Understand Plan Objects

Cisco Crosswork Planning networks consist of objects, such as nodes (which represent routers), interfaces, circuits, SRLGs, LSPs, ports, and port circuits. A site is also an object, and is a Cisco Crosswork Planning construct for simplifying the visualization of a network by grouping nodes within a site, or even by grouping sites within a site.

Most objects are represented in the network plot, and all of them are represented in Network Summary tables on the right side. They have *properties* that identify and define them, many of which are discovered. They can also be manually added and changed. For example, all circuits have a discovered **Capacity** property that can be edited. Other properties are derived. For example, **Capacity sim** is derived from the **Capacity** property. Another example is that interfaces have a **Util sim** property that identifies the percentage of **Capacity sim** the simulated traffic is using. Properties are viewable and editable through the Edit window. These are represented by columns in the object's table, or by entries in tables of related objects.

Cisco Crosswork Planning has a Layer 3 (L3) view containing objects. Throughout this guide, the terms *node* and *circuit* refer to objects in the L3 view.

This section describes these basic objects and their relationships, as well as how to create, edit, and delete them.

Nodes and Sites

Both *node* and *site* are Cisco Crosswork Planning terminology.

- Node—A device in the network, which can be one of three types: physical, PSN (pseudonode), or Virtual. The **Type** property distinguishes whether the node represents a real device or an abstraction, such as a single node representing a number of edge nodes connected in the same way to the network. A physical node is a Layer 3 device, or router. Physical and virtual nodes behave in the same way within Cisco Crosswork Planning. A pseudo-node (PSN) is typically used to represent a Layer 2 device or a LAN.

  Nodes can reside both inside and outside of sites. The external arrangement could be useful for small networks where routers are not geographically dispersed.

- Site—A collection of nodes and/or other sites that potentially form a hierarchy of sites. Any site that contains other sites is called the *parent* site.

  Both nodes and sites have simulated traffic, while nodes also have measured traffic.

- Nodes are shown as blue router icons ( ). The border color is an indication of traffic sourced from and destined to the node. A light blue outline indicates that the node is selected. For more information, click the icon in the network plot.

- Sites are shown as blue circles ( ). The border color indicates the traffic utilization of all the nodes and circuits inside the site, including all nested nodes and circuits. A light blue outline indicates that the site is selected . The number inside the circle indicates the number of nodes in the site. For more information, click the icon in the network plot.

  Note that sites can contain L3 nodes. Empty sites and sites containing L3 nodes appear in the L3 view.

Parent sites and contained objects

Unless a site is empty, there is a hierarchy of the sites and nodes that a site contains. A site can be both a parent and a child site. If a site contains another site, it is a *parent* site. Any nodes, sites, or circuits within a parent site are *contained* (*nested*) objects. The contained nodes and sites are also called *children*. Often the child nodes and sites are geographically co-located. For example, a site might be a PoP where the routers reside.

- The site’s **Parent site** property defines whether it is nested within another site. If it is empty, the site is not nested.
- In the network plot, the parent site shows all egress inter-site interfaces of all nodes contained within it, no matter how deeply the nodes are nested. Similarly, this is true for each child site plot within it.
- Selecting a site from the network plot does not select the sites or nodes under it.

Delete sites

Selecting a site from the network plot does not select the sites or nodes under it except when deleting the site. In this case, all objects within a site are selected for deletion. However, in the confirmation that appears, you have the option to keep the contained sites and nodes. If you do, then the objects that are contained directly within it are moved to be on the same level as the site that is removed. The other, more deeply nested objects maintain their parent relationships.

PSN nodes

Cisco Crosswork Planning network models can contain nodes of with a **Type** property of “psn”. These nodes represent pseudonodes (PSNs), which are used to model LANs or switches that connect more than two routers. They are used in two situations: for IGP modeling and BGP peer modeling.

In an IGP network, a LAN interconnecting multiple routers is represented by a PSN node, with circuits connected to each of the nodes representing the interconnected routers. Both OSPF and IS-IS have a built-in system whereby one of the routers on that LAN is the designated router (DR) for OSPF or the designated intermediate system (DIS) for IS-IS. The PSN node is named after this designated router. Cisco Crosswork Planning creates nodes with a property Type of **PSN** automatically during IGP discovery.

When BGP peers are discovered, Cisco Crosswork Planning might find that a router is connected to multiple peers using a single interface. This is typical at switched Internet Exchange Points (IXPs). Cisco Crosswork Planning then creates a node with a property Type of **PSN**, and connects all the peers to it, each on a different interface.

Few points to consider when working with nodes that have **PSN** as a **Type** property are:

- Two PSNs cannot be connected by a circuit.
- If a PSN node is created by Cisco Crosswork Planning, “psn” is prepended to the designated router’s node name.
- When creating demand meshes, Cisco Crosswork Planning does not create demands with nodes of Type psn as sources or destinations. This is possible in manual demand creation, but not recommended. Cisco Crosswork Planning sets the IGP metric for all egress interfaces from a node of Type psn to zero. This ensures that the presence of a PSN in a route does not add to the IGP length of the path.

Create nodes and sites

Create nodes

To create nodes, follow the steps in Create objects, on page 10, where *Object* is **Node**.

These are some of the frequently used fields and their descriptions.

- Name—Required unique name for the node.
- IP address—Often the loopback address used for the router ID.
- Site—Name of the site in which the node exists. If left empty, the node resides in the network plot. This offers a convenient way to create a site while creating the node, move nodes from one site to another, or remove nodes from a site so it stands alone in the network plot.
- AS—Name of the AS in which this node resides, which identifies its routing policy. This can be left empty if no BGP is being simulated.
- BGP ID—IP address that is used for BGP.
- Function—Identifies whether this is a Core or Edge node.
- Type—The node type, which is physical, PSN, or virtual. Because a PSN node represents a Layer 2 device or a LAN, interfaces on a PSN must all have their IGP metrics set to zero, and two PSN nodes cannot be directly connected to one another. If you change a node type to PSN, Cisco Crosswork Planning automatically changes the IGP metrics on its associated interfaces to zero.
- Longitude and Latitude—Geographic location of the node within the network plot. These values are relevant when using geographic backgrounds.

Create sites

To create sites, follow the steps in Create objects, on page 10, where *Object* is **Site**.

These are some of the frequently used fields and their descriptions.

- Name—Unique name for the site.

- Display name—Site name that appears in the plot. If this field is empty, the Name entry is used.
- Parent site—The site that immediately contains this site. If empty, the site is not contained within another one.
- Location—Select the location from the list of cities. To automatically place a site in its correct geographic location and update the Longitude and Latitude fields, enter the airport code and press Enter.
- Longitude and Latitude—Geographic location of the site within the network plot. These values are relevant when using geographic backgrounds.

Merge nodes

Real network topologies often have a number of nodes, typically edge nodes, connected to the network in the same way. For example, they might all be connected to the same core node or pair of core nodes. For planning and design of the network core, it is often desirable to merge these physical nodes into a single virtual node, which simplifies the plan and accelerates the calculations and simulations performed. Note that merging nodes changes the plan itself, not just the visual representation.

The name of a newly merged node can be based on the site name, selected node name (base node), or have a new user-specified name. The node merge effects are as follows:

- Reattach circuits from other nodes to the base node.
- Move demands to or from other nodes to the base node.
- Move LSPs to or from other nodes to the base node.
- Set base node traffic measurements to the sum of measurements of the selected nodes.
- Delete other nodes.

Follow these steps to merge nodes.

Procedure

Step 1 Open the plan file (see Open plan files). It opens in the **Network Design** page.

Step 2 From the toolbar, choose **Actions** > **Initializers** > **Merge nodes**.

Step 3 Select the nodes that you want to merge in the Merge Nodes wizard. If you do not select any nodes, Cisco Crosswork Planning merges all nodes.

Step 4 Click **Next**.

Step 5 Select whether to merge the nodes per site or merge them into one node.

- Separate merge per site—Merges nodes on a per-site basis. For example, if you selected all nodes in the plan, the result would be one merged node per site. If you do not specify a new suffix, the default name is the same as the site.
- Merge all nodes together into base node—Merges all nodes selected into one node. For example, if you selected two nodes in one site and three nodes in another, the result would be a single node in the site and node combination selected as the base node.

  If you do not specify a new name, the default is to use the name of the base node.

- Merge nodes table—Merges nodes based on the file containing <MergeNodes> table. You can choose this file either from the user space or local machine.

Step 6 Click **Next**.

Step 7 Preview the list of effects of node merge. If these are acceptable, then click **Merge**.

Circuits and interfaces

In Cisco Crosswork Planning, an interface is either an individual logical interface or a LAG logical interface. If there is a one-to-one mapping between a logical and physical interface, then the interface contains both Layer 3 properties (for example, Metric) and physical properties (for example, Capacity). If there is a one-to-many mapping between logical and physical interfaces, then the interface is the logical LAG and the ports are included in the plan file as the physical ports in the LAG. For more information on ports and port circuits, see Ports, port circuits, and LAGs, on page 7.

Each circuit connects a pair of interfaces on two different nodes. Therefore, an interface always has an associated circuit. Both the Edit Interface and Edit Circuit windows let you simultaneously edit properties for the pair of interfaces and the circuit.

Interfaces have both measured and simulated traffic. The traffic that appears in the Circuits table is the higher of the traffic in the two interfaces.

Create circuits and interfaces

To create circuits, follow the steps in Create objects, on page 10, where *Object* is **Circuit**. As a result of creating a circuit, two interfaces are also created.

Following are some of the frequently used fields:

- Capacity—The amount of total traffic this circuit can carry. The drop-down list has a selection of the most widely used capacities.
- SRLGs—If you want this circuit to belong to an SRLG, select it from this list or create a new one by clicking **Edit**. See Create SRLGs for circuits only, on page 6.
- Parallel group name—To include this circuit in a new or existing parallel grouping, enter its name.
- Interface A and B—You must specify two interfaces that are connected by the circuit.

Merge circuits

You can simplify the plan by merging circuits that have the same source and destination endpoints (nodes). This capability is useful, for example, in long-term capacity planning where multiple parallel circuits can be ignored and only the site-to-site connections are of interest.

Merging circuits changes the network model itself, not just the visual representation.

The effects of circuit merge are as follows:

- Sets base circuit capacity to the sum of capacities.

- Sets base circuit metric to minimum of metrics.
- Sets base traffic measurements to the sum of measurements.
- Deletes other circuits.

Follow these steps to merge circuits.

Procedure

Step 1 Open the plan file (see Open plan files). It opens in the **Network Design** page.

Step 2 From the toolbar, choose **Actions** > **Initializers** > **Merge circuits**.

Step 3 Select the circuits that have the same source and destination endpoints.

Step 4 Preview the list of effects of circuit merge. If these are acceptable, then click **Submit**.

SRLGs

An SRLG is a group of objects that might all fail due to a common cause. For example, an SRLG could contain all the circuits whose interfaces belong to a common line card.

Create SRLGs

Follow these steps to create SRLGs.

Procedure

Step 1 Open the plan file (see Open plan files). It opens in the **Network Design** page.

Step 2 Create SRLGs by following the steps in Create objects, on page 10, where *Object* is **SRLG**.

Step 3 Enter the SRLG name.

Step 4 From the **Object type** drop-down list, choose the type of object that you want to include in the SRLG.

Step 5 For each object you want to include in the SRLG, check the check box under the **Included** column.

Step 6 Click **Add**.

Create SRLGs for circuits only

Follow these steps to create SRLGs for circuits.

Procedure

Step 1 Open the plan file (see Open plan files). It opens in the **Network Design** page.

Step 2 Open the Add/Edit Circuits window using any of these methods.

- If you are creating a new circuit, follow the steps in Create objects, on page 10, where *Object* is **Circuit**.
- If you are creating SRLGs for selected circuits, select one or more circuits from the **Circuits** tab. Then, click .

Step 3 Click the **Edit** button associated with the **SRLGs** field.

Step 4 Associate the circuits with one or more existing SRLGs, or create a new SRLG.

Associate Circuits with Existing SRLGs	Create New SRLG
a. For each SRLG in which you want to include the selected circuits, check the check box. **b.** Click **Save**.	**a.** Click . **b.** Enter the new SRLG name, and click **Save**.

Step 5 Click **Add** or **Save** in the Add or Edit Circuit window, as appropriate.

Ports, port circuits, and LAGs

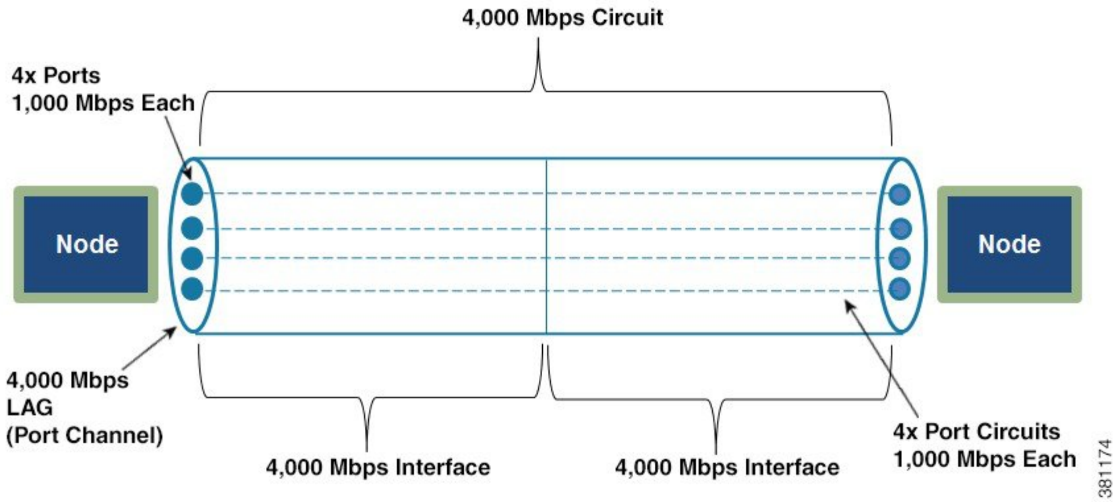
In Cisco Crosswork Planning, a port is a physical interface. You can model link aggregation groups (LAGs) and port channels using Cisco Crosswork Planning port and port circuits.

A LAG is a group of physical ports that are bundled into a single logical interface. A LAG is also known as *bundling* or *trunking*.

By default, each logical interface listed in the Interfaces table corresponds to a single physical port, and these ports need not be explicitly modeled. The exception is when the logical interface is a LAG, which bundles more than one physical port. In this case, the physical ports are listed in the Ports table.

A port circuit is a connection between two ports. However, ports are not required to be connected to other ports by port circuits.

Figure 1: Ports, port circuits, and LAGs



Create ports

To create ports, follow the steps in Create objects, on page 10, where *Object* is **Port**.

These are some of the frequently used fields and their descriptions.

- Name—Required name of the port.
- Site and Node—Site and node on which this port exists.
- Interface—Logical interface to which this port is mapped. This must be defined to create port circuits using this port.
- Capacity—The amount of total traffic this port can carry. The drop-down list has a selection of the most widely used capacities.

Create port circuits

A port circuit specifies a pair of connected ports.

- Both of the ports must exist and be mapped to interfaces that are connected by a circuit.
- When selecting two ports for the port circuit, note that if one is assigned to an interface, the other must be assigned to the remote interface on the same circuit.

  To create ports and map them to their interfaces, see Create ports, on page 8.

  To create port circuits, follow the steps in Create objects, on page 10, where *Object* is **Port circuit**.

  These are the required fields and their descriptions.

  - Site and Node—Site and node on which the port exists.
  - Port—Name of the port.

- Capacity—The amount of total traffic this port circuit can carry. The drop-down list has a selection of the most widely used capacities.

Create LAGs

Follow these steps to make one of the existing interfaces into a LAG by assigning ports to it. If the interface does not contain ports, you must first create them (see Create ports, on page 8).

Procedure

Step 1 Open the plan file (see Open plan files). It opens in the **Network Design** page.

Step 2 In the Network Summary panel on the right side, from the **Ports** table, select all ports that belong to the LAG. You can quickly do this by filtering to their common interface.

Step 3 Select one of the ports and click to open the Edit window.

Step 4 Select the interface that contains these ports.

Step 5 Click **Save**.

Set LAG simulation properties

Each interface is considered to be a LAG (port channel). You can configure LAG properties so that if it loses too much capacity due to non-operational ports, the entire LAG is taken down.

Follow these steps to configure LAG properties.

Procedure

Step 1 Open the Edit window of an interface or circuit (see Edit objects, on page 10).

Step 2 Click the **Advanced** tab.

Step 3 In the **Port channel** area, set one or both of the following parameters for one or both interfaces on the circuit:

a) In the **Min number of ports** field, enter the minimum number of ports that must be active and operating for the LAG circuit to be up.

b) In the **Min capacity** field, enter the minimum capacity that must be available for the LAG circuit to be up.

Step 4 Click **Save**.

Key operations you can perform on objects

Following sections describe the operations that you can perform on plan objects.

Create objects

This topic describes how to add objects to a plan file.

Procedure

Step 1 Open the plan file (see Open plan files). It opens in the **Network Design** page.

Step 2 Create objects using one of these methods:

- From the toolbar, choose **Actions** > **Insert** > *Object*.
- In the Network Summary panel on the right side, navigate to the *Objects* tab and then click [+].

  The required *Objects* tab may be available under the **More** tab. If it is not visible, then click the **Show/hide tables** icon ( ) and check the relevant *Object* check box.

  For details, see Work with tables and object selections.

Step 3 Enter the required details. The properties differ for each object.

Step 4 Add the object.

The object is added to the plan file.

Edit objects

Most objects in the plot and in the associated tables have a set of properties that you can manage using the Edit page. These are the properties Cisco Crosswork Planning uses to define and simulate an object.

This topic describes how to edit objects in a plan file.

Procedure

Step 1 Open the plan file (see Open plan files). It opens in the **Network Design** page.

Step 2 In the Network Summary panel on the right side, navigate to the desired *Object* tab, and edit the object properties.

Step 3 To edit a single object, use one of these methods:

- Select the required object and click .
- In the **Actions** column, click ··· > **Edit** for the object whose properties you want to edit.

Step 4 To edit multiple objects (bulk edit), select the required objects and click .

Note
In case of a bulk edit operation, you can

- select all objects and edit them

- filter objects, then select and edit them, or
- select objects from the network plot and edit them.

Step 5 Edit the properties, as required.

Step 6 Save the changes.

The selected objects are updated with the new properties.

Delete objects

This topic describes how to delete objects from a plan file.

Procedure

Step 1 Open the plan file (see Open plan files). It opens in the **Network Design** page.

Step 2 In the Network Summary panel on the right side, navigate to the desired *Object* tab, and delete the objects.

Step 3 To delete a single object, use one of these methods:

- Select the required object and click .
- In the **Actions** column, click > **Delete** for the object whose properties you want to delete.

Step 4 To delete multiple objects (bulk delete), select the required objects and click .

The object deletion successful message appears.