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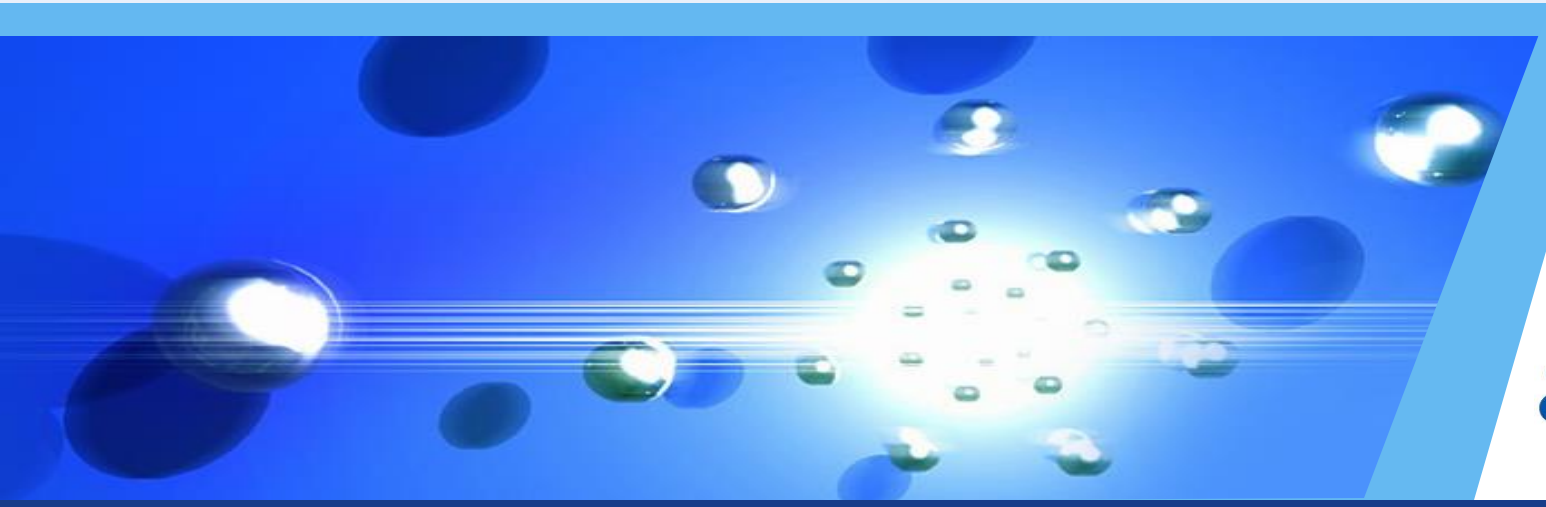


IERC
European Research Cluster on the Internet of Things

E4Connect - Everything Everywhere Every-time Every-path Connect

Internet of Things and Platforms for Connected Smart Objects

EUCNC 2014
European Conference on Networks and Communications | Bologna, Italy

Panel

26th June 2014, Bologna, Italy

Ovidiu Vermesan, Chief Scientist, SINTEF, Norway

E4Connect - Panel

- Roberto Minerva (Telecom Italia, Italy)
- Mario Gerla (University of California, Los Angeles, CA, USA)
- Markus Dillinger (Huawei, Germany)
- Nicolas Demassieux (Orange, France)

- Chair (organizer and moderator):

Ovidiu Vermesan (SINTEF, Norway)

IERC - IoT European Research Cluster

- Bring together the EU-funded projects and policy activities with the aim of:

Internet of Things

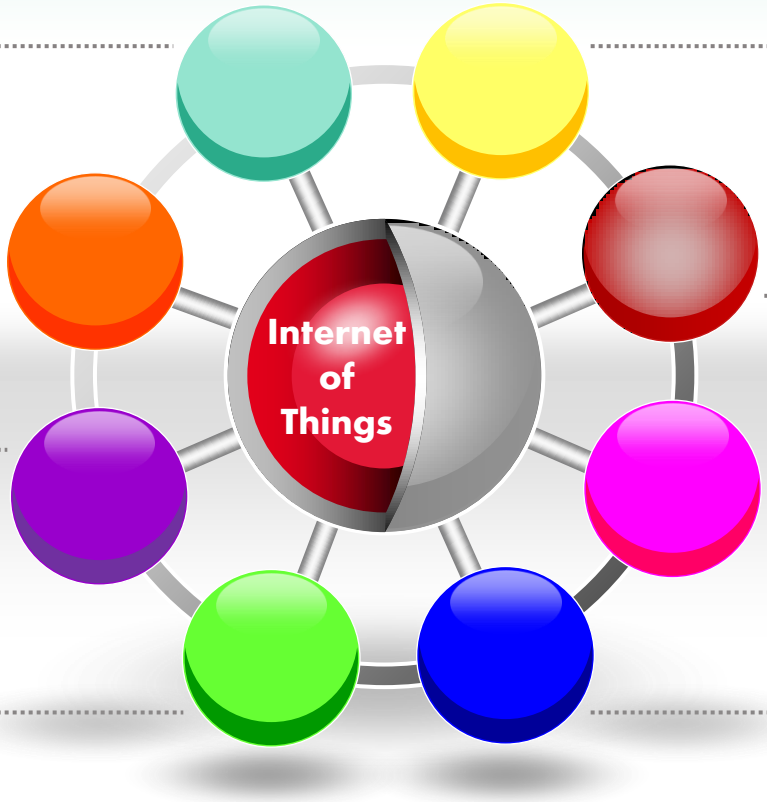
- Internet of Things (IoT) is an integrated part of the Future Internet defined as:

A *dynamic global network infrastructure*

with *self configuring capabilities*

based on *standard and interoperable communication protocols*

where *physical and virtual "things"*



have *identities, physical attributes, and virtual personalities*

use *intelligent interfaces*,

and are *seamlessly integrated*

into *the information network.*

Seamless Integration: An addition of a new application, routine or device that works smoothly with the existing system. It implies that the new feature or program can be installed and used without problems. Contrast with "transparent," which implies that there is no discernible change after installation. Computer Desktop Encyclopedia copyright ©1981-2012

Internet of Things – DG CONNECT

Future Internet WP 2014-2015

IoT

Internet of things-
Smart Connected Objects

Net Innovation
- Collective awareness platforms
- Web entrepreneurship

Cloud computing, software and services
- Advanced cloud infrastructures and services
- ECP: pre-commercial and joint procurement
- Innovative tools & methods for SW development

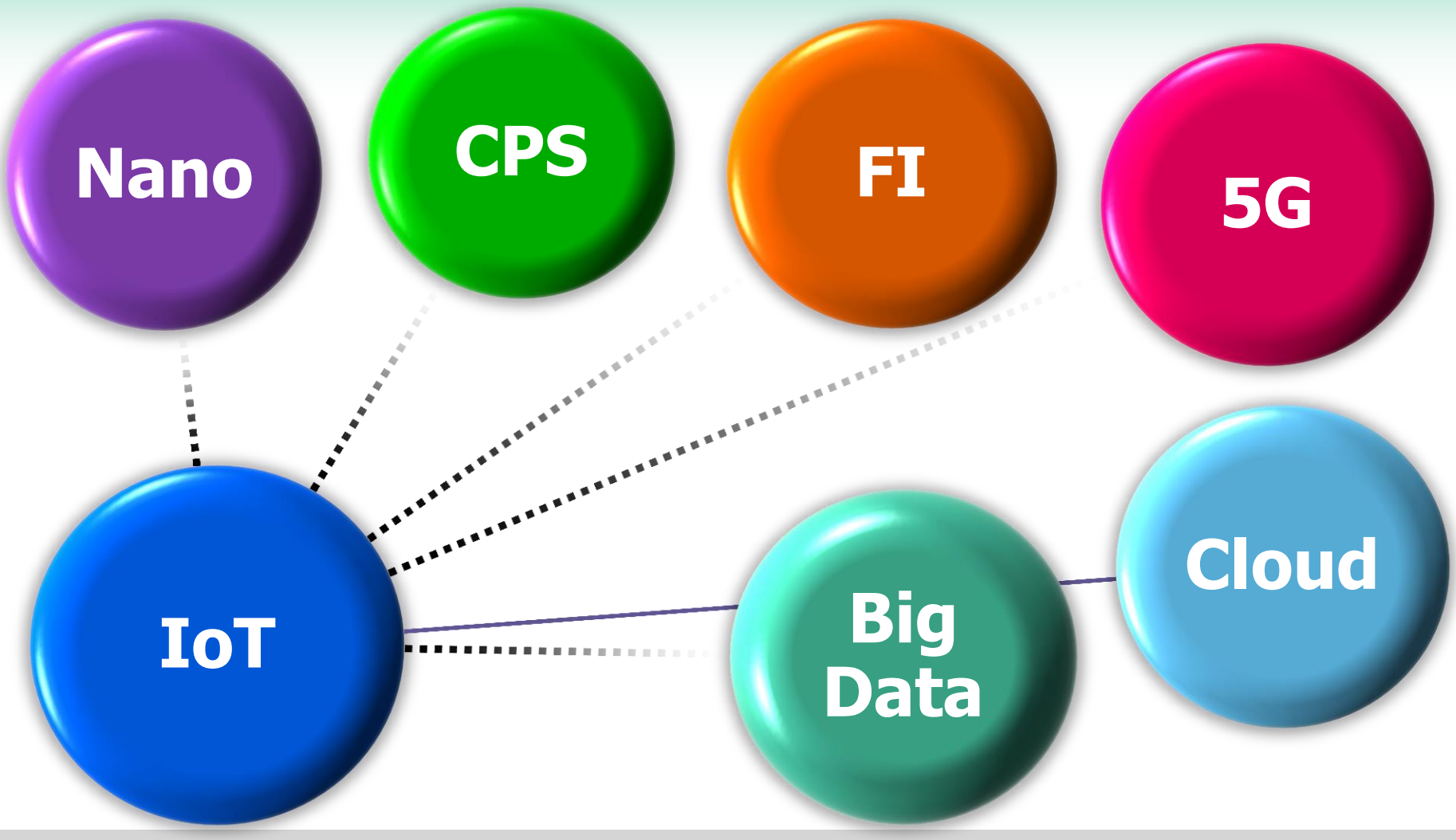
Experimental Platforms
- FIRE+
- Building upon FIRE

Network technologies
- **Smart networks & novel architectures**
- **Optical and wireless network technologies**

Network technologies
- **5G PPP on advanced network infrastructures**

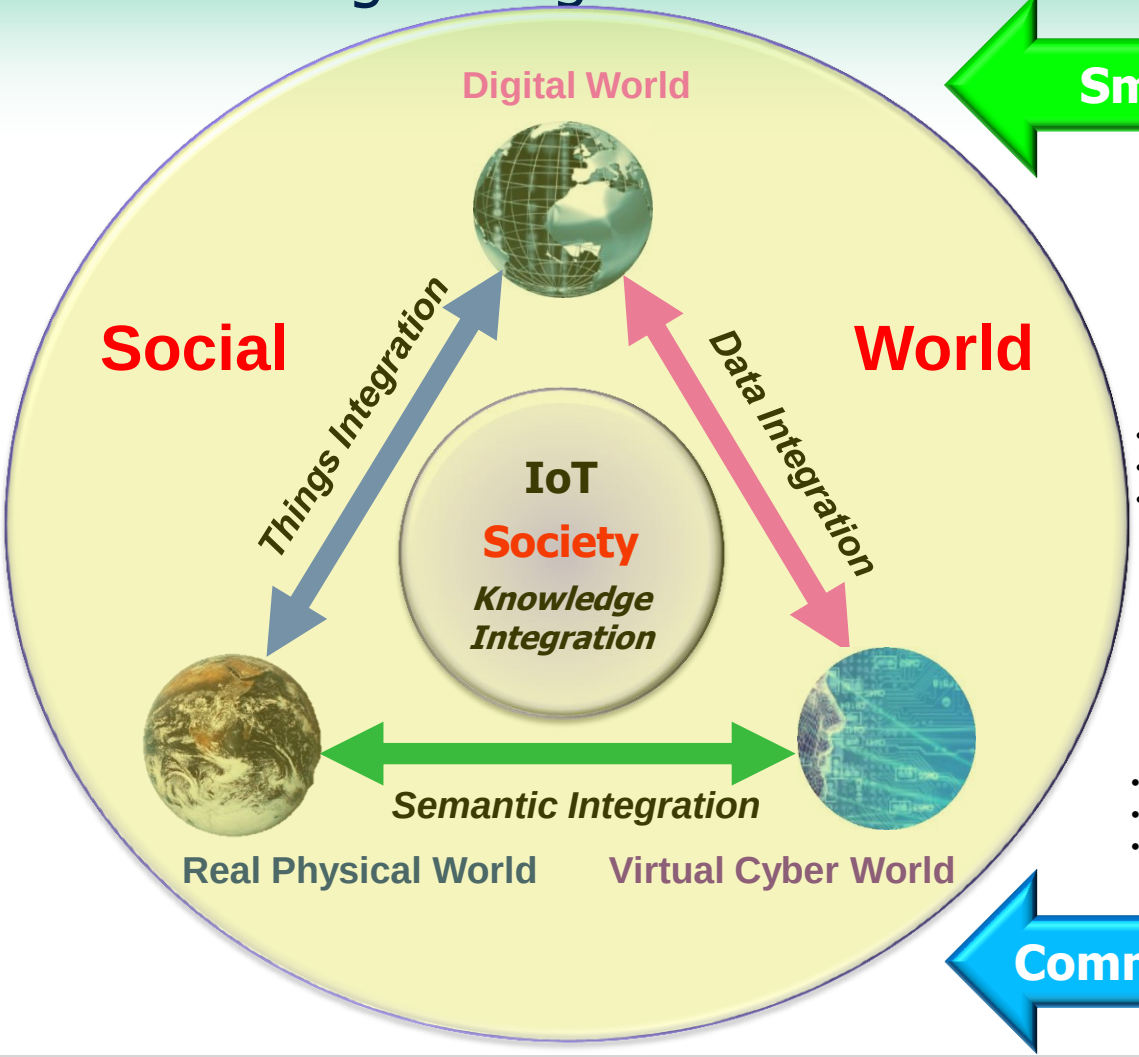
Internet of Things

- Internet of Things Links



Internet of Things

Knowledge Integration



Smart

Smart Transport

ITS, HEVs, EVs

- Electric Mobility, EVs and HEVs
- High Speed Trains
- Infrastructure, V2I, V2V, V2I+I

Smart Cities

Connected Communities

- Lighting, water management
- Monitoring & security
- Traffic control

Smart Energy

Electric Grid

- Voltage and power sensors
- Meters and breakers
- Fault detection

Smart Buildings

Buildings, Smart Homes

- Thermostats, HVAC, lighting
- Presence sensors, lockers, actuators
- Meters, smart-plugs, HEC

Smart Industry

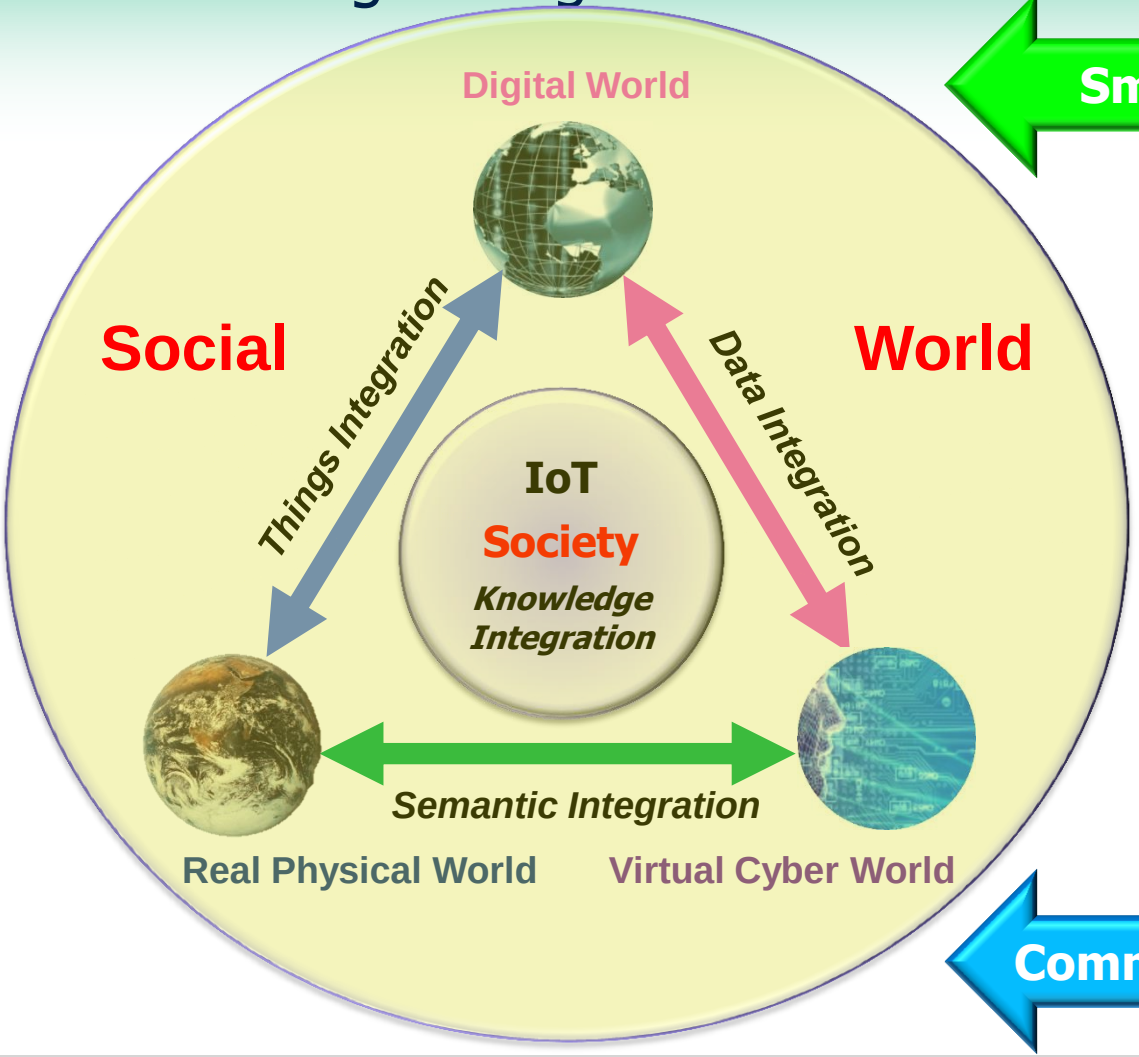
Industrial Environments

- Lightning, security, actuators
- Production control
- Robotics

Community

Internet of Things

- Knowledge Integration



Smart

Smart Planet

Green Environment

- Environmental sensors
- Water, power leak detection
- Pollution, weather monitoring

Smart Living

Entertaining, Leisure

- Independence through technology
- Information when you need it
- Connected when you need it

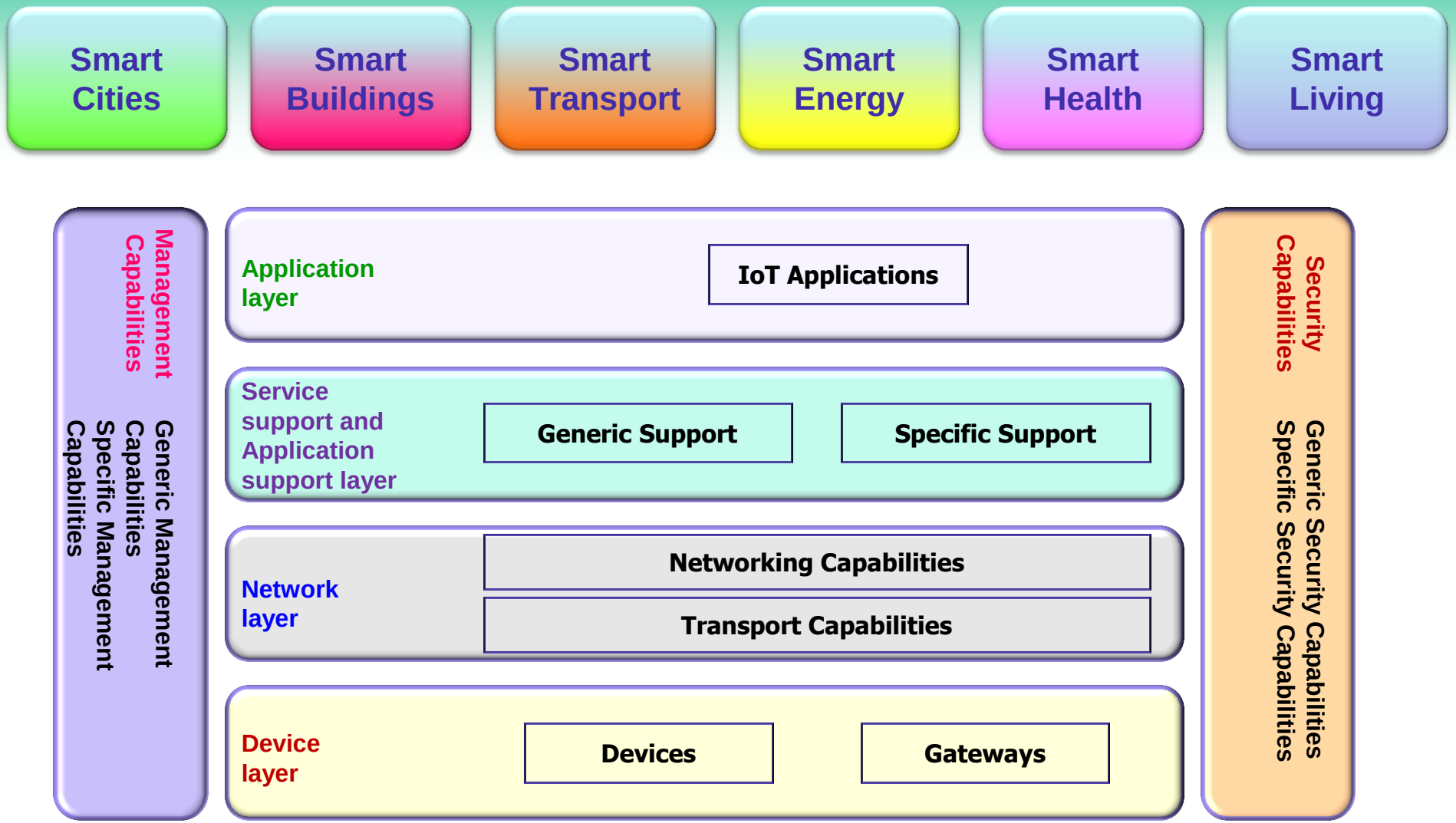
Smart Health

Healthcare System

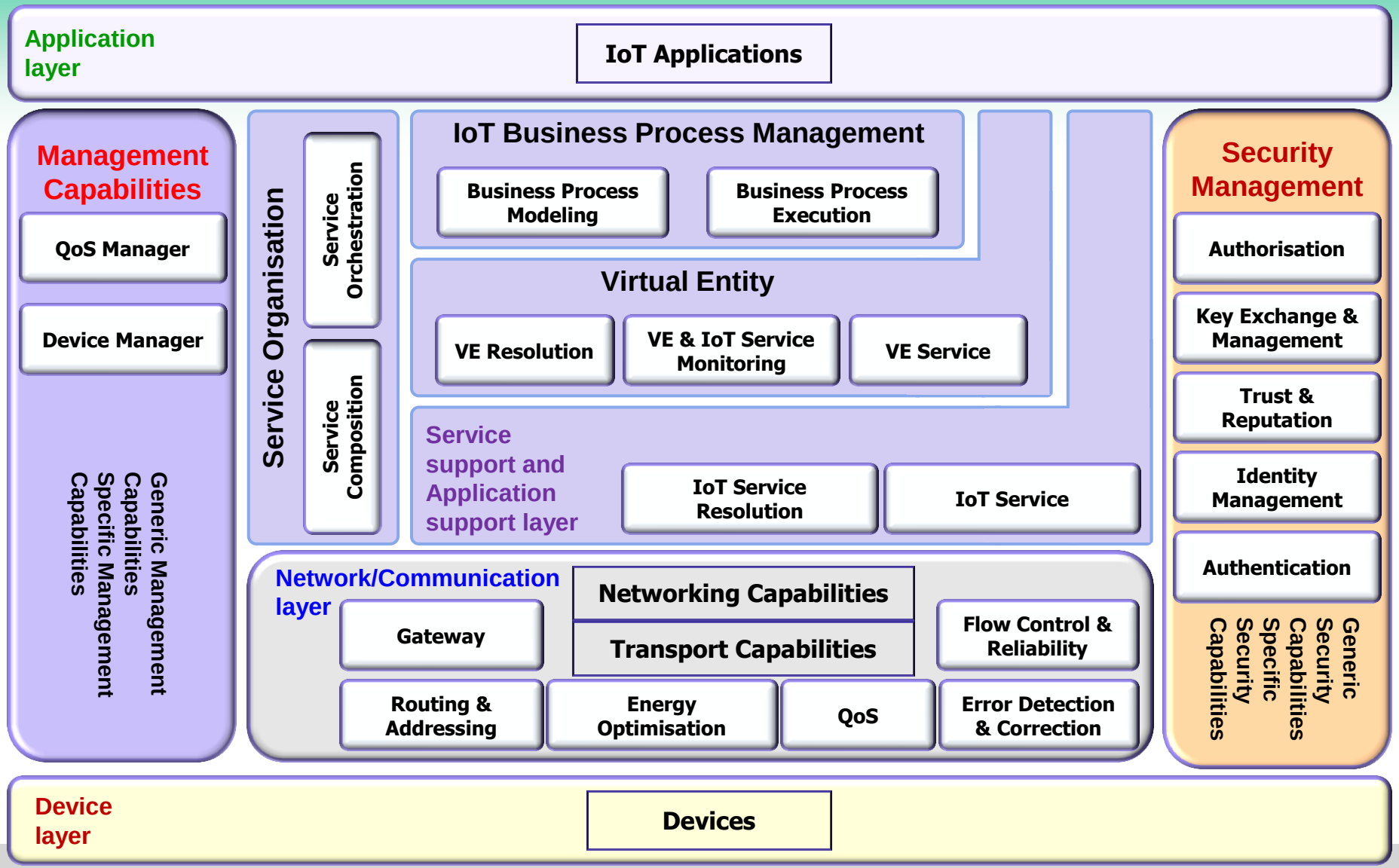
- People monitoring
- Bio sensors, probes
- Remote health

Community

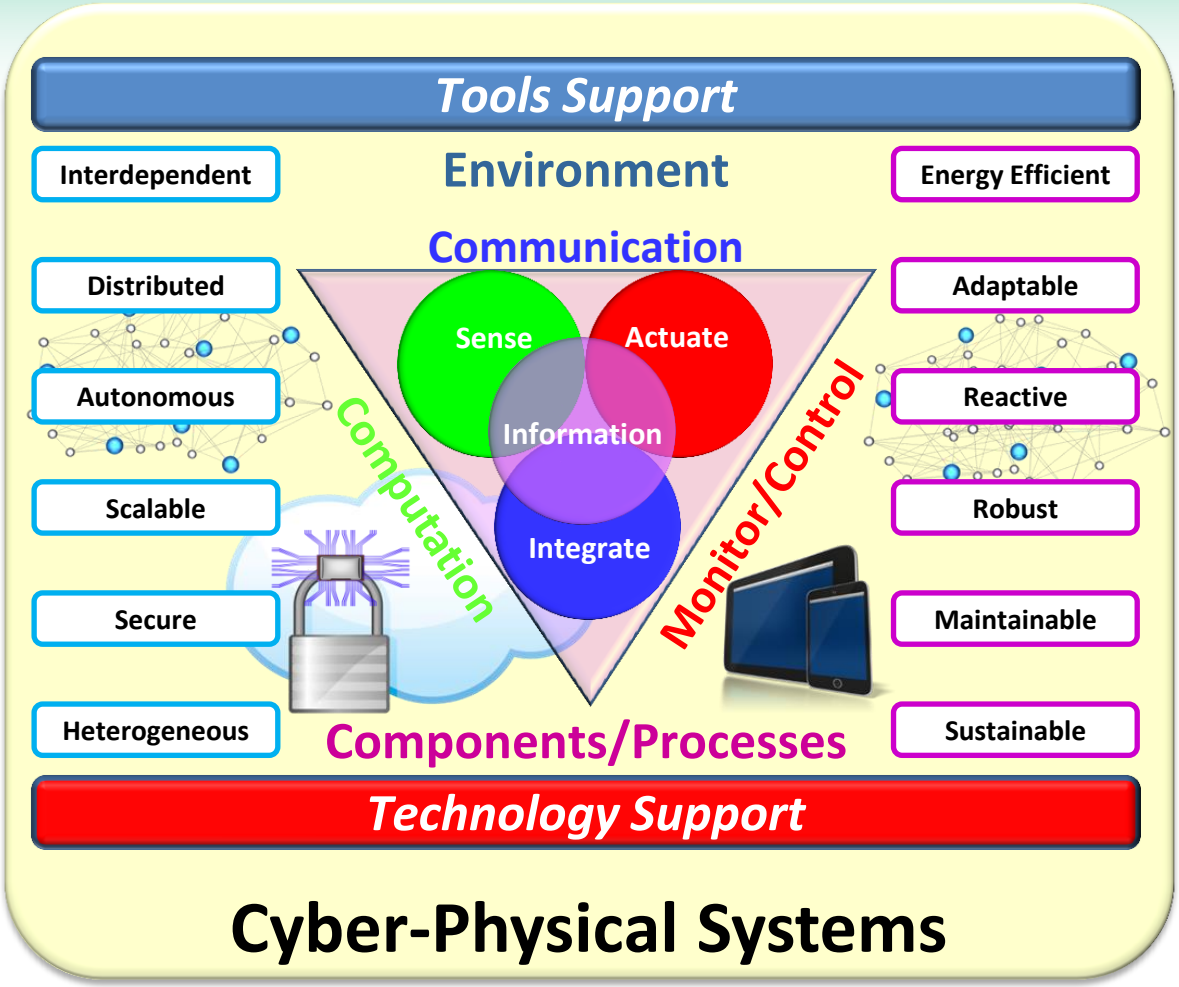
IoT Model


Smart Cities
Smart Buildings
Smart Transport
Smart Energy
Smart Health
Smart Living
Management Capabilities
Generic Management Capabilities
Specific Management Capabilities
Application layer
IoT Applications
Service support and Application support layer
Generic Support
Specific Support
Network layer
Networking Capabilities
Transport Capabilities
Device layer
Devices
Gateways
Security Capabilities
Generic Security Capabilities
Specific Security Capabilities

IoT Extended Model

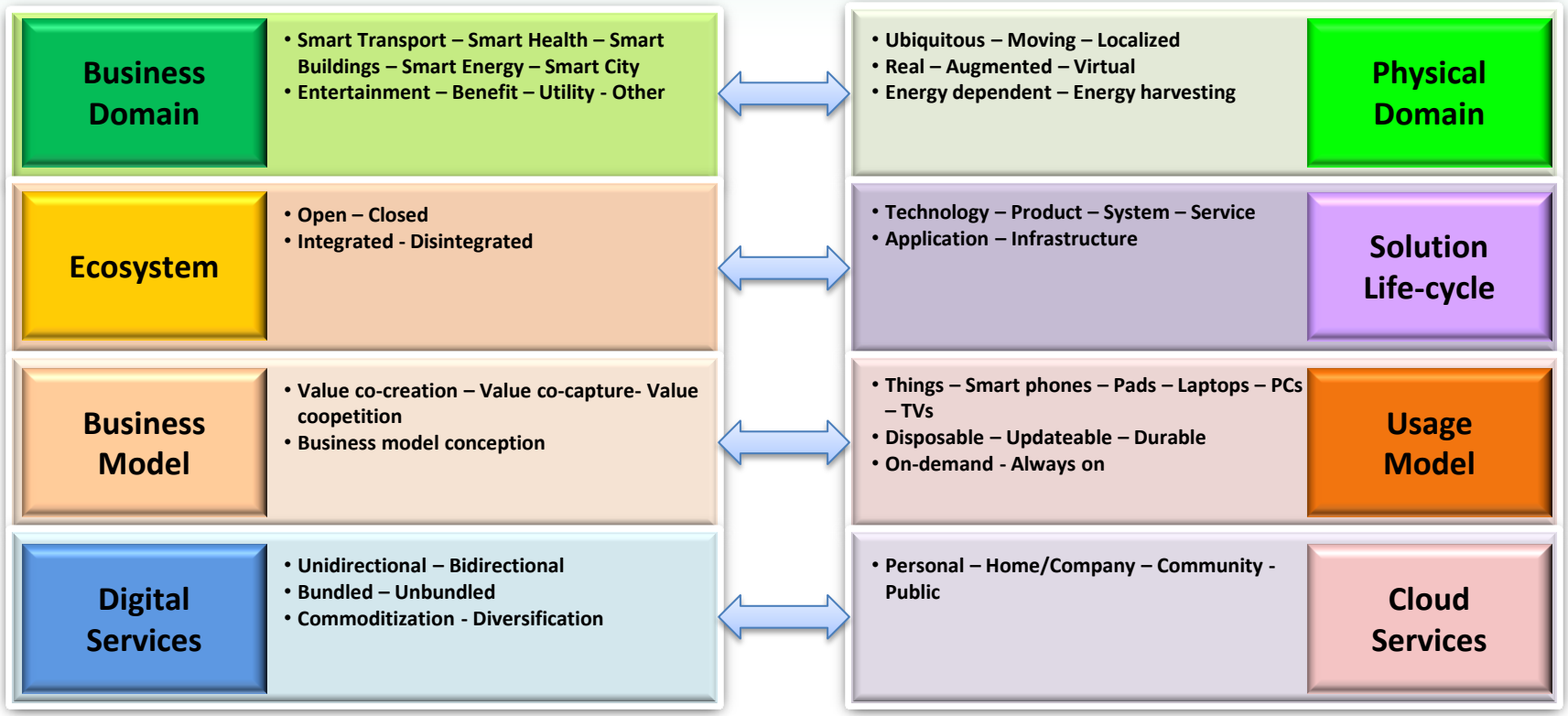


Cyber-Physical Systems



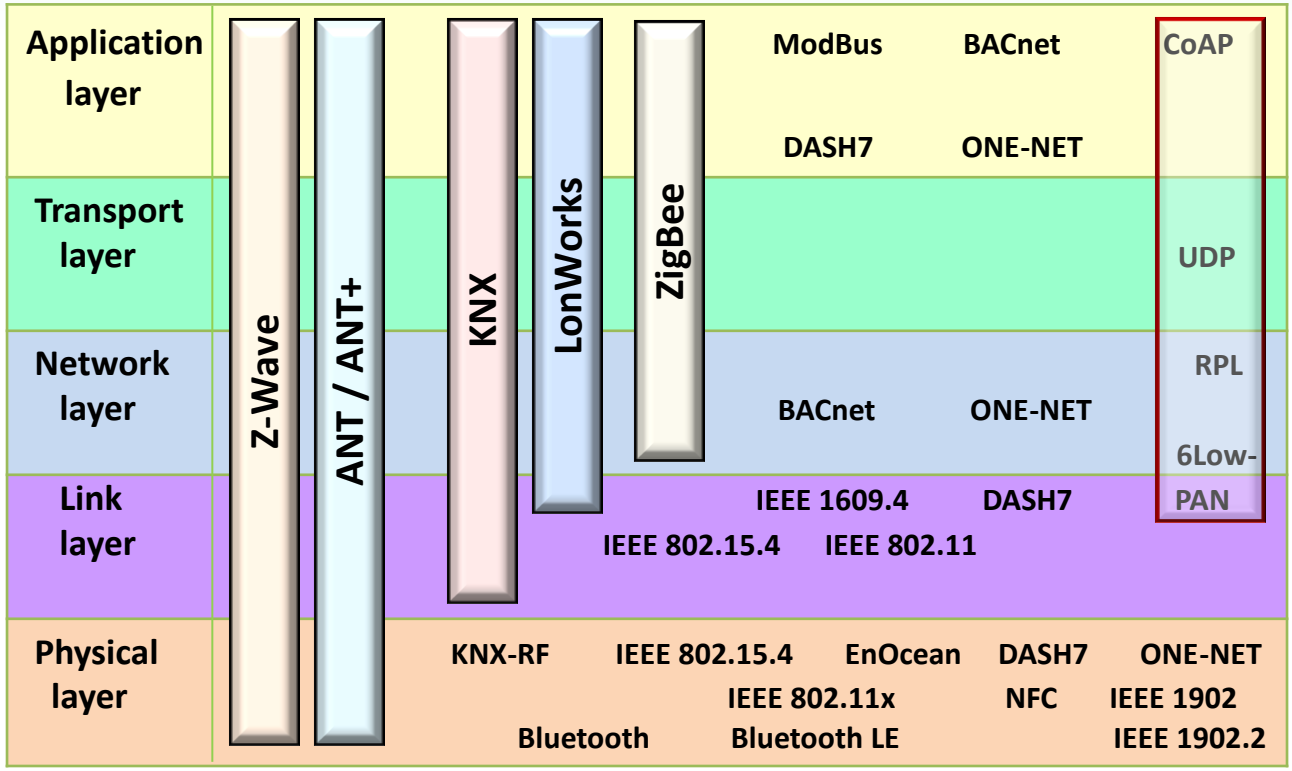
IoT Multi Perspective

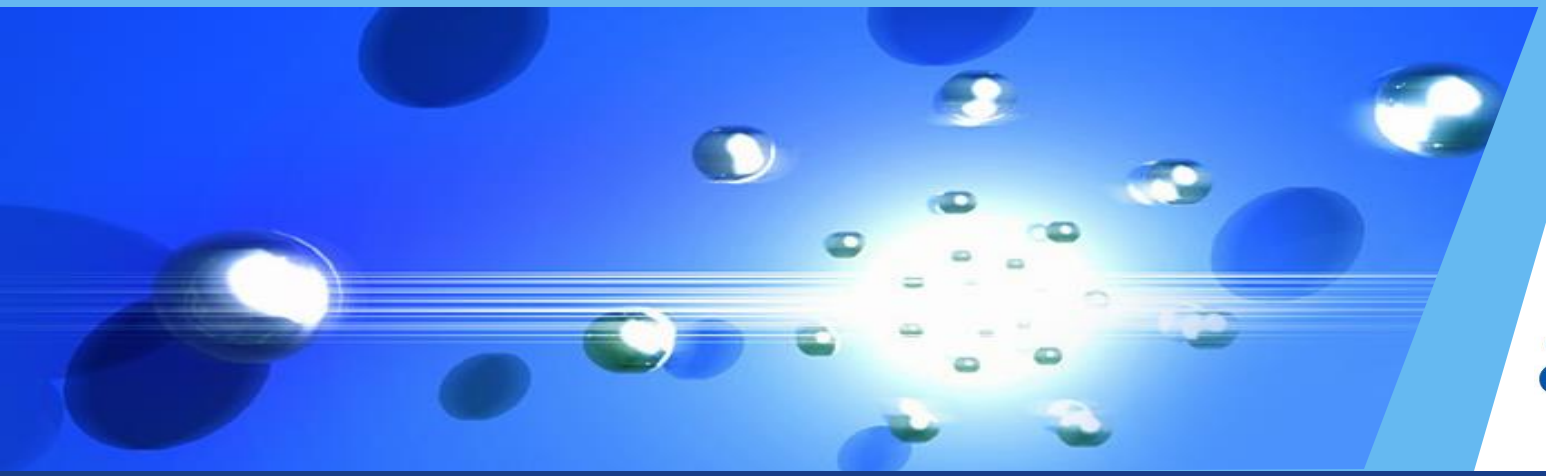
- Business perspective vs. Technical perspective



IoT Heterogeneity Perspective

- Multi frequency – Multi protocols





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Thank you!

Ovidiu.Vermesan@sintef.no

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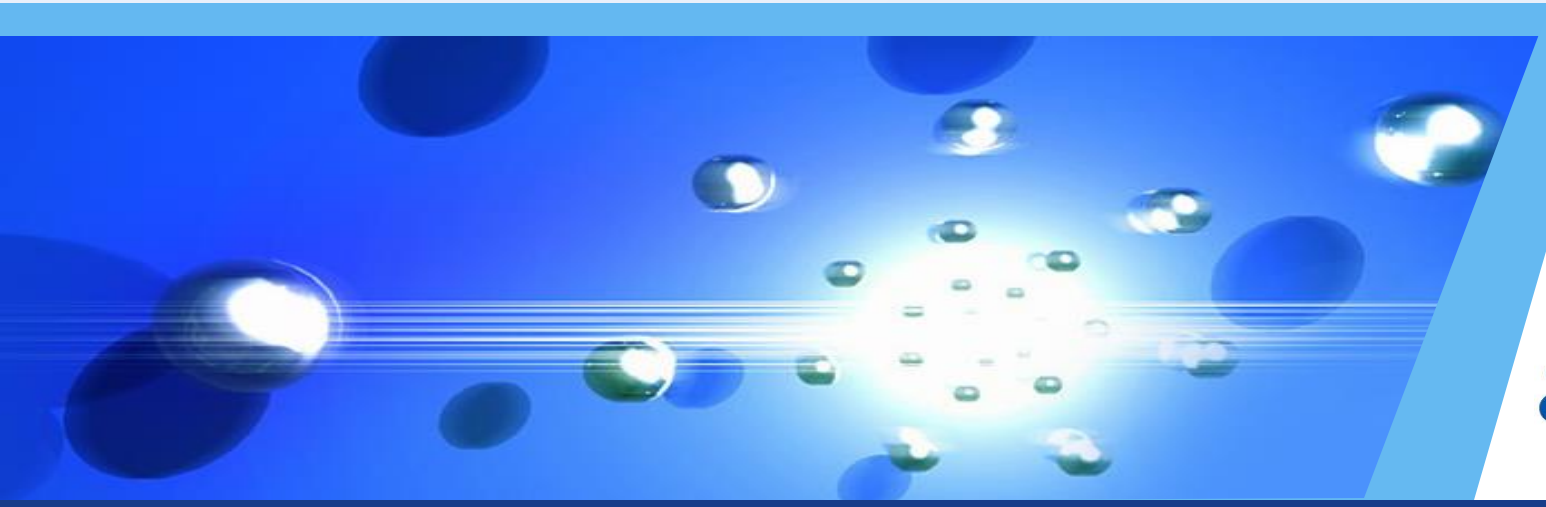

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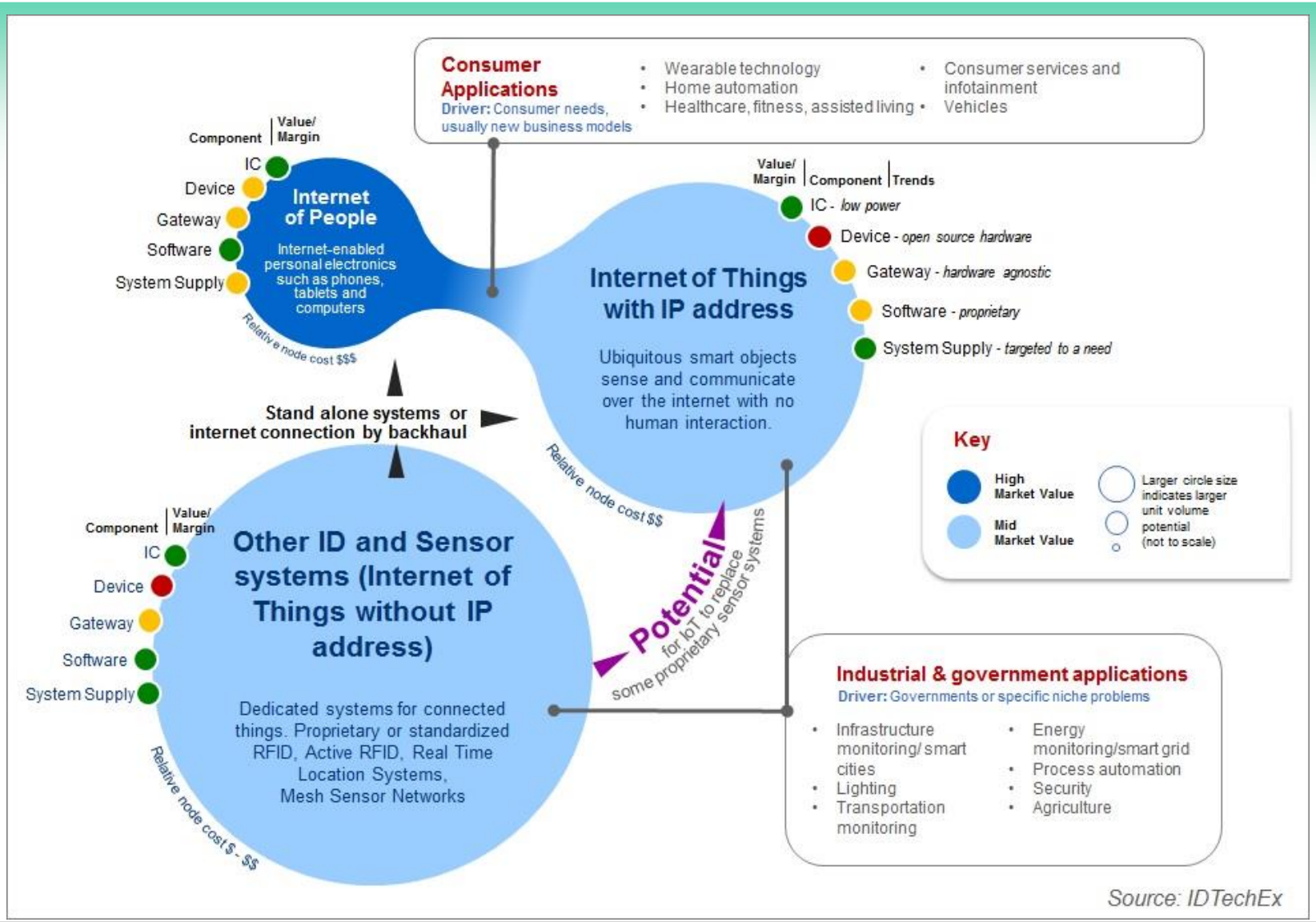
IoT Market Potential



Source: IDTechEx

E⁴Connect - Panel

- Strong basis of research, smart systems, manufacturing and integration providers
- Lack of ecosystem(s) for creating a strong Internet of Things (IoT) up take.
- Strong need of a multi-stakeholder ecosystem, rather than the deployment of individual, fragmented and not compatible solutions.

E4Connect - Panel

- Requirement for integration of results from a number of disciplines, e.g. cloud and networking technologies (5G), big data, cyber physical systems, components.
- Technologies for ensuring privacy/security
- New strategies for international collaboration focusing on IoT architectures, semantics, security and privacy, and standardisation.

E⁴Connect - Panel

- How to achieve semantic interoperability between IoT platforms covering multiple technologies and device types, including mobile autonomous devices, drones and robots?
- How to integrate smart devices into self-adaptive, robust, safe, intuitive, affordable and interconnected smart network and service platforms?
- What are the innovative use scenarios, beyond health, smart buildings, energy, mobility, environment and commercial services?
- What new concepts should be proofed and in what scale?

E⁴Connect - Panel

- ***Simplicity***: Easy to install and operate. Easy to connect. Seamless integration.
- ***Stability***: Work for months/years. Rebooting, updating, reconnecting.
- ***Security***: Tradeoffs between time to market, cost and security. Security as a primary factor in the design
- ***Standards***: Standards needed to ensure that devices work together, regardless of manufacture
- ***Scalability***: tens to tens of thousands of devices
- ***Energy efficiency***

E4Connect - Panel

- ***Frequency Spectrum***
- ***Business Models***: Heterogeneous business models
- ***RoI***: Value added over time.
- ***Cloud and Fog***: Network edge much deeper and varied. Cloud used to describe the diverse suite of hardware consisting of edge routers, switches, application delivery controllers and servers, as well as the server-based applications, databases and services that are hosted in the data center. Fog used to describe the edge of network realm where all the new "things" of the IoT exist.

E⁴Connect - Panel

- Challenges IoT – 5G
  - Devices that transmit and receive in some 14, 15 different radio bands - plus Bluetooth, Wi-Fi, WSN, FM, radio and NFC
  - Testing efforts. Intermodulation between adjacent frequency bands.. Testing frequency bands plus their interaction..

E⁴Connect - Panel

- Challenges: Different requirements and specifications
  - Industrial IoT: harsh, unforgiving environments - dirty, dusty, humid, loud
  - Favor more wired connectivity, no-compromise control, stringent security and reliability..
  - 1 billion devices connected in industrial settings means
  - IoT connectivity must co-exist and evolve with legacy protocols, legacy connectivity (both wired and wireless)
  - Connectivity challenges:
    - Internet of Vehicles
    - Internet of Buildings
    - Internet of Energy
    - Internet of Industry
    - Internet of Cities

Internet of Vehicles

Converging Technologies

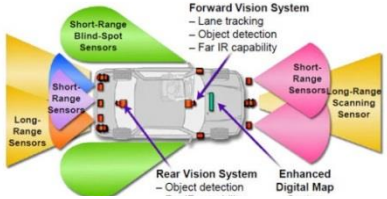
Electric Vehicle
Electric Smart Grid
Connected Vehicle
Autonomous Vehicle

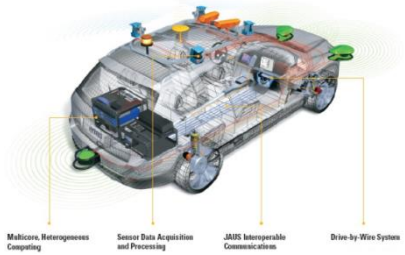
Vehicle to Vehicle

V2V

- **Communication**

Internet of Vehicles
Vehicle to Internet





Vehicle to Device

V2D

- **Telematics**

Vehicle to Grid

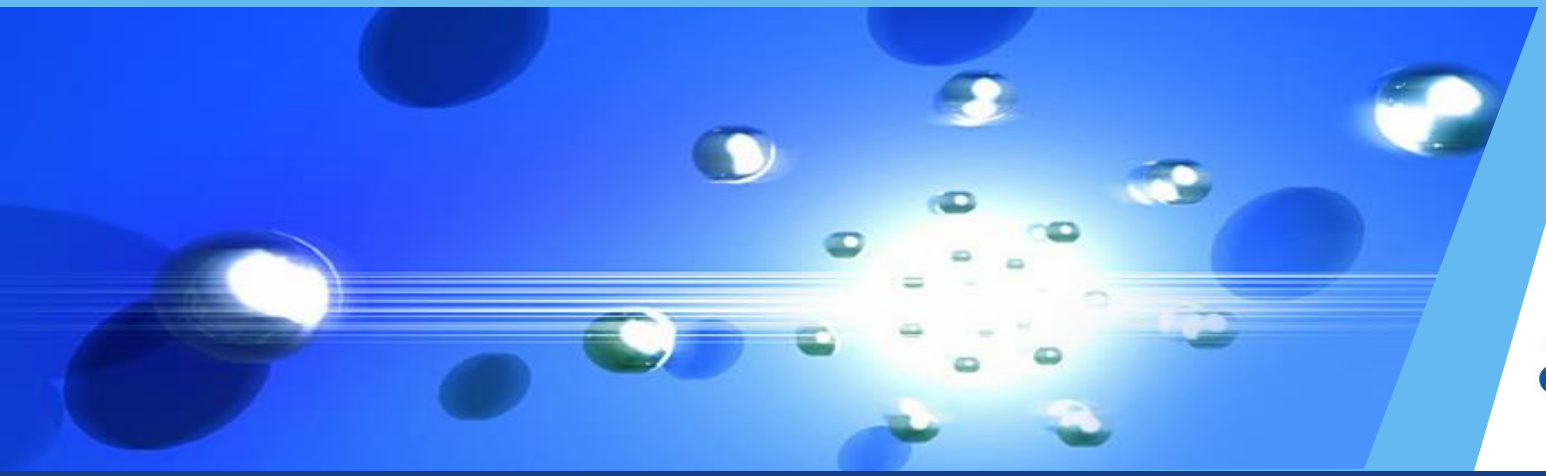
V2G + G2V

- **Charging Stations**

Vehicle to Infrastructure

V2I

- **Communication**



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