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PESIT Bangalore South Campus
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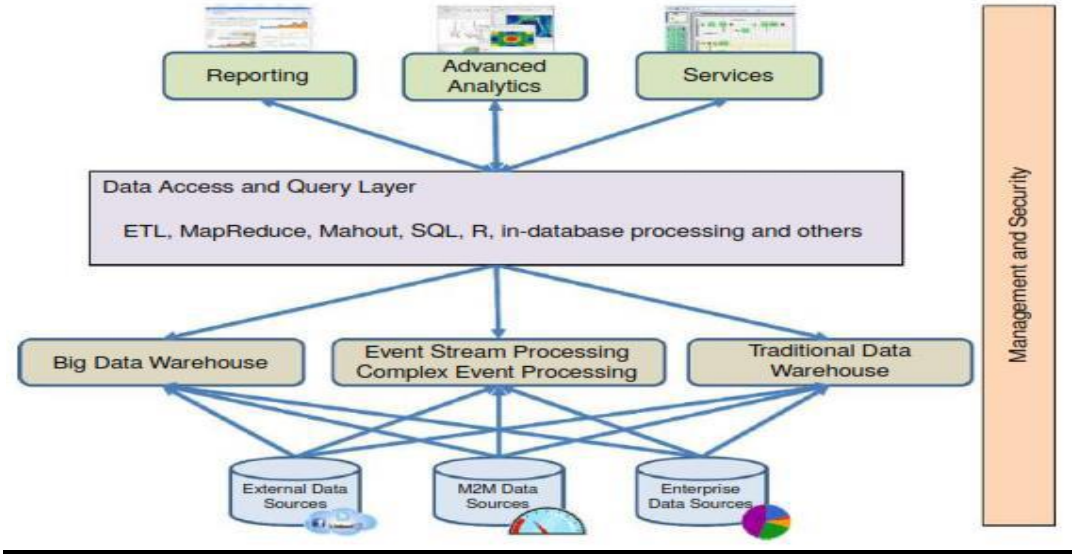
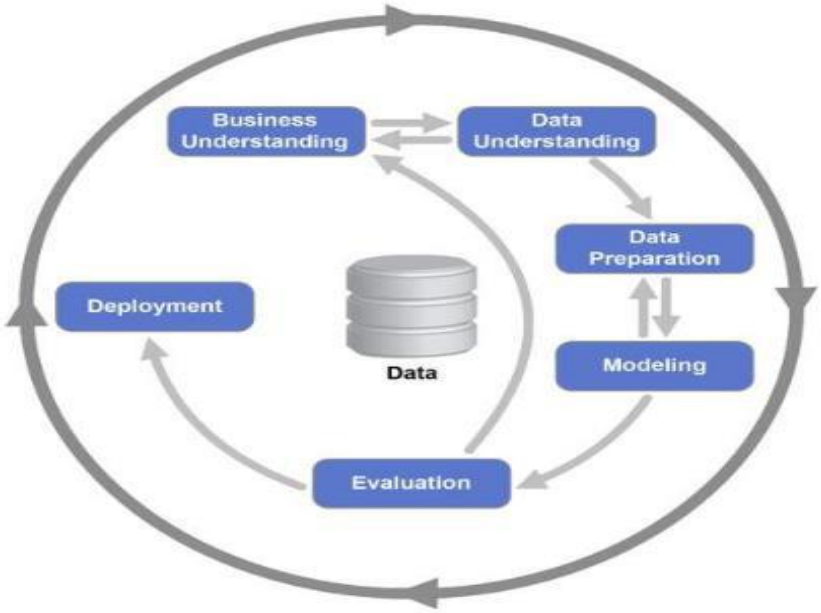
Department of Master of Computer Applications

INTERNAL ASSESSMENT TEST II

Date :25.09.2019	**Max Marks:**40
Subject &Code: Internet of Things (17MCA552)	
Name of Faculty: Prof. Arya. S.S	**Time:** 08:30AM-10:00 AM

Note: ***Answer FIVE full questions. Selecting One question from each part.***

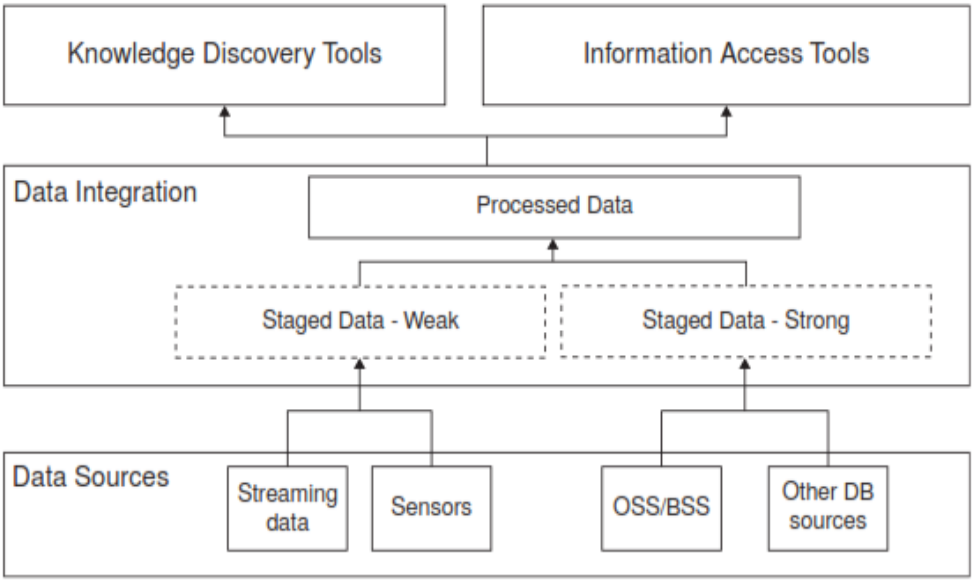
	Part I	
Q 1	With the diagram, explain analytics architecture overview **Answer:**  	**8** **2**
	• Analytics architecture serves as a platform for data exploration and modelling by data scientists and for business analytics by customers. • It also offers a development platform with the necessary computing resources required to perform complex analytics on very big data sets. • A sandbox for Big Data analytics can be realized in a number of ways, of which the **Hadoop ecosystem** is probably the best known. • Hadoop Ecosystem is neither a programming language nor a service, it is a platform or framework which solves big data problems. It as a suite which encompasses a number of services (ingesting, storing, analyzing and maintaining) inside it.	**6**
	OR	
Q 2.	Define Device. List and explain the properties of device • **A device is a hardware unit that can sense aspects of it's environment and/or actuate, i.e. perform tasks in its environment.** • IoT devices include	**8** **2**

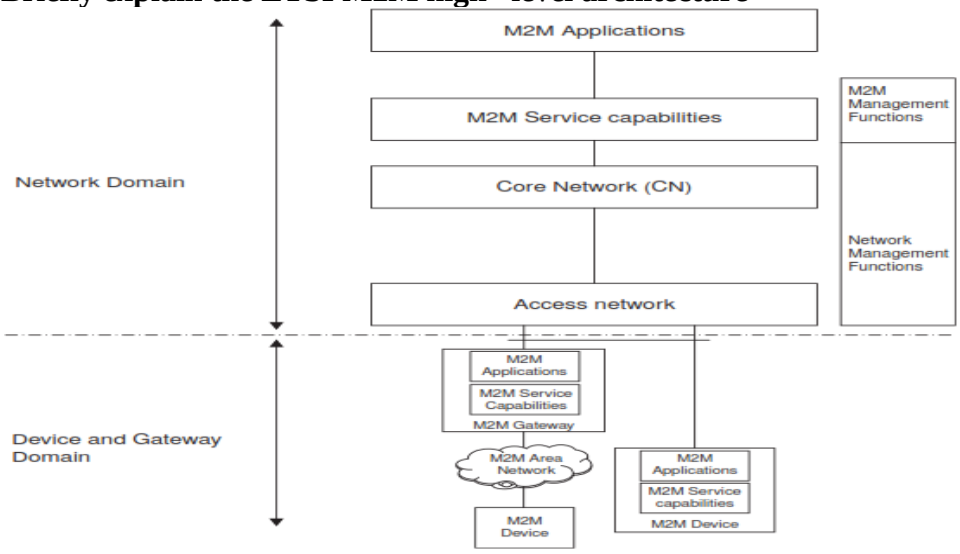
	– Sensors (temperature, light, motion, etc.), – Actuators (displays, sound, motors, etc.), – Computers(can run programs and logic), – Communication interfaces (wired or wireless). They are attached to a particular object that operates through the internet, enabling the transfer of data among objects or people automatically without human intervention • A device can be characterized as having several properties. including: – Microcontroller: 8-, 16-, or 32-bit working memory and storage. – Power Source: Fixed, battery, energy harvesting, or hybrid. – Sensors and Actuators: Onboard sensors and actuators, or circuitry that allows them to be connected, sampled, conditioned, and controlled. – Communication: Cellular, wireless, or wired for LAN and WAN communication. – Operating System (OS): event-based, real-time, or full featured OS – Applications: Simple sensor sampling or more advanced applications. – Device Management (DM) – Execution Environment (EE)	**6**
	Part II	
Q3	Explain CRISP-DM Process Diagram with example.  	**8** **2**

	1.<u>Business Understanding</u> • The first phase in the process is to understand the business objectives and requirements, as well as success criteria. This forms the basis for formulating the goals and plan Two different approaches to predicting maintenance actions: • Action Forecasting • Similar Case Recommendations **2. <u>Data Understanding</u>** • The next phase consists of collecting data and gaining an understanding of the data properties, such as amount of data and quality in terms of inconsistencies, missing data, and measurement errors. **3. <u>Data Preparation</u>** • Before it's possible to start modeling the data to achieve our goals, it's necessary to prepare the data in terms of selection, transformation, and cleaning. • Several operations are performed to prepare the data, and three data sets are constructed 4. **<u>Modeling</u>** • At the modeling phase, it's finally time to use the data to gain an understanding of the actual business problems that were stated in the beginning of the project. 5. **<u>Evaluation</u>** • Now the project is nearing its end and it's time to evaluate the models from a business perspective using the success criteria that were defined at the beginning of the project. 6. **<u>Deployment</u>** At this last phase in the project, the models are deployed and integrated into the Organization.	**4**
	OR	
Q4. a)	a) Explain the role of Gateways in IOT. <u>Answer</u> • An Internet of Things (IoT) gateway is a physical <u>device</u> or software program that serves as the connection point between the <u>cloud</u> and <u>controllers</u>, sensors and intelligent devices. • Some <u>sensors</u> generate tens of thousands of data points per second. A gateway provides a place to preprocess that data before sending it on to the cloud. data is aggregated, summarized and tactically it minimizes the volume of data that needs to be forwarded on to the cloud, which can have a big impact on response times and network transmission costs –	**4**
b)	Discuss the types of devices. **Advanced Devices:** In this case the devices also host the application logic and WAN connection. • eg: A powerful CPU or microcontroller with enough memory and storage to host advanced applications, such as a printer offering functions for copying, faxing, printing, and remote management.	**4** **2**

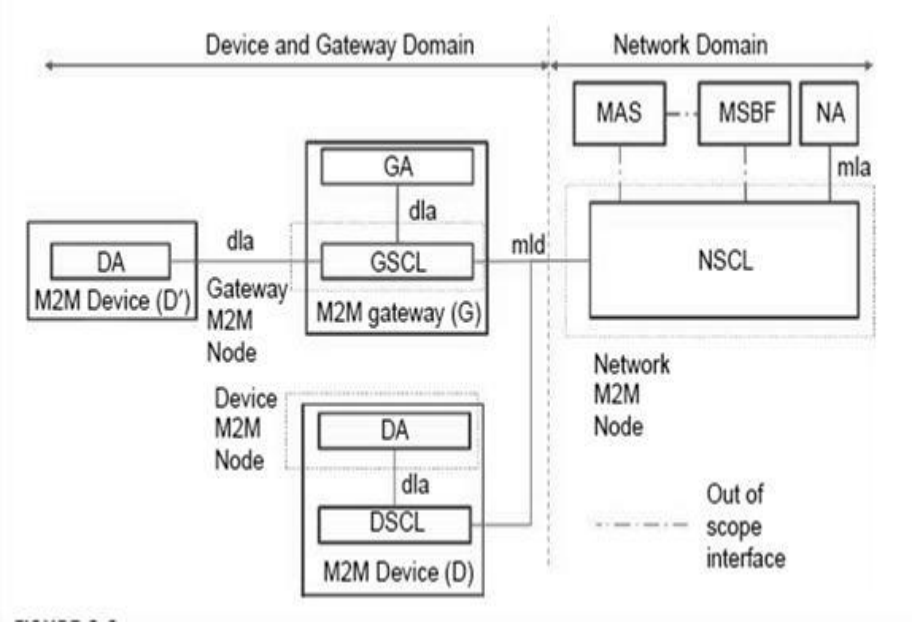
	• A more advanced user interface with, for example, display and advanced user input in the form of a keypad or touch screen. **Basic Devices** – Devices that only provide the basic services of sensor readings and/or actuation tasks, and in some cases limited support for user interaction. – LAN communication is supported via wired or wireless technology, a gateway is needed to provide the connection. – The requirements on hardware are low, both in terms of processing power and memory. – Basic devices are good for performing simple processes like alarms, metering, standalone smart thermostats and others.	**2**
	Part III	
Q 5	List and explain key technologies of distributed M2M application and IoT. Answer • **Power Line Communication (PLC)** Power Line Communication (PLC) is a communication technology that enables sending data over existing power cables. This means that, with just power cables running to an electronic device (for example) one can both power it up and control/retrieve data from it in a half-duplex manner. • *LAN (and WLAN)* • *Bluetooth Low Energy(Bluetooth Smart)* In contrast to Classic **Bluetooth**, **Bluetooth Low Energy** (**BLE**) is designed to provide significantly **lower power consumption**. • ***IPv6 Networking*** The limited size of its predecessor, IPv4, has made the transition to IPv6 unavoidable • ***6LoWPAN*** IPv6 Over Low Power Wireless Personal Area Networks • *RPL* IPv6 Routing Protocol for **Low-Power and Lossy Networks(LLN)** • *CoAP* Constrained Application Protocol (CoAP) is a protocol that specifies how low-power compute-constrained devices can operate in IoT.	**8**
	OR	
Q6 a)	Define cloud computing and its characteristics • Cloud computing is a model for enabling ubiquitous, on-demand network access to a shared pool of configurable computing resources (e.g. networks, servers, storage, applications, and services) • These resources can be provisioned, configured, and made available service provider interaction. • All applications need access to three things: compute, storage, and data processing capacities. Characteristics of cloud computing • **On-Demand Self-Service** • **Broad Network Access.**	**4**

	• **Resource Pooling.** • **Rapid Elasticity.** • **Measured Service.**	
Q 6 b)	List and explain cloud computing deployment models 1. ***Private Cloud*** – The cloud infrastructure is provisioned for exclusive use by a single organization comprising multiple consumers (e.g. business units). – It may be owned, managed, and operated by the organization, a third party, or some combination of them, and it may exist on or off premises. 2. ***Community Cloud*** – The cloud infrastructure is provisioned for exclusive use by a specific community of consumers from organizations that have shared concerns (e.g. mission, security requirements, policy, and compliance considerations). 3. ***Public Cloud*** – The cloud infrastructure is provisioned for open use by the general public. – It may be owned, managed, and operated by a business, academic, or government organization, or some combination thereof. 4. ***Hybrid Cloud:*** – The cloud infrastructure is a composition of two or more distinct cloud infrastructures (private, community, or public).	**4**
	Part IV	
Q 7.	How data is managed in M2M? Explain the stages involved in data management The data flow from the moment it is sensed up to the moment it reaches the backend system will be undergone some processing. **Data generation** • first stage within which data is generated actively or passively from the device, system, or as a result of its interactions. • The sampling of data generation depends on the device as well as the application needs. **Data acquisition** • Data acquisition deals with the collection of data (actively or passively) from the device, system, or as a result of its interactions. • The data acquisition systems usually communicate with distributed devices over wired or wireless links to acquire the needed data. **Data Validation** • Data acquired must be checked for correctness and meaningfulness within the specific operating context. The latter is usually done based on rules, semantic annotations, or other logic. **Data storage** • The data generated by M2M interactions is what is commonly referred to as "Big Data." • Only the fraction of the data relevant to a business need may be stored for future reference.	**8**

	Data processing • Data processing enables working with the data that is either at rest (already stored) or is in motion (e.g. stream data). **Data remanence** • Even if the data is erased or removed, residues may still remain in electronic media, and may be easily recovered by third parties _ often referred to as data remanence. **Data analysis** • Data available in the repositories can be subjected to analysis with the aim to obtain the information they encapsulate and use it for supporting decision-making processes	
	OR	
Q 8.	Briefly explain Knowledge Management reference architecture  • Illustrates how data sources from M2M and IoT may be combined with other types of data, for example, from databases or even OSS/ BSS data • There are three levels to the diagram: (1) data sources, (2) data integration, and (3) knowledge discovery and information access. 1. **Data sources** – Data sources refer to the broad variety of sources that may now be available to build enterprise solutions. 2. **Data integration** – The data integration layer allows data from different formats to be put together in a manner that can be used by the information access and knowledge discovery tools. Strong Type Data: – Strong type data refers to data that is stored in traditional database formats. Weak Type Data: – Weak type data is data that is not well structured according to traditional database techniques.	**8** **2** **6**

	• **Processed data** Processed data is combined data from both strong and weak typed data that has been combined within an IoT context to create maximum value for the enterprise. • **Retrieval layer** – Once data has been processed, it is time to develop insights from the data via retrieval. – This can be of two main forms: ***Information Access and Knowledge Discovery***	
	Part V	
Q 9	**Briefly explain the ETSI M2M high –level architecture**  There are two main domains, a network domain and a device and gateway domain. The Device and Gateway Domain contains the following functional/topological entities: **M2M Device:** An M2M device connects to the Network Domain either directly or through an M2M Gateway **M2M Area Network:** This is typically a local area network (LAN) or a Personal Area Network (PAN) and provides connectivity between M2M Devices and M2M Gateways. **M2M Gateway** The device that provides connectivity for M2M Devices in an M2M Area Network towards the Network Domain. The M2M Gateway contains M2M Applications and M2M Service Capabilities. **Access Network:** Network that allows the devices in the Device and Gateway Domain to communicate with the Core Network. **Core Network:** Examples of Core Networks are 3GPP **(3rd Generation Partnership Project** (**3GPP**) is a standards organization which develops protocols for mobile telephony) Core Network **M2M Service Capabilities:** These are functions exposed to different M2M Applications through a set of open interfaces. **M2M Applications:** These are the specific M2M applications (e.g. smart metering)	**8** **2** **6**

	that utilize the M2M Service Capabilities through the open interfaces. **Network Management Functions:** These are all the necessary functions to manage the Access and Core Network (e.g. Provisioning, Fault Management, etc.).	
	OR	
Q 10	Describe the ETSI M2M interfaces with neat diagram	**8**



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- The main **interfaces mIa, dIa, and mId** can be briefly described as follows: **6**

mIa:

This is the interface between a Network Application and the Network Service Capabilities Layer (NSCL).

The procedures supported by this interface are (among others) registration of a Network Application to the NSCL, request to read/write information to NSCL, GSCL, or DSCL, request for device management actions (e.g. software updates), subscription and notification of specific events.

dIa:

This is the interface between a Device Application and (D/G)SCL or a Gateway Application and the GSCL.

The procedures supported by this interface are (among others) registration of a Device/Gateway Application to the GSCL, registration of a Device Application to the DSCL, request to read/write information to NSCL, GSCL, or DSCL, subscription and notification of specific events.

mId:

This is the interface between the Network Service Capabilities Layer (NSCL) and the GSCL or the DSCL.

The procedures supported by this interface are (among others) registration of a Device/Gateway SCL to the NSCL, request to read/write information to NSCL, GSCL,or DSCL, subscription and notification of specific events.