Kongu Engineering College
Continuous Assessment Test-III
20CST62 Internet of Things and Cloud

PART-A

ANSWER ALL THE QUESTIONS

1. **Mention any 4 cloud service providers.**
   - Microsoft Azure
   - Google Cloud Platform
   - Alibaba Cloud
   - Salesforce
   - IBM
   - Digital Ocean

2. **Categorize the different architectural styles used for process innovation.**
   - Loose Coupling.
   - Distributed Application.
   - Stateless Component.
   - Data Access Component.
   - Idempotent Processor.
   - Transaction-based Processor.
   - Timeout-based Message Processor.
   - Multi-Component Image.

3. **State the role of special purpose cloud and specify any two special purpose clouds.**

   Apart from the generic public, private, community, and hybrid clouds, there are several purpose-specific clouds being built and sustained by various organizations. For example, there are clouds being built and sustained by various organizations. For example, there are mobile backup clouds for stocking up all kinds of mobile messages, videos, audio clips, photos, e-mails, and so on.
   - iCloud
   - Dropbox

4. **Point out the significance of Edge/Fog clouds.**

   Fog and edge computing push both data and intelligence to analytic platforms that are situated either on, or close to where the data originated from. This helps to reduce latency cost and increase user experience.

5. **Recall the four processes expected to support with software defined system.**
   - Abstraction

- Instrumentation
- Automation
- Orchestration.

6. **List AWS IoT core services (any 4).**
   - AWS Lambda,
   - Amazon Kinesis,
   - Amazon S3,
   - Amazon SageMaker,
   - Amazon DynamoDB,
   - Amazon CloudWatch,
   - AWS CloudTrail, and
   - Amazon QuickSight

7. **Determine the role of AWS Lambda function for developing IoT application.**
   - Lambda function when you want to invoke another AWS service or a third-party service.
   - When an incoming IoT message triggers the rule, AWS IoT invokes your Lambda function asynchronously and passes data from the IoT message to the function.

8. **Highlight the key features of using Rules Engine for building IoT applications.**
   The technical definition of rules engine is of expert systems that analyze collected data and determine if they meet the necessary conditions needed to take specific actions. It comprises of the following components:
   - **Message** – This refers to the incoming event which generally comes from IoT hardware. These events can be sensor data, RPC requests, or device/equipment life-cycle/work-cycle events.
   - **Rule Node** – The rule node provides the logic the rules engine operates with.
   - **Rule Chain** – Connected rule nodes receive outbound messages according to the rule chain that defines their connections.

9. **Differentiate between different types of cloud.**

Public Cloud	Private Cloud	Hybrid Cloud
No maintenance costs	Dedicated, secure	Policy-driven deployment
High scalability, flexibility	Regulation compliant	High scalability, flexibility
Reduced complexity	Customizable	Minimal security risks
Flexible pricing	High scalability	Workload diversity supports high reliability
Agile for innovation	Efficient	Improved security

10. Specify the benefits of AWS IoT analytics.

- Better visibility and control result in faster decision-making.
- Scalability of business requirements and expansion into other markets.
- Automation results in lower operational costs and greater resource utilization.
- New revenue streams as a result of operational difficulties being resolved.

PART-B
ANY THREE QUESTIONS

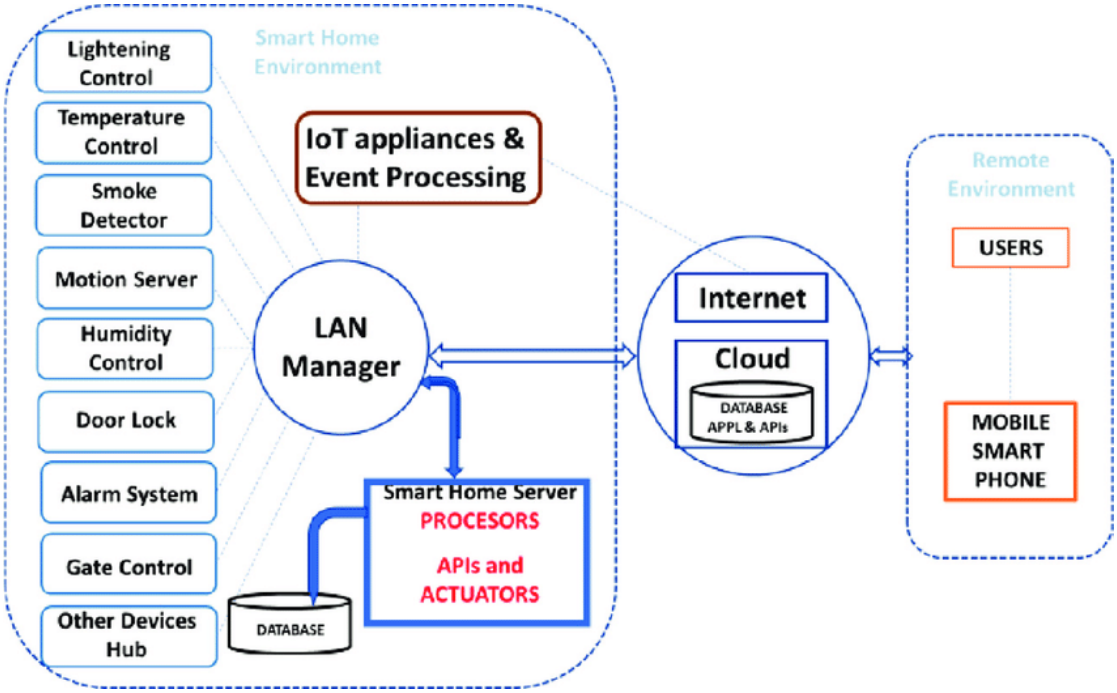
11. Home is the most lively and lovely place for people in their everyday lives. People spend more time in their homes and hence automating home operations acquires special significance. The present day's smart home involves home servers inside homes for integrating diverse household electronics and for their effective control and usage. Describe the suitable cloud-based solutions to the smarter environment for home automation.

Explanation about smarter environment for home automation - (5)

A Smart home is a solution to the normal home with smartness enabled into the things inside a home such as appliances, lighting, heating, air conditioning, TVs, computers, entertainment systems, big home appliances such as washers/dryers and refrigerators/freezers, security and camera systems capable of communicating with each other and being controlled remotely by a time schedule, phone, mobile or internet. These systems consist of switches and sensors connected to a central hub controlled by the home resident using wall-mounted terminal or mobile unit connected to internet cloud services.

Installation of smart products provide convenience and savings of time, money and energy. Such systems are adaptive and adjustable to meet the ongoing changing needs of the home residents. The basic architecture enables measuring home conditions, process instrumented data, utilizing microcontroller-enabled sensors for measuring home conditions and actuators for monitoring home embedded devices.

Sensors collect internal and external home data and measure home conditions. These sensors are connected to the home itself and to the attached-to-home devices. The sensors' data is collected and continually transferred via the local network, to the smart home server



Cloud-based Solutions: **- (5)**

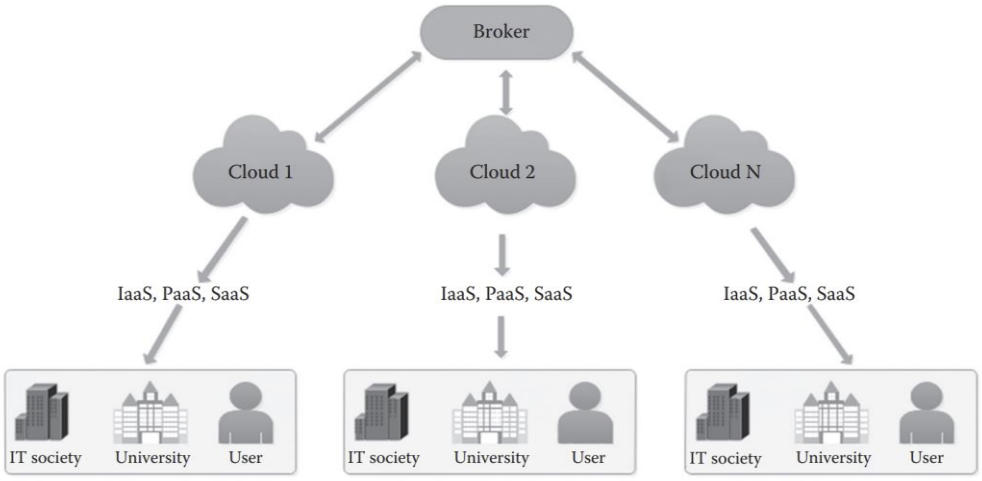
Cloud Deployment Model:

Normal computer system can be used to control a single home, provided the user should be inside the home. If the user moves out of the home and wishes to control the things from a remote location, then we can setup a private cloud, connect the devices to this cloud and monitor the devices. If we want to control the things in multiple homes in a particular street/city/area, it is better to go for public cloud model, as the volume of data get increased and the private cloud setup may not be sufficient in terms of storage and processing capacity. Hence, it is a right choice avail the services offered by public cloud providers.

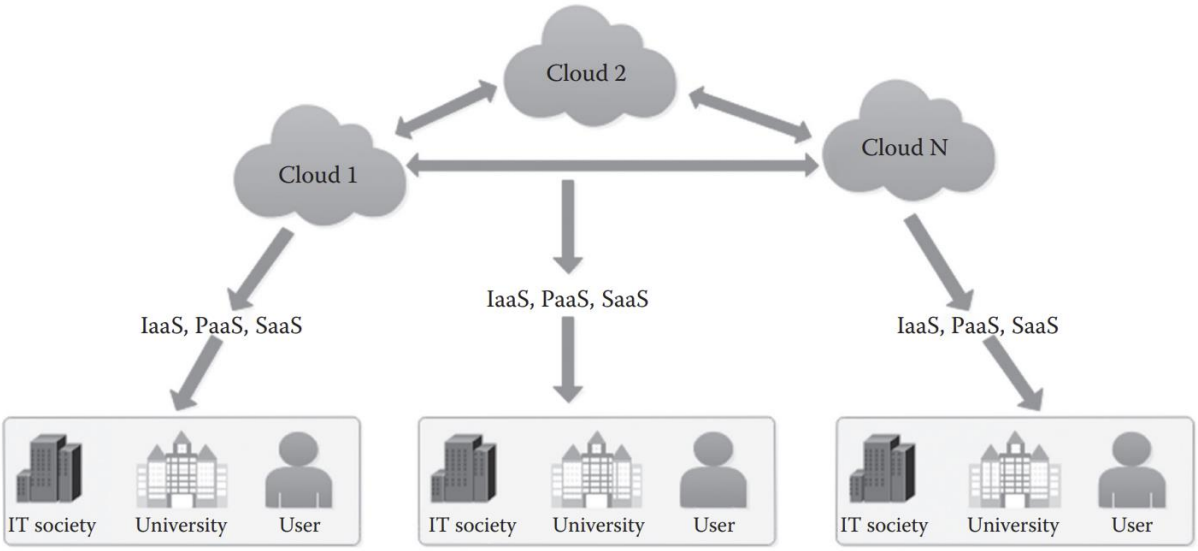
Cloud Service Model:

Both Platform-as-a-Service (PaaS) and Infrastructure-as-a-Service (IaaS) need to be used to collect, process, make decisions, and convey the decision to the end user. IaaS service such as S3 can be used to store the data that has been collected from the IoT devices/Sensors, EC2 can be used to process the collected data, AWS IoT Core services can be used to connect the devices to cloud, frame rules to act on abnormal conditions and send response message to the user. Suitable PaaS service can be used to develop a web or mobile application so that the users can control the things inside their home from anywhere at anytime.

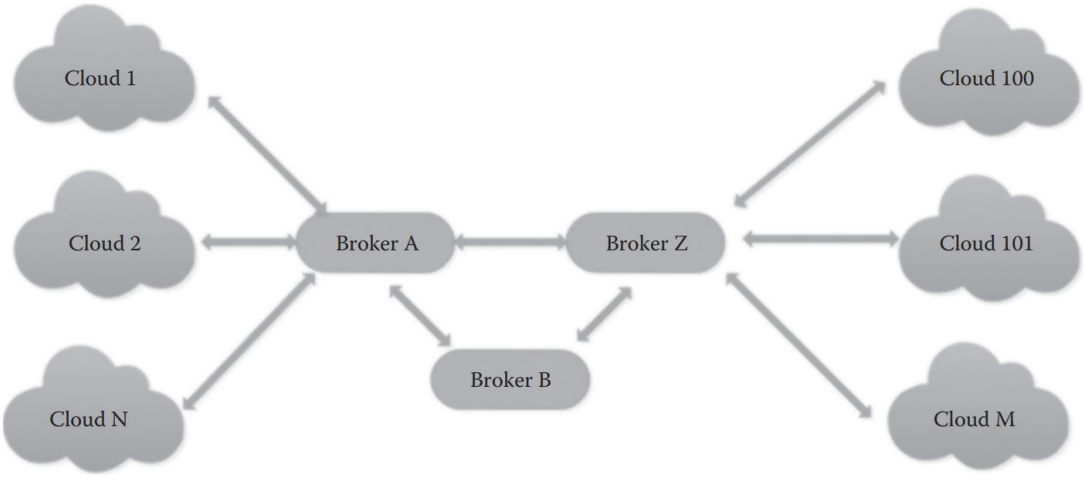
12. a. Elucidate the details of different cloud federations approaches with a neat sketch.



Centralizred approach



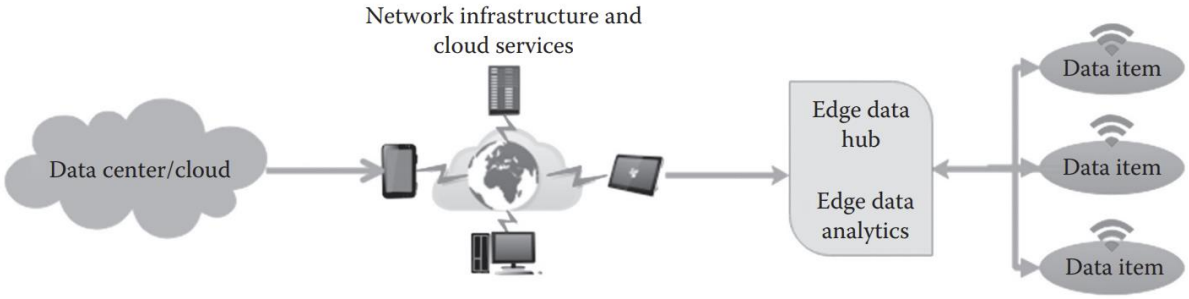
Decentralized Approach



Hierarchical Approach

12. b. Illustrate the various architectural components of smarter traffic system and explain each component in detail.

1. As articulated above, as far as physical components are concerned, a smarter traffic system has to include traffic lights, sensors, and actuators within its jurisdictional region so that the reaction time is on the order of <10 milliseconds.
2. A miniaturized orchestration platform is an overseeing software solution, which has to be a part and parcel of the system. This module is greatly obligated to orchestrate and manage all the other software modules of the system effectively. It has to be policy-aware. That is, well-intended policies can be established easily and enforced accordingly toward effective governance



3. A centralized decision-enabling module is another noteworthy one for garnering data from all the deployed traffic lights and pushing the decisions to individual traffic lights through a messaging bus, which is another mandatory software solution for enabling data transmission on both directions.

13. Technology plays the major role in healthcare not only for sensory devices but also in communication, recording and display device. IOT serves as a catalyst for the healthcare and plays prominent role in wide range of healthcare applications. Identify the key components and steps involved in creating a web application for smart healthcare services using AWS.

Explanation about the Healthcare Services with IoT - (6)

IoT for Patients

Devices in the form of wearables like fitness bands and other wirelessly connected devices like blood pressure and heart rate monitoring cuffs, glucometer etc. give patients access to personalized attention. These devices can be tuned to remind calorie count, exercise check, appointments, blood pressure variations and much more

IoT devices enable constant tracking of health conditions. On any disturbance or changes in the routine activities of a person, alert mechanism sends signals to family members and concerned health providers.

IoT for Physicians

By using wearables and other home monitoring equipment embedded with IoT, physicians can keep track of patients' health more effectively. They can track patients' adherence to treatment plans or any need for immediate medical attention. IoT enables healthcare professionals to be more watchful and connect with the

patients proactively. Data collected from IoT devices can help physicians identify the best treatment process for patients and reach the expected outcomes.

Description about Any two Healthcare Services using IoT

Remote patient monitoring

It is the most common application of IoT devices for healthcare. IoT devices can automatically collect health metrics like heart rate, blood pressure, temperature, and more from patients who are not physically present in a healthcare facility, eliminating the need for patients to travel to the providers, or for patients to collect it themselves. IoT sensor detects a patient's unusually low heart rate may and generate an alert so that healthcare professionals can intervene.

Glucose monitoring

IoT devices provide continuous and automatic monitoring of glucose levels in patients. These devices eliminate the need to keep records manually, and they can alert patients when glucose levels are problematic. It does not consume so much electricity that it needs to be recharged frequently. It can monitor glucose level continuously without causing a disruption to patients

Heart-rate monitoring

Conventional devices for continuous cardiac monitoring used in hospitals require patients to be attached to wired machines constantly, impairing their mobility. But IoT devices make the patients free to move around as they like while ensuring that their hearts are monitored continuously.

Parkinson's disease monitoring

In order to treat Parkinson's patients most effectively, healthcare providers must be able to assess how the severity of their symptoms fluctuate through the day. IoT sensors simplifies this task by continuously collecting data about Parkinson's symptoms. At the same time, the devices give patients the freedom to go about their lives in their own homes, instead of having to spend extended periods in a hospital for observation.

Steps to Design a Web Application - (4)

1. Use AWS IoT Core services to connect the sensors and related devices with the cloud
2. Make use of AWS Elastic BeanStack to design a Web Application for delivering Healthcare services.
    a. Sign in to the AWS Management Console and open the Elastic Beanstalk console.
    b. Click on "Create a new environment" or "Get started" to begin creating a new environment.
    c. Select the application platform that matches your application. Elastic Beanstalk supports various platforms such as Node.js, Java, Python, Ruby, PHP, .NET, Go, and Docker. Choose the appropriate platform for your application.

d. Select the application code source. You can choose to upload your code directly, use a sample application, or select a code repository like AWS CodeCommit, AWS CodePipeline, or GitHub
e. Configure your environment settings. Provide a unique environment name, choose an environment tier (web server or worker environment), and select the desired environment type (single instance or load balanced).
f. Set up additional environment options if necessary. This includes specifying the instance type, configuring capacity options, selecting a VPC and subnets, and enabling features like HTTPS or SSH access.
g. Review and modify the environment settings as needed. Double-check the provided information and make any necessary modifications

14. Consider the amount of data to be transmitted, the power consumption of the devices, distance between the devices, the reliability and security of the communication. Analyse the different types of protocols for communication with and between IoT devices.

List of Protocols (any 4) - (2)

- Message Queue Telemetry Transport (MQTT)
- HyperText Transfer Protocol (HTTP)
- Constrained Application Protocol (CoAP)
- Data Distribution Service (DDS)
- WebSocket.
- Advanced Message Queue Protocol (AMQP)
- Extensible Messaging and Presence Protocol (XMPP)
- OPC Unified Architecture (OPC UA)
- MQTT: A protocol for collecting device data and communicating it to servers (D2S)
- XMPP: A best protocol for connecting devices to people, a special case of the D2S pattern, since people are connected to the servers
- DDS: A fast bus for integrating intelligent machines (D2D)
- AMQP: A queuing system designed to connect servers to each other (S2S)
- CoAP: An optimized protocol

Brief Description about any 4 Protocols - (8)