

IP addressing and Static Routing

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1 Objective

The aim of this lab is to configure **IP addressing** on multiple hosts and routers, implement **static routing**, and validate connectivity using diagnostic tools. The study also analyzes router behavior when forwarding packets (TTL and checksum modifications) and verifies routing decisions based on prefix matching.

2 Topology and Setup

The initial network consists of two hosts connected through a router. Later, the topology is extended with host3 and nsa2 to test routing tables and default routes.

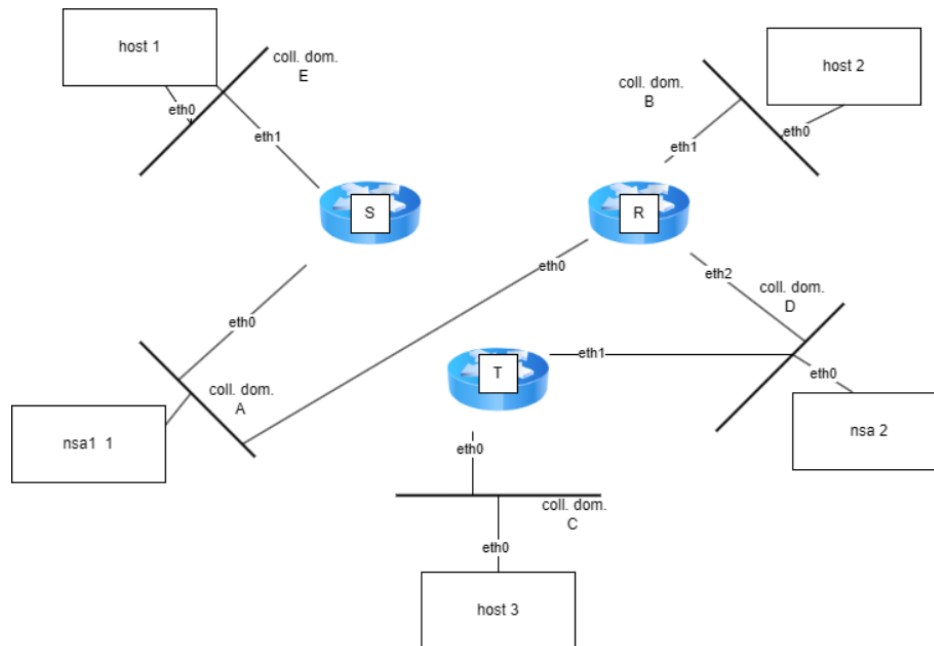


FIGURE 1 – Network topology used in the lab

3 Procedure and Results

3.1 IP Addressing

Host1 is configured with the address 69.192.27.44/23. With a /23 mask, the first 23 bits define the network ID, leaving 9 bits for the host ID. In binary, the host ID corresponds to 100101100.

Host2 uses the address 38.17.3.42/24, which allows for $2^8 = 256$ addresses in the subnet. After excluding the network and broadcast addresses, 254 hosts are usable.

For the collision **domain B**, the address was 17.44.46.192/26. This mask provides $2^6 = 64$ addresses, with 62 usable for hosts.

To simplify routing, host1 and host2 addresses is reconfigured so that their host ID was equal to 1 :

- **host1** : 69.192.26.1/23
- **host2** : 38.17.3.1/24

Router configuration :

```
router$ ip addr add 69.192.26.1/23 dev eth0
router$ ip addr add 38.17.3.1/24 dev eth1
```

P.S. : Ping tests confirmed connectivity between host1 and host2.

3.2 Traceroute Analysis

Running **traceroute** from host1 to host2 produces a single hop with the destination 38.17.3.1, confirming direct connectivity through the router. The reverse path from host2 to host1 also shows a single hop.

Traceroute provides :

- Hop count : 1
- Destination IP : 38.17.3.1
- RTT values : 1 ms, 1 ms, 0 ms

This confirms symmetrical direct paths between both hosts.

3.3 Static Routing

When pinging from nsa2 to host3, no reply is received. Checking with **ip route** reveals that host3 had no default route.

This is resolved by adding :

```
host3$ ip route add default via 17.44.46.129 proto static
```

After this modification, host3 can successfully reply to pings from nsa2.

3.4 Router Behavior

Analysis of IP headers shows two fields are modified when a datagram passes through the router :

- TTL : decrements by 1 (from 64 to 63).
- Checksum : recalculates to account for the TTL change.

The router forwards packets according to the longest prefix match in its routing table.

3.5 Routing Table Completion

The routing table is completed by associating each interface with its corresponding collision domain.

```
Welcome to Netkit

root@R:~# ip route show
root@R:~# ip route add 17.44.46.192/26 via 17.44.46.192 proto static
Error: Nexthop has invalid gateway.
root@R:~# ip route add 17.44.46.192/26 via 17.44.46.193 proto static
root@R:~# ip route show
17.44.46.192/26 via 17.44.46.193 dev eth1 proto static
root@R:~# ip route add 17.44.46.192/26 via 17.44.47.1 proto static
RTNETLINK answers: File exists
root@R:~# ip route add 17.44.47.0/25 via 17.44.47.1 proto static
root@R:~# ip route add 17.44.46.0/25 via 17.44.46.2 proto static
root@R:~# ip route show
17.44.46.0/25 via 17.44.46.2 dev eth2 proto static
17.44.46.192/26 via 17.44.46.193 dev eth1 proto static
17.44.47.0/25 via 17.44.47.1 dev eth0 proto static
```

FIGURE 2 – Routing table of router R after configuration

Each entry is configured using :

```
ip route add <IP/MASK> via <NEXT-HOP> proto static
```

A default route is not required since explicit routes cover all reachable networks.

4 Conclusion

This lab demonstrates the process of configuring IP addressing, analyzing subnet sizes, and implementing static routing. Traceroute validates connectivity and shows the direct paths between hosts. We observe how routers decrement TTL and recompute checksums when forwarding packets. Finally, the completion of the routing table ensures that all nodes could communicate without the need for a default route.