

# Evaluation of MPTCP on PRAGMA-ENT

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@ PRAGMA27, Indiana University Bloomington, IN



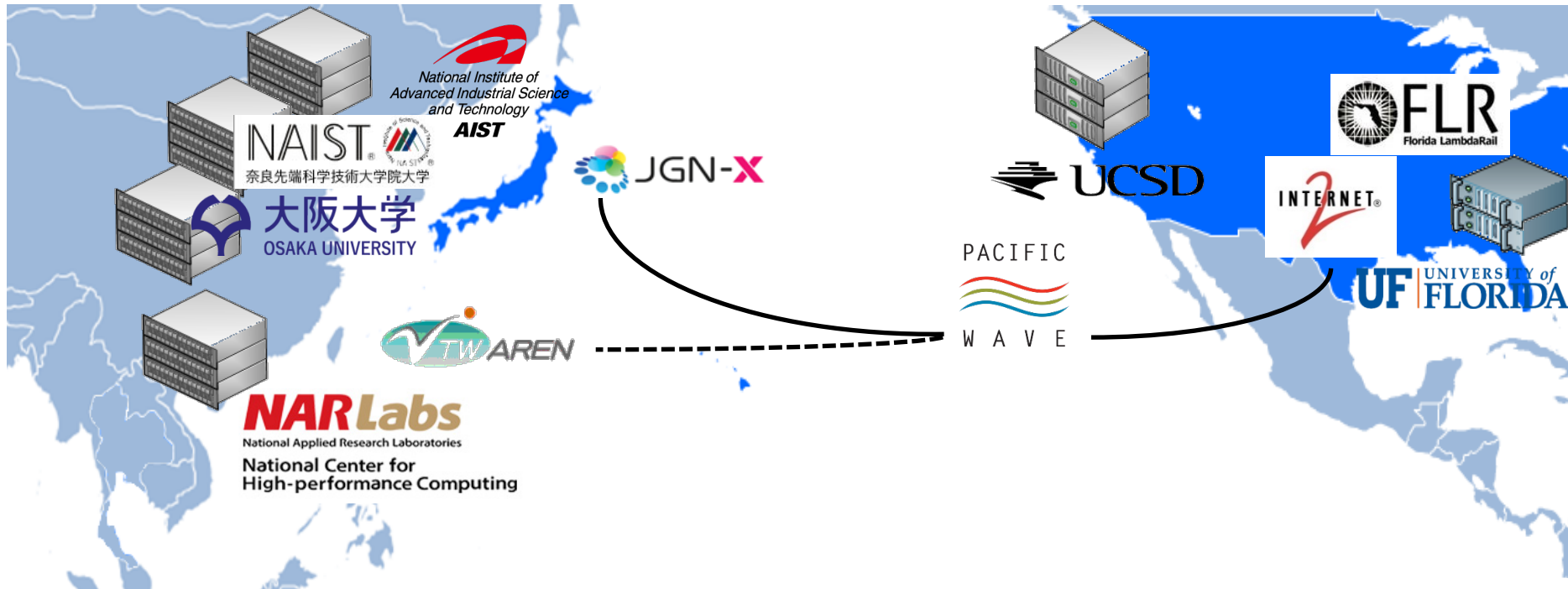
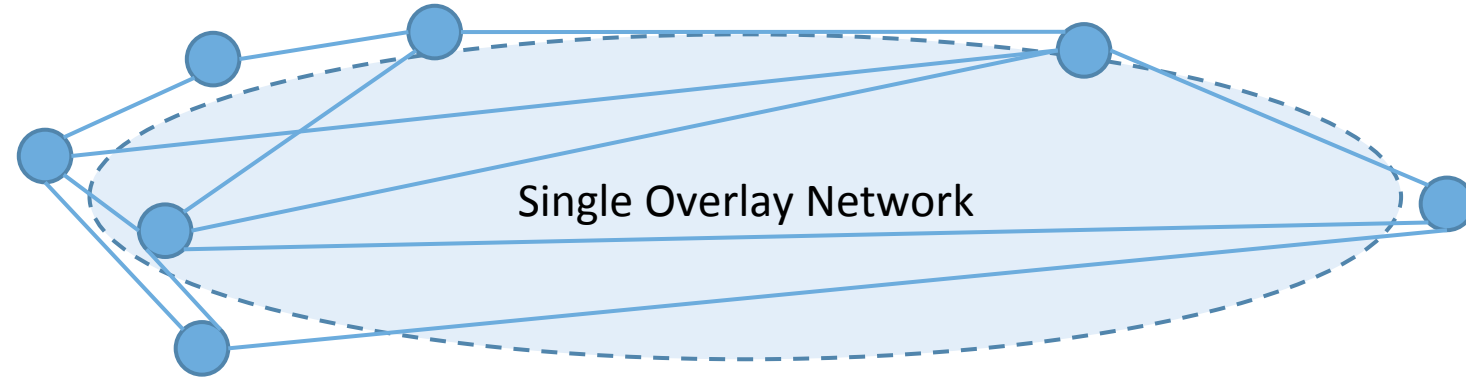
Laboratory for  
Software  
Design & Analysis

established in 2005



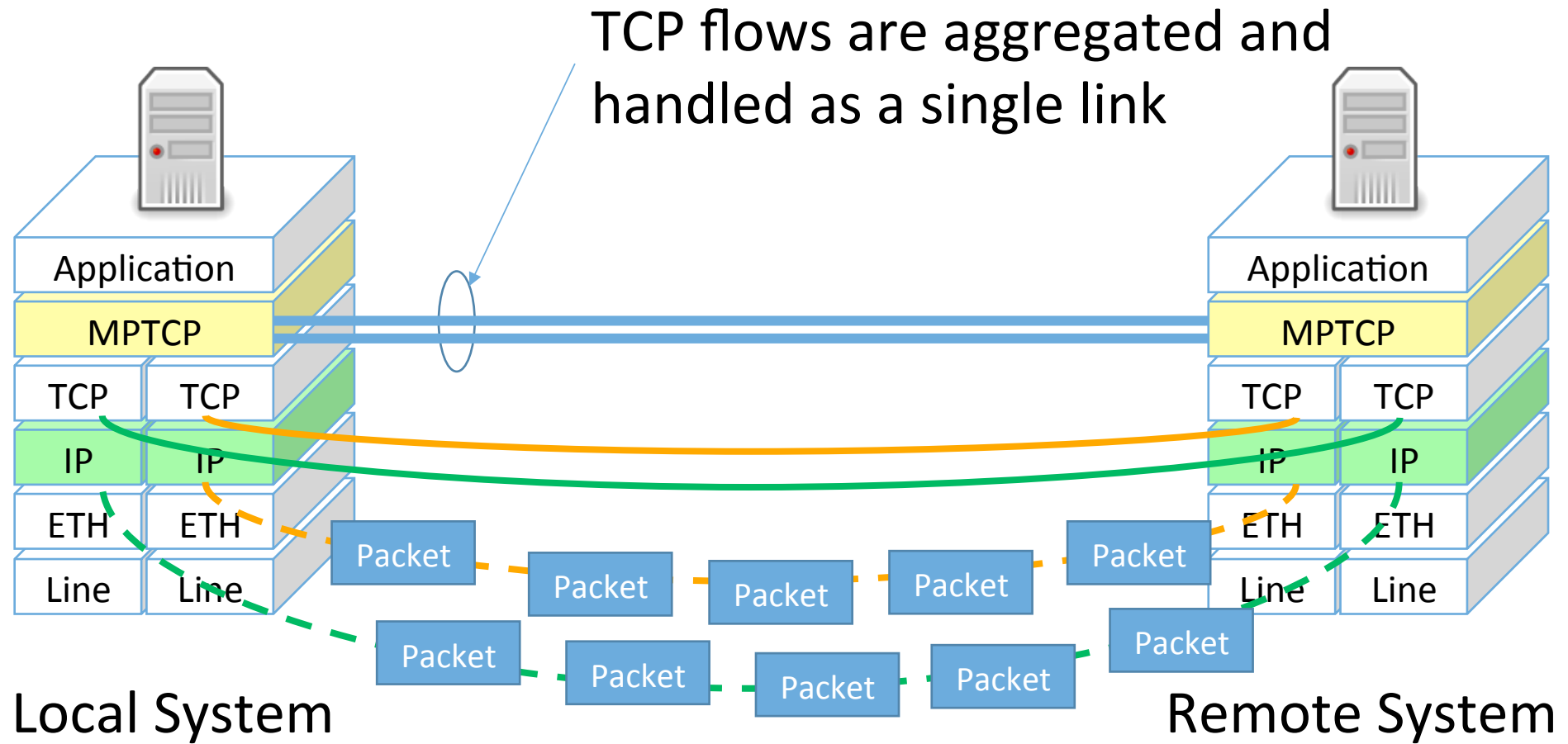
From the Lightning Talk

# What is PRAGMA-ENT?



From the Lightning Talk

# What is MPTCP?



# Why MPTCP?

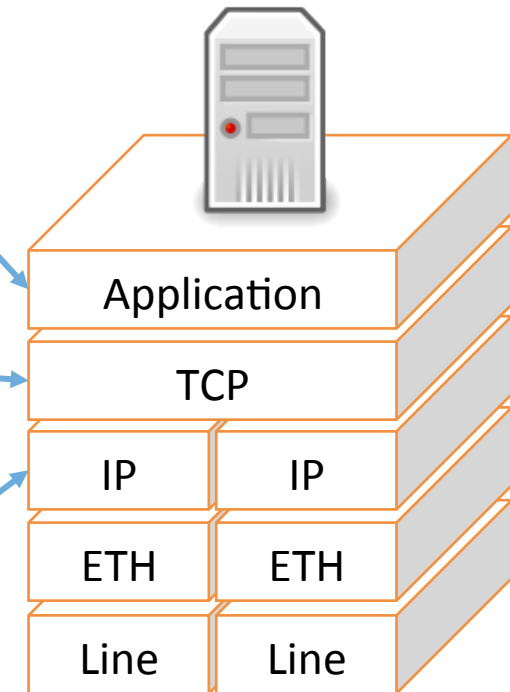
Then I have to manage both sockets manually. Put 100 bytes in sock1, another 100 bytes in sock2 ...

```
Manage sockets from apps  
sock1 = socket.new()  
sock2 = socket.new()
```

“MPTCP”

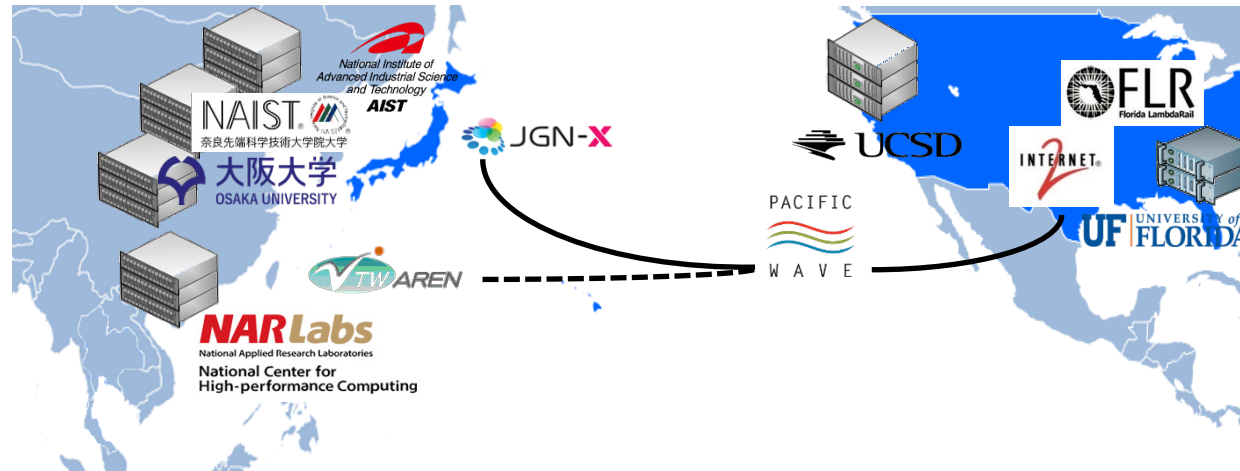
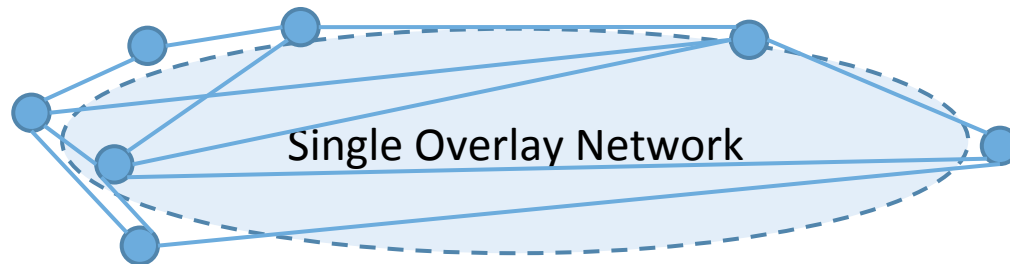
The WAN environment is unfortunately not equal-cost. Packet may arrive out-of-order and prompt TCP to retransmit.

Equal-Cost Multipath (ECMP)  
Packet 1 => route 1  
Packet 2 => route 2  
etc.

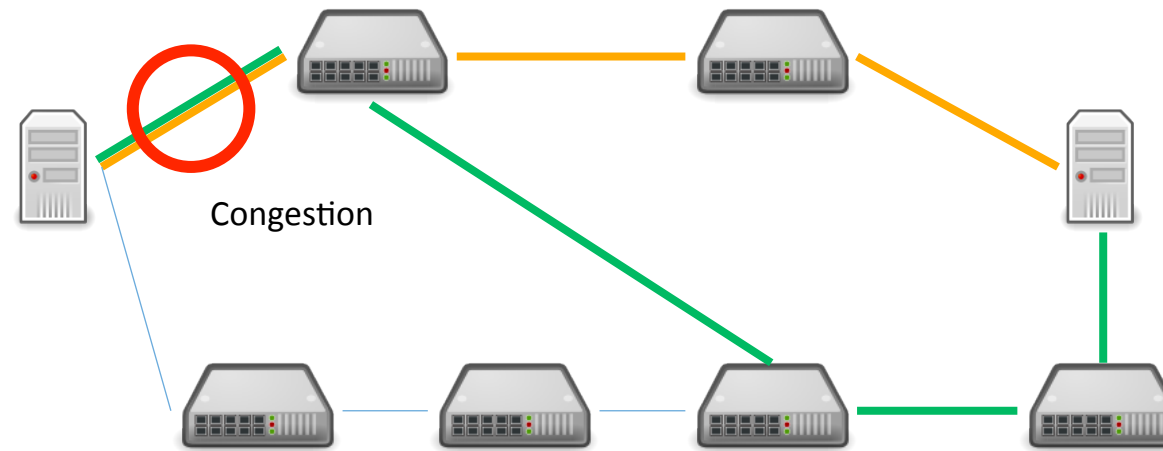


# Then why PRAGMA-ENT?

- Because it's Big: WANs work differently from LANs
- Because it's SDN: Easy to try out routing mechanisms & protocols



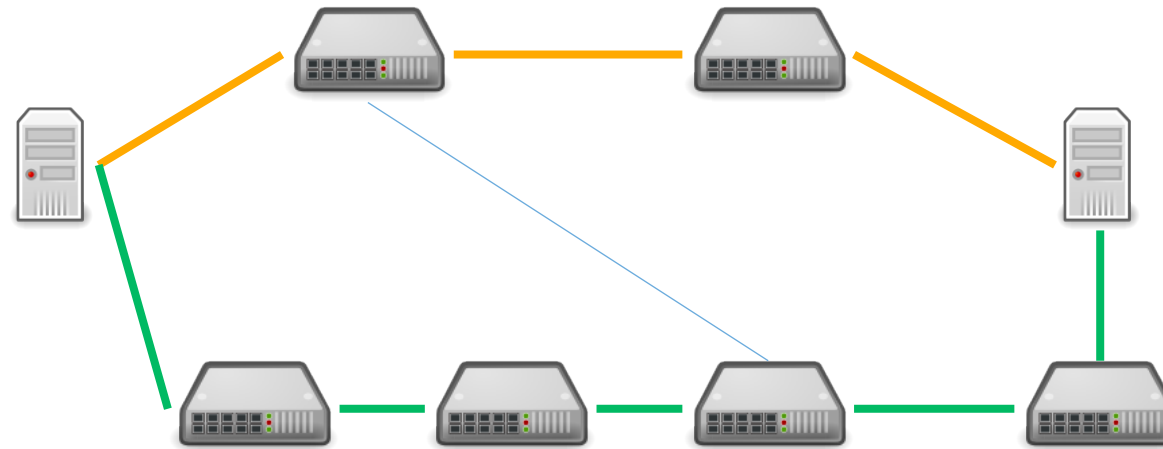
# Conventional routing may behave less than optimally with MPTCP



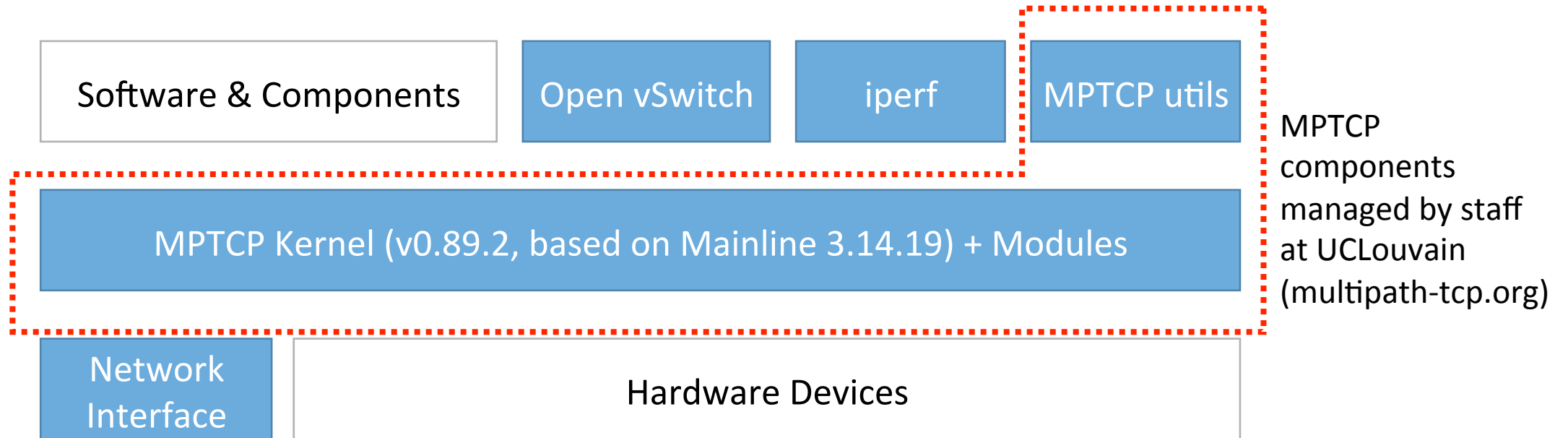
(assuming we use “minimum hops” routing and don’t use “exact same” route twice)

# This is a solution. But how can we make this automatic?

- We'll find out later.



# Basics of MPTCP Kernel



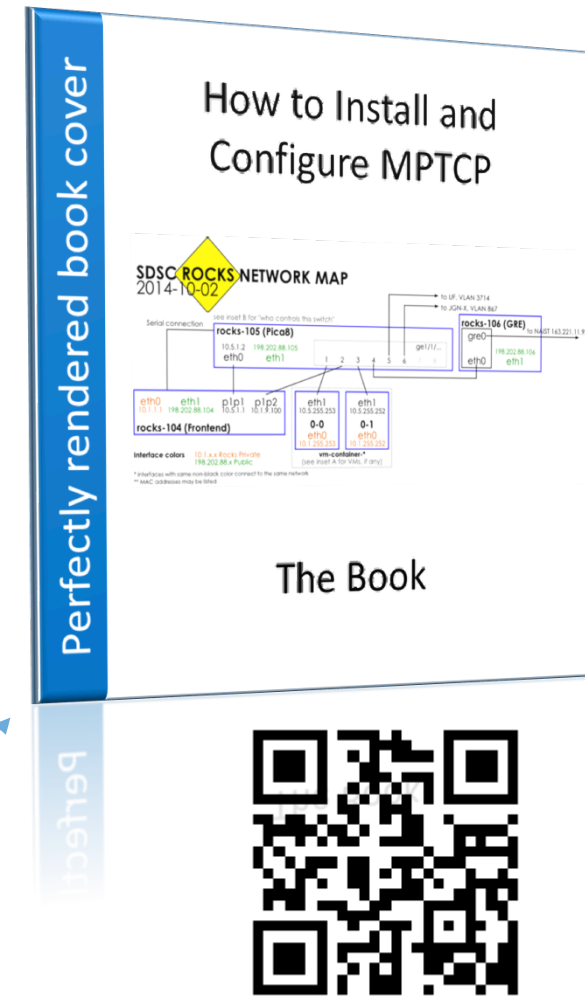
■ Parts related to experiment

□ Other parts



# What must be done to set up MPTCP?

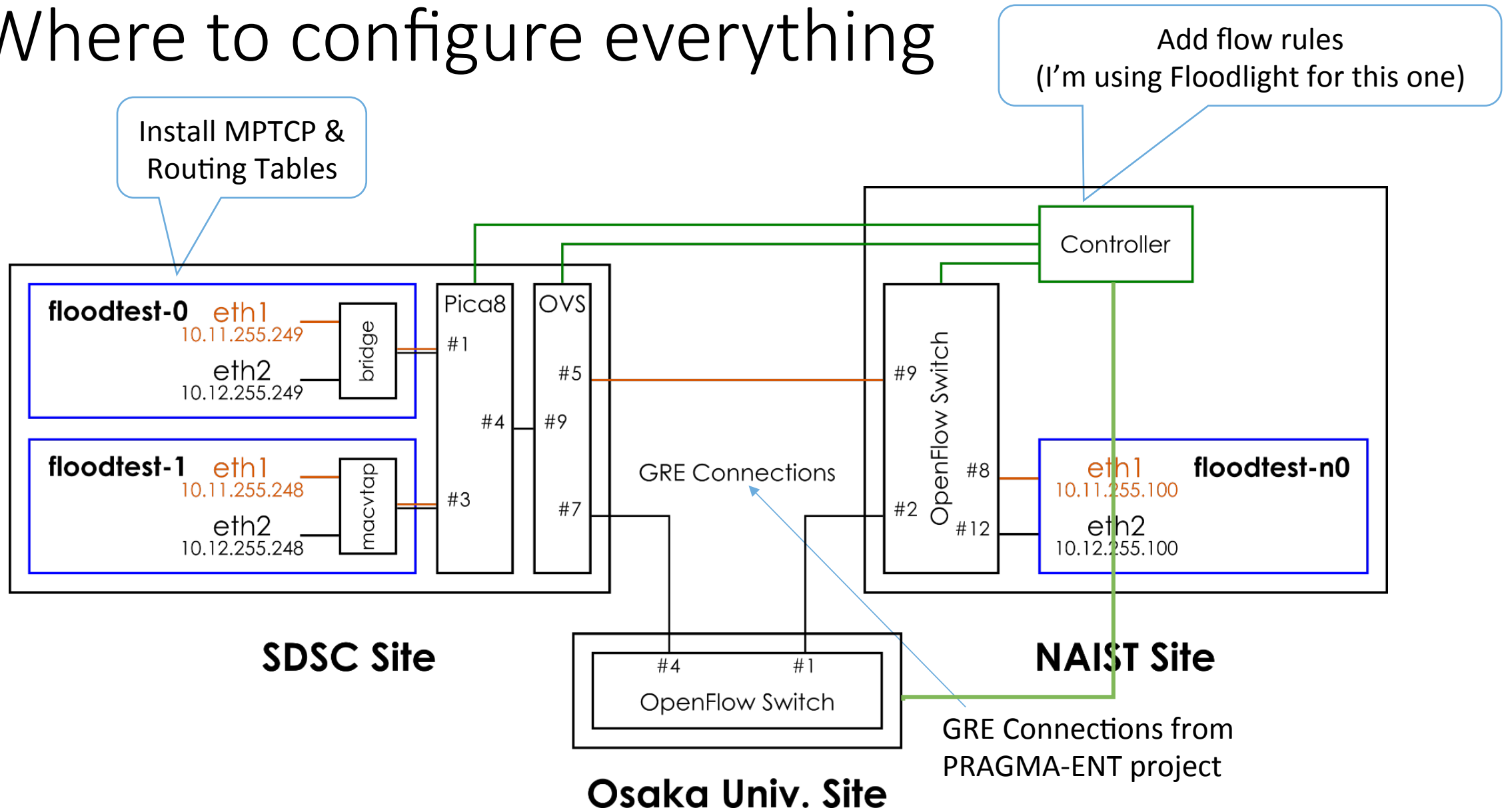
- Compile Kernel
- Set up routing tables
  - Must use multiple routing tables
- Install additional
  - Specialized version of net-tools, tcpdump, etc. allow you to play with more options
- Enjoy!



Do I look like a world-renowned book author now?  
Seriously, the book is worthless. Get it here →→→

<http://goo.gl/PpPqBb>

# Where to configure everything



# Live Demo

Rules:

1. Please tell me if I'm too fast.
2. Murphy's Law may be in effect. I'm actually sharing the network with the previous and the next guys.

# Verifying settings

- dmesg | MPTCP; ip rule show; ip route show table 1

```
root@floodtest-0:~  
[root@floodtest-0 ~]# dmesg | grep MPTCP  
MPTCP: Stable release v0.89.2  
[root@floodtest-0 ~]# ip rule show  
0:      from all lookup local  
32760:  from 10.12.255.249 lookup 2  
32761:  from 10.11.255.249 lookup 1  
32762:  from 10.12.255.249 lookup 2  
32763:  from 10.11.255.249 lookup 1  
32764:  from 10.12.255.249 lookup 2  
32765:  from 10.11.255.249 lookup 1  
32766:  from all lookup main  
32767:  from all lookup default  
[root@floodtest-0 ~]# ifconfig eth1  
eth1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500  
        inet 10.11.255.249  netmask 255.255.0.0  broadcast 10.11.255.255  
        ether 6a:58:ca:00:00:07  txqueuelen 1000  (Ethernet)  
        RX packets 1476575  bytes 1181435910 (1.1 GiB)  
        RX errors 0  dropped 39449  overruns 0  frame 0  
        TX packets 446314  bytes 33548995 (31.9 MiB)  
        TX errors 0  dropped 0  overruns 0  carrier 0  collisions 0  
  
[root@floodtest-0 ~]# ifconfig eth2  
eth2: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500  
        inet 10.12.255.249  netmask 255.255.0.0  broadcast 10.12.255.255  
        ether 6a:58:ca:00:00:0d  txqueuelen 1000  (Ethernet)  
        RX packets 831790  bytes 241703971 (230.5 MiB)  
        RX errors 0  dropped 39448  overruns 0  frame 0  
        TX packets 117045  bytes 9122017 (8.6 MiB)  
        TX errors 0  dropped 0  overruns 0  carrier 0  collisions 0  
  
[root@floodtest-0 ~]# ip route show table 1  
default via 10.11.255.100 dev eth1  
10.11.0.0/16 dev eth1  scope link  
[root@floodtest-0 ~]# ip route show table 2  
default via 10.12.255.100 dev eth2  
10.12.0.0/16 dev eth2  scope link  
[root@floodtest-0 ~]#
```

```
root@floodtest-n0:~  
[root@floodtest-n0 ~]# dmesg | grep MPTCP  
MPTCP: Stable release v0.89.2  
[root@floodtest-n0 ~]# ip rule show  
0:      from all lookup local  
32762:  from 10.12.255.100 lookup 2  
32763:  from 10.11.255.100 lookup 1  
32764:  from 10.12.255.100 lookup 2  
32765:  from 10.11.255.100 lookup 1  
32766:  from all lookup main  
32767:  from all lookup default  
[root@floodtest-n0 ~]# ifconfig eth1  
eth1  Link encap:Ethernet  HWaddr 52:54:00:00:AA:10  
        inet addr:10.11.255.100  Bcast:10.11.255.255  Mask:255.255.0.0  
        inet6 addr: fe80::5054:ff:fe00:aa10/64 Scope:Link  
        UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1  
        RX packets:511752 errors:0 dropped:63337 overruns:0 frame:0  
        TX packets:780564 errors:0 dropped:0 overruns:0 carrier:0  
        collisions:0 txqueuelen:1000  
        RX bytes:38536603 (36.7 MiB)  TX bytes:1141801370 (1.0 GiB)  
  
[root@floodtest-n0 ~]# ifconfig eth2  
eth2  Link encap:Ethernet  HWaddr 52:54:00:00:AA:20  
        inet addr:10.12.255.100  Bcast:10.12.255.255  Mask:255.255.0.0  
        inet6 addr: fe80::5054:ff:fe00:aa20/64 Scope:Link  
        UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1  
        RX packets:180087 errors:0 dropped:61826 overruns:0 frame:0  
        TX packets:134054 errors:0 dropped:0 overruns:0 carrier:0  
        collisions:0 txqueuelen:1000  
        RX bytes:13809057 (13.1 MiB)  TX bytes:201226008 (191.9 MiB)  
  
[root@floodtest-n0 ~]# ip route show table 1  
default via 10.11.255.249 dev eth1  
10.11.0.0/16 dev eth1  scope link  
[root@floodtest-n0 ~]# ip route show table 2  
default via 10.12.255.249 dev eth2  
10.12.0.0/16 dev eth2  scope link  
[root@floodtest-n0 ~]#
```