

## SUPERFLUIDITY

A SUPER-FLUID, CLOUD-NATIVE, CONVERGED EDGE SYSTEM

Research and Innovation Action GA 671566

### DELIVERABLE D8.6:

### FINAL REPORT ON COMMUNICATION, DISSEMINATION

### ACTIONS, DATA MANAGEMENT PLAN

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Abstract:	This deliverable provides the final report on communication and dissemination actions progress, as well as on resulting awareness and outcome from them. This deliverable also lists project outcomes, such as public deliverables and datasets, which were contributed to Open Research Data repositories.
Keyword List:	Communication, Dissemination, Data Management



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## Glossary

SUPERFLUIDITY DICTIONNARY	
TERM	DEFINITION
Communication	Targeted information to multiple audiences (including the media and the public) aimed at non specialists, including stakeholders whose interest is in potential application of the results.
Dissemination	Public disclosure of the results by any appropriate means (other than resulting from protecting or exploiting the results), including by scientific publications in any medium, aimed at peers, usually other researchers working in the area of the project.
Results	Any tangible or intangible output of the Action, such as data, knowledge and information whatever their form or nature, whether or not they can be protected, which are generated in the Action as well as any rights attached to them, including Intellectual Property Rights.
General Public	Audience composed by people, groups and organizations which do not have specific competences/knowledge in the matter of the project but only a general interest at the application of results in society at a large.
5G PPP	The 5G Infrastructure Public Private Partnership – Initiative supported by the EU Commission and industry manufacturers, telecommunications operators, service providers, SMEs and researchers for delivering solutions, architectures, technologies and standards for the ubiquitous next generation communication infrastructures of the coming decade.
Hackathon	Event in which computer programmers and others involved in software development and hardware development, including graphic designers, interface designers and project managers, collaborate intensively on software projects in competition with other teams.
Data Management Plan	Formal document that outlines how data will be handled (stored, shared and published) both during research activity, and after the project completion.

*Table 1 – SUPERFLUIDITY Dictionary*



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## 1 Introduction

This deliverable provides a complete report on the communication actions and dissemination actions undertaken, overall progress against plan, as well as awareness and results achieved for the project from them. This deliverable builds upon the previous reports D8.2 and D8.4 by updating the activities performed during the last part of the project (M24 – M33) and therefore it gives a complete overview of the activities realised. Moreover, it include the Data Management Plan and the open access policy adopted by the project.



## 2 Communication and Dissemination Objectives

Key performance indicators have been identified to monitor the efficacy of the dissemination activity at the proposal stage.

The following table captures the planned objectives as reported in Deliverable D8.1 “Communication and Dissemination plan” (and identified already at the proposal stage), as well as the overall progress against each objective. The column “Progress Summary” refers to the section of this document describing the performed activity, or directly describes the progress achieved or the planned activity.

N. OBJ	WHAT	DESCRIPTION	KEY PERFORMANCE INDICATOR (KPI)	PROGRESS SUMMARY
OBJ 4	Attend industrial and academic events and present key findings	<p>Organisation of special sessions at events like OpenStack Summits and Xen Hackathons to disseminate SUPERFLUIDITY results.</p> <p>One SUPERFLUIDITY-organised Hackathon for deep-dive into SUPERFLUIDITY software.</p>	2 Hackathon session (e.g., XEN)	<p>2</p> <ul style="list-style-type: none"> <li>- <a href="#">QoS hackathon in Red Hat TLV office on July 2015</a></li> <li>- Design Session at 2017 Xen Project Developer and Design Summit</li> <li>See §3.1.5</li> </ul>
OBJ 5			2 OpenStack Summit presentation	<p>4</p> <ul style="list-style-type: none"> <li>- OpenStack Mitaka session <a href="#">“QoS - A Neutron n00bie”</a> by Livnat Peer (Red Hat)</li> <li>- OpenStack Israel session by Livnat Peer “Networking QoS, Liberty, Mitaka and Newton”</li> <li>- OpenStack Newton session by Antoni Segura (RED HAT): “Networking approaches in a container world”</li> </ul>



				- OpenStack Ocata session by Antoni Segura (RED HAT): “Kuryr-Kubernetes – The Seamless Path to Adding Pods to Your Datacenter Networking”
OBJ 6			1 SUPERFLUIDITY Hackathon	Originally planned on the second year. Will take place at IEEE HPSR 2018, sponsored by NEC, UPB, CNIT & CITRIX.
OBJ 7	Industry events and ad-hoc meetings	“Marketing-oriented” presentations at industry events (e.g., Mobile World Congress, Open Networking Summit, Layer123 SDN Congress, RIPE / NANOG / DENOG, World Hosting Days (6.000 visitors in 2014), Hosting Con events.	At least 2 presentations per year	70 + 4 See Table 4 See Table 5
OBJ 8		Discussions with policy makers, social and environmental organisations regarding project results: SUPERFLUIDITY workshop organisation.	1 SUPERFLUIDITY Workshop	6 See §3.1.2
OBJ 9	Collaboration with 5G-PPP stakeholders	Cooperate with other peer 5G-PPP projects in the framework of the 5G-PPP overall programme	Allocate resources as described in the WP1 table	Participation to 5G-PPP Steering Board and Technical Board work and meetings. Participation and contributions to the 5G Architecture WG and 5G Software Networks WG. Contributions to the 5G Architecture White Paper and to the SDN/NFV White Paper. See §3.1.6



OBJ 10	Education and Training	World-wide dissemination tour	2 world-wide dissemination tours	3 See §3.1.4
OBJ 11		SUPERFLUIDITY's academic workshop and winter school camp events.	1 academic workshop and 2 winter schools	2 Undergraduate & graduate courses by BGU & NOKIA-IL See §3.1.5
OBJ 12	Publications	Key scientific publications at top tier conferences (e.g., SIGCOMM, CONEXT, INFOCOM, NSDI, OSDI, etc.), associated workshops, and magazine/journals (IEEE Transactions, ACM Computer Communications Review)	At least 2 per year	38 See §3.1 Conferences
OBJ 13			At least 7 total	4 See §3.1 Journals
OBJ 14	Web site, Social Networks, Press Releases	Wiki-style website allowing easy retrieval of main project data (including software repositories), as well as social networks presence.  Press releases targeting the public at large to allow for wide dissemination of project concepts and results.	Website up and running from M1	Website up and running from M1: <a href="http://www.superfluidity.eu">www.superfluidity.eu</a> <a href="http://superfluidity.eu">superfluidity.eu</a> See §4.1
OBJ 15			Social networks' account ready from M2, 1 post/update per month	<b>LinkedIn:</b> 23 discussions in total See §4.2 <b>Twitter:</b> 54 posts in total See §4.3 <b>YouTube:</b> 477 views See §4.4
OBJ 16			1 press release per year	2 See §4.5

Table 2 – Dissemination Key Performance Indicators

The following table captures the expected progress of other success indicators, introduced in Deliverable D8.1 “Communication and Dissemination plan”, along with the actual results.

COMMUNICATION CHANNEL	INDICATOR	PROGRESS	
		EXPECTED M1 - 33	ACTUAL M1 - 33
Web site	Number of Posts	25	22
	Number of Visitors	6000	9000



Brochure	Number Brochures distributed	1000	160 CNIT
Press	Number of online/paper press publications	100	Total: 12 See §3.2.5
Events	Number of Conferences, workshops, exhibition where the project is presented	40	Total: 70 See Table 4
SUPERFLUIDITY sponsored Events	Number of Attendees	70	Total: 152 SWFAN 2016: 40 attendees LANMAN 2016: 64 attendees SWFAN 2017: 25 attendees OSM 2018: 23 See §3.1.3
Social Media	Number of Feedback collected	500	<b>LinkedIn:</b> 18 <b>Twitter:</b> 800 impressions per month (average over last 12 months) <b>YouTube:</b> 477 views
Other Projects	Number of participation to meetings organised by other projects		3 ALB: Carlos Parada – has participated in 1 SELFNET meeting, as ALB is partner of both projects NOKIA IL: Danny Raz and Erez Biton attended COGNET workshop at EUCNC 2016 CITRIX: Christos Tselios has participated to workshop by the SONNET (RISE) project
Other Projects	Number of people from other projects participating in SUPERFLUIDITY events	20	>>20

*Table 3 – Additional Success Indicators*



### 3 Communication and Dissemination Activity

#### 3.1 Scientific and Industrial Dissemination

The Table below shows the activities performed so far by SUPERFLUIDITY’s partners as regards participation to scientific and industrial dissemination. The table lists the industrial and scientific events where SUPERFLUIDITY Partners represented in different ways the SUPERFLUIDITY Project. The column “Activity” specifies the kind of contribution (Project Presentation, Technical Speech or other contribution). In total the Superfluidity partners attended to date 70 events.

SUPERFLUIDITY - EXHIBITIONS, FAIR, CONGRESS, WORKSHOP	Partner Involved/ Proposer	Title	Authors	Name of the activity	Location	Date
EUCNC 2015 - NetWorld 2020 Workshop	TELCARIA			SPF Presentation	Paris, France	June 29- July 2, 2015
SDN World Congress	BT	Practicalities of NFV Orchestration	Andy Reid	Speech	Duesseldorf, Germany	October 13, 2015
SDN World Congress	CITRIX Constantine Polychronopoulos			Speech	Duesseldorf, Germany	October 15, 2015
IETF/IRTF-94	Telefonica	"SUPERFLUIDITY" [An SDN] Project Grand Challenges	Pedro Aranda Gutierrez	SPF Presentation	Yokohama, Japan	November 2-4, 2015
OSS in Era of SDN & NFV	BT		Andy Reid	SPF Presentation	London, UK	November 6, 2015
IEEE 5G Silicon Valley Summit	TUD	A Superfluid, Cloud-native, Converged Edge System	Vodafone Chair Prof. Gerhard Fettweis (TUD)	Speech	Santa Clara, California	November 16, 2015
IEEE GlobeCom 2015	CNIT			SPF Presentation	San Diego, California	December 7, 2015
ETSI NFV workshop	BT	Multiple standards organisations discussing Information model	Andy Reid	SPF Presentation	Denver	January 2016



<a href="#">SWFAN 2016</a>	ULG BGU	1st International Workshop on Software-Driven Flexible and Agile Networking	Laurent Mathy - Danny Raz	Speech	San Francisco, CA	April 11, 2016
<a href="#">IEEE LANMAN 2016</a>	UPB	OpenStack networking for humans: symbolic execution to the rescue	Radu Stoenescu, Dragos Dumitrescu, Costin Raiciu	Article Presented	Rome	June 13 - 15, 2016
2016 Unikernels and More: Cloud Innovators Forum Call For Participation <a href="http://wiki.xenproject.org/wiki/2016_Unikernels_and_More:_Cloud_Innovators_Forum_Call_For_Participation">http://wiki.xenproject.org/wiki/2016_Unikernels_and_More:_Cloud_Innovators_Forum_Call_For_Participation</a>	NEC	Building the Superfluid Cloud with Unikernels	Simon Kuenzer	Speech	Pasadena CA	January 22, 2016
EUCNC 2016	CITRIX		George Tsolis	SPF Presentation	Athens Greece	June 27 , 30 2016
ETSI-MEC	TID	Superfluidity: A Superfluid, Cloud-Native, Converged Edge System	Pedro Aranda Gutierrez	SPF Presentation	Madrid	
Technion Computer Engineering Center - The 2nd Academia and Industry Research Event: Challenges in Network Functions Virtualization	RED HAT	Networking QoS, Liberty, Mitaka and Newton	Livnat Peet	Speech	Raanana - Israel	Apr 03, 2016
NFVRG IETF 95 Buenos Aires <a href="https://www.ietf.org/meeting/95/">https://www.ietf.org/meeting/95/</a>	TID	Open Source Mano	Diego Lopez	Speech	Buenos Aires - Argentina	April 3-8, 2016
IETF 95 Buenos Aires <a href="https://www.ietf.org/meeting/95/">https://www.ietf.org/meeting/95/</a>	NEC	VMs, Unikernels and Containers: Experiences on the Performance of Virtualization Technologies	Felipe Huici, Filipe Manco, Jose Mendes, Simon Kuenzer	Speech	Buenos Aires - Argentina	April 3-8, 2016
ACM SIGCOMM 2016	UPB	SymNet: scalable symbolic execution for modern networks	Radu Stoenescu, Matei Popovici, Lorina Negreanu, Costin Raiciu	Paper	Florianópolis - Brazil	August 22-26 2016
ITS European Congress 2016 - Workshop: 5G pushing the limits of innovation in Automotive	CNIT	OpenGeoBase: spatial database applications supported by innovative	Lorenzo Bracciale	Speech	Glasgow UK	June 6-9 , 2016



		communications networks				
OpenStack Israel	RED HAT	Networking QoS, Liberty, Mitaka and Newton	Livnat Peet	Speech	Tel Aviv - Israel	June 2, 2016
IEEE LANMAN 2016	CNIT		Nicola Blefari Melazzi	SPF Presentation	Rome Italy	June 13-15, 2016
IEEE QoMex 2016	USTR	KPI Mapping for Virtual Infrastructure Scaling for a Realistic Video Streaming Service Deployment	Rufael Mekuria, Michael McGrath, Christos Tselios, Dirk Griffioen and George Tsolis.	Paper	Lisbon, Portugal	June 2016,
IBC 2016 International Broadcasting Convention	USTR	Enabling Future OTT Video Streaming in the 5G Superfluid Edge Cloud	Rufael Mekuria	Project Presentation	Amsterdam, The Netherland	8-12 Sept 2016
IETF/IRTF 96	TID	High level VNF Descriptors using NEMO	Pedro Aranda Gutierrez - Diego Lopez	Presentation	Berlin, Germany July 17-22, 2016	18/07/2016
	TID	Chair NFVRG	Diego Lopez (TID) chairs NFVRG			18/07/2016
	NEC	"An Analysis of Lightweight Virtualization Technologies for NFV"	Felipe Huici	Presentation		18/07/2016
	BT	Co-chair L4S	Philip Eardley			19/07/2016
	TID	The abstract art of composing SDN applications"	Pedro Aranda Gutierrez	Presentation		22/07/2016
Applied Networking Research Workshop 2016 (ANRW'16)	TID	Session on SDN, Routing and Peering	Pedro Aranda Gutierrez	Presentation	Berlin, Germany	16/07/2016
IEEE CAMAD 2016	CITRIX	"On QoE-awareness through Virtualized Probes in 5G Networks"	Christos Tselios, George Tsolis	Paper	Ryerson University, Toronto, ON, Canada	23-25 October 2016
2016 IEEE Conference on Network Function Virtualization and Software Defined Networks (NFV-SDN)	CNIT	"Performance Evaluation and Tuning of Virtual Infrastructure Managers for (Micro) Virtual Network Functions"	Pier Luigi Ventre, Claudio Pisa, Stefano Salsano, Giuseppe Siracusano, Florian Schmitz, Paolo	Paper	Palo Alto, California, USA	7-9 November 2016



			Lungaroni, Nicola Blefari-Melazzi			
ICUMT 2016 – The 8th International Congress on Ultra Modern Telecommunications and Control Systems.	CNIT	Data Plane Programmability the next step in SDN	Prof. Giuseppe Bianchi	keynote speech	Lisbon, Portugal	18 – 20 October, 2016
EWSDN 2016, co-located with the SDN World Congress 2016	CNIT	“Superfluid NFV: VMs and Virtual Infrastructure Managers speed-up for instantaneous service instantiation”.	Prof. Stefano Salsano	Invited Talk	The Hague, Netherlands	10-11 October 2016
Open Stack Summit	RED HAT	Networking approaches in a container world	Antoni Segura Puimedon (Red Hat)	Presentati on	Barcelona, Spain	October 25-28, 2016
Open Stack Summit	TID	Panel on: the evolution of NFV orchestration	Dr Diego R. Lopez	Project introducti on	Barcelona, Spain	October 25-28, 2016
SUPERFLUIDITY's Taiwan tour	CNIT	“Revisiting control/data plane separation in Software Defi–ned Networking”	Prof. Giuseppe Bianchi	Speech	Taiwan	31 October - 2 November 2016
ITUC Caleidoscope 2016 - In conjunction con ITU Telecom world	CNIT	5G in Rural and Low-Income Areas: Are We Ready?"	Luca Chiaraviglio	Paper Presentati on	Bangkok	15 November 2016
SDN World Congress 2016	BT	Containers for NFV	Louise Krug	<u>Speech</u>	The Hague, Netherlands	10 - 14 October 2016
MEC Congress	ALB	Implementing the ETSI MEC Architecture – Challenges and Lessons Learnt	Carlos Parada	Presentati on	Munich, Germany	20-22 Sep 2016
SPIE Applications of Digital Image Processing	USTR	An improved enhancement layer for octree based point cloud compression with plane projection approximation		Presentati on	San Diego (USA)	30 August 2016
ACM Multimedia Conference	USTR	"Multi-Protocol Video Delivery with Late Trans-Muxing"	R.Mekuria, J. Fennema, R. Belleman, D. Griffioen	Presentati on	Amsterdam (NL)	16-19 October 2016
International Broadcasting Convention	USTR	Server Side Playlists: The alternative for manifest manipulation	Simon Westbroek, Vice President of Global Sales -	Presentati on	Amsterdam (NL)	19 Septembe r 2016



			Unified Streaming BV			
IEEE International Symposium on Information Theory (ISIT)	BGU	On Secrecy Rates and Outage in Multi-User Multi-Eavesdroppers MISO Systems	Joseph Kampeas, Asaf Cohen, Omer Gurewitz	Presentati on	Barcelona, Spain	July 10-15, 2016
IEEE 5G Summit Dresden	TUD	Flexible Signal and Data Processing Platforms for Wireless Communications	Emil Matus	Presentati on	Dresden, Germany	29.9.2016
5G-PPP cross-project workshop	CITRIX UPB	Architecture Concepts Symbolic Execution	George Tsolis Matei Popovici	Presentati on	Athens, Greece	February 6-7, 2017
INW 2017 - 14th Italian Networking Workshop	CNIT	"Performance Evaluation and Tuning of Virtual Infrastructure Managers for Unikernel support"	Stefano Salsano (Pier Luigi Ventre, Claudio Pisa, Stefano Salsano, Giuseppe Siracusano, Florian Schmidt, Paolo Lungaroni, Nicola Blefari-Melazzi)	Presentati on	Falcade, Italy	January 13th 2017
Schloss Dagstuhl – Leibniz Center for Informatic	UPB		Costin Raiciu UPB Felipe Huici NEC	SPF Presentati on	Wadern, Germany	January 15-18, 2017
Schloss Dagstuhl – Leibniz Center for Informatic	TID	Network Function Virtualization in Software Defined Infrastructures	Dr. Diego Lopez	Workshop Organizati on	Wadern, Germany	January 15-18, 2017
2017 Global Future Network Development Summit	ULG	High-performance software data-plane for NFV	Laurent Mathy (ULG)	keynote speech	Nanjing, China	April 17, 2017
NetFPGA Summit 2017	CNIT	"Packet Manipulator Processor", "Open Packet Processor".	Marco Spaziani Brunella, Valerio Bruschi	Presentati on	Cambridge, UK	20th and 21th April 2017
SWFAN 2017	CNIT	2nd International INFOCOM Workshop on Software-Driven Flexible and Agile Networking in conjunction with IEEE INFOCOM 2017.	TPC: CNIT, NOKIA IL, INTEL, NEC, ONAPP	Workshop organisati on	Atlanta, GA	May 1, 2017
EBU Broadthinking	USTR	Extended Origin Functionalities	Rufael Mekuria	Talk	Geneva, CH	May 3-4, 2017



EUCNC 2017	CNIT	Invited by 5G SN (Software Networks) Working Group + Talk: "Deployment and orchestration of Unikernels in the NFV Infrastructure",	Stefano Salsano	Talk	Oulou, Finland	June 12-15, 2017
EUCNC 2017	CNIT	Superfluid Orchestration of heterogeneous RFBs (Reusable Functional Blocks) for 5G networks.	CNIT - NOKIA FR	Booth - demo	Oulou, Finland	June 12-15, 2017
IEEE CAMAD 2017	CITRIX	Special session: "5G: An Era of Agile, Brisk and Superfluid Networking"	Special Session Chairs: George Tsolis Christos Tselios	Special Session: Call for Paper	Lund, Sweden	June 19-21, 2017
Xen Project Developer and Design Summit Organised by Linux Foundation.	NEC	Talk 1: uniprof: Transparent Unikernel Performance Profiling and Debugging Talk 2: NoXS: Death to the XenStore	Talk 1: Florian Schmidt Talk 2: Filipe Manco	Talk	Budapest, Hungary	July 11-14, 2017
Xen Project Developer and Design Summit Organised by Linux Foundation.	ONAPP	Xen-lite for ARM - adapting Xen for a Samsung Exynos MicroServer with hybrid FPGA IO acceleration	Julian Chesterfield / Anastassios Nanos	Talk	Budapest, Hungary	July 11-14, 2017
IFIP 2017	NOKIA FR	Participate in IFIP/IEEE International Symposium on Integrated Network Management		Presentati on	Lisbon, Portugal	8-12 May 2017
Networking Innovation & Research Symposium, CISCO	CNIT	Superfluid chaining of Unikernel VNFs	Stefano Salsano	Presentati on	Paris, France	March 21st 2017
Workshop GARR 2017 - Netvolution	CNIT	"La ricerca sui nuovi modelli di rete"	Stefano Salsano	Speech	Rome , Italy	06-apr-17
IEEE NetSoft 2017	CNIT	Data Plane Programmability the next step in SDN	Giuseppe Bianchi	keynote speech	Bologna, Italy	3-7 Jul 2017



IEEE NetSoft 2017	CNIT	Smashing SDN "built-in" actions: programmable data plane packet manipulation in hardware	Marco Spaziani Brunella, Valerio Bruschi	Presentati on	Bologna, Italy	3-7 Jul 2017
European Wireless 2017	UPB	Using Multipath TCP to enable smooth connectivity in 5G networks	Costin Raiciu UPB	keynote speech	Dresden, Germany	May 17 - 19, 2017
DATE 2017 - Design, Automation and test in Europe	TUD	KPN framework at Design	Emil Matus	Demo	Lausanne, Switzerland	27 - 31 March, 2017
The 13th IEEE International Conference on Wireless and Mobile Computing, Networking and Communications - WiMob 2017	CNIT	Complete Edge Function Onloading for Effective Backend-driven Cyber Foraging	Flavio Esposito, Andrej Cvetkovski, Tooska Dargahi, and Jianli Pan	Paper	Rome, Italy	October 9-11, 2017
ACM SIGCOMM 2017	NEC - CNIT	TCP Proxy Bypass: All the Gain with No Pain!	Giuseppe Siracusano, Roberto Bifulco, Stefano Salsano	Poster Abstract	Los Angeles, USA,	August 20 - 25, 2017
ACM SIGCOMM 2017	NEC	uniprof: A Unikernel Stack Profiler	Florian Schmidt	Paper	Los Angeles, USA,	August 20 - 25, 2017
ACM SIGCOMM 2017	NEC	Network Data Monetization Using Net2Vec	Roberto Gonzalez, Alberto Garcia- Duran, Filipe Manco, Mathias Niepert, Pelayo Vallina:	Demo Abstract	Los Angeles, USA,	August 20 - 25, 2017



Big-DAMA 2017 (workshop at SIGCOMM)	NEC	Net2Vec: Deep Learning for the Network, ACM Workshop on Big Data Analytics and Machine Learning for Data Communication Networks	Roberto Gonzalez, Filipe Manco, Alberto Garcia-Duran, Jose Mendes, Felipe Huici, Saverio Niccolini, Mathias Niepert	Paper	Los Angeles, USA,	August 20 - 25, 2017
Soft5 Workshop, 1st International Workshop on Softwarized Infrastructures for 5G and Fog Computing, in conjunction with 29th ITC conference	CNIT - ALB - USTR	Toward Superfluid Deployment of Virtual Functions: Exploiting Mobile Edge Computing for Video Streaming	S. Salsano, L. Chiaraviglio, N. Blefari-Melazzi, C. Parada, F. Fontes, R. Mekuria, D. Griffioen	Paper	Genoa, Italy	8th September 2017
ITC 29 - Ubiquitous, software-based, and sustainable networks and services	CNIT	Data Plane Programmability: the Next Step in Software Defined Networking	G. Bianchi	keynote speech	Genoa, Italy	4. - 8. SEPTEMBER 2017
IEEE Conference on Network Function Virtualization and Software Defined Networks	CNIT	RDCL 3D, a Model Agnostic Web Framework for the Design and Composition of NFV Services	Stefano Salsano	Presentation	Berlin, Germany	6-8 November 2017
ICIN 2018 - 21st International Conference on Innovation in Clouds, Internet and Networks	CNIT	Optimal Design of 5G Superfluid Networks: Problem Formulation and Solutions	Luca Chiaraviglio, Fabio D'Andreagiovanni, Giulio Sidoretti, Nicola Blefari-Melazzi, Stefano Salsano	Paper	Paris, France	February 2018
ICIN 2018 - 21st International Conference on Innovation in Clouds, Internet and Networks	CNIT	Energy-efficient Path Allocation Heuristic for Service Function Chaining	Mohammad Mahdi Tajiki, Stefano Salsano, Mohammad Shojafar, Luca Chiaraviglio, Behzad Akbari	Paper	Paris, France	February 2018



IEEE GLOBECOM 2017	CNIT	P5G: A Bio-inspired Algorithm for the Superfluid Management of 5G Networks	Mohammad Shojafar, Luca Chiaraviglio, Nicola Blefari-Melazzi, Stefano Salsano	Presentati on	Singapore	05 December 2017
IEEE GLOBECOM 2017	CITRIX	Evaluating Hammer Network Traffic Simulator: System Benchmarking and Testbed Integration	I. Prevezanos, C. Tselios, A. Angelou, M. McGrath, R. Mekuria, V. Tsogkas and G. Tsolis	Presentati on	Singapore	06 December 2017
SmartCom 2017 -The 4th International Workshop on Smart Wireless Communications	CNIT	Superfluid networking for 5G: vision and state of the art	Stefano Salsano	Speech	Rome; Italy	23 - 24 October 2017.
ETSI – Open Source Mano Meeting	CNIT	Extending OpenVIM R3 to support Unikernels (and Xen)	Stefano Salsano	Presentati on and sponsorship	Rome, Italy	06 - 09 February 2018
ICIN 2018 - 21st International Conference on Innovation in Clouds, Internet and Networks	CNIT	Energy-efficient Path Allocation Heuristic for Service Function Chaining	Stefano Salsano	Presentati on	Paris, France	21 February 2018

*Table 4 –Participation to conferences and other events*



The following table lists the meetings and events where Superfluidity project was presented to Industry sector so far.

SUPERFLUIDITY - Target Stakeholder: Industrial Sector	Partner Involved	Name of the activity	Type of Activity	Location	Date
Altice USA (Cablevision, Suddenlink and other Altice brands) and SFR	ALB	Project Presentation	Expertise Involvement	Aveiro, Portugal	25/10/2016
David del Val CEO of Telefonica Research and Luis-Ignacio Vicente del Olmo - Manager for Return of Innovation	TID	Booth Visits at 5G Global Event	R&D collaboration	Rome Italy	9 - 10/11/2016
Meeting Cisco	CNIT	Service Function Chaining – SR net programming modle	R&D collaboration	Florence, Italy	30/05/2017
Intel® Developer Zone SDN/NFV Network Developer Lab	CNIT	Presentation: Packet Manipulator Processor: Smashing "Atomic" Actions	R&D collaboration	San Jose, CA	19 - 20/09/2017

*Table 5 – Industrial sector involvement*

### 3.1.1 Talks and published papers

Below, we give more details about talks and published papers. This information is reflected on the website where we divided the attended events in **Talks** (for some of them the presentations give are available for download) and **Conferences** where we lists the papers accepted and published in conferences’ proceedings. Finally, this section includes article and paper published on scientific **Journals**.

#### Talks

1. Andy Reid, BT: **“Practicalities of NFV orchestration”**, SDN World Congress, Duesseldorf, Germany, October 13, 2015.
2. Vodafone Chair Prof. Gerhard Fettweis, TUD: **“A Superfluid, Cloud-native, Converged Edge System”**, IEEE 5G Silicon Valley Summit, Santa Clara, CA, November 16, 2015.
3. Simon Kuenzer, NEC Europe: **“Building the Superfluid Cloud with Unikernels”**, 2016 Unikernels and More: Cloud Innovators Forum, Pasadena, CA, January 22, 2016.
4. Livnat Peer, REDHAT: **“Networking QoS,Liberty, Mitaka and Newton”**, Technion Computer Engineering Center – The 2nd Academia and Industry Research Event: Challenges in Network Functions Virtualization, Raanana, Israel, April 03, 2016.
5. Diego Lopez, TID: **“Open Source Mano”**, NFVRG-IETF 95, Buenos Aires, Argentina, April 3-8, 2016.



6. Felipe Huici, Filipe Manco, Jose Mendes, Simon Kuenzer, NEC: **“VMs, Unikernels and Containers: Experiences on the Performance of Virtualization Technologies”**, NFVRG-IETF 95, Buenos Aires, Argentina, April 3-8, 2016.
7. Lorenzo Bracciale, CNIT: **“OpenGeoBase: spatial database applications supported by innovative communications networks”**, Workshop: 5G pushing the limits of innovation in Automotive – ITS European Congress, Glasgow, UK, June 7, 2016
8. Livnat Peer, REDHAT: **“Networking QoS, Liberty, Mitaka and Newton”**, OpenStack Israel, Tel Aviv, Israel, June 2, 2016.
9. Prof. Giuseppe Bianchi, CNIT: Keynote speech **“Data Plane Programmability the next step in SDN”**, ICUMT 2016 – The 8th International Congress on Ultra Modern Telecommunications and Control Systems, Lisbon, Portugal, October 18-20, 2016.
10. Simon Westbroek, USTR: **“Server Side Playlists: The alternative for manifest manipulation”**, International Broadcasting Convention, Amsterdam, The Netherlands, September 19, 2016
11. Stefano Salsano CNIT, Felipe Huici NEC: Invited talk **“Superfluid NFV: VMs and Virtual Infrastructure Managers speed-up for instantaneous service instantiation”**, Invited talk, EWSDN 2016, co-located with the SDN World Congress 2016, The Hague, Netherlands, October 10-11, 2016
12. Giuseppe Bianchi, CNIT: **“Revisiting control/data plane separation in Software Defined Networking”**, SUPERFLUIDITY’s Taiwan Tour: October 31: Distinguished Lecture speech at Institute of Information Science – Academia Sinica; November 1: Talk at National Chiao Tung University; November 2: talk at National Taiwan University of Science and Technology, 31 October – 2 November 2016.
13. Louise Krug, BT: **“Containers for NFV”**, Technology Forum SDN World Congress 2016, EWSDN 2016, co-located with the SDN World Congress 2016, The Hague, Netherlands, October 10-11, 2016.
14. George Tsolis, CITRIX: **“Superfluidity: Architecture concepts, Putting them in practice, Challenges”**, 5G Cross-Project workshop, Athens, Greece, February 6-7, 2017.
15. Matei Popovici, UPB: **“Symnet: scalable symbolic execution for modern networks”**, 5G Cross-Project workshop, Athens, Greece, February 6-7, 2017.
16. Laurent Mathy, ULG: Keynote speech **“High-performance software data-plane for NFV”**, 2017 Global Future Network Development Summit, Nanjing, China, April 17, 2017.
17. Rafael Mekuria, USTR: **“Extended Origin Functionalities”**, EBU Broadthinking, Gevenva, Switzerland, May 3-4, 2017.
18. Stefano Salsano, CNIT: **“Deployment and orchestration of Unikernels in the NFV Infrastructure”**, EuCNC 2017, Oulu, Finland, June 12-15, 2017.



19. Florian Schmidt, NEC: **“uniprof: Transparent Unikernel Performance Profiling and Debugging”**, Xen Project Developer and Design Summit, Budapest, Hungary, July 11-14, 2017.
20. Felipe Manco, NEC: **“NoXS: Death to the XenStore”**, Xen Project Developer and Design Summit, Budapest, Hungary, July 11-14, 2017.
21. Julian Chesterfield, Anastassios Nanos, ONAPP: **“Xen-lite for ARM – adapting Xen for a Samsung Exynos MicroServer with hybrid FPGA IO acceleration”**, Xen Project Developer and Design Summit, Budapest, Hungary, July 11-14, 2017.
22. Prof. Giuseppe Bianchi, CNIT: Keynote speech **“Data Plane Programmability the next step in SDN”**, IEEE NetSoft 2017, Bologna, Italy, July 3-7, 2017.
23. Costin Raiciu, UPB: Keynote speech **“Using Multipath TCP to enable smooth connectivity in 5G networks”**, European Wireless 2017, Dresden, Germany, May 17 – 19, 2017
24. Stefano Salsano, CNIT: Invited talk **“Superfluid networking for 5G: vision and state of the art”**, SmartCom 2017 -The 4th International Workshop on Smart Wireless Communications, Rome, Italy, October 23-24, 2017.
25. Giuseppe Bianchi, CNIT: Keynote speech **“Data Plane Programmability: the Next Step in Software Defined”**, ITC 29 conference – Ubiquitous, software-based, and sustainable networks and services, Genoa, Italy. September 4-8, 2017.
26. Daniel Mellado, Luis Tomas Bolivar, RED HAT: Invited talk **“Superfluidity: One network to rule them all!”**, [Openstack Summit](#), Vancouver, BC. May 21-24, 2018.
27. Rufael Mekuria, USTR: Tutorial **“Point cloud coding: techniques, applications and standardization”**, [IEEE VCIP 2017](#) – Visual Communication and Image Processing, St. Petersburg, FL. December 10, 2017.
28. Felipe Huici, NECLC: Talk **“Unikraft – Unleashing the Power of Unikernels”**, [QCon London](#), London, Uk. March 5-6, 2018.
29. Felipe Huici, NECLC: Talk **“My VM is Lighter (and Safer) than your Container”**, [University of Cambridge](#). Cambridge, UK. March 8, 2018

## Conference

1. Radu Stoenescu, Matei Popovici, Lorina Negreanu, and Costin Raiciu: **“SymNet – Scalable Symbolic Execution for Modern Networks”**, proc. of Conference on ACM SIGCOMM’16, August 22-26, 2016, Florianópolis, Brazil. DOI: 10.1145/2934872.2934881.
2. H. J. Asghar, L. Melis, C. Soldani, E. De Cristofaro, M. A. Kaafar, and L. Mathy: **“SplitBox: Toward Efficient Private Network Function Virtualization”** ACM SIGCOMM, proc. of the Workshop on Hot Topics in Middleboxes and Network Function Virtualization (HotMiddlebox 2016), Co-located with ACM SIGCOMM’16, August 22-26, 2016, Florianópolis, Brazil. DOI: 10.1145/2940147.2940150.



3. Giuseppe Siracusano, Roberto Bifulco, Simon Kuenzer, Stefano Salsano, Nicola Blefari Melazzi, Felipe Huici: **“On-the-Fly TCP Acceleration with Miniproxy”**, ACM SIGCOMM, proc. of the Workshop on Hot Topics in Middleboxes and Network Function Virtualization (HotMiddlebox 2016), Co-located with ACM SIGCOMM’16, August 22-26, 2016, Florianópolis, Brazil. DOI: 10.1145/2940147.2940149.
4. Radu Stoenescu, Dragos Dumitrescu, Costin Raiciu: **“OpenStack networking for humans: symbolic execution to the rescue”** invited paper in IEEE LANMAN 2016, Rome, Italy, June 13 - 15, 2016. DOI: 10.1109/LANMAN.2016.7548840.
5. Rufael Mekuria, Michael McGrath, Christos Tselios, Dirk Griffioen, George Tsolis, Shahar Beiser: **“KPI Mapping for Virtual Infrastructure Scaling for a Realistic Video Streaming Service Deployment”**, 8th International Conference on Quality of Multimedia Experience, Lisbon, Portugal, June 6-8, 2016.
6. R.Mekuria, J. Fennema, R. Belleman, D. Griffioen: **“Multi-Protocol Video Delivery with Late Trans-Muxing”** accepted paper at ACM Multimedia, 15 – 19 October 2016, Amsterdam, The Netherlands.
7. Luca Chiaraviglio, Nicola Blefari-Melazzi, William Liu, Jairo A. Gutierrez, Jaap Van De Beek, Robert Birke, Lydia Chen, Filip Idzikowski, Daniel Kilper, Paolo Monti, Jinsong Wu: **“5G in Rural and Low-Income Areas: Are We Ready?”**, ITU Kaleidoscope Conference, Bangkok, Thailand, November 2016.
8. Christos Tselios, George Tsolis: **“On QoE-awareness through Virtualized Probes in 5G Networks”**, paper accepted for publication at IEEE CAMAD 2016, 21st IEEE International Workshop on Computer Aided Modelling and Design of Communication Links and Networks, 23-25 October 2016, Ryerson University, Toronto, ON, Canada.
9. Pier Luigi Ventre, Claudio Pisa, Stefano Salsano, Giuseppe Siracusano, Florian Schmitz, Paolo Lungaroni, Nicola Blefari-Melazzi: **“Performance Evaluation and Tuning of Virtual Infrastructure Managers for (Micro) Virtual Network Functions”**, 2016 IEEE Conference on Network Function Virtualization and Software Defined Networks (NFV-SDN), 7-9 November 2016, Palo Alto, California, USA.
10. Joseph Kampeas, Asaf Cohen, Omer Gurewitz: **“On Secrecy Rates and Outage in Multi-User Multi-Eavesdroppers MISO Systems”**, 2016 IEEE International Symposium on Information Theory (ISIT), 10-15 July 2016, Barcelona, Spain.
11. Alejandro Cohen, Asaf Cohen, Omer Gurewitz: **“Secure Group Testing”**, 2016 IEEE International Symposium on Information Theory (ISIT), 10-15 July 2016, Barcelona, Spain.
12. Emil Matus: **“Flexible Signal and Data Processing Platforms for Wireless Communications”**, IEEE 5G Dresden Summit, 29 September 2016, Dresden, Germany.



13. Rufael Mekuria, Pablo Cesar: **“MP3DG-PCC, Open Source Software Framework for Implementation and Evaluation of Point Cloud Compression”**, ACM Multimedia Conference 2016, 15-19 October 2016, Amsterdam, The Netherlands. DOI: 10.1145/2964284.2973806.
14. Khartik Ainala, Rufael N. Mekuria, Birendra Khathariya, Zhu Li, Ye-Kui Wang, Rajan Joshi: **“An improved enhancement layer for octree based point cloud compression with plane projection approximation”**, SPIE Applications of Digital Image Processing XXXIX, DOI:10.1117/12.2237753.
15. G. Aravinthan, H. Dalia, C.S. Chen, L. Rouillet: **“Virtualization of Radio Access Network by Virtual Machine and Docker: Practice and Performance Analysis”**, IFIP/IEEE Integrated Network Management Symposium (IM 2017), May, 8-12, 2016, Lisbon, Portugal.
16. Arjen Wagenaar, Dirk Griffioen, Rufael Mekuria: **“Unified Remix: a Server Side Solution for Adaptive Bit-Rate Streaming with Inserted and Edited Media Content”**, ACM Multimedia Systems Conference, Taipei, Taiwan, June 20-24, 2017.
17. Paul Veitch, Edel Curley and Tomasz Kantecki: **“Performance Evaluation of Cache Allocation Technology for NFV Noisy Neighbour Mitigation”**, IEEE NetSoft 2017, Bologna, Italy, 3-7 July 2017.
18. Luca Chiaraviglio, Lavinia Amorosi, Stefania Cartolano, Nicola Blefari-Melazzi, Paolo Dell’Olmo, Mohammad Shojafar, Stefano Salsano: **“Optimal Superfluid Management of 5G Networks”**, IEEE NetSoft 2017, Bologna, Italy, 3-7 July 2017.
19. Salvatore Pontarelli, Marco Bonola, Giuseppe Bianchi: **“Smashing SDN “built-in” actions: programmable data plane packet manipulation in hardware”**, IEEE NetSoft 2017, Bologna, Italy, July 3-7, 2017.
20. Luca Chiaraviglio, Nicola Blefari-Melazzi, Carla-Fabiana Chiasserini, Bogdan Iatco, Francesco Malandrino, Stefano Salsano: **“An Economic Analysis of 5G Superfluid Networks”**, 18th IEEE International Conference on High Performance Switching and Routing (IEEE HPSR), Campinas, Brazil, June 18-21, 2017.
21. Laura Vasilescu, Vladimir Olteanu, Costin Raiciu: **“Sharing CPUs via endpoint congestion control”**, IEEE SIGCOMM KBNets 2017, Los Angeles, US-CA, August 21-25, 2017.
22. Marco Bonola, Roberto Bifulco, Luca Petrucci, Salvatore Pontarelli, Angelo Tulumello, Giuseppe Bianchi: **“Implementing advanced network functions for datacenters with stateful programmable data planes”**, IEEE LANMAN 2017 – The 23rd IEEE International Symposium on Local and Metropolitan Area Networks, Osaka, Japan, June 12-14, 2017.
23. Marco Bonola, Roberto Bifulco, Luca Petrucci, Salvatore Pontarelli, Angelo Tulumello, Giuseppe Bianchi: **“Demo: implementing advanced network functions with stateful programmable data planes”**, IEEE LANMAN 2017 – The 23rd IEEE International Symposium on Local and Metropolitan Area Networks, Osaka, Japan, June 12-14, 2017.



24. Ioannis Prevezanos, Andreas Angelou, Christos Tselios, Alexandros Stergiakis, Vassilis Tsogkas and George Tsolis: **“Hammer: A Real-world, end-to-end Network Traffic Simulator”**, IEEE CAMAD 2017, 22nd IEEE International Workshop on Computer Aided Modelling and Design of Communication Links and Networks, Lund, Sweden, 19-21 June 2017.
25. Mohammad Shojafar, Luca Chiaraviglio, Nicola Blefari-Melazzi, Stefano Salsano: **“P5G: A Bio-inspired Algorithm for the Superfluid Management of 5G Networks”**, Accepted for IEEE GLOBECOM 2017, Singapore, December 2017.
26. I. Prevezanos, C. Tselios, A. Angelou, M. McGrath, R. Mekuria, V. Tsogkas and G. Tsolis: **“Evaluating Hammer Network Traffic Simulator: System Benchmarking and Testbed Integration”**, Accepted for IEEE GLOBECOM 2017, Singapore, December 2017.
27. Flavio Esposito, Andrej Cvetkovski, Tooska Dargahi, and Jianli Pan: **“Complete Edge Function Onloading for Effective Backend-driven Cyber Foraging”**, IEEE International Conference on Wireless and Mobile Computing, Networking and Communications – WiMob 2017, Rome, Italy, October 9-11, 2017.
28. Giuseppe Siracusanò, Roberto Bifulco, Stefano Salsano: **“TCP Proxy Bypass: All the Gain with No Pain!”**, ACM SIGCOMM 2017, Los Angeles, USA, August 20-25, 2017.
29. Florian Schmid: **“uniprof: A Unikernel Stack Profiler”**, ACM SIGCOMM 2017, Los Angeles, USA, August 20-25, 2017.
30. Roberto Gonzalez, Alberto Garcia-Duran, Filipe Manco, Mathias Niepert: **“Network Data Monetization Using Net2Vec”**, ACM SIGCOMM 2017, Los Angeles, USA, August 20-25, 2017.
31. Roberto Gonzalez, Filipe Manco, Alberto Garcia-Duran, Jose Mendes: **“Net2Vec: Deep Learning for the Network”**, ACM Workshop on Big Data Analytics and Machine Learning for Data Communication Networks, Big-DAMA 2017 (workshop at SIGCOMM), Los Angeles, USA, August 20-25, 2017.
32. S. Salsano, L. Chiaraviglio, N. Blefari-Melazzi, C. Parada, F. Fontes, R. Mekuria, D. Griffioen: **“Toward Superfluid Deployment of Virtual Functions: Exploiting Mobile Edge Computing for Video Streaming”**, Soft5 Workshop, 1st International Workshop on Softwarized Infrastructures for 5G and Fog Computing, in conjunction with 29th ITC conference, Genoa, Italy, September 8, 2017. Presentation.
33. Luca Chiaraviglio, Fabio D’Andreagiovanni, Giulio Sidoretti, Nicola Blefari-Melazzi, Stefano Salsano: **“Optimal Design of 5G Superfluid Networks: Problem Formulation and Solutions”**, ICIN 2018 – 21st International Conference on Innovation in Clouds, Internet and Networks, Paris, France, February 2018.
34. Mohammad Mahdi Tajiki, Stefano Salsano, Mohammad Shojafar, Luca Chiaraviglio, Behzad Akbari: **“Energy-efficient Path Allocation Heuristic for Service Function Chaining”**, ICIN 2018 –



- 21st International Conference on Innovation in Clouds, Internet and Networks, Paris, France, February 2018.
35. Mohammad Shojafar, Luca Chiaraviglio, Nicola Blefari-Melazzi, Stefano Salsano: **“P5G: A Bio-inspired Algorithm for the Superfluid Management of 5G Networks”**, IEEE GlobeComm 2017 – Global Hub: Connecting East and West, Singapore, 4-8 December 2017.
  36. I. Prevezanos, C. Tselios, A. Angelou, M. McGrath, R. Mekuria, V. Tsogkas and G. Tsolis: **“Evaluating Hammer Network Traffic Simulator: System Benchmarking and Testbed Integration”**, IEEE GlobeComm 2017 – Global Hub: Connecting East and West, Singapore, 4-8 December 2017.
  37. F. Manco, C. Lupu, F. Schmidt, J. Mendes, Simon Kuenzer, S. Sati, K. Yasukata, C. Raiciu, F. Huici: **“My VM is Lighter (and Safer) than your Container”**, ACM SOSP 17 – 26th Symposium on Operating Systems Principles, Shanghai, China, 28-31 October 2017.
  38. K. Yasukata, F. Huici, V. Maffione, G. Lettieri, M. Honda: **“HyperNF: Building a High Performance, High Utilization and Fair NFV Platform”**, SoCC '17 – ACM Symposium on Cloud Computing 2017, Santa Clara, CA, 25-27 September 2017.
  39. R. Mekuria, M. J. McGrath, V. Bayon-Molino, V. Riccobene, C. Tselios, A. Dobrodub, J. Thomson: accepted paper **“Automated Profiling of Virtualized Media Processing Functions using Telemetry and Machine Learning”**, ACM MMSys 2018 - ACM Multimedia Systems Conference. Amsterdam, the Netherlands. June 12 - 15, 2018.
  40. R. Mekuria, S. Laserre and C. Tulvan: **“Performance assessment of point cloud compression”**, [IEEE VCIP 2017](#) – Visual Communication and Image Processing, St. Petersburg, FL. December 10 – 13, 2017.
  41. Paolo Lungaroni, Claudio Pisa, Stefano Salsano, Giuseppe Siracusano, Francesco Lombardo: **“Extending OpenVIM R3 to support Unikernels (and Xen)”**, ETSI – Open Source Mano Conference. Rome, Italy. February 06 - 09, 2018.
  42. Marco Spaziani Brunella, Salvatore Pontarelli, Marco Bonola, Giuseppe Bianchi: **“V-PMP: a VLIW Packet Manipulator Processor”**, EuCNC2018 – NET. Ljubljana, Slovenia, June 18-21, 2018

## Journals

1. **“Hybrid IP/SDN networking: open implementation and experiment management tools”**  
*S. Salsano, P. L. Ventre, F. Lombardo, G. Siracusano, M. Gerola, E. Salvadori, M. Santuari, M. Campanella, L. Prete.*  
IEEE Trans. on Network and Service Management 2016. DOI: 10.1109/TNSM.2015.2507622.
2. **“Superfluidity: A Flexible Functional Architecture for 5G Networks”**



*G. Bianchi, E. Biton, N. Blefari-Melazzi, I. Borges, L. Chiaraviglio, P. de la Cruz Ramos, P. Eardley, F. Fontes, M. J. McGrath, L. Natarianni, D. Niculescu, C. Parada, M. Popovici, V. Riccobene, S. Salsano, B. Sayadi, J. Thomson, C. Tselios, G. Tsolis.*

Transactions on Emerging Telecommunications Technologies, Wiley 2016. DOI: 10.1002/ett.3082.

**3. “Bringing 5G in Rural and Low-Income Areas: Is it Feasible?”**

*Luca Chiaraviglio, Nicola Blefari-Melazzi, William Liu, Jairo A. Gutierrez, Jaap van de Beek, Robert Birke, Lydia Chen, Filip Idzikowski, Daniel Kilper, Paolo Monti, Antoine Bagula, Jinsong Wu.*

IEEE Communications Standards Magazine, 2017.

**4. “A Survey on the Security of Stateful SDN Data Planes”**

*Tooska Dargahi, Alberto Caponi, Moreno Ambrosin, Giuseppe Bianchi, Mauro Conti*

IEEE Communications Surveys and Tutorials, 30 March 2017, DOI: 10.1109/COMST.2017.2689819.

**5. “Are We Ready to Drive Software-Defined Networks? A Comprehensive Survey on Management Tools and Techniques”**

*Elisa Rojas, Roberto Doriguzzi-Corin, Sergio Tamurejo, Andres Beato, Arne Schwabe, Kevin Phemius, Carmen Guerrero.*

ACM Computing Surveys (CSUR), March 2018, DOI: 10.1145/3165290.



### 3.1.2 Sponsored and organised events

#### SWFAN 2016

SUPERFLUIDITY co-organised and sponsored the **1st International Workshop on Software-Driven Flexible and Agile Networking** (SWFAN, <http://www.swfan.org>) held on the 11th of April, 2016 in San Francisco, CA, USA, in conjunction with [IEEE INFOCOM 2016](#). SWFAN was held with great success and in a very interactive atmosphere, as both keynote talks and most paper presentations stimulated intense discussions. The attendance was very high and the feedback from speakers and attendees was very positive. We had up to 45 attendees. Several Partners' representatives gave key contributions:

#### Workshop Organisers:

CNIT – Nicola Blefari Melazzi, Giuseppe Bianchi

NOKIA IL – Danny Raz, Erez Biton.

#### TPC Co-Chair:

NOKIA IL - Erez Biton

#### Superfluidity participation to the Technical Programme Committee:

NOKIA IL - Erez Biton

BGU - Omer Gurewitz,

NEC – Felipe Huici

INTEL - Michael McGrath

**Keynote #1:** ULG - Laurent Mathy: “Foggy Networking: Networking in the cloud”

**Keynote #2:** NOKIA IL - Danny Raz: “Network and Cloud optimization: it’s all about the model”



Figure 1 – SWFAN 2016



## IEEE LANMAN 2016

SUPERFLUIDITY supported as Technical Sponsor and with key contributions the **22th IEEE International Symposium in Local and Metropolitan Area Networks (IEEE LANMAN 2016)**.

LANMAN is the forum for presenting and discussing the latest technical advances in local and metropolitan area networking. This year, the symposium's central theme was "**Adaptive, Agile and Fluid networking**", a broad topic encompassing autonomic and reconfigurable networking, network function virtualisation and software-defined networking and of clear interest for SUPERFLUIDITY. During the Conference, SUPERFLUIDITY Project was introduced by the Project Coordinator, Prof. Nicola Blefari Melazzi, and informational material, such as brochures, were distributed to attendees. The symposium was hosted by the Italian National Research Council in Rome on 13 -15 June 2016.

Several Partners' representatives gave key contributions:

### General Co-Chair:

CNIT – Nicola Blefari Melazzi

### TPC Co-Chair:

CNIT –Giuseppe Bianchi

### Publication Chair:

CNIT –Luca Chiaraviglio

**Invited Paper:** "OpenStack networking for humans: symbolic execution to the rescue" Radu Stoenescu, Dragos Dumitrescu, Costin Raiciu (University Politehnica of Bucharest).



*Figure 2 – IEEE LANMAN 2016 Symposium*



## SWFAN 2017

SUPERFLUIDITY has driven the organisation of the **2nd International Workshop on Software-Driven Flexible and Agile Networking** that has been organised in conjunction with IEEE INFOCOM 2017. The organising committee included three SUPERFLUIDITY's representatives out of seven persons:

CNIT - Giuseppe Bianchi,

CNIT - Nicola Blefari Melazzi,

NOKIA IL - Danny Raz, Technion

**TPC Co-Chair:** CNIT - Stefano Salsano.

The two keynotes planned and the high quality of the papers presented stimulated many questions and interesting discussions among the participants.

The audience reached the number of 25 attendees.



*Figure 3 – SWFAN 2017*

## IEEE CAMAD 2017

Superfluidity organised a special session and call for paper at the 22nd International Workshop on Computer-Aided Modeling Analysis and Design of Communication Links and Networks on June 19-21, 2017, in Lund, Sweden. The special session was entitled: 5G: An Era of Agile, Brisk and Superfluid Networking

### Special Session Chairs

George Tsois – Principal Architect, Citrix Systems Inc.

Christos Tselios – Senior Researcher, Citrix Systems Inc.



## Scope and Motivation

The advent of 5G Networks introduces significant challenges in almost every link of the network value chain. The demand for seamless connectivity, extremely low latency, high-speed data transfer and energy efficiency along with the exponential increase of interconnected devices will shape an ecosystem with such complexity that enforces the replacement of almost every current standard.

5G Network design aims to mitigate problems and shortcomings of today's networks, such as long service instantiation times, resource over-provisioning for meeting peak subscriber demand, and dependence on obsolete and cost-ineffective hardware devices. This intention leads to an increasing need for networking briskness and agility that can be attained via the architectural decomposition of network elements and network services into basic, reusable primitives as well as the virtualization of network processing functions, which will further enhance the superfluid and holistic nature of the proposed ecosystem.

In this respect, this Special Session aims at providing a forum where researchers, engineers, and practitioners may discuss the latest advances on architectures, algorithms, abstractions, and technologies for briskness, flexibility, and agility in 5G networking.

## Main Topics of Interest

The submission of innovative work on 5G Network Design was encouraged. The following is a non-exhaustive list of topics:

- 5G Network architectures, protocols, application programming interfaces, and programming languages
- New forwarding abstractions and programmability paradigms in 5G Networks
- Reliability, verification, resiliency, and fault management in 5G Networks
- Autonomic management technologies in 5G Networks
- Security functions and services in 5G Networks
- Application of machine learning, big data analytics in 5G Networks
- Scalable distributed and hierarchical controller architectures
- Software-based integration of computing, storage, and networking elements in 5G Networks
- Architectures for Cloud-native micro-services in 5G Networks
- Use and performance of container techniques
- Data and control plane conformance, interoperability, scalability, and performance studies
- Design guidelines for scalable, available, composable, and modular elements for 5G Networks



- Re-architecturing 5G Network elements to advance interoperability and increase performance
- Dynamic service function chaining
- OpenStack/Open vSwitch(OVS)/OPNFV/ONOS/OpenSourceMANO -related research & explorations
- Orchestration APIs
- Service chaining/orchestration and traffic steering in NFV and SDN
- Tools for validating network services and automated deployment and management
- Applying compositional patterns for parallelism, control logic, performance, and reliability of network services
- Design of NFV and SDN-based forwarding elements (switch/router, optical, wireless, gateway)
- Performance evaluation, optimization, isolation, tradeoffs with NFV workloads
- Control plane architectures and network operating systems in NFV and SDN
- NFV infrastructure architectures including hardware acceleration technologies
- NFV & SDN on public/private clouds
- Commercial models and implications for NFV and SDN ecosystems
- Applications of 5G Networks in IoT, CPS, Smart Cities

## Results

Ten (10) publications were submitted to the special session. Five (5) were accepted and published.

## Demo Poster presentation

During the event CITRIX also participated with a demo poster on: **HAMMER a real-world, end-to-end traffic generator**, where Citrix Traffic Generator (Hammer) was demonstrated to the visitors.

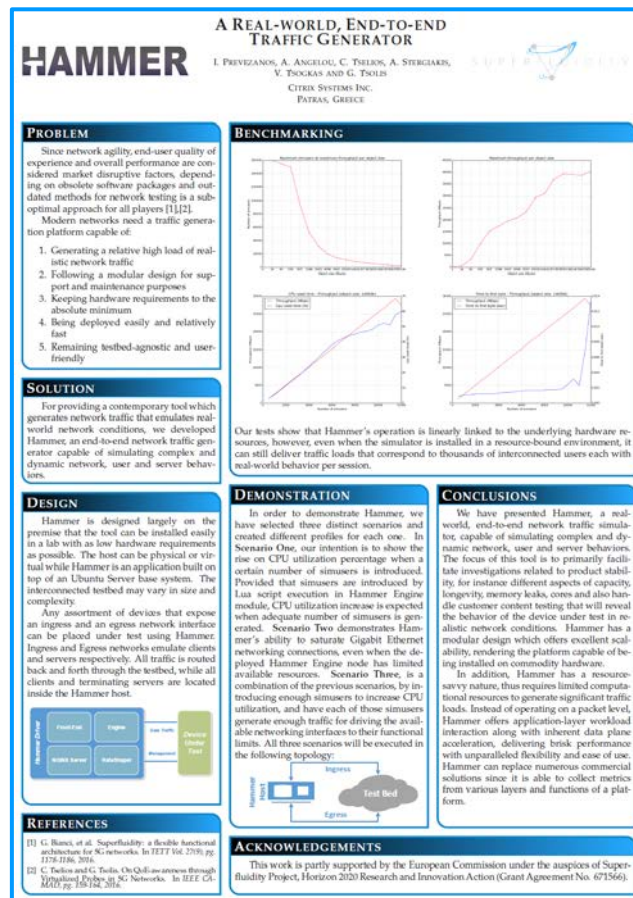


Figure 4 – CITRIX's poster presented at CAMAD 2017



Figure 5 – Christos Tselios and John Prevezanos presenting the Demo on Hammer



## Xen Project Developer and Design Summit Organised by Linux Foundation 2017

Superfluidity was Gold sponsor of the event Xen Project Developer and Design Summit. In addition to the talks below, Superfluidity partners (ONAPP & CITRIX) organized a Design Session (see §3.1.5).

The screenshot shows the 'Our Sponsors' page for the Xen Project Developer and Design Summit. At the top, there is a navigation bar with links for 'EVENTS //', 'VIEW EVENTS', 'SPONSOR', 'EVENT MANAGEMENT SERVICES', 'CFP', 'CODE OF CONDUCT', and 'CONTACT US'. Below this is a secondary navigation bar with 'Home', 'Program', 'Attend', and 'Sponsors'. The main banner features the Xen Project logo and the event title 'DEVELOPER AND DESIGN SUMMIT' against a background of a city skyline. The event dates are 'July 11 - 13, 2017' and the location is 'Corinthia Hotel Budapest, Budapest, Hungary'. Social media icons for Twitter, Facebook, LinkedIn, and YouTube are also present. The 'Our Sponsors' section is divided into 'Diamond Sponsor' and 'Gold Sponsors'. Citrix is listed as the Diamond Sponsor, and Intel is listed as a Gold Sponsor. The Superfluidity logo is also visible at the bottom of the sponsor list.

Figure 6 – Sponsorship page of the Xen event

During the summit, Superfluidity partners, NEC and ONAPP, contributed with the following talks:

- NEC, Florian Schmidt: **uniprof: Transparent Unikernel Performance Profiling and Debugging**
- NEC, Filipe Manco: **NoXS: Death to the XenStore**
- ONAPP, Julian Chesterfield and Anastassios Nanos: **Xen-lite for ARM - adapting Xen for a Samsung Exynos MicroServer with hybrid FPGA IO acceleration**



Figure 7 - Sponsorship special communication on site

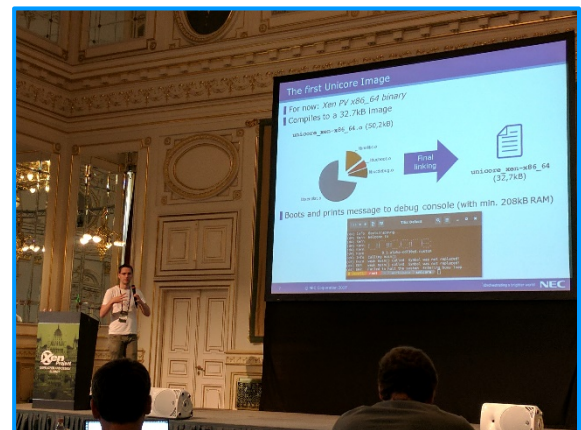
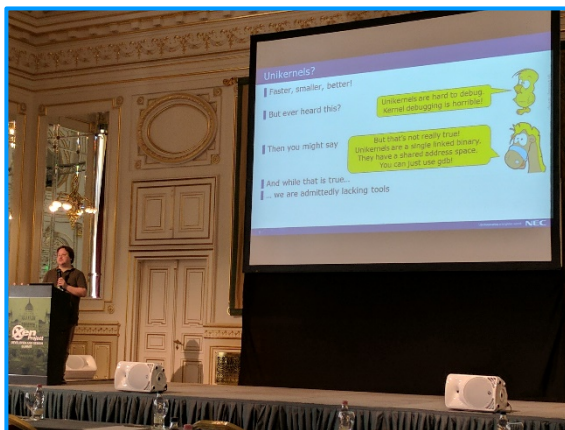


Figure 8 – Florian Schmidt (left) and Simon Kuenzer (right) from NEC

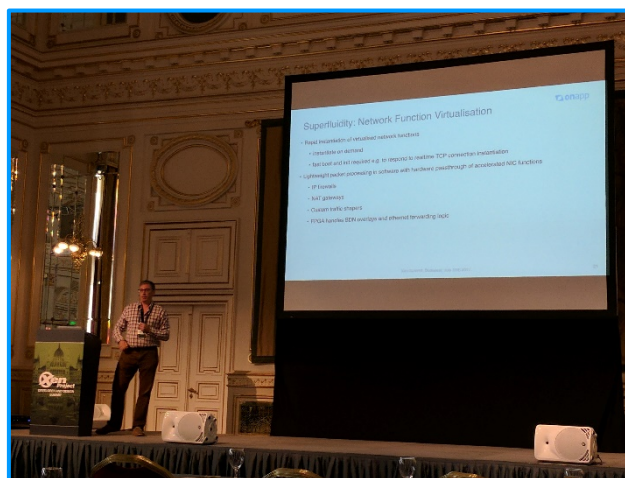


Figure 9 – Julian Chesterfield from ONAPP



## ETSI – Open Source Mano Conference 2018

Superfluidity sponsored the ETSI Open Source Mano conference held in Rome on 05-09 February 2018. CNIT took care about the organisation of the meeting at the Italian National Research Council headquarter. The meeting focused on “**OSM-Mid-Release#4**” hosted 23 attendees and several researchers coming from CNIT and also involved in Superfluidity.

CNIT has presented the work performed in Superfluidity concerning the integration of OpenVIM (and other VIMs) with Unikernels and the RDCL 3D network service designer and orchestrator. Concerning OpenVIM, which is part of the OSM project, CNIT is contributing to the community a patch to allow the instantiation of Xen-based virtual network functions such as ClickOS-based Unikernels. RDCL 3D is a web-based graphical open source tool developed in the Superfluidity project which allows the design and orchestration of network services. RDCL 3D focuses on flexibility by supporting heterogeneous network service description standards and platforms, and facilitating developers in extending its capabilities.

Stefano Salsano presented the Live Demo “**Extending ETSI NFV Release 2 models (IFA011, IFA014) and OpenVIM to support Unikernels orchestration**”. The Demo aimed at showing how RDCL 3D has been used to design graphically a chain of click-based virtual network functions and then to deploy them as ClickOS VMs by leveraging OpenVIM in an actual virtual environment.



*Figure 10 – CNIT Stefano Salsano presenting the demo*

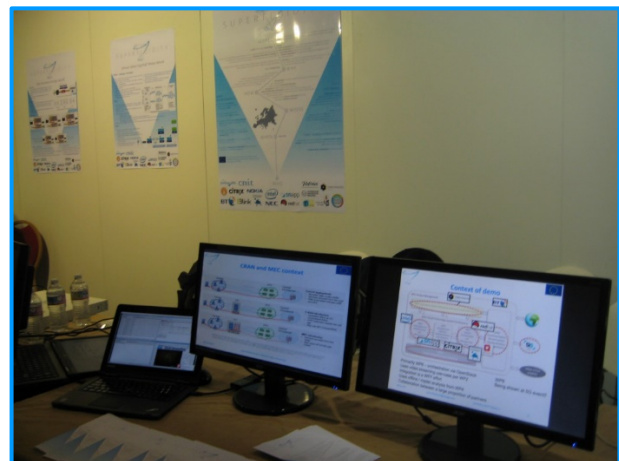


### 3.1.3 Exhibitions

#### Second 5G Global Event: “Enabling the 5G ecosphere”

SUPERFLUIDITY Consortium participated at the second **5G Global Event** held in Rome on 9<sup>th</sup> and 10<sup>th</sup> November 2016, by organising an exhibition booth and attending the conference. The local organisation was coordinated by CNIT, which offered the Volunteers Team to the Conference organisers and funded the SUPERFLUIDITY’s booth costs.

The SUPERFLUIDITY’s booth was organised by Francisco Fontes from Altice Labs, John Thomson from ONAPP, Shahar Beiser from Nokia – Alcatel Lucent Israel, Lionel Natarianni and Bessem Sayadi from Nokia Bell Lab France. There were exhibited two demos: 1) rapid deployment/reconfiguration of a software-defined wireless network (C-RAN), integrated with Mobile Edge Computing, for efficient video delivery from the edge; 2) Demand-driven orchestration for 5G deployments.



*Figure 11 – Exhibition Booth*

During the event, Mr. Roberto Viola DG Connect visited the exhibition area, and John Thomson depicted the demos and the results achieved so far. Dr. Diego R. Lopez from Telefonica, Chair of ETSI NFV visited the SUPERFLUIDITY’s booth as well. Dr. Diego R. Lopez participated at the conference with a presentation on “Software Networks in the Transition to 5G”, in the Session 4 – 5G network management & software networks. The event was very successful with a numerous participation, about 400 attendees.



*Figure 12 – Special guests at SUPERFLUIDITY's Booth*



*Figure 13 – SUPERFLUIDITY's representatives*

In occasion of the booth preparation, CNIT produced a new general poster about SUPERFLUIDITY project and a new leaflet. One hundred leaflets were distributed during the exhibitions.



Figure 14 – SUPERFLUIDITY’s new poster

The new poster and leaflet are available for download on the web site from the section “Communication”.

The SUPERFLUIDITY’s booth also exhibited posters dedicated to demos.

As mentioned before, three demos were exhibited:

1. Demand-driven orchestration for 5G deployments;
2. Software-Defined “Superfluid” Wireless Network;
3. Video transmuxing at the edge, using MEC.



<p>All these posters are available for download on the web site <a href="http://superfluidity.eu/download/">(http://superfluidity.eu/download/)</a></p> <p><b>Demo 1 - Demand-driven orchestration for 5G deployments</b></p>	
<p><b>Demo 2 - Software Defined “Superfluid” Wireless Network</b></p>	
<p><b>Demo 3 - Video transmuxing at the edge, using MEC</b></p>	

Figure 15 – Demos’ posters



## EU CNC 2017

Superfluidity project in the frame of the collaboration within the Software Network Working Group of the 5G PPP participated in the organisation of the workshop : **“Software Networks and 5G: from network programmability to SDN/NFV combination for effective network slicing”**.

The project was presented in the Session 3 - Orchestration and Programmability by Stefano Salsano with the presentation entitled: “Deployment and orchestration of Unikernels in the NFV Infrastructure”.

The partner NOKIA FR organised the Superfluidity’s booth and the demo entitled: **“Superfluid Orchestration of heterogeneous RFBs (Reusable Functional Blocks) for 5G networks”**.

Here below we report some pictures of the event.



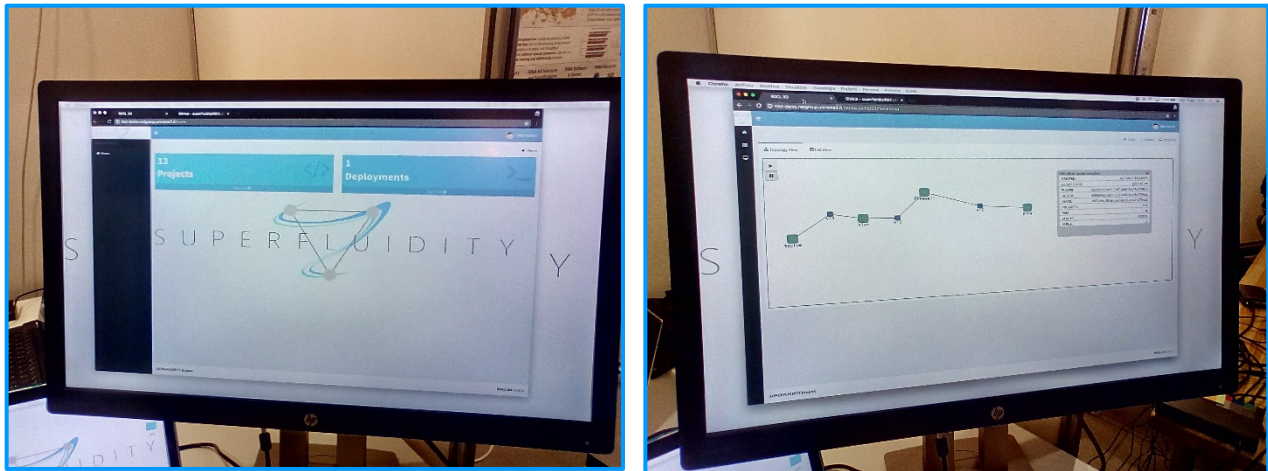


Figure 16 – Superfluidity's Booth at EUCNC 2017

### 3.1.4 World Dissemination Tours and Education

1. **1st International Workshop on Software-Driven Flexible and Agile Networking:** Keynote speaker Laurent Mathy – ULG
2. SUPERFLUIDITY's Taiwan Tour on **“Revisiting control/data plane separation in Software-Defined Networking”**, Giuseppe Bianchi – CNIT.
3. 2017 Global Future Network Development Summit: **“High-performance software data-plane for NFV”** Laurent Mathy – ULG
4. **RESCOM 2017 – Summer school: VIRTUALISATION & DEHARDWARIZATION**, June 19-23, 2017 Le Croisic, France. Giuseppe Bianchi – CNIT
  - Data Plane programmability: the next step in SDN
  - SDN: evolution, opportunities and challenges
5. Gran Sasso Science Institute PhD School: **“Towards superfluid Network Function Virtualization (NFV)”**, February 2, 2017 L'Aquila, Italy. Stefano Salsano - CNIT.
6. Lipari School on Network and Computer Sciences: **“Stateful data planes in Software Defined Networks”**, July, 9 – 15, 2017. Lipari, Italy. Giuseppe Bianchi – CNIT
7. DevConf.cz 2018: **“OpenShift on OpenStack integration”**, January, 27, 2018. Brno, Czech. Luis Tomas Bolivar – RED HAT.

### 3.1.5 Community Building and Hackathons

- 1 Undergraduates/graduate course on **“Virtualization of cloud communication services”**: Co-organised by BGU and NOKIA IL, Beersheba, Israel.



- 2 **Ninux Day 2016.** The Ninux Day is the national meeting of the Italian wireless community network ninux.org. Community networks are network infrastructures with a decentralised management, built bottom-up by individuals and organisations employing mostly COTS wireless hardware. CNIT's researcher gave a talk about SUPERFLUIDITY's work on the chaining of Virtual Network Functions and how this can be applied to the ninux.org network.
- 3 OpenStack Boston Summit. **Kuryr Project On-Boarding Session.** Organised by Red Hat.
- 4 **Xen Project Developer and Design Summit.** Design Session: "Unikernel support for NFV-like applications on Xen ARM 64bit". Hosted by OnApp and CITRIX (Budapest, July 11-14, 2017).
- 5 **Hackathon: Build your Unikernel with Unikraft.** Organized by NEC&UPB. Sponsored (not using project funds) by NEC, UPB, CNIT & CITRIX at IEEE HPSR 2018 (Bucharest, June 17-20, 2018).

### 3.1.6 5GPPP Collaboration

Superfluidity is playing a unique role at building a cloud native 5G design covering the hardware abstraction, advanced virtualization techniques, hybrid orchestration of VM/container/Unikernel, KPI predictive based on Telemetry and machine learning, security etc. Being one of the very few projects that comprise all these aspects, Superfluidity played an important role in various 5G PPP WGs, with special emphasis on the architecture, the software network and the vision groups contributing to the KPIs identified by 5G PPP, and the worldwide leadership role around the cloud native principles and technologies.

Superfluidity has contributed to the 5G Architecture WG, the software network WG and the Vision and Societal Challenges WG. Superfluidity actively contributed in the architecture WG which has edited a new version of a white paper that provides the European vision on the fundamental building blocks of future 5G networks and their deployment. The paper has been submitted for concertation in July 2017.

In terms of the KPIs defined by 5G PPP, Superfluidity has designed various technologies that are contributing to the 5G PPP KPIs. The Superfluidity project demonstrated an end-to-end service deployment in few seconds. The different technology advanced in Superfluidity directly and indirectly contribute towards achieving the key performance enhancements: 1) 1000 times higher mobile data volume per geographical area, 2) 10 to 100 times more connected devices, 3) 10 to 100 times higher typical user data rate, 4) 10 times lower energy consumption, 5) End-to-End latency of < 1ms and 6) Ubiquitous 5G access including in low-density areas

It is also worth highlighting that Superfluidity succeed to contribute and make the impact in many open sources projects like Kuryr, Openstack, ManagelQ and advanced new one like RDCL. In that area, the project contributed in the white paper published in January 2016 by the Software Network WG and organized a workshop on the WG outcomes in EUCNC 2017. Superfluidity is established as a leading project in cloud native technologies worldwide, and thus it is strongly contributing to reinforce the leadership role of Europe and 5G PPP.



Superfluidity contributed also in the white paper edited by WG vision and societal challenges and published in MWC 2017 and entitled “5G innovations for new business opportunities” (<https://5g-ppp.eu/wp-content/uploads/2015/02/5G-Vision-Brochure-v1.pdf>)

Superfluidity contributed actively in the definition of the Golden nuggets of Phase 1 and their dissemination and in the different dissemination activities organized by 5G PPP Technical Board e.g. Second European 5G Annual journal, Book chapter in “5G Networks: an European Vision”.

The successful work in this and other 5G PPP working groups will be continued in the remaining project duration.

Finally, we report that concepts from Superfluidity are being moved into the NGPaaS project (5GPPP Phase-II), in particular the RFB architectural concept. This is performed in coordination with the Sonata project.

## 4 General Communication and Dissemination Channels

### 4.1 SUPERFLUIDITY Web Site

The SUPERFLUIDITY’s web site was set up at the beginning of the project and will remain available after the end of the project. The website is accessible online at <http://superfluidity.eu>. The website is regularly updated with project-related activities and announcements. The main Structure of the Web Site has been described in the Deliverable D8.1, delivered in due time at month 6 (December 2015).

At Content level, the Web Site has been enriched with the description of activities and achievements along the activities realisation. Here below we provide a description of the “alive” pages, which are regularly updated.

- **About -> Step by Step** - SUPERFLUIDITY Road Map
- **About -> Related Projects**: In this page, related Projects’ logos and links have been added. We expect to add more EU projects and initiatives to collaborate with in the future
- **Results -> Communication**: In this page, all activities related to Communication on Community Building, World Dissemination Tour and collaboration with 5G PPP are regularly updated.
- **Results -> Communication -> Download**: In this section, it is possible to download general communication such as Presentations, Leaflets and Posters. Posters related to demos presented in exhibitions are also available. Download section is accessible from the Footer menu as well.
- **Results -> Dissemination**: In this page, all the dissemination activities so far have been recorded, such as Participation at International Conferences, Fairs and Publications.
- **Results -> Standardization**: In this page, Standardisation works and papers are published.
- **Results -> Deliverables**: In this page, the complete list of Deliverables has been published. Public deliverables can be downloaded by the general public, while confidential deliverables can be



downloaded only through a private account to the web site. A private access has also been delivered to the EC Officer and monitors on the occasion of the First Period Review.

- **News:** This section is the blog of the web site. The news published in this section are shared through LinkedIn and Twitter Account. To date, 22 news have been published. In the following paragraphs, we will describe the communication activities performed through Social Networks. Here below we report a screenshot of the News' page.

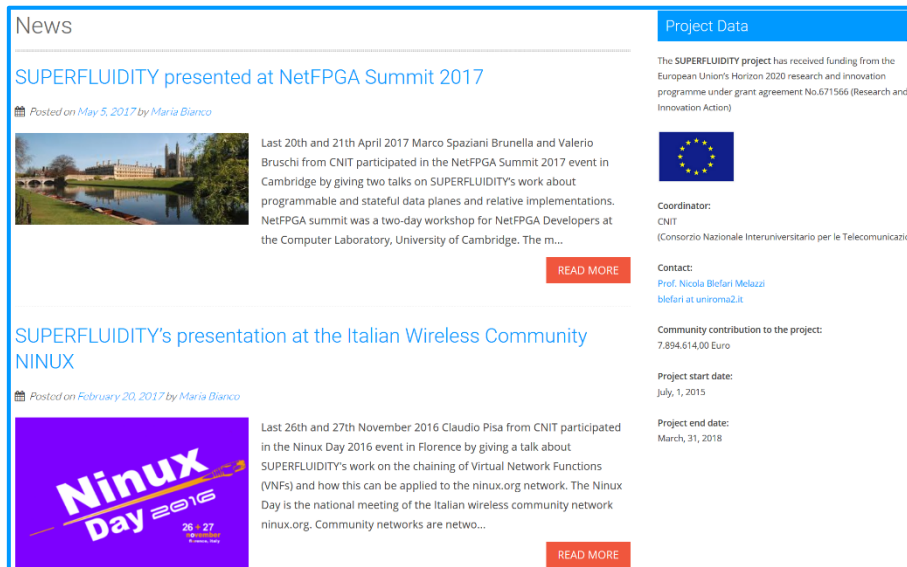


Figure 17 – SUPERFLUIDITY News page

#### 4.1.1 Google Analytics Overview

We have added the Google Analytics tracking code in the template of SUPERFLUIDITY website, thus enabling the tracking of statistics of the project's website.

This report presents analytics data lower than the previous reports (D8.4). The reason of the decrease of traffic data on Superfluidity's web site is due to the fact that we faced a security issue related to Ghost/referrer spam activity aimed at the search engines. At a certain point we recognised an abnormal traffic from Russia and other countries which become suspected in relation to the expected traffic of a European project web site.

The previous Analytics data were therefore affected by this spamming activities while the current data reported below can be considered the actual analytics performance of the web site, which have been cleaned of main suspected traffic. Key statistics are shown in Figure 18 below.

The SUPERFLUIDITY web site shows the following main access data since the beginning of the web site:

- N. of Session: 12.244
- N. of Users: 9.009
- Page Views: 28.457
- Page/Session: 2,32



- Average session Duration: 1 min 38 sec
- Bounce Rate: 62,28%
- % New Visitor: 89,1%

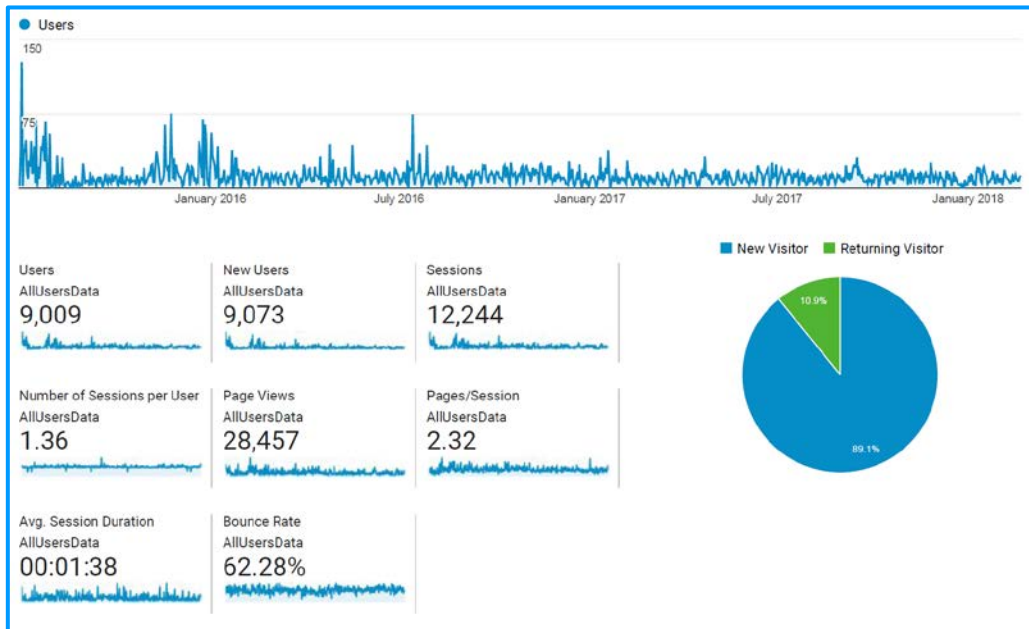
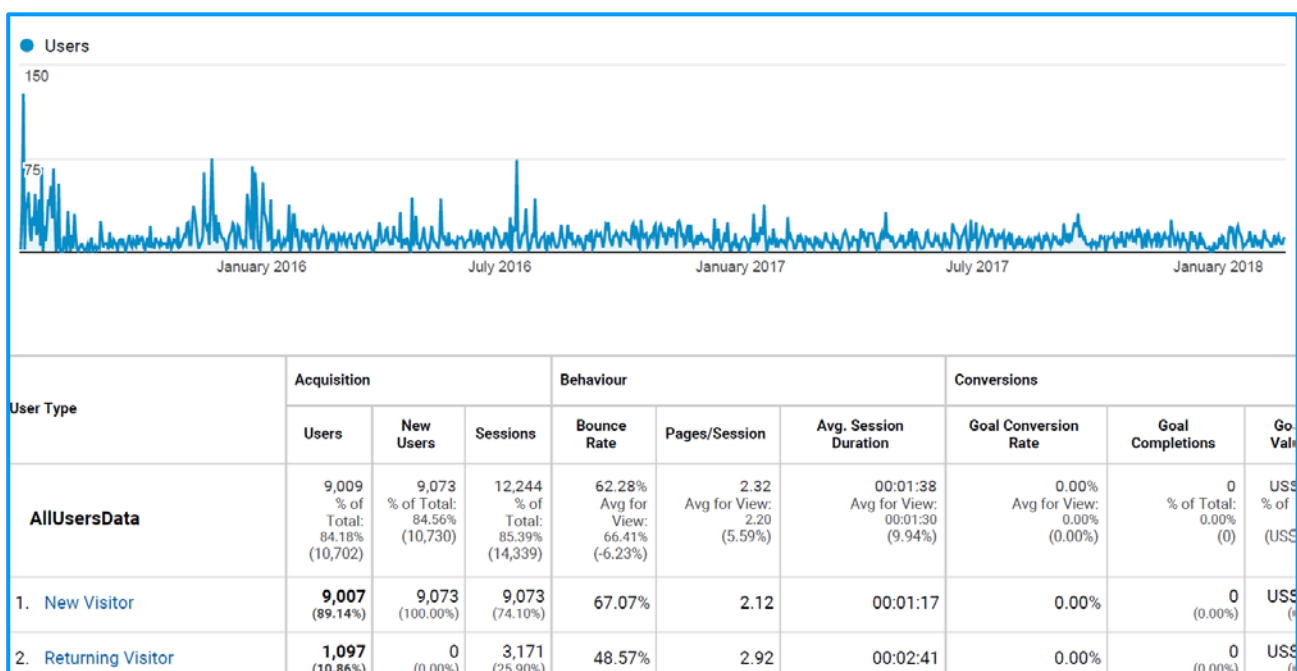


Figure 18 – Audience General Overview

#### 4.1.1.1 New vs Returning

Concerning the Audience, we can see that 89,1 % of users are New Visitors. In the figure below, we can see that Returning Visitors performed in the period 9007 sessions with a Bounce Rate of 67,07% and an Average Session Duration about 1,17 minutes.



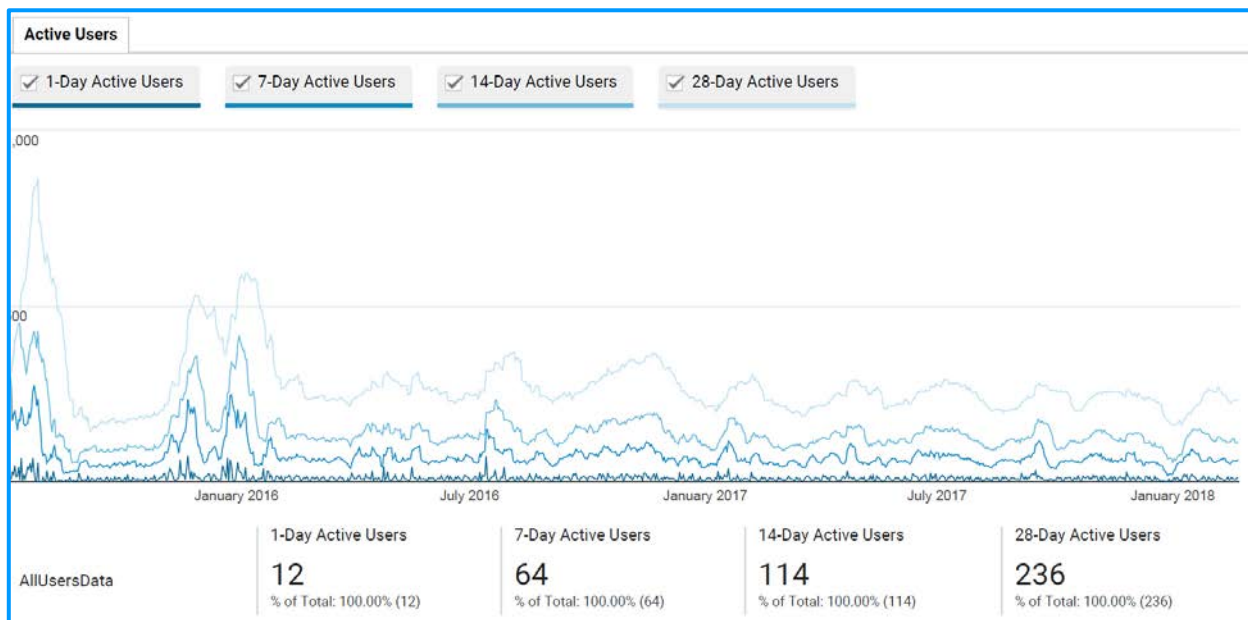


*Figure 19 – New Visitors and Returning Visitors*

#### 4.1.1.2 Active Users

The figure shows the number of Active Users per period. “Active Users” means the number of unique users who visited the website in the last 1 day – 30 days in the selected period. In this case since the creation of the web site.

- 1 day: 12 users
- 7 days: 64 users
- 14 days: 114 users
- 30 days: 236 users



*Figure 20 – Number of unique users per n. of days*



#### 4.1.1.3 Location

The figure below shows an Analytics map about the number of accesses from different countries.

■

*Figure 21 – World Map of Users*

The list below reports the number of access for the top 10 countries. We can see a relevant number of accesses from United States, UK, Italy, France but also from countries not represented by project partners, such as India and China.

*Figure 22 – Number of Session per Countries*



#### 4.1.1.4 Page Business Performance Efficiency

The table below shows pages with the best performing contents.

Page Title	Page Views	Unique Page Views	Avg. Time on Page	Entrances	Bounce Rate	% Exit
<b>AllUsersData</b>	28,457 % of Total: 90.17% (31,561)	23,349 % of Total: 91.75% (25,449)	00:01:14 Avg for View: 00:01:14 (-0.33%)	12,201 % of Total: 85.35% (14,296)	62.28% Avg for View: 66.41% (-6.23%)	42.88% Avg for View: 45.30% (-5.35%)
1. Superfluidity Project   the ability to instantiate internet services on-the-fly	<b>6,348</b> (22.31%)	<b>5,085</b> (21.78%)	00:01:19	<b>4,412</b> (36.16%)	<b>42.61%</b>	<b>41.29%</b>
2. Partners   Superfluidity Project	<b>2,894</b> (10.17%)	<b>1,865</b> (7.99%)	00:00:44	<b>455</b> (3.73%)	<b>55.07%</b>	<b>23.15%</b>
3. Home page	<b>1,861</b> (6.54%)	<b>1,861</b> (7.97%)	00:00:00	<b>1,693</b> (13.88%)	<b>100.00%</b>	<b>100.00%</b>
4. Deliverables   Superfluidity Project	<b>1,192</b> (4.19%)	<b>1,051</b> (4.50%)	00:02:50	<b>203</b> (1.66%)	<b>77.72%</b>	<b>56.96%</b>
5. Dissemination   Superfluidity Project	<b>1,056</b> (3.71%)	<b>857</b> (3.67%)	00:02:12	<b>204</b> (1.67%)	<b>69.08%</b>	<b>42.90%</b>
6. Specific Objectives   Superfluidity Project	<b>931</b> (3.27%)	<b>811</b> (3.47%)	00:01:43	<b>169</b> (1.39%)	<b>79.88%</b>	<b>35.77%</b>
7. News   Superfluidity Project	<b>730</b> (2.57%)	<b>575</b> (2.46%)	00:00:58	<b>67</b> (0.55%)	<b>61.19%</b>	<b>24.11%</b>
8. Communication   Superfluidity Project	<b>664</b> (2.33%)	<b>567</b> (2.43%)	00:00:40	<b>48</b> (0.39%)	<b>63.27%</b>	<b>17.92%</b>
9. Intel Research & Development Ireland Ltd   Superfluidity Project	<b>663</b> (2.33%)	<b>557</b> (2.39%)	00:01:32	<b>448</b> (3.67%)	<b>64.73%</b>	<b>59.88%</b>
10. (not set)	<b>630</b> (2.21%)	<b>563</b> (2.41%)	00:01:44	<b>563</b> (4.61%)	<b>98.22%</b>	<b>89.37%</b>

Figure 23 – Best Performing Contents

## 4.2 LinkedIn

A SUPERFLUIDITY Group page has been created on LinkedIn (SUPERFLUIDITY – 5GPPP) and all the Partners Team individuals have been invited to join the Group. The LinkedIn group is available at: <https://www.linkedin.com/groups/8416290>. The group includes 63 members.



*Figure 24 – SUPERFLUIDITY's LinkedIn Group*

On the LinkedIn group all the News and Information published on the SUPERFLUIDITY web site have been shared. To date, 28 discussions were published.

### 4.3 Twitter

Twitter is the constant posting system that rests on the idea of short sentences and reactions that show the positive or negative attitudes of its users. Messages can link to the SUPERFLUIDITY website, photos, videos, etc. This link provides followers the opportunity to spend more time interacting with SUPERFLUIDITY online.

SUPERFLUIDITY account (<https://twitter.com/Superfluidity5g>) was created in October 2015 and to date it counts 231 followers (79 more than those reported at M18). Among these followers, we list:

- EC Net Technologies: Official European Commission account on Network Technologies.
- H2020-ICT: Ideal-Ist: worldwide ICT support network consisting of more than 70 ICT National Contact Points (NCP) from all over the world
- EUCHINA-IoT5G: The EU-China Study on IoT and 5G, analyses the research and innovation ecosystem for IoT and 5G in China and compares it with the European model.
- 5GTestNetwork: Test network for 5G technologies, applications, business models,
- Ericsson Deutschland
- 5G World Series
- [LTEto5G.com](http://LTEto5G.com): resource providing comprehensive market intelligence about every facet of the Next Generation Networks.
- Tehran5G



*Figure 25 – SUPERFLUIDITY's Twitter home page*



SUPERFLUIDITY tweeted 80 posts and received appreciations and retweets from ETSI, 5GPPP, Telecom News,

Concerning the audience interest, the figure below reports the interest categories to which followers belong to. The 86% of Superfluidity audience is interested in Tech News.

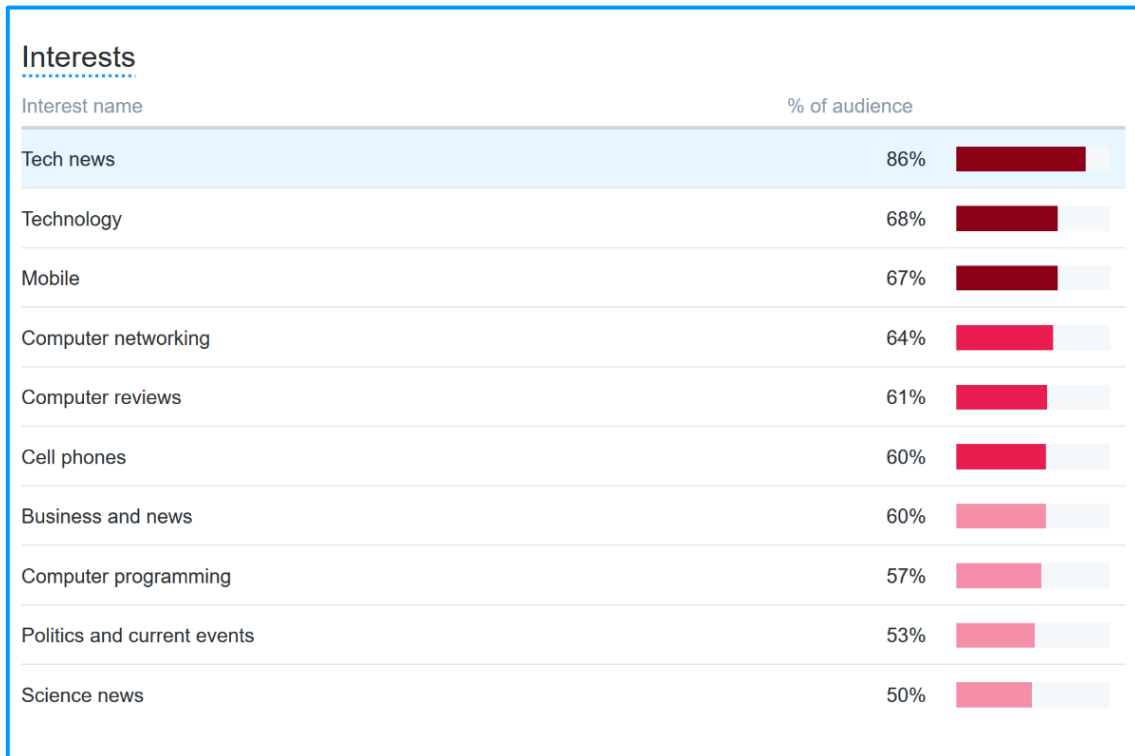
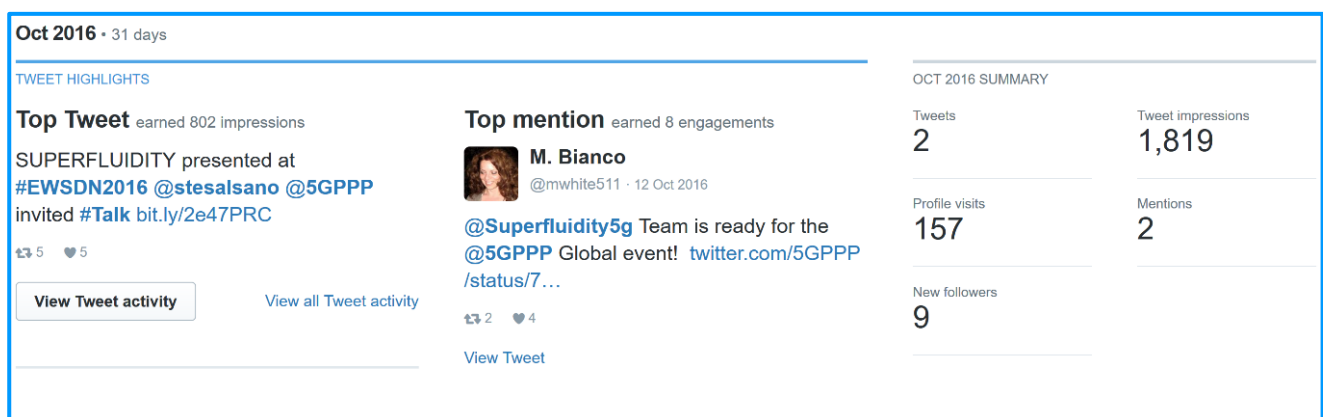


Figure 26 – Audience Interests

#### 4.3.1 Twitter Analytics

In this section we report some of the most effective twitter activities over the whole life span of the project.

- EWSDN 2016






- 5G Global Event 2016

**Nov 2016** • 30 days

TWEET HIGHLIGHTS


**Top Tweet** earned 556 impressions  
 @global5g exhibition. Second day. People visiting Superfluidity's booth @5GPPP @inginternet @\_johngt pic.twitter.com/HPKxUvGTXn



5 2

[View Tweet activity](#) [View all Tweet activity](#)

**Top mention** earned 72 engagements  
**5G-PPP** @5GPPP · 9 Nov 2016  
 Now art the @Superfluidity5g discovering latest progress @ViolaRoberto @PODcloudEU @DSMeu #GLOBAL5G @Networld2020 pic.twitter.com/xdub3LoukF



NOV 2016 SUMMARY


Tweets	6	Tweet impressions	2,328
Profile visits	451	Mentions	8
New followers	9		

- LANMAN 2017 and EUCNC 17

**Jun 2017** • 30 days

TWEET HIGHLIGHTS


**Top Tweet** earned 629 impressions  
 CNIT's researcher Marco Bonola presenting @Superfluidity5g results at LANMAN 2017 lanman2017.ieee-lanman.org @5GPPP #SDN #osaka pic.twitter.com/g5QCEBic93



5 3

[View Tweet activity](#) [View all Tweet activity](#)

**Top mention** earned 48 engagements  
**Stefano Salsano** @stesalsano · Jun 13  
 Great @Superfluidity5g demo on stage at #Eucnc17 about #CRAN deployment, #unikernel orchestration, see slides bit.ly/2rqRtb5 pic.twitter.com/FS2c4ncFU



4 4

JUN 2017 SUMMARY

Tweets	4	Tweet impressions	1,687
Profile visits	211	Mentions	6
New followers	14		

- Superfluidity General Meeting at Nokia (Paris)



Jul 2017 • 31 days

TWEET HIGHLIGHTS

**Top Tweet** earned 847 impressions

"@Superfluidity5g meeting held at Nokia, France over the last 3 days was successful with lots of progress made in many areas related to #5G pic.twitter.com/J5en7Qpbrk



12 7

View Tweet activity

View all Tweet activity

**Top mention** earned 49 engagements

"@Superfluidity5g meeting held at Nokia, France over the last 3 days was successful with lots of progress made in many areas related to #5G pic.twitter.com/J5en7Qpbrk



12 7

View Tweet activity

View all Tweet activity

JUL 2017 SUMMARY

Tweets	2	Tweet impressions	1,566
Profile visits	375	Mentions	4
New followers	6		

- Superfluidity General Meeting at Unified Streaming (Amsterdam)

Sep 2017 • 30 days

TWEET HIGHLIGHTS

**Top Tweet** earned 436 impressions

@Superfluidity5g Seventh Face to Face meeting in Amsterdam hosted by #Unifiedstreaming, working on System integration @5GPPP #5g pic.twitter.com/5DG4MCf6Kh



**Top mention** earned 41 engagements

@Superfluidity5g Seventh Face to Face meeting in Amsterdam hosted by #Unifiedstreaming, working on System integration @5GPPP #5g pic.twitter.com/5DG4MCf6Kh



SEP 2017 SUMMARY

Tweets	1	Tweet impressions	1,001
Profile visits	174	Mentions	3
New followers	9		

- Superfluidity presentation at SmartCom 2017

Oct 2017 • 31 days

TWEET HIGHLIGHTS

**Top Tweet** earned 493 impressions

.@stesalsano invited at SmartCom 2017 for presenting @Superfluidity5g : Superfluid network for #5G @5GPPP twitter.com/stesalsano/sta...

6 2

View Tweet activity

View all Tweet activity

**Top mention** earned 8 engagements



**Stefano Salsano**  
@stesalsano · Oct 24

@Superfluidity5g invited talk at SmartCom 2017: "Superfluid networking for 5G: vision and state of the art" slideshare.net/stefanosalsano...

1 3

View Tweet

OCT 2017 SUMMARY

Tweets	1	Tweet impressions	1,168
Profile visits	125	Mentions	2
New followers	10		

- Superfluidity presentation at IEEE NFV-SDN Conference 2017



Nov 2017 • 30 days

TWEET HIGHLIGHTS

**Top Tweet** earned 116 impressions

@stesalsano is in Berlin presenting @Superfluidity5g RDCL 3D framework for advanced #NFV modelling @NFV\_SDN Conference, see the presentation [twitter.com/stesalsano/sta...](https://twitter.com/stesalsano/sta...)

1 retweet 1 like

[View Tweet activity](#) [View all Tweet activity](#)

**Top mention** earned 13 engagements

 **Stefano Salsano** @stesalsano · Nov 6

@Superfluidity5g RDCL 3D framework for advanced #NFV modelling presented @NFV\_SDN conference in Berlin [slideshare.net/stefanosalsano...](https://slideshare.net/stefanosalsano...)

2 retweets 2 likes

[View Tweet](#)

NOV 2017 SUMMARY

Tweets	1	Tweet impressions	957
Profile visits	196	Mentions	2
New followers	14		

#### 4.4 YouTube Channel


The SUPERFLUIDITY project has set up its own YouTube channel at:


<https://www.youtube.com/channel/UCUEOAQ5x5BC3ANYwe22DICA>.

This channel is used to share videos presented at conferences and other events.

For instance, CNIT realised a SUPERFLUIDITY video, presented at the conference IEEE [Globecom 2015](#), San Diego, California, in a demo booth organised and run by the 5G Architecture Working Group. This Project video is available at: <https://www.youtube.com/watch?v=6xEMZMFB1XU>.

3 subscribers 91 views Video Manager



**Superfluidity 5G**  [Subscribe](#) 3

[Channel description](#)

**Uploads** Public


 **SUPERFLUIDITY video**  
6 months ago • 91 views  
Short presentation about what SUPERFLUIDITY is.

Figure 27 – SUPERFLUIDITY's YouTube channel

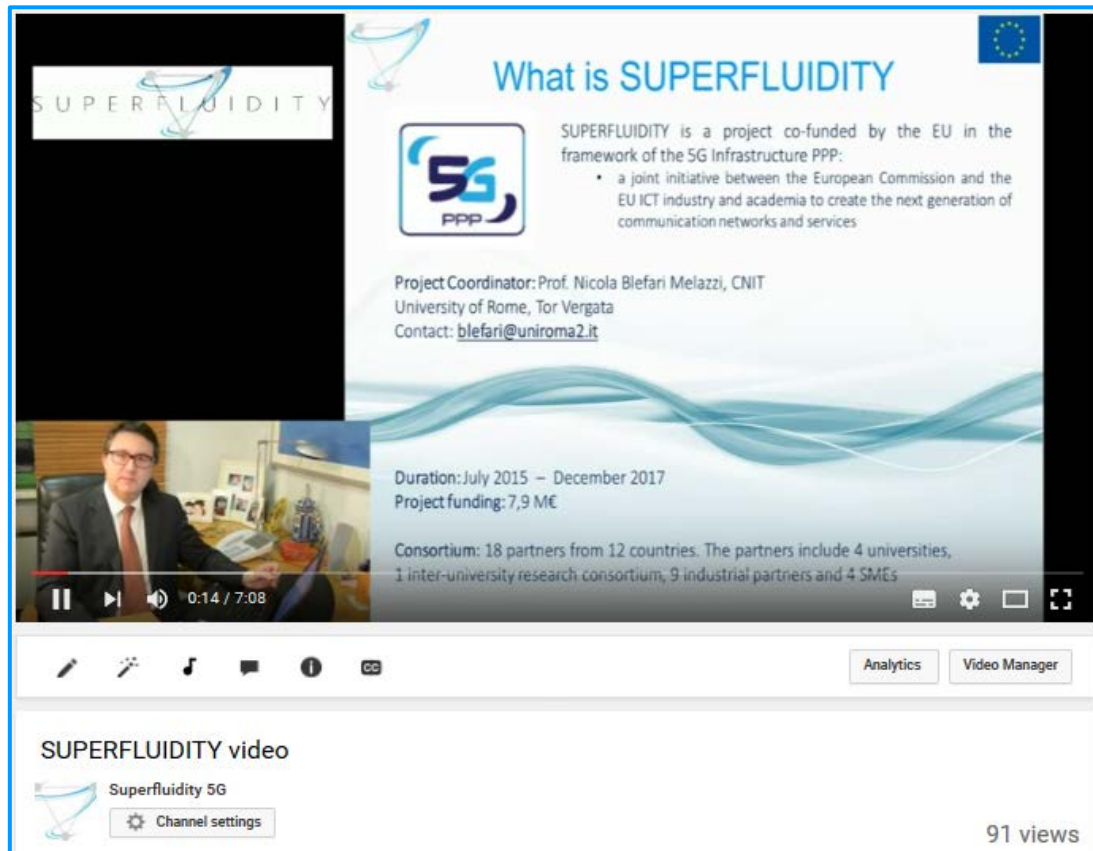


Figure 28 – Screenshot of SUPERFLUIDITY's video

To date, the channels counts 11 subscribers and an overall number of views of 477.

Two more videos have been uploaded on occasion of the Demos Exhibition at the Second 5G Global Event.

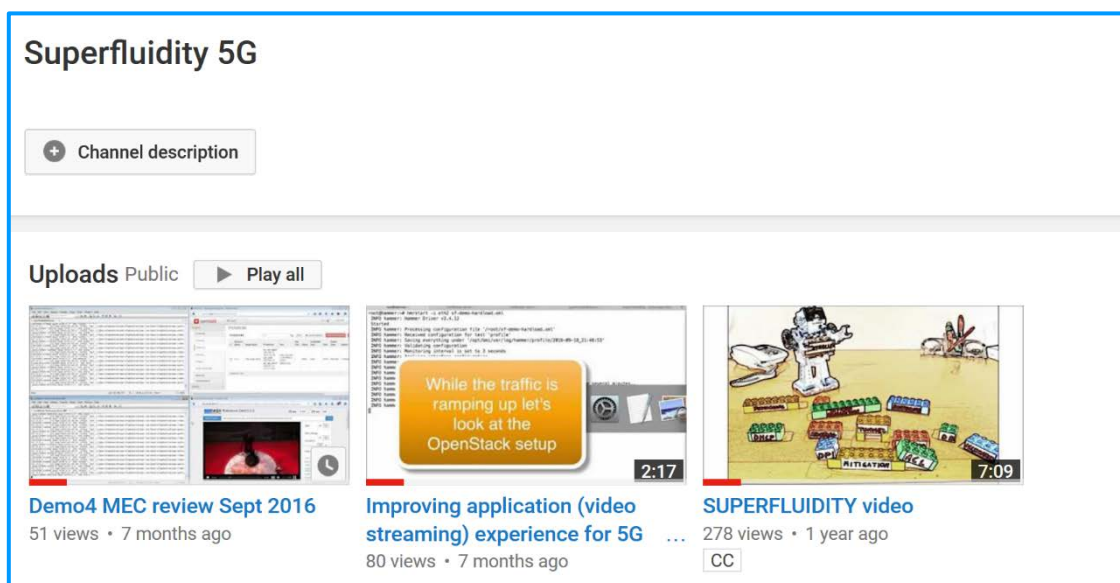


Figure 29 – List of uploaded video.



## 4.5 Press Releases and Public Interviews

On September 2015, the First Press release was released by NEC. The contents were shared and agreed by all the partners.

The Press Release ([http://www.nec.com/en/press/201511/global\\_20151109\\_02.html](http://www.nec.com/en/press/201511/global_20151109_02.html)) was followed by an interview of Saverio Niccolini from NEC on Telecom TV.

(<http://www.telecomtv.com/articles/5g/defining-superfluidity-as-a-key-piece-in-the-5g-jigsaw-puzzle-13018/>)

The Interview was published by several online newspapers listed below:

1. TelecomsTech: <http://www.telecomstechnews.com/news/2015/nov/10/superfluidity-project-wants-build-cloud-based-5g-network/>
2. Telecoms.com: <http://telecoms.com/451992/euro-consortium-to-develop-cloud-based-5g/>
3. Telecompaper: <http://www.telecompaper.com/news/nec-joins-eus-superfluidity-5g-development-project—1112462>
4. Business Cloud News: <http://www.businesscloudnews.com/2015/11/09/nec-and-partners-in-europe-to-develop-converged-cloud-based-5g-network/>
5. Equities.com (via M2): [http://www.equities.com/index.php?option=com\\_k2&view=newsdetail&id=464697](http://www.equities.com/index.php?option=com_k2&view=newsdetail&id=464697)
6. Wireless: <http://www.wireless-mag.com/News/39517/nec-joins-european-5g-virtual-network-and-service-platform-project.aspx>

A second Press release was issued by CNIT in the framework of the common communication activities planned:

<https://5g-ppp.eu/superfluidity-a-super-fluid-cloud-native-converged-edge-system/>

Unified Streaming published on its own web site an article entitled “5G Superfluidity and the future of streaming video” on November 2016: <http://www.unified-streaming.com/blog/5g-superfluidity-and-future-streaming-video>

Luis Tomas Bolivar from RED HAT published on his personal blog five different articles describing the SUPERFLUIDITY’s results and activities:

- 1- Superfluidity: Containers and VMs in the Mobile Network (Part 1): <https://ltomasbo.wordpress.com/2017/01/16/superfluidity-containers-and-vms-at-the-mobile-network-part-1/>
- 2- Superfluidity: Containers and VMs in the Mobile Network (Part 2): <https://ltomasbo.wordpress.com/2017/01/24/superfluidity-containers-and-vms-deployment-for-the-mobile-network-part-2/>
- 3- Side-by-side and nested Kubernetes and OpenStack deployment with Kuryr: <https://ltomasbo.wordpress.com/2017/01/29/side-by-side-and-nested-kubernetes-and-openstack-deployment-with-kuryr/>



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- 4- Kuryr Ports Pool: Speeding up containers booting time on Neutron networks:  
<https://ltomasbo.wordpress.com/2017/05/09/kuryr-ports-pool-speeding-up-containers-booting-time-on-neutron-networks/>
  - 5- OpenShift with Kuryr on top of OpenStack VMs: step by step set up:  
<https://ltomasbo.wordpress.com/2017/05/19/openshift-with-kuryr-on-top-of-openstack-vms-step-by-step-set-up>



## 5 Data Management Plan

We have worked on the update of the data management plan. Following the original plan described in D8.1, we have collected information about data sets that the partners will produce in their experiments and that they do not have concern sharing. We have identified a default procedure and a default repository for the management and publication of the data sets. The procedure is not prescriptive, each partner that produces the data set can decide to use a different procedure/repository (or even not to publish the data set).

The data sets that have been identified are related to the scientific papers that will be produced based on the project work and results. The papers will be submitted to different conferences / publishers that usually retain the copyright on the final camera ready version but allow self-archiving of the pre-print version and/or submission to public preprint repositories. The idea is to publish the data set that have been used to produce the scientific publication and that can be reused by other researchers to reproduce the results.

The project has identified the Zenodo repository (<http://zenodo.org/>, supported by the EC OpenAIRE Initiative) as the default repository for publishing the data sets. The Zenodo repository allow to publish data sets independently from the scientific paper (it is possible to make a reference to an external paper not published in the Zenodo repository).

As for the papers, all the conferences and publishers that we are considering allow to perform the self-archiving. Using self-archiving, all papers published by the project partners are available on the web. The use of Arxiv repository is also possible.

The project has identified the Creative Commons Attributions 4.0 (also known as “CC-BY”) as the default license for the publication of the data sets. This license allows everyone to share and remix (create derivative works), even for commercial use, so long as attribution is given. This is in line with the fact that the data set we are considering are mostly related to research aspects / scientific publications.

### 5.1 Released Data Sets

The data sets that have been released are reported in this section.

#### 5.1.1 Reference Workload for Traffic Generation

##### *Data set description*

CITRIX collects content (web pages, files, videos, etc.) that is used as one of the reference workloads for traffic generation, in the context of the hardware profiling activities of Task 4.1 (WP4).

Starting from the content in the data set collection, it is possible to create reference workloads and evaluate traffic profile characteristics, such as TCP/UDP protocol mix, HTTP/HTTPS content type mix,



video content mix, device type mix, average object sizes, average TCP connection durations, HTTP/HTTPS transaction rates, etc. is captured.

*Data set availability*

Available on zenodo: <https://doi.org/10.5281/zenodo.1241114>

### 5.1.2 Containers for studying auto-scaling

*Data set description*

In order to evaluate various mechanisms such as automated auto scaling, and since containers are still scarce in the community, BGU designs and implements a set of containers, which are intended to be shared by the community. BGU has already deployed three containers that are memory, network or bandwidth demanding, including a dedicated video streaming container which has high CPU and memory requirements (“videoruvn”). The other containers do do complicated calculation operations. These containers are available on Docker hub repository and draw attention by the community (over 6500 downloads in less than two months).

*Data set availability*

The containers can be retrieved with docker pull as follows:

```
Docker pull ruvenmil/videoruvn
Docker pull ruvenmil/mycont2
Docker pull ruvenmil/phpruvn
```

### 5.1.3 Measurements of instantiation time and other timestamps in the Virtual Infrastructure Managers enhanced for Unikernel support.

*Data set description*

The dataset contains the results measured in the experiment about the performances of different Virtual Infrastructure Managers (OpenVIM, OpenStack and Nomad) supporting Unkinernel orchestration.

*Data set availability*

Available on zenodo: <http://doi.org/10.5281/zenodo.1241097>



#### 5.1.4 Performance data of video streaming VMs (KPI mappings).

##### *Data set description*

The dataset contains the performance data collected by SNAP during the process of off-line characterization of the RFBs used in the video streaming service.

##### *Data set availability*

Available on zenodo: <http://doi.org/10.5281/zenodo.1241148>

#### 5.1.5 Network experiments with Network Performance Framework (NPF) tool

##### *Data set description*

These datasets result from network experiments that were conducted on a ULiège testbed with the Network Performance Framework (NPF) tool. Those can be easily reproduced on a different testbed by checking out <https://github.com/tbarbette/npf> which contains both the tools and the test files used for those tests.

Two datasets are available: i) Router with trace replay; ii) Router with synthetic traffic.

##### *Data set availability*

Available on zenodo: <http://doi.org/10.5281/zenodo.1241095>



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## 6 Conclusion

As reported by this deliverable, the SUPERFLUIDITY project has substantially exceeded the originally planned objectives, in terms of successfully fulfilling the communication and dissemination goals.