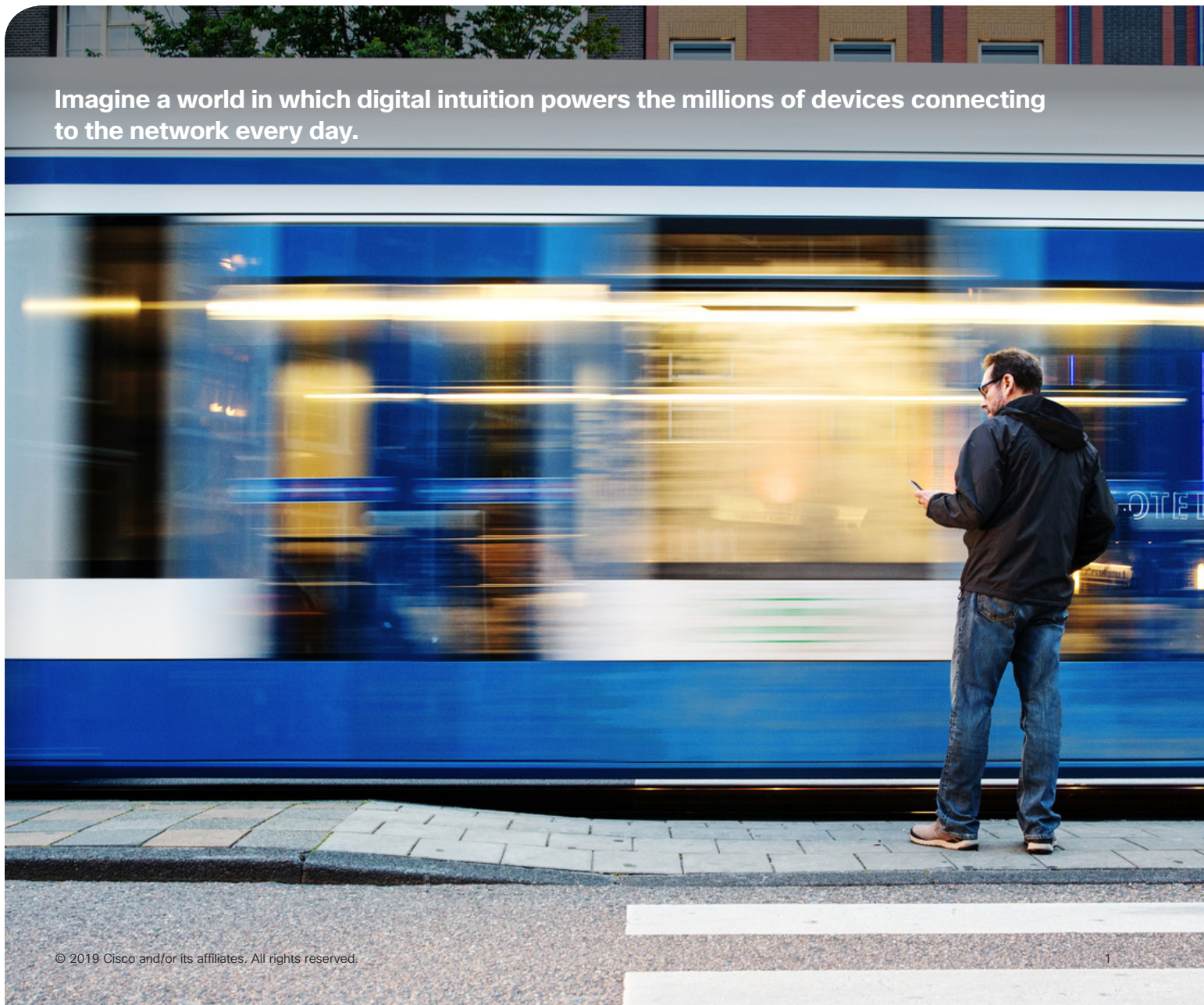


SDN Migration: The Movement to Cisco DNA

Imagine a world in which digital intuition powers the millions of devices connecting to the network every day.



Digitization is upending the world. Organizations and governments are rushing to harness the power of digital technologies.

It's a world in which the complexity of automating, powering, and securing those connections is transformed within the network. Those processes become intuitive. They save plenty of money. And they become more secure than ever.

This isn't science fiction. It's reality. First there was software-defined networking (SDN). And now there is Cisco® Digital Network Architecture, or Cisco DNA.¹

Cisco DNA changes the playbook for building and managing networks in the digital age. It rises above the bundle of network technologies that make up SDN. It brings them together into a holistic framework to achieve improved business outcomes. Cisco DNA makes network services relevant and easy to use on the road to digital transformation. It includes ready-to-use applications as well as readily consumable application programming interfaces (APIs). And it's here now.

This white paper delivers several insights:

- Examines the pressing need for digital-ready networks
- Reviews the history of SDN and its advantages over networks based on physical devices
- Explores how Cisco DNA greatly enhances and extends SDN
- Describes the new skills that application developers and networking professionals must acquire so they can deliver the business benefits of Cisco DNA
- Shares the evolved certifications that Cisco has established to help enterprises make the most of Cisco DNA

The digital-era network gap is costly

Digitization is upending the world. Organizations and governments are rushing to harness the power of digital technologies. They want to leverage digitization to build trust, move faster, add greater value, and grow.

Several main technology trends are driving digitization. They include mobility, the Internet of Things (IoT), the cloud, and security. Only the network brings all of these trends and elements together, allowing organizations to achieve their full potential.

Organizations that plan to take as much advantage of digitization as they can must advance their networks to operate at digital speed. This is reality. It's the only way to capture business data that yields real-time and historical information and insights for making better decisions or building new business models. They also require this speed for IT. By simplifying the network and automating processes, IT can adapt quickly to new business demands and meet service level agreements.

1. Cisco, "[Digital Network Architecture](#)," 2017.

Legacy networks cost a lot more to operate than those that are digital-ready. They also leave significant money on the table, and they are more at risk from cybercrimes or regulatory liabilities.

They require this speed for security. By quickly spotting real-time attacks throughout a completely visible network, they can contain threats much faster and follow compliance requirements.

But so far, the network is not keeping up with the digital revolution. The whole point of digitization is to make technology directly serve business strategies instead of existing on the margins. Yet IDC research revealed that just 20 percent of global organizations have a strong degree of alignment between their networks and their digital strategies.²

Today's networking professionals devote 80 percent of their time just to "keeping the lights on." They spend the small amount of remaining time working on projects to improve the organization. What's the net result? Networks that are not digital-ready cost between \$24,200 and \$38,300 more every year per 100 users.

This comes from WAN, network infrastructure, and efficiency costs. This is the amount of money organizations can save when they upgrade their networks to be more digital-ready, according to an IDC study.³ The same research shows that organizations with digital-ready networks gain a yearly value of \$188,000 to \$745,000 per 100 users.

Here are more impressive numbers. Organizations with networks that are highly aligned with their digital strategies post more than double the rate of revenue growth, customer retention, and profits, compared with those with only partial or no alignment in their networks. Organizations with more advanced stages of network readiness perform significantly better on each of the preceding key metrics than those with less advanced networks.

The IDC research shows that 45 percent of large and midsize organizations worldwide plan to achieve advanced network readiness within two years. This is just above three times more than current network readiness levels. Organizations with more digitally mature networks are unleashing almost twice as many digital capabilities as those with less mature networks. Digital-ready networks enable organizations to improve security and cut risks, resulting in significant revenue growth and cost reductions, according to IDC.

In other words, legacy networks cost a lot more to operate than those that are digital-ready. They also leave significant money on the table, and they are more at risk from cybercrimes or regulatory liabilities. In fact, 92 percent of executives expect increased scrutiny of their cybersecurity practices from regulators and bankers, and 71 percent said cybersecurity concerns are hindering innovation in their organizations.⁴

2. IDC, "[Is Your Network Ready for Digital Transformation?](#)" January 2017.

3. IDC, "[Why a Digital-Ready Network Makes Business Sense.](#)" January 2017.

4. Cisco white paper, "[Key Insights: Cybersecurity as a Growth Advantage.](#)" 2016.

With SDN, it is much easier to access public and private cloud services. Organizations can use any device to work with their data anywhere at any time while maintaining security and regulatory requirements.

Enough already. The network must go digital, too. Change is now impacting the network, and it is just as monumental as the move from analog to digital. It is the shift away from physical devices—hardware—to software that virtualizes device functions and supports digital innovation. The network is becoming programmable thanks to the new SDN technology.

In addition, more systems have moved to the cloud in recent years, while organizational demand for mobile device access is rising. As a result, network traffic patterns have changed. When systems operated in a basic client-server setup, the static Ethernet tree structure worked well for networks. But a framework with more flexibility is necessary in the digital cloud era.

That framework is SDN. With SDN, it is much easier to access public and private cloud services. Organizations can use any device to work with their data anywhere at any time while maintaining security and regulatory requirements. SDN is also infinitely better at handling big data because it enables organizations to ramp up multiple servers or virtual machines for parallel processing much faster and at lower cost.

SDN delivers a competitive edge, and organizations are eager to exploit it to support their digital projects and goals. It gives organizations a steady yet flexible framework to manage systems that blend in-house with cloud frameworks by separating network control and forwarding from the underlying network structure. Therefore, network control can be programmable and managed entirely by software.

Keeping control apart from forwarding makes the network more agile. It allows organizations to adjust traffic across the network as it occurs so it can meet changing volumes. This makes it possible to centralize network management and capture an overview of the network to assess which applications or devices are generating the most traffic.

Adoption of SDN will be intense because it has become established in the market. In fact, the worldwide SDN market is predicted to have a compound annual growth rate of nearly 54 percent between 2014 and 2020.⁵ It is expected to be worth almost \$12.5 billion by 2020.

SDN delivers multiple advantages

A glance at current and future advantages of SDN helps to explain why it is so popular and growing so rapidly.⁶ These returns include the following:

- 1. Easier centralized network provisioning**—SDN accelerates service delivery because it is more agile at provisioning both virtual and physical network devices from a central location.

5. BusinessWire, "[SDN Market to Experience Strong Growth Over Next Several Years, According to IDC](#)," February 2016.

6. Ingram Micro Advisor blog, "[7 Advantages of Software Defined Networking](#)," 2014.

While SDN on its own provides considerable benefits, Cisco DNA greatly exceeds them, making it easier for organizations to get their networks digital-ready.

- 2. Holistic enterprise management**—SDN allows IT managers to test network configurations without affecting the network. It supports management of physical and virtual switches and network devices from a central controller. SDN also offers one set of APIs to create a lone management console for physical and virtual devices.
- 3. More visible centralized security**—The SDN controller is the one central point that distributes security and policy information consistently throughout the organization.
- 4. Reduced operating costs**—SDN administration is more efficient because it improves server utilization and better controls virtualization—both of which can deliver operational savings.
- 5. Hardware savings and reduced capital expenditures**—SDN brings new life to existing network devices. It also makes it easier to optimize standard hardware because the SDN controllers store all intelligence.
- 6. Cloud abstraction**—SDN makes it easier to unify cloud resources. Abstraction is the process by which cloud computing enables shared access for users everywhere. The SDN controller manages all components that make up massive data center platforms that the cloud uses to deliver this access.
- 7. Guaranteed content delivery**—Service quality for voice over IP and multimedia is easier with SDN, as is streaming high-quality video, because SDN boosts network performance.

Cisco is making SDN even better

While SDN on its own provides considerable benefits, Cisco DNA greatly exceeds them, making it easier for organizations to get their networks digital-ready. The Cisco DNA framework includes these enhancements:

- **Built-in automation**—Cisco DNA reduces the difficulty, expense, time, and effort required to launch and manage networks and services.
- **Pervasive analytics**—It also provides insights into network operations, IT frameworks, and the business itself.
- **Virtualization**—Cisco DNA runs services anywhere, independent of a platform, which can be physical, virtual, on the premises, or in the cloud.
- **Open, extensible, and programmable layers**—It perfectly blends Cisco and third-party technology, open APIs, and a developer platform.
- **Security advances**—It uses the network as a powerful security sensor and enforcer.

That last point deserves a bit of further discussion because SDN is a game changer in security. Strong security starts with the network. Without it, robust cybersecurity cannot be possible.

IT professionals must adopt rapidly changing technologies while taking full advantage of the cloud. Throughout this process, one technology affects the others.

In the past, security has been built on firewalls, intrusion detection, virtual private networks, and access control. But today's networks have billions more devices attached, and these devices are much more varied in functions and formats. This situation drives up the levels and scope of vulnerabilities and possible network entry points.

As a result, previous approaches to security become much more difficult to perform effectively without advanced security on every network port to observe and control all network activity. Cisco DNA uses the NetFlow data from network devices to boost the ability to view everything running across the network. Cisco DNA also provides several ways to analyze, detect, and stop threats.

In short, Cisco DNA gives organizations an open, software-driven platform. It provides a roadmap to a digital-ready network, allowing organizations to innovate much faster and to slash costs and risks with services that are easy to consume.

IT professionals will need new job skills

Analytics plays a key role in Cisco DNA. It reveals rich contextual insights about users, applications, devices, and threats. This helps organizations and their IT professionals make more informed decisions. To make this happen, however, organizations must do two things. First, they must liberate IT time and resources by automating daily networking tasks. This makes room to focus on more critical business innovation.

Second, organizations must build key programming skills in their network engineers. These new skills will enable them to tap into network intelligence. They also will be able to devise powerful new network-enabled applications through open APIs. In dealing with virtual networks, network engineers must understand and make use of Cisco DNA controllers and network orchestration systems.

The arrival of Cisco DNA means IT job functions are moving away from device and platform configurations. Instead, they are heading toward secure and policy-based services with business-focused analytics capabilities. These services are made possible thanks to abstraction and automation within controller-based frameworks. It's more outcome-focused, which makes it integrate better with business goals.

But establishing and supporting a digital-ready network poses many challenges. IT professionals must adopt rapidly changing technologies while taking full advantage of the cloud. Throughout this process, one technology affects the others. For example, an organization cannot set up cloud and enhanced access without clearly understanding the critical security requirements behind it.

Foundational skills are still essential for both network engineers and programmers. Now that networking is an integral part of IT in the digital era, these two jobs are merging into a single entity known as the network programmer.

There is another key aspect to enterprise digitization. It's the ability to connect data, processes, people, and things securely. To do this, organizations require trained and certified personnel to design and build secure frameworks. They also require IT professionals who are properly trained to detect and respond to increasingly stealthy cybersecurity threats.

Where does digital migration leave IT professionals? As businesses migrate to digital, they are looking for professionals with automation and programming skills. They require IT professionals who are trained and certified in a new skills framework so they can take advantage of innovations that enable maximum flexibility and reduced operational costs.

Think like a business here. You may regard SDN offerings like Cisco DNA as fascinating new technology in and of itself. But organizations ultimately regard these advances as a means to reach their desired business outcomes and remain competitive. The smart ones look for IT professionals—like you—who keenly understand the intimate relationship between technology and business. The parts of IT most relevant to business cannot be automated. They require creativity, vision, and architectural savvy, which comes in human form.

You need valuable digital networking skills

However, foundational skills are still essential for both network engineers and programmers. Now that networking is an integral part of IT in the digital era, these two jobs are merging into a single entity known as the network programmer. Only those network engineers, programmers, or other IT professionals who gain these skills will be in a position to collect the juicy rewards of the digital era. Will you be among them?

Since digital networks are automated, basic scripting is an excellent skill for every IT professional because it forms the basis for automating any task. And there will be many tasks that will be automated in digital networks. If your current title is network engineer, consider adding programming to your skill sets, too. Python is an excellent language choice because it helps you switch your thinking between procedural programming and object-oriented programming. You should also learn Linux and become comfortable working with APIs.

From these basics, network engineers like yourself can move into infrastructure programming. It will be necessary to learn about common automation protocols, such as Network Configuration Protocol (NETCONF) and representational state transfer (REST). You also must understand how both of these relate to YANG data models. In addition, you should delve into types of SDN controllers, such as Cisco Application Policy Infrastructure Controller (APIC), Cisco Application Policy Infrastructure Controller—Enterprise Module (APIC-EM), and Cisco Open SDN Controller. You also should understand how to use APIs that reside in devices.

At Cisco, we are providing the necessary updated training and certification to take IT talent to an entirely new level.

On the programming side, IT software engineers must learn networking basics. Automating infrastructure is primary. But you also should understand how to use APIs and toolkits to interface with SDN controllers and individual devices. Other basics are also necessary, such as IPv4 and IPv6 addressing and subnetting. These are functions of basic components in a network. Programmers and network engineers alike will need extensive knowledge of virtualization because digital networks are largely virtualized and highly fluid.

The IT jobs of the future are being defined right now. Organizations already need criteria for evaluating IT professionals like you who have the advanced skills to take on digital networks and to understand how to maximize them. Best of all, the career opportunities are growing exponentially.

Earn your Cisco Network Programmability certifications

At Cisco, we are providing the necessary updated training and certification to take IT talent to an entirely new level. This training will help IT and networking professionals to grow into incredibly strong strategic business resources in their organizations. You won't be standing on the sidelines any longer because IT is at the eye of the digital storm.

Cisco has introduced new and updated certifications that are relevant for digital-ready networks. Digitization is catching fire in the industry. So, we are delivering the necessary skills to design and implement virtual, software-based networks that support ongoing digital innovation.

We recently introduced two key Specialist certifications with training. Cisco also unveiled additional courses to expand our progressive learning portfolio. They are as follows:

- [Cisco Network Programmability Design and Implementation Specialist](#) certification and training
- [Cisco Network Programmability Developer Specialist](#) certification and training
- The [Cisco Digital Network Architecture Implementation Essentials \(Cisco DNAIE\)](#) boot camp for professionals who are already using Cisco DNA
- [Cisco Programming for Network Engineers \(PRNE\)](#), a course that is immediately valuable for network engineers who are moving into programming

Let's examine these offerings in more detail.

For network engineers, this program provides a complete, soup-to-nuts course to develop and validate automation and programming skills.

For network engineers: Network Programmability Design and Implementation Specialist certification

Designed especially for network engineers, the Cisco Network Programmability Design and Implementation Specialist certification is for those who hold an active Cisco CCNP or Cisco CCDP certification. They now want to learn crucial programmable network skills. Passing the NPDESI exam associated with this certification renews any existing Cisco CCNA or CCNP certifications.

For network engineers, this program provides a complete, soup-to-nuts course to develop and validate automation and programming skills. It directly addresses the role of network engineers as this role moves toward more programmability, automation, and orchestration.

The training explains network programming basics, such as Linux and Python; common automation protocols, such as NETCONF and REST; and how they relate to YANG data models. It also covers DevOps, agile software development, and automation tools such as Ansible, Chef, and Puppet. The course explains the many types of SDN controllers, and it emphasizes hands-on learning through lab exercises so learners acquire practical experience.

Training for the NPDESI exam is offered as an instructor-led training workshop via Cisco Learning Partners. It also comes in the form of self-paced interactive training replete with videos, integrated labs, and assessments.

The PRNE course self-paced training is immediately valuable to network engineers who must use network programming to simplify or automate tasks. PRNE is recommended before undertaking the Cisco Network Programmability Design and Implementation Specialist certification course and NPDESI exam. It covers the basics of Python programming within the context of performing tasks relevant to network engineers.

For application developers: Network Programmability Developer Specialist training

Cisco Network Programmability Developer Specialist training provides application developers with a thorough course to gain network infrastructure programming skills. It teaches data handling and formats, the basics of networking, network programmability, APIs and automation protocols, data models, operations, and controller platforms and protocols. Passing the NPDEV exam associated with this certification automatically renews any existing CCNA or CCNP certifications.

Training for the NPDEV exam is offered as an instructor-led workshop through Cisco Learning Partners. It also comes in the form of self-paced interactive training with videos, integrated labs, and assessments.

For engineers rolling out Cisco DNA today: Cisco Digital Network Architecture Implementation Essentials (Cisco DNAIE)

The Cisco DNAIE course supports networking professionals who are establishing Cisco DNA today. It consists of five days of Cisco DNA implementation training that teaches general concepts. These include the role of orchestration and automation enabled by controllers in Cisco DNA. 9

As always, we are committed to updating our list of certifications to help your skills stay valuable and relevant as the industry evolves and new technologies emerge.

When you complete the Cisco DNAIE program, you will be able to do the following:

- Describe the Cisco DNA vision, strategy, and general concepts, including the role of orchestration and automation that controllers make possible.
- Identify use cases of Cisco DNA controllers and the role of various applications in the APIC-EM controller
- Explain how security is implemented in Cisco DNA using secure access, along with pervasive security features and their benefits.
- Identify how Cisco DNA combines various technologies such as advanced analytics and Cisco Connected Mobile Experiences (CMX) Cloud

This course is available as an instructor-led workshop from Cisco Learning Partners. It also may be taken as self-paced interactive training with videos, integrated labs, and assessments.

Become more valued with Cisco certification

Cisco has been a training leader for decades. The company continues to deliver maximum value, helping to mold IT talent that is exceedingly capable of positive business transformation in the digital age.

We are continuously expanding our list of digital skills training with topics such as Cisco DNA fundamentals, data analytics, network programmability, cybersecurity, IoT, cloud, and business skills. These subjects and fields are embedded into all of our CCIE programs, as well as in the CCNA and CCNP certifications.

As always, we are committed to updating our list of certifications to help your skills stay valuable and relevant as the industry evolves and new technologies emerge. Additions such as the Network Programmability Design and Implementation Specialist certification help you and other IT professionals acquire essential IT skills so you can ensure enterprise success for your employer today and in the future. That is exactly what will support your quest to become increasingly valued and rewarded in your profession.

These are our commitments to the technical community. What about you? What is your commitment to your career? Do you have that internal passion to stay relevant? How strong is your desire to become “digital ready” by learning new skills and new technologies? If you are among those with that kind of drive, then we will help you obtain the best possible advantage from all the advancement opportunities that digitization offers IT professionals.

Visit the [Cisco Learning Network](#) to learn more about Specialist certification training in network programmability. For more information about demystifying SDN, please visit the [network programmability site](#) on the Cisco Learning Network.