QoS/QoE on LTE/LTE Advanced Networks

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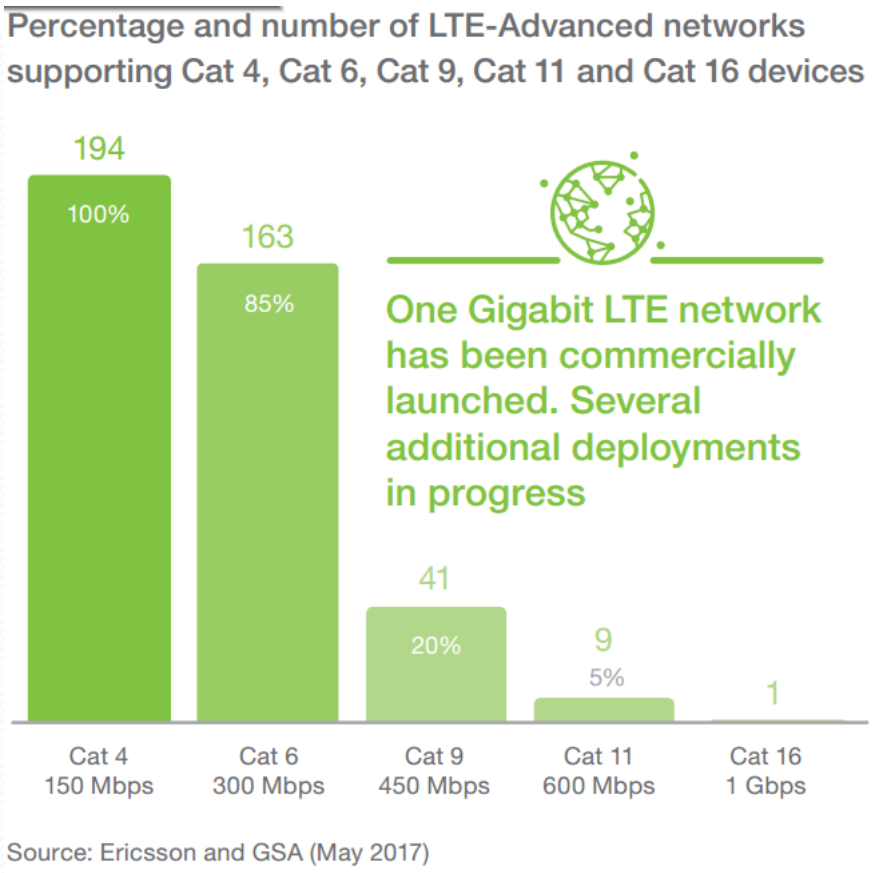
Plan

1. LTE in figures
2. QoS/QoE on LTE Networks
3. #TN_Experience

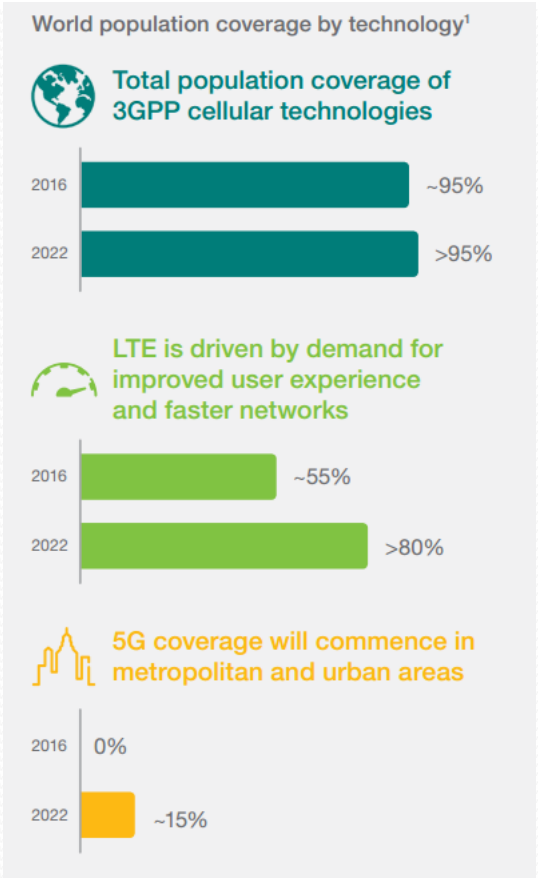
LTE in figures (1/5)

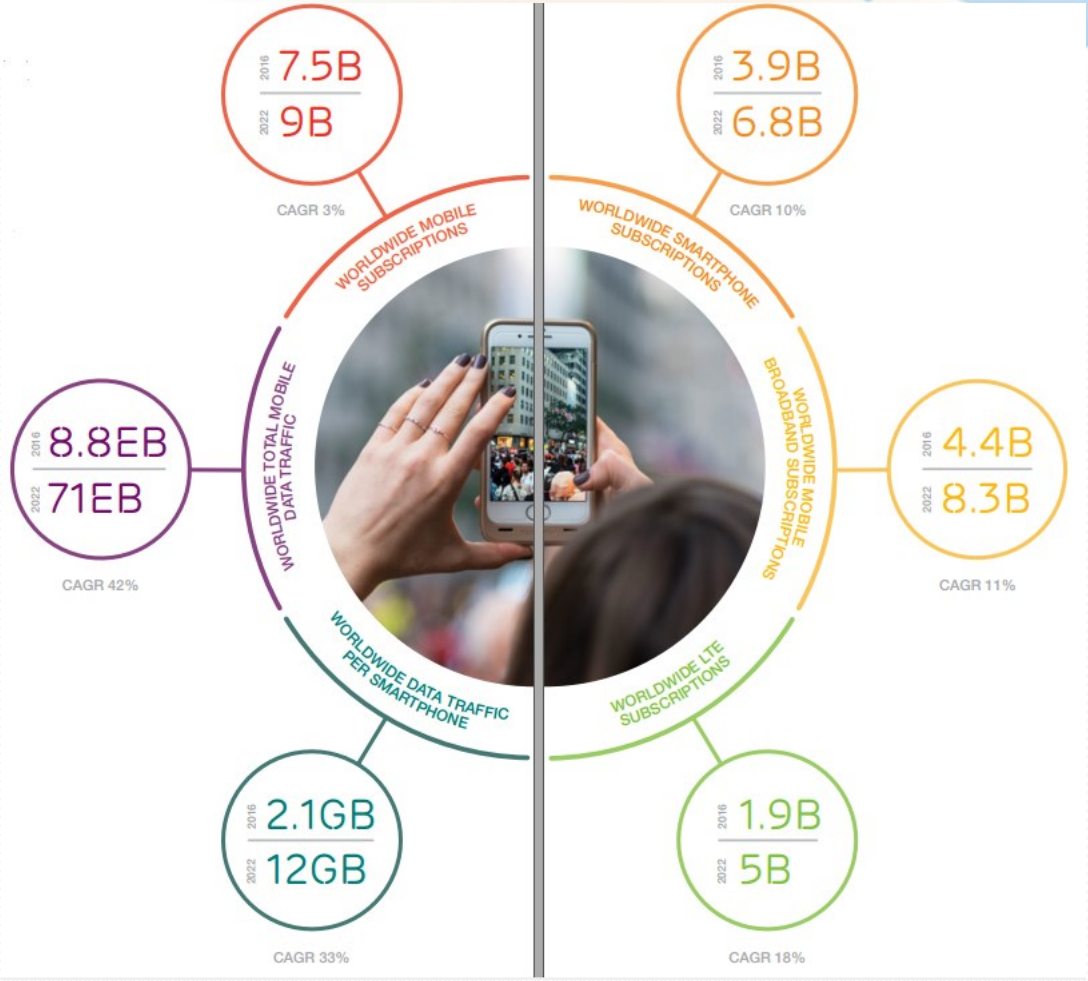


165 operators are investing in VoLTE in 73 countries *including 102 operators with commercially launched VoLTE-HD voice service in 54* countries.

source *:GSA Report January 30 2017*

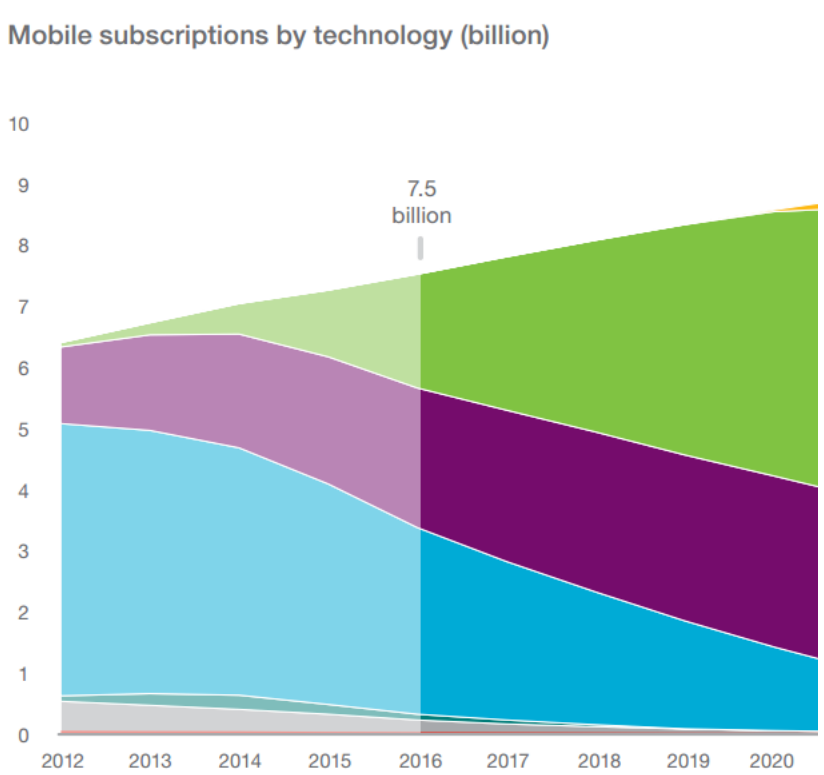
LTE in figures (2/5)

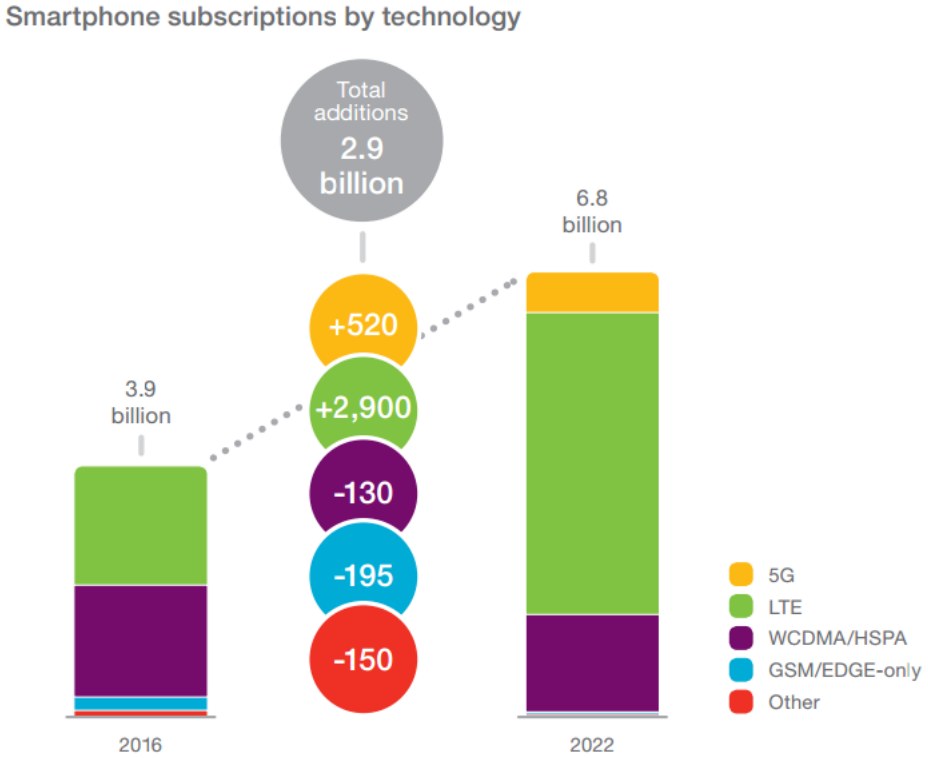




Source: *Ericson mobility report, June 2017*

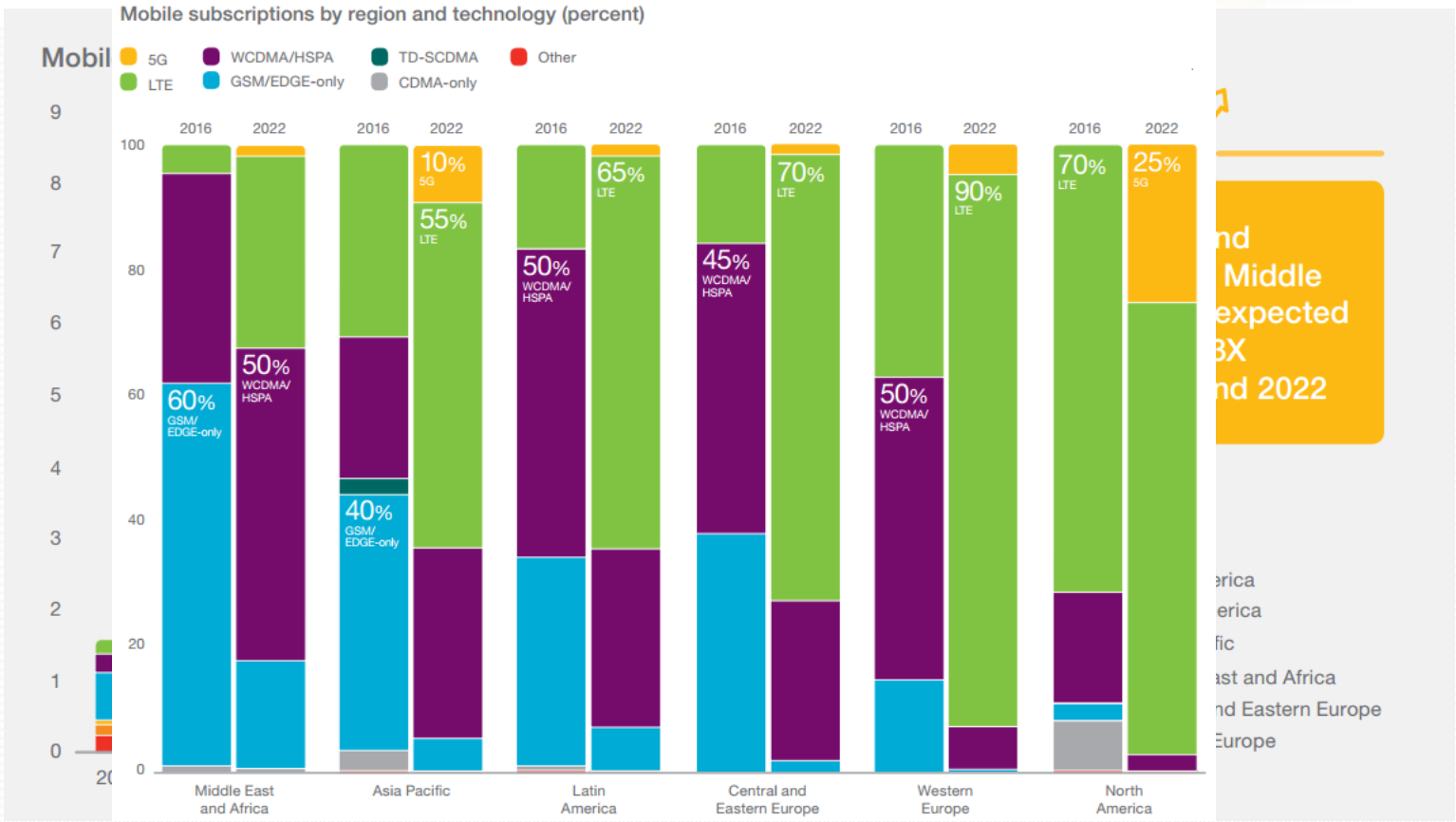
LTE in figures (3/5)





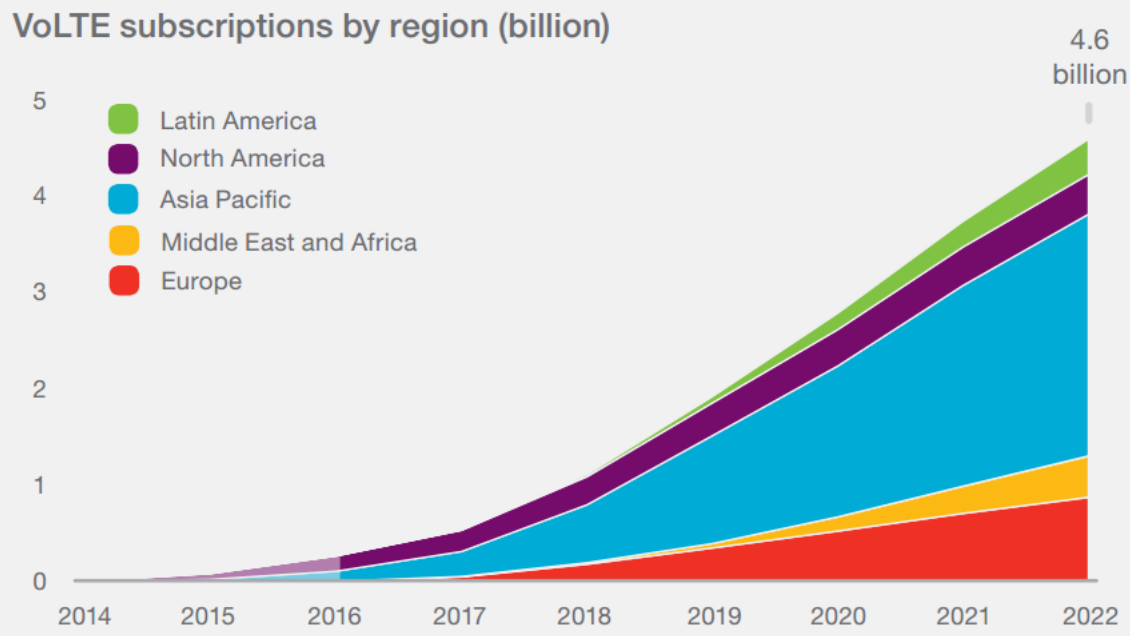
Source: *Ericson mobility report, June 2017*

LTE in figures (4/5)



Source: *Ericson mobility report, June 2017*

LTE in figures (5/5)

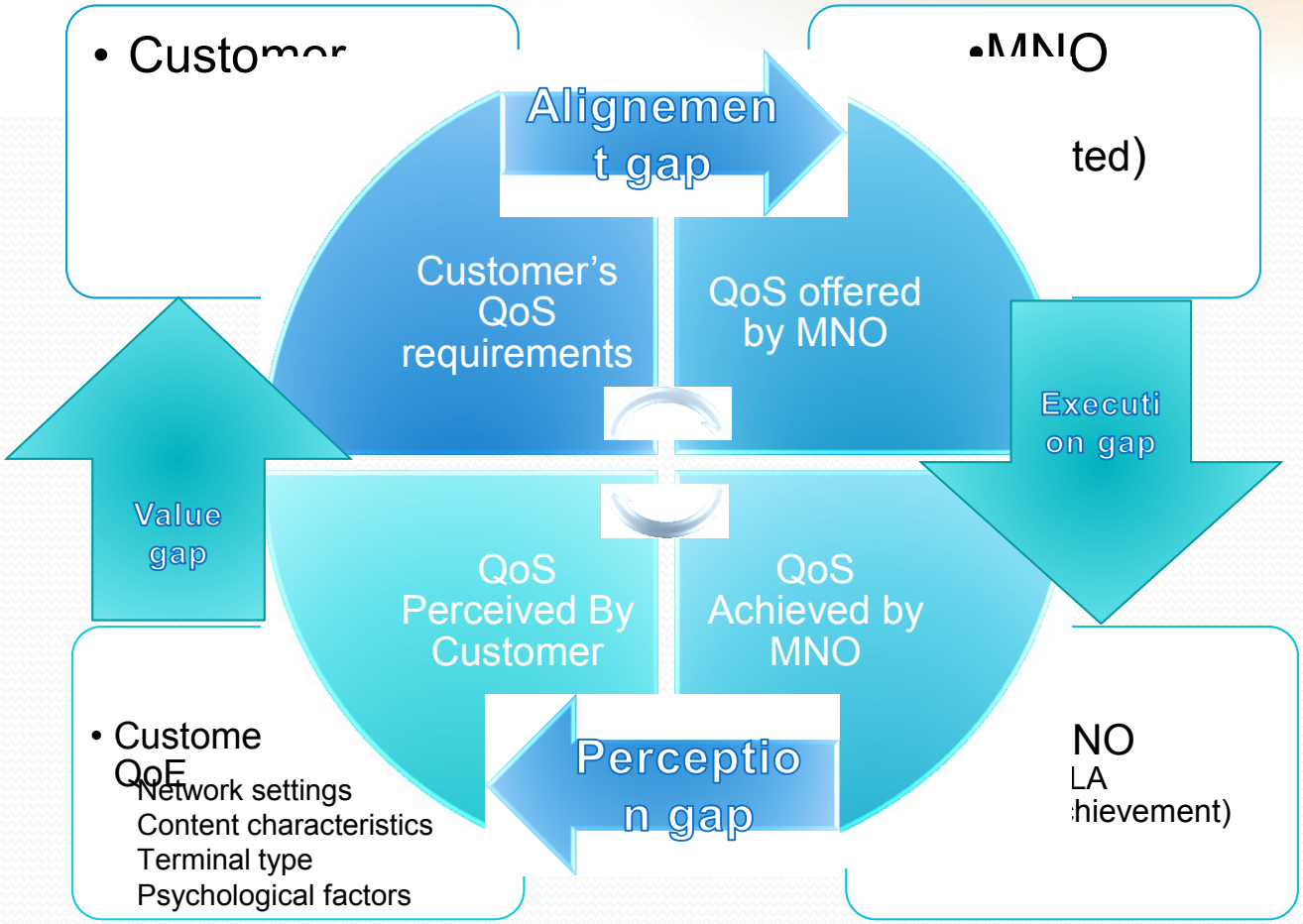


Data traffic grew 70% between Q1 2016 and Q1 2017

VoLTE subscriptions expected to reach 4.6 billion in 2022

[1] A subscriber is counted as having a VoLTE subscription if making at least one VoLTE call per month
[2] GSA (April 2017)
[3] GSMA (March 2017)

QoS/QoE on LTE networks (1/4)



ITU-T G.1000 *: Communications quality of service: A framework and definitions*

QoS/QoE on LTE networks (2/4)

Voice services	Data services
VoLTE CSFB	File Transfer Social Media Web Browsing Audio/Video Streaming

- *QoS for LTE* data services would be measured in similar way as legacy mobile data services,
- *QoS for VoLTE* service should be carefully measured in particular taking into account the difference in network architecture compared to legacy voice/circuit-switched network.

QoS/QoE on LTE networks (3/4)

- VoLTE requires full implementation of QoS on bearer level, IP and lower levels,
- QoS for VoLTE is somehow a bit specific taking into account the difference in network architecture compared to legacy voice/circuit-switched network
- QoS measurements of VoLTE can be done either in the handset or the network,
  - QoS measurements done in the handset are similar legacy voice QoS measurements (measurement of the incoming stream based on some KPIs)

From the end user perspective	From the network perspective
• Better call set up time • Voice quality depending on codec usage	• Variable paths compared to legacy voice which has its dedicated path for signalling and user plans • VoLTE shares its user and signalling paths with packet switched traffic • VoLTE signalling is carried inside a data user plan

VoLTE compared to Legacy

QoS/QoE on LTE networks (4/4)

KPIs of typical voice service	KPIs relevant to VoLTE
−Voice Quality −Call success rate −Call setup success rate −Call drop rate −Call setup time	−SRVCC −RTP packet loss −RTP jitter −IMS KPIs (e.g. Initial Registration Success Rate) −EPC KPIs (e.g. Bearer Establishment Success Rate)

Recommandation ITU-T G.1028 : end-to-end QoS for voice over LTE mobile networks.

KPIs for data services are the same of those of legacy networks

#TN_Experience (1/7)

11 299,4 inhabitants
163 610 Km²

3 LTE networks Launched on April 2016

62.8%

23.5%

27.5 To

99.59% 99.58% 70.43%

5 IP

7,2%

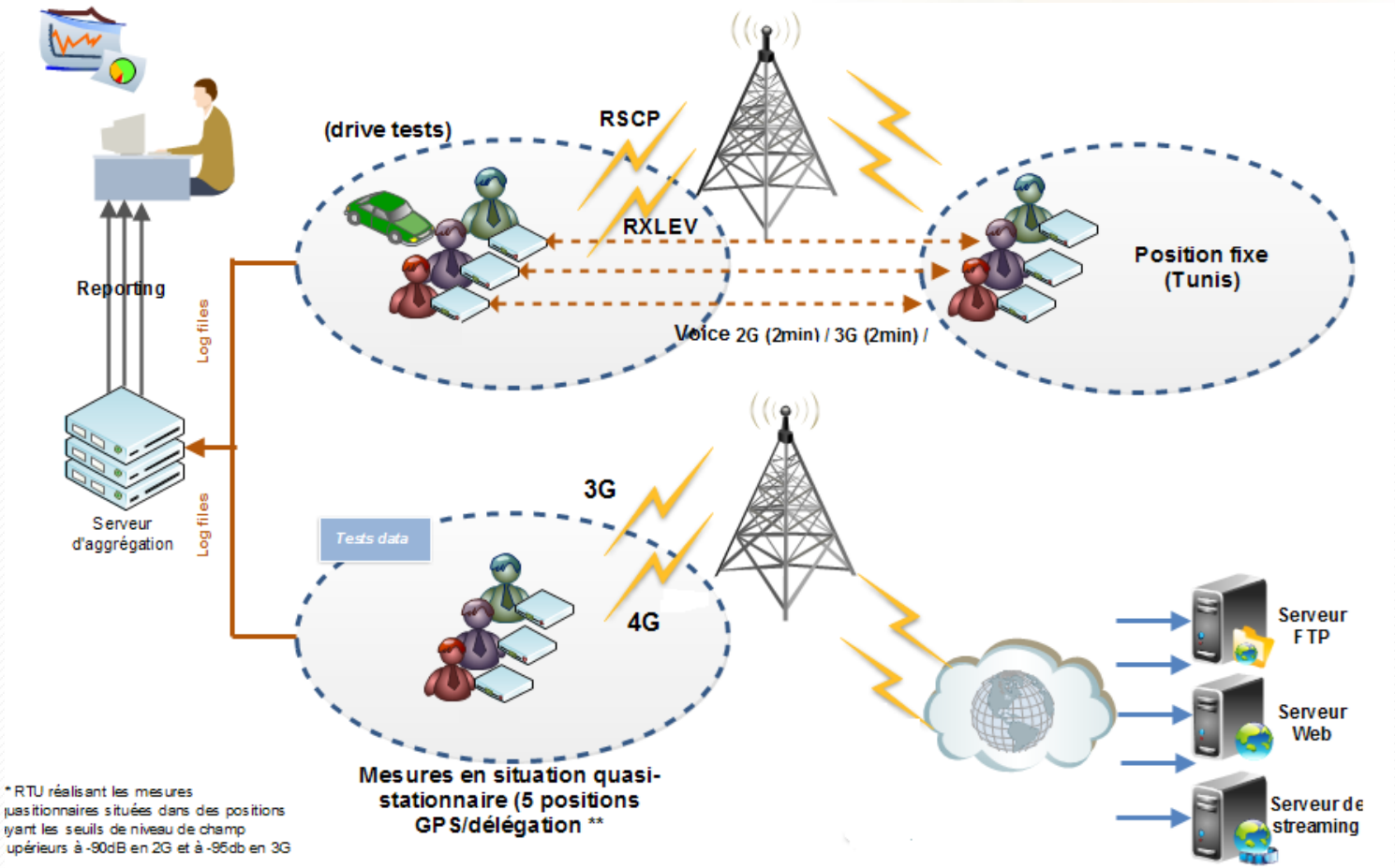
#TN_Experience (2/7)

- Legal Frame work :
  - Article 63 of the TN Telecommunications Code,
  - Decree 3026 of 15 September 2008, fixing general operating conditions for public telecommunications networks and access networks,
  - Decision No 67/2014 of the National Authority for Telecommunications of 02 July 2014 fixing methods for collecting information on the telecommunications sector in Tunisia,
  - Decision Coll / Reg / 2017/12 of the National Telecommunication Authority of 08 May 2017 fixing the list of quality of service indicators for mobile networks and the protocol for measuring these indicators, the protocol for the evaluation of radio coverage And the terms and conditions for the publication of coverage maps and the general obligations of public telecommunications network operators and virtual telecommunication network operators in terms of quality of service.

#TN_Experience (3/7)

Year	Geographic scope	Period	Tested service	Method
2006	Capitol and its suburbs	June 2006	Coverage, Voice 2G & SMS	Investigators with mobile phone
2007-2010	24 Gouvernorats	Monthly	Coverage, Voice 2G & SMS	Investigators with mobile phone
2012 – 2013	24 Gouvernorats	Monthly	2G/3G Coverage, 2G/3G Voice, SMS, MMS, Web 2G/3G, FTP & Streaming	Probs
2015 – 2016	24 Gouvernorats	Monthly	2G/3G Coverage, 2G/3G Voice, SMS, MMS, Web 2G/3G, FTP & Streaming	Probs
2017	24 Gouvernorats	Monthly	2G/3G/4G Coverage, 2G/3G Voice, 3G/4G data services	Probs and INTT mobile App.

#TN_Experience (4/7)



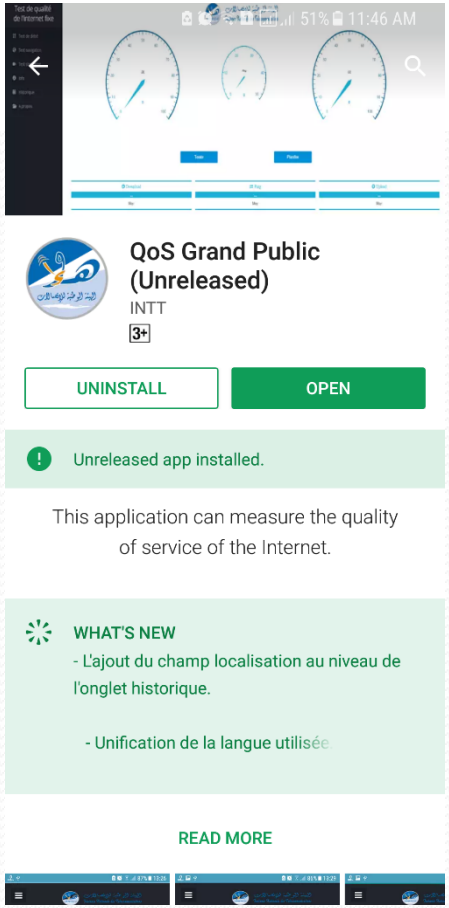
#TN_Experience (5/7)

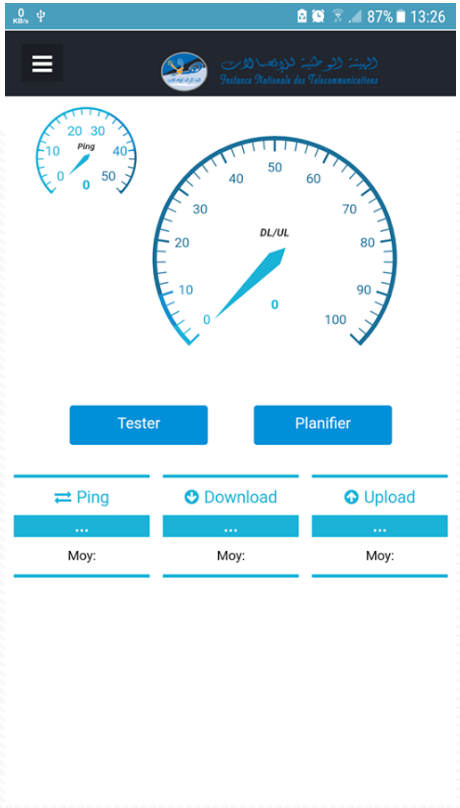
- Measurements scripts based on ITU-T recommandations and IEEE standards,
- For measurments sampling:
  - The distribution of the sample by governorate is weighted by the size of the population aged 10 years and over.
  - The distribution of the sample at the level of a delegation is weighted by a coefficient that takes into account population density as well as other socio-economic factors.
  - Sample size, offering an accuracy of 10^{-3} for **5%** p-value for estimated KPIs.

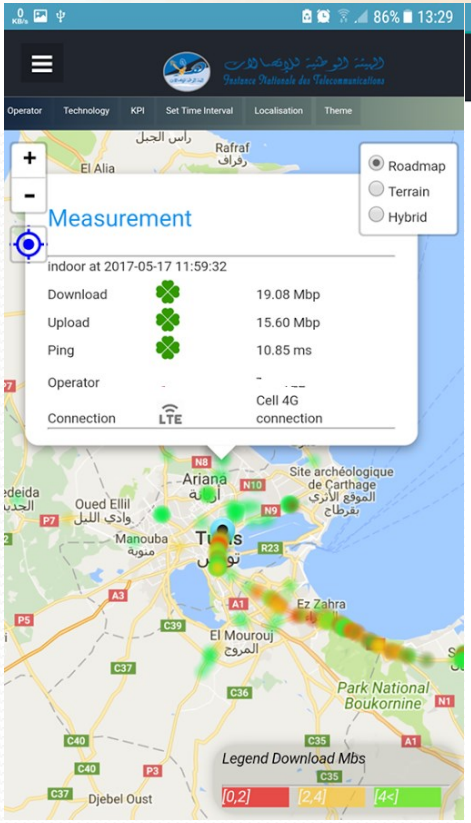
#TN_Experience (6/7)

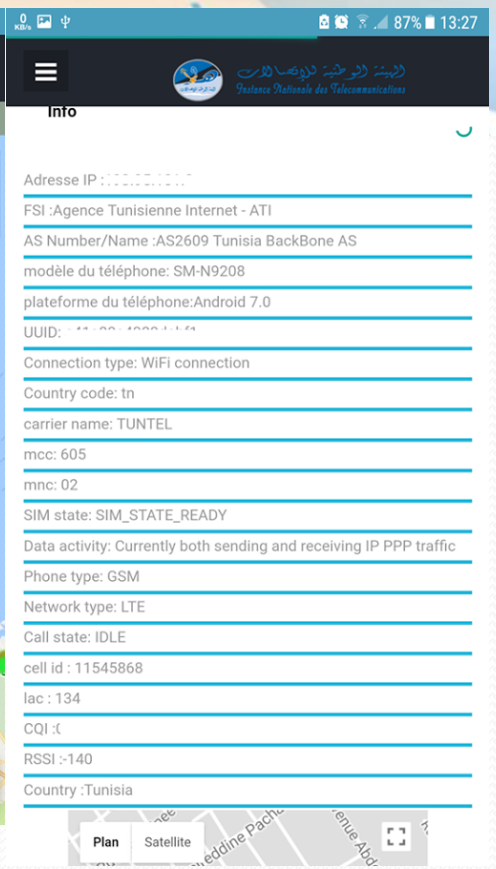
- Results are communicated to operators and published on the INTT website, monthly,
- Conducting follow-up meetings with operators to discuss action plans undertaken to remedy identified deficiencies.

#TN_Experience (7/7)









Thank you for your attention

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