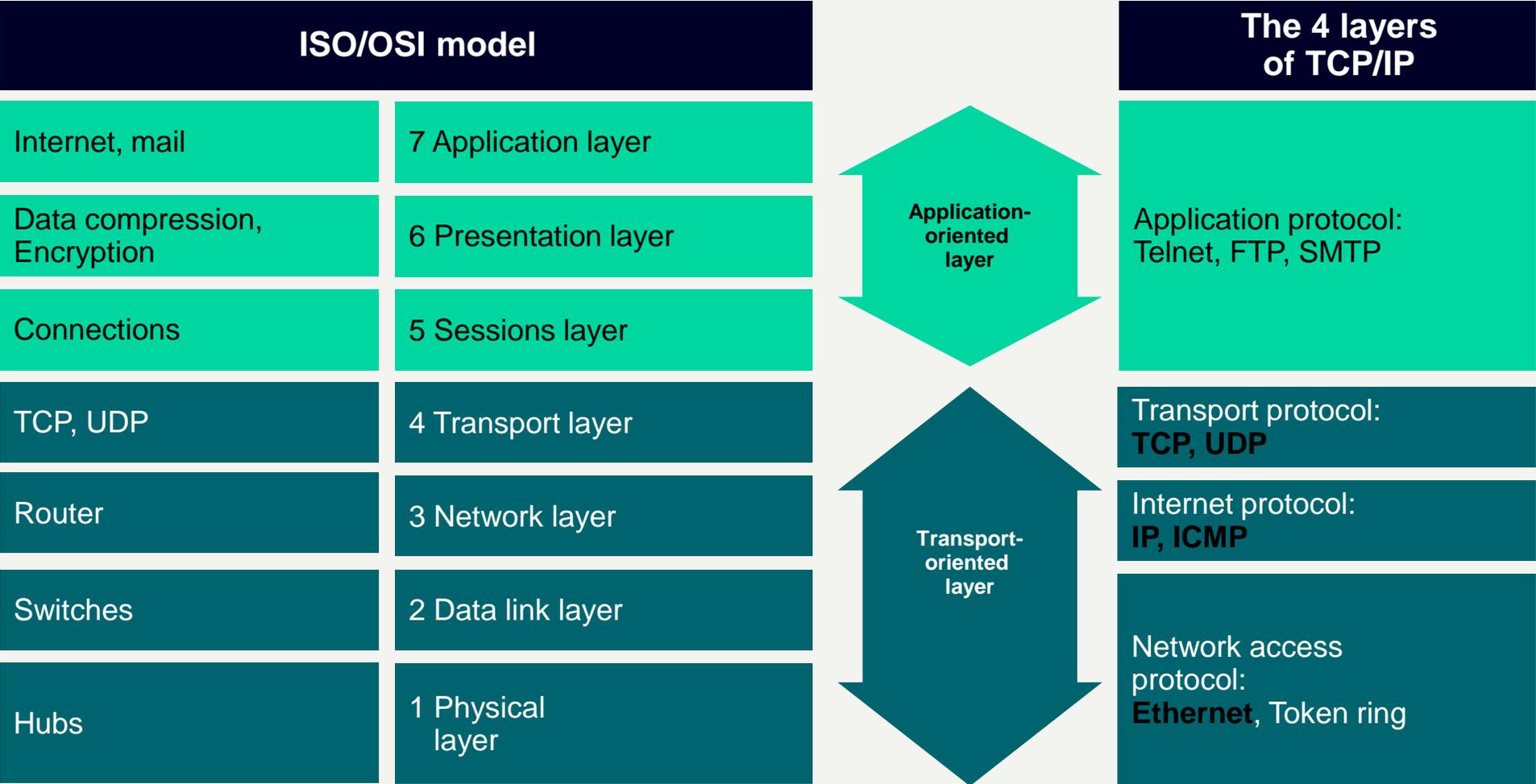
- Please copy the PDF of this presentation onto the digital desktop of each PG prior to the workshop. In this way, attendees will be able to follow along during the lecture as well as reference during the labs.
- Please print out copies of slide 23 (IP addresses of stations) and slide 80 (Things to Try) for each attendee if it makes sense – alternatively the attendees can rely on the digital version on the PG desktop.
- The lecture material has a gray background in the header. The labs have a tan background in the header. The entire deck with labs is targeted at 4 – 5 hours.
- There are speaker notes for all the lecture slides. The labs are detailed step by step, so only a brief introduction to each lab is required. There is no intention that the presenter must comment on each lab slide.
- Prior to each lecture and lab section, the agenda slide is inserted, and the forthcoming section is highlighted in bold.
- The presentation is prepared and marked as “Unrestricted” so it can be shared with the attendees
- The last section (Network Monitoring) is optional, and the slides are hidden by default.

Agenda

- 1 Introduction - Network Concepts
- 2 Comparing Office and Industrial Networks
- 3 Portfolio Overview
- 4 Hands On
 - Setup and Pre-work
 - PRONETA
 - Switch Diagnostics and Best Practices
 - ✓ Information Folder
 - ✓ System Folder
 - ✓ Layer 2 Folder
 - Configuring a redundant ring
 - Coupling redundant rings
- 5 Interconnecting to IT – Passive Listening
- 6 Review Network Monitoring (Optional)

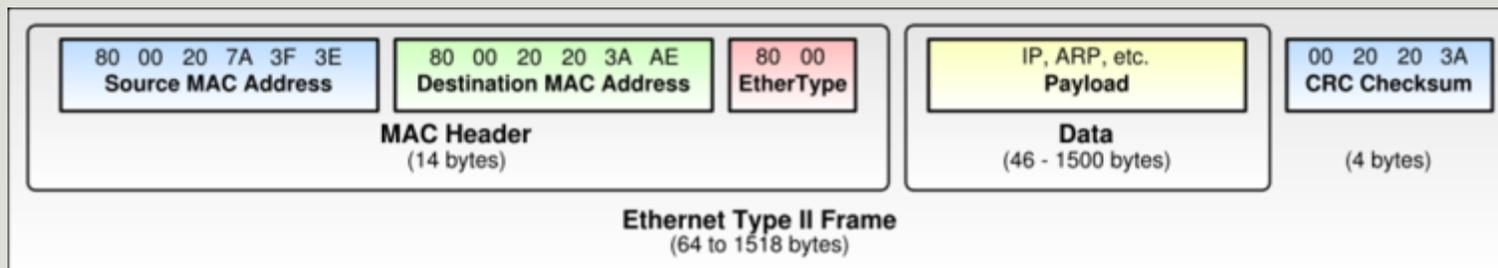


Network Concepts – OSI Model



Network Basics – MAC Addressing and the Ethernet frame

- Network Adapter can be a network card in the PC, Switch, Router, S7-Ethernet CP, S7-PN-CPU,.....
- Each Network Adapter has a globally unique address called the MAC address (Media Access Control).
- The MAC address is made up of 6 Bytes which are used to send and receive packets. The first three bytes are the vendor ID (OUI) and the last three bytes are unique to the device. e.g. 08-00-06-6F-F1-59
- Siemens has nearly 50 OUIs. Common ones amongst networking and automation products are “**08-00-06-xx-xx-xx**”, “**00-1B-1B-xx-xx-xx**”, and “**20-87-56-xx-xx-xx**”.
- Every Ethernet frame has a field for source and destination MAC address



Network Basics

IP Addressing

	Decimal	Binary
Network Address	192.168.52.0	11000000.10101000.00110100.00000000
Subnet Mask	255.255.255.0	11111111.11111111.11111111.00000000

- 32 Bit IPv4 address is defined in 4 decimal digits (0..255) which are separated with a dot, i.e. 141.73.4.238
- A subnet mask is defined for every IP address. The subnet mask is also like the IP address, a 32-bit value.
- A device can only communicate directly with another device on the same subnet.
- IP Network Classes include:
 - Class A: 1.0 - 127.0 up to 16 Mio. hosts
 - Class B: 128.0 - 191.255 up to 65.000 hosts
 - Class C: 192.0 - 223.255.255 254 hosts
- Each Host within a network has a unique IP-Address

Networking Basics

Subnetting Example #1

This table shows a standard Class C network address that is NOT subnetted.

	Decimal	Binary
Host Address	192.168.52.2	11000000.10101000.00110100.00000010
Subnet Mask	255.255.255.0	11111111.11111111.11111111.00000000



Resulting network address with subnet mask expressed as prefix length: 192.168.52.0/24

Parameters of this network:

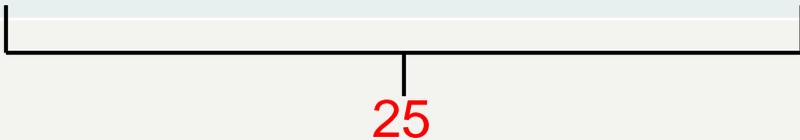
- Network Address: 192.168.52.0
- Subnet Mask: 255.255.255.0
- Number of available host addresses: $256 - 2 = 254$
- First host address: 192.168.52.1
- Last host address: 192.168.52.254
- Broadcast address: 192.168.52.255

Networking Basics

Subnetting Example #2

This table shows the previous address after it is subnetted by borrowing one host bit, creating two subnets.

	Decimal	Binary
Network Address	192.168.52.0	11000000.10101000.00110100.00000000
Subnet Mask	255.255.255.128	11111111.11111111.11111111.10000000



Network address with subnet mask expressed as prefix length: 192.168.52.0/**25**

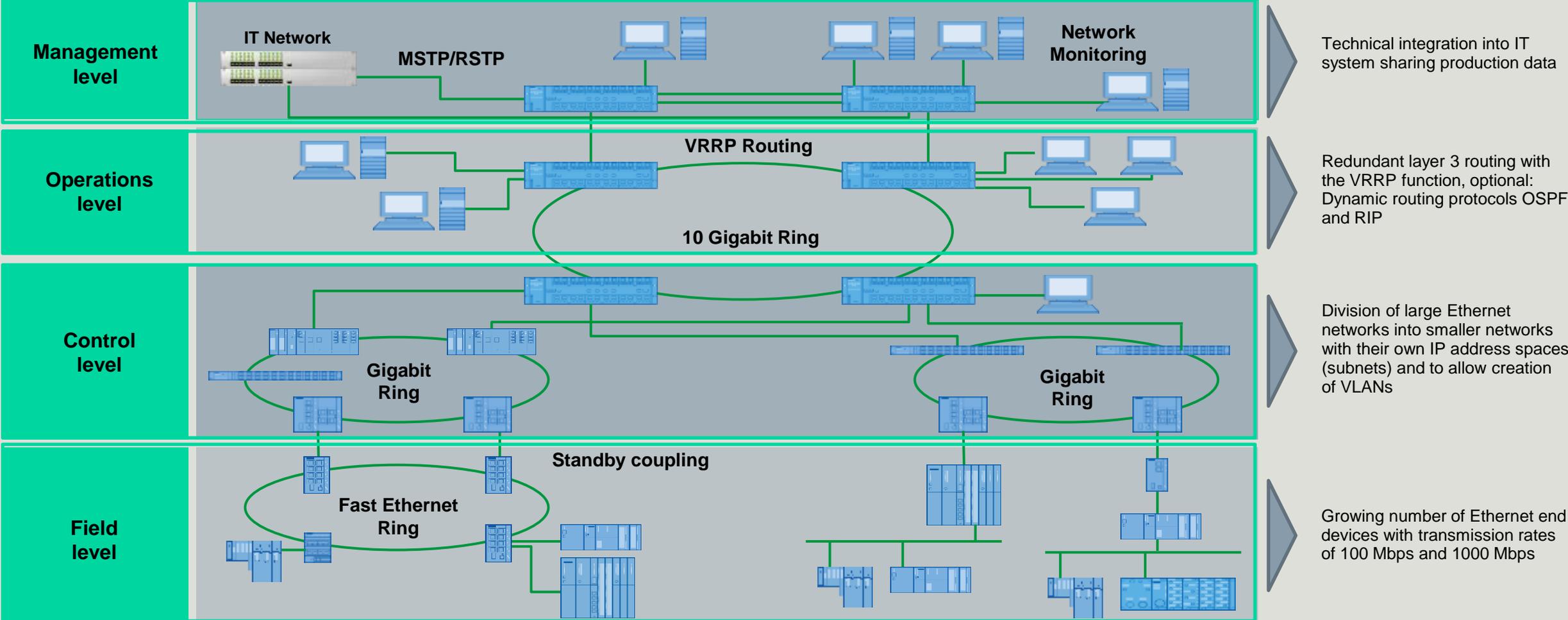
Parameters of this network:

- Network Address: 192.168.52.0
- Subnet Mask: 255.255.255.128
- Number of available host addresses:
 $128 - 2 = \underline{126}$
- First host address: 192.168.52.1
- Last host address: 192.168.52.126
- Broadcast address: 192.168.52.127

Parameters of the other network:

- Network Address: 192.168.52.128
- Subnet Mask: 255.255.255.128
- Number of available host addresses:
 $128 - 2 = \underline{126}$
- First host address: 192.168.52.129
- Last host address: 192.168.52.254
- Broadcast address: 192.168.52.255

Plant Wide Network Architectures



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Differences Between Office and Industrial Networks



	Industry	Office
Environment	Harsh environment temperature, moisture, EMI	Climate-controlled offices
Installation	Field - commissioned cables	Pre-fabricated cables
Topology	Plant-specific structure line, star, ring, tree	Star-shaped structure
Availability	No Network downtimes	Downtimes up to several minutes
Redundancy Mechanism	MRP, High Speed Redundancy, Standby	Link aggregation, RSTP, MSTP
Network Administration	Engineer	Certified IT specialist

The Benefits of Industrial Grade Products

High Availability

- To avoid significant economic losses or other damages

Robustness

- Extreme temperatures, dusty or corrosive environments

Flexibility

- Optimization and innovation causes changing production layouts

Determinism

- Real-time requirements of automation tasks

Security

- Threat of unauthorized access; secure remote access, e.g. for OEMS

Mobile Applications

- Reliable communication, e.g. for automated guided vehicles, monorails

Safety

- Fail-safe communication to provide safety for operators and assets

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Industrial Communications

SCALANCE

SCALANCE X – Industrial Ethernet Infrastructure Switches

Control Level / Operations Level	Managed L2/L3	 <p>XR500 Networking and structuring of plant areas and interfacing to IT</p>
		 <p>XM400 Networking and structuring of subsystems / plant areas</p>
		 <p>XR300 Networking of Subsystems / plant areas</p>
Field Level	Managed L2	 <p>XB/XC-200 Applications at the machine in networked subsystems</p>
		 <p>XC100</p>
	unmanaged	 <p>XB000 Small machines</p>

SCALANCE W – Industrial Wireless



Access Points, Clients
IP30, IP65, Outdoor
802.11 a/b/g/n

SCALANCE S – Industrial Security



Firewall & VPN Products
Secure Remote Access

FastConnect – Industrial Cables and Connectors



Highlights

Fast Connect

- Minimal installation time
- Easy stripping of outer sheath and braided shield in one step
- Simple connection method for Industrial Ethernet FastConnect cables
- Easy assembly thanks to preset FastConnect stripping tool
- Reliable shield contacting and strain relief
- M12 and RJ45 connection method for Industrial Ethernet/PROFINET and PROFIBUS



Highlights

Unmanaged XB, XC



XB000 Family

- To implement simple machine networks or small Ethernet networks



XC100 Family

- For setting up electrical and/or fiber-optic networks and star structures in applications close to machines
- To turn off nodes during operation
- For high climatic requirements (-40(-40 °C to +70 °C)
- Various fiber-optic port versions (ST/BFOC, SC)

Highlights

Managed XC, XP



XC200 Family

- Extended temperature range from -40 °C to +70 °C
- Gigabit-capable, can be equipped with SFPs, PROFINET and EtherNet/IP
- Certifications for trackside railway applications, marine applications
- Additional FW functionalities: Fiber monitoring, VLANs, HRP standby



XP200 Family

- High degree of protection (IP65/67) for use outside of the control cabinet and in extreme ambient conditions from -40 °C to +70 °C
- PROFINET, EtherNet/IP applications with up to 1 Gbit/s and IEEE 802.3at Type 2 (max. 120 W)
- Certifications for railway, motor vehicles, marine applications

Highlights

Managed XC, XP



XR300

- For modular network structures, up to 12 x 2-port media modules
- For use in railway applications, EN 50155 and e1/E1
- SCALANCE XR324-12M TS
- SCALANCE XR324-12M PoE TS)
- Extended temperature range from -40 °C to +70 °C



XR300 WG

- Cost-optimized rack-switch with appropriate range of functions for industrial environments or control rooms
- Versions with 10/100 Mbps and 1 Gbps
- Fiber optic via combo ports
- Temperature range: 0 to +60 °C

Highlights

Managed L3 XM400, XR500



XM400 Family

- Flexible and structured networking of plants / plant areas
- Modular expandability using Port Extenders (PE)
- Mobile diagnostics and dynamic device data access with NFC
- Constructed in SIMATIC Design (S7-1500)
- Combo ports provide alternative connectors (RJ45 or SFP)
- Layer 3 optionally configured
- Serial RJ11 Console Port interface



XR500 Family

- Networking/structuring of high-performance industrial networks
- Modular adaptability with media modules
- Extended IT functionality: Layer 3, router redundancy
- SNMP, Web server, STEP 7, and on-site diagnostics
- Support of high (1 Gbps) or very high (10 Gbps) bandwidth
- Variants with different and optionally redundant power supplies
- Combo ports provide alternative connectors (RJ45 or SFP)

Highlights

SCALANCE W

- Support of IEEE 802.11n with up to 450 Mbps gross data rate eliminates existing capacity limits
- All SCALANCE W products support 2.4 and 5 GHz
- Some of the products support Multiple In Multiple Out (MIMO): Higher bandwidth, greater reliability
- Thanks to the iFeatures iPCF and iPCF-MC, industrial requirements such as real-time data transfer can be met trouble-free
- Some of the products can be extended using the KEY-PLUG which enables iFeatures
- SCALANCE W700 is now available as a compact device in the SIMATIC design for even better integration in the cabinet
- Selected products are particularly suitable for the transportation sector and have the relevant approvals
- Extensive antenna portfolio suitable for every application



Highlights Scalance M/SRC

Management of Devices and Users

- User management with the configuration of rights
- Device and user management with group management

Connection Management:

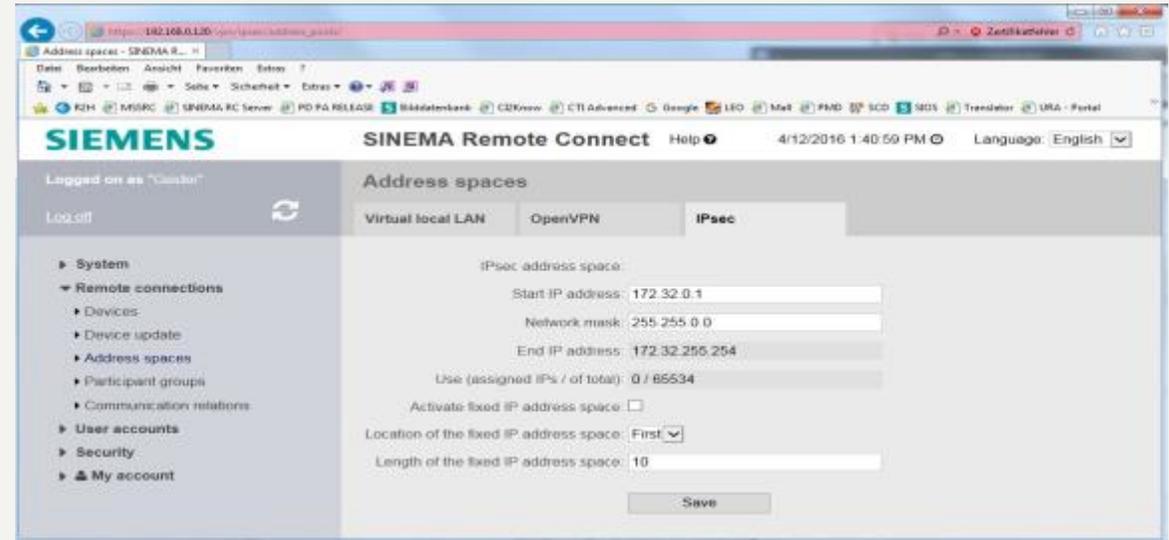
- Establishment of encrypted connections with OpenVPN and IPsec
- Establishment of permanent or event-based connections (establishment by wake-up SMS or digital input (DI))

Support during commissioning

- Interface for auto configuration of devices and users
- Support of SCALANCE M-800 mobile wireless devices, SCALANCE S615 and SINEMA RC Client
Support of SCALANCE M-800 DSL devices planned for the beginning of 2016

Connecting subnets downstream from SCALANCE M /SCALANCE S:

- Support of routing
- Support of 1:1 NAT for mapping locally identical subnets
- Support of NAT for mapping dedicated local IP addresses
- Support of multiple subnets downstream from a SCALANCE M or SCALANCE S



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Host and Device IP Addressing

* Subnet mask for all addresses is 255.255.0.0

Station 1a

PG:172.16.1.1 SW: 172.16.1.5

Station 1b

PG:172.16.1.2 SW: 172.16.1.10

Station 2a

PG:172.16.2.1 SW: 172.16.2.5

Station 2b

PG:172.16.2.2 SW: 172.16.2.10

Station 3a

PG:172.16.3.1 SW: 172.16.3.5

Station 3b

PG:172.16.3.2 SW: 172.16.3.10

Station 4a

PG:172.16.4.1 SW: 172.16.4.5

Station 4b

PG:172.16.4.2 SW: 172.16.4.10

Station 5a

PG:172.16.5.1 SW: 172.16.5.5

Station 5b

PG:172.16.5.2 SW: 172.16.5.10

LAB 1

Setup - Restore Factory Defaults to the Switch

We want to start the labs with no previous configuration on the switch. Therefore, we will restore the factory default settings.

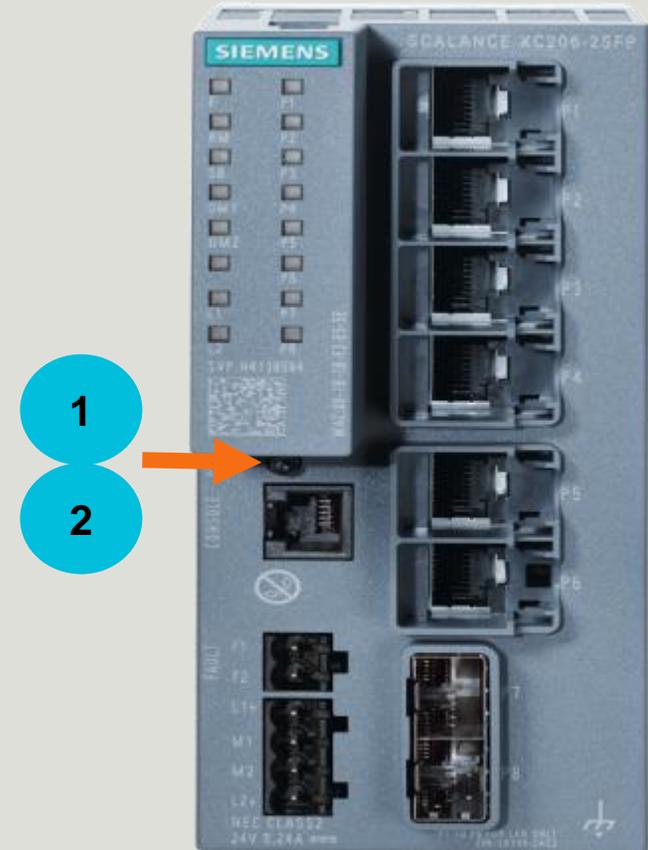
With Power On:

1. Toggle to display mode A.

- Display mode A is active if the LEDs "DM1" and "DM2" are UNLIT.
- If the "DM1" and "DM2" LEDs are lit or flashing, you will need to press the "SET/SELECT" repeatedly until the "DM1" and "DM2" LEDs go off.

2. Hold down the "SELECT/SET" button for 12 seconds.

- After 9 seconds, the "DM1" and "DM2" LEDs start to flash for 3 seconds.
 - After you have held down the button for 12 seconds, the device restarts and the factory defaults are restored.
-
- The switch can also be reset while power is initially off
 - The SELECT/SET button can be disabled via Web Based Management



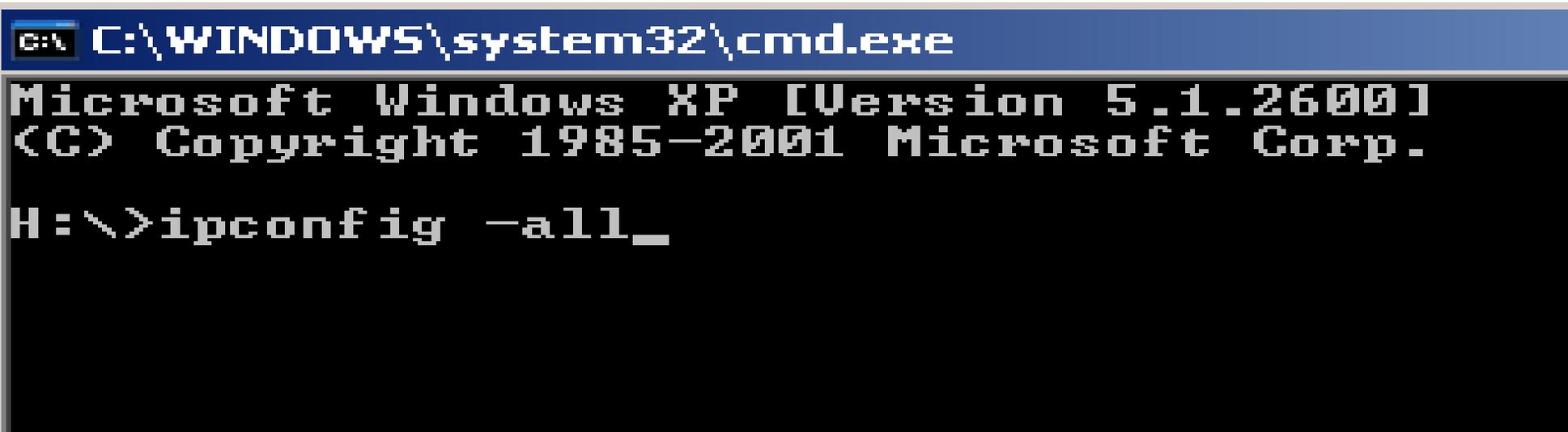
LAB 1

Setup - Configure PC IP Address

Before we start, check if your PC has the correct IP address for your subnet

The easiest way to confirm this is using the command line interface and the “ipconfig – all” command

**If the IP address is not correct for your station, then use the following two slides to set the correct IP address. Otherwise, proceed to the slide titled “Review Web Based Management”.

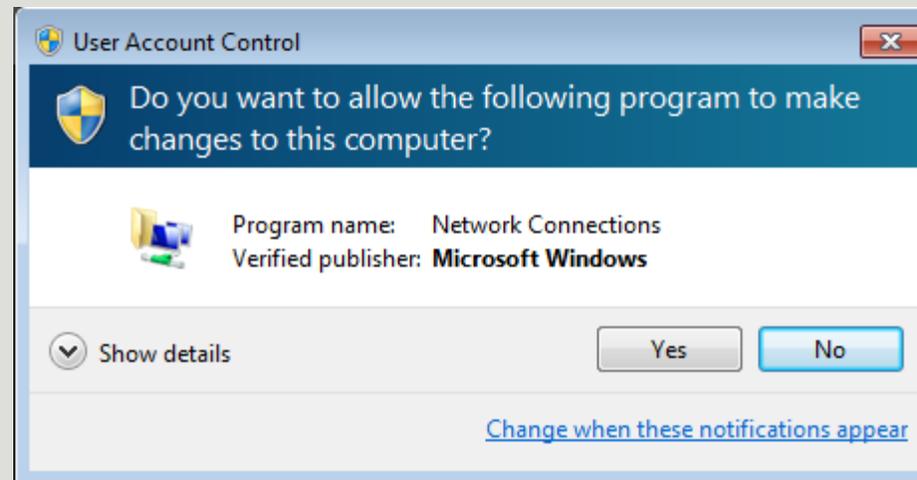
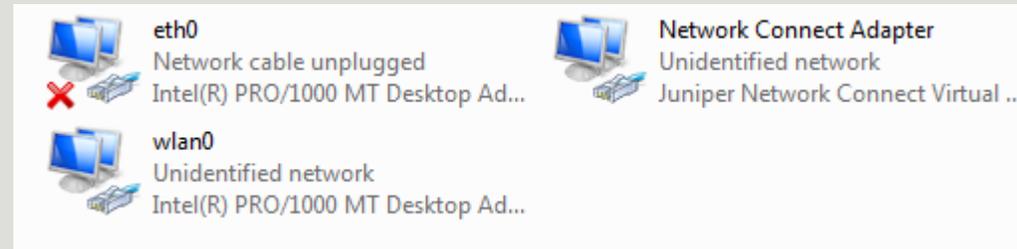
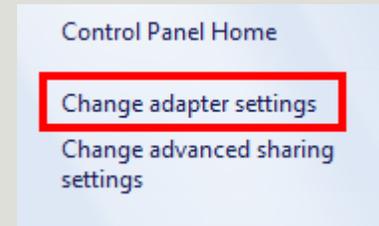
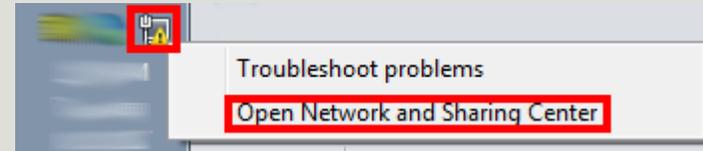


```
C:\WINDOWS\system32\cmd.exe
Microsoft Windows XP [Version 5.1.2600]
(C) Copyright 1985-2001 Microsoft Corp.
H:\>ipconfig -all_
```

LAB 1

Setup - Configure PC IP Address

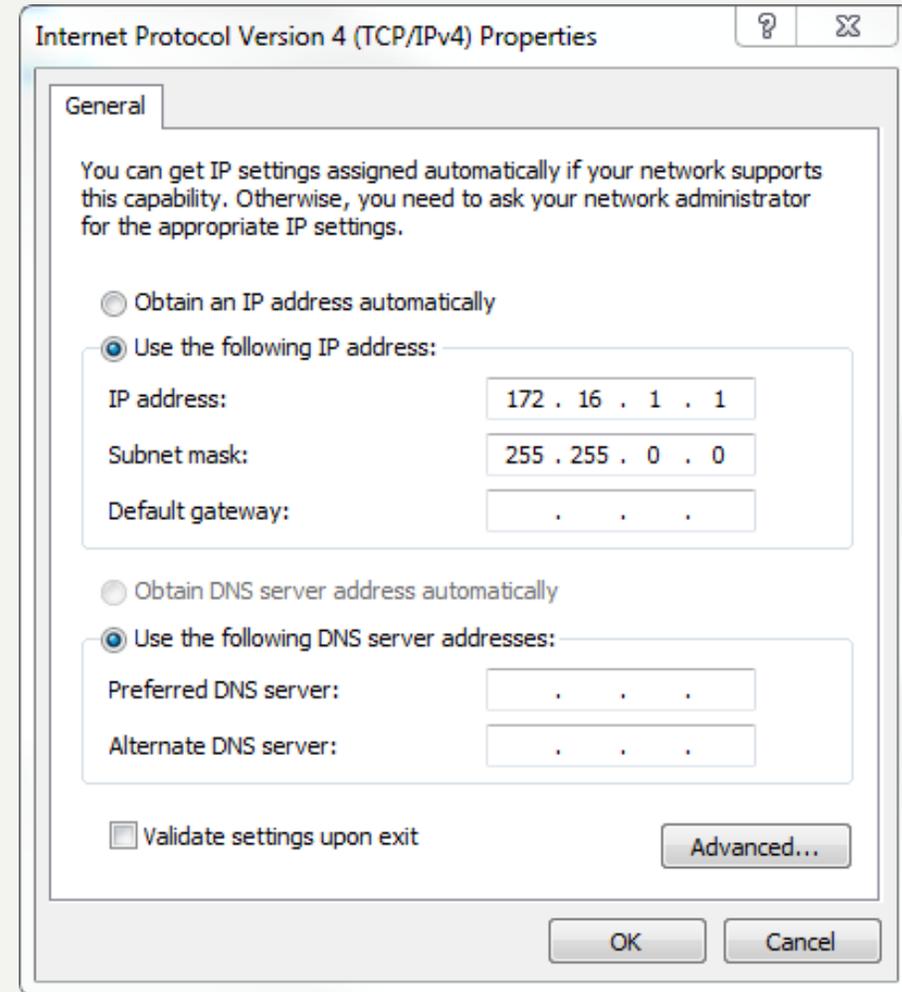
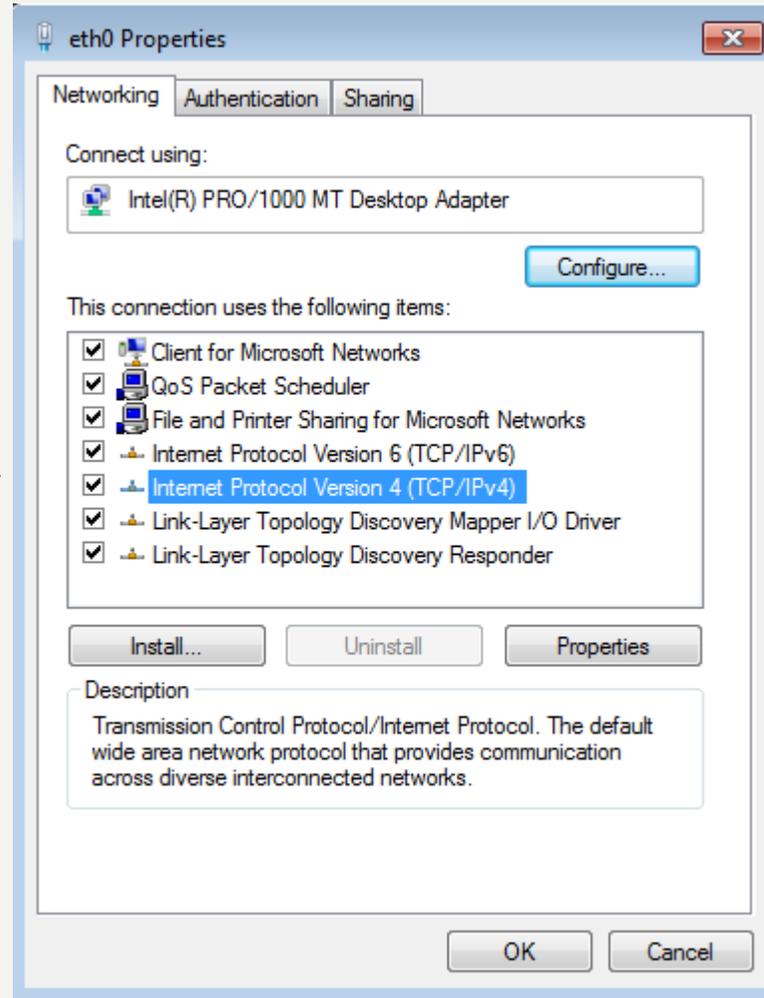
- 1) Right Click on the Network Icon in the Notification Area
- 2) Click on Open Network and Sharing Center
- 3) Click Change adapter settings
- 4) Select the connected network and double click
- 5) Accept the Windows warning by clicking Yes



LAB 1

Setup - Configure PC IP Address

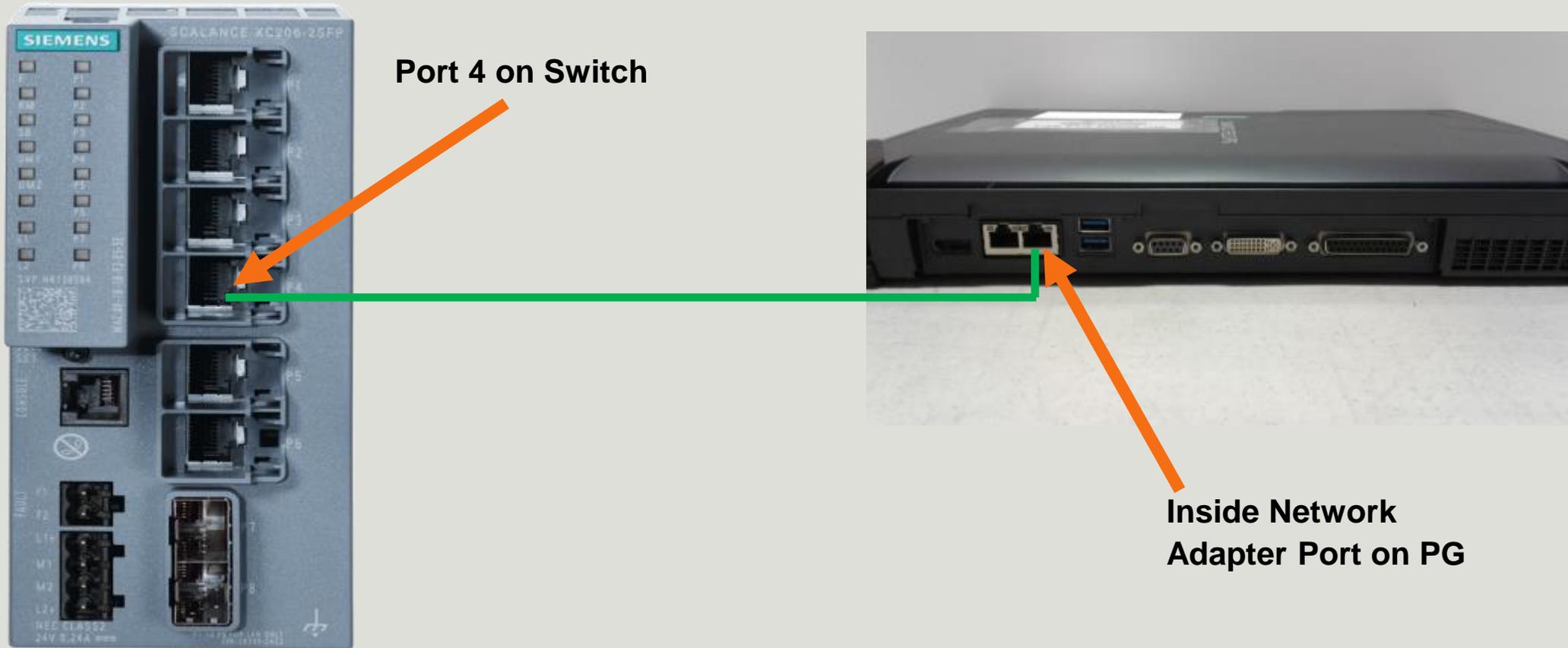
- 1) Click on Internet Protocol Version 4 (TCP/IPv4)
- 2) Click Properties
- 3) Select Use the following IP address:
- 4) Enter IP and Subnet Mask Only as shown
- 5) Click OK until all the way out of the network properties screens.
- 6) Close any remaining open screens.



LAB 1

Setup - Review Web Based Management

Now please connect your PC "L" Port (inside network adapter) to the marked port



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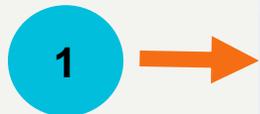
LAB 2

PRONETA – Set the Network Adapter

PRONETA is a no cost Industrial Ethernet Analyzer tool from Siemens that can be used to set the IP address of our switches, as well as scan the topology of the network.

After starting PRONETA, we want to ensure that it points to the right NIC card that is connected to the switch.

1. Click on Settings



LAB 2

Network analysis	<ul style="list-style-type: none">▪ Online: show online topology and configure devices▪ Offline: show offline topologies▪ Comparison: compare online and offline topologies▪ Configuration: adopt device names from an offline topology or a STEP7 project
IO test	<ul style="list-style-type: none">▪ Force and monitor values of SIMATIC ET 200 devices
Settings	<ul style="list-style-type: none">▪ Change Proneta settings

LAB 2

PRONETA – Set the Network Adapter

2. Click on the second tab, Network Adapter Selection.
3. Select the Network Adapter that corresponds to your connection
4. Click on Home to complete setting up the Network Adapter

The screenshot shows the Siemens PRONETA web interface. The browser title is 'Siemens - PRONETA'. The navigation bar includes 'Home', 'General Settings', 'Network Adapter Selection', and 'GSDML Manager'. The 'Network Adapter Selection' tab is selected. Below the navigation bar is a section titled 'Select a network adapter' containing a table with the following data:

Name	Description	IP address
<input type="radio"/> No adapter		
<input checked="" type="radio"/> Local Area Connection	Intel(R) 82579LM Gigabit Network Connection	192.168.1.1
<input type="radio"/> Bluetooth Network Connection	Microsoft	169.254.93.242
<input type="radio"/> Local Area Connection* 11	Juniper Network Connect Virtual Adapter	169.254.77.187
<input type="radio"/> Wireless Network Connection	Microsoft	169.254.228.168

LAB 2

PRONETA – Set the Network Adapter

5. To scan the network and find our switch, click on Network Analysis.

5 →

	Network analysis	<ul style="list-style-type: none">▪ Online: show online topology and configure devices▪ Offline: show offline topologies▪ Comparison: compare online and offline topologies▪ Configuration: adopt device names from an offline topology or a STEP7 project
	IO test	<ul style="list-style-type: none">▪ Force and monitor values of SIMATIC ET 200 devices
	Settings	<ul style="list-style-type: none">▪ Change Proneta settings

LAB 2

PRONETA – Set the Switch IP Address

Notice the left window displays your PC and the switch, while the right window displays the switch details and fields which can be managed.

1. Right mouse click anywhere on the switch line in the right window
 2. Select “Set network parameters” from the drop down menu
- ❖ Notice other options in the menu such as flash LED, Open web server, and Reset network parameters.

The screenshot shows the Siemens PRONETA interface. The top navigation bar includes 'Online', 'Offline', 'Comparison', and 'Configuration'. Below this is a 'Topology View - online' section with various icons. The main area is divided into two panes. The left pane shows a network topology with a 'SCALANCE XC-200' switch and a 'md1cmn3c PRONETA' PC. The right pane, titled 'Accessible Devices - online', contains a table with the following data:

Name	#	DNS Name	Device Type	IP Address	Subnet Mask	MAC Address
	1		SCALANCE XC-200	0.0.0.0	0.0.0.0	20:87:56:1c:7b:50

A context menu is open over the table, with the 'Set network parameters' option highlighted. The menu also includes 'Flash LED', 'Open web server', 'Reset network parameters', and 'Use as starting point in graphical view'. Two blue circles with arrows indicate the steps: circle 1 points to the table, and circle 2 points to the context menu.

LAB 2

PRONETA – Set the Switch IP Address

3. Set the IP address for your switch:

Station Xa 172.16.X.5

Station Xb 172.16.X.10

[Station# (X)] 1...5

4. Set the Network subnet mask

Network mask 255.255.0.0

5. Click the Set button to apply the network address settings.

Set Network Parameters

Please select your network parameters.

Assign device name

IP configuration

Static IP configuration

IP address: 172. 16. 1. 5

Network mask: 255. 255. 0. 0

Use router for Gateway: 0. 0. 0. 0

Obtain IP configuration from a DHCP server and identified by

MAC address

Device name

Client ID

Devices connected to an enterprise network or directly to the internet must be appropriately protected against unauthorized access, e.g. by use of firewalls and network segmentation. For more information about industrial security, please visit <http://www.siemens.com/industrialsecurity>

Apply settings permanently

Set Cancel

LAB 2

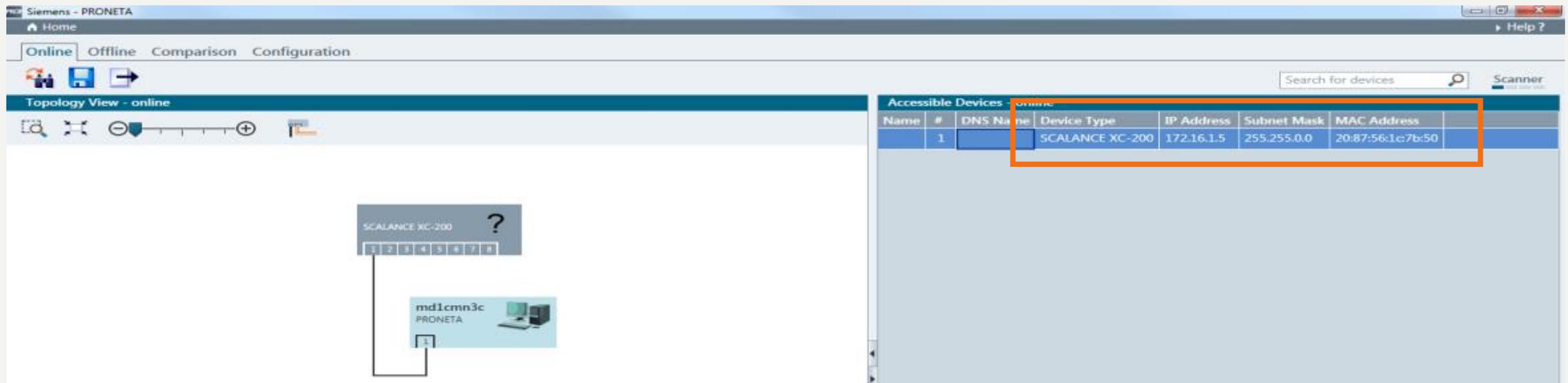
PRONETA – Set the Switch IP Address

The network address settings are now updated in the right window.

Now the switch can be accessed opening a browser and typing in the IP address

OR

Alternatively by selecting the Web Server option in the drop down menu



The screenshot displays the Siemens PRONETA configuration software. The interface is split into two main sections. On the left, the 'Topology View - online' shows a network diagram with a 'SCALANCE XC-200' switch connected to a 'md1cmn3c PRONETA' device. On the right, the 'Accessible Devices' table lists the discovered devices. The table has columns for Name, #, DNS Name, Device Type, IP Address, Subnet Mask, and MAC Address. The first row, representing the SCALANCE XC-200 switch, is highlighted with an orange border.

Name	#	DNS Name	Device Type	IP Address	Subnet Mask	MAC Address
	1		SCALANCE XC-200	172.16.1.5	255.255.0.0	20:87:56:1c:7b:50

LAB 2

Login to the switch

From a web browser, **type in the IP address** and access the switch with the username **admin** and password **admin**. Click **Login**.

When prompted, please change the password to Admin!123



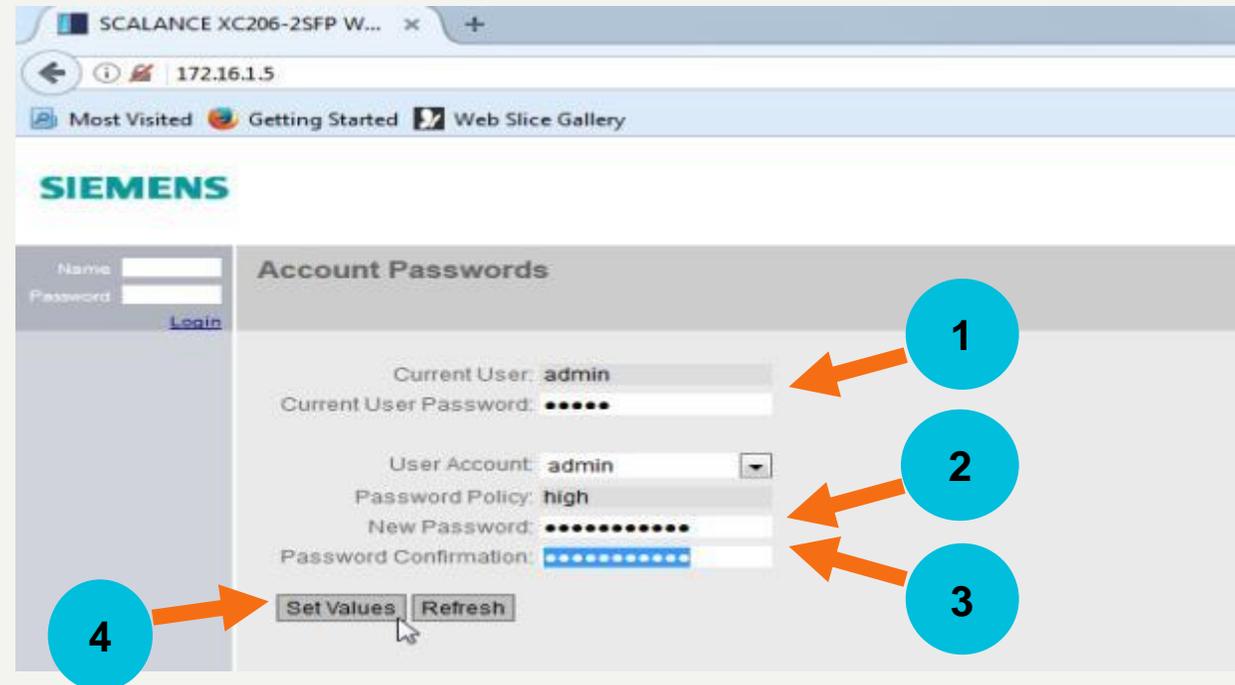
LAB 2

Login to the switch

When logging in after a factory reset, the switch requires that the default password be changed.

High password policy requires at least 8 characters including at least 1 digit, 1 uppercase letter and 1 special character.

Change the new password to **Admin!123**
Click **Set Values**



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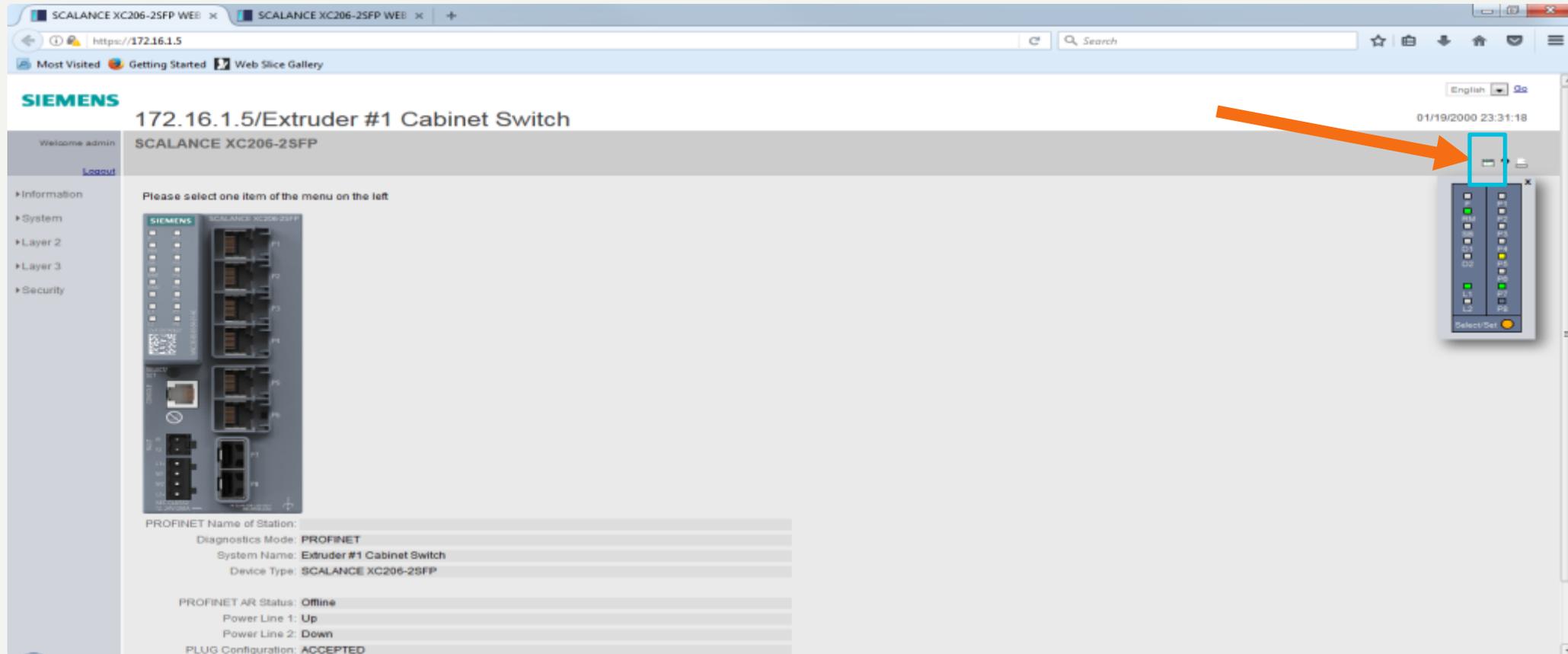
Diagnostic Approaches

Diagnosing the SCALANCE XC switch configuration *may* require multiple approaches:

- Which connections are down?
- Where is the cable break located in the cable?
- Which ports are Half or Full duplex?
- Which port(s) are assigned to which VLAN?
- Does PRONETA find the switch from a VLAN port?
- Is it possible to get to the Web based Management from a VLAN port?
- What is the ring mode: Active or Passive?
- Which switches are on the ring?
- Which ports are ring ports?
- What is the reconfiguration time for the ring?
- Which ports are blocked, and which ports are in forwarding mode?

XC2xx LED Diagnostic Island

Click on the LED icon to display the LED Diagnostic Island for the switch



XC2xx WBM Menu Structure

SCALANCE XC206-2SFP W...

172.16.1.5

Most Visited Getting Started Web Slice Gallery

SIEMENS

172.16.1.5/SCALANCE XC206-2SFP

SCALANCE XC206-2SFP

Welcome admin [Logout](#)

- Information
- System
- Layer 2
- Layer 3
- Security

Please select one item of the menu on the left

PROFINET Name of Station:

Diagnostics Mode: **PROFINET**

System Name: **sysName Not Set**

Device Type: **SCALANCE XC206-2SFP**

PROFINET AR Status: **Offline**

Power Line 1: **Up**

Power Line 2: **Down**

PLUG Configuration: **ACCEPTED**

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Identification and Maintenance

SIEMENS

172.16.1.5/Extruder #1 Cabinet Switch

Welcome admin [Logout](#)

Identification & Maintenance

- Information
 - Start Page
 - Versions
 - I&M**
 - ARP Table
 - Log Table
 - Faults
 - Redundancy
 - Ethernet Statistics
 - Unicast
 - Multicast
 - LLDP
 - FMP

Manufacturer ID: 42
Order ID: 6GK5 206-2BS00-2AC2
Serial Number: VPHD138562
Hardware Revision: 1
Software Revision: V02.01.00
Revision Counter: 0
Revision Date: 00/00/0 00:00:00
Function Tag:
Location Tag:
Date:
Descriptor:

Alternatively, the Versions folder can be used to see the FW version

Event Log Table View

SIEMENS 172.16.1.5/Extruder #1 Cabinet Switch

Welcome admin [Logout](#)

Information

- Start Page
- Versions
- I&M
- ARP Table
- Log Table**
- Faults
- Redundancy
- Ethernet Statistics
- Unicast
- Multicast
- LLDP
- FMP
- DHCP Server
- Diagnostics
- SNMP
- Security

System

Layer 2

Log Table

Severity Filters

Info
 Warning
 Critical

Restart	System Up Time	System Time	Severity	Log Message
11	00:00:26	Date/time not set	6 - Info	MRP ring manager falls back to passive state.
11	00:00:25	Date/time not set	6 - Info	MRP ring manager entered active state.
11	00:00:25	Date/time not set	6 - Info	MRP ring manager falls back to passive state.
11	00:00:25	Date/time not set	6 - Info	Link up on P0.8.
11	00:00:25	Date/time not set	6 - Info	Link up on P0.7.
11	00:00:23	Date/time not set	6 - Info	Device is configured to ring MRP AUTO-Manager.
11	00:00:23	Date/time not set	6 - Info	MRP ring manager entered active state.
11	00:00:00	Date/time not set	6 - Info	Cold start performed, Ver: V02.01.00 - event/status summary after startup:
11	00:00:00	Date/time not set	6 - Info	Startup configuration: PLUG storage PLUG: Configuration accepted
11	00:00:00	Date/time not set	6 - Info	Power supply: L1 is connected. L2 is not connected. No line is monitored.

1 - 10 of 408 entries [Show all](#)

1 [Next](#)

System Event Log Table can be reviewed on the Information > Log Table page

Faults

SIEMENS

172.16.1.5/Extruder #1 Cabinet Switch

Welcome admin

[Logout](#)

Information

- Start Page
- Versions
- I&M
- ARP Table
- Log Table
- Faults**
- Redundancy
- Ethernet Statistics
- Unicast

Faults

No. of Signaled Faults: 1

[Reset Counters](#)

Fault Time	Fault Description	Clear Fault State
23m 37s	Link up on P0.4.	Clear Fault State
1h 7m 0s	Fiber Monitoring: Port P0.8 entered the maintenance demanded state (Rx Power = -21.3 dBm)	Clear Fault State

[Refresh](#)

Example of Link Up and FMP faults (both configured). Note the Fault Time is equal to the system uptime since the device system time has not yet been set.

Redundancy Status

The screenshot shows the Siemens web interface for a switch at IP 172.16.1.5. The page title is "Ring Redundancy". The left sidebar has a menu with "Redundancy" highlighted. The main content area shows the following details:

- Redundancy Function: MRP Auto-Manager
- RM Status: Passive
- Observer Status: -
- Ring Port 1: P0.7
- Ring Port 2: P0.8
- No. of Changes to RM Active State: 1
- Max. Delay of RM Test Packets[ms]: 7

Buttons for "Reset Counters" and "Refresh" are visible at the bottom.

The screenshot shows the same Siemens web interface, but the Ring Redundancy status is now Active. The details are:

- Redundancy Function: MRP Auto-Manager
- RM Status: Active
- Observer Status: -
- Ring Port 1: P0.7
- Ring Port 2: P0.8
- No. of Changes to RM Active State: 2
- Max. Delay of RM Test Packets[ms]: 7

Buttons for "Reset Counters" and "Refresh" are visible at the bottom.

- Example showing in-tact ring (left, passive) and broken ring (right, active).
- If this were an MRP Client, the name under the Redundancy Function would say MRP Client

Ethernet Statistics

SIEMENS

172.16.1.5/Extruder #1 Cabinet Switch

Welcome admin

Logout

Information

- Start Page
- Versions
- I&M
- ARP Table
- Log Table
- Faults
- Redundancy
- Ethernet Statistics**
- Unicast
- Multicast
- LLDP

Ethernet Statistics: Packet Type

Interface Statistics | Packet Size | **Packet Type** | Packet Error | History

Port	Unicast	Multicast	Broadcast
P0.1	0	0	0
P0.2	0	0	0
P0.3	0	0	0
P0.4	17454	1135	315
P0.5	0	0	0
P0.6	0	0	0
P0.7	4135	124575	380
P0.8	8553	124208	217

Reset Counter

Refresh

Use the Packet Type statistics to verify there is not an overly weighted volume of the wrong type of traffic.

Ethernet Statistics

SIEMENS

172.16.1.5/Extruder #1 Cabinet Switch

Welcome admin

[Logout](#)

Information

- Start Page
- Versions
- I&M
- ARP Table
- Log Table
- Faults
- Redundancy
- Ethernet Statistics**
- Unicast
- Multicast
- LLDP

Ethernet Statistics: Packet Error

Interface Statistics | Packet Size | Packet Type | **Packet Error** | History

Port	CRC	Undersize	Oversize	Fragments	Jabbers	Collisions
P0.1	0	0	0	0	0	0
P0.2	0	0	0	0	0	0
P0.3	0	0	0	0	0	0
P0.4	0	0	0	0	0	0
P0.5	0	0	0	0	0	0
P0.6	0	0	0	0	0	0
P0.7	0	0	0	0	0	0
P0.8	0	0	0	0	0	0

[Reset Counter](#)

[Refresh](#)

Verify that no port(s) are experiencing re-occurring errors. Reset the counters if required.

Fiber Monitoring Protocol

SIEMENS

172.16.1.5/Extruder #1 Cabinet Switch

Fiber Monitoring Protocol (FMP) Diagnosis

Welcome admin [Logout](#)

- Information
 - Start Page
 - Versions
 - I&M
 - ARP Table
 - Log Table
 - Faults
 - Redundancy
 - Ethernet Statistics
 - Unicast
 - Multicast
 - LLDP
 - FMP**
 - DHCP Server
 - Diagnostics
 - SNMP
 - Security
- System
 - Layer 2
 - Layer 3
 - Security

Port	Rx Power State	Rx Power[dBm]	Power Loss State	Power Loss[dB]
P0.7	ok	0.0	idle	-
P0.8	maint. dem.	0.0	idle	-

[Refresh](#)

Fiber Monitoring Protocol - Google Chrome

172.16.1.5/protected/fmp_inf_help_en.htm

Rx Power State

- disabled**
Fiber monitoring is disabled.
- ok**
The value for the received power of the optical link is within the set limits.
- maint. req.**
Check the link.
A warning is signaled.
- maint. dem.**
The link needs to be checked.
An alarm is signaled and the fault LED is lit.
- link down**
The connection to the communications partner is down. No link is detected.

Rx Power [dBm]

Shows the current value of the received power. The value can have a tolerance of +/- 3 dB.

If there is no connection (link down) or fiber monitoring is disabled, "-" is displayed. If fiber monitoring is not enabled on the partner port, the value 0.0 is displayed.

To receive FMP results, FMP must be enabled under Layer 2 > FMP.

Agenda

- 1 Introduction - Network Concepts
- 2 Comparing Office and Industrial Networks
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- 4 **Hands On**
 - Setup and Pre-work
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 - ✓ Information Folder
 - ✓ **System Folder**
 - ✓ Layer 2 Folder
 - Configuring a redundant ring
 - Coupling redundant rings
- 5 Interconnecting to IT – Passive Listening
- 6 Review Network Monitoring (Optional)



System Folder

General Information

SIEMENS

172.16.1.5/Extruder #1 Cabinet Switch

Welcome admin [Logout](#)

- Information
- System
 - Configuration
 - General**
 - Agent IP
 - Restart
 - Load&Save
 - Events
 - SMTP Client
 - DHCP

Device

Device	Coordinates
Current System Time:	01/01/2000 00:38:04
System Up Time:	38m 3s
Device Type:	SCALANCE XC206-2SFP
System Name:	Extruder #1 Cabinet Switch
System Contact:	sysContact Not Set
System Location:	sysLocation Not Set

English

01/01/2000 00:49:49

- If no System Name is assigned, the device name is displayed; e.g. SCALANCE XC206-2SFP
- If System Time is not synchronized with a master clock, it will restart after every reboot from Jan 1st 2000, zero out the System Up Time, and increment the restart counter

System Folder

Load & Save

The screenshot shows the Siemens web interface for a cabinet switch. The page title is "172.16.1.5/Extruder #1 Cabinet Switch" and the sub-header is "Load and Save via HTTP". The left sidebar contains a menu with "Load & Save" highlighted. The main content area has tabs for "HTTP", "TFTP", and "Passwords", with "HTTP" selected. Below the tabs is a table with columns: Type, Description, Load, Save, and Delete. Two orange arrows point to the "Load" and "Save" columns. Several rows are highlighted with blue boxes, including "Config", "ConfigPack", "Firmware", "LogFile", and "Users".

Type	Description	Load	Save	Delete
Config	Startup Configuration	Load	Save	
ConfigPack	Startup Config, Users and Certificates	Load	Save	
Copyright	Copyright		Save	
Debug	Debug Information for Siemens Support		Save	Delete
EDS	EtherNet/IP Device Description		Save	
Firmware	Firmware Update	Load	Save	
GSDML	PROFINET Device Description		Save	
HTTPSCert	HTTPS Certificate	Load	Save	Delete
LogFile	Event Log (ASCII)		Save	
MIB	SCALANCE X200 MSPS MIB		Save	
RunningCLI	'show running-config all' CLI settings		Save	
Script	Script	Load		
StartupInfo	Startup Information		Save	
Users	Users and Passwords	Load	Save	

Refresh

- * Config Files, Firmware, and System Event Log Table can be **downloaded** on the System > Load & Save page
- * Config Files and Firmware can be loaded onto the switch.

System Folder

Agent IP

SIEMENS 172.16.1.5/Extruder #1 Cabinet Switch

Welcome admin [Logout](#)

Agent Internet Protocol (IP)

Information

System

- Configuration
- General
- Agent IP**
- Restart
- Load&Save
- Events
- SMTP Client
- DHCP
- SNMP
- System Time

IP Assignment Method: Static

IP Address: 172.16.1.5

Subnet Mask: 255.255.0.0

Default Gateway: 0.0.0.0

Agent VLAN ID: -

MAC Address: 20-87-56-1d-bb-9d

- The MAC Address of the overall switch can be found at System > Agent IP
- Be careful changing the IP address from this menu.

System Folder

System Time

SIEMENS 172.16.1.5/Extruder #1 Cabinet Switch

Welcome admin [Logout](#)

Manual Setting DST Overview DST Configuration SNTP Client NTP Client SIMATIC Time Client

Information

System

- Configuration
- General
- Agent IP
- Restart
- Load&Save
- Events
- SMTP Client
- DHCP
- SNMP
- System Time**
- Auto Logout

Time Manually

System Time: 04/18/2017 15:09:08

Use PC Time

Last Synchronization Time: 04/18/2017 15:09:08

Last Synchronization Mechanism: Manual

Daylight Saving Time: inactive (offset + 0h)

Set Values **Refresh**

If none of the synchronized time settings (e.g. NTP, SNTP, Simatic Time, etc.) are feasible, use the PC Time under the Manual Setting tab.

System Folder

Ports Overview

SIEMENS

172.16.1.5/Extruder #1 Cabinet Switch

Welcome admin

[Logout](#)

Ports Overview

Overview Configuration

Port	Port Name	Port Type	Status	OperState	Link	Mode	Negotiation	Flow Ctrl. Type	Flow Ctrl.	MAC Address
P0_1		Switch-Port VLAN Hybrid	enabled	down	down	100M FD	enabled	<input type="checkbox"/>	disabled	20-87-56-1d-bb-9e
P0_2		Switch-Port VLAN Hybrid	enabled	down	down	100M FD	enabled	<input type="checkbox"/>	disabled	20-87-56-1d-bb-9f
P0_3		Switch-Port VLAN Hybrid	disabled	down	down	100M FD	enabled	<input type="checkbox"/>	disabled	20-87-56-1d-bb-a0
P0_4		Switch-Port VLAN Hybrid	enabled	up	up	100M FD	enabled	<input type="checkbox"/>	disabled	20-87-56-1d-bb-a1
P0_5		Switch-Port VLAN Hybrid	enabled	down	down	100M FD	enabled	<input type="checkbox"/>	disabled	20-87-56-1d-bb-a2
P0_6		Switch-Port VLAN Hybrid	enabled	down	down	100M FD	enabled	<input type="checkbox"/>	disabled	20-87-56-1d-bb-a3
P0_7		Switch-Port VLAN Hybrid	enabled	up	up	1G FD	enabled	<input type="checkbox"/>	disabled	20-87-56-1d-bb-a4
P0_8		Switch-Port VLAN Hybrid	enabled	up	up	1G FD	enabled	<input type="checkbox"/>	disabled	20-87-56-1d-bb-a5

[Refresh](#)

Information

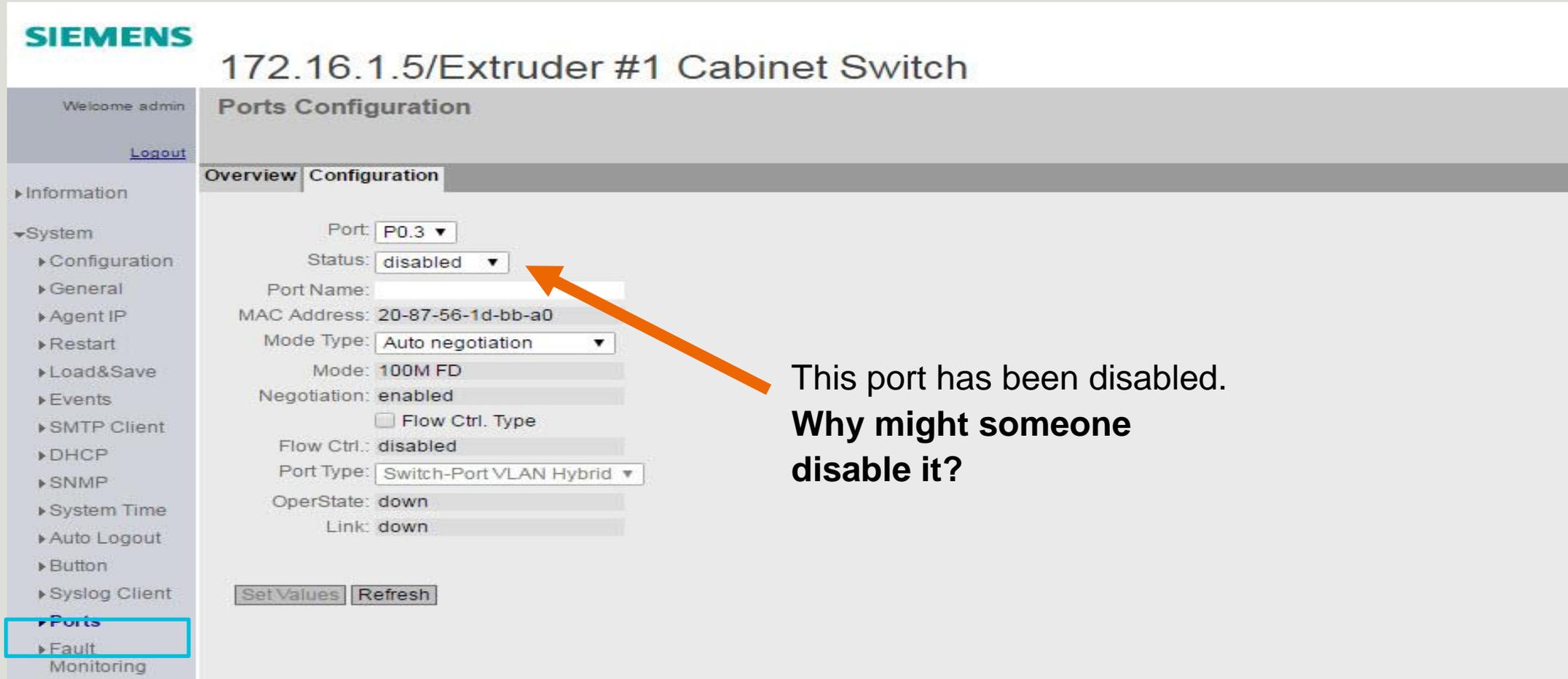
System

- Configuration
- General
- Agent IP
- Restart
- Load&Save
- Events
- SMTP Client
- DHCP
- SNMP
- System Time
- Auto Logout
- Button
- Syslog Client
- Ports**

- An overview of all ports can be reviewed on the System > Ports page.
- Individual Port settings can be selected by clicking on the Port number.
- The individual MAC Address of each port is also listed.

System Folder

Ports Status & Settings



SIEMENS 172.16.1.5/Extruder #1 Cabinet Switch

Welcome admin [Logout](#)

Ports Configuration

Overview Configuration

Port: P0.3
Status: disabled
Port Name:
MAC Address: 20-87-56-1d-bb-a0
Mode Type: Auto negotiation
Mode: 100M FD
Negotiation: enabled
 Flow Ctrl. Type
Flow Ctrl.: disabled
Port Type: Switch-Port VLAN Hybrid
OperState: down
Link: down

This port has been disabled.
Why might someone disable it?

System Folder

Fault Monitoring Power Supply

SCALANCE XC206-2SFP WEB x 172.16.1.5

172.16.1.5/Extruder #1 Cabinet Switch

Welcome admin Logout

Information

System

- Configuration
- General
- Agent IP
- Restart
- Load&Save
- Events
- SMTP Client
- DHCP
- SNMP
- System Time
- Auto Logout
- Button
- Syslog Client
- Ports
- Fault Monitoring**
- PROFINET

Fault Mask Power

Power Supply | Link Change | Redundancy

Line 1
 Line 2

Set Values Refresh

- We can monitor the health of one or both power supplies
- Also illuminates Fault LED

System Folder

Fault Monitoring - Link Status

The screenshot shows the SCALANCE XC206-2SFP WEB interface. The browser address bar shows 172.16.1.5. The interface has three tabs: Power Supply, Link Change, and Redundancy. The Link Change tab is active. On the left, a navigation menu has 'Fault Monitoring' highlighted with a blue box. The main content area contains a table with columns 'Port' and 'Setting'. The table lists ports P0.1 through P0.8. Ports P0.1 to P0.6 have a '-' setting, while P0.7 and P0.8 have a 'Down' setting. An orange arrow points to the 'Down' setting for P0.8. Below the table are 'Set Values' and 'Refresh' buttons.

Port	Setting
P0.1	-
P0.2	-
P0.3	-
P0.4	-
P0.5	-
P0.6	-
P0.7	Down
P0.8	Down

We can generate a fault for link state change (Up or Down) on any port

System Folder

Fault Monitoring - Redundancy

SCALANCE XC206-2SFP WEB

172.16.1.5

Most Visited Getting Started Web Slice Gallery

SIEMENS

172.16.1.5/Extruder #1 Cabinet Switch

Welcome admin

[Logout](#)

- Information
- System
 - Configuration
 - General
 - Agent IP
 - Restart
 - Load&Save
 - Events
 - SMTp Client
 - DHCP
 - SNMP
 - System Time
 - Auto Logout
 - Button
 - Syslog Client
 - Ports
 - Fault Monitoring**
 - PROFINET

Fault Monitoring Redundancy

Power Supply Link Change **Redundancy**

Redundancy Lost (HRP only)

[Set Values](#) [Refresh](#)

We can generate a fault message for loss of redundancy (HRP only)

System Folder

Log Table Fault Messages Review

To view the generated faults, we need to return to the Log Table under Information

172.16.1.5/Extruder #1 Cabinet Switch

Log Table

Severity Filters

- Info
- Warning
- Critical

Restart	System Up Time	System Time	Severity	Log Message
17	00:34:04	Date/time not set	6 - Info	MRP ring manager entered active state.
17	00:34:04	Date/time not set	4 - Warning	New Fault state: "Link down on P0.8."
17	00:34:04	Date/time not set	6 - Info	Link down on P0.8.
17	00:26:14	Date/time not set	4 - Warning	New Fault state (reconfiguration): "Power down on L2."
17	00:26:09	Date/time not set	4 - Warning	Fault state gone (reconfiguration): "Power down on L2."
17	00:26:02	Date/time not set	4 - Warning	New Fault state (reconfiguration): "Power down on L2."
17	00:10:31	Date/time not set	4 - Warning	WBM: Authentication failure. 172.16.1.69
17	00:10:07	Date/time not set	6 - Info	Link up on P0.4.
17	00:00:26	Date/time not set	6 - Info	MRP ring manager falls back to passive state.
17	00:00:25	Date/time not set	6 - Info	MRP ring manager entered active state.

1 - 10 of 423 entries [Show all](#)

System Folder

Port Diagnostics Cable Tester - Copper

SCALANCE XC206-2SFP WEB

172.16.1.5

172.16.1.5/Extruder #1 Cabinet Switch

Welcome admin

Cable Tester

Logout

Cable Tester SFP Diagnostics

Port: P0.2

Run Test

Pair	Status	Distance
1-2	open	1
3-6	open	0
4-5	not tested	0
7-8	not tested	0

Refresh

Port Diagnostics

- For testing copper cables only
- Do not test on data connection used for WBM interface
- 10/100MB cables only test pairs 1-2 and 3-6.
- Status can be Open, Wire Break, Short Circuit, Not Tested, and OK
- Distance value will show the distance to the cable end, cable break, or short-circuit in meters with a tolerance of +/- 1M

System Folder

Port Diagnostics Cable Tester – SFP

The screenshot shows the SCALANCE XC206-2SFP WEB interface. The browser address bar shows the IP address 172.16.1.5. The navigation menu on the left includes 'Logout', 'Information', 'System', 'Configuration', 'General', 'Agent IP', 'Restart', 'Load&Save', 'Events', 'SMTP Client', 'DHCP', 'SNMP', 'System Time', 'Auto Logout', 'Button', 'Syslog Client', 'Ports', 'Fault Monitoring', 'PROFINET', 'EtherNet/IP', 'PLUG', 'Ping', and 'Port Diagnostics'. The 'Port Diagnostics' menu item is highlighted. The main content area displays the 'SFP Diagnostics' for Port P0.7. The SFP information includes Name: SIEMENS, Model: SFP992-1, Revision: 1, and Serial: IF0068Q1100144. The Nominal Bit Rate is 1300 MBit/s. The Max. Link (50.0/125um) is 550m and the Max. Link (62.5/125um) is 270m. The diagnostic table shows the following values:

	Current	Low	High
Temperature[°C]:	46.21	-40.00	110.00
Voltage[V]:	3.29	3.00	3.60
Current[mA]:	4.64	0.10	15.00
Rx Power[uW]:	318.07	15.08	631.00
Tx Power[uW]:	212.00	89.01	501.02

A 'Refresh' button is located below the table.

- **Good connection**
- Link Up
- Ring Functional
- Receive power well within low/high limits

System Folder

Port Diagnostics Cable Tester - SFP

The screenshot shows the SCALANCE XC206-2SFP WEB interface. The browser address bar shows the URL 172.16.1.5. The page title is "Cable Tester SFP Diagnostics". The left navigation menu is expanded to "Port Diagnostics". The main content area displays the following information:

Port: P0.8
Name: SIEMENS
Model: SFP992-1
Revision: 1
Serial: IF0068Q1100391

Nominal Bit Rate[MBit/s]: 1300
Max. Link (50.0/125um)[m]: 550
Max. Link (62.5/125um)[m]: 270

	Current	Low	High
Temperature[°C]:	46.96	-40.00	110.00
Voltage[V]:	3.29	3.00	3.60
Current[mA]:	4.99	0.10	15.00
Rx Power[uW]:	17.04	15.08	631.00
Tx Power[uW]:	252.00	89.01	501.02

Refresh

- **Fiber Connection slightly pulled out**
- Link Up (still)
- Ring Functional (still)
- Fault from low receive power

System Folder

Port Diagnostics Cable Tester - SFP

The screenshot shows the SCALANCE XC206-2SFP WEB interface. The browser address bar shows the URL 172.16.1.5. The page title is "Cable Tester SFP Diagnostics". The left navigation menu is expanded to "Port Diagnostics". The main content area displays the following information:

Port: P0.8
Name: SIEMENS
Model: SFP992-1
Revision: 1
Serial: IF0068Q1100391

Nominal Bit Rate[MBit/s]: 1300
Max. Link (50.0/125um)[m]: 550
Max. Link (62.5/125um)[m]: 270

	Current	Low	High
Temperature[°C]:	46.87	-40.00	110.00
Voltage[V]:	3.29	3.00	3.60
Current[mA]:	5.05	0.10	15.00
Rx Power[uW]:	3.00	15.08	631.00
Tx Power[uW]:	253.06	89.01	501.02

A "Refresh" button is located below the table.

- **Fiber Connection pulled mostly out**
- Link Down
- Ring Active
- Receive power outside of acceptable tolerances

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Layer 2 Folder

Mirroring (General)

Required Steps:

1. Create a Session (General Tab)
2. Assign Ingress and Egress of the Port(s) to the Session (Port Tab)
3. Enable Mirroring (General Tab)

SCALANCE XC206-2SFP WEB x +

https://172.16.1.5

Most Visited Getting Started Web Slice Gallery

SIEMENS

172.16.1.5/Extruder #1 Cabinet Switch

Welcome admin [Logout](#)

Mirroring General

General Port

Mirroring

Monitor Barrier

Select	Session ID	Session Type	Status	Dest. Port
<input type="checkbox"/>	1	Port Based	inactive	P0.4

1 entry.

[Create](#) [Delete](#) [Set Values](#) [Refresh](#)

Layer 2 Folder Mirroring (Port)

SCALANCE XC206-2SFP WEB x +

https://172.16.1.5

Most Visited Getting Started Web Slice Gallery

SIEMENS

172.16.1.5/Extruder #1 Cabinet Switch

Welcome admin [Logout](#)

Information

System

Layer 2

- Configuration
- QoS
- Rate Control
- VLAN
- Mirroring**
- Dynamic MAC Aging
- Ring Redundancy
- Spanning Tree

General | **Port**

Session ID: 1

Port	Ingress Mirroring	Egress Mirroring
P0.1	<input type="checkbox"/>	<input type="checkbox"/>
P0.2	<input type="checkbox"/>	<input type="checkbox"/>
P0.3	<input type="checkbox"/>	<input type="checkbox"/>
P0.4	<input type="checkbox"/>	<input type="checkbox"/>
P0.5	<input type="checkbox"/>	<input type="checkbox"/>
P0.6	<input type="checkbox"/>	<input type="checkbox"/>
P0.7	<input type="checkbox"/>	<input type="checkbox"/>
P0.8	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

[Set Values](#) [Refresh](#)

Layer 2 Folder

Loop Detection

The screenshot shows the SCALANCE XC206-2SFP WEB interface. The browser address bar shows 172.16.1.5. The page title is "Loop Detection". The sidebar on the left has "Loop Detection" highlighted. The main content area has a "Loop Detection" checkbox checked and a "VLAN Loop Detection" checkbox unchecked. Below this is a summary table and a detailed table of port settings.

	Threshold	Remote Reaction	Local Reaction	Copy to Table
All ports	No Change	No Change	No Change	Copy to Table

Port	Setting	Threshold	Remote Reaction	Local Reaction	Status	Source Port	Source VLAN	Reset
P0.1	forwarder	2	disable	disable	active	-	-	Reset
P0.2	forwarder	2	disable	disable	active	-	-	Reset
P0.3	forwarder	2	disable	disable	active	-	-	Reset
P0.4	forwarder	2	disable	disable	active	-	-	Reset
P0.5	forwarder	2	disable	disable	active	-	-	Reset
P0.6	forwarder	2	disable	disable	active	-	-	Reset
P0.7	forwarder	2	disable	disable	active	-	-	Reset
P0.8	forwarder	2	disable	disable	active	-	-	Reset

- Special loop detection frames are used to check whether loops exist on the suspected ports
- Only possible at ports that were not configured as ring ports or standby ports
- Helps to find the loop more quickly but does not eliminate it
- Creates additional load: use the sender, forwarder, and blocked functions appropriately

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Network Availability Requirement

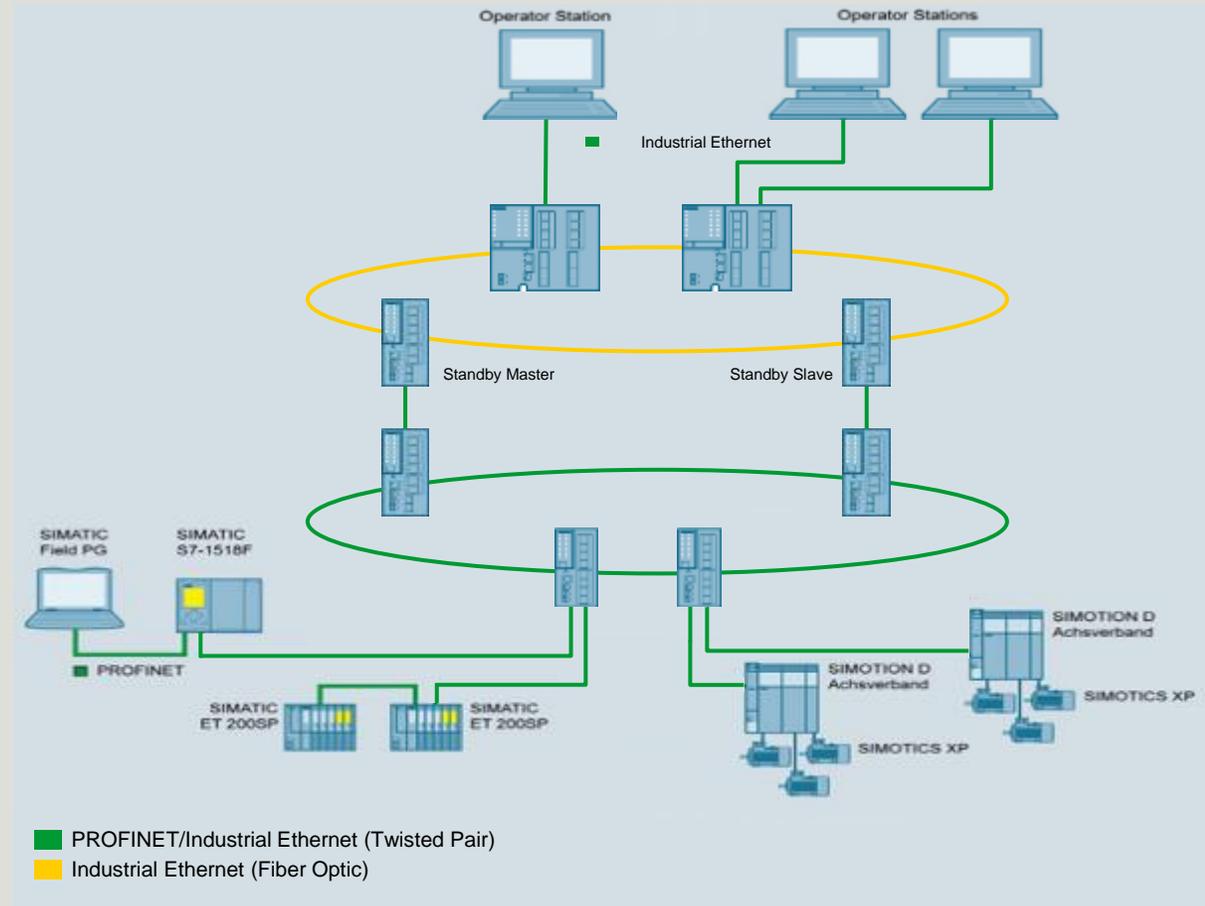
Reliable networks, capable of withstanding failures are achieved by:

- Reliable devices
- Fault-tolerant systems
- Redundancy

The network should have a topology that allows fast convergence following a fault.

Requirements:

- Automatic reconfiguration following line failure
- Automatic reconfiguration following port deactivation
- Automatic reconfiguration following component failure
- Monitoring of redundancy mechanisms



Network Availability Solutions

Line-Redundancy:



Device-Redundancy:

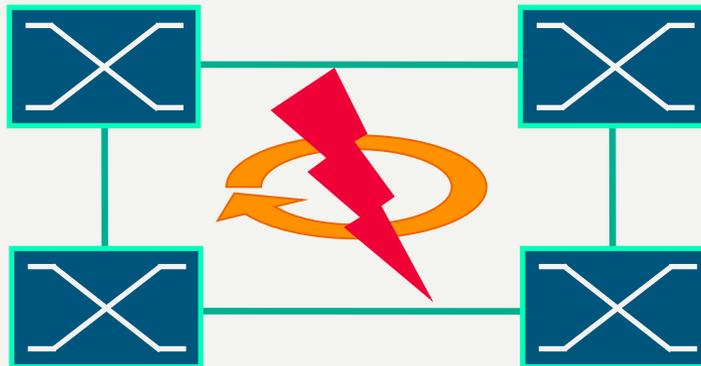


Network Availability Problem

Problem: Loops

If there are loops in a network, Broadcast-Frames will circle around the loop. This causes a very high network load, which makes all useful communication impossible.

→ In Ethernet Networks, Loops are not allowed!

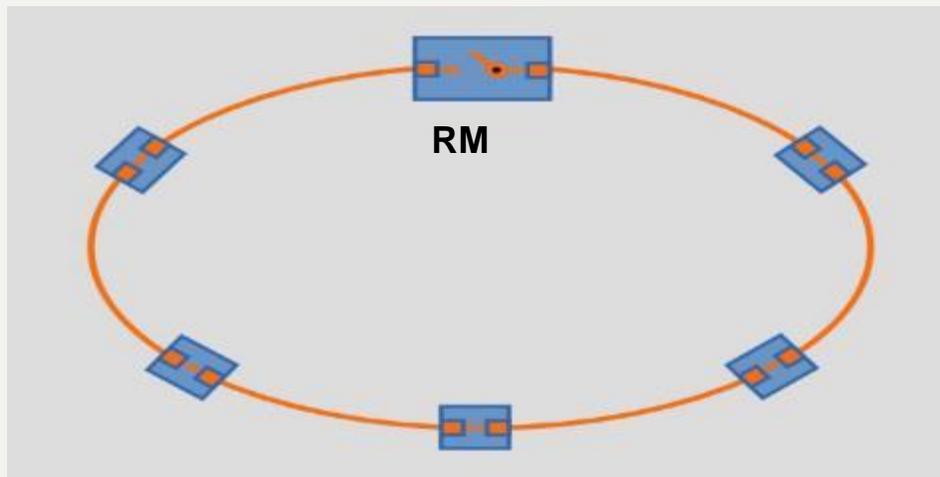


Redundant Rings

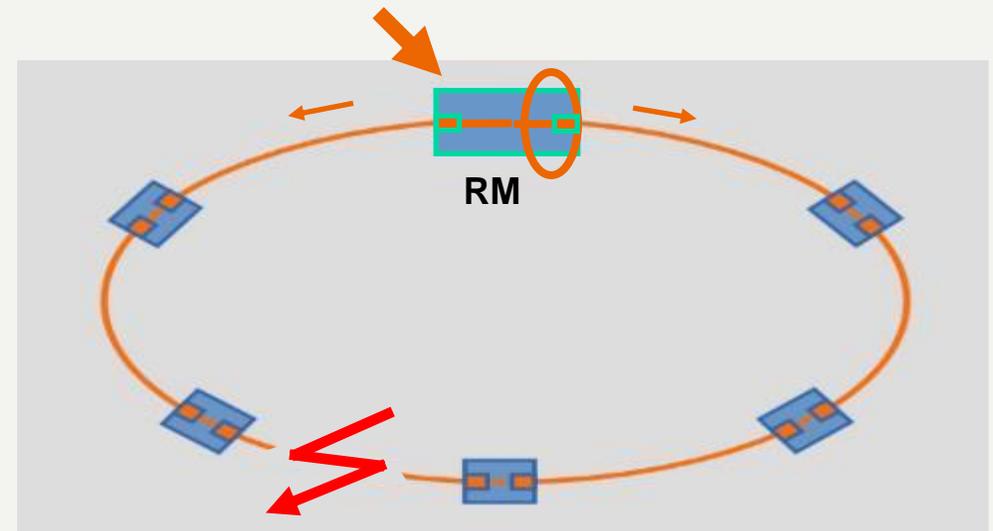
How it Works

Starting with our XC200 series you have a Ring Redundancy Manager included.

- The Ring manager opens the ring in no failure cases
- Looking at the data transmission, the bus is now linear
- Cyclic test frames are used to check ring status
- As soon as there is a failure the ring manager connects through and informs Ring clients



Failure
→



Redundant Rings

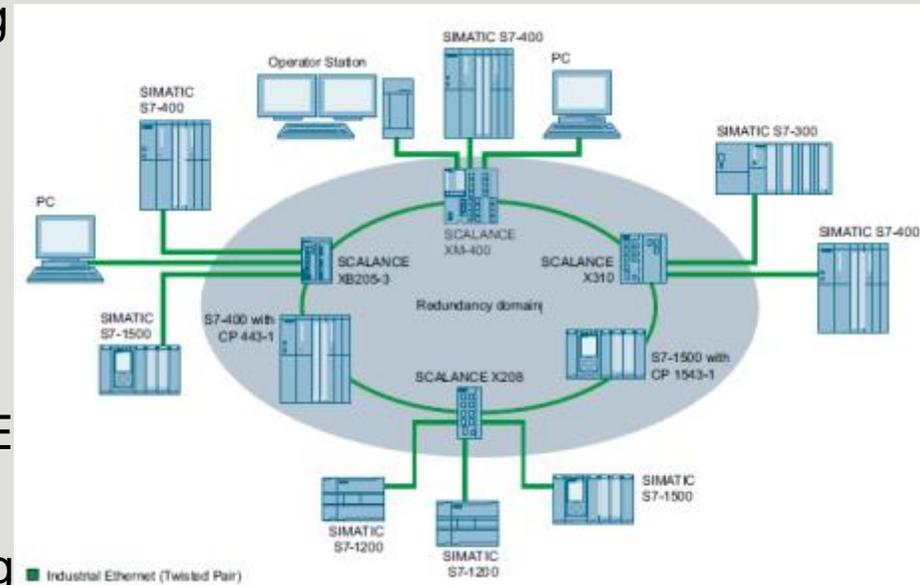
Siemens switches offer different protocols for using redundant rings:

High Speed Redundancy Protocol (HRP):

- typical reconfiguration < 300ms with up to 100 ring nodes
- only devices that support the HRP function can be used in the ring
- devices that do not support HRP must be linked to the ring using special devices with HRP capability

Media Redundancy Protocol (MRP):

- typical reconfiguration < 200ms with up to 50 ring nodes
- conforms to the Media Redundancy Protocol (MRP) specified in IEC 62439-2 Release 1.0 (2010-02)
- only devices that support the MRP function can be used in the ring
- MRP is part of the PROFINET standard



LAB 3: Pre-Lab Notes

(Configure High Speed Redundancy Protocol)

- Configure High Speed Ring Redundancy on your switch according to the pictures on the next page.
- We will be using Ring Ports 7 and 8.
- When changing from the default ring ports (1 and 2) we will get a message after changing ring port 1 that the ring ports are different types. This is normal since we are moving from copper to fiber.
- Note: Ring Redundancy Mode can be selected on the Configuration Menu as well (but not ring ports).



HRP Manager (.5)

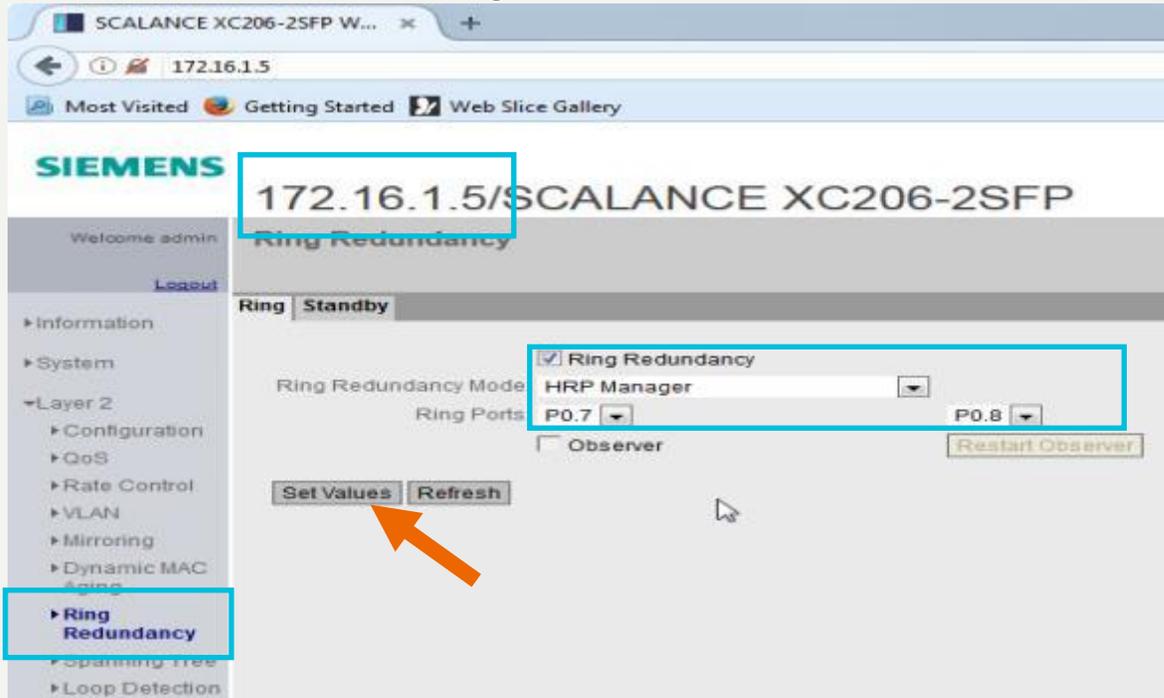
HRP Client (.10)



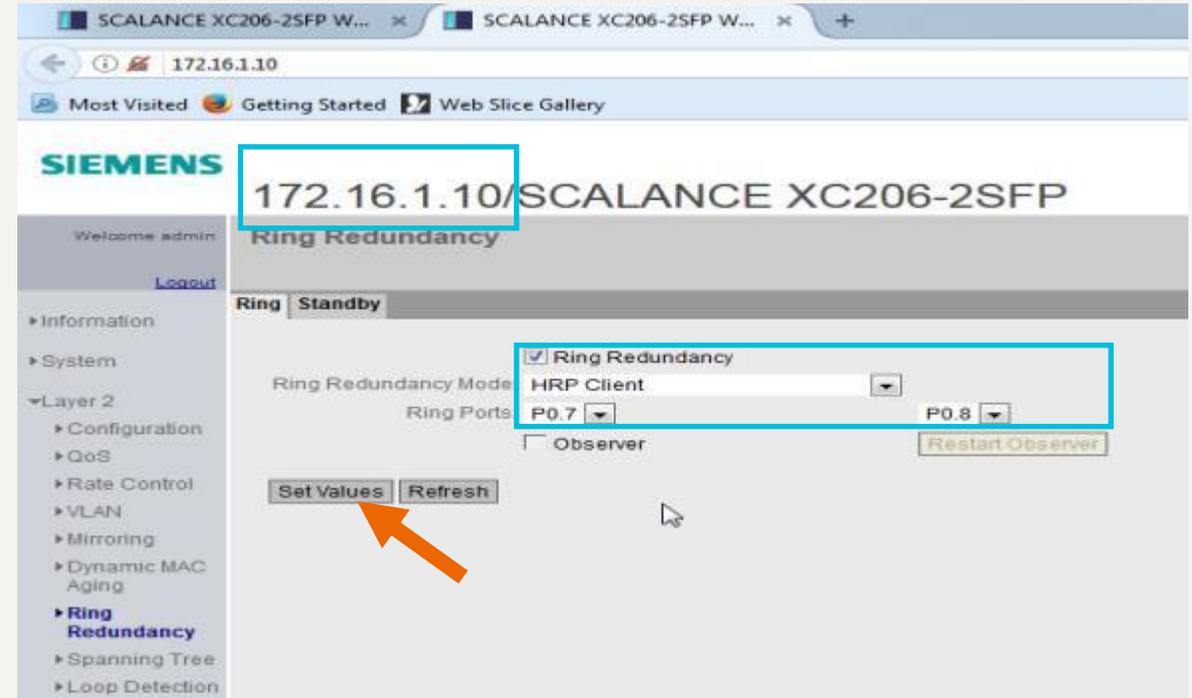
LAB 3

Configure High Speed Redundancy Protocol

HRP Manager Station nA



HRP Client Station nB



- Be sure to click Set Values after you have completed the settings.
- The settings will take effect in 1 minute, but you click on the link to take you directly to the Write Startup Config page to bypass the delay.
- **Do not connect switches together until the configuration is complete**

LAB 3

Configure High Speed Redundancy Protocol

- After the configuration of the High-Speed Redundancy in your switch, please **connect the ring as shown below**.
- In this 2-switch ring, we could also connect ports 7 together and ports 8 together, however for more than 2 switches, best practices (for debugging) would be to connect 7 to 8, 7 to 8, 7 to 8, and so on back to the first switch.
- After a short time, the ring will be established.



LAB 3

Check the status of the Ring Manager

- Using the Ring Manager switch (.5), go to **Information > Log Table** page to view the events that took place when the ring connections were made.
- Notice the Ring Manager was Active when the first connection was made, and that it changed to passive after the second connection was made
- Check the FMP Page

The screenshot shows the Siemens SCALANCE XC206-2SFP Web Slice Gallery interface. The page title is "172.16.1.5/SCALANCE XC206-2SFP". The left sidebar contains a navigation menu with "Log Table" selected. The main content area shows the "Log Table" page with a "Severity Filters" section and a table of log entries. The table has the following columns: Restart, System Up Time, System Time, Severity, and Log Message. The log entries are as follows:

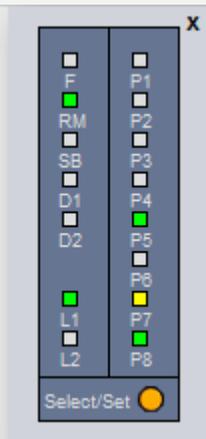
Restart	System Up Time	System Time	Severity	Log Message
1	1d 20:09:55	Date/time not set	6 - Info	HRP ring manager falls back to passive state.
1	1d 20:09:54	Date/time not set	6 - Info	Link up on P0.8.
1	1d 20:09:30	Date/time not set	6 - Info	HRP ring manager entered active state.
1	1d 20:09:30	Date/time not set	6 - Info	Link up on P0.7.
1	1d 20:08:52	Date/time not set	6 - Info	Link down on P0.5.
1	1d 20:08:33	Date/time not set	6 - Info	Link up on P0.5.
1	1d 20:08:31	Date/time not set	6 - Info	Link down on P0.5.
1	1d 19:40:40	Date/time not set	6 - Info	Device is configured to ring HRP Manager.
1	1d 19:26:49	Date/time not set	6 - Info	Link up on P0.5.
1	1d 19:26:14	Date/time not set	6 - Info	IP communication is possible. Remote logging activated.

At the bottom of the table, it says "1 - 10 of 36 entries [Show all](#)". There are "Clear" and "Refresh" buttons below the table.

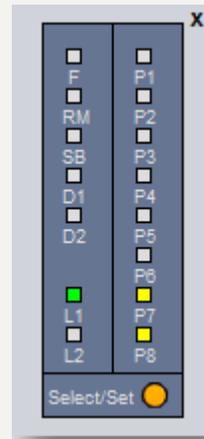
LAB 3

Check the status of the Ring Manager

- Using the Ring Manager switch (.5), go to **Information > Redundancy > Ring Redundancy** to view an overview of the Redundancy Role/Function and the status.
- Notice the RM Led on the Ring Manager switch is solid green when passive and blinking green when active.
- What about the port 7 and 8 LEDs on both the HRP Manager and HRP Client?



HRP Manager LED
Diagnostic Island



HRP Client LED
Diagnostic Island

A screenshot of a web browser displaying the SCALANCE XC206-2SFP web interface. The browser address bar shows the URL 172.16.1.5. The page title is '172.16.1.5/SCALANCE XC206-2SFP'. The main content area is titled 'Ring Redundancy' and includes a navigation menu with 'Spanning Tree', 'Ring Redundancy', and 'Standby'. The 'Ring Redundancy' section displays the following information: 'Redundancy Function: HRP Manager', 'RM Status: Passive', 'Observer Status: -', 'Ring Port 1: P0.7', and 'Ring Port 2: P0.8'. Below this information, there are two buttons: 'Refresh' and 'Reset Counters'. A blue box highlights the 'Redundancy Function' and 'RM Status' fields.

LAB 3

Ring Redundancy – Things to Try

Disconnect one of the fiber cables:

- What happens to the RM LED on the Ring Manager?
- What events are logged in the Event Log?
- How does the status change on the Ring Redundancy tab?

Switch to the HRP Client and perform the same tasks:

- What events are logged in the Event Log?
- How does the RM LED behave?
- How does the status change on the Ring Redundancy tab?

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 - Setup and Pre-work
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 - **Coupling redundant rings**
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Coupling Redundant Rings

How do we couple redundant rings without giving up the high performance in case of a failure or switch over?



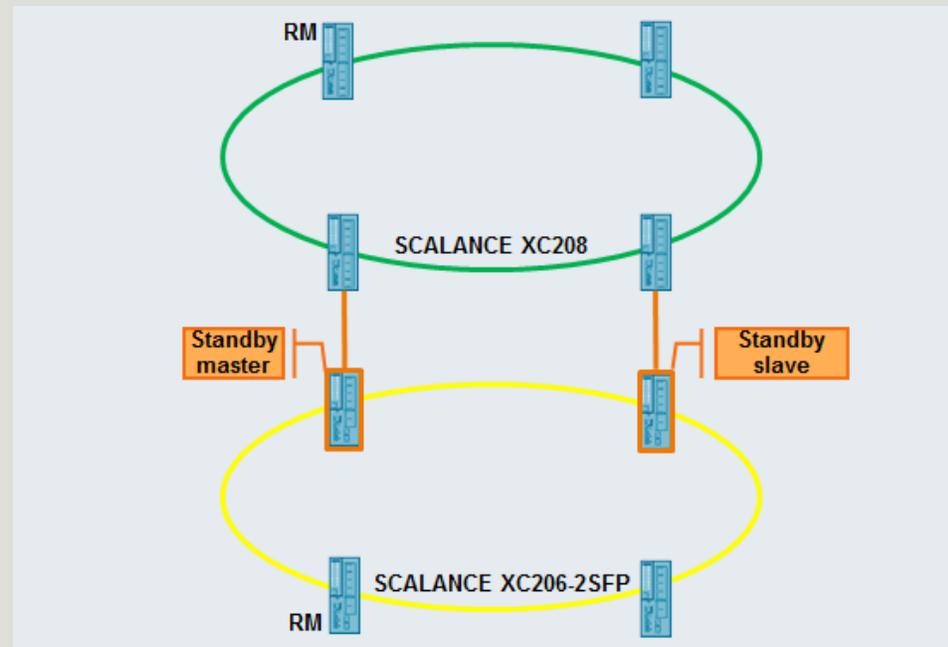
Standby Connection Functionality

The Standby-Connection allows to couple two High Speed Redundancy rings

- Available in X200IRT, XC200, XP200, X300, X400, XM400, X500, and XR500 switches
- Two switches are defined as standby master and standby slave
- In the best case scenario, the master connection is used and the slave blocked

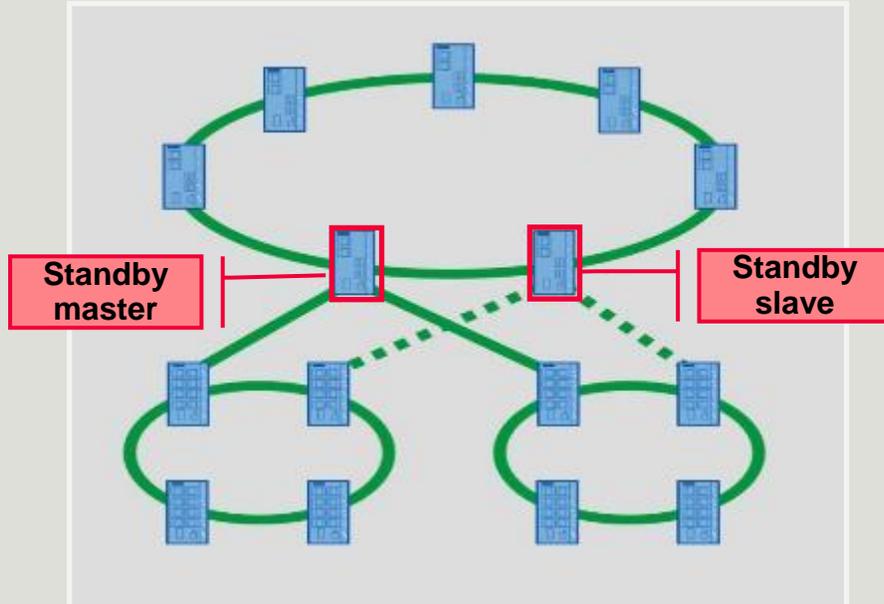
Note:

Standby works only in High Speed Redundancy Networks, no support for MRP



Standby Connection Details

Standby - Connection from Central Ring



Advantage:

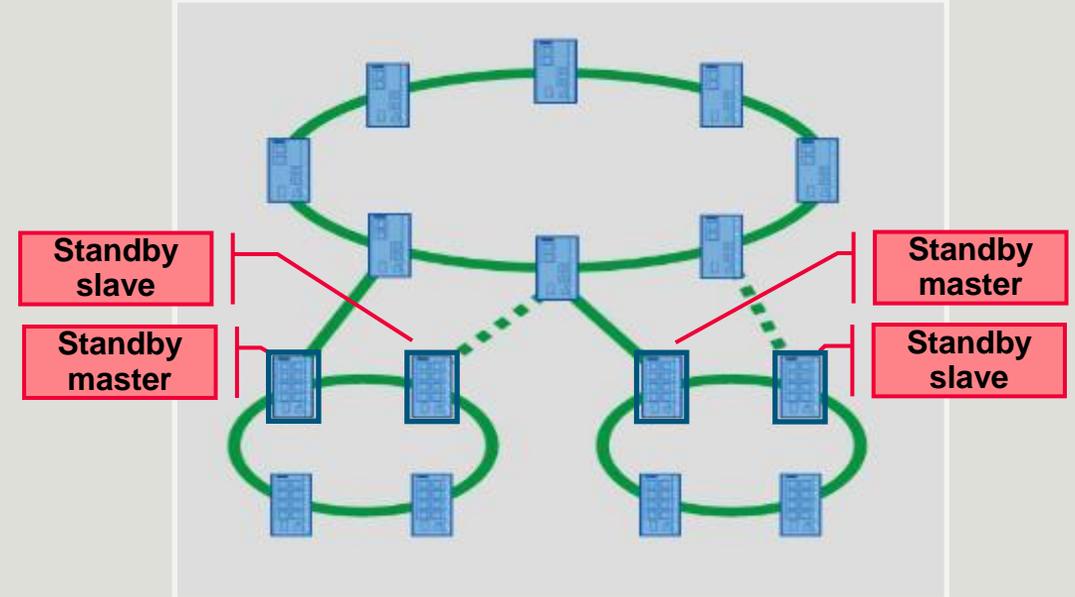
Less costly solution, because only two switches in the central ring must support the standby-function, e.g. X200IRT, XC200, X300, XR500

Disadvantage:

The switch-over of the standby-master works for all standby-connections, but not individually

→ **Causes conflicts**

Standby - Connection from Sub-Rings



Advantage:

The switch-over of the standby-master will be performed from every sub-ring individually

→ **No conflicts**

Disadvantage:

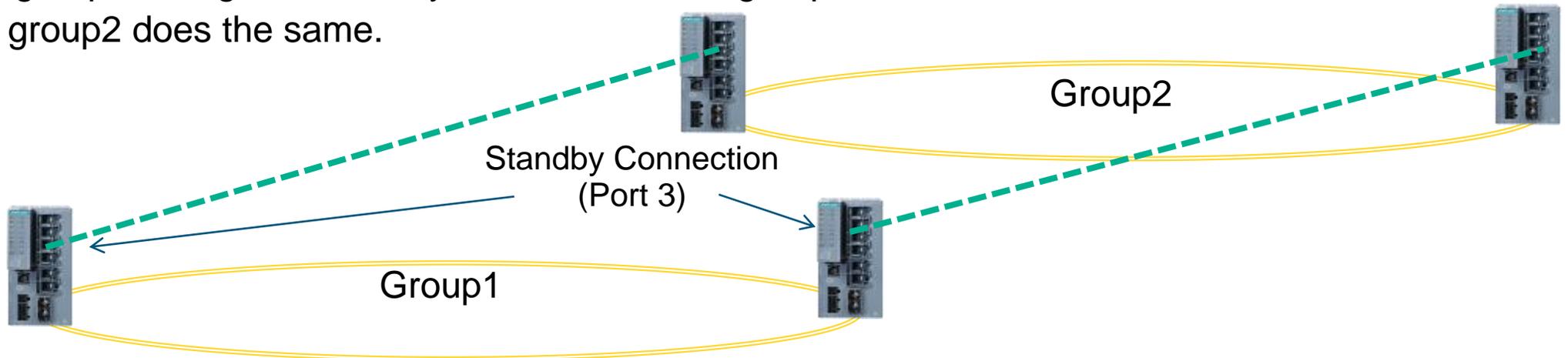
More expensive solution, because two switches in each of the sub-rings must support the Standby-function, e.g. X200IRT, XC200, X300, XR500

LAB 4

Configure a Standby Connection

- Before we can use the standby functionality, we have to configure the standby master and standby slave.
- Please choose your partner-ring to connect using the standby functionality
- Define a name for the standby connection, i.e. standby-teamX ; X = team number. The standby connection name **must exactly match** for the master and slave.

Standby must only be configured in one ring, therefore we will do this in two steps. First only group1 configures standby, after evaluation, group1 will switch off standby and group2 does the same.



LAB 4

Configuring Standby Functionality

BEFORE making the physical connections, please configure standby on both switches in the same ring using port 3 and a name according to the previous slide.

REMEMBER: The names have to match exactly.

- We will not configure “Force device to Standby Master”, therefore the switch with the higher MAC address will become the Standby Master.
- Be sure to click **Set Values** after completing the configuration changes.
- Take a look at the Log Table under the Information menu after completing each switch to see the switch behavior.

Complete for both switches (.5, .10)

Port	Setting
P0.1	<input type="checkbox"/>
P0.2	<input type="checkbox"/>
P0.3	<input checked="" type="checkbox"/>
P0.4	<input type="checkbox"/>
P0.5	<input type="checkbox"/>
P0.6	<input type="checkbox"/>
P0.7	<input type="checkbox"/>
P0.8	<input type="checkbox"/>

LAB 4

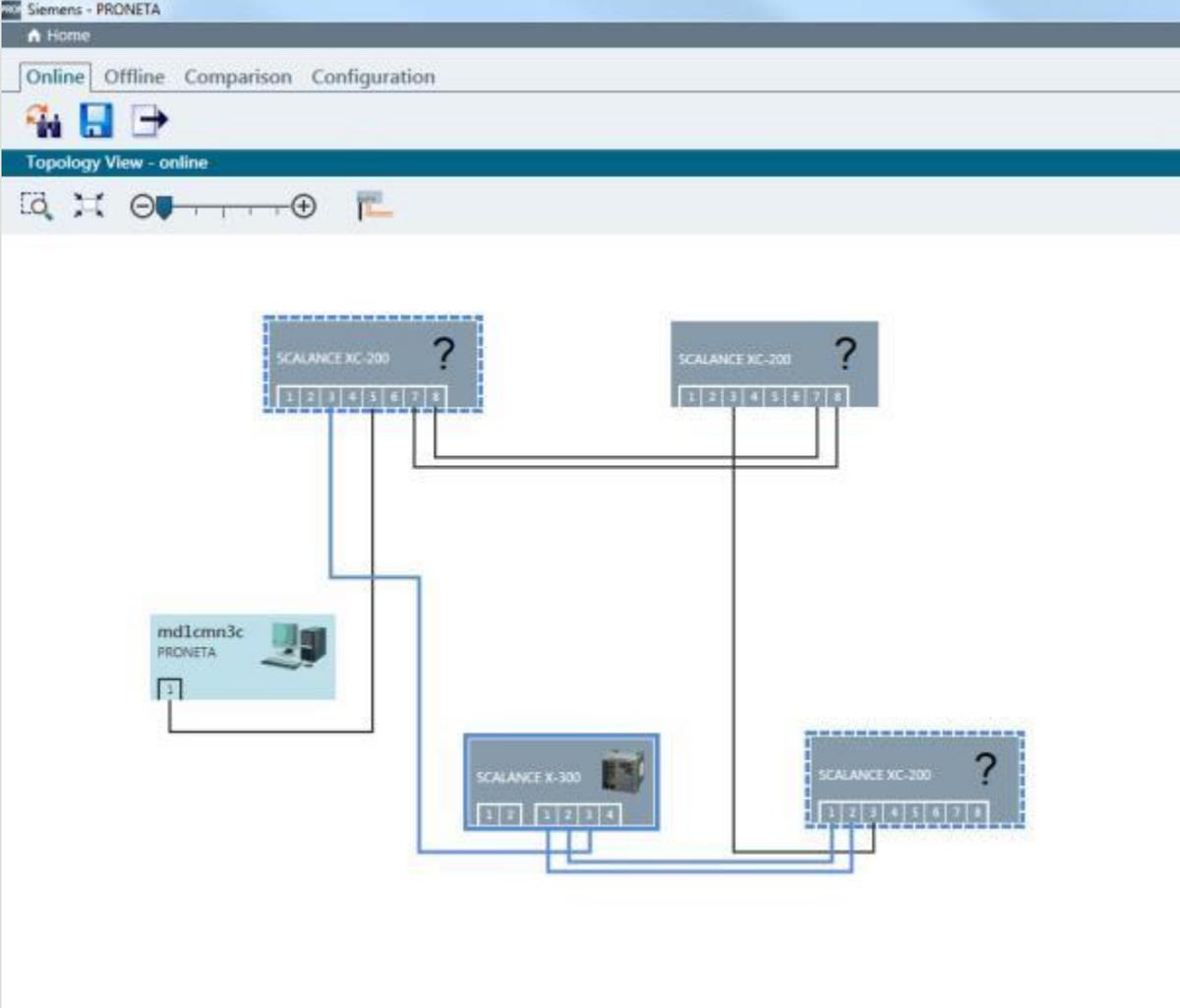
Configuring Standby Functionality

- We can also tell who is the Standby Master or Standby Slave as well as the status of the Redundancy by looking in the Information tab under Ring Redundancy.
- Now connect one cable to the respective port 3 on one of the switches in the partner ring. Can you ping the other switches using the Ping feature under the System menu?
- Now connect the second cable to the respective port 3 on the remaining switch in the partner ring. Can you still ping the other switches? This should be possible (with no loop) if it is configured correctly.

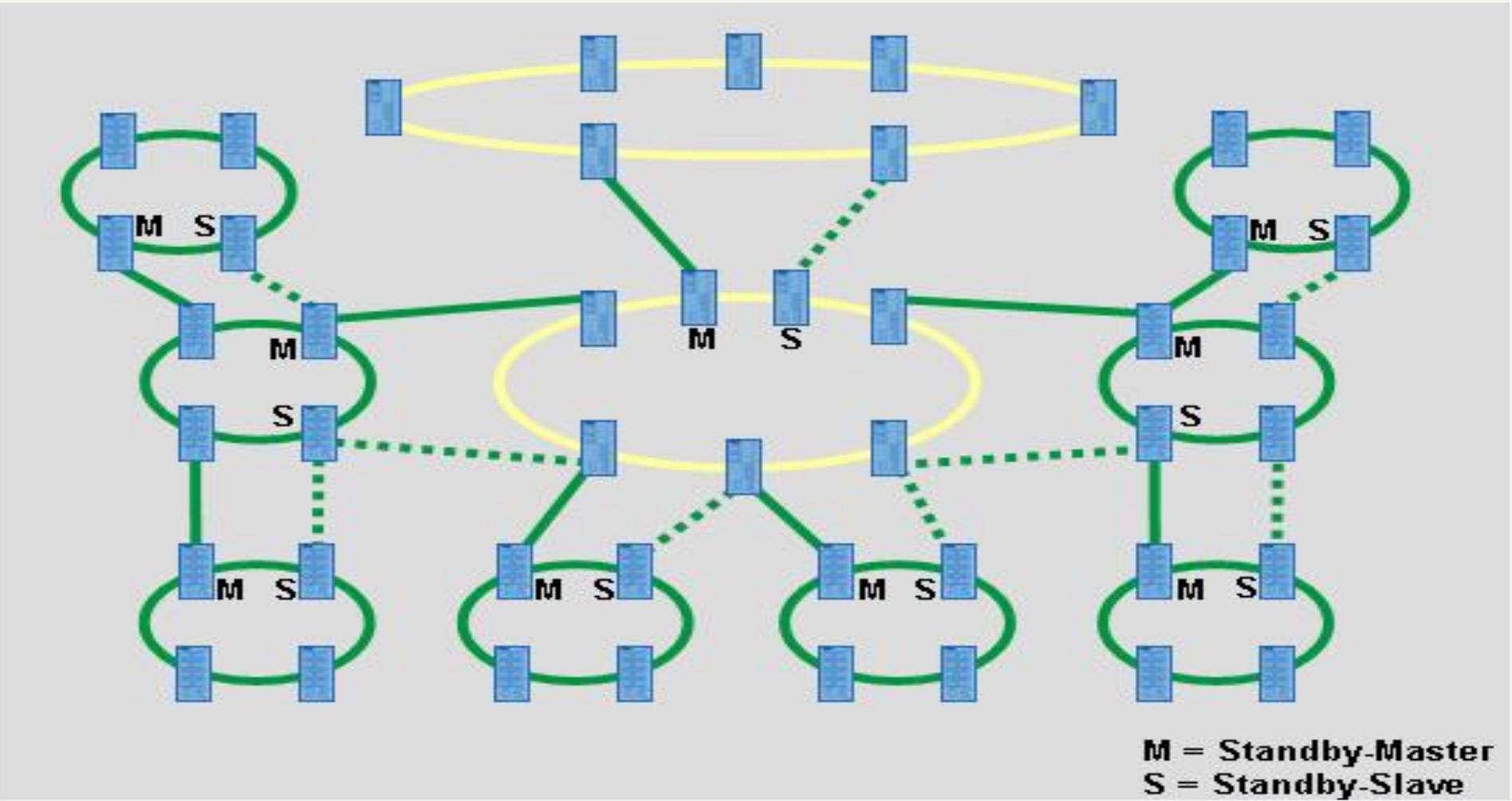
The screenshot displays the web interface for a Siemens SCALANCE XC206-2SFP switch. The browser address bar shows the URL 172.16.1.5. The page title is "SIEMENS 172.16.1.5/SCALANCE XC206-2SFP". The main content area is titled "Standby" and contains a navigation menu with "Spanning Tree", "Ring Redundancy", and "Standby" tabs. The "Standby" tab is selected and highlighted with an orange arrow. Below the tabs, the configuration details are displayed: "Standby Ports: P0.3", "Standby Name: standby-team1", "Standby Function: Master", and "Standby Status: Passive". The "Standby Function" and "Standby Status" fields are highlighted with a blue box. Below these details, there is a "No. of Changes to Standby Active State: 0" and a "Reset Counters" button. A "Refresh" button is also visible at the bottom left. On the left side of the interface, there is a navigation menu with "Information", "Start Page", "Versions", "I&M", "ARP Table", "Log Table", "Faults", "Redundancy", and "Ethernet Statistics". The "Redundancy" menu item is highlighted with a blue box and an orange arrow.

PRONETA

Screen Capture of Standby Rings



Higher Availability and Fast Reconfiguration in a Structured Industrial Ethernet Network



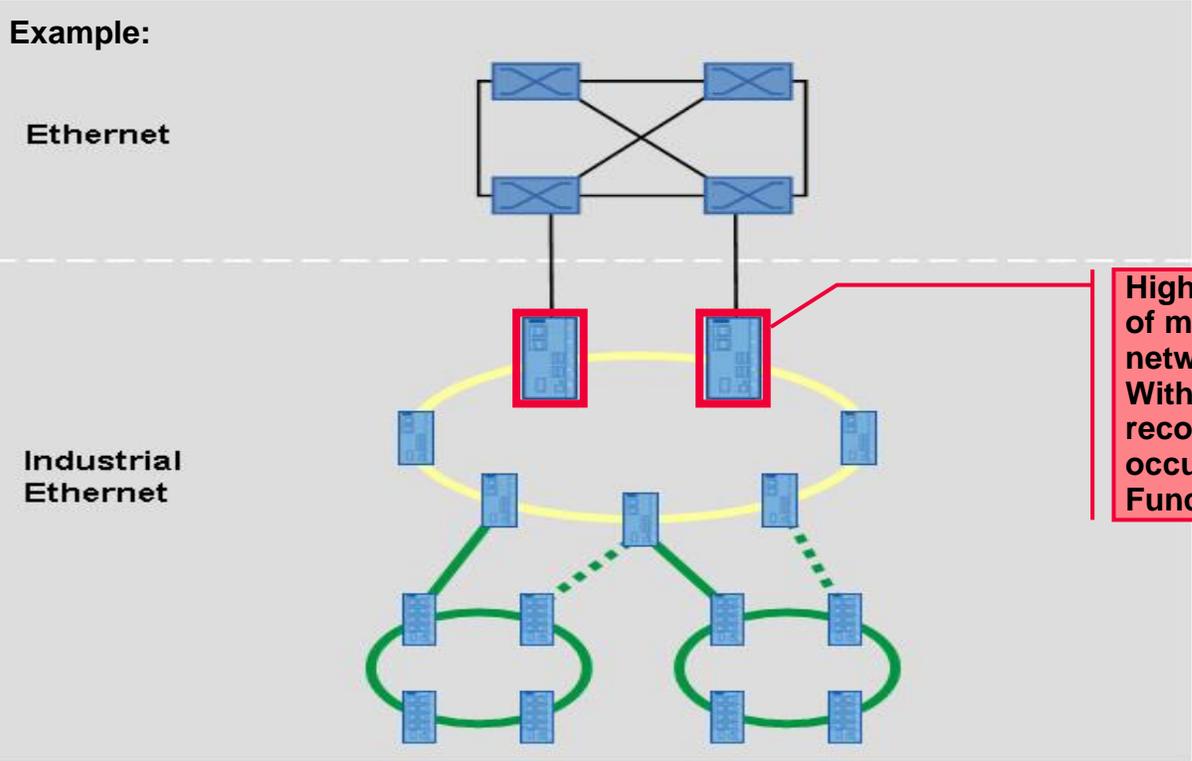
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Passive Listening

Siemens developed Passive Listening to support redundant connections with fast recovery between SCALANCE Industrial Ethernet Networks with IT-networks supporting STP/RSTP **without having to understand RSTP.**

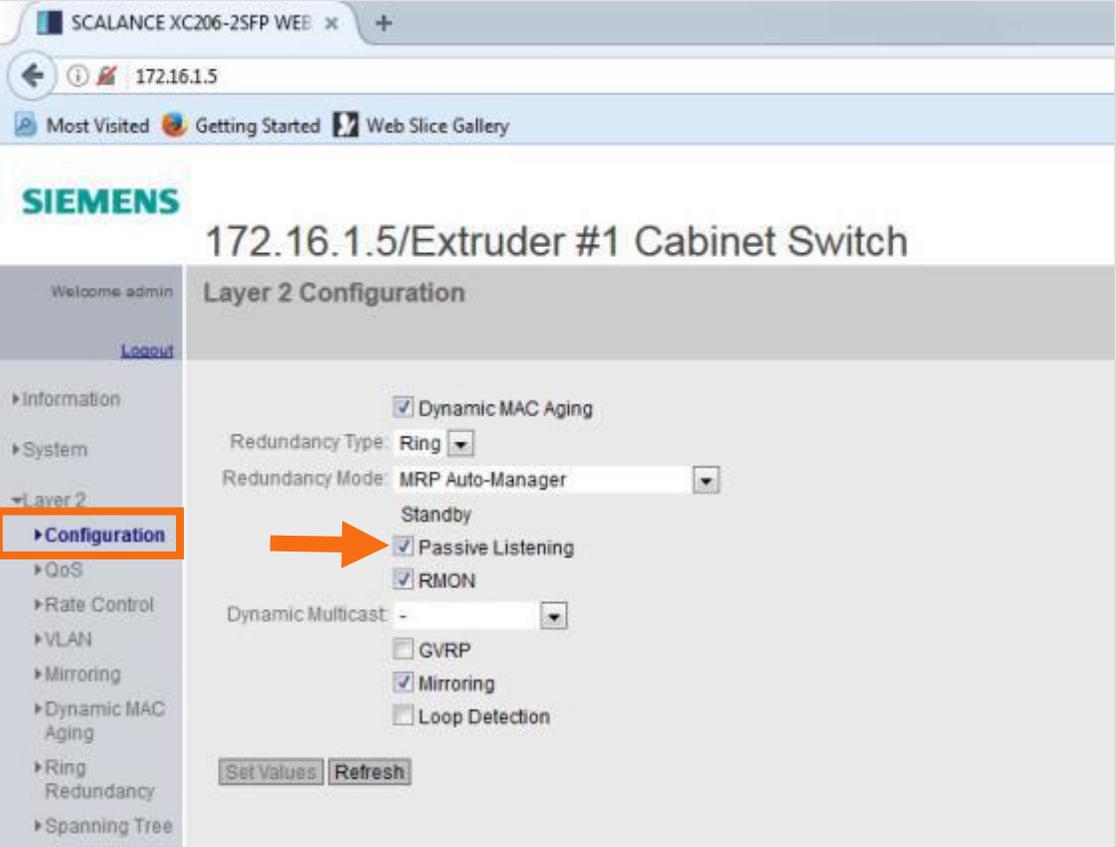


Higher availability due to redundant connection of meshed IT networks with Industrial Ethernet networks.
With expansion to achieve optimized reconfiguration if changes are made or errors occur.
Function: Passive listening

Passive Listening Parametrization

The passive listening function is activated by default in the "Layer 2 Configuration" menu.

All ring nodes in a ring coupled to an (R)STP must have Passive Listening activated



Summary

- Industrial grade network products offer significant advantages and overcome pitfalls and hidden costs of office grade products when applied in an industrial environment.
- The SCALANCE family of industrial grade network products offers a comprehensive portfolio to cover requirements from unmanaged L2 switches to managed L2/L3, as well as wireless WiFi and Cellular, security appliances, and cables and connectors.
- The built-in information and diagnostic features of the SCALANCE X family promote simple and efficient troubleshooting.
- In important differentiation between industrial network applications and office network applications is the requirement for reliable networks capable of withstanding failures. This is achieved by reliable devices, fault-tolerant systems, and network redundancy.
- With the growing demand for networks to be vertically integrated, the features and functionality of an industrial network should be capable of connecting to the office network without disruption to the time sensitive industrial network.

Thank you for
your
attention!

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