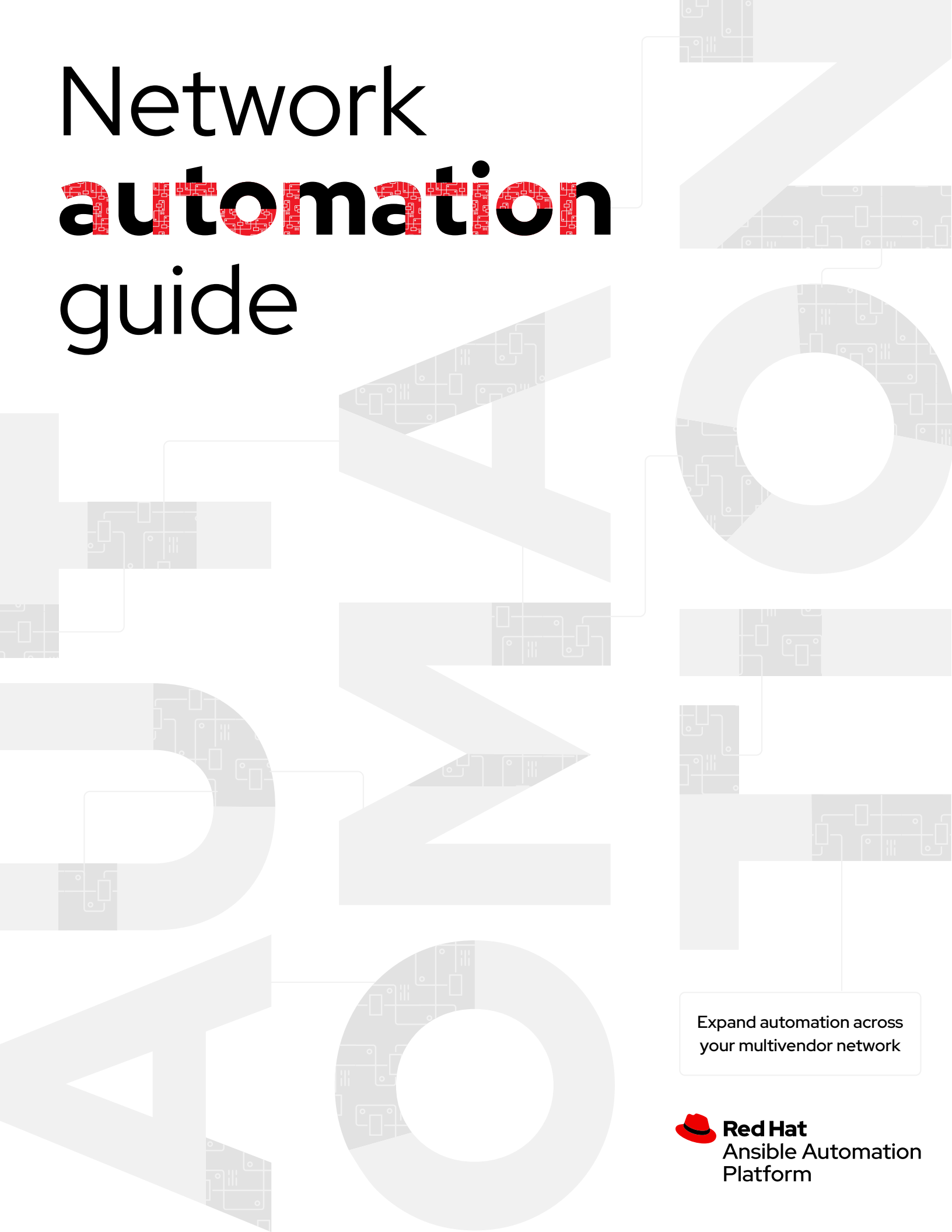


Network **automation** guide



Expand automation across
your multivendor network



Red Hat
Ansible Automation
Platform

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Why network automation and why now?

It wasn't long ago that an organization's network was thought of as an always-on resource to provide connectivity for the rest of IT infrastructure and systems.

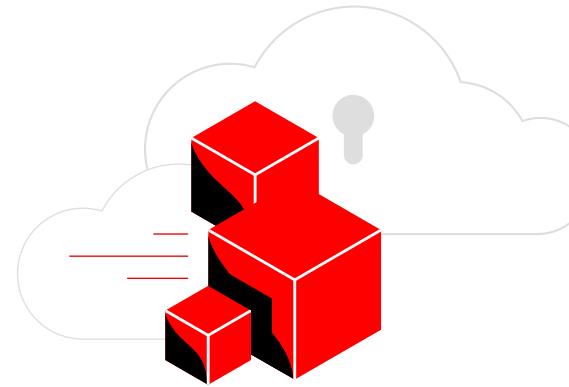
And although vital, the network was rarely viewed as a strategic investment as long as everything continued to run smoothly. Even as underlying technologies have evolved, network management has remained largely the same for decades. Networks are typically built, operated, and maintained by hand—but that's all changing.

To remain relevant in a hybrid cloud world, organizations know they must modernize. Traditional, manual approaches to network configuration and updates are too slow and error-prone to effectively support the needs of rapidly shifting workload requirements. Not to mention, there is added pressure that these tasks place on the people responsible for maintaining your network. Network automation is growing in popularity

but often implemented with a wide assortment of automation tools, each with a singular management function.

Enterprises and communications service providers are investing heavily in network automation to ensure their networks can support the demands of modern digital infrastructure. Modern networks need remediation more rapidly than can be manually applied, regardless of the size of your organization.

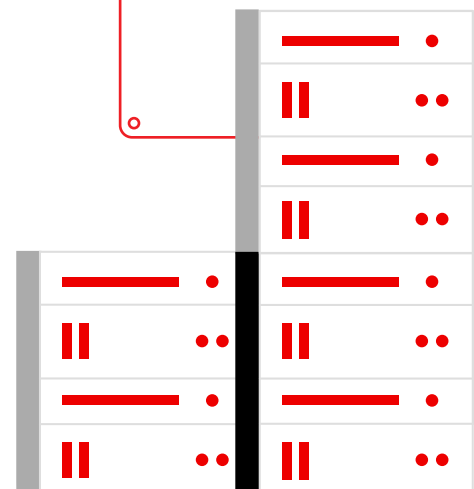
This guide provides network managers, architects and operators with some best practices for an operational framework that supports next-generation network operations, managing network infrastructure-as-code, and connecting teams across your IT organization, including network and cloud experts.



EMA research found that

86%

of organizations will increase their budget for datacenter network automation solutions over the next two years.¹



¹ McGillicuddy, Shamus. "[The Future of Data Center Network Automation](#)." EMA, sponsored by Red Hat, Feb. 2022.

Set your automation strategy

In the age of digital business and hybrid cloud, more organizations are investing in network automation to gain network resilience and reliability to remain competitive.

Despite this trend toward network automation, nearly 77% of technology professionals see room for improvement in areas such as datacenter network automation strategies.¹

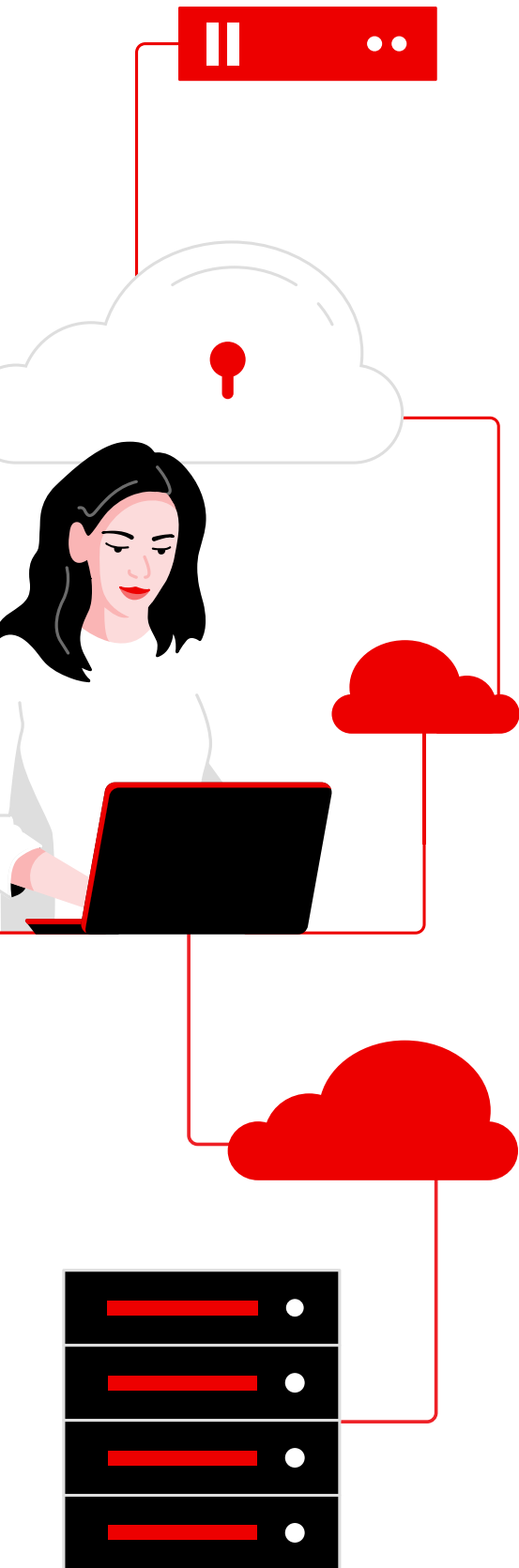
The absence of an organization-wide automation strategy has less to do with a lack of planning or vision, and is more the result of rapidly changing industry and global conditions. Many of these conditions are unavoidable, including:

- The lasting impacts of the global pandemic.
- A remote workforce that is here to stay, often bringing multiple devices and needing connectivity from just about anywhere.
- A sudden need for digital experiences to get and stay connected to customers, suppliers, partners, and teams.
- The growing shift toward edge and internet of things (IoT) devices that require a managed and secure network.
- A rise in hybrid cloud applications.
- The importance of reliability, which is essential for the network and more.

72%

of organizations require their tools to orchestrate network automation across multiple, geographically dispersed datacenters.¹

¹ McGillicuddy, Shamus. "[The Future of Data Center Network Automation](#)," EMA, sponsored by Red Hat, Feb. 2022.



In addition to shifting global conditions, the structure and practices of network operations teams had simply not changed over a long period of time, exposing inefficiencies in many organizations, including:

- **NetOps teams being specialized in isolated domains and platforms.**
- **Network vendors that often focus on individual product capabilities, rather than overall operational improvements.**
- **Disparate, cross-departmental teams that were not set up to collaborate effectively.**
- **Legacy, paper-based operational practices that were difficult to update and change.**
- **Reliance on network device command-line interfaces (CLIs) which are slow and impede automation.**
- **Existing monolithic, proprietary platforms that either lack automation capabilities or offer singular function and vendor specific network automation.**
- **Organizational momentum, which makes it difficult to adapt to changing customer needs.**

Together these factors have increased the importance of the corporate network as well as its scope, scale, and complexity. But in the race to meet these shifting conditions in recent years, many organizations and service providers have addressed each factor individually, on an as-needed-basis. This resulted in islands of automation driven by narrowly focused management tools from a variety of network solutions vendors. In fact in a recent study, EMA found that more than 48% of participants use two tools to automate various aspects of their network and 34% use three.¹

Setting an effective network automation strategy starts with a single platform. With a solid foundation for automation, you can unify within and across networking domains, and within and across all the IT functions of your organization.

¹ McGillicuddy, Shamus. [“The Future of Data Center Network Automation.”](#) EMA, sponsored by Red Hat, Feb. 2022.

Benefits of a single automation platform

As hybrid cloud environments expand in purpose and complexity, it's neither sustainable nor feasible to find a different solution for every automation challenge that comes along. This is where the benefits of a single automation platform can move your organization beyond ad-hoc incremental efficiencies, and truly accelerate business outcomes across your organization.

A single automation platform can provide many benefits that multiple, disconnected tools cannot, which help you:

- **Manage growing complexity.** A single platform can help maintain consistency as you incorporate new technologies such as edge devices into your network environment and mitigate configuration drift with automated configuration and maintenance.
- **Enhance communication across teams.** Bring teams together under one view of automation with a single platform deployed across your organization. IT process

integration such as ServiceNow® service ticketing and configuration management information can help set up systems that define, manage, automate, and structure services, while providing an easily maintained "single source of truth."

- **Boost security and risk management.** Give network operations (NetOps) teams the ability to quickly respond to dynamic needs for capacity, application security, load balancing, and multicloud integrations.
- **Embrace a culture of automation.** Break down barriers between teams and standalone automation tools and initiatives in your organization, to adopt a culture of automation with a single platform as the foundation.
- **Focus on network reliability.** Gain consistent ways to change the network that help with governance and control—all at a time when the network is essential to hybrid cloud, remote workforces, and digital business.

No matter where your organization is in its automation journey, a single platform can help open up unlimited possibilities. So, what should your organization automate? What does your NetOps team need to succeed? And where do you need to run your automation to be successful? Red Hat® Ansible® Automation Platform is a great place to start.

Setting an effective network automation strategy starts with a single platform. With a solid foundation for automation, you can unify within and across networking domains.

Learn how to modernize network management using automation.

[Download The future of datacenter network automation](#)

Get to know Red Hat Ansible Automation Platform

The key to successful automation is to deliver a consistent experience across your entire network, everywhere that automation is running.

It is important to note: use a single platform to automate across multiple network domains and functions, such as the WAN, campus network, wireless, and edge, in addition to integration with solutions such as firewalls, load-balancers, information technology service management (ITSM) solutions and more.

As networks expand and become more complex, you need a foundation for building and operating automation across your entire organization.

It provides an enterprise framework for building and operating IT automation at scale, from hybrid cloud to the network to the edge. Red Hat Ansible Automation Platform combines a universal automation language with management services and trusted, certified content for automating, deploying, and operating applications, infrastructure and services securely at enterprise scale.

Red Hat Ansible Automation Platform provides:

- **Ansible automation.** A scalable implementation for describing, building, and managing many aspects of IT including a growing network, infrastructure, cloud, enterprise IT applications, security-focused needs, edge devices and much more across diverse enterprise architectures.
- **Enterprise grade capabilities.** These include WebUI, API access, ITSM integrations such as ServiceNow, role based access

(RBAC), identity and access management integrations, audit and insights capabilities and more. This is covered in more depth in Chapter 6.

- **Hybrid cloud-based services.** Gain the flexibility to scale your business wherever it is. Whether on-premise, within a regional footprint, across a global enterprise network, or to your farthest edge nodes, use Red Hat Ansible Automation Platform on Azure and other cloud providers to automate the management of IT resources.
- **Certified Content Collections.** This automation content is certified by Red Hat and supported by Red Hat partners to help you start new automation projects more quickly for many technologies across environments.

Need to get up to speed quickly?

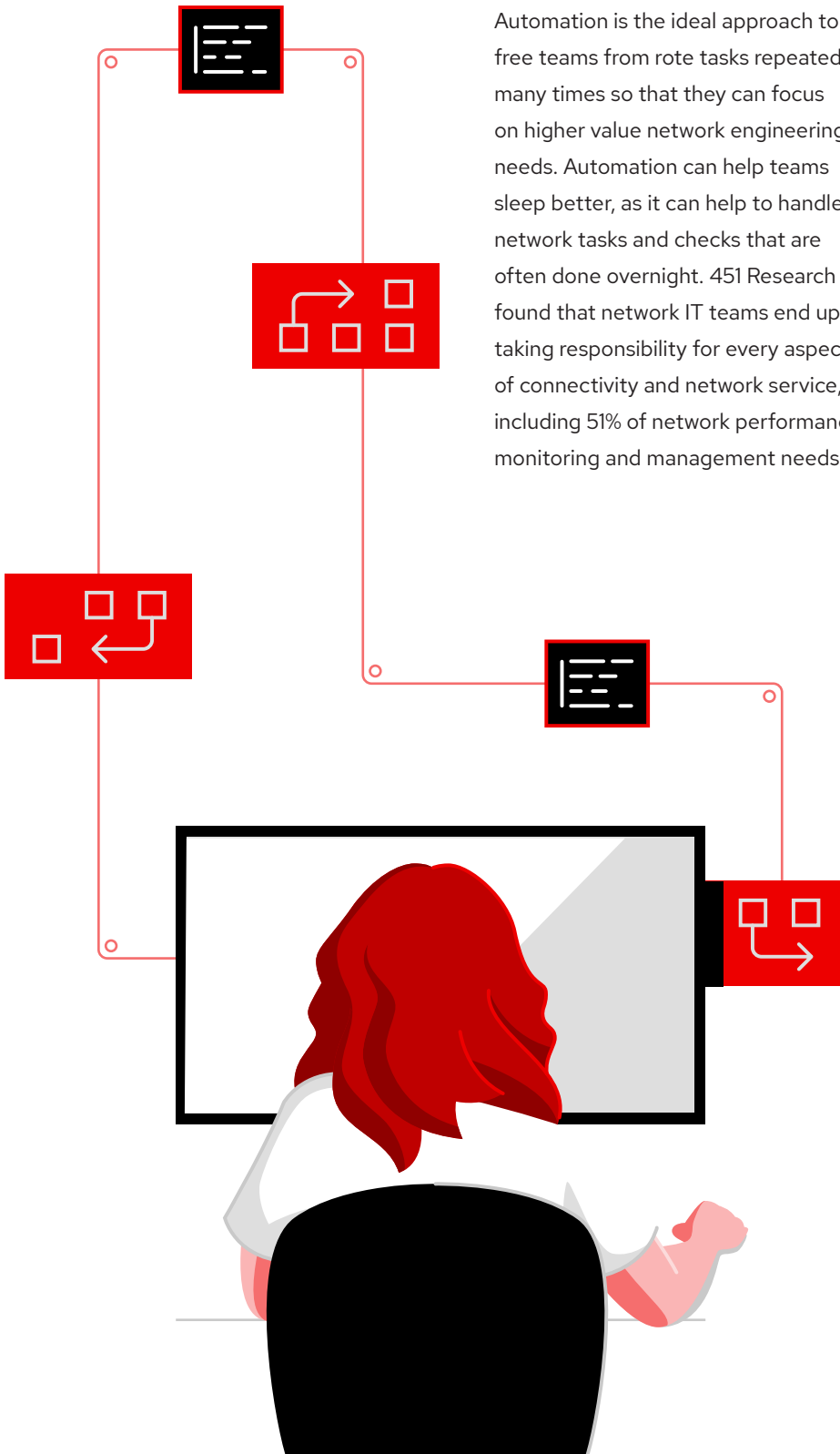
[Read The beginner's guide to Red Hat Ansible Automation Platform](#)

Look at automation differently

Automation is the ideal approach to free teams from rote tasks repeated many times so that they can focus on higher value network engineering needs. Automation can help teams sleep better, as it can help to handle network tasks and checks that are often done overnight. 451 Research found that network IT teams end up taking responsibility for every aspect of connectivity and network service, including 51% of network performance monitoring and management needs.²

Because networks are relied on to do more and connect virtually every aspect of your business, it's important to look at automation in a new way. Consider how automation can unify your extended team, improve communication, and boost collaboration to help you:

- **Provide a high level of service to users.**
- **Deliver resources to application development and IT operations teams on demand.**
- **Enforce adherence to configurations and standards for governance including GitOps "single source of truth" processes.**
- **Understand and manage inventory effectively.**
- **Maintain configuration standards across disparate network platforms.**
- **Build a more proactive and self-sufficient NetOps team.**
- **Rapidly and accurately implement patches when needed, across hundreds or thousands of devices.**
- **Drive automation from ServiceNow tickets and build toward event-driven automation.**



² A commissioned study conducted by 451 Research on behalf of Red Hat. ["Using Network Automation to Power Modern Applications,"](#) 2021.

Plan automation for today and tomorrow

Automation is the key to next generation networking. Figure 1 can help you visualize how automation can help your network for today and into the future.

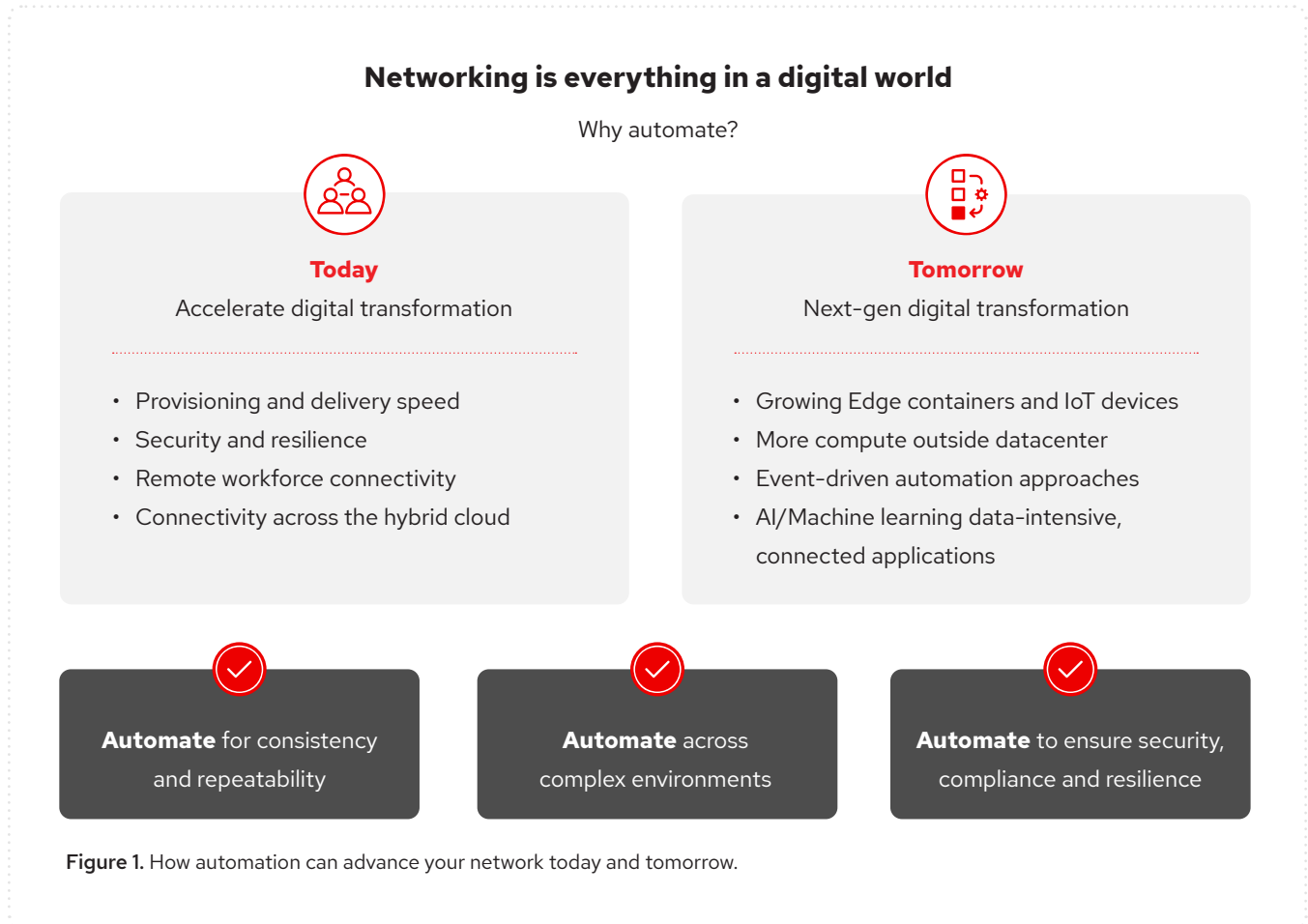


Figure 1. How automation can advance your network today and tomorrow.

Speak a unified language

Using a common, human readable language, Red Hat Ansible Automation Platform makes everyday tasks repeatable and scalable using [YAML](#)-based playbooks and roles. Its flexible framework lets you choose where you automate first, so you can embrace incremental change helping you to start small and expand over time.

Red Hat Ansible Automation Platform workflows let you create simple, effective automation sequences using a visual user interface. No special programming skills are required, so NetOps engineers can use their networking expertise and start implementing Red Hat Ansible Automation Platform immediately.

Want to see Ansible in action?

[Watch Five great use cases for Ansible Network Automation](#)

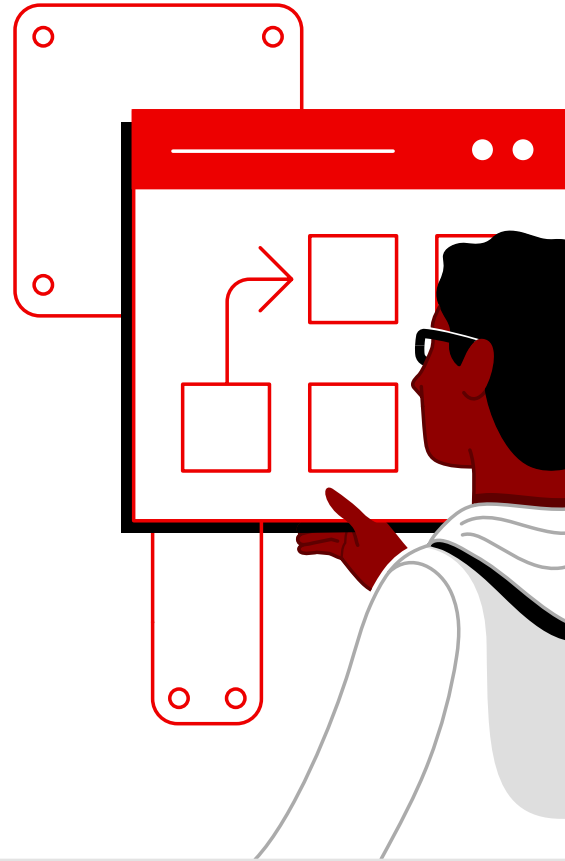
What is a Certified Content Collection?

Ansible Certified Content Collections are certified by Red Hat and supported by Red Hat and Red Hat's partners to make it easier for Red Hat Ansible Automation Platform users to get up and running with precomposed content. This helps you jumpstart new automation projects with trusted content so your organization can gain the benefits of automation more quickly.

Ansible Content Collections are a distribution format for Red Hat Ansible Automation Platform content that can include playbooks, roles, modules, and plug-ins around specific solutions or topic areas. This type of content is not certified or supported.

Ready to learn more?

[Take the free Basics of Ansible training course](#)



Ready for reference architecture

To help you get the most value out of your automation the latest [reference architecture](#) is available to subscribers. It incorporates key building blocks to optimize your Red Hat Ansible Automation Platform environments, including:

- **Centralized logging across multiple Red Hat Ansible Automation Platform environments.**
- **Protecting installation inventory passwords using Ansible-vault.**
- **Using a combination of GitOps practices (configuration as code capabilities) and Git webhooks to streamline the automation and delivery of configurations to multiple Red Hat Ansible Automation Platform sites automatically, immediately and consistently.**

Assess your network automation maturity

While every organization may be at a different stage in their network automation journey, the desire to manage the network more efficiently and effectively is common to all.

As you assess where your organization is on its path to NetOps, it's helpful to think of that journey as a spectrum.

At one end of the spectrum are traditional network operating systems that often don't have the ability to install software, so they cannot run an automation agent that may be required by some automation tools. At the other end is a fully automated NetOps design. No matter if you are just starting out or running fully automated NetOps, Red Hat Ansible Automation Platform can help.

One of the most powerful and unique features of Red Hat Ansible Automation Platform is that it's agentless, so you don't need to install an agent on any of the devices in your network. This feature makes Red Hat Ansible Automation Platform ideally suited for network automation and it is also extremely scalable to help you rapidly manage broad, global network implementations simultaneously.

**Learn how to use
Red Hat Ansible
Automation Platform.**

[Experience Ansible Network
Automation self-paced labs](#)

Start small

Where to start is a common question with IT automation. Red Hat suggests taking a "start small, think big" approach. The key to getting up and running quickly with automation is to start with processes that are most repetitive and time consuming to manage.

Starting small with something like configuration backup and restore, dynamic documentation and scoped configuration management, can build confidence in using automation and begin steps toward more complex projects.

Think big

After a few smaller victories with automation, you will be ready to think bigger, institutionalizing automation across your organization. With greater confidence in automation you might tackle network compliance, operation state validation or automated NetOps. In chapter 6, we take a closer look at these automation use cases to illustrate the start small, think big approach in action.



Manage across the network technology stack and across processes

Your network ecosystem is varied and as it grows with new technologies that need to be hosted and managed on your network, complexity can escalate quickly.

Tools that automate within an area help at the task level but can increase security vulnerabilities.

However, automation can help at a broader level across these domains to improve communication, collaboration, and make processes consistent and repeatable—boosting your security efforts. Certified Content Collections are trusted to help jumpstart new automation projects across a range of vendors, while helping you to align to compliance needs.

Access Red Hat's extensive ecosystem of trusted partners to help you:

- **Manage multi-vendor network solutions with a single automation tool.**
- **Set up and run IP address and identity management.**
- **Authenticate, authorize, and integrate with solutions including domain name service management.**
- **Manage application security risks and load balancing.**
- **Administer datacenter and campus networks.**
- **Control, update and manage security risks on Edge devices.**



Automate your network technology stack

A robust ecosystem of technology partners contribute to the Red Hat Ansible Automation Platform Certified Content Collections, to help you to get up and running as we have described and to help you manage across your multivendor network environment with a single platform.

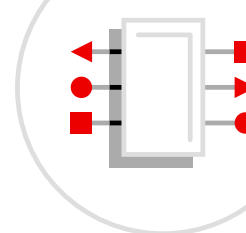
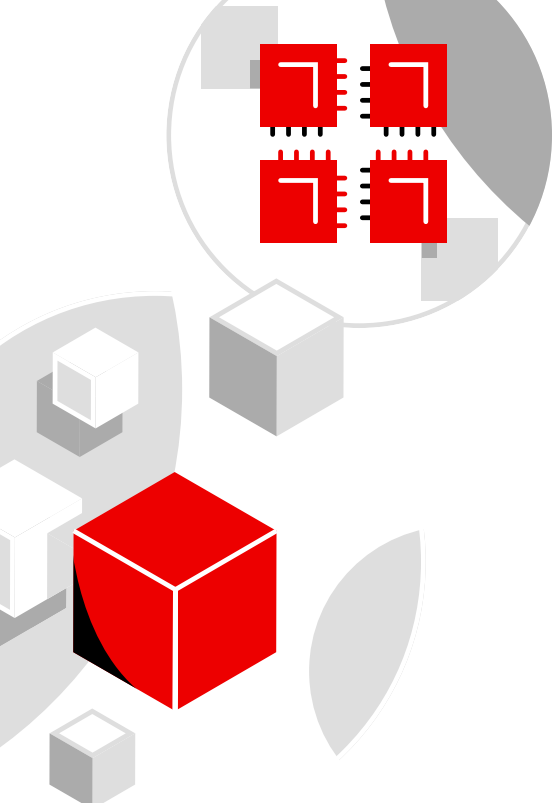
This pre-composed content is supported, trusted, and validated for use with Red Hat Ansible Automation Platform and consists of bundles of modules, plug-ins, roles, and documentation that you can use all from a single place or collection.

Get to know the complete list of Red Hat Ansible Automation Platform Certified Content Collections

Ansible network ecosystem



Figure 2. A robust ecosystem of technology partners are contributors to Red Hat Ansible Certified Content Collections and help you automate across multivendor network environments.



A single source of truth in IT Service Management

Creating a single source of truth ensures you are operating based on standardized, relevant data across your organization. You can improve the value of your service chain using ServiceNow as the single source of truth for information about your IT assets, while using Red Hat Ansible Automation Platform to programmatically open, close and update service requests, incidents, problems and change requests.

This helps you create faster, more efficient IT service management using the Red Hat Ansible Certified Content Collection for ServiceNow that integrates Red Hat Ansible Automation Platform and ServiceNow solutions.

The combination of these solutions provides many benefits, including:

- **Faster service delivery for improved customer and stakeholder satisfaction.**
- **Faster time-to-resolution.**
- **Improved productivity across IT teams.**

Using Certified Content Collection, you can dramatically increase value

from service chains, while enabling a closed loop process that automatically updates your ServiceNow workflows without manual intervention. This helps you to:

- **Work across incidents, problems, and change requests to make remediations easier.**
- **Create playbooks to automate common service request actions, such as resetting a network router.**
- **Automatically establish a digital trail for audit purposes.**
- **Automate the retrieval of configurations, eliminating manual steps.**
- **Simplify with modules and plug-ins for managing incident tickets, interacting with problem tickets, handling change requests, and managing the configuration management database in ServiceNow.**

With a Red Hat Ansible Automation Platform subscription, you also have access to Automation hub where you can browse and download solutions, and curate your preferred solutions into a private collection.



Ready to try it step by step?

[Read the network automation instructional e-book](#)

Top network automation use cases

Network operators are in a challenging position as they expand capabilities on the path to next generation networking.

The growing shift to hybrid cloud environments and the business opportunity of new applications, data-intensive computing, and new technologies such as edge, and IoT devices and cloud networking provide the perfect opportunity for automation across three key use cases as depicted in Figure 3.

These three use cases can be mapped to three broad stages of your automation journey. Let's take a look at each individually to help you assess and implement automation across your network.

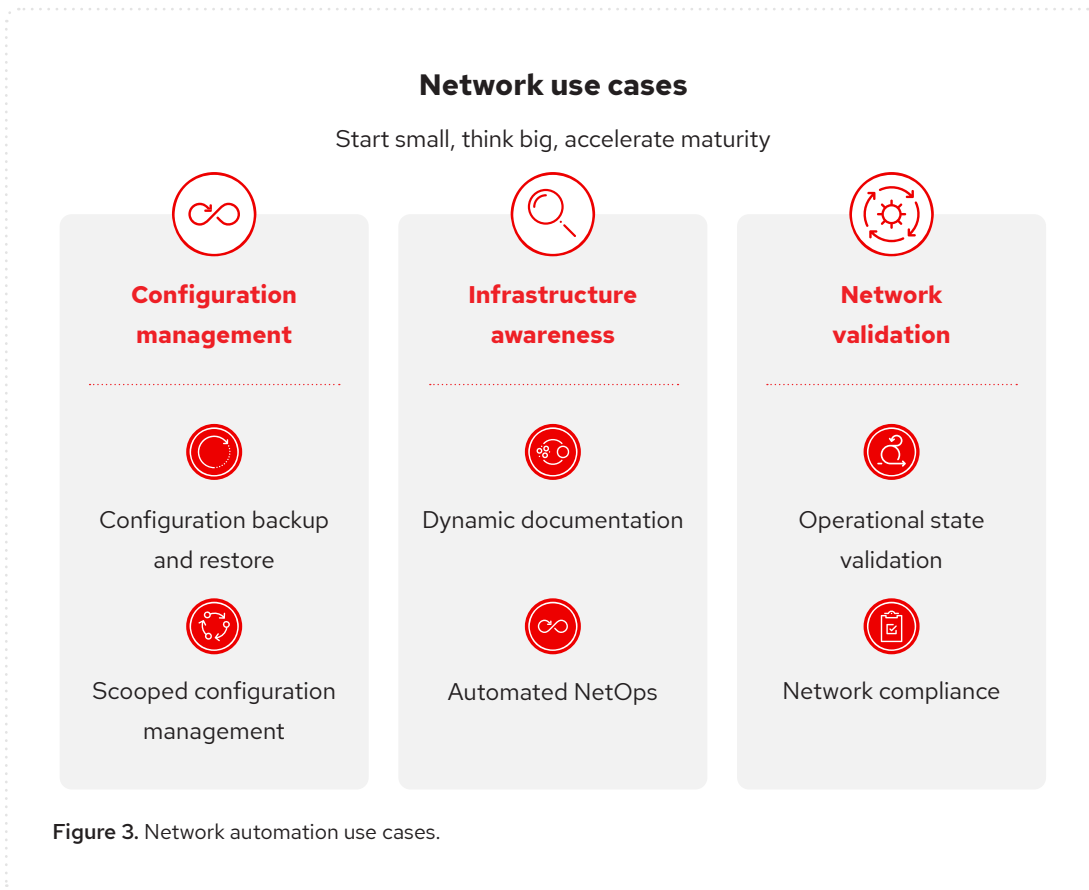
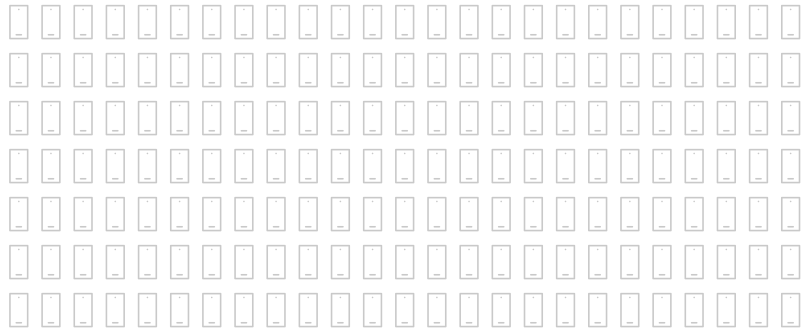


Figure 3. Network automation use cases.

Configuration management use case

At this stage in the journey ask, "How can we simplify a task or set of tasks using automation?"

Red Hat Ansible Automation Platform makes it easy to get started with automation, see how Ansible works, and try features without having to go all-in with automation. At this stage you are not affecting production, you are automating read-only tasks that network operators would have to do anyway using playbooks as illustrated in Figure 4.



The eight lines of code depicted in Figure 4 can back up hundreds if not **thousands of devices** at the same time, saving network operators time without the need to learn a programming language like Python or having to write, explain and maintain their own custom scripts.

```
---
- name: network backup
  hosts: all
  gather_facts: false
  tasks:
    - name: multi platform backup
      include_role:
        name: network.toolkit.backup
```

Figure 4. Example of a playbook based in YAML.

Red Hat Automation Platform takes this one step further. When two or more people are using the same automation jobs, these can be added to the Automation Controller component of this platform, allowing push-button IT and network management. This means automation can easily be put into action via a web user interface. Automation Controller also has an API so you can initiate your automation jobs in another tool such as ServiceNow and bring it into Automation Controller.

Infrastructure awareness use case

As you become familiar with using automation, the next question to ask is "How do we centralize our processes?"

Infrastructure awareness is another great use case as your organization ramps up to full network automation because it involves read-only tasks, which do not affect production. Instead, the goal is to run operational tasks to get information from your network, generate dynamic documentation and improve network visibility and performance.

Dynamic documentation is about gathering information from your network, converting it into a usual format or structured data, and then using that information to standardize and enforce best-practices.

Structured data is much easier to work with and lets you plug your data into your choice of tools, including websites, reports, database, or a solution such as Infoblox so you can glean insights into network performance, devices running on the network, and other workloads.

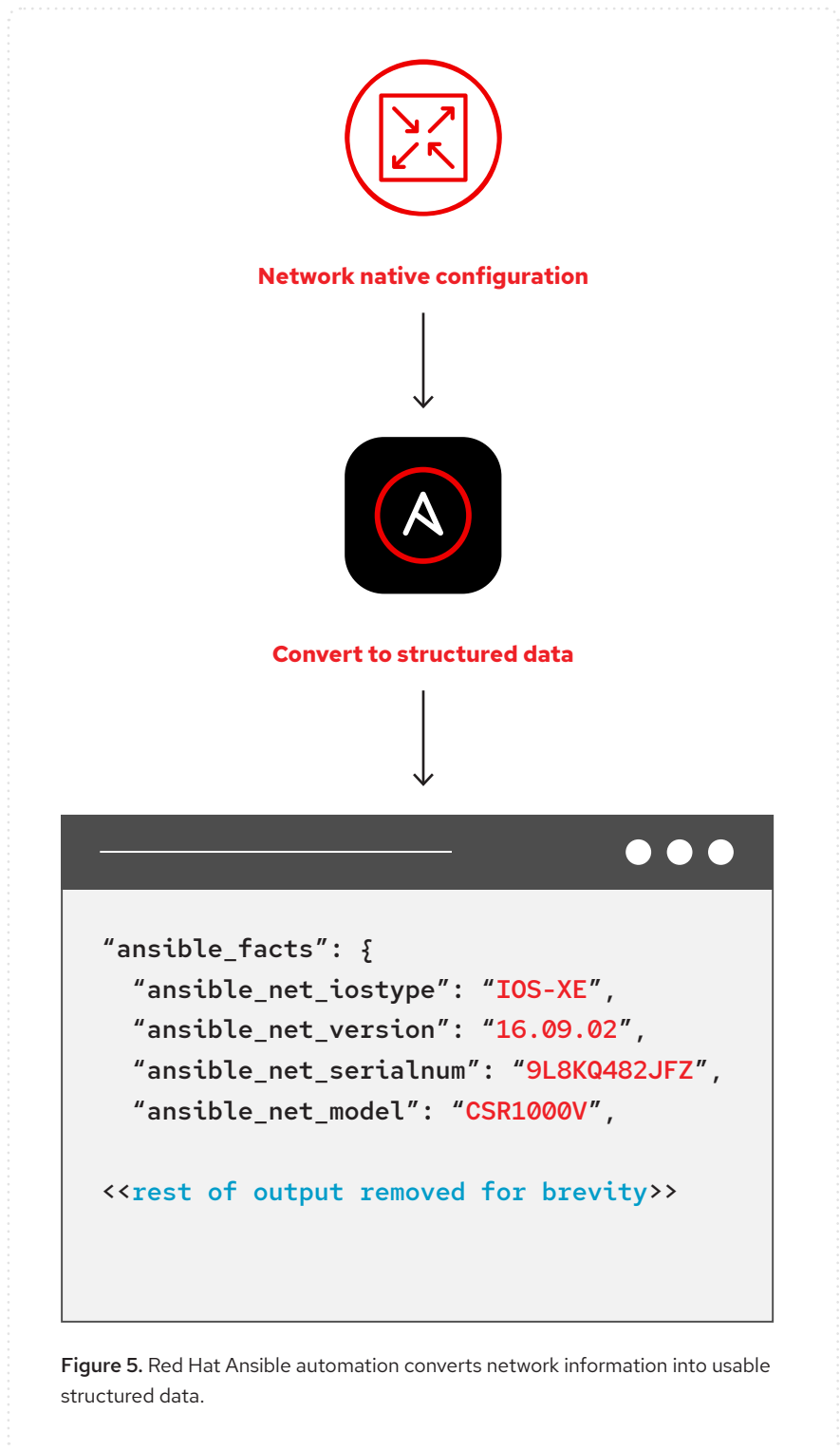


Figure 5. Red Hat Ansible automation converts network information into usable structured data.

Network validation use case

This use case focuses on the question, “How do we orchestrate our processes?”

In this example, we’re doing more than rebooting or backing up a switch. The goal is to look at the operation state, meaning we want to look at show commands, put them into a structured data scheme as we did in Figure 5 and work with that data to examine the operational state to check network

connectivity and protocols and enhance operational workflows to help measure network intent.

The first step is to decide which show commands you want to parse. Figure 6 demonstrates how, using Red Hat Ansible Automation Platform, you can deploy parsing automation, understand your operational state and make changes across your network.

Red Hat Ansible Automation Platform workflows also allow rollbacks which help make configuration changes simple. For example, if you made a configuration change such as changing a VLAN, then you checked connectivity across your network and realize it’s down, execute a rollback action and create another job template based on the previous template using the information about what worked and what didn’t.

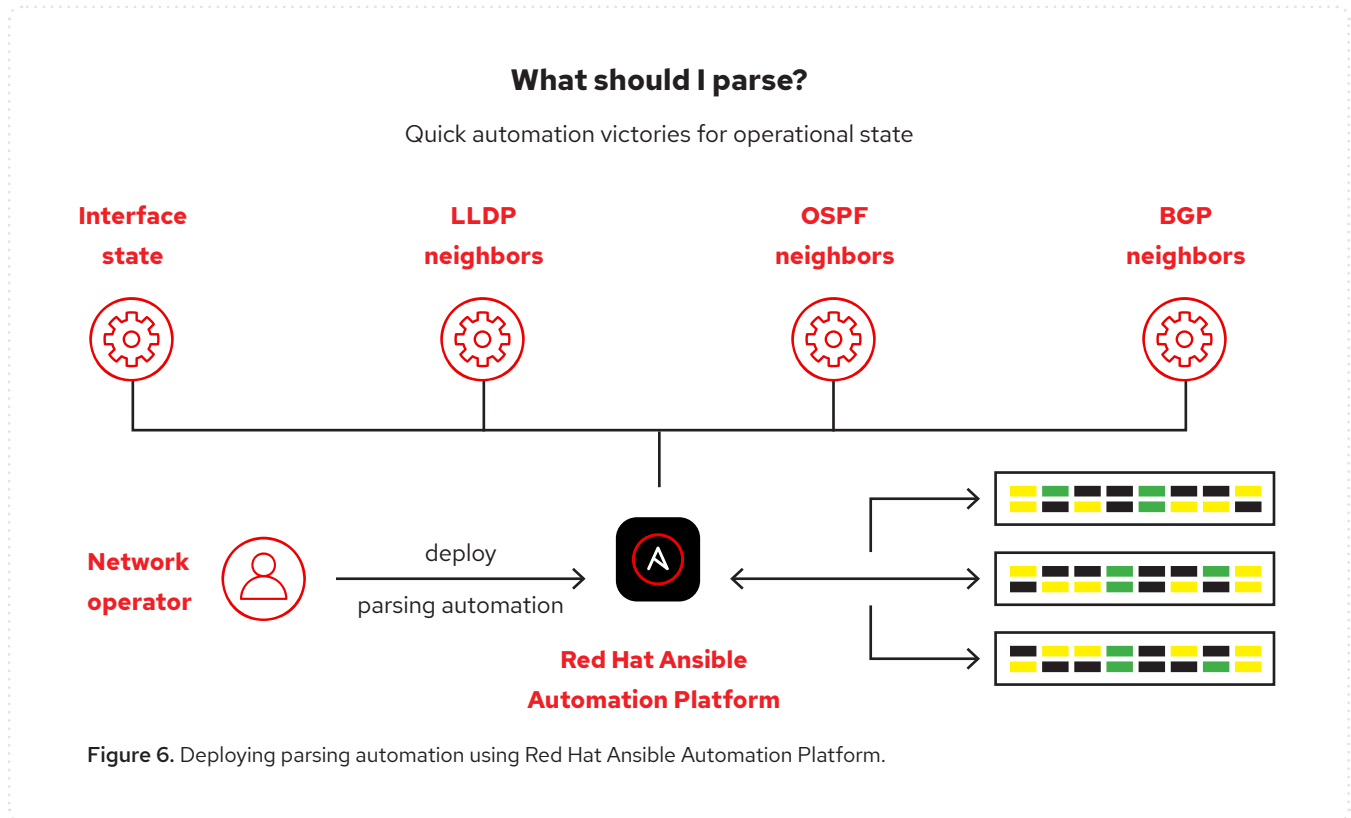


Figure 6. Deploying parsing automation using Red Hat Ansible Automation Platform.



Infrastructure as code

Provisioning infrastructure has historically been a time consuming and costly manual process. As infrastructure management has predominantly moved away from physical hardware in datacenters to virtualization, containers, and cloud computing, the number of infrastructure components has also grown. More applications are being released to production on a daily basis, which means infrastructure needs to be able to be spun up, scaled, and taken down more frequently.

[Infrastructure as code \(IaC\)](#) practices help organizations manage IT infrastructure needs while also improving consistency and reducing errors and manual configurations. With IaC, configuration files are created that contain your infrastructure specifications, which makes it easier to edit and distribute configurations. It also ensures that you provision the same environment every time.

By codifying and documenting your configuration specifications, IaC aids configuration management and helps you to avoid undocumented, ad-hoc configuration changes.

Policy as code

It's also important to make sure that your IaC implementation is in compliance with your organization's standards and policies. While the code may work, it will likely also need to conform to specific company naming conventions, labels, and security requirements—a process that can be time consuming for infrastructure teams.

Policy as code aligns technical environments, processes, and resources to agreed standards. For example, checking to make sure that none of your computing resources have a direct route to the Internet (potentially violating security policy), or limiting the service ports to just HTTPS and SSH.

Automating infrastructure as code and policy as code

Automating infrastructure provisioning with IaC means that developers don't need to manually provision and manage servers, operating systems, storage, and other infrastructure components each time they develop or deploy an application. Codifying your infrastructure gives you a template to follow for provisioning, and although this can still be accomplished manually, an automation tool, such as Red Hat Ansible Automation Platform, can help save time and resources.

Red Hat Ansible Automation Platform works with IaC solutions and includes all the tools needed to implement enterprise-wide automation, including playbooks, a visual dashboard, and analytics.

A GitOps approach to automating NetOps

Stay up to date with the latest tips and technical knowledge.

[Read the Red Hat Network Automation blog](#)

Another way to implement NetOps or infrastructure as code is using GitOps. This more prescriptive approach uses Git as a single source of truth instead of a configuration management database such as ServiceNow.

Red Hat Ansible Automation Platform provides great support for a GitOps approach by providing native integration with GitHub and GitLab via webhooks. It also makes it easy to get started with brownfield projects, so automation deployments don't need to be an all-or-nothing approach. This helps you take incremental steps toward automation and helps teams work in unison on automation projects throughout the entire process.

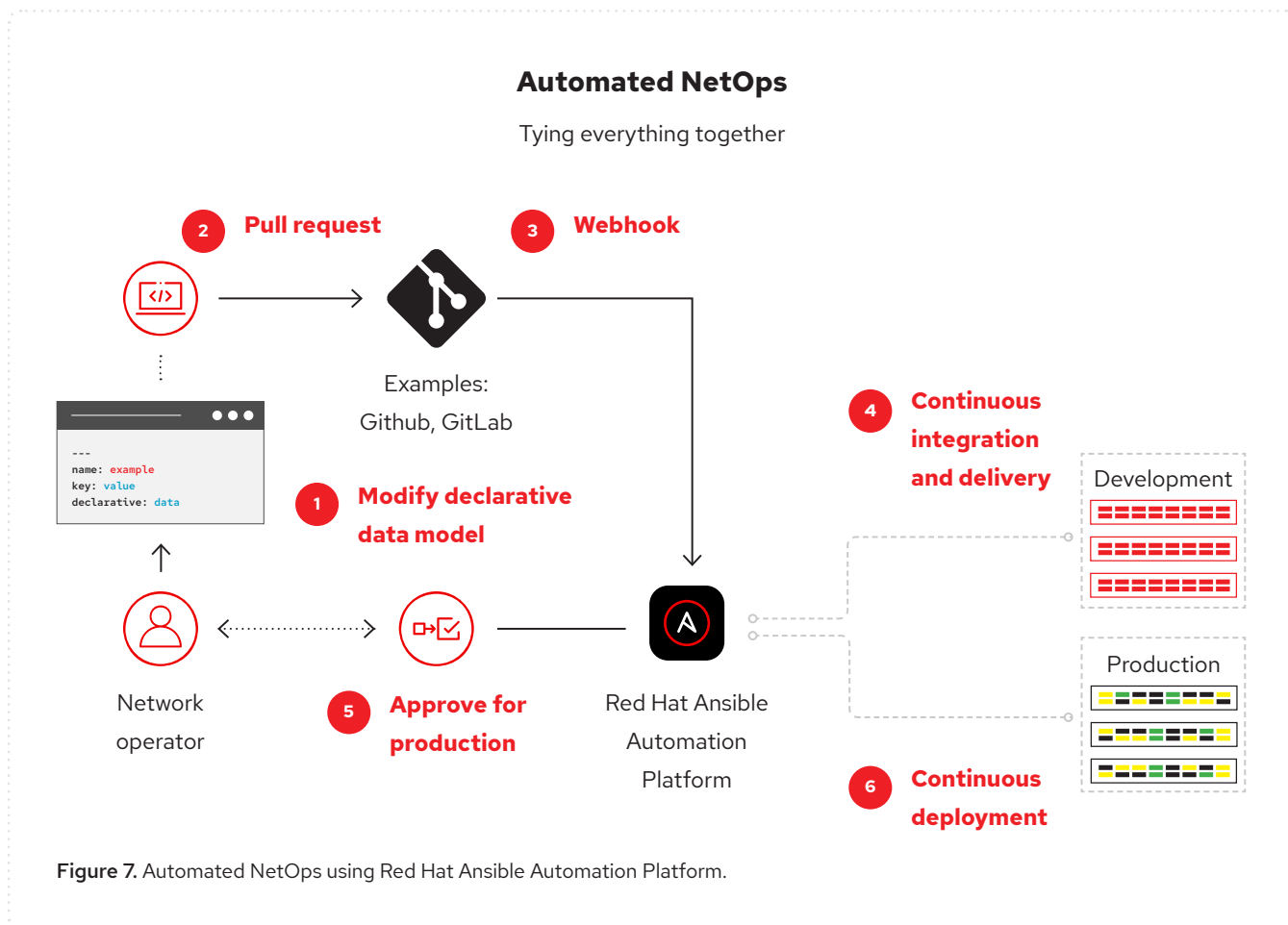


Figure 7. Automated NetOps using Red Hat Ansible Automation Platform.

Services to advance your journey

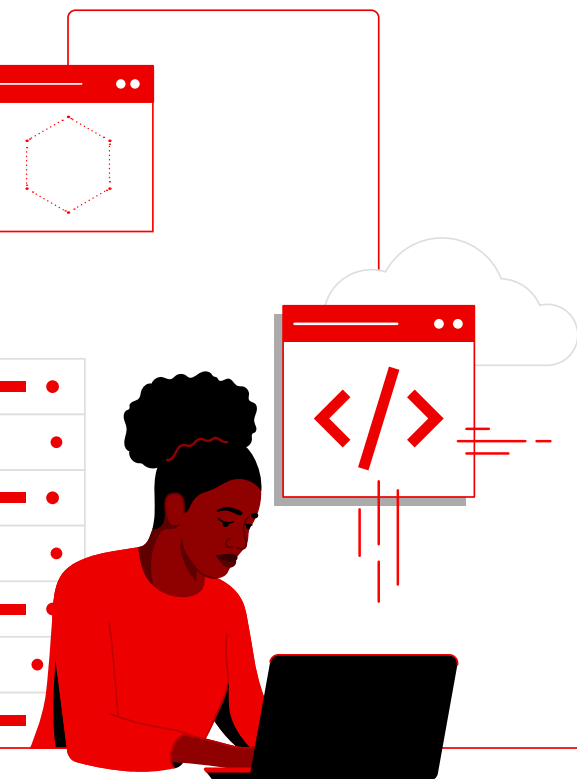
Both Red Hat Consulting and Red Hat partners offer a range of services to help get you started with network automation and advance along your network automation journey.

This assistance can include:

- Designing architectures.
- Optimizing processes and workflows before automating them for the best automation experiences.
- Building skills across IT teams.
- Creating automation content designed for your automation use cases.
- Helping to establish communities of practice for automation.
- Assisting with what to automate next—from network functions to use cases such as cloud or edge automation.

can take time and careful planning. Consider the following tips to move your organization's mindset toward automation:

- Identify a champion or executives to talk about the value of automation, including staying competitive and innovating quickly.
- Share results and successes as a way to build trust and legitimacy.
- Highlight and reuse trusted content to save time.
- Find the best teams for automation opportunities and work with them to create content and implement automation.
- Show, rather than tell, by offering demos and use cases teams can relate to.
- Once the community of practice has momentum, develop standards boards and policies.



For more ideas, tips, best practices for extending automation across your organization, read [The automation architect's handbook](#).

Build an automation-first mindset

Successful end-to-end automation is not just a technology change, but also a change in mindset across your organization, which

Advancing with edge automation and event-driven architectures

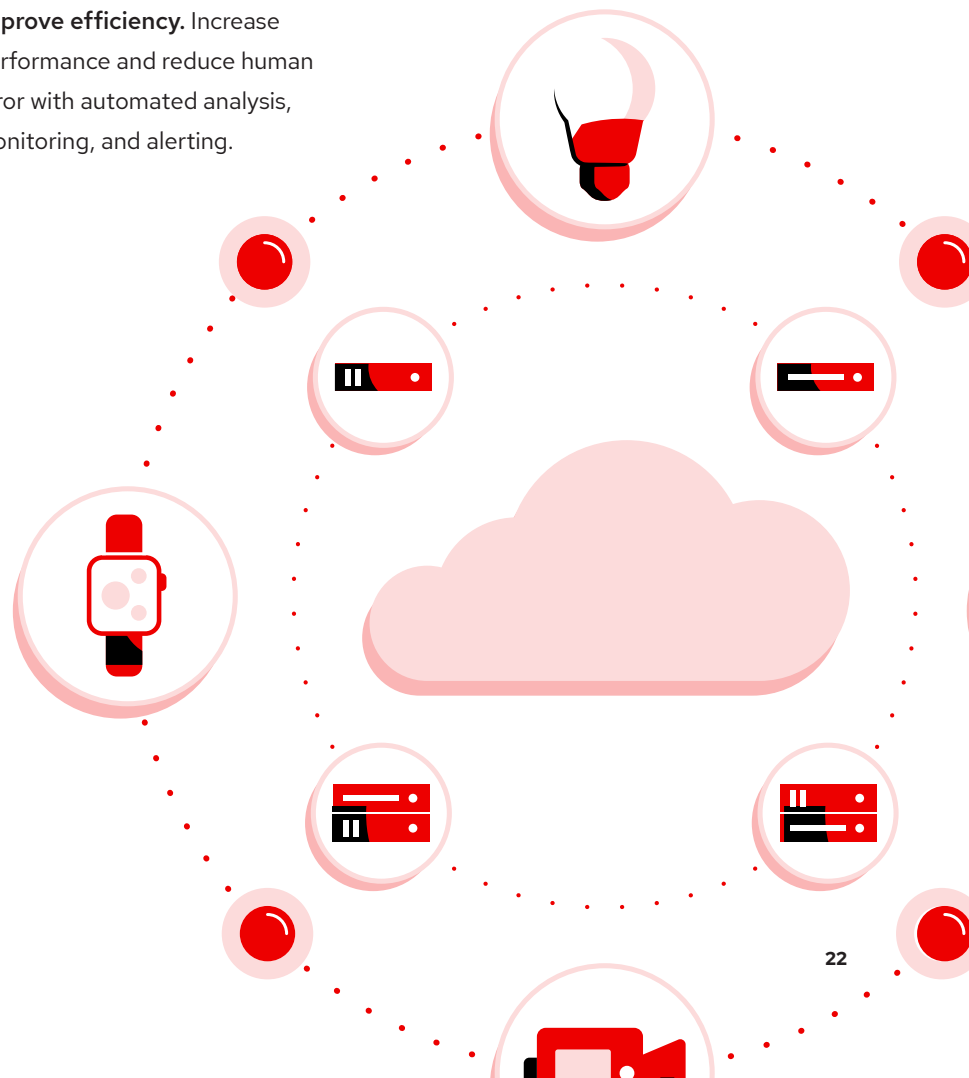
Edge computing has extended hybrid cloud infrastructures for many organizations. They need to connect data from remote sources back to the datacenter to support business decisions.

As an organization expands, devices are added, and data volumes grow, automation at the edge can simplify complexity and help organizations gain measurable benefits.

Red Hat Ansible Automation can help your organization:

- **Focus on security and efficiency.** Run updates, patches, and required maintenance automatically without, in some cases, the need to send a technician to the site.
- **Increase scalability.** Apply configurations consistently across your infrastructure and scale edge devices more quickly.
- **Boost agility.** Adapt to changing customer demands using edge resources only as needed.

- **Reduce downtime and complexity.** Simplify network management across multi-vendor and multi-purpose devices, reduce network failure, and boost your bottom line.
- **Improve efficiency.** Increase performance and reduce human error with automated analysis, monitoring, and alerting.



Extend automation to the edge

As your organization progresses through automation maturity, you may be interested in automating certain tasks without human intervention. For example perhaps you want to reset a network switch without user intervention, or you want to gather facts about that switch to aid in issue resolution.

Automation helps improve response times, security, and control over the infrastructure that supports data generation at the edge of the network. Across every industry, edge and automation can place a business at the epicenter of opportunity to help produce tangible business results.

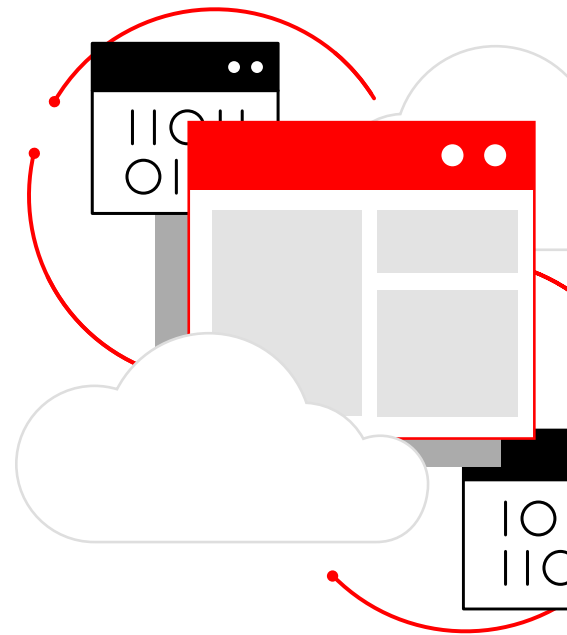
Moving to event-driven automation

Event-driven automation can be used to go from an “event” that is identified by one or more solutions to automated actions that are based on these events. At this advanced stage of automation, you can employ automation in many ways. For example, if a network device ticket arrives indicating too much latency, a playbook can be automatically kicked off to collect configuration information from that device to help expedite resolution of that ticket.

Event-driven automation is the next step in advanced in automation that offers big benefits when simple repeatable tasks are done. This can help you retain talent by eliminating mundane tasks, especially those that must be done outside of work hours. It also helps improve resilience by expediting resolution.

Learn more about event-driven architectures.

[Read the blog, Achieving speed and accuracy through event-driven automation](#)



Get started

Ready to take the next step in your automation journey?

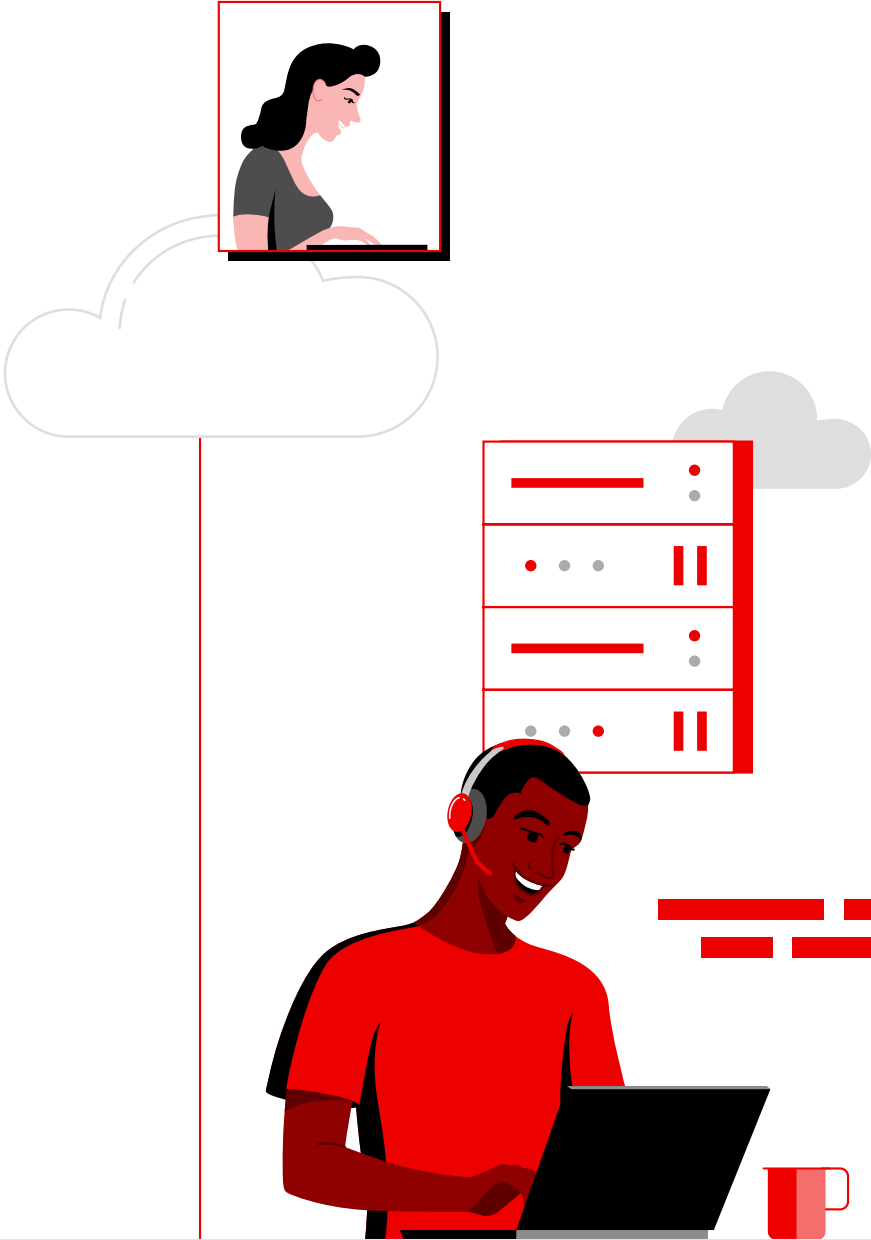
Extend the power of Red Hat Ansible Automation Platform to your entire network.

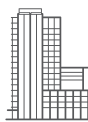
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