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Yesterday
Mobile Telephony
Today
Mobile Broadband
Tomorrow
The Networked Society
Access to information and sharing of data
anywhere and anytime for anyone and anything

FUTURE WIRELESS ACCESS – "5G"

More than just bigger and better mobile broadband

"A platform on which any wireless application can be implemented"

FUTURE WIRELESS ACCESS

A wide range of requirements

High data rates everywhere

Very high traffic capacity

Very low latency

Massive number of devices

Very low device energy consumption

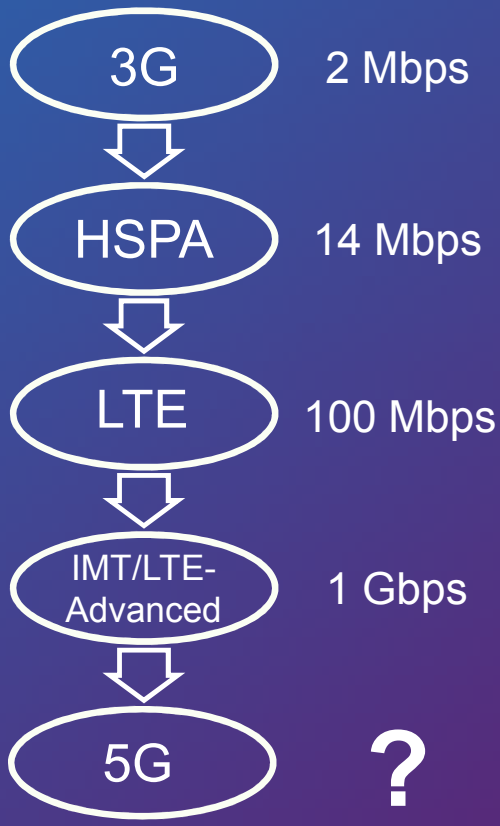
Very low device cost

Ultra-high reliability

• • •

Affordable and sustainable

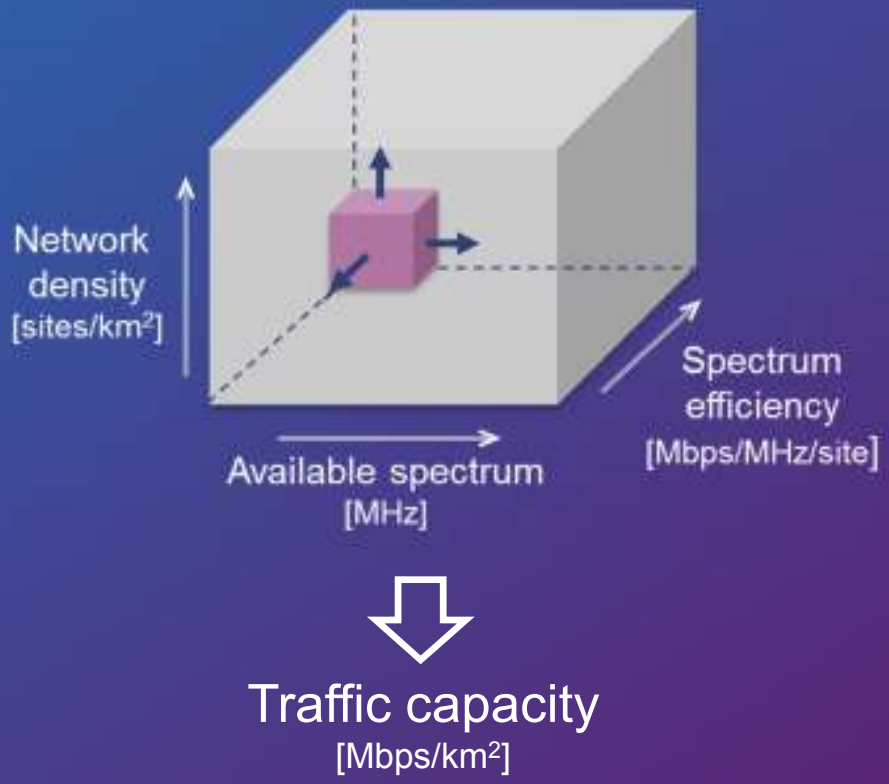
DATA RATES



- More than 10 Gbps in specific scenarios
- Several 100 Mbps generally available in urban/suburban scenarios
- Multi-Mbps connectivity essentially everywhere

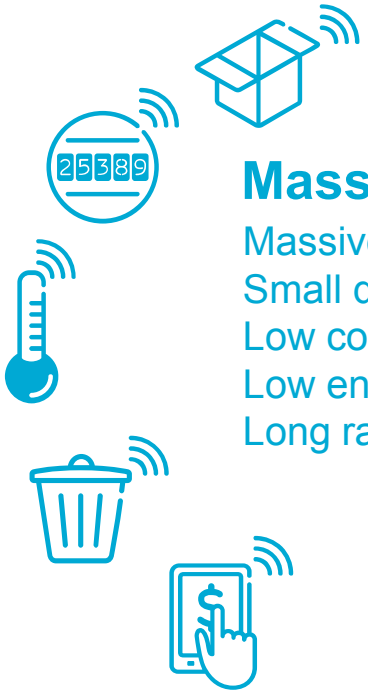
High data rates everywhere

TRAFFIC CAPACITY



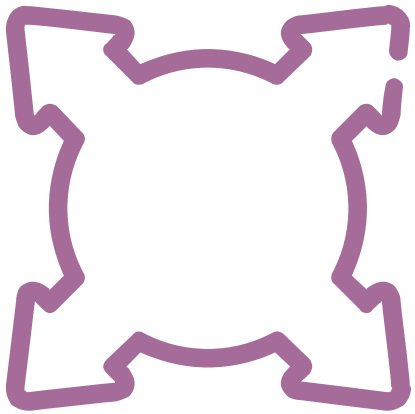
- More dense networks
- More spectrum
- Enhanced technology

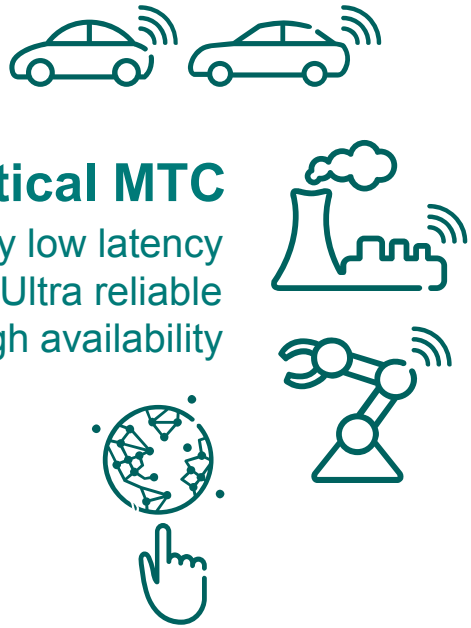
MACHINE-TYPE COMMUNICATION



Massive MTC

Massive numbers
Small data volumes
Low cost
Low energy
Long range



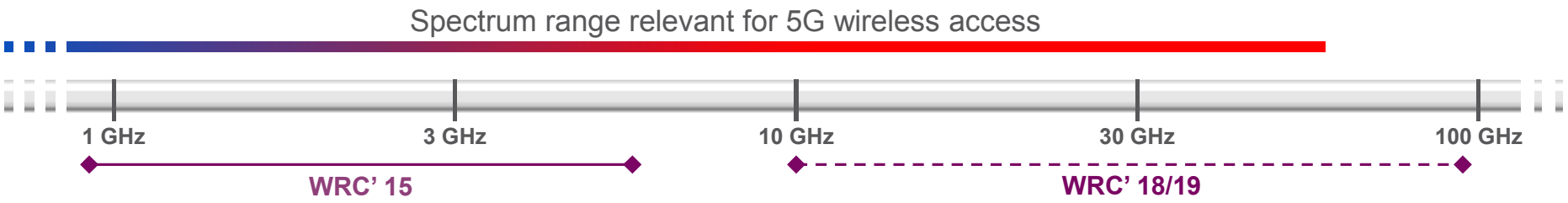


Critical MTC

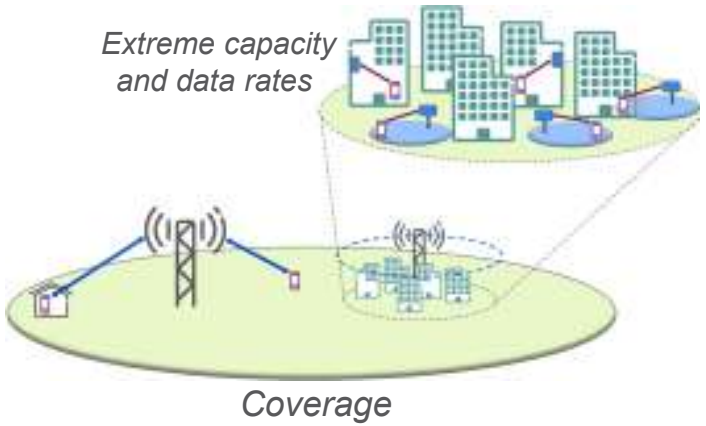
Very low latency
Ultra reliable
Very high availability

A wide range of disperse requirements

5G – SPECTRUM

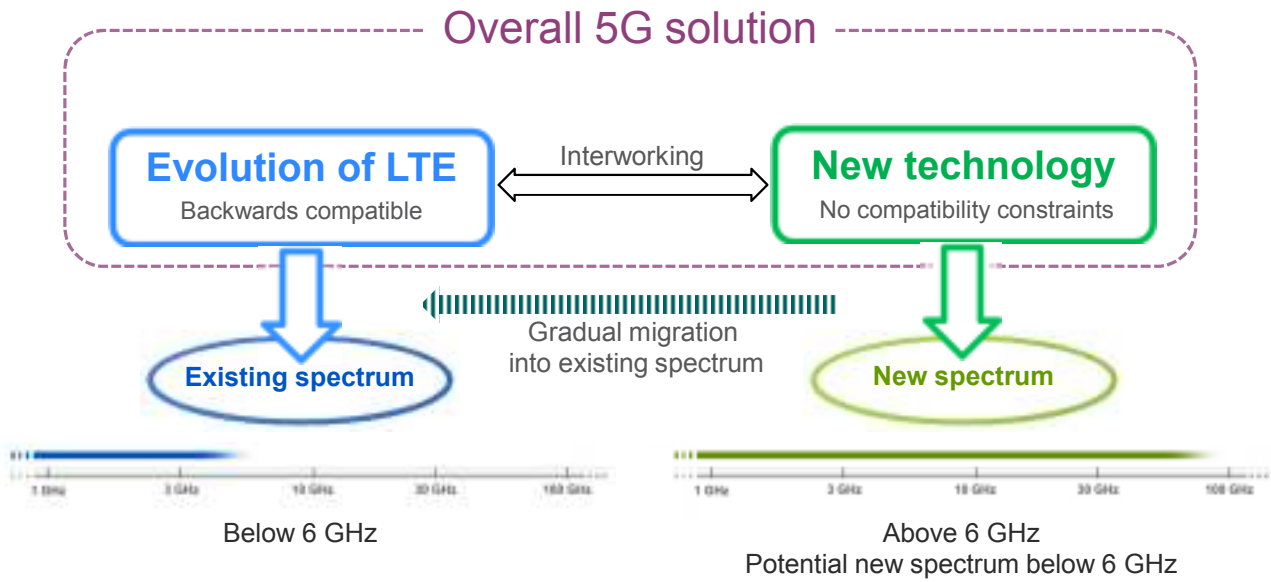


- From sub-GHz to mmw
- Lower frequencies for full-area coverage
- Complementary use of higher frequencies
  - Extreme traffic capacity and data rates in dense scenarios



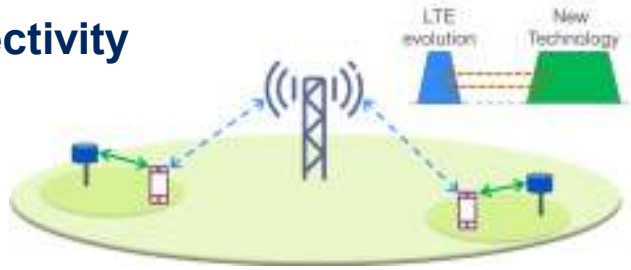
5G WIRELESS ACCESS

Evolution of existing technology + New radio-access technology



INTERWORKING – EXAMPLES

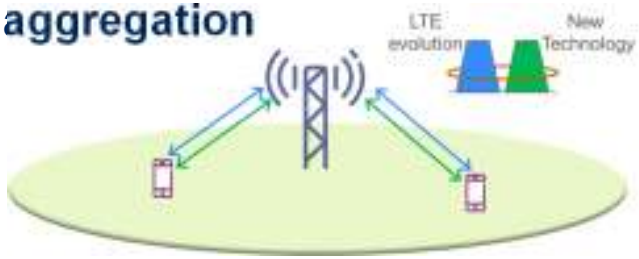
Dual-connectivity



- Initial deployment of new RAT on higher bands for extreme traffic capacity and data rates
- LTE on lower bands for full coverage and robust mobility

⇨ **Smooth introduction of new RAT in new spectrum**

User-plane aggregation



- Migration of new RAT into legacy bands while retaining full bandwidth availability for new devices

⇨ **Smooth migration of new RAT into legacy bands**

5G – SPECTRUM

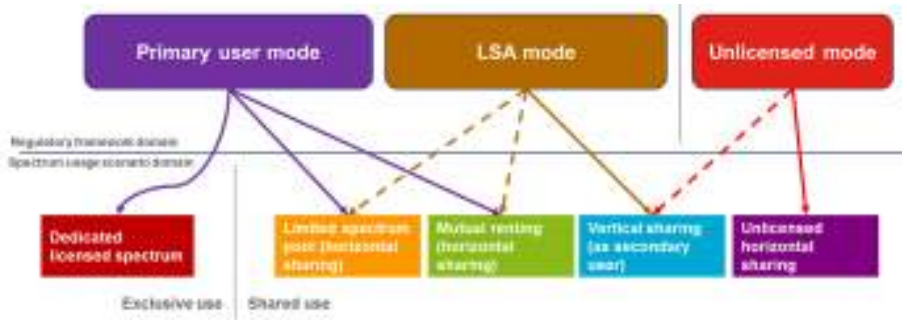
Dedicated licensed spectrum

- Will remain the backbone of IMT
  - Controlled interference ⇨ "Guaranteed" quality
  - Efficient at high load
- Complemented by unlicensed spectrum
  - To get access to more spectrum
  - WiFi or unlicensed LTE

Spectrum sharing

- Becoming more relevant for very wide bandwidths in dense deployments
  - Difficult to find dedicated spectrum for multiple operators
  - More dynamic traffic variations

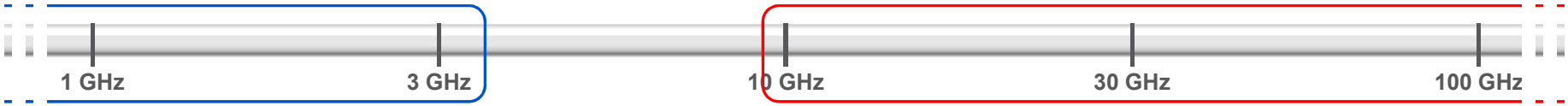
- Unlicensed
- Shared licensed spectrum



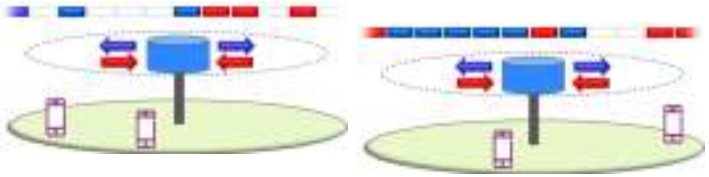
5G – DUPLEX ARRANGEMENT

FDD dominating in lower (licensed) bands
- Coverage benefits
- Avoids some nasty interference situations (BS ↔ BS, device ↔ device)

TDD more relevant for higher bands targeting very wide bandwidths in dense deployments
- Easier to find unpaired spectrum
- More dynamic traffic variations
- Access nodes and devices becoming more similar



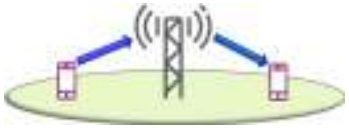
Fully dynamic TDD



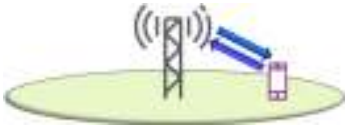
Dynamic assignment of downlink/uplink resources

Prepared for full duplex

On system level …

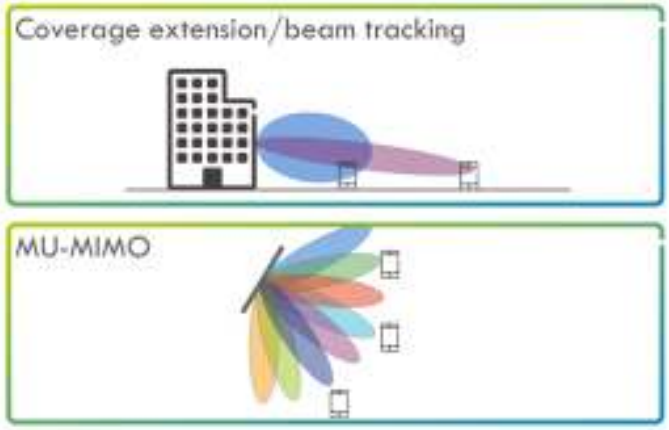


… or even on link level



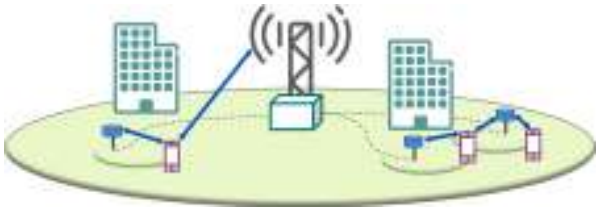
MULTI-ANTENNA TECHNOLOGY

- For both low and high frequencies
- Beam forming for coverage
- Multi-user MIMO for capacity



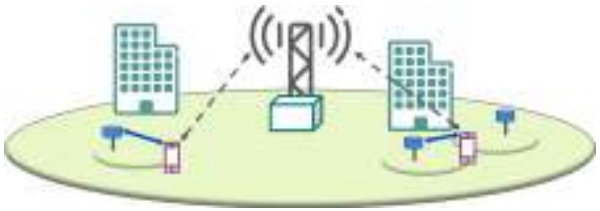
Multi-site transmission/reception

- Multi-antenna TX/RX extended to multiple sites



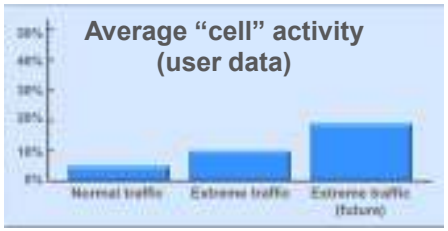
Multi-layer connectivity

- RRC connectivity to overlaid layer
- Robust mobility for (ultra) dense deployments



LEAN DESIGN

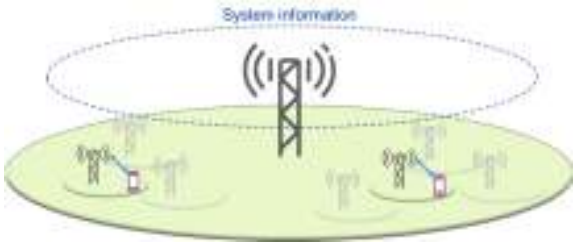
- Networks lightly loaded on average
- Will not change dramatically in the future
  - Much more traffic but also much more network nodes



- Network transmissions not related to user data
  - Reference signals, system information, …’
  - *Contributes to network energy consumption*
  - *Interference limits the achievable data rates*

Lean design

- *Minimize transmissions not related to user data*
- Minimize broadcast of system information
  - Main part provided on a per-need basis
- Separate user-data plane from system information
  - System information broadcast wide-area
  - Underlaid nodes only active when user-data to convey



Higher achievable data rates
Enhanced energy efficiency

ACCESS/BACKHAUL INTEGRATION

Today: Massive use of wireless backhaul

- P2P mmW line-of-sight links to macro sites using dedicated technology in dedicated spectrum

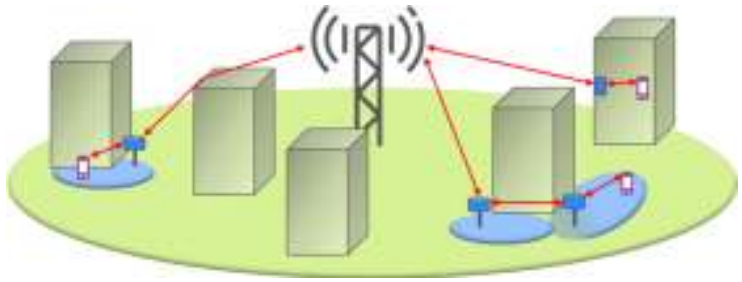
Tomorrow: Large number of low-power nodes

- Targeting very high data rates
- Indoor and outdoor
- *Backhaul is a major issue*

Access/Backhaul integration

› Same technology for access and backhaul

› Same spectrum resource for access and backhaul



"Multi-hop" connectivity

DEVICE-TO-DEVICE COMMUNICATION

Today

Clear difference between base-stations and devices!

Tomorrow

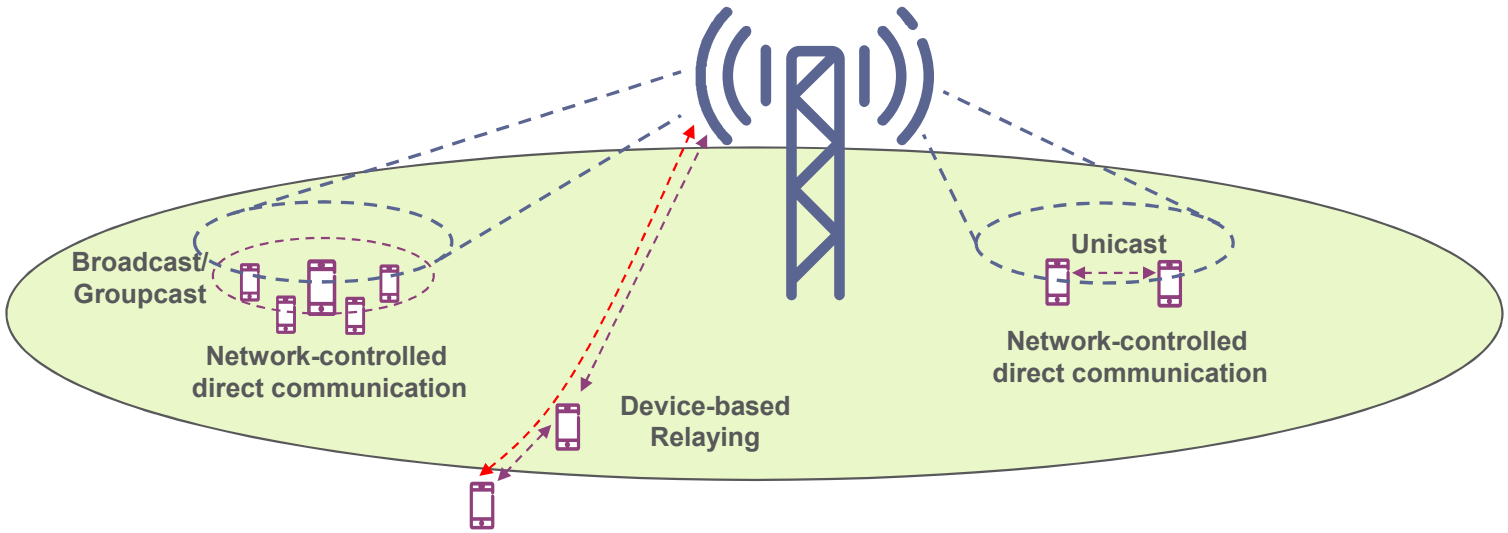
Less clear difference between base-stations and devices!

D2D is a “natural” extension to extreme densification

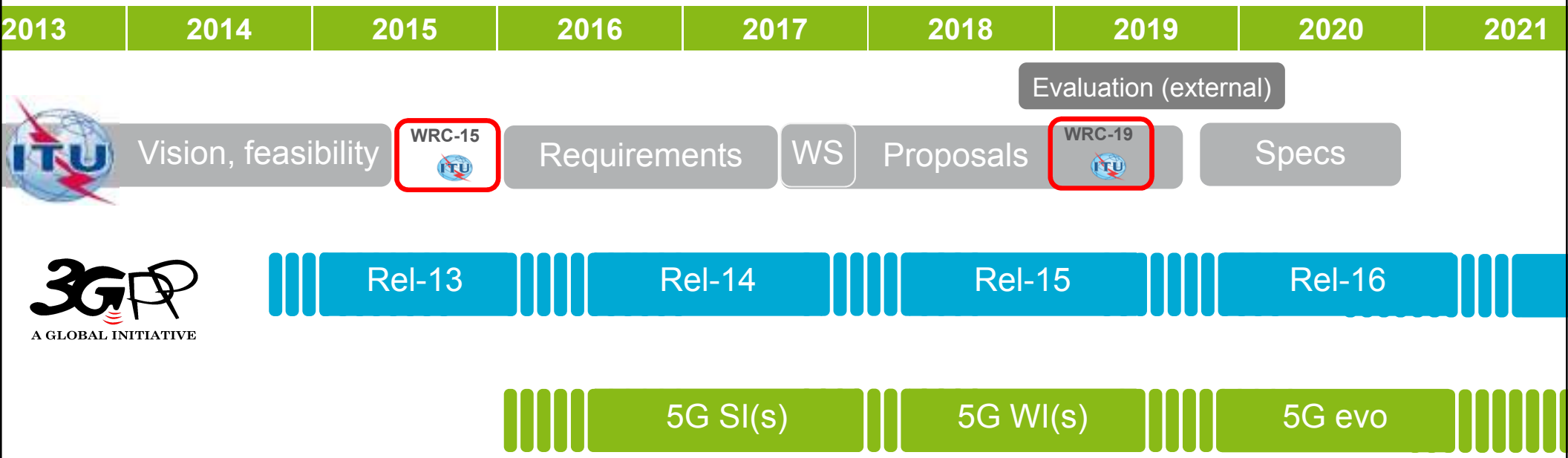
D2D FOR 5G

Tightly integrated device-to-device communication

Device-to-device links under network control



5G TIMEPLAN


2013
2014
2015
2016
2017
2018
2019
2020
2021
Evaluation (external)
Vision, feasibility
WRC-15
Requirements
WS
Proposals
WRC-19
Specs
Rel-13
Rel-14
Rel-15
Rel-16
5G SI(s)
5G WI(s)
5G evo

ERICSSON 5G TRIALS

PRESS RELEASE
JULY 1, 2014

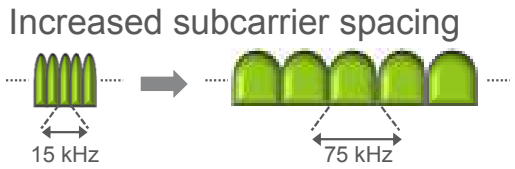
ERICSSON

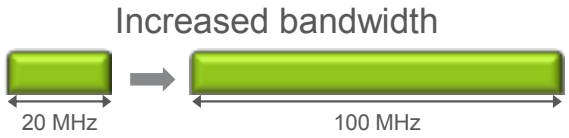
ERICSSON 5G DELIVERS 5 GBPS SPEEDS

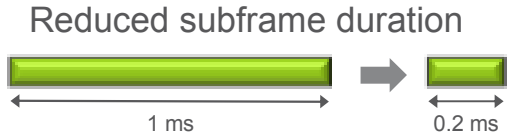
- Live, over-the-air demonstration of Ericsson pre-standard 5G technology achieves 5 Gbps throughput in the 15 GHz frequency band
- NTT DOCOMO and SK Telecom senior management witness Ericsson's achievement that employs innovative radio interface and advanced MIMO technology
- 5G performance will enable new machine-to-machine applications that benefit both consumers and enterprises

5G implementation in commercial mobile networks is expected in 2020, but Ericsson (NASDAQ:ERIC) has already achieved speeds of 5 Gbps in live, over-the-air demonstrations of the company's pre-standard 5G network technology. This proven performance will be critical to addressing both the relentless growth in mobile data demand and enabling the next-generation machine-to-machine applications. NTT DOCOMO and SK Telecom senior management witnessed Ericsson's achievement at Ericsson lab in Kista, Sweden.

- 15 GHz band
- 400 MHz bandwidth
- 5/10 Gbps







5G TRIAL OVERVIEW

Commercial HW

Measurement terminal

June 2014