IoT Level and Template

Internet of Things, Lecture-8

Rahul Shandilya

Levels of IoT

IoT system components can be categorised as following levels:

- **Device:**A smart connected thing or smart device is defined as one which has communication capabilities, compute power, and can make decisions at a local level in a limited context. An IoT device allows identification, remote sensing, actuating and remote monitoring capabilities. Moreover, power resources are also very important, as they can provide operational autonomy to the Devices.

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- **Controller Service:** Controller service is a native service that runs on the device and interacts with the web services. Controller service sends data from the device to the web service and receives commands from the application (via web services) for controlling the device.

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- **Application:** IoT applications provide an interface that the users can use to control and monitor various aspects of the IoT system.

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- An example of a level-1 IoT system can be given for home automation. The system consists of a single node that allows controlling the lights and appliances in a home remotely. The status information of each light or appliance is maintained in a local database. REST services deployed locally allow retrieving and updating the state of each light or appliance in the status database. The controller service continuously monitors the state of each light or appliance (by retrieving state from the database) and triggers the relay switches accordingly. The application which is deployed locally has a user interface for controlling the lights or appliances. Since the device is connected to the Internet, the application can be accessed remotely as well.

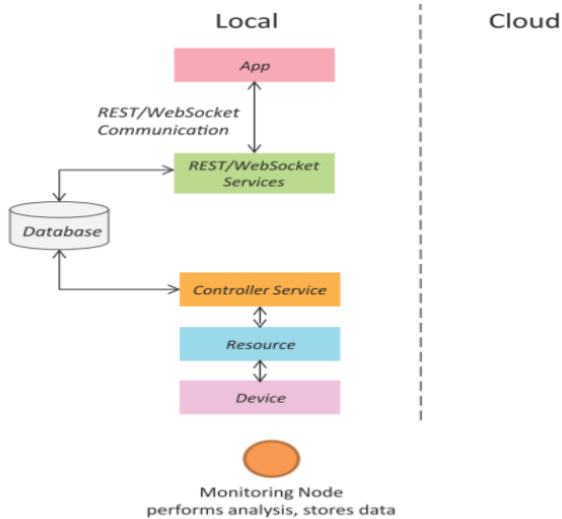

Figure: IoT Level-1

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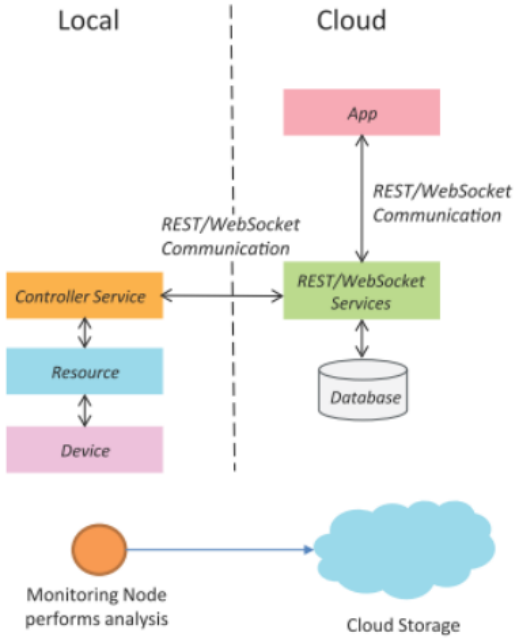
- Example of a level-2 IoT system can be given for smart irrigation. The system consists of a single node that monitors the soil moisture level and controls the irrigation system. For controlling the irrigation system actuators such as solenoid valves can be used. The controller also sends the moisture data to the computing cloud. A cloud-based REST web service is used for storing and retrieving moisture data which is stored in the cloud database. A cloud-based application is used for visualizing the moisture levels over a period of time, which can help in making decisions about irrigation schedules.



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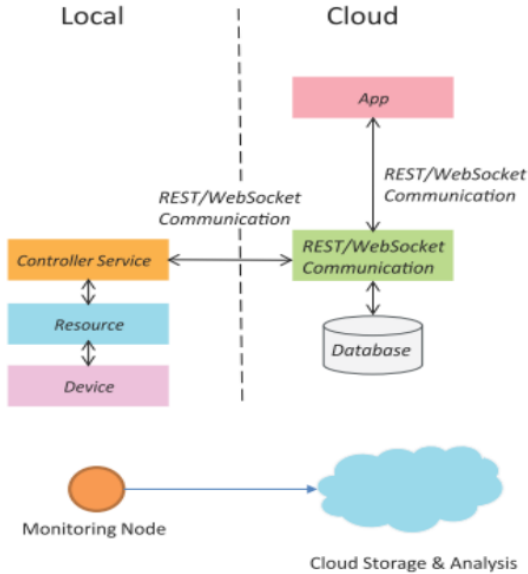
- An example of level-3 IoT system for tracking package handling. The system consists of a single node (for a package) that monitors the vibration levels for a package being shipped. The device in this system uses accelerometer and gyroscope sensors for monitoring vibration levels. The controller service sends the sensor data to the cloud in real-time using a WebSocket service. The data is stored in the cloud and also visualized using a cloud-based application. The analysis components in the cloud can trigger alerts if the vibration levels become greater than a threshold. The benefit of using WebSocket service instead of REST service in this example is that, the sensor data can be sent in real time to the cloud. Moreover, cloud based applications can subscribe to the sensor data feeds for viewing the real-time data.



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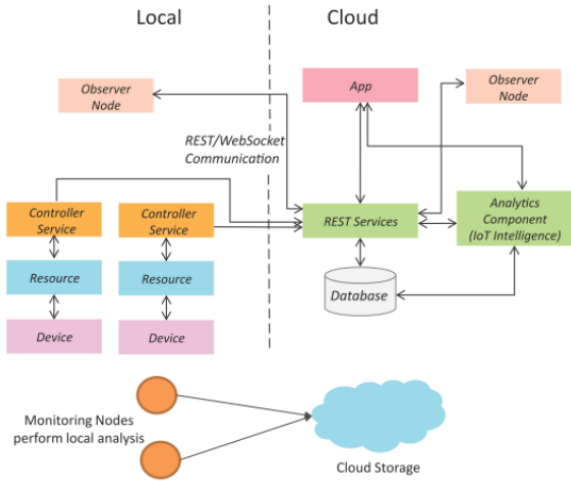
- Level-4 IoT systems are suitable for solutions where multiple nodes are required, the data involved is big and the analysis requirements are computationally intensive.
- level-4 IoT system for noise monitoring, The system consists of multiple nodes placed in different locations for monitoring noise levels in an area, The nodes in this example are equipped with sound sensors. Nodes are independent of each other, Each node runs its own controller service that sends the data to the cloud. The data is stored in a cloud database. The analysis of data collected from a number of nodes is done in the cloud. A cloud-based application is used for visualizing the aggregated data.



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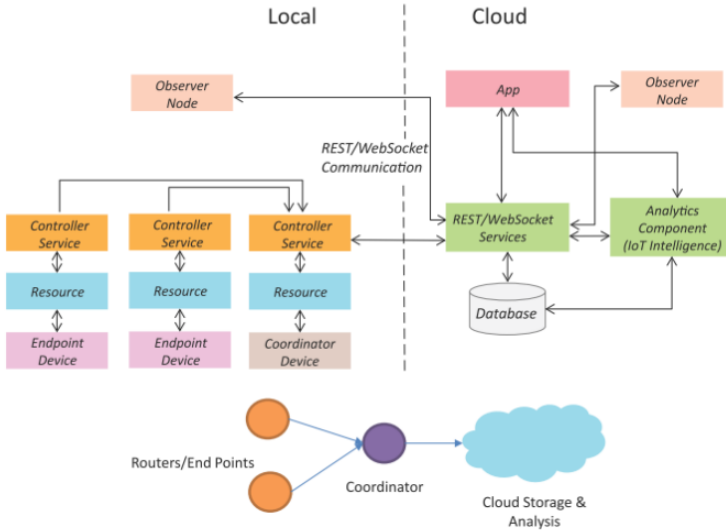
- Level-5 IoT systems are suitable for solutions based on wireless sensor networks, in which the data involved is big and the analysis requirements are computationally intensive.
- An example of a level-5 IoT system can be given for forest fire detection. The system consists of multiple nodes placed in different locations for monitoring temperature, humidity and carbon dioxide (CO_2) levels in a forest. The end nodes in this example are equipped with various sensors (such as temperature, humidity and CO2). The coordinator node collects the data from the end nodes and acts as a gateway that provides Internet connectivity to the IoT system. The controller service on the coordinator device sends the collected data to the cloud. The data is stored in a cloud database. The analysis of data is done in the computing cloud to aggregate the data and make predictions. A cloud-based application is used for visualizing the data.



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- 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.

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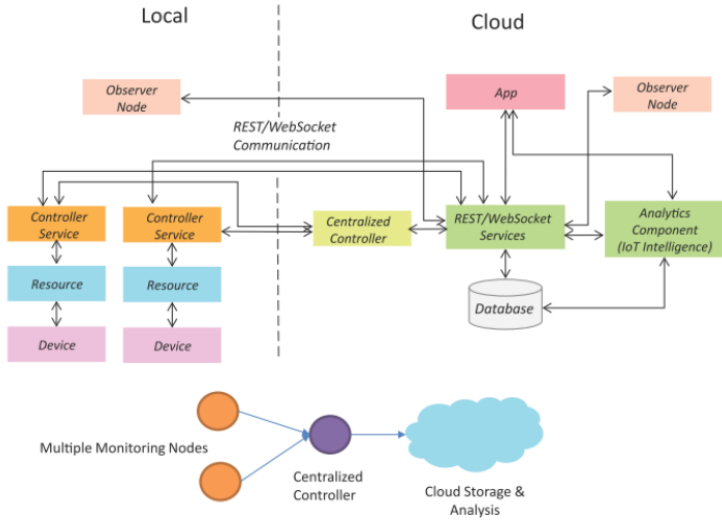
- The results are visualized with the cloud-based application. The centralized controller is aware of the status of all the end nodes and sends control commands to the nodes.
- An example of a level-6 IoT system can be made for weather monitoring. The system consists of multiple nodes placed in different locations for monitoring temperature, humidity and pressure in an area. The end nodes are equipped with various sensors (such as temperature, pressure and humidity). The end nodes send the data to the cloud in real-time using a WebSocket service. The data is stored in a cloud database. The analysis of data is done in the cloud to aggregate the data and make predictions. A cloud-based application is used for visualizing the data.



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