Software Defined Networks (SDN) - Detailed Notes

1. Core Concepts of SDN:

- Definition: SDN is an architecture that separates the control and data planes, allowing for centralized control of the network.

- Layers:

- Application Layer: Hosts network applications and business logic.

- Control Layer: Acts as a mediator, using protocols like OpenFlow to manage the data plane.

- Data Plane: Consists of network devices that forward packets based on the control layer's instructions.

2. OpenFlow Protocol:

- Facilitates communication between the SDN controller and switches.

- Key Features:

- Packet matching using flow tables.

- Reactive and proactive flow setups.

- Version Updates: Adds support for more flexible table structures and additional features like per-flow metering.

3. SDN Controllers:

- Examples:

- Floodlight: Open-source, Apache-licensed.

- POX: Python-based, simpler than NOX.

- Ryu: Developed for OpenFlow experimentation.

- Trema: Known for its modular design.

- Role: Manage flow tables, ensure network programmability, and interact with applications.

4. Networking Concepts:

   - VXLAN: Used for overlay networks, supports up to 16 million isolated virtual networks.

   - Underlay vs Overlay Networks:

     - Underlay: Physical network infrastructure.

     - Overlay: Virtual networks running on top of underlays.

5. Flow and Flow Tables:

   - Flow: A set of instructions for handling packets (e.g., routing, dropping).

   - Flow Table: Contains entries for packet matching and actions.

   - Flow Types:

     - Proactive: Pre-defined flows for predictable traffic.

     - Reactive: Created dynamically in response to packets.

6. Data Centers and Virtualization:

   - SDN Use Cases:

     - Improves scalability and resource utilization.

     - Simplifies multi-tenancy management.

   - Tunneling Protocols:

     - VXLAN: Virtual Extensible LAN.

     - NVGRE: Network Virtualization using GRE.

     - STT: Stateless Transport Tunneling.

7. Licensing and Open Source Tools:

   - Open Source Implementations:

     - Indigo: Lightweight OpenFlow switch.

     - OVS (Open vSwitch): A production-quality multi-layer switch.

- Licensing Models:

  - GPL: General Public License.

  - Apache License: Permissive and widely used.

8. Applications of SDN:

  - Security: Enables dynamic policy enforcement and threat detection.

  - Energy Savings: Elastic Tree model for data centers.

  - Mobile Networks: SDN helps in handling roaming and optimizing traffic.

This compilation captures essential concepts, repeated themes, and practical applications from the previous five papers.