

# IoT Open Systems Interconnection (OSI) model, ITU-T reference model and ETSI high level M2M architecture

# IETF Modified-OSI Six Layers

- Data communicate at source end from Application end (Layer 6) device-end (Layer 1)
- Stack means Data part + protocol header bits/words which transfer at one go
- Data stack creates by the processes at in-between layers from top layer 6 to bottom functional-layer 1 for communication

# IETF Modified OSI Six Layers Architecture

- Data transmits from the device end (layer 1) from an Application, Service or Process end (Layer 6) and
- Data stack communicate between the physical layers at source and destination ends.

# IETF Modified-OSI Six Layers Architecture

- Data stack receives at the device end (layer 1) and to an Application, Service or Process end (Layer 6)
- Data stack processes during the communication between the physical and application layers

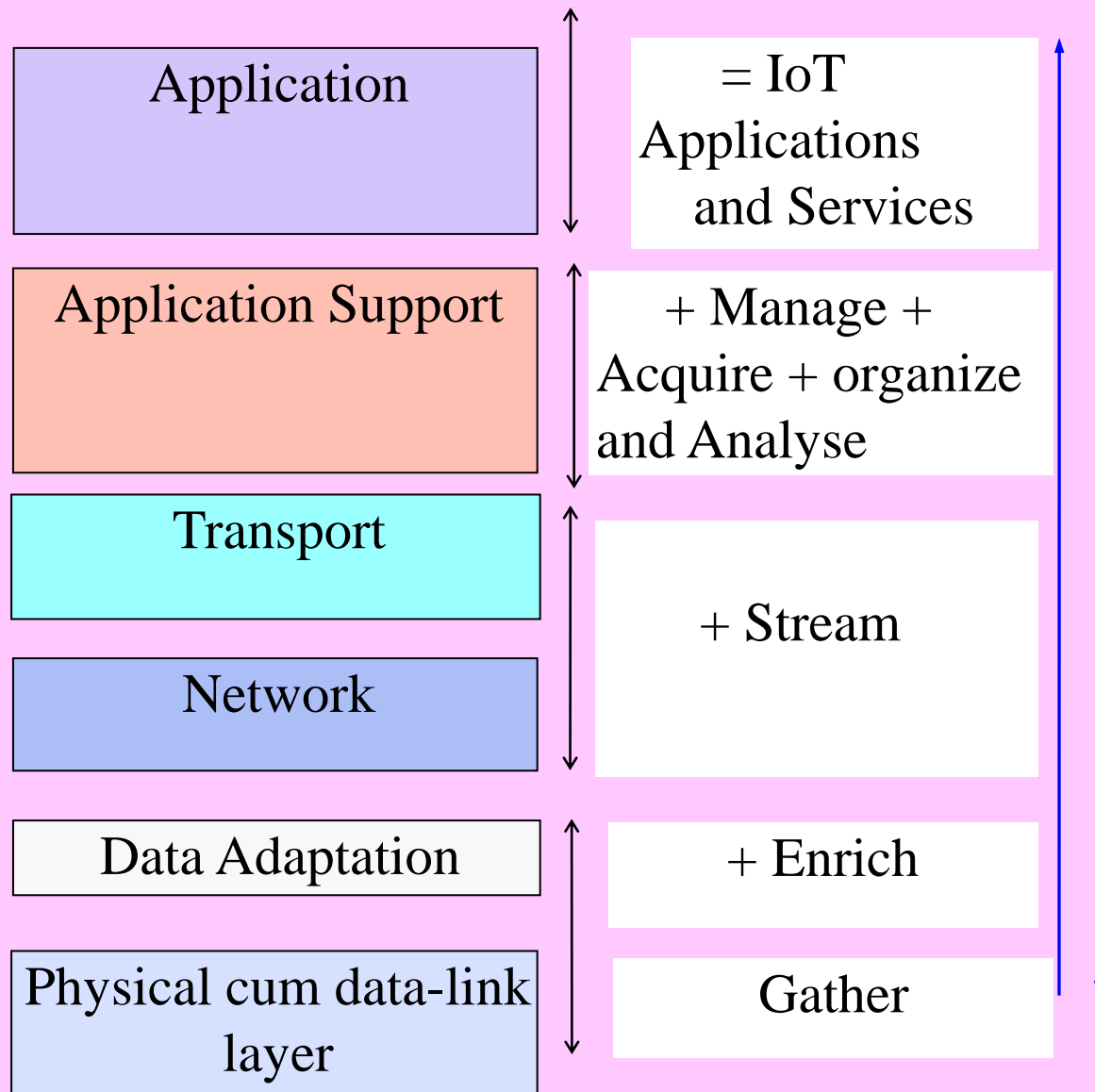


Fig. 2.1 IETF Six-layer modified-OSI model for IoT/M2M and similarity with a conceptual framework Equation for IoT Apps and Services 5

# Data Interchange in Streetlight Example Layer 1

- Layer 1: smart sensing and data-link circuit with each streetlight for transferring the sensed data to the layer 2

# Data Interchange in Streetlight Example Layer 2

- Group controller controls a group of streetlights as per the program-commands from a Central station
- Layer 2: **Data Adaptation** the group-controller receives data of each group through Bluetooth or ZigBee, then aggregates and compacts the data for communication to Internet,

# Data Interchange in Streetlight

## Example Layers 3 and 4

- Layer 3: **Network** stream on the **Internet** to next layer
- Layer 4: **Transport** layer for device identity management, identity registry and data routing to next layer



# Data Interchange in Streetlight Example Layers 5 and 6

- Layer 5: Application support by data managing, acquiring, organising and analysing

# Data Interchange in Streetlight Example Layer 6

- Layer 6: Application a remotely stored service program which issues the commands or programs the firmware at the service controllers
- Service controllers switch on-off, and monitor each group of streetlights in whole of the city.

# 2. ITU-T reference model

Application (Services and Applications capabilities)

Services and Application Support layer (Generic and Specific support capabilities)

Network layer (Transport and Network capabilities)

Device layer (Device and Gateway Capabilities)

**Fig. 2.2 ITU-T Reference Model**

# ITU-T Reference Model Four-Layers' capabilities

- Data communicate from device-end (Layer 1) to Application end (Layer 4)
- Data stack creates by the processes at in-between layers; between the top layer 4 and bottom functional-layer 1.
- Stack means Data part + protocol header bits/words which interchanges between two layers

# ITU-T Four Capabilities Layers

- Data also receives at the device layer (layer 1) from an Application, Service or Process end (Layer 4)
- Data stack processes bottom device layer to top functional-layer

# Device layer 1

- Device and Gateway Capabilities
- (For example, Physical Devices' Functions in CISCO Reference Architecture)

## Network layer 2

- Transport and Network capabilities
- (For example, Connectivity layer in CISCO Reference Architecture)



# Services and Application Support layer 3

- Generic and Specific support capabilities
- [For example, Data abstraction, Accumulation, Elements Analysis and Transformation (CISCO Reference Architecture)]

# Application Layer 4

- Services and Applications
- (Collaboration, Processes and Application in CISCO Reference Architecture)

# Internet of RFIDs Example: Layer 1 Capabilities

- Device and gateway capabilities
- RFID physical device-cum- RFID reader acquires the ID data, and communicate the enriched data according to a wireless protocol to an access point.

# Internet of RFIDs Example: Layer 2 Capabilities

- Transport and Network capabilities
- Access network (access points and Internet connectivity to server)

# Internet of RFIDs Example: Layer 3 Capabilities

- Services and application support layer capabilities at server
- RFID devices ID registry, ID management, RFIDs data routing to server or data center, data analysis for the time series device presence and device tracked positions.

# Internet of RFIDs Example: Layer 4 Capabilities

- **Application:** Services and Applications of RFIDs
- Tracking and inventory control of goods
- Business processes, for example, for the supply-chain management.

# 3. ETSI reference model

# ETSI M2M Two domains reference model

- Data communicate from device-end (Domain 1) to Application end (Domain 2)



# ETSI M2M domains High-level capabilities

- Data stack processes between top functional-domain and bottom device domain.

# ETSI M2M:

## Device and Gateway Domain 1

- Gateway (M2M Service capabilities, Applications), M2M Area Network and M2M Devices

# ETSI M2M: Application and Network Domain 2

- Applications, Management,
- Service capabilities, and
- Core and Access Networks

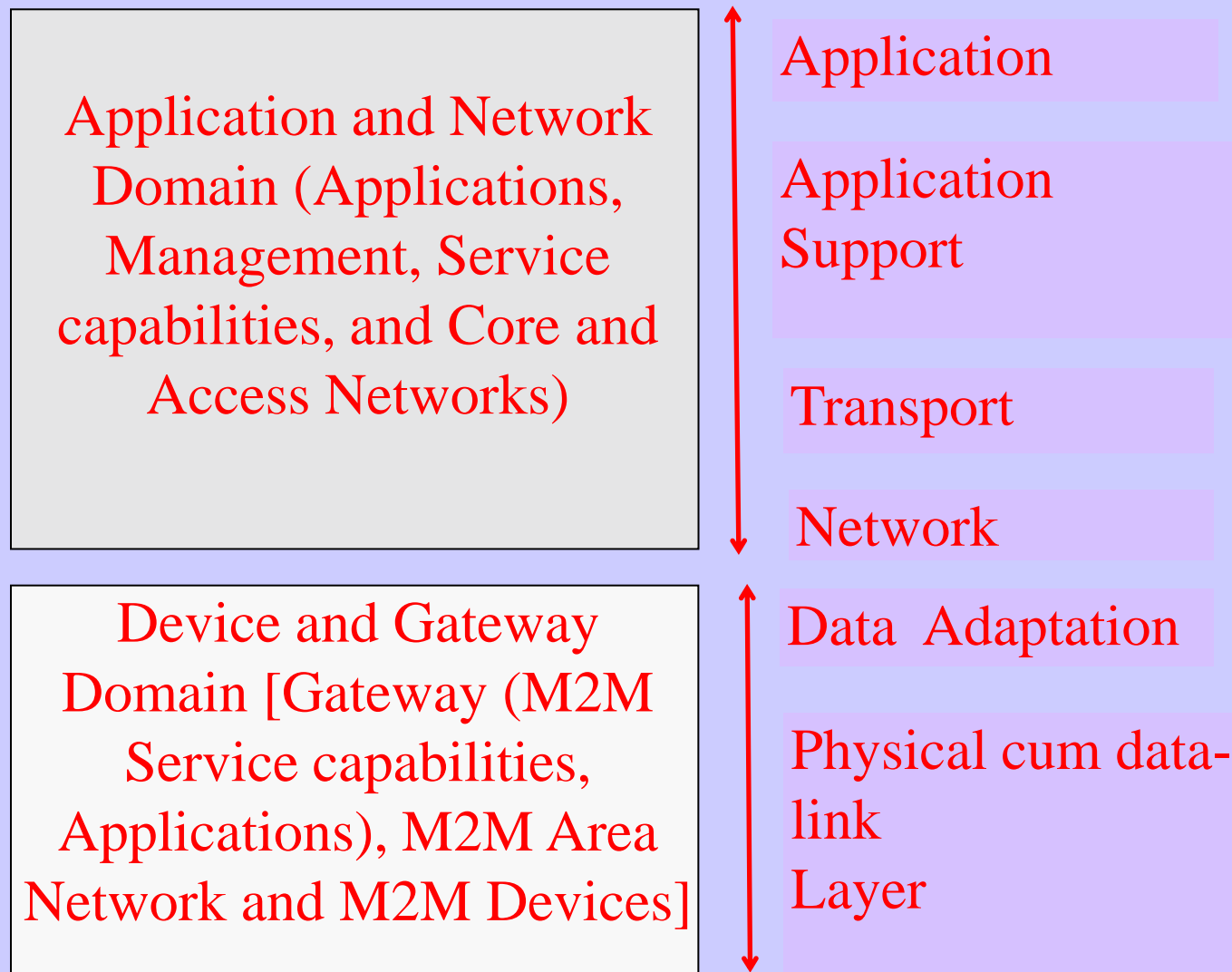


Fig. 2.3 ETSI M2M-domains architecture and its High-level capabilities, and their correspondences with six layers of modified OSI reference model

# Applications and Network Domain

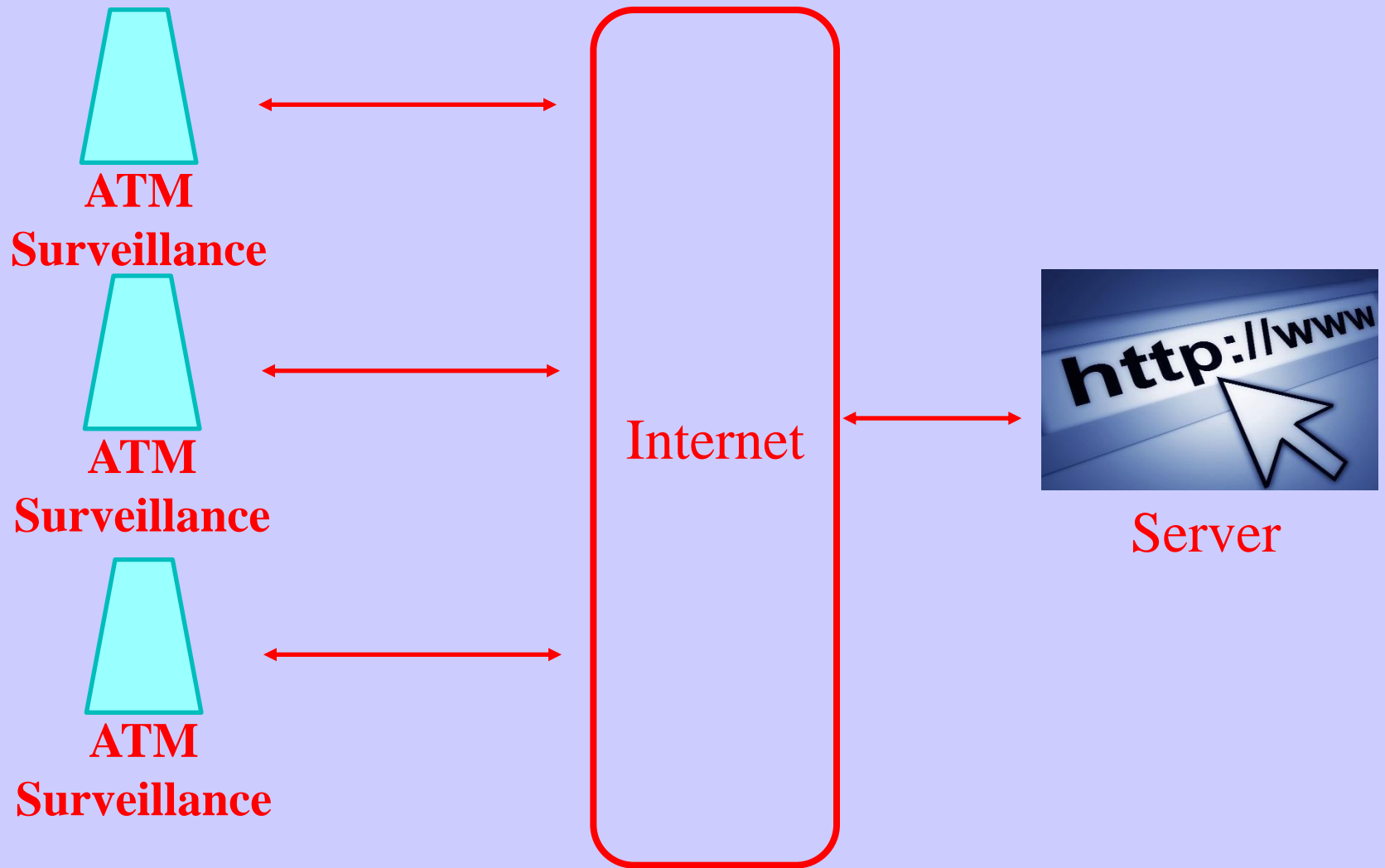
- M2M Applications, Service Capabilities, M2M Management functions
- Network Management Functions
- Core Network
- Access network

# Devices and Gateway Domain

- Gateway between M2M area Network and core and access network
- M2M service capabilities and Applications.
- M2M Area Network
- M2M Device

# Example of ETSI domains and high level architecture

- Applications and services ATMs-to-Bank Server





# Applications and Network Domain

- ATMs management functions
- Network management functions
- Banking Applications and Service capabilities for the ATMs
- Communicates with a core network
- Core connects the access networks of ATM gateways

# Devices and Gateway Domain

- Cards and ATMs
- ATM service capabilities and ATM applications
- ATM-gateway
- Cash dispensing system and a surveillance system

# Summary

We learnt

- IoT OSI Modified 6 layers model
- ITU-T Four Layer Capabilities Model
- ETSI M2M Two domains model  
(Network and Application Domain and  
Devices and Gateway Domain)

End of Lesson 1 on  
IoT Open Systems Interconnection  
(OSI) model, ITU-T reference model  
and ETSI high level M2M  
architecture