Software Defined Networking (SDN)

# Introduction

Software Defined Networking (SDN) is a revolutionary approach to network management that separates the control plane from the data plane in networking equipment. This separation allows network administrators to programmatically configure, manage, and optimize network resources via software applications, rather than relying on hardware-specific configurations.

# Concept and Architecture

The core concept of SDN is to centralize the network intelligence in a software-based controller. This controller has a global view of the network and communicates with underlying hardware using standardized protocols, most notably OpenFlow. The architecture of SDN typically includes three layers:  
1. Application Layer: Where network applications and business logic reside.  
2. Control Layer: The SDN controller which manages flow control to the networking devices.  
3. Infrastructure Layer: The physical network devices such as switches and routers.

# Benefits of SDN

SDN offers several benefits including:  
- Centralized network control  
- Improved network agility and flexibility  
- Enhanced security and network visibility  
- Reduced operational and capital expenses

# Use Cases

SDN is widely used in data centers, enterprise networks, and carrier networks. Common use cases include:  
- Dynamic routing and traffic engineering  
- Network virtualization  
- Efficient bandwidth management  
- Improved disaster recovery

# References

[1] Kreutz, D., Ramos, F. M. V., Verissimo, P. E., Rothenberg, C. E., Azodolmolky, S., & Uhlig, S. (2015). Software-Defined Networking: A Comprehensive Survey. Proceedings of the IEEE, 103(1), 14-76.

[2] Open Networking Foundation (ONF). (2020). Software-Defined Networking (SDN) Definition. https://opennetworking.org/sdn-definition/