

**5th Hungarian Future Internet Conference**  
**» Focusing on Smart Cities «**



**Next Generation Internet  
Perspectives**

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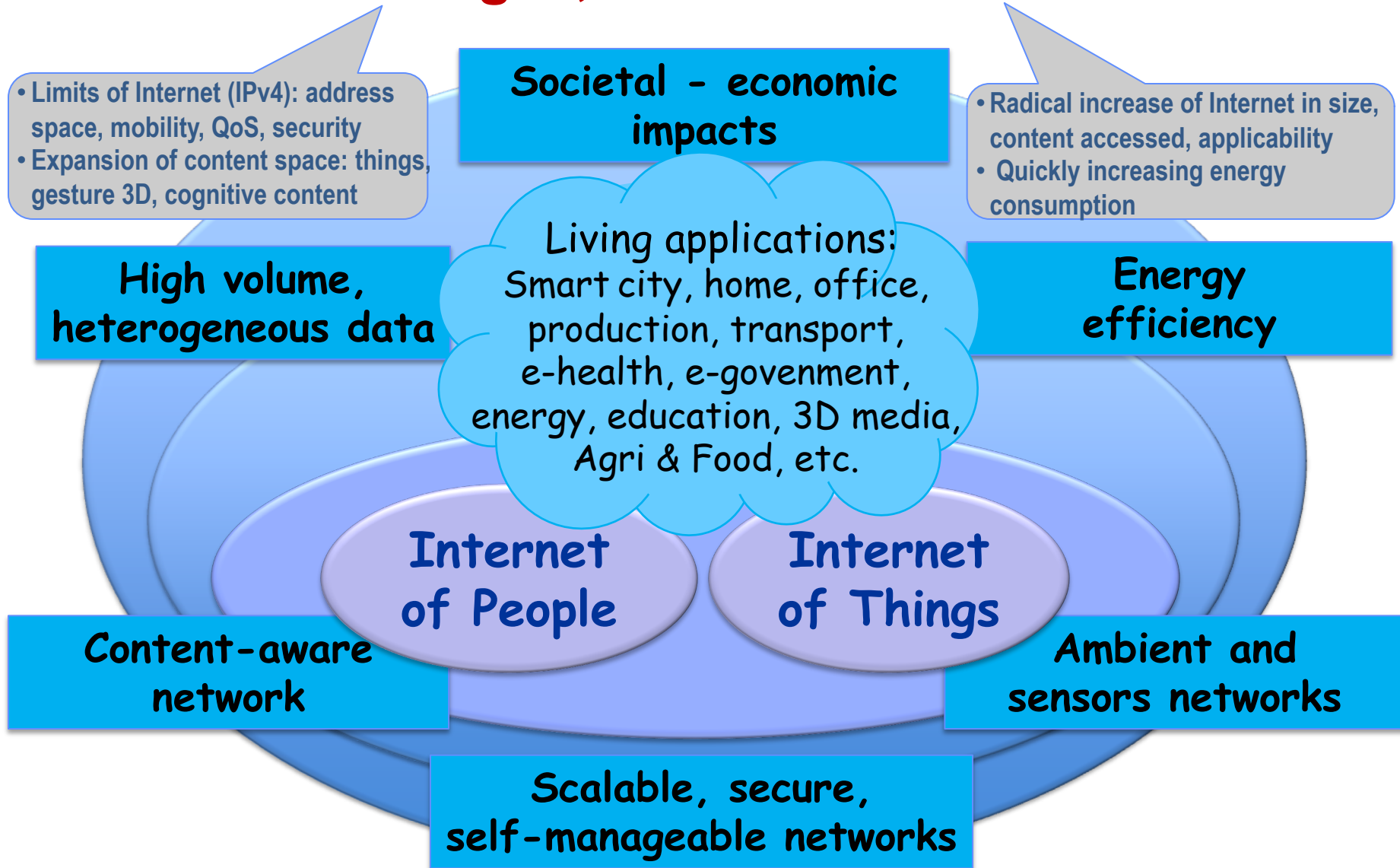
**BME Dept. Telecommunications and Media Informatics**

**Budapest, 28 November 2018**

# Content

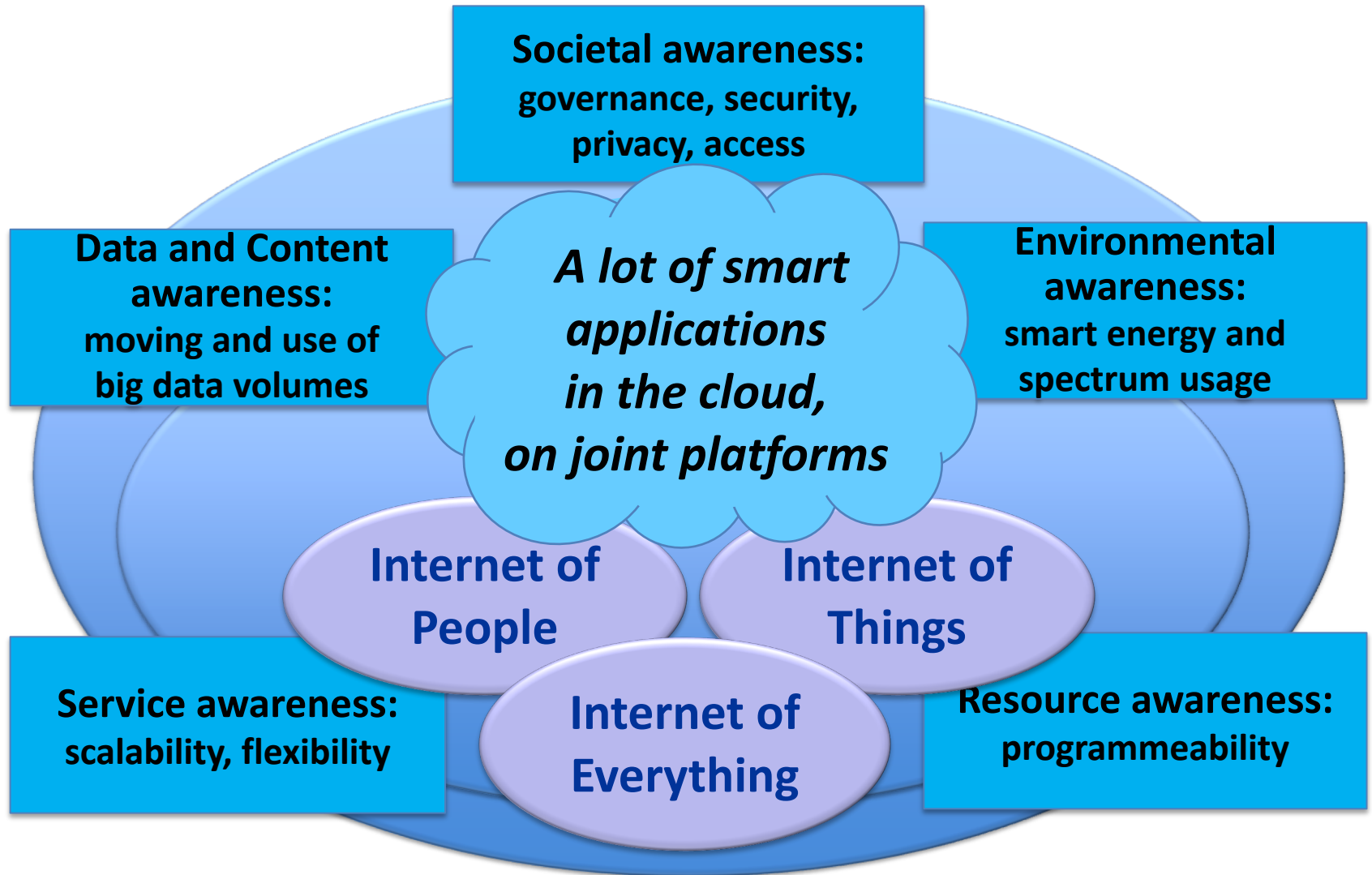
- ❑ **Challenges of Internet technology**
- ❑ **Future Internet vision, objectives, concepts and solutions**
- ❑ **Smart applications, Smart City key areas**
- ❑ **The driving forces of the Next Generation Internet, 2018**
- ❑ **Evolution of a Smart Internet Ecosystem**

# Internet's challenges, Future Internet's issues 2008



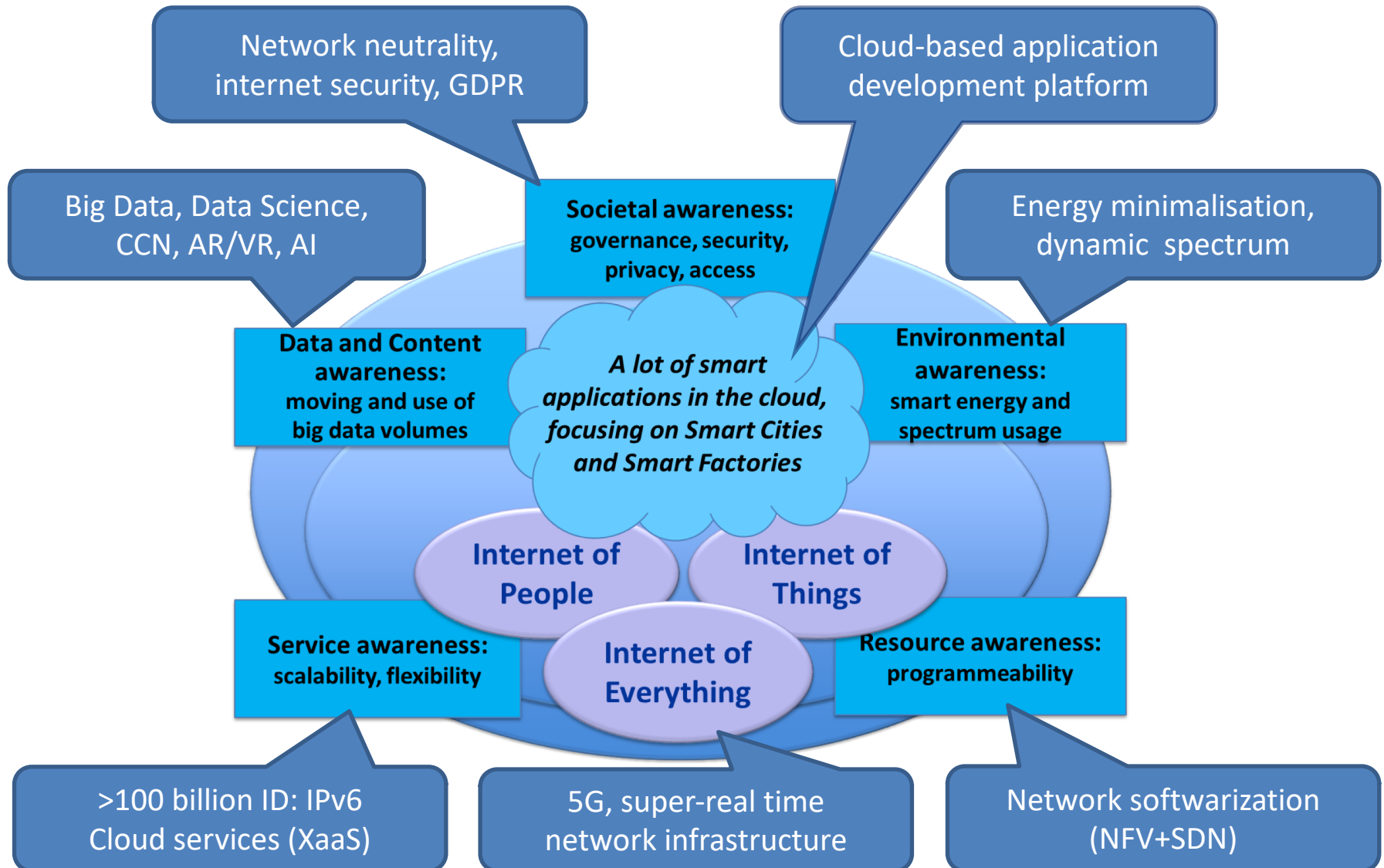
Source: NICT vision

# Future Internet vision 2011



Source: NICT vision, ITU-T recommendations, FIA2011 Budapest and Poznan

# Future Internet concepts and solutions 2018

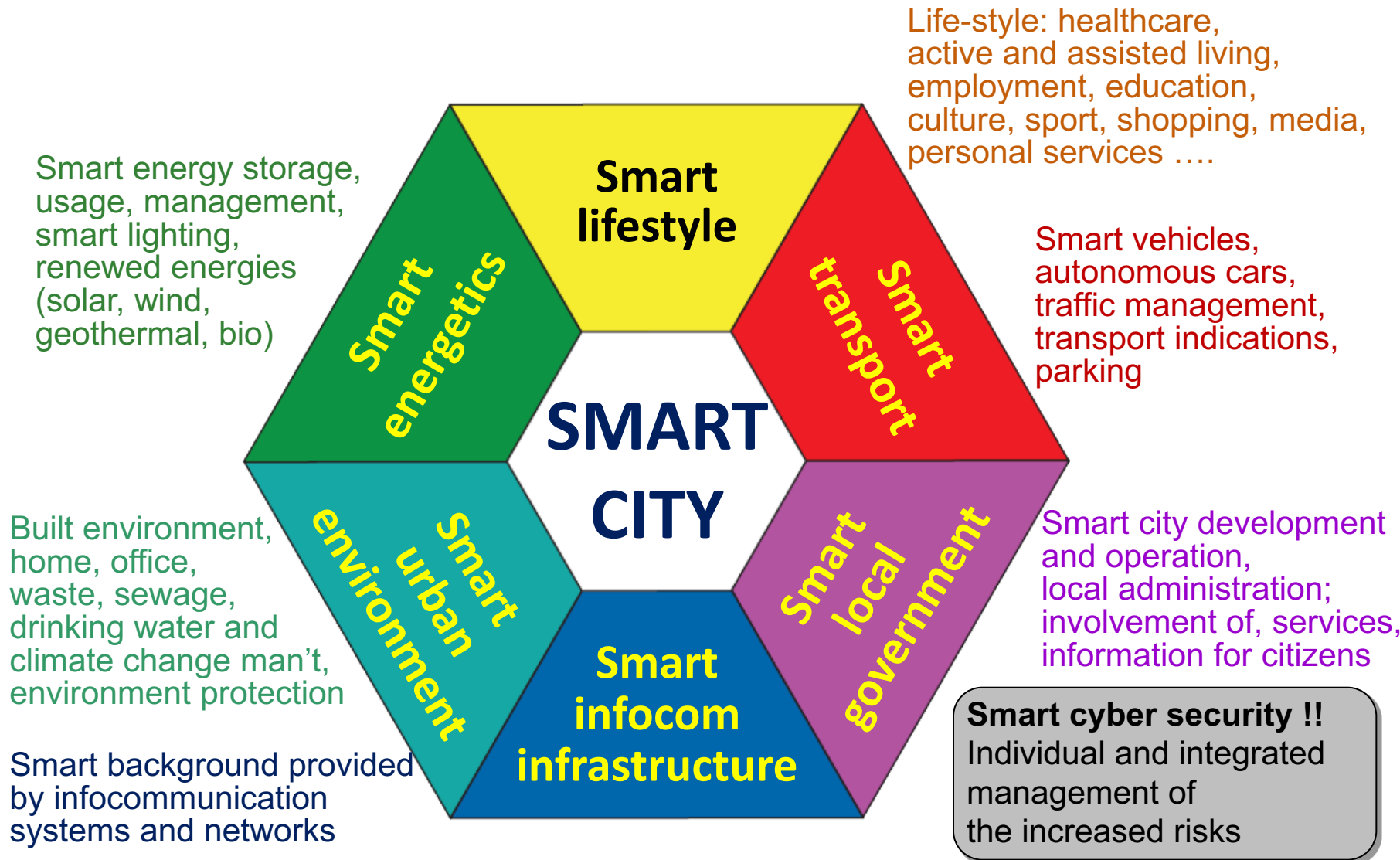


# Relevant Smart Internet functions (Future / Next Generation Internet)

1. Identification and connect of things, devices, sensors, cyber-physical systems (CPS) (IoT = Internet of Things)
  2. Mobility centric networked infrastructure, „always on” accessibility
  3. Cloud computing and networking: recourse of resources (infrastructure, platform, software, network, etc.) as a service (IaaS, PaaS, SaaS, NaaS, etc.)
  4. Network functions virtualization, software-defined network (NFV+SDN)
  5. Real-time management, analysis and usage of big heterogeneous multimedia data sets (Data centres, Big Data, Artificial Intelligence AI)
  6. Content-aware technologies, content-centric networks (CCN, CDN)
  7. Managing 3D and cognitive content, augmented and virtual reality (AR/VR)
  8. Super-real time infrastructure, collaboration of remote processes, control of physical processes (5G holistic network infrastructure, Tactile Internet)
  9. **IoE = Internet of Everything**: global net, interconnection of people, things, computers, data, content, software.
- 
- A. **Society and human centric technologies** supporting the Internet governance, the net and data neutrality, the involvement of people
  - B. **Privacy and security enhancing technologies**, personal data protection (GDPR)
  - C. *Managed quality, application orientation (application platforms)*
  - D. *Energy-awareness: constraint both in planning and operation*
  - E. *Customized solutions and és visualisation (own profile)*

# Smart City's key areas

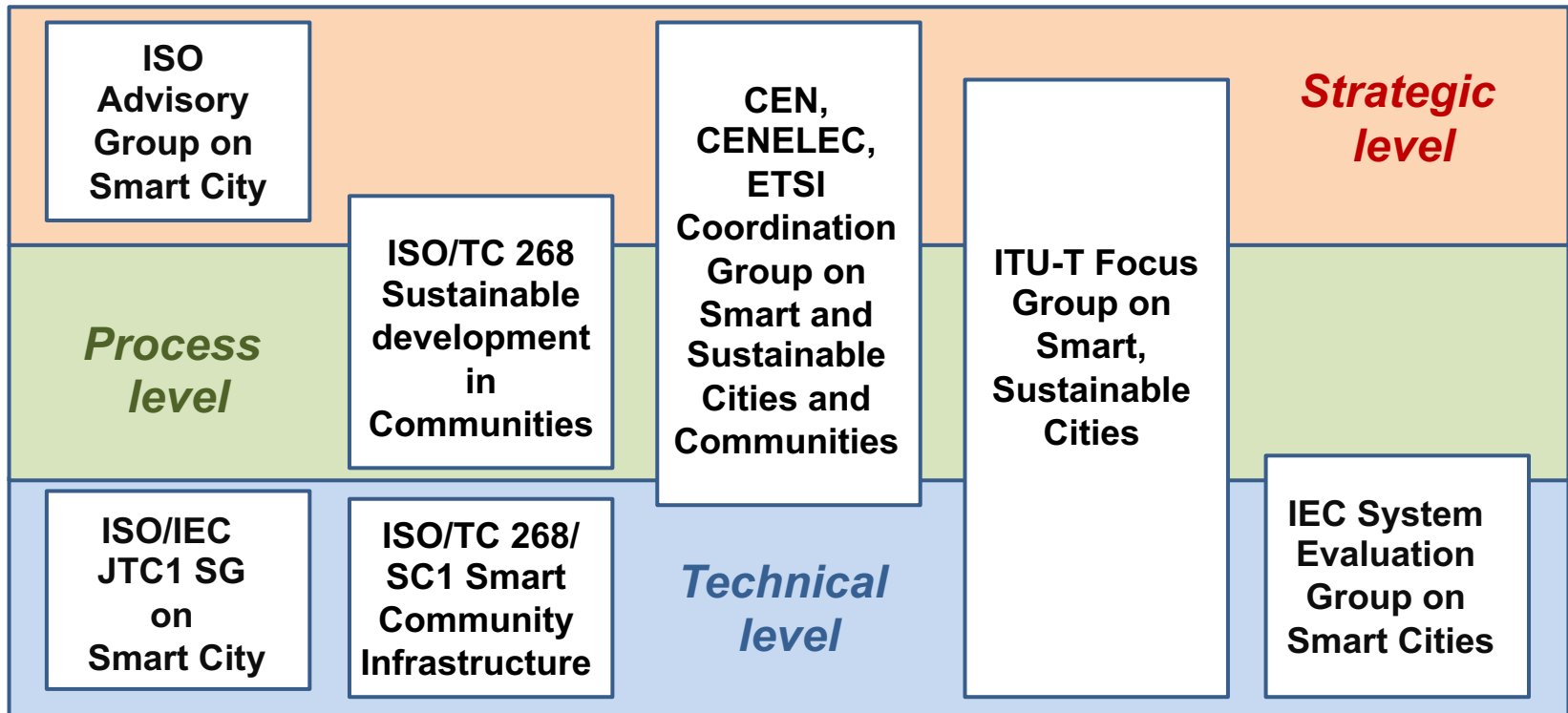
## Strategic components of Smart City concept



# Standardization of IoT and Smart Cities

ITU, ETSI, 3GPP, IETF, IEEE, ISO, IEC....

ITU-T Rec. Y.4000-Y.4999: IoT and Smart Cities and Communities, 2016



**EU, 2015: Alliance for Internet of Things Innovation (AIOTI)**

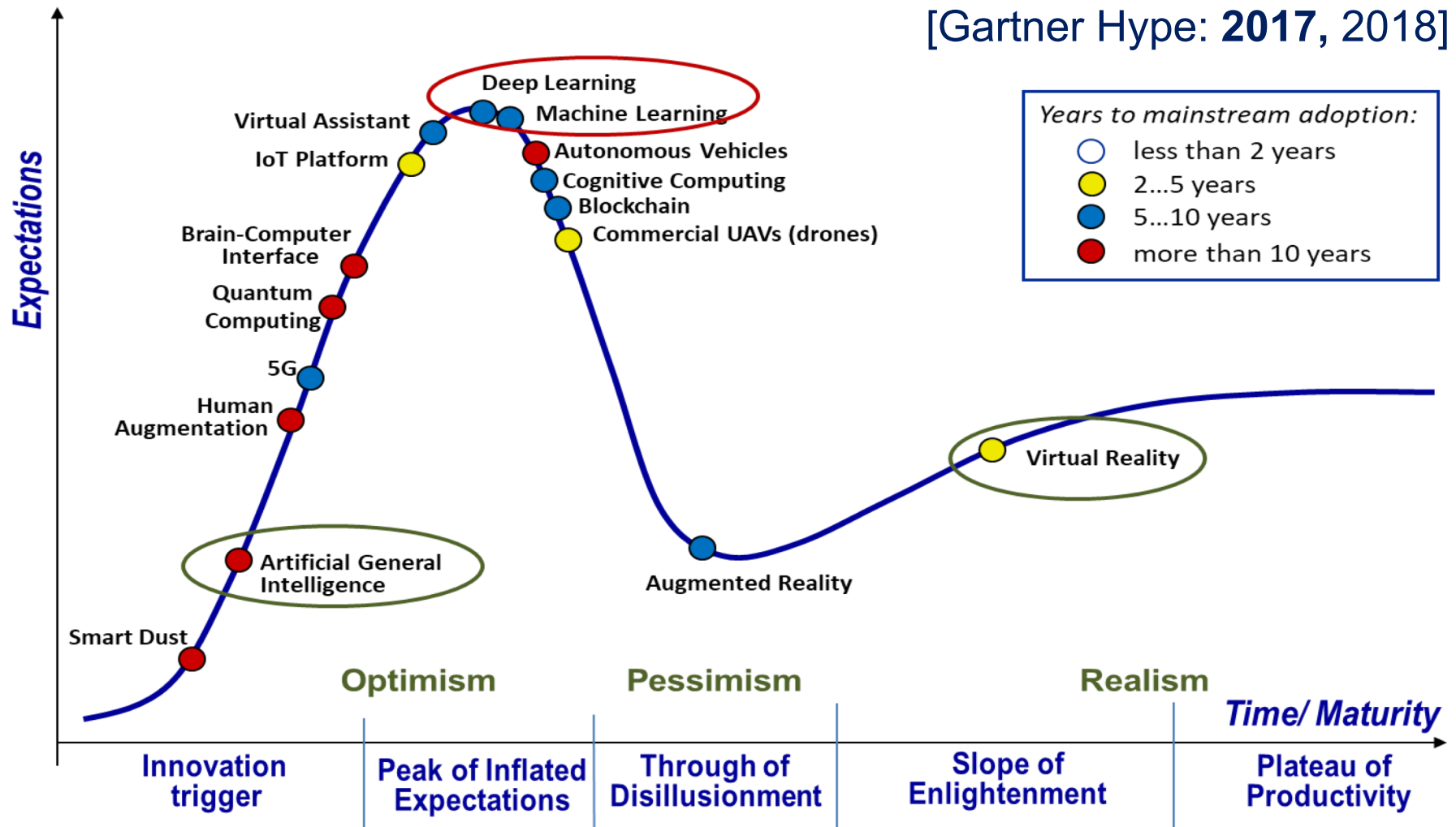
Working groups (9): Smart City, Smart Mobility, Smart Energy, Smart Living Environment for Ageing Well, Smart Buildings and Architecture, Smart Water Management, etc.



# Exponential technologies

Innovations progressing at a pace with or exceeding Moore's Law

- IoT, sensors, sensor networks [Gartner Hype: 2014]
- Artificial Intelligence (AI), eg. **deep learning**, **machine learning** (ANI) [Gartner Hype: **2017**, 2018]



# New wave of technological opportunities and threats

## ❑ Exponential and leading technology innovations

- IoT, sensors, sensor networks [Gartner Hype: 2014]
- Artificial Intelligence (AI), eg. deep learning, machine learning (ANI) [Gartner Hype: 2017, 2018]
- Augmented/Virtual Reality (AR/VR),
- Human Augmentation, Wearable Computing,
- 3D printing and scanning
- Cyber-Physical Systems (CPS), Industrial IoT (IIoT)
- Autonomous vehicles, mobile robotics
- Alternative energy systems ...

## ❑ Combinatorial value creation

(combining platforms and applications)

## ❑ Business model innovations: change in the „game rules”

## ❑ Cyber threats:

- **Cyber crime** (for money)
- **Cyber warfare** (5th seat of war)
- **Cyber terrorism** (to raise fear, disorder)

# Next Generation Internet requirements

## NGI Summit 2017 Brussels

### Next Generation Internet (NGI)

(Future Internet is present, from 2020 NGI changes the term of Future Internet)  
EU wishes to provide the best political, regulatory and financing conditions to the desired development of Internet technology. The European Commission:

- issued the Next Generation Internet Initiative and its public consultations;
- checked the fulfillment of the Future Internet objectives;
- surveyed the societal expectation from Internet in the next decade.

### Statements for NGI:

- **Be NGI a Human-centric Internet !**

Meaning of it is open (we should find the harmony between access to information and freedom of information, etc.), but priorities are:

1. Privacy (personal data protection)
2. Cyber security
3. Access

- **Major impact and research focus:**

BigData, AI; IoT, IIoT, IoE; Blockchain (FinTech)

- **NGI  $\approx$  Smart Internet**, smart universal application platforms:  
Smart City, Smart Factory (Industry 4.0)

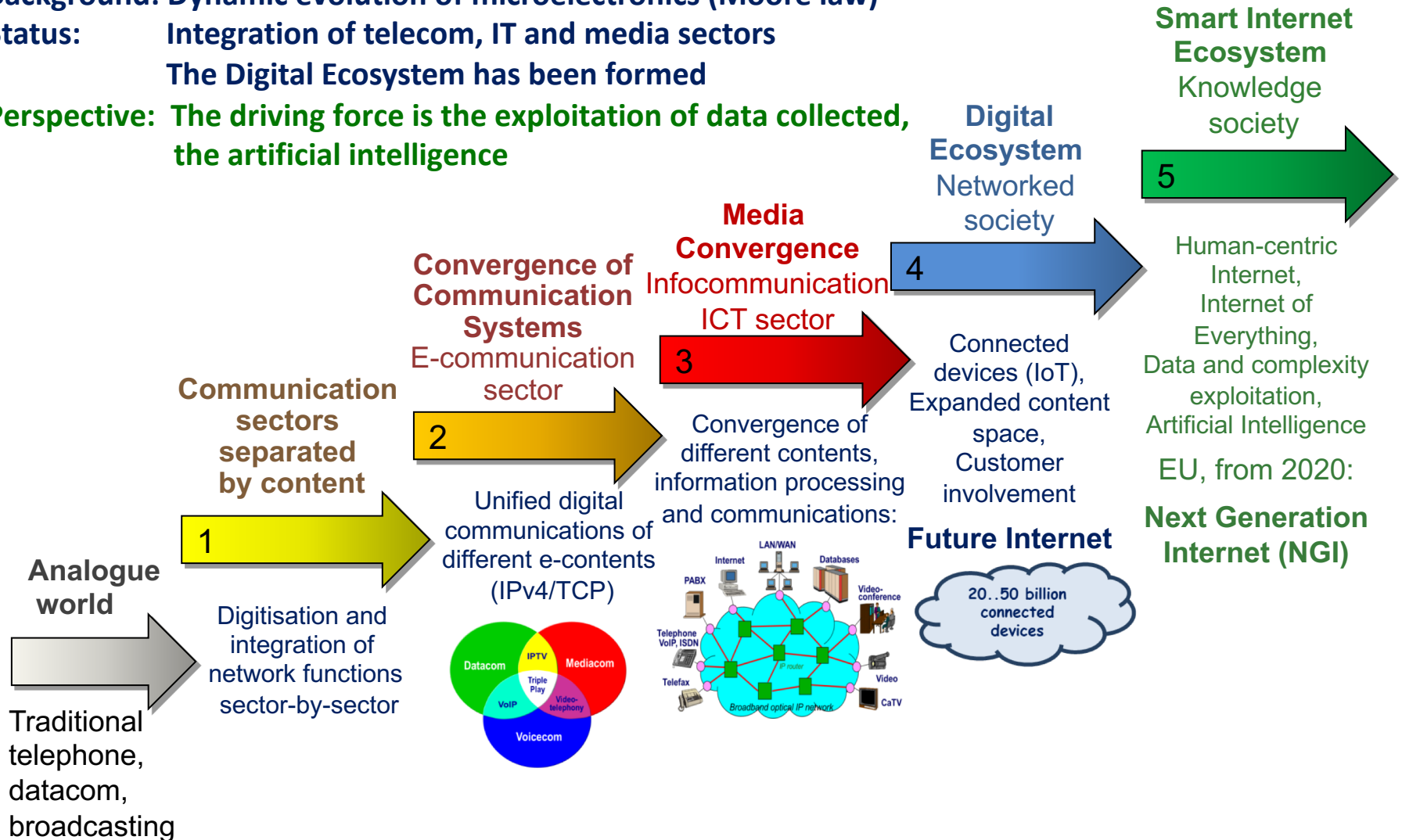
# The 5th Phase of the Digitalization

**Background:** Dynamic evolution of microelectronics (Moore law)

**Status:** Integration of telecom, IT and media sectors

The Digital Ecosystem has been formed

**Perspective:** The driving force is the exploitation of data collected, the artificial intelligence



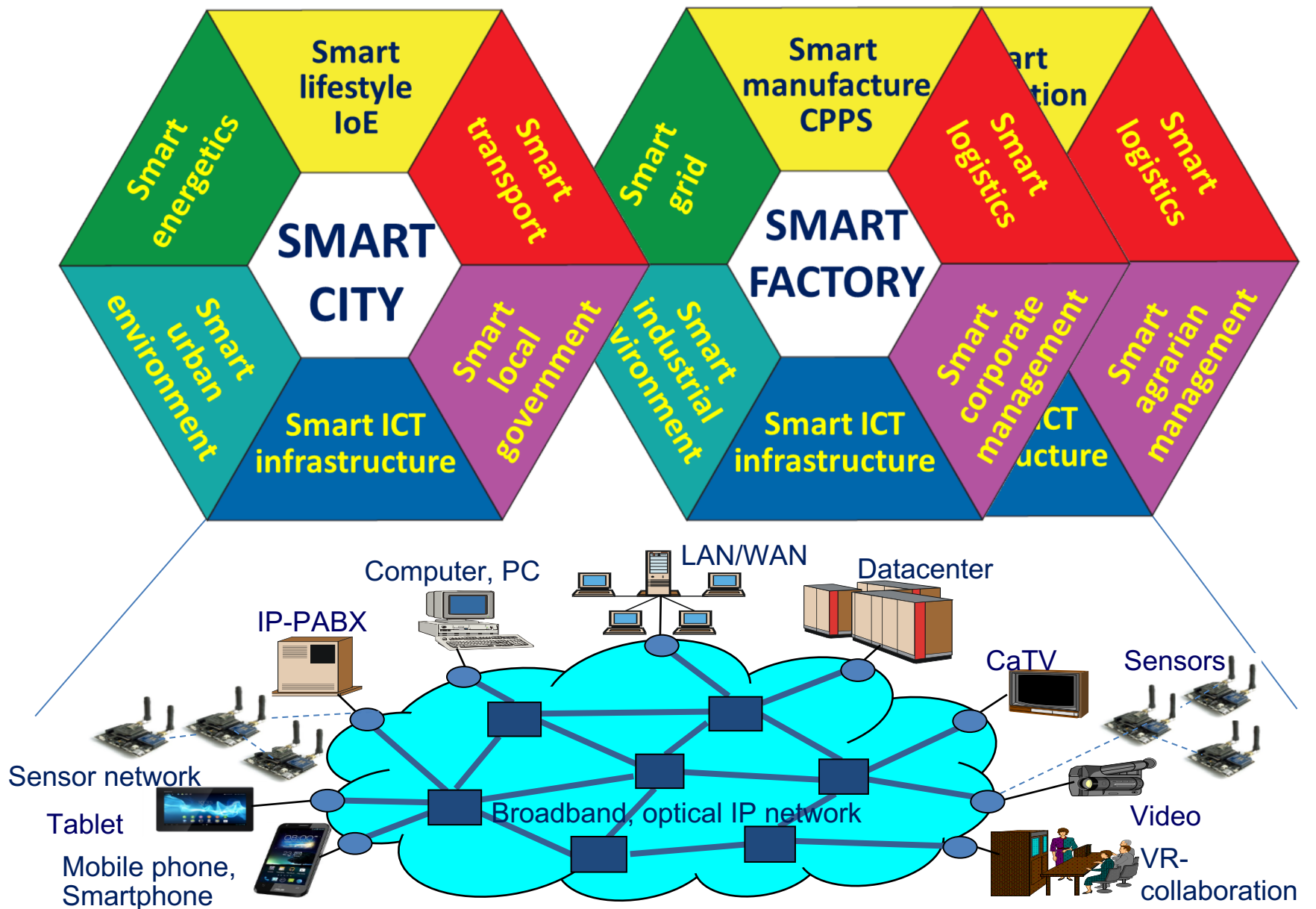
# Smart Internet Ecosystem

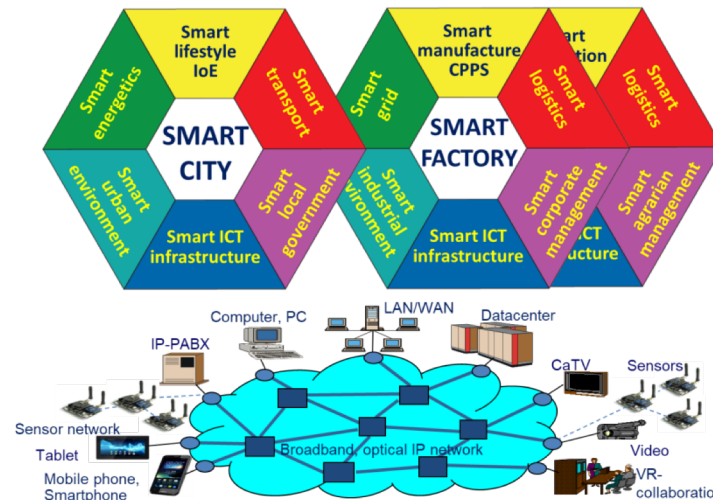
An “ecosystem” is an interdependent and dynamic network of living organisms and their physical environment. The “Digital Ecosystem” is the space formed by the digital convergence of the media, telecoms and IT sectors. It consists of users, companies, governments and civil society (human sphere), as well as the infrastructure that enables digital interactions (physical sphere).

[World Economic Forum, 2007: Definitions and scenarios until 2015]

- ❖ There are rapid, Internet-based technological breakthroughs. Therefore more and more we talk on **Internet** (moreover Smart Internet) **Ecosystem**, expressing the applied technology, the global network and the social impact, too.
- ❖ The society already accepted the Internet, and generates newer and newer demands (**Smart City, Digital/Internet Age**). The group of content producers is quickly widening (crowdsourcing, social media).
- ❖ The youngest generation is growing up in the integration with Smart Internet: **Cognitive Entity (Alfa) Generation**
- ❖ The integrated, cyber-physical production systems (CPPS) generates a change of technological era in the manufacturing industry (**Smart Factory/Industry 4.0**).
- ❖ **Unexpected business failure** due to underestimating the impact of digital environment (Nokia, Kodak...).

# Smart Internet Ecosystem's vision





# Next Generation Internet Perspectives

Thank you very much for your kind attention

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