Flexible Algorithms

Flexible Algorithm allows operators to customize and compute the IGP shortest path according to their own needs and constraints (specific metrics and link properties). Many possible constraints can be used to compute a path over a network. For example, Flexible Algorithm can confine the path to a particular plane for networks with multiple logical planes. Since the meaning of the algorithm is not defined by any standard, but is defined by the user, it is called a Flexible Algorithm.

Crosswork enables you to filter the IGP topology based on Flexible Algorithm and visualize the subset of the network that is capable of providing a specific set of transport characteristics. The ability to visualize Flexible Algorithm topologies provides an important tool to help you deploy, maintain, and verify that the configured Flexible Algorithm intent is realized in your network. For example, to improve service availability, you may use Flexible Algorithm to define disjoint logical topologies to increase resiliency to network failures. Crosswork allows you to visualize both Flexible Algorithm topologies simultaneously and verify they have no common nodes or links. Or if they do, help you determine the common network elements so that you can update Flexible Algorithm configurations.

This section contains the following topics:

Configure Flexible Algorithm Affinities

Flexible Algorithm affinity names that are defined on devices are not collected by Crosswork. You can optionally define affinity mapping on the Cisco Crosswork UI for consistency with Flexible Algorithm affinity names in device configurations. Cisco Crosswork will only send bit information to SR-PCE during provisioning. If an affinity mapping is not defined in the UI, then the affinity name is displayed as "UNKNOWN". If you want to configure affinity mappings in Cisco Crosswork for visualization purposes, you should collect affinities on the device, then define affinity mapping in the Cisco Crosswork UI with the same name and bits that are used on the device.

See SR configuration documentation for your specific device to view descriptions and supported configuration commands (for example: *Segment Routing Configuration Guide for Cisco ASR 9000 Series Routers*

The following example shows the Flexible Algorithm affinity configuration (`affinity-map`) on a device:

```
router isis CORE
 is-type level-2-only
 net 49.0001.0000.0000.0002.00
 log adjacency changes
```

```
affinity-map b33 bit-position 33
affinity-map red bit-position 1
affinity-map blue bit-position 5
flex-algo 128
 priority 228
 advertise-definition
 affinity exclude-any blue indigo violet black
!
```

For visualization purposes, you must map the affinity names to the bits using the following procedure:

Step 1 From the main menu, select **Administration** > **Settings** > **System Settings > Traffic Engineering > Affinity > Flex-Algo Affinities** tab.

Step 2 To add a new Flexible Algorithm affinity mapping, click **+ Create** .

Step 3 Enter the name and the bit it will be assigned. For example (using the above configuration):

Example:

TE Link Affinities	Flex-Algo Affinities	
+ Create		**▼**
Name ⑦	Bit Position (0-255) ⑦	Actions
b33	33	Edit Delete
red	1	Edit Delete
blue	5	Edit Delete

Step 4 Click **Save** to save the mapping. To view all Flexible Algorithm affinities for a link, see View Flexible Algorithm Details , on page 3.

Visualize Flexible Algorithm Topologies

Crosswork allows you to visualize Flexible Algorithm nodes and links on the topology map that have been manually configured or dynamically provisioned using the UI in your network.

Note To apply a Flexible Algorithm constraint when dynamically provisioning an SR-MPLS policy, see Create Dynamic SR-MPLS Policies Based on Optimization Intent.

Before you begin

You must understand and configure Flexible Algorithms in your network. See the SR Flexible Algorithm configuration documentation for your specific device to view descriptions and supported configuration commands (for example: *Segment Routing Configuration Guide for Cisco NCS 540 Series Routers*).

> **Note**   You cannot visualize Flexible Algorithms if a Flexible Algorithm ID is the same across different domains.

Step 1   From the main menu, select **Services & Traffic Engineering** > **Traffic Engineering**.

Step 2   From the topology map, click ⬙.

Step 3   Click the **Flex Algo** tab.

Step 4   From the drop-down list, select up to two Flexible Algorithm IDs.

Step 5   View the Flexible Algorithm Types and confirm that the selection is correct. Also, note the color assignments for each Flexible Algorithm.

Step 6   (Optional) Check the **Show selected Flex Algo topology only** check box to isolate the Flexible Algorithms on the topology map. When this option is enabled, SR policy selection is disabled.

    a)   Check the **Show Flex Algo A+B links only** to show only those links and nodes that participate in both Flexible Algorithms.

Step 7   Click **Apply**. You must click **Apply** for any additional changes to Flexible Algorithm selections to see the update on the topology map.

    Example:
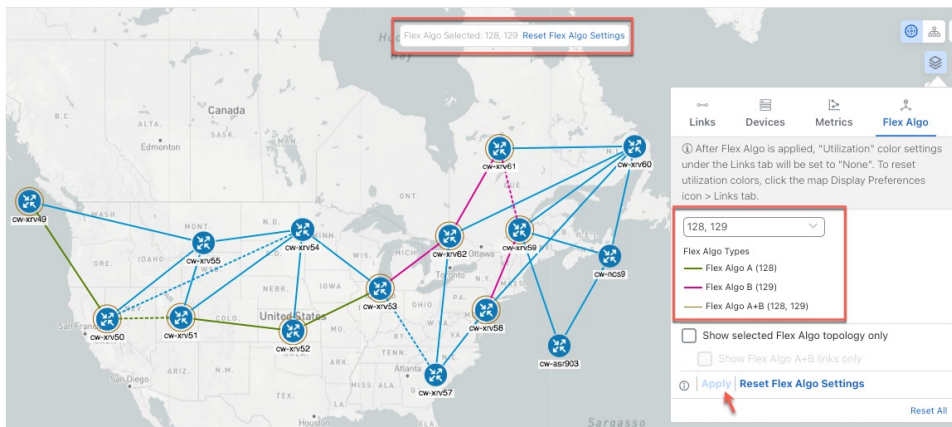
> **Note**   If a selected Flexible Algorithm is defined with criteria but there are no link and node combinations that match it (for example, a defined affinity to include all nodes or links with the color blue), then the topology map will be blank. If a selected Flexible Algorithm is not configured on a node or link, then the default blue link or node color appears.

Step 8   (Option) Click **Save View** to save the topology view and Flexible Algorithm selections.

View Flexible Algorithm Details

To view device or link Flex Algorithm details, do the following:

Step 1   From the main menu, choose **Services & Traffic Engineering** > **Traffic Engineering**.

Step 2   To view device Flexible Algorithm details:

a)   From the topology map, click on a device.

b)   In the **Device Details** window, navigate to the **Traffic Engineering** > **Flex-Algo** tab. For example:

Device Details   ✕

| Details | Links | Traffic Engineering |

General   SR-MPLS   SRv6   Tree-SID   RSVP-TE   **Flex Algo**

IGP: Domain ID: 300, ISIS System ID: 0000.0000.0062, Level: 2   ⌃

Collapse All

Algo 128   ⌃

Participating Yes
Elected Definition Metric Type: LATENCY
           Exclude-Any Affinity:
           Include-Any Affinity:
           Include-All Affinity:
   Advertised Yes
           Priority: 128
           Definition Equal to Local: Yes

Algo 129   ⌄

Algo 130   ⌄

Algo 131   ⌄

Note   If the device is not a member, then you will only see IGP domain and OSPF ID information.

Step 3   To view whether a link is part of a Flexible Algorithm topology:

a)   From the topology map, click on a link.

b)   Click the **Traffic Engineering** tab. If the link is a member, then the **FA Topologies** row displays what Flexible Algorithm each source and destination device belong to.

Link Details   🗑 ✕

| Summary | Traffic Engineering |

General   SR-MPLS   SRv6   Tree-SID   RSVP-TE

	A Side	Z Side
Node	cw-xrv61	cw-xrv62
IF Name	GigabitEthernet0/0/0/3	GigabitEthernet0/0/0/3
FA Affinities		
FA TE Metric	1	23
FA Delay Metric		
FA Topologies	128, 129, 130, 131	128, 129, 130, 131

Note	• Application-Specific Link Attribute (ASLA) is supported on PCC and core routers that are Cisco IOS XR 7.4.1 or later versions.
	• Cisco Crosswork only supports strict ASLA handling for Flexible Algorithm topologies.
	• For Flexible Algorithms defined with Traffic Engineering (TE) or Delay metric types, only nodes advertising OSPF or IS-IS ASLA TE and ASLA Delay link metrics will be included in the corresponding Flexible Algorithm topology.