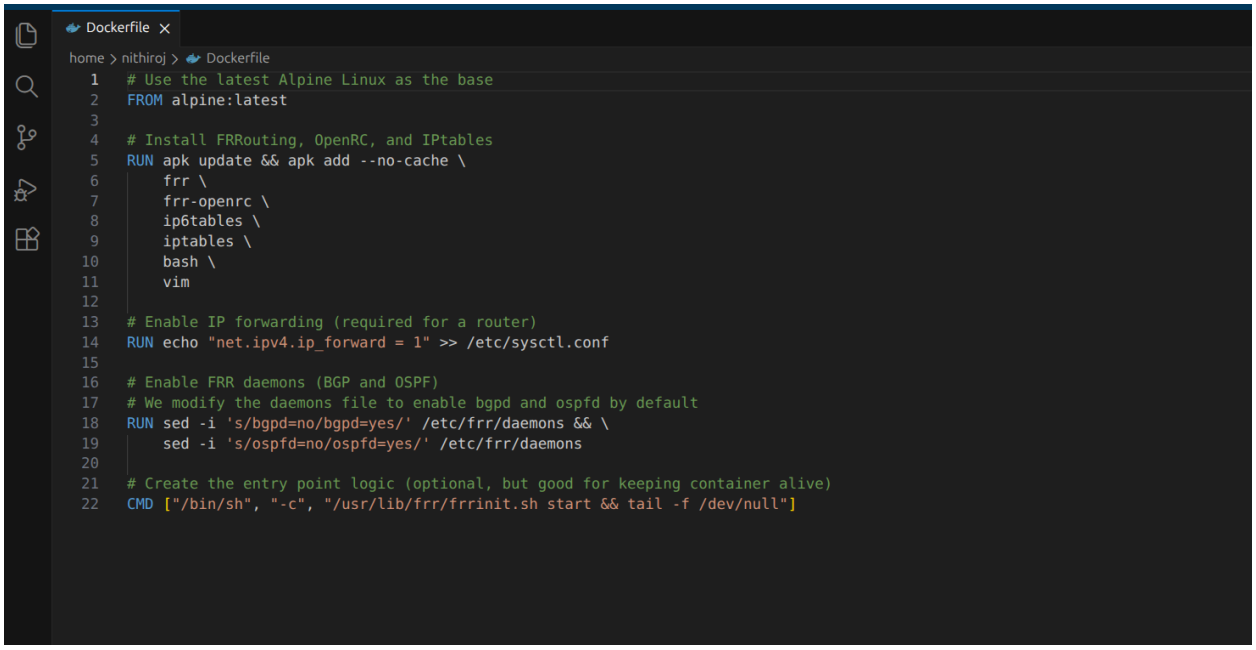
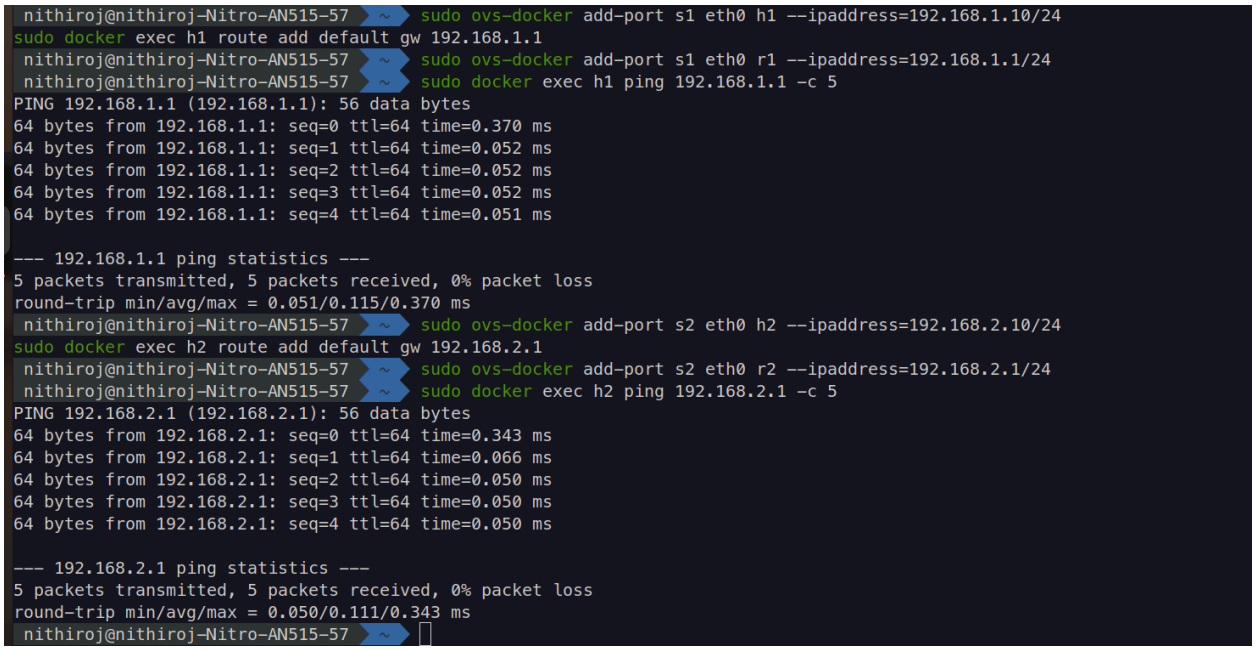
Assignment 4 Modern network

นายนิธิโรจน์ นันทวโนทยาน 663040653-3



```
# Use the latest Alpine Linux as the base
FROM alpine:latest

# Install FRRouting, OpenRC, and IPtables
RUN apk update && apk add --no-cache \
    frr \
    frr-openrc \
    ip6tables \
    iptables \
    bash \
    vim

# Enable IP forwarding (required for a router)
RUN echo "net.ipv4.ip_forward = 1" >> /etc/sysctl.conf

# Enable FRR daemons (BGP and OSPF)
# We modify the daemons file to enable bgpd and ospfd by default
RUN sed -i 's/bgpd=no/bgpd=yes/' /etc/frr/daemons && \
    sed -i 's/ospfd=no/ospfd=yes/' /etc/frr/daemons

# Create the entry point logic (optional, but good for keeping container alive)
CMD ["/bin/sh", "-c", "/usr/lib/frr/frrinit.sh start && tail -f /dev/null"]
```

Docker file for Config router



```
nithiroj@nithiroj-Nitro-AN515-57 ~ sudo ovs-docker add-port s1 eth0 h1 --ipaddress=192.168.1.10/24
sudo docker exec h1 route add default gw 192.168.1.1
nithiroj@nithiroj-Nitro-AN515-57 ~ sudo ovs-docker add-port s1 eth0 r1 --ipaddress=192.168.1.1/24
nithiroj@nithiroj-Nitro-AN515-57 ~ sudo docker exec h1 ping 192.168.1.1 -c 5
PING 192.168.1.1 (192.168.1.1): 56 data bytes
64 bytes from 192.168.1.1: seq=0 ttl=64 time=0.370 ms
64 bytes from 192.168.1.1: seq=1 ttl=64 time=0.052 ms
64 bytes from 192.168.1.1: seq=2 ttl=64 time=0.052 ms
64 bytes from 192.168.1.1: seq=3 ttl=64 time=0.052 ms
64 bytes from 192.168.1.1: seq=4 ttl=64 time=0.051 ms

--- 192.168.1.1 ping statistics ---
5 packets transmitted, 5 packets received, 0% packet loss
round-trip min/avg/max = 0.051/0.115/0.370 ms
nithiroj@nithiroj-Nitro-AN515-57 ~ sudo ovs-docker add-port s2 eth0 h2 --ipaddress=192.168.2.10/24
sudo docker exec h2 route add default gw 192.168.2.1
nithiroj@nithiroj-Nitro-AN515-57 ~ sudo ovs-docker add-port s2 eth0 r2 --ipaddress=192.168.2.1/24
nithiroj@nithiroj-Nitro-AN515-57 ~ sudo docker exec h2 ping 192.168.2.1 -c 5
PING 192.168.2.1 (192.168.2.1): 56 data bytes
64 bytes from 192.168.2.1: seq=0 ttl=64 time=0.343 ms
64 bytes from 192.168.2.1: seq=1 ttl=64 time=0.066 ms
64 bytes from 192.168.2.1: seq=2 ttl=64 time=0.050 ms
64 bytes from 192.168.2.1: seq=3 ttl=64 time=0.050 ms
64 bytes from 192.168.2.1: seq=4 ttl=64 time=0.050 ms

--- 192.168.2.1 ping statistics ---
5 packets transmitted, 5 packets received, 0% packet loss
round-trip min/avg/max = 0.050/0.111/0.343 ms
nithiroj@nithiroj-Nitro-AN515-57 ~
```

h1 and h2 ping their gateway

```
 nithiroj@nithiroj-Nitro-AN515-57  ~  sudo ovs-docker add-port link_13 eth1 r1 --ipaddress=192.168.13.1/30
sudo ovs-docker add-port link_13 eth0 r3 --ipaddress=192.168.13.2/30
 nithiroj@nithiroj-Nitro-AN515-57  ~  sudo ovs-docker add-port link_34 eth1 r3 --ipaddress=192.168.34.1/30
sudo ovs-docker add-port link_34 eth0 r4 --ipaddress=192.168.34.2/30
 nithiroj@nithiroj-Nitro-AN515-57  ~  sudo ovs-docker add-port link_24 eth1 r4 --ipaddress=192.168.24.2/30
sudo ovs-docker add-port link_24 eth1 r2 --ipaddress=192.168.24.1/30
 nithiroj@nithiroj-Nitro-AN515-57  ~  sudo docker exec -it r1 sh -c "ping 192.168.13.2 -c 5"
PING 192.168.13.2 (192.168.13.2): 56 data bytes
64 bytes from 192.168.13.2: seq=0 ttl=64 time=0.409 ms
64 bytes from 192.168.13.2: seq=1 ttl=64 time=0.054 ms
64 bytes from 192.168.13.2: seq=2 ttl=64 time=0.059 ms
64 bytes from 192.168.13.2: seq=3 ttl=64 time=0.059 ms
64 bytes from 192.168.13.2: seq=4 ttl=64 time=0.059 ms

--- 192.168.13.2 ping statistics ---
5 packets transmitted, 5 packets received, 0% packet loss
round-trip min/avg/max = 0.054/0.128/0.409 ms
 nithiroj@nithiroj-Nitro-AN515-57  ~  sudo docker exec -it r3 sh -c "ping 192.168.34.2 -c 5"
PING 192.168.34.2 (192.168.34.2): 56 data bytes
64 bytes from 192.168.34.2: seq=0 ttl=64 time=0.275 ms
64 bytes from 192.168.34.2: seq=1 ttl=64 time=0.049 ms
64 bytes from 192.168.34.2: seq=2 ttl=64 time=0.046 ms
64 bytes from 192.168.34.2: seq=3 ttl=64 time=0.046 ms
64 bytes from 192.168.34.2: seq=4 ttl=64 time=0.048 ms

--- 192.168.34.2 ping statistics ---
5 packets transmitted, 5 packets received, 0% packet loss
round-trip min/avg/max = 0.046/0.092/0.275 ms
 nithiroj@nithiroj-Nitro-AN515-57  ~  sudo docker exec -it r4 sh -c "ping 192.168.24.2 -c 5"
PING 192.168.24.2 (192.168.24.2): 56 data bytes
64 bytes from 192.168.24.2: seq=0 ttl=64 time=0.035 ms
64 bytes from 192.168.24.2: seq=1 ttl=64 time=0.044 ms
64 bytes from 192.168.24.2: seq=2 ttl=64 time=0.028 ms
64 bytes from 192.168.24.2: seq=3 ttl=64 time=0.038 ms
64 bytes from 192.168.24.2: seq=4 ttl=64 time=0.055 ms

--- 192.168.24.2 ping statistics ---
5 packets transmitted, 5 packets received, 0% packet loss
```

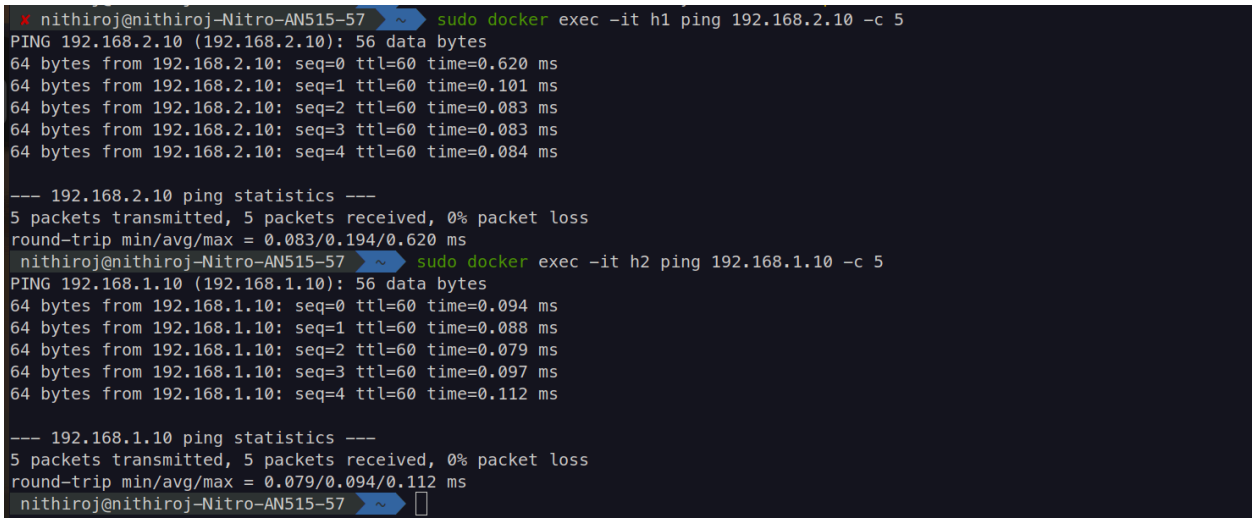
Link r1 to r3 & r3 to r4& r4 to r2

```
nithiroj@nithiroj-Nitro-AN515-57 ~ sudo docker exec -it r1 vtysh -c "show ip route"
Codes: K - kernel route, C - connected, L - local, S - static,
       R - RIP, O - OSPF, I - IS-IS, B - BGP, E - EIGRP, N - NHRP,
       T - Table, v - VNC, V - VNC-Direct, A - Babel, F - PBR,
       f - OpenFabric, t - Table-Direct,
       > - selected route, * - FIB route, q - queued, r - rejected, b - backup
       t - trapped, o - offload failure

IPv4 unicast VRF default:
C>* 192.168.1.0/24 is directly connected, eth0, weight 1, 00:10:05
L>* 192.168.1.1/32 is directly connected, eth0, weight 1, 00:10:05
B>* 192.168.2.0/24 [20/12] via 192.168.13.2, eth1, weight 1, 00:01:50
B   192.168.13.0/30 [20/0] via 192.168.13.2 inactive, weight 1, 00:02:15
C>* 192.168.13.0/30 is directly connected, eth1, weight 1, 00:09:05
L>* 192.168.13.1/32 is directly connected, eth1, weight 1, 00:09:05
B>* 192.168.24.0/30 [20/20] via 192.168.13.2, eth1, weight 1, 00:02:19
B>* 192.168.34.0/30 [20/0] via 192.168.13.2, eth1, weight 1, 00:02:15
nithiroj@nithiroj-Nitro-AN515-57 ~ sudo docker exec -it r2 vtysh -c "show ip route"
Codes: K - kernel route, C - connected, L - local, S - static,
       R - RIP, O - OSPF, I - IS-IS, B - BGP, E - EIGRP, N - NHRP,
       T - Table, v - VNC, V - VNC-Direct, A - Babel, F - PBR,
       f - OpenFabric, t - Table-Direct,
       > - selected route, * - FIB route, q - queued, r - rejected, b - backup
       t - trapped, o - offload failure

IPv4 unicast VRF default:
B>* 192.168.1.0/24 [20/12] via 192.168.24.2, eth1, weight 1, 00:01:42
C>* 192.168.2.0/24 is directly connected, eth0, weight 1, 00:09:33
L>* 192.168.2.1/32 is directly connected, eth0, weight 1, 00:09:33
B>* 192.168.13.0/30 [20/20] via 192.168.24.2, eth1, weight 1, 00:01:42
B   192.168.24.0/30 [20/0] via 192.168.24.2 inactive, weight 1, 00:01:37
C>* 192.168.24.0/30 is directly connected, eth1, weight 1, 00:08:38
L>* 192.168.24.1/32 is directly connected, eth1, weight 1, 00:08:38
B>* 192.168.34.0/30 [20/0] via 192.168.24.2, eth1, weight 1, 00:01:37
nithiroj@nithiroj-Nitro-AN515-57 ~
```

Router 1 and router 2 show ip route after bgp and ospf configuration

```
nithiroj@nithiroj-Nitro-AN515-57 ~ sudo docker exec -it r3 vtysh -c "show ip route"
Codes: K - kernel route, C - connected, L - local, S - static,
       R - RIP, O - OSPF, I - IS-IS, B - BGP, E - EIGRP, N - NHRP,
       T - Table, v - VNC, V - VNC-Direct, A - Babel, F - PBR,
       f - OpenFabric, t - Table-Direct,
       > - selected route, * - FIB route, q - queued, r - rejected, b - backup
       t - trapped, o - offload failure

IPv4 unicast VRF default:
B>* 192.168.1.0/24 [20/0] via 192.168.13.1, eth0, weight 1, 00:04:05
O>* 192.168.2.0/24 [110/12] via 192.168.34.2, eth1, weight 1, 00:02:04
O   192.168.13.0/30 [110/10] is directly connected, eth0, weight 1, 00:08:29
C>* 192.168.13.0/30 is directly connected, eth0, weight 1, 00:09:19
L>* 192.168.13.2/32 is directly connected, eth0, weight 1, 00:09:19
O>* 192.168.24.0/30 [110/20] via 192.168.34.2, eth1, weight 1, 00:07:16
O   192.168.34.0/30 [110/10] is directly connected, eth1, weight 1, 00:08:28
C>* 192.168.34.0/30 is directly connected, eth1, weight 1, 00:09:04
L>* 192.168.34.1/32 is directly connected, eth1, weight 1, 00:09:04
nithiroj@nithiroj-Nitro-AN515-57 ~ sudo docker exec -it r4 vtysh -c "show ip route"
Codes: K - kernel route, C - connected, L - local, S - static,
       R - RIP, O - OSPF, I - IS-IS, B - BGP, E - EIGRP, N - NHRP,
       T - Table, v - VNC, V - VNC-Direct, A - Babel, F - PBR,
       f - OpenFabric, t - Table-Direct,
       > - selected route, * - FIB route, q - queued, r - rejected, b - backup
       t - trapped, o - offload failure

IPv4 unicast VRF default:
O>* 192.168.1.0/24 [110/12] via 192.168.34.1, eth0, weight 1, 00:02:51
B>* 192.168.2.0/24 [20/0] via 192.168.24.1, eth1, weight 1, 00:03:31
O>* 192.168.13.0/30 [110/20] via 192.168.34.1, eth0, weight 1, 00:07:20
O   192.168.24.0/30 [110/10] is directly connected, eth1, weight 1, 00:08:04
C>* 192.168.24.0/30 is directly connected, eth1, weight 1, 00:08:53
L>* 192.168.24.2/32 is directly connected, eth1, weight 1, 00:08:53
O   192.168.34.0/30 [110/10] is directly connected, eth0, weight 1, 00:08:05
C>* 192.168.34.0/30 is directly connected, eth0, weight 1, 00:09:07
L>* 192.168.34.2/32 is directly connected, eth0, weight 1, 00:09:07
nithiroj@nithiroj-Nitro-AN515-57 ~
```

Router 3 and router 4 show ip route after bgp and ospf configuration



PC1 ping PC2 successful

Configuration command file