

Ubiquitous clouds & IOT

- Cloud Trends in Supporting Ubiquitous Computing-

Ubiquitous computing → computers in the things where we don't expect it to be.

Scenario in which computing is omnipresent.

Ubiquitous cloud computing refers to the use of Internet resources at any place & any time for any objective.

Ubiquitous - "existing or being everywhere at the same time".

- Use of Clouds for HPC/HTC & Ubiquitous Computing-
 - High performance computing - HPC
 - High throughput computing - HTC

Properties of HPC -

- web service-Based - all resources from data storage to cluster job management are done via self-describing web services.
- Virtualization - used for flexibility.
- Clusters Are provided on-Demand-
- Guaranteed performance.
- Use the pay as You Go Model -

e.g. IBM RC2 cloud, cloud system from SGI,

Because of high Demand, ^{HPC won't enough} HTC is introduced.



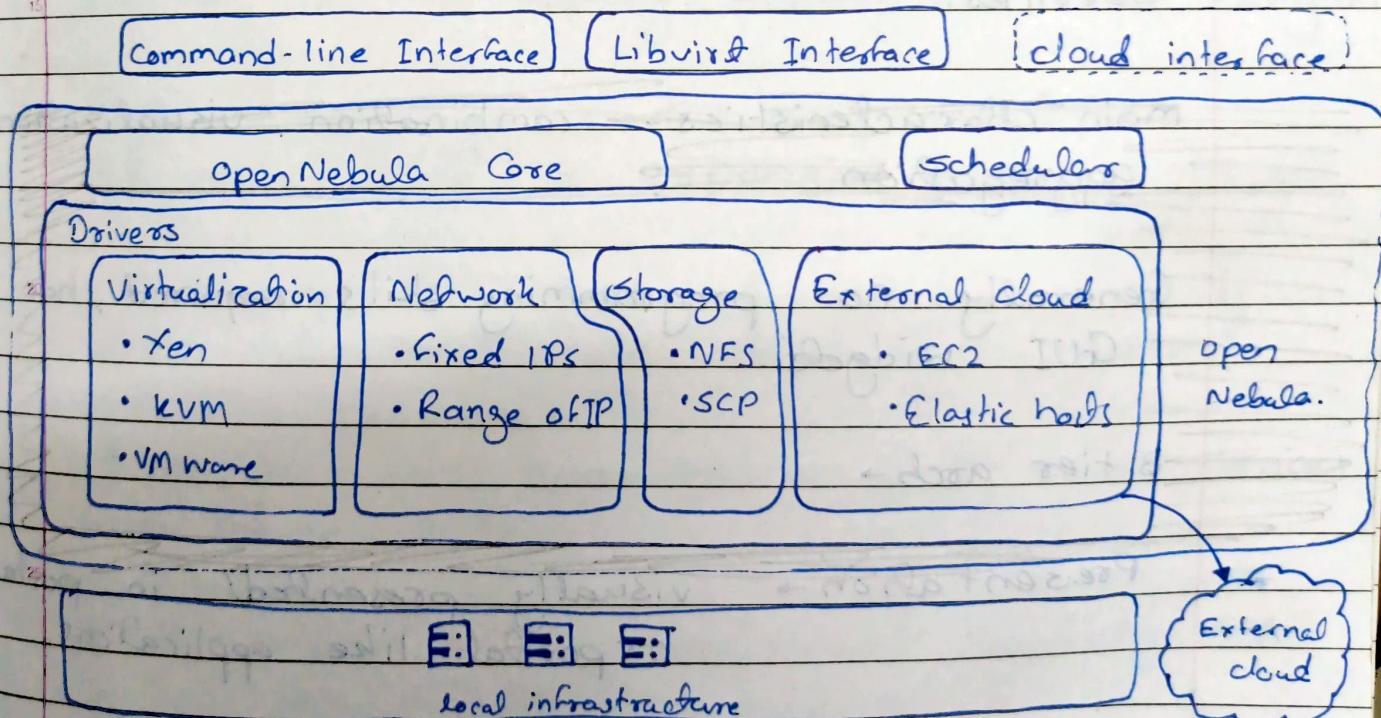
② Large-Scale Private Clouds at NASA & CERN

- Nasa's Nebula Cloud - open-source platform to provide an easier way for NASA scientists & researchers to share large, complex data sets with external partners & the public.

currently use for education & public outreach.

enables nasa to build complex weather models around its data centres which is more cost effective.

Nebula can serve SaaS, PaaS, IaaS needs across agency.



- Core - manages the VM life cycle i.e. setting network group for vm, software env creation
- Capacity manager / scheduler - governs functionality provided by the core.

Access drivers - provide an abstraction of the underlying infrastructure to expose the basic functionality of monitoring, storage, virtualization services available in the cluster.

Nebula's arch is designed from ground up for interoperability with commercial cloud services such as aws.

③ Cloud Mashups for Agility & Scalability -

It combines data, presentation or functionality from two or more sources to create new services.

main characteristics - combination, visualization, aggregation.

Generally no programming skills required, has GUI widgets.

3 tier arch →

Presentation → visually presented in portal or portal like applications.

Mashup Infrastructure → Tech for accessing assembling & processing mashups.

Information Infrastructure →

This includes databases, flat files, Java objects, web services & REST & external RSS feeds.

adv → rapid app assembly & prototyping
time saving

provides scalability on EC2 virtual clusters.
no programming skills req.
reduce cost.

dis adv → Most data sources not made as service.
Service & reliability & QoS.
Integrity can not be guaranteed.
security.

④ Cloudlets for Mobile Cloud Computing.

- computational resources of these devices are limited due to memory, battery life, heat & weight.
- ∴ cloud computing is the best solution but major issue is expensive roaming charges.
- A cloudlet is introduced it is mobility-enhanced small-scale cloud data centre.

it provides computing resources to mobile devices with lower latency.

it is middle tier of 3-tier arch hierarchy.
mobile - cloudlet cloud.

It is used as flexible portal or gateway to access distant cloud. can be implemented on PCs, workstations or lower-cost servers.

cloud

cloudlet

Hard state & softstate

hard state.

professionally administered
24x7 operatorSelf-managed, little to no
professional attention.Machine room with "Data centre in a box"
power conditioning at business premises.
4 cooling

Centralized ownership Decentralized ownership

Internet bandwidth

LAN bandwidth

more users at a time

less users at a time.

- Performance of Distributed system & the cloud -
Performance Metrics for HPC/HTC systems.

Scalability, availability measure, data security
and cost effectiveness.

- ① System throughput - no. of jobs done per unit time.
- ② Multitasking Scalability - use of system to handle many jobs simultaneously.
- ③ System Availability → % of time system is up and running normally.
- ④ Cloud security
- ⑤ cost effectiveness

RFID - Radio-frequency Identification

automatic data capture tech that uses radio waves to read a movable item.

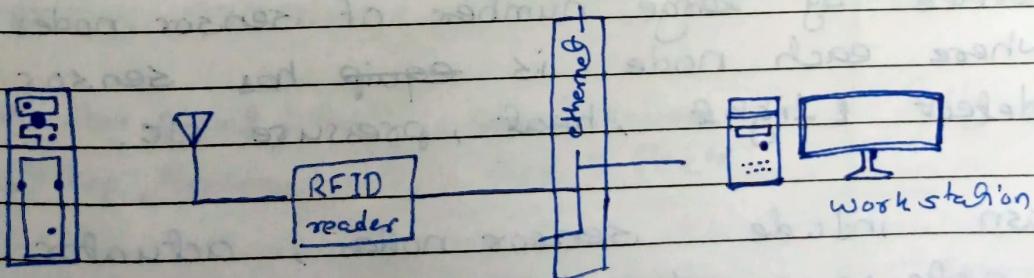
fast, does not req physical contact b/w reader / scanner. and tag item.

Contains 2 major parts - ① IC for storing & processing info and for RF signals.
 ② Antenna for receiving & transmitting radio signals.

Tags can be read only or read-write.

Major components of RFID hardware -

- RFID tag - silicon chip attached to small antenna.
- Reader antenna - radiates energy & capture signal sent back by the tag.
- Reader - device station that talks with tags. may support 1 or more antenna.



Working -

① reader sends signal to tag using antenna

② tag receives info and sends it along with info in its memory.



Rifd

③ reader receives signal & transmits to processor.

④ host processor / controller processes the data.

Types of RFID -

active - tags has its own power source.
can be used over larger distance.

passive - tags get power through reader antenna to reader antenna.
Short range.

- adv →
- automates data collection, reduced human efforts.
 - tag reading with no line-of-sight
 - can read multiple tags simultaneously.
 - all tags in range can be detected instantly
 - can provide totally automated tracking solution

WSN - (Wireless sensor network)

Formed by large number of sensor nodes where each node is equipped with sensor to detect light, heat, pressure etc.

wsn include sensor nodes, actuator nodes, gateways & clients.

Sensor nodes transmits the data to other nodes by hopping. after multiple hops are req to get to gateway.

every sensor node has transducers, micro computer, transceiver and power source.

transducers generates electrical signal based on sensed data.

micro computer stores the sensor output.

transceiver receives commands from computer & transmits data to computer.

power for each node is received from electric utility or battery.

Standards for WSN are Zigbee & IEEE 802.15.4

First gen.	Second gen.	Third gen.
Separate sensing processing & communication	Integrated	Fully Integrated.
Proprietary protocol	Proprietary Protocol	Standard (Wi-Fi, Wi-Mo)
P2P, Star, Point 2 Point multihop topology	Client server & Peer 2 Peer	Fully peer 2 peer.
large batteries	AA batteries	Solar
lifespan of days	days - weeks.	months - years.
custom construction	Crossbow Technology Inc. Sensoria Corp. Ember Corp.	Dust, Inc others

ZigBee Technology - (IEEE 802.15.4)

- Data rates 250 kbps, 20 kbps & 40 kbps.
- Star or peer-to-peer operations.
- Support for low latency devices.
- CSMA-CA channel access.
- Dynamic device addressing.
- Fully hand shake protocol → transfer reliability.
- Low power consumption.
- 50m with 250 kbs for 125 to 400 uW.
- Sleep when nothing's happening.

2 transfer modes

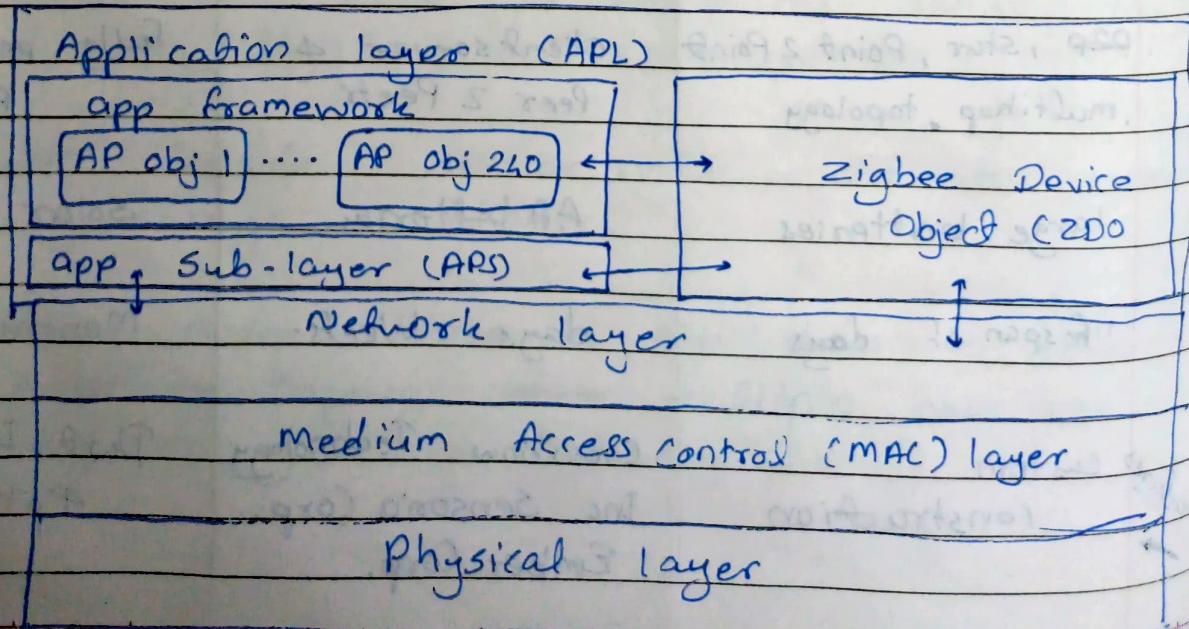
Beacon Beacon

low power state
when device is not
sending data

Non Beacon

high performance
when device is
sending data.

Zigbee arch has Physical data/Link layer, Network layer & application layer.



Physical Layer - modulation & demodulation of signal.

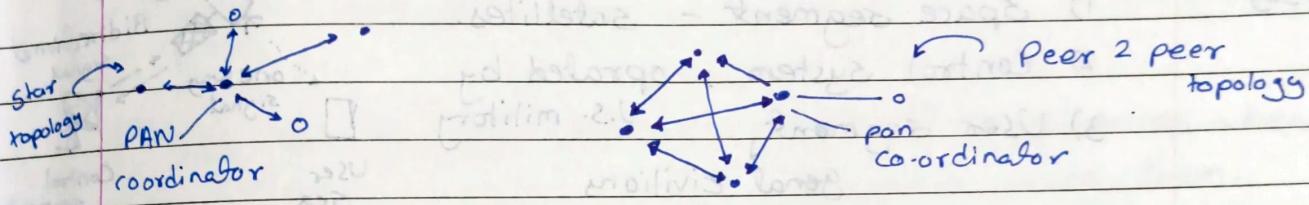
MAC layer - reliable transmission of data.

- Transmits beacon frames for synchronous communication
- Uses CSMA-CA

Network Layer - network operations, setup, end device connection, routing

Application sub layer-

enables service for zigbee device objects.



3 type of devices

Zigbee Co-ordinator → 1 co-ordinator in each network
acts as trust center & repository of security keys.

Zigbee router → passing data from end device to end device.

ZigBee End device → contains just enough functionality to talk to parent node.
requires least amount of mem
∴ less expensive.

adv→

flexible structure.

easy to control & monitor

Suitable for devices with low power.

GPS - (Global Positioning System)

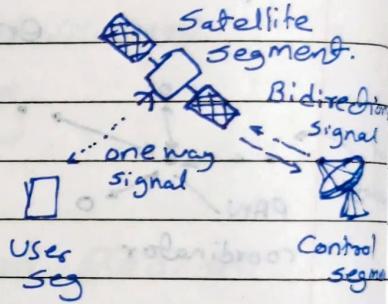
satellite navigation system for location & time information.

used for navigation in plains, cars, ships, trucks.
also used by military & civilians.

Provides continuous real time, 3-dimensional positioning, navigation & timing.

3 segments

- 1) Space segment - satellites.
- 2) Control system, operated by U.S. military
- 3) User segment, general civilians



29 satellites, 5 monitor stations, 4 GPS receiver in each device.

GPS requires data from 3 satellites to calculate location.

TTFF (time to fix first) time req to download data around 6 bytes per second.

65 to 80 milliseconds to receive signal.

If device used frequently TTFF will be small because data is already downloaded.

① Active GPS → monitor moment in real time, speed, location

GPERS module to transmit data to server.

Passive GPS - Info can only be viewed after it's downloaded to computer.

- time, direction traveled & stops made.

• Smart Buildings -

can be home, hospital or high-rise office tower
need monitoring & regulation of heating, air conditioning, lighting & env changes.

There are interconnected devices to monitor & control smart homes.

energy saving applications - turn off appliances when no one's using them.

Smart control lights -

automatic light control system - uses (LDR) Light Dependant Resistor.

Smoke or gas detector sensor - MQ2 sensor

Intrusion detection → - PIR sensor - to detect presence

- RFID to authenticate.

- CCTV camera for pictures

- Internet connection

The different I/O devices are controlled using TCP/IP over IEEE 802.11 standard protocol. Data from all the sensors is processed on a microcontroller as sensor.

Smart power Grid -

adv version of electricity grids that are being used currently.

Uses modern tech to communicate electricity related info of both suppliers & consumers.

efficiency & reliability , improve production , & improve distribution.

Process of installing means technical redesigning of infrastructure . Replacing existic electronic meters with smart meters.

It uses info technologies to improve how electricity travels from power plants to consumers.

It will require wide ,seamless , real-time uses of applications & tools that enable grid operation to make decisions quickly.

can be used in power generation that uses renewable energy , grid equipment , commercial facilities , factories & homes.

Retailing-

Sale of goods from single point to consumer in small quantities for his end use.

~~Inventor~~ effect of IOT on inventory management is very significant.

existing tech such as bar coding, RFID are helpful for managing inventories.

10 IOT can improve supply chain efficiency - to help with

can improve process of ordering, storing, tracking & managing goods.

15 Large retailers like wall mart are already using IOT

Route generation & scheduling

Route generation & scheduling system

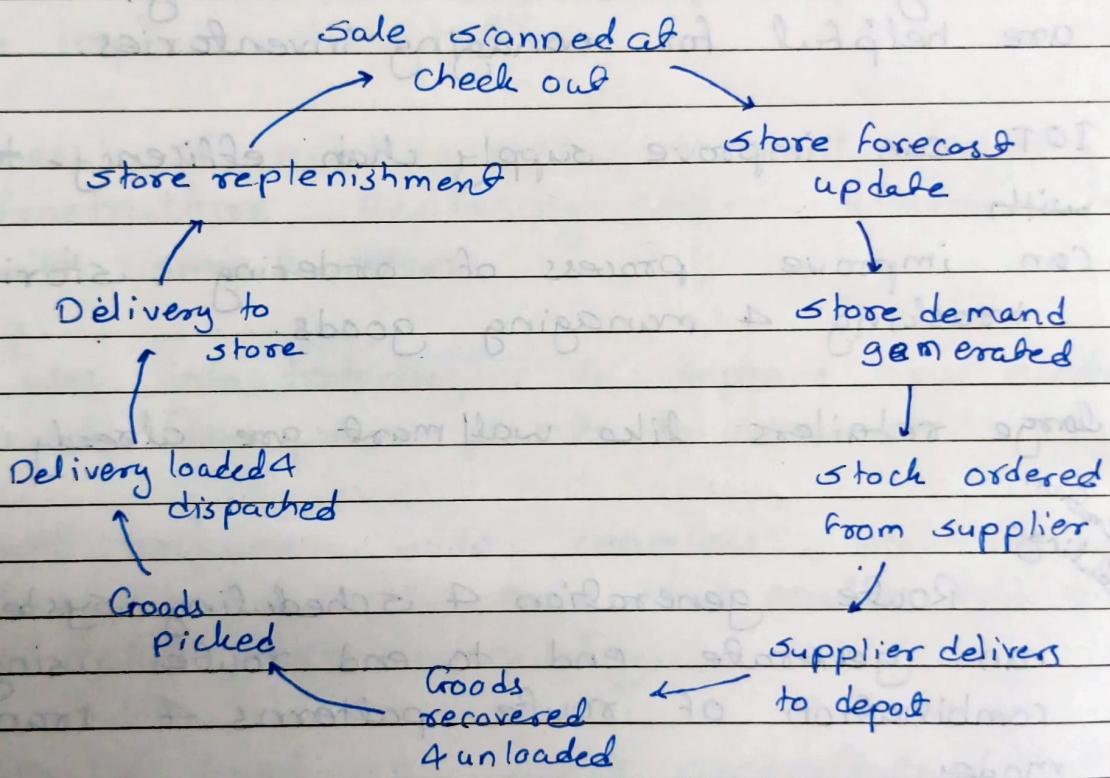
20 can generate end to end routes using combination of route patterns & transportation modes.

25 IOT helps & provides info in services, improving traffic efficiency, enhancing traffic safety, implementing supervision and control etc.



Supply Chain Management-

It's an efficient network of facilities that procures materials, transform these materials to finished products and finally distributes the finished products to customers.



Involves material suppliers, distribution centers, communication links, cloud data centers, large number of retail stores, corporate head quarters & bank payments.

RFID, GPS are used.

Steps in supply chain → planning & co-ordination,

Material & equipment supplies.
 Manufacturing & testing
 Product Delivery -
 After-Sale Service & Returns.

- Cyber-Physical system-

System that combines physical components with digital technologies to enable interaction b/w physical & virtual world.

IOT is fundamental tech that provides connectivity & networking infrastructure for CPS.

(helps in) Integration of various sensors,

data exchange & control.

In CPS IOT devices act as physical components.

It uses cloud-based platform as control-system.

applications - smart cities, industrial automation, health care, transport & agriculture.

U can elaborate this even more.

- Online Social & Professional network-

Twitter → microblogging site

created by Jack Dorsey

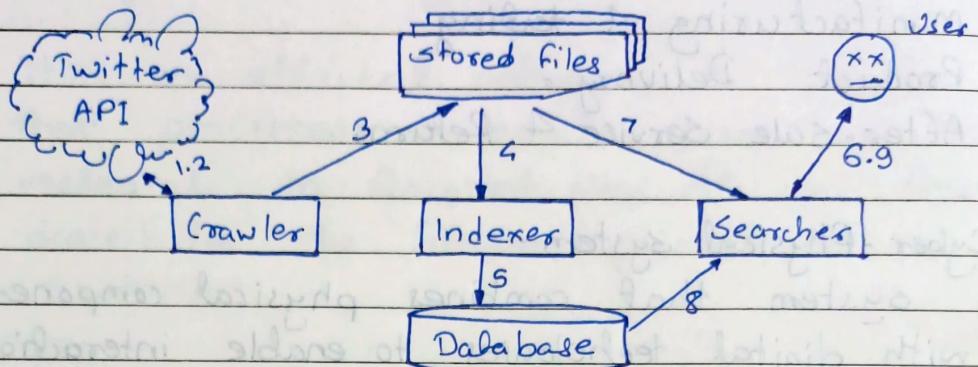
140 character msg

uses Ruby on Rails framework.

explain '#' & '@' & retweet

Some twitter based services - Twitme, UberTwitter,
 Auto pilot Twitter, Blip.FM, oMap.to

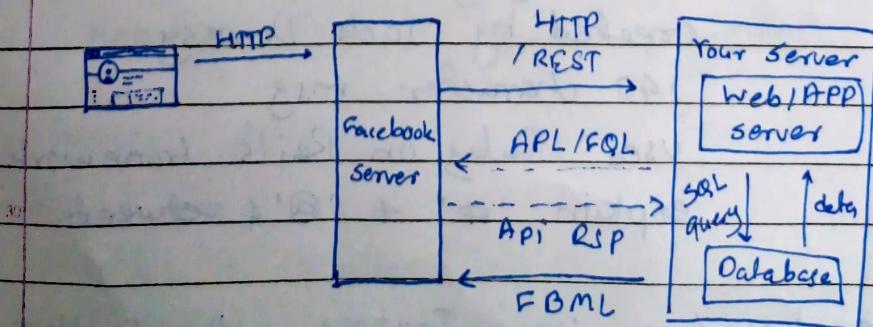
architecture -



3 comp crawler, indexer, and searcher

- 1- Crawler sends request to Twitter API
- 2- API responds with Twitter data.
- 3- crawler stores data into files.
- 4- indexer reads the stored files as input
- 5- User sends a search query to the searcher
- 5- indexer stores the data in a database as output
- 6- User sends a searcher query to searcher
- 7- The searcher reads the data from database
- 8- calculates a rank.
- 9- The searcher reads associated raw texts

Facebook - uses friendship model based on mutual agreement.



FQL - Flows Query language. FBML → FB markup language.

1. Graph API - core of FB platform read / write data.
simple consistent view of Facebook.
2. Authentication - enables developer's applications to interact with graph api
3. Social plugins - It includes button, recommendations & activity feed.
enables developers to provide social experience to their user with just few lines of HTML.
4. Open graph protocol - enables developers to integrate their pages into Facebook's global mapping / tracking tools social graph.