

Smart Farming: Agriculture 4.0 as an IoT-Plattform

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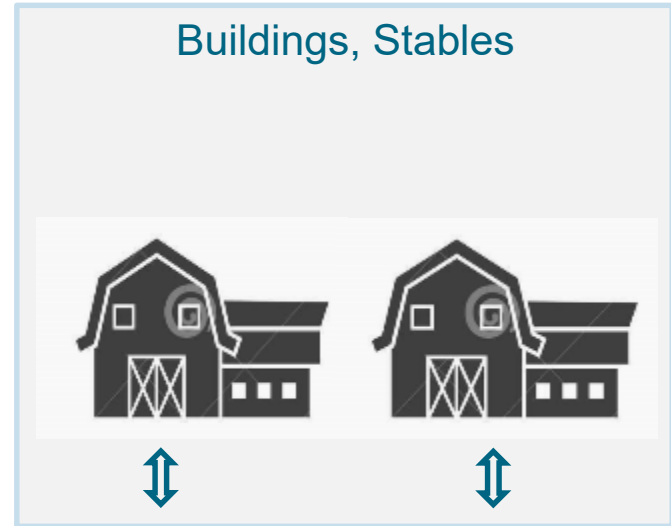
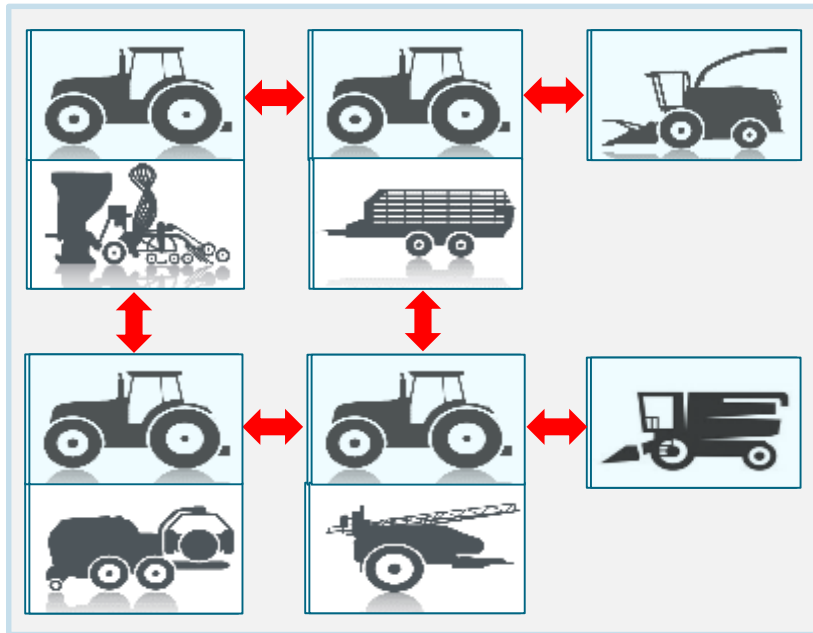
22. November 2018

23rd LEIBNIZ-CONFERENCE OF ADVANCED SCIENCE, Lichtenwalde

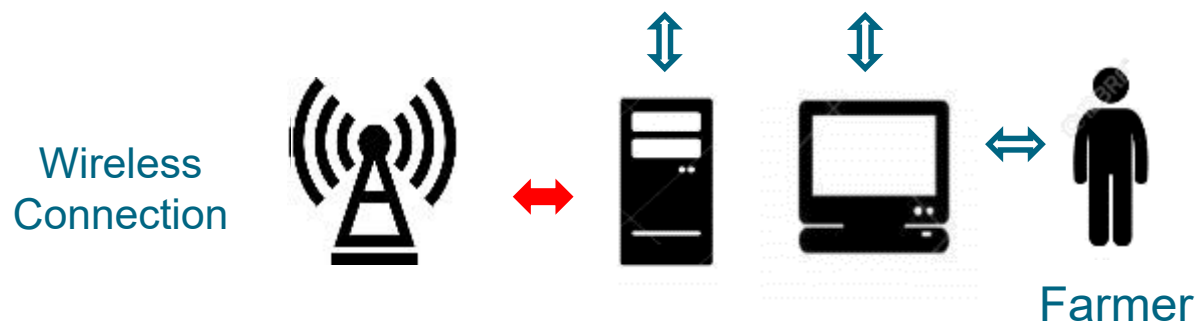
Future Farming



Satellites, Drones
Navigation, Communication,
Remote sensing



Farm Management Information System



What is digital farming?

Consistent linking of individual process steps with digital information

Example: plant production process



Tillage
soil cultivating

Planting
seeding

Fertilizing
spreading

Crop protection
spraying

Harvesting
chopping

Transporting
logistics



What is digital farming?

Consistent linking of individual process steps with digital information

Example: animal husbandry process



Breeding

Feeding

Milking

Fattening

Transporting
logistics

Slaughtering



What is digital farming?

Consistent linking of individual process steps with digital information

Example: processes along the food value chain



Agricultural chemistry

Agricultural traders

Agriculture & livestock farming

Grain mills & dairies

Food industry

Food distribution



Use Cases

In

Agriculture

Use Case Categories

a. Process data exchange

- Positions, velocities
- Maps and tracks
- Content of displays



b. Cooperative machines

- with and without mutual control
- Tractor to implement communication
- Tractor to car communication



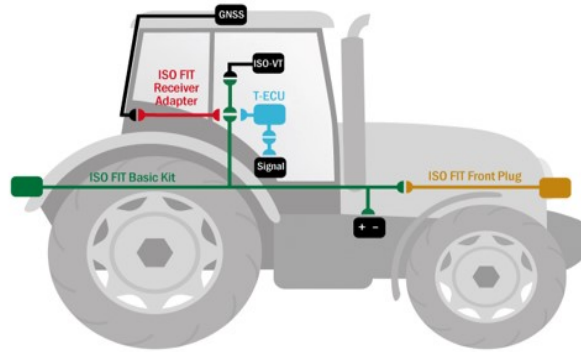
c. High volume data exchange

- Driver assistant system
- Live streaming media
- Virtual / augmented reality



Use Case Ranges

Ultra-Short Range



Mid Range



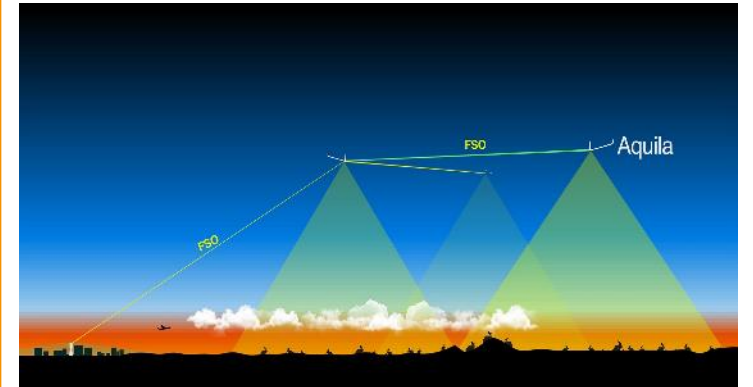
Long Range



Short Range



Ultra-Long Range



Ultra-short Range

Replacing wired field buses



Ultra-short Range

Connecting cameras



Short Range

Process

Truck transports

Machines

2



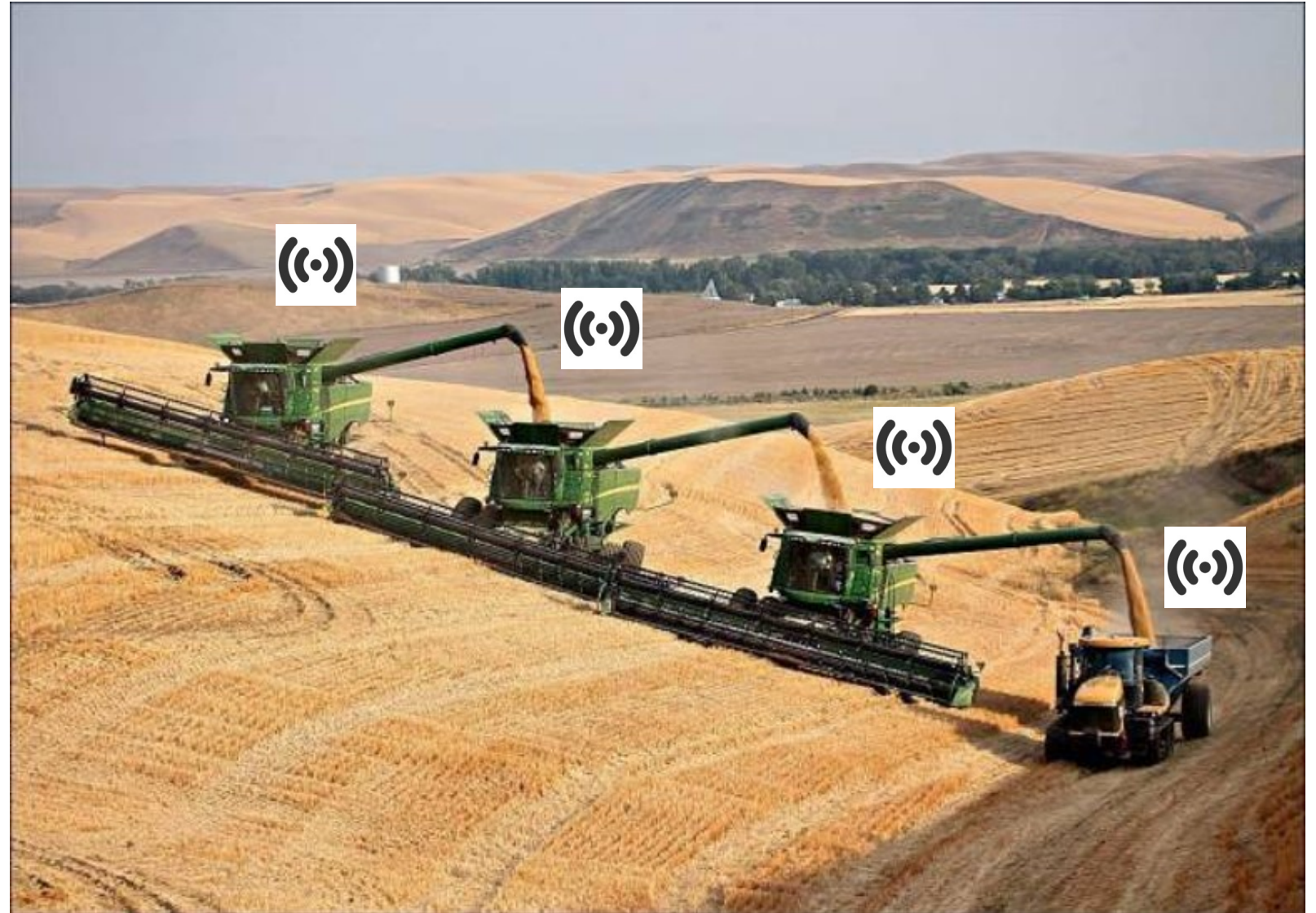
Short Range

Process

Golden harvest

Machines

4



Mid Range



Connecting drones to machines and process automation

Mid Range



Process Golden harvest
Machines 7

Mid Range



Process **Sowing**
Machines **3**

Mid Range

BoniRob

Amazone, Bosch

Deepfield Robotics

From 2012 to 2015

Electric drive

Autonomous navigation

Multi-purpose platform

Application modules for

Planting, weeding, etc.



Mid Range

Project See & Spray

John Deere

Blue River Technology

From 2012 to 2017

Computer vision

Machine learning

12 km/h, 18 rows

80% less herbicides



Mid Range



Project Xaver

AGCO - Fendt

Mobile Agricultural Robot Swarm (MARS)

from 2015 to 2017

Electric drive

Satellite navigation

Cloud based control

1 ha / h / robot



Mid Range

Agricultural drones

Applications

Remote sensing

- Multi-spectral plant observation
- 3D field mapping
- Field accessibility (humidity)

Communication servers

Mobile edge clouds

Spraying on hillside locations

...



Mid Range

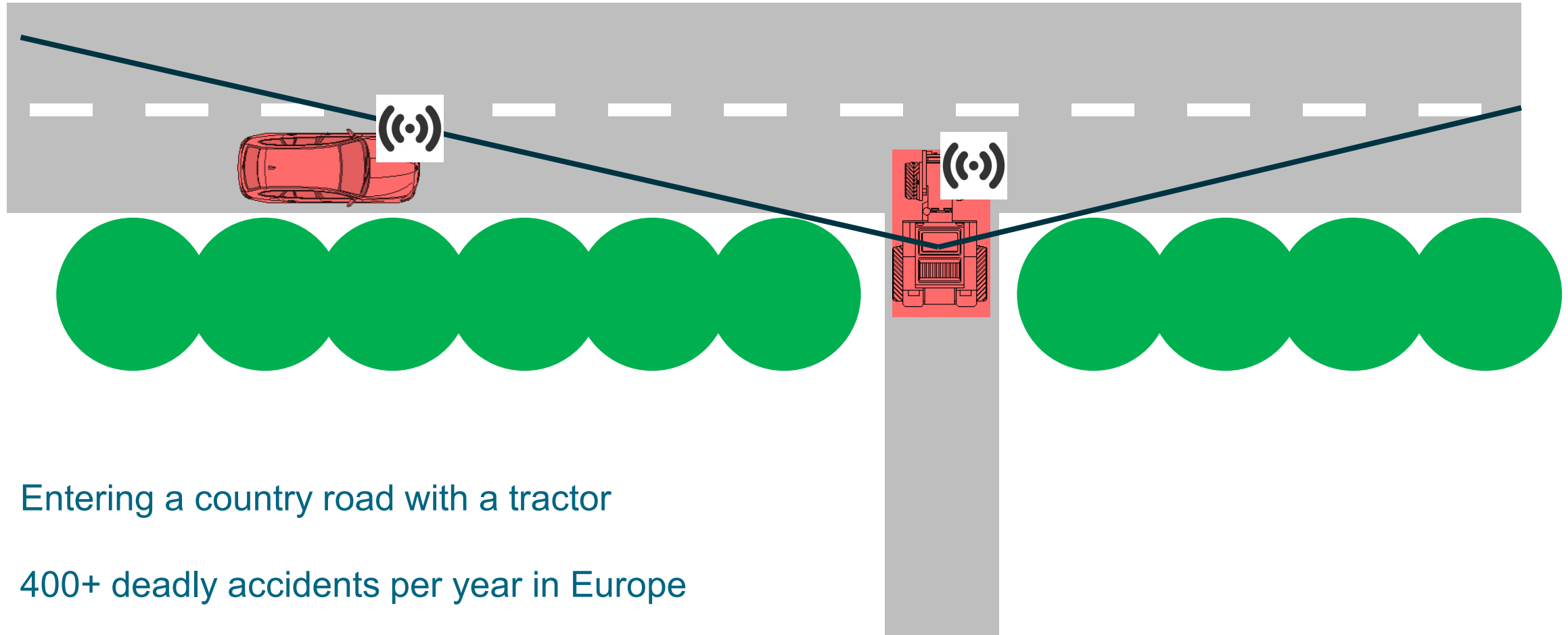
Agricultural robots

Some examples



Mid Range

Typical dangerous traffic situation (tractor, car)



Entering a country road with a tractor

400+ deadly accidents per year in Europe

Source: EC

Mid Range (non-cooperative machines)



Mid Range



Large Vehicle Alert System

Cloud to Cloud Lösung (Claas, Here)
Claas and BMW, 11/2017

Mid Range



WIFI-p (G5)

Range 2000 m free sight
 400 m within forest
John Deere and AEF, ETSI, Car2Car, 10/2018



Mid Range

Continental

no steering wheel, no mirrors

Innovative Tractor Cab

front 3D camera, proximity sensors



Long Range

Process
Transport

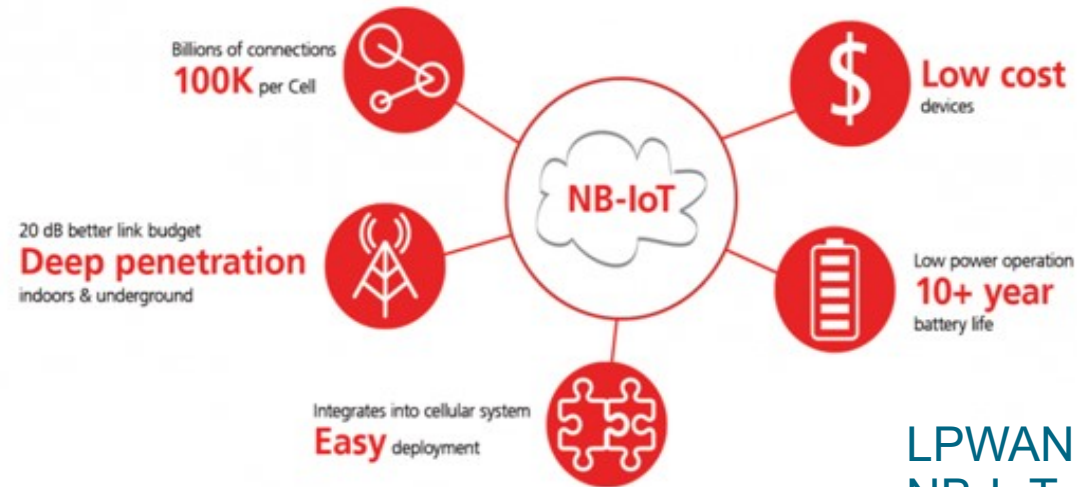
Machines
many



Long Range



Viability parameters



LPWAN Low Power Wide Area Network
NB-IoT Narrow Band Internet of Things

Use Case Requirements



		Process Data exchange	Cooperative Machines	High volume data exchange
Ultra-short range	< 5 m	X	X	X
Short range	< 25 m	X	X	X
Mid range	< 1 km	X	X	X
Long range	< 25 km			X
Ultra-long range	< 100 km			X
Resilience	%	0,01	0,001	0,1
Latency	ms	10	1	100
Throughput	Mbit/s	100	10	1000

Activities of the German government for digitization in agriculture



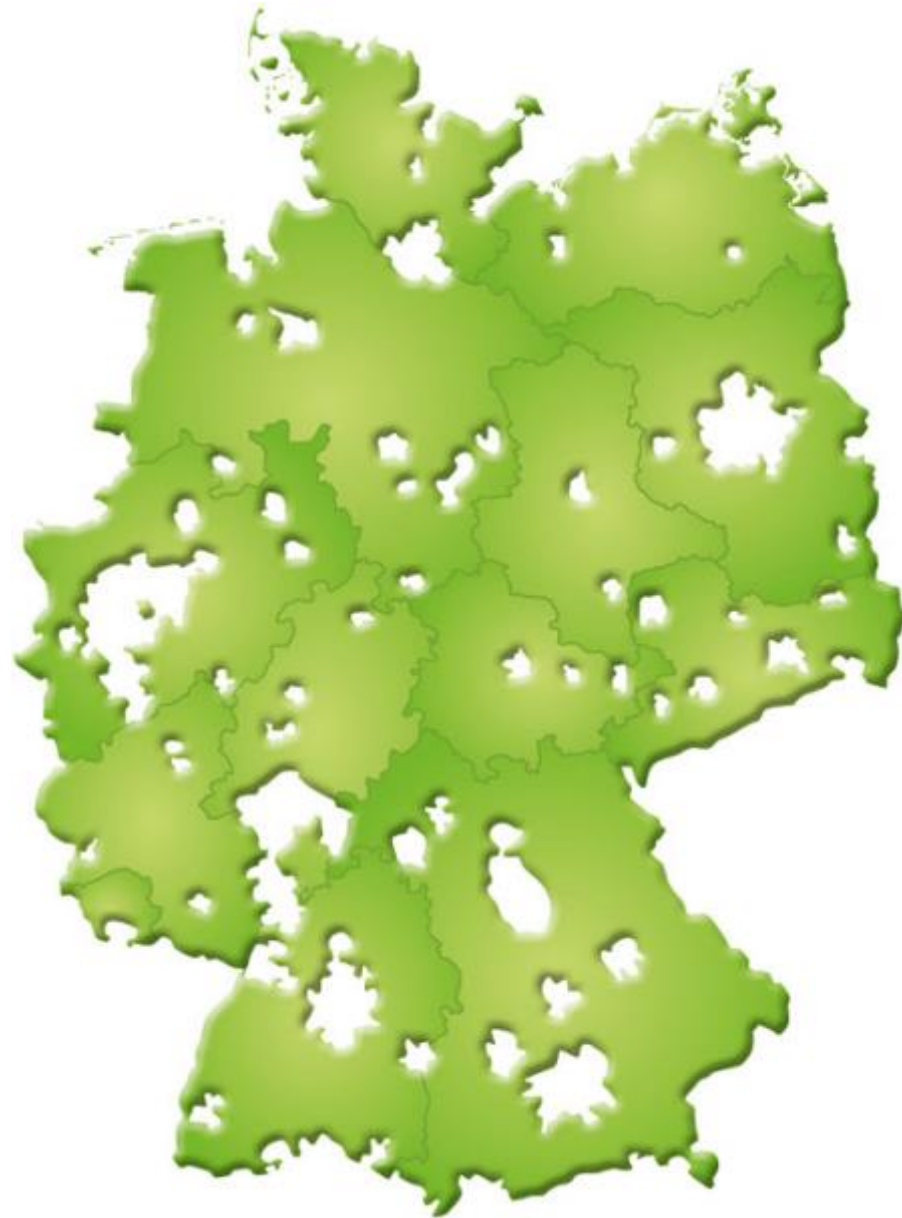
5G-Strategy for Germany BMVI



Digital Policy Agriculture BMEL



Germany's rural area



BMEL Federal Promotion Program



„Digital Agriculture“

Submissions 25.9. to 9.11.2018
Project time 2019 to 2022
70 Mio. € federal funding
x Mio. € state funding

5 to 10 model regions

Bayern	Passau
Sachsen	Meißen
Niedersachsen	Osnabrück
Brandenburg	Luckau
Sachsen-Anhalt	Bernburg
Nordrhein-Westfalen	Düsse
Mecklenburg	Neubrandenburg
Baden-Württemberg	Hohenheim

...



Gefördert durch:



Bundesministerium
für Ernährung
und Landwirtschaft

ptble

Projekträger Bundesanstalt
für Landwirtschaft und Ernährung

aufgrund eines Beschlusses
des Deutschen Bundestages

Model region in Saxony



Simul+

- Announcement on 22.08.2018
- 250 guests in Radebeul
- Julia Klöckner
- Michael Kretschmer

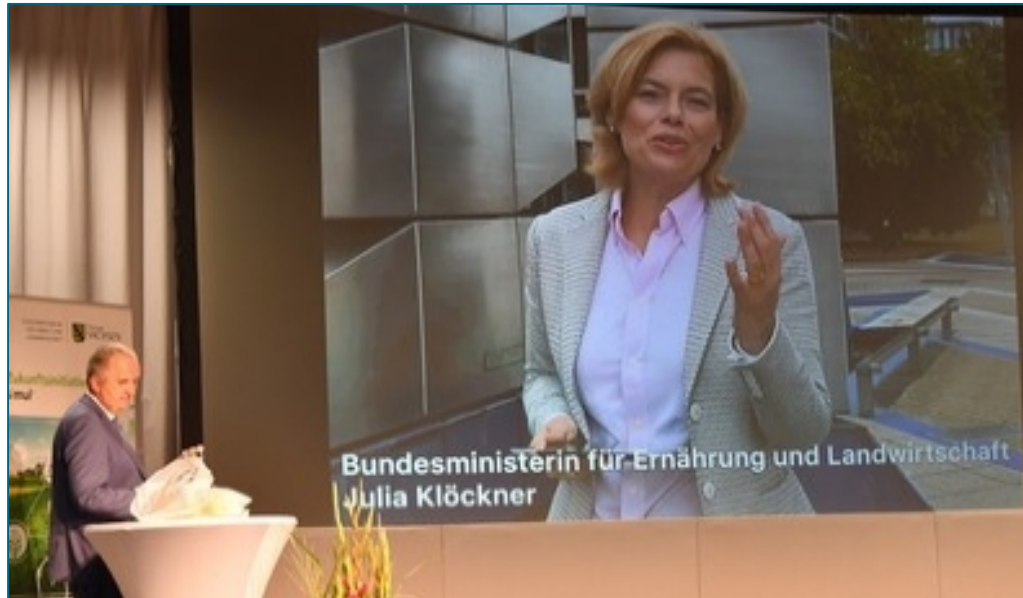
Funding

Saxon funding

- Communication infrastructure 8 Mio.€
- Agricultural use cases 8 Mio.€
- Traffic infrastructure 4 Mio.€

Federal funding

15 Mio.€



Teilprojekte (TP) des SIH

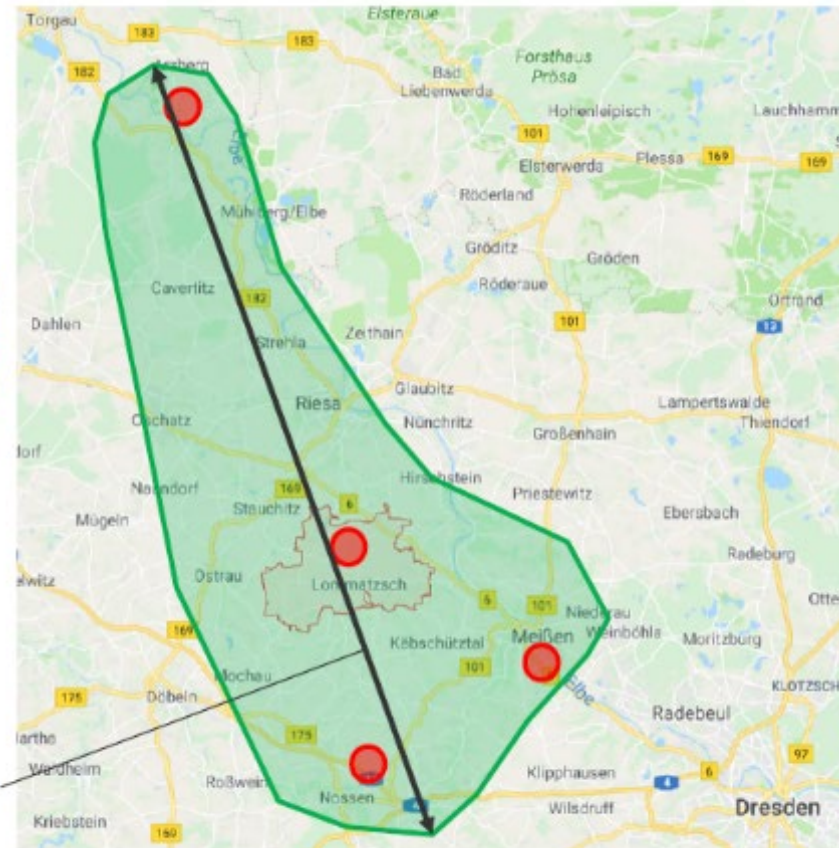
- TP 1: Aufbau einer 5G-Kommunikationsinfrastruktur (gefördert vom BMEL)
- TP 2: Test- und Demonstrationsfeld Smart Farming
- TP 3: Kreislauftechnologien und Nachhaltigkeit
- TP 4: Land- und Forsttechnik
- TP 5: Digitalisierung im ländlichen Raum

Model region in Saxony



Kommunikationsinfrastruktur ländlicher Raum

Modellregion



ca. 55 km

Simul+

TU Dresden

– Agrartechnik

– 5GLab

FhG IVI

Nokia, etc.

Kickoff on 6.12.2018

2019 to 2022

35+ Mio. €

200 qkm

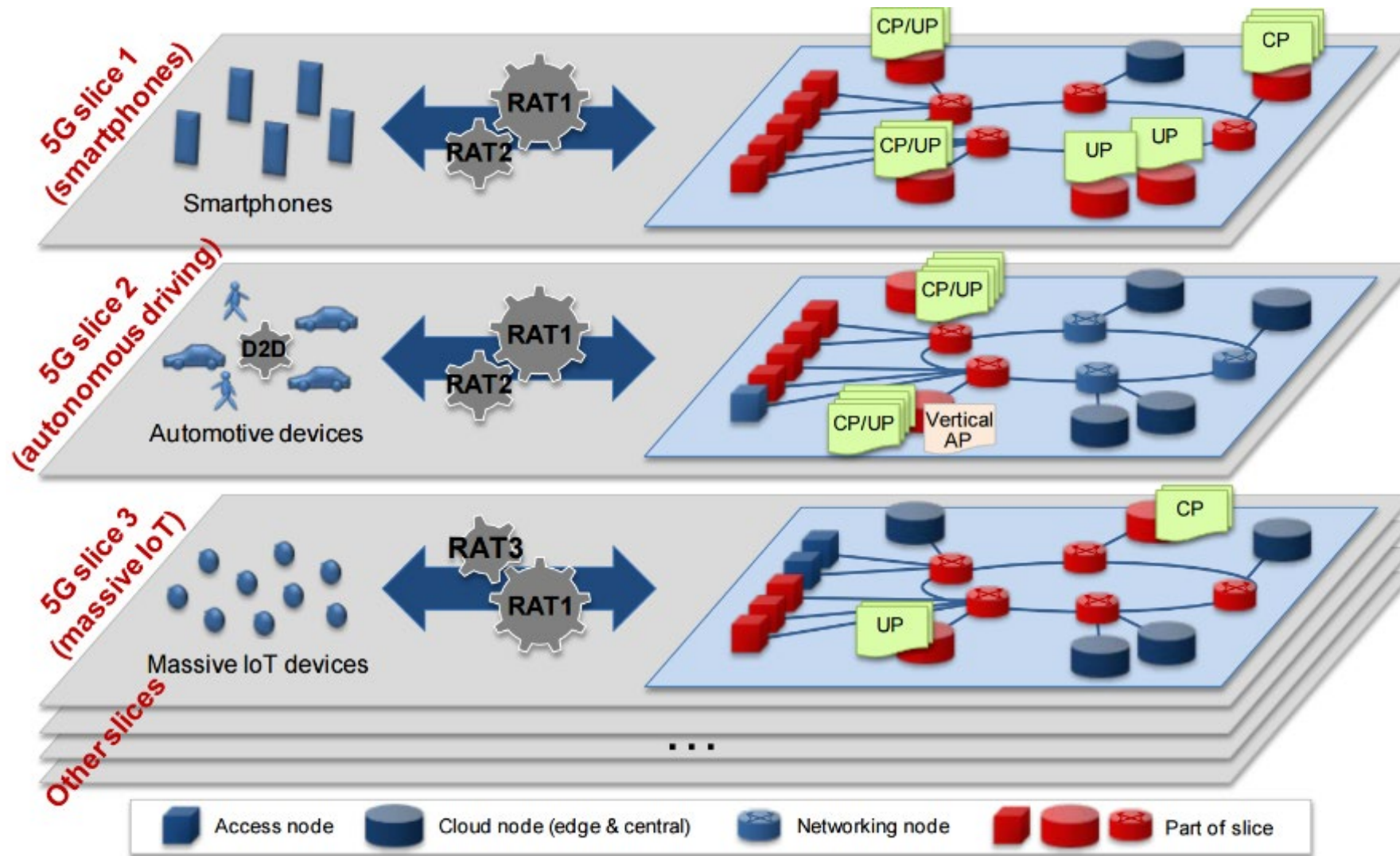
20+ antennas

2G to 5G networks

100% coverage

3,7 to 3,8 GHz

5G - Network slicing



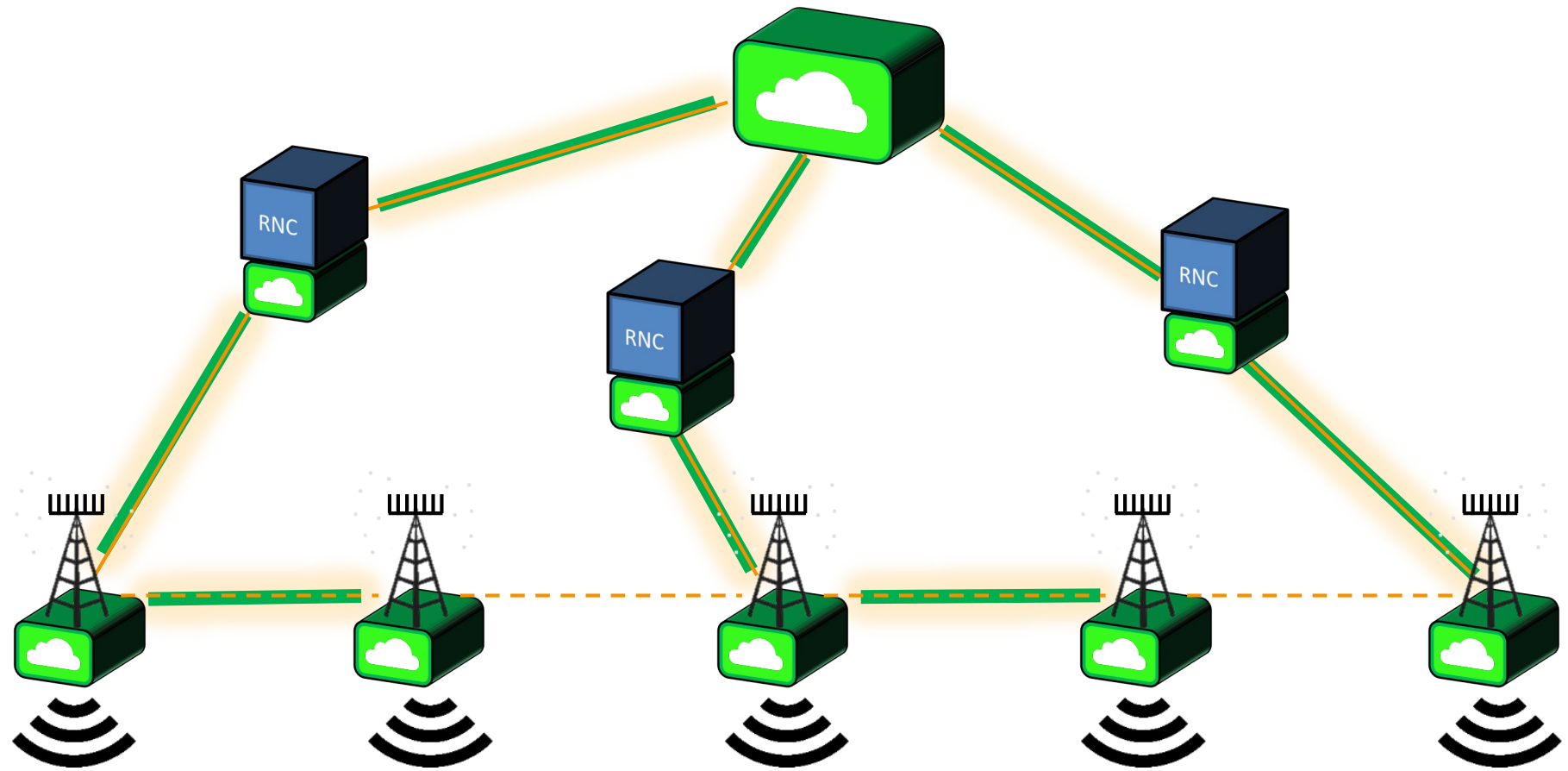
5G - Latency and real time requirements



Cloud

Micro cloud

Edge cloud

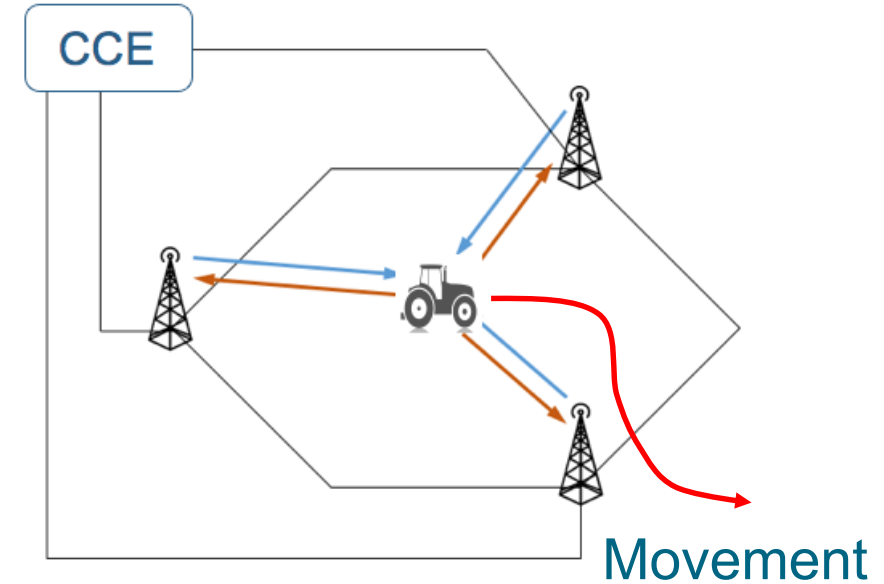
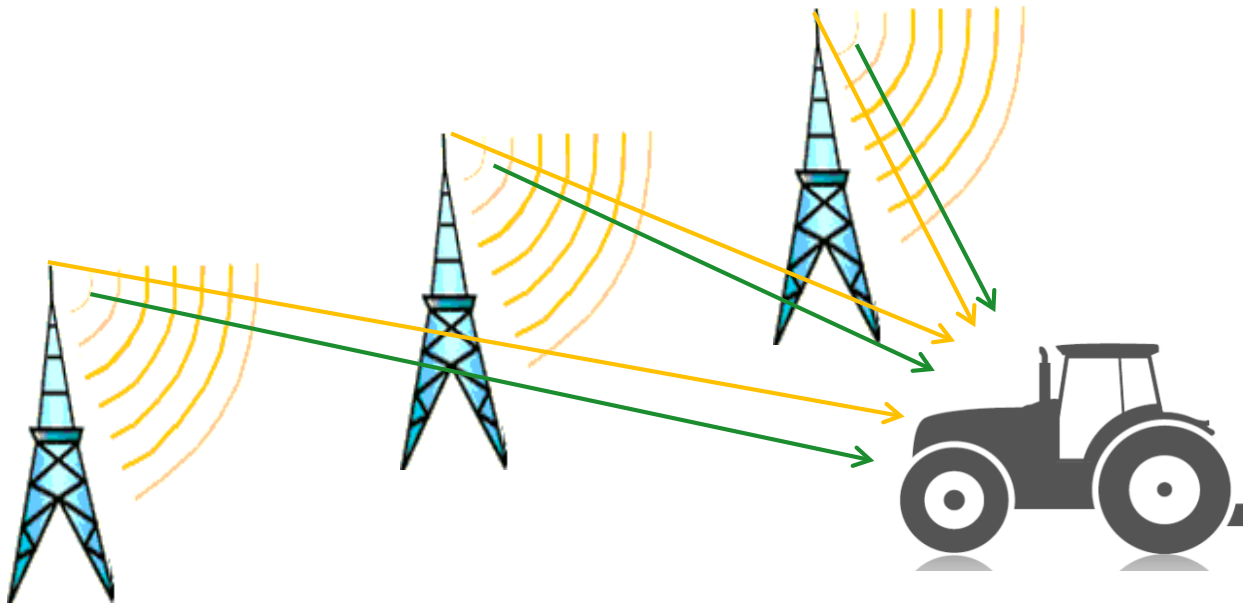


5G - Resilience



CCE: Connectivity
Coordination Entity

# uncorrelated channels	1
Outage Probability	3%



Challenge

dynamic numbers of links and handovers

5G - Throughput

