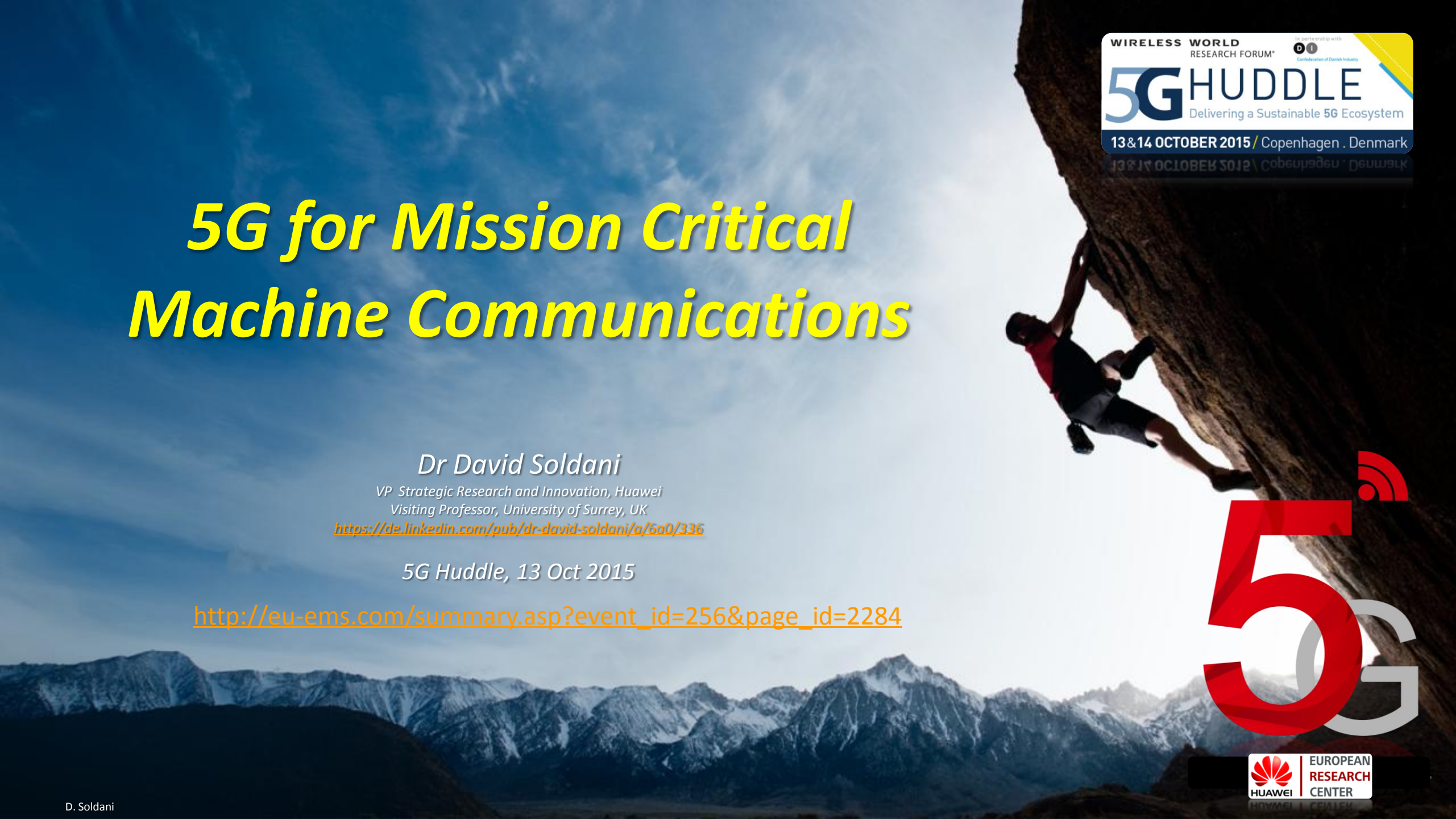

5G for Mission Critical Machine Communications

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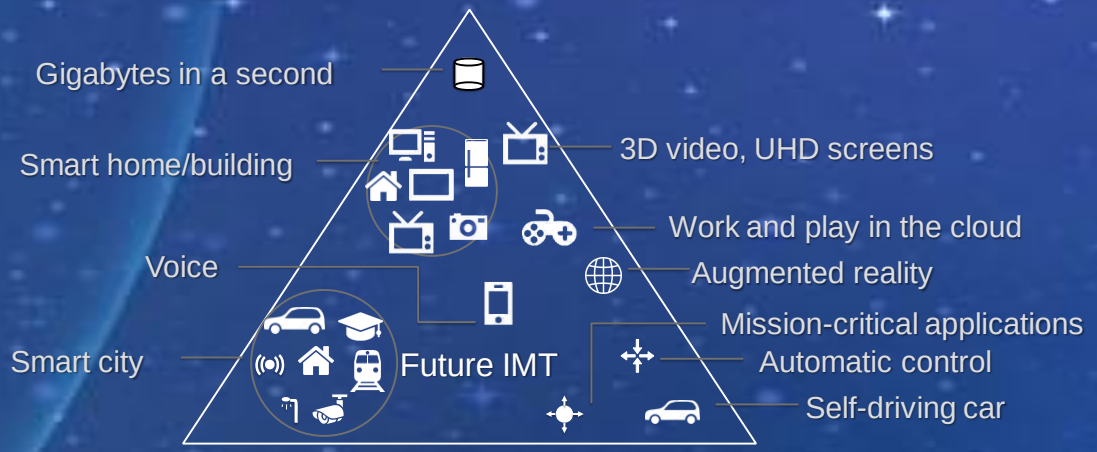
5G Huddle, 13 Oct 2015

http://eu-ems.com/summary.asp?event_id=256&page_id=2284

Key recommendations and capabilities

3 Enhanced Mobile Broadband



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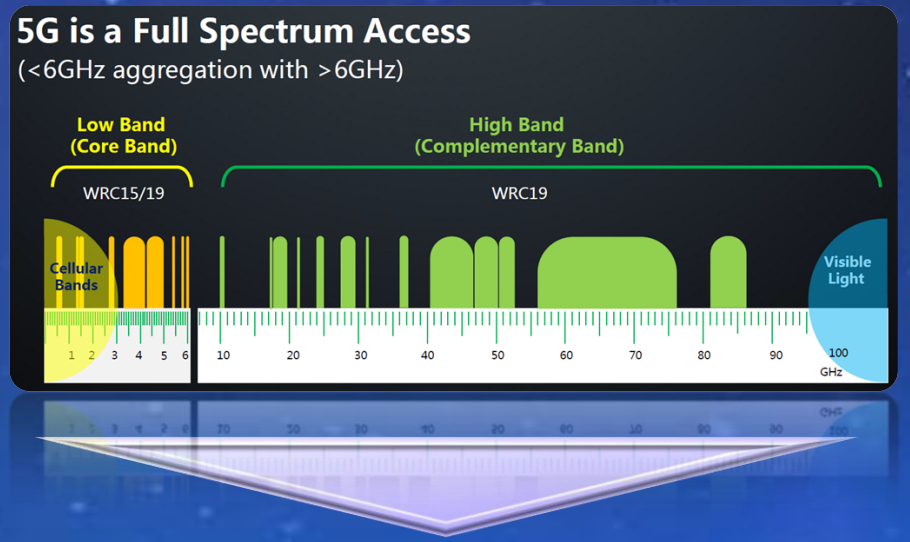


2 Massive M2M Communications

1 Ultra-reliable, Low-latency Communications

100 Billion
Connections

1 Millisecond
Latency

10 Gbit/s
Peak Speed

New Air Interface

Flexibility &
Spectrum Efficiency

New Architecture

One Physical Network
Multiple Industries

5G Vertical Industry Accelerator (VIA): Tests and trials (Tentative)

➔*Tests and large scale trials in Europe (open platform): 10 Gb/s wireless speed (rendering) and 1ms latency end to end (sensing-reasoning-acting)*

Private

Public

L1-3 Routing/ Forwarding

MEC Server

3) Reasoning

Orchestration

Control

5) Slicing (NSaaS)

Outdoor (below 6GHz)

4

4) Acting

Control

[ORO: Sant'Anna University, Italy]

Control

3

4) Acting

Indoor (mmW)

Sound field

1

2) Rendering

3) Interacting

1) Sensing

4K/8K video
24 beams audio

Camera array

Microphone array

2

4K stereo video
binaural audio

iCub
www.icub.org

[ORO: Sant'Anna University, Italy]

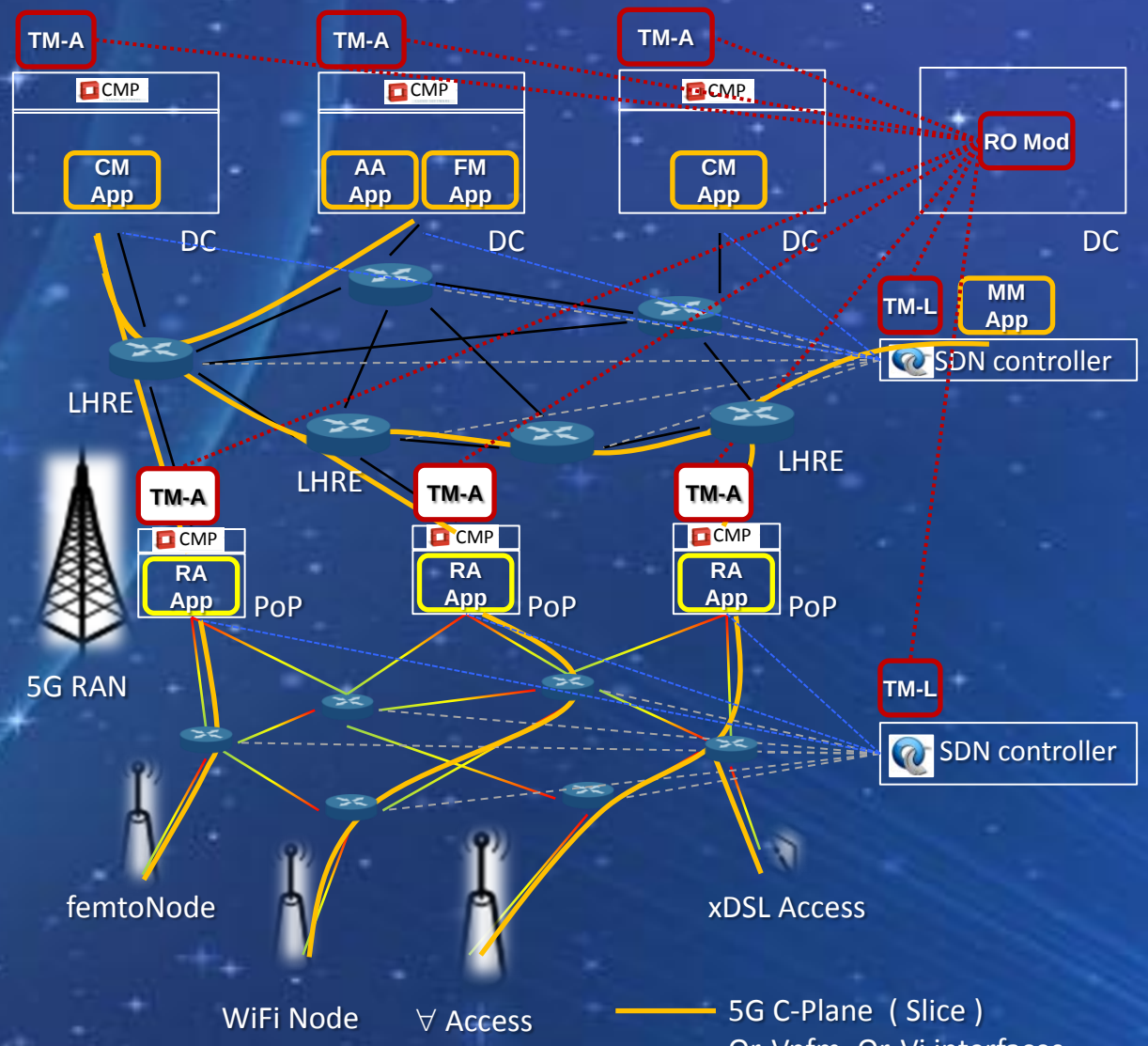
4) Acting

Phase I | Phase II | Phase III

1 Sensing
2 Rendering
3 Connected cars
4 Connected service robots

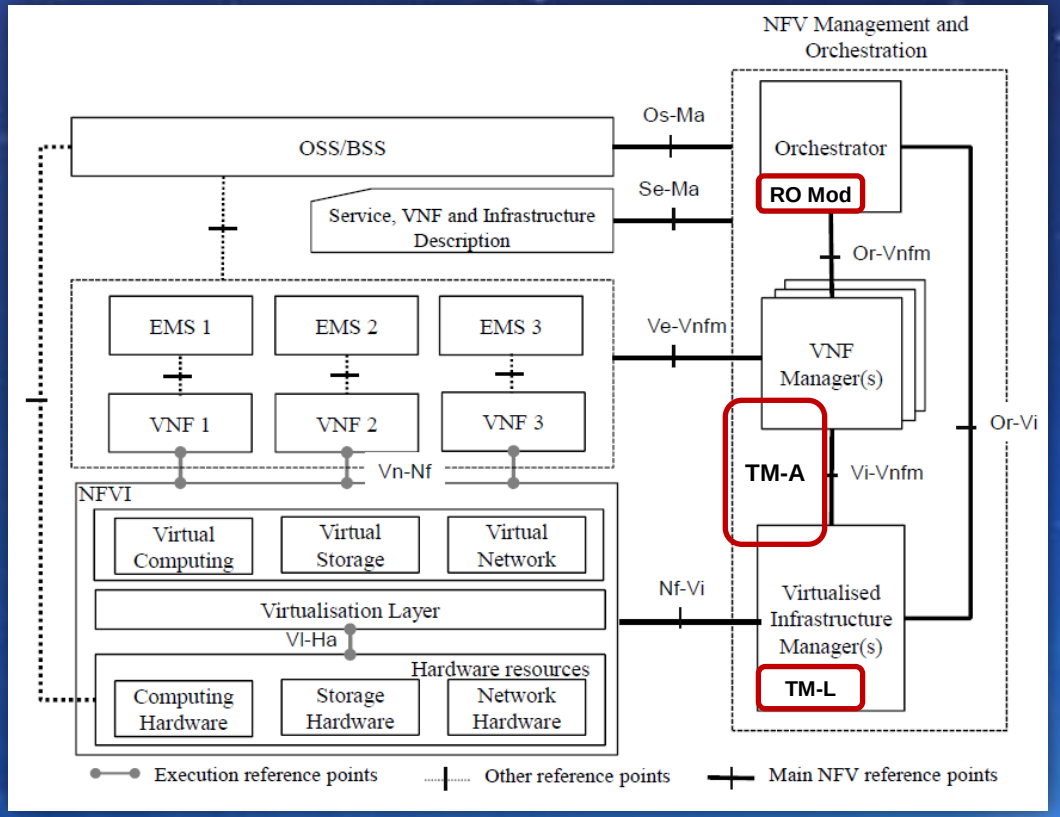
5G Plastic Architecture: how to achieve that?

➔ *Unified Connection, Security, Mobility and Routing management without tunneling protocols*



= Orchestration
- RO (Resource Orchestration): Apps and Link s *CP*
- TM-A (Topology Management): Apps Enf./Maint.
- TM-L (Topology Management): Links Enf./Maint.

= Control plane
- FM (Flow Management) App: Links *DP*



- RO functions are performed by NFV-O
- TM-A functions are performed by VNF-M and VIM
- TM-L functions are performed by VIM

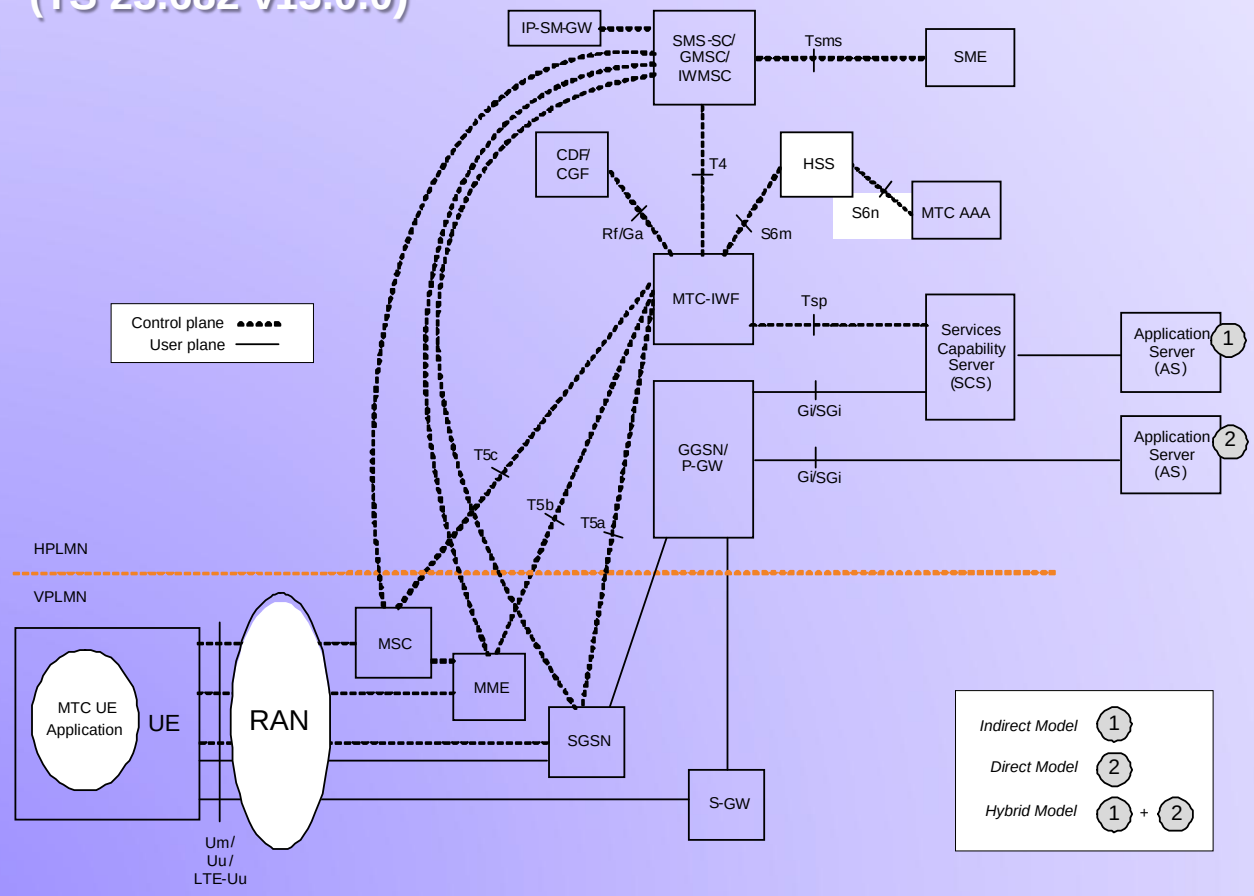
[R. Trivisonno. R. Guerzoni, I. Vaishnavi, D. Soldani, Huawei]

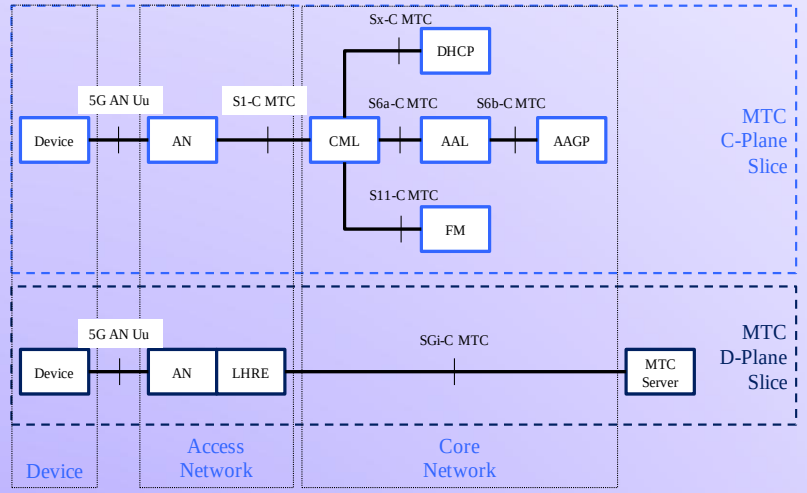
5G E2E System Concepts

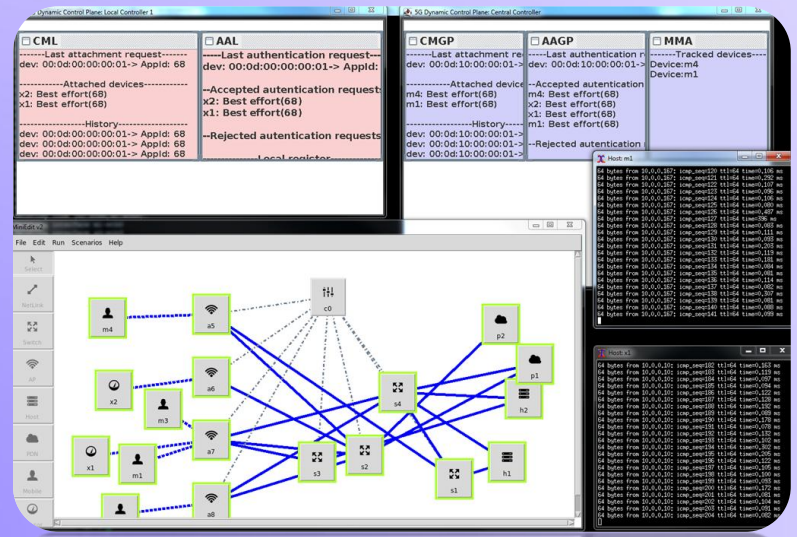
Example: 5G Slice for Delay Critical Static MTC Service

AN = generic Access Network element (AN)
CML = Connectivity Management Local function
FM = Flow Management function
DHCP = Dynamic Host Configuration Protocol function, e.g. Addresses
AA = Authentication and Authorization (AA) function
GP = centralized General Purpose

4G MTC Architecture (TS 23.682 v13.0.0)



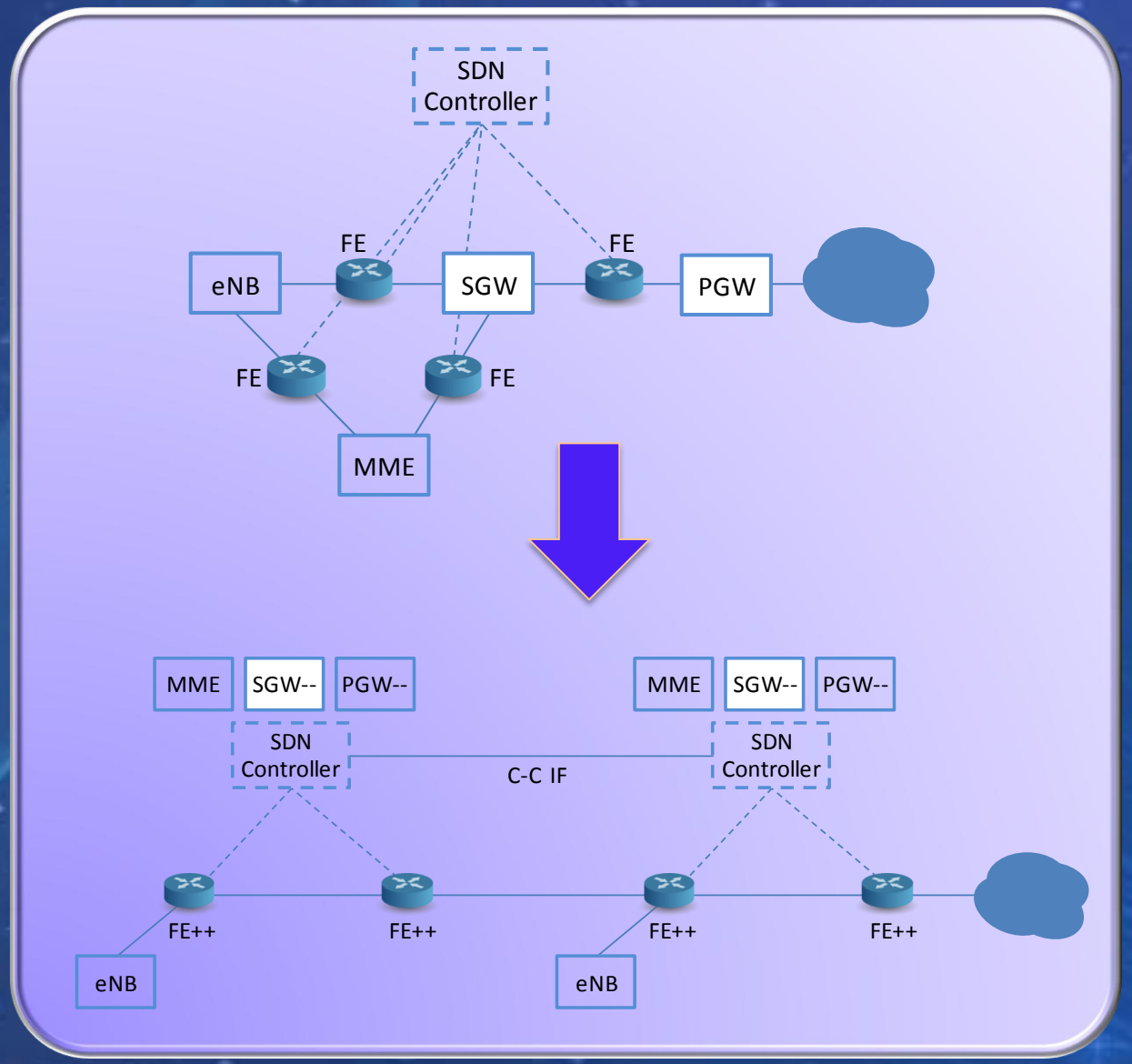


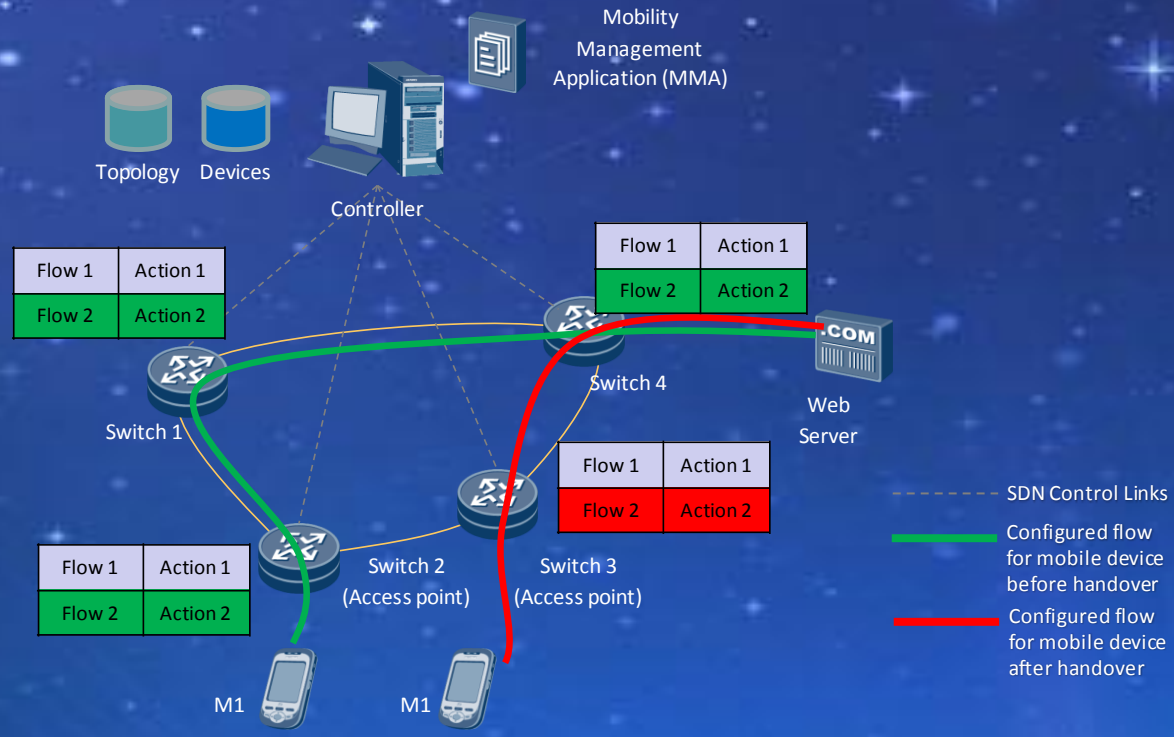


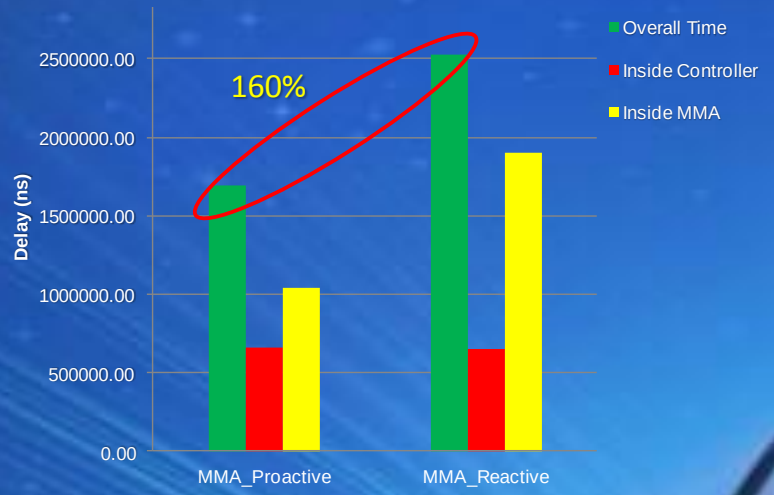
David Soldani, Huawei, 5GIA Board Member

[I. Vaishnavi, D. Perez, R. Guerzoni, R. Trivisonno, C. Marquezan, Z. Despotovic, X. Xiao, A. Hecker, Huawei]

Mobility Management Application (MMA) for SDN: case study





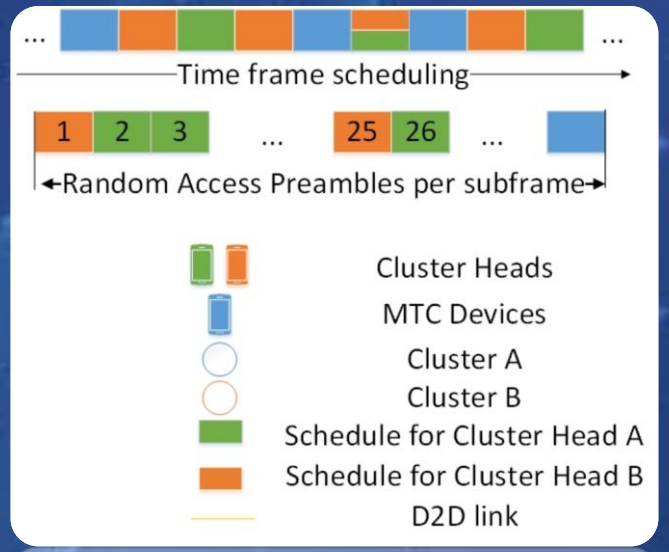


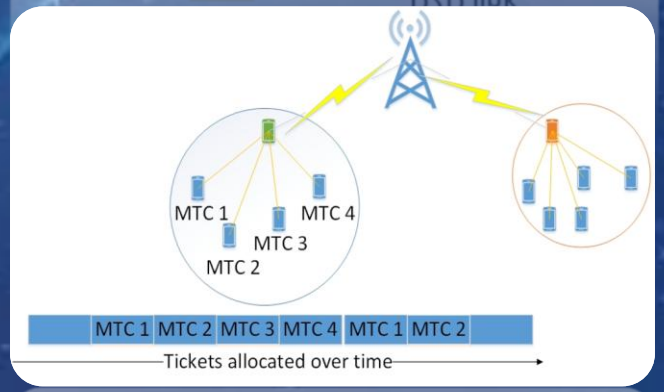
- Topology: 10 Access Points, 200 active mobiles
- 10 Handovers/s with random mobility

[Z. Despotovic, I. Vaishnavi, D. Perez, R. Guerzoni, R. Trivisonno, C. Marquezan, X. Xiao, A. Hecker, Huawei]

Radio Access Application (RAA) for SDN: case study

1. *Fine tune existing network functions/protocols according to the vertical (e.g., no mobility for static devices)*
2. *Introduce new protocols in different slices e.g., modify RACH access mechanism for mMTC (e.g., grouping)*

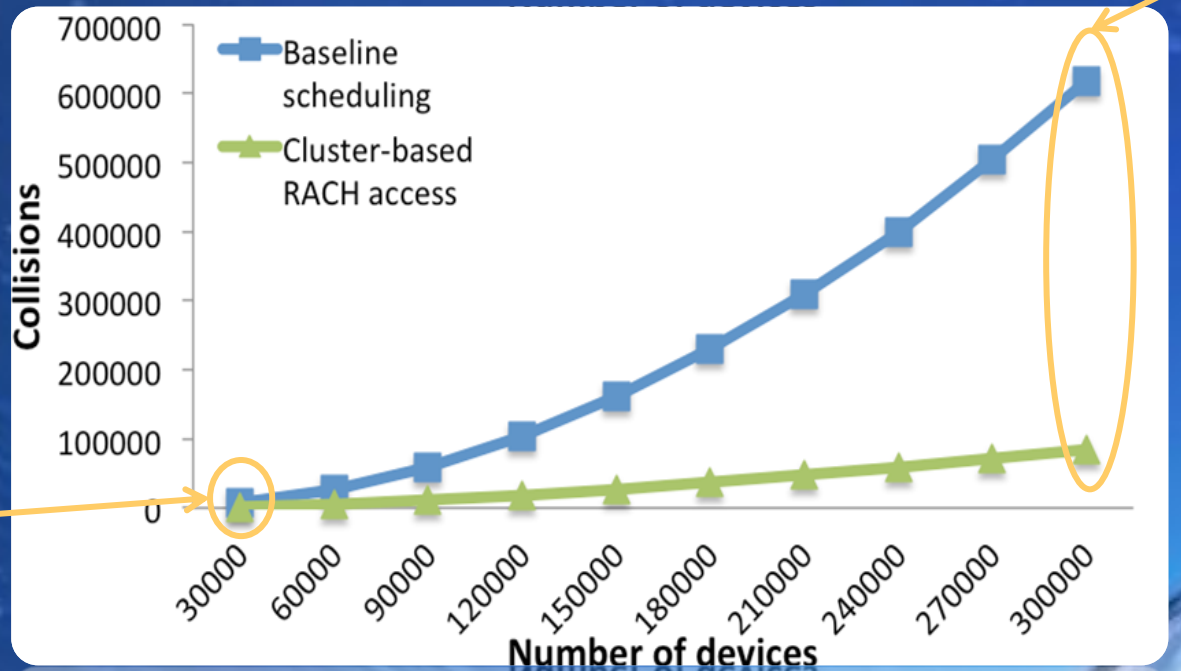




4x *reduction of collisions* for 30.000 devices

Type	Value
Number of devices	[30.000, 300.000] - reference METIS FP7 Project
Transmission Periodicity	Periodic (1/minute, 1/hour, 1/day) or asynchronous
Data Transmission size	20, 75 or 125 bytes
Packet Delay	Small delay [5,10] ms or Larger delay [1, 5] s
Devices Mobility	Stationary or Low mobility (i.e., <3km/h)

Up to **7.3x** *reduction of collisions* for **by spatial grouping**

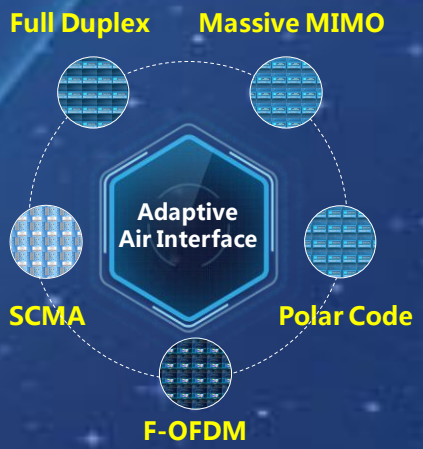


[K. Chatzikokolakis, A. Kaloxylos, P. Spapis, et al., "On the Way to Massive Access in 5G: Challenges and Solutions for Massive Machine Communications," CrownCom 2015]

5G Milestone Schedule

5G Test Bed

2014	Lab Test	• Key technologies lab test
2015~ 2016	Field Test	1. MBB first (tech) ➔ Verticals (usage)
2017~ 2018	Pre-Commercial Trials	• Trial with strategic partner



2. EC/MS for Verticals: policy and regulations
3. University platforms includes other vendors (e.g. 5GIC)
4. Large scale trials led by operators with Vendors involvement
5. International collaboration ➔ Global standards

Conclusions

5G tests and trials with Verticals essential step towards effective standardization

3GPP primary organization and others – such as, e.g., ONF and IETF – complementary

Public party crucial role in early consensus (e.g. 5GPPP), policies, regulatory processes

IP Rights shall not hinder 5G technologies adoption and market uptake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