Topology Configuration for the Global Manager

This chapter describes the topology functions of the Global Manager and contains information on ensuring a consistent view of topology, and organizing topology into groups. This chapter contains the following topics:

- Topology Synchronization, page 22-1
- Ensuring a Consistent Representation of Topology, page 22-2
- Organizing Topology with Groups, page 22-4

Topology Synchronization

The Global Manager imports topology information from the underlying domains specified in its ics.conf configuration file. To maintain an up-to-date representation topology, the Global Manager synchronizes its topology with an underlying domain when any one of the following occur:

- The underlying domain is disconnected or restarted.
- The Global Manager is started.
- The underlying domain performs a full or incremental discovery, rediscovers an object, or a manual discovery is initiated.
- A change is made to the DomainType section of the Global Manager’s ics.conf configuration file. When the Global Manager is reconfigured, it automatically synchronizes its topology with all of the underlying domains.
Ensuring a Consistent Representation of Topology

A Global Manager imports topology information. Because the topology information comes from disparate sources, it is important that the Global Manager present a correct and consistent representation of the topology. This is especially true when two or more domains manage the same devices.

NCM incremental device support (IDU) updates include an expanded and updated list of certified devices. This might mean that a device classified as Uncertified or Node by an older version of NCM is classified as a Router or Switch by an NCM IDU.

For best results, Cisco recommends that you download the latest NCM IDU from Cisco.com. You can download device packages for new devices from Cisco.com and find information about all supported devices by logging into Cisco.com at http://www.cisco.com/kobayashi/sw-center/sw-cw2000.shtml.

Two issues can arise when the Global Manager receives inconsistent topology information:

- The Global Manager imports information about two or more devices with the same name but the devices are classified differently in their respective underlying domains.
- The Global Manager imports the same device from two or more underlying domains but the device is named differently in each underlying domain.

The Global Manager does not import instances of the Unsupported and Undiscovered classes. However, the topology of the Global Manager may include instances, such as Hosts, with a value of Undiscovered for their Certification attribute.
Same Device Classified Differently in Separate Underlying Domains

The Global Manager can receive conflicting topology information when two underlying domains discover the same device but classify it differently. The scenarios where this may occur are:

- A device has the same name but is an instance of different classes in two or more underlying domains. In addition, the device is classified as Uncertified or Node in one or more of the underlying domains. When this occurs, the Global Manager replaces an instance of a less specific class, Uncertified or Node, with an instance of a more specific class. Incoming event information for the device is consolidated to the instance in the Global Manager’s topology.

  For example, device1.mydomain.com is classified as Uncertified in one underlying domain and classified as a Router in a second underlying domain. The Global Manager classifies the device as a Router in its topology. All incoming notifications related to device1.mydomain.com are associated with the Router instance in the Global Manager’s topology.

- A device has the same name but is an instance of different classes in two or more underlying domains. In this case, the device is not classified as Uncertified or Node in any underlying domain. The Global Manager classifies the device according to the first topology information it receives from an underlying domain. Relationship information for the device is updated during consecutive topology synchronizations. Incoming event information for the device is consolidated to the instance in the Global Manager’s topology.

  For example, device2.mydomain.com is classified as a Host in one underlying domain and a Router in a second underlying domain. If the first underlying domain synchronizes first with the Global Manager, the Global Manager classifies the device as a Host in its topology. However, any relationship information for the router from the second underlying domain is preserved by the Global Manager and added to the Host instance. All incoming notifications related to device2.mydomain.com are associated with the Host instance in the Global Manager’s topology.
Same Device Named Differently in Separate Underlying Domains

The Global Manager creates its topology based on the names of the devices it imports from the underlying domains. When the Global Manager imports the same device from two or more underlying domains with the same name, it creates a single corresponding device in its own topology. The Global Manager associates any incoming events from the underlying domains that are related to this device with the single device in its own topology.

When the Global Manager imports the same device from two or more underlying domains and each domain gives the device a different name, the Global Manager creates unique elements in its topology for each device.

For example, one underlying domain discovers a device and gives it the name device3. A second underlying domain discovers the same device but gives it the name device3.mydomain.com. When the Global Manager receives topology information from these underlying domains, it creates two instances in its topology—one named device3 and one named device3.cisco.com.

For more information about NCM discovery and the convention NCM uses to name devices, see Chapter 8, “Overview of Topology Discovery.”

Organizing Topology with Groups

Grouping provides a method by which you can organize topology elements. With domain consolidating, you can create groups and organize topology elements to help you more efficiently manage large numbers of elements.

Before you start, you may find it useful to devise a strategy around which you organize topology elements into groups. Common strategies include organizing by:

- Business units
- Geographical regions
- Resources
General Properties of Groups

A group is a user-defined collection of instances from the Global Manager’s topology. A group consists of members or child groups. A member is a topological element such as a switch. A child group (or subgroup) is another group, which may be a collection of members or additional subgroups. A group that contains child groups is referred to as the parent group.

Parent and child groups are organized into a tree structure. At the root of each tree is a top-level group. Each top-level group is a distinct organization of groups and members—its configuration or removal does not affect other top-level groups. In the Map Console, top-level groups are displayed directly beneath the icon for the Global Manager.

- A member is also a member of the groups above it within the same group hierarchy.
- Within a single group hierarchy, an element cannot be a member of more than one group. An element can belong to two or more groups that descend from different top-level groups.
- You cannot create a circular group where a group is specified as a subgroup of itself or one of its subgroups.

Before we explain how to create groups, you may find it helpful to understand how groups are displayed in the Global Console.

How Groups Are Displayed in the Map Console

The Map Console only displays the members of a group when that group does not contain any child groups. If a group contains one or more child groups as well as members, only the child groups are displayed.

When you create groups to display them in the console maps, Cisco recommends that you create a catch-all group within a parent group. The catch-all group should contain all the members that do not belong to any of the other subgroups. This technique prevents a parent group from containing both members and child groups.
Types of Groups

Domain consolidation supports two types of groups: selective groups and hierarchical groups. A selective group is a group whose members are determined by a matching pattern that you specify through the Global Console. Hierarchical groups are specified in a data file which is then imported by the Global Manager.

In addition to the methods by which they are created, there exist several other differences between selective and hierarchical groups. These differences are described in the following section.

Properties of Selective Groups

Selective groups contain three properties that distinguish them from hierarchical groups: matching criteria, priority, and target classes. These properties help to determine what elements become members of a selective group.

Matching Criteria

Matching criteria are attributes defined in the NCM information model that you use to determine what elements are eligible to become a member of a group. When you create a selective group, you specify a matching pattern that is compared against the attributes of the element. If the pattern matches the value of the specified attribute, the element becomes a member of the group. A matching pattern is comprised of one or more characters and wildcards. If you do not specify a matching pattern, all managed elements that pass the target class filter match the group; priority will determine if any elements become members.

Table 22-1 lists attributes against which you can apply a matching pattern. The group’s target class determines which attributes are available to match against. For example, if the target class is IPNetwork, attributes that describe a managed system, such as Certification, are not listed.
### Table 22-1 Attributes for Matching Criteria

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Certification</td>
<td>Level of certification assigned to this device during discovery. Possible values include: UNCERTIFIED, GENERIC, TEMPLATE, CERTIFIED, or VALIDATED.</td>
</tr>
<tr>
<td>CreationClassName</td>
<td>Name of the class of which the managed element is an instance. This is used as the ClassDisplayName attribute in notifications affecting this element.</td>
</tr>
<tr>
<td>Description</td>
<td>A brief description of the element.</td>
</tr>
<tr>
<td>DisplayClassName</td>
<td>Same as creation class name.</td>
</tr>
<tr>
<td>DisplayName</td>
<td>Name of the managed element. For systems, DisplayName and Name are usually the same.</td>
</tr>
<tr>
<td>IsManaged</td>
<td>Determines if the system is monitored by Global Manager. Note that unmanaged elements do not appear in the Global Manager topology. Value is TRUE or FALSE.</td>
</tr>
<tr>
<td>Location</td>
<td>A brief textual description of the system’s physical location.</td>
</tr>
<tr>
<td>Model</td>
<td>Vendor’s name for the system.</td>
</tr>
<tr>
<td>Name</td>
<td>Name of the managed element. For systems, Name and DisplayName are usually the same.</td>
</tr>
<tr>
<td>PrimaryOwnerContact</td>
<td>Information on how to contact the system’s owner.</td>
</tr>
<tr>
<td>PrimaryOwnerName</td>
<td>Name of the system’s owner.</td>
</tr>
<tr>
<td>ServiceName</td>
<td>Name of external system used to import attributes and events.</td>
</tr>
<tr>
<td>SystemName</td>
<td>Name of the system that contains this managed element.</td>
</tr>
<tr>
<td>Type</td>
<td>Classifies the type of system. Possible values include: Bridge, Host, Hub, Node, Other, Probe, Router, RSFC, RSM, Switch, and TerminalServer.</td>
</tr>
<tr>
<td>Vendor</td>
<td>Name of the system’s manufacturer.</td>
</tr>
</tbody>
</table>
For information regarding the wildcards you can use to build a matching pattern, see Appendix D, “Wildcard Patterns.”

Priority

Priority distinguishes between groups at the same level of the hierarchy with the same parent. Each such group is automatically assigned a different priority. When a topology element matches the pattern of two different groups, it becomes a member of the group with the higher priority. Because of this, you should assign a higher priority to a group with a stricter matching pattern. If a group has a high priority and it matches all the topology elements, it will contain all the available members.

Target Classes

A target class acts like a filter, allowing only those elements that are instances of the target class, or one of its subclasses, to become members of the group. Managed elements must pass the target class filter before they are compared against the matching criteria.

When you create a child group, the child group should have the same target class as its parent. The exception to this rule is when the new target class is a subclass of the parent group’s target class. For example, the ICIM_ManagedSystemElement class is near the top of the ICIM hierarchy. All of the other target classes are a subclass of ICIM_ManagedSystemElement. If ICIM_ManagedSystemElement is the target class of a parent group, you can select a different target class for a child group.

Similarly, VLAN, NetworkConnection, and IPNetwork are subclasses of ICIM_LogicalLink. If ICIM_LogicalLink is the target class of the parent, you can choose one of these three classes as the target class for a child group.

Table 22-2 lists the target classes you can assign to a selective group when you create it. Classes are listed in the order that they appear in the ICIM class hierarchy. The description indicates when a class is a subclass of another target class.
Creating Selective Groups

You create and edit selective groups using the Global Console. Creating or editing groups through the console requires administrator privileges from the Global Manager. Operators with monitoring privileges can view groups in the Topology Browser and Map Console but are not able to create or edit groups.

Table 22-2 Target Classes for Selective Groups

<table>
<thead>
<tr>
<th>TargetClass</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ICIM_ManagedElement</td>
<td>Base class for the system element hierarchy. This is the broadest target class.</td>
</tr>
<tr>
<td>UnitaryComputerSystem</td>
<td>Represents a single computer system. This is the superclass for the Bridge, Host, Hub, Probe, MSFC, Router, RSFC, RSM, Switch, TerminalServer, and Node classes.</td>
</tr>
<tr>
<td>ApplicationService</td>
<td>Represents service provided by software. Examples include e-mail, Web server, and database applications.</td>
</tr>
<tr>
<td>LogicalLink</td>
<td>Represents a link between two endpoints. Examples include database transactions, IP networks, and cables.</td>
</tr>
<tr>
<td>VLAN</td>
<td>Virtual LAN typical in switched networks. VLAN is a subclass of LogicalLink.</td>
</tr>
<tr>
<td>NetworkConnection</td>
<td>A connection between two routers, typically a virtual circuit. NetworkConnection is a subclass of LogicalLink.</td>
</tr>
<tr>
<td>IPNetwork</td>
<td>Subnet of an IP network. IPNetwork is a subclass of LogicalLink.</td>
</tr>
<tr>
<td>ServiceSubscriber</td>
<td>Customer who receives services provided through a service offering.</td>
</tr>
<tr>
<td>ServiceOffering</td>
<td>A service provided to customers.</td>
</tr>
</tbody>
</table>
You should be aware of the following points when creating selective groups:

- Top-level selective groups cannot contain members, only child groups. As such, you need to create both a top-level group and one or more child groups to assign topology elements to a group.

- By default, each top-level group contains all the topology elements that match its target class and matching criteria.

- Each group is identified by a unique name. The name is displayed in group maps and in the Topology Browser. It is the value of the DisplayName attribute for the group instance.

- Hierarchical groups are visible in the Group Definition window but cannot be edited.

**Layout of the Group Definition Window**

You create and edit groups through the Group Definition window. You open this window by selecting Groups from the Configure menu of the Global Console.

The Group Definition window is divided into two panels. The left panel displays the Global Manager, groups, and the group members. When you select a group in the left panel, the Properties, Priorities, and Matching Criteria tabs display in the right panel of the Group Definition window.

**Note**

When you select a top-level group, only the Properties tab is displayed. Top-level selective groups do not have priority or matching criteria.

Priority and matching criteria determine which topology elements are members of each group. If you have worked with configuration groups (Polling Groups and Threshold Groups) for NCM programs, the priority and matching criteria for topology groups function similarly.

For more information about priority and matching criteria, see the “Properties of Selective Groups” section on page 22-6.
The toolbar of the Group Definition window contains four buttons:

- **Delete** removes the specified group from the topology of the Global Manager. If the deleted group contains child groups, the child groups are also deleted.

  **Note** The **Delete** command does not remove hierarchical groups.

- **Regroup** tells the Global Manager to rebuild the selective groups *from the selected group down to the bottom of the group hierarchy*. If you select the Global Manager icon and invoke Regroup, the Global Manager rebuilds all of the selective groups. This, however, is not usually necessary. It is more efficient to regroup a section of the group hierarchy when there are large numbers of topology elements in each group.

  You need to invoke **Regroup** after you make changes to the priority or matching criteria of a group. The Global Manager automatically regroups the topology when it synchronizes its topology with the underlying domains.

  **Note** The **Regroup** command does not affect hierarchical groups.

- **Create Top Level Group** displays the New Group dialog where you specify the name, description, and target class for the group. This command is only available when the Global Manager is selected.

- **Create New Group** displays the New Group dialog where you specify the name, description, and target class for a child group. This command is available when a group is selected in the group tree hierarchy in the left panel of the Group Definition window.

  You can also find these commands under the Group menu. In addition, the Group menu also contains the Save Groups command. When you invoke **Save Groups**, the Global Manager saves its in-memory database to the repository file.
Method for Creating Selective Groups

To create a selective group, use the Create Top Level Group or Create New Group command.

**Step 1**  Select **Groups** from the Configure menu of the Global Console. This displays the Group Definition window.

Note that this requires administrator privileges. The Configure menu is not displayed for users with monitoring privileges.

**Step 2**  Do one of the following:

- To create a top-level group, select the Global Manager icon and click **Create Top Level Group**. Alternatively, right-click on the Global Manager and select **Create Top Level Group** from the popup menu.

- To create a child group, select the parent group and click **Create New Group**. Alternatively, right-click on the parent group and select **Create New Group** from the pop-up menu.

This displays the New Group dialog box.

**Step 3**  Specify a name, description, and target class for the group. After you finish specifying values for these three fields, click **OK**.

The new group displays in the Group Definition window. You can also see the group as an instance of the SelectiveGroup class in the Topology Browser Console or as a group in the Groups tab of the Map Console.

**Step 4**  Change the priority of the new group by selecting the group whose priority you wish to change. In the Priorities tab, do one of the following:

- To give the group a higher priority, click the up arrow.
- To give the group a lower priority, click the down arrow.

**Note**  If there are other groups at the same level of the group hierarchy, they are listed under the Priorities tab. By default, a new group is assigned the lowest priority.
Step 5  Click the Matching Criteria tab and specify a matching pattern for the group. By default, a new group does not contain matching criteria, meaning it matches all possible elements.

For example, if you want to create a group that includes systems from a certain geographical area then you might match against the value of the Type and Location attributes. First, specify a pattern that matches the type of systems you want to group. To create a group of routers you would add Type as a matching criteria attribute and specify a matching pattern of Router. Next, specify a pattern that matches against the geographical locale specified in the system’s Location attribute. To match against routers in New York, you could add Location as a matching criteria attribute and specify a pattern of “*NY*|*New York*”. This pattern would match against “NY” and “New York” anywhere in the Location attribute. Table 22-1 lists the classes whose values you can match against.

Step 6  Select the parent for the newly created group, or the Global Manager, and click Regroup. You can also right-click on the parent and select Regroup from the popup menu.

Note  To create a catch-all group, create a group with no matching criteria and assign it the lowest priority.

Editing the Properties of a Selective Group

You can edit the description, target class, priority, and matching criteria of a selective group. Similar to creating a group, you must attach to Global Manager with administrative privileges and select Groups from the Configure menu.

You can edit all the properties of a group before applying the changes. However, if you select another group before clicking Apply, your changes are not applied. In this case, the console displays a dialog window asking if you want to abandon the changes that have not been applied.
To edit the properties of a selective group, perform the following steps:

---

**Step 1**
Select the group whose properties you wish to edit. The properties of the group are displayed in the right panel of the Group Definition window.

**Step 2**
The description and target class of the group are displayed under the Properties tab.
- To change the target class, select a class from the pop-up menu.
- To change the description, edit the text in the Description text box.

**Step 3**
Select the Priority tab to change the priority of the group.

**Step 4**
Select the Matching Criteria tab to change the matching pattern of the group.

**Step 5**
Click **Apply**. If you change the target class, priority, or matching criteria, you also need to click **Regroup**.

---

### Creating Hierarchical Groups

This section describes how to create hierarchical groups. It also describes the syntax of the group data file and how to load the group information into the Global Manager.

Creating hierarchical groups is a three step process:

1. Create one or more hierarchical group data files that specify the groups and their members.
2. List the hierarchical group data files in the configuration file of the Global Manager.
3. Reconfigure the Global Manager.

You create hierarchical groups by specifying the groups, child groups, and members in one or more data files. These data files must be located in the BASEDIR/smarts/local/conf/ics directory and their names specified in the BusinessSection of the ics.conf file.

After you edit the group data file to specify group information, import this information into the Global Manager by invoking the command to reconfigure the Global Managers or by invoking the regroup command to process only the
BusinessSection of the ics.conf file. Administrative privileges for the Global Manager are required to invoke either command, as described in the “Loading Hierarchical Group Data into the Global Manager” section on page 22-17.

**Creating Hierarchical Group Data Files**

The syntax for group data files provides a means for specifying groups, children (subgroups), and members. The following example illustrates the syntax of a hierarchical group data file.

```plaintext
HierarchicalGroup NewYork children NY-Routers "NY Customers"
HierarchicalGroup NY-Routers members Router::nyc1
HierarchicalGroup "NY Customers" file:/opt/dev/Incharge5/smarts/conf/ics/ny-customers.data
```

The example illustrates the following syntactic rules of hierarchical group data files:

- Each line that specifies a hierarchical group must start with the keyword `HierarchicalGroup`.
- Elements of a hierarchical group must be separated by one or more spaces.
- The name of the group follows the keyword `HierarchicalGroup`. The name of the group must be unique for all existing groups.
- If the name of a group contains a space, it must be enclosed in double quotes.
- The keyword `children` indicates that this line specifies subgroups of the named group. For example, `NY-Routers` and `NY Customers` are child groups, or subgroups, of the group named `NewYork`.
- The keyword `members` indicates that this line specifies members of the named group. For example, the router `nyc1` is a member of the group named `NY-Routers`. You must specify the class name and the instance name of the topology element, separating them with a double colon (::).
- You cannot specify child groups and members in the same line. You can, however, use multiple lines to specify members or children for the same group.
- You can specify a list of members in a member file. For example, the file `ny-customers.group.data` lists members of the NY Customers group. However, you must specify the full path to the file, using the correct syntax for the host operating system.
The following example shows the syntax of a file that lists the members of a group. Because the hierarchical group data file specifies the name of the group, you only need to specify the `<class>::<instance>` pairs, one per line, for each member.

Router::nycbrd1
Router::nycbrd3
Switch::nycs2

**Syntax of the Group Data File in ics.conf**

The name of the file or files that define the hierarchical group data must be specified in the ics.conf file, located in the BASEDIR/smarts/local/conf/ics directory. The following example shows the syntax of the BusinessSection of the ics.conf file.

```
BusinessSection
{
    Name = "topology-group.data.template";
    Name = "service.data.template";
}
```

The BusinessSection is used to specify the data files for hierarchical groups and service topology. You can use any number of files by specifying additional “Name” lines, as shown in the following example.

```
BusinessSection
{
    Name = "new-york-group.data";
    Name = "albany-group.data";
    Name = "san-francisco-group.data";
}
```

**Creating a Hierarchical Group Data File**

Domain consolidation includes an example data file, topology-group.data.template, for specifying hierarchical groups. It is located in the BASEDIR/smarts/local/conf/ics directory. Any hierarchical group or service topology data files you create and specify in the ics.conf file must also be located in this directory.
To create a hierarchical group data file, make a copy of the example file and rename it appropriately. Create groups and populate them with topology elements from the topology of the Global Manager. Finally, edit the BusinessSection of the ics.conf file to specify your newly created file, as described in the following section.

**Loading Hierarchical Group Data into the Global Manager**

There are two methods for loading the hierarchical group information into the Global Manager: reconfiguring the Global Manager and regrouping the group data files. Remember the following to decide which command to use:

- Use the reconfigure command to load the group data files for the first time or to reload the ics.conf file if you edit the BusinessSection.
- Use the regroup command to regroup the group data from files previously loaded by the Global Manager. If you edit the hierarchical group data files already imported by the Global Manager, it is not necessary to reconfigure the Global Manager. If you edit the ics.conf configuration file, you must reconfigure the Global Manager.

When either method is invoked, the Global Manager processes the group and service topology data specified in the BusinessSection. If the Global Manager does not encounter any errors, it removes all of the current group and service information from its topology and replaces it with the information contained in the data files.

**Note** Both reconfiguring and regrouping update the service topology, if any. After the hierarchical group data is loaded into the Global Manager, you can view hierarchical groups through the Global Console.

**Reconfiguring the Global Manager**

To reconfigure the Global Manager, invoke the following command from the BASEDIR/smarts/bin directory:

```
# sm_adapter -s <global_manager> ics/ICS_RemoteConfig.asl
```

Depending on your security configuration, you may be prompted for your NCM username and password.
When the Global Manager reloads the ics.conf file, it sends output to stdout verifying that it was able to read each section of the configuration file or report an error if one was encountered.

If the Global Manager encounters an error, it does not update its configuration.

Regrouping Hierarchical Group Data

To regroup the hierarchical group topology data files, invoke the following command from the BASEDIR/smarts/bin directory:

```
% dmctl -s <global_manager> invoke GA_DaemonDriver::ICS-Group-Driver start
```

**Note**

The command must typed as one line.

Depending on your security configuration, you may be prompted for your NCM username and password.

When the Global Manager regroups the topology information in the data files, it first checks for errors. If the Global Manager encounters an error, it writes output to the terminal or its log file and does not process the data files.