CHINA'S BELT & ROAD INITIATIVE – ICT: Automated Driving in Luxembourg with 5G networks and satellite communications

CHAMBRE DE COMMERCE LUXEMBOURG

CHINALUX
China-Luxembourg Chamber of Commerce
中卢商会

WELCOME ADDRESS: Jeannot Erpelding, Chamber of Commerce of the Grand Duchy of Luxembourg

CHAMBRE DE COMMERCE LUXEMBOURG

CHINALUX
China-Luxembourg Chamber of Commerce
中卢商会

HPC PROGRAM IN EUROPE AND LINKING WITH LUXEMBOURG INNOVATION STRATEGY: Jean-Marie Spaus, Luxembourg Ministry of the Economy

CHAMBRE DE COMMERCE LUXEMBOURG

CHINALUX
China-Luxembourg Chamber of Commerce
中卢商会

HPC program in Europe

and linking with

Luxembourg's Innovation Strategy

China's Belt & Road Initiative - ICT

Luxembourg's Innovation Strategy

- Preparing Luxembourg for the "digital economy"

  - Study: The 3rd Industrial Revolution
  - Support adoption of HPC and Big Data technologies in Luxembourg

- Implementing a state of the art HPC-Big Data environment for Europe and Luxembourg

  - European initiatives : EuroHPC and the IPCEI initiative
  - National initiative : Plan to create a national HPC-Big Data Competence Center

Preparing Luxembourg for the “digital economy”

- HPC - Big Data infrastructures and applications are contributing significantly and increasingly to scientific progress, industrial competitiveness, national and regional security and the quality of human life.

  - The Luxembourg government presented “The 3rd INDUSTRIAL REVOLUTION” study in November 2016.
  - The aim of the initiative is to prepare the transition to a “digital economy”; to strengthen and consolidate in the long term the country's position in a globalized economy.

HPC & Big Data are important enabling parts of the “The 3rd INDUSTRIAL REVOLUTION” initiative.

- Helping the Lux. economy to stay competitive in a very though business environment.
- Transfer of scientific and engineering solutions to private companies.
- Development of new business opportunities and business models.
- Development of HPC-Big Data skills.

Developing a state-of-the-art HPC-BD environment for Europe and Luxembourg

How are we going to achieve this?

- Luxembourg together with France, Italy and Spain launched an “Important Project of Common European Interest” (IPCEI) on HPC and Big Data Enabled Applications.
- Luxembourg intends to develop in the framework of the IPCEI a number of HPC-Big Data applications.
- Luxembourg is a leading player in the European HPC initiative
- Important socio-economic subjects will be addressed in this context

Enhancing Luxembourg's ICT value chain

- High performance computing resources will complete Luxembourg's first class IT landscape with new service oriented components.

  An additional **value proposition** for companies and investors

HPC and BDA enabled services	State of the art and easy to access high performance computing resources. Preinstalled massive and rapid online data storage for Data analytics and Big Data Applications (pay as you use model).
Data Centers	High Quality Data Centers, Equipment Housing, Hosting and Maintenance, of customer owned/leased equipment.
Optical Fiber Networks	Secure & redundant world wide connectivity via national & international broad band networks.

Luxembourg plans to create a national HPC-Big Data Competence Center

- HPC-BD technologies are required for an increasingly wide range of disciplines within academia and industry to remain competitive and boost innovation.

- The use of large computational resources for modelling and simulation has become an increasingly important practical and strategic tool to reach solutions fast, or even break new grounds.

- This constitutes HPC as a virtual laboratory of great importance to many companies and should thus be easily accessible and usable.

The national HPC-BD Competence Center should provide a range of services to its customers:

- access to state-of-the art HPC-BD infrastructures (hardware investment),
- advanced and deep technical expertise for helping companies to leverage HPC effectively,
- co-development of customer-specific algorithms & software applications,
- industry training programs.

China & Luxembourg; an historical relationship

- The roots of relationship reach back to a time before Luxembourg was a financial centre and when the coal and steel industry was still booming.
- Diplomatic relations between the two countries were officially established in 1972
- Today, 45 years later, the Grand-Duchy hosts seven Chinese financial institutions.
- Luxembourg also serves as a channel for European investments into China and Asia.
- Luxembourg and China keep knotting close ties.

Economic & Trade Missions to China:

- 2012, 2013, 2016, 2017,

The Belt and Road Initiative (BRI)

BRI seeks to bring together the Silk Road Economic Belt and the Maritime Silk Road through a vast network of railways, roads, pipelines, ports and telecom-infrastructures.

The Belt and Road Initiative (BRI)

- Introduced by China's President Xi Jinping in 2013, the Belt and Road Initiative (BRI) is a global development concept that wants to achieve economic and social integration from Asia to Europe.

- The initiative aims to boost economic development, investment, and cultural exchanges throughout Eurasia by funding port, rail, road construction and telecom-networks along routes linking China and Europe.

- Turning this grand vision into reality requires close collaboration between countries, between public and private sectors, and between people from different cultures.

- Telecom-infrastructures represent an essential part in the BRI initiative. Enhanced connectivity will provide positive impacts to other economic sectors because ICT technologies are essential components in a global value chain.

Thank you

LUXEMBOURG

LET'S MAKE IT HAPPEN

LUXEMBOURG ON THE ROAD TO AUTONOMOUS DRIVING:

Joost Ortjens, Luxinnovation

CHAMBRE DE COMMERCE LUXEMBOURG

CHINALUX
China-Luxembourg Chamber of Commerce
中卢商会

Luxembourg

Automotive Sector

Towards green, connected and automated mobility

Luxembourg automotive sector

Facts and figures

LUXINNOVATION
TRUSTED PARTNER FOR BUSINESS

- ✓ About 50 companies
- ✓ OEM's (2), component suppliers, connectivity & smart mobility service providers
- ✓ University of Luxembourg and 2 Luxembourg based public research institutes
- ✓ About 1,5 billion € sales turnover
- ✓ About than 2.5 billion € additional turnover (equivalent) related to Luxembourg based R&D cost-centres
- ✓ About 10.000 employees in total
- ✓ About 2.500 multi-lingual and multi-cultural professionals in R&D
- ✓ Sector "powered" by German, French and Italian automotive engineering experts
- ✓ Export to 5 continents
- ✓ Founding member of AUTOREGION (Greater Region - cross border - automotive cluster)

© 2017 Luxinnovation

Luxembourg automotive sector

Our global players

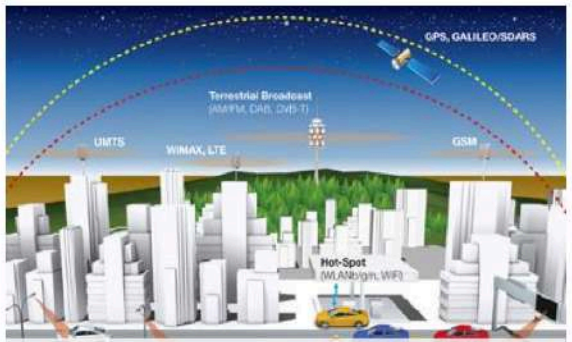
LUXINNOVATION
TRUSTED PARTNER FOR BUSINESS

© 2017 Luxinnovation

Coverage of all major key-competences

LUXINNOVATION
TRUSTED PARTNER FOR BUSINESS

Vehicle dynamics



Connectivity & mobility services

ADAS – automated driving

Chassis & body

Powertrain (engines, BEV, HEV)

Comfort & Convenience - HMI

© 2017 Luxinnovation

Luxembourg Greater-Region

LUXINNOVATION
TRUSTED PARTNER FOR BUSINESS

11.5 million European inhabitants, 4 different European countries, all founding members of the European union, speaking 3 European languages in average (English, German, French

In the heart of Europe, well connected to all major European automotive development centres

© 2017 Luxinnovation

Greater-Region, the Autoregion

LUXINNOVATION
TRUSTED PARTNER FOR BUSINESS

Luxinnovation is founding member of Autoregion e.v, connecting the automotive eco-systems in Lorraine (F), Rheinland-Pfalz (D), Saarland (D) and Luxembourg (L). The Greater-Region is hosting 8 OEM's, more than 15 public research centres and over 500 suppliers! Together they generate about 150.000 jobs in automotive production, product- and process-development and (fundamental) research

autoregion e.v.
Das Cluster der GroBregion
Cluster de la Grande Région

© 2017 Luxinnovation

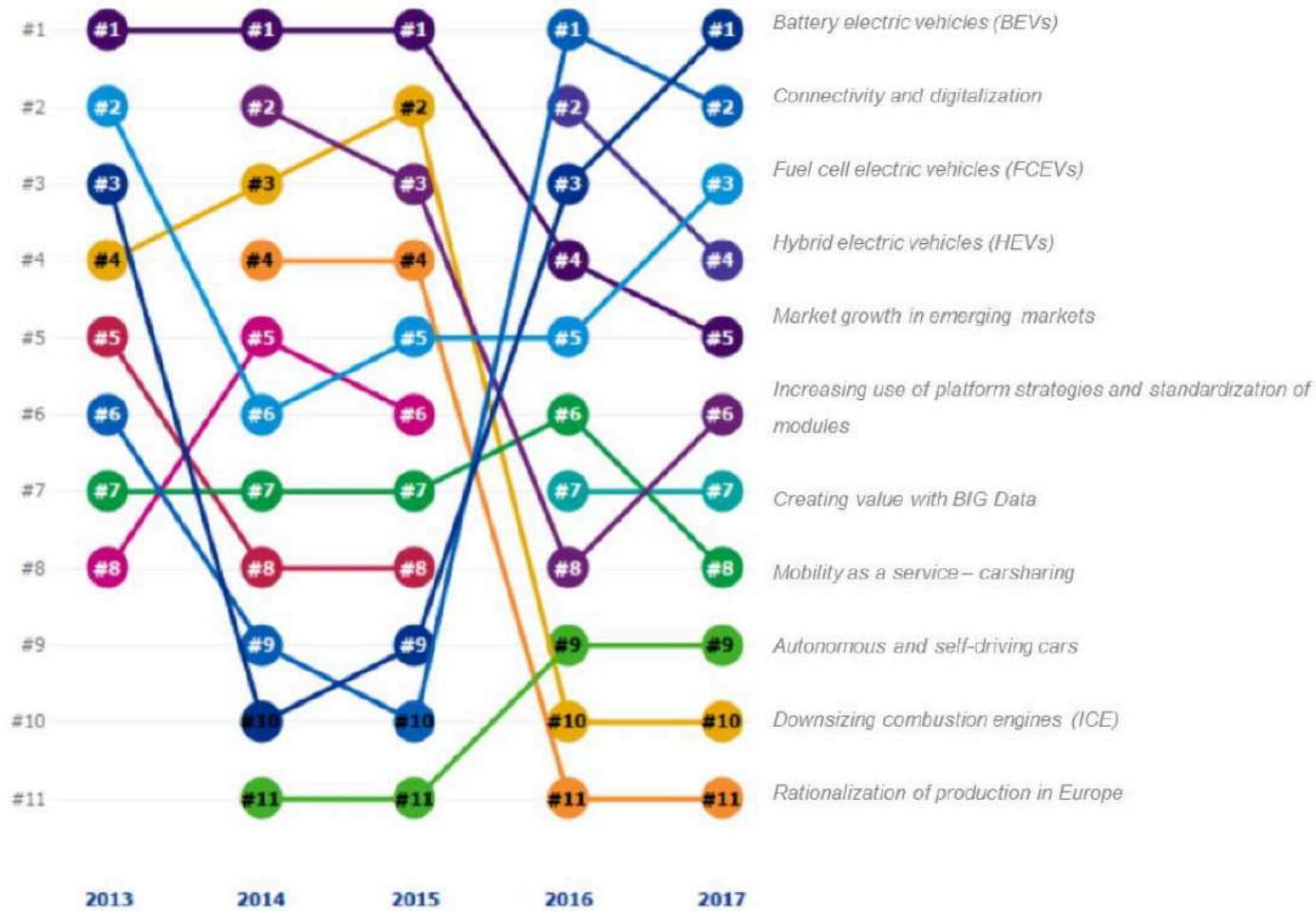
Greater-Region, the R&D region

LUXINNOVATION
TRUSTED PARTNER FOR BUSINESS

LIST Luxembourg institute for science and technology SnT Security and Trust DFKI Deutsches Forschungszentrum für Kunstliche Intelligenz INM Leibnitz Institut für Neue Materialien MPII Max-Planck Institut für Informatik MECS Material Engineering Center Saarland IVW Instutut für Verbundwerkstoffe CISPA Centre for IT-security, Privacy and Accountability ZeMa Zentrum für Mechatronik FITT Institut für Technologie Transfer Fraunhofer IZFP Institut für Zerstörungsfreie Prüfverfahren IRT M2P Institut de Recherche Technologique – Matériaux, Métallurgie et Procédés Materalia Pôle de compétivité de Matérieaux CeaTech New energy, Biotech, Digitalisation, Material science MetaFensch Métallurgie

© 2017 Luxinnovation

Automotive sector – growth strategy



Source: KPMG global automotive executive survey 2017

#1 Electrification of mobility

#2 Connectivity, digitalization, automation

© 2017 Luxinnovation

Connectivity, digitalization, automation

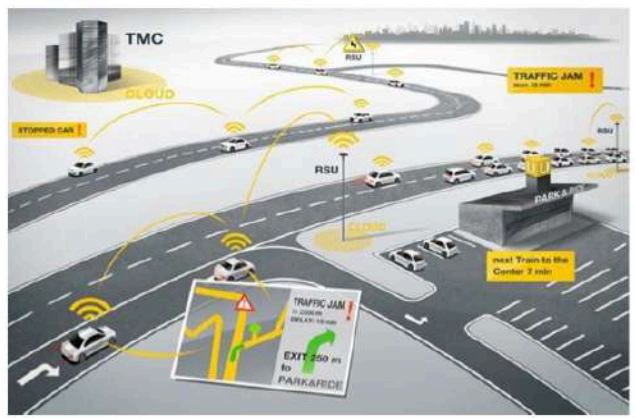
LUXINNOVATION
TRUSTED PARTNER FOR BUSINESS

The internet car

Future vehicles will become “smart devices” facilitating internet-based services, creating new business-opportunities and business-models (e.g. ride sharing, car sharing), reducing costs of mobility, increasing on-board efficiency, improving customer satisfaction and loyalty

The self-driving car

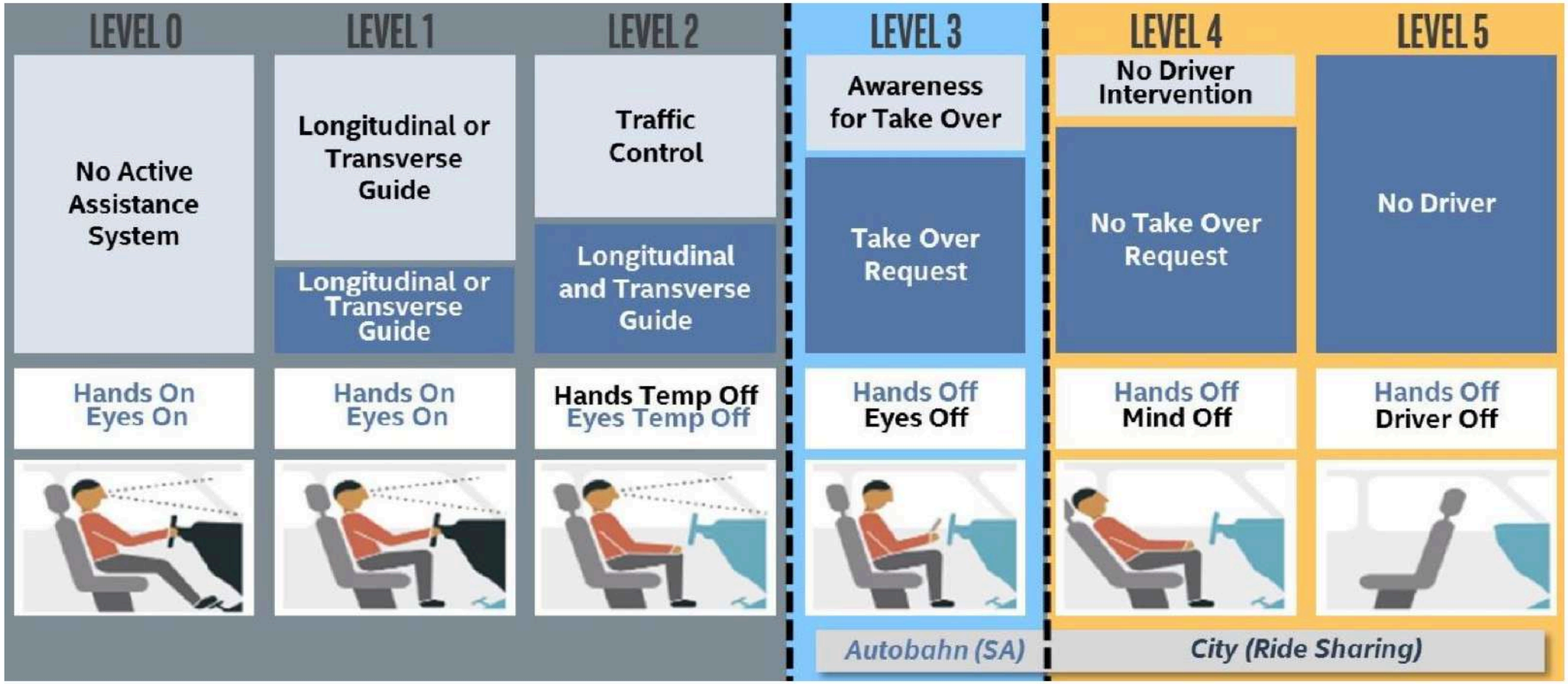
Car connectivity will play an important role in the development of automated driving, using safety relevant data provided by smart infrastructures: dynamic HD maps with real time updates on road conditions, exact position of traffic jams and accidents. If necessary, position, direction and speed of other road users. Safety-relevant data needs to be reliable and secure, and safety-relevant connectivity needs to be uninterrupted



© 2017 Luxinnovation

Automated driving roadmap

LUXINNOVATION
TRUSTED PARTNER FOR BUSINESS



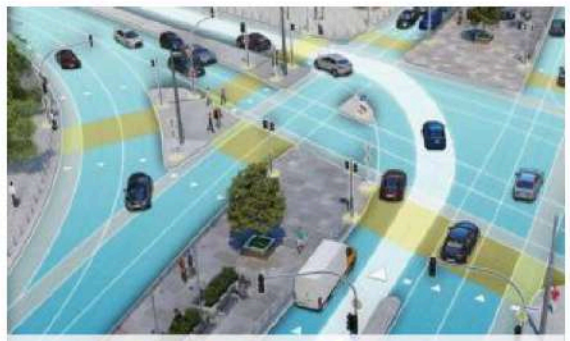
> 2020

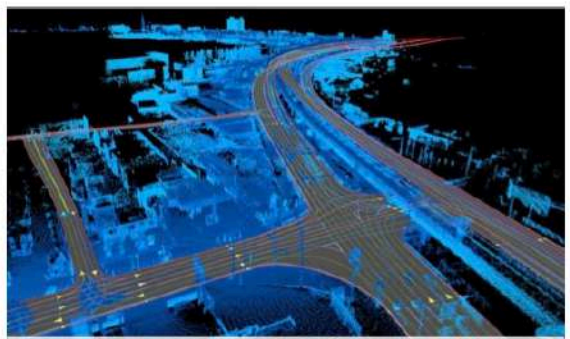
© 2017 Luxinnovation

Connected & automated driving

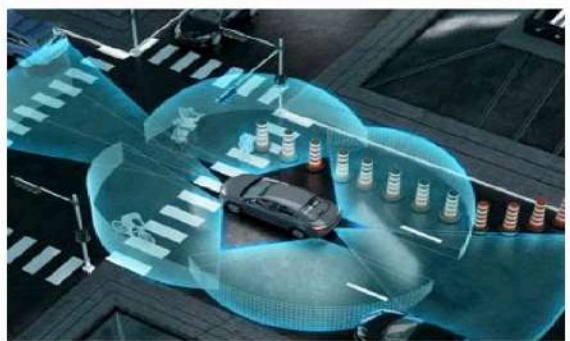
LUXINNOVATION
TRUSTED PARTNER FOR BUSINESS

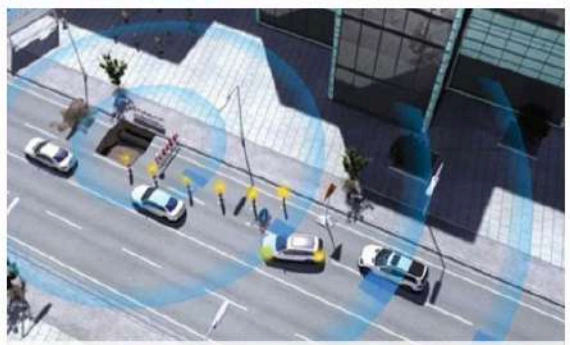
E-horizon (cross border)


Smart digital infrastructures


HD mapping

Digital traffic sign recognition


Data fusion, vehicle/infrastructure


Real-time map updates

Examples of use-cases in connected & automated driving. Many other use-cases are in discussion with industry players and RTO partners, in Luxembourg and the Greater-Region. On behalf of testing and validation of the use-cases, German, French and Luxembourg authorities are developing a cross-border digital testbed!

© 2017 Luxinnovation

Cross border digital testbed - objectives

Extension to Luxembourg agreed and signed on the 14th of September 2017

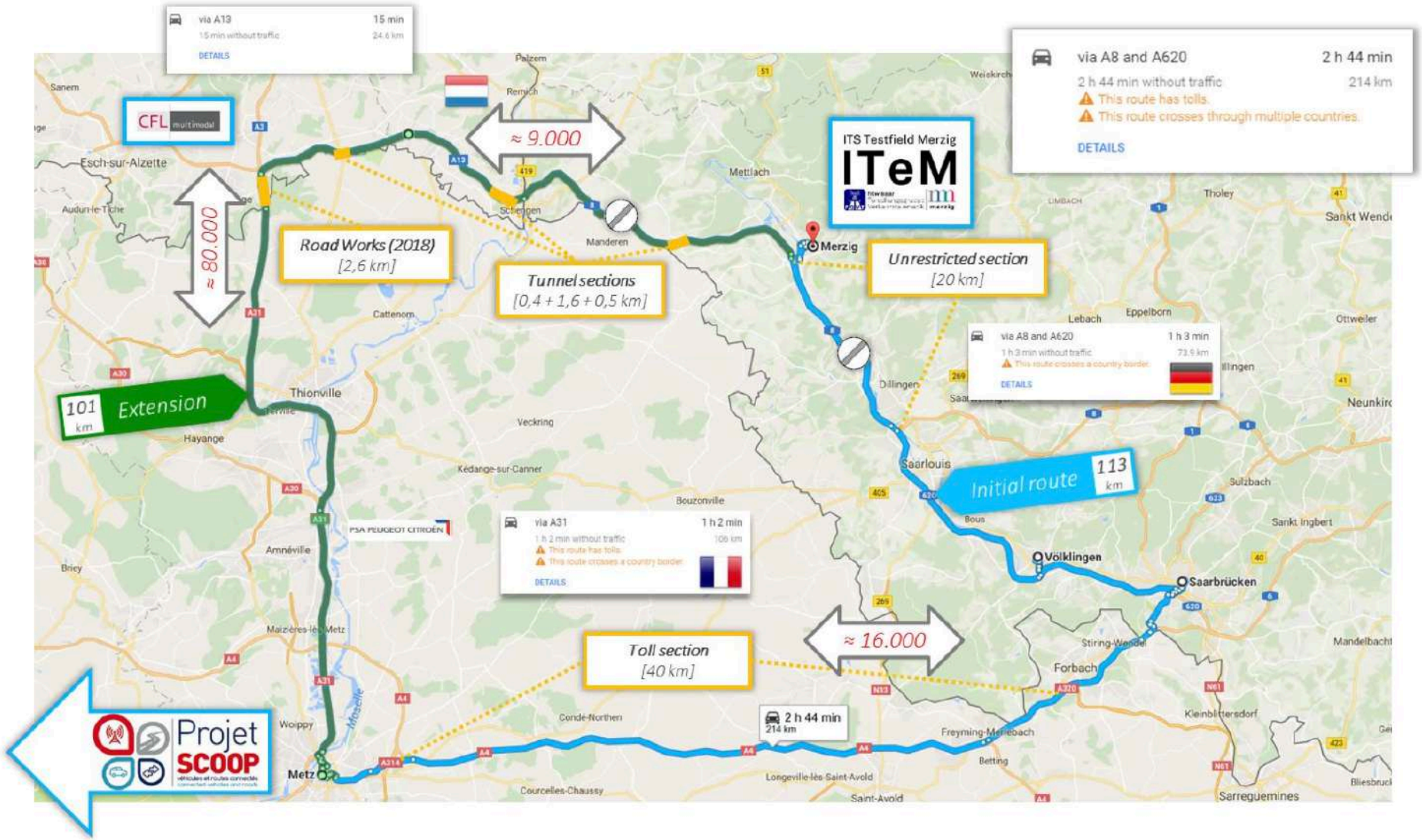
1. Test compatibility (inter-operability) of automated driving vehicles
2. Development and testing of use-cases in connected & automated driving
3. Study the impact and effects of automated driving on future mobility
4. Development of BIG DATA enabled services supported by High-Performance Computing (HPC)

© 2017 Luxinnovation

Cross border digital testbed

LUXINNOVATION
TRUSTED PARTNER FOR BUSINESS

Open testbed on behalf of the development, testing and validation of automated driving vehicles and next generation C-ITS technologies.
Uninterrupted cross-border 5G connectivity supported by vehicular Wifi (G5) and satellite communication.
Use-cases and technical constraints (specification) in discussion with ICT, Telecom and Automotive industry-players



© 2017 Luxinnovation

Mobility Innovation Campus

LUXINNOVATION
TRUSTED PARTNER FOR BUSINESS

Project	Automotive Campus Bissen
Strategy	Public – Private partnership in **open innovation and shared R&D** on behalf of next generation green, connected and automated mobility
Capacity	Total surface 14 hectare of which 8 hectare available for new investors, infrastructure capable for hosting 4.000 engineers and scientists daily – business incubation surface 1.400m2
Planning	Inauguration phase 1 early 2019

© 2017 Luxinnovation

Green, connected and automated mobility

Why Luxembourg?

LUXINNOVATION
TRUSTED PARTNER FOR BUSINESS

* Big-data enabled applications

© 2017 Luxinnovation

Joost Ortjens

Head of Sector development - Automotive

LUXINNOVATION GIE
7, rue Alcide de Gasperi
L-1615 Luxembourg

T (+352) 43 62 63 - 653

M (+352) 621 139 474
joost.ortjens@luxinnovation.lu

LUXINNOVATION
TRUSTED PARTNER FOR BUSINESS

Thank you!

Questions and answers

© 2017 Luxinnovation

MEGA TRENDS OF GLOBAL AUTOMOTIVE FUTURE DEVELOPMENT:

Paul Schockmel, IEE

CHAMBRE DE COMMERCE LUXEMBOURG

CHINALUX
China-Luxembourg Chamber of Commerce
中卢商会

Mega Trends

Paul Schockmel
VP Strategy, Business Development and Marketing

China's Belt & Road Initiative - ICT:
Automated Driving in Luxembourg with 5G Networks and Satellite Communications
ChinaLux
Luxembourg, October 16th, 2017

a sense for innovation IEE

Trends

"We will see more change in the next 5 years than there's been in the last 50"

Marry Barra, CEO of General Motors

Copyright IEE S.A. © All rights reserved

What are the challenges

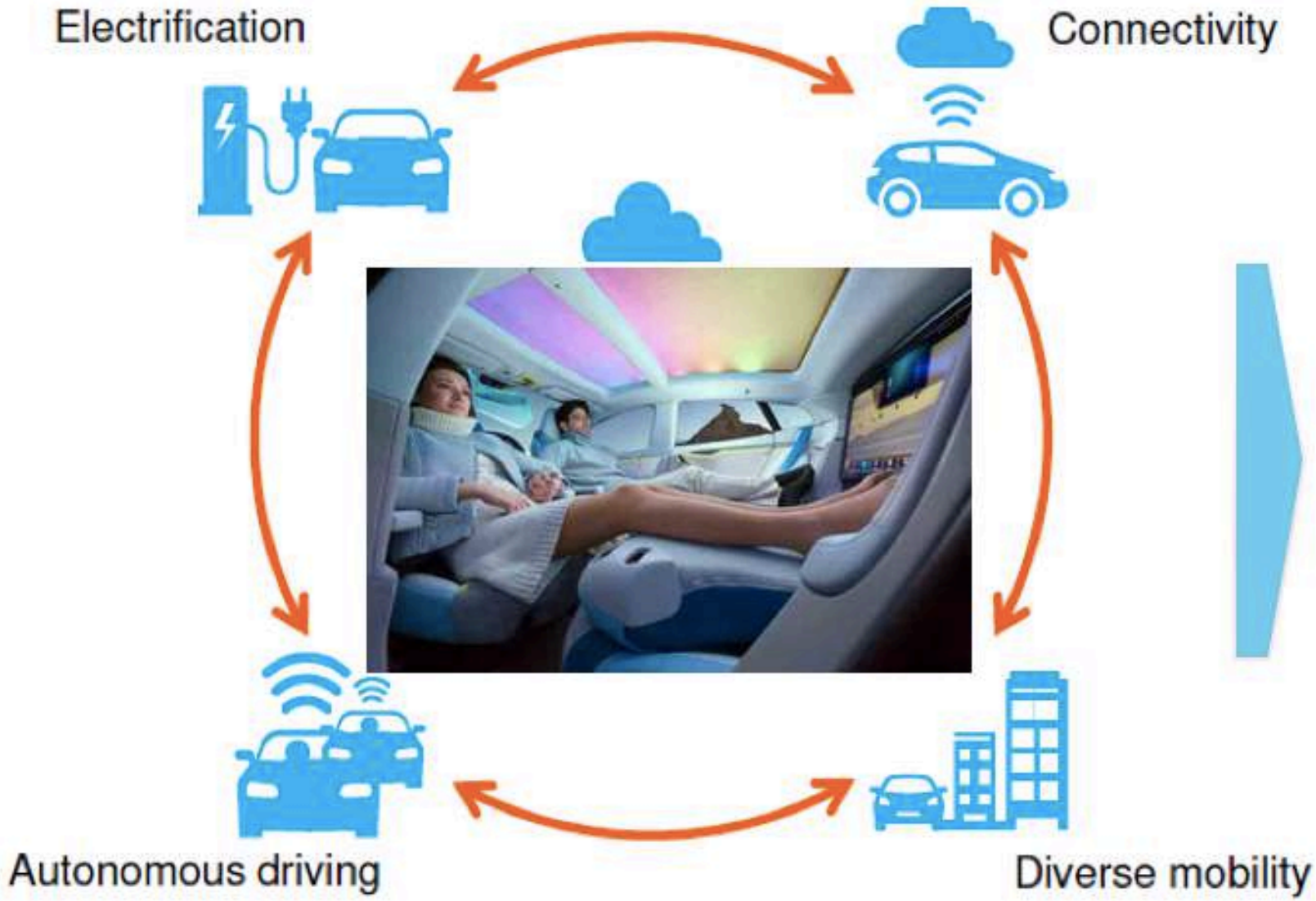
- Climate Change
- Air Quality

- Changing Consumer profiles
- Global Population Growth
- Urbansiation

- Cost & Profitability
- Economies of Scale

Copyright IEE S.A. © All rights reserved

Disruptive technology-driven trends



...radically changing the mobility industry

Copyright IEE S.A. © All rights reserved

Source: McKinsey&Company (2016): Automotive Revolution – perspective towards 2030. 22.04.2016

a sense for IEE innovation

The pathway to Autonomous Driving

Today (~ 2015 -2022)

Autonomous driving is a reality in controlled restricted environments, e.g.

- Rio Tinto's autonomous trucks
- Supervised autonomy by John Deere or full automation by New Holland

- 90% labour cost savings
- 60% CO2 savings

Medium-term (~ 2023 – 2040)

Trucks will likely be the first to enter the stage of autonomy on public roads, e.g.

- Daimler Future Truck 2025 prototype
- Volvo sensor fusion system

- 30% operational cost savings

Long-term (~ 2040 +)

Automated commercial fleets beyond cars, e.g.

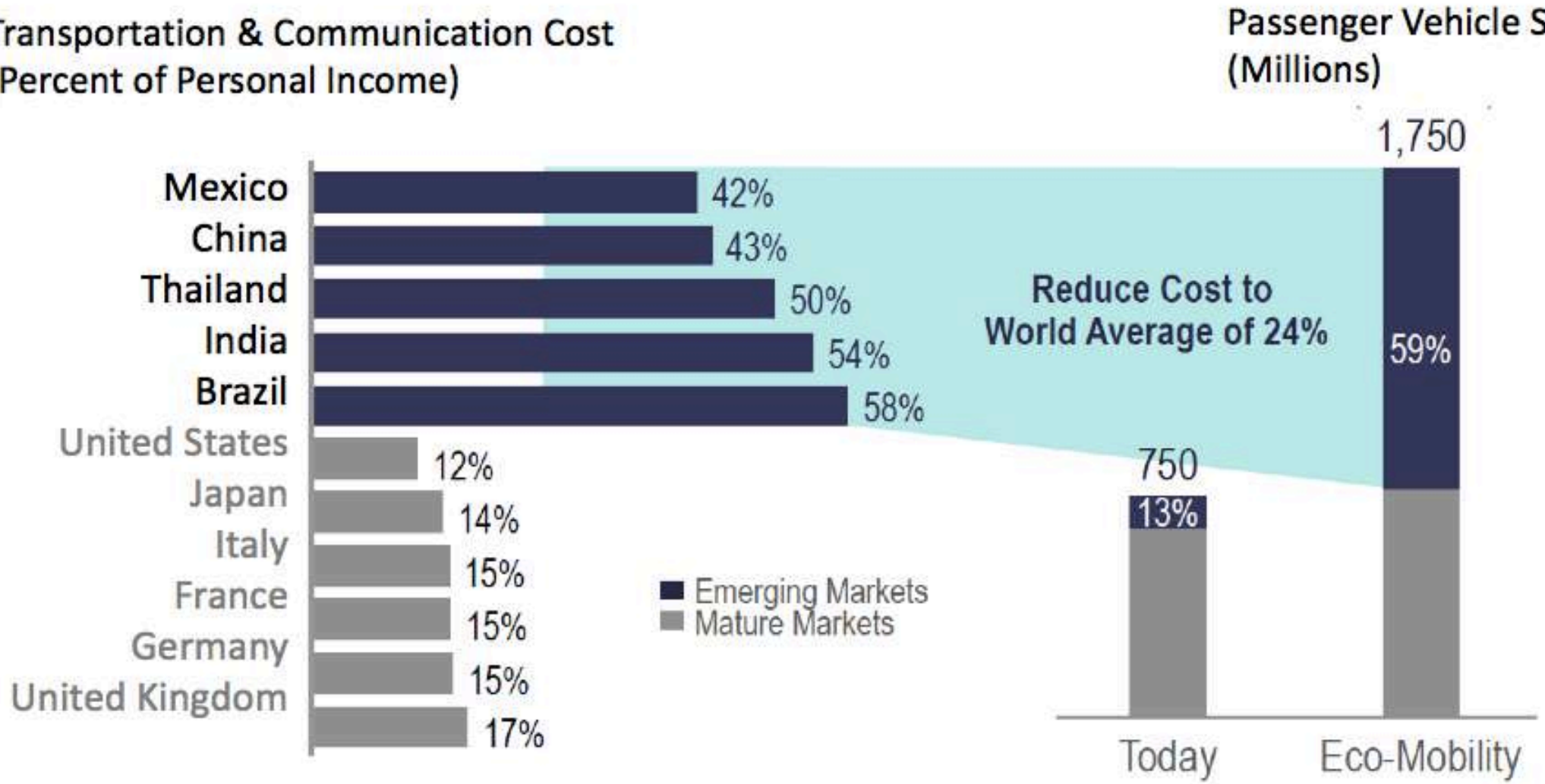
- Connected/automated planes
- Parcel deliver via drones (on a large scale)

- 50% operational cost savings

Source: McKinsey & Company

a sense for innovation IEE

The pathway to Autonomous Driving

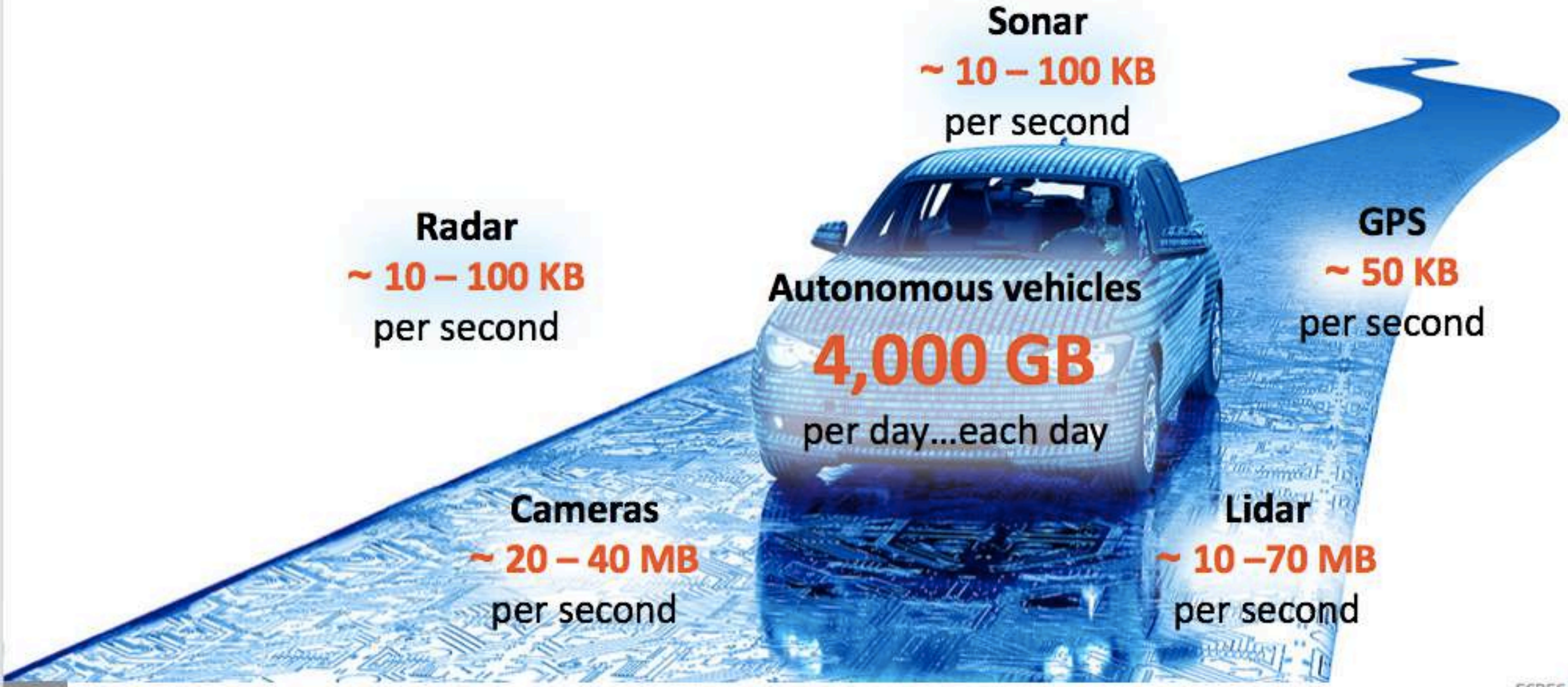


Source: Cisco

Copyright IEE S.A. © All rights reserved

Connectivity and Big Data

The coming flood of data in autonomous vehicles

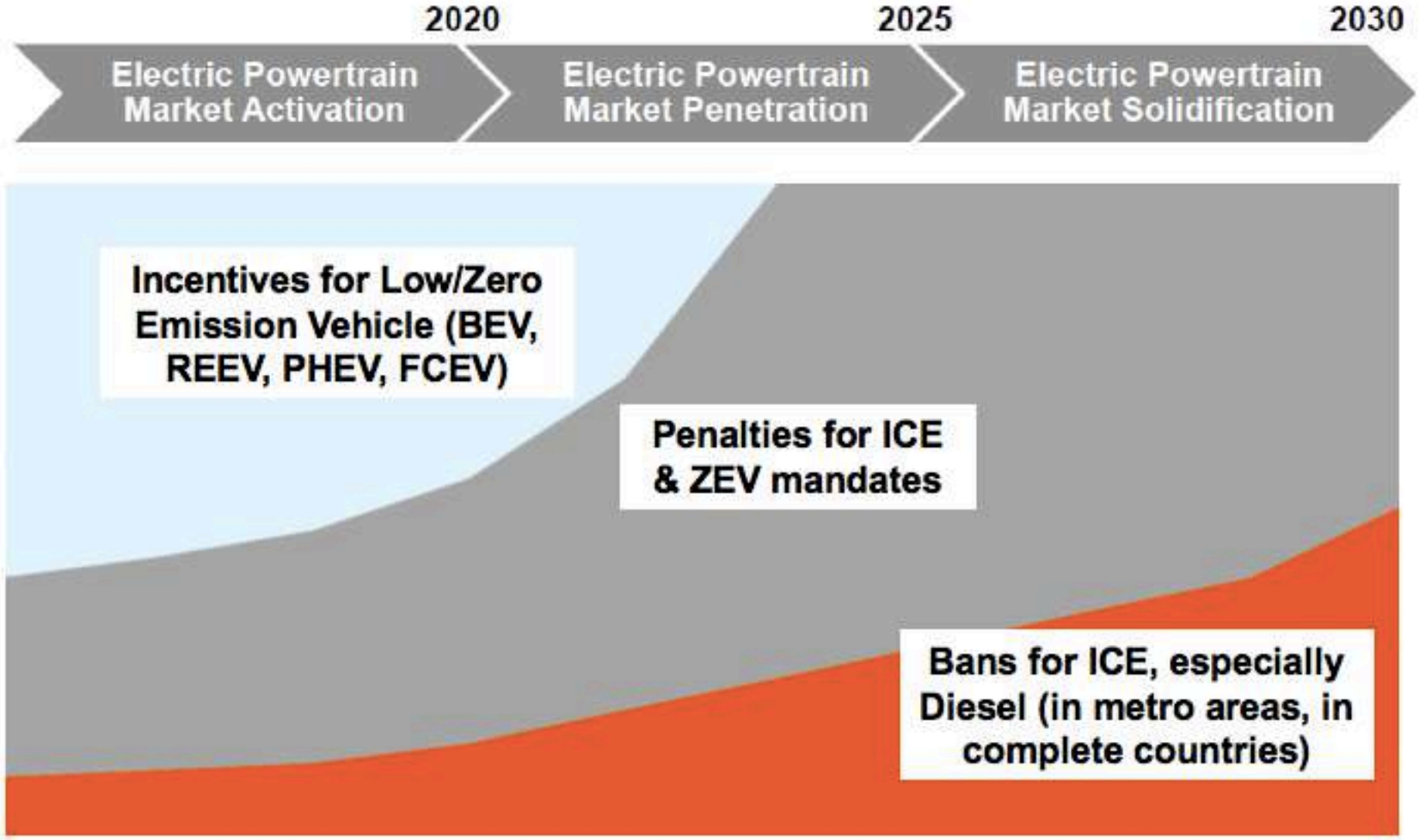


Source: Intel Corporation

Copyright IEE S.A. © All rights reserved.

Zero Emission Vehicles

Move from ZEV incentives to Internal Combustion Engine (ICE) bans



Source: Ricardo

a sense for innovation IEE

The new industry paradigm

- Changes in mobility behaviour and shifting markets
- Diffusion of advanced technologies
  - Automated driving
  - Connectivity solutions Big Data
  - Software
  - Electrical vehicles become viable and competitive
- New market entrants and cooperation models

Copyright IEE S.A. © All rights reserved
a sense for innovation IEE

5G MOBILE NETWORKS SOLUTIONS FOR AUTOMATED DRIVING IN LUXEMBOURG: Karel Sotek, Huawei

CHAMBRE DE COMMERCE LUXEMBOURG

CHINALUX
China-Luxembourg Chamber of Commerce
中卢商会

5G Mobile Networks Solutions for Automated Driving in Luxembourg

www.huawei.com

EU Wireless Marketing
karel.sotek@huawei.com

HUAWEI TECHNOLOGIES CO., LTD.

HUAWEI

New Industries Use-cases Fueling 5G Evolution

GSM → UMTS → LTE → 5G

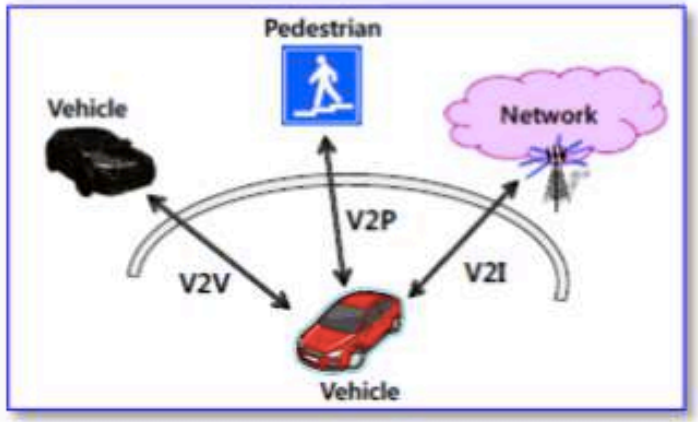
Voice Anywhere → Data Anywhere → Device Anywhere

Personal Devices

Device Vertical Industries

- Connected Car
- Industry 4.0
- Internet of Things
- eHealth

Latency, Reliability | ***Low-Cost, Deep Indoor***

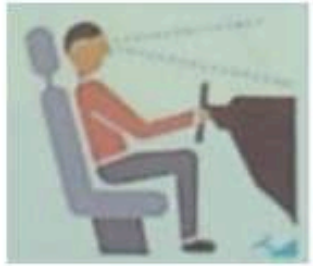
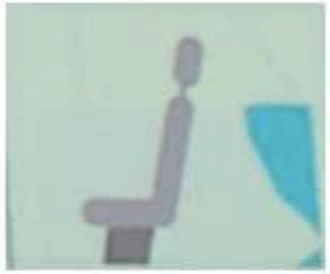


- V2V: vehicle exchanges safety-related messages with each other.
- V2I: vehicle exchanges information with road and network infrastructures
- V2P: vehicle exchanges information with vulnerable road users, e.g., pedestrians, cyclists, motorcycles, etc.

V2X

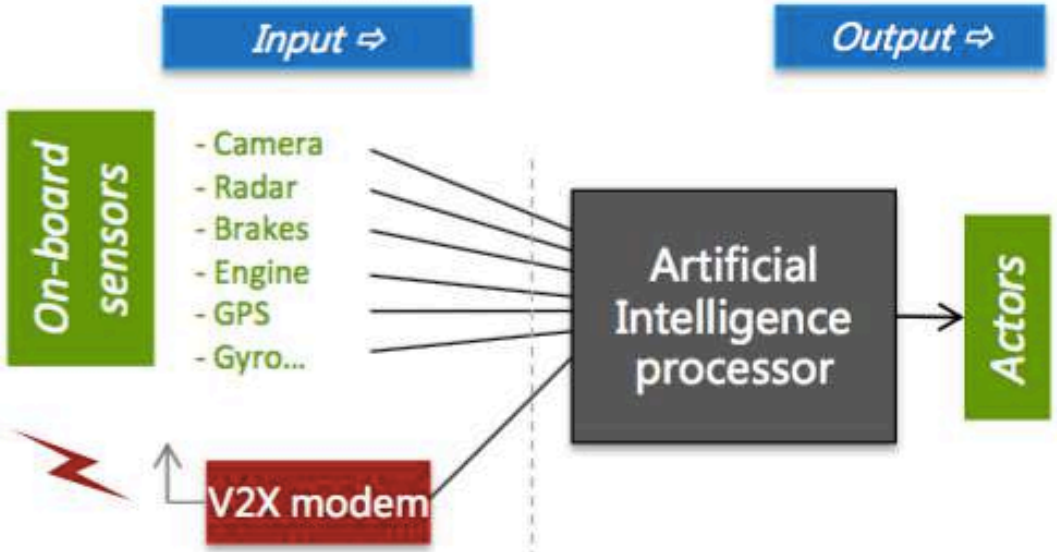
Automated Driving Introduce Machine Responsibility

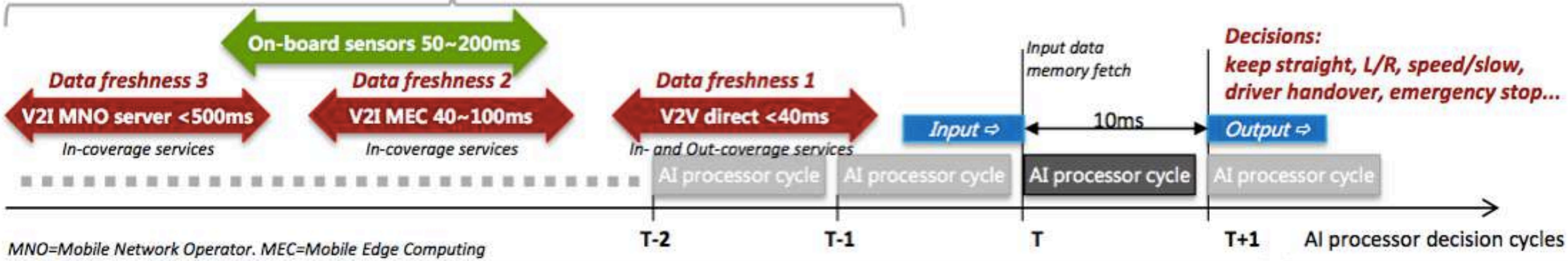
Human only → Machine only

Commercially available now		Demos & Trials	Deployment Candidates		Long-term
Level 0	***L1-Assisted***	***L2-Partial Auto***	***L3-Half Auto***	***L4-Full Auto***	***L5-Full Auto***
No active assistance system	Longitude or Transverse Guide	Traffic Control	Awareness for take over	No Driver Intervention	No Driver
	Longitude or Transverse Guide	Longitude and Transverse Guide	Take Over Request	No Take Over Request	
Hands on	Hands on	Hands temp. Off	Hands off	Hands off	Hands off
Eyes on	Eyes on	Eyes temp. Off	Eyes off	Mind off	Driver off
					

Wireless Complement Car Sensors for Machine Decisions

Wireless provides information:
- what sensor cannot see
- faster than sensor can see
- plausibility check of sensors





MNO=Mobile Network Operator. MEC=Mobile Edge Computing

Local Content Provision Is Key 5G V2X Wireless Asset

1. Global content (V2I)

Google Maps

Voice, video, messaging,
Car maintenance, navigation

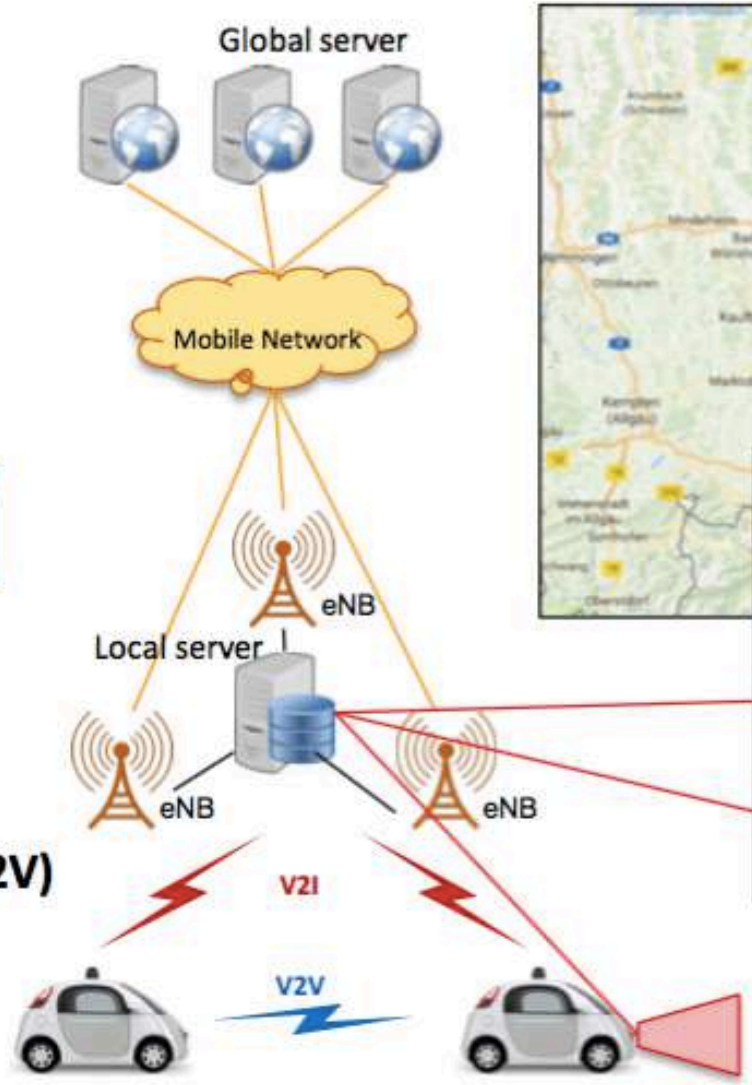
2. Local content (V2I)

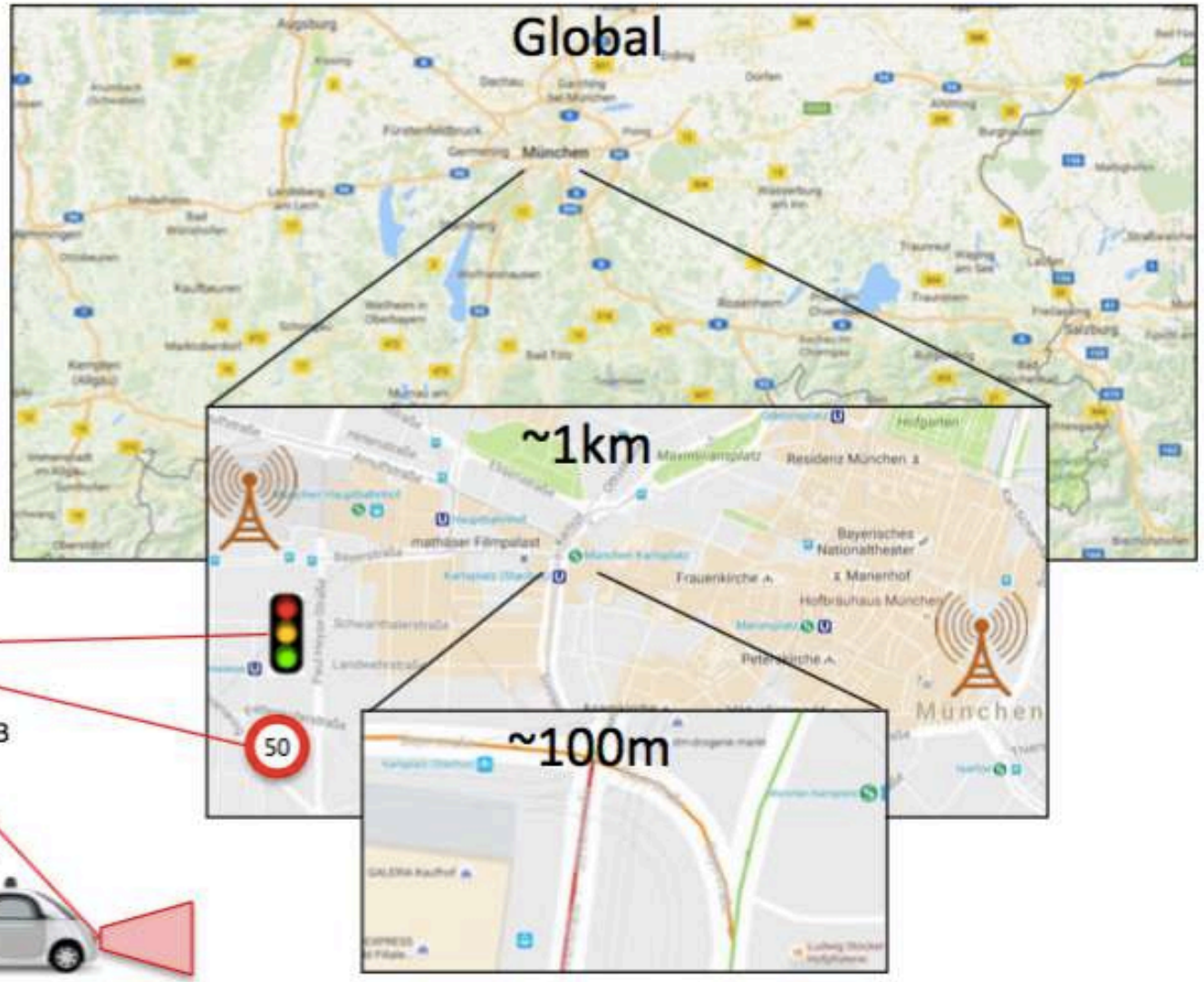
+

Traffic status, road objects
Sources: **(1) road sensors**
(2) car sensors

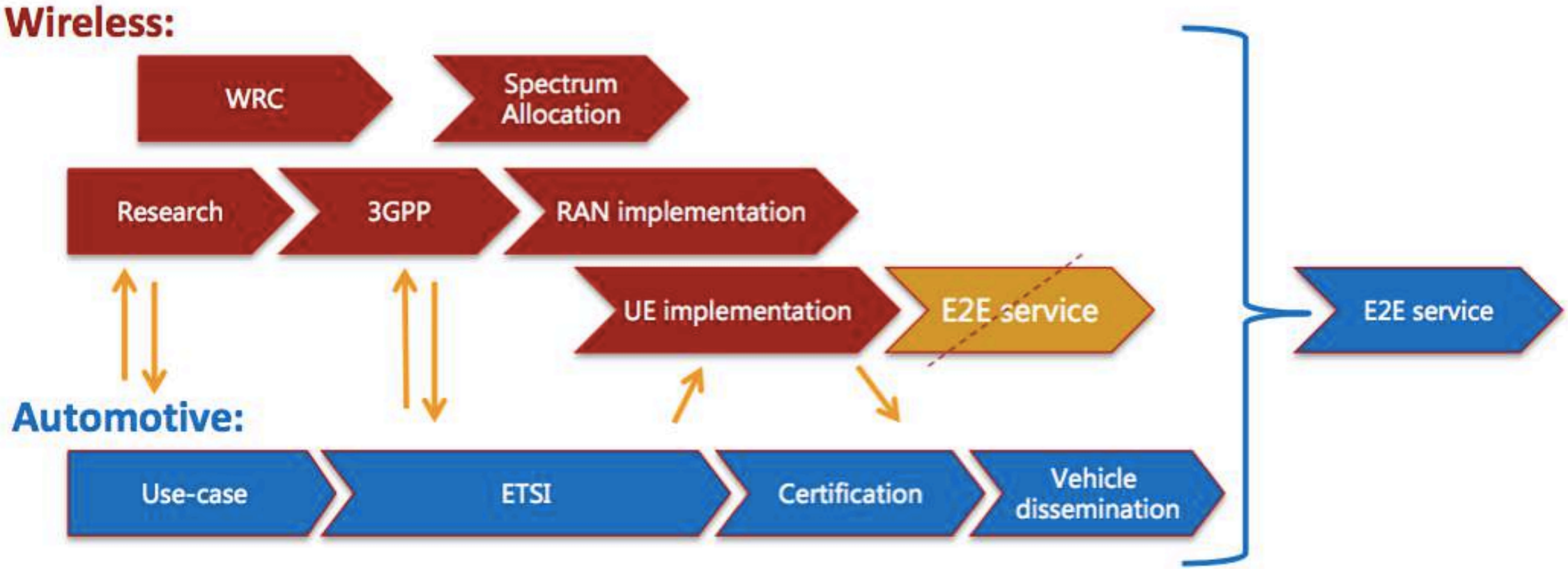
3. Proximity service (V2V)

Car trajectory & intention data
Sources: **car CPU**





V2X Adds Automotive Standardization Into Technical E2E Availability



=> Slower service introduction, longer device life-cycle

5GAA To Converge Automotive & Telco Industries

Association Links Industry Sectors

Automotive Industry
Vehicle Platform, Hardware and Software Solutions

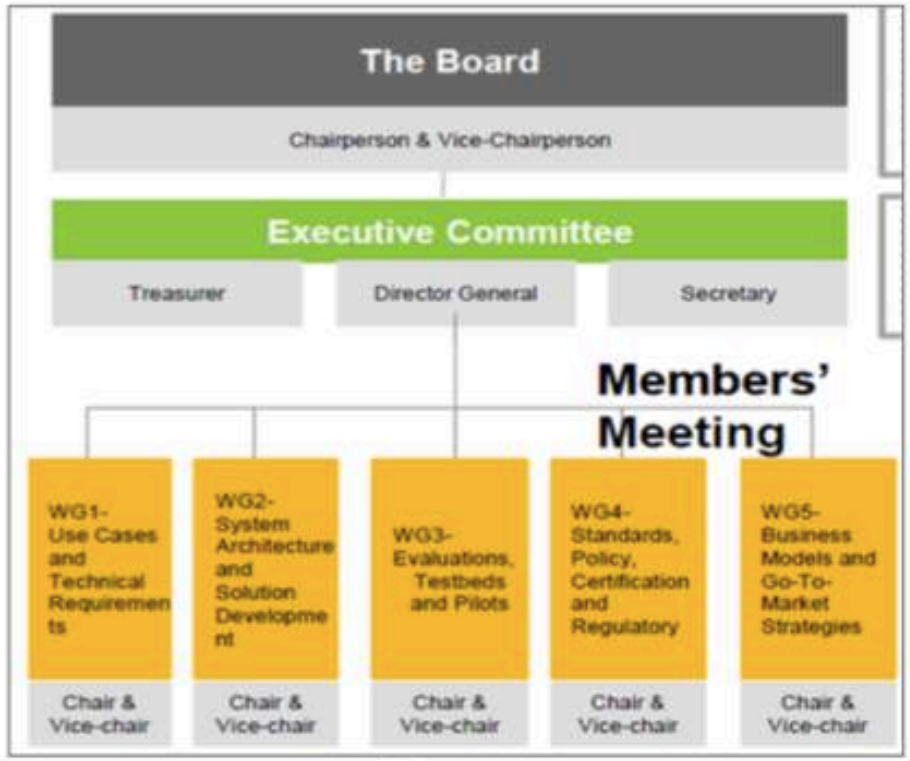
Telecommunications
Connectivity and Networking Systems, Devices and Technologies

End to End Solutions for Intelligent Transportation, Mobility Systems and Smart Cities

Opportunity to further connect telecom industry and vehicle manufacturers and work closely together to develop end-to-end solutions for future mobility and transportation services

AUDI BMW DAIMLER ERICSSON HUAWEI intel NOKIA QUALCOMM

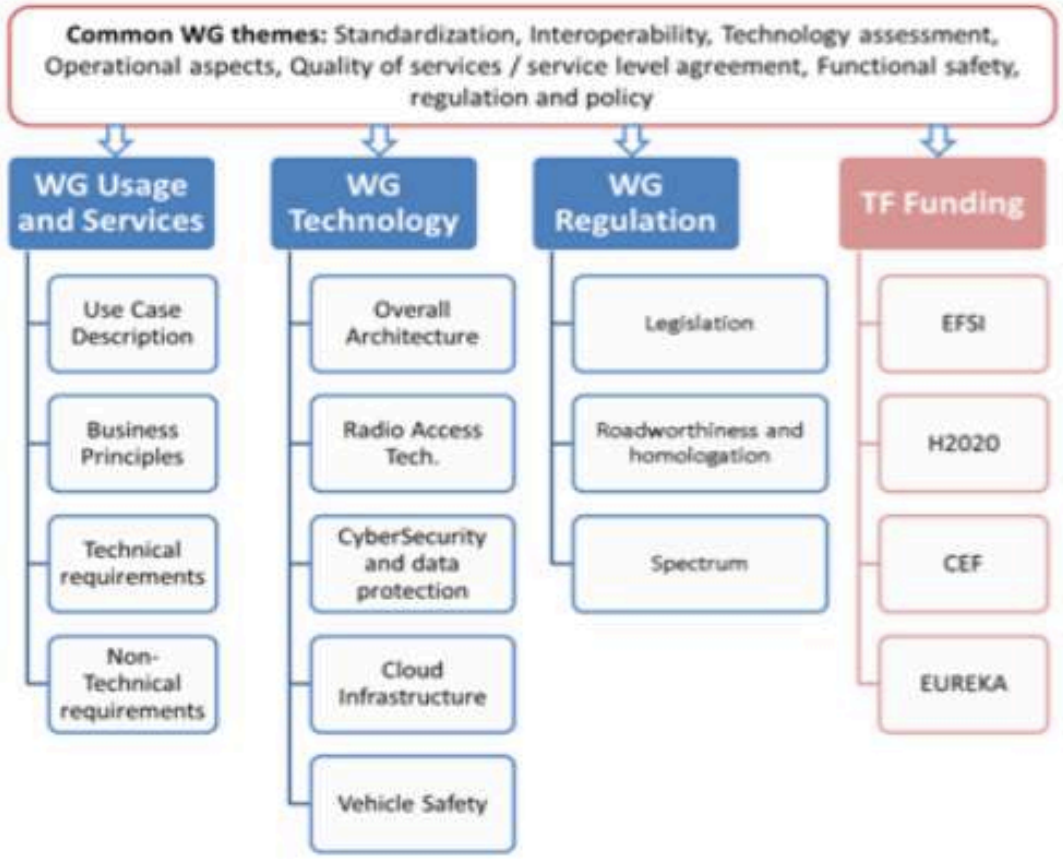
-Technical alignment
-Regulation & Policy
-Test and GoTo Market



Contact:
Walter.Waigel@huawei.com

EU Commission "European Pre-Deployment C&AD Project "

Automotive & Telecoms Sector to launch EU project for connected & automated driving
Hosted by commissioner Mr. Oettinger, lead by ERTICO, focused on V2X in general

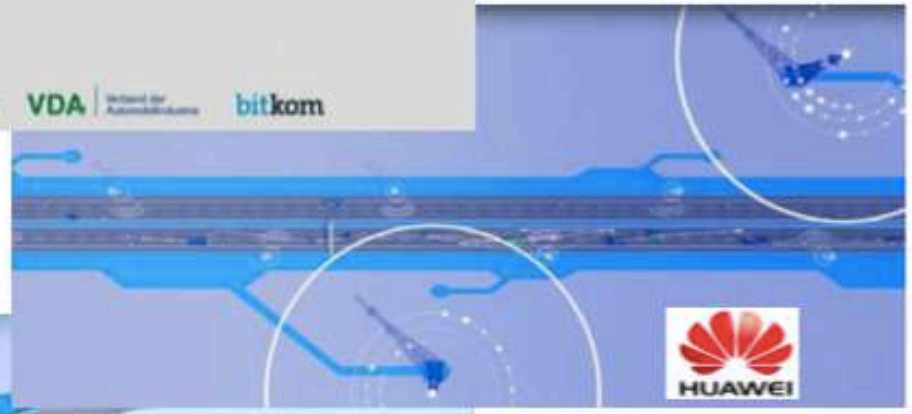


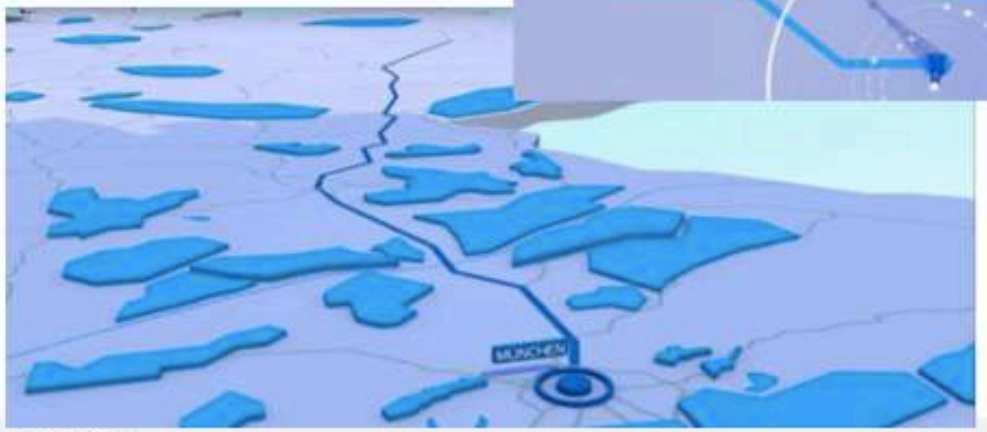
- directives for national regulations
- technical requirements
- spectrum allocation
- technology project funding

- Achieve more coherent and quicker rollout of V2X
- Common deployment roadmaps by end 2016 sync-ed between telcos and car infra
- Target = pre deployment project plan by early 2017
- Aim to submit the plan to Open CEF Transport Call 2016 by end of the year
- Companies involved = 6 associations + 38 companies
- Next round of funding = 140M€
- Existing corridors can apply for additional budget for automation (go beyond Cooperative ITS – C-ITS)
- Funding rates up to 50% (studies and pilot) or up to 20% (works)

http://www.gsma.com/newsroom/press-release/joint-press-note-automotive-telecoms-sectors-launch-eu-project/

Germany BMVi A9 Highway Test Field „Connected & Automated Driving“





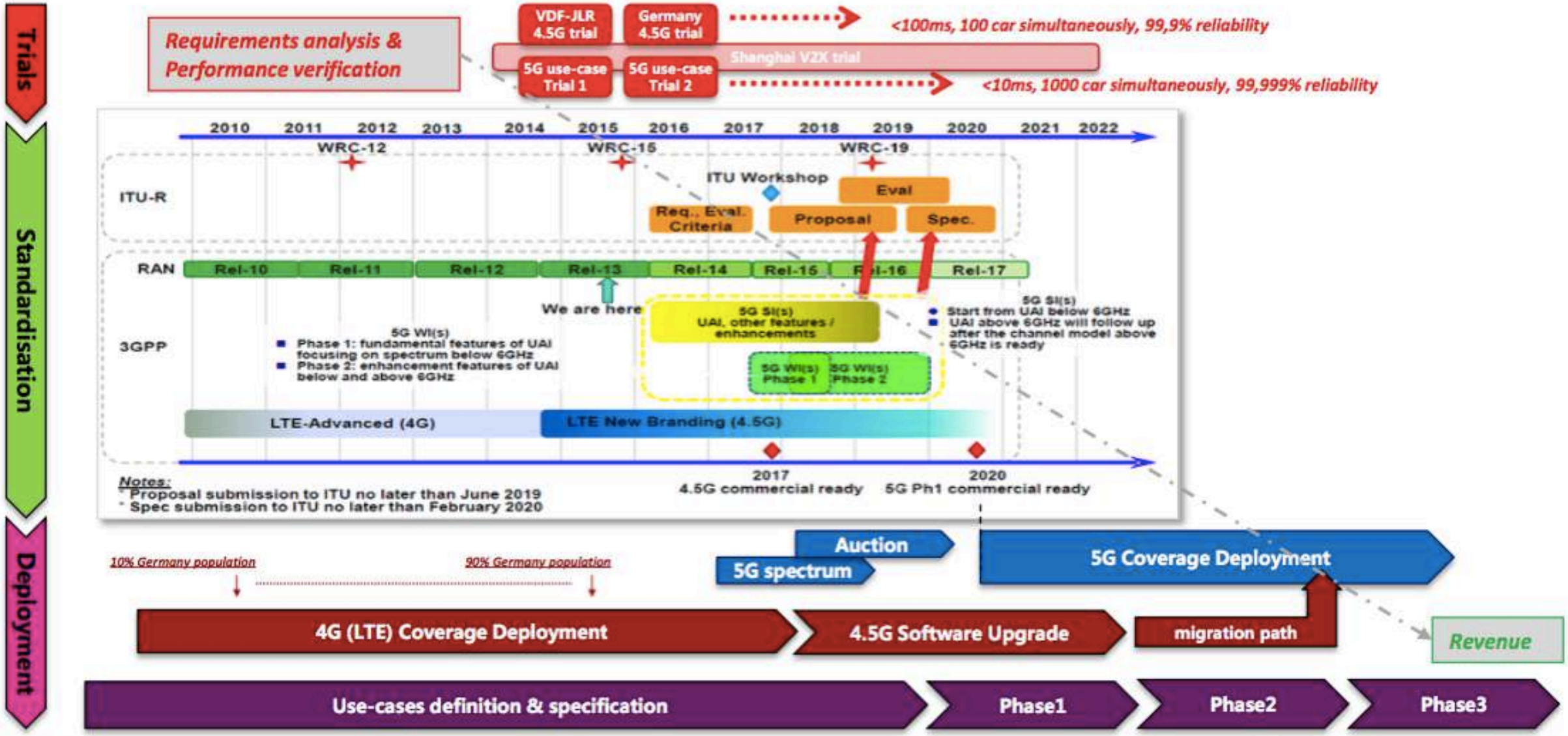
- bi-monthly project meetings
- industry to demonstrate trends
- BMVi to argument towards EU
- EU to release implementation directives on country levels

2015/16 demonstrated projects:
- Audi and Daimler highway autopilot
- DT/Nokia/Continental Mobile Edge Computing
- DT/Audi/Toyota/Huawei LTE-V
- other……
- Two project types: with or without subventions

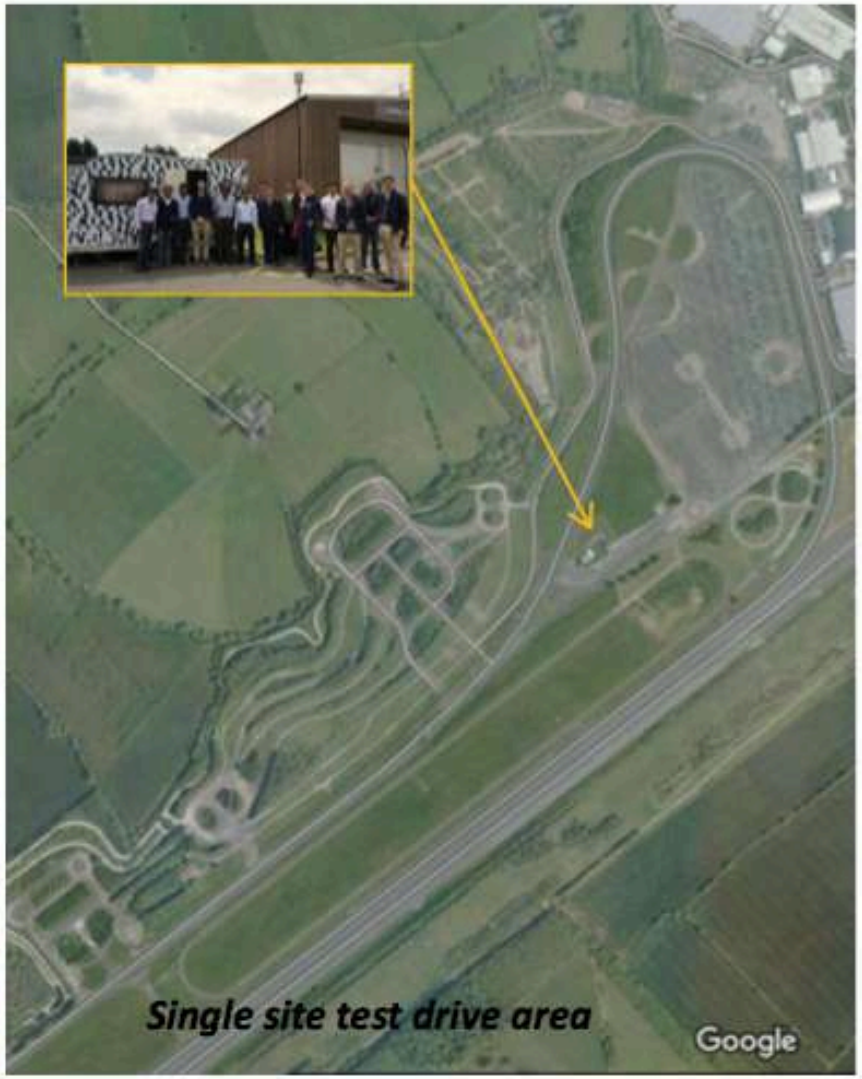
http://www.bmvi.de/DE/DigitalesUndRaumentwicklung/DigitalUndMobil/DigitalesTestfeldAutobahn/digitales-testfeld-autobahn_node.html

BMVi Contact:
Ref-DG24@bmvi.bund.de

Huawei 4.5G and 5G Availability Timeline



4.5G V2X Trial, Use-Cases Test



V2V use cases	Brake Warning	Emergency vehicle warning	Overtaking warning	Intersection collision warning
In-coverage	yes	yes	yes	yes
Out-coverage	yes	yes	yes	yes

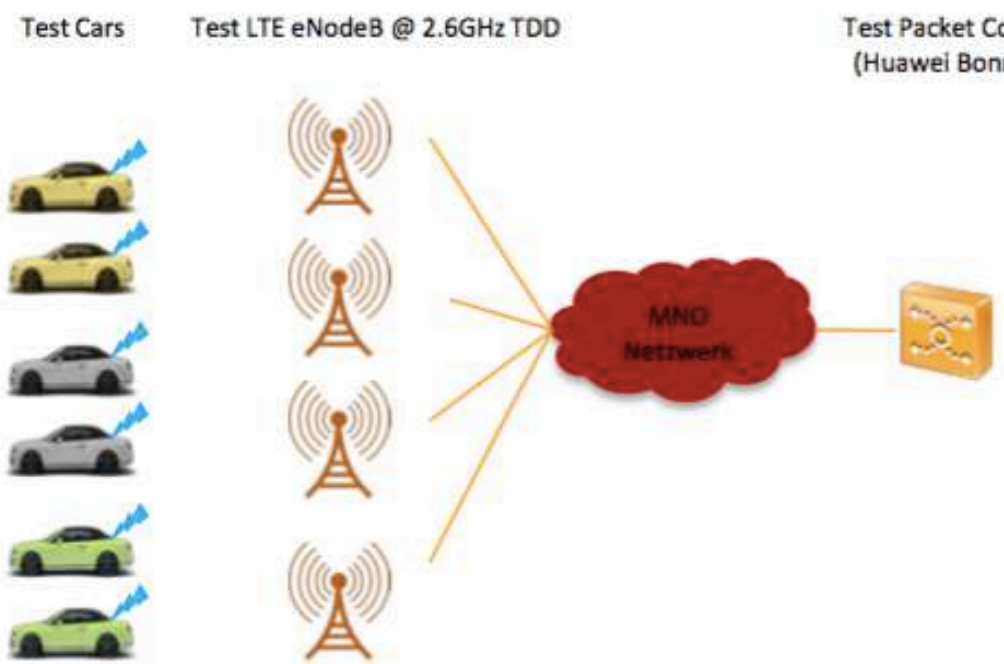
Test Cars

Test LTE eNodeB @ 2.6GHz

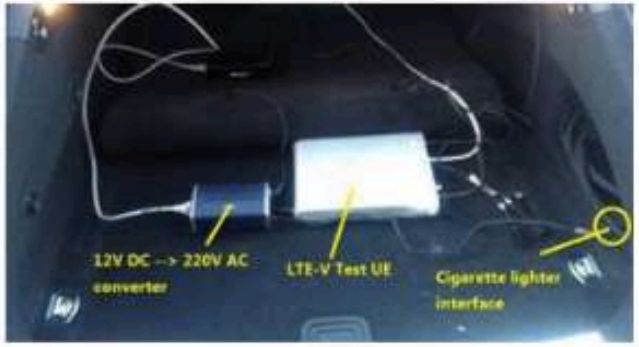
Test Packet Core (compact version)

230V AC Power supply

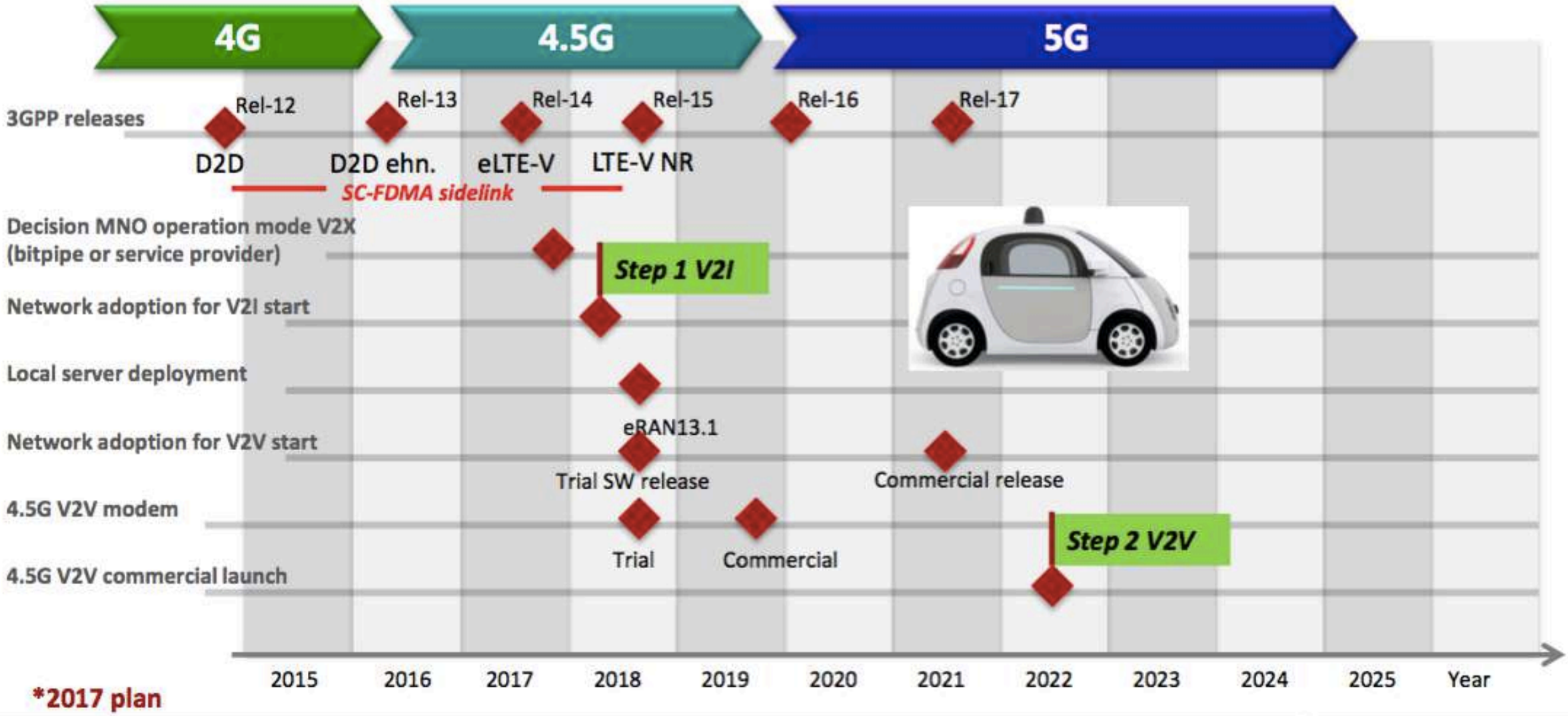
4.5G V2X Trial, Highway Section, Performance Test



Test cases	V2V range	V2V BLER	V2I BLER	V2V delay	V2I delay
In-coverage	yes	yes	yes	yes	yes
Out-coverage	yes	yes	-	yes	-
In⇨out/Out⇨in coverage	-	yes	yes	yes	yes



Huawei Wireless Roadmap for Automated Driving *



*2017 plan

Thank you

www.huawei.com

SATELLITE COMMUNICATIONS SOLUTIONS FOR AUTOMATED DRIVING: Alexander Geurtz, SES

CHAMBRE DE COMMERCE LUXEMBOURG

CHINALUX
China-Luxembourg Chamber of Commerce
中卢商会

SES
beyond frontiers

Satellite communications and automated driving

PRESENTED BY
Alexander Geurtz

PRESENTED ON
16 October 2017

SES Proprietary and Confidential

Outline of Presentation

1 Automated Driving – Key Enablers

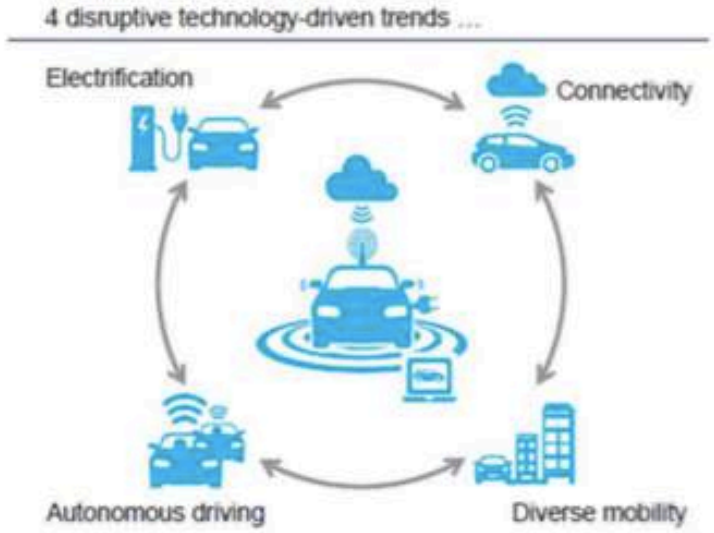
2 Automated Driving – Why Satellites Matter

3 Automated Driving – Key Success Factors for Satellite

4 Automated Driving – Positioning SES for the Future

5 Conclusions

Automated Driving
Key Enablers



Connected car market to grow to USD 156 billion by 2022 from USD 35 billion in 2015 (Strategy& 2016)

Automated Driving is part of a set of disruptive global trends

Communications and data analysis capabilities enable the connected car

Automated Driving is expected to be a disruptive market opportunity.
Communications capabilities, including 5G and satellite, represent a key enabler

Automated Driving
Why Satellites Matter

SES

Source: ESOA

Key satellite features:

Ubiquity
Mobility
Broadcast
Security

Unique features of satellite bring unrivalled benefits to the global communications infrastructure

Automated Driving
Why Satellites Matter

SES

Satellite 5G use cases (examples)

- Providing information and entertainment services
- Enabling Over the Air Firmware and Software (FOTA/SOTA) services
- Information updates such as map information including points of interest (POI)
- Real-time traffic and Parking availability
- Cyber Protection & Security Enhancements (e.g. alternate secure channel for global certificate and key management)
- Increased coverage and reliability for e-Call services, vehicle tracking and remote diagnostics
- Enhanced navigation and positioning

Source: ETSI

Satellite connectivity

Direct: connecting cars directly via satellite

Indirect: efficiently connecting, via satellite, mobile towers with large amounts of data through multicast and local storage (caching)

Satellite enable efficient collection and delivery of massive amounts of data across a wide area

SES
World's Leading Satellite Operator

SES

GEO wide beam

- Over 50 satellite constellation in geostationary orbit
- Reaching 325 million TV households worldwide

GEO HTS

- Global High Throughput Satellite (HTS) platform in geostationary orbit
- Improving value proposition for data applications

MEO HTS

- 12 satellite Medium Earth Orbit (MEO) constellation plus 8 more launching from 2018
- High throughput, lowest latency
- 5 years ahead of competition

65 Satellites

99% of the globe and world population covered

2,000 Employees

65 Nationalities

20 Locations

2B Revenue in euros

Automated Driving
Key Success Factors for Satellite

Success factor	Key Features
Disruptive network capabilities	Ubiquitous, high capacity satellite and ground network, fully integrated into 5G
Unparalleled user experience	Fostering key technologies and products: Low-cost car antennas Satellite-friendly applications
Innovative business models	Work closely with key stakeholders (e.g., Automotive, MNOs, Media, Device, Search and Social Media companies)

Positioning satellite successfully for the future of Automated Driving requires strategic determination. Network infrastructure, user experience and ecosystem elements are key to success

Automated Driving
Positioning SES for the Future

Success factor	Key Features	SES Actions
Disruptive network capabilities	Ubiquitous, high capacity satellite and ground network, fully integrated into 5G	
Unparalleled user experience	Fostering key technologies and products: Low-cost car antennas Satellite-friendly applications	
Innovative business models	Work closely with key stakeholders (e.g., Automotive, MNOs, Media, Device, Search and Social Media companies)	**PARTNER OF CHOICE** serving over 700 broadcasters, telcos, enterprises, governments and institutions in over 130 countries

Thanks to significant investments in disruptive satellite network capabilities and its leadership in the integration of satellite into 5G, SES is well-positioned for the future of Automated Driving

Automated Driving
Conclusions

- **Automated Driving represents a huge opportunity, also for satellite**
- **Satellite's unique features (Ubiquity, Mobility, Broadcast and Security) can be of tremendous benefit to Automated Driving**
- **Network infrastructure (including satellite integration into 5G), user experience and ecosystem elements are key to success for satellite**
- **SES is well-positioned thanks to substantial investments in those key capabilities and ecosystem developments**

SPECTRUM RELATED TRENDS TOWARDS C2C-COMMUNCATIONS AND 5G: Claude Rischette, ILR

CHAMBRE DE COMMERCE LUXEMBOURG

CHINALUX
China-Luxembourg Chamber of Commerce
中卢商会

INSTITUT LUXEMBOURGEOIS
DE RÉGULATION

SPECTRUM RELATED TRENDS TOWARDS C2C-COMMUNICATIONS AND 5G

Claude Rischette
Head of Spectrum department

Outline

- Introduction
- Spectrum aspects on ITS
  - Spectrum harmonization for ITS
  - Coexistence of 2 evolutions
  - Possible scenarios
- European Activities on 5G and ITU steps towards 5G
  - 5G Action Plan
  - 5G Pioneer Frequency Bands

Outline

- Introduction
- Spectrum aspects on ITS
  - Spectrum harmonization for ITS
  - Coexistence of 2 evolutions
  - Possible scenarios
- European Activities on 5G and ITU steps towards 5G
  - 5G Action Plan
  - 5G Pioneer Frequency Bands

ITS and the impact of 5G to C2C Communication

- 5G will enable the “connected car” concept and the development of the **Intelligent Transportation Systems (ITS)** sector
  - 5G will provide *high reliability*, *high data rates*, *low latency* and *massive connectivity* and thus the requirements for supporting billions of connected cars will be fulfilled
  - Current *3G and 4G networks*, do not have that capacity to enable such a connected environment and to deliver safe and efficient services for car communications
  - 5G will ensure continuous and reliable reception from moving vehicles
  - Concept of *virtualization* and *network slicing* of 5G will be significant for implementing different use case for autonomous driving
  - 5G will support also a wide range of *M2M/ IoT applications* to enhance connectivity capabilities

- 5G will play therefore a **key role in the development of future ITS systems**

Outline

- Introduction
- Spectrum aspects on ITS
  - Spectrum harmonization for ITS
  - Coexistence of 2 evolutions
  - Possible scenarios
- European Activities on 5G and ITU steps towards 5G
  - 5G Action Plan
  - 5G Pioneer Frequency Bands

Spectrum harmonisation for ITS in Europe

- **Main band 5.9GHz** (5.875-5.905MHz)
  - Supplemental *band 63-64 GHz* is designated for ITS for *long term evolution*

1. **CEPT** (*Conférence Européenne des Postes et Télécommunications*)
   - Group representing *48 European regulatory administrations* with the main goal to *harmonize spectrum* for different radiocommunication services
   - *CEPT Decisions are NOT binding*, however, in general, high level of compliance as Decisions are developed in consensus
   - In 2008, CEPT developed an ITS harmonization decision (ECC Decision (08)01) designating:
     - **30MHz,** for **safety-related ITS** (5.875-5.905 MHz)
     - **20MHz, extension for safety-related ITS** (5.905 – 5.925 MHz)

Spectrum harmonisation for ITS in Europe

2. European Commission (EC)

- **30MHz** are harmonized for **safety-related ITS** (5.875-5.905 MHz)
  - Mandatory implementation by Member States (*Decision EC/2008/671*)
- **New EC Mandate to CEPT** will be issued this year:
  - to analyse feasible *extension of 20 MHz* **for safety-related ITS (5.905-5.925MHz)**
  - CEPT act as a kind of technical body to develop compatibility studies for EC

Spectrum harmonisation for ITS in Europe

- Principles of **spectrum regulation**:
  - Technology neutrality of spectrum use
    - Spectrum regulation *does not make the choice of a technology*
    - e.g. all current and future harmonized bands for public mobile service are issued according to this principle
    - Consequence → **Market will decide**
  - Efficient use of spectrum
  - Uncompromised safety services for all users in case of multiple technologies implementation (for this ITS specific case)

Global spectrum harmonisation for ITS

- ITS on the agenda of next WRC-19 (World Radiocommunication Conference) in 2019
  - Objective: **global harmonization of ITS**
  - Band already harmonized in EU, USA, CAN and China
  - Good common basis reached already at this stage as all regions cooperate during preparation phase

Coexistence of 2 evolutions

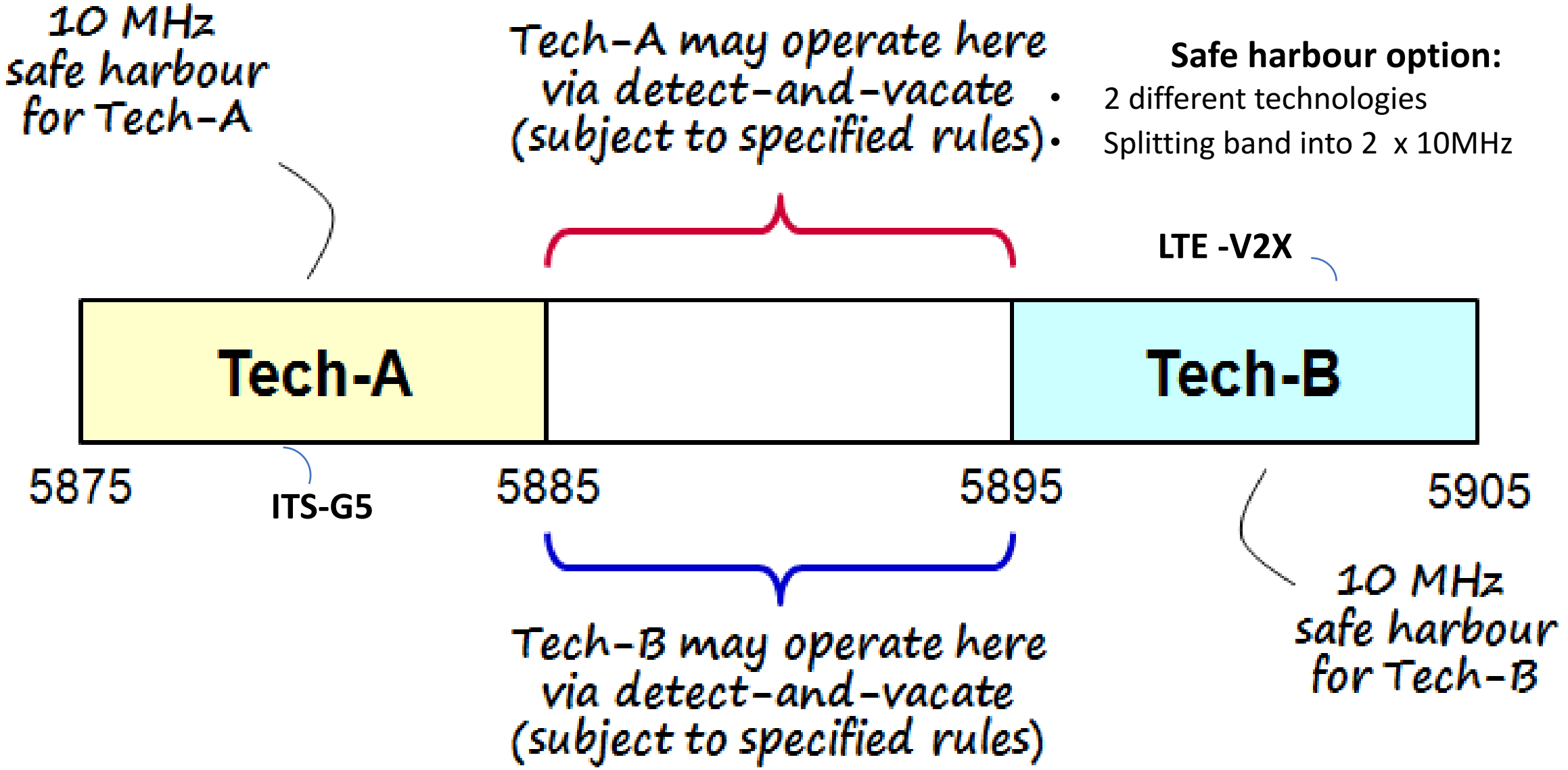
- For the 5.9GHz band, we are facing a **parallel evolution for Intelligent Transport Systems (ITS)**, based on **2 different technologies**:

I. RLAN (wifi) based: **ITS-G5** (**IEEE 802.11p**)
   - Developed for more than 10 years by automotive industry
   - Mature technology

II. LTE based: **LTE-V2X** (vehicle-to-X)
   - X corresponds to **V**ehicle, **I**nfrastructure or **P**ersons
   - Driven by mobile industry (manufacturers/suppliers and different supporting groups like 5G AA automotive association)

Coexistence of 2 evolutions

- Conflict as 2 technologies for ITS in the frequency band (**5.875-5.905MHz**)
  - *could not co-exist* in the same frequency band
  - could result in a *fragmentation* of the 5.9 GHz band
  - **RLAN (ITS-G5) community** claiming:
    - Incumbent service, compliant to ETSI standard (EN 302 571)
    - Some road infrastructure already deployed (e.g. motorways in France or Austria)
  - **LTE-V2X community** response:
    - No requirements for interoperability at this stage
    - No compliance to existing standard necessary (backward compatibility)
    - Short range technology would naturally be integrated in cellular networks



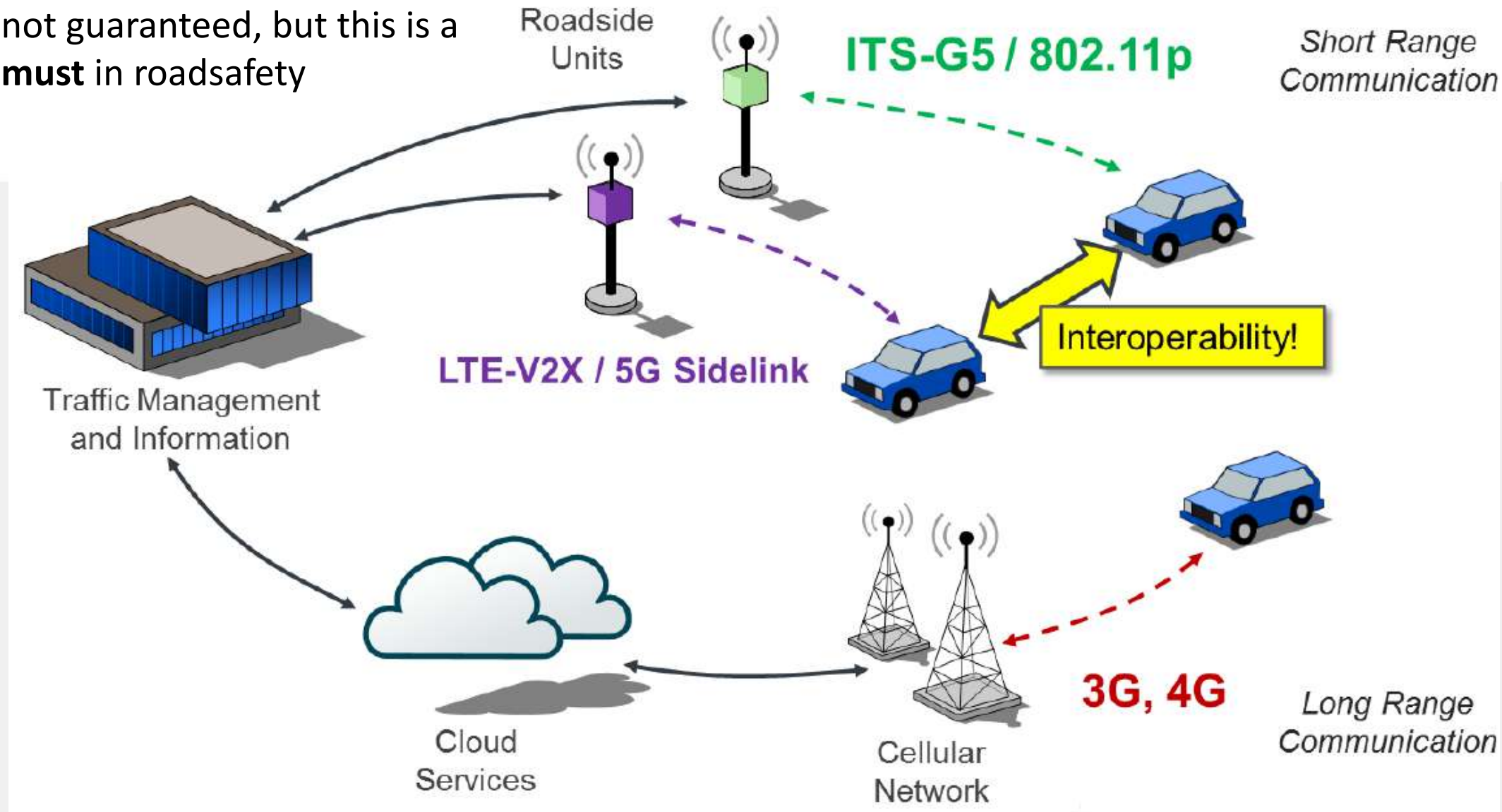
Source: www.5GAA.org

Possible scenarios

However, this might not be an optimal solution, at least not at a long term perspective, as:

- 2 different technologies deployed
- No efficient use of spectrum
- No investment certainty for automotive industry
- Long life cycles of vehicle to be considered
- Compatibility issue still not solved
- Solutions should be future proved, also in terms of future development of 5G

Interoperability at this stage not guaranteed, but this is a **must** in roadsafety



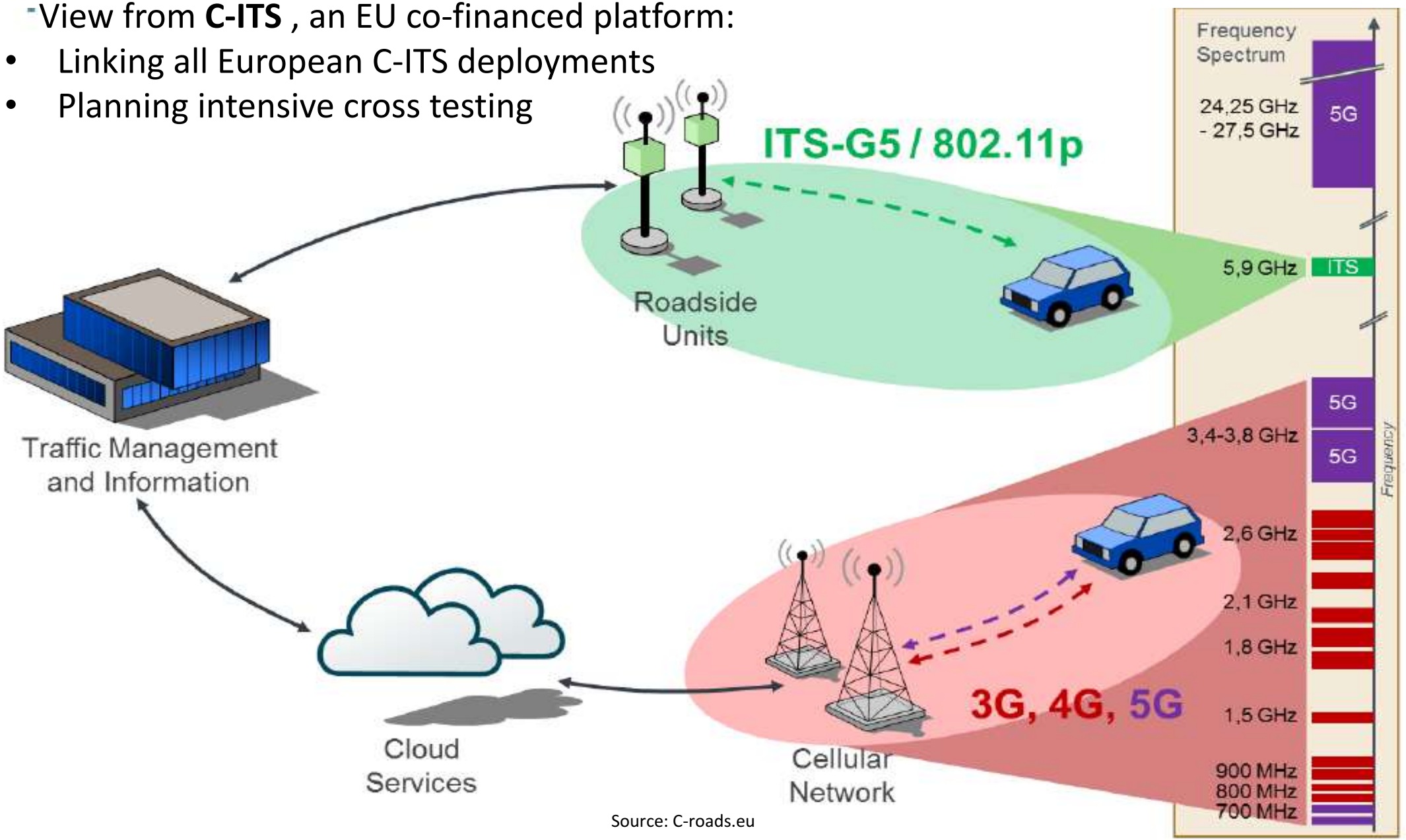
Source: C-roads.eu

Possible scenarios

- Some use cases require performances such as low latency , this could technically only be met by *short range communication*
- Some others need *cellular*, **managed services**
- **Not all ITS services** are **safety related**
- So, of *combination of both demands might be the right option*…

View from **C-ITS** , an EU co-financed platform:

- Linking all European C-ITS deployments
- Planning intensive cross testing



Source: C-roads.eu

Possible scenarios

- This view might lead to a possible solution but still the remaining issue of interoperability
- Proponents of the 2 technologies must find a **common basis** to pave the way to guarantee rad safety for European citizens
- **Hybrid cooperation model with cellular V2X AND ITS-G5** might be the compromise solution:
- **Cellular V2X** would be operated:
  - in **licensed 5G bands**
- **ITS-G5** would be operated:
  - in **unlicensed 5.9GHz** band (as initial foreseen)
- **EU View:** Longer Term evolution of 5G is expected to bring further improvements in cellular communication
  - This should not compromise already deployed ITS services

Outline

- Introduction
- Spectrum aspects of ITS technologies
  - Co-existence of the 2 evolutions
  - Possible scenarios
- European Activities on 5G and ITU steps towards 5G
  - 5G Action Plan
  - 5G Pioneer Frequency Bands

European Commission (EC) – 5G Action Plan

- In the context of the **Digital Single Market** strategy, EC underlines the importance of 5G to strengthen Europe in order to compete in the global market

- The **5G Action Plan** has been adopted in September 2016, main targets:
  - **Early 5G launch** in selected areas in 2018
  - Commercial launch of 5G in at least **one major city of every MS until 2020**
  - **5G everywhere until 2025**
  - **MS** are encouraged **to develop national 5G deployment roadmaps** (by end 2017)

European Commission (EC) – 5G Action Plan

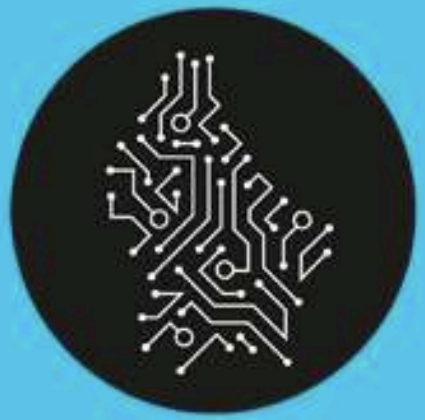
European Commission (EC) – Pioneer Bands

- EC has identified 3 main bands, called ***'Pioneer bands'*** for early introduction of 5G:
  - **700MHz** (694 – 790 MHz)
    - 2 x 30MHz harmonised at EC level for 5G, mainly for **national and indoor coverage**
    - Band should be available by 2020
    - At a first step LTE technology will be used and later in 5G
  - **3400-3800 MHz**
    - 400MHz harmonised at EC level, mainly for **urban areas**
    - Throughputs in first pre-5G trials up to 2 Gb/s
    - Probably first band deployed in 5G in Europe, in other regions, only parts of this band is harmonised for 5G
  - **26GHz (24.25-27.5GHz)**
    - In total more than 3GHz in theory available, many incumbent use e.g. P2P/satellite services links
    - Very high throughputs possible for **very limited ranges**
    - Availability likely > 2020

ITU – Steps forward for 5G

- **WRC-19 (*World Radiocommunication Conference*)** in November 2019, organised every 4 years by ITU
- Following candidate bands for 5G are currently studied with regard to compatibility to other *existing radio services* in these bands
- Goal is during negotiations at WRC-19 worldwide harmonisation for several of these bands:
  - 24.25-27.5 GHz
  - 31.8-33.4 GHz
  - 37-40.5 GHz
  - 40.5-42.5 GHz
  - 42.5-43.5 GHz
  - 45.5-50.2 GHz
  - 50.4-52.6 GHz
  - 66-76 GHz
  - 81-86 GHz

Many thanks for your attention!



Digital
Luxembourg

Leading the way towards a smart nation

PANEL SESSION

Digital connectivity and automotive innovation: shaping a large scale cross-border testbed for automated driving

Moderation

Mr. Peter Sodermans | Digital Luxembourg

Panel members

Mr. Jean Schiltz | Ministry of the Economy

Mr. Karel Sotek | HUAWEI

Mr. Claude Rischette | ILR

Mr. Alexander Geurtz | SES

Digital Luxembourg

CLOSING REMARKS: Dirk Dewitte, CHINALUX

CHAMBRE DE COMMERCE LUXEMBOURG

CHINALUX
China-Luxembourg Chamber of Commerce
中卢商会

BELT & ROAD EVENT SERIES – Next Seminar

CHINA'S BELT & ROAD INITIATIVE – FINANCE SEMINAR:
What does China's Belt & Road Initiative mean for Luxembourg?

Friday 10 November 2017, 10:00am – 1:30pm
Chamber of Commerce of the Grand Duchy of Luxembourg