Juniper Networks | Engineering Simplicity

Juniper Mist Location Services Guide

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The information in this document is current as of the date on the title page.

YEAR 2000 NOTICE

Juniper Networks hardware and software products are Year 2000 compliant. Junos OS has no known time-related limitations through the year 2038. However, the NTP application is known to have some difficulty in the year 2036.

END USER LICENSE AGREEMENT

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Table of Contents

1

CHAPTER

Get Started

Juniper Mist Location Services Overview

IN THIS SECTION

Virtual Bluetooth LE (vBLE) is a patented technology for indoor Location Services, using virtual beacons to locate BLE devices with great precision. Juniper Networks access points (APs) use a dynamic 8-directional antenna array that blankets an area with BLE signals and is capable of both transmitting and receiving BLE signals.

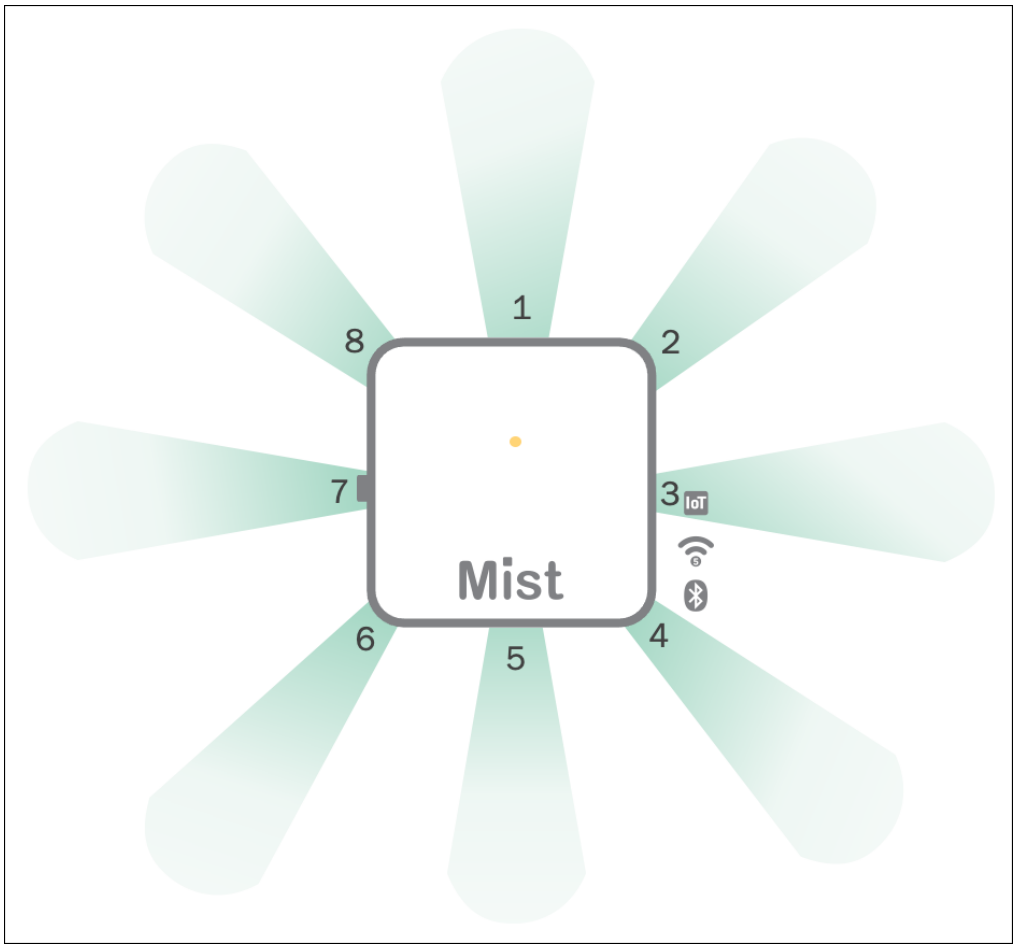
Virtual beacons are an efficient alternative when compared to physical beacons in terms of time and cost savings. With virtual beacons, there is no need to install and configure physical beacons, no need for site surveys, and no need for additional hardware. This makes for simpler, more efficient deployments and makes adding and moving vBeacons a hassle-free experience, as you configure everything from the Juniper Mist™ portal.

Video: Location Services with Mist

How It Works: vBLE Antenna Array

Juniper Mist APs transmit BLE signals using an 8-element directional vBLE antenna array.

Figure 1: vBLE Antenna Array



Video: Location - How it Works

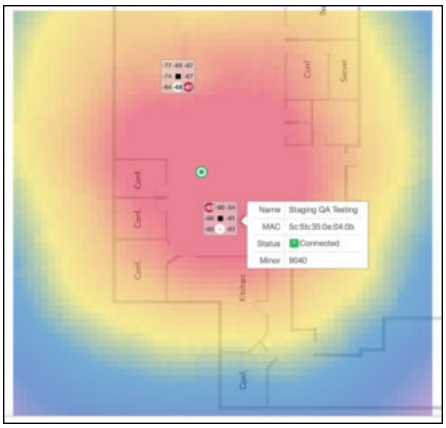
How It Works: Probability Surfaces

When your customer or visitor uses your Juniper Mist SDK-enabled application, the Juniper Mist cloud uses probability surfaces to determine the user's location. Probability surfaces provide the best possible location accuracy with sub-second latency.

The Juniper Mist cloud uses the RF fingerprints sent by the SDK client to create probability surfaces. This is done by splitting the floorplan up into 1-meter squares and calculating the estimated RF fingerprints for each square.

Each of the AP's eight directional beams contribute to the likely location of the client device, examining all the probability surfaces (one for each beam) and combining them to find the likely point on the map where the device is located.

In this example, the center of the red area is the peak of the surface and the highest probability of the client's location. The blue area depicts the lowest area of the surface and the least probability of the client's location.



As the SDK client sends RF fingerprints to the Juniper Mist cloud, Juniper Mist enters the machine learning process, and the location model is optimized for that device.

How It Works: Indoor Location Experiences

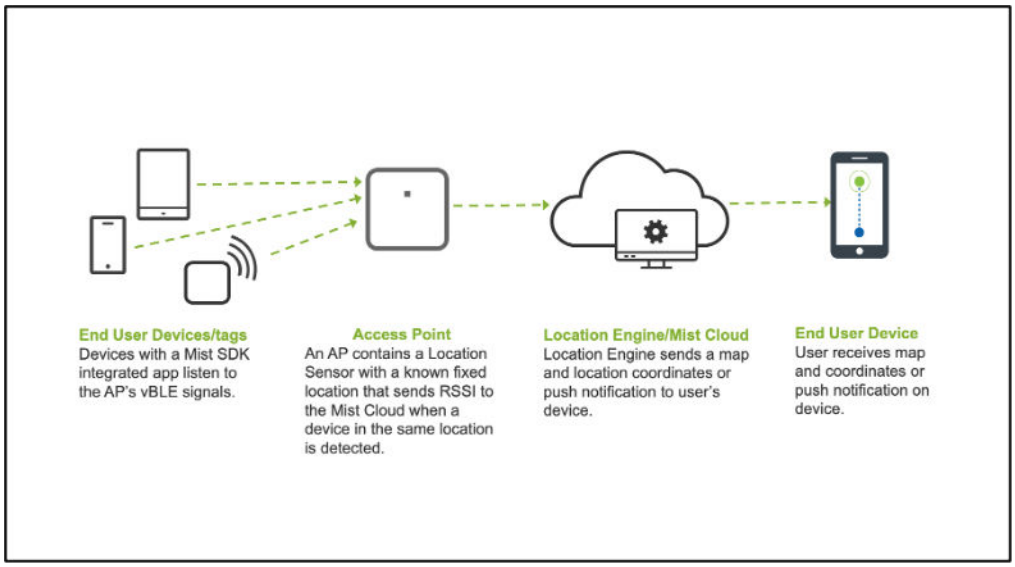
The Juniper Mist SDK provides the tools that you need for building customer-facing applications that deliver indoor location services. When you integrate the Juniper Mist SDK with Juniper Mist Wi-Fi and location-based services, you can determine a user's location and deliver proximity-based notifications using Juniper Mist's patented vBLE Technology.

SDK-integrated mobile devices listen for and receive the Bluetooth Low Energy (BLE) packets that are transmitted by the APs. The information in these packets gets packaged up by the SDK client and sent to the Juniper Mist cloud. Finally, the cloud returns the x,y coordinates to the mobile device every second based on the information that it received.

For more information, see "Juniper Mist SDK" on page 88.

Your application uses this information to provide relevant experiences, such as wayfinding directions and push notifications.

Figure 2: How Mist Shows User Location With vBLE



Video: Modern RF Glass

Use Cases

Juniper Mist supports many location-based use cases. A few possibilities are described below.

Wayfinding

Wayfinding is just like the Google and Apple Maps experience, navigating you from point A to point B.

Picture a retail location. A customer is shopping at a store, and they have the retailer's mobile application on their cell phone. APs transmitting BLE are located all over the store. If you integrate the SDK into your customer-facing app, you can support wayfinding. The retail customer can search for an item and then be guided turn by turn to the location of the item within the store.

For more information, see "Wayfinding Use Case" on page 51.

Video: Wayfinding Use Case

Asset Visibility

Quickly locate assets such as electronics and equipment. To support asset tracking, you attach BLE beacon tags to the assets that you want to track. When the AP hears the BLE transmission from the tag, it locates that asset on the Live View in the Juniper Mist portal. Staff at a hospital can use this feature to track down the location of medical equipment, such as wheelchairs.

For more information, see "Find Equipment Use Case" on page 76.

Figure 3: Asset Tracking Example

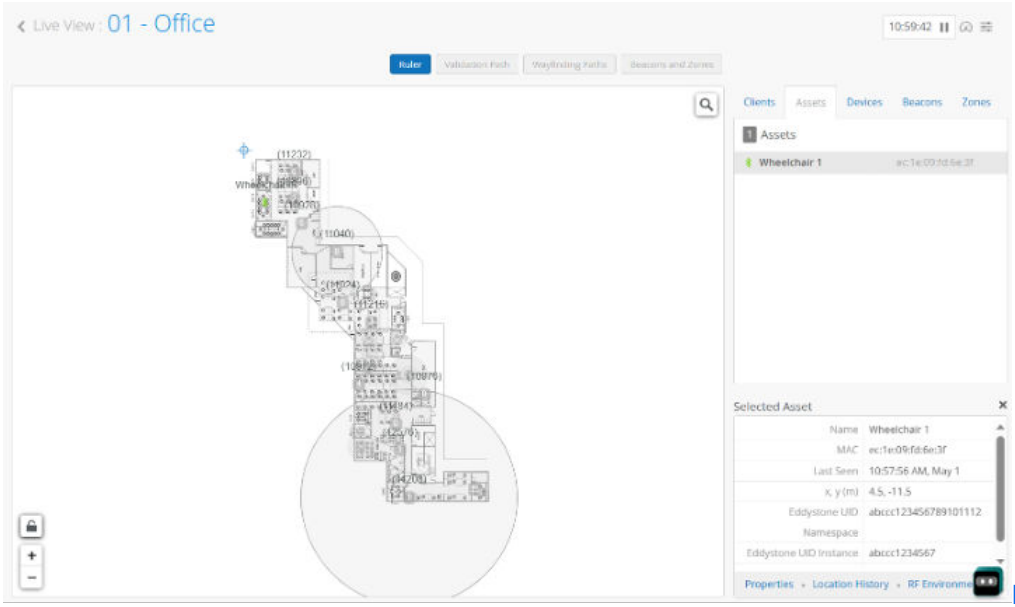


Figure 3 on page 6

Video: User Experiences with Location Services Webinar

User Engagement

When a site visitor enters a virtual beacon's coverage area, the Location Engine sends a push notification to display a greeting. One example of this is when a person enters through the front door of an office building and a redirect link to the company homepage is sent to their device.

Figure 4: User Engagement Example

Video: Juniper Mist User Engagement Demo

What's Next?

- Obtain and activate your subscriptions. See "Activate Subscriptions" on page 8.
- Select your APs. See "Access Points for Location Services" on page 8.
- Place your APs to ensure full BLE coverage. See "Access Point Placement for Location Services" on page 8.
- Set up your floorplan to ensure location accuracy. See "Floorplan Setup Overview" on page 30.
- Implement your use cases.

  For example, see:

  - "Wayfinding Use Case" on page 51
  - "Find Equipment Use Case" on page 76

Activate Subscriptions

Decide which Mist AI and Cloud Services you need, and then contact MistRenewal@juniper.net to purchase them. We'll email your activation code(s) to you. Now you're ready to activate your subscriptions.

1. From the left menu of the Juniper Mist portal, select **Organization** > **Subscriptions**.
2. Click **Apply Activation Code**.
3. Enter the code.
4. Click **Activate**.

Access Points for Location Services

The following access points (APs) include Juniper's patented virtual Bluetooth Low Energy (vBLE) technology:

- Indoor access points: AP45, AP43, AP41, AP33, and AP21
- Outdoor access points: AP63 and AP61
- BLE only: BT11

> **NOTE**: You can use the BT11 to ensure full BLE coverage in areas where you don't need an AP for Wi-Fi coverage.

Compare these access points at Juniper.net.

Access Point Placement for Location Services

To ensure the best possible accuracy and stability, follow these guidelines:

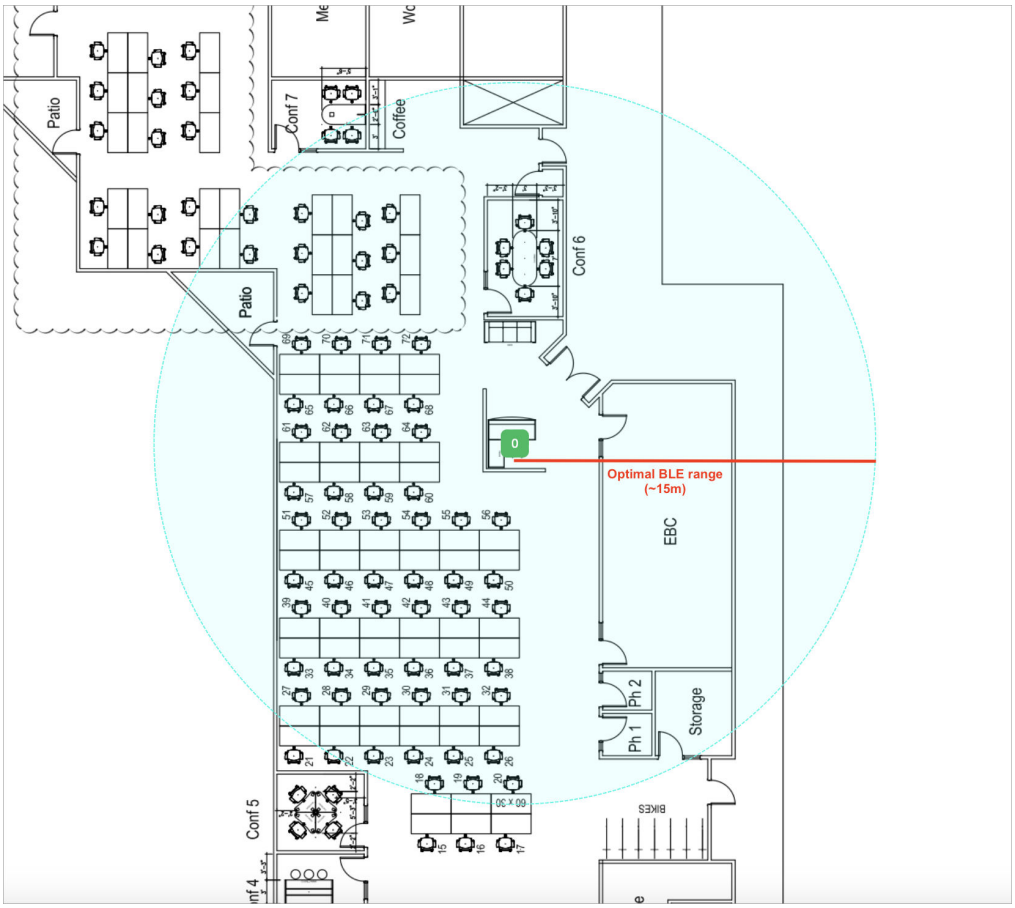
- Mount the access points (APs) on the ceiling, with the LED facing the floor.

  Example

  - Ceiling mounting results in the best directionality for the Bluetooth Low Energy (BLE) beams.

  - If ceiling mounting isn't possible and you must mount the AP on a wall, pole, column, or similar structure, use brackets to position the AP with the LED facing the floor.

- Ensure that the AP is 9 to 15 feet (2.7 to 4.5 meters) above the floor.
  - The height requirement ensures that BLE clients receive a strong received signal strength indicator (RSSI) and the best possible directionality for the BLE beams.
  - If you need to install APs in an area with ceilings higher than 15 feet, consult with a sales engineer.
  - We do not recommend above-ceiling mounting. Again, consult with a sales engineer.
- Each AP should have an unobstructed line of sight to at least two other APs.
  - Optimal BLE range is a radius of approximately 15 meters (49 feet) from the AP.



  - Install APs within 10 to 15 meters (32 to 49 feet) of one another.
  - For wayfinding, be sure to provide coverage at junction points and corners.

- Don't place APs any closer than 8 meters (26 feet) in the same room or space. Closer placement offers no benefit in terms of coverage and could cause interference.

  NOTE: If APs are in different rooms, separated by a wall, close placement doesn't pose an issue.

- For corners, hallways, and areas where you need only BLE and not Wi-Fi services, consider using Juniper BT11 access points.

- Don't install an AP:

  - Behind, inside, or on top of other objects.
  - On the floor.
  - Next to metal, glass, or concrete.

Access Points Deployment Assessment

IN THIS SECTION

Overview

Read this topic to understand how to evaluate the sufficiency of the access points deployed at your site using Juniper Mist's Marvis Actions, Wireless Service Level Expectation (SLE), and RF Health and Utilization dashboard in Premium Analytics. You can use the details that are covered in this topic to determine if additional access points are required for optimal connectivity and user experience.

Methodology

Use the following tools and features to conduct the assessment:

- **Marvis Actions**: Utilize Marvis, the virtual network assistant, to analyze network issues, troubleshoot problems, and optimize performance.
- **Wireless SLE**: Monitor key performance indicators related to coverage, roaming, throughput, and capacity to gauge the effectiveness of the current access point deployment.
- **RF Health and Utilization dashboard in Premium Analytics**: Evaluate the radio frequency (RF) health, interference, and utilization to identify potential areas of improvement in the wireless network.

Assessment Criteria

The assessment will focus on the following aspects:

1. **Signal Coverage**: Analyze the signal strength and quality across the site to ensure comprehensive coverage and minimal dead zones.
2. **Roaming Performance**: Assess the seamless transition of client devices between access points to maintain uninterrupted connectivity.
3. **Throughput Analysis**: Evaluate the data transfer speeds and capacity to accommodate the expected user load and application demands.
4. **RF Health and Utilization**: Monitor RF health, interference, and spectrum utilization to optimize the performance of the wireless network.

Juniper Mist Tools

Juniper Mist™ is a subscription-based service. For more details about Juniper Mist subscriptions, see Juniper Mist Subscriptions and Subscription Requirements for Marvis Actions.

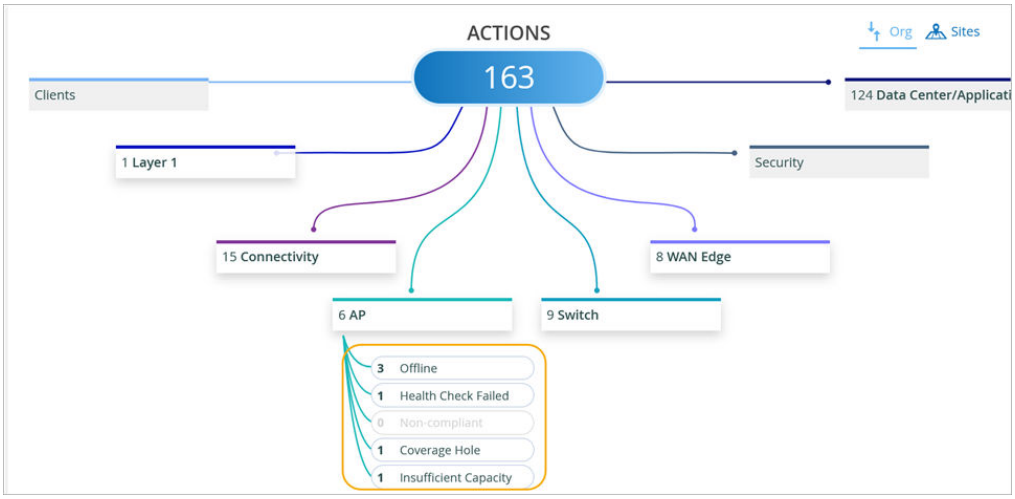
Marvis Actions

In order to ensure optimal network performance and coverage, it is essential to regularly assess the sufficiency of the Access Points (APs) deployed within your network. By leveraging the Marvis Actions in Juniper Mist portal, you can efficiently identify and address any issues affecting your APs.

To view the Marvis Actions dashboard, select **Marvis** > **Marvis Actions** from the left menu.

When you click the **AP** button on the Actions dashboard, you'll see a list of all available actions. You can then click an action to investigate further.

Figure 5: Marvis Actions



See Marvis Actions Overview for details.

Offline AP Detection

Marvis can detect APs that are offline due to various reasons, such as power loss or loss of cloud connectivity. This report indicates a need for further investigation or potential troubleshooting to restore connectivity.

Investigate the Offline AP action on the Actions dashboard to address any APs that are showing as offline. This report help in restoring network connectivity and ensuring seamless operation.

If Marvis identifies multiple APs as offline, it signals the need for immediate attention to resolve the connectivity issues impacting network performance.

Health Check Failures

Health check failures reported by Marvis might indicate underlying hardware or software issues affecting APs within the network. Swift action is required to rectify these issues to prevent any network disruptions.

Use the Health Check Failed action to investigate and address any APs experiencing health check failures. Consider hardware replacement or firmware upgrades as necessary steps to resolve the issue.

An AP that continuously fails health checks may need to be replaced or have its firmware upgraded to ensure proper functioning within the network.

Non-Compliant Firmware

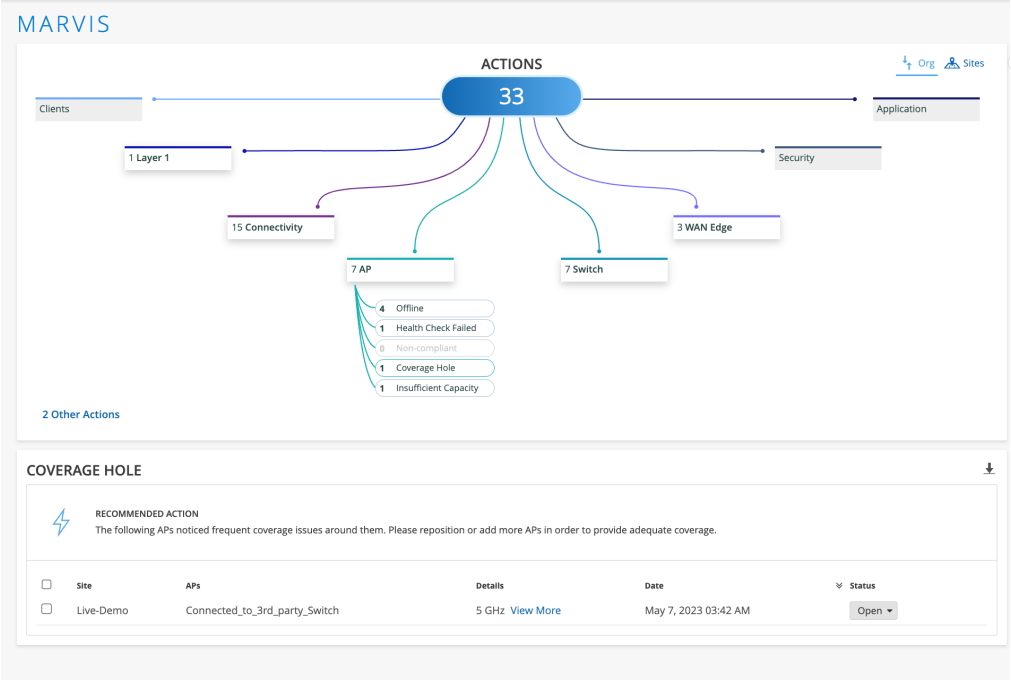
The Non-Compliant action flags APs running outdated firmware versions compared to other APs of the same model at the site. Updating firmware is crucial to ensure security, stability, and performance improvements.

Upgrade the firmware of Non-Compliant APs from the Marvis Actions page to align with the latest version. This step helps in maintaining consistency across APs and mitigating potential vulnerabilities.

A prompt upgrade of firmware on Non-Compliant APs can enhance network security and performance, ensuring all APs operate optimally within the network.

Coverage Hole Detection

The Coverage Hole action identifies areas within your network experiencing poor coverage, allowing you to optimize placement and configuration of APs to improve network efficiency.

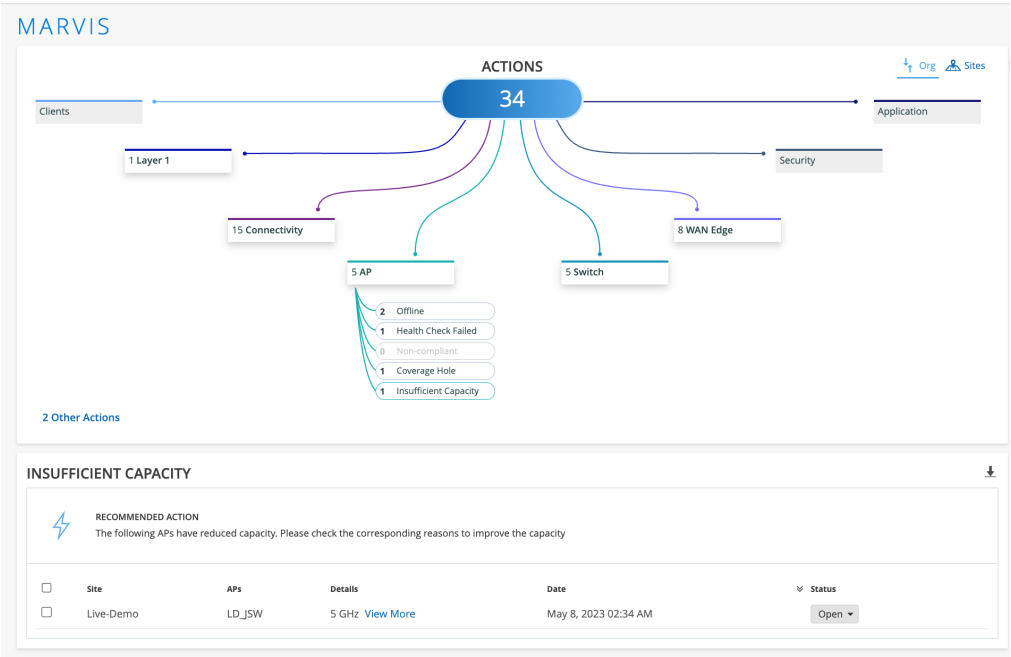


Utilize the floor plan visual provided by Marvis to pinpoint areas with coverage issues and take necessary steps such as adding APs, adjusting placements, or increasing power output to address the coverage gaps.

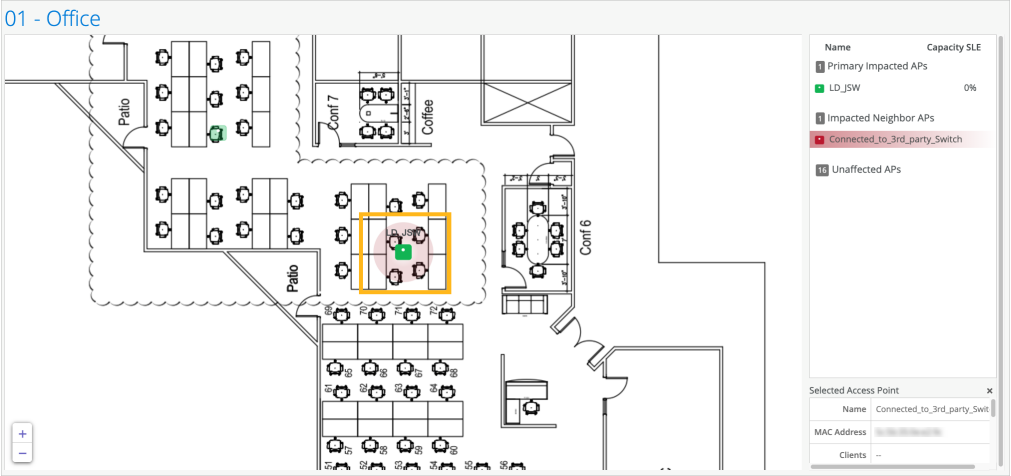
By identifying and resolving coverage holes promptly, you can enhance network connectivity and user experience, ensuring seamless communication across all areas.

Insufficient Capacity Alert

The Insufficient Capacity action detects capacity issues arising from increased utilization, especially during peak client traffic. Addressing capacity constraints is vital to maintain network performance and avoid congestion.



Analyze the floor plan visual provided by Marvis to identify APs experiencing capacity issues and make design improvements to alleviate congestion and optimize network capacity.

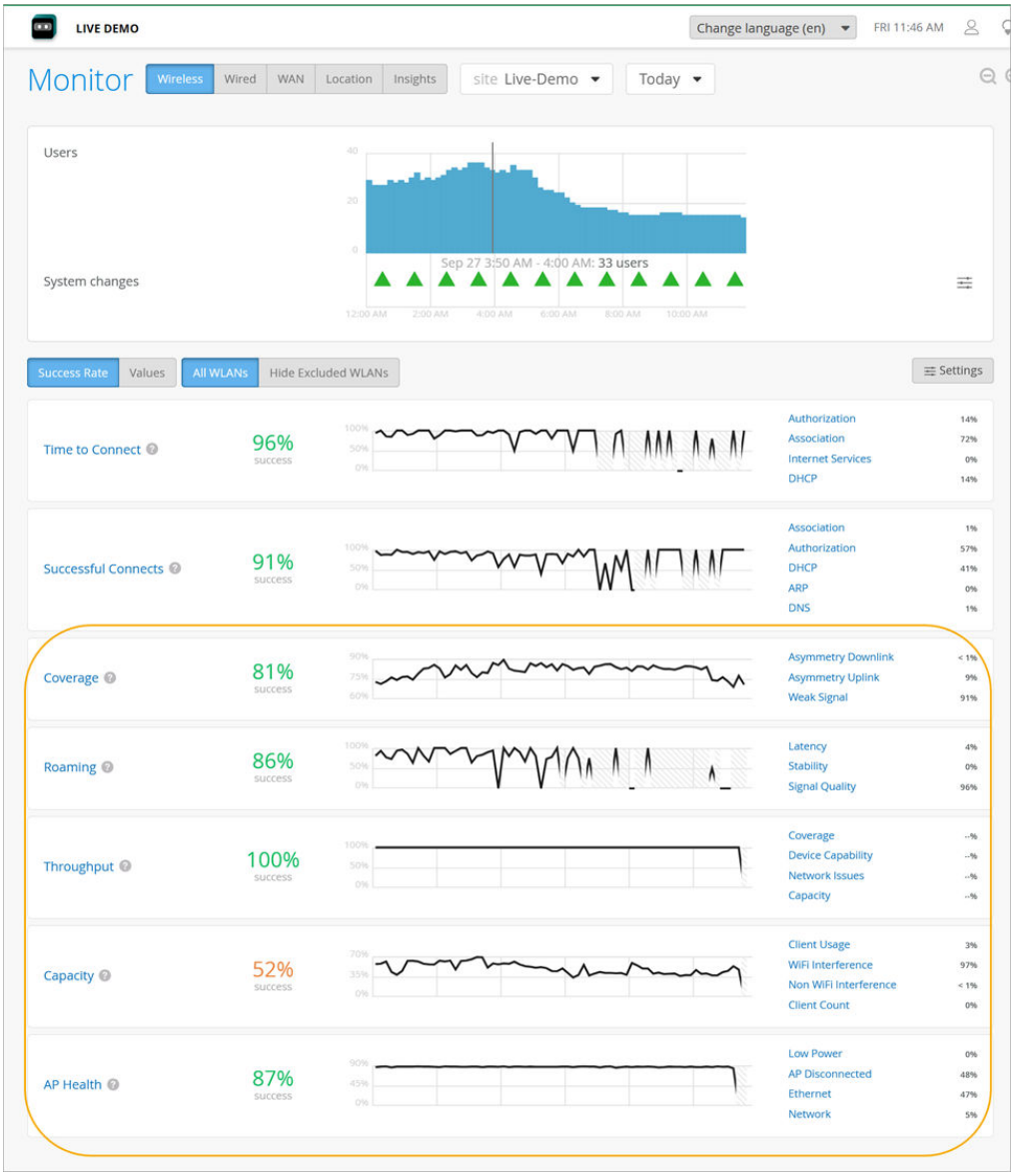


Wireless SLE Analysis

Juniper Mist uses Service Level Expectations (SLEs) to measure user experiences, with customizable thresholds for factors like throughput, capacity, and device health. If experiences fall short, Juniper Mist identifies the root causes and provides detailed information for resolution. The SLE dashboard offers a quick overview of service levels and issues needing attention.

See Wireless SLEs Dashboard for more information.

Select **Monitor** > **Service Levels** from the left menu, and then click the **Wireless** button.



Use the following SLE to assess your users' experiences with signal strength, throughput, RF channel capacity, roaming between APs, and APs availability.

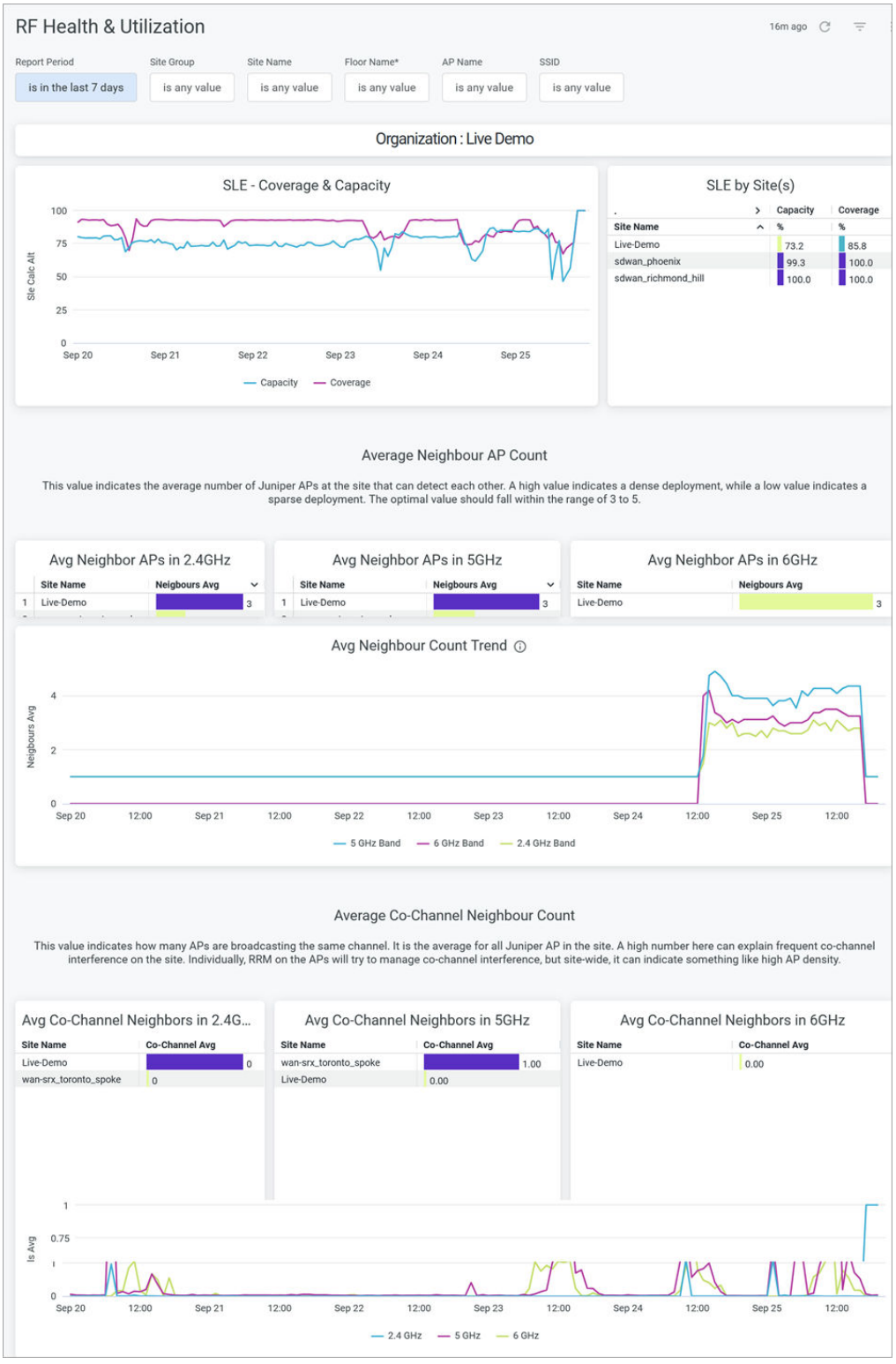
1. **Signal Coverage:** Analyze the Received Signal Strength Indicator (RSSI) and signal quality data to identify areas with weak coverage or potential signal asymmetry.
2. **Roaming Performance:** Evaluate the success rate of client device roams between access points and identify any issues related to latency or signal stability.
3. **Throughput Analysis:** Assess the estimated per-client throughput and investigate any capacity or coverage-related constraints impacting user experience.
4. **Capacity Analysis:** Review the RF channel capacity availability and potential limitations due to interference or client usage.

5. **AP Health Status:** Track AP health to assess your users' experience with AP availability. Get percentage of time the APs are operational without rebooting or losing connectivity to the cloud.

RF Health and Utilization Dashboard in Premium Analytics

The RF Health and Utilization dashboard provides long-term radio frequency (RF) health and utilization pattern for your network. With the information, you can analyze channel utilization trends for different radio bands across various sites, floors, and access points (APs), ensuring optimal performance and capacity planning.

In Juniper Mist portal, click **Analytics** > **Premium Analytics**. On the Premium Analytics page, click **RF Health and Utilization**.



Here you can analyze channel utilization trends for different access points (APs).

SLE Coverage and Capacity: This report evaluates the SLE coverage and capacity across APs and sites, identifying sites with poor signal strength, high interference, or coverage gaps. By analyzing these metrics, you can determine where additional APs are needed to improve coverage and signal quality.

Average Neighbor AP Count: This value indicates the average number of APs at the site that can detect each other. A high count signifies a dense deployment, while a low count indicates a sparse deployment. Ideally, the value should range between 3 and 5 for optimal performance.

Average Co-Channel Neighbor Count: This value represents the number of APs broadcasting on the same channel, averaged across all Juniper APs at the site. A high count suggests frequent co-channel interference on the site. While individual APs use Radio Resource Management (RRM) to mitigate interference, a high site-wide count points to broader density challenges.

By using RF health and utilization data, you can make informed decisions about where to place new APs to balance the network load and enhance overall performance.

See RF Health and Utilization for details.

Recommendations

Based on the assessment findings, the following recommendations are proposed:

- Optimize the placement and configuration of existing access points to improve signal coverage and address any identified dead zones. See Access Point Placement for Location Services
- Implement recommended actions provided by Marvis to address ongoing network issues and enhance overall network performance. See Marvis Actions Overview.
- Consider the deployment of additional access points in areas with high client density or limited coverage to improve user experience and accommodate growing demand.
- Mitigate any identified RF interference sources and optimize spectrum utilization to ensure a healthy RF environment for the wireless network.

Regularly monitoring and addressing the actions highlighted by Marvis can help you maintain an efficient and reliable network infrastructure. This action ensures that the deployed APs are functioning optimally and meet the demands of your network environment.

RELATED DOCUMENTATION

No Link Title

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2
CHAPTER

BLE Settings

Enable Bluetooth Based Location Services

Virtual Bluetooth LE (vBLE) enables businesses to deliver location-based services to their customers and employees. Juniper Networks Access Points (APs) use a dynamic 8-antenna array that transmits BLE signals and blankets an entire area with BLE.

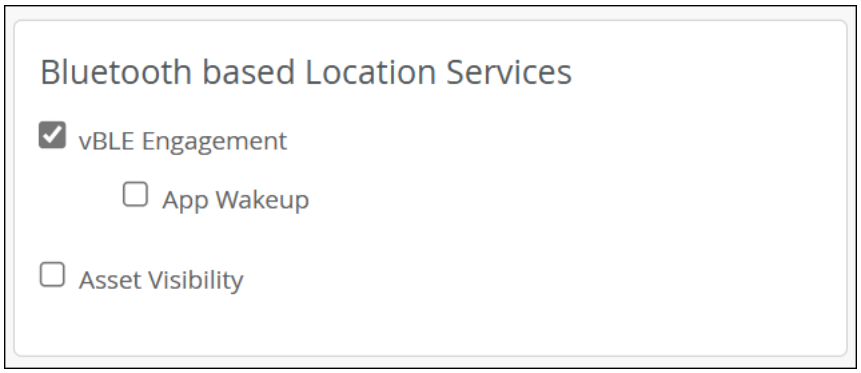
Enable vBLE Engagement if you want the vBLE antenna array to transmit BLE signals for indoor location wayfinding. This comes in handy in a retail setting, for example, when a customer in a store needs directions for how to get to a particular department.

Enable Asset Visibility if you also want to use the APs for asset tracking. When you enable Asset Visibility, the AP will listen for and locate devices containing BLE tags. This comes in handy for tracking equipment, monitoring occupancy, or analyzing staffing.

You can enable vBLE Engagement and Asset Visibility in the site configuration or the device profiles in the Juniper Mist portal. In this procedure, you'll enable them at the site level.

To enable Bluetooth Based Location Services:

1. From the left menu of the Juniper Mist portal, select **Organization** > **Site Configuration**.
2. Select the **Site** where you want to enable location-based services.
3. Scroll down to **Bluetooth based Location Services**.
4. Select the **vBLE Engagement** check box.



   This enables the vBLE array for all APs at this site; all APs will transmit BLE signals for location wayfinding.

5. (Optional) Select the **App Wakeup** check box if you want the AP to transmit a ninth omni beam ("super beacon").

   For example, a retailer might want “super beacons” at the front of a store. When customers enter, they get a notification on the retailer’s Mist SDK-enabled mobile application. There are many other use cases that you can implement based on your business goals.

6. (Optional) Select the **Asset Visibility** check box if you want to use the APs to track assets.

   Note:

- When you enable Asset Visibility, the APs listen for BLE signals and will indicate the location of these BLE clients and assets on the Live View.
- If you enable both vBLE Engagement and Asset Visibility, the AP must transmit and receive BLE signals. To optimize performance, enable only the features that you need for your use cases.

  The following table shows how your selections affect the rate at which the AP sends data to the Juniper Mist cloud.

  Table 1: Transmission Rates

Location Service Enabled	Transmission Rate
Both vBLE Engagement and Asset Visibility	Every 2 seconds
Only vBLE Engagement	Every second
Only Asset Visibility	Every 2 seconds

BLE Beacons

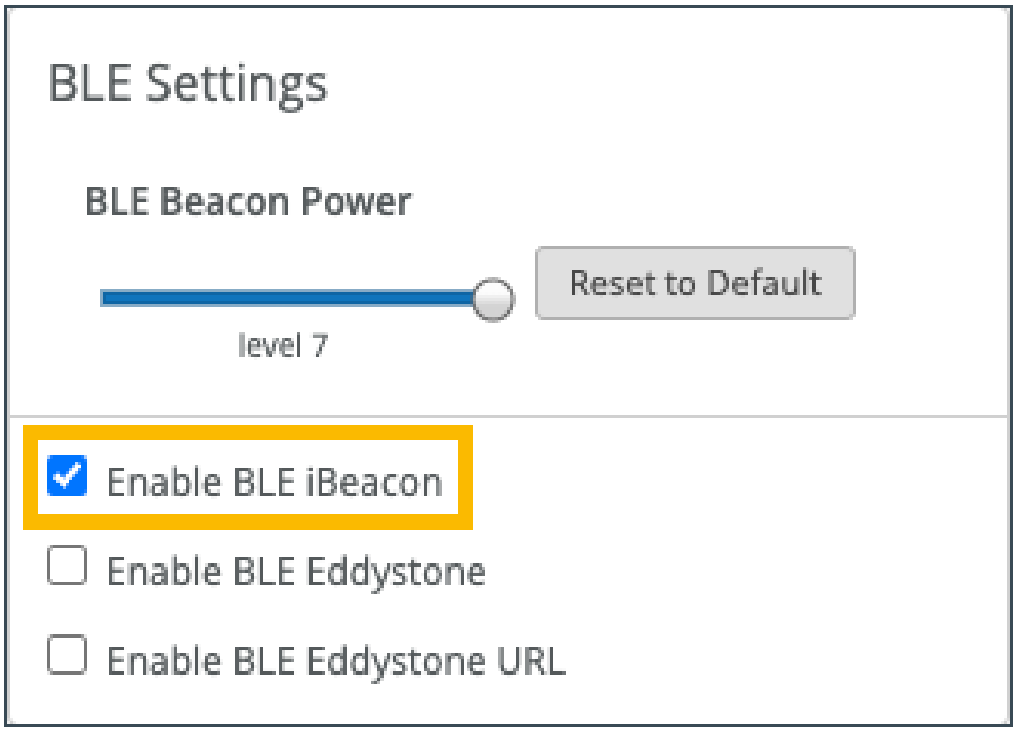
Virtualized Bluetooth® Low Energy (vBLE) beaconing technology allows exact calculations for locating BLE-enabled devices. Juniper Mist access points (APs) use this technology and can simulate third-party beacons to locate devices containing BLE sensors. Beacons can be broadcast with different payload structures.

Juniper Mist APs broadcasts three types of beacons:

- **iBeacon**–iBeacon is a protocol Apple developed that mobile devices use that allows the device to act as a Bluetooth transmitter. When the device gets within range of an AP broadcasting iBeacon, the AP detects the device signal and then uses the installed mobile application to trigger an action or push a notification to the user's mobile device. Both iOS and Android devices can use iBeacon.
- **Eddystone UID**–Eddystone (Unique beacon ID) UID is a protocol that Google developed. It allows mobile devices to act as Bluetooth transmitters. When the device is within range of an AP broadcasting Eddystone UID, the AP detects it and uses an installed mobile application to trigger an action on the mobile device. Both iOS and Android devices can use Eddystone UID.
- **Eddystone URL**–Eddystone URL is a protocol that Google developed. When a device is within range of an AP broadcasting Eddystone-URL, the AP will detect it and send a URL from the web in the form

of a notification to the mobile device. A mobile application is not needed for this to work. Eddystone URL is compatible only with Android devices.

1. From the left menu of the Juniper Mist portal, select **Access Points**.
2. Select the **Access Point** that is going to broadcast BLE beacons.
3. Scroll down to the **BLE Settings** configuration block.
4. Select **Enable** for each type of BLE beacon you want to broadcast, and then update the payload according to the payload structure.



5. Click **Save** (in the top right corner).

NOTE: To verify that the beacons are broadcasting, you can use the Beacon Simulator Application. You can download the app from the Apple App Store or from the Google Play Store. Make sure to turn on Bluetooth on your mobile device prior to using the app.

Change the BLE Power Settings for Access Points

SUMMARY

When needed, you can adjust an access point's Bluetooth Low Energy (BLE) and Virtual Bluetooth Low Energy (vBLE) power levels.

IN THIS SECTION

It's rarely necessary to change the BLE power settings for an access point (AP). Typically, you would change them only if you want to fine-tune the location-based services at your site.

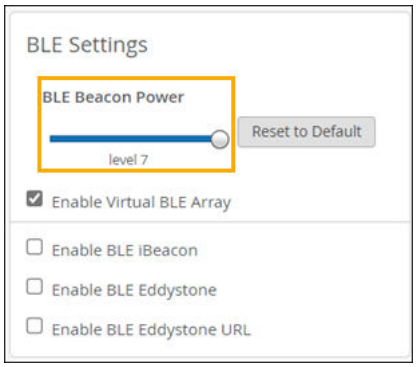
You can change these settings for a single AP or for multiple APs as a batch.

- "Change the BLE and vBLE Power Settings for an AP" on page 25
- "Change the Power Settings for Multiple APs as a Batch" on page 26

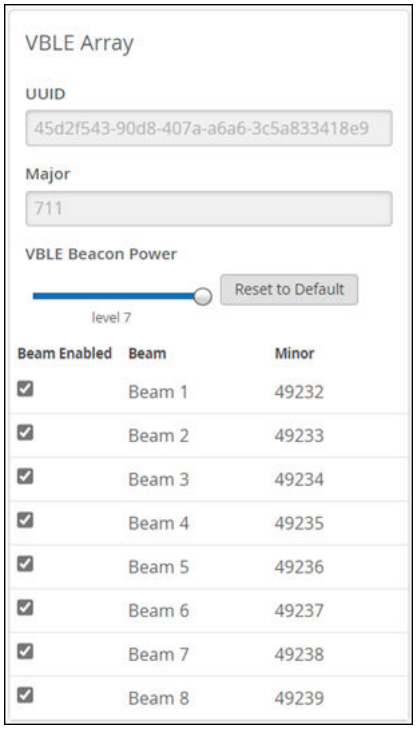
Change the BLE and vBLE Power Settings for an AP

Follow these steps if you need to adjust only one AP.

1. From the left menu of the Juniper Mist™ portal, select **Access Points**.
2. Click the AP that you want to adjust.
3. Under **BLE Settings**, drag the **BLE Beacon Power** slider left (lower power) or right (higher power).



4. Under **vBLE Array**, drag the **VBLE Beacon Power** slider left (lower power) or right (higher power).



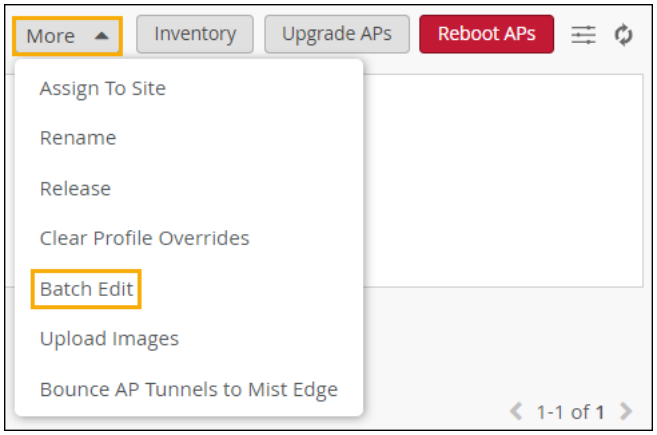
The power level options are from Level 1 (the lowest power) up to Level 7 (the highest power). The corresponding transmission power (in dBm) varies for each AP model. For more information, see "BLE Power Settings for Juniper Access Points" on page 28.

5. Click **Save** (near the top right corner of the page).

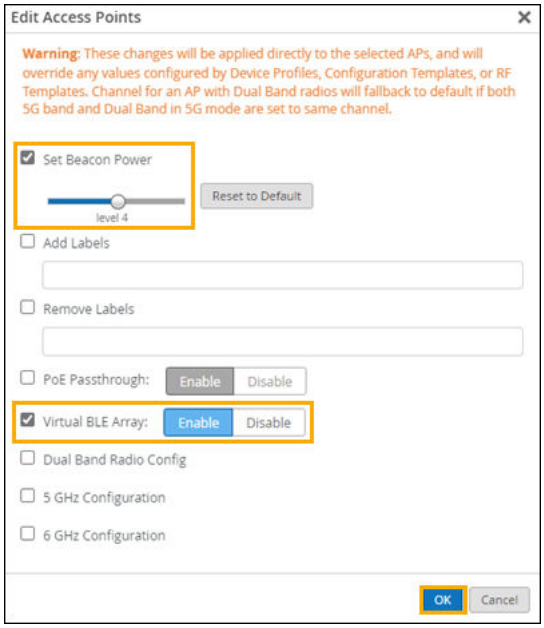
Change the Power Settings for Multiple APs as a Batch

Follow these steps if you want several APs to have the same BLE and vBLE power levels.

1. From the left menu of the Juniper Mist portal, select **Access Points**.
2. Select the check boxes for the APs that you want to adjust.
3. Click **More**, and then click **Batch Edit**.



4. Drag the **Set Beacon Power** control left (lower power) or right (higher power).



The power level options are from Level 1 (the lowest power) up to Level 7 (the highest power). The corresponding transmission power (in dBm) varies for each AP model. For more information, see "BLE Power Settings for Juniper Access Points" on page 28.

5. If you want these same settings to apply to vBLE on the selected APs, enable **Virtual BLE Array**.
6. Click **OK**.

BLE Power Settings for Juniper Access Points

Table 2: BLE Power Settings for BT11, AP41-US, and AP61-US

Level	Power
6	12 dBm
5	8 dBm
4	4 dBm
3	0 dBm
2	-4 dBm
1	-8 dBm

Table 3: BLE Power Settings for AP21, AP33, AP41-WW, AP43, AP45, AP61-WW, and AP63

Level	Power
6	9 dBm
5	5 dBm
4	1 dBm
3	-3 dBm
2	-7 dBm
1	-11 dBm

3

CHAPTER

Floorplan Setup

Floorplan Setup Overview

IN THIS SECTION

Importance of the Floorplan

The floorplan is an essential component of location services. Your floorplan provides Juniper Mist™ with accurate information about the site and the access points (APs).

An accurate floorplan enables the location engine to generate accurate location estimates for the client devices, assets, and users at your site.

The floorplan must be correctly scaled, must include all APs, and must correctly represent their positions, heights, and orientations. If an AP is installed at your site but not represented on the floorplan, it does not participate in location services.

Video Overview

Video: Adding a Floorplan

Process Overview

To implement the scenario, do these tasks.

Table 4: Floorplan Setup Process

Step	Action	More Information
1	Add a floorplan to a site—You can upload an image or import a complete floorplan from Ekahau or iBwave.	*Manually Upload Your Floorplan* *Import a Floorplan*
2	Scale the floorplan.	*Scale a Floorplan*
3	Add elements such as access points, location zones, and wayfinding paths.	"Add Location Zones to a Floorplan" on page 40 "Add Wayfinding Paths to a Floorplan" on page 31
4	Validate your floorplan.	"Validate Your Floorplan" on page 47

Add Wayfinding Paths to a Floorplan

IN THIS SECTION

In a Juniper Mist™ implementation, indoor location wayfinding paths are just like roads in a GPS navigation application. The wayfinding paths are the routes that users travel to reach their indoor destination, usually in the form of hallways, corridors, or intersections. You should be familiar with the physical space before you add wayfinding paths to the floorplan.

NOTE: Wayfinding paths are not required for indoor location wayfinding. However, we strongly recommend that you configure these paths so that the blue dot on the user's

mobile app will snap to the path that you want users to follow. The blue dot will separate from the path when a user strays away.

When creating a wayfinding path, follow these best practices:

- Minimize the number of wayfinding paths on the floorplan. Draw a single, long path for a single hallway, for example. This approach reduces error and prevents gaps between paths. It also reduces the chance of the blue dot moving around jumpily while the user is on the path.
- If you have multiple paths, make sure that they are truly connected and that no gaps exist. To avoid potential issues, draw paths so that they intersect one another.
- Delete any excess segments or nodes by selecting them and then clicking **Delete** on your keyboard.
- Add paths for narrow walkway areas such as hallways, corridors, or any areas where your users need guidance.

  You do not need to add paths to open areas, such as a cafeteria. As users move around the area, the blue dot guides them toward nearby paths.

Video: Adding Wayfinding Paths to a Floorplan

1. From the left menu of the Juniper Mist portal, select **Location** > **Live View**.
2. Select the site and the floorplan.
3. Click **Wayfinding Paths**.
4. Under **Drawing Tool** on the right, click **Insert Path**.
5. Start drawing your path, as follows:
   a. Click inside the floorplan to indicate the starting point of the path.
   b. Move to the next point that you want the path to include and click there to continue drawing the path.
   c. Click the last point drawn to finish drawing the path. This exits the drawing tool.

NOTE: To replay the animation, refresh the web page.

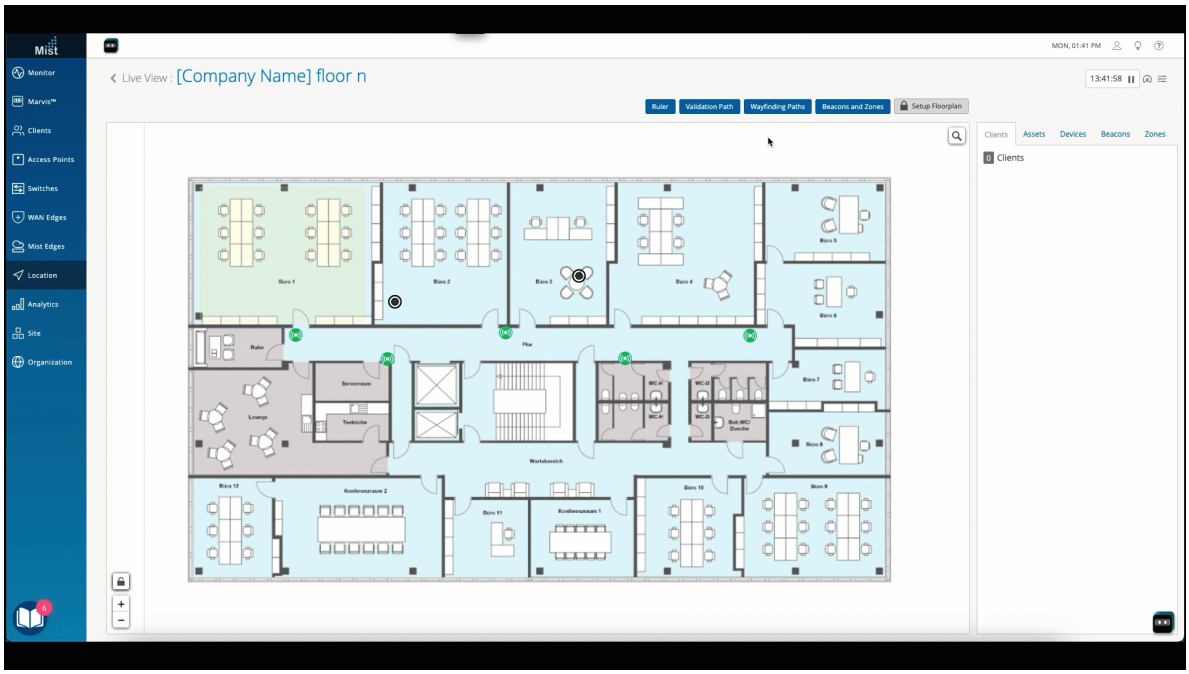
6. Fine-tune your paths.
   - If you added multiple lines, zoom in on the floorplan to verify that no gaps exist.
   - Add walls to keep the blue dot contained within a desired vicinity. For example, if there are walls around the room that a user is in, the blue dot will be contained within that space. Walls prevent the blue dot from snapping to paths outside of an enclosed area. For more information, see "Add Walls to Improve Wayfinding" on page 33.
   - Add **Exclusion Zones** to indicate areas where you don't want the blue dot to go, such as restrooms and outdoor areas. For more information, see "Add Exclusion Zones to Improve Wayfinding" on page 35.
7. Click **Save**.

Add Walls to Improve Wayfinding

You can add walls to the floorplan to keep the blue dot contained within a desired vicinity. For example, if there are walls around the room that a user is in, the blue dot will be contained within that space. Walls prevent the blue dot from snapping to paths outside of an enclosed area.

1. From the left menu of the Juniper Mist™ portal, select **Location** > **Live View**.

2. Select the site and the floorplan.
3. Click **Wayfinding Paths**.
4. Under **Drawing Tool** on the right, click **Insert Wall**.
5. Start drawing your wall, as follows:
   a. Click inside the floorplan to indicate the starting point of the wall.
   b. Move to the next point that you want the wall to include and click there to continue drawing the wall.
   c. Click the last point drawn to finish drawing the wall. This exits the drawing tool.



NOTE: To replay the animation, refresh the web page.

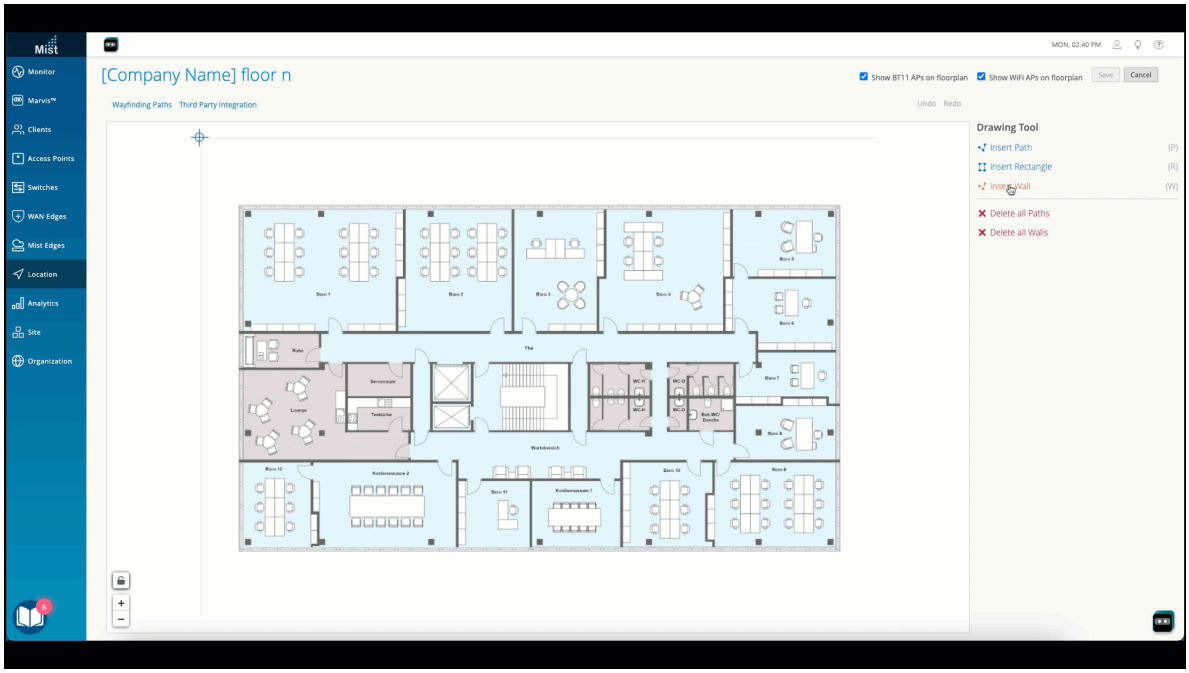
- Make sure that the walls and the wayfinding paths do *not* intersect.
- Do not block doorways with walls, or your app will not be able to lead your users through those doors. Make sure there is enough space for the blue dot to enter and exit as needed.

6. Delete any excess segments or nodes by selecting them and then pressing Delete.
7. Click **Save**.

Add Exclusion Zones to Improve Wayfinding

Add exclusion zones to indicate areas where you don't want the blue dot to go, such as restrooms and outdoor areas. Complete enclose these areas, without any gaps, so that the blue dot cannot enter the exclusion zone.

1. From the left menu of the Juniper Mist™ portal, select **Location** > **Live View**.
2. Select the site and the floorplan.
3. Click **Wayfinding Paths**.
4. Under **Drawing Tool** on the right, click **Insert Wall**.
5. Start drawing the boundaries of the exclusion zone, as follows:
   a. Click inside the floorplan to indicate the starting point of the exclusion zone.
   b. Move to the next point that you want to include and click there to continue drawing the exclusion zone.
   c. Click the last point drawn to finish drawing the exclusion zone. This exits the drawing tool.



NOTE: To replay the animation, refresh the web page.

- Enclose Exclusion Zones fully by overlapping the corners of the walls with one another as you draw them.

- The blue dot will stop at the edge of the Exclusion Zone and cannot enter by any means. Juniper Mist will not collect data while a client or asset is within those areas.

6. Delete any excess segments or nodes by selecting them and then pressing Delete.
7. Click **Save**.

Add Other Items to a Floorplan

IN THIS SECTION

NOTE: Before adding items to a floorplan, ensure that it is accurately scaled. See *Scale a Floorplan*.

You must add your access points to the floorplan. Only APs that are on the floorplan can participate in location-based services.

You also can add many other items, including:

- Location zones
- Third-party beacons
- Virtual beacons
- Wayfinding paths, walls, and exclusion zones

For details, continue to the next topics in this guide.

Add Third-Party Beacons to a Floorplan

Access point (AP) installation can be challenging in certain types of buildings or structures. One example is an atrium, where cabling might interfere with aesthetics. In this case, you can use third-party, battery-operated beacons to help provide coverage.

NOTE:

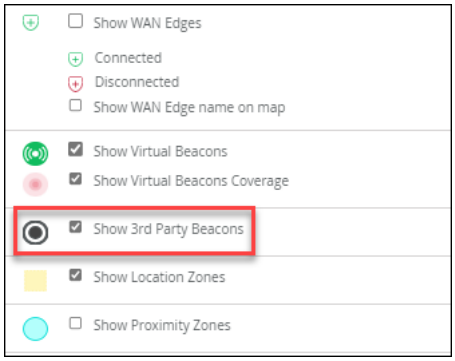
- To ensure location accuracy, always use Juniper Mist™ APs. Third-party beacons are not meant as a replacement for Juniper Mist APs. Third-party beacons can supplement Juniper Mist APs in Mist SDK-enabled wayfinding deployments where AP placement proves difficult.
- Don't confuse third-party beacons with Juniper Mist's virtual beacons. Third-party beacons are physical, battery-operated beacons that exist onsite. You can deploy them to help provide coverage. Juniper Mist's virtual beacons, on the other hand, do not provide coverage. For more information about virtual beacons, see "Add Virtual Beacons to a Floorplan" on page 44.

To add third-party beacons to a floorplan:

1. From the left menu of the Juniper Mist portal, select **Location** > **Live View**.
2. Click the floorplan to which you want to add the third-party beacons.
3. To ensure that the floorplan displays beacons:
   a. Click the **Settings** button (near the top right corner of the page).

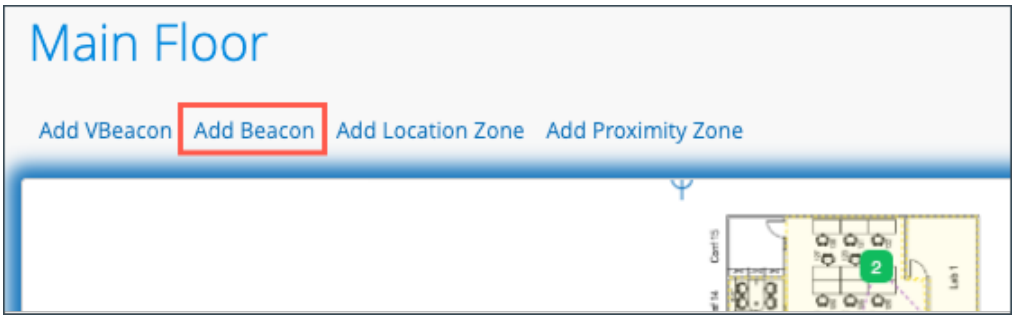
   

   b. Select the **Show 3rd Party Beacons** check box.

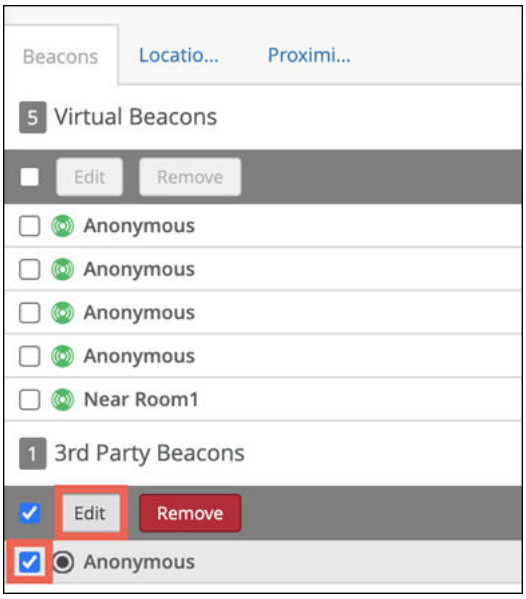
   c. Close the **Location Settings** window.
4. Click **Beacons and Zones** (above the map).

5. Click **Add Beacon** (above the map).



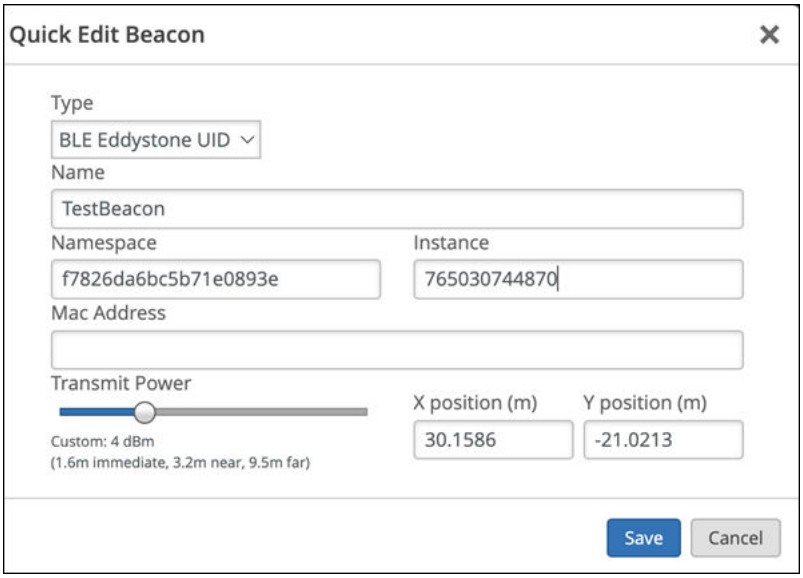
The third-party beacon appears at the center of the floorplan. The icon is a black-and-white circle. Above the icon is the default name, Anonymous.

6. Drag the new Anonymous beacon into the correct position on the floorplan.
7. On the right side of the screen, under **3rd Party Beacons**, select the check box for the new Anonymous beacon.
8. Click **Edit**.



9. Enter the information about the beacon:
   - For **Type**, select **BLE Eddystone UID** (required).
   - Enter a unique **Name** so that you can easily identify the various beacons that you add.
   - Ensure that the **Namespace**, **Instance**, and **Mac Address** fields contain the correct information.

- Drag the **Transmit Power** slider left or right so that it shows the transmission power that is configured on the physical beacon.
- Ensure that the **X position** and the **Y position** match the physical location of the beacon.



NOTE: Juniper Mist will neither manage the beacon nor detect its health.

10. Click **Save**.

    Your third-party beacon is visible on the floorplan.

The AI engine adds the beacon to the beams received. The engine uses the X,Y coordinates and transmission power to help calculate beacon location.

Add Location Zones to a Floorplan

Location zones are useful whether you're developing applications or using the occupancy and engagement analytics pages in the Juniper Mist™ portal.

After you add location zones to a floorplan, you can use these zones in several ways.

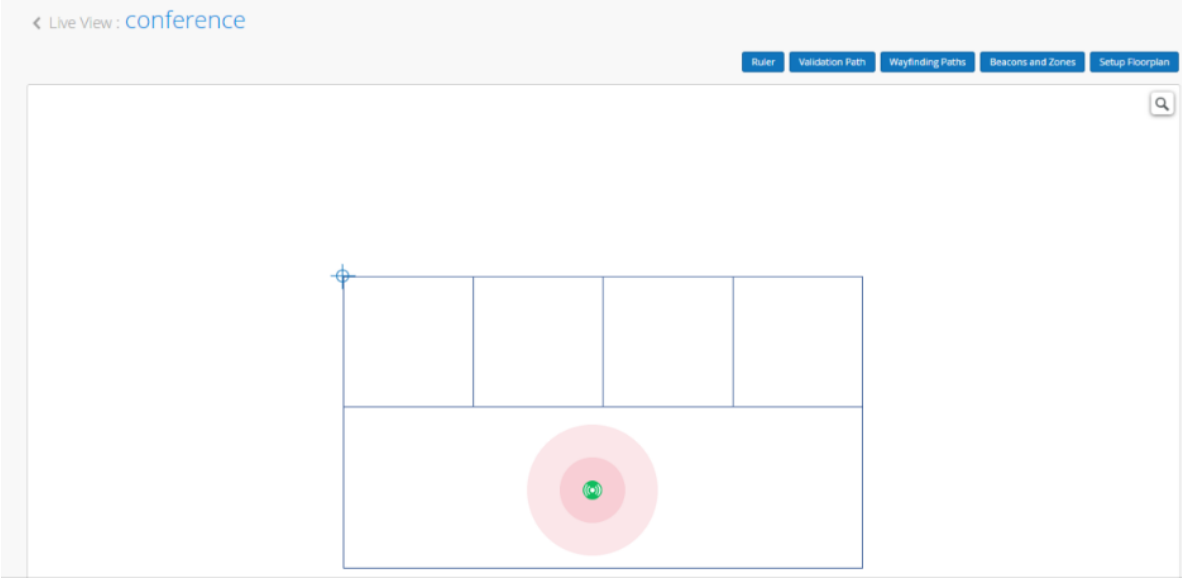
- On the Occupancy Analytics page, you can monitor each zone's occupancy.
- On the Engagement Analytics page, you can analyze visitor and employee dwell times in each zone.
- With API calls, you can capture every zone entry and exit event for client devices, assets, and SDK clients.
- With your Juniper Mist SDK-enabled applications, you can trigger alerts when people enter and exit high-security zones.

To add location zones to a floorplan:

1. From the left menu of the Juniper Mist portal, select **Location** > **Live View**.
2. Select the site and the floorplan.
3. Click **Beacons and Zones**.

4. Click **Add Location Zone**.
5. Drag the mouse to define the zone.

   Start from the top left corner of the area that you want to define. Release the mouse at the lower right corner of the area.

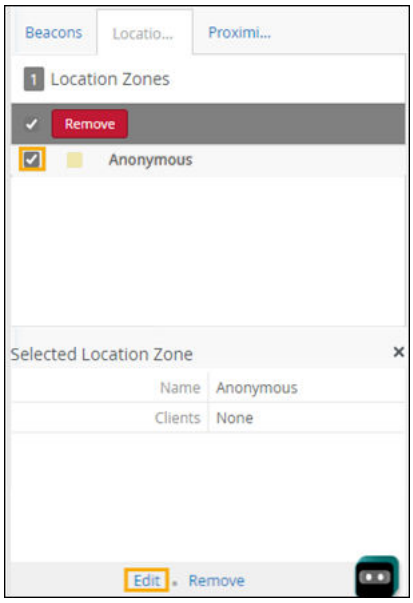


TIP: To replay the animation, refresh the page or open the image in a new tab.

6. Give the zone a unique name:

   a. On the **Location Zones** list, select the check box for the zone.

   b. Click **Edit**.



c. Enter a name.

d. Click **OK**.

7. Add other zones as needed.
8. Click **Save**.

Add Proximity Zones to a Floorplan

You can create and use Proximity Zones to gather occupancy and engagement data for SDK clients, named assets, and connected and unconnected WiFi clients. Users can create individual or grouped Proximity Zones for each AP (access point). Proximity Zones triggering is based on the RSSI data received from the clients.

When creating Proximity Zones, you can create:

- An individual Proximity Zone per AP
- Multiple Proximity Zones per AP
- Grouped Proximity Zones per grouped APs

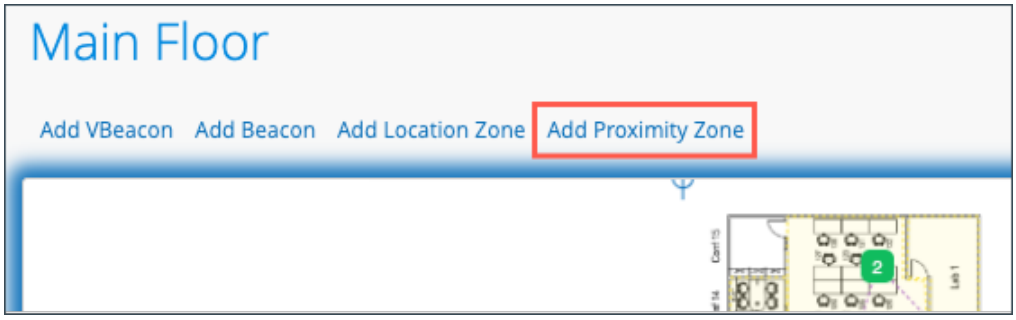
After you add proximity zones to a floorplan, you can use these zones in several ways.

- On the Occupancy Analytics page, you can monitor each zone's occupancy by selecting Client Density and Proximity Zones. Make sure to enable the Public Occupancy Dashboard in the site configuration.
- On the Engagement Analytics page, you can analyze visitor and employee dwell times in each zone.
- With API calls, you can capture every zone entry and exit event for client devices, assets, and SDK clients. Make sure Proximity Zones is selected as the Streaming API under Webhooks in the site configuration.
- With your Juniper Mist™ SDK-enabled applications, you can trigger alerts when people enter and exit high-security zones.

To add proximity zones to a floorplan:

1. From the left menu, select **Location** > **Live View**.
2. Select the site and the floorplan.
3. Click **Beacons and Zones**.

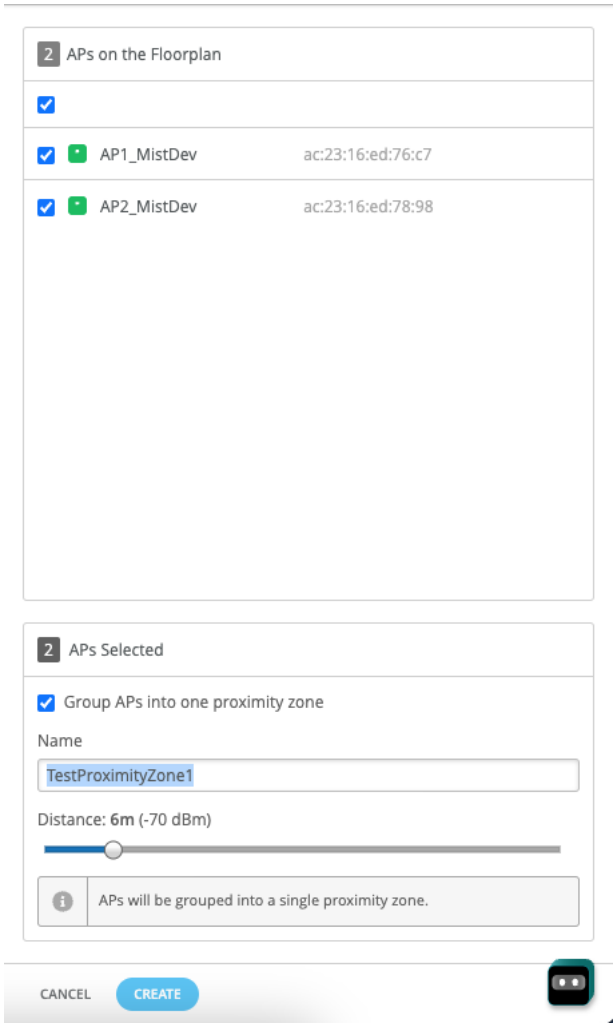
4. Click **Add Proximity Zone**.



5. Select the AP or group of APs that you want to be in the proximity zone.

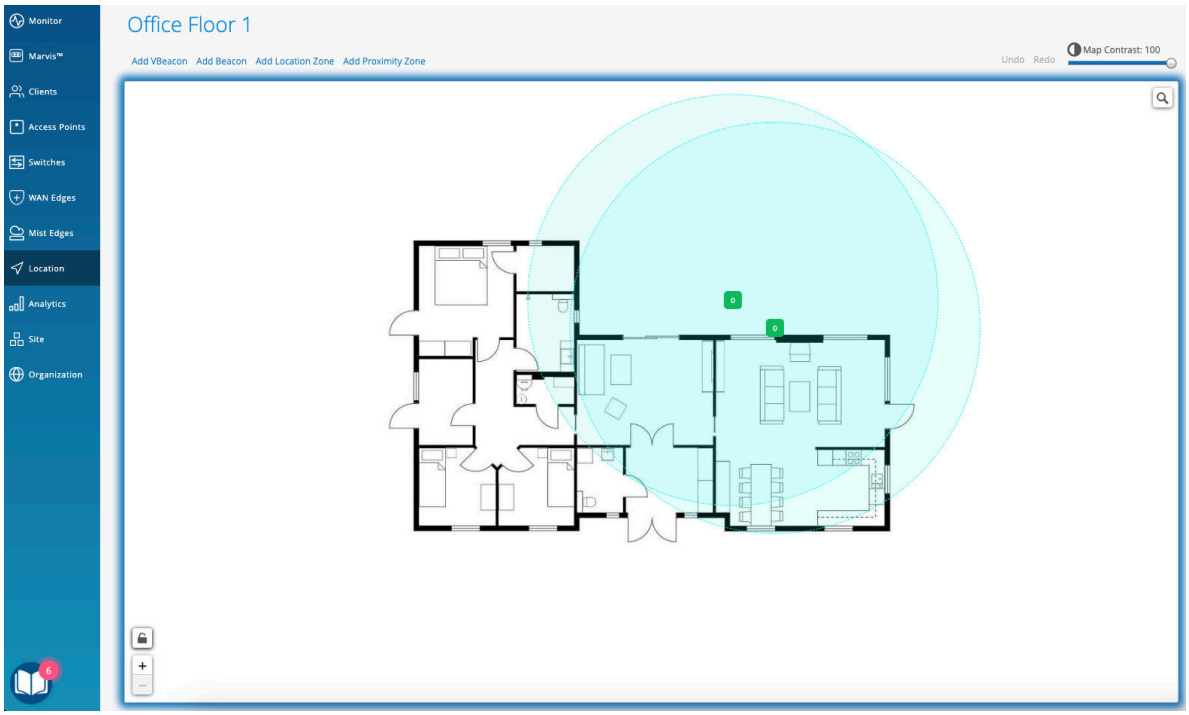
   If you selected a group of APs, also select the **Group APs into one proximity zone** check box to add them all to a single proximity zone.

6. Give the proximity zone a name.
7. Set the RSSI threshold.



When a client reaches the indicated RSSI threshold or higher, an `in_event` is triggered. Similarly, if the client travels further away from the AP and the RSSI goes lower than the threshold, an `out_event` will occur.

8. Click **Create**.
   You will see the proximity zone on the floorplan based on the information you provided.



9. Add other proximity zones as needed.

Add Virtual Beacons to a Floorplan

A virtual beacon is an object on the floorplan that you can use to trigger proximity-based events through your Juniper Mist™ SDK-enabled applications.

Examples

- At your building entrance: When visitors arrive, display a greeting on their mobile devices.
- Inside a store: Offer coupons as shoppers pass special displays.
- At a conference: Prompt attendees to download lecture slides when they enter a breakout room.

NOTE: A virtual beacon does not transmit or receive signals. It is purely virtual, for the purpose of defining a coverage area for a Juniper Mist SDK-enabled interaction.

1. From the left menu of the Juniper Mist portal, select **Location** > **Live View**.
2. Click the site and the floorplan.
3. Ensure that the floorplan is showing the virtual beacons and their coverage areas:
   a. Click the **Settings** button (near the top right corner of the page).

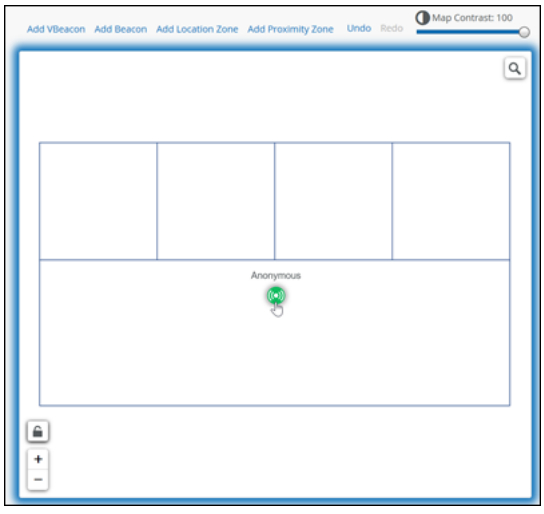
   b. In the pop-up window, select the check boxes for **Show Virtual Beacons** and **Show Virtual Beacons Coverage**.

   c. Close the pop-up window.
4. Click **Beacons and Zones**.

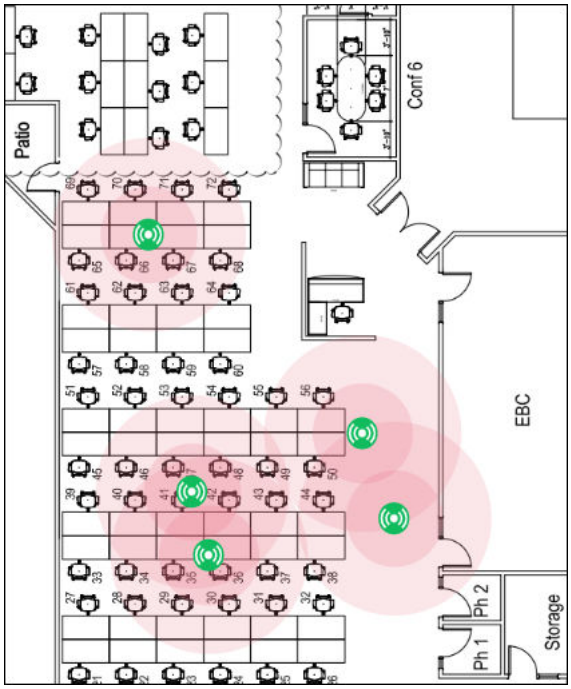
   

5. Add a virtual beacon:
   a. Click **Add VBeacon**.
   b. Drag the new **Anonymous** beacon to the area where you want the users to see the notification.

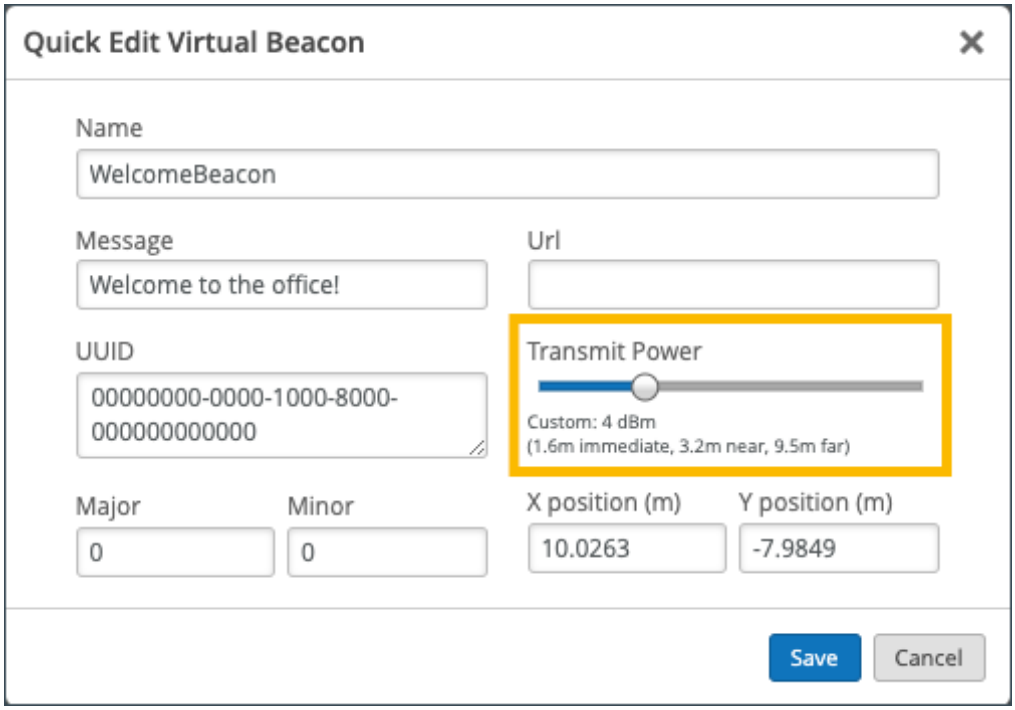
   

   c. As needed, add and position more virtual beacons.Click **Save**.

The floorplan shows the virtual beacons, surrounded by pink circles that indicate their coverage area.



6. Set the name and coverage area for each virtual beacon:
   a. Click the virtual beacon.
   b. Click **Quick Edit** (near the bottom right corner of the page).
   c. Enter a **Name** to uniquely identify this virtual beacon on the floorplan.
   d. Adjust the **Transmit Power** to make the coverage area larger or smaller.



- If the pink area on the map is smaller than the desired coverage area, drag the **Transmit Power** control to the right. After you save the settings, the pink circles will widen.
- If the pink area is too large, drag the **Transmit Power** to the left. After you save the settings, the pink circles will become narrower.

e. Click **Save** to save the settings in the **Quick Edit** pop-up window.

Next Steps

Configure the message that you want to display or the webpage that you want o launch when people enter a virtual beacon's coverage area. See "Configure Push Notifications for User Engagement" on page 57.

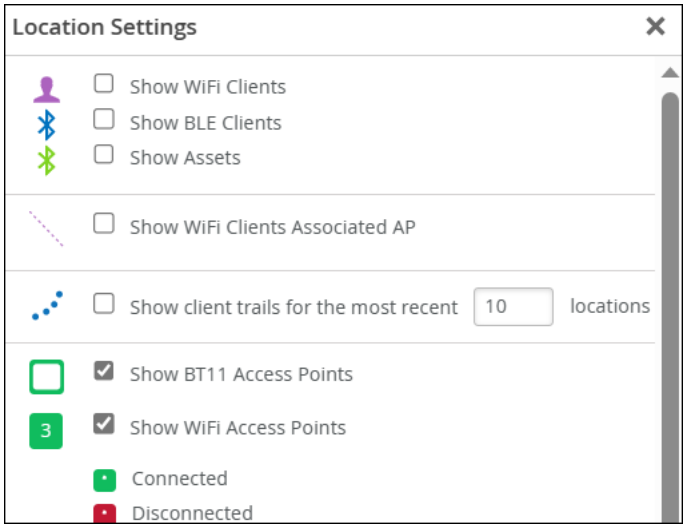
Validate Your Floorplan

Most issues with location can be traced to floorplan inaccuracies. To enable the AP to generate accurate location estimates, the position information in the Juniper Mist portal must match the AP's actual position at your site.

1. From the left menu of the Juniper Mist portal, select **Location** > **Live View**.
2. Select the site and the floorplan.
3. If APs are not visible on the floorplan:

a. Click the **Settings** button (near the top right corner of the page).

b. Select the check boxes to show BT11 and Wi-Fi APs.



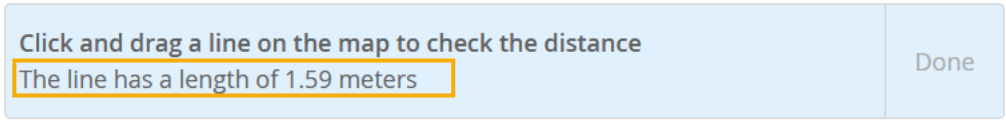
c. Close the **Location Settings** window.

4. Check the scale to ensure that distances on the floorplan match the actual distances at the site.

a. Click **Ruler**.

b. Draw a line between two points on the floorplan, such as two walls of a room.

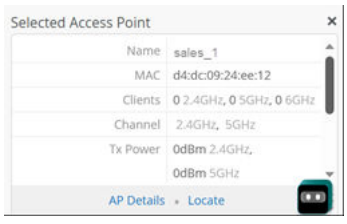
c. Verify that the line length in the blue box matches the actual measurement at the site.



d. Click **Done** to put away the ruler.

If you need to change the scale, click **Setup Floorplan**, and then make the changes. For help, see *Scale a Floorplan*.

5. Click each AP, and verify the information in the **Selected Access Point** area of the page.



- The MAC address shown on the floorplan must match the MAC address of the corresponding AP at the site. If the MAC addresses don't match, then Juniper Mist has inaccurate information about the location of the AP, and the location estimates will be incorrect.
- The position, height, and orientation must be accurate to enable Juniper Mist to generate correct location estimates.

If you need to make changes, click **Setup Floorplan**. Make changes by dragging the AP or by editing the position details. For help with AP edits, see *Manually Place an Access Point on a Floorplan*.

4

CHAPTER

Wayfinding and User Engagement

Wayfinding Use Case

IN THIS SECTION

Benefits

With virtual Bluetooth LE (vBLE)-equipped Access Points (APs), a Juniper Mist User Engagement subscription, and the Juniper Mist SDK, you can integrate turn-by-turn wayfinding into your on-site customer engagement applications.

You can implement wayfinding at large-scale locations such as conference centers, sporting events, theme parks, museums, hospitals, department stores, and universities. Wayfinding helps your app users find their way to rooms, events, and products.

See more information about the Juniper Mist User Engagement Subscription.

Scenario

For this scenario, let's imagine that your professional association is hosting a large conference at a busy convention center. You want to integrate wayfinding into an app that attendees can use to find their conference rooms, dining facilities, and other important locations.

Video: Wayfinding Use Case

Components

Juniper Mist uses the following devices and systems to compute location precision.

- Access Points—APs with the vBLE antenna array transmit BLE signals and broadcast BLE Beacons.

  For more information, see "Access Points for Location Services" on page 8.

- Mobile Devices—Mobile devices use Bluetooth to listen to BLE beacons broadcast from APs.

  For more information, see "BLE Beacons" on page 23.

- Mobile Device Application with Juniper Mist SDK—The SDK (in the mobile app) receives data from the AP and sends that data to the cloud.

  For more information, see "Juniper Mist SDK" on page 88.

- Juniper Mist Cloud—The cloud takes the data that the device sends and runs it through the Location Engine. The Location System then returns the location wayfinding information to the user on the mobile application.

Process Overview

To implement the scenario, do these tasks.

Table 6: Wayfinding Setup Process

Step	Action	More Information
1	Purchase a Juniper Mist User Engagement subscription, and activate it in the Juniper Mist portal.	• Juniper User Engagement information • "Activate Subscriptions" on page 8
2	Ensure that vBLE Engagement is enabled for the site. **NOTE**: vBLE Engagement is enabled by default after you activate your User Engagement subscription.	"Enable Bluetooth Based Location Services" on page 22
3	Ensure that the **Live View** floorplan includes accurate position, height, and orientation data for your APs.	"Floorplan Setup" on page 30
4	Add wayfinding paths to the floorplan.	"Add Wayfinding Paths to a Floorplan" on page 31

Table 6: Wayfinding Setup Process *(Continued)*

Step	Action	More Information
5	Obtain the Juniper Mist SDK and integrate it into your customer-facing mobile application.	"Juniper Mist SDK" on page 88
6	Configure push notifications to provide feedback and information to customers as they pass through specific areas on their route.	"Configure Push Notifications for User Engagement" on page 57

Hybrid Use Case

IN THIS SECTION

Juniper Mist™ offers a wide variety of indoor location services that you can mix and match (a hybrid approach) depending on your use cases.

Below is a real-life example of a Mist customer (a large retailer) who uses the following mix of location services:

- Super beacons
- Indoor location wayfinding
- Zones for zone analytics
- Asset tracking

Super Beacons

This Juniper Mist customer placed access points (APs) transmitting a ninth omni beam (“super beacons”) at the entrances of the store. When customers enter, they get a notification on the retailer’s Mist SDK-enabled mobile application. For details about implementing this location service, see "Enable Bluetooth Based Location Services" on page 22.

Indoor Location Wayfinding

All main aisles and concrete pathways are wayfinding paths for indoor location wayfinding. See "Wayfinding Use Case" on page 51.

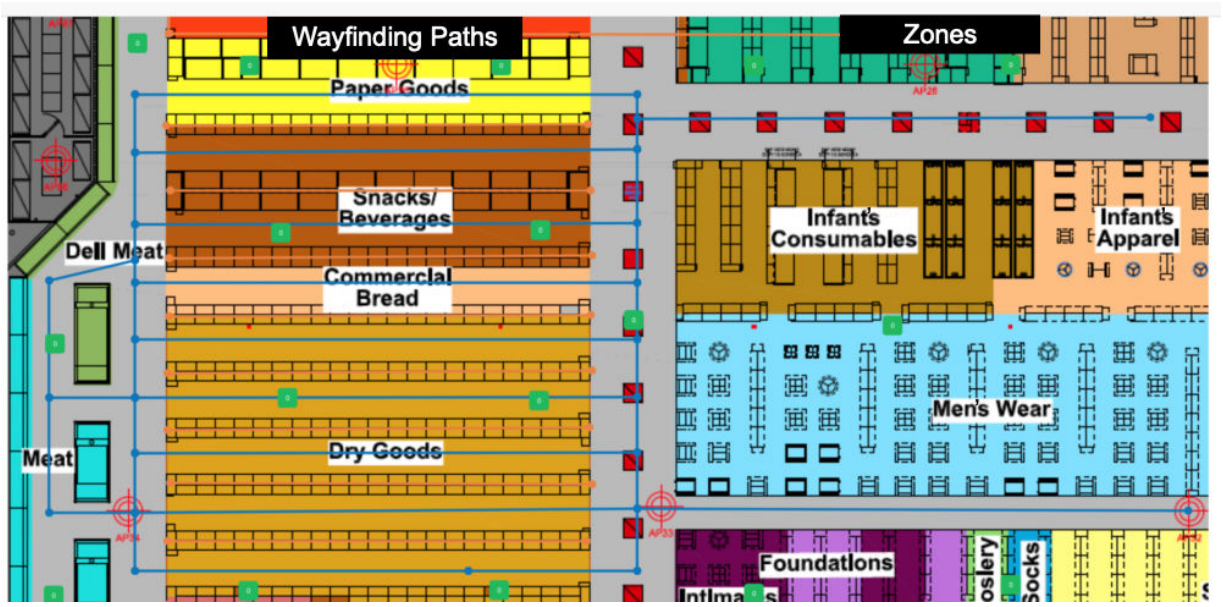
The customer installed the APs with drop-threaded rods over the center of an aisle, approximately every two aisles.

This customer used daisy chaining in several parts of the store where it made sense to save switch ports. See "Daisy Chain BT11 Access Points" on page 56 .

Zones for Zone Analytics

Departments in the center of the store, such as infants’ apparel or men’s clothing, are zones for the purpose of gathering zone analytics. See "Add Location Zones to a Floorplan" on page 40.

Notice that the customer mounted BT11 APs on existing support columns and structural poles. In these areas, the retail customer leaves the established wayfinding paths and provides X and Y coordinates to the back end for the zone analytics engine to process for retail customers’ shopping habits.



Asset Tracking

This Mist customer uses asset tracking so that store employees can locate misplaced items, such as warehouse pallets. The customer placed Bluetooth Low Energy (BLE) beacon tags on the items to be tracked. With those tags in place, employees can track the location of the assets on the Live View page of the Juniper Mist portal. See "Find Equipment Use Case" on page 76.

Guidelines

- We always recommend that you refer to the "Access Point Placement for Location Services" on page 8 to ensure that you have proper coverage.
- You must ensure that products on the shelves do not block APs, as this blockage can interfere with Bluetooth.
- When placing your APs, be sure that you follow the Rubber Band Model to ensure location accuracy and keep customers inside of the APs at the outer edges of the floorplan. See "Rubber Band Model" on page 75 .
- If you cover a large area with Mist APs, you may experience AP Reflection. The AP Reflection Detection event on the Analytics > Events page means that the AP is receiving packets sent from its own Ethernet port (the source address for inbound packets is the address of the AP itself). Double check your physical connections to fix any loops that you may have inadvertently created on your network.

Daisy Chain BT11 Access Points

It can be challenging to support turn-by-turn indoor wayfinding in long hallways. To provide continuous Bluetooth Low Energy (BLE) coverage, the access points (APs) must be within 30 to 50 feet (10 to 15 meters) of one another. If your site has several long hallways, you'll need a lot of access points (APs).

Purchasing a large number of full-featured APs can get expensive. And powering them can quickly use up your switch ports.

The BLE-only BT11 is an economical choice in any area where you're either overlaying an existing wireless network or supporting only location-based services (not Wi-Fi).

By daisy chaining these APs, you can power four APs per switch port (the directly connected AP and three others).

Before You Begin

Place your APs to ensure continuous BLE coverage and location accuracy. See "Access Point Placement for Location Services" on page 8.

To daisy chain BT11 access points:

Enable PoE Passthrough to extend power from the first AP to the *enabled* Ethernet ports and/or the module port. This allows the first AP to provide Power over Ethernet (PoE) to devices connected to Eth1 on the AP. To configure PoE Passthrough, see *PoE Passthrough*.

Connect the first BT11 AP to a Link Layer Discovery Protocol (LLDP)-enabled switch or a 30-watt (W) power injector. Then connect up to three other APs in a daisy chain.

NOTE: If you use a 15W power injector or a switch without LLDP enabled, you can power only two daisy-chained units (the directly connected AP and one other).

Tips

- If the APs lack sufficient power, they will reboot. This issue can occur if:
  - The first AP is not connected to an LLDP-enabled port or 30W power injector.
  - The daisy chain includes more than the recommended number of APs.
- Be mindful of the cable length between the switch and the first BT11. A device loses 4.5W of power for every 100 meters of cable separating it from its power source.
- If the switch port has MAC limiting enabled, increase the limit to allow the actual number of APs in the daisy chain.

Configure Push Notifications for User Engagement

When developing applications with the Juniper Mist SDK (Software Development Kit), you can include notifications. For example, you can display a greeting when a user enters your building. You can display a special offer when a customer approaches a sales display.

To set up these notifications, add "virtual beacons" on page 44 to your floor plan. Because the beacons are virtual, you can add as many of them as you need. For each one, specify the message or web page to display, and define the coverage area. When your mobile app user enters the virtual beacon's coverage area, as shown in pink below, the specified message or web page appears in the app.

Video Overview

Video: What are Virtual Beacons

Before You Begin

Add virtual beacons to the floorplan. See "Add Virtual Beacons to a Floorplan" on page 44.

To configure push notifications:

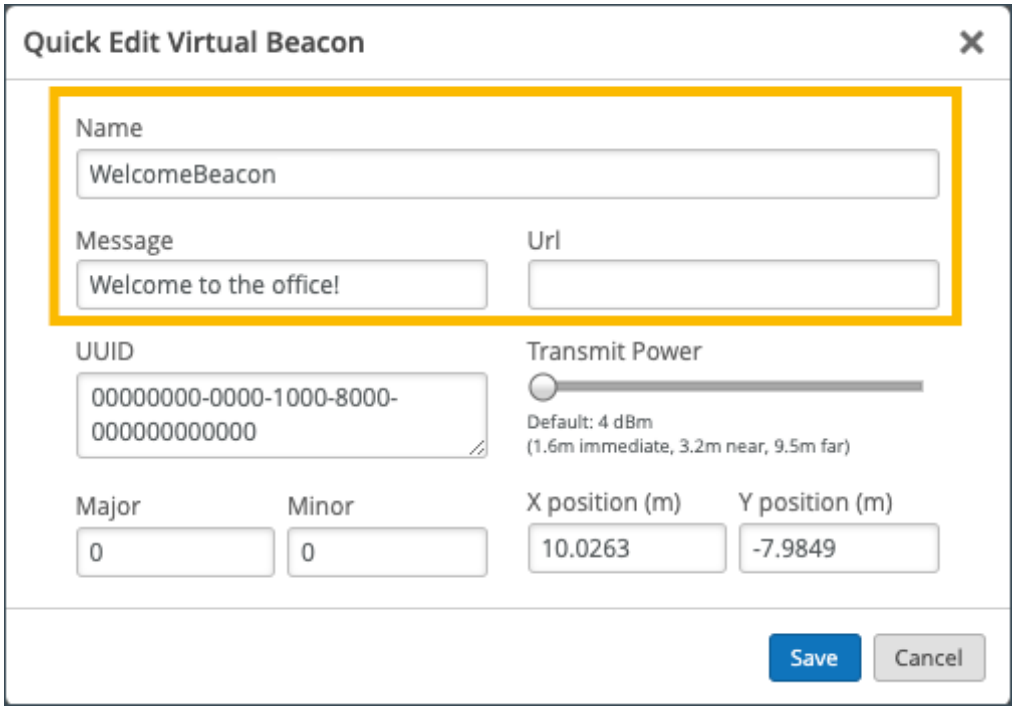
1. From the left menu of the Juniper Mist portal, select **Location** > **Live View**.
2. Click the site and the floorplan.
3. Ensure that the floorplan is showing the virtual beacons and their coverage areas:
   a. Click the **Settings** button (near the top right corner of the page).

   b. In the pop-up window, select the check boxes for **Show Virtual Beacons** and **Show Virtual Beacons Coverage**.

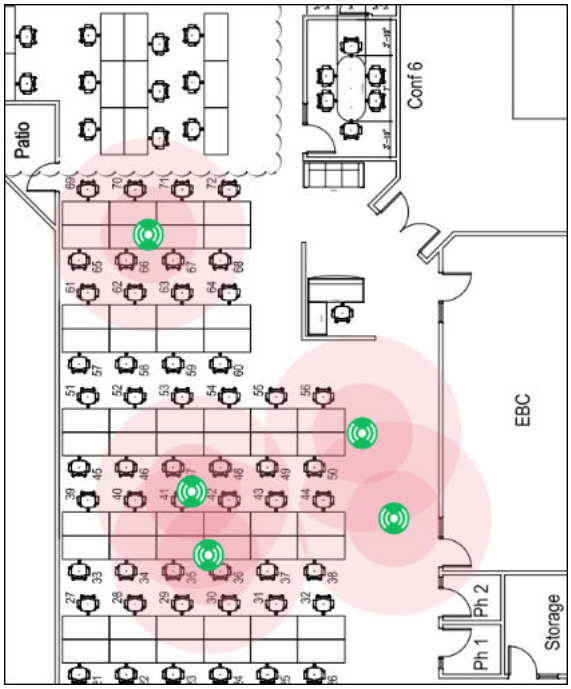
   c. Close the pop-up window.
4. Configure the notifications for each virtual beacon:
   a. Click the virtual beacon.
   b. Click **Quick Edit** (near the bottom right corner of the page).
   c. Enter a **Name** to uniquely identify this virtual beacon on the floorplan.
   d. Enter the **Message** or **URL** that you want to display in your application when users enter the coverage area of this virtual beacon.



e. Click **Save** to save the settings in the **Quick Edit** pop-up window.

5. Test your application to ensure that the notifications appear when expected. If needed, adjust the coverage area of the virtual beacon.

   A pink circle represents a virtual beacon's coverage area.

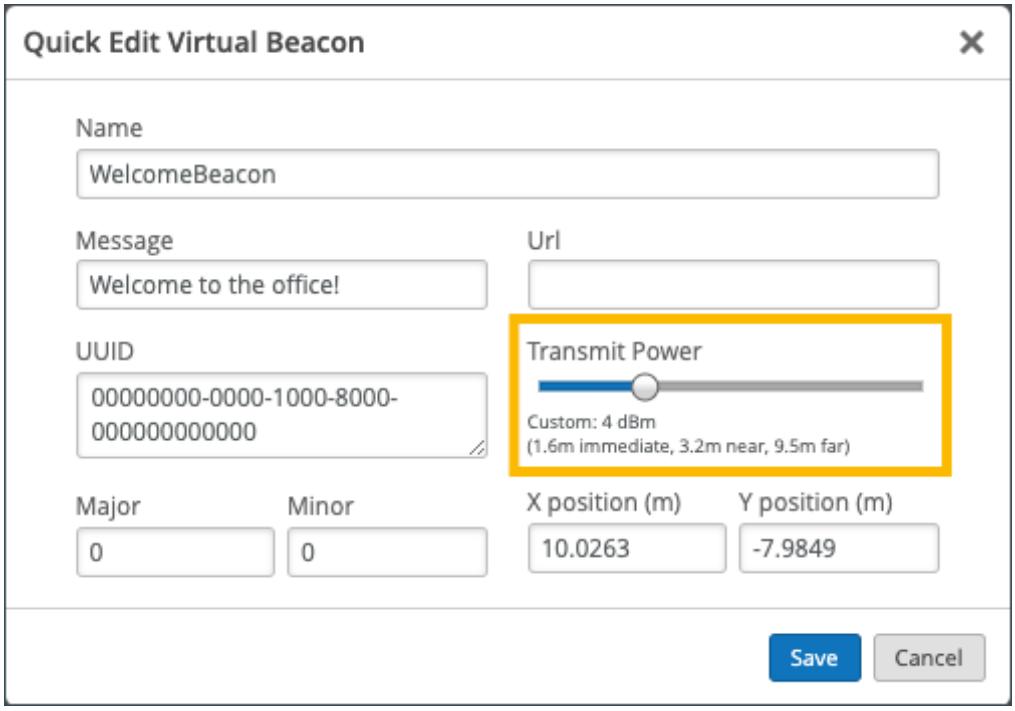


   To adjust the coverage area:

a. Click the virtual beacon.

b. Click **Quick Edit** (near the bottom right corner of the page).

c. Adjust the **Transmit Power** to make the coverage area larger or smaller.



- If the pink area on the map is smaller than the desired coverage area, drag the **Transmit Power** control to the right. After you save the settings, the pink circles will widen.
- If the pink area is too large, drag the **Transmit Power** to the left. After you save the settings, the pink circles will become narrower.

d. Click **Save** to save the settings in the **Quick Edit** pop-up window.

5
CHAPTER

Asset Visibility and Room Occupancy

View and Manage BLE Clients

SUMMARY

The BLE Clients page shows information about all Bluetooth Low Energy (BLE) clients that have been active at the selected site and floorplan.

IN THIS SECTION

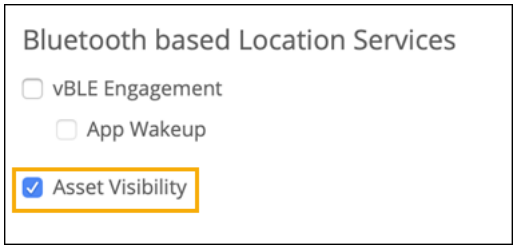
Juniper Mist Asset Visibility is a cloud service that provides real-time tracking and historical location analytics for people, Bluetooth Low Energy (BLE) assets, and IoT devices. For example, with asset location and tracking configured on a site, you can quickly account for high-value construction equipment, or pinpoint the location of key human resources such as nurses or security guards. It's not uncommon, however, for the number of assets under management to scale to the thousands and even tens of thousands, making it hard to find and track individual items or groups in a meaningful way.

Juniper Mist provides multiple ways to name, filter, and categorize BLE assets so you can organize and identify them at scale.

Prerequisites

The BLE Clients page is available only if Asset Visibility is enabled. First purchase and enable an Asset Visibility subscription, and then enable Asset Visibility in the site configuration.

1. Purchase and activate your Asset Visibility subscription. See "Activate Subscriptions" on page 8.
2. From the left menu of the Juniper Mist portal, select **Organization** > **Site Configuration**.
3. Select the site.
4. Scroll down to the Bluetooth based Location Services section of the site configuration.
5. Select the **Asset Visibility** check box.



Find the BLE Clients Page

Juniper Mist Asset Visibility solves this by providing a variety of ways that you can use to name, filter, and categorize your BLE assets.

To view your existing BLE Clients in the Mist dashboard, select a site with BLE clients and then choose the following:

- **Clients > BLE Clients**

Figure 6: BLE Clients

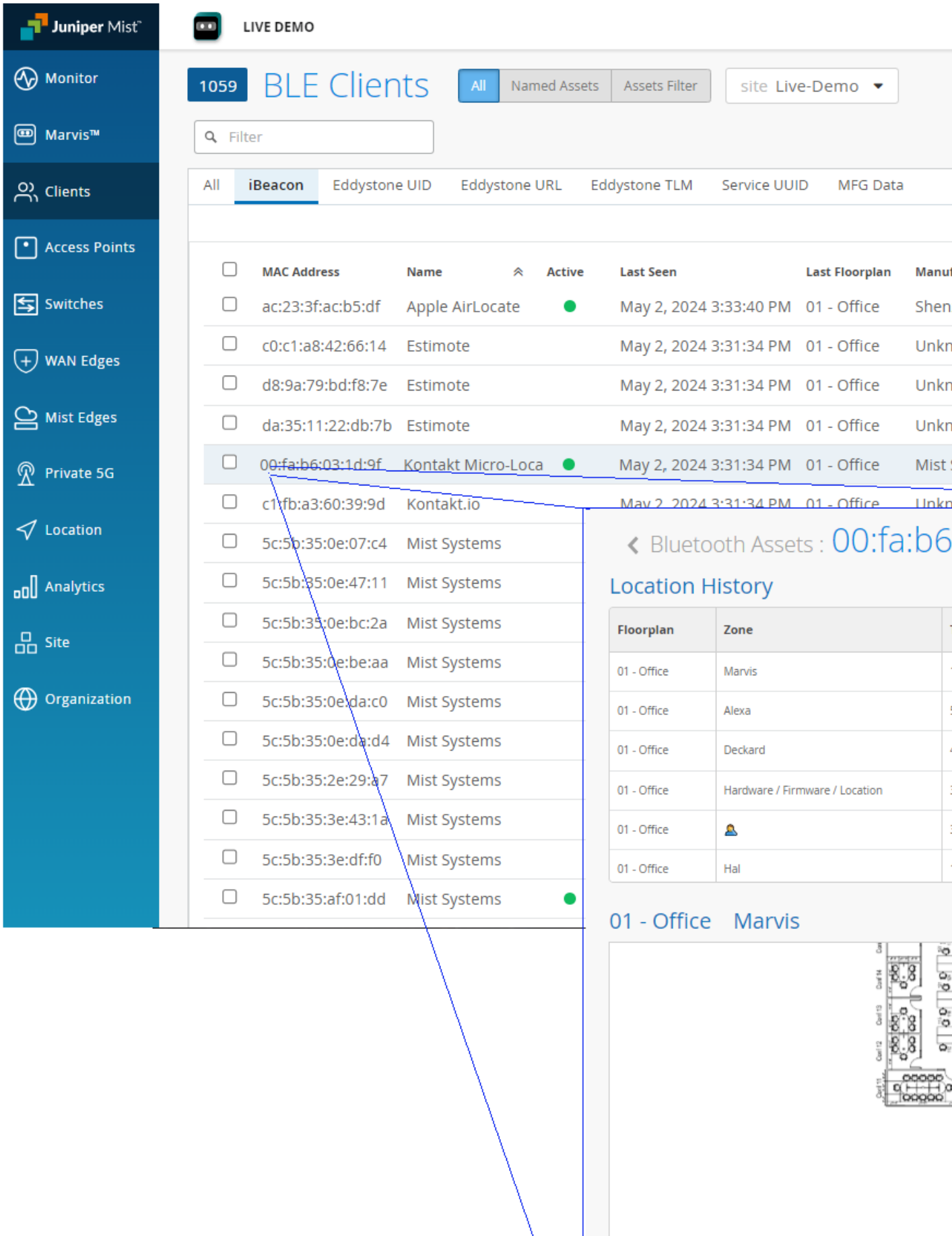


Figure 1 shows a typical list of BLE clients (also called tracked assets, and BLE tags) along with the Live View and location history of one selected BLE client. By default, Juniper Mist Asset tracking supports BLE MAC addresses and RSSI signal strength. The omnidirectional Bluetooth antenna in Juniper Mist APs also works in conjunction with RSSI signal strength identify the quadrant, or relative direction, of the asset to the AP.

From BLE clients page, you can select the site and use the tabs to quickly filter assets that have already been grouped:

- **By Site**—Select a site from the drop down. Note that if the site does not have any BLE clients, that option will not show up in the menu.
- **By Tab**:
  - **All**—Shows all client BLE assets in the site. If a Juniper Mist AP can hear the signal, the asset will be listed, regardless of whether the tag is named or labeled or otherwise.
  - "Create Named Assets" on page 67—Use named assets to find and display assets by their custom Mist asset label and beacon type.
  - "Create Asset Filters" on page 70—The Asset Filters tab shown a list of existing asset filters, if any, that are available in the Mist portal.
    - To add assets to the list, click the **Add Asset** button to create the filters, as explained below.
- **By Attribute**—To filter based on an attribute such as MAC address or manufacturer, start typing in the Filter box. For example, you only need to type **uni** to find assets with "Juniper Networks" in the name. You can also use multiple filters to further narrow the list, as shown here:
  - 

Filter the Data

Use the buttons and the Filter box to narrow or expand the data that is displayed on the BLE Clients page.

- To show only named assets, click the **Named Assets** button near the top of the page.

> **NOTE**: For help naming assets, see "Create Named Assets" on page 67.

- To select a site, use the **Site** drop-down list near the top of the page.

- To filter by BLE advertisement details, click the tabs above the table: **iBeacon**, **Eddystone UID**, **Eddystone URL**, **Eddystone TLM**. For example, if you select iBeacon, the table shows only the clients that are advertising iBeacon UUID/Major/Minor packets.

  See "BLE Beacons" on page 23.

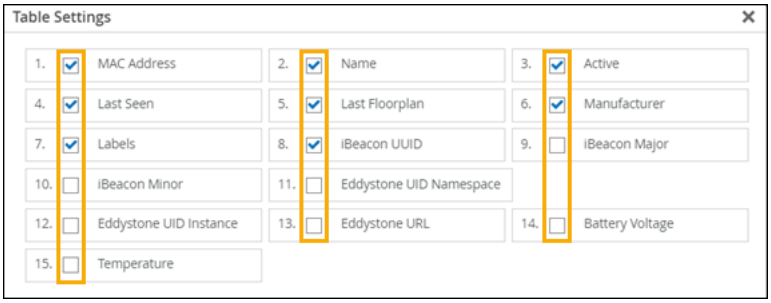
Adjust the Columns

You can add, remove, and sort the columns on the BLE Clients page.

- To sort by a column, click the column heading. To reverse the sort order, click the column heading again.
- To view the column options, click the settings button at the top right corner of the page.

  In the Table Settings window, select the check box for each column to include. Clear the check box for each column to remove. Close the window to apply the changes.



Add, Modify, or Remove Assets

- To add an asset, click **Add Asset**. Then enter the name, select any labels that you want to apply, and enter the MAC address.

  NOTE: You also can import a list of assets. See "Import Assets" on page 74.

- To add or remove labels for assets, select the check boxes for the assets, and then click **Edit Assets**. Then make your changes, and click **OK**.
- To delete assets, select the check boxes for the assets, and then click **Delete Assets**.

Create Named Assets

SUMMARY

For asset visibility use cases, it's helpful to assign names to the assets.

IN THIS SECTION

Naming assets helps you to identify them in Live View and other areas of the Juniper Mist™ portal. Behind the scenes, Juniper Mist prioritizes named assets, compared to the unnamed BLE client devices in your environment. This prioritization results in even better location accuracy for the assets that you want to track.

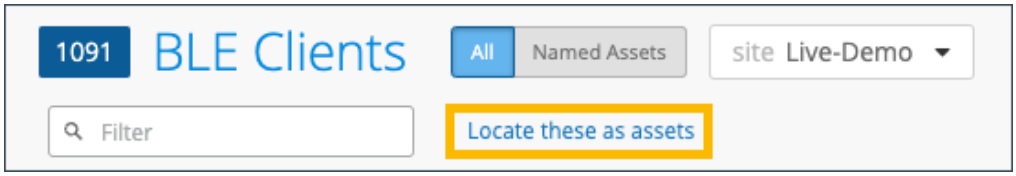
You can use any of these methods to name assets:

- "Select BLE clients to name." on page 67
- "Use a filter to generate a common name for similar assets." on page 69
- "Use a CSV file to assign names to assets." on page 69

Select BLE Clients to Name

You can select any Bluetooth Low Energy (BLE) client and enter a name manually or use variables to generate a name that includes details such as the site name. Or select multiple clients and use a counter to assign similar names, such as Asset 1, Asset 2, and so on.

1. From the left menu of the Juniper Mist portal, select **Clients** > **BLE Clients**.
2. Select the check box for each client that you want to name.
3. At the top of the page, click **Locate this as an asset** (if you selected one client) or click **Locate these as assets** (if you selected multiple clients).



4. In the pop-up window:

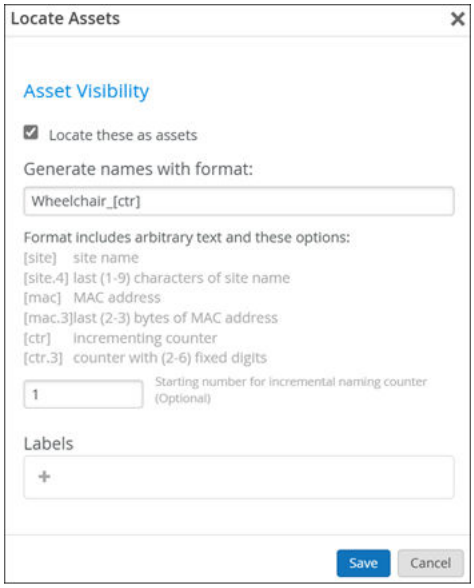
   a. Select the check box.

   b. In the **Generate names with format** box, enter characters, variables, or both.

      The asset name can include characters that you type, plus information that Juniper Mist generates from variables. Read the on-page information to learn more about the variables. To enter a variable, type it as shown, including the square brackets.

      NOTE: If you selected multiple clients, you must use a counter variable, such as [ctr] or [ctr.3], to give each client a unique name.

      Example: Let's say that you've attached BLE beacon tags to three wheelchairs. You want to name them Wheelchair_1, Wheelchair_2, and Wheelchair_3. You'd enter the text, *Wheelchair_*, along with the [ctr] variable.



      TIP: If you have multiple sites, consider including the [site] variable. Then, when viewing the BLE Clients page, you can use the site name as a filter.

5. Click **Save**.

Use a Filter to Generate a Common Name for Similar Assets

You can use a filter to identify and name assets that have a common attribute, such as the manufacturer or the iBeacon UUID. For example, let's say that you attached BLE beacon tags to the inventory carts that your employees use in your retail store. You want to name all of these assets *Inventory Cart* so that you can easily identify them in **Live View**.

1. From the left menu of the Juniper Mist portal, select **Clients** > **BLE Clients**.
2. In the **Filter** box, enter the value that you want to use for this filter.

   For this example, the tags on the inventory carts have a common UUID, so you'd enter the complete UUID in the **Filter** box.
3. Click **Create Label**.

4. In the pop-up window, enter the name that you want to assign to these assets.

   For our example, you'd enter *Inventory Cart* as the name.
5. To confirm that the label was added, you can look for the assets on the BLE Clients page and in the Live View.

   - On the BLE Clients page, enter the name in the **Filter** box, and press Enter. The table is filtered to show the assets with that name.
   - On the Live View page, click the **Assets** tab and then scroll through the list to see the assets with the new name.

Use a CSV File to Assign Names to Assets

With this approach, you enter the names and MAC addresses in a file, and then upload it on the BLE Clients page.

For instructions, see "Import Assets" on page 74.

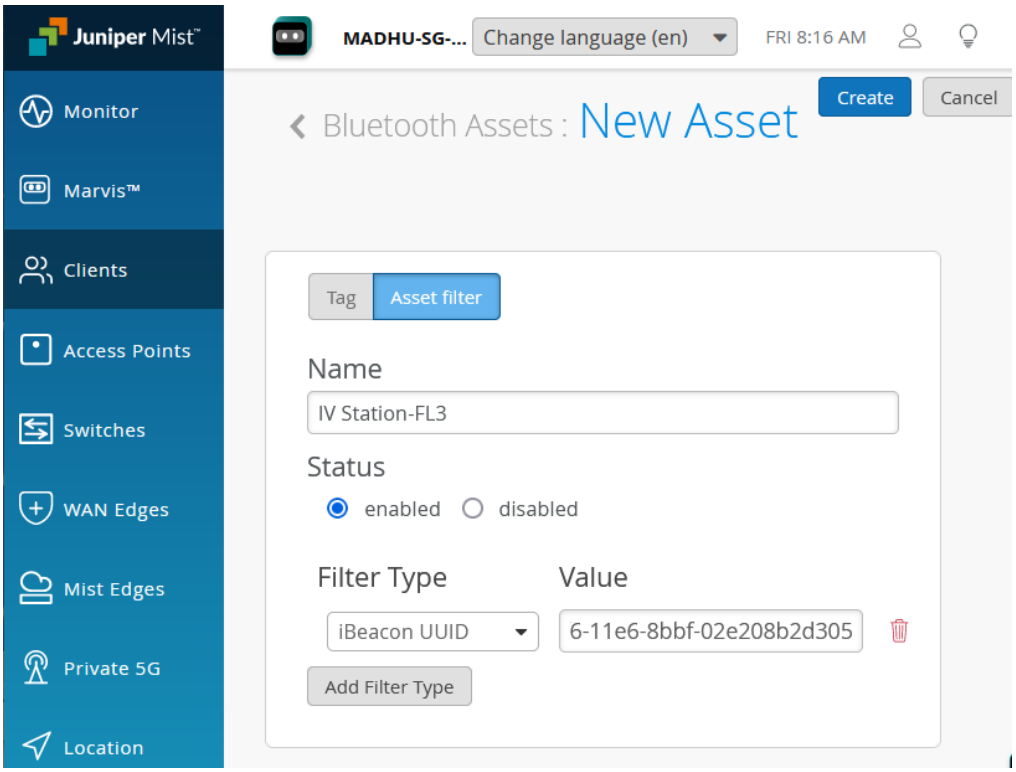
Create Asset Filters

IN THIS SECTION

Juniper Mist provides multiple ways to name, filter, and categorize BLE assets so you can organize and identify them at scale. One of them is asset filters, which is a method for identifying and tracking asset using the asset's existing tags. Many IoT devices and BLE clients come pre-configured with a manufacture's tag, asset name, or other identifier that they broadcast along with the BLE beacon. The device manufacturer may also provide a way for you to create your own custom tag for their assets.

Mist BLE can read these values, which means you just need to create a corresponding filter to automatically select asset groups according to their filter value. Thus in a hospital setting, for example where you may have tens of thousands of tracked assets, asset filters gives you a way to quickly focus on just the asset class or type you want, such as EKG stations, IV tables, or Medicine Carts.

Figure 7: Adding an Asset Filter

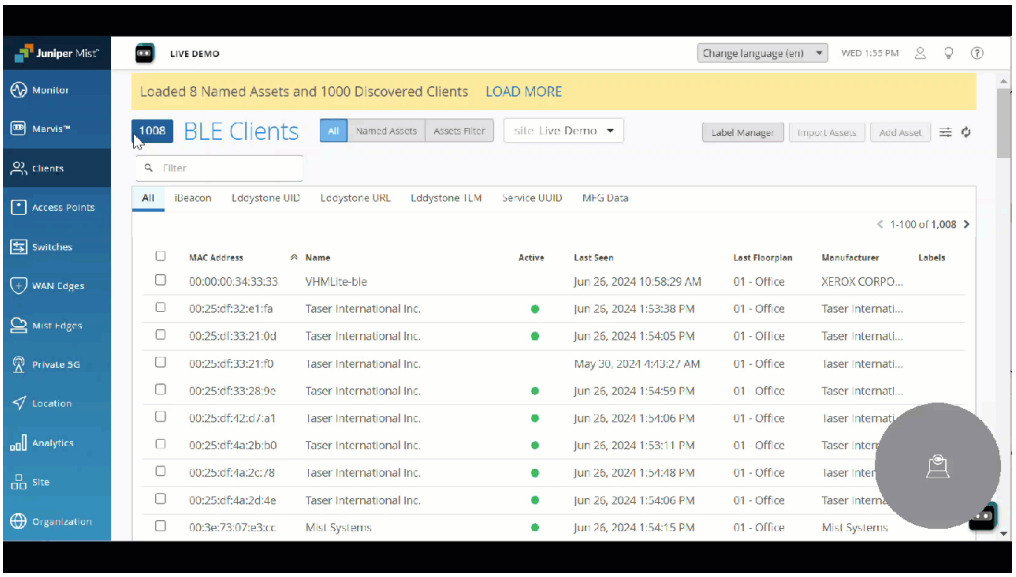


Create an Asset Filter

As explained below, you can use asset filters to find and display assets according to their beacon type and embedded asset value, which can be a very practical way to call-out specific assets from what may otherwise be a very long list.

- In the BLE Clients page, click the **Add Asset** button and select **Asset Filter** to open the asset filter page.
  - For **Filter Type**, specify the beacon used by the assets you want to identify.
  - For **Value**, used the value embedded in the beacon you want to identify and/or track.

Figure 8: Create an Asset Filter



You can combine up to six different filter types (that is, the existing tag data embedded in on the asset) and values per asset filter, although in many cases a single, unique and class-identifying value such as a manufacture's ID is sufficient for the filter to produce the needed specificity.

BLE Beacons for Filtering

BLE provide two types of data exchange modes, connected and advertising. Connected mode transfers data in a one-to-one connection (which means both data transmission and receipt are acknowledged), and advertising mode, which broadcasts data out to anyone who is listening (which means there is no guarantee of receipt).

The two main types of BLE beacons used by BLE assets are iBeacons, created by Apple Computers, and Eddystone, developed by Google. Both these operate in advertising mode and periodically broadcast specially formatted advertising packets, which can include corresponding data fields.

To read the data field correctly and thus perform filtering, Mist needs to know how to interpret the BLE signal (what we call the *asset type* in the GUI) and where to look for the payload (what we call the *value* in the GUI).

- - **iBeacon**—this is an Apple standard that lets mobile devices listen for BLE advertisements "through" the lock screen. iBeacon sub-classifier fields for additional levels of distinction, as described below:
    - **Proximity UUID** (Universally Unique Identifier)—A 128-bit value that uniquely identifies the beacon by type or organization. They look like this: *f7826da6-4fa2-4e98-8024-bc5b71e0893e*

    - **Major** —A 16-bit unsigned integer that can be used to group related beacons that have the same proximity UUID.
    - **Minor**—A 16-bit unsigned integer that differentiates beacons with the same proximity UUID and major value.
- **Eddystone UID**—A 128-bit beacon ID that is comprised of an 80-bit namespace and a 48-bit instance ID. The namespace can be used to group beacons, while the instance ID identifies individual devices in the group.
- **Eddystone URL**—A URL compressed to fit within the limits of the advertisement frame, that, once decoded, the Wi-Fi client can use to access the internet.
- **Eddystone TLM**— This frame broadcasts telemetry such as battery voltage and device temperature. This frame must be paired with an identifying frame of type Eddystone-UID or Eddystone-URL to include an ID.
- **Service UUID**—A 128-bit value that uniquely identifies the beacon. They can look like this: *Service UUID*: *0000f7fd-0000-1000-8000-00805f9b34fb*
- **MFG Data**—When used, displays the name of the device manufacture or other selected data.

Requirement: Asset Visibility

Asset Visibility must be enabled for the AP to receive BLE signals. Go to **Organization | Admin > Site Configuration > *Site Name* > Bluetooth based Location Services**.

On the same page, you can also, optionally, enable vBLE Engagement for wayfinding. On the APs (or via device profile), you may also need to "Enable Bluetooth Based Location Services" on page 22 for the beacon type. These options are explained here:

- Enable **Asset Visibility** to have the APs *listen* for BLE signals from nearby devices and display a Live View of the locations on the floor plan (note that the APs must already be placed on a floor plan).
- Enable **vBLE Engagement** to have the APs *transmit* BLE signals APs for location wayfinding.
- Enable **App Wakeup** to have APs send a "super beacon" that works in conjunction with your customized Mist-SDK implementation and mobile app, for example, to pop-up a notification on customer's mobile phone when the enter a premises.

See also "Activate Subscriptions" on page 8.

Import Assets

You can import assets from a CSV (Comma-Separated Values) file.

1. Create a CSV file that includes the asset names and MAC addresses.

   CSV Example

   Asset Name,MAC Address

   Asset 1,00:00:00:00:00:01

   Asset 2,00:00:00:00:00:02

   NOTE: If you use a spreadsheet application to create the CSV file, enter the data in two columns. The column headings must be *Asset Name* and *MAC Address*.

2. From the left menu of the Juniper Mist™ portal, select **Clients** > **BLE Clients**.
3. Click **Import Assets**.
4. Upload the file, and then click **Import**.
5. Click **OK** to close the pop-up window.
6. To confirm that the assets were added, scroll down the **BLE Clients** page, or use the **Filter** box.

Guidelines for BLE Beacon Tags

When selecting Bluetooth Low Energy (BLE) beacon tags to use with Juniper Mist™ Asset Visibility, consult with the tag vendor to ensure that the tags meet the following requirements:

- 1000 to 100 millisecond (ms) interval rate

  The interval rate is the rate at which the BLE tag broadcasts BLE signals. Any setting from 1 second (1000 ms) to 0.1 seconds (100 ms) is suitable for asset tracking. More frequent transmissions mean that the AP location sensor has more data to use. However, the battery life of the BLE tag will be shorter.

- 0 decibel milliwatt (dBm) for power

  If the power setting is less than 0 dBm, the ceiling-mounted AP will have trouble detecting the BLE signal.

- Static MAC Address

Juniper Mist uses the MAC address to identify the asset and to match it to the named assets that you configure in the portal. If the address is not static, Juniper Mist cannot match it to your named assets.

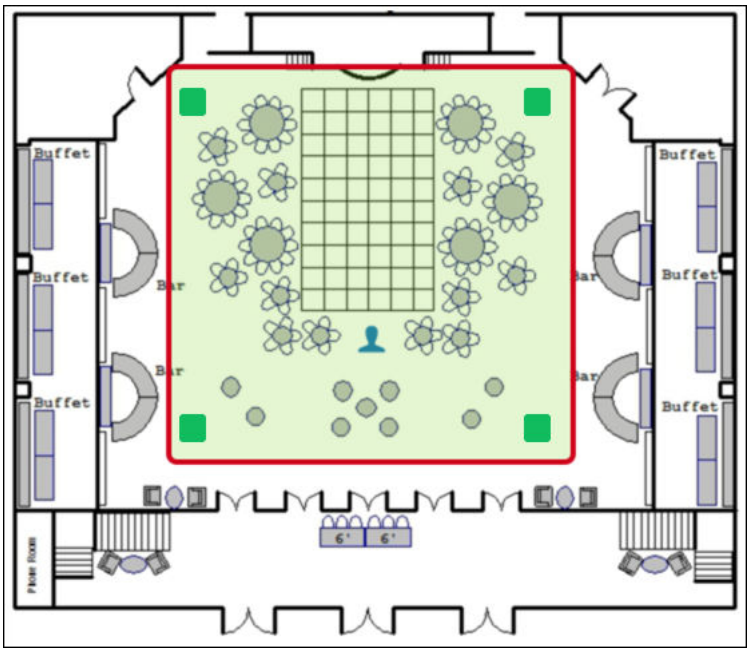
If your BLE tags don't meet these standards, reach out to Juniper Mist Support for assistance. To contact Support, click the question button in the top right corner of the portal, and then click **Support Tickets**.

Rubber Band Model

When placing access points (APs) for asset visibility use cases, apply the "rubber band model" to ensure location accuracy.

NOTE: We recommend the rubber band model for asset visibility only; it is not necessary for other use cases such as wayfinding.

To apply this model, envision a rubber band that encompasses the desired coverage area. Imagine anchoring the rubber band with four APs, one at each corner of the space. Then apply the "AP placement guidelines" on page 8 to distribute additional APs, as needed, within that space.



This approach differs from the way that you'd deploy APs for Wi-Fi coverage. For Wi-Fi, you'd typically work from the center outward.

If you've already deployed APs without this model in mind, consider deploying Juniper BT11 APs to fill in. Place these APs at the outer edges of the space to provide the anchor points for the imaginary rubber band.

Find Equipment Use Case

IN THIS SECTION

Benefits

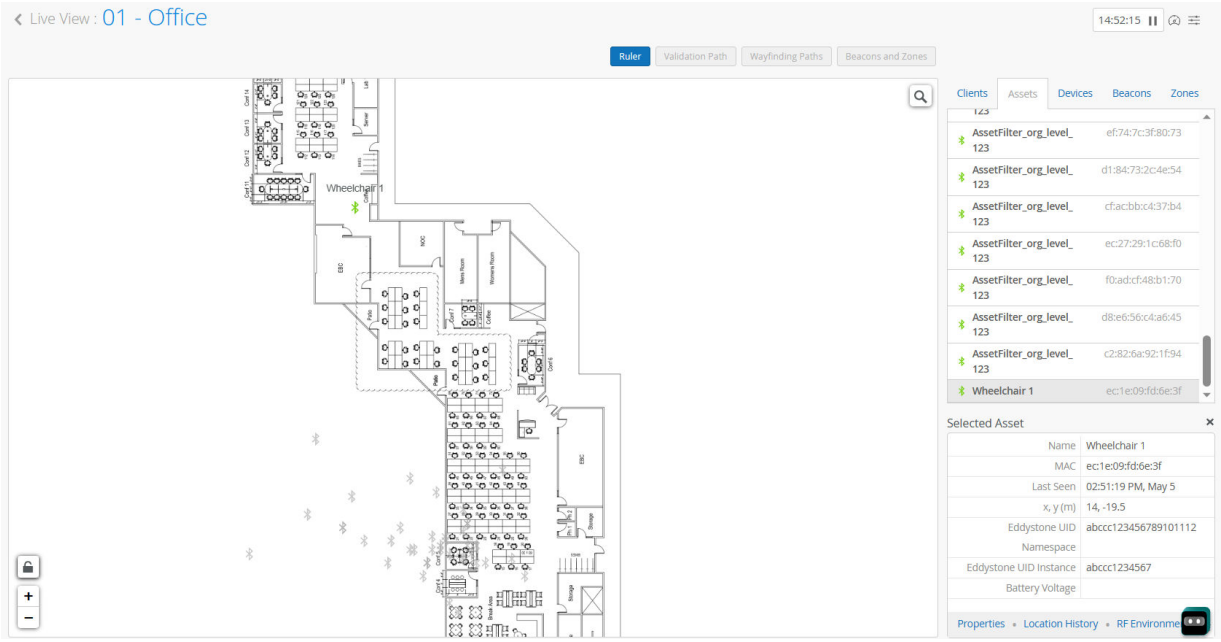
With a Juniper Mist™ Asset Visibility subscription, you can easily find equipment and other assets, with detailed analytics based on their location.

You can use Asset Visibility in many settings and industries (education, energy, government, health care, entertainment, retail, and more).

Video: Introducing Mist Asset Visibility

Scenario

For this scenario, let's consider an example in health care. People often abandon wheelchairs in the lobby or hallways. When a patient needs a wheelchair, you need to find one quickly. As shown below, you can go to the **Live View** floorplan and quickly spot a wheelchair that was left in the lobby.



Components

This scenario relies on these components:

- Bluetooth Low Energy (BLE) Beacon Tags—BLE tags broadcast a BLE signal at a regular interval. You can use any tag that meets our "Guidelines for BLE Beacon Tags" on page 74.
- Access Point (APs)—The AP detects the signals from the BLE tags.
- Juniper Mist Location Engine—The location engine in the Juniper Mist Cloud processes the available information to determine the location of the asset.

  NOTE: With BLE beacon tags, the only available information is the BLE signal itself. With this limited information, Juniper Mist can provide zonal accuracy, identifying the location within 3 to 5 meters.

- Juniper Mist Portal—In the portal, you'll activate your subscription, enter names for your assets, and use **Live View** to track them.

Process Overview for Equipment Finding

To implement the scenario, do these tasks.

Table 8: Setup Process

Step	Action	More Information
1	Purchase a Juniper Mist Asset Visibility subscription, and activate it in the Mist portal.	• Juniper Mist Asset Visibility information • "Activate Subscriptions" on page 8
2	Go to **Organization** > **Site Configuration**, and complete both of these tasks: • Ensure that **Asset Visibility** is enabled. **NOTE**: This feature is enabled by default after you activate your Asset Visibility subscription. • To optimize performance for asset tracking, disable **vBLE Engagement**. When both features are enabled, the AP must transmit and receive. Giving the AP extra tasks means that it has less time to scan for signals from your BLE tags.	
3	Ensure that your APs are placed according to the "rubber band model."	"Rubber Band Model" on page 75
4	Ensure that the floorplan includes accurate position, height, and orientation data for your APs.	"Floorplan Setup" on page 30
5	Obtain compatible BLE beacon tags and attach them to the assets that you want to track.	"Guidelines for BLE Beacon Tags" on page 74
6	Name the assets.	"Create Named Assets" on page 67

Table 8: Setup Process *(Continued)*

Step	Action	More Information
7	Track the assets in **Live View**.	"Find the Current Location of a Named Asset" on page 81

Room Utilization Use Case

IN THIS SECTION

Benefits

With a Juniper Mist Asset Visibility subscription, you can find assets and people, with detailed analytics based on their location. You can use asset tracking in many settings and industries (education, energy, government, health care, entertainment, retail, and more).

Scenario

This scenario takes place in a busy medical clinic. The main goal is to track the doctors' use of various examination rooms. Another goal is to quickly locate a doctor's laptop if the doctor leaves it behind anywhere in the facility. You can use location data from the in-room BT11 access points (APs) and the APs that provide wireless throughout the clinic.

Video: Generic Guest Wi-Fi and In-Room Analytics

Components

This scenario relies on these components:

- Bluetooth Low Energy (BLE) beacon tags—BLE tags that are attached to the doctors' badges and the laptops. You can use any tag that meets Juniper's "Guidelines for BLE Beacon Tags" on page 74.
- APs—The AP detects the signals from the BLE tags. In situations where you want BLE coverage but don't need wireless coverage, you can use BT11 APs. For best results, install the AP on the ceiling at the exact center of the room.
- Juniper Mist location engine—The location engine in the Juniper Mist cloud processes the available information to determine the location of the BLE beacon tag. With BLE beacon tags, Juniper Mist can provide zonal accuracy, identifying the location within 3 to 5 meters.
- Juniper Mist portal—In the portal, you'll activate your subscription, enter names for your assets, and use **Live View** to track the assets.
- Juniper Mist API—You can use the programmable API to collect the data that you need for your business goals.
- (Optional) Third-party software—You can pull the data into your favorite third-party software and then create colorful data visualizations and reports.

Process Overview

Table 9: Asset Tracking Setup Process

Step	Action	More Information
1	Purchase a Juniper Mist Asset Visibility subscription, and activate it in the Mist portal.	• Juniper Mist Asset Visibility information • "Activate Subscriptions" on page 8

Table 9: Asset Tracking Setup Process *(Continued)*

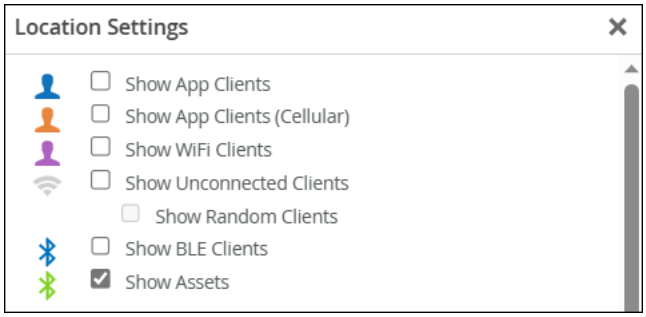
Step	Action	More Information
2	Go to **Organization** > **Site Configuration**, and complete both of these tasks: • Ensure that **Asset Visibility** is enabled. • To optimize performance for asset tracking, disable **vBLE Engagement**. When both features are enabled, the AP must transmit and receive. Giving the AP extra tasks means that it has less time to scan for signals from your BLE tags.	
3	Ensure that your APs are placed according to the "rubber band model."	"Rubber Band Model" on page 75
4	Ensure that the floorplan includes accurate position, height, and orientation data for your APs.	"Floorplan Setup" on page 30
5	Purchase BLE badges and assign them to your employees.	"Guidelines for BLE Beacon Tags" on page 74
6	Name the badges so that you can quickly identify each doctor.	"Create Named Assets" on page 67
7	Use the Juniper Mist API to collect the data that you need.	API documentation is available in the Juniper Mist portal. At the top right corner of the Juniper Mist portal, select the question icon, and then select **API Documentation**.

Find the Current Location of a Named Asset

1. From the left menu of the Juniper Mist portal, select **Location** > **Live View**.
2. (Optional) To simplify the display:

a. Select the **Settings** button (near the top right corner of the page).

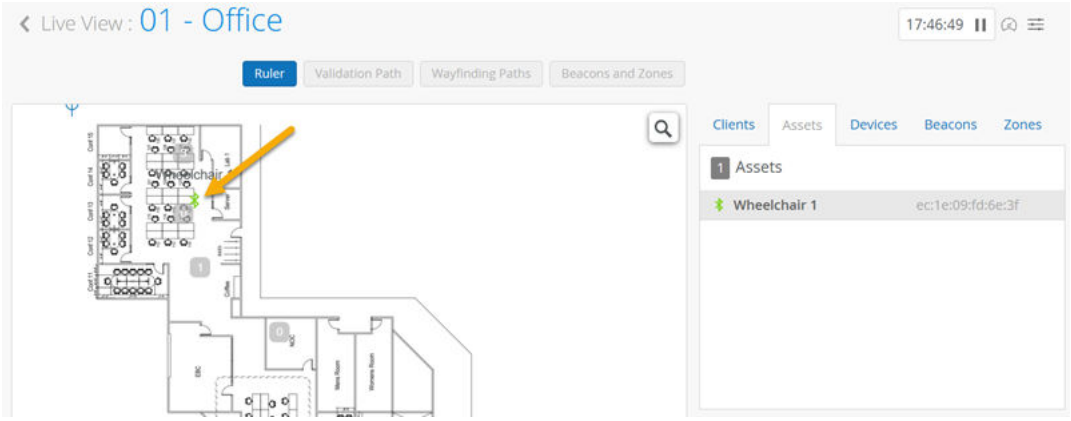
b. Clear all check boxes except **Show Assets**.



c. Close the pop-up window.

3. Select the **Assets** tab (on the right side of the page).
4. Scroll down the list to find the name of the asset.

   For this example, we selected Wheelchair 1. When you click on the asset name, the asset appears with a green icon on the floorplan. All other assets are grayed out to make the selected asset more visible.



NOTE: Juniper Mist provides zonal accuracy, within 3 to 5 meters. Pinpoint accuracy is not possible, due to the limited information from the BLE beacon tags.

5. If you want to see more information about the asset, select **Location History** (in the lower right corner of the page).

   You can select the time frame to see the asset's locations over time and the percentage of time spent in various zones.

6
CHAPTER

Analytics

Analytics Overview

Once you've set up your sites and floorplans for Location Services, you can use the following Analytics Dashboards to gather various types of location services data:

- Engagement Analytics
- Occupancy Analytics
- Premium Analytics

These dashboards provide insights into space occupancy, user visits, user dwell times, location history, proximity zones, and so on.

NOTE: Engagement and Premium Analytics require a subscription. You will need to purchase and activate these subscriptions in order for these dashboards to appear in the Juniper Mist™ portal. See "Activate Subscriptions" on page 8.

MAC Randomization and Location Analytics

IN THIS SECTION

Certain data can be collected passively from Bluetooth devices, without any active engagement with the users. However, passive analytics has limitations. Read further to understand the issues and how active analytics can help.

Available Data from Bluetooth Devices

A Bluetooth device, like any wireless device, announces itself to the world by sending advertisement packets. The most common payloads are:

- Local Name
- Power Level
- Manufacturer-Specific Data (including payloads for iBeacon, AltBeacon, and Eddystone)

However, BLE devices do not advertise constantly. For example, a phone might not advertise when ringing or when receiving a text message.

MAC Randomization

While advertising, the device can also indicate if it is using its physical MAC address or a random MAC address.

Generally, MAC randomization does not occur with BLE beacon tags or accessories such as wireless headsets. However, most mobile devices randomize their MAC address. For example, each time that an iOS or MacOS device wakes up, it uses a new, random MAC address.

Impact of MAC Randomization

MAC randomization benefits users by protecting their privacy and ensuring that the device is not easily trackable. However, if you're relying on passive analytics, MAC randomization poses some challenges.

- Hidden MAC addresses—If you try to search the data by using a device's physical MAC address, you won't find it. Only a random MAC address is advertised, so the physical MAC address is not detectable.
- Multiple MAC addresses—Because certain devices advertise new MAC addresses whenever they wake up, you might see multiple addresses from one device.

Active Analytics

Passive analytics has challenges due to the limited data in the advertisement packets, the fact that devices do not transmit constantly, and MAC randomization.

Active analytics can be a much more valuable approach. By developing Juniper Mist™ SDK-enabled applications, you can drive user engagement and collect more information. For example, you can collect information when users log in, click buttons, and follow links. Because the users identify themselves when they log in, the data that you collect is de-anonymized. You're counting and tracking the actual users of your application, without the issues that can result from MAC randomization.

CHAPTER 7

Location-Based Applicaton Development

Juniper Mist SDK

IN THIS SECTION

The Juniper Mist SDK (Software Development Kit) provides the tools you need to build customer-facing applications that deliver indoor location services.

How to Get the Juniper Mist SDK

The Juniper Mist SDK is an advanced topic for indoor location services. For installation and integration steps, see the Juniper Mist SDK Manual on github for Android Devices and iOS Devices.

For Android devices, you can add the dependency with the latest version of the Juniper Mist SDK in the build.gradle file or manually download the .aar files from github. See the Juniper Mist Location SDK Android latest version.

For iOS, you can use CocoaPods to include SDK in code, or download a framework file from github. See the Juniper Mist Location SDK iOS latest version.

NOTE: In the legacy version of the Juniper Mist SDK, the MSTCentralManager class was used when integrating the SDK. Now, with the latest release of the Juniper Mist SDK, the IndoorLocationManager class is used. For integration steps, please see:

- Android SDK Integration Steps
- iOS SDK Integration Steps

Webhooks for Location Services

IN THIS SECTION

When you configure webhooks, Juniper Mist™ automatically pushes data to a provided URL. You'll get real-time notifications in the Juniper Mist portal as events happen across your organization or within a particular site. You can use this data in your Juniper Mist SDK-enabled applications or analyze the data with third-party software.

Location-Based Webhooks

Location-based webhooks include:

- **Location coordinates**—Updated at regular intervals of less than 1 second.
- **Zone entry and exit events**—Updated when a client device enters or exits a location zone.
- **Virtual beacon entry and exit events**—Updated when a client device enters or exits the coverage area of a virtual beacon.

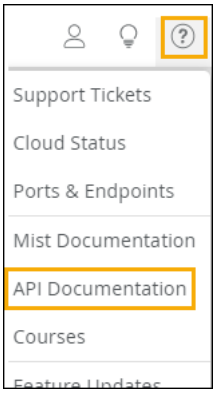
Requirements for Using Webhooks

- Correctly scale the floorplan.
- Place the access points (APs) on the floorplan. Ensure that the orientation and the position on the floorplan match the physical orientation and location of the AP at the site.
- For zone entry and exit events, add zones to the floorplan.
- For virtual beacon entry and exit events, add virtual beacons to the floorplan.

Learn More

For more information about webhooks:

- In the Juniper Mist portal, click the question mark icon, and then click **API Documentation**. See the Webhooks section of that site.



- In the Juniper Technical Library, see the Webhooks chapter of the Juniper Mist Automation and Integration Guide .

CHAPTER 8

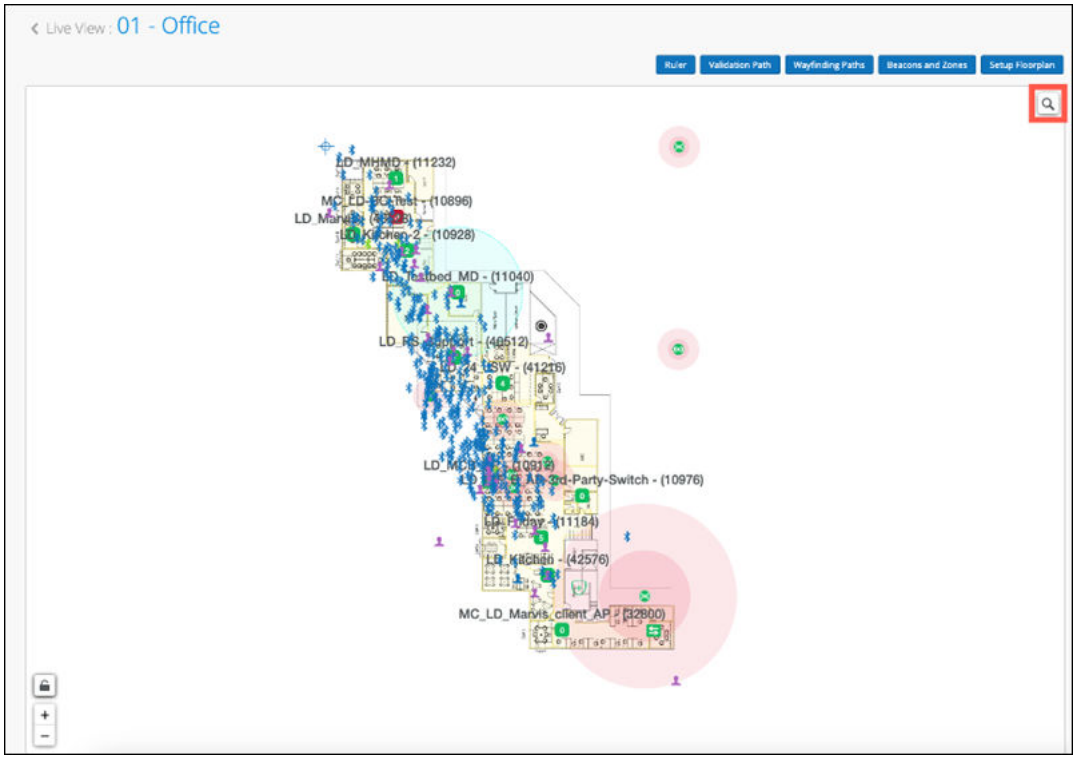
Troubleshoot Location Services

Search in Live View

Use the search button on the Live View page to help you find items on a floorplan quickly. You can search for clients, access points (APs), assets, beacons, zones, and so on, by name.

To search in Live View:

1. From the left menu of the Juniper Mist™ portal, select **Location** > **Live View**.
2. Select the site and the floorplan.
3. Click the search button at the top right corner of the floorplan.



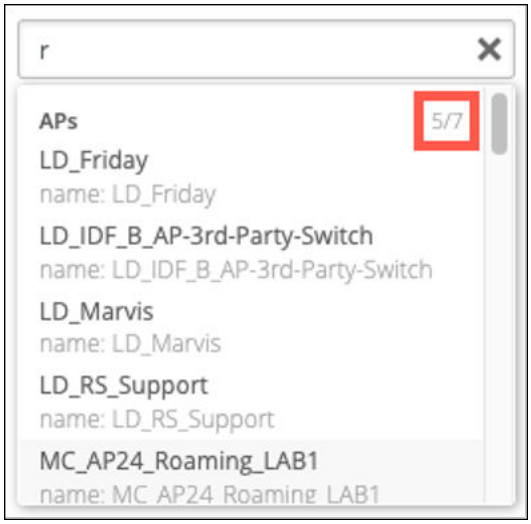
4. Start typing the name of the item that you're looking for.

   You can search the following items:

   - AP name
   - AP MAC address
   - WiFi client name
   - WiFi client MAC address
   - SDK client name
   - SDK client UUID

- BLE client name
- BLE client MAC
- Asset name
- Asset MAC address
- vBeacon name
- vBeacon UUID
- Third-party beacon name
- Third-party beacon UUID
- Zone name

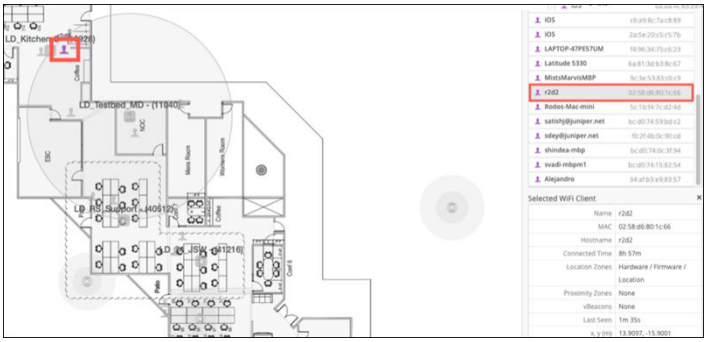
As you start typing, the matching items appear in the drop-down list.



NOTE: The list displays only five elements for each category. A fraction in the top right corner of the list indicates the total number of possible matches. For example, *5/7* indicates that the list displays 5 out of 7 items.

5. From the drop-down list, click the item that you want to see on the floorplan.

The item is now highlighted on the floorplan and is also selected in the list on right side of the page.



Troubleshoot Location Services Using the RF Environment

In your Juniper Mist network, you can use the RF Environment (also known as RF Glasses) for troubleshooting location accuracy issues. This tool helps you gain insight into what is going on with Mist SDK-enabled clients and named assets.

Video Demo

Video: Modern RF Glasses

Steps

1. From the left menu of the Juniper Mist portal, select **Location** > **Live View**.
2. Click the site and the floorplan that you want to troubleshoot.
3. Adjust the page settings to show the app clients:
   a. Click the **Settings** button (near the top right corner of the page).

   b. In the Location Settings window, select the **Show App Clients** and **Show App Clients (Cellular)** check boxes.

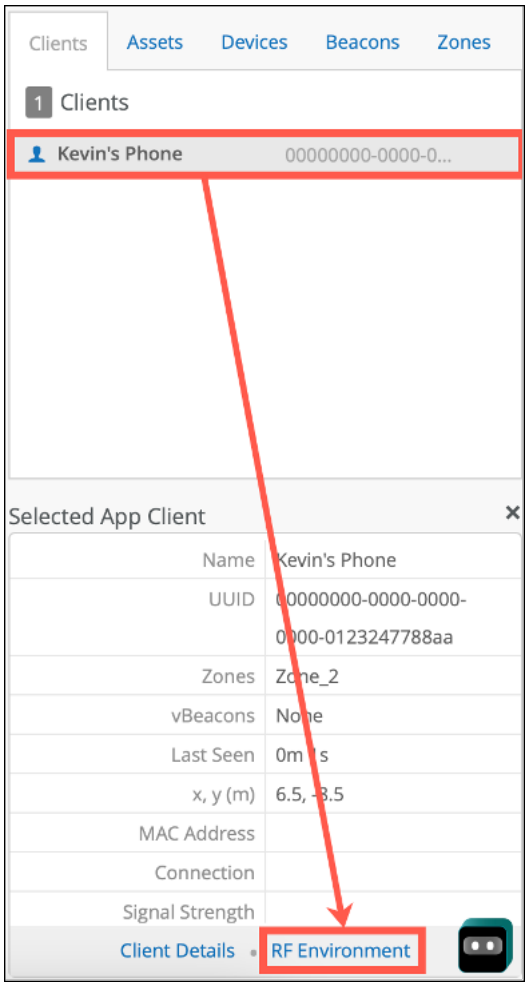
   c. Click **X** to close the Location Settings window.

The floorplan displays any clients that are running the Juniper Mist SDK.

4. Select a client and record the RF environment:

   a. Select the **Clients** tab on the right side of the page, and then select the client that you want to troubleshoot.

   b. Click **RF Environment** (near the bottom right corner of the page).



> **NOTE**: The **RF Environment** link is available only for SDK clients, named assets, and connected wireless clients.

   c. Click **Record Session** (near the top right corner of the page).

   - Your session begins recording. A progress bar appears at the top of the screen.
   - In the **Rename Session** window, you can rename the session recording or close the window to keep the current date and time as the session name.
   - When finished, click **Stop Recording**.

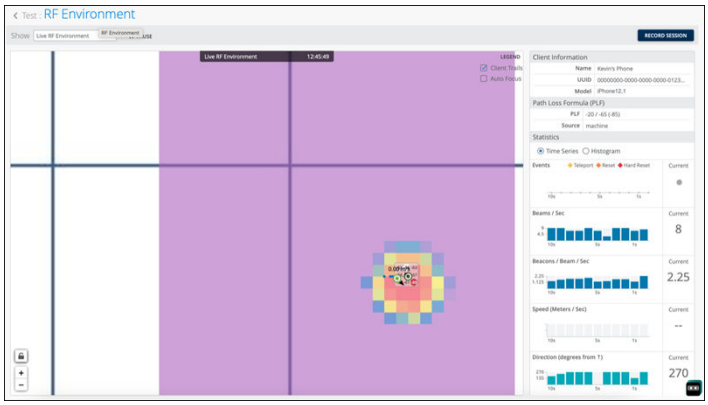
> **NOTE**: If you do not stop the recording manually by clicking the button, the recording stops automatically after three minutes.

5. Replay the recording:

   a. From the left menu, select **Location** > **RF Environment Replay**.

   b. From the **Recorded Sessions** list, click the session you just recorded.

You will see your recording. You can use it to gain an understanding of the current issues, troubleshoot, or send to customer support for review.



Troubleshooting Tips

When troubleshooting in the RF Environment, pay attention to these elements:

- **Smoothed Location Estimate**

  The lime green colored dot represents the smoothed location estimate. (See the Legend in the top right corner of the page.) This estimate takes the received signal strength indicator (RSSI) data and smooths it out for accuracy and user readability.

- **Beams and Beacons**

  On the right side of the page, see how many access points (APs) the client detects. Look at:

  - Beams per second
  - Beacons per beam per second

  These RSSI values come from the AP from the client's perspective. They indicate how many APs the client detects and the number of beams the client detects from the AP.

- **Speed and Direction**

  On the right side of the page, **Speed** and **Direction** are updated as the client moves within the site.

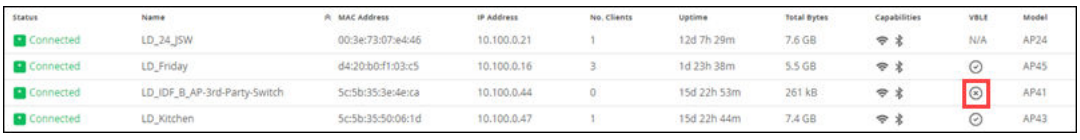
  - When the client is in motion, the probability surface spreads out.
  - As the client slows down or becomes still, the probability surface shrinks.
  - The red area depicts the peak of the surface and the highest probability of the client's location.
  - The blue area depicts the lowest area of the surface and the least probability of the client's location.

Keep in mind:

- With a lower-than-average number of beams per second or beacons per beam per second, location accuracy might deteriorate.
- If the RSSI values are not updated for SDK clients, the client is offline.
- If the RSSI values are not updated for assets, data from the tag is not detected.
- If the RSSI values are missing, the environment has less data to work with. Less data means that location accuracy might deteriorate. If you notice missing RSSI values:
  - Check the organization settings to ensure that vBLE Engagement is enabled. See "Enable Bluetooth Based Location Services" on page 22.
  - Check the Access Points page to ensure that the vBLE array is turned on for all APs. See "Enable the vBLE Array on an Access Point" on page 97.
  - Ensure that the AP has been added to the floorplan. See "Floorplan Setup Overview" on page 30.

Enable the vBLE Array on an Access Point

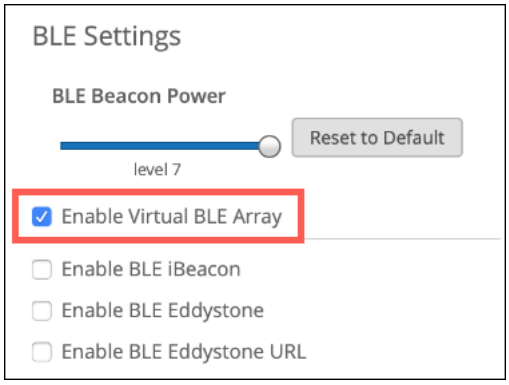
When troubleshooting location issues in your Juniper Mist™ network, check the Access Points page to see if virtual Bluetooth Low Energy (vBLE) is enabled for all access points (APs). If you see an X in the vBLE column, the vBLE array has been turned off.



Status	Name	MAC Address	IP Address	No. Clients	Uptime	Total Bytes	Capabilities	VBLE	Model
Connected	LD_24_JSW	00:3e:73:07:e4:46	10.100.0.21	1	12d 7h 29m	7.6 GB		N/A	AP24
Connected	LD_Friday	d4:20:b0:f1:03:c5	10.100.0.16	3	1d 23h 38m	5.5 GB			AP45
Connected	LD_IDF_B_AP-3rd-Party-Switch	5c:5b:35:3e:4e:ca	10.100.0.44	0	15d 22h 53m	261 kB			AP41
Connected	LD_Kitchen	5c:5b:35:50:06:1d	10.100.0.47	1	15d 22h 44m	7.4 GB			AP43

To enable the vBLE array on an access point:

1. From the left menu of the Juniper Mist portal, select **Access Points**.
2. Check the vBLE column to see if any APs need to have vBLE enabled.
3. To enable vBLE for an AP:
   a. Click the AP.
   b. Under **BLE Settings**, select the **Enable Virtual BLE Array** check box.



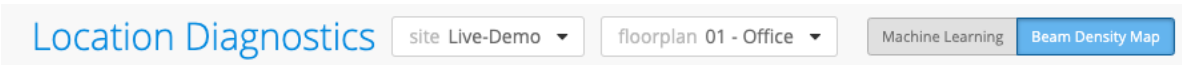
   c. Click **Save**.

View the Beam Density Coverage Map

On the Location Diagnostics page of the Juniper Mist portal, you have the option to view “coverage” on the Beam Density Map. This map displays color coding to indicate how much coverage a Mist Access Point (AP) is providing a device based on the device's proximity to the AP. This color coding is based on the Received Signal Strength Indicator (RSSI) that the device sends to the AP. The RSSI values are based on the device’s coordinate (X,Y) location estimate.

To view the Beam Density Coverage Map:

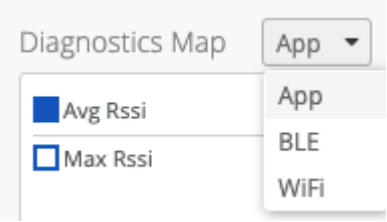
1. From the left menu of the Juniper Mist portal, select **Location** > **Location Diagnostics**.
2. Click **Beam Density Map** (near the top center of the page).
3. Ensure that you have the appropriate site and floorplan selected:



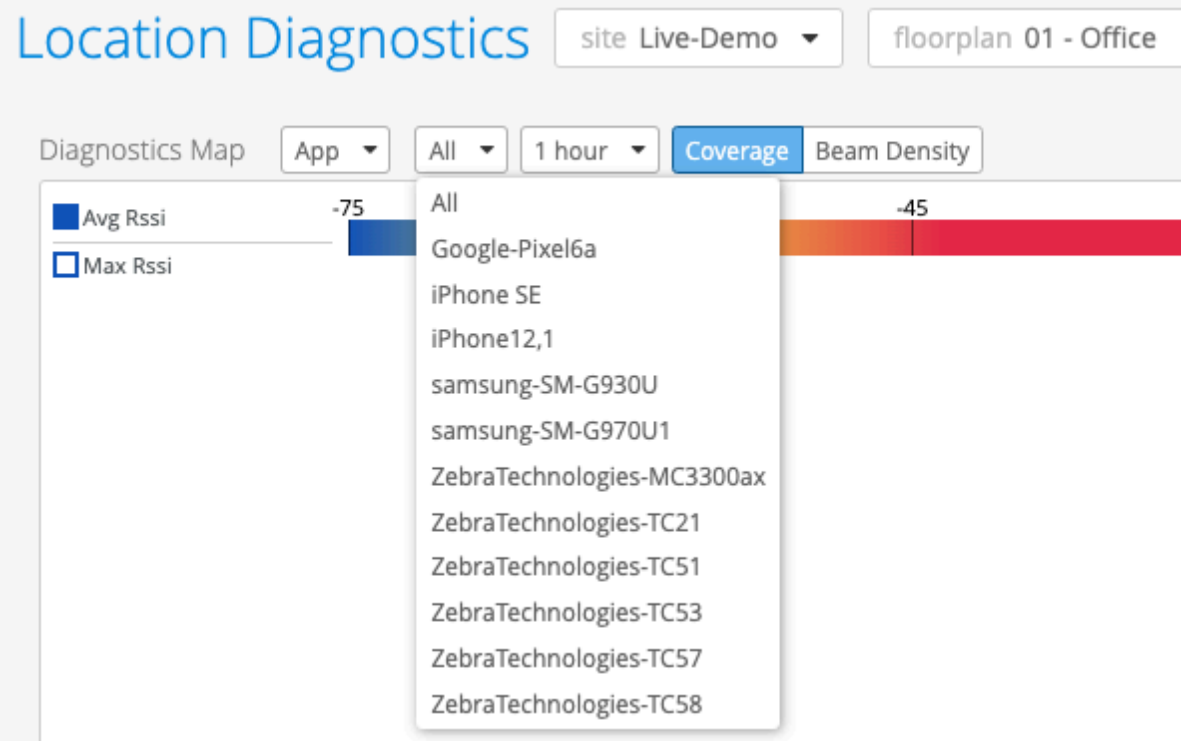
4. Click **Coverage**.

On the map, you have the option to view coverage for App (Mist SDK Mobile App clients), BLE (named assets), and WiFi (unconnected and connected WiFi clients). Select the device type from the

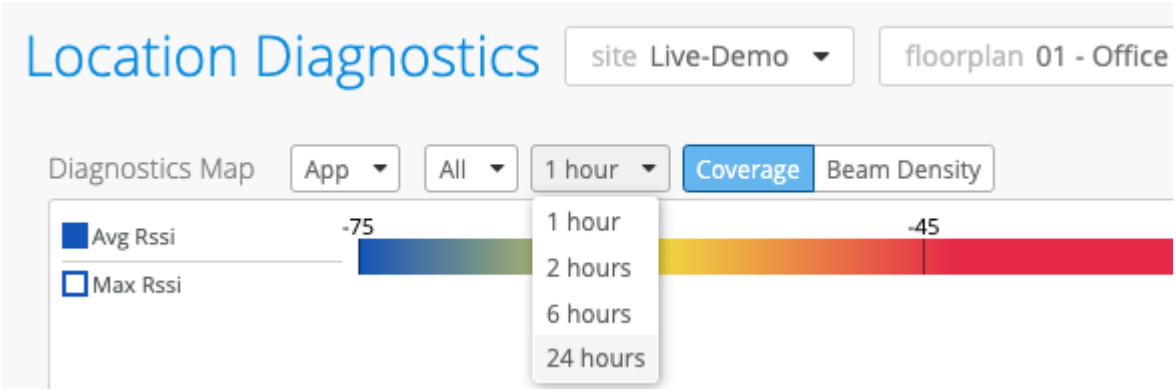
drop-down list to view the coverage for that device type on the map. The App device type is the only device type that has the Beam Density option available in addition to Coverage.



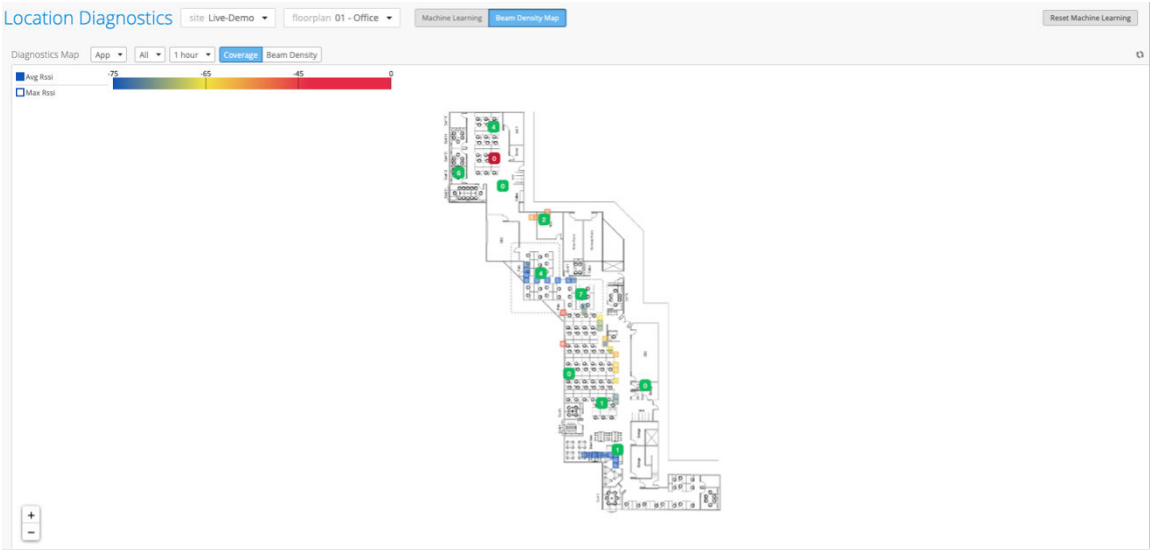
You can choose to view All clients (selected by default), or you can select a specific client from the drop-down list (the options that appear depend on the device type that you select).



You can also select a time range for which to view coverage. For example, if you would like to see coverage from the past hour, you can select “1 hour”.



5. Notice the RSSI color scale in the top left corner of the page. Use this as your reference as you look at the coverage on the map. RSSI values closer to zero indicate that the device is in closer proximity to the APs.



6. Hover your mouse over a device on the map to see the average and maximum RSSI values.

   The values appear to the left of the color scale.

Troubleshoot the Juniper Mist SDK

This topic provides information about how to troubleshoot common issues when you develop and test your Juniper Mist™ Software Development Kit (SDK).

NOTE: If you need general information about the SDK, see "Juniper Mist SDK" on page 88.

To build a customer-facing application using the Juniper Mist SDK, your system must meet the following requirements:

- iOS System Requirements
- Android System Requirements

Prior to troubleshooting, ensure that you are using the correct API callbacks:

- iOS: didUpdateRelativeLocation
- Android: onRelativeLocationUpdated

To troubleshoot the SDK, identify the potential issue and then apply the recommended remedy:

Table 11: SDK Issues and Remedies

Potential Issue	Remedy
For iOS devices only: You receive SDK errors, or you cannot develop and test the project on the simulator. (Testing requires a Juniper Mist SDK-enabled device on which to run the SDK.) **NOTE**: This issue applies only to iOS devices.	Use the following sample app and sample code to run the project on the simulator: Sample App (iOS only) Sample Code (iOS only)
The floorplan doesn't load, the blue dot is inaccurate, or the app doesn't work when you run it on a simulator.	1. Confirm that the X,Y placement of the access points (APs) on the floorplan matches the physical placement of the APs in your deployment. See *Manually Place an Access Point on a Floorplan*. 2. Scale the floorplan accurately. See *Scale a Floorplan*. 3. Ensure that you are running the SDK on a device. 4. Ensure that you enabled Bluetooth permission on the device. 5. Ensure that the Mobile SDK secret is correct.

Table 11: SDK Issues and Remedies *(Continued)*

Potential Issue	Remedy
The blue dot is not accurate.	1. Confirm that you are using the latest version of the SDK. To get the latest version, click the relevant link: • Juniper Mist Location SDK Android latest version • Juniper Mist Location SDK iOS latest version 2. Ensure that you placed your APs according to the deployment guidelines. See "Access Point Placement for Location Services" on page 8. 3. Collect RF Environment recordings—specifically, the Received Signal Strength Indicator (RSSI) values—to see if the SDK receives a strong enough signal. See "Troubleshoot Location Services Using the RF Environment " on page 94.
Juniper Mist cannot receive virtual beacon notifications.	1. Confirm that you placed the virtual beacons on the floorplan accurately. 2. Ensure that the **Name**, **Message**, and **Url** fields are complete.
Juniper Mist cannot receive zone notifications.	1. Confirm that you placed the zones on the floorplan accurately. 2. Ensure that the zone has a name. See these topics: • "Add Location Zones to a Floorplan" on page 40 • "Add Proximity Zones to a Floorplan" on page 42
The SDK returns invalid latitude and longitude values.	To resolve this issue, follow the steps in "Troubleshoot Incorrect Latitude and Longitude (SDK)" on page 102.

Troubleshoot Incorrect Latitude and Longitude (SDK)

Go through these steps if the SDK returns invalid latitude and longitude values.

Prior to troubleshooting, ensure that you are using the correct API Callbacks:

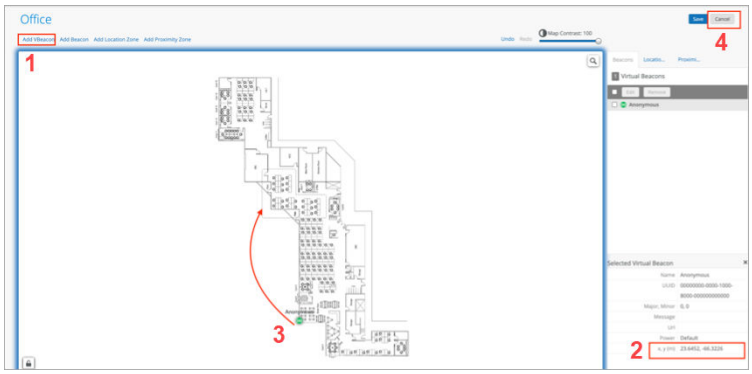
- iOS: didUpdateRelativeLocation
- Android: onRelativeLocationUpdated

To troubleshoot incorrect latitude and longitude:

1. In the Juniper Mist™ portal, open the floorplan, click **Add VBeacon**, and then drag the virtual beacon (vBeacon) to any point on the floorplan.

   Select a position that you can easily identify later when looking at your site on Google Maps or Apple Maps. For example, drag the vBeacon to a corner of the building.

   > **NOTE**: If you need general information about adding vBeacons, see "Add Virtual Beacons to a Floorplan" on page 44.

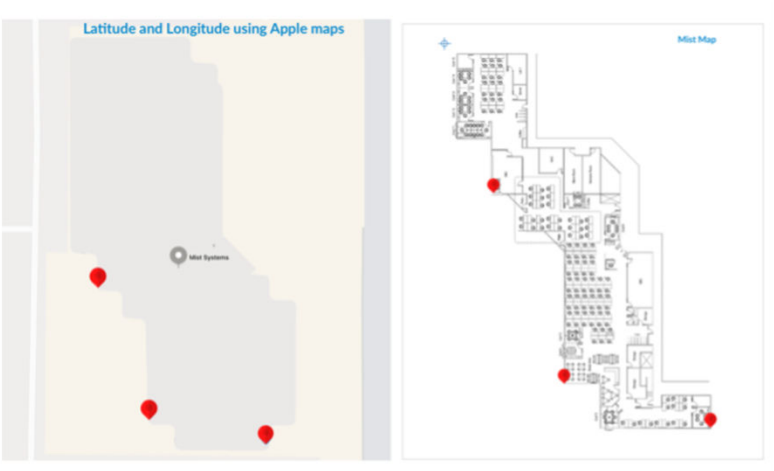
   

2. Copy and save the X and Y values, which appear near the lower-right corner of the page. Both the values should be positive. In case of negative values, remove the negative signs from them.
3. Drag the vBeacon to a new, identifiable position and save the X and Y values. Then, repeat this step for one more point on the floorplan.
   You should now have the X and Y values for three identifiable points on the floorplan.
4. Click **Cancel** so that you *do not* save the vBeacon.
5. Close the floorplan.
6. In Google Maps or Apple Maps, complete these steps to get the latitude and longitude values for the points that you selected on the floorplan:

   a. Go to the map location for your site, and zoom in.

   b. For each point that you selected on your floorplan, click the corresponding point on the Google Map or Apple Map, and save the latitude and longitude values.

      As shown in the following illustration, the points on the map need to correspond to the points that you select on your floorplan:



For more information, go to the support site for Google Maps or Apple Maps.

Suggested topics:

- Google Support topic (See the information about about getting the coordinates of a place.)
- Apple Toolbox topic (See the instructions about dropping a pin and getting the information.)

> **NOTE**: The links are suggestions only. For up-to-date information, search the Google or Apple support site.

After completing the preceding steps, you should have the latitude and longitude values for the same three points that you identified on your floorplan.

7. Go to the GeoRefParamv2 payload, add the latitude and longitude values that you just obtained, and check the sample payload. See the following sample payload.

   The following values match the coordinates shown:

   - lat_lon X value—This is the latitude coordinate.
   - lat_lon Y value—This is the longitude coordinate.

```
"GeoRefParamsv2": {
     "active": true,
     "p1": {
       "mist_xy": {
         "x": 13.4194,
         "y": 39.2581
       },
       "lat_lon": {
         "x": 37.29546,
```

```
          "y": -122.03323
        }
      },
      "p2": {
        "mist_xy": {
          "x": 23.3224,
          "y": 67.2408
        },
        "lat_lon": {
          "x": 37.29512,
          "y": -122.03306
        }
      },
      "p3": {
        "mist_xy": {
          "x": 52.3277,
          "y": 75.7614
        },
        "lat_lon": {
          "x": 37.29506,
          "y": -122.03269
        }
      }
    }
```

8. Add the PUT request for the GeoRefParamv2 payload into the maps API. `/api/v1/sites/:siteID/maps/:mapID`

   By default, the SDK returns invalid latitude and longitude values if the GeoRefParams is not configured in the maps API.

Additional Troubleshooting

If the SDK encounters an error, it calls the didErrorOccur method, as follows:

```
didErrorOccur(_ withError:,withErrorMessage).
```

The SDK displays details of the errors in the following two values:

- errorMessage of type NSString
- errorType of type ErrorType Enum

For help, see the Integration Steps section of the Github Wiki.

iOS SDK Github Wiki

Android SDK Github Wiki

Other Troubleshooting Tips for Location Services

Use this information to troubleshoot common location accuracy issues in your Juniper Mist™ network. You'll learn what to check to determine the cause of the issues. The majority of location accuracy issues come from an incorrect access point (AP) setup. **Ensure that the AP information on the floorplan of the Juniper Mist portal matches the APs in the physical deployment.**

After reviewing the issues and remedies below, we highly recommend that you refer to "Troubleshoot Location Services Using the RF Environment " on page 94.

Table 12: Other SDK Issues and Remedies

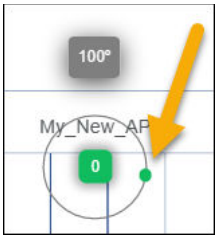
Potential Issue	Remedy
Significantly small or large movements occur on a floorplan.	***Scale.*** Scale the floorplan accurately. See *Scale a Floorplan*. **TIP**: If you don't know the actual dimensions, look for a standard door on the floorplan and scale that door to 0.91 meters (3 feet). This will get you close to the actual scale.
An unexpected jump to another area of the floorplan (also known as "teleporting").	***Placement.*** Confirm that the X,Y placement of the APs on the floorplan matches the physical placement of the APs in your deployment. See *Manually Place an Access Point on a Floorplan*.
An inaccuracy with the client's or asset's location; for example, the client's or asset's location appears on the opposite side of the AP (also known as the location being "flipped").	***Rotation.*** Confirm that the AP's LED is facing the same direction in which the green dot is facing on the floorplan.  See *Manually Place an Access Point on a Floorplan*.

Table 12: Other SDK Issues and Remedies *(Continued)*

Potential Issue	Remedy
Other unspecified issues	***Height.*** Ceiling height of APs can also play a part in location-accuracy issues. For any issues you may be experiencing, refer to "Access Point Placement for Location Services" on page 8 to ensure that you have proper coverage. If your deployment calls for installing APs outside of these guidelines, contact **support@mist.com** to consult with a sales engineer.