Grandstream Networks, Inc.

GWN78xx - Port QinQ Configuration Guide

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Overview

Port QinQ (also known as **Basic QinQ**, **Port-based QinQ**, or **IEEE 802.1ad QinQ**) is a Layer 2 tunneling technology that allows customer VLANs (CVLANs) to be transparently transported across a service provider or enterprise backbone by encapsulating them with an additional Service VLAN (SVLAN), also referred to as a provider VLAN.

Instead of replacing the customer's VLAN tag, a QinQ port adds a second tag to create a double-tagged Ethernet frame.

Simply put, frames entering a **QinQ port** carry **two VLAN tags**: the original inner Customer VLAN (CVLAN) tag and an outer Service VLAN (SVLAN) tag. The backbone forwards traffic by the outer tag, which prevents conflicts between customers that use the same CVLAN IDs.

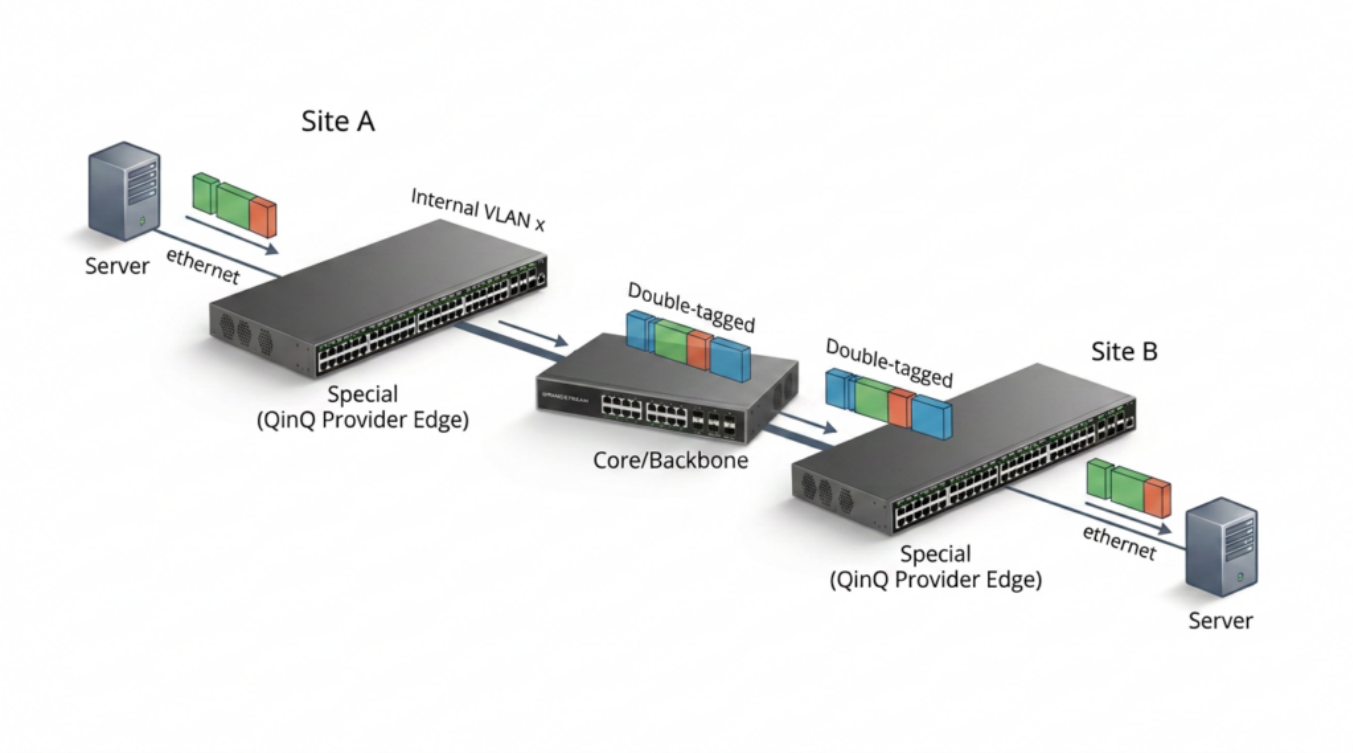
How Port QinQ Works

A QinQ port operates according to the IEEE 802.1ad standard.

The forwarding process is as follows:

1. A user device sends traffic containing its original customer VLAN (CVLAN).
2. The switch receives the traffic on a Tunnel (QinQ) port.
3. The switch automatically adds a predefined outer VLAN tag (SVLAN).
4. The double-tagged packet is forwarded across the backbone network.
5. The remote switch receives the packet.
6. Before forwarding traffic toward the destination network, the outer SVLAN tag is removed.
7. The original customer VLAN is preserved throughout the process.

This mechanism extends Layer 2 connectivity between geographically separated sites while conserving VLAN IDs in the backbone. Traffic keeps its original CVLAN from Site A to Site B, while the backbone uses the added SVLAN to transport and isolate it.



Port QinQ

Before You Begin

- Confirm that both switches support QinQ and use the same TPID across the QinQ path. The Web UI example in this guide uses TPID 0x8100.
- Create the required SVLANs on both switches and allow them on every backbone trunk between the sites.
- Ensure that customer traffic is already tagged with the intended CVLAN before it enters a QinQ tunnel port.
- Account for the additional 4-byte outer VLAN tag when validating the end-to-end MTU.

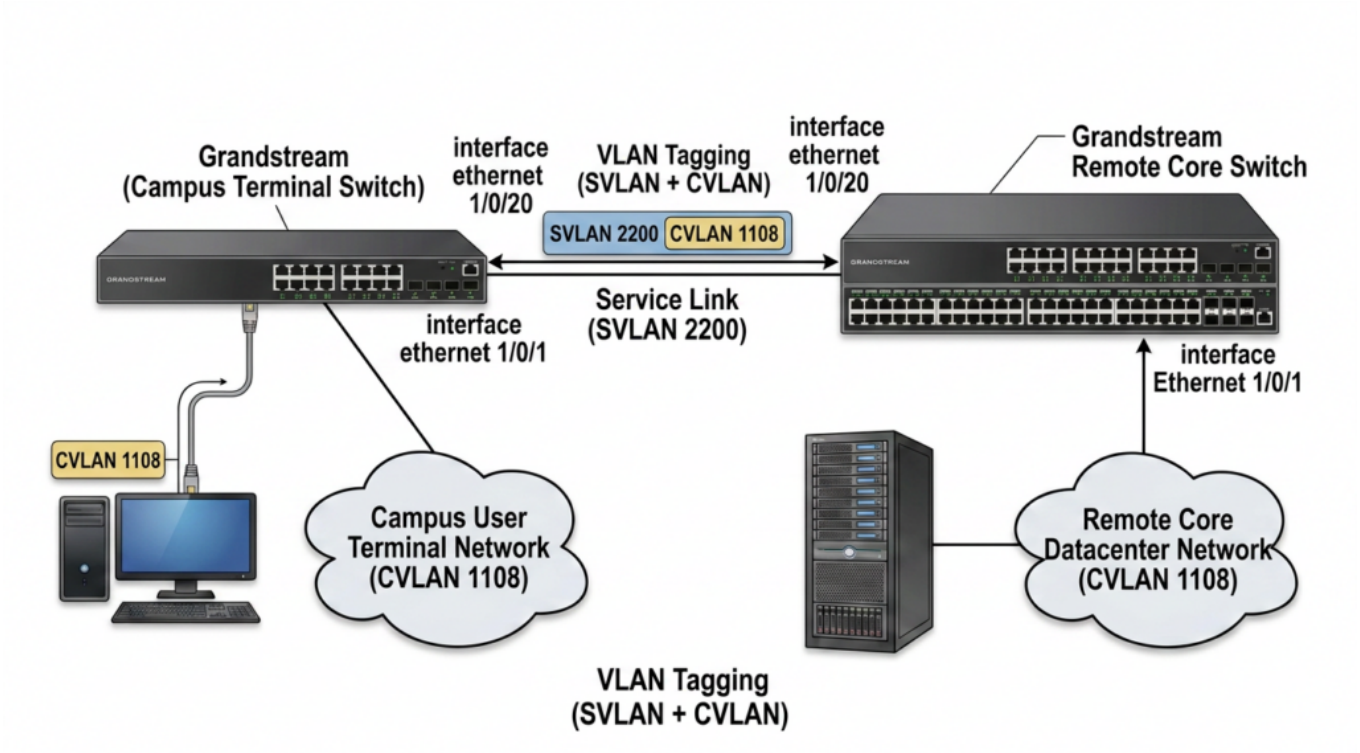
Configuration Example 1

Network Scenario

In this example:

- PC1 acts as a campus user terminal.
- The terminal must establish Layer 2 connectivity with a remote core switch.
- The terminal belongs to **Customer VLAN (CVLAN) 1108**.
- The backbone network uses **Service VLAN (SVLAN) 2200**.
- The objective is to minimize VLAN consumption within the backbone while maintaining transparent Layer 2 communication.

Network Topology



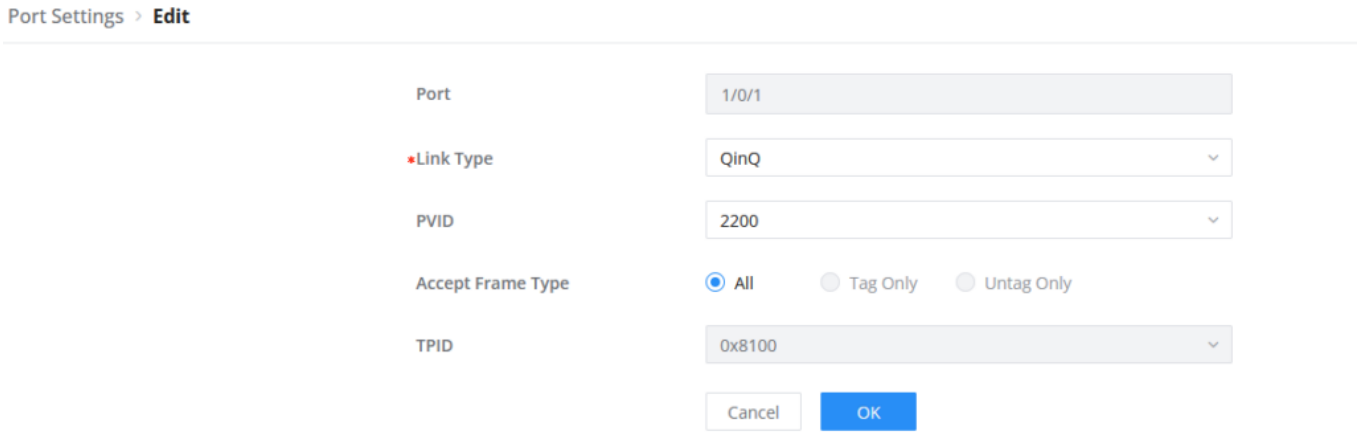
Configuration Strategy

Configure both switches so that the customer-facing ports add or remove the SVLAN and the backbone trunk carries that SVLAN between the sites.

Step 1 Configure the User Facing Tunnel Port

Configure the interface connected to the customer network as a Tunnel (QinQ) port.

When a frame carrying CVLAN 1108 enters this port, the switch adds outer SVLAN 2200.



Configure the User Facing Tunnel Port

Step 2 Configure the Backbone Trunk

Configure the interconnection interfaces between Device A and Device B as trunk ports. This will allow Service VLAN 2200 across the trunk so double-tagged traffic can traverse the backbone.

Step 3 Configure the Remote Tunnel Port

On Device B, configure the interface connected to the destination network as a QinQ port.

When traffic exits this interface, the switch removes the outer SVLAN tag and preserves the original CVLAN 1108 tag.

CLI Configuration

Throughout the remainder of this guide, the terms Tunnel Port and QinQ Port are used interchangeably. A Tunnel Port is simply a switch port with a Link Type configured as QinQ.

Configure Device A

```
DeviceA# configure
DeviceA(config)# vlan 2200
DeviceA(config-vlan)# exit
DeviceA(config)# interface Ethernet 1/0/1
DeviceA(config-if)# switchport mode tunnel
DeviceA(config-if)# switchport tunnel vlan 2200
DeviceA(config-if)# exit
DeviceA(config)# interface Ethernet 1/0/20
DeviceA(config-if)# switchport mode trunk
DeviceA(config-if)# switchport trunk allowed vlan add 2200
```

Ethernet 1/0/1 adds SVLAN 2200 to customer traffic, and trunk port Ethernet 1/0/20 carries SVLAN 2200 toward Device B.

Configure Device B

```
DeviceB# configure
DeviceB(config)# vlan 2200
DeviceB(config-vlan)# exit
DeviceB(config)# interface Ethernet 1/0/1
DeviceB(config-if)# switchport mode tunnel
DeviceB(config-if)# switchport tunnel vlan 2200
DeviceB(config-if)# exit
DeviceB(config)# interface Ethernet 1/0/20
DeviceB(config-if)# switchport mode trunk
DeviceB(config-if)# switchport trunk allowed vlan add 2200
```

Trunk port Ethernet 1/0/20 receives SVLAN 2200 from Device A. When traffic exits customer-facing port Ethernet 1/0/1, Device B removes the outer SVLAN and forwards the frame with its original CVLAN 1108 tag.

Verifying the Configuration

Verify the Tunnel Port Configuration

Run:

```
show running-config interfaces Ethernet 1/0/1
```

Expected output:

```
interface eth1/0/1
switchport mode tunnel
switchport tunnel vlan 2200
```

This confirms that the interface is operating in Tunnel mode and is using Service VLAN 2200.

Verify MAC Address Learning

Run the following command on Device A:

```
show mac address-table interfaces Ethernet 1/0/1
```

The MAC address of the connected user device should be learned under Service VLAN 2200.

Verify Cross Device MAC Learning

Run the following command on Device B:

```
show mac address-table interfaces Ethernet 1/0/1
```

The MAC address should also appear under Service VLAN 2200, confirming that the tagged traffic is traversing the backbone successfully.

Verify End to End Connectivity

Perform a ping test between the user terminal and the remote core switch.

Successful replies confirm transparent Layer 2 communication through the QinQ tunnel.

Configuration Example 2

Network Scenario for Example 2

In this example, Device A and Device B connect two independent customer networks that are geographically separated and interconnected through a shared backbone.

The backbone uses separate Service VLANs to transport traffic for each customer network.

- User Network A uses Customer VLANs 10-50.
- User Network B uses Customer VLANs 20-60.
- Service VLAN 100 is assigned to User Network A.
- Service VLAN 200 is assigned to User Network B.

The CVLAN ranges overlap from 20 through 50. This is intentional: the different outer SVLANs keep User Networks A and B isolated even when they use the same inner VLAN IDs.

This configuration allows:

- Communication between User Network A sites.
- Communication between User Network B sites.
- Complete isolation between User Network A and User Network B.

Configuration Procedure

Apply the following configuration on both Device A and Device B.

Step 1 Create the Service VLANs

```
Device# configure
Device(config)# vlan 100,200
Device(config-vlan)# exit
```

SVLAN 100 transports User Network A traffic, while SVLAN 200 transports User Network B traffic.

Step 2 Configure the Customer Facing Tunnel Ports

```
Device(config)# interface Ethernet 1/0/1
Device(config-if)# switchport mode tunnel
Device(config-if)# switchport tunnel vlan 100
Device(config-if)# exit
Device(config)# interface Ethernet 1/0/2
Device(config-if)# switchport mode tunnel
Device(config-if)# switchport tunnel vlan 200
```

- Ethernet 1/0/1 maps User Network A traffic to SVLAN 100.
- Ethernet 1/0/2 maps User Network B traffic to SVLAN 200.

Step 3 Configure the Backbone Trunk

```
Device(config)# interface Ethernet 1/0/3
Device(config-if)# switchport mode trunk
Device(config-if)# switchport trunk allowed vlan add 100,200
```

The trunk carries both SVLANs between the switches while keeping User Networks A and B isolated.

Verification

After completing the configuration, perform the following tests.

Test 1 User Network A Connectivity

Hosts within User Network A behind Device A should successfully communicate with hosts in the same VLAN behind Device B.

Expected Result

Communication succeeds.

Test 2 User Network B Connectivity

Hosts within User Network B behind Device A should successfully communicate with hosts in the same VLAN behind Device B.

Expected Result

Communication succeeds.

Test 3 Network Isolation

Use an overlapping CVLAN ID, such as VLAN 20, to test between User Network A and User Network B. The hosts should **not** communicate because the traffic is separated by SVLAN 100 and SVLAN 200.

Expected Result

Communication fails.

This confirms that the Service VLANs maintain isolation between the two customer networks.

Configuration Summary

Configuration Element	Example 1	Example 2
Customer VLAN (CVLAN)	1108	VLANs 10-50 and 20-60
Service VLAN (SVLAN)	2200	VLAN 100 and VLAN 200
Tunnel Ports	Ethernet 1/0/1	Ethernet 1/0/1 and Ethernet 1/0/2

Backbone Trunk	Ethernet 1/0/20	Ethernet 1/0/3
Verification	Running configuration, MAC learning, Ping	Connectivity and isolation tests

Supported Devices

Device Name	Supported	Firmware Required
GWN7801	Yes	1.0.3.19 or higher
GWN7801P	Yes	1.0.3.19 or higher
GWN7802	Yes	1.0.3.19 or higher
GWN7802P	Yes	1.0.3.19 or higher
GWN7803	Yes	1.0.3.19 or higher
GWN7803P	Yes	1.0.3.19 or higher
GWN7811	Yes	1.0.1.8 or higher
GWN7811P	Yes	1.0.1.8 or higher
GWN7812P	Yes	1.0.1.8 or higher
GWN7813	Yes	1.0.1.8 or higher
GWN7813P	Yes	1.0.1.8 or higher
GWN7806	Yes	1.0.1.14 or higher
GWN7806P	Yes	1.0.1.14 or higher
GWN7816	Yes	1.0.3.8 or higher
GWN7816P	Yes	1.0.3.8 or higher
GWN7830	Yes	1.0.3.3 or higher
GWN7831	Yes	1.0.3.3 or higher
GWN7832	Yes	1.0.3.3 or higher
GWN7801P Pro	Yes	1.0.15.211 or higher
GWN7802P Pro	Yes	1.0.15.211 or higher
GWN7803 Pro	Yes	1.0.15.211 or higher
GWN7803PL Pro	Yes	1.0.15.211 or higher
GWN7803PH Pro	Yes	1.0.15.211 or higher
GWN7806PL Pro	Yes	1.0.15.211 or higher
GWN7806PH Pro	Yes	1.0.15.211 or higher