Cross-testbed experimentation using the Planetlab-NITOS federation ⋆ ⋆⋆

Nikos Makris[⊕], Stratos Keranidis[⊕], Dimitris Giatsios[⊕], Thanasis Korakis[⊕], Iordanis Koutsopoulos[⊕], Leandros Tassiulas[⊕], Thierry Rakotoarivelo[⋆], and Thierry Parmentelat[†]

[+]Department of Computer Engineering and Telecommunications, University of Thessaly, Greece
[○]Centre for Research and Technology, Hellas
[⋆]National ICT Australia (NICTA), Alexandria, Australia
[†]INRIA, Sophia Antipolis, France
{nimakris,efkerani,gidimitr,korakis,jordan,leandros}@uth.gr,thierry.rakotoarivelo@nicta.com.au,thierry.parmentelat@sophia.inria.fr

Abstract. Federation of network testbeds has been identified as a key goal in the experimental testbeds community, leading to a recent activity burst in this research field. In this demo, we describe a federated experiment between the NITOS wireless testbed and the Planetlab Europe (PLE) testbed. The federation scheme supporting this experiment was initially established during the Onelab2 EU project and was enhanced during the OpenLab EU project. The experiment constitutes in testing the implementation of an end-to-end delay aware Wi-Fi association scheme, in an environment where a wireless station situated at NITOS is sending traffic towards a remote PLE server.

1 Introduction

Federation between heterogeneous testbeds introduces several issues that arise due to the different nature of experimental resources, but more importantly due to the use of different software frameworks for resource control and management. In the present demo, we focus on the federation between Planetlab Europe (PLE) and NITOS testbeds, which took place during the Onelab2 project [1]. For the purposes of the demo, we present a simple Wi-Fi association experiment across the federated testbeds.

PLE [3] is the European portion of the publicly available PlanetLab testbed, a global distributed facility offering more than 1000 nodes worldwide. Each PLE node is a dedicated server, hosting multiple virtual machines referred to as *slivers*. Users access a number of slivers by means of so-called *slices*. These are a

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central notion in the Planetlab software framework, which deals with all the complex management tasks, such as authentication, resource allocation and accountability. Experimentation per se, however, is not treated in the Planetlab software and users may use their own solutions to orchestrate an experiment.

NITOS [2] is a publicly available testbed, located in the premises of University of Thessaly, and is mainly focusing on wireless experimentation. It has adopted OMF [4] as its control and management framework. The basic building blocks of OMF are the Experiment Controller (EC) and the Resource Controller (RC). During an experiment, the user interacts with an EC instance, which orchestrates the behavior of the experiment resources, on which RCs are running. OML, a measurement software framework closely related to OMF, is being used to handle experiment measurements at NITOS.

2 The federated PLE-NITOS architecture

The federated framework between NITOS and PLE is based on three main architectural components:

- **Single sign up**: Any user of PLE can log into the NITOS testbed portal without having to go through any extra registration process.
- **Deployment of OMF/OML at PLE resources**: PLE has incorporated OMF support on demand. For PLE slices with this tag activated, an OMF RC is installed and initiated in the related slivers.
- **XMPP Communication using slices**: The resources in an OMF experiment must be registered in a set of peering XMPP pubsub servers, in order to be able to communicate with the EC. Such a peering has taken place between the NITOS and PLE XMPP servers during the OpenLab project. This essentially means that an experimenter only needs to connect to a single testbed and has access to the resources of both testbeds through OMF commands. This architecture is depicted in Fig. 1.

3 The experiment

The experiment highlights the importance of association mechanisms in the general context of a network involving both wired and wireless (Wi-Fi) components. The scenario is that of Fig. 2. A wireless station (STA) operating in an environment with two available access-points (APs) is sending traffic to a remote destination through the Internet. In current 802.11 WLANs, the STA decides about upcoming associations by taking into account only RSSI measurements from neighboring APs. The goal of this experiment is to shed light on an important parameter, often neglected in this context, the fact that the perceived QoS of a station depends on end-to-end performance metrics, rather than AP-specific metrics. In particular, one specific metric is taken into account, the end-to-end delay.

In Fig. 3 we can see a snapshot of the observed measurements during the experiment. It is clear from the figure that the station is always associated with the access-point that offers the lowest end-to-end delay to the stream towards the remote destination.

4 Conclusion

The federation between the NITOS and PlanetLab Europe testbeds was demonstrated by means of an experiment spanning both testbeds. There is an ongoing effort to extend the federation bonds between the two testbeds, particularly those related to trust management and resource allocation functionalities.

References

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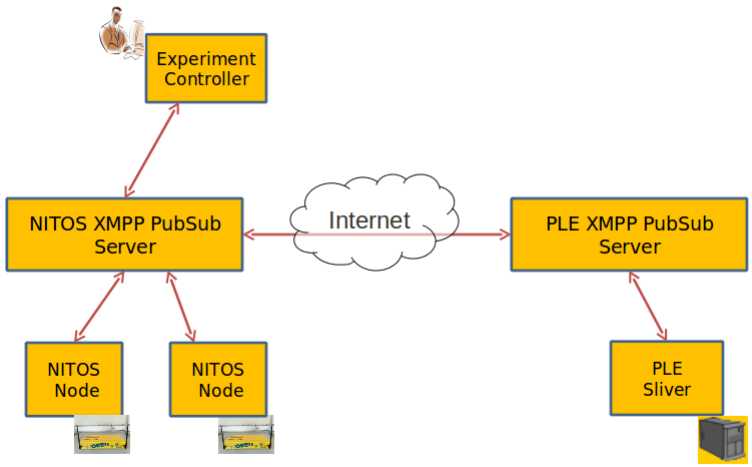

Fig. 1. PLE-NITOS federation architecture

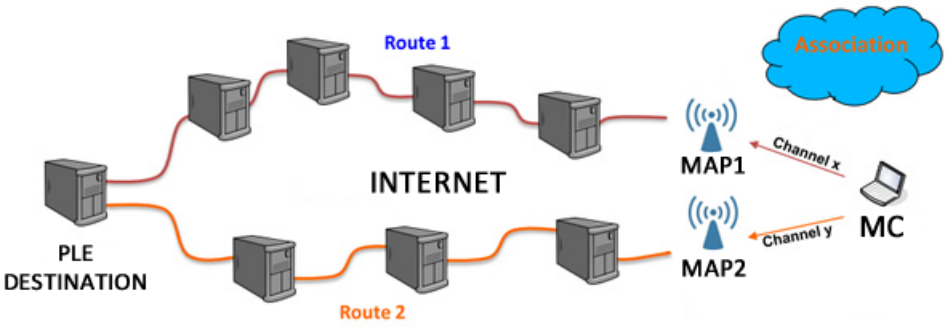

Fig. 2. Experiment topology

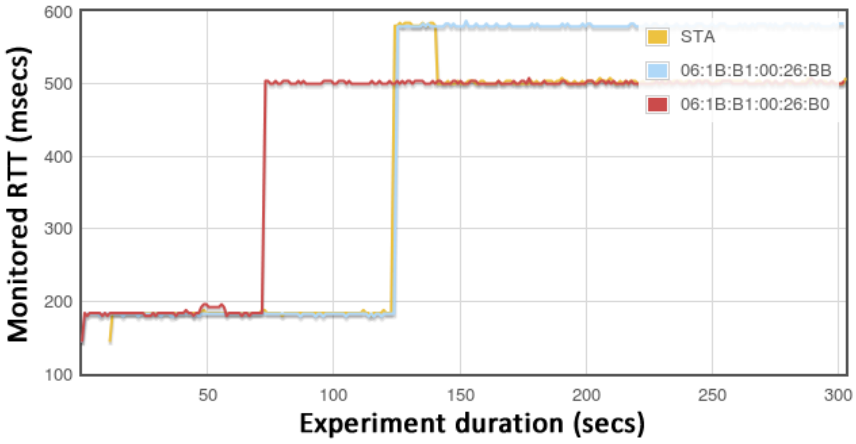

Fig. 3. Snapshot of experiment measurements