

DNEMU: An Architecture for Distributed Network Emulation

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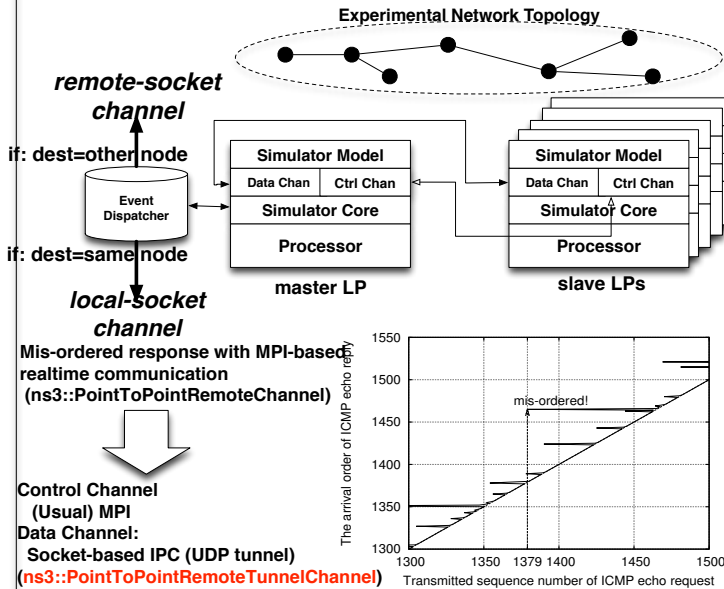
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Abstract

In this work, we propose the *Distributed Network Emulator* (DNEMU) that exploits existing MPI-based network simulation for the requirements of a planetary-scale network experiment. DNEMU addresses the issue of real-time execution with message synchronization through distributed processes, and enables us to evaluate protocols with actual background traffic using a fully controlled distributed environment. Through evaluation with micro-benchmarks, we find that our DNEMU prototype implementation is similar in terms of packet delivery delay and throughput to the existing non-virtualized environment. We also present a use-case of our proposed architecture for a large distributed virtual machine service in a simple control scenario involving actual background traffic on the global Internet. DNEMU will contribute to research in protocol evaluation and operation in a huge network experiment without interfering with the existing infrastructure.

The Architecture



Usage (just replacing with realtime scheduler)

```

1: main () {
2:   MpiInterface::Enable (&argc, &argv);
3:   GlobalValue::Bind ("SimulatorImplementationType",
4:     StringValue ("ns3::RealtimeSimulatorImpl"));
5:   if (rank == 0) { // master
6:     (configuration of AS1)
7:     (establish inter-connect)
8:   }
9:   else { // slaves
10:    (configuration of ASN)
11:    (establish inter-connect)
12:   }
13: }

```

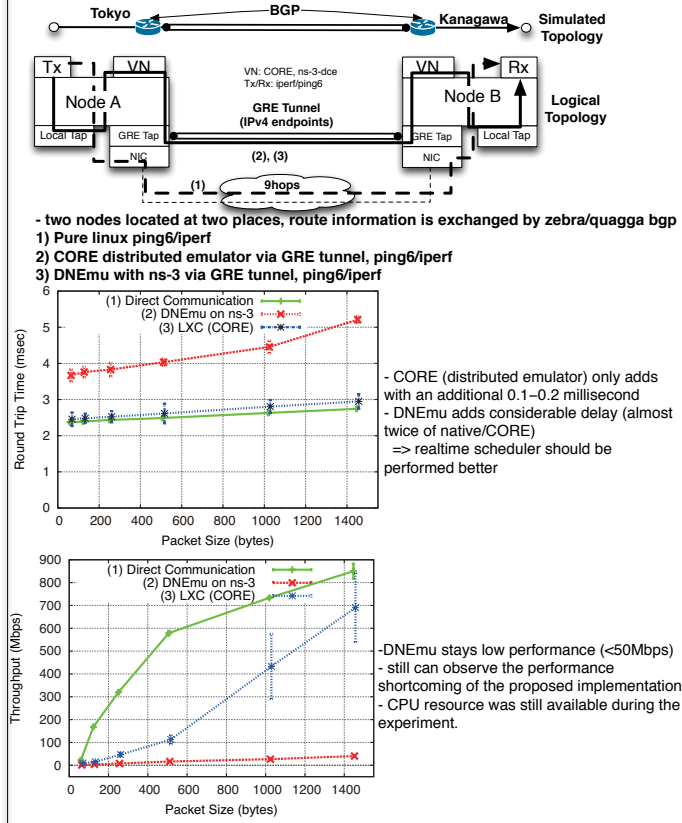
OR

```

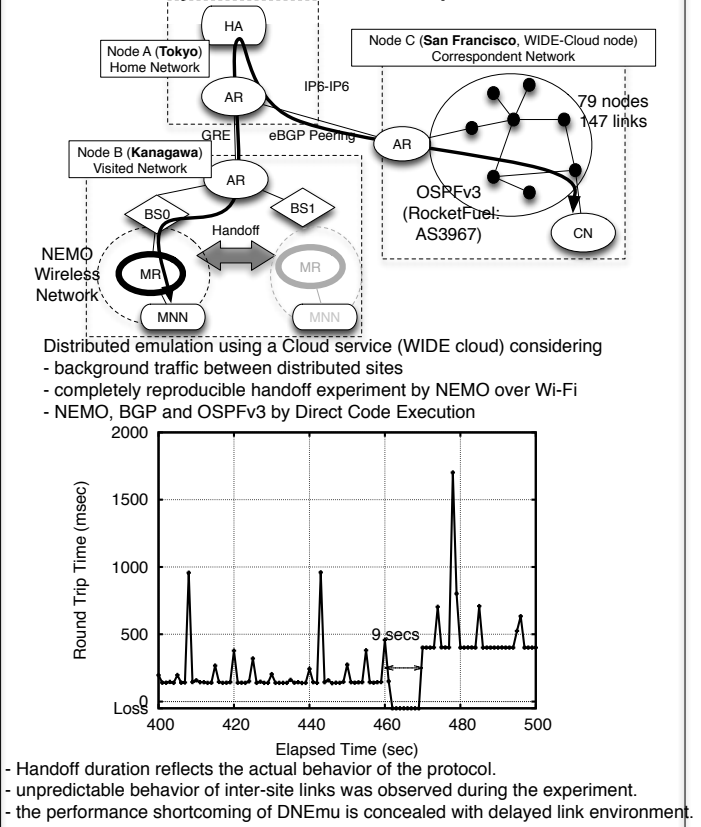
# mpirun -np 2 ./waf --run simple-distributed --
SimulatorImplementationType=ns3::RealtimeSimulatorImpl

```

Micro-Benchmarking



Use-Case (on Distributed VMs)



Related Work

NEPI: a general framework for network experiments with Python programming interface. Targeting on using multiple testbeds (ns3, Planetlab, Emulab, Orbit, etc) simultaneously.

CORE: a distributed emulator based on light-weight virtualization in kernel space (netns/IMUNES). Thus the performance is good (shown above results).

DNEMU focuses on a "single toolset" of the software with a built-in functionality of ns-3. Thus, can use transparently with existing ns-3 simulation models.