

CATRENE Study Semiconductor Technologies for Smart Cities **Information & Communication**

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Smart City

Study Mapping Smart Cities in the EU,
DG Internal Policies 2014:

A city seeking to address public issues **via ICT based solutions** on the basis of a multi-stakeholder, municipality-based partnership.

Smart community infrastructure

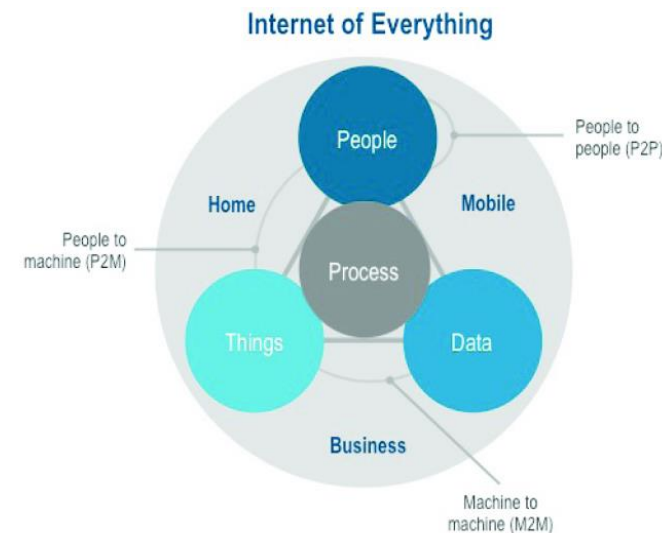
ISO TC 268/SC 1:

community infrastructure with enhanced technological performance that is designed, operated and maintained to contribute to sustainable development and resilience of the community

- *Note 1: It is the infrastructure that is considered to be “smart” in this standard and not the community.*
- *Note 2: Sustainable development tends to require community infrastructures that meet multiple, often contradictory, needs at the same time.*
- *Note 3: ICT is an enabler but not a precondition for achieving smart community infrastructures.*

Conceptual View

- Key enabling technologies of smart cities
 - cyber physical systems (CPS)
 - Internet of Things (IoT)
- Four layers for ICT of smart cities
 1. Perception or Device Layer
 2. Network or Transmission Layer
 3. Middleware Layer or Information Processing Layer
 4. Application Layer



Source: Cisco IBSG, 2012

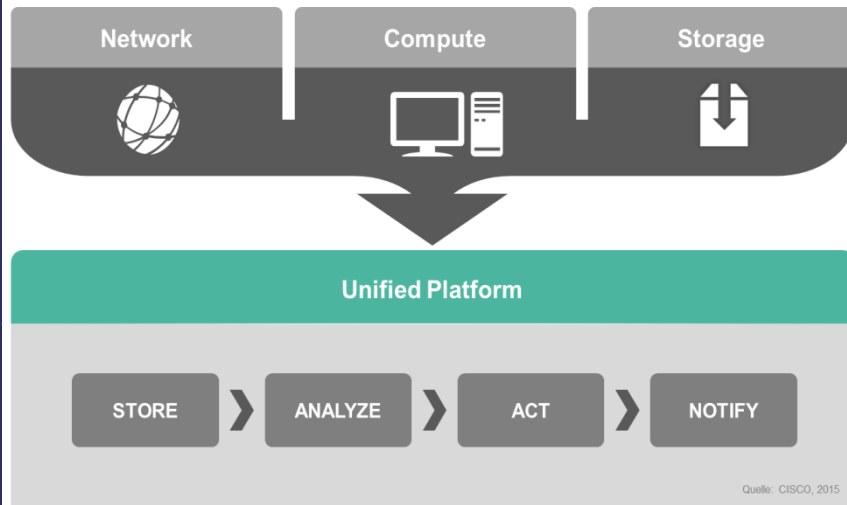
Key Products

- Functionality of each of these layers is based on some fundamental technologies
 - Smart sensor nodes and wireless sensor networks (WSNs) are the pivot of the perception layer
 - Tb/s telecommunication equipment, robust communication networks and protocols enable the network layer
 - Information processing layer relies on high-performance, parallel computing and virtualization of storage, computing and analytics services
 - Smart mobile devices are the driving forces of data-driven services and the application layer, which are characterized by new human-computer interfaces, multimedia technologies and information presentation and visualization solutions

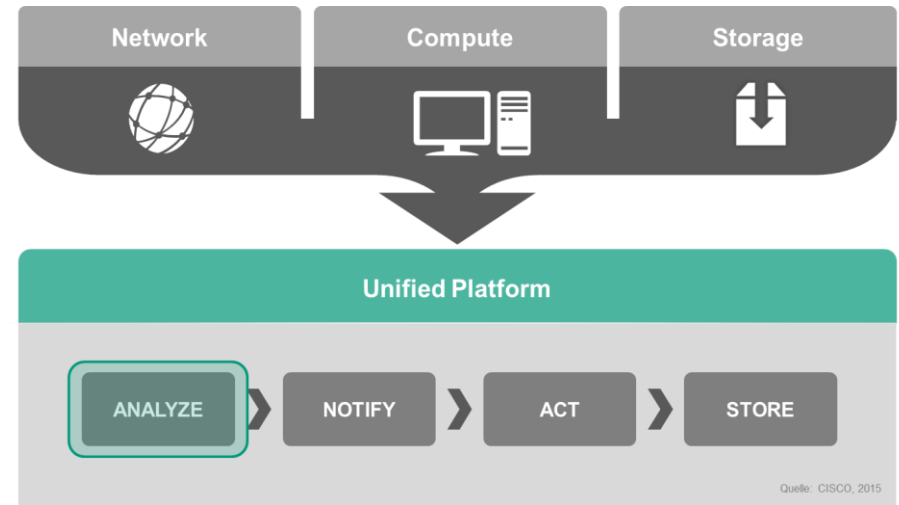
Refinement of Key Products

- Smart Sensor Nodes
 - Localization Support
 - Computation Features
 - Short Range Communication Chip Sets
 - Harvesting-Based Communication
- Robust Communication Networks
 - Wireless Sensor Networks
 - Machine-to-Machine Communication
 - Tb/s Telecommunication Equipment
- Data-Driven Services
 - Data Storage in Clouds / *Fog Computing*
 - Data Collection and Provisioning Features
 - Big Data Solutions

Cloud & Fog Data Analytics



Cloud Computing



Fog Computing

Challenges for full acceptance and deployment

- Concepts and approaches for data-driven innovation based on trust and ownership of data while at the same time assuring security and privacy in complex urban environments
- Concepts for the resilience and safety of ICT-based urban infrastructures including energy, water and other supply networks while at the same time assuring flexibility in the timely evolution of the ICT components
- Scalable concepts for the semantic interoperability of urban data and information supporting near real-time data analytics and information exchange in heterogeneous environments
- Reference architecture for ICT in smart cities including open formats, protocols, services and interfaces for the vertical and horizontal integration and interoperability of ICT components

Technical Requirements

- Low-Power Consumption and Flexibility of RF Front-End
- New Semiconductor Technologies
- Software Flexibility

Smart City Reference Architecture

ICT for the city of the future will be constituted by Integrative CPS. Six key areas:

1. Concepts and methods for dynamized urban infrastructures
2. Construction and quality assurance of genuine security
3. Multidisciplinary and integrative urban development
4. The field – including (i) sensors, e.g. for monitoring real processes in the city, (ii) ‘things’, i.e. machines, devices, vehicles, systems, etc. and (iii) human beings, i.e. both the people working in the field (cf. ICT solutions for blue-collar workers) and members of the public (cf. citizen services) – as an integral part of the ICT platform
5. The network itself as a dedicated public urban infrastructure and as a critical infrastructure
6. The urban control to focus on user empowerment and teamwork

Summary

- ICT for smart cities will be constituted by **Dynamized Integrative Cyber-Physical Systems**
 - Concepts and methods for dynamized urban infrastructures
 - Construction and quality assurance of genuine security
 - Multidisciplinary and integrative urban development
 - The field – including (i) sensors, e.g. for monitoring real processes in the city, (ii) ‘things’, i.e. machines, devices, vehicles, systems, etc. and (iii) human beings, i.e. both the people working in the field (cf. ICT solutions for blue-collar workers) and members of the public (cf. citizen services) – as an integral part of the ICT platform
 - The network itself as a dedicated public urban infrastructure and as a critical infrastructure
 - The urban control to focus on user empowerment and teamwork

Fall back/ Standards

Important to guarantee interoperability of solutions

- * More than simply defining standards required: we need interoperability tests of equipment claiming to be standard compliant (e.g. WiFi Alliance defines (industry-relevant) use cases and associated tests for 802.11 (=standard) equipment)
- * Link-technology standards --- 802 standard family, mainly WiFi 802.11, Ethernet 802.3, and 802.15; & cellular networks (LTE / future 5G networks).
- * European standards mainly drive cellular link technology vs IEEE standards drive the shared spectrum / industrial and scientific bands, i.e. those frequencies that do not require a paid licence from regulators
- * need "middle ware standards" as well, e.g. exchange of data / profiles from of devices. here: OneM2M, ETSI M2M

Standards related to semantics, i.e. how to represent data.

- * W3C is driving this process

- * In Europe, DCAT AP should be followed for data portals: The **DCAT Application profile for data portals in Europe** (DCAT-AP) is a specification based on the Data Catalogue vocabulary ([DCAT](#)) for describing public sector datasets in Europe.