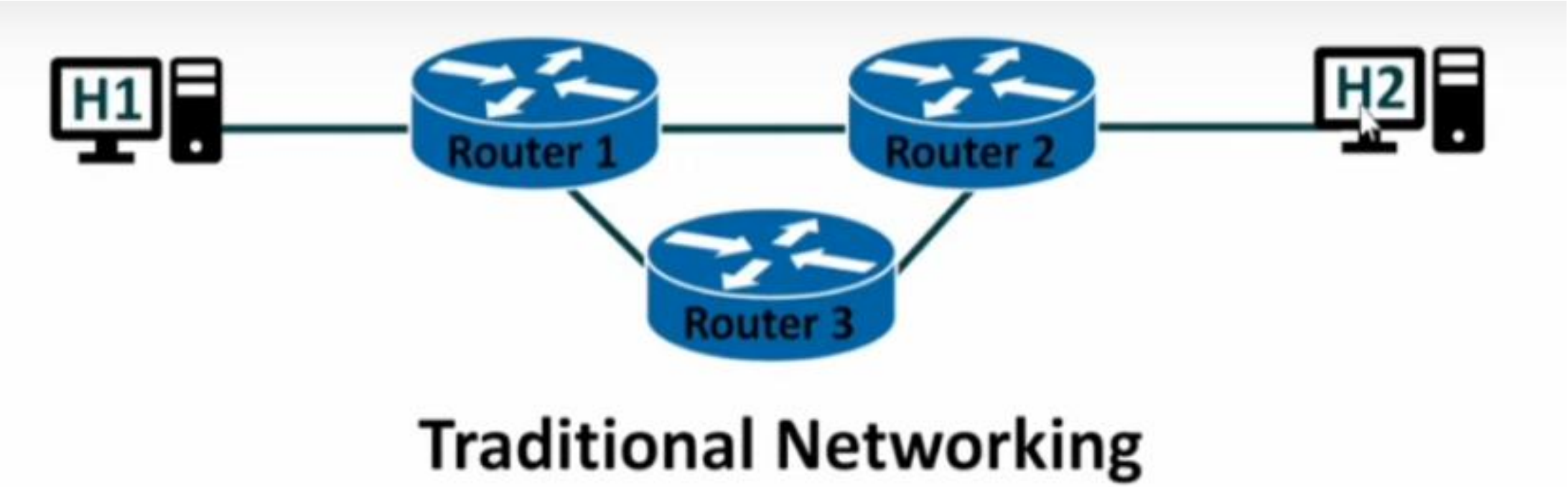
Software Defined Networking

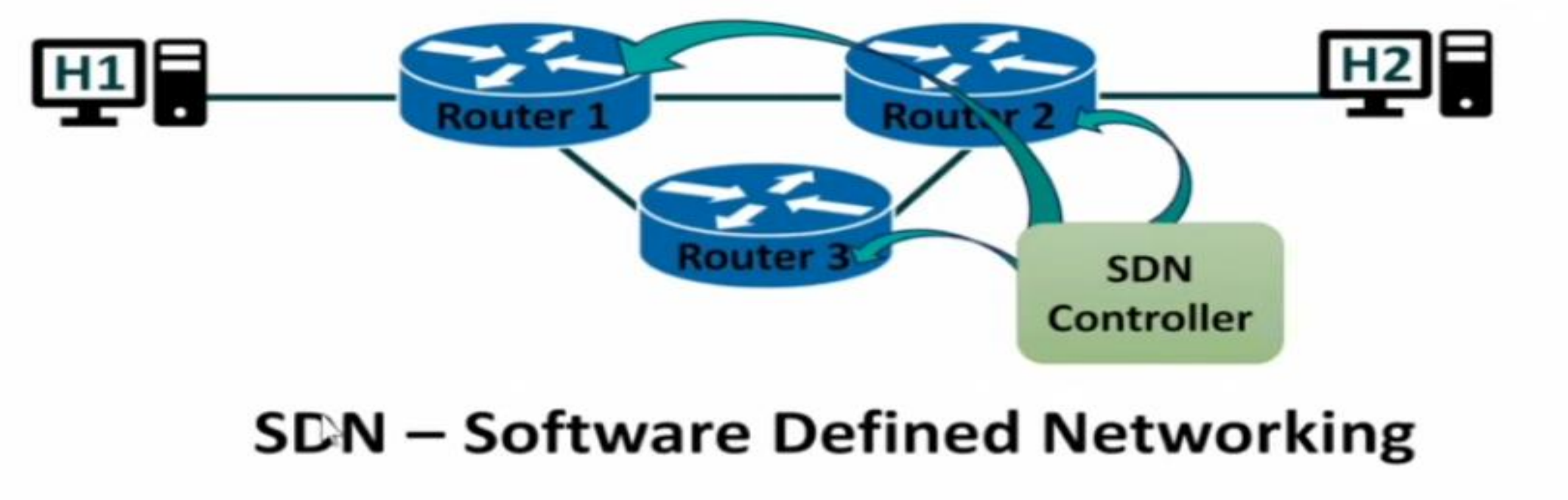
- Traditionally, networks are controlled by hardware devices like routers and switches, which can be complex and hard to configure.
- SDN is a networking architecture approach.
- It enables the control and management of the network using software applications.
- Through SDN, the networking behaviour of the entire network and its devices are programmed in a centrally controlled manner through software applications using open APIs.
- **SDN is an approach to network management that enables dynamic, programmatically efficient network configuration to improve network performance and monitoring. This is done by separating the control plane (which decides where traffic is sent) from the data plane (which actually moves packets to the selected destination).**
- SDN acts as a “Bigger Umbrella or a HUB” where the rest of other networking technologies come and sit under that umbrella and get merged with another platform to bring out the best of the best outcome by decreasing the traffic rate and by increasing the efficiency of data flow.

Traditional Networking vs SDN



In traditional networking, Let us assume computer H1 wants to send data to computer H2. so, computer H1 will send data first to router 1. now the network is having two layers one is **control plane** which will decide whether to send data to Router R2 or R3 and other is **data forwarding plane** which will actually sends the data to the next router. Once the data reaches to router 2, router 2 will see its routing table based on that router 2 will send data to computer H2.

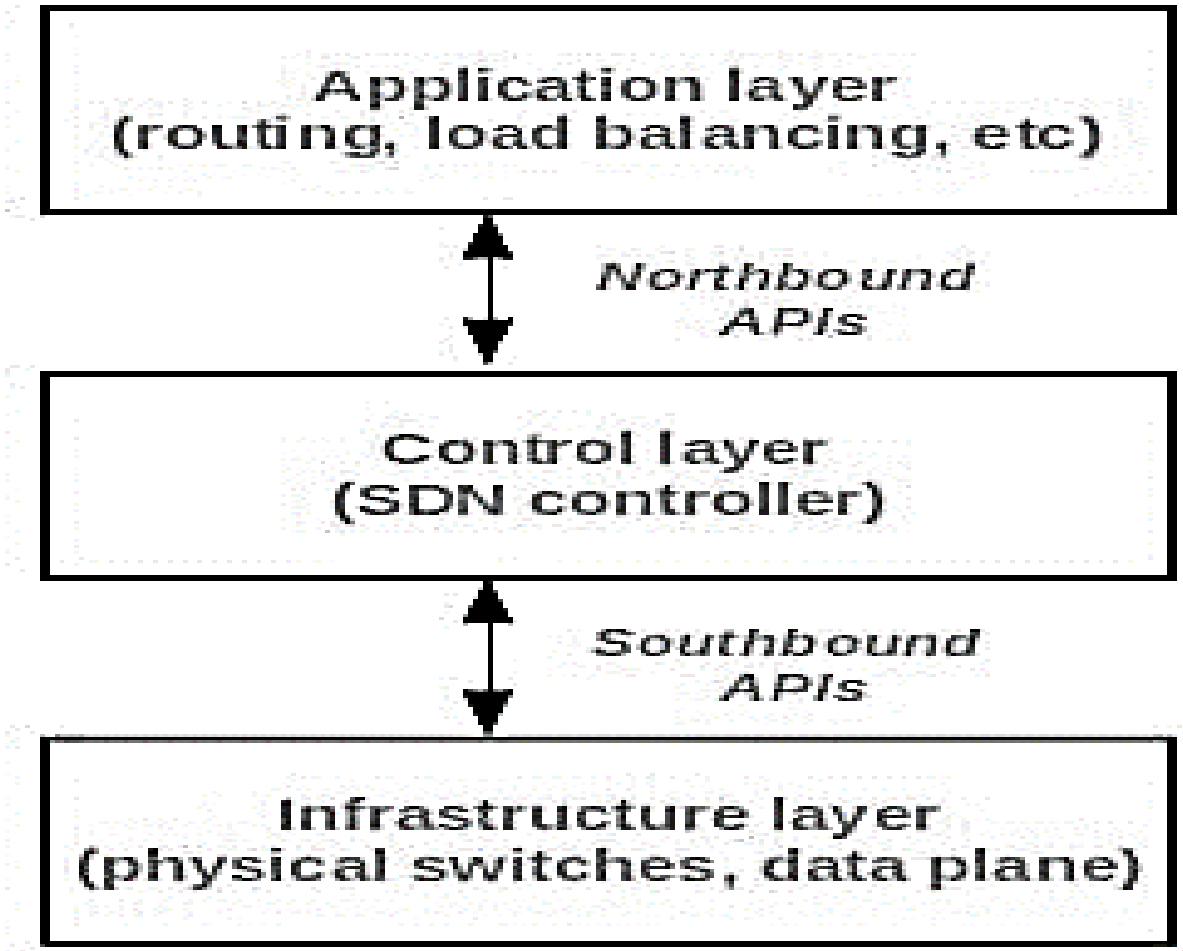
Cont…

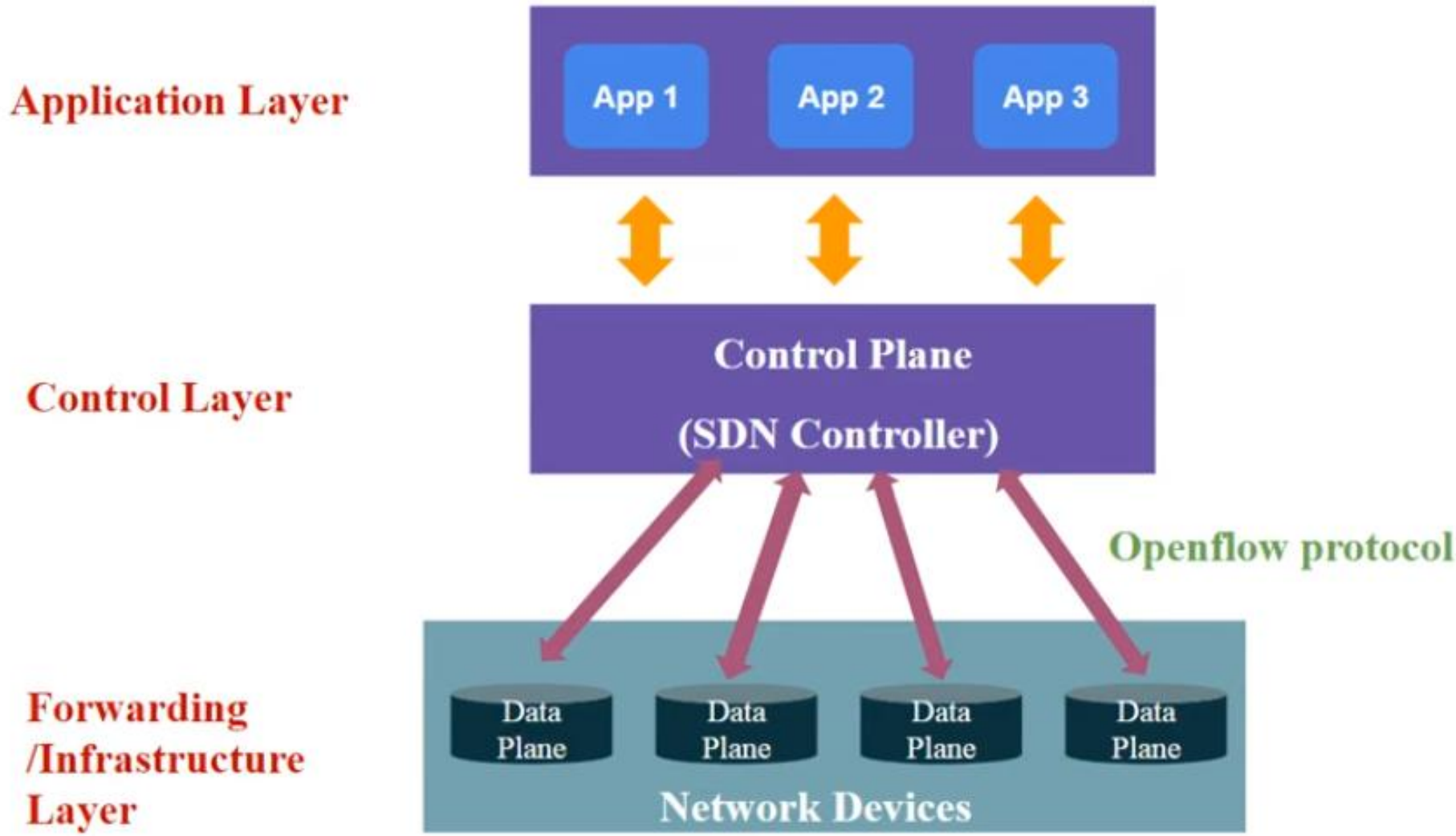


- For same network with SDN controller, SDN controller is connected to each and every router and decides whether the data is through which router or we can simply say the routing of data is controlled by SDN.
- SDN simply removes the task of the control plane of the routers.
- Decision of data routing are taken care by SDN controller.

- Software-defined networking (SDN) is an approach via which we take the control plane away from the switch and assign it to a centralized unit called the SDN controller.
- Hence, a network administrator can shape traffic via a centralized console without having to touch the individual switches.
- The data plane still resides in the switch and when a packet enters a switch, its forwarding activity is decided based on the entries of flow tables, which are pre-assigned by the controller.

SDN Architecture




Application Layer
App 1
App 2
App 3
Control Layer
Control Plane
(SDN Controller)
Openflow protocol
Forwarding
/Infrastructure
Layer
Data Plane
Data Plane
Data Plane
Data Plane
Network Devices

A typical SDN architecture consists of three layers

- **Application Layer:** It contains the typical network applications like intrusion detection, firewall, and load balancing.
- **Control Layer:** It consists of the SDN controller which acts as the brain of the network. It also allows hardware abstraction to the applications written on top of it.
- **Infrastructure Layer:** This consists of physical switches which form the data plane and carries out the actual movement of data packets.
- The layers communicate via a set of interfaces called the north-bound APIs(between the application and control layer) and southbound APIs(between the control and infrastructure layer).

❖ with northbound APIs enabling communication between a component and a higher-level component, and southbound APIs enabling communication between a component and a lower-level component.

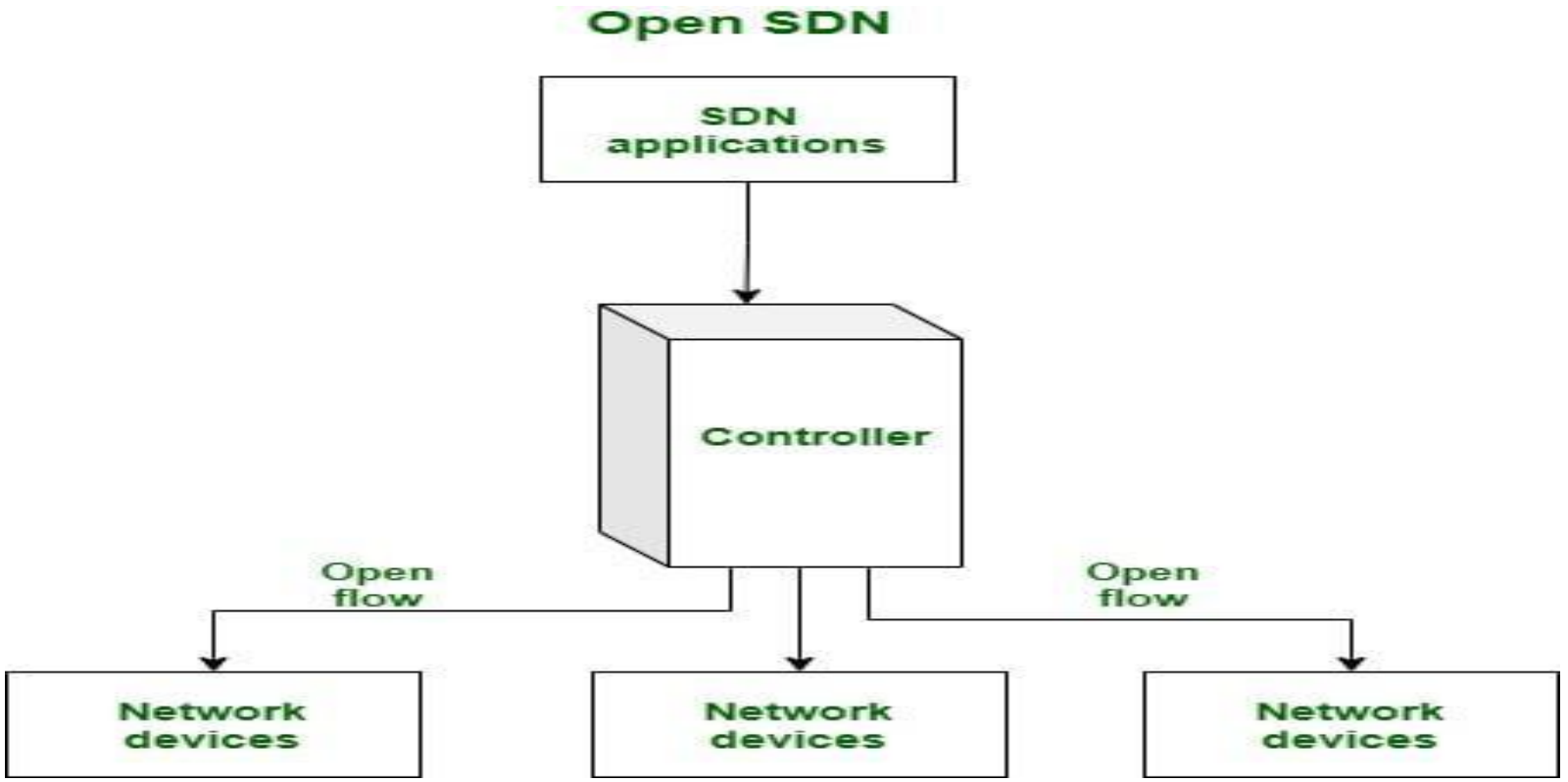
Importance of SDN

- **Better Network Connectivity:** SDN provides very better network connectivity for sales, services, and internal communications. SDN also helps in faster data sharing.
- **Better Deployment of Applications:** Deployment of new applications, services, and many business models can be speed up using Software Defined Networking.
- **Better Security:** Software-defined network provides better visibility throughout the network. Operators can create separate zones for devices that require different levels of security. SDN networks give more freedom to operators.
- **Better Control With High Speed:** Software-defined networking provides better speed than other networking types by applying an open standard software-based controller.

SDN IN IoT

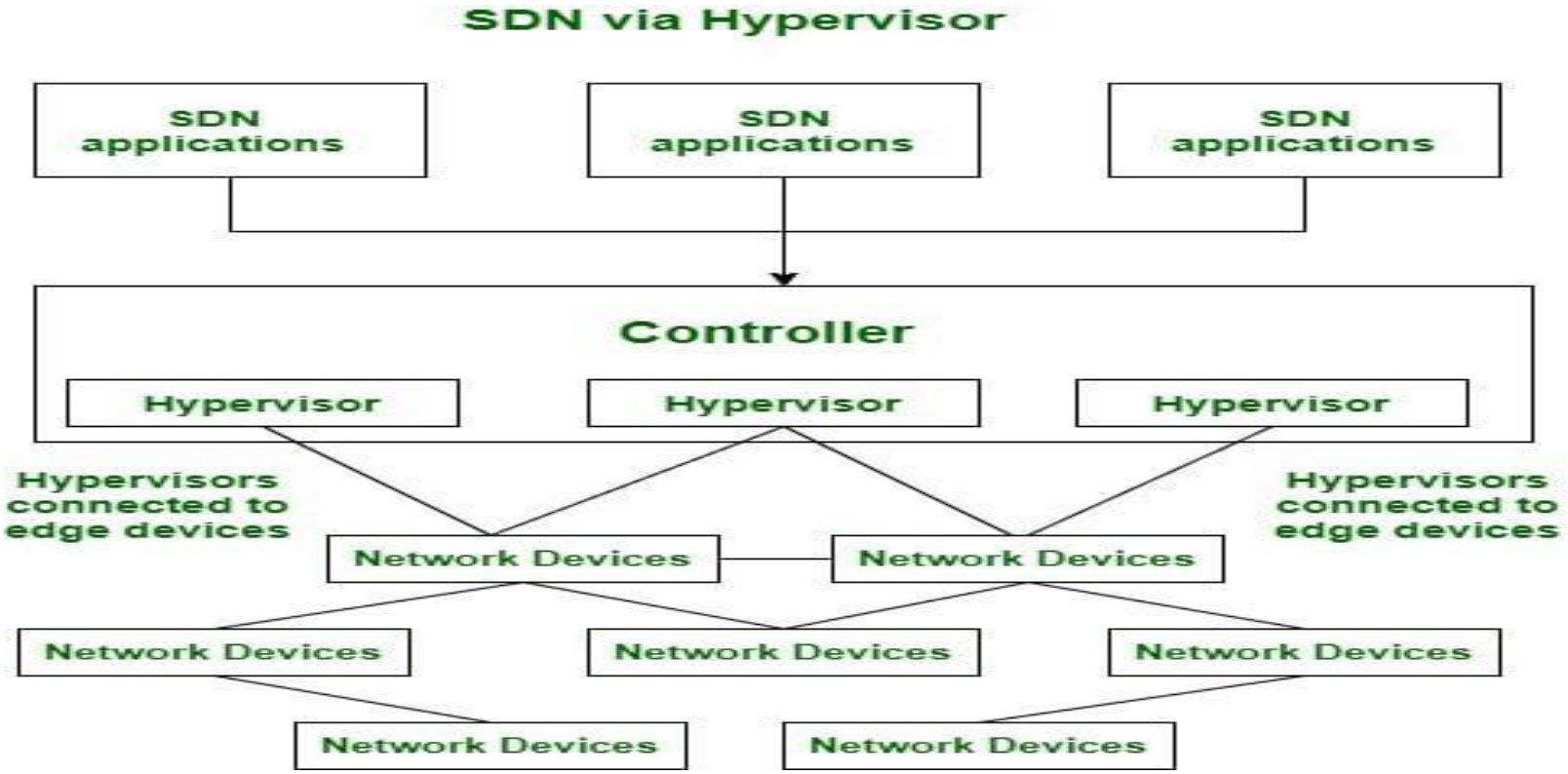
The SDN offers different varieties for IoT networks:

- **Open SDN:** network plan and govern both virtual and physical devices, seamlessly directing the flow of data packets.



- **API SDN:** the potential of programming interfaces, known as southbound APIs, to regulate the intricate exchange of data between devices, ensuring efficient data flow management.
- **Hybrid Model SDN:** this versatile approach enables the optimal selection of protocols for various traffic types.

Overlay Model SDN: Overlay Model SDN constructs a virtual network layer above existing hardware infrastructure, keeping data tunnels and channels to data centers. This innovative model skillfully allocates bandwidth within each channel and effectively assigns devices to their designated channels.



- A hypervisor is a software program that allows multiple virtual machines (VMs) to run on a single physical machine

Significance of SDN in IoT

- **Enhanced Control with Unparalleled Speed and Flexibility:** SDN eliminates the need for manual configuration of various hardware devices from different vendors. Instead, developers can exert control over network traffic by programming a software based controller adhering to open standards. This approach empowers networking managers with the freedom to select networking equipment and communicates with multiple hardware devices using a single protocol via a centralized controller, resulting in remarkable speed and flexibility.
- **Customizable Network Infrastructure:** With SDN, administrators can centrally design network services and swiftly allocate virtual resources to modify the network infrastructure. This capability allows network administrators to prioritize applications that demand increased availability and optimize the flow of data across the network according to specific requirements.
- **Robust Security:** SDN in IoT offers comprehensive visibility across the entire network, presenting a holistic view of potential security threats. As the number of intelligent devices connecting to the Internet continues to proliferate, SDN surpasses traditional networking in terms of security advantages. Operators can create distinct zones for devices requiring different security levels or promptly isolate compromised devices to prevent the spread of infections throughout the network.

Difference Between SDN and Traditional Networking

Software Defined Networking	Traditional Networking
Software Defined Network is a virtual networking approach.	A traditional network is the old conventional networking approach.
Software Defined Network is centralized control.	Traditional Network is distributed control.
This network is programmable.	This network is non-programmable.
Software Defined Network is the open interface.	A traditional network is a closed interface.
In Software Defined Network data plane and control plane is decoupled by software.	In a traditional network data plane and control plane are mounted on the same plane.