WHITE PAPER

The Value of NQE

Make the Impossible Possible With Forward Networks' Network Query Engine (NQE)

Your network is complex and dynamic — and full of risk. It's also replete with "gold," aka your network data, which can tell you what those risks are and where they are lurking. That data can also help you understand what's in your network and whether those objects are operating as they should.

If you equip your network, security, and cloud teams with the right tools to surface that precious gold quickly, you'll save them from countless hours of manual work trying to dig it up themselves. They can instead devote their talents to critical projects that add value to the business and also steer clear of burnout.

The Network Query Engine (NQE) feature that's included in the Forward Enterprise platform from Forward Networks is a powerful tool for uncovering your network data gold, so you can use it to your advantage. It's also easy to use. With NQE, your network and security teams can search your network just like a database. NQE provides an open platform for accessing structured data about your network as human-readable, JavaScript Object Notation (JSON) data in a fully parsed form. This information is normalized and presented uniformly across the dozens of vendors, thousands of devices, billions of lines of configuration code, and multiple public cloud providers that you likely have across your enterprise network.

By structuring and normalizing this data, it becomes actionable for your entire IT team — as well as for other key stakeholders in your IT organization who need quick answers about network behavior and security and want to know the full inventory of objects in the network.

An End-to-End Experience Within the Forward Enterprise Platform

Forward Networks developed NQE a few years ago in response to requests from our customers who were looking to do more with the configuration and state data that our platform collects, parses, and normalizes. Forward Enterprise indexes the normalized and raw source data to provide rapid responses to network queries.

To help our customers search their network data, we initially created an application programming interface (API) that paired well with any programming language, such as the Python programming language. Network engineers could write scripts in Python, pull the data they wanted from the Forward Enterprise platform, and then analyze that data in an environment separate from our platform. However, while Python is a very flexible, general-purpose programming language, not all network teams were well-versed in programming and maintaining Python codebases. In addition, this put the burden of deploying and operating these data processing scripts on the network team, an unwelcome demand on already busy network engineers.

To help our customers work smarter and faster, we built NQE as a user-friendly, end-to-end experience within the Forward Enterprise platform. NQE enables network engineers to easily query their data without coding or other tools. Network engineers don't need to learn Python because NQE lets them build queries in a simple query language, often by simply clicking on data fields of interest.

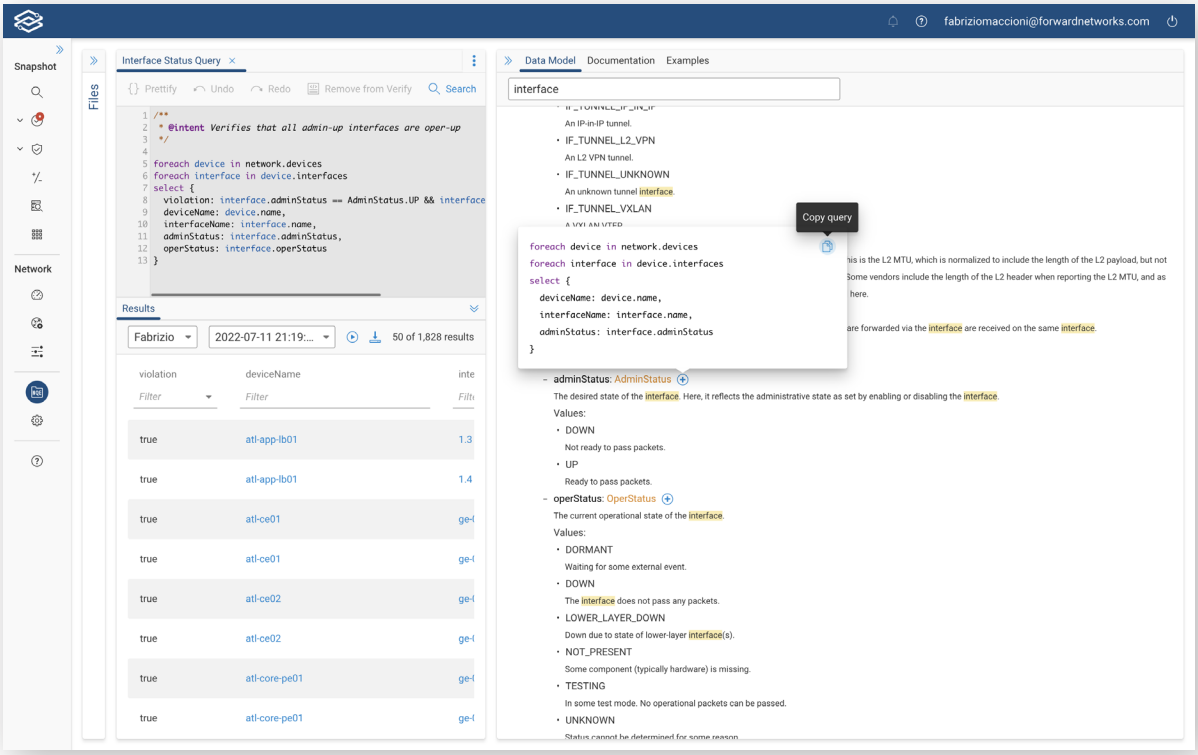

Figure 1 - Query example from built-in NQE Data Model documentation

They don't need a code IDE or version control system because NQE provides this in the platform. And they don't need to worry about deploying code and operating servers because NQE automatically runs queries on every new snapshot, generates new failure notifications, shows trends on dashboards, and denotes differences between snapshots. This integrated system reduces the learning curve and helps network administrators get results faster.

Queries That Stay Fresh, and Data That's Kept in Sync

NQE query results can be turned into verification checks that Forward Enterprise runs with every snapshot it takes of network configurations and device state, so your team can monitor trends over time. Importantly, once NQE queries are written, they will continue to perform as the network changes and ages. The information that NQE queries provide is also easy to share throughout the IT organization.

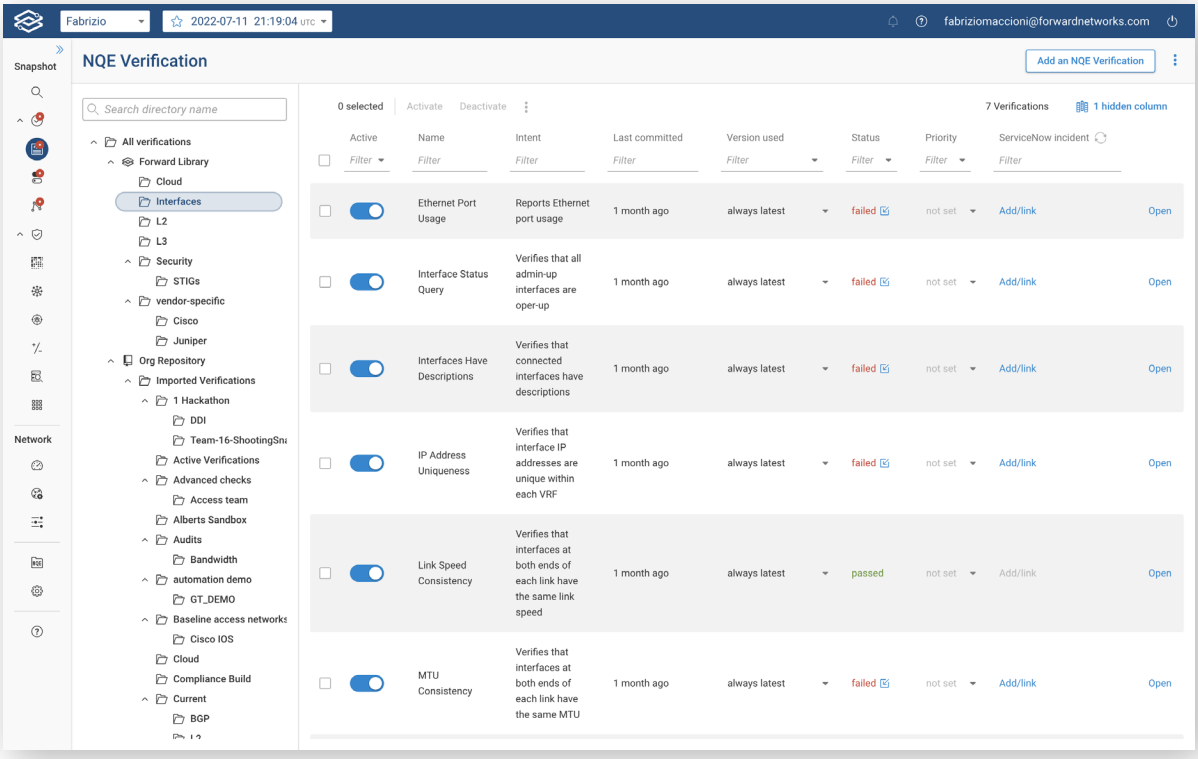

Figure 2 - NQE Verifications

NQE also integrates with data about your network that you already have. Most IT teams have started their automation journey, which means your teams have already documented network device inventory; various settings, such as IP address assignments; spreadsheets; and perhaps, YAML or JSON documents in Git repositories. All of that work is leveraged with NQE to provide maximum benefit for your investment.

Forward Enterprise can integrate with all this existing data and keep copies of it in sync with every network snapshot, so you can gain new insights into your network.

Key Benefits of Using NQE

The current evolution of NQE in the Forward Enterprise platform lets you search your entire network for devices by type, specific configuration, IP address, MAC address, and much more. There are also hundreds of prebuilt verification checks loaded into the Forward Enterprise platform to make the most common tasks easy to perform. Engineers can also craft custom searches using REST API.

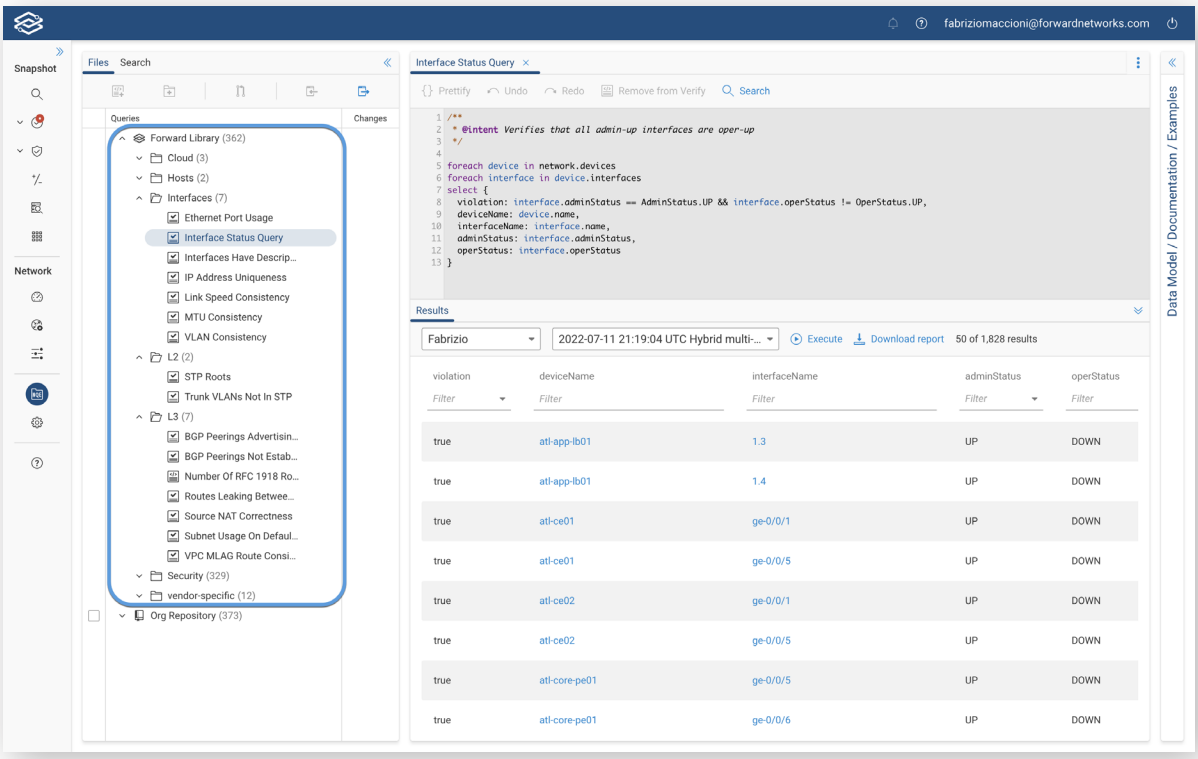

Figure 3 - NQE Forward Library

Following is an overview of some key benefits your organization can realize from using NQE:

GET NETWORK INSIGHTS

Because NQE is a network database that allows your IT team to use simple queries to gain deep insights into your network's configuration and operation, it can help them quickly answer questions that would otherwise take them a lot of time to address, such as:

- Which allocated IP addresses and subnets are actually in use?
- Which Border Gateway Protocol (BGP) sessions are currently down?
- Which digital certificates are about to expire?

INCREASE AGILITY

NQE, as an easy-to-query database, makes it possible to rapidly turn ideas into answers. Your teams can glean powerful actionable insights in minutes or hours — not months. And if they can respond rapidly to unexpected requests for information, your organization can finish more critical projects, faster.

PROACTIVELY UNCOVER ISSUES

Every network troubleshooting session uncovers some insight — some lesson learned about what type of configuration and state combination can lead to operational problems. You can take those lessons and encode them as best practices in queries, and then use NQE to run those queries on all devices across your network to surface where else an identified problem may already exist or could potentially arise.

AUTOMATE BEST PRACTICES

Best practices encoded in NQE queries are run automatically on every snapshot of your network, multiple times per day, in the Forward Enterprise platform. You can track your progress toward eliminating known problems with charts that show how these violations are trending over time.

What Makes Forward Networks' NQE Unique?

It structures and normalizes your enterprise network data.

It allows you to access data from deep within your network for analysis.

It provides data unique to your network digital twin, which is created by the Forward Enterprise platform and delivers actionable insights in context.

It integrates with data sets you already have (e.g., spreadsheets, YAML files).

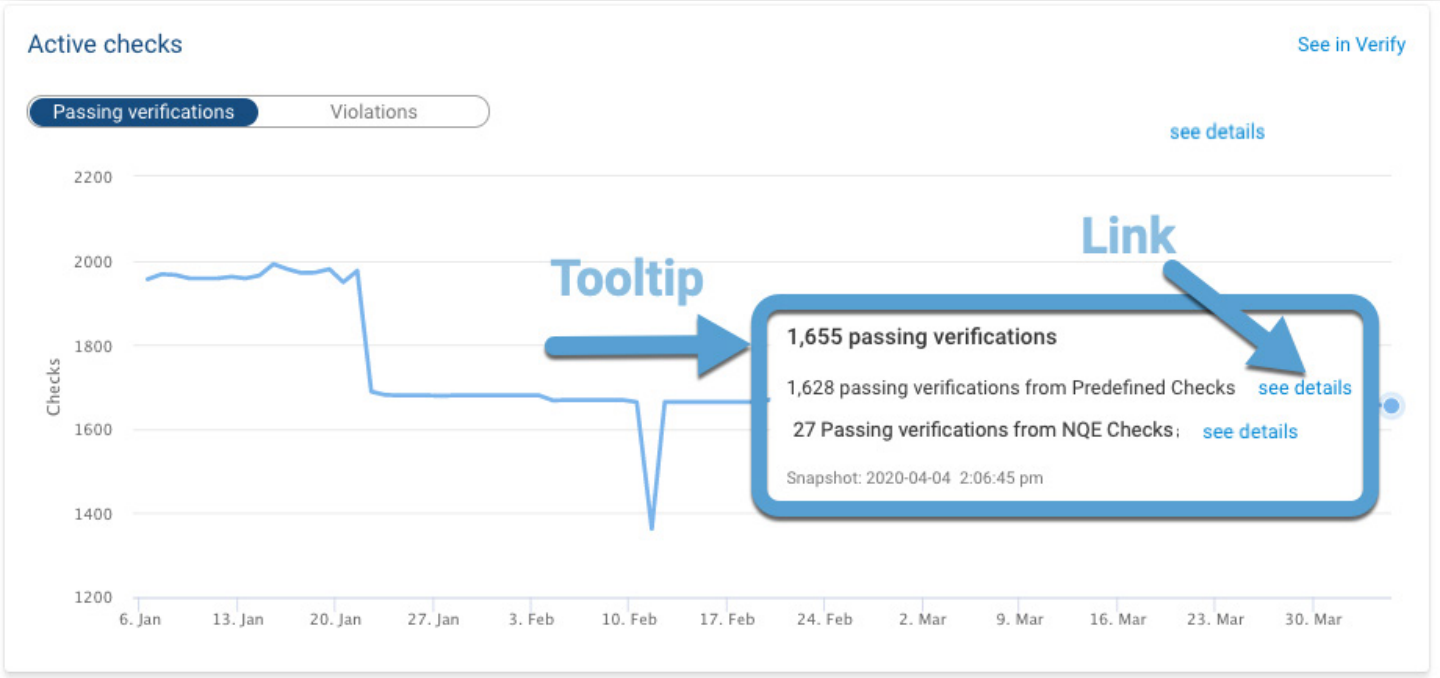

Figure 4 - Verification trends

BOLSTER NETWORK SECURITY

Your network is a sensor. It has eyes on your IT infrastructure, and what it sees is of great interest to your security teams. For example, the network sees hosts on the network, even if those hosts aren't running agents or they're registered in unexpected ways. Use the NQE feature in the Forward Enterprise platform to find those hosts and determine where they're located and where they've been over time.

STREAMLINE DEVELOPMENT

Because NQE normalizes and structures network data, your developer teams don't need to figure out how to parse each vendor's specific formats. That means they no longer need to spend time seeking answers to questions such as:

- Which commands do we need to run?
- What format do we need to use?
- Does this MTU (maximum transmission unit) include the Layer 2 frame — or not?

Forward Networks can provide a catalog of all the data available in your network digital twin, and your developers can use NQE to find the data of interest within that catalog. They can write a query once and run it on all devices. And they don't need to write a lot of code — think 10-20 lines versus hundreds or even thousands of lines.

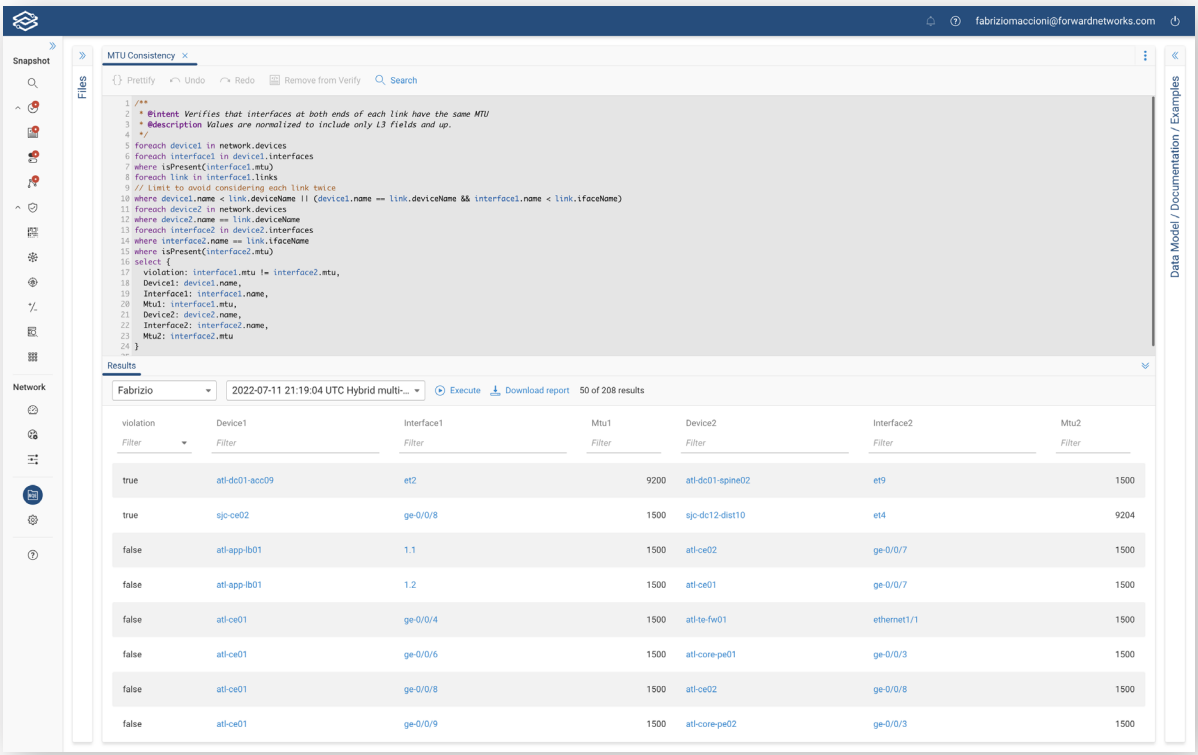

Figure 5 - MTU Consistency query example

FORWARD NETWORKS' NQE IN ACTION

Ever since Forward Networks made NQE even easier to use, we've been closely following how our customers have been utilizing the tool to surface their network data gold, so we can understand how NQE is creating value for them.

What we have learned is that NQE is often helping them to make the impossible possible. They are surfacing actionable insights that they would never have been able to get at, or perhaps even thought to look for, before they started using NQE.

The following are just a few recent use cases that highlight the bottom-line business value that organizations are realizing with the NQE feature included in the Forward Enterprise platform:

NQE USE CASE 1: AUTOMATED DESIGN VALIDATION

Bottom-line result: Avoidance of a costly, critical outage due to potential backup failure

When the fun temporarily stops at an amusement park because of a technical glitch with a ride or attraction, it's more than just a disappointment for attendees. The downtime can cost the venue's operator $100,000 per hour, on average, according to the International Association of Amusement Parks and Attractions (IAAPA). And, of course, there is the cost of potential brand reputation damage.

Even something as small as a light bulb can wreak havoc on an entertainment experience if that bulb doesn't turn on at the right moment or if backup systems fail.

One network engineer who works in infrastructure operations and service delivery at a famous U.S. amusement park recently encountered this situation. He was leading an IT team tasked with verifying the integrity of the network designs for rides and attractions as part of an internal hackathon event.

The team decided to use Forward Networks' NQE checks for design verification to see if it would help save time. It did — in fact, using NQE checks reduced the design validation process to less than five minutes, instead of the hours typically required to log into network devices and review configurations manually. But the NQE checks helped the team do something even more important: validate circuit redundancy and identify missing links.

They discovered that if the primary circuits or links failed during a light show held nightly at the park, that live event would come to a screeching halt because the redundant circuits or links weren't set up to kick in. "It was a problem we didn't even know we had, and we weren't even looking for it," the network engineer said. "If we hadn't run these checks on NQE, any failover scenario we might have had would've been unsuccessful, causing massive segments of the show to go down. We avoided an outage that would've been impossible to calculate by preventing a spectacular customer service fail."

Moreover, the team was able to leverage their work to define the attraction's network design in NQE to validate the design of other attractions that followed a similar design but with different parameters.

NQE USE CASE 2: LEVERAGING NETWORK DATA FOR INFORMED DECISION MAKING

Bottom-line result: $6 million savings in unnecessary IT costs

Networks change over time, making it increasingly more difficult for network teams to get full visibility into a network's structure. That lack of insight can be costly, as a large government agency in the United States discovered after deciding to refresh its network infrastructure down to its Layer 2 switches.

The agency's IT team first turned to the Forward Enterprise platform to help them save hours of manual effort that would otherwise be required to synchronize spreadsheets from various inventory tools and internal sub-organizations. However, it turned out that the rapid insights about the network that they derived from the NQE feature were even more valuable.

One of the agency's executives wanted to know what the Layer 2 network switches were connected to because he wanted to identify opportunities to reduce IT costs. He was particularly interested in finding out whether the agency still needed to support all the 100 megabit interfaces in its network, which were expensive to maintain, or if the organization could standardize on the 1 gigabit Ethernet standard.

The agency used Forward Networks' NQE to create an inventory of all the devices connected to the network switches by MAC and VLAN. That list was then cross-referenced with the manufacturer to determine what was actually connected to the agency's network switches.

The team discovered that the agency didn't need to support all those 100 Mb interfaces because the devices connected to them would support 1G. The network was then upgraded to 1G across the board — saving the agency more than $6 million in IT costs annually.

Without the Forward Enterprise platform and NQE, the agency would not have conducted the network inventory, and now, would not only be supporting unnecessary devices at a high cost but also likely facing future device failures as it evolved its network.

NQE USE CASE 3: COMPREHENSIVE SCAN FOR ALL INSTANCES OF A CRITICAL MISCONFIGURATION

Bottom-line result: Pinpointing the root cause of a massive network outage

A major U.S. airline experienced a highly disruptive systemwide outage that was both costly and reputation-bruising.

The network team eventually discovered the root cause of the outage: a Network Address Translation (NAT) rule in a load balancer that was rewriting the source IP address to an interface address belonging to another router on the network. This glitch meant that network traffic wasn't returning to the load balancer, as it should, and thus, was being dropped. The team addressed this problem and restored service.

However, the team was not satisfied with just fixing this one point problem. They wanted to prevent this sort of issue from ever happening again. After all, a similar NAT problem might be lurking elsewhere in the network and might be triggered tomorrow or next week.

To prevent this issue from reoccuring, the airline's IT team used NQE to search for every problematic NAT rule in every device across all operating systems from every vendor in the company's network. Using one simple query in NQE, which required about 20 lines of code, the IT team was able to check every corner of the airline's network, fix every occurrence of the problem, and ensure that it never goes undetected again.

Your Network Data Is Gold — Get the Most Value From It With Forward Networks' NQE

The use cases above are only three examples of how NQE is making the impossible possible for enterprises in the public and private sectors by providing structured and normalized network data that is easy to search and delivers previously unavailable insights.

These insights, using data from your network's digital twin available in the Forward Enterprise platform, can help ease the burden on and elevate the performance of your network and security teams, and help technology leadership in your organization make more informed decisions that can improve the health, functionality, and security of your enterprise network environment — including your hybrid and multi-cloud environments.

To learn more about how your business can use NQE and the Forward Enterprise Platform to get the most value from your network data gold, schedule a demo today.

ABOUT FORWARD NETWORKS

Forward Networks' mission is to de-risk and accelerate network operations by increasing efficiency, reducing outages, and verifying network intent. Built on a series of breakthrough algorithms, the Forward Platform provides enhanced network visibility, policy verification, and change modeling for legacy, SDN, or hybrid environments.

Forward Networks is headquartered in Santa Clara, California, and funded by top-tier investors, including Andreessen Horowitz, DFJ, A.Capital, SV Angel, and several luminaries in the networking and systems space.