IT & DATA MANAGEMENT RESEARCH,
INDUSTRY ANALYSIS & CONSULTING

Prepared for:

Enterprise Network Automation:

Emerging From the Dark Ages and Reaching Toward NetDevOps

March 2024 EMA Research Report Summary
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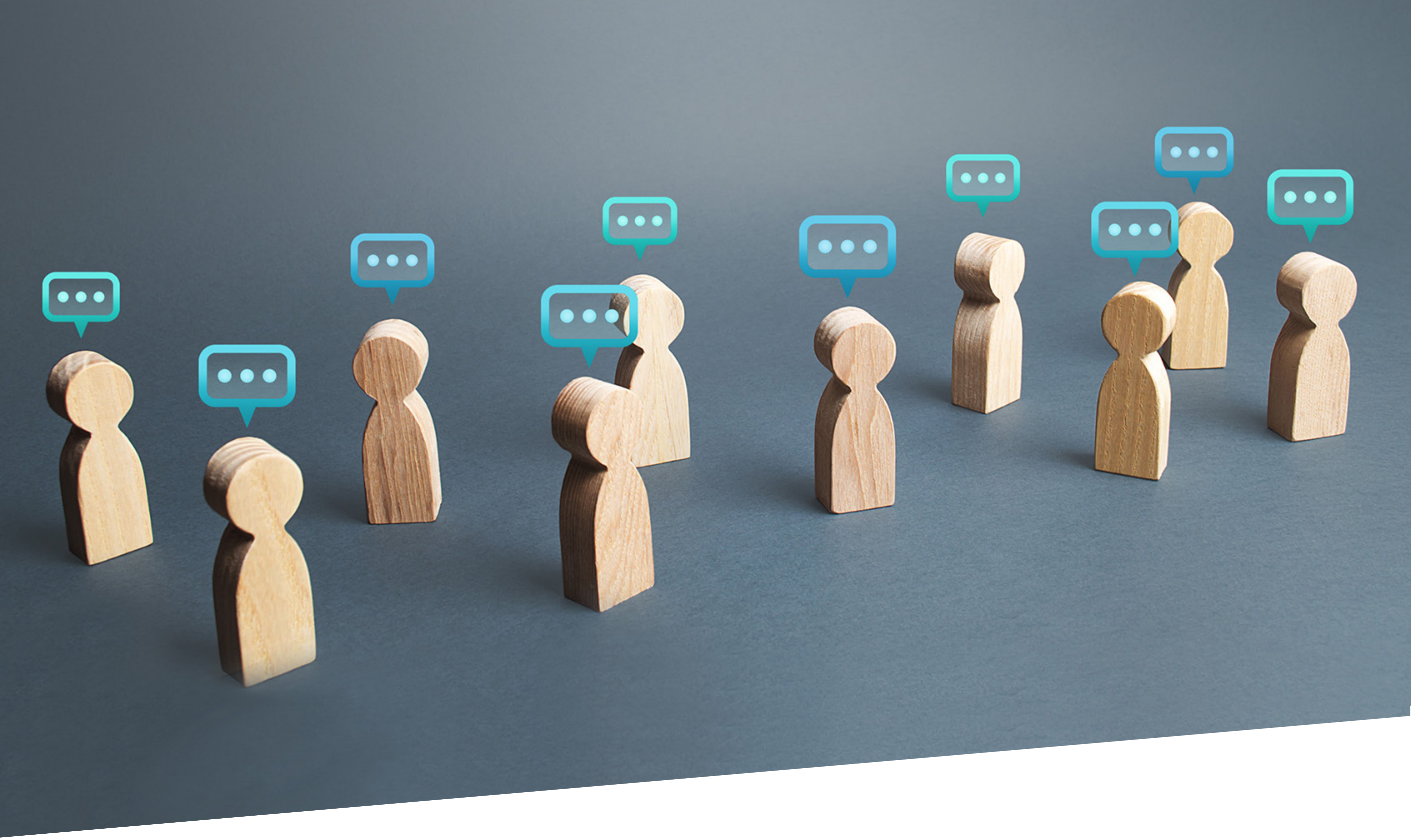


Executive Summary

This summary of independent, multi-sponsor market research explores the state of network automation initiatives in enterprise IT organizations. Based on a survey of 354 network automation stakeholders and in-depth one-on-one interviews with ten network automaton professionals, the report explores the entire lifecycle of network automation strategies, including both homegrown and commercial solutions.

Introduction

Network automation remains an unsolved problem for enterprise IT organizations. For decades, vendors and IT professionals have developed and implemented tools aimed at reducing manual management of networks with mixed results.

Enterprise Management Associates' (EMA) Network Infrastructure and Operations practice has tracked this issue for years. We have consistently found that IT organizations cobble together a mix of homegrown, open source, and commercial tools to automate their networks. Clearly, IT organizations recognize that there isn't one tool that can solve the entire problem. Instead, they need a portfolio of tools – but what makes a successful network automation tool portfolio? This report explores that question in depth. Through survey data and interviews with network automation experts, EMA will attempt to provide a roadmap toward network automation success by revealing what your peers are doing, where they run into problems, and where they are finding success.

Methodology

EMA surveyed 354 IT professionals in January 2024 about their organization's approaches to network automation. All respondents had direct involvement with network automation as developers of homegrown tools, implementers of commercial tools, users of tools, or managers of teams responsible for network automation.

Also, EMA interviewed ten networking professionals, primarily from Fortune 500 enterprises, who either implement or use network automation tools. These interviews enriched EMA's analysis of its survey data and interview subjects are quoted anonymously throughout this report. The interview subjects were a:

- Network tools engineer at a Fortune 500 retailer
- Network automation engineer at a large university
- Network automation engineer at a medical school and hospital chain
- IT tool architect at a Fortune 500 media company
- Network automation engineer at a $3 billion SaaS provider
- NOC analyst at a very large private media company
- Network engineer at a Fortune 500 food and agriculture company
- Network engineer at a midmarket business services company
- Network automation engineer at a Fortune 500 manufacturer
- Network engineer at a private gaming company

Demographic Overview

Figure 1 details the demographics of the 354 people EMA surveyed for this research. It reveals a diverse mix of job roles and IT groups, industries, and sizes of enterprise. Also, it reveals a transatlantic view of network automation, with respondents from the Unites State, Canada, France, Germany, and the United Kingdom.

FIGURE 1. DEMOGRAPHIC OVERVIEW

Job Titles

22%	Network administrator/engineer/architect
5%	Network automation engineer/NetDevOps engineer
7%	Project manager
49%	IT middle management
18%	IT executives

IT Groups

17%	Network engineering
17%	Network operations/NOC
16%	CIO suite/executive management
14%	IT architecture
11%	Cloud engineering/operations
10%	Information security/cybersecurity
7%	IT tool engineering/development
7%	Security operatio

Top Industries

20%	Finance/Banking/Insurance
20%	Manufacturing
13%	Retail/Wholesales/Distribution
9%	Health Care
6%	Business Services – not related to IT
4%	Education/Research
4%	Consumer Services
4%	Oil/Gas/Mining

Company Size (Employees)

49%	1,000 to 4,999
38%	5,000 to 19,999
13%	20,000 or more

Revenue

19%	$100 million to less than $500 million
25%	$500 million to less than $1 billion
39%	$1 billion to less than $5 billion
15%	$5 billion or more
3%	Unknown/Not applicable

Region

63%	United States/Canada
37%	France/Germany/UK

Key Findings

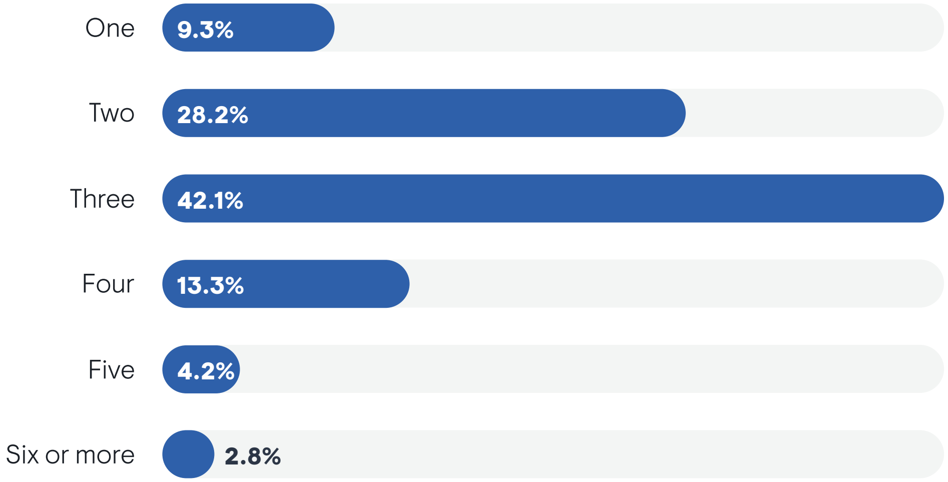
- Only 18% of organizations have a completely successful network automation strategy
- The top technical issues with network automation are:
  - Integration issues
  - Lack of network standards
  - Legacy network issues (poor vendor APIs, inconsistent features)
- The top business issues with network automation are:
  - Poor IT leadership
  - Staffing issues
  - Budget issues
- Nearly 94% of organizations use both vendor solutions and do-it-yourself solutions for network automation
- 91% of network automation strategies are multi-tool
- Top drivers of vendor adoption are:
  - Security/Compliance requirements
  - Platform requirements (stability, scalability)
  - Breadth/Depth of functionality
- Top drivers of DIY adoption are:
  - Functionality aligned to specific network requirements
  - Security/compliance requirements
  - Cost savings
- Cloud migration and hybrid multi-cloud architectures are the primary drivers of network automation
- Network automation investments are primarily aimed at addressing network complexity and improving operational efficiency
- Security policy management, configuration compliance management, and network validation/assurance are the more important features organizations are seeking from their tools
- Most organizations (58%) are looking for low-code automation solutions, where minimal coding skills are required
- 80% of organizations have a network source of truth, but only 20% say those solutions are very effective
- 98% of organizations have tools and processes in place to validate an automated change before committing it
- 99% of organizations have tools and processes in place to validate an automated change after committing it
- These pre- and post-change validations typically check for potential network performance impacts and security policy compliance
- The top benefits of network automation investments are operational efficiency and reduced security risk

Snapshot of Network Automation Strategies

Network Automation is a Multi-Tool Proposition

Figure 2 reveals that the typical IT organization has two or three network automation tools. Note that this number does not include the scores of single-use scripts that many network engineering teams use to automate individual tasks. EMA's analysis found that organizations tend to be more successful with network automation when they use a larger toolset. Also, the larger a company is, the more tools it has.

FIGURE 2. EXCLUDING SINGLE-USE SCRIPTS (E.G., PYTHON, PERL, RUBY, GO), HOW MANY TOOLS (CONFIG MANAGEMENT, DISCOVERY, VALIDATION, SOURCES OF TRUTH, ASSURANCE, ETC.) ARE PART OF YOUR ORGANIZATION'S NETWORK AUTOMATION FRAMEWORK?



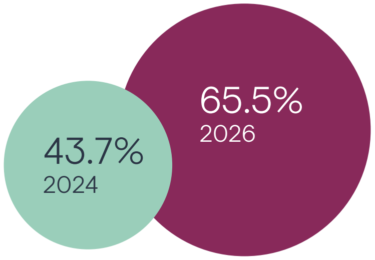
Sample Size = 354

EMA typically advocates that network teams consolidate their toolsets to unified, multifunction platforms. However, in the world of network automation, tool categories are emerging that solve very specific problems around network automation, such as task orchestration, configuration management, data management (e.g., network sources of truth), and network validation (network modeling and digital twins). Vendors that specialize in different areas are increasingly partnering to deliver comprehensive solutions. In fact, research participants who reported the most success with network automation told EMA that they were expecting to add more tools in the future, suggesting that they are identifying opportunities to add new tools to optimize their overall automation strategy.

Extent of Automation

Figure 3 reveals the mean response to a question that asked respondents to estimate the percentage of their organization's overall network management tasks that are automated today versus where they expect to be in two years. It reveals that IT organizations expect to increase their overall level of network automation by nearly 50% by the end of 2025. Midmarket enterprises expected more progress than larger enterprises. Respondents who reported more success with network automation also reported higher rates of automation.

FIGURE 3. ESTIMATE TO WHAT EXTENT YOUR ORGANIZATION'S NETWORK MANAGEMENT TASKS ARE AUTOMATED TODAY AND TO WHAT EXTENT THEY WILL BE AUTOMATED BY THE BEGINNING OF 2026.



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This chart is best read as a measure of how much progress organizations expect to make with network automation over the next two years, rather than a true measure of how much automation they have implemented. EMA does not believe these percentages are particularly exact. When our analysts interviewed networking professionals one on one, we asked a similar question. Interviewees indicated that it was impossible for them to offer a good estimate because they don't have full visibility into the daily tasks of all their colleagues.

Where are They Automating?

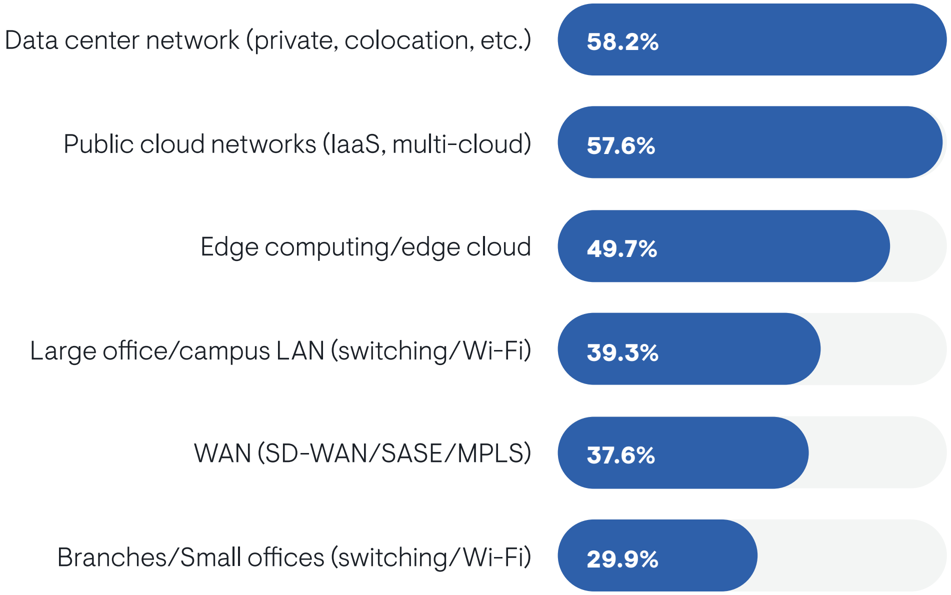
Most of the enterprises represented in this survey tended to focus their network automation strategies in data center networks and public cloud networks, as **Figure 4** reveals. Nearly half were also applying network automation to edge computing and cloud edge deployments. Organizations that focused on these three areas were more likely to be successful than unsuccessful with network automation in general.

"We are automating everything," said a network automation engineer at a Fortune 500 manufacturer. "There is nothing we won't automate."

The chart shows that large office LAN, branch office LAN, and WAN infrastructure were all secondary priorities for automation. Organizations that focus on automation of large office LANs were more likely to buy proprietary network automation software from a tool vendor and less likely to use a vendor-supported open source network automation tool.

"There are two things that are very important to automate," said a network engineer at private gaming company. "We are managing peering relationships, so insertions, deletions, and modifications of peering relationships with different internet exchanges. The other is our EVPN-VXLAN data center fabric, making it easier for server people to plug in servers and get new connectivity without delays or any EVPN weirdness. A third big focus for us over the last two years is deploying new remote points of presence."

FIGURE 4. WHICH DOMAINS OF YOUR ORGANIZATION'S NETWORK ARE THE FOCUS OF ITS NETWORK AUTOMATION STRATEGY?



Sample Size = 354, Valid Cases = 354, Total Mentions = 964

Build Versus Buy Network Automation

One major area of discussion in the network automation world is the concept of build versus buy. Network teams often perceive this as a choice, where they either buy a network automation tool from a vendor or they craft a do-it-yourself (DIY) solution with developers writing homegrown software and/or using open source software. Anecdotally, EMA has often observed DIY network automation strategies that use open source software as foundational components for internally developed network automation software platforms.

Based on past research, EMA believes that build versus buy is a false choice. In reality, IT organizations usually do both. This research confirmed this hypothesis. We found that more than nine out of 10 organizations build AND buy network automation.

DIY Network Automation

Nearly 94% of respondents have some kind of DIY network automation tool.

Figure 5 reveals that nearly 94% of respondents have some kind of DIY network automation tool. Nearly 64% developed software in house, possibly leveraging open source components. Also, 57% are using open source software that has no associated vendor support.

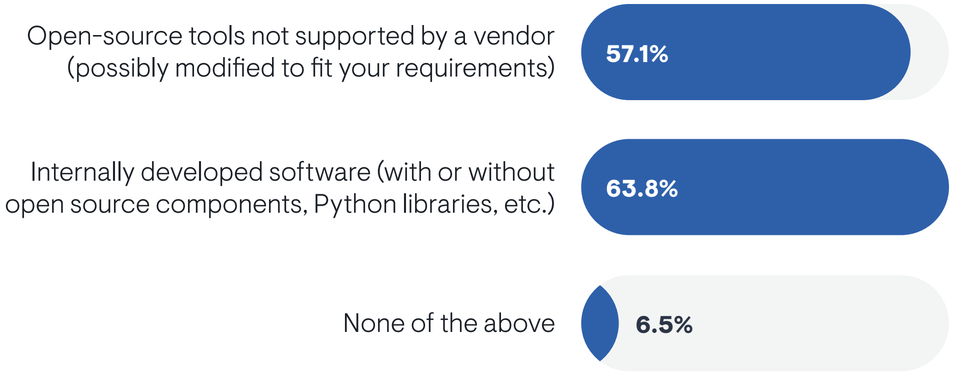
Cloud teams were more likely than IT tool engineering teams to report use of unsupported open source network automation. Open source was less common in very large enterprises (20,000 or more employees). Organizations that use unsupported open source tools were also more likely to use commercially supported open source. In other words, they use a mix of different open source tools, some of which have vendor support and some that don't. Meanwhile, organizations that use homegrown software are more likely to use proprietary network automation software, too. This suggests that organizations create homegrown software to close gaps in their proprietary solutions or vice versa.

"We started with some scripting," said a tool architect at a Fortune 500 media company. "Now, we're going into complex automation, and we're building internal, homegrown tooling with a UI that users can work with."

"We implement a lot of open source, like Ansible, Python, Go, Jenkins, Kibana, Elasticsearch," said a network engineer at a midmarket business services company. "I wouldn't call myself a software engineer. It's more about scripting, but sometimes a bit more advanced. I try to integrate Ansible playbooks into our CI/CD process. Fifty percent of my time is spent writing those scripts."

"We're at the point where we build our own tools," said a network automation engineer at a Fortune 500 manufacturer. "We rarely go off the shelf for anything. We even have multiple automation teams. Almost all of our in-house development uses open source."

FIGURE 5. WHICH OF THE FOLLOWING TYPES OF DIY NETWORK AUTOMATION TOOLS DOES YOUR ORGANIZATION USE?



Sample Size = 354

Drivers of DIY Network Automation

Figure 6 explores why organizations adopt or build DIY network automation tools. First, many believe that a DIY project allows them to build tools with functionality and capabilities that are better aligned with their networks. Many also report that their security and compliance requirements require a DIY approach. Security and compliance were more prevalent among very large enterprises (20,000 or more employees). Secondarily, one in three organizations see DIY as a way to save money. IT tool engineering and cloud teams were the most likely to cite cost savings.

“Some of the [commercial] tools we looked at buying are too damned expensive,” said a network engineer at a private gaming company. “The price is way more than the value when we compare it to writing the code ourselves. On other parts of our network there wasn’t anything that did what we wanted. So, we had to figure out how to glue things together.”

“I’m pro build-your-own because you get more flexibility,” said a network automation engineer at a $3 billion SaaS provider. “You also get a lot of savings out of it, and you build your skills up by building your own product, rather than buying something and trying to make it fit your needs, which can often require more effort.”

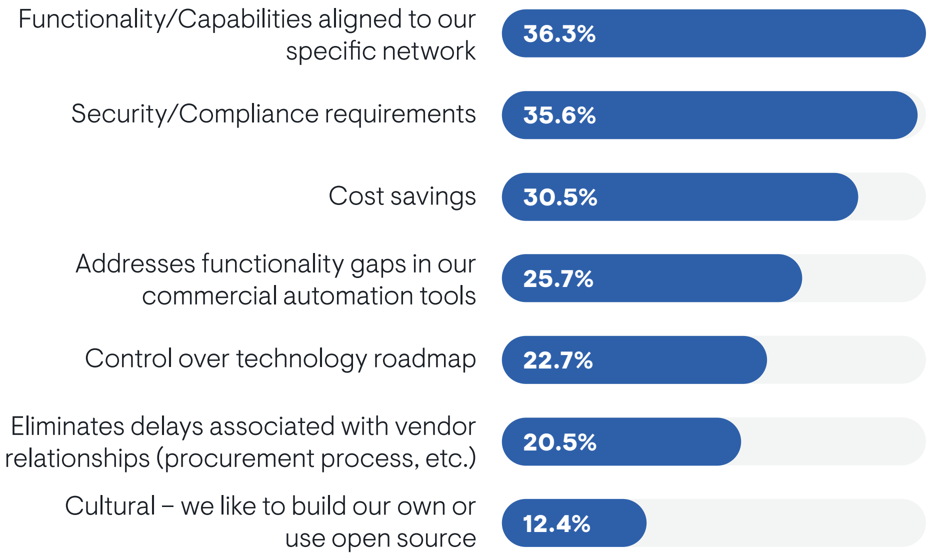
A network engineer at a midmarket business services company said cost savings isn’t what drives him to use DIY. It’s more about a lack of budget. “I request budget for network automation software, and I don’t get it. So, I use a lot of open source software.”

Control over technology roadmap is a minor driver, but networking personnel and IT project managers were more likely to cite it than IT middle managers. Cultural preferences for DIY were the biggest nonfactor, but network automation engineers and NetDevOps engineers named it a major driver. “We try to stay away from software vendors because we don’t want to get locked in,” said a network automation engineer at a large university. “Also, I don’t think a software vendor can come up with one orchestration tool that can fit everyone’s needs.”

“If you have enough people, going in the development direction makes sense because you can control everything,” said a tool architect at Fortune 500 media company. “But if you don’t have enough manpower, commercial tools make sense.”

“You can’t get all the features you want [from one vendor],” said a network automation engineer at a Fortune 500 manufacturer. “Usually, they do some subset of things. Vendors can’t do everything we need. Also, it’s about a level of customization. We can get exactly what we want when we need it.”

FIGURE 6. WHAT ARE THE PRIMARY REASONS WHY YOUR ORGANIZATION USES DIY TOOLS LIKE HOMEGROWN SOFTWARE OR UNSUPPORTED OPEN SOURCE TOOLS?



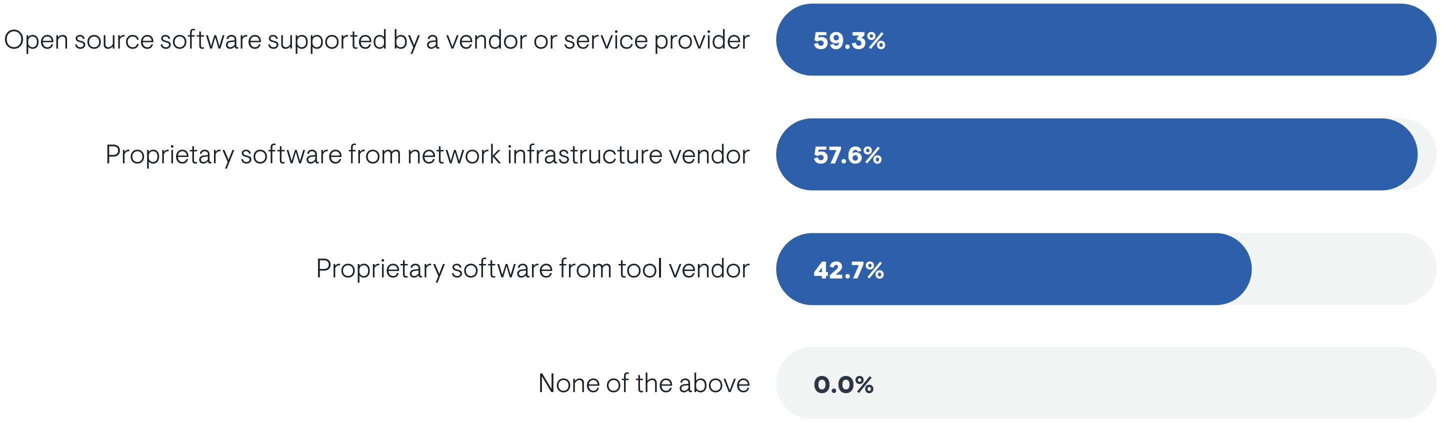
Sample Size = 354

Commercial Network Automation

Figure 7 reveals that 100% of research respondents are using some kind of vendor-supported network automation solution. More than 59% use an open source tool that a vendor (or managed service provider) supports. Nearly the same number use a proprietary network automation tool offered by a network infrastructure vendor. This might include an element management tool from a switching vendor or a controller from an SD-WAN vendor. Nearly 43% use a proprietary solution from a network automation tool vendor. EMA also observed an affinity between proprietary solutions from tool vendors and infrastructure vendors. If an organization was using one, they were likely to be using the other. Meanwhile, customers of vendor-supported open source solutions tended to avoid proprietary tools.

Respondents who use a proprietary solution from a tool vendor were more likely to report that their overall network automation strategy is successful rather than unsuccessful. EMA observed no statistically relevant relationship between success and failure and use of proprietary tools from an infrastructure vendor or vendor-supported open source tools.

FIGURE 7. WHICH OF THE FOLLOWING TYPES OF VENDOR-SUPPORTED NETWORK AUTOMATION TOOLS DOES YOUR ORGANIZATION USE?



Sample Size = 354

Drivers of Commercial Network Automation

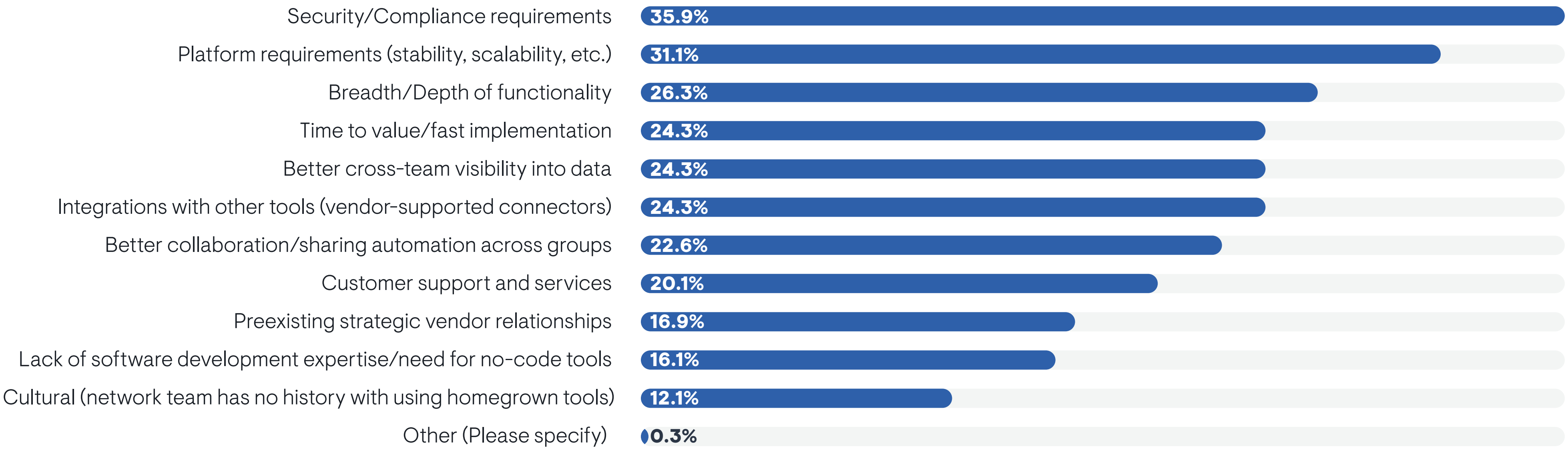
Figure 8 reveals why an organization might spend the money on commercial tools rather than stick with DIY tools. First, they have security and compliance requirements. Note, this is a top motivator for DIY, too. This suggests that network teams have complex network environments, where they trust commercial tools to fulfill certain requirements and they trust only DIY tools to fulfill others. The other driver is general platform requirements, where commercial tool vendors tend to outperform DIY tools, such as stability and scalability.

"There are some things you can't really build on your own, especially if it touches multiple groups and systems," said a network automation engineer at $3 billion SaaS provider. "IPAM solutions, for instance. We did a lot of research comparing and looking at what was available on the market. It's a company-wide tool that touches multiple teams and needs to be very customizable."

Successful organizations found platform requirements less compelling. Instead, they were more likely to select secondary drivers like breadth and depth of functionality and cultural preferences. Networking personnel were more likely to cite cultural preferences than IT middle managers. Breadth and depth of functionality is also a bigger driver for larger enterprises (20,000 or more employees).

Organizations that use proprietary network automation tools from a third-party tool vendor were more likely to cite better collaboration and sharing of automation across groups as a driver, while users of commercially supported open source tools were less likely.

FIGURE 8. WHICH OF THE FOLLOWING ARE THE MOST COMPELLING REASONS TO ADOPT COMMERCIAL NETWORK AUTOMATION SOLUTIONS, AS OPPOSED TO DIY NETWORK AUTOMATION?



Sample Size = 354

Weighing Vendor Solutions Against DIY Solutions

> *"We have a hybrid strategy," said a tool architect at a Fortune 500 media company. "We can buy some commercial tools where it makes sense. But we are also developing tools internally where we can't get the capabilities we need from vendors.*

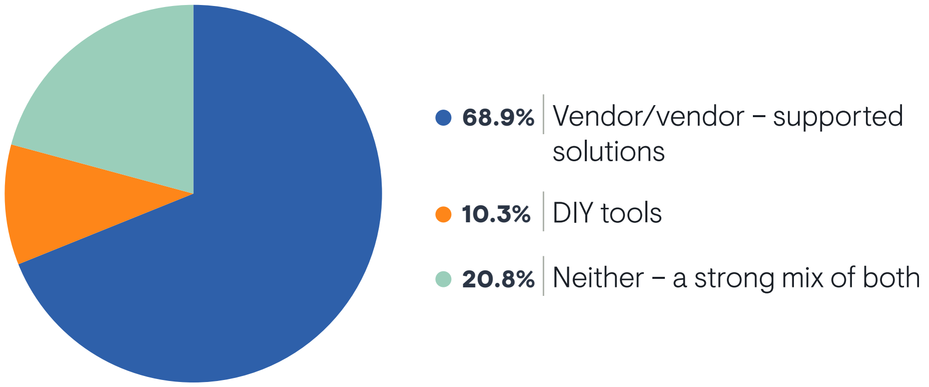
Of the 331 respondents who use both commercial and DIY network automation, 69% reported that commercial solutions, like proprietary tools and vendor-supported open source, dominate their overall network automation toolset, as **Figure 9** details. Only 10% are primarily a DIY shop. Another 21% said they use a roughly equal balance of both classes of tools.

"We have a hybrid strategy," said a tool architect at a Fortune 500 media company. "We can buy some commercial tools where it makes sense. But we are also developing tools internally where we can't get the capabilities we need from vendors. Commercial tools can meet about 80% of our needs."

"We are trying to figure out if we're going to use open source tools or buy a platform," a said network engineer at a Fortune 500 food and agriculture company. "I think the outcome will be to do open source. If you buy something, then you're accountable for the success of that investment. If it doesn't work, you're going to be blamed for the bad investment."

Members of network engineering and security teams were the most likely to report a commercial-centric approach to network automation. DevOps teams were split between commercial and DIY, but rarely reported a balance of using both. IT tool engineering teams were more likely than others to embrace a balance of both.

FIGURE 9. YOU INDICATED THAT YOU USE BOTH COMMERCIAL OR COMMERCIALLY SUPPORTED NETWORK AUTOMATION AND DIY NETWORK AUTOMATION. WHICH CLASS OF SOLUTION IS MORE PREVALENT IN YOUR OVERALL NETWORK AUTOMATION STRATEGY?



Sample Size = 331

Network Automation Solution Requirements

General Feature Requirements

Figure 10 reveals which network automation tool features are most important to organizations. Security policy management topped the list. The CIO's suite, network operations, security, and cloud teams all rated it high, but network engineering teams made it a low priority. Larger enterprises (20,000 or more employees) were more likely than midsized enterprises (1,000 to 4,999) to select it.

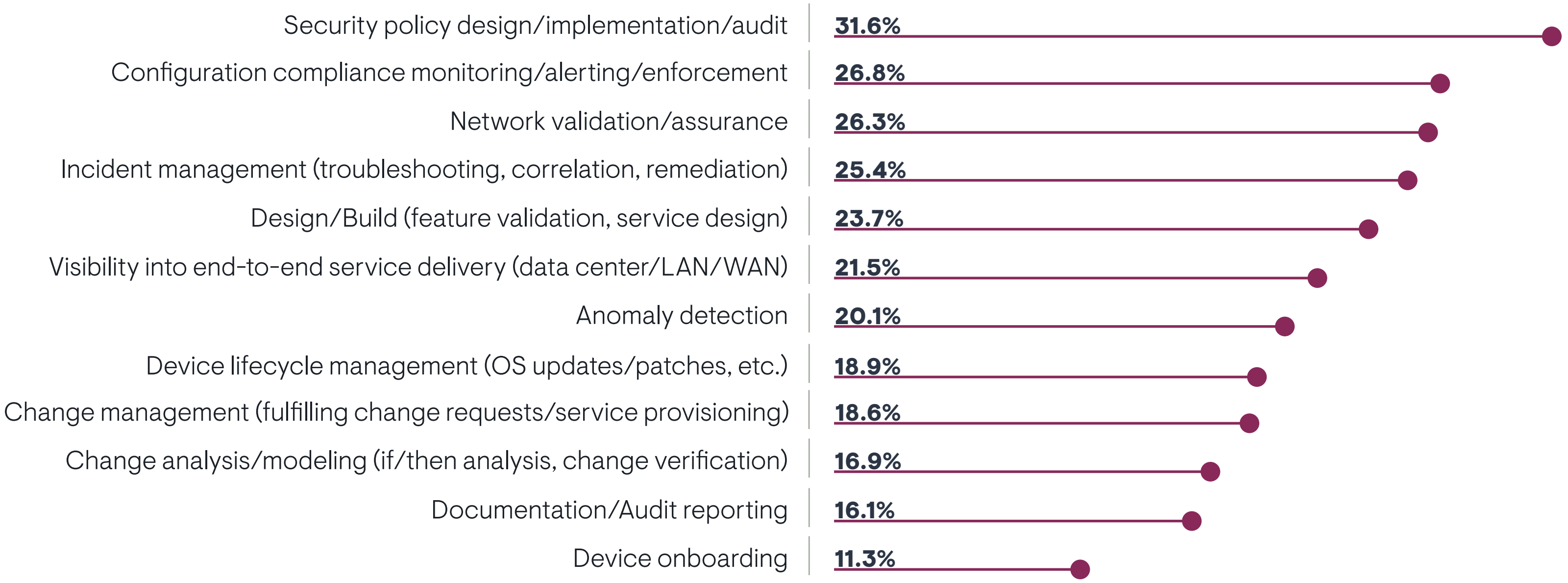
"One of the complex use cases we're looking at is firewall automation and updating firewall policies or adding rules," said a tool architect at a Fortune 500 media company. "These are very frequent requests, but it's very difficult. We get hundreds of tickets a month on firewalls. Our firewall vendors all have their own configuration management tools that are supposed to push those changes out, but when you're as big as us, you have multiple firewall vendors. We need to automate across them."

Secondarily, configuration compliance, network validation and assurance, incident management, and design/build features were very important. Configuration compliance was especially important to organizations that use proprietary network automation tools that a network infrastructure vendor supplied.

"We try to automate any kind of new network deployments. We have a bunch of security projects we are deploying to new locations. Being able to do that fast is important," said a network tools engineer at a Fortune 500 retailer.

Change analysis/modeling, documentation and auditing, and device onboarding were low priorities. Device onboarding was a high priority for midsized enterprises.

FIGURE 10. WHICH OF THE FOLLOWING NETWORK AUTOMATION FEATURES ARE MOST IMPORTANT TO YOUR ORGANIZATION?



Sample Size = 354

General Platform Requirements

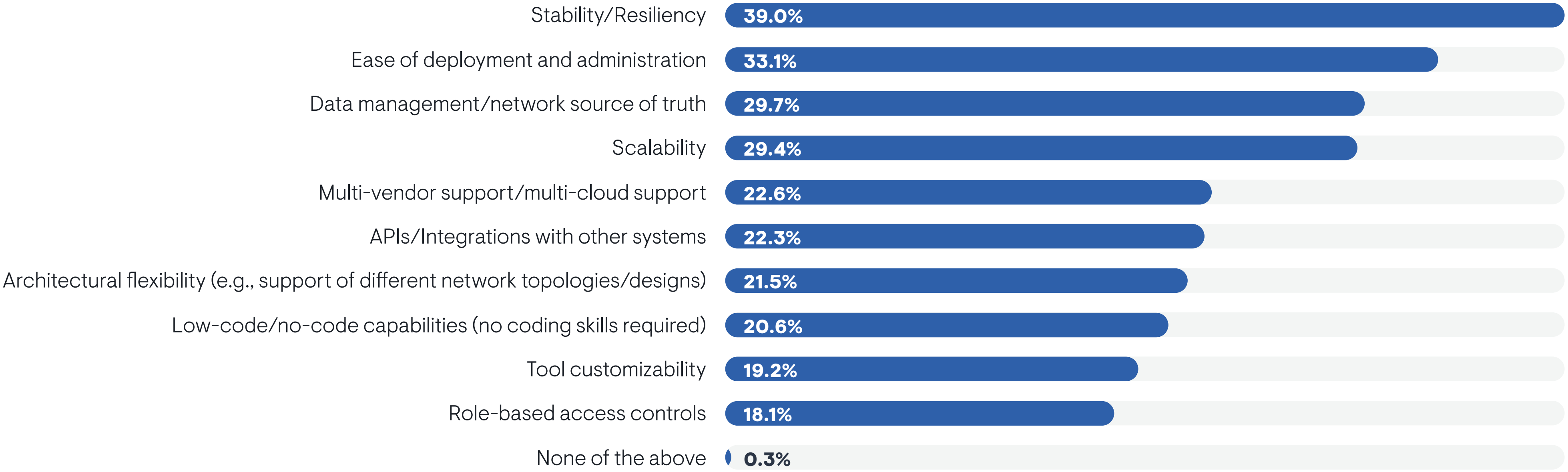
Figure 11 reveals the general platform requirements that enterprises set for their network automation tools. The chart clearly shows that four characteristics are priorities. First, organizations are looking for tools that are stable and resilient. Next, they want tools that are easy to deploy and administer. Finally, these tools must have strong data management capabilities and platform scalability.

Successful organizations were less likely to select stability and resiliency. DevOps and network engineering teams also made stability and resiliency a low priority, but security and IT tool engineering teams made it a high priority. Scalability was more important to organizations that avoid DIY tools.

Role-bases access control (RBAC) was the lowest priority, but networking staff (administrators, engineers, and architects) were more likely to select it than IT middle management.

Tool customizability was another low priority, but users of vendor-supported open source tools were more likely to demand this than customers of proprietary tools.

FIGURE 11. WHICH OF THE FOLLOWING PLATFORM CHARACTERISTICS OF A NETWORK AUTOMATION TOOL ARE MOST CRITICAL TO YOUR ORGANIZATION?



No-Code, Low-Code, High-Code?

Network engineers rarely describe themselves as software developers, but they tend to have some coding skills, given that so many of them have spent years leaning on scripts to implement ad hoc network automation. Unfortunately, many IT organizations struggle to hire expert network engineers with such skills.

“We want to enable self-service capabilities for normal network engineers who don’t have a lot of scripting skills. They work in the UI,” said a tool architect at a Fortune 500 media company.

Thus, network automation teams must think about the scripting and coding abilities of automation users when implementing solutions. Many network automation tools, both DIY and commercial, often require some coding skills of their users. **Figure 12** reveals how organizations are navigating this issue. Only 6% are aiming for “no-code” tools. More than 35% target “high-code” tools, where users must have strong coding skills. Most follow a middle path, a “low-code” tool, where users need some coding skills but are not expected to be experts.

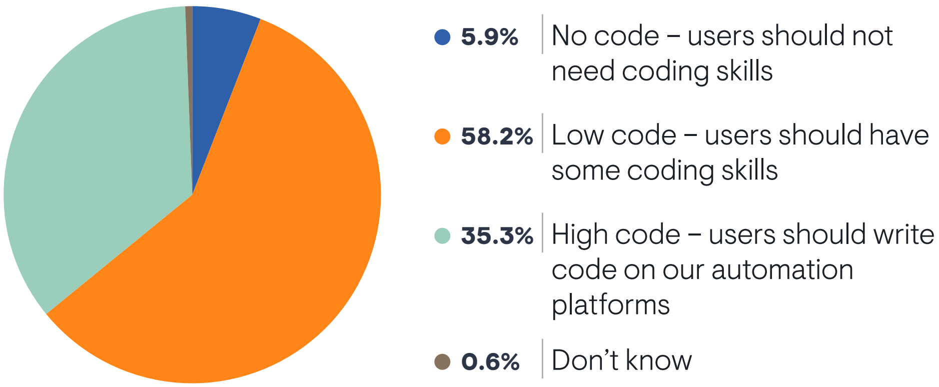
Network operations teams preferred low-code tools while network engineering and security teams preferred high-code tools.

Network operations teams preferred low-code tools while network engineering and security teams preferred high-code tools. Smaller companies targeted low-code and larger companies targeted high-code. NetDevOps engineers and network automation engineers, who tend to be coding ninjas, were more likely to report a high-code strategy.

“I’m building a low-code environment for our network engineers to get started with automation,” said a network automation engineer at a medical school and hospital network. “Presently, I’m doing automation by using Python scripting and open source Ansible, but we’re going to adopt a platform.”

“We have a team with different levels of understanding of networking,” said a network engineer at a Fortune 500 food and agriculture company. “Some want to work within a system, but others want to go deep and do custom automation. We want to be able to work within a platform at different levels because there are some guys who are low-code/no-code, but sometimes, we have people who want to do the code.”

FIGURE 12. WHAT ARE YOUR ORGANIZATION’S GOALS IN TERMS OF THE MINIMUM AMOUNT OF CODING SKILLS NETWORKING PERSONNEL NEED TO HAVE WHEN USING YOUR ORGANIZATION’S NETWORK AUTOMATION TOOLS?

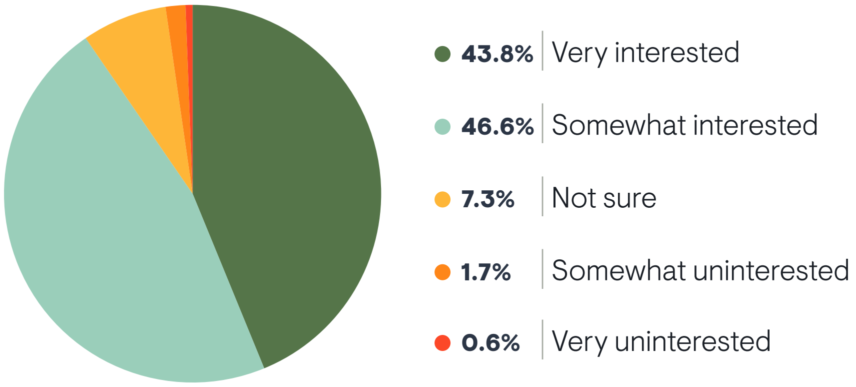


Sample Size = 354

Intelligent Automation with AI and Machine Learning

Artificial intelligence and machine learning (AI/ML) are everywhere today. Most IT vendors are building and training AI/ML algorithms to make their solutions more effective and useful. Network automation is no exception. **Figure 13** reveals that 98% of organizations have at least some interest in adopting network automation products that leverage AI/ML technology. Organizations that are the most successful with network automation are the most interested in AI/ML.

FIGURE 13. ARE YOU INTERESTED IN INCORPORATING SOLUTIONS THAT LEVERAGE AI/ML TECHNOLOGY INTO YOUR NETWORK AUTOMATION STRATEGY?



IT executives, IT middle managers, and networking professionals (administrators, engineers, architects) are the most likely to covet AI/ML features. IT project managers, NetDevOps engineers, and network automation engineers are the least interested. From an IT silo perspective, the CIO's suite, cloud engineering/operations, and security are the most interested in AI/ML. DevOps and network engineering are least interested. Midsized enterprises (1,000 to 4,999 employees) were more interested than very large enterprises (20,000 or more).

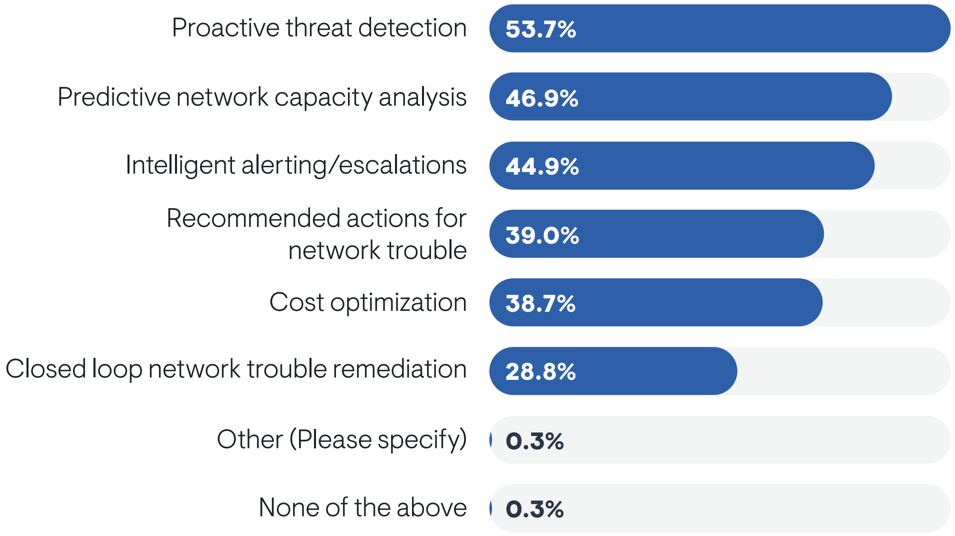
Sample Size = 354

Using AI/ML-Driven Network Automation

Figure 14 reveals how organizations want to use AI/ML capabilities in their network automation tools. The biggest focus is on security with proactive threat detection. Organizations want network automation tools that are capable of recognizing threats on the network and adjusting accordingly. Many are also interested in predictive capacity analysis and intelligent alerting and escalations. Predictive capacity analysis is especially interesting to very large enterprises (20,000 or more employees).

Recommended actions for network trouble, cost optimization, and closed loop network trouble remediation are lower priorities. Cloud and network operations teams were more interested in cost optimization.

FIGURE 14. WHICH OUTCOMES FOR AI/ML-DRIVEN NETWORK AUTOMATION ARE YOU MOST INTERESTED IN ADOPTING?



Continuous Network Compliance Monitoring

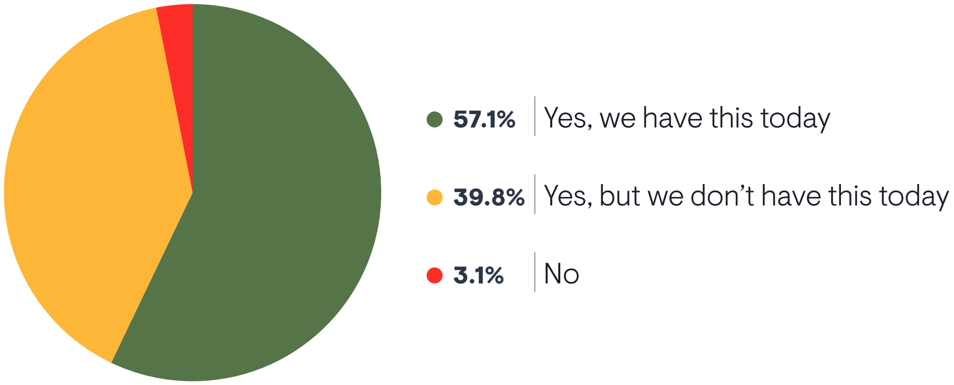
Network compliance is a key component of a network automation strategy. Network change is constant, and network automation only accelerates the rate of change. Network teams need ways to ensure that network standards are complied with, whether those are configuration and design standards or security standards. **Figure 15** reveals how many organizations are actually monitoring network compliance. Well over half are doing it today, and nearly 40% have plans to adopt this in the future. Successful organizations are more likely to do this today. Organizations that use proprietary network automation tools from a network tool vendor or homegrown, internally-developed software are the most likely to do this today. Organizations with an effective network source of truth are also more likely to continuously monitor network compliance. Fully funded network automation budgets also correlate with using this today.

> *"We are constantly doing validations between intended state and running state to make sure they are in sync. If it goes off, we generate a config drift alert to address it," said a network automation engineer at a $3 billion SaaS provider.*

"We are constantly doing validations between intended state and running state to make sure they are in sync. If it goes off, we generate a config drift alert to address it," said a network automation engineer at a $3 billion SaaS provider.

Network automation strategies that are launched in response to a security incident are more likely to be doing continuous network compliance monitoring today. Network engineering and cloud teams perceive continuous monitoring more often than the CIO's suite, IT tool engineering, and IT architecture groups.

FIGURE 15. ARE YOU CONSIDERING A TOOL THAT CAN CONTINUOUSLY ASSESS NETWORK COMPLIANCE (E.G., CONFIG COMPLIANCE, SECURITY POLICY COMPLIANCE, ETC.)?



Spotlight on Network Source of Truth

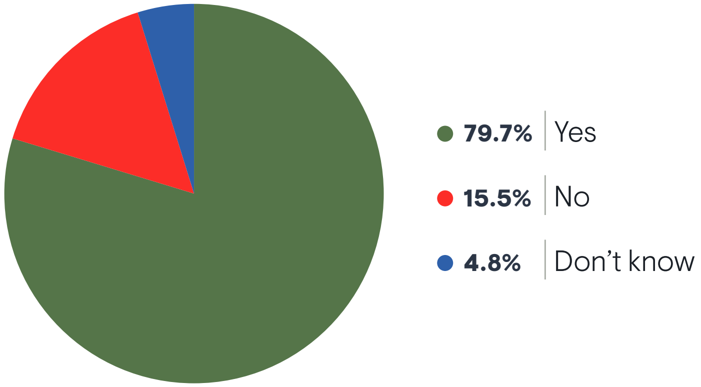
This section explores an essential component of network automation toolsets. A network source of truth is a repository of critical data about a network. A network source of truth ensures that all network management tools (including network automation tools) have the same information about the intended state of a network and the actual state of a network. When an IT professional uses a network automation tool, they gather data from a source of truth to ensure that a network change will comply with design standards, configuration standards, security polices, IP address space, and much more. It will supply inventory data so that users know which devices they need to reconfigure, where they are, and whether the current software versions on those devices can accept a proposed change. In other words, a network source of truth should provide all the data and information a user could possibly need to make automated changes without breaking the network.

"I would say the source of truth is the production network," said a network automation engineer at a Fortune 500 manufacturer. "But I think you need to be able to model intent and then match it to state.

"I would say the source of truth is the production network," said a network automation engineer at a Fortune 500 manufacturer. "But I think you need to be able to model intent and then match it to state. You have to have a very well-engineered solution to be able to say that [our intent repository] is correct 100% of the time. If you can just make your network super, super discoverable, then it's almost self-documenting."

Figure 16 reveals that nearly 80% of research participants believed that they have a network source of truth today. Network automation success correlates with having a source of truth. Network engineering, DevOps, and cloud teams were more likely to perceive a source of truth than the CIO suite and IT architecture and IT tool engineering teams. North Americans were much more likely to have one than Europeans.

FIGURE 16. DO YOU BELIEVE YOUR ORGANIZATION HAS A NETWORK SOURCE OF TRUTH?



"That's been a source of debate for a while," said a network automation engineer at a large university. "Our network architect wants a source of truth, but what is a source of truth? In our minds, it's what is currently on the devices. If the network is set up the way it should be, the source of truth should be the network itself. We're still working on the best way to rectify this problem."

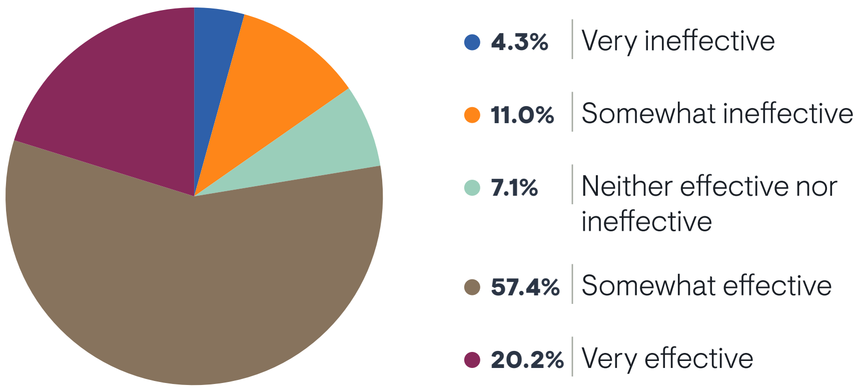
Users of proprietary network automation software from a tool vendor were more likely to have a source of truth today. However, users of DIY tools, including unsupported open source and homegrown tools, also reported high rates of source of truth adoption.

Effectiveness of Sources of Truth

Organizations that had an effective source of truth reported more success with their network automation strategies.

Among the 282 research participants who believed that they had a network source of truth, only 20% described this source of truth as very effective, as seen in **Figure 17**. Most respondents felt these repositories were only somewhat effective, suggesting that they saw room for improvement. More than 15% describe their solutions as somewhat or very ineffective. Organizations that have fully implemented their network automation strategy were more likely to believe their source of truth was effective. Users of proprietary network automation software from a tool vendor also tended to report effective sources of truth. Unsurprisingly, organizations that had an effective source of truth reported more success with their network automation strategies.

FIGURE 17. HOW EFFECTIVE IS YOUR ORGANIZATION'S NETWORK SOURCE OF TRUTH?



Sample Size = 282

"We're not 100% satisfied," said a network automation engineer at a $3 billion SaaS provider. "It was a quick and dirty solution to get something out the door. We're planning to revise it. It takes too long to pull data from it, especially in our larger sites."

"I'm pretty satisfied with it," said a network tools engineer at a Fortune 500 retailer who uses multiple vendor-supported open source tools for his source of truth. "We considered ServiceNow, but it wasn't maintained by the network team. It's maintained by different groups that are not focused on data governance of the network. We lacked full control of it."

"There is no perfect tool for a source of truth," said a network automation engineer at a medical school and hospital network. "There is always something we'd like added to it. But it's okay. I'd like easier reporting from it. It's not a click and run tool. You have to know how to run queries and how to use Python."

Organizations with a good source of truth reported that a higher percentage of network management tasks were automated. They also reported that they were more consistent with running pre-change and post-change validation when using network automation tools. These validations also tended to focus on configuration and design compliance. Organizations with an ineffective source of truth tended to report that their network automation tools suffered from slower returns on investment or time to value.

"We're not happy with our source of truth right now," said a network engineer at private gaming company. "There are various pieces to it. Historically, we did not always have a source of truth. Some of it is discoverable, but people do not always keep things up to date and it's difficult to do that discovery. It's an issue that goes across tooling, people, and processes."

EMA observed the following tendencies among organizations with an effective source of truth:

- Fully funded network automation budgets
- Reported that it is easier to understand the difference between network intent and network state
- Gathering data before making an automated network change is more automated
- Automation tools focus on large office LANs and data center networks
- Strong multi-vendor support
- Automation toolset integrations with
    - IT service management
    - Security monitoring
    - DevOps automation/orchestration
- Strong automation tool support for
    - Maintaining intent repositories
    - Discovery and reporting on network state
    - Discovering and reporting on differences between network intent and network state
- Sources of truth contain security policies

Organizations that have an effective source of truth emphasized the importance of a data reconciliation feature.

Critical Features of a Source of Truth

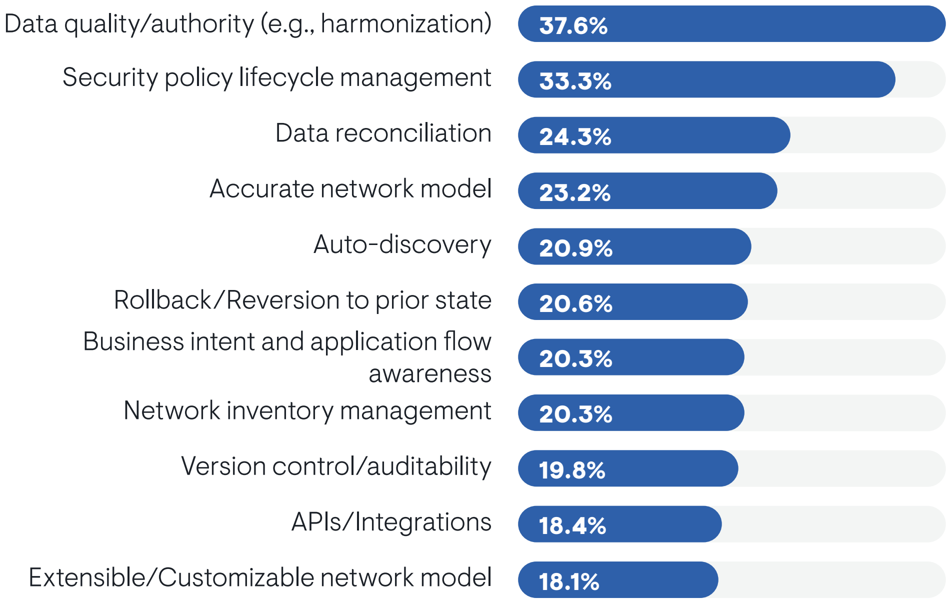
Figure 18 identifies what IT organizations are looking for in a network source of truth. The two primary requirements are data quality and security policy lifecycle management. Secondarily, organizations want data reconciliation and an accurate data model.

Organizations that have an effective source of truth emphasized the importance of a data reconciliation feature.

“A network source of truth can be expanded [beyond device management] to alerting concepts,” said a tools architect with a Fortune 500 media company. “You can expand it to configuration alerts, performance alerts, fault alerts. So, we have an event management tool that provides that source of truth.”

Among tertiary priorities, version control was a higher priority to larger companies. Version control was also important to organizations that concentrate on vendor solutions rather than DIY network automation. Organizations with ineffective solutions singled out business intent and application flow awareness as important features. Cloud and security teams emphasized the importance of APIs and integrations.

FIGURE 18. WHAT ARE THE MOST IMPORTANT FEATURES TO HAVE IN A NETWORK SOURCE OF TRUTH?



Sample Size = 354

Achieving a Source of Truth

EMA asked all respondents, regardless of whether they reported having a source of truth, to tell us where they store all the information that might be found in one. **Figure 19** reveals that it's rare for an organization to have a single platform that holds all this data. Instead, most of them have federated multiple systems of record, either through direct integration or integration into a central platform. In other words, they have multiple sources of truth, but those systems are sharing and reconciling data to maintain an authoritative view of the network. Network automation engineers and NetDevOps engineers were more likely to perceive this federated source of truth. Among IT groups, this approach was also reported more often by network engineering, DevOps, and cloud teams.

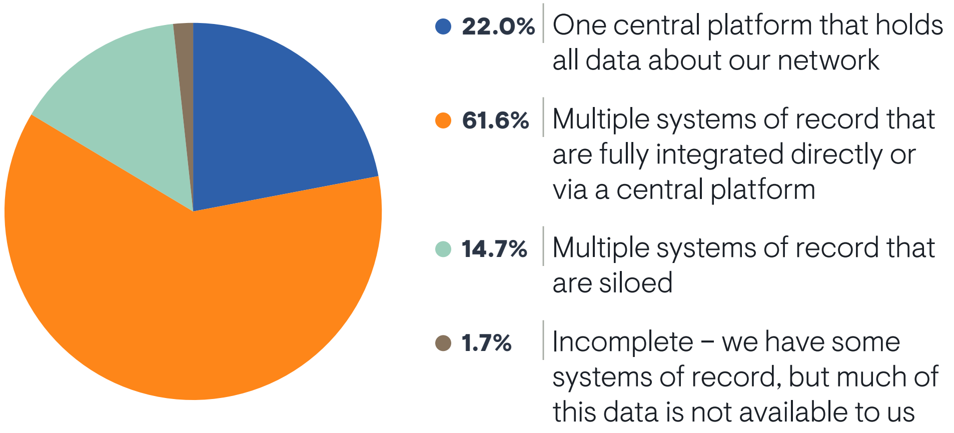
"No matter how hard you try, you're not going to have one tool that has all this information," said a tool architect at a Fortune 500 media company. "You have to get good at aggregating and integrating things from multiple places.

"No matter how hard you try, you're not going to have one tool that has all this information," said a tool architect at a Fortune 500 media company. "You have to get good at aggregating and integrating things from multiple places. For automating devices, we have to pull data from ten different places. We don't stop at devices. We have a source of truth for sites, so we have a data feed from our SD-WAN solution."

Organizations that have one centralized platform reported that their sources of truth were more effective. Organizations that relied on multiple, siloed systems of record reported a poor source of truth. Europeans were also more likely to have siloed systems. Organizations that write their own network automation software were also more likely to report using a federated source of truth.

Organizations with siloed systems of record told EMA that their network automation toolsets had weak support for network intent repositories and reporting on configuration drift. Organizations that used one central platform had strong support for reporting configuration drift and provisioning and deploying network changes. Teams that used a federated source of truth reported strong support of intent repositories.

FIGURE 19. HOW WOULD YOU DESCRIBE YOUR ORGANIZATION'S CURRENT APPROACH TO COLLECTING, STORING, AND MAINTAINING ALL THE INFORMATION THAT MIGHT BE CONTAINED IN A NETWORK SOURCE OF TRUTH?



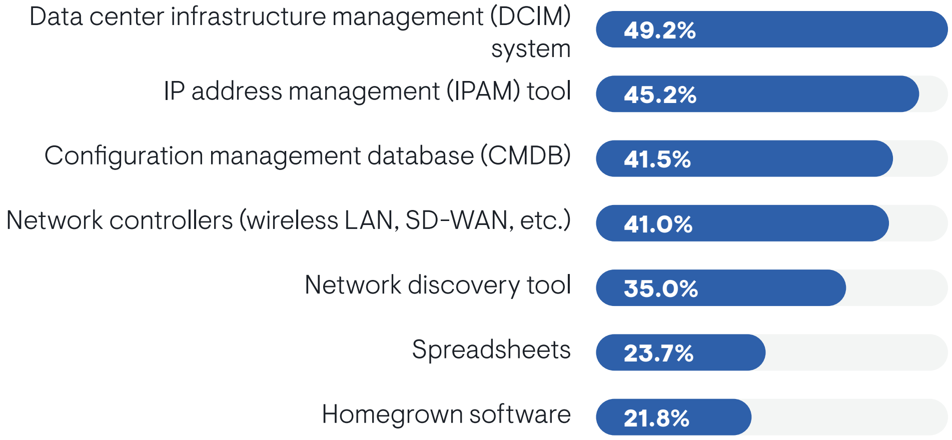
Sample Size = 354

Where Do You Find the Truth?

Given that so many organizations maintain a federated network source of truth, it's important to understand which systems of record might be involved. **Figure 20** reveals which repositories respondents have that contain data that is important to a source of truth. It reveals that data center infrastructure management (DCIM) tops the list. DCIM tools typically maintain device inventory data. Some also maintain IP address space information and configuration data.

Secondarily, IP address management (IPAM), configuration management databases (CMDB), and network controllers (like wireless LAN controllers or SD-WAN controllers) are important. Successful network automation projects were more likely to involve CMDB. Organizations that avoid DIY network automation also cited CMDB as more prominent. IPAM was more common in North America, while homegrown software was more common in Europe.

FIGURE 20. WHICH OF THE FOLLOWING TOOLS AND SOLUTIONS DOES YOUR ORGANIZATION CURRENTLY USE TO COLLECT AND STORE DATA THAT WOULD BE CONTAINED IN A NETWORK SOURCE OF TRUTH?



Sample Size = 354

Spotlight on Network Validation

> *"The most challenging thing about network automation is testing to make sure that whatever you are doing will work," said a network automation engineer at a medical school and hospital network.*

In this section, we explore a critical and sometimes underrated stage of network automation. Network validation is the process of understanding how changes made through automation might impact the state of the network. Network validation should be performed before a change is made to ensure that the proposed change is good, but it should also be performed after the change is made to ensure the change was successful and had the expected outcome.

"The most challenging thing about network automation is testing to make sure that whatever you are doing will work," said a network automation engineer at a medical school and hospital network. "Network automation is powerful, but it is also dangerous. You can make a change that can bring down the whole network."

Pre-Change Validation

Figure 21 reveals how network automation strategies are currently accounting for pre-change network validation. First, at least 98% are doing at least some form of pre-change validation. Most are using network modeling software or digital twin software to simulate their networks, and they are relying on text analysis and manual processes to validate change. A smaller number are emulating a network using a virtual or physical lab or testbed. Successful network automation strategies are more likely to leverage network modeling or digital twin technology for pre-change validation.

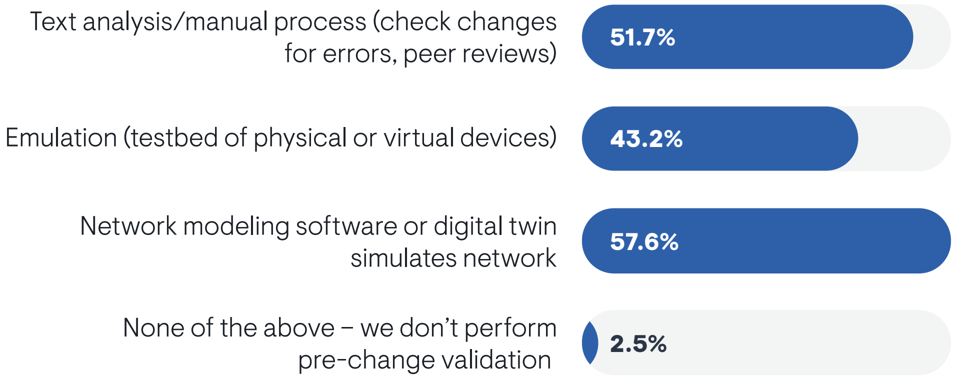
"Some of our tooling is able to look at the entire network and create a digital twin, so we look at how traffic is supposed to flow from point A to point B," said a tool architect at Fortune 500 media company. "But we're a bit early on this."

Network automation engineers and NetDevOps engineers perceived more use of network modeling and digital twin software than network administrators, network engineers, or network architects. Text analysis was more commonly used by organizations that write their own homegrown network automation software.

"We have a virtual lab environment of our network. We have replicated most of our network in it, but not at the scale that we have in production," said a network tools engineer at a Fortune 500 retailer. "The team tests it in the lab first. Once everything is confirmed and running for a couple weeks, we decide it's good to go. We then push it out as the new standard."

"We have some containers we run in a lab environment to check changes, and also some custom scripts," said a network engineer at a midmarket business services company. "It's not a full topology of our network, just a reference model. We don't have the resources to simulate our production environment."

FIGURE 21. WHAT IS YOUR ORGANIZATION'S TYPICAL PROCESS FOR PRE-CHANGE VALIDATION (EVALUATING HOW A PROPOSED CHANGE MADE VIA NETWORK AUTOMATION MIGHT IMPACT THE STATE OF A NETWORK)?



Sample Size = 354

Post-Change Validation

Once a change is implemented, there are more ways to perform a post-change validation, partly because the change now impacts the production network. A monitoring tool will detect many problems that occur because of a bad change. Of course, one might not want to rely on such a reactive approach to post-change validation, because it takes time for network engineers to connect the dots between a monitoring alert and a bad change.

Figure 22 reveals that as with pre-change validation, network modeling and digital twin software are the most popular approaches to post-change validation. Again, successful network automation strategies are more likely to use these tools. Also, they are perceived more by network operations, security, and cloud teams, and they are perceived less by IT tool engineering and IT architecture groups.

“This was a challenge in my last role,” said a network automation engineer at a Fortune 500 manufacturer. “If I had continued at that company, I would have put a lot of focus on trying to model the network. Validation is really tricky. It gets cumbersome to be able to say without any doubt that the intended change had the effect that I intended. Part of the problem is that the network vendors don’t provide good APIs.”

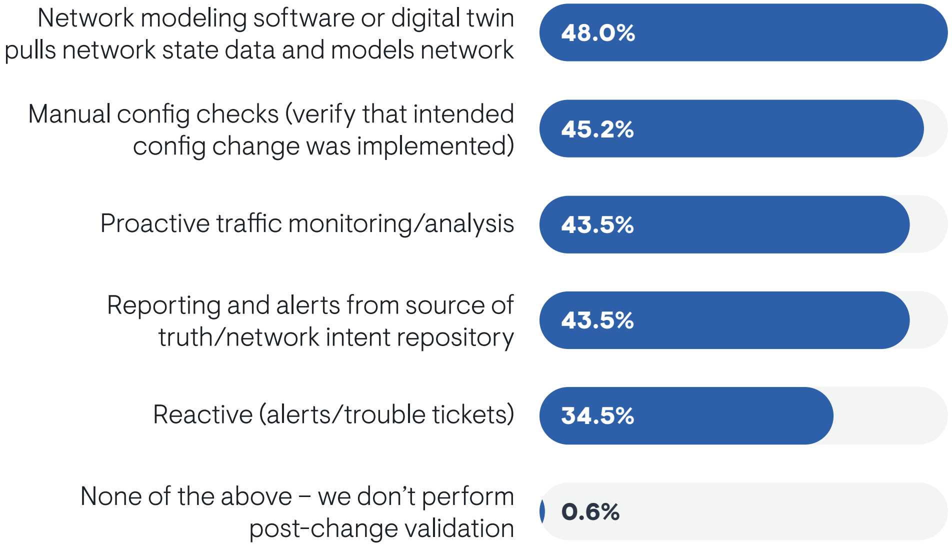
Many organizations also rely on manual configuration checks, proactive traffic monitoring and analysis, and alerts from a network source of truth. Source of truth alerts are more popular among very large enterprises (20,000 or more employees). It’s also more common among organizations that are using vendor-supported open source tools, rather than those that use proprietary software that a network infrastructure vendor offers.

The least popular approach is the reactive strategy of waiting for alerts from tools and trouble tickets. EMA would like to see the number of organizations that rely upon this method to shrink over time.

“We will get alerts from our monitoring system that something is wrong,” said a network automation engineer at a medical school and hospital network. “If it was not successful, we have to roll back the change and document what went wrong and analyze why it didn’t work.”

“Right now, we do show-version at the beginning and end of a change and hopefully the end state is what your target was,” said a network engineer at a Fortune 500 food and agriculture company. “We’re trying to bake things in, like what ports are up on devices, then look at it when you reload the device post-upgrade to answer the question, ‘Is the same set of interfaces up?’ But integrating that into our processes is so complex.”

FIGURE 22. WHAT IS YOUR ORGANIZATION’S TYPICAL PROCESS FOR POST-CHANGE VALIDATION (EVALUATING HOW A CHANGE MADE VIA NETWORK AUTOMATION IS IMPACTING THE STATE OF A NETWORK)?



Sample Size = 354

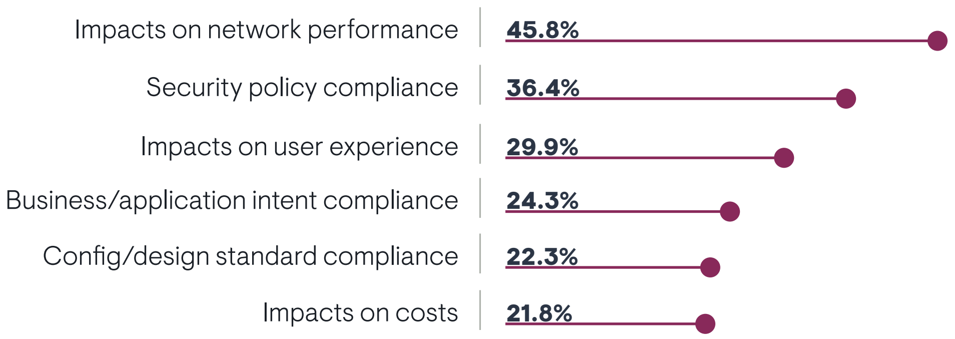
What is Validated?

There are multiple ways that a network change can impact a network. IT organizations will vary in what they want to validate when they perform pre- and post-change checks. **Figure 23** reveals that most network teams are focused on understanding overall network performance. Successful organizations are less likely to validate impacts on network performance. The second priority is understanding compliance with security policy, especially among IT executives and middle management.

Nearly 30% try to get a more abstract understanding than just network performance by trying to understand impacts on user experience.

The lowest priorities are business or application intent compliance, configuration or design standard compliance, and impacts on costs.

FIGURE 23. WHEN PERFORMING PRE- AND POST-CHANGE VALIDATION, WHAT IS YOUR NETWORK TEAM PRIMARILY TRYING TO VERIFY?



Sample Size = 354

Comparing Network Intent and State

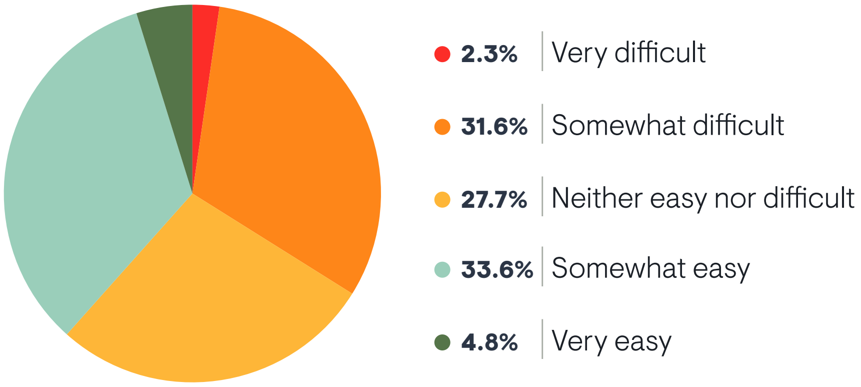
Less than 5% of organizations believe it is very easy to compare and understand the difference between intent and state.

The key question to answer when performing pre- and post-change network validation is whether network intent and network state are in synch. It is not a trivial question to answer. **Figure 24** reveals that less than 5% of organizations believe it is very easy to compare and understand the difference between intent and state. Nearly 34% report actual difficulty, while nearly another 34% believe it is only somewhat easy, meaning they see room for improvement. Organizations that have successful network automation strategies are more likely to have an easy time with this issue. Network engineering teams reported an easier time with comparing differences than most other groups, especially more so than DevOps, cloud, and IT tool engineering teams.

EMA found that differences between network intent and state are easier to find when organizations have the following:

- Larger network automation toolsets, possibly because that toolset includes a dedicated solution for reporting these differences
- Network modeling or digital twin software for network validation
- High-code network automation tool strategies
- Fully funded network automation budgets
- An effective network source of truth
- Tools that perform continuous configuration compliance monitoring

FIGURE 24. HOW EASY OR DIFFICULT IS IT FOR YOU TO COMPARE, VISUALIZE, AND UNDERSTAND ANY DIFFERENCES BETWEEN BASELINE NETWORK INTENT AND CURRENT NETWORK STATE?



Sample Size = 354

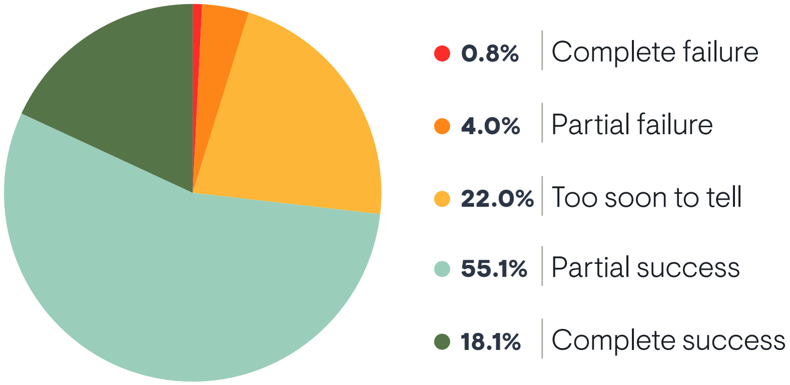
Project Outcomes

Project Success

Only 18% of research participants believe that their network automation strategy is a complete success. Another 55% described their efforts as a partial success. Only 5% admitted to failure, as **Figure 25** shows. North Americans were more confident than Europeans, and larger companies claimed to be doing better than smaller ones.

IT executives, middle managers, and networking personnel (administrators, engineers, and architects) were all more optimistic than project managers, network automation engineers, and NetDevOps engineers. In other words, the people who build network automation tools are feeling the most pessimistic. This conclusion is further solidified by the fact that members of IT tool engineering teams were pessimistic or uncertain about success.

FIGURE 25. HOW WOULD YOU RATE YOUR ORGANIZATION'S OVERALL NETWORK AUTOMATION STRATEGY TO THIS POINT?



Benefits of Network Automation Investments

Figure 26 identifies the benefits that IT organizations experience when they invest in and use network automation tools. There are two major opportunities: operational efficiency and reduced security risk. In other words, network automation boosts network team productivity and eliminates errors that might lead to security events.

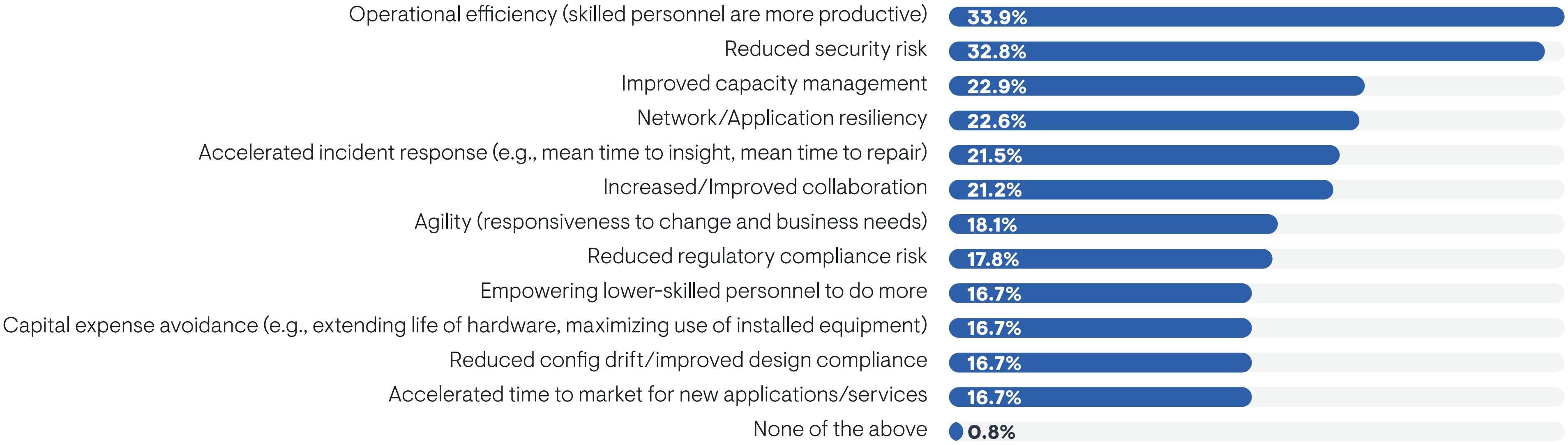
“We often provide our vice presidents with metrics in terms of estimates of how many man hours we spend today doing it manually versus how many hours we can potentially save by having an automated workflow,” said a tools architect with a Fortune 500 media company. “If I’m spending 100 hours a month on firewall changes, I can show them that I can reduce it by half with automation. That’s how I demonstrate value.”

“Automation takes human error out of the network. We’ve decreased outages by a significant amount,” said a network automation engineer at a large university. “When people hit a button to automate something, we have scripts running so many checks before a change is done. Also, we’ve empowered technicians who lack the skillsets to make changes and write configs. Field teams can be made up of people with lower skillsets, who can go out and hit a button to troubleshoot things.”

Secondarily, organizations told EMA that they improved capacity management, improved the resiliency of networks and applications, accelerated incident management processes, and boosted collaboration. Resiliency and operational efficiency were more common benefits for users of proprietary network automation software. Network operations teams were more likely to perceive reduced configuration drift, increased collaboration, and improved capacity management.

“I want to find ways to work together and see what’s going on and get more collaboration out there,” said a network engineer at a Fortune 500 food and agriculture company.

FIGURE 26. WHAT ARE THE MOST VALUABLE BENEFITS THAT YOUR ORGANIZATION HAS EXPERIENCED FROM ITS INVESTMENTS IN NETWORK AUTOMATION?



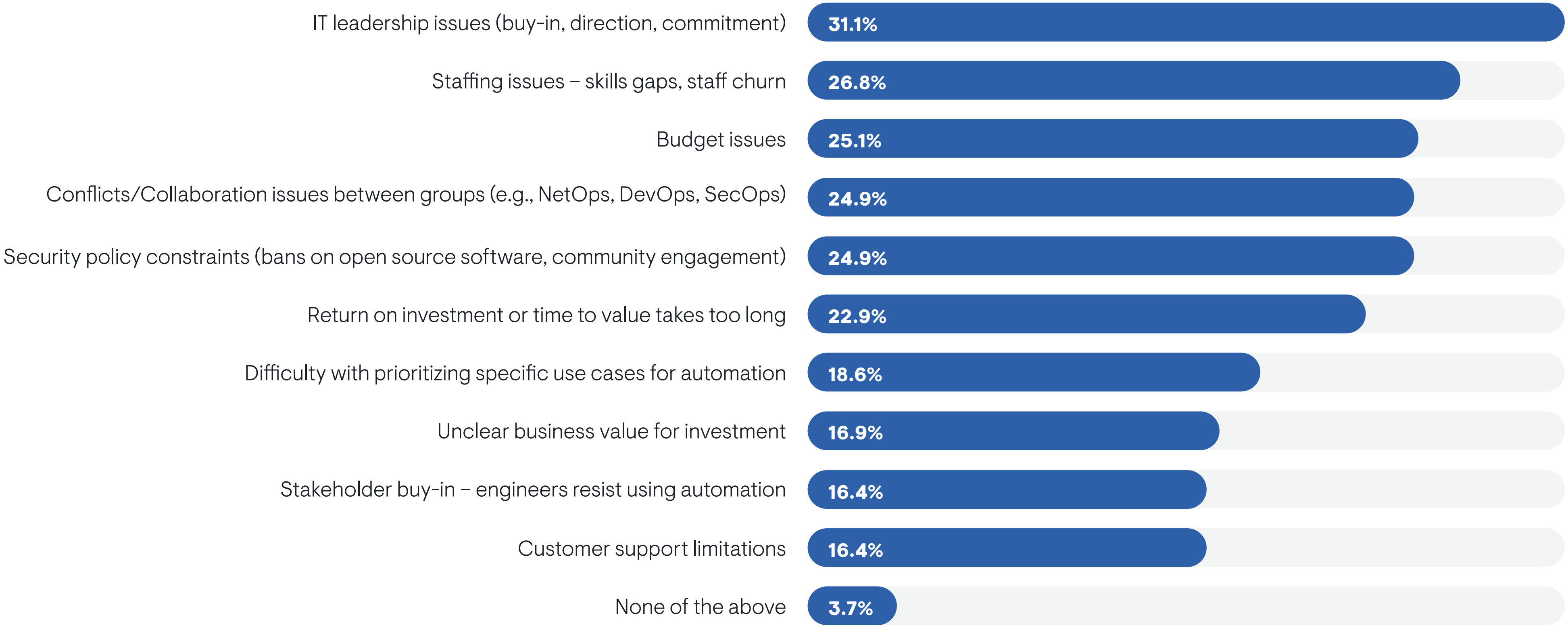
Sample Size = 354

Business Challenges

Figure 27 reveals the business challenges that IT organizations struggle against when trying to implement a network automation strategy. IT leadership topped the list. Executives aren't aligned with the people trying to execute on automation, or they're failing to set an agenda for technology strategy and adoption.

Staffing issues are the chief secondary problem. Both midsized (1,000 to 4,999 employees) and very large enterprises (20,000 or more) struggled with this issue, while all other companies were less likely to have a budget problem.

FIGURE 27. WHICH OF THE FOLLOWING BUSINESS ISSUES ARE MOST CHALLENGING TO YOUR NETWORK AUTOMATION STRATEGY?



Sample Size = 354

"It's hard to convince a developer to work with networking because they don't understand it or want to work with it," said a tools architect with a Fortune 500 media company.

"Even though we have expanded to a six-person team, the amount of automation that's required is overwhelming," said a tools architect with a Fortune 500 media company. "We need more scripts and developers. It's easy to find people who can automate and to find people who are network engineers. But it's hard to find people who understand both of these worlds very well. It's hard to convince a developer to work with networking because they don't understand it or want to work with it."

"The most challenging thing for me is the lack of network engineers who can contribute to automation," said a network engineer at a midmarket business services company. "The community is small, and it's hard to find people who can help you solve a problem."

"One big thing is training, because the cognitive lift for the team is going to be a huge thing," said a network engineer at a Fortune 500 food and agriculture company.

"You have to have wide and deep knowledge," said a network automation engineer at a Fortune 500 manufacturer. "That's the biggest barrier to entry. It's become clear to me now that I'm a software engineer with a network engineering background. I can't know everything about BGP anymore. It all changes so fast. There's lots of learning to do."

Budget, conflicts, and collaboration issues between groups, security policy constraints, and slow returns on investment are also prominent problems. Successful organizations were less likely to complain about budget or slow returns on investment. Very large enterprises were also more likely to run into budget shortfalls. Organizations that use internally developed software perceived slow returns on investment as a bigger issue.

"One thing that needs to improve is collaboration," said a network automation engineer at a medical school and hospital network. "Departments work in silos. Sometimes you might have a challenging use case that you are trying to figure out, but you might not realize that someone else is already doing it. They've figured out a way to solve it."

"It's not easy to automate a task, because you don't know all the variables that might be affected by it," said an NOC analyst at a very large media company. "It's not just the data, but also authorization by a change review board. Sometimes the process is above your paygrade, so you have to leave it to a supervisor to make the decision. It's hard to control that authorization process."

Resistance to automation (stakeholder buy-in) emerged as a very minor issue. That wasn't always the case.

"Right now, network teams are more on board with it. Three or five years ago, all our teams were anti-automation," said a network automation engineer at a large university. "They worried that they would be automated out of a job. That has shifted because they are seeing how beneficial it is. Automation can take things off their plates."

"Bypassing automation is an issue," said a network engineer at a private gaming company. "In areas where automation tools exist, people might have a good reason for doing things manually. But doing things manually stops you from fixing the tooling problems you are working around and it increases the likelihood that you implemented something incorrectly. We need to remove that temptation."

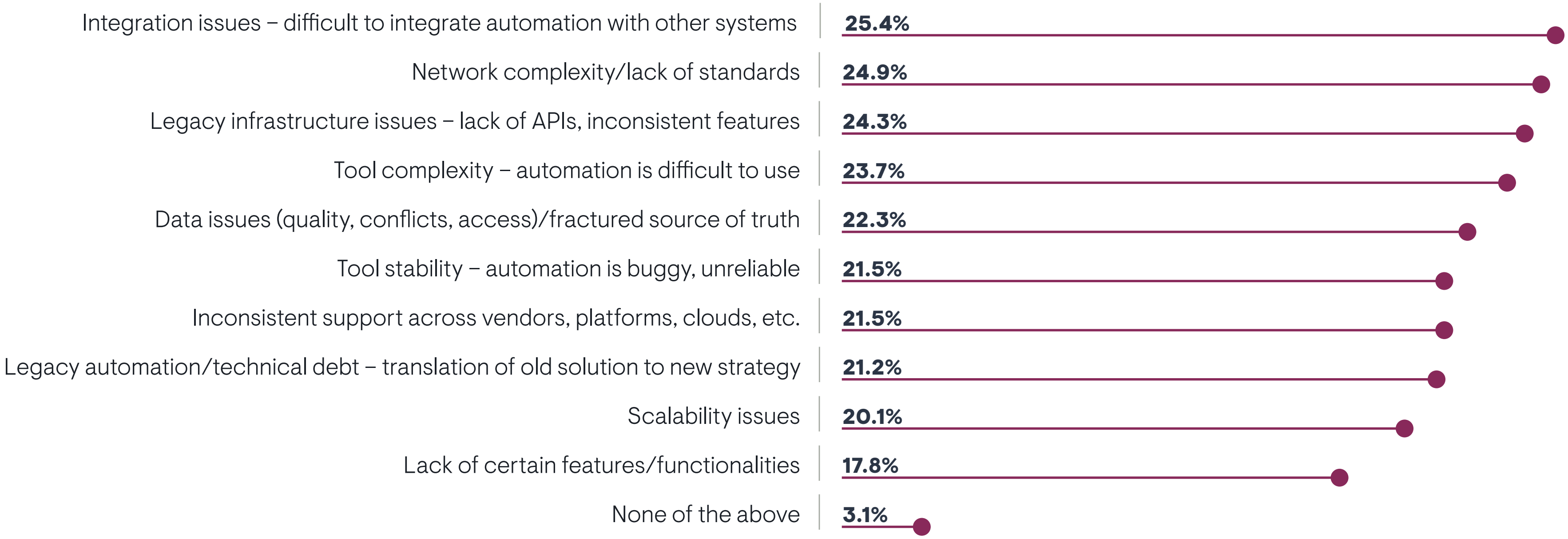
Technical Challenges

Figure 28 identifies the technical challenges that organizations encounter with network automation. There isn't much distance separating the top four issues. Integration problems and network complexity edge out legacy infrastructure issues and tool complexity.

Nearly everyone that EMA interviewed one on one had some issue with standard compliance.

"Standardization is the biggest obstacle," said a network tools engineer at a Fortune 500 retailer. "When the network is not standardized and the data is not standardized and you don't have a standard way of generating inventories and a source of truth, it's a big problem. You can't automate at scale because you're forced to automate one device at a time without standardization."

FIGURE 28. WHICH OF THE FOLLOWING TECHNICAL ISSUES ARE MOST CHALLENGING TO YOUR NETWORK AUTOMATION STRATEGY?



“If you don’t have standards, what are you going to base your automation on?” asked a tool architect at a Fortune 500 media company. “You can’t just tell automation to do something. It has to have some inventory to go on.”

“If you don’t have standards, what are you going to base your automation on?” asked a tool architect at a Fortune 500 media company. “You can’t just tell automation to do something. It has to have some inventory to go on.”

“The biggest challenge is the standards,” said a tools architect with a Fortune 500 media company. “No matter how much we try, we still find devices not adhering to standards. Everything greenfield has a good standard, but the challenge is retrofitting brownfield to standards.”

“We have 160 sites that have all been deployed at different times by different people,” said a network engineer at a Fortune 500 food and agriculture company. “When we go over that to make sure we meet some kind of golden standard and compliance, we find that none of them are compliant right now. They are all ‘artisanally’ configured.”

Legacy infrastructure issues were cited more often by organizations that use proprietary network automation software from a network infrastructure vendor. This suggests that their networking vendor is offering automation that doesn’t fully support their older products.

DevOps, IT tool engineering, network operations, and cloud teams all complained of integration issues more often than network engineering and IT architecture teams.

Inconsistent support across multiple vendors is a tertiary problem, but organizations with failing network automation strategies selected it at a very high rate, suggesting it can make or break many projects.

Scalability was a minor challenge, but organizations that use proprietary automation software from a tool vendor encountered it more often. Network complexity also challenged these tools.

A network engineer at a midmarket business services company said API issues with his network infrastructure vendors are causing technical issues everywhere in his automation strategy, and it’s not limited to legacy network equipment with old APIs. “API documentation is poor and it often has bad information. Open source APIs don’t have this problem because they’re not trying to hide commercial secrets. Network vendors have this mindset that they should not share too much information.”

Conclusion

For network automation, clearly, there is not one tool that addresses every requirement an IT organization has. Instead, network automation is a multitool endeavor. It's also going to be a mix of commercial and DIY solutions. Most organizations work with vendors, but they also build their own tools. There are myriad reasons for this state of affairs. Partly, it appears that no one vendor does everything that an IT organization needs. Moreover, no internal development team can build tools that can cover every requirement an organization has.

The future of network automation is an ecosystem of tools and products that must integrate to provide a fully effective solution.

EMA believes that the future of network automation is an ecosystem of tools and products that must integrate to provide a fully effective solution. For instance, there have long been multiple vendors that automate network design, provisioning, configuration, and change. Now, there are multiple providers of network validation and assurance software, too. Furthermore, there are multiple vendors that specialize in providing a network source of truth. In many cases, these vendors complement each other, but also, they complement many of the open source tools that network teams adopt on their own without vendor support.

In other words, there are multiple paths toward success with network automation, and each path appears to involve a constellation of components. Anecdotally, EMA finds that even the largest IT organizations with healthy budgets and large teams of talented engineers have vastly different approaches to network automation. Some of them focus on developing large libraries of single-use scripts. Others are working with multiple vendors of proprietary and/or open source software. Still others are writing full-featured homegrown automation tools. Yet somehow, all of them are finding success.

There may be no one path to network automation success, but there are a few things an organization can do to ensure success. First, network data is essential. Organizations must maintain an authoritative repository of network intent and network state data to ensure compliance with design standards and security policies. They should also monitor this compliance continuously to avoid security branches and outages. Moreover, organizations need tools to validate changes to protect against unintended consequences. It's not just about automating the provisioning and implementation of a change. It's about knowing the impact of that change and making sure the change is successful.

Organizations must maintain an authoritative repository of network intent and network state data to ensure compliance with design standards and security policies.

This will take commitment. IT executives must be prepared to lead and to provide the budget and resources needed to do network automation right. It will also require network teams to make sure their networks are ready to be automated. They must clean up their networks, establish standards, deal with legacy infrastructure that have limitations (such as a lack of APIs), and ensure that they have good data management. Excel spreadsheets and wikis won't cut it. Network teams need to build modern repositories of golden configurations, IP address space, device inventories, and more. The potential payoff of an effective network automation strategy is immense. Get to work.

"At the scale we do things with thousands of locations, even doing a little thing like running a simple change or command on a network device is just a huge job," said a network tools engineer at a Fortune 500 retailer. "Automation just makes life so much easier for people in terms of compliance, gathering config files from devices, running reports, and deployment."

About Enterprise Management Associates, Inc.

Founded in 1996, Enterprise Management Associates (EMA) is a leading IT analyst research firm that specializes in going “beyond the surface” to provide deep insight across the full spectrum of IT management technologies. EMA analysts leverage a unique combination of practical experience, insight into industry best practices, and in-depth knowledge of current and planned vendor solutions to help its clients achieve their goals. Learn more about EMA research, analysis, and consulting services at **www.enterprisemanagement.com** or follow EMA on **X** or **LinkedIn**.

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