

The Future of the Network: Evolving Routing and Switching for Today's Digitized Landscape

There's a whole lot of change in business today.

Broadband, the cloud, the Internet, the Internet of Things (IoT), mobility, and on-demand business models have been big drivers of that change.

As a result, customers expect more from businesses.



In terms of capacity, the more bandwidth we as a society get, the more we want. And as network pipes get fatter, content and services swell to fill them.

Now that change—fueled by network connections, content, and new business imperatives—is coming full circle. It’s creating the need for networks themselves to change.

Routing and switching will continue to be the basis of networking, and of networking experts’ skill sets. But software-defined networking (SDN) is changing how we will plan, design, deploy, and operate our networks.

That will have its challenges, of course. But there’s a big upside for network experts like you. It puts you in a power position.

The power position

Just look at what’s already happened.

Estimates indicate that network-related jobs will see 31 percent or greater growth by 2024.¹ That includes network administrator, network support specialist, and computer network architect titles.

But businesses aren’t just looking for titles and people with legacy know-how. They want men and women who can help them address today’s technologies and market forces. And they’re seeking experts who can take them and their networks into the future.

To understand these changes, we have put together some resources to help you get started:

- An overview of the market
- A discussion of how SDN is impacting routing and switching
- An overview of what network experts need to know today
- Details on how Cisco can help you attain that know-how

A market overview

A variety of factors are creating the need for a new kind of network and network expert.

One is the sheer growth in the capacity needed to support today’s usage. Another is the growing number of endpoints and the growing volume of content—including rich-media applications—on the network. And the overarching factor is commonly referred to as digital transformation.

In terms of capacity, the more bandwidth we as a society get, the more we want. And as network pipes get fatter, content and services swell to fill them. Using online services and applications has become second nature for many of us.

Mobile devices and networks, and cloud-based applications, enable us to work from wherever we are. Work is no longer a place; it’s an activity.

1. Pfitzer, Gary, "[Network Administrator, Do You Have What It Takes?](#)" Talking Tech with Cisco blog, July 2016.

Mobile data traffic worldwide increased 63 percent last year. In the past five years, it's grown 18-fold.

And millennials have made a big impact in this change. Just consider these data points about millennials in the business arena, reported by a Gartner survey:²

- 44 percent of millennial workers say they have the latest and greatest personal devices. That's just 33 percent for older workers.
- 31 percent of this group uses social media at least once a day, versus just 18 percent for those with more experience.
- 57 percent of the younger group uses storage and sharing tools at least once a week. That's opposed to 41 percent for others in the workplace.
- And 30 percent of the younger set feels highly productive working in public, compared to 15 percent for the more mature set.

Whether we're at work or play, networks are integrated into nearly every aspect of our lives. That has helped fuel a big increase in online traffic, especially mobile traffic. Mobile data traffic worldwide increased 63 percent last year. In the past five years, it's grown 18-fold.

Video accounts for a huge chunk of that traffic. Last year, 60 percent of the traffic on mobile networks was video, according to Cisco's Visual Networking Index.³ And video, as we all know, is a bandwidth-loving kind of traffic.

Gartner expects 8.4 billion connected devices to be in use this year.⁴ If that forecast plays out, that number will be up 31 percent from last year. And more growth will follow.

All that puts more pressure on networks to scale efficiently.

So does the fact that the cloud and connected technology are becoming part of everything businesses do today. Product design. Manufacturing. Distribution. Marketing. Sales. Human resources. Customer service. Every department and discipline in business has been transformed by connected technology. This is what we mean when we talk about digital transformation. And it is driving the need for new enterprise network architectures.

"We're at a critical time for the digital economy," notes a recent article in the Harvard Business Review.⁵ "Digital is no longer the shiny front end of the organization. It's integrated into every aspect of today's companies."

And it's become a business imperative. Indeed, there's a direct correlation between digital adoption and business outcomes.

As someone who works in tech, you're probably already familiar with many of these trends. So what's the point?

2. Gartner, "[How Millennials Disrupt Workplace Technology](#)," October 2016.

3. Cisco white paper, "[Cisco Visual Networking Index: Global Mobile Data Traffic Forecast Update, 2016-2021 White Paper](#)," March 2017.

4. Gartner Newsroom, "[Gartner Says 8.4 Billion Connected 'Things' Will Be in Use in 2017, Up 31 Percent from 2016](#)," February 2017.

5. Grossman, Rhys, "[The Industries That Are Being Disrupted the Most by Digital](#)," Harvard Business Review, March 2016.

In this on-demand world, people are no longer willing to wait. Customers have become conditioned to demand and expect products and services now. So businesses need to deliver solutions faster.

A whole lot of apps, content, devices, and users need network resources. And people, companies, and content creators want to get their digital hands on bandwidth and services quickly.

So, the people who build and manage networks need to address these growing and changing needs. And they have to do it without breaking the bank—or IT team members' backs.

Today's networks need to become more intelligent. And the people responsible for them need to make some changes as well.

It's the only way that businesses and their networks can become more efficient, strategic, and profitable. And only that way can network experts make the most of their own careers.

The network today

Of course, when it comes to networks, change has been a constant. Over the years, networking has continued to evolve.

But iterative change is no longer good enough. Disruptive change is happening in the world and in business. And disruptive change needs to happen now in the network.

Networks today simply aren't very flexible.

Legacy networks are based on closed technology. Different network functions often live in different boxes. And the ability to scale is limited.

Then there's the issue of network management and provisioning.

Adding boxes to the network to allow for more capacity or new services isn't always easy. Neither is monitoring them or fixing them when there are problems. They require a lot of manual work. And sometimes that work takes a long time. Bringing new features and services to market can take weeks—sometimes even months.

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Yet legacy networks are struggling to combat sophisticated cyberthreats. They can't keep up with the needs of today's mobile workforce. And they are not prepared to support the growing number of cloud applications and IoT devices. Again, a new approach is required.

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Evolving the network

Networks have to become faster in their ability to enable new applications, features, and functions. They need to become smarter and more application-aware.

All this has become possible with the arrival of software-defined networks and technologies like [Cisco Digital Network Architecture \(DNA\)](#). Cisco DNA decouples hardware from software, which allows for greater speed and flexibility. And it helps businesses extend network services, like routing or security, to a diverse set of platforms, including branch, campus, colocation center, and public cloud scenarios.

This new world will still rely on routing and switching. In fact, they will be central to it. But Cisco DNA and SDN make the network more efficient by allowing it to execute repeatable tasks, respond to the needs of specific applications, scale, and become programmable.

Programmability can be applied in the data center and in access, core, and wide-area networks as well. And it allows for analytics, automation, cloud service management, and virtualization.

- Network virtualization decouples hardware from software, delivering dynamic and elastic scaling. And it offers the freedom to run different virtual network functions (VNFs) on the same server resources. It also allows third-party applications to run on the network.
- Cloud service management is among the benefits of new, SDN-based networks. Service management delivered from the cloud unifies policy and orchestration across the network. That allows for business agility. And it contributes to security and the control of on-premises solutions.
- Automation is made possible by SDN, too. SDN allows network operators to erect policies so the network knows what to do in various situations.
- A digital-ready network has another great benefit. It can reveal rich insights into users, applications, devices, and threats. These analytics can help businesses and IT teams make better decisions. That advantage, of course, is huge.

In these new networks, powered by Cisco DNA, controllers simplify the network through abstraction, which makes cloud services available to many users simultaneously. Box-by-box management is replaced by network-wide, policy-based automation. And IT staff members are freed from doing manual, repeatable tasks. Instead, they can focus on business strategy and new service rollouts.

That shift makes your role far more strategic. But with great power comes great responsibility.

The more you know, the more value you provide to your company. The same could be said about any business where you might want to work going forward.

The new expert

Network experts have to move quickly to take advantage of this opportunity. To do that, you need to learn all you can.

Learning about Cisco DNA, SDN, and other new technologies should be part of that. So should understanding what's driving their adoption.

Only that way can you navigate the sea change of digitization.

Learning@Cisco analyst Mark Leary, in a recent blog, suggests the following steps for Cisco CCNA certification holders to make the most of these changes:⁶

- Build knowledge
- Communicate and collaborate
- Diversify skill sets
- Keep an open mind
- Understand larger change agents

“Carve out the time to advance your skills, expertise, and experience,” Leary advises. “Offered the chance to break ground in technology or business? Take it. Offered the chance to work on a new complex and critical project? Accept it. Offered the chance to consult with groups beyond your usual suspects? Step up. Offered the chance to develop deeper or broader technology knowledge? Jump at it. Offered the chance to access a new learning tool (for example, collaboration, digital workplace, learning management)? Use it to full effect.”

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Whatever the company, businesses tend most to value talent that is well-rounded and has an appetite for knowledge.

“Know what impacts your area,” Leary says. “Know what your area impacts.”

For example, he says, network experts should be able to answer questions like the following:

- What is the effect of deploying that new networking device?
- What is the effect of activating that new networking service?
- What is the effect of establishing that new networking policy?
- What are the desired business outcomes?
- What should the end-user experience look like?

The answers to these and other questions won't always be rote, he adds. So network experts need to do more than memorize; they need think conceptually and strategically.

6. Leary, Mark, “[Top 10 Career Pointers for the CCNA Holder](#),” Talking Tech with Cisco blog, January 2016.

You will learn about both physical hardware and virtual network functions. Both are important, because the transition to new networks and software-based models will take time.

“Literally, think outside of the box, the network,” Leary continues. “In digital business, success is based on the whole—not the sum of its parts. Traditional networking job focal points such as device deployments, network uptime, and user/site connectivity are table stakes these days.

“Increasingly, knowledge of enterprise design, network optimization, and service integration and integrity separate the great from the good.”

Good to great

We are here to help you expand your knowledge and skills in these ways. Greater knowledge and skills will help you better contribute to the success of your organization and increase your professional opportunities. And it will help businesses address the skills gap that SDN and other disruptors helped create.

That’s why we continue to update our certifications in line with changing business and network requirements. And it’s why we have removed barriers to education by creating new business models, platforms, and opportunities to learn.

Programmability will be one of the central features of new software-defined networks. Since this skill is important for network engineers, these topics are being incorporated into Cisco’s certifications. Most recently they have been added to the [CCNA Routing and Switching](#) certification. As a network administrator, you need to understand how to provision controllers, rather than just configuring and provisioning using the CLI, which is the legacy way. So we’ve updated this certification to help you learn this new skill.

The other big part of SDN is policy, with quality of service (QoS) at its heart. So we’ve added QoS-related materials about marking, policing, and shaping to this certification. That learning will enable CCNA Routing and Switching certification holders to better manage congestion within enterprise networks.

Of course, virtualization is another important aspect of new software-defined networks. And we’re only going to see more functions become virtualized in the future. So the CCNA Routing and Switching program now addresses virtualization as well.

The CCNA Routing and Switching certification also places greater emphasis on analytics and enterprise VPN. Enterprise VPN includes Dynamic Multipoint VPN (DMVPN), site-to-site VPN, and client VPN learning content. Connecting branch offices and mobile workers to the enterprise remains critical.

While significant, these updates do not mark a wholesale change of this certification. You will learn about both physical hardware and virtual network functions. Both are important, because the transition to new networks and software-based models will take time. Traditional and new solutions will coexist for at least a while.

So the core skills you build upon for various certification pathways are still in the mix. And they will provide great value no matter which path you take in

The CCNA Routing and Switching certification is unique in the industry. It's the most recognized and sought-after networking certification in the IT arena.

your career, whether you stick with Routing and Switching training or branch out into Cisco CCDA or other CCNA tracks. These core skills will form the foundation that supports you throughout your networking career. The CCNA Routing and Switching certification continues to offer the fundamentals for job roles such as network administrator, network engineer, or network specialist.

Candidates gain know-how in installing, monitoring, and troubleshooting network infrastructure. The curriculum includes Cisco switches, routers, and basic mitigation of security threats. And it offers an introduction to wireless networking concepts and terminology and emphasizes performance-based skills.

The CCNA Routing and Switching certification is unique in the industry. It's the most recognized and sought-after networking certification in the IT arena. It's the benchmark for Associate-level network engineers in core routing and switching and other enterprise segments.

The Cisco [CCNP Routing and Switching](#) certification builds on that foundation, validating the core networking skills for Professional-level network engineers with at least one year of networking experience. It demonstrates your ability to plan, implement, verify, and troubleshoot enterprise LANs and WANs. And it readies you to work with specialists on advanced security, voice, wireless, and video solutions.

The Cisco CCIE certification validates the next level of expertise. Achieving [CCIE Routing and Switching](#) certification demonstrates an end-to-end, solution-level understanding of enterprise network architectures. It validates the network engineer's ability to plan, operate, and troubleshoot complex, converged networks using the latest Cisco technologies.

We deliver education services through [Authorized Learning Partners](#) in a variety of formats. Instruction is available in classroom environments. We also offer classes online through the Cisco Learning Network. And other resources are available on the [Cisco Learning Network](#) so you can use them as needed along the way.

If you're interested in building on your core routing and switching skills with further SDN know-how, there's more.

The [Cisco Network Programmability Design and Implementation Specialist](#) certification is designed for engineers who deploy network applications in programmable environments and make them work. This program helps your core routing and switching skills to evolve with programmability, automation, and orchestration, which leverage the powerful level of abstraction provided by controller-based architectures. Professional-level certification (CCNP or CCDP) or any Expert-level certification (CCIE or CCDE) are prerequisites.

For network engineers who are new to SDN, we recommend taking [Programming for Network Engineers \(PRNE\)](#), which covers Python programming fundamentals specific to the network engineer job role.

The world is changing quickly. So are businesses, and now, networks. Those changes have created a steep learning curve. So you can't just go with the flow.

Ready, set, go

The adoption of software-defined network technology is growing. Now is the perfect time to learn about what's possible with software-based networks.

If you're not sure that now is the right time to dig in, consider these facts:⁷

- Organizations around the world will triple their adoption of automated networks over the next two years. And you want to be ready to help them when they do.
- Over the next two years, 45 percent of organizations expect to achieve digital-ready network capabilities. That number represents three times the current adoption rates.
- Companies with modern networks see two to three times the rate of growth of competitors in revenue, customer retention, and profit. They have also deployed twice as many digital transformation initiatives as companies with legacy networks. As others see these results, broader adoption seems sure to accelerate. And you will be there.

Just consider this excerpt from the 2016 edition of the popular career guide *What Color Is Your Parachute?*:⁸

"The ability of each of us to survive in this new world depends on our understanding how the world, especially the world of work, is being reimagined," writes author Richard N. Bolles. "Things that never used to be connected are increasingly being reimagined as connected. This reimagining of our world as hyperconnected is not going to be implemented someday, down the road. It is being implemented now."

The world is changing quickly. So are businesses, and now, networks. Those changes have created a steep learning curve. So you can't just go with the flow.

Only by acquiring new skills can you keep your head above water and ride the wave. There's a lot to learn, and the water may be choppy at times. But the folks who face the challenge early will be the best positioned to address what's happening now and what awaits in the future.

Come join Cisco and drive the future of the network [forward](#).

7. Greene, Nolan, et al., IDC white paper sponsored by Cisco, "[Is Your Network Ready for Digital Transformation?](#)" January 2017.

8. Bolles, Richard N., "What Color Is Your Parachute? 2017: A Practical Manual for Job-Hunters and Career-Changers," Ten Speed Press, revised edition, 2016.