IK2215: Network Design Report

Ísak Arnar Kolbeins <kolbeins@kth.se>
Chăngróng Lǐ <changrli@kth.se>

1 General Information

ASN: 125 **NETWORK:** 1.125.0.0/20

2 Network overview

This section contains an overview of network design.

2.1 Network diagram

The network design is illustrated in Figure 1 below.

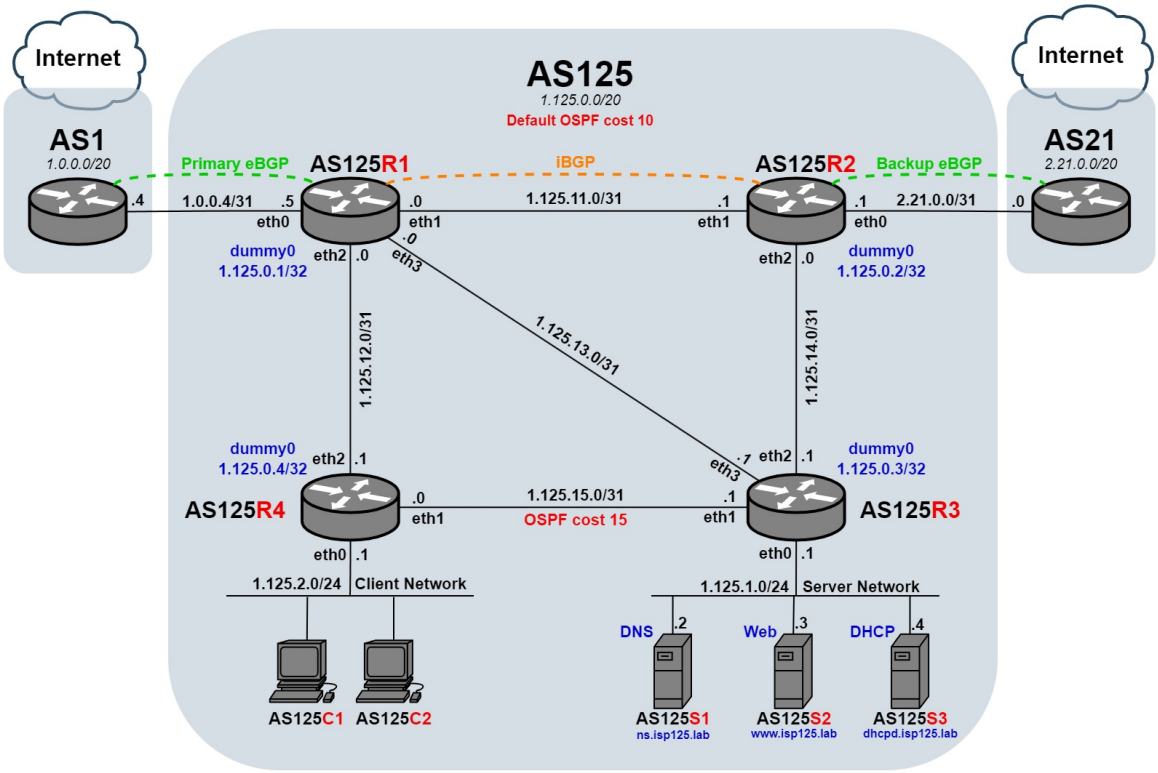

Figure 1: Network Diagram

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.isp125.lab
r1	eth1	1.125.11.0/31	r1eth1.isp125.lab
r1	eth2	1.125.12.0/31	r1eth2.isp125.lab
r1	eth3	1.125.13.0/31	r1eth3.isp125.lab
r1	dummy0	1.125.0.1/32	r1dummy0.isp125.lab
r2	eth0	2.21.0.1/31	r2eth0.isp125.lab
r2	eth1	1.125.11.1/31	r2eth1.isp125.lab
r2	eth2	1.125.14.0/31	r2eth2.isp125.lab
r2	dummy0	1.125.0.2/32	r2dummy0.isp125.lab
r3	eth0	1.125.1.1/24	r3eth0.isp125.lab
r3	eth1	1.125.15.1/31	r3eth1.isp125.lab
r3	eth2	1.125.14.1/31	r3eth2.isp125.lab
r3	eth3	1.125.13.1/31	r3eth3.isp125.lab
r3	dummy0	1.125.0.3/32	r3dummy0.isp125.lab
r4	eth0	1.125.2.1/24	r4eth0.isp125.lab
r4	eth1	1.125.15.0/31	r4eth1.isp125.lab
r4	eth2	1.125.12.1/31	r4eth2.isp125.lab
r4	dummy0	1.125.0.4/32	r4dummy0.isp125.lab
s1	eth0	1.125.1.2/24	ns.isp125.lab
s2	eth0	1.125.1.3/24	www.isp125.lab
s3	eth0	1.125.1.4/24	dhcpd.isp125.lab
c1	eth0	DHCP 1.125.2.[10-99]/24	c1.isp125.lab
c2	eth0	DHCP 1.125.2.[10-99]/24	c2.isp125.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 decided on using OSPF for our intra-domain routing mainly because OSPF converges faster than RIP and by using different cost paths we can avoid having equal-cost paths between two end-points, which would not be possible with RIP since it uses the hop counts as the metric.
By connecting all routers with at least 2 interfaces to the network we can be sure that network can stay operational even when an internal link fails.
Furthermore, we also used the additional interfaces on both r1 and r2 to create a shorter path between themselves as well as providing a shorter path for other routes.
The cost of one path r3-r4 is higher than the cost of other paths. We chose 15 for the higher cost one and 10 for the default. By doing that we do not face equal-cost paths even in the event that one link goes down and we need to use the secondary route.

Table 1 and Table 2 below show the primary and secondary routing paths respectively.

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

Table 1: 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	r3	r2 r3	r3 r4
r2	r3	X	r1 r3	r3 r4
servers	r3 r2	r3 r1	X	r1 r4
clients	r4 r3	r4 r3	r4 r1	X

Table 2: 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

Using AS125R1 and AS125R2 as border routers for the BGP implementation where AS125R1-AS1 is used as the primary link and AS125R2-AS21 is used as a backup link.
Furthermore, in the default state, all traffic exiting and entering AS125 will go through the primary link AS125R1-AS1R1, except for direct traffic from and to AS21 going over the backup link AS125R2-AS21.
If the primary link were to go down, all traffic would go and come through the backup link AS125R2-AS21. This is achieved by making AS125R1 the DR (Designated Router) and AS125R2 the BDR (Backup Designated Router) by setting the BGP community value for AS125R1 to 1:50, where it will set the local preference for AS125R1. Since it is lower than the default local preference (100) the traffic will take the AS125R1-AS1 route.
For the BDR, we advertise the BGP community value of AS125R2 to 1:200 making its local preference higher than the default. So the route will not be used unless the primary link goes down.
For the direct traffic to and from AS21, we also set the local preference to be lower for a specific IP prefix of AS21 - 2.21.0.0/20 by setting the BGP community value for said prefix to 80. Using the same way around for traffic coming from AS125 towards AS21 by setting it to 80 for 1.125.0.0/20 prefix of the AS125.
By using these prefixes we can stop other ASes from using AS125 in transit since the traffic will not match the prefixes and will be routed another way.

3.2 Internet service

This section describes ISP implementation to fulfil service requirements.

3.2.1 DNS

We use AS125S1 with IP address 1.125.1.2/24 as the DNS server and name it ns.isp125.lab.
We use BIND 9 to set up the DNS service with forwarders to set up the forward lookup zone for our domain isp125.lab. This zone contains records mapping host names to IP addresses for all devices in our network. For reverse lookup zone configuration, since the TLD DNS servers (for .lab and 1.in-addr.arpa domains) are already preconfigured with DNS delegation, we can easily configure the reverse lookup zone by independently managing the reverse lookup involving AS125.
We configure DNS delegation on the root DNS servers 1.0.1.2 to delegate DNS requests to the DNS server on AS125S1, allowing it to resolve device names within AS125 and vice versa configure the

DNS server AS125S1 to use root DNS server and .lab DNS as external DNS servers (Primary and backup) to resolve internet domain names. Finally, we monitor the performance and availability of the DNS server to ensure its proper operation.
In this way, we ensure that all clients and servers can resolve the host names or IPs in the local AS, other ASes and the internet, and also allow other ASes to resolve device names in our ISP and ensure that both forward and reverse lookups work correctly.

3.2.2 Web

The device that runs the web server is AS125S2 with the IP address 1.125.1.3/24 and it resides within the Server Network (1.125.1.0/24). The domain name of the server is www.isp125.lab and the server will therefore be accessible through the domain name.

3.2.3 DHCP

The device that runs the DHCP server is AS125S3 with the IP address 1.125.1.4/24 and it resides within the Server Network (1.125.1.0/24), and has the dhcpd.isp125.lab domain name.
The DHCP relay is set up on AS125R4 since the server is not located on the same LAN as the clients, from there the relay will send DHCP requests along to AS125R3 and to the DHCP server.