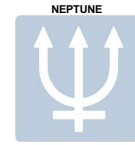




# NEPTUNE for fast and easy deployment of OMF virtual network testbeds



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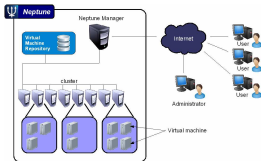
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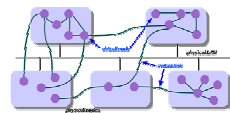


## NEPTUNE: Network Emulation for Protocol TUNning and Evaluation

- Open-source cluster-based network emulation system developed at University of Napoli Federico II
- Based on XEN for node virtualization
- Link virtualization through XEN virtual interfaces and NETEM
- Description of topologies in a proprietary XML format



Neptune architecture



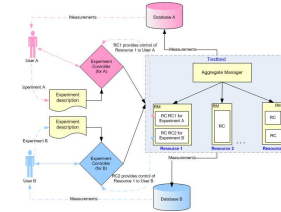
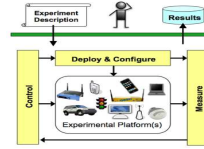
Virtual network topologies created by NEPTUNE on a cluster of computers

Further details on NEPTUNE in:

P. Di Gennaro, R. Bifulco, R. Canonico, **Link Multiplexing in a Xen-based Network Emulation System**, Proceedings of NGNM 2009, 6th International Workshop on Next Generation Networking Middleware, co-located with MANWEK 2009, October 27-28, 2009, Venice, Italy.  
Multicon Lecture Notes no. 11, S. Figueira, M. Curado (Eds.), Multicon Verlag, Berlin, pp.51-64.

## OMF: cOntrol and Management Framework

- OMF is a framework for the automatic execution of experiments on a networking testbed developed and maintained by NICTA and Winlab-Rutgers
- To execute an experiment, user supplies an "experiment description" specifying the testbed resources to be used and the steps needed to execute the experiment
- The main components of OMF are:
  - **Aggregate Manager**: controls the whole set of testbed resources
  - **Resource Controller**: manages a single resource, e.g. a node
  - **Experiment Controller**: accepts as input the Experiment Description and orchestrates the testbed resources in order to execute the experiment

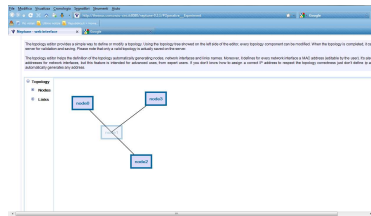


## Deployment of OMF-ready virtual testbeds in NEPTUNE

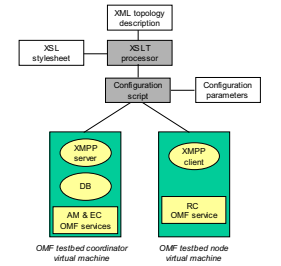
Our system allows the fast creation of "virtual OMF testbeds", a feature that can be useful for teaching OMF and demoing its capabilities.

Experiment execution:

- User first describes the network, i.e. nodes and links, by using the web interface of Neptune.
- User then adds to the system the machine which hosts the Aggregate Manager and the Experiment Controller
- User run a script which configures the OMF component taking in input the topology file created by Neptune (see Figure below).



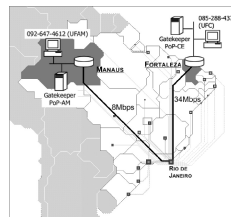
Virtual testbed design in the NEPTUNE environment



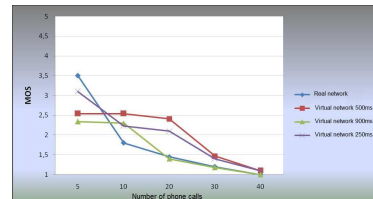
Automatic creation and configuration of the OMF virtual testbed

## Proof-of-concept experiments

- We created a virtual testbed replicating the experimental setup of a real network in order to run on it a VOIP experiment
  - Setup and picture taken from (\*):  
Carvalho, Mota, Aguiar, Lima, de Souza, and Barreto. An E-Model Implementation for Speech Quality Evaluation in VoIP Systems. In Proc of the 10th IEEE Symposium on Computers and Communications ISCC, June 2005
- The real network is composed of two satellite links, the first one between Fortaleza and Rio De Janeiro, the second between Rio de Janeiro and Manaus
- The objective of the test is to infer the setup of the real network, then change a parameter of the virtual testbed, i.e. the delay of one link, and evaluate its impact on the VOIP quality



Experimental setup described in (\*) and replicated on the OMF virtual testbed



Experimental results obtained from the virtual testbed compared against those reported in (\*) and obtained on a real network

## Future developments

- Integration of wireless emulation models and mechanisms into the virtual substrate provided by NEPTUNE
- Integration of a virtual testbed into public large scale testbeds such as PlanetLab Europe
- Authentication of users through PlanetLab