How do you configure a Virtual Local Area Network (VLAN) in PCS 7?

SIMATIC PCS 7

FAQ · January 2013

Service & Support

Answers for industry.
Question

How do you configure a Virtual Local Area Network (VLAN) in PCS 7?

Answer

Follow the descriptions, instructions and notes listed in this document for a detailed answer to the above question.
Using VLANs in PCS 7

Below we give you an overview of the use and structure of VLAN technology in the PCS 7 environment. There is also a description of the configuration of the devices in the network.

Note

There are restrictions on the use of VLANs in PCS 7. The implementation of a redundant connection via VLAN is not recommended, inter alia, for reasons of availability. This could lead to unexpected or unrequested behavior of the system.

What is a VLAN?

A Virtual Local Area Network (VLAN) is a logical subnetwork. This subnetwork can be assigned to a switch or be an entire physical network.
The subnetwork can extend beyond one or multiple switches. A VLAN divides physical networks into logical subnetworks. VLAN-compatible switches split up the frames (data packages) between the separate VLANs. The frames are not forwarded to another VLAN even though the subnetworks might be connected to common switches.

Figure 2

More information is available in the FAQ entry at:
When do you use VLANs in PCS 7?

The use of VLANs in the PCS 7 environment is limited to the applications below.

- **Combined plant and terminal bus**
  This architecture consists of just one physical Ethernet network that is used for both the plant bus and the terminal bus. VLAN separates these two network levels on a logical level. By using a common medium, the networks might influence one another. The separation of communication networks recommended for PCS 7 is achieved on a logical level.

- **VMware ESXi server in virtual infrastructures**
  In virtual infrastructures various PC stations (OS clients, for example) are virtualized together on one server. This means that not all the PC stations have to be physically present.

Which devices are needed for using VLANs?

VLAN-compatible switches are needed for using VLANs in the PCS 7 environment. The following switches from the Siemens network device family support port-based VLANs with tagged frames:

- SCALANCE X-300
- SCALANCE X-400
- SCALANCE X-500

When you configure the switch you define which VLAN is assigned to which port of the switch and therefore also the nodes connected to it. The port-specific VLAN tags serve as identification.

- A VLAN tag is added to a message (Ingress) when received on the switch from a terminal node.
- A VLAN tag is removed from a message (Egress) when sent from the switch to a terminal node.

In the case of communication between two switches (Trunk) the VLAN tags are not removed when leaving the switch. When received, the VLAN tags are retained in the partner switch which ensures that the VLANs remain separated. Tagged messages are always used in the switch.

More information is available in the FAQ entry at:
**How do you configure VLANs for use in PCS 7?**

The following configuration instructions show how to create two static VLANs for a terminal bus and a plant bus.

Refer to the following manual for more configuration parameters:

"SIMATIC NET Industrial Ethernet Switches SCALANCE X-300 SCALANCE X-400 Configuration Manual"


Proceed as follows for the configuration:

1. Define the criteria for creating at least two or more VLANs.
2. Assign the nodes to the separate VLANs.
3. Create a configuration list.
4. Assign the VLAN ID for each node and each switch.
5. Define to which device and at which port there is a connection.

Configure the switch as follows:

1. Define all the VLANs used on this device.
2. Define which VLAN is to be supported on which port.
3. Define how the messages are to be processed at the input and output sides of the port (ingress and egress filters).
4. Specify whether messages at the port are to be sent with or without tag.
Before configuring the VLANs you should make sure that the Web-based Management of the switch can be reached from each port during and after parameterization of the VLAN.

Open the "Web-based Management" and in the "Agent" menu you enable the "Accessible in all VLANs" function.

For switches that do not have this option make sure that at least one port of the switch is in the "Agent VLAN" or that the "Agent VLAN" is changed according to the port configuration.

**WARNING**  
If the parameters are set incorrectly, it is possible that the web interface and the configuration of the switch can no longer be called.
**Configuration**

Figure 6

The "Current VLAN Configuration" page shows the current VLAN configuration parameters of the port.

**Table 1**

<table>
<thead>
<tr>
<th>Abbreviations</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>–</td>
<td>The port is not a member of the specified VLAN.</td>
</tr>
<tr>
<td>M</td>
<td>Member: The port is member of the VLAN; sent messages receive a VLAN tag with the VID specified in the first column.</td>
</tr>
<tr>
<td>R</td>
<td>Registered: The port is member of the VLAN; registration was through a GVRP message.</td>
</tr>
<tr>
<td>U</td>
<td>Untagged: The port is member of the VLAN; sent messages do not receive a VLAN tag.</td>
</tr>
<tr>
<td>F</td>
<td>Forbidden: The port is not member of the VLAN and it is not possible for a VLAN to be registered dynamically at this port by means of GVRP.</td>
</tr>
</tbody>
</table>

In the case of a new definition all the ports are preset with the ID "–".

A switch that supports VLAN is parameterized by default on all ports with the VLAN ID "1" (default VLAN).

The VLAN-ID "500" is reserved and already configured for a future application.

All the ports on the switch send messages by default without a VLAN tag to ensure that the terminal nodes can receive the messages.

This basic setting is necessary because it is not sure whether a node can interpret tagged frames.
How do you configure a VLAN in PCS 7?

V 1.0, Entry ID: 66807297

Click the “New Entry” button or click an available configuration to assign ports to a VLAN. The “Static VLAN Configuration” page is displayed.

Create a new VLAN for the terminal bus. Define a unique VLAN ID of your choice (from area 2 – 4096. In the example: VLAN ID = 10). Now select the ports to be used for the terminal bus.

Set “U” for the ports to which terminal nodes are connected (Static Access Port).

Set “M” for ring ports or connection ports that lead to other switches (Trunk Port).

Note

If a VLAN is to communicate through the ring ports, the ring ports must be located in the VLAN. In the case of multiple VLANs the ring ports must be configured accordingly in each of the VLANs concerned.

Now create a new VLAN for the plant bus. Proceed exactly as for the configuration of terminal bus VLAN.

In our example we have selected the VLAN ID = “20” for the plant bus.
On the "Current VLAN Configuration" page you select the item "Default VLAN 1".
Set "–" for all the ports to be used for the terminal bus and the plant bus.
Set "U" for all the ports not used.
Set "M" for ring ports or connection ports that lead to other switches (Trunk Port).
The "Current VLAN Configuration" page shows the current VLAN configuration parameters of the ports for the terminal bus and the plant bus.

The overview shows which VLANs are created and at which ports messages of the corresponding VLANs are output (Egress Configuration).
In the next step we define the input behavior (Ingress behavior) of the switch for the VLANs concerned.

Figure 10

On the "VLAN Port Configuration" page all the ports have their associated Port IDs:
- The ports on the terminal bus have the Port VLAN ID of the terminal bus.
- The ports on the plant bus have the Port VLAN ID of the plant bus.
How do you configure a VLAN in PCS 7?

On the "VLAN Port Parameters" page all the ports are displayed with their configured Port VLAN IDs and the associated Ingress behavior. Untagged messages sent to the switch receive the relevant VLAN tag depending on the configured Ingress behavior.

The basic parameterization of the VLANs for the terminal bus and plant bus is completed. The networks are defined port specific and are separated logically. Direct communication between nodes of the plant bus and nodes of the terminal bus is not possible.