Running Code Simulation with Zebra Routing Software

Keio University, JAPAN

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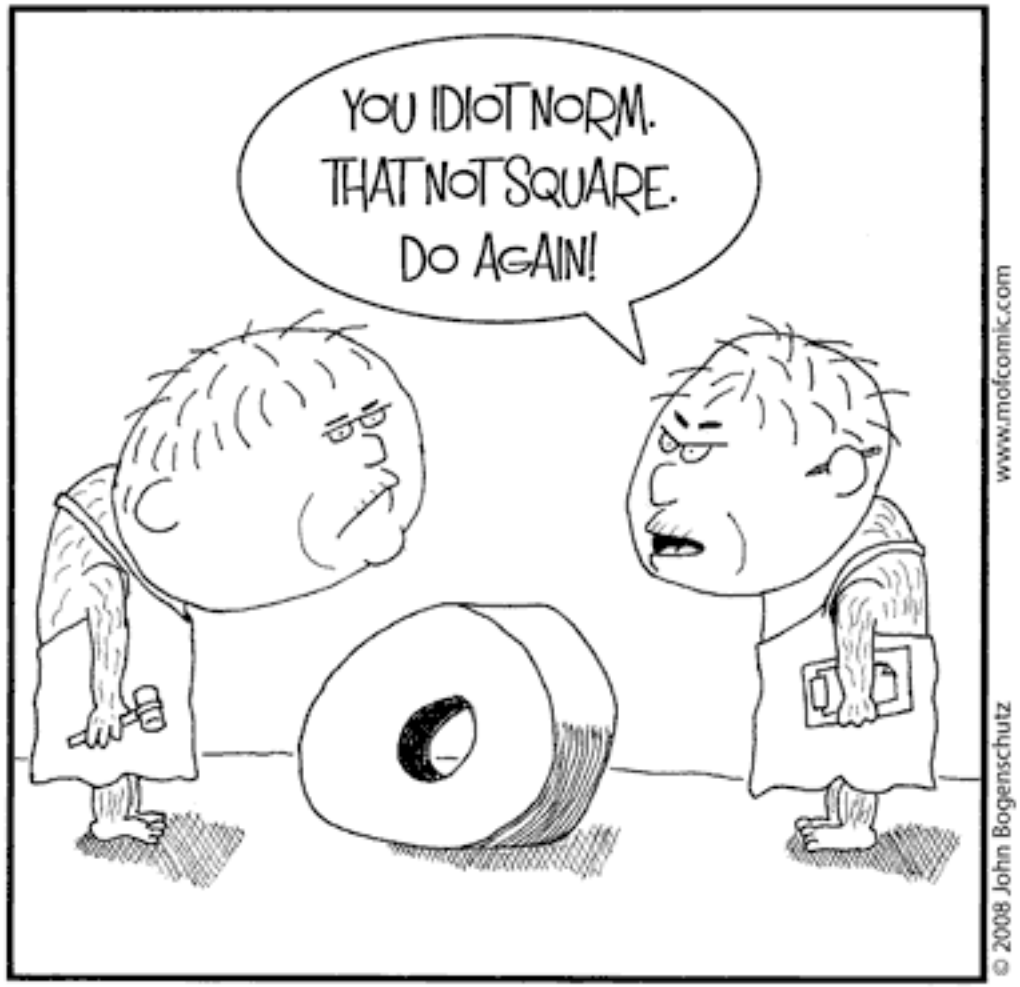
March, 2010 WIDE Spring Camp at Hamanako

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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Summary

- Reinventing is happening in ns-3! (I hate it!)
- Running code on simulator (ns-3)
  - Zebra (actual running code) as a routing daemon
  - Virtualization inside simulator
- Simulator as a experimental environment
  - Light-weight? Controllable?

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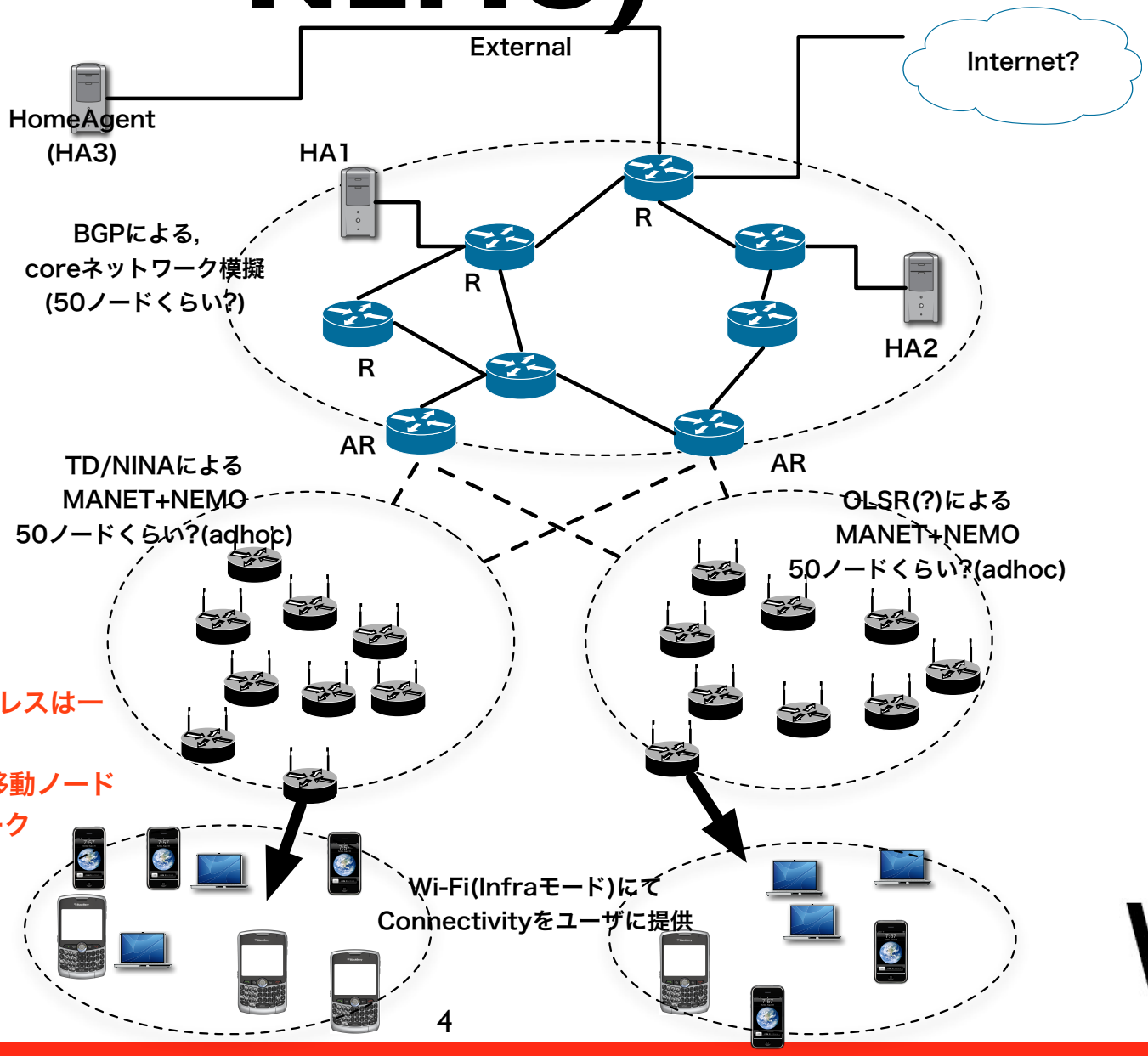
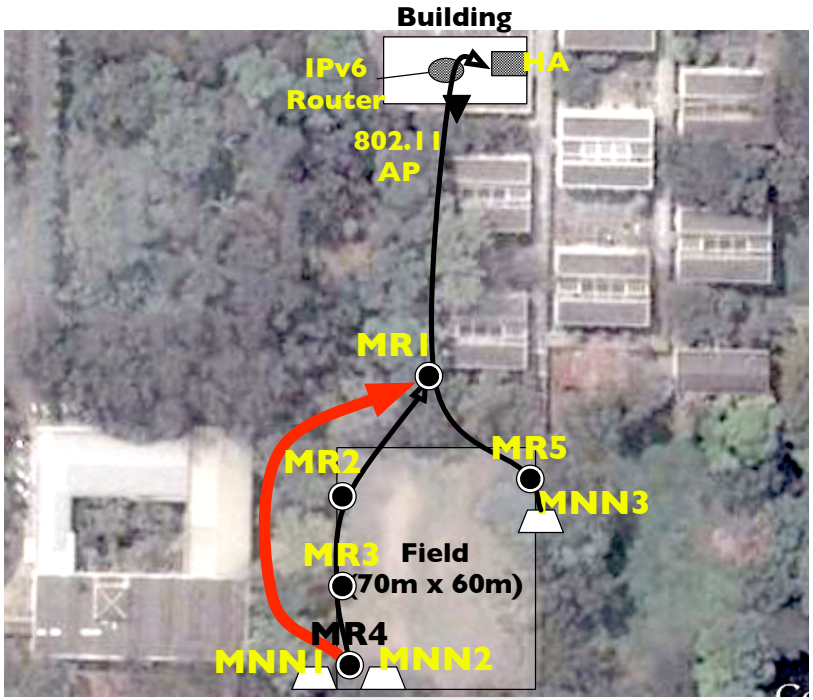
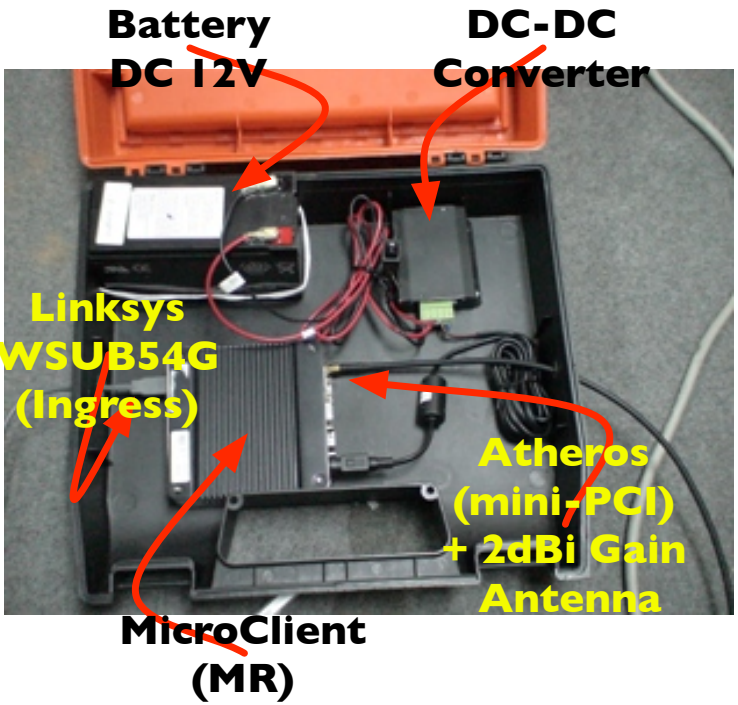
Ex. MANEMO (MANET for NEMO)

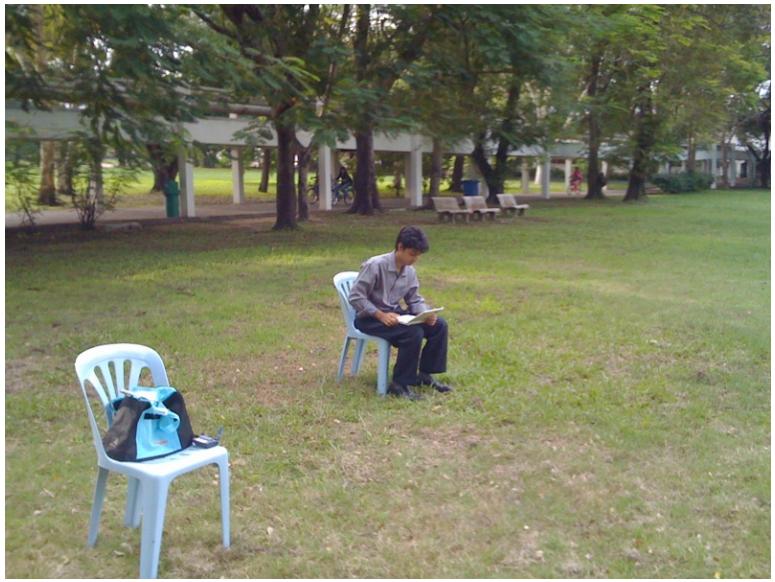


・NEMOにより，Endノードのアドレスは一意

・ユーザが直接繋ぐネットワークは,移動ノードによるマルチホップネットワーク







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Problems of Mobile Experiment

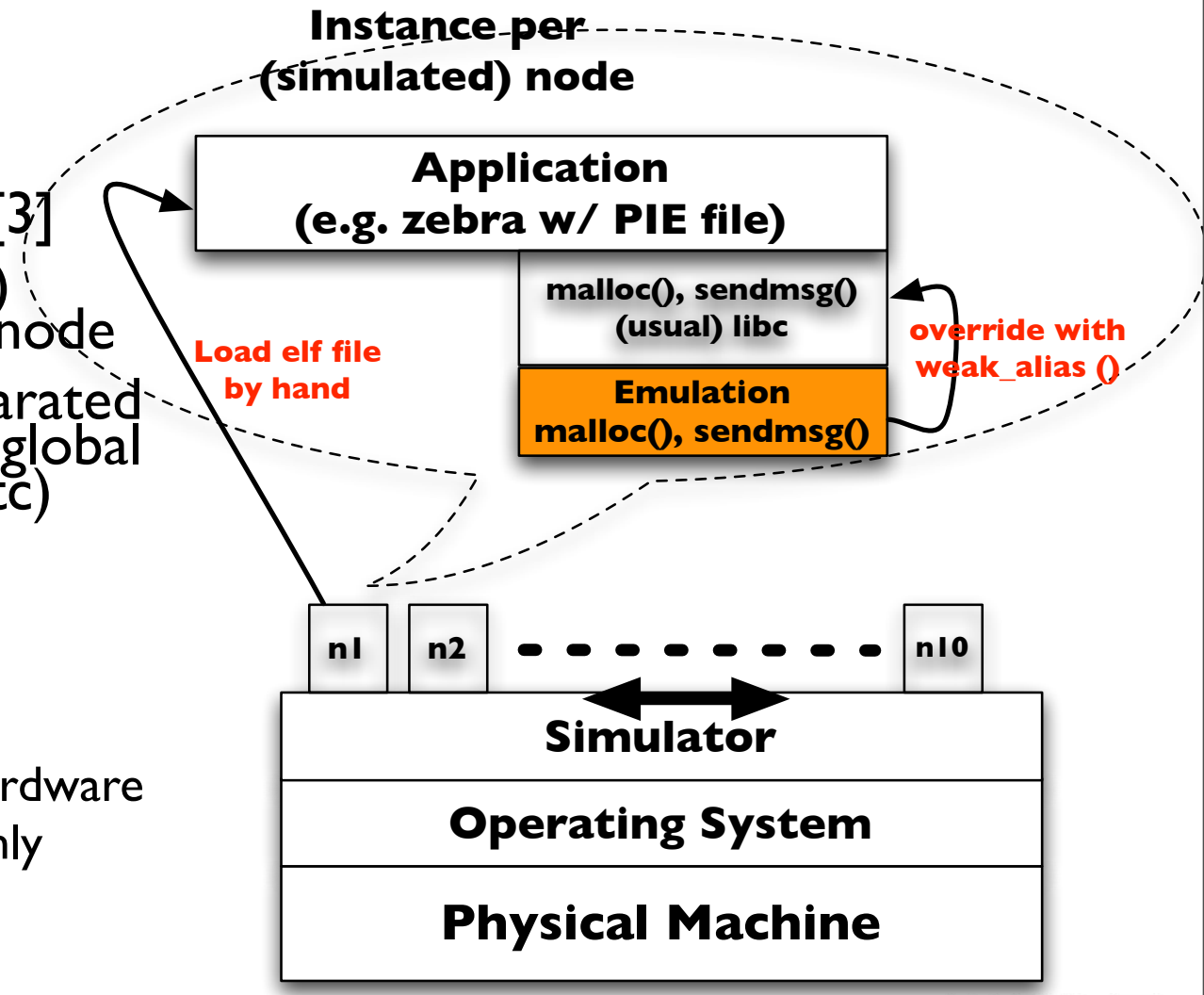
- Difficulty of experiment
  - Maintaing the experimental environment
  - Hard to manage permanent testbed
  - Mobility of nodes with a large number of human
- Experiment in virtual environment
  - (Traditional) network simulation
    - Reliability?
  - Virtual machine based experiment
    - Heaviness in the large numbers's emulation (60 vnodes/1VM)
    - Controllable experiment with a bunch of script

Motivation

- Simulator is useful, but
  - Simulation considered as harmful [Kurkowski05]
  - Who validate the model?
- Ns-3 tries to tackle to negative image
- A lot of bugs in ns-3
  - Hoplimit (TTL) of Echo Reply packet was always 64
  - TCP state machine doesn't work only with linux endpoint
  - getsockname () only work with connected socket (accepted socket returns empty address)
- How many times are we implement the protocol stack?

Virtualization in Simulator

- Private branch of ns-3 [3]
- 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



[3] ns-3 POSIX/socket emulation branch by Mathieu Lacage:
http://code.nsnam.org/mathieu/ns-3-simu/

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Point of Experiment

- Realistic experiment w/ Toy
- Mobile router for the default gateway
  - Use simulator (ns-3) for the node mobility
  - Zebra as routing protocol
    - No modification in source code
- Performance of the virtual environment
  - Load of the simulator's process
  - Actual traffic via real world

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Demonstration

Overview

- 10 nodes (in Mac-Mini) runs bgpd (zebra)
- 10 nodes (in ThinkPad) runs Tree Discovery (TD, zebra)
- 10 nodes (in ThinkPad) runs OLSR (zebra)

- Provides IPv6 connectivity attached to MANET (TD/OLSR)

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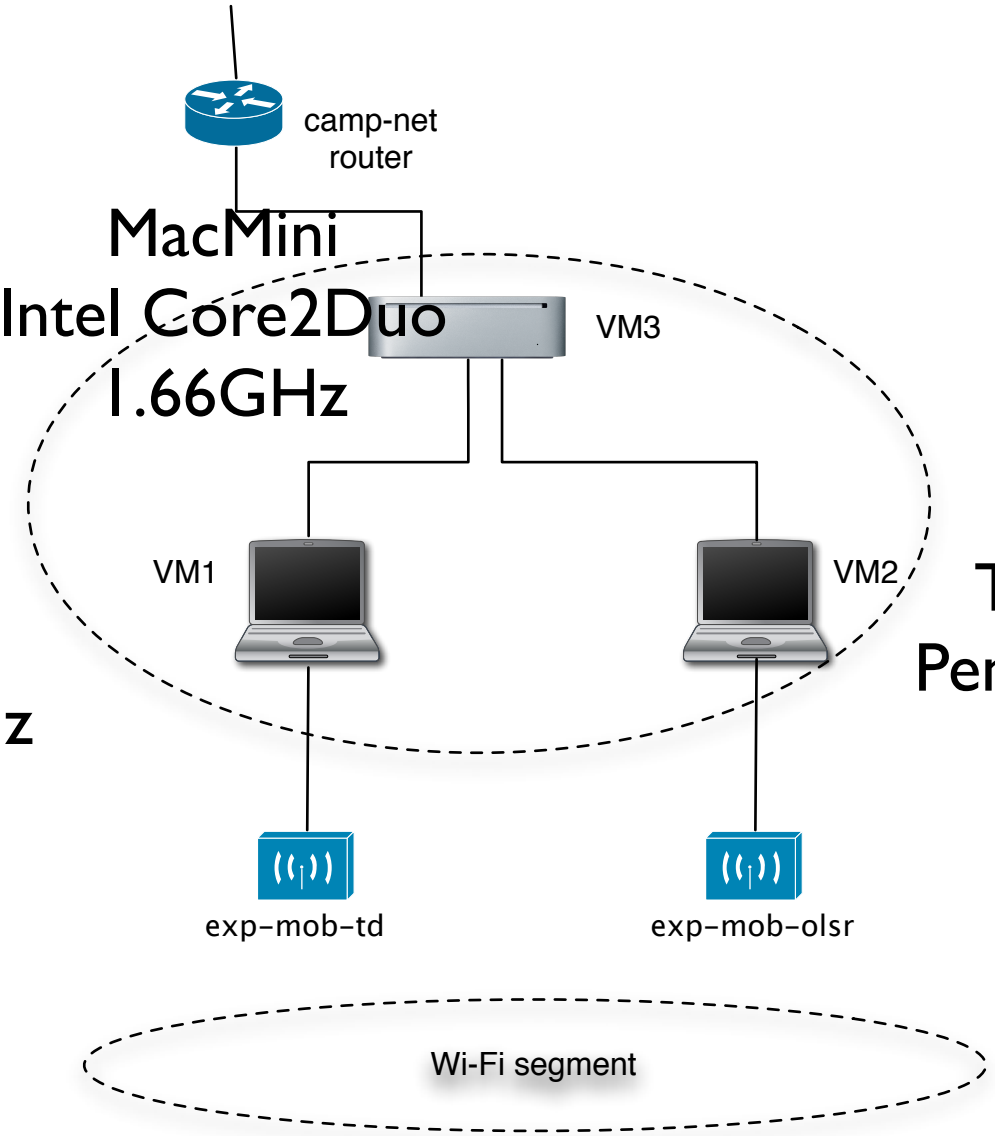

Thinkpad X31
Pentium M1.6GHz

Thinkpad X31
Pentium M1.6GHz

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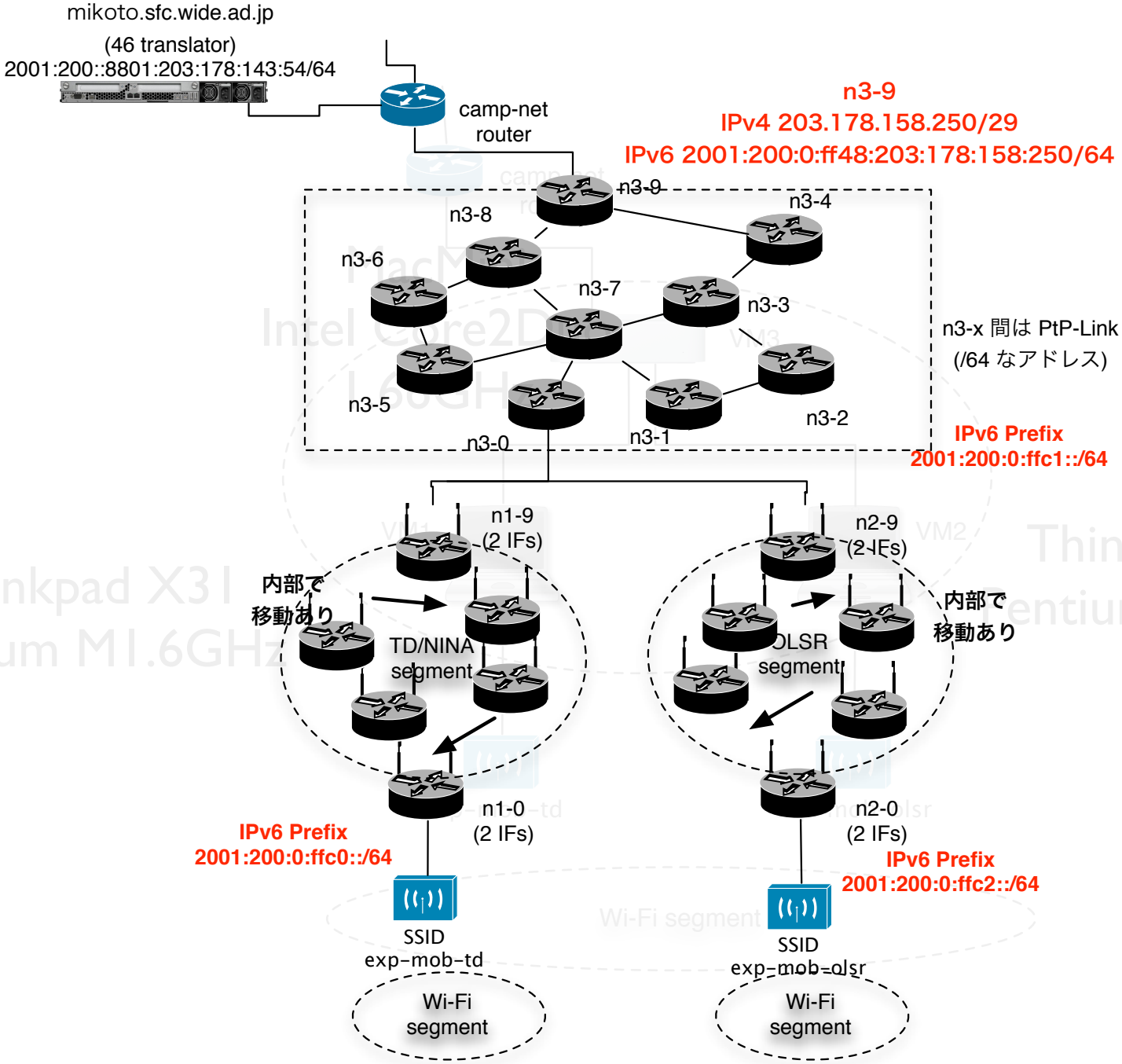
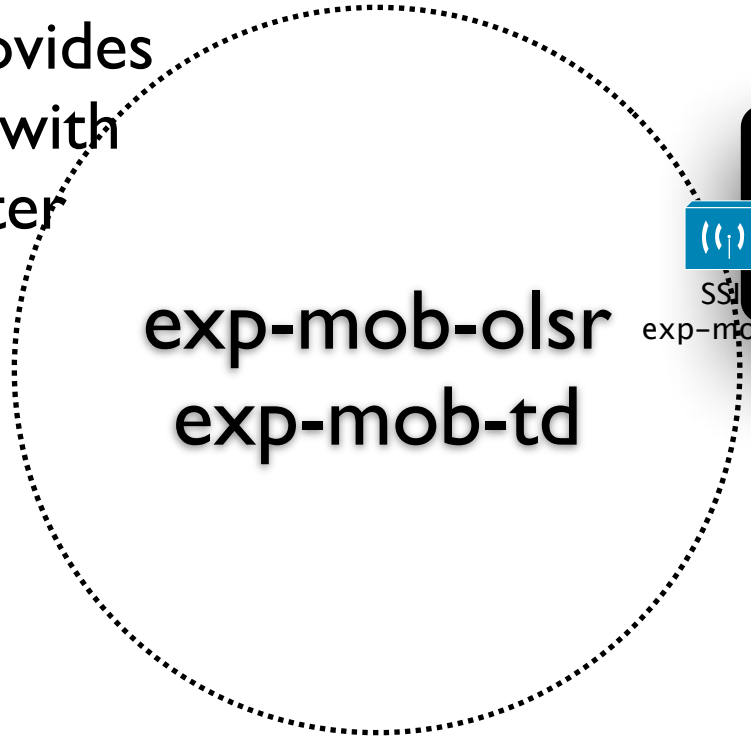
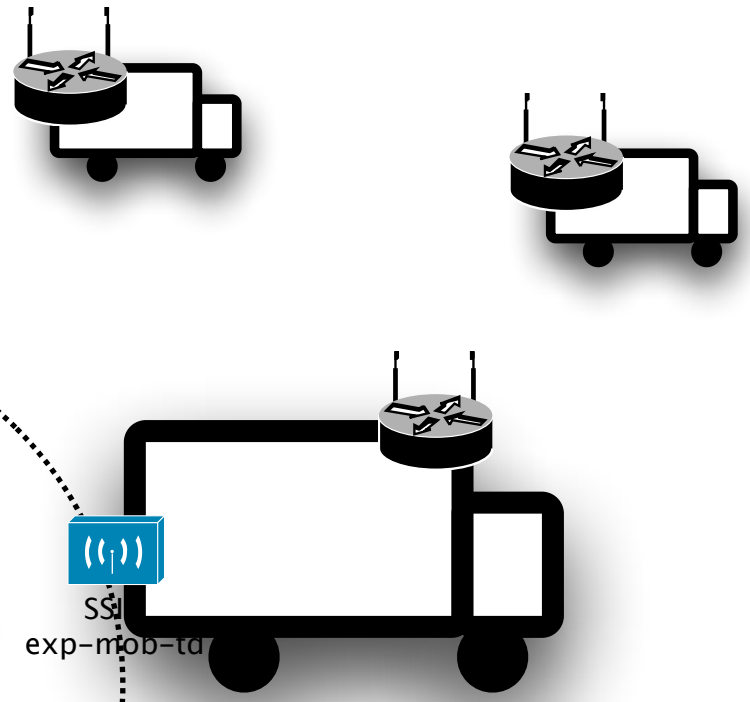

mikoto.sfc.wide.ad.jp
(46 translator)
2001:200::8801:203:178:143:54/64
camp-net
router
n3-9
IPv4 203.178.158.250/29
IPv6 2001:200:0:ff48:203:178:158:250/64
n3-9
n3-8
n3-4
n3-6
n3-7
n3-3
n3-5
n3-2
n3-0
n3-1
n3-x 間は PtP-Link
(/64 なアドレス)
IPv6 Prefix
2001:200:0:ffc1::/64
n1-9
(2 IFs)
n2-9
(2 IFs)
内部で
移動あり
TD/NINA
segment
OLSR
segment
内部で
移動あり
n1-0
(2 IFs)
n2-0
(2 IFs)
IPv6 Prefix
2001:200:0:ffc0::/64
IPv6 Prefix
2001:200:0:ffc2::/64
SSID
exp-mob-td
SSID
exp-mob-olsr
Wi-Fi
segment
Wi-Fi
segment

Joining to AP provides group mobility with attached router





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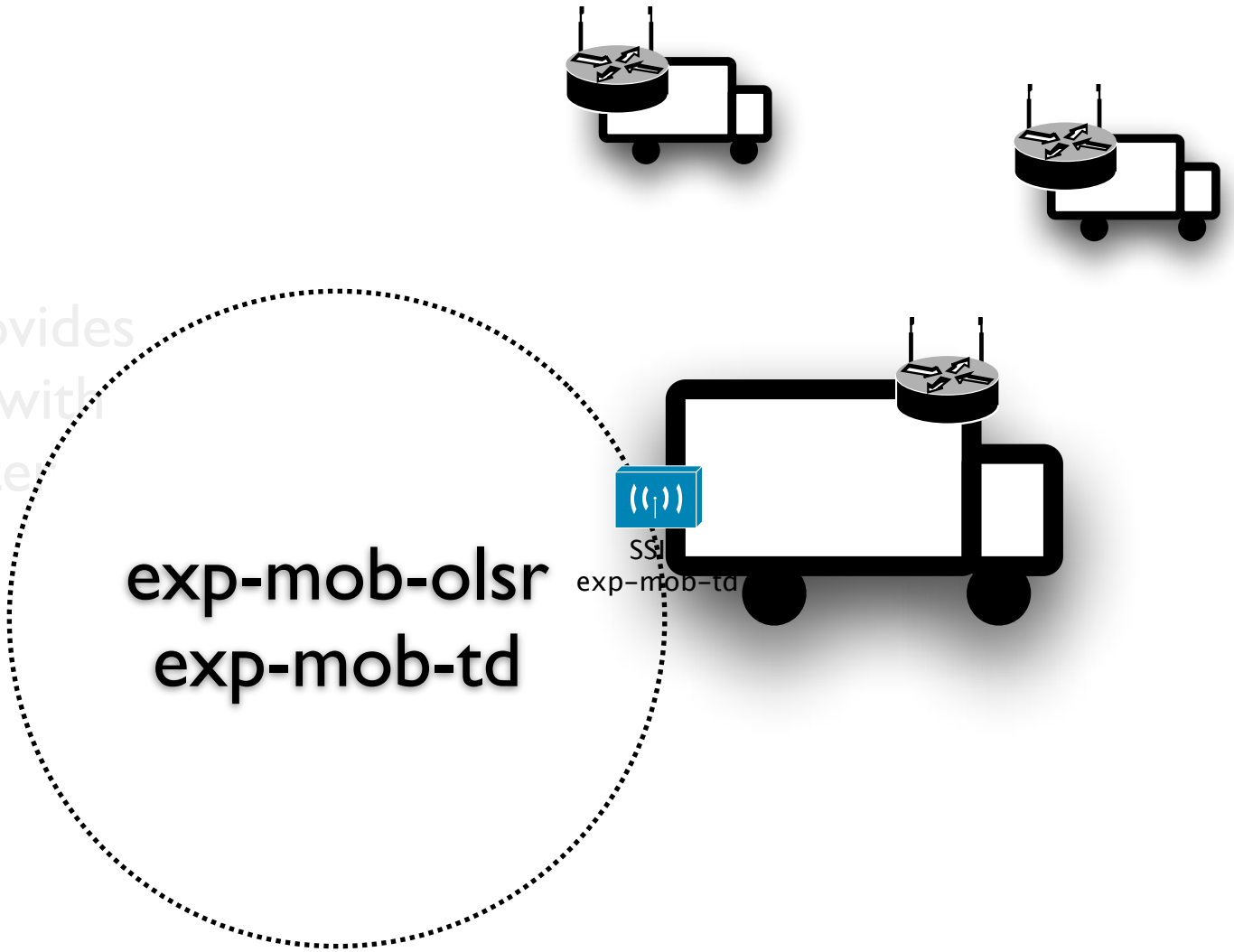
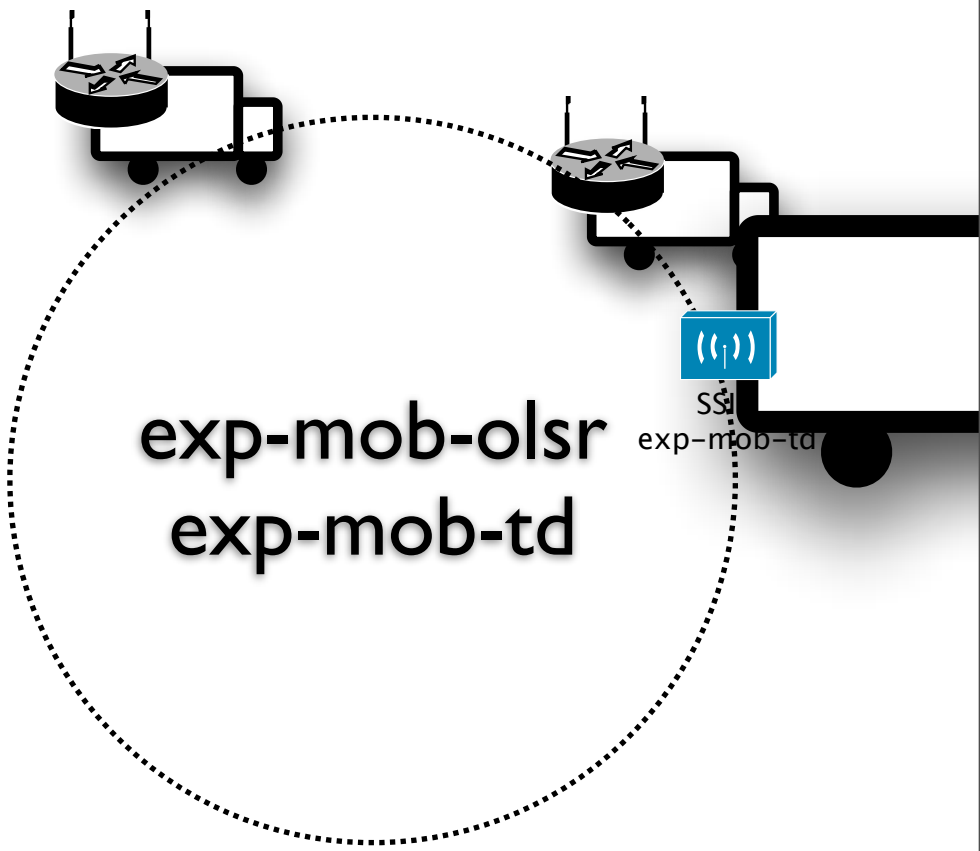
Joining to AP provides group mobility with attached routers



Joining to AP provides group mobility with attached router

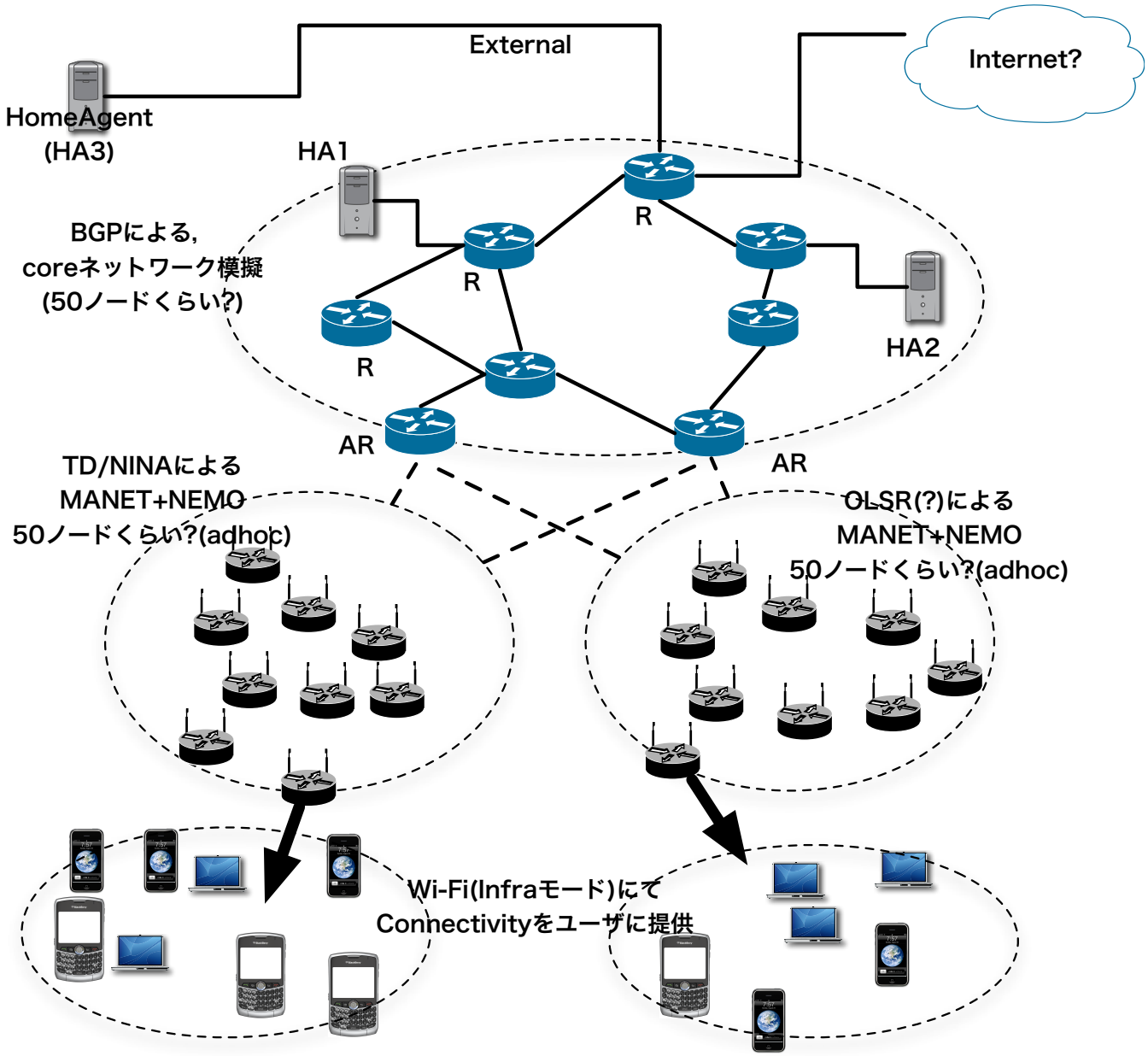


SHISA (実ノード)

zebra+bgpd on ns-3

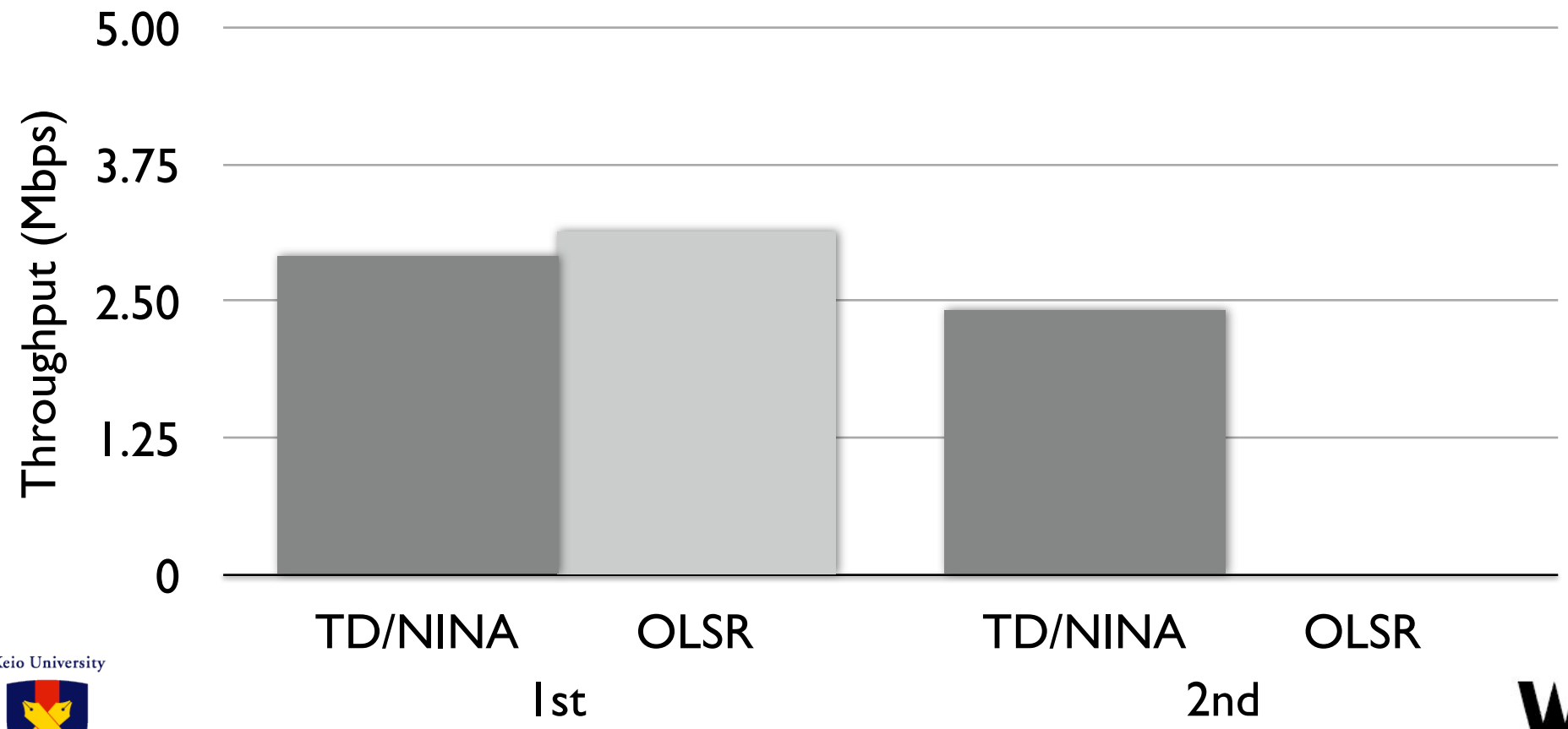
zebra(TD or OLSR)
on ns-3

ユーザ端末



Demonstration

Preliminary Result



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Wish List (Future Work)

- Kernel-land source code emulation
  - Network Mobility (NEMO)
  - IPv6 stack code

- Future plans
  - WNS3 Demonstration/Short Talk (3/15)
  - 2010/8 SIGCOMM Demos ?
  - 2010/10 MOBICOM Demos ?

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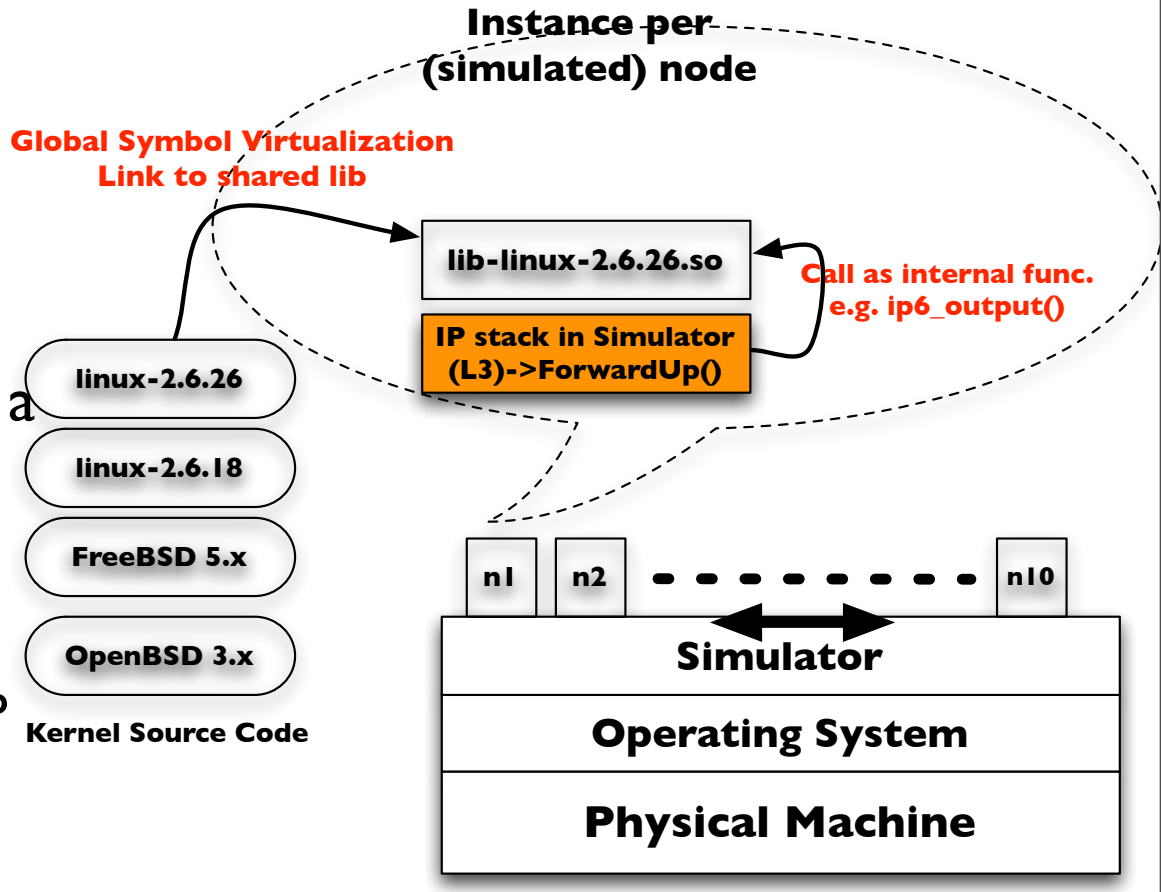
Software component (on going)

- Various kernel-land source can be integrated on simulator
- We can choose IP stacks as a library
- Currently under development
  - for the support of NEMO/HIP



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How to Join Experiment?

- Wi-Fi
  - ESSID
    - exp-mob-td (Tree Discovery protocol)
    - exp-mob-olsr (OLSR)
  - Authentication: same as camp-pc's Wi-Fi (EAP-TLS)
- Nameserver configuration
  - 2001:200:0:8801:203:178:143:54 (Located@SFC, faith=TCP-v6-v4-relay)
  - (DNS service for Windows XP is not available)
- Information of this experiment Web
  - http://zak-rtr.camp.wide.ad.jp/

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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 (contributors are welcome)
  - Hajime Tazaki (tazaki@sfc.wide.ad.jp)

Thank you

Backup