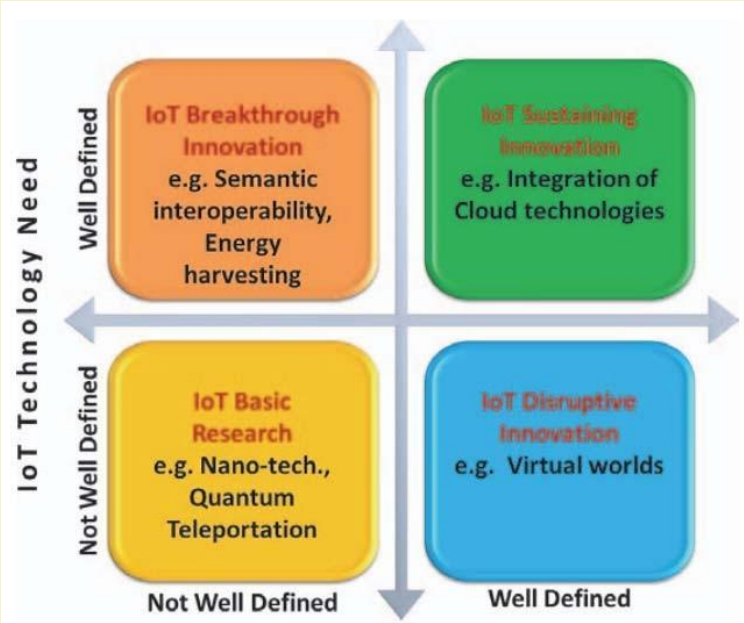
- Convergence of Domain
- IoT Components
- IoT working
- Functional Components of IoT
- An Example of IoT Implementation
- IoT interdependencies
- IoT Service Oriented Architecture
- IoT categories
- IoT Gateways

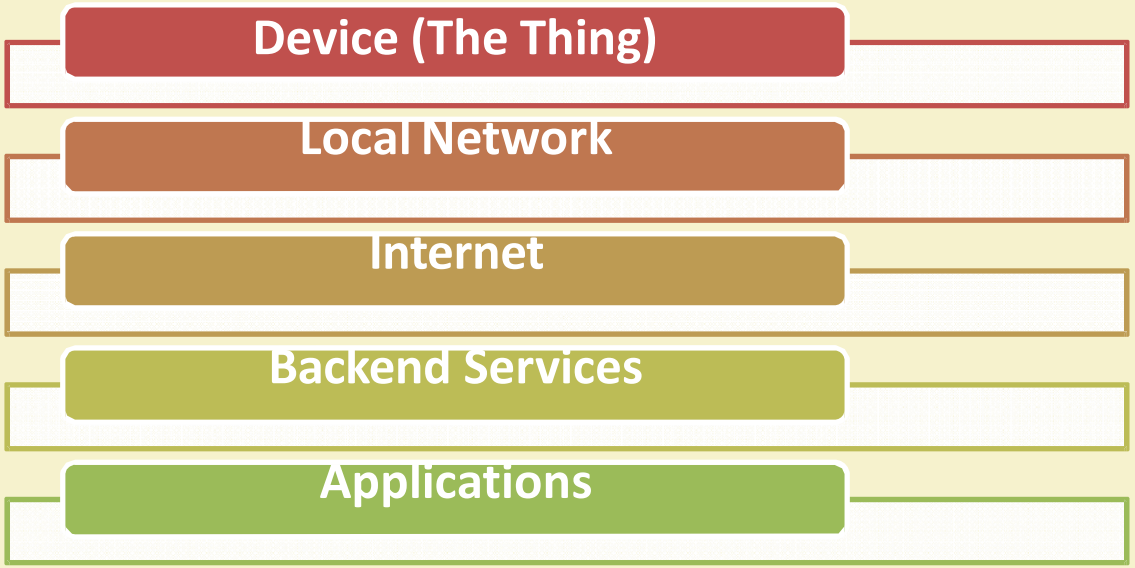
- IoT and Associated Technologies
- Technical Deviation from Regular Web
- Key technologies for IoT
- IoT Challenges
- Different considerations for building IoT
- Complexity of Networks
- Wireless networks
- Scalability

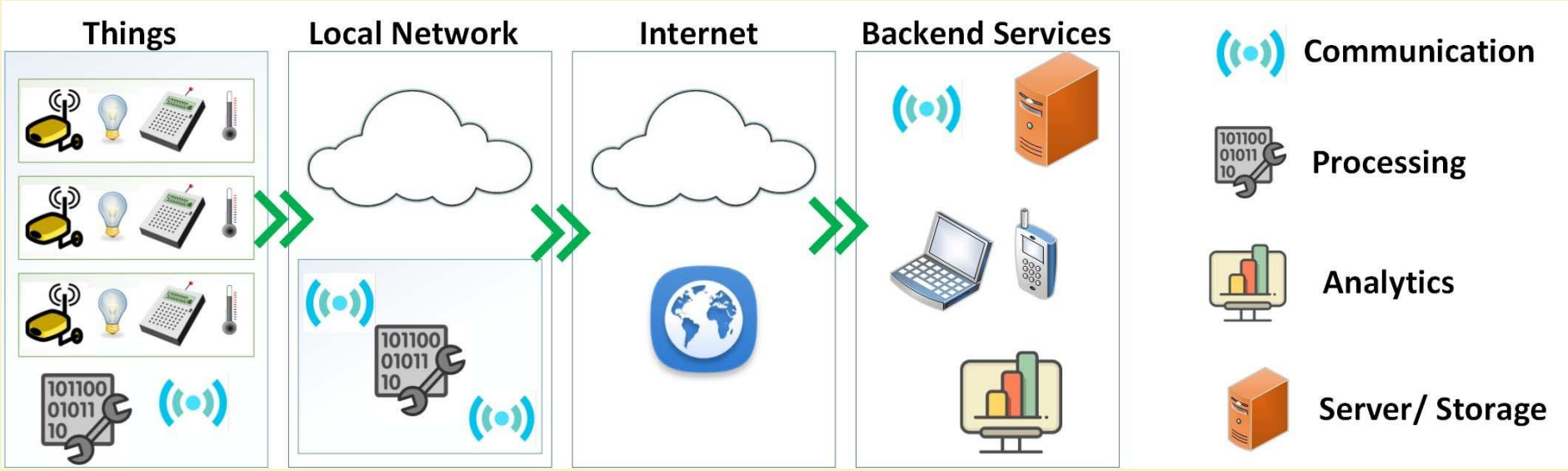
Convergence of Domains



Source: O. Vermesan, P. Friess, "Internet of Things – Converging Technologies for Smart Environments and Integrated Ecosystems", River Publishers, Series in Communications, 2013

IoT Components



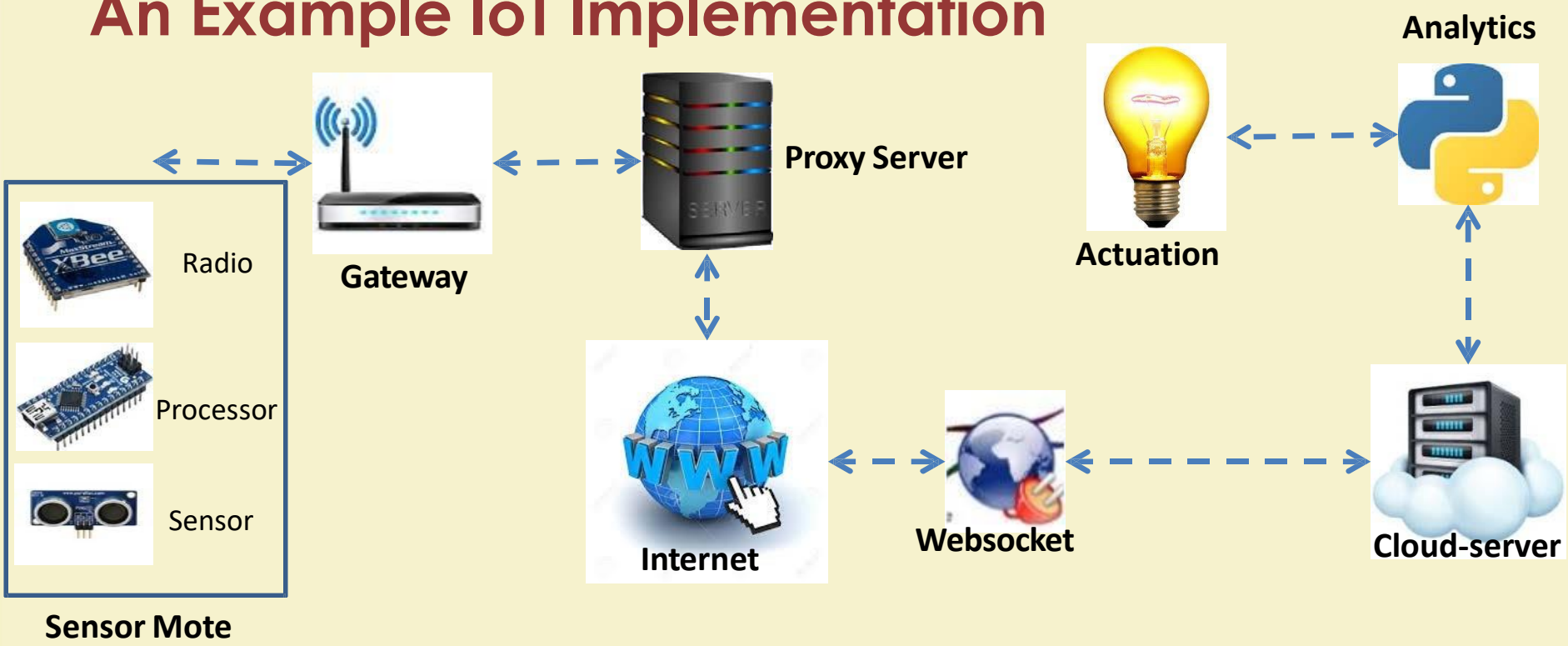

Things
Local Network
Internet
Backend Services
101100
01011
10
Communication
Processing
Analytics
Server/ Storage

Functional Components of IoT

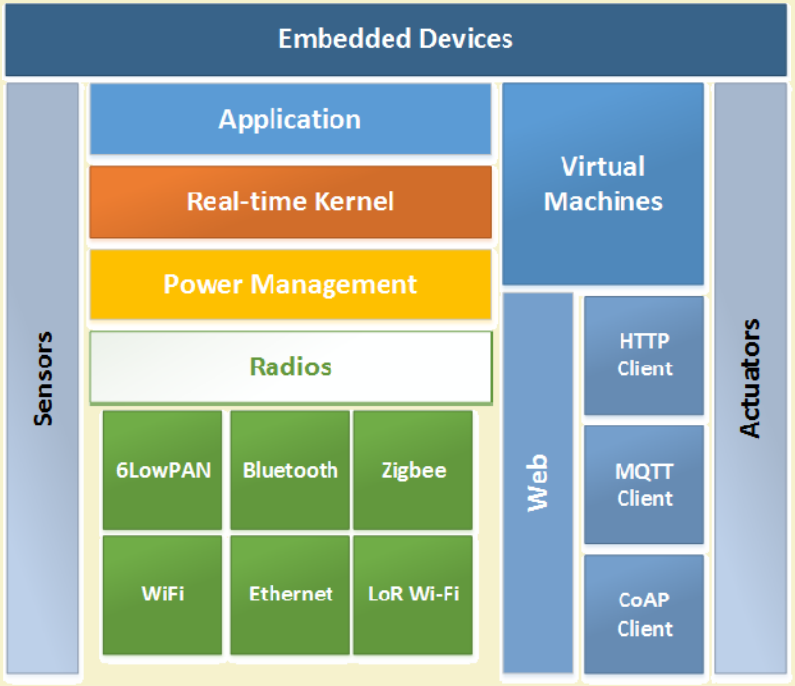
- ✓ Component for interaction and communication with other IoT devices
- ✓ Component for processing and analysis of operations
- ✓ Component for Internet interaction
- ✓ Components for handling Web services of applications
- ✓ Component to integrate application services
- ✓ User interface to access IoT

Source: O Vermesan, P. Friess, "Internet of Things – Converging Technologies for Smart Environments and Integrated Ecosystems", River Publishers, Series in Communications, 2013

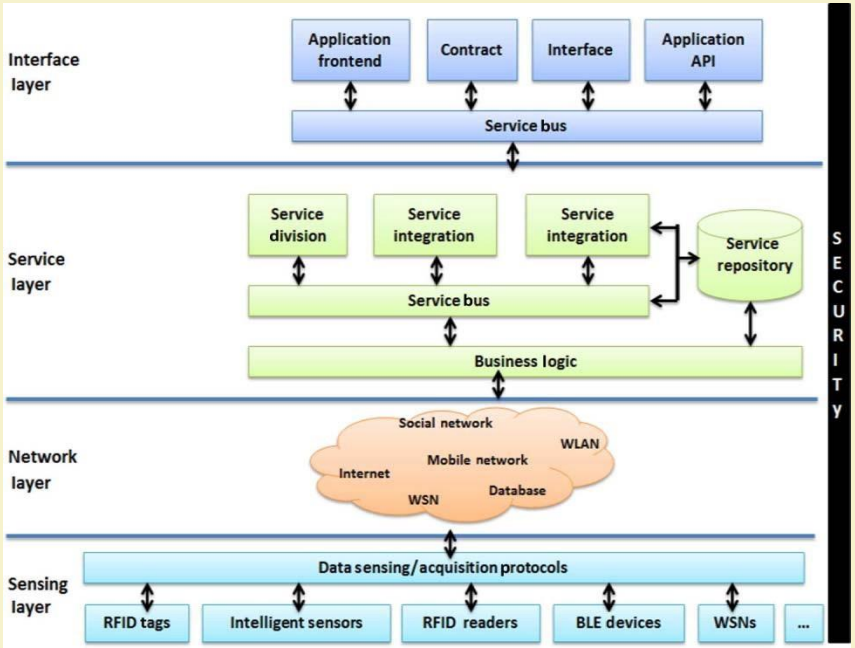
An Example IoT Implementation



IoT Interdependencies



IoT Service Oriented Architecture

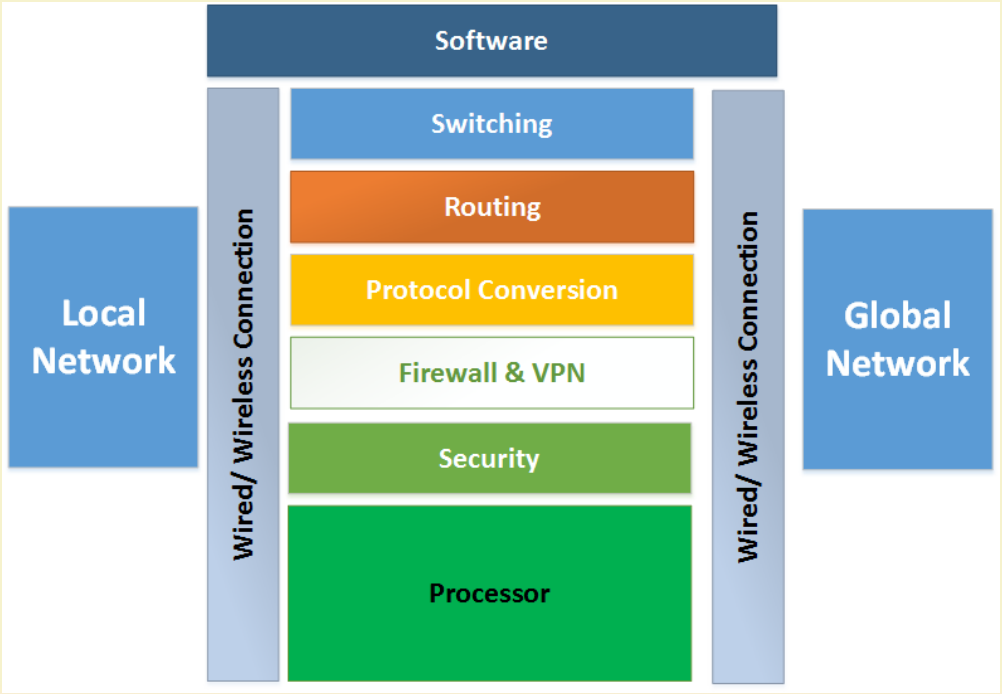


Source: Li Da Xu, Wu He, and Shancang Li, "Internet of Things in Industries: A Survey ", IEEE Transactions on Industrial Informatics, Vol. 10, No. 4, Nov. 2014.

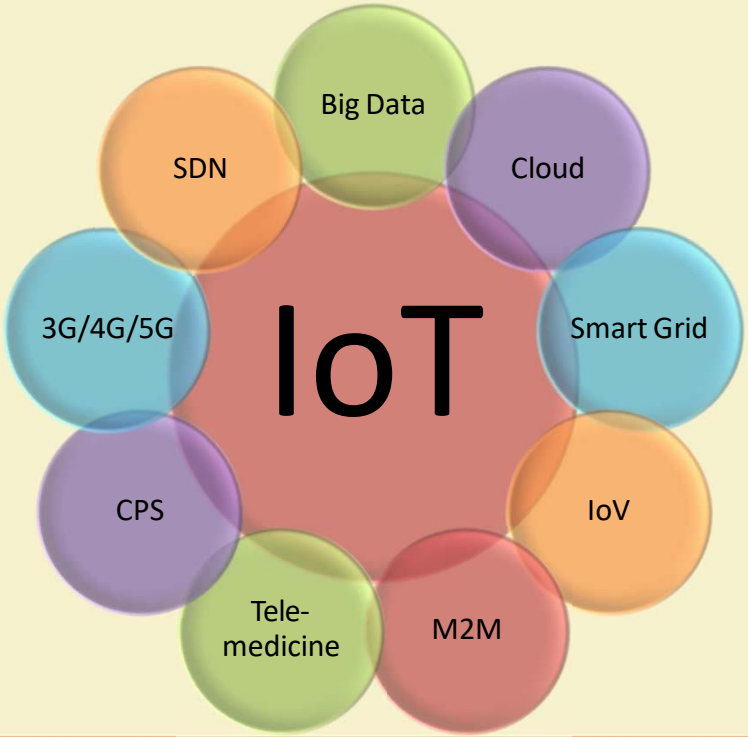
IoT Categories

- ✓ **Industrial IoT**
  - IoT device connects to an IP network and the global Internet.
  - Communication between the nodes done using regular as well as industry specific technologies.
- ✓ **Consumer IoT**
  - IoT device communicates within the locally networked devices.
  - Local communication is done mainly via Bluetooth, Zigbee or WiFi.
  - Generally limited to local communication by a Gateway

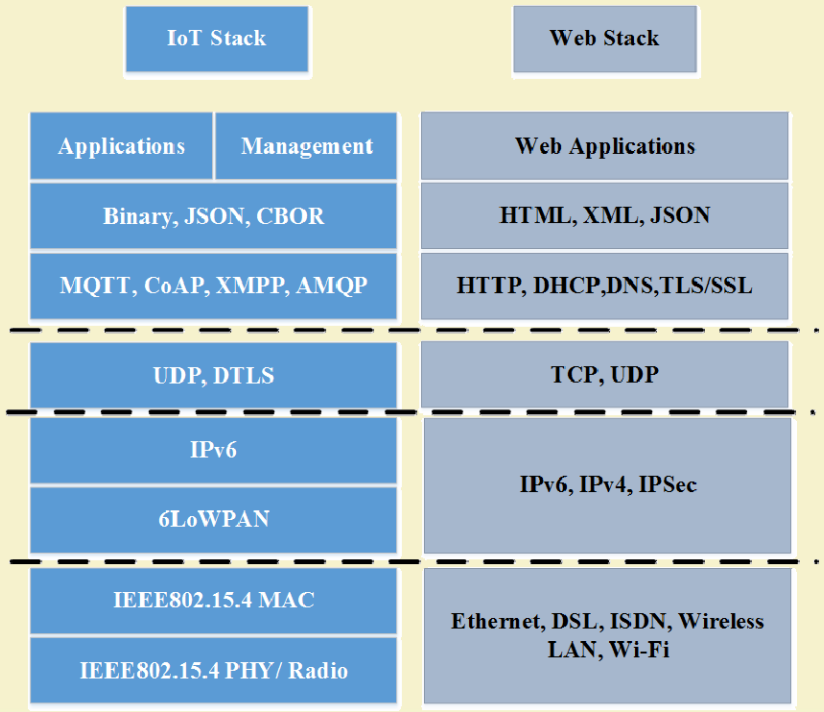
IoT Gateways



IoT and Associated Technologies



Technical Deviations from Regular Web



Key Technologies for IoT

Source: O Vermesan, P. Friess**, "**Internet of Things – Converging Technologies for Smart Environments and Integrated Ecosystems", River Publishers, Series in Communications, 2013

IoT Challenges

- ✓ Security
- ✓ Scalability
- ✓ Energy efficiency
- ✓ Bandwidth management
- ✓ Modeling and Analysis
- ✓ Interfacing
- ✓ Interoperability
- ✓ Data storage
- ✓ Data Analytics
- ✓ Complexity management (e.g., SDN)

Considerations

- ✓ Communication between the IoT device(s) and the outside world dictates the network architecture.
- ✓ Choice of communication technology dictates the IoT device hardware requirements and costs.
- ✓ Due to the presence of numerous applications of IoT enabled devices, a single networking paradigm not sufficient to address all the needs of the consumer or the IoT device.

Complexity of Networks

- ✓ Growth of networks
- ✓ Interference among devices
- ✓ Network management
- ✓ Heterogeneity in networks
- ✓ Protocol standardization within networks

Source: O Vermesan, P. Friess**, "**Internet of Things – Converging Technologies for Smart Environments and Integrated Ecosystems", River Publishers, Series in Communications, 2013

Wireless Networks

- Traffic and load management
- Variations in wireless networks – Wireless Body Area Networks and other Personal Area Networks
- Interoperability
- Network management
- Overlay networks

Source: O. Vermesan, P. Friess, **"**Internet of Things – Converging Technologies for Smart Environments and Integrated Ecosystems", River Publishers, Series in Communications, 2013

Scalability

- Flexibility within Internet
- IoT integration
- Large scale deployment
- Real-time connectivity of billions of devices