Continued demand for operator voice

**New Use-Cases**

**New Distribution Channels**

- **Voice Service Evolution**
  - Smartphone Revolution

- **Multi-Device**
  - Group Number
  - Multi-Persona
  - Work
  - Community
  - Private

- **Automotive Industry**
  - eCall
  - Emergency/service call button

- **Building Construction Industry**
  - Intercom
  - Elevator alarm/voice button

- **Industry & Medical**
  - Haptic Comm.

- **AR / VR**

- **Mission Critical Comm.**

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2G/3G  Different Economics  5G
Introduction

- 5G is driven by the ever increasing need for higher data speeds and new services
  - But voice also important for
    1) High 5G data speeds in smartphones
    2) Support for new 5G specific use cases
    3) CS legacy phase out

- IMS continues as the voice service engine
  - Full VoLTE service set also in 5G

- 5G voice introduction starts with VoLTE
  - 5G coverage initially with high frequencies only
    - VoLTE needed as fallback

Voice on high frequencies

- Most initial 5G deployments are using medium to high frequency bands
  - New bands for higher data speeds

- Challenges with voice on high frequencies
  - High free-space propagation loss
  - High diffraction loss
  - High wall penetration loss

- Solutions to overcome 5G coverage issues
  - Dual connectivity with a lower 4G band
  - Fallback or handover to a lower 4G band
  - Carrier aggregation with a lower 5G band
5G voice evolution steps

1. Dual Connectivity (EN-DC)
   April 2019
   - NR
   - VoLTE
   - VoCS
   - LTE to CS HO

2. EPS Fallback
   Q2 2020
   - NR
   - VoLTE
   - LTE to CS HO

3. Voice over NR
   Q3 2020
   - VoNR
   - VoLTE
   - LTE to CS HO
   - NR to LTE HO

Voice Solutions

1. Dual Connectivity (EN-DC)
   April 2019
   - LTE for voice while using NR as a data boost
   - Data over NR may optionally be stopped during calls in order to ensure enough uplink power for voice over LTE on cell edges
   - Legacy VoLTE/LTE
   - Impact from 5G voice

2. EPS Fallback
   Q2 2020
   - NR for data but falling back to LTE (for voice and data) when making or receiving calls
   - Data over NR may optionally be re-established after EPS-FB (with EN-DC)
   - EPC and 5GC with N26 interworking and IP address preservation in 5GC

3. Voice over NR
   Q3 2020
   - NR for both voice and data
   - NR dimensioned for voice coverage
   - Seamless handover between 5G and 4G (and WiFi)
   - No handover/fallback from 5G to CS
Voice solution versus 5G build out

1. Local spotty NR coverage
   - Dual Connectivity
   - or
   - EPS Fallback

2. Local continuous NR coverage
   - Voice over NR with IRAT handover to/from VoLTE

3. Full national NR coverage
   - Voice over NR

Spectrum allocation over time

- First 5G voice deployments (EN-DC) on 3.5 GHz (5G) and 2.6 GHz (4G)
- New 5G spectrum for increased data capacity
- More spectrum combinations supported by RAN and devices, first deployments for EPS FB and later on VoNR
- 2G/3G spectrum migrated to 5G as licenses expires etc
- New 5G low band spectrum for improved IoT & voice coverage
Mobility and call continuity use cases 1(3)
Dual Connectivity (EN-DC)

Mobility and call continuity use cases 2(3)
EPS Fallback

Fallback with consecutive handover

Fallback between shared 5G-4G carrier with consecutive handover
Mobility and call continuity use cases 3(3)
Voice over NR

Consecutive handover case
Indoor coverage case
Low spectrum handover case

New and enhanced multi-media communication opportunities with 5G
IMS data channel 1(2)
5G real-time interaction

<table>
<thead>
<tr>
<th>4G real-time communication</th>
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IMS data channel 2(3)
New real-time interacting services

- Session Robustness
- Session Management
- Device Onboarding
- Authentication
- End-to-end encryption
- Global find & connect
- Binary data (New in 5G)
- HD Audio/Video
- Quality of Service
- Mobility
- High Throughput
- Low Latency

- Remote Health
- Machine control
- VR with collaboration
- Remote haptic control
- Remote support
- Remote Surgery
- Drone Steering
- AR with control
IMS data channel 3(3)
Extend telephony with real-time interactivity in 5G

Extend telephony with:
- In-call screen sharing
- In-call photo album sharing
- In-call co-browsing
- In-call co-editing
- In-call document signing
- In-call gaming
- In-call AR/VR
- In-call custom menus & UI
- Any other web feature

More interesting and fun consumer telephony with media, gaming, AR, etc.

More meaningful business telephony for customer support,

Hologram communication
From science fiction to reality in 5G networks

R2D2 sending a hologram message from princess Lea in the 1977 movie Star Wars

Youtube: Star Wars
End-user values

**Faster data speeds in smartphones**
- 3-4 times faster than 4G
  - Better quality in streaming videos etc
  - Shorter delays for on-line gaming

**New services**
- Interacting with industrial, medical and entertainment applications
- Talking and watching during haptic (touch) communication sessions
- Futuristic services such as spatial codecs and hologram communication

**Improved speech quality**
- EVS mandatory for all voice capable 5G devices
- High capacity in radio network allowing use of wider codecs

**Improved video calling quality**
- Clearer picture and better lip synch

**Reduced latency for on-line gaming**
- Maintained gaming performance also when answering calls

**Improved security and integrity**
- 5G security also for voice and smartphone apps etc.
  - Improved privacy protection, more difficult to attack, trace, and move users to older (more vulnerable) G’s

Operator values

**Increased data revenues**
- Coverage boosted by migration of lower 2G/3G spectrum to 5G
- 30% mobile traffic growth until 2024 of which 35% from 5G smartphones

**New revenues from 5G specific services**
- Real-time interactive services through IMS data channel
- Industrial and medical applications, haptic (touch) communication, drone control etc.
- Spatial audio codecs

**Revenue growth from increased usage**
- Better capacity and performance for:
  - Video calling, augmented reality, mission critical communication, real-time translation etc.
  - Improved and generalized authentication for secure communication with non-SIM devices

**Reduced TCO**
- Substantial cost reduction from running fewer network generations in parallel
- Shut down of either 2G or 3G near term
- Maintain only minimum capacity for roaming and IoT until complete 2G/3G phase out is completed

**Increased ARPU**
- Increasing part of early adopters and high spenders
  - Who’s the better customer? Needs a new phone and:
    a) Doesn’t care which generation it supports, or
    b) Really wants the latest generation

**Reduced risks and vulnerability**
- Stronger security reducing risks for fraud, cyber attacks, penalties and bad publicity etc.
- Network slicing reducing risk for disturbances between different customer segments
35% of mobile data traffic generated by 5G smartphones by 2024

Ericsson Mobility Report, November 2019

https://www.ericsson.com/digital-services