Overview of Cat-M and NB-IoT

Standard, Market and OAI perspective

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Outline

- Cat-M and NB-IOT
  - Overview, market
- Sequans and OAI

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3GPP releases

Release Code	Name	Status	Start date	End date
Rel-16	Release 16	Open	2017-03-22	
Rel-15	Release 15	Open	2016-06-01	2018-09-14 (SA#81)
Rel-14	Release 14	Frozen	2014-09-17	2017-06-09 (SA#76)
Rel-13	Release 13	Frozen	2012-09-30	2016-03-11 (SA#71)
Rel-12	Release 12	Frozen	2011-06-26	2015-03-13 (SA#67)
Rel-11	Release 11	Frozen	2010-01-22	2013-03-06 (SA#59)
Rel-10	Release 10	Frozen	2009-01-20	2011-06-08 (SA#52)

Rel. 8, 9 | Rel. 10-12 | Rel. 13,14 | Rel. 15,16

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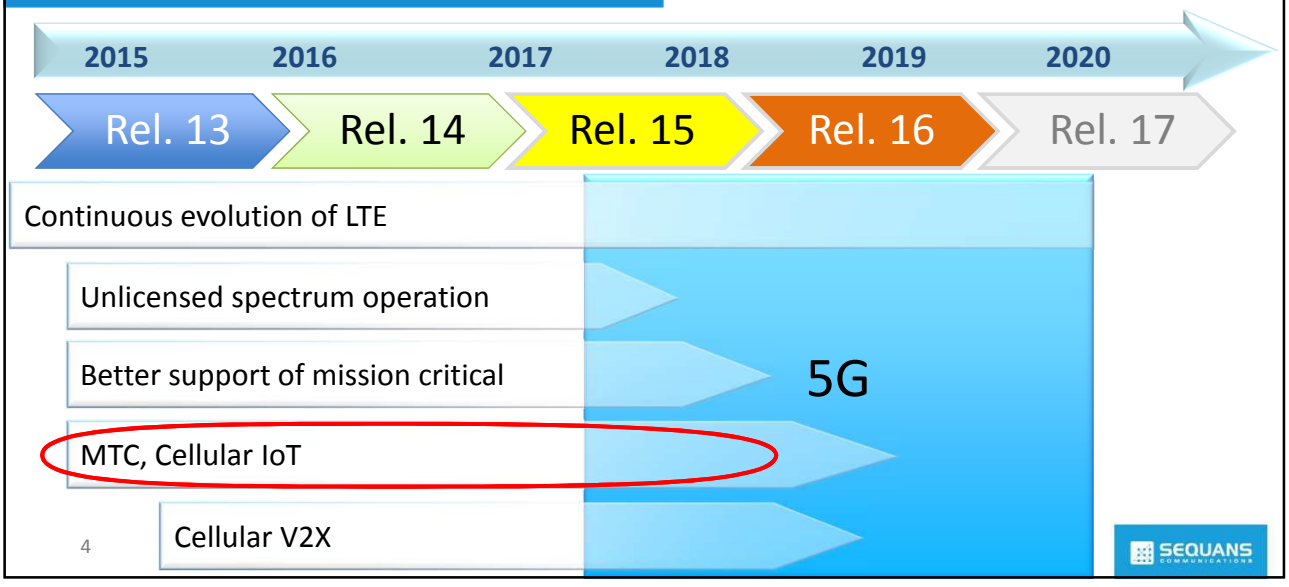
Main topics per releases



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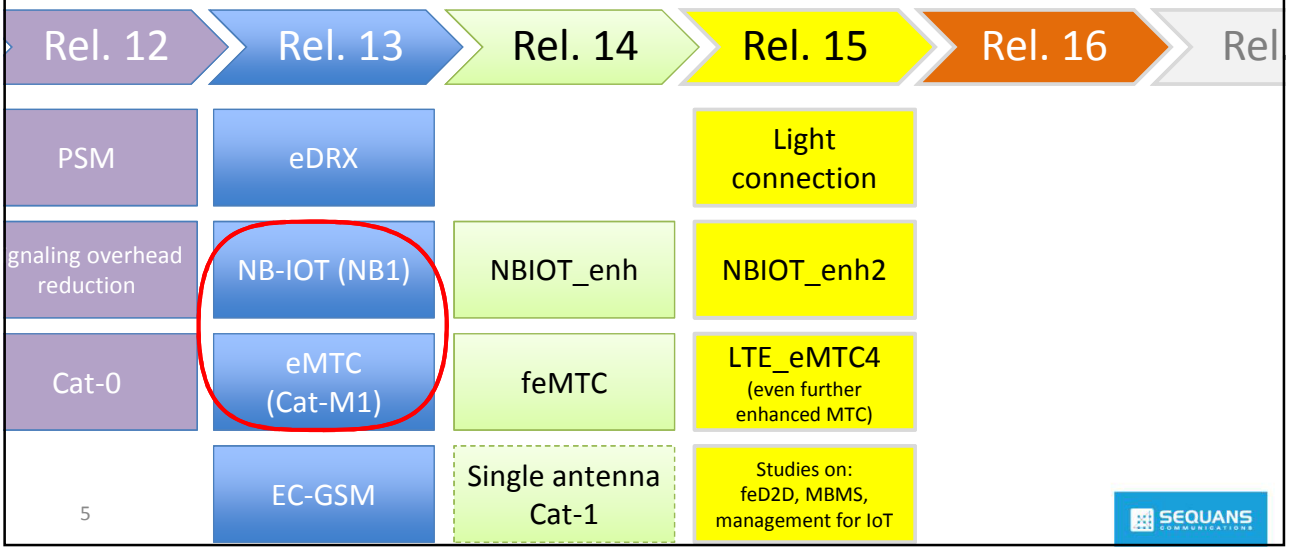
Evolution of MTC features



Comparison of LTE IoT

	Cat 1	Cat M1	Cat NB1
Deployment scenarios	In Band FDD, TDD, (HD-FDD)	In-band HD/FD-FDD, TDD (1.4MHz)	Stand-alone, guard-band, in-band HD-FDD
Bandwidth	Up to 20MHz	1.4MHz	180kHz
Coverage (MCL)	Up to ~144 dB	Up to ~162 dB	Up to ~164 dB
Rx Antenna	Baseline is 2 Rx	Single Rx	single Rx
Mobility	Full Mobility	Full mobility except in CE mode B	Only cell reselection
Data Rate (peak vs. sustained)	UL/DL: 5/10Mbps	UL/DL: 375/300 kbps	UL/DL: 17(63) / 30 kbps (63 in multi-tone)
Power (peak vs. sustained)	23dBm	23, 20dBm	23, 20dBm
Other	VoLTE, LBS, PWS, eMBMS, etc.	VoLTE, LBS, PWS	-

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Evolution of Cat-M and NB-IoT

- Release 14
  - Single Cell Multicast
  - Positioning support
  - Higher data rate
  - VoLTE improvements (Cat-M only)
- Outcomes
  - Improvements for Cat-M1
  - New category: Cat-M2
  - New category: Cat-NB2

- Release 15
  - Latency and Power consumption
    - Early data transmission
    - SI acquisition
    - Relaxed monitoring for cell selection
  - Load control
  - TDD support (NB only)
  - Higher spectral efficiency (Cat-M only)
- Outcomes
  - On going activity in 3GPP

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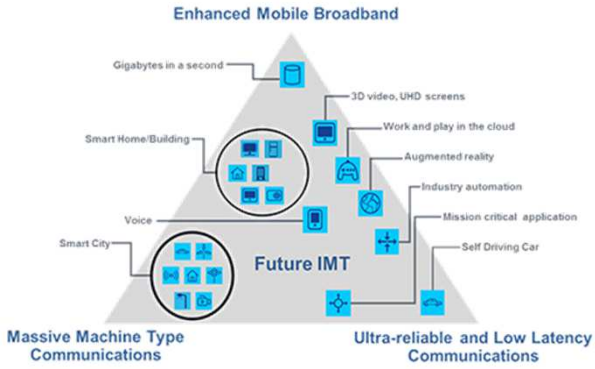
5G and mMTC

- Cat-M and NB-IoT are good enough to fulfill 5G requirements
- Not expected to see an IoT NR before Rel. 17



Source: ITU

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Quick Cellular IoT Market overview

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Key Drivers Converge
LTE-M & NB-IoT designed for IoT
Worldwide network availability
Data plans adapting to IoT
Ecosystem now ready
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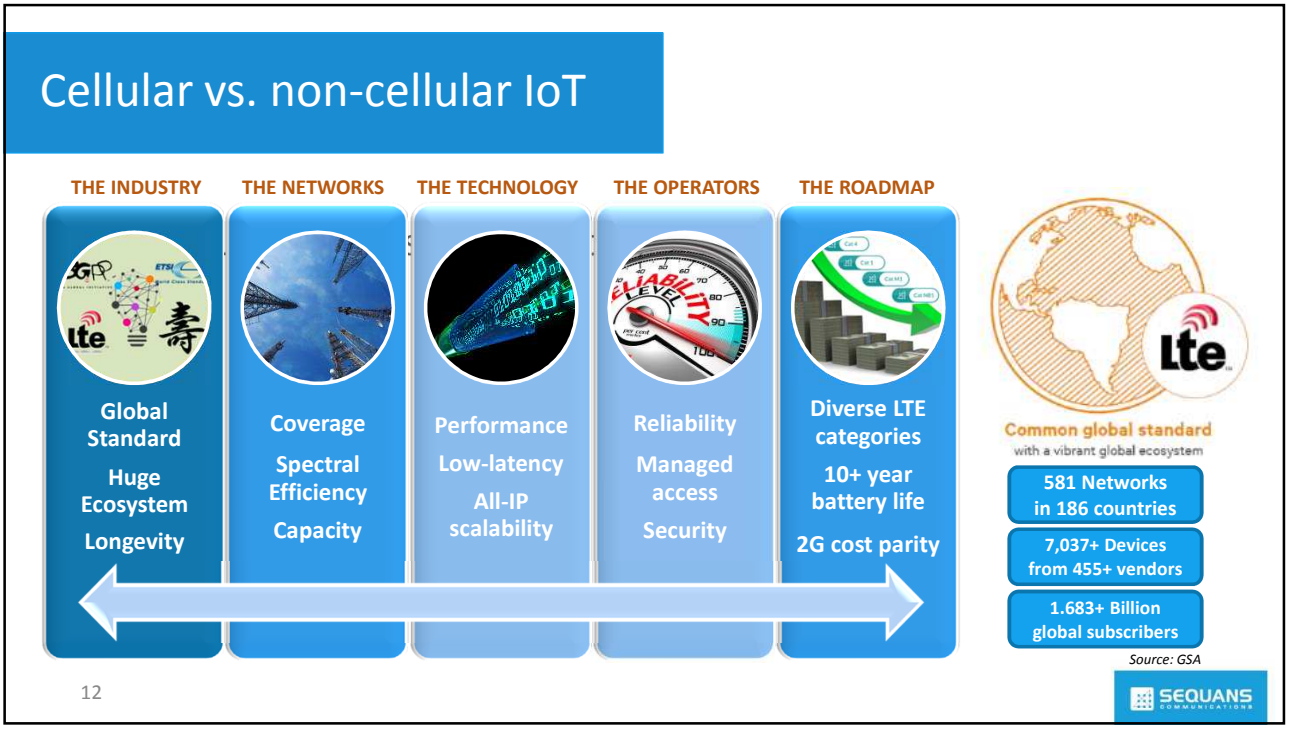
Cellular vs. non-cellular IoT
THE INDUSTRY
THE NETWORKS
THE TECHNOLOGY
THE OPERATORS
THE ROADMAP
Global Standard
Huge Ecosystem
Longevity
Coverage
Spectral Efficiency
Capacity
Performance
Low-latency
All-IP scalability
Reliability
Managed access
Security
Diverse LTE categories
10+ year battery life
2G cost parity
Common global standard
with a vibrant global ecosystem
581 Networks in 186 countries
7,037+ Devices from 455+ vendors
1.683+ Billion global subscribers
Source: GSA
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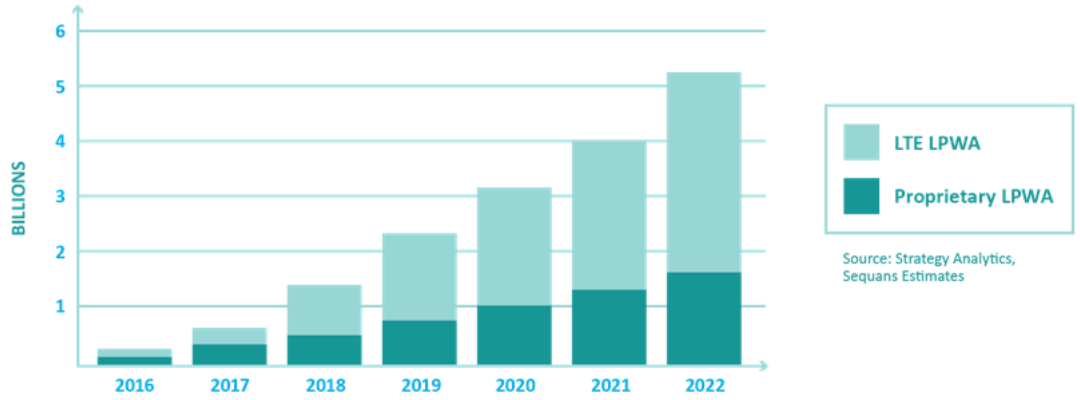
Market opportunity

LPWA connection Worldwide



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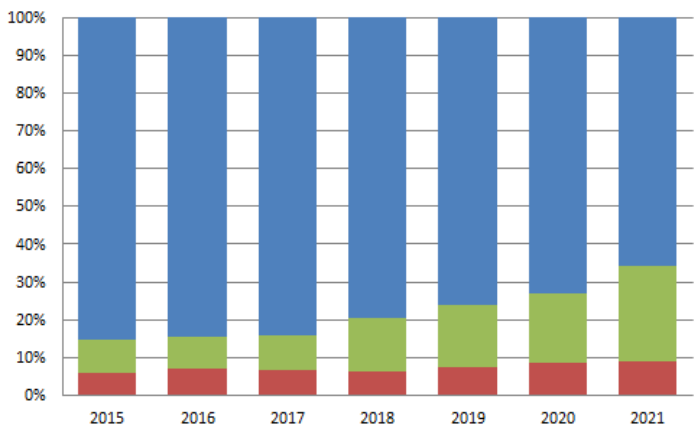
Market Segmentation

(3GPP IoT)



The mature market

The promising one

cloë Tracker Platform

The challenging one

monarchSX Wearable Platform

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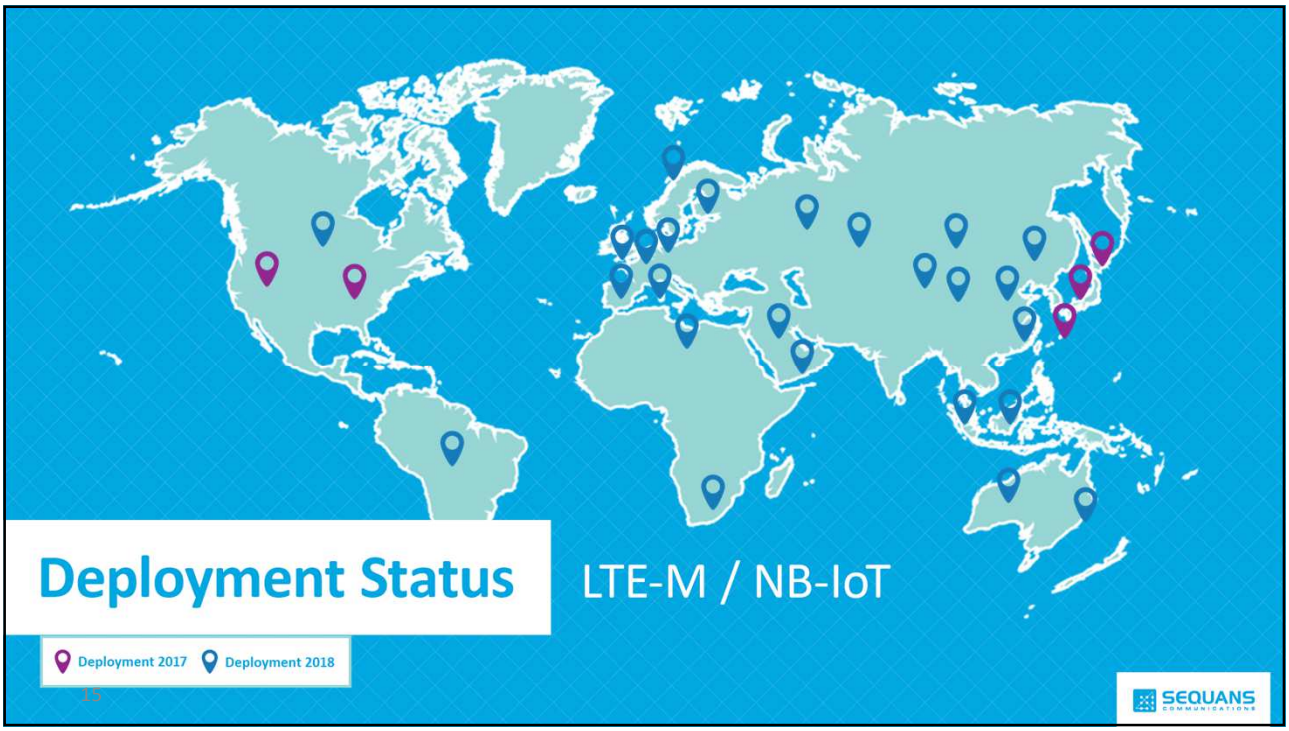

Conclusion on Market

- Cellular IoT is happening since long (2G...) and 4G is renewing this position
  - Much more connected devices than in proprietary systems
- Excellent opportunity for OAI (network side)…
  - Could be a solution for private deployments
    - Though would require to implement MuLTEfire specs.
- …Unfortunately OAI is not for UE side
  - Power consumption, size, cost… will not match the requirements!

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Sequans and OAI

- Cooperation since long
- Examples from the past:
  - Development of Carrier aggregation: in front of Sequans UE
  - Development of eMBMS: in front of Sequans UE
  - Extensive use of our internal debug and monitoring tool
- More recently
  - Development of Cat-M: in front of a Sequans UE

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Debug and Monitoring tool

- Proprietary Trace tool to collect logs and data from UE
- Wireshark for message decoding
- Quite convenient for IoT and to debug OAI!

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Wish list for OAI

- Gain in maturity and features
- To become #1 platform for 5G prototyping
- Possible usages for a chipset company
  - Affordable test equipment for quick non regression
  - Fast prototyping
  - Simulation

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