

IK2215: Network Design Report

Tangyujun Han
<tanghan@kth.se>

Yukun Zou
<yukunzou@kth.se>

1 General Information

ASN: 113

NETWORK: 1.113.0.0/20

2 Network overview

This section contains an overview of network design.

2.1 Network diagram

The network design is illustrated in Figure 1 below.

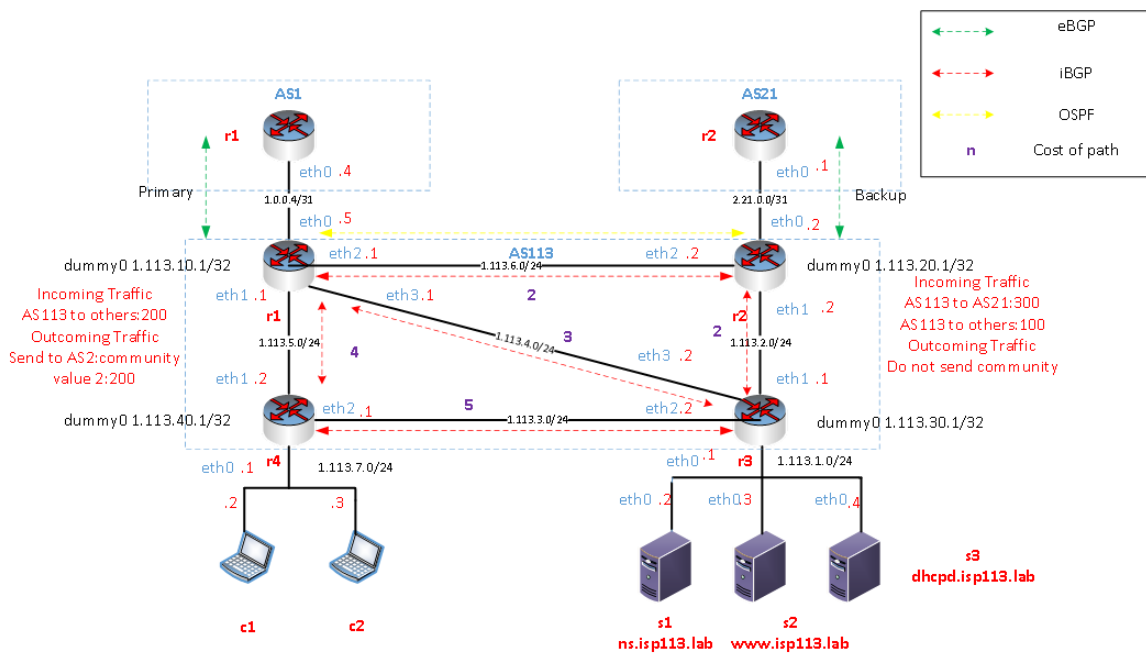


Figure 1: Network Diagram

2.2 IP address allocation

The IP addresses and domain names of all device interfaces are shown in the table below.

Device	Interface	IP address	Domain name
r1	eth0	1.0.0.5/31	r1eth0.isp113.lab
r1	eth1	1.113.5.1/24	r1eth1.isp113.lab
r1	eth2	1.113.6.1/24	r1eth2.isp113.lab
r1	eth3	1.113.4.1/24	r1eth3.isp113.lab
r1	dummy0	1.113.10.1/32	r1dummy0.isp113.lab
r2	eth0	2.21.0.2/31	r2eth0.isp113.lab
r2	eth1	1.113.2.2/24	r2eth1.isp113.lab
r2	eth2	1.113.6.2/24	r2eth2.isp113.lab
r2	dummy0	1.113.20.1/32	r2dummy0.isp113.lab
r3	eth0	1.113.1.1/24	r3eth0.isp113.lab
r3	eth1	1.113.2.1/24	r3eth1.isp113.lab
r3	eth2	1.113.3.2/24	r3eth2.isp113.lab
r3	eth3	1.113.4.2/24	r3eth3.isp113.lab
r3	dummy0	1.113.30.1/32	r3dummy0.isp113.lab
r4	eth0	1.113.7.1/24	r4eth0.isp113.lab
r4	eth1	1.113.5.1/24	r4eth1.isp113.lab
r4	eth2	1.113.3.1/24	r4eth2.isp113.lab
r4	dummy0	1.113.40.1/32	r4dummy0.isp113.lab
s1	eth0	1.113.1.2/24	ns.isp113.lab
s2	eth0	1.113.1.3/24	www.isp,113.lab
s3	eth0	1.113.1.4/24	dhcpd.isp.113.lab
c1	eth0	1.113.7.2/24	c1.isp113.lab
c2	eth0	1.113.7.3/24	c2.isp113.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

OSPF is selected for our network's intra-domain routing since the scale of our network is not big, which means it won't take lots of memories, and the converge will be fast.

We will configure the cost to different path manually to satisfy the requirements as follows

Cost	r1	r2	r3	r4
r1	X	2	3	4
r2	2	X	2	-
r3	3	2	X	5
r4	4	X	5	-

Table 1: OSPF cost of direct link between routers. X represents a node itself, - represents there is no direct link connecting the nodes.

By configuring the cost like this, we can make sure that traffic will traverse a certain path we want and there are no equal-cost paths between two end-to-end points. In addition, the traffic from r2, r3, r4 is inclined to take a direct path to r1, where the primary link is located, and vice versa.

Table 2 and Table 3 below show the primary and secondary routing paths respectively.

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

Table 2: Intermediate nodes in the primary routing path from row to column. X represents a path to itself, - represents a direct link without any intermediate node.

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

Table 3: Intermediate nodes in the secondary routing path from row to column (when the primary routing path fails). X represents a path to itself, - represents a direct link without any intermediate node.

3.1.2 Inter-domain routing

It is required that primary link is used for both incoming and outgoing traffic 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. Moreover, we need to ensure that the policy is enforced not only for AS113 but also for other ASes. For instance, AS21 shouldn't use AS113 to transit to AS1 and vice versa during normal operation. Moreover, our network must work even when either r1 or r2 is taken offline! However, we must not provide transit for other ASes, except AS21. ISP must advertise only the aggregated prefix 1.ASN.0.0/20 in all BGP routing updates.

We will set up a iBGP connection between r1 and r2 in AS113 and make r1 become the DR and r2 become the BDR. To make sure the traffic prefers to go through the primary link, on as113r1, we will set the Local Preference of destinations including all the other ASes to 200. On as113r2, we will set the Local Preference of destinations match ip address prefix-list 1.113.0.0/20 to 300. By doing so, since the local preference of other traffic whose destination is any other ASes is default value 100, the normal traffic will go through from r1 and there is a direct link between AS113 and AS21.

For packets incoming to AS113, since as1r1 and as2r1 both support BGP community, routing information going out from AS113 will be added a Community Value 1:00 and 2:200. In this case, the prefixes of those routing information that received by as1r1 and as2r1 will be added a higher Local Preference, making the connection between as113r1 and as1r1 the primary link of AS113. And other ASes won't use AS113 to transit.

We will use dummy0 for iBGP and use ip address for eBGP. The dummy interface of r1 is 1.113.10.1/32; the dummy interface of r2 is 1.113.20.1/32.

3.2 Internet service

This section describes ISP implementation to fulfill service requirements.

3.2.1 DNS

s1 is used as the web server and IP address 1.113.1.2/24 is assigned to it. The domain "isp113.lab" will be assigned to each host within the AS.

BIND 9 is used to configure the DNS service, which creates and maintains a distributed host name and address database for network computers. We configured it first and used it to ensure that the DNS service functions properly. As113s1 is named ns.isp113.lab, as113s2 is named www.isp113.lab,

and as113s3 is named dhcpd.isp113.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 the Web server. The ip address assigned to it is 1.113.1.3 and it is named as www.isp113.lab. The web server main page "index.html" contains the following information:

- ASN: 113
- NETWORK: 1.113.0.0/20
- NAME1: <Tangyujun Han>
- EMAIL1: <tanghan@kth.se>
- NAME2: <Yukun Zou>
- EMAIL2: <yukunzou@kth.se>

3.2.3 DHCP

DHCP is employed, with s3 acting as the DHCP server and r4 acting as the DHCP relay. The ip address assigned to S2 is 1.113.1.4. And the name of s3 is dhcpd.isp113.lab. The ip address assigned to r4 is 1.113.7.1, which is on the same network as the client.

The DHCP relay is used to transfer between the DHCP client and the DHCP server that are not in the same subnet, and that's why we select r4 as the DHCP relay. As a result, it requires a direct connection to the DHCP client network segment. However, it is not required to be directly connected to the network segment hosting the DHCP server.