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IOT DIGITAL ASSIGNMENT 2

AIM: To compare and contrast the 6 levels of IoT deployment using the given parameters.

Question: What is the necessity of different levels of IoT deployment?

Answer: Implementations of IOT deployment models vary with the problem being addressed, i.e. from scenario to scenario. The number of local nodes present, coordinator or observer nodes in the local environment or in the cloud (if required), type of storage to be used (local or cloud), and location of processing of data varies. Thus, a single deployment model cannot be used, and we need different deployment models to cater to different types of scenarios.

CRITERIA	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4	LEVEL 5	LEVEL 6
Description	It is the simplest and first level of IOT deployment. It is suitable **for low cost** and **low complexity solutions.** Data involved is not too big, and analysis is not computationally intensive.	In the second level, the **data** is stored in the cloud and the **application** is often cloud based. This is suitable for solutions where the data involved is big. Also, the **primary analysis** is not computationally intensive and can be done locally.	In the third level, the data is stored and analysed in the cloud. The application is cloud-based. This is suitable for solutions where the data involved is big and the **analysis** requirements are computationally intensive.	In the fourth level, multiple nodes are required along with local and cloud based **observer nodes**. The data is stored in the cloud and application is cloud-based. It is suitable for solutions where the data involved is big and analysis requirements are computationally intensive.	In the fifth level, multiple nodes are used along with a **coordinator node**. It is suitable **for solutions utilizing wireless sensor networks**. The data involved is big and analysis requirements are computationally intensive.	This is the most complex IOT deployment model. It consists of multiple independent end nodes along with a **cloud based centralized controller.** The data is stored and analysed in the cloud The application is cloud-based, and the analysis requirements are computationally intensive.
Components *(Devices, resource, controller service, database, web service, and analysis component)*	**All components** are available locally and the cloud is not used. It consists of a **single node / device** which stores the data. The local database interacts with the controller service and the web service through **REST / WebSocket based**	The components **locally present** are: a single node / device and the controller service. The **database** is present in the cloud, and the application is also operated there. REST / WebSocket services interact with the database, controller service and	The architecture of level 2 and level 3 is almost same. A single node / device is present along with the controller service. The **database** and **application** are operated in the cloud. REST / WebSocket services interact with the database,	It consists of multiple local monitoring nodes. In addition, it has **local and cloud-based observer nodes** which process the information received (in the cloud) from the devices. The database and application are cloud based. The REST / WebSocket services	It consists of multiple local monitoring nodes and **one coordinator node**. The local and cloud based observer nodes are also present. There is a local **coordinator node** collects data from the end nodes and sends it to the database in the cloud. The analytics	The architecture consists of multiple local monitoring nodes, local and cloud based observer nodes. **Replacing the local coordinator node** (as in level 5), there is a **centralized controller in the cloud.** This controller is aware of the status of all the

	communication. The **application** is operated locally. There is no dedicated analytics component present in the cloud.	the application. **There is no dedicated analytics component present in the cloud.**	controller service and the application. The **difference between level 2 and level 3** is that the analysis in level 3 involves heavy computation and is thus done in the cloud.	interact with observer nodes (both local and cloud), the application, and the **analytics component**. The analytics component interacts with the database.	component and application are cloud based. The REST / WebSocket services interact with the local coordinator node, observer nodes (both local and cloud based), the application and the **analytics component**. The analytics component interacts with the database.	end nodes and sends control commands to the nodes. All the data is sent to the database in the cloud. The application and the analytics component are also cloud based. REST / WebSocket services interact with the observer nodes, the centralized controller, **analytics component**, database and the application.
Applications	**Home automation**	**Smart irrigation**	**Tracking package handling**	**Noise Monitoring**	**Forest fire detection**	**Weather monitoring**
Communication protocols	The protocols used are common for all the 6 levels. This is because each level extends from the facility of sensing the environment, to display the output on the application interface, i.e. from data link layer to the application layer. **Data link:** 802.11ah (WiFi-HaLow), 802.15.4 (Zigbee), Bluetooth-Low Energy, Cellular **Network:** IPv4, IPv6, 6LoWPAN, RPL **Transport:** TCP / UDP **Application:** MQTT, CoAP, WebSocket, XMPP, AMQP, DDS					
Storage	Since the **data** involved is **not big**, the **storage** in the monitoring node is utilised.	The **data** involved is large and **cannot be stored locally.** Data storage is in the cloud.	Since the **data** involved is large and cannot be stored locally, it is stored in the cloud.	The **data** involved is large and cannot be stored locally. Data storage is in the cloud.	Since the **data** involved is large and cannot be stored locally, it is stored in the cloud.	The **data** involved is large and cannot be stored locally. Data storage is in the cloud.
Analysis	**Analysis requirements** are not computationally intensive and analysis can be **done at the monitoring node** itself.	In level 2, although the data involved is big, the computation is not very intensive and is **done at the monitoring node itself.**	Since the data is very large and analysis is computationally intensive, it cannot be done at the monitoring node. Thus, **analytics is done in the cloud.**	The **observer nodes** subscribe to the data sent by the devices to the cloud, and **can process this data.** While **analytics** can be done in the cloud, the observer node is used to do some local analysis as well.	The data stored in the cloud database is large and analysis is computationally intensive. Hence, **analytics is done in the cloud.**	Since the data received and stored in the cloud database is very large, and analysis is computation heavy, it is **done in the cloud** and not on the monitoring node side.