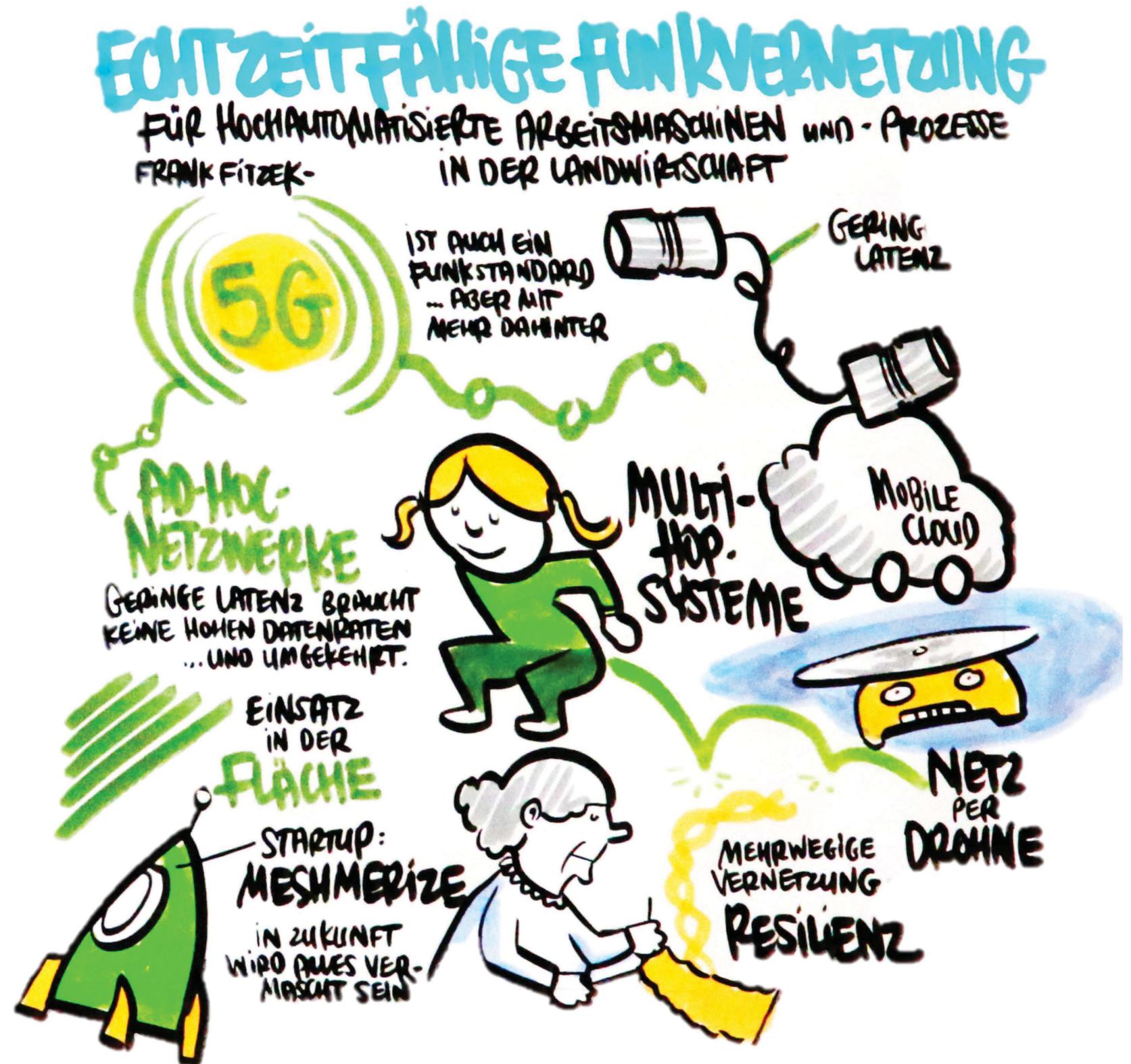
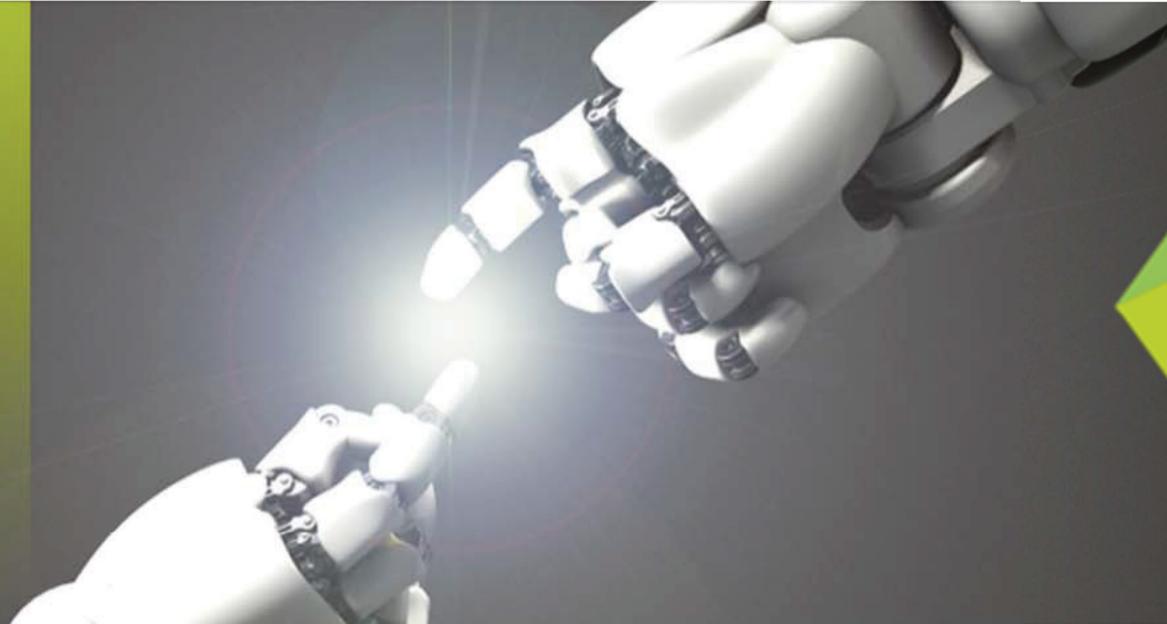


Die fünfte Generation des Mobilfunks, abgekürzt 5G, wird maßgeblich in Dresden entwickelt. Im sogenannten 5G Lab Germany an der dortigen Technischen Universität werden lokale Netzwerktechnologien entwickelt, die eine vollständige Netzabdeckung erzeugen. Dieser Funkstandard ist nicht einfach nur schneller als seine Vorgänger, sondern orientiert sich am Bedarf nach hohen Datenraten (GB/s) einerseits und schnellen Antwortzeiten andererseits (1 ms).

*Prof. Dr.-Ing. Frank H.P. Fitzek, Leiter der Deutschen Telekom Professur für Kommunikationsnetze in Dresden:
„Echtzeitfähige Funkvernetzung für hochautomatisierte Arbeitsmaschinen und -prozesse in der Landwirtschaft“*





**5G LAB
GERMANY**

Echtzeitfähige Funkvernetzung für hochautomatisierte Arbeitsmaschinen und -prozesse in der Landwirtschaft

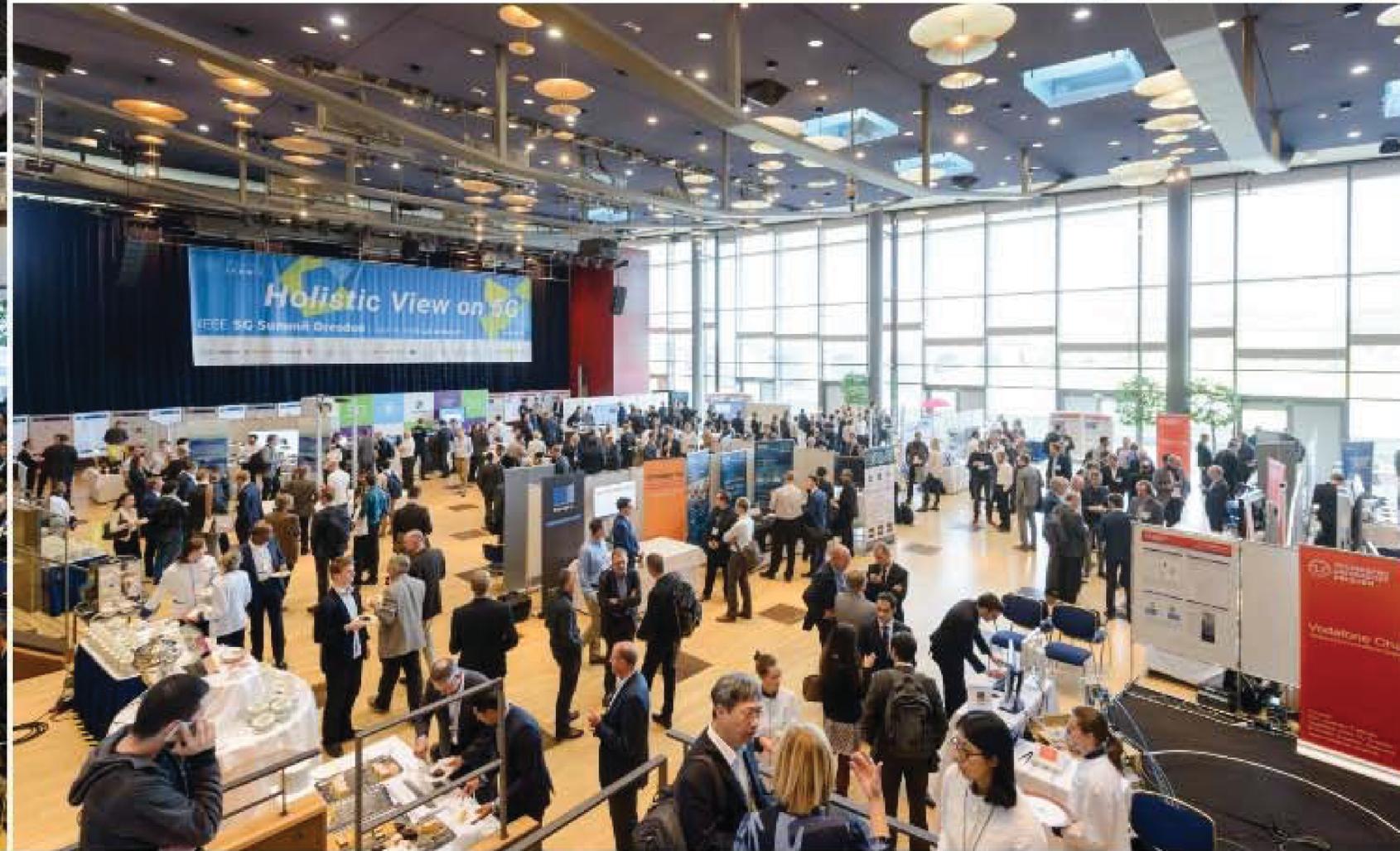
Prof. Dr.-Ing. Dr. h.c. Frank H.P. Fitzek



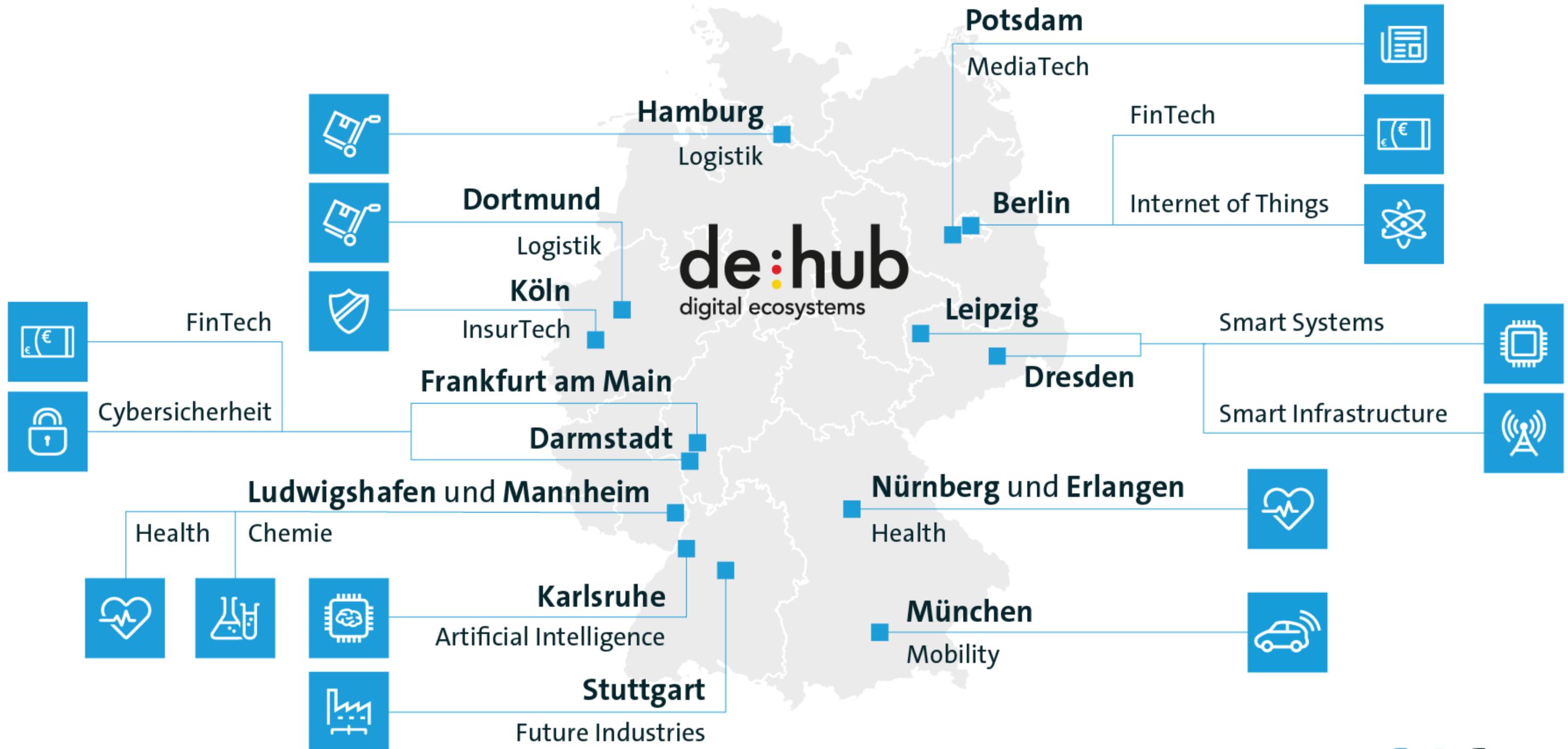
5G Summit

Dresden, Germany

25.09.2018



Digital Hubs in Germany



Main Idea of this talk

- Definition of 5G Networks
 - More than 4G
 - Wireless vs. Wired
 - 802.11p vs LTE-V vs 5G
 - Reservation based vs. Contention based
 - Cellular vs. Local Area Network
 - More than connectivity: Softwarization
 - Mobile Edge Cloud
 - Network Slicing
- Discussion what YOU really need!



Short-range Communication

3m – 25m



© BMBF Project „5G NetMobil“



Off-Road Platooning



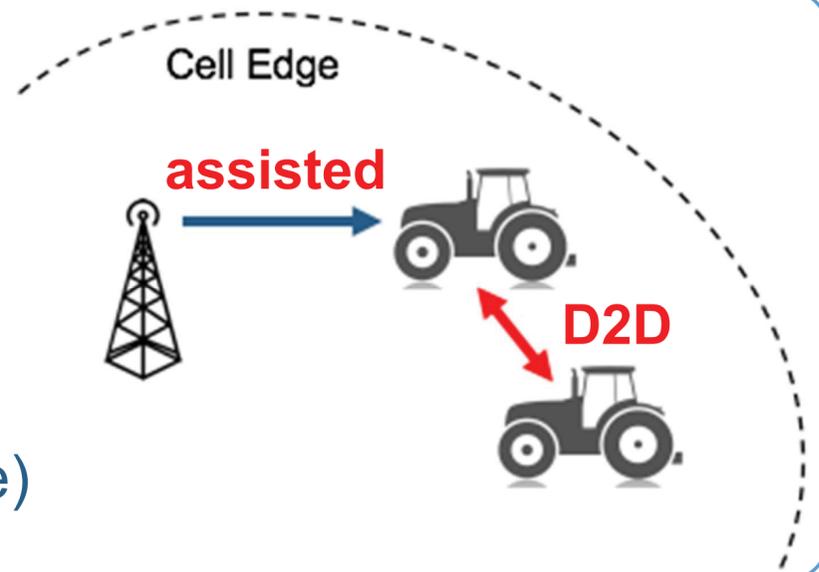
Off-Road Parallel Platooning



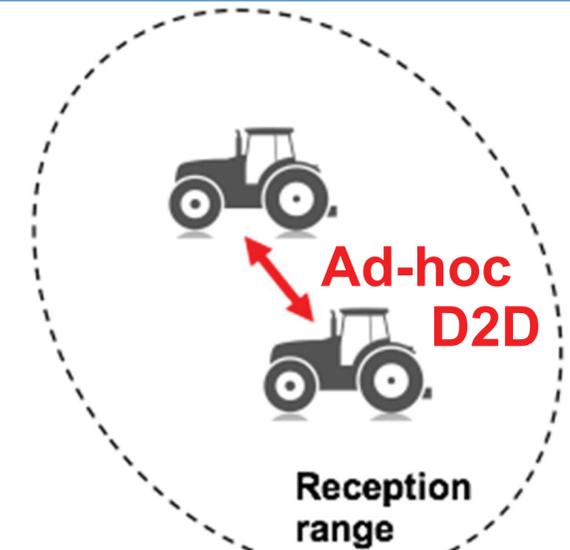
Off-Road Longitudinal Platooning

Connectivity options:

**Network-assisted
Device-to-Device
(D2D)
Communications**
(if infrastructure available)



**(Autonomous)
Ad-hoc
Infrastructure-less
D2D
Communications**



Mid-Range Communication

25m – 1.000m



Drone can also act as a relay station

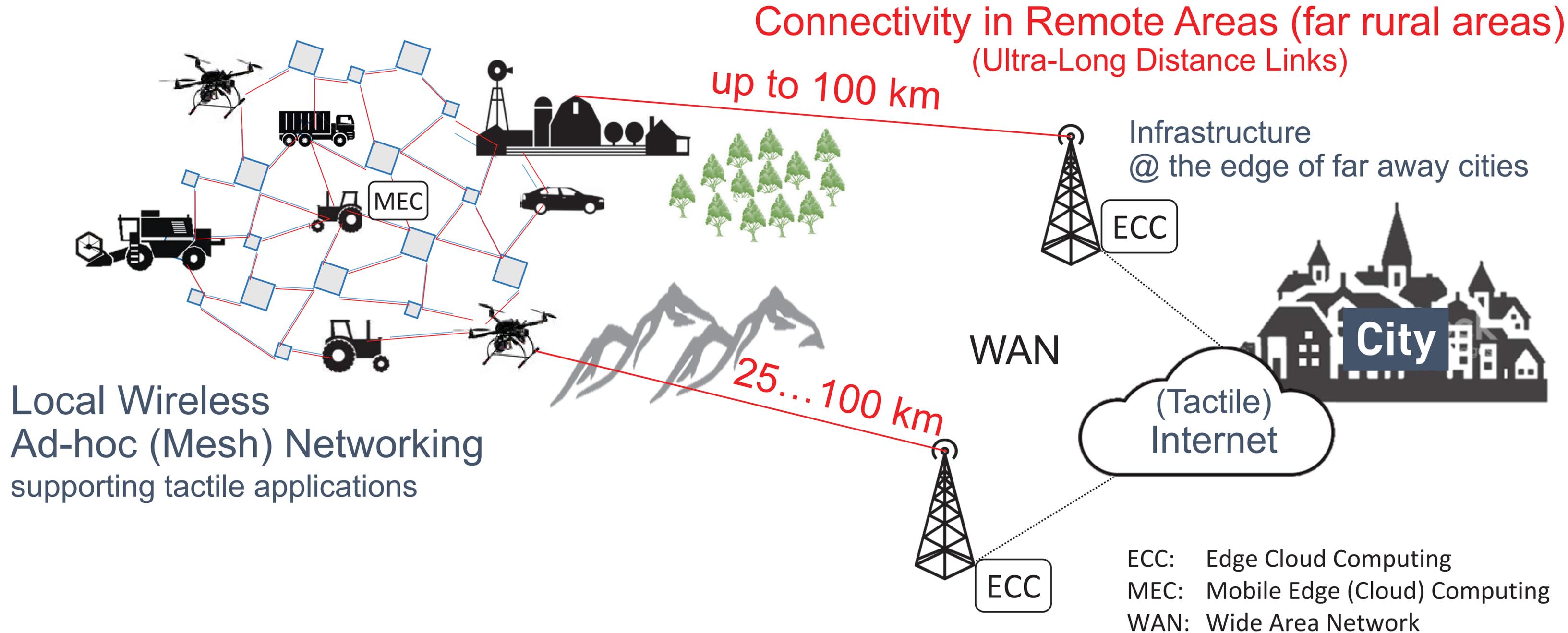
Single- or Multi-hop communication



Cooperative machines, monitoring of process data, remote control, connecting drones to machines and process automation

Ultra-Long-Range Communication

25.000m – 100.000m



Local Wireless
Ad-hoc (Mesh) Networking
supporting tactile applications

Connectivity in Remote Areas (far rural areas)
(Ultra-Long Distance Links)
up to 100 km

Infrastructure
@ the edge of far away cities

WAN

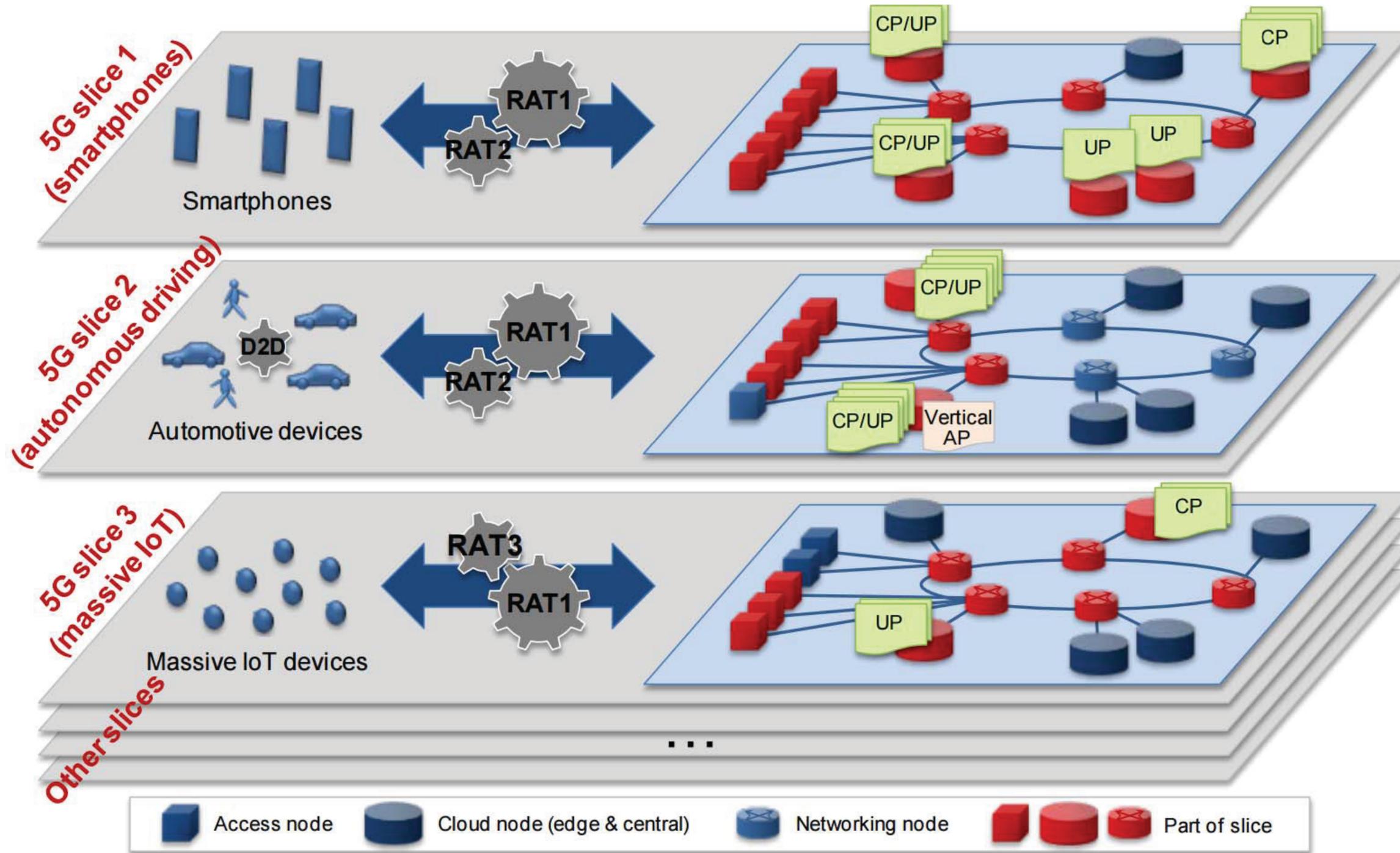
(Tactile)
Internet

City

25... 100 km

ECC: Edge Cloud Computing
MEC: Mobile Edge (Cloud) Computing
WAN: Wide Area Network

Network Slicing

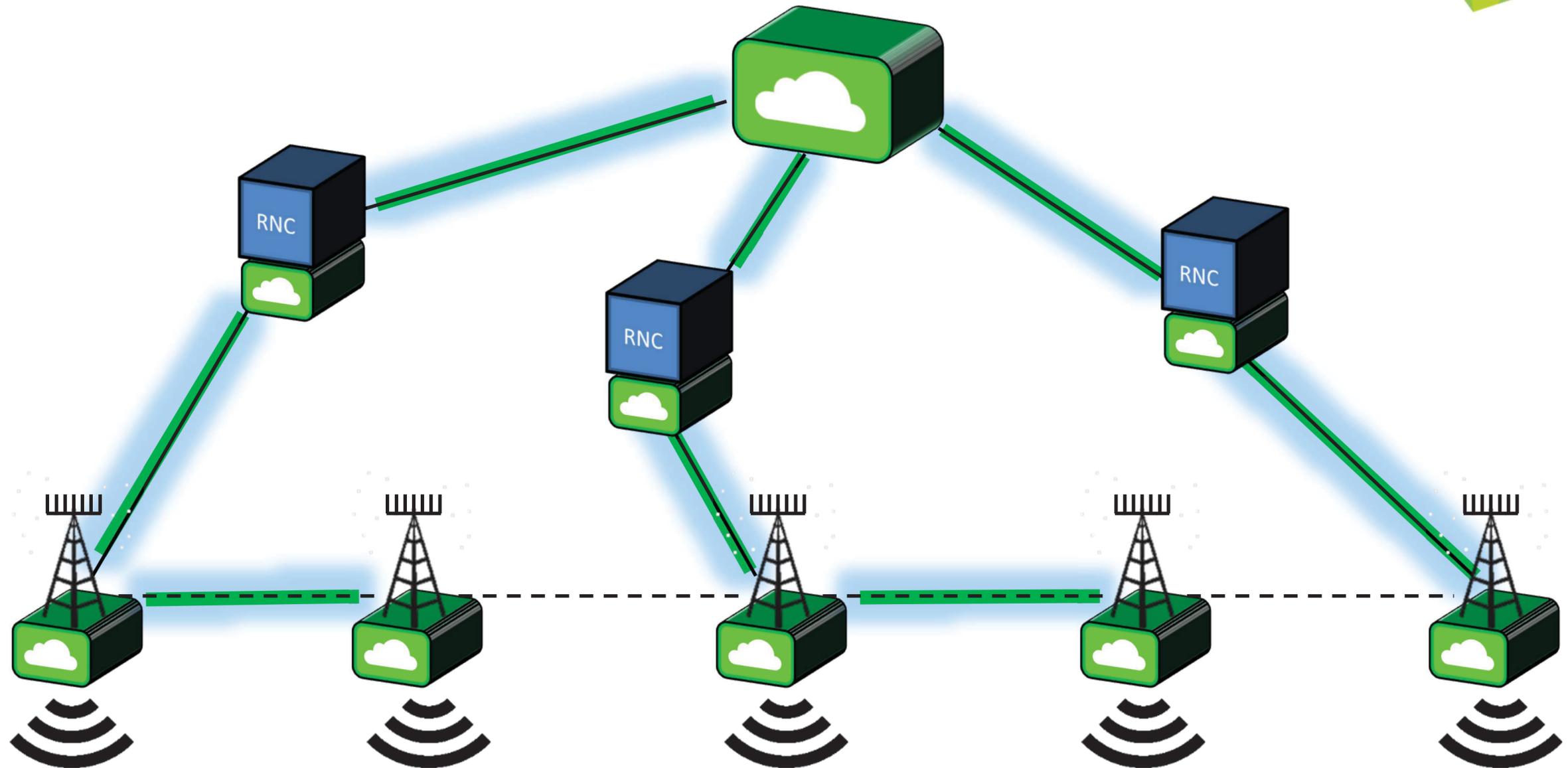


Latency – Real-time Capabilities

Cloud

Micro Cloud

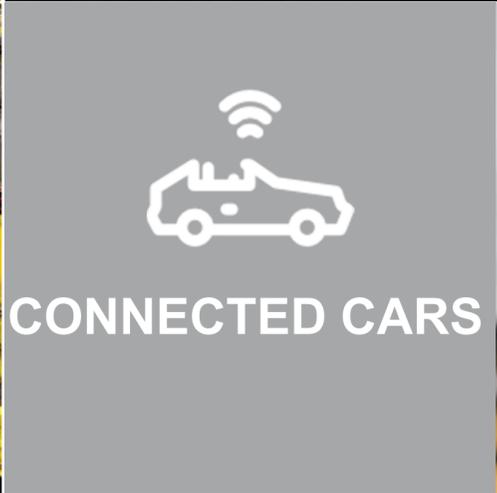
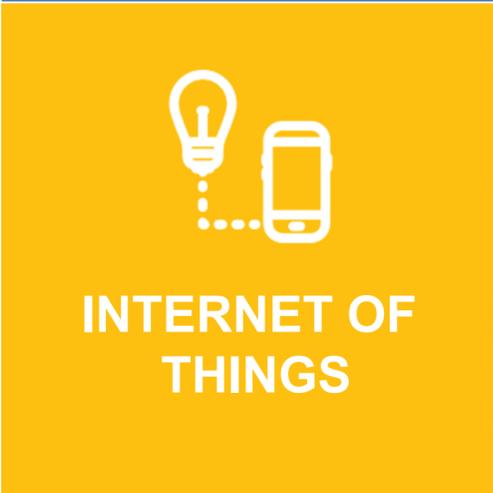
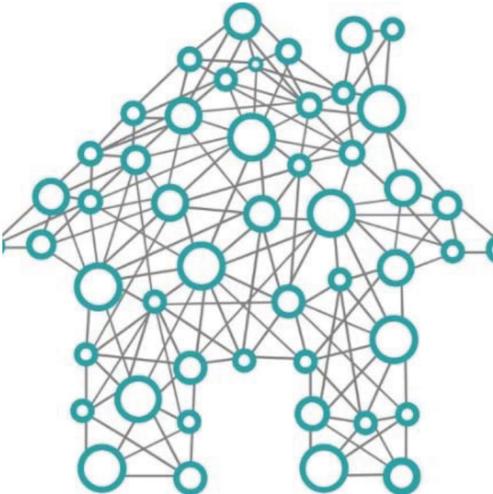
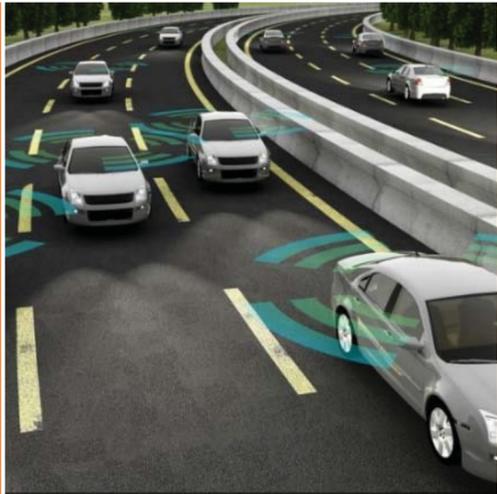
Mobile
Edge Cloud



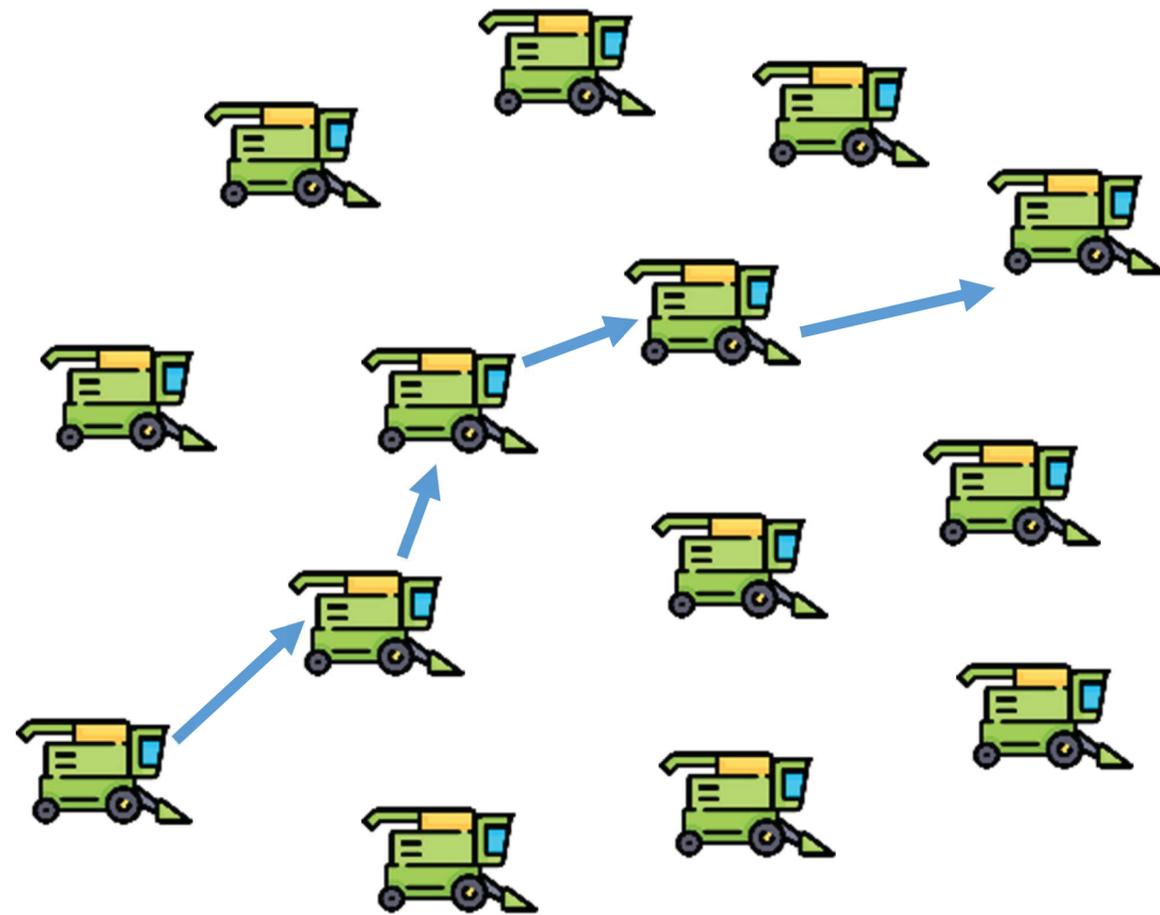
MESHMERIZE

NEXT GENERATION MESH NETWORKS

PRODUCT
WHO NEEDS MESH

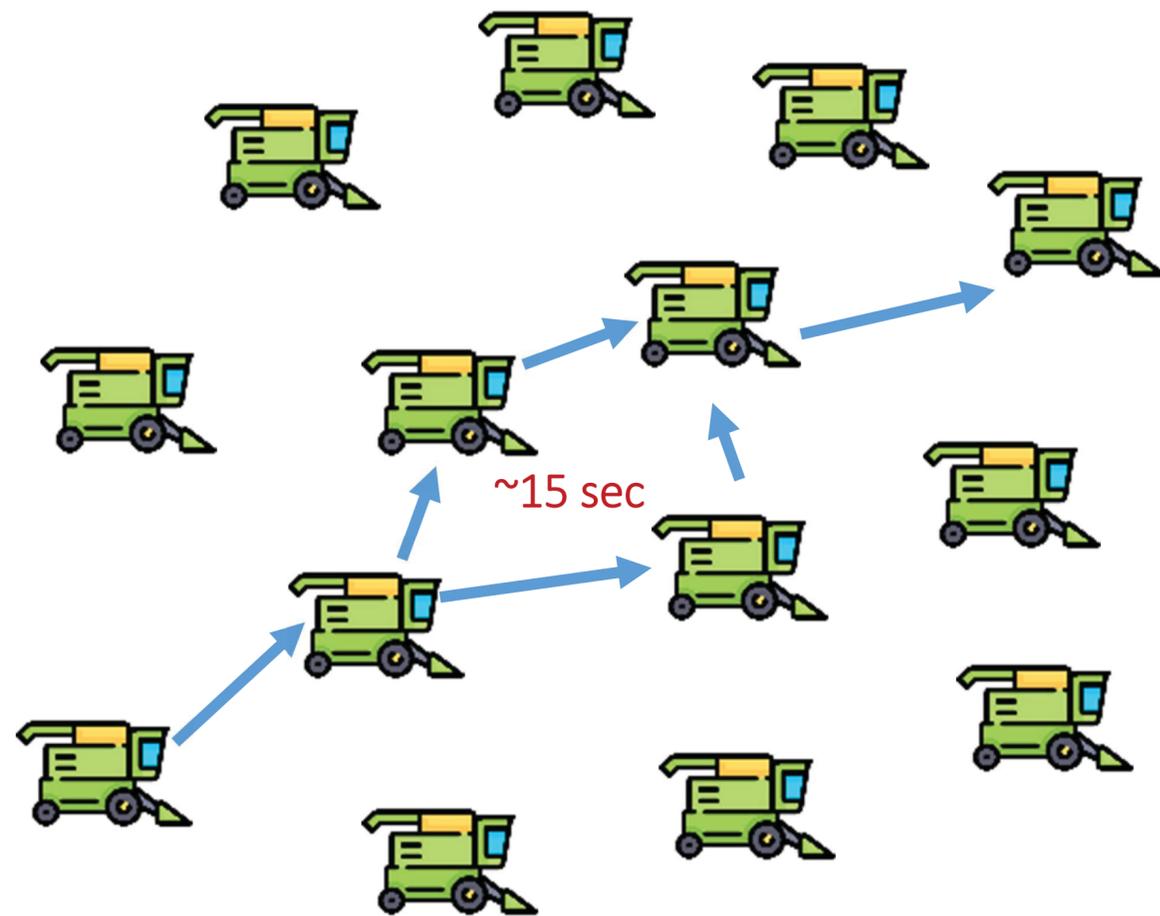


TECHNICAL CLASSICAL MESH



- Find a (pre-calculated) single path hop-by-hop route
- Route works perfect as long as link conditions are stable

TECHNICAL CLASSICAL MESH

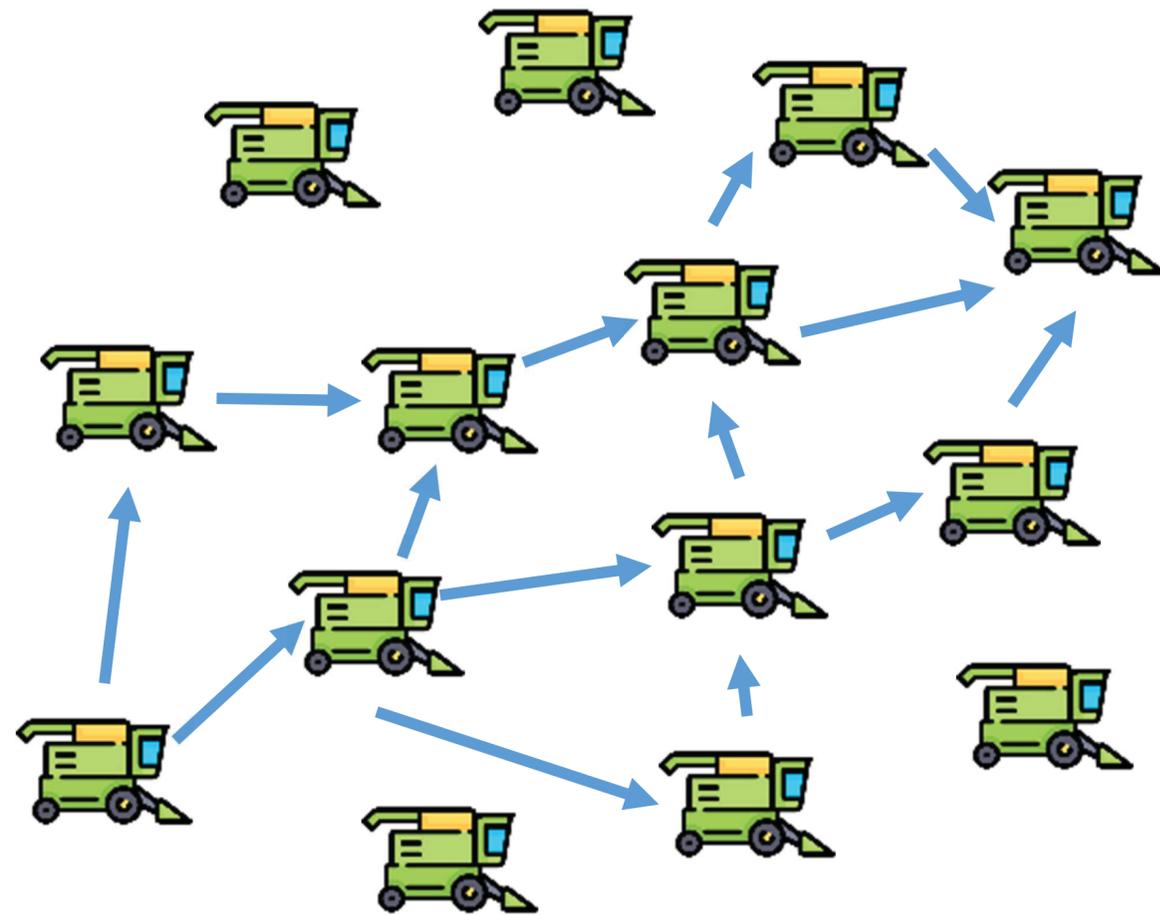


- Find a (pre-calculated) single path hop-by-hop route
- Route works perfect as long as link conditions are stable

But when a node dies out:

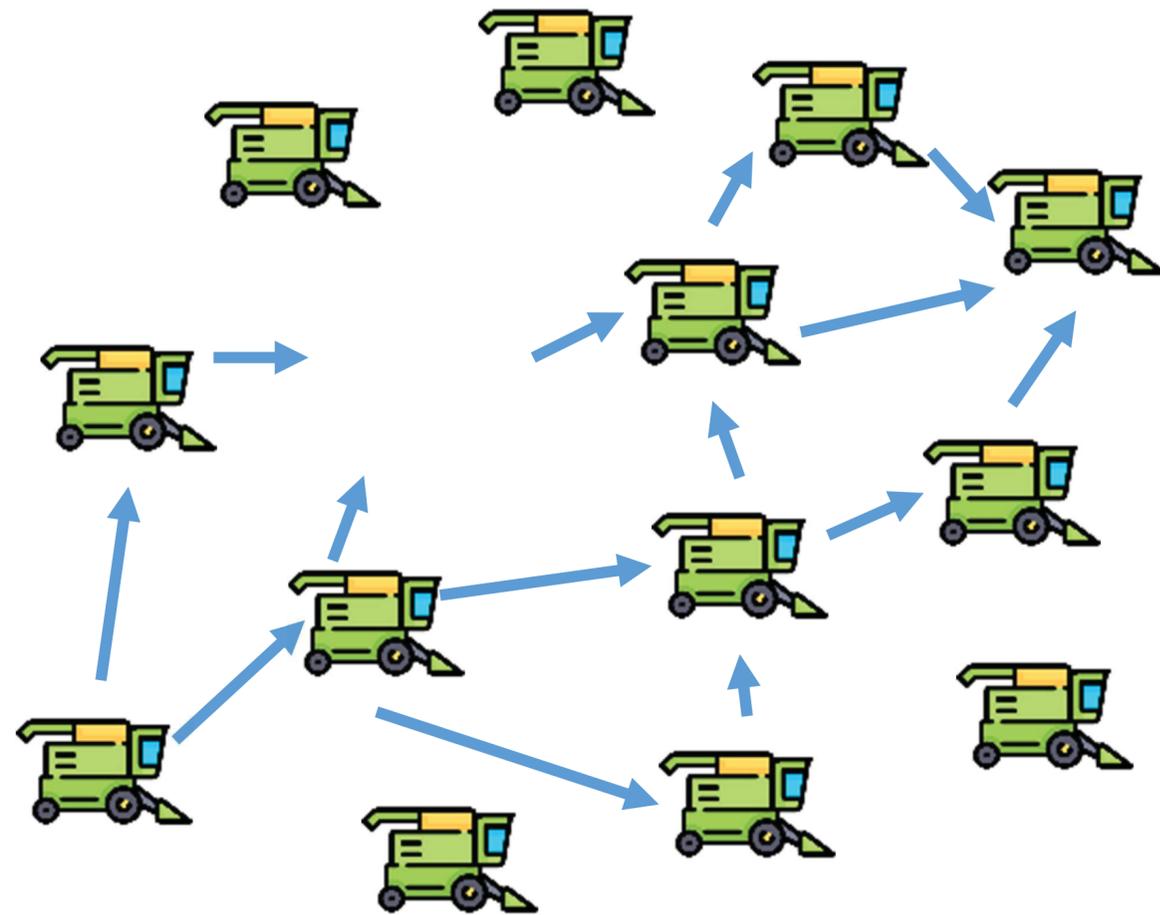
- ~5 to 15 seconds downtime
- Similar problems if link quality changes
- No Go for time critical applications, including VoIP and cyber physical systems

TECHNICAL MESHMERIZE ROUTING



- Route along corridors instead of hops
- Only “parts of data” is forwarded to individual paths
- High resilience achieved at low cost of throughput.
- Each node contributes a different amount based on its position in the corridor.
- Use coded transmissions to provide high granularity

TECHNICAL MESHMERIZE ROUTING



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PRODUCT

OUR ROUTING PROTOCOL PROVIDES



PRODUCT

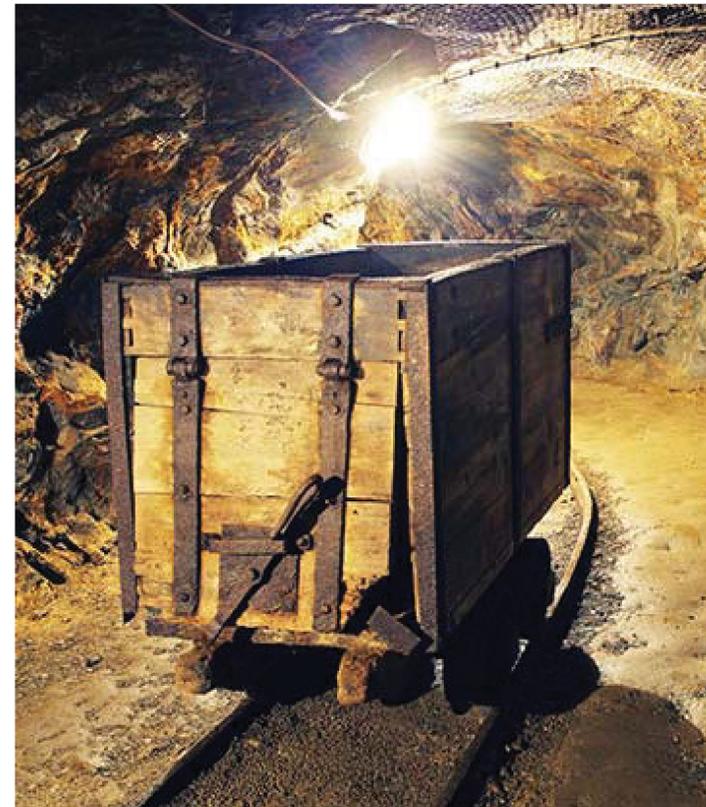
DIFFERENT APPLICATIONS, DIFFERENT REQUIREMENTS



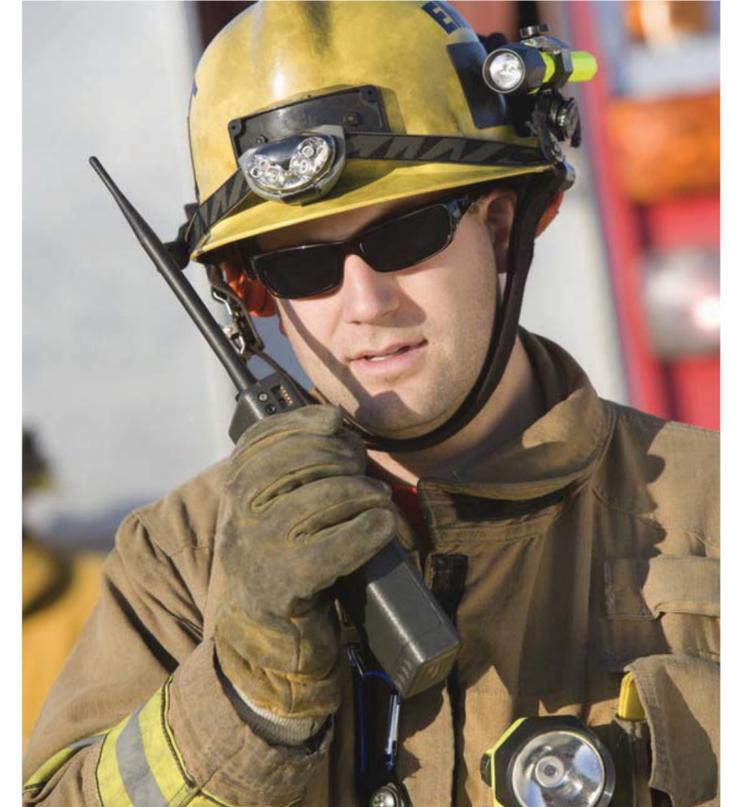
Farming 4.0



CONSTRUCTION



MINING

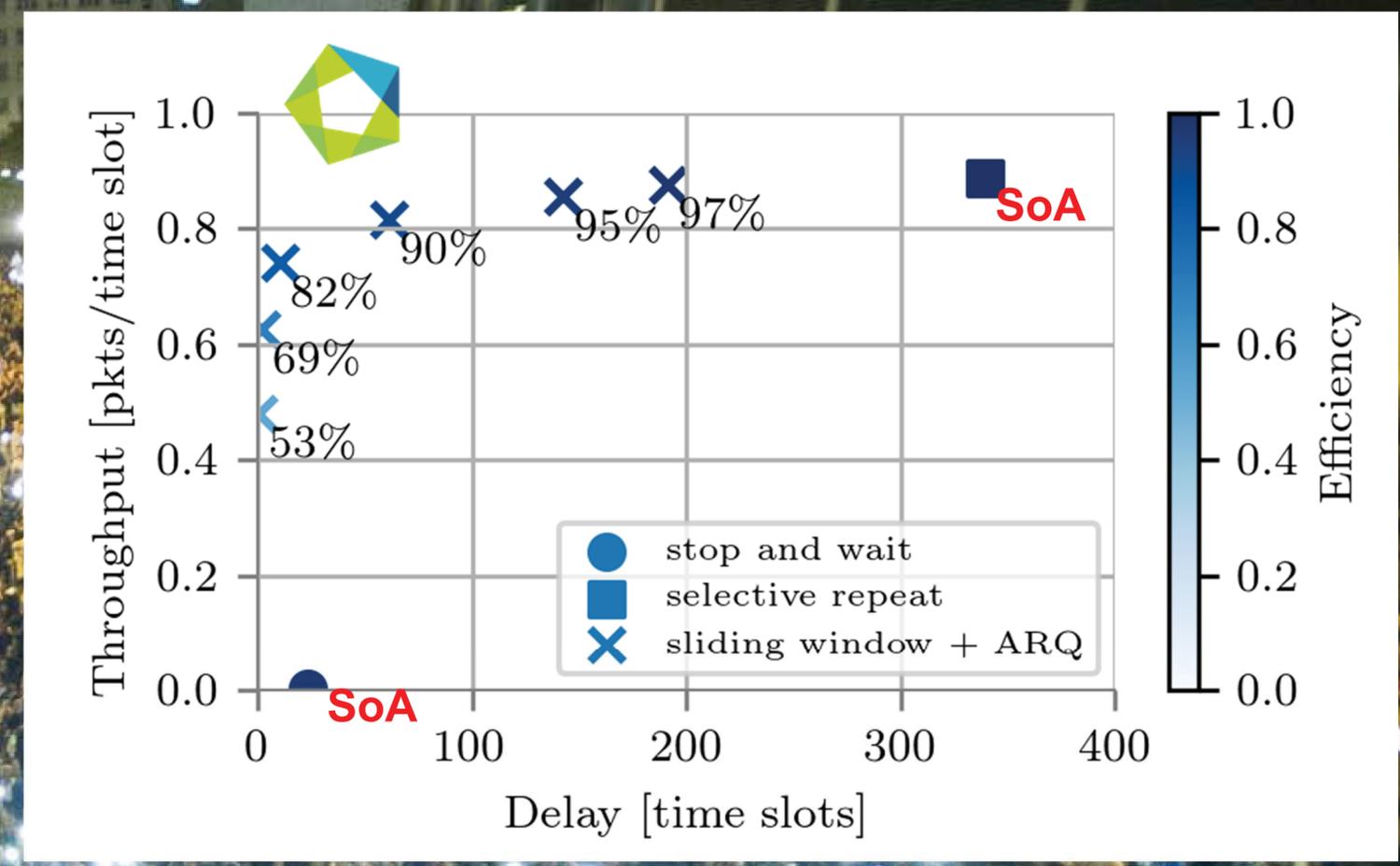
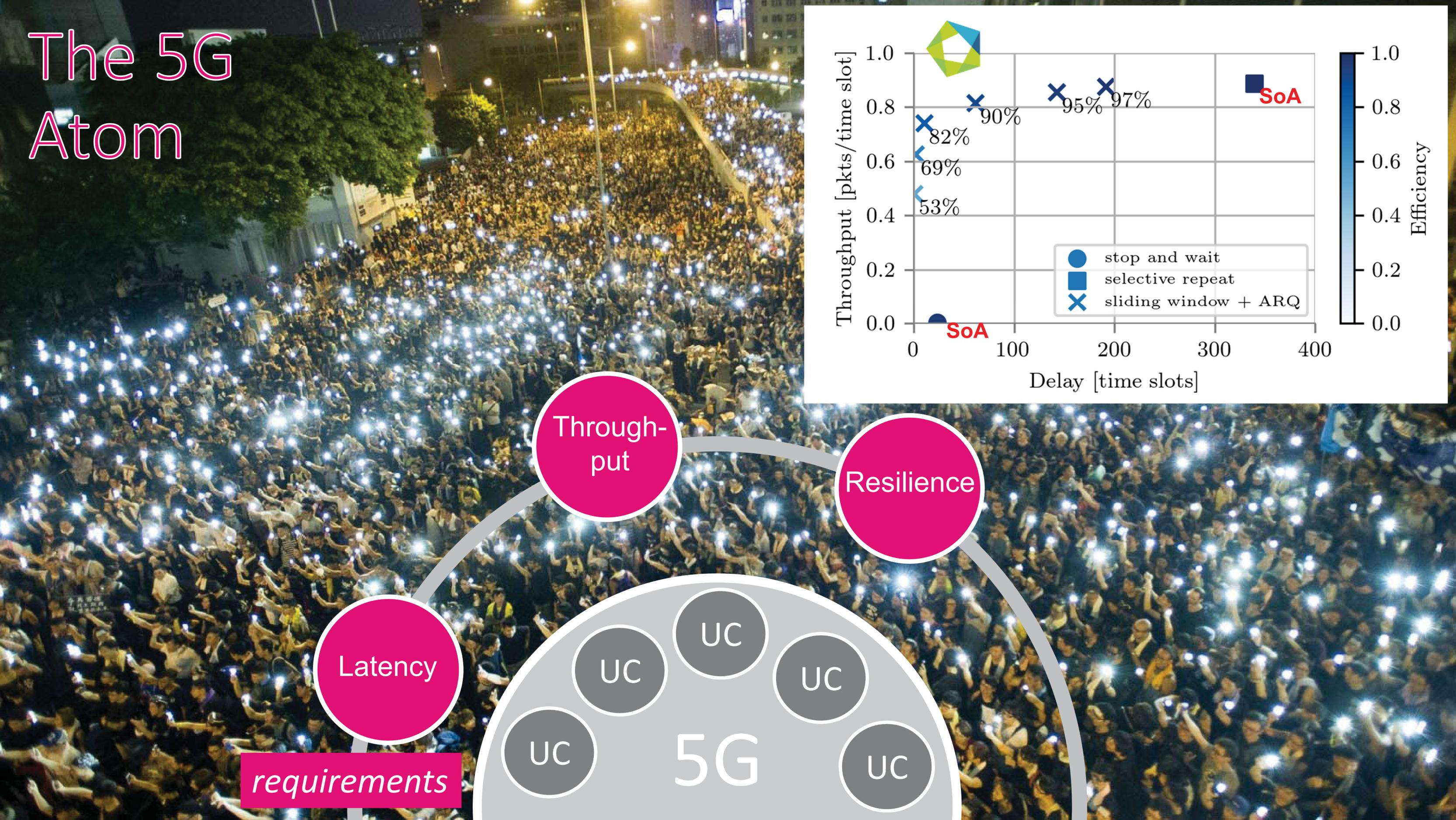


PUBLIC SAFETY



ESSENTIALLY, THE SAME PRODUCT. JUST DIFFERENT CONFIGURATIONS

The 5G Atom

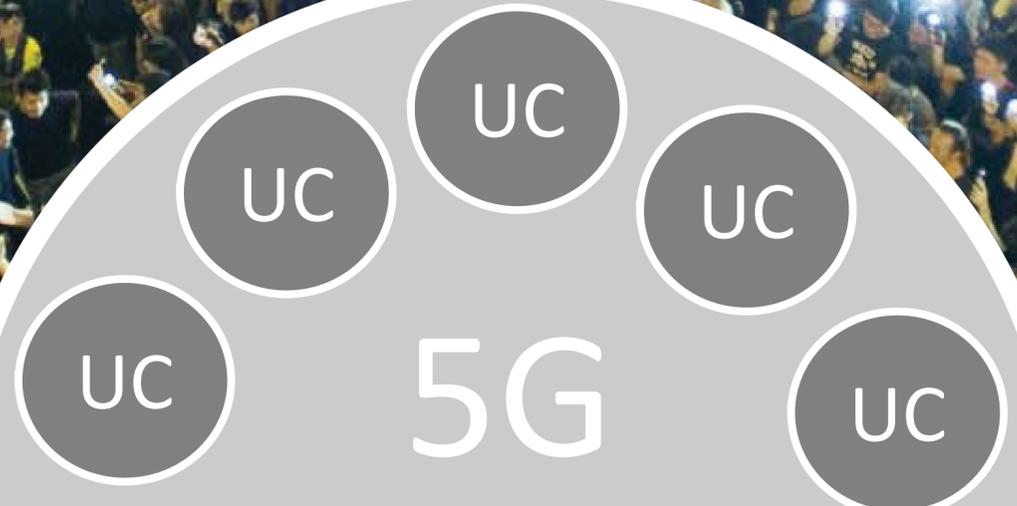


Throughput

Resilience

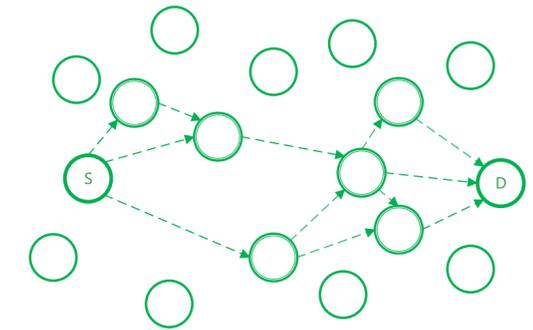
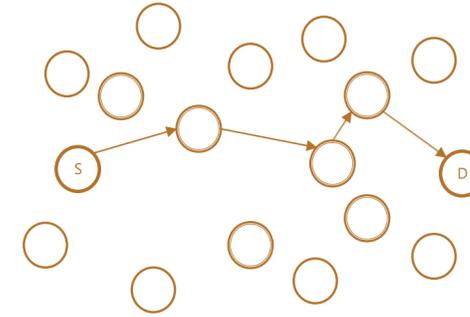
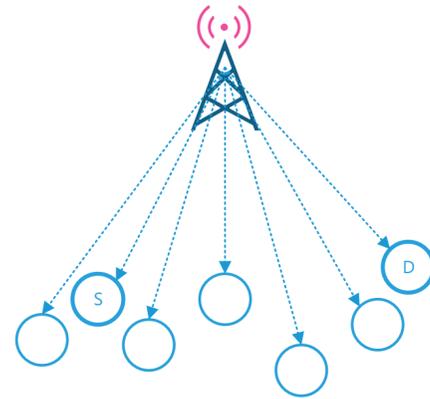
Latency

requirements



OUR MESH

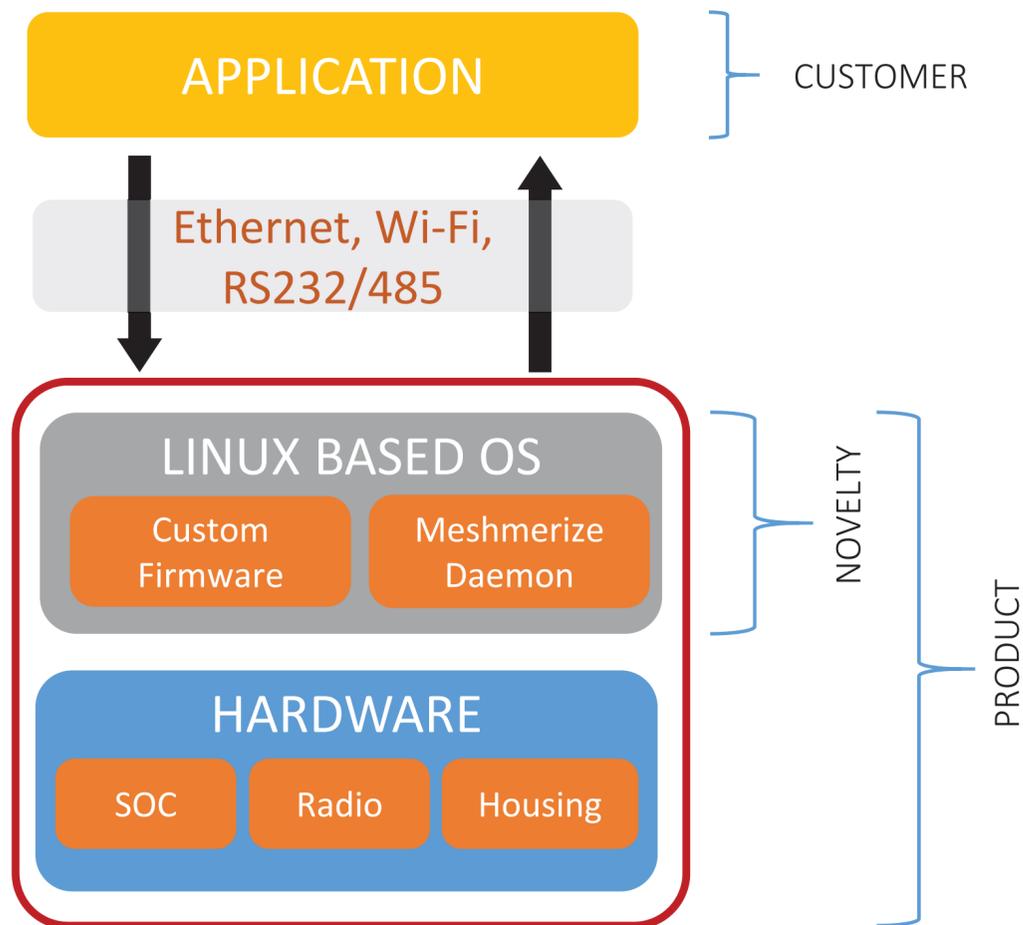
WHAT DO WE DO DIFFERENTLY



	LTE	STANDARD WIFI	CLASSICAL MESH	MESHMERIZE
SETUP COMPLEXITY	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
ROUTING	Master-Slave	Master-slave	Single path	Organic Multipath
LATENCY	10ms-500ms	10ms – 500ms	1ms – 2000ms	1ms – 50ms
SAFETY CRITICAL	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
MOBILITY	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
FAILOVER TIME	No Self healing	No self healing	3s to 15s	< 50ms
THROUGHPUT	3 - 150Mbps	3 – 500Mbps	1 – 20 Mbps	3 – 50 Mbps

PRODUCT WHAT DO WE MAKE

MESHMERIZE IN A BOX



MESHMERIZE AS AN APP

