IoT Applications for Value Creations

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Introduction

- IoT has become part of your daily life.
- Things connected to the internet" areas of continuously evolving in content, idea is applications, visions and technology.
- New real life and industrial projects have been done and joint future oriented industry and government initiatives such as Industry 4.0 in Germany,
- Since Industrial production is one of the world's biggest economic factors one of the major objectives of these initiatives is to bring the paradigms of the IoT to the factories enabling them to cope with the challenges raised by popular megatrends.
- Central effects are the acceleration of innovation cycles and the increasing customer demand for individualized mass produces with highest quality expectations.

Introduction

- The value question is extremely pertinent in the industry: in the manufacturing industry entire factory related processes, but also in industrial applications where it comes to ensure operation of industrial installations and provide supervision, and improved life service.
- It is the value which such applications bring which will determine their adoption, acceptance and wide use.
- However, this value is very difficult to quantify and prove, and it depends on multiple aspects which are strongly application area dependent.
- This unit is focusing on IoT applications form the point of view of value creation for industry and brings together expert opinions from academia, research and industry.

IoT Applications and value creation and challenges

- To start a project in industry environment the expected benefit, the expected value to the company has to be estimated and later needs to be re-evaluated and proved during operation.
- To define the value of an industrial IoT application is difficult.
- There are numerous reasons for that.

Value and Benefit

- There is agreement that IoT brings benefit in different areas, however numbers to quantify that value are scarce.
- More recently CISCO proposed a view called Internet of everything based on IoT and additionally "connecting to internet everything not connected yet" [3].
- The global potential, the "value at stake", for what was called Internet of Everything economy and for the decade 2013–2022, was estimated to $14.4 trillion.

Value and Benefit

- There is no value but “values” each contributing to the total benefit such as:
  - Value from visibility identification, location tracking
  - Value form IoT-supported safety in hard industrial environments
  - Value from reduced production losses
  - Value from reduced energy consumption
  - Value from new type of processes made possible by IoT applications
  - Value form new type of maintenance and lifetime approaches
  - Value enabled by smart objects, connected aspects
  - Value from sustainability.

Value and Benefit

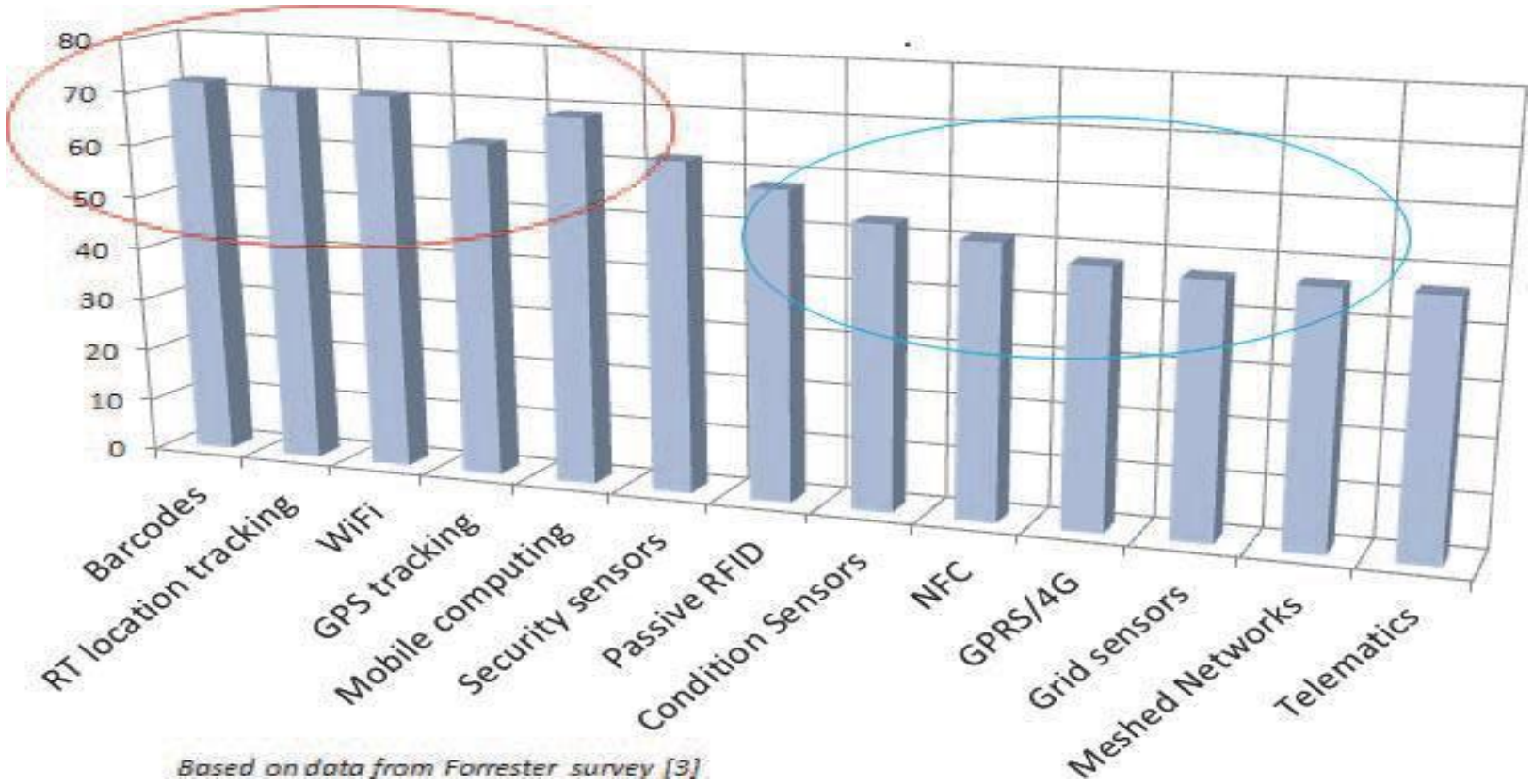

Fig 1 View on very important and important perceived IoT technologies expected to bring value in applications.

IoT Applications -values creation for Industry

Areas	Supply chain	Industry	Lifetime
Activities	Logistics	Manufacturing	Service
IoT **present** Applications and Value	Many	Some	Few
IoT **additional** Applications **Potential**	Increase	Strong	Strong

Fig 2 Status and estimated potential of IoT applications

IoT Application - requirement

- Robustness
- Reasonable cost
- Security and safety
- Simple use
- Optimal and adaptive set of features
- Low or no maintenance
- Standardization
- Integration capabilities
- Industry grade support and services

Challenges faced by IoT industry applications

- Challenges can be subject of more extended treatment, however for the needs of present IoT applications and value creation they have been divided in 4 groups:
  - IoT device technical challenges
  - Lifetime and energy challenge
  - Data and information challenge
  - Humans and business

Future factory concept

1. Lever mechanisms for IoT in future factory

IoT implementations mainly focus three aspects

- the network and addressability aspect.
- the ambient intelligence aspect.
- the ambient assistance aspect.

Future factory concept

2. Smart factory KL initiative

- In order to transfer the central paradigms of the IoT to factory automation, many technologies working well in the consumer world have to be applied under industrial conditions.
- One of the biggest obstacles keeping responsible away from the application of new technologies is missing trust and the lack of best practice examples.
- For this reason in 2004, a group of people from industry and academia met and formulated the vision of a smart factory of the future.
- After feasibility study the technology initiative SmartFactory KL was founded in 2005 as a public private partnership.
- Its target is to develop, apply and distribute innovative industrial plant technology.
- The basic equipment of the SmartFactory KL is an automated production facility for liquid colored soap as shown in figure 3.
- It contains a process manufacturing part as well as a piece handling part.
- Based on state of the art automation technology the equipment demonstrates the migration path to the application of smart technologies in factory environments.

SmartFactory KL Production facility

continuous flow process
colored soap production

discrete handling process
bottling, handling, labeling, QC, packaging...

Live-Webcam: http://www.smartfactory.de/webcam.de.htm

IoT Applications- value creation for Industry

Digital product memories in open-loop processes

IoT Applications- value creation for Industry

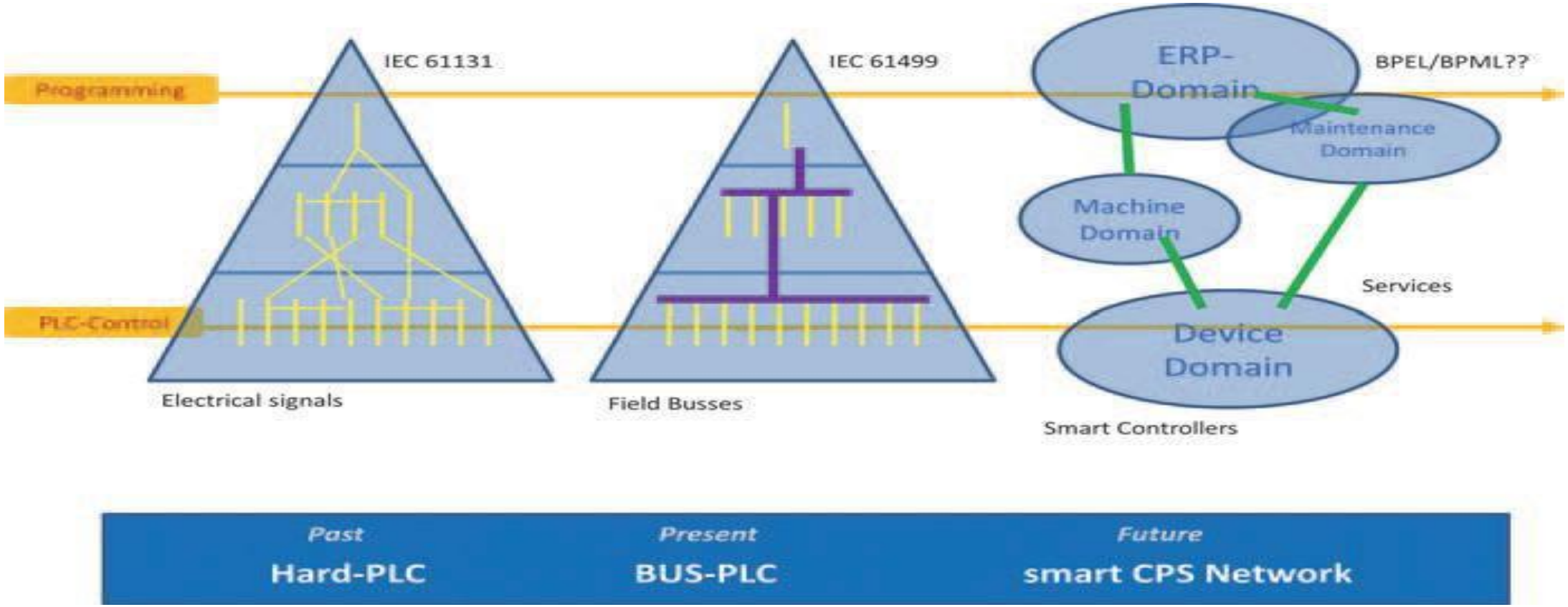

Fig 5 From automation pyramid to automation network

Brownfield IoT- Technology for retrofitting

- The IoT aims to be a disruptive technology in many ways and may change how future industry will work.
- However, enabling technologies like RFID or Wireless Sensor Networks are in place, it is often hindered by the fact that huge investments are needed and the local value is considered too low for adoption.
- The creation of a global network of various ubiquitous networks is one of the driving technological vision behind IoT.
- The economical vision of creating domain-and network-wide business fields and usage scenarios by pervasive information networking uses the "Internet" both as a technical and economical analogon.
- On one hand, as the global IP-based network that connects over 5 billion devices of different networks, and on the other the resulting economic growth and business cases.

IoT retrofitting

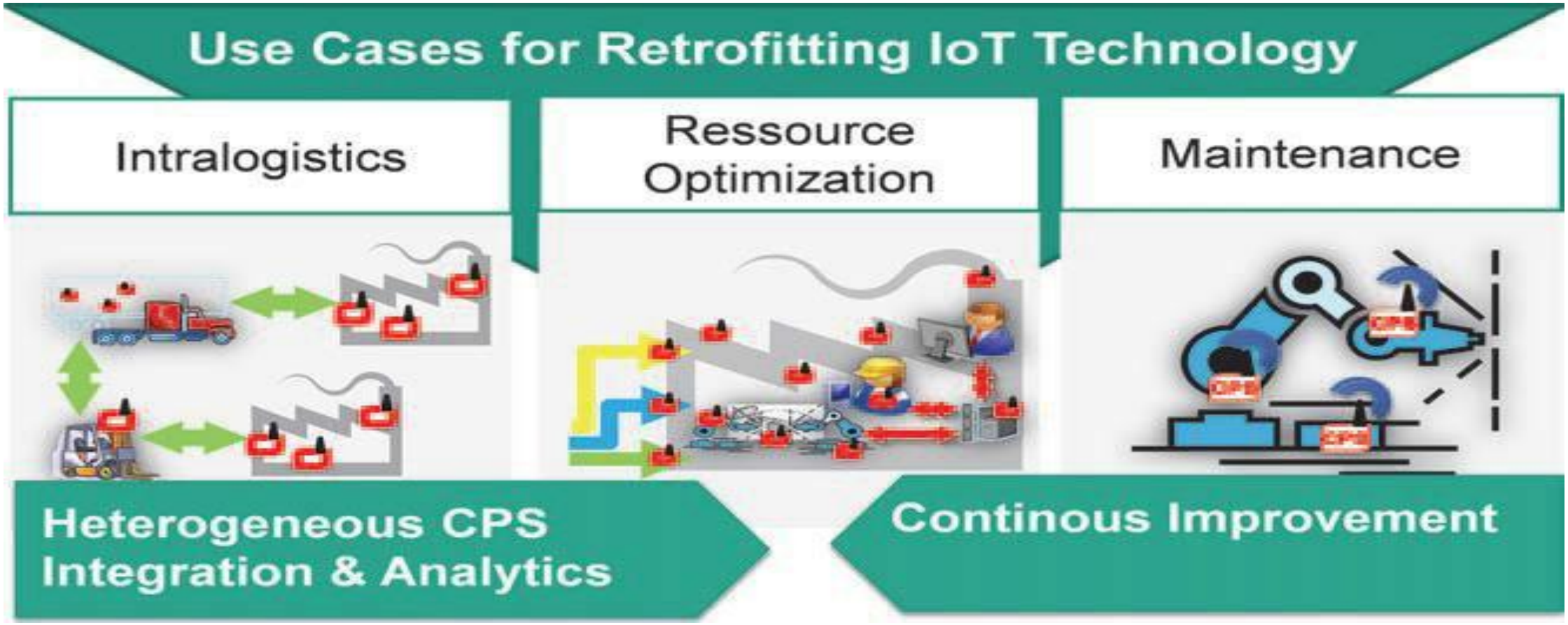

Fig 6 High value use cases for IoT retrofitting

IoT supported interaction

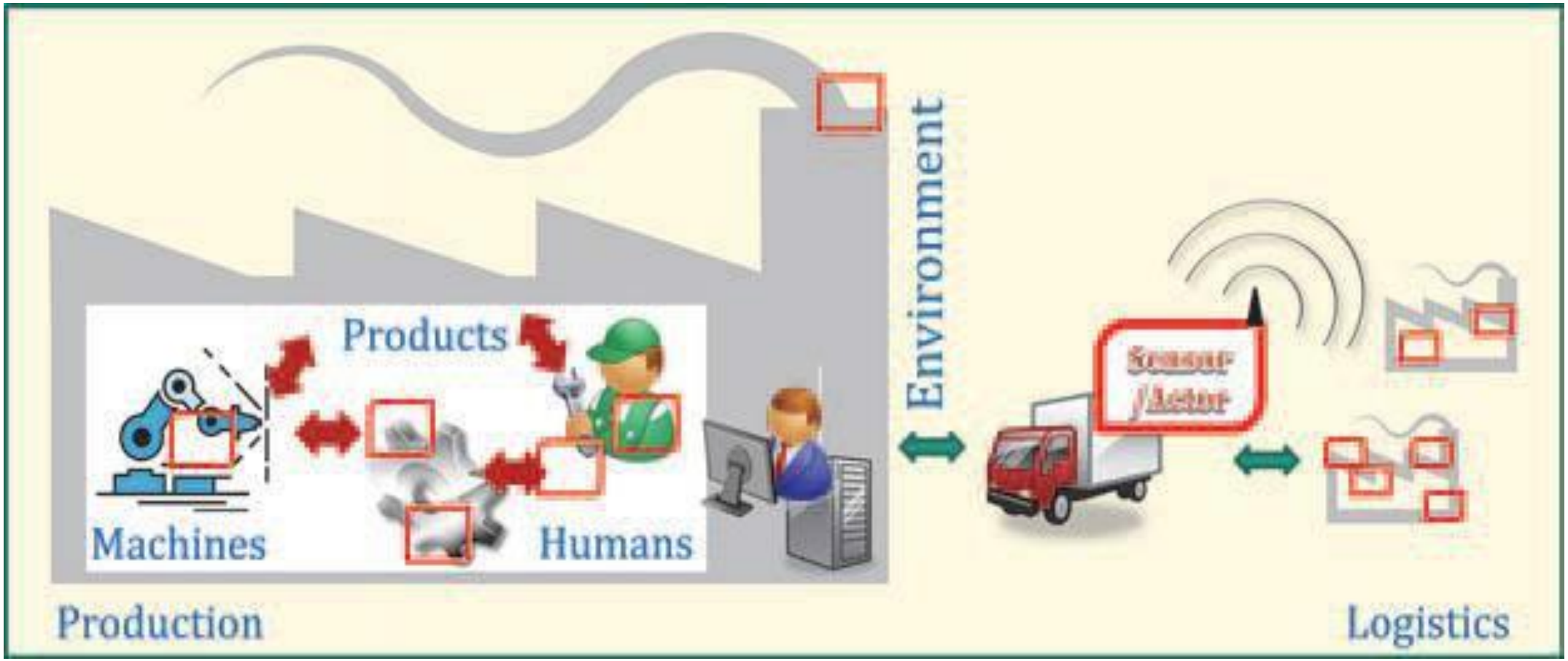

Fig 7 IoT supported interaction as part of cyber-physical- system

TECO generated gateway architecture

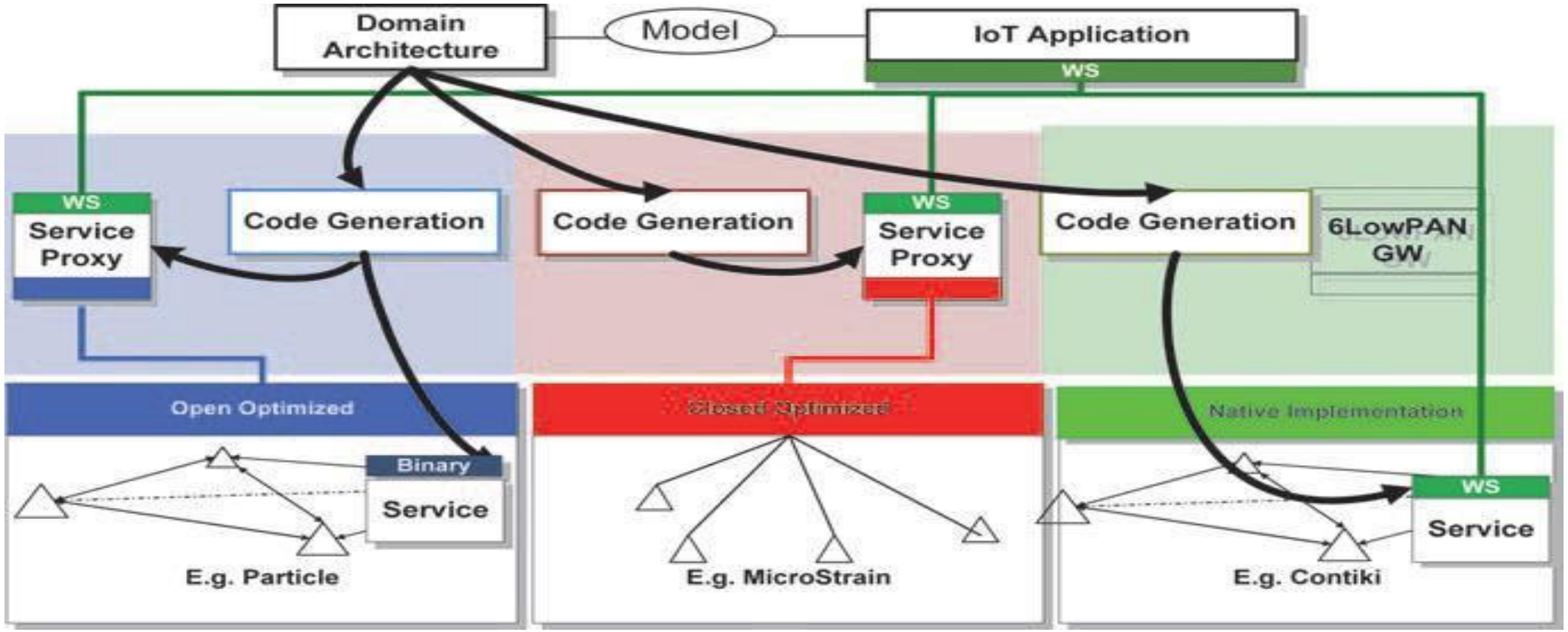

Fig 8 Gateway architecture for exposing IoT to ad-hoc SOA

Smart Objects, smart applications

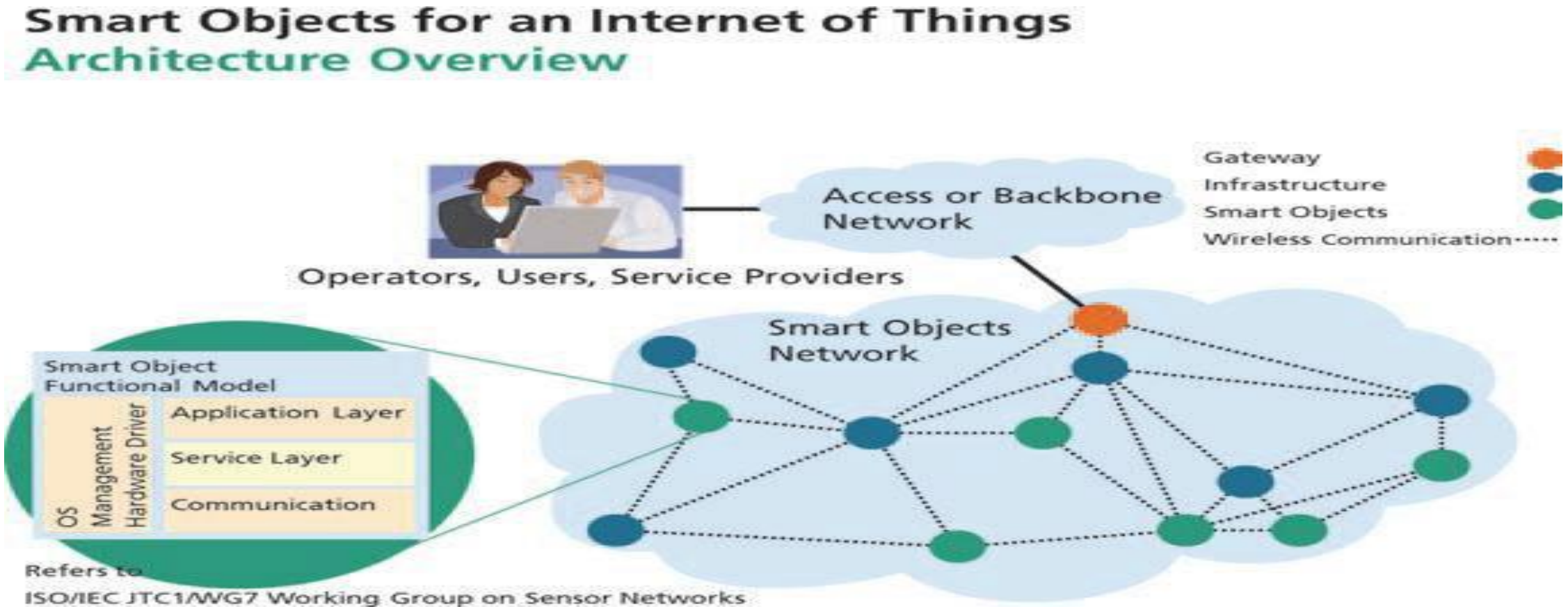

Fig 9 Architecture overview of interconnected smart objects

Smart Objects, smart applications

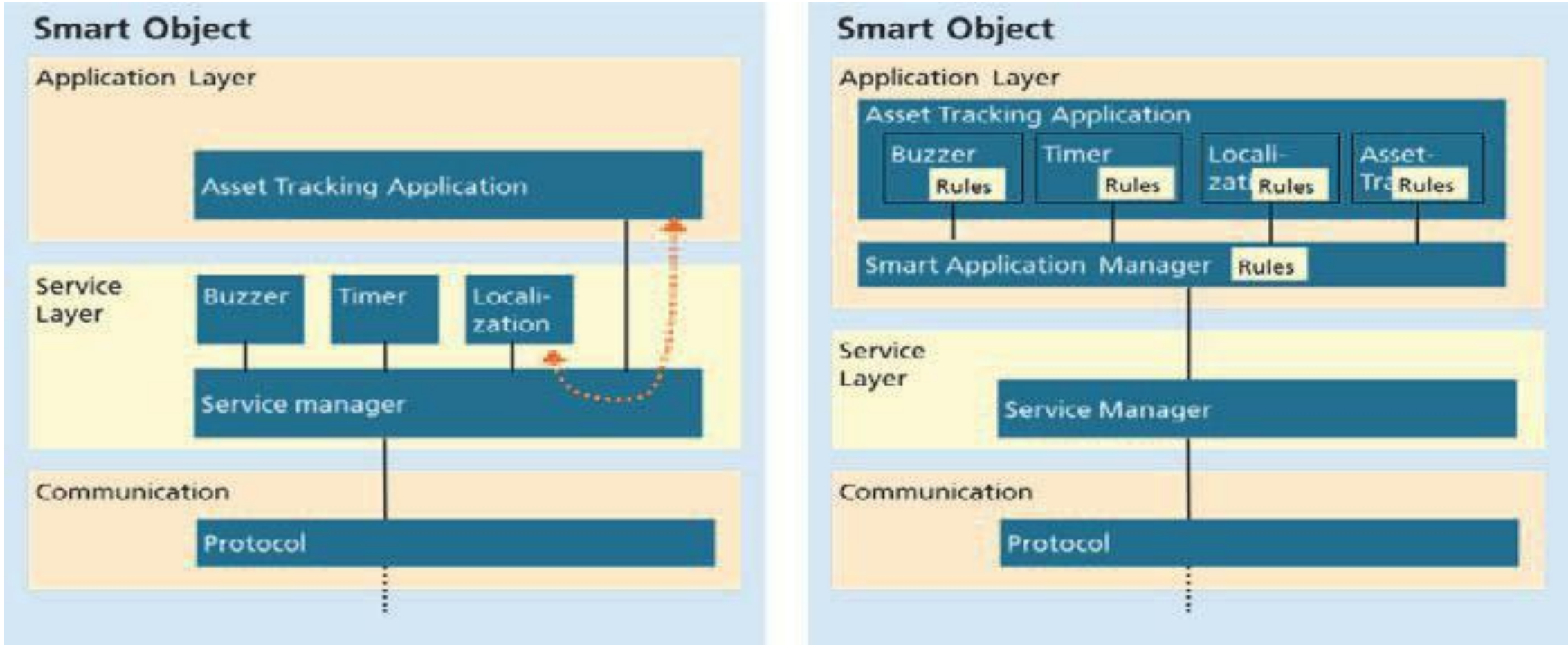

Fig 10 Service oriented approach (left), smart application approach (right)

Smart Objects, smart applications

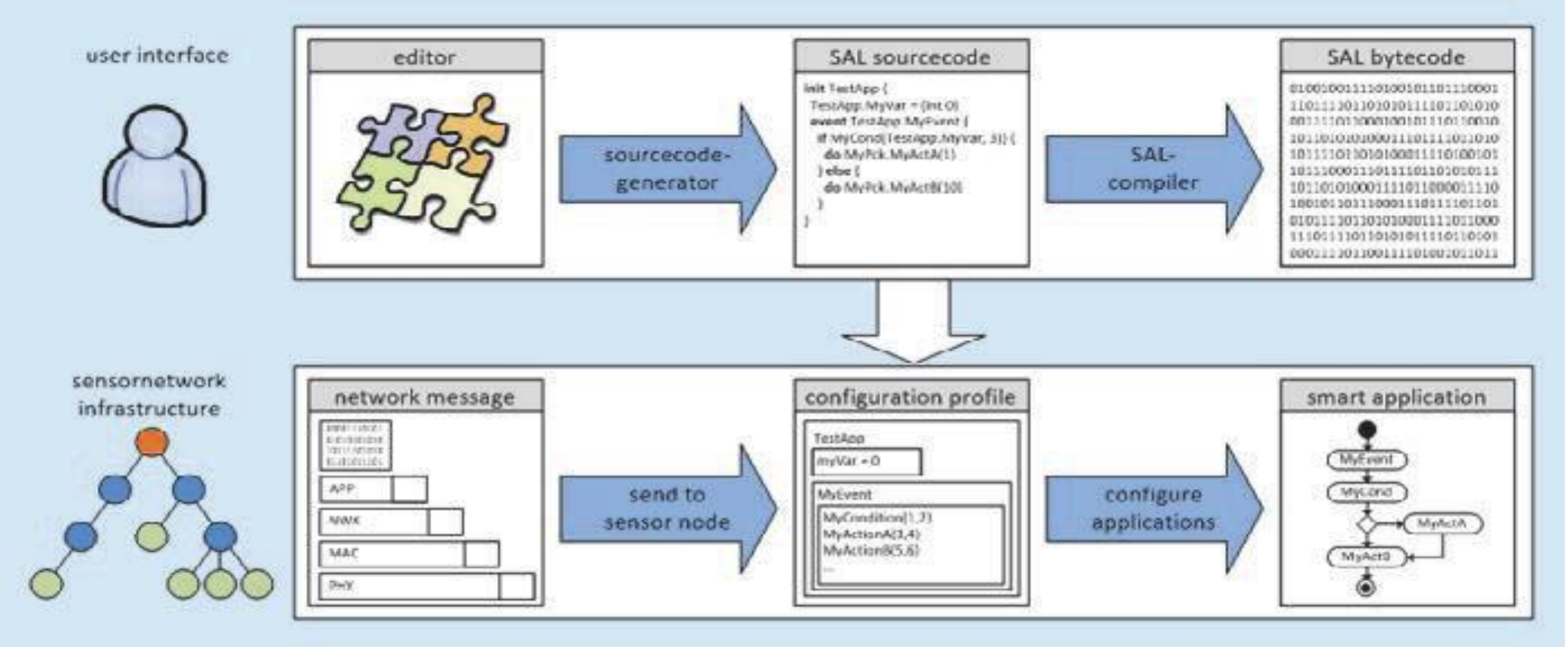

Fig 11 Smart Application Approach

Four aspects in business to master IoT

- Internet conquering product business
- Strategic business aspects
- Vertical business domains for IoT
- Reference architecture and the core competence for business

Internet conquering product business

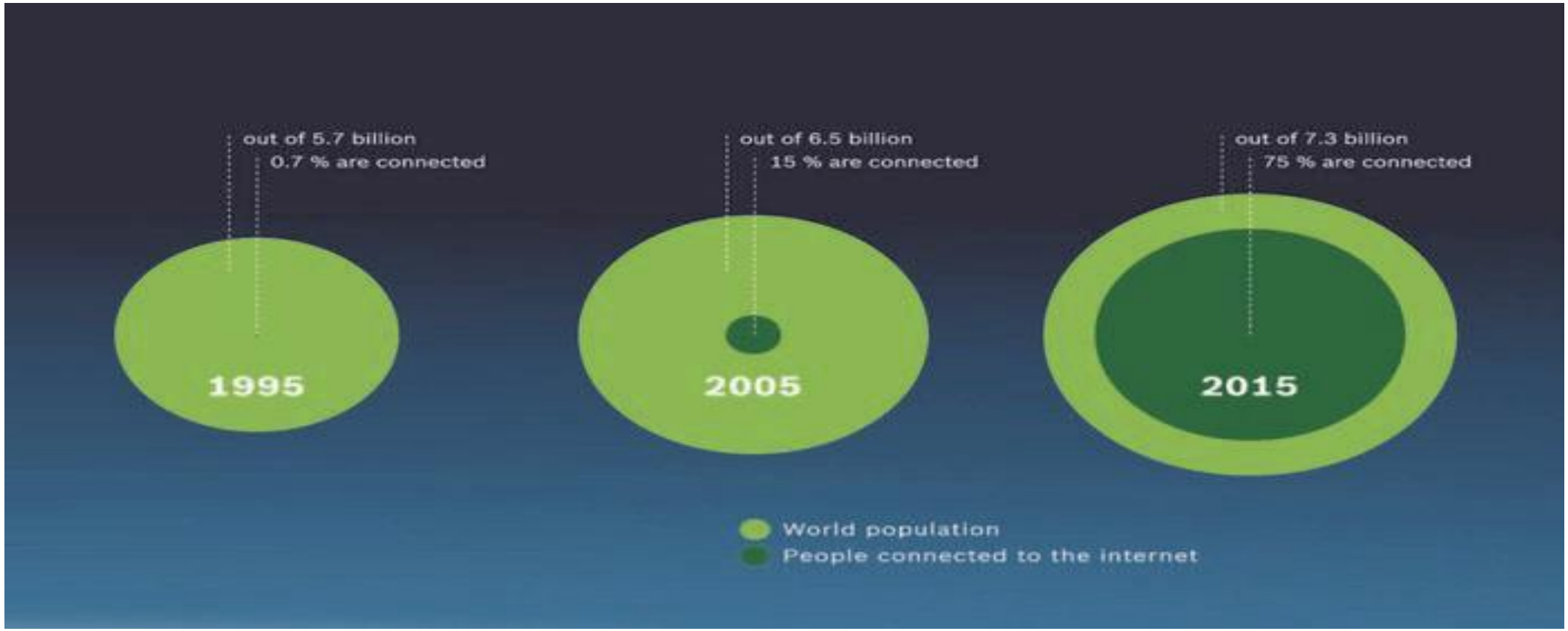

Fig 12 Impressive growth in Internet access

Internet conquering product business

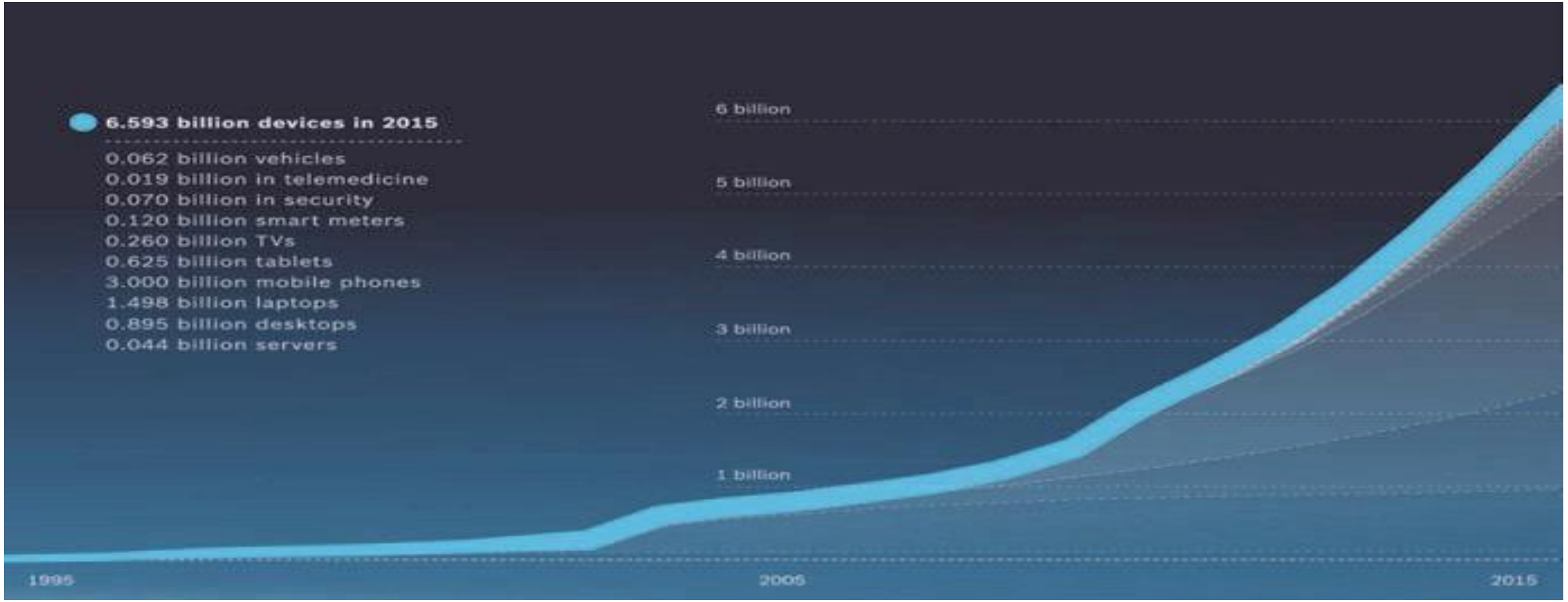

Fig 13 By 2015 expected IP ready-devices connected to internet

Strategic business aspects

- Four aspects of IoT and services
  - Technology advances
  - Business innovation
  - Market disruptions
  - People competences

Vertical business domains for IoT

- The value of IoT and services technology is delivered in vertical applications domains.
- There are many hot candidates to be clearly movers
  - Connected energy
  - Connected industry

Reference architecture and core competence for business

- The business success in one vertical domain is the key entry point, but successful architectures will reach out to other verticals later.
- Only architectures that can cover multiple domains will be successful in the long run, as the domain "silos" of the past still prevents a lot of innovation between the domains: e.g., between automotive and energy in electro mobility.

Value creation from big data and serialization

- Industries are maturing at a faster rate than ever before.
- Manufacturing is increasingly distributed and outsourced.
- Companies are increasingly looking to optimize savings across the total product lifecycle.

Serialization role in IoT

- As industries instrument complex processes beyond manufacturing plants in the supply chain and aftermarket services, Automated Information Data Collection(AIDC) technologies including optical scanning of printed linear or 2D bar codes, radio frequency “reads” of passive RFID tags together with new telemetry technologies, provide a powerful portfolio of tools for product lifecycle visibility.
- Serialized identifiers are the keys to building an Internet of Things; just as unique IP addresses are integral to the web itself.
- One global system of such identifiers, the MIT Auto-ID Center Electronic Product Code (EPC), was licensed by GS1 for use by its member manufacturers in all 124 countries, together with EPCGenII RFID specs, are now instantiated in ISO Automatic Identification and Data Capture Techniques.

Big data in phatmaceutical

- A radical transformation of the pharmaceutical manufacturing industry is taking place, much as occurred previously in the textile and electronics manufacturing sectors.

- Big Data can be compared to the discovery of the microscope,Professor Eric Byrnolfsson, Ph.D. said in his keynote at the MIT Sloan "Big Data: The Management Revolution" conference and in a recent Harvard Business Review article.

Big data in phatmaceutical

Fig 14 The 7 flows of supply chain information

IoT for retailing industry

- The IoT has become a dominant term for describing the integration of information with real-world products, items, and things.
- IoT is broad term comprising applications from manufacturing, smart power grids, RFID, mobile applications, track & trace, traffic monitoring, smart cities and retail.
- Internet oriented development
- Thing oriented development
- IoT gives access about real-world processes and phenomena in real time.
- For instance, it offers the opportunity to integrate social media into the sales floor.
- This allows retailers to gain more insights into the opinions of their customers and to benefit from viral marketing as shown in fig 15.

IoT for retailing industry

Fig 15 Embedding social media on sales floor

IoT for retailing industry

- provision of data-points
- products providing data
- focus on community building

Fig 16 Opportunities for retailing using IoT

IoT small survey structure

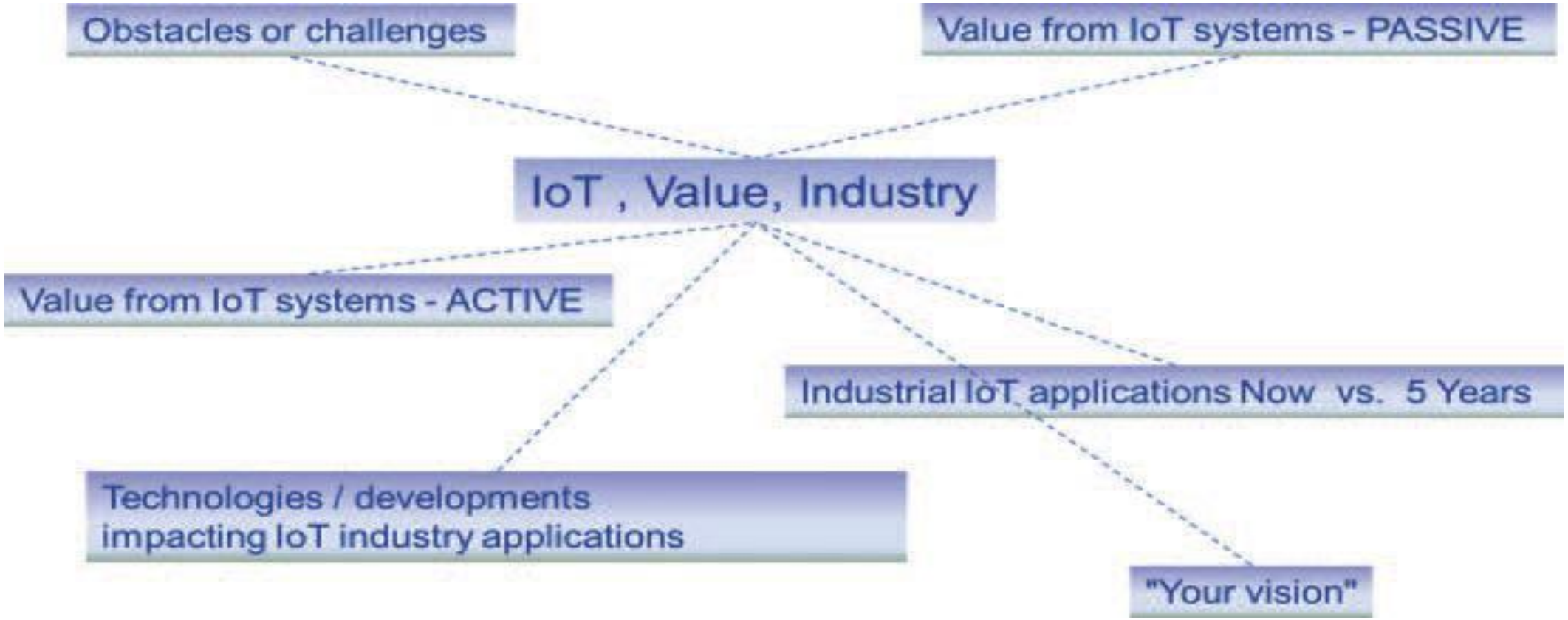

Fig 17 IoT small survey structure