IMPLEMENTING BRANCH NETWORKS FOR AI-DRIVEN ENTERPRISE CUSTOMERS

Using Mist AI to Create, Deploy and Manage a Full Network Stack

**Introduction**

This solution guide provides unique insight into Juniper’s AI-driven Enterprise (AIDE) via the implementation of wireless, wired and wide area solutions in a branch office. Juniper Mist Cloud is used to operate Session Smart Routers (SSR), EX switches, and Mist access points.

By illustrating a walkthrough of deploying a branch for your customer, this guide highlights the key components of how a full stack AIDE (router, switch, and access point) is built, and showcases the unique advantages of using the AIDE to build an experience-first, client-to-cloud network for a distributed enterprise.

The process of planning, deploying and managing the AIDE has become easier than ever before, and this guide provides the highlights, along with public resource links such as documentation and videos for more information. As a Managed Service Provider (MSP), you can use the Juniper MSP Dashboard to manage your entire customer estate.

Furthermore, you can see firsthand how to perform the tasks in this document by setting up an account at manage.mist.com. There are tutorials available and your account representative can help you get started.

Please contact your Juniper representative to set up a guided demonstration of all the features covered in this document. To learn more about how to become a provider in Juniper’s Managed Services program, consult the Juniper Unified Managed Services page.

**The Branch Network in the Distributed Enterprise**

In the example shown here (Figure 1), there will be three network entities created: a router, a switch, and an access point:

- The router is an SSR120 Session Smart Router (SSR) (interchangeable with all SSR devices)
- The switch is an EX 2300 (interchangeable with a 3400, 4100, or 4300 series)
- The access point is an AP41 (interchangeable with all APs)

Deploying a full stack branch—including the router, switch and access point—with Mist AI is very straightforward and intuitive.
Implementing Branch Networks for AI-driven Enterprise Customers

Figure 1 shows a topology diagram of the full stack deployment. In this example, there will be two WAN links connected to the datacenter and one for Internet Breakout, which will consume cloud services. The data center is already configured, and only the branch is being deployed. The Mist access points, EX switches, and SSRs are all managed by Mist AI.

There is full documentation for the tasks discussed in this guide:

- For the SSR, see Guided Setup for Juniper Mist WAN Assurance
- For the EX and Mist AP, see Configure and Manage the EX Switch and Mist AP in the Juniper Mist Cloud

These will all be managed by Mist AI, which allows you to deploy, operate and maintain all customers from a single console.

Within this console, Wi-Fi Assurance, Wired Assurance and WAN Assurance simplify every part of administration and deployment as well as with root cause isolation and correction, anomaly detection, insights from client to cloud, and AI integration for the help desk.

This discussion is illustrated in deployment stages (Figure 2).

Industry-wide, the stages are defined as follows:

- Day 0: Planning and Design
- Day 1: Zero Touch Deployment
- Day 2: AI-driven Operation and Benefits
- Day 2+: Ongoing Maximization of the User Experience

Note: See the Resources section below for other helpful documentation and content assets.

Figure 2: Deployment Stages
Day 0: Planning and Design
When you log into manage.mist.com, you will be presented (assuming you have been granted access) with the Managed Service Provider (MSP) Dashboard and the organizations within your estate. The process of setting up organizations, applications and networks begins by defining the sites within the organization.

Setting Up Organizations, Applications and Networks
To start, click the "Create Organization" button in the upper right. Once initialized, the new organization will appear in the list below. Click into the organization to continue with configuration.

In the menu, under Organizations, you can set up your administrators, and invite new ones if need be. You can give the administrators different roles, up to super user authority.

Site Configuration
To create a site under Organization, select Site Configuration. After giving the site a name, you select a location for the site (Figure 3).

Using Site Variables
For automation and scaling purposes, you can assign variables for a variety of items. These variables can be called when claiming devices later in the process.

For instance, in Figure 4, you can see this site variable being entered in a site definition. Thus, you can configure many sites with only a few templates.

For more detail on how the use of site variables facilitates site creation under Mist, see the Guided Setup for Mist WAN Assurance.

Setting Up Networks and Applications
In configuring the SSR, you determine the network layout. This includes specifying access groups—the users and devices that will access the network and will be made reachable. Access groups define the entities that will access certain resources (applications or services).
This is achieved with a zero-trust security model: none of the entities (devices or users) in the access group can access any applications by default. There is no access unless it is explicitly granted.

Networks
You thus set up Networks (Figure 5), which in SSR terminology specifies the tenants (who) that access services (what).

This is where operators can divide the branch LAN into multiple VLANs, each with its own access group. For example, a drug store chain might have one VLAN used for point of sale, one VLAN used for ATM, another VLAN for the pharmacy, etc.

Applications
Once the Networks are globally defined, the next step is to define Applications. While networks include tenants, applications are the services that those tenants utilize. Without a defined association between networks and applications, traffic is not permitted on the SD-WAN—this is the deny-by-default nature of SD-WAN driven by Mist AI.

Thus, you must define all the applications to which you want to route. Applications can be selected off a list or via an application category, or defined by a customized approach.

Some applications are predefined for operator selection: Office 365 is a common example. Operators might want to have special routing when traffic is going to a Microsoft cloud versus (for instance) to a non-business application such as a social media site for personal use. Depending on corporate policies, operators might want to have special routing or block that type of traffic. Similarly, it would be common to prioritize conferencing and business over all personal (but permitted) activities.

Applications and services will be set up in the routers as access control lists (ACLs), allowing networks to access those applications under certain conditions. Adjustments can be made as operators notice patterns in the routing that could be optimized. For instance, if video conferencing is slow it may need higher prioritization.

Under Application Categories, for instance, you might see items such as conferencing, file sharing, or financial (Figure 6).
Implementing Branch Networks for AI-driven Enterprise Customers

Using these categories, operators can select an entire section or a set of applications; special treatment defined here might include blocking of adult web sites.

**Note:** SSRs recognize over 7,000 applications using over 230,000 identifiers.

**WAN Edge Templates**

Deploying a branch network continues by creating templates for the network elements. The SSR at the branch edge will be defined using WAN Edge Templates (*Figure 7*).

**Note:** You can create a new template or use an existing one. If you’re going to connect it to a hub (data center), you’ll make it a spoke (branch).

A key advantage of templates is that if a supported organization has many sites (even into the thousands) and a change needs to be made to all (or a large subset) of them, that change can be made in one spot and applied to the other sites.

In these WAN Edge Templates you input:

- **General Information** such as the name of the template and which sites it applies to
- **Servers for NTP and DNS**
- **WAN Interfaces**: names and descriptions; this includes whether DHCP, NAT, or traffic shaping is enabled
- **LAN Interfaces**: names and descriptions; this is where you assign the Networks that were previously created, and it’s also where you create VLANs for access groups or for device types such as IoT
- **Traffic Steering** which defines policies for steering traffic through selected interfaces
- **Application Policies** which define access for the traffic steering as well as branch security policies for IDP
- **Routing** for links between branches and hubs, where traditional routing protocols or static routes might be used

All of the above is discussed in more detail in the [Guided Setup](#) for Juniper Mist WAN Assurance.
Implementing Branch Networks for AI-driven Enterprise Customers

Defining Interfaces
A sample WAN Interface definition is shown in Figure 8.

For example, consider a common case where you would have one WAN Interface for Internet Breakout and two others for redundant and load-balanced connections to a data center. For each of the WAN links, you can define the physical interface, the type of WAN (i.e., broadband or LTE), the IP configuration, and the overlay hub endpoints (for instance, an SSR in a data center) for the interfaces.

Note the Overlay Hub Endpoints selection in Figure 8; this is where you tell the spoke (branch) about the hub (data center) endpoints.

All three of the defined WAN interfaces discussed here are shown in Figure 9.
Figure 10: Sample LAN Interface Definition

Of course, the SSR also connects to the LAN; sample LAN Interface definition is shown in Figure 10.

Traffic Steering and Application Policies

Once all the WAN and LAN interfaces are defined, traffic steering can be set up. You can set up multiple traffic steering policies. The one shown in Figure 11 is for Internet Breakout traffic.

For any traffic steering policy, you can include several paths to be included in that policy, as well as the strategies for utilizing those paths.

There are different “strategies” that you may choose; these are:

- **Ordered**: Start with a specified path and failover to backup path(s) when needed
- **Weighted**: Distribute traffic across links according to a weighted bias, as determined by a cost that you input
- **ECMP**: Equal-cost multipath; load balance traffic equally across multiple paths

In the case of Internet Breakout, **Ordered** is often selected. As this is breakout traffic, there is no overlay connection to a data center.

Figure 11: Traffic Steering Policy Setup for Internet Breakout
Having set up these traffic steering policies, you can set up application policies, which define “who” (which access group) is going to use certain traffic steering policies. For instance, Figure 12 shows an application policy allowing the LAN to access the Internet.

The selected traffic steering policy tells the network what to do when traffic matches this application policy. In this case, the traffic will be referred to the Internet application policy, which forwards traffic out of the Internet Breakout interface.

For traffic destined to applications in the data center, you would set up a different traffic steering policy for data center backhaul (Figure 13).

In this example, the LAN access group can access corporate network applications and IP camera (ipcams) applications, and will use the DC Backhaul application policy.

You could also set up static or BGP routing if needed.

After saving this, the branch WAN template is defined, and you can move on to defining templates for the switches and access points.
Switch Templates

Setting up new switch templates begins by going to Organization, then selecting Switch Template under Wired (Figure 14). You then have a blank branch template to begin filling in switching parameters (Figure 15).
For instance, you can set up RADIUS servers for authentication or accounting, DNS settings, OSPF areas, static routes, or management. Under Shared Elements (Figure 16), you can create networks, port profiles and dynamic port configuration.

You can set up static or dynamic rules for port configuration. Using dynamic port configuration, you can ensure that the switch recognizes the roles of network elements with certain MAC addresses (such as an access point).

For more information on setting up an EX switch, see the section in the documentation entitled, Configure and Manage the EX Switch and Mist AP in the Juniper Mist Cloud.

WLAN Templates
Select WLAN Templates under Organization/Wireless to see the following template (Figure 17).
You begin by creating a template and giving it a name (Figure 18). Under Applies To, you can assign the template to a site. But first, you would just add a WLAN (Figure 19) to create a wireless network. Here, you can assign an SSID, set up Wi-Fi Settings, radio bands, data rates, access policies, rate limiting, and other advanced settings. You can also set up Security (such as WPA) and a guest portal.

You can create multiple SSIDs. For instance, you can create both a corporate network and a guest network under Create WLAN.

For more information on setting up a Mist AP, see the documentation section entitled, Configure and Manage the EX Switch and Mist AP in the Juniper Mist Cloud.
Assigning Templates to Sites

Once you’ve created your sites and completed your templates for each domain, you can then assign the templates to them. For every template, select Assign to Site (Figure 20).

This process is the same for switch templates and access point templates.

Figure 21 shows the access point template being assigned to a branch.
Hubs and Data Centers
Operators can also set up a hub such as a data center or a head end router. Doing that involves creating a hub profile, entering configuration parameters for that hub, and applying it to the router (Figure 22).

In terms of configuration, hub profile templates are very similar to WAN Edge Templates. Many of the same parameters such as general information, NTP servers, DNS settings, WAN and LAN definitions, traffic steering policies and application policies, and routing, are present in these types of templates.

The hub profiles will define overlays, which are essentially the SD-WAN topology and which will be used to configure branches. Between the nodes in these overlays, traffic can be forwarded using secure vector routing (SVR), which provides the deny-by-default access, tunnel-free adaptive encryption, and 30-50% bandwidth savings compared to other SD-WAN implementations.

Day 1: Zero Touch Deployment
Having completed Day 0 operations, you can begin the process of deploying your devices using Zero Touch Provisioning (ZTP). These operations are referred to as Day 1 tasks.

Under Inventory (Figure 23), you can claim your devices, which (assuming they are assigned to a site) will be automatically configured via their respective templates.
After selecting Claim WAN Edges, enter the claim code for the SSR, which can be found on the back of your device (Figure 24).

If you are claiming multiple devices, you can do so here. You must also enter the site assignment. Site variables can be called upon here.

You can enter license tracking information, and generate a name for the WAN edge devices; you can also enter the password to manage the devices using Mist.

You can claim the switches and access points in the same way (Figure 25).
Implementing Branch Networks for AI-driven Enterprise Customers

For any device that doesn’t have a claim code, you can "adopt" the device using a provided set of CLI commands (Figure 26).

As with all devices (WAN, Switch, or AP), you can use the Mist AI Mobile App from an application store (e.g., from Apple or Google) to get your device into inventory. You start this process by scanning the device’s QR code with the mobile application (Figure 27).

After scanning the code, you then simply refresh the Inventory page for the related domain to see it appear.

Following that, the devices—as they connect to the Mist Cloud—will get their configurations assigned through the templates.

Once all of the device interfaces and their endpoints are defined (and templates assigned to sites and equipment deployed), the network will start to ensure connectivity by sending bidirectional forwarding detection (BFD) traffic between the endpoints. BFD will help measure jitter, loss, and latency along the path.

Figure 26: Adopting a Switch

Figure 27: QR Code on an Access Point
Days 2 and Beyond: AI-driven Operational Benefits

Day 2 operations refer to all administrative and operational tasks after deployment. This includes troubleshooting, maintenance, and day-to-day operations.

The MSP Dashboard

As a Managed Service Provider (MSP) serving many enterprises, your task is simplified with the Juniper MSP Dashboard. You can manage your entire customer estate and quickly onboard new customers with correct attributes and configurations.

The dashboard (Figure 28) provides a view of all the organizations being managed.

For each organization, there is a list of all access points, switches, and WAN edges, along with the status of any subscriptions.

In a similar way that the MSP dashboard shows you all the organizations you manage, you can (by selecting an individual organization and using a drop-down menu) view all the sites within an organization (Figure 29).

Service Level Experiences (SLE)

For all of these organizations and sites (and in every network domain), you can manage Service Level Experiences (SLE) for users and operators. SLEs are maintained using applied data science and machine learning to understand the actual end user experience on the network.

Going well beyond the concept of client health (i.e., whether a device is functioning or not), SLEs measure actual user experiences in real-time, based on continuously delivered (and actionable) telemetry.
As an MSP, you can check SLEs for all the organizations being managed (Figure 30).

The SLEs are color-coded so that serious problems appear in yellow or red. This lets you correlate problems across domains, which is discussed in the following sections.

SLEs by Domain

The ability to view SLEs by domain (wireless, wired and WAN), and to correlate them, is extremely powerful. The different domains (Table 1) are interrelated: problems in each domain often affect other domains.

Table 1. SLEs by Domain

<table>
<thead>
<tr>
<th>Wireless</th>
<th>Wired</th>
<th>WAN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall Service</td>
<td>Overall Service</td>
<td>Overall Service</td>
</tr>
<tr>
<td>Time to Connect</td>
<td>Switch Health</td>
<td>WAN Edge Health</td>
</tr>
<tr>
<td>Successful Connections</td>
<td>Successful Connections</td>
<td>WAN Link Health</td>
</tr>
<tr>
<td>Coverage</td>
<td>Throughput</td>
<td>Application Health</td>
</tr>
<tr>
<td>Roaming</td>
<td>Throughput</td>
<td></td>
</tr>
<tr>
<td>Throughput</td>
<td>Capacity</td>
<td></td>
</tr>
<tr>
<td>Health</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Other debugging sessions may begin with SLEs in any domain. Toggling to WAN statistics, for instance, you can view SLEs for WAN Edge health, WAN Link health, or application health (Figure 31).

For each device, you can see upstream paths or applications that are being accessed.

Similarly, clicking the Wired button, you can check the relevant characteristics such as throughput, successful connections, or switch health (Figure 32).
For wireless devices, you can check, for example, coverage, roaming, capacity, and overall AP health (Figure 33).

**Using SLE Classifiers**

To help you find the root causes of problems, SLEs are subdivided into classifiers. SLE classifiers may include authentication or authorization, latency, signal strength, and other characteristics that help you diagnose and correct issues.

For instance, if you see unsuccessful connections, you can determine if the problem is one of authorization (Figure 34).

---

**Figure 33: Wireless Statistics**

**Figure 34: Use of Classifiers to Isolate a Problem**
You can see which SSRs, paths, and clients are associated with each site, and isolate the causes of problems such as an intersite VPN path being down (Figure 35).

Using the guidance provided by SLEs and their classifiers, you can gather further information on relevant events by viewing the Monitor page under an organization (Figure 36).
Figure 37: Throughput Shown from the Monitor Page

Under the Insights view, this page provides an overview of what each device is doing and any events that are occurring. You can see site events, client events, and access point events. Monitor also helps you see (at a glance) which applications people are accessing on the network. You can also see what type of traffic is passing, along with bandwidth usage, throughput, and connection efficiency (Figure 37).

In other per-domain diagnostics, you can see which ports are up or down, and look at throughput, connections, and switch health. For access points, you can see which ports are down at a particular site, along with which clients are attached to which switches. Indoor Location Services helps you determine whether some access points are overloaded with too many users, and can also help with site planning.

This level of visibility, event correlation and problem isolation is state of the art, and the AIDE goes further with AI/ML capabilities that will lead quickly to problem resolution, and can in many cases correct problems in the network for you.

The Marvis Virtual Network Assistant

The Marvis Virtual Network Assistant (VNA) recognizes behavior on the network and offers suggestions as to how problems can be fixed across the Wired, Wireless, and WAN domains.

Marvis Actions, for instance, divides into different possible problems for each device type (Figure 38).
With each of these options, Marvis offers suggestions as to how to fix them. For instance, for a weak LTE signal, Marvis suggests that it could be an ISP problem with DHCP or simply caused by a bad cable (Figure 39).

Similarly, for switches, Marvis may indicate whether the cause of a problem is a missing VLAN or a bad cable. For access points, you can do a health check for connectivity, authorization failures, DHCP, ARP, or (again) a Layer 1 problem such as a bad cable.

With Marvis, you click on an Action and see where the problem lies. This represents a major breakthrough for troubleshooting capabilities, a greatly simplified and proactive process from traditional techniques.

Additionally, Marvis offers very specific help through a natural language processing (NLP) chat interface. You can type in specified search terms, user names, a trouble ticket number, or questions (Figure 40).
For example, let’s say users are reporting trouble with Microsoft Teams. You can suggest different sites to look at, and can find users from Teams. Depending on how clients are set up, you may get an answer just by typing “troubleshoot teams” in the chat box (Figure 41).

As you scroll through suggestions, Marvis will show a simple graphic in the chat box to help you find where the problem is. From the user to an application—including all intermediate hops—Marvis helps you locate the source of the problem (Figure 42).

From the Marvis chat, you can quickly determine what is working and what is not, indicated by either a caution icon or green check mark. You may see that the switch, the router, and Teams is all working correctly, but the wireless is not. In a case like that, the problem may be in the access point itself.

This level of insight greatly reduces troubleshooting time. Furthermore, isolating by time period is very valuable; you may notice, for example, that in a different time slice it may be that the WAN router was the source of the issue.

Note: For additional ease of use, there are mobile applications for Mist Experience and the Marvis Client available for Android or Apple devices.

Conclusion

This solution guide has provided a summary of what can be accomplished with Juniper’s AI-driven Enterprise in a full stack deployment. Simplicity is the key—the Mist AI Cloud is designed to be easy to use and to make the network easy to troubleshoot across all domains.

This is how you deploy, maintain and operate networks with an AI-driven Enterprise—it is the essence of experience-first networking for both users and administrators.
Implementing Branch Networks for AI-driven Enterprise Customers

Resources

Mist Management and Live Demo
  - Juniper Mist Live Demo at Manage.mist.com

Documentation
  - Guided Setup for Mist WAN Assurance
  - Configure and Manage the EX Switch and Mist AP in the Juniper Mist Cloud
  - Overview of the Cloud-Managed Midsize Branch Office

Solution Briefs and White Papers
  - Client-to-Cloud Assurance with an AI-driven Enterprise
  - Session Smart Routing: How it Works

Data Sheets
  - SSR 100 Line of Routers
  - WAN Assurance
  - Wireless Assurance
  - Wired Assurance

Web Pages
  - Juniper Networks Presents at Network Field Day 23 (July 2022)
  - Managed Service Provider (MSP) Dashboard
  - Mist AI and Cloud
  - Marvis Virtual Network Assistant
  - Session Smart Routers (SSR)
  - EX switches

About Juniper Networks

Juniper Networks brings simplicity to networking with products, solutions and services that connect the world. Through engineering innovation, we remove the constraints and complexities of networking in the cloud era to solve the toughest challenges our customers and partners face daily.

At Juniper Networks, we believe that the network is a resource for sharing knowledge and human advancement that changes the world. We are committed to imagining groundbreaking ways to deliver automated, scalable and secure networks to move at the speed of business.