ICTs as an ITS Infrastructure

Chaesub LEE
Director of TSB

Contents

ITU - What we do

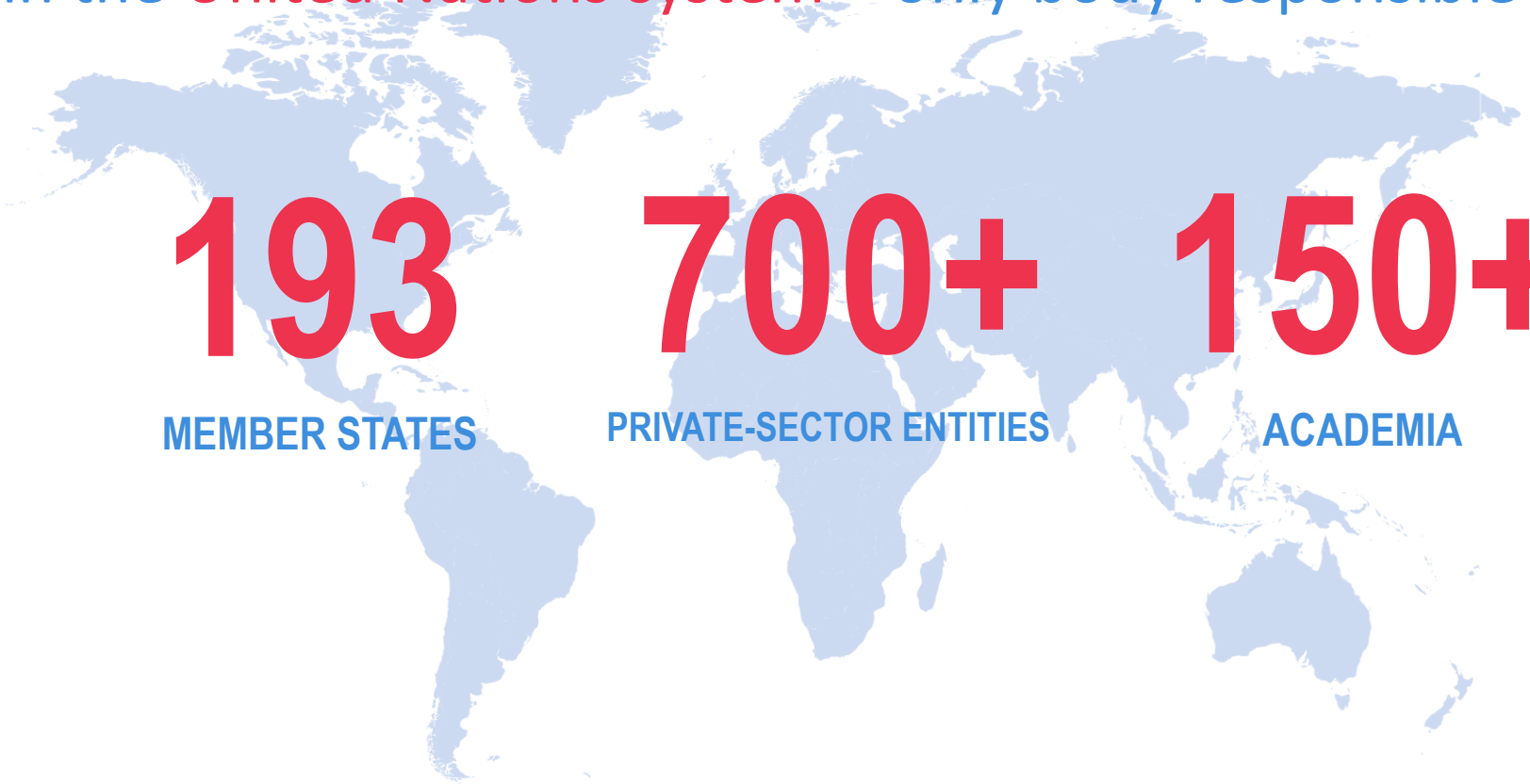
The UN specialized agency for ICTs

- **Allocation** of radiofrequency spectrum and satellite orbits
- **Bridging** the digital divide
- **Establishing** international standards

ITU - Who we are - Who are our Members

Unique in the standards ecosystem – only body including governments and private sector

Unique in the United Nations system – only body responsible for ICT

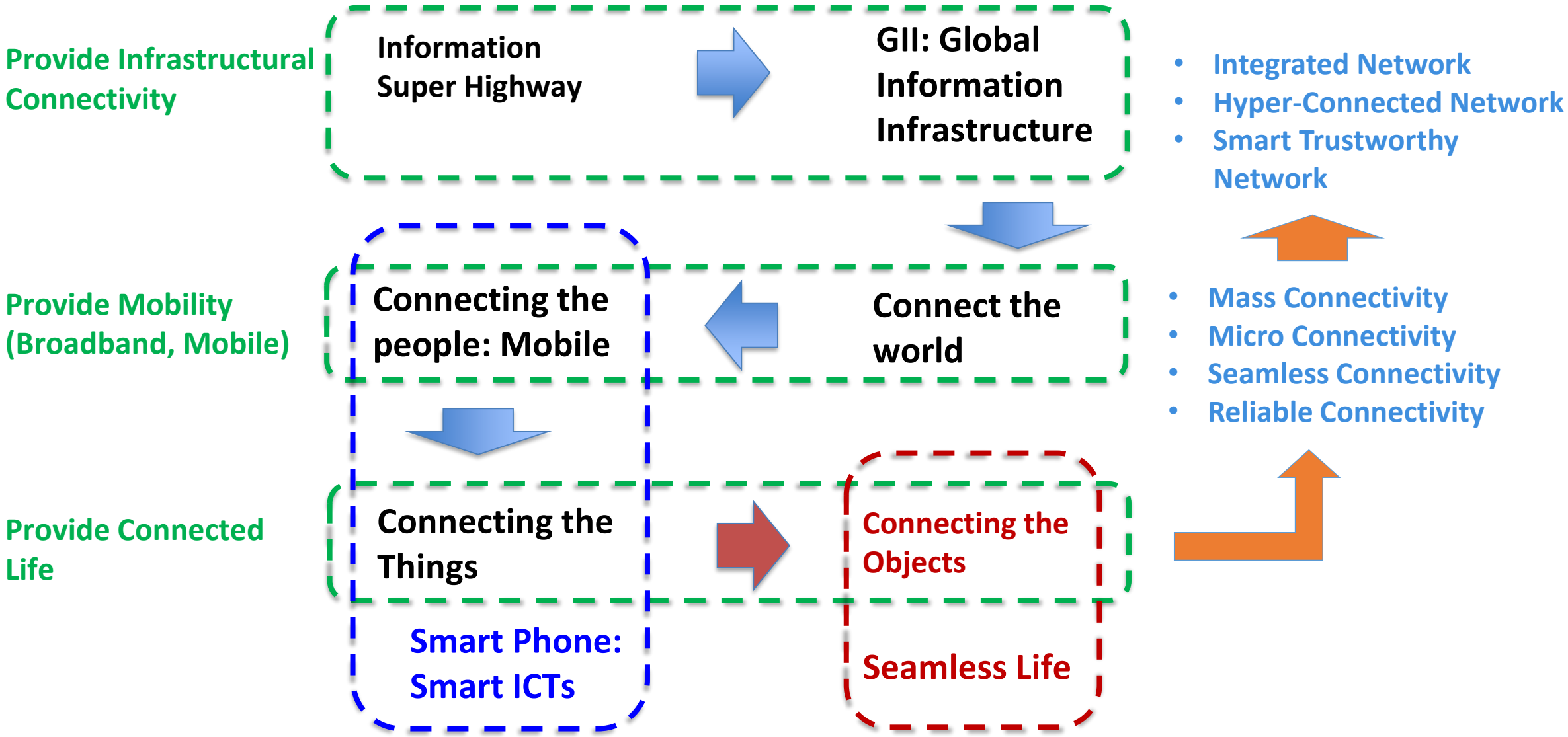


193
MEMBER STATES

700+
PRIVATE-SECTOR ENTITIES

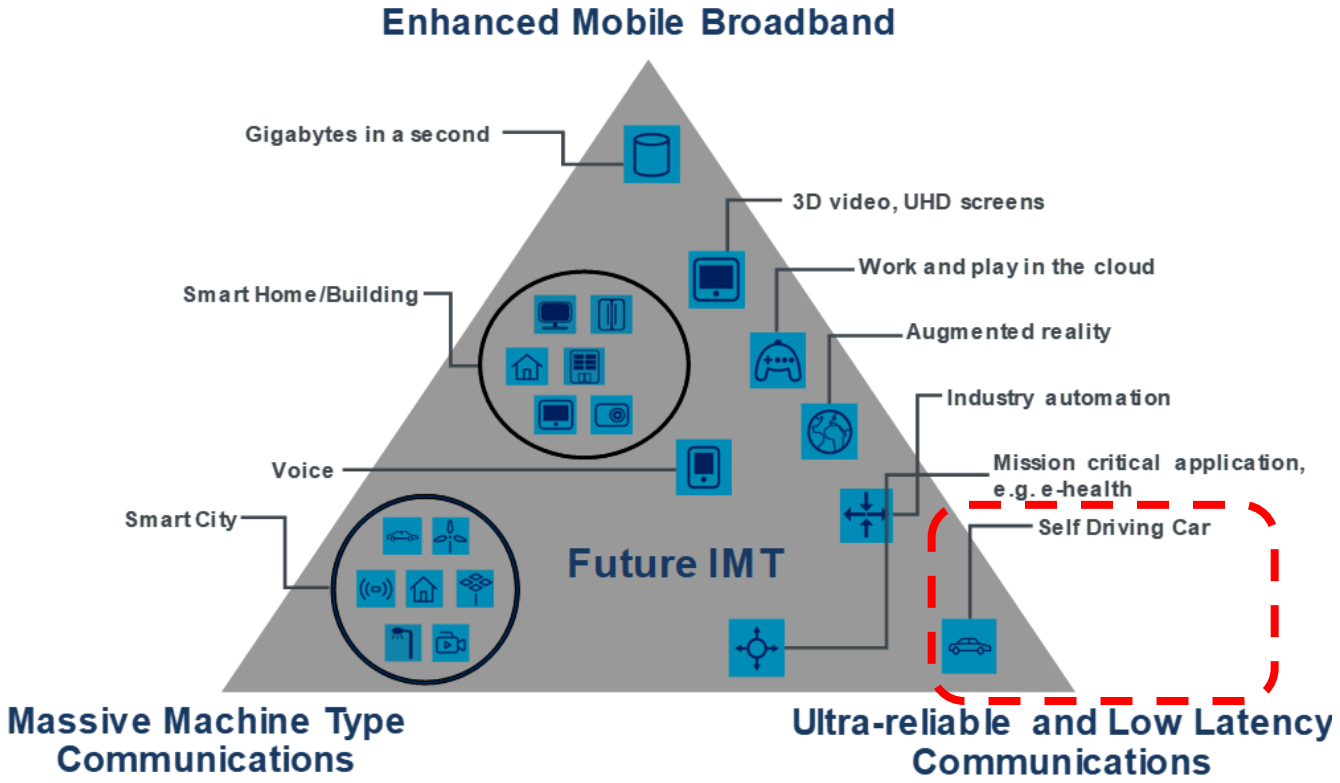
150+
ACADEMIA

Social developments and ICTs (1)

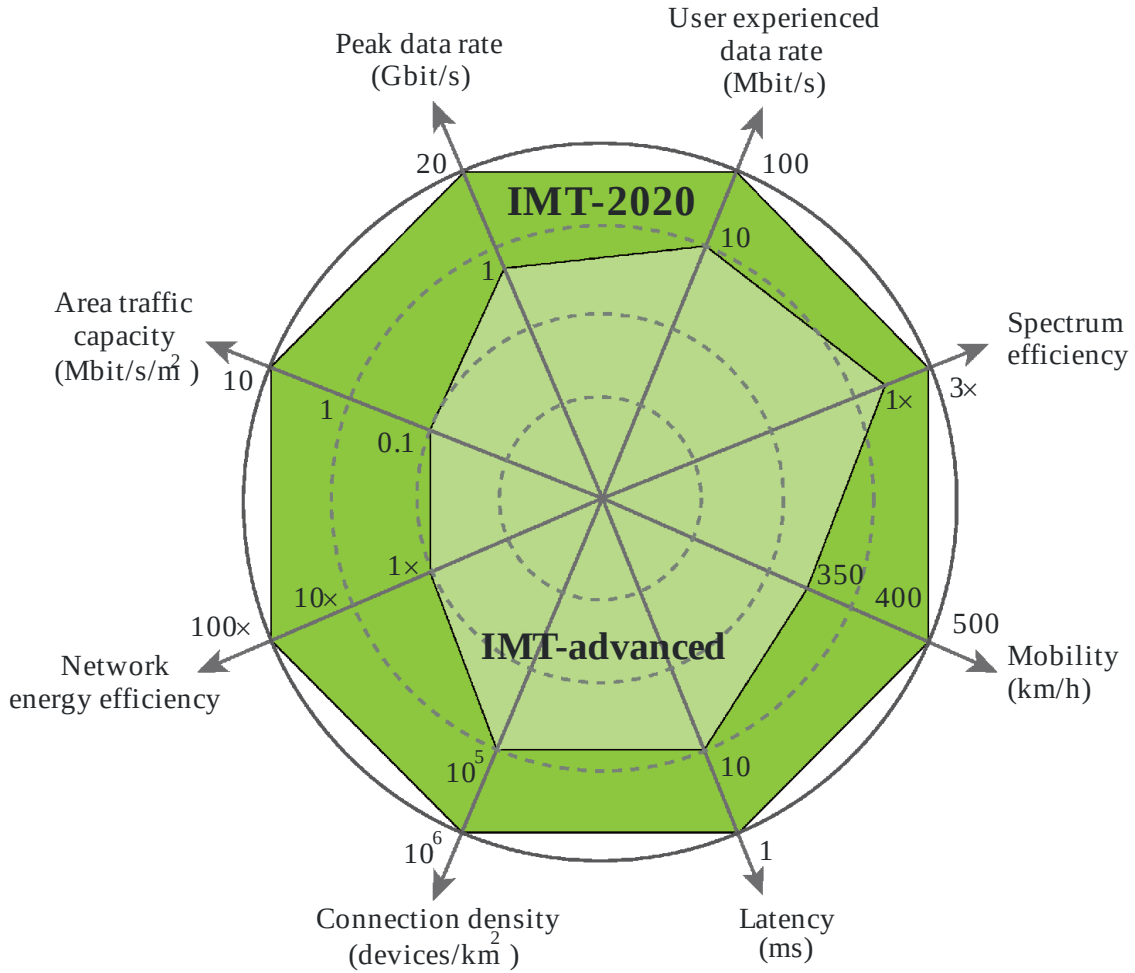


Social developments and ICTs (2)

5G as a Social Infrastructure



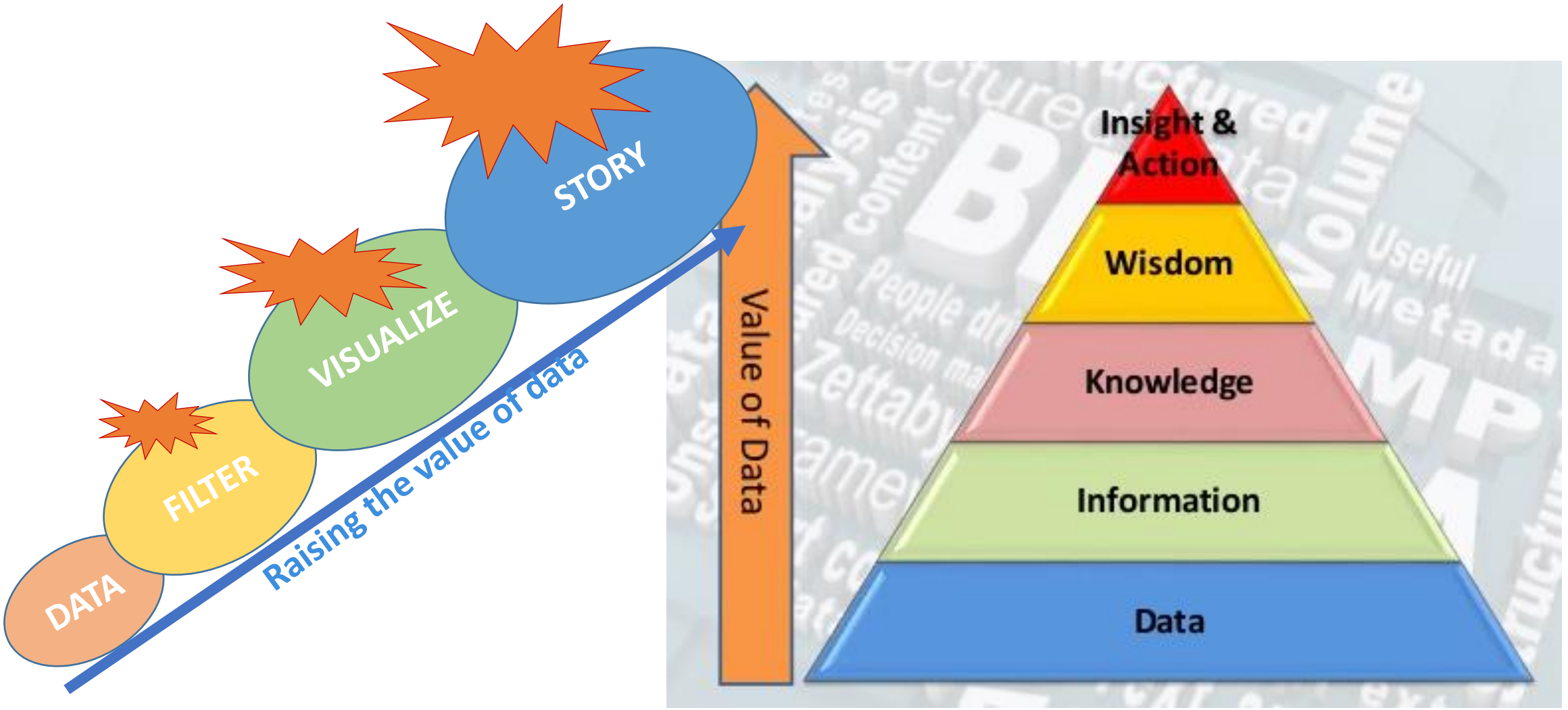
Service Features



Performance Features

M.2083-03

Social developments and ICTs (3)



Innovations with ICTs (1): by ICTs and of ICTs

Innovation by ICTs

- Smart Grid & Mobility
- Mobile Money/DFS
- Smart Sustainable City
- Smart Mobility (inc. Car)

Innovation of ICTs

- Cloudrization
- Softwarization
- IoT/Data PM
- AI & ML
- Emerging Networks

Innovations with ICTs (2)

Business Trends

H/W + S/W

Service Products

Ownership

Sales business

Global/National market

H/W + **S/W**

Application Products

Sharing

Networking business

Regional/City & Community market

Innovations with ICTs (3)

on-Demand Car

AUDI at Home (Since November 2015): San Francisco, Hong Kong

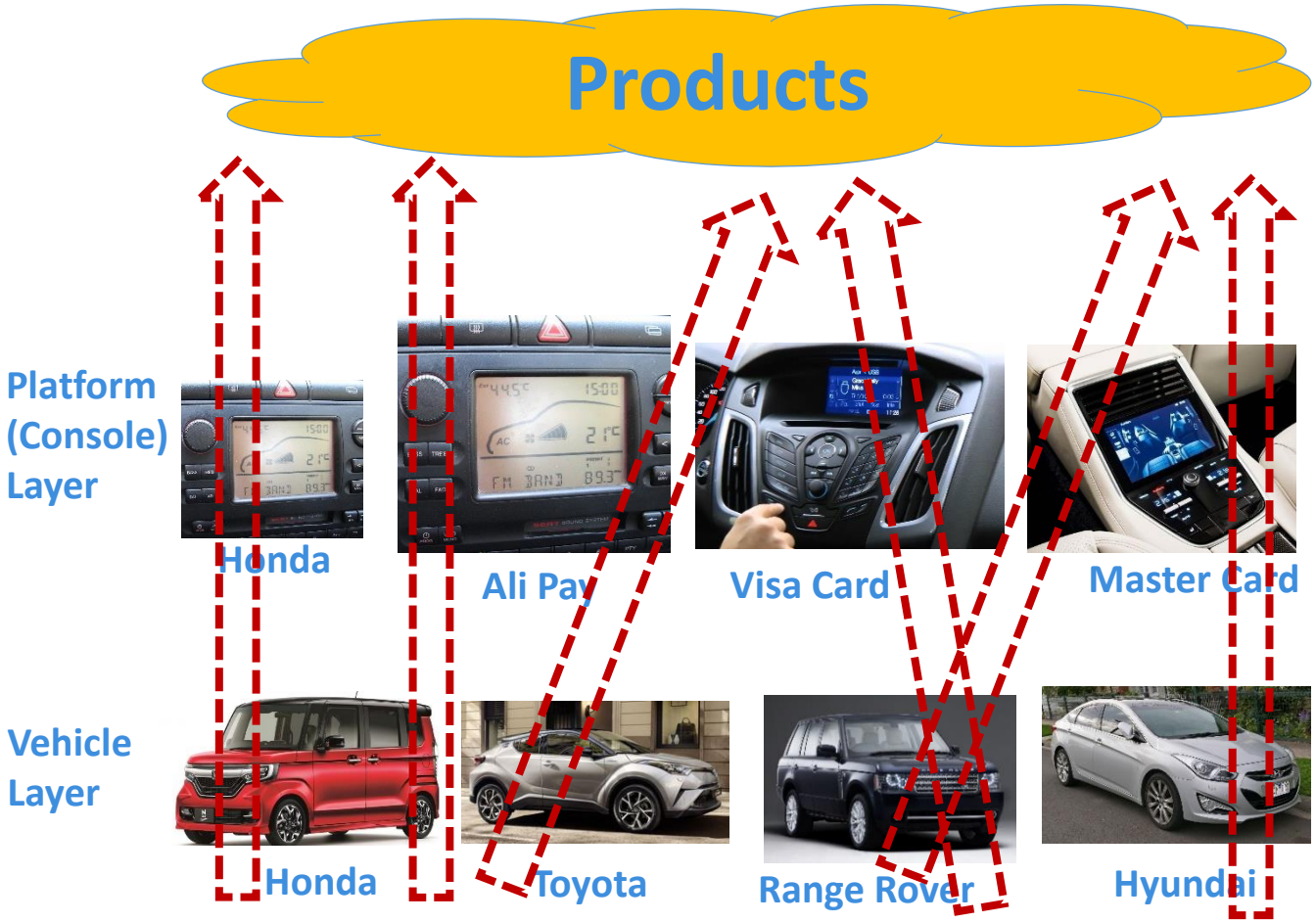
September, 2016: residents of the nearly 1,000-unit "Dragons Range" apartment complex can book their preferred Audi model by smartphone, spontaneously or by prior reservation. Billing is convenient and based on the length of use, from one hour to seven days.

AUDI On-Demand (September 2017): Beijing, Hong Kong, San Francisco, Munich

All customers can now flexibly make use of cars equipped with exclusive features – ranging from compact cars to SUV, as well as high-performance models from Audi Sport. They can use their smartphones to book the model they want or reserve it in advance for time periods lasting from one hour to a month.

Innovations with ICTs (4)

Over the Connected Car: Mobile Payment



According to Gartner, some 250 million connected cars worldwide will be on the road by 2020, just three years away.

Powered by a secure platform for mobile transactions, in-car payments will soon be within a driver's reach. Drivers will be able to view and complete their purchases to smart parking meters and fuel pumps directly from the Vehicle consoles.

Mobilities and Smartness (1)

–Safe-Driving Cars

- Don’t Crash, **Stay in their lane and keep us from mis-behaving**
- **Always on** Automated Emergency Braking, Lane Centering & and Speed Limiting
- Delivers: **Safety**

Mobilities and Smartness (2)

- Self-Driving Cars
  - Safe-Driving + Ability to take Hands-Off Wheel and/or Feet-Off Pedals
    - ONLY: On Some Stretches of Some Roads at Some Times
    - Requires "Adult Supervision"
  - Delivers: User Comfort & Convenience + some Environmental Benefits (less speed variation)
    - Always with Adult-Supervision (?)

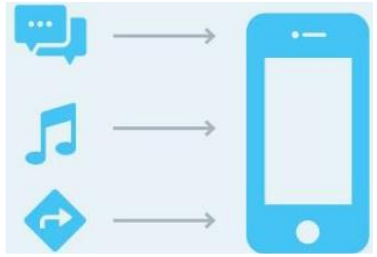
Mobilities and Smartness (3)

- Driverless Cars
  - Safe-Driving + Always: Hands-Off, Feet-Off; No Steering Wheel or Pedals (NO Adult Supervision)
  - Sharing Some Streets at Some Times with Conventionally-driven vehicles
  - Delivers: Mobility for All + Substantial Environmental Benefits (Maybe)
  - These can be “Mobility Machines”
  - More people able to travel More in order to take advantage of More

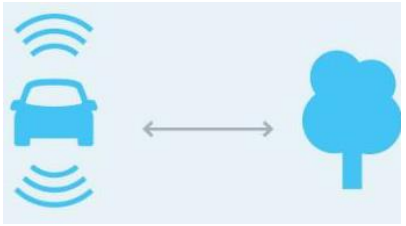
Issues on Smart Mobilities (1)

- **Key Technical Issues on Smart Mobilities: Energy and Smartness (User convenience and Collaboration with Infrastructure)**
  - **Energy: Fossil fuel, Electric, Hydrogen and Hybrid**
  - **Smartness:**
    - **User Convenience: Manual/Automatic, Safe-Driving, Self-Driving and Driverless Driving**
    - **Collaboration with Infrastructures: Traffic systems, ICT equipped road conditions, communication with pedestrian**

Issues on Smart Mobilities (2)



Apps and Services
According to drivers' needs



External sensors
Retrofit & embedded

Behavioral data
Improve performance

Input & output
Custom user experience

Incident data
Improve service

Ref: “The Digital Co-Driver”, German Autolabs, FNC2019, Geneva

Issues on Smart Mobilities (3)

Safety

- Improve support of driver
- Reduce accidents caused by human errors

Efficiency

- Reduced number of crashes
- Better vehicle throughput
- Road capacity learning systems

Mobility

- Shared/on demand mobility
- Access for aging people
- Increasing urban customers
- Multi-modal

Resources

- Sustainability: climate and environmental gains
- Productivity: value of time
- Differentiated use of land/urban/suburban
- Upgraded city planning

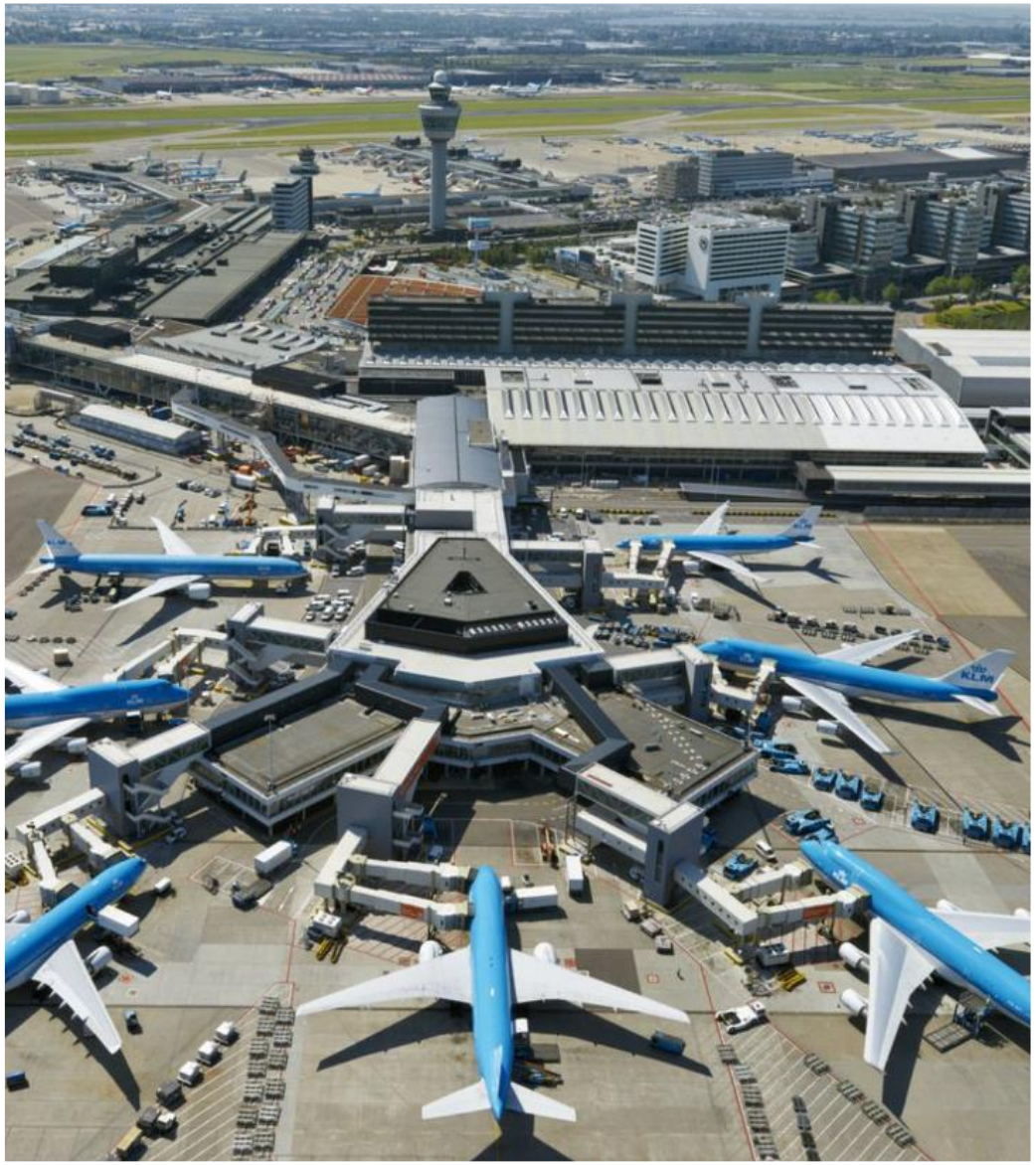
* Ref: “The deployment of automated mobility services”, Joost Vantomme, ACEA, FNC-2019, Geneva

Issues on Smart Mobilities (4)

- Connectivity for automation
  - C-ITS
  - M2M and telecoms legislation
  - Satellite (very precise geo positioning)
- Data economy
  - V2V, V2I, V2X data sharing
  - No need for ex-ante regulatory intervention -> new markets, innovation
- Data protection & privacy
- Liability rules
- Artificial intelligence and Machine Learning
- Spectrum
- Refit public transport legislation for shared autonomous driving ?
- MaaS: data sharing, public/private

* Ref: “The deployment of automated mobility services”, Joost Vantomme, ACEA, FNC-2019, Geneva

Issues on Smart Mobilities (5): Control Tower



Even when equipped with autopilot, a fleet of airplanes still depends on a **control tower** to be operated.

The benefits of autonomous mobility don't lie solely in autonomous vehicles, but in what they can offer when they are **operated and managed collectively**

Ref: "SMART MOBILITY SERVICES PLATFORM", bestmile, FNC2019, Geneva

Connectivity & Data (1)

Results from Studies

- 20% of revenues of an OEM could come from mobility and connected services (Deloitte, 05.2017)
- «Access to car-generated data» is one of six top trends expected to change the aftermarket game (McKinsey, 06.2017)
- New ownership models, access to fleet business, mobility as a service are key to participate in the market growth (QVARTZ / Stern Stewart & Co, 09.2018)
- The access to data model should mitigate the risk of concentration of power with one group of market participants and prevent the situation of a distorted market to the detriment of consumers before competition law can be applied. (TRL, 09.2017)
- Policy makers could consider measures to promote more competition in these markets and reduce the OEMs monopolistic hold on car data and service delivery channels (JRC, Digital EconomyWorking Paper 09.2018)

Ref: “The deployment of automated mobility services”, Frank Schlehuber, CLEPA, FNC-2019, Geneva

Connectivity and Data (2)

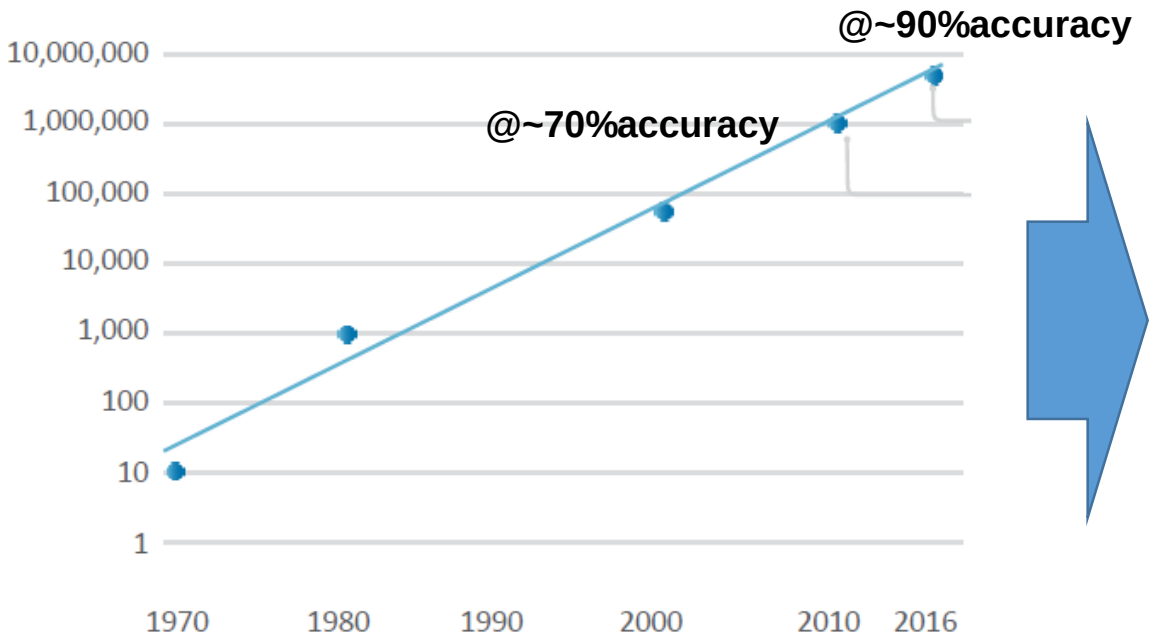
Examples for Mobility Services –Just the Beginning

- Predictive maintenance services
- Parts design optimisation
- Driver style surveillance (insurance use case)
- Vehicle functions on demand (aux. heating, engine power, ..)
- Software updates over the air
- Fleet management services
- Smart access (delivery services, car sharing, ..)
- Remote diagnostics
- Concierge services (parking, payment, ….)
- Information and entertainment offers
- …

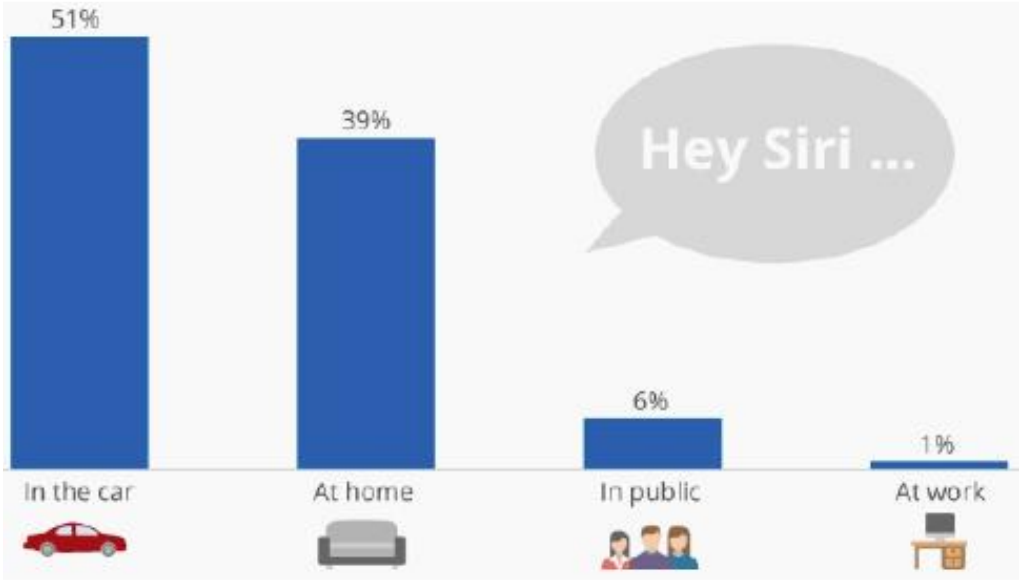
Ref: “The deployment of automated mobility services”, Frank Schlehuber, CLEPA, FNC-2019, Geneva

Connectivity and Data (3)

Words recognized by machine (per Google), 1970 –2016



Where people use voice assistance (by smartphone)

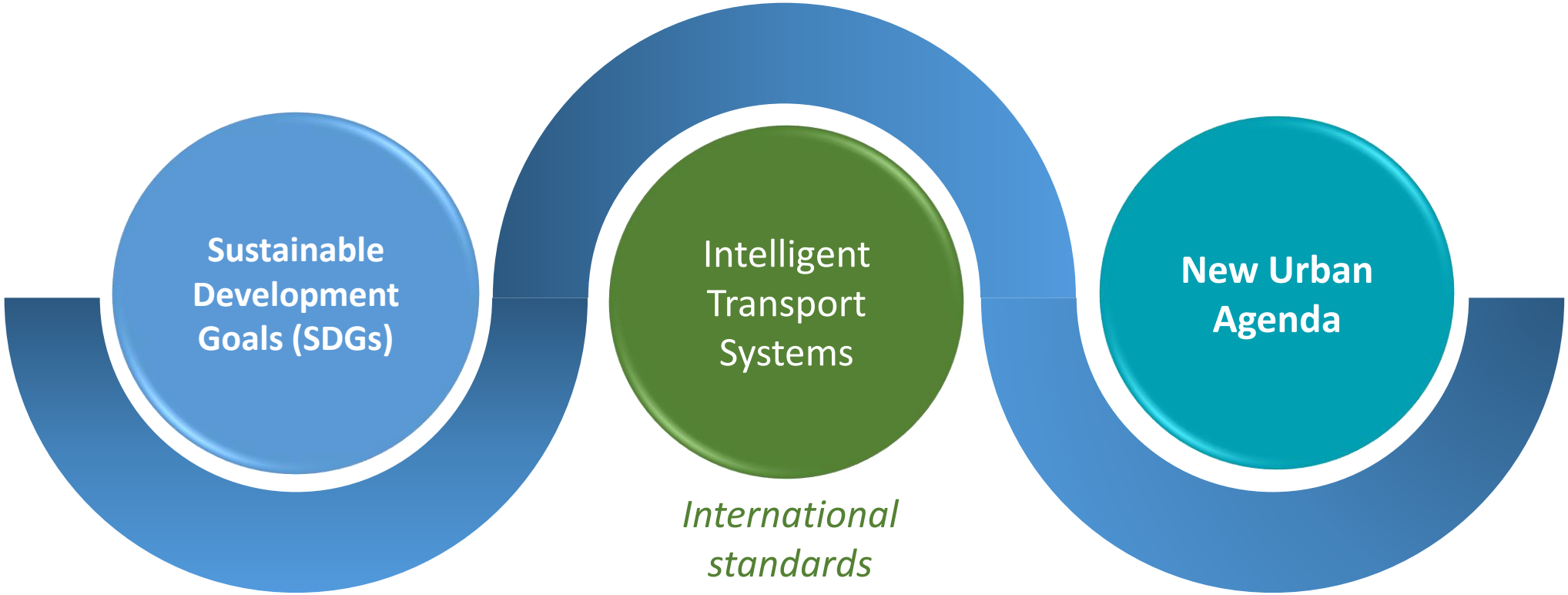


Source: Mary Meeker Report, June 2016

ITS in the context of United Nations (1)

- 17 SDG goals set by United Nations (2015)
- Serves as “blueprint” and underlying framework for a sustainable future for all by 2030

- Outcome of the bi-decennial United Nations Conference (2016) on Housing and Sustainable Urban Development
- Serves as guideline for urban development until 2036



ITS in the context of United Nations (2)

ITS in UN SDGs

11 SUSTAINABLE CITIES AND COMMUNITIES

11.2 By 2030, provide access to safe, affordable, accessible and sustainable transport systems and improve road safety by expanding public transport

3 GOOD HEALTH AND WELL-BEING

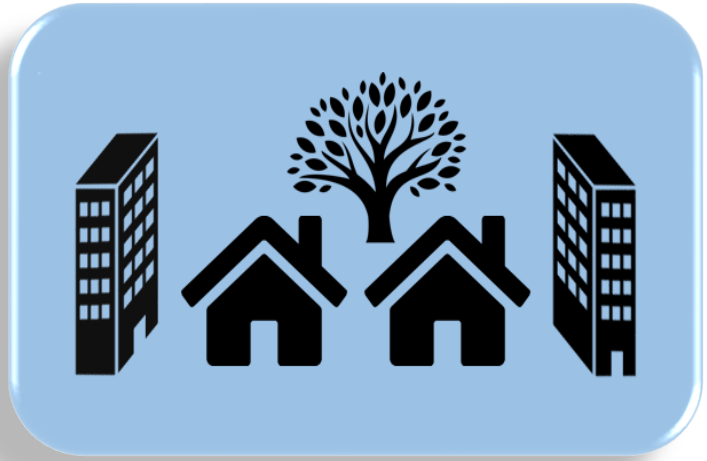
3.6 By 2020, halve the number of global deaths and injuries caused from road traffic accidents

7 AFFORDABLE AND CLEAN ENERGY

7.3 By 2030, double the global rate of improvement in energy efficiency

ITS in the context of United Nations (3)

Link to ITS in the New Urban Agenda



Quito, Ecuador from 17-20 October 2016

- It provides the basis for **planning** and **investment** for **sustainable, safe, accessible** urban mobility **for all**

- Term "**transport**" mentioned **30** times underscoring:
  - **resource-efficient** transport
  - **sustainable** transport
  - **innovative** transport technologies

Standardization on ITS (1)

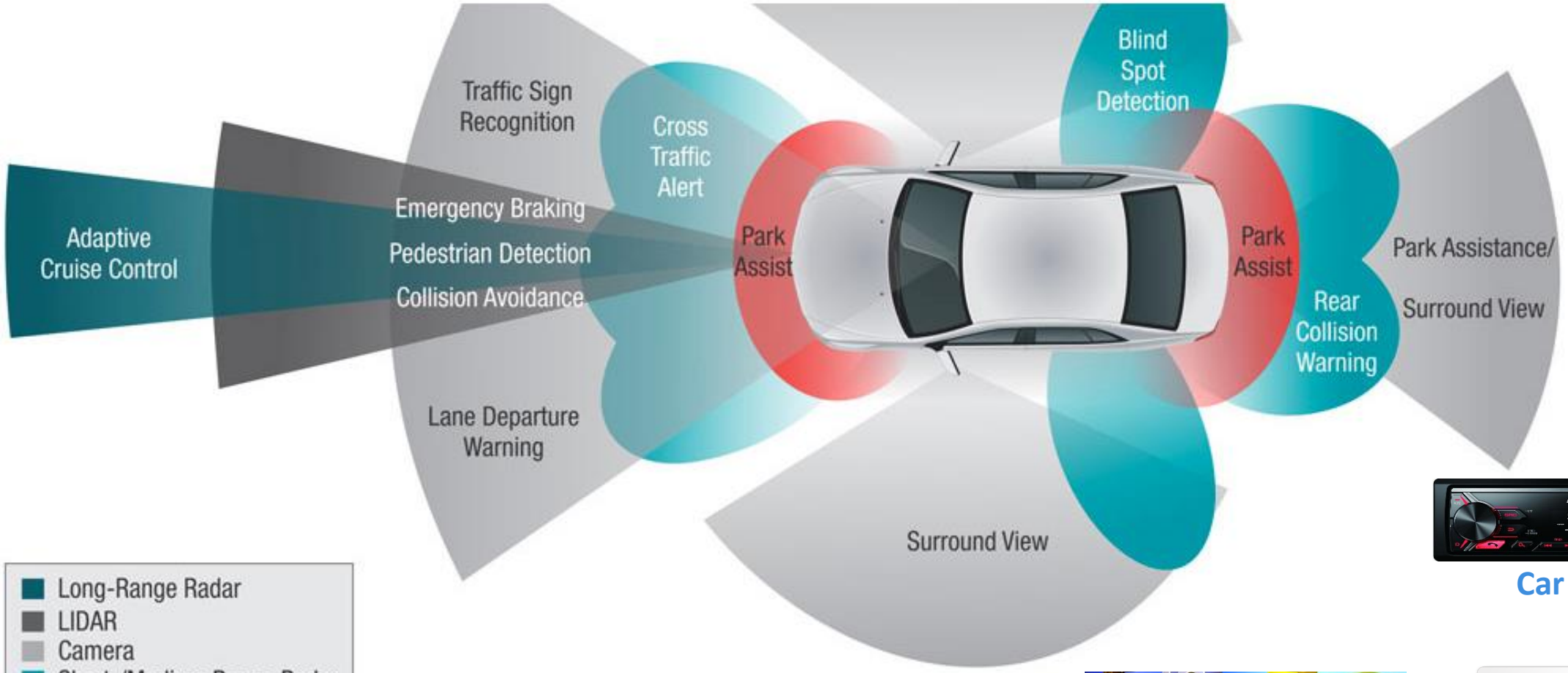
Radiocommunication Sector (ITU-R)

- Working Party 5A (spectrum allocation & harmonization, automotive radar)

Telecommunication Standardization Sector (ITU-T)

- Study Group 17 : ITS and automotive cybersecurity (remote SW update)
- Study Group 12 : Quality of Service of speech and audio in vehicles
- Study Group 2 : Numbering for In Car Emergency Communication (ICEC)
- Study Group 20 : ITS and Internet of Things and Smart Cities
- Study Group 16 : Vehicle gateway and in car multimedia platforms
  - *ITU-T Focus Group on Vehicular Multimedia (FG-VM)*

Standardization on ITS (2): spectrum for vehicles (1)



GPS

Car Radio

Mobile communication and Internet access

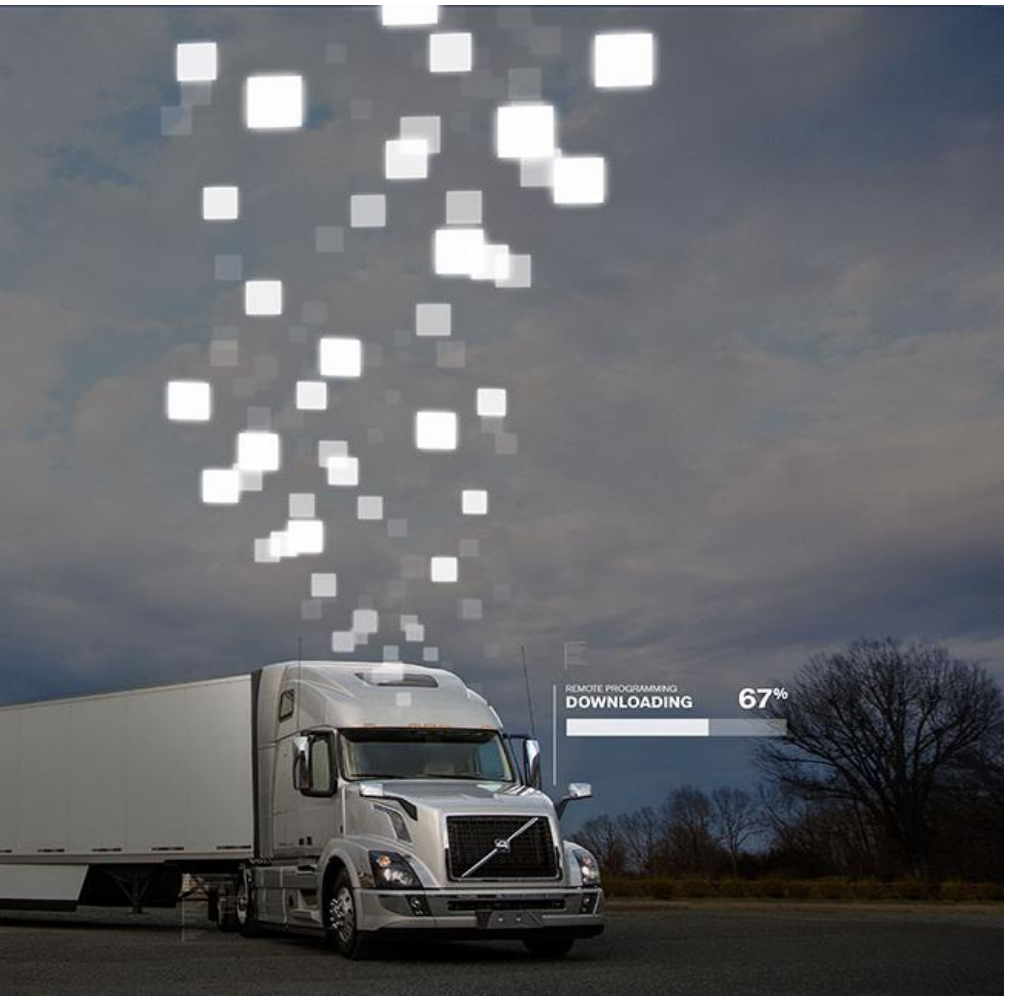
Standardization on ITS (2): spectrum for vehicles (2)

- WRC 2019
  - Key forum
  - Need for globally harmonised frequency allocation
- Frequency allocation
  - Scare resource
  - Ensure efficient use of spectrum
  - Safeguard 5,9 GHz for road ITS safety
- V2V : interoperability and backwards compatibility in European C-ITS approach

Standardization on ITS (3): ITU-R

- Techniques to transfer data over short distances between a roadside infrastructure and mobile units (V2V and V2X) - M.2084-0
- Technologies and characteristics for Dedicated Short Range Communications (DSRC) - 5.8 GHz - M.1453-2
- System characteristics and applications for Automotive radar in various frequency bands) - M.1452, M.1453, M.1890, M.2057
- System requirements for Millimetre wave radiocommunication (including Collision avoidance radar) ~ 60-80 GHz- M.1452-2
- Automotive Radar technologies and possible interference with incumbent services – 78 GHz - M.2322-0
- Usage of ITS technologies, frequency bands, status of standardization, and related applications and deployments in ITU Member States M.[ITS_USAGE]
- Studies on harmonisation of frequency bands for ITS services M.[ITS_FRQ]
- Currently working on studies in preparation of WRC-19: Plans to consider possible global or regional harmonized frequency bands for evolving ITS

Standardization on ITS (4): ITU-T SG17



SG17: ITU standards secure over-the-air software updates for vehicles

ITU-T X.1373 (2017-03)

A successful future automated driving car must ensure security and safety through cybersecurity mechanisms and secure over-the-air software updates

Standardization on ITS (5): ITU-T SG17

SG17: Ongoing ITS Security standards work

In ITS environment a vehicle may act as router to transmit to other vehicles.
So the vulnerability of a vehicle can be propagated to the other vehicles
→ Security is very important

- X.srcd: Security requirements for categorized data in V2X communication
- X.itssec-2: Security guidelines for V2X communication systems;
- X.itssec-3: Security requirements for vehicle accessible external devices;
- X.itssec-4: Methodologies for intrusion detection system on in-vehicle systems;
- X.itssec-5: Security guidelines for vehicular edge computing;
- X.stcv: Security threats in connected vehicles
- X.edrsec: Security guidelines for cloud-based event data recorders in automotive environment
- X.fstiscv: Framework of security threat information sharing for connected vehicles
- X.eivnsec: Security guidelines for the Ethernet-based in-vehicle networks
- X.mdcv: Security-related mis-behavior detection mechanism based on big data analysis for connected vehicles

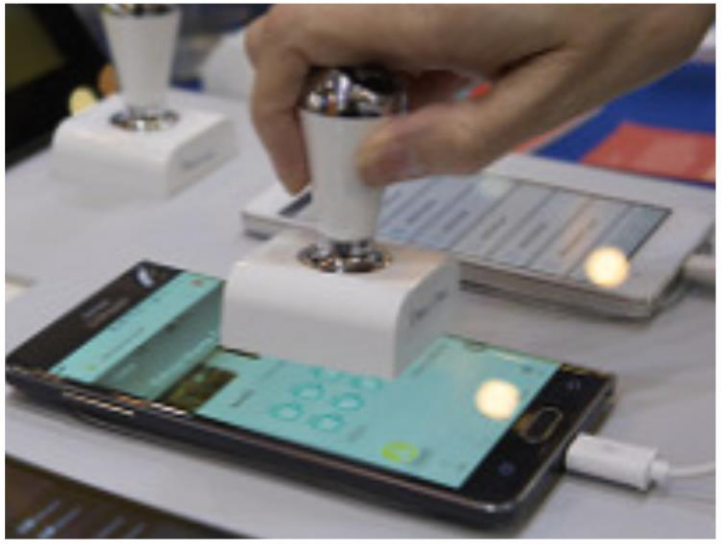
ITU-T SG17 collaborate actively with UNECE WP.29 *[**UN Task Force on Cyber Security and OTA Issues (CS/OTA)**]* Regulations for cyber security and over-the-air updates in progress

Standardization on ITS (6): ITU-T SG12

SG12: ITU standards improve quality of hands-free communication in vehicles

ITU-T P.1100
ITU-T P.1110
ITU-T P.1120
ITU-T P.1130

ITU Telecom World 2017 Busan

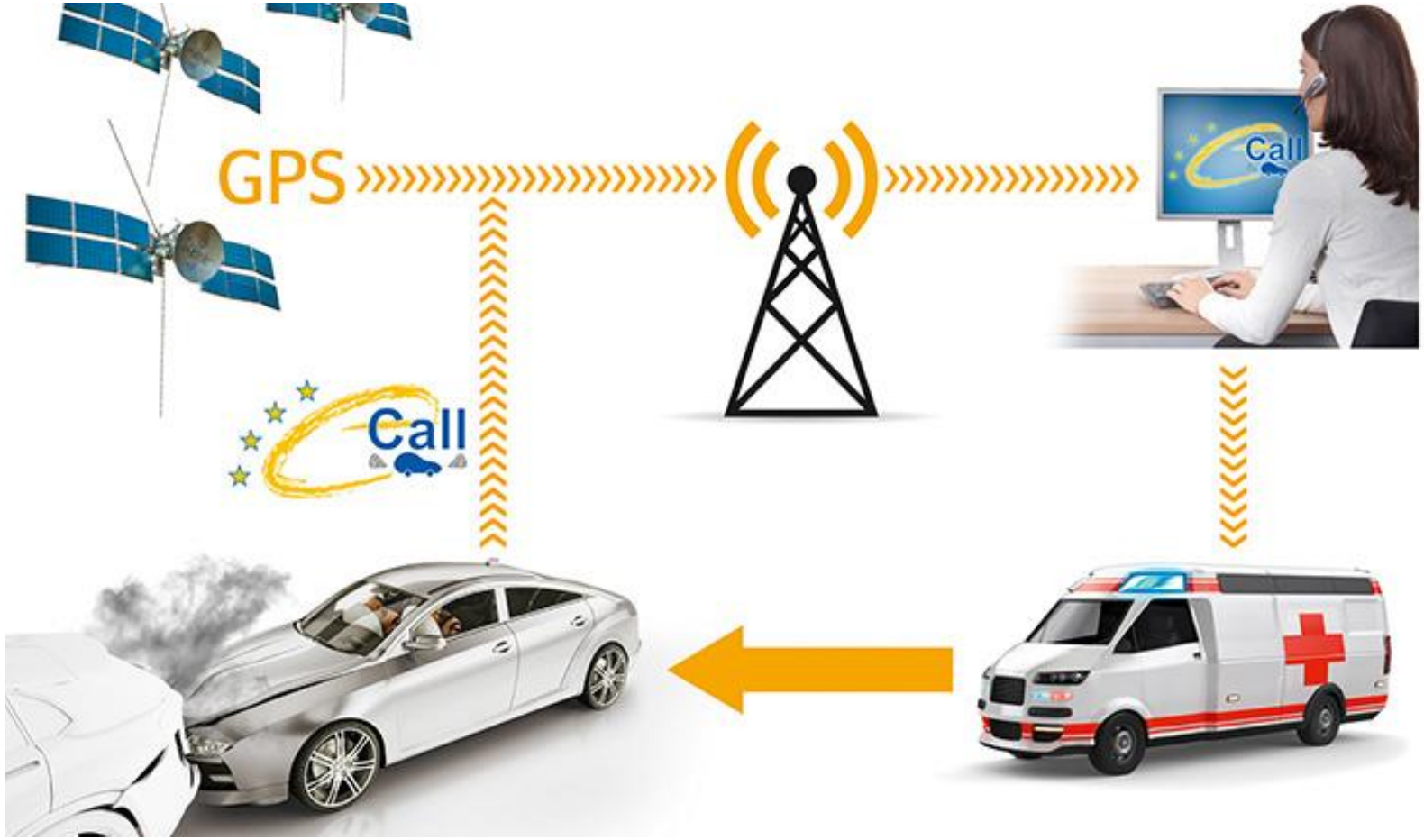


ITU Telecom World 2016 Bangkok

ⓘ ITU conducts test events of mobile phones and vehicle hands-free systems

Standardization on ITS (7): ITU-T SG12

SG12: ITU standards make e-calls intelligible



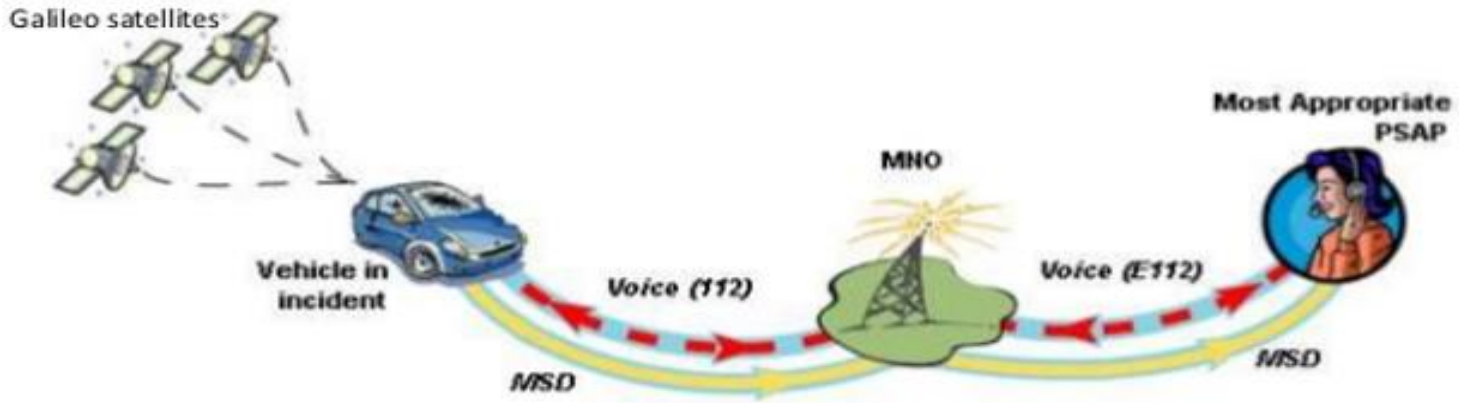
Source: Continental - Automatic Emergency Call

ITU-T P.1140: Speech communication requirements for emergency calls originating from vehicles
Referenced in new UN regulation on automatic emergency call system for road traffic accidents (UNECE WP.29)

Standardization on ITS (8): ITU-T SG2

SG2: Numbering for in Car Emergency Communication (ICEC) calls

Global numbering resources used for ICEC calls are under consideration



MSD – Minimum Set of Data
PSAP – Public Safety Answering Point

Standardization on ITS (9): ITU-T SG20

SG20: Standards for IoT and Smart Cities

Completed standards work

- ITU-T Y.4116: Requirements of transportation safety services including use cases and service scenarios.
- ITU-T Y.4119: Requirements and capability framework for IoT-based automotive emergency response system

Ongoing standards work

- Y.IoT-ITS-framework: Framework of Cooperative ITS based on the IoT
- Y.IoT-UAS-Reqts: Use cases, requirements and capabilities of unmanned aircraft systems for IoT
- Y.AERS-msp: Minimum set of data structure for automotive emergency response system
- Y.AERS-mtp: Minimum set of data transfer protocol for automotive emergency response system
- Y.TPS-afw: Architectural framework for providing transportation safety service
- Y.NDA-arch: Functional architecture of network-based driving assistance for autonomous vehicles

Standardization on ITS (10): ITU-T SG16

SG16: ITS Standards for vehicle gateway platform (VGP)

Vehicle gateway platform (VGP) Standards

- ITU-T F.749.1: Functional requirements for vehicle gateways
- ITU-T F.749.2: Service requirements for vehicle gateway platforms
- ITU-T H.550: Architecture and functional entities of vehicle gateway platforms
- ITU-T H.560: Communications interface between external applications and a vehicle gateway platform

ITS technical paper agreed

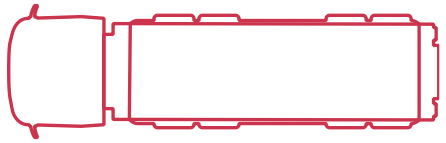
- HSTP-CITS-Reqs (2014) - Global ITS Communication Requirements

ITS technical papers under study

- F.AUTO-TAX - Taxonomy for ICT-enabled motor vehicle automated driving systems
- HSTP-VG-Gap - Technical Paper: Gap Analysis of Vehicle Gateways defined by SDOs
- F.VS-AIMC - Use cases & requirements for MM comm. enabled vehicle systems using AI

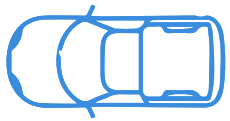
Standardization on ITS (11): ITU-T FG-VM

Focus Group on "Vehicular Multimedia" (FG-VM)



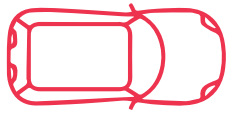
Vehicular multimedia system

- 4th screen after *TV, PC & Mobile Phone*
- 3rd infotainment space after *home, office*



Aim of FG-VM

- Integration of Terrestrial and Satellite networks
- Integration of Broadcasting and Internet services
- Reduce costs using converged networking
- Provide wide area coverage

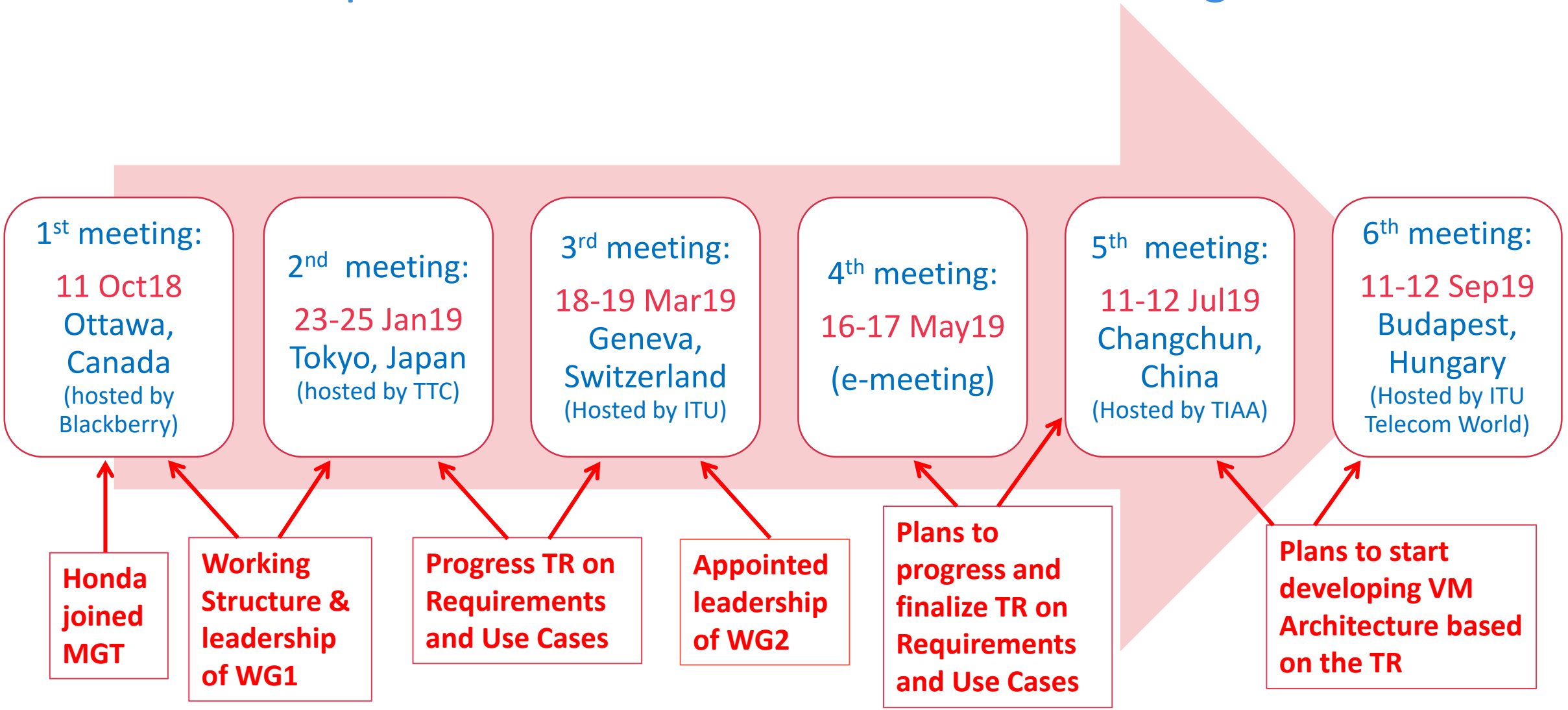


Challenges

- Integration and compatibility with mobile communication: 3, 4, 5G and beyond
- Software protocols and hardware specifications standardization and adoption
- Harmonization of Transport regulations
- Involve international experts and stakeholders

Standardization on ITS (12): ITU-T FG-VM

Focus Group on "Vehicular Multimedia" – Meetings overview



Standardization on ITS (13): ITU-T FG-VM

Focus Group on "Vehicular Multimedia"– Status of the work

- Two events were organized to brainstorm on the future of vehicular multimedia: **mini-Workshop** (Ottawa) and **Workshop** (Tokyo)
- Agreed working structure
  - WG1: VM use cases and Requirements
  - WG2: VM Architecture
  - WG3: Implementation aspects of VM
- Started developing a Technical Report (TR)
  "Use cases and requirement for the Vehicular Multimedia system"
- Management team for WG1 and WG2 appointed
- Calling for stakeholders to contribute to progress the TR above and start discussing a VM Architecture

Standardization on ITS (13): ITU-T FG-VM

TIAA Conference & ITU FG VM Meeting, Changchun China 11-13 July 2019







Remarks (1): Opportunities for Collaboration

New:
Global online free ITS communication Standards DB

Collaboration on ITS Communication Standards (CITS)

- Established by the ITU to provide a Platform to share knowledge and coordinate ITS standardization
- Attended by worldwide SDOs
- Three meetings x year, back to back with the ITS-related regional events:
  Asia (~July), America (~Dec.) Geneva (~March)
- Aims for a coordinated set of interoperable ITS Communication Standards

http://itu.int/go/ITScomms
Subscribe to the CITS mailing list!

for more info contact Stefano POLIDORI at:
tsbcits@itu.int or tsbfgvm@itu.int

Remarks (2): ITU-T as an ITS platform

Vehicle Yearly Events (Europe, Asia, America) in ITU-T

ITU TIA SAE INTERNATIONAL

Organized by UNECE ITU

CCSA ITU

TTC Telecommunication Technology Committee

INFOCOMM MEDIA DEVELOPMENT AUTHORITY

Future Networked Car Symposium

7 March 2019
Geneva, Switzerland

Geneva International Motor Show

Next planned on
5 March 2020 !

https://www.itu.int/en/fnc/2019
tsbcar@itu.int

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