Exploration of Internet Routing using GNS3

Contents

Overview and Objectives

This project is about a hands-on exploration of actual Internet routing using FRR routers on GNS3. You are expected to create small networks on GNS3, configure and run well-known routing protocols on FRR routers, and observe their behaviour using Wireshark. *You should create scenarios such as link failures or changes in link characteristics and observe how routing protocols handle this.* You are expected to document, analyse, discuss, and visualize your results as expected from a professional engineer.

FRRouting (FRR) is a free and open-source Internet routing protocol suite for Linux and Unix platforms. It implements BGP, OSPF, RIP, IS-IS, PIM, LDP, BFD, Babel, PBR, OpenFabric and VRRP, with alpha support for EIGRP and NHRP.

You have already configured OSPF in your previous workshops and know how to use Wireshark.

Project Scoping

This is an open-ended project and scoping the project is your responsibility. In other words, this is your project, and you decide how to achieve the objectives described above.

Please keep in mind that you have only 5 weeks. Therefore, there is no time to waste, and you need to be very realistic about what you can achieve in 5 weeks. There is no need for stress, nobody is expecting you to deliver a capstone project in 5 weeks!

You will be well-supported during your project. Firstly, **you have to talk to the lecturer in the beginning about your project plan and scope and get feedback**. This is a requirement and is not optional! Secondly, your demonstrator will be there to help as much as possible. Thirdly, keep your lecturer in the loop regarding how the project is progressing and get feedback to ensure that you are on the right track.

Directions and Resources

Although the project is open-ended, here are a few possible directions and online resources that may help you make quick progress. Please note that some of the online tutorials assume CISCO routers while you will be using FRR. The commands are very similar but if in doubt check the FRR documentation.

Generic Information

- https://docs.frrouting.org/en/latest/
- https://opensource.com/article/20/5/vty-shell
- https://www.iljitsch.com/2022/11-02-free-range-routing-vs-quaggacisco.html
- https://docs.nvidia.com/networking-ethernet-software/cumulus-linux-41/Layer-3/Configuring-FRRouting/
- https://gns3vault.com

OSPF

Extending what you have done in the previous workshop and exploring the properties of OSPF routing protocol using FRR could be a great starting point. You can create a network, for example with 5-6 routers, and then observe how routers communicate with each other, what happens when a link goes down, how routers see the network, etc.

Resources that may contain relevant information:

- https://docs.frrouting.org/en/latest/ospfd.html
- https://wesl.ee/Routing/FRR_OSPFv2_Plus_GSN3/
- https://upcommons.upc.edu/handle/2117/133050?show=full
- https://docs.nvidia.com/networking-ethernet-software/cumulus-linux-37/Layer-3/Open-Shortest-Path-First-OSPF/

RIP

We have covered RIP (Routing Information Protocol) in lectures already. RIP is a historical interior gateway protocol. RIP was developed in the 1970s at Xerox Labs. RIP is a distance-vector protocol and is based on the Bellman-Ford algorithms.

- https://docs.frrouting.org/en/latest/ripd.html
- https://davidbombal.com/configuration-basic-rip-cisco-routers/
- http://zobayer.blogspot.com/2012/10/simple-rip-routing-in-gns3.html
- https://www.9tut.com/rip-routing-protocol-tutorial
- https://www.9tut.com/configuring-rip-gns3-lab
- https://www.youtube.com/watch?v=B0YIlswLYsg

Additional Directions

Depending on your time and preferences, other routing protocols to explore are EIGRP or MPLS. Both are supported by FRR.

If all these are very easy for you and you wish for a challenge, then I would recommend exploring BGP. However, you may need a reference book for that as a starting point.

Suggested Tasks

Here are a few suggested tasks which you might include in your project.

- Try different topologies with a few routers, add subnets and VPCSs and use ping to verify connectivity.
- Observe the routing protocol messages between the routers via Wireshark.
- Login to routers via terminal/shell and print/record the route/network information as seen by the routers.
- Make changes in links (large delays or link failures) or add a new link. Observe how the routing protocols react, and record messages between them via Wireshark.
- Explore some of the scenarios for example in https://gns3vault.com/labs that are used in network certification exams.