

2015 IEEE Conference on Network Function Virtualization and Software Defined Network (NFV-SDN 2015)

**San Francisco, California, USA
18-21 November 2015**



**IEEE Catalog Number: CFP15B47-POD
ISBN: 978-1-4673-6885-8**

**Copyright © 2015 by the Institute of Electrical and Electronic Engineers, Inc
All Rights Reserved**

Copyright and Reprint Permissions: Abstracting is permitted with credit to the source. Libraries are permitted to photocopy beyond the limit of U.S. copyright law for private use of patrons those articles in this volume that carry a code at the bottom of the first page, provided the per-copy fee indicated in the code is paid through Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923.

For other copying, reprint or republication permission, write to IEEE Copyrights Manager, IEEE Service Center, 445 Hoes Lane, Piscataway, NJ 08854. All rights reserved.

******This publication is a representation of what appears in the IEEE Digital Libraries. Some format issues inherent in the e-media version may also appear in this print version.***

IEEE Catalog Number:	CFP15B47-POD
ISBN (Print-On-Demand):	978-1-4673-6885-8
ISBN (Online):	978-1-4673-6884-1

Additional Copies of This Publication Are Available From:

Curran Associates, Inc
57 Morehouse Lane
Red Hook, NY 12571 USA
Phone: (845) 758-0400
Fax: (845) 758-2633
E-mail: curran@proceedings.com
Web: www.proceedings.com

CURRAN ASSOCIATES INC.
proceedings
.com

2015 IEEE Conference on Network Function Virtualization and Software Defined Network (NFV-SDN)

NFV-SDN'15 DEMOS: IEEE Conference on Network Function Virtualization and Software Defined Networks 2015 Demo Track

Demos

- Elastic Network Monitoring with Virtual Probes

Heikki Mahkonen (Ericsson, Finland), Ravi Manghirmalani (Ericsson, Inc, USA), Meral Shirazipour (Ericsson, USA), Ming Xia (Ericsson Research US, USA), Attila Takacs (Ericsson, USA) 1

- DiG: Data-centers in the Grid

Hardik Soni (University of Nice Sophia Antipolis & INRIA Sophia Antipolis, France), Damien Saucez (INRIA, France), Thierry Turlatti (INRIA, France) 4

- Mobile Cloud Networking (MCN)

Giuseppe Carella (TU Berlin / Fraunhofer FOKUS, Germany), Andy Edmonds (Zürcher Hochschule für Angewandte Wissenschaften, Switzerland), Florian Dudouet (Zurich University of Applied Sciences, Switzerland), Marius Corici (Fraunhofer FOKUS, Germany), Bruno Sousa (OneSource, Portugal), Faqir Zarrar Yousaf (NEC Laboratories, Europe, Germany) 7

- End-to-End Network Service Lifecycle Demonstration

Jason Hunt (IBM, USA), Charlie Hale (IBM, USA), Jochen Kappel (IBM Germany, Germany) 9

- T-NOVA: Network Functions as-a-Service over Virtualised Infrastructures

George K Xilouris (NCSR Demokritos, Greece), Michail Alexandros Kourtis (NCSR Demokritos, Greece), Michael J McGrath (Intel Labs Europe, Leixlip, Co. Kildare, Ireland, Ireland), Vincenzo Riccobene (Intel Labs Europe, Leixlip, Co. Kildare, Ireland, Ireland), Giuseppe Petralia (Intel Labs Europe, Leixlip, Co. Kildare, Ireland, Ireland), Evangelos K. Markakis (Technological Educational Institute of Crete, Heraklion, Greece, Greece), Evangelos Pallis (Technological Educational Institute of Crete, Greece), George Alexiou (Technological Educational Institute of Crete, Greece), Georgios Gardikis (Space Hellas S.A., Greece), Aurora Ramos (Atos, Spain), Jordi Ferrer Riera (Fundació i2CAT, Internet i Innovació Digital a Catalunya, Spain), Jose Bonnet (Portugal Telecom Inovacao, Portugal) 13

- NFPA: Network Function Performance Analyzer

Levente Csikor (Budapest University of Technology and Economics, Hungary), Márk Szalay (Budapest University of Technology and Economics, Hungary), Balázs Sonkoly (Budapest University of Technology and Economics, Hungary), Laszlo Toka (Budapest University of Technology and Economics, Hungary) 15

- Scalability Analysis and Flow Admission Control in Mininet-based SDN Environment

Müge Erel (Istanbul Technical University, Turkey), Emre Teoman (Istanbul Technical University, Turkey), Yusuf Özçevik (Istanbul Technical University, Turkey), Gökhan Seçinti (Istanbul Technical University, Turkey), Berk Canberk (Istanbul Technical University, Turkey) 18

- Software Defined Wireless Network Testbed using Raspberry Pi OF Switches with Routing Add-on

Mehmet Ariman (Istanbul Technical University, Turkey), Gökhan Seçinti (Istanbul Technical University, Turkey), Müge Erel (Istanbul Technical University, Turkey), Berk Canberk (Istanbul Technical University, Turkey) 20

- Deploying elastic routing capability in an SDN/NFV-enabled environment

Steven Van Rossem (Ghent University & iMinds - IBCN, Belgium), Wouter Tavernier (Ghent University - iMinds, Belgium), Balázs Sonkoly (Budapest University of Technology and Economics, Hungary), Didier Colle (iMinds - Ghent University, Belgium), János Czentye (Budapest University of Technology and Economics, Hungary), Mario Pickavet (Ghent University - iMinds, Belgium), Piet Demeester (Ghent University - iMinds, Belgium) 22

- NFV Use Case - Delivering Virtual CPE with Multi-Vendor VNF Orchestration

Srini Beereddy (Co-Founder & CTO, USA), Kiran Sirupa (Anuta Networks, USA) 25

- Customizable real-time service graph mapping algorithm in carrier grade networks

Balázs Németh (Budapest University of Technology and Economics, Hungary), János Czentye (Budapest University of Technology and Economics, Hungary), Gábor Vaszkun (Budapest University of Technology and Economics, Hungary), Levente Csikor (Budapest University of Technology and Economics, Hungary), Balázs Sonkoly (Budapest University of Technology and Economics, Hungary) 28

- SDN-based Resilience for Smart Grid Communications

Abdullah Aydeger (Florida International University, USA), Kemal Akkaya (Florida International University, USA), A. Selcuk Uluagac (Florida International University, USA) 31

- Flowsim: Interactive SDN Switch Visualization

Christopher Jasson Casey (Texas A&M University, USA), Muxi Yan (Texas A&M University, USA), Colton Chojnacki (Texas A&M University, USA), Alex Sprintson (Texas A&M University, USA) 34

- CrossFlow: A Cross-layer Architecture for SDR Using SDN Principles

Prithviraj Shome (Texas A&M University, USA), Muxi Yan (Texas A&M University, USA), Jalil Modares (University at Buffalo, USA), Nicholas Mastronarde (University at Buffalo, USA), Alex Sprintson (Texas A&M University, USA) 37

NFV-SDN'15: 2015 IEEE Conference on Network Function Virtualization and Software Defined Network (NFV-SDN)

Deployment, Scaling and Monitoring

- Cloud API Support for Self-service Virtual Network Function (VNF) Deployment

Stephan Baucke (Ericsson Research, USA), Racha Ben Ali (Ericsson Research, USA), James Kempf (Ericsson Research, USA), Srinu Seetharaman (Infinera, USA), Anirudh Ramachandran (Deutsche Telekom Labs, USA) 40

- Experimental Results on the use of Genetic Algorithms for Scaling Virtualized Network Functions

Windhya Rankothge (Universitat Pompeu Fabra, Spain), Alessandra Russo (Imperial College London, United Kingdom), Franck Le (IBM T. J. Watson, USA), Jorge Lobo (ICREA - Universitat Pompeu Fabra, Spain) 47

- A Monitoring Framework at Layer4-7 Granularity Using Network Service Headers

Meral Shirazipour (Ericsson, USA), Heikki Mahkonen (Ericsson, Finland), Ming Xia (Ericsson Research US, USA), Ravi Manghirmalani (Ericsson, Inc, USA), Veronica Sanchez Vega (Ericsson, Spain), Attila Takacs (Ericsson, USA) 54

Hardware

- Virtual TCAM for Data Center Switches

Qasim Maqbool (xFlow Research, Pakistan), Junaid Zulfiqar (xFlow Reserach Inc., Pakistan), Sohaib Ayub (Lahore University of Management Sciences, Pakistan), Aamir Shafi (School of Electrical Engineering and Computer Science, NUST, Pakistan) 61

- Towards High Performance Packet Processing for 5G

Balázs Pinczel (Ericsson, Hungary), Dániel Géhberger (Ericsson Research, Hungary), Zoltán Richárd Turányi (Ericsson, Hungary), Bence Formanek (Ericsson, Hungary) 67

- Enhancing VNF Performance by Exploiting SR-IOV and DPDK Packet Processing Acceleration

Michail Alexandros Kourtis (NCSR Demokritos, Greece), George K Xilouris (NCSR Demokritos, Greece), Vincenzo Riccobene (Intel, Ireland), Michael J McGrath (Intel Labs & Intel, Ireland), Giuseppe Petralia (Intel, Ireland), Harilaos Koumaras (NCSR Demokritos, Greece), Georgios Gardikis (Space Hellas S.A., Greece), Fidel Liberal (University of the Basque Country, Spain) 74

Performance

- On the Performance of SDN Controllers: A Reality Check

Yimeng Zhao (Telecom Paristech, France), Luigi Iannone (Telecom ParisTech, France), Michel Riguidel (Telecom Paristech, France) 79

- SnabbSwitch user space virtual switch benchmark and performance optimization for NFV

Michele Paolino (Virtual Open Systems SAS, France), Nikolay Nikolaev (Virtual Open Systems SAS, France), Jérémy Fanguède (Virtual Open Systems SAS, France), Daniel Raho (Virtual Open Systems SAS, France) 86

- NFV-VITAL: A Framework for Characterizing the Performance of Virtual Network Functions

Lianjie Cao (Purdue University, USA), Puneet Sharma (HP Labs Palo Alto, USA), Sonia Fahmy (Purdue University, USA), Vinay Saxena (Hewlett-Packard, USA) 93

Access Control and Firewall

- NFShunt: a Linux firewall with OpenFlow-enabled hardware bypass

Simeon Miteff (University of the Witwatersrand & Council for Scientific and Industrial Research, South Africa), Scott Hazelhurst (University of the Witwatersrand, South Africa) 100

- VNGuard: An NFV/SDN Combination Framework for Provisioning and Managing Virtual Firewalls

Juan Deng (Clemson University, USA), Hongxin Hu (Clemson University, USA), Hongda Li (Clemson University, USA), Zhizhong Pan (Clemson University, USA), Kuang-Ching Wang (Clemson University, USA), Gail-Joon Ahn (Arizona State University, USA), Jun Bi (Tsinghua University, P.R. China), Younghee Park (San Jose State University, USA) 107

- FlowIdentity: Software-Defined Network Access Control

Sadiq T. Yakasai (Cisco Systems & University of Reading, United Kingdom), Chris G. Guy (The University of Reading, United Kingdom) 115

Orchestration and Management

- CPMAN: Adaptive Control Plane Management for Software-Defined Networks

Jian Li (Pohang University of Science and Technology, Korea), Jae-Hyoung Yoo (POSTECH, Korea), James W. Hong (POSTECH, Korea) 121

- Policy-based NFV Management and Orchestration

Christian Makaya (IBM T. J. Watson Research Center, USA), Douglas Freimuth (IBM, USA), David A. Wood (IBM Research, USA), Seraphin B. Calo (IBM Research, USA) 128

- nf.io: A File System Abstraction for NFV Orchestration

Md. Faizul Bari (University of Waterloo, Canada), Shihabur Rahman Chowdhury (University of Waterloo, Canada), Reaz Ahmed (University of Waterloo, Canada), Raouf Boutaba (University of Waterloo, Canada) 135

Containers

- GNFC: Towards Network Function Cloudification

Richard Cziva (University of Glasgow, United Kingdom), Simon Jouet (University of Glasgow, United Kingdom), Dimitrios P Pazaros (University of Glasgow, United Kingdom) 142

- SPN OS: Managing Network Services with Virtual Network Objects

Xi Wang (Fujitsu Laboratories of America, USA), Cong Chen (Fujitsu Laboratories of America, USA), Paparao Palacharla (Fujitsu Laboratories of America, USA), Motoyoshi Sekiya (Fujitsu Laboratories of America, Japan), Steffen Smolka (Cornell University, USA), Nate Foster (Cornell University, USA) 149

- Dynamic Virtual Network Configuration between Containers using Physical Switch Functions for NFV Infrastructure

Yukihiro Nakagawa (Fujitsu Laboratories Ltd., Japan), Chunghan Lee (Fujitsu Laboratories Ltd., Japan), Kazuki Hyoudou (Fujitsu Laboratories Ltd., Japan), Shinji Kobayashi (Fujitsu Laboratories Ltd., Japan), Osamu Shiraki (Fujitsu Laboratories Ltd., Japan), Tanaka Jun (Fujitsu Laboratories Ltd, France), Tomohiro Ishihara (Fujitsu Laboratories Ltd., Japan) 156

Control and Consistent Updates

- Protocols to Support Autonomy and Control for NFV in Software Defined Networks

Ali Mohammadkhan (University of California, Riverside, USA), Guyue Liu (The George Washington University, USA), Wei Zhang (The George Washington University, USA), K. K. Ramakrishnan (University of California, Riverside, USA), Timothy Wood (The George Washington University, USA) 163

- vDNS Closed-Loop Control: A Framework for an Elastic Control Plane Service

Anestis Karasaridis (AT&T Labs - Research, USA), Kenichi Futamura (AT&T Labs - Research, USA), Eric Noel (AT&T Labs - Research, USA), Paul Reeser (AT&T Labs - Research, USA), Ashwin Sridharan (AT&T Labs - Research, USA), Carolyn Johnson (AT&T Labs - Research, USA), Pat Velardo (AT&T Labs - Research, USA) 170

- Update Consistency in Software-defined Networking based Multicast Networks

Thomas Kohler (University of Stuttgart, Germany), Frank Dürr (University of Stuttgart, Germany), Kurt Rothermel (University of Stuttgart, Germany) 177

- Enhanced Algorithms for Consistent Network Updates

Radhika Sukapuram (Indian Institute of Technology, Guwahati, India), Gautam Barua (Indian Institute of Technology Guwahati, India) 184

Placement

- Impact of Processing Costs on Service Chain Placement in Network Functions Virtualization

Marco Savi (Politecnico di Milano, Italy), Massimo Tornatore (Politecnico di Milano & University of California, Davis, Italy), Giacomo Verticale (Politecnico di Milano, Italy) 191

- Pairing SDN with Network Virtualization: The Network Hypervisor Placement Problem

Andreas Blenk (Technische Universität München, Germany), Arsany Basta (Technische Universität München, Germany), Johannes Zerwas (Technische Universität München, Germany), Wolfgang Kellerer (Technische Universität München, Germany) 198

- Latency and Policy Aware Hierarchical Partitioning for NFV Systems

Dilip Krishnaswamy (IBM Research, India), Ravi Kothari (IBM, India), Vijay Gabale (IBM Research, India) 205