netmap-fwd

userland L3 router application

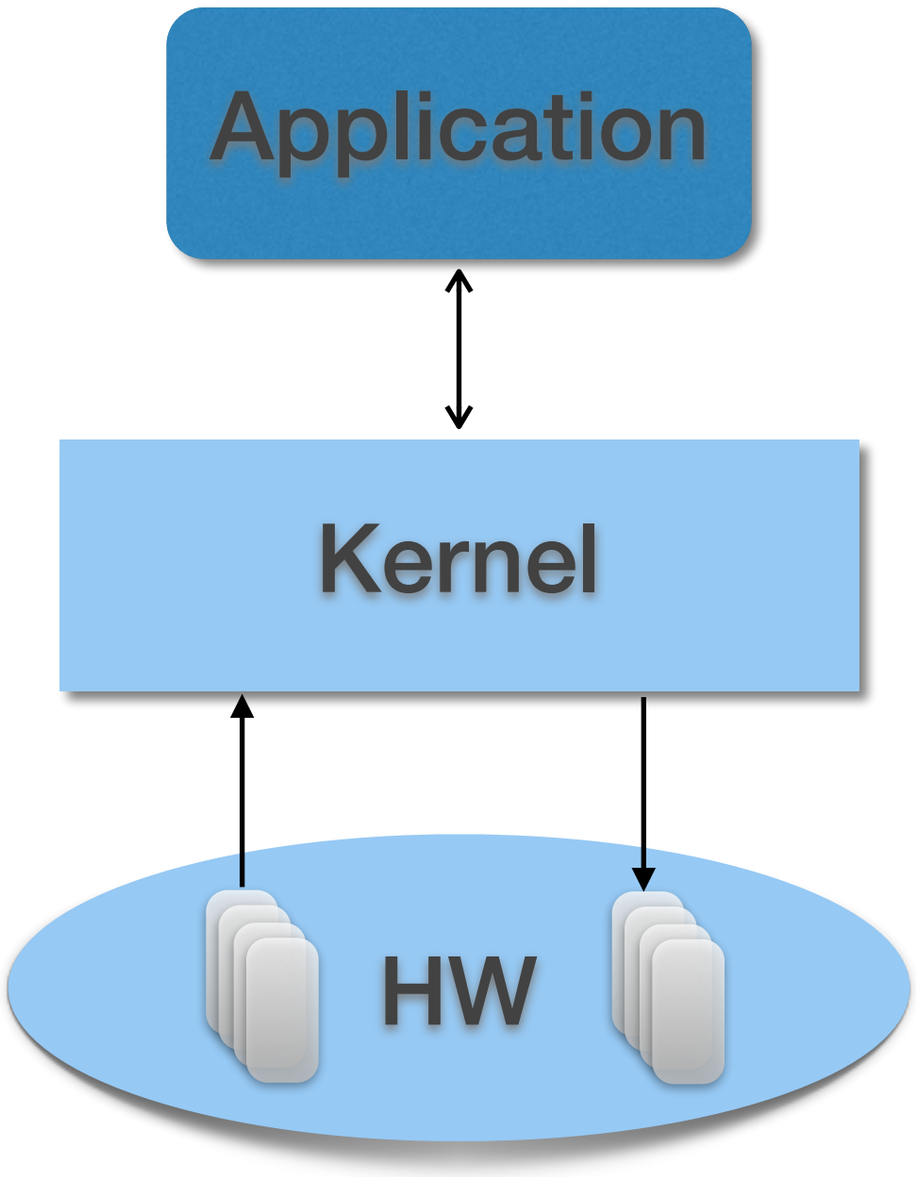
netmap-fwd

- **netmap**
- netmap-fwd
- usage
- numbers
- missing features

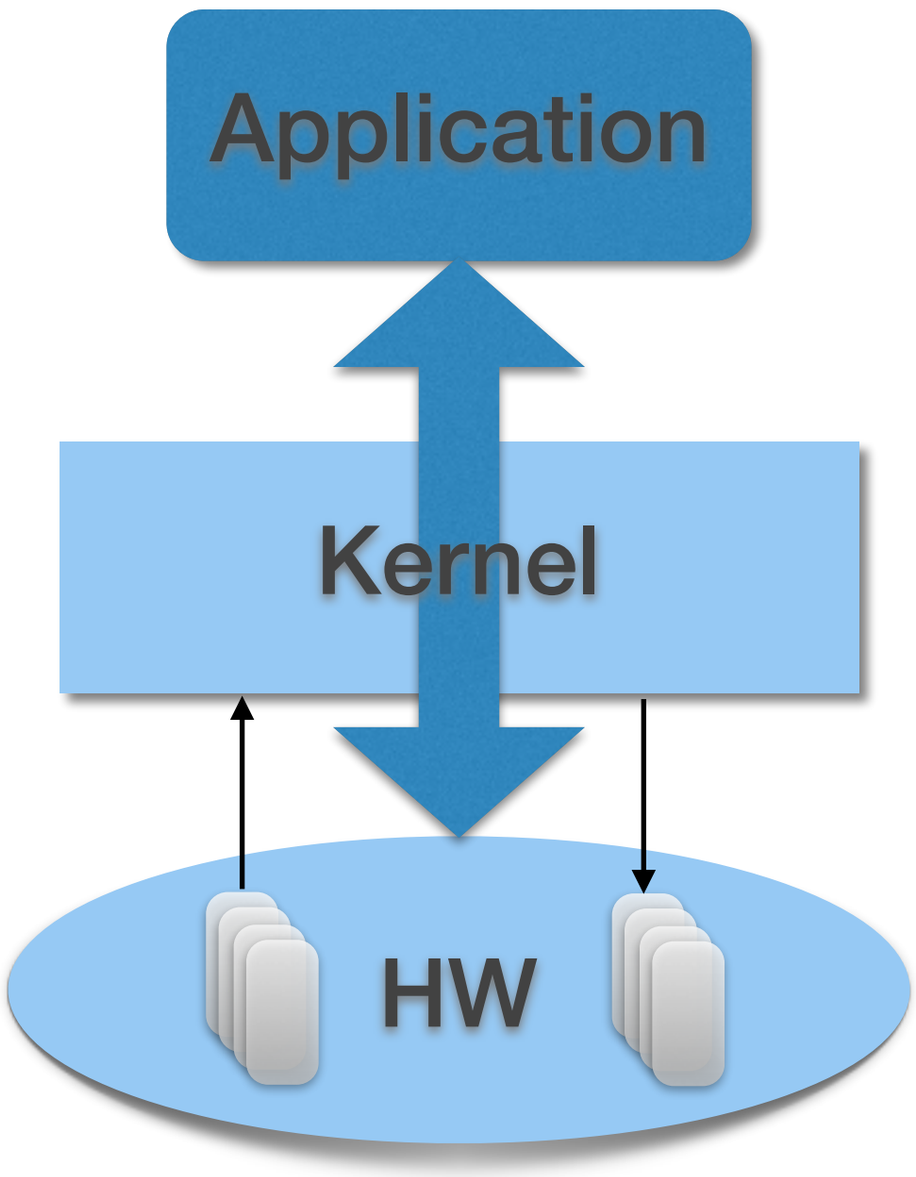
netmap

- a framework for high speed packet I/O
- can easily reach line rate on 10G NICs (14.88Mpps)
- device and OS independent:
  - Operating Systems: FreeBSD, Linux and Windows
  - devices: cxgbe, em, igb, ixgbe, ixl, lem, re and virtio (FreeBSD)

netmap



netmap



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- requires little to no configuration
- automatic fallback to kernel forwarding
- any number of NICs
- VLANs
- Single thread

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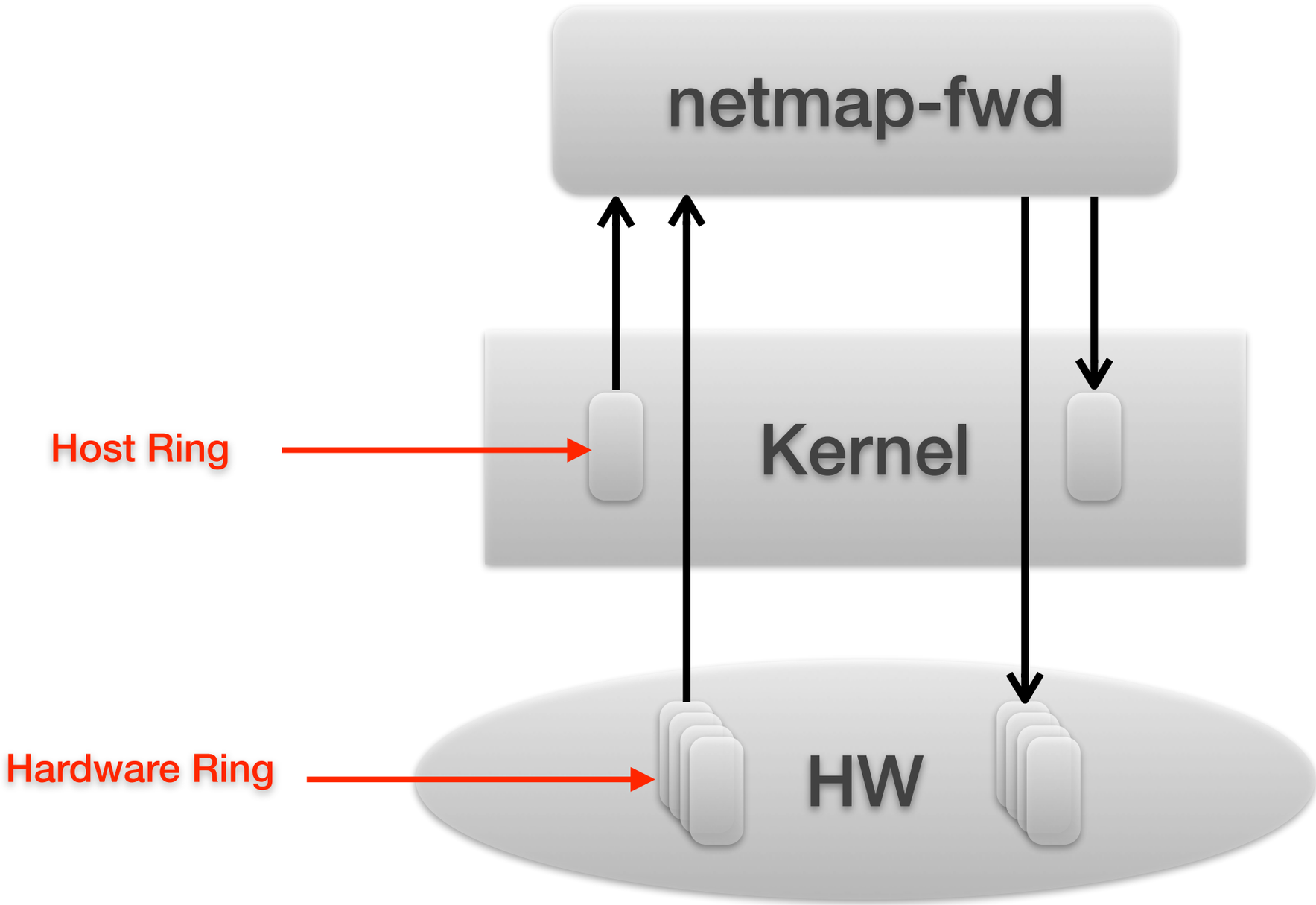

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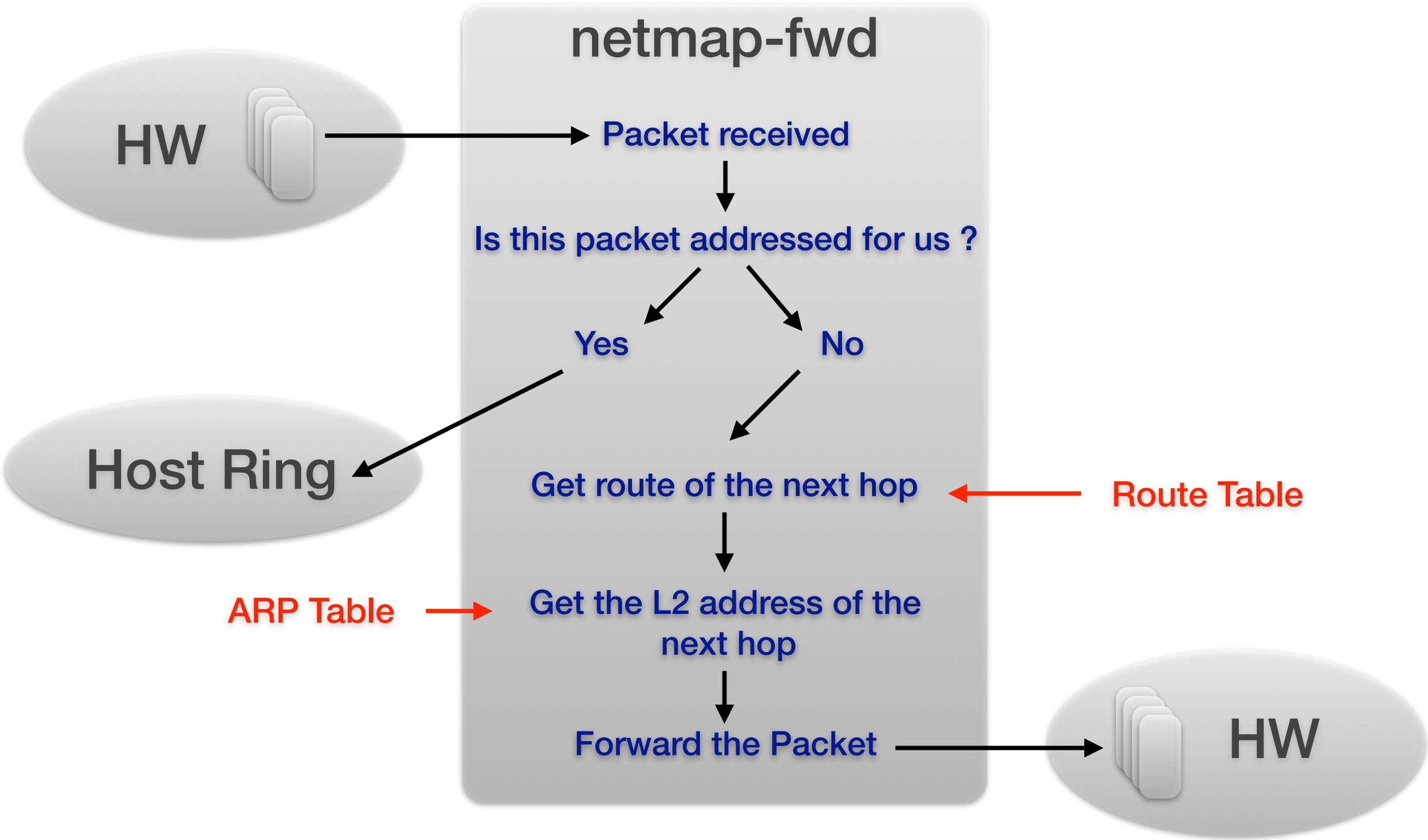
HW
netmap-fwd
Packet received
Is this packet addressed for us ?
Yes
No
Host Ring
Get route of the next hop
Route Table
ARP Table
Get the L2 address of the next hop
Forward the Packet
HW

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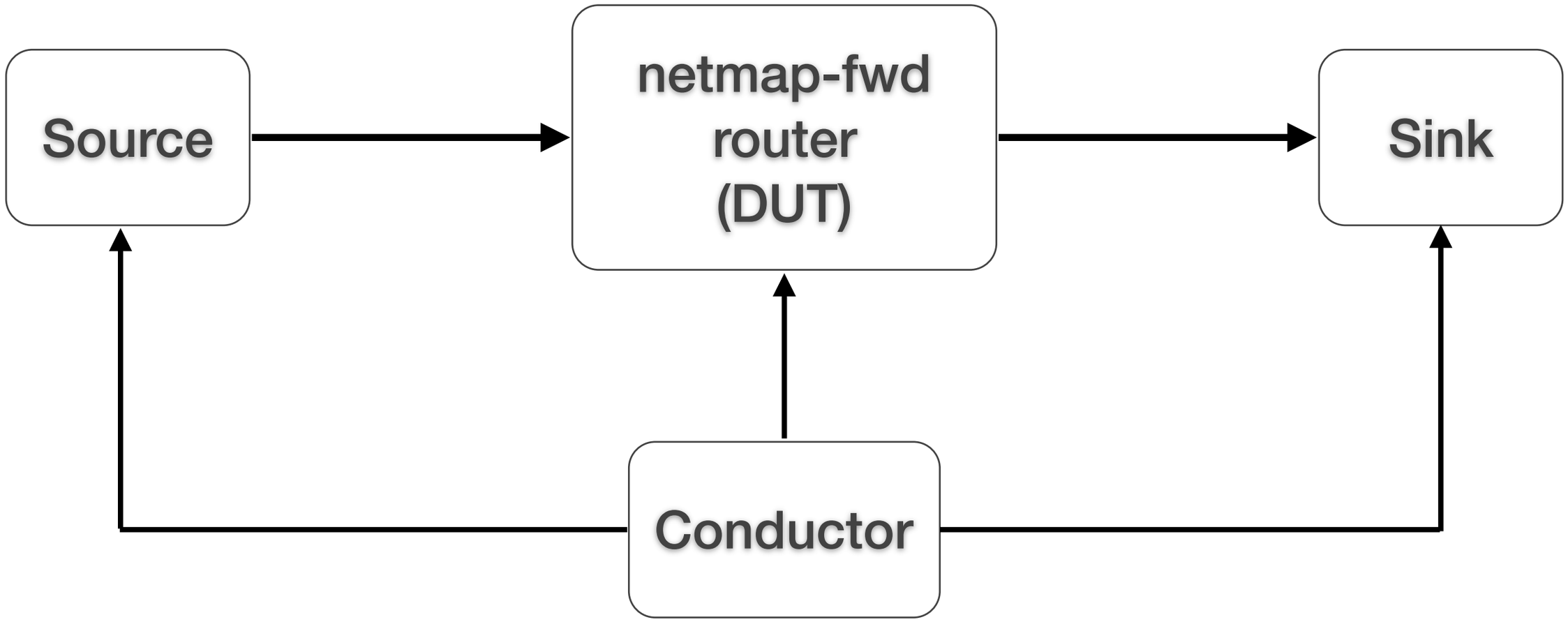
Tests



netmap-fwd

```
# ifconfig ncxl0
ncxl0: flags=8843<UP,BROADCAST,RUNNING,SIMPLEX,MULTICAST> metric 0 mtu 1500
        options=100000<NETMAP>
        ether 00:07:43:2e:32:f1
        inet 10.0.10.1 netmask 0xffffff00 broadcast 10.0.10.255
        inet 10.0.10.2 netmask 0xffffffff broadcast 10.0.10.2
        nd6 options=29<PERFORMNUD,IFDISABLED,AUTO_LINKLOCAL>
        media: Ethernet 10Gbase-Twinax <full-duplex>
        status: active
# ifconfig ncxl1
ncxl1: flags=8843<UP,BROADCAST,RUNNING,SIMPLEX,MULTICAST> metric 0 mtu 1500
        options=100000<NETMAP>
        ether 00:07:43:2e:32:f9
        inet 10.0.0.1 netmask 0xffffff00 broadcast 10.0.0.255
        nd6 options=29<PERFORMNUD,IFDISABLED,AUTO_LINKLOCAL>
        media: Ethernet 10Gbase-Twinax <full-duplex>
        status: active
# ifconfig ncxl1.100
ncxl1.100: flags=8843<UP,BROADCAST,RUNNING,SIMPLEX,MULTICAST> metric 0 mtu 1496
        ether 00:07:43:2e:32:f9
        inet 10.0.100.1 netmask 0xffffff00 broadcast 10.0.100.255
        nd6 options=29<PERFORMNUD,IFDISABLED,AUTO_LINKLOCAL>
        media: Ethernet 10Gbase-Twinax <full-duplex>
        status: active
        vlan: 100 parent interface: ncxl1
        groups: vlan
```

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```
# netmap-fwd ncxl0 ncxl1 ncxl1.100
ncxl0: flags=8843<UP,BROADCAST,RUNNING,SIMPLEX,MULTICAST> metric 0 mtu 1500
        options=0<>
        ether: 00:07:43:2e:32:f1
        inet 10.0.10.1 netmask 255.255.255.0 broadcast 10.0.10.255
        inet 10.0.10.2 netmask 255.255.255.255 broadcast 10.0.10.2
switching interface ncxl0 to netmap mode.
ncxl1: flags=8843<UP,BROADCAST,RUNNING,SIMPLEX,MULTICAST> metric 0 mtu 1500
        options=0<>
        ether: 00:07:43:2e:32:f9
        inet 10.0.0.1 netmask 255.255.255.0 broadcast 10.0.0.255
switching interface ncxl1 to netmap mode.
ncxl1.100: flags=8843<UP,BROADCAST,RUNNING,SIMPLEX,MULTICAST> metric 0 mtu 1496
        options=0<>
        ether: 00:07:43:2e:32:f9
        inet 10.0.100.1 netmask 255.255.255.0 broadcast 10.0.100.255
        vlan: 100 parent interface: ncxl1
```

netmap-fwd

```
# telnet /var/run/netmap-fwd.sock
Trying /var/run/netmap-fwd.sock...
Connected to /var/run/netmap-fwd.sock.
Escape character is '^]'.
netmap-fwd cli interface
> arp
? (10.0.100.1) at 00:07:43:2e:32:f9 on ncxl1.100 permanent
? (10.0.0.1) at 00:07:43:2e:32:f9 on ncxl1 permanent
? (10.0.10.2) at 00:07:43:2e:32:f1 on ncxl0 permanent
? (10.0.10.1) at 00:07:43:2e:32:f1 on ncxl0 permanent
> route
Routing tables

Internet:
Destination       Gateway           Flags       Netif
10.0.0.0/24                         U           ncxl1
10.0.0.1                            UH          ncxl1
10.0.10.0/24                        U           ncxl0
10.0.10.1                           UH          ncxl0
10.0.10.2                           UH          ncxl0
10.0.100.0/24                       U           ncxl1.100
10.0.100.1                          UH          ncxl1.100
>
```

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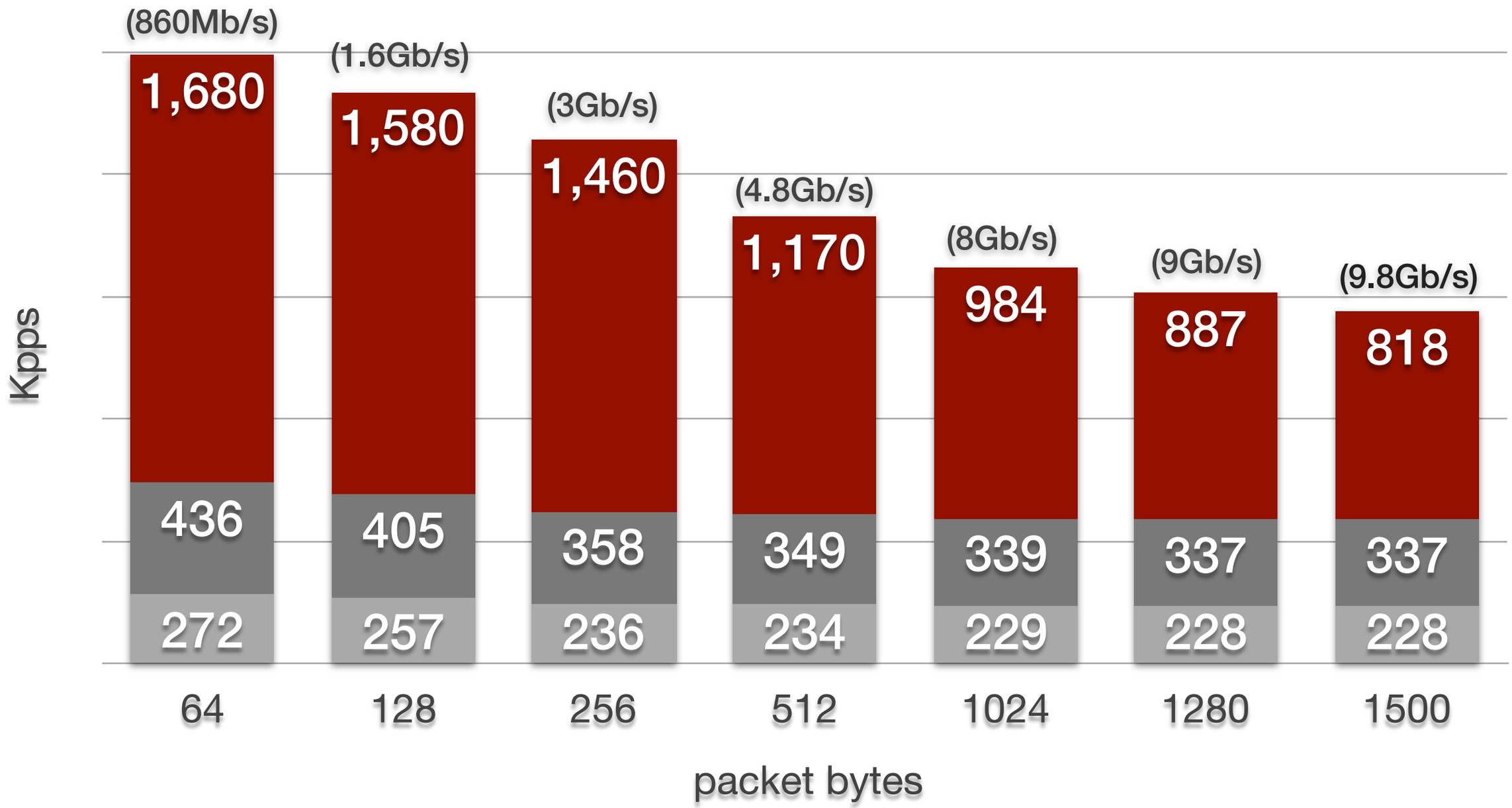
C2758 @ 2.40GHz + Chelsio T520-CR

Single IP flow (pkt-gen as source and sink)



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How it scales ?

DUT	Network Interface	Kernel Forwarding	Fastforward	netmap-fwd
C2358 (2 core, 1.7GHz)	Intel I354	123 Kpps	217 Kpps	945 Kpps
C2758 (8 core, 2.4GHz)	Chelsio T520 10G	270 Kpps	426 Kpps	1.683 Mpps
XEON-D 1540 (8 core, 2Ghz)	Intel X552 10G	439 Kpps	557 Kpps	2.230 Mpps
XEON E3-1275 (4 core, 3.5GHz)	Intel X520-2 10G	1.058 Mpps	1.331 Mpps	5.053 Mpps

*Courtesy of Netgate

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Missing features

- ACLs
- IPv6
- capsicum
- Multithreading
- bgpd / FIB integration
- better runtime statistics

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Questions ?

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Thanks!

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