IK2215: Network Design Report

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1 General Information

ASN: 127 **NETWORK:** 1.127.0.0/20

2 Network overview

This section contains an overview of network design.

2.1 Network diagram

Figure 1 below.

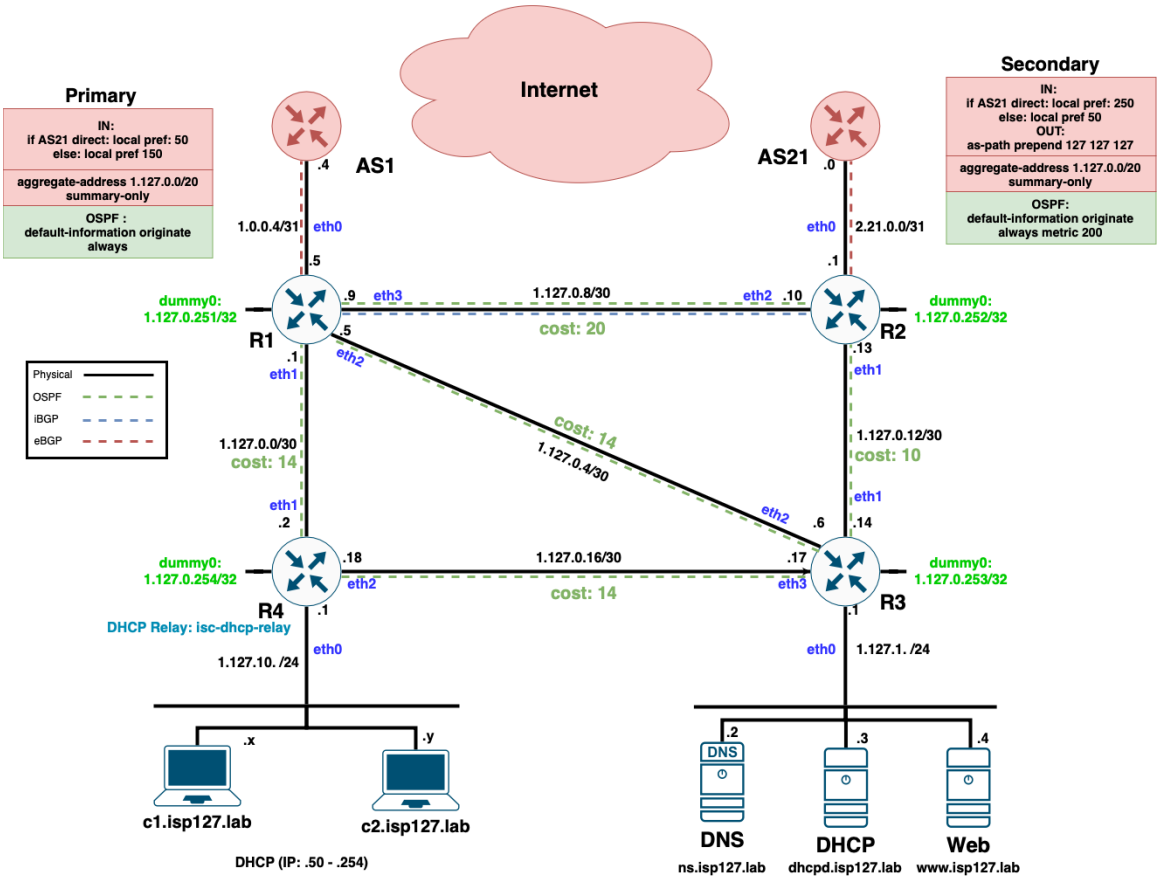

Figure 1: Network Diagram

2.2 IP address allocation

Our ISP uses only /24 networks. Exceptions are transfer networks (/30) and dummy interfaces (/32).

1.127.0.0/24: Reserved for transfer networks (stating from 0 and increments) and dummy interfaces (starting from 254 and decrements)
1.127.0.1/24 - 1.127.9.254/24: Reserved for server segments
1.127.10.1/24 - 1.127.15.254/24: Reserved for client segments

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	r1as1.isp127.lab
r1	eth1	1.127.0.1/30	r1r4.isp127.lab
r1	eth2	1.127.0.5/30	r1r3.isp127.lab
r1	eth3	1.127.0.9/30	r1r2.isp127.lab
r1	dummy0	1.127.0.251/32	r1d0.isp127.lab
r2	eth0	2.21.0.1/31	r2as21.isp127.lab
r2	eth1	1.127.0.13/30	r2r3.isp127.lab
r2	eth2	1.127.0.10/30	r2r1.isp127.lab
r2	dummy0	1.127.0.252/32	r2d0.isp127.lab
r3	eth0	1.127.1.1/24	r3s.isp127.lab
r3	eth1	1.127.0.14/30	r3r2.isp127.lab
r3	eth2	1.127.0.6/30	r3r1.isp127.lab
r3	eth3	1.127.0.17/30	r3r4.isp127.lab
r3	dummy0	1.127.0.253/32	r3d0.isp127.lab
r4	eth0	1.127.10.1/24	r4c.isp127.lab
r4	eth1	1.127.0.2/30	r4r1.isp127.lab
r4	eth2	1.127.0.18/30	r4r3.isp127.lab
r4	dummy0	1.127.0.254/32	r4d0.isp127.lab
s1	eth0	1.127.1.2/24	ns.isp127.lab
s2	eth0	1.127.1.3/24	dhcpd.isp127.lab
s3	eth0	1.127.1.4/24	www.isp127.lab
c1	eth0	1.127.10.X/24; $X = \{x \mid 50 \leq x \leq 254\}$	c1.isp127.lab
c2	eth0	1.127.10.Y/24; $Y = \{y \mid 50 \leq y \leq 254\}$	c2.isp127.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

Our ISP Network uses OSPF as an internal routing protocol. We use OSPF-cost manipulation to archieve our intra-domain routing design. OSPF is easy to troubleshoot and has fewer drawbacks than RIP. OSPF is configured on all routers with link cost defined in Table 3. These link costs are used to enforce primary and secondary paths as defined in Table 1 and Table 2.

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

cost	r1	r2	r3	r4
r1	X	20	14	14
r2	20	X	10	-
r3	14	10	X	14
r4	14	-	14	X

Table 3: Defined OSPF cost from row to collumn to ensure primary and secondary routing paths. X represents a path to itself, - represents a direct link without any intermediate node.

3.1.2 Inter-domain routing

In our network design, we implement iBGP between as127r1 and as127r2. For the iBGP peering, we use dummy0 interfaces. In this way, iBGP peering can stay up even when the physical link goes down. eBGP will be set up between as127r1 and as1r1 (primary link) and between as127r2 and as21r1 (backup link).

Our BGP policy is described in following manner:
Our ISP uses command 'aggregate-address 1.127.0.0/20 summary-only' to only announce the aggregated prefix. The internal subnet information will not be disclosed. The inbound and outbound configuration of our ISP is described as follows:

```
as127r1:
    inbound:
        if (AS21 direct traffc) -> local pref 50
        else -> local pref 150
as127r2
    inbound:
        if (AS21 direct traffic) -> local pref 250
        else: local pref 50
    outbound:
        as-path prepend 127 127 127
```

Inbound: Configuring a higher local preference for AS21 direct traffic on router as127r2 will ensure that traffic is forwarded form as127r2 to as AS21. Every other communication will use the path to as127r1 because there is a higher local preference configured. There, the traffic will be forwarded to AS1.

Outbound: On as127r2, AS-Path prepend is configured. Other AS will think that the path over as127r2 is higher than the path over as127r1. Therefore, traffic from outside will prefer our primary link.

When the primary link fails, BGP withdraws route advertisements from the primary link. Because local preference and AS path prepending are preconfigured, outgoing traffic will use as127r2 to traverse through AS21. At the same time, the external autonomous system recalculates the AS path and selects a shorter path to direct the incoming traffic. It will use the backup link (the only link possible) from AS21 to as127r2 to reach our local AS.

3.2 Internet service

This section describes ISP implementation to fulfill service requirements.

3.2.1 DNS

Our ISP uses a linux-based server. We provide DNS functionality with BIND 9. The DNS server has IP: 1.127.1.2/24 and name: ns.isp127.lab. To ensure that all clients and servers can resolve the names of all servers on the Internet, the DNS server is set to forward external queries to public DNS servers, such as 1.0.1.2, so our ISP can resolve external domain names. In BIND 9, forward and reverse lookup zones are configured. The forward zone is used to resolve internal device names (e.g., www.isp127.lab), and the reverse zone is used to resolve IP addresses to their corresponding domain names.

3.2.2 Web

Our ISP uses a linux-based server. To run the web server, we use Apache HTTP. The web server uses IP: 1.127.1.4/24 and name: www.isp127.lab. Our configured index.html webside shows our AS Number, our names and our emails.

3.2.3 DHCP

Our ISP uses a linux-based server. To provide DHCP services, we use dhcpd. The DHCP has assigned IP: 1.127.1.3/24 and name: dhcpd.isp127.lab.
The DHCP server has configured a pool to provide hosts with IP addresses. The pool ranges from 1.127.10.50/24 to 1.127.10.254/24. Besides that, DHCP provides default gateway, broadcast address and DNS. Other IP addresses in this subnet are reserved for future use. To provide important routing information to hosts, router r4 will be configured as a DHCP relay. The relay is configured to forward requests to the DHCP Server.