CLEEN2018 workshop

Sixth International Workshop on

Cloud Technologies and Energy Efficiency
in Mobile Communication Networks
(CLEEN 2018)

In conjunction with VTC2018-spring, 3 June 2018, Porto, Portugal

Porto, June 3rd, 2018

Dario Sabella
(INTEL, Next Generation and Standards)

CLEEN workshops: the series

Cloud Technologies and Energy Efficiency in Mobile Communication Networks (CLEEN)

How cloudy and green will mobile network and services be?

Purpose: study novel concepts for 5G to allow for flexibly centralised radio access networks using cloud-processing based on open IT platforms, in coordination with NFV and MEC.

The aim is to allow:

- guaranteed high QoS/QoE for mobile access to cloud-processing resources and services
- future network evolution focused on energy efficiency and cost-effectiveness.

This requires new concepts for the design, operation, and optimization of radio access networks, backhaul networks, operation and management algorithms, and architectural elements, tightly integrating mobile networks and cloud-processing.

Past editions

1st international Workshop on Cloud Technologies and Energy Efficiency in Mobile Communication Networks (CLEEN 2013), at IEEE VTC fall 2013.

- www.ict-ijoin.eu/cleen2013

2nd international Workshop on Cloud Technologies and Energy Efficiency in Mobile Communication Networks (CLEEN 2014), at WCNC2014.

- www.ict-ijoin.eu/cleen2014

3rd international Workshop on Cloud Technologies and Energy Efficiency in Mobile Communication Networks (CLEEN 2015), at EUCnC2015.

- www.ict-ijoin.eu/cleen2015

4th international Workshop on Cloud Technologies and Energy Efficiency in Mobile Communication Networks (CLEEN 2016), at CrownCom 2016.

- http://www.flex5gware.eu/cleen2016

5th international Workshop on Cloud Technologies and Energy Efficiency in Mobile Communication Networks (CLEEN 2017), as a regular IEEE conference technically co-sponsored by IEEE ComSoc.

- http://www.flex5gware.eu/cleen2017

CLEEN2018 edition

Special topic for this 2018 edition
(co-located with IEEE Vehicular Technology Conference)

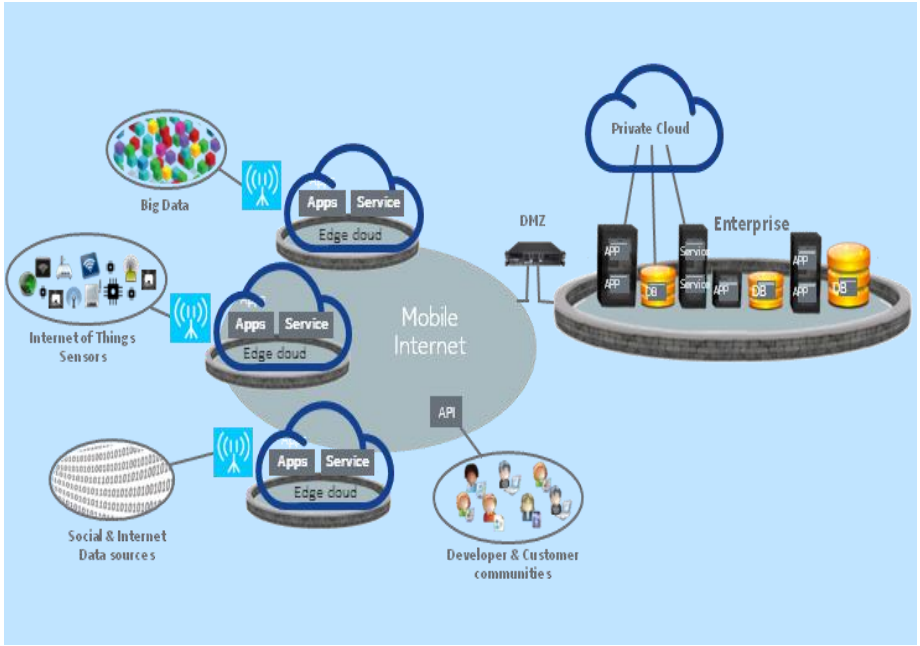
Final panel on *"MEC and V2X: the role of edge computing in Automotive use cases"*

Panelists:

- prof. Thomas Haustein, Fraunhofer Institute for Telecommunications, HHI
- Rui Frazao, CTO, Vasona Networks
- Leonardo Gomes Baltar, WG1 vice-chair in 5G Automotive Association (5GAA), Intel
- Frank Schaich, One5G project coordinator, Nokia Bell Labs

Why Edge Computing?

… as in Real Estate, it's about just 3 things: **Location, Location, Location**



Cloud-computing at the network edge.

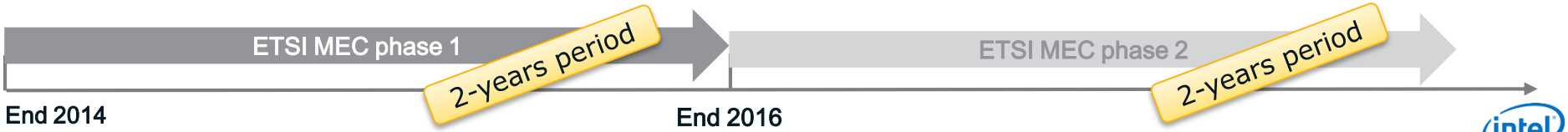
- Proximity
- Ultra-low latency
- High bandwidth
- Real-time access to access network and context information
- Location awareness

What is MEC?

Multi-access Edge Computing offers to application developers and content providers cloud-computing capabilities and an IT service environment at the edge of the network.

A bit of history…

Sept 2014	The founding companies of MEC (including INTEL) published a white paper which defined it as: "IT and cloud-computing capabilities within the radio access network in close proximity to mobile subscribers."
End of 2014	This initiative led to the creation of the standardization body ETSI MEC ISG. MEC acronym (in PHASE 1) stood for Mobile Edge Computing. In Phase 1, INTEL was Vice-Chair of MEC.
Begin of 2016	After more than one year from its foundation, MEC, in Feb. 2016, counted about 60 members/participants, including INTEL (one of the founding members).
March 2017	With the starting of PHASE 2 of ETSI MEC ISG, the acronym MEC stands for Multi-access Edge Computing. Now, the MEC standard is not limited to mobile networks, but is covering also non-3GPP access and fixed networks as well. In Phase 2, INTEL is again part of the MEC leadership, with the position of ETSI MEC Secretary and Lead of industry Group Relationship.



ETSI Multi-Access Edge Computing

Pioneering open standards for Edge Computing

- Since 2014

First and still only international Standard available on this space

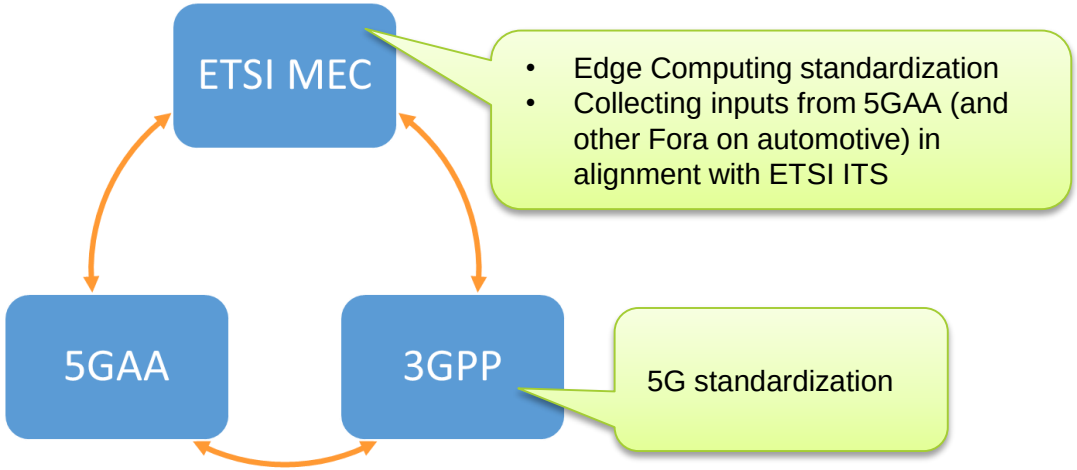
Leadership across Ecosystem

Hewlett Packard Enterprise, NOKIA, intel, VIAVI, vodafone, HUAWEI

Broad Participation

MEC, Edge Computing, 5G and verticals.

- Edge computing is commonly recognized as an important technology for 5G.
- 3GPP is adopting the Edge Computing concept and putting measures in place accordingly.
- ETSI MEC is currently the first and only standard available for Edge Computing.
- ETSI MEC is covering many verticals like automotive, as well as other industrial use cases.
  - *Example*: 5GAA (5G Automotive Association)



ETSI MEC and Industry Groups (*)

VRARA (VR/AR association)
OFC (Open Fog Consortium)
AREA (Augmented Reality for Enterprise Alliance)
5GAA
SCF (Small Cell Forum)
GSMA
BBF (BroadBand Forum)
…

(*) ETSI MEC is establishing collaborations with different industry organizations

5GAA Automotive Association

5GAA was created to connect telecom industry and vehicle manufacturers and work closely together to develop end-to-end solutions for future mobility and transportation services

AUTOMOTIVE INDUSTRY

Vehicle Platform, Hardware and Software Solutions

TELECOMMUNICATIONS

Connectivity and Networking Systems, Devices and Technologies

End to end solutions for intelligent transportation, mobility systems and smart cities

intel

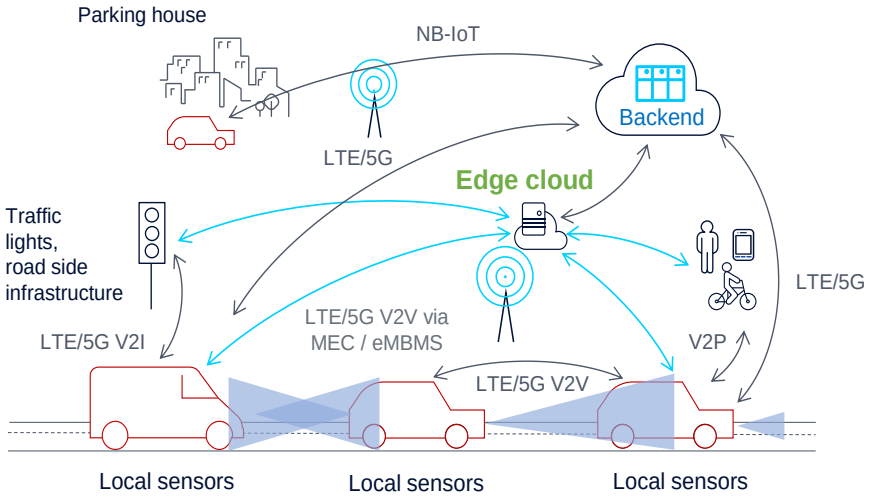
Members


Airgain
ANALOG DEVICES
Anritsu
envision : ensure
AT&T
Audi
北汽集团
BAIC GROUP
BMW GROUP
Rolls-Royce
BOSCH
大唐电信科技产业集团
CETECOM
中国移动
China Mobile
Continental
The Future In Motion
DAIMLER
DANLAW
AUTOMOTIVE MADE SMART
DEKRA
DENSO
ERICSSON
FEV
FICOSA
Ford
gemalto
security to be free
Hirschmann
Car Communication
A VOXX INTERNATIONAL COMPANY
HUAWEI
infineon
intel
INTERDIGITAL
JAGUAR
LAND ROVER
KDDI
KEYSIGHT
TECHNOLOGIES
kt
Laird
LG
muRata
NISSAN
MOTOR CORPORATION
NOKIA
docomo
orange
P3
Panasonic
proximus
QUALCOMM
ROHDE&SCHWARZ
ROHM
SEMICONDUCTOR
SAIC
上汽集团
SAIC MOTOR
SAMSUNG
SAVARI
安亭·上海国际汽车城
Anting • Shanghai International Automobile City
SK telecom
SKYWORKS
SoftBank
Telefónica
TÜVRheinland
Valeo
verizon
VIAVI
vodafone
Volkswagen
ZF
ZTE

5GAA White Paper on Edge Computing

In Dec 2017, 5GAA published a white paper (led by INTEL):

- This white paper provides an overview of automotive use cases and shows how Edge Computing provides compute/storage/networking capabilities at the network edge, and how it can be considered a supporting technology for multiple services for connected AD vehicles.



http://5gaa.org/wp-content/uploads/2017/12/5GAA_T-170219-whitepaper-EdgeComputing_5GAA.pdf

CLEEN2018 workshop

programme

Workshop programme

8:30	Welcome and presentation by the workshop chair, Dario Sabella (Intel)
9:00	Keynote, Merging new cloud and air-interface capabilities to meet requirements of emerging use cases from verticals in 5G (prof. Thomas Haustein, Head of Wireless Communications and Networks Department, Fraunhofer Institute for Telecommunications, HHI)
9:30	Paper #1: "Operating Systems for 5G services infrastructures"; A. Manzalini, TIM; F. Marino, Scuola Superiore Sant'Anna
10:00	Coffee Break
10:30	Paper #2: "Energy-Efficient Beamforming and Time Allocation in Wireless Powered Communication Networks"; M. Fu, Shenzhen University; C. Guo, Shenzhen University; S. Zhang, Shenzhen University; D. Feng, Shenzhen University; G. Qian, Shenzhen University
11:00	Paper #3: "FFR Based Interference Coordination Scheme in the Next Generation WLAN"; P. Sun, Xidian University; R. Hou, Xidian University; X. Ma, Xidian University; H. Li, Xidian University
11:30	Paper #4: "Joint Transceiver Design in Full-Duplex MISO Wireless Powered Communication Networks with User Cooperation"; R. Cai, Beijing University of Posts and Telecommunications (BUPT); L. Li, BUPT; Z. Wang, BUPT
12:00	Lunch Break

Workshop programme

13:00	Keynote, *MEC: Building a Bridge to 5G* (Rui Frazao, CTO, Vasona Networks)
13:30	Paper #5: "Minimizing power consumption in virtualized cellular networks"; G. Nardini, University of Pisa; A. Virdis, University of Pisa; N. Iardella, University of Florence; A. Frangioni, University of Pisa; L. Galli, University of Pisa; G. Stea, University of Pisa
14:00	Paper #6: "A hierarchical MEC architecture: experimenting the RAVEN use case"; D. Sabella, Intel Deutschland GmbH; N. Nikaein, Eurecom; A. Huang, Eurecom; J. Xhembulla, Politecnico di Torino; G. Malnati, Politecnico di Torino; S. Scarpina, TIM.
14:30	Paper #7: "The ONE5G approach towards the challenges of multi-service operation in 5G systems"; F. Schaich, Nokia; M.-H. Hamon, Orange; M. Hunukumbure, Samsung Electronics UK; J. Lorca, Telefónica I+D; K. Pedersen, Nokia; M. Schubert, Huawei; E. Kosmatos, WINGS ICT solutions; G. Wunder, Freie Universitaet Berlin; K. Reaz, Freie Universitaet Berlin;
15:00	coffee Break
15:30	FINAL PANEL discussion
16:30	Wrap-Up & Closing by the Workshop Chair