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Here's your content formatted into clean, exam-ready **notes** style for Weeks 7 and 8:

✅ Week 7: Software-Defined Networking (SDN)

🔹 Traditional vs SDN Architecture

- **Traditional Networks:** Distributed control (e.g., **OSPF**) on each device.
- **SDN:** Separation of control plane (decision-making) and data plane (packet forwarding).

🔹 SDN Architecture Components

- **Controller:** Centralized decision-making entity.
- **Switches:** Simple forwarding devices.
- **APIs:** Facilitate communication between controller ↔ switches, controller ↔ apps.

🔹 Flow Table and Rule Placement

- **Flow Table:** Contains flow-rules in switches.
- **PACKET-IN:** Triggered when no matching flow-rule found.
- **Controller installs rule** via flow-mod messages.

🔹 Challenges in Rule Placement

- Limited **TCAM** memory in switches.
- **Delays** in packet-in handling and rule installation.

🔹 Objectives

- Efficient **TCAM** usage.
- Minimize **PACKET-IN** events.

🔹 Controller Placement

- Can be **Local** or **Remote (Cloud-based)**.

🔹 Tools and Controllers

- **Mininet:** Virtual SDN network emulator.
- **Popular Controllers:** Pox, Nox, FloodLight, OpenDayLight, ONOS.

🔹 SDN in IoT

- Use-cases:
  - **Rule-placement & traffic engineering** (backbone networks).
  - **Flow classification & security** (data centers).

🔹 Software-Defined Wireless Sensor Networks (Soft-WSN)

- Applies SDN principles to **WSNs**.
- Features:
  - Real-time reprogramming.
  - Dynamic path updates.

📊 **Experimental Benefits of Soft-WSN**

- ↑ **Packet delivery ratio**
- ↓ **Replicated packets**
- ↑ **Control messages** (due to PACKET-IN)

🔹 SDN-WISE

- A **software-defined WSN** platform.
- Sensor nodes use flow tables.
- Programming support via APIs (any language).

✅ Week 8: Cloud Computing

🔹 Definition (NIST)

> "A model enabling convenient, on-demand access to a shared pool of configurable computing resources."

🔹 Essential Characteristics

1. **On-demand self-service**
2. **Broad network access**
3. **Resource pooling**
4. **Rapid elasticity**
5. **Measured service**
6. **Availability & reliability**
7. **Performance & optimization**

🔹 Cloud Service Models (NIST Visual Model)

- **IaaS (Infrastructure-as-a-Service):** Users manage OS/apps (e.g., AWS EC2).
- **PaaS (Platform-as-a-Service):** Users develop/run apps (e.g., Google App Engine).
- **SaaS (Software-as-a-Service):** Full apps delivered online (e.g., Google Workspace).

🔹 Cloud Deployment Models

- **Private Cloud:** Exclusive to one organization.
- **Community Cloud:** Shared by a specific group.
- **Public Cloud:** Open to general public.
- **Hybrid Cloud:** Combination of above.

🔹 SLAs (Service Level Agreements)

- Define non-functional guarantees: **Availability, Performance, Response time**, etc.

🔹 Accounting & Billing

- **Service accounting:** Tracks usage.
- **Billing:** Applies pricing models to usage data.

🔹 Economics of Scaling

- **Cap-Ex free computing**
- On-demand scalability
- Rapid deployment
- Cost-efficiency

🔹 Data Management in Cloud

- Choose **DBMS** based on deployment type.
- **DBaaS** examples: **Amazon RDS, Azure SQL, Google Cloud SQL**

🔹 Trust & Risk in Cloud

- **Trust mechanisms:** SLAs, audits, ratings, self-assessment tools.
- **Risk Assessment:** Formal/informal, qualitative/quantitative analysis.

🔹 Cloud Simulators

- **CloudSim, CloudAnalyst:** For simulating and evaluating cloud environments.

🔹 Amazon EC2

- Offers **instances** with customizable configurations.
- Supports multiple **OS**, **EBS/S3 storage**, **auto-scaling**, **security groups**.

Let me know if you'd like this as a PDF or formatted for Anki flashcards too!

Here's a clean, easy-to-learn **notes-style format** for Weeks 9 and 10, perfect for MCQ exam prep:

✅ Week 9: Sensor-Cloud and Fog Computing

🔹 WSNs Recap

- **Components:** Sensing unit, Processing unit, Communication unit
- **Features:** Short range, rely on **multi-hop** communication
- **Applications:** Target tracking, Healthcare, Smart cities

🔹 Cloud Computing Recap

- **Services:** SaaS, PaaS, IaaS
- **Benefits:** Elasticity, Pay-per-use, Self-service

🔹 Sensor-Cloud

- **Goal:** Virtualization of **physical sensor nodes**
- **Key Concepts:**
  - **Virtual Sensors (VSs)** are composed from real sensors
  - **CoV-I:** Same region
  - **CoV-II:** Multiple regions
- **Management Issues:**

The optimal composition of Virtual sensor nodes is a management issue in sensor-cloud. (

  - Optimal **VS composition**
  - **Data caching**

Internal Cache (IC) and External Cache (EC) are two different types of caching

  - **Pricing strategy**:
    - **pH (hardware)** – Usage of physical sensors
    - **pI (infrastructure)** – Usage of cloud infrastructure

🔹 Fog Computing

- **Why Needed:** Cloud can't handle IoT's volume, latency, and bandwidth needs
- **Definition:** Layer between IoT devices and the cloud
- **Fog Nodes:** Routers, switches, embedded servers
  - Provide **storage, compute, and network** services

⏱️ Time Sensitivity-Based Handling

Data Type	Action
Very time-sensitive	Processed at nearest fog node
Less time-sensitive	Processed at aggregate node
Non-time-sensitive	Sent to cloud for storage and analysis

✅ Advantages

- ↓ Latency → Faster decisions
- ↑ Privacy → Local data analysis
- ↑ Business agility

- 💡 **Use Cases:**
  - Real-time health monitoring
  - Smart energy systems
  - Rail & pipeline monitoring
  - Wind turbine optimization

TCP/IP works best with localized data, which is not present in V2X environments.

This restricts the use of TCP/IP for V2X communication.

⚠️ Challenges

- ↑ Power usage (extra nodes)
- Ensuring **data security** across distributed fog
- Maintaining **reliability**

Link durations are short due to the highly dynamic nature of VANETs.

✅ Week 10: Smart Parking & Intelligent Connected Vehicles (ICVs)

🔹 Smart Parking

📡 Information Collection Methods

- Sensors
- Parking meters
- Sensor networks
- Crowd sensing

CCN (Content Centric Networking) is derived from Information Centric Networking (ICN)

The phases of ICV development:
Phase 1: Based on 2G,
Phase 2: Based on 4G LTE,
Phase 3: Vehicles connected to cloud

🧠 System Deployment

- Software system
- E-parking & guidance
- Data analytics for optimization

ai can bridge Decision making gaps between sensors and actuators

📈 Decision Layer

- **Monitors** parking conditions
- **Controls** sensors

HAN standards

Physical and MAC layers are defined by IEEE802.15.4.
Network layer
and Application layers are defined by Zigbee.

🔹 Intelligent Connected Vehicles (ICVs)

📶 Spectrum Allocation

- **75 MHz (5850–5925 MHz)** reserved for ICVs by US DoT & FCC

📘 IEEE WAVE Standards (DSRC)

Standard	Focus
IEEE 1609.2	Security services (messages & apps)
IEEE 1609.3	Networking services
IEEE 1609.4	Multi-channel operations
IEEE P1609.11	Over-the-air data exchange for ITS

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