



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

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- **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]**
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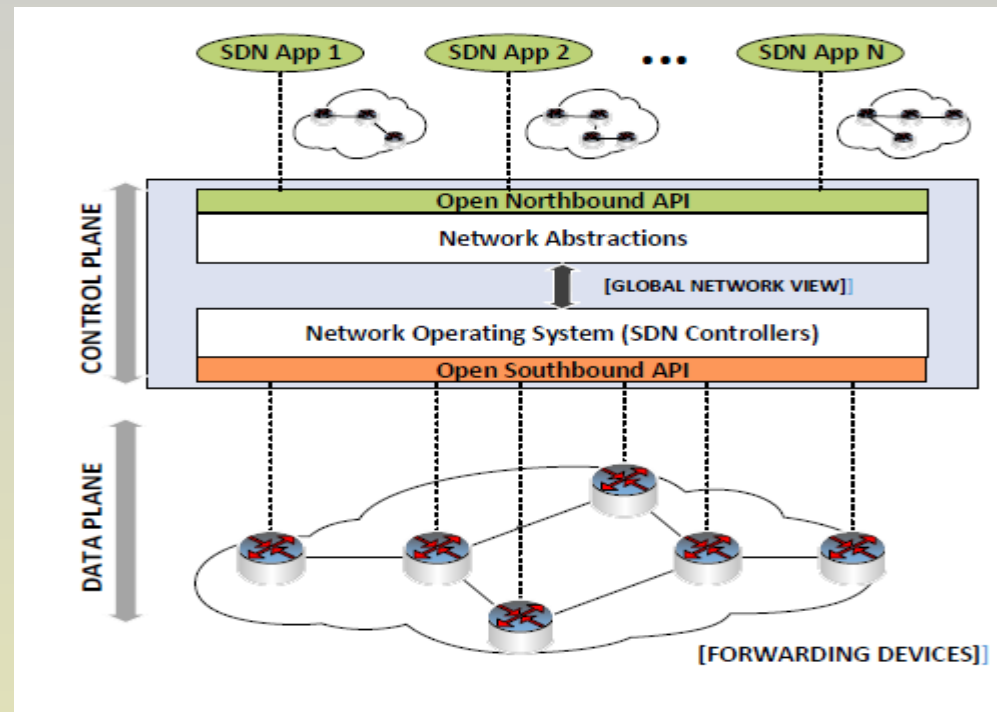
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- **SDN & NFV**
- Novel, **complementary technologies** developed in the last decade
 - **new paradigms** in the process of moving towards open software and network hardware
- High interest for industry, academia, operators, etc.
 - Many studies, projects, 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

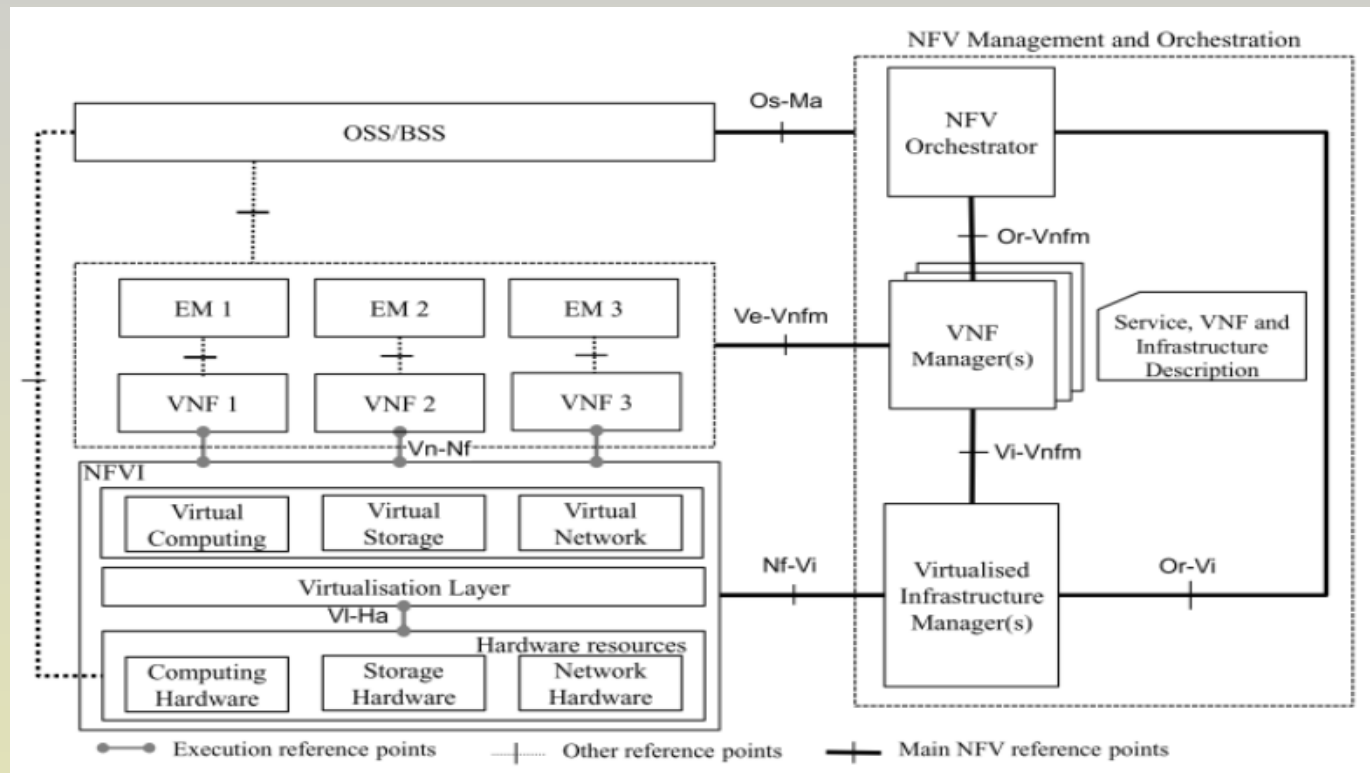
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- SDN
- Programmable networks - by separating the control and data planes



Source: D. Kreutz, F. M. V. Ramos, P. E. Veríssimo, C. E. Rothenberg, S. Azodolmolky, and S. Uhlig. 2015. Software-Defined Networking: A Comprehensive Survey. *Proc. IEEE* 103, 1 (Jan 2015), 14–76. DOI:<http://dx.doi.org/10.1109/JPROC.2014.2371999>

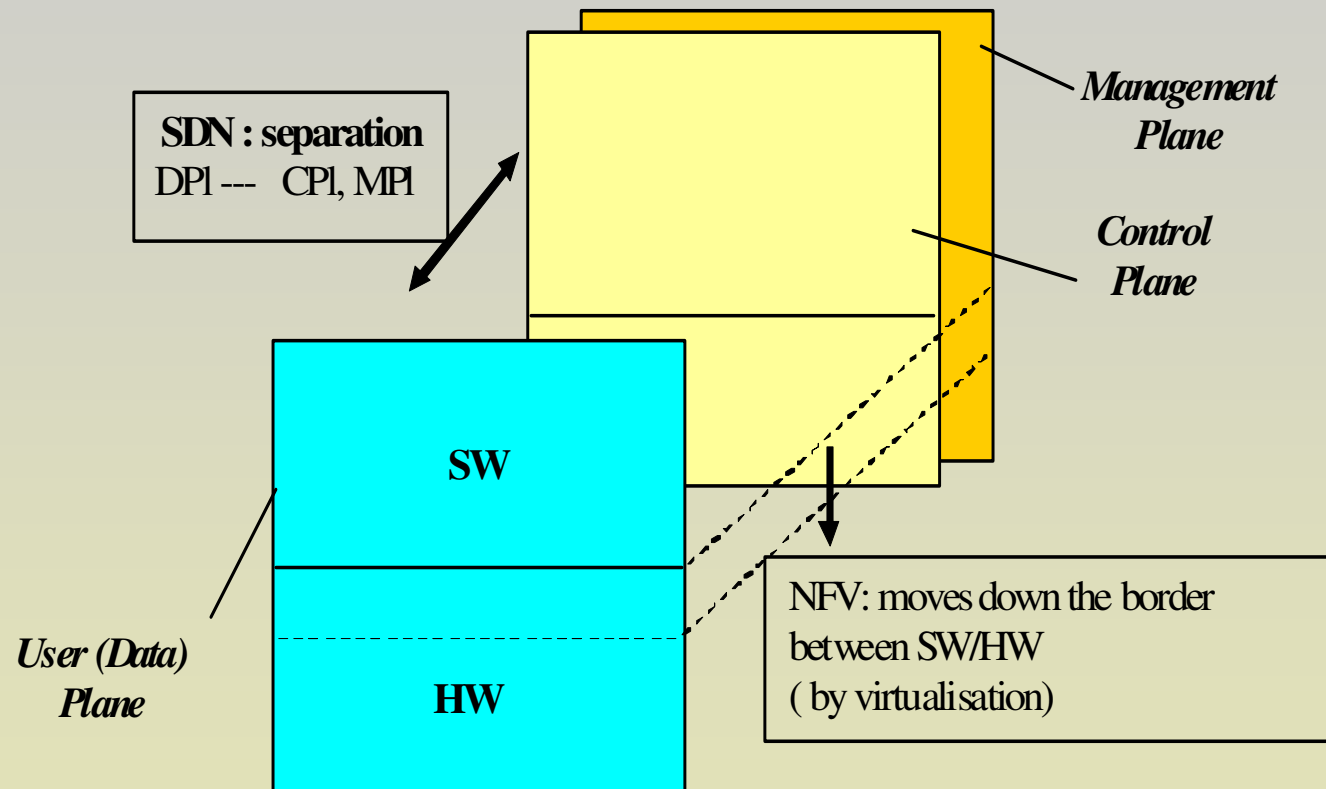
- **NFV**
- virtualize network functions and deploy them into general purpose HW



Source: ETSI. 2014. Network Functions Virtualisation (NFV) - Architectural Framework. ETSI GS NFV 002 V1.2.1 http://www.etsi.org/deliver/etsi_gs/nfv/001_099/002/01.02.01_60/gs_nfv002v010201p.pdf

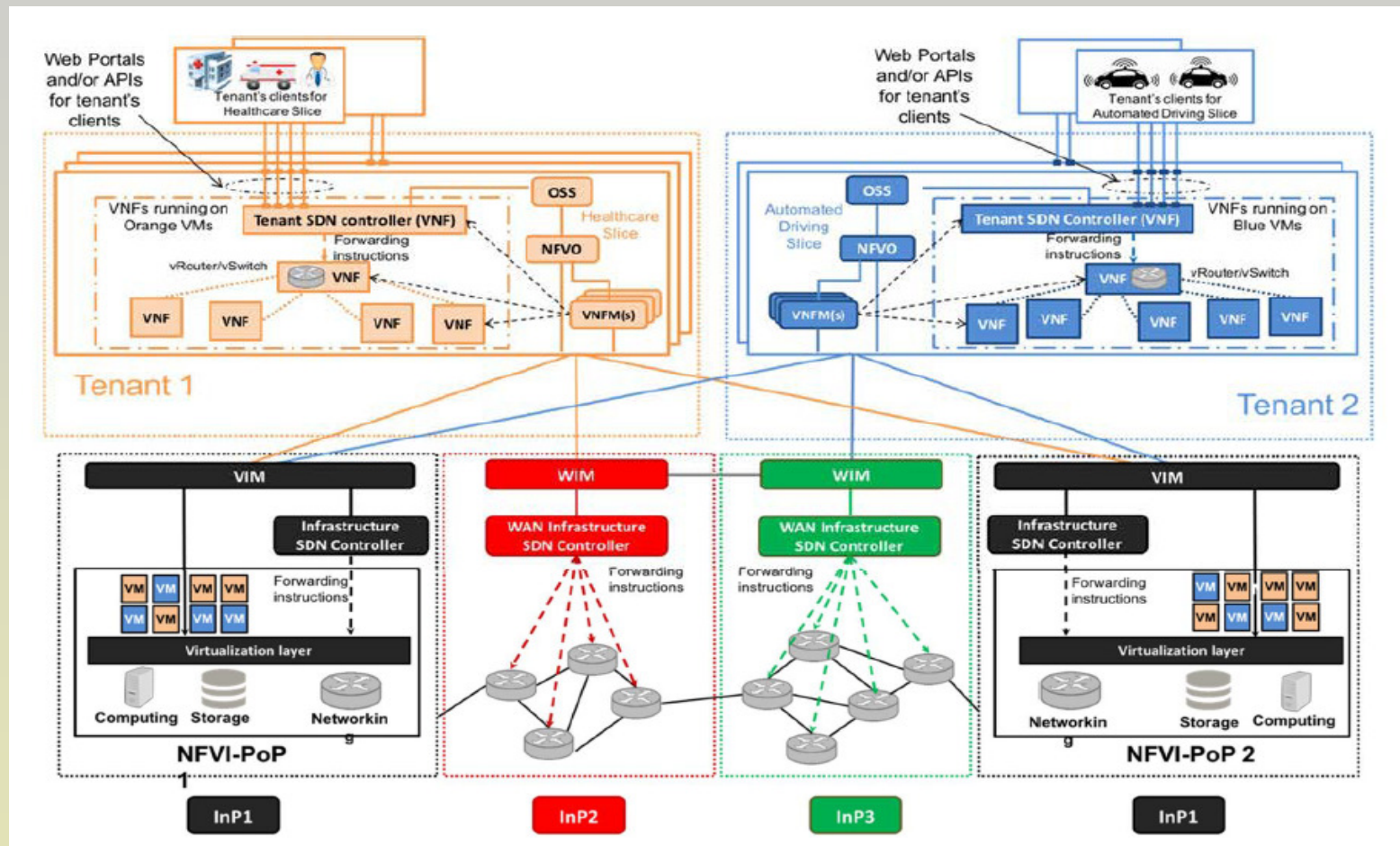
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- SDN and NFV- complementary



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



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- **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

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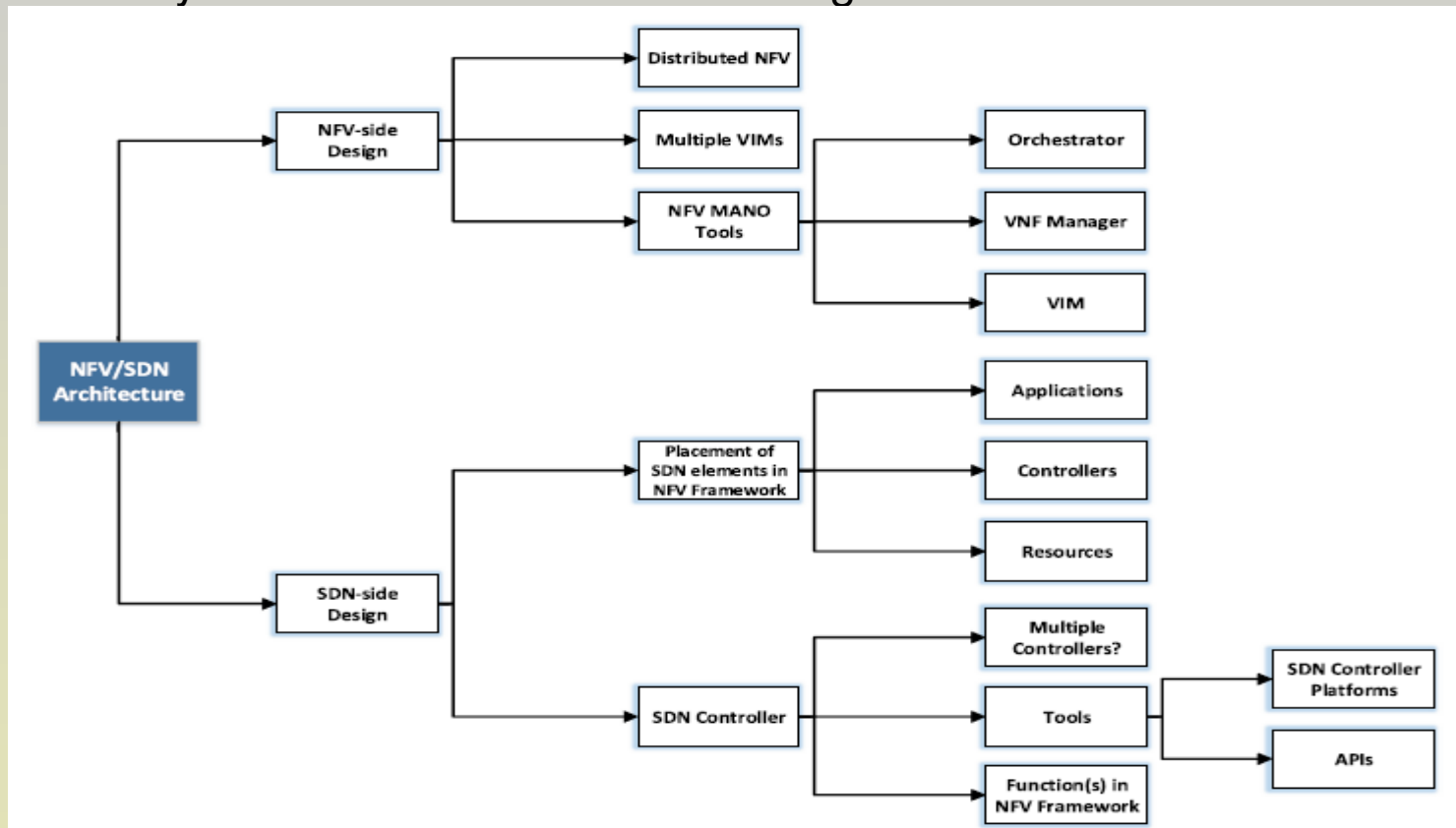


- **SDN&NFV integration - Open research –specific issues**
- Deployment of Network Services- related to Service Function Chaining (SFC)
 - VNF Performance(Orchestration, isolation, security, etc.)
 - VNFs Scheduling and Placement
 - High-level Policies
 - Traffic management
 - Dynamic service scaling (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



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- **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

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- 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

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- **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/>

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

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- 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>

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



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- 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



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- **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 tool 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/>**

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

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- **THANK YOU !**

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