21ES614 – Internet of Things

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Syllabus

Unit 1

Introduction to IoT - Definitions, frameworks and key technologies. Functional blocks of IoT systems: hardware and software elements- devices, communications, services, management, security, and application. Challenges to solve in IoT

Unit 2

Basics of Networking & Sensor Networks - Applications, challenges - ISO/OSI Model, TCP/IP Model, Sensor network architecture and design principles, IoT technology stack, Communication models. Communication Protocols - Overview of protocols in each layer, Application protocols for the transfer of sensor data, Infrastructure for IoT: LoRa-Wan, 6LoWPAN, 5G and Sigfox.

Unit 3

Introduction to Cloud, Fog and Edge Computing. Modern trends in IoT – Industrial IoT, Wearable. Applications of IoT - Smart Homes/Buildings, Smart Cities, Smart Industry, and Smart Medical care, Smart Automation etc.

IoT Technology Stack

TECHNOLOGY STACK

- People and Business Processes Intelligent decision making based on "Things" data and Apps
- **Applications** Analysed "Things" data used in development of custom Apps
- **Data Analytics** Mining, reporting, machine learning
- **Data Storage** Big Data, harvesting & storage of "Things" data
- Cloud Infrastructure Public, private, hybrid, managed
- Connectivity / Edge Computing Communications, Networks, M2M, Wi-Fi, Telecoms
- Sensors, devices, machines, controllers



Layer

- **Cloud Applications** The customer interface for dashboards, settings and devices
- Cloud Platform Where data from IoT devices is captured. processed and stored
- Communications How devices connect to the internet and transfer data
- **Device Software** Runs on the device's processor and controls its functionality
- Device Hardware Embedded into 'Things' in the loT

Things Physical objects found in your home, workplace and everyday life







Device management, data visualisation, data analytics, alerts and alarms set-up, machine learning







Bare metal server (e.g. SanCloud hosted) or cloud hosted (e.g. Amazon Web Services (AWS), Microsoft Azure, Google Cloud Platform (GCP)









Wired, Bluetooth, WiFi, Zigbee, Thread, LTE-M/NB-IoT/2G/3G/4G/5G cellular networks, LoRaWAN



Languages used include: Linux, C, Perl, Python, Qt













IoT devices include: Sensors, SBCs. gateways, PLC interface modules and connectors























https://iotbusinessnews.com/2022/07/13/86750-what-is-the-iot-technology-stack/

https://www.technologygateway.ie/applied-iot-cluster-providing-expertise-resources-across-the-internet-of-things-technology-stack/

IoT Technology Stack

	IOT STACK	WEB STACK
TCP/IP	IOT applications Device Management	Web applications
Data Format	Binary, JSON, CBOR	HTML, XML, JSON
Application Layer	CoAP, MQTT, XMPP, AMPQP	HTTP, DHCP, DNS, TLS/SSL
Transport Layer	UDP, DTLS	TCP, UDP
Internet Layer	IPv6/IP Routing	IPv6, IPv4, IPSec
	6LOWPAN	
Network/Link Layer	IEEE 802.15.4 MAC	Ethernet (IEEE 802.3), DSL, ISDN, WIreless LAN (IEEE 802.11), Wi-Fi
	IEEE 802.15.4 PHY / Physical Radio	(IEEE 802.11), Wi-Fi

Ref: https://iotbusinessnews.com/2022/07/13/86750-what-is-the-iot-technology-stack/

Local App REST/WebSocket Communication REST/WebSocket Services Database Controller Service Resource



Monitoring Node

Device

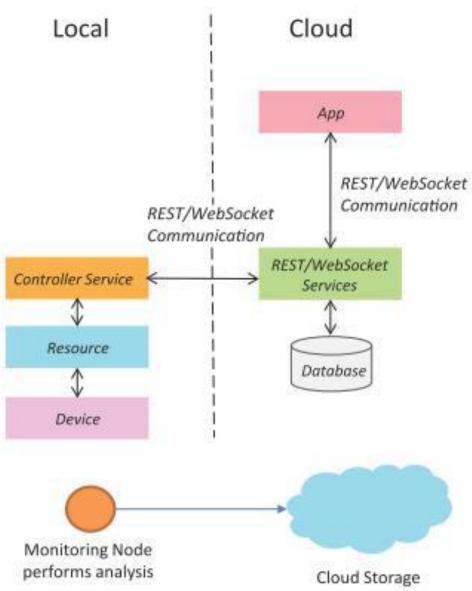
performs analysis, stores data

Ref: Arshdeep Bahga and Vijay Madisetti, "Internet of Things: A Hands-on Approach", Universities Press, 2015.

IoT Level 1

Cloud

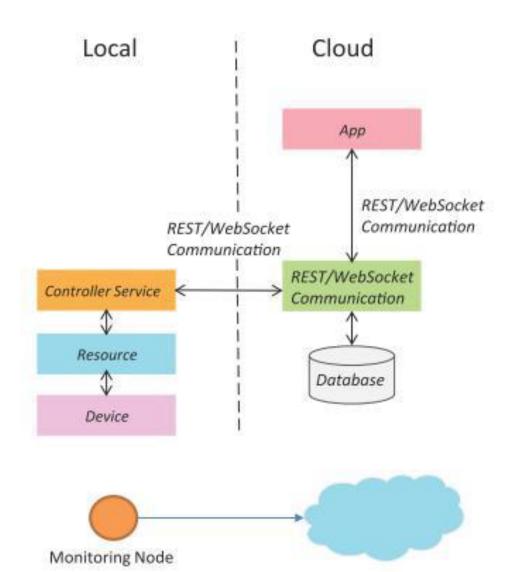
IoT Level 2



Ref: Arshdeep Bahga and Vijay Madisetti, "Internet of Things: A Hands-on Approach", Universities Press, 2015.

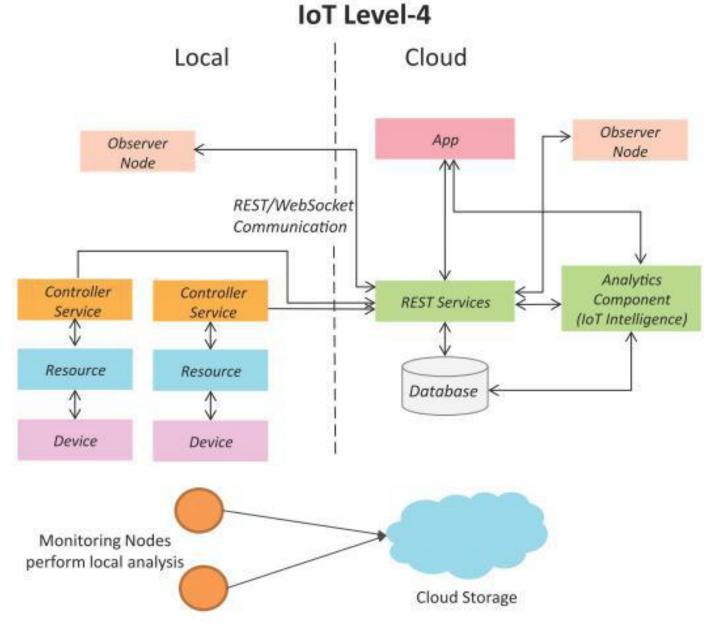
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IoT Level 3



Cloud Storage & Analysis

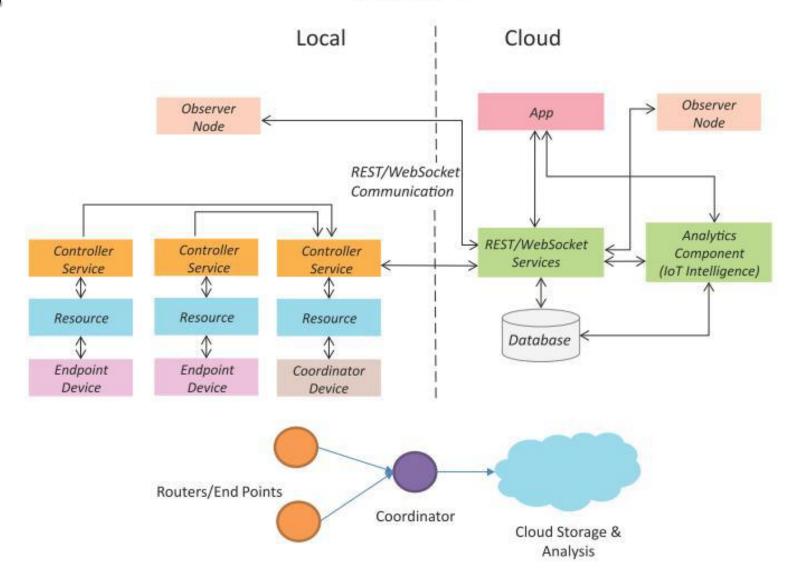
Ref: Arshdeep Bahga and Vijay Madisetti, "Internet of Things: A Hands-on Approach", Universities Press, 2015.



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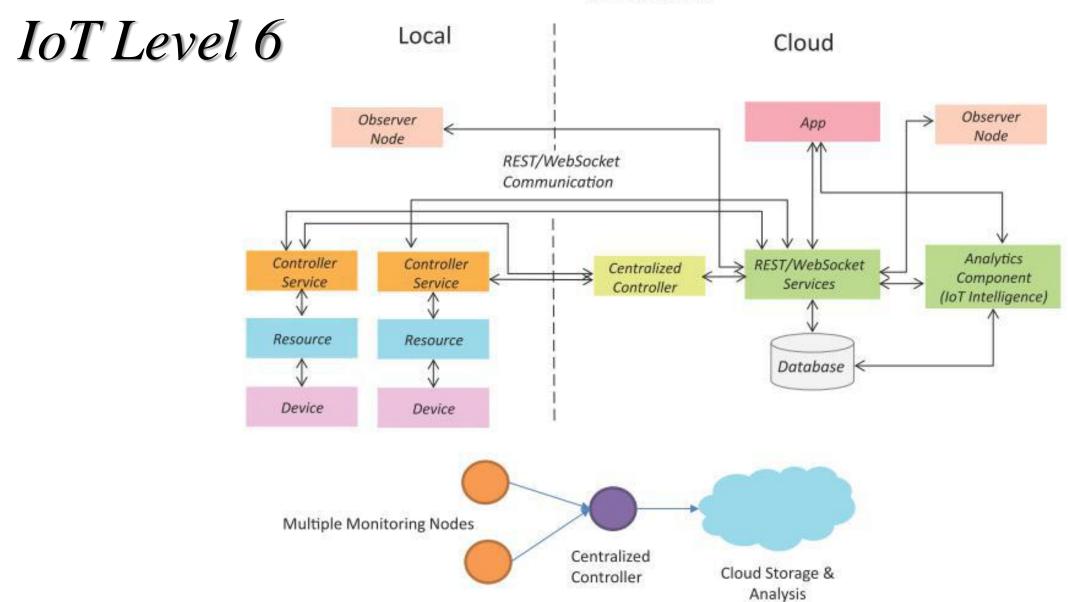
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IoT Level-5



Ref: Arshdeep Bahga and Vijay Madisetti, "Internet of Things: A Hands-on Approach", Universities Press, 2015.

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Ref: Arshdeep Bahga and Vijay Madisetti, "Internet of Things: A Hands-on Approach", Universities Press, 2015.

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Thank You...