3GPP SOLUTIONS AND SPECTRUM FOR IOT/MTC

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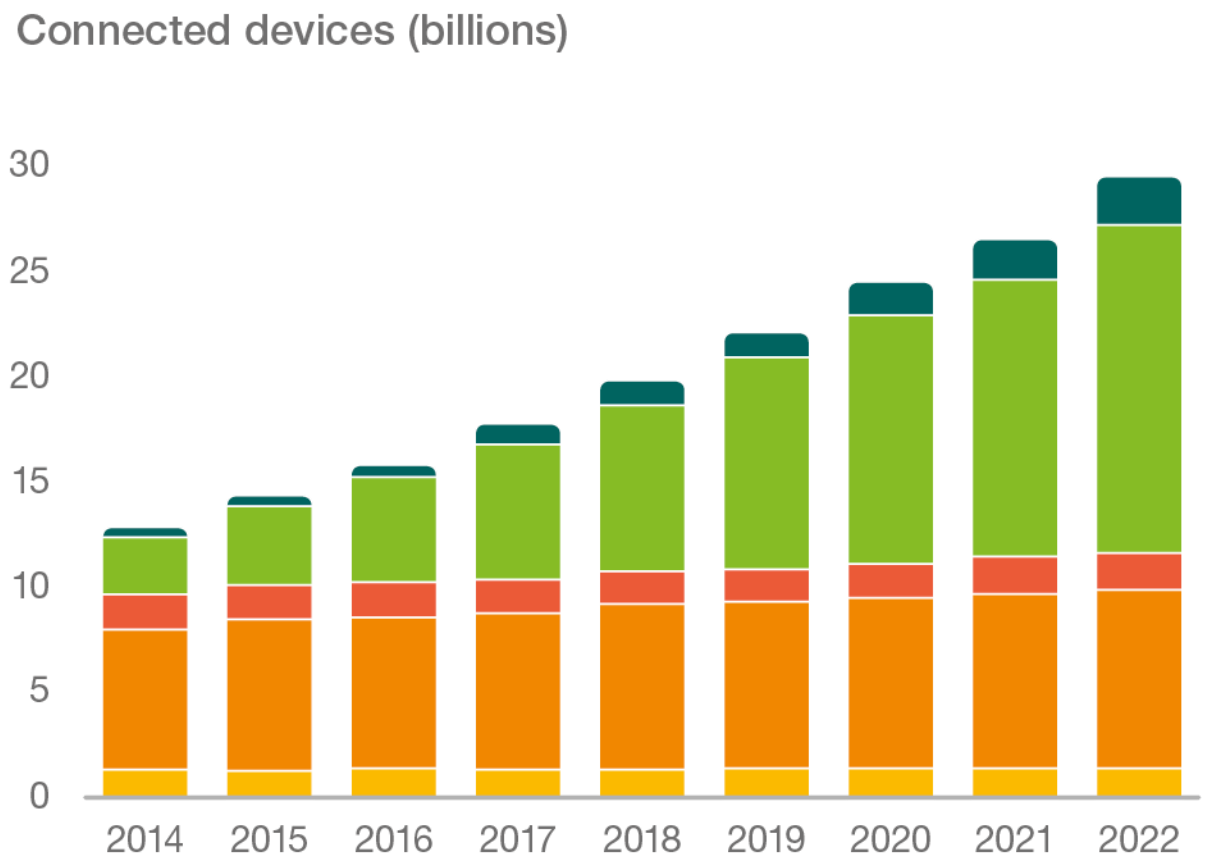
70% OF WIDE-AREAS IOT DEVICES WILL USE CELLULAR TECHNOLOGY IN 2022



	2016	2022	CAGR
Wide-area IoT	0.4	2.1	30%
Short-range IoT	5.2	16	20%
PC/laptop/tablet	1.6	1.7	0%
Mobile phones	7.3	8.6	3%
Fixed phones	1.4	1.3	0%
	16 billion	29 billion	10%

SPECTRUM MOTIVATIONS

extreme Mobile Broadband (xMBB)

- capacity, coverage, and latency

massive Machine-Type Communications (mMTC)

- 50 B devices, coverage including deep indoor

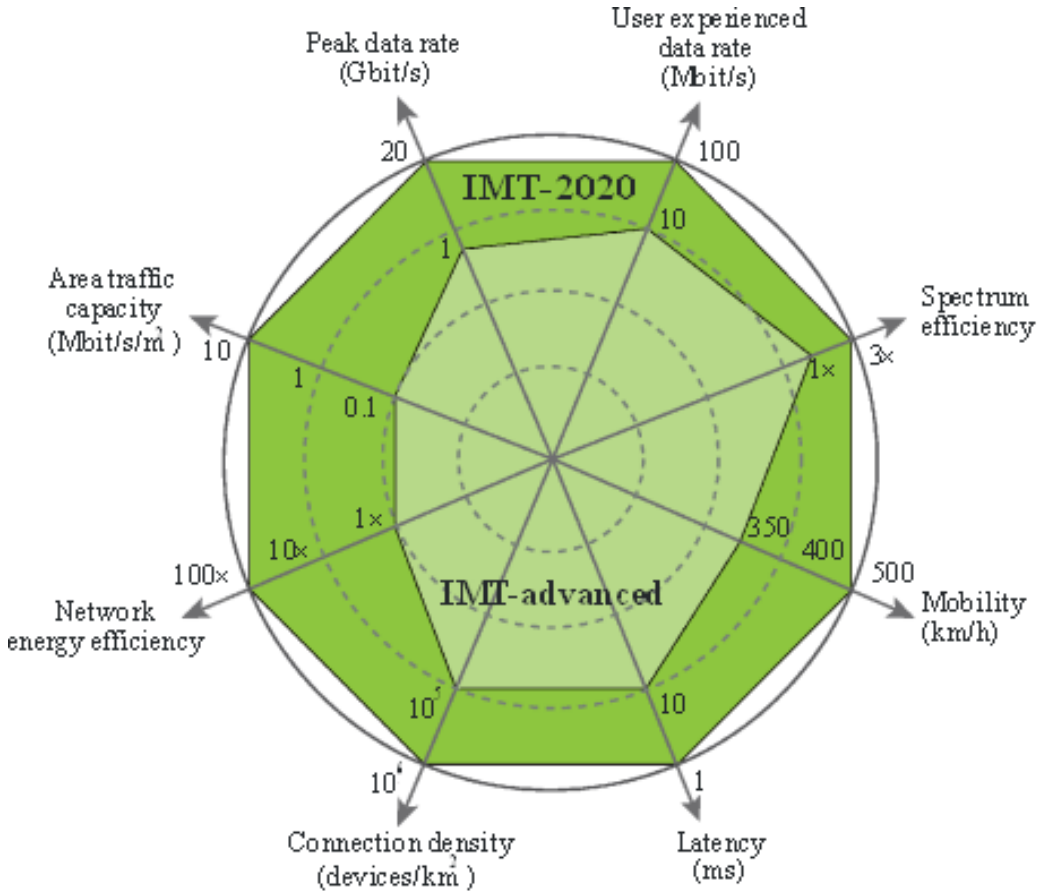
ultra-reliable Machine-Type Communications (cMTC)

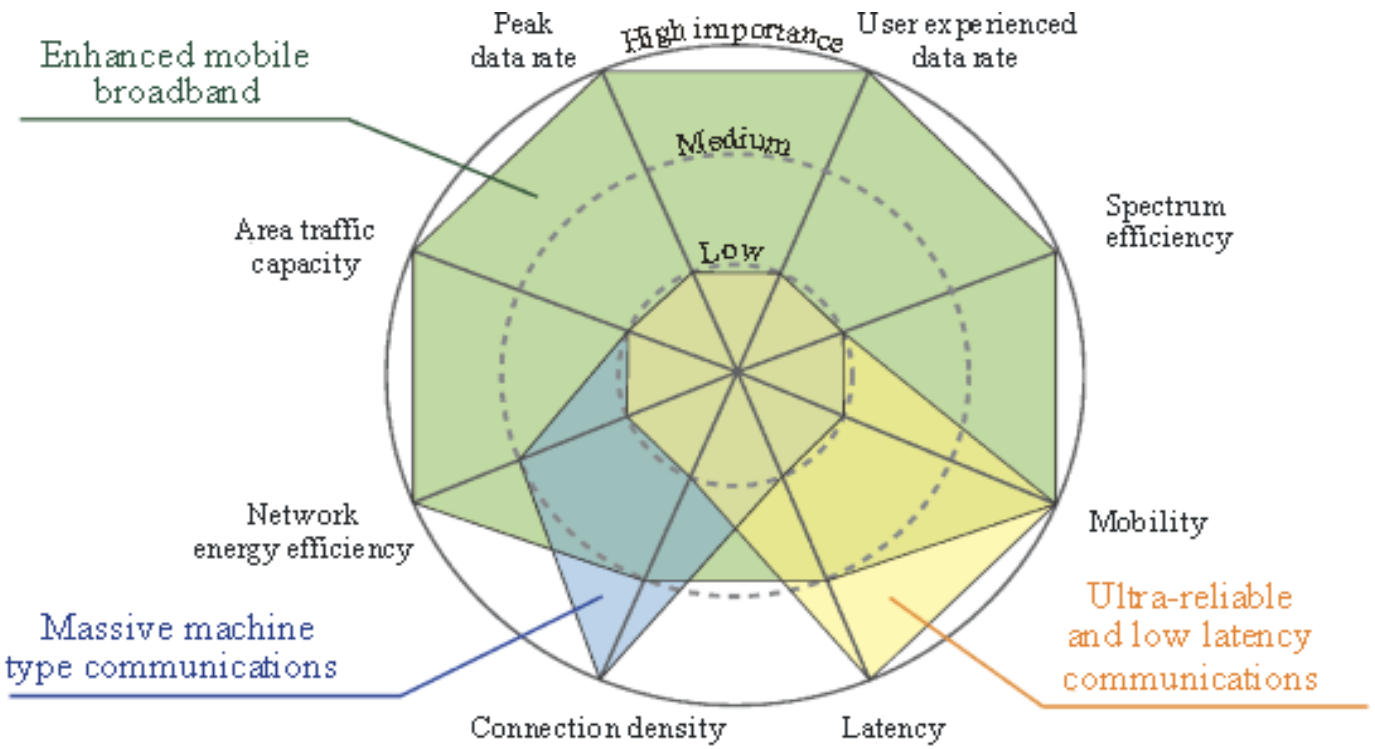
- reliable, resilient, and latency

Understanding the 5G motivations and challenges while exploring spectrum requirements

Capacity extremely wide bandwidth of contiguous spectrum using “higher” bands
Coverage ubiquitous access using “lower” bands while providing for a “5G experience” and IoT
Reliability QoS in dedicated licensed spectrum using multiple bands and sites in both “lower” and “higher” spectrum
Resilient critical services robust against intentional obstructions using multiple bands, sites and/or repetition of transmissions

KEY CAPABILITIES ENHANCEMENTS

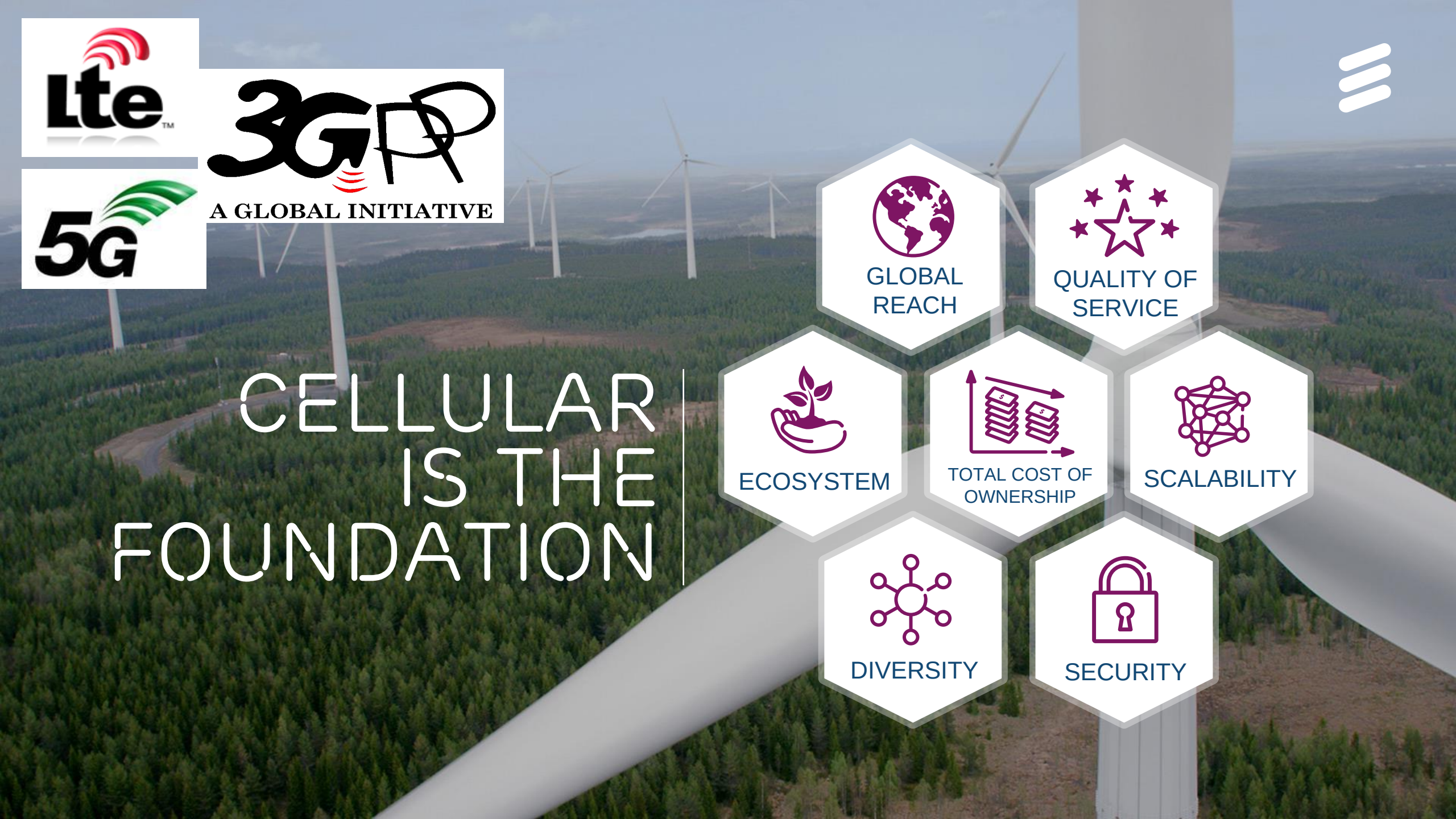




Reference: [Recommendation ITU-R M.2083](#) "IMT Vision – Framework and overall objectives of the future development of IMT for 2020 and beyond"

ONE NETWORK
FULFILLING THE NEEDS

A common network platform with
dynamic and secure Network Slices


Lte
3GPP
A GLOBAL INITIATIVE
5G
CELLULAR IS THE FOUNDATION
GLOBAL REACH
QUALITY OF SERVICE
ECOSYSTEM
TOTAL COST OF OWNERSHIP
SCALABILITY
DIVERSITY
SECURITY

FULL RANGE OF SOLUTIONS

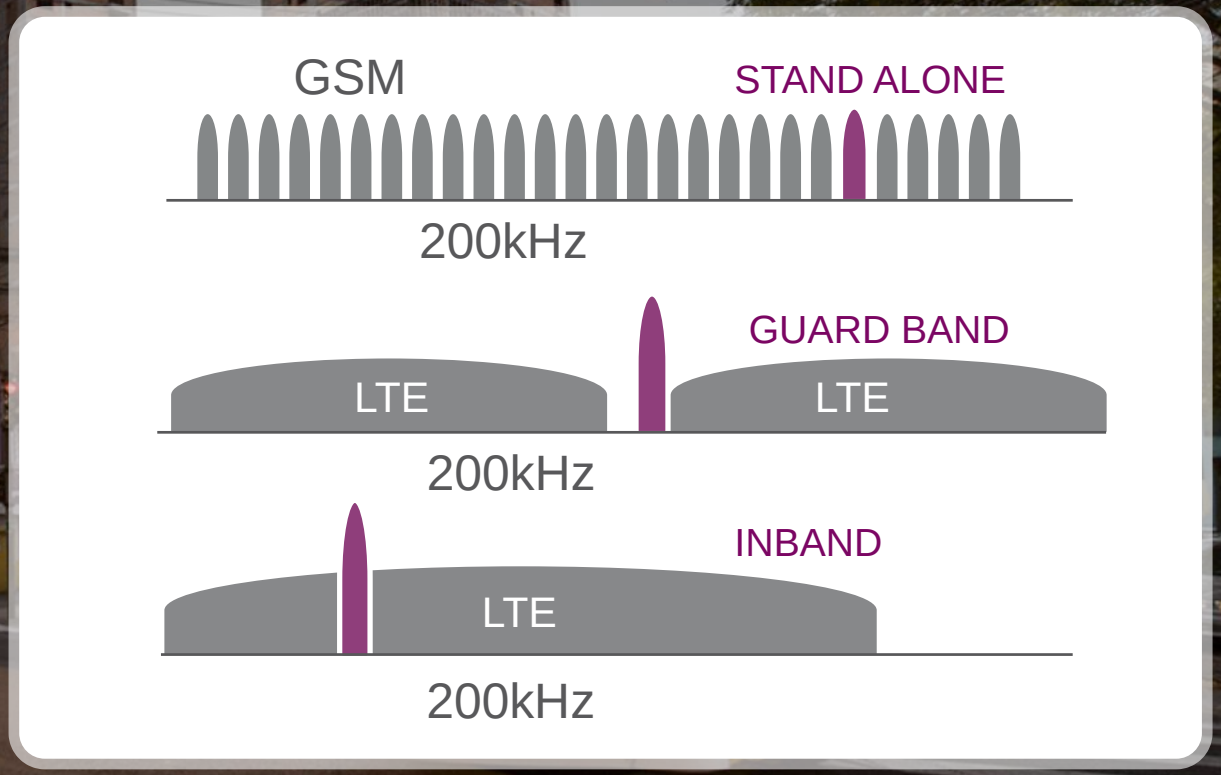
Addressing diversity of use cases

EC-GSM	Global cellular IoT for all GSM markets
LTE-M	Wide range of Massive IoT applications
NB-IoT	Low-bitrate Massive IoT applications
5G NR	Critical Machine-Type Communication

FLEXIBLE DEPLOYMENT

Enabled by new software on LTE installed base

NB-IoT



Device receives NB-IoT carrier
The capacity of NB-IoT carrier is shared by all devices
Capacity is scalable by adding additional NB-IoT carriers

3GPP DEVELOPING TO HANDLE IOT

LTE-M (CAT-M1) AND NB-IOT

	LTE-M	NB-IoT
SW upgrade on LTE installed base	●	●
UE Complexity	LOW	ULTRA LOW
UE Bandwidth	1.4 MHz (Cat-M1)	200 kHz
10+ Year Battery Lifetime	●	●

	LTE-M	NB-IoT
Extended Coverage	+15~20 dB	+20 dB
Deployment	LTE Carrier	FLEXIBLE
Peak rate (DL/UL)	1/1 Mbps	227/250 kbps
Capacity for applications	1M+ per cell	200k per cell

3GPP Bands

LTE-M (Cat-M1): HD/FD-1,2, 2, 3, 4, 5, 7, 8, 11, 12, 13, 18, 19, 20, 21, 25, 26, 27, 28, 31 / TDD-39, 40, 41

NB-IoT: HD-1, 2, 3, 5, 8, 11, 12, 13, 17, 18, 19, 20, 25, 26, 28, 31, 66, 70

DIVERSE CELLULAR SOLUTIONS FOR MASSIVE IOT

INTERNET OF THINGS – IoT
MACHINE TYPE COMMUNICATIONS - MTC

- Different bands needed depending on application
  - mMTC: 450 MHz to 6 GHz, in particular re-using commercial spectrum
  - cMTC/URLLC: 5G frequency bands – low and high frequencies
- Regulatory schemes; Licensed / Light Licensed / Local licensed / Unlicensed
- Examples
  - ITS: Dedicated spectrum as well as licensed spectrum for vehicle-to-infrastructure
  - Industry 4.0: existing and new schemes

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