Arista Cognitive Campus Network

Küresel çaptaki son gelişmeler, kurumsal iş akışları ve kampus ağlarında beklenmedik değişimlere yol açtı. Çalışanlar ve ağ yöneticileri, sadece dağıtık kampus çalışma ortamlarının yeni bir modelini benimsemekle kalmadılar, sosyal mesafe, ve birlikte çalışma araçlarının artan önemiyle ortaya çıkan güvenlik, destek ve birlikte çalışabilme sorunlarına da uyum sağlamak zorunda kaldılar. Ayrıca, dağıtık işgücü uygulamaları yaygınlaştıkça ortaya çıkan yeni gereksinimler yerleşkelerdeki IoT cihaz kurulumlarında da inanılmaz artışa yol açıyor. İşgücü üretkenliğinin artırılması, iş yükü, çalışanlar ve fiziki iş ortamlarının daha iyi gözlemlenmesi gibi ihtiyaçlar yerleşkedeki cihaz sayısının artışına yol açıyor.

Altyapı iyileştirmeleri ve yükseltimlerinde, LAN ve Wi-Fi teknlojilerinin fiyat performans gelişmeleri önemli bir kriter olarak kalmaya devam ederken, üzerlerinde aşırı yük olan ağ operasyonları (NetOp) ve güvenlik operasyonları (SecOp) ekiplerinin üzerindeki yükü azaltmak ve düzenlemek için de otomasyon, telemetri ve karar destek analitiğine vurgu yapılıyor. Ayrıca, ağ yöneticilerinin sıfır temasla yerleşke ağlarının kurulumu ve işletmesine olanak tanıyacak otomatik kurulumlar, konfigürasyon yönetimleri ve iyileştirmeler için de ilave gereksinimler bulunuyor.

Ağ yöneticileri, yüksek kalitede, kolay yönetilebilir ve şablonlaşmış kurulumları kolaylaştırmak için tutarlı bir yönetim örneği sağlamak ve yöneticilere en iyi ağ deneyimini ve endüstrinin en iyi uygulamalarını sunabilmek için belirli standartlar üzerine kurulu çözümlerin arayışına girer.

Kurumlar operasyon verimliliği arayışında oldukça, sabit telefondan mobile telefonlara, IP kameralara, güvenlik, RF okuyucuları ve varlık yönetim ekipmanına kadar değişen IoT cihazlarının artışı ile ortaya çıkan ağ yöneticisi başına düşen araç sayısındaki artış, bu yeni iş modellerine geçişi de gerekli kılar.

Arista'nın sunduğu Cognitive Campus Architecture, kablosuz ve kablolu yerel ağ bağlantılarının ötesine geçerek, giderek dağınık bir yapıya bürünen çalışma ortamlarında çalışanların karşılaştığı sorunları azaltır. Çalışanlar, bulut ve kurumsal kaynaklara sürekli erişim ihtiyacına sahipken, Arista'nın Cognitive Campus çözümü, sürekli erişilebilirlik ihtiyaçlarını, istemci bağlantı sorunlarına sunduğu proaktif çözümler, uzaktan yükseltim ve yama yüklemeleri ve kayıpsız kesinti olanakları ile karşılar.

Arista'nın yüksek güvenlikli, eş zamanlı, durum raporlama özellikleri, ölçeklenebilir Saas veya NetDB tabanlı veri algılayıcıları, açık API'lar, otomatik iyileştirme tribünleri ile eşleştirilerek sunduğu geniş görülebilirlik özellikleri, makine öğrenmesi ile birleştirilerek, kablolu ve kablosuz altyapı uygulamaları için hayati önem taşıyan kurum çapında bir bilişsel yönetim düzlemi oluşturur (CPM – Congitive Management Plane). Arista'nın Cognitive Campus mimarisi, telemetri,veritabanı, otomasyon, karar destek sistemleri ve API kodlama noktaları ile yöneticilere görülebilirlik, geçmiş veriler ve ekosistem içerisindeki kurumlardan sunduğu sınıfının en iyisi çözümler ile günümüz uzaktan çalışma ve ofis ortamları için pürüzsüz bir operasyon ve büyüme olanağı sunar.

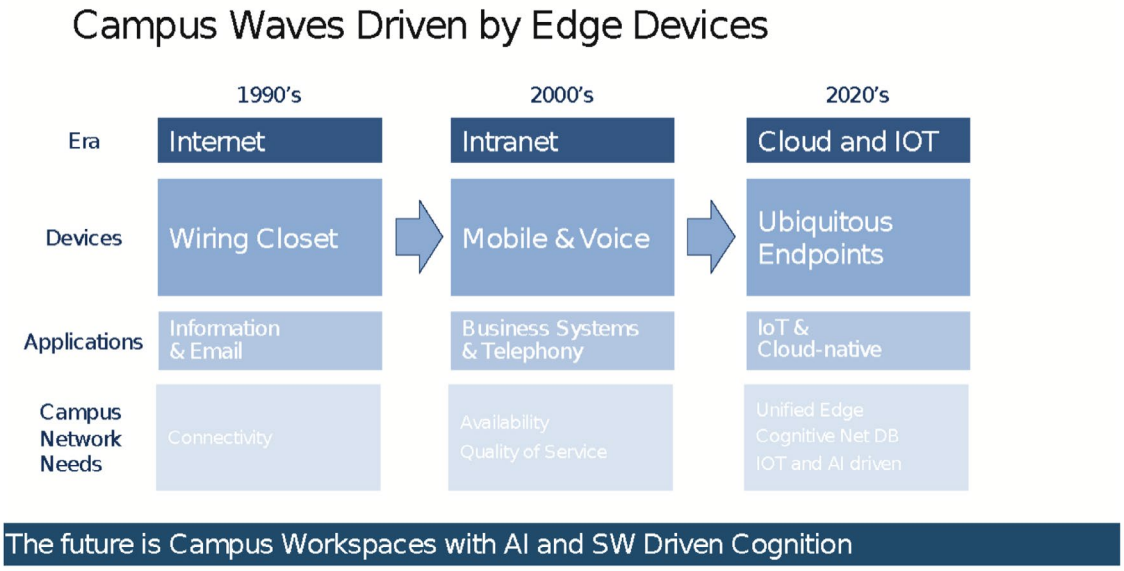


Figure 1:Evolution of the Cognitive Campus Network

Bulut Sınıfı İlkeleri Kampus'e Yaymak

Günümüzün bulut bilişim çağı, ağların oluşturulma, işletilme ve kazanca dönüştürülme şeklini kökten değiştiriyor. Veri merkezlerinde en iyi uygulamalar haline gelen ve şimdi kampüs ağlarında değerlendirilip uygulanmakta olan bulut sınıfı ilkelerinin çoğu. Bu ilkeler arasında daha verimli yaprak / omurga mimarileri, yüksek düzeyde programlanabilir bir API güdümlü ağ işletim sistemi (sıradan dağıtım ve yapılandırma görevlerinin çoğunu otomatikleştirmek için), güvenlik risklerini azaltmak için zengin gerçek zamanlı telemetri, proaktif düzeltme, konum hizmetleri ve regülasyon gereği diğer endüstri standartlarına uyum için özelleştirilmiş uygulamalar (temaslı takibi) yer alıyor.

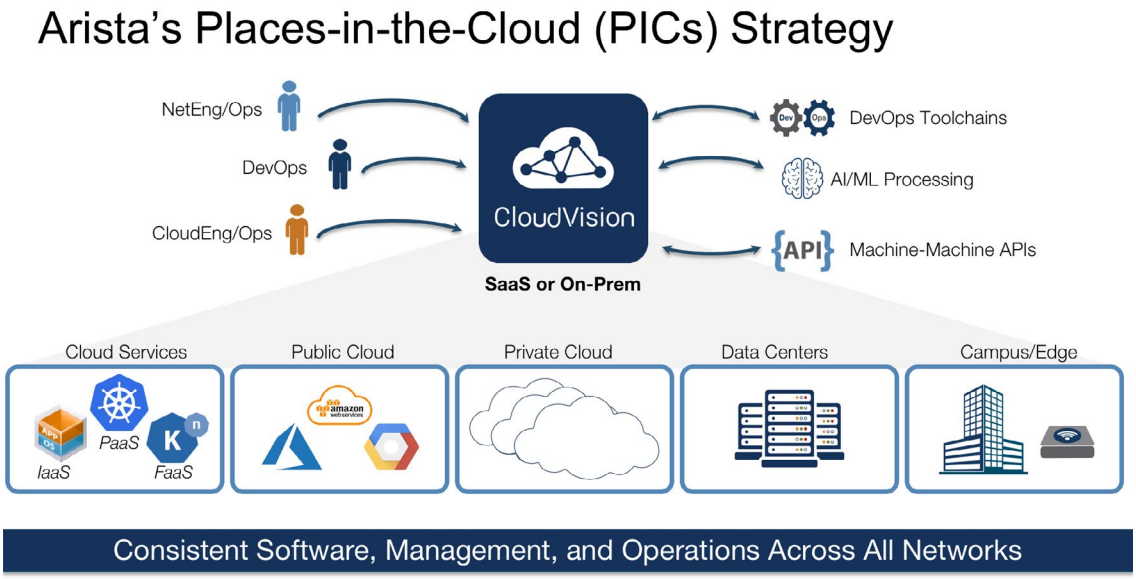


Figure 2: Universal Cloud Network

Her ne kadar, uzaktan çalışan bir personelin performans gereksinimleri, dakikada binlerce işlem gerçekleştiren bir web sunucusundan farklı olsa da güvenlik, güvenilirlik, trafik görünürlüğü ve analitik, deneyim kalitesi (Quality of Experience - QoE) ve sorunları minimize etme ihtiyaçları ortaktır. Sonuç olarak, kampus ağlarının, veri merkezi ağlarının son 10 yılda geliştiği gibi gelişmesi gerekiyor.
Bilişsel kampüsün amacı, değişen ortama uyum sağlarken işgücünün üretken kalmasına yardımcı olmaktır: Temel performans göstergelerinin daha iyi görünürlüğü yoluyla kampüs deneyiminin kalitesini yerine getirmek, uyumluluk iyileştirme sorunlarını gidermek ve otomatikleştirmek için makine zekasını kullanmak. Sonuç olarak, bilişsel kampüs, açık olan ve diğer lider çözümlerden yararlanan güvenilir, tutarlı bir mimari üzerine inşa edilir. Yöneticilerin kırılgan, kurulumu ve bakımı maliyetli olan ve farklı işletim sistemi özellik setleri ve yönetim araçlarıyla uğraşan verimsiz eski mimarilerin tuzaklarından kaçınmalarına yardımcı olmak için kalite ve tutarlılık sağlar. Şekil 3'te gösterildiği gibi, eski erişim toplama ana topolojileri bir kampus yaprak-omurgasına daraltılarak maliyet ve performans verimlilikleri elde edilebilir.

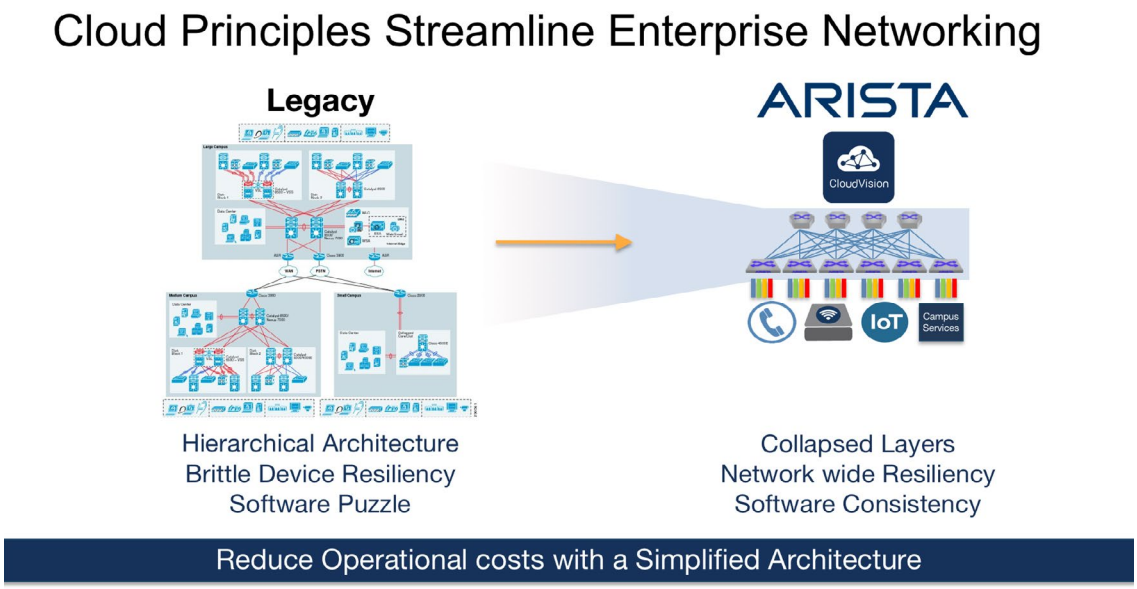


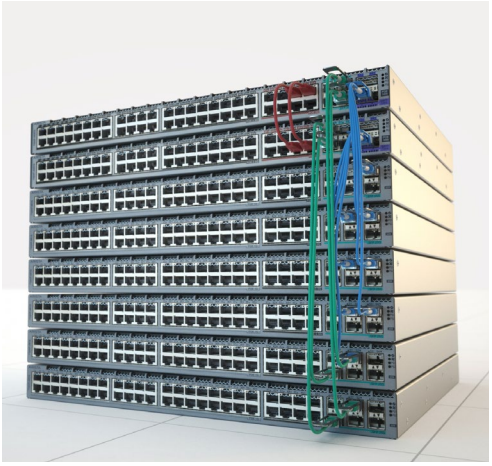
Figure 3: Three Tiered Layers versus Single Tier Campus Leaf Spine or Spline™

Kampus mimarları ayrıca VoIP, QoS, RADIUS veya 802.1X gibi masaya yatırılmış hizmetler ve uzaktan erişim, SAML / SSO, davranışsal segmentasyon ve AI / ML sorun giderme gibi daha yeni kritik iş hizmetlerinin, anında uyum gösterecek ortamlarda çalışabilmesini ve özel uçtan uca çözümlerin kurulumuna veya mevcut teknolojilerin yenilenmesine gerek duymamasını beklemelidir. New architectures should be able to embrace best of breed ecosystems to enhance security, monitoring and segmentation. Yeni mimariler, güvenliği, izlemeyi ve segmentasyonu artırmak için en iyi tür ekosistemleri kucaklayabilmelidir.

Campus designers should look to their data center peers for the automation, telemetry, and AI capabilities of the data center that simplify provisioning, compliance, rich visualization and machine assisted troubleshooting while also automating compliance and segmentation. Additionally, campus administrators should look to the price/performance benefits of cloud grade platforms that marry cost effective, open standards systems supporting 10/25/40/50/100G Spline uplinks to evolving 10/100M, 1G, 2.5-5MGig and WiFi6 access technologies.

Collapsing the mid-tier aggregation and core layers reduces equipment count and costs while increasing reliability. Next generation, active-active, dynamically load sharing paths improve spine to leaf bandwidth utilization, improving both performance and reliability. This obsoletes the "reliability or performance" compromise of active-passive control plane architectures. New cloud campus spines and leaf architectures enable hitless maintenance and advanced reliability features that prevent network degradation and failure. Finally, open L2, L3 and virtual overlay feature sets are scalable, interoperable, and dynamically reconfigurable, giving network designers the flexibility to accommodate workload variety and graceful evolution. Examples range from reconfigurable route scale to supporting open standards based EVPN-VXLAN in the campus, letting managers integrate with, and transcend the limitations of 802.1q 4K VLANs to the possibility of 16 million VNIs (Virtual Network Interfaces) to accommodate device and workload proliferation.

MLAG Aggregation



In the 1990's, proprietary stacking architectures were developed to simplify expansion and management of grouped campus wiring closet switches. However these stacking schemes have not aged well, showing compromised reliability and elevated CapEX/OpEX due to complicated, proprietary hardware architectures and costly cabling accessories, brittle software life cycle management and underwhelming performance from oversubscribed daisy chained network devices.

Arista's EOS MLAG uses industry standard LACP-LAG with dynamic load balancing to deliver active/active connectivity to stacked switches by leveraging standard, economical Ethernet from 1G-100G. Field validated in thousands of data centers, MLAG is simpler, more reliable, standards based, and interoperable with other LAG capable devices. Maintenance and expansion is hitless, while monitoring and software lifecycle management is simplified through Arista's CloudVision Management platform, or other industry standard DevOps tools.

Cloudscale, Real-Time Telemetry for the Enterprise

Today's business critical applications rely on the wired and wireless distributed campus infrastructure. This is also the case for the exploding variety of IoT devices such as cameras, monitors, sensors, security devices and other user critical appliances. The scope of the enterprise campus is evolving too, incorporating branch, remote and home workspaces. Therefore, to maintain service levels and ensure user productivity and application performance, campus administrators require management systems that can monitor the collective infrastructure to facilitate troubleshooting, compliance and remediation of the entire campus net. The management architecture's scope must be comprehensive, incorporating as much of campus workspaces as possible to enable better visibility for administrators and their tools.

Campus architects must also evaluate state of the art, real time monitoring services that can deliver more information, more efficiently. Real time monitoring, coupled with AI/ML performance analytics that track workspace infrastructure, workgroups, applications and users, helps the operations team maintain SLAs, spot or even anticipate potential problems, and rationalize infrastructure investment. To achieve these goals, campus infrastructure platforms must deliver comprehensive state streaming telemetry, beyond bytes and drops, to include throughput and latency data at the client, workgroup, and application level. Campus networking systems must be able to glean and report on the thousands of user and application flows in the enterprise, detailing throughput, duration, latency and congestion, to name a few. Lastly, administrators should expect no compromise in reliability, performance or manageability.

Of course, innovations in telemetry must be matched with advances in monitoring systems. Even at five second intervals, polling schemes, like SNMP, are too slow and limited in the new world of the distributed cloud and campus. In contrast to legacy schemes, cognitive cloud-based telemetry combines real-time streaming with big data analytics as shown in Table 1. Open architectures such as OpenConfig use standard APIs, like gRPC/gNMI to deliver a wealth of streaming information quickly and efficiently. Publish-subscribe exchange models are inherently more efficient and adaptable because only information updates are shared. The shared data model is also more advanced, providing both data definition or keys, along with data values. Combined, this architecture greatly increases visibility, while reducing telemetry processing and network load.

Table 1: Legacy vs Modern Telemetry

Traditional / Legacy Approach	Campus Telemetry Requirements
Polling Approach (1-15 min)	Real-time Streaming
State scope limited to MIB definition	Complete state history
Per-Switch Per Device	Network-wide scope
Static, discrete events. Manually correlated	Dynamic event correlation

While many networking companies understand the value of telemetry and analytics, few have architected analytics to create, stream and process networking data effectively.

Arista's Cognitive Campus Network

Arista's vision and framework for the Cognitive Campus Network leverages cloud capabilities and state of the art merchant silicon to deliver critical services that automate deployment, configuration, visibility troubleshooting and security. The Arista Cognitive Campus delivers spline, leaf and wireless infrastructure platforms, telemetry and analytics, and a single Image EOS that supports an ecosystem of solutions from industry leading partners as shown in Figure 4.

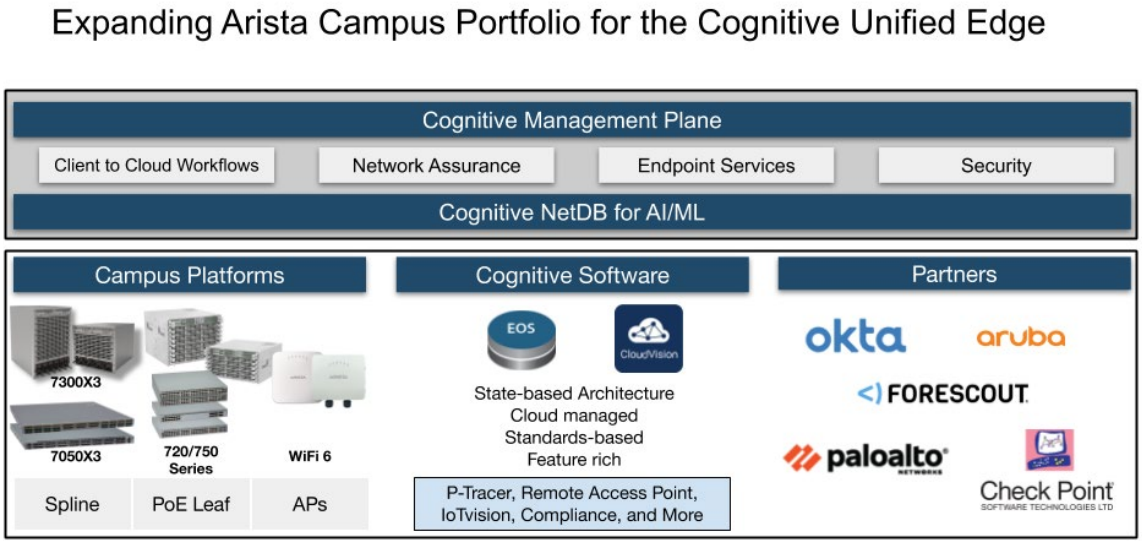


Figure 4: Arista Cognitive Campus - Cognitive Wifi, PoE Leaf, & Spline Platforms, EOS and Cognitive Management Plane based on CloudVision

1. **Splines for Collapsed Campus Fabric**

   Arista has uniquely extended cloud grade capabilities to the campus with the modular 7300X3 and fixed 7050X3 platforms. These spline platforms are designed to provide a suite of cognitive features and actions for high availability and simplicity. Self healing, hitless upgrades and live patching are cognitive actions that avoid impact on the infrastructure. Arista's Smart System Upgrade (SSU) feature enables switch operating software to be completely upgraded while the platform continues to process campus traffic.

   The X3 series switches provide a variety of connectivity options: 1-10G, multi-rate 10/25G SFP+, 40G, 50G and 100G QSFP. These platforms support dynamic load balancing and buffer allocation available to all networked ports to help avoid data loss from link faults, congestion or micro-bursts. The splines work with all devices that support static or dynamic port aggregation to preserve and enhance the installed base investment.

2. **Cognitive Leaf POE Switches**

   With the release of the CCS 750 series modular switches, Arista expands its offering of cognitive, secure, high performance and high density PoE connectivity in the wiring closet, delivering 10M through 10G connectivity, MACsec security, segmentation and power options for all campus user workloads. The suite of platforms delivers a variety of connection options for user desktops, POE appliances and IoT devices. Managed 802.3af-t/bt power services deliver up to 60W, with speed options ranging from 10Mbps - 1Gbps, and 100M - 10Gbps (including MGig) over UTP, to support a variety of campus workloads. Modular SFP and QSFP uplinks support speeds from 1Gbps to 100Gbps which offer flexibility in network architecture and scalability. As with all Arista platforms, the 750 Series runs Arista's common binary EOS, providing a comprehensive set of layer 2 and layer 3 open standard features including MLAG, 802.1Q, EVPN/VXLAN virtualization, and table stakes QoS and segmentation services. Arista EOS supports standards based 802.1X and RADIUS access control and LLDP device identification services to automate admission and segmentation of appliances, users, and applications in the campus.

The 7050X3 and 7300X3 Spline and the CCS 720 and 750 series share the same silicon architecture, and are designed to provide scale up networks with dynamic traffic load balancing, and real time flow monitoring of all campus workloads.

The campus dynamic load balancing makes forwarding decisions based on the rates of existing flows in addition to the traditional static 5-tuple hash. Therefore, new flows are balanced to the least utilized link and are re-ordered as stale flows age out. this performance optimizing feature interoperates with all devices that support link aggregation to ensure trouble free interoperability and migration.

Arista's campus switches also provide real time flow tracker telemetry. Supporting CloudVision and IPFIX APIs, flow tracker allows administrators to capture thousands of key performance indicators in real time for infrastructure, device, application and user data for SLA monitoring and troubleshooting use cases. The combined telemetry of the campus leaf and spline helps administrators better understand the proliferation of mobile, diverse and bursty traffic generated by campus users and devices. Salient EOS features and their benefits enhancing the cognitive campus are listed below in Figure 5.

Flow Tracker	Track flows through the network and detect anomalies
Dynamic Path Selection	Self correcting hashing based on real-time traffic
Dynamic Shared Buffer	Void video and data, to IoT, WiFi, video and sensors
Smart Software Upgrade	EOS SSU for hitless operations
Unified Forwarding Table	Access, edge, L2/L3 spine, balanced deployments
Remote Monitoring	GRE encapsulation & mirroring to DMF and sensors
Macro Segmentation	Granular firewall services for DMZ, guest networks, etc.

Figure 5 : Key Attributes of Cognitive Campus Splines and EOS

Finally, Arista's campus platforms accommodate a variety of layer 2 and 3 scaling demands with the help of its dynamically configurable Unified Forwarding Table (UFT). Unlike other static architectures with fixed L2 MAC and L3 routing tables, the X3/XP platforms let administrators select from multiple profiles optimized for either L2 MAC addressing, L3 host addressing or IPV4-6 route table scale. This simplifies design considerations because a common platform can be optimized for various campus use cases. Consistent with other Arista platforms, the X3 series supports wire speed L2 VLAN, L3 routing and L2 over L3 VXLAN that transcends 4K vlans to more than 16.7 million industry standard VXLAN virtual networks. Campus-wide dynamic segmentation of workgroups is accomplished through .1Q and EVPN services facilitated with CloudVision automation. CloudVision can extend segmentation orchestration to data center and cloud based workloads.

3. Cognitive WiFi Edge

Arista's distributed data plane architecture for WiFi embeds manageability, telemetry and .1Q or overlay VXLAN segmentation within the access points. This controller-less architecture continues to evolve with Arista's expanding family of Wi-Fi6, cognitive access points. The new AP230 series of 2 X 2 indoor and outdoor APs employ second generation 802.11ax radio technology providing upstream/downstream MU-MIMO and OFDMA transmission which greatly improves performance and user density compared to earlier WiFi5 and Gen1 802.11ax systems. These economical access points complement the AP250 and AP260 platforms which come packaged with a third scanning radio, and optional BLE.

As enterprises cope with the impact of social distancing, campus net admins are tasked to extend accessibility of business critical IT functions to workers without compromising their security profile. Arista's cognitive WiFi solution now offers standard VPN overlay features in its APs to extend the campus network to branch, remote or home workspaces. Leveraging IPSEC tunnelling services, Arista WiFi APs interoperate with leading VPN concentrator solutions to extend campus services under the enterprise's existing security infrastructure. CloudVision WiFi's Zero Touch Provisioning (ZTP) services simplifies remote office AP deployment, allowing administrators to drop ship APs to their distributed workforce who simply plug the device into their home network. Fully managed by CloudVision WiFi and with AP support for optional tunneled Ethernet connectivity, Arista's remote access solution fulfills the need for administrators to connect their socially distant workforce.

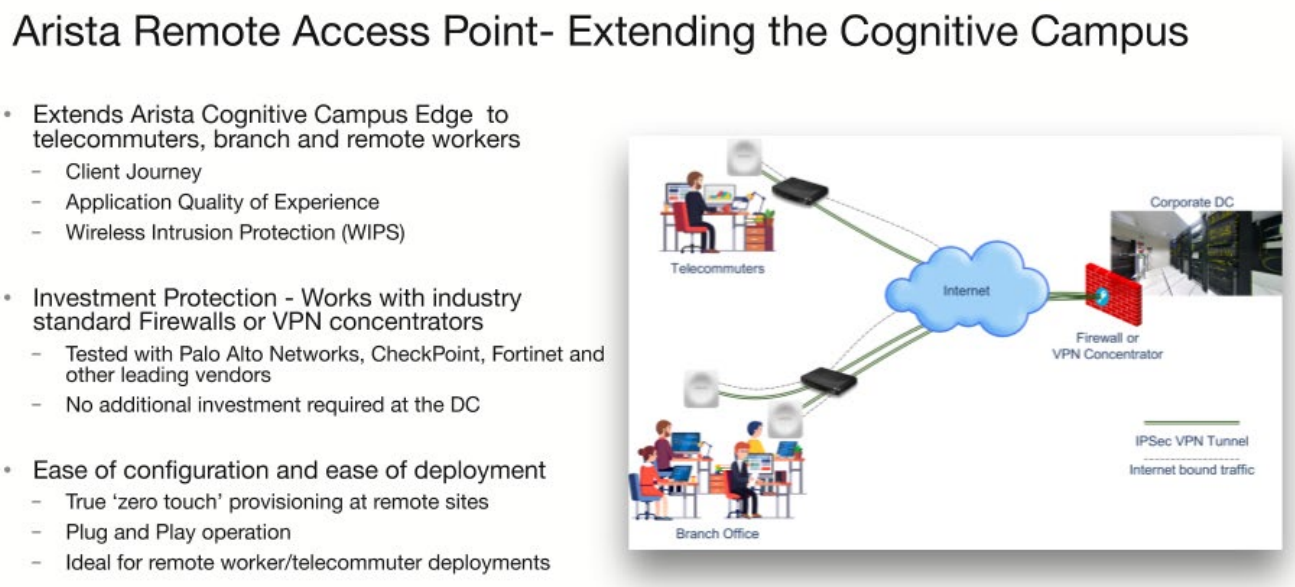


Figure 6: Extending Cognitive WiFi across Distributed Campus Workspaces

Arista's expanded family of WiFi6 platforms delivers the highest performance, utility and security to the wireless campus edge. Combining location and scanning radios with AI/ML heuristics in Arista's CloudVision WiFi Manager gives network administrators new capabilities in mobile client monitoring and location.

CloudVision's WiFi manager, available as an on prem or in cloud service, helps optimize the workforce's quality of experience. CVP WiFi facilitates network and application performance monitoring and remediation, provides tools for location and segmentation, and finally secures and monitors campus airwaves.

These features include:

Client Journey:

- Connection troubleshooting dashboard to streamline identification of campus users connectivity problems. The dashboard simplifies access troubleshooting including WiFi association, authentication and address allocation, to name a few.
- Inference based WiFi client problem diagnosis
  CloudVision WiFi leverages AI/ML heuristics applied to individual client sessions to analyze and diagnose probable causes of degraded WiFi client experience. As illustrated in Figure 7, the cloud based inference robot offers troubleshooting tips and possible remediation steps to administrators, reducing troubleshooting complexity and downtime while improving operations staff and client productivity.

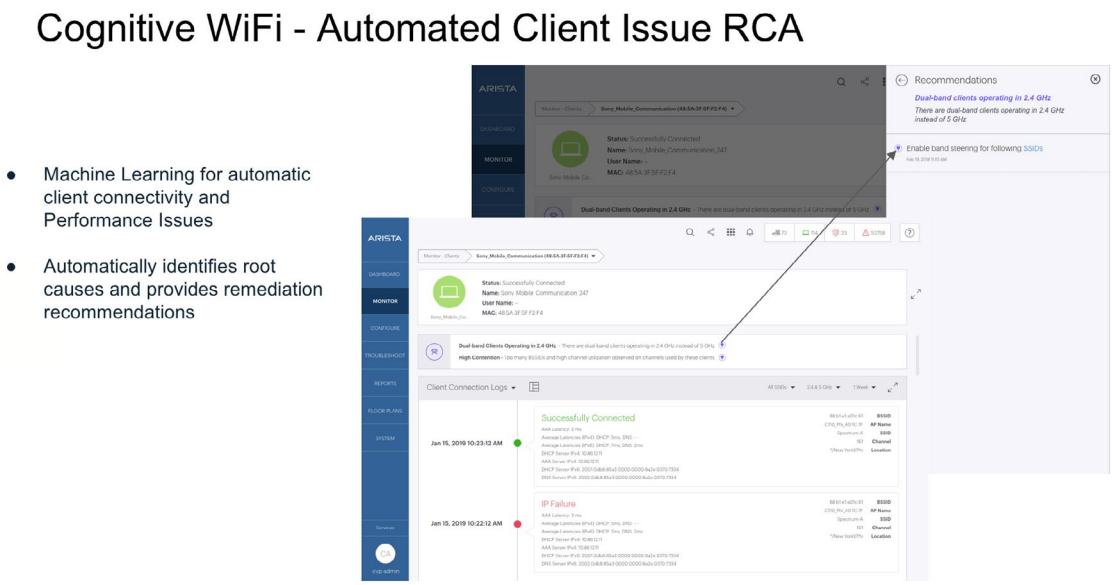


Figure 7: Client Inference Problem Resolution

- Site specific Inference based troubleshooting
- The focus of CloudVision WiFi's inference tools can be expanded from individual devices, to AP, and site level views, to address issues impacting user groups or workloads. The inference robot can be trained to an AP, floor or location to help assess problems that may be common to users, applications or a site. Power settings, channelization, interference and infrastructure deployment are among the factors evaluated for remediation recommendations.
- Client and Infrastructure Location Services
- A properly instrumented WiFi infrastructure offers both administrators and clients the ability to locate assets and resources in the cognitive campus network. Arista wireless platforms utilize WiFi and BLE technologies to locate and facilitate mapping of client and infrastructure devices in the campus. CloudVision WiFi discovers and facilitates placement of devices in the mapped campus. Administrators can refine their view of the cognitive WiFi network using a variety of filters/views aimed to identify:
  - Slow or intermittent clients
  - Clients exhibiting weak signals, high error or retry rates
  - Clients not meeting Quality of Experience (QoE) expectations for key applications.
  - Clients that are failing to connect.
  - Expanded applications monitoring for user Quality of Experience
  - CloudVision WiFi can now monitor collaboration tools like Microsoft teams and Zoom, in addition to Webex, Skype, GotoMeeting and hangouts. With this expanded capability, administrators can ensure the productivity of users' collaborative applications

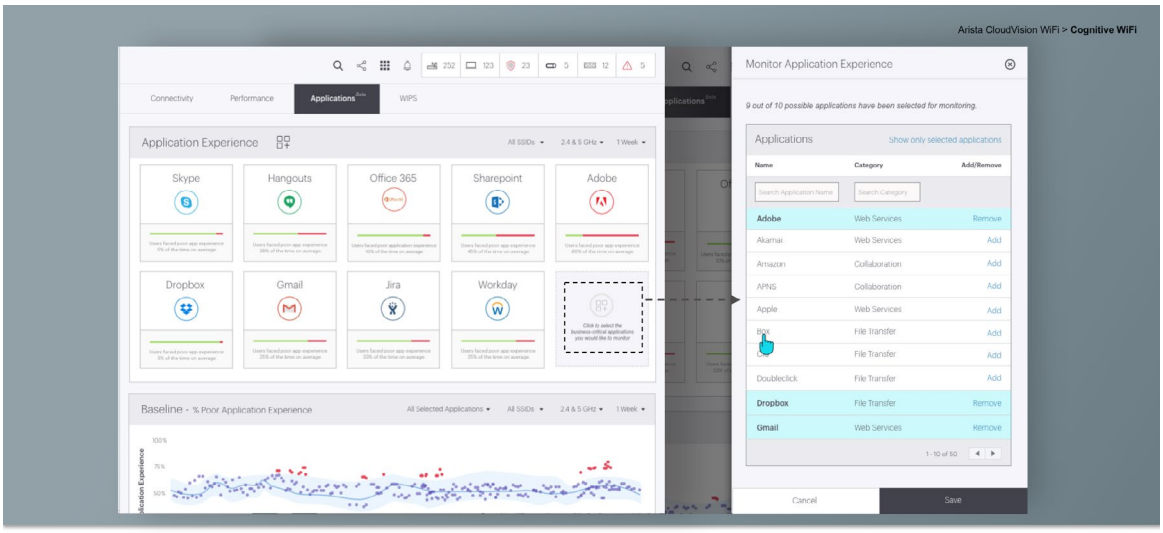
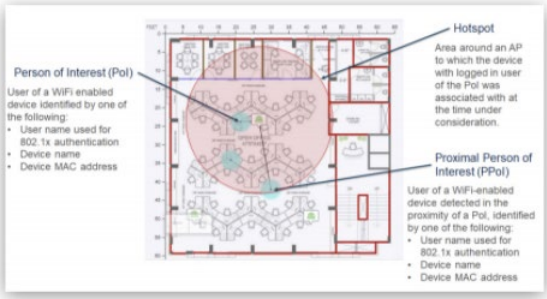


Figure 8: Application Quality of Experience for Business Critical Applications

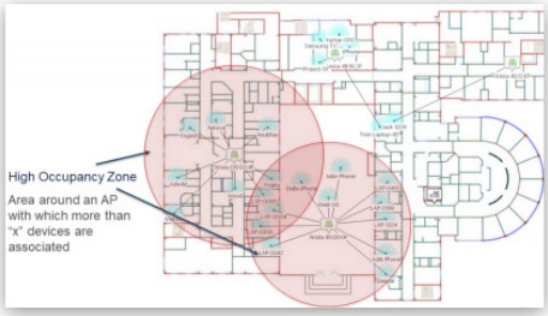
Finally, Arista leverages WiFi location services to provide enhanced location capabilities to help organizations cope with workforce location monitoring requirements.

Client Location Monitoring

Arista's Cognitive WiFi Management plane collects a multitude of real time client telemetry used to improve and ensure user and application Quality of Experience. CloudVision's inference engines sifts through the accumulated database of RF signal data, mac addresses, machine names, connection times and durations, roaming states, 802.1X authentication and a myriad of other Layer-2 through Layer-4 network data to provide context relevant troubleshooting assistance and KPI trend reporting that's helpful to NetOps administrators.



CloudVision WiFi is now leveraging this rich real time data with a new feature called P-tracer. P-Tracer runs WiFi telemetry through a policy engine to physically track clients connected to any CloudVision WiFi managed access point. P-Tracer identifies AP's where connection densities exceed pre-defined thresholds. Moreover, P-Tracer provides the time of stay duration per AP's. While P-Tracer's information can be leveraged for a variety of location services, it can also help organizations develop reporting for tracking essential workers in the enterprise. P-Tracer helps enterprises measure compliance with social distancing protocols and enables them to provide mandated contact tracing reporting to health agencies.



- WiFi Tracers:
  - Wireless Intrusion Prevention System to protect against rogue devices
  - Application and Internet reachability tools to diagnose connectivity problems
  - WiFi airwave health scanning tools that don't compromise WiFi resources
  - Extended testing and troubleshooting incorporating guest and BYOD web portals
- CloudVision WiFi's connection troubleshooting dashboard now has enhancements to diagnose typical problems with web provisioning portals. Portal accessibility and functionality are new additions to the client journey suite of diagnostic tools, extending analysis from the airwaves to association, registration, network services and finally quality of WiFi experience.

Utilizing the comprehensive telemetry derived from the Cognitive Management Plane, Arista's CloudVision WiFi tools streamlines and automates provisioning, securing, troubleshooting and ensuring client Quality of Experience throughout all segments of the distributed campus enterprise.

4. Cognitive Arista EOS

Arista EOS provides a common software foundation for the cognitive campus network. The transformational Extensible Operating System (EOS) brings its baseline advantages to the campus with cloud grade control, monitoring, virtualization, scale and reliability. Arista's unique self-healing architecture isolates software defects, supports live patching and redefines hitless upgrade and rollback.The same binary EOS image is used across Arista's entire product line: from campus to cloud. Doing so ensures that EOS quality and reliability is consistently validated across the thousands of Arista customer data center, cloud and campus networks.

Open standard APIs in EOS support industry leading DevOps, monitoring solutions. Core to Arista's EOS architecture is NetDB: the network-wide, state-driven, publish-subscribe-notify database. Unlike legacy polling or inter-processor communication (IPC) schemes, NetDB is purpose-built to share all state in real time. Streaming of real-time data is complete and efficient, communicating thousands of state changes at sub-second intervals to monitoring platforms using open JSON over HTTP. Implementing dynamic JSON dictionaries means NetDB can dynamically evolve, sharing new, additional key/value information to monitoring tools.

5. Cognitive Management Plane

There is a striking contrast between the maturity and robustness that has evolved in networking data and control planes, and the lack thereof in the corresponding management plane. Arista's CloudVision incorporates our cornerstone Cognitive Management Plane (CMP) to automate deployments, simplify infrastructure, user and application monitoring, anticipate errors, and avoid outages across all Arista platforms in real time. CloudVision harnesses the capabilities of cloud computing, big data, and machine learning, collecting and archiving all network state over time.

CloudVision's Cognitive Management Plane ingests all streaming state from all EOS campus, cloud and data center platforms, while its open APIs allow data sharing with CloudVision and other applications, either custom developed or from third parties. This allows administrators the flexibility to use best-of-breed tools for data-driven actions and analysis. The Cognitive Management Plane's API conveys commands as well as telemetry data, allowing configuration management tools to control the campus infrastructure. Together with NetDB's schema and native OpenConfig APIs, Arista's CMP fulfills customer's requirements for standards, openness and flexibility with flexible management and actions as depicted in Figure 9.

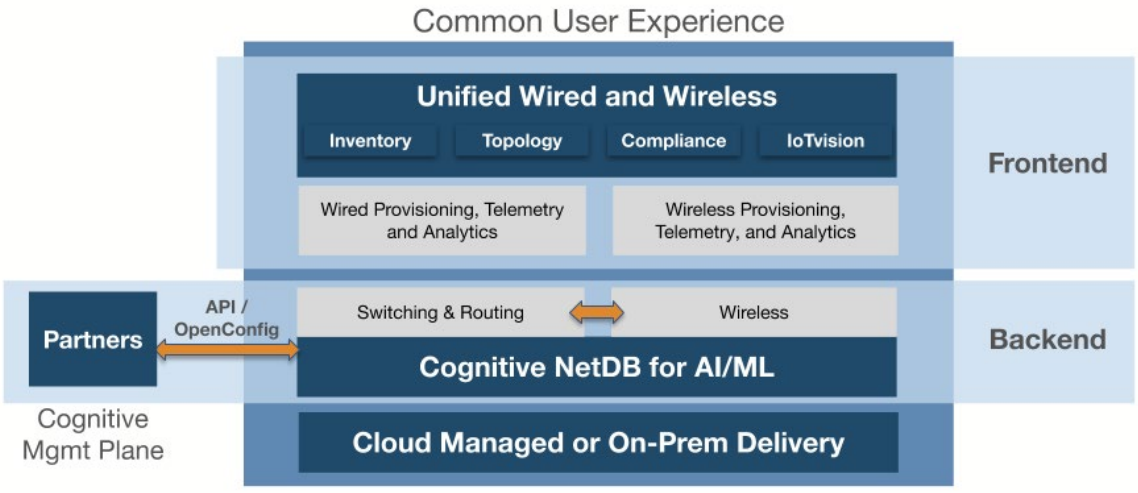


Figure 9: Cognitive Management Plane, a repository to drive network analysis and actions

The Cognitive Management Plane supports a growing list of analytics options. Based on real-time state streaming (NetDB) and open source tools including Hbase and Kafka, these streaming processors, called turbines, simplify, timestamp and correlate streaming state. Turbines help visualization and other machine processes better identify and make network-state actionable. Turbines that monitor software compliance, resource utilization and FRU health, not only track parameters for signs of degradation, they anticipate and alert operators of expected failure points, and support behavioral network actions that help network operators improve overall reliability.

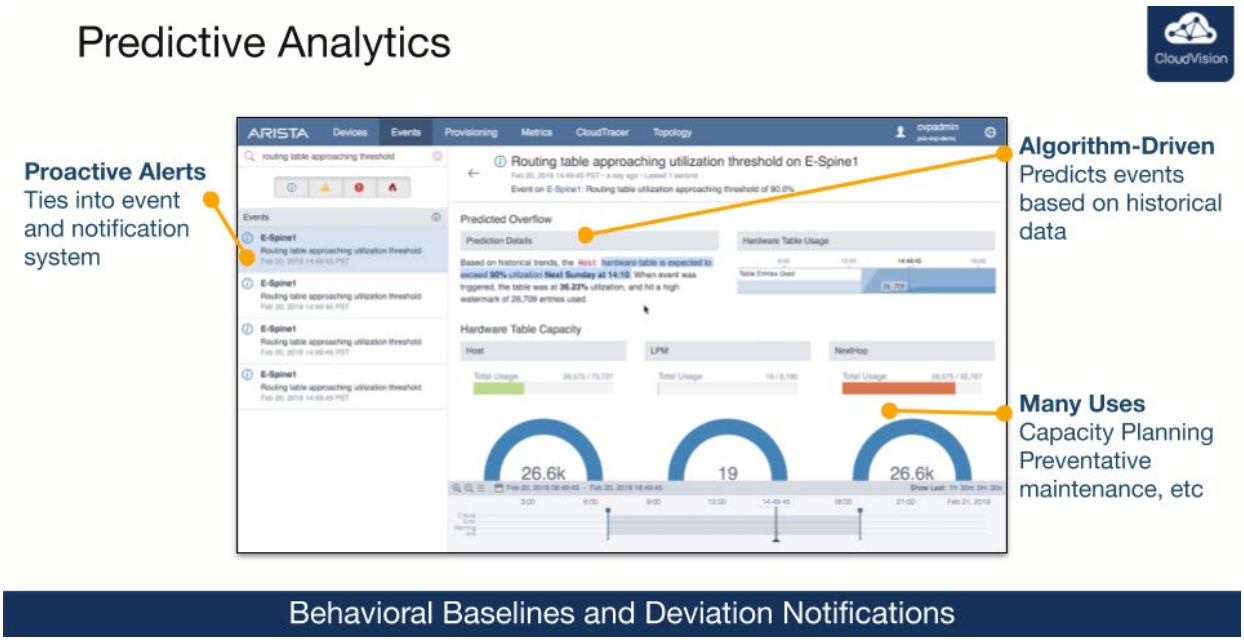


Figure 10: AI/ML Predictive Alerting

Arista's CMP also collects rich telemetry of IoT appliance, user, and application state through standard IPFIX and accelerated SFlow streaming. This real time data opens new use cases for administrators including:

- Identifying and inventorying campus devices, users and applications
- Monitoring key application and IoT SLAs, such as VoIP or security camera applications
- Identifying critical workflows and segmenting the network to protect them
- Automatically capture device or user rogue behavior and quarantine them

Pervasive Analytics in the Campus

Some workforce environments require complete and thorough data capture of network traffic to comply with organizational or regulatory requirements. Arista's DANZ Monitoring Fabric (DMF) analytics nodes deliver a scalable solution for collecting and analyzing standard data streams including Netflow (V5 and 9), sFlow and IPFIX.

DANZ Monitoring Fabric

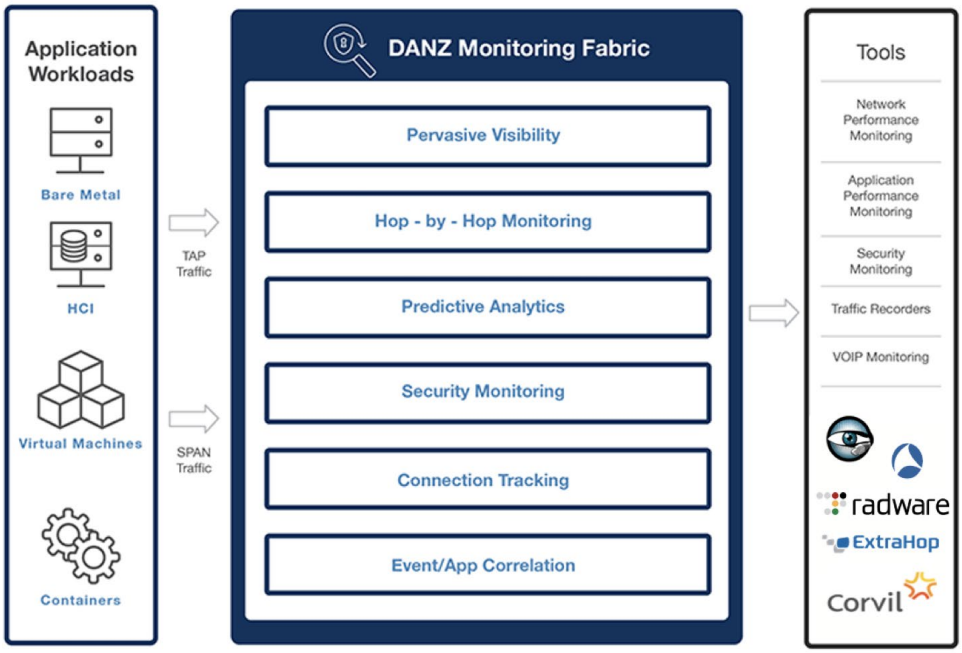


Figure 11: Architecture for Predictive, App-Aware, Pervasive Analytics

DMF analytics nodes can scale to meet the telemetry requirements of any sized enterprise. Providing forensic analytics and machine learning capabilities, the DMF analytics platform fulfills requirements for network data aggregation, archival and analytics. DMF analytics is part of Arista's comprehensive traffic acquisition, packet brokering, archival and processing solution for enterprise network analytics.

AI Driven Threat Detection and Response: Awake

The explosive proliferation of client and IoT devices in the enterprise correlates to an increased and often unmonitored attack surface and the corresponding risks of malicious attacks. Infosec managers have no other option but to leverage AI/ML systems that can aggregate enterprise scale data flows and constantly hunt for traffic patterns that signal a data probe or ransomware attack.

The Awake Security Platform, Arista's newest security investment, is the only advanced network detection and response solution that provides the SecOp team with answers, rather than alerts that lack context. By combining artificial intelligence with human expertise, Awake autonomously models and hunts for both insider and external attacker behaviors while providing triage, digital forensics, and incident response support across the distributed enterprise network.

The Awake Security Platform deeply analyzes billions of network sessions to autonomously discover, profile and classify every device, user and application across any network. Using a multi-dimensional machine learning approach, Awake then models complex adversarial behaviors and connects the dots across entities, time, protocols and attack stages. Unlike legacy network detection and response tools that rely primarily on unsupervised learning to spot anomalies from "normal" baselines, Awake compares entity behaviors to the peer group and the rest of the organization. This enables the platform to deliver threat detections with low false positives and negatives, and additionally provides the context and decision support data necessary for triage, incident response and remediation. Independent testing proves out these differentiators and shows Awake is more than twice as accurate and produces almost 1500% less operational overhead than other NDR systems.

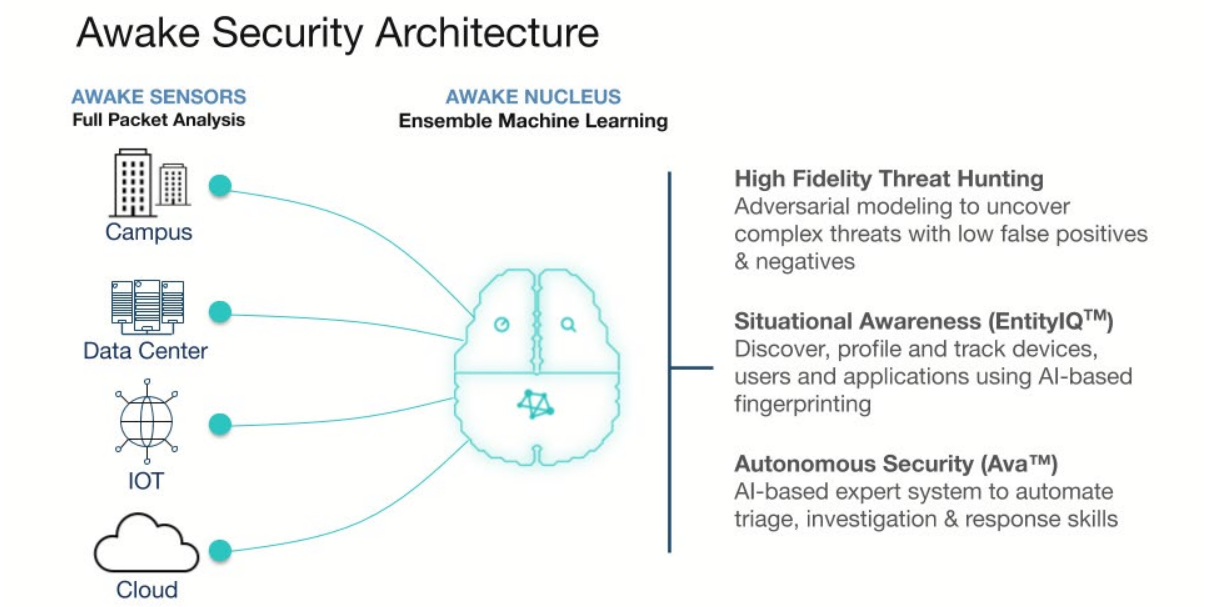


Figure 12: Ensemble Machine Learning for Threat Hunting, Awareness and Response

Awake monitoring sensors consume mirrored packets from either the DMF monitoring fabric or directly from infrastructure devices. Awake Sensors are deployed locally ensuring that sensitive data does not leave your network. Sensors send summarized metadata to the Awake Nucleus which can be deployed on premises or in the Awake cloud. The Awake Nucleus leverages Awake's EntityIQ technology to build a graph of network connected devices and their networked relationship.

EntityIQ does this by analyzing device communications, leveraging AI to glean devices from traffic flow data. Awake leverages EntityIQ to Analyze all devices through Adversarial modeling. Awake provides pre-configured adversarial models which can be customized by administrators through an easy to use AMI interface. Finally Awake's Ava expert system automates the investigation and remediation process.

Cognitive NetDB for CloudVision

In addition to CloudVision's native capabilities, the platform's open architecture allows administrators to integrate expanded functions like threat detection and network access control services from a partner ecosystem of industry leaders and tech innovators.

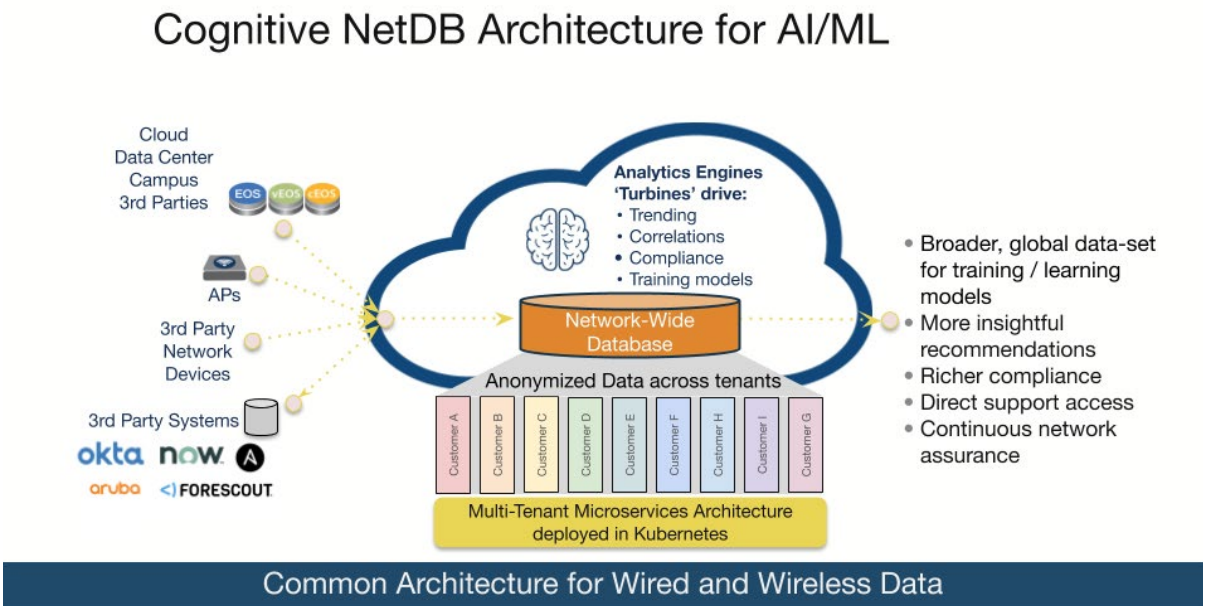


Figure 13: Open Architecture Supports Best of Breed Solutions

Together with CloudVision's suite of configuration management, automation, monitoring and analytics tools, network administrators now have the means to simplify design, automate deployment, streamline monitoring of infrastructure and workloads, anticipate problems and avoid outages. CloudVision can be deployed on premises or as a cloud based service to better fit the organization's operational and budgeting requirements.

Key features of the powerful cognitive management plane include:

- Network view: Arista CloudVision fully supports all Arista products using streaming telemetry but can also ingest standard SNMP MIBs to facilitate data collection from legacy management planes. CloudVision Turbines catalog data in the Hadoop time series database and present actionable information in various device or topology views.
- State history: Operators can see all state of any device from any point in time. Historical visibility is a big help in debugging transient or intermittent issues.
- Machine learning: CMP supports machine learning algorithms to automatically identify alerts that are important for likely root causes of anomalous behavior.
- Multi-vendor scalability. Third parties can provide their own CMP and offer their unique benefits to customers. Multiple CMP clusters can be replicated and distributed to better serve organizational or geographic domains.
- Templatized provisioning with customizable configuration screens: CVP's extensive programmability allows administrators to tailor "day 0" provisioning and "day n" change management to the organization's unique workflow. Network architects can create custom provisioning workflows, leverage existing templates from Arista's Github library of tools, or commission bespoke workflows through Arista's EOS+ services team or its ecosystem partners.
- Configuration and image archiving with change control/automated bug remediation: CVP AI/ML turbines leverage archived configuration and image data sets with Arista's online bug database to correlate potentially impactful bugs against running configurations. CVP compliance manager then alerts administrators of vulnerabilities and suggests actionable remedies.
- In-service roll-out: Because the management plane is independent from the managed devices control plane, CloudVision can be maintained independent of the physical infrastructure. The management plane doesn't affect applications; hence, management plane upgrades are low risk, and new features can be deployed frequently.
- High availability: CMP clusters co-ingest state from the same set of devices, such that if a node in the cluster fails, the cluster continues to manage devices.
- Cross-cluster awareness: Through state export, an application can run in one cluster based on state in other clusters.
- Programmable extensibility: The Cognitive Management Plane (CMP) provides a rich set of telemetry APIs that allow users and Arista's partner ecosystem providers to extend CloudVision's capabilities or leverage CloudVision's Netdb to enhance third party applications.

Cognitive Campus: Client to Cloud Use Cases

As campus networks transform to support the latest frontier, many examples and use cases are emerging:

- Monitoring the distributed campus workforce
- Flow tracking to pinpoint hotspots
- Improved security from audit to segmentation
- Enhanced client to cloud automation

Here are a few examples:

1. **Connecting and Monitoring the Distributed Workforce**

   WiFi access points support standard IPSEC tunneling features that allow remote workers to securely connect into the campus network and have complete access to enterprise resources. This gives workgroups, like customer service teams, secure and simplified access to critical CRM and knowledge based systems allowing them to work safely and remotely.

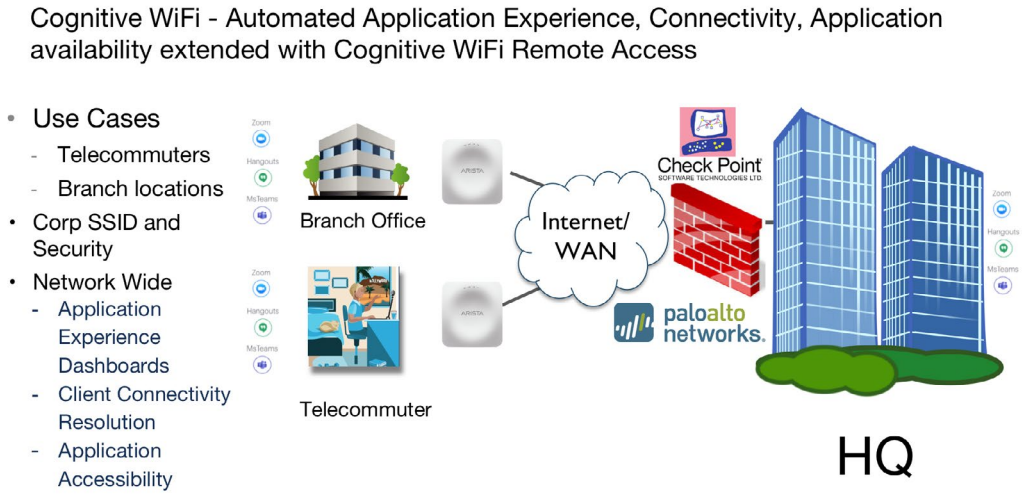


Figure 14: Remote Connectivity Leveraging Existing VPN Concentrators

Arista's Zero Touch Provisioning (ZTP), simplifies deployments, letting administrators templatize configurations that include WiFi and VPN security provisioning and credentials that are downloaded when the AP is connected to the internet. Provisioning is simplified and automatic: APs are shipped to the remote workforce who then plug and play.

Arista's innovative P-tracer leverages WiFi telemetry collected by the Cognitive Management Plane to track movements of essential workers in campus offices as seen in Figure 15.

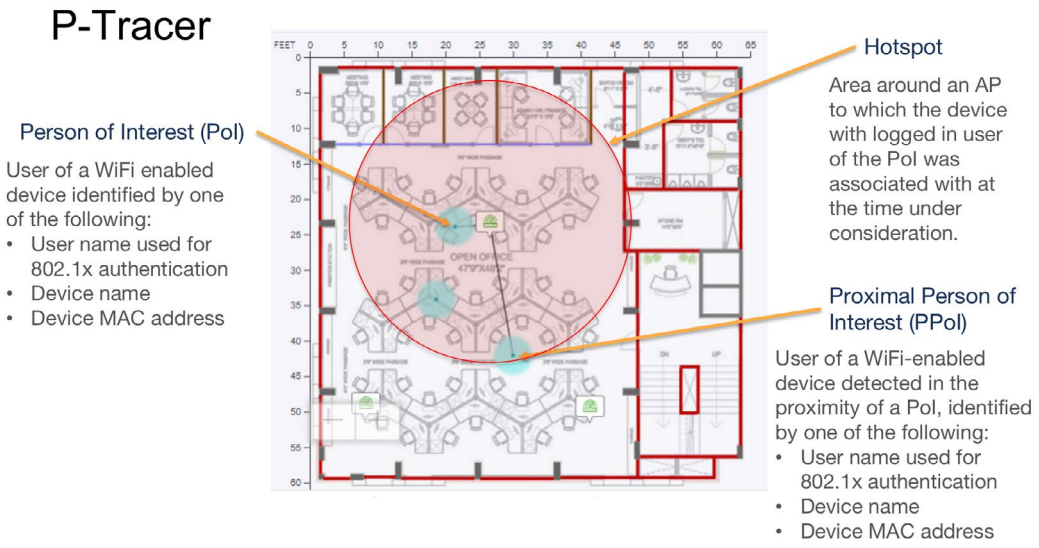


Figure 15: Essential Worker Tracking and Reporting

Worker location is saved in CloudVision's database to allow organizations to audit social distancing compliance and provide regulatory contact reporting if needed.

2. **Cognitive Use Case - Intelligent Monitoring**

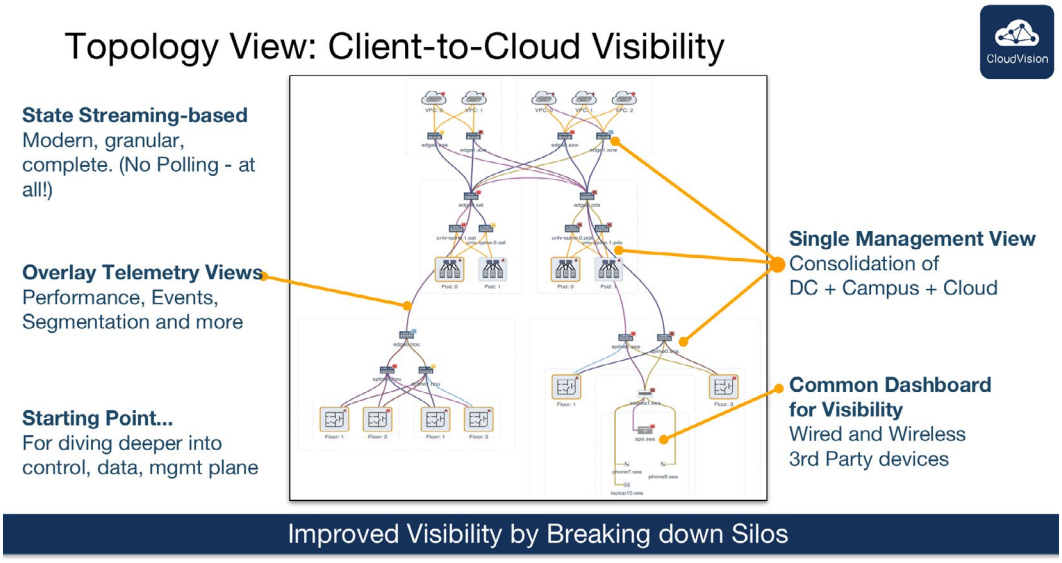


Figure 16: CloudVision Telemetry Visualization from Client to Cloud

Campus LAN and WiFi platforms deliver real-time user and IoT appliance flow tracking alongside real-time network state telemetry so administrators can monitor key performance indicators and maintain service levels in the cognitive campus network. Device Analyzer and IoTvision visualize port connections and correlate network, application and IoT/user flow data to identify and rectify performance or security issues. Administrators can use timestamped data to pinpoint and correct network hotspots before applications are adversely impacted or users even notice.

IoTvision: An evolution of CloudVision's device analyzer, IoTvision extends visibility, classification and monitoring to all networked IoT devices: wired or WiFi. CloudVision's analytics turbines sift through flowtracker and SFlow session telemetry to identify, locate and correlate all kinds of appliances including sensors, security and monitoring devices, common office and other specialized appliances. IoT tracer's database functions let administrators catalog appliances using a variety of search criteria allowing administrators to locate devices, review their communications sessions, identify MAC/IP details and more signatures when possible.

IoTvision is a key asset for administrators who need to know the status and interaction of business critical user, security and environmental appliances.

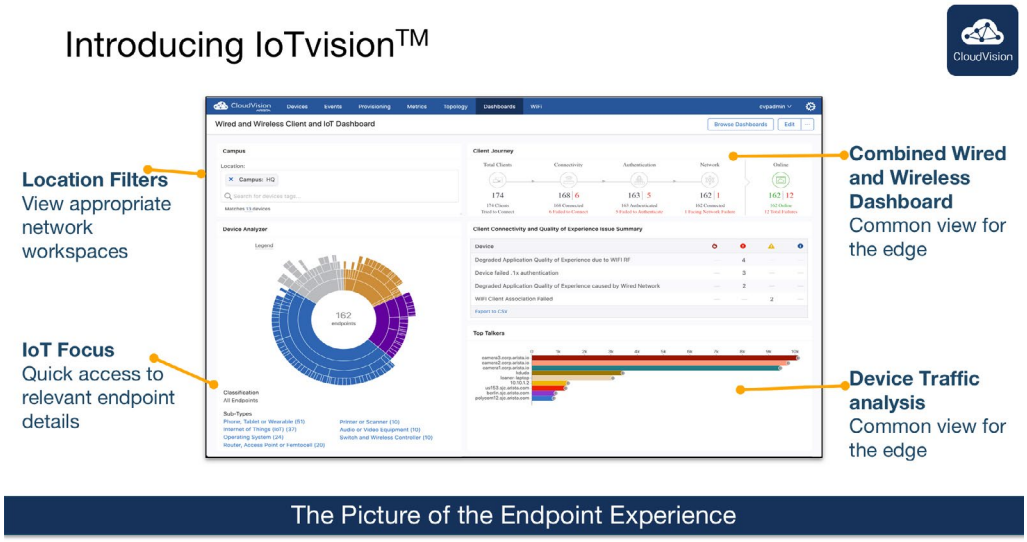


Figure 17: Expanding Monitoring and Visibility to Campus IoT Devices

3. Cognitive Use Case - Comprehensive Campus Security: from Authentication to Segmentation to WIPS

Campus security officers are constantly balancing security requirements alongside worker productivity. Organizations' workflows also affect optimal security solutions. To optimize the balance of security and accessibility, campus administrators and infosec personnel must look for campus networking solutions that support a large ecosystem of segmentation partners that offer a variety of credential, single sign-on or IoT-centric behavioral authentication systems.

Unlike complex, proprietary segmentation schemes, open, standards-based 802.1q and VXLAN-based EVPN segmentation services can be combined to secure critical workloads or isolate suspect workflows across a campus-wide, multi-vendor environment. For outlier workflows, CloudVision provides traffic steering and segmentation capabilities in its Macro Segmentation Services (MSS) feature set or through Arista's ecosystem partners. The campus is dynamically configured to enforce security policy with no impact to other workloads. This simplifies campus network administration, and helps automate security enforcement using standard traffic segmentation technologies.

okta aruba FORESCOUT

The ease of WiFi accessibility poses a continuous security challenge to campus administrators. To ensure the security of the campus airwaves, cognitive WiFi systems must automate security scans, provide constant coverage and produce actionable threat assessments. Arista's Cognitive Wireless Intrusion Protection Services (WIPS) provides a comprehensive architecture. Starting with dedicated scanning resources at the edge, telemetry is fed to Arista's Cognitive WIPs turbines which constantly log, process and synthesize performance and threat assessments to ensure the security and availability of the campus WiFi.

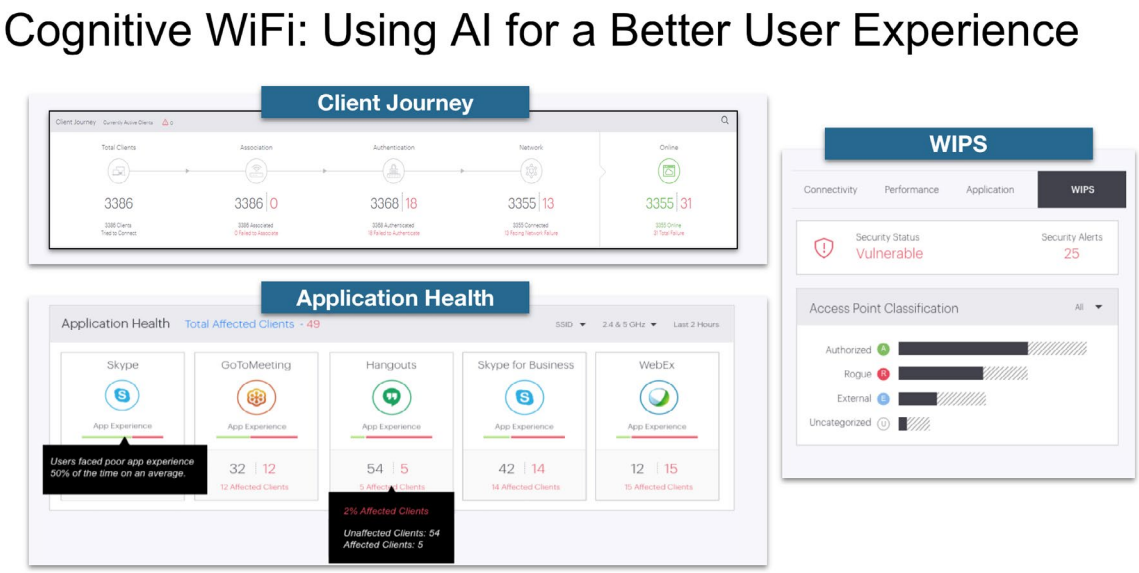


Figure 18: Key Attributes of Cognitive WiFi Including Intrusion Detection/Prevention

In addition, the Awake Security Platform, when deployed, can provide ongoing security monitoring, detect threats and then respond through integrations with a variety of partners including endpoint security and firewall providers.

4. Cognitive Use Case: Compliance, Audit Control, and Predictive Analytics

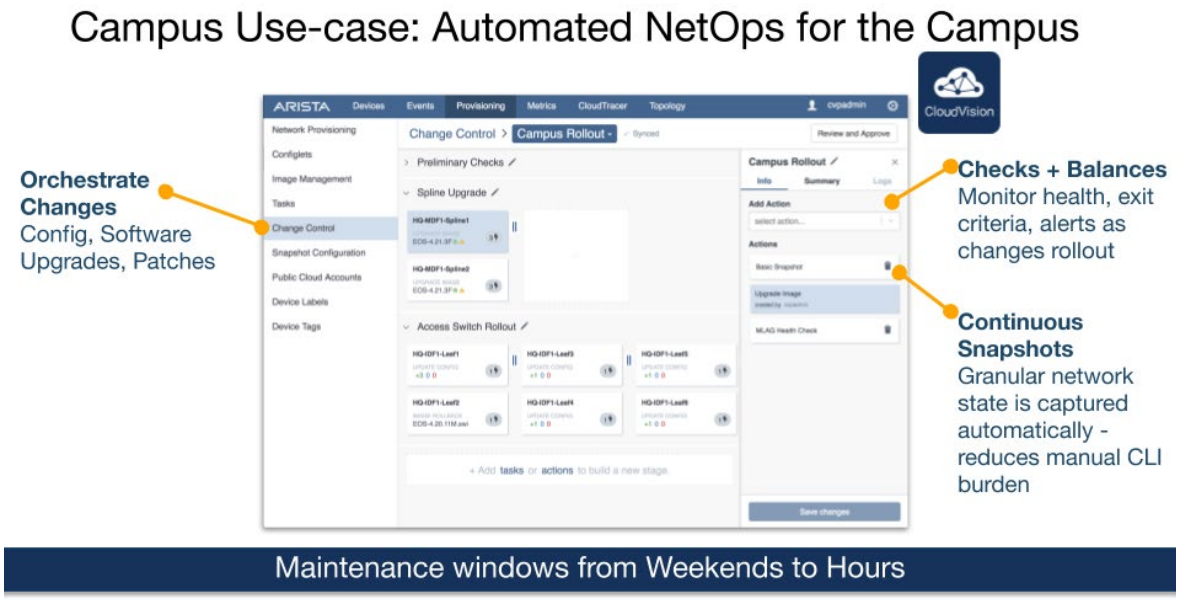


Figure 19: Compliance and Remediation Simplified and Automated

DevOps solutions have proven their worth in countless data centers for both server and network administration. When used to manage uniform software platforms, DevOps systems have a proven record of reducing errors while improving deployment time.

Yet even in DevOps, there are opportunities for data analytics to further reduce TCO. Databases of system configurations can be checked against bug databases to identify and warn administrators of possible vulnerabilities before they become outages. Cognitive compliance checking is better when configurations and operating systems are uniform and consistent, particularly in a sprawling campus. CloudVision's compliance dashboard helps perform cognitive audits.

Systems configurations and running OS images are compared against Arista's bug tracker database to identify possible compliance issues as depicted in Figure 20. This forewarns administrators of potential vulnerabilities and offers remediation options before a catastrophic incident. CloudVision's proactive visibility of pre- and post-differentials for VLANs, MAC or route metric adds additional and valuable audit control.

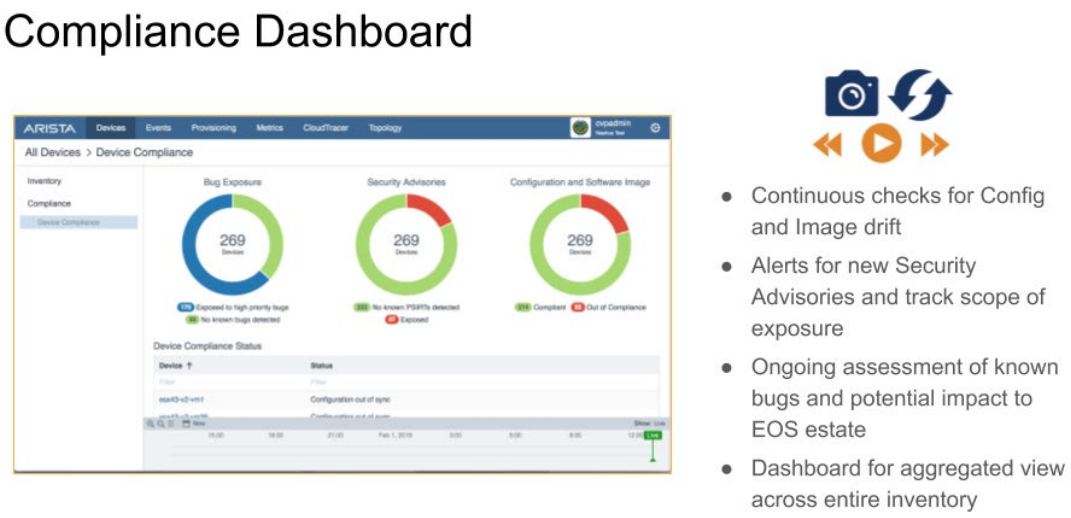


Figure 20: Cognitive Checking Simplifies Compliance Decisions

Predictive Analytics:

The quality and actionability of all analytics systems are deeply dependent on the telemetry it consumes. That is why CloudVision's Event Monitoring can detect anomalies before they become failures and alert administrators of the need for corrective actions.

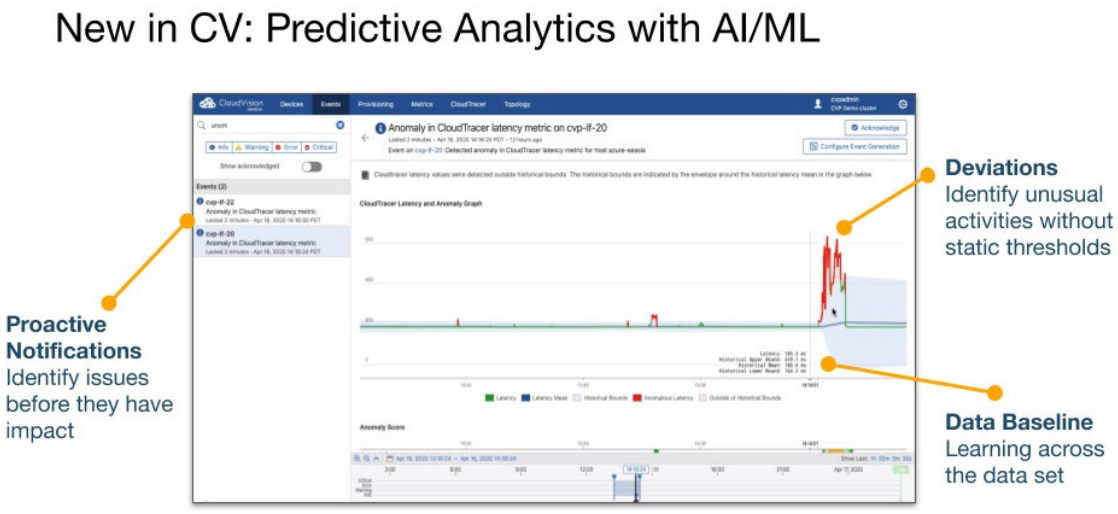


Figure 21: Real Time Telemetry Coupled With Analytics Helps Prevent Service Disruptions

The scope of CloudVision's predictive analytics is comprehensive since NetDB consumes all state within EOS. Real time telemetry improves both the analytic fidelity of AI/ML turbines and the timeliness of alarms generated. CVP provides webhooks and easy to use APIs so notifications can be passed to Network Operator's preferred alerting system.

5. Cognitive Use Case: Zero Touch Provisioning (ZTP) in the Campus

There is an ever-increasing frustration with the inconsistencies of legacy campus networks. Campus administrators struggle to manage user's traffic from computers and smartphones, and are additionally faced with mission critical IoT traffic from badge readers, security cameras and environmental controllers, just to name a few. The challenge of securing and protecting information is paramount, but extreme measures may degrade or outright break legitimate applications. Lastly, the complexities of maintaining heterogeneous legacy infrastructure can be its own full-time job as managers must certify discrete platform images for different parts of their multi-tiered network.

Extending cloud networking principles, Arista Cognitive Campus Architecture is designed to address users' and administrators' needs with automated end-to-end configuration builder and orchestration services that are consistent across the entire campus edge as shown in Figure 22 below.

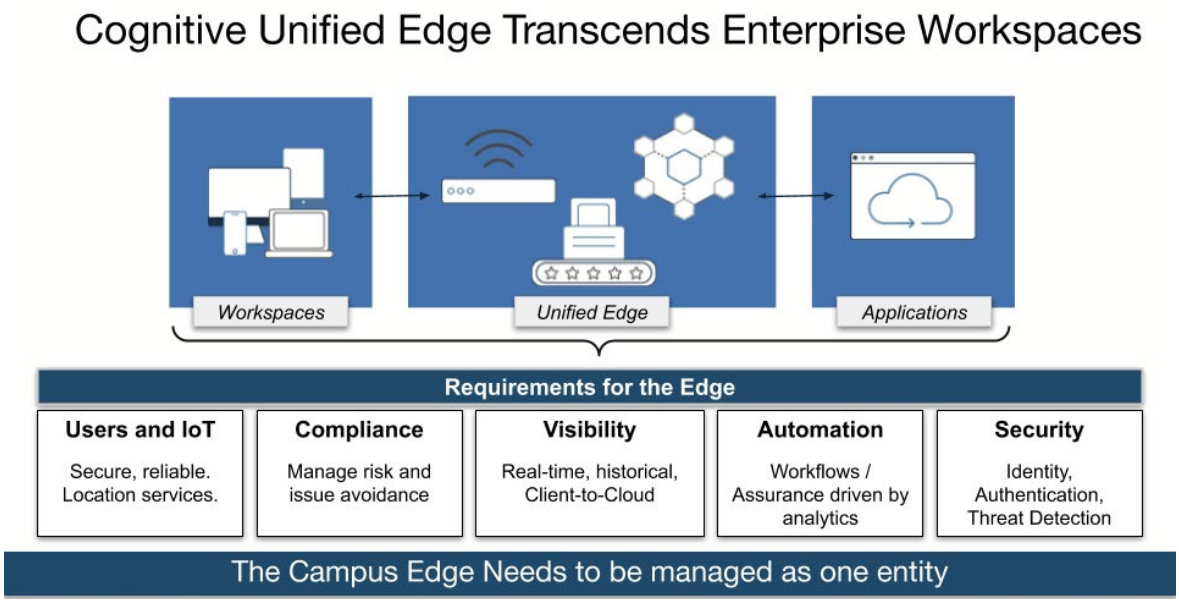


Figure 22: Prudent Automation Steps From Client to Cloud.

Arista ZTP works in conjunction with CloudVision templates to rapidly on-board new infrastructure and clients, while simplifying QoS, user, guest and IoT segmentation policy across the enterprise WiFi and Wired LAN. Provisioning templates and automation scripts help simplify the definition and deployment of the underlying fabric and overlay workgroup segments across distributed enterprise workspaces. Coupled with CloudVision's Integrated WiFi and Wired LAN topology view, administrators enjoy rich visibility of the entire campus network to simplify troubleshooting.

CloudVision's unique compliance management tool is invaluable for mission critical deployments. It automatically pushes and validates segmentation configurations against the campus infrastructure, ensuring end-end dataplane consistency that can be leveraged by popular NAC solutions.

Dağıtık Kampuste Verimlilik Sorunlarını Çözmek

Kampus kullanım örneklerinin, sosyal mesafe uygulamalarından kaynaklı, büyük bir değişime uğraması, işletme genelinde dikkatli bir değerlendirme gerektirir. Birlikte çalışabilirlik ve toplantı araçlarına artan bağımlılık, temel çalışanları takip etmek için uygun araçlara yatırım yaparken çalışanları dağıtık yapıda çalıştırma ihtiyacıyla birleştiğinde, iş kritik uygulamalar listesini de inanılmaz ölçüde artırdı. Ağ tasarımları, bu gelişmelere uyum sağlayabilmenin yanında karmaşıklıktan uzaklaşmalı ve aynı zamanda toplam sahip olma maliyetini de düşürmelidir. Arista'nın evrensel EOS'u üzerinde çalışan ve CloudVision ile yönetilen geniş kampus platformu portföyü, dağıtık iş gücü ve ağ yöneticileri performans, güvenilirlik, güvenlik ve otomasyon düzeyini bir sonraki adıma taşıyabilmek için Bilişsel Yönetim Düzleminin sunduğu telemetri yeniliklerinden de yararlanır.

Arista'nın sunduğu pragmatik bilişsel güdümlü çözümleri ile rakiplerinin sunduğu yüzeysel çözümler arısındaki fark açıktır. Arista'nın bulut sınıfı EOS, CVP ve bilişsel kampüs LAN ve WiFi platformları ile ağ liderleri ve BT yöneticileri, mevcut ve gelecekteki zorluklarının üstesinden gelebilmelerini sağlamak için uyarlanabilir ve bilişsel bir kampus mimarisi uygulayabilir.

Santa Clara—Corporate Headquarters
5453 Great America Parkway,
Santa Clara, CA 95054

Phone: +1-408-547-5500
Fax: +1-408-538-8920
Email: info@arista.com

Türkiye Distribütörü - Exclusive Networks
İçerenköy, Karaman Çiftliği Yolu Cd. No:47
Kat:1, 34752 Ataşehir/İstanbul

Telefon: +90 216 464 04 90
Faks: +90 216 464 0491

Ireland—International Headquarters
3130 Atlantic Avenue
Westpark Business Campus
Shannon, Co. Clare
Ireland

Vancouver—R&D Office
9200 Glenlyon Pkwy, Unit 300
Burnaby, British Columbia
Canada V5J 5J8

San Francisco—R&D and Sales Office
1390 Market Street, Suite 800
San Francisco, CA 94102

India—R&D Office
Global Tech Park, Tower A & B, 11th Floor
Marathahalli Outer Ring Road
Devarabeesanahalli Village, Varthur Hobli
Bangalore, India 560103

Singapore—APAC Administrative Office
9 Temasek Boulevard
#29-01, Suntec Tower Two
Singapore 038989

Nashua—R&D Office
10 Tara Boulevard
Nashua, NH 03062