FG-SSC
ICT Infrastructure

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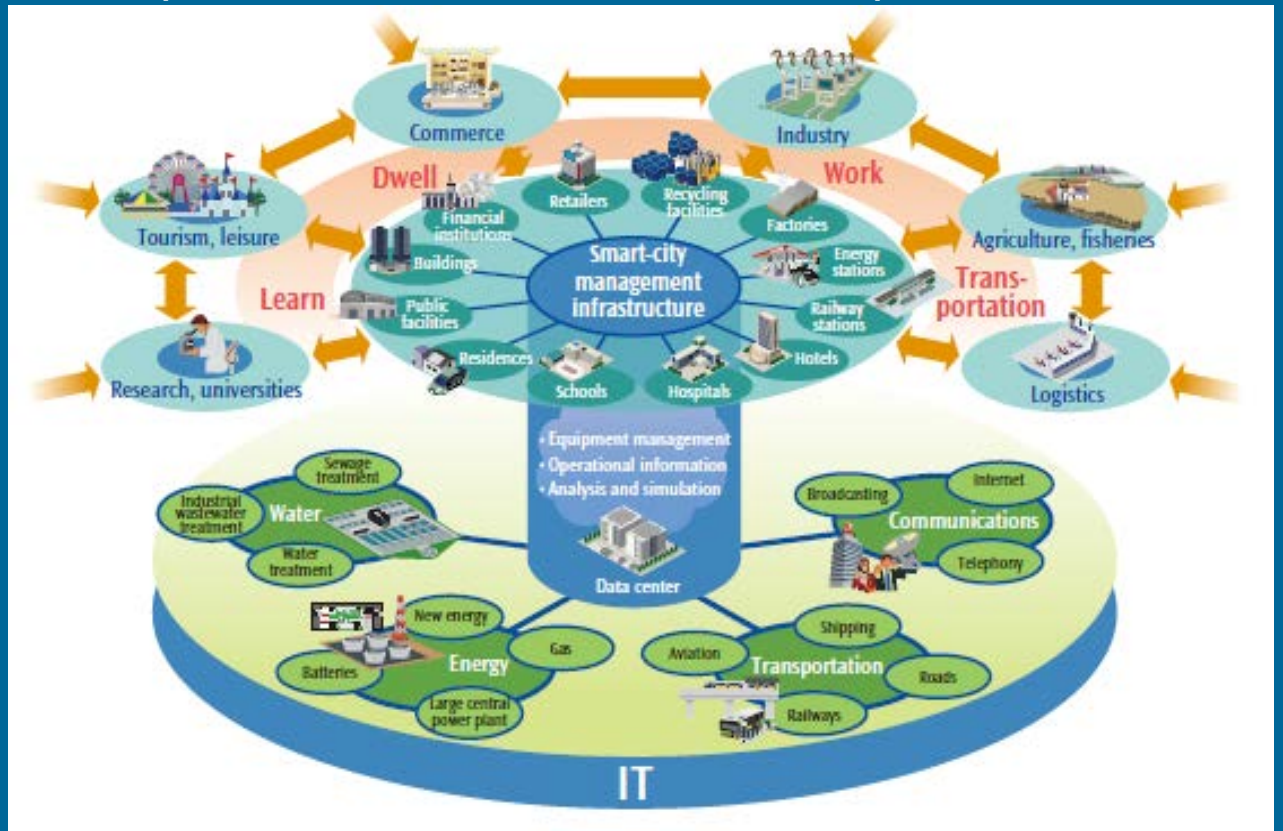
WG2 -

"Infrastructure" Report led by MTC – Peru

Purpose

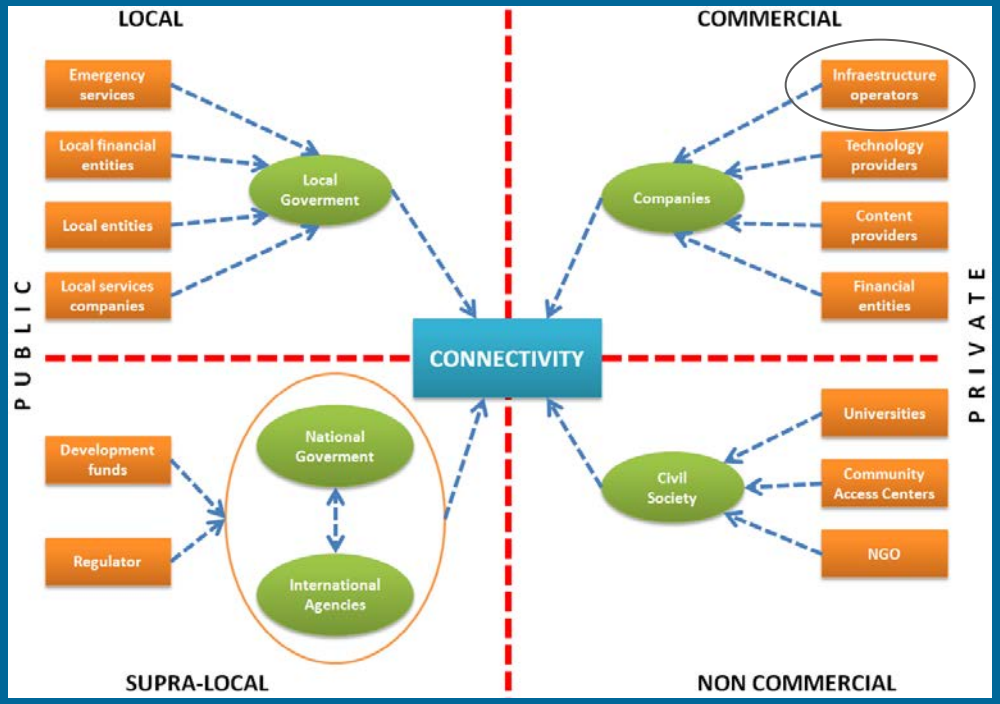
To provide a technical overview on infrastructure related to information and communications technology (ICT) in smart sustainable cities (SSC) and specifically, for the main applications, to get an overview on what ICT is there already; what additional is needed and the path to its sustainable development.



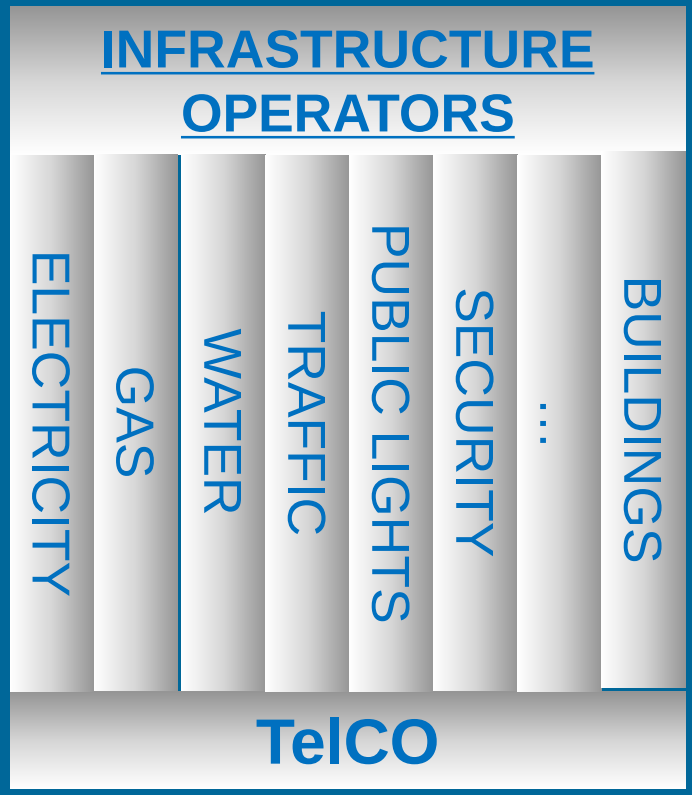
“Infrastructure” Report - INTRODUCTION

STAKEHOLDERS IN SSC

Stakeholders refer to the major players involved in SSC

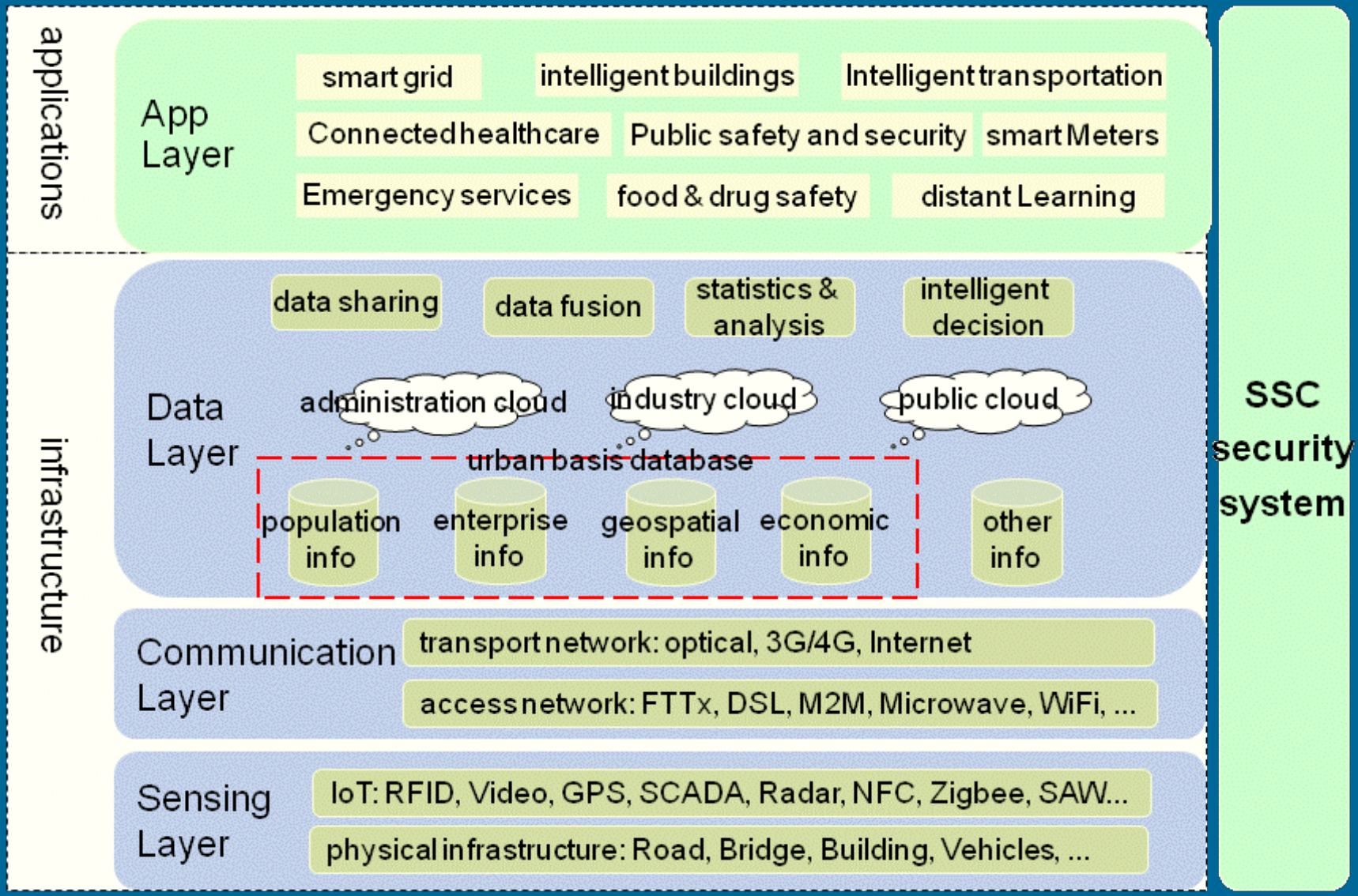


Infrastructure Operators



All these actors (and other identifiable ones) will act and will have interests linked to the idea of "Smart Sustainable City“.

"Infrastructure" Report - TECHNICAL ARCHITECTURE OF SSC



“Infrastructure” Report - DIGITAL/ICT INFRASTRUCTURE FOR SSC

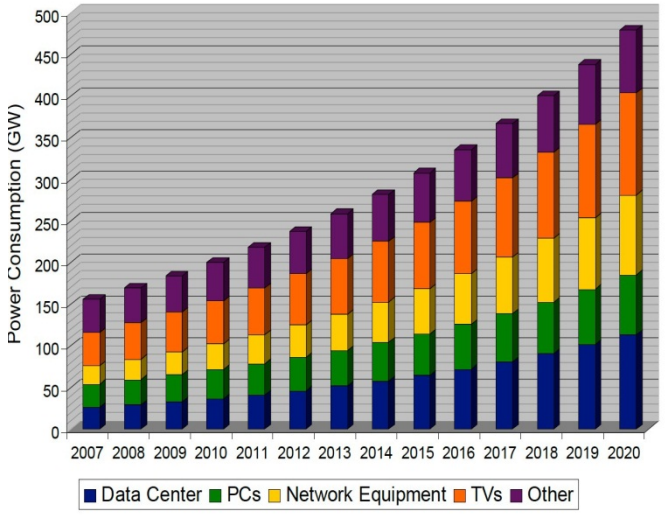
- ENERGY EFFICIENCY OF ICT INFRASTRUCTURE
- TERMINALS, SENSING & MULTI-DEVICE LAYER
- NETWORK FACILITIES LAYER
- ICT FACILITIES: OVER THE TOP, SERVICES, APPLICATIONS AND CONTENTS

ICT energy consumption

Table 1: EU wide estimates of the ICT sector electricity consumption

	2005	2020 BAU	2020 ECO
Total ICT sector electricity use in EU 25 (TWh/a)	214.5	409.7	288.2
ICT sector **without consumer electronics** in EU-25 (TWh/a)	118.6	245.1	185.2
Total ICT sector electricity use in EU-27 (TWh/a)	216.0	433.1	304.7
ICT sector **without consumer electronics** in EU-27 (TWh/a)	119.4	259.1	195.8
Share of the ICT sector electricity use over total EU-27 electricity use (%)	7.8%	10.9%	7.7%
Share of the ICT sector electricity use (**without consumer electronics**) over total EU-27 electricity use (%)	4.3%	6.5%	4.9%

Source: http://ec.europa.eu/information_society/activities/sustainable_growth/docs/studies/2008/2008_impact-of-ict_on_e



TELCO's networks = 1% of national electrical energy use = huge costs

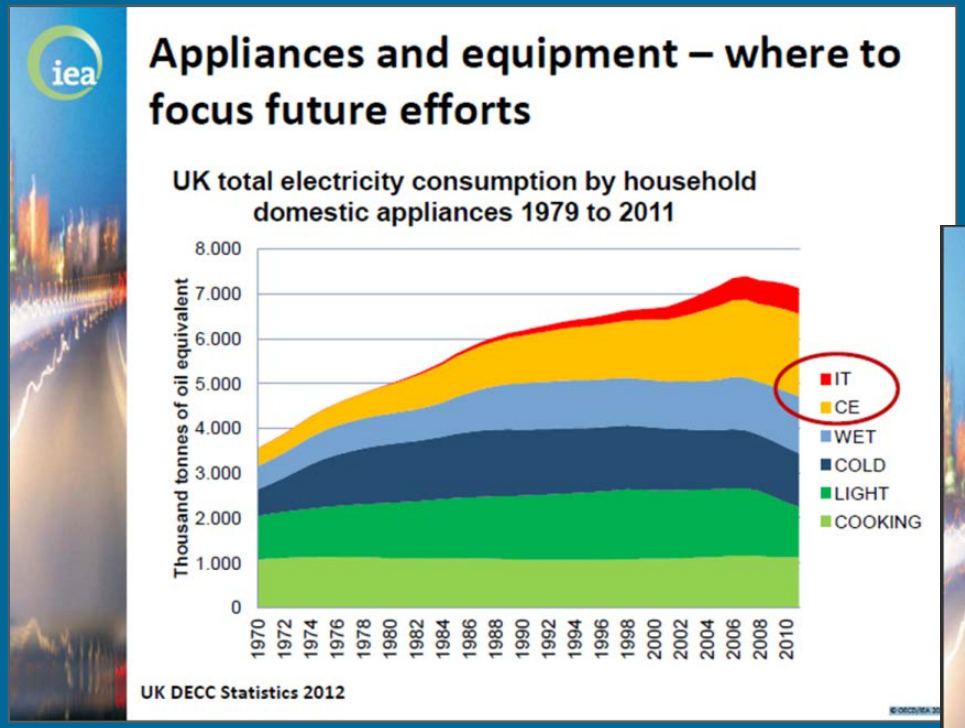
ICT in 2005 = ~ 8% of EU electricity usage

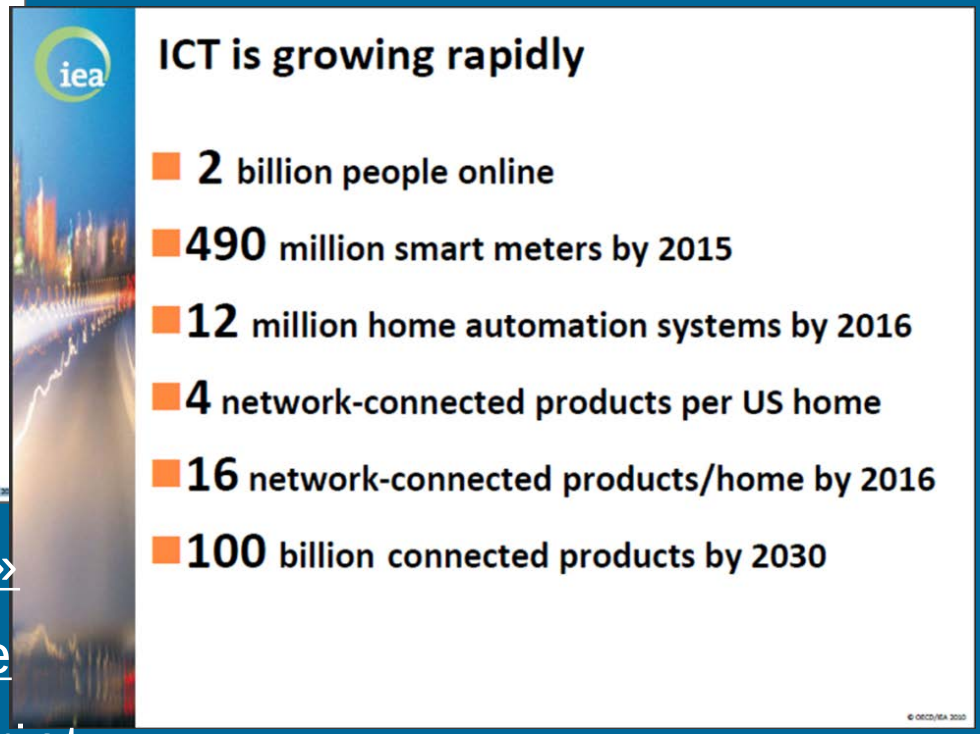
- Meanwhile:
  - Broadband has expanded its reach
  - **The energy load is shifting towards the home**

ICT energy consumption

ICT in Europe

- ICT in 2005 = 8% of EU electricity usage
- Its energy share is increasing





- Everything is becoming «Smart»
- IoT, Smart Grids, Cities are here
- Will further increase ICT's footprint

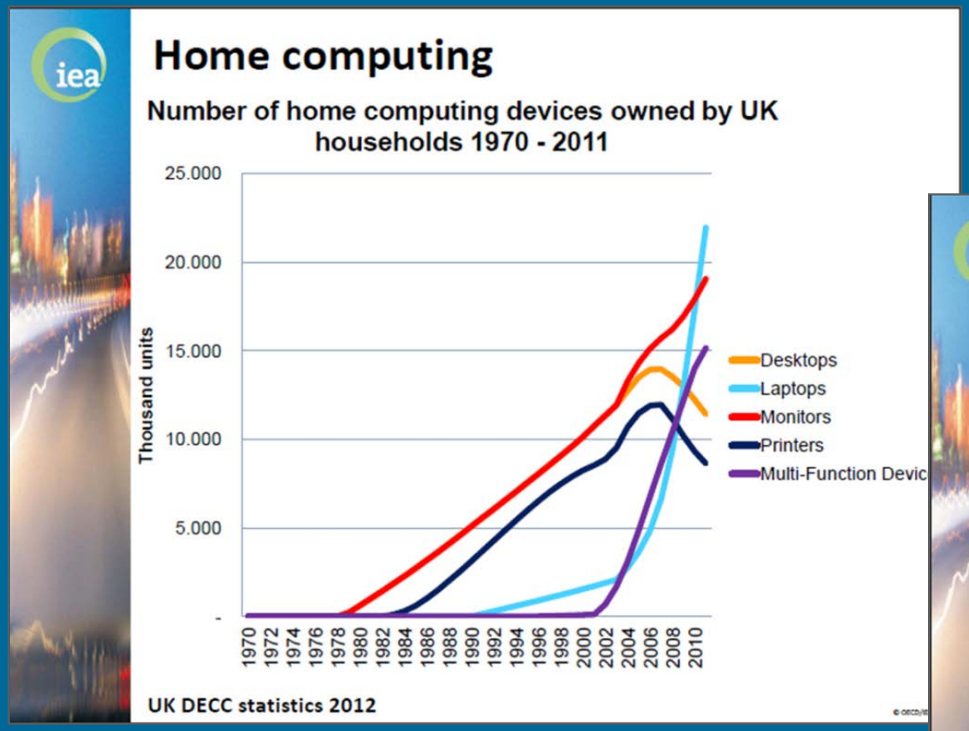
11-V.Rozite IEA… https://ecodesign-company.com/iea-experts-ws

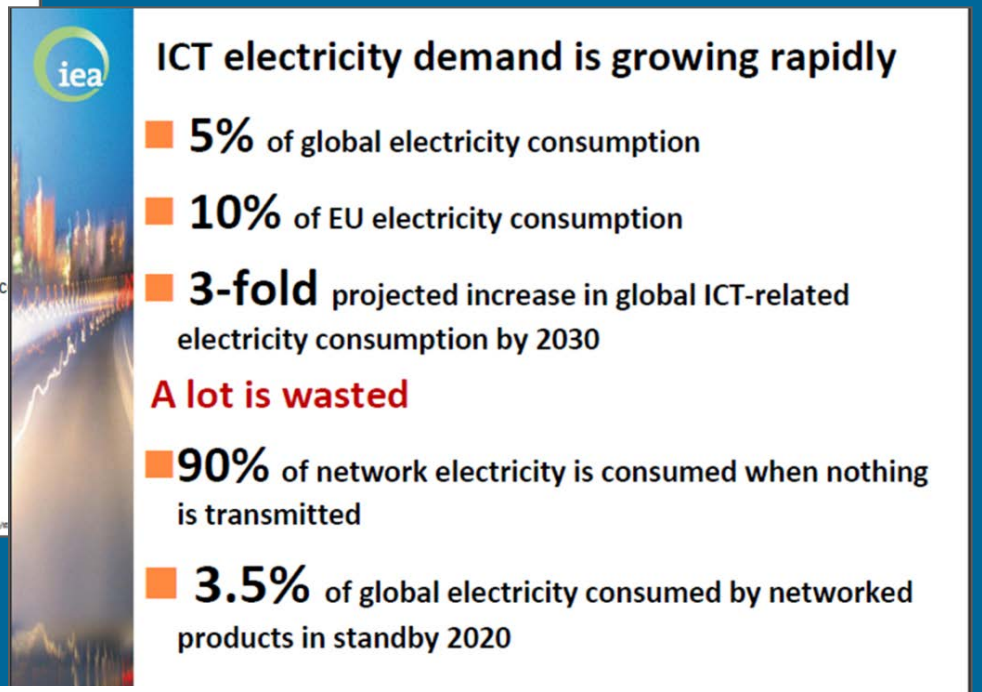
ICT energy consumption

ICT consumption trends

- Home computing and networking are booming

So is energy consumption of ICT





11-V.Rozite IEA… https://ecodesign-company.com/iea-experts-ws

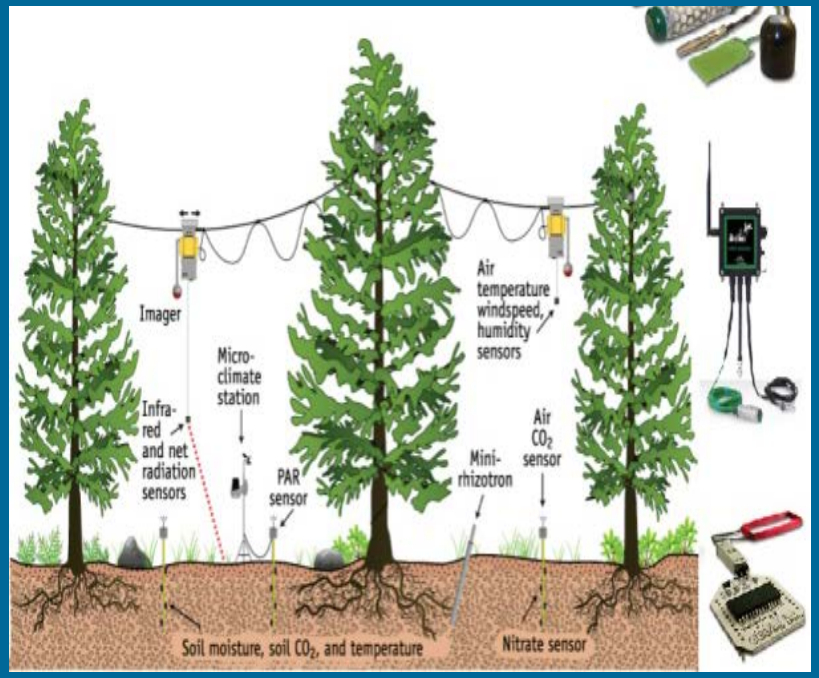
- Most of its energy is wasted
- Meanwhile …

… CO_2 taxation is looming

Need for efficient ICT and architectures

Terminals, sensing & multi-device layer

Environmental Data Collection



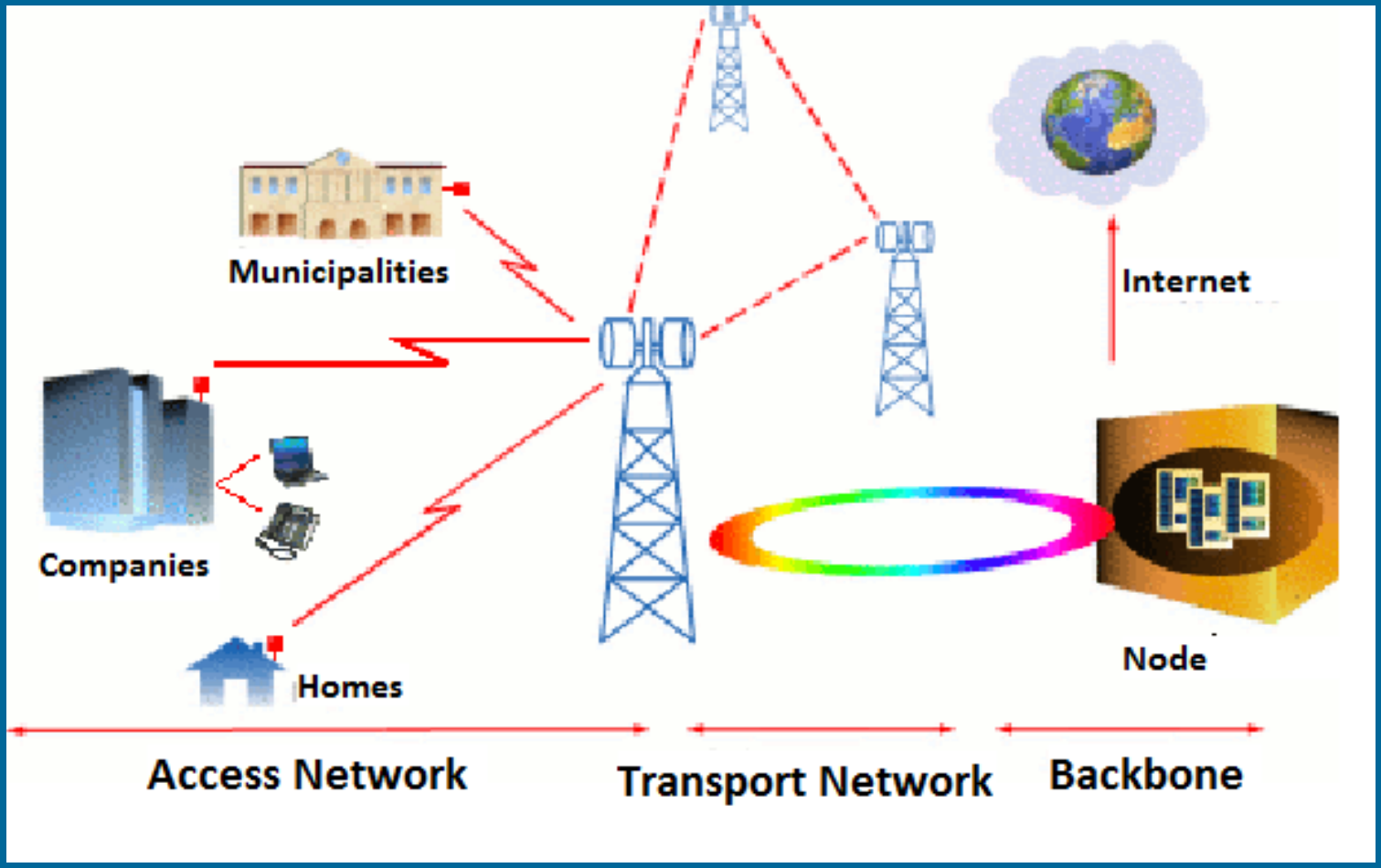
Low cost
Lots of batteries
Many are «fit and forget»

Risk of E-waste issues

Security Monitoring

Node tracking scenarios

COMMUNICATION LAYER

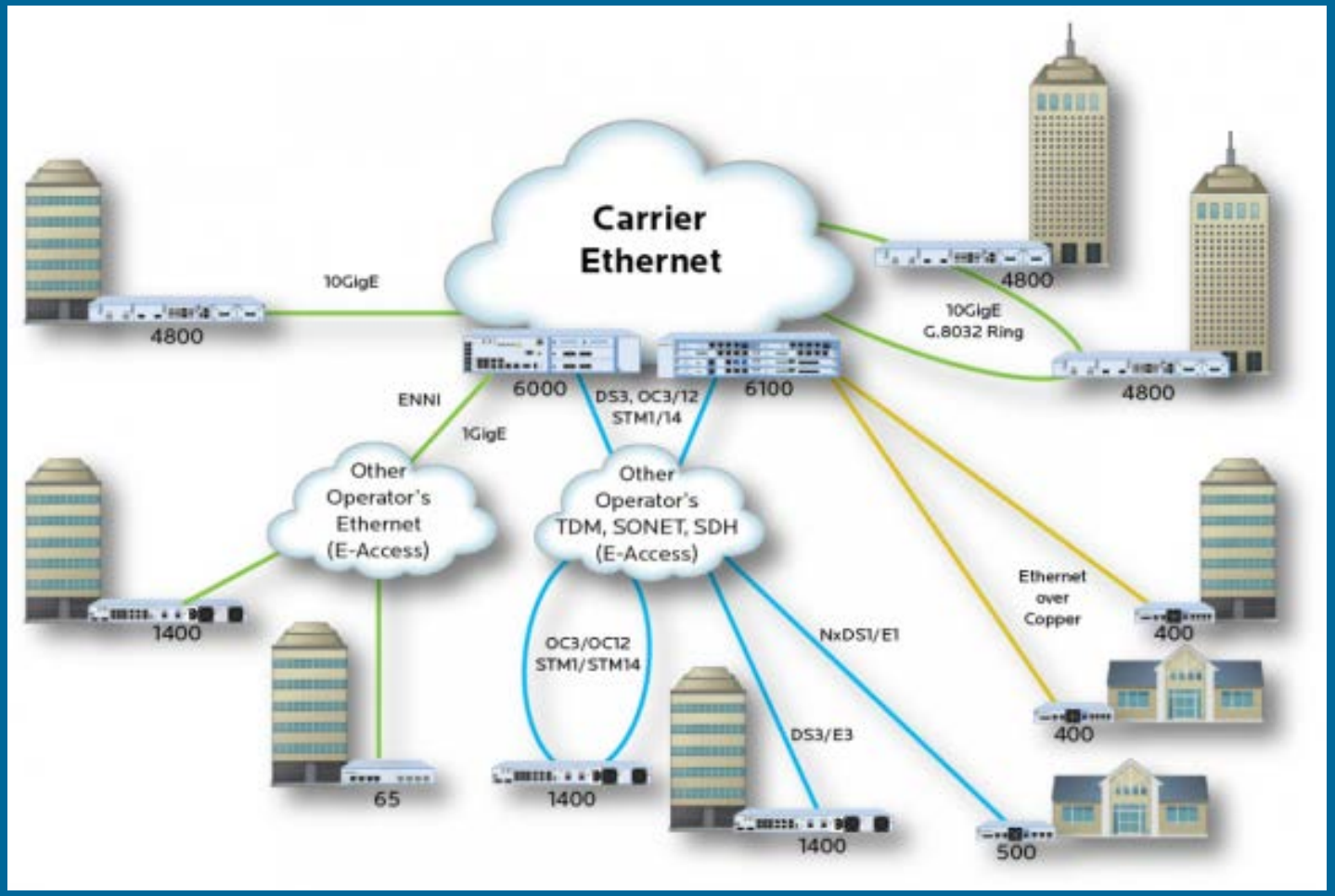


- FTTx – Optical Access
- xDSL – G-Fast
- Mobile Broadband
- Milimeter Wave Communication
- Capillary networks

- Optical Transport
- DWDM
- Ethernet data link
- MPLS
- Carrier Ethernet

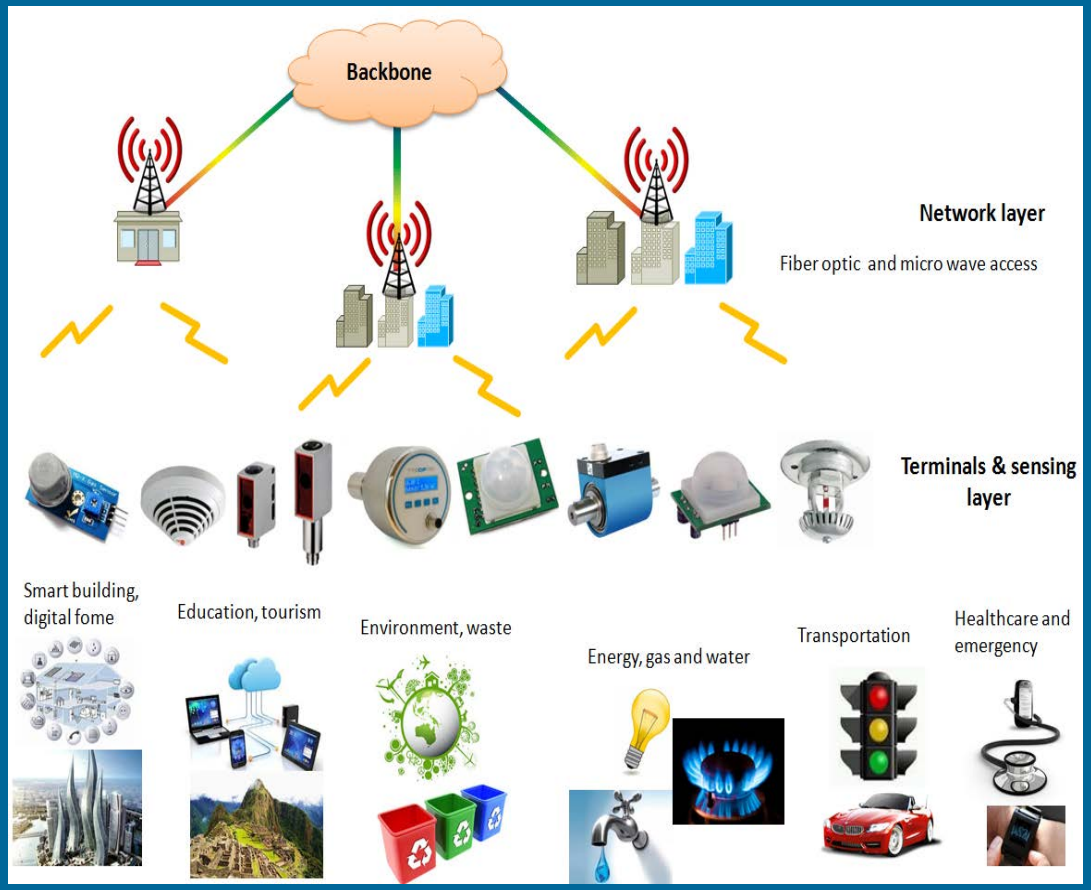
- Data Security
- Quality of Service
- Class of Service

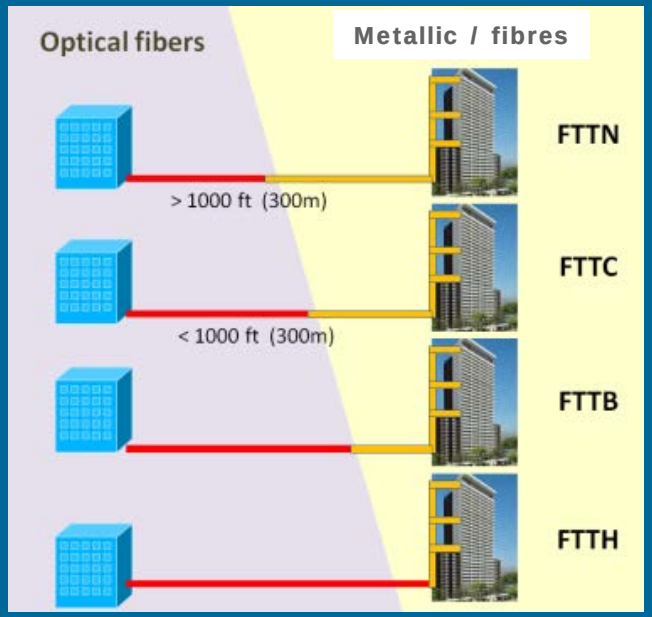
Ethernet is the dominant data link protocol



In a world that is moving to a packet-based future, Ethernet is the dominant data-link protocol for today's networks, supporting a multitude of communication applications. Also, Ethernet is one of the key protocols used to interconnect routers and to carry applications in high-speed optical networks to backhaul access traffic.

Access network



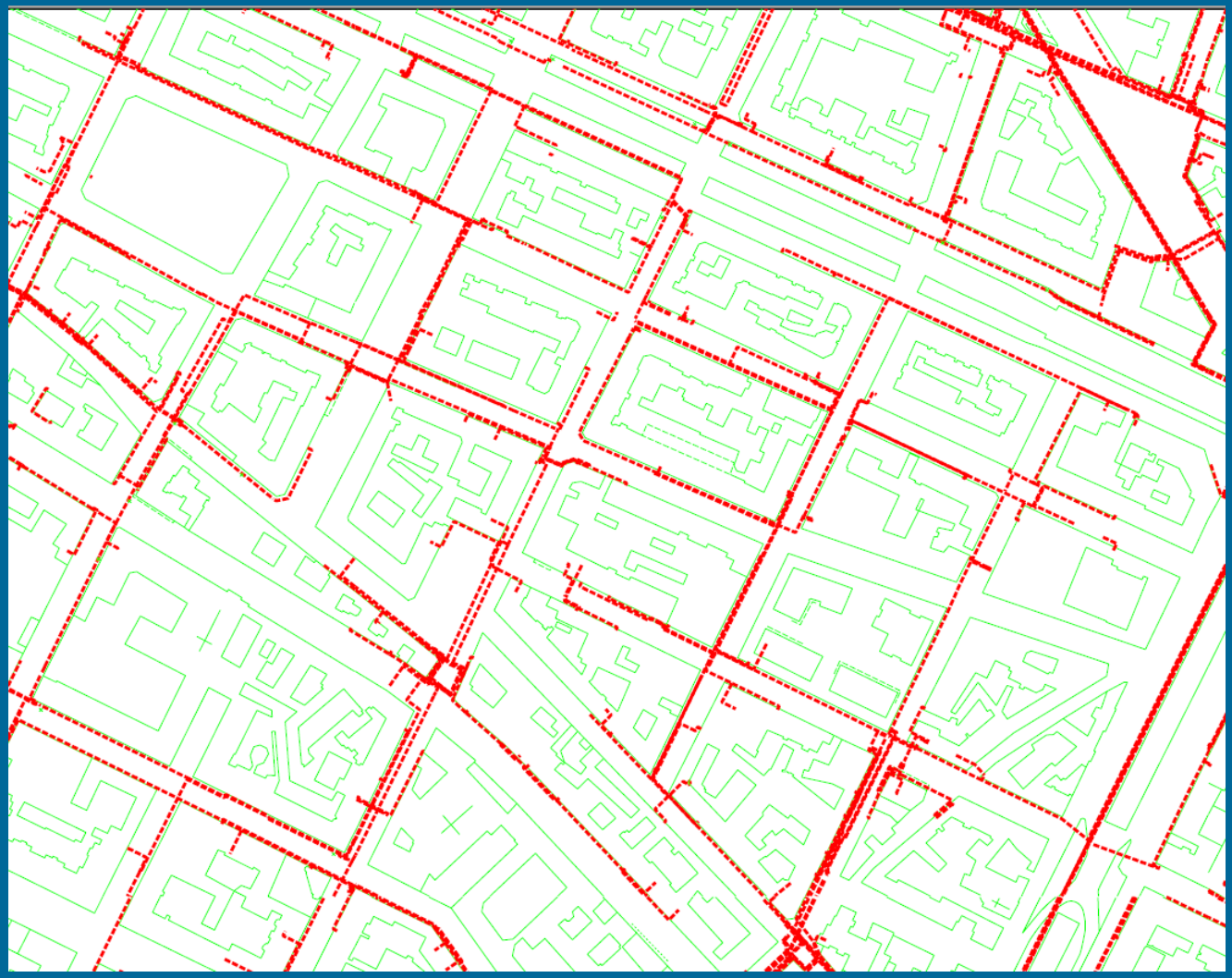


FTTx Access Networks

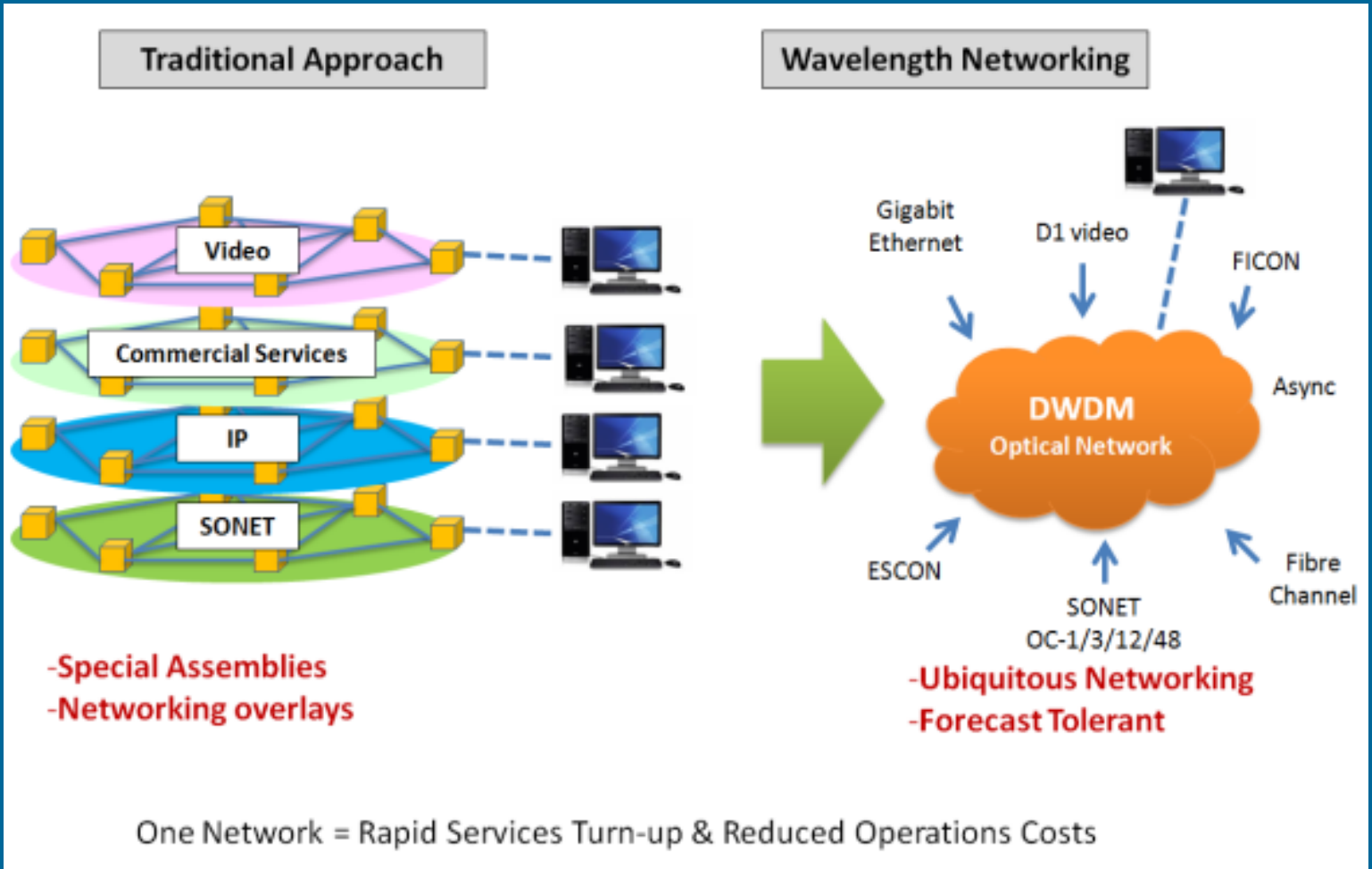
These are shaped by fixed and mobile access, preferably by broadband communication networks. Mobile networks are especially important for a smart city to permit permanent and wireless connection of objects, people and environments. Things that are occurring as the *offloading* between mobile and fixed networks serving to relieve the "Digital Tsunami" would be included at this point.
The Digital Tsunami will be really tangible as high number of networked elements and multitude of packets between “things”. Although its remarkable amount of data, it is not expected to be main data traffic source of the future internet

Access networks

Wireless networks are obviously essential
Wireline network can complement thanks to their ubiquitous reach



CONVERGENCE AT THE OPTICAL LAYER



PHYSICAL INFRASTRUCTURE AND ITS INTELLIGENT UPGRADING

3.1 ENERGY AND WATER
3.2 TRANSPORTATION
3.3 HEALTHCARE
3.4 PUBLIC SAFETY AND EMERGENCY
3.5 EDUCATION AND TOURISM
3.6 ENVIRONMENT AND WASTE MANAGMENT
3.7 SMART BUILDING, DIGITAL HOME

ICT and the Smart Grid

- SG has different meanings for different players and uses
- ICT supplies the pillars for the development of the Smart Grid, but great risk of fragmentation is present
- Issues
  - too many contexts
  - system of systems
    - heterogeneous communication technologies
    - integration and interoperability

Distributed services and applications

Data models and information exchange

CIM, IEC61850, DLMS/COSEM

Networking

LAN/HAN, NAN/MAN, WAN

Communication media and technologies

Wired (Ethernet, xDSL, Cable, optical fibre), Power-Line (HomePlug, HomePNA, HomeGrid), Wireless (ZigBee, Z-wave, W-Mbus, WiFi, WiMax, GSM, UMTS/LTE) …

SMART WATER MANAGEMENT IN CITIES

•Smart Water Management enhances water quality and reliability, ensures proper management of green systems, decreases water loss due to leakage, reduces operational costs as wells improves customer control and choice.

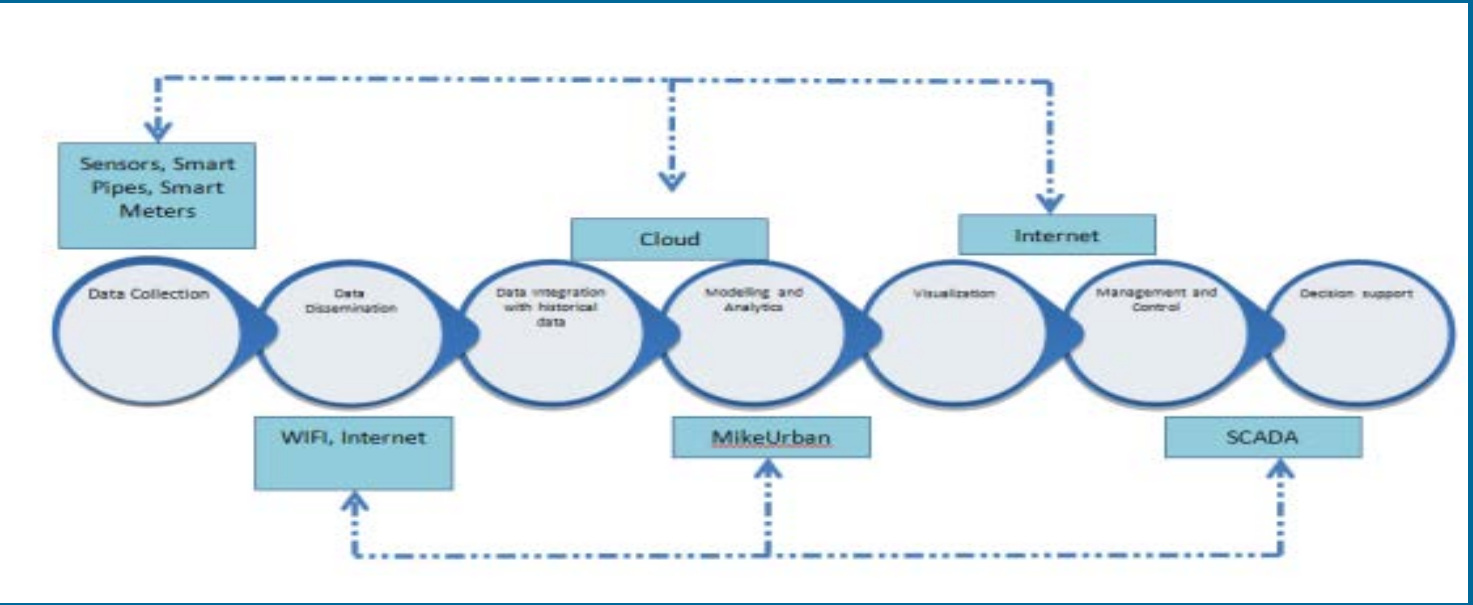
•These improvements increases the efficiency of the water sector while ensuring its economic sustainability since municipalities and water utilities are better able to recover costs from non-revenue water and are better able to detect illegal connections.

•ICTs permit the continuous monitoring of water resources, providing real time monitoring and measuring, making improvements in modelling and by extension problems diagnosis, enabling proper maintenance and optimization all aspects of the water network.

Current implementation of Smart Water Management technologies and tools

Smart Water Management Technologies and tools:

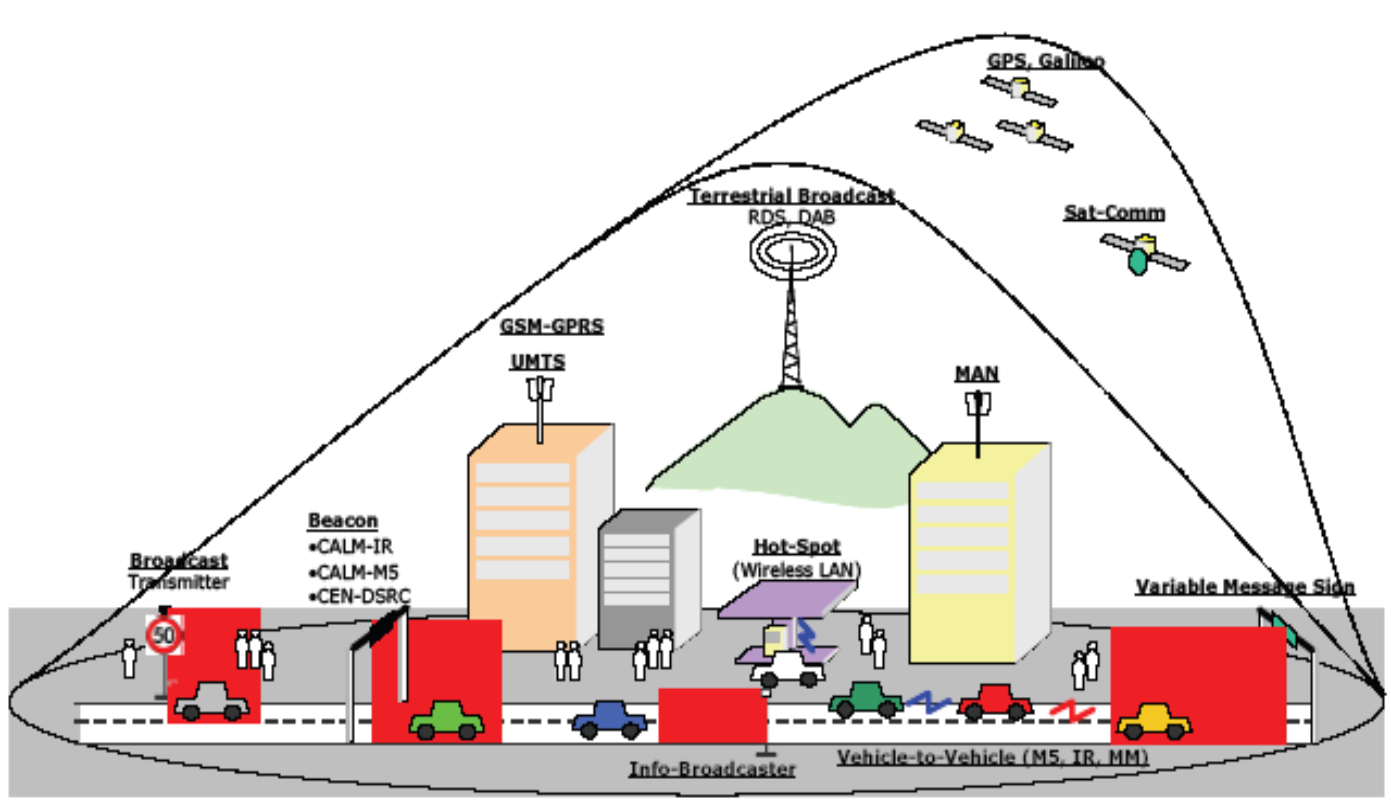
- Data acquisition & integration; (E.g. sensor networks, smart pipes, smart meters etc.)
- Data dissemination; (E.g. Radio transmitters, WIFI, Internet etc.)
- Modelling and analytics; (E.g. GIS, MikeURBAN, Aquacycle, AISUWRS, and UGROW etc.)
- Data processing and Storage; (E.g. SaaS, Cloud computing, etc.)
- Management and Control; (E.g. SCADA, optimization tools, etc.)
- Visualization and decision support; (E.g. Web-based communication and Information systems tools etc.)



Schematic representation of Smart Water Management technologies and tools

Transportation

Intelligent Transport Systems (ITS) may be defined as systems utilizing a combination of computers, communications, positioning and automation technologies to use available data to improve the safety, management and efficiency of terrestrial transport, and to reduce environmental impact .



Source: The CALM Forum/ISO TC 204, reprinted in ITU-R Land Mobile Handbook, Vol 4: Intelligent Transport Systems (2006), available at: www.itu.int/pub/R-HDB-49-2006/en

Application in wireless multiservice payment system for vehicles

Toll payment collection on highways is one of the applications of Intelligent Transport System (ITS) technology.

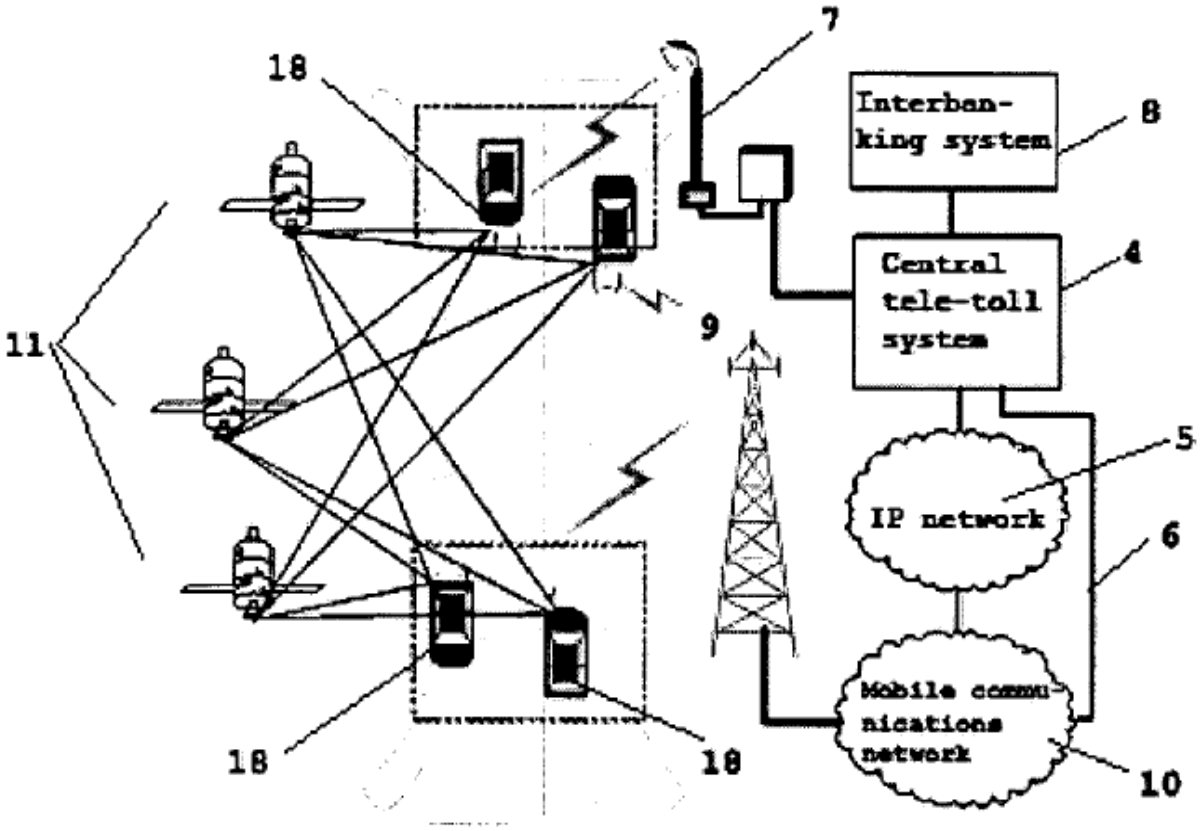


Diagram of the operation of the toll payment systems on highways
Source: European Patent Application EP 1944736 A1

Public safety and emergency

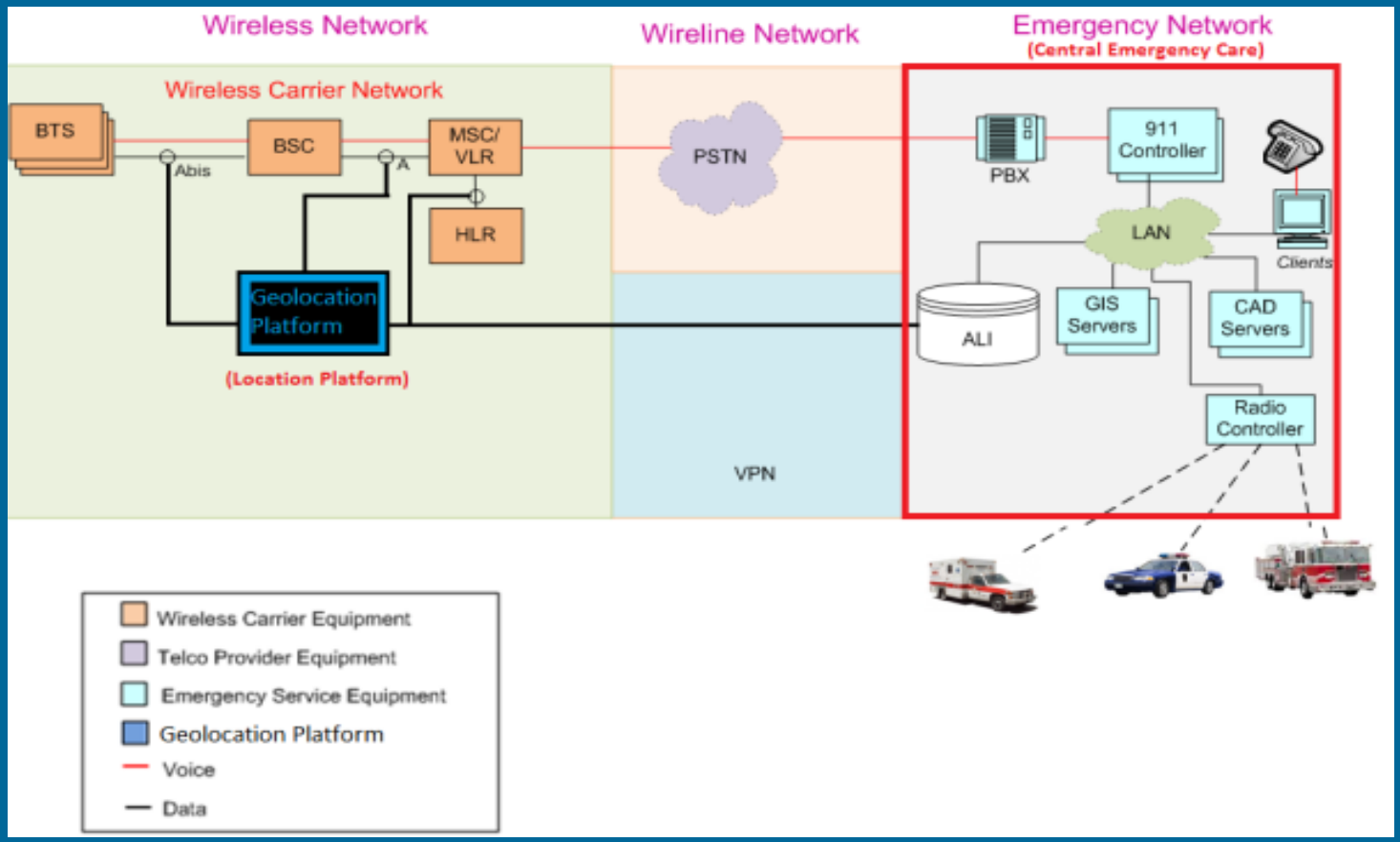
Below we show two important systems for public safety:

1.Geo-location Systems of Cell Phones.
2.System of National Alert using cell broadcast.

Both systems are part of a law project of Public Safety in Peru called SISGET and SISMATE respectively. Both system will be interconnected and managed by the Centralized Emergency Center.

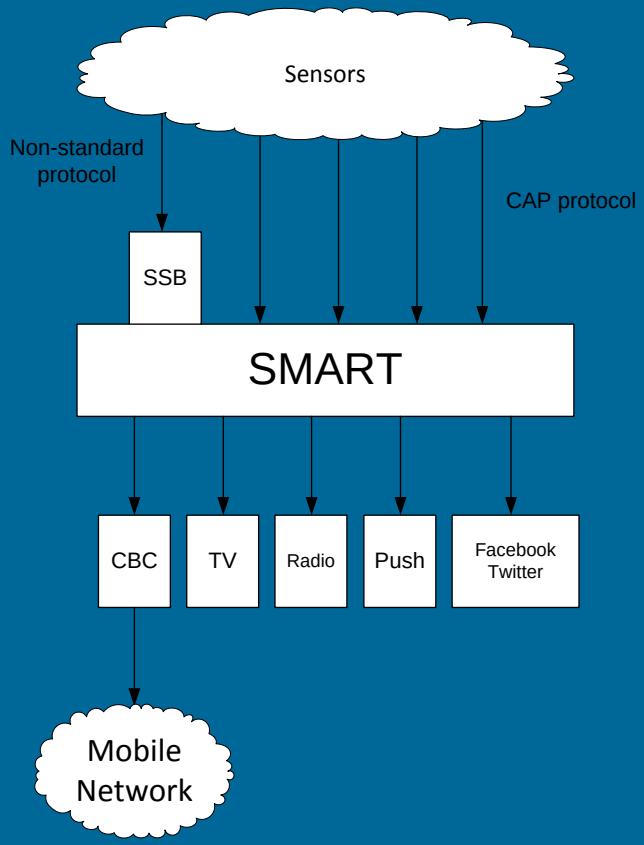
Location of Emergency Calls (1)

This solution locate emergency calls of fixed and wireless network automatically, and route them to qualified personnel equipped with equipment of latest technology, showing the location information.



National Alert System Using Cell Broadcast

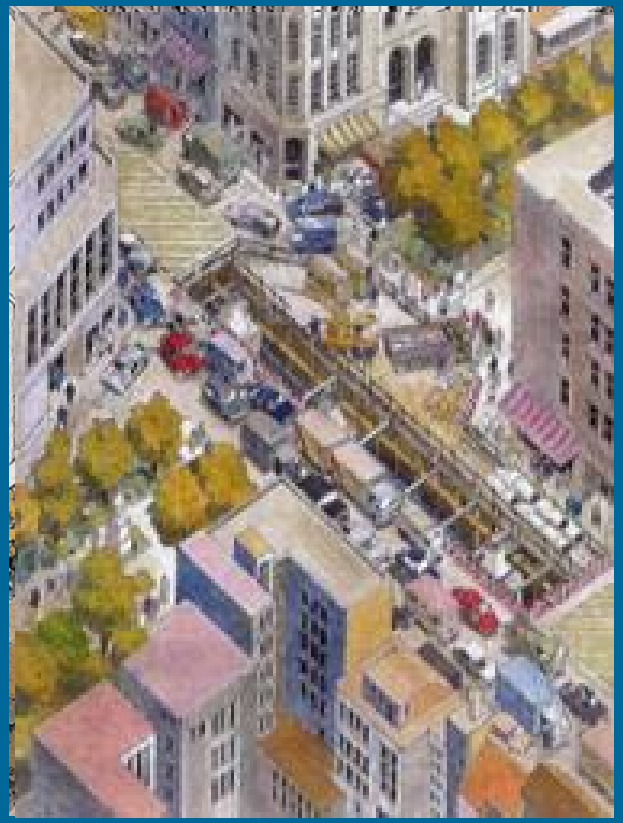
The proposed system architecture includes the use of a CBC (Cell Broadcast Center) directly driven by a SMART system.
The architecture of the system can be summarized under the following diagram:



City infrastructures

Cooperation opportunities

- City infrastructures are complex and costly
- New civil works = traffic issues + damages to existing infrastructure
- Cooperation is possible both on new and existing infrastructure



Picure source: http://www.unep.org/publications/search/pub_details_s.asp?ID=458

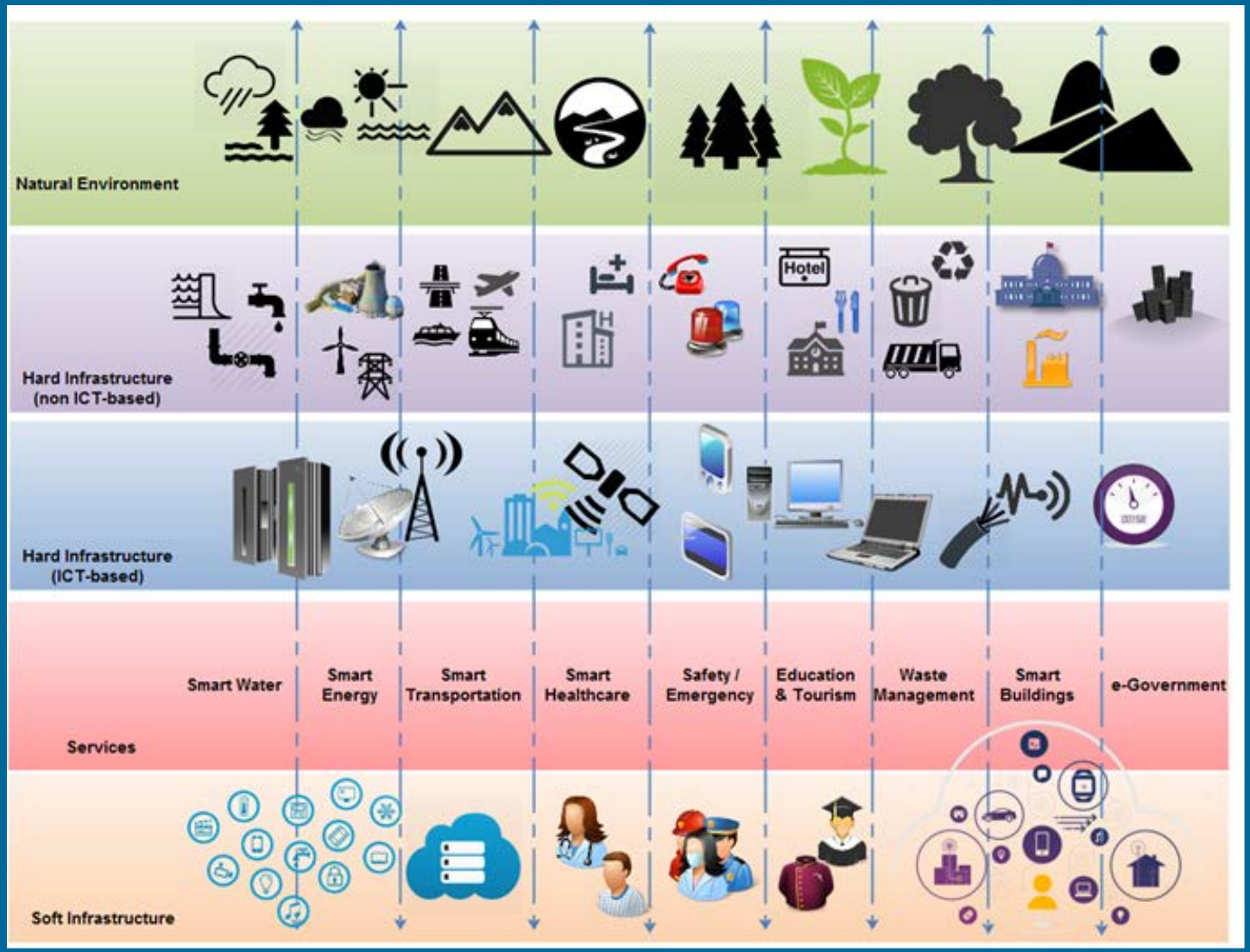
WG2 -
"Architecture for SSC"

- Abstract representation of a system or structure
- Analysis of a SSC in its subsystems, components or entities
- Interconnection amongst them
- Understand and visualize its synthesis

SSC dimension / *SSC KPIs*	People	Living	Government	Environment	Economy
ICT	X	X	X	X	X
Environmental sustainability		X		X	
Productivity		X	X		X
Quality of life	X	X	X	X	X
Equity and social inclusion	X	X	X	X	
Physical infrastructure	X	X	X	X	X

“Architecture for SSC”

Multi-tier architecture for a smart sustainable city

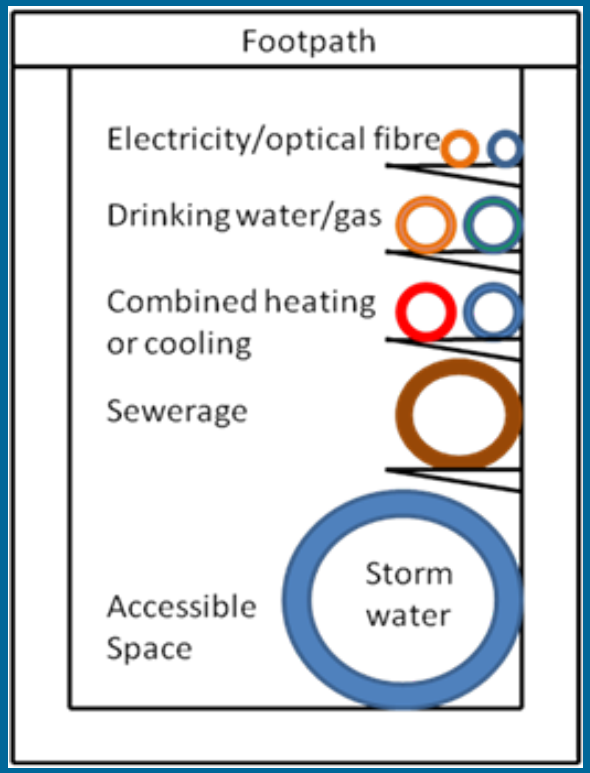


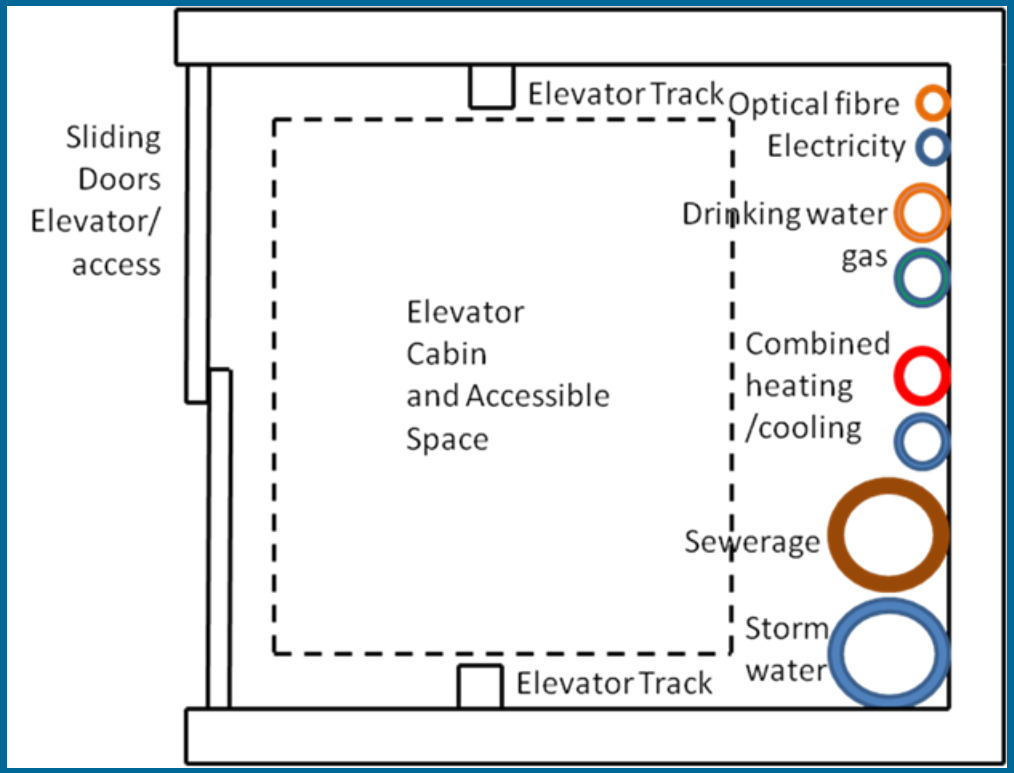
WG2 -
"Multi-service infrastructure for SSC in New Build Areas"

The Scope of this Recommendation includes:

- **common physical infrastructure highlighting ICT**
- **over ground, ducted and trenched infrastructure**
- **common physical infrastructure**
- **common risers in buildings**
- **safety considerations**
- **operational recommendations**
- **lifecycle considerations including possible obsolescence, flexibility points, scalability and growth**

WG2 - "Multi-service infrastructure for SSC in New Build Areas"





Opportunities for Infrastructure sharing

WG2 -
"Anonymization infrastructure and open data in smart sustainable cities"

Summarized introduction on open data in SSC.

Characterizes open data in seven aspects:

- the demand of open data in smart sustainable cities
- the framework of open data in smart sustainable cities
- the constraint of open data in smart sustainable cities
- the technology of open data in smart sustainable cities
- the management of open data in smart sustainable cities
- use cases
- solutions

"Anonymization infrastructure and open data in smart sustainable cities"

Why Data Anonymity

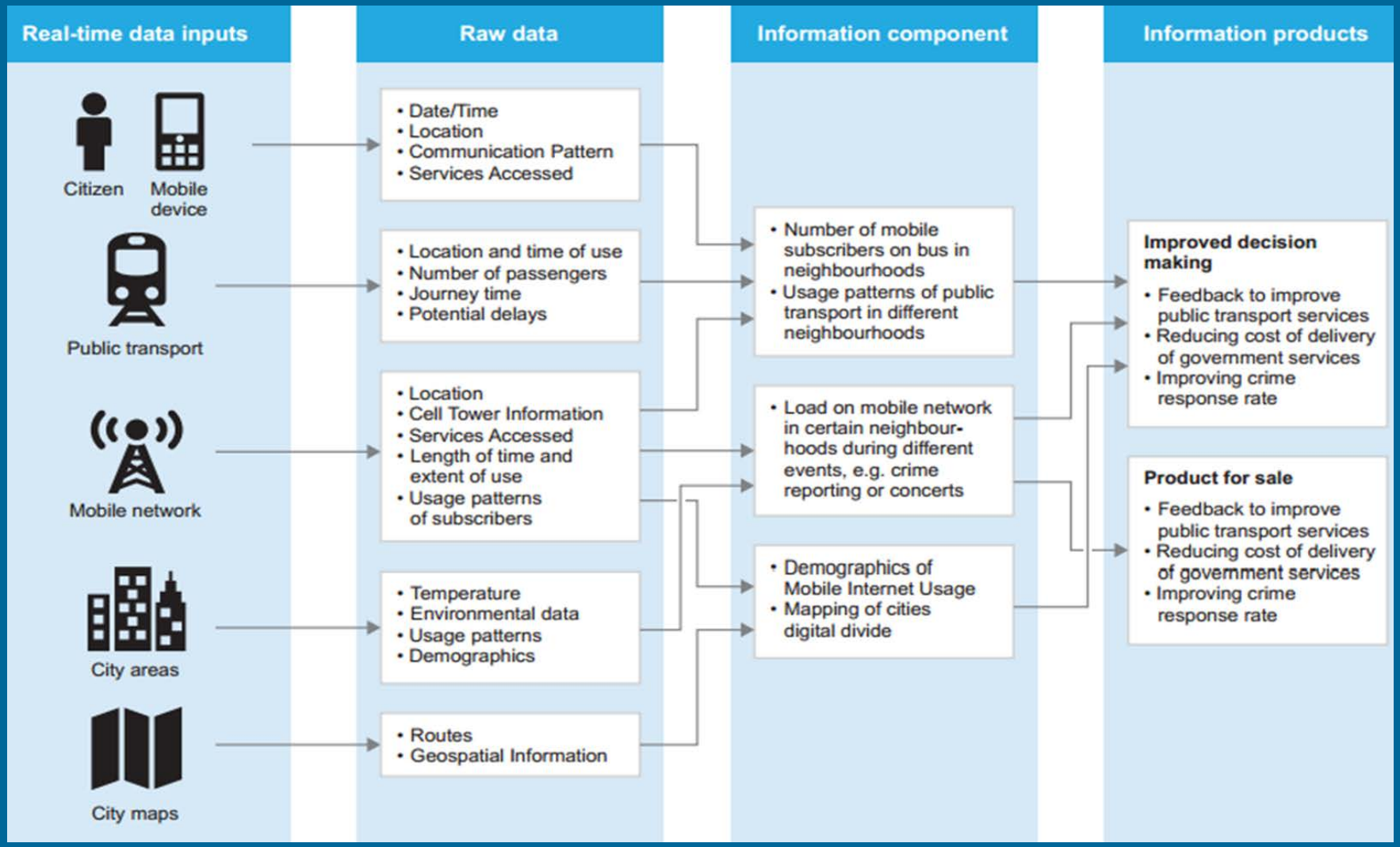
- Protecting Sensitive Business Data
- Minimize misuse of personal data
- Address privacy issues
- Economic Impact of Data "Misuse"
- Reduced Risk related to 3rd Parties
- Legal and compliance requirements

Value of Open Data

- Trust & Transparency
- Enables Participation By All
- Self-empowerment
- Innovation
- Improved efficiency & effectiveness
- 1+1 = 3 : New knowledge from combined data sources and patterns in large data volumes

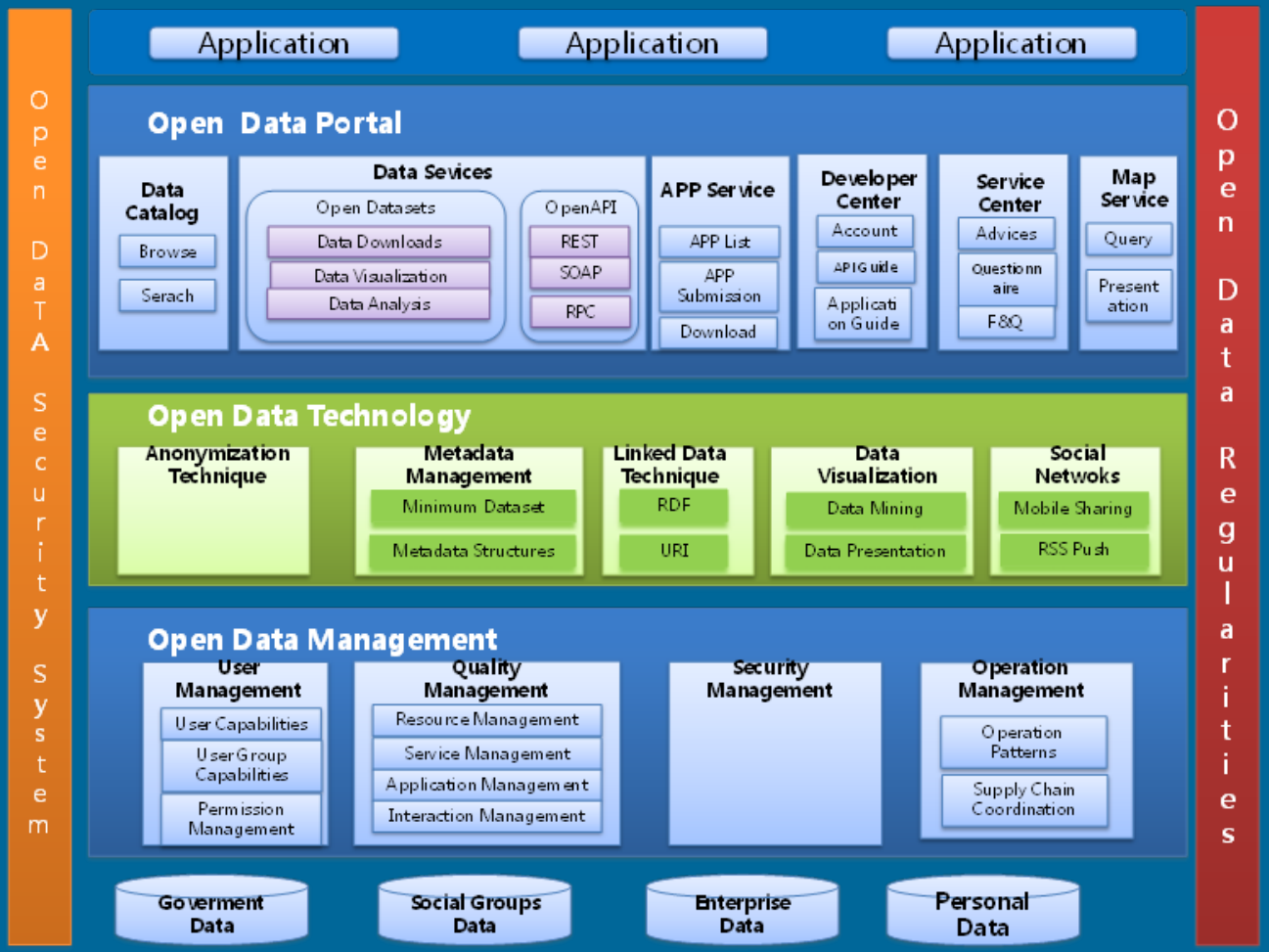
"Anonymization infrastructure and open data in smart sustainable cities"

Open data flow



“Anonymization infrastructure and open data in smart sustainable cities”

The Principles of Overall Design:



"Anonymization infrastructure and open data in smart sustainable cities"

Ways of Information Anonymization

`1	Replacement	Substitute identifying numbers
22	Suppression	Omit from the released data
33	Generalization	Replace birth date with something less specific, like year of birth
44	Perturbation	Make random changes to the data

Expected (anonymous) applications of Open Data in SSC

- Application of Open Data on Smart Forecasts
- Application of Anonymization Method for a Smart Metering
- Infrastructure of Secondary Use of Data

Regional actions - Europe

Directive 2014/61/CE on broadband cost reduction

- The European Commission recently issued a Directive aiming at cost reduction of broadband deployment
- It urges for synergies between Utilities (electricity, gas, water, airports, …) and TelCOs
- Three pillars
  - Access to & transparency of existing physical infrastructure
  - Coordination & transparency of planned civil works
  - Permit granting
    - https://ec.europa.eu/digital-agenda/cost-reduction-telco-utility-event

Regional actions - Europe

Study on use of commercial mobile networks for mission critical communications

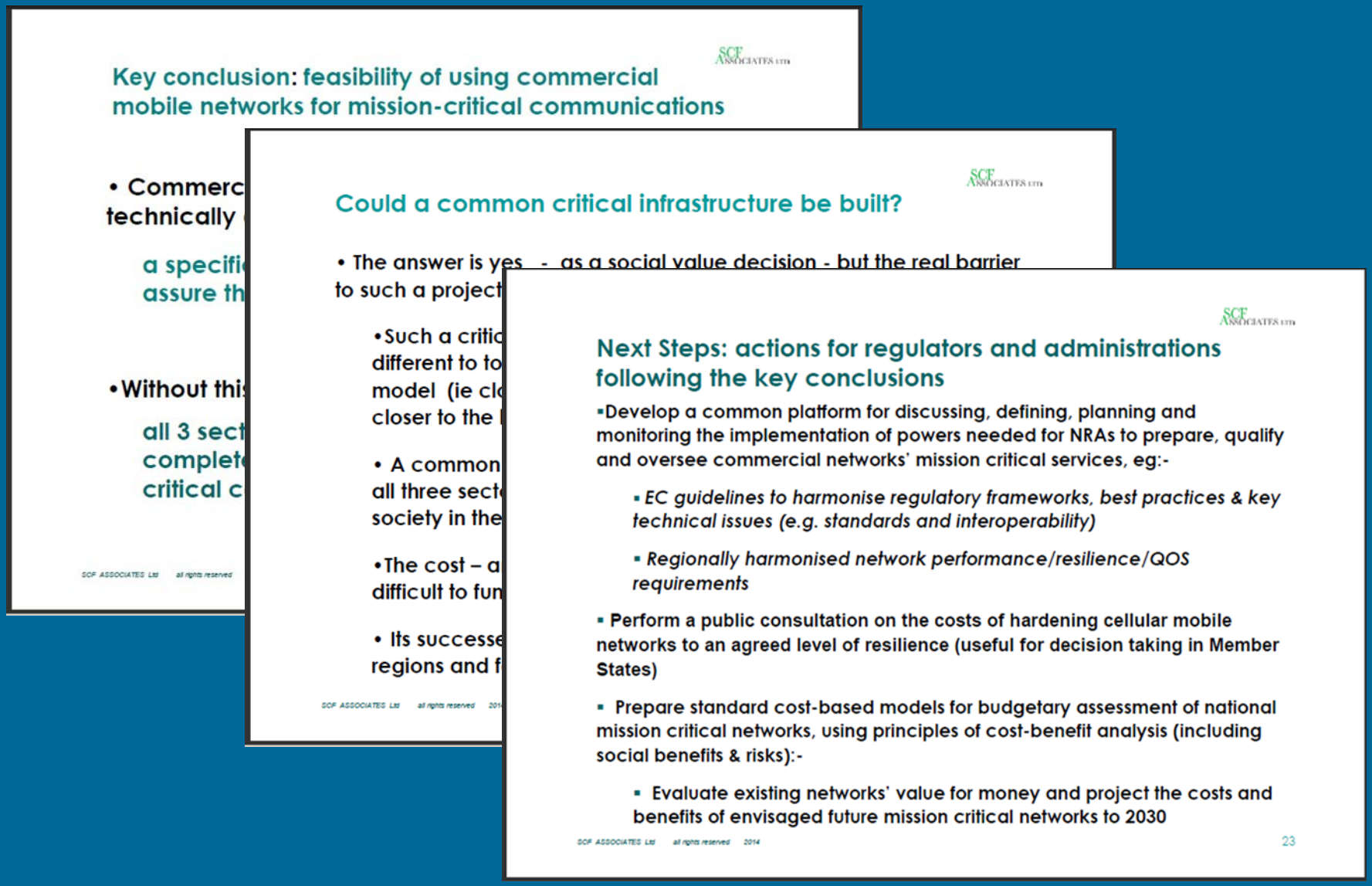
•The European Commission is examining the potential role that commercial mobile networks – with associated economies of scale for commercial equipment (including handheld devices for end-users) – could play in ensuring the provision of "mission-critical" high-speed broadband communications in the following sectors

1. Public safety, civil protection and disaster relief (PPDR);
2. Utilities – intelligent energy management systems and smart energy grids;
3. Intelligent transport safety and transport management systems (ITS).

- http://ec.europa.eu/information_society/newsroom/cf/dae/document.cfm?doc_id=8211
- http://ec.europa.eu/information_society/newsroom/cf/dae/document.cfm?doc_id=8208

Regional actions - Europe

Outcomes of the study



Source: https://circabc.europa.eu/d/a/workspace/SpacesStore/fc61f873-ac9f-4676-89f2-66c5c7197faa/AI-5-SCF_presentation.pdf

Planning national deployment of ICT infrastructure for SSC

The planning of a SSC is in charge of the Government. It should focus on generating cross-cutting, inclusive and comprehensive strategies, using ICTs, to optimize the meeting of the diverse needs of the citizens.

The use of ICT in the planning of a SSC must be aimed at interrelating the complex systems that form an urban area (utilities, communications, production, information, infrastructure, vulnerability, etc.), as well as, proposing smart and inclusive solutions oriented to use efficiently and sustainably the resources required by the citizens, particularly the non-renewable ones.

Thank you

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