ALL CLOUDS ARE NOT CREATED EQUAL

HOW TO DELIVER SCALABLE, RESILIENT AND AUTOMATED WLAN SERVICES WITH THE MIST CLOUD

Mist
A.I. is in the AIR™

How to Deliver Scalable, Resilient and Automated WLAN Services with the Mist Cloud

Many companies are moving key applications like CRM, HR, and finance to the cloud as a way of maximizing IT efficiency, minimizing IT costs, and improving the overall agility of business operations. For the same reasons, key infrastructure elements like security and storage are also being transitioned to the cloud. However, wireless networks have been slower to adopt this transition, with more than 90% of the Wireless LAN (WLAN) market still delivered via on-premises controllers. But this is changing rapidly.

Moving wireless to the cloud gives CIOs a more scalable and resilient infrastructure with better operational simplicity and efficiency. In addition, it gives CMOs and business owners actionable insight from the petabytes of data flowing through wireless networks today. This is why cloud wireless is the fastest growing segment of network IT, with one third of the total market expected to transition to the cloud by 2020 (IDC).

The first generation of cloud Wi-Fi products, first introduced in 2007, were basically on-premises controllers that were virtualized and run as VMs in distributed data centers (with management functions in the cloud.) These products simplified the deployment and management of wireless networks and sparked a major shift in the industry away from on-premises hardware. However, because they are built on old technologies they lack the agility and scale needed to satisfy the modern requirements of today's companies and they do not provide a proper foundation for addressing key WLAN requirements, such as automation using machine learning and visibility into the mobile user experience.

Only recently have modern technologies emerged that bring the possibility of true web scale, agility and performance to the burgeoning cloud WLAN market. When combined with Artificial Intelligence (AI), machine learning, and Big Data analytics, the new generation of cloud WLANs not only simplify WLAN deployment, they automate ongoing operations for substantial cost savings. This has allowed the modern WLAN to shift its focus from the infrastructure to the user, enabling Wi-Fi to be delivered as a predictable, reliable, and measurable service.

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> *- IDC*

Mist is leading the charge into the next generation of cloud Wi-Fi. We looked at how big data companies like Amazon, Google, Facebook and LinkedIn correlate massive amounts of information using machine learning in cloud and asked "How do we harness these same principles to build the first user-centric wireless network?"

The result is the first truly innovative WLAN platform in over a decade. Built on a microservices architecture using the latest cloud, AI, and wireless technologies, the Mist Learning WLAN provides capabilities not available on first generation cloud WLANs, which include:

- Rapid deployment of new services without impacting existing services
- Elastic scale
- Actionable insight using global data sets and machine learning
- Security
- High availability

This paper discusses the core architectural features of the Mist Cloud in more detail.

BIG BENEFITS FROM MICROSERVICES

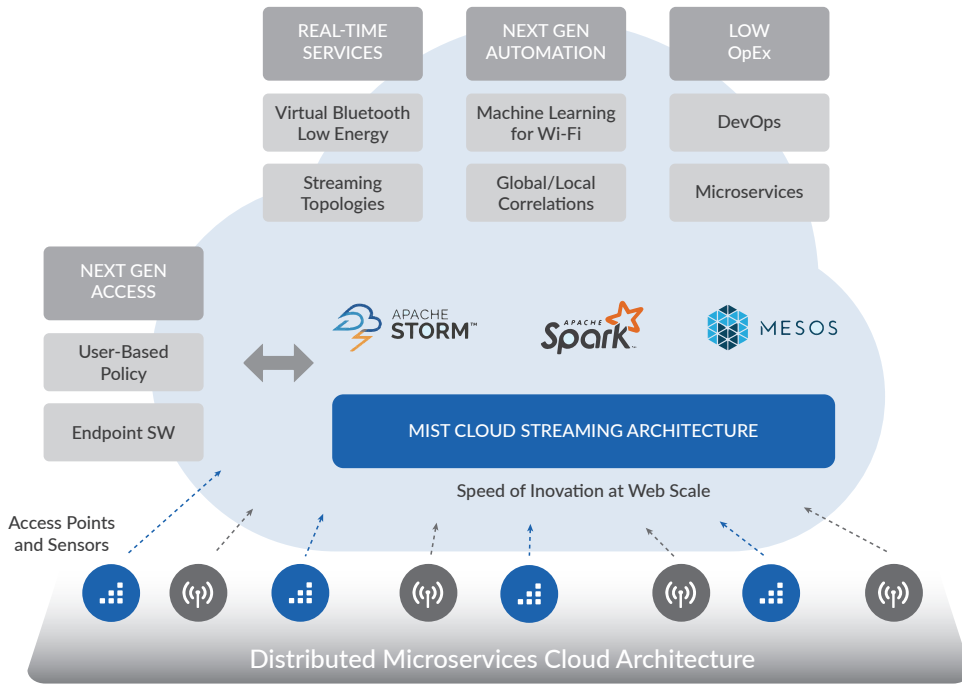
A microservice architecture is a method of developing software applications or functions as a distributed set of independently deployable and manageable modular services. Each service has a unique function that communicates with others via a well-defined mechanism. By leveraging a microservices architecture, the Mist Cloud provides service velocity without disruption and unprecedented elastic scale.

Service Velocity without Service Disruption

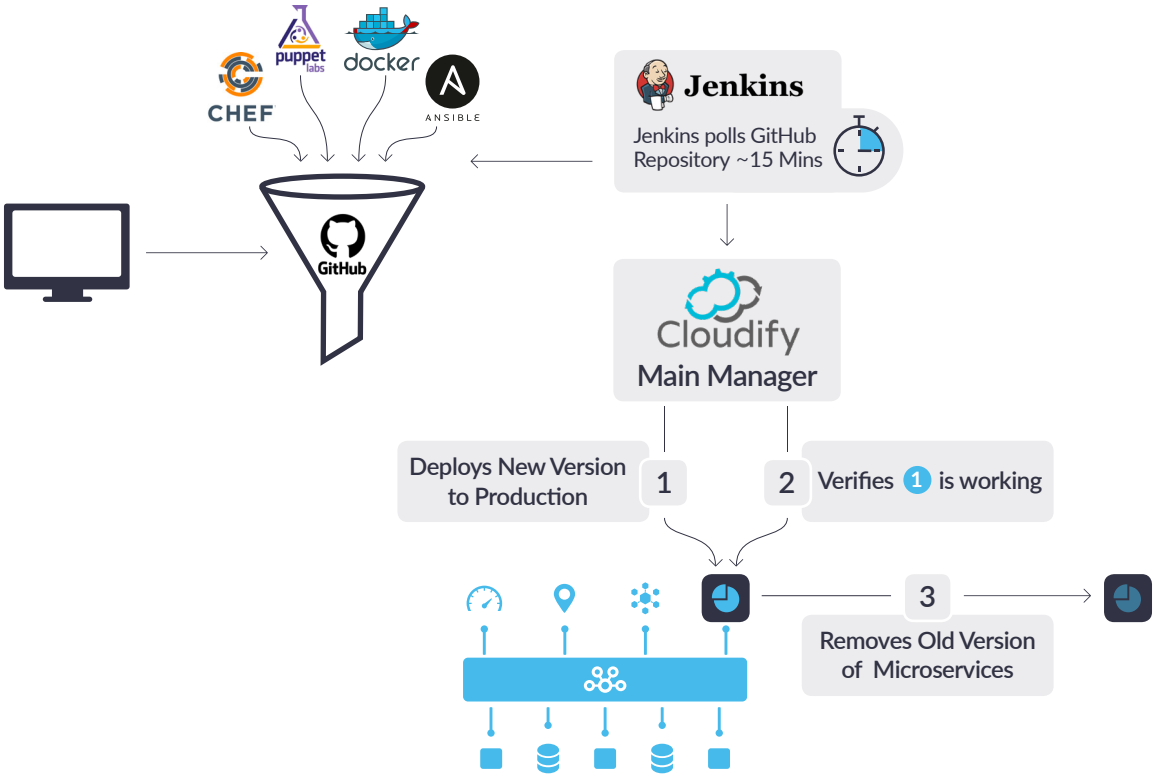
Network IT teams are increasingly expected to do more with ever shrinking budgets and resources. This includes rolling out new applications that maximize productivity, supporting new services that drive business revenue, and guaranteeing the high availability of existing resources. As a result, many IT departments have taken a DevOps mentality, where the process of software integration, testing, and deployment are automated and tightly monitored so new features can be built, tested and released rapidly, frequently, and reliably.

The Mist Cloud strikes the perfect balance in the "optimize, innovate, disrupt" DevOps paradigm. On one hand, the Mist architecture offers the resiliency of a business-critical wireless service. On the other hand, Mist ensures the rapid roll-out of wireless functions with minimal down-time, which is unprecedented in the WLAN space.

This is achieved because different service modules are logically segmented in their own containers within the Mist cloud. For example, the authentication module for the integrated guest captive portal is separate from the location engine, Wi-Fi analytics engine, Radio Resource Management (RRM), and other services. All of the individual modules are tied together by a real-time message bus (and share a long term data store.) This allows Mist the flexibility of rolling out new features or making modifications to a specific section of the platform without impacting other services. For example, social sign-on for guest portal authentication can be added without affecting Mist's location services, or Mist's Proactive Automation and Correlation of Events (PACE) can be upgraded without affecting RRM.



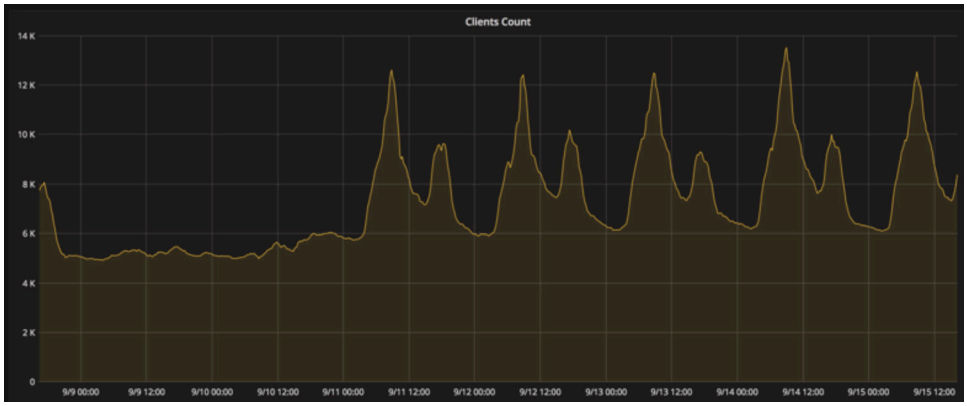
When rolling out a new feature, Mist heavily utilizes A/B testing to automatically measure performance and perform incremental rollouts. The Mist microservice architecture allows multiple different versions of the same microservice to run in parallel, on the same data sources and environment. This allows a new service, or version of an existing service, to run on real data before being put into live service. Once the data accuracy and performance is verified, the individual microservice switches over to the new version on the live system, with minimal downtime and customer impact.



The distributed microservices architecture in the Mist Cloud enables new features and bug fixes to happen with extreme agility – i.e. at a pace that far eclipses what is possible with traditional WLAN controllers and first generation cloud architectures. In a Mist environment, for example, updates happen almost every week. In contrast, alternative solutions require new updates to take place on scheduled release cycles, which typically occur every few months or longer.

Unprecedented Elastic Scale – Horizontally and Vertically

Traditional wireless architectures fail to deliver at scale due to monolithic designs that use vertically integrated systems. Take, for example, a distributed enterprise spread globally across 100s to 1000s of locations with 10,000+ Access Points. In the old world, on-premises or cloud-hosted controller pairs would have to be replicated for resiliency. In certain scenarios, additional controllers are required for providing management and troubleshooting, as packet captures, debug logs, and event logs, eat up substantial processing power. On top of this, some industries (e.g. retail and hospitality) require even more controllers to be pre-instantiated to handle temporal surges in demand, such as an increase in RADIUS authentication requests, during the holidays.

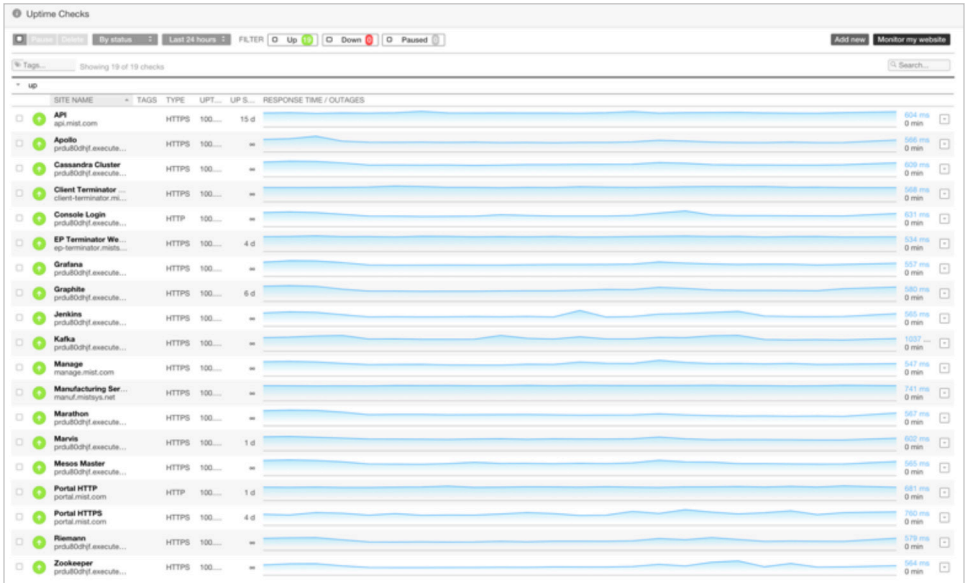


Mist cloud has the web scale to manage and monitor large amounts of client data

When it comes to scale, Mist's microservices architecture has a unique advantage. The Mist Cloud monitors utilization of different services and scales each module up or down dynamically without requiring end user intervention. The Mist cloud offers elastic scale, without a physical cap on the number of Access Points, client devices, or sites (per customer or globally.)

With Mist, you can shrink and expand resources with minimal lead time. This is a fundamental advantage of being built on the modern cloud, as the network IT team no longer needs to worry before a critical event (such as Black Friday for retail stores) as to whether pre-instantiated resources will scale and perform to the demands on the network.

The Mist Cloud complements application performance management with infrastructure monitoring using purpose-built tools that provide real-time analytics and visibility into the health of the cloud. Mist has a Network Operation Center (NOC) that uses modern and comprehensive cloud application and infrastructure monitoring tools to provide IT teams the peace of mind needed to deliver a continuous 24x7 "always on" WLAN service.



Mist enables a 24x7 always on WLAN service

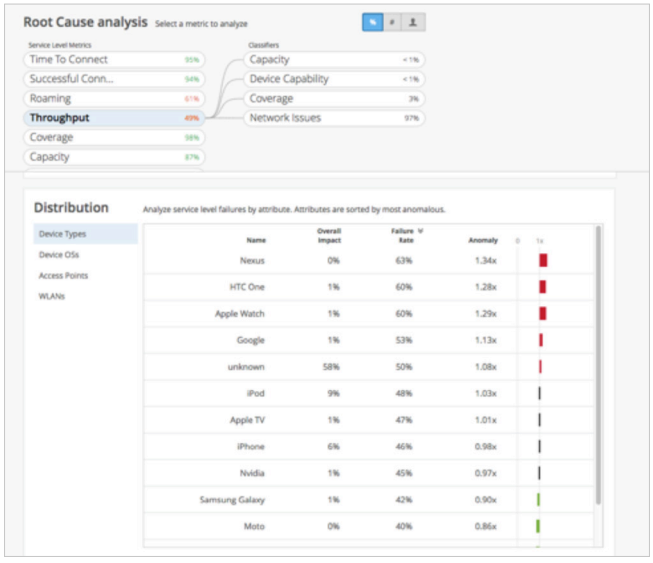
ARTIFICIAL INTELLIGENCE - TURNING BIG DATA INTO BIG KNOWLEDGE

Neural networks and machine learning concepts have been around since the 1950s. However, ease of access to immense compute power needed to solve large computational problems did not exist until the modern cloud emerged in the mid 2000's. Cloud infrastructures like Amazon AWS, Google Cloud, and Microsoft Azure have turned A.I. into a mass market technology by pricing compute cost effectively (with elastic growth), enabling companies of all sizes to quickly and cost-effectively build A.I. platforms on massively scalable and secure global cloud infrastructures. Because the Mist platform is built using modern cloud elements, it is the first WLAN capable of using AI to automate Wi-Fi operations, simplify troubleshooting, detect anomalies, analyze trends, and provide predictive recommendations.

The Mist platform has a unique Proactive Analytics and Correlation Engine (PACE), which provides the foundation for AI data collection and analysis in the Wi-Fi / BLE domain. PACE collects over 100 pre- and post- connection user and location states in near real-time from every wireless device. This state information is sent to the Mist cloud, where AI algorithms are used for real-time analysis.

In addition, the Mist environment uses design intent metrics to classify and monitor the wireless user experience using AI. For example, Mist lets you set, monitor, and enforce your own Service Level Expectations (SLE) for various key Wi-Fi metrics such as "Time to Connect", "Successful Connections", "Throughput", "Coverage", "Capacity", "Roaming" and "AP uptime". These are then used to quantify the Wi-Fi performance of clients, Access Points, and entire locations. For example, you can define a throughput SLE of 30 Mbps for all users in your main campus. PACE will tell you exactly what percentage of the time this SLE is being hit, which users are not getting this level of service, and which device types/operating systems/applications are consistently causing problems. In addition, it can predict if this SLE will be achieved in the future based on current conditions.

Mist's architecture allows for the capacity and performance to aggregate global metadata across customers. Not only is Mist capable of collecting data for insight into a specific client behavior and location information, it can provide insights and analytics across device types, operating systems, applications, and more. This is key for baselining and monitoring trends, and identifying macro issues early so they can be addressed proactively. For example, client roaming time, hardware radio performance and device throughput can all be analyzed to identify global issues, such as a performance degradation when a new client operating system version is released.



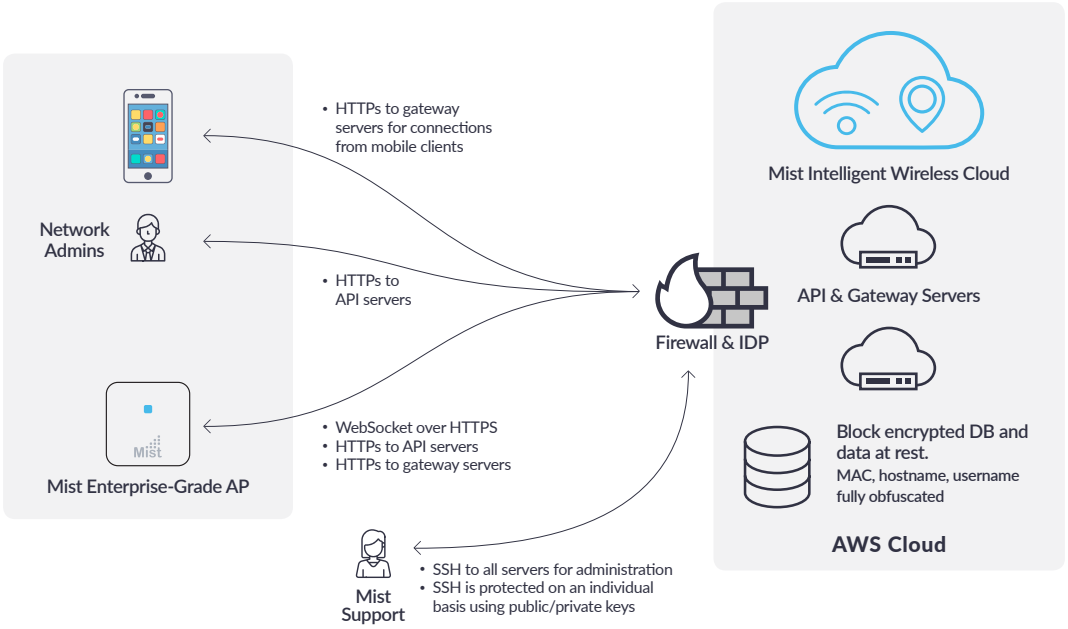
Mist collects state information and does event correlation for easy root cause identification

It is worth noting that only metadata is collected and analyzed in the Mist cloud. Payload or other sensitive data is never collected or stored, eliminating privacy concerns. Finally, the Mist cloud sets the stage for a virtual wireless assistant, which uses AI to answer questions and predict problems with high accuracy and reliability.

THE HIGHEST LEVEL OF SECURITY

We live in a world where data center breaches are in the headlines almost monthly, and there is a fear of security in public cloud due to fears around data security. Clearly, there are myths that cloud computing is inherently less secure than traditional approaches. The paranoia is due largely to the fact that the approach itself feels insecure, with your data stored on servers and systems you don't own or control.

The truth, however, is that cloud providers have robust security mechanisms in place. That is because cloud providers are more paranoid and attentive to security risks throughout their entire stack. They are efficient at systematic security services, such as looking out for attacks using pattern matching and AI technologies. In addition, they are always leveraging the most up-to-date security technologies and solutions for minimizing exploits.



In addition to the above, Mist takes additional measures to ensure the highest security in the Mist cloud. For example:

- Mist uses a type2 soc2 cloud data center
- User access is highly restricted
- Industry standard encryption is utilized at various levels
- Any user information stored in the cloud is obfuscated with an organization specific key
- Security is integrated with the development cycles and pen tests are performed to detect vulnerabilities at the network and application levels

HIGH AVAILABILITY – MIST'S "ALWAYS ON" WIRELESS NETWORK

Mist has taken numerous steps to ensure the highest availability of our wireless services.

By leveraging the public cloud, the infrastructure components and services of the Mist cloud are deployed redundantly (across clusters and zones) to provide 24 x 7 availability. In addition, the Mist cloud is divided into microservices so issues with one microservice do not directly affect other microservices. The Mist cloud buffers data in the event of a component disaster, such as the loss of backend microservice. Once the disaster has been addressed, the data is replayed to fill in the lost analytics. System upgrades and feature introductions also benefit from microservices so there is no service impact when performing either.

The Mist system is designed so a disaster does not affect Wi-Fi users. All the business critical services are delivered at the edge through the Access Points. In the rare event of a cloud connectivity disruption for the Access Points where the WAN is still functional, all business critical services will continue to be delivered at the edge through the Access Points. Any existing client device already authorized will continue to access applications through Wi-Fi without undergoing any disruption of services. In case of a WAN outage, all local services will continue to function through the wireless network while WAN services are restored. In other words, Mist Access Points at the edge are completely site survivable in the case of a customer WAN outage or a catastrophic cloud outage.

Finally, the Mist engineering and support team acts as an extension of the customer. Using the Mist NOC with global data insights, we detect trends and proactively alert customers of potential issues. This avoids problems before they arise, eliminating the reactive troubleshooting issues that plagued first and second generation WLAN systems.

The New Wireless Network

Outdated WLAN infrastructures cannot meet the needs of the modern enterprise. The move to the cloud was a great first step, but first generation cloud architectures lack the scale, resiliency, agility, and elasticity needed for today's business requirements.

Mist is leading the charge from first-generation cloud WLAN solutions to purpose-built cloud solutions based on modern elements, such as containers and microservices. On top of this, Mist is bringing new insight and automation to wireless networks with big data and machine learning.

For the first time, Wi-Fi is reliable, predictable, and measurable. In addition, it is easy to deploy and cost effective to operate. This is the new wireless network, made possible by the modern Mist Cloud.