LESSONS LEARNED FROM THE FRAUNHOFER FOKUS 5G READY TRIAL PLATFORM WITHIN THE BERLIN 5G TESTFIELD INITIATIVE“

Marc Emmelmann, 31. Mai 2017

Network Virtualizaiton Europe,
Madrid, Spain, 28-31 May 2017

Fraunhofer FOKUS

Engineering a Connected World

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LESSONS LEARNED FROM THE FRAUNHOFER FOKUS 5G READY TRIAL PLATFORM WITHIN THE BERLIN 5G TESTFIELD INITIATIVE“

Marc Emmelmann, 31. Mai 2017

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AGENDA

1. Fraunhofer FOKUS – Software Defined Networks (NGNI)
2. What is 5G – the melting pot of networking solutions
3. NFV—SDN—5G: the network function and infrastructure perspective
4. Fraunhofer FOKUS 5G Playground – Toolkits for 5G deployments
5. Berlin 5G Testfield Initiative
6. FOKUS 5G-Ready Trial Platform
7. Lessons learned

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FRAUNHOFER FOKUS

The networking / connectivity institute

- Fraunhofer
  - 67 R&D institutes focusing each on a dedicated topic
  - 24.000 researchers
  - 2.1 billion € R&D volume
- FOKUS
  - The networking / connectivity institute
  - 450 Researchers
  - 31 Mio € annual R&D volume

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SOFTWARE DEFINED NETWORKS (NGNI)

FOKUS' core competence in network technologies: transforming network infrastructures into software-based networks in 5G

- R&D focus
  - Evolution of core network
  - Software-based networks
  - Virtualization
  - M2M Communication
- Providing Toolkits and Testbeds solutions
  - Licensed worldwide to industry and academia
  - Covering 5G, M2M, NVF, SDN
- Tight cooperation with TU Berlin

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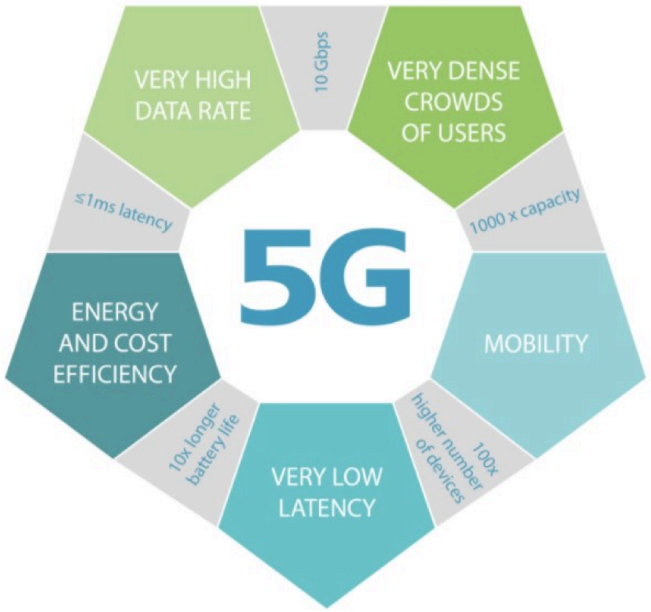
WHAT IS 5G

A melting pot of radio centric advances, novel network management paradigms, and tight integration of OTT services with network core management

- *"5G is an end-to-end ecosystem to enable a fully mobile and connected society. It empowers value creation towards customers and partners, through existing and emerging use cases, delivered with consistent experience, and enabled by sustainable business models."* ***NGMN 5G Vision***
- *A highly responsive, faster system for dense crowds of users*
- *Applying SDN & NFV to core services and combining it with new radio technology*



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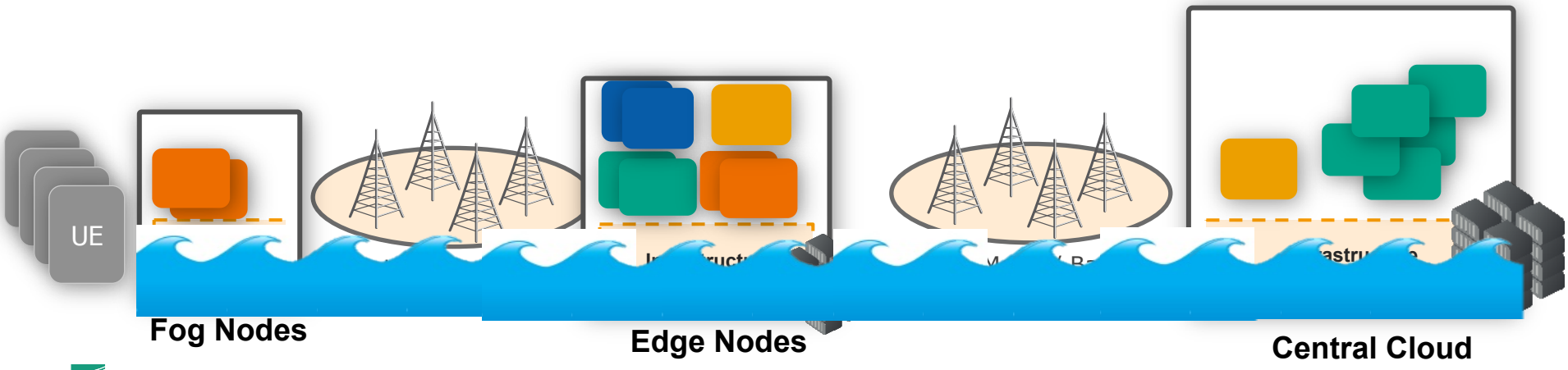
NFV – SDN – 5G

The network function perspective

- NFV for 5G core functionality resulting in a distributed system
- The 5G system aims at being adaptable enough to run on the available infrastructures (or at least be able to determine on which infrastructures it can run)
- Applicable to both, core network management functions as well as “OTT” applications



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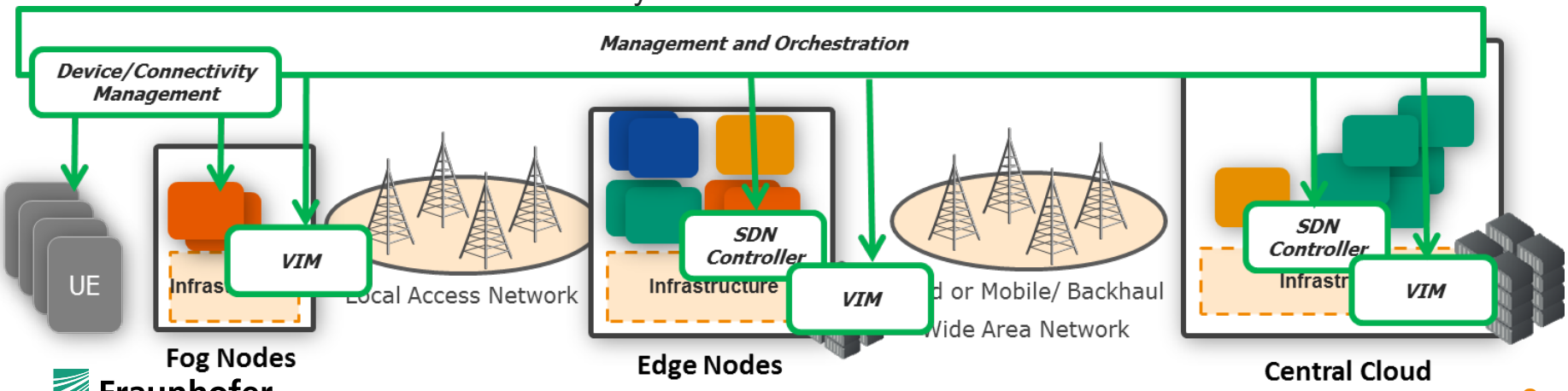
NFV – SDN – 5G

The infrastructure perspective

- Providing mechanisms and features needed for distributed system deployments
- Performance enhancement – load balancing and high availability
- Resilience of the end-to-end communication
- Security at infrastructure level & Secure and Reliable Connectivity management
- Real-time orchestration of functionality



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FOKUS 5G PLAYGROUND – TOOLKITS FOR 5G DEPLOYMENTS

5G Playground provides a single stop for a comprehensive set of toolkits with virtually all that it is needed to be installed for a live 5G testbed

OPEN BATON

Management and orchestration for NFV environments, running on top of OpenStack (and soon OpenMANO).

open5GMTC

A new, efficient approach for remote connectivity management of M2M and multimedia, based on standard protocols.

Open SDN Core

Extensive platform for SDN added value features for flexible routing, virtual environments and core network data paths.

open5Gcore

R&D prototype for mobile core networks beyond 3GPP Release 13, supporting 5G, 4G (LTE) and WLAN.

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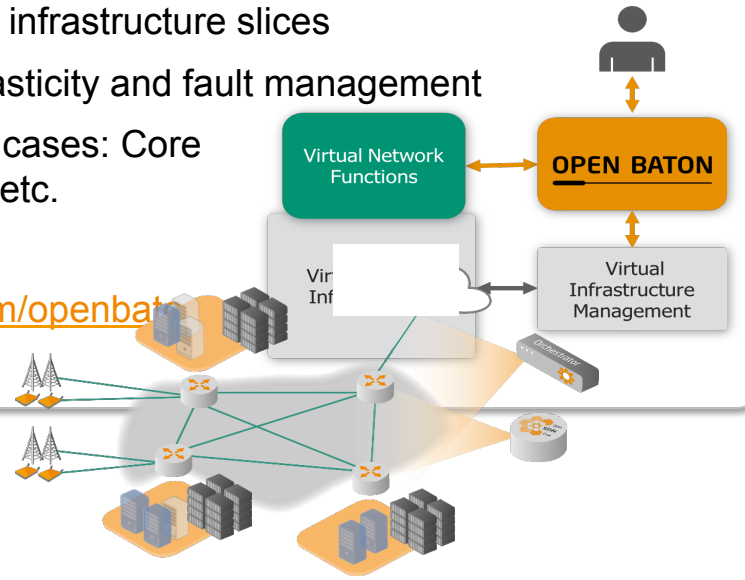
FOKUS 5G PLAYGROUND – TOOLKITS FOR 5G DEPLOYMENTS

Playground components at a glance

- A standard aligned implementation of the ETSI NFV MANO
- Running on top of OpenStack (and soon OpenMANO)
- Providing independent infrastructure slices
- Support for runtime elasticity and fault management
- A large amount of use cases: Core networks, multimedia, etc.
- Available on github:
  - https://github.com/openbat

OPEN BATON



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FOKUS 5G PLAYGROUND – TOOLKITS FOR 5G DEPLOYMENTS

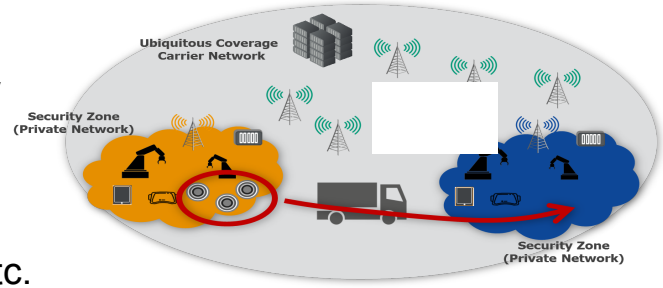
Playground components at a glance

- A standard aligned implementation of the ETSI NFV MANO

OPEN BATON

- A new approach to device communication, M2M and multimedia
- Addressing connectivity of a large number of devices
- Connectivity control on top of heterogeneous environments
  - Security
  - Customized connectivity
  - Service capabilities
- Based on standard protocols
  - OMA LW M2M, eSIM, etc.

open5GMTC



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FOKUS 5G PLAYGROUND – TOOLKITS FOR 5G DEPLOYMENTS

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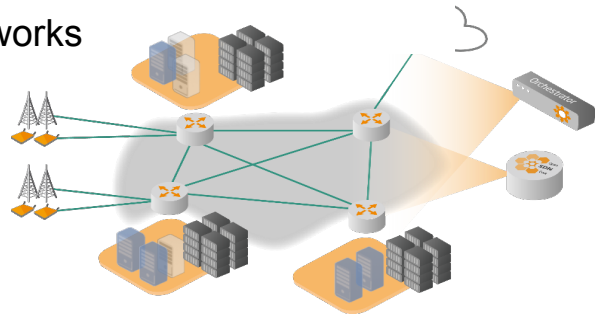
OPEN BATON

- A new approach to device communication, M2M and multimedia

open5GMTC

- Providing an extensive platform for SDN added value features
- Based on standard components (IETF, ONF, etc.)
- Establishment of dynamic data paths
- Backhaul control for dedicated networks
- Data center networking
- Deep data plane programmability
- Service Function Chaining
- Factory shop-floor communication



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FOKUS 5G PLAYGROUND – TOOLKITS FOR 5G DEPLOYMENTS

Playground components at a glance

- A standard aligned implementation of the ETSI NFV MANO

OPEN BATON

- A new approach to device communication, M2M and multimedia

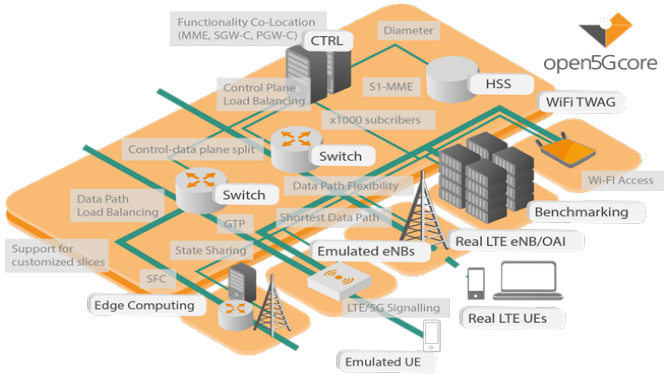
open5GMTC

- Providing an extensive platform for SDN added value features

Open SDN Core

- R&D prototype of mobile core networks beyond 3GPP Release 13
- Support for (5G), LTE and WLAN
- Cloud-native core network for NFV
- Seamless elasticity
- Mobile edge network support
- Service oriented data paths
- Highly customizable (for DCNs)
- Benchmarking and experimentation

open5Gcore

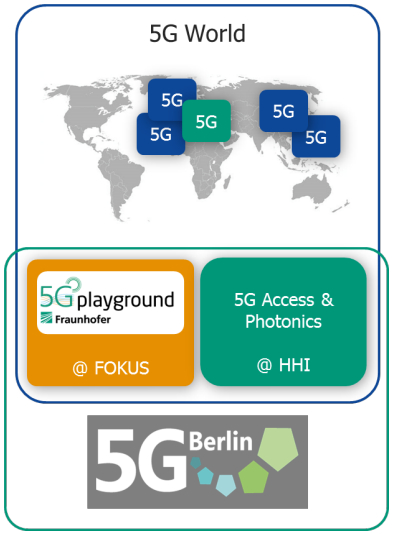


BERLIN 5G TESTFIELD

Mission Statement:

Provides a comprehensive, cost-effective and easy-to-use trial platform for developing, assessing, testing or demonstrating upcoming 5G technologies,

- Federation of testbed sites, each having a distinct scope and purpose and complementing each other
- The Berlin-located comprehensive testbed operated currently by Fraunhofer FOKUS and Fraunhofer HHI.
- Covering all aspects of 5G, from the radio network perspective, over network management up to “OTT applications”
- From a local, Berlin-based seed to a worldwide federation



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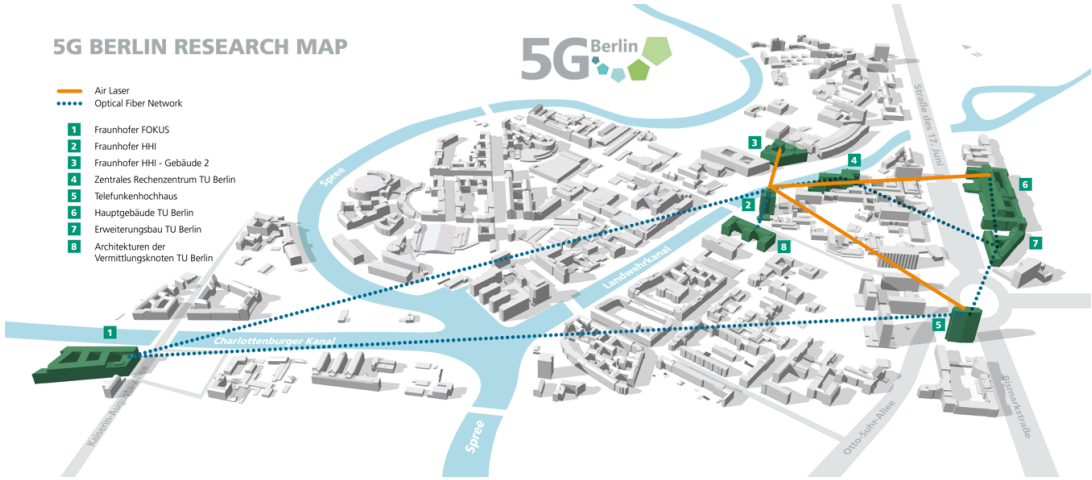
5G BERLIN TESTFIELD

Berlin premises: 4 central nodes (Communication & Datacenters) and 2 experimentation sites (Fraunhofer FOKUS & HHI)

- Currently extended towards Japan: 5G World federation with 5G!Pagoda project providing network slicing and orchestration
- Indoor deployments of BSs available for tests
- Outdoor deployments planned
- Available for
  - Network R&D
  - Equipment testing
  - Service and Application development testing



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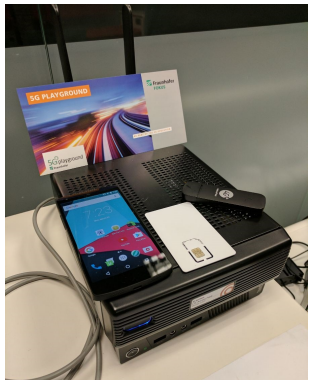
5G READY TRIAL PLATFORM

Support for the technology development between practical implementation and commercial systems

5G READY TRIAL PLATFORM

- A **consolidated turn-key solution** of the Fraunhofer FOKUS software components

- **Customized packet core**: adapting control and data plane processing to the size and QoS requirements of the applications
- Generic enablers addressing
  - **IoT** deployments – device connectivity & management, information aggregation and processing
  - **Multimedia** enablers – IMS and media servers
- **Backhaul management**: Secure, dynamic edge network selection
- Integrating with IoT convergence (at application level) and third party applications



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Fraunhofer FOKUS is actively searching for integrators, small and large infrastructure, network software components, applications and use case providers for using the 5G Ready platform

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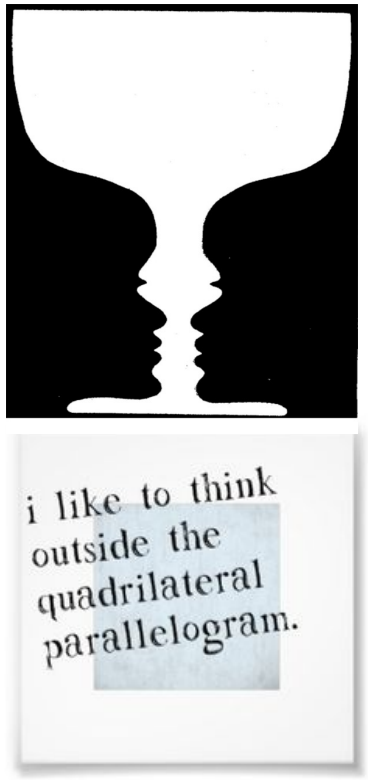
LESSONS LEARNED

We have to be willing to see and consider all perspectives of 5G

- Once 5G base stations / RF is available, there is no time for further experiments
  - Use “old” LTE & WiFi to test 5G features
  - Emulate UEs
- Exploiting 5G technical advances requires edge computing
  - Large amount of data
  - Low delay
- Network edge will extend into the home and onto the UE
- Easy set-up essential

- Atypical application areas may become reality



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VISIT US AND SEE THE TECHNOLOGY IN ACTION

IEEE CSCN

IEEE Conference On Standards for Communications and Networking

31 Oct – 02 Nov 2016
cscn2016.ieee-cscn.org

IEEE 5G SUMMIT

5G Prototyping – Emerging Testbeds, First Trials, and Relevant Standards

02 Nov 2016
www.5gsummit.org/berlin/

FUSECO Forum 2016
FUTURE SEAMLESS COMMUNICATION

Understanding 5G Application Drivers and Technology Evolution Towards Softwarized 5G Networks

03 Nov – 04 Nov 2016
www.fuseco-forum.org

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PRESENT YOUR VIEW OF THE SDN, NFV, & 5G FUTURE

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