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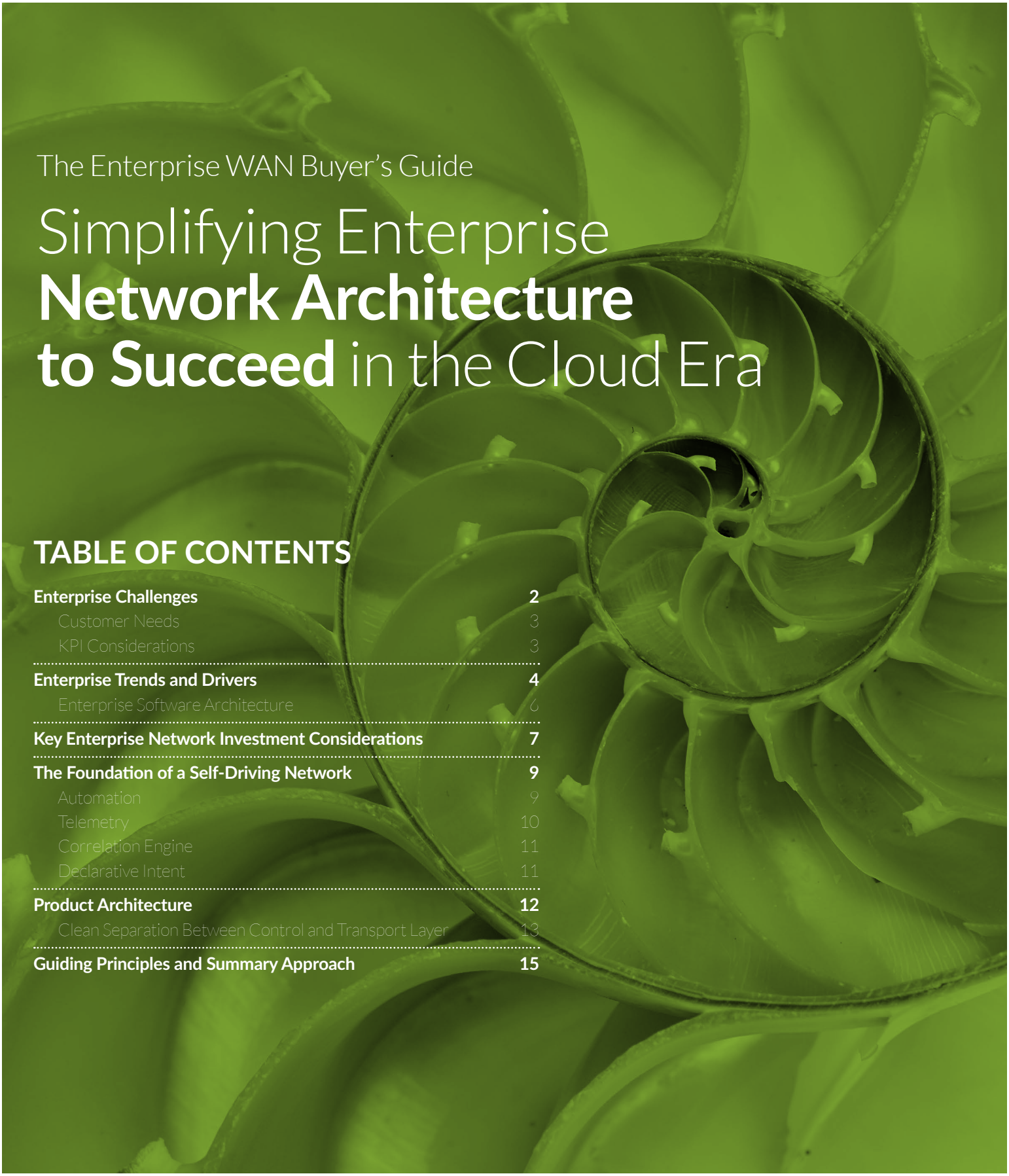


The Enterprise WAN Buyer's Guide

Simplifying Enterprise **Network Architecture to Succeed** in the Cloud Era

TABLE OF CONTENTS

January 2019

Enterprise **Challenges**

The Enterprise WAN Buyer's Guide

Simplifying Enterprise **Network Architecture to Succeed** in the Cloud Era

Enterprise Challenges

- **While the benefits of virtualization are well understood, enterprise IT organizations are challenged on many fronts to bring those benefits to fruition.**
- **Top-of-mind issues center around meeting the network and application services KPIs at the lowest cost point.**
- **In other words, enterprises are on the hunt to do more with less without compromising services.**

Customer Needs

IT Service Availability and Usability

When surveyed, Juniper's enterprise CIO customers say IT service availability is the one key priority keeping them awake at night.

With many applications running in different modes (on-premises, cloud, or hybrid), networks are challenged more than ever with seamless roll-out and simple, effective manageability. These are critical as they get rolled into service availability and MTTR (Mean Time to Resolution) as a measurable performance indicator.

Automation

With ever-shrinking IT budgets, the expectation from IT teams is to deliver more with less while maintaining availability. Driving operational simplicity and lowering costs means minimizing operational errors. This is driving them to automation.

Agility

IT teams within enterprise organizations are under constant pressure to deliver services on time. But users do have choices, like Software as a Service, or hosting applications in the public cloud. While agility becomes an imperative, cloud adoption is inevitable, especially with benefits like CapEx reduction, on-demand horizontal scale, and utility pricing that's based on consumption.

KPI Considerations

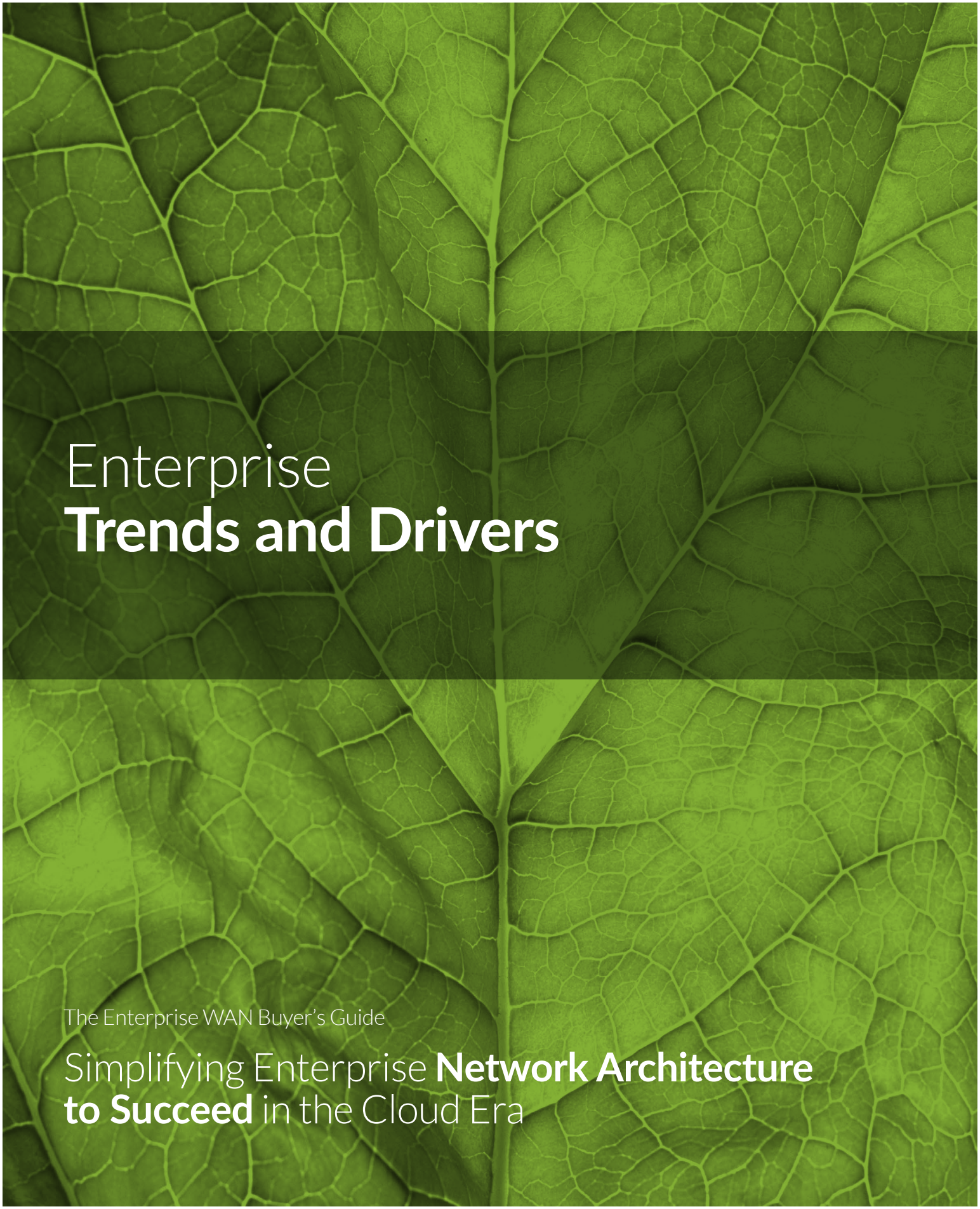
Cost, complexity, and application availability can be deeply impacted by some of the key KPI considerations highlighted in the following:

Fragmented Orchestration and Tools

While there is a tight coupling between networks and applications, the reality is that they're siloed by the fragmentation of tools used for orchestration and operations. This adds friction to the adoption of virtualized services, as well as day-to-day operational challenges in maintaining service performance.

Hybrid Applications and Hybrid Cloud Connectivity

As virtualization spans multicloud (on-premises, public cloud, or a combination of these), it amplifies problems further. Most often, large enterprise organizations would have hybrid applications and cloud connectivity. This could be for any number of reasons, such as custom applications too cumbersome for cloud migration and/or applications housing sensitive or regulated data.



Enterprise **Trends and Drivers**

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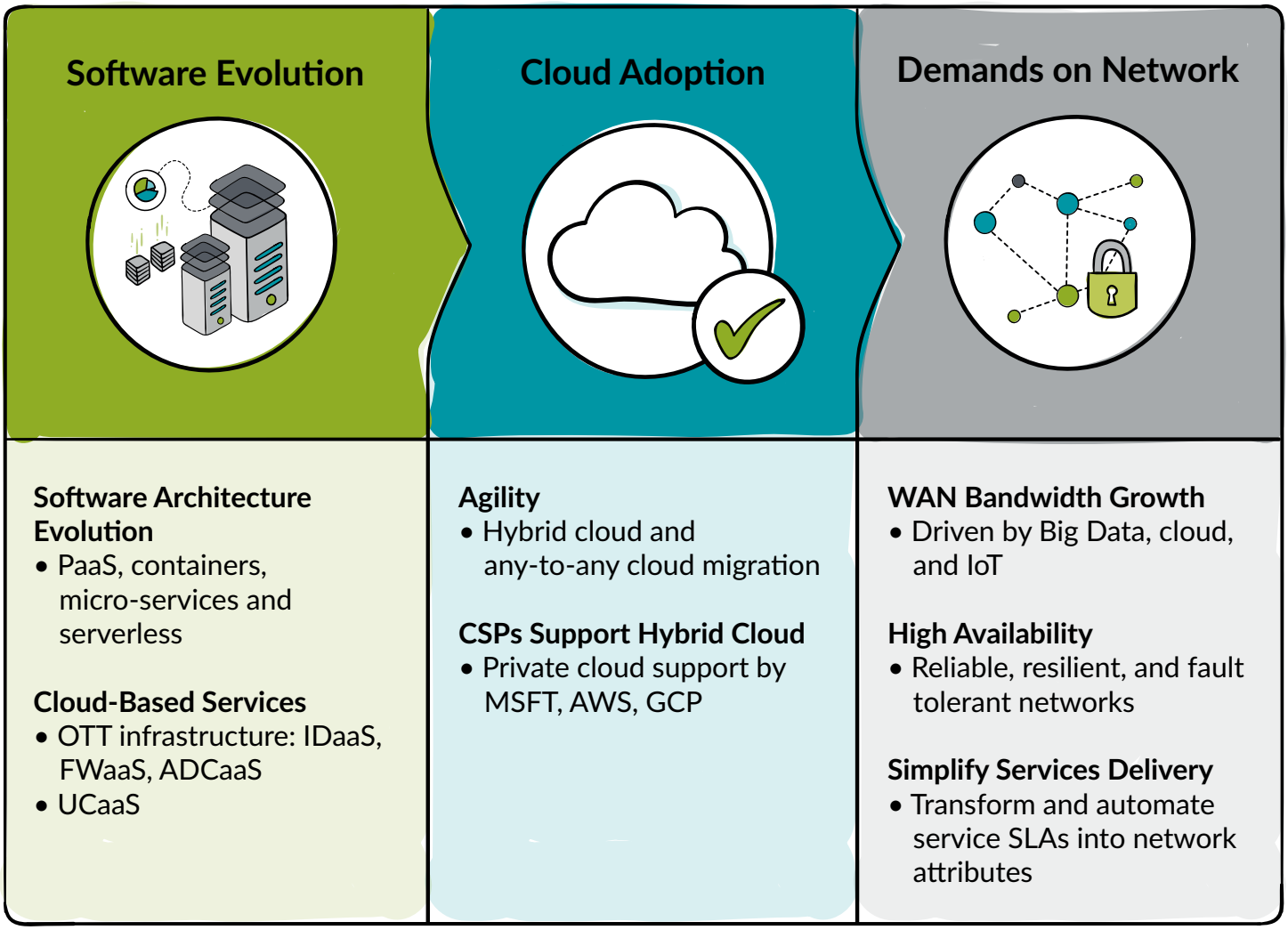
Enterprise Trends and Drivers

Enterprise networking is going through transformational changes at a rapid pace. These changes are primarily driven by:

1. The evolution of **Enterprise Software Architecture** driving the digital transformation of businesses.
2. The **virtualization** of IT network functions, enterprise infrastructure and applications, and the availability of such services in the cloud.



Enterprise Software Architecture

The evolution of enterprise technology architecture has passed through three phases, each one promising a new level of agility, scale, performance, cost efficiency, and ease of manageability.

1. **Infrastructure as a Service and Platform as a Service:**
   The first steps towards cloudification of enterprise applications.

2. **Containers and Microservices:**
   Enabling de-aggregation of software to run each logical functionality/module independently, where microservices leverage container technology to enable a multicloud solution.

3. **Serverless with Edge Compute:**
   Stateless enterprise software that executes on demand without the need to explicitly configure server resources, a key driver being Edge Compute and IoT.

Virtualization

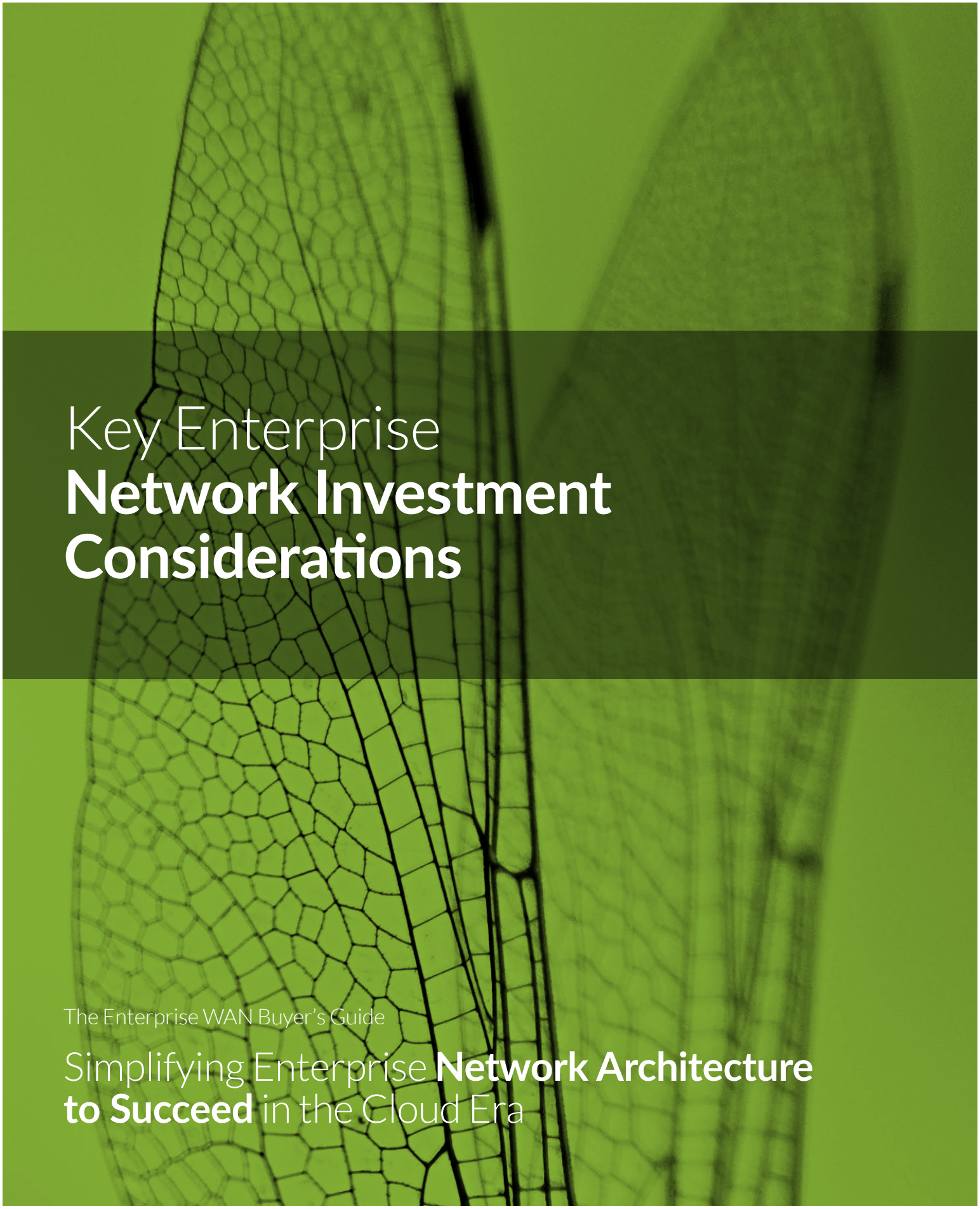
The evolution of software architecture has fueled the growth of virtualization across the network, data center infrastructure, and applications. Enterprises have embraced these technology advancements, realizing all the benefits that cloud has to offer.

Here's a quick snapshot of the benefits:

a) The network includes SD-WAN and virtual routers.
b) The infrastructure includes WAN optimization, ADC (Application Delivery Controllers), and virtual firewalls.
c) The application includes UCaaS and DRaaS.

Virtualization is driving new business models such as OTT (Over the Top) services and places new demands on service orchestration and delivery. This is disrupting the traditional ways of working across each of the IT planes mentioned above.

However, there remain significant challenges in layering virtualized applications over a virtualized network and/or infrastructure plane(s). The next wave in evolution is going to be about simplifying this with requisite SLAs – also known as **Service Assurance.**



Key Enterprise **Network Investment Considerations**

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Key Enterprise
Network Investment Considerations

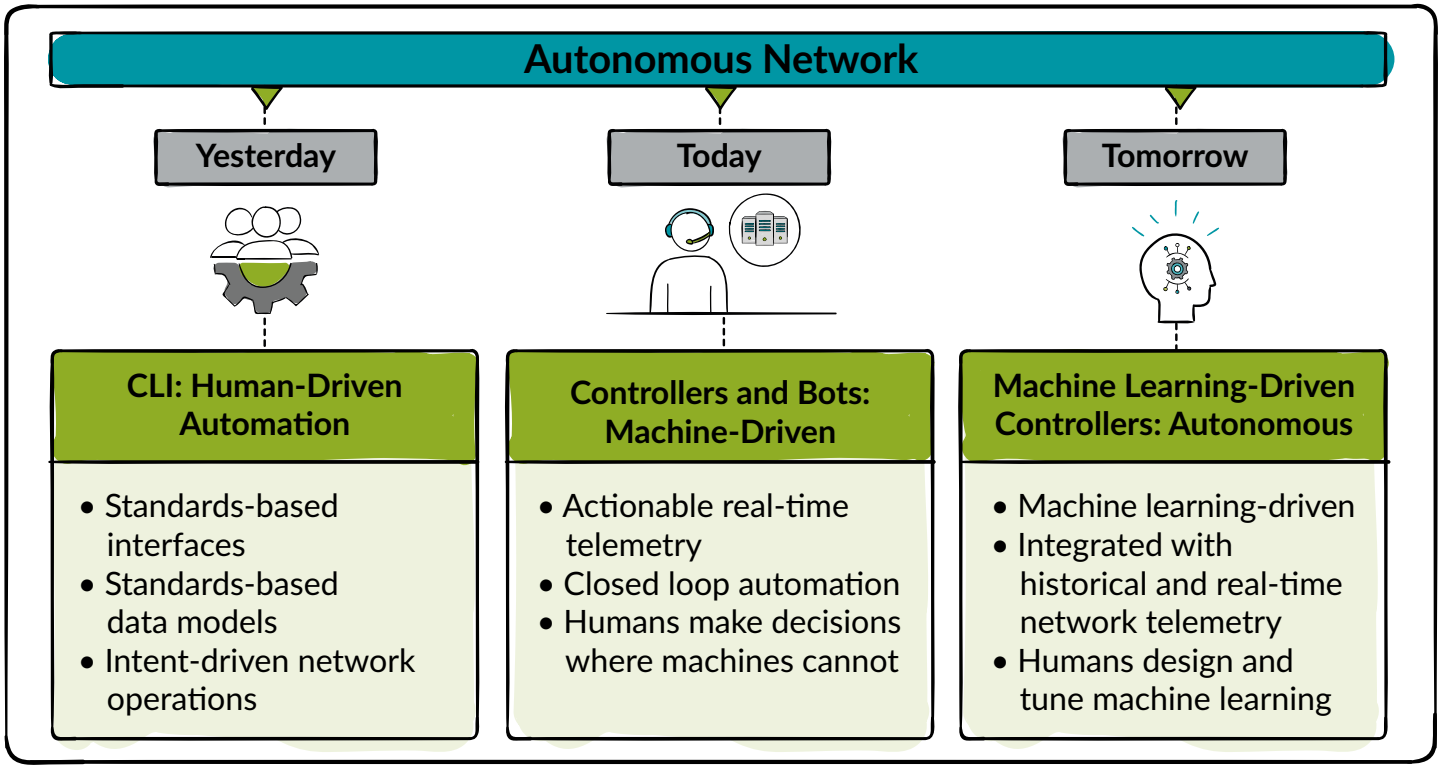
Virtualization lays new demands on network architecture. When we think of Salesforce, Office 365 or any custom public/private cloud-based service, seldom does network reachability cross our mind.

Underlying networks are expected to just work – always be available and seamlessly scalable with cloud services.

- Virtualization and cloud blurs the notion of a physical enterprise boundary. **Network-level security** becomes a key part of a defense-in-depth strategy, with the ability to tie the **overlay network** to the virtualized service. This ensures seamless security and connectivity regardless of workload location.
- While virtualization generally reduces capital expenditure, operating expenditure can exponentially grow with the scale of the enterprise, the network and the number of virtualized services. So, **network visibility** and **automation** play a crucial role.

At Juniper, we are on a journey to realize the vision of a predictive and adaptive autonomous network:

- Automation frameworks infused with telemetry, analytics and machine learning.
- High-level intent provides input for the network to self-discover, self-monitor, self-configure and self-heal.



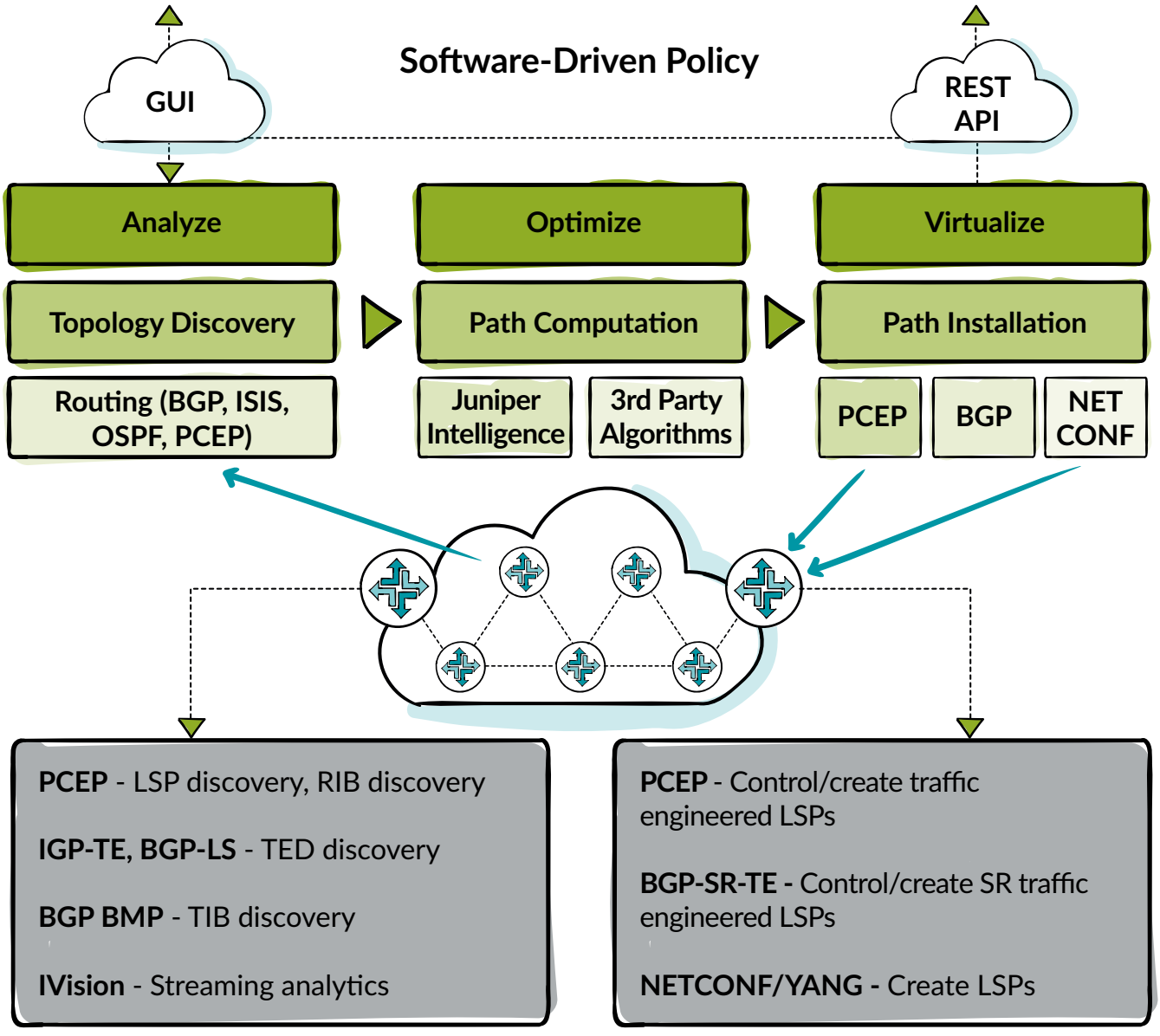
Autonomous network success depends on the performance of predictive algorithms, which depend on the data models **(correlation engines).** The fidelity of such data models is directly proportional to the amount of data collected **(telemetry)** from the network over time.

The Foundation of a **Self-Driving Network**

Juniper's Self-Driving Network™ is our vision of an autonomous, fully-automated network that is brought to life through the following principles that guide the evolutionary architecture of your network infrastructure:

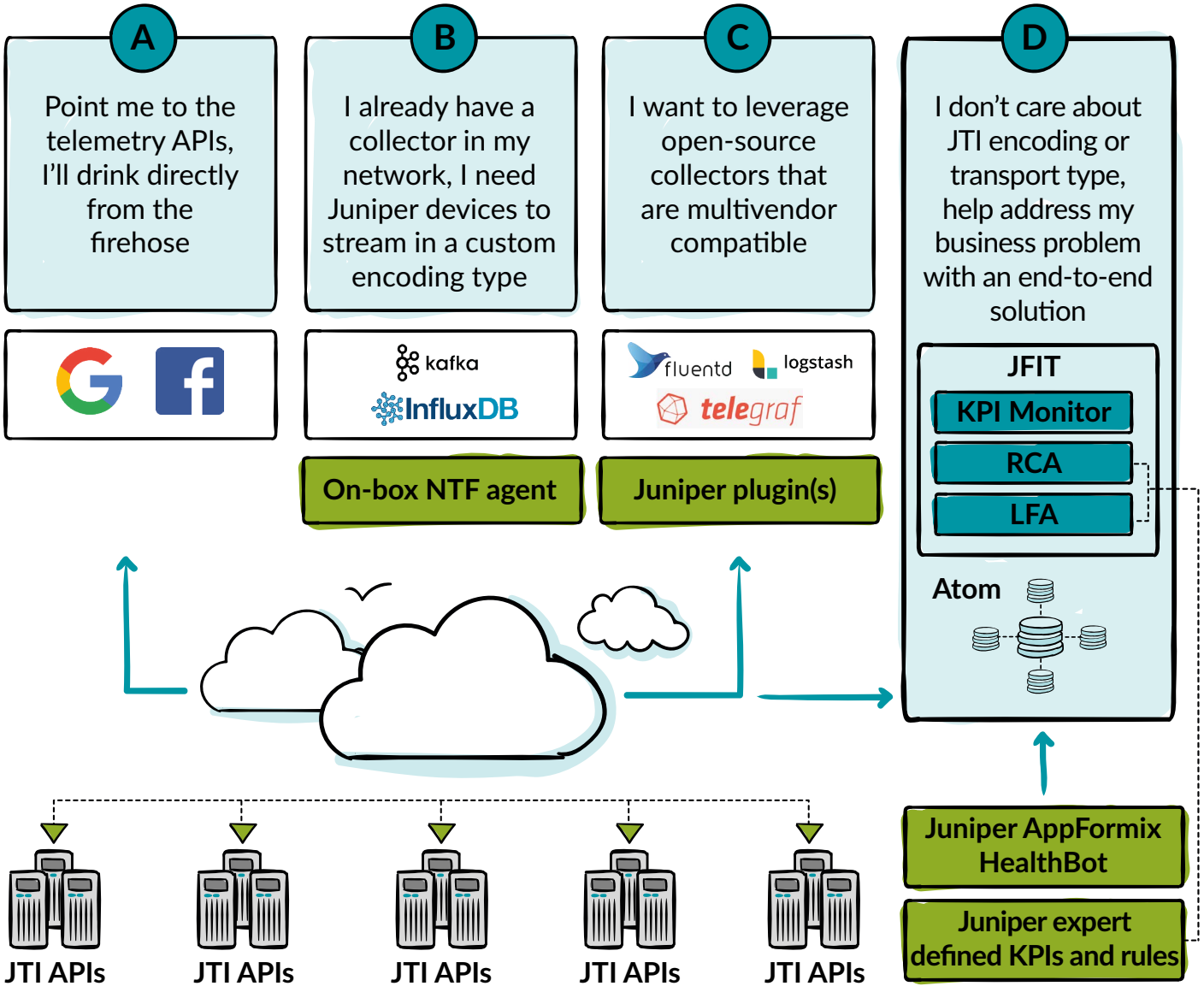
Automation

- Programmability is essential in building adaptive, network-aware applications where the start point is programmability using standard, low-level APIs to provide granular controls over network devices, all the way down to the chip level.

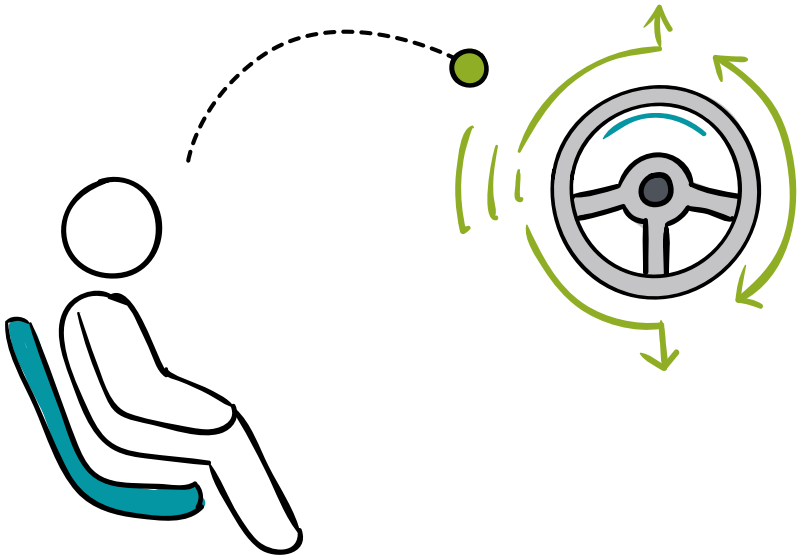


Telemetry

- The traditional model for monitoring the health of a network is based on a so-called 'pull' model, using SNMP and CLI to periodically poll network elements. But, they're limited in scale and resource-intensive. Instead, streaming telemetry natively from the data plane eliminates the need for polling by asynchronously delivering telemetry data as a stream to a downstream collector.



A key building block of a Self-Driving Network is automation equipped with real-time insight into all aspects of the network state, including device-level, service-level and component-level data. Telemetry is the enabler for 'closing the loop' and providing detailed instrumentation back to automation systems.

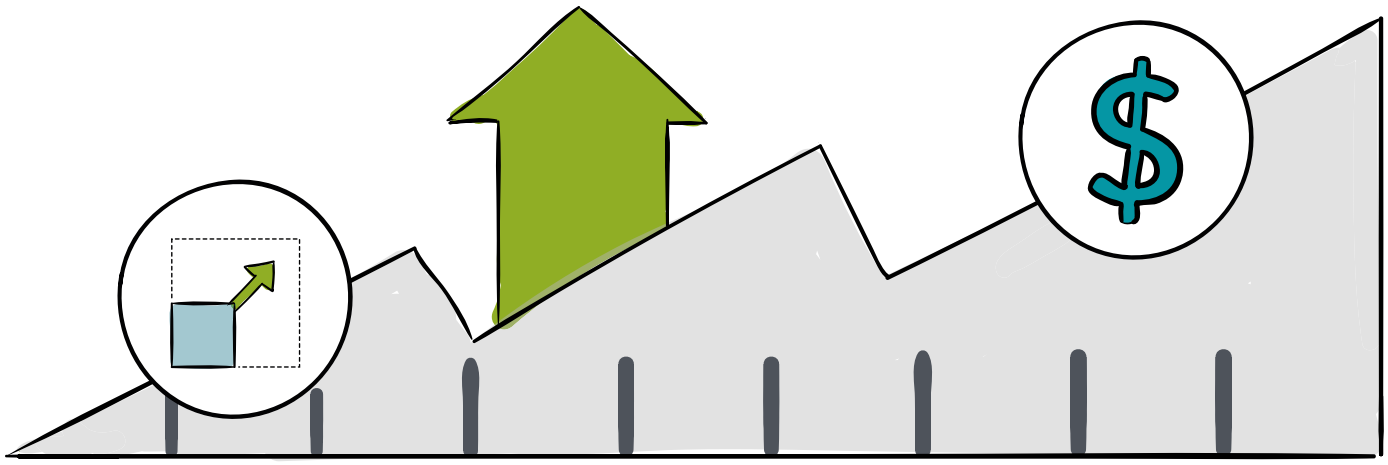


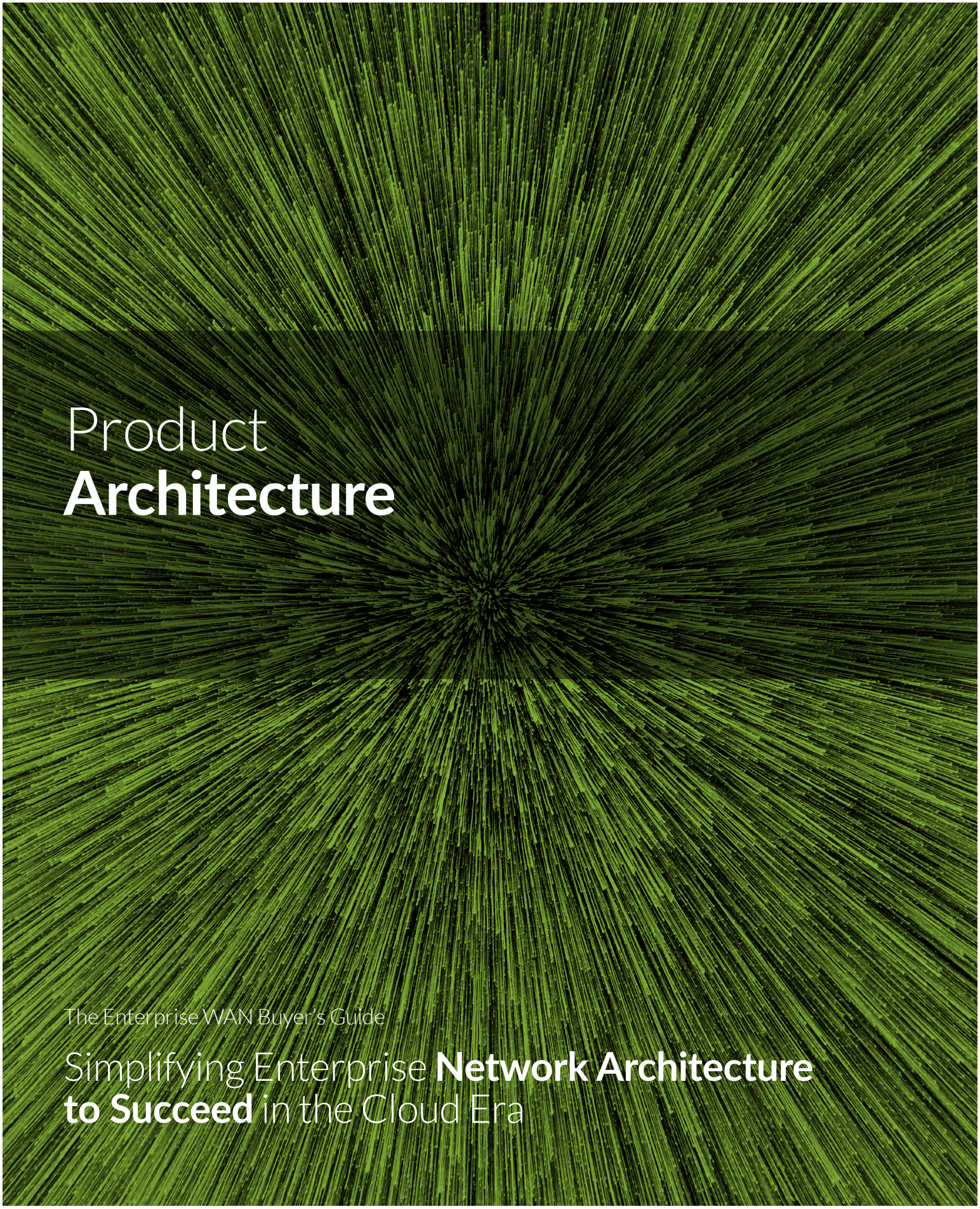
Correlation Engine

- Traditionally, customers deploy domain-level EMSs (Enterprise Management Systems) to manage specific portions or services within the network. In the event of a failure, the task of extracting, correlating and understanding data from multiple systems in order to understand the root cause can be overwhelming. Juniper implements decision-making logic within the system and the controller to interpret the state of the network (via telemetry) and make changes to the network based on the configuration.

Declarative Intent

- As networks become more complex, operational costs to manage them typically grow. Today, network administrators have to be technically prescriptive for successful network interaction. Everyday tasks are quite often technical and require highly skilled staff. Declarative intent is a fundamental shift towards having networks accept 'guidance' from network administrators in the form of 'intent'. Intent becomes more aligned with the business than with the technology.





Product **Architecture**

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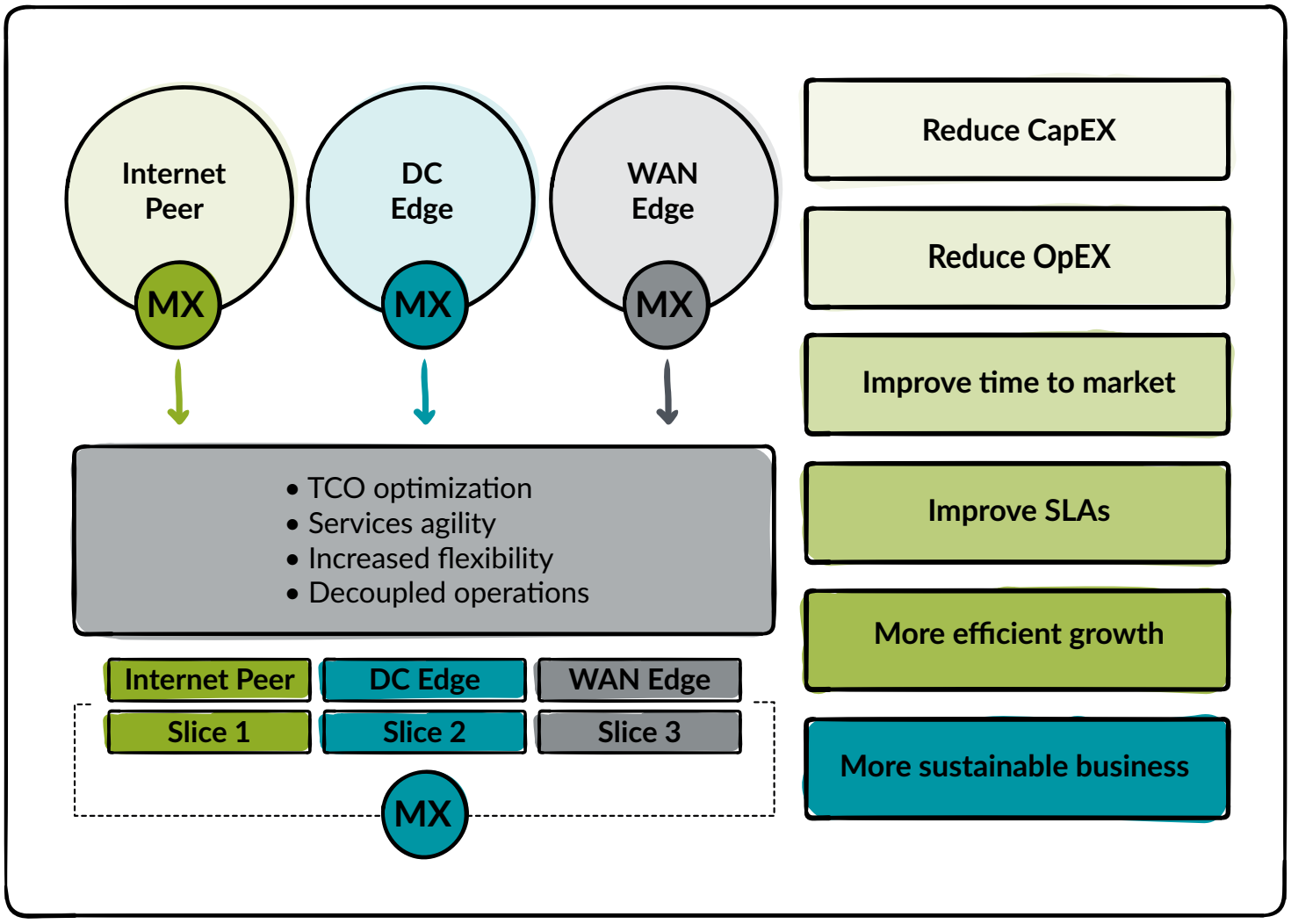
Product **Architecture**

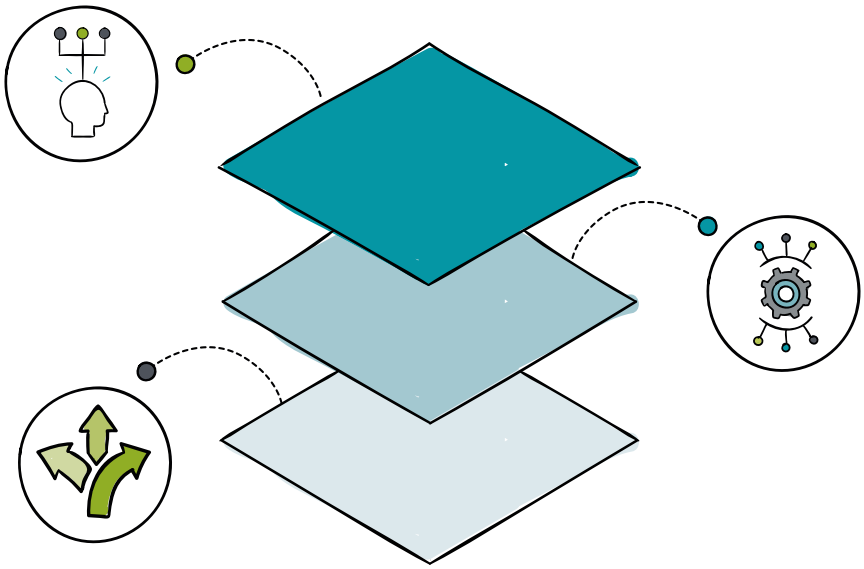
Clean Separation Between Control and Transport Layer

The most important architectural enhancement that improves network simplicity and service agility is decoupling network services from the underlying network transport itself. Such separation enables different network layers to evolve independently.

A clean separation simplifies new service roll-outs and enables operators to utilize 3rd party networks, even the internet, to improve their market reach. Most importantly, this separation enables a new level of network reliability and availability.

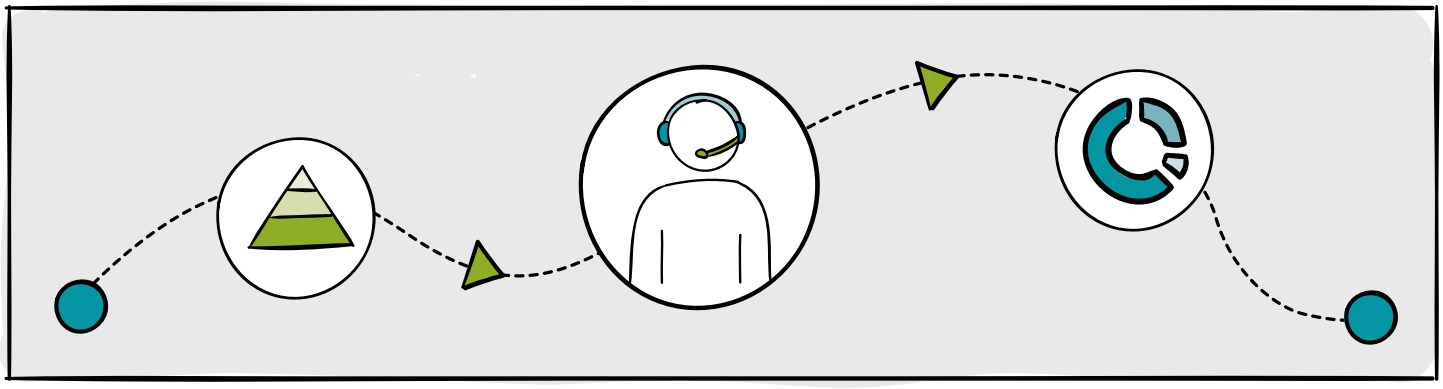


- The separation of different network layers extends even further to include controllers, supporting controller-driven automation. Controllers enable path computation and traffic engineering across different network domains and across different transport technologies like MPLS and SPRING, thereby simplifying service roll-outs and accommodating increasingly disperse application workloads running on the network.



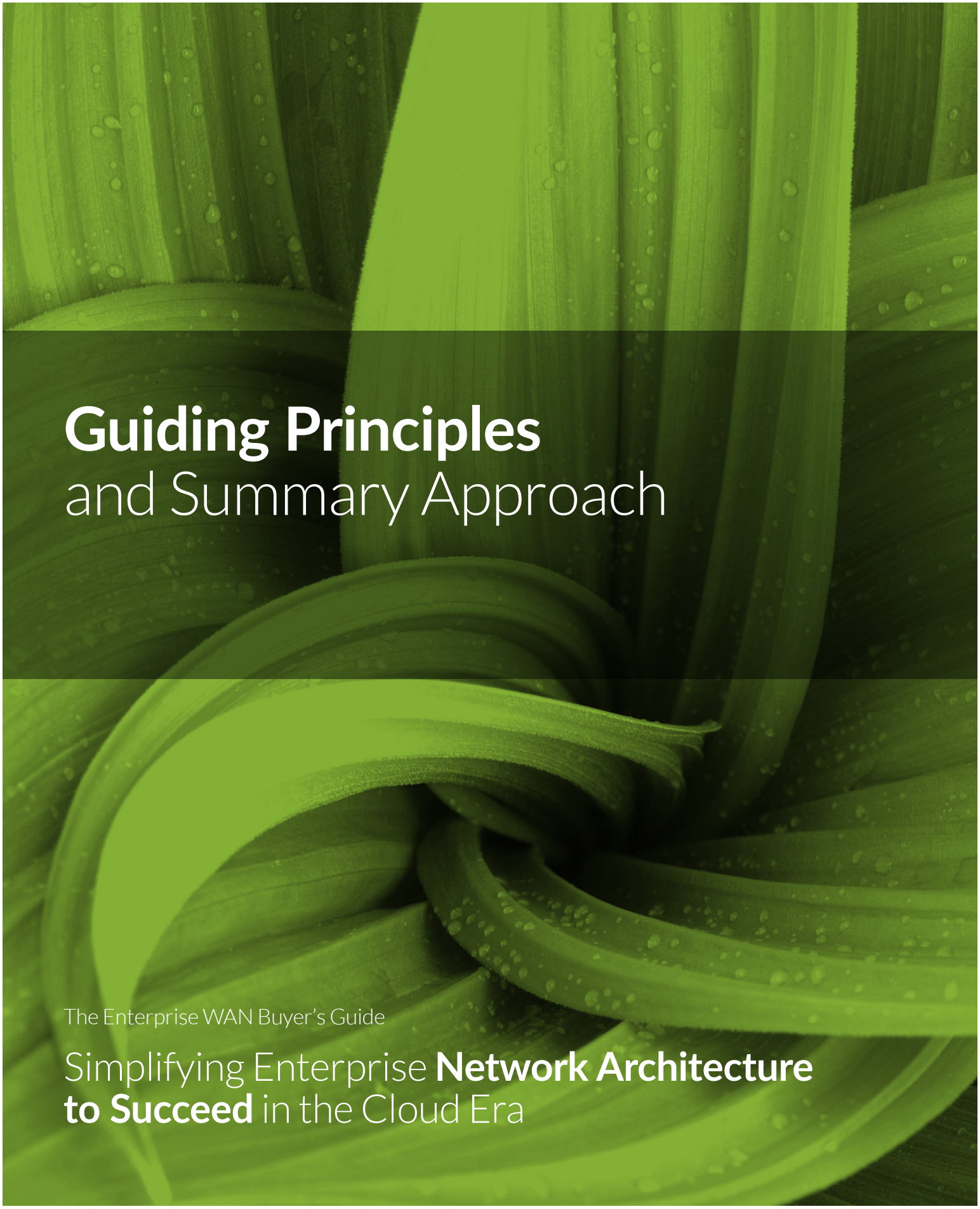
Transport Layer

- SPRING (aka Segment Routing) simplifies the transport layer by eliminating the need for running MPLS protocols. Additionally, with the help of a controller, SPRING allows each service to determine its own path through the network (using label stack) as per its SLA requirements, without maintaining any state in the network. Additionally, the latest IP fabric innovations allow network administrators to offer services over simple IP transport, dramatically simplifying network underlay.



Control Layer

- NorthStar Controller determines the optimal path for an application based on monitored network operating parameters and encodes that path as a label stack on the service routers. De-aggregating the control plane and the transport provides flexibility in translating higher level application or infrastructure plane services intent to the desired network slice. This provides the desired SLA for the service independent of other services on the same network.



Guiding Principles and Summary Approach

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Guiding Principles
and Summary Approach

A good approach to a sound architecture is to start with high-level objectives captured in the KPIs for network and application services. The ability to map business needs to corresponding technology that addresses these is key to developing a sound approach.

Customer Need	Technology Solution

• Cost and network optimized site-to-site connectivity with assurance
  • Better SLAs
  • Service agility
  • In-transit data security
	• Cost-optimized platforms
	• Network optimized
	  • Over internet with MX150 and IPsec
	  • MPLS-enabled networking and NorthStar service mapping with CSD
	  • MACsec and IPsec without performance impact

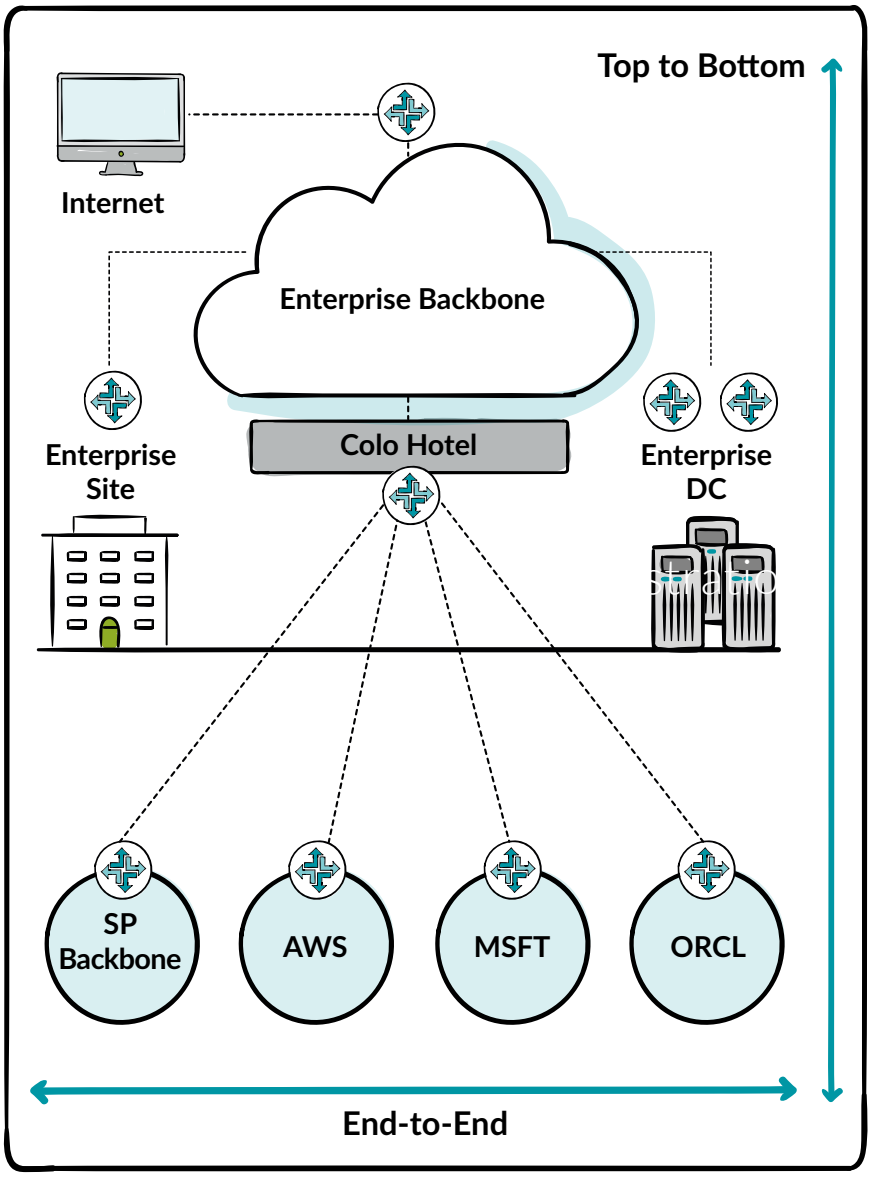
• Optimized DCI network to manage large east-west traffic	• EVPN DCI for different workloads • SPRING
• Better customer experience and security for the internet	• EPE solution with NorthStar controller • DDoS protection
• Connectivity between private data centers and public clouds	• EVPN for all workloads • In-transit data security

Guiding Principles for the Architecture Design.

1. The KPIs are translated to the SLAs.
2. These SLAs can be further categorized into tiers .
3. Tag each of the application services with the appropriate SLA tier.
4. Factor in the number of sites, employees and the type of application (for example, SaaS, public or private/on-premises cloud-hosted app).
5. Consider planning and design, including network underlay/overlay, network capacity, QoS, redundancy/availability as per the above needs.
6. Review operations and management requirements, including network and application visibility for utilization, failure conditions and auto-healing.

Each of the application SLA tiers can be mapped to the specific network characteristics, which defines the declarative intent for the application service. This intent can then be applied in an automated way to the underlying network and the related resource(s) leveraging the product architecture.

Routing solutions for scales and performance



Protocol

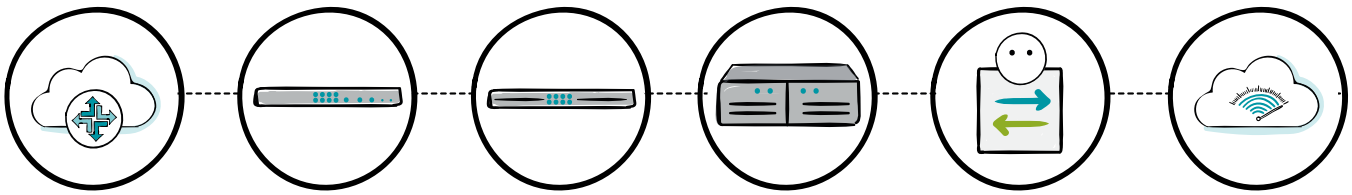
- EVPN for seamless network extension
- SPRING for controller driven network engineering
- IPsec for protection against man-in-middle

Infrastructure

- NODE splicing for integrated network roles
- Open APIs for network programmability
- Standards-based telemetry

Automation

- Monitoring
- Planning and optimization
- Maintenance



vMX | NFX150/ NFX250 | MX204 | MX10003 | PeerBot | NorthStar

In Summary

Modern enterprise WANs simplify and secure your network architecture from the branch to the cloud. And what's certain is that multicloud has arrived, bringing with it a fundamental shift in the traffic patterns and security posture of your network. These shifts add complexity to your WAN, making management even more difficult.

For anyone building a WAN backbone today, consider:

1. A Future-Proofed Outcome

- IT function virtualization for cost reduction
- Edge compute for latency-sensitive applications as well as for cost reduction
- Network-level security for a multicloud environment
- Streaming telemetry for in-depth network analytics and detailed instrumentation

2. Service Assurance

- Meeting the needs of the business user applications and the network KPIs
- Simplifying management tasks through intent-based protocols

3. Automation

- To reduce operational errors and complexity
- To enable adaptive, network-aware applications

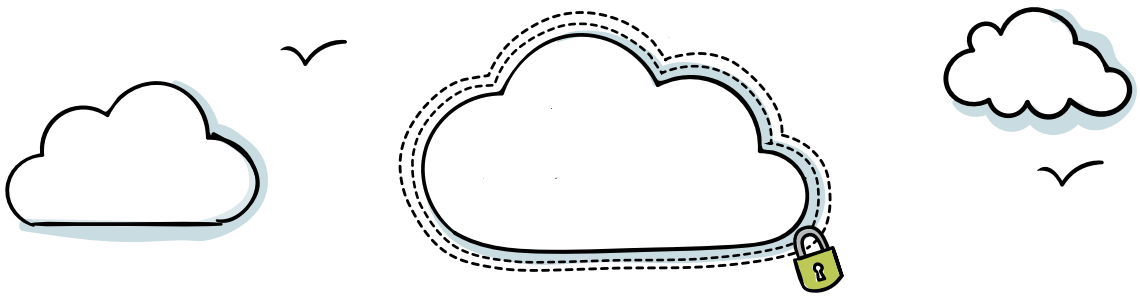
4. An Open, End-to-End Approach

- Juniper products provide top-to-bottom and end-to-end solutions to meet all network needs.

Whether you manage your company's WAN or use WAN services, it's time to rethink your approach to network architecture and connectivity. You need a solution that's secure, scalable and doesn't increase network complexity.

That solution is a Juniper Self-Driving Network.

Take the first step. Click here.



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