SDN

Software-Defined Networking (SDN) is an approach to networking that uses software-based controllers or application programming interfaces (APIs) to communicate with underlying hardware infrastructure and direct traffic on a network.

Thismodeldiffers fromthatoftraditionalnetworks,whichusededicatedhardwaredevices(i.e., routers and switches) to control network traffic. SDN can create and control a virtual network – or control a traditional hardware – via software.

While network virtualization allows organizations to segment different virtual networks within a single physical network, or to connect devices on different physical networks to create a single virtual network, software-defined networking enables a new way of controlling the routing of data packets through a centralized server.

WhySoftware-DefinedNetworkingisimportant?

SDNrepresentsasubstantialstepforward fromtraditionalnetworking,inthatitenablesthefollowing:

- **Increased control with greater speed and flexibility:** Instead of manually programming multiple vendor-specific hardware devices, developers can control the flow of traffic over a network simply by programming an open standard software-based controller. Networking administrators also have more flexibility in choosing networking equipment, since they can choose a single protocol to communicate with any number of hardware devices through a central controller.
- **Customizable network infrastructure:** With a software-defined network, administrators can configure network services and allocate virtual resources to change the network infrastructure in real time through one centralized location. This allows network administrators to optimize the flow of data through the network and prioritize applications that require more availability.
- **Robust security:** A software-defined network delivers visibility into the entire network, providing a more holisticview ofsecuritythreats.Withtheproliferationofsmart devicesthat connecttotheinternet, SDNoffersclearadvantagesovertraditionalnetworking.Operatorscancreateseparatezonesfordevices that require different levels of security, or immediately quarantine compromised devices so that they cannot infect the rest of the network.

The key difference between SDN and traditional networking is infrastructure: SDN is software-based, while traditional networking is hardware-based. Because the control plane is software-based, SDN is much more flexible than traditional networking. It allows administrators to control the network, change configurationsettings,provisionresources,andincreasenetwork capacity —allfromacentralized user interface, without the need for more hardware.

There are also security differences between SDN and traditional networking. Thanks to greatervisibilityand the abilityto define secure pathways, SDN offers better securityin manyways. However, because software-defined networks use a centralized controller, securing the controller is crucial to maintaining a secure network.

HowdoesSoftware-DefinedNetworking(SDN)work?

Here are the SDN basics: In SDN (like anything virtualized), the software is decoupled from the hardware. SDN moves the control plane that determines where to send traffic to software, and leavesthe data plane that actually forwards the traffic in the hardware. This allows network administratorswho use software-defined networking to program and control the entire network via a single pane of glass instead of on a device by device basis.

There are three parts to a typical SDN architecture, which may be located in different physicallocations:

Applications, which communicate resourcerequests or information about the networkas awhole

Controllers, which use the information from applications to decide how to route a data packet

Networkingdevices,whichreceiveinformationfromthecontrolleraboutwheretomovethedata

Physical or virtual networkingdevices actually move the data through the network. In some cases, virtual switches, which may be embedded in either the software or the hardware, take over the responsibilitiesofphysicalswitches and consolidatetheirfunctionsintoasingle,intelligentswitch.The switch checks the integrity of both the data packets and their virtual machine destinations and movesthe packets along.

BenefitsofSoftware-DefinedNetworking(SDN)

Many of today's services and applications, especially when they involve the cloud, could not function without SDN. SDN allows data to move easilybetween distributed locations, which is critical for cloud applications.

Additionally, SDN supports moving workloads around a network quickly. For instance, dividing a virtual network into sections, using a technique called network functions virtualization (NFV), allows telecommunications providers to move customer services to less expensive servers or even to the customer's own servers.

Finally, because of the speed and flexibility offered by SDN, it is able to support emerging trends and technologies such as edge computing and the Internet of Things, which require transferring dataquickly and easily between remote sites.

HowisSDNdifferentfromTraditionalNetworking?

The key difference between SDN and traditional networking is infrastructure: SDN is software-based, while traditional networking is hardware-based. Because the control plane is software-based, SDN is much more flexible than traditional networking. It allows administrators to control the network, change configuration settings, provision resources, and increase network capacity—all from a centralized user interface, without adding more hardware.

Therearealso securitydifferences betweenSDNandtraditional networking.

WhatarethedifferentmodelsofSDN?

Whilethepremiseofcentralized softwarecontrollingtheflowofdatain switches and routers applies to all software-defined networking, there are different models of SDN.

- **Open SDN:** Network administrators use a protocol like OpenFlow to control the behavior of virtual and physical switches at the data plane level.
- **SDN by APIs:** Instead of using an open protocol, application programming interfaces control how data moves through the network on each device.
- **SDN Overlay Model:** Another type of software-defined networking runs a virtual network on top of an existing hardware infrastructure, creating dynamic tunnels to different on-premise and remote data centers. The virtual network allocates bandwidth over a variety of channels and assigns devices to each channel, leaving the physical network untouched.
- **Hybrid SDN:** This model combines software-defined networking with traditional networking protocols in one environment to support different functions on a network. Standard networking protocols continue to direct some traffic, while SDN takes on responsibility for other traffic, allowing network administrators to introduce SDN in stages to a legacy environment.