UNIT-3 - SENSOR N/W

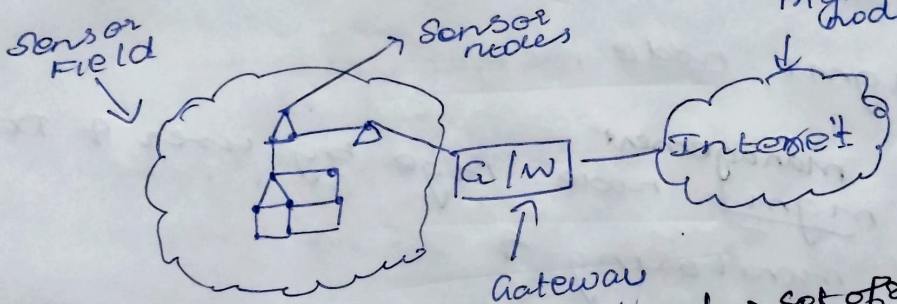
Operation of Sensor N/W

age
deaths
weight

* Comprises group of small, resourced devices N/W INFRASTRUTURES, RECORD CONDITIONS in Any no of environment, Including Industrial facilites, farms, hospitals etc.

* Sensor N/W connect to the N/w to transfer Information.

management.



S N/W Include.

* Sensor / actuator node.
* g/w / client gateway.
* Sensor nodes group inside Sensor field with diff N/w Topology.

Sensor N/w operator

* Sensor nodes - monitor
* Collect Data by sensor & Tx Rx data transfer to other Sensor nodes.
* During Data transfer Data forwarded through multiple nodes to Reach gateway.
* Data transfered through Internet to mgmt node.
* mgmt (management) node mge by user & Determine monitoring & collect Data.

Sensor Nodes → Transducer | Sensor, MC, transceiver, power supply.
(microcontroller)

Sensor - Sense physical Condition.
* change into electrical signal.
* Signal sent to MC for processing.

* central processor send commander to transceiver & Data transfer

Self Driving car – Radar Sensor, LIDAR

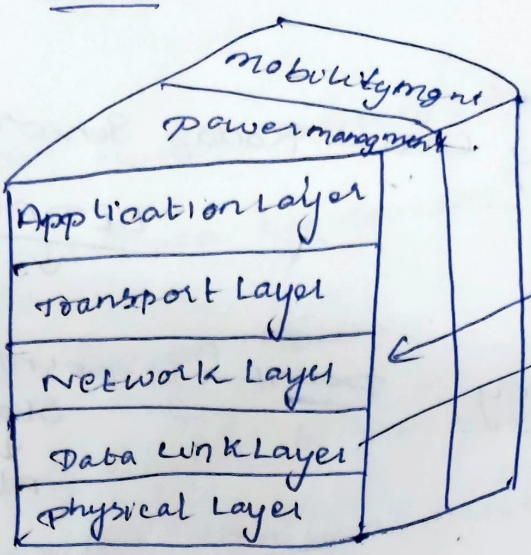
N/w topology :- point - to-point ; tree, star, MESH.
All to 1.

Applications
* Automating
* Medical. & Healthcare:
* Navigation
* Aviation.

Unit-3

Sensors N/W

protocol Stack



Physical Layer

* Modulation.

digital.

TDMA Time Division

Data link Layer

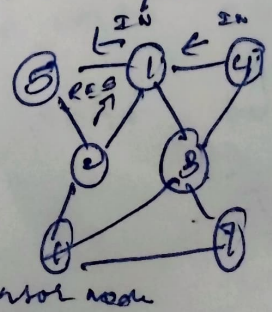
* MAC – Media Access Control
* TDMA – Time Division Multiple Access

* NODE 1 WAKE UP
  LISTEN
  NO RESPONSE
* Send Nw invitation

  Node 1 → Node 2.

  Active Node Respond

  Link formed.



Model
↓
modulator & Demodulator

1) Radio Space communication

2) Fiber optical → light
   cable

3) wire → voltage

temperature → electr...
sign...

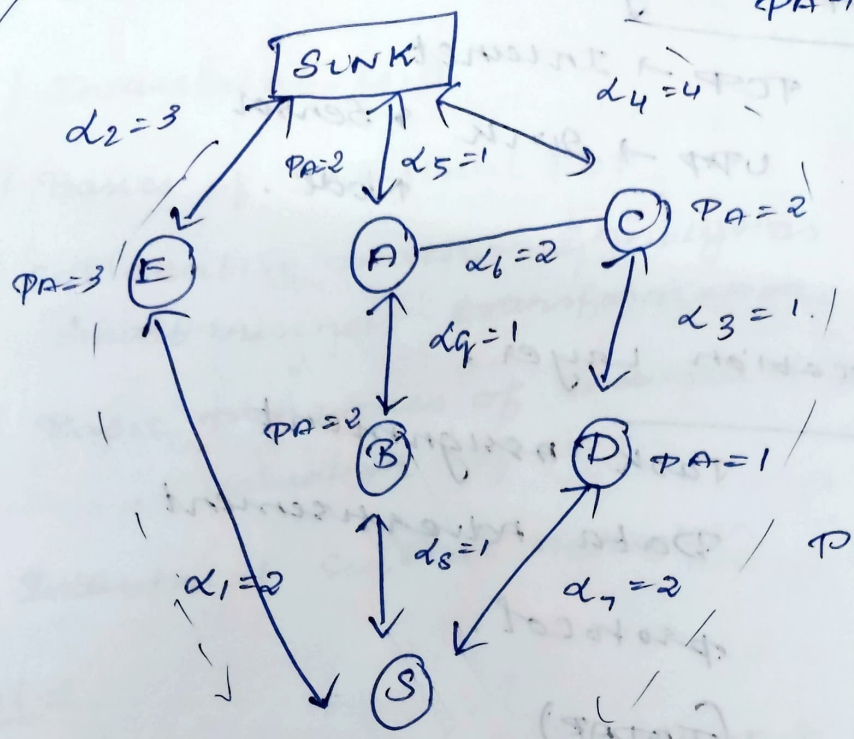
ADC conver...

Analog → Digital.

Network Layer → Routing.

α → Distance

PA → Available power.



PA → Available power.

Route

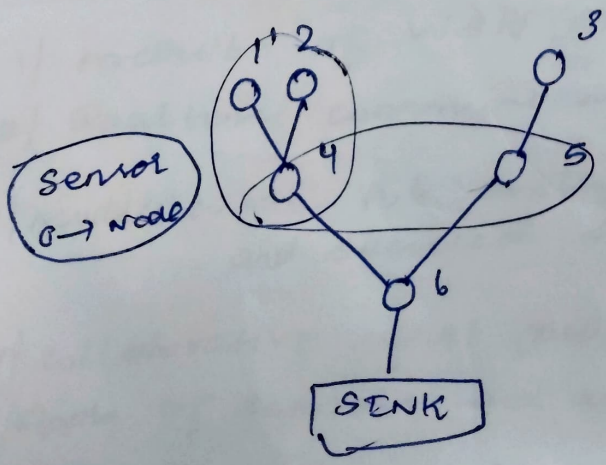
① → Sink → A → B → S PA=4 → 3

② → " → E → S PA=3 → 5

③ → " → C → D → S PA=3 → 7

④ Sink → C → A → B → S PA=6 → 8 ✓

Data Aggregation



6 → Data aggregation.

Transport Layer

TCP → Internet

UDP → Sink & Sensor Node.

Application Layer.

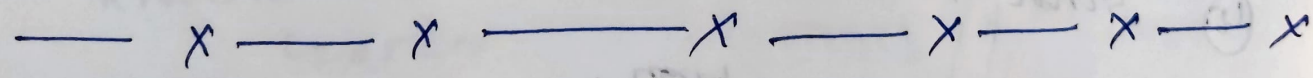
Task assignment

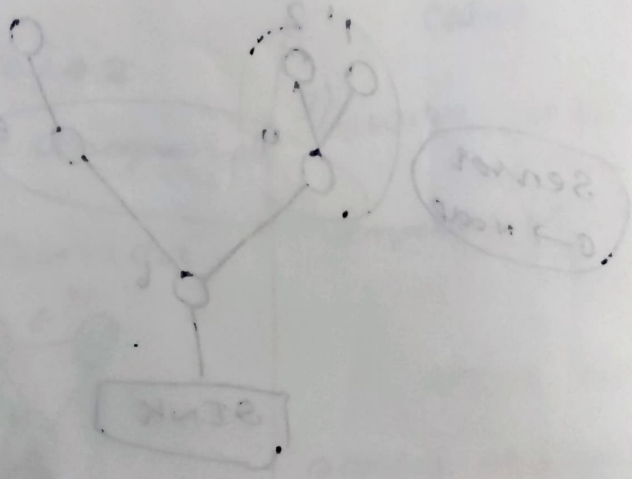
Data Advertisement.

protocol.

(STADAR)

* Sensor managment protocol.
* multiply management network protocol.





unit-1

1) Industrial Internet System

2) Industrial 4.0

3) Basics of Industrial IOT.

4) collabative platform & Analytics for Smart business transformation.

5) Basic principles of Industrial Design valuation of CPS.

6) Industrial sentrial Actuators.

unit-2

1) Embebbed def, Specification & Languages.

2) Different abstraction levels in Ebbe syst model

3) Design analysis techniques for Decentralized computs Asearcher

4) CPS hardware platform

5) Real time OS with example.

unit-3

1) Archit. of WSN

2) Real time communication protocols.

3) Middle ware for distributed realtime and secured services.

4) collaborative signal processing & Data wa

5) Appls of sensors and actuators.

6) Time dependences & clock synquences.

Transport

Real Time Protocol (RTP)

Real time Communication (RTC).

* Software protocols.
* Communication hardware media
  → gives real time guarantees
* eg :- VOICE OVER LANDLINE,
* mobile phones
* ✓ o/p → voice over internet protocal IP
* Instant messaging (whatsapp etc, F/b messager)

REAL TIME TRANSPORT PROTOCOL (RTP)

RTP → handle Realtime table

RTP → used with UDP → User Datagram protocol.

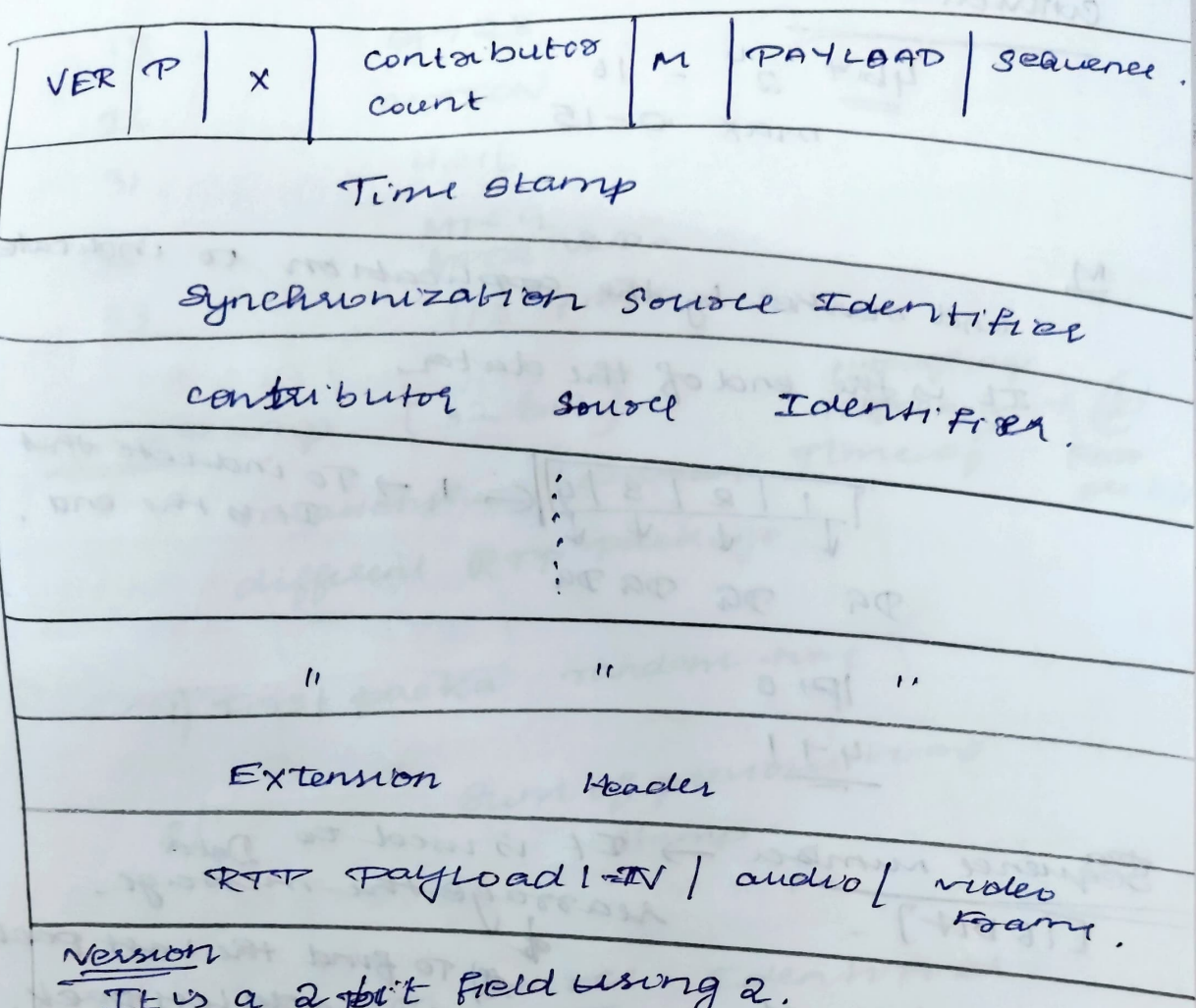
→ no delivery mechanism

RTP → supports DIFF File Format

MPEG, JPEG etc.
↓ moving picture expert. ↓ joint picture.

→ more sensitive to packet delay.
Less " Lost.

RTP → header format / packet format.



Version
It is a 2 bit field using 2.

P → It is a 1 bit
It is used for whether

1000 0000 → padding

1 → means 0 are padded at end.

0 → no padding

X → extention header → after a basic header

(1 bits)

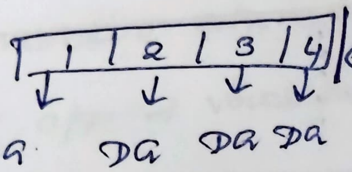
1 → extention header

0 → no extention header

Contributor Count → 4 bit

4 bit $2^4 = 16$
max 0 - 15

M.
end marker by the application to indicate
It is the end of the data



← 1 → To indicate that It is the end.

1 → 0
4 → 1

Sequence number → It is used to Data reassage the message
[16 bit].

*) To find the Last package
order Less pack.

1) Depost
2) withdrawl.

Payload → 7 bit. Payload type

Encoding NAme.

0 → Audio PCM micro audio.

1 → 1016

3 GSM

5-6 DV14

7 PLMA

8 a722

9 a 722.

10-11	L16
14	MPED
15	G728
26	MOTION
31	H216
32	MPEG MPEG VRDo
33	112 ram.

Timestamp [32 bit]

relationship between Time of different RTP package.

11 package
12 package → First priority

1) First packa random time

2) Sum of previous time stamp

Synchronization source Identifier.

[32 bits].

* Define the source.
* random number.

=

contributor

[32].

* used for source ID where.

Q4 = (16) → max contrar

max : 0-15.

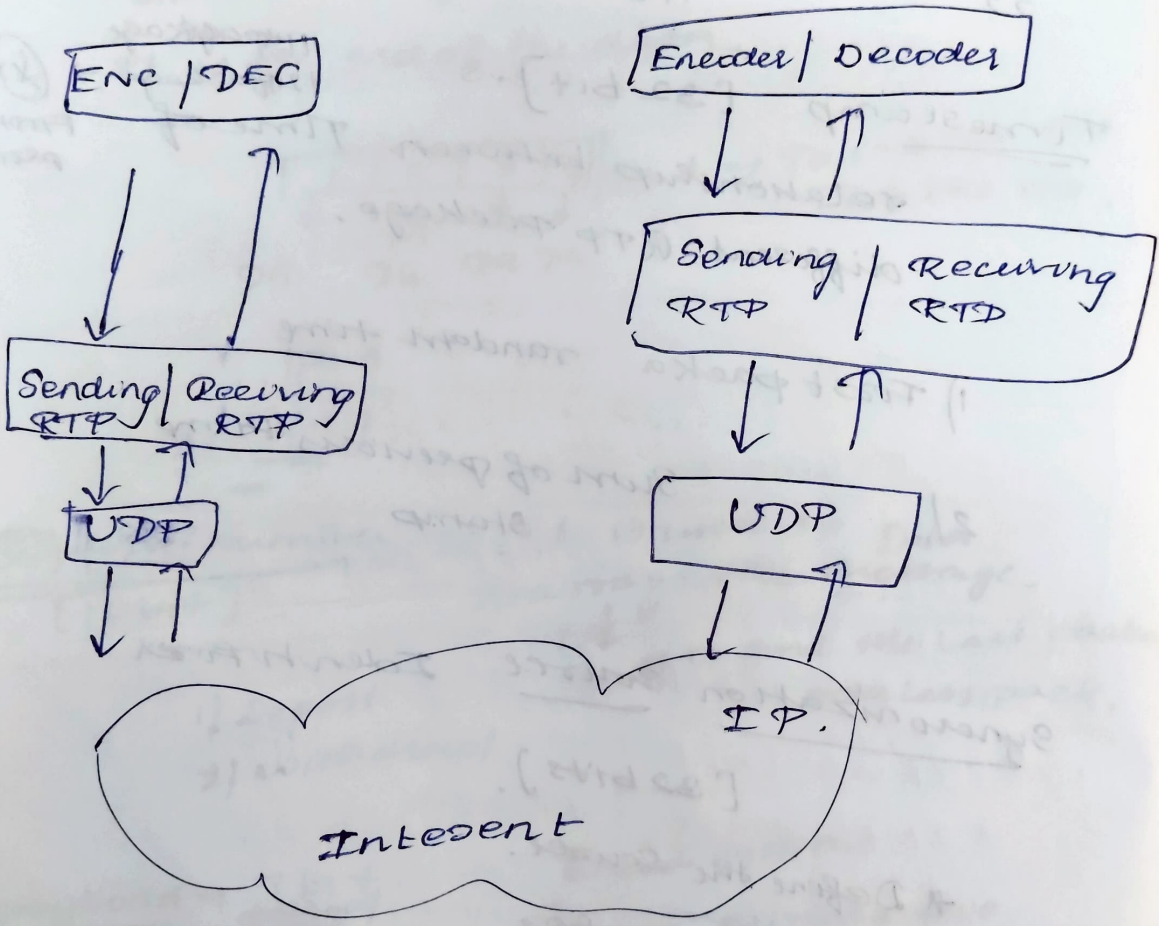
1 → is main source
others are contributors

the where there is more than source present.

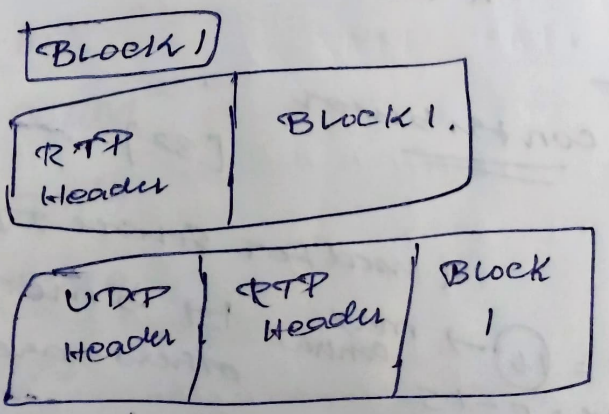
no two source are present

=

RTP



Digitized Bitstream



RTP pkt

UDP packet

Appln
MW
OS
H/W

Middle Ware (MW).

* Include S/W tech to help message complexity & heterogenity to Development of DS/Applications / Information system.

* Higher Level programming abstraction. For developing Distributed application.

* Higher than Lower Level abstraction, such as sockets, monitors provided by OS.

M/W

- S/W b/w application program & OS.
- Integration for applications, Devices, system software & Data.

Distributed MW

provide comprehensive set of higher level Distributed computing capabilities & set of I/E interface access that.

Socket : a common End point from which Data can be RD/WR.

Reading & writing.

Middleware System Views

* OS → Software makes underlying Hardware usable.

* MW System makes DS programmable & managable.

* Bare m/c without OS can be programmed.

→ programs written in Assembly Lang.

DS → Distributed System.

Distributed applications.

* can be developed without middle ware

→ but cumbersome.

Various middle ware

* JVM
* SOAP
* XML
* MQTT (message queuing Tel.)
* CORBA → common object request broker architecture protocol.
* IaaS
* PaaS
* NaaS
* Simple object access protocol.

Distributed System

* NC of Interconnected autonomous comp. that Information processing needs of modern Enterprises

* Connection of End Comp but appears to the User as single computer.

Characteristics

* multiple computers each has CPU memory, storage, I/O paths
* connect-to Environment

Interconnection

* some I/O path Interconnect. Computers talk to each other

Shared state

System cooperate to maintain

* maintain global Invariant Requires Correct & coordinated operation of multiple computers.

Reasons For Distributed computing

* Inherent Distribution
* Bridge customer, ~~support~~ Suppliers & companies at different site.
* Speedup → Improve performance.
* Fault tolerance
* Resources Sharing
* Scalability
* Flexibility

Reason For DS H/W

* Scale → numeric, geographic → administrative
* Loss of control over parts of the system.
* unreliability of msg passing.
* Failure.

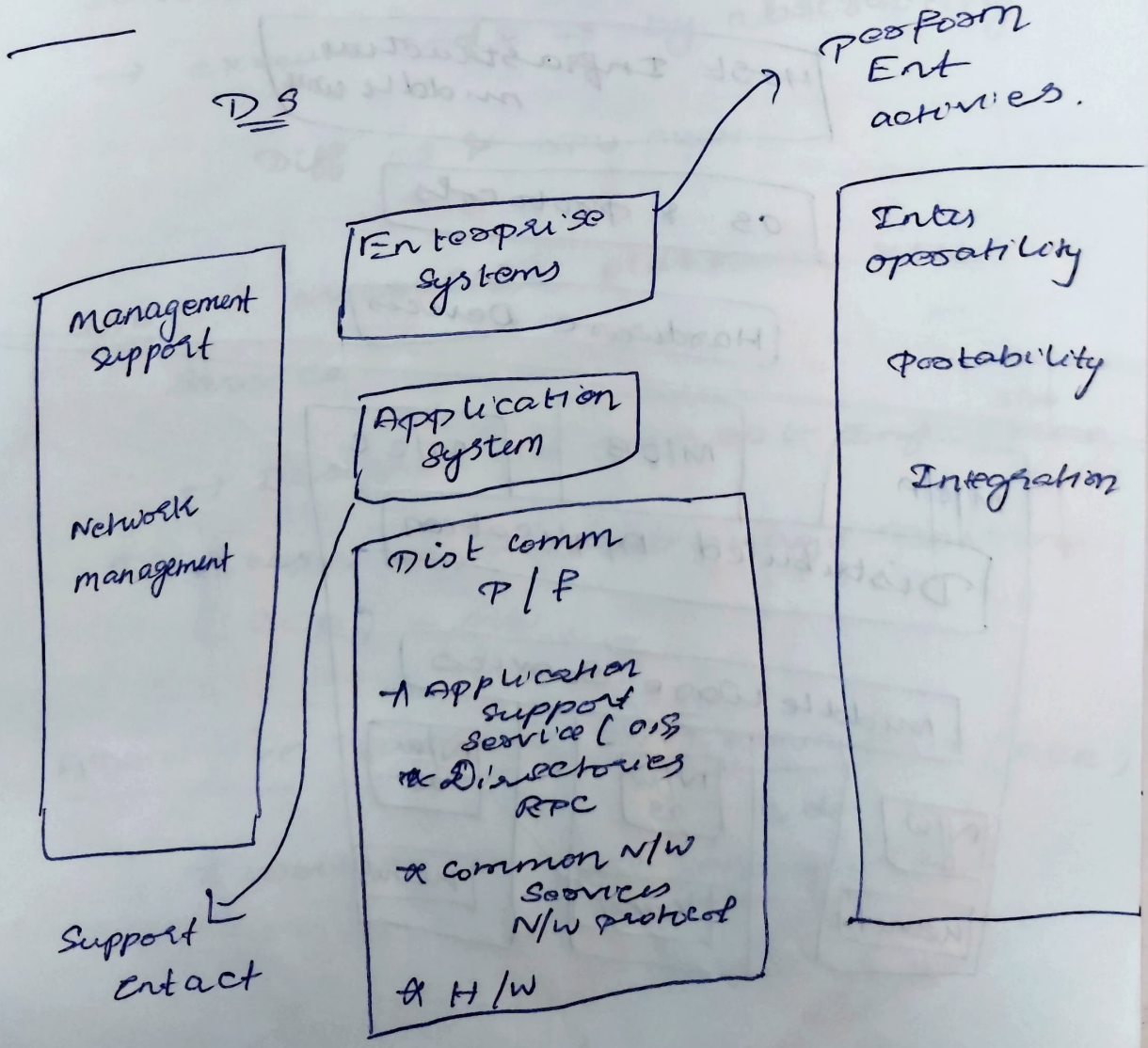
Design Goals of DS

Sharing - H/W, S/W, applications services

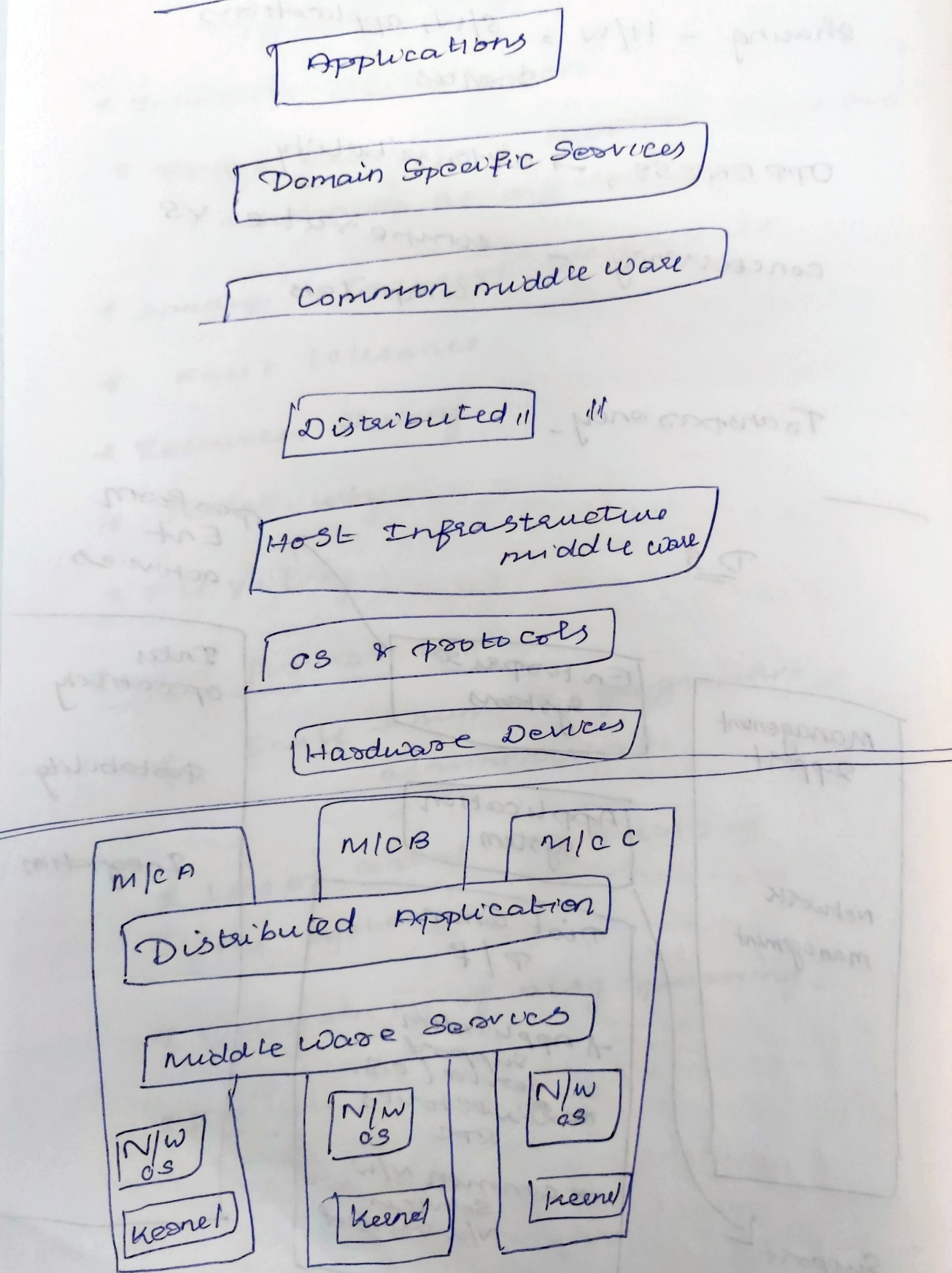
OPPENESS, → extensibility

concurrency - compete vs compete

Transparency.



Distributed Middleware



Host Infra structure MW.

→ encapsulate & enhance native OS & concurrency.

→ Mech to create reusable, Network N/W ining component

reactor, monitor objects, acceptor, active " .

Sun JVM → platform P|F independent.

→ execute code → by abstracting Diff OS & CPU ARCH.

.NET Microsoft platform XML Service.

→ Designed to connect Infra structure Devices, common Language Routine (CLR) - MW.

ADAPTIVE COMMON ENVERONMENT (ACE) hides.

→ written in C++ encapsulation OS.

Distribution MW.

* higher Level Distributed programming.

* Reusable API (Application program interface).

→ * Components automate & extend Native OS Network programming capabilities encapsulation by host IS MW.

OMG CORBA - common object request Broker Architecture. (object management group.)

→ object component Interoperate across network.

SUN JAVA RMI (Remote method Invocation).

→ Methods Invoked from other JVMs.

Micro ~~MS Office~~ microsoft Distributed component object Model (DOM).

→ S/W component communicate via Remote component.

SOAP → Simple Object Access Protocol.

→ enable auto WEB SERVICES

→ shared open web Infrastrue

Common MW Services.

→ allow application Developer to concentrate on program business Logic without writing code to Develop. DS use to low level MS Directly.

OMG CORBA

- event notification, Logging, multimedia streaming security, Global RT, RT scheduling, Fault tolerance, concurrency control & transaction,

SUN Extended Java Bean.

→ DS
→ prebuilt software services called Beans
↓
(not code from scratch).

.Net

application Logic into components.

Domain Specific MW

→ used for particular Domain such as telecom, ecommerce, Healthcare, process, automation, reusable Hardware mech & service.

OMG → (object management group).

→ Domain task forces (DTF) concentrate on all above.

E commerce (DTF).

Development of E commerce & Electronic marketing.

Siemens medicals Solution Group.

→ medical Image include ultra sound, MRI CT SCAN etc.

Collaborative Signal processing (CSP)

* Signal processing (SP) is an electrical Engg sub field, focus on analysing, modifying & synthesize signals such as sound, image, scientific measurement.

* CSP & SP → process signals to extract Information. From that collaboration means work together.

* In sensor N/W ~~Elements~~
  → Sensors
  Elements → Sensors
  Information - Location of target.

~~Time~~

* collaborative signal processing
* Data gathering
* Time Dependent systems.
* clock synchronization.

Reason - CSP

* unity is strength
* goal → Identify, Detect & track any objects.
* each sensor → Process event for certain time.
→ Detect share local Information

Time Dependent & clock sync.

* Distributed System (DS) → collection of computers via high speed common system.
* In DS → H/W & S/W components communicate coordinate by message passing.
* Each node share Information with other nodes.

cluster head.
↓
will pass all infos

* need proper allocation of Resources &
Help coordinate b/w diff process.

* To resolve conflicts synch is used.

* Synch achieved in DS via clock.

* Time set based on universal.
universal time control.
Time coordination (UTC).

Clk synch 2 ways → External clk Synch
→ Internal clk Synch.

clock.
Ext clk synch :- Ext clk is present

* used on Ref → All nodes adjust the time accordingly.

clock
Int clk : each node has it own local time & share with other nodes

* all other nodes, set time according.

2 types of

clock synch algorithm → centralized

→ Distributed

centralized - Time server used as Ref

* Single time server propagates it time to all the nodes.

* Single time systems → node fails.

- It lose synch

eg:- Berkley algo; passive Time server.

Active Time server

Distributed

→ no centralized / server.

* node adjust by local time

* overcome Issue in centralized like scalability, single point failure etc

eg:- Global avging algo,
Localized avge algo,
N/W time protocal (NTP).

Network//.

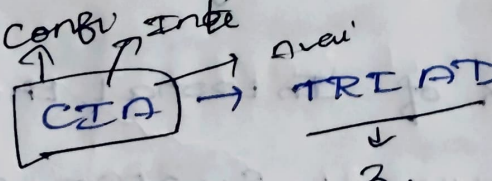
Unit-4

Security of CPS

Confidentiality → authorized party can access.

Integrity → modified only by authorized party.

Availability → accessed By authorized time [one time password].



Authentication → verify Identity.

Data communication components - 1) Sender,
2) receiver,
3) transmitter, medium,
4) message,
5) rule should be Follow → protocol.

Non Repudiation.

→ cannot Deny the action performed.

CPS could be.

* Potential Risk Areas.

→ combination of different elements.

* Focus on Risk → uninterrupted Function of organization Flow.

* cyber attack Damage physical Assets.

Because of Risks.

* Hackers, ~~&~~ not damage CPS by targetting privileged a/c.

all Risk of Internal threats with access to critical System & Data

* 5G → easy to attack as Security protocols are complex.

plan the security of CPS.

before.

* Set business strategy b/f

planning security

MODULES. MAKE CPS more secure.

1) privileged session manager →

→ allows to control all session

in IT, prevent access management.

2) Central password management (password)

verify all privileged session

in Network - store pw in your a/c account.

password

-aledged

3) 2-Factor verification (gmail)

verification,

Request suspicious places ERF

→ Time auth by user.

4) Dynamic Data masking (Snapchat, disappear mess.

or whatapp messages)

→ Record & Mask All Actions

of system Admin

* prevent suspicious action.

[3 times access to password]. [Forget Password, and change]

5) privileged Task automatic.

Increase Efficiency &

Eliminate Service Interruptions.

by automating Routine task.

6) Radius Assessment. [OTP] (time password)

offers comprehensive auth &

extends multi login in capabilities

& cyber security policy

CPS & IOT → using sensors. → automatic → dam down → ICU → heart beat sugar → airplane check

* Security needed in Development process.

* Human Interact → physical Damage. (Dev)

* Insider gain →

→ autonomous car.

→ life threat

Major problems

System → Legacy.

Software → No update
→ security issues.
→ hard to tackle.

classic security measures.
→ AL & ML but need in DL.

Sensor & Actuator.

Damaged by human or Natural
Disaster if not secured properly.

X X