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WIRELESS CONNECTIVITY TECHNOLOGIES EVOLUTION FOR INTERNET OF THINGS AND MACHINE TO MACHINE COMMUNICATION

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KEY CHALLENGES FOR THE NETWORKED SOCIETY

Massive growth in

Connected Devices

Massive amount of communicating machines

“500 billion devices”

Massive growth in

Traffic Volume

Further expansion of mobile broadband

Additional users and increased usage

Additional traffic due to communicating machines

“>1000x”

Wide range of

Requirements & Characteristics

Multi-Gbps in specific scenarios

Hundreds of Mbps generally available

Ultra-low latency (~ms)

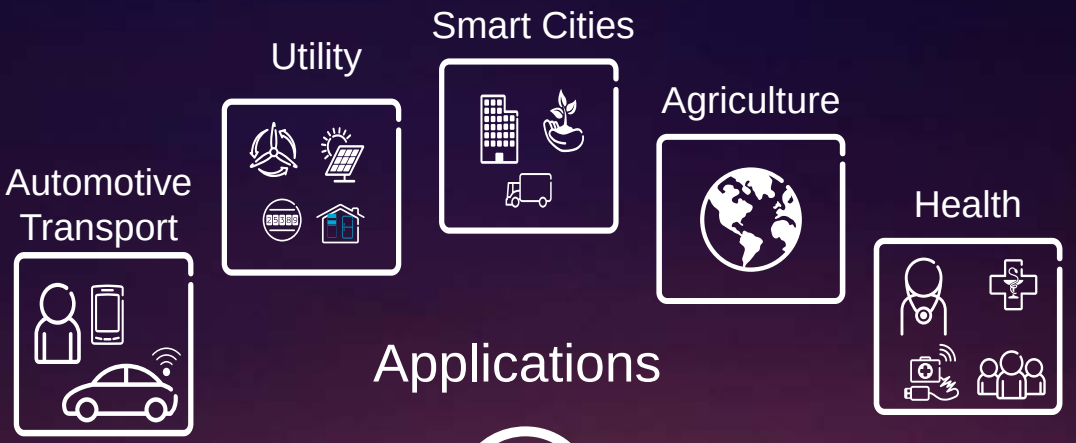
New requirements and characteristics due to communicating machines

Affordable and sustainable

THE INTERNET OF THINGS

TRANSFORMING
THE WORLD WE LIVE IN

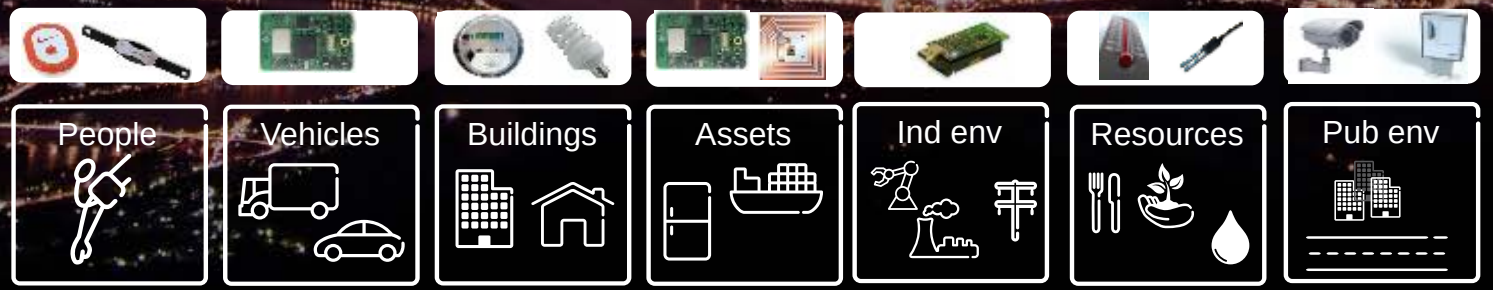
& NEW DEMAND FLOWS



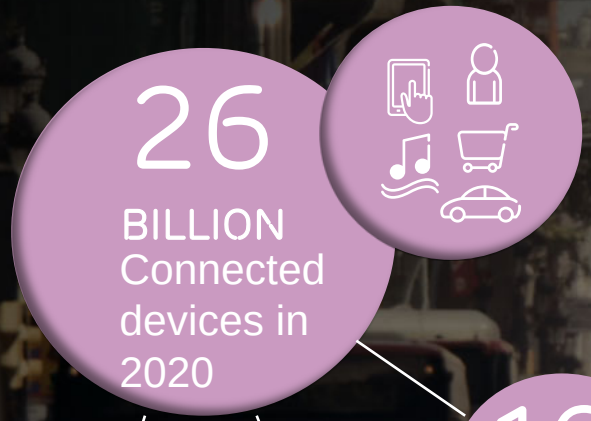
Applications

Application Enablement

Mobility & Internet



ACCELERATING INTERNET OF THINGS – IOT



26 BILLION Connected devices in 2020

10 BILLION Consumer electronics

9 BILLION Mobile phones

7 BILLION M2M devices

1.9 TRILLION

Predected value-add of IoT across sectors in 2020

CONNECTIVITY IS KEY

IoT brings value across a range of industry sectors. Connectivity is the enabler for making the Ineternet of Things happen.

WIDE RANGE OF REQUIREMENTS

MASSIVE MTC

SMART BUILDING

LOGISTICS, TRACKING AND FLEET MANAGEMENT

SMART METER

SMART AGRICULTURE

CAPILLARY NETWORKS

CRITICAL MTC

REMOTE HEALTH CARE

TRAFFIC SAFETY & CONTROL

INDUSTRIAL APPLICATION & CONTROL

REMOTE MANUFACTURING, TRAINING, SURGERY

LOW COST, LOW ENERGY
SMALL DATA VOLUMES
MASSIVE NUMBERS

ULTRA RELIABLE
VERY LOW LATENCY
VERY HIGH AVAILABILITY

FOUNDATION FOR CELLULAR IOT

COST

BATTERY LIFE

DEEP INDOOR COVERAGE

LTE Cat 1

Power Saving Mode

Extended DRX

LTE Cat 0 & HD-FDD

Extended Coverage

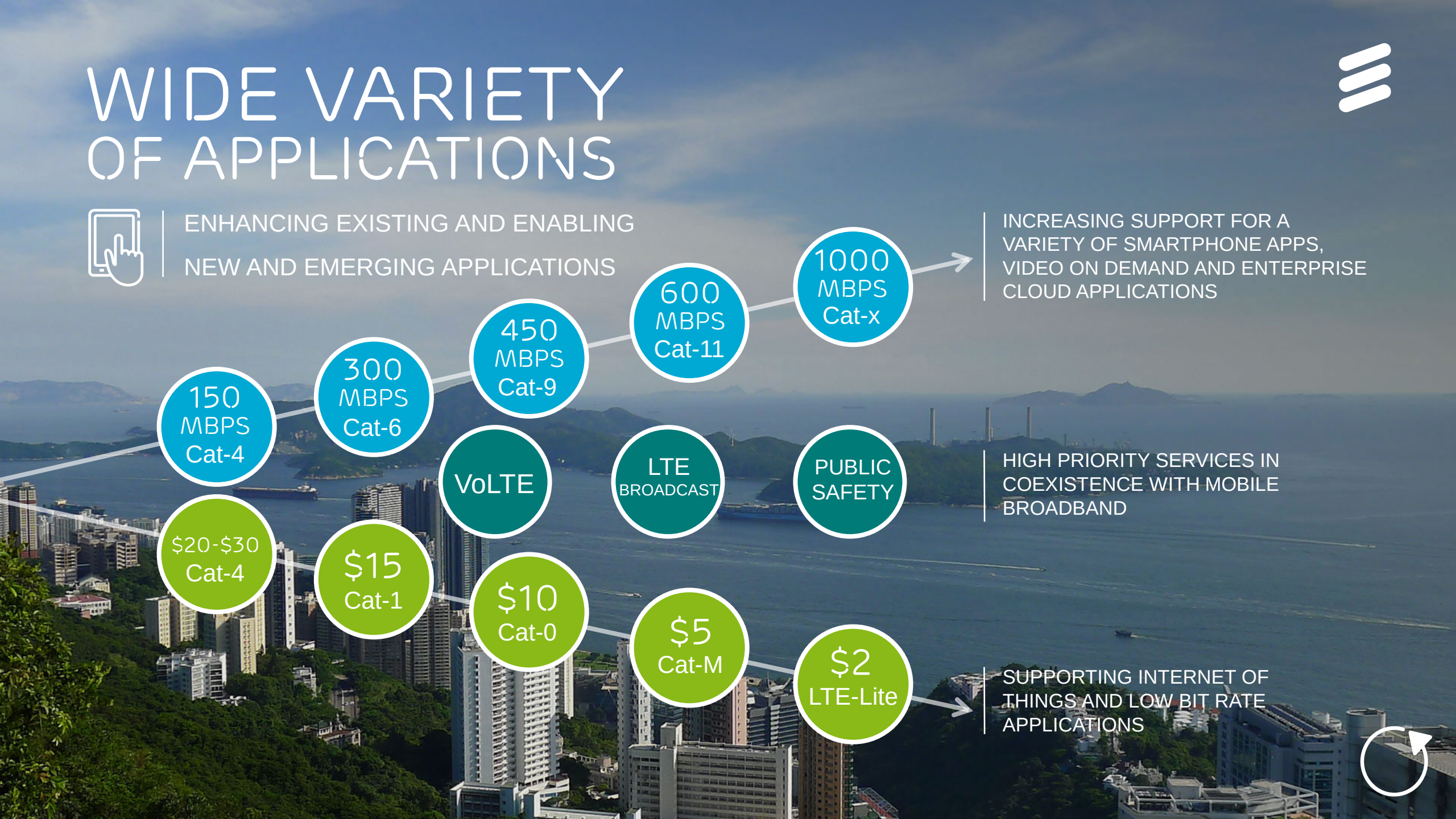
LTE Cat-M

LTE Lite (Narrowband LTE)

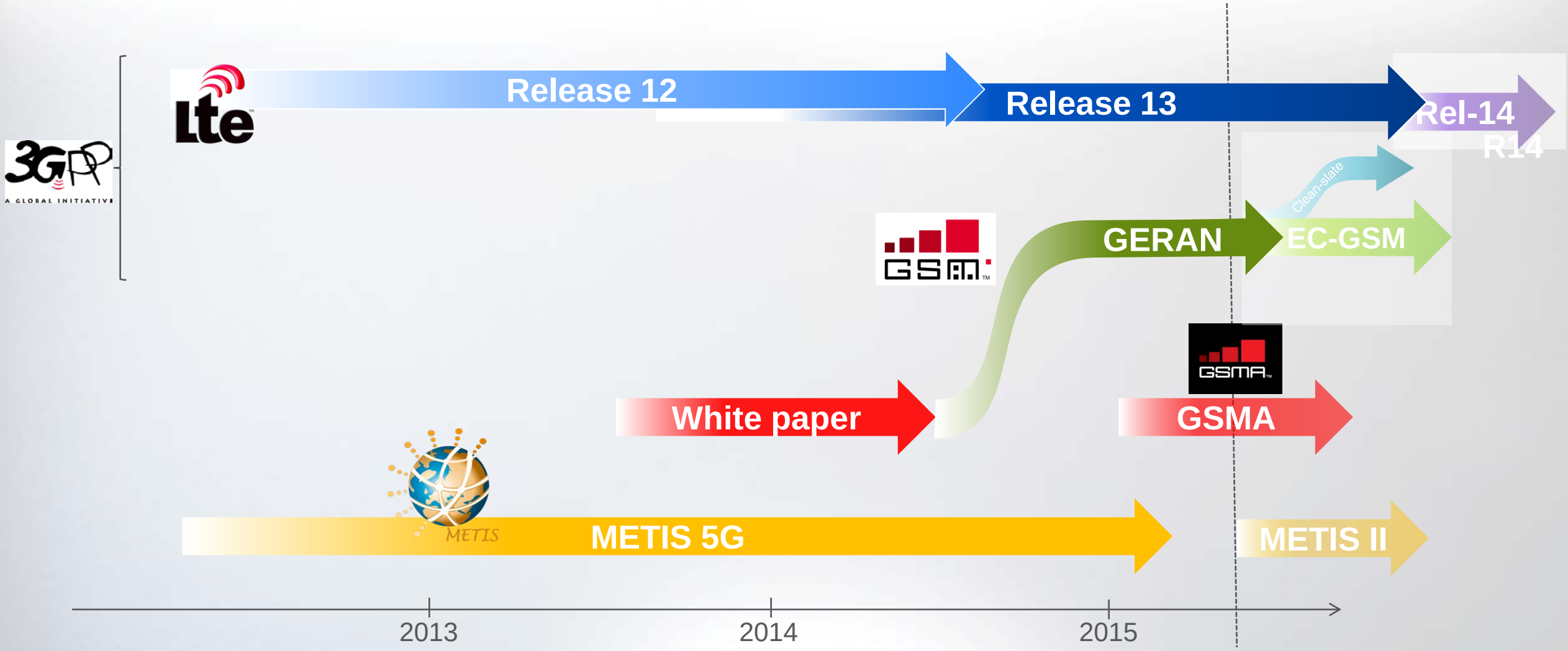
Reduced Device Cost

Improved Coverage

Improved Battery Life


WIDE VARIETY
OF APPLICATIONS
ENHANCING EXISTING AND ENABLING
NEW AND EMERGING APPLICATIONS
150 MBPS Cat-4
300 MBPS Cat-6
450 MBPS Cat-9
600 MBPS Cat-11
1000 MBPS Cat-x
INCREASING SUPPORT FOR A VARIETY OF SMARTPHONE APPS, VIDEO ON DEMAND AND ENTERPRISE CLOUD APPLICATIONS
VoLTE
LTE BROADCAST
PUBLIC SAFETY
HIGH PRIORITY SERVICES IN COEXISTENCE WITH MOBILE BROADBAND
$20-$30 Cat-4
$15 Cat-1
$10 Cat-0
$5 Cat-M
$2 LTE-Lite
SUPPORTING INTERNET OF THINGS AND LOW BIT RATE APPLICATIONS

CELLULAR MASSIVE MTC

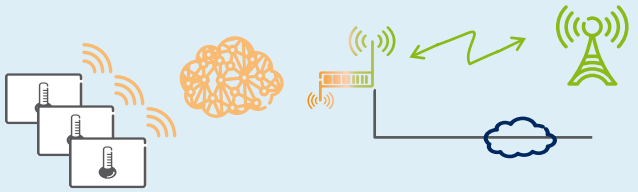


MASSIVE MTC – TECHNOLOGY CHOICES

Licensed Cellular IoT

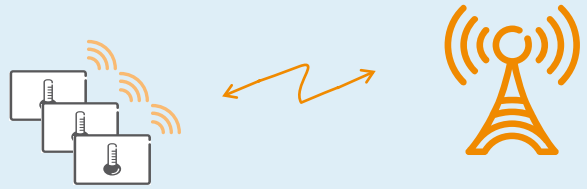
- **Licensed IMT spectrum**
- GSM, GSM evolution
- WCDMA/HSPA evolution for MTC
- LTE evolution for MTC
- Clean-slate narrowband (GERAN)

Short-range radio



- **License-exempt spectrum for local connectivity**
  - IEEE 802.15.4, ZigBee,
  - Bluetooth Low Energy,
  - IEEE 802.11ah,
  - Z-Wave, …
  - …
- **Backhaul cellular or fixed**

Unlicensed long range radio



- **License-exempt spectrum for long range**
  - Weightless
  - Sigfox
  - OnRamp
  - LoRA
  - ….

KEYS TO ACCELERATE IOT

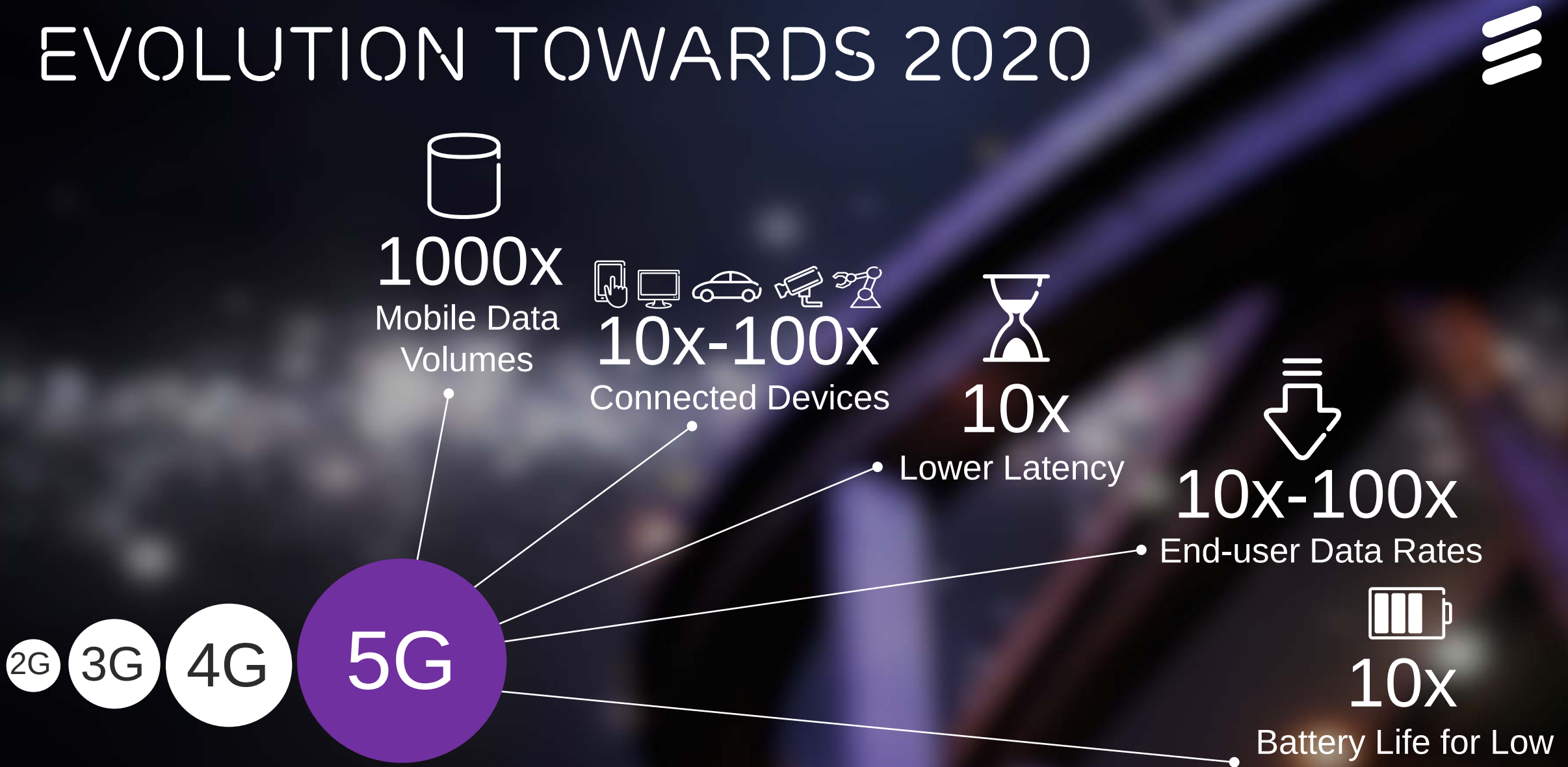
COST

BATTERY LIFE

COVERAGE

QUALITY OF SERVICE

EVOLUTION TOWARDS 2020



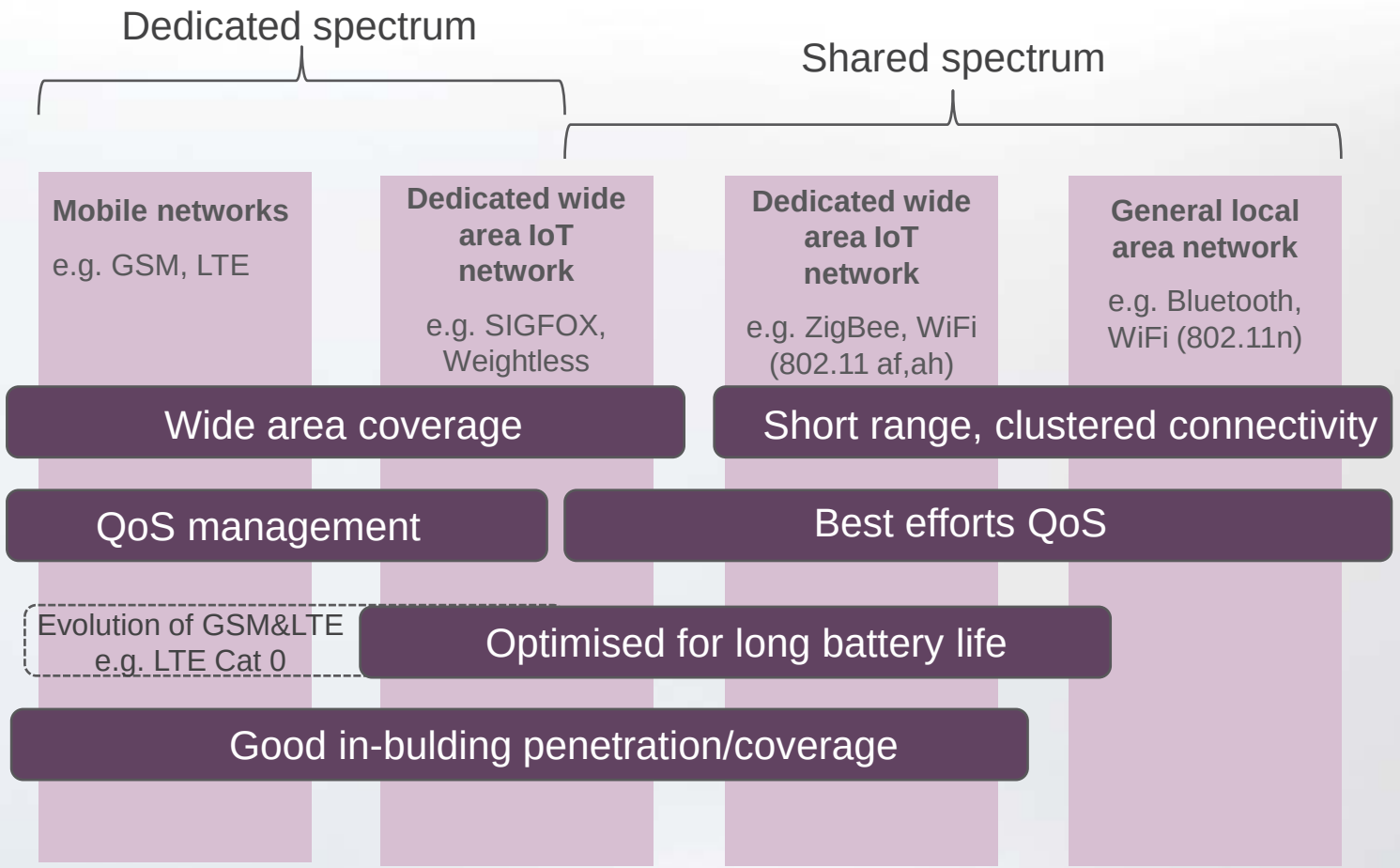
Source: METIS

5G IS DRIVEN BY THE APPLICATIONS

5G USE CASES

- BROADBAND EXPERIENCE EVERYWHERE, ANYTIME
- MEDIA EVERYWHERE
- SMART VEHICLES, TRANSPORT & INFRASTRUCTURE
- CRITICAL CONTROL OF REMOTE DEVICES
- INTERACTION HUMAN-IOT

LICENCESED OR UNLINCENSED SPECTRUM FOR IOT



Example bands	800 MHz 900 MHz	400 MHz 870-876 MHz 915-921 MHz	870-876 MHz 915-921 MHz	2.4 GHz 5 GHz

MARKET DYNAMICS

Cellular in Licensed Spectrum

GSM, WCDMA, LTE

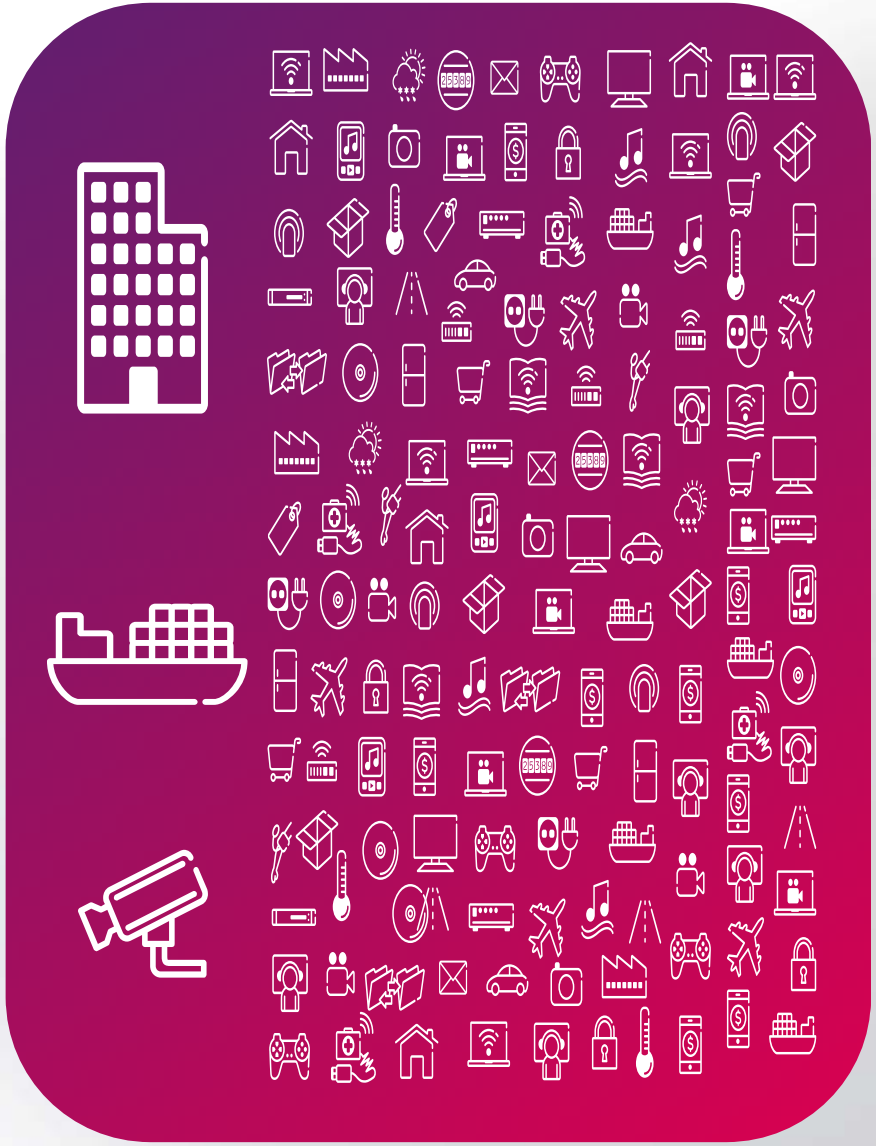
Telecom Grade MTC

Unlicensed Long Range

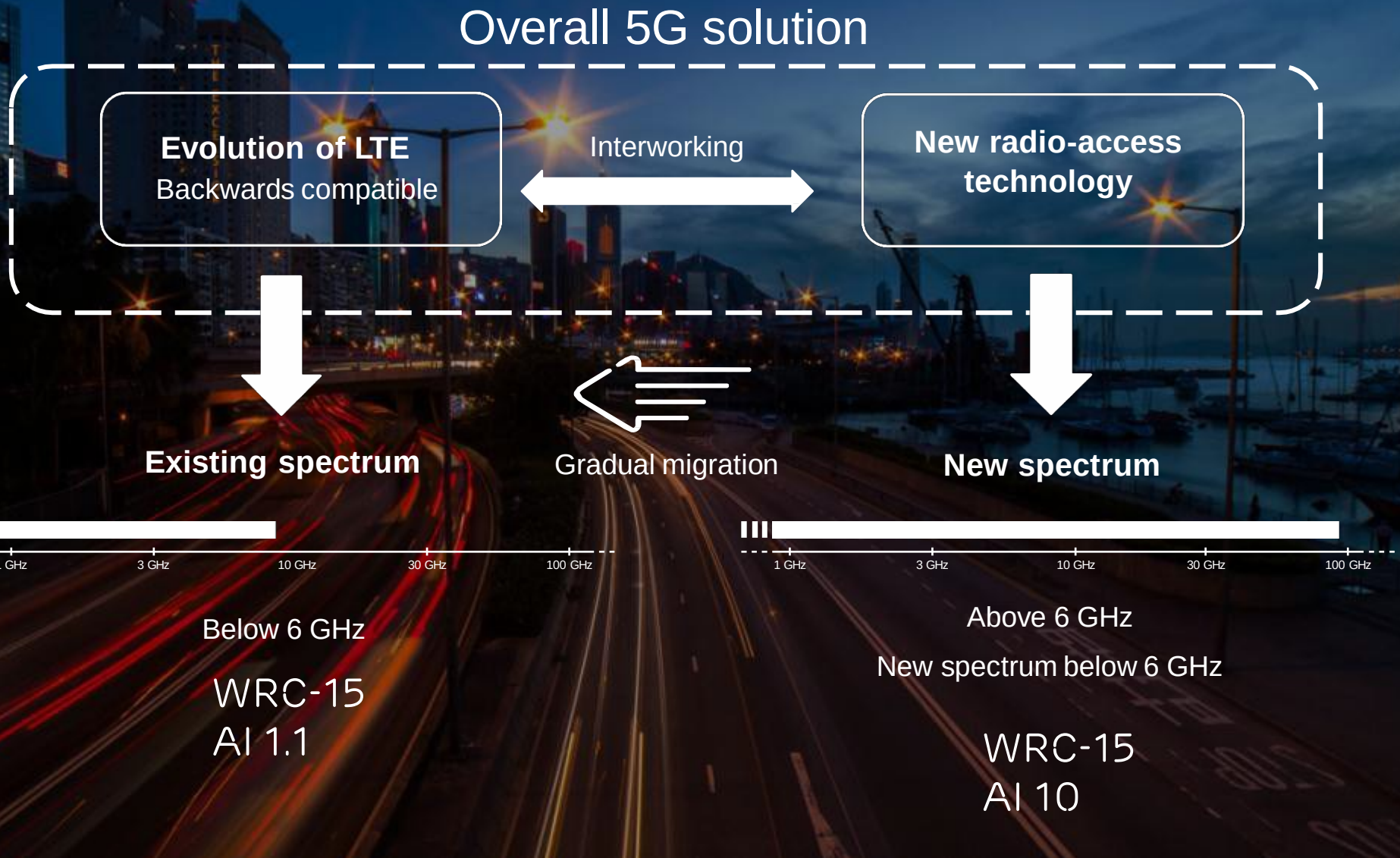
Weightless, Sigfox, OnRamp, LoRA, Iotera,…
Dedicated IoT Network

Unlicensed Short Range

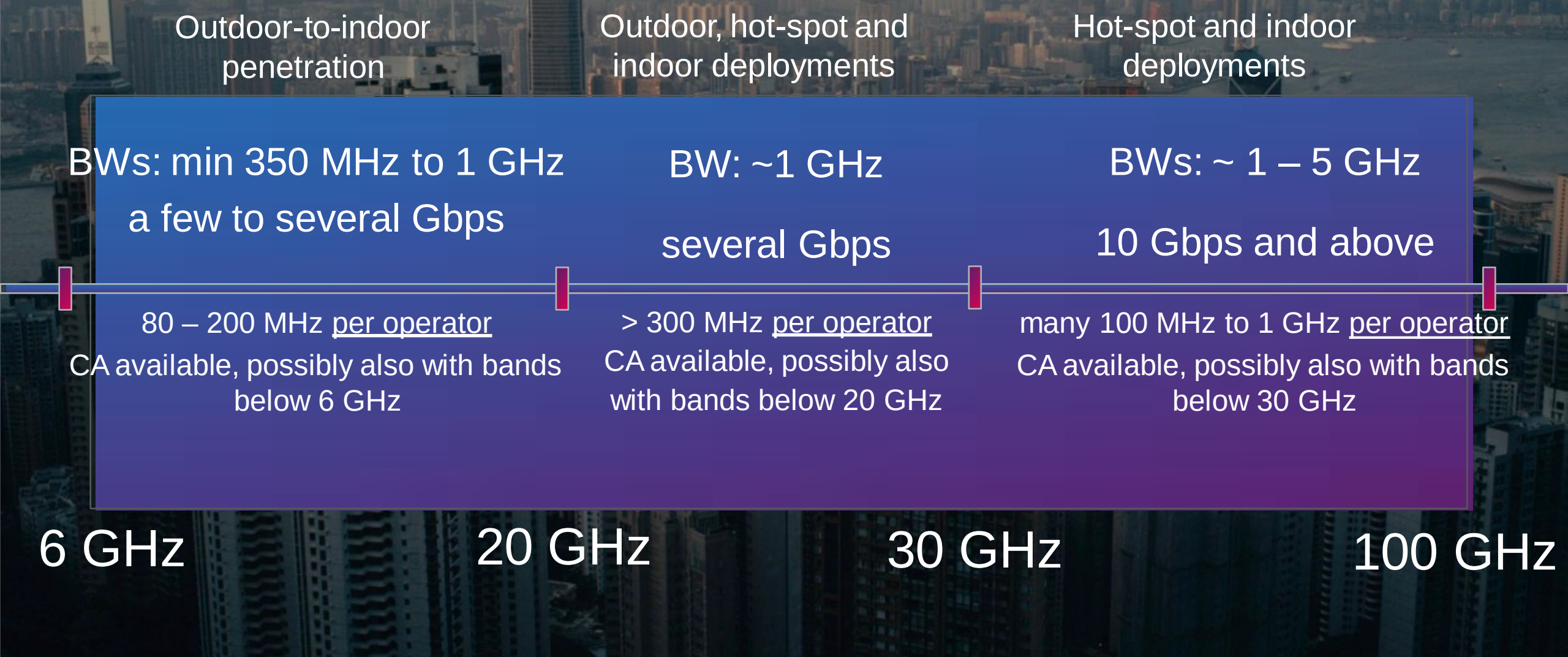
ZigBee, Bluetooth, IEEE 802.ah, Z-Wave,…



5G RADIO AND SPECTRUM



PRELIMINARY AGENDA FOR WRC-19
(AI 10)



LTE-U

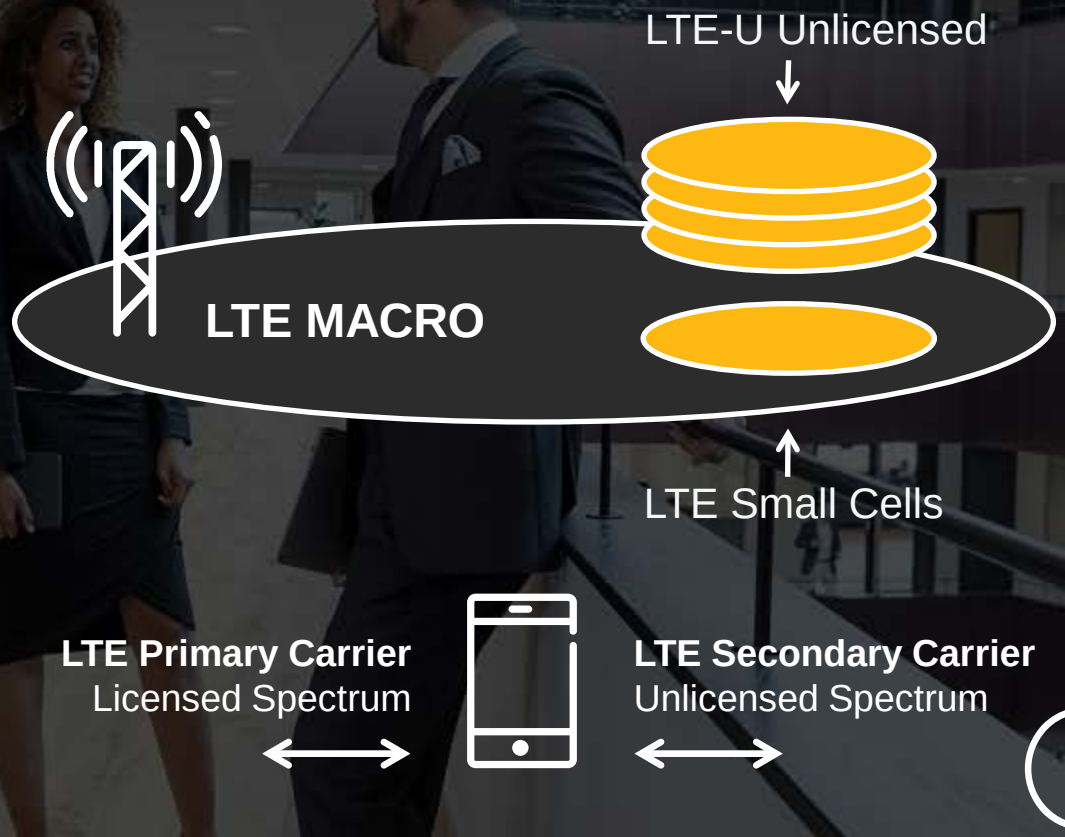
UNLOCKS UNLICENSED SPECTRUM FOR INDOOR LTE APP COVERAGE

LTE licensed spectrum for performance

LTE unlicensed spectrum for speed boost

- Carries additional data payload
- 4% of the 5 GHz band provides up to 150 Mbps speed increase
- LTE efficiencies on unlicensed spectrum

LTE ADVANCED ON LICENSED & UNLICENSED SPECTRUM



CONCLUSIONS

- LTE already addressing requirements for M-MTC
  - 10 years battery life from Rel-12
  - 15 dB coverage enhancements in Rel-13
  - Device complexity reduced to 50% in Rel-12 and to 20-25% in Rel-13.
  - Capacity not a issue in wide system bandwidth.
- 5G is not a new RAT replacing everything but rather one network which can serve a very diverse set of use cases.
  - 5G is happening now.
  - Radio resources can be shared & no need to provision based on prediction.
    - Inclusive to any future extensions/alterations.
  - Already ubiquitious coverage due to existing deployment.


ERICSSON