IoT Components, IoT Levels & Deployment Templates
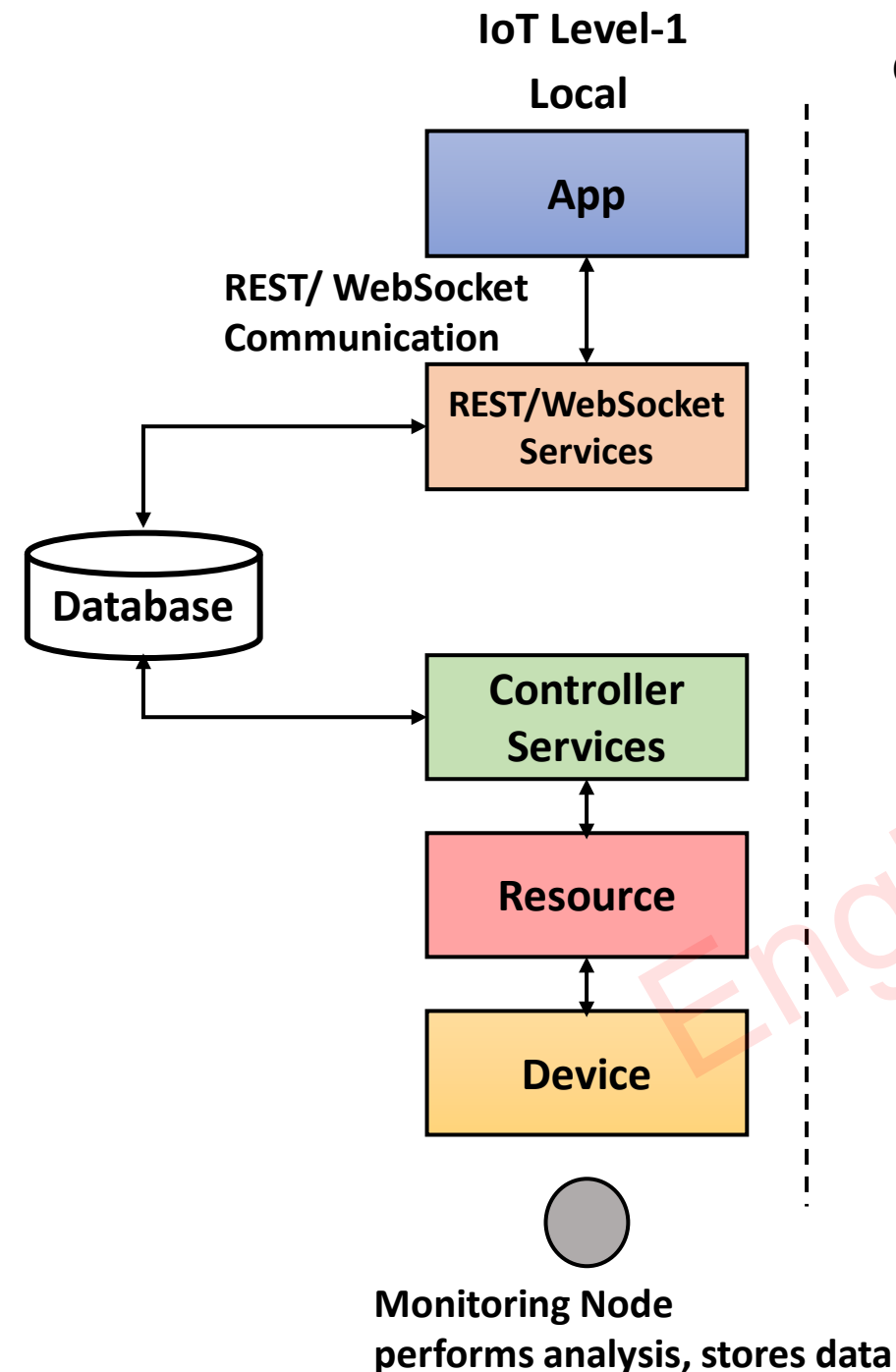
IoT Components

An IoT system comprises of the following components:

- **Device:** An IoT device allows identification, remote sensing, actuating, and remote monitoring capabilities.

- **Resource:** Resources are software components on the IoT device for accessing, processing, and storing sensor information, or controlling actuators connected to the device. Resources also include the software components that enable network access for the device.

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

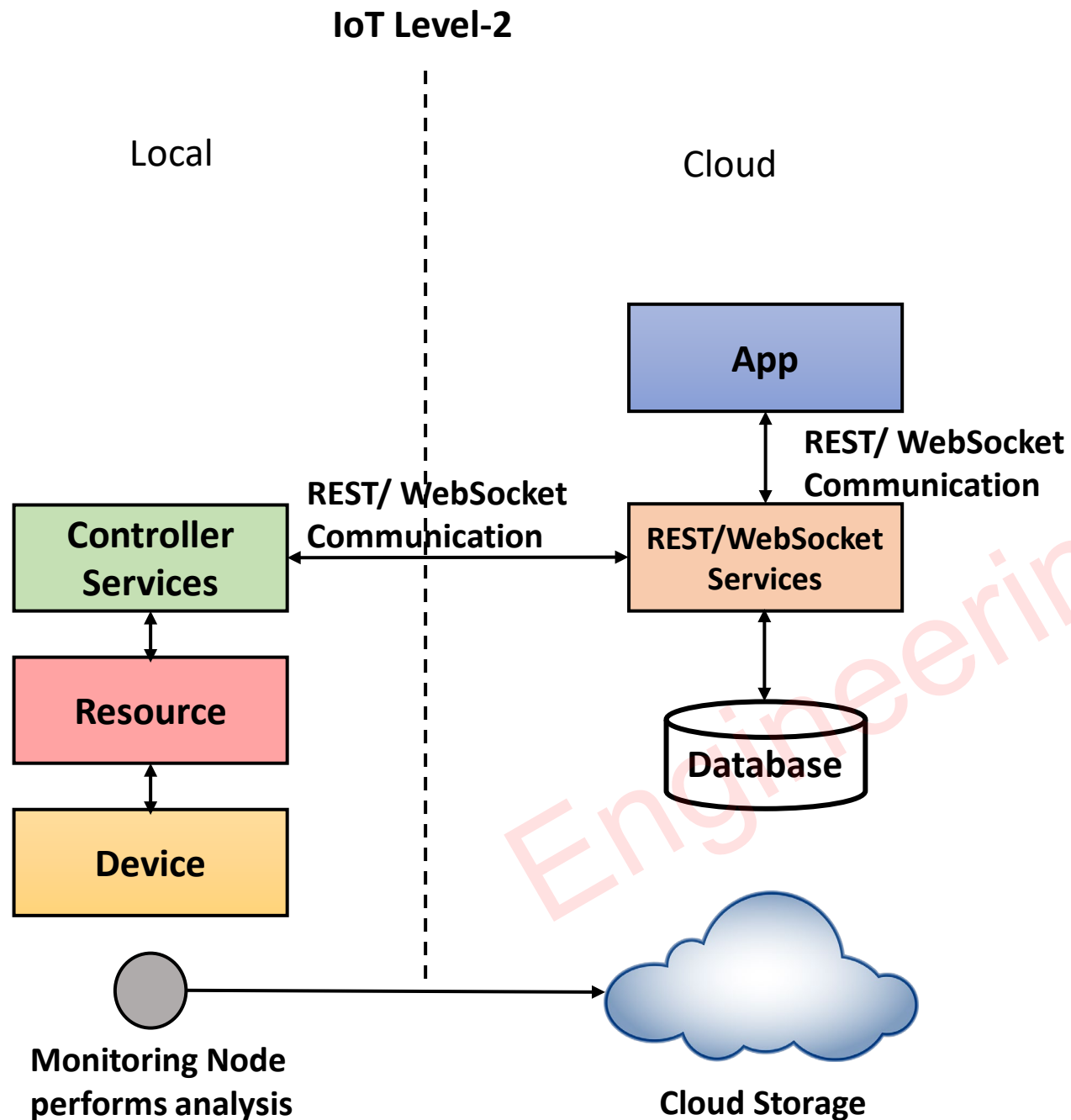- **Database:** The Database can be either local or in the cloud and stores the data generated by the IoT device.

- **Web Service:** Web services serve as a link between the IoT device, application, database, and analysis components. Web service can be either implemented using HTTP and REST principles (REST service) or using WebSocket protocol (WebSocket service).

- **Analysis Component:** The Analysis Component is responsible for analyzing the IoT data and generating results in a form which are easy for the user to understand.

- **Application:** IoT applications provide an interface that the users can use to control and monitor various aspects of the IoT system. Applications also allow users to view the system status and view the processed data.

IoT Level-1
Local

App

REST/ WebSocket
Communication

REST/WebSocket
Services

Database

Controller
Services

Resource

Device

Cloud

Monitoring Node
performs analysis, stores data

IoT Level-1

- level-1 IoT system has a single node/device that performs sensing and/or actuation, stores data, performs analysis, and hosts the application.

- Level-1 IoT systems are suitable for modeling low-cost and low-complexity solutions where the data involved is not big and the analysis requirements are not computationally intensive.
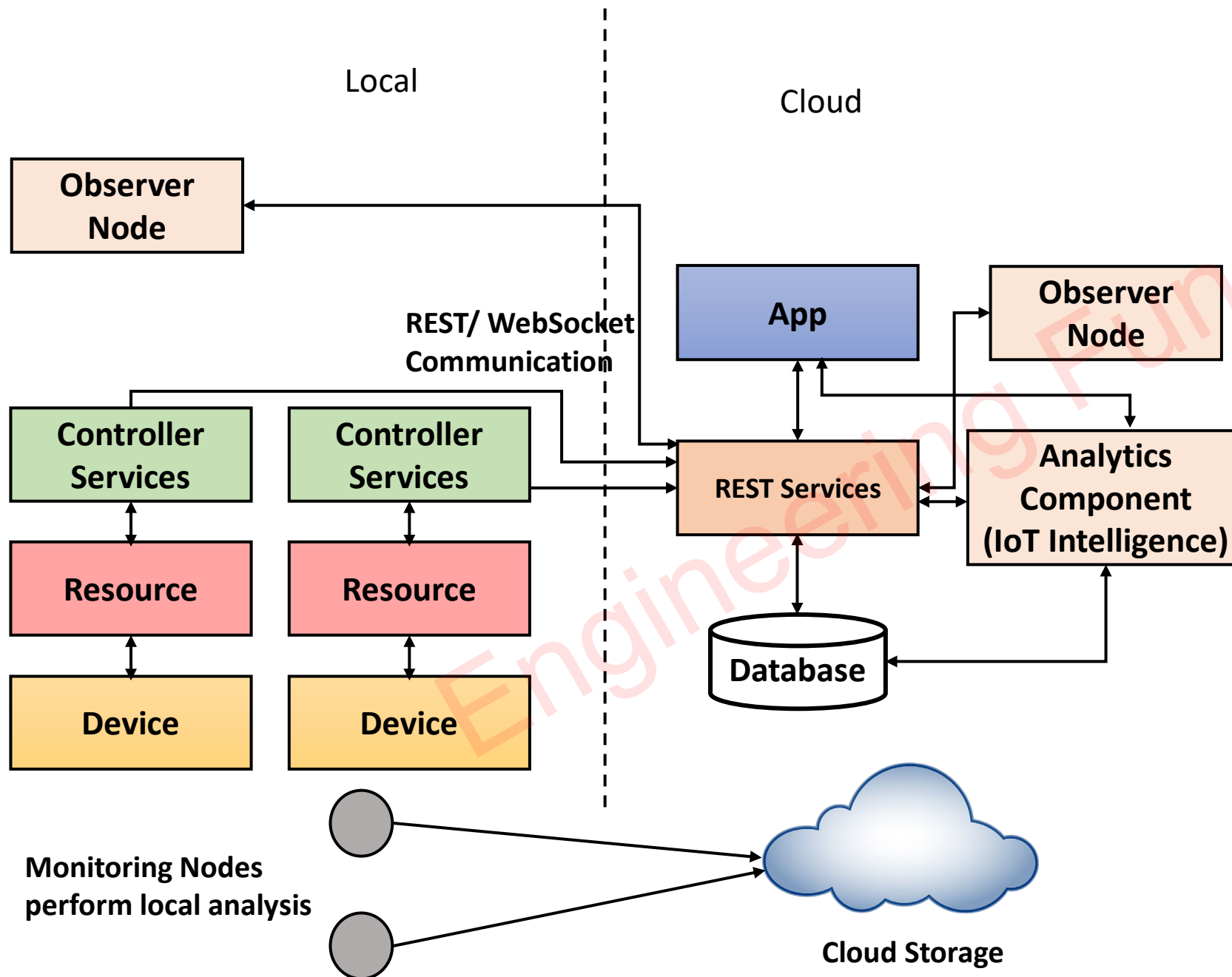
IoT Level-2

Local

Cloud

Controller Services

REST/ WebSocket Communication

App

REST/ WebSocket Communication

REST/WebSocket Services

Resource

Device

Database

Monitoring Node performs analysis

Cloud Storage

- ▪ **A level-2 IoT system has a single node that performs sensing and/or actuation and local analysis.**

- ▪ **Data is stored in the cloud and the application is usually cloud-based.**

- ▪ **Level-2 IoT systems are suitable for solutions where the data involved is big, however, the primary analysis requirement is not computationally intensive and can be done locally itself.**

IoT Level-3
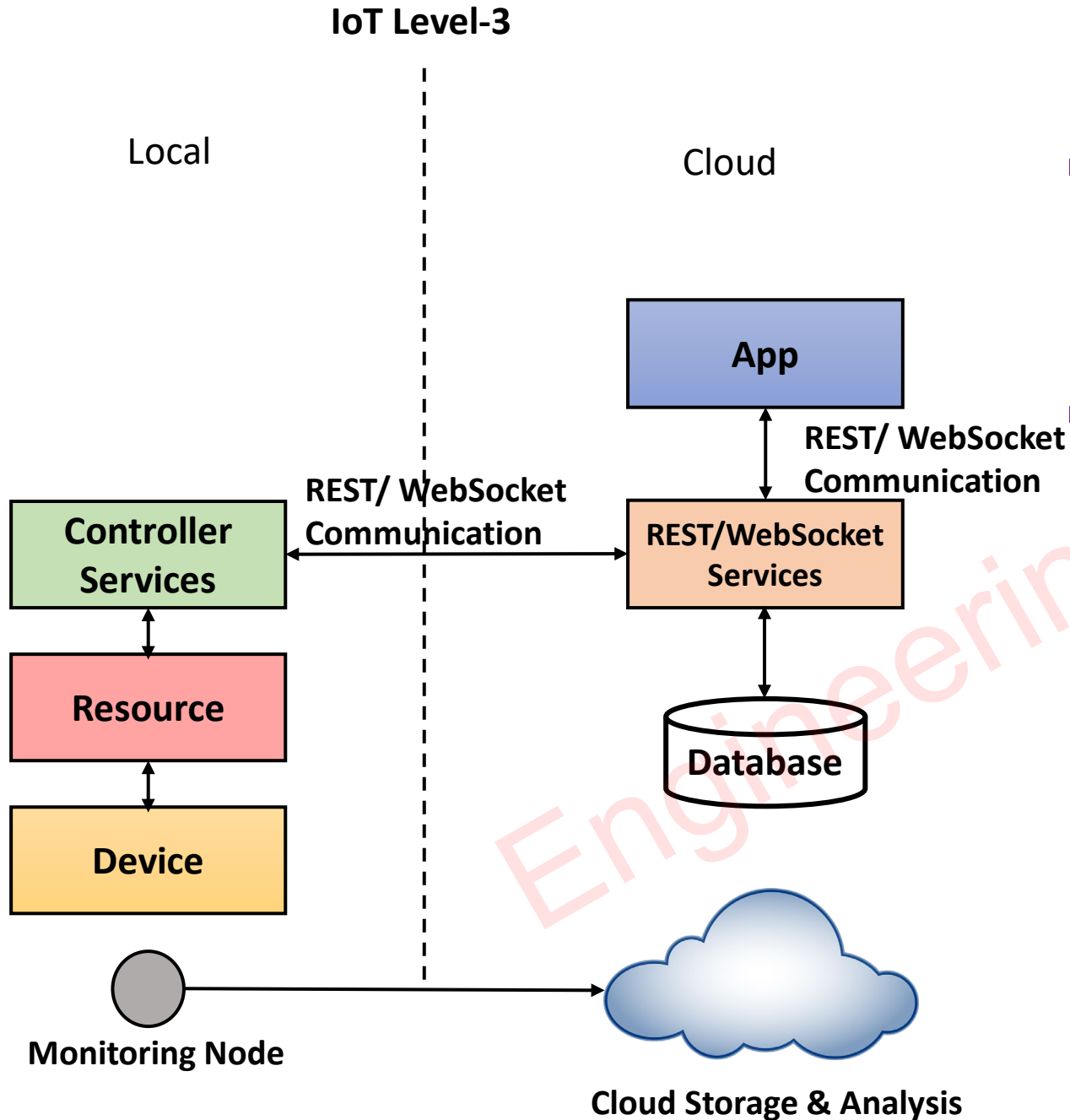
- A level-3 IoT system has a single node. Data is stored and analyzed in the cloud and the application is cloud-based.

- Level-3 IoT systems are suitable for solutions where the data involved is big and the analysis requirements are computationally intensive.
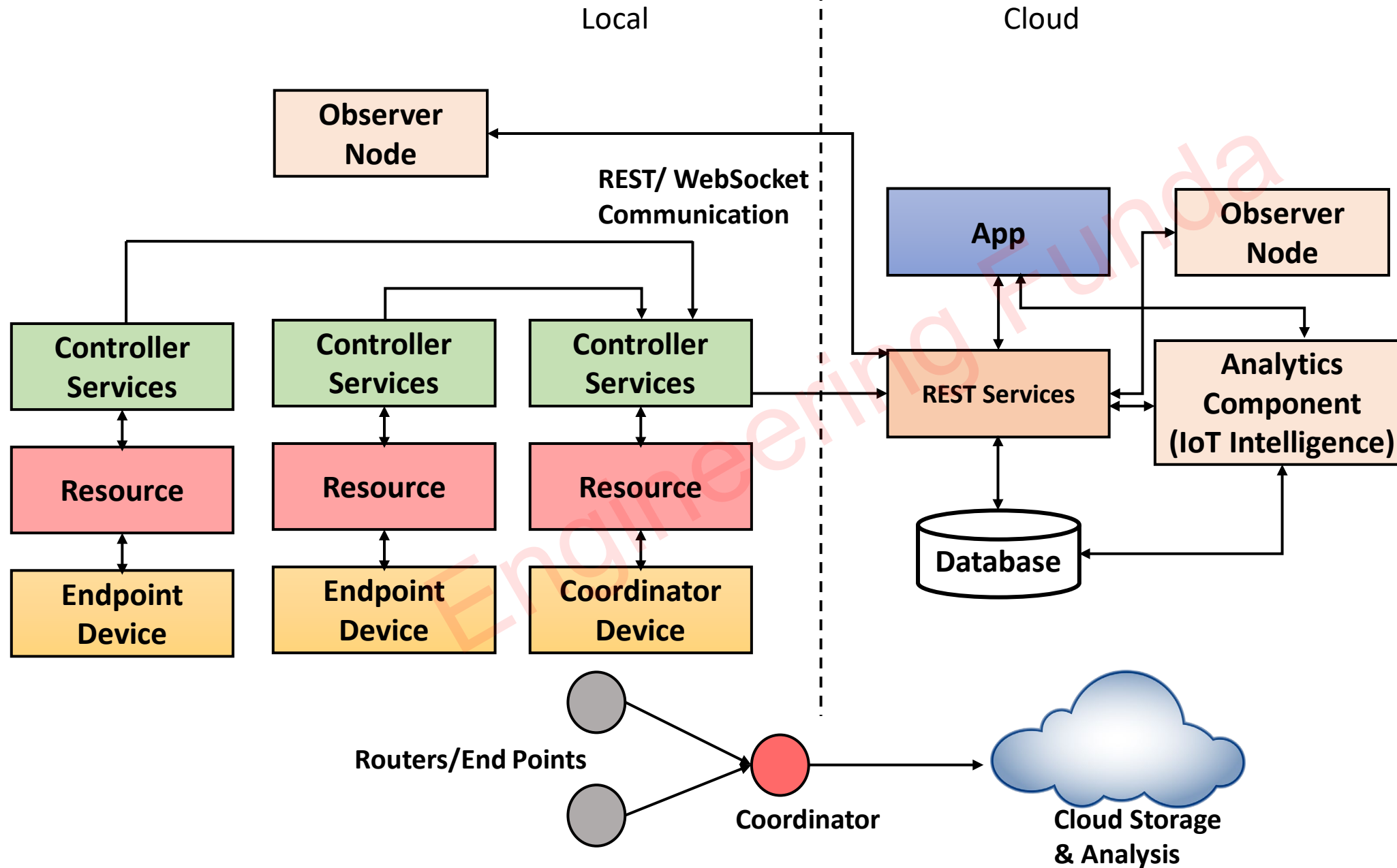
IoT Level-4

- **level-4 IoT system has multiple nodes that perform local analysis. Data is stored in the cloud and the application is cloud-based.**

- **Level-4 contains local and cloud-based observer nodes which can subscribe to and receive information collected in the cloud from IoT devices.**

- **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.**

IoT Level-5

Local   Cloud

IoT Level-5

Observer Node

REST/ WebSocket Communication

App

Observer Node

Controller Services

Controller Services

Controller Services

REST Services

Analytics Component (IoT Intelligence)

Resource

Resource

Resource

Database

Endpoint Device

Endpoint Device

Coordinator Device

Routers/End Points

Coordinator

Cloud Storage & Analysis

IoT Level-5

- A level-5 IoT system has multiple end nodes and one coordinator node.

- The end nodes that perform sensing and/or actuation.

- Coordinator node collects data from the end nodes and sends to the cloud.

- Data is stored and analyzed in the cloud and application is cloud-based.

- 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.

IoT Level-6
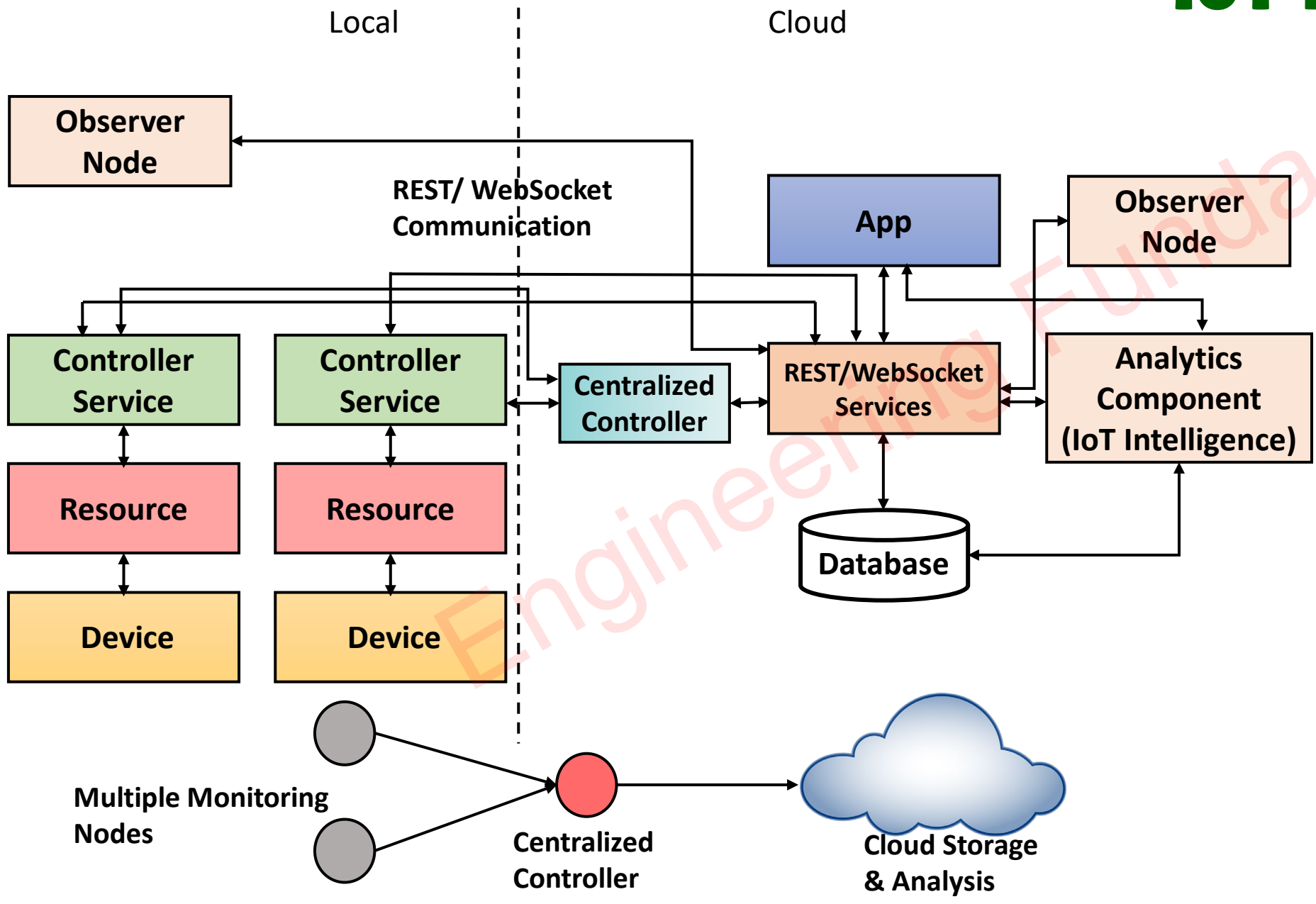
IoT Level-6

- A level-6 IoT system has multiple independent end nodes that perform sensing and/or actuation and send data to the cloud.

- 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.