Running Code Simulation with Zebra Routing Software

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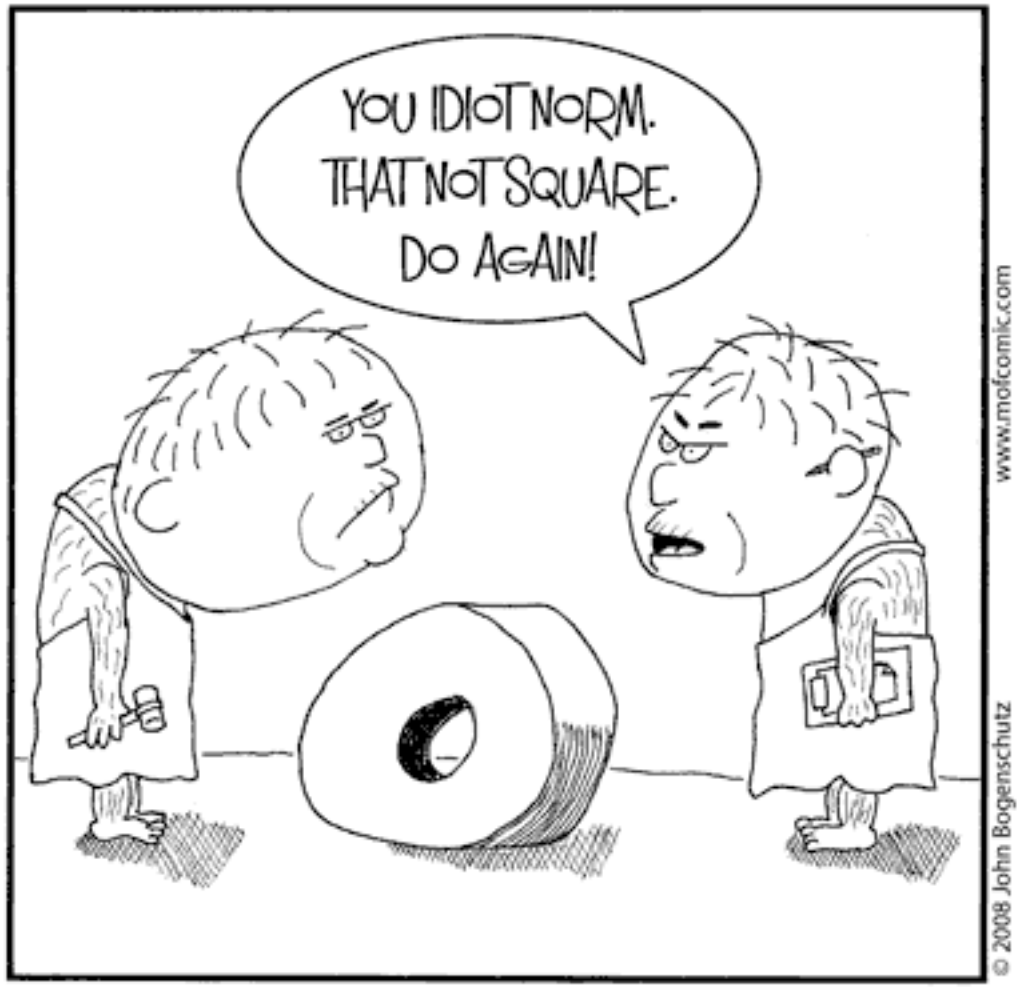
WIDE

Reinventing of the wheel again?



500 years later, the wheel was reinvented.

http://www.mofcomic.com/matteroffact/reinvention-of-the-wheel/

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WIDE

Goal of this talks

- Reinventing is happening in ns-3!
- **Code should be re-used, not from scratch**

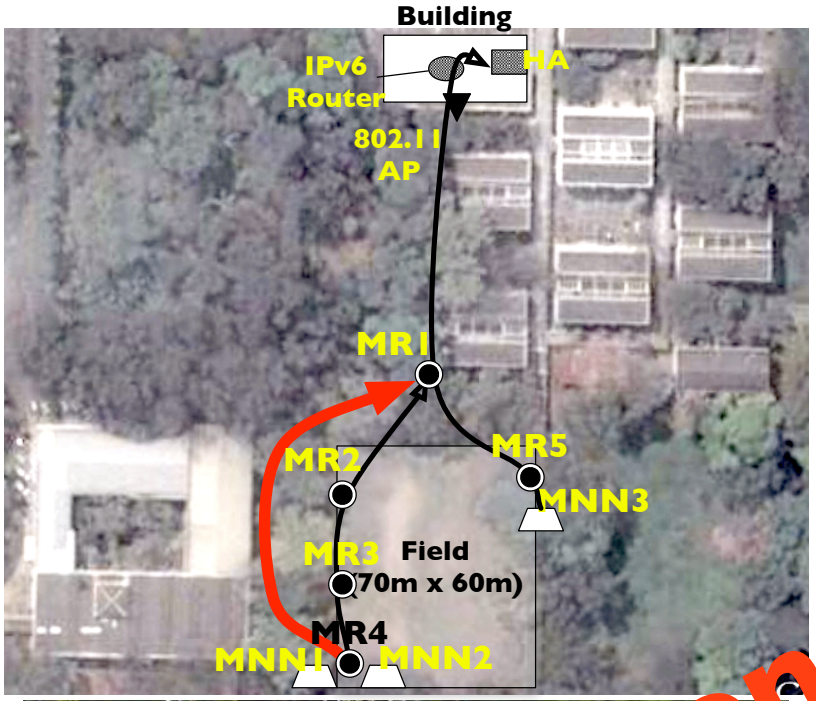
- Running code on simulator (ns-3)
  - Zebra (actual running code) as a routing daemon
  - BGP/OLSR/TD in IPv6 are already available

Who am I?

- Research area: MANET can be a part of Internet
- I Like
  - Internet
  - Code than Document :-)
  - Inter-Operability
  - Inter-Connection
  - Still believe the magic of Internet
- Has developed
  - Zebra/Quagga
  - kbfd (Bi-directional Fwd Detection)
  - SHISA (NEMO stacks for NetBSD)

- Research on the right hand, Operation on the left hand
- Simulation was considered as harmful in our lab ...

MANET Experiment



3 months!

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VIDE

Problems of Mobile Networking Experiment

- Difficulty of in-field experiment
  - Maintenance, preparation is hard, and temporary
  - Mobility with a large number of nodes (1000 nodes?)
- Experiment in virtual environment
  - Heaviness in the large numbers's emulation (60 vnodes/1 Phy)
  - Controllable experiment with a bunch of script

On the other hand....

- Simulation is often used
  - Easy to use
  - Reproducibility of the result
- Is the result reliable?
  - Who validate the simulator itself?
  - Who validate the routing daemon on simulator?

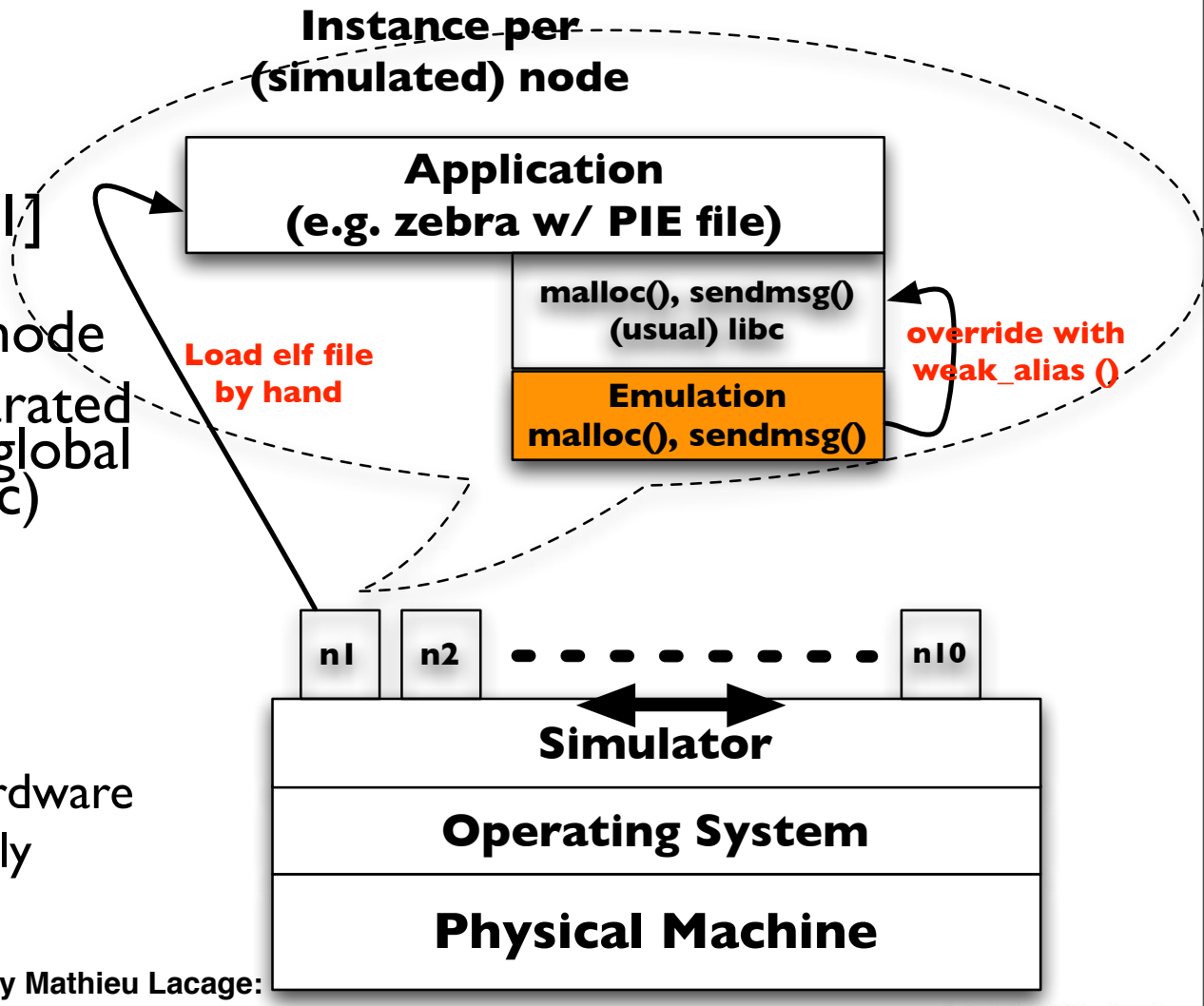
- Inter-Operability
  - Of the Application/Protocol
  - Is the value of Inter Networking
- "Rough consensus and Running Code"

Motivation

- Bugs what I saw (from Feb. 2009 to Feb. 2010)
  - Common: packet-> GetSize() returns invalid size
  - IPv6L3: Hoplimit of IPv6 Echo Reply is always 64
  - Icmpv6L4: Ignore NA packet (IPv6) without LL option
  - TCP: getsockname () only works for connected socket
    - socket by accept() lacks endPoint
  - and more and more .....
- Writing code from scratch is :
  - **Re-inventing the wheel**
  - Build inter-operability from the beginning
- How many times are we implement the protocol stack?

Virtualization in Simulator

- Private branch of ns-3 [1]
- Each zebra (application) instance on the virtual node
- Simulator provides separated program resource (e.g. global sym, mem, sched, file, etc)
- Can be use real world program AS-IS!
- Minimum overhead of virtualization
  - No need to virtualize hardware
  - Required resources is only virtualized



[1] ns-3 POSIX/socket emulation branch by Mathieu Lacage:
http://code.nsnam.org/mathieu/ns-3-simu/
Hajime Tazaki, WNS3 March 2010, "Running Code Simulation with Zebra Routing Software"

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Zebra w/ ns-3-simu

- Netlink support in ns-3
  - http://code.nsnam.org/lj/quagga-porting/
- Also use IPv6 code in ns-3-dev

- Still outside of ns-3-simu code
  - http://www.sfc.wide.ad.jp/~tazaki/hg/ns-3-simu_zebra_ipv6-2nd/

- Zebra includes
  - Several routing protocol (RIP, OSPF, BGP, IPv4/IPv6)
  - Our extension for Zebra (Tree-Discovery [2], OLSR [3])

[2] Nested Nemo Tree Discovery http://tools.ietf.org/html/draft-thubert-tree-discovery-08

[3] Optimized Link State Routing Protocol (OLSR) http://tools.ietf.org/html/rfc3626

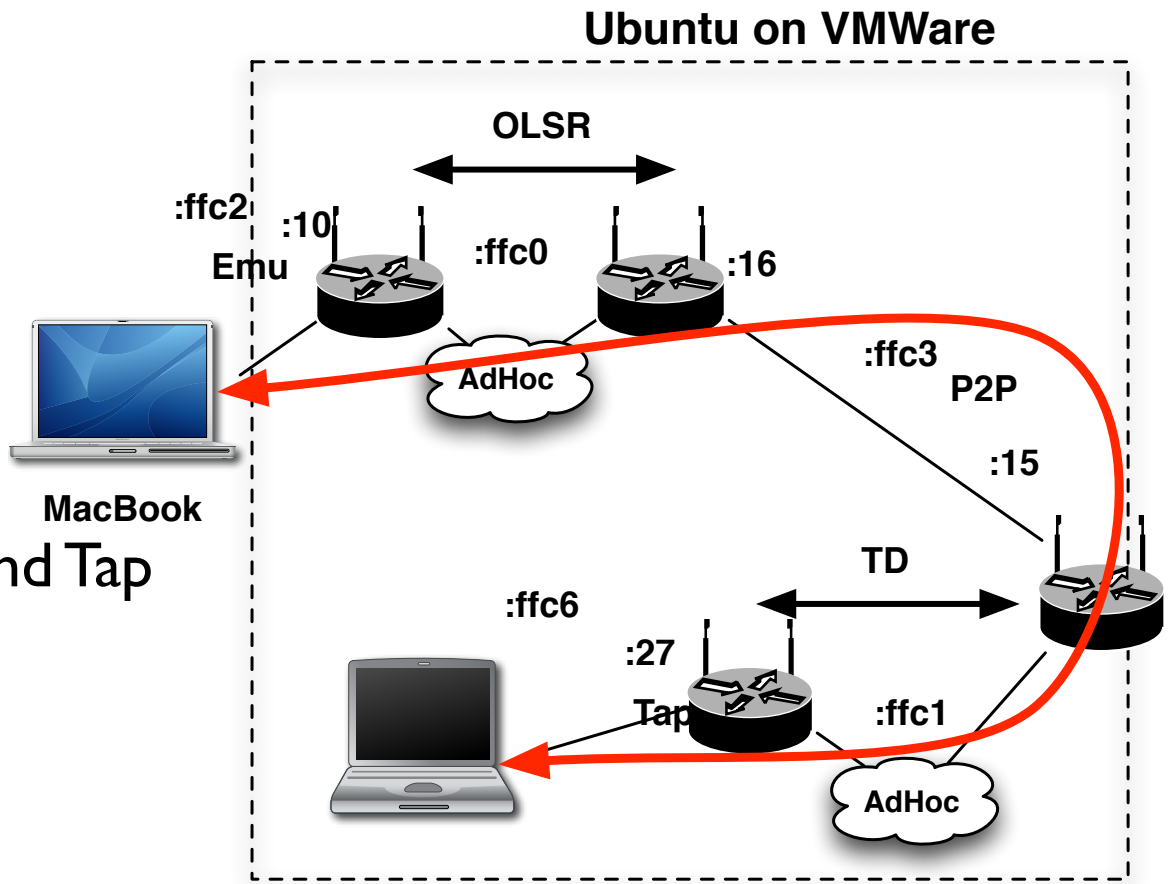
[4] Zebra http://www.zebra.org

Demonstration

Topology

- 10 nodes (OLSR, RWP)
- 10 nodes (TD, RWP)

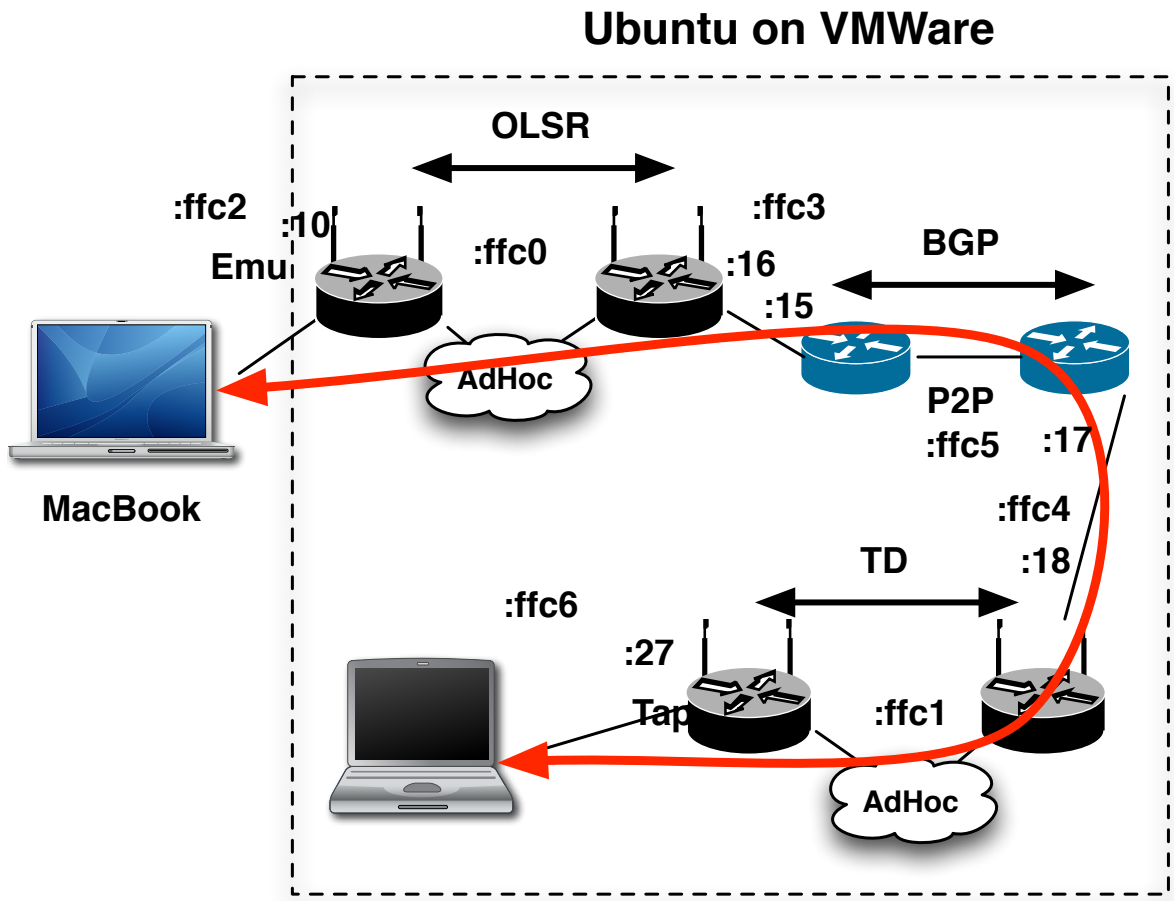
- Connectivity via Emu and Tap between MacBook and Ubuntu



Topology (given up...)

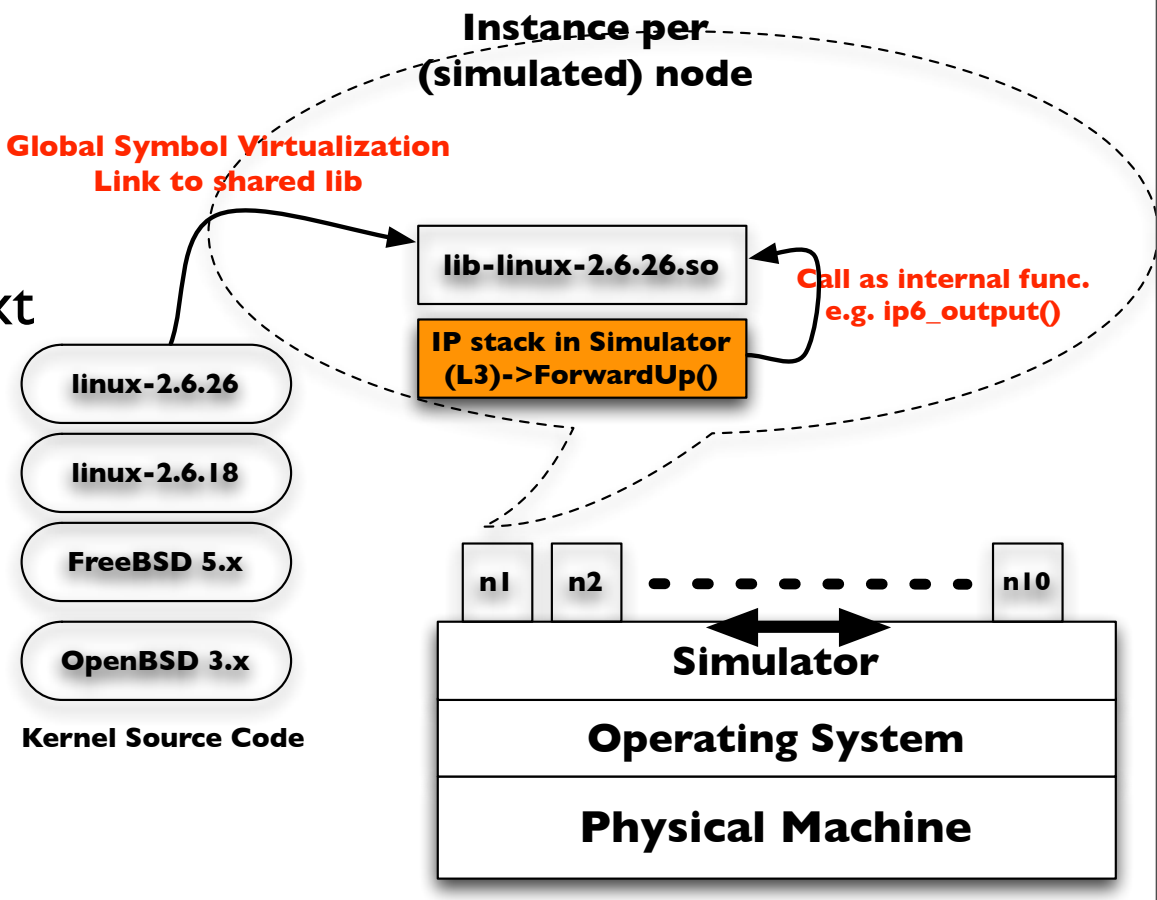
- 10 nodes (OLSR, RWP)
- **2 nodes (bgp)**
- 10 nodes (TD, RWP)

- Ping for connectivity
- Reset BGP session



Next Steps

- Obviously, kernel-land is next Battle Field
  - IP stacks (e.g., NSC)
  - Mobility protocol stack (e.g., MIP6, NEMO)



Conclusion

- Running Code Simulation with Zebra
- Currently, bgpd, zebra-mndpd/olsrd (out extension) is running
- Quagga can be supported

- Can be integrated with Real World network (Internet)

Reference

- Software
  - ns-3 zebra support
    - http://www.sfc.wide.ad.jp/~tazaki/ns3
  - zebra-mndpd
    - http://www.sfc.wide.ad.jp/~tazaki/zebra-mndpd/
  - ns-3-simu (by Mathieu Lacage, INRIA)
    - http://code.nsnam.org/mathieu/ns-3-simu/
- Paper
  - My paper at ACM PE-WASUN09'
    - http://doi.acm.org/10.1145/1641876.1641895
- Contact
  - Hajime Tazaki (tazaki at sfc.wide.ad.jp)

Backup