

5G Picking up steam

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Overview

- Technology drivers
- Age of 5G
- 5G requirements
- Enabling technologies
- Timeline

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NETWORKS**

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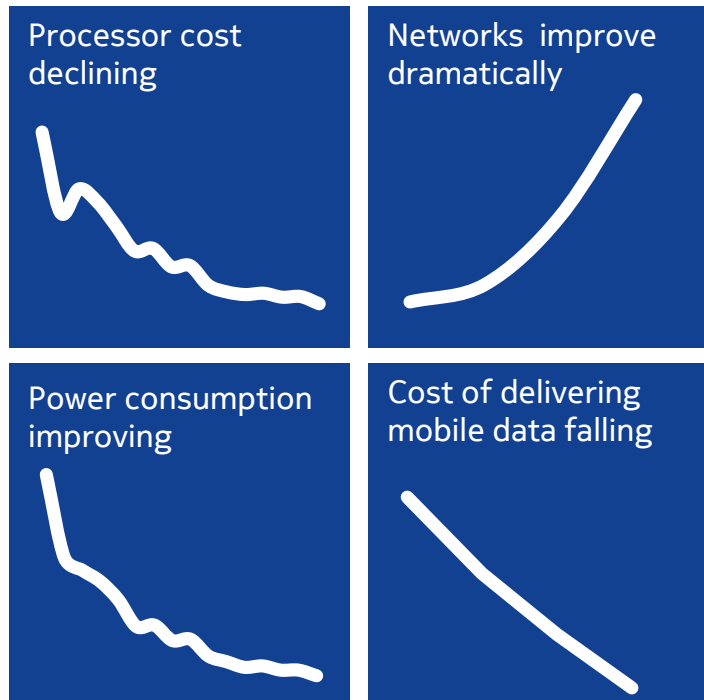
**NOKIA
TECHNOLOGIES**



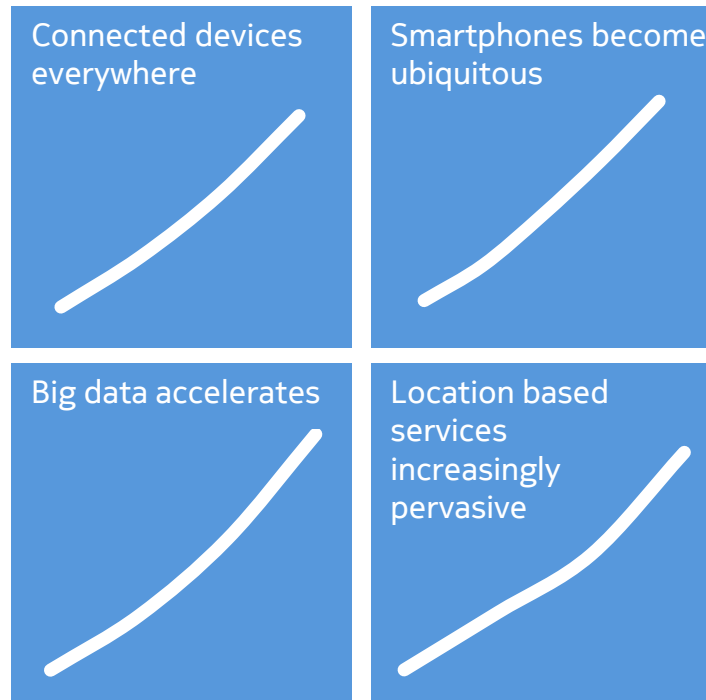
**OUR GOAL IS TO BE A
LEADER IN TECHNOLOGIES
IN A WORLD WHERE
EVERYBODY AND
EVERYTHING WILL BE
CONNECTED**

THE WORLD IS CHANGING

Dramatic technological advances...

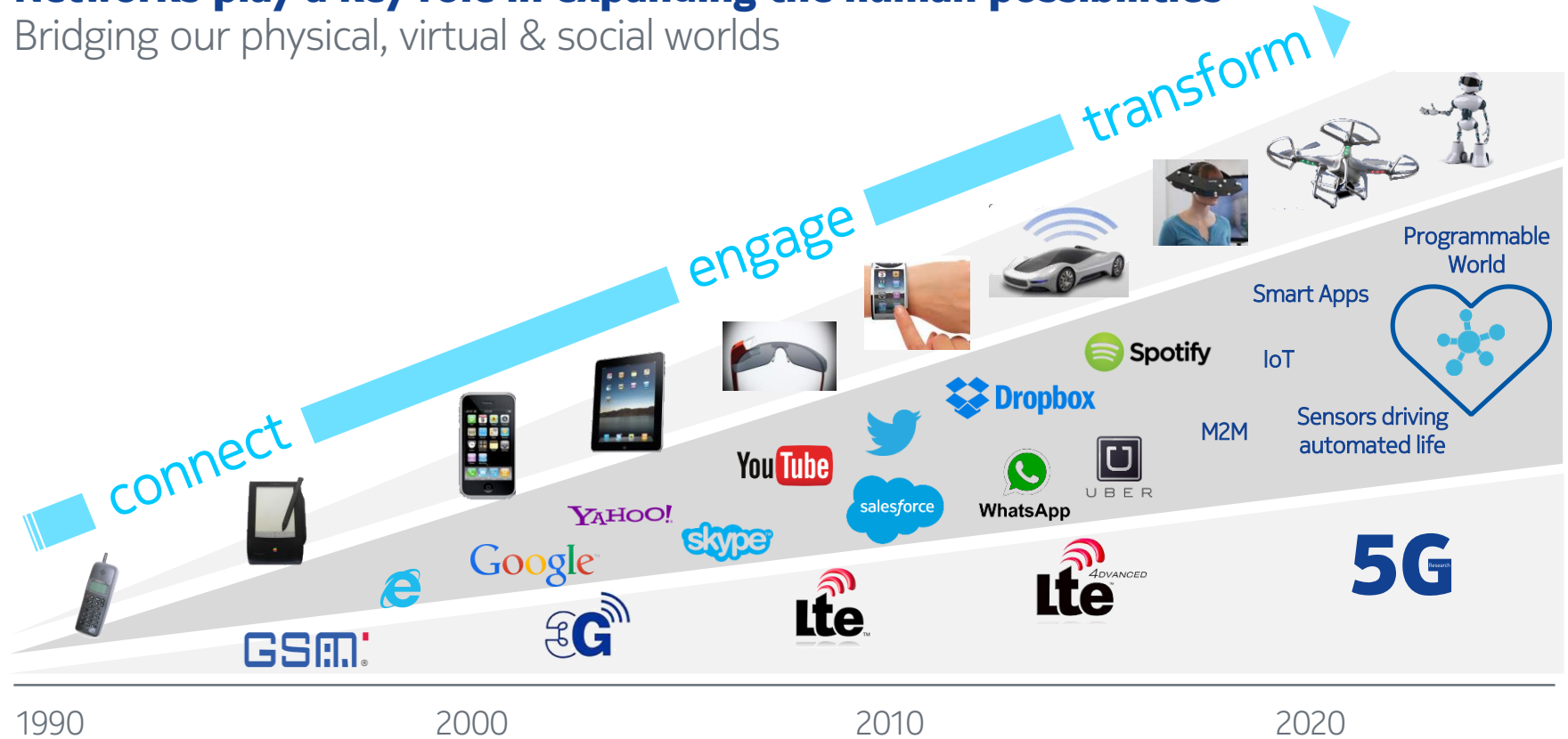


driving dramatic usage



Networks play a key role in expanding the human possibilities

Bridging our physical, virtual & social worlds



CONNECTED CAR



Roadworks Ahead

Roadworks ahead!
1km left lane closure

Speed safely adjusted, vehicle sensors
detect immediate obstruction ahead

3 Meters



Traffic Incident



120 Meters

Warning!

Route updated, changing
lanes to avoid congestion



20 Meters



here

SENSING THE WORLD



15°
Temperature

2 Meters above sea level



4 Friends nearby



Next Generation Manufacturing

Courtesy of Rethink Robotics, Inc.

THIS NEW WORLD REQUIRES MANY ENABLERS

Connecting
tens of
billions of
devices

Connecting
the real and
virtual worlds
with location
intelligence

Connecting
massive
amounts of
data for
analysis and
action

Connecting
development
in technology
to regulatory
and social
environment

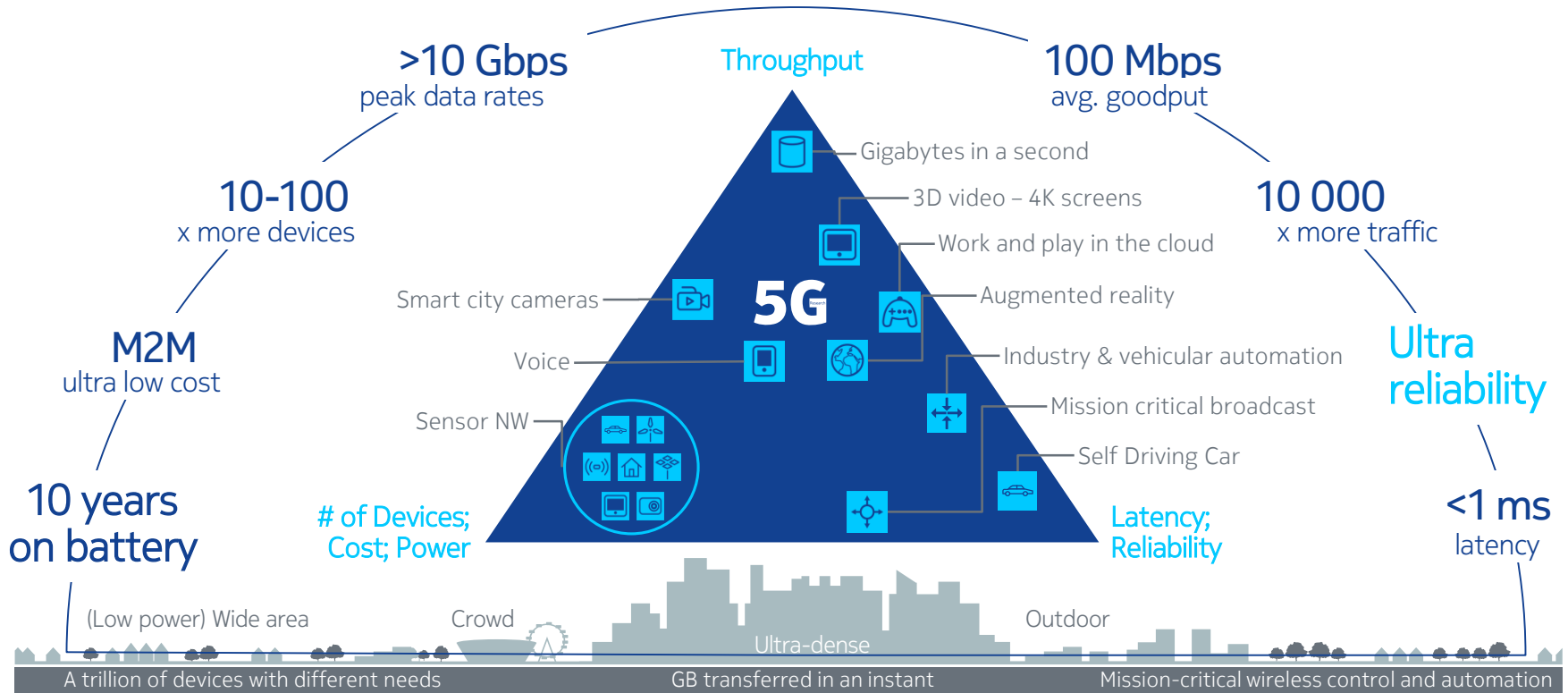


Improved lives

Trust &
Security

Looking ahead to 5G

5G will expand the human possibilities of the connect world



What 5G is NOT

Myth #1

5G = millimeter wave only



Myth #2

5G = utilizes above 6 GHz only



Myth #3

5G = will use totally new access



Myth #4

5G will be fully specified by 2018



What 5G is ...

5G might have one UDN access technology leveraging mmW to complement other lower band wide area/cellular access technologies

5G will use existing and new IMT spectrum below 6 GHz as well as above 6 GHz (WRC2019)

5G is expected to leverage OFDM and cyclic-prefix single carrier for best massive-MIMO and beamforming support as well as cost and energy efficiency

3GPP 5G releases 14 and 15 last into 2018/19 World Radio Conferences takes place in 2019 IMT process for “5G” runs till 2020. First commercial 5G deployments in 2020

5G system vision

A symbiotic integration of novel and existing access technologies

5G Wide area deployments

Scalable service experience
anytime and everywhere

4G 'massive mobile data and M2M'

3G 'voice, video and data'

2G 'high quality voice and M2M'

Wi-Fi 'best effort data'

Fixed access

Zero perceived latency and
GB experience

5G Ultra dense deployments

Architecture

For end user:

Ubiquitous connectivity and
consistent user experience

Unified solution

For operator:

tight integration, simplified
network mgmt and gradual
introduction of 5G

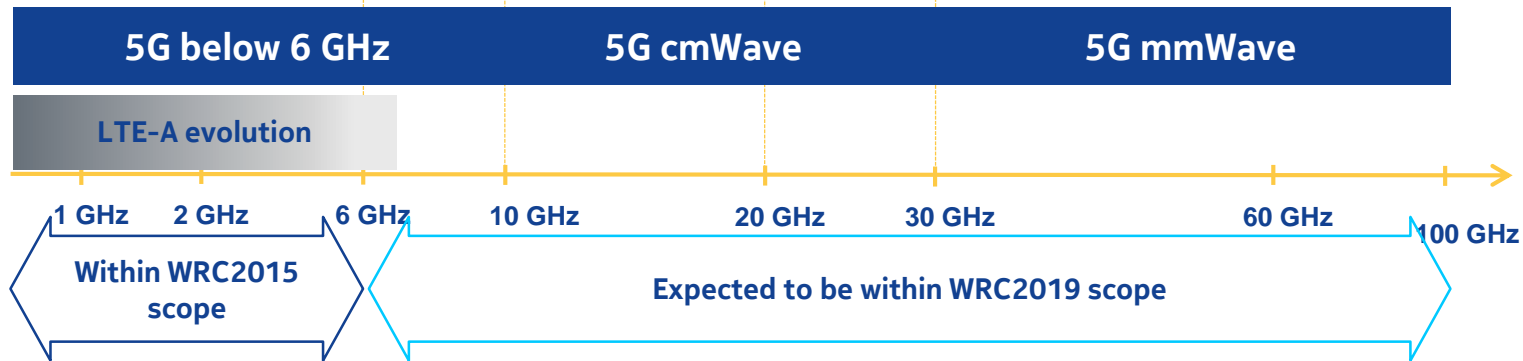
Integration enabling seamless user experience and efficient
operation with cloud and SDN technologies as underlying
principles

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5G radio access to match the available new and old frequency bands

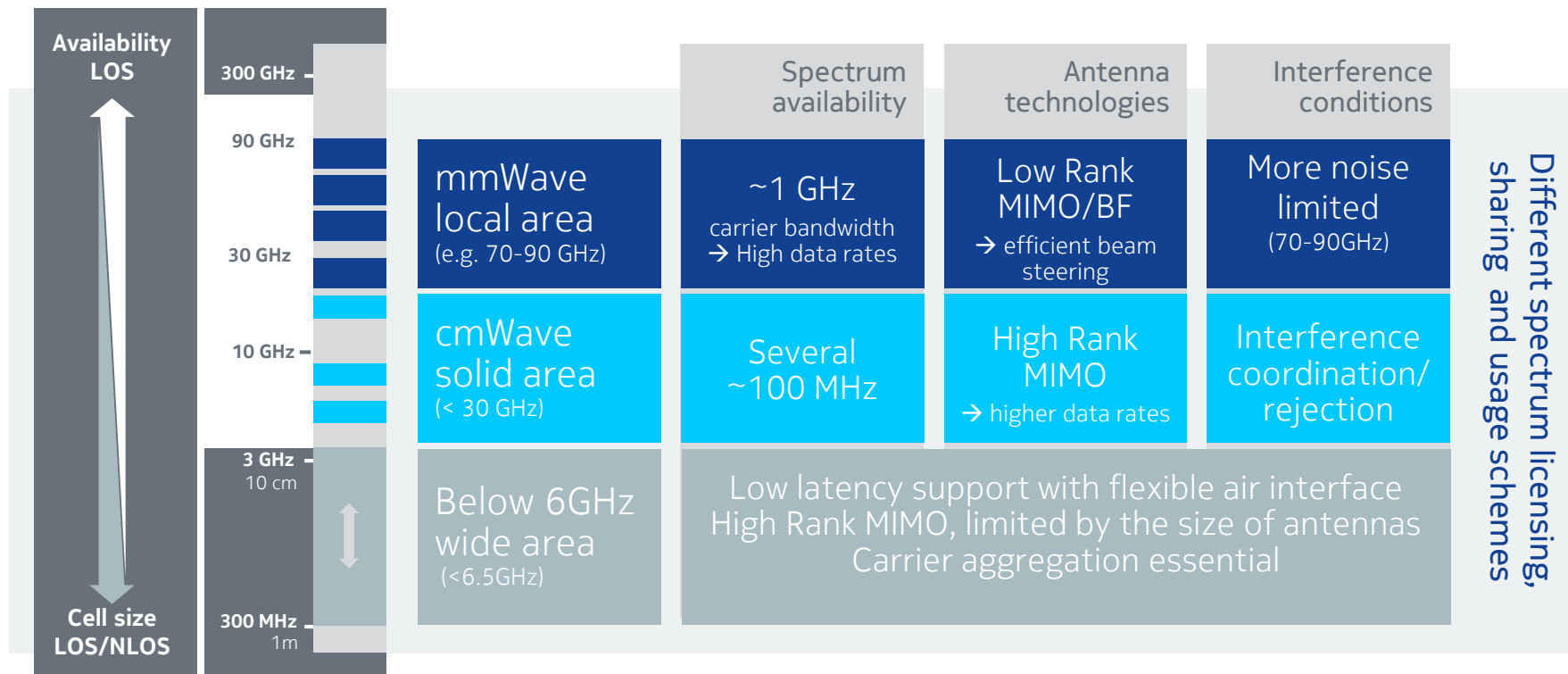
A new RAT may be motivated by new spectrum allocation (bands above 6GHz), lower latency, or specific use cases.

LTE-A will be essential foundation of the integrated 5G system – must continue to evolve in parallel to 5G



5G is to optimize below 6 GHz access and enable above 6 GHz access

Expanding the spectrum assets to deliver capacity and experience



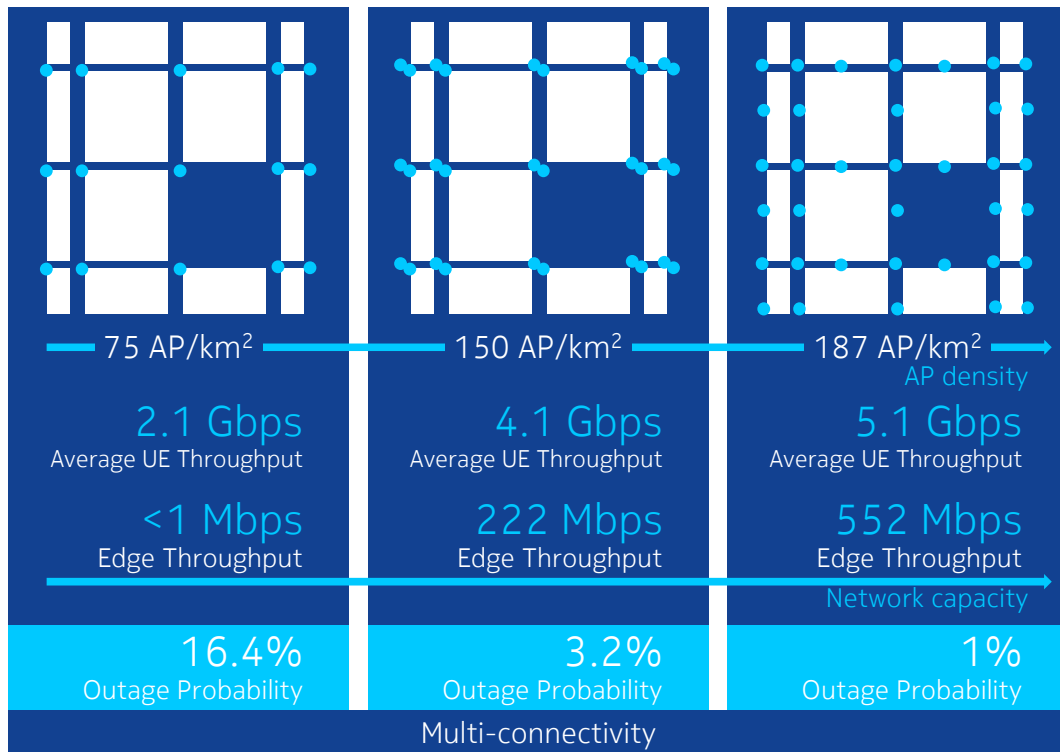
5G technology verification

Nokia is actively engaging with most advanced operators globally to bring 5G to reality

<http://blog.networks.nokia.com/mobile-networks/2015/01/16/5g/>



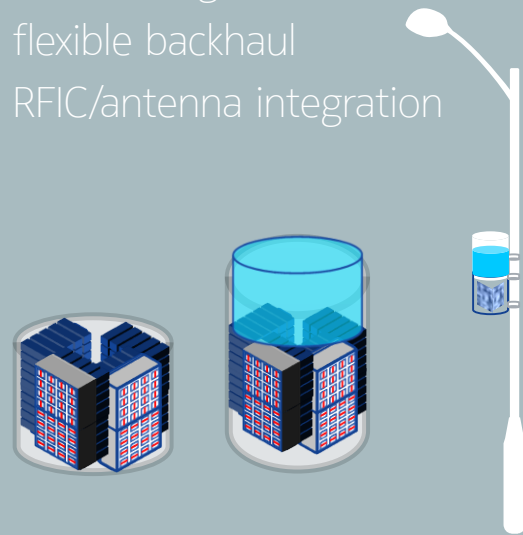
mmWave – 5G requirements can be met even in challenging environments



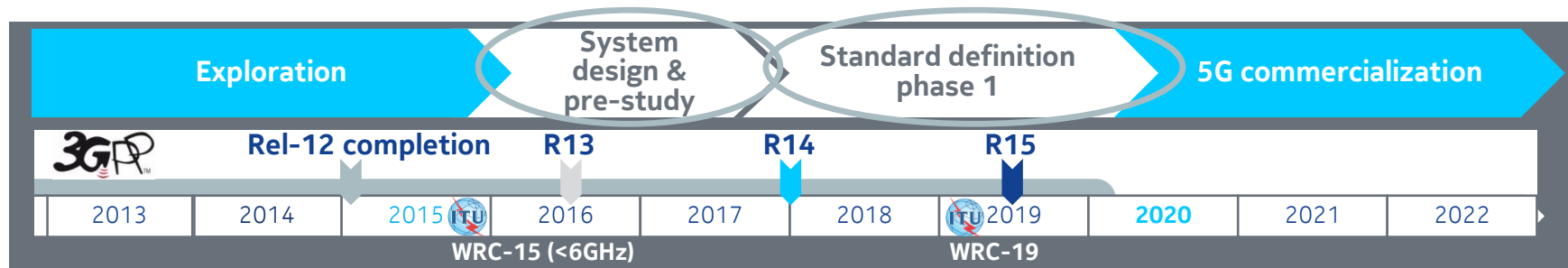
Performance in outdoor environments

Enabled through

- flexible backhaul
- RFIC/antenna integration



5G from research to standards



Release 13: Clean LTE-A evolution release
5G research progressing outside 3GPP

Release 14: The 5G study phase
leading to Rel-15 work item phase

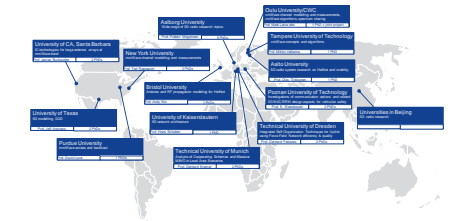
Release 15: The first phase of 'The Real 5G';
completion between 2018 and 2020

“5G starts early 2016 in 3GPP
with Release 14 and then into
Release 15”

“ITU-R processes for IMT2020
run in parallel in close synch”

Note: Future 3GPP release timing uncertain

“If you want to go fast, go alone but if you need to go far, go together”





Thank you!

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