802.1Q Tunneling (Q-in-Q) Configuration Example

Detail Configuration for Cisco Q-in-Q in Cisco Devices

Haydar Fadel
July-2016

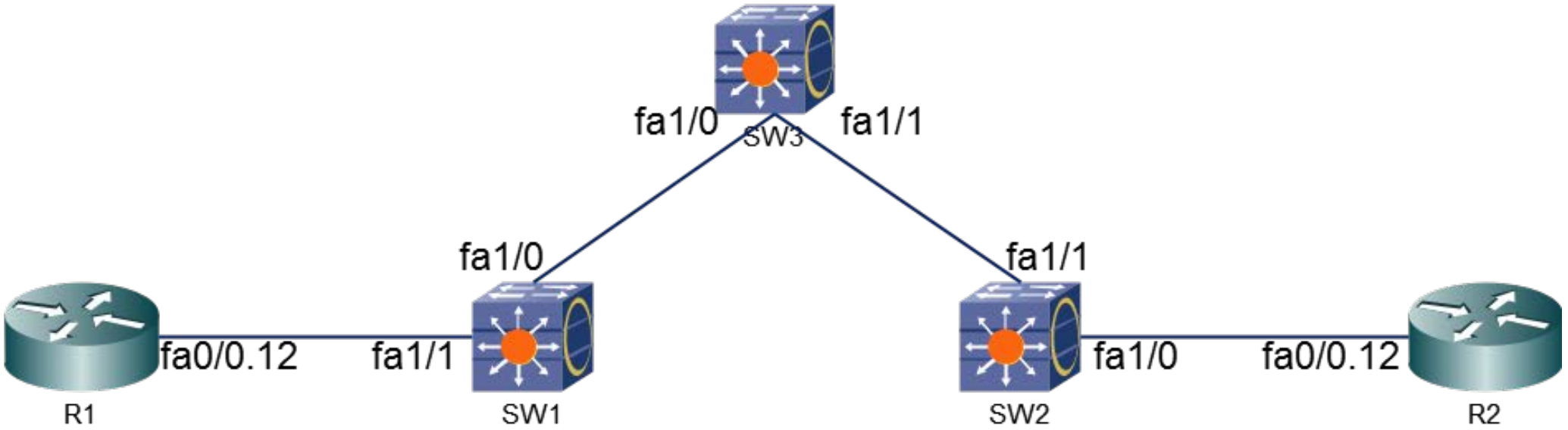
Introduction to Q-in-Q Principle

- 802.1Q tunneling (aka Q-in-Q) is a technique often used by Metro Ethernet providers as a layer 2 VPN for customers.
- 802.1Q (or dot1q) tunneling is pretty simple…the provider will put a 802.1Q tag on all the frames that it receives from a customer with a unique VLAN tag.
- By using a different VLAN tag for each customer we can separate the traffic from different customers and also transparently transfer it throughout the service provider network.

Introduction to Q-in-Q Principle

- One of the advantages of this solution is that it's easy to implement, you don't need exotic hardware and we don't have to run any routing protocols between the service provider and customer (unlike MPLS VPN).
- From the customer's perspective, it's just like their sites are directly connected on layer 2.

Q-in-Q Configuration



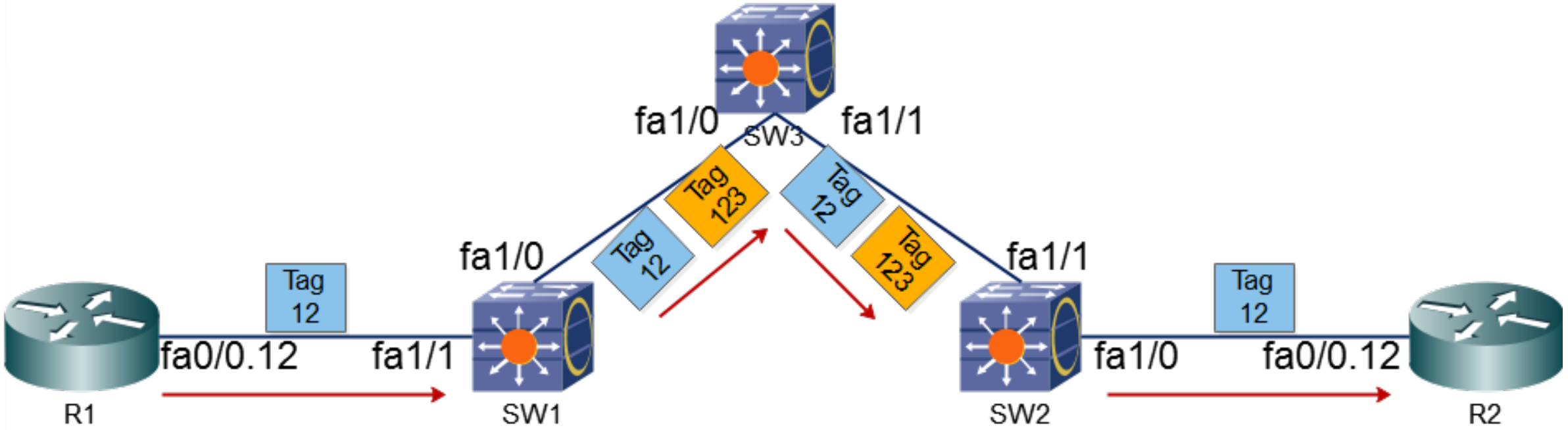
Q-in-Q Configuration

- In the previous diagram you see two routers called **R1** and **R2**, imagine these routers are the customer sites that we want to connect through the service provider network which consists of **SW1**, **SW2** and **SW3**.
- Our customer wants to use **VLAN 12** between the two sites and expects our service provider to transport this from one site to another.

Q-in-Q Configuration

- In our example our customer will be using **VLAN 12** for traffic between their sites.
- The service provider has decided to use **VLAN 123** to transport everything for this customer.
- Basically this is what will happen when we send frames between **R1** and **R2**:

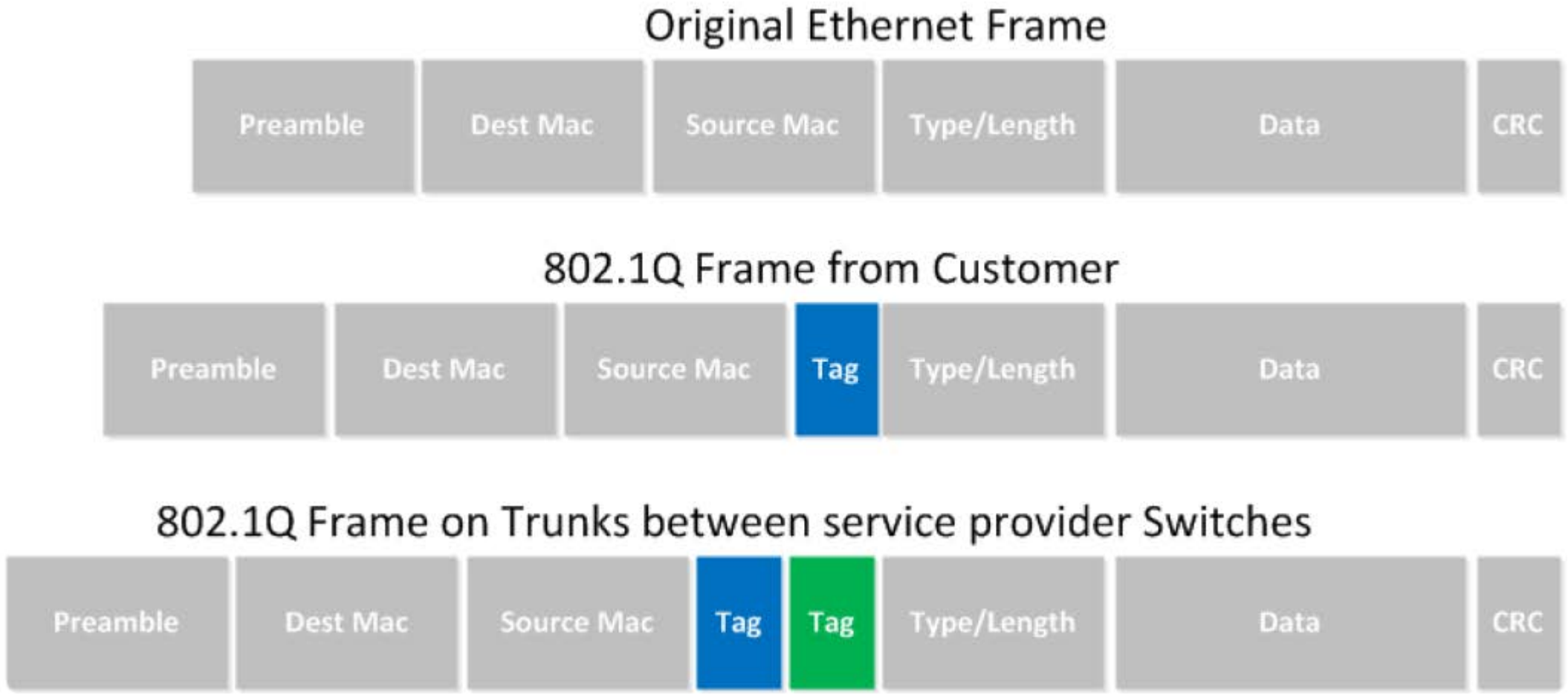
Q-in-Q Configuration



Q-in-Q Configuration

- Whenever **R1** sends traffic it will tag its frames for **VLAN 12**.
- Once it arrives at the service provider, SW1 will add an additional VLAN tag **(123).**
- Once **SW2** forwards the frame towards **R2** it will remove the second VLAN tag and forwards the original tagged frame from **R1**.

Q-in-Q Configuration



Q-in-Q Configuration Customer Side

```
R1(config)#interface fastEthernet 0/0
R1(config-if)#no shutdown
R1(config-if)#exit
R1(config)#interface fastEthernet 0/0.12
R1(config-subif)#encapsulation dot1Q 12
R1(config-subif)#ip address 192.168.12.1 255.255.255.0
R1(config-subif)#no shutdown
```

```
R2(config)#interface fastEthernet 0/0
R2(config-if)#no shutdown
R2(config-if)#exit
R2(config)#interface fastEthernet 0/0.12
R2(config-subif)#encapsulation dot1Q 12
R2(config-subif)#ip address 192.168.12.2 255.255.255.0
R2(config-subif)#no shutdown
```

R1 and R2 are both configured with sub-interfaces and use subnet 192.168.12.0 /24. All their frames are tagged as **VLAN 12**.

Q-in-Q Configuration Service Provider Side

- On the service provider network we'll have to configure a number of items.
- First I will configure 802.1Q trunks between **SW1 – SW3** and **SW2 - SW3**:

```
SW1(config)#interface fastEthernet 1/0
SW1(config-if)#switchport mode trunk
SW1(config-if)#switchport trunk encapsulation dot1q

SW2(config)#interface fastEthernet 1/1
SW2(config-if)#switchport trunk encapsulation dot1q
SW2(config-if)#switchport mode trunk

SW3(config)#interface fastEthernet 1/0
SW3(config-if)#switchport trunk encapsulation dot1q
SW3(config-if)#switchport mode trunk
SW3(config-if)#exit
SW3(config)#interface fastEthernet 1/1
SW3(config-if)#switchport trunk encapsulation dot1q
SW3(config-if)#switchport mode trunk
```

Q-in-Q Configuration Service Provider Side

- The next part is where we configure the actual “Q-in-Q” tunneling.
- The service provider will use VLAN 123 to transfer everything from our customer.
- We’ll configure the interfaces towards the customer routers to tag everything for VLAN 123:

```
SW1(confg)#interface fastEthernet 0/1
SW1(confg-if)#switchport access vlan 123
SW1(confg-if)#switchport mode dot1q-tunnel

SW2(confg)#interface fastEthernet 0/2
SW2(confg-if)#switchport access vlan 123
SW2(confg-if)#switchport mode dot1q-tunnel
```

Q-in-Q Configuration Service Provider Side

- The **switchport mode dot1q-tunnel** command tells the switch to tag the traffic and switchport access vlan command is required to specify the **Q-in-Q VLAN of 123**.
- Make sure that VLAN 123 is available on SW1, SW2 and SW3.
- By assigning the interfaces above to this VLAN it was automatically created on SW1 and SW2 but I also have to make sure that:
- SW3 has VLAN 123 in its database

Q-in-Q Verification

- Everything is now in place, let's do a quick test to see if R1 and R2 can reach each other:

```
R1#ping 192.168.12.2

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.12.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 28/30/32 ms


R2#ping 192.168.12.1

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.12.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 20/29/32 ms
```

Q-in-Q Verification

- Great! Our ping is working! Let's take a look at some commands to verify our work:

```
SW1#show dot1q-tunnel
dot1q-tunnel mode LAN Port(s)
------------------------------
Fa1/1

SW2#show dot1q-tunnel
dot1q-tunnel mode LAN Port(s)
------------------------------
Fa1/0
```

Q-in-Q Verification

- The **show dot1q-tunnel command** doesn't give me a lot of information.
- The only thing we see are the interfaces that are configured for dot1q tunneling.
- A good way to prove that the service provider switches are really tunneling the frames from the customer is by looking at the trunks between SW1, SW2 and SW3:

Q-in-Q Verification

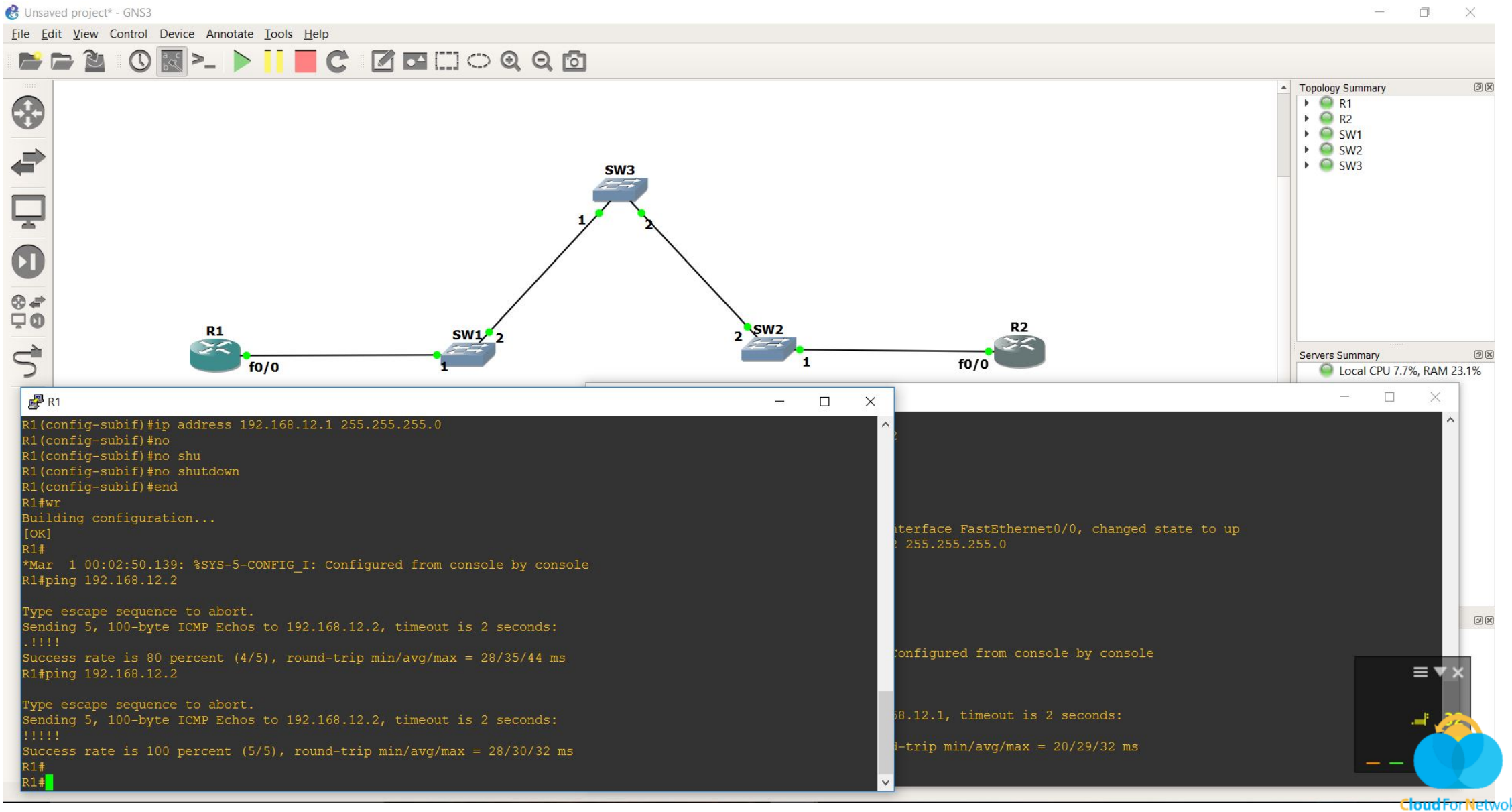
```
SW1#show interfaces fa0/19 trunk
Port Mode Encapsulation Status
Port Vlans allowed and active in management domain
Fa1/0 1,123
Port Vlans in spanning tree forwarding state and not pruned
Fa1/0 1,123

SW2#show interfaces fa0/19 trunk
Port Mode Encapsulation Status
Port Vlans allowed and active in management domain
Fa1/1 1,123
Port Vlans in spanning tree forwarding state and not pruned
Fa1/1 1,123
```

Q-in-Q Verification

```
SW3#show interfaces trunk
Port Mode Encapsulation Status
Port Vlans allowed and active in management domain
Fa1/0 1,123
Fa1/1 1,123
```

- As you can see above the only VLAN that is active (besides VLAN 1) on these trunk links is VLAN 123.
- You won’t see VLAN 12 here because that’s the customer traffic and it’s encapsulated with VLAN 123.

Behind the Scenes



The End
Thank You

References :
https://networklessons.com/switching/802-1q-tunneling-q-q-configuration-example/

CloudForNetwok