

November 2014

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# LTE MTC: Optimizing LTE Advanced for **Machine-Type** **C**ommunications

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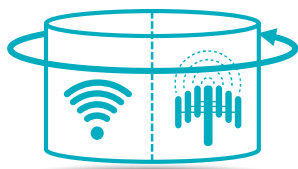
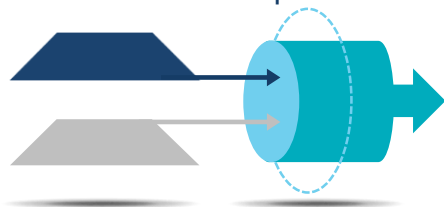


# LTE Advanced is evolving and expanding into new frontiers



## Using all spectrum types

Extending LTE Advanced to unlicensed spectrum



Making Wi-Fi a virtual extension of LTE

## Empowering new services

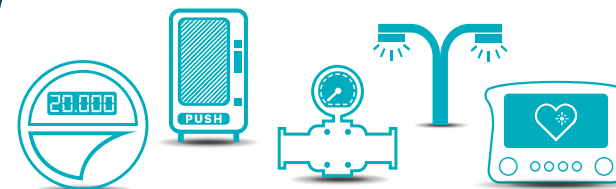
LTE Direct always-on proximity awareness



Evolving LTE Broadcast, going beyond mobile

## Connecting more industries

Optimizing LTE Advanced for machine-type communications



Connecting more verticals like cars

1000X

Faster and better  
mobile broadband

Further enhancing HetNets

Advanced antenna features

Evolving carrier aggregation

Advanced receivers

# Optimizing LTE Advanced for **M**achine-**T**ype **C**ommunication

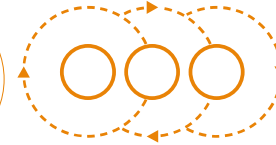
LTE MTC is part of the upcoming Release 13 of the global 3GPP standard

1



Benefits from the reliability, pervasiveness, efficiency, and longevity of 4G LTE

3



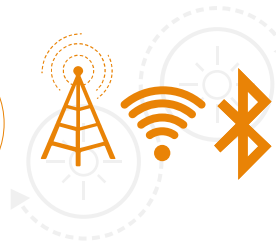
Co-exists with mobile broadband services enabling continued M2M business model innovations

2



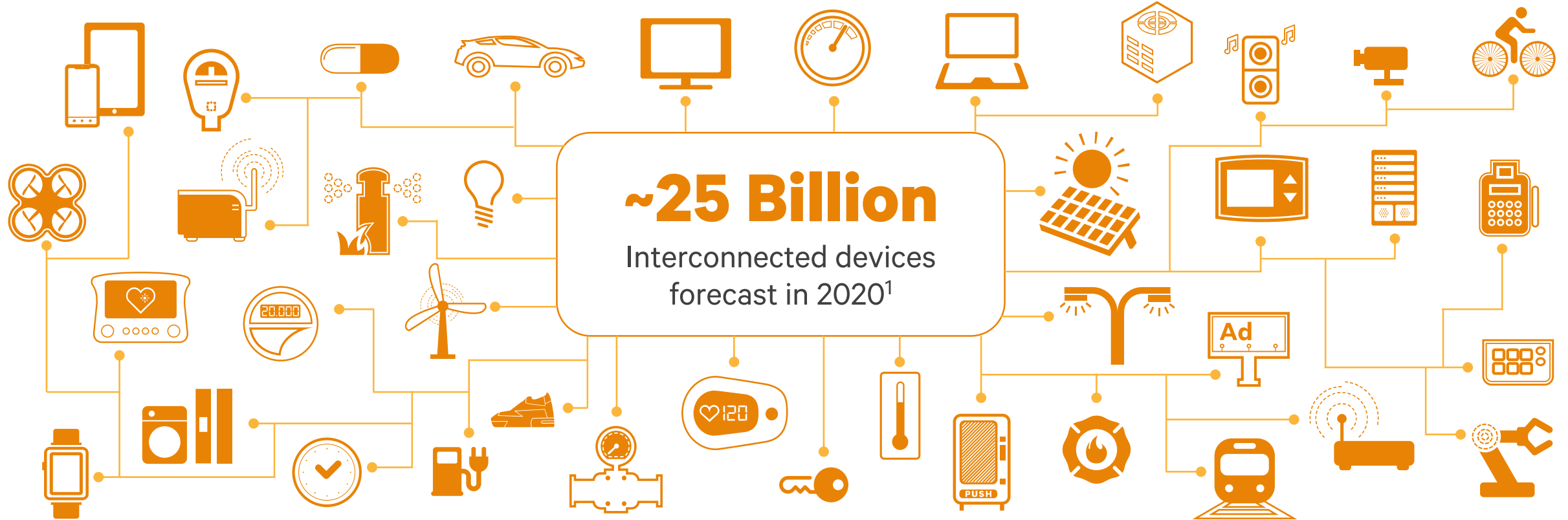
Significantly increases battery life, while reducing cost/complexity and enhancing coverage

4



Plays a key role among the multiple solutions required to connect the Internet of Everything

# The IoE is bringing a massive surge of smart, connected things



**Transforming industries  
with innovative services  
and useful information**



## Smart Cities



## Industrial



## Transportation



## Connected Home



## Healthcare



## Retail



## Education

# Connecting the IoE requires heterogeneous wireless connectivity

Powered by global standards with seamless interoperability across multiple vendors

## Personal Area (WPAN)



### Bluetooth

Replaces cables for connecting mobile/PC accessories, evolving for the IoE with Bluetooth Smart

## Local Area (WLAN)



### Wi-Fi 802.11

The center of the connected home/enterprise, evolving for the IoE with 802.11ah

## Wide Area (WWAN)

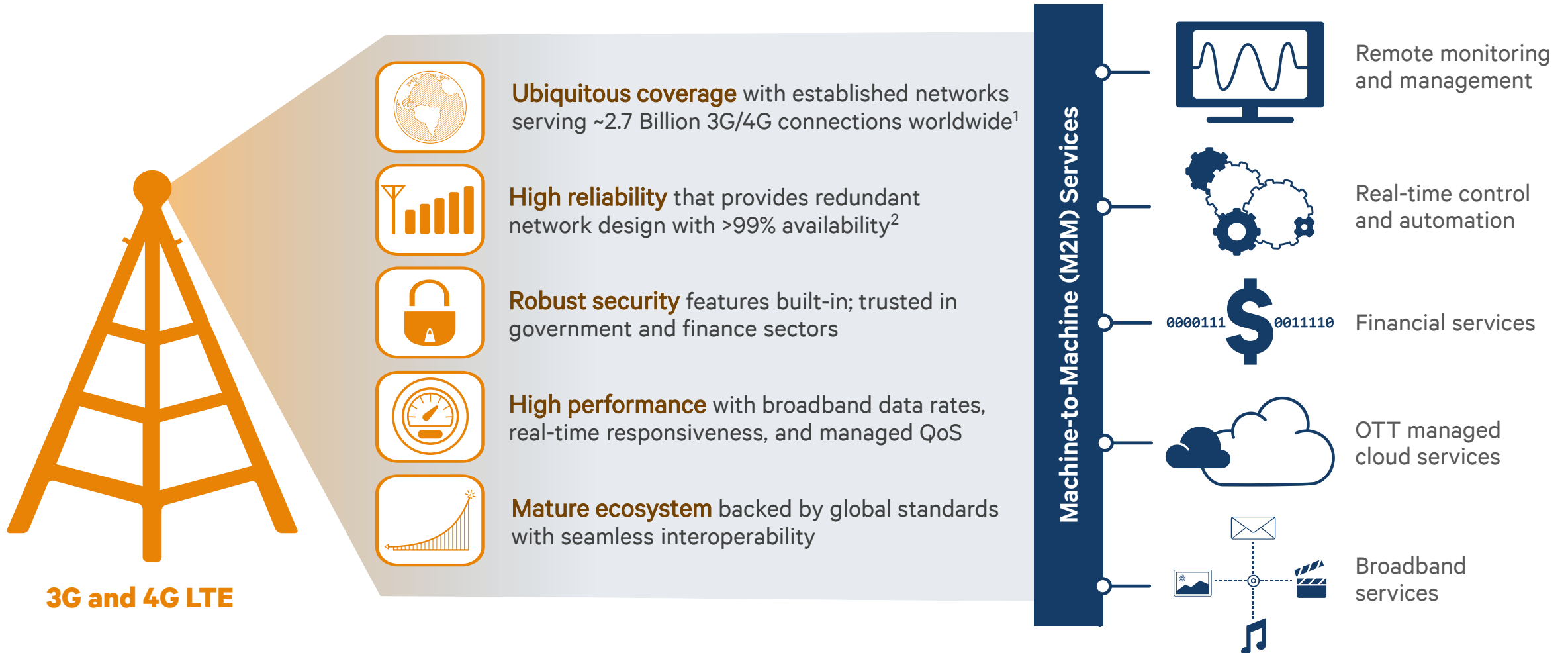


### 3G and 4G LTE

For applications that demand ubiquitous coverage and high reliability, evolving for the IoE with LTE MTC

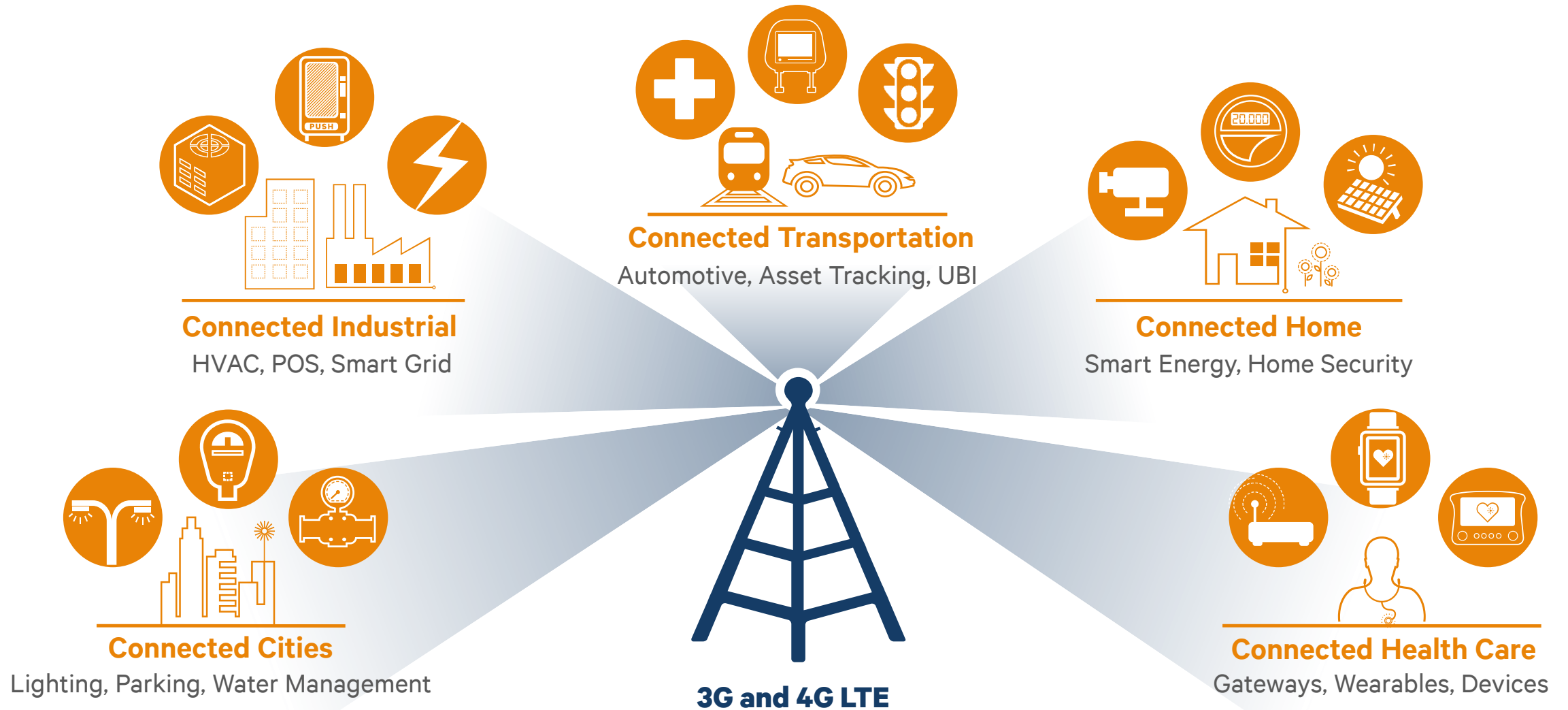
**Supporting the wide range of IoE use cases with varying performance, cost, and energy requirements**

# Valuable M2M services are enabled by the pervasiveness, reliability, security, and performance of 3G and 4G LTE





# M2M services are transforming the way we live and do business



# 4G LTE provides a solid foundation for future M2M growth



**Common global standard**  
with a vibrant global ecosystem

**310+ Networks**  
in 110+ countries

**1,500+ Devices**  
from 100+ vendors

## Network longevity

LTE has become one of the fastest growing wireless technologies providing a solid foundation for many years to come

## Network efficiency

Increased spectral efficiency, simplified network infrastructure, and more efficient signaling

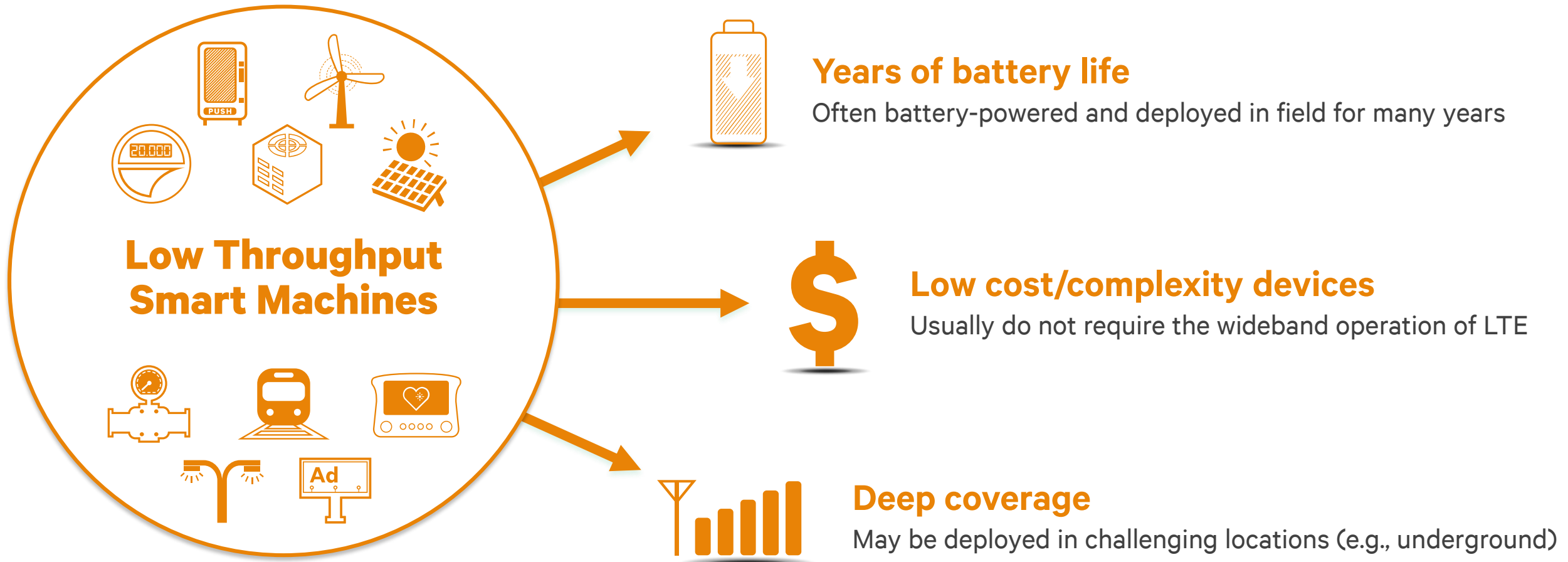
## Superior performance

LTE and LTE Advanced provides the fastest and best broadband experiences for applicable M2M services



# M2M requirements often differ from mobile broadband

Requires optimizations to make technology scalable to a wide range use cases



# LTE MTC optimizes LTE Advanced for M2M

Part of the upcoming Release 13 of the global 3GPP standard



## Co-existence

Efficiently integrates with existing  
LTE Advanced services



## Significantly increases battery life

New enhanced power save modes and efficient signaling



## Reduces device cost/complexity

New device category with narrowband operation

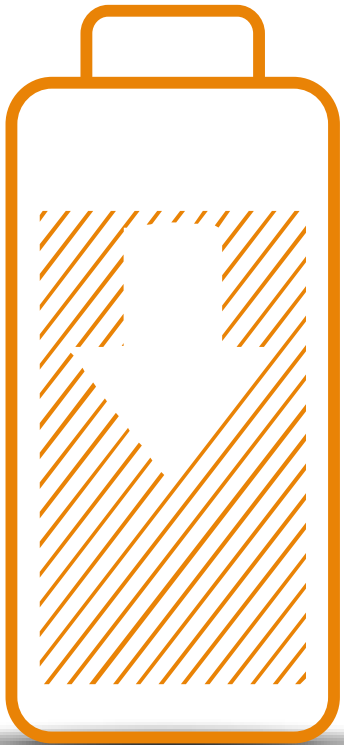


## Enhances coverage

Advanced techniques to reach challenging locations

# LTE MTC significantly increases battery life

With new enhanced power modes and efficient signaling



**Capable of many  
years of battery life**

## **Enhanced Power Save Mode (PSM)**

More efficiently turn on/off modem; optimized for device-originated or scheduled applications

## **Extended Discontinuous Reception (DRX)**

Longer sleep cycles optimized for delay-tolerant, device-terminated applications

## **Connectionless Random Access Channel (RACH)**

Data transmissions via common channel for more efficient transition between states

## **Less frequent Tracking Area Updates (TAUs) and measurements**

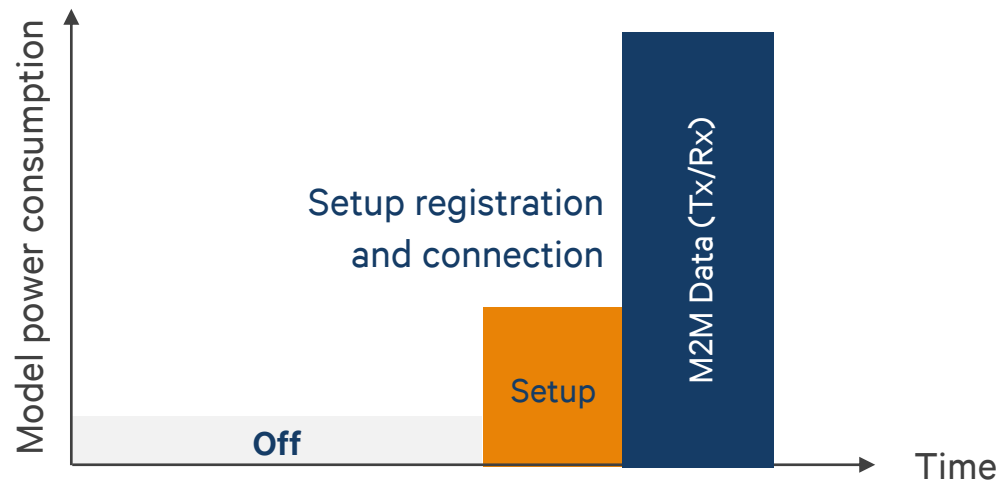
Configurable for low- to zero-mobility M2M applications

# LTE MTC introduces a new Power Save Mode (PSM)

More efficiently turn on/off modem for device-originated or scheduled applications

## Without LTE MTC

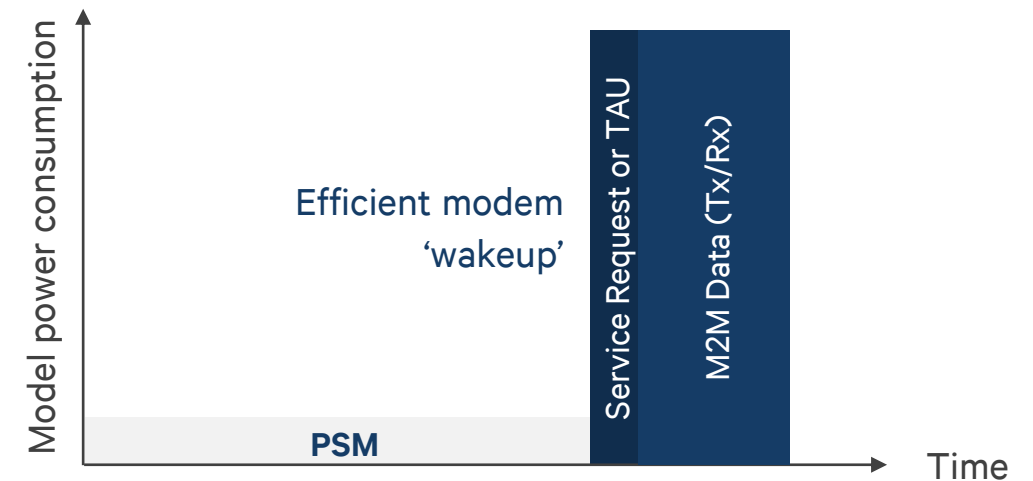
LTE Advanced with deep sleep



Device requires signaling prior to data transmission in order to register with the network

## With LTE MTC

LTE Advanced with Power Save Mode (PSM)



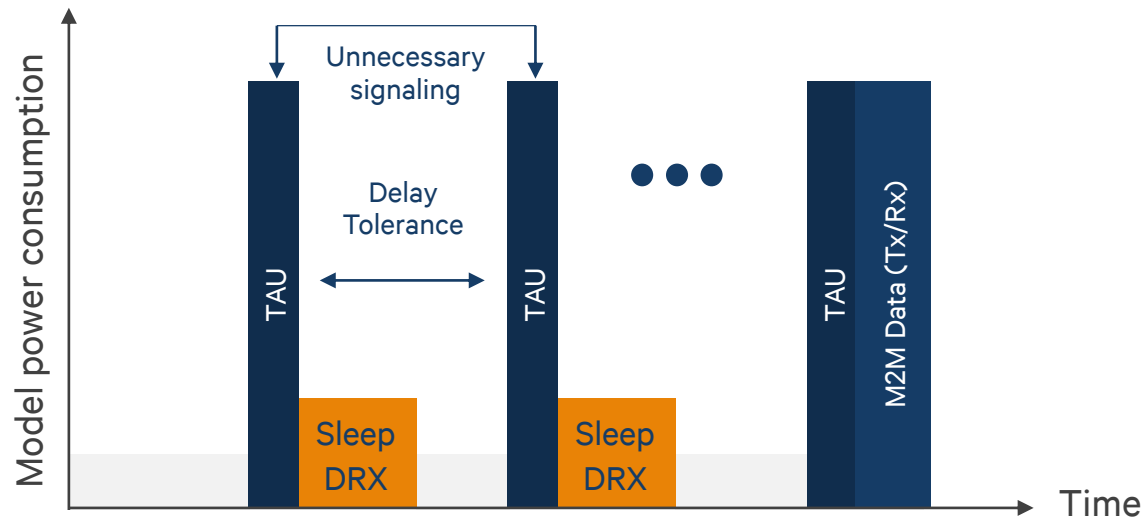
Device remains registered with the network, reducing the signaling required for modem wakeup

# LTE MTC introduces longer sleep cycles

Delivering critical power savings for delay-tolerant, device-terminated applications

## Without LTE MTC

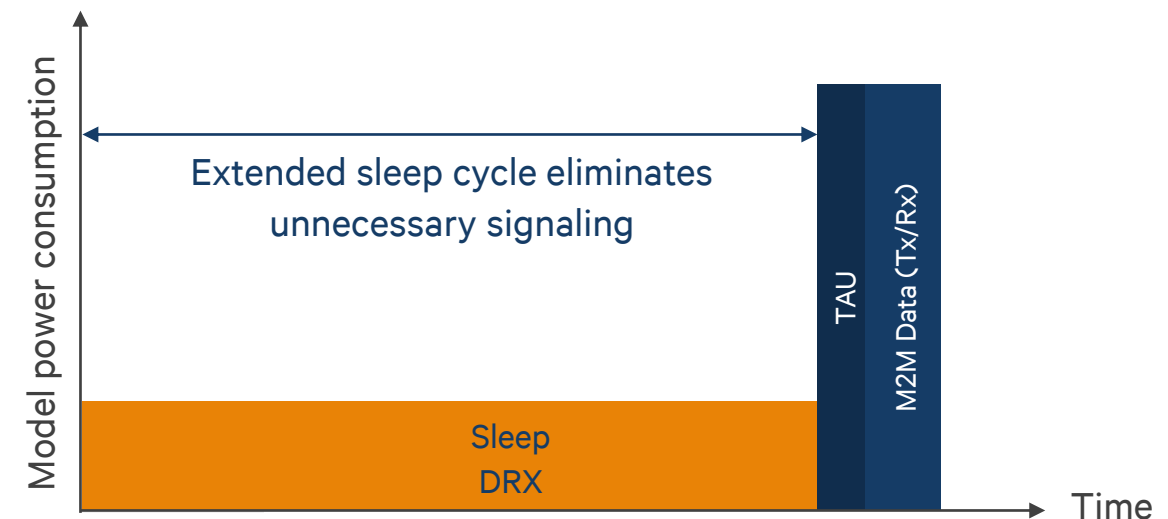
Sleep cycles optimized for human-type communications



Current maximum sleep cycle is 2.56 seconds, resulting in unnecessary signaling

## With LTE MTC

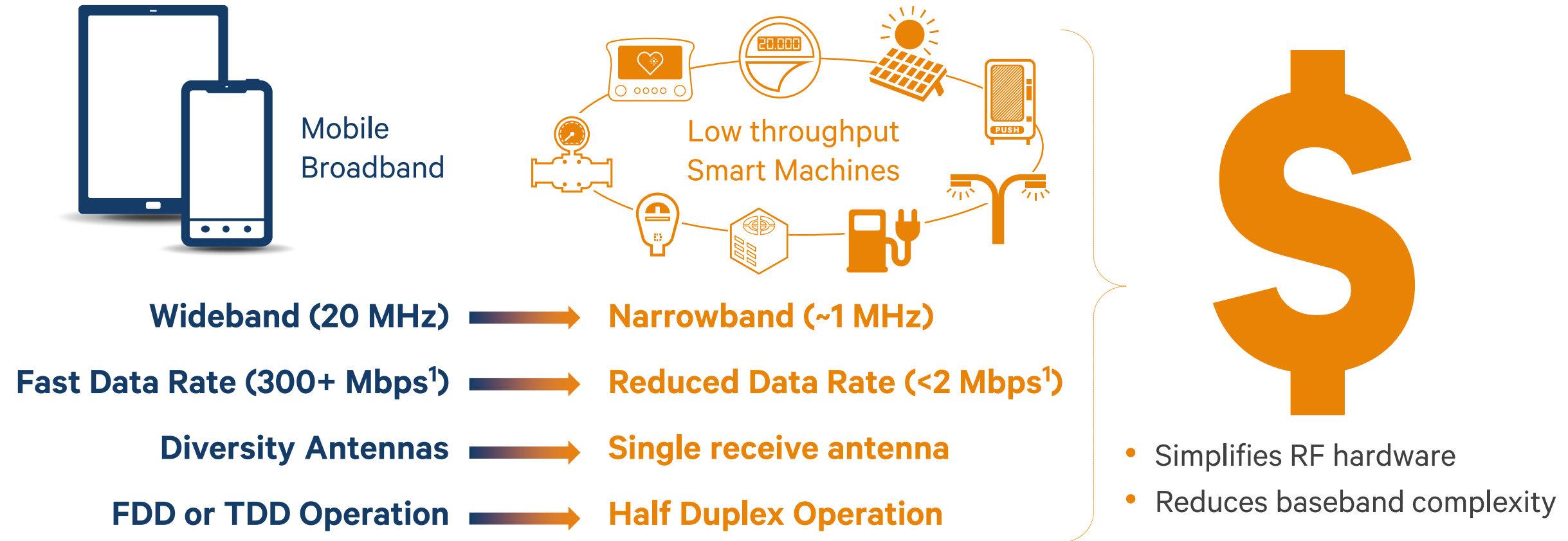
Sleep cycles extendable for machine-type communications



Capable of extending sleep cycles to many minutes, eliminating unnecessary signaling to save power

# LTE MTC enables a new, simpler M2M device capability

Optimized for relatively small, infrequent data transmissions



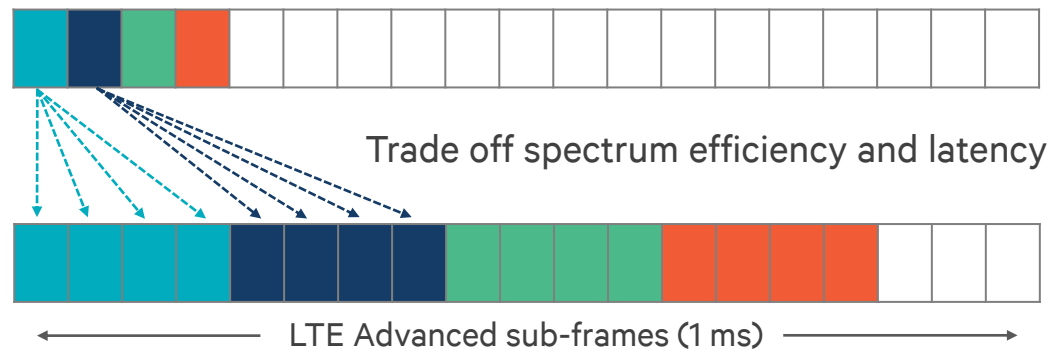
<sup>1</sup> Based on peak data rates per 3GPP standard



# LTE MTC delivers enhanced coverage

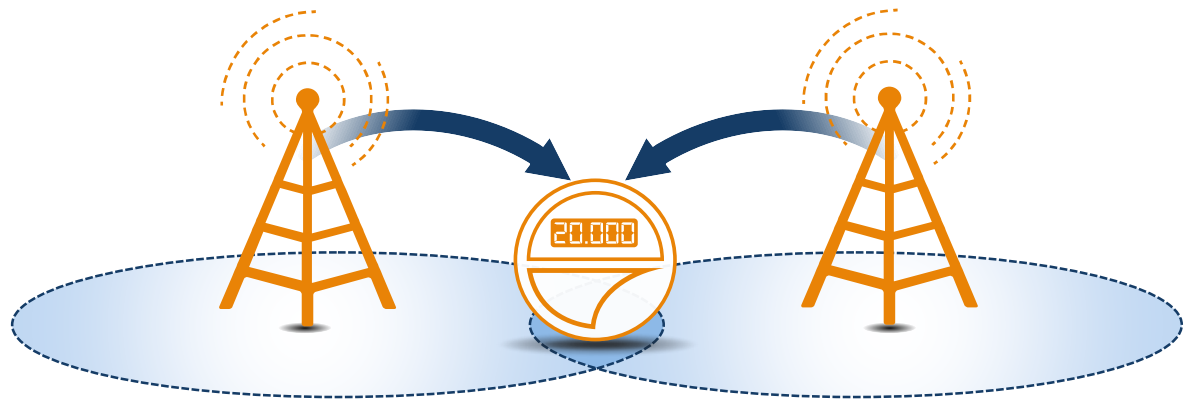
## Redundant UL/DL Transmissions

Send same data in consecutive Transmit Time Intervals



## Single Frequency Network (SFN) Multicast

Same broadcast signal from all cells



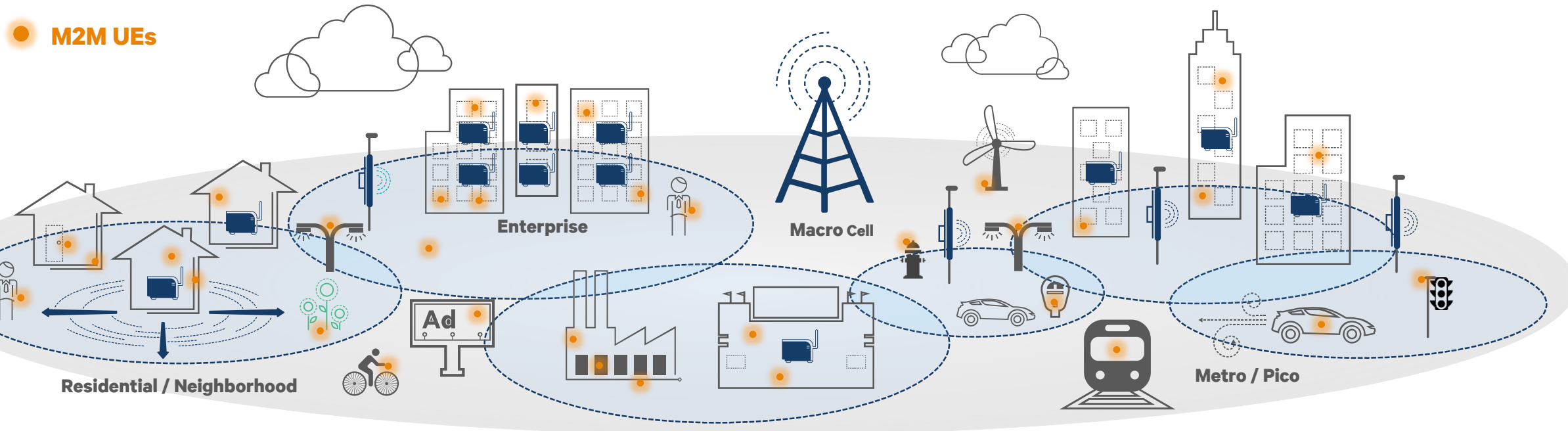
**More reliable in-building coverage**

**Better cell-edge performance**

**Configurable per cell/UE/channel**

# LTE MTC capitalizes on hyper-densification of small cells

Solving the 1000x data challenge with small cells everywhere improves M2M coverage



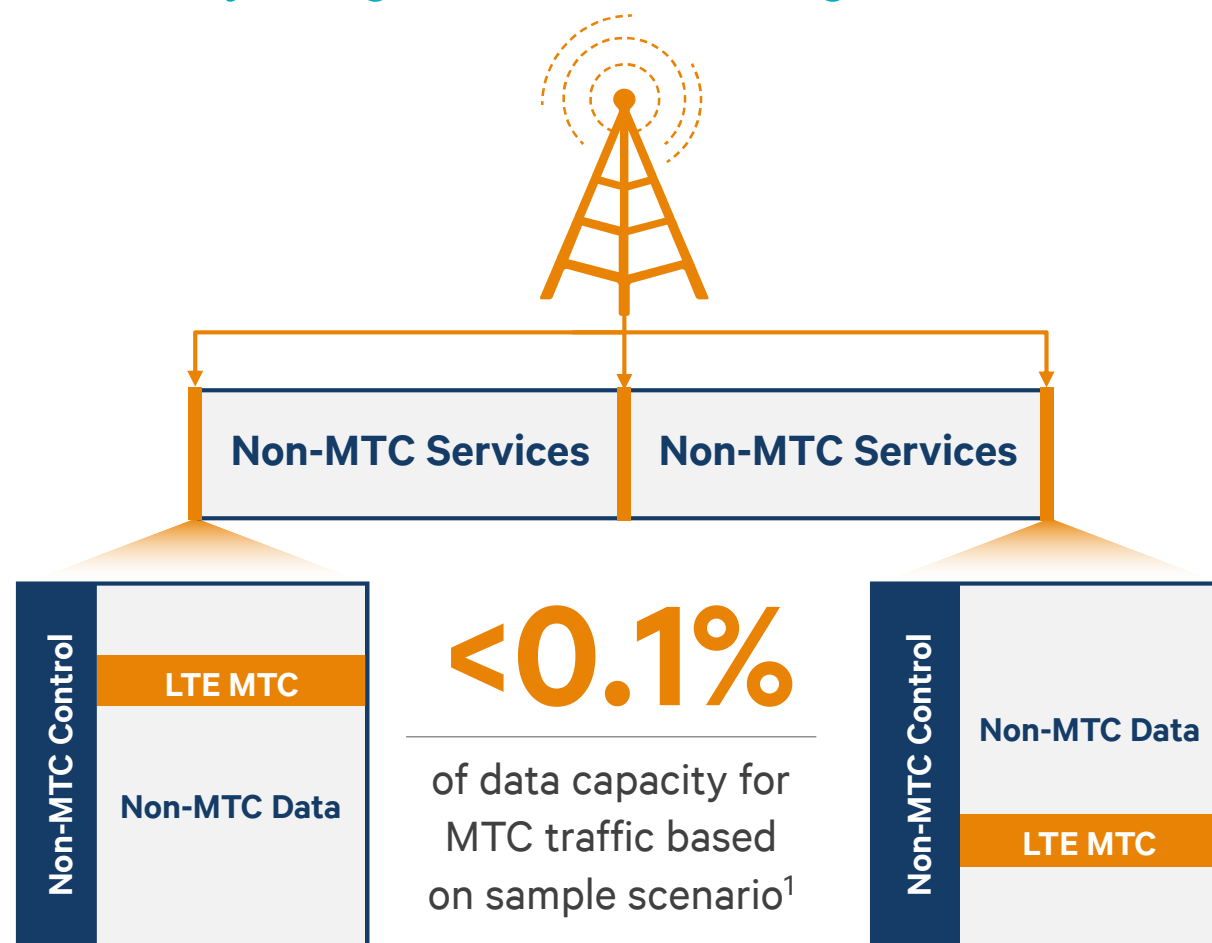
**Brings the network closer improving coverage and reducing power**

**Enhances uplink link budget**

**Enables flexible deployment models**  
(macro cells, small cells, and relays)

# LTE MTC co-exists with today's mobile broadband services

Efficiently integrated with existing LTE Advanced spectrum and networks



## Co-existence

Time- and Frequency-Division Multiplexing between LTE MTC services and other services (e.g., mobile broadband)

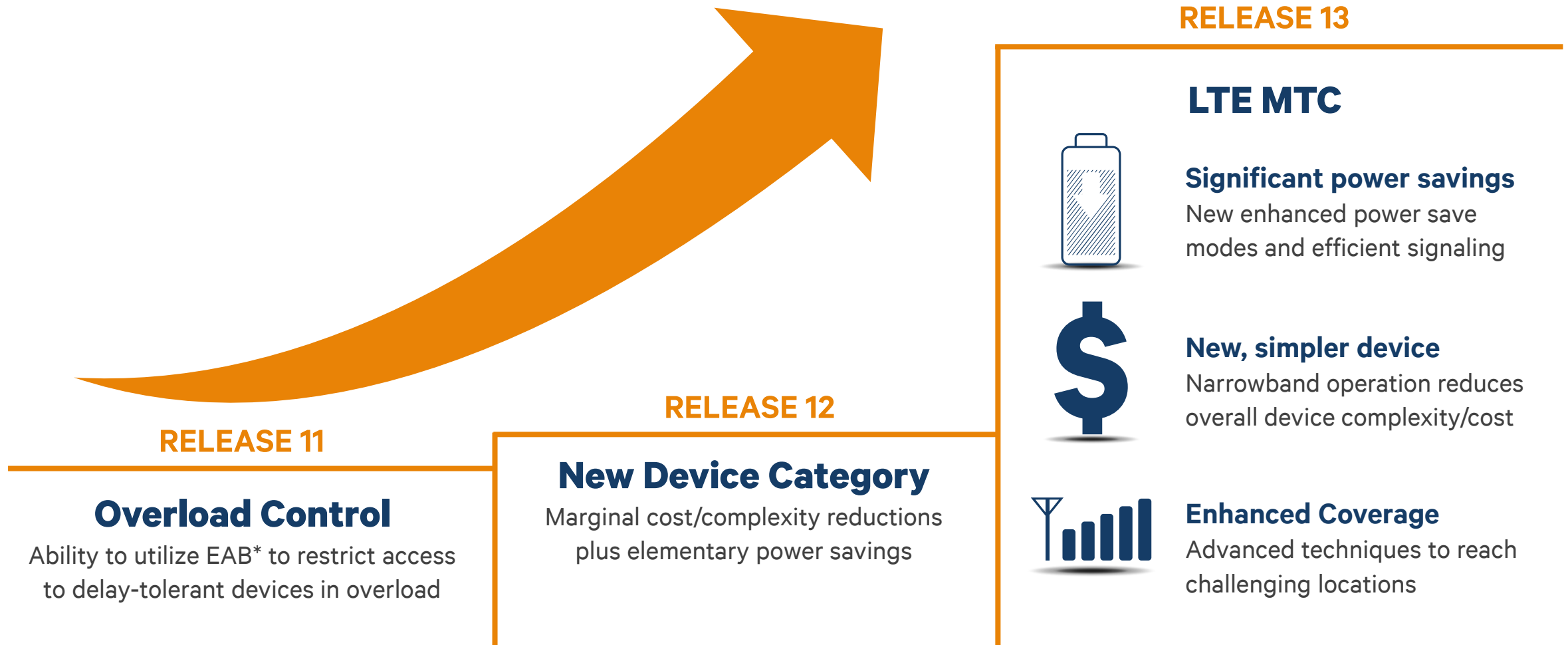
## Flexible capacity

Multiple narrowband regions supported for scalable resource allocation between LTE MTC and non-MTC

<sup>1</sup> Assumptions: ISD Urban – 500m, 3 cells per site, Channel b/w 10MHz, Cell capacity: DL 14Mbps, UL 9.6Mbps; Traffic types include data and commands for Electric Meter, Water Meter, Security Panel, HVAC – Residential, Outdoor Street Light, Off Street Parking Meter, Parking Space Sensor, Water Assets; 100% of traffic assumed in 6hr. busy period – see appendix for more details on MTC sample scenario

# LTE MTC proposed as part of Release 13 of the 3GPP standard

New features introduced in R11 and R12, but critical optimizations realized with R13

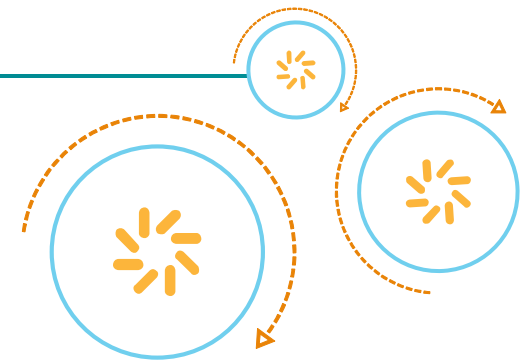


\* Extended Access Barring



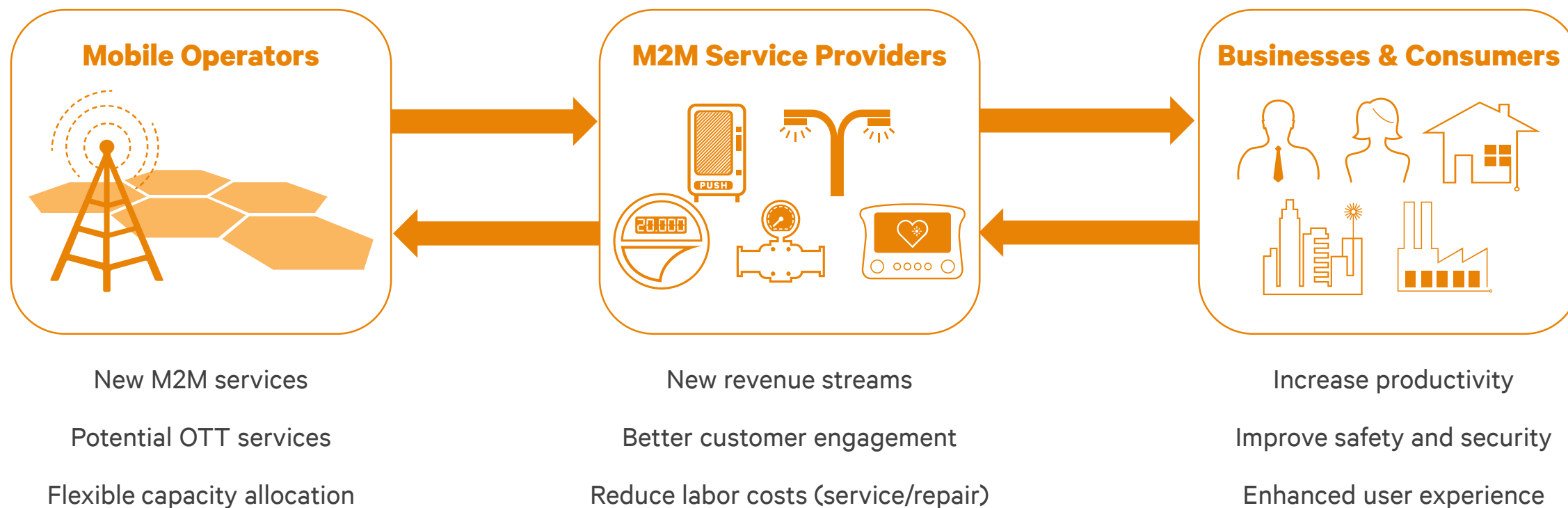
# **The 4G LTE ecosystem is already delivering innovative solutions to support the growth of M2M services**

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# M2M services are benefiting the entire 4G LTE ecosystem

## Capitalizing on the massive surge of smart, connected things with the Internet of Everything

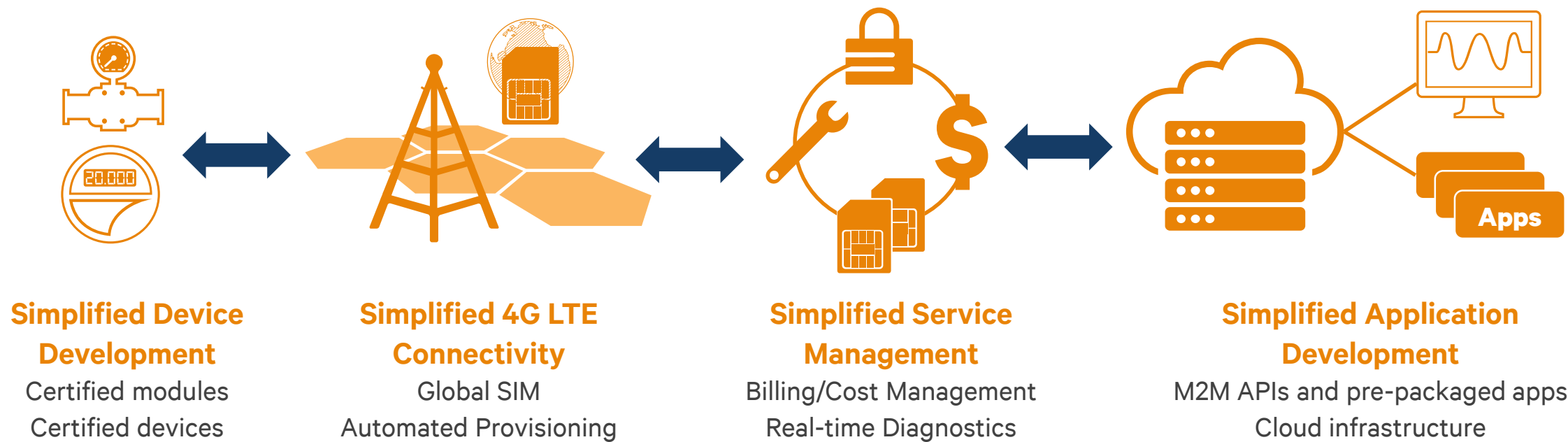


**The high growth potential of M2M is resulting in unprecedented levels of interest and investment**



# Mobile operators are embracing innovative M2M business models

With solutions to simplify the deployment and management of M2M services



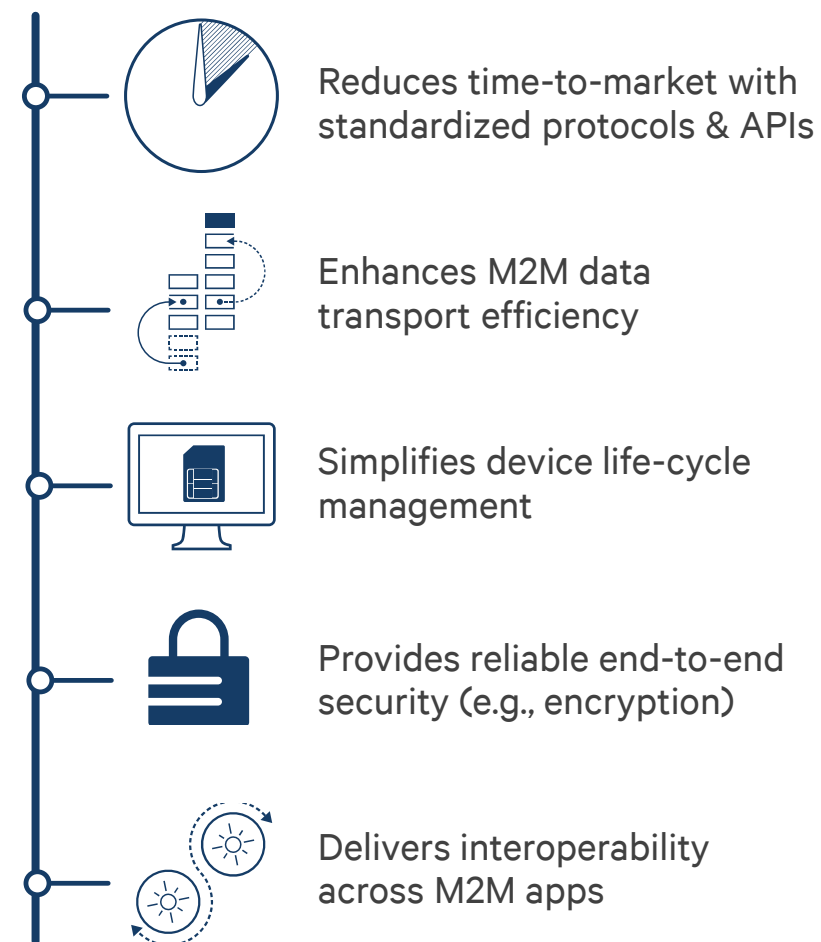
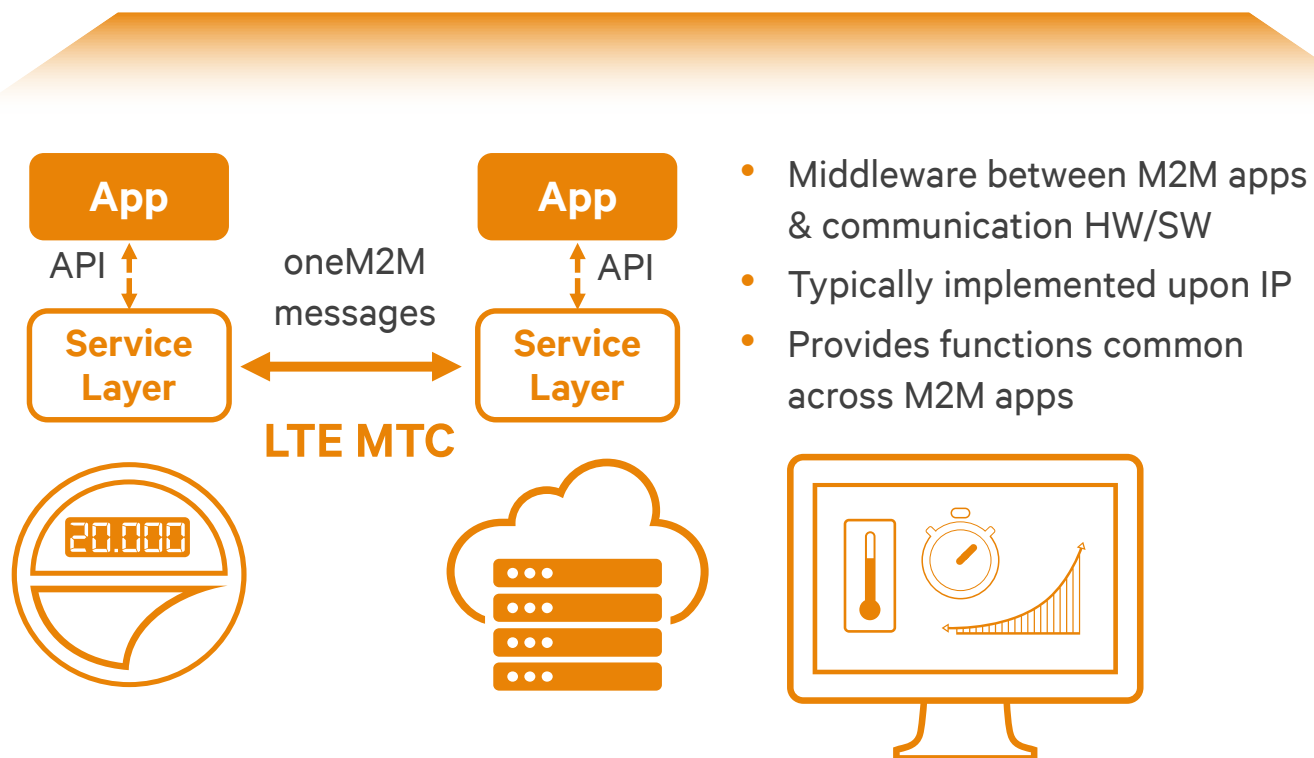
End-to-end personalized service offerings through partnerships

Flexible billing options that cater to M2M applications and services

Dedicated M2M customer service and professional services

# The industry is working on a standardized M2M service layer

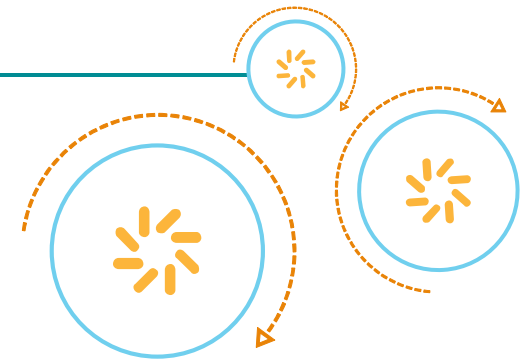
oneM2M provides a secure and efficient end-to-end data/control exchange





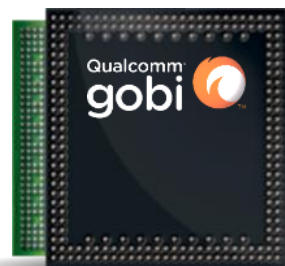
# Qualcomm is uniquely positioned to connect the Internet of Everything

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# Qualcomm 4G LTE technology leadership

A history 4G LTE technology firsts and product innovation



## Industry-first Chipsets from QTI

- World's 1st LTE Advanced solution (Jun '13)
- First with LTE Broadcast (Jan '14)
- LTE Advanced cat 6 (300 Mbps) solution announced in Nov. '13



## Standards Leadership

- A main contributor to key LTE Advanced features
- Instrumental in driving interference cancellation and other Hetnets features
- Pioneering work on LTE Direct, LTE MTC and LTE in unlicensed spectrum



## Industry-first Demos

- MWC 2012: Live Over-The-Air (OTA) HetNet Demo with Mobility
- MWC 2013: Live OTA opportunistic HetNet Demo with VoIP Mobility; Authorized Shared Access (ASA) demo
- MWC 2014: Enhanced HetNets with data- channel interference cancellation; Live OTA LTE Direct demo

**At the forefront of evolving and expanding LTE Advanced into new frontiers**

# Qualcomm® Gobi™ 3G and 4G M2M solutions

Proven global solutions supporting multiple carriers with multimode capability



- Integrated applications processors, location capability, and WiFi/BT connectivity support
- Extended product life
- Additional products available, including Qualcomm® Snapdragon™ Processors for Automotive



**More than 175 3G/4G and Wi-Fi / HPGP modules and solutions from leading OEMs<sup>1</sup>**

A partial list of cellular modules from various vendors is available at: [www.m2msearch.com](http://www.m2msearch.com)

## An unmatched technology portfolio and end-to-end solutions across the entire IoE value chain





# Optimizing LTE Advanced for **M**achine-**T**ype **C**ommunication

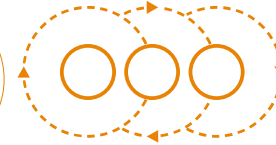
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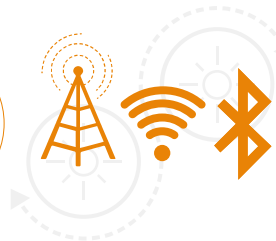
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**Learn more at:**

[www.qualcomm.com/lte-mtc](http://www.qualcomm.com/lte-mtc)

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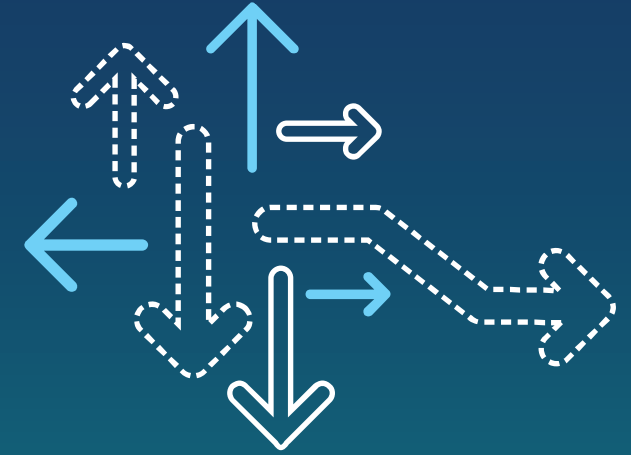
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