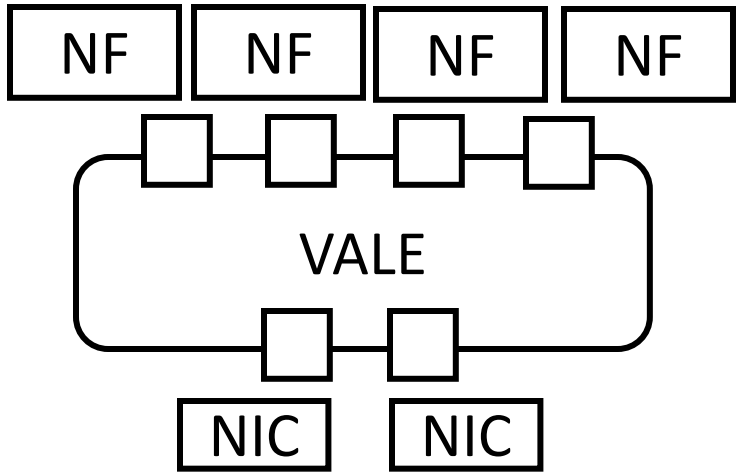
# VALE (mSwitch)

# Overview

- What?
  - In-kernel virtual switch
    - Like Linux bridge
  - Interconnect NICs and virtual interfaces
- Why?
  - Fast (10 Mpps > w/ a single core)
  - Scalable (100s – 1000s of ports)
  - Flexible (arbitrary packet processing logic)




**Perfect for NFV**

mSwitch: A Highly-Scalable, Modular Software Switch, SOSR'15

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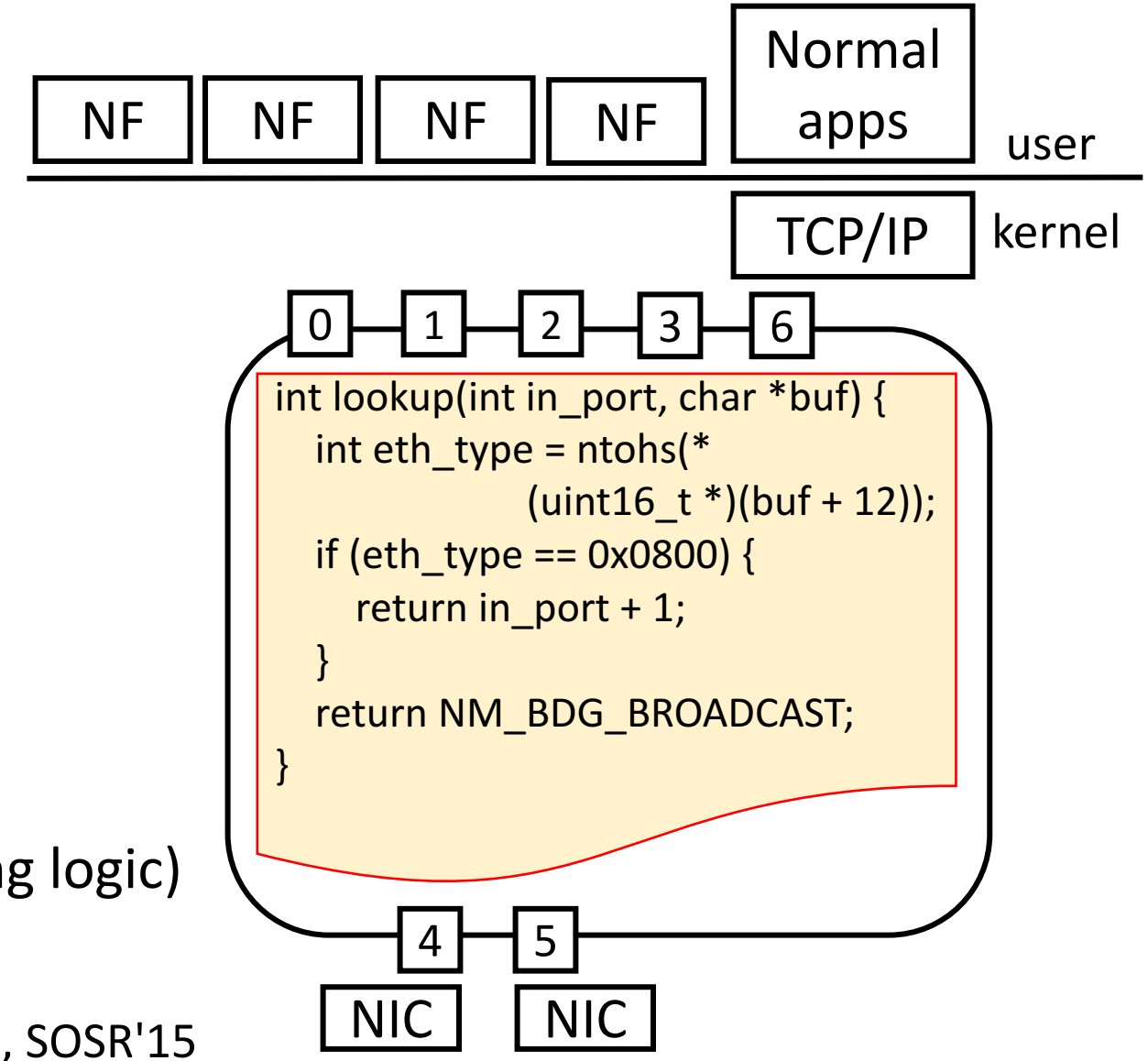


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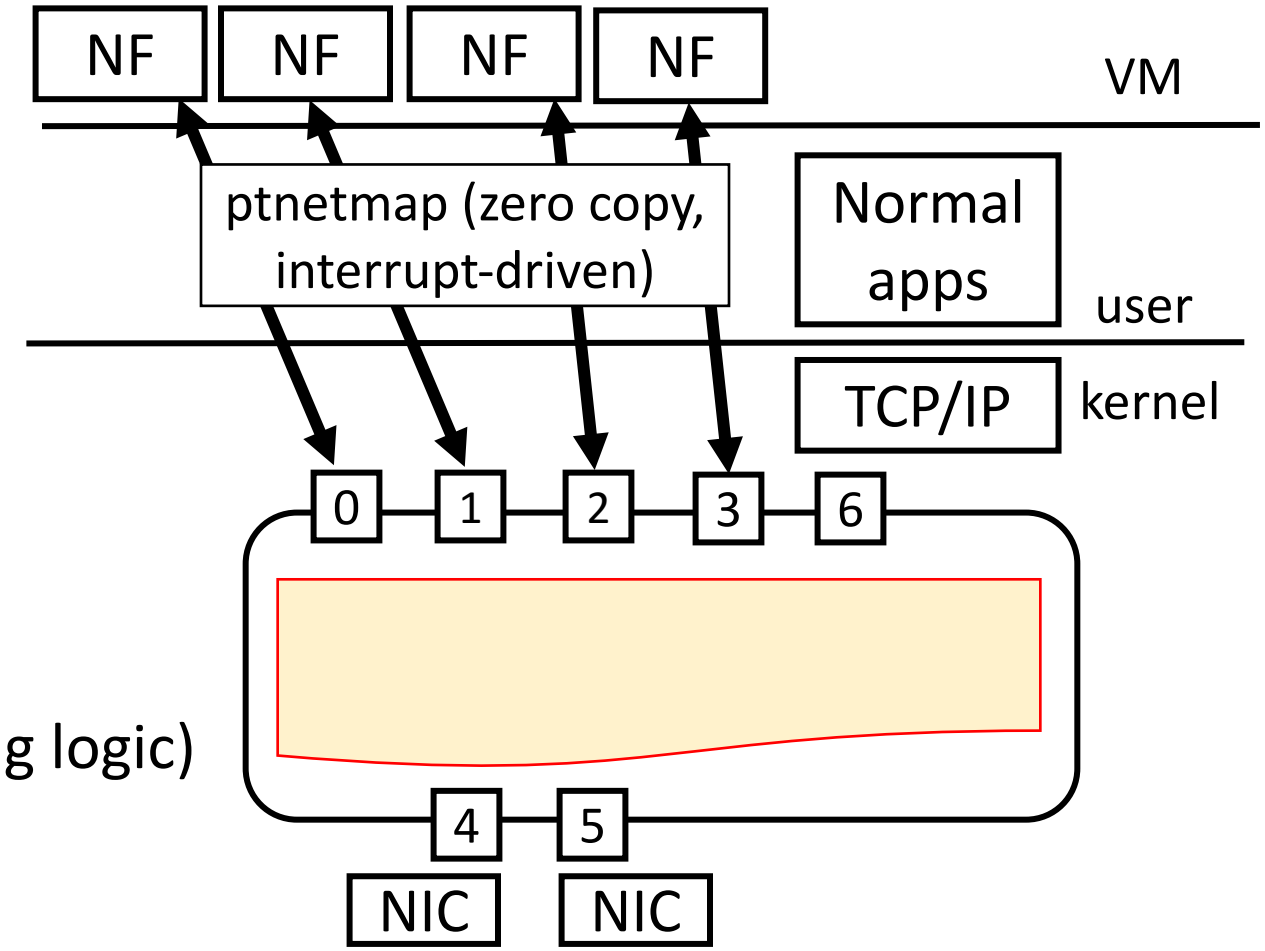

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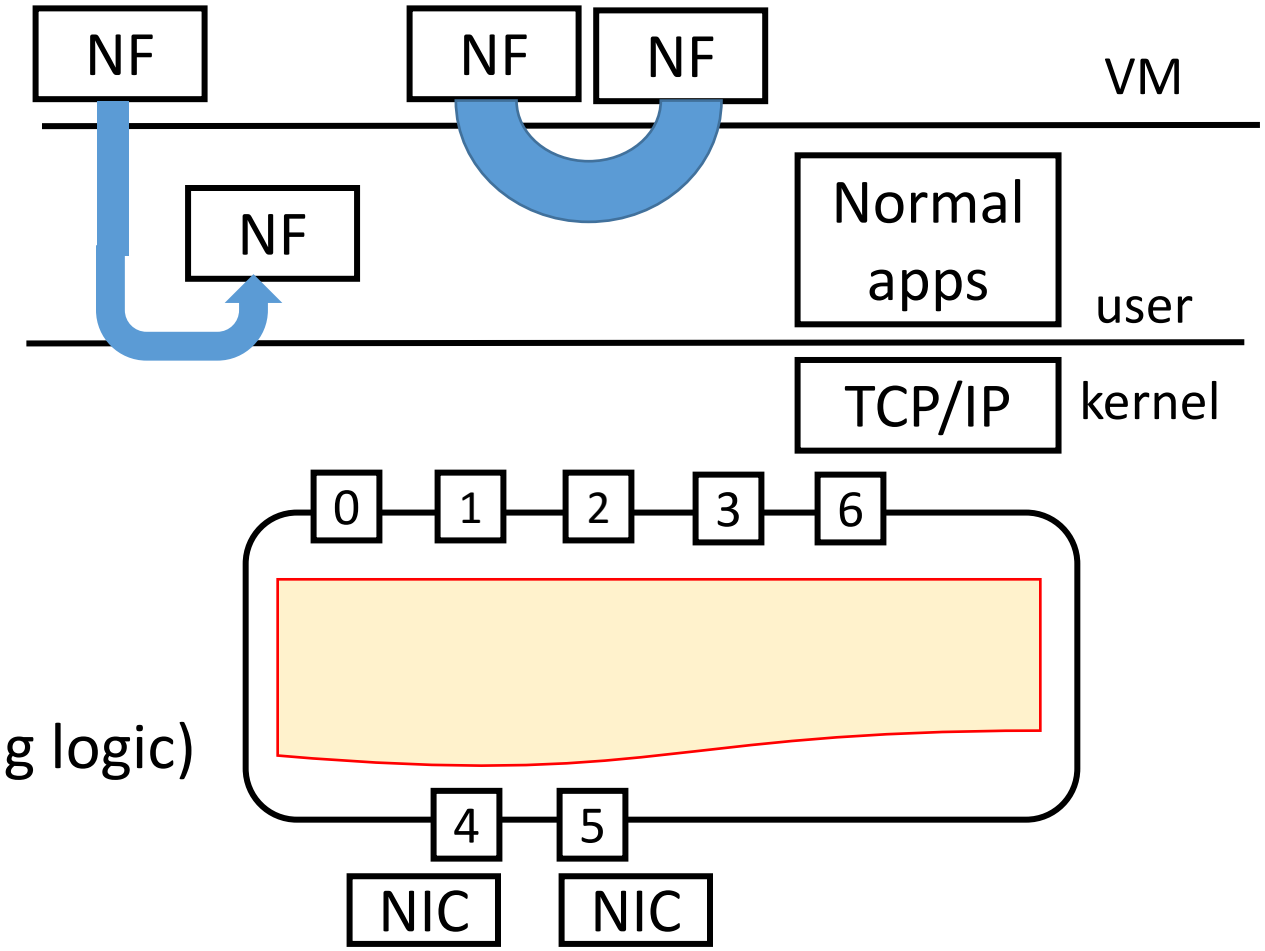

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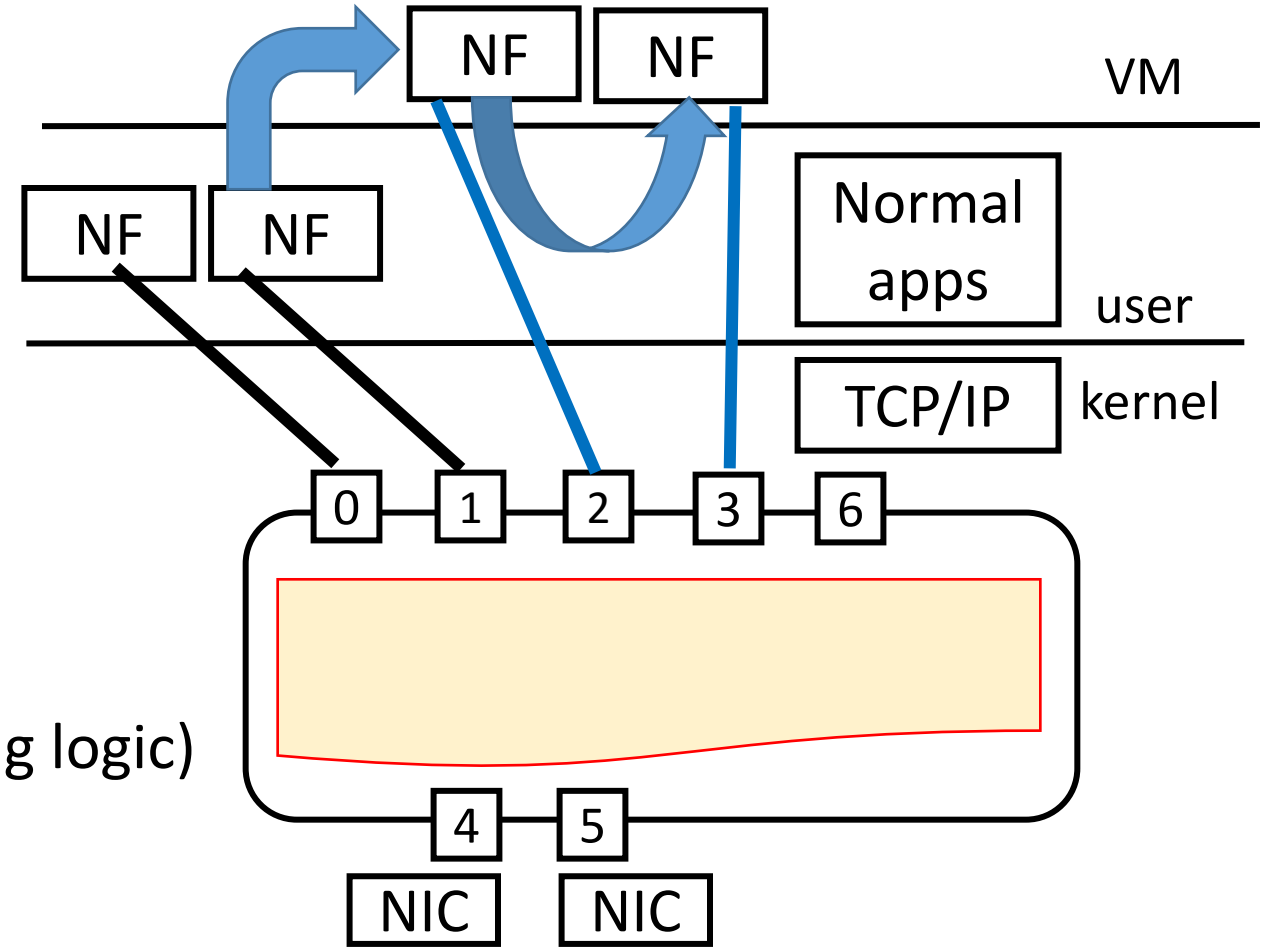


# Download and compile

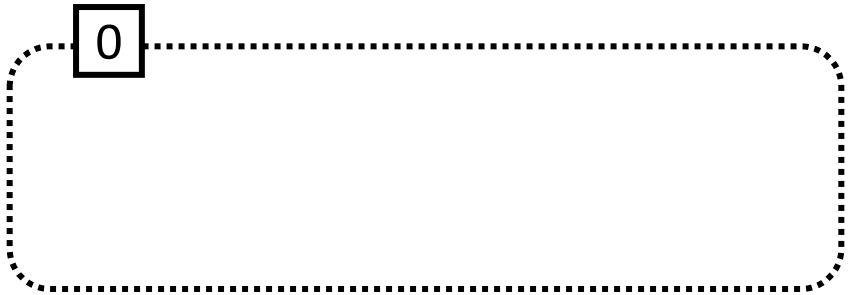
% git clone git@github.com:micchie/mymodule.git

% cd mymodule/LINUX

% make KSRC=/lib/modules/`uname –r`/build NSRC=WHERE_YOUR_NETMAP_IS

# How to

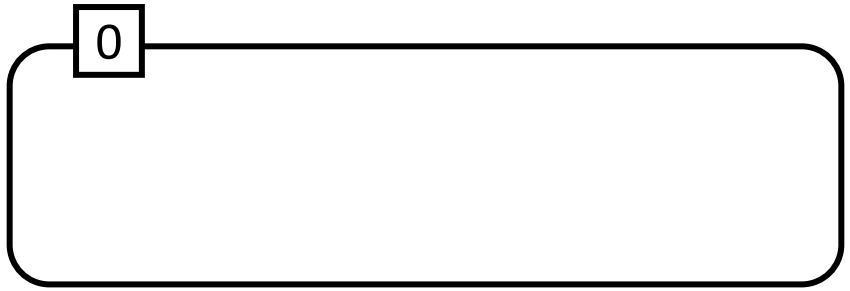
% vale-ctl –n vi0



# How to

% vale-ctl –n vi0

% vale-ctl –a vale0:vi0



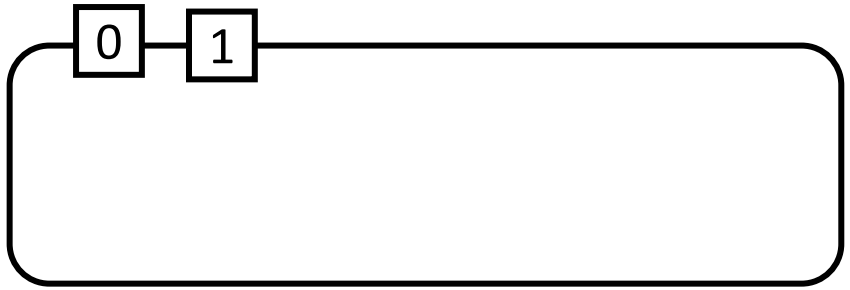
# How to

% vale-ctl –n vi0

% vale-ctl –a vale0:vi0

% vale-ctl –n vi1

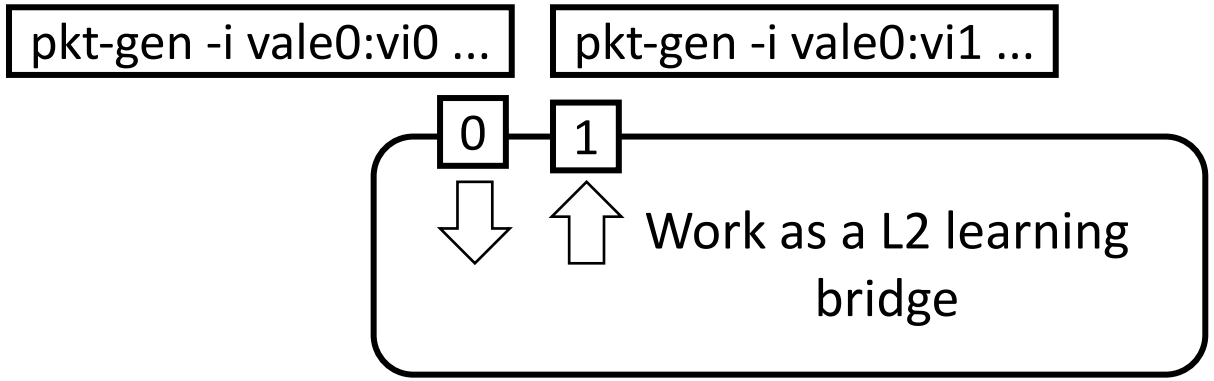
% vale-ctl –a vale0:vi1



# How to

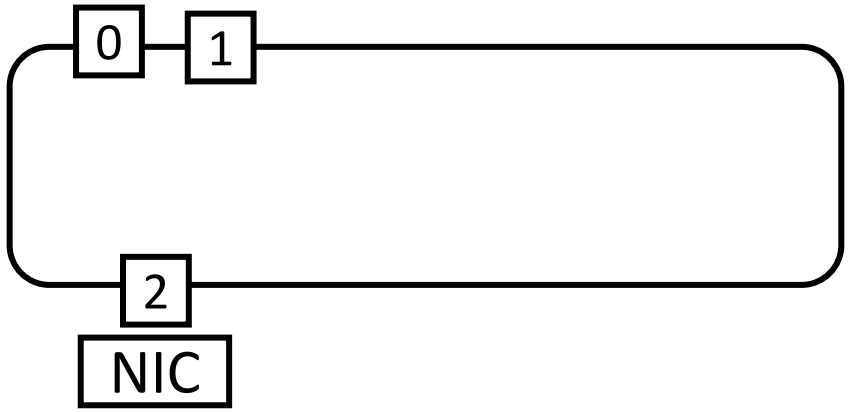
% pkt-gen -i vale0:vi0 –f tx
(another terminal)
% pkt-gen -i vale0:vi1 –f rx

Cleanup:
% vale-ctl –d vale0:vi0
% vale-ctl –r vi0
% vale-ctl –d vale0:vi1
% vale-ctl –r vi1



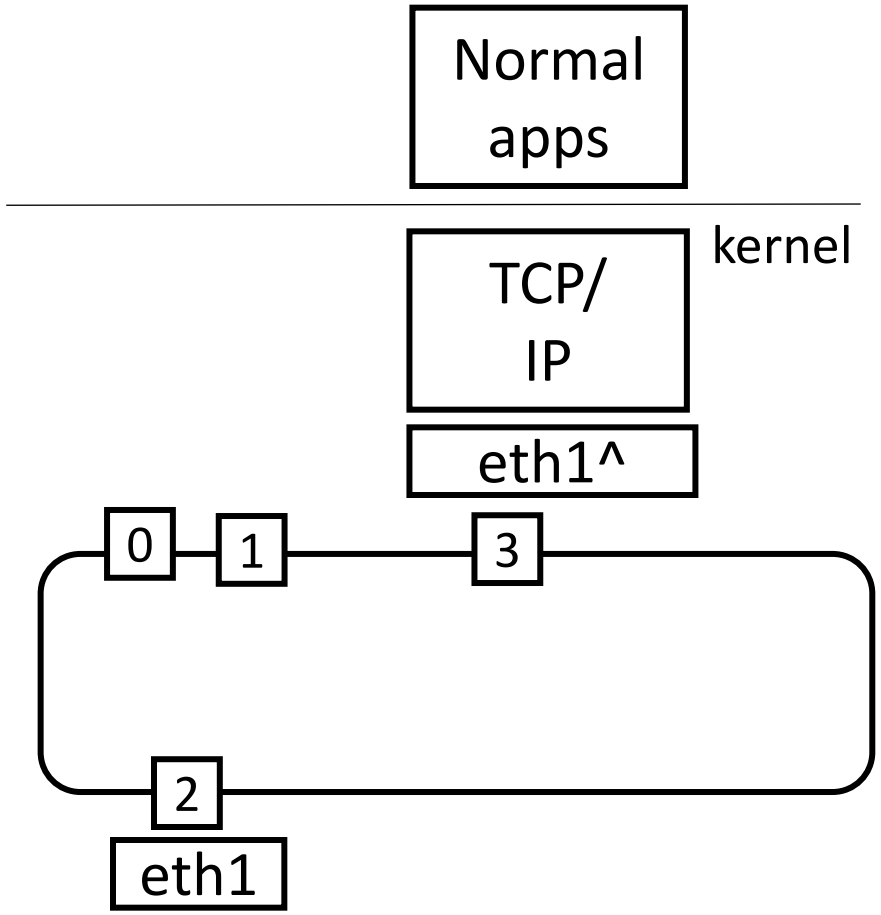
# Playing with a NIC

% vale-ctl –a vale0:eth1
(-d to detach)



# Playing with a NIC

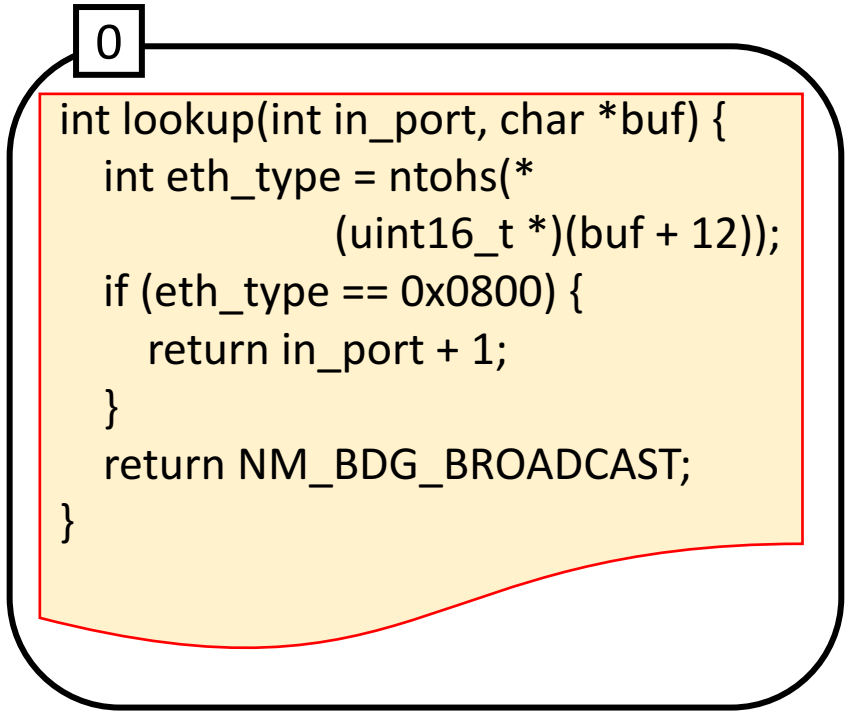
% vale-ctl –h vale0:eth1
(-d to detach)



# Loading a custom module

% git clone git@github.com:micchie/mymodule.git
% cd mymodule/LINUX
% make KSRC=WHERE_YOUR_KERNEL_IS
NSRC=WHERE_YOUR_NETMAP_IS

% vale-ctl –n vi0
% vale-ctl –a vale0:vi0
% sudo insmod  mymodule_lin.ko



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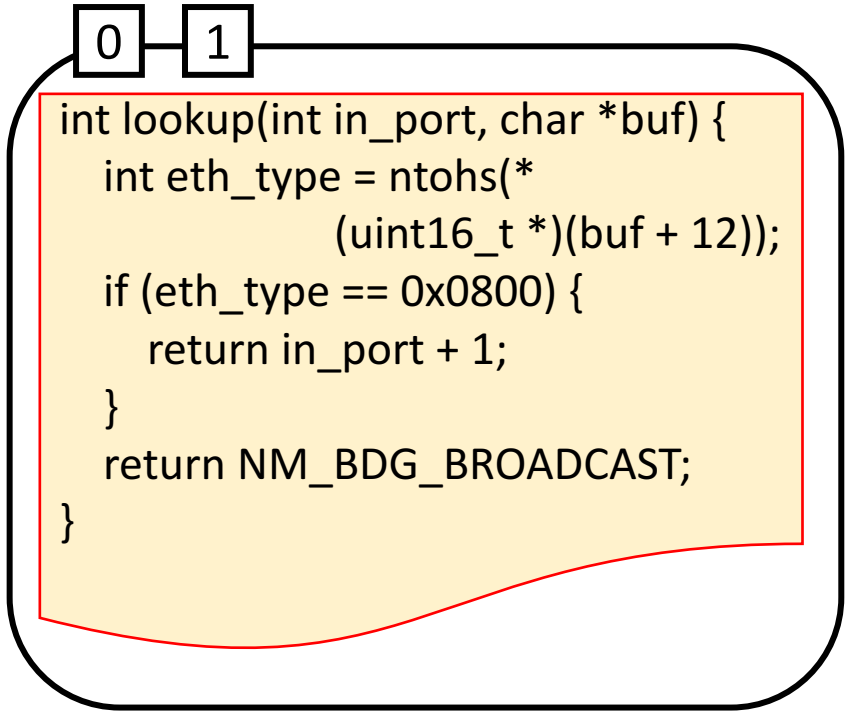
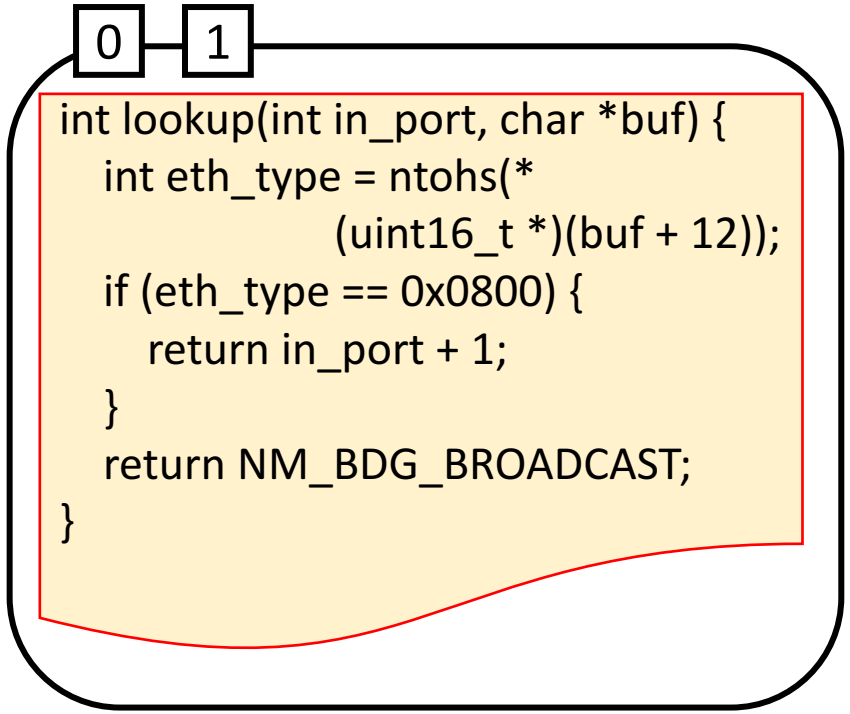
% vale-ctl –a vale0:vi0
% sudo insmod  mymodule_lin.ko
% vale-ctl –n vi1
% vale-ctl –a vale0:vi1



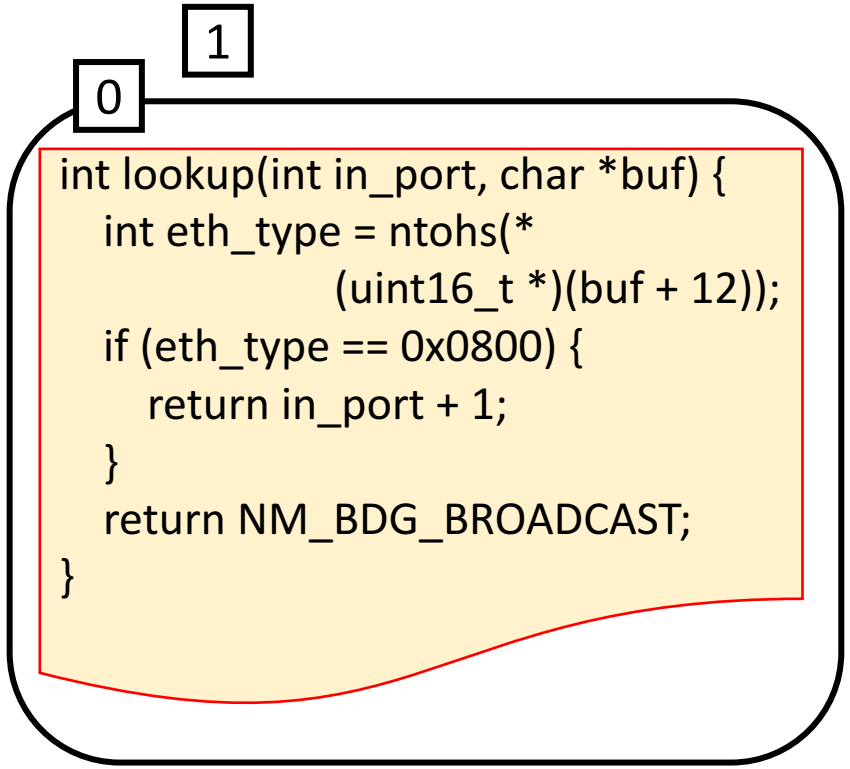
# Loading a custom module

% pkt-gen -i vale0:vi0 –f tx
(another terminal)
% pkt-gen -i vale0:vi1 –f rx
% vale-ctl –n vi2
% vale-ctl –a vale0:vi2
(another terminal)
% pkt-gen –i vale0:vi2 –f tx
(you don't see packets)



# Loading a custom module

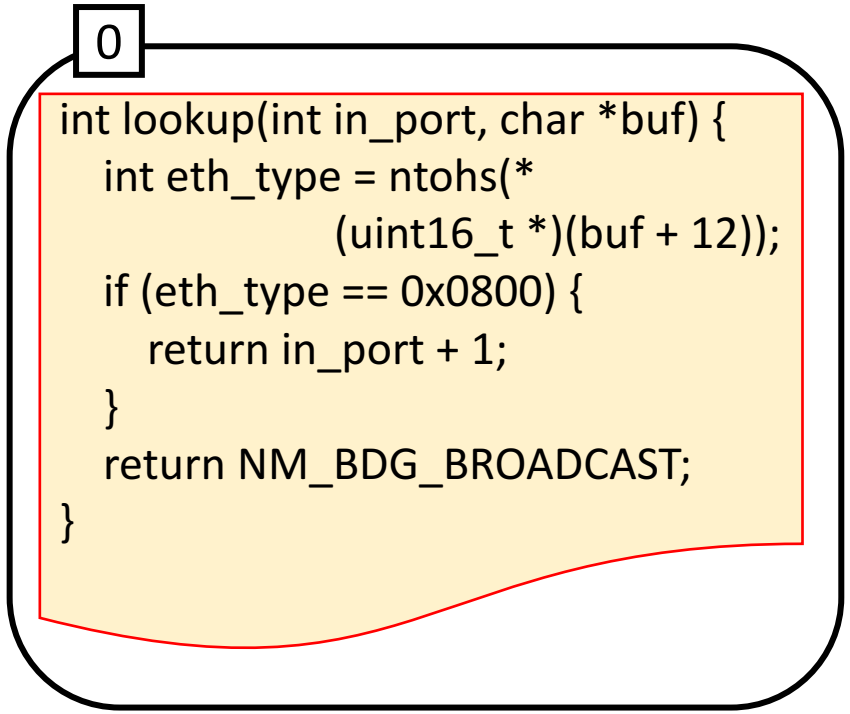
% vale-ctl –d vale0:vi1



# Loading a custom module

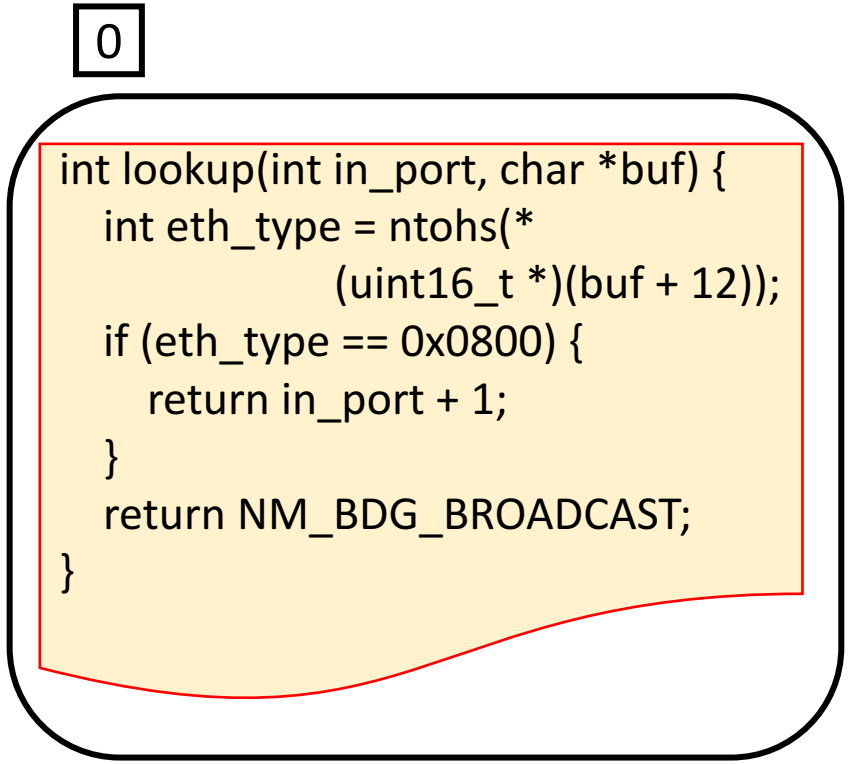
% vale-ctl –d vale0:vi1

% vale-ctl –r vi1



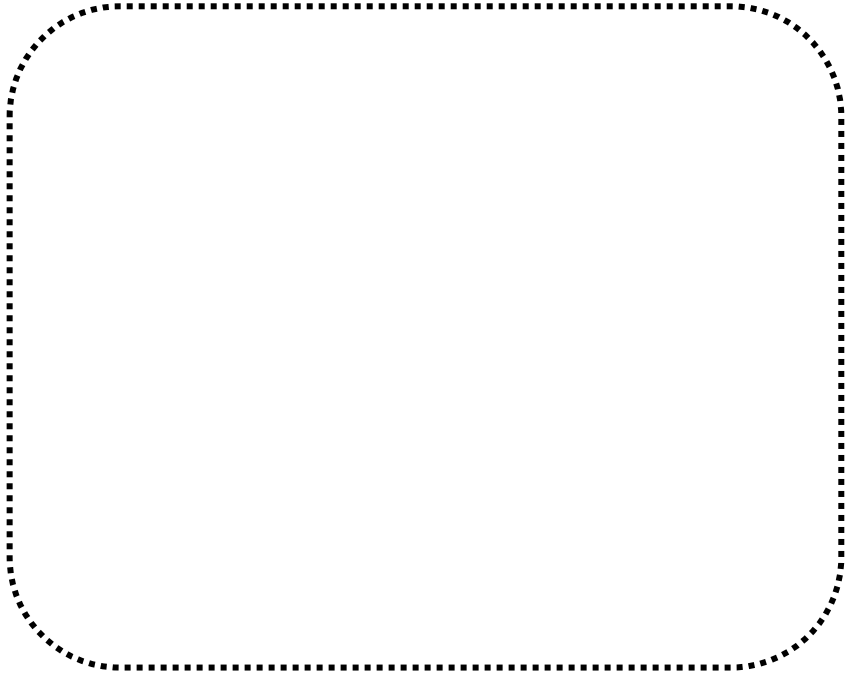
# Loading a custom module

```
% vale-ctl –d vale0:vi1
% vale-ctl –r vi1
% vale-ctl –d vale0:vi0
```



# Loading a custom module

% vale-ctl –d vale0:vi1
% vale-ctl –r vi1
% vale-ctl –d vale0:vi0
(module is automatically unloaded)
% vale-ctl -r vi0



# Writing a module

- Open sys/contrib/mymodule/mymodule.c
- Find a function my_lookup()
  - This function extracts the ethernet type (at 12 byte offset)
  - It returns the source switch port + 1 for IPv4 packets
  - It indicates broadcast for the other packets

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# Writing a module

- Let's change this module to forward packets based on the source port and user-specified destination port

- Remove code under #endif in my_lookup()
- Activate #if 0 -- #endif
- See my_config(), another callback which is plugged in to the VALE switch
  - struct mmreq is in sys/net/mymodule.h
  - User gives mreq->mr_sport and mreq->mr_dport

# References


- *Netmap: a novel framework for fast packet I/O* (USENIX ATC'11)
  - NIC I/O and Basic API
- *Vale, a switched ethernet for virtual machines* (ACM CoNext'12)
  - Learning bridge between VMs
- *mSwitch: A Highly-Scalable, Modular Software Switch* (ACM SOSR'15)
  - Many ports, modular switching logic
  - Papers using it:
    - Rekindling network protocol innovation with user-level stacks (ACM CCR April 2014)
    - Prism: A Proxy Architecture for Datacenter Networks (ACM SoCC'17)
- *Flexible Virtual Machine Networking Using Netmap Passthrough* (IEEE LANMAN'16)
  - Pipes, ptnetmap
- *A Study of Speed Mismatches Between Communicating Virtual Machines* (ACM ANCS'16)
  - Modeling producer (sender) - consumer (receiver) speeds and resulting performance
- *PASTE: Network Stacks Must Integrate with NVMM Abstractions* (ACM HotNets'16)
  - netmap with persistent memory (ongoing)