SNS COLLEGE OF TECHNOLOGY

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Coimbatore-35

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DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

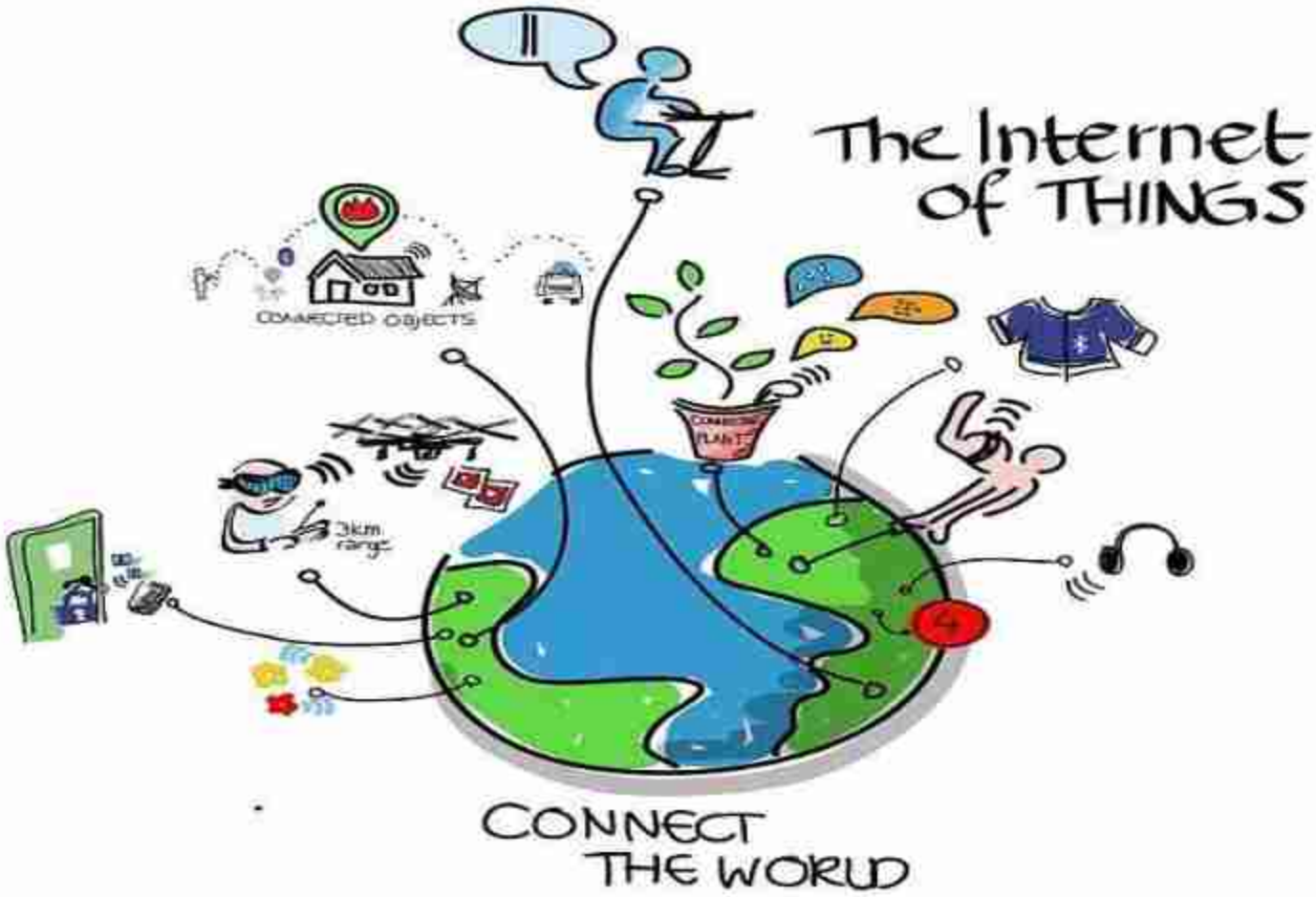
19ECT308-WIRELESS TECHNOLOGIES FOR IoT

III YEAR/ VI SEMESTER

UNIT 4 – PROTOTYPING AND DESIGNING SOFTWARE FOR IOT APPLICATIONS

TOPIC Internet and Web/Cloud services software development.

Connecting IoT to Cloud

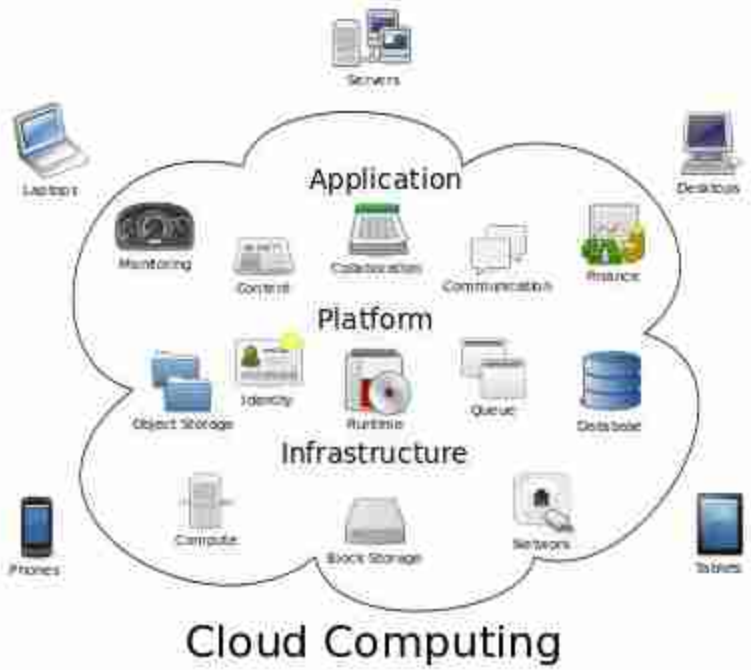


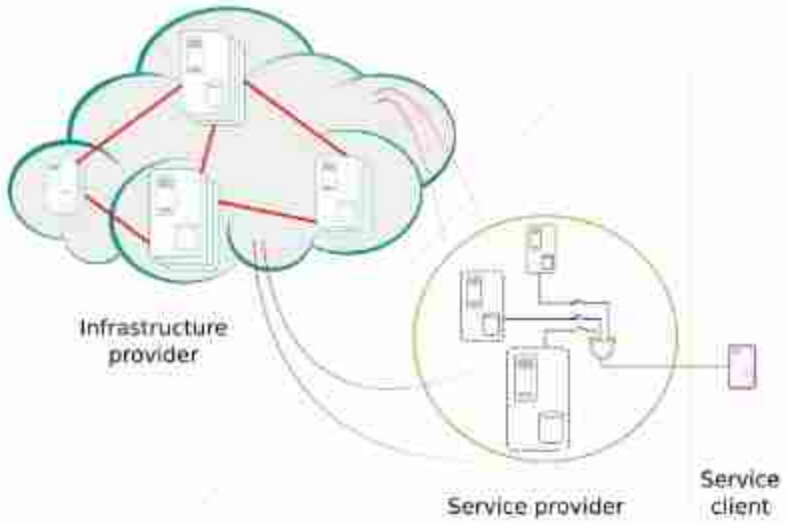
Connecting IoT to Cloud

- A huge amount of IoT data should be translated into meaningful information.
- IoT devices are not having enough computing facilities in the field.
- Cloud computing services facilitate instantaneous, on-demand delivery of computing infrastructure, databases, storage and applications needed for the processing and analysis of data points generated through hundreds of IoT devices.
- No wonder 96% of the organizations have adopted cloud in one form or the other. And with the emergence of the likes of Amazon Web Services, Google Cloud Platform, Microsoft Azure and IBM Cloud, the growth prospects of IoT appear even brighter.

Connecting IoT to Cloud

Introduction to the Cloud





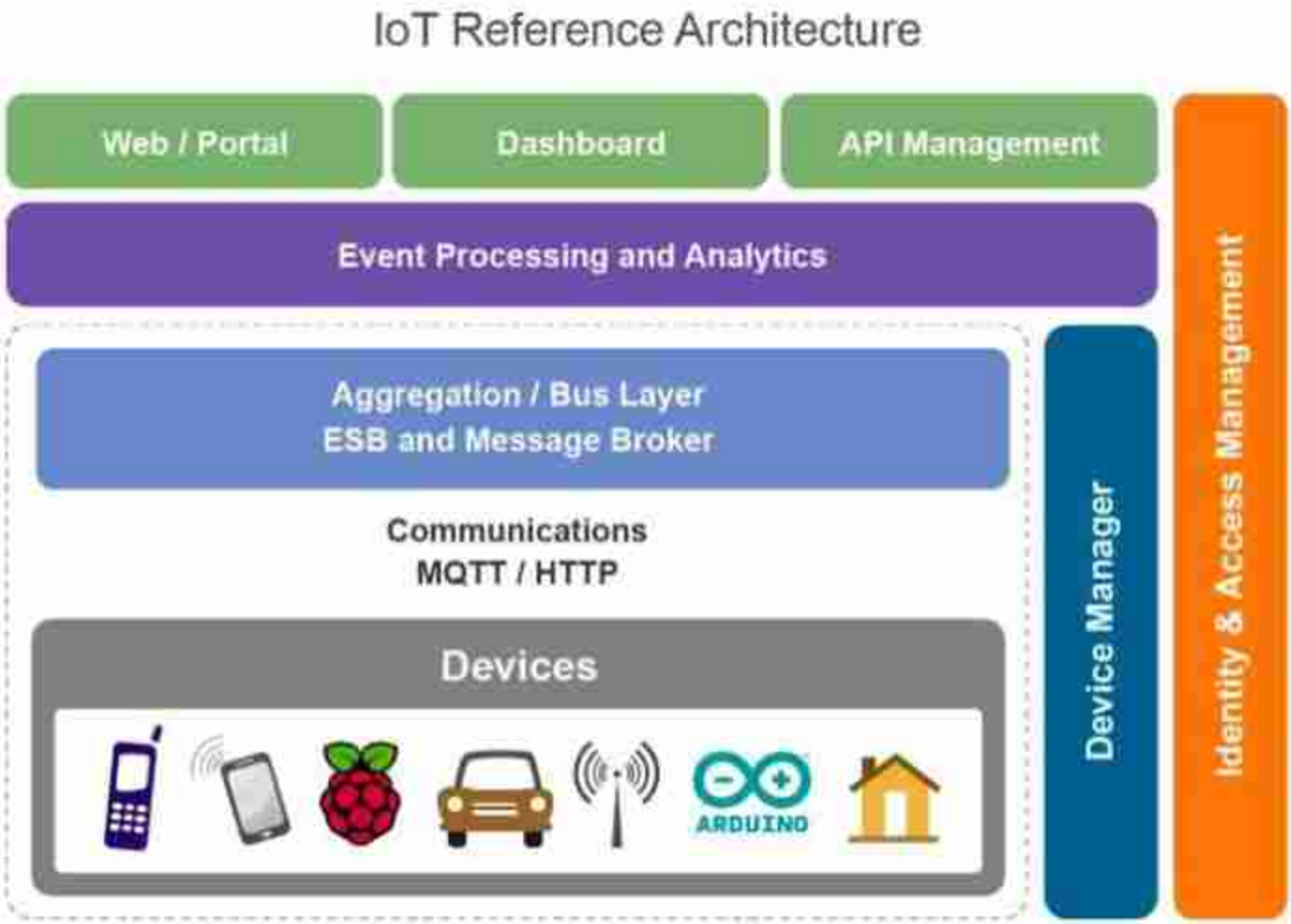
Connecting IoT to Cloud

Introduction to the Cloud

Cloud computing is typically defined as a type of computing that relies on sharing computing resources rather than having local servers or personal devices to handle applications.

In cloud computing, the word cloud (also phrased as "the cloud") is used as a metaphor for "the Internet," so the phrase cloud computing means "a type of Internet-based computing," where different services — such as servers, storage and applications —are delivered to an organization's computers and devices through the Internet.

Connecting IoT to Cloud



IoT Architecture

Connecting IoT to Cloud

An IOT platform has basically three building blocks

1. Things
2. Gateway
3. Network and Cloud

Connecting IoT to Cloud

Beaglebone Back

Raspberry Pi

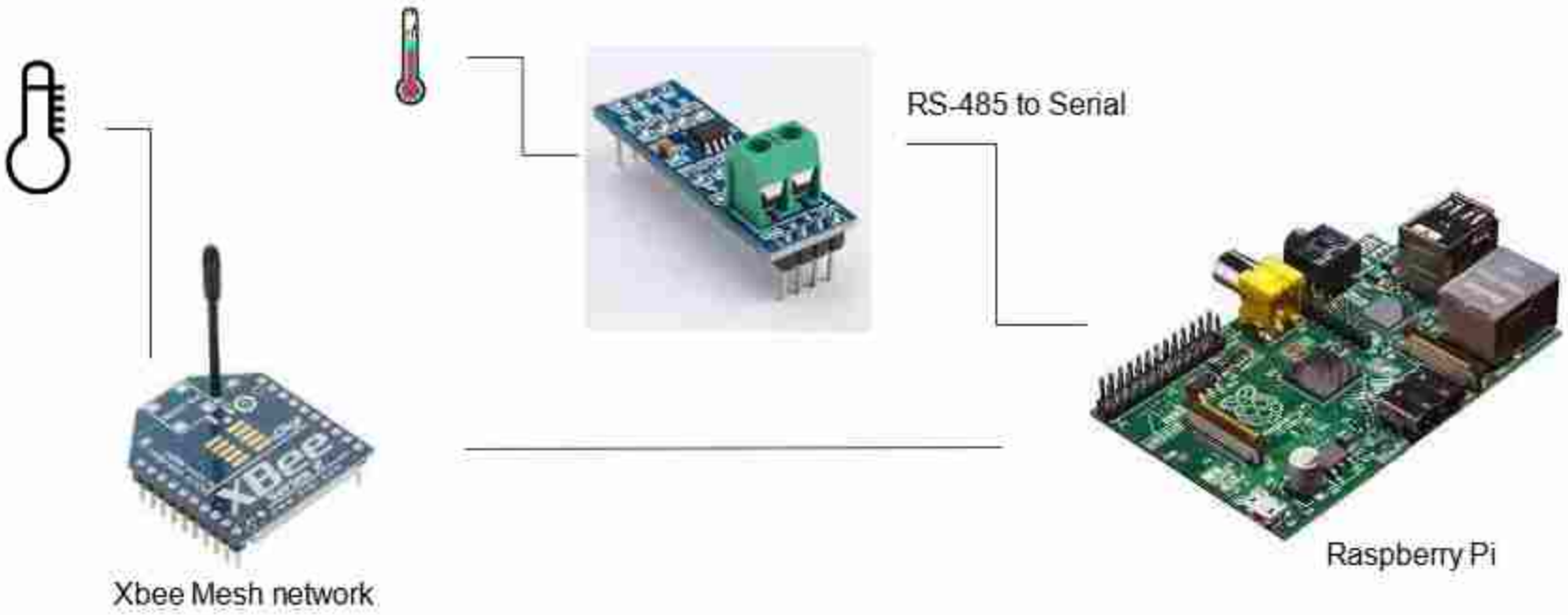
Intel Galileo

The heart of a cloud platform could use open source boards like the Raspberry Pi, Beaglebone Black, Intel Galileo etc.

These are usual Linux boards that run different flavours of Linux like Raspbian on the Raspberry Pi, Angstrom on the Beaglebone etc. These boards interface with devices on the one hand and the cloud platform on the other.

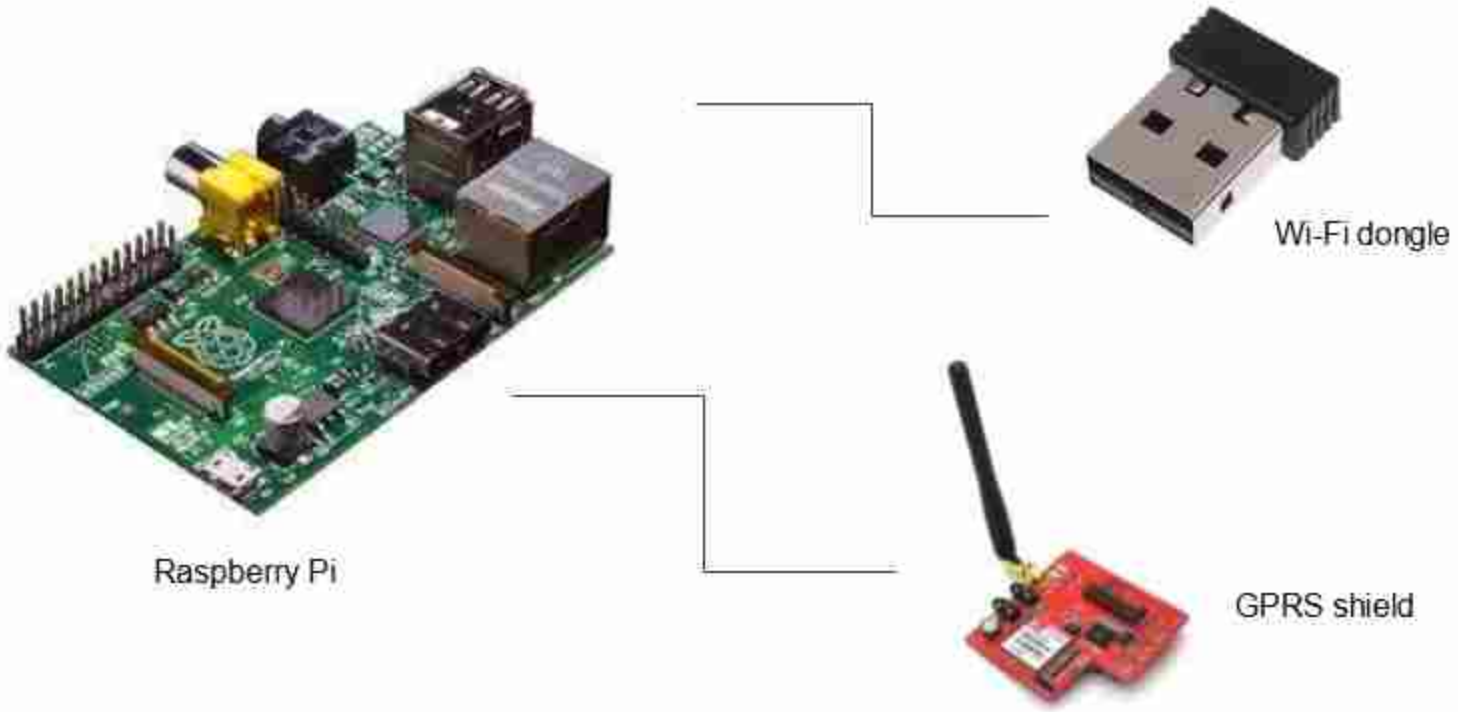
Sensor Interfaces

Connecting IoT to Cloud



Let's take a look at the device interfaces. So for example, devices could interface with the Raspberry Pi over RS-485, and Xbee. An RS-485 network allows a multi-dropped serial wired network allowing a host of devices to connect. The Xbee creates a wireless mesh network allowing large number of wireless devices to connect. These are open source interfaces and allows creation of a large sensor network. We could also use the GPIO on the Raspberry Pi for physical inputs.

Connecting IoT to Cloud

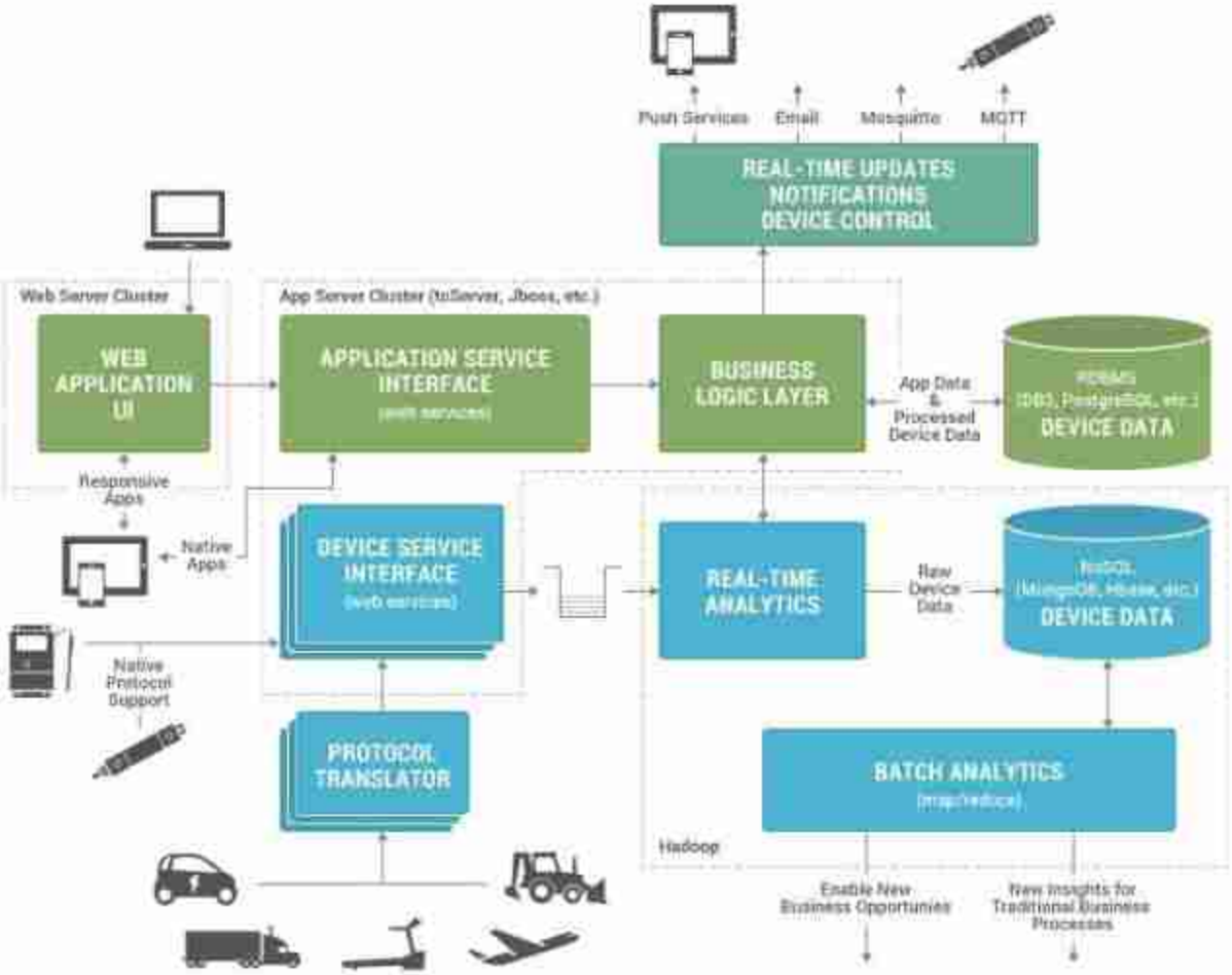


The next interface we look at is the cloud interface. This is achieved using a simple WiFi dongle or a GPRS shield.

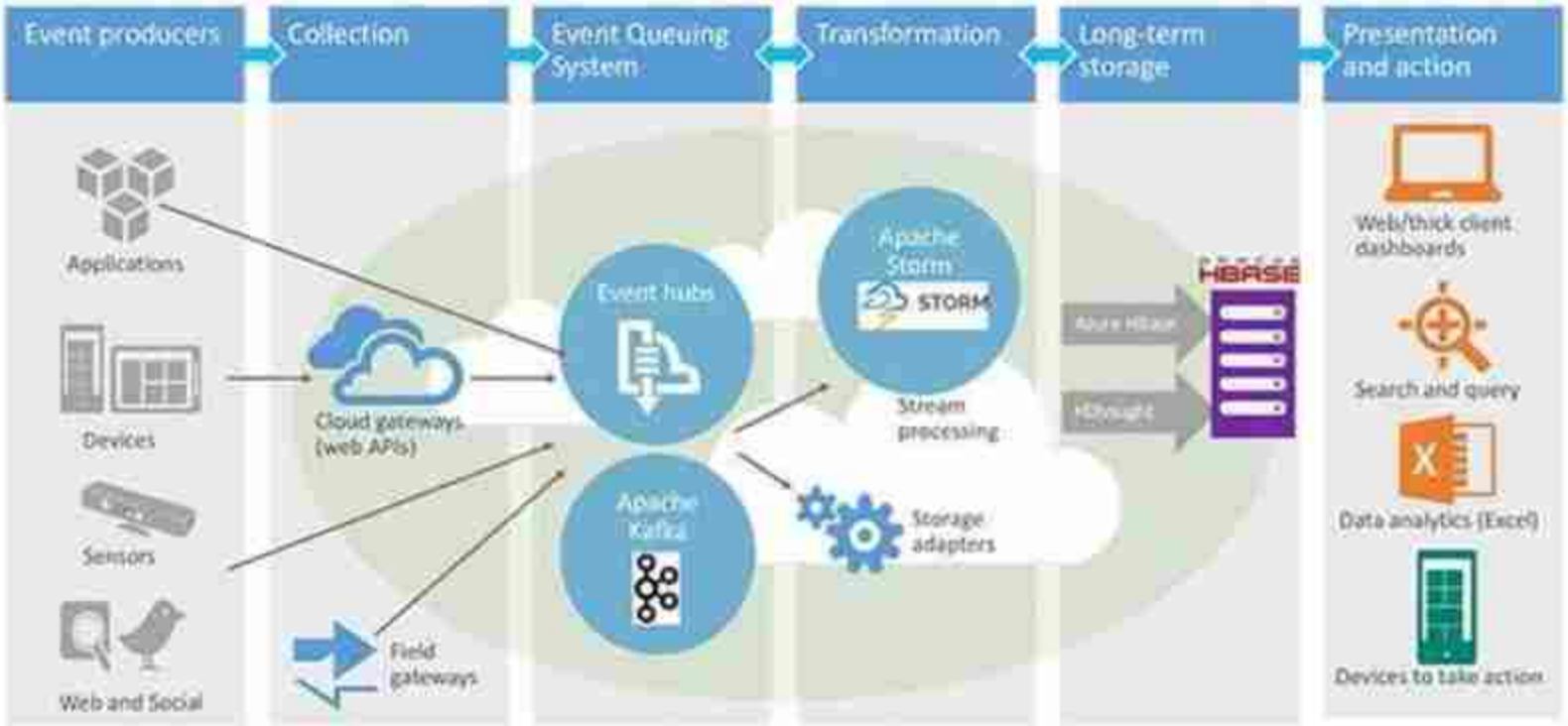
The WiFi dongle interfaces over USB and the GPRS shield uses the serial interface. Also available is the Ethernet port which could be used for interface.

Cloud Architecture

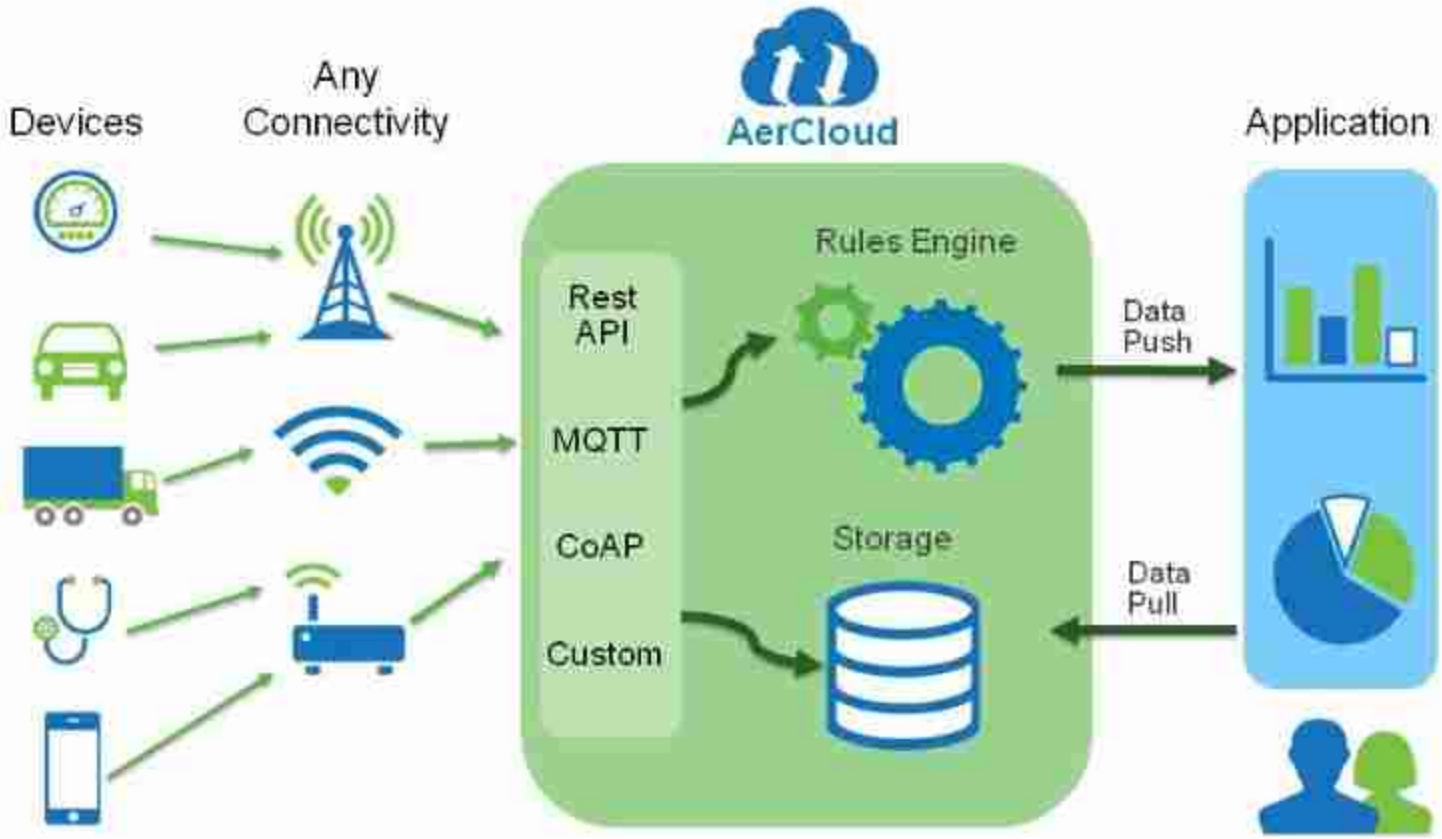
Connecting IoT to Cloud



Connecting IoT to Cloud

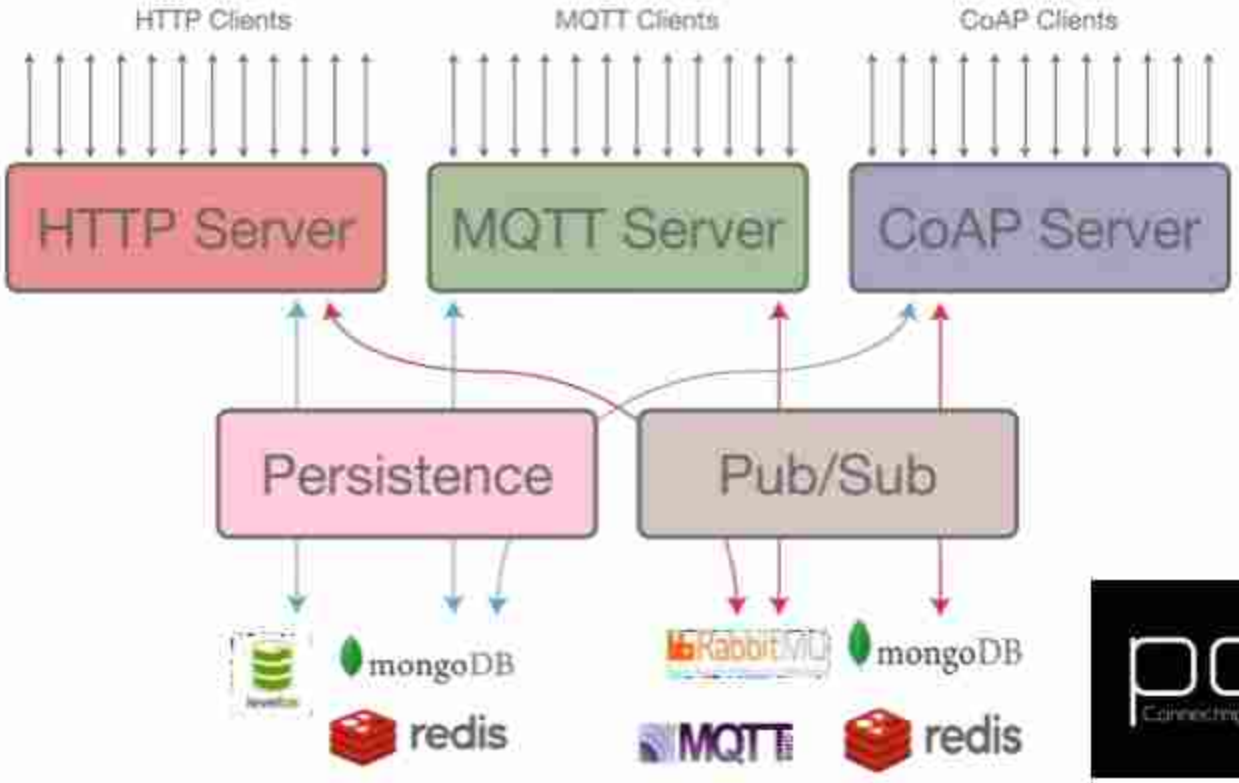


Connecting IoT to Cloud



Cloud Data Acquisition

Connecting IoT to Cloud



•Use of a very good open-source implementation called Ponte, developed by Matteo Collina (@matteocollina).

•It supports three of the most widely used protocols for gateway interfaces, namely HTTP, MQTT and COAP.

• It support multiple databases like MongoDB, Redis and LevelDB. Also has an inbuilt pub-sub mechanism for publishing and subscribing to other devices over multiple protocols.

Connecting IoT to Cloud

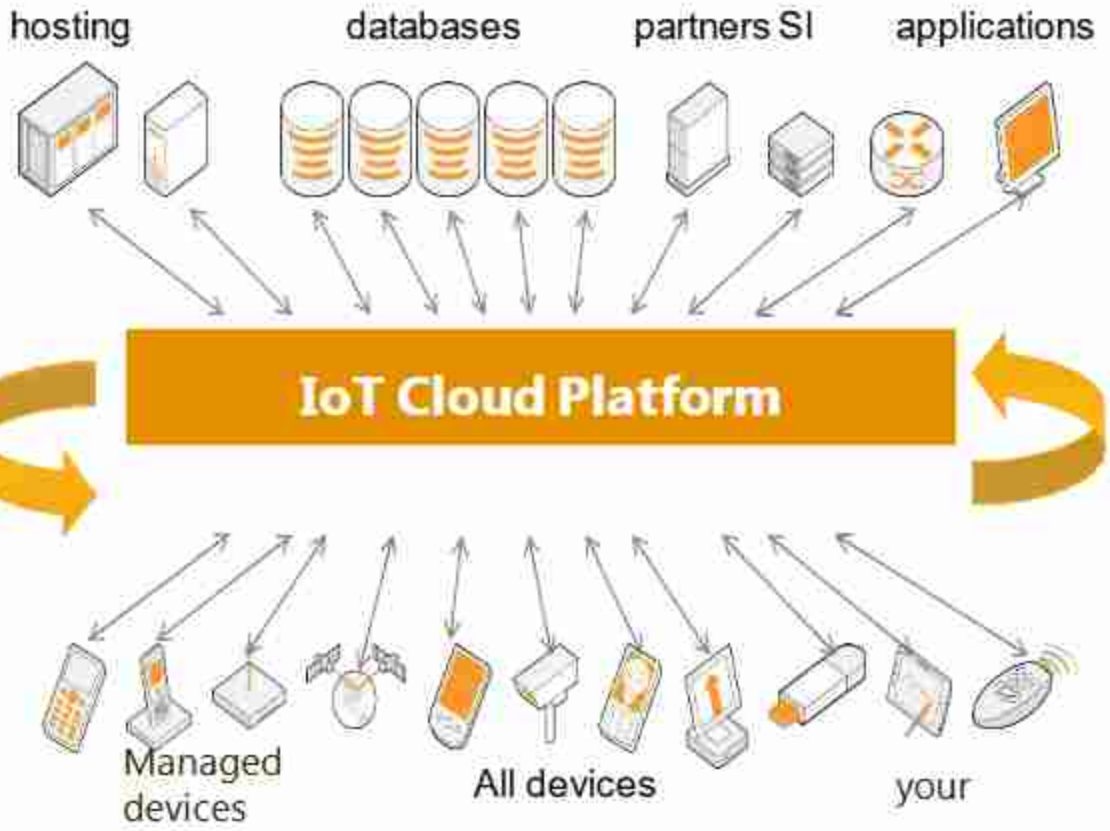
CONVERGENCE APPROACH'S

–Cloud-centric IoT (Bring IoT functionalities in Cloud)

–IoT-Centric Cloud (Bring Cloud functionalities in IoT)

Connecting IoT to Cloud

CLOUD-CENTRIC IOT PLATFORM



Simple, scalable, robust, resilient, trustful & secure

Connecting IoT to Cloud

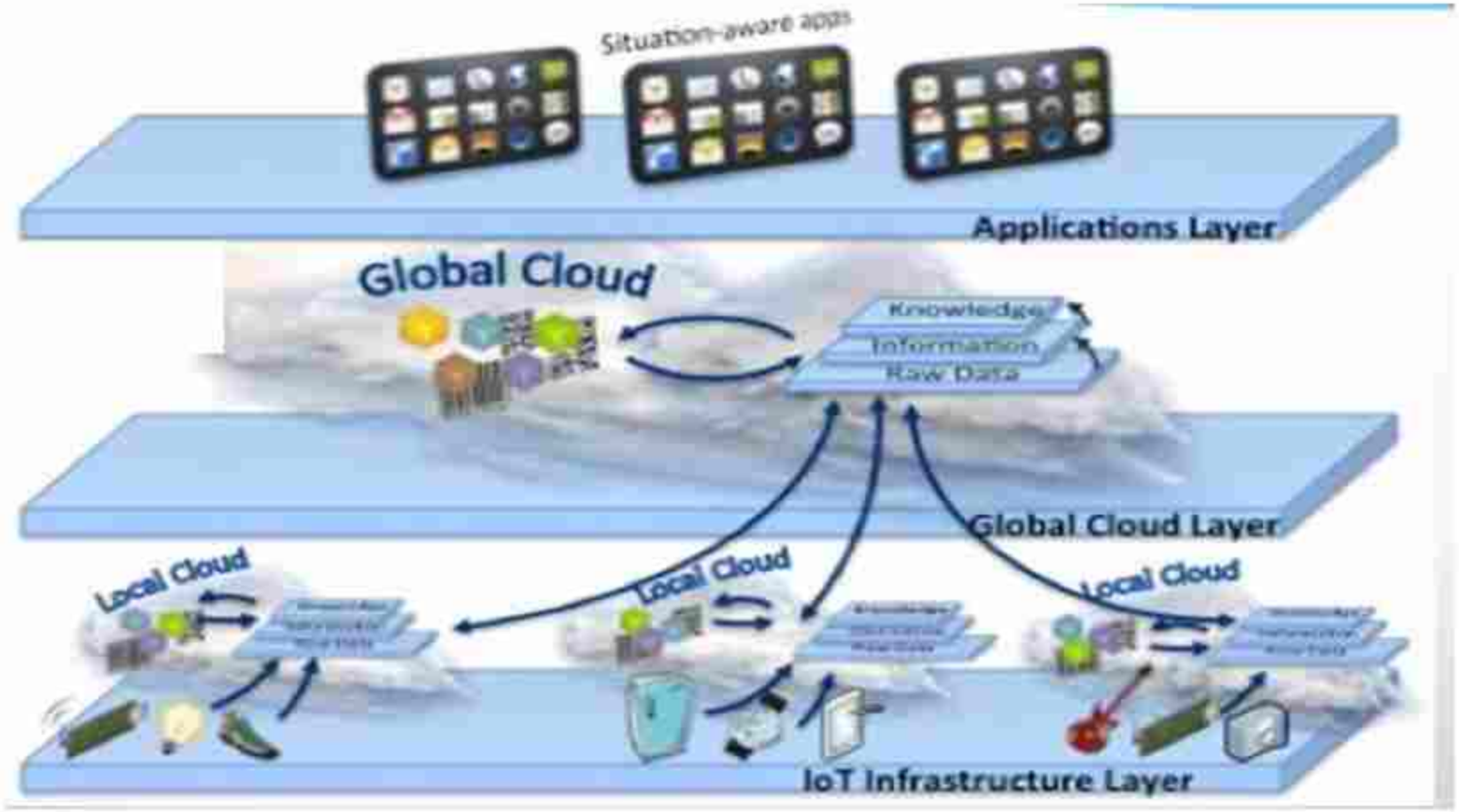
CLOUD-CENTRIC IOT

- Bring IoT data in the cloud
- Processing and computing the data and deploy management tools in cloud
- This approach is good if services are provided among objects

located in multiple location

Connecting IoT to Cloud

IOT-CENTRIC CLOUD COMPUTING



Connecting IoT to Cloud

IOT- CENTRIC CLOUD COMPUTING

- IoT infrastructure will provide the opportunities to take services, workloads, applications and large amounts of data and deliver it all to the network.
- Processing and storage of data close to users/near to sources

– support mobile computing and data streaming

- Creating dense geographical distribution
- This approach are useful when data coming from same location
- Supporting end-users security
- Data process and service execute locally

Connecting IoT to Cloud

Software as a Service (SaaS)

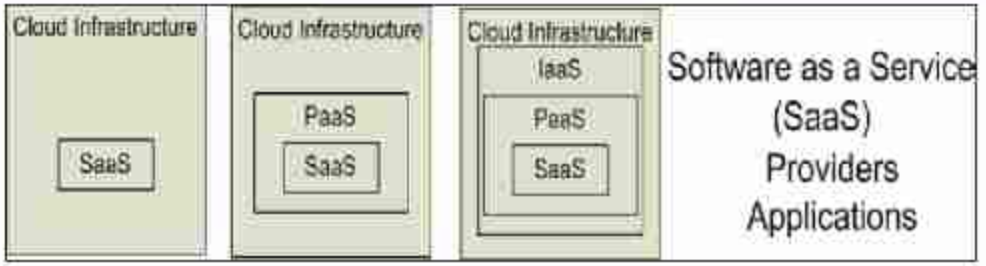
Platform as a Service (PaaS)

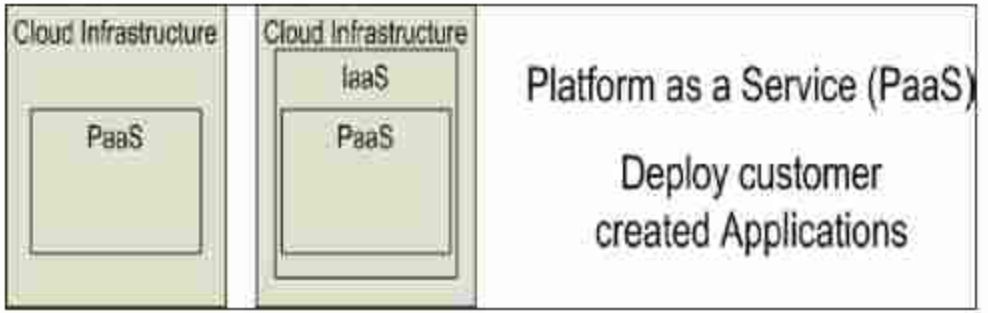
Infrastructure as a Service (IaaS)

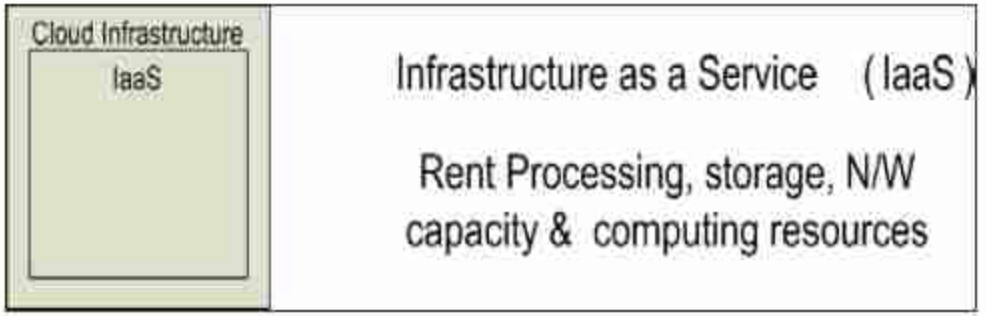
SalesForce CRM

LotusLive

Google App Engine



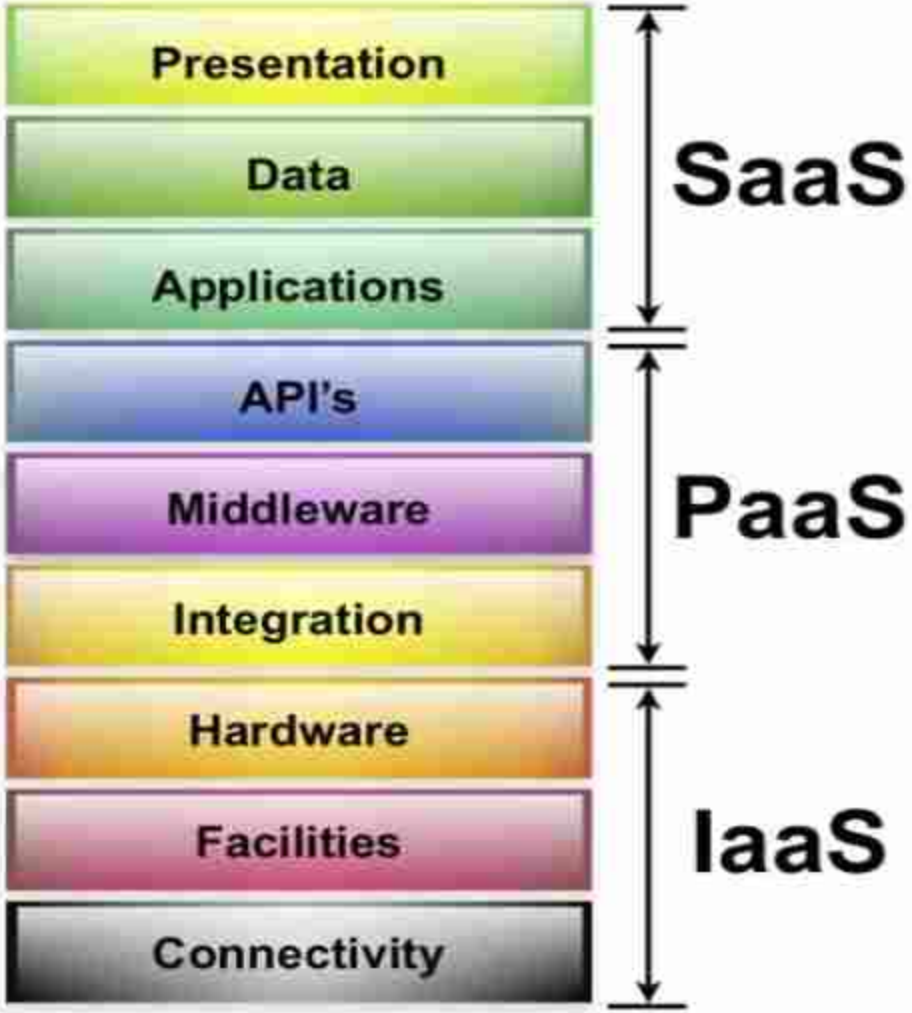




CLOUD SERVICE MODELS

Connecting IoT to Cloud

CLOUD ARCHITECTURE



ADVANTAGES OF CLOUD COMPUTING

- Lower computer and software costs:
  - You do not need a high-powered and high-priced computer to run cloud

computing's web-based applications.

- Improved performance:
  - Computers in a cloud computing system boot and run faster because they have fewer programs.
- Instant software updates
- Unlimited storage capacity
- Increased data reliability
- Universal document access
- Latest version availability

DISADVANTAGES OF CLOUD COMPUTING

- Requires a constant Internet connection.
- Stored data might not be secure.
- Stored data can be lost.
- Does not work well with low-speed connections
- Can be slow:

– Everything about the program, from the interface to the current document, has to be sent back and forth from your computer to the computers in the cloud.

Programming APIs and Hacks Various Real time applications of IoT

- All the big giant tech firms such as Google, Microsoft, Facebook and twitter all have their own APIs for developers to integrate their projects into one another with ease.
- Developers can create new applications that can integrate with web services such as Facebook, Twitter or DropBox
- APIs make it possible for developers to create a mashup of different web services to enhance the overall end user experience
- APIs based around the IoT are mostly web service APIs and they can come in different forms such as SOAP, REST or XML/JSON.
- Examples of popular web service APIs are Flickr API, Google maps API and Google maps web services API.
- When an application or client wants to communicate with a web service, the application sends back an HTTP request to the client in response.

SOAP – Simple Object Access Protocol

- SOAP is a protocol that defines the method of communication between the client and the server.
- The transfer of data is done in a XML format.
- A SOAP web service publishes a definition of its interface in a machine-readable document using web services definition language.

XML and JSON

- XML and JSON are much older methods than SOAP.
- Instead of using a specific format for data transfer, both methods use a simpler approach to calls and tend to use much less bandwidth, which sometimes can be preferred.

Programming APIs and Hacks Various Real time applications of IoT

REST – Representation State Transfer

- REST APIs are a set of architectural principles rather than a protocol.
- Some of the features required for a REST service include the simplicity of interfaces, identification of resources within the request made and also the ability to manipulate the resources via that particular interface.

Code :

https://github.com/openhomeautomation/CC3000_REST/blob/master/cc3000_rest/cc3000_rest.ino

Programming APIs and Hacks Various Real time applications of IoT

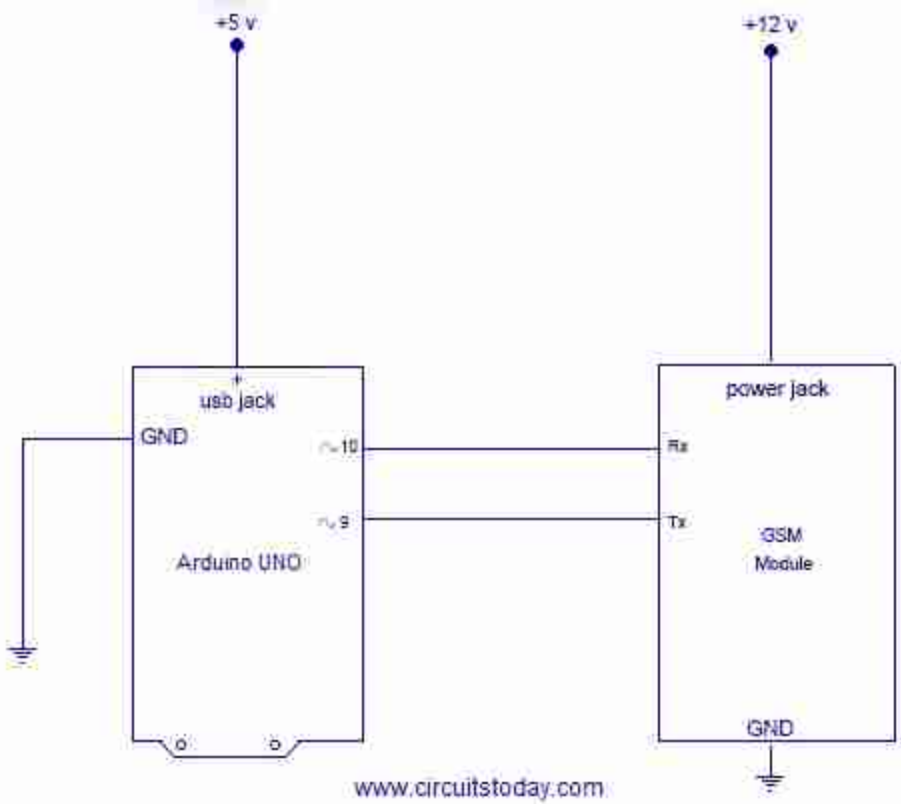
Web socket

- WebSocket is a technology that keeps the TCP connection open, so you can constantly send data back and forth between the ESP and the client, with low latency. And since it's TCP, you're sure that the packets will arrive intact.

Code: https://tttapa.github.io/ESP8266/Chap14%20-%20WebSocket.html

Programming APIs and Hacks Various Real time applications of IoT

How to Interface GSM Module to Arduino-Send and Receive SMS



Play video

Programming APIs and Hacks Various Real time applications of IoT

Example

```
#include <SoftwareSerial.h>

SoftwareSerial mySerial(9, 10);

void setup()

{

 mySerial.begin(9600);  // Setting the baud rate of GSM

    Module    Serial.begin(9600);   // Setting the baud rate of Serial Monitor

    (Arduino)   delay(100);

}
```

Programming APIs and Hacks Various Real time applications of IoT

```
Void loop()
{
 if (Serial.available()>0)
switch(Serial.read())
{
case 's':
 SendMessage();
break;
 case 'r':
RecieveMessage();
   break;
  }
if (mySerial.available()>0)
 Serial.write(mySerial.read());
}
```

3.3 Programming APIs and Hacks Various Real time applications of IoT

```
void SendMessage()
{
mySerial.println("AT+CMGF=1");   //Sets the GSM Module in Text  Mode
delay(1000);  // Delay of 1000 milli seconds or 1 second
 mySerial.println("AT+CMGS=\"+91xxxxxxxxxx\"\r"); // Replace x with
    mobile number
delay(1000);
 mySerial.println("I am SMS from GSM Module");// The SMS text you want
    to send
delay(100);
 mySerial.println((char)26);   // ASCII code of CTRL+Z
delay(1000);
}
```

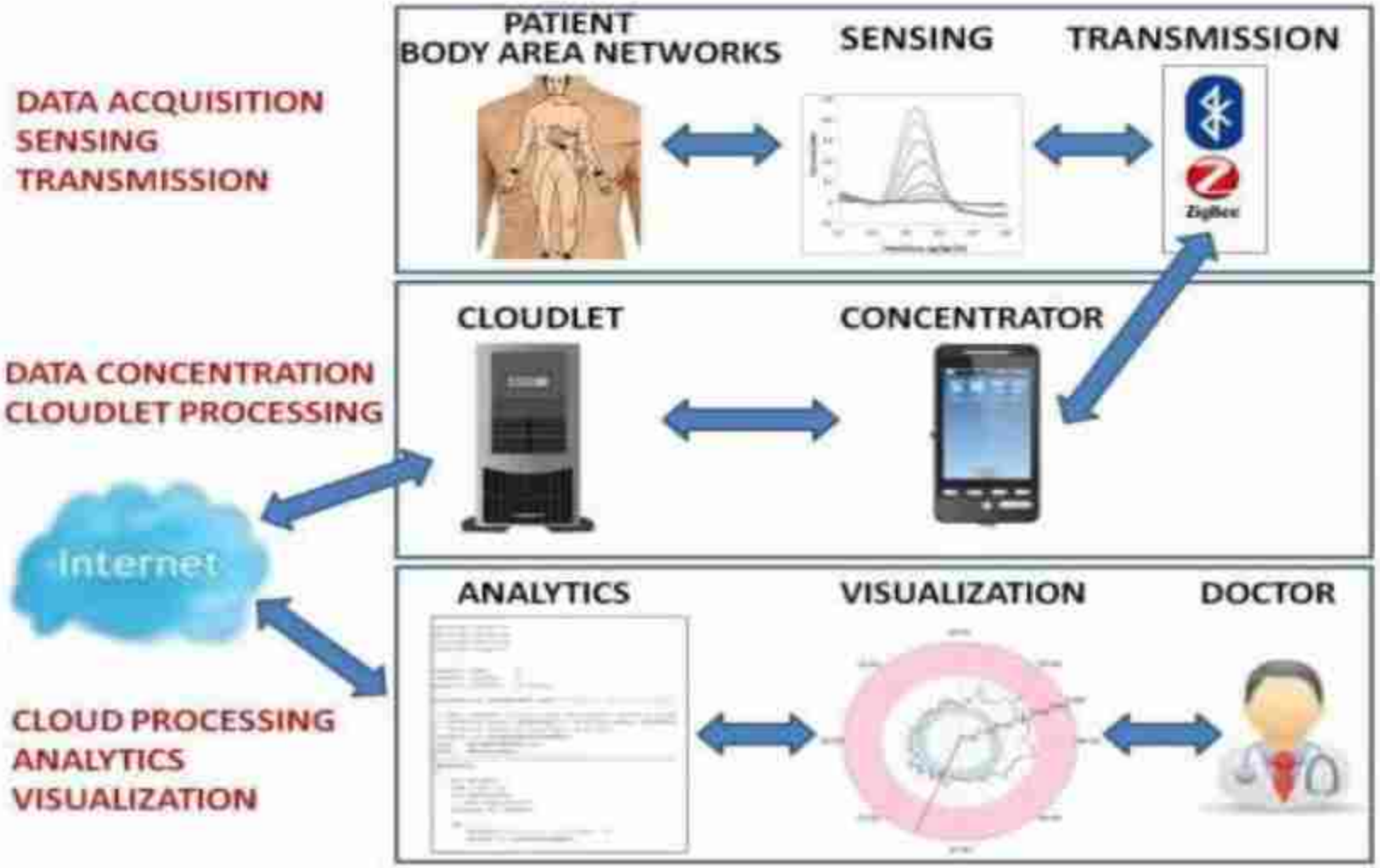
Programming APIs and Hacks Various Real time applications of IoT

```
void RecieveMessage()
 {
mySerial.println("AT+CNMI=2,2,0,0,0"); // AT Command to receive a live SMS
delay(1000);
}
```

APPLICATIONS

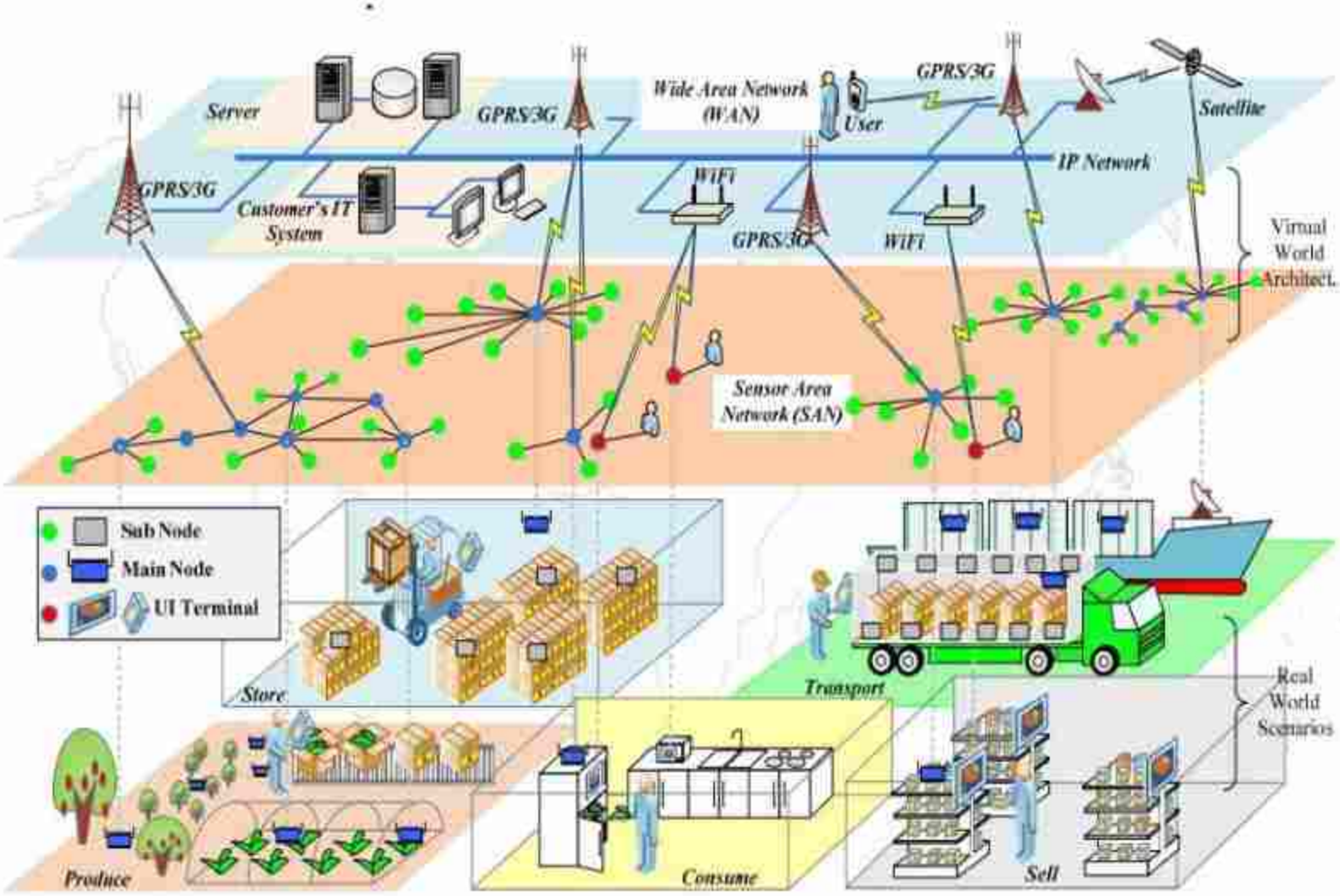
HEALTH

Connecting IoT to Cloud



FOOD

Connecting IoT to Cloud



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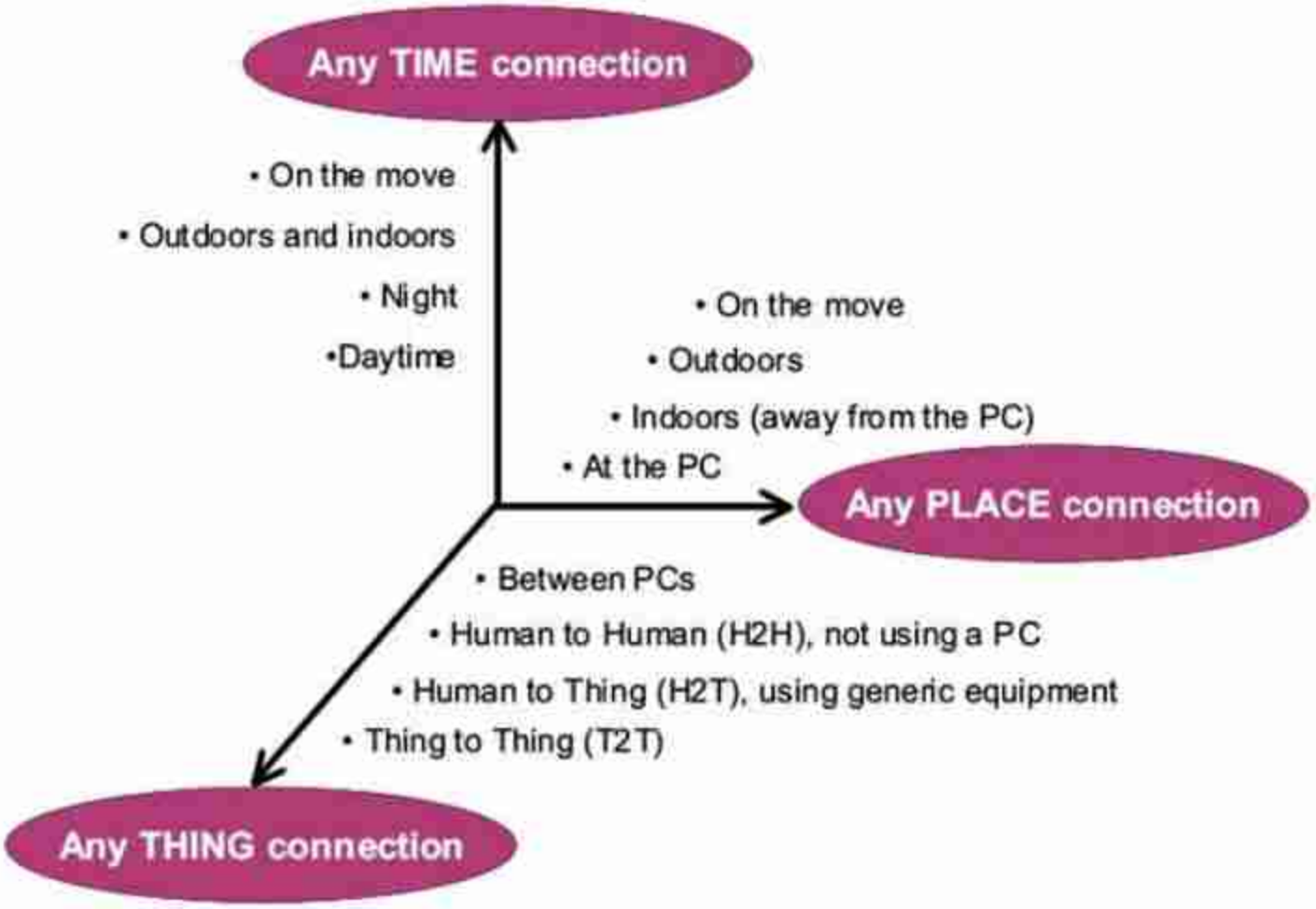

Source: ITU adapted from Nomura Research Institute

Test Your Skill

How to setup own cloud server solution

How to send data to think speak cloud