

# The Arista Advantage Cloud Networking Trends

The world is expeditiously moving to the cloud to achieve greater agility and economy, following the lead of the cloud titans. Arista's revolutionary innovations in software-driven cloud networking are propelling this dynamic transformation that weaves private, public and hybrid clouds into a seamless single-image network.

Avant-garde applications including artificial intelligence, social media and big data, coupled with emerging architectures such as, dense server virtualization and IP Storage have placed enormous demands on the network infrastructure in datacenters.

Key transformations include:

- Architectures are transforming the enterprise, extending to the campus and branch, converting siloed places in the network to a cloud first strategy resulting in places in the cloud.
- Applications are changing to new standards and methodologies for agility and elastic demand, blending cloud native and business worlds.
- Traffic patterns of the past are supplanted by highly distributed applications that drive east-west traffic for workloads, workflows, and workstreams and disparate devices.
- The pressing mandate facing cloud-scale to enterprise providers is easy portability between different AI workloads without compromising cycle time.
- Datacenters are moving to microservices, be they physical, virtual and containerized models.
- Demands for hitless upgrades and high availability are mandatory with automatic rollback and uninterrupted services.

Network architectures, and the network operating systems that make the cloud possible, need to be fundamentally different from the highly over-subscribed, hierarchical, multi-tiered and costly legacy solutions of the past.

## Arista Purpose

Arista Networks was founded to deliver software-driven cloud networking for cloud scale, cloud class and hybrid cloud networking environments. Unlike intent-driven methodologies, Arista’s portfolio is based on cognitive and software-driven principles for cloud networking.

Arista, a pioneer and market leader in cloud networking, has emerged as one of the fastest growing companies in the industry. Arista has more recently forayed into the routing arena that offers another multi-billion dollar market opportunity. Arista has disrupted the market with two significant innovations. Arista’s principle invention is an advanced network operating system, Arista EOS® (Extensible Operating System), that is built from the ground-up on a standards-based open architecture that delivers high reliability and unique programmability at all system levels, allowing integration with third-party software to achieve best-of-breed solutions in multi-vendor networks. Topping it, EOS offers a cross-cloud network platform that automates IT workflows or video-based workstreams, provides network-wide visibility, and faster problem resolution.

Arista’s other key innovation is the exclusive use of best-of-breed merchant silicon that enables open standards-based networking with rapid time-to-market. Notably, our merchant silicon family from several vendors, delivers state-of-the-art platforms that provide greater price/performance enabled by technology advances associated with Moore’s Law. In stark contrast, legacy approaches typically have relied on custom ASICs that are tightly coupled with monolithic software – resulting in vendor lock-ins, and proprietary costly choices. The figure below illustrates Arista’s revolutionary approach of universal cloud networking.

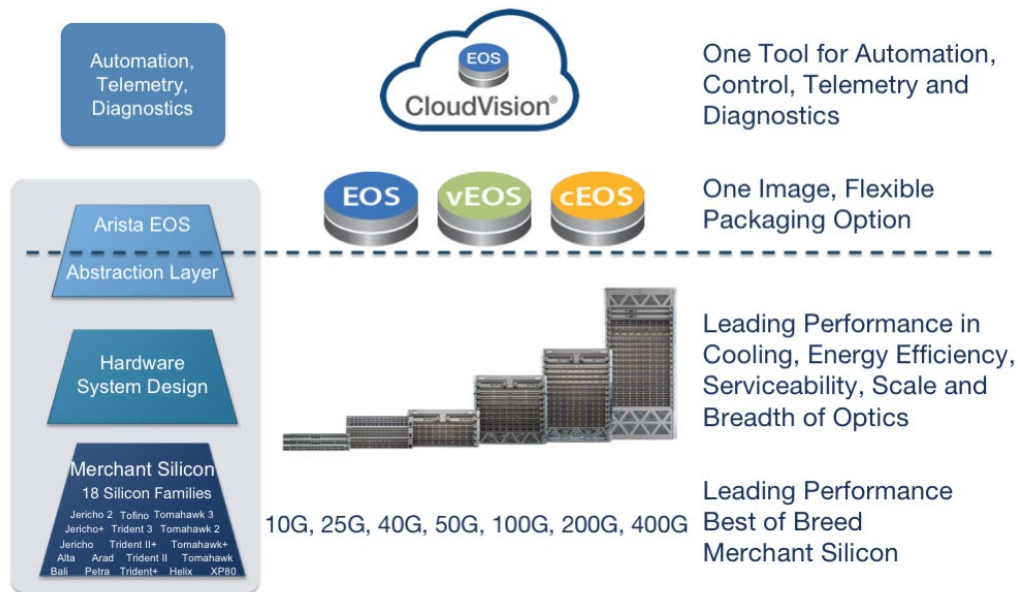


Figure 1 - Differentiated Portfolio for Universal Cloud Networking

## PINs to PICs Migration:

In another transformative shift, the rapid acceptance of cloud networking in datacenters across industry verticals has challenged the network status quo that has siloed separations for datacenters, core, campus and branches. Consequently, the lines bordering traditional box-approach is morphing into a software-driven cloud networking landscape.

The advent of native cloud applications and SAAS (Software as a Service) models is transforming siloed PINs (places in the network) into PICs (places in the cloud). Arista has embarked on a new course through leading-edge programmable state-based foundation to balance workloads between the public and private enterprise. This innovative confluence underscores the transition from static to dynamic provisioning of workloads, workflows and workstreams through agility, availability, automation and analytics across any API for cloud networks. Arista Five “A”s, the underpinnings of software-driven cloud networking for the PIC migration, are changing the way old-style datacenters, branches, core and campus networks are built.

### Key Attributes of Arista’s Five “A”s

As enterprises increasingly adopt cloud networking and computing architectures, they garner advantages including automation, scalability, always-on availability, and lower TCO realized by the public cloud providers today. Importantly, hybrid clouds, that are formed when private clouds and campus networks extend to public clouds, can deploy a uniform set of management and orchestration tools for cognitive cloud-grade networking.

The Arista Advantage incorporates the following five ‘A’ principles:

1. Available Architecture: Delivers a self-healing architecture of quality and aperture of data-collection across a highly available leaf-spine network with link, path, device and network-wide redundancy;
2. Agile Work-X: Handles micro-services, such as workloads, work-streams, and workflows based on Arista universal cloud network foundation unlike legacy networks that are unaware of new microservices;
3. Automation: Supports workload mobility across the cloud network, and the emerging container infrastructures for rapid and agile provisioning in minutes instead of hours or days;
4. Analytics: Traces the cross-domain workflow information to quickly pinpoint problems through telemetry tracers; and,
5. Any Cloud API: Enables the state of the network (via Arista NetDBTM) and open APIs, seamlessly connecting the cloud and premises.

Arista’s five “A”s architecture is illustrated in the following figure.

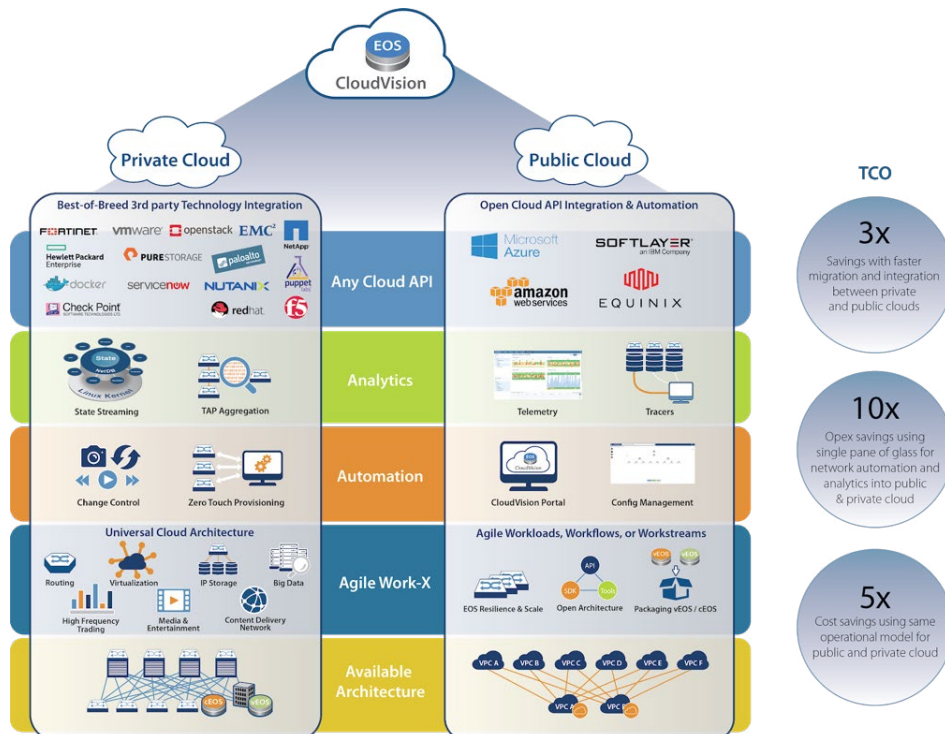


Figure 2.: Arista’s five “A”s Architecture

**Arista Architectural Innovation**

Arista engineering team brings over 100,000 man years of expertise in architecting EOS with non-stop availability, agility and differentiated software principles. Arista assiduously architected a ground-breaking foundation that imbibed complex cloud-scale requirements of high availability and programmability. Networking alternatives that have failed to understand this crucial concept, or have recognized it as an afterthought continue to play catch-up. Arista continues to outpace competitors, bringing sustainable and long-term advantages. Arista’s unique architecture is based on three guiding principles: State Orientation, Open Standards-based Approach, and Single Software Image for consistency.

**State Orientation for publish subscribe communication**

State Orientation uses a unique multi-process state-sharing architecture that separates state information from protocol processing and application logic. Its design resembles an enterprise IT infrastructure wherein a central database is shared by diverse applications. Arista has applied the same architectural principle wherein the State database is the source that software processes rely for synchronization to switching. System state and data is stored in the EOS and maintained in a highly efficient, centralized system database called “State,” where the data is accessed via an automated publish/subscribe/notify model. This distinct design principle provides module independence, self-healing resiliency, and multi-process software stability.

Arista EOS contrasts with the decades-old legacy approach that uses extensive inter-process communications (IPC) to communicate across the system, occasionally adding ad hoc databases. This mechanism requires manual integration of subsystems without the benefit of an inherent structured state. As dynamic events, such as system crashes occur in large legacy networks, recovery is often cumbersome if not impossible. The distinct difference between the legacy and Arista’s Cloud-Scale Software Foundation is shown below.

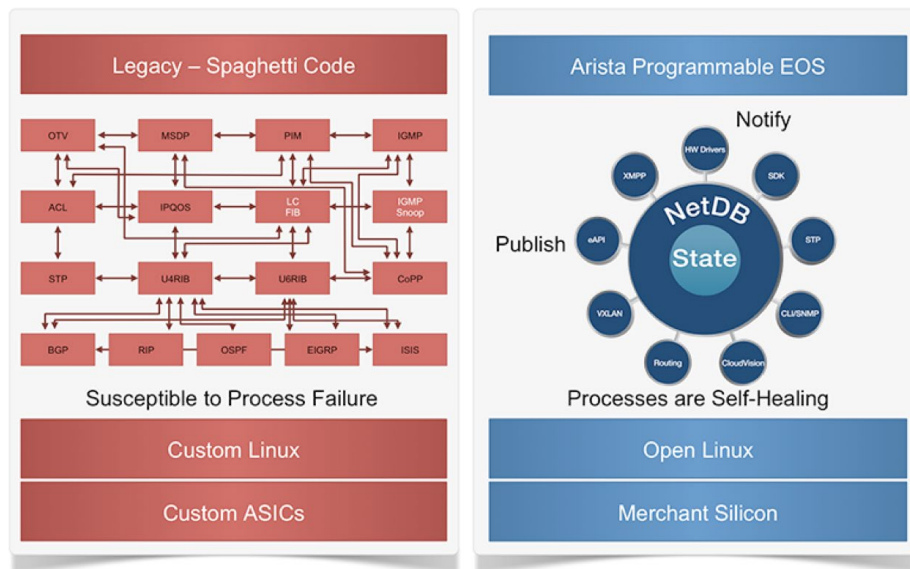


Figure 3: Arista's Cloud Scale Software Foundation

**An Open Approach**

Arista took to heart the lessons of the open source world and built the EOS on top of an unmodified Open Source Linux kernel, maintaining full, secured access to the Linux shell and utilities. It is notable that it is the same open Linux OS that Arista’s customers run in their datacenters and on their servers. This foundational methodology enables EOS to preserve the security, feature development and tools of the Linux community, unlike legacy approaches where the original OS kernel is either modified or based on older and less well-maintained versions of Unix. By adhering to open standards-based Linux, EOS also natively supports Linux containers and virtual machines, simplifying the deployment of new services and bringing Devops practices.

### A Single Image

Arista's third and crucial guiding principle is to provide a single software image that runs across all its products in various packaging forms - physical, virtual and containerized. The single image concept implies the use of the same source code, and the same version of the software release across the entire portfolio of switches and routers, to boost reliability, and reduce the complexity and cost of the network.

This approach is in stark contrast to legacy vendors that use multiple operating systems, each with numerous images, to implement a chaotic network. This arduous exercise along with quality control and test measures multiply operational costs. In contrast, when Arista releases a new software version, customers merely deploy a single image networkwide.

On the automation front, customers merely have to write the script for one image that works across the entire Arista network unlike legacy vendor implementations where an automation deployment might not work across their diverse operating systems.

### Cognitive Cloud World

#### Software-Driven Networking

Arista has continued to evolve the principle of EOS State Orientation into a network-wide concept called the NetDB™ - the Linux-based open source Network Tracking Database - enhancing scalability and visibility. We are taking classic SDN - software-defined networking - to software-**driven** networking-control, while building on its core pillars of reliability, open standards and programmability. The following illustration explains the EOS Foundation and Evolution.

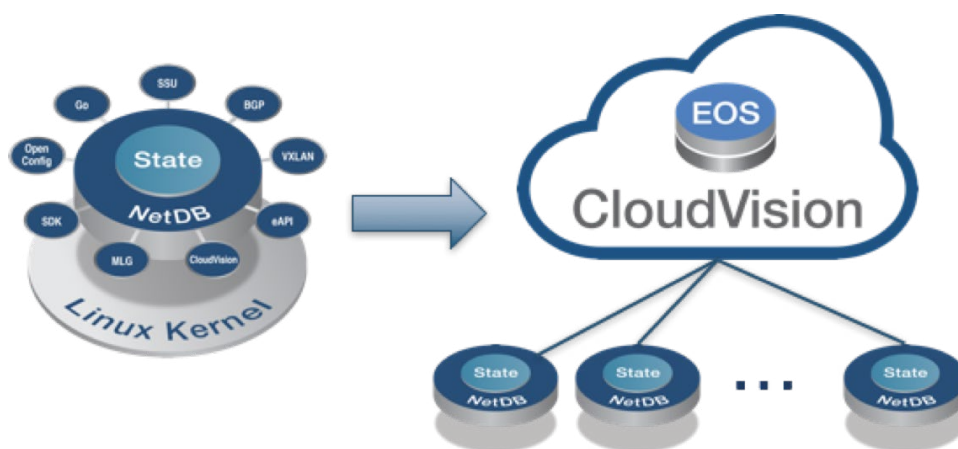


Figure 4: EOS Foundation & Evolution

The three major extensions that make up the NetDB architecture are:

1. NetDB with Cognitive Management Plane that stores all of the network state, including historical data, in a federated repository with HBase, Kafka or other third-party systems, simplifying orchestration, and providing a single touch-point for third-party controllers. It is also crucial for real-time streaming, analytics, compliance, audit, monitoring, forensics and capacity planning.
2. NetDB NetTable mechanism allows EOS to scale the routing stack to hold more than two million routes with millisecond convergence. And,
3. Thirdly, NetDB replication enables Arista switches to stream their state to other systems, synchronizing updates with that of the receiving system.

## Programmability at Many Levels

Programmability is imperative to enable automation and customization of networking equipment. In marked contrast to networking companies who promote basic programmability, a capability merely bolted on to their OS, Arista architected EOS with inherent open programmability.

Arista offers five types of extensibility for EOS that provide granular control and management for multiple EOS consumption models as shown in the following figure:

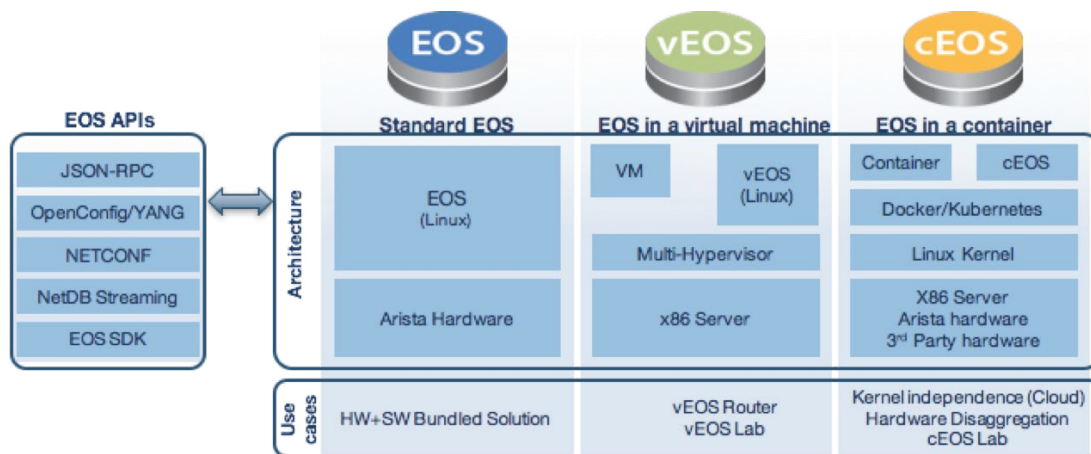


Figure 5: Programmability at all levels brings Extensible Options

1. eAPI - inputs ordinary CLI commands in the form of JSON RPC calls, and responds with an output that is easy to parse in a programmatic way, providing direct access to industry management systems.
2. OpenConfig - an industry effort to standardize something similar to eAPI is a way for external software to get programmatic control of networking devices.
3. NetDB Streaming - streams the state of every EOS device into a single database, delivering granular real-time view of the current and historical state of the network.
4. CloudVision API - gathers all of the state through NetDB streaming to provide network-wide visibility across all our platforms. And,
5. EOS SDK - a comprehensive software development kit for creating applications that runs directly on the switch.

## Turnkey Automation:

Organizations are rapidly automating IT to address their OPEX, often accounting for roughly 60 percent of the total cost of ownership of a network. While programmability helps automate network provisioning and cuts costs, automating network maintenance can eliminate crucial downtimes for maintenance. Arista has engineered a Smart System Upgrade (SSU) capability, which in conjunction with Arista's Zero Touch Provisioning feature utilizes automation to create a smooth and non-disruptive software upgrade process through the intelligent insertion and removal of network elements from the network topology. Yet another capability, Arista's network rollback feature, simplifies restoring an earlier configuration or software version across a network, if needed. These offer a stark contrast to legacy approach done on a box by box manual basis.

### Real-Time Streaming Analytics

An important element of a software driven cloud network is the ability to proactively identify, troubleshoot, and fix problems before they become impactful.

Legacy tracking approaches have been ineffective, falling woefully short by using SNMP, which uses a polling approach, as the primary solution. The downside of this process is if an issue occurs between the polls, it is invisible and unretrievable regardless of historical analysis. Incomplete and inflexible MIBs are also fraught with missing information, leaving network operators in legacy networks blind to problematic network events.

Arista's original approach using a state-oriented architecture with streaming telemetry has addressed this limitation by identifying issues as they occur, thus eliminating SNMP's shortcomings of a sampling window with limited MIBs. The EOS detects changes in state for every interface and every micro-burst across the entire network using network state-oriented NetDB. This process yields the ability to capture and view network-wide statistics with sub-second visibility. Arista EOS provides unprecedented visibility for rapidly troubleshooting application and performance problems, without the proprietary out-of-band monitoring infrastructure or backhaul networks.

Arista's State-streaming Analytics for Cognitive Telemetry is expounded in the following figure.

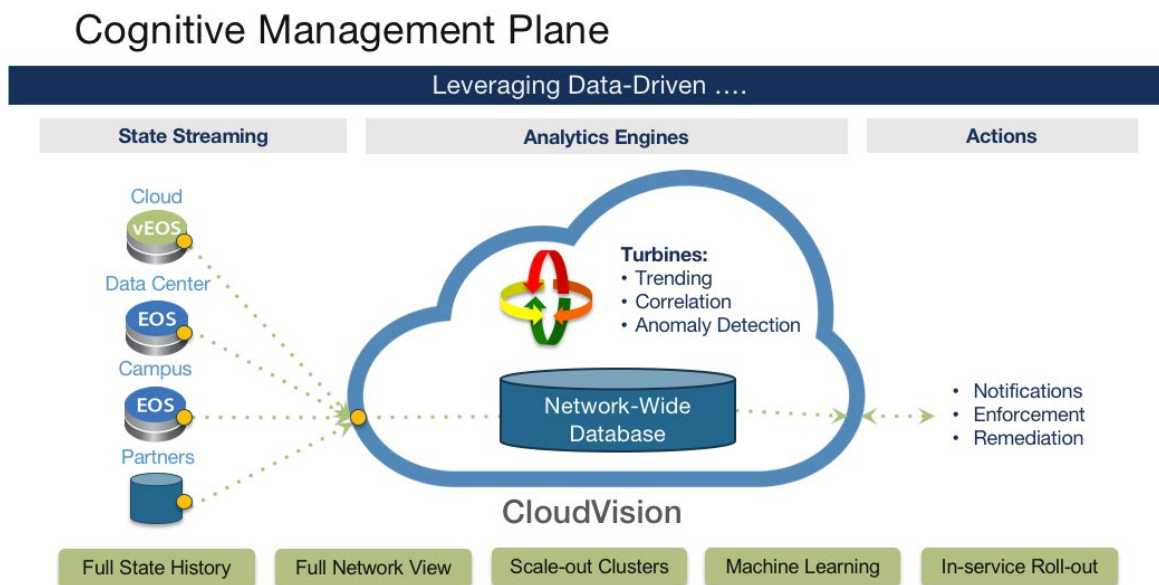


Figure 6: State Streaming Analytics for Cognitive Telemetry

Arista's Triggered Workflow analyzers, LANZ (Latency Analyzer) and DANZ (Data Analyzer), provide deeper insight into the network operations. DANZ cost-effectively monitors, without loss, all datacenter network traffic while capturing and analyzing only the most appropriate traffic. LANZ is a breakthrough technology from Arista that tracks sources of congestion and latency with real-time reporting in microseconds.

Network Tracers provide links between the network infrastructure, cloud orchestration and virtualization environments. These powerful features bring visibility at deeper application levels by integrating with cloud applications like big data, cloud, and virtualized environments. Arista supports many cognitive tracking tracers for specific use-cases including, VM Tracer, Container Tracer, MapReduce Tracer, and Cloud Tracer.

**CloudVision for Turnkey Approach**

Cloud titans have taken advantage of Arista’s open programmable cognitive cloud architecture by writing their own management and automation tools. Yet this benefit is not merely privy to mega organizations. Arista’s CloudVision offers comparable operational advantages incorporating powerful control features for proactive change-control trouble -shooting, performance monitoring, and compliance. The advantages of EOS’s state, extended to CloudVision delivers a network-wide solution for workload orchestration, workflow automation and real-time telemetry.

The CloudVision platform is based on a built-in cognitive management architecture to serve as the state repository for the entire network. Together with analytics engine that processes raw streamed data into actionable information, CloudVision captures state data to track trends, correlate data across devices and layers, and detect anomalies for three segments of customers that can benefit from it. These customer segments as shown in Figure below are: Cloud Converged - traditional enterprises that predominantly deploy turnkey solutions and are rapidly embracing the cloud, Cloud Class - enterprise verticals that prefer best of breed solutions for competitive advantage, and Cloud Scale - cloud providers and service providers that consider scale and control as paramount.

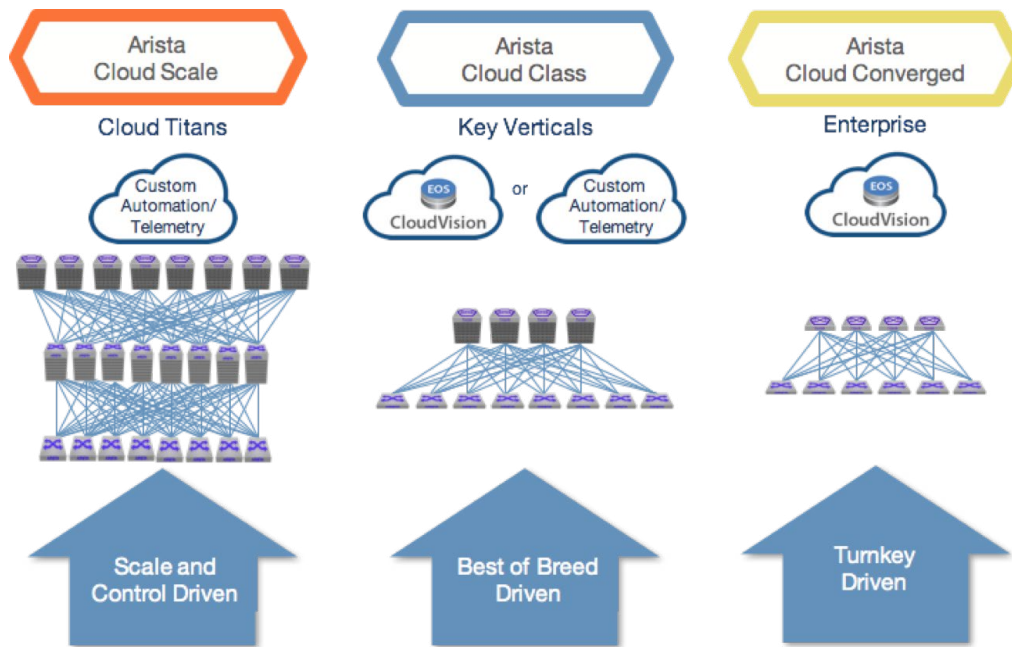


Figure 7: CloudVision offers Operational Advantages for range of customer types

**Platform Innovation**

Arista’s EOS platform is uniquely engineered to support multiple families of merchant silicon to optimize price/performance and feature innovation of the entire switch portfolio for data center, cloud and campus. This sharply contrasts with the legacy approach that tightly couples software to their preferred proprietary ASICs resulting in multiple families of switches, each with numerous software images.





Figure 8: Cognitive Cloud Platform Portfolio

The figure below displays Arista's Cognitive Cloud Platform portfolio.

Arista, as a founding member of the 25 Gigabit Ethernet consortium, is presently heading the industry in defining 400 Gbps and higher data rates for network spines. Likewise, Arista's policy towards optics protects customers' investments in optical cabling infrastructure while supporting industry standards. Arista's matrix of products offer both value and price-sensitive options. The award-winning modular platforms provide customers considerable investment protection as they represent three interoperable generations of highest performance and density in the same system developed over the past six years. Product environmental also play a critical role in keeping a green sustainability and lowering operating costs. Arista has led in the areas of power efficiency, space utilization, port density and reversible airflow, with true front-rear cooling, underscoring a deep commitment to efficient datacenter operations and support for environment sustainability initiatives.

#### Cloud Grade Routing

Proliferation of cloud architectures and principles are significantly transforming the traditional routing landscape, creating new business models around Service Provider NFV, Cloud WAN, Content Edge and data center interconnect (DCI).

Arista's next-generation routing solution applies the same cloud networking principles to scale and simplify software driven networking beyond the data center to routing use-cases. Based on Arista's 7280R Universal Leaf and 7500R Universal Spine platforms, these platforms can be used for both switching, and high performance routing that, unlike legacy box-based routers, encompass high port density and deep buffers, integrated DWDM with wirespeed MACSec encryption, and cloud automation.

The next figure delineates Arista's Expanding Routing Use Cases that subsume legacy routers.

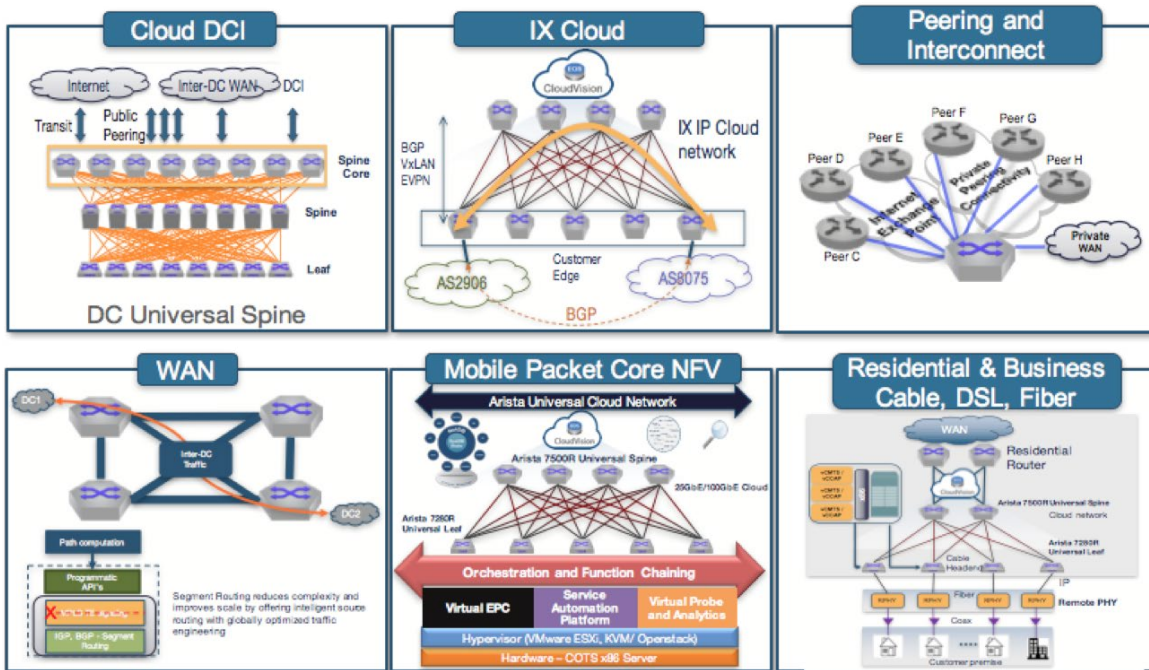


Figure 9: Arista's Expanding Routing Use Cases subsumes Legacy Routers

**Hybrid Cloud IT for Any and Multi- Cloud:**

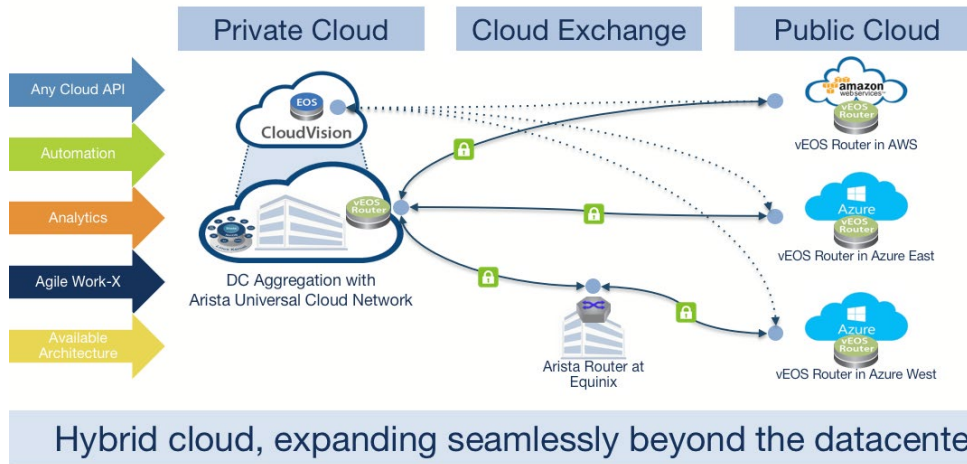
Arista's hybrid cloud suite extends networking solutions from private cloud networks to multiple public cloud networks, all with a single image management tool. This solution consists of vEOS Routers - a virtualized packaging of EOS - that can be deployed within various public cloud services. Notably, Arista vEOS Router supports native cloud API integration and full support for automation and visibility with CloudVision.

The Arista Any Cloud platform provides unmatched operational consistency across public, private, and hybrid clouds including:

- Arista vEOS Router, the hypervisor agnostic/cloud-native packaging of the EOS binary with a purpose-built software data plane, for use as a standalone software on any cloud environment including Amazon AWS, Microsoft Azure, Oracle Cloud Infrastructure, and Google Cloud Platform,
- Cloud-grade routing solutions for interconnection of private, public and hybrid clouds across clouds using Arista Platforms in Equinix Cloud Exchange and similar services,
- The Arista CloudVision platform that leverages the same automated provisioning, change management, analytics and telemetry for any EOS instance, including private, public, or hybrid cloud environments, and,
- The Cloud Vision family of telemetry tracers that includes Cloud Tracer that monitors performance, and proactively avoids problems in workloads running in the public cloud.

The ensuing illustration highlights Arista's Any Cloud that provides seamless access across hybrid clouds.

### Arista Any Cloud Platform



Hybrid cloud, expanding seamlessly beyond the datacenter...

Fig 10: Any Cloud for seamless access across hybrid cloud

#### Zone Segmentation Security

Enterprises hosting workloads in the cloud have to address security challenges. As workloads migrate across multiple clouds, virtual routers enable a new set of inter-cloud routing and security capabilities. Arista’s pioneering inter-cloud router vEOS offers a crucial built-in security feature called Zone-Segmentation Security or ZSS that eases workload migration. The combination of Arista’s Macro-Segmentation and ZSS form the underlying foundation of a secure cloud framework for on-premises (Campus and datacenter) and public clouds. ZSS can assign several network segments, and associated router interfaces as security domains called Zones. ZSS access-control monitors and secures traffic across zones. The end result is enterprises are empowered to efficiently define and control all traffic across the inter-cloud.

#### Cognitive Campus Networks

Arista’s recent breakthroughs drive campus networks to the cognitive cloud era, disrupting the wasteful, oversubscribed legacy three-tier architecture of access-aggregation-core. As the devices move to more disparate IOT for voice, video and data traffic, Arista is redefining the campus network into a cognitive single-tier Spline™ driven by a single image operating system that extends across the campus and the data center. Using a cloud based approach reduces operational costs by incorporating a network that is a seamless end to end solution rather than silos of different places in the network. Arista has upped its ante with its cognitive action for proliferation of users, IOT and behaviors. It is the difference between designing an intent based hopeful network versus a cognitive action-based one. The 2020 evolution requires the right design migrating from box-based complexity to simplified cloud networks shown below.

### Cloud Networking Evolution from Legacy

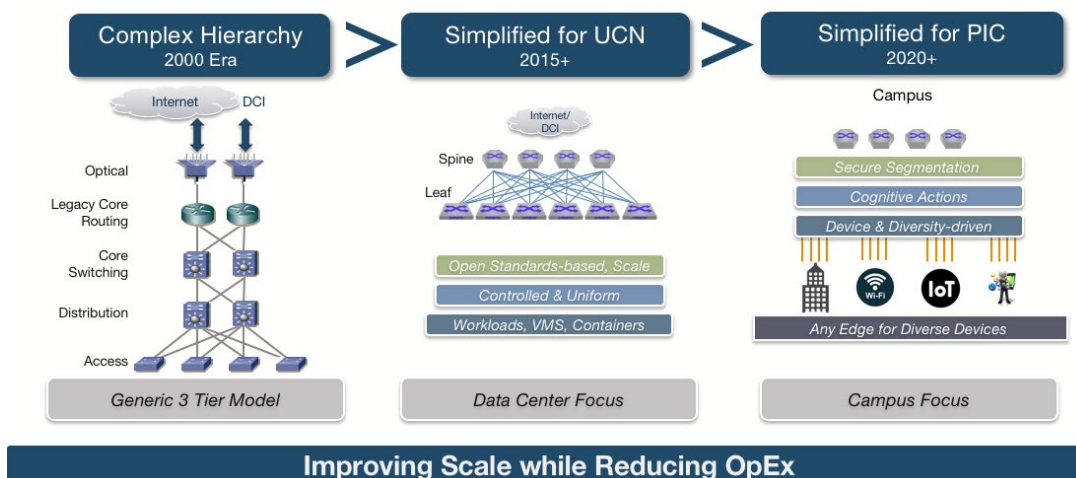


Figure 11: Continued Cloud Networking Evolution

Arista's goal to secure cognitive campuses reached new heights with the integration of CloudVision WiFi; a Cognitive Wireless suite based on Wireless Intrusion Protection System (WIPS) and associated standards that offers real-time application security. Other key security features such as authentication and authorization, besides detection and remediation of rogue APs (access points), further boost campus security. Together with Arista's Spines and PoE leaf switches, EOS, and Cognitive Management plane, a new generation of simplified, secure and automated operations can now be extended beyond the data center into the campus network.

## Arista Cognitive Campus Portfolio

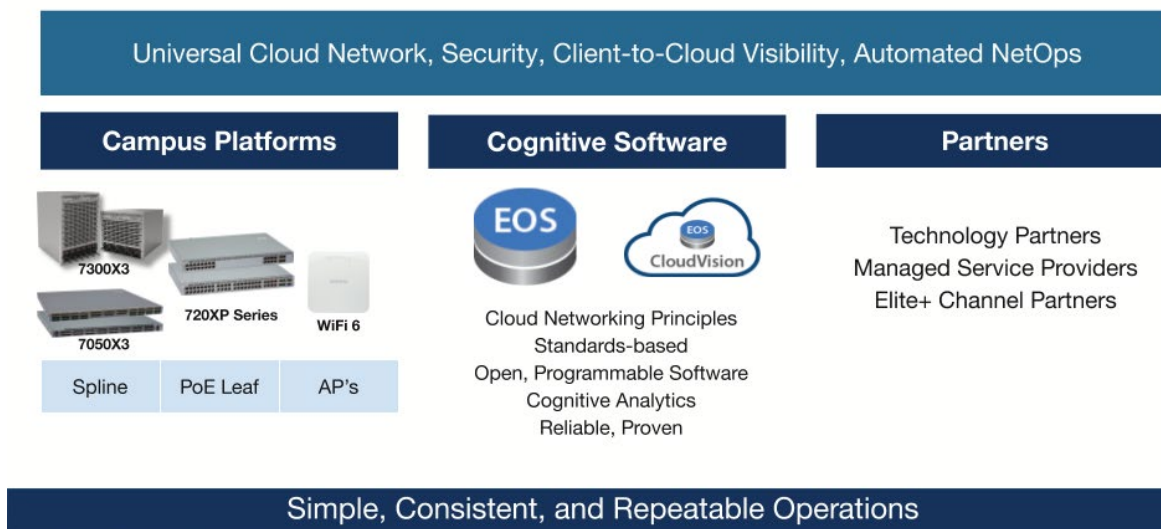


Figure 12: Arista's Cognitive Campus Platforms redefine the new generation of cloud based campus networks.

### Cloud Networking in the 2020 Era:

Arista, outstripping legacy providers, has met the momentous demand with its innovative software-driven cloud networking principles and portfolio. Adopted broadly by hyper scale cloud computing companies, Arista's industry-leading switches, developed from ground-up, have fueled the new generation of cognitive cloud networking solutions. Core to Arista's architecture is EOS (Extensible Operating System) with a single source image and use of diverse merchant silicon driving the five A's (Availability, Agility, Automation, Analytics and Any Cloud APIS) across datacenters and campus in private, public and hybrid environments. Arista's continues to aggressively invest in R&D to outpace competitors, thereby bringing differentiated and long-term advantage to our customers. Arista's architecture with cognitive cloud networking is transformational, changing complex and silo Places in the Network (PINS) to Places in the Cloud (PICs) for profound impact on networking in the 2020 era.

### For further reading

#### Cloud Networking:

- Facebook Blog - [Introducing datacenter fabric, the next-generation Facebook datacenter network](#)
- Arista Cloud Networking [www.arista.com/en/solutions/cloud-networking](http://www.arista.com/en/solutions/cloud-networking)

#### Arista's EOS

- EOS [www.arista.com/en/products/eos](http://www.arista.com/en/products/eos)
- EOS Programmability [www.arista.com/en/products/eos/open-and-programmable](http://www.arista.com/en/products/eos/open-and-programmable)
- Automation [www.arista.com/en/products/eos/automation](http://www.arista.com/en/products/eos/automation)
- Telemetry and Analytics [www.arista.com/en/products/eos/telemetry-analytics](http://www.arista.com/en/products/eos/telemetry-analytics)

#### CloudVision:

- At a Glance [www.arista.com/assets/data/pdf/TechBulletins/CloudVision\\_AAG.pdf](http://www.arista.com/assets/data/pdf/TechBulletins/CloudVision_AAG.pdf)
- White Paper [www.arista.com/en/products/arista-eos-cloud-vision](http://www.arista.com/en/products/arista-eos-cloud-vision)

#### Platform Overview:

- Switch/Routing Platforms - [www.arista.com/en/products/platforms](http://www.arista.com/en/products/platforms)
- Products Quick Reference Guide - [www.arista.com/assets/data/pdf/AristaProductQuickReferenceGuide.pdf](http://www.arista.com/assets/data/pdf/AristaProductQuickReferenceGuide.pdf)

#### Cloud Grade Routing and Hybrid Clouds:

- Cloud Grading Routing - [www.arista.com/en/solutions/cloud-scale-routing](http://www.arista.com/en/solutions/cloud-scale-routing)
- Arista's AnyCloud - [www.arista.com/en/solutions/hybrid-cloud](http://www.arista.com/en/solutions/hybrid-cloud)

#### Cognitive Campus:

- Cognitive Campus White Paper - [www.arista.com/assets/data/pdf/Whitepapers/Cognitive-Campus-WP.pdf](http://www.arista.com/assets/data/pdf/Whitepapers/Cognitive-Campus-WP.pdf)
- Security White Paper - <https://www.arista.com/assets/data/pdf/Whitepapers/Migration-from-silo-security-WP.pdf>

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