IK2215: Network Design Report

Qinglin Zou
<qinglinz@kth.se>

Akshay Manappatty
<akshayma@kth.se>

1 General Information

ASN: 118 **NETWORK:** 1.118.0.0/20

2 Network overview

The figure shows the network diagram of the project that we are going to for this lab. In the project we are using four routers(r1,r2,r3,r4) and five hosts(three servers that are s1,s2,s3 and two clients i.e c1,c2). The routers r1 and r2 plays the role of eBGP while connected to AS1 and AS21. In this network the routers r1 and r3 are connected with all the routers and the remaining router r2 and r3 are connected with two routers.Three servers are connected with r3 and the two clients are connected with r4.And more detailed ip allocation is mentioned in the ip allocation part.

2.1 Network diagram

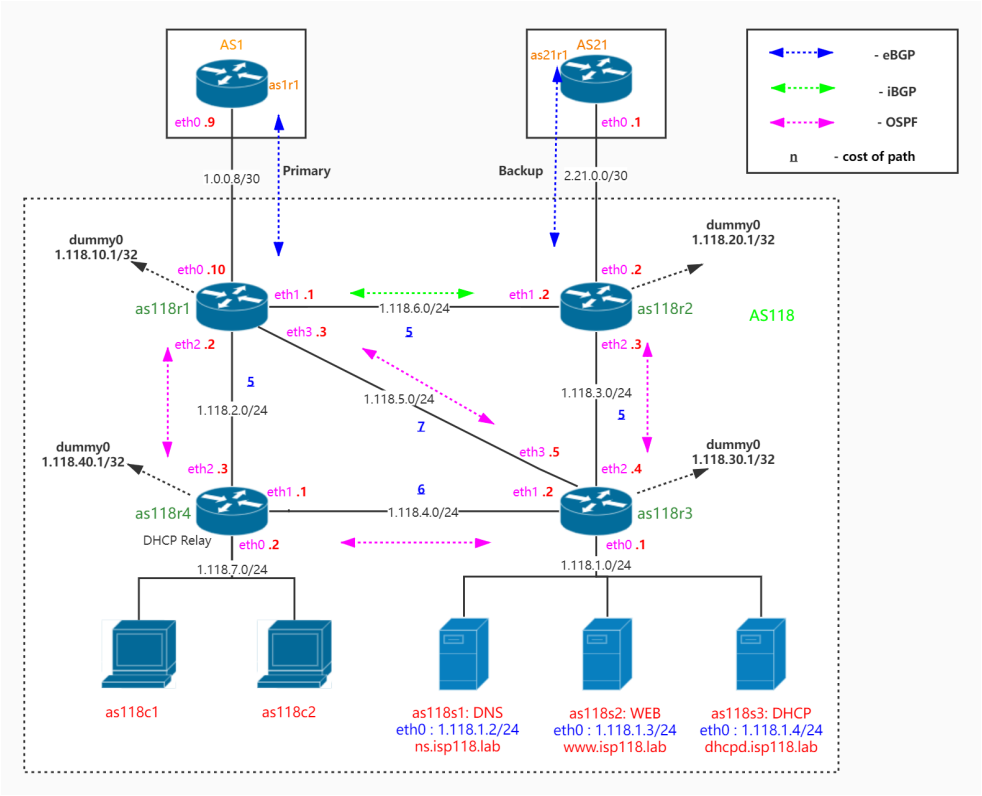

Figure 1: Network Diagram

2.2 IP address allocation

A constructed ip allocation is shown in the table below

Device	Interface	IP Address	Domain name
as118r1	eth0	1.0.0.10	r1eth0.isp118.lab
as118r1	eth1	1.118.6.1	r1eth1.isp118.lab
as118r1	eth2	1.118.2.2	r1eth2.isp118.lab
as118r1	eth3	1.118.5.3	r1eth3.isp118.lab
as118r1	dummy0	1.118.10.1/32	r1dum0.isp118.lab
as118r2	eth0	2.21.0.2	r2eth0.isp118.lab
as118r2	eth1	1.118.6.2	r2eth1.isp118.lab
as118r2	eth2	1.118.3.3	r2eth2.isp118.lab
as118r2	dummy0	1.118.20.1/32	r2dum0.isp118.lab
as118r3	eth0	1.118.1.1	r3eth0.isp118.lab
as118r3	eth1	1.118.4.2	r3eth1.isp118.lab
as118r3	eth2	1.118.3.4	r3eth2.isp118.lab
as118r3	eth3	1.118.5.5	r3eth3.isp118.lab
as118r3	dummy0	1.118.30.1/32	r3dum0.isp118.lab
as118r4	eth0	1.118.7.2	r4eth0.isp118.lab
as118r4	eth1	1.118.4.1	r4eth1.isp118.lab
as118r4	eth2	1.118.2.3	r4eth2.isp118.lab
as118r4	dummy0	1.118.40.1/32	r4dum0.isp118.lab
as118s1	eth0	1.118.1.2	ns.isp118.lab
as118s2	eth0	1.118.1.3	www.isp118.lab
as118s3	eth0	1.118.1.4	dhpcd.isp118.lab
as118c1	eth0	1.118.7.10...20/24	c1eth0.isp118.lab
as118c2	eth0	1.118.7.10...20/24	c2eth0.isp118.lab

3 Routing and service implementation

This section describes ISP implementation to realize routing and service requirements.

3.1 Routing

This section describe ISP implementation to fulfill routing requirements.

3.1.1 Intra-domain routing

We will use the OSPF protocol in the intra-domain routing. OSPF uses the shortest path algorithm to determine the transmission route. It converges faster and doesn't need to send update messages regularly.
We will configure the cost of every path to make sure that router will choose the certain path we want and there are no equal-cost paths between two end-to-end points. The cost is given in the diagram above.

- r1 to client network and vice versa
- r1 to server network and vice versa
- r2 to client network and vice versa
- r2 to server network and vice versa

  Routers have at least two disjoint paths and the network stays operational when one of the internal links fails. The primary and second path a certain traffic will traverse are as below:
  C:clients S:servers

Path	r1	r2	servers	clients
r1	X	-	r1 r3 S	r1 r4 C
r2	-	X	r2 r3 S	r2 r1 C
servers	S r3 r1	S r3 r2	X	S r3 r4 C
clients	C r4 r1	C r1 r2	C r4 r3 S	X

Table 1: Primary Path

Path	r1	r2	servers	clients
r1	X	-	r1 r2 r3 S	r1 r3 r4 C
r2	-	X	r2 r1 r3 S	r2 r1 r3 r4 C
servers	S r3 r2 r1	S r3 r1 r2	X	S r3 r1 r4 C
clients	C r4 r3 r1	C r4 r3 r1 r2	C r4 r1 r3 S	X

Table 2: Secondary Path

3.1.2 Inter-domain routing

The primary link is used for all traffic (incoming and outgoing) during normal operation. However, the traffic connecting neighboring AS21 will take a direct path over the backup link. The backup link also provides Internet connectivity in case the primary link fails.
We will set up a iBGP connection which contains r1, r2 in AS118. r1 will be the DR and r2 will be the BDR.To differ the primary and the secondary path, we will set the local-preference and use some commands to make sure that those packets whose destination is other autonomous systems will go over the primary link in normal operations and go over the backup links if a certain link breaks down.
Routers running BGP will select the next hop under some attributes:

- First, BGP prefers the path with a higher local-preference.
- Then, BGP prefers the path with a shorter as-path.

For packets coming out of AS118, like the diagram above, the local preference of r1 for all other ASes will be set to 300 (default is 100). We will aslo set the local preference for as118r2 to as21r1 as 300. Whats more, the local preference of other traffic whose destination is any other ASes is set by 50.Thus, the private link between AS118 and AS21 is enhanced.
For packets incoming to AS118, we will filter the ip address by whether its destination is AS118 or just pass through AS118. The specific operation for as118r1 and as118r2 incoming traffic is as followed.
For the potential traffic which may just pass through AS118, on as118r1 we use command to add 6 virtual as-paths (as-path all 118). For as118r2, the link between as118r2 and as2r1 is as default, but for the rest ASes which are about to use AS118 as a transfer autonomous system, 6 virtual as-paths are added to avoid this circumstance. Besides, to meet the requirement that others ASed cannot use AS21 to enter AS118, 7 virtual as-paths are added. By this way, the primary link is enhanced even if the is a link failure on AS118. We can also avoid potential loops, because the will always be a best path and an optimal one.
We will use dummy0 (logical IP address) for iBGP and use ip address for eBGP.

3.2 Internet service

This section describe ISP implementation to fulfill service requirements.

3.2.1 DNS

According to the guideline, s1 is used as the web server and IP address 1.118.1.2/24 is assigned to it.Each host within tour AS will be assigned with the domain "isp118.lab".
BIND 9 is used to set up the DNS service in order to create and maintain a distributed host name and address database for computers on the network. We will configure it first and use it to ensure the DNS service works as expected. In our design, the as118s1 is named ns.isp118.lab, as118s2 is named www.isp118.lab and as118s3 is named dhcpd.isp118.lab.The DNS ip address and default gateway will be assigned to the hosts when they receive the ip address from DHCP server.

3.2.2 Web

s2 is used as web server in this project. The ip address that assigned to it is 1.118.1.3 and it is named as www.isp118.lab
The web server main page should be a simple text-based page named index.html and it will be edited as:

- ASN: 118
- NETWORK: 1.118.0.0/20
- NAME1: Qinglin Zou
- EMAIL1: qinglinz@kth.se
- NAME2: Akshay Manappatty
- EMAIL2: akshayma@kth.se

The implemented version is given below

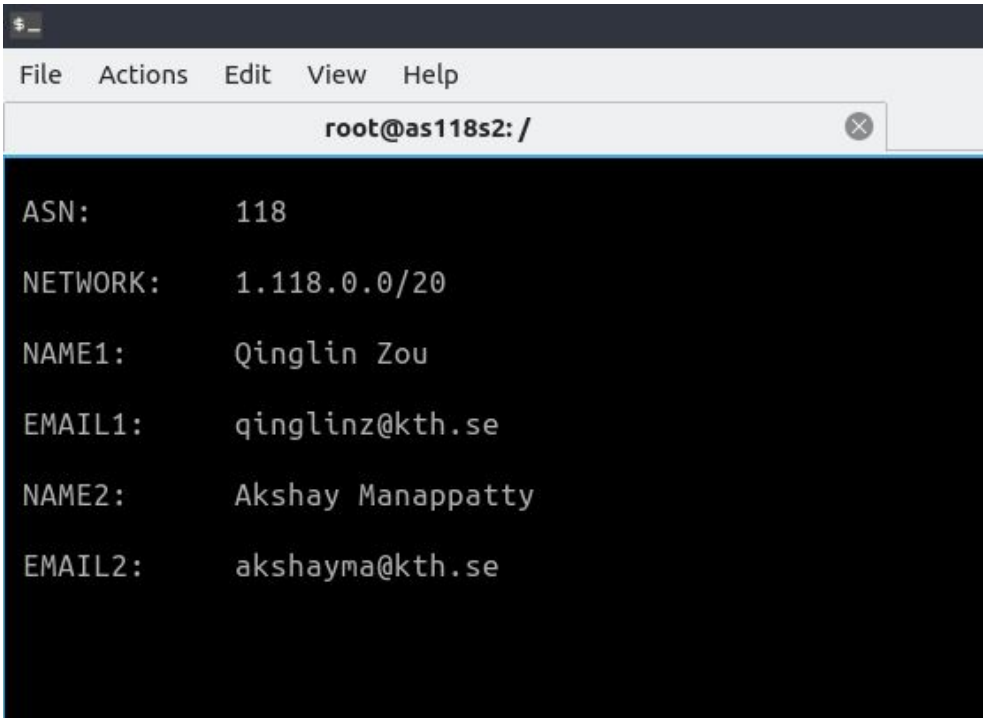

Figure 2: Web

3.2.3 DHCP

s3 is used as DHCP server and r4 is the DHCP relay agency. The ip address allocated to the DHCP is 1.118.1.4 and named as dhcpd.isp118lab.
We initiate isc-dhcp service on as118s3 and initiate isc-dhcp-relay service on as118r4. The subnet which dhcp server service for is 1.118.7.0 and ip address assingned randomly to the clients in the range 1.118.7.10 to 1.118.7.20.