Advanced Computer Networking (ACN)

Router Project – Problem 2

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Dos and Don’ts

Dos

- Do use the Moodle forum for discussion
- Do start early with the exercises (not on the weekend before submission)
- Commit & push early and often (VMs shut down after 12h of inactivity)

Don’ts

- Do not try to install DPDK on the client VMs, it will fail (too little RAM)
- Do not disable your management interface

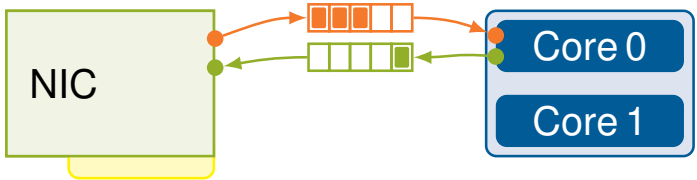
In case you broke your VM

- You can reboot your machines by restarting them via the management host

2 a) Router command line interface (CLI)

- DPDK works on Ethernet frames → IP must be done manually
- `./router -p 0,10.0.10.1 -r 10.0.10.2/32,52:54:00:cb:ee:f4,0`
- `-p`
  - `0`: DPDK interface ID
  - `10.0.10.1`: IP address of this interface
- `-r`
  - `10.0.10.2/32`: destination subnet (in this case single IP address)
  - `52:54:00:cb:ee:f4`: MAC address of next hop
  - `0`: DPDK interface ID where the next hop can be reached
- **Note 1:** You are allowed to repeat the parameters (`-r` / `-p`) to add more than one router port/route!
- **Note 2:** You will use dummy routing data for Problem 2, the CLI data will be used for Problem 4.
- **Note 3:** Have a look at the dpdk-framework repo. We included several functions in `router.c` to simplify the development of the parser.

Architecture of network cards



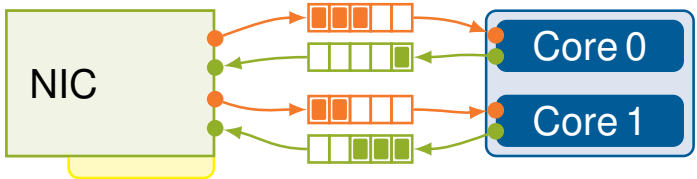
The Network Interface Card (NIC) offers:

- Interface for incoming transfer (RX queue)
- Interface for outgoing transfer (TX queue)

Problems:

- Only one core can access the NIC simultaneously
- Scalability of multithreaded network applications very poor
- Single core performance limits throughput of whole system

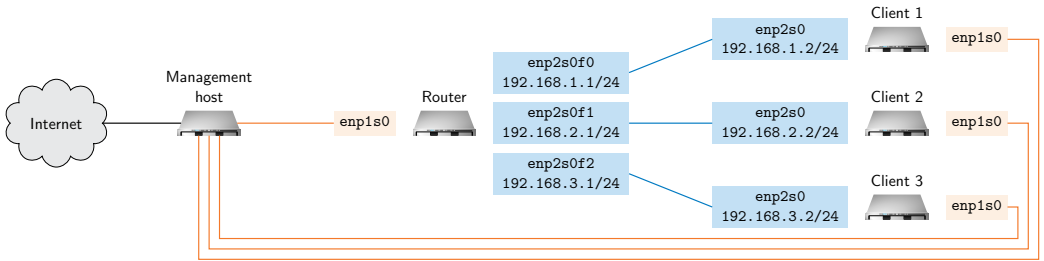
Architecture of modern network cards



Modern NICs have multiqueue support:

- High number of queues (e.g., 2048 queue pairs on Intel E810 / 100 GbE NICs)
- Can be used completely independent from each other
- A queue is typically used by a CPU core exclusively to improve cache locality
- Allows for perfect linear multi-core scaling

2 b) Multithreaded router architecture



- NIC queues enable efficient multithreaded architectures
- One thread handles one interface
- Each thread receives packets from a single interface (1 RX queue)
- Each thread can possibly send to any interface (3 TX queues)

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2 c) IP header checks

- RFC 1812 describes checks performed by routers on IPv4 packets
- Drop packets if they are invalid
- You are responsible for memory management (clean up)

2 d) Forwarding

- Implement the forwarding functionality
- You have to adapt the MAC addresses to your VM setup!

2 e) ARP replies

- The router knows the MAC addresses of the clients via the CLI
- The clients do not know the router's respective MAC addresses
- Enable your router to answer ARP requests from the clients

2 f) Test your router

- Let the clients ping each other, it should work now :)