Design a Topology

Design a Topology Overview

The design phase is the initial step in creating a network topology. During the design phase, you will perform the tasks described in the following sections.

Topology Nodes and Connections

The topology you design consists of nodes and connection functions. See Navigating Within the Cisco Modeling Labs Client for additional information about how to select and edit nodes and connection functions.

Topology Nodes

Table 1: Node Subtypes

Node Name	Node Type
Cisco IOSv	Router node. Runs a Cisco IOS operating system.
Cisco IOSvL2	Router node. Runs a Cisco IOS Layer 2 operating system.
Server	Server node. Runs a Linux operating system.
Cisco IOS XRv	Router node. Runs a Cisco IOS XR operating system.
Cisco IOS XRv 9000	Router node. Runs a Cisco IOS XR 9000 operating system. (Available separately.)

Node Name	Node Type
Cisco CSR1000v	Router node. Runs a Cisco CSR 1000 operating system. (Available separately.)
Cisco ASAv	Router node. Runs a Cisco ASAv operating system.
Cisco NX-OSv 9000	Router node. Runs a Cisco Nx-OS 9000 operating system.

A node subtype is a virtual machine that runs on top of OpenStack, which itself is running in a Linux virtual machine that is running on top of VMware software. Because the node is virtual, specific hardware is not emulated. For example, there are no power supplies, no fans, no ASICs, and no physical interfaces. For all router nodes, the interface type is a Gigabit Ethernet network interface. A server node has an Ethernet network interface.

You can choose an image and image flavor for each node type. See the ***User Workspace Management*** chapter in the *Cisco Modeling Labs Corporate Edition System Administrator Installation Guide, Release 1.5* for information on how to access the VM Image and the VM Flavor choices. In most cases, you need not select an image and flavor. By default, the node subtype is associated with an image and flavor that runs with the topology.

Table 2: Node VM Images

VM Image Name	Used For
server	Server node
CSR1000v	Cisco CSR1000 node
IOSv	Cisco IOS node
IOSvL2	Cisco IOS Layer 2 node
IOS XRv	Cisco IOS XR node
IOS XRv 9000	Cisco IOS XR 9000 node
AVAv	Cisco AVAv node
Nx-OSv 9000	Cisco NX-OSv 9000 node

Table 3: Node VM Flavors

VM Flavor Name	Used For
m1_tiny	Linux server
m1_small	Linux server
m1_medium	Linux server
m1_large	Linux server
m1_xlarge	Linux server

VM Flavor Name	Used For
server	Linux server
CSR1000v	Cisco CSR 1000 node
IOS XRv	Cisco IOS XR node
IOS XRv 9000	Cisco IOS XR 9000 node
IOSv	Cisco IOS node
IOSvL2	Cisco IOS Layer 2 node
AVAv	Cisco AVA node
NX-OSv 9000	Cisco NX-OS 9000 node

Each Linux flavor provides a different amount of memory and CPU allocated to the server.

Connection Functions

Cisco Modeling Labs provides the connection functions shown in the following table.

Table 4: Connection Functions

Connection Type	Description
Connection	Creates a connection between two interfaces. Interfaces are created in the node to support a connection. Any unused interfaces present are automatically assigned. All the interfaces in router nodes are represented as Gigabit Ethernet interfaces. Multiple parallel connections are supported.
External Router	Creates an external router connection point. When the external router is used in conjunction with a Layer 2 External (Flat) network and IOSv instances, AutoNetkit is able to configure an L2TPv3 tunnel to connect simulations to remote devices in a transparent manner.
Layer 3 External (SNAT)	Creates a Layer 3 external connection point using static network address translation (SNAT). This external connection point allows connections outside of Cisco Modeling Labs to connect to the topology.
Layer 2 External (Flat)	Creates a Layer 2 external connection point using FLAT. This external connection point allows connections outside of Cisco Modeling Labs to connect to the topology.

Create a Topology

Before you begin

A topology project folder must exist.

There are several methods for creating a topology. These are discussed in the following sections.

Method 1: Create a Topology from the Menu Bar

Step 1 Select a topology project folder.

Step 2 Enter a filename, ensuring that it ends with the extension **.virl**.

Step 3 Click **Finish**.
A filename .virl topology file is created in the selected project folder.

Method 2: Create a Topology from the Projects View

Step 1 Right-click **Projects** view.

Step 2 Choose **New** > **Topology**.

Step 3 Select a topology project folder.

Step 4 Enter a filename, ensuring that it ends with the extension **.virl**.

Step 5 Click **Finish**.
A filename .virl topology file is created in the selected project folder.

Method 3: Create a Topology from the Toolbar

Step 1 Click the **New Topology File** icon in the toolbar.

Step 2 Select a topology project folder.

Step 3 Enter a filename, ensuring that it ends with the extension **.virl**.

Step 4 Click **Finish**.
A filename .virl file is created in the selected project folder.

What to do next

Place the nodes.

Place the Nodes on the Canvas

Before you begin

- A topology file must exist.
- The topology file must be open and the canvas visible in the **Topology Editor**.

Step 1 Click a node type, which is under the **Nodes** heading in the **Palette** view.

Step 2 Click the canvas at each point where you want to place a node. You can also drag the nodes on the canvas to position them. You can then arrange the nodes using several methods:

What to do next

Create connections and interfaces.

Create Connections and Interfaces

Before you begin

Nodes must be in place on the canvas of the **Topology Editor**.

Step 1 Click **Connection** in the **Tools** view.

Step 2 Click the first node.

Use Unmanaged Switches

Users have the choice to use either an unmanaged switch or Cisco IOSv layer 2 to provide a switching service. Unmanaged switches are used in place of the multipoint connection which was available in previous versions of Cisco Modeling Labs. For example, in the following figure there are 3 IOSv instances connected to an unmanaged switch. Each of the interfaces on iosv-1, iosv-2, and iosv-3 appear to be on the same subnet for point to point communication through the unmanaged switch. Unmanaged switch instances use the underlying Linux bridge process running under OpenStack control to provide this connectivity between the various virtual machines. It is a transparent switch.

Before you begin

A topology file with the extension .virl must exist. Router nodes or server nodes are placed on the canvas. Optionally, connections may exist between nodes.

Step 1 In the **Nodes** view, click **Unmanaged Switch**.

Step 2 Click the area on the canvas where you want the unmanaged switch to appear.

Step 3 In the **Tool** view, click **Connect**.

Step 4 On the canvas, click the unmanaged switch node then click an end node. A connection appears.

Continue clicking unmanaged switch-node combinations until all connections are made.

The Cisco IOSvL2 Switch Image

The Cisco IOSvL2 switch image is a virtual machine like Cisco IOSv, Cisco IOS XRv, and so on. It runs and is configured in the same way as all other virtual machines. It runs a Cisco IOSv 15.2 switch image.

Note All Cisco IOSvL2 switch images in a topology are counted against the licensed node limit.

A Cisco IOSvL2 switch image provides sixteen Gigabit Ethernet interfaces, reserving interface Gi0/0 for OOB management. It can be configured manually or using AutoNetkit.

Cisco IOSvL2 switch instances can operate in:

- Layer 2 mode
- Layer 3 mode

By default the instances operate in layer 3 mode. However, the primary use of the Cisco IOSvL2 switch image is for switching purposes.

Any routers set up to connect to the Cisco IOSvL2 switch will be in switchport access mode. By default, all routers are placed in VLAN 2. You can specify which VLAN to place a port in by setting a VLAN attribute on the router interface. See Assign VLANs for details on how to do this.

Switch to switch connections configured using AutoNetkit are by default set to operate as an 802.1q trunk.

Use the Cisco IOSvL2 Switch Image

Step 1 In the **Nodes** view, click **IOSvL2**.

Step 2 Click the canvas at each point where you want to place an IOSvL2 node. You can also drag the nodes on the canvas to position them.

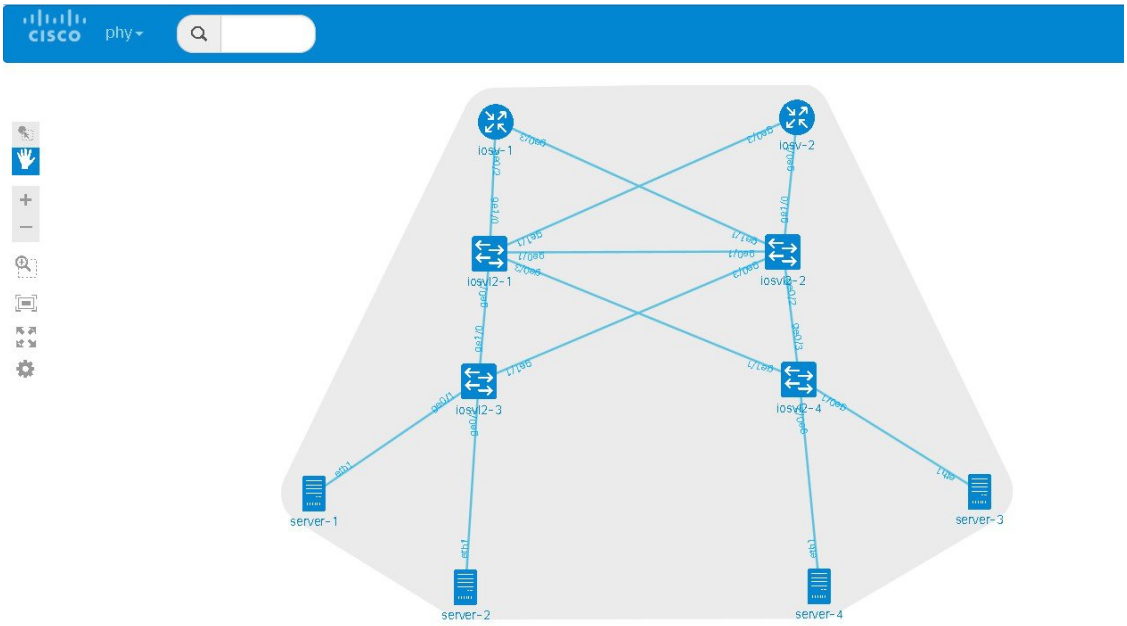
Step 3 Add additional node types as required.

Step 4 Use the **Connect** tool to create connections between the nodes.

Step 5 Under **Properties** > **AutoNetkit**, enter a value for the **VLAN** field, as shown.

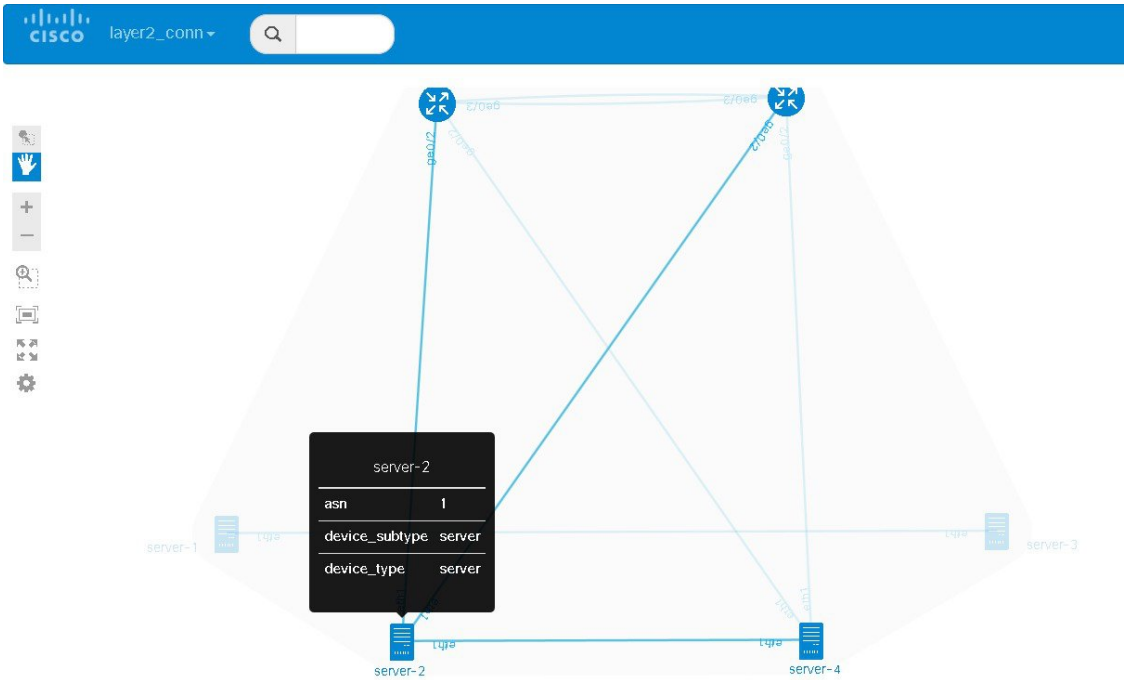
Step 6 From the toolbar, click **Build Initial Configurations** to generate a configuration for the topology using AutoNetkit. When prompted to open AutoNetkit visualization, click **Yes**.
AutoNetkit visualization for the topology opens in a browser window.

Figure 1: AutoNetkit Visualization



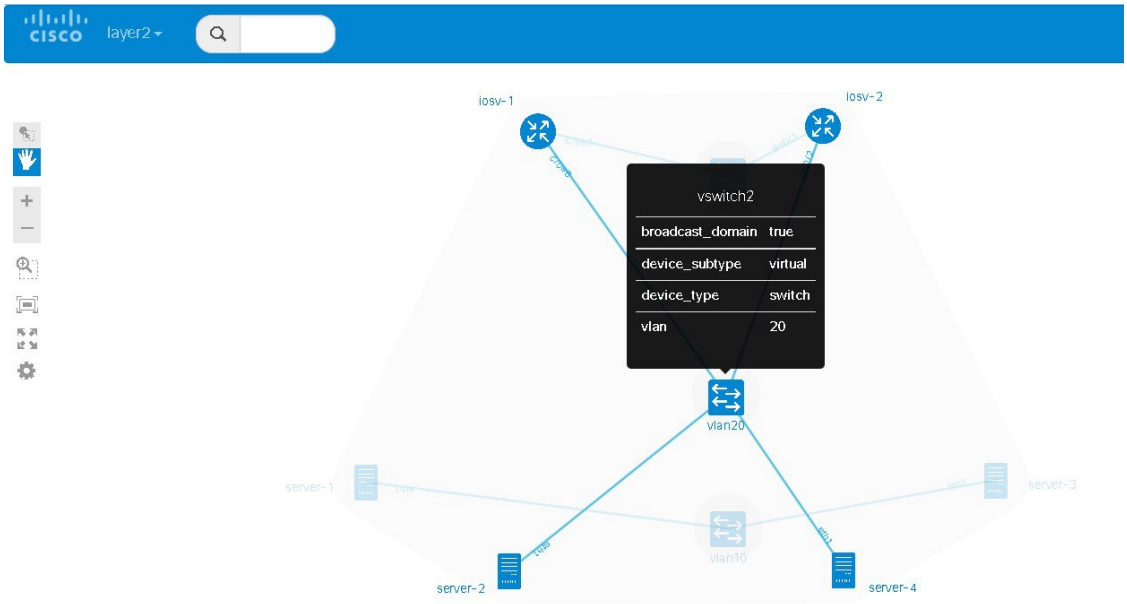
Step 7 To view all broadcast domains that are enabled, select **layer2_conn** from the **phy** drop-down list. For example, hovering over server-2 in this example shows the routers and servers that are in the same VLAN. All other devices are greyed out.

Figure 2: Layer 2 Connectivity



Selecting **layer2** from the **phy** drop-down list shows the switches representing the VLANs in place.

Figure 3: Layer 2 Switches



Step 8 In the Cisco Modeling Labs client, click **Launch Simulation** to start the simulation.
The simulation starts and is visible in the **Simulations** view.

Docker Container Support

Cisco Modeling Labs provides the ability to integrate Docker images into Cisco Modeling Labs topologies.

Users are able to select docker images from public repositories (such as hub.docker.com) or private repositories. Once downloaded to your Cisco Modeling Labs server, you are able to design a network topology that will include your docker image.

In Cisco Modeling Labs, docker functionality is placed inside another virtual machine, CoreOS; which acts as a host for running docker instances. This is done for two reasons, for security and to constrain and restrict how many instances you have running by putting in place memory controls around the resources utilizations of the various docker instances.

Note You must install the CoreOS virtual machine image. This is available for installation from the Cisco Modeling Labs FileExchange. Please contact cml-info@cisco.com if you require access.

You can have many docker instances but you need to be careful with the amount of memory that docker instances require. Understand that CoreOS is running docker services as well as the docker instances themselves.

There is a limit of 22 docker instances running at any one time. This limit is set by the number of interfaces that the KVM supports.

Basic configuration information (interface and routing details) are provided by AutoNetkit using the build initial configurations function. As part of the simulation launch, the CoreOS virtual machine is spun up and the docker instance started within it. The docker instance will appear as if it were directly connected to the other nodes within your simulation. The neighboring devices are unaware of the presence of the CoreOS VM that is hosting the docker instances. Each link that is created in the topology design results in an external tap interface being created on the CoreOS instance. The CoreOS VM is configured to run with 2Gb RAM and 2vCPUs. If the amount of memory is insufficient, it can be adjusted using the **Node Resources/Flavors** function in the **User Workspace Management** interface.

There are thousands of docker images available on public repositories. However, not all images will run on Cisco Modeling Labs (or any other docker deployment), so care must be taken when selecting the image.

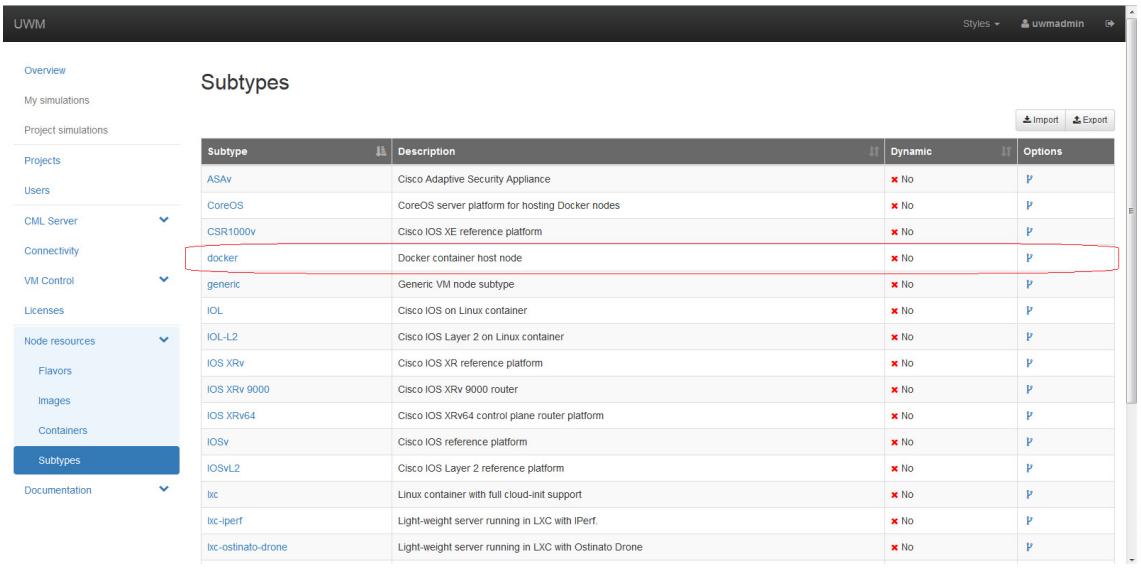
Using Integrated Docker Containers in Cisco Modeling Labs Topologies

To use integrated docker containers in your topologies, complete the following steps.

Step 1 Download the docker image to the Cisco Modeling Labs server.

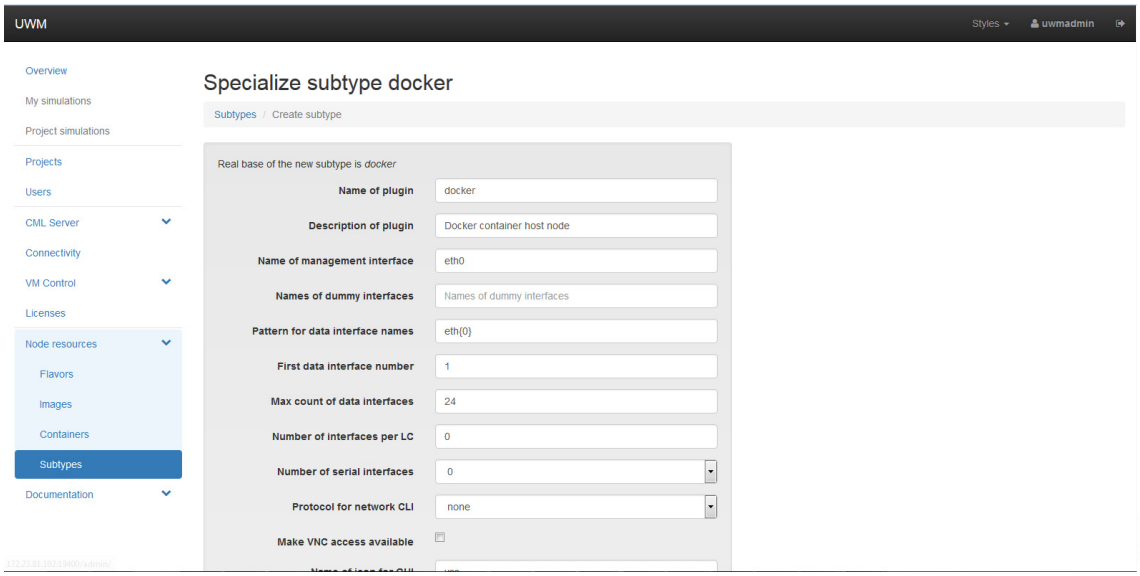
Step 2 In the User Workspace Management interface, the list of available subtypes is accessed using **Node Resources** > **Subtypes** as shown.

Figure 4: List of Available Subtypes



For each docker type that is added, you need to create a subtype using the **Specialize** option to clone the template provided.

Figure 5: Create a Subtype Docker Container



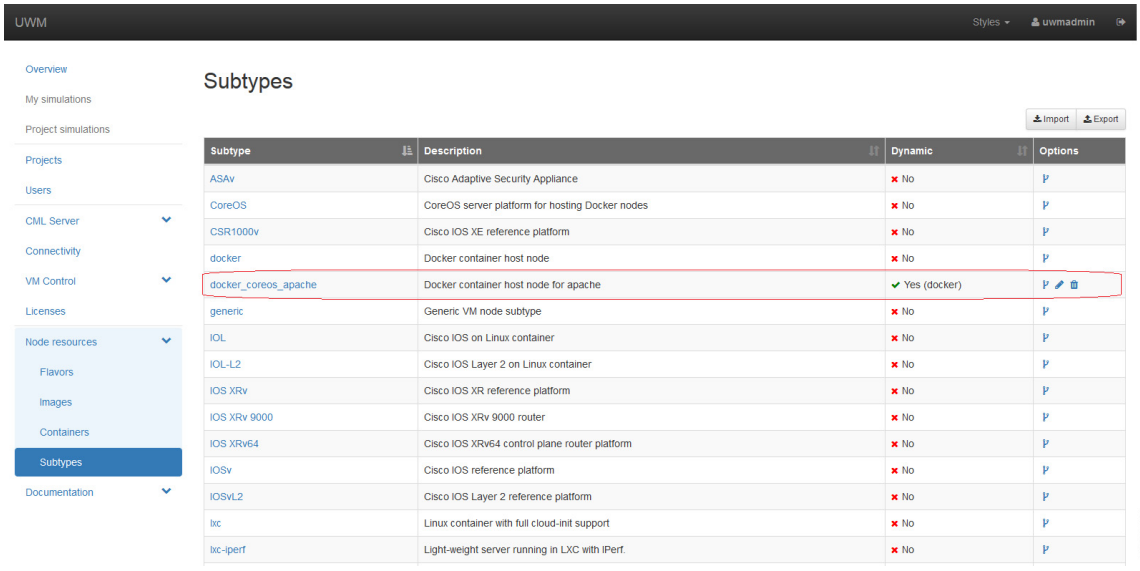
The required fields to complete are:

- Name of plugin
- Name of Default Image
- Arguments for LXc template; docker run CMD

Click **Create**.

The newly created subtype is displayed in the Subtypes list.

Figure 6: Docker Subtype Created

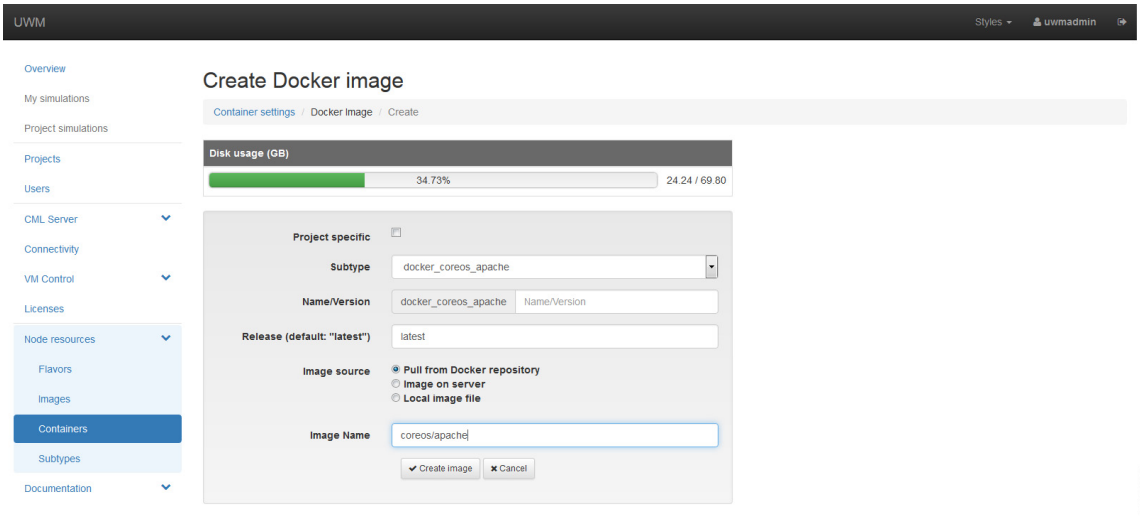


Step 3 Under **Node Resources** > **Containers** > **Docker Images**, click **Add**.

Browse the docker repository and search for the applicable image, for example, coreos/apache. Select the option and note down the applicable Docker Pull Command, eg. `docker pull coreos/apache`.

Step 4 In the **Create Docker Image** page, select the newly created docker subtype from the drop-down list.

Figure 7: Create Docker Image



In the **Image Name** field, enter the docker pull command noted earlier. Click **Create Image**.

The content is now downloaded. The new docker image is displayed in the **Docker Images** list.

Step 5 To add the docker image for use in Cisco modeling Labs topologies, open the Cisco modeling Labs client.

Step 6 Choose **File** > **Preferences** > **Node Subtypes** and click **Fetch from Server**.
The newly created docker image is displayed in the Node Subtypes list. Additionally, the docker image icon is also available from the **Topology Palette** for use in topology design.