

On the Advanced 5G Network Infrastructure for the Future Internet

IEEE ICC 2013 – Panel 8

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www.huawei.com

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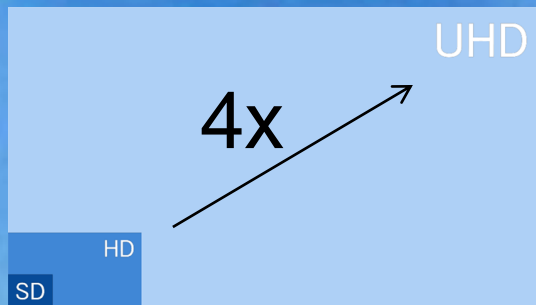
Huawei European Research Centre (ERC)

Munich, Germany



Technology trends for multimedia beyond 2020

- Ultra-high definition formats and codec(s)



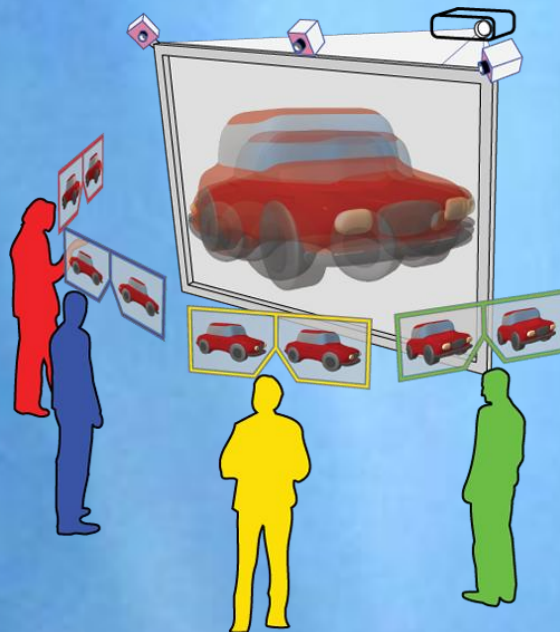
www.futuretimeline.net/21stcentury/2020.htm

- Augmented Reality (AR) for mobile devices



www.mebao.com

- Immersive multimedia services
 - 3D Video
 - 3D Audio



<http://www.imvis-eu.org/>
(EU FP7 funded project)



Huawei audio lab in Munich

UHDTV (Ultra High Definition TV)

- 7680 x 4320, 120 fps → **up to 800 Mb/s**
 - > x 3D x Views
- 22.2 multichannel 3D audio → **~ 1.5 Mb/s**
- **Interactive Experience and AR**
 - Roundtrip latency **< 100 ms**

Ultimate immersive experience

Learning



Sharing



Gaming



- Ultimate goal for physiological characteristics of the human eye



5G design challenges

The Need for Immersive Experience

GSM 12kbps voice
3G 1Mbps HTTP
4G 10MBps Web Browsing
5G 1Gbps Multi-View UHD

The Need for Fibre-Like User Experience

GSM 20kbps
3G 24Mbps
4G 300Mbps
5G 10Gbps

The Need for Zero Latency Experience

GSM 150ms
3G 50ms
4G 10ms
5G 1ms

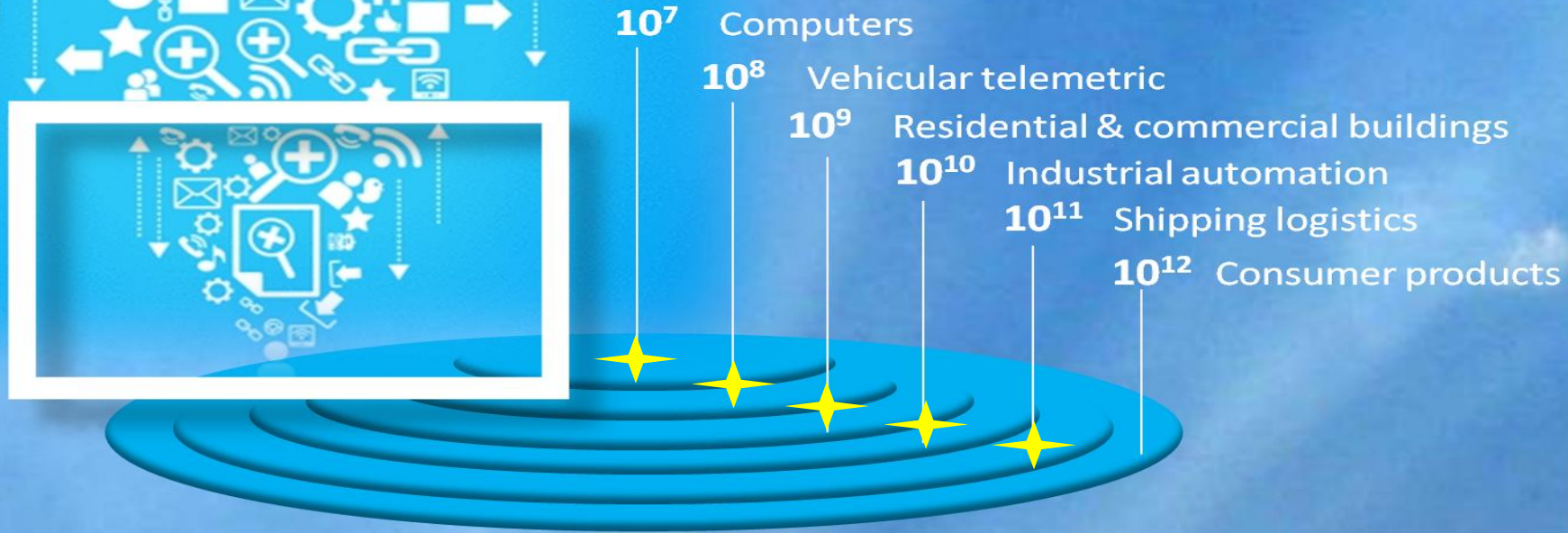
The Need for 0-Switching Time Experience

GSM Seconds
3G 500ms
4G 200ms
5G 10ms

The Need for Always-On Experience

5 Billions People
100 Billions of Things
3 Billions of Apps

100 Billions of Connections

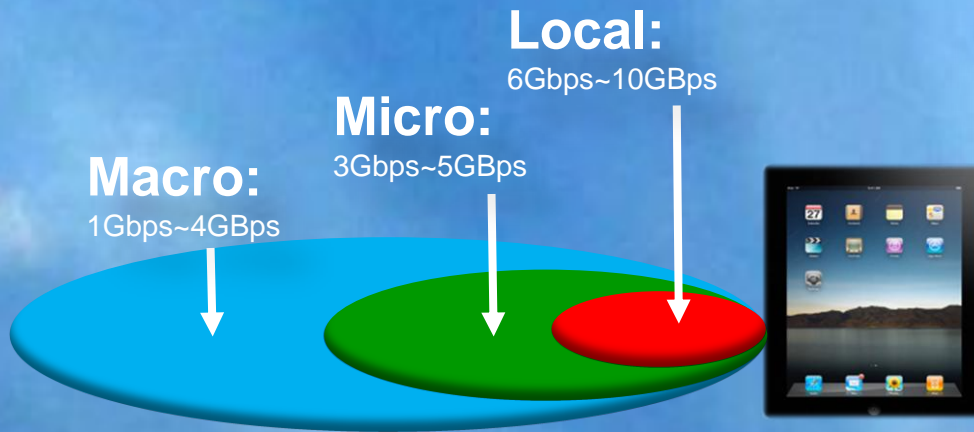


5G for Massive Connectivity

10 Giga-World

A true visual virtual reality experience

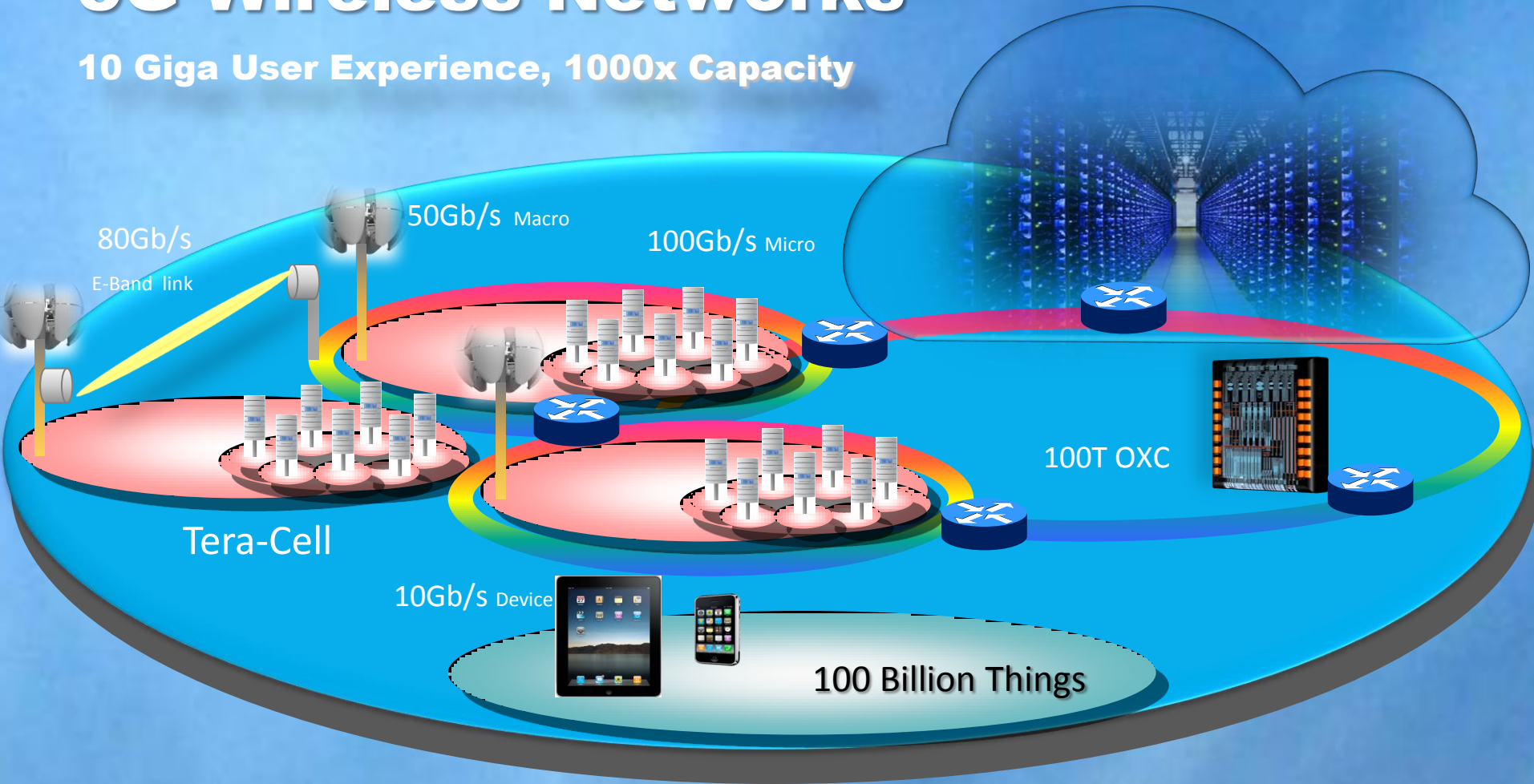
You have zero distance to the Future Internet
You have zero distance to the world



5G for Massive (1000x) Capacity

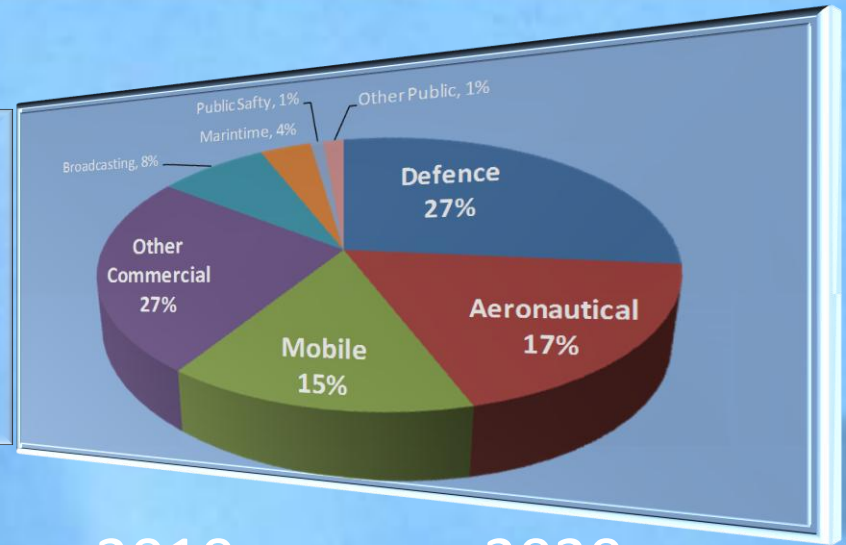
5G Wireless Networks

10 Giga User Experience, 1000x Capacity



New Spectrum

- Every 8 years, for IMT new spectrum allocation
- About 300 MHz spectrum is allocated
- The future spectrum allocation will be mostly concentrated in >3GHz and <1GHz
- Need at least additional 500MHz new spectrum by 2020



1990



WRC-1992

- 806-960 2x35M Europe
- 1710-1885 2x75M Europe

230MHz

2000



WRC-2000

- 1885-2025 2x60M Europe
- 2110-2200
- 2500-2690

519MHz

2010



WRC-2007

- 450-470 CDMA450
- 698-790 2x30MHz
- 790-806 non-IMT in EU
- 2300-2400 non-IMT in EU
- 3400-3600 200MHz in EU

428MHz

2020



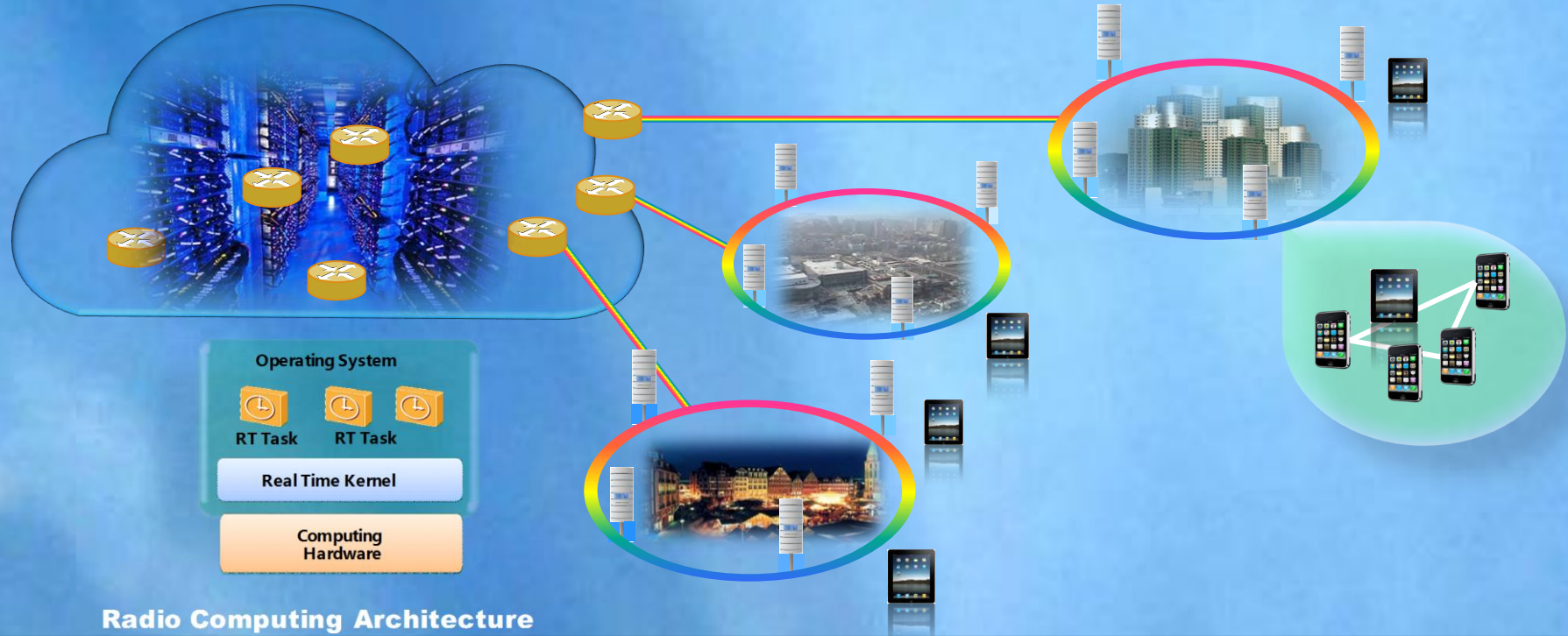
WRC-2015

- Whitesapce/DD2 (<1GHz)
- 1427-1525
- 3800-4200

300~500MHz?

Mobile
Industry
Acquired

C-RAN Ultra Dense SDN Networks

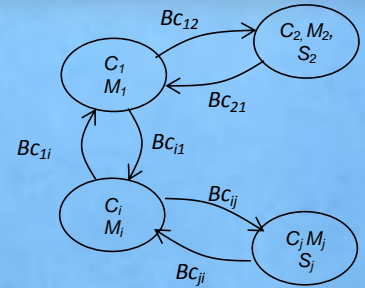
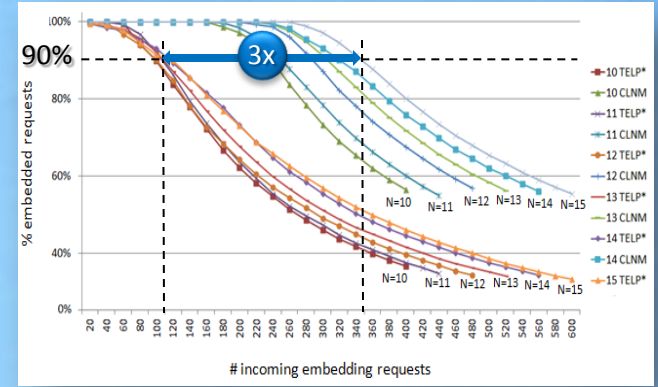
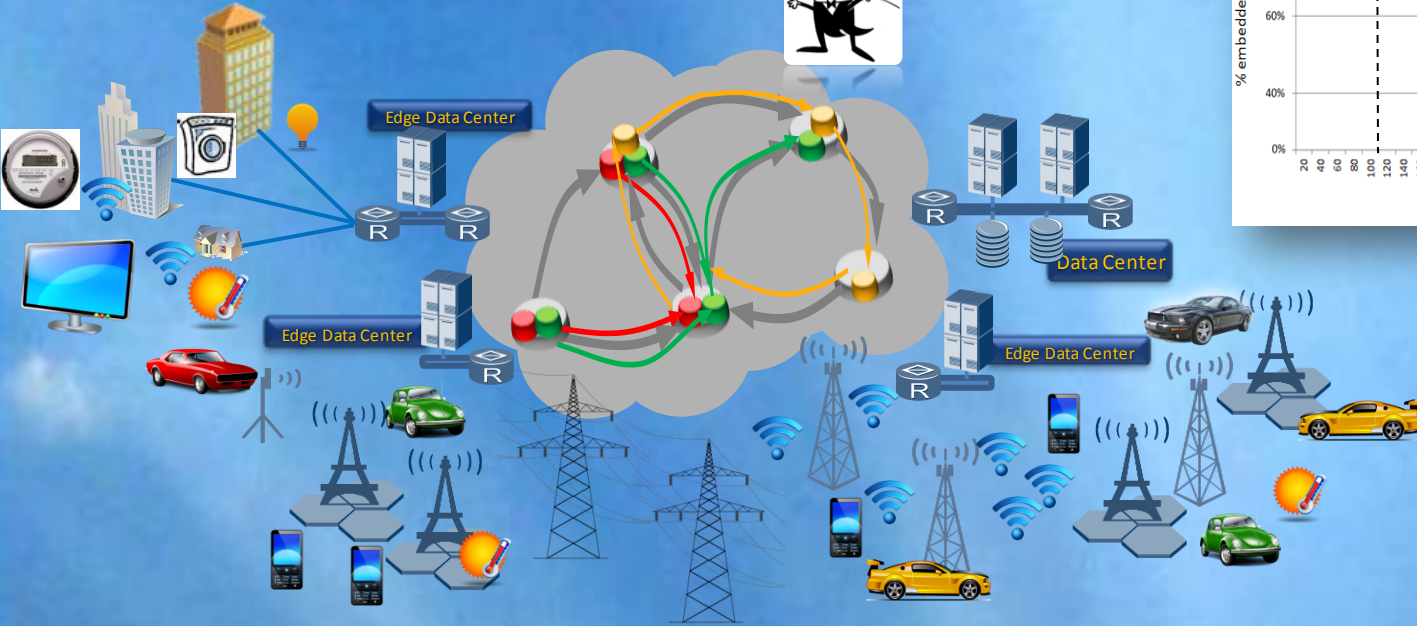


Air-Interface as Software Defined Platform

- Decouple of HW/SW (SDN)
- Decouple of Spectrum (SDR)
- Openness: OpenFlow Controlled MAC State-Machine
- De-Layering: TCP/IP is not designed for Radio/Mobility

Management and Orchestration

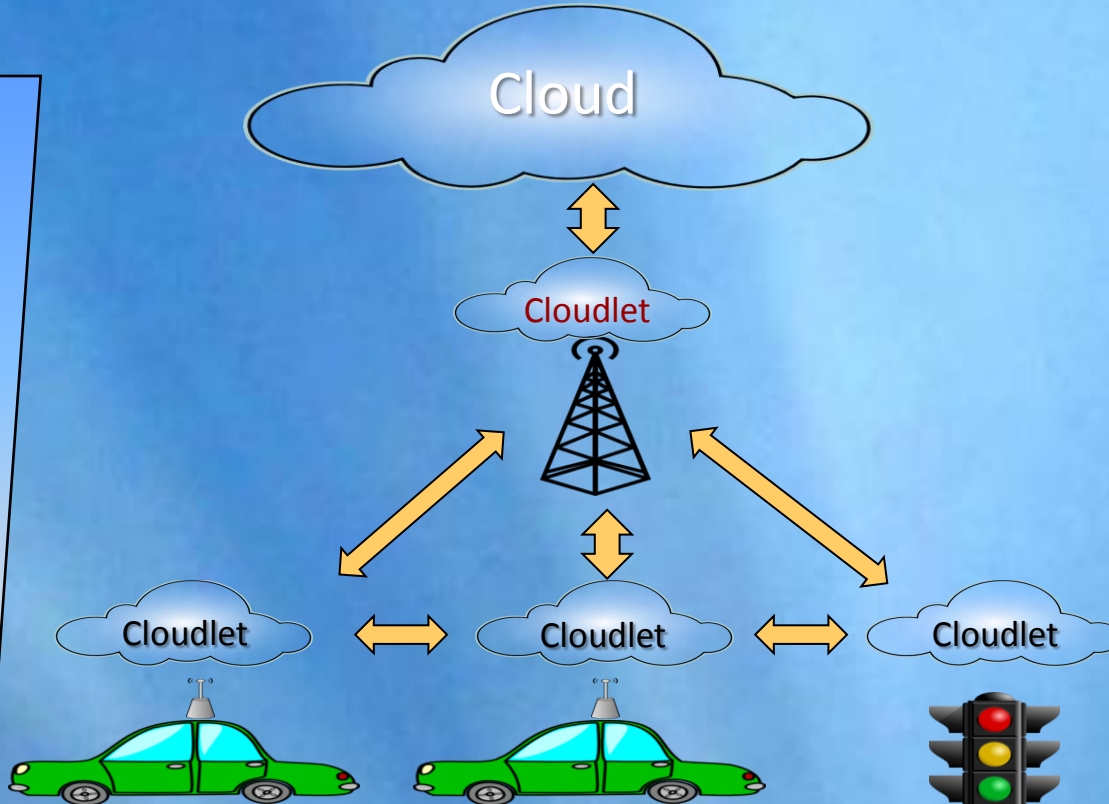
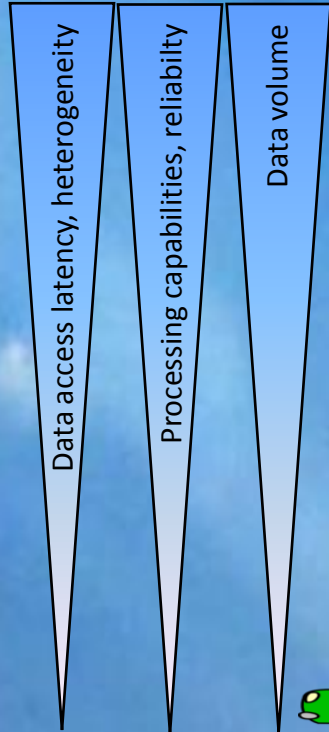
Orchestrator



Optimal location for network functions, IT and CT resources, services and corresponding states

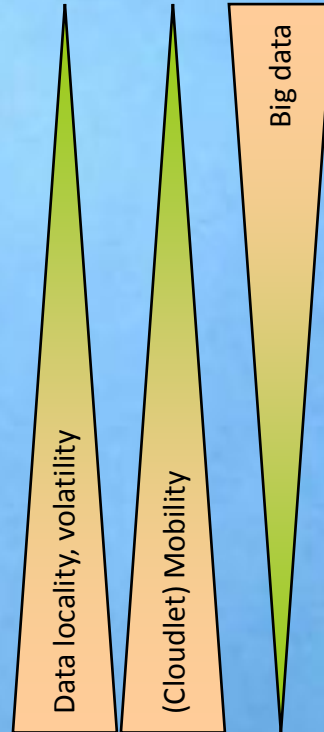
Internet of Vehicles – Safety Critical Network of Cloudlets

Environment



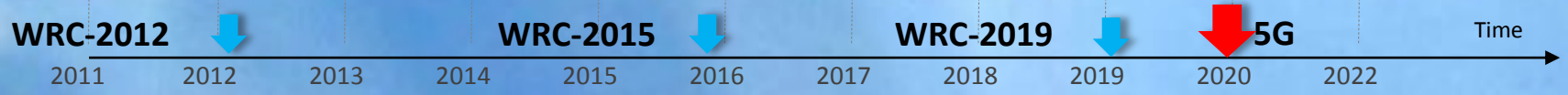
PROsumers
Network of cloudlets

Challenges



5G Timeline

Build Towards IMT-2020



Conclusions



Huawei will collaborate with government and private sector companies in Europe and contribute to R&D and Innovation of crucial technologies for 5G Wireless



We target to enable an overall 1000x improvement in network throughput and demonstrate the technical feasibility and business viability of the proposed technical solutions (technologies)

IEEE Software Defined Networks for Future Networks and Services (SDN4FNS 2013)

Organizing Committee

Chair: Antonio Manzalini

David Soldani

Ezio Zerbini

Heiner Stuttgen

Roberto Saracco

Stephen F. Bush

Important Dates

1 August 2013:

Papers submission deadline

23 September 2013:

Papers acceptance notification

13 October 2013:

Papers - final camera ready submission

30 September 2013:

Early registration

11-13 November 2013:

2013 SDN4FNS Conference



<http://sites.ieee.org/sdn4fns/>



Thank you

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