What is DNA

Objective

Completion Time: 15 minutes

• Understand the design and components of DNA at a high level.

Prerequisites

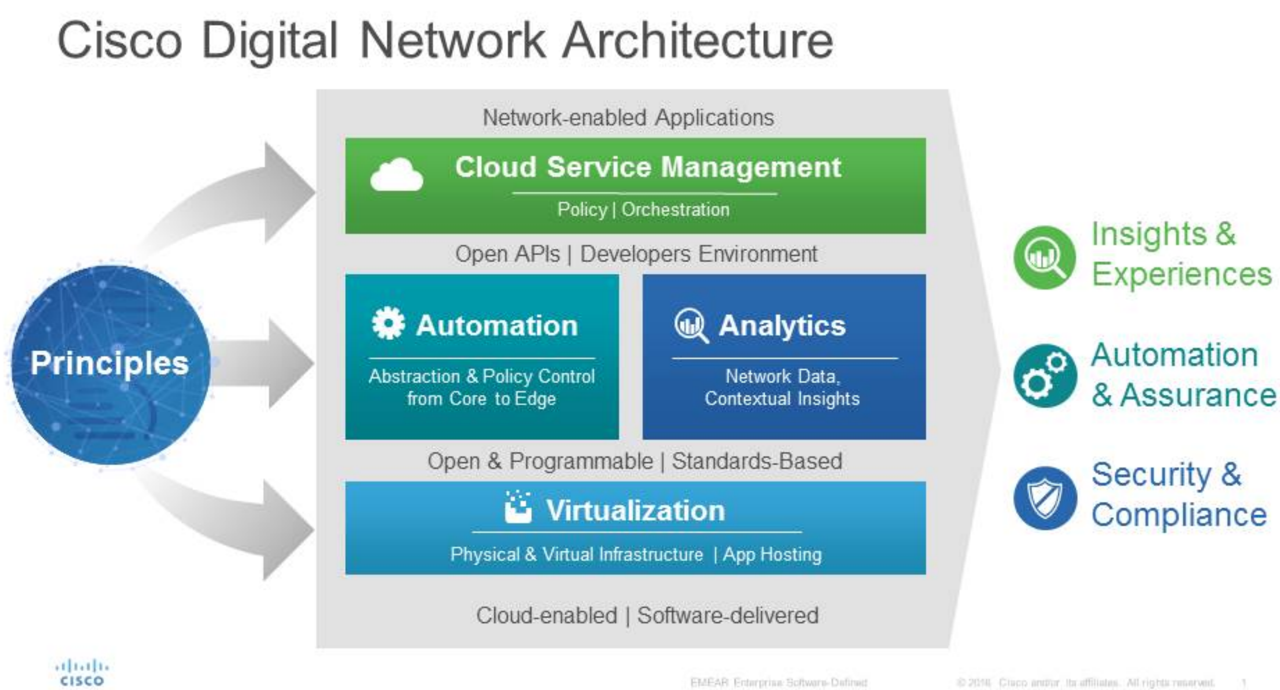
None

Cisco Digital Network Architecture (DNA)

Cisco DNA is an open, extensible, and software-driven architecture designed to meet the needs of a digital organization. Today's digital organization needs the network to provide:

• Insights and Experience
• Automation and Assurance
• Security and Compliance

These outcomes are acheived through cloud service management, automation and policy control, network security, analytics and virtualization.



In this model, the network is the center of an entire system, where the data center provides data management, cloud provides storage, and Internet of Things (IoT) provides network-aware applications. All of these components are supported with programmability at every layer.

Design Principles

Cisco DNA is based on five fundamental design principles:

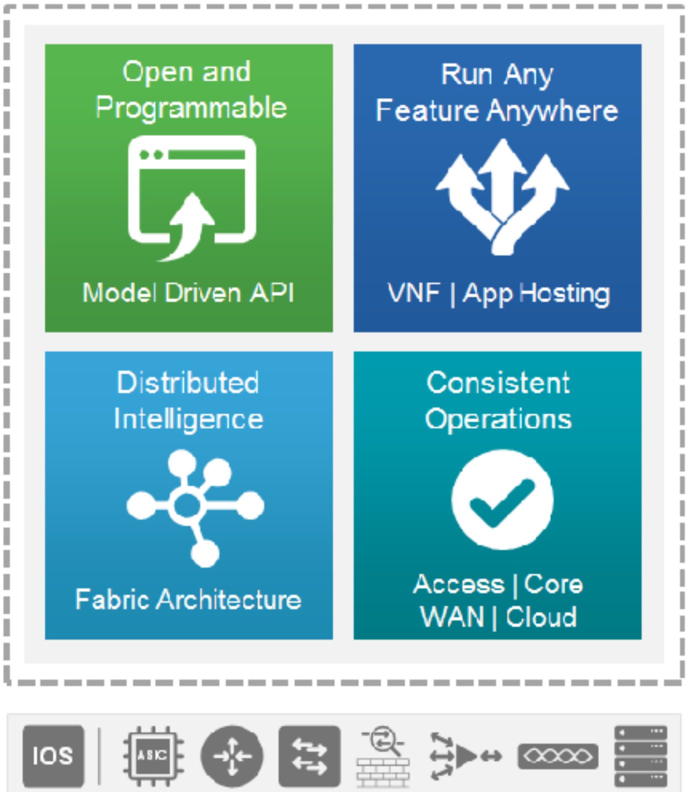
- Virtualize everything to give organizations freedom of choice to run any service anywhere, independent of the underlying platform. It can be physical or virtual, on premise or in the cloud.
- Design for automation to make networks and services on those networks easy to deploy, manage and maintain. This fundamentally changes the approach to network management.
- Provide pervasive analytics to provide insights on the operation of the network, IT infrastructure and the business relative to information that only the network can provide.
- Deliver service management from the cloud to unify policy and orchestration across the network enabling the agility of cloud with the security and control of on premises solutions.
- Provide open, extensible programmability at every layer to integrate Cisco and 3rd party technology, open API's and a developer platform, to support a rich ecosystem of network-enabled application

Components

Let's take a closer look at the principles and how DNA components support them.

Virtualization

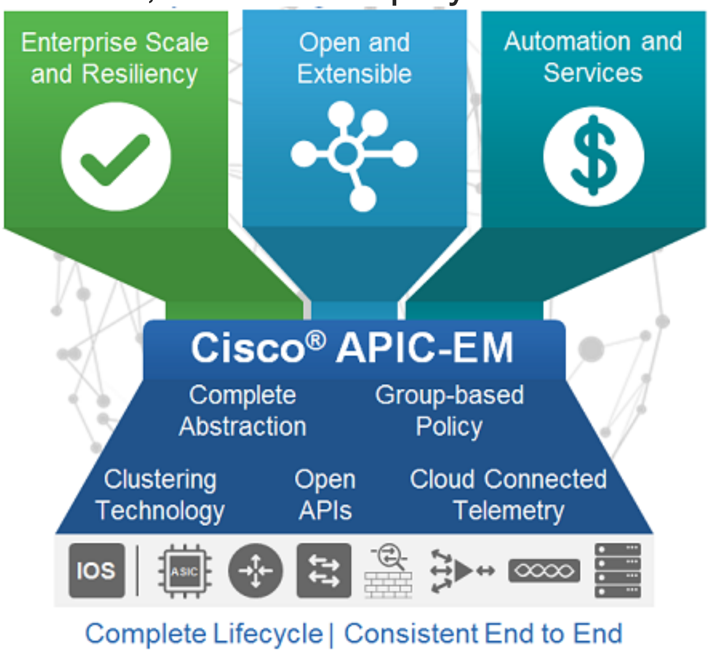
DNA embraces virtualization, which supports the requirements for automation and analytics, including the needs for geographic independence of networking functions. Virtualization in DNA is enhanced by the use of Network Function Virtualization (NFV), which allows network functions to run in a virtual machine. NVF decouples the network intelligence from the underlying hardware. Network engineers have the flexibility to rapidly deploy functions anywhere in the network based on factors other than physical location, which significantly increases the speed of deployments. Enterprise Network Function Virtualization (NFV) reduces infrastructure cost, improves asset reuse and increases innovation speed.



Automation

Network automation is essential in the network to reduce cost. Automation also allows you to deploy and deliver network, digital, and security services within minutes rather than weeks or months. The central idea in automation is the concept of the DNA controller. When triggered by the orchestration applications, new digital services are deployed by the controller onto the relevant network elements at the right time. Speed and agility are critical requirements for service roll out and network operations, and a controller–based system helps to facilitate this. Network functions can also be instantiated by the controller. The DNA controller is vital to consistently drive the policies associated with digital services throughout the network infrastructure. It translates the business intent for the digital services into actionable and verifiable network policies.

The APIC-EM Controller provides many features, such as Plug-n-Play, to automate network deployment and management. In addition, it can be deployed into existing network infrastructure.

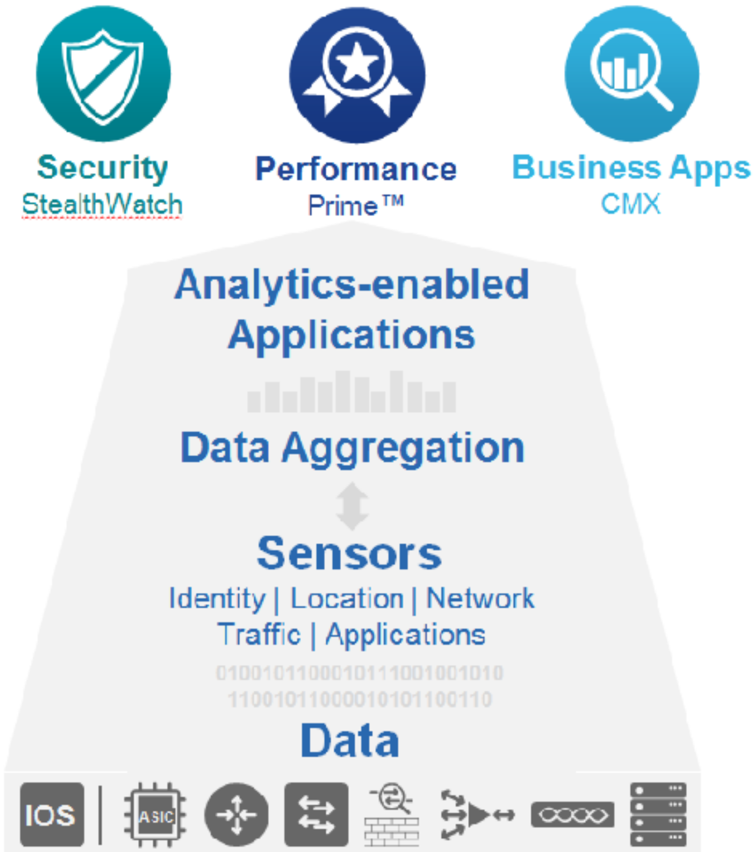


Analytics and Telemetry

Telemetry provides for an automated process to communicate various measurements about the network and service state to an analytics engine. Support for telemetry and analytics comes in the following forms with the DNA infrastructure:

- Network sensors: Enhance the network elements in the DNA fabric with mechanisms to monitor and collect data for infrastructure events and service delivery state so as to allow for the irrespective characterization.
- Communications infrastructure: Support the efficient transport of the telemetry data for analysis by the analytics engine in the network. Analysis data can be substantial requiring monitoring and management of bandwidth.
- Analytics engine: The analytics engine is also part of the Cisco DNA, typically hosted in the enterprise data center, or even in the cloud. DNA telemetry and analytics are an important tenet to

address the requirements to support pro–active feedback loops. The CMX Cloud is an example of how utilizing IoT sensors provide extremely valuable analytics, such as new business insights on customer trends, preferences, and how to engage.



Cloud

The DNA platform fully integrates different cloud models, including private clouds, virtual private clouds, hybrid clouds, or public cloud environments. This integration is designed, both at the transport and the control layer of the network. Analytics and telemetry engines accessing and storing information in the cloud are also part of the cloud enablement aspect of DNA. By making the cloud an integral part of the enterprise network, DNA is addressing the requirement for cloud enablement to drive rapid application prototyping, fast application deployment, and continuous feedback loops to speed digitized business processes.

Network-Aware Applications and Common Models

Supporting Network-Aware Applications

In order for the applications to fully function, they must be network-aware. The network has to provide the capability to flexibly enable communication paths between end users and applications while supporting key transport characteristics such as security, high availability, and quality of service. In DNA, applications are also supported by a network feedback mechanism, allowing the applications to be optimized based on usage or communication patterns. For example, the network can provide continuous feedback for voice applications to the controller, which then triggers the instantiation of an updated QoS policy to ensure voice quality. A network running DNA continuously collects data that can be mined to improve network operations or to support digitalized applications.

Enabling applications to be inherently network–aware is particularly relevant to the following concepts:

Collaboration

DNA supports collaboration with voice and video (for example, Cisco TelePresence®, or instant messaging) in real time with high–quality, helping to ensure that stringent SLAs are met. Non–real–time applications, such as document sharing, are also increasingly network–based, often taking advantage of the cloud to foster collaboration (for example, SmartSheets, Box file sharing).

Mobility

DNA supports mobile access, such as to digitized applications, and also can act as a sensor to provide feedback to support and enhance such applications. Examples of where the network can assist to enhance mobile applications are mapping out movement patterns of mobile users or collecting data on device types and locations.

IoT

An increasing number of business applications are running on devices other than traditional compute hosts. The Cisco DNA infrastructure extends the network to seamlessly include any connected device types used in vertical industries, such as health care, transportation, or retail. Applications controlling such devices, or telemetry data collected from them, can be networked to run in the enterprise data centers or the cloud. They can even be distributed onto network elements with compute resources.

Security

Digitalized business applications can be supported by network security services. Application traffic flows can be encrypted when passing over untrusted domains in the end–to–end communication path. Furthermore, the network can detect communication anomalies or allow policies to be associated with the application to restrict individual users or groups from access.

Common Models

DNA provides common network models so that various network devices, even those made by other vendors, could be controlled by a common set of APIs. The language used to design these models is called YANG (Yet Another Next Generation Modeling Language). A YANG model represents a network device configuration along with its attributes. Tools such as Pyang can be used to convert a YANG model to a common format in order to modify network devices. The protocols that interface with YANG to make these changes on the network devices are the network configuration protocol known as NETCONF and a REST-based network configuration protocol called RESTCONF. See the RESTCONF, NETCONF and YANG module for more information.

Additional Resources to Learn More

Cisco DevNet provides resources that further discuss the DNA building blocks . In addition, the Cisco DNA Product page provides more resources for learning.

Congratulations! You have completed the 'What is DNA?' lab!

What is Network Programmability

Objective

Completion Time: 10 minutes

- Understand how programmability fits into DNA.

Prerequisites

- You should complete the lab 'What is DNA'.

Digital Possibilities

How does an open, software-driven network help you in business terms? It delivers network-based insights, automates processes, and protects against threats. For example, in the digital age, you can mine network analytics that reveal users' locations and behaviors.

Analytics can tell you how customers move through your store or venue and how that's reflected in what they consume. And network devices can detect and shut down a pipeline spill automatically. Or track energy usage in your manufacturing plant.

What makes all this possible is a fundamental transformation occurring in how networks are built and run. Behind this transformation is the idea of programmability at every layer. This means:

- Closed and hardware-centric models are giving way to open, programmable, and software-centric ones.
- Manual, repetitive command-line-interface-driven management is being largely superseded by policy-based automation.
- Perimeter-based, reactive security has been supplanted by network-embedded, context-based security that reaches from the cloud to enterprise edge.
- IT-centric analytics are morphing into business-centric analytics.

The Cisco Digital Network Architecture reflects all these changes. With this architecture, business and IT can become far more nimble and respond to business conditions quicker and more intelligently.

Controller Programmability

Programmability is a critical supporting aspect of the DNA controller. Configuration of the underlay network, the overlay architecture, or even specific services is handled by a south–bound interface between the controller and the network elements and functions. This south–bound interface may rely on command– line interface (CLI), or other standards–based mechanisms such as YANG, representational state transfer (REST) or REST Configuration Protocol (RESTCONF). Supporting standards–based southbound interfaces contributes to the openness of the DNA and also allows also third–party vendors to participate in the network infrastructure.

The programmability aspect of the DNA controller is vital to delivering on the automation, as well as fast and flexible configuration, of DNA.

Building Blocks

The Cisco Digital Network Architecture provides the network infrastructure to support the move to programmability. The architecture consists of several main building blocks.

Transport fabrics connect users, applications, and things seamlessly to greatly simplify network operations.

Virtualization in DNA allows for the decoupling of network or transport functions from the underlying hardware elements, and offers the flexibility and speed required to instantiate services in the network.

The cloud becomes an integral part of the Cisco DNA infrastructure. Network operators are empowered to run applications where it makes sense from a business perspective. They can take full advantage of cloud infrastructure to operate the DNA, or to offer advanced analytics services.

The DNA controller centralizes the network control plane of the infrastructure and plays a critical role in automating its operations. It configures policies that govern network access and transport to instantiate the intent of the network services delivered to business applications.

Analytics and telemetry offer the feedback mechanisms to support network–enabled applications, providing real–time data to application developers for continuous improvement cycles.

Based on these building blocks, Cisco Digital Network Architecture delivers a flexible and innovative environment to deliver transport, security, and digital network services. Being fundamentally a software–driven and fully open environment with APIs, programmability, and virtualization, the Digital Network Architecture platform allows network operators, partners, or network function vendors to drive required innovation in the network to keep pace with the developments in digitalizing business operations for years to come.