MCA571: Cloud Computing
Assignment-Case Study

Name: Dharamraj Bhatt
Reg.No: 1947216

Cloud solution for IoT

The Internet of Things (IoT) intends to connect the physical world, which is made up of devices, sensors, and actuators, to the virtual world of the Internet in order to interconnect objects and generate information from the data collected. In general, devices have limited computing power and storage capacity. Cloud Processing (CC) is built on sharing resources and has essentially unlimited capacity in terms of storage and computing power. As a result, one of the most promising options appears to be the convergence of IoT with CC.

Architectures: Architecture is defined as: In reference to computers, software or networks, the overall design of a computing system and the logical and physical interrelationships between its components. The architecture specifies the hardware, software, access methods, and protocols used throughout the system.

1. **IoT architecture:**

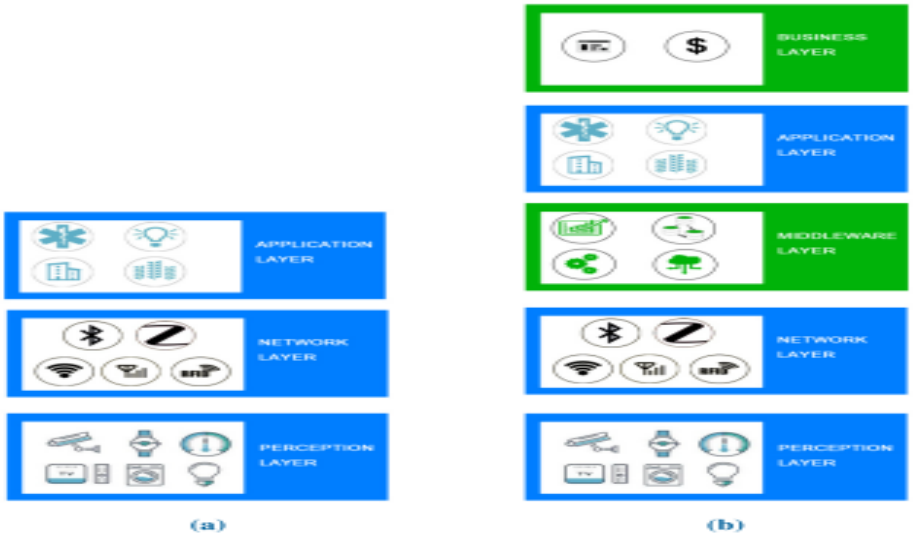

FIGURE 1. IoT architectures: (a) 3 layers and (b) 5 layers.

The growing number of heterogeneous connected and interconnected things necessitates the use of a layered approach.FIGURE 1: Internet of Things Architectures architecture (a) 3 layers and (b) 5 layers. Even if no reference model exists, the most common models in the literature are 3 or 5 layer architectures. The Application, Network and Perception Layers make up the three-layer architecture shown in Figure 1a. The five layers in Figure 1b. offer more abstraction by putting a Middleware layer between the Network and the Application, as well as a Business layer on top.

2. **CLOUD-IoT ARCHITECTURE:** The User Layer, Proximity Network, Public Network, Provider Cloud, and Enterprise Network are the essential components of the architecture represented in Fig.2. IoT users and their end-user applications are found in the User Layer. It is not bound by anyone's network domain. The Proximity Network domain supports networking. The Proximity Network domain includes devices (such as sensors/actuators, firmware, and administration agents) as well as the physical entity. The Public Network uses a wide area network, usually the Internet, to connect the devices of different proximity networks. It also contains Edge Service, which allows the safe flow of data from the Internet into the Provider Cloud. The Provider Cloud collects data from devices and other sources, as well as provides fundamental IoT applications and services (storage, analytics, visualization). It includes device management components (provisioning, remote administration, software updating, remote control). In the Enterprise Network domain, the insights created by the Provider Cloud are used by users and enterprise applications. All parts of the architecture are covered by IoT governance and security subsystems. Identity and access management (IAM), data protection, security monitoring, analysis, and reaction are all aspects of the security system that must be considered.

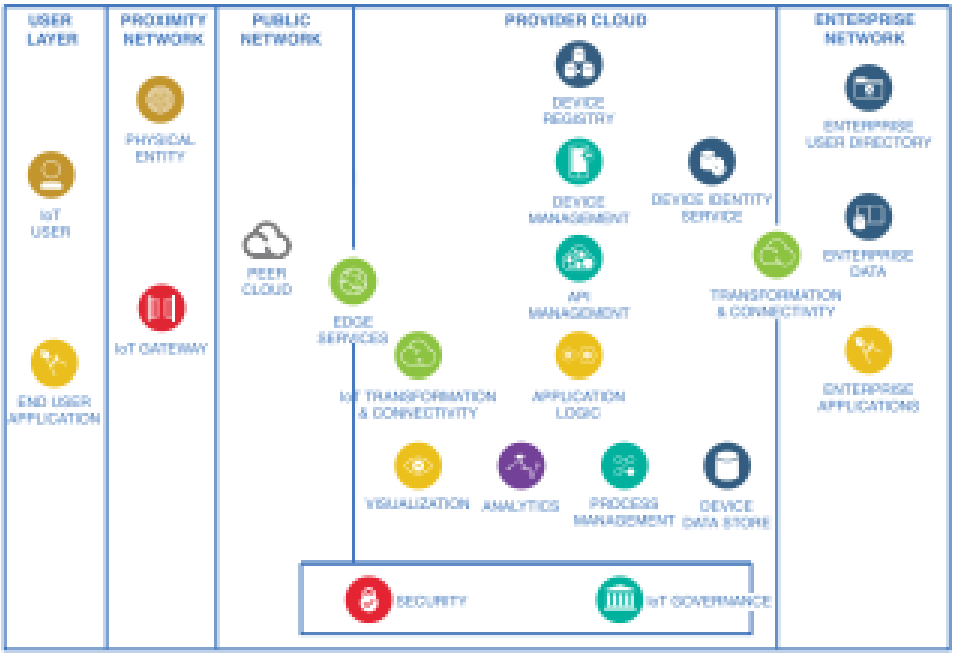

FIGURE 2. Elements of IoT solutions. (Source: Cloud standards customer council, *Cloud customer architecture for IoT, 2016).*

According to the Industrial Internet Consortium Reference Architecture (Fig.3), the Cloud components of IoT architecture are organized in a three-tier manner. This architecture is

made up of three layers: edge, platform, and enterprise. The reference architecture's edge tier includes the Proximity and Public Networks, which collect and send data from devices. A device can communicate with the Cloud either directly or through an intermediary gateway. Before delivering data to the Cloud, the field gateway does protocol translation and may be able to perform local storage, filtering, and processing on received data. The Provider Cloud is the platform tier. It manages and visualizes APIs and receives, processes, and analyses data flow in flight and at rest from the edge tier. It also allows control orders to be initiated from the Enterprise Network to the Public Network. The enterprise tier is responsible for implementing domain-specific applications, decision support systems, and end-user interfaces. It accepts data from the edge and platform tiers and sends control directives to both the platform and edge tiers.

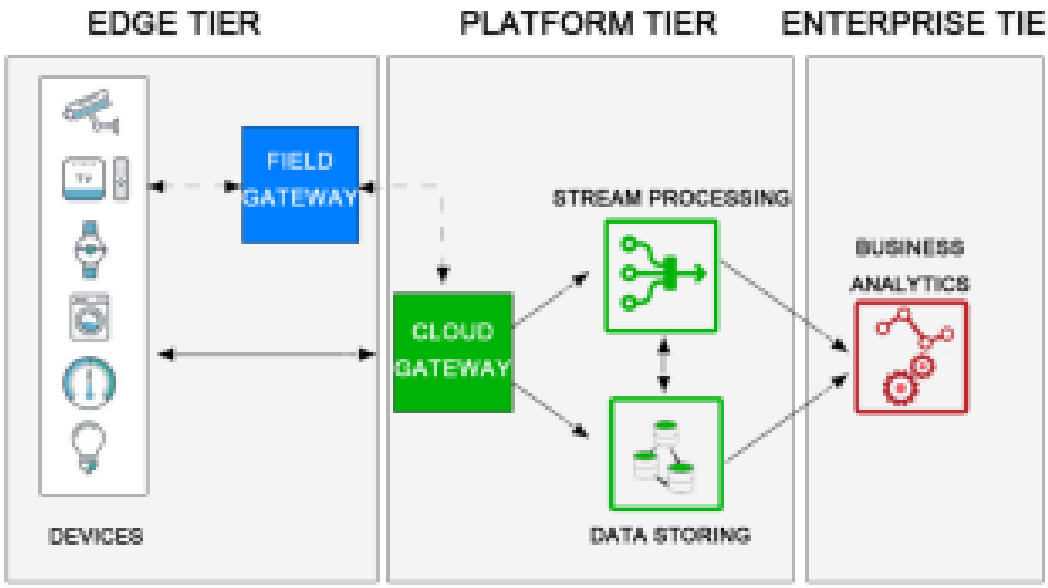

FIGURE 3. High level cloud-IoT 3-tier architecture.

IoT and cloud integration: With the integration of IoT and Cloud we have the opportunity to expand the use of the available technology that is provided in cloud environments. Applications and information that use the Internet of Things technology with this integration can be used through cloud storage. The cloud offers to mobile and wireless users to access all the information and the application that needed for the IoT

1. AWS IoT Core

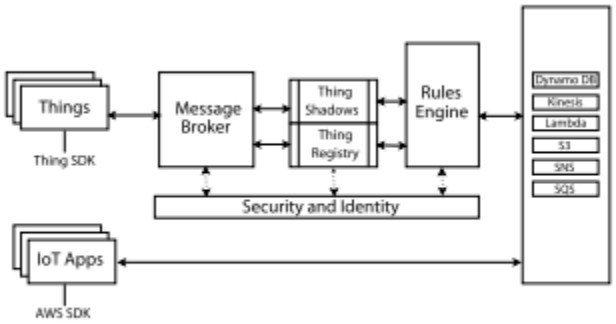

FIGURE 5. AWS IoT Core architecture and integration.

2. MICROSOFT AZURE FOR IoT

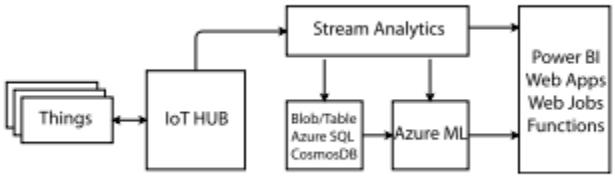

FIGURE 6. Azure solution architecture and integration.

3. GOOGLE CLOUD IoT CORE

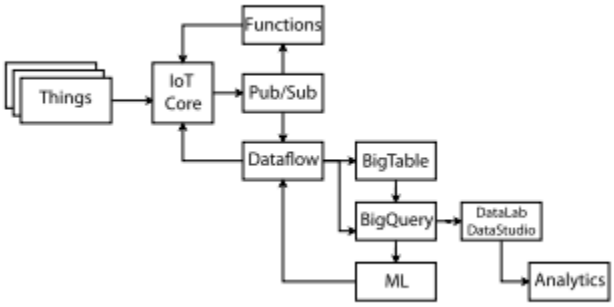

FIGURE 7. Google cloud IoT core architecture and integration.