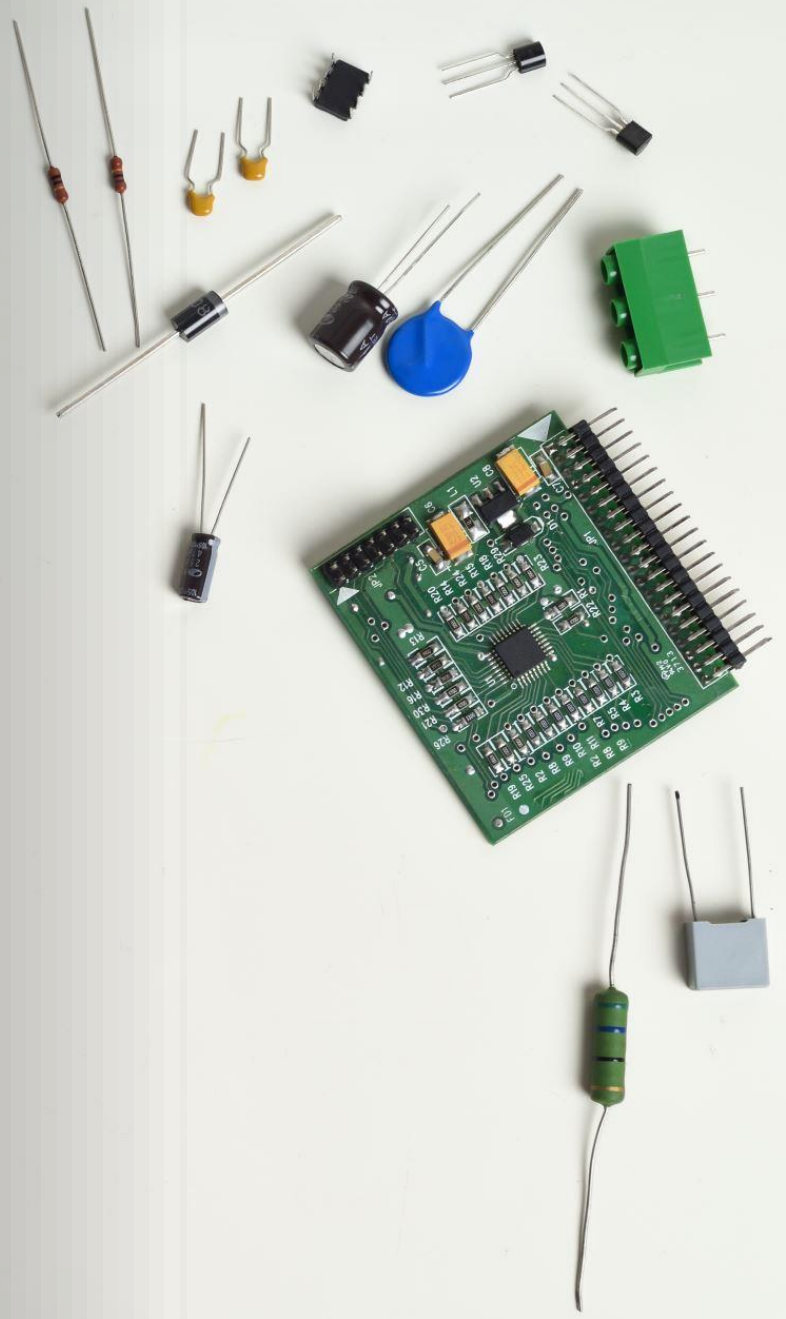
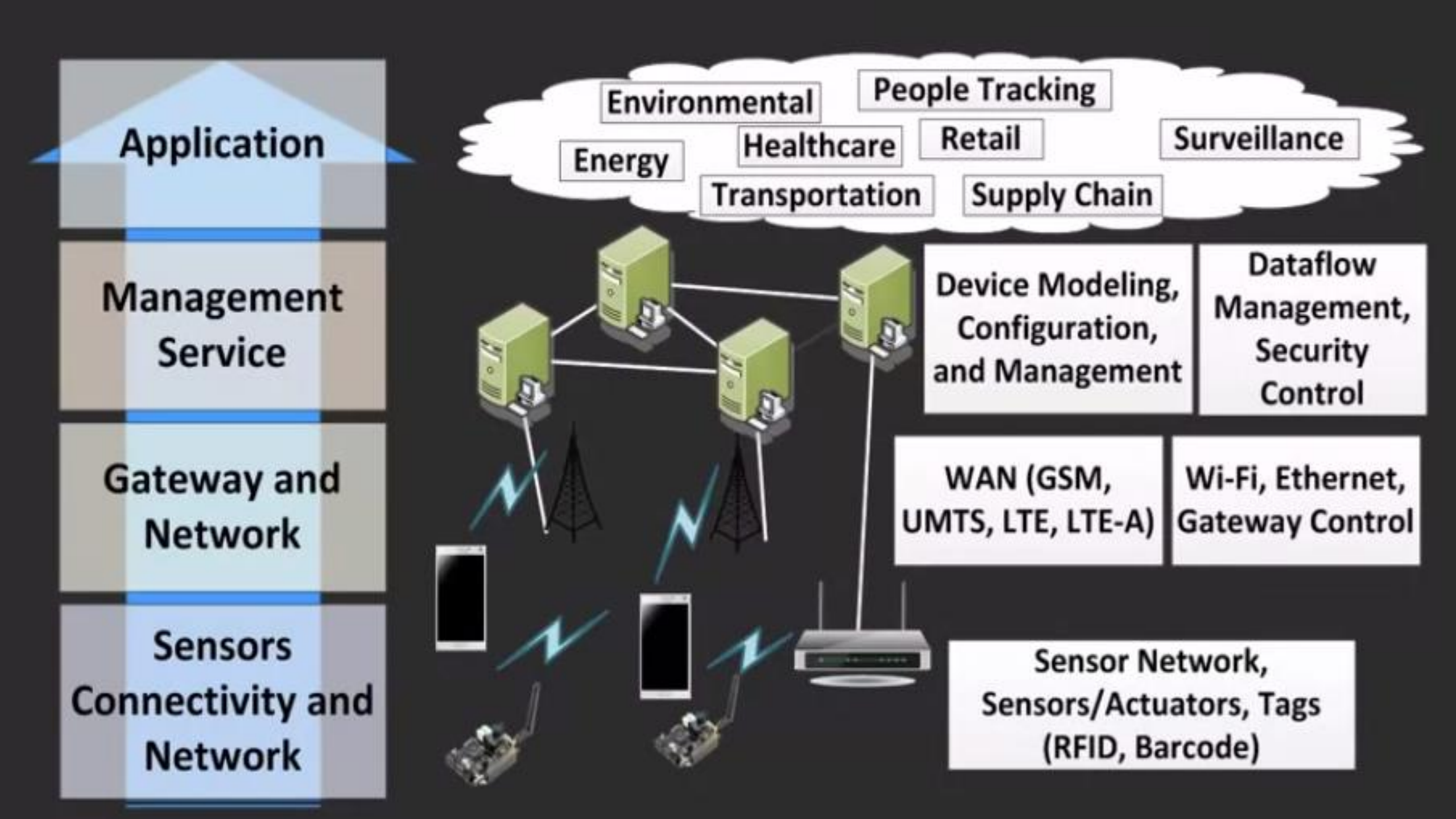
Iot Architecture




Application
Management Service
Gateway and Network
Sensors Connectivity and Network
Environmental
People Tracking
Energy
Healthcare
Retail
Surveillance
Transportation
Supply Chain
Device Modeling, Configuration, and Management
Dataflow Management, Security Control
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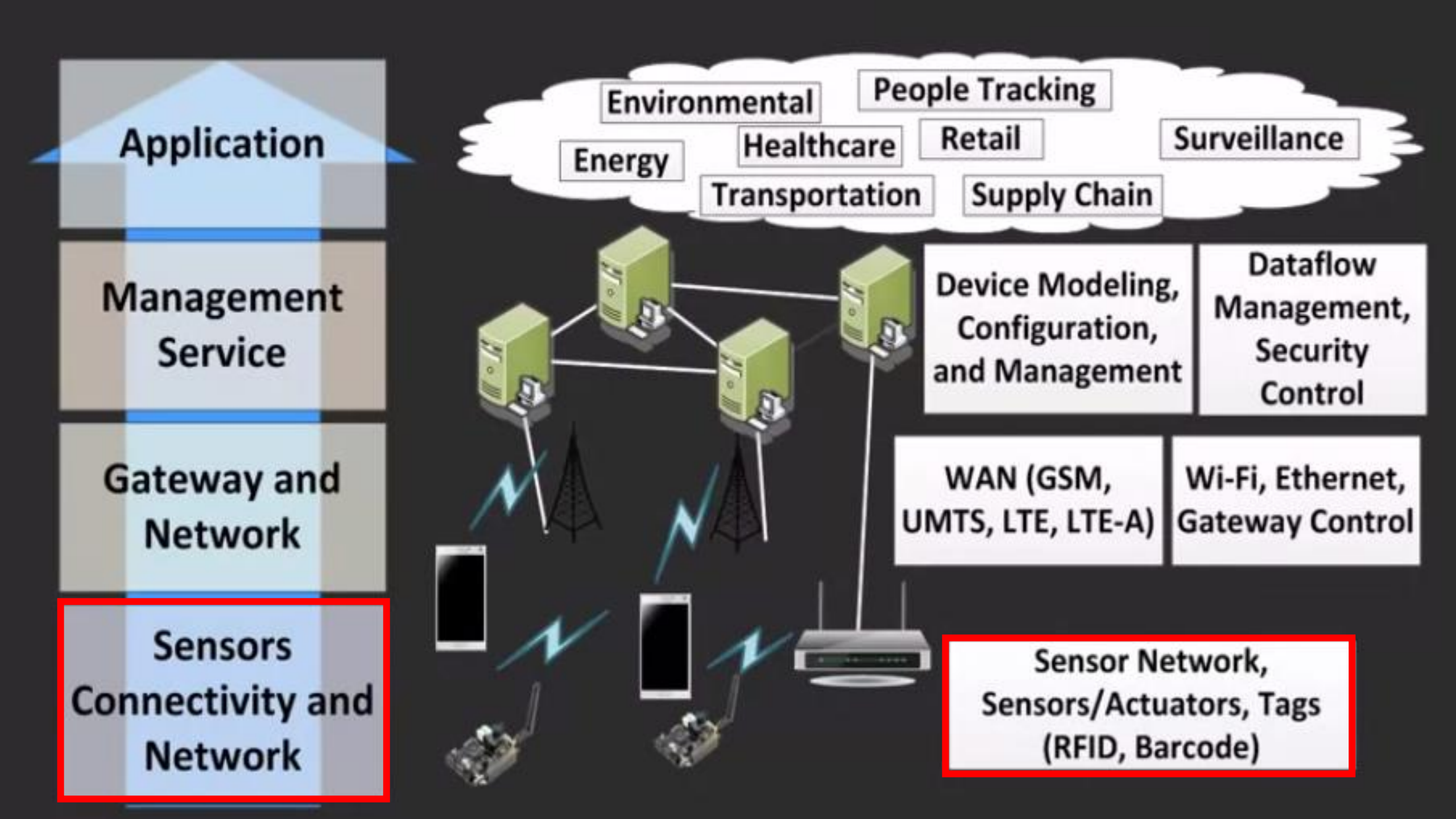
Wi-Fi, Ethernet, Gateway Control
Sensor Network, Sensors/Actuators, Tags (RFID, Barcode)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❖ Sensor Layer

Sensors Connectivity and Network

LAN

Wi-Fi | Ethernet

PAN

UWB | ZigBee | Bluetooth | 6LoWPAN | Wired

Sensors / Actuators

Solid State	Catalytic	Gyroscope
Photochemistry	GPS	Photoelectric
Infrared	Accelerometer	

Tag

RFID | Barcode (1D, 2D)

Sensors

❖ Sensor Layer

- Made up of Sensors and Smart Devices

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- Real-time information to be collected and processed
- Sensors use low power and low data rate connectivity
- WSN (Wireless Sensor Network)
- Sensors are grouped according to their purpose and data types
  - Environmental sensors, Military sensors, Body sensors, Home sensors, Surveillence sensors, etc.

❖ Sensor Aggregators (Gateways)

- LAN (Local Area Network)
  - Ethernet and Wi-Fi connections
  - WLAN (Wireless LAN) → Wi-Fi

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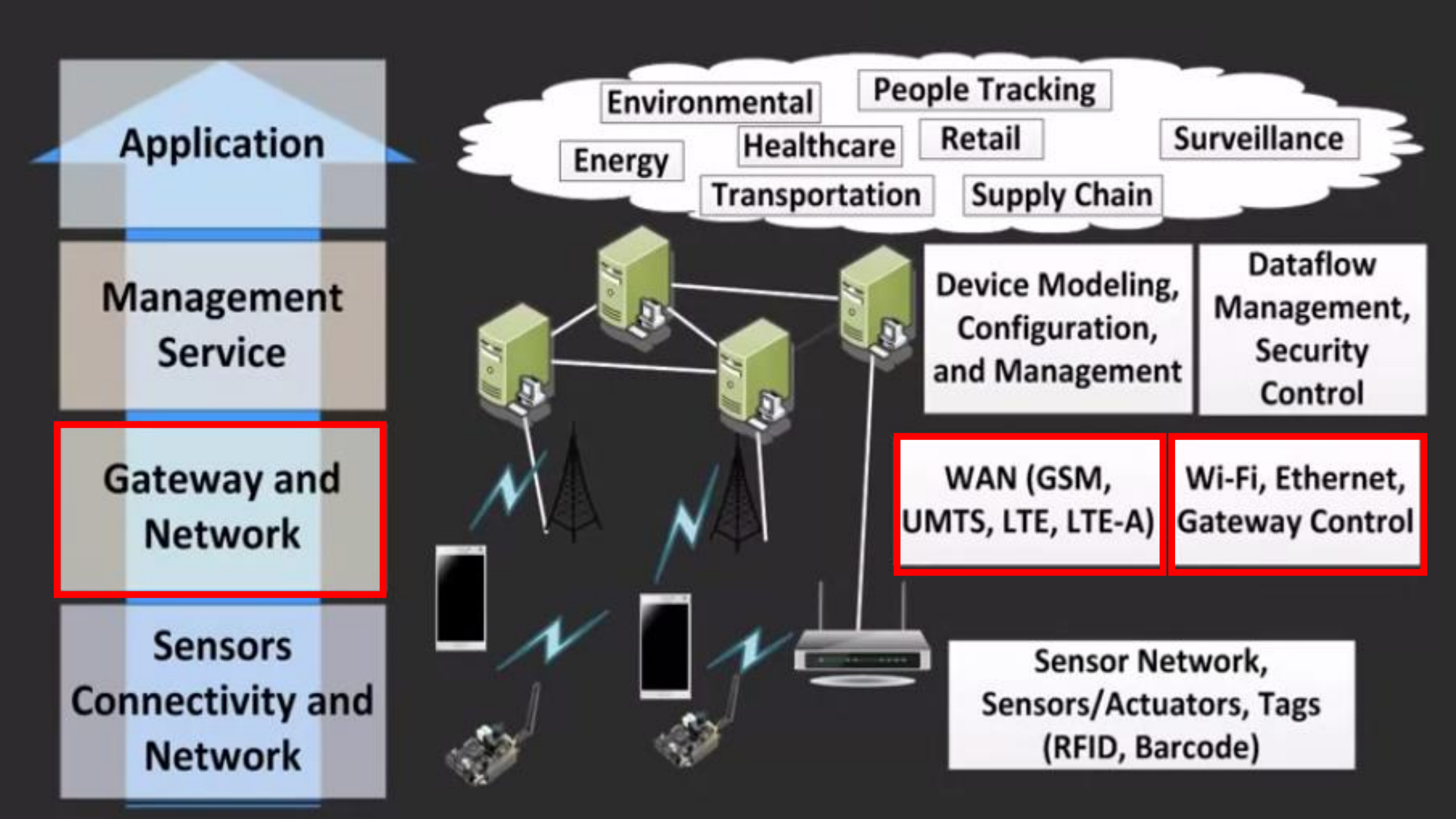
- Sensors that do not require connectivity to a LAN gateway can be directly connected to the Internet through a WAN (Wide Area Network) interface.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❖ Gateway & Network Layer

Gateway and Network

Gateway Network

WAN

- 3G
- LTE
- LTE-A

LAN

- Wi-Fi
- Ethernet

Gateway

- Micro-Controller
- Radio Communication Module
- Signal Processor & Modulator
- Access Point
- Embedded/OS
- SIM Module
- Encryption

❖ Gateway and Network Layer

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- Requires a robust and reliable performance.
- Support private, public, hybrid network models.
- Network models QoS requirements:
  - ➢Low Latency and Error probability
  - ➢High throughput and Energy efficiency
  - ➢High levels of Security and Scalability

❖ Gateway and Network Layer

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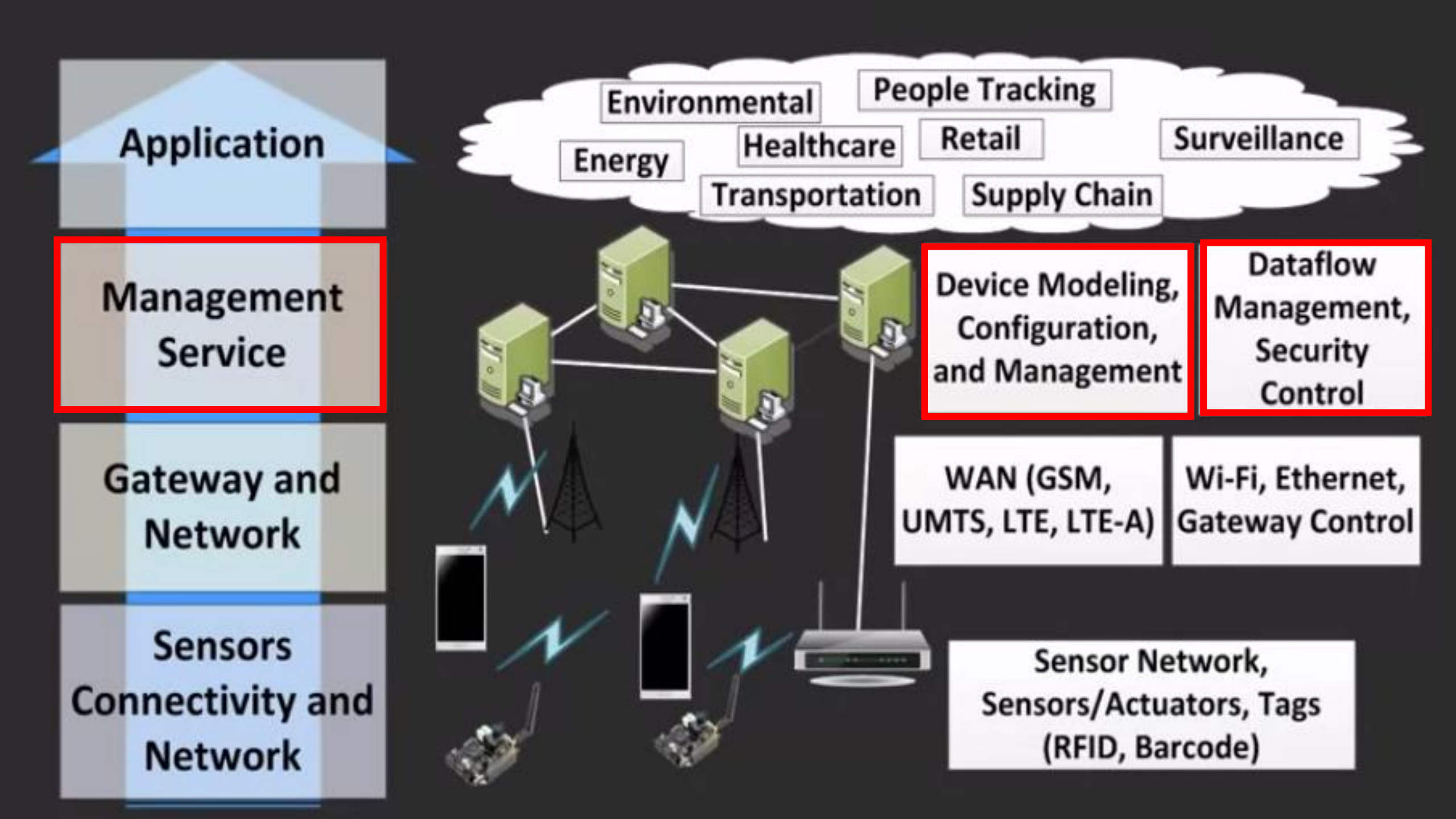
- IoT sensors are aggregated with various types of protocols and heterogeneous networks using different technologies.
- IoT networks need to be scalable to efficiently serve a wide range of services and applications over large-scale networks.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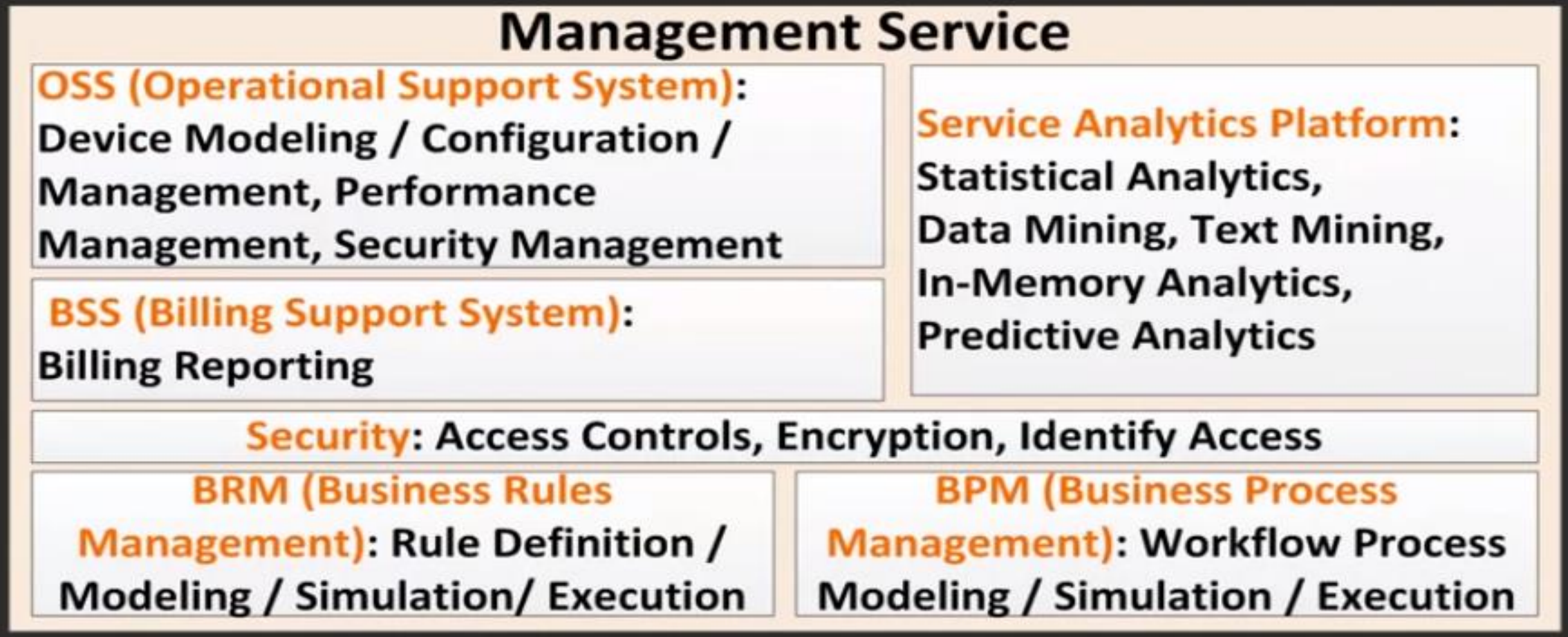
❖ Management Service Layer



❖ Management Service Layer (MSL)

- MSL is responsible of:
  - Information Analytics
  - Security control
  - Process modelling
  - Device Management

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- Data Management
  - Periodic IoT sensor data requires filtering
  - Aperiodic event triggered IoT sensor data may require immediate delivery and response.
    - Example: Patient medical emergency sensor data.
  - Manages data information flow
  - Information access, integration, and control.
- Data Abstraction
  - Information extraction processing
  - Used as a common business model

Application

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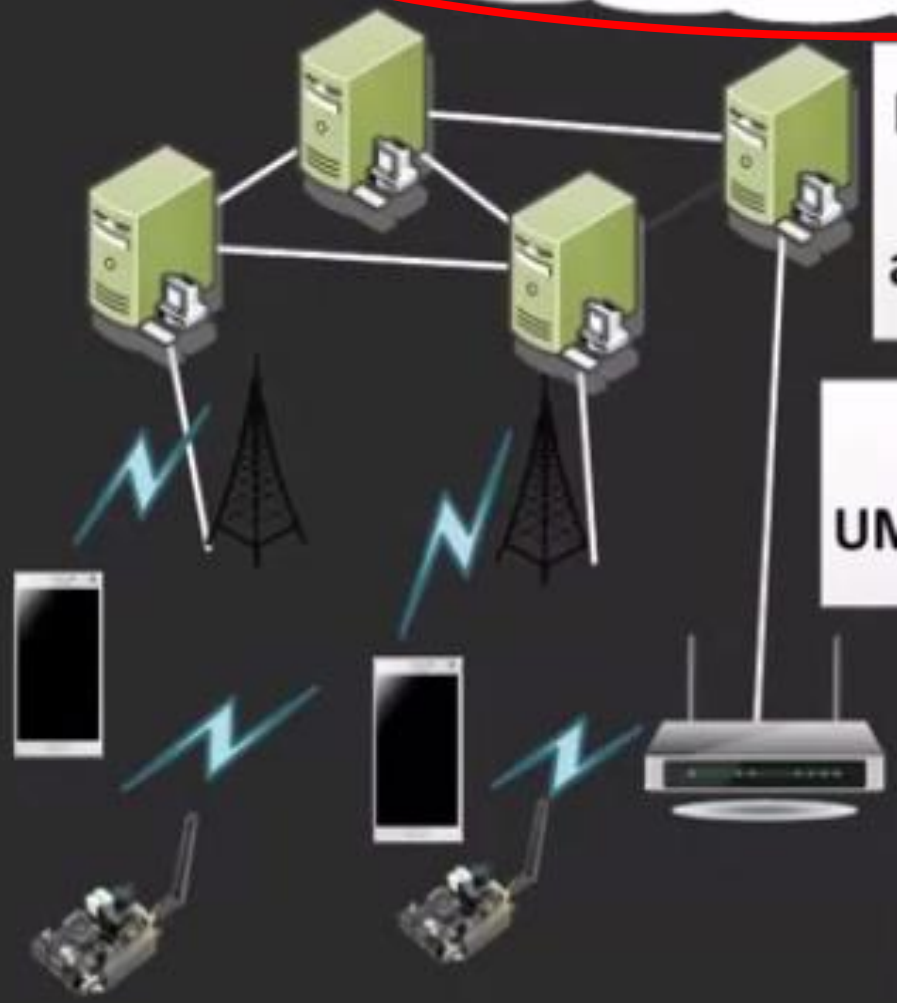

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❖ Application Layer

Applications

Sector

Environmental	Energy	Transportation	Healthcare	Retail	Military

Horizontal Market

Fleet Management	Asset Management	Supply Chain	People Tracking	Surveillance

❖ Application layer

- Various applications from industry sectors can use IoT for service enhancement.

- Application classification
  - Business model, type of network
  - Availability, Heterogeneity
  - Coverage, Size
  - Real-time or Non-Real-Time requirements.

❖ Application layer

- Personal and Home
  - IoT at the scale of an individual or home

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  - IoT at the scale of an individual or home
- Enterprise
  - IoT at the scale of a company or community
- Utility
  - IoT at a national or state scale
- Mobile
  - Devices are usually spread across other domains mainly due their mobility

❖ Application Layer

- Smart Environment Application Domains

	Smart Home	Smart Office	Smart Retail	Smart City	Smart Agriculture	Smart Energy & Fuel	Smart Transportation	Smart Military
Network Size	Small	Small	Small	Medium	Medium /Large	Large	Large	Large
Network Connectivity	WPAN, WLAN, 3G, 4G, Internet	WPAN, WLAN, 3G, 4G, Internet	RFID, NFC, WPAN, WLAN, 3G, 4G, Internet	RFID, NFC, WLAN, 3G, 4G, Internet	WLAN, Satellite Comm., Internet	WLAN, 3G, 4G, Microwave links, Satellite Comm.,	WLAN, 3G, 4G, Satellite Comm.	RFID, NFC, WPAN, WLAN, 3G, 4G, Satellite Comm.
Bandwidth Requirement	Small	Small	Small	Large	Medium	Medium	Medium~Large	Medium~Large

- WLAN: Wi-Fi, WAVE, IEEE 802.11 a/b/g/p/n/ac/ad, etc.
- WPAN: Bluetooth, ZigBee, 6LoWPAN, IEEE 802.15.4, UWB, etc.

❖ Application Layer

- Smart Environment Application Domains

Service Domain	Services
Smart Home	Entertainment, Internet Access
Smart Office	Secure File Exchange, Internet Access, VPN, B2B
Smart Retail	Customer Privacy, Business Transactions, Business Security, B2B, Sales & Logistics Management
Smart City	City Management, Resource Management, Police Network, Fire Department Network, Transportation Management, Disaster Management
Smart Agriculture	Area Monitoring, Condition Sensing, Fire Alarm, Trespassing
Smart Energy & Fuel	Pipeline Monitoring, Tank Monitoring, Power Line Monitoring, Trespassing & Damage Management
Smart Transportation	Road Condition Monitoring, Traffic Status Monitoring, Traffic Light Control, Navigation Support, Smart Car Support, Traffic Information Support, ITS (Intelligent Transportation System)
Smart Military	Command & Control, Communications, Sensor Network, Situational Awareness, Security Information, Military Networking

Reference

https://www.coursera.org/learn/iot-wireless-cloud-computing