



# APPENDIX **A**

## Sample Configlets

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This appendix provides sample configlets for L2VPN and Metro Ethernet service provisioning in ISC. It contains the following sections:

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## Overview

The configlets provided in this appendix show the CLIs generated by ISC for particular services and features. Each configlet example provides the following information:

- Service
- Feature
- Devices configuration (network role, hardware platform, relationship of the devices and other relevant information)
- Sample configlets for each device in the configuration
- Comments




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**Note**

The configlets generated by ISC are only the delta between what needs to be provisioned and what currently exists on the device. This means that if a relevant CLI is already on the device, it does not show up in the associated configlet.

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**Note**

The CLIs shown in bold are the most relevant commands.

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**Note**

All examples in this appendix assume an MPLS core.

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## ERS (EVPL) (Point-to-Point)

### Configuration

- Service: L2VPN/Metro Ethernet.
- Feature: ERS (EVPL) (point-to-point).
- Device configuration:
  - The N-PE is a Cisco 7600 with IOS 12.2(18)SXF, Sup720-3BXL.  
Interface(s): FA8/17.
  - The U-PE is a Cisco 3750ME with 12.2(25)EY1, no port security.  
Interface(s): FA1/0/4 – FA1/0/23.
  - L2VPN point-to-point.

### Configlets

UP-E	N-PE
<pre> vlan 772 exit ! interface FastEthernet1/0/23 switchport trunk allowed vlan 500,772 ! interface FastEthernet1/0/4 no cdp enable no keepalive no ip address switchport trunk allowed vlan 500,772 spanning-tree bpdudfilter enable mac access-group ISC-FastEthernet1/0/4 in ! mac access-list extended ISC-FastEthernet1/0/4 deny any host 0100.0ccc.cccc deny any host 0100.0ccc.cccd deny any host 0100.0ccd.cdd0 deny any host 0180.c200.0000 permit any any           </pre>	<pre> vlan 772 exit ! interface FastEthernet8/17 switchport trunk allowed vlan 1,451,653,659,766-768,772,878 ! interface Vlan772 no ip address description L2VPN ERS xconnect 99.99.8.99 89027 encapsulation mpls no shutdown           </pre>

### Comments

- The N-PE is a 7600 with an OSM or SIP-600 module.
- The U-PE is a generic Metro Ethernet (ME) switch. Customer BPDUs are blocked by the PACL.

## ERS (EVPL) (Point-to-Point, UNI Port Security)

### Configuration

- Service: L2VPN/Metro Ethernet.
- Feature: ERS (EVPL) (point-to-point) with UNI port security.
- Device configuration:
  - The N-PE is a Cisco 7600 with IOS 12.2(18)SXF, OSM.  
Interface(s): FA2/18.
  - The U-PE is a Cisco 3550 with IOS 12.2(25)SEC2. Port security is enabled.  
Interface(s): FA3/31– FA3/23.
  - L2VPN point-to-point.

### Configlets

UP-E	N-PE
<pre> vlan 788 exit ! interface FastEthernet3/23 no ip address switchport trunk allowed vlan 783,787-788 ! interface FastEthernet3/31 no cdp enable no keepalive no ip address switchport switchport trunk encapsulation dot1q switchport mode trunk switchport trunk allowed vlan none switchport trunk allowed vlan 788 <b>switchport port-security</b> <b>switchport nonegotiate</b> <b>switchport port-security maximum 45</b> <b>switchport port-security aging time 34</b> <b>switchport port-security violation shutdown</b> <b>switchport port-security mac-address</b> <b>3456.3456.5678</b> spanning-tree bpdupfilter enable mac access-group ISC-FastEthernet3/31 in ! mac access-list extended ISC-FastEthernet3/31 deny any host 0100.0ccc.cccc deny any host 0100.0ccc.cccd deny any host 0100.0ccd.cdd0 deny any host 0180.c200.0000 <b>deny any host 1234.3234.3432</b> permit any any           </pre>	<pre> vlan 788 exit ! interface FastEthernet2/18 switchport trunk allowed vlan 350,351,430,630,777,780,783,785-788 ! interface Vlan788 no ip address description L2VPN ERS with UNI port security xconnect 99.99.5.99 89028 encapsulation mpls no shutdown           </pre>

### Comments

- The N-PE is a 7600 with an OSM or SIP-600 module.
- The U-PE is a generic Metro Ethernet (ME) switch. The customer BPDUs are blocked by the PAACL.

- Various UNI port security commands are provisioned.
- A user-defined PACL entry is added to the default PACL.

## ERS (EVPL) (1:1 VLAN Translation)

### Configuration

- Service: L2VPN/Metro Ethernet.
- Feature: ERS (EVPL) with 1:1 VLAN translation.
- Device configuration:
  - The N-PE is a Cisco 7600 with IOS 12.2(18)SXF, Sup720-3BXL  
Interface(s): FA8/34.
  - The U-PE is a Cisco 3750ME with IOS 12.2(25)EY1. VLAN translation on the NNI port (uplink).  
Interface(s): FA1/0/8 – GI1/1/1.
  - L2VPN point-to-point.

### Configlets

UP-E	N-PE
<pre> ! vlan 123 exit ! interface FastEthernet1/0/8 no cdp enable no keepalive no ip address switchport trunk allowed vlan 123 switchport nonegotiate switchport port-security maximum 34 switchport port-security aging time 23 switchport port-security violation protect switchport port-security spanning-tree bpduguard enable mac access-group ISC-FastEthernet1/0/8 in ! interface GigabitEthernet1/1/1 no ip address switchport mode trunk switchport trunk allowed vlan 1,123 switchport vlan mapping 123 778           </pre>	<pre> vlan 778 exit ! interface FastEthernet8/34 switchport switchport trunk encapsulation dot1q switchport mode trunk switchport trunk allowed vlan 1,778 ! interface Vlan778 no ip address description L2VPN ERS 1 to 1 vlan translation xconnect 99.99.8.99 89032 encapsulation mpls no shutdown           </pre>

### Comments

- VLAN translation is only for L2VPN (point-to-point) ERS (EVPL).
- In this case, the 1:1 VLAN translation occurs on the U-PE, a 3750. It is provisioned on the NNI (uplink) port.
- The customer VLAN 123 is translated to the provider VLAN 778.

## ERS (EVPL) (2:1 VLAN Translation)

### Configuration

- Service: L2VPN/Metro Ethernet.
- Feature: ERS (EVPL) with VLAN 2:1 translation. Device configuration:
  - The N-PE is a Cisco 7600 with IOS 12.2(18)SXF, Sup720-3BXL  
Interface(s): FA8/34.
  - The U-PE is a Cisco 3750ME with IOS 12.2(25)EY1. VLAN translation on the NNI port (uplink).  
Interface(s): FA1/0/5 – GI1/1/1.
  - L2VPN point-to-point.

### Configlets

UP-E	N-PE
<pre> <b>vlan 567</b> exit ! interface FastEthernet1/0/5 no cdp enable no keepalive no ip address switchport <b>switchport access vlan 567</b> <b>switchport mode dot1q-tunnel</b> switchport trunk allowed vlan none switchport nonegotiate spanning-tree bpdupfilter enable mac access-group ISC-FastEthernet1/0/5 in ! interface GigabitEthernet1/1/1 no ip address switchport trunk allowed vlan 1,123,567 <b>switchport vlan mapping dot1q-tunnel 567</b> <b>234 779</b> ! mac access-list extended ISC-FastEthernet1/0/5 deny any host 0100.0ccc.cccc deny any host 0100.0ccc.cccd deny any host 0100.0ccd.cdd0 deny any host 0180.c200.0000 permit any any           </pre>	<pre> vlan 779 exit ! interface FastEthernet8/34 switchport trunk allowed vlan 1,778-779 ! interface Vlan779 no ip address description L2VPN ERS 2 to 1 vlan translation xconnect 99.99.8.99 89033 encapsulation mpls no shutdown           </pre>

### Comments

- VLAN translation is only for L2VPN (point-to-point) ERS (EVPL).
- In this case, the 2:1 VLAN translation occurs on the U-PE, a 3750. It is provisioned on the NNI (uplink) port.
- The customer VLAN 123 and the provider VLAN 234 (as part of Q -in-Q) are translated to a new provider VLAN 779.

# ERS (Pseudowire Class, E-Line, L2VPN Group Name, IOS XR Device)

## Configuration

- Service: L2VPN/Metro Ethernet.
- Feature: ERS (EVPL).
- Device configuration:
  - The N-PE is a CRS-1 with IOS XR 3.6.1 or later.
  - UNI on N-PE.
  - UNI on U-PE.

## Configlets

UP-E	N-PE
<pre> ! vlan 700 exit ! interface FastEthernet1/0/2  switchport trunk encapsulation dot1q  switchport trunk allowed vlan 700  switchport mode trunk  switchport nonegotiate  no keepalive  mac access-group ISC-FastEthernet1/0/2 in  no cdp enable  spanning-tree bpdufilter enable ! ! interface GigabitEthernet1/0/1  switchport trunk encapsulation dot1q  switchport trunk allowed vlan 700  switchport mode trunk  keepalive 10 ! ! mac access-list extended ISC-FastEthernet1/0/2 deny any host 0100.0ccc.cccc deny any host 0100.0ccc.cccd deny any host 0100.0ccd.cdd0 deny any host 0180.c200.0000 permit any any ! </pre>	<pre> ! interface GigabitEthernet0/3/1/1.700  l2transport  dot1q vlan 700 ! ! <b>l2vpn</b> <b>pw-class PW_AD3-AD7_Customer1</b>   encapsulation mpls   transport-mode vlan   preferred-path interface tunnel-te 1370 <b>fallback disable</b> ! ! <b>xconnect group L2VPN_Customer1-Gold_class</b>   <b>p2p GoldPkg_AD3-AD7_Customer1</b>     interface GigabitEthernet0/3/1/1.700       neighbor 192.169.105.30 pw-id 1000       <b>pw-class PW_AD3-AD7_Customer1</b> ! ! </pre>

## Comments

- The N-PE is a CRS-1 with IOS XR 3.7.
- The pseudowire class feature is configured with various associated attributes like encapsulation, transport mode, preferred-path, and fallback option.
- The disable fallback option is required for IOS XR 3.6.1 and optional for IOS XR 3.7 and later.
- The E-Line name (**p2p** command) and L2VPN Group Name (**xconnect group** command) is user configured.

# ERS (EVPL) (NBI Enhancements for L2VPN, IOS Device)

## Configuration

- Service: L2VPN/Metro Ethernet.
- Feature: ERS (EVPL).
- Device configuration:
  - The N-PE is a 12.2(18)SXF with IOS.
  - The U-PE is a 12.2(25)EY4with IOS.
  - UNI on N-PE.
  - UNI on U-PE.

## Configlets

UP-E	N-PE
<pre> ! vlan 3200 exit ! interface FastEthernet1/0/2 no cdp enable no ip address duplex auto switchport switchport trunk encapsulation dot1q switchport mode trunk switchport trunk allowed vlan none switchport trunk allowed vlan 3200 switchport nonegotiate switchport port-security aging type inactivity switchport port-security maximum 100 switchport port-security aging time 1000 switchport port-security violation protect switchport port-security <b>storm-control unicast level 1.0</b> <b>storm-control broadcast level 50.0</b> <b>storm-control multicast level 50.0</b> shutdown <b>keepalive</b> spanning-tree bpdupfilter enable  ! interface GigabitEthernet1/0/1 no ip address switchport switchport trunk encapsulation dot1q switchport mode trunk switchport trunk allowed vlan 3200 ! </pre>	<pre> ! vlan 3300 exit ! interface FastEthernet1/0/24 no cdp enable no ip address duplex auto switchport switchport trunk encapsulation dot1q switchport mode trunk switchport trunk allowed vlan none switchport trunk allowed vlan 3300 switchport nonegotiate switchport port-security aging type inactivity switchport port-security maximum 100 switchport port-security aging time 1000 switchport port-security violation protect switchport port-security <b>storm-control unicast level 1.0</b> <b>storm-control broadcast level 50.0</b> <b>storm-control multicast level 50.0</b> shutdown keepalive spanning-tree bpdupfilter enable  ! <b>interface Vlan3300</b> no ip address xconnect 192.169.105.40 7502 encapsulation mpls no shutdown ! </pre>

## Comments

None.

## ERS (EVPL) or EWS (EPL) (IOS XR Device)

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### Configuration

- Service: L2VPN/Metro Ethernet.
- Feature: ERS (EVPL) or EWS (EPL).
- Device configuration(s):
  - The N-PE is a CRS-1 with IOS XR 3.4.2.
  - UNI on N-PE. ERS (EVPL) only.
  - U-PE. EWS (EPL) or ERS (EVPL).

**Configlets****N-PE**

```

<?xml version="1.0" encoding="UTF-8"?>
<Request MajorVersion="1" MinorVersion="0">
  <Set>
    <Configuration Source="CurrentConfig">
      <InterfaceConfigurationTable>
        <InterfaceConfiguration>
          <Naming>
            <Name>GigabitEthernet0/0/0/1.302</Name>
            <Active>act</Active>
          </Naming>
          <InterfaceModeNonPhysical>L2Transport</InterfaceModeNonPhysical>
        </InterfaceConfiguration>
      </InterfaceConfigurationTable>
      <L2VPN>
        <Enabled>true</Enabled>
        <XConnectGroupTable>
          <XConnectGroup>
            <Naming>
              <Name>VPNSC</Name>
            </Naming>
            <Enabled>true</Enabled>
            <P2PXConnectTable>
              <P2PXConnect>
                <Naming>
                  <Name>GigabitEthernet0_0_0_1.302</Name>
                </Naming>
                <Enabled>true</Enabled>
                <AttachmentCircuitTable>
                  <AttachmentCircuit>
                    <Naming>
                      <Name>GigabitEthernet0/0/0/1.302</Name>
                    </Naming>
                    <Enabled>true</Enabled>
                  </AttachmentCircuit>
                </AttachmentCircuitTable>
                <PseudoWireTable>
                  <PseudoWire>
                    <Naming>
                      <Neighbor>
                        <IPv4Address>10.11.13.15</IPv4Address>
                      </Neighbor>
                      <PseudowireID>1005</PseudowireID>
                    </Naming>
                    <PseudoWireParameters/>
                  </PseudoWire>
                </PseudoWireTable>
              </P2PXConnect>
            </P2PXConnectTable>
          </XConnectGroup>
        </XConnectGroupTable>
      </L2VPN>
    </Configuration>
  </Set>
</Commit/>
</Request>

```

**Comments**

- In IOS XR, device configuration is specified in XML format.

- With respect to the XML schemas, different versions of IOS XR generate different XML configlets. However the configurations will be almost identical, except for changes in the XML schema.
- There are different cases to consider. For example, when a service request is decommissioned or modified, the XML configuration will slightly differ.

## ERS (EVPL) and EWS (EPL) (Local Connect on E-Line)

### Configuration

- Service: L2VPN/Metro Ethernet.
- Feature: ERS (EVPL) and EWS (EPL).
- Device configuration:
  - The N-PE is a CRS-1 with IOS XR 3.6 or later.
  - The U-PE is a 12.2(18)SXF with IOS.

### Configlets

UP-E	N-PE
	<pre>interface GigabitEthernet0/0/0/2.559 dot1q vlan 559 l2transport ! interface GigabitEthernet0/0/0/4.559 dot1q vlan 559 l2transport ! l2vpn xconnect group ISC p2p <b>cl-test-l2-crs1-1--0--559</b>   interface GigabitEthernet0/0/0/2.559   interface GigabitEthernet0/0/0/4.559   !   !   !</pre>

### Comments

- The default E-Line name has changed for local connect configlets.
- The format of the default E-line name is:  
*device\_name\_with\_underscores--VCID--VLANID*

# ERS (EVPL), EWS (EPL), ATM, or Frame Relay (Additional Template Variables for L2VPN, IOS and IOS XR Device)

## Configuration

- Service: L2VPN/Metro Ethernet.
- Feature: ERS (EVPL), EWS (EPL), ATM and Frame Relay.
- Device configuration:
  - The N-PE is a 12.2(18)SXF with IOS for ERS (EVPL), EWS (EPL), Frame Relay service.
  - The N-PE is a CRS-1 with IOS XR 3.6 or later for ERS (EVPL), EWS (EPL) service; and IOS XR 3.7 or later for ATM service (ATM port mode).
  - The U-PE is a 12.2(25)EY4 with IOS for ERS (EVPL) or EWS (EPL) service.

## Configlets

UP-E	N-PE
(None).	<p>Template Content:</p> <pre>interface Loopback0 description LocalLoopbackAddress=\$L2VPNLocalLoopback LocalHostName=\$L2VPNLocalHostName RemoteLoopbackAddress=\$L2VPNRemoteLoopback RemoteHostName=\$L2VPNRemoteHostName</pre> <p>Configlets:</p> <pre>interface Loopback0 description LocalLoopbackAddress= 192.169.105.40 LocalHostName=c1-test-12-7600-2 RemoteLoopbackAddress=192.169.105.80 RemoteHostName= c1-test-12-7600-4</pre>

## Comments

- These four variables are supported only on the N-PE.
- The values will be empty for all other device roles (U-PE, PE-AGG, and CE).

## EWS (EPL) (Point-to-Point)

### Configuration

- Service: L2VPN/Metro Ethernet.
- Feature: EWS (EPL) (point-to-point).
- Device configuration:
  - The N-PE is a Cisco 7600 with IOS 12.2(18)SXF, Sup720-3BXL.  
Interface(s): FA8/17.
  - The U-PE is a Cisco 3750ME with IOS 12.2(25)EY1. No port security, no tunneling.  
Interface(s): FA1/0/20 – FA1/0/23.
  - L2VPN point-to-point.
  - Q-in-Q UNI.

### Configlets

UP-E	N-PE
<pre> system mtu 1522 ! vlan 774 exit ! interface FastEthernet1/0/20 no cdp enable no keepalive switchport switchport access vlan 774 switchport mode dot1q-tunnel switchport nonegotiate spanning-tree portfast spanning-tree bpdupfilter enable ! interface FastEthernet1/0/23 no ip address switchport trunk allowed vlan 774,787-788           </pre>	<pre> vlan 774 exit ! interface FastEthernet8/17 switchport trunk allowed vlan 1,451,653,659,766-768,772,773-774,878 ! interface Vlan774 no ip address description L2VPN EWS xconnect 99.99.8.99 89029 encapsulation mpls no shutdown           </pre>

### Comments

- The N-PE is a 7600 with a OSM or SIP-600 module. Provisioning is the same as the ERS (EVPL) example.
- The U-PE is a generic Metro Ethernet (ME) switch.
- No PACL provisioned by default. BPDU can be tunneled if desired.
- The system MTU needs to set to 1522 to handle the extra 4 bytes of Q-in-Q frames.

# EWS (EPL) (Point-to-Point, UNI Port Security, BPDU Tunneling)

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**Configuration**

- Service: L2VPN/Metro Ethernet.
- Feature: EWS (EPL) (point-to-point) with Port security, BPDU tunneling.
- Device configuration:
  - The N-PE is a Cisco 7600 with IOS 12.2(18)SXF, Sup720-3BXL.
  - The U-PE is a Cisco 3750ME with IOS 12.2(25)EY1. No port security, with tunneling.
  - L2VPN point-to-point.
  - Q-in-Q UNI.

## Configlets

UP-E	N-PE
<pre> system mtu 1522 ! vlan 775 exit ! system mtu 1522 ! vlan 775 exit ! interface FastEthernet1/0/19 no cdp enable no keepalive switchport switchport access vlan 775 switchport mode dot1q-tunnel switchport nonegotiate <b>switchport port-security maximum 34</b> <b>switchport port-security aging time 32</b> <b>switchport port-security violation shutdown</b> <b>switchport port-security</b> <b>l2protocol-tunnel cdp</b> <b>l2protocol-tunnel stp</b> <b>l2protocol-tunnel vtp</b> <b>l2protocol-tunnel shutdown-threshold cdp 88</b> <b>l2protocol-tunnel shutdown-threshold stp 99</b> <b>l2protocol-tunnel shutdown-threshold vtp 56</b> <b>l2protocol-tunnel drop-threshold cdp 56</b> <b>l2protocol-tunnel drop-threshold stp 64</b> <b>l2protocol-tunnel drop-threshold vtp 34</b> <b>storm-control unicast level 34.0</b> <b>storm-control broadcast level 23.0</b> <b>storm-control multicast level 12.0</b> spanning-tree portfast spanning-tree bpdupfilter enable mac access-group ISC-FastEthernet1/0/19 in  interface FastEthernet1/0/23 no ip address switchport trunk allowed vlan 774-775,787-788  ! mac access-list extended ISC-FastEthernet1/0/19 no permit any any <b>deny any host 3456.3456.1234</b> permit any any </pre>	<pre> vlan 775 exit ! interface FastEthernet8/17 switchport trunk allowed vlan 1,451,653,659,766-768,772,773-775,878 ! interface Vlan775 no ip address description L2VPN EWS xconnect 99.99.8.99 89029 encapsulation mpls no shutdown </pre>

## Comments

- The N-PE is a 7600 with an OSM or SIP-600 module. Provisioning is the same as the ERS (EVPL) example.
- The U-PE is a generic Metro Ethernet (ME) switch.
- PACL with one user-defined entry.
- BPDUs (CDP, STP and VTP) are tunneled through the MPLS core.
- Storm control is enabled for unicast, multicast, and broadcast.

## EWS (EPL) (Hybrid)

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**Configuration**

- Service: L2VPN/Metro Ethernet.
- Feature: EWS (EPL) hybrid. One side is EWS (EPL) UNI; the other side is ERS (EVPL) NNI.
- Device configuration:
  - The N-PE is a Cisco 7600 with 12.2(18)SXF, Sup720-3BXL.  
Interface(s): FA8/17.
  - The U-PE is a Cisco 3750ME with 12.2(25)EY1. No port security, with tunneling.  
Interface(s): FA1/0/20 – FA1/0/23.
  - L2VPN point-to-point.
  - Q-in-Q UNI.

**Note**

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The first configlet example is the EWS (EPL) side (UNI). The second configlet is the ERS (EVPL) side (NNI).

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## Configlets (EWS)

UP-E	N-PE
<pre> system mtu 1522 ! vlan 775 exit ! system mtu 1522 ! vlan 775 exit ! interface FastEthernet1/0/19 no cdp enable no keepalive switchport switchport access vlan 775 switchport mode dot1q-tunnel switchport nonegotiate <b>switchport port-security maximum 34</b> <b>switchport port-security aging time 32</b> <b>switchport port-security violation shutdown</b> <b>switchport port-security</b> <b>l2protocol-tunnel cdp</b> <b>l2protocol-tunnel stp</b> <b>l2protocol-tunnel vtp</b> <b>l2protocol-tunnel shutdown-threshold cdp 88</b> <b>l2protocol-tunnel shutdown-threshold stp 99</b> <b>l2protocol-tunnel shutdown-threshold vtp 56</b> <b>l2protocol-tunnel drop-threshold cdp 56</b> <b>l2protocol-tunnel drop-threshold stp 64</b> <b>l2protocol-tunnel drop-threshold vtp 34</b> <b>storm-control unicast level 34.0</b> <b>storm-control broadcast level 23.0</b> <b>storm-control multicast level 12.0</b> spanning-tree portfast spanning-tree bpdupfilter enable mac access-group ISC-FastEthernet1/0/19 in  interface FastEthernet1/0/23 no ip address switchport trunk allowed vlan 774-775,787-788  ! mac access-list extended ISC-FastEthernet1/0/19 no permit any any <b>deny any host 3456.3456.1234</b> permit any any </pre>	<pre> vlan 775 exit ! interface FastEthernet8/17 switchport trunk allowed vlan 1,451,653,659,766-768,772,773-775,878 ! interface Vlan775 no ip address description L2VPN EWS xconnect 99.99.8.99 89029 encapsulation mpls no shutdown </pre>

## Comments

- This is the EWS (EPL) side (UNI).
- N-PE is 7600 with an OSM or a SIP-600 module. Provisioning is the same as the ERS (EVPL).
- The U-PE is a generic Metro Ethernet (ME) switch.
- PACL with one user-defined entry.
- BPDUs (cdp, stp and vtp) are tunneled through the MPLS core.
- Storm control is enabled for unicast, multicast, and broadcast.

## Configlets (ERS)

UP-E	N-PE
<pre> system mtu 1522  vlan 775 exit  interface FastEthernet1/17 switchport trunk allowed vlan 1,451,653,659,766-768,772,773-775,878  interface FastEthernet1/10 switchport trunk allowed vlan 1,451,653,659,766-768,772,773-775,878 </pre>	<pre> vlan 775 exit ! interface FastEthernet8/17 switchport trunk allowed vlan 1,451,653,659,766-768,772,773-775,878 ! interface Vlan775 no ip address description L2VPN EWS xconnect 99.99.8.99 89029 encapsulation mpls no shutdown </pre>

## Comments

- This is the ERS (EVPL) side (NNI).
- The N-PE is a 7600 with an OSM or a SIP-600 module. Provisioning is the same as the ERS (EVPL).
- The U-PE is really a PE-AGG. It connects to the wholesale customer as an NNI. Both ports are regular NNI ports.

# EWS (EPL) (Pseudowire Class, E-Line, L2VPN Group Name, IOS XR Device)

## Configuration

- Service: L2VPN/Metro Ethernet.
- Feature: EWS (EPL).
- Device configuration:
  - The N-PE is a CRS-1 with IOS XR 3.6.1 or later.
  - UNI on U-PE.

## Configlets

UP-E	N-PE
<pre> ! system mtu 1522 ! vlan 700 exit ! interface FastEthernet1/0/2 switchport switchport access vlan 700 switchport mode dot1q-tunnel switchport nonegotiate no keepalive no cdp enable spanning-tree portfast spanning-tree bpdupfilter enable ! interface GigabitEthernet1/0/1 no ip address switchport switchport trunk encapsulation dot1q switchport trunk allowed vlan 700 switchport mode trunk ! </pre>	<pre> ! interface GigabitEthernet0/3/1/1.700 l2transport dot1q vlan 700 ! ! l2vpn pw-class PW_AD7-AD3_Cutsomer2 encapsulation mpls transport-mode ethernet preferred-path interface tunnel-te 2730 ! ! xconnect group ISC p2p c1-test-12-12404-2--1000 interface GigabitEthernet0/3/1/1.700 neighbor 192.169.105.30 pw-id 1000 pw-class PW_AD7-AD3_Cutsomer2 ! </pre>

## Comments

- The N-PE is a CRS-1 router with IOS XR 3.7.
- The pseudowire class feature is configured with various associated attributes like encapsulation, transport mode, preferred-path, and fallback option
- The disable fallback option is required for IOS XR 3.6.1 and optional for IOS XR 3.7 and later.
- The E-Line name (**p2p** command) and L2VPN Group Name (**xconnect group** command) is an ISC-generated default value, if user input is not provided.

# EWS (EPL) (NBI Enhancements for L2VPN, IOS Device)

## Configuration

- Service: L2VPN/Metro Ethernet.
- Feature: EWS (EPL).
- Device configuration:
  - The N-PE is a 12.2(18)SXF with IOS.
  - The U-PE is a 12.2(25)EY4with IOS.
  - UNI on N-PE.
  - UNI on U-PE.

## Configlets

UP-E	N-PE
<pre> ! vlan 3201 exit ! interface FastEthernet1/0/2 no cdp enable no ip address duplex auto switchport switchport access vlan 3201 switchport mode dot1q-tunnel switchport nonegotiate switchport port-security aging type inactivity switchport port-security maximum 100 switchport port-security aging time 1000 switchport port-security violation protect switchport port-security <b>storm-control unicast level 1.0</b> <b>storm-control broadcast level 50.0</b> <b>storm-control multicast level 50.0</b> shutdown <b>keepalive</b> spanning-tree bpdudfilter enable  ! interface GigabitEthernet1/0/1 no ip address switchport switchport trunk encapsulation dot1q switchport mode trunk switchport trunk allowed vlan 3201 ! </pre>	<pre> ! vlan 3301 exit ! interface FastEthernet1/0/24 no cdp enable no ip address duplex auto switchport switchport access vlan 3301 switchport mode dot1q-tunnel switchport nonegotiate switchport port-security aging type inactivity switchport port-security maximum 100 switchport port-security aging time 1000 switchport port-security violation protect switchport port-security <b>storm-control unicast level 1.0</b> <b>storm-control broadcast level 50.0</b> <b>storm-control multicast level 50.0</b> shutdown <b>keepalive</b> spanning-tree bpdudfilter enable  ! <b>interface Vlan3301</b> no ip address xconnect 192.169.105.40 7502 encapsulation mpls no shutdown ! </pre>

## Comments

None.

# ATM over MPLS (VC Mode)

## Configuration

- Service: L2VPN.
- Feature: ATM over MPLS (ATMoMPLS, a type of AToM) in VC mode.
- Device configuration:
  - The N-PE is a Cisco 7200 with IOS 12.0(28)S.
  - No CE.
  - No U-PE.
  - L2VPN point-to-point (ATMoMPLS).
  - C7200 (ATM2/0).

## Configlets

UP-E	N-PE
(None)	<pre>interface ATM2/0.34234 point-to-point pvc 213/423 l2transport encapsulation aal5 xconnect 99.99.4.99 89025 encapsulation mpls</pre>

## Comments

- The N-PE is any MPLS-enabled router.
- L2VPN provisioning is on the ATM VC connection.

# ATM over MPLS (VP Mode)

## Configuration

- Service: L2VPN.
- Feature: ATM over MPLS (ATMoMPLS, a type of AToM) in VP mode.
- Device configuration:
  - The N-PE is a Cisco 7200 with IOS 12.0(28)S.
  - Interface(s): ATM2/0.
  - No CE.
  - No U-PE.
  - L2VPN point-to-point (ATMoMPLS).

## Configlets

UP-E	N-PE
(None)	<pre>pseudowire-class ISC-pw-tunnel-123 encapsulation mpls preferred-path interface tunnel123 disable-fallback ! interface ATM2/0 atm pvp 131 l2transport xconnect 99.99.4.99 89024 pw-class ISC-pw-tunnel-123</pre>

## Comments

- The N-PE is any MPLS-enabled router.
- L2VPN provisioning is on the ATM VP connection.
- The L2VPN pseudowire is mapped to a TE tunnel.

# ATM (Port Mode, Pseudowire Class, E-Line, L2VPN Group Name, IOS XR Device)

## Configuration

- Service: L2VPN/Metro Ethernet.
- Feature: ATM.
- Device configuration:
  - The N-PE is a CRS-1 with IOS XR 3.7 or later for ATM service (port mode only).
  - UNI on N-PE.

## Configlets

UP-E	N-PE
(None)	<pre>interface ATM0/1/0/0 description UNIDesc_AC1 l2transport ! ! l2vpn pw-class PWClass-1 encapsulation mpls preferred-path interface tunnel-te 500 fallback disable ! ! xconnect group ISC p2p ELine_AC1 interface ATM0/1/0/0 neighbor 192.169.105.70 pw-id 100 pw-class PWClass-1 !</pre>

## Comments

- The N-PE is a CRS-1 router.
- The pseudowire class feature is optional and not configured.
- The E-Line name (**p2p** command) and L2VPN Group Name (**xconnect group** command) are user configured.
- Only PORT mode is supported in IOS XR.
- This PORT mode will not generate any specific command, such as **pvp** or **pvc**, on IOS XR devices.
- The ATM interface is included under **xconnect**.

# Frame Relay over MPLS

## Configuration

- Service: L2VPN.
- Feature: Frame Relay over MPLS (FRoMPLS, a type of AToM).
- Device configuration:
  - The N-PE is a Cisco 7200 with IOS 12.0(28)S.
  - Interface(s): ATM2/0.
  - No CE.
  - No U-PE.
  - L2VPN point-to-point (ATMoMPLS).

## Configlets

UP-E	N-PE
(None)	<pre>interface Serial1/1 exit ! connect C1_89001 Serial1/1 135 12transport xconnect 99.99.4.99 89001 encapsulation mpls</pre>

## Comments

- The N-PE is any MPLS-enabled router.
- L2VPN provisioning is on the serial port for the Frame Relay connection.

# Frame Relay (DLCI Mode)

## Configuration

- Service: L2VPN over a L2TPv3 core.
- Feature: FR in DLCI mode.
- Device configuration:
  - The N-PE is a Cisco 7200 with IOS 12.0(28)S.  
Interface(s): ATM2/0.
  - No CE.
  - No U-PE.
  - L2VPN point-to-point (ATMoMPLS).

## Configlets

UP-E	N-PE
(None)	<pre>pseudowire-class ISC-pw-dynamic-default encapsulation l2tpv3 ip local interface Loopback10 ip dfbit set ! interface Serial3/2 encapsulation frame-relay exit ! connect ISC_1054 Serial3/2 86 l2transport xconnect 10.9.1.1 1054 encapsulation l2tpv3 pw-class ISC-pw-dynamic-default</pre>

## Comments

- The N-PE is any L2TPv3 enabled router.
- L2VPN provisioning is on the serial port for the Frame Relay connection.

# VPLS (Multipoint, ERMS/EVP-LAN)

## Configuration

- Service: L2VPN/Metro Ethernet.
- Feature: VPLS (multipoint) ERMS (EVP-LAN).
- Device configuration:
  - The N-PE is a Cisco 7600 with IOS 12.2(18)SXF, Sup720-3BX.L  
Interface(s): FA2/18.
  - The U-PE is a Cisco 3750ME with IOS 12.2(25)EY1. No port security, no tunneling.  
Interface(s): FA1/0/21 – FA1/0/23.
  - VPLS Multipoint VPN with VLAN 767.

## Configlets

UP-E	N-PE
<pre> vlan 767 exit ! interface FastEthernet1/0/21 no cdp enable no keepalive no ip address switchport switchport trunk encapsulation dot1q switchport mode trunk switchport trunk allowed vlan none switchport trunk allowed vlan 767 switchport nonegotiate spanning-tree bpdupfilter enable mac access-group ISC-FastEthernet1/0/21 in ! interface FastEthernet1/0/23 no ip address  mac access-list extended ISC-FastEthernet1/0/21 deny any host 0100.0ccc.cccc deny any host 0100.0ccc.cccd deny any host 0100.0ccd.cdd0 deny any host 0180.c200.0000 permit any any           </pre>	<pre> 12 vfi vpls_ers_1-0 manual vpn id 89017 neighbor 99.99.10.9 encapsulation mpls neighbor 99.99.5.99 encapsulation mpls ! vlan 767 exit ! interface FastEthernet2/18 switchport trunk allowed vlan 350,351,430,630,767,780,783,785-791 ! interface Vlan767 no ip address description VPLS ERS xconnect vfi vpls_ers_1-0 no shutdown           </pre>

## Comments

- The N-PE is a 7600 with OSM or SIP-600 module.
- The VFI contains all the N-PEs (neighbors) that this N-PE talks to.
- The U-PE is a generic Metro Ethernet (ME) switch. The customer BPDUs are blocked by the PACL. The VPLS ERMS (EVP-LAN) UNI is the same as the L2VPN (point-to-point) ERS (EVPL) UNI.
- The SVI (interface 767) refers to the global VFI, which contains multiple peering N-PEs.

# VPLS (Multipoint, EMS/EP-LAN), BPDU Tunneling)

## Configuration

- Service: L2VPN/Metro Ethernet.
- Feature: VPLS (multipoint) EMS (EP-LAN) with BPDU tunneling.
- Device configuration:
  - The N-PE is a Cisco 7600 with IOS 12.2(18)SXF, Sup720-3BXL.  
Interface(s): FA2/18.
  - The U-PE is a Cisco 3750ME with IOS 12.2(25)EY1. No port security, no tunneling.  
Interface(s): FA1/0/12 – FA1/0/23.
  - VPLS Multipoint VPN, with VLAN 767.
  - Q-in-Q UNI.

## Configlets

UP-E	N-PE
<pre> system mtu 1522 ! errdisable recovery interval 33 ! vlan 776 exit ! interface FastEthernet1/0/12 no cdp enable no keepalive switchport switchport access vlan 776 switchport mode dot1q-tunnel switchport nonegotiate l2protocol-tunnel cdp l2protocol-tunnel stp l2protocol-tunnel vtp l2protocol-tunnel shutdown-threshold cdp 88 l2protocol-tunnel shutdown-threshold stp 64 l2protocol-tunnel shutdown-threshold vtp 77 l2protocol-tunnel drop-threshold cdp 34 l2protocol-tunnel drop-threshold stp 23 l2protocol-tunnel drop-threshold vtp 45 no shutdown spanning-tree portfast spanning-tree bpdupfilter enable           </pre>	<pre> 12 vfi vpls_ews-89019 manual vpn id 89019 neighbor 99.99.8.99 encapsulation mpls ! vlan 776 exit ! interface FastEthernet8/17 switchport trunk allowed vlan 1,451,653,659,766-768,772-776,878 ! interface Vlan776 no ip address description VPLS EWS xconnect vfi vpls_ews-89019 no shutdown           </pre>

## Comments

- The N-PE is a 7600 with an OSM or SIP-600 module.
- The VFI contains all the N-PEs (neighbors) that this N-PE talks to.
- The VPLS EMS (EP-LAN) UNI is the same as L2VPN (point-to-point) EWS (EPL) UNI.
- The SVI is the same as VPLS ERS (EVP-LAN) SVI.

# FlexUNI/EVC (Pseudowire Core Connectivity, UNI Port Security)

## Configuration

- Service: FlexUNI (EVC)/Metro Ethernet.
- Feature: FlexUNI/EVC with pseudowire core connectivity, with UNI port security.
- Device configuration:
  - The N-PE is a Cisco 7600 with IOS 12.2(33)SRB3.  
Interface(s): GI2/0/0.
  - The U-PE is a Cisco 3750ME with IOS 12.2(25)EY2. Port security is enabled.  
Interface(s): FA1/14– FA3/23.

## Configlets

UP-E	N-PE
<pre> vlan 788 exit ! interface FastEthernet3/23 no ip address switchport trunk allowed vlan 783,787-788 ! interface FastEthernet1/14 no cdp enable no keepalive no ip address switchport switchport trunk encapsulation dot1q switchport mode trunk switchport trunk allowed vlan none switchport trunk allowed vlan 788 switchport port-security switchport nonegotiate switchport port-security maximum 45 switchport port-security aging time 34 switchport port-security violation shutdown switchport port-security mac-address 3456.3456.5678 spanning-tree bpdupfilter enable mac access-group ISC-FastEthernet3/23 in ! mac access-list extended ISC-FastEthernet3/31 deny any host 0100.0ccc.cccc deny any host 0100.0ccc.cccd deny any host 0100.0ccd.cdd0 deny any host 0180.c200.0000 deny any host 1234.3234.3432 permit any any           </pre>	<pre> interface GigabitEthernet4/0/1 no shut service instance 10 ethernet encapsulation dot1q 500 rewrite ingress tag push dot1q 555 symmetric xconnect 192.169.105.20 505 encapsulation mpls           </pre>

## Comments

- UNI on U-PE.
- Single match tag is performed.
- The rewrite operation **push** pushes the outer VLAN tag of 555.

# FlexUNI/EVC (Pseudowire Core Connectivity, UNI, without Port Security, with Bridge Domain)

## Configuration

- Service: FlexUNI(EVC)/Metro Ethernet.
- Feature: FlexUNI/EVC with pseudowire core connectivity, with UNI, without port security, and with bridge domain.
- Device configuration:
  - The N-PE is a Cisco 7600 with IOS 12.2(33)SRB3.  
Interface(s): GI2/0/0.
  - The U-PE is a Cisco 3750ME with IOS 12.2(25)EY2. Port security is enabled.  
Interface(s): FA1/14– FA3/23.

## Configlets

UP-E	N-PE
<pre>vlan 772 exit ! interface FastEthernet3/23 switchport trunk allowed vlan 500,772 ! interface FastEthernet1/14 no cdp enable no keepalive no ip address switchport trunk allowed vlan 500,772 spanning-tree bpdupfilter enable mac access-group ISC-FastEthernet3/23 in ! mac access-list extended ISC-FastEthernet1/14 deny any host 0100.0ccc.cccc deny any host 0100.0ccc.cccd deny any host 0100.0ccd.cdd0 deny any host 0180.c200.0000 permit any any</pre>	<pre>vlan 100 interface GigabitEthernet2/0/0 no shut service instance 10 ethernet encapsulation dot1q 500 rewrite ingress tag push dot1q 23 second-dot1q 41 symmetric bridge-domain 100 split-horizon  Interface Vlan100 no shut xconnect 192.169.105.20 101 encapsulation mpls</pre>

## Comments

- UNI on U-PE.
- Single match tag is performed.
- The rewrite operation **push** pushes two tags.

# FlexUNI/EVC (Pseudowire Core Connectivity, UNI, and Pseudowire Tunneling)

## Configuration

- Service: FlexUNI(EVC)/Metro Ethernet.
  - Feature: FlexUNI/EVC with pseudowire core connectivity, with UNI, with pseudowire tunneling.
  - Device configuration:
    - The N-PE is a Cisco 7600 with IOS 12.2(33) SRB3.
- Interface(s): GI4/0/0 <-> GI2/0/0.

## Configlets

UP-E	N-PE
(None)	<pre>pseudowire-class ISC-pw-tunnel-2147 encapsulation mpls preferred-path interface Tunnel2147 disable-fallback  interface GigabitEthernet4/0/0 service instance 1 ethernet encapsulation dot1q 11 second-dot1q 41 rewrite ingress tag pop 2 symmetric xconnect pw-class ISC-pw-tunnel-2147</pre>

## Comments

- UNI on N-PE (the CE is directly connected).
- Match of both tags is performed.
- The rewrite operation pops both the inner and outer VLAN tags.

# FlexUNI/EVC (VPLS Core Connectivity, UNI Port Security)

## Configuration

- Service: FlexUNI(EVC)/Metro Ethernet.
- Feature: FlexUNI/EVC with VPLS core connectivity, with UNI port security.
- Device configuration:
  - The N-PE is a Cisco 7600 with IOS 12.2(33) SRB3.  
Interface(s): GI4/0/1.
  - The U-PE is a Cisco 3750ME with IOS 12.2(25) EY2. Port security is enabled.  
Interface(s): FA1/14– FA3/23.

## Configlets

UP-E	N-PE
<pre>vlan 788 exit ! interface FastEthernet3/23 no ip address switchport trunk allowed vlan 783,787-788 ! interface FastEthernet1/14 no cdp enable no keepalive no ip address switchport switchport trunk encapsulation dot1q switchport mode trunk switchport trunk allowed vlan none <b>switchport trunk allowed vlan 788</b> switchport port-security switchport nonegotiate switchport port-security maximum 58 switchport port-security aging time 85 switchport port-security violation shutdown switchport port-security mac-address 1252.1254.2544 spanning-tree bpdupfilter enable mac access-group ISC-FastEthernet3/23 in ! <b>mac access-list extended</b> <b>ISC-FastEthernet3/31</b> <b>deny any host 0100.0ccc.cccc</b> <b>deny any host 0100.0ccc.cccd</b> <b>deny any host 0100.0ccd.cdd0</b> <b>deny any host 0180.c200.0000</b> <b>deny any host 1234.3234.3432</b> permit any any</pre>	<pre>12 vfi attest-226 manual vpn id 226 neighbor 192.169.105.20 encapsulation mpls  vlan 200 bridge-domain 200 split-horizon  interface GigabitEthernet4/0/1 no shut service instance 10 ethernet encapsulation dot1q 500 rewrite ingress tag translate 1-to-1 dot1q 222 symmetric  Interface vlan 200 xconnect vfi attest-226</pre>

## Comments

- UNI on U-PE.
- The rewrite operation translates the incoming VLAN tag 500 to 222.

## FlexUNI/EVC (VPLS Core Connectivity, no UNI Port Security)

### Configuration

- Service: FlexUNI(EVC)/Metro Ethernet.
- Feature: FlexUNI/EVC with VPLS core connectivity, without UNI port security.
- Device configuration:
  - The N-PE is a Cisco 7600 with IOS 12.2(33) SRB3.  
Interface(s): GI4/0/1.
  - The U-PE is a Cisco 3750ME with IOS 12.2(25) EY2.  
Interface(s): FA1/14– FA3/23.

### Configlets

UP-E	N-PE
<pre> vlan 772 exit ! interface FastEthernet3/23 switchport trunk allowed vlan 500,772 ! interface FastEthernet1/14 no cdp enable no keepalive no ip address switchport trunk allowed vlan 500,772 spanning-tree bpdupfilter enable mac access-group ISC-FastEthernet3/23 in ! mac access-list extended ISC-FastEthernet1/14 deny any host 0100.0ccc.cccc deny any host 0100.0ccc.cccd deny any host 0100.0ccd.cdd0 deny any host 0180.c200.0000 permit any any           </pre>	<pre> 12 vfi attest1-458 manual vpn id 452 neighbor 192.169.105.20 encapsulation mpls  vlan 200 bridge-domain 200 split-horizon  interface GigabitEtherne4/0/1 no shut service instance 10 ethernet encapsulation dot1q 500 rewrite ingress tag translate 1-to-2 dot1q 222 second-dot1q 41 symmetric  Interface vlan 200 xconnect vfi attest1-458           </pre>

### Comments

- UNI on U-PE.
- The rewrite operation translates the incoming VLAN tag 500 to two tags, 222 and 41.

# FlexUNI/EVC (Local Connect Core Connectivity, UNI Port Security)

## Configuration

- Service: FlexUNI(EVC)/Metro Ethernet.
- Feature: FlexUNI/EVC with local connect core connectivity, with UNI port security.
- Device configuration:
  - The N-PE is a Cisco 7600 with IOS 12.2(33) SRB3.  
Interface(s):GI2/0/0.
  - The U-PE is a Cisco 3750ME with IOS 12.2(25) EY2. Port security is enabled.  
Interface(s): FA1/14– FA3/23.

## Configlets

UP-E	N-PE
<pre>vlan 788 exit ! interface FastEthernet3/23 no ip address switchport trunk allowed vlan 783,787-788 ! interface FastEthernet1/14 no cdp enable no keepalive no ip address switchport switchport trunk encapsulation dot1q switchport mode trunk switchport trunk allowed vlan none switchport trunk allowed vlan 788 switchport port-security switchport nonegotiate switchport port-security maximum 45 switchport port-security aging time 34 switchport port-security violation shutdown switchport port-security mac-address 4111.4545.1211 spanning-tree bpdudfilter enable mac access-group ISC-FastEthernet3/23 in ! mac access-list extended ISC-FastEthernet3/31 deny any host 0100.0ccc.cccc deny any host 0100.0ccc.cccd deny any host 0100.0ccd.cdd0 deny any host 0180.c200.0000 deny any host 1234.3234.3432 permit any any</pre>	<pre>Connect Customer_1 GigabitEthernet4/0/1 10 GigabitEthernet4/0/10 25  interface GigabitEtherne4/0/1 no shut service instance 10 ethernet encapsulation dot1q 500 rewrite ingress tag push dot1q 555 symmetric  interface GigabitEtherne4/0/10 no shut service instance 25 ethernet encapsulation dot1q 500 second-dot1q 501 rewrite ingress tag translate 2-to-1 dot1q 222 symmetric</pre>

## Comments

- UNI on U-PE.
- Two tag matching operations are carried out.

- The rewrite operation translates two tags to a single tag.
- Two service instances are connected through the **connect** command.

# FlexUNI/EVC (Local Connect Core Connectivity, UNI, no Port Security, Bridge Domain)

## Configuration

- FlexUNI(EVC)/Metro Ethernet.
- Feature: FlexUNI/EVC with local connect core connectivity, with UNI, without port security, and with bridge domain.
- Device configuration:
  - The N-PE is a Cisco 7600 with IOS 12.2(33) SRB3.  
Interface(s):GI2/0/0.
  - The U-PE is a Cisco 3750ME with IOS 12.2(25) EY2.  
Interface(s):FA1/14– FA3/23.

## Configlets

UP-E	N-PE
<pre>vlan 772 exit ! interface FastEthernet3/23 switchport trunk allowed vlan 500,772 ! interface FastEthernet1/14 no cdp enable no keepalive no ip address switchport trunk allowed vlan 500,772 spanning-tree bpdupfilter enable mac access-group ISC-FastEthernet3/23 in ! mac access-list extended ISC-FastEthernet1/14 deny any host 0100.0ccc.cccc deny any host 0100.0ccc.cccd deny any host 0100.0ccd.cdd0 deny any host 0180.c200.0000 permit any any</pre>	<pre>interface GigabitEthernet2/0/0 no shut service instance 10 ethernet encapsulation dot1q 500 second-dot1q 501 rewrite ingress tag translate 2-to-2 dot1q 222 second-dot1q 41 symmetric bridge-domain 200 split-horizon  interface GigabitEthernet2/0/10 no shut service instance 15 ethernet encapsulation dot1q 24 rewrite ingress tag pop 1 symmetric bridge-domain 200 split-horizon</pre>

## Comments

- UNI on U-PE.
- The rewrite operation maps/translates the incoming two tags into two different tags.
- The service instances here are connected through bridge domain.

