S-38.192
ITGuru Excercise (4: Building the MPLS BGP VPNs)

Task Description

In ITGuru MPLS VPN creation is highly automated. The VPN Creation Wizard configures automatically e.g. BGP peers and VRF tables, and even the assignment of IP-addresses and autonomous system numbers is handled by the Wizard. This means that you should have a very clear view of how the network and the VPNs should be built before starting the wizard. Once the VPN has been created, it requires a lot of manual work to clear the configurations from the routers and build the VPN again if something went wrong in the first time.

When creating a VPN with the Wizard, you first have to decide what sites you want to connect. You must select one LSR router for each site (in the MPLS core network) that will be designated as a Provider Edge (PE) router. These PE routers will be automatically configured as BGP peers and a VRF configuration will be created in each of them. An additional gateway, representing the site, will also be automatically connected to each PE router.

Before you start configuring the wizard, do the following

- If you have some separate server objects in the access networks, remove them. In the exercise we will utilize the server object available in the LAN object itself. If you have used an Ethernet switch to connect the separate server and the LAN, remove the switch as well.

- Add an IP gateway to Berlin, Lisbon and Rome subnet and connect it with the LAN object (notice that you don't have to add a gateway to Paris and Athens since the DSLAM can be used as a gateway). Later when the VPN has been built, this gateway will be connected to the starting point of the VPN.

- Name the devices in the access networks consistently. In this way it is much easier to read the configuration reports, for instance the IP-addresses assigned for the devices.

- AutoAssign IP-addresses for all the devices in the network (**Protocols->IP->Addressing->Auto Assign IP addresses**). Create a configuration report (**Protocols->IP->Configuration Reports->Select All**) and check that there are no overlapping IP-addresses in the network.

- Enable OSPF in the core network (**Protocols->IP->Routing->Configure Routing Protocols**). Select all the links where you want to run OSPF.

As you have done this, start the VPN Wizard (**Protocols->MPLS->Deploy MPLS VPNs**). After you have created the VPN with the Wizard, remember that

- You must NOT touch the IP-addresses that the Wizard has assigned for the devices in the core network. For instance, if you select 'Clear IP addresses on all interfaces' and after this use AutoAssignment, this will clear and reassign ALL IP-addresses in the network, including the addresses of the core devices. The Wizard has configured BPG peers, VRF tables etc., and thus the IP-

addresses of these peers MUST NOT be changed, otherwise you have to manually reconfigure the devices.

- If you need to assign IP-addresses to some interfaces (for example, if you create new routers in the access network), you may use AutoAssignment, as long as you do not erase the existing addresses. Check from the configuration reports or directly from the router configurations that IP-addresses were really created in the right interfaces.

- Disable OSPF from the interfaces connecting the VPN site gateway and the corresponding PE router.

- Configure static routes from the VPN site gateway to all interfaces in the corresponding access network. Notice that in those PE routers where VPN has been enabled you have to have two entries for the addresses in the access network: one entry where the VRF tag is enabled for VPNs and another entry without the VRF tag for normal IP routing.

- Configure RIP in the access network.

- Configure Default Gateway in the access network. Notice that in reality you would only have to configure the Default Gateway in one interface and other routers in the access network would learn this by RIP redistribution. However, RIP redistribution does not seem to work in ITGuru, so you have to configure the Default Gateway separately for each access network router. The Default Gateway can be configured either by using the Default Network attribute or by defining a static route to destination 0.0.0.0/0.0.0.0. It is recommended to use the static route approach.

- Redistribute static routes into BGP in those PE routers that are part of the VPN.

- Redistribute static routes into OSPF in all PE routers.

- Check that MPLS is enabled in all core routers and that the VRF tables have been correctly configured.

Configuring routing between the ADSL access networks

Notice that you will also have to configure routing for the sites that are not part of the VPN. The core routers have already been set as OSPF enabled. In addition, you have to configure static routes to the ADSL access networks, as well as necessary static routes from the access networks to the core. Remember that BGP will not be run in the PE routers that are not part of the VPN.

Testing the VPN

It is very recommended that you test the VPN at this point with simple IP Traffic Demands. First, select two site gateways belonging to the VPN and create a

bidirectional IP traffic flow between these points ('**Traffic->Create IP Traffic Flows**'). Record the statistics that you want from the network by right clicking the mouse and selecting '**Choose Individual DES Statistics**'. Choose at least the throughput statistics from '**Path Statistics->LSP**' and from '**Link Statistics->point-to-point**'. In this way you can examine whether the traffic flows through the LSPs. If it seems that there is no traffic in the LSPs, check if there is traffic in the links between the end points. It might be that conventional IP routing is used instead of the MPLS LSPs if you have not done the configuration properly.

If the connection between the site gateways seems to be working, try another test. Create an IP Traffic Demand between the LANs of two cities belonging to the VPN and check whether the traffic flows through all links that it should. Check also the VRF tables created by the PE routers. You can export the VRF table information by right clicking the mouse and selecting '**Edit Attributes->Reports->VRF Table->Export at End of Simulation**'. You may also export other tables, such as IP Forwarding Table and OSPF Routing Table. Make sure that you have all the necessary destinations in the IP Forwarding Table. If something seems to be wrong, check the static route configuration, route redistribution rules and configuration of default gateways.

Hints

You can check fast the routing domains and protocol configuration by choosing '**View->Visualize Protocol Configuration->IP Routing Domains**'. The appearing Routing Domain Legend shows the meaning of the symbols. In this view you are able to see the routing domains, points where static routes are used and points where redistribution is used. In order to visualize BGP peers, choose '**View->Visualize Protocol Configuration->BGP peers**'. The BGP peers should now be connected with green, dotted lines.

Exercise Sessions

The exercise session for this task will be arranged on **Thursday**, 17th March at 14 o'clock in computer class Maari-A.

Handout Requirements

The exercise should be returned before the beginning of the next exercise session (23rd March, 14 o'clock). Send the exercise package as an e-mail attachment to Johanna Antila (jmantti3@netlab.hut.fi) or Timo Viipuri (tviipuri@netlab.hut.fi) provided that the size of the attachment is reasonable. You have to pack the files with the command:

"tar -cf - -C ~ op_models | gzip > 4_building_vpn.tar.gz"

Remember to include only the relevant files (we do not want all the backups).