

>>> network .toCode()

Transformation Services

Take back control of your network by transforming how it is managed and operated, allowing you to complete more work faster and more efficiently than ever before. Deploy network automation in partnership with a dedicated team from Network to Code.

>>> network .toCode()

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Introduction

Transformation Services are for organizations committed to making the shift from a legacy and manual approach of networking to a modern, agile, and software-driven approach that transforms how networks are deployed and managed on a day-to-day basis. The benefits of a software-driven approach include lower opex, improved site reliability, increased innovation, greater insight and network control, and increased business agility. Network to Code's Transformation Services provide the leadership, cultural, and technical expertise to make your network automation initiatives a reality.

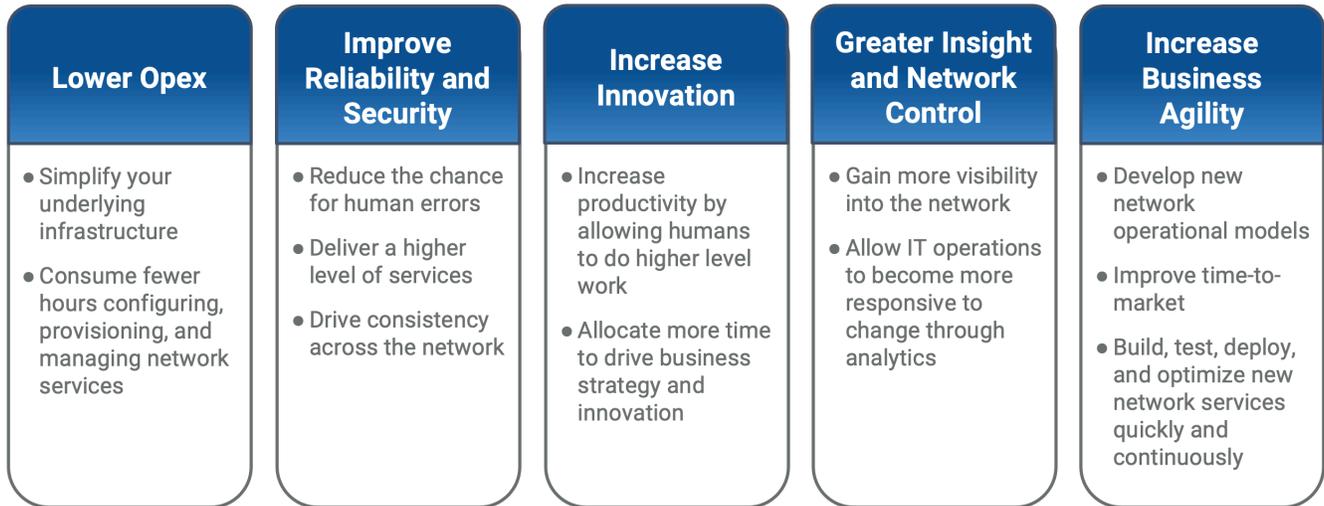


Figure: Benefits of Network Automation

As a Transformation Services client, you will work with a dedicated team of specialists that is focused entirely on your unique challenges and initiatives. Our team will accelerate the delivery of positive outcomes from multiple aspects of transformation: platform development, workflow automation, training & enablement, and ongoing support services.

Platform Development

- Perform a Strategic Assessment of existing tools, leading to a comprehensive three-year network automation plan.
- Integrate a robust set of tools within your environment to serve as the foundation for all future network automation.
- Operate your network as code, with proper version control, configuration and data management, CI/CD, and security.
- Integrate third-party applications such as Microsoft Teams and ServiceNow to offer various consumption models to your users.

Workflow Automation

- Perform a Strategic Assessment of existing workflows, leading to the design of a self-service catalog for automation.
- Begin automating immediately after workflow discovery to recognize value quickly on top of a minimal viable platform.
- Migrate workflows onto the developing automation platform to ensure proper performance, scalability, and reliability.
- Build, groom, and prioritize a backlog of automation workflows to ensure value is demonstrated and measurable results are achieved.

Training & Enablement

- Perform a Strategic Assessment of team member knowledge and experience, leading to the development of a highly tailored training curriculum that is specific to your team and deployment.
- Deliver live instructor-led training, coaching, and office hours, as well as paired development and coaching from the same professional services engineers that are building your solution.
- Re-host the self-paced training content and recorded course videos within your site to be available for reference in perpetuity.

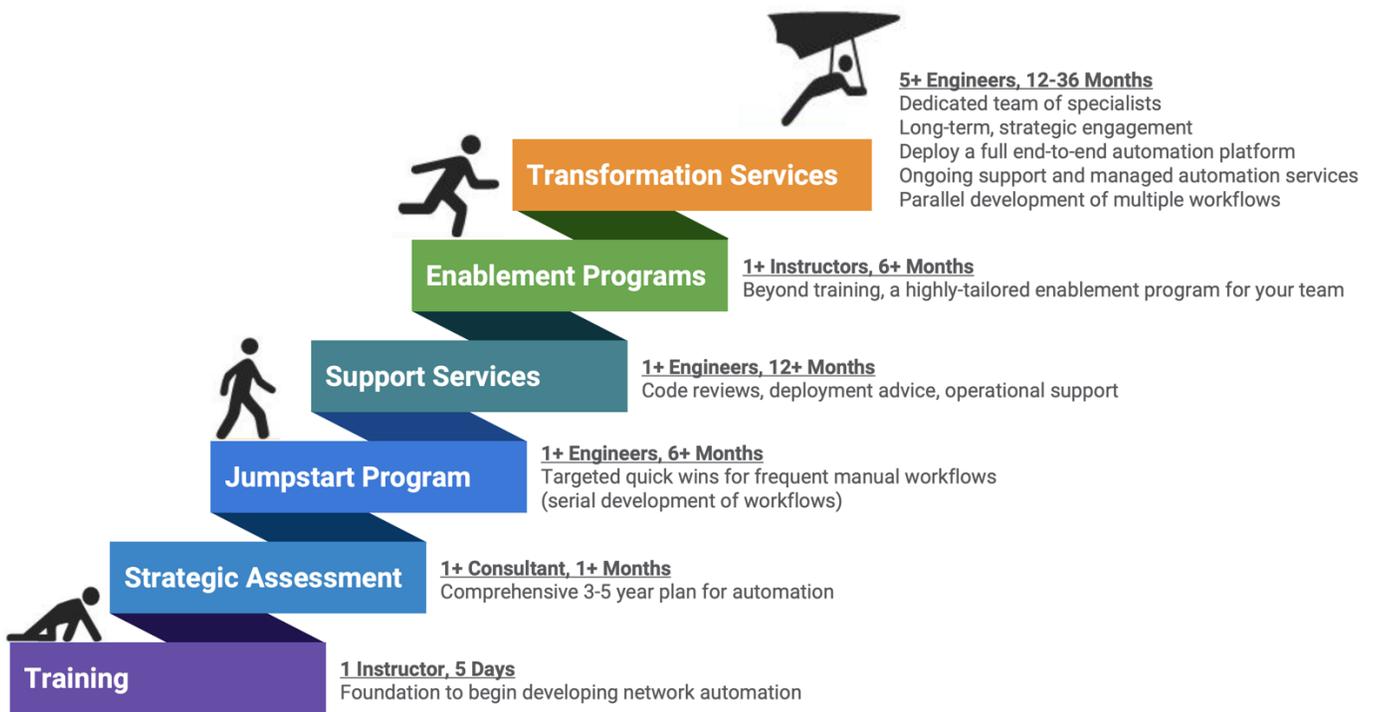


Figure: Comparison of Service Offerings from Network to Code

Industry Challenges

Information networks are the heart of modern digital business. Typically, every customer contact, order submitted, part manufactured, shipment delivered, and payment collected touches the network. To complete these feats, networks are vast and far reaching – they traverse many boundaries and connect responsible parties both inside and outside of the enterprise. This complexity is necessary, but it also introduces several challenges as described below.

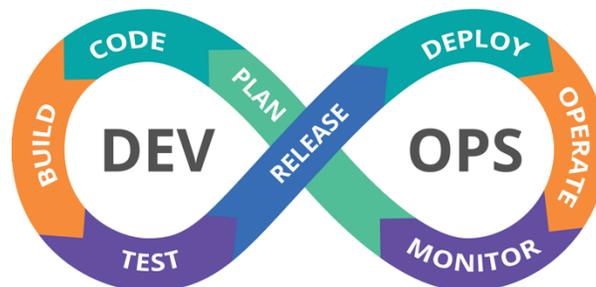
Speed of Change

Business moves fast. Internal users of the network are evolving quickly to compete. Business services have been virtualized, segmented into micro-services, automated and moved to the cloud, and now often span multiple private and public clouds for high availability and resiliency.

Application builders have adopted DevOps principles with agile scrum teams and product owners in their quest to move even faster. Their automation uses APIs to deploy, migrate, and destroy entire application stacks at the push of a button and on demand.

Application monitoring and analytics are incorporated to provide real-time insights about performance and stability, while integrated testing with CI/CD pipelines enable them to push updates far more frequently than before.

Most enterprise networks have not kept pace with their users. Multiple reasons exist for this condition (a few are described below), but this has to change. Digital networks are critical to the success of every business, and they must evolve to be as adaptable, versatile and resilient as the applications they support.



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Size, Scale, and Complexity

Digital networks are vast. A typical enterprise may connect over a hundred-thousand devices from thousands of branch offices or remote sites back to multiple private data centers and public clouds. The pandemic of 2020 brought new challenges with the majority of employees now connecting from self-installed home Wi-Fi networks and consumer-grade internet. And every one of those remote users has dozens of business-critical applications that need to communicate over the corporate VPN.

Digital transformation has driven a sharp rise in application complexity. The result is a mind-bending array of systems that is far too massive to manage by hand. Automated systems are needed to track the intended network configuration, to monitor performance, and to make network adjustments in real time to preserve the end-user's quality of experience.

Consider a modern SD-WAN solution. Those systems include features to monitor the quality of third-party WAN circuits and to automatically redirect traffic between alternate circuits based on the performance requirements of each application flow. This is a prime example of using intelligent monitoring and carefully crafted logic to make event-driven network changes in real time.

Firewall rule management and application load balancing are two other examples of exponentially increasing complexity that will require rigid configuration tracking to continue in a stable but secure fashion. Not only are the number of applications growing, but the adoption of micro-segmentation is driving far more granular security policies.

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Data and Management Fragmentation

Network automation requires accurate and authoritative data on each of the transit systems to be managed. These systems include configurations for wired and wireless LAN, SD-WAN, service provider circuits, internet service providers, data centers, private or public clouds, as well as transit services for firewalls, load-balancers, web caching, VPN, and so on.

In a typical enterprise, the management of these systems is highly fragmented. Different teams are responsible for each system, and different best-of-breed vendors are selected for each function. Each team has a preferred store for their data that is either in a vendor's proprietary management software or in local spreadsheet files saved on a network share.

Best-of-breed solutions are important to any enterprise; they continue to push the envelope for the most innovative state-of-the-art capabilities in their respective areas of expertise. The trade-off of a best-of-breed approach is that it results in multiple vendors in the environment that frequently do not interoperate or share data between systems. To interoperate, new methods must be developed to federate between vendors for Software Defined Networking and other controller-based solutions.

Many vendors offer automation within their management systems, but it is frequently a siloed capability for each system independently. Well-intentioned teams sometimes attempt to build automation from these vendor APIs, but all too often the result is a departmental power tool that is difficult to maintain, offers no cross-department utility, and is abandoned or forgotten when the original developer moves on and those left behind lack the knowledge to maintain it.

To realize meaningful, enterprise-wide automation, these fragmented technology silos and fragmented data models must be overcome. Some method is needed to normalize the data and allow interoperability between departments.

This all leads to one inevitable conclusion: data rules. Network automation requires a single, enterprise-wide Source of Truth for authoritative data on all systems to be managed. This in turn unlocks the potential for an enterprise-wide automation platform that will unite siloed network technologies.

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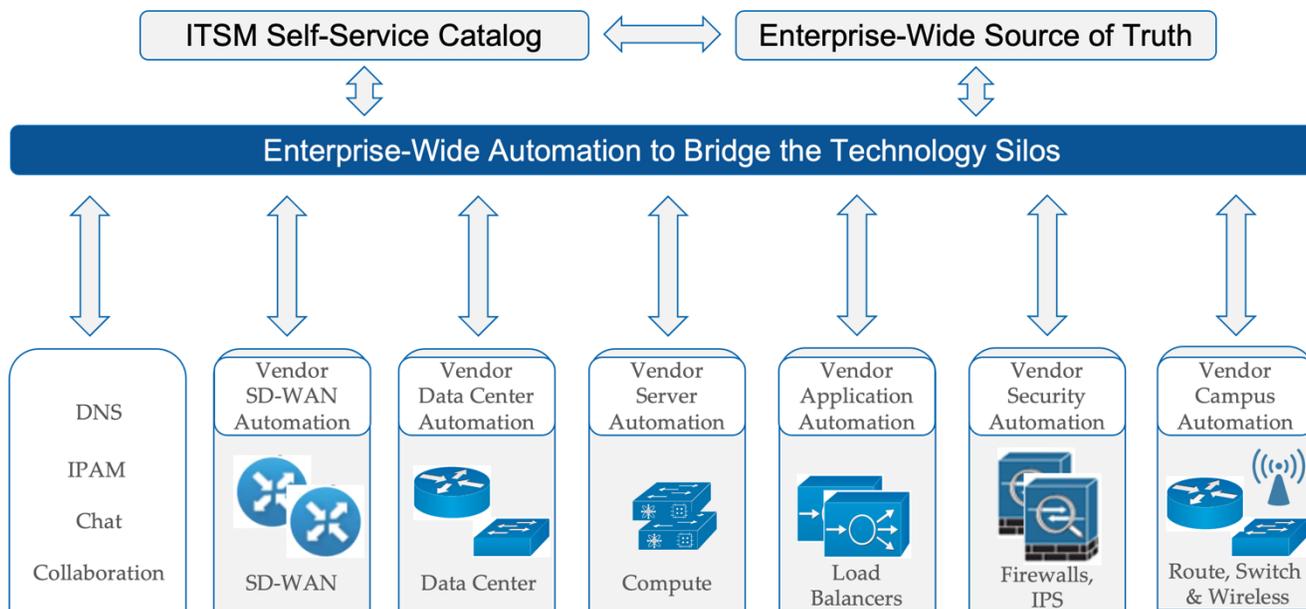


Figure: Fragmented Automation Silos per Technology Domain

Tooling, Testing, and Operational Limitations

The size, scale, and complexity of enterprise networks mentioned earlier will also lead to other limitations in tooling for test and operations. How often has a large enterprise needed to make a design or configuration improvement, but was limited by the sheer number of sites or devices that would need to be manually touched?

Take for example a large enterprise with thousands of remote sites connecting over VPN. Sometime after the initial deployment, the equipment vendor has released an improved encryption method for the VPN configuration. The new configuration option is faster to connect, fails over between dual circuits more quickly, and is generally a more stable connection. The enterprise might like to migrate to this new configuration, but the time required to manually touch each of the thousands of sites is prohibitive. Given all of the initiatives on the team's backlog, there simply is not enough time in the day to prioritize this activity, so the potential improvement will remain unrealized.

Consider a second example of an enterprise with thousands of dual WAN circuits for fail-over and resiliency. Do all of the standby circuits work as expected? How can they be sure without actively testing the alternate circuits in production? Does the out-of-the-box tooling offer this testing capability, or is a manual intervention required to test the failover circuit at each and every site?

Too many times, a recommended best practice cannot be implemented because of limitations in the tooling or because the effort would be operationally burdensome or impractical to do manually. Network automation offers an effective option to extend the capabilities of the out-of-box toolset. With a little know how and practice, your teams will be able to implement changes at scale that just were not practical to do manually prior to automation.

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Network to Code Methodology

Network to Code was founded on the belief that with a software-centric, programmatic approach to building, consuming, and operating IT infrastructure, enterprise and service provider organizations will recognize significant benefits and accelerate their digital transformation strategies.

We help companies transform the way their networks are deployed, managed, and consumed on a day-to-day basis by leveraging network automation, software development, and DevOps technologies and principles. We work with clients across all industries and geographies, taking a vendor- and tool-agnostic approach, making automation a reality for any network.

Our experience has shown that to be most effective, organizations must take a holistic approach to enterprise-wide transformation. Our methodology focuses on all three sides of the change triangle - people, process, and technology - to realize maximum benefits for you - the end client.

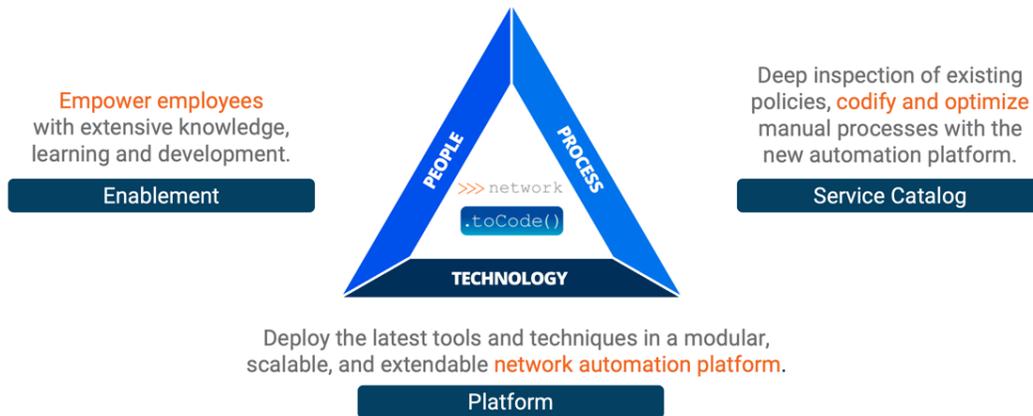


Figure: Network to Code Change Triangle

Professional Service engagements at Network to Code mirror this change triangle. As a Transformational Services client, you will partner with NTC teams that are organized by their expertise in Enablement (People), Service Catalog (Workflow Process), and Platform (Technology), as well as Solution Services for post-deployment support.

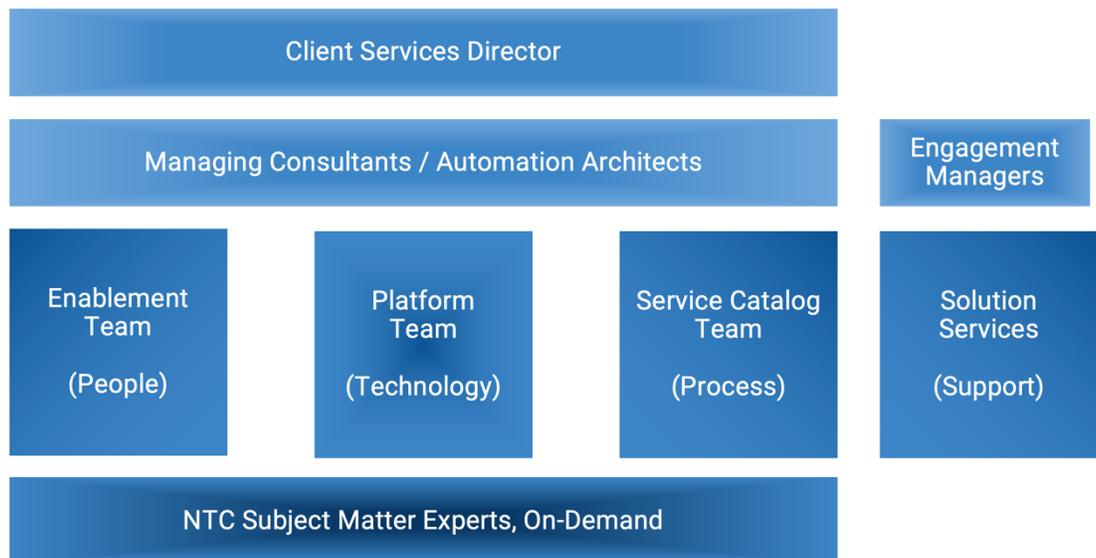


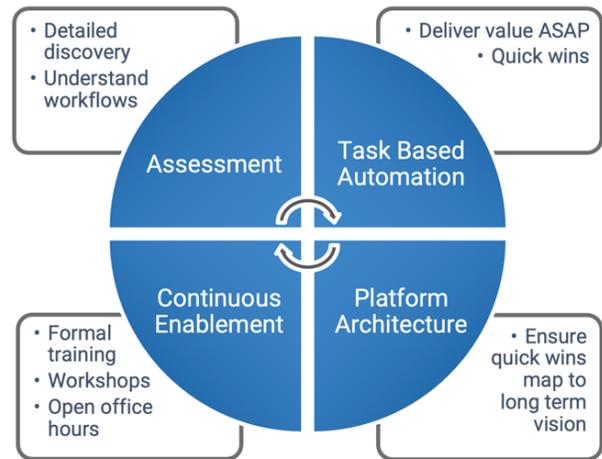
Figure: Typical Network to Code Team Structure

Transformation Services

Transformation Services are for organizations committed to making the shift from a legacy and manual approach of networking to a modern, agile, and software-driven approach that transforms how networks are deployed and managed on a day-to-day basis. These clients are “all-in” with a long-term, strategic engagement of 24 - 48 months in duration, supported by a dedicated team of NTC experts that are focused entirely on the client’s unique needs.

During the course of the engagement, you will benefit from the creation of a full end-to-end solution including:

- A detailed Network Automation Assessment
- Comprehensive 3-5 year Network Automation Plan
- Tailored NTC Reference Architecture for your needs
- Design and deploy the Network Automation Platform
- Design and deploy the Self-Service Catalog of workflows
- Implement telemetry and analytics to track and report the measurable benefits delivered by your automated workflows
- Receive continuous enablement for your staff to learn, operate, and extend the automation platform
- Partner with an expert support team to ensure your success



Transformation is about so much more than the technology or the platform. Your organization will be learning how to adopt new NetDevOps methods to work across departments, learning how to architect and design future networks with automation in mind, and your managers will be learning how to lead new agile teams that work on smaller, iterative changes to the network.

In addition to the dedicated client team, you will be surrounded by a deep bench of on-demand subject matter experts from Network to Code to guide your transition through these organizational changes.

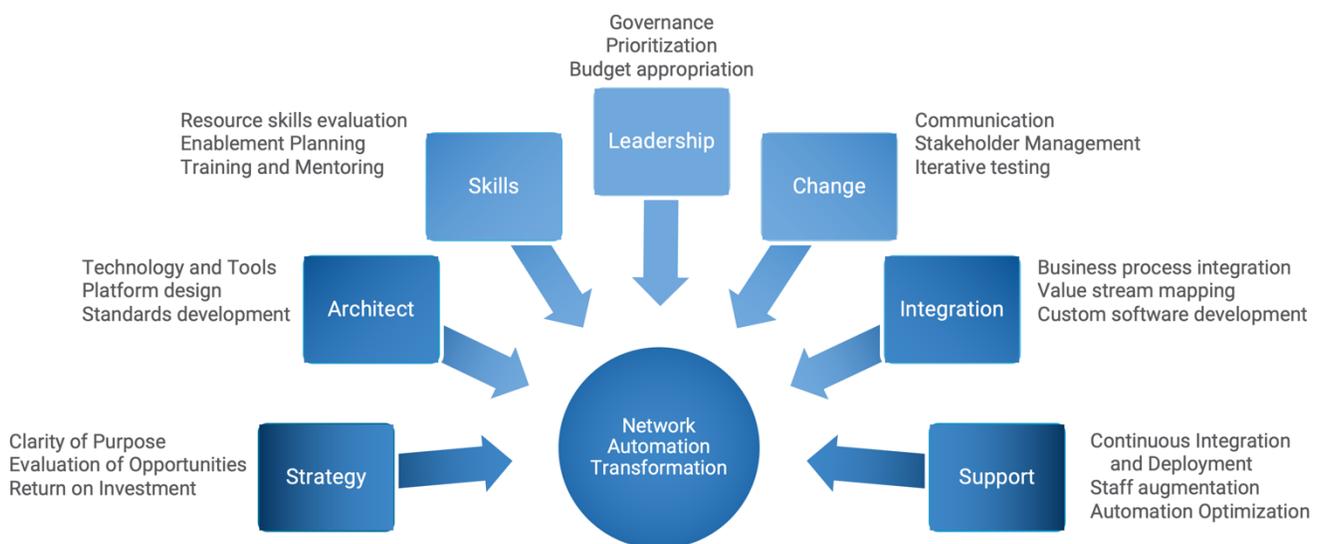


Figure: On-Demand Subject Matter Experts

Technology Transformation with a Network Automation Platform

Our team will design and integrate a robust set of tools within your existing infrastructure to serve as the foundation for all future network automation. Applying our best practices derived from years of experience, we'll work with you to build a system to operate your network as code, with proper version control, configuration and data management, CI/CD workflows, and security. We'll integrate the platform to third party applications, such as Microsoft Teams and ServiceNow, offering various consumption models to your users.

Reference Architecture for Network Automation

Through years of experience developing solutions for clients, Network to Code has developed an evolving reference architecture that is used as a comprehensive network automation framework and solution. This architecture encompasses the most common functional elements of any automation solution and illustrates how they interact with one another and how users interact with the system itself. It is intended to be used as a high-level guide when tailoring solutions for individual clients and use-cases, with the understanding that there is no one-size-fits-all approach.

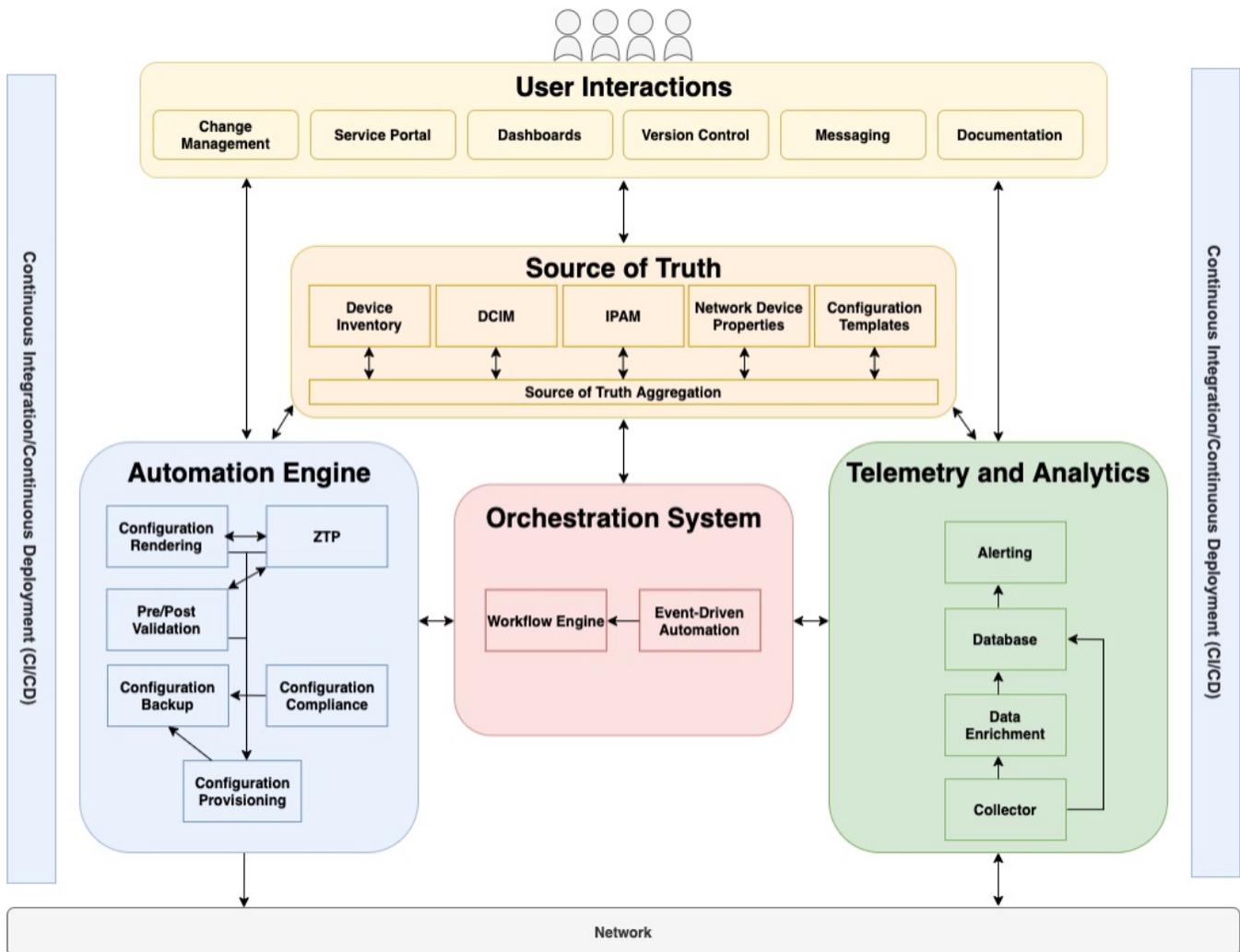


Figure: Network to Code Reference Architecture for Network Automation

Each of the following sections will describe the role of each functional block of the NTC Reference Architecture.

Source of Truth (SoT)

The Source of Truth encompasses all of the elements that define the intended state of the network, e.g. how the network should be configured and what the desired operational state of the network should be, including the tools that are meant to simplify the consumption of these types of data sets. This information is usually spread across many different tools and solutions.

Automation Engine

The Automation Engine includes all components required to deploy and push changes to the network as well as the commands and API required for diagnostics and troubleshooting. The overall change management workflow, often integrated as part of a Continuous Integration / Continuous Deployment pipeline in an automated environment includes many components that need to be considered carefully.

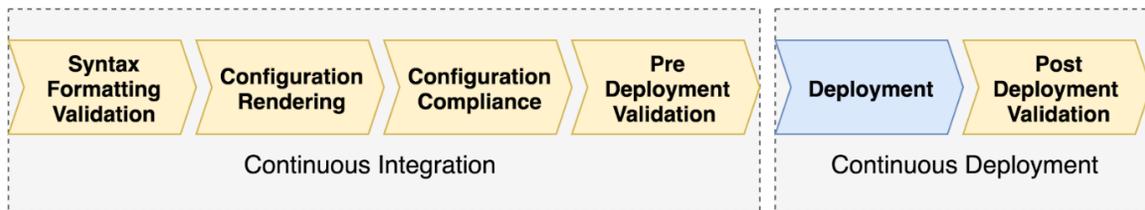


Figure: High-Level Change Management Pipeline

Telemetry and Analytics

Network Telemetry and Analytics is the evolution of Network Monitoring. Network monitoring has been around for decades, but in recent years there have been numerous new elements that have taken this discipline to the next level. A modern Telemetry and Analytics stack might look similar to a traditional network monitoring solution, but the main difference resides in the flexibility and the extensibility of these solutions. With the proper Network Telemetry and Analytics stack it is possible to collect, analyze, visualize, and alert on any information, across multiple domains of the infrastructure.

The Network Telemetry and Analytics stack is a critical piece of a network automation strategy and is a prerequisite to build advanced workflows and enable event-based network automation.

Orchestration System

While the heart of the orchestration system is a workflow engine, the orchestration system groups all of the components that are used to define advanced automated workflows and auto-remediation workflows triggered by incoming events from the network. The Orchestration system relies heavily on the other components: Source of Truth, Telemetry and Analytics stack and Automation Engine.

User Interactions

User Interactions group all the components that end users and contributors are using to interact with the network and the network automation platform. Whenever possible the recommendation is to leverage existing tools or solutions that are already used within the organizations like ITSM, e.g. ServiceNow or Chat, e.g. Slack/MS Teams. This approach maximizes the uptake of network automation because users will interact with the automation using systems they are already familiar with in their day-to-day work.

External Integrations

External integration includes interactions between the network automation framework and external systems regardless of the location of the system. The two main types of integration are: APIs and Webhooks. APIs are used for read/write operations: query information, create objects, start workflows while webhooks are mainly used as a notification mechanism.

Process Transformation with Workflow Automation

We work with customers to significantly reduce the time it takes to deliver tasks by using automation technology and vendor APIs, software development, and custom integrations. Our consultants will identify the right tools and technologies that fit your organization's needs, skill sets, and existing infrastructure to quickly automate the tedious, manual, repetitive tasks that consume your network engineering team's time.

Whether it's deploying switch port configurations, verifying current device configurations against corporate standards, or providing your application developers with required network services, we can take any common workflow and automate it.

Our workflow automation team will begin automating immediately following the initial workflow discovery to ensure value is quickly recognized on top of a minimal viable platform. As the platform is developed in parallel, we'll migrate these workflows on top of it to ensure proper performance, scalability, and reliability. We continuously build, groom, and prioritize a backlog of workflows making sure value is demonstrated and measurable results are achieved.

Service Catalog Definition

In order to transform network operations and simplify changes, there needs to be a self-service catalog of workflows that change requestors can choose from. During the Network Assessment phase of the project, Network to Code will meet key stakeholders within the network and surrounding teams to build out a service catalog.

The Network Assessment will focus on a few key areas, not limited to the following:

- Create a definition of a service within the context of your existing network operations.
- Implement a standard review process of existing tasks to streamline the development process of the service catalog.
- Identify security and access requirements for each service.
- Understand existing and repetitive tasks and estimated yearly person-time per task.
- Baseline common elements of existing tasks.
- Review all existing data sources that are in-use today that dictate how operators know what and how to configure on a network device within the scope of any given change.
- Create a cross-functional matrix of services to data sources to network domains and devices.
- Create and propose a self-service catalog.
- Scope the technical effort to implement each of the services.
- The outcome of the service catalog phase is the definition of a prioritized list of items that can be automated immediately ("quick wins") and longer-term within the network automation platform.

Process Analysis & Optimization

In order to effectively implement large scale network automation, we must analyze and document the current processes for the most common repetitive tasks performed today. As each existing process is documented, Network to Code will provide an analysis including if and how repetitive tasks should be changed with the implementation of a network automation platform.

It is only natural that process will have to change if the mechanism to store data, extract data, and deploy network changes is modified. Through this phase of process analysis and optimization, Network to Code will also ensure the items in the service catalog have processes and workflows defined to depict the human and automation interactions that will occur when using the network automation platform as the engine to perform changes and more general operational tasks. There will be detailed workflow diagrams built for each service that depicts each step and decision required in order for a change to be made including which steps could be automated, and which steps may require manual input.

People Transformation with Training and Enablement

Network Automation is not just technology - it is more importantly about people. Training & Enablement will transform the skills of network operators to be next-generation network engineers by leveraging network programmability and automation. The curriculum uses proven methods of engagement for various learning styles of each individual student.

Your team members will learn to use automation technologies to operate the business more efficiently, to respond to client requests more quickly, and to provide a higher level of service. But first they must be trained with the methods, tools, and

techniques to use automation. In addition, Network to Code will help your teams operate more effectively cross-organization by adopting modern agile development techniques.

Beyond Training

Our enablement team of consultants and trainers will work to build and deliver a unique education plan with custom trainings and workshops for on-going skills development throughout the length of the engagement. Each client program begins with a skills assessment of the team members to gauge their knowledge and experience level before and after training – so you get a tangible measure of improvement.

The Network to Code curriculum is extremely hands-on. For example, our signature five-day Network Programming and Automation course is half lecture and half lab time. Students receive live instruction on each topic, and then log into their virtual lab to put the skills they just learned into practice – maximizing retention of the content through personal repetition.

Recognizing that individuals have vastly different preferences for learning and development, our curriculum offers multiple forums for learning which range from live, instructor-based courses (offered in multiple global time zones) to self-paced training modules with videos on demand.

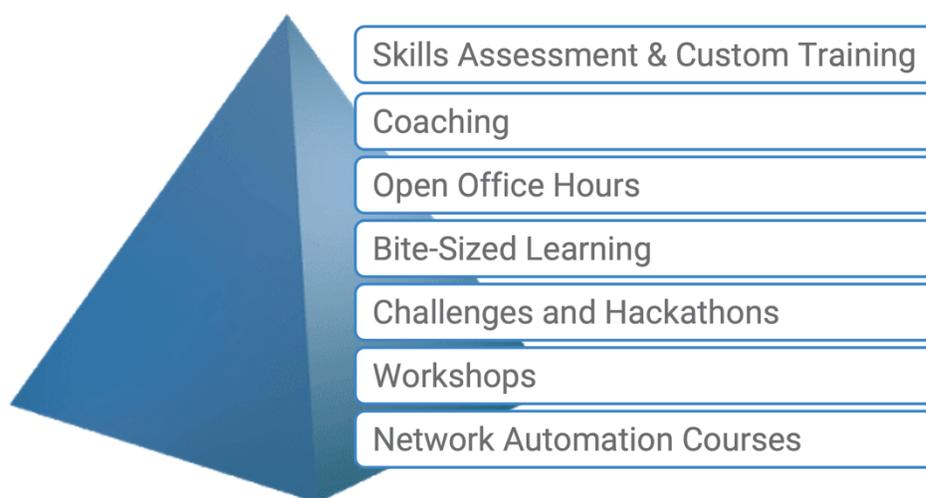


Figure: Enablement Options which Go Beyond Training

Acknowledging User Types

A common misconception is that all network engineers should become developers, but this is simply not the case. The Network to Code enablement program scales the training content for three types of engineers as follows.

- **Users of Network Automation:** As entry-level users, they will utilize an interface provided to them (ServiceNow, Chat Bots, or click-button interfaces) to activate pre-built automation workflows. No knowledge will be required to author or create new workflows.
- **Contributors to Network Automation:** As intermediate users, they will possess the knowledge and skills necessary to modify existing automation or create new workflows. These results will be built upon the existing automation platform. The new or modified workflows will typically be designed for reuse and added to the catalog of workflows for consumption by entry-level users. For example, contributors may create a new Ansible playbook using existing integrations.
- **Developers of Network Automation:** As advanced users, developers will understand the complete end-to-end automation platform. They hold the knowledge and skills to modify or extend the underlying platform with new capabilities and features. For example, developers will integrate the API of a new network system such as SD-WAN into the automation platform, which will enable contributors to write Ansible Playbooks built upon those new APIs.

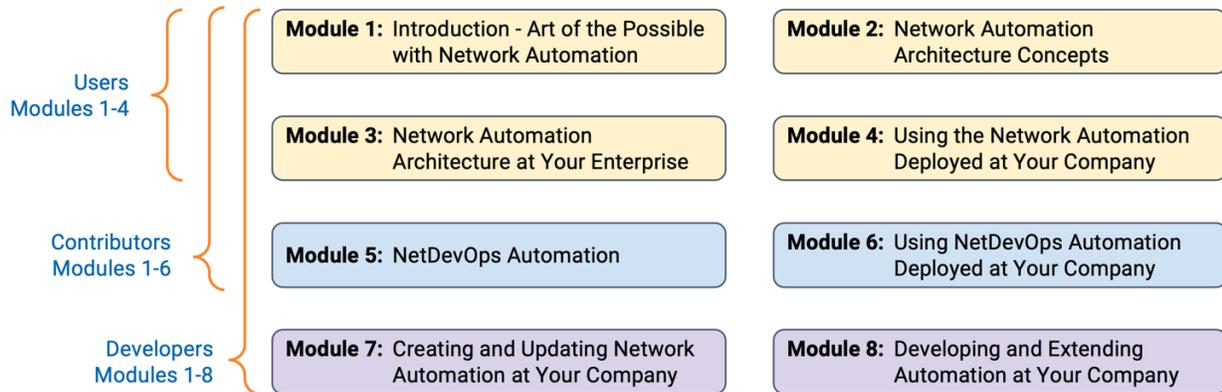


Figure: Example Scaling of Custom Training Content for Different User Types

Topic-Based Courses

In addition to the custom training content shown above, Transformation Enablement Programs may also include topic-based courses such as the examples shown below.

| Title | Audience | Type | Length | Schedule |
|---|-------------|------------|-------------|----------|
| Enablement Kickoff - Network Operations Re-Imagined | All | Bite-Sized | 1.5-2 hours | Month 1 |
| Getting Started with Linux and Text Editors | Level 1 | Workshop | 4 hours | Month 1 |
| Introduction to Data Structures (JSON, YAML, XML) | Level 1 | Bite-Sized | 1 hour | Month 2 |
| Introduction to REST APIs (Postman, Curl, API Docs) | Level 1 | Bite-Sized | 1 hour | Month 2 |
| Network Programming & Automation | Level 1-2 | Course | 5 days | Month 2 |
| Developer Environments | Level 1-2 | Workshop | 2.5 hours | Month 3 |
| Designing Networks for Automation | All | Bite-Sized | 1 hour | Month 3 |
| Configuration Templating (Jinja2) Deep Dive | All | Workshop | 4 hours | Month 3 |
| Source of Truth & Nautobot | All | Bite-Sized | 1 hour | Month 4 |
| Rundeck and AWX | Level 1 & 2 | Bite-Sized | 1 hour | Month 4 |
| Telemetry & Visibility | All | Bite-Sized | 1 hour | Month 5 |
| Extending Ansible | Level 2-3 | Training | 1 day | Month 5 |
| NetBox Extensibility | Level 2-3 | Workshop | 4 hours | Month 5 |
| Git & Travis | Level 1-2 | Training | 1 day | Month 6 |
| Automated Testing with Batfish | Level 2-3 | Workshop | 4 hours | Month 6 |
| Building a CI/CD Pipeline | Level 2-3 | Training | 1 day | Month 7 |
| NetBox Plugins | Level 3 | Workshop | 1 day | Month 7 |

Figure: Example Topic-Based Network Automation Courses

Technical Advantages of Network Automation

The tools and techniques of network automation bring a number of technical advantages, and their benefits are compounding. The iterative, closed loop methods of DevOps encourage continuous improvements. The standardization of designs will increase repeatability and re-use. A centralized source of truth and intent-based management increase quality and reliability, while new user interactions like ServiceNow and ChatOps encourage self-service with fewer interpretations of intentions between the original requestor and implementation.

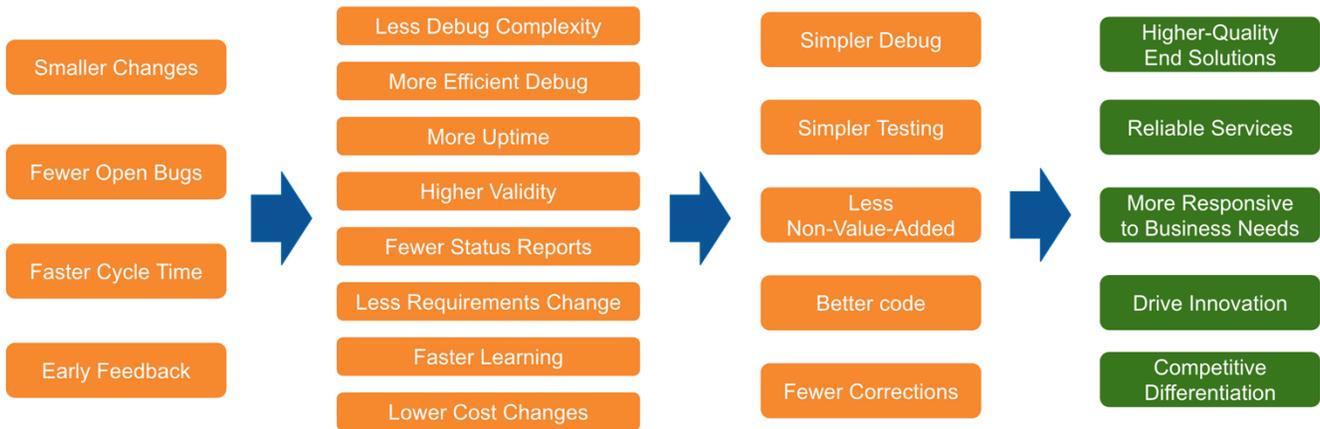
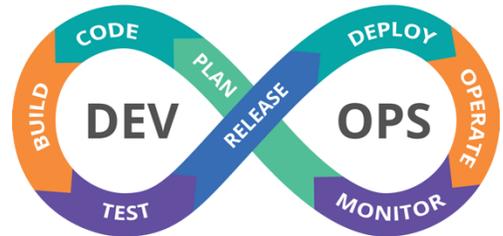


Figure: Compounding Advantages of Network Automation

Transformation is about adopting better operational practices that add up to significant change. Several of those improved operational practices are listed here for your consideration.

Embrace a NetDevOps Culture

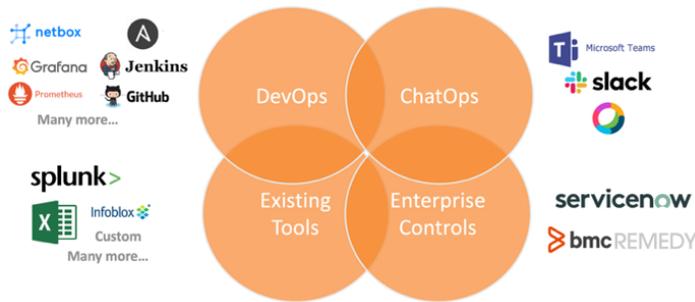
NetDevOps brings the culture, technical methods, strategies, and best practices of DevOps to Networking. DevOps is a new approach to software engineering that combines the “Development” and “Operation” of software into a single unified team and mindset. It is a full lifecycle approach where “if you build it, you own it” and accountability for success is forefront in everyone’s mind. Technical principles such as automation and monitoring are key to DevOps, but it is much more than just a “Continuous Development” practice. DevOps is a cultural change in IT focusing on providing solutions faster, more often, more reliably, and aligned with business requirements.



Advantages of a NetDevOps Culture

- Improve networking administration by breaking down silos, increasing automation, and reducing manual work.
- Increase efficiency by encouraging collaboration and communication between teams.
- Enable collaboration within and between teams to be more pragmatic and efficient when facing problems.

Adopt an Enterprise-Wide Platform for Network Automation



Most engineer’s exposure to network automation has been to power tools, such as stand-alone scripts, single-purpose Ansible playbooks, or custom applications. Power tools generally live at the individual or team level; they are created and used by a single developer for a single purpose with little reuse or extensibility. While perhaps quick and dirty to accomplish an initial task, power tools are inherently difficult and expensive to maintain in the long-term.

With Transformation Services, your teams will build and deploy an enterprise-wide platform standard for network automation. This strategy encourages maximum reuse of common tool sets and design patterns, which results in maximum portability and speed to value.

Advantages of an Enterprise-Wide Platform for Network Automation

- Pre-built integrations such as ServiceNow, SoT, and Telemetry speed development and time to value.
- Common tool sets and design patterns encourage code reuse and portability.
- A trusted and centralized Source of Truth enables all workflows to consume from and contribute to the most up-to-date information.

Adopt a Unified and Central Source of Truth

A centralized Source of Truth (SoT) will hold structured information models so that every data element is managed (or edited) in only one authoritative place. Any possible linkages to this data element from other systems are by reference only. Because all other locations of the data just refer back to the primary SoT location, updates to the data element in the primary location propagate to the entire system without the possibility of a duplicate or conflicting value present in other systems.

Any data can be stored within the Source of Truth including inventory, IP addresses, VLANs, VRFs, BGP ASNs, interfaces, connections, power feeds, circuits, and much more. The source of truth should be extensible for future data requirements that go well beyond what may be initially required.

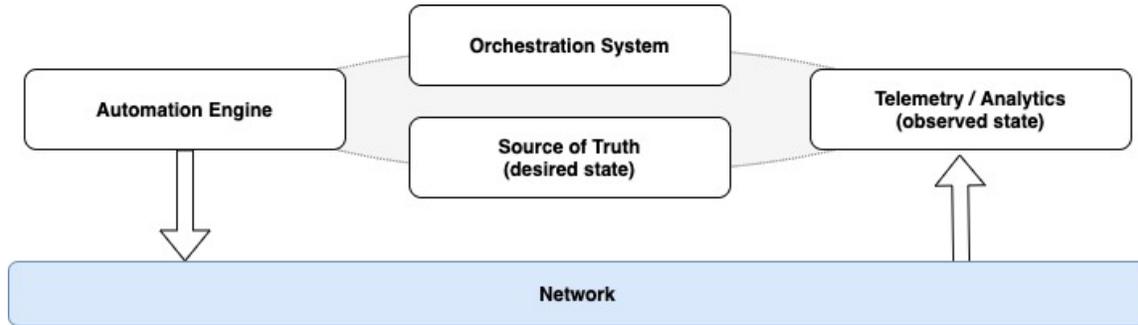


Advantages of a Unified and Central Source of Truth

- Eliminates manual files with duplication and discrepancies.
- Share data breaks down traditional information silos between departments.
- Updates are posted to a single authoritative source where all consumers will query for the most up-to-date information.

Adopt Intent-Based Network Management

The separation of *intended state* and *actual state* is critical to proper network automation. *Intended state* is the equipment configuration that the network engineers have planned to be deployed to the various elements of the corporate network. *Actual state* is the equipment configuration that is actually running in production on the network. A common use of network automation is to query the *actual state* of the network for comparison against the *intended state* of the network. Any differences between the two indicate a problem with either unintended changes being deployed to production or design documentation that requires updating.



Advantages of Intent-Based Network Management

- Implements proper separation of intended and actual state data.
- Enables streamlined configuration auditing of the actual network to match the intended design requirements.
- All subsequent and advanced network automation will depend upon intent-based networking to be properly deployed.

Embrace New User Interactions to Scale Adoption

New methods of user interaction will be implemented that meet users where they work. End business users will use self-service forms to request changes via ServiceNow. Support and operations may use read-only interactions with a chatbot for quick status and data collection to speed troubleshooting.

ServiceNow Form

Direct from Chat

Webhook from Source of Truth

| ID | Site | Group | Name |
|-----|--------|-------|----------|
| 121 | HOU-01 | — | vlan-121 |
| 122 | HOU-01 | — | vlan-122 |
| 1 | NYC | — | vlan-1 |
| 33 | NYC | — | test |

Direct from IT Ops Workflows

Advantages of a Self-Service ITSM Portal (ServiceNow)

- Many network changes are a result of ITSM requests. Connecting automation with the underlying business requests improves efficiency and shortens completion times.
- By organizing common requests from end users in a service catalog, patterns can be established and automation deployed to target the most repetitive tasks.

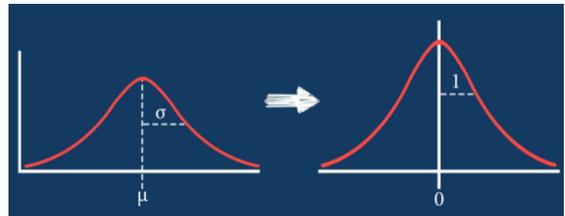
Advantages of Chat Bots

Interactive chatbots are incredibly powerful. They allow support personnel to quickly collect network information and speed troubleshooting and resolution.

- Find an IP Address
- View Rack Elevation
- View devices by role and site
- View top talkers
- View the health of the network (circuit, site, device)
- Execute an Ansible Playbook
- Perform pre-defined operations

Drive Standardization of Designs

Design Standardization refers to the practice of keeping the number of design variations to an absolute minimum. For example, sometimes network site designs are described similar to T-shirt sizes of “Small,” “Medium,” or “Large.” The design philosophy is to keep the number of variations small and drive high commonality across as many instances of a design as possible.



Some say that “*Standardization is the mother of automation.*” Perhaps better explained: Standardization increases the repeatability and reliability of a system to a point where automation can be deployed with high confidence in a successful outcome. Standardization drives consistency which drives trust in automation.

Advantages of Design Standardization

- Fewer permutations of a design results in fewer variations and inconsistencies between copies, which allows for simpler automation. And, simpler automation is more reliable.
- A shorter list of options will drive well-understood designs that are more frequently deployed with high repeatability and fewer backed-out change windows.
- Documentation, operational support, and troubleshooting are far simpler and may be aided by automation.

Adopt a Modern Development Environment

A development environment is a collection of procedures and tools for developing, testing and debugging network automation. The development environment normally has three tiers called development, test, and production. The purpose of a development environment is to have a place for a developer to test anything they want without worrying about it affecting any production users or systems.



Advantages of a Modern Development Environment

- Provides mandatory segmentation between active development work, acceptance testing and production.
- Automated quality checks can be required to pass before work may be promoted from Development to Test or from Test to Production.

Deploy CI/CD for Network Automation

NetDevOps is a principle, a philosophy, a culture, a discipline, and a set of holistic methodologies. It is not one tool, one process, or one particular set of CI/CD pipelines. NetDevOps is about bringing all that is good in Software DevOps and applied towards Networking – for an end goal where changes can be rapidly and reliably applied to your network.

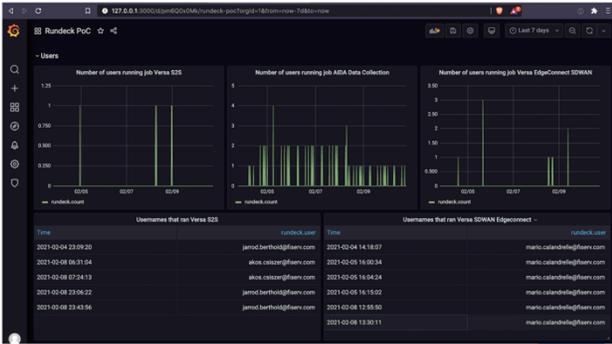
Continuous Integration / Continuous Deployment bridges the gaps between development and operation activities and teams by enforcing automation in building, testing and deployment of applications. Modern day DevOps practices involve continuous development, continuous testing, continuous integration, continuous deployment and continuous monitoring of software applications throughout its development life cycle. The CI/CD practice or CI/CD pipeline forms the backbone of modern day DevOps operations.

Advantages of CI/CD for Network Automation

- Smaller changes are simpler and easier to handle, with fewer issues that may need to be repaired at a later date.
- Fault isolation is faster to detect and easier to implement.
- Faster Mean Time to Resolution (MTTR) because the changes are smaller and faults are easier to detect.
- Test reliability improves due to the bite-size and specific changes introduced to the system, allowing for more accurate positive and negative tests to be conducted.
- Faster release rates with a higher confidence in the reliability of changes that pass the pipeline. You will gain confidence to allow more frequent network updates of well-understood changes, and experience fewer backed out changes.
- Smaller backlog. The benefits of solving non-critical issues ahead-of-time are many. For example, your network engineers will have more time to focus on larger problems or improving the system.
- Reduce Costs. Automation in the CI/CD pipeline reduces the number of errors that can take place in the many repetitive steps of CI and CD. Doing so also frees up engineer time that could be spent on other initiatives.

Deploy Telemetry and Analytics to Track KPIs and ROI

The Network Automation Platform will include extensive Telemetry and Visibility.



These features will document the ongoing migration of manual workflows to automation, the success-rates of the automation, as well as the time savings and efficiency gains realized by these initiatives.

Advantages of Telemetry and Analytics

- Document the ongoing migration of manual workflows to automation.
- Document the success rates and quickly identify any anomalies of the automation.
- Document the time savings and efficiency gains realized by these automation initiatives.

Business Benefits of Network Automation

When engaging with Transformation Services from Network to Code, you can expect your teams to complete more work faster, more efficiently, and more reliably than ever before.

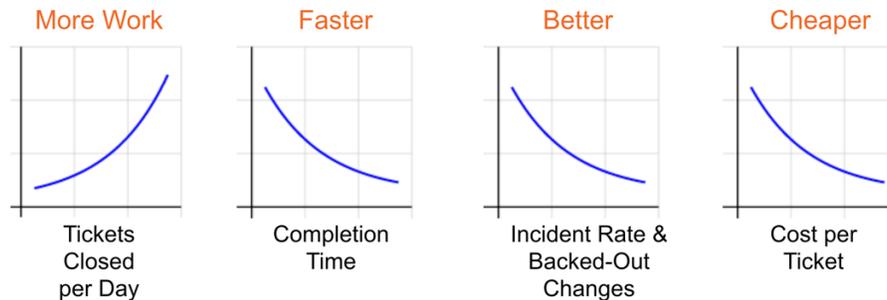


Figure: High-Level Results from Network Automation

Lower OPEX

Simplify your underlying infrastructure with automation, resulting in dramatically fewer hours required for configuring, provisioning, and managing network services. The completion times of automated tasks are significantly shorter than the manual tasks they replace, allowing more work to be done in the same amount of time. Standardization of designs and redeployment of known-good configurations will drive higher success rates with reduce costs from fewer backed out changes and fewer troubleshooting incidents.

Improve Reliability

Network automation solutions reduce the chance for human errors while delivering a higher level of services with more consistency across the network. Standardization increases the repeatability and reliability of a system to a point where automation can be deployed with high confidence in a successful outcome. Standardization drives consistency which drives reliability and trust in automation.

Increase Innovation

By automating repetitive tasks subject to human error, companies increase productivity, allocating more time to drive business strategy and innovation. The advances from network automation empower those teams to become drivers of innovation rather than a bottleneck resulting from the massive scale and complexity of modern networks.

Greater Insight and Network Control

Gain more visibility into the network, allowing IT operations to become more responsive to change through analytics. Instrument your automated systems to monitor and report on Key Performance Indicators, with time-series data available on-demand from live monitoring portals.

Increase Business Agility

Develop new network operational models that improve time-to-market with automation. Build, test, deploy, and optimize new network services quickly and continuously. The closed-loop methods of DevOps will also break down traditional departmental silos and encourage cross-team communication and collaboration to build shared solutions that benefit all stakeholders.

Why Network to Code

When partnering with Network to Code, you gain access to years of personal experience and intellectual property for cutting-edge network automation. Our engineering teams have been developing solutions for these problems since 2014, along with significant open-source contributions back to the larger network automation community.

Our flexible service offerings provide you with a dedicated team of experienced experts, backed by subject matter experts that are available on demand for advanced topics such as Source of Truth or advanced Telemetry and Analytics.

And Network to Code Support Services will be there to aide your continued development and provide maintenance support of the platform, workflows, and tools that we build together throughout the length of the engagement.



Network Automation Solutions Provider

Founded in 2014, we help companies transform the way their networks are deployed, managed, and consumed using network automation and DevOps technologies.



Industry-Recognized Thought Leaders

Working with clients across all industries and geographies, we promote a vendor- and tool-agnostic approach, making automation a reality for any network.



A Diverse Team of Top Performers

Engineers and developers in network automation, software and security, with leadership from vendors, integrators, and top tier consulting firms - all drive value to our clients.



Network Automation Community

18,000+ members and 300+ channels hosted at slack.networktocode.com

Conclusion

Network to Code offers Transformation Services for organizations committed to making the shift from a legacy approach of networking to a modern, agile, and software-driven approach that transforms how networks are deployed and managed on a day-to-day basis. The benefits of a software-driven approach include lower opex, improved site reliability, increased innovation, greater insight and network control, and increased business agility.

You will work with a dedicated team of specialists that is focused entirely on your unique challenges and initiatives. Our team will accelerate the delivery of positive outcomes for holistic transformation around the network automation platform, workflow automation, and team member enablement.

Network to Code's Transformation Services provide the leadership, cultural, and technical expertise to make your network automation initiatives a reality.

Resources

| | |
|--|---|
| Network to Code | https://www.networktocode.com |
| Network to Code Blog | https://blog.networktocode.com |
| Network Automation Community | https://www.networktocode.com/community |
| Open Source Nautobot for Source of Truth | https://www.networktocode.com/nautobot |
| Meet the NTC Team | https://www.networktocode.com/team |



```
>>> network.toCode()
```