Managing heterogeneous ns-3 experiments with NEPI

Alina Quereilhac, Thierry Turletti, Walid Dabbous

{Alina Quereilhac, Thierry.Turletti, Walid.Dabbous}@inria.fr

I – NEPI

➢ What is NEPI?

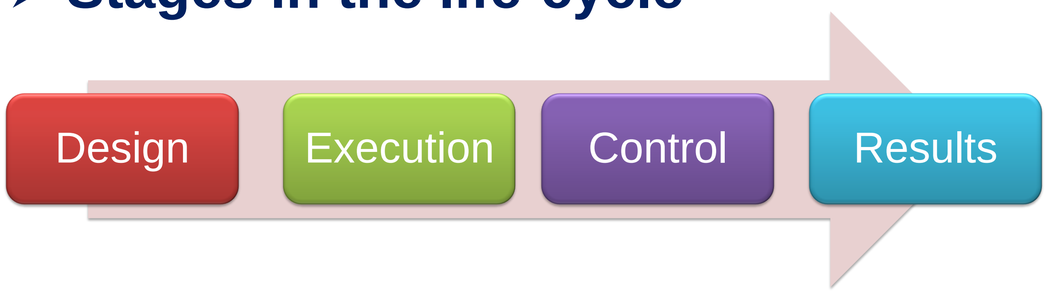
❑ The Network Experimentation Programming Interface (NEPI), is **an experiment life-cycle management tool** that enables conducting heterogeneous experiments where PlanetLab nodes and Emulated nodes can be seamlessly integrated with ns-3 simulations.

➢ Objectives of NEPI

❑ Support all stages in the experiment life-cycle.
❑ Automate repetitive and complex tasks.
❑ Provide a platform-independent API.
❑ Make it easy to conduct experiments that mix heterogeneous platforms (simulators, emulators, physical testbeds).

II – Life-cycle support

➢ Stages in the life-cycle



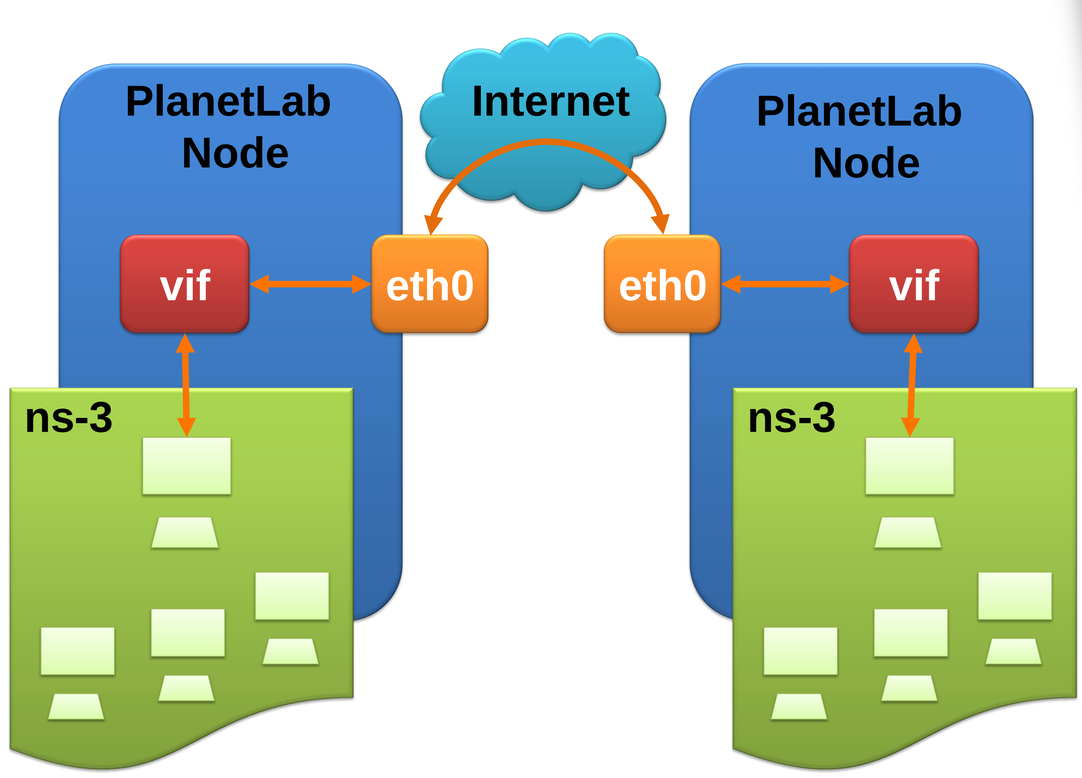
➢ Experiment design

❑ An experiment description (**ED**) is created by connecting **boxes**, representing experiment components, to other boxes on named ports called **connectors**. Each connector defines specific rules on how to create, configure and connect components during experiment deployment.

➢ Experiment execution

❑ The **ED** generated during design is used as the input for the Experiment Controller (**EC**). The **EC** is responsible for supervising the whole experiment, and instantiating the Testbed Controllers (**TC**) in charge of supervising the different experimentation platform instances involved in the experiment.
❑ Upon creation, the **EC** translates the **ED** into platform-independent messages (e.g. “create Node N”), and sends them to the corresponding **TC**s. When a **TC** receives a message, it performs a platform-specific action in response (e.g. a ns-3 **TC** would create a ns3::Node C++ object in the ns-3 simulation upon receiving a create node message).

III – Heterogeneous experiments



❑ NEPI allows to build scenarios where ns-3 simulated networks can be integrated with the PlanetLab network. This is achieved by connecting an edge node inside the simulation to a virtual interface in the PlanetLab node where the simulation is running. The traffic generated inside the simulation can then be tunneled across the Internet to reach other PlanetLab nodes.
❑ ns-3 simulations can also be integrated with emulated Ethernet networks, making it easy to inject in the simulation traffic generated by arbitrary unmodified applications.

IV – Graphical User Interface

❑ The Network Experimentation Frontend (NEF), is a Graphical User Interface for NEPI that allows to design experiments by drag & dropping and interconnecting boxes in a canvas.
❑ Deployment is done simply by selecting an option on the main Menu.
❑ NEF provides several runtime views to monitor the evolution of the experiment, such as:
  ○ **Topology View**, to change experiment configuration during runtime.
  ○ **Mobility View**, to view the 2D changes in mobile nodes
  ○ **Results View**, to list and retrieve experiment results

Inria Sophia Antipolis - Méditerranée
2004 route des Lucioles - BP 93
06902 Sophia Antipolis Cedex

Planète Project-Team: http://planete.inria.fr/
ns-3 project: http://www.nsnam.org/