M2M Architecture & IoT

1. Allow devices to communicate and share data autonomously and without human intervention, create a web of intelligent communication

2. M2M (machine to machine) is designed to communicate (Bluetooth , ZigBee etc.) with **individual devices** with specific purposes **whereas IoT is generalizing our idea in a broad network**

3. We need to handle heterogeneous data and make them interoperable. Hence a standardization of machine-to-machine communication is needed for IoT

Comparing IoT Architectures

1. oneM2M architecture
2. IoT World Forum (IoTWF)

OneM2M IoT Standardized Archi.

- 3 Layers-
  - Application Layer- Smart object connected with device, device applications. It interacts with service layer
  - Service Layer – Helps things to work efficiently
  - Network Layer- Ensures quick and secure data transfer

OneM2M IoT Standardized Archi.

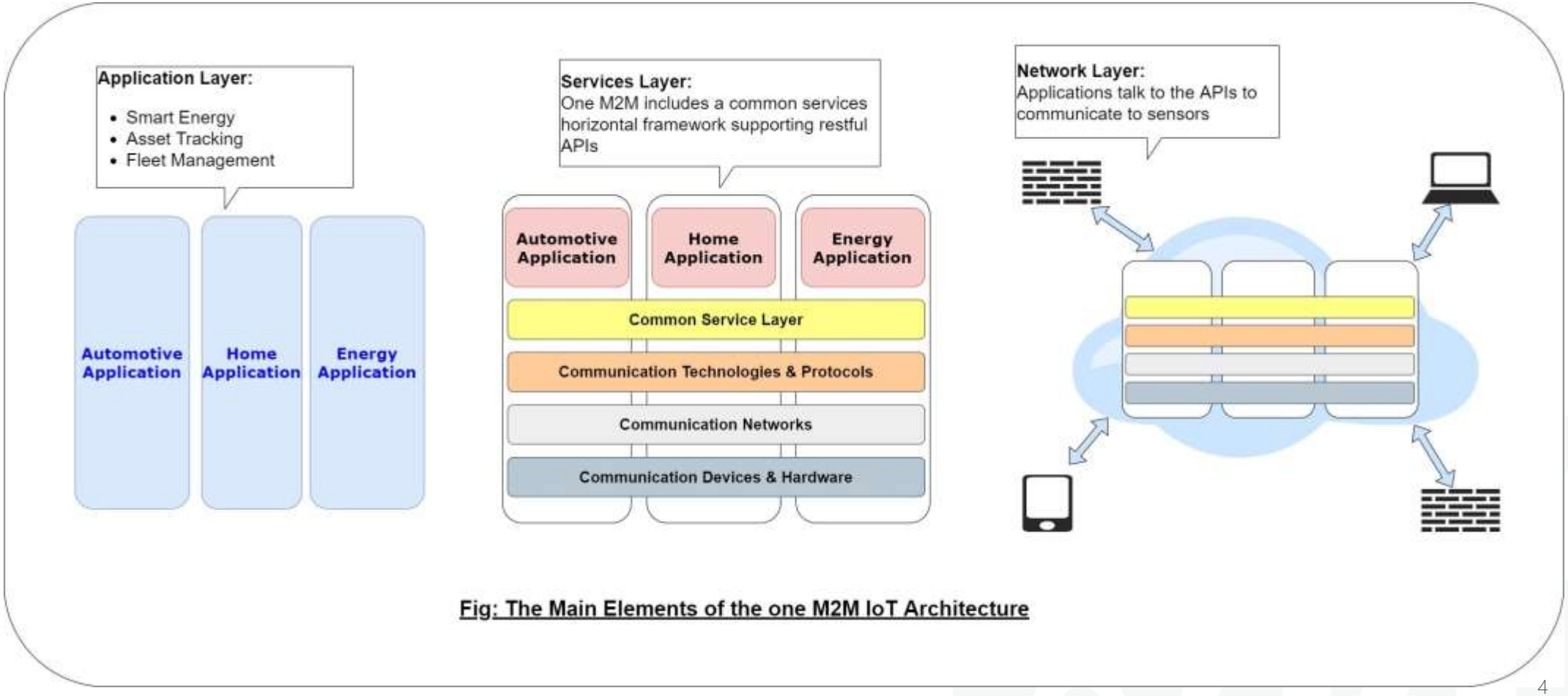


Fig: The Main Elements of the one M2M IoT Architecture

Application Layer

1. Focuses on connectivity between devices and their applications

2. Attempts to standardize northbound API definitions for interaction with Business Intelligence system

3. Applications are problem-specific and have their own data models (not depended on each other)

Service Layer

1. Physical network that IoT applications run on
2. Underlying management protocols
3. Security protocol
4. Different hardware- sensors, actuators, network devices
5. Some APIs & middleware supporting third party & applications

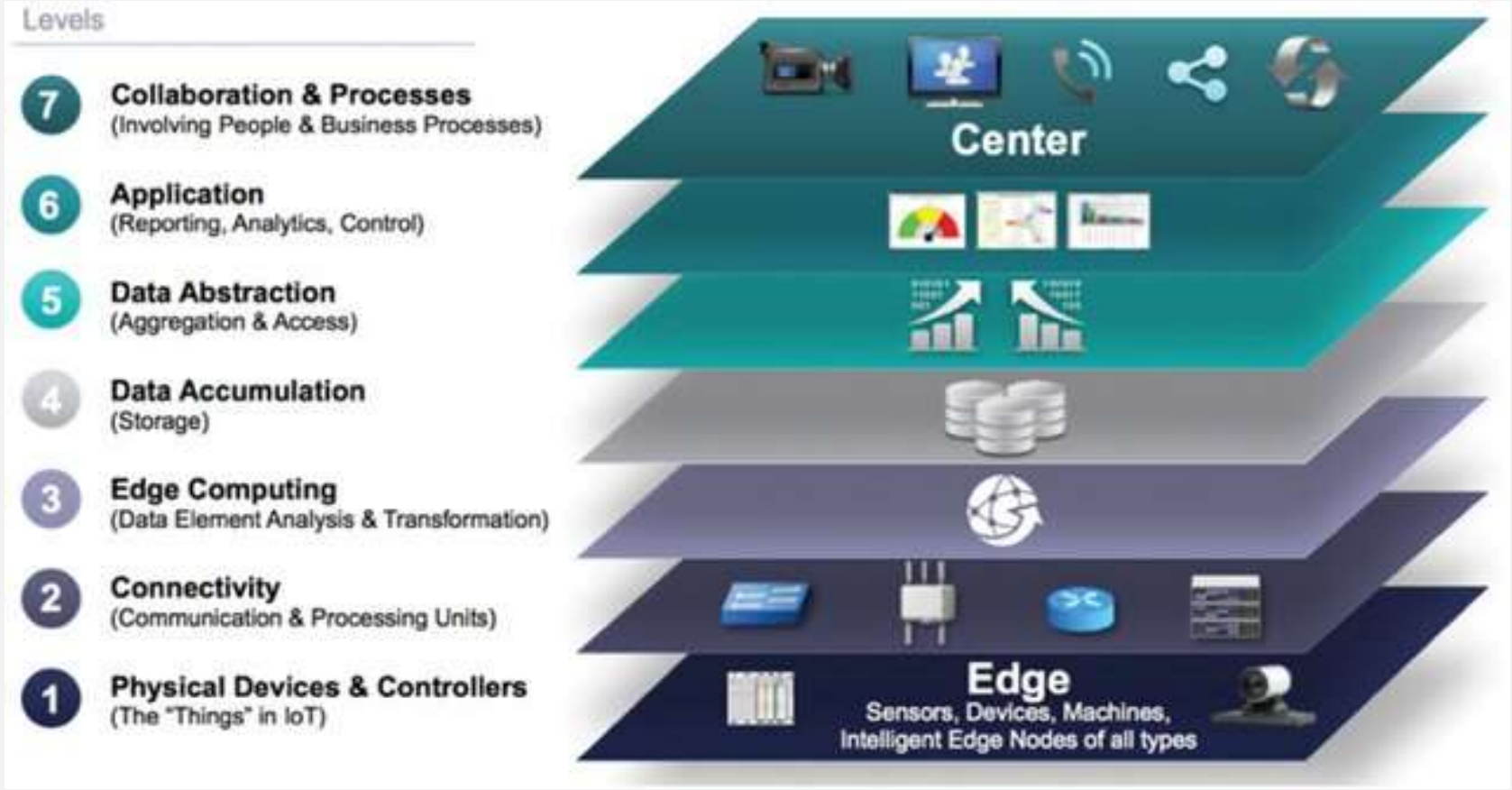
Network Layer

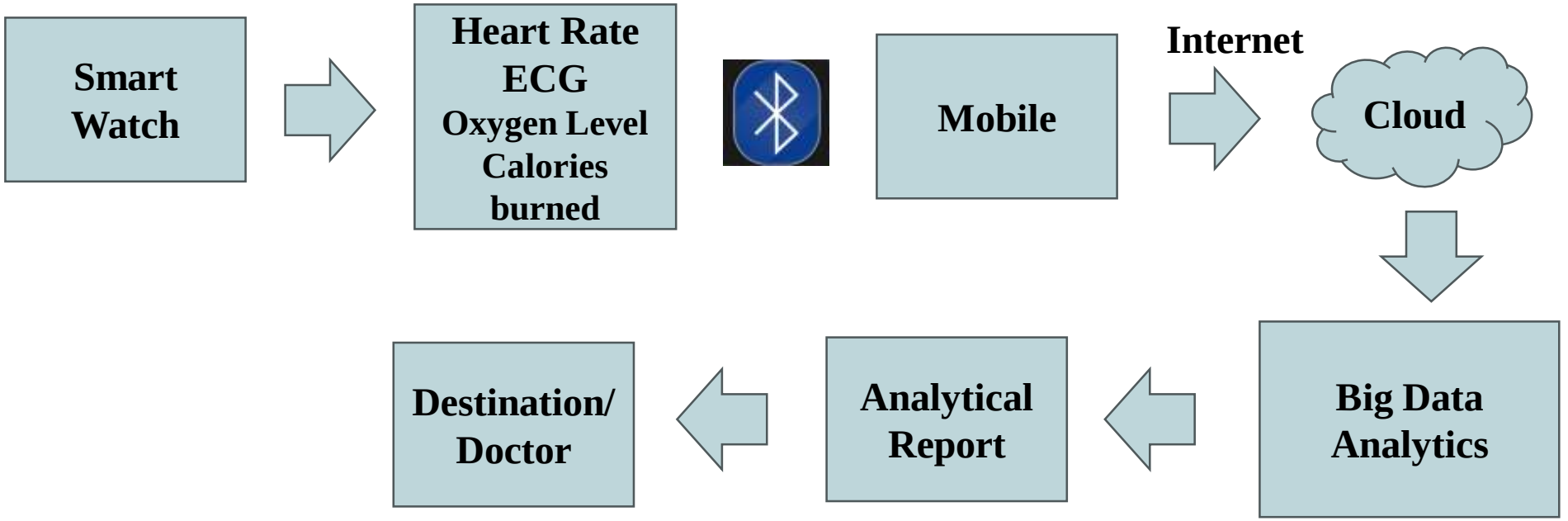
1. Communicate with different IoT devices

2. Examples- wireless mesh technologies i.e. IEEE 802.15.4 , wireless point-to—multipoint systems, i.e. IEEE 801.11ah

IoT World Forum (IoTWF), 2004

- 7 layer IoT reference model




Smart Watch
Heart Rate
ECG
Oxygen Level
Calories burned
Mobile
Internet
Cloud
Big Data Analytics
Analytical Report
Destination/ Doctor

Layer 1: Physical Devices and Controllers Layer

1. The various endpoint devices and sensors that send and receive information. The size of these “things” can range from almost microscopic sensors to giant machines in a factory.

2. Their primary function is generating data and being capable of being queried and/or controlled over a network.

Layer 2: Connectivity Layer

Layer 2: Connectivity Layer

- In the second layer of the IoT Reference Model, the focus is on connectivity. The most important function of this IoT layer is the reliable and timely transmission of data.

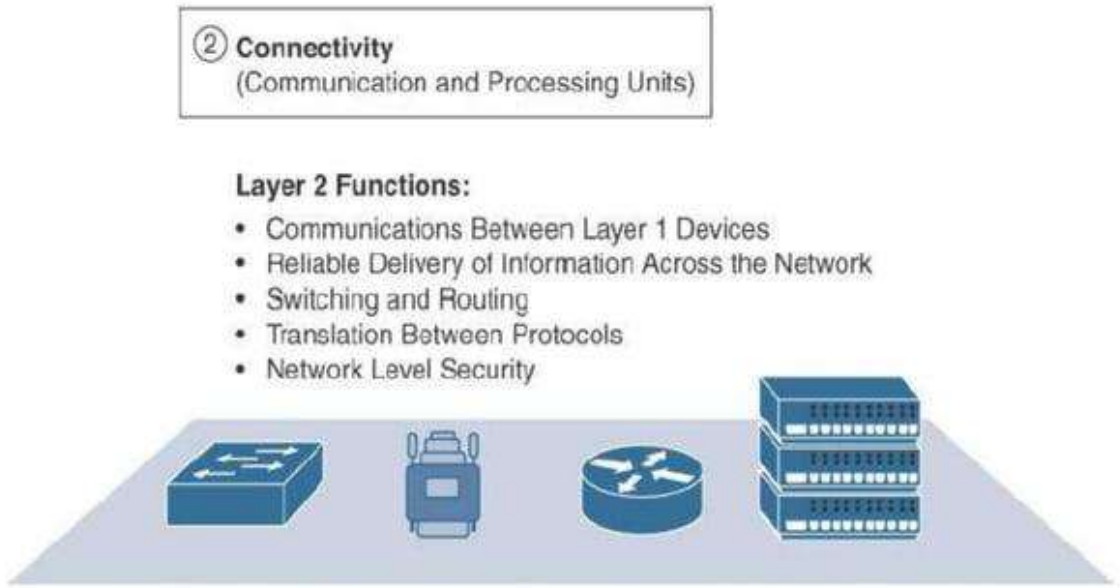


Figure 2-3 *IoT Reference Model Connectivity Layer Functions*

Layer 3- Edge Computing

- At this layer, the emphasis is on data reduction and converting network data flows into information that is ready for storage and processing by higher layers.

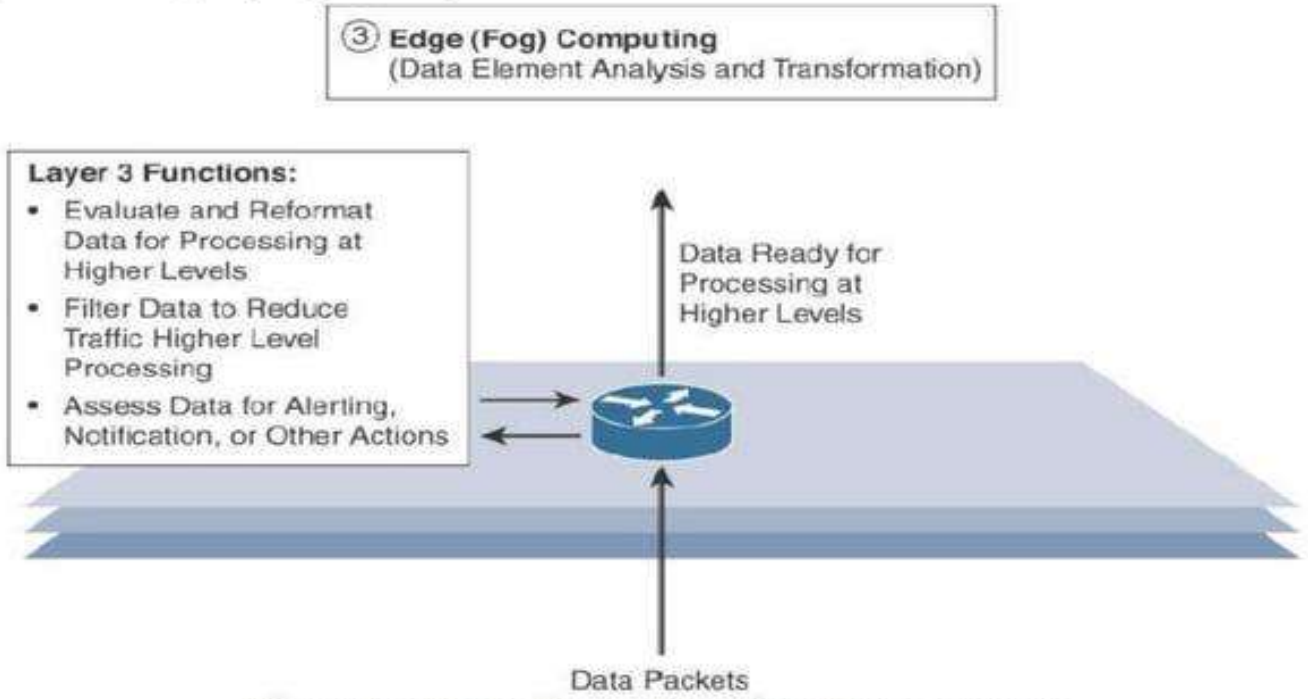


Figure 2-4 *IoT Reference Model Layer 3 Functions*

Upper Layers: Layers 4-7

IoT Reference Model Layer	Functions
Layer 4: Data accumulation layer	Captures data and stores it so it is usable by applications when necessary. Converts event-based data to query-based processing.
Layer 5: Data abstraction layer	Reconciles multiple data formats and ensures consistent semantics from various sources. Confirms that the data set is complete and consolidates data into one place or multiple data stores using virtualization.
Layer 6: Applications layer	Interprets data using software applications. Applications may monitor, control, and provide reports based on the analysis of the data.
Layer 7: Collaboration and processes layer	Consumes and shares the application information. Collaborating on and communicating IoT information often requires multiple steps, and it is what makes IoT useful. This layer can change business processes and delivers the benefits of IoT.

Table 2-2 *Summary of Layers 4–7 of the IoTWF Reference Model*

IT and OT Responsibilities in the IoT Reference Model

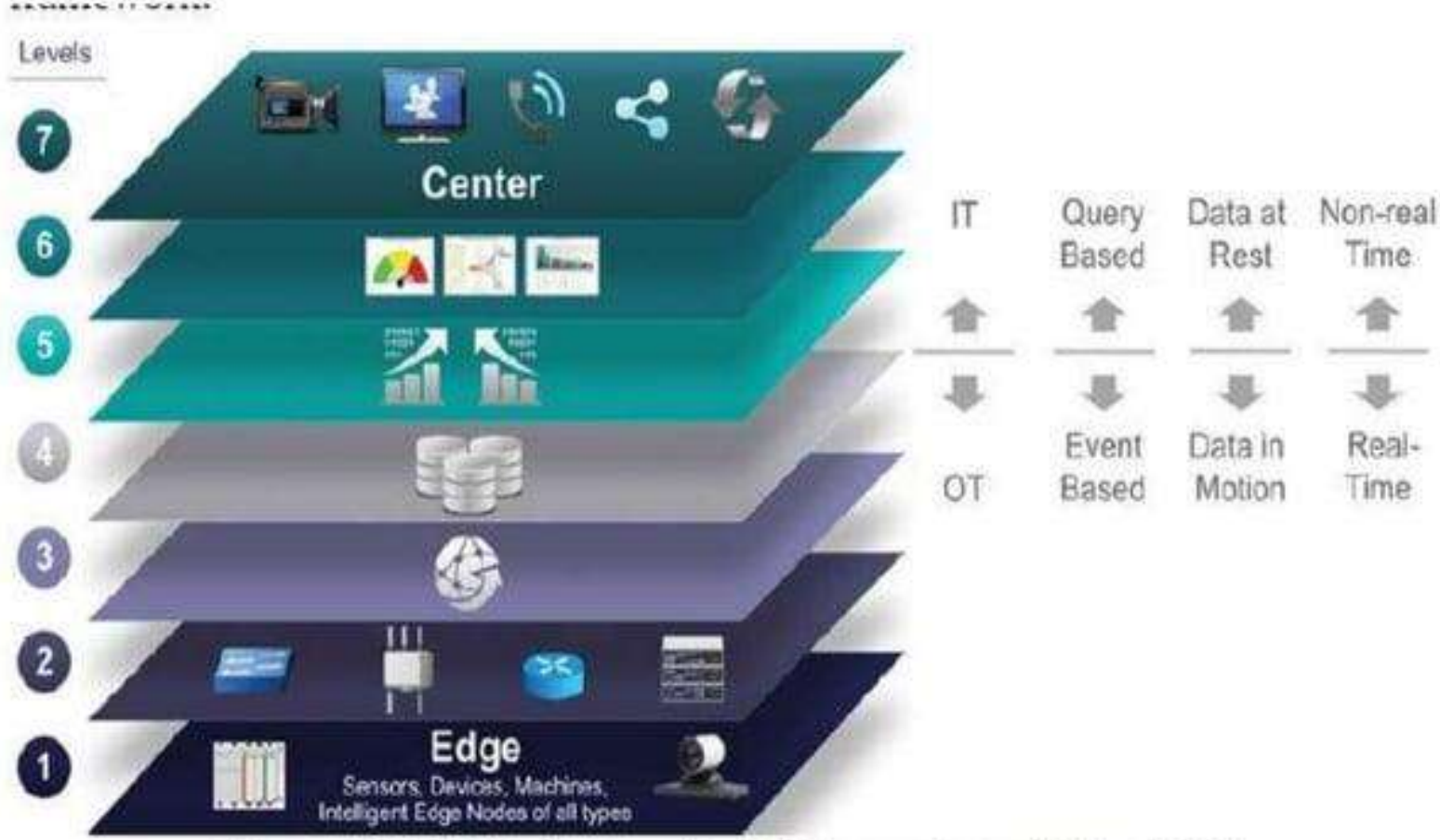
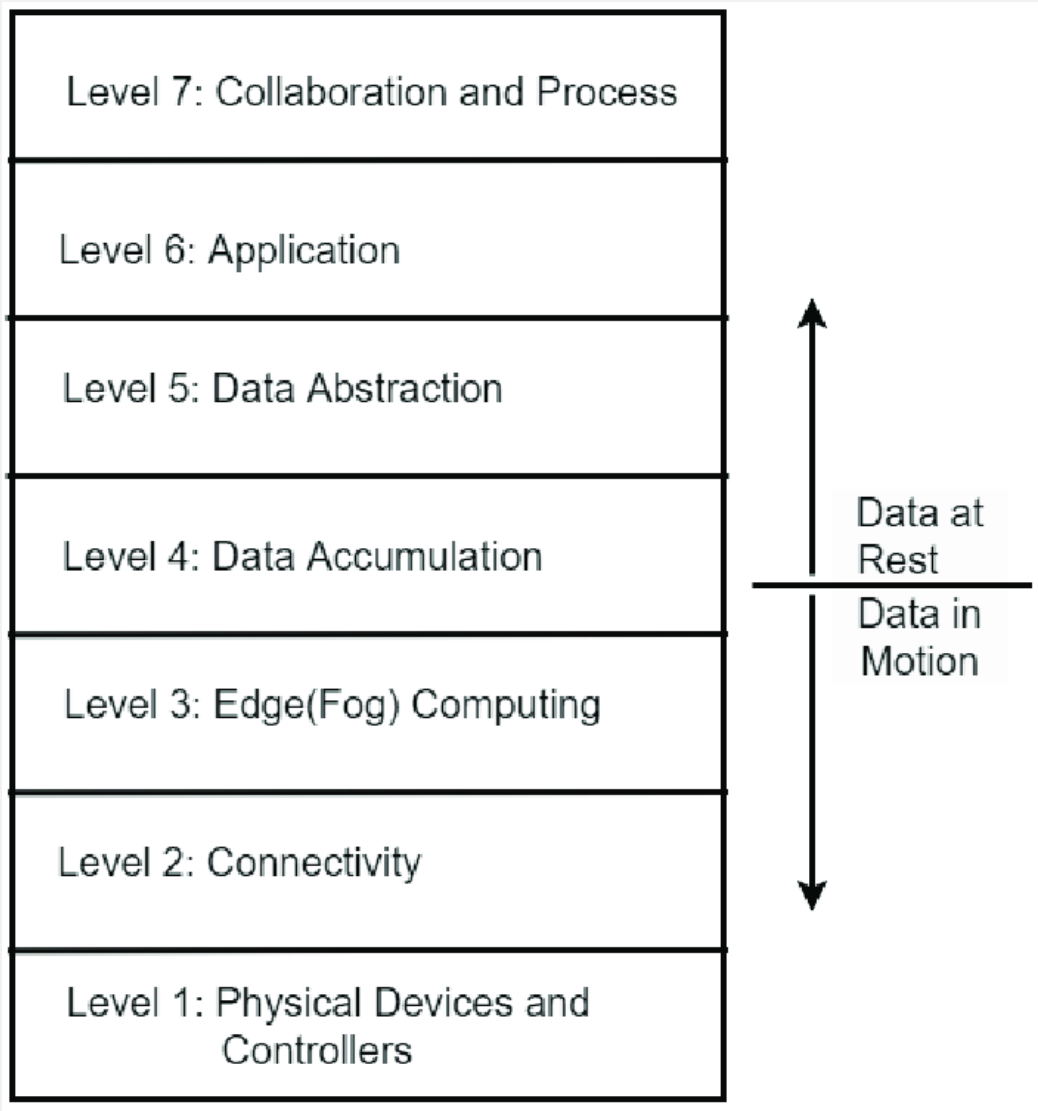


Figure 2-5 *IoT Reference Model Separation of IT and OT*

- The bottom of the stack is generally in the domain of OT. For an industry like oil and gas, this includes sensors and devices connected to pipelines, oil rigs, refinery machinery, and so on.
- The top of the stack is in the IT area and includes things like the servers, databases, and applications, all of which run on a part of the network controlled by IT.

IoT World Forum (IoTWF), 2004

- 7 layer IoT reference model



References

- IoT Fundamentals Book Chapter-2