IoT Architectural View

COCSC20

Basic Premises

Devices

send and receive data interacting with the

Network

where the data is transmitted, normalized, and filtered using

Edge Computing

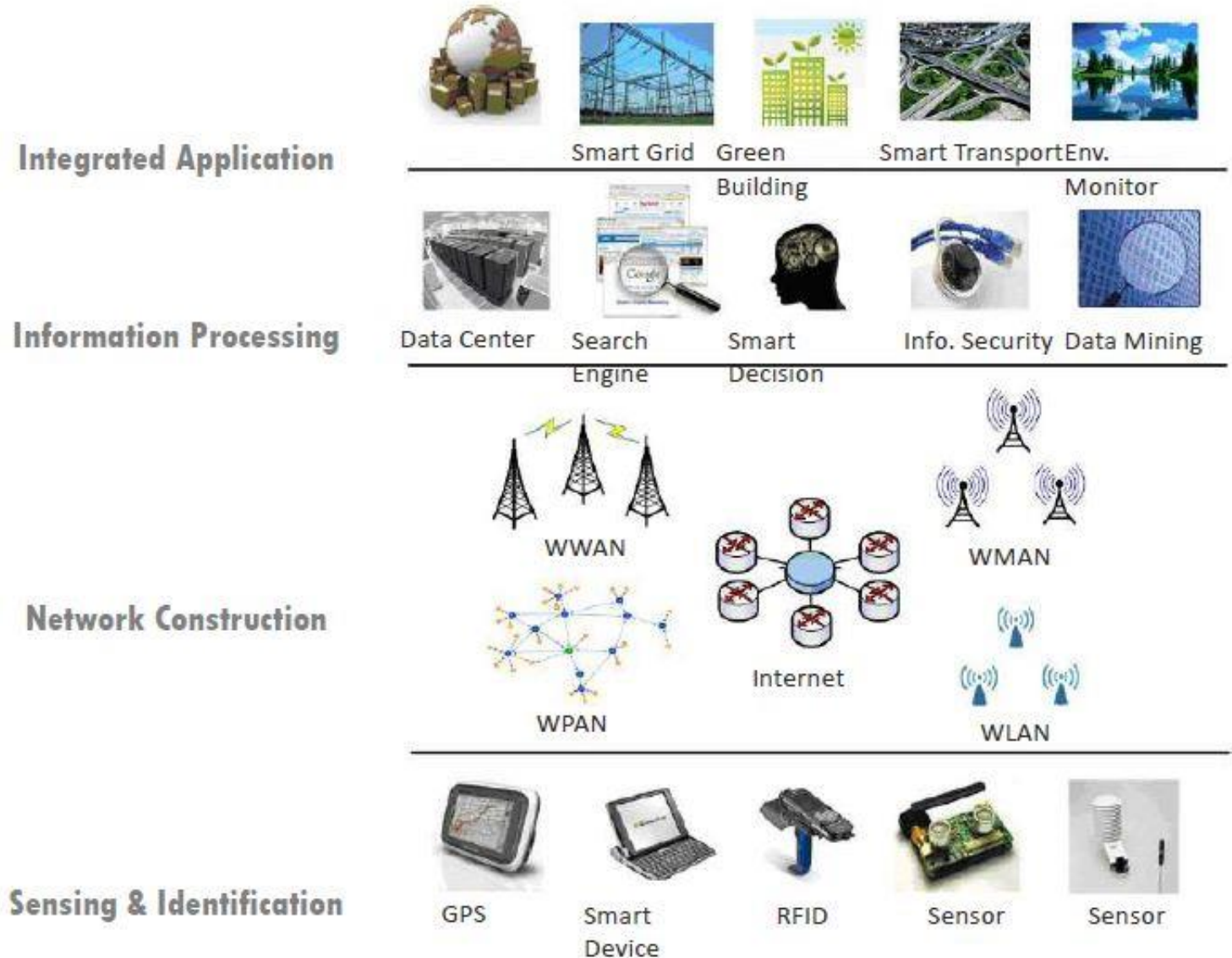before landing in

Data storage / Databases

accessible by

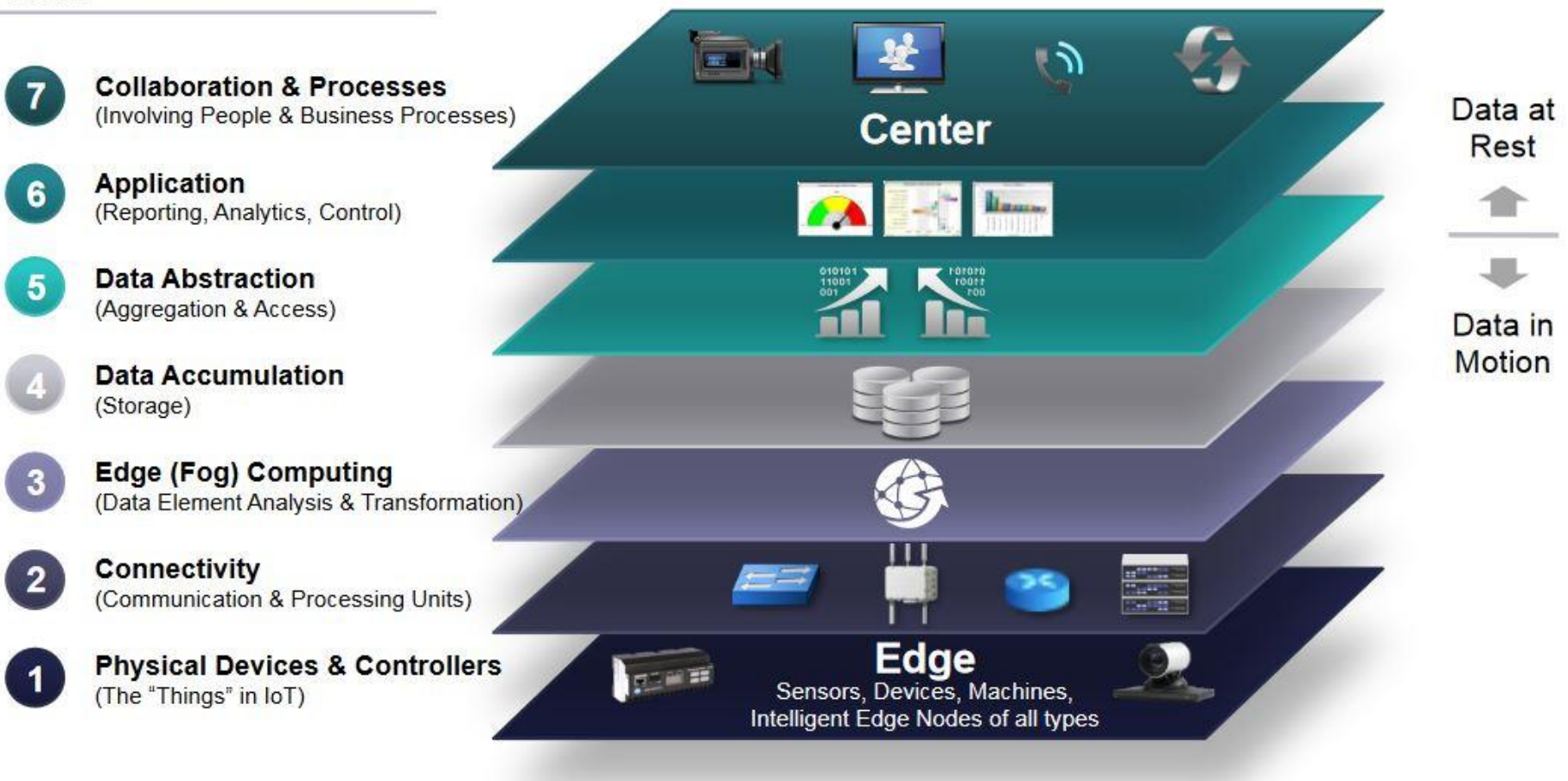**Applications**

which process it and provide it to people who will

Act and Collaborate

IoT 4 Layers model

Integrated Application

Smart Grid — Green Building — Smart Transport — Env. Monitor

Information Processing

Data Center — Search Engine — Smart Decision — Info. Security — Data Mining

Network Construction

WWAN — Internet — WMAN — WPAN — WLAN

Sensing & Identification

GPS — Smart Device — RFID — Sensor — Sensor

Reference Model

CISCO IoT Reference Model

1 **Physical Devices &
Device Controllers**
(The "Things" in IoT)

IoT "devices" are capable of:

- Analog to digital conversion, as required
- Generating data
- Being queried / controlled over-the-net

Edge
Sensors, Devices, Machines,
Intelligent Edge Nodes of all types

2 Connectivity
(Communication & Processing Units)

Level 2 functionality focuses on East-West communications

Connectivity includes:

- Communicating with and between the Level 1 devices
- Reliable delivery across the network(s)
- Implementation of various protocols
- Switching and routing
- Translation between protocols
- Security at the network level
- (Self Learning) Networking Analytics

3 **Edge (Fog) Computing**
(Data Element Analysis
& Transformation)

Level 3 functionality
focuses on North-South
communications

Include;
- Data filtering, cleanup, aggregation
- Packet content inspection
- Combination of network and data level analytics
- Thresholding
- Event generation

Data packets

Information
understandable
to the higher levels

Data Accumulation
(Storage)

4

- Event filtering/sampling
- Event comparison
- Event joining for CEP
- Event based rule evaluation
- Event aggregation
- Northbound/southbound alerting
- Event persistence in storage

Query Based Data Consumption

↓

↑

Event Based Data Generation

Making network data usable by applications

1. Converts data-in-motion to data-at-rest
2. Converts format from network packets to database relational tables
3. Achieves transition from 'Event based' to 'Query based' computing
4. Dramatically reduces data through filtering and selective storing

or

5 Data Abstraction
(Aggregation & Access)

Abstracting the data interface for applications

Information Integration

1. Creates schemas and views of data in the manner that applications want

2. Combines data from multiple sources, simplifying the application

3. Filtering, selecting, projecting, and reformatting the data to serve the client applications

4. Reconciles differences in data shape, format, semantics, access protocol, and security

6 **Application**
(Reporting, Analytics, Control)

Control
Applications

Vertical and
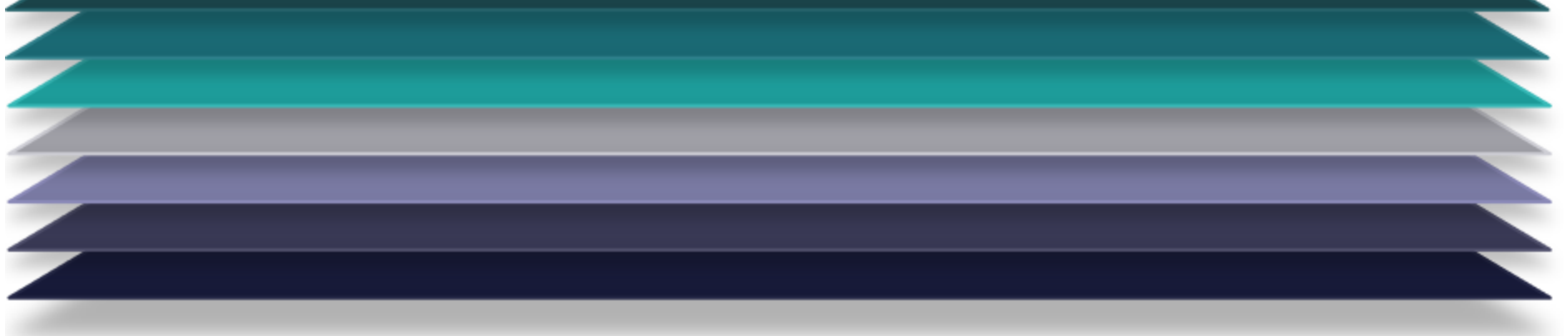Mobile
Applications

Business
Intelligence
and Analytics

7 Collaboration & Processes
(Involving people and business processes)

Center

How Many Layers in OSI model?

A. Four
B. Five
C. Six
D. Seven
E. None of the above.

TCP/IP stands for?

_____

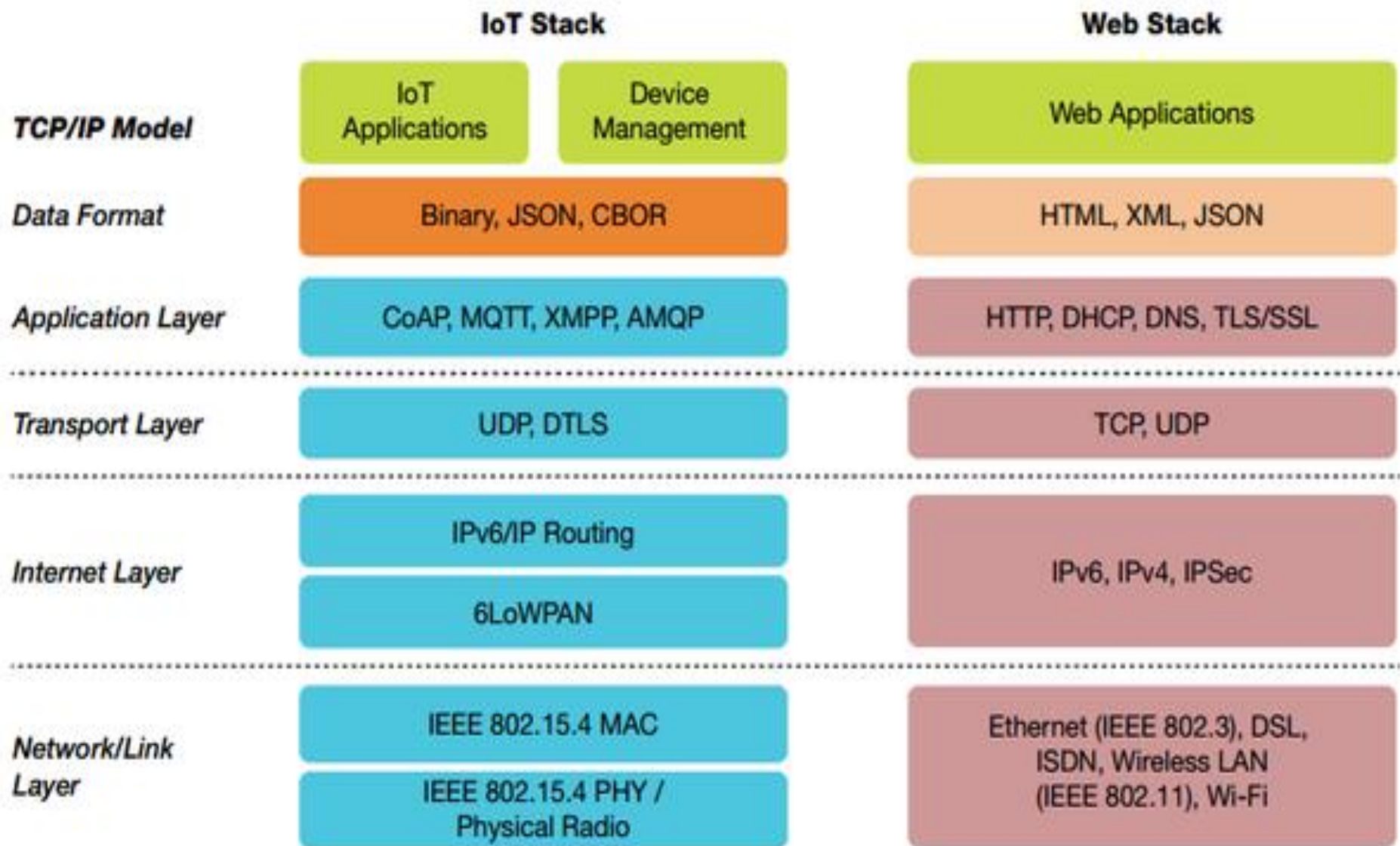# Transmission Control Protocol/Internet Networking Protocol have

A. Four

B. Five

C. Six

D. Seven

E. None of the above.

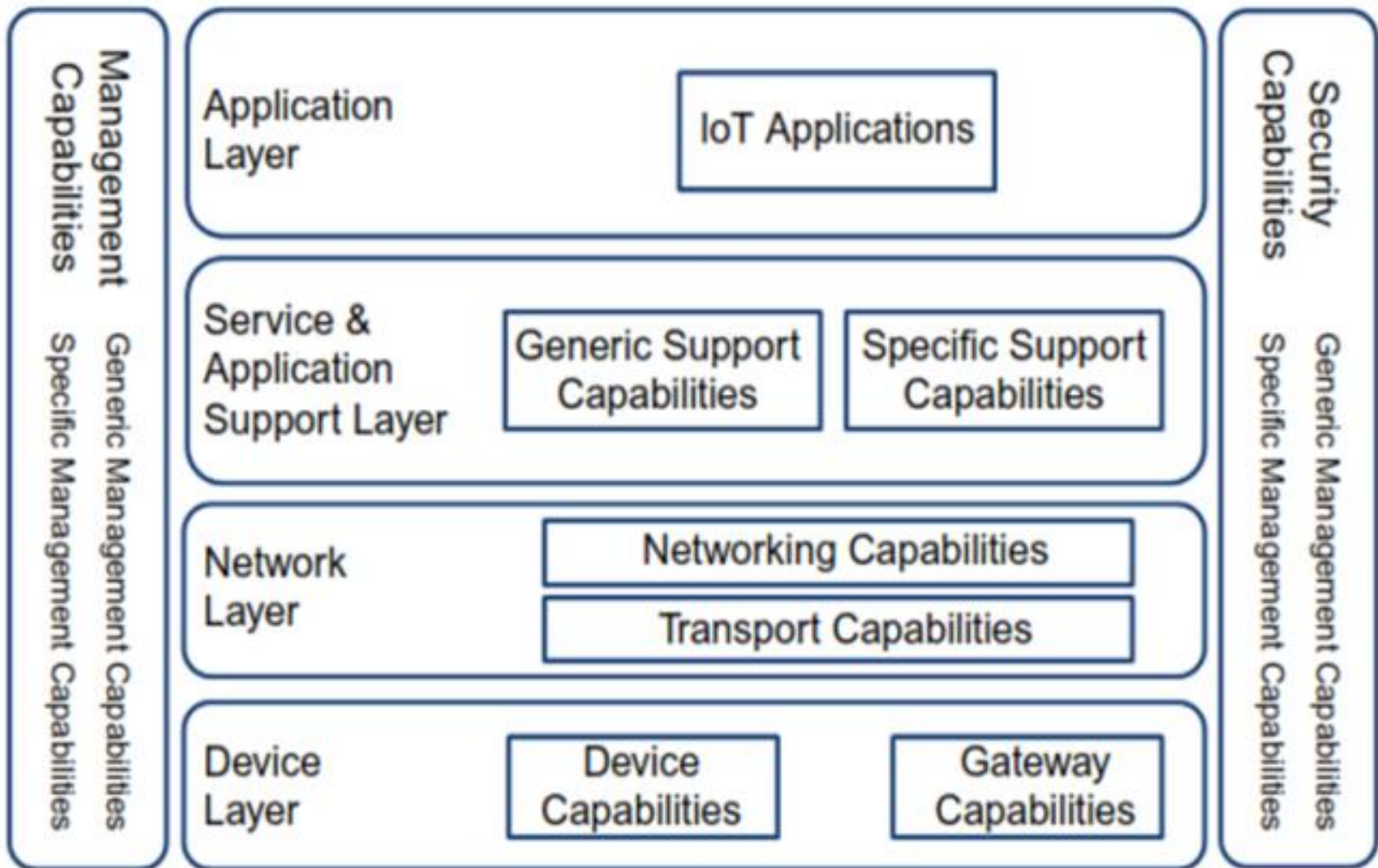| OSI MODEL	TCP/IP MODEL
Application Layer	Application Layer
Presentation Layer	
Session Layer	
Transport Layer	Transport Layer
Network Layer	Internet Layer
Data Link Layer	Network Access Layer
Physical Layer	

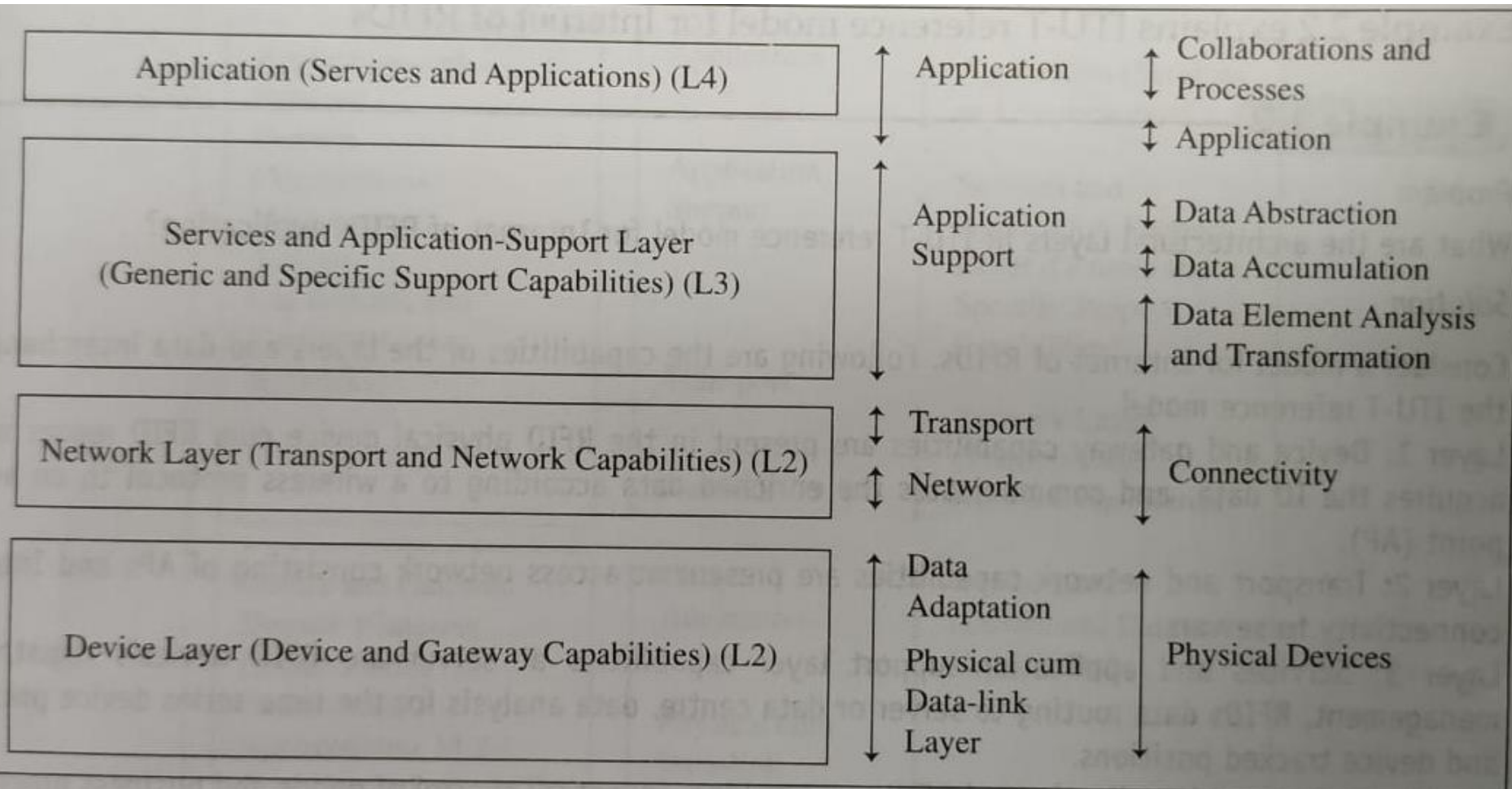|	**IoT Stack**		**Web Stack**
TCP/IP Model	IoT Applications	Device Management	Web Applications
Data Format	Binary, JSON, CBOR		HTML, XML, JSON
Application Layer	CoAP, MQTT, XMPP, AMQP		HTTP, DHCP, DNS, TLS/SSL
Transport Layer	UDP, DTLS		TCP, UDP
Internet Layer	IPv6/IP Routing / 6LoWPAN		IPv6, IPv4, IPSec
Network/Link Layer	IEEE 802.15.4 MAC / IEEE 802.15.4 PHY / Physical Radio		Ethernet (IEEE 802.3), DSL, ISDN, Wireless LAN (IEEE 802.11), Wi-Fi

ITU-T IoT Reference Model

ICMP stands for

A. Internet Connect Message Protocol
B. Internet Control Message Protocol
C. International Connect Message Protocol
D. International Control Message Protocol

Comparison

Application (Services and Applications) (L4)	↕ Application	↕ Collaborations and Processes
		↕ Application
Services and Application-Support Layer (Generic and Specific Support Capabilities) (L3)	↕ Application Support	↕ Data Abstraction
		↕ Data Accumulation
		↕ Data Element Analysis and Transformation
Network Layer (Transport and Network Capabilities) (L2)	↕ Transport	↕ Connectivity
	↕ Network	
Device Layer (Device and Gateway Capabilities) (L2)	↕ Data Adaptation	↕ Physical Devices
	Physical cum Data-link Layer	

Thank You

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