Possible network parameters on IMT-2020/5G transport network

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KDDI (Japan)
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Agenda

1. Introduction
   ✓ ITU-R IMT vision
   ✓ Possible usage scenarios

2. Possible 5G network deployment scenario
   ✓ Network structures
   ✓ Deployment scenario

3. Possible 5G network parameters
   ✓ Network topology
   ✓ Bandwidth, Interface type, Latency, etc.

4. Summary
ITU-R IMT Vision (IMT-2020)

- Enhancement of key capabilities from IMT-Advanced to IMT-2020

- Peak data rate: 20Gbps
- User experienced data rate: 100Mbps
- Area traffic capacity: 10Mbps/m²
- Connection density: $10^6$/km²
- Latency: 1ms (Radio segment)

The importance of key capabilities in different usage scenarios
- eMBB, mMTC, and URLLC

Possible 5G usage scenarios

The user-centric broadband world

**Vivid experience**
Realistic-sensational remote virtual experience

Viewing real-time free-viewpoint 3D video

**Industry promotion, Social Infrastructure**
Connected car
Control of unmanned agricultural machine

**Security camera**

URLLC

**eMBB**

**mMTC**

**au**: The mobile brand of KDDI.
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4. Summary
Possible radio access network

- 5G bands will be used in combination with 4G to complement each other.
  - Requirement of use cases (Mobility, Area, Latency, etc.)
  - Separation of C-plane and U-plane
  - Standalone(SA), Non-Standalone(NSA) scenarios

Possible frequency allocation

<table>
<thead>
<tr>
<th></th>
<th>3.6GHz</th>
<th>6GHz</th>
<th>28GHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>4G</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5G</td>
<td></td>
<td>Below 6GHz</td>
<td>28GHz-band</td>
</tr>
</tbody>
</table>

Application example:
- 5G: High speed, Small area.
  - Complementary
- 4G: Lower speed, Wide area.
Example: Multiple slices concurrently operated on the same infrastructure.

Toward 5G network (3GPP)

3GPP has approved a consensus to move forward on plans to accelerate specifications for a non-standalone (NSA).

**NSA (Non-Standalone)** will use the existing LTE core and RAN while adding a new 5G RAN.

**Standalone (SA)** means full user and control plane capability for 5G RAN, using the new 5G core network.

Option x: Proposal for 5G in 3GPP

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Possible 5G deployment scenario

- Initial phase: Large capacity services (eMBB)
- Second phase: Low latency services (URLLC), IoT services (mMTC)

NSA: Non-stand alone, SA: Stand alone

- High speed, large capacity service
- Wireless Low latency
- E2E Low latency
- Connected car
- Existing band: 4G
- New RAT: 28GHz
- Existing 3GPP band: Below 6GHz

HD Video
Security Camera
Connected car

5G

Down Max.20Gbps
Up Max.10Gbps

eMTC
NB-IoT

Rel.13,14

Rel.16: High density, Massive connection service

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4. Summary
Possible network topologies

- **Fronthaul, Middlehaul, and Backhaul networks**
  - **Network reach**
    - Fronthaul network: Less than 20 km
    - Middlehaul/Backhaul network: Less than 200 km

Possible network topologies are the same as the networks described in TD78r2/G.

Possible network topologies (Cont’d)

# Possible 5G network parameters

<table>
<thead>
<tr>
<th>Items</th>
<th>Parameters</th>
</tr>
</thead>
</table>
| Network reach                              | Fronthaul: Less than 20 km  
Middle/Backhaul: Less than 200 km                                      |
| Estimated values for bandwidth             | Fronthaul: $N \times 10\ G$ or higher (e.g. $25\ G$)  
Middle/Backhaul: $N \times 100\ G$ or beyond $100\ G$                     |
| Estimated values for latency allocation    | UE – CU: less than 4 ms (Tentative)                                       |
| Estimated interface type                   | Fronthaul: eCPRI, etc.  
Middle/Backhaul: 100 GbE or beyond 100 GbE (over OTN)                    |
| Slice                                      | Each service should be isolated at layer 2 or higher (e.g. VLAN, etc.)     |
| Synchronization                            | N/A (GPS-based synchronization)                                           |
| OAM                                        | Packet network based OAM (e.g. E-OAM)                                     |
Summary

Possible usage scenarios for 5G network era
- Three important capabilities
  - eMBB, mMTC, URLLC
- Vivid experience, Industry promotion, Social infrastructure
  - Viewing real-time free-viewpoint video, Connected car, etc.

Possible 5G network deployment scenario
- The 5G networks are going to be built around a combination of the 4G networks (Non-standalone (NSA) approach).

Possible 5G network parameters
- Network reach, Bandwidth, Latency allocation, Interface type, Slice, Synchronization, and OAM.