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VoLTE: Particularities from Measurements to Analysis

Haarlem, 9.5.2016 – Alberto Pérez

agenda

1. Introduction
2. VoLTE – a new old technology
3. Measuring VoLTE – Test Scenarios
4. Analysing VoLTE – Particularities

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Maximised Experience, Minimised Cost

We provide consulting and expert services for telecom operators and regulators in network strategy, design and quality assurance. Our mission is to maximise customer experience and minimise operator network expenditures.

Delivering Omnitele Experience

The company was founded in 1988 to set up world's first GSM network. Since then we have completed 1000+ projects in over 80 countries worldwide. Always delivering Omnitele Experience – a fact proven by our long lasting client relationships.

International and Independent

Our headquarters is located in Helsinki, Finland and we have local presence in the Netherlands. Our company is owned by Finnish telecom investors and we are independent of all operator groups and network equipment vendors.

The Omnitele Way

Our unique way of working sets us apart from the competition and gives us a strong identity in the world of telecommunications. We call this the *Omnitele Way*, which means being Straightforward, Trusted and Intelligent.

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Technology Strategy

Network Design & Optimisation

Audit and Benchmark

Consulting and engineering services for mobile operators in network strategy, deployment and quality assurance. Maximised customer experience, minimised network cost.

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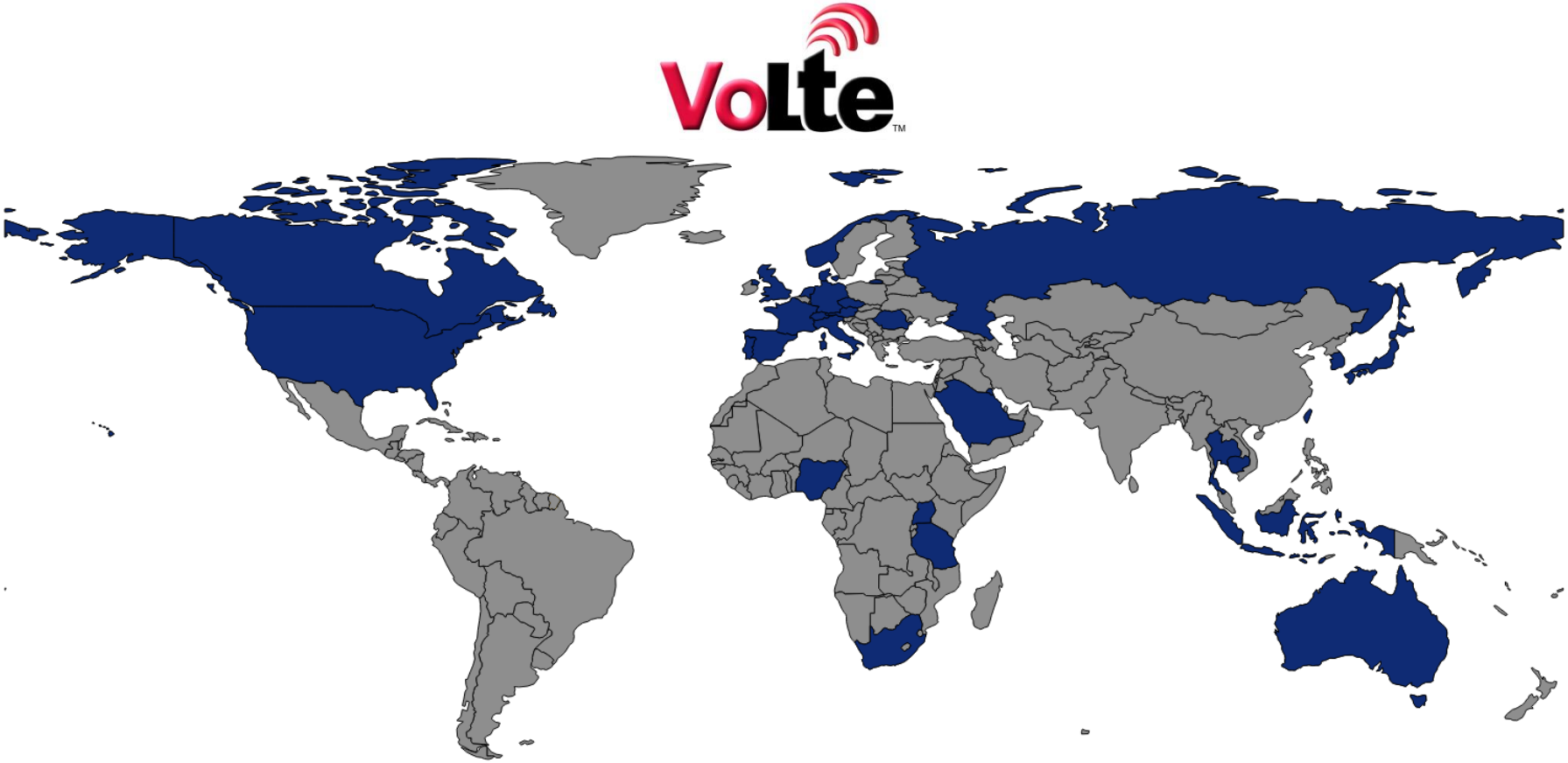

VoLTE has been officially deployed already in 33 countries by 58 operators

It is expected that by 2019 56% of LTE-related cellular subscriptions will be using VoLTE

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2. VoLTE – a new old technology

- Fundamentally VoLTE allows subscribers to make mobile voice calls, a service that has been available since the origins of mobile cellular networks

- VoLTE main benefits from End-User QoS standpoint:
  - VoLTE supports higher quality calls (7KHz bandwidth, AMR-WB 23.85kbps)
  - Faster call setup times
  - Improved battery life (compared to using 3rd party VoIP apps)
  - Enable simultaneous voice and LTE data
- Technologically it is though an implementation challenge for the operators that will result in a more efficient use of the spectrum for such a basic service

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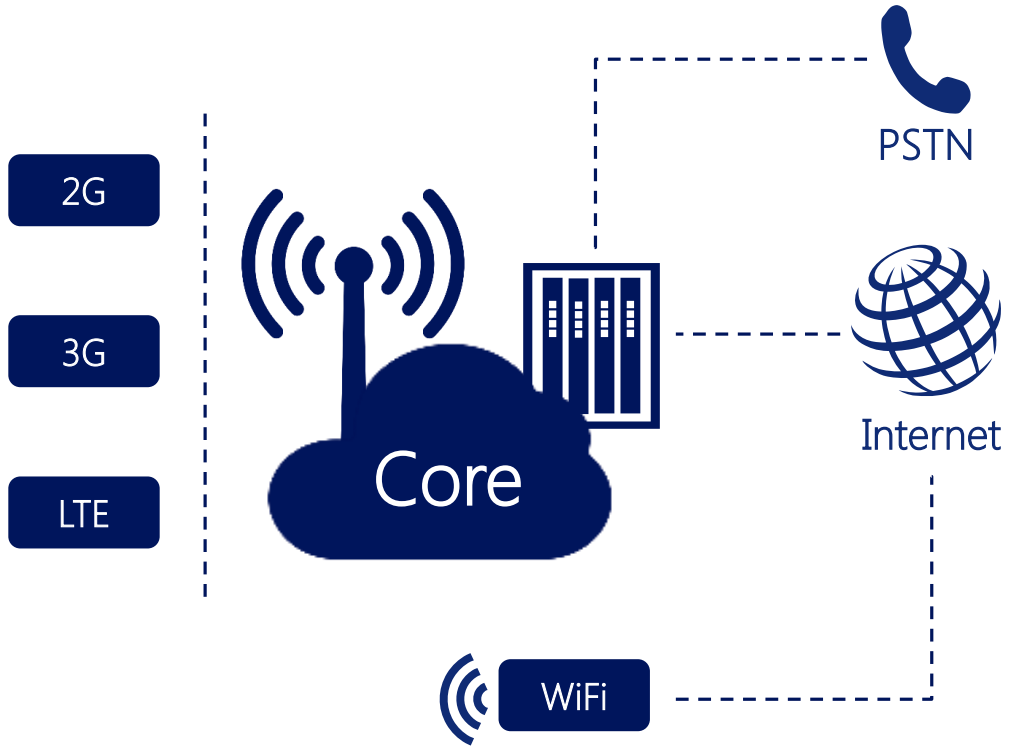
3. Measuring VoLTE - Considerations

Assuming VoLTE service is deployed within the network, the number of different voice call use case scenarios is rather big:

- VoLTE enable subscribers calling:
  - VoLTE enable subscriber
  - LTE enable subscriber
  - 2G/3G subscriber
  - PSTN
- LTE enable subscriber calling:
  - VoLTE enable subscriber
  - LTE enable subscriber
  - 2G/3G subscriber
  - PSTN
- 2G / 3G subscriber calling:
  - VoLTE enable subscriber
  - LTE enable subscriber
  - 2G/3G subscriber
  - PSTN



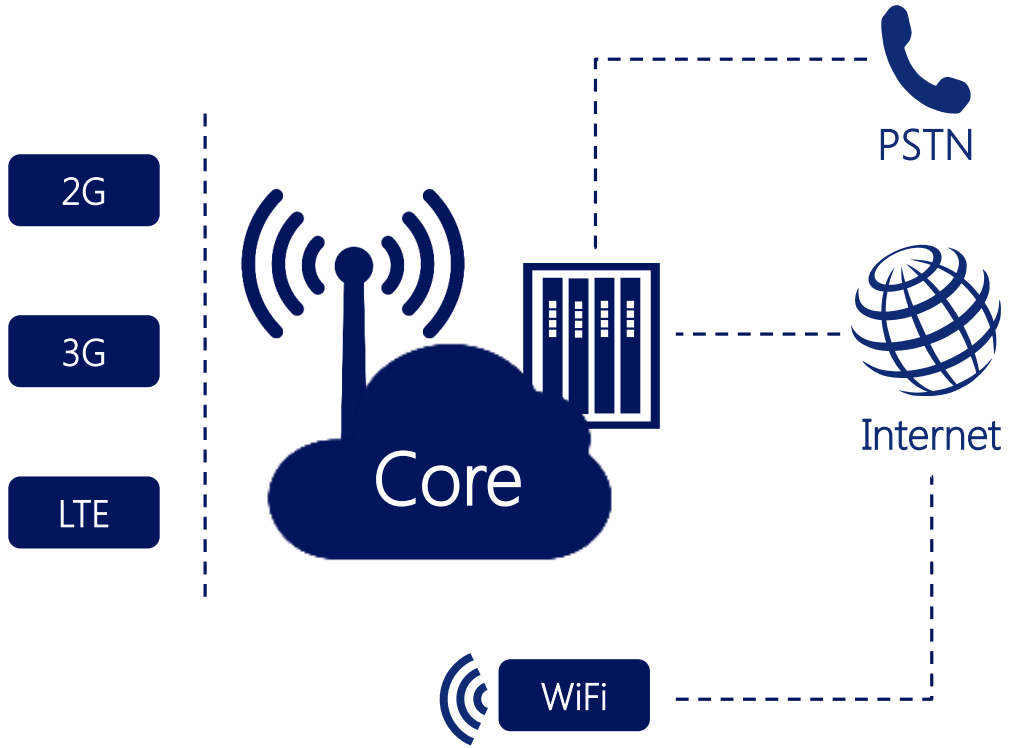
3. Measuring VoLTE – Test Scenarios

1. VoLTE to VoLTE mobile-to-mobile call
   a. Short calls for testing Accessibility and/or Integrity (MOS)
   b. Long calls (until drop) for testing Retainability and/or Integrity (MOS)
2. VoLTE to 2G/3G/LTE/PSTN
   a. Short calls for testing Accessibility
   b. Long calls (until drop) for testing Retainability
   - Test focus on Session Border Management (routing between EPC/IMS and other networks)
3. VoLTE to 'Any' with background data activity
   - Test focus on QoS Class Identifier (QCI) Integrity
4. LTE to 2G/3G/LTE/PSTN
   - No VoLTE specific test scenario. Test focus on CSFB Integrity
5. 2G/3G to 2G/3G mobile-to-mobile call
   - For comparison with VoLTE

3. Measuring VoLTE – Test Scenarios

In addition, mobility should also be considered:

1. VoLTE to legacy interworking
   - Test focus on SRVCC
2. VoLTE to VoWiFi
   - Test focus on ePDG



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4. Analysing VoLTE - KPIs

- From End-User point of view Voice call service is characterised by the following KPIS:
  - Call Setup Success Rate (CSSR)
  - Call Drops
  - Call Success Rates (CSR)
  - Call Setup Time (CST)
  - Voice Audio Quality (MOS)

- From end-user perspective VoLTE is essentially providing voice call service, thus same KPIs apply when depicting VoLTE Accessibility, Retainability and Integrity

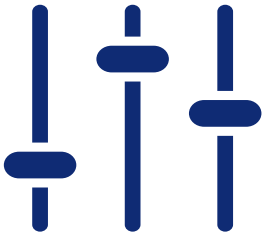
4. Analysing VoLTE - Particularities

- Omnitele has come accross a number of particular issues when testing VoLTE in networks where service has not been deployed yet

1. MOS distribution includes number of very low scores
   - Even in good network conditions MOS might be unexpectedly low -> high delay or jitter may cause degraded audio quality
   - MOS values tend to decrease in areas where handovers are increased. Occasionally silence is detected after handover
2. Call continuity issues might occur after handovers
   - No RTP packets received after handover -> SIP server disconnection
3. Measurement equipment might not identify all call events always correctly

4. Analysing VoLTE - Troubleshooting

- Therefore it is worth considering other KPIs in order to troubleshoot issues with premature VoLTE networks:
  - RTP loss / delay / jitter
  - Impact of handovers (even successful)
  - Over-the-air packet loss
  - Over-the-air packet delay
  - Duration of SIP messages (180Ring / 200OK / Traffic Start)
  - QCI distribution



thank you for your attention!

questions

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