Technologies to support new/future services and applications

ITU/TSB
Hiroshi OTA

Outline

- Artificial intelligence (AI)
  - General
  - AI for health
  - AI/machine learning for 5G/IMT-2020
- Internet of things (IoT)
- Distributed ledger technologies (DLT)
- Intelligent transport system (ITS)
- Quantum key distribution (QKD)

ITUEvents

AI for Good Global Summit

Accelerating progress towards the SDGs

28-31 May 2019
Geneva, Switzerland

#AIforGood

In partnership with

XPRIZE

acm

Organized by

ITU

THE SUMMIT

AI for Good
Global Summit

- The AI for Good Global Summit is **THE** leading United Nations platform for global and inclusive dialogue on AI
- Hosted each year in Geneva by the ITU in partnership with UN Sister agencies, XPRIZE Foundation and ACM

THE GOAL

AI for Good
Global Summit

- Connect **AI innovators** with **problem owners**, to identify **practical applications of AI** to **accelerate progress** towards the **UN Sustainable Development Goals**
- Ensure **trusted**, **safe** and **inclusive** development of AI technologies and **equitable access** to their benefits

Focus Group on AI for Health (FG-AI4H)

- ITU-T SG16 in partnership with WHO
- Standardized assessment framework for the evaluation of AI-based methods for health, diagnosis, triage or treatment decisions
- Evaluation and benchmarking of AI-Health models to enable certification & widespread use

AI for Health
An ITU Focus Group
In collaboration with WHO

Focus Group on Artificial Intelligence for Health

https://www.itu.int/en/ITU-T/focusgroups/ai4h/Pages/default.aspx

Focus Group on AI for Health (FG-AI4H)

Background:

- Machine Learning can provide ubiquitous health diagnostics at negligible cost, non-invasive, high frequency - early stage detection can lead to lower cost of treatment and improved treatment outcomes
- Machine Learning competitions have elevated AI for health diagnostics to superhuman performance
- Medicine regulators (Food and Drug Administration, European Medicine Agency, CFDA, etc.) are equipped to certify tools that aid medics with analyses, not tools that perform analyses

Consequently:

- AI for health exists mostly as an academic exercise,
- Models are not being certified for professional use

Focus Group Objective:

- Provide a trusted benchmark for AI4H, to enable certification by health regulators

Machine Learning & 5G FG

- Communication networks not designed to cope with Big Data and Machine Learning (ML)
- Standardization strategies to increase efficiency and security of 5G systems using ML
- Focus Group has developed a functional architecture based on ML5G uses cases

More info: https://www.itu.int/en/ITU-T/focusgroups/ml5g/Pages/default.aspx

Rec. ITU-T Y.3170 -(formerly Y.qos-ml): Requirements of machine learning based QoS assurance for IMT-2020 network

This Recommendation describes:

- Overview
- Functional model
- High level requirements
- Functional requirements

This Recommendation uses machine learning only in the context of QoS assurance. Therefore any other use of machine learning is out of scope of this Recommendation.

ITU-T SG20: IoT and Smart Cities & Communities

Lead Study Group on:

- Internet of things (IoT) and its applications
- Smart cities and communities, including its e-services and smart services
- Internet of things identification

4 Regional Groups

- SG20RG-LATAM
- SG20RG-AFR
- SG20RG-ARB
- SG20RG-EECAT

Collaboration with other SDOs

- Joint Coordination Activity on Internet of Things and Smart Cities and Communities (JCA-IoT and SC&C)
- For example: OneM2M, ISO, IEC

What is SG20 currently working on:

Internet of things (IoT)

- **Drones** for IoT
- IoT requirements for **edge computing**
- **Artificial Intelligence** and IoT
- **Accessibility for IoT**
- **Blockchain** and IoT
- IoT for **developing countries**
- **Intelligent Transport Systems (ITS)** based on IoT
- **Privacy and trust** of IoT systems
- **Interoperability**
- **Edge computing**
- **IoT-devices authentication**
- **Digital twins for IoT**

Smart cities and communities

- **Open Data** in Smart Cities
- **Use cases, requirements and architectures for** Smart cities and communities
- **Smart Services in rural communities**
- **Disaster notification** of the population in smart cities and communities
- **Smart Tourist** destinations
- *Smart City Infrastructure*

Data management & processing

- Data structure and data transfer protocol for **automotive emergency response system**
- Function description and metadata of Spatio-temporal Information Service for SSC
- *Integrity*

ITU-T SG20 last meeting main results
Geneva, Switzerland, 9-18 April 2019

Statistics:

170 Participants

4 Draft Recommendations consented

1 Draft Recommendation determined

1 Supplement agreed

7 New work items

ITU-T SG20 Main outcomes
Geneva, Switzerland, 9-18 April 2019

4 draft Recommendations consented

ITU-T Rec.	Provisional name	Title	Q
Y.4206	Y.UCS-reqts	Requirements and capabilities of user-centric work space service	2/20
Y.4207	Y.SEM	Requirements and capability framework of Smart Environmental Monitoring	2/20
Y.4460	Y.dev-IoT-arch	Architectural reference model of devices for IoT applications	3/20
Y.4906	Y.AFDTS	Assessment Framework for digital transformation of sectors in smart cities	7/20

1 draft Recommendation determined

ITU-T Rec.	Provisional name	Title	Q
Y.4556	Y.SC-Residential	Requirements and functional architecture of smart residential community	4/20

ITU-T SG20 Main outcomes
Geneva, Switzerland, 9-18 April 2019

7 new work items

Question	Working title	Title
1/20	Y.rrm-data	Requirements and reference model of IoT related data from city infrastructure
3/20	Y.IoT-AOS-prot	Protocols of supporting autonomic operations in the Internet of things
4/20	Y.smart-education	Requirements and reference architecture of smart education
4/20	Y.BC-SON	Framework of blockchain-based self-organization networking in IoT environments
4/20	Y.IoT-SCS	Requirements and functional architecture for smart construction site services
4/20	Y.UAV-BSI	Requirements and functional architecture of base station inspection services using unmanned aerial vehicles
4/20	Y.smoke-detection	Requirements and Functional Architecture of Smart Fire Smoke Detection Service

United 4 Smart Sustainable Cities (U4SSC)

U4SSC is a **United Nations Initiative** to achieve Sustainable Development Goal 11: "Make cities and human settlements inclusive, safe, resilient and sustainable.

Supported by:

Convention on Biological Diversity

United Nations Economic Commission for Africa

World Meteorological Organisation

Empowered lives. Resilient nations.

United Nations Educational, Scientific and Cultural Organization

UNEP FINANCE INITIATIVE

United Nations Framework Convention on Climate Change

UNIDO

UNITED NATIONS UNIVERSITY
UNU-EGOV
Operating Unit on Policy-Driven Electronic Governance

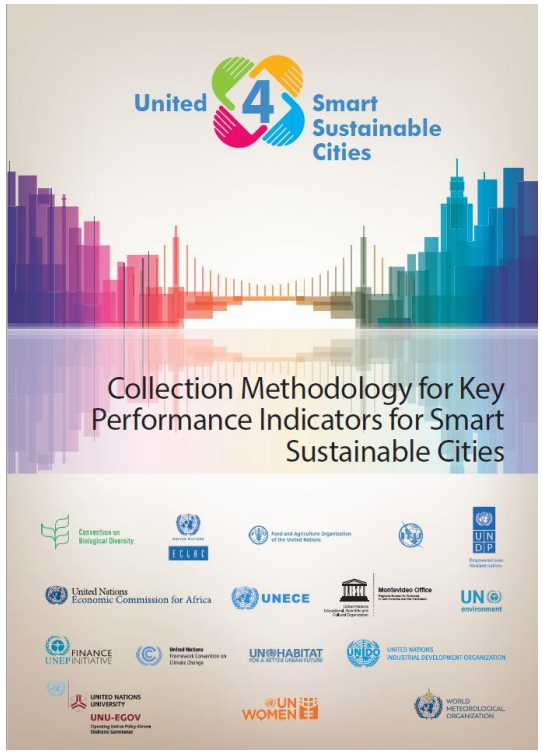
Coordinated by:

ITU

UNECE

UN HABITAT
FOR A BETTER URBAN FUTURE

U4SSC Key performance indicators for Smart Sustainable Cities



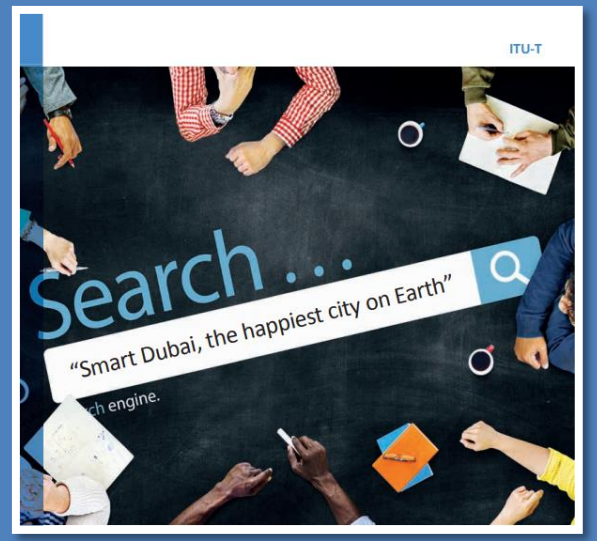
To establish the criteria to **evaluate ICT´s contributions** in making cities **smarter** and **more sustainable**, and to provide cities with the means for **self-assessments**.

Over 50 cities worlwide are already implementing these KPIs

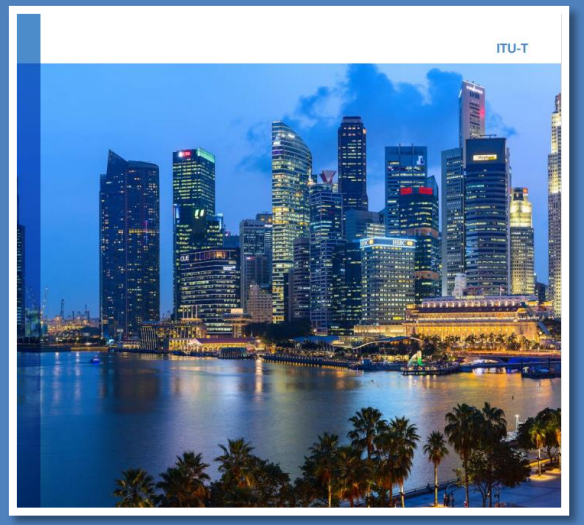
We invite you to implement the U4SSC KPIs in your city

Coming soon: ITU Global Smart Sustainable Cities Index

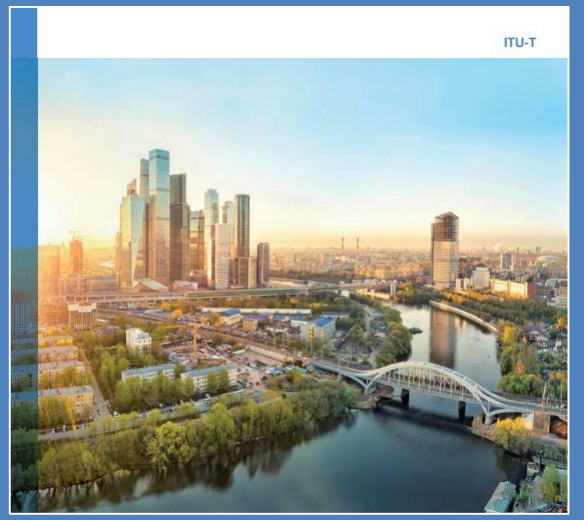
Case Studies on the Implementation of KPIs for SSC



The Case of Dubai



The Case of Singapore



The Case of Moscow

Visit: http://www.itu.int/go/ITU-T-SSC

Blockchain and DLT – ITU portfolio

ITU-T Focus Groups
Pre-standardization

- **Application of DLT (FG DLT) -** identifies use cases, works on terminology, a high-level architecture, an assessment framework, and regulatory aspects
- **Digital Fiat Currency (FG DFC)** - explores blockchain as enabler for CBDC
- **Data Processing and Management to support IoT and Smart Cities & Communities (FG DPM)** - studies use of blockchain in this context

ITU-T Study Groups
Formal standardization

- **SG13** - Cloud computing requirements for blockchain as a service (BaaS); blockchain in NGNe (2 work items)
- **SG16** - DLT and e-services (Question 22/16) (6 work items)
- **SG17** - Security aspects for DLT (Question 14/17: 10 work items)
- **SG20** - “Blockchain of things” (4 work items)

Open to non-members

ITU members only

Focus Group on Application of DLT (FG DLT) – Overview

Leaders

Wei Kai
(CAICT, China)

Suzana Maranhão Moreno
(BNDES, Brazil)

Structure

WG1: Terms, Definitions, Concepts

WG2: Applications & Services

WG3: Technology Ref. Framework

WG4: Policy Framework

WG5: Standardization Roadmap

Timeline

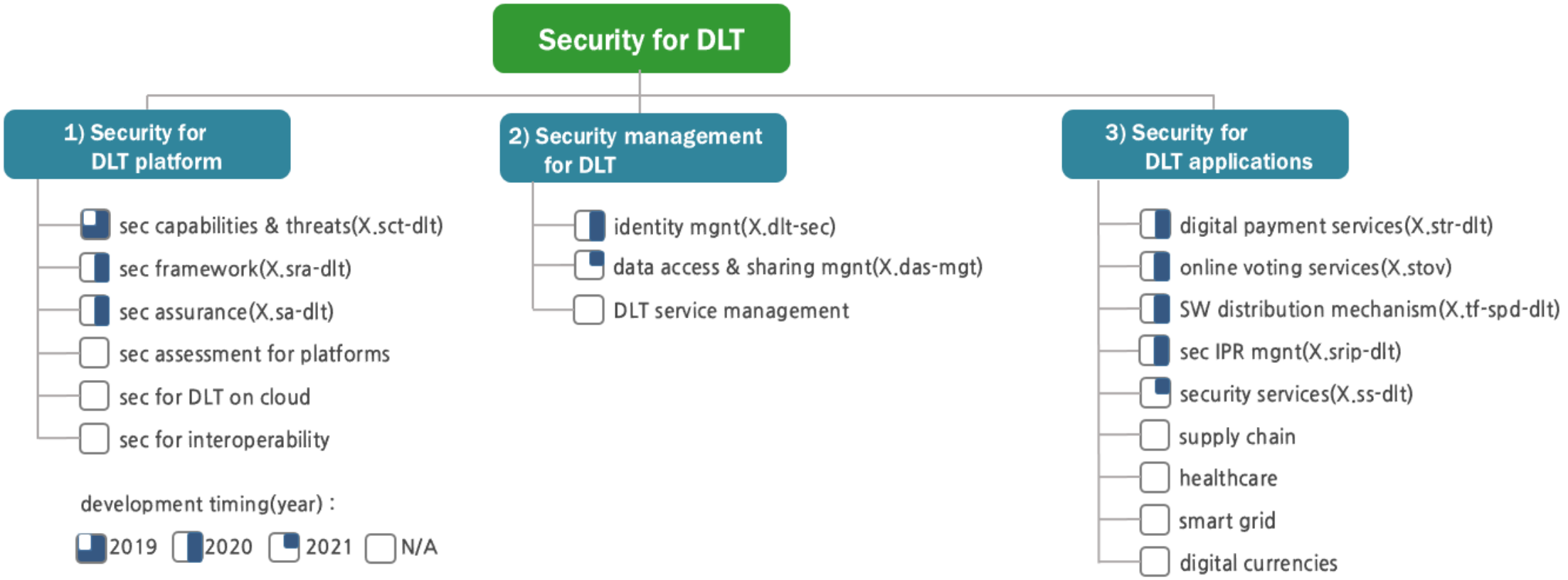
Lifetime from Oct 2017 to Sept 2019

1. Geneva, 17-19 October 2017 (ITU)
2. Bern, 5-7 February 2018 (Swisscom)
3. Geneva, 28-30 May 2018 (ITU)
4. Beijing, 9-12 Oct 2018 (CAICT)
5. Rio de Janeiro, 14-17 Jan 2019 (BNDES)
6. Madrid, 1-4 April 2019 (Alastria)
7. **Geneva: 29 July-2 August 2019 (ITU)**

FG DLT – Status of Deliverables

Deliverables (Number, title)		Description	Possible Study Group output / comments
D1.1	Terms and definitions	Harmonization with related terminology from ITU-T SG17, ISO/TC 307, NIST, and others.	Recommendation
D2.1	DLT use cases	50+ use cases reviewed, including from finance, healthcare, utilities, telecoms sectors, as well as cross-cutting DLT applications (e.g., identity management, data provenance).	Technical Paper
D3.1	DLT reference architecture	Includes hierarchical relationships, specific functions and modules.	Recommendation
D3.2	Overview of existing platforms and mapping to DLT reference architecture	Covers most popular DLT platforms.	Technical Paper
D3.3	Assessment criteria for DLT platforms	Introduction of 15 DLT platform assessment criteria.	Recommendation
D4.1	Regulatory framework	Discussion of key DLT features and associated regulatory challenges. Examples of approaches for users, regulators and solution providers to address these challenges.	Technical Paper
Dx.y	Outlook on future DLT	Introduction of emerging concepts related to DLT.	Technical Paper

ITU-T Study Group 17 – Security aspects for DLT



Standardization on Intelligent Transport Systems (ITS): Multiple Study Group approach

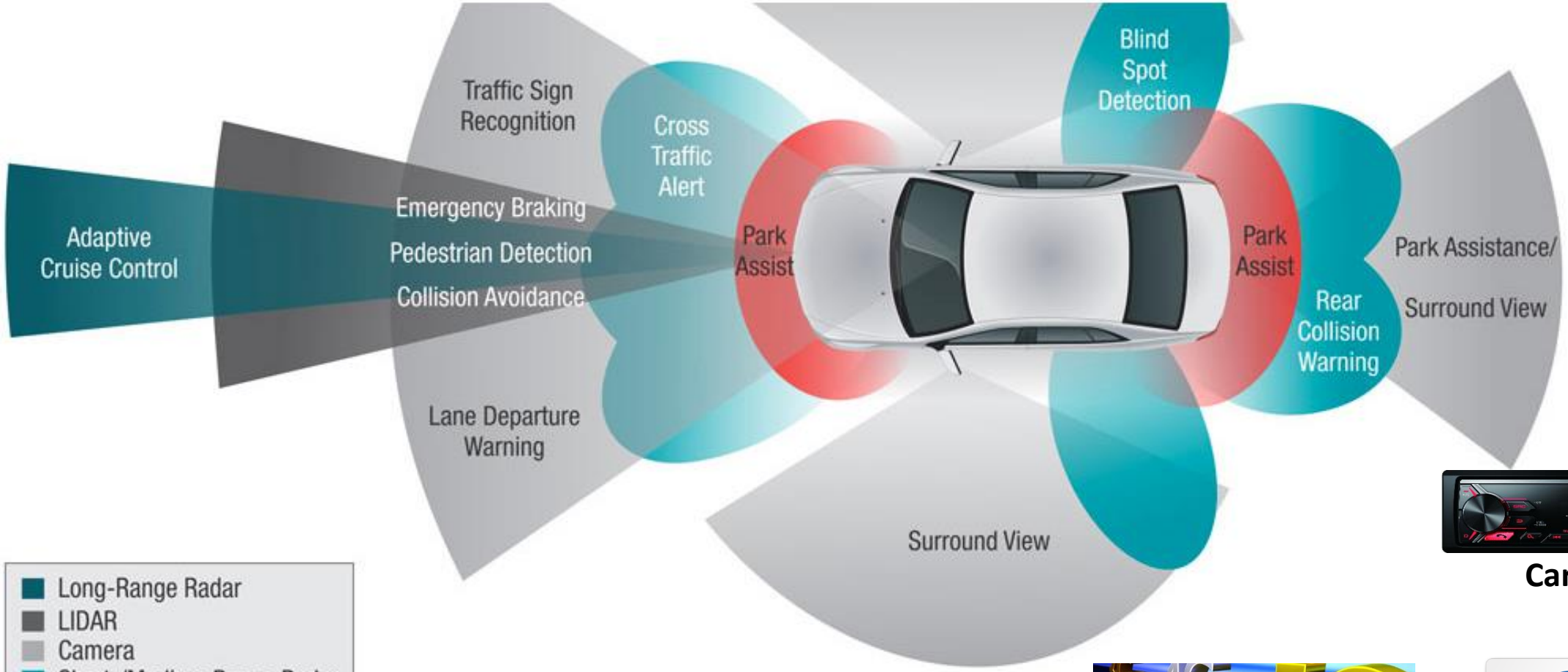
Radiocommunication Sector (ITU-R)

- 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)*

ITU allocates spectrum for vehicles



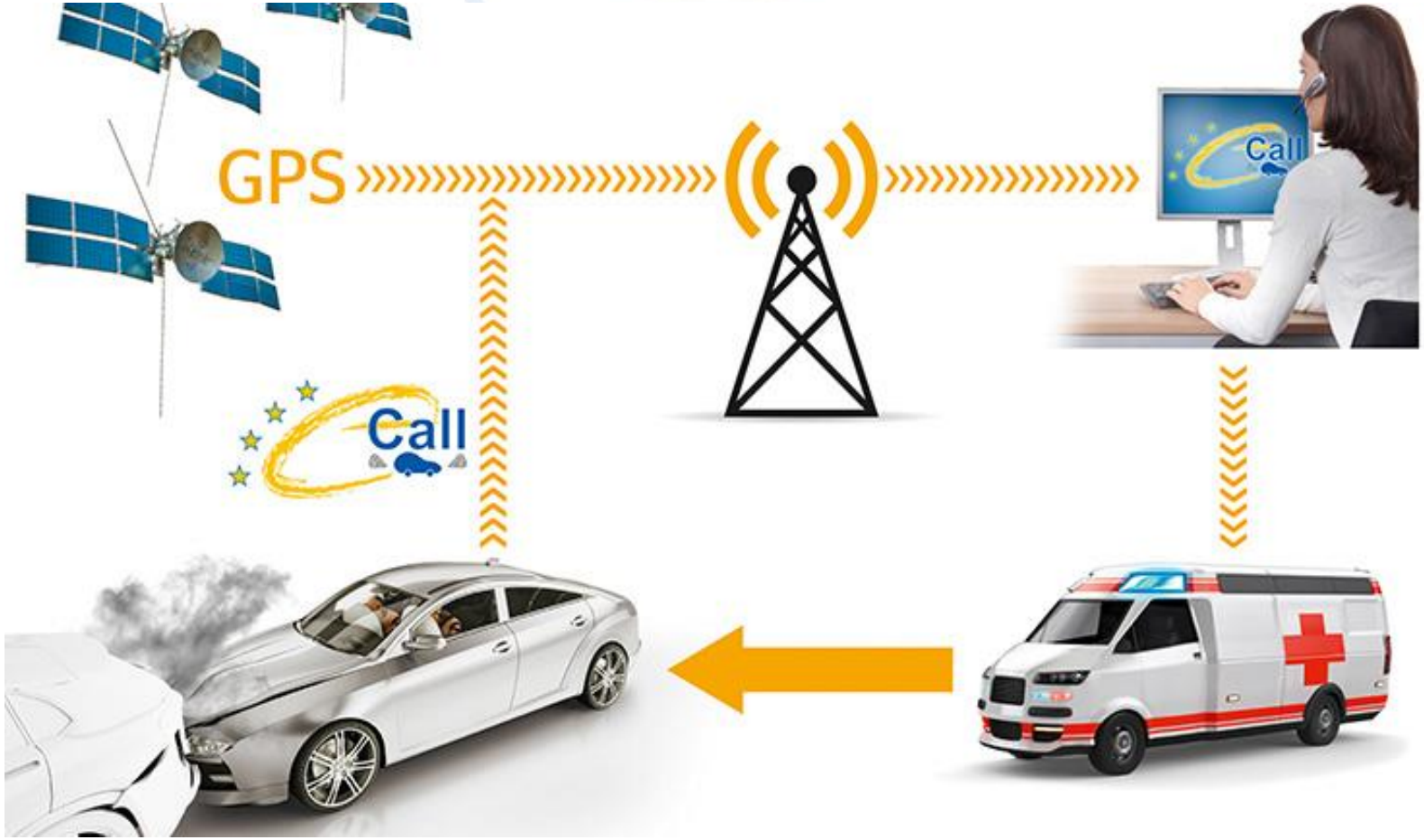
GPS

Car Radio

Wi-Fi

Mobile communication and Internet access

ITU-T SG12: ITU standards make e-calls intelligible

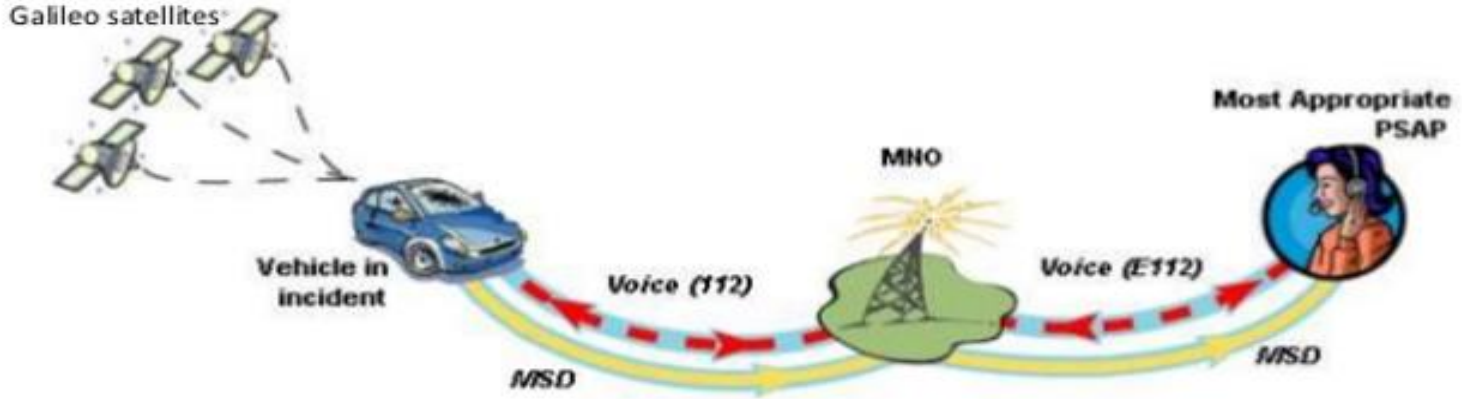


Source: Continental - Automatic Emergency Call

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)

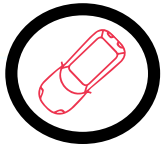
ITU-T SG2: Numbering for in Car Emergency Communication (ICEC) calls

Global numbering resources used for ICEC calls are under consideration



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

ITU-T SG20 - Develops international standards to enable the coordinated development of IoT technologies in smart cities, including related big data



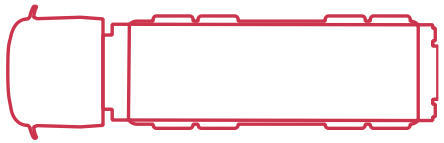
Completed standards work

- 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

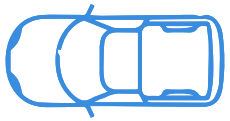
- Y.IoT-ITS-framework: Framework of Cooperative ITS based on the IoT
- Y.IoT-UAS-Reqts: Use cases, requirements and capabilities of unmanned aircraft systems for IoT
- Y.AERS-msp: Minimum set of data structure for automotive emergency response system
- Y.AERS-mtp: Minimum set of data transfer protocol 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

Focus Group on “Vehicular Multimedia” (FG-VM)



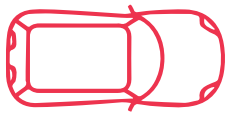
Vehicular multimedia system

- 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

For more information: https://itu.int/en/ITU-T/focusgroups/vm
Contact: tsbfgvm@itu.int

Focus Group on Vehicular Multimedia (FG-VM) – future meetings

The following meetings are planned:

- 4th FG-VM Meeting (16-17 May 2019, e-meeting)
- 5th FG-VM Meeting (11-12 July 2019, Changchun, China)
- 6th FG-VM Meeting (11-12 September 2019, Budapest, Hungary, TBC)

For more information: https://itu.int/en/ITU-T/focusgroups/vm

Contact: tsbfgvm@itu.int

Quantum Key Distribution (QKD) – ITU-T SG17: Secutiry aspects

Current work items:

- X.sec-QKDN-ov - Security requirements for quantum key distribution networks – overview
- X.cf-QKDN - Use of cryptographic functions on a key generated in Quantum Key Distribution networks
- X.sec-QKDN-km - Security requirements for quantum key distribution networks - key management
- TR.sec-qkd - Technical report on security framework for quantum key distribution in telecom network

Quantum Key Distribution (QKD) – ITU-T SG13: Network aspects

Current work items:

- Y.QKDN_FR - Framework for Networks to supporting Quantum Key Distribution
- Y.QKDN_Arch - Functional architecture of the Quantum Key Distribution network
- Y.QKDN_KM - Key management for Quantum Key Distribution network


ITU

Backup

SG17: X.sec-QKDN-ov - Security requirements for quantum key distribution networks - overview

- General security requirements on Quantum Key Distribution (QKD) networks;
- Security requirements for QKD networks on
  - key management;
  - core quantum key relaying functions;
- Threats and Security functions for communications between
  - QKD systems and applications (cryptographic applications)
  - QKD systems and management & monitoring systems

SG17: X.cf-QKDN - Use of cryptographic functions on a key generated in Quantum Key Distribution networks

- Aims to add specifications for QKD to existing cryptographic standards to make QKD systems approvable
- Focuses on making the keys generated and distributed by a QKD system approvable based on these existing standards

SG17: X.sec-QKDN-km - Security requirements for quantum key distribution networks - key management

- Provides help for design, implementation, and operation of key management of QKD network with approved security
- Analysis of security issues on a QKD network
- Security requirements on a QKD network
- Methods and technical specifications of key management to meet these security requirements

Note: Basic functions of a QKD network including key management functions relevant to this Recommendations are given in the Draft Recommendation ITU-T Y.QKDN_FR ""Framework for Networks to supporting Quantum Key Distribution"" in SG13.

SG17: TR.sec-qkd - Technical report on security framework for quantum key distribution in telecom network

- Provides security framework of quantum key distribution
- Introduction to the QKD network
- General architecture for security functions of QKD in telecom network
- Threats and security functions for communications between the QKD systems and other entities.

SG13: Y.QKDN_FR - Framework for Networks to supporting Quantum Key Distribution

Describes the framework for Networks to support Quantum Key Distribution (QKD), which addresses architectural network aspects to help the implementation of QKD technologies on user network including:

- QKD technologies
- Relationship between user network and QKD technologies
- Integrated network
- Network requirements to support QKD technologies and QKD network
- General structure of QKD network
- Basic functions of QKD network
- Overall service procedure in the layered model

SG13: Y.QKDN_Arch - Functional architecture of the Quantum Key Distribution network

Provides functional architectures of the Quantum Key Distribution (QKD) network including:

- The reference model
- Functional elements and reference points
- Deployment model
- Overall operational procedures

NOTE – This Recommendation addresses the architecture of the QKD network based on the general structure defined in [ITU-T Y.QKDN_FR] as a foundation for further QKD network studies.

SG13: Y.QKDN_KM - Key management for Quantum Key Distribution network

Describes key management for Quantum Key Distribution (QKD) network including:

- Requirements
- Functional elements
- Procedures
- Key formats (key data and meta-data)
- Refers the overall structure and basic architecture of QKD network that are defined in Y.QKDN_FR.