

The Self-Driving Network

The Future State of Operations for Cloud-Grade Networking

Introduction

“Cloud-Grade Networking” builds on carrier-grade reach and reliability and enterprise-grade control and usability, bringing cloud-level agility and operational scale to networks everywhere. Cloud-Grade Networking essentially adds a new set of principles and capabilities to what the industry already knows, making networks less capital intensive, more automated, and ultimately better suited for innovation, both on and within the network.

In many ways, Cloud-Grade Networking is an acknowledgement that the way networks are currently designed, built, and operated is changing. While these principles might have originated with the major cloud-scale properties, they are now transforming networks of all shapes and sizes, across all industry verticals.

What is the Self-Driving Network

The vision of a self-driving network describes the eventual combination of telemetry, workflow automation, DevOps, and machine learning to create an infrastructure that is responsive, adaptive, and ultimately predictive. The Self-Driving Network™ is the natural culmination of the automation, DevOps, and analytics efforts currently sweeping the industry.

Networks are complex, and that complexity has two major implications. First, it takes a team of certified professionals to build, operate, and manage a traditional network, and the effort is hugely labor-intensive. Second, due to their complexity, networks are often fragile and intolerant of change. As a result, traditional networks are the bottleneck in most IT operations, largely due to the unwieldy processes required to insulate companies from change-induced failures.

The end goal of the Self-Driving Network is to reduce the amount of friction involved in making changes. This will have the dual benefit of speeding up operations while reducing fragility, allowing companies to focus their efforts on business difference activities rather than merely keeping the lights on.

Technology Requirements for the Self-Driving Network

To achieve the vision of the Self-Driving Network, several critical technology areas must be considered:

- **Telemetry:** SNMP, streaming telemetry, and deep packet inspection (DPI) are beginning to show limitations. The Self-Driving Network needs telemetry based on push semantics and anomaly detection based on machine learning. Telemetry will be active, zooming in and out as needed. Deep telemetry helps determine device state, customer state, and packet state.



- **Automation:** Operators today automate topology discovery, path computation, and path installation. When networks are self-driving, service placement and service motions are automatic, upgrades are based on configured services, and network responses are inductive, based on machine learning.
- **Declarative intent:** Autonomous networks will operate based on hints and suggestions rather than constraints. Services will self-assemble to form a cohesive customer experience, and the network will make decisions based on its knowledge of the most valued customers, application priorities, or peering costs.
- **Decision making:** Today's rules-based systems involve simple programming (if X happens, then do Y). These rules are rigid and programmed. Machine learning will move decision making from static programming to algorithms that learn from data inputs, make predictions, and take appropriate actions. The more data that is fed into training algorithms, the smarter networks become.
- **Local and global views:** As part of software-defined networking (SDN), network management and control are becoming more centralized. While local awareness will remain essential, increased global awareness will usher in the Self-Driving Network, featuring root cause analysis via supervised learning; time-based trending to establish and adapt baselines; correlation of information across geographies, layers, and peers; and optimal local decisions based on a global state.

The Journey to the Self-Driving Network

Only part of the technology required for the Self-Driving Network exists today. This means that the migration to autonomous networking, which involves little direct human interaction, will be a journey for the entire industry.

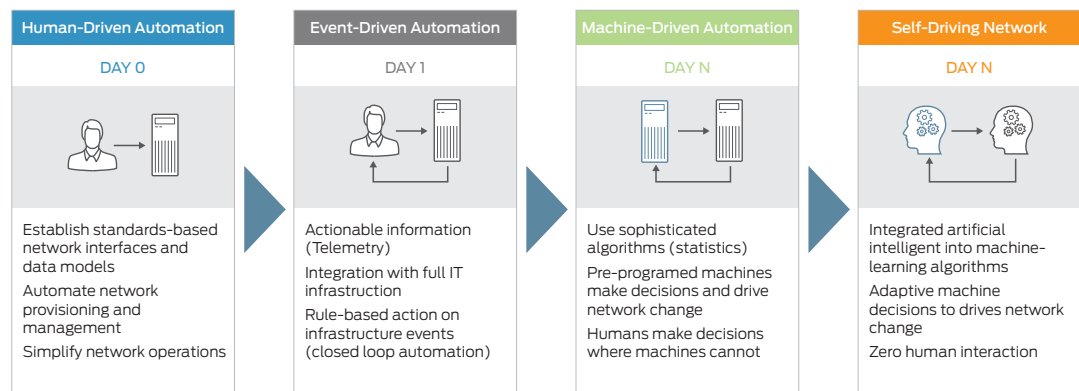


Figure 1: The journey to the Self-Driving Network.

That journey begins with human-driven automation. Built primarily around existing network interfaces and data models, human-driven automation leverages common scripting languages to automate day-to-day tasks. Colloquially, this is the equivalent of a network engineer setting up a chain of dominoes and then knocking over the first one.

As telemetry and rule-based actions are adopted, human-driven automation will be replaced by event-driven automation. Event-driven automation focuses on integrating data sources and then creating appropriate rules (if this, then that). Scripted responses are executed when a defined event occurs. Using the domino analogy, event-driven automation is where the operator sets up the dominoes, but the system knocks over the first one.

Telemetry data forms the foundation for machine learning, a combination of state and events that allows operators to develop algorithms that drive network behavior. Combined with declarative intent, operators fundamentally evolve from specifying configurations to documenting higher level intent. For example, an engineer might indicate that an application must be PCI or HIPAA compliant, but would not necessarily translate that into a device configuration. In this model, the system not only knocks over the dominoes but also sets them up, using operator intent as the map.

Finally, machine learning will yield to first augmented and then eventually artificial intelligence. The Self-Driving Network will ultimately read and react to conditions within and around the network, creating an environment that is both adaptive and predictive. In the Self-Driving Network, operators do not even provide a domino map.

Conclusion: A Journey Starts with a Single Step

The most fundamental starting point for automation begins with a question: what should be automated?

The vast majority of companies pursuing automation will not be able to answer this question. In a networking context, the answer is commonly "the network." But a network cannot be automated any more than a table can. Automation is about verbs; it is about making the act of doing something more automatic. If a company cannot identify what that something is, it is not ready for automation.

The path to self-driving Cloud-Grade Networks starts with people and processes, not technology. Identifying key workflows to automate is critical, forming the foundation for the technology transformation to follow.

About Juniper Networks

Juniper Networks challenges the status quo with products, solutions and services that transform the economics of networking. Our team co-innovates with customers and partners to deliver automated, scalable and secure networks with agility, performance and value. Additional information can be found at [Juniper Networks](#) or connect with Juniper on [Twitter](#) and [Facebook](#).



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