Direct Code Execution: Increase Simulation Realism using Unmodified Real Implementations

Hajime Tazaki*, Emilio Mancini◦, Daniel Câmara◦, Thierry Turletti◦, Walid Dabbous◦

*University of Tokyo, Japan: ◦INRIA, France

Motivation

By using simplified implementations and models of protocols, traditional simulators do not provide functional realism. DCE aims to increase the realism of experimentation results by running existing protocol implementations inside a network simulator.

	Simulator	Testbeds	Emulators
Functional Realism	???	✓	✓
Timing Realism	✓	✓	✓
Topology Flexibility	✓	(limited)	✓
Easy Replication	✓	✓	✓
Easy Debug	✓		
Experimental Scalability	✓		

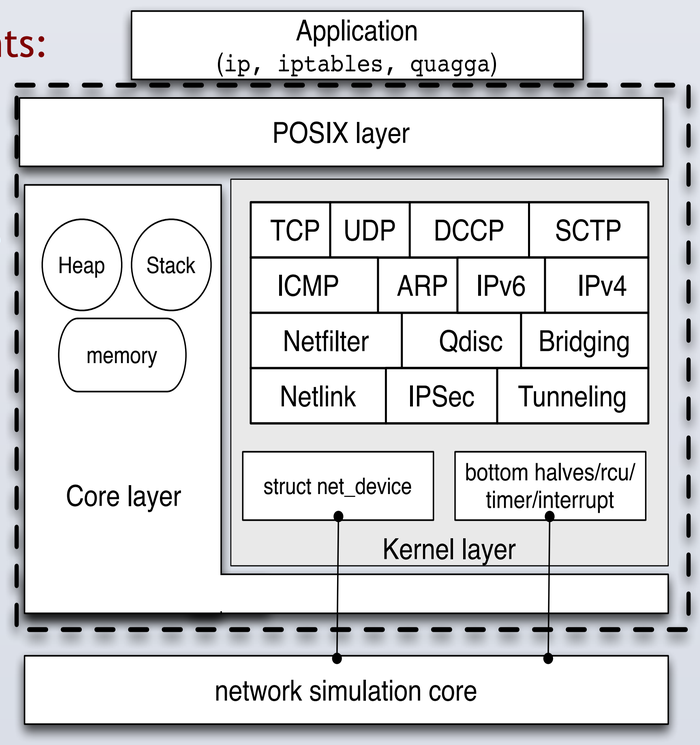
What is DCE helpful for?

- To obtain **realistic** results from network simulation
- To **avoid re-implementing** possibly complex protocols for simulation (e.g., OSPF or BGP)
- To **debug** and **test** your code within a controlled environment
- To create a model of a **large scale** network (let's say, a model of an ISP network) in a single node

DCE Architecture

DCE consists of 3 Components:

- **Core layer**
  virtualization primitives handles stacks, heaps, global memory in a single host process.
- **Kernel layer**
  asm-generic implementation of Linux with glue code
- **POSIX layer**
  reimplementation of standard socket API



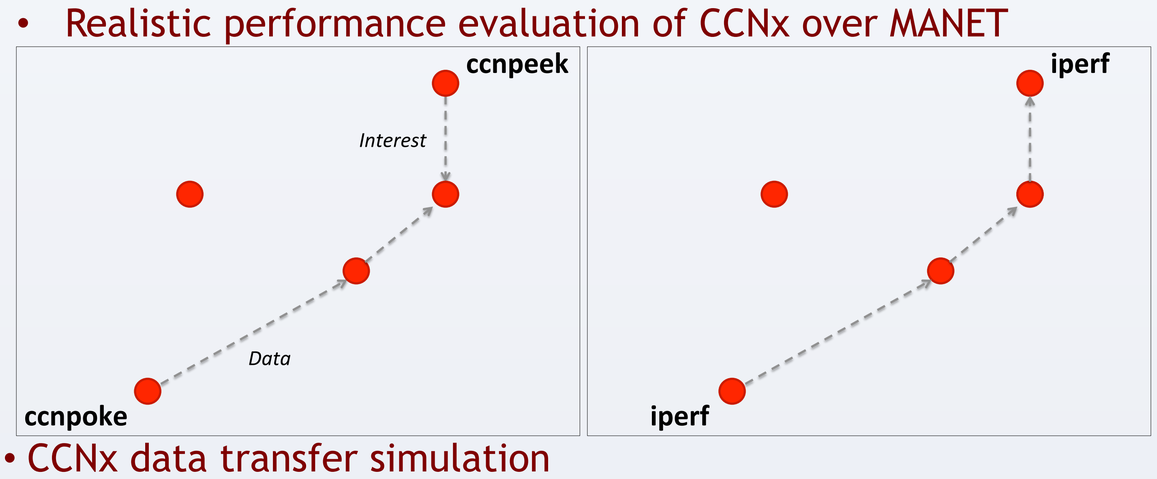
Supported Applications /Kernels:

- **Linux kernel (2.6.36, 3.4, 3.5, 3.7, and 3.10)**
  - **IPv4, IPv6, TCP/UDP, DCCP, mptcp, Mobile IPv6, etc.**
- **Quagga, PARC ccnx, iperf, ip, ping/ping6, umip, bind9, unbound, thttpd, BitTorrent**

Demonstration 1

Highlights

- Realistic performance evaluation of CCNx over MANET

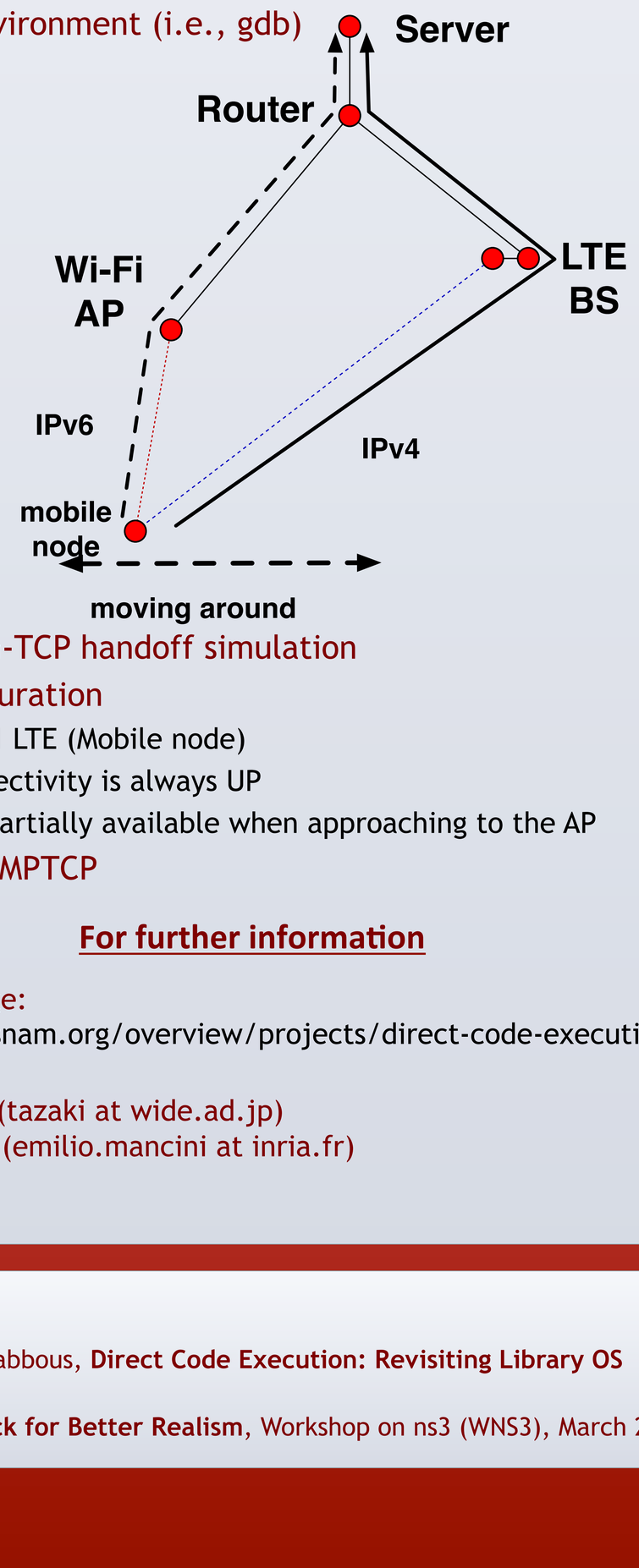


- CCNx data transfer simulation
- Network configuration:
  - WiFi mobile nodes, random direction model (RD)
  - MANET routing such as OLSR, DSR (for comparison with CCNx)
- Traffic: ccnpeek, ccnpoke, iperf

Demonstration 2

Highlights

- Realistic simulation (Linux MPTCP)
- Debugging environment (i.e., gdb)



- Linux Multipath-TCP handoff simulation
- Network configuration
  - 1 Wi-Fi, 1 LTE (Mobile node)
  - LTE connectivity is always UP
  - Wi-Fi is partially available when approaching to the AP
- Traffic: iperf + MPTCP

For further information

- Project Web page:
  http://www.nsnam.org/overview/projects/direct-code-execution/
- Contact:
  Hajime Tazaki (tazaki at wide.ad.jp)
  Emilio Mancini (emilio.mancini at inria.fr)

References

• Hajime Tazaki, Fréderic Urbani, Emilio Mancini, Mathieu Lacage, Daniel Câmara, Thierry Turletti, and Walid Dabbous, **Direct Code Execution: Revisiting Library OS Architecture for Reproducible Network Experiments**, ACM CoNEXT 2013, December 2013.

• Hajime Tazaki, Frederic Urbani, and Thierry Turletti, **DCE Cradle: Simulate Network Protocols with Real Stack for Better Realism**, Workshop on ns3 (WNS3), March 2013.