Interactive session on

“Smart Grids for Smart Cities”

30th October 2018

India Habitat Centre, New Delhi

Presentation Title:Cellular Tech Talk

By: Jitender Sandhu (Gemalto)

Jointly Organized by

National Smart Grid Mission
Ministry of Power
Government of India

ieema
your link to electricity

The Road to Highspeed LTE Connectivity

1G

1st Generation

- Basic Voice
- Analog Protocols

Upto 14.4 kbps

2G

2nd Generation

- Voice Optimised Design
- Capacity and Coverage

GSM, GPRS, EDGE
9.6 - 384 kbps

3G

3rd Generation

- Voice with Data add-on - Internet access
- First Highspeed Broadband

UMTS, HSPA, HSPA+
2 - 42 Mbps

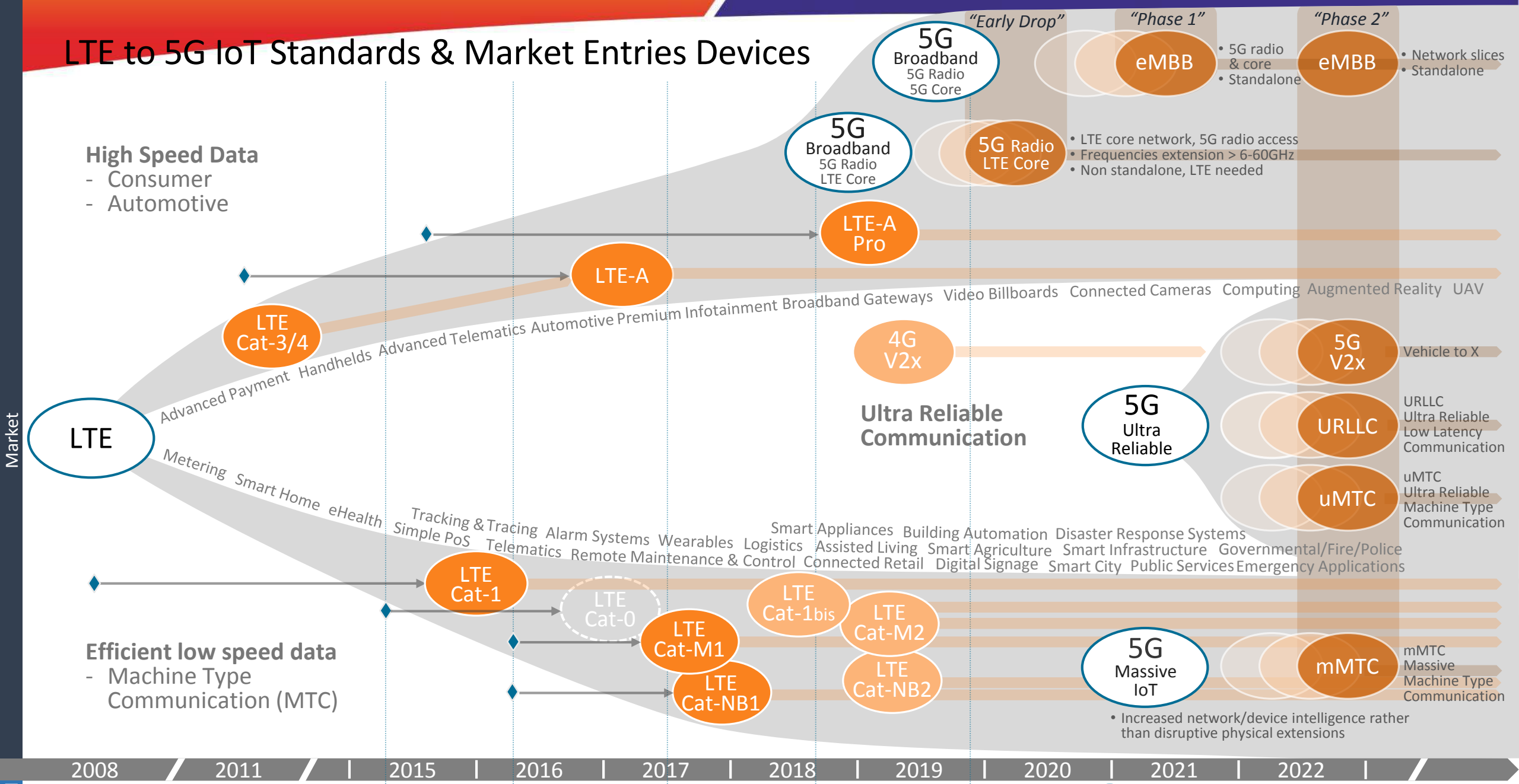
4G

4th Generation

- Focus shift from Voice to Data
- IP-Based Protocols
- Real Mobile Broadband

LTE, LTE-A, LTE-A Pro
100 Mbps ++

LTE to 5G IoT Standards & Market Entries Devices

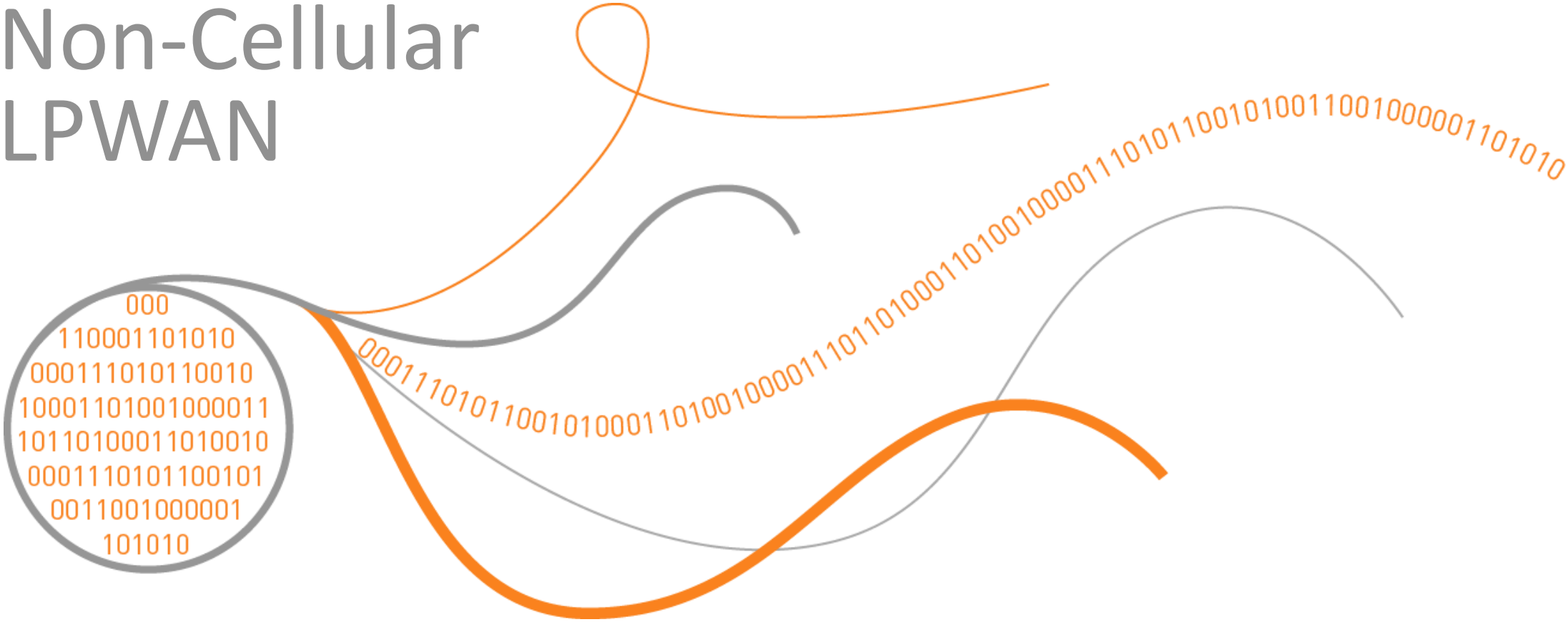


Comparison of LTE Technologies for the IoT

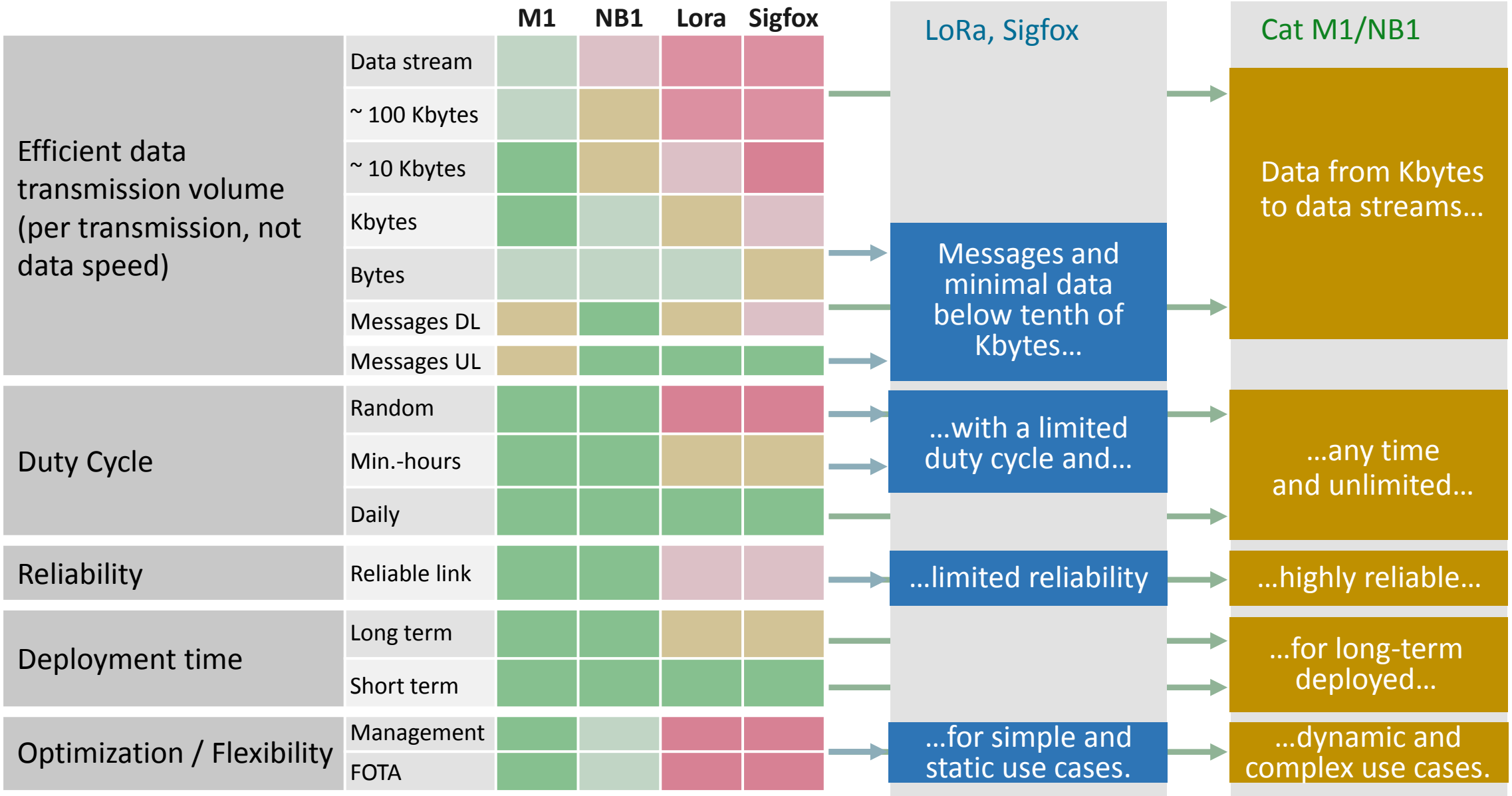
	LTE Cat.1	LTE Cat.M1	LTE Cat.NB1
SYSTEM BANDWIDTH	20MHz	1,4MHz	200KHz
PEAK DATA RATE (UL/DL)	10Mbps / 5Mbps	300kbps/375kbps	17kbps / 30kbps
COVERAGE / PENETRATION	+ 0dB vs. GSM (similar as GSM)	+ 15dB vs. GSM (approx. 2-3 x as GSM)	+ 23dB vs. GSM (approx. 4 x as GSM)
LATENCY	milliseconds, real time	80 ms to 4 s	1.4s to 10s
MOBILITY	seamless, full handover	Connected mobility with some limitations (inter freq handover)	limited, changing cells without handover
VOICE	full Voice	Restricted voice, for simple use cases, like alarm panels	1100 1010 0101 no voice, data only
BATTERY LIFE	<5 years	>10 years	>10 years
ANTENNA	2 Antenna, single Antenna by exception only	single Antenna	single Antenna
APPLICATION	>100 kB Continuous data stream. Full Lifecycle Management Existing, well understood Focus are existing markets	<100 kB Limited data stream. FOTA capable TCP/UDP communication Focus is enabling new markets	<1 kB Messaging centric Incr. FOTA only Suited for UDP Communication Focus is enabling new markets

* Peak: 1Mbps/1Mbps using full duplex ** Assumed half duplex performance

Non-Cellular LPWAN



How to select – an example…



Technology comparison

	Sigfox	LoRa	EC-GSM	Cat-1	Cat-M1	Cat-NB1	5G MTC
	Non 3GPP technology with very focused capabilities	Non 3GPP technology with very focused capabilities	Extension of most common global cellular standard with range and power saving functionalities	MTC extended standard LTE. Extensions will position Cat 1 in the LPWA proximity.	Further MTC optimized LTE	Very optimized narrowband LTE	Next generation technology adopting many LTE MTC elements
Peak Data Rate / kbps	<0.1	<10	150	10000/5000	300 (in half duplex)	100	<1000
Spectrum	Unlicensed	Unlicensed	Licensed	Licensed	Licensed	Licensed	Licensed
Voice	No	No	Full voice capable	Full voice capable	Voice option in future	No	open
Reliability	Best effort, no QoS, no collision avoidance, cumulative resource usage	Best effort, no QoS, no collision avoidance, cumulative resource usage	Very high, QoS	Very high, QoS	Very high, QoS	Very high, QoS	Extra highest reliability class (eMTC), QoS
Latency	Not applicable	Not applicable	Mid-Low	Very low	Low	Low	Ultra low
Coverage	Selected areas, urban focus	Selected areas, urban focus	Global	Global	Global	Global	Global
Supplier Eco System	Tiny - single vendor	Very small	Very large	Very large	Very large	Very large	Very large
Standard	Full Proprietary	Proprietary Standard	Global standard	Global standard	Global standard	Global standard	Global standard
Platform scalability	Non scalable, single flavor	Non scalable, single flavor	Performance and feature scalable	Performance and feature scalable	Performance and feature scalable	Performance and feature scalable	Performance and feature scalable
Network Operation	MNO like network operated by Sigfox	Network set up and run individually	Feature extension within existing GSM bands	Use of existing LTE networks	Extension on top of existing LTE networks	Stand-alone, guard band or in-band operation	2 dedicated networks: massive & reliable MTC

IoT Radio Technologies – General advantages for 3GPP standardized LPWAN vs. proprietory solutions:

- More mature, already successfully through the peak of „hype cycle“.
- Ready in terms of coverage, due to re-use of existing networks.
- Investment protection and prepared for global deployment, following global 3GPP standards
- Similar or less power consumption in comparable use cases.
- Enhanced security, as high standards included within 3GPP.
- QoS Guarantee for mission critical usage.
- Enhanced 2 Way Communication.
- Lifecycle management for maintenance and optimization (e.g. FOTA, scheduling, power profile).
- Flexibility of choice due to more competitive environment.

Enhancements in new LTE CatM and CatNB1 standards for the IoT

UP TO 50.000 DEVICES PER CELL!

Efficient use of current LTE spectrum, guard bands etc.

LOWER COSTS!

Cost efficient RF design, Half-Duplex in DL/UL

DEEP INDOOR & ENHANCED COVERAGE!

Up to 23dB through repetition, for delay tolerant use cases

POWER EFFICIENT DURING OPERATION!

Extended DRX (Enhanced Discontinous Reception) cycles up to ~3hr

SIGNIFICANT POWER SAVING DURING OPTIMIZED SLEEP MODE!

Max. duration of PSM (Power Saving Mode) enhanced to ~1 year

What drives the MNOs with the IoT? Disruptive competition!

WHAT DRIVES 3GPP AND THE MNOs?

- IoT is considered a huge market and a logical step for MNOs, leveraging their networks
- Several privately owned companies try to compete with proprietary LPWAN technology in unlicensed bands, e.g.: Lora, Sigfox, etc.

THIS LEADS MNOs TO:

- Update their well established networks for LPWAN standards.
- Communicate ambitious roll-out dates for LPWAN.
  (e.g. LTE Cat NB at VF, **LTE Cat M at** AT&T in 2017 for some countries)
- Commit to existing technologies (e.g. 2G until 2025 in Europe) to avoid disruption.
- Offer competitive, low cost data tariffs.

→ ...good for device makers, service providers and module makers!

Who benefits most from LTE Cat-M / NB-IoT?

1. **STATIONARY APPLICATIONS**
   Because seamless mobility is limited due to support of power save modes.

2. **NON-REAL-TIME APPLICATIONS**
   Because only this applications benefit most of the power saving possible with eDRX and enhanced sleep modes, when the device turns its receiver off and enters a low power state.

3. **DATA ONLY APPLICATIONS**
   Because Network Operators will launch IoT optimized data tariffs.

4. **INDOOR MOUNTED APPLICATIONS**
   Because enhanced coverage supports delay tolerant transmissions.

5. **BATTERY OPERATED DEVICES**
   But here the use case is imperative (could be that short transmission using Cat 1 is more efficient than Cat M/NB-IoT).

Thank You