Scheme of Evaluation

KIIT Deemed to be University

Online End Semester Examination(Autumn Semester-2020)

Subject Name & Code: **IOT(IT-3007) Regular**

Applicable to Courses: **B.Tech(IT, CSSE)** **Full Marks=50**

Time:2 Hours

SECTION-A(Answer All Questions. Each question carries 2 Marks)

Time:30 Minutes **(7×2=14 Marks)**

Question No	Question Type (MCQ/SAT)	Question	CO Mapping	Answer Key (For MCQ Questions only)
Q.No:1	(MCQ	Which one out of these is not a data link layer technology a. Bluetooth b. UART c. WiFi d. HTTP		**d. HTTP**
	(MCQ	Which one out of these is not LPWAN technologies: a. SigFox b. WiFi c. NB-IoT d. LoRa		**b. WiFi**
	(MCQ	Which of the following language is preferred for IoT analytics ? a. Python b. S c. R d. All of the mentioned		**a. Python**
	(MCQ	The method by which companies analyze customer data or other types of information in an effort to identify patterns and discover relationships between different data elements is often referred to as:		**b. Data mining**

		a. Customer data management b. Data mining c. Data digging d. None of the above		
Q.No:2	**(MCQ**	MQTT is better than HTTP for sending and receiving data. a) True b) False		**a) True**
	(MCQ	MQTT stands for _____ a) MQ Telemetry Things b) MQ Transport Telemetry c) MQ Transport Things d) MQ Telemetry Transport		**d) MQ Telemetry Transport**
	MCQ	Which protocol is lightweight? a) MQTT b) HTTP c) CoAP d) SPI		**a) MQTT**
	(MCQ	_____ allows us to control electronic components a) WebSocket API b) RESTful API c) HTTP d) MQTT		**a) RETful API**
Q.No:3	**(MCQ**	Which of the following is not a valid HTTP methods used in RESTful web services? A - OPTIONS B - DELETE C - DATE D - POST		**C - DATE**
	(MCQ	A RESTful web service usually defines a URI, Uniform Resource Identifier a service, provides resource representation such as JSON and set of HTTP Methods. A - false B - true		**B - true**
	(MCQ	Which of the following is a best practice for designing a secure RESTful web service? A - No sensitive data in URL		**C - Both of the above.**

		- Never use username, password or session token in URL , these values should be passed to Web Service via POST method. B - Restriction on Method execution - Allow restricted use of methods like GET, POST, DELETE. GET method should not be able to delete data. C - Both of the above. D - None of the above.		
	(MCQ	HTTP resources are located by a. unique resource locator b. unique resource identifier c. none of the mentioned d. uniform resource identifier		**d. uniform resource identifier**
Q.No:4	**(MCQ**	Which is the software or a programming language used for controlling of Arduino? a) Assembly Language b) C Languages c) JAVA d) Any Language		**d) Any Language**
	(MCQ	Do Arduino provides IDE Environment? a) True b) False		**a) True**
	(MCQ	Does Raspberry Pi need external hardware? a) True b) False		**b) False**
	(MCQ	How many USB ports are present in Raspberry Pi 3? a) 5 b) 2 c) 4 d) 3		**c) 4**
Q.No:5	**(MCQ**	Raspbian is: a. Assembler b. Language c. Compiler d. OS		**d. OS**
	(MCQ	MQTT is: a. Based on client-server architecture		**b. Based on publish-subscribe architecture**

		b. Based on publish-subscribe architecture c. Based on both of the above d. Based on none of the above		
	(MCQ	What is the access point (AP) in wireless LAN? a. none of the mentioned b. wireless devices itself c. both (a) and (b) d. device that allows wireless devices to connect to a wired network		**d. device that allows wireless devices to connect to a wired network**
	(MCQ	IEEE 802.15.4 e is a _____ layer protocol * A)application B) datalink C) physical D) session		**B) datalink**
Q.No:6	**(MCQ**	According to analysts, for what can traditional IT systems provide a foundation when they're integrated with big data technologies like Hadoop? **A.** Big data management and data mining **B.** Data warehousing and business intelligence **C.** Management of Hadoop clusters **D.** Collecting and storing unstructured data		**A. Big data management and data mining**
	(MCQ	_____ has the world's largest Hadoop cluster. **A.** Apple **B.** Datamatics **C.** Facebook **D.** None of the mentioned		**C. Facebook**
	(MCQ	What are the five V's of Big Data?		**D. All the above**

		A. Volume **B.** Velocity **C.** Variety **D.** All the above		
	(MCQ	Hadoop is a framework that works with a variety of related tools. Common cohorts include _____ a) MapReduce, Hive and HBase b) MapReduce, MySQL and Google Apps c) MapReduce, Hummer and Iguana d) MapReduce, Heron and Trumpet		**a) MapReduce, Hive and HBase**
Q.No:7	**(MCQ**	In this type of cloud, the cloud is composed of multiple internal or external cloud. a) Private b) Public c) Protected d) Hybrid		**d) Hybrid**
	(MCQ	_____ is a paradigm of distributed computing to provide the customers on-demand, utility based computing service. a) Remote Sensing b)Remote Invocation c)Cloud Computing d)Private Computing		**c) Cloud Computing**
	(MCQ	Which of the following is not a type of cloud? a) Private b) Public c) Protected d) Hybrid		**c) Protected**
	(MCQ	These cloud services are of the form of utility computing i.e. the _____ uses these services pay-as-you-go model. a) Cloud providers b) Clients c) End users d) Cloud users		**d) Cloud users**

8 . Question 1 :What are the technology areas behind IoT's? [12]

Ans : The technology areas behind IoT are:

Wireless Sensor Network: **[2.5]**

It is a network formed by large no. of sensor nodes to detect light heat , pressure etc. i.e. used to monitor environmental and physical conditions.Each node can have several sensors attached to it.Each node can also acts as a routers.Coordinator collects data from all nodes Coordinator acts as gateway that connects WSN to the internet.

Cloud Computing : [2.5]

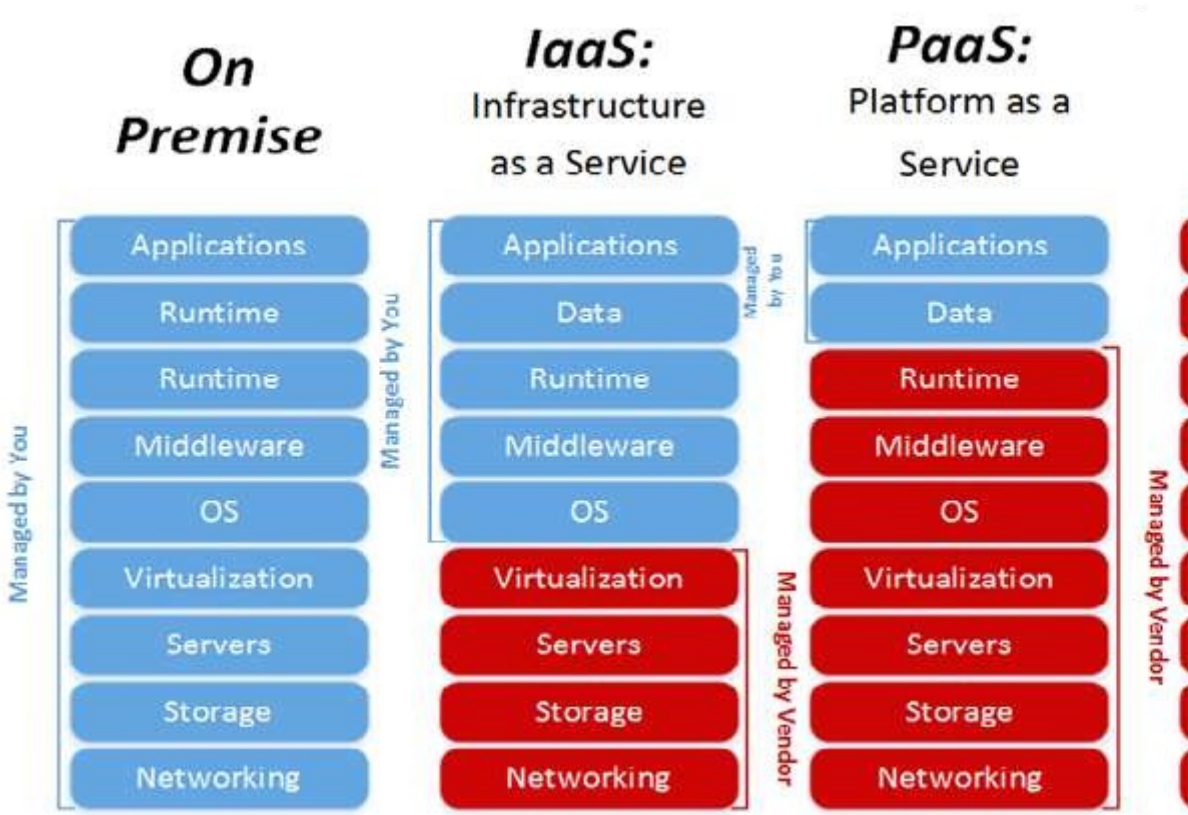
Deliver applications and services over internet Provides computing, networking and storage resources on demand Cloud Computing is a way of making use of virtual computer world wide using the same personalized experience.

Types of Cloud computing services

IaaS(Infrastructure as a Service),

PaaS(Platform as a Service and

SaaS(Software as a Services)



Big Data Analy

Collection of da process and analy

Big data Analyti

Data cleansing

Data munging (D

Data Processing a

Communicatior

Backbone of IC formats.Data enc

Other Functions are Sequence control(ordering data packets) ,Flow control(controlling transfer rate) ,Retransmission of lost packets

Embedded Systems: **[2]**

A microcontroller-based, software-driven, reliable, real- time control system, designed to perform a specific task.It can be thought of as a computer hardware system having software embedded in it.An embedded system can be either an independent system or a part of a large system.

Question 2 :What are some innovative applications which a smart city can deploy?[12]

Classification based on following domain:

- Natural resources and energy(smart grid, lighting, renewable energy, waste management, water management,..) [2]

-Transport and mobility(city logistics, smart trafficking,,) [2]

-Smart building(facilities service, house quality, construction service..) [2]

-Daily life(entertainment, hospitality, pollution control..) [2]

-Government(e-governance, trans

-Economy & society(innovation,

Question 3: Briefly explain

Net Diagram

Describe about 40 pins(if you want you may classify on some basis and discuss(like power pin, digital pin, analogy pin..etc)) [10]

Question 9:

1st question: Specify functions of CoAP, RESTful HTTP, MQTT, AMTP,DDS in IoT applications.

Ans: **CoAP:** **[2.5]**

The Constrained Application Protocol (CoAP) is another session layer protocol designed by IETF Constrained RESTful Environment (Core) working group to provide lightweight RESTful (HTTP) interface. Representational State Transfer (REST) is the standard interface between HTTP client and servers. However, for lightweight applications such as IoT, REST could result in significant overhead and power consumption. CoAP is designed to enable low-power sensors to use RESTful services while meeting their power constrains. It is built over UDP, instead of TCP commonly used in HTTP and has a light mechanism to provide reliability. CoAP architecture is divided into two main sublayers: messaging and request/response. The messaging sublayer is responsible for reliability and duplication of messages while the request/response sublayer is responsible for communication.

RESTful HTTP :
[2.5]

The Representational State Transfer (REST) architectural style is a set of guidelines and best practices for building distributed hypermedia systems. At its core is a set of constraints, which when fulfilled enable desirable properties for distributed software systems such as scalability and modifiability. When REST principles are applied to the design of a system, the result is often called RESTful and in particular an API following these principles is called a RESTful API.

MQTT:
[2.5]

Message Queue Telemetry Transport (MQTT) was introduced by IBM in 1999 and standardized by OASIS in 2013. It is designed to provide embedded connectivity between applications and middleware's on one side and networks and communications on the other side. It follows a publish/subscribe architecture, where the system consists of three main components: publishers, subscribers, and a broker. From IoT point of view, publishers are basically the lightweight sensors that connect to the broker to send their data and go back to sleep whenever possible. Subscribers are applications that are interested in a certain topic, or sensory data, so they connect to brokers to be informed whenever new data are received. The brokers classify sensory data in topics and send them to subscribers interested in the topics.

AMQP:
[2.5]

The Advanced Message Queuing Protocol (AMQP) is another session layer protocol that was

designed for financial industry. It runs over TCP and provides a publish/ subscribe architecture which is similar to that of MQTT. The difference is that the broker is divided into two main components: exchange and queues. The exchange is responsible for receiving publisher messages and distributing them to queues based on pre-defined roles and conditions. Queues basically represent the topics and subscribed by subscribers which will get the sensory data whenever they are available in the queue .

DDS: **[2]**

Data Distribution Service (DDS) is another publish/subscribe protocol that is designed by the Object Management Group (OMG) for M2M communication. The basic benefit of this protocol is the excellent quality of service levels and reliability guarantees as it relies on a broker-less architecture, which suits IoT and M2M communication. It offers 23 quality-ofservice levels which allow it to offer a variety of quality criteria including: security, urgency, priority, durability, reliability, etc. It defines two sublayers: data-centric publish-subscribe and data-local reconstruction sublayers. The first takes the responsibility of message delivery to the subscribers while the second is optional and allows a simple integration of DDS in the application layer. Publisher layer is responsible for sensory data distribution.

2nd question: how does Internet of Things differ from Internet-Controlled devices?Explain with an example. **[12]**

Ans: The concept of IoT and Connected Devices is similar in nature, but they are two very different concepts. The term IoT, or the Internet of Things, was introduced by programmers at MIT in the 1990s. The main premise of IoT is to connect all electronic devices and gadgets over a common medium, the internet. The IoT is a system of connected devices, gadgets, and computational devices, with embedded systems that allow sharing of data over the internet.

Connected Devices are devices who have a primary purpose of communication. Connected devices operate over a common network and exchange information. However, connected devices are very much different from IoT devices. The only purpose if Connected Devices over a network is the communication between them.

IoT devices are devices that are connected over the internet, and the main purpose of IoT-enabled devices is continuous exchange of data, and making this data available to other IoT devices, thus facilitating a continuous learning process.

3rd question: What are RFIDs? Bring out 4 differences between M2M and IoT.Mention the various Data Link Layer Protocols with respect to IoT.

Ans:

RFID: [2]

Radio-frequency identification (**RFID**) uses electromagnetic fields to automatically identify and track tags attached to objects. An RFID tag consists of a tiny radio transponder; a radio receiver and transmitter. When triggered by an electromagnetic interrogation pulse from a nearby RFID reader device, the tag transmits digital data, usually an identifying inventory number, back to the reader. This number can be used to track inventory goods.There are two types of RFID tags:*Passive tags* are powered by energy from the RFID reader's interrogating radio waves and *Active tags* are powered by a battery and thus can be read at a greater range from the RFID reader; up to hundreds of meters.

Differences between M2M and IoT. [4]

M2M	IOT
It is Machine to Machine communication and completely hardware based.	It’s Machine to Machine, Machine to sensors, or Humans to Machines. And software based.

M2M is a point to point communication and uses non –IP protocols.	Its uses IP networks and protocols as the communication is multipoint.
Limited integration option devices must have corresponding communication standards	Unlimited integration option, but requires a solutions that can manage all the communication
These devices don't rely on internet.	Devices required internet connections.

Data Link Layer Protocols with respect to IoT: **[6]**

Link Layer (description of each protocols)

802.3 – Ethernet

802.11 – WiFi

802.16 – WiMax

802.15.4 – LR-WPAN(Low Rate Wireless Personal Area Network)

2G/3G/4G

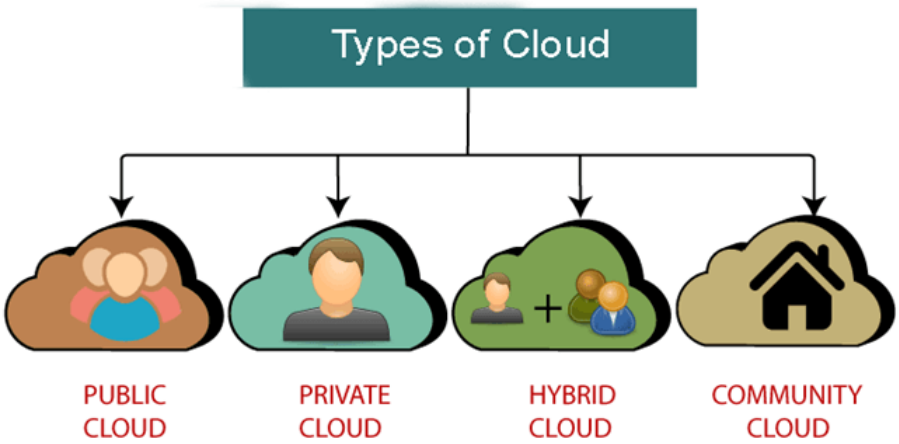
Question 10:

1st question: Explain the various services and deployment models of cloud computing. [12]

There are the following three types of cloud service models:

Infrastructure as a Service (IaaS)
Platform as a Service (PaaS)
Software as a Service (SaaS)

IaaS	Paas	SaaS
It provides a virtual data center to store information and create platforms for app development, testing, and deployment.	It provides virtual platforms and tools to create, test, and deploy apps.	It provides web software and apps to complete business tasks.
It provides access to resources such as virtual machines, virtual storage, etc.	It provides runtime environments and deployment tools for applications.	It provides software as a service to the end-users.
It is used by network architects.	It is used by developers.	It is used by end users.
IaaS provides only Infrastructure.	PaaS provides Infrastructure+Platform.	SaaS provides Infrastructure+Platform +Software.

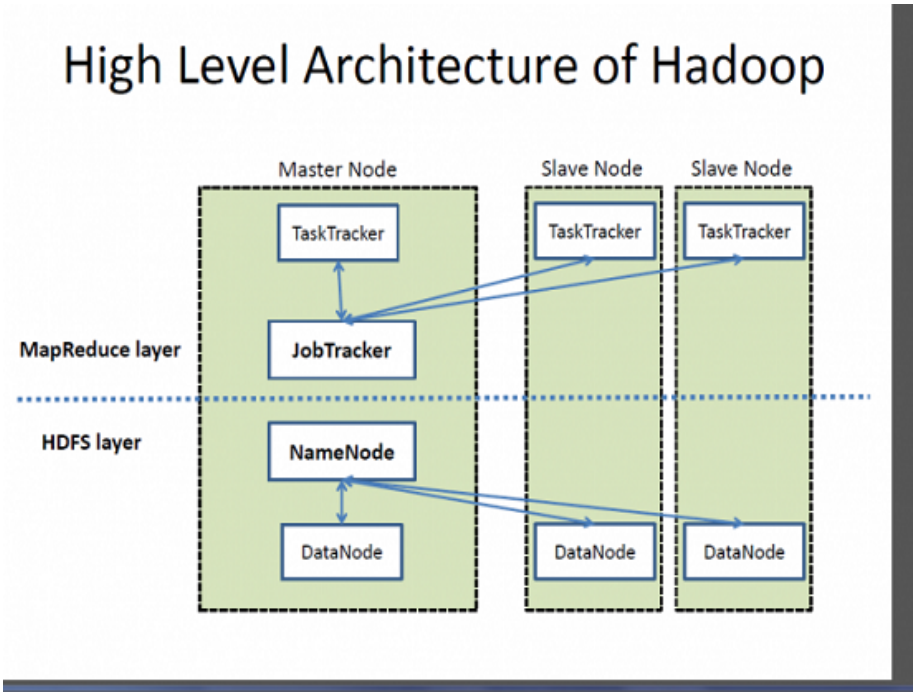


Parameter	Public Cloud	Private Cloud	Hybrid Cloud	Community Cloud
Host	Service provider	Enterprise (Third party)	Enterprise (Third party)	Community (Third party)
Users	General public	Selected users	Selected users	Community members
Access	Internet	Internet, VPN	Internet, VPN	Internet, VPN
Owner	Service provider	Enterprise	Enterprise	Community

2nd question: What do you mean by Data analytics for IoT? Explain in brief about Map Reduce and HDFS with the help of a diagram(architecture diagram of HADOOP). Also mention two difference between Qualitative and Quantitative Data Analytics.

Ans:

Data analysis is a process of : inspecting, cleansing, transforming and modeling data with the goal of discovering useful information, informing conclusions and supporting decision-making.



MapReduce algorithms help organizations to process vast amounts of data, parallelly stored in the **Hadoop** Distributed File System (**HDFS**). It reduces the processing time and supports faster processing of data. This is because all the nodes are working with their part of the data, in parallel.

QUALITATIVE ANALYSIS VERSUS QUANTITATIVE ANALYSIS

Qualitative analysis	Quantitative analysis
It is a subjective analysis that is more concerned with non-statistical data that cannot be computed	It is an objective analysis that quantifies data
Typical data include color, gender, nationality, religion and many more	Typical data include measurable quantities such as length, size, weight, mass and many more
The analysis is used to understand why a certain phenomenon occurs	The analysis is concerned with how many or how much a certain phenomenon occurs
Sample is small and is non-representative of the entire population	The sample is large and can be generalized to cover the entire population
Interprets and understands social interactions	Test hypotheses and give future predictions
Research methodology is exploratory	Research methodology is often conclusive

DifferenceBetween.net

3rd question: Bring out the difference between Rest and Web socket API with the help of a real time example.

Ans: **[12]**

In IoT, there are 2 communication APIs –

- REST Based Communication APIs
- Web Socket Based Communication APIs

Web service can either be implemented using REST principles or using Web Socket Protocol –

1. REST Based Communication API :

REpresentational State Transfer (REST) is a set of architectural principles by which you can design web

services and web APIs that focus on a system's resources and how resource states are addressed and transferred. REST APIs follow the request-response communication model. The REST architectural constraints apply to the components, connectors, and data elements, within a distributed hypermedia system.

2. Web Socket Based Communication APIs :

Web Socket APIs allow bi-directional, full-duplex communication between clients and servers. It follows the exclusive pair communication model. This Communication API does not require a new connection to be set up for each message to be sent between clients and servers. Once the connection is set up the messages can be sent and received continuously without any interruption. WebSocket APIs are suitable for IoT Applications with low latency or high throughput requirements.

Difference between Rest API and Web Socket API :

REST API	WEB SOCKET API
It is Stateless protocol. It will not store the data.	It is Stateful protocol. It will store the data.
It is Uni-directional. Only either server or client will communicate.	It is Bi-directional. Messages can be received or sent by both server or client.
It is Request-response model.	It is Full duplex model.
HTTP request contains headers like head section, title section.	It is suitable for real time applications. It does not have any overhead.
New TCP connection will be set up for each HTTP request.	Only Single TCP connection.
Both horizontal and vertical scaling (we can add many resources and number of users both horizontally and vertically).	Only vertical scaling (we can add resources only vertically).
It depends upon the IP address and port number to retrieve the data.	It depends upon the HTTP methods to retrive the data.
It is slower than web socket regarding the transmission of messages.	web socket transmits messages very fastly than REST API.

It does not need memory or buffers to store the data.	It requires memory and buffers to store the data.

Question 11:

1st question: Briefly explain all the required steps in IoT Design.

Ans: Neat diagram [2]

Description of each steps [10]

Steps:

Purpose & Requirements Specification

Process Specification

Domain Model Specification

Information Model Specification

Service Specifications

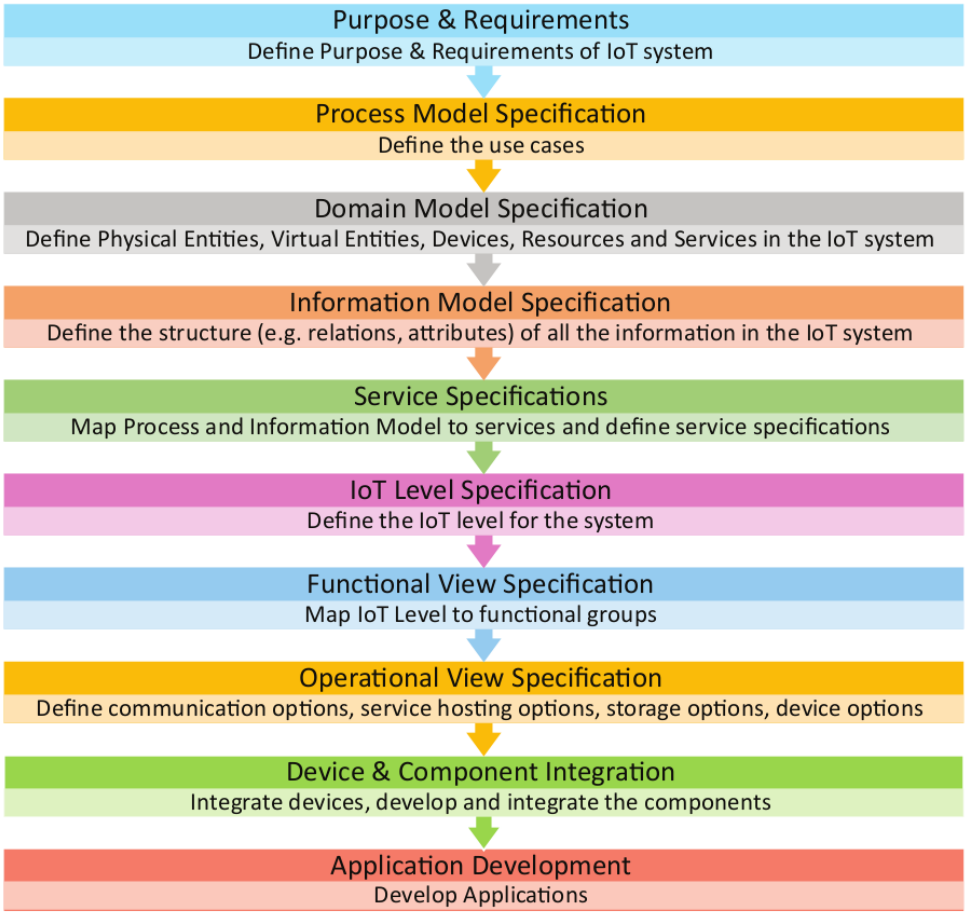
IoT Level Specification

Functional View Specification

Operational View Specification

Device & Component Integration

Application Development



Description of each steps

The first step in IoT system design methodology is to define the purpose and requirements of the system. In this step, the system purpose, behavior and requirements (such as data collection requirements, data analysis requirements, system management requirements, data privacy and security requirements, user interface requirements, ...) are captured.

The second step in the IoT design methodology is to define the process specification. In this step, the use cases of the IoT system are formally described based on and derived from the purpose and requirement specifications.

The third step in the IoT design methodology is to define the Domain Model. The domain model describes the main concepts, entities and objects in the domain of IoT system to be designed. Domain model defines the attributes of the objects and relationships between objects. Domain model provides an abstract representation of the concepts, objects and entities in the IoT domain, independent of any specific technology or platform. With the domain model, the IoT system designers can get an understanding of the IoT domain for which the system is to be designed.

The fourth step in the IoT design methodology is to define the Information Model. Information Model defines the structure of all the information in the IoT system, for example, attributes of Virtual Entities, relations, etc.

Information model does not describe the specifics of how the information is represented or stored. To define the information model, we first list the Virtual Entities defined in the Domain Model. Information model adds more details to the Virtual Entities by defining their attributes and relations.

The fifth step in the IoT design methodology is to define the service specifications. Service specifications define the services in the IoT system, service types, service inputs/output, service endpoints, service schedules, service preconditions and service effects.

The sixth step in the IoT design methodology is to define the IoT level for the system. In Chapter-1, we defined five IoT deployment levels.

The seventh step in the IoT design methodology is to define the Functional View. The Functional View (FV) defines the functions of the IoT systems grouped into various Functional Groups (FGs). Each Functional Group either provides functionalities for interacting with instances of concepts defined in the Domain Model or provides information related to these concepts.

The eighth step in the IoT design methodology is to define the Operational View Specifications. In this step, various options pertaining to the IoT system deployment and operation are defined, such as, service hosting options, storage options, device options, application hosting options, etc

The ninth step in the IoT design methodology is the integration of the devices and components.

The final step in the IoT design methodology is to develop the IoT application.

2nd question: With the help of a block diagram explain Level 4 and Level 6 deployment Templates.

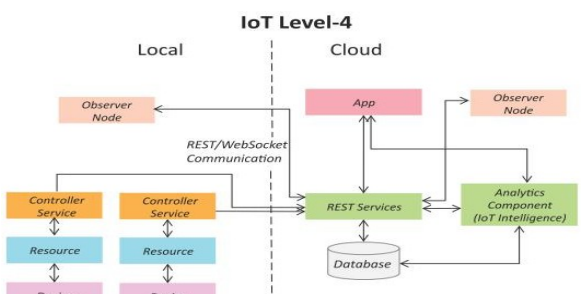
Ans:

Level 4 : [6]

A level-4 IoT system has multiple nodes that perform local analysis. Data is stored in the cloud and application is cloud-based.

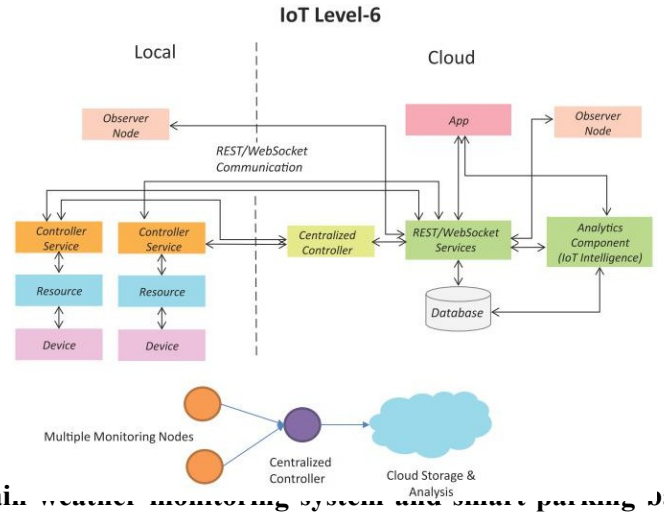
It contains local and cloud- based observer nodes which can subscribe to and receive information collected in the cloud from IoT devices.

It IoT systems are suitable for solutions where multiple nodes are required, the data involved is big and the analysis requirements are computationally intensive.



Level 6: [6]

A level-6 IoT system has multiple independent end nodes that perform sensing and/or actuation and send data to the cloud.Data is stored in the cloud and application is cloud-based.The analytics component analyzes the data and stores the results in the cloud database.The results are visualized with the cloud-based application.The centralized controller is aware of the status of all the end nodes and sends control commands to the nodes.



3rd question: Explai.. weather monitoring system and smart parking based on various design methodology.

Ans:

Smart Parking [6]

Weather Monitoring [6]