

NTT DOCOMO 5G toward 2020 and Beyond

NTT DOCOMO, INC.
Takehiro Nakamura

Mobile Communications in 2020 and Beyond

Everything connected by wireless

Multiple personal devices



Transportation (Car/Bus/Train)



Consumer electronics



Watch/jewelry/cloths



House



Sensors



Cloud computing

ドコモクラウド

Extended and enriched wireless services

Video streaming



New types of terminal/HI



Healthcare



Education

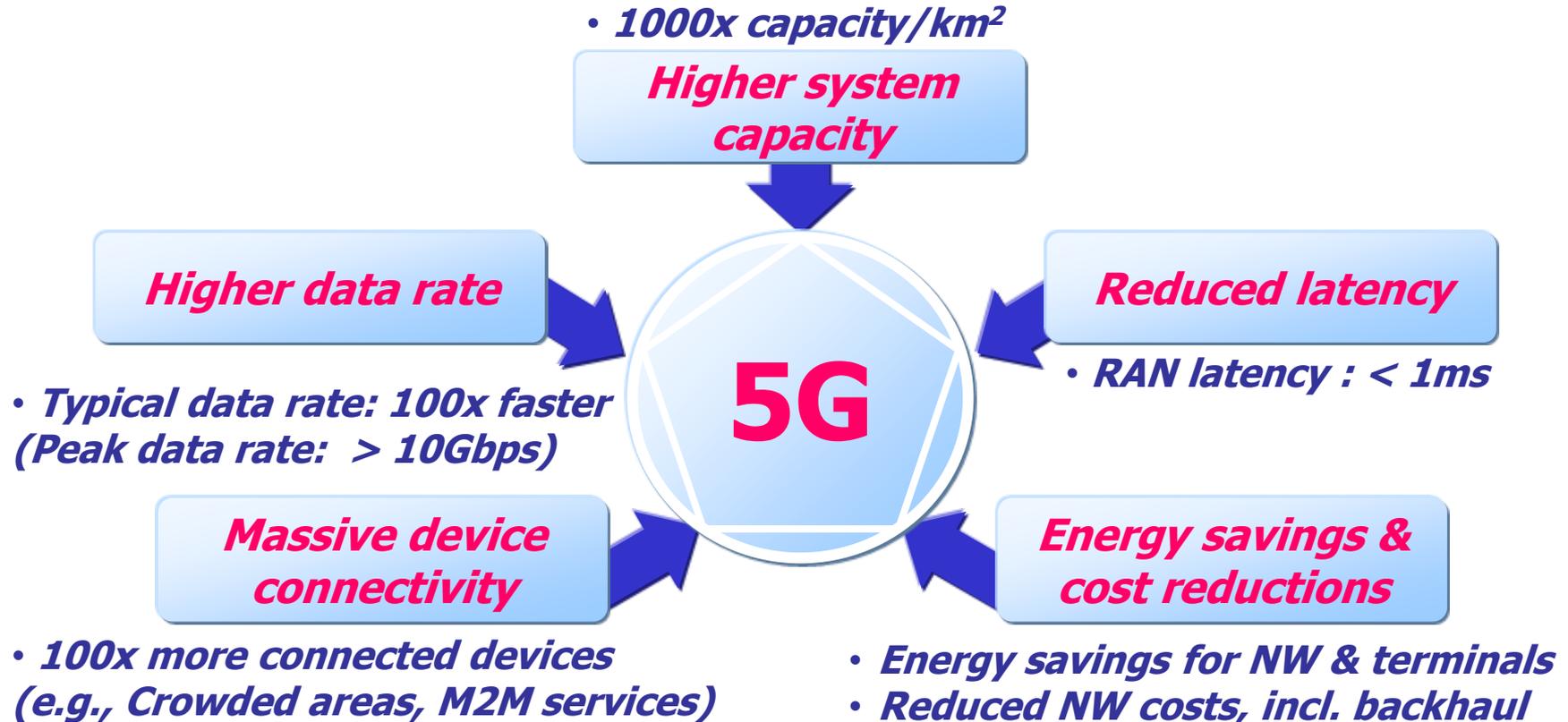


Safety and lifeline system



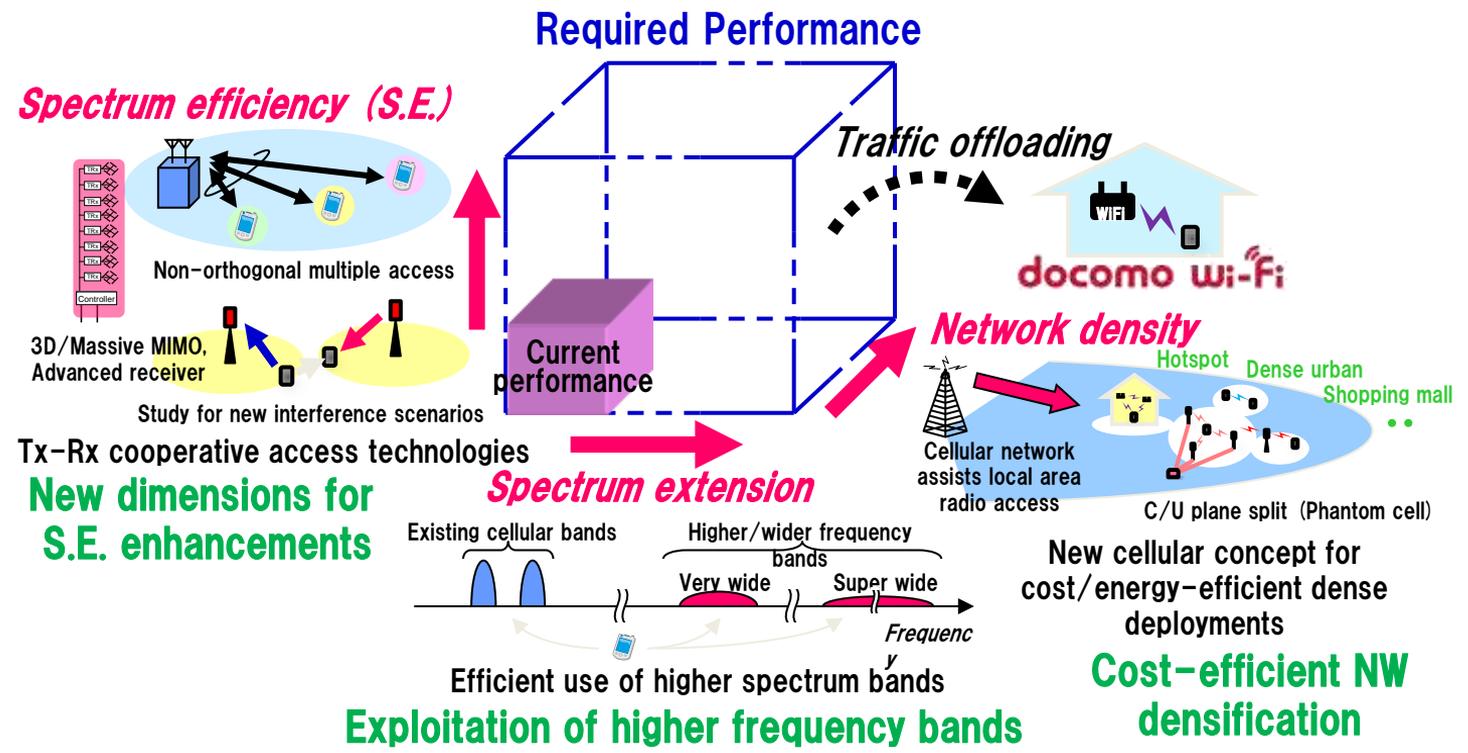
5G Target Performance

5G radio access will provide a total solution for a *wider range of requirements* in 2020 and beyond



Directions of Evolution: "The Cube"

A set of radio access technologies is required to satisfy future requirements

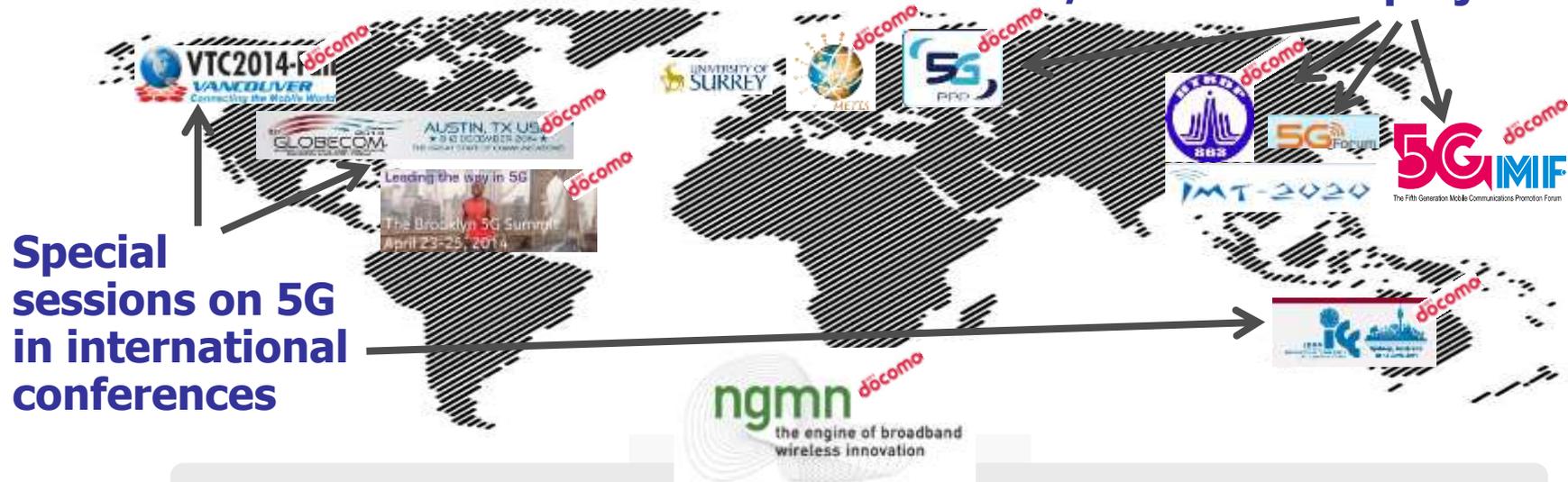


5G Global Trend



Future IMT Vision in ITU-R WP5D

National/international projects on 5G



Special sessions on 5G in international conferences

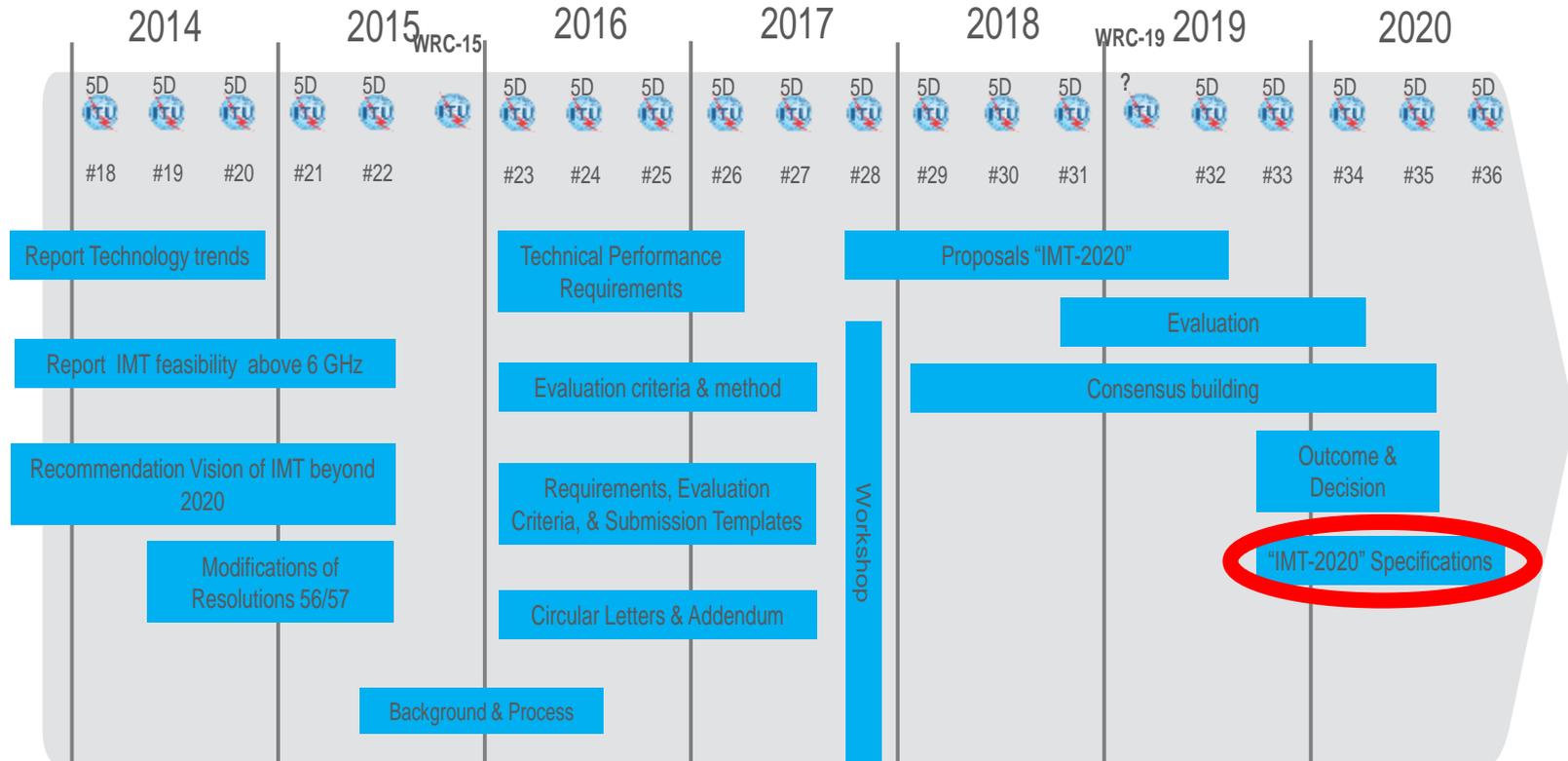
Global initiative to define operator requirements for 5G

Vision2020/ Network2020

3GPP 5G Workshop in Sep. 2015

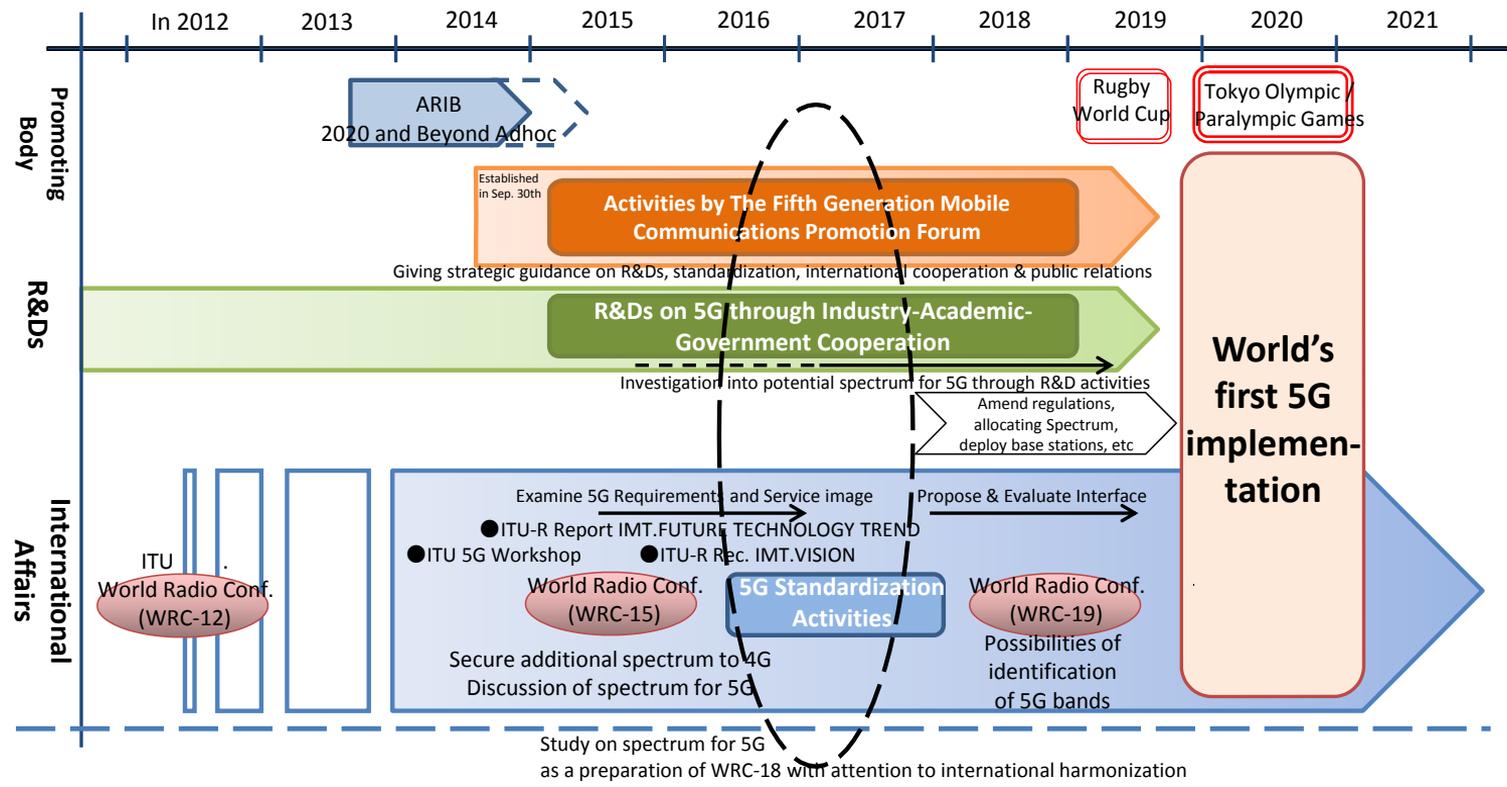
5G Work Plan in ITU-R

ITU-R is targeting completion of 5G specification development in 2020



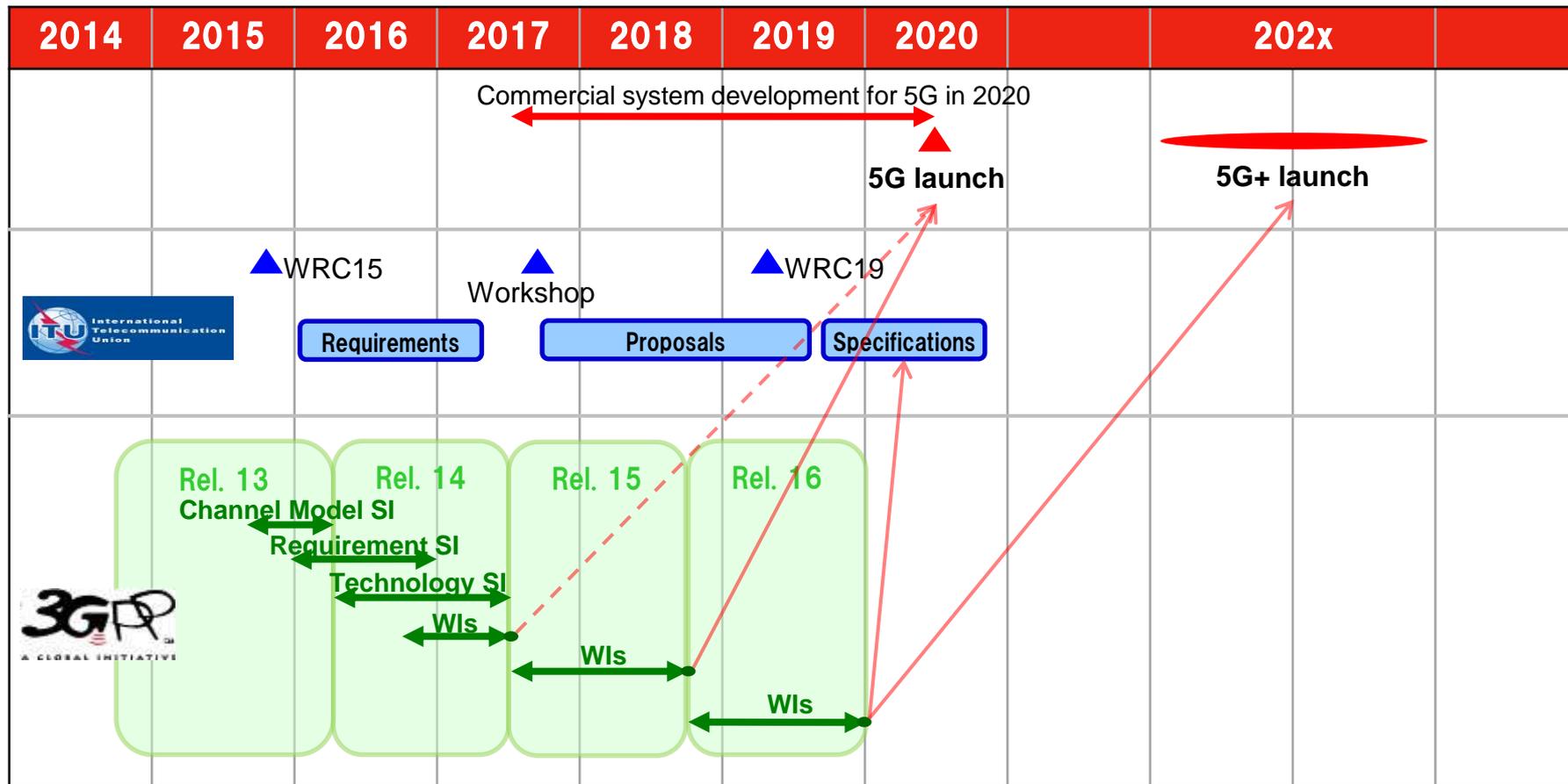
5G Commercial Requirements

Japan is targeting 5G commercial launch in 2020



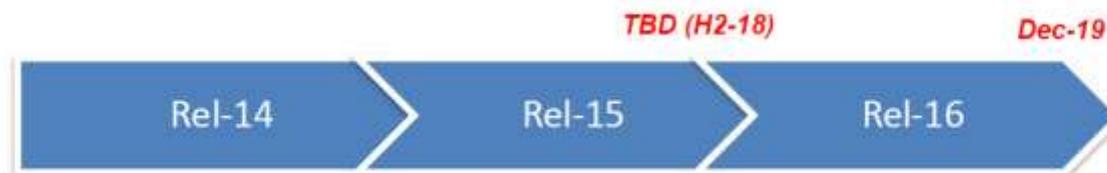
Translated from "Final Report from the Radio Policy Vision Council", Ministry of Internal Affairs and Communications, Japan, December 2014.

Time Plan for 5G and 5G+



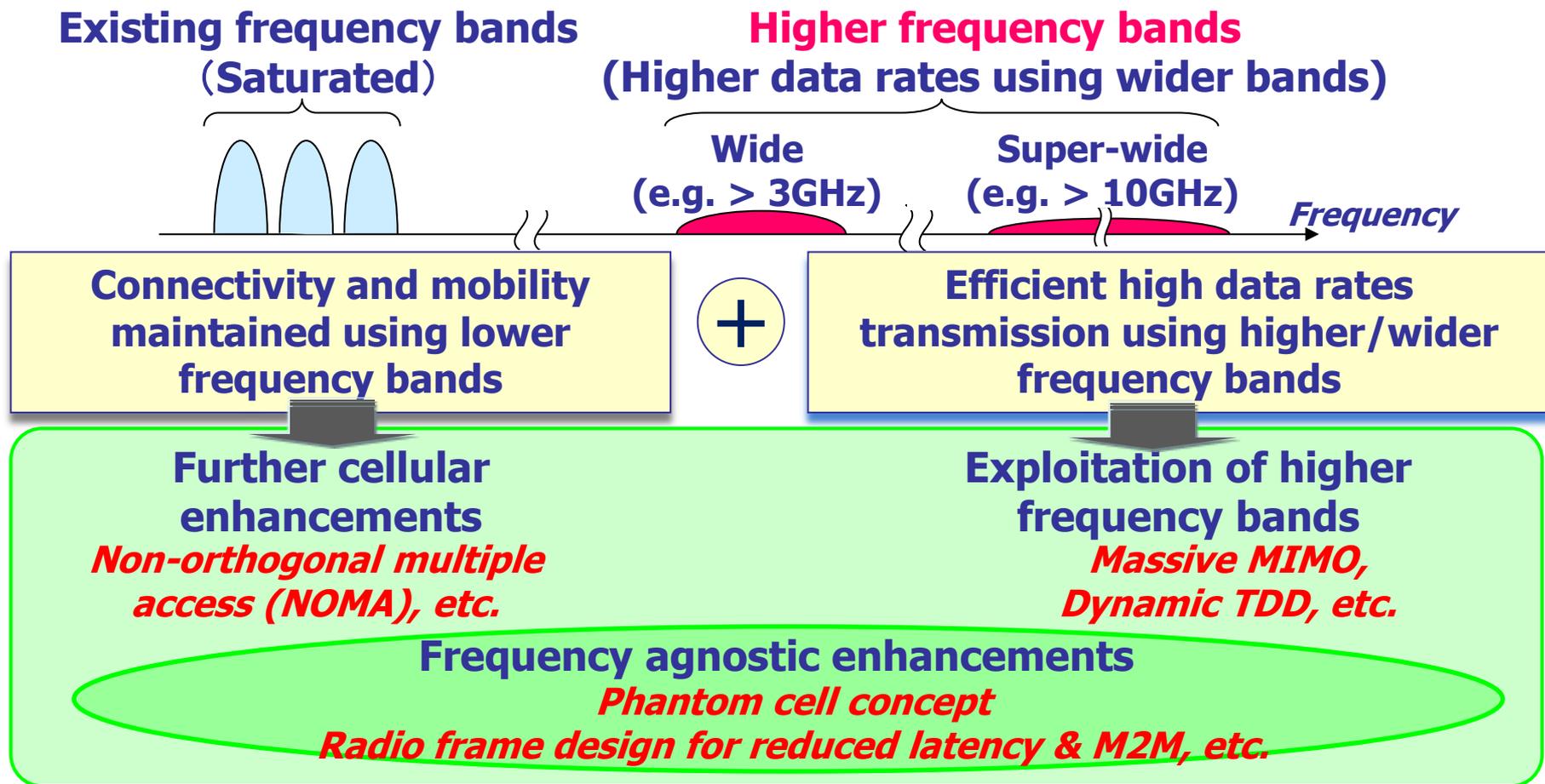
Phasing

- Emerging consensus that there should be two phases for the normative work
 - Phase 1 to be completed by H2 2018 to address a more urgent subset of the commercial needs (to be agreed)
 - Phase 2 to be completed by Dec 2019 for the IMT 2020 submission and to address all identified usecases & requirements
- The above implies the following, tentative, release timing



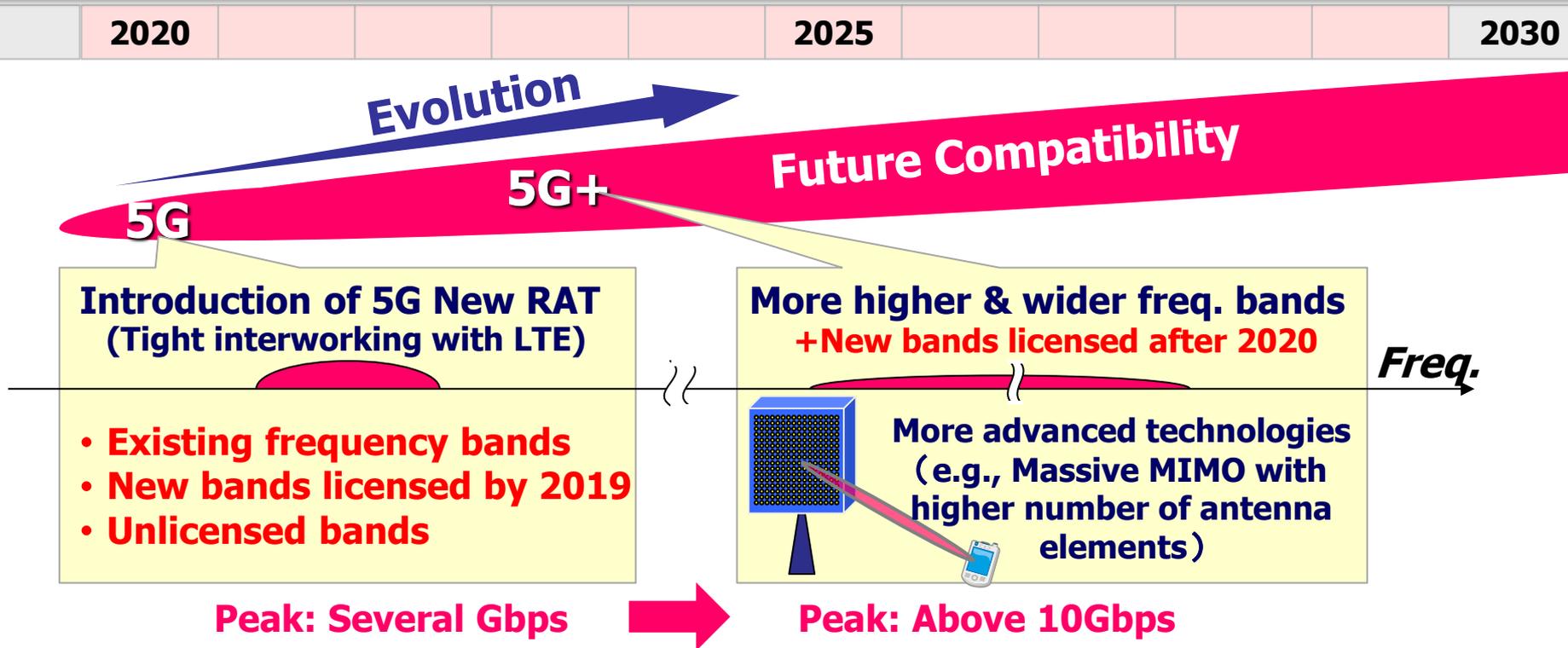
* NOTE: Dates above refer to "stage-3 functional freeze" of specs. ASN.1 freeze is typically one quarter after that.

DOCOMO 5G Technical Concept



5G Phased Realization

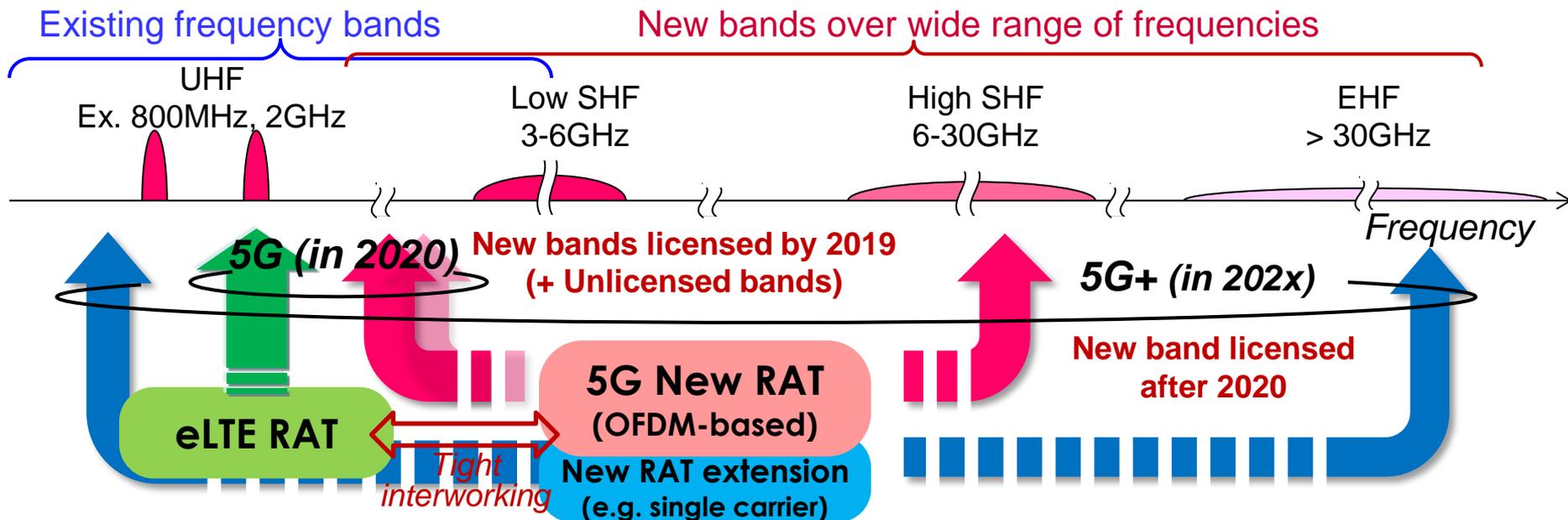
5G will evolve by incorporating new freq. bands and technologies
→ Future compatibility is key for system design to continue evolution



5G and 5G+

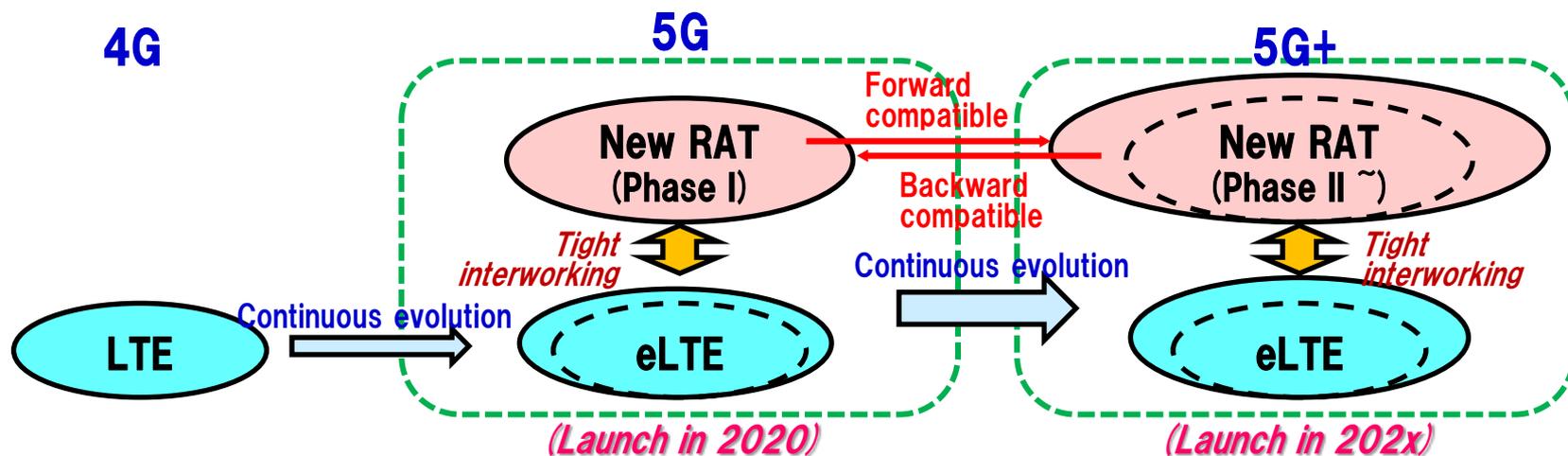
■ Phased approach for 5G standardization and commercialization

- **5G (in 2020)** : eLTE + New RAT optimized for cmW (3-30GHz)
- **5G+ (in 202x)** : 5G extension for all range of spectrum (up to 100GHz)



5G Forward/Backward Compatibility

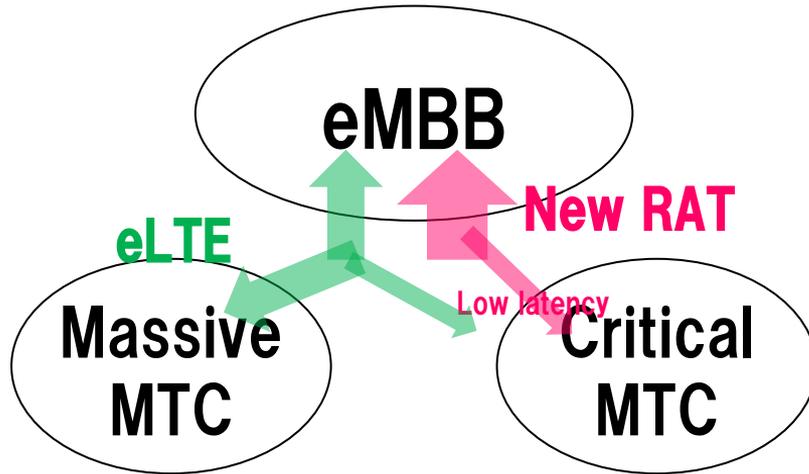
- It is important to make sure 5G continuous evolutions and 5G forward/backward compatibility considering:
 - Unclear spectrum allocation plan especially for mmW
 - Difference in 5G launch timing between countries/regions



eMBB and New Use Cases

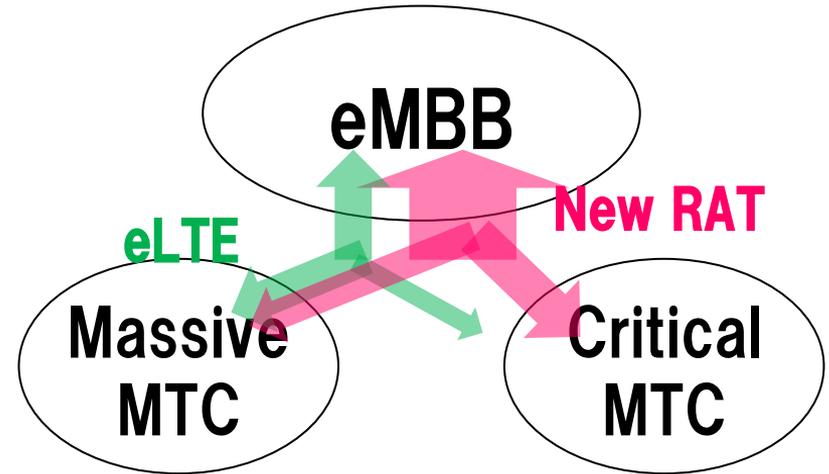
5G will support both eMBB and MTC use cases together with LTE evolution

5G in 2020



New RAT will mainly focus on eMBB

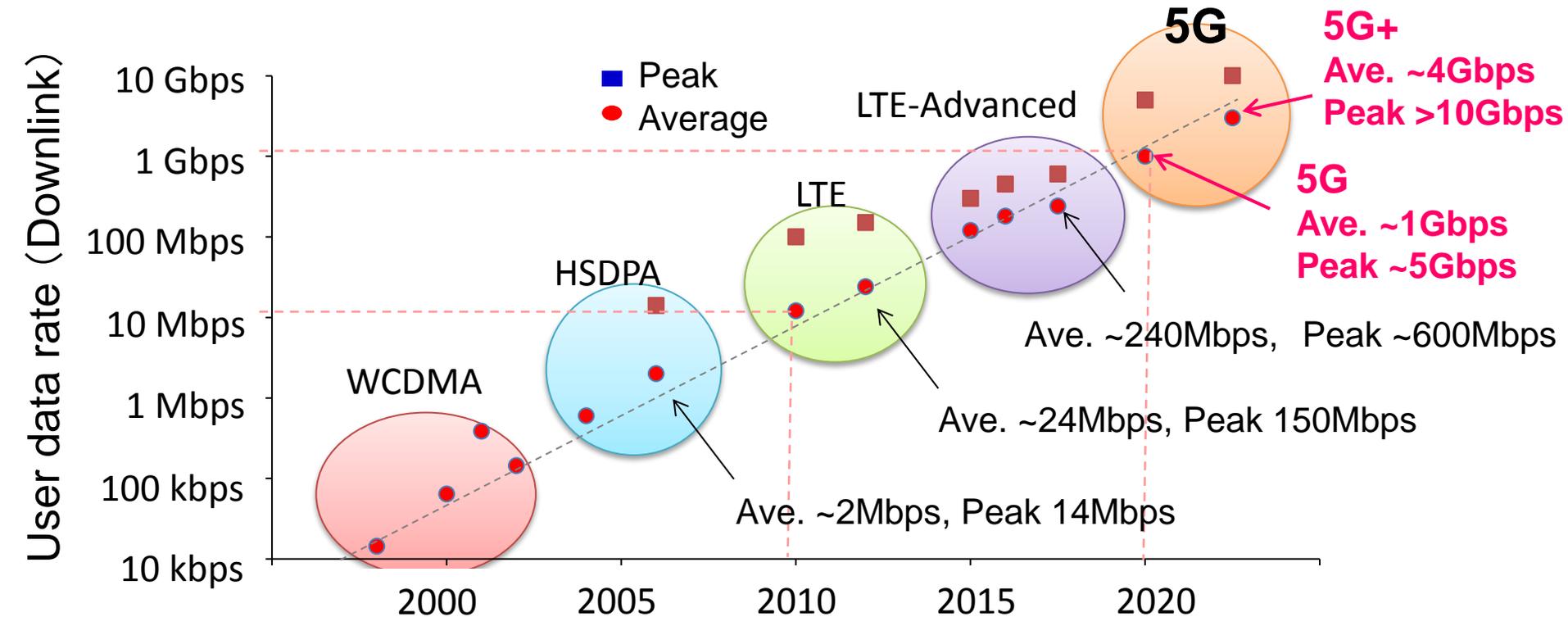
5G+ in 202X



New RAT will be enhanced for all use cases

Data Rate Improvements Toward 2020 and Beyond

Continuous improvement of user experienced throughput toward 5G/5G+



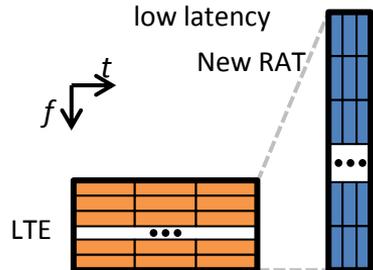
✓ Data rate increase will continue (approx. 100x per 10 years) (quasi-Moore law)

5G Key Technologies for 2020 Deployment

New RAT

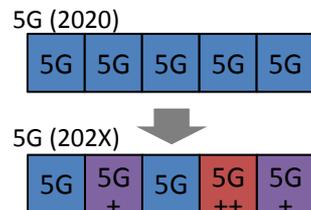
New numerology with shorter TTI

Wider bandwidth and low latency

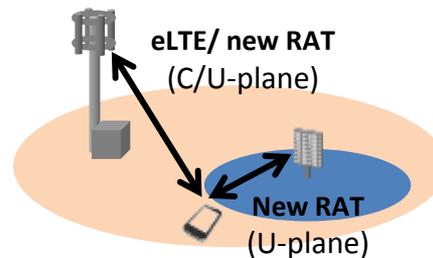


Lean radio frame

Less inter-cell interference, energy saving, good forward compatibility

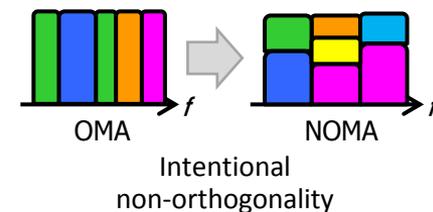


C/U-plane split (dual connectivity, CA)

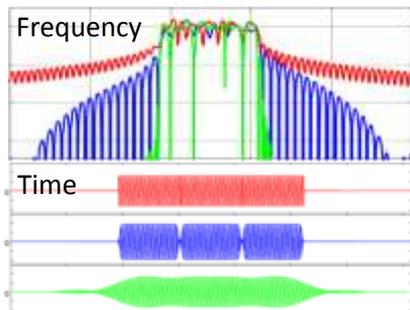


NOMA on LTE

Further cellular enhancement with massive connectivity

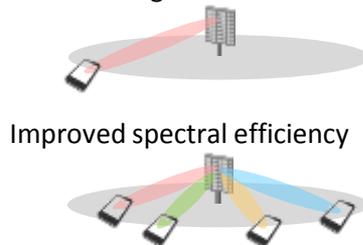


Well localized waveform

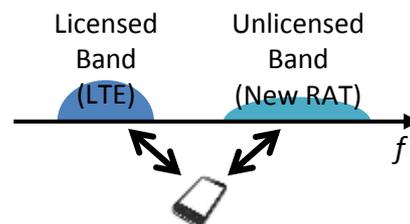


Massive MIMO/beamforming

Cell range extension



Flexible duplex with unlicensed spectrum (e.g. LTE-assisted access)



IoT related LTE enhancements

Low cost / Long battery life devices



NTT
docomo