L2VPN Provisioning

To provision L2VPN using the Cisco IP Solution Center (ISC) API, you need an L2VPN service policy of a specific subtype and an L2VPN service request.

The service policy (defined in a service definition) specifies the attributes common to the end-to-end wires and attachment circuits (ACs).

The service request defines the device interfaces for each end-to-end wire connection (called link endpoints in the GUI), and can optionally override policy attributes in each end-to-end wire link and AC.

When you deploy an L2VPN service request using a service order, the attributes specified in the service definition are applied to the devices and interfaces listed in the service request, along with the attributes for each end-to-end wire link and AC.

This chapter describes L2VPN service concepts and the steps required to provision L2VPN services using the ISC API. The provisioning example includes the process flow from creating the inventory to auditing the service deployment.

For more information on L2VPN provisioning using ISC, refer to the *Cisco IP Solution Center L2VPN User Guide, 4.1*.

This chapter contains the following sections:

L2VPN Service Definitions

An L2VPN service definition specifies the policy subtype, the properties for the CPE and PE devices, and the user network interface (UNI). The properties that can be set are based on the policy subtype that is specified in the service definition.

ISC supports the following L2VPN service definition subtypes:

- EthernetEVCS (Ethernet Virtual Circuit Service)
- EthernetEVCS_NO_CE
- EthernetTLS (Transparent LAN Service)
- EthernetTLS_NO_CE
- ATM (Asynchronous Transfer Mode)
- ATM_NO_CE

- FRAME_RELAY
- FRAME_RELAY_NO_CE

Note For all service definition subtypes with NO_CE, you do not declare the CE devices to be CPEs, and you do not set policy attributes for the CE devices in the service definition.

A service definition can be shared by one or more service requests that have similar requirements. L2VPN service definitions include the following information about the end-to-end wires and attachment circuits:

- Service definition subtype (examples: EthernetEVCS or ATM_NO_CE)
- Device interface type (example: GigabitEthernet)
- VLAN IDs
- UNI Port Security
- Protocols (examples: CDP, VTP)

Note For each service definition property, you can set an additional attribute, **editable=true,** to allow the network operator to override these attributes when creating the service request. If an attribute is set to **editable=false**, these attributes cannot be changed in the service request.

L2VPN Service Requests

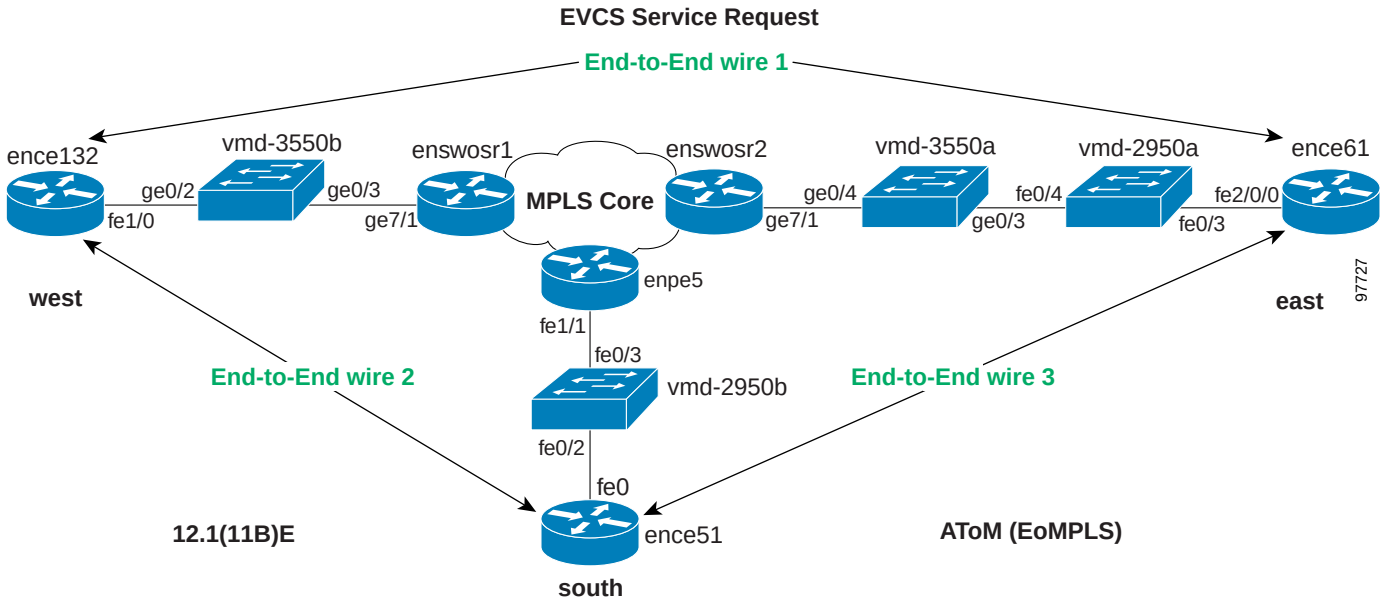
An L2VPN service request specifies the service definition, assigns device interfaces for the end-to-end wire connections, and the attachment circuit details.

End-To-End Wires

An end-to-end wire is the link from one endpoint through the service provider cloud to another endpoint. In most cases, these links are from CE to CE. An attachment circuit is the link from the CE to the PE. If there is not CE present, the attachment circuit link is from PE-CLE to PE-CLE.

In the **EthernetEVCS** network example shown in Figure 7-1, End-to-End wire1 is shown from ence132 to ence61. The two attachment circuits are the links from ence132 to enswosr1 and from ence61 to enswosr2.

Figure 7-1 End to End Wire Network Example



The number of end-to-end wires and attachment circuits that can be created are based on the policy subtype.

There can be 1 or 2 **AttachmentCircuits** for every **EndToEndWire** for the following policy subtypes:

- EthernetEVCS
- EthernetEVCS_NO_CE
- EthernetTLS
- EthernetTLS_NO_CE

There are 2 **AttachmentCircuits** for every **EndToEndWire** for the following policy subtypes:

- FRAME_RELAY
- FRAME_RELAY_NO_CE
- ATM
- ATM_NO_CE

Provisioning Example

This section describes the required steps for using the API to provision L2VPN, and includes the operation, class, and required parameters for each step.

Process Summary

In this L2VPN provisioning example, the following steps are listed:

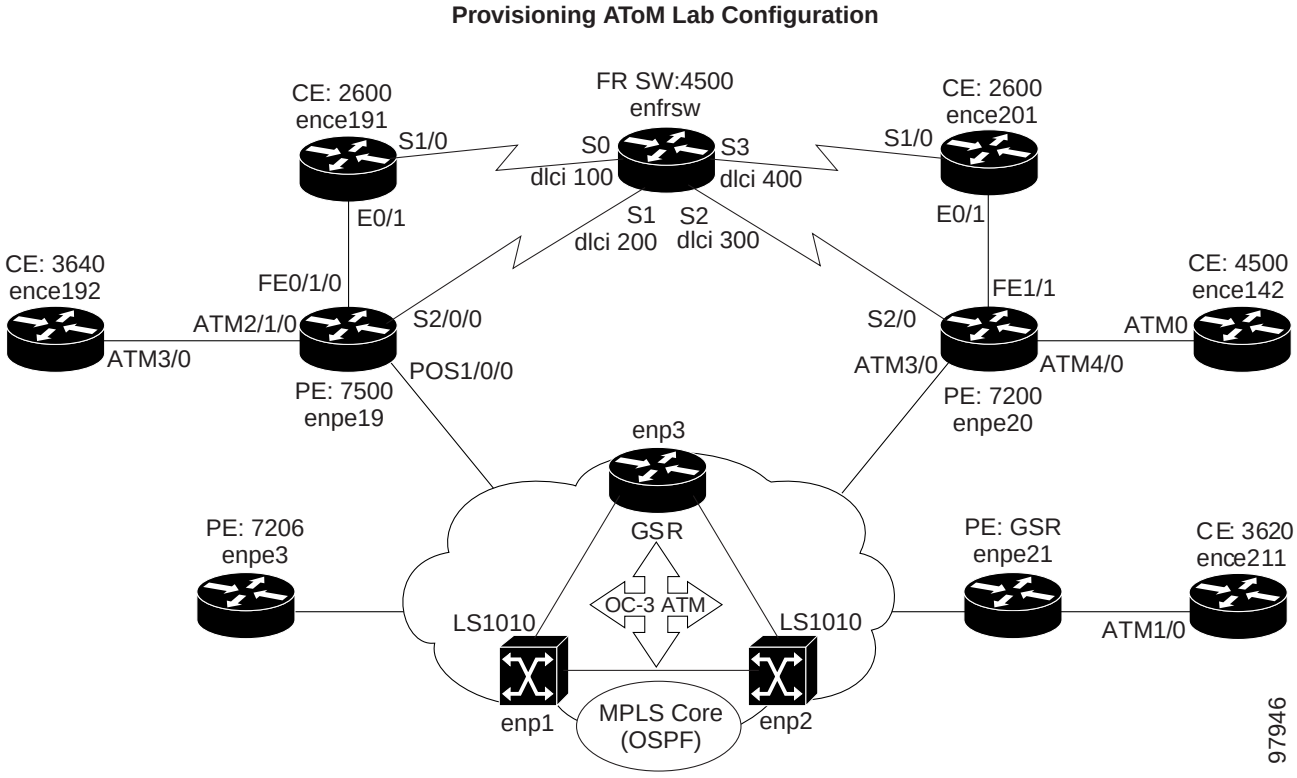
- Create device groups (optional)
- Create devices

- Collect device configurations
- Create provider
- Create regions
- Declare devices as PEs
- Create access domains
- Create customer
- Create sites
- Declare devices as CPEs (not required for No_CE service subtypes)
- Create named physical circuits
- Create VLAN ID pool
- Create VC ID pool
- Create VPN
- Create the L2VPN service definition (policy)
- Create the L2VPN service request

Note For clarity, this provisioning process shows each step as a separate XML request. Many of these steps can be combined using **performBatchOperations**.

The provisioning example in this section is based on the partial network diagram shown in Figure 7-2.

Figure 7-2 L2VPN Provisioning Network Example



Prerequisites

For security reasons, ISC requires the virtual terminal protocol (VTP) to be configured in transparent mode on all switches involved in Ethernet Relay Service (ERS) or Ethernet Wire Service (EWS) before provisioning L2VPN service requests.

To set the VTP mode, enter the following Cisco IOS commands:

```
configure terminal
vtp mode transparent
```

Enter the following Cisco IOS command to verify that the VTP has changed to transparent mode:

```
Show vtp status
```

RBAC

ISC uses a Cisco role-based access control (RBAC) product for user login and logoff. These user roles and permissions are set up using the GUI.

When you establish an API session, you are given a session token during the login. For each API XML request, the session token is verified against the RBAC processor to ensure that the API user has permissions for that operation. If the user does not have permissions, the API returns an error.

Refer to the *Cisco IP Solution Center Infrastructure Reference, 4.1* for information on setting up user roles and permissions.

Provisioning Process

This section provides an example provisioning process using XML examples. The inventory of XML examples for the ISC API can be found at the following location:
http://www.cisco.com/univercd/cc/td/doc/product/rtrmgmt/isc/4_1/api_set/api_ref/examples/index.htm

Step 1 Create device groups (optional).

Table 7-1 Create Device Group

Operation	className	Required Parameters
createInstance	DeviceGroup	Name

In this example, one device group is created for the customer, and one for the provider.

- CreateDeviceGroup_ProvDev.xml
- CreateDeviceGroup_CustDev.xml

XML Examples:

CreateDeviceGroup.xml

Tip If you plan to create device groups, create the empty device groups before you create the devices. As you create each device, add the associated device group name as a key property in the create device XML request.

In the following example, the device group (CustDev) is added as a key property when creating the device **CiscoRouter**:

```
<ns1:createInstance>
    <objectPath xsi:type="ns1:CIMObjectPath">
     <className xsi:type="xsd:string">CiscoRouter</className>
            <properties xsi:type="ns1:CIMPropertyList"
soapenc:arrayType="ns1:CIMProperty[]">
           <item xsi:type="ns1:CIMProperty">
                <name xsi:type="xsd:string">DeviceGroup</name>
                <value xsi:type="xsd:string">CustDev</value>
              </item>
           <item xsi:type="ns1:CIMProperty">
                <name xsi:type="xsd:string">CfgUpDnldMech</name>
                <value xsi:type="xsd:string">DEFAULT</value>
              </item>
              <item xsi:type="ns1:CIMProperty">
                <name xsi:type="xsd:string">TransportMechanism</name>
                <value xsi:type="xsd:string">DEFAULT</value>
              </item>
              <item xsi:type="ns1:CIMProperty">
                <name xsi:type="xsd:string">Password</name>
                <value xsi:type="xsd:string">vpnsc</value>
              </item>
```

Step 2 Create devices.

Every network element that ISC manages must be defined as a device in the system. An element is any device from which ISC can collect information. In most cases, devices are Cisco IOS routers and Catalyst switches.

Table 7-2 Create Devices

Operation	className	Required Parameters
createInstance	• CiscoRouter • CatOS	One or more of the following: • ManagementIPAddress • HostName • DomainName

In this example, an XML request is created for each device in the CPE to PE link, as shown in Figure 7-2.

- CreateDevice_enpe20.xml
- CreateDevice_enpe21.xml
- CreateDevice_ence142.xml
- CreateDevice_ence211.xml

XML Examples:

- CreateCiscoRouter.xml
- CreateCat.xml

Step 3 Collect device configurations.

A device configuration collection is a task. This task uploads the current configuration from the device to the ISC database. The collection task is executed through a service request, and the service request is scheduled through a service order.

Table 7-3 Collect Device Configurations

Operation	className	Required Parameters
createInstance	ServiceOrder	• ServiceName • NumberofRequests • ServiceRequest

Table 7-3 Collect Device Configurations (continued)

Operation	className	Required Parameters
	ServiceRequest	• RequestName • Type=Task • ServiceRequestDetails
	ServiceRequestDetails	• SubType=COLLECTION • Device (or DeviceGroup) **Note** You must select at least one device or device group. • RetrieveVersion=true • RetrieveDeviceInterfaces=true

In this example, device collection is divided into two separate tasks. One task performs a configuration collection on the devices in the customer device group, and the second task is for the provider device group. (Device groups were created in Step 1.)

- CreateTaskServiceOrderCollection1.xml
- CreateTaskServiceOrderCollection2.xml

Note To perform a collection on a device group, specify the **DeviceGroup** keyword in the **ServiceRequestDetails**. (For example, **DeviceGroup=Group_CustDev**, **DeviceGroup=Group_ProvDev**).

XML Example:

- CreateTaskServiceOrderCollection.xml

Step 4 Create Provider.

The provider is the administrative domain of an ISP, with one BGP autonomous system (AS) number. The network owned by the provider is called the backbone network. If an ISP has two AS numbers, you must define it as two provider administrative domains.

Table 7-4 Create Provider

Operation	className	Required Keywords
createInstance	Provider	• Name • AsNumber

XML Example:

- CreateProvider.xml

Step 5 Create Regions.

Each provider can contain multiple regions. In this example, an XML request is created for each region.

- CreateRegion1.xml
- CreateRegion2.xml

Table 7-5 Create Region

Operation	className	Required Keywords
createInstance	Region	• Name • Provider

XML Example:

- CreateRegion.xml

Step 6 Declare devices as PEs.

The XML request that assigns a PE role (PE-POP or PE-CLE) to a device is also used to:

- Assign PE devices to Regions/Provider
- Specify PE interface information

Table 7-6 Create PEs

Operation	className	Required Keywords
createInstance	PE	• Provider • Region • Role= – PE_CLE – PE_POP • Device • Interface

In this example, an XML request is created for each device to be declared as a PE. Using Figure 7-2 for reference, enpe21=PE1 and enpe20=PE2.

- CreatePE1.xml
- CreatePE2.xml

XML Example:

- CreatePE.xml

Step 7 Create Access Domains.

Create an access domain for Ethernet-based services where ISC automatically assigns a VLAN for the link from the VLAN pool. Select all PE-POP devices to be associated with this domain, and later in the process, when VLAN pools are created for an Access Domain, the PE-POP is automatically assigned a VLAN ID.

Table 7-7 Create Access Domains

Operation	className	Required Keywords
createInstance	AccessDomain	• Name • Provider • PE (Role must be PE_POP)

XML Example:

- CreateAccessDomain.xml

Step 8 Create Customer.

A customer is a requestor of VPN services. Each customer can contain multiple customer sites. Each site belongs to only one customer and can contain many CPEs.

Table 7-8 Create Customer

Operation	className	Required Keywords
createInstance	Organization	• Name

XML Examples:

- CreateOrganization.xml

Step 9 Create Sites.

Create sites and assign customers (**Organizations**) to them. In this example, an XML request is created for each site.

- CreateSite1.xml
- CreateSite2.xml

Table 7-9 Create Sites

Operation	className	Required Keywords
createInstance	Site	• Name • Organization

XML Examples:

- CreateSite.xml

Step 10 Declare devices as CPEs.

The XML request that assigns a CPE to a site is also used to specify:

- The management type.
- CE interface information. If no CE is present, specify the UNI (PE-CLE or PE-POP) interface information.

Table 7-10 Create CPE Devices

Operation	className	Required Keywords
createInstance	Cpe	• Site • Device • ManagementType

In this example, an XML request is created for each device you want specified as a CPE. Using the network diagram for reference, ence142=Cpe1 and ence211=Cpe2.

- CreateCpe1.xml
- CreateCpe2.xml

XML Example:

- CreateCpe.xml

Step 11 Create Named Physical Circuits.

Create an NPC for each physical link in the CPE to PE-POP end-to-end wire. If there are intermediate devices, those links must also be added to the NPC using **PhysicalLink**.

Note When creating an NPC, you must specify the CPE as the source device and the PE-POP as the destination device. If there are intermediate devices, such as PE-CLEs, the source and destination devices must follow the direction of the CPE to PE-POP wire. If no CE is present, the source device interface is the UNI.

Table 7-11 Create NPCs

Operation	className	Required Parameters
createInstance	NamedPhysicalCircut	PhysicalLink
	PhysicalLink	• SrcDevice • DestDevice • SrcIfName • DestIfName

In this example, create an XML request for each CPE to PE-POP link. Using Figure 7-2 for reference, ence142 to enpe20=NPC1 and from ence211 to enpe21=NPC2.

- CreateNPC1.xml
- CreateNPC2.xml

Optionally, you can create one XML request for the **NamedPhysicalCircuit** and include multiple **PhysicalLinks** as shown in the following example:

```
<ns1:createInstance>
     <objectPath xsi:type="ns1:CIMObjectPath">
      <className xsi:type="xsd:string">NamedPhysicalCircuit</className>
      <properties xsi:type="ns1:CIMPropertyList"
                  soapenc:arrayType="ns1:CIMProperty[]">
      </properties>
      <objectPath xsi:type="ns1:CIMObjectPath">
           <className xsi:type="xsd:string">PhysicalLink</className>
           <properties xsi:type="ns1:CIMPropertyList"
                   soapenc:arrayType="ns1:CIMProperty[]">
             <item xsi:type="ns1:CIMProperty">
             <name xsi:type="xsd:string">SrcDevice</name>
             <value xsi:type="xsd:string">Device1</value> </item>
             <item xsi:type="ns1:CIMProperty">
             <name xsi:type="xsd:string">DestDevice</name>
             <value xsi:type="xsd:string">Device2</value> </item>
             <item xsi:type="ns1:CIMProperty">
              <name xsi:type="xsd:string">SrcIfName</name>
              <value xsi:type="xsd:string">Intf1/0</value> </item>
             <item xsi:type="ns1:CIMProperty">
              <name xsi:type="xsd:string">DestIfName</name>
              <value xsi:type="xsd:string">Intf2/1</value> </item>
            </properties>
      <objectPath xsi:type="ns1:CIMObjectPath">
           <className xsi:type="xsd:string">PhysicalLink</className>
           <properties xsi:type="ns1:CIMPropertyList"
                   soapenc:arrayType="ns1:CIMProperty[]">
             <item xsi:type="ns1:CIMProperty">
             <name xsi:type="xsd:string">SrcDevice</name>
             <value xsi:type="xsd:string">Device3</value> </item>
             <item xsi:type="ns1:CIMProperty">
             <name xsi:type="xsd:string">DestDevice</name>
             <value xsi:type="xsd:string">Device5</value> </item>
             <item xsi:type="ns1:CIMProperty">
              <name xsi:type="xsd:string">SrcIfName</name>
              <value xsi:type="xsd:string">Intf3/0</value> </item>
             <item xsi:type="ns1:CIMProperty">
              <name xsi:type="xsd:string">DestIfName</name>
              <value xsi:type="xsd:string">Intf5/1</value> </item>
            </properties>
        </objectPath>
       </objectPath>
   </ns1:createInstance>
```

XML Examples:

- CreateNamedPhysicalCircuit.xml
- CreateNamedPhysicalCircuitRing.xml—Use this example if there is a Ring topology configuration on the PE-CLEs.
- CreateNamedPhysicalCircuitRingExisting.xml—Use this example to reference an NPC ring that has already been created.

Step 12 Create VLAN ID pool.

Create a VLAN ID pool, specify a range, and associate it to an access domain to manually enter the parameters for a VLAN pool. To have ISC automatically assign VLANs to end-to-end wire links, specify the **AutoPickVlanId** keyword in the service definition (see Step 15).

Table 7-12 Create VLAN Pool

Operation	className	Required Keywords
createInstance	VlanIdPool	• Start • Size • AssocClassType • AssocClassId

XML Example:

- CreateVlanIdPool.xml

Step 13 Create a VC ID pool. A VC ID pool is global and not associated with a provider or organization.

Table 7-13 Create VC ID Pool

Operation	className	Required Keywords
createInstance	VcIdPool	• Start • Size

XML Example:

- CreateVcIdPool.xml

Step 14 Create a VPN.

A VPN in an L2VPN network is only a name used to group L2VPN links.

Table 7-14 Create VPNs

Operation	className	Required Parameters
createInstance	VPN	• Name

XML Example:

- CreateVPN.xml

Step 15 Create the L2VPN service definition (policy).

A service definition is a template of the parameters needed to define an L2VPN service request. Once you define the policy template, it can be used by all L2VPN service requests that share a common set of attributes.

Certain properties in the service definition can set an additional attribute, **editable=true**. This allows the service request creator to change the values on specific policy attributes. If the property is set to **editable=false**, the service request creator cannot change the policy attributes. See the following example:

```
<objectPath xsi:type="ns1:CIMObjectPath">
            <className xsi:type="xsd:string">ServiceDefinitionDetails</className>
            <properties xsi:type="ns1:CIMPropertyList"
```

```
          soapenc:arrayType="ns1:CIMProperty[]">
<item xsi:type="ns1:CIMProperty">
  <name xsi:type="xsd:string">SubType</name>
  <value xsi:type="xsd:string">ATM</value>
</item>
<item xsi:type="ns1:CIMProperty">
  <name xsi:type="xsd:string">PE_Encap</name>
  <value xsi:type="xsd:string">AAL0</value>
  <qualifier xsi:type="ns1:CIMQualifier">
    <name xsi:type="xsd:string">editable</name>
    <value xsi:type="xsd:string">true</value>
  </qualifier>
</item>
<item xsi:type="ns1:CIMProperty">
  <name xsi:type="xsd:string">CE_Intf_Type</name>
  <value xsi:type="xsd:string">Switch</value>
  <qualifier xsi:type="ns1:CIMQualifier">
    <name xsi:type="xsd:string">editable</name>
    <value xsi:type="xsd:string">true</value>
  </qualifier>
</item>
```

In this example, a service definition is created, with a **SubType=ATM**, and policy attribute values for the Cpe, PE, and UNI with the **ServiceDefinitionDetails**.

- CreateL2VPNServiceDefn_ATM.xml

Table 7-15 Create a Service Policy

Operation	className	Required Parameters
createInstance	ServiceDefinition	• Name • Type=L2Vpn • ServiceDefinitionDetails
	ServiceDefinitionDetails	• SubType= – EthernetEVCS – EthernetEVCS_NO_CE – EthernetTLS – EthernetTLS_NO_CE – FRAME_RELAY – FRAME_RELAY_NO_CE – ATM – ATM_NO_CE • Provider or Organization **Note** If you do not specify a **Provider** or **Organization**, the service policy is global.

Note If you set the **AutoPickVlanId** keyword in the **ServiceDefinitionDetails**, be sure that an access domain is attached to the PE that the PE-CLE (switch) is connected to, and a VLAN pool is assigned to the access domain.

XML Examples:

- CreateL2VPNServiceDefn_EVCS.xml
- CreateL2VPNServiceDefn_EthernetEVCS_NO_CE.xml
- CreateL2VPNServiceDefn_EthernetTLS.xml
- CreateL2VPNServiceDefn_EthernetTLS_NO_CE.xml
- CreateL2VPNServiceDefn_ATM.xml
- CreateL2VPNServiceDefn_ATM_NO_CE.xml
- CreateL2VPNServiceDefn_FRAME_RELAY.xml
- CreateL2VPNServiceDefn_FRAME_RELAY_NO_CE.xml

Step 16 Create the L2VPN service request.

An L2VPN service request consists of one or more end-to-end wires, connecting various sites in a point-to-point topology. When you create a service request, you enter several parameters, including the service definition to use, the specific interfaces on the CPE (or UNI) and PE devices, routing protocol information, and IP addressing information.

In this example, an L2VPN service request is created for an ATM network with the CE present. The service request is deployed through a service order. The **ServiceRequestDetails** specify the attributes for the end-to-end wires and attachment circuits.

Table 7-16 Create a Service Request

Operation	className	Required Parameters
createInstance	ServiceOrder	• ServiceName • NumberOfRequests • ServiceRequest
	ServiceRequest	• RequestName • Type=L2Vpn • ServiceRequestDetails
	ServiceRequestDetails	• ServiceDefinition – ServiceDefinitionType=L2Vpn • EntoEndWire • VPN
	EndtoEndWire	• AttachmentCircuit
	AttachmentCircuit	• ACAttrs – LinkTemplate (optional) **Note** See the "Templates in a Service Request" section on page 4-9.

Tip Record the **LocatorId** value that is returned for the service request. The locator ID is required to perform a configuration audit of the service request.

XML Examples:

- CreateL2VPNServiceOrder_EVCS.xml
- CreateL2VPNServiceOrder_EVCS_NO_CE.xml
- CreateL2VPNServiceOrder_EthernetTLS.xml
- CreateL2VPNServiceOrder_EthernetTLS_NO_CE.xml
- CreateL2VPNServiceOrder_ATM.xml
- CreateL2VPNServiceOrder_ATM_NO_CE.xml
- CreateL2VPNServiceOrder_FRAME_RELAY.xml
- CreateL2VPNServiceOrder_FRAME_RELAY_NO_CE.xml

Auditing Service Requests

A configuration audit occurs automatically each time you deploy a service request. During this configuration audit, ISC verifies that all Cisco IOS commands are present and that they have the correct syntax. An audit also verifies that there were no errors during deployment by examining the commands configured by the service request on the target devices. If the device configuration does not match what is defined in the service request, the audit flags a warning and sets the service request to a *Failed Audit* or *Lost* state.

If you do not want the configuration audit to occur, change the value for the **Audit** parameter. The **Audit** parameter supports these values:

- **Audit**—This is the default. A successfully deployed service request is automatically audited unless this flag is changed.
- **NoAudit**—Do not perform a configuration audit when the service request is deployed.
- **ForceAudit**—Perform a configuration audit even if the service request deployment is not successful.

You can use the Audit parameter with a **Create**, **Modify**, or **Decommission** service request or a **Deployment** task. See the "Service Decommission" section on page 3-10 for more information. To perform a configuration audit as a separate task, see the "Configuration Audit" section on page 3-11.