

Video - Network Programming, SDN, and Controllers (5 min)

Network programming, SDN and controllers. Network programming is used to program and virtualize the network. We're talking about protocols, programming scripting, data modeling and markup languages as well as architectures and APIs or application programming interfaces, protocols like the OpenFlow protocol which allows a programming language to control the forwarding plane of a switch or a router as well as NETCONF and RESTCONF, programming languages like C, C++ and Java, scripting languages like Python, Ruby and Lua, data modeling languages like YANG, markup languages XML and architectures and APIs like the REST architecture and API used over a web browser and the Java API with all of its libraries and pre-written classes and blocks of code.

SDN or software defined networking is an approach to networking where the network is software programmable remotely. It involves the open network foundation which supports the concept and the development of SDN and has also been responsible for releasing the OpenFlow protocol or standard which is a protocol that separates the control plane from the forwarding plane in switches and routers. Also listed here is OpenStack which is a software platform for cloud computing and providing IaaS or infrastructure as a service which means the ability to manage pools of processing power, virtualized servers and network storage on an as needed basis for the customer through a data center.

In this image you can see a comparison between a traditional architecture and an SDN architecture. Notice how in the traditional architecture each device, device 1, device 2 and device 3, let's say they're network switches, each device has a control plane and a data plane. To configure those devices, you configure the control plane on each of those devices. In an SDN or software defined networking architecture, notice how the control plane has been separated from the data plane. Now the three devices, let's say they're three switches, could be controlled from a single control plane or from a single controller using the OpenFlow protocol. This way the three switches can be programmed from a single point or a single software program.

In this image you can see this example further. In this case, the application has been developed using Cisco's onePK open network environment platform kit. The software has been written in let's say the C, or Java or Python programming languages. The application can program the data plane on the three switches, device 1, device 2, device 3 using the OpenFlow standard. Network controllers are SDN control plane devices which are a programmable point of automation to manage, configure, monitor and troubleshoot virtual and physical network infrastructures. This automates the configuration of the network infrastructure. A network controller is a hardware device which locates the SDN control plane.

An example of a network controller used in SDN or software defined networking might be the OpenDaylight platform. The OpenDaylight platform is an open source SDN controller platform. You can see in this example where the SDN controller works with an application to then control the network devices here listed as device 1, 2, and 3 at the data plane. The Cisco ACI or application centric infrastructure is Cisco's approach to software defined networking and network controllers. It involves three main things, an ANP or application network policy, an APIC, application policy infrastructure controller, in this case the APIC-EM which is the enterprise module for APIC and switches that are application programmable like the Nexus 9000 series switches. In this example we can see how the Cisco APIC-EM works. The APIC-EM or enterprise module is the SDN controller which sits between the application, and policy and the data plane devices, device 1, 2 and 3.