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► To cite this version:

Alina Quereilhac, Thierry Turetti, Walid Dabbous. Managing heterogeneous ns-3 experiments with NEPI. WNS3 - Workshop on ns-3, Mar 2012, Desenzano, Italy. , 2012. hal-01270466

HAL Id: hal-01270466

<https://inria.hal.science/hal-01270466>

Submitted on 8 Feb 2016

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Managing heterogeneous ns-3 experiments with NEPI

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I – NEPI

➤ What is NEPI?

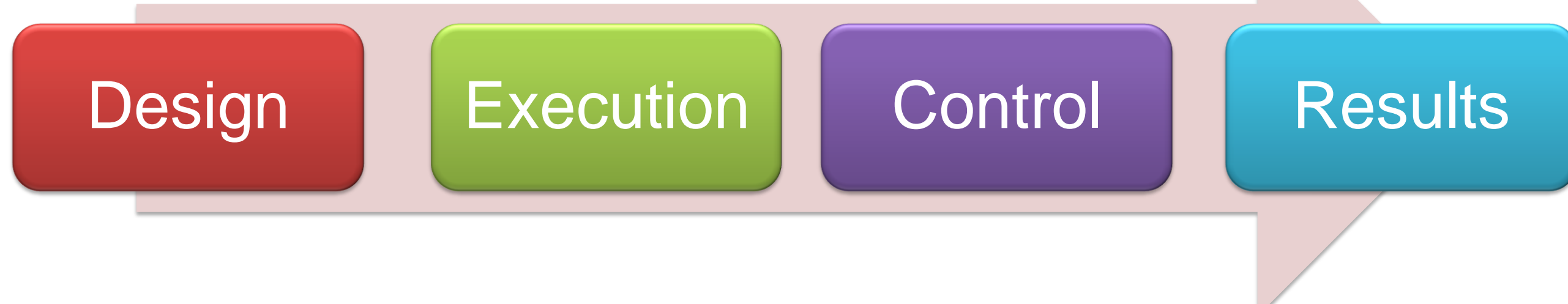
□ The Network Experimentation Programming Interface (NEPI), is an **experiment life-cycle management tool** that enables conducting heterogeneous experiments where PlanetLab nodes and Emulated nodes can be seamlessly integrated with ns-3 simulations.

➤ 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



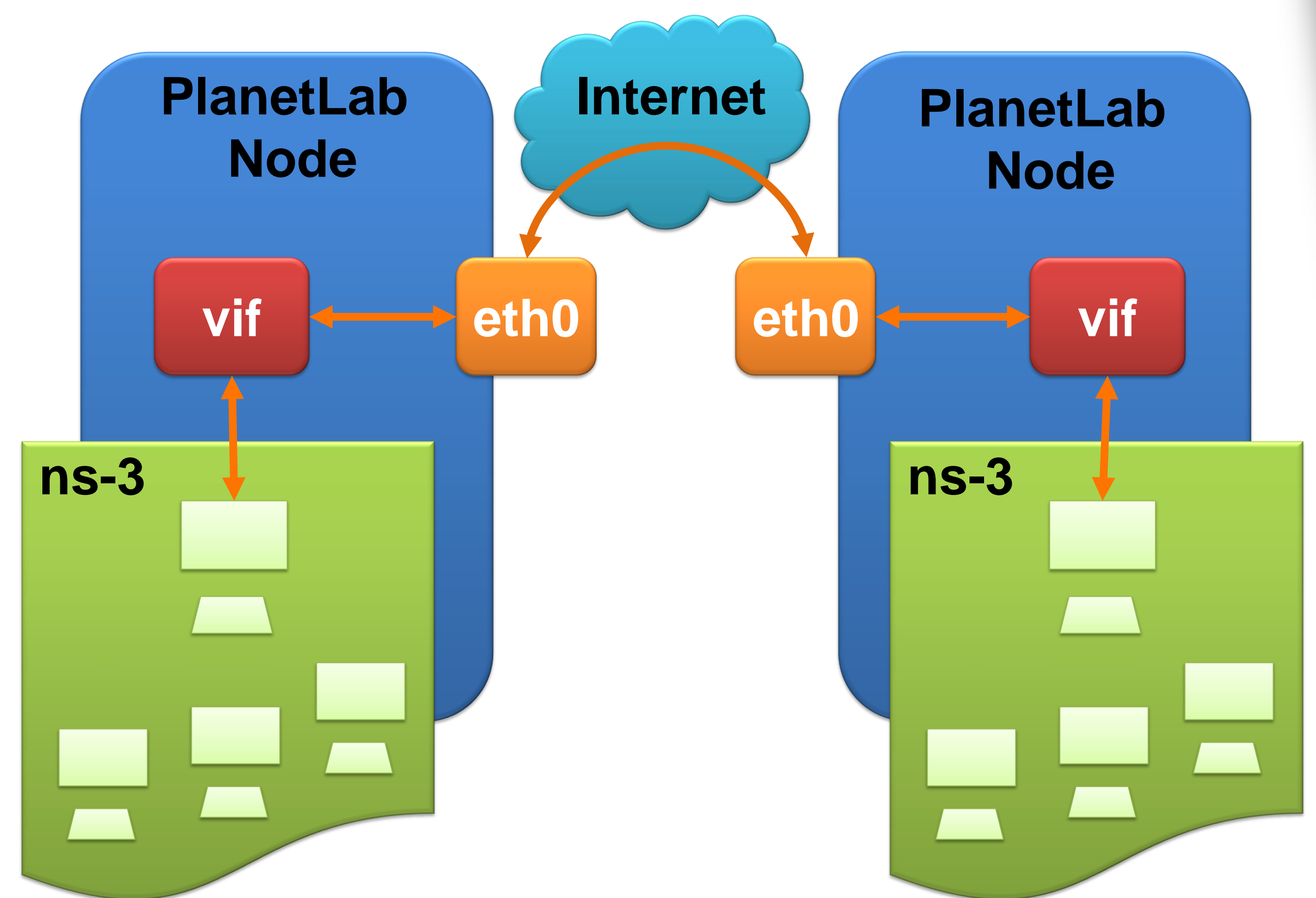
➤ Experiment design

- 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 **TCs**. 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