

Application Example: 2 Virtual Control Instances use VLAN and a CISCO switch and are connected to different fieldbus stacks (EN)

- - **1. Step: Install the Docker container on the IPC / Server / deploy two Instances of the CODESYS Virtual Control**
 - **Step 2: Setup VLAN - create bash file**
 - **Step 3: Transferring the VLAN interfaces in the CODESYS Deploy Control SL tool**
 - **4. Step: Configuration of the required ports of the Cisco switch**
 - **5. Step: Assigning fieldbus devices in the CODESYS application**

Hardware used:

Any IPC or Server with Debian based Linux OS

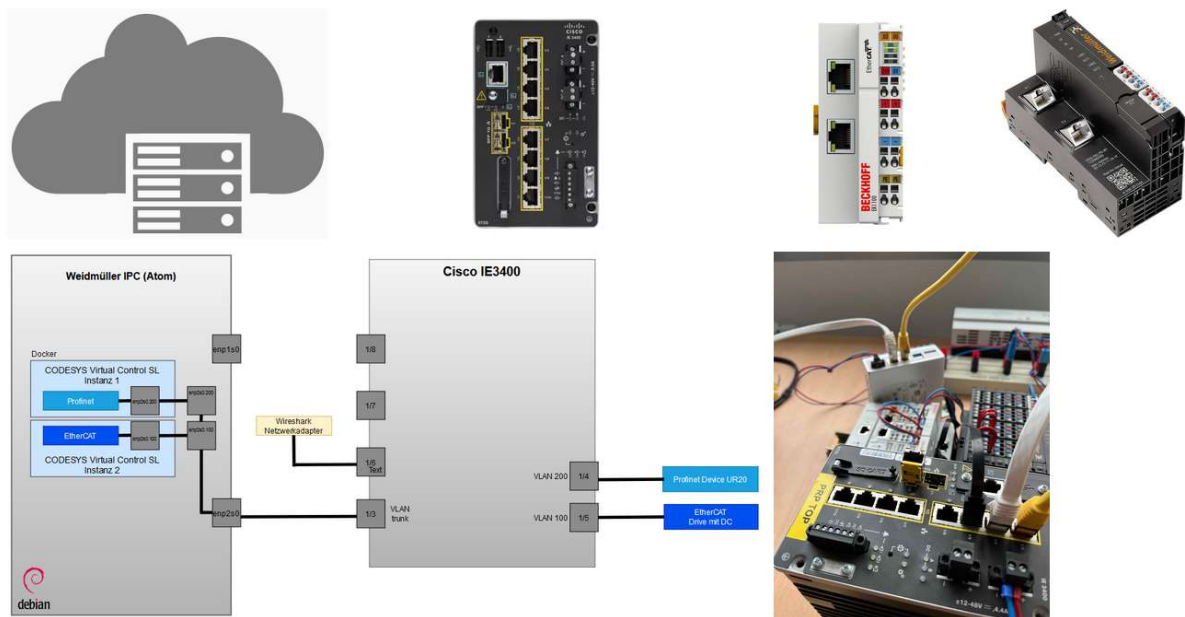
IE3400
Device

Beckhoff EtherCAT-Device

Cisco Switch

Weidmüller Feldbuss-

including RT_preempted kernel



Step 1: Install the Docker container on the IPC / Server / deploy two Instances of the CODESYS Virtual Control

https://content.helpme-codesys.com/en/CODESYS%20Control/_rtsl_virtual_control_sl_overview.html

Step 2: Setup VLAN - create bash file

- To use the virtual interfaces, two VLAN interfaces must be created in a bash file (extension .sh). One for Profinet and one for EtherCAT.

- Input for creating a bash file

```
sudo nano ConfigureVLANInterfaces.sh
```

```
# create VLAN Interfaces
```

```
# activate VLAN Option on Linux
```

```
sudo modprobe 8021q
```

```
# Activate physical Adapter
```

```
sudo ip link set up enp2s0
```

```
# EtherCAT VLAN Interface
```

```
sudo ip link add link enp2s0 name enp2s0.100 type vlan id 100
```

```
sudo ip addr add 192.168.0.200/24 dev enp2s0.100
```

```
sudo ip link set dev enp2s0.100 address 02:a0:04:d3:00:11
```

```
# Profinet VLAN Interface
```

```
sudo ip link add link enp2s0 name enp2s0.200 type vlan id 200
```

```
sudo ip addr add 192.168.179.90/24 dev enp2s0.200
```

```
# Acitvate links
```

```
sudo ip link set up enp2s0.100
```

```
sudo ip link set up enp2s0.200
```

- Then press Ctrl+O to hide and save
- Input to make the file executable

```
sudo chmod +x ConfigureVLANInterfaces.sh
```

```
sudo ./ConfigureVLANInterfaces.sh
```

check with 'ip a' the two new VLAN interfaces should now appear (enp2s0.100@enp2s0 and enp2s0.200@enp2s0):

```

weidmuelleratom@weidmuelleratom:~$ ip a
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default qlen 1000
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
    inet 127.0.0.1/8 scope host lo
        valid_lft forever preferred_lft forever
    inet6 ::1/128 scope host noprefixroute
        valid_lft forever preferred_lft forever
2: enpls0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc mq state UP group default qlen 1000
    link/ether 00:15:7e:03:0a:a2 brd ff:ff:ff:ff:ff:ff
    inet 192.168.99.5/21 brd 192.168.103.255 scope global dynamic noprefixroute enpls0
        valid_lft 604764sec preferred_lft 604764sec
    inet6 fe80::215:7eff:fe03:aa2/64 scope link noprefixroute
        valid_lft forever preferred_lft forever
3: enp2s0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc mq state UP group default qlen 1000
    link/ether 00:15:7e:03:0a:a3 brd ff:ff:ff:ff:ff:ff
    inet6 fe80::215:7eff:fe03:aa3/64 scope link
        valid_lft forever preferred_lft forever
4: docker0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc noqueue state UP group default
    link/ether 02:42:4e:f6:a1:71 brd ff:ff:ff:ff:ff:ff
    inet 172.17.0.1/16 brd 172.17.255.255 scope global docker0
        valid_lft forever preferred_lft forever
    inet6 fe80::42:4eff:fef6:a171/64 scope link
        valid_lft forever preferred_lft forever
6: veth79b5fcf@if5: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc noqueue master docker0 state UP group default
    link/ether 9a:3a:c8:6a:a6:db brd ff:ff:ff:ff:ff:ff link-netnsid 0
    inet6 fe80::983a:c8ff:fe6a:a6db/64 scope link
        valid_lft forever preferred_lft forever
7: enp2s0.100@enp2s0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc noqueue state UP group default qlen 1000
    link/ether 02:a0:04:d3:00:11 brd ff:ff:ff:ff:ff:ff
    inet 192.168.0.200/24 scope global enp2s0.100
        valid_lft forever preferred_lft forever
    inet6 fe80::a0:4ff:fed3:11/64 scope link
        valid_lft forever preferred_lft forever
8: enp2s0.200@enp2s0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc noqueue state UP group default qlen 1000
    link/ether 00:15:7e:03:0a:a3 brd ff:ff:ff:ff:ff:ff
    inet 192.168.179.90/24 scope global enp2s0.200
        valid_lft forever preferred_lft forever
    inet6 fe80::215:7eff:fe03:aa3/64 scope link
        valid_lft forever preferred_lft forever
weidmuelleratom@weidmuelleratom:~$

```

Step 3: Transferring the VLAN interfaces in the CODESYS Deploy Control SL tool

Profinet:

Configure Instance

Instance	
Autostart	False
Capabilities	cap_chown, cap_ipc_lock, cap_kill, cap_net_admin, cap_net_bin
Dependencies	
Genericcommands	
Hostname	vplcweidmueller
Image	codesyscontrol_virtuallinux:4.12.0.0-b.trunk.112
Ipc	
Licenseserver	192.168.99.5
Mounts	/var/opt/codesyscontrol/instances/vplcweidmueller/conf/codes
Network	
Nic	enp2s0.200/192.168.179.90/24
Ports	
Producttype	Runtime
Technology	Docker

Autostart
Whether the instance should start on system boot up or not.

```
! create VLAN Interfaces
# activate VLAN Option in Linux
sudo modprobe 8021q

# Activate physical Adapter
sudo ip link set up enp2s0

# EtherCAT VLAN Interface
sudo ip link add link enp2s0 name enp2s0.100 type vlan id 100
sudo ip addr add 192.168.0.200/24 dev enp2s0.100
sudo ip link set dev enp2s0.100 address 02:a0:04:d3:00:11

# Profinet VLAN Interface
sudo ip link add link enp2s0 name enp2s0.200 type vlan id 200
sudo ip addr add 192.168.179.90/24 dev enp2s0.200

# Acitvate links
sudo ip link set up enp2s0.100
sudo ip link set up enp2s0.200
```

OK Cancel

EtherCAT:

Configure Instance ✕

Instance

Autostart	False
Capabilities	cap_chown, cap_ipc_lock, cap_kill, cap_net_admin, cap_net_bin
Dependencies	
Genericcommands	
Hostname	vplcweidmueller_ethercat
Image	codesyscontrol_virtuallinux:4.12.0.0-b.trunk.112
Ipc	
Licenseserver	
Mounts	/var/opt/codesysvcontrol/instances/vplcweidmueller_ethercat/cc
Network	
Nic	enp2s0.100/192.168.0.200/24
Ports	
Producttype	Runtime
Technology	Docker

Autostart
Whether the instance should start on system boot up or not.

```
create VLAN Interfaces

# activate VLAN Option in Linux
sudo modprobe 8021q

# Activate physical Adapter
sudo ip link set up enp2s0

# EtherCAT VLAN Interface
sudo ip link add link enp2s0 name enp2s0.100 type vlan id 100
sudo ip addr add 192.168.0.200/24 dev enp2s0.100
sudo ip link set dev enp2s0.100 address 02:a0:04:d3:00:11

# Profinet VLAN Interface
sudo ip link add link enp2s0 name enp2s0.200 type vlan id 200
sudo ip addr add 192.168.179.90/24 dev enp2s0.200

# Activate links
sudo ip link set up enp2s0.100
sudo ip link set up enp2s0.200
```

4. Step: Configuration of the required ports of the Cisco switch

- First, VLAN100 and VLAN200 must be created under Configuration → Layer2 → VLAN

Configuration > Layer2 > VLAN

SVI **VLAN** VLAN Group

[+ Add](#) [- Delete](#)

VLAN ID	Name	Status	Ports
<input type="checkbox"/> 1	default	active	Gi1/1, Ap1/1
<input type="checkbox"/> 15	ProductionVLAN_debian5	active	
<input type="checkbox"/> 16	ProductionVLAN_debian6	active	
<input type="checkbox"/> 20	VLAN0020	active	Gi1/2, Gi1/6, Gi1/7, Gi1/8, Gi1/9, Gi1/10
<input type="checkbox"/> 100	VLAN0100	active	Gi1/5
<input type="checkbox"/> 200	VLAN0200	active	Gi1/4

1 - 6 of 6 items

- Profinet must be enabled and assigned to VLAN200

Administration > Industrial Protocols > PROFINET

Enable Profinet: **ENABLED**

VLAN:

- The Ethernet interfaces must then be configured under Configuration → Interface → Ethernet

Configuration > Interface > Ethernet

Multi Port Configuration

Name	Admin Status	Operational Status	IPv4 Address	IPv6 Address	Layer	Description
<input type="checkbox"/> GigabitEthernet1/1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	unassigned	Unassigned	L2/L3	
<input type="checkbox"/> GigabitEthernet1/2	<input checked="" type="checkbox"/>	<input type="checkbox"/>	unassigned	Unassigned	L2/L3	
<input type="checkbox"/> GigabitEthernet1/3	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	unassigned	Unassigned	L2/L3	trunk
<input type="checkbox"/> GigabitEthernet1/4	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	unassigned	Unassigned	L2/L3	Profinet
<input checked="" type="checkbox"/> GigabitEthernet1/5	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	unassigned	Unassigned	L2/L3	Ethercat
<input type="checkbox"/> GigabitEthernet1/6	<input checked="" type="checkbox"/>	<input type="checkbox"/>	unassigned	Unassigned	L2/L3	
<input type="checkbox"/> GigabitEthernet1/7	<input checked="" type="checkbox"/>	<input type="checkbox"/>	unassigned	Unassigned	L2/L3	
<input type="checkbox"/> GigabitEthernet1/8	<input checked="" type="checkbox"/>	<input type="checkbox"/>	unassigned	Unassigned	L2/L3	
<input type="checkbox"/> GigabitEthernet1/9	<input checked="" type="checkbox"/>	<input type="checkbox"/>	unassigned	Unassigned	L2/L3	
<input type="checkbox"/> GigabitEthernet1/10	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	unassigned	Unassigned	L2/L3	

1 - 10 of 11 items

- Configuration of a trunk port (Port Gig 1/3)

Configuration > Interface > Ethernet

Name	Admin Status	Operational Status	IPv4 Address	IPv6 Address
<input type="checkbox"/> GigabitEthernet1/1	🟢	🔴	unassigned	Unassigned
<input type="checkbox"/> GigabitEthernet1/2	🟢	🔴	unassigned	Unassigned
<input checked="" type="checkbox"/> GigabitEthernet1/3	🟢	🟢	unassigned	Unassigned
<input type="checkbox"/> GigabitEthernet1/4	🟢	🟢	unassigned	Unassigned
<input type="checkbox"/> GigabitEthernet1/5	🟢	🟢	unassigned	Unassigned
<input type="checkbox"/> GigabitEthernet1/6	🟢	🔴	unassigned	Unassigned
<input type="checkbox"/> GigabitEthernet1/7	🟢	🔴	unassigned	Unassigned
<input type="checkbox"/> GigabitEthernet1/8	🟢	🔴	unassigned	Unassigned
<input type="checkbox"/> GigabitEthernet1/9	🟢	🔴	unassigned	Unassigned
<input type="checkbox"/> GigabitEthernet1/10	🟢	🟢	unassigned	Unassigned

Configure Interface GigabitEthernet1/3

General Advanced

Interface: GigabitEthernet1/3

Description: (1-200 Characters)

Speed: auto
 10 100 1000

Duplex: auto

Admin Status: **UP** 🟢

Port Fast: trunk

Enable Layer 3 Address: DISABLED

Switchport Mode: trunk

Allowed VLAN: All VLAN IDs

Native VLAN:

- Configuration of a Profinet port (Port Gig 1/4)

Configuration > Interface > Ethernet

Name	Admin Status	Operational Status	IPv4 Address	IPv6 Address
<input type="checkbox"/> GigabitEthernet1/1	🟢	🔴	unassigned	Unassigned
<input type="checkbox"/> GigabitEthernet1/2	🟢	🔴	unassigned	Unassigned
<input type="checkbox"/> GigabitEthernet1/3	🟢	🟢	unassigned	Unassigned
<input checked="" type="checkbox"/> GigabitEthernet1/4	🟢	🟢	unassigned	Unassigned
<input type="checkbox"/> GigabitEthernet1/5	🟢	🟢	unassigned	Unassigned
<input type="checkbox"/> GigabitEthernet1/6	🟢	🔴	unassigned	Unassigned
<input type="checkbox"/> GigabitEthernet1/7	🟢	🔴	unassigned	Unassigned
<input type="checkbox"/> GigabitEthernet1/8	🟢	🔴	unassigned	Unassigned
<input type="checkbox"/> GigabitEthernet1/9	🟢	🔴	unassigned	Unassigned
<input type="checkbox"/> GigabitEthernet1/10	🟢	🟢	unassigned	Unassigned

Configure Interface GigabitEthernet1/4

General Advanced

Interface: GigabitEthernet1/4

Description: (1-200 Characters)

Speed: auto
 10 100 1000

Duplex: auto

Admin Status: **UP** 🟢

Port Fast: disable

Enable Layer 3 Address: DISABLED

Switchport Mode: dynamic auto

Access VLAN:

Allowed VLAN: All VLAN IDs

Native VLAN:

- Configuration of an EtherCAT port (Port Gig 1/5)

Configuration > Interface > Ethernet

Name	Admin Status	Operational Status	IPv4 Address	IPv6 Address
GigabitEthernet1/1	+	-	unassigned	Unassigned
GigabitEthernet1/2	+	-	unassigned	Unassigned
GigabitEthernet1/3	+	+	unassigned	Unassigned
GigabitEthernet1/4	+	+	unassigned	Unassigned
GigabitEthernet1/5	+	+	unassigned	Unassigned
GigabitEthernet1/6	+	-	unassigned	Unassigned
GigabitEthernet1/7	+	-	unassigned	Unassigned
GigabitEthernet1/8	+	-	unassigned	Unassigned
GigabitEthernet1/9	+	-	unassigned	Unassigned
GigabitEthernet1/10	+	+	unassigned	Unassigned

Configure Interface GigabitEthernet1/5

General Advanced

Interface GigabitEthernet1/5

Description EtherCAT (1-200 Characters)

Speed auto

10 100 1000

Duplex auto

Admin Status UP

Port Fast d'sable

Enable Layer 3 Address DISABLED

Switchport Mode dynamic auto

Access VLAN 100

Allowed VLAN All VLAN IDs

Native VLAN 20

5. Step: Assigning fieldbus devices in the CODESYS application

- for Profinet

Ethernet x

General

Ethernet Device I/O Mapping

Ethernet Device IEC Objects

Log

Status

Information

Network interface enp2s0.200 Browse...

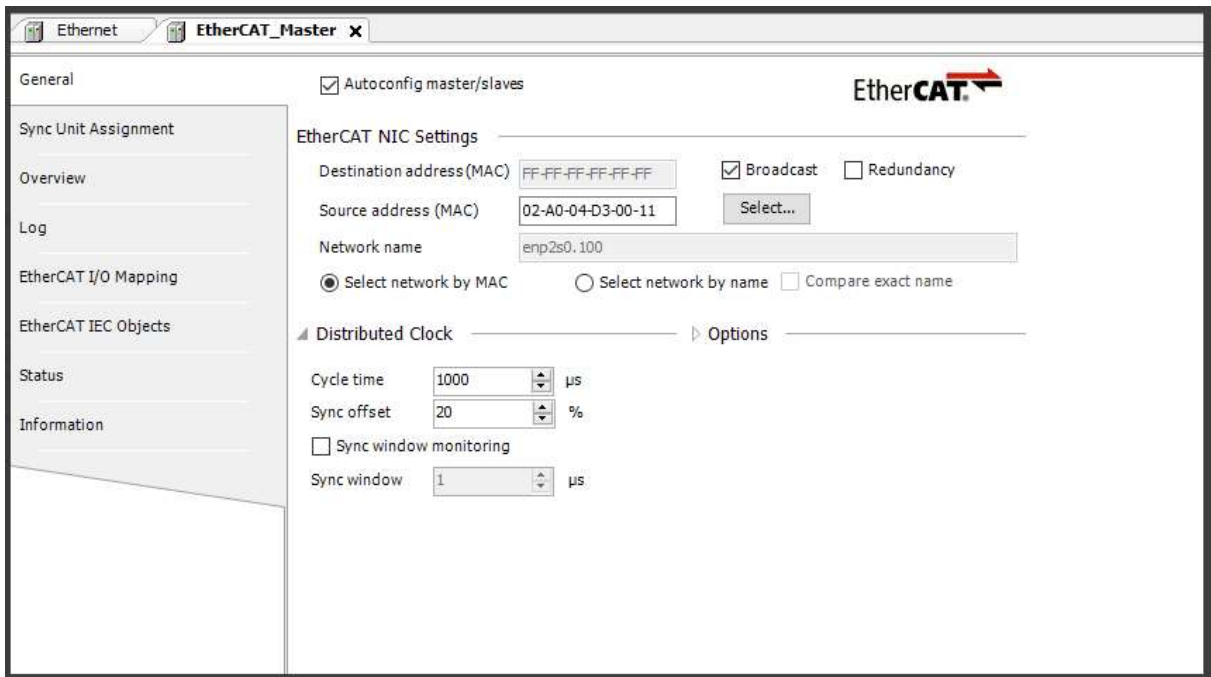
IP address 192 . 168 . 179 . 90

Subnet mask 255 . 255 . 255 . 0

Default gateway 0 . 0 . 0 . 0

Adjust operating system settings

- for EtherCAT



This is what the application should look like at the end after downloading and starting the application

