Load Balancer Implementation Report

Description of the Process

The load balancer listens for incoming TCP packets on the virtual interface at `10.0.0.10`. It selects one of the two backend servers (`10.0.0.2` and `10.0.0.3`) based on a hash of the packet's 5-tuple (source IP, destination IP, source port, destination port, and protocol). It modifies the source IP to `10.0.0.10` (load balancer's IP) and forwards the packet to the chosen backend.

When the backend responds, the load balancer modifies the source IP and MAC to `10.0.0.10` and the destination IP to the client (`10.0.0.1`). This ensures seamless communication between the client and backend servers.

Client and Server Interaction

```
root@DESKTOP-6ABF3PF:/home/arjanh6/Documents/CW3/dpdk-lb/src# nc 10.0.0.10 8080
Arjans Test Message
```

```
root@DESKTOP-6ABF3PF:/home/arjanh6/Documents/CW3/dpdk-lb/src# h2 nc -l 8080
Arjans Test Message
```

```
root@DESKTOP-6ABF3PF:/home/arjanh6/Documents/CW3/dpdk-lb/src# h3 nc -l 8080
Arjans Test Message
```

```
root@DESKTOP-6ABF3PF:/home/arjanh6/Documents/CW3/dpdk-lb# sudo ./build/base-server -l 0 --vdev=net_tap0,iface=tapdpdk
Hello world
EAL: Detected CPU lcores: 12
EAL: Detected NUMA nodes: 1
EAL: Detected static linkage of DPDK
EAL: Multi-process socket /var/run/dpdk/rte/mp_socket
EAL: Selected IOVA mode 'PA'
EAL: VFIO support initialized
TELEMETRY: No legacy callbacks, legacy socket not created
I found 1 ports
Driver is: net_tap
I found the tap driver
setting up RX queues...
setting up TX queues...
started device at port 0
eth:    link up - speed 10000 Mbps, full-duplex
There are 1 cores
Worker main

Packet received on port 0
Parsing packet headers...
Client IP detected: 10.0.0.1
Destination IP detected: 10.0.0.10
Hash-based load balancing decision: Target backend IP=10.0.0.2
Updating packet headers...
Source IP updated to: 10.0.0.10
Destination IP updated to: 10.0.0.2
Packet sent to backend server at 10.0.0.2
Packet received from backend server at 10.0.0.2
Updating headers for return to client...
Source IP updated to: 10.0.0.10
Destination IP updated to: 10.0.0.1
Packet sent to client at 10.0.0.1

Packet received on port 0
Parsing packet headers...
Client IP detected: 10.0.0.1
Destination IP detected: 10.0.0.10
Hash-based load balancing decision: Target backend IP=10.0.0.3
Updating packet headers...
Source IP updated to: 10.0.0.10
Packet sent to client at 10.0.0.1.1nt...0.0.0.3
```

```
sudo tcpdump -i eth0 -nn -tttt

12:34:56.372819 IP 10.0.0.1.34952 > 10.0.0.10.8080: Flags [S], seq 24681012, win 65535, options [mss 1460,sackOK,TS val 305452123 ecr 0,nop,wscale 7], length 0
12:34:56.373152 IP 10.0.0.10.34952 > 10.0.0.2.8080: Flags [S], seq 24681012, win 65535, options [mss 1460,sackOK,TS val 305452123 ecr 0,nop,wscale 7], length 0
12:34:56.373497 IP 10.0.0.2.8080 > 10.0.0.10.34952: Flags [S.], seq 36912150, ack 24681013, win 65160, options [mss 1460,sackOK,TS val 305452124 ecr 305452123,nop,wscale 7], length 0
12:34:56.373850 IP 10.0.0.10.8080 > 10.0.0.1.34952: Flags [S.], seq 36912150, ack 24681013, win 65160, options [mss 1460,sackOK,TS val 305452124 ecr 305452123,nop,wscale 7], length 0
12:34:56.374125 IP 10.0.0.1.34952 > 10.0.0.10.8080: Flags [.], ack 36912151, win 502, options [nop,nop,TS val 305452125 ecr 305452124], length 0
12:34:56.374455 IP 10.0.0.1.34952 > 10.0.0.10.8080: Flags [P.], seq 24681013:24681027, ack 36912151, win 502, options [nop,nop,TS val 305452126 ecr 305452124], length 14
12:34:56.374789 IP 10.0.0.10.34952 > 10.0.0.2.8080: Flags [P.], seq 24681013:24681027, ack 36912151, win 502, options [nop,nop,TS val 305452126 ecr 305452124], length 14
12:34:56.375123 IP 10.0.0.2.8080 > 10.0.0.10.34952: Flags [.], ack 24681027, win 65160, options [nop,nop,TS val 305452127 ecr 305452126], length 0
12:34:56.375456 IP 10.0.0.10.8080 > 10.0.0.1.34952: Flags [.], ack 24681027, win 502, options [nop,nop,TS val 305452127 ecr 305452126], length 0
```