



Network Simulations Using the ns-3 Simulator

The ns-3 project: <http://www.nsnam.org>



ns-3 Project Overview

ns-3 is an open source project developing a new simulation environment for networking research, with two broad goals:

- ✦ Develop a tool aligned with the simulation needs of networking research;
- ✦ Provide an open-source project that encourages community contribution, peer review, and validation of the software.

ns-3 basic information

- ✦ ns-3 is a new simulator (not backwards-compatible with ns-2);
- ✦ C++ core with Python scripting;
- ✦ ns-3 licensing is GPLv2;
- ✦ First stable software release was in June 2008.

Project Support

- ✦ NSF grants CNS-0551686, CNS-0551378, CNS-0551706;
- ✦ Planete, INRIA Sophia Antipolis;
- ✦ Georgia Institute of Technology;
- ✦ The University of Washington;
- ✦ Google Summer of Code 2008.

What's New in ns-3

ns-3 responds to trends in how Internet research is being conducted

- ✦ **Extensible software core:** extensive use of C++ design patterns with components from yans, Georgia Tech Network Simulator (GTNetS) and ns-2;
- ✦ **Attention to realism:** use of IP addressing, APIs similar to real implementations;
- ✦ **Software integration:** use of real TCP implementation code, a novel ELF loader for integrating applications, reuse of pcap-based analyzers, etc.
- ✦ **Support for virtualization and testbeds:** several modes of virtual machine integration, including integration with testbeds;
- ✦ **Flexible tracing and statistics:** callback-based tracing architecture allows heavy customization of simulation data output;
- ✦ **Attribute system:** systematic documentation and configuration of most values and variables in the system;
- ✦ **New models:** new WiFi PHY/MAC models, IPv6 and WiMax under development.

Today's Demo Overview

Designed to illustrate two views of ns-3

ns-3 Workflow

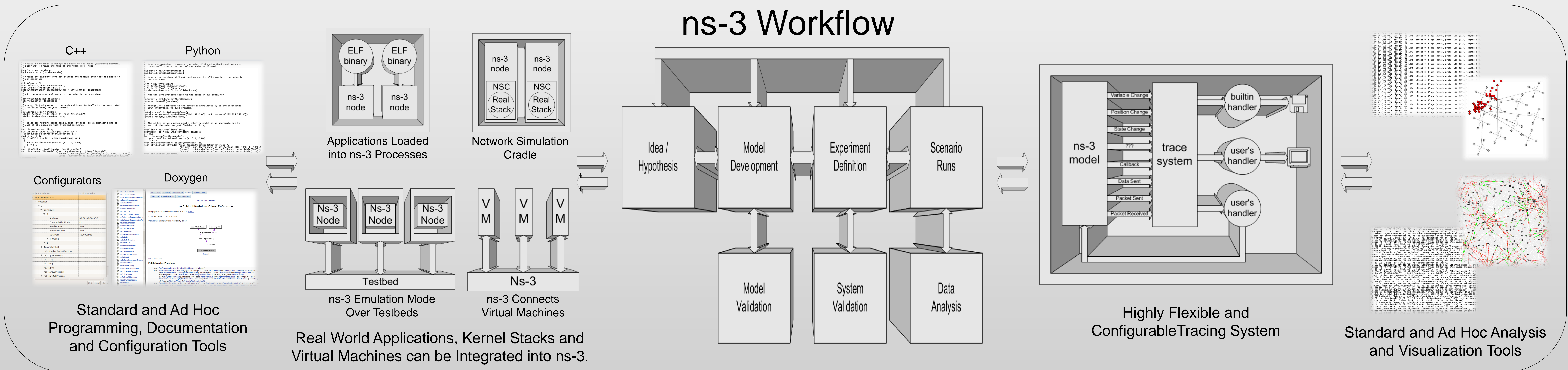
A look at a representative workflow of a networking researcher using simulation, and some aspects of ns-3 that may aid the process.

- ✦ Scenario and model development;
- ✦ Scenario scripting and simulation execution;
- ✦ Data output collection;
- ✦ Data analysis.

Mixed wireless scenario

A scenario illustrating some of the new features and models of ns-3.

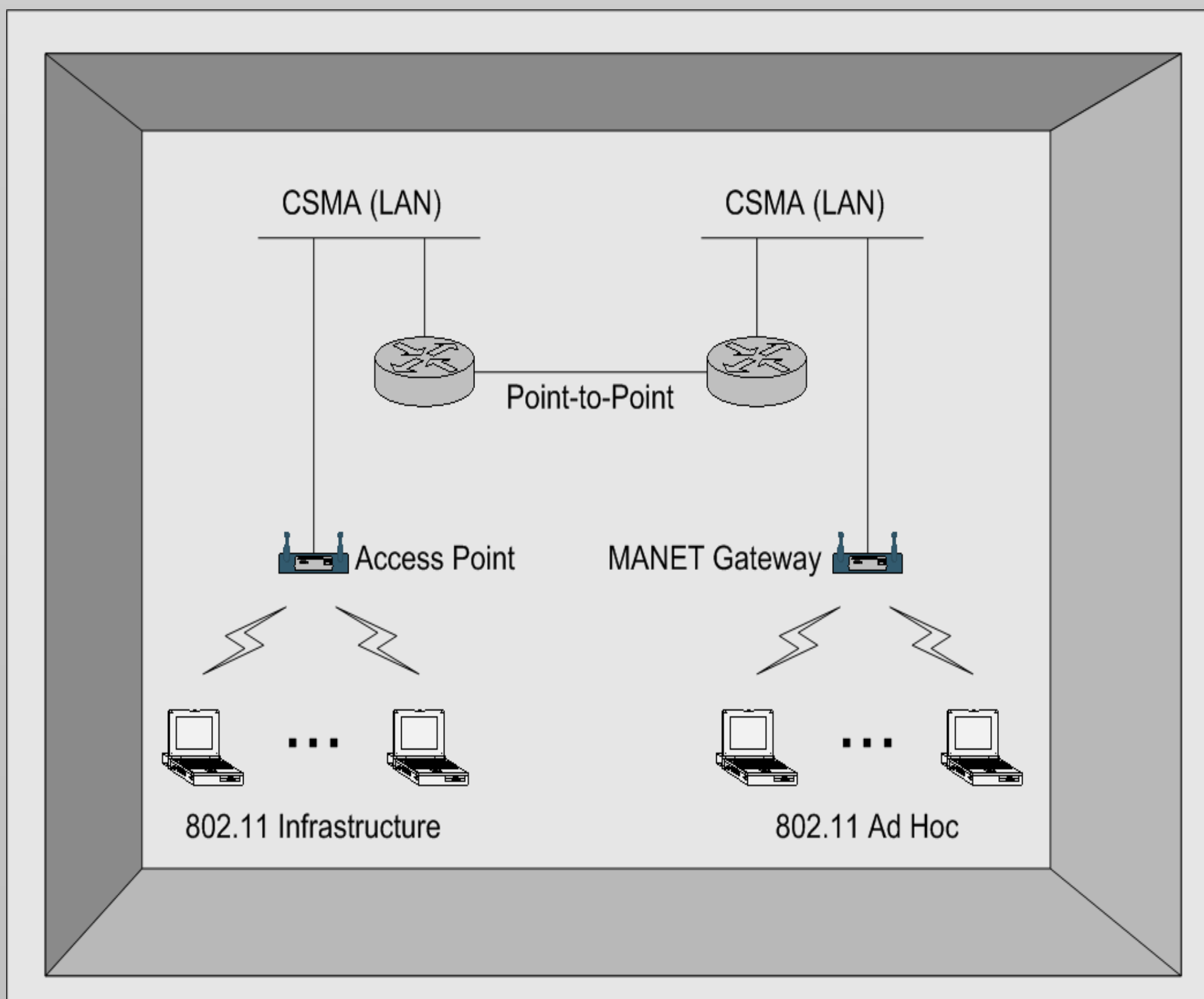
- ✦ Multi-interface wireless nodes; adhoc and infrastructure WiFi;
- ✦ Real-time scheduler, emulation and virtual machine integration;
- ✦ ns-3 process environment for easily ported applications;
- ✦ Network Simulation Cradle port of Linux 2.6.18 stack to ns-3.



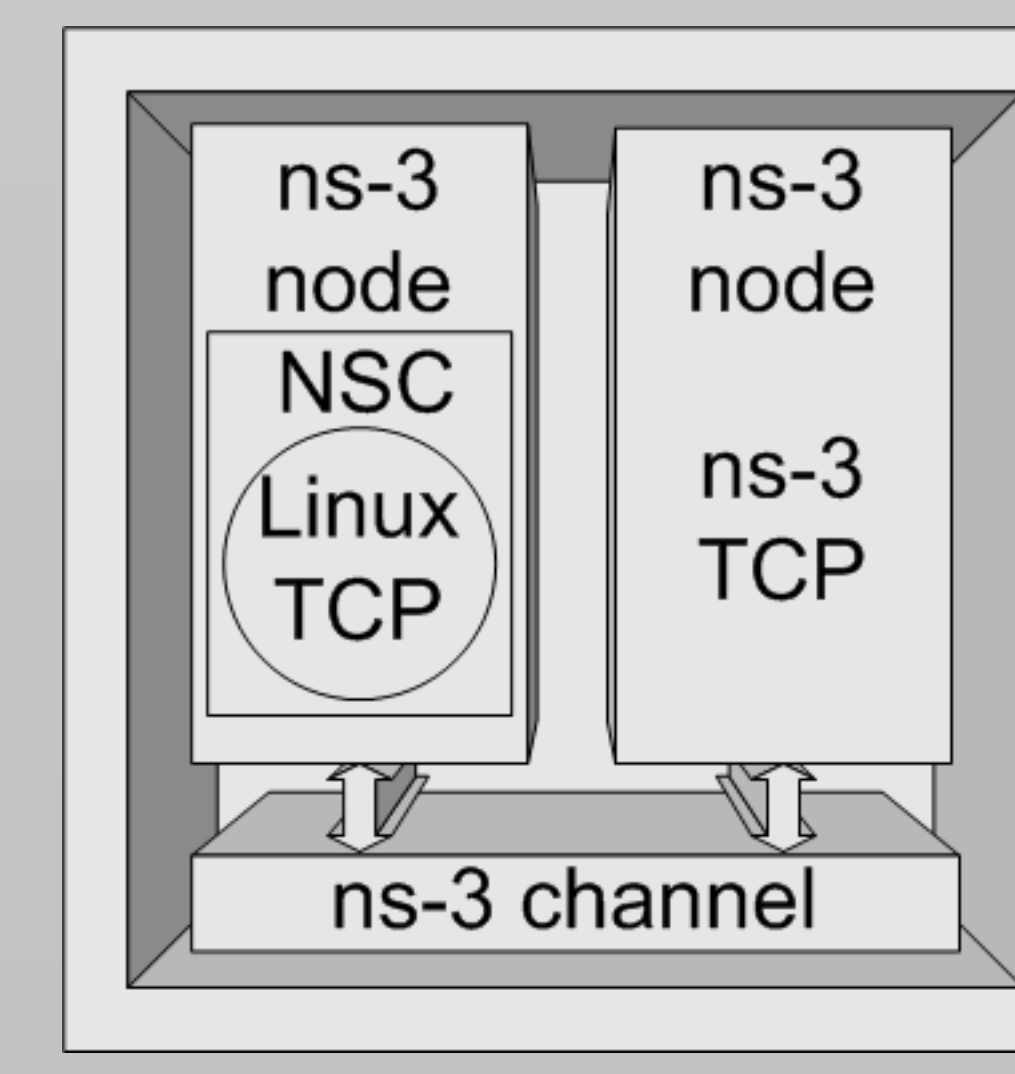
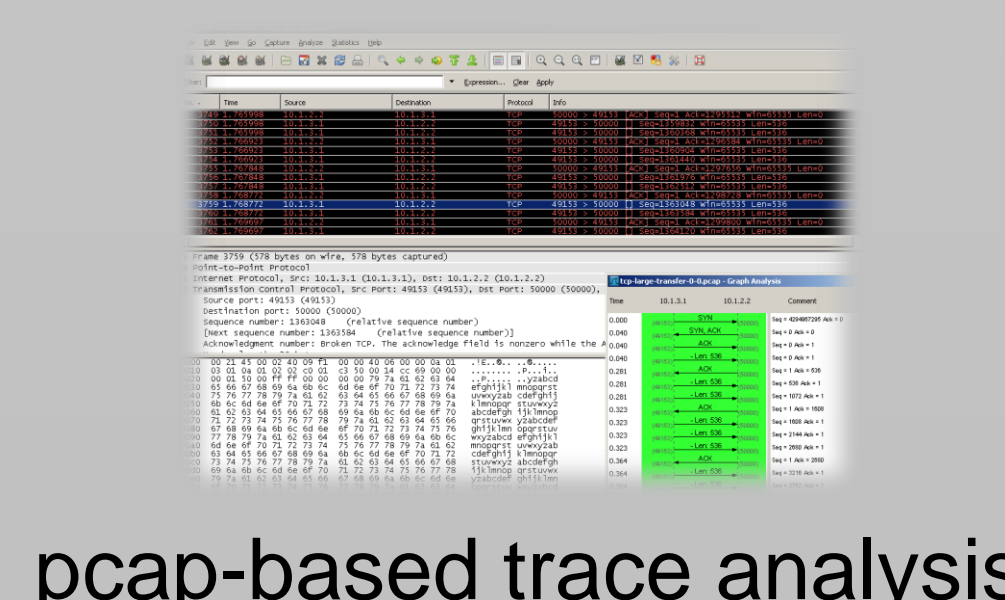
Today's Scenarios

A mixed-media topology

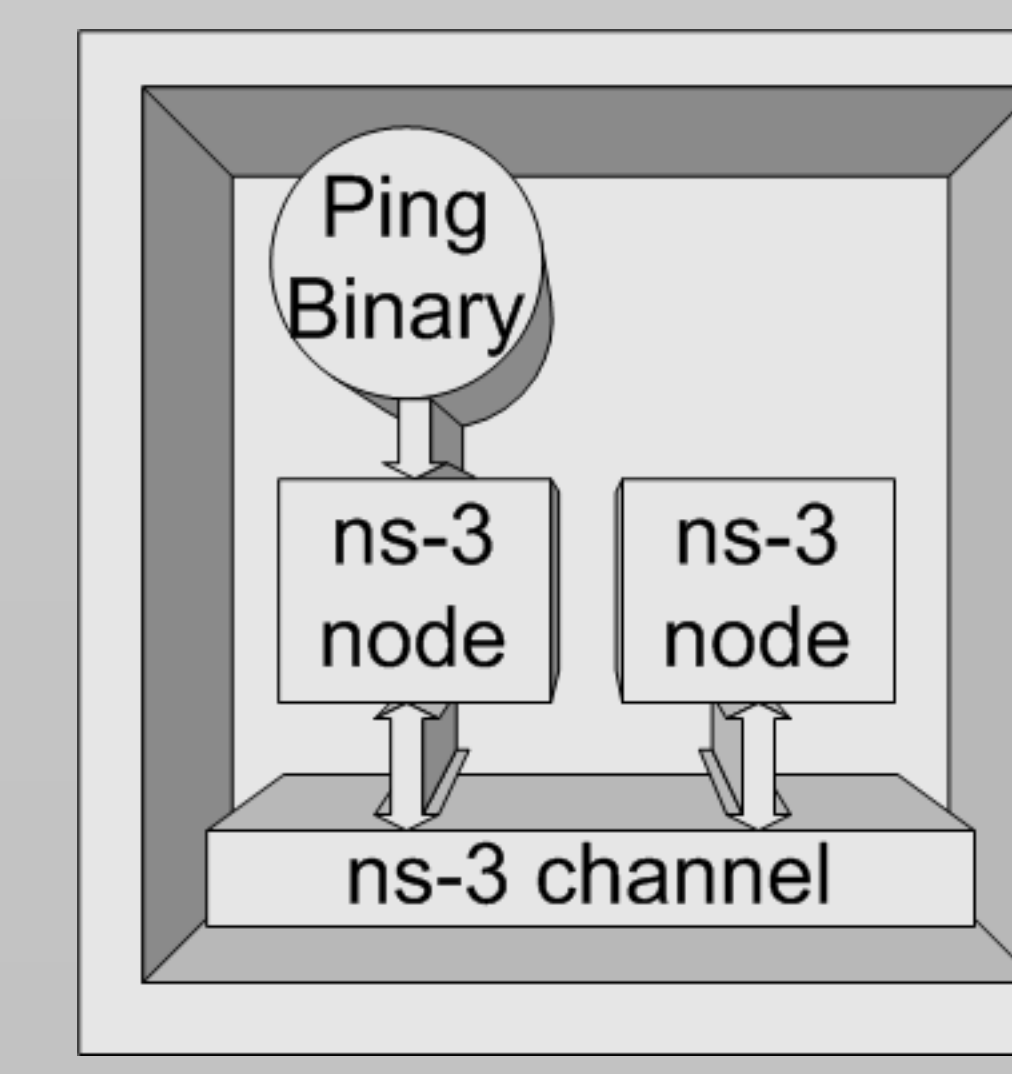
- ✦ 802.11 mobile ad-hoc mode with gateway;
- ✦ 802.11 infrastructure mode with access point;
- ✦ Multiple interface support;
- ✦ Dynamic routing;
- ✦ Ipv4 addressing;
- ✦ Generation of packet traces visible by WireShark;
- ✦ ns-2 style ASCII traces;
- ✦ Linux 2.6.18 TCP via NSC;
- ✦ Mobility models and course-change traces;
- ✦ On-Off Applications;
- ✦ Number of node configurable by command line.



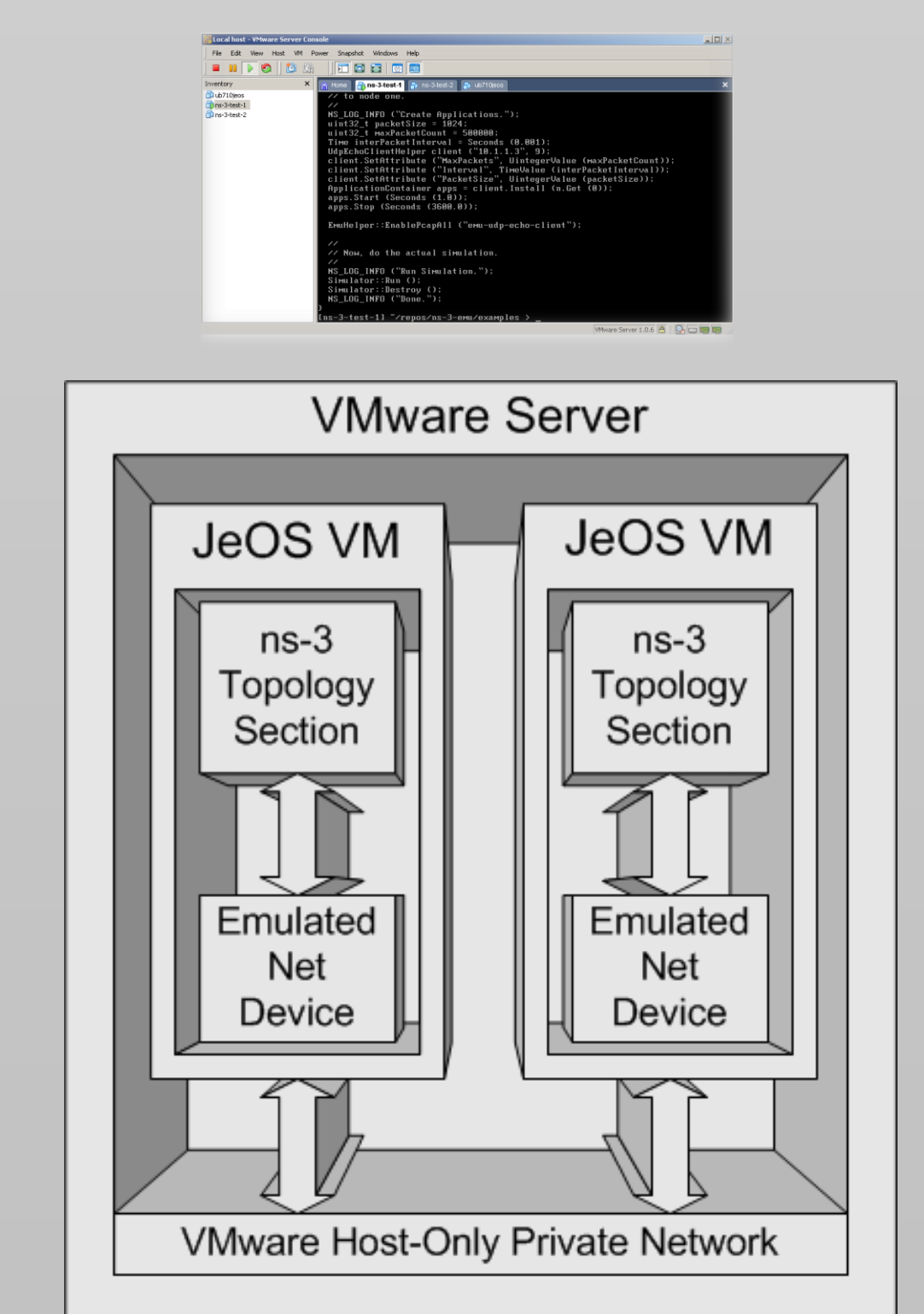
GTK-based configuration of ns-3 attribute system



An NSC (Linux 2.6.18) TCP sender talking to an ns-3 receiver



Multiple instances of unmodified ping program loaded with specialized ELF loader in ns-3 process environment



Partitioned topology run in real-time in emulation mode over a host-only VMware LAN.