



School of Computing Skills
Session: 2020-21 (Summer Semester)
B. Voc. Program, V Semester,
2nd In-Sem. Examination

Course Code: ITN1504

Time: 1 Hour

Course Name: Internet of Things (IoT)

Max. Marks: 20

Section – A

05X01 = 05 Marks

05 objective type questions, each question carries 01 mark.

1. _____ provides virtual machines, virtual storage, virtual infrastructure, and other hardware assets.
a) SaaS
b) SaaS
c) IaaS
d) All of the mentioned
2. The huge number of devices connected to the Internet of Things has to communicate automatically, not via humans. What is this called?
a) Skynet
b) Machine 2 Machine
c) Bot 2 Bot
d) Intercloud
3. IoT is an advanced automation and analytics system which deals with?
a) sensor, networking
b) electronic
c) cloud messaging
d) All of the above
4. What is the frequency range of the ultrasonic sound waves used by the ultrasonic sensors?
a) 20000Hz to 25000Hz
b) 25KHz to 50KHz
c) 25Hz to 50Hz
d) 25Hz to 55Hz
5. In the current market scenario, IoT captures the maximum share in which one of these?
a) Security
b) Healthcare
c) Home automation
d) Industry

Section – B

03X02 = 06 Marks

03 short answer type questions, each question carries 02 marks.

1. What are the Machine to Machine (M2M) applications?
2. What is IoT Middleware? Why it is called middleware?
3. Explain different IoT analytics challenges.

Section – C

03X03 = 09 Marks

03 essay type questions, each question carries 03 marks.

1. What is M2M communication? How M2M works?
2. What is IoT analytics? Just brief types of IoT analytics.
3. What are the different categories of IoT platforms across the IoT technology stack?



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Ans. c) IaaS

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Ans. b) Machine 2 Machine

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Ans. d) All of the above

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Ans. D) 25Hz to 55Hz

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Ans. D) Industry

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1. What are the Machine to Machine (M2M) applications?

Ans. M2M Applications

The possibilities in the field of M2M can be seen in four major use cases, which we've detailed below:

Manufacturing

Every manufacturing environment—whether it's food processing or general product manufacturing—relies on technology to ensure costs are managed properly and processes are executed efficiently. Automating manufacturing processes within such a fast-paced environment is expected to improve processes even more.

Home appliances



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IoT already affects home appliance connectivity through platforms like Nest. However, M2M is expected to take home-based IoT to the next level. An M2M-capable washing machine could send alerts to the owners' smart devices once it finishes washing or drying, and a smart refrigerator could automatically order groceries from Amazon once its inventory is depleted.

Healthcare device management

One of the biggest opportunities for M2M technology is in the field of health care. With M2M technology, hospitals can automate processes to ensure the highest levels of treatment.

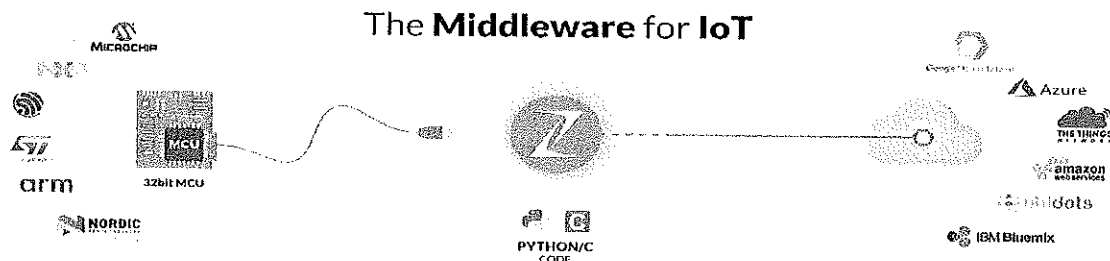
Smart utility management

In the new age of energy efficiency, automation will quickly become the new normal. As energy companies look for new ways to automate the metering process, M2M comes to the rescue, helping energy companies automatically gather energy consumption data, so they can accurately bill customers.

2. What is IoT Middleware? Why is it called middleware?

Ans. IoT Middleware:

- Middleware is software that is used to bridge the gap between applications and other tools or databases. Middleware sits between an operating system and the applications that run on it.
- It is effectively software that provides a method of communication and data management between applications that would otherwise not have any way to exchange data -- such as with software tools and databases.
- Middleware appears in many locations; however, organizations and developers make specific use of middleware to more efficiently build applications.
- Some examples of middleware activities include handling data and API management, authentication and messaging services.
- Internet of Things middleware is software that serves as an interface between components of the IoT, making communication possible among elements that would not otherwise be capable.
- Middleware connects different, often complex and already existing programs that were not originally designed to be connected.
- The essence of the Internet of Things is making it possible for just about anything (any Thing) to be connected and to communicate data over a network.
- Middleware is part of the architecture enabling connectivity for huge numbers of diverse Things by providing a connectivity layer for sensors and also for the application layers that provide services that ensure effective communications among software.
- Microsoft, Oracle, RedHat and WSO2 are among the companies that offer IoT middleware. These products provide API management as well as basic messaging, routing and message transformation. More comprehensive IoT platforms include middleware along with sensors and networking components.



Why is it called middleware?

- The name *middleware* stems from the fact that it is the software that sits between the client-side requests on the front end and the back-end resource being requested.



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- A client can make a request with network-based interactions. That client is typically an application that resides on the front end, which is where the user interacts with software.

Resources such as databases, message queues, NoSQL data stores and file servers are often referred to as being part of the back end. Middleware will sit between these ends.

3. Explain different IoT analytics challenges.

Ans. IoT Analytics Challenges

One way to view IoT analytics challenges is to consider a possible IoT deployment. Let's take the following scenario. A huge industrial food storage warehouse and distribution center uses Internet-connected devices to maintain the temperature of specific zones, such as a refrigeration area for items that need ongoing, non-freezing cooling, and a freezer area for items that need to be consistently frozen. Following challenges may occur:

Too much data

The total amount of data being collected may be so large that it may not be possible to move it over the network to a central location.

Security

It is essential for connected devices to work together for most IoT use cases, but this approach raises security issues. The overall security profile is only as effective as the weakest device. If the security on a specific vendor's outdoor sensor is weak, and the sensor is connected to other devices, situation's critical impact is high.

Misbehaving devices

These are devices or sensors that go bad and begin sending false readings to the system. This could ruin the inventory of the warehouse.

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1. What is M2M communication? How M2M works?

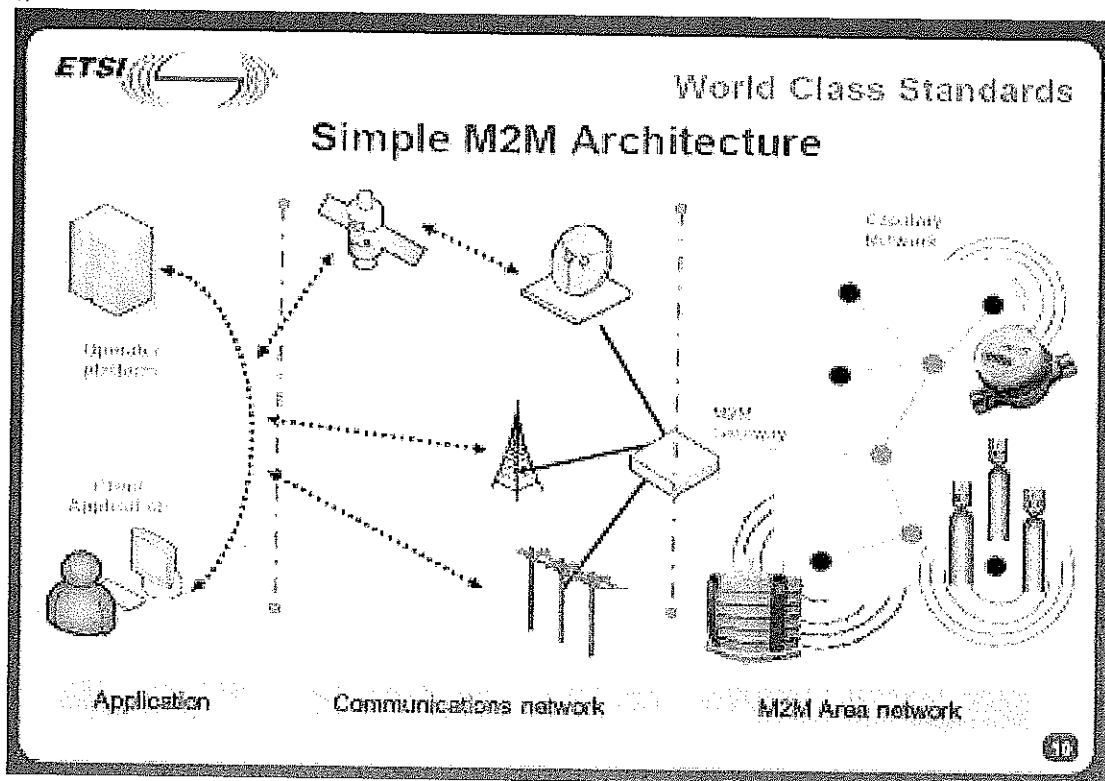
Ans. The machine to machine (M2M) concept represents any technology that allows two devices to exchange information with each other, for example, communicate and send data. The communication that occurs between the machines or devices is autonomous, there is no need for human intervention for this data exchange to take place.

M2M connectivity is related to the Internet of Things (IoT). Both are part of the same concept and complement each other. A system of machines or interrelated devices can be connected wirelessly, and exchange and analyze data automatically in the cloud.

Connectivity Types used in M2M

There are different types of connectivity between machines.

- First, we have the **RFID**, or radiofrequency identification. The limitation of this type of connectivity is that it has a maximum range of 10 meters.
- On the other hand, there are **Bluetooth** and **Wi-Fi** that also have a limited range, from 10 to 20 meters in the case of Bluetooth and 50 meters in the case of Wi-Fi.
- These types of connectivity are short range.
- Connectivity using **low frequency** has a range of up to 1,000 km and the **GSM** network (using SIM cards) or the satellite is worldwide.



How M2M Works

- Machine-to-machine communication makes the Internet of Things possible. According to Forbes, M2M is among the fastest-growing types of connected device technologies in the market right now, largely because M2M technologies can connect millions of devices within a single network. The range of connected devices includes anything from vending machines to medical equipment to vehicles to buildings. Virtually anything that houses sensor or control technology can be connected to some sort of wireless network.
- This sounds complex, but the driving thought behind the idea is quite simple. Essentially, M2M networks are very similar to LAN or WAN networks, but are exclusively used to allow machines, sensors, and controls, to communicate.
- These devices feed information they collect back to other devices in the network. This process allows a human (or an intelligent control unit) to assess what is going on across the whole network and issue appropriate instructions to member devices.

2. What is IoT analytics? Just brief types of IoT analytics.

Ans. IoT Analytics

IoT analytics is the method to gain value from large volumes of data generated by devices connected via the Internet of Things (IoT). Organizations can derive a number of benefits from it: optimize operations, control processes automatically, engage more customers, and empower employees. Organizations use Industrial IoT to collect and analyze data from pipelines, weather stations, sensors on manufacturing equipment, smart meters, delivery trucks, and other machinery. IoT analytics is also used in retail, data center management, healthcare.

Types of IoT Analytics

Descriptive analytics on IoT data

Focuses on what's happening, by monitoring the status of IoT devices, machines, products and assets. Determines if things are going as planned, and notifies if anomalies occur. Descriptive analytics is generally implemented as dashboards that show current and historical sensor data, key performance indicators (KPIs), statistics and alerts.

Diagnostic analytics on IoT data

Analyzes IoT data to identify core problems and to fix or improve a service, product or process.



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Diagnostic capabilities are typically extensions to dashboards that permit users to drill into data, compare it, and visualize correlations and trends in an ad-hoc manner. Many organizations employ domain experts knowledgeable about a specific process, machine, device or product, rather than data scientists, to perform diagnostics on data.

Predictive analytics on IoT data

Assesses the likelihood that something will happen within a specific timeframe, according to historical data. The aim is to proactively take corrective action before an undesired outcome occurs, to mitigate risk, or to isolate opportunities.

Prescriptive analytics on IoT data

Suggests actions based on the result of a prediction or diagnosis, or provides some visibility to the rationale behind a prediction or diagnostic. Recommendations tend to be about how to optimize or fix something.

3. What are the different categories of IoT platforms across the IoT technology stack?

Ans. Categories of IoT Platforms

IoT products are very complex because they have to integrate multiple components across the five layers of the IoT technology stack as device hardware, device software, communications, cloud platform and cloud platform. Given this complexity, it is not likely that you'll find one single IoT platform that covers all areas of the IoT technology stack. Therefore, you will need a few different types of IoT platforms to cover the whole spectrum.

The most common categories of IoT platforms are:

- IoT Cloud platforms
- IoT connectivity platforms
- IoT device platforms
- IoT Analytics platforms

IoT Cloud Platforms

This category of IoT platforms provides the core building blocks for your product, including consuming, transporting, storing, analyzing, and displaying data. As the name implies, their aim is to enable the rapid development of your application by abstracting the complexities of building an IoT solution. Application enablement platforms come in all flavors, including: Industrial platforms, Consumer platforms, Platforms targeting developers, Platforms focusing on specific verticals etc.

Cloud platforms: Microsoft Azure IoT, AWS IoT, Google Cloud's IoT Platform etc.

IoT Connectivity Platforms

- Connectivity is an integral part of the IoT technology stack, linking on-the-ground IoT devices to the Cloud or any other big data repository.
- Many IoT products rely on Wi-Fi to connect to the Internet. For these products, connectivity management might be included in their application enablement platform. Therefore, spending the extra time and effort to guarantee connectivity may not be worth the investment.
- On the other hand, products that are part of what's called "critical IoT," such as manufacturing equipment, connected cars, or the smart grid require more robust communication technologies to reach the Internet. For example, many of these IoT devices rely on cellular technologies like 4G, 5G, or NB-IoT (Narrow Band IoT)

Connectivity platforms : SIGFOX, Hologram, Jasper by Cisco etc.

IoT Device Platforms

IoT device platforms provide hardware building blocks for developing IoT devices. And considering that hardware is usually the "long pole in the tent" for IoT product development, it is important to consider what already exists in the market to accelerate your efforts. Selecting the right IoT device platform depends on where you are in the IoT product adoption curve. Keep in mind that an IoT product should integrate seamlessly from the IoT device, all the way to the Cloud. To do so, you'll need to run specialized software on your IoT device.

IoT Analytics Platforms

- The goal of an IoT product is not to collect data. It is to provide actionable insights to your users. That's why analyzing the data is as important than collecting the data.



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- Most of the Cloud platforms already include analysis tools, which may be enough for many applications.
- But if your application has additional requirements around visualization, data processing, digital twins, artificial intelligence (A.I), or machine learning (ML), an IoT analytics platform can accelerate your IoT development.
- Some of these platforms offer generic analytics capabilities that you can customize, while others offer specialized, vertical-specific capabilities such as logistics, asset tracking, or predictive maintenance.

Analytics platforms: Watson by IBM, C3 AI, SparkCognition etc.