UNIFY Service Provider DevOps: opportunities for NRENs

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The FP7 UNIFY[1] project enables flexible and rapid service introduction in software-defined infrastructures combining compute, network and storage resources within the telecom carrier network domain that supports service chaining and network function virtualization. To efficiently deal with the large-scale infrastructure and diverse service demands from users, the UNIFY architecture follows an abstract design principle based on the concept of layering, communication interfaces, and recursive decomposition. The UNIFY framework is built on the three main layers, namely, service layer, orchestration layer, and infrastructure layer. The orchestration layer plays a pivotal role in terms of programmability in the UNIFY infrastructure since it is responsible for translating a user service demand onto capabilities of physical and virtual resources interpreted by the infrastructure layer.

The roles of developers and operators in a software-defined telecom infrastructure change with respect to traditional TMForum or ITIL definitions. We discussed these changes in a draft submitted to the NFV Research Group at IRTF [nrfrgdraft]. Developer roles are related to either defining the service to be provisioned in terms of a service graph (we call this role Service Developer) or performing the actual software development for a particular Virtual Network Function that is to be deployed on the infrastructure (we call this role VNF Developer). Operator roles focus on assuring the availability and reliability of the software defined infrastructure resources, and potentially providing support to VNF Developers during joint investigations. Programmability of the infrastructure resources and virtual network functions, including fine-granular control of monitoring and troubleshooting functionality, is key to facilitating the interaction between Developers and Operators along DevOps principles.

A significant part of the configuration management tasks of Operators, as well as of Developers attempting to test their code in production-like environments, are expected to be automated by resource orchestration processes in the UNIFY architecture [D2.2]. The SP-DevOps Observability process

[1] https://www.fp7-unify.eu/

in turn is expected to automate a significant part of the tasks related to monitoring and performance management [D4.1]. In this presentation, we will focus on functionality related to the Observability process as basic building blocks are more advanced in terms of development.

Many of the requirements telecom carriers have towards DevOps processes supporting software-defined infrastructure, which were outlined in [nrfrgdevops], apply directly to NREN environments. NRENs operate complex infrastructures that combine cloud (compute, network and storage), wide-area networks and in some cases campus networks as well. This infrastructure is expected to be highly available and manageable. In the presentation, we will discuss the requirements in more detail based on the evolution of the NFVRG draft between now and May 2015.

NRENs have for a long time evolved functionality in their infrastructure in collaboration with highly demanding users (network researchers in the beginning, followed by advanced applications). As such highly demanding users develop capabilities to optimize their applications for different scenarios and the network virtualization increases the programmability of NREN infrastructure, we consider that a significant part of them will transition to a role which is very close to the UNIFY VNF Developer. Highly demanding users will need to be able to deploy their own virtual network function code within the NREN infrastructure in an isolated environment, monitor and test the functionality and then potentially transition it towards a wider-available service together with the NREN. These users, as well as operators, would benefit from increased observability support in the infrastructure, in particular if such support could be made available through APIs that complement existing initiatives like PerfSONAR.

Finally, we present two tools developed to support the SP-DevOps Observability process with particular focus on software-defined networks. One tool, developed at Ericsson Research, allows evaluating packet loss and potentially delay on traffic described using aggregate flow descriptors in OpenFlow-compatible switches [jm2014]. The tool is under development and at TNC we will show results from the prototype that validate the tool functionality and evaluate its performance, as well as discuss our implementation of the APIs that enable integrating it in the UNIFY environment for automation as outlined in [M4.1].

A second tool, developed at SICS, supports the SP-DevOps Observability process addresses resource-efficient monitoring of network load. Current state of the art methods based on load averages either give very low accuracy, since averages over longer durations hide momentary overload situations, or very high monitoring overhead, since short duration averages have to be distributed over the network and aggregated at central locations at a very high rate. A tool capable of producing accurate load estimates locally, close to where the raw data is produced was developed and evaluated in [ks2015]. The approach is based on local high rate flow counter updates, including a flexible mechanism to install and modify monitoring functions that read the counters at variable rates. We show how to characterize the traffic in a highly compact way by using only the estimated parameters of the distribution, which enables prediction of the risk of link overload. We will also compare the UNIFY API integration of the two tools with relevant parts of the PerfSONAR API and briefly outline a DevOps scenario in an NREN environment that could make use of these capabilities.

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Vitae

Catalin Meirosu joined Ericsson Research in Stockholm, Sweden in 2007. Prior to Ericsson, he was a project development officer with TERENA in Amsterdam. Catalin holds an MSc (2000) and a PhD in telecommunications (2005) from Politehnica University, Bucharest, Romania. He was a project associate at CERN, Geneva, Switzerland during his PhD. Catalin has four granted patents and co-authored over thirty scientific papers. He is currently developing DevOps capabilities for service providers in the FP7 UNIFY project. Catalin is a Guest Editor for the IEEE Communications Magazine Special Issue on Network and Service Virtualization, to be published in February 2015.