5G and Open Source Networking

#Generation5G

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• From 1G to 5G
• 5G Customer expectation, usage & main challenges
• 5G core network transformation
  • Network Slicing
  • Service-Based Architecture
  • Control and User Plane Separation
• 5G Open Network Platform
1G All Mobile Network

1980
Analog mobile network
Radiocom 2000, closed in 1998

Voice only
3G All Internet Network

2000 Mobile broadband
UMTS and its developments (HSPA, HSPA+)

Voice, text messaging, data
Up to 40 Mbits/s
What about 5G?
5G will answer customer expectation

<table>
<thead>
<tr>
<th>Coverage</th>
<th>the customer’s expectation is increasing: a high quality connection everywhere (home, transports, rural,...)</th>
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<tr>
<td></td>
<td>customers ask for a more affordable basic internet access (50 Mb/s)</td>
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<td>Data Rate</td>
<td>new usages, like virtual reality or augmented reality, requires very high bit rate &gt; 1Gb/s</td>
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<td>Connected Objects</td>
<td>some objects, like driverless vehicles, drones or robots, call for low latency 1ms</td>
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<td>low-end, low energy consumption sensors will be massive and should be handled properly</td>
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Main 5G services: not just mobile broadband

Enhanced Mobile Broadband

- Gbps data rates
- Video (3D, HD, VR/AR)
- Smart home/building
- Work and play in the cloud
- Ultra-low cost global coverage
- Industry automation
- Mission critical applications
- Smart city
- Self-driving cars
- Massive IoT
- Ultra-reliable and low latency

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5G is on track for deployments from ~2020

**Standards**
- **Reqs. & initial studies Release 14**
- **Phase 1 specs Release 15**
  - Launch of RAN technical studies
- **Phase 2 specs Release 16**
  - Mid 2018: Phase 1 (Release 15)
- **3GPP**

**Spectrum**
- **Identification of 5G spectrum candidates**
  - Above 6Ghz (FWA)
- **ITU**

**Adoption**
- **Demos**
- **Large-scale field trials**
- **Deployments**
  - WRC '19

**FWA** Fixed Wireless Access

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Main Challenges for 5G

1. How to meet network requirements of 5G services?
   - Network Slicing, Virtualization and Mobile Edge Cloud MEC

2. How to simplify 5G Network Function Interfaces and protocols?
   - Service Based-Architecture

3. How to improve QoS, Policy usage for 5G services?
   - Control and User Plane Separation SDN & ultra Reliable and Low Latency
1- Network Slicing, Virtualization & MEC
Network Slicing
Network partition ‘Slice’ for a usage scenario

Slice: collection of **Network Functions** to support a 5G Service(s)

1. **Enhanced Mobile Broadband**
   >1Gb/s

2. **Massive Machine Type Com IoT**
   >100 000/km²

3. **Ultra Reliable and Low Latency Com**
   <1ms
2- Service Based-Architecture (SBA)
5G Service-Based Architecture SBA
From telecom-style protocol interfaces to web-based APIs

SBA: Network Functions offers services to other Network Functions using REST API instead of direct point-to-point interfaces between two functions. SBA includes service registration and discovery features.

SBA Benefits:
- Extensibility (add NF)
- Updatability (Loosely-Coupled)
- Reusability

One HTTP-2 Service Bus for Control and Application Functions
3- Control and User Plane Separation
Ability to advertise the capabilities of the User plane to the Control plane

- **Control and User Plane Separation** (SDN approach)
- **3GPP Packet Forwarding Control Protocol** (PFCP) for:
  - Packet Forwarding
  - Policy
  - Charging Control
  - Lawful Interception

*also used for 4G LTE*
• How we can use the power of open source networking to meet 5G requirements and standards?
ONAP Architecture

**DESIGN-TIME**
- Service Design Creation
- Resource Onboarding
- Service & Product Design
- Policy Creation & Validation
- Closed Loop Design
- Catalog

**RUN-TIME**
- Dashboard O&M
- External API
- Active & Available Inventory
- Service Orchestration
- Policy Framework
- SDN Controller (L0-L3)
- Multi-VIM/Cloud
- Application Controller (L4-L7)
- Data Movement DMaaS & MicroService Bus
- Data Collection Analytics & Events
- Catalog
- Assurence
- Portal & Use Case-UI

**Cloud Infrastructure**
- IP Network
- EDGE

**Network Function**
- VNF
- PNF
- IP Network

**Portal & Use Case-UI**
- Policy Creation & Validation
- Service Orchestration
- Closed Loop Design
- Catalog
- Fullfillment
- Assurance
Data Movement as a Platform DMaaP is a Kafka-based platform for high performing (high volume & low latency) data movement (Filtering, Transport & Processing) services with REST API.

MicroServices Bus MSB provides service registration/discovery, service routing and load balancing.
5G All IT Network

- Network Slicing
- Service-Based Architecture
- SDN based Control Plane
- Virtualization Infrastructure
Thank you