NexComm 2019
The Eighteen International Conference on Networks
ICN 2019

Special Track on
Advances in Software Defined Networking and Network
Functions Virtualization
SOFTNETWORKING 2019

Introduction

Eugen Borcoci
University Politehnica Bucharest
Eugen.Borcoci@elcom.pub.ro

NexComm 2019, Valencia, 24-28 March 2019
Special track Program

ICN3 / SOFTNETWORKING : Software Defined Networking
Session chair: Jaime Lloret Mauri

Introduction / Editorial [PRESENTATION]
Eugen Borcoci

The Strategic Role of Inter-Container Communications in RAN Deployment Scenarios
Carlo Vitucci, Luca Abeni, Tommaso Cucinotta, Mauro Marinoni

IaaS Environment Creation Experiments With OpenStack
Silviu - Gabriel Topoloi, Eugen Borcoci

Open Discussion and Closing Remarks [DISCUSSION]
Eugen Borcoci

NexComm 2019, Valencia, 24-28 March 2019
SDN & NFV

Novel, complementary technologies developed in the last decade
- new paradigms in the process of moving towards open software and network hardware

High interest for industry, academia, operators, etc.
- Many studies, projects, standards, implementations/deployments
- Many organizations: Standardization, Forums, etc. – working in this area providing large number of specs
- Large area of applications to be supported by SDN&NFV: Cloud/Edge computing, 4G/5G networks, IoT, IoV, ..

SDN&NFV integration of architectures - important for transition from the static design of conventional networks to an intelligent, open network environment.

Still many research open issues exist – especially in the area of efficient cooperation between the two technologies

NexComm 2019, Valencia, 24-28 March 2019
SDN
Programmable networks - by separating the control and data planes


NexComm 2019, Valencia, 24-28 March 2019
NFV
virtualize network functions and deploy them into general purpose HW


NexComm 2019, Valencia, 24-28 March 2019
- SDN and NFV - complementary

SDN: separation
DPI --- CPI, MPI

NFV: moves down the border between SW/HW (by virtualisation)
SDN and NFV- integrated architecture- Example

- 5G Network slicing deployment applying NFV concepts to achieve isolation

Source: ETSI GR NFV-EVE 012 V3.1.1 (2017-12), Release 3; NFV Evolution and Ecosystem; Report on Network Slicing Support with ETSI NFV Architecture Framework

NexComm 2019, Valencia, 24-28 March 2019
SDN&NFV integration - Open research issues- generic list

- Use cases- requirements

- Architectural aspects – NFV-SDN cooperation (hierarchies?)

- Performance-related aspects of NFV
  - Real-time response, VM moving

- Management and control, operation
  - Resource (re) allocation optimization
  - Dynamicity and flexibility related aspects
  - AI and Cognitive management introduction

- SDN-NFV cooperation in slicing environment (5G challenges)
  - Multi-Tenant, Multi-Service, Multi-Domain/Operator Support
  - Security and isolation mechanisms between slices
  - Dynamic scaling of slice instances
  - Scalability (multi- VIM, multi-SDN controllers)

- NFV/SDN - Data and functional models
SDN&NFV integration - Open research –specific issues
- Deployment of Network Services- related to Service Function Chaining (SFC)
  - VNF Performance (Orchestration, isolation, security, etc.)
  - VNFs Scheduling and Placement
  - High-level Policies
  - Traffic management
  - Dynamic service scaling (at runtime)
- Cooperation Cloud/Fog/Edge computing – in NFV/SDN approach
- Security (centralization versus distribution balance)

Implementation aspects
- Which stack/framework? (many options)
- Convergence aspects among different specs/organizations:
  - ETSI, ONF, IETF, ITU, 3/5GPP, Linux Foundation, Industry specs,
  ...
- Backward compatibility of NFV/SDN systems w.r.t. traditional systems

See also: M.S. BONFIM, et.al., Integrated NFV/SDN Architectures: A Systematic Literature Review 4 Jan 2018
SDN&NFV integration - Open research –specific issues
Taxonomy of SDN/NFV architecture design

Source: M.S. BONFIM, et.al., Integrated NFV/SDN Architectures: A Systematic Literature Review 4 Jan 2018
NexComm 2019, Valencia, 24-28 March 2019
SDN&NFV integration - Open research –issues

Implementation aspects
- Which stack/framework? (many options)

OPNFV Open Platform for NFV
- Objectives: OPNFV - Open Platform for Networks Functions Virtualization (2014, Linux Foundation)
  - OPNFV facilitates the development and evolution of NFV components across various open source ecosystems.
  - Through system level integration, deployment and testing, OPNFV creates a reference NFV platform to accelerate the transformation of enterprise and service provider networks.

- OPNFV aims to provide open source reference implementation of some of the key ETSI NFV concepts by integrating upstream projects such as OpenStack, OpenDaylight, KVM, etc
- Other projects integrated with OPNFV: OPEN-O (part of ONAP), OpenBaton and Tacker.

Access: https://www.opnfv.org/

See also: M.S. BONFIM, et.al., Integrated NFV/SDN Architectures: A Systematic Literature Review 4 Jan 2018

NexComm 2019, Valencia, 24-28 March 2019
SDN&NFV integration - Open research –issues

Implementation aspects
- Which stack/framework ? (many options)
- MANO implementation examples
  - OSM  Open-Source MANO (~2016)
    - ETSI project
    - Objective: reference implementation of the ETSI MANO specification, to meet the requirements for orchestration of production NFV networks
    - OSM initiative is based on open-source tools like GitHub
  - Examples of Software components
    - VIM connector corresponding to Virtual Infrastructure Management (VIM)
    - Canonical JuJu corresponding to VNF Management (VNFM)
    - Rift.io’s Rift ware corresponding to NFV Orchestration layer (NFVO).
    - Access: https://osm.etsi.org/

See also: M.S. BONFIM, et.al., Integrated NFV/SDN Architectures: A Systematic Literature Review 4 Jan 2018
NexComm 2019, Valencia, 24-28 March 2019
**SDN&NFV integration - Open research – issues**

**Implementation aspects**
- Which stack/framework? (many options)
- MANO implementation examples

**ONAP** Open Network Automation Platform (~2016)
- **Type:** the project evolved from the former Linux Foundation Open-O and ATT ECOMP (Enhanced Control, Orchestration, Management and Policy) MANO projects originally initiated by industry governed by the Linux Foundation (to form one unique code)
- **Objective:** building a comprehensive framework for real-time, policy-driven *software automation of VNFs*.

- It enables the design, creation, and orchestration of services on an infrastructure layer on top of individual VNF or SDN—or even a combination of the two.

- **Access:** [https://www.onap.org/](https://www.onap.org/)

*See also: M.S. BONFIM, et.al., Integrated NFV/SDN Architectures: A Systematic Literature Review 4 Jan 2018*

NexComm 2019, Valencia, 24-28 March 2019
SDN&NFV integration - Open research – specific issues

Implementation aspects
- Which stack/framework? (many options)
  - **OpenStack Tacker (~2015)**
    - **Type:** OpenStack Tacker is under the OpenStack projects
    - **Objective:** Tacker builds an open orchestrator with a general purpose VNF Manager to deploy and operate VNFs on an NFV platform.
    - Tacker is an official OpenStack project building a Generic VNF Manager (VNFM) and a NFV Orchestrator (NFVO)
    - to deploy and operate Network Services and (VNFs) on an NFV infrastructure platform like OpenStack
    - It is based on ETSI MANO architecture
  - **Access:** [https://wiki.openstack.org/wiki/Tacker](https://wiki.openstack.org/wiki/Tacker)

See also: M.S. BONFIM, et.al., Integrated NFV/SDN Architectures: A Systematic Literature Review 4 Jan 2018

NexComm 2019, Valencia, 24-28 March 2019
SDN&NFV integration - Open research –specific issues

Implementation aspects
  - Which stack/framework ? ( many options)
    - OpenBaton (~2015)
      - **Type:** open source project- by Fraunhofer FOKUS. Open Baton is an extensible and customizable NFV MANO-compliant framework.
      - **Objective:** provides an implementation of the ETSI Management and Orchestration specification.
      - **Access:** https://openbaton.github.io/

See also: M.S. BONFIM, et.al., Integrated NFV/SDN Architectures: A Systematic Literature Review 4 Jan 2018

NexComm 2019, Valencia, 24-28 March 2019
SDN&NFV integration - Open research –specific issues

Implementation aspects
- Which stack/framework? (many options)
  - **Type:** SONATA is an open-source project based on the ETSI MANO specification.
  - **Objective:** to develop a NFV framework
    - providing to third party developers a programming model
    - a suite of tools for virtualized services integrated with an orchestration system
    - SONATA reduces TTM of networked services, by optimizing and reducing the costs of network services (NS) deployment in telecom industry
    - It builds a service programming and orchestration framework providing a development tool-chain and a Srv DK development kit for virtualized services integrated with a service platform and orchestration system
  - **Access:** [http://sonata-nfv.eu/](http://sonata-nfv.eu/)

See also: M.S. BONFIM, et.al., Integrated NFV/SDN Architectures: A Systematic Literature Review 4 Jan 2018

---

NexComm 2019, Valencia, 24-28 March 2019
THANK YOU!