

Technical Overview

Dr. Dirk Hetzer

DTAG

Dirk.Hetzer@t-systems.com

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Focus of the innovation

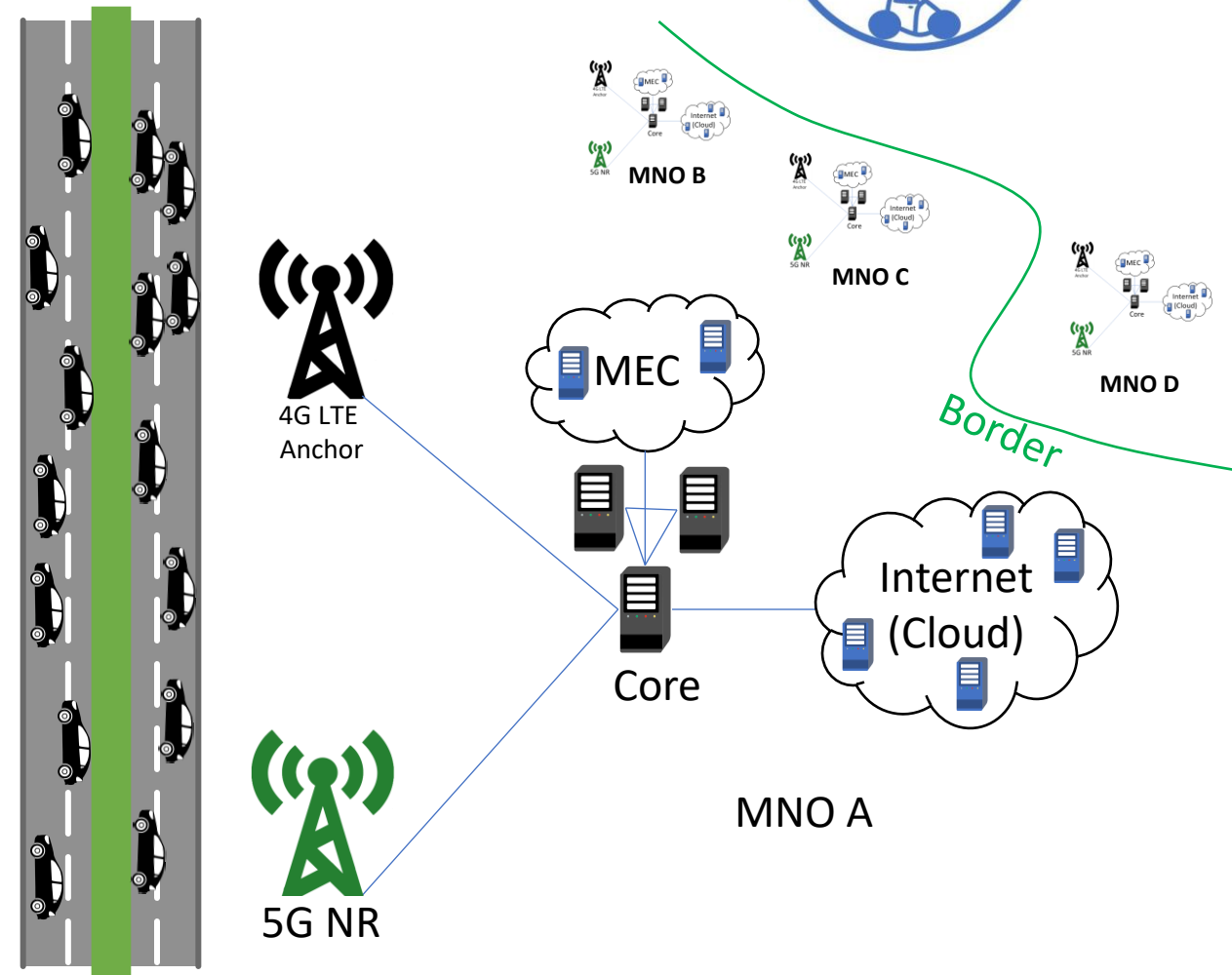
- **5G Technology** features
 - Cross-border/MNO/vendor/generation Operation
 - Distributed Computing enabled by Mobile Edge Computing (MEC)
 - New Radio
 - Network Slicing
 - Predictive QoS
 - Improved Positioning
- Recommendations for **Regulation** and **Spectrum**
- Identification of **new business model** opportunities
- Impact on **standardization** (3GPP, ISO, ETSI, SAE, ...)

Mobile Edge Computing (MEC)

- Local breakouts enable MEC
- Serves small geographic areas with low delay

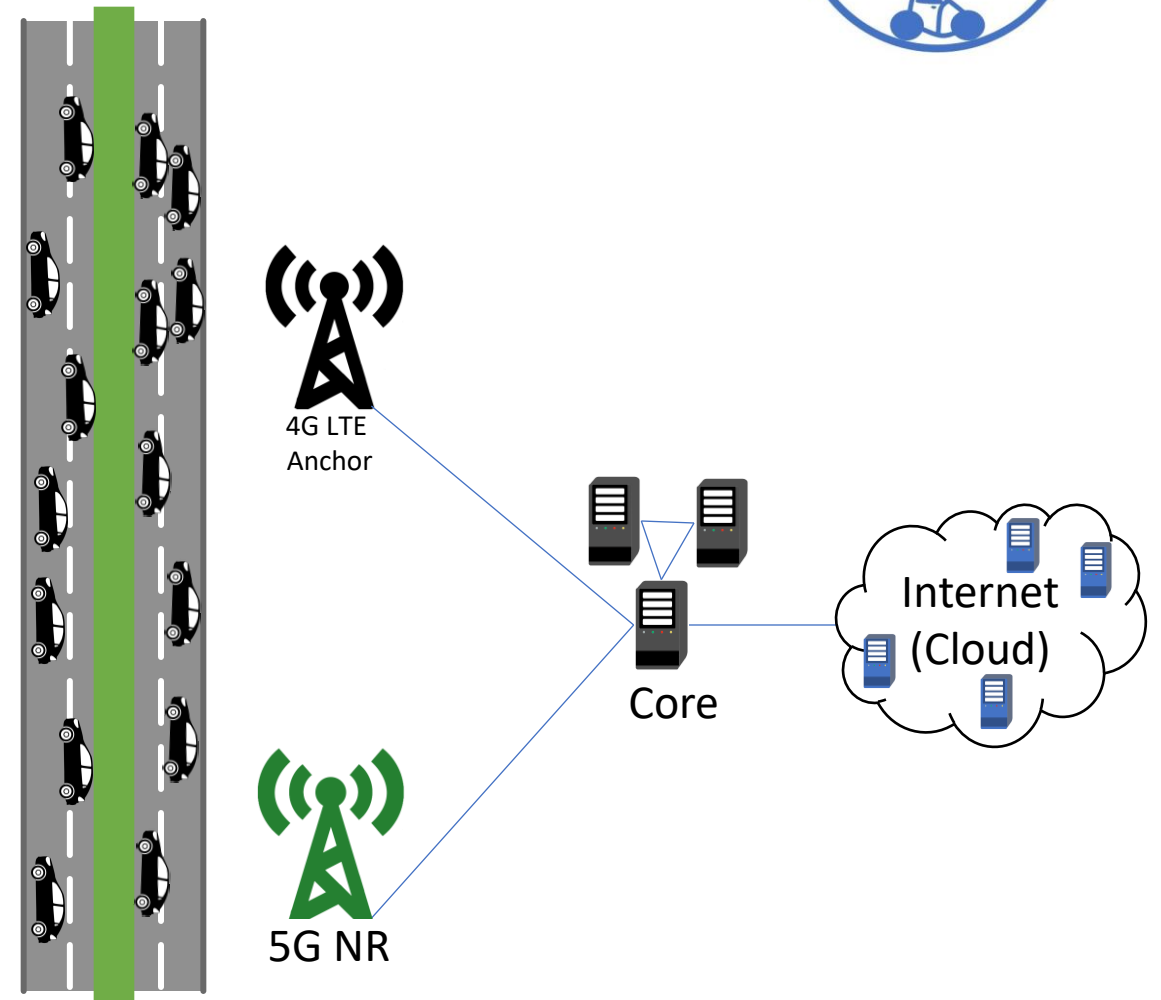
Challenges:

- Better transport network vs. MEC closer to base stations
- Service continuity, also cross-MNO
- Integration with road traffic authority clouds
- Localization and geocasting



5G New Radio (NR)

- Increased system capacity
- Enhanced reliability
- Reduced latency



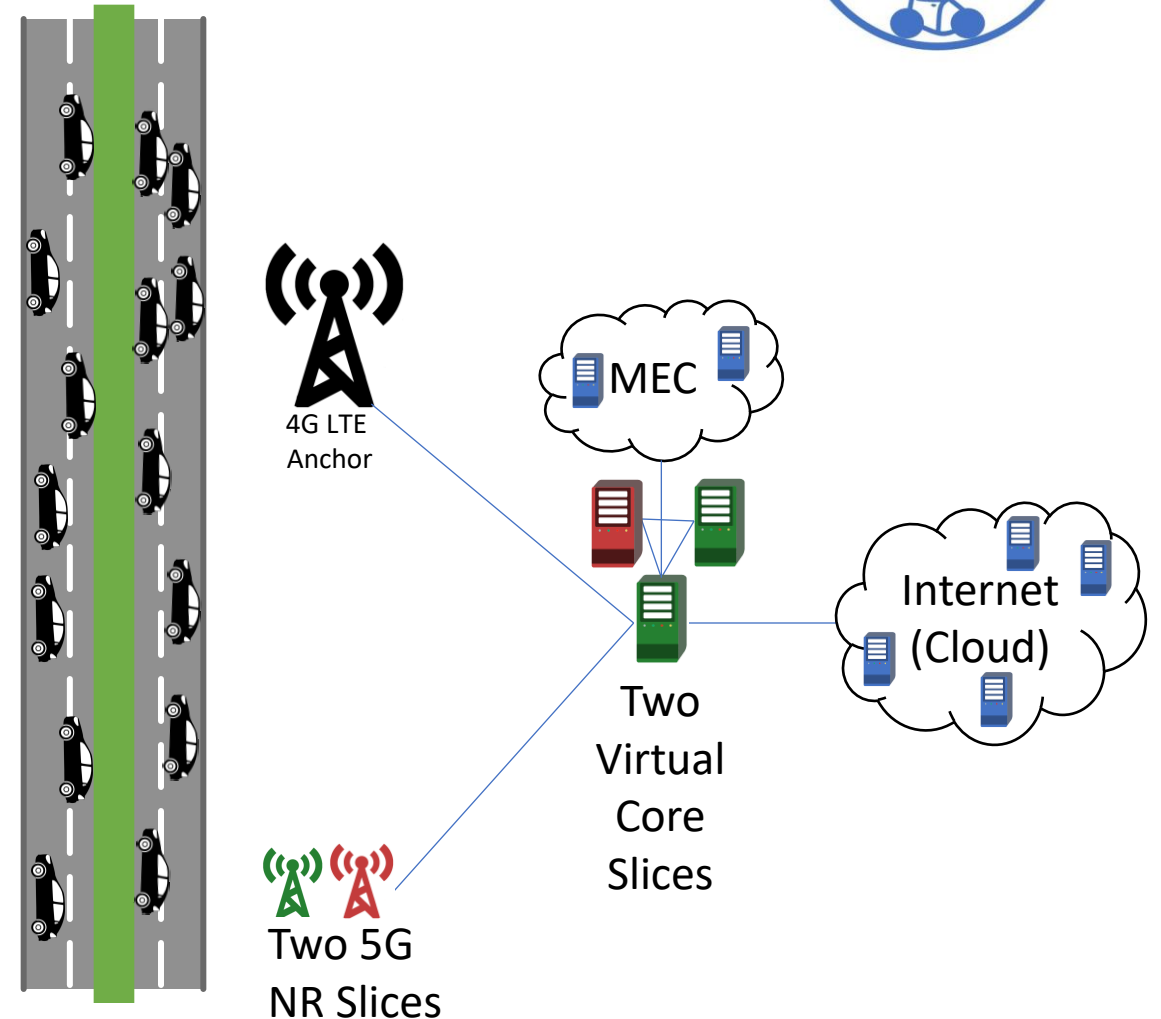
E2E QoS with Network Slicing



New degrees of freedom:

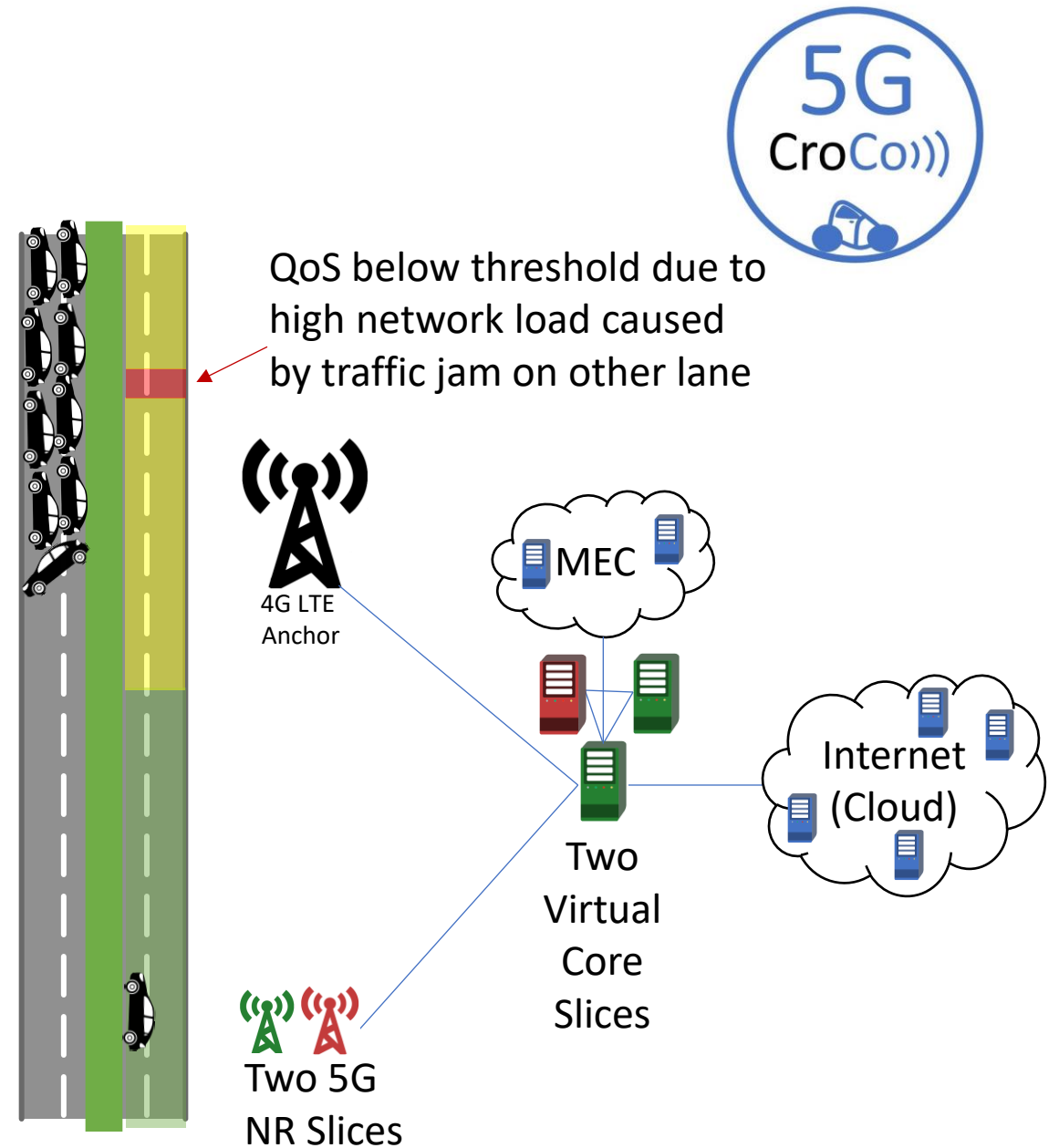
- Individual virtual Network Functions (VNFs) per Slice
- VNF configuration optimized for V2X
- VNF deployment optimized for V2X
- General purpose slice vs. V2X specific one: which service served where?

➔ Obtain universally applicable best practice and MNO specific one



Predictive QoS

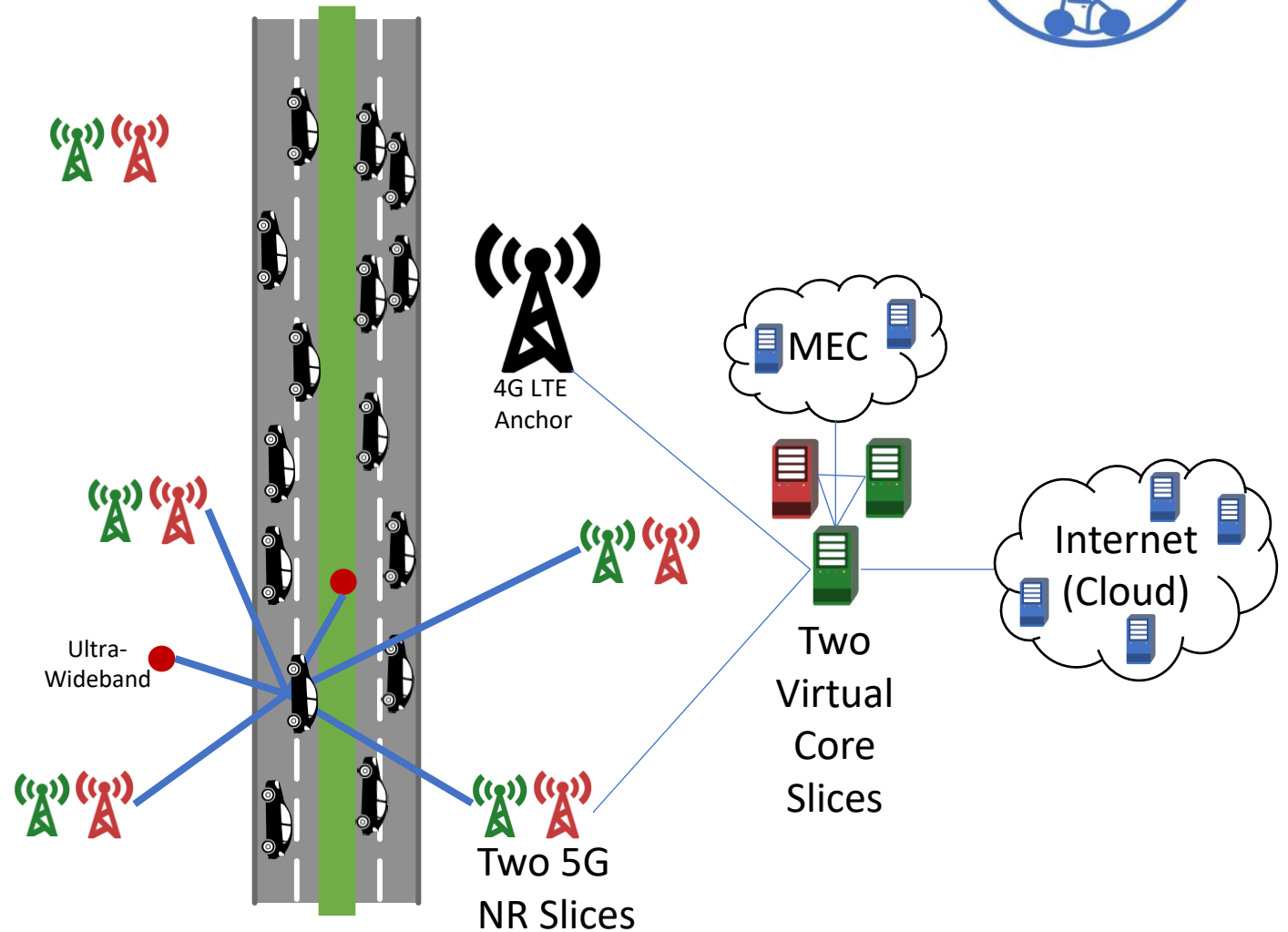
- Reliably predict QoS at given location
- Assure functional safety even if QoS below threshold
- Evaluate in realistic scenarios
- Evaluate network to application interfaces incl. cross-MNO / cross-border aspects



Network Supported Precise Localization



- Precise positioning + information about position integrity
- Lane accurate (cm accuracy)
- Seamlessly integrated into overall architecture with cross-MNOs and cross-border support
- Radio Access Technology (RAT) (in)dependent and hybrid





Use Cases

5GCroCo – Pilots & Testing

The 5G Croco Project has identified 3 use cases

- Tele-Operated Driving (ToD)
- High Definition Map Generation and Distribution for Autonomous Driving (HD Maps)
- Anticipated Cooperative Collision Avoidance (ACCA)

5G CroCo will implement, roll-out and showcase these Use Cases.

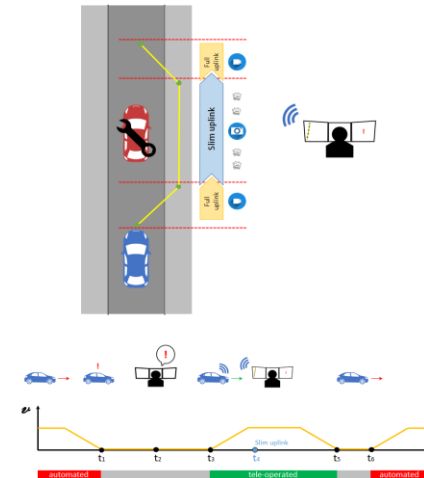
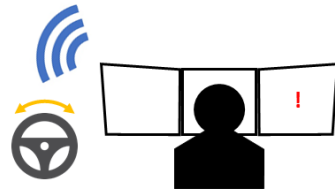
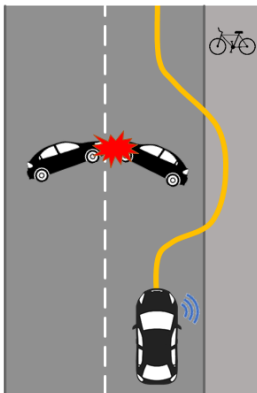
- First on small scale Pilot sites in Barcelona, UTAC-Monthléry, Munich, A9 Germany,
- And finally on a Large Scale Cross-Border Corridor between Germany, France and Luxemburg



Use Case 1 Status Overview



- User stories
 - #1 - Remotely Controlled Maneuvering (direct control, low velocity)
 - #2 - Remotely Controlled Trajectory-based Driving (indirect control, low velocity)
 - #3: Remotely Controlled Trajectory-based Driving on Rural Crossed Country Road (indirect control, high velocity)
 - #4: Slim Uplink for tele-operated driving (ToD) (low speed and small scale)



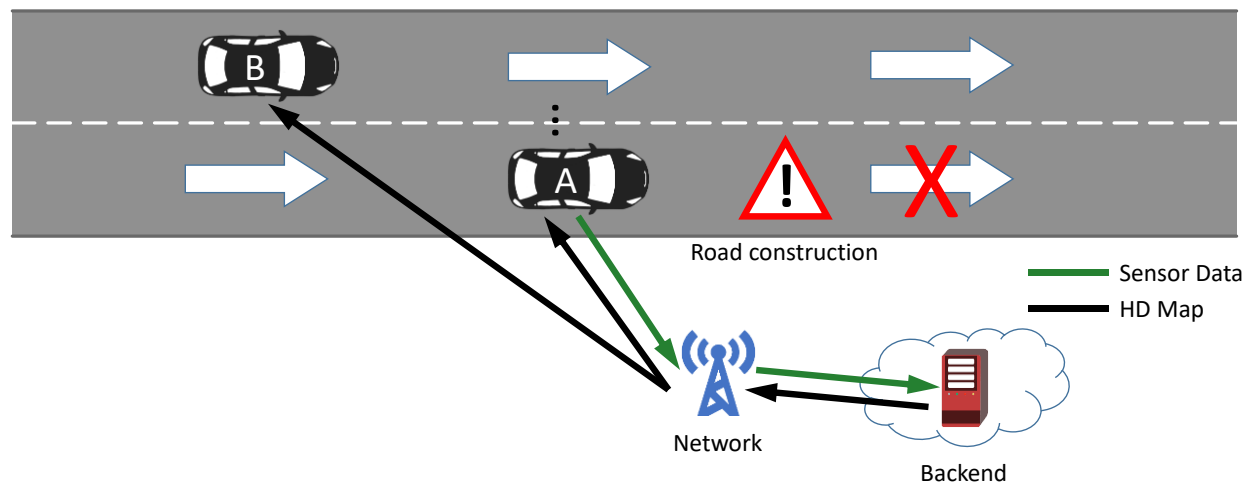


Use Case 1 Main KPIs

- Radio Latency: < 40 ms
- E2E Latency: < 100 ms
- Reliability
 - Uplink: > 99 %
 - Downlink: > 99.9 %
- Data Rates
 - Uplink: up to 50 Mb/s
 - Downlink: up to 500 kb/s

Use Case 2 Status Overview

- User stories
 - #1 – Streaming the map to the car
 - #2 – Streaming sensor data to the cloud
 - #3 – Closing the loop
 - #4 - Upload/Download sensor data in non-real time





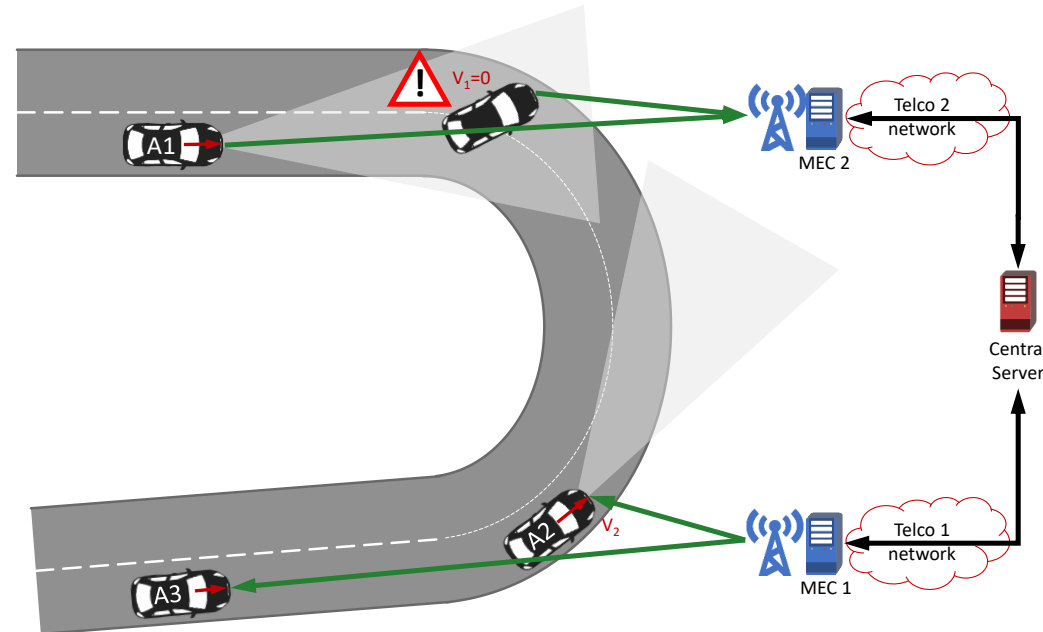
Use Case 2 Main KPIs

- Latency and Data Rate Requirements to be Evaluated
- Seamless Availability of the Service (very high Area Coverage)
- Reliability
 - Uplink: > 99.99 %
 - Downlink: > 99.99 %

Use Case 3 Status Overview



- User stories
 - #1 – Hidden obstacle detection in local area – 3 scenarios
 - #2 – Hidden obstacle detection cross border consideration – 2 scenarios
 - #3 – Cut Out. Critical Information complex maneuver – 1 scenario





Use Case 3 Main KPIs

- Maximum Age of Information: < 500 ms
- Reliability
 - Uplink: $> 99.xxx\%$ (exact Values need to be Evaluated)
 - Downlink: $> 99.xxx\%$ (exact Values need to be Evaluated)
- Data Rates: Small (up to 500 kb/s)

Main 5G Needs of Use Cases

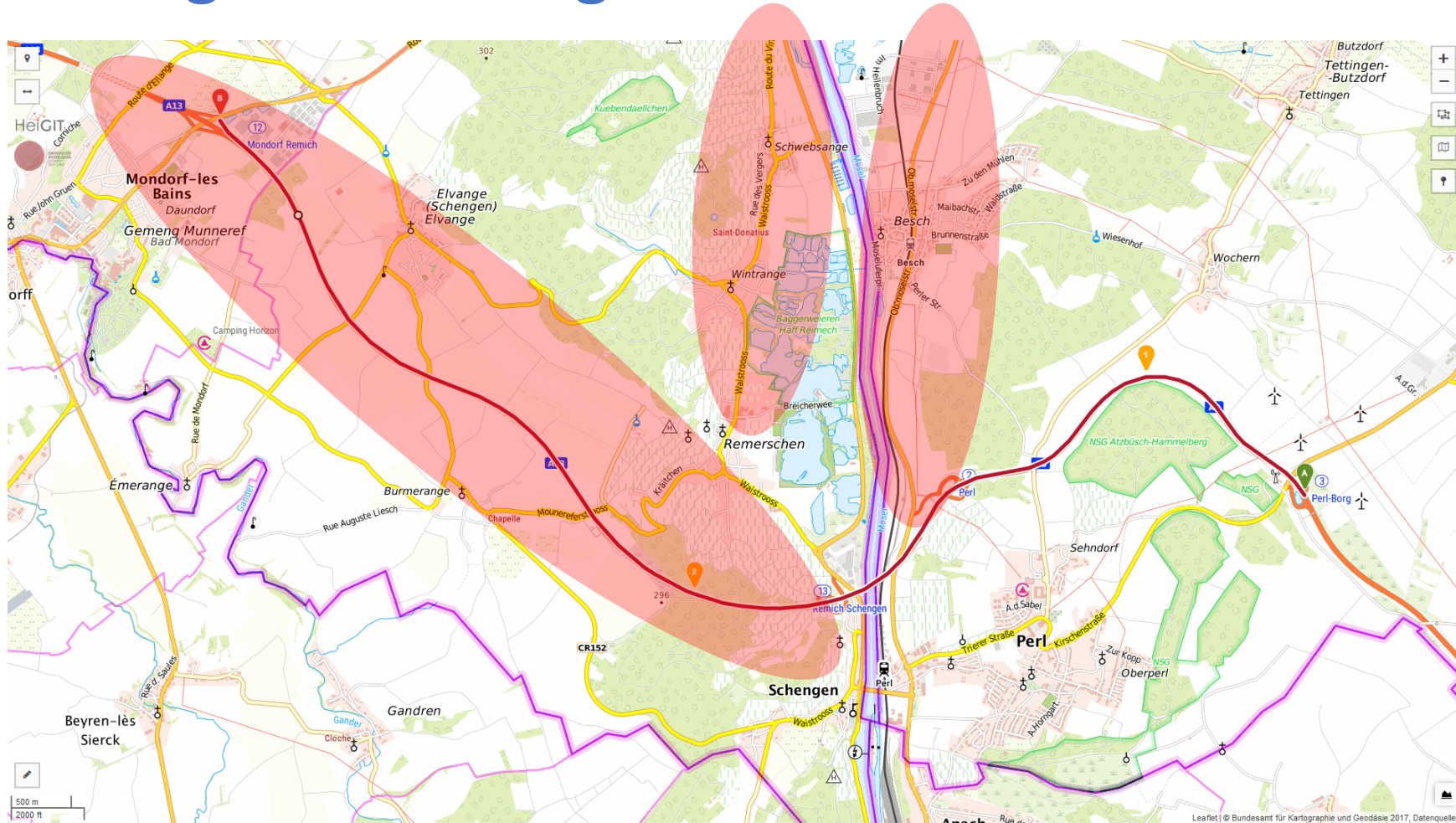


5G Feature	ToD	HD mapping	ACCA
High data rate	X	X	
Functional safety	X		
High reliability	X		X
Low latency	X		X
Seamless availability		X	
QoS prediction	X	X	
Mobile Edge Computing			X

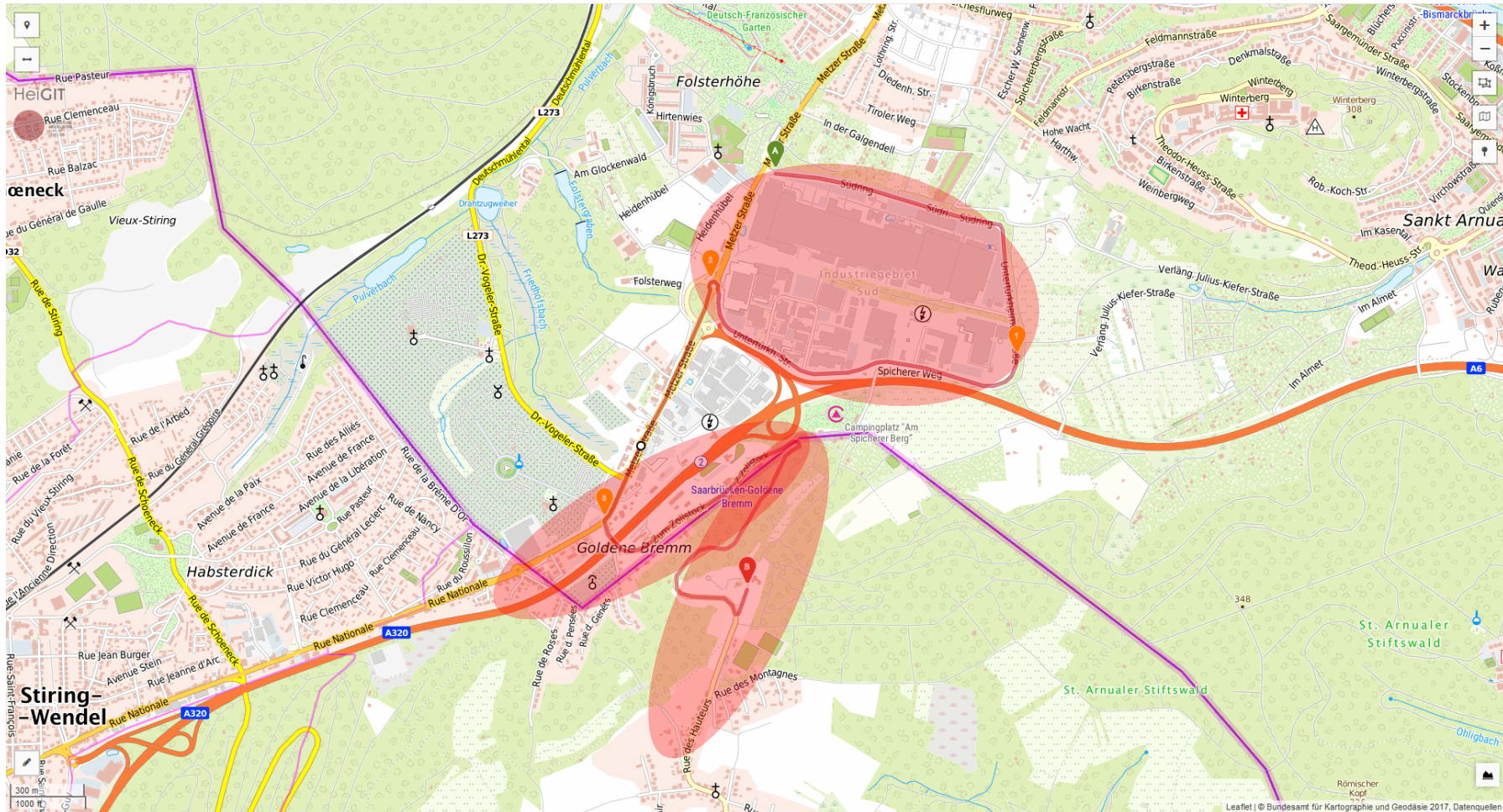


Test Area Selection

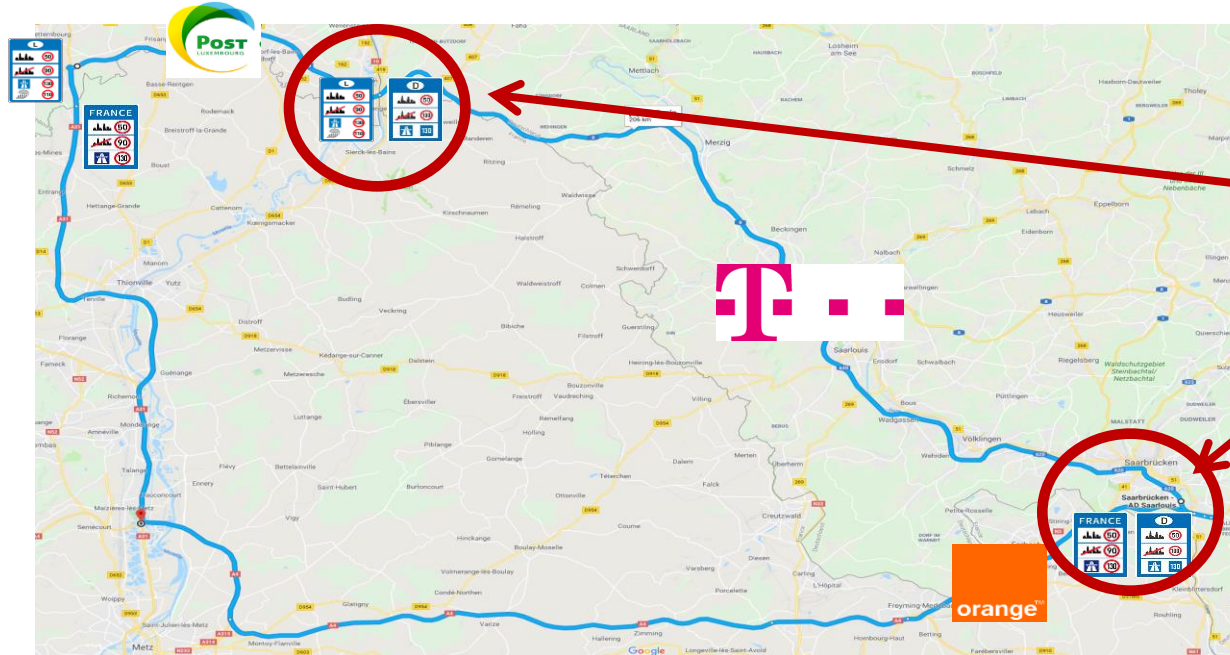
Large Scale Test Site Metz-Merzig-Luxembourg Area



Large Scale Test Site Saarbrücken Area



5GCroCo – Time Line for Pilot Sites



Planned Cross-Border areas
on Large Scale Corridor

Cross-Border Trials (06-09/2021)

Preparation (studies, architecture, development)

Preparation



Trials on Small Scale pilots (07-09/2020)

THANKS!!

Dirk Hetzer

5GCroCo Technical Coordinator

DTAG

Dirk.Hetzer@t-systems.com

To know more:

<http://5gcroco.eu>

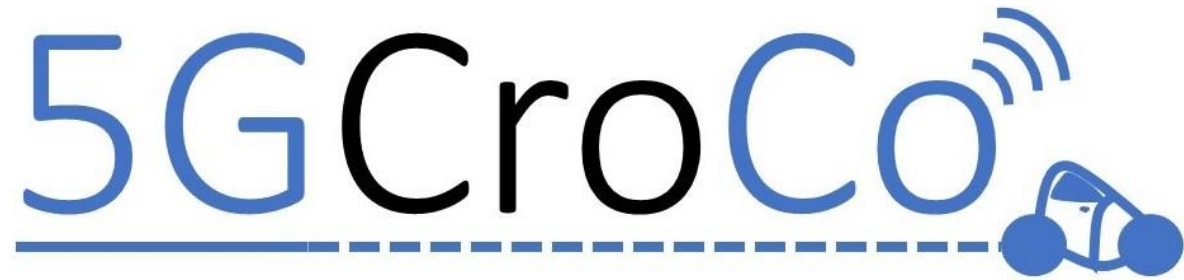
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5G Cross Border Control

Innovation Action H2020-ICT-18-2018
Contract 825050

Cooperative, Connected and Autonomous Mobility (CCAM)
a 5G-PPP Phase III Project

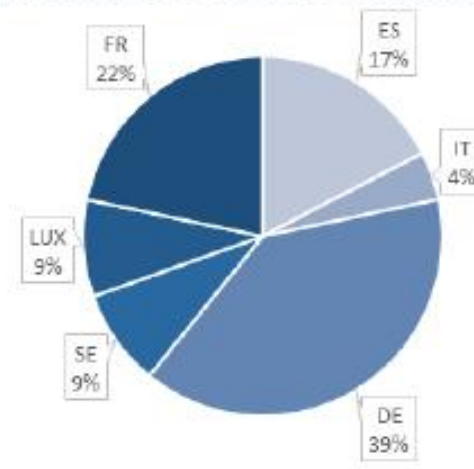
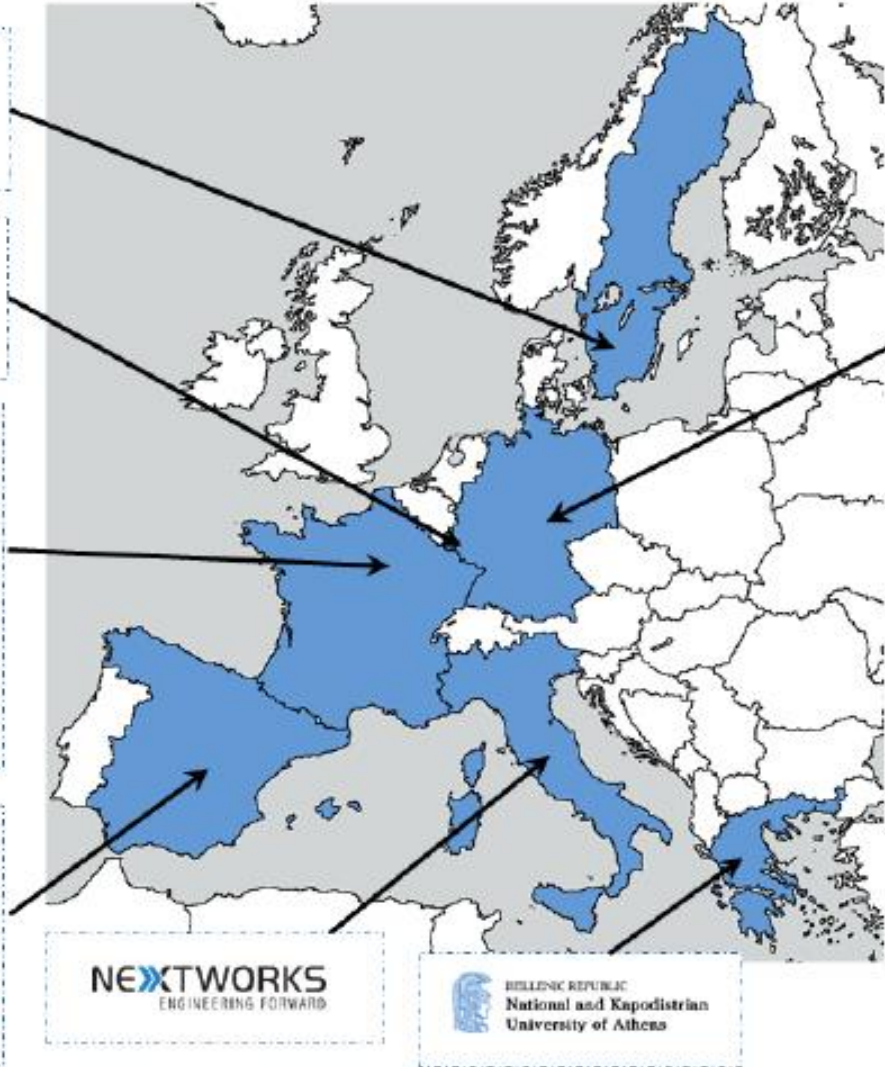


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Backup



5G Large-Scale Trials



Large-scale validation of 5G
along France, Germany, and Luxembourg



Small-scale pilots

- **Motivation:**
 - For integration before large-scale deployment in corridor
 - For generation of outcomes and KPI validation
- Distributed **locations:**
 - France (Montlhéry test track)
 - Germany (Munich City Center and Motorway A9 5G-ConnectedMobility Testbed)
 - Spain (Barcelona City Center)



Expected impact

- Contributions to **standards**
- Contributions to **regulation** and **spectrum**
- **Business models** for new services
- **Security, privacy** and **legal** compliance
- **Dissemination** and **outreach**
- Alignment with **5G-PPP** Goals (KPIs)
- Contribute to European **5G Action Plan**