Network Automation Project

Pierre FRANCOIS, Oana IOVA

1 Network Configuration

Consider the network in Figure 1. The owner of AS X deployed RIP in their network. The owner of AS Y deployed OSPF in their network. Make the necessary configuration so that the networks in the two ASes can communicate with each other. You will have to:

- Make an address plan for each of the AS.
- Deploy RIP in AS X.
- Deploy OSPF in AS Y.
- Deploy eBGP and iBGP wherever needed.
- Validate the configuration.

Do not forget during the configuration phase to *write* the configuration of the routers. You can then find the router configurations in your project directory. You can also edit your configurations by directly writing in these files and reloading your routers.

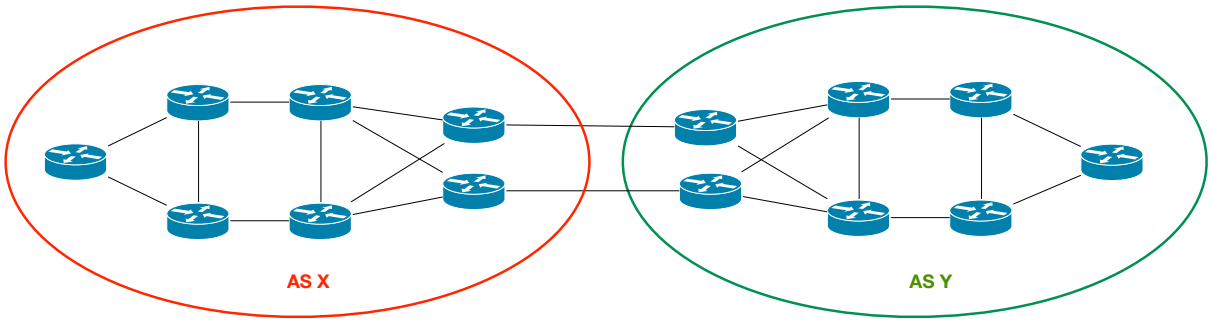

Figure 1: Network setup

2 Network Intent

Manual network configuration is cumbersome and error-prone. Nowadays, network operators describe their network configuration intents using tools. Such intents are processed by external software in order to generate the router configurations that meet their needs.

Your goal is to define a json or xml structure that describes your network intents, and develop software that will generate the cisco configurations using your intent file as an input.

Using the configurations obtained in the first part of the project, define what needs to be put in the intent file in order to automate the network configuration.

3 Network Automation

Develop software that automates the generation of router configuration based on an intent file. Define the approach used to validate the generated configurations.

3.1 Architecture

The configuration script MUST know the physical network architecture. Define which router is connected to which router on which interface.

3.2 Addressing

A choice must be made in the approach followed to address the physical and loopback interfaces of the routers.

- Human defined: The intent file will contain the IP addresses of the interfaces.
- Automated: The intent file will contain an IP range that will be used for the addressing of the physical and loopback interfaces of a given AS. The script will allocate subnets from the specified range. It is recommended to provide an IP range for the physical interfaces and another IP range for the loopback interfaces.

3.3 Protocols

The intent file MUST describe which Interior Gateway Protocol is used in an AS. The script will automatically enable the specified IGP on the routers of the AS.

The intent file MUST describe to which BGP AS a given router belongs. The intent file MUST capture the necessary information for the iBGP sessions and eBGP to be established.

3.4 Policies

3.4.1 BGP Policies

Specific routing policies are typically applied on BGP sessions based on the business relationship with the neighboring AS. The intent file SHOULD capture such policies so that network automation can tweak the policies applied on the eBGP sessions accordingly.

- Learn how to tag routes received from eBGP neighbours with communities.
- Learn how to configure iBGP sesssions to transmit communities along with BGP paths.
- Learn how to filter routes using route-maps based on BGP communities.
- Tag paths received from an eBGP neighbor with a community in your gns setup.
- Filter the paths advertised to another eBGP neighbor so as to only advertise the paths which have the community.

Once this is done, you can automate your external policies in your network configuration tool.

- Adapt your intent file so as to be able to describe whether a neigbhouring AS is a customer, a provider, or a settlement-free peer.
- Automate the setting of the local-pref attribute of BGP paths so as to prefer customers over settlement-free peers over providers.
- Automate the configuration of your policies using communities so as to only propagate customer paths to providers and settlement-free peers.
- Enjoy the fact that your peers and providers no longer get free rides on your network(s) :)

3.4.2 OSPF Metric Optimization

OSPF can be engineered for better traffic distribution by setting link costs to other values than the default capacity-based value. The intent file SHOULD allow for the definition of such metrics.

- Learn how to set the metric of a link in OSPFv3 using the *cost* command.
- Validate the effect of the cost command has on your internal routing.
- Allow for the configuration of such costs in your intent file.

4 Deployment

Multiple approaches can be followed to deploy the generated configurations.

4.1 Drag and Drop

You can manually replace the startup-config files in your project in order to update the configuration

4.2 Drag and Drop bot

You can write a script which knows in which directory each router is, and copies the generated config files in the right location.

4.3 Telnet

You can write a script that connects to your routers with telnet through a management interface, and emulates the writing of the configurations in the console in the cli. Note: This is a bonus. You MUST also provide generation of config files.