

# Beyond 5G



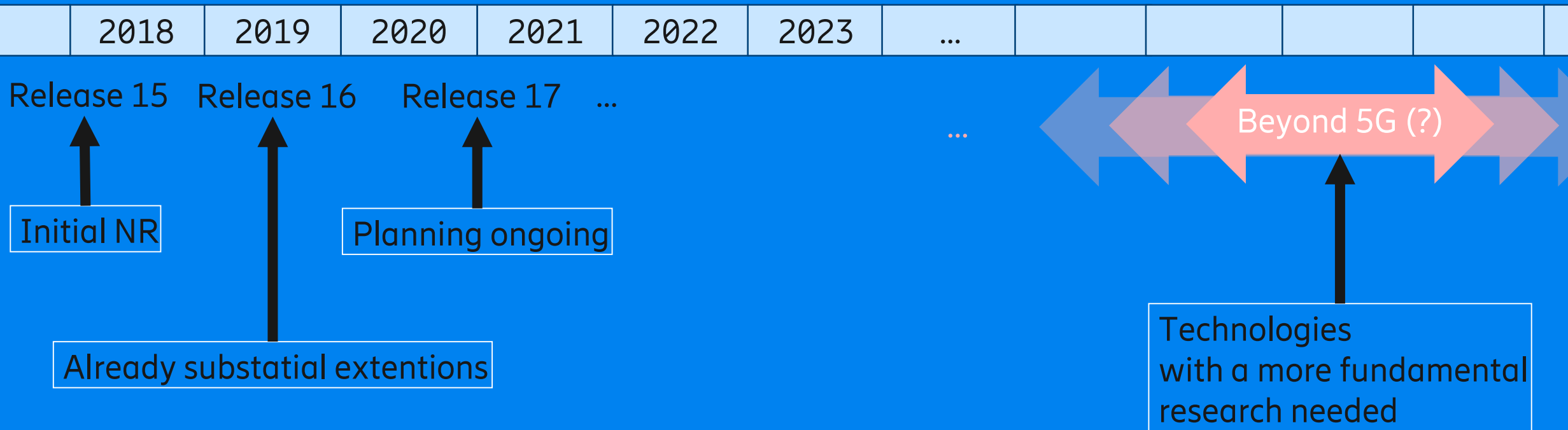
Globecom 2018

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# 3GPP releases

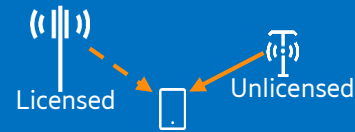


# 3GPP release 16



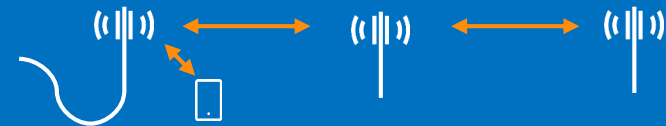
## NR in unlicensed spectrum

with or without assistance from LT or NR licensed spectrum



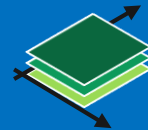
## Integrated Access Backhaul

Same technology as access, but different configurations



## NOMA (Non-Orthogonal Multiple Access) ?

For uplink, short latency, small overhead



## Ultra Reliable Low Latency Communications

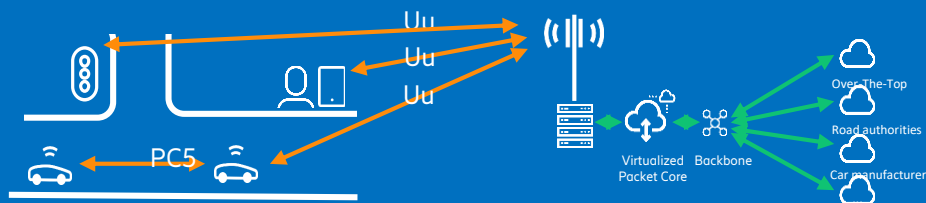
Redundancy (time, frequency, spatial, packets, coding)

Short tx (numerology, slots, processing)

Scheduling



## Cellular Vehicular-to-anything



## Remote Interference Management

Base station distance 150-300 km

Agressor identification by reference signals

Power, time, frequency, spatial



# Beyond 5G – long term



## Carrier frequencies beyond 100 GHz

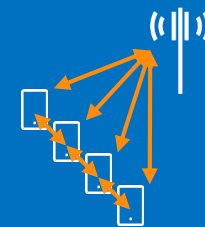
Air interface?



## Device cooperation

Device-based relaying

Co-operative transmission and reception

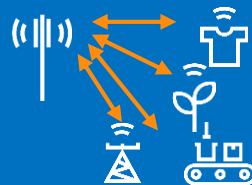


## Massive IoT

Medium capable sensors

Zero cost devices

Zero energy devices – energy harvesting, backscattering



## Machine Learning – Artificial Intelligence

Selection of training data and reward functions

Degree of flexibility down to air interface?

Network programmable devices

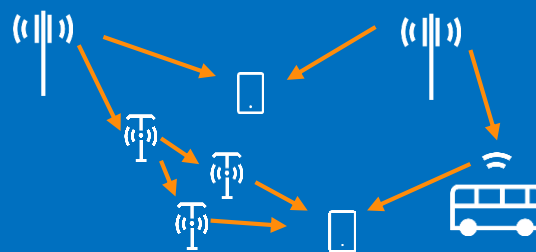


## Flexible network topologies

Multi-hop

Multi-site

Mobile relays



## Cellular as a sensor

Extract network information

Air interface as a sensor



