



White Paper

Build and Manage Your Networks with the Leading-Edge Serverless EnGenius Cloud

Abstract

This article demonstrates how EnGenius Cloud—with its simple interface, superior performance, analytical tools, and top-notch security—delivers a state-of-the-art, license-free network management solution for SMBs and large enterprises.



Build and Manage Your Networks with the Leading-Edge Serverless EnGenius Cloud

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Introduction

Cloud-managed networks have gained widespread acceptance in the enterprise world over just the past few short years. Cloud services are now so pervasive and advanced, experts predict that 80 percent of all enterprise, mission-critical workloads will move to the cloud by 2025.¹

Much of this growth stems from a demand for greater network scalability and agility, especially for businesses with globally distributed branches managed by a single IT team.

Many years ago, EnGenius began to develop cloud technology as more and more customers demanded easy-to-use cloud services. EnGenius Technologies has since developed a strong serverless license-free cloud network solution that simplifies setup and configuration, delivers high resilience and performance, ensures security, and enables real-time insights to identify and troubleshoot problems quickly. The EnGenius Cloud solution is ideal for any business—but especially those with limited budgets and minimal IT support that still want a powerful network solution.

The Power of EnGenius Cloud: Function-as-a-Service (FaaS)

To be competitive, you need to ensure you have a cloud solution that works quickly, is scalable, and operates uninterrupted while also providing a security framework that protects your network data.

The EnGenius Cloud solution delivers the power and efficiency of function-as-a-service (FaaS), a critical feature of serverless cloud architecture. The most important thing to know about the serverless Cloud is that it is not constrained by the limited capacity of a physical server. If clients need to add more users and devices, there is no need to buy more or higher-capacity servers, transfer files, and then populate services/software on those servers, which inevitably results in downtime. The architecture of the serverless Cloud has no walls, and thus has enormous power to seamlessly expand capacity for clients without interrupting service at all.

This is much different from the humble beginnings of cloud services.

The History and Evolution of EnGenius Cloud

EnGenius' involvement in cloud technology development began many years ago when customers began to demand cloud services that wouldn't interrupt business operations. In response, EnGenius built a first-generation cloud to deploy a customized instance of ezMaster manager onto cloud-based Docker containers, and created a Docker manager to allocate resources. The server or Docker-based cloud approach is a traditional approach among many cloud solution vendors. However, we still discovered several problems after performing a variety of stress tests on our version.

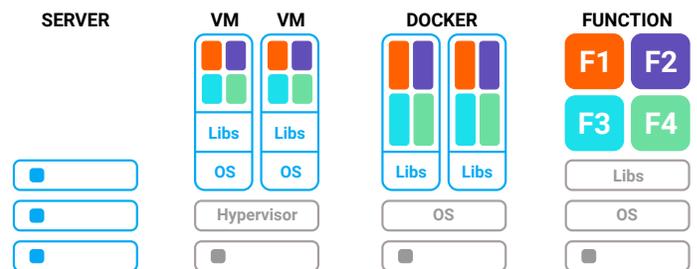


Figure 1: Server vs. Virtual Machine vs. Docker

Server-based Cloud consists of physical machines placed in cloud data centers with limited CPU, memory, etc. It is like traditional IaaS (Infrastructure as a Service), which suffers from unexpected costs, process changes, security risks, and lack of support.

Virtual Machine-Based Cloud has no physical machine limit, but the virtual machine still requires specific CPU and memory space to install OS and bins/libs to run the applications. Virtual machines also require hypervisors (software that creates and runs virtual machines) to manage physical servers underneath.

Docker-based Cloud runs on the same OS for smaller services, thus benefitting from shared OS resources, but each container still contains its own binaries and directories. The Docker container manager usually manages the container lifecycle and scaling.

In our experience, we realized cloud services should be able to handle needs both large and small, anytime, anywhere. Likewise, the cloud network manager should be able to handle hundreds of thousands of devices in a scalable way and provide uninterrupted service with a design built for resiliency and disaster recovery. We concluded that none of the three previously mentioned Cloud solutions were true Cloud solutions.

In the Docker-based first-generation cloud infrastructure, we discovered the following common problems:

- Inadequate data protection
- Inability to scale and required manual adjustment
- No plug-and-play and port settings required on the firewall
- Limitation on the number of managed nodes per site
- Poor performance when capacity limit is reached

Customers would initially be unaware of these problems because the cloud operation team could manage them by closely monitoring capacity, fine-tuning size, or rebuilding the Docker container if necessary. In the long run, however, this might result in downtime caused by machine performance issues or human error. EnGenius decided to migrate to a next-generation cloud architecture designed to ensure a more sustainable level of quality for EnGenius services to customers.

1. Next-Generation Serverless FaaS Cloud

Serverless infrastructures abstract the server components and scale up or down based only on the event-driven functions a business needs to perform. Whenever there is a new function request, appropriate resources are allocated to successfully complete the request, no more and no less.

Serverless design not only increases the efficiency of resource utilization, but also improves performance for each function. Serverless design is therefore referred to as FaaS or Function-as-a-Service.

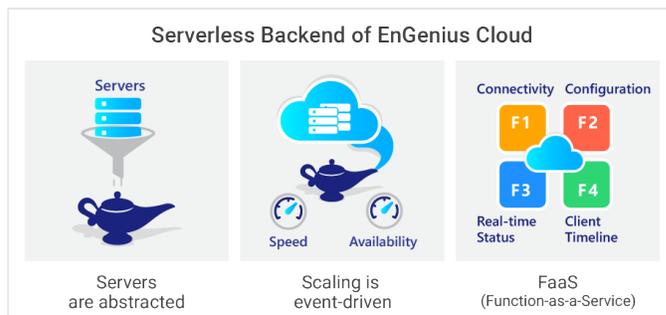


Figure 2: Serverless Cloud

There are many different functions in network management, including the testing of hardware device connectivity, configuration, historical dashboard readings, real-time device utilization status, and notifications. Each function has unique requirements in its backend design for high efficiency.

Serverless FaaS architecture dispatches different function requests to different backend service pipelines on an event-triggered basis. FaaS doesn't need to deal with server/VM/Docker limitations, making the infrastructure flexible and scalable to adapt to sudden demand spikes that would overwhelm those previous architectures. Most importantly, serverless design allows EnGenius Cloud to streamline the redundancy of components in cloud infrastructure and perform database backup and restoration right where the customer's network information is located.

2. FaaS vs. Older Architectures

The following table (figure 3) compares the server based, VM, Docker container, and FaaS architectures. The scale limitation for a server-based or on-premises server is on the machine's CPU, memory and database size. When scaling up, IT users must purchase additional servers and copy all relevant files to the new server, which may take days or months. VM or Docker scalability relies on the physical machines in the datacenter. IT users need to select appropriate sizes based on demand. VM and Docker are also constrained by the size of the database, and the limitation of applications. Moving to a different scale environment will take from minutes to days to complete, depending on the flexibility of container management deployment. For FaaS serverless design, all servers are abstracted, and scaling takes mere seconds, increasing ease of scalability, as well as reducing resources when demand is lower.

	Server	VM	Docker	FaaS
Scale Boundary	On Premises Machine	Machine	Machine Application Libs	Function (Micro-Service)
Run Time	Day-Months	Hours-Days	Minutes-Days	Microseconds
Cost	New Server	Per VM	Per VM	New Server
Solution	On-Prem ezMaster	On-Prem ezMaster on AWS	1st Generation Cloud	On-Prem ezMaster

Figure 3: Comparison between different cloud architecture approaches

3. Securing Your Cloud Devices with Multiple Factor Authentication

To safeguard your network, you need a security infrastructure capable of defending against ever-evolving threats like malware and targeted breaches that can originate from anywhere and anyone.

With EnGenius Cloud, your network devices are protected with two-factor authentication, non-sequential serial numbers, and MAC address verification to ensure only authorized cloud devices are on your network. Once devices are authenticated, a secure tunnel is established only between that device and the cloud server with a unique certificate provided by EnGenius Cloud to encrypt transmissions.

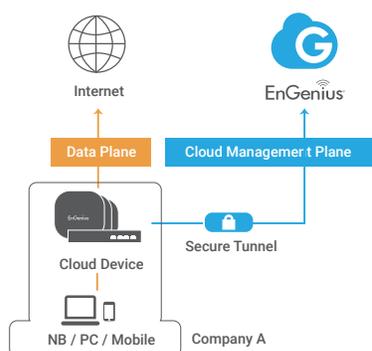


Figure 4: Secure tunnel for management plane

By encrypting data over a multi-layered defense infrastructure, EnGenius Cloud keeps managed data secure while it is transmitted between any two or more devices over any of your networks.

4. AI-Ready “Visualized” Infrastructure

When the scale is greater, the complexity of data storage and analytics also increases. EnGenius Cloud leverages big-data storage and analytics technology to do client timestamp analysis, customizable dashboard and notifications. EnGenius Cloud is designed to easily add modules and perform AI analysis, machine learning, and correlative advisory for troubleshooting.

5. Cost-Savings to Customers

The other key benefit of Serverless FaaS architecture is cost savings. Research conducted by Libhiv and Heavywater supports the conclusion that moving applications from server-based to serverless architecture can achieve cost savings of up to 90%. EnGenius Cloud has built in-house serverless FaaS infrastructure to provide more efficient cloud infrastructure and return the cost savings in the form of affordable solutions for SMB customers.

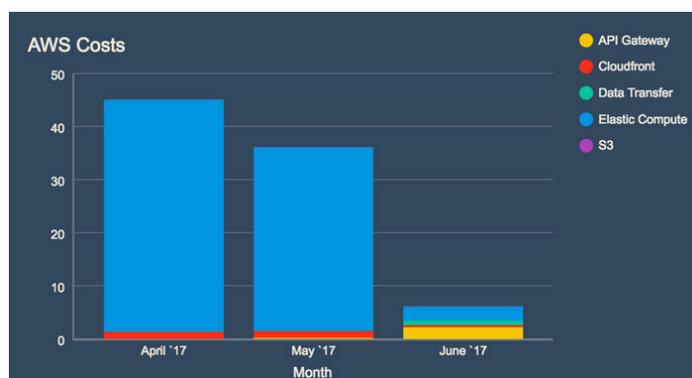


Figure 5: Company cost saving in June 2017 after leveraging API Gateway serverless technology. Source: Libhiv

When demand spikes or drops for event-driven functions, FaaS responds instantly and independently by scaling up or down depending on your network needs and pulling only the resources needed from virtual servers to complete the task.

It's important to note that, while many other companies charge licensing fees along with device and installation costs, EnGenius does not charge a licensing fee at all.

Furthermore, EnGenius Cloud can support up to a whopping 100,000 access points and switches per account completely free of charge as well. At those numbers, EnGenius Cloud FaaS is still able to deliver the

speed and efficiency that gives businesses enough flexibility to address customer needs, marketplace changes, and growth objectives without breaking the bank.

Even for industry titans, this solution can deploy a cloud infrastructure across multiple locations worldwide. Growing companies can experience smooth, fast, uninterrupted service no matter how global they go.

The EnGenius Cloud Solution Package

The serverless EnGenius Cloud solution offers you a wealth of tools to build your license-free enterprise network from start to finish:

- The EnGenius ezWi-Fi Planner allows you to plan and deploy the layout of your network.
- The Cloud To-Go app registers and configures your cloud access points and switches in minutes.
- The enhanced cloud interface enables you to review and monitor the health of your network with a state-of-the-art topology view.
- Analytical tools that give you deep insights into granular network data and information allowing you to troubleshoot and repair your network quickly and efficiently.

Each tool is designed to do all the heavy lifting for you, making network setup, deployment, and management a snap. Let's examine how.

Planning Your Network with ezWi-Fi Planner

Before utilizing any Cloud-related tools, you can use our time-tested EnGenius ezWi-Fi Planner to simulate your floor plan deployment. (There is also a built-in version of ezWiFi Planner in the floor plan view of the Cloud interface.)

You can upload, crop, and set to scale an image of your floor plan, and then define Wi-Fi coverage areas such as elevators, warehouses, or office spaces. You can also include obstacles with building materials that may affect signal strength, such as concrete walls and metal doors.

1. Built-In Intelligent Advisor

The EnGenius ezWiFi Planner gives you the tools to simulate your floor plan deployment. You can upload, crop, and set to scale an image of your floor plan, and then define Wi-Fi coverage areas such as elevators, warehouses, or office spaces. You can also include obstacles with building materials that may affect signal strength, such as concrete walls and metal doors.

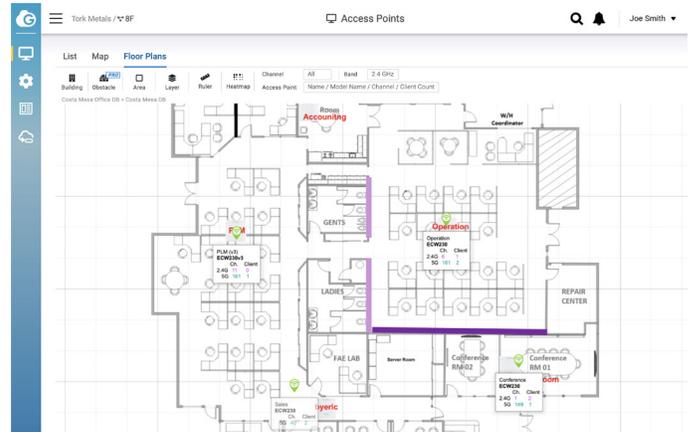


Figure 6: Floor plan with strategically placed access points

2. Color-Coded Heatmaps

Color-coded heatmaps also provide a detailed view of your manually entered access point layout floor-by-floor, allowing you to examine signal strength for each access point to avoid coverage holes and over-congestion. You can also review inventory data for individual access points, such as model names, channels, power usage, and locations.

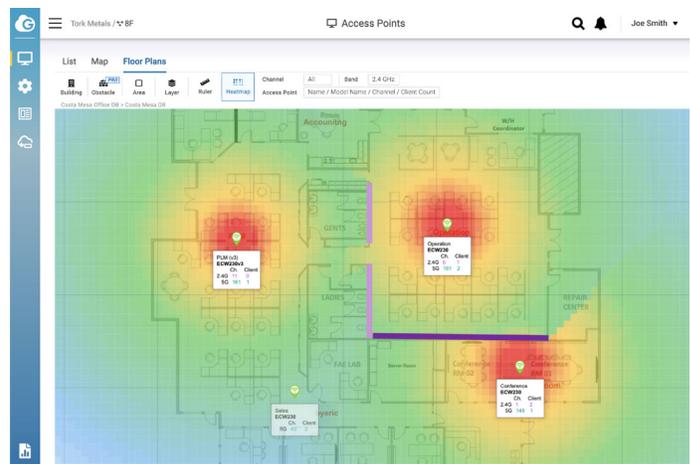


Figure 7: Heatmap showing strong signal strength at all access point locations

Building Your Network with EnGenius Cloud To-Go

Cloud To-Go is a powerful mobile app that allows you to manage and monitor your network onsite or remotely, improving business communications and bringing seamless connectivity to your customers. The brand-new license-free Cloud To-Go app allows you to set up and configure your network in minutes. The interface is so simple, anyone can use it—tech-savvy or not.

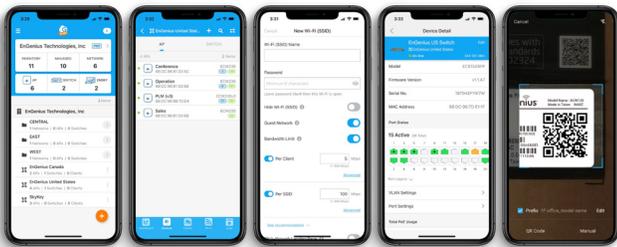


Figure 8: The EnGenius Cloud To-Go mobile app interface

1. Deploy Your Network in Minutes

After using the ezWi-Fi Planner to determine the placement of all access points and other network devices throughout your facility, you can use the Cloud To-Go app to scan, register and automatically configure each network device.

2. Register and Configure Devices Automatically

You can simply remove your device from the box, flip it over, scan the QR code on the back, and allow the app to do the rest. You then assign each device to a specific network and the devices will auto-configure with staff- or guest-network-specific information about your SMB or large enterprise department networks—even across geographically dispersed company locations.



Figure 9: Cloud To-Go allows users to register, configure, and deploy network devices instantly.

3. Create Your Own Captive Portal and Customized “Splash” Page

One of the first things you can do is customize the captive portal and splash page for your guest network. Cloud To-Go allows you to personalize your customers’ Wi-Fi experience by creating a personalized “splash” page that customers will see when they first log in. Use templates to customize this page to greet and deliver important messages to your customers.

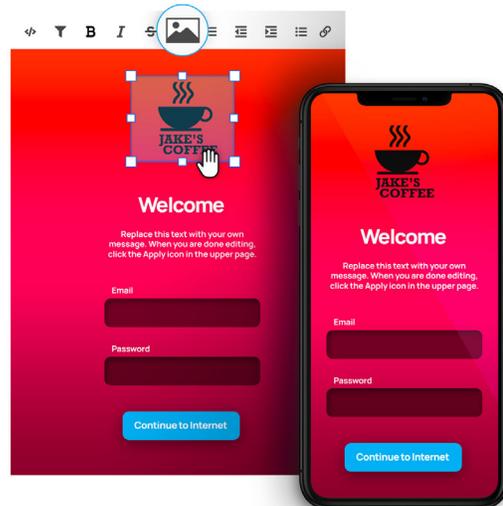


Figure 10: A sample splash page created using the Cloud To-Go app

4. Select the Security Type and Set Password

EnGenius offers the latest in wireless security, WPA3, but also gives you the ability to implement multiple authentication methods when Captive Portal is enabled to keep your network secure. EnGenius provides their own EnGenius Radius service, Custom Radius, Voucher Service and Social Login options when Captive Portal is enabled.

5. Shape Network Traffic and Set Up Bandwidth Control

Depending on how much traffic you are getting for any system or app, you can allocate the amount of bandwidth you want for your guest network, business network, and any department within your company. You can further allow admins to control the download and upload limits per SSID or client.

6. Auto-Update Firmware from EnGenius Cloud

You can create firmware upgrade tasks for groups of devices and save time by scheduling firmware updates for multiple sites and networks based on region, local time zones, and other parameters. EnGenius also provides beta, stable, and previous-stable versions of firmware so customers can choose which versions they want.

Monitoring Your Network with Clean Dashboard View

EnGenius Cloud's dashboard provides administrators a visual overview of their network health status. The Cloud dashboard highlights the access points, SSIDs, clients, and applications gobbling up the most network bandwidth, giving administrators a quick way to prevent potential bottlenecks and other problems.

1. Review Devices and Network Status

Administrators can review the current status of access points or jump to specific configurations such as radio configurations, IP addressing, and system information in case problems arise or adjustments need to be made.



Figure 11: Cloud To-Go dashboard offers at-a-glance view of network health as well as device status and throughput speed.

With the best service level agreement (SLA) of current cloud computing solutions, EnGenius Cloud guarantees 99.99 percent uptime for as many as 100,000 devices per account. The EnGenius Cloud at-a-glance dashboard allows you to keep your networks operating at top performance, even with hundreds of tasks operating simultaneously.

2. Assign Administrative Privileges

Organizations can assign each user as either an administrator (full access privileges) or viewer (read only privileges). Administrators can also be assigned at either the organization or network level, giving full power to manage all aspects of the networks under that organization, or at the network level only, which allows full changes to specific networks within organizations. Within the hierarchical view, administrators have a clear picture of all users' access and privileges to make management as efficient as possible.

Organization Team Members - user permissions for Organization and Networks

- Viewer- viewing rights for the assigned organization or networks but no editing rights
- Admin -view and edit rights for the assigned organization or networks
- Front Desk -the ability to add wireless users for a limited time

Network Team Members - user permissions for Network/s

- Viewer – viewing rights for certain assigned networks
- Admin – view and edit rights for the assigned networks
- Front Desk – the ability to add wireless users for a limited time

Name	Email	Network Managed	Status	Last Login	Actions
Alan Davis	alan.davis@tokmetals.com	Viewer x 1	Active	2021/03/24 21:10:40	View
Jessie Lee	jessie.lee@tokmetals.com	Viewer x 1	Active	2021/03/17 15:45:43	View
Edward Johnson	edward.johnson@tokmetals.com	Viewer x 1	Active	2021/03/05 14:54:30	View
Steven Rickard	steven.rickard@tokmetals.com	Admin x 1	Active	2020/12/09 17:07:03	View
Bruce Chekov	bruce.chekov@tokmetals.com	Viewer x 1	Active	2021/03/21 00:24:45	View
Cindy Kim	cindy.kim@tokmetals.com	Admin x 1	Active	2021/03/24 12:30:12	View
Lee Smith	lee.smith@tokmetals.com	Viewer x 1	Active	2021/03/23 16:44:07	View
Claude Renoir	claudio.renoir@tokmetals.com	Viewer x 1	Active	2021/03/24 16:16:31	View
Vincent Mackson	vincent.mackson@tokmetals.com	Viewer x 1	Active	2021/03/23 20:59:28	View
Ron Jeffries	ron.jeffries@tokmetals.com	Admin x 1	Active	2021/03/23 15:54:30	View
Lisa Anson	lisa.anson@tokmetals.com	Viewer x 1	Active	2021/03/12 13:36:02	View
Chris Choi	chris.choi@tokmetals.com	Viewer x 1	Active	2021/03/24 18:19:37	View

Figure 12: Administrative (multi-tenant) settings per team member

3. Monitor All Connected Devices and Clients

The EnGenius Cloud dashboard also enables you to monitor the status, location, and performance of any device on the network as well as the activity of any connected client. With EnGenius Cloud, you can:

- Check the port connection and PoE power usage of each individual switch
- See the real-time CPU performance, memory, and throughput of any device
- Determine the location of any access point with a blinking indicator light
- Check the MAC, SSID, OS, and other information about any client connected to your networks
- Discover potential connection problems by examining the client timeline

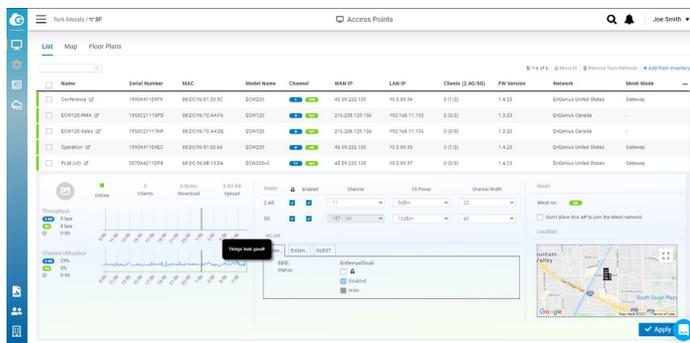


Figure 13: Real-time client view for specific access point

Overall, the EnGenius Cloud dashboard allows you to monitor and troubleshoot your entire network from one interface, anytime, anywhere in the world.

Protecting Your Network with Advanced Controls and Security Features

The EnGenius Cloud solution offers the latest in security and features to protect your business assets, provide your customers with secure Wi-Fi, and keep unauthorized users off your network, all with the best authentication and encryption technology available.

1. Separate Networks

EnGenius Cloud access points allow up to 8 broadcast names (SSIDs) that can be uniquely configured. IT users can take advantage of broadcasting on different radio frequencies, selecting security levels, utilizing advanced client onboarding features, and implementing sophisticated authentication methods. For establishments that want to segment wireless traffic into user groups such as staff and guest networks—each with their own Wi-Fi network and captive portal—the best solution is to create isolated network (VLANs), one for staff only and one for guests only. This creates a hard barrier between networks to ensure privacy and security.

2. Blocked List

Client monitoring tools allow you to deny access to your SSID network for unauthorized clients. Specifically, the Cloud interface has a block, VIP, and kick feature. Block will deny the client device access to the network permanently. VIP allows the client device to access the network permanently. Kick will temporarily boot (within seconds) the client device off the network and then allow the client device to access the network again immediately.

3. WPA3 Authentication

EnGenius Cloud devices are equipped with the latest WPA3 technology, which enhances identity authentication and data encryption while improving wireless network adaptability. WPA3 actually meets the standards of military-grade security and protection, making it more than adequate for government agencies, large corporations, and other entities dealing in highly sensitive information.

Using More High-Quality Tools for Granular Analysis of Your Network

EnGenius Cloud has even more tools that continually analyze your network and alert you to potential problems. Administrators can review the data these tools gather and then proactively prevent problems instead of suffering a full network outage resulting in a loss of productivity.

1. Client Timeline

EnGenius Cloud records each client's journey throughout the network with timestamps. IT users can pull up the entire device history using the client name. This includes the access point the device is connected to, the authentication status, frequency band, signal strength, and the duration of time it took when the client roamed to another access point.

In Figure 14 below, the client has been associated with and authenticated by one access point successfully, and then connected successfully with two additional access points while roaming through the facility. However, the client has failed to connect to a third access point because, while the access point might have detected the client device, the client's transmission power might have been too low to connect to the access point successfully.

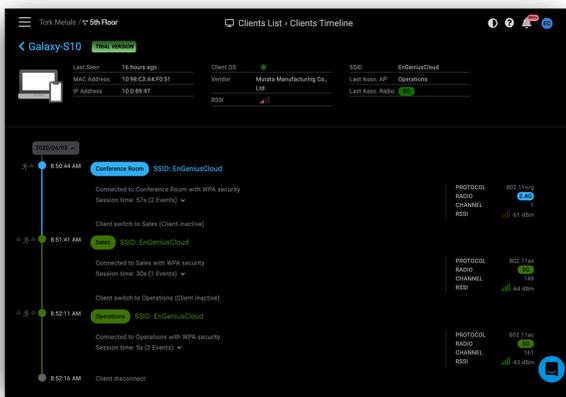


Figure 14: Client Timeline

2. Historical Statistics Dashboard

As mentioned before, when a specific access point is identified with potential issues, the historical throughput statistics dashboard will help IT users visualize any abnormal traffic patterns degrading the network performance. The Layer 7 traffic dashboard lets IT users see which application takes up the most traffic.

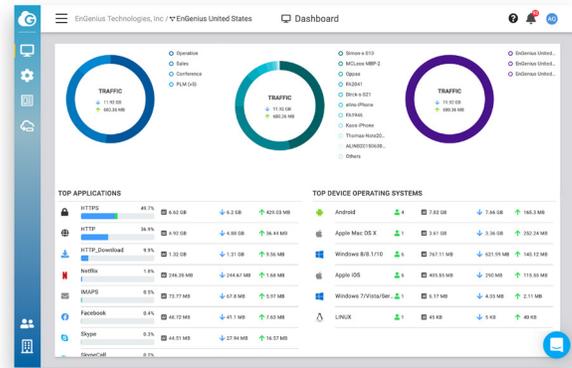


Figure 15: Throughput and utilization view

3. Real-Time Status of Cloud Devices

Slow network performance can be caused by high CPU or memory use by network devices. EnGenius Cloud can invoke a "real-time function" module, building a specific tunnel to observe the CPU/memory use rate in real-time. When real-time device information and throughput is compared to historical statistics the IT managers can decide whether they should reset the device or just monitor to see if any problems continue.

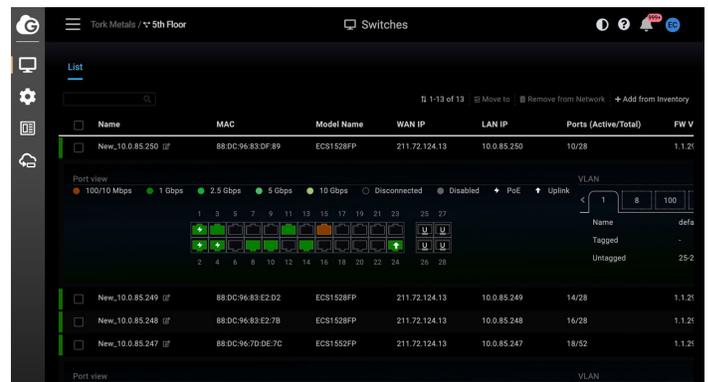


Figure 16: Real-Time CPU and memory of a switch

4. Layer 7 Application-Aware Traffic Dashboard

EnGenius Cloud has a Layer 7 application-aware traffic dashboard that collects and analyzes Wi-Fi traffic information from access points. It keeps historical data for each wireless client device so that IT admins can review traffic data and see if anything has gone awry.

The deep packet inspection (DPI) this type of heavy-duty monitoring consumes, however, requires a lot of CPU power, typically resulting in a 15% decrease in access point performance. Therefore, EnGenius Cloud gives you the option to adjust your DPI settings anytime through the cloud interface if increasing performance is a priority.

5. Speed Bottleneck Analysis

Continually reviewing the status of your networks is not an effective use of your time. That's why EnGenius Cloud's effective notification system (through cloud interface, email, or mobile app) saves time by pinpointing and alerting you to a network problem at precisely the moment it occurs.

EnGenius Cloud enables you to customize your notification criteria per network base. It leverages stream processing technology to build a highly scalable, fully fault-tolerant, secure, and low-latency messaging platform to send the most important notification messages to the right people.

This ensures that critical notifications are received and sent to the person who can fix the problem while preventing a flood of pointless notifications to everyone else.

6. Historical Data Patterns

When a specific access point is identified with potential issues, the EnGenius Cloud historical throughput statistics dashboard visualizes traffic patterns for Wi-Fi network devices in easy-to-read graphs that let you compare data and look for patterns. Often these insights can help you pin down how, why, when, and where problems develop so you can intervene to prevent them.

Generating Specialized Network Reports Automatically

1. Comprehensive Event Log Report

One of the biggest headaches for IT users is to piece together threads of an issue from log files across one or more machines in a network. EnGenius Cloud automatically consolidates all log files in a single convenient location, including system log, event log, and configuration changes of all managed cloud devices.

EnGenius Cloud then allows you to use powerful filtering functions to simply compare and analyze data for many different devices and cloud configurations, filtering by time-period, event types, networks, SSIDs, specific devices or clients, errors, warnings, or general states. EnGenius Cloud provides a wealth of network information, right at your fingertips.

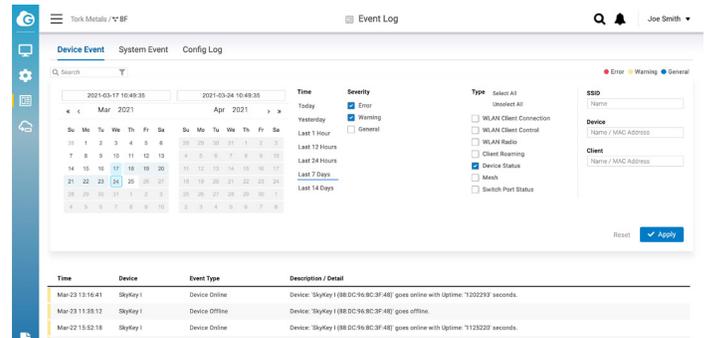


Figure 17: Centralized event log report with powerful filtering function

2. Customized Notifications per Network

Continually reviewing the status of your networks is not an effective use of your time. That's why EnGenius Cloud's effective notification system (through cloud interface, email, or mobile app) saves time by pinpointing and alerting you to a network problem at precisely the moment it occurs.

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This ensures that critical notifications are received and sent to the person who can fix the problem while preventing a flood of pointless notifications to everyone else.

3. Customizable Scheduled Reports

For tracking the status of your network, you can get network reports customized to your needs. In just a few steps, you can quickly design the cover, select the content, and schedule the report to be delivered automatically to its recipient.

EnGenius Cloud: Unmatched quality, simplicity, and security

The EnGenius Cloud offers the best in cloud-managed network technology. It streamlines all network functions—from setup and installation to management and expansion—giving you the unmatched quality, simplicity, and security EnGenius is known for.

EnGenius already offers all the latest access points, switches, and other network devices you need to build your network. It now offers an easy, license-free, cloud-managed network solution that takes the “work” out of building your network and frees you up for more important things—serving your customers and growing your business.

For MSPs and Eco-Partners

EnGenius Cloud also provides a complete set of application programming interfaces (APIs) for managed service providers (MSPs) and eco-partners to extend and customize the capabilities of EnGenius Cloud. We offer the flexibility to change the theme, front end design, add on modules, traffic redirection, and even add new IoT devices, all in one convenient place. Contact us for more information.

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