Business model-driven 5G deployment
Michele Zarri, Technical Director, GSMA
We are GSMA

The GSMA represents the interests of mobile operators worldwide, uniting nearly 800 mobile operators in the broader mobile ecosystem.

Industry Purpose
- UN Sustainable Development Goals
- Big Data for social good

Convene the industry
- Mobile World Congress events
- Mobile 360 events

Regulation & Public Policy
- Spectrum
- Mobile for Development

Technology Development
- Security, Terminals, Networks, Internet, Wholesale, SDO Engage.

Programmes
- Identity, IoT (including Remote SIM provisioning), Future Networks

Connecting everyone and everything to a better future.
We sought our members views to develop a vision for the 5G Era…

In October 2016 we asked the CEOs of our 750+ mobile operator members 20 questions (CEO 5G Survey)

And derived 10 insights…

<table>
<thead>
<tr>
<th></th>
<th>1. 5G will transform the mobile broadband experience in early deployments and drive new intelligent automation use cases later.</th>
<th>6. Competition and collaboration between operators and other ecosystem players to provide services will intensify in the 5G era.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2. 5G as a technology will evolve over time and leverage a variety of spectrum ranges, plus robust security, to support new use cases.</td>
<td>7. New models for infrastructure ownership, competition and partnerships will be required for the 5G era.</td>
</tr>
<tr>
<td></td>
<td>3. Enterprise services and solutions will drive 5G’s incremental potential.</td>
<td>8. Regulation, licensing and spectrum policy will make or break the 5G opportunity.</td>
</tr>
<tr>
<td></td>
<td>4. 5G will start as an urban-focused technology and integrate with 4G to provide boundless connectivity for all.</td>
<td>9. The industry should strive to avoid spectrum and technology fragmentation for 5G.</td>
</tr>
<tr>
<td></td>
<td>5. 5G will deliver revenue growth to mobile operators, with a 2.5% CAGR in the early 5G era.</td>
<td>10. Interoperable and interconnected IP communication services, including device-to-device, supported as default in the 5G era.</td>
</tr>
</tbody>
</table>
The 5 GSMA goals for the 5G era

1. BOUNDLESS CONNECTIVITY FOR ALL
2. INNOVATION & NETWORK ECONOMICS
3. TRANSFORMATION OF VERTICAL INDUSTRIES
4. REVOLUTIONIZE THE MOBILE BROADBAND EXPERIENCE
5. HELP TO GROW NEW USE CASES
The Role of GSMA in the 5G Era

GSMA role in 5G

Influence

Guide

Support

Moderate

Policymaking

Advocacy & messaging

Standards

New Business model

5G building blocks

EU CNC 2018
Unlocking business innovation
5G Radio: Non-standalone (NSA) vs. Standalone (SA)

Option 3 (NSA)
- Quick time-to-market
- Leverages existing 4G deployment
- Minor modification to 4G network required
- User plane provided over NR and LTE
- Control plane provided over LTE
- Legacy 4G devices still supported
- “5G devices” only need to support New Radio protocols

Option 2 (SA)
- Requires both NR and new 5G core
- No impact on LTE radio
- May require interworking between EPC and 5GC
- Full support for 5G services
- Supports Network slicing
- “5G devices” need to support New Radio and core network protocols

Option 3 specification completed in December 2017
Option 2 specification completed in June 2018
Option 4 and Option 7 will also be part of Release 15 in a “late drop” expected in December 2018
5G Core Network: a new paradigm

Advantages

- Decomposed functional elements offering specific network services (authentication, mobility management, etc)
- Common message bus using RESTful APIs. HTTP/2 over TCP transport
- Enables network capabilities exposure for fast service creation
- Control plane and user plane separation
- Supports network slicing
- Designed to leverage virtualisation principles

Disadvantages

- Further work required in some areas (e.g. roaming/interworking)
- Update on skills of operator’s workforce required
- Potential latency issues
- Multivendor deployment analysis required
- No CS interworking defined for Release 15
Fixed Wireless Access in 5G

**FWA role**

- 5G radio evolution designed to operate also in mmWave where large bandwidths are available
- Fixed Wireless Access combined with 5G radio technology is a relevant fibre substitute
- Falls into consumer focussed category but has enterprise applications too
- May be initially fragmented (several technical specifications)

Source: Samsung Electronics
Consumer-driven deployment
Consumer focused 5G introduction

Dual connectivity deployment

- This deployment option addresses the enhanced Mobile Broadband demand
- 5G is a capacity layer providing high data throughput initially in traffic hotspots
- Reliance on 4G for coverage
- Seamless usage of both LTE and NR

Quite likely to be the deployment of choice where Data usage is high (e.g. >30Gbit/month per user), low WiFi penetration

<table>
<thead>
<tr>
<th>Element</th>
<th>Impact</th>
</tr>
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<tbody>
<tr>
<td>EPC</td>
<td>Minor modifications</td>
</tr>
<tr>
<td>LTE</td>
<td>Minor modifications</td>
</tr>
<tr>
<td>UE using LTE</td>
<td>EPC stack</td>
</tr>
<tr>
<td>UE using NR</td>
<td>EPC stack</td>
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Core Network
- Minor impact on EPC to support NR

Radio network
- Minor Impact on LTE to support dual connectivity

Devices
- 4G-only devices will continue to operate normally
- 5G capable device should support 5GC stack for forward compatibility
Voice over IMS continuity considerations

<table>
<thead>
<tr>
<th>From</th>
<th>To</th>
<th>Impact</th>
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<tr>
<td>NR</td>
<td>LTE</td>
<td>Yes (PS HO)</td>
</tr>
<tr>
<td>NR</td>
<td>CS</td>
<td>Yes* (SRVCC)</td>
</tr>
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</tr>
<tr>
<td>LTE</td>
<td>CS</td>
<td>No</td>
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CS Fallback
- NR CS Yes*
- LTE CS Yes

* May have long interruption time

Impacts

- Some differences depending on whether EPC or 5GC is used to connect to the radio networks
- EPC continues to support CS Fallback and Single Radio Voice Service Continuity.
- Use of voice over IMS over NR strongly recommended for best user experience
- CS Fallback not supported in first 5G release when 5GC is used
  - 3GPP studying this for Release 16
Not all roaming scenarios are supported

<table>
<thead>
<tr>
<th>Home CN ▶ Visited CN</th>
<th>EPC</th>
<th>5GC</th>
<th>EPC+5GC</th>
</tr>
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<tbody>
<tr>
<td>EPC</td>
<td>✅</td>
<td>❌</td>
<td>✅</td>
</tr>
<tr>
<td>5GC</td>
<td>❌</td>
<td>✅</td>
<td>✅</td>
</tr>
<tr>
<td>EPC+5GC</td>
<td>✅</td>
<td>✅</td>
<td>✅</td>
</tr>
</tbody>
</table>

**Commercial value vs complexity**

- Two scenarios have been identified as potentially problematic by 3GPP:
  - Roaming agreement between two networks supporting different Core networks
  - May require complex solution
  - Problem will probably disappear over time
Enterprise-driven deployment
5G core takes centre stage

**Impacts for SA**

- New core network designed around service oriented paradigm will allow operators to leverage
  - low latency,
  - high reliability
  - Mobile network APIs
  - Network slicing
- Deployment focussed on enterprises and for exploring new horizons
- Through 5GC tailoring network behaviour to use case and acceleration of service creation become possible
- Focus on B2B

**Impacts for EPC**

<table>
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<tr>
<th>Element</th>
<th>Impact</th>
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<tr>
<td>EPC</td>
<td>IW with 5GC</td>
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<tr>
<td>LTE</td>
<td>No impact</td>
</tr>
<tr>
<td>UE using LTE</td>
<td>EPC stack</td>
</tr>
<tr>
<td>UE using NR</td>
<td>5GC stack</td>
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**Impacts for LTE**

- No impact

**Impacts for UE**

- UE using LTE EPC stack

**Impacts for NR**

- Support of 5GC stack required

**Support of EPC stack highly desirable**
Unleashing the full potential of network slicing

Adapting to the use case

- Network Slicing allows designing the network to adapt to the requirements of each use case
- Needs 5G Core to realize its full potential
- Enables new types of business models depending on level of control granted to customer
  - hosted solutions
  - Integration with customer’s system
Industry use cases → capabilities → standardised slice type

Finding the “baseline” slices

- Extracted a multitude of use cases from the analysis of industry verticals, using relations with sectorial associations, interviews and desk research.
- Mapped requirements into network capability requirements and network services requirements (Performance features, Operational features, Functional features).
- Will define a set of slice types that serve large portions of the use cases.
Example of configuration of a slice: telemetry

**Use case**

**Vertical requirements**
- **Throughput**: low
- **Mobility**: high
- **Reliability**: high
- **Latency**: not important
- **Power constrained**: No
- **Isolation needed**: No

**Technical requirements**
- **Throughput**: 1Mbps
- **Mobility**: < 200 Km/h
- **Reliability**: 99.99%
- **Latency**: -
- **Power constrained**: No
- **Isolation needed**: No

These values are placed in the GST

**Template for deployment**
- **Baseline SST**: IoT
- **CN configuration**
- **RAN configuration**
- **Transport configuration**

**Machine readable**

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Throughput</td>
<td>(&lt;1…1k)</td>
</tr>
<tr>
<td>Max UP Latency</td>
<td>[1…100]</td>
</tr>
<tr>
<td>Performance</td>
<td></td>
</tr>
<tr>
<td>Isolation</td>
<td>[1-5]</td>
</tr>
<tr>
<td>Security model</td>
<td></td>
</tr>
<tr>
<td>Mobility</td>
<td>[YES/NO]</td>
</tr>
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</table>
Migration from initial deployment
Impacts of integrating LTE

- Integration of LTE with 5GC requires upgrades to LTE, NR and 5GC.
- Roaming impacts:
  - Roaming not supported between operators with different core networks. Fallback to 4G roaming.
  - NG studying this issue.
- Recommendation: EPC still useful.
- Support of legacy devices.
- Interworking with some roaming partners.
- LTE eNodeB can still be connected to EPC.
- Benefits of LTE integration may be moderate.
- Network slicing extended to LTE coverage.

All configurations can coexist in the same network.
Any question?

If not, get in touch at your convenience