* Unit-4

→ Implementation of IoT with RaspberryPi

→ Introduction to SDN

- ~~SDN~~ - SDN architecture

  - ~~SDN~~ SDN Vs Conventional architecture

  - Key elements of SDN

  - Challenges to implement SDN

→ SDN for IoT

→ Data Handling & Analytics

- Characteristics of BIG DATA

- Flow of data

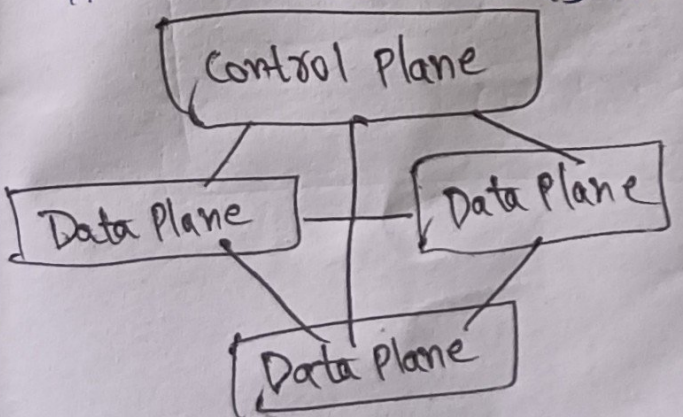
- Data Handling using Hadoop

→ - Data Analytics

Traditional or Conventional architecture ante same

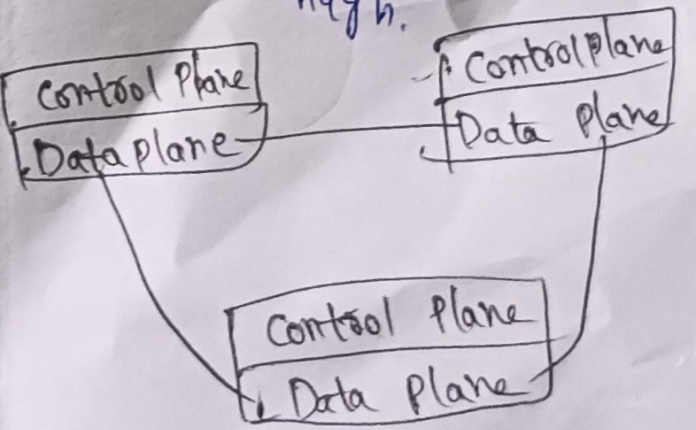
SDN

1). It is a virtual networking approach.
2). It is centralized control.
3). It is programmable.
4). It is open interface
5). Data Plane & Control Plane are decoupled.
6). It takes less time.
7). It is easier
8). Cost is low
9). Structural Complexity is low.
10). Extensibility is high
11). Easy to report, trouble shoot.
12). Maintenance cost is lower



Conventional

1). It is old conventional networking approach.
2). Distributed control.
3). It is not programmable.
4). It is closed interface.
5). Data Plane & control Plane are coupled.
6). It takes more time.
7). It is difficult.
8). Cost is high.
9). Structural Complexity is high.
10). Extensibility is low.
11). Difficult to report, trouble shoot,
12). Maintenance cost is high.



Key Elements of SDN

1. SDN Controller: Brain of SDN
   - decides routing
2. Southbound APIs: Connects controller with switches (eg: OpenFlow)
3. Northbound APIs: Interface b/w controller & apps
4. Switches
5. Applications

Challenges in SDN

- Scalability
- High cost
- Security Risks
- Standardization
- Compatibility

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TRADITIONAL ARCHITECTURE
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📊 8. Data Handling & Analytics in IoT

🧠 a. Characteristics of Big Data (5 V's):

1. **Volume** – Huge amount of data.
2. **Velocity** – Data comes in real-time.
3. **Variety** – Different formats (text, video, sensor data).
4. **Veracity** – Accuracy/reliability of data.
5. **Value** – Useful insights gained from data.

🔁 b. Flow of Data in IoT:

1. **Data Generation** – by sensors/ devices.
2. **Data Transmission** – via network (Wi-Fi, Bluetooth).
3. **Data Processing** – at edge/cloud.
4. **Data Storage** – in databases (SQL/ NoSQL).
5. **Data Analysis** – using analytics tools (Python, Hadoop).
6. **Action** – Based on insights (e.g., alert user).

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Data handling ante antha rayali

🗃️ c. Data Handling Using Hadoop

What: Hadoop is a framework for processing and storing large data.

Components:

- **HDFS** (Hadoop Distributed File System): Stores big data in blocks.
- **MapReduce**: Processes data in parallel.

Why Hadoop for IoT?

- Handles large unstructured sensor data.
- Open-source and scalable.

Example: Analyzing pollution data from 1000s of sensors using Hadoop.

📈 d. Data Analytics in IoT

What: Process of examining IoT data to find useful patterns and trends.

Types:

1. **Descriptive** – What happened?
2. **Predictive** – What might happen?
3. **Prescriptive** – What should be done?

Tools: Python (Pandas, Matplotlib), R, Hadoop, Spark.

Use Case: Predict water usage in smart homes, detect machine failure.