ICN personalized global-scale testbed using GTS

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ABSTRACT

The demonstration presented in this document aims to show how to use the GÉANT Testbed Service (GTS) to create personalized global-scale ICN testbeds. The demonstration will illustrate to the audience how to easily define network topologies and deploy ICN experiments based on both NDN and CICN implementations. Additionally, it will show how using GTS in combination with vICN, the orchestration and management service from the CICN project, most of the tasks necessary for an ICN deployments can be automated, speeding up the configuration of ICN experiments. As use-case scenarios, other than sample applications from NDN and CICN, we will deploy an implementation of the SAID protocol developed from CICN code.

CCS CONCEPTS

• **Networks → Network experimentation**;

KEYWORDS

Information Centric Networks, GÉANT Testbed Service

1 INTRODUCTION

Research in Information Centric Networking (ICN), and particularly in Content Centric Networks (CCN) [1] architecture, has reached an incredible level of maturity, with several research projects, like Name Data Networking (NDN) [2], that clearly show the benefits of this communication paradigm.

Simulated environments allow ICN researchers to test out their proposals and prototypes, but to make a step forward in the everyday adoption, global-scale experiments are fundamental. However, those type of deployments are often hard to configure and not all the researchers have the needed technical skills. In addition, the cost of the required hardware can be exorbitant, in particular for academic organization.

Geographically distributed testbeds created in coordination with different organizations are really helpful to increase the available hardware resources, but they still present some drawbacks when it
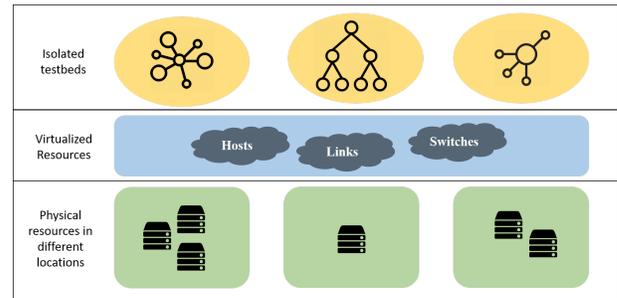
Figure 1: GTS resources architecture

comes to complex experiment deployments. Among those, probably the most important is the NDN testbed [3], an impressive deployment that enables a real global NDN-based network with 37 nodes spread across several countries. This type of deployment, although ideal to test out applications that make use of the established NDN architecture and implementation, present some issues when dealing with experimental deployments:

- it is not possible to have real-time control of the nodes/routers of the testbed;
- it is not possible to create specific network topologies;
- experiments are not isolated, so results can be affected by other activities on the testbed;
- it is not possible to easily and rapidly test temporary modification to the nodes/routers (i.e., modification to the forwarding engine).

This demonstration will show our experience with the GÉANT Testbed Service (GTS) [4] to create personalized, isolated and global-scale testbeds for ICN experiments as a solution of the issues mentioned above. GTS is a service for network researchers that offers personalized testbeds using virtual resources (i.e, Hosts, Links, OpenFlow Switches). The virtual resources are abstraction of physical installations organized in pods distributed in different geographical locations (Fig. 1). During the creation of a testbed, whose topology and resource characteristics can be described using a special DSL (Domain Specific Language), several parameters can be set, including the physical location where the virtual resource has to be hosted. Using GTS we created testbeds for both NDN [5] and CICN [6] implementations, but we claim that the platform is suitable for any type of implementation.

The rest of this document gives an overview of the demo we plan to realize and the different aspects involved in the creation of a personalized global-scale ICN testbed. During the demo we will also show the benefits of this approach deploying our actual ongoing experiment with the SAID [7] implementation made from CICN code.
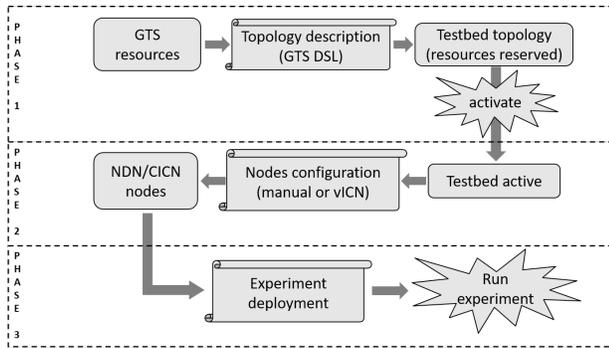
Figure 2: Demo phases overview

2 DEMO OVERVIEW

The demo is ideally separated in three phases (Fig. 2): i) topology setup, ii) nodes configuration and iii) experiment execution. Additionally, we would like to allow the audience to participate in the demo and test out their custom deployments under our guidance.

2.1 Topology setup

The testbed configuration is done by the definition of the network topology via the DSL and uploaded to the GTS service as a text file. In this phase it is possible to select the number of nodes (virtual machines) to be deployed, their physical location (at least 3 physical location will be available during the demo), and their interconnections. Subsequently, a reservation of the resources can be executed and, if successful, is possible to activate the testbed.

The access to the testbed internal network can be done using a VPN (credentials to access the VPN are automatically granted for each GTS project).

2.2 Nodes configuration

Each node of the topology is essentially a virtual machine (VM) deployed on the physical location selected in the previous phase. When the testbed is active, the VMs can be configured as ICN nodes. Because VMs have access to Internet, the needed packages can be installed using public repositories (both NDN and CICN have public repositories for the major linux distributions).

2.3 Experiment execution

For the experiment phase our prototype of the SAID protocol is used as use-case scenario. The implementation is related to the *any next packet* (ANP) forwarding behavior added to the socket-based forwarder, called METIS, of the CICN project. The experiment will show how the ANP forwarding works by monitoring one producer and two or more consumers deployed in different locations (Fig. 3).

2.4 Audience interaction

The audience will be invited to try out the tools we presented in the demonstration. To help in this phase, other than step-by-step instructions, some basic deployments will be provided with example applications taken from both NDN and CICN projects.
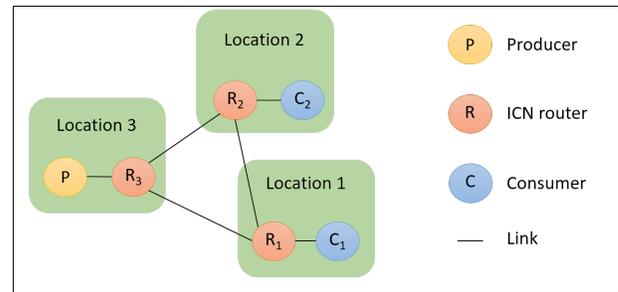

Figure 3: SAID experiment deployment

3 CONCLUSIONS

We presented a demonstration of how to create personalized, isolated testbeds for ICN experiments in a fast and easy way using the GTS service. We claim that this service would be incredibly useful for ICN researchers and will help not only to speed up the deployments of the experiments, but also to provide an environment to build experimental global-scale deployments without any effort in terms of hardware requirements, configuration and management.We also believe that such service can be used not only when special deployments are required, but also as an extension to add new functionalities to existing deployments supporting the creation of federated testbeds.

To the extent of our knowledge, although the existence of similar projects as the NDN Testbed in Open NL [8], any of those are capable of such level of customization and resources abstraction, allowing also non-networking experts to easily deploy their ICN experiments.

As a next step, we plan to further integrate the GTS service with CCN entities, allowing the direct description of a CCN deployment via the DSL, and work on the interconnection to the NDN Testbed.

4 ACKNOWLEDGMENTS

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