

Figure 1: Topology 1 (GNS3 project [REDACTED])

### Task 1.1 IPv4 Routing (50%)

- (6) Create the topology represented on Figure 1 in GNS3. Ensure each router gets proper interfaces assigned to its slots. Assign names to the routers.
- Make an IP addressing plan and apply it for the network. Make sure it is visualized in GNS3 in a neat and compact way, see Figure 2 as an example.

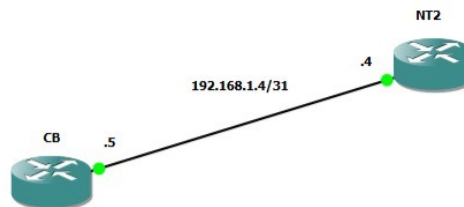


Figure 2: Network visualization example

- (4) All routers, except Level 3, should have two loopback interfaces (loopback0 and loopback1). A loopback interface has an IP address assigned and configured with a /32 mask (255.255.255.255).
- (4) NextTel has been assigned a single overall range of IP addresses 192.168.0.0/16, including customers and loopbacks. Apply the IP subnet 192.168.0.0/24 for all internal links, the subnet 192.168.1.0/24 for external links (i.e. toward customers) and use 10.10.0.0/24 network towards Level 3. Loopback interfaces should use addresses from 192.168.2.0/24 range.

(c) (4) TeleStar has been assigned a single overall range of IP addresses 172.16.0.0/16, including customers and loopbacks. Apply the IP subnet 172.16.0.0/24 for all internal links, the subnet 172.16.1.0/24 for external links (i.e. toward customers) and use 10.10.0.0/24 network towards Level 3. Loopback interfaces should use addresses from 172.16.2.0/24 range.

(d) (2) For Level 3, a single loopback interface should be configured using IP address 10.10.1.1/32.

<https://www.overleaf.com/project/658166ac90e8041b9d0d5456>

3. Configure routing. When completed, all routers should have a routing table containing all IP addresses used in the network (all loopback interface, all link addresses) and the route to Internet (0.0.0.0/0):

(a) (4) configure OSPF;

(b) (4) configure RIP;

(c) (4) configure BGP;

(d) (2) injected static Null0 route in Level 3 to represent the Internet.

4. (6) Configure VLANs. When completed, make sure that only 2 PCs on the same VLAN can ping each other. VLAN 10 is intended for Production and VLAN 40 is used for Testing. For VLAN 10 use 10.0.10.0/x and 10.0.100.0/x IP subnets. For VLAN 40, use 10.0.40.0/x and 10.0.80.0/x IP subnets. To determine the size of the subnet take into account that the number of connected devices in the future expansion (per each broadcast domain) is 100.

5. (4) Ensure that inside the OSPF domains for TeleStar GE links are preferred instead of the FE links. Static routes should not be used for this purpose.

6. (4) Ensure Loopbacks 0 are not advertised outside of their respective AS.

7. (6) Capture packet exchange on any chosen link within OSPF domain to illustrate how the protocol works.

## Task 1.2 IPv6 Routing (50%)

**Start with exporting project from Task 1.1 as each task should be supported by a separate export of GNS3 project. When creating an export, do not include base image or snapshots to keep it compact.**

TeleStar has decided to sell their IPv4 address space and move to IPv6 only so all IPv4 addresses previously assigned to the TeleStar network as well as to Customer B (AS 64498) should be removed. A new IPv6 addressing plan should be specified. The plan should cover all links specified in the network shown, i.e. links of the TeleStar core network and its related external links.


1. (10) Update IP addressing plan from Task 1, also in a visual way in GNS3, and implement based on the following requirements. TeleStar has been assigned a single overall range of IPv6 addresses fd00::0/32 with subnet fd00:0:0:1000::0/64 used for internal links, subnet fd00:0:0:2000::0/64 used for external links (i.e. toward customers) and network fd00:0:0:3000::0/64 towards Level 3. Loopback interfaces should use addresses from fd00:0:0:4000::0/64 range. A loopback interface has an IP address assigned and configured with /128 mask.

For Level 3, a loopback interface should be configured using IP address fd00:0:0:5000::4001/128.

2. Ensure both internal and external connectivity is preserved for IPv6-based network:

(a) (10) re-configure OSPF and ensure GE links are prioritized in TeleStar domain.

(b) (10) re-configure BGP.

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3. **(20)** Configure IPv4-over-IPv6 tunnel, to connect PCs that belong to the same VLAN. The validation should be done by executing both ping and traceroute commands with results included into the final report as screenshots.

**Hint:** The IPv4 address of a tunnel should be chosen from the IP subnet you haven't been using in the rest of the project.

## Appendix A

Here are some useful Cisco commands you might want to use:

- `ip add <ip> <mask>`,
- `no shut`
- `encapsulation dot1 <vlan_id>`
- `switchport mode access`
- `switchport access vlan <vlan_id>`
- `switchport mode trunk`
- `router ospf <process_id>`
- `router-id <router_id>`
- `network <ip> <mask> area <area_id>`
- `sh ip ospf neigh`
- `router bgp <as_number>`
- `neighbor <ip> remote-as <as\_number>`
- `sh ip bgp`
- `redistribute ospf <ospf_process_id> match internal external 1 external 2`
- `redistribute bgp <as_number> subnets`
- `redistribute connected subnets`
- `redistribute static`
- `neighbor <neighbor ip> distribute-list <acl_name> out`
- `sh ip route`
- `no ip address`
- `ipv6 address <ip>`
- `interface tunnel <tunnel_number> mode ipv6`