The bridge to possible

Meraki Observability

Be the hero, avoid the blame game

Paul Hasstedt – Technical Solutions Architect, Cisco Meraki

BRKOPS-2013

cisco Live!

“If I had a dollar for every packet I’ve sent to prove my innocence, I would have retired 10 years ago!”

-Multiple Network Engineers in this room

...probably ;)

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@PaulHasstedt

→ Colorado born and raised, now living in Phoenix, AZ

→ Masters in Music with an emphasis in Vocal Performance/Conducting

→ Previously professional opera singer and middle school music teacher

→Joined Cisco 2016 -> Meraki 2018

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Cisco Webex App

https://ciscolive.ciscoevents.com/ciscolivebot/#BRKOPS-2013

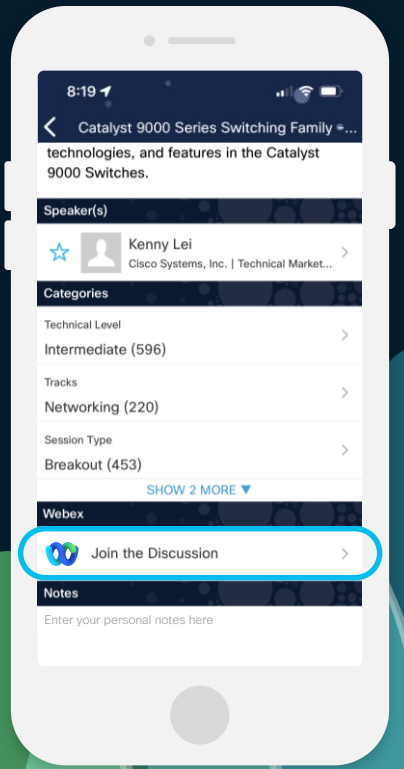
Questions?

Use Cisco Webex App to chat with the speaker after the session

How

1. Find this session in the Cisco Live Mobile App
2. Click “Join the Discussion”
3. Install the Webex App or go directly to the Webex space
4. Enter messages/questions in the Webex space

Webex spaces will be moderated by the speaker until June 7, 2024.



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Agenda

- A Hero’s challenge
- Device Health Champion
- Meraki Insight Master
- ThousandEyes Power
- Demo

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The tsunami of data

“I have copious amounts of spare time to do manual correlation of the data…”

“It’s always been easy to keep track of how distributed our users and resources are…”

“Identifying the device or service that is our issue’s root cause is very straightforward…”

-Probably no one who has ever worked in IT…

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Number of hours spent on Deploying, Scaling and Managing an IT infrastructure

is 10 hours a week!

Source: Forrester Report

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Meraki's Mission

Simplifying powerful technology to free passionate people to focus on their mission

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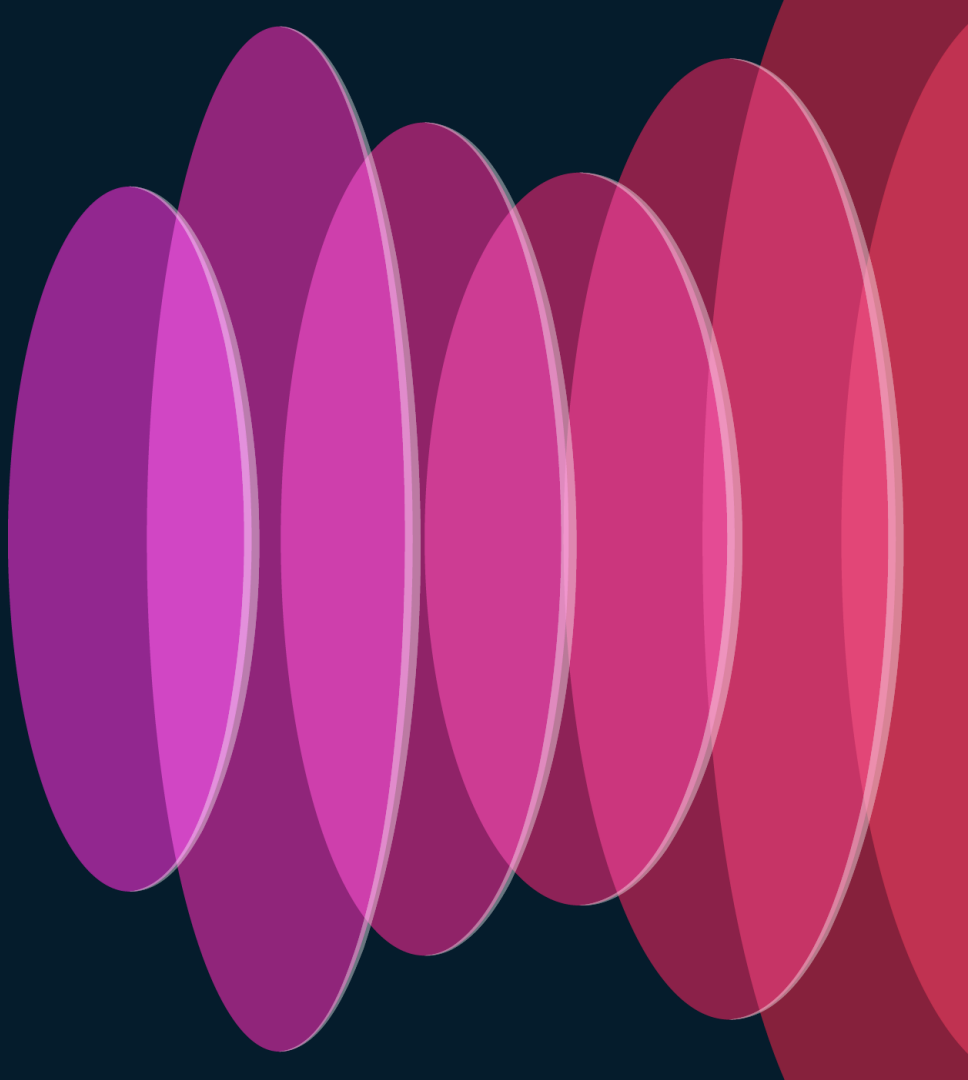
Device Health Champion



“...to clarify, you’re calling me from your laptop that is connected to the wifi, to tell me the wifi is down...”

-Anyone who has worked in support...

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Traditional visibility

Tool	Cost	Overhead
All things cli/debug	-	
SNMP, Netflow, syslog	$	
Wifi spectrum analyzer and monitoring software	$$$	

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All the switching data

```
Switch# debug platform vlan [ error |event ] [ switch switch-number ]

Switch# show vlan [ brief | group | id vlan-id | group-name WORD user_count | mtu | name vlan-name | remote-span | summary ]

Switch# show interface ethernet 1/1 | i CRC

Switch# show cable-diagnostics tdr interface gigabitEthernet 0/1
```


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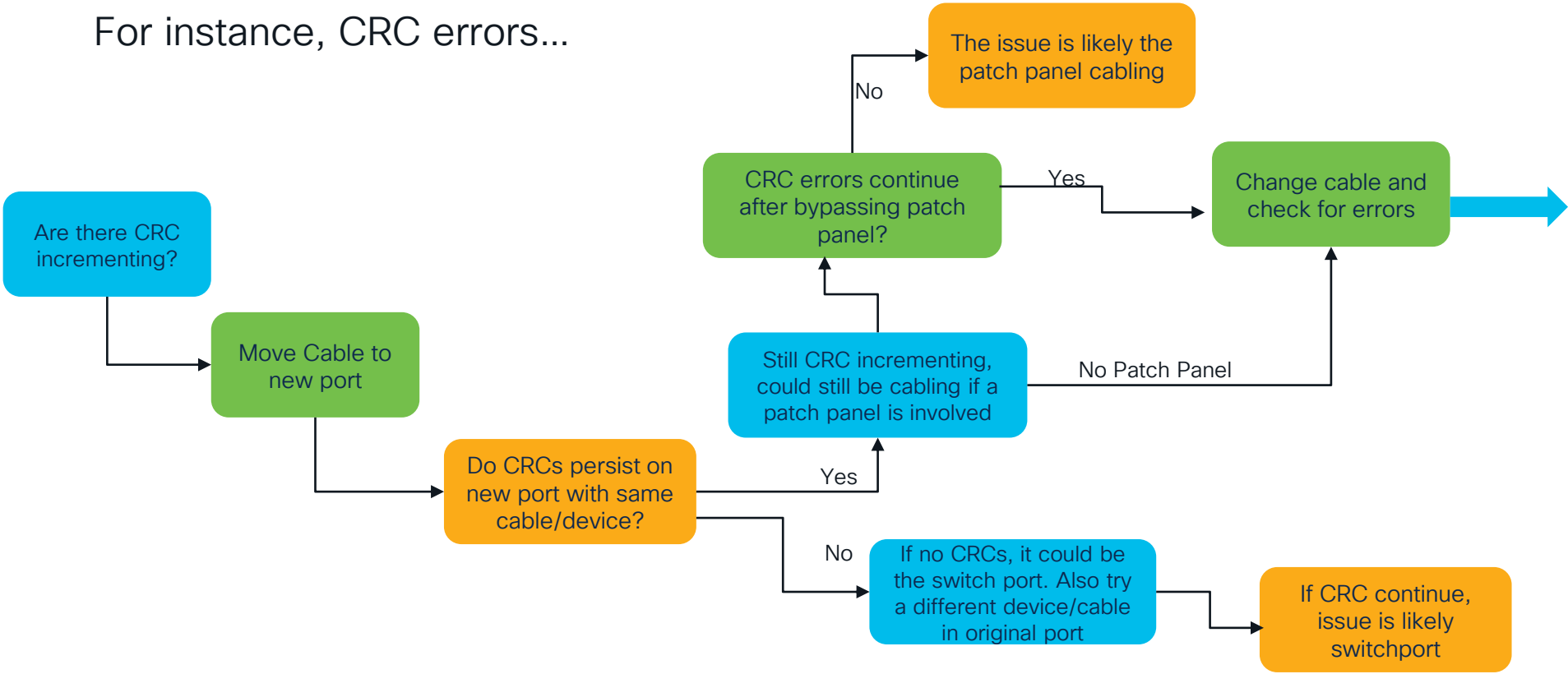
Manual correlation with the data

For instance, CRC errors…



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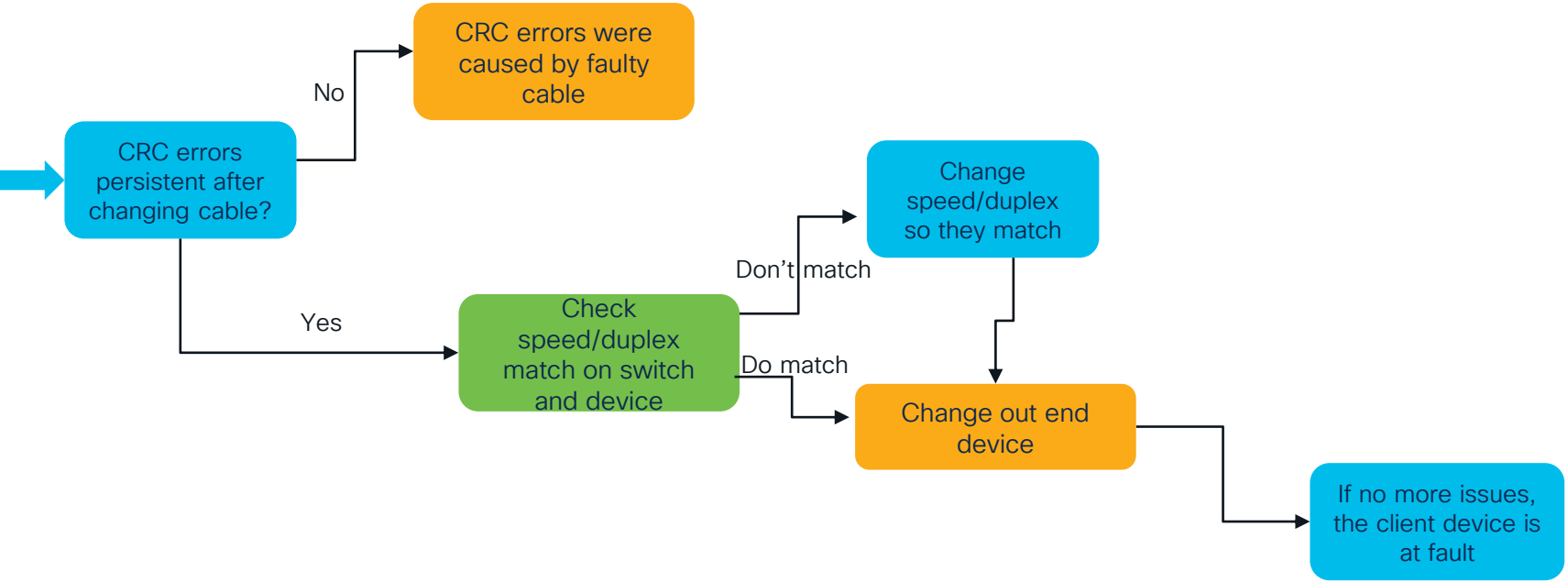
Manual correlation with the data

For instance, CRC errors…



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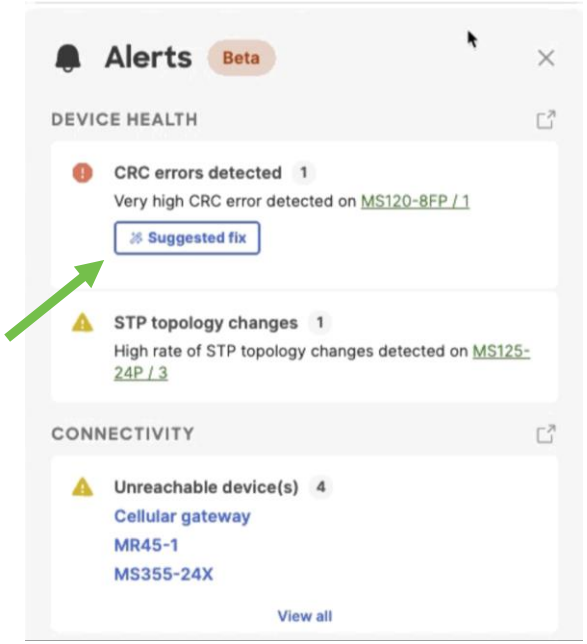
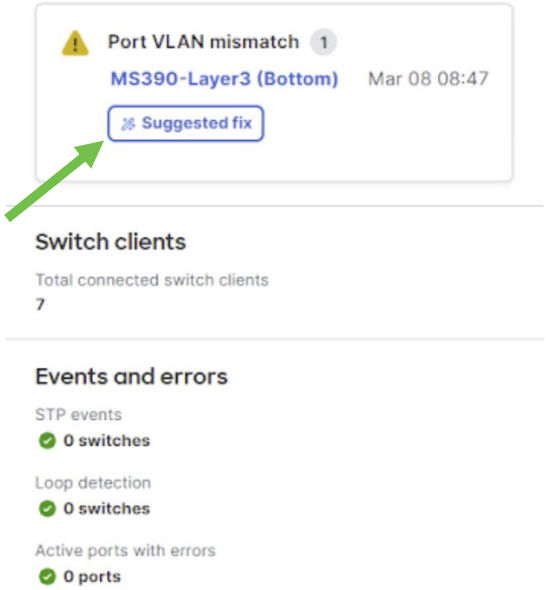
Targeted switching data





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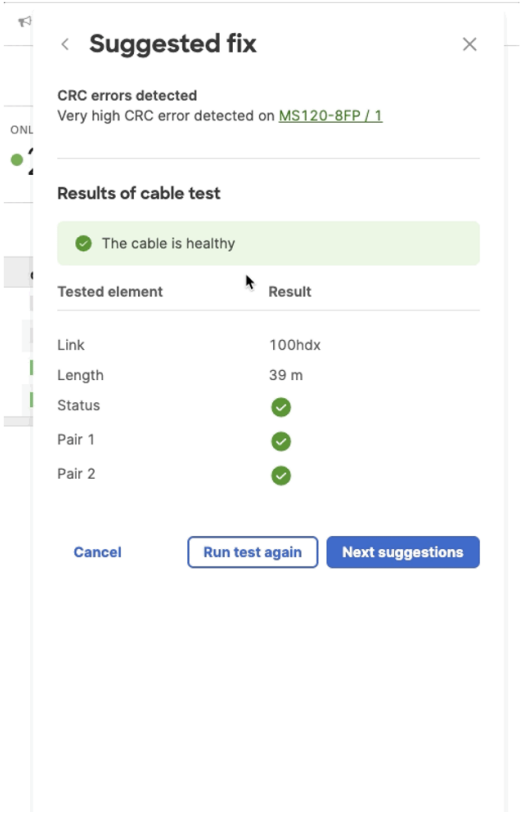
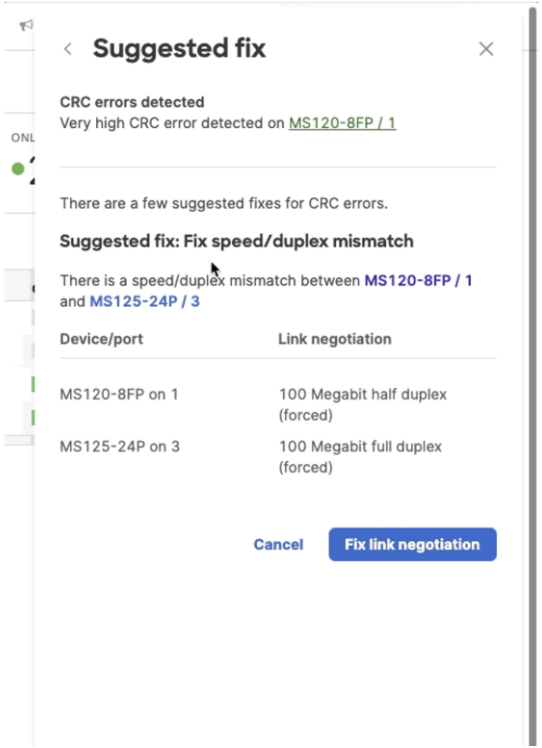
Suggested fixes





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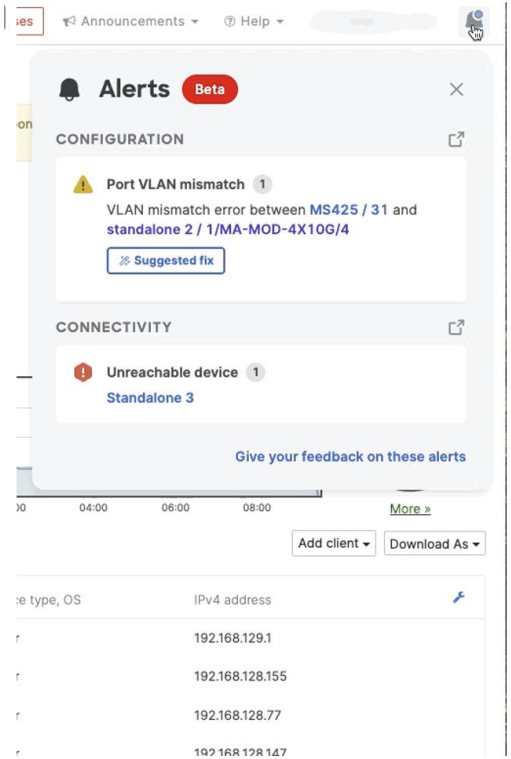
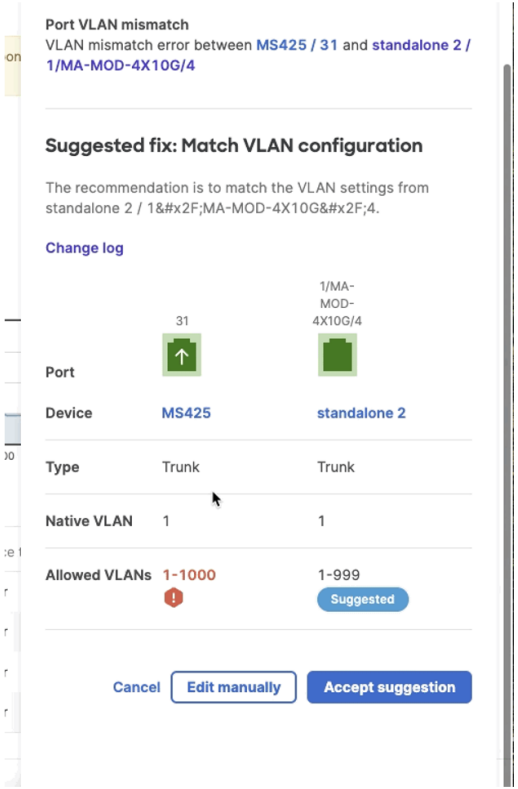
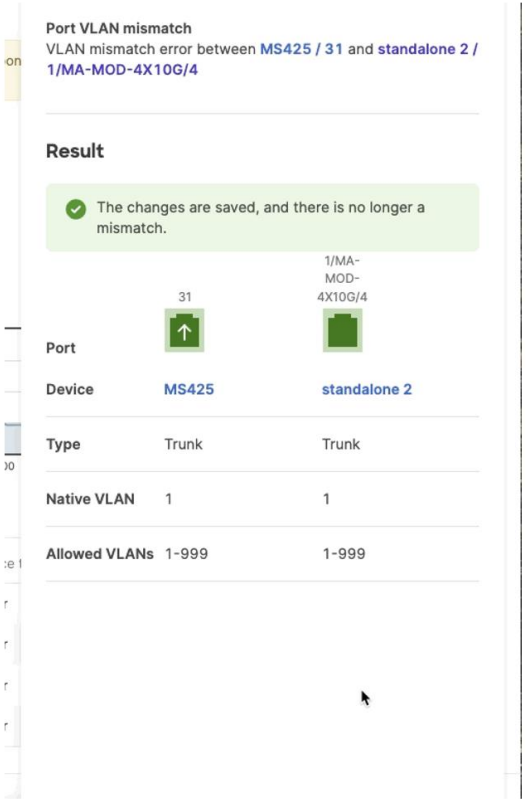
Suggested fixes







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All the wireless data

```
(AP-01) >debug capwap client {ble | detail | efficient-
upgrade | error | events | flexconnect | info | keepalive
| payload | pmtu | qos | reassembly | security}

(Wifi Controller) >debug client 00:00:00:00:00:00

(Wifi Controller) >debug aaa all enable

(Wifi Controller) >show debug
```


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Reason code comprehension

802.11 Association Status Codes

Code	802.11 definition	Explanation
0	Successful	
1	Unspecified failure	For example : when there is no ssid specified in an association request
10	Cannot support all requested capabilities in the Capability Information field	Example Test: Reject when privacy bit is set for WLAN not requiring security
11	Reassociation denied due to inability to confirm that association exists	NOT SUPPORTED
12	Association denied due to reason outside the scope of this standard	Example : When controller receives assoc from an unknown or disabled SSID
13	Responding station does not support the specified authentication algorithm	For example, MFP is disabled but was requested by the client.
14	Received an Authentication frame with authentication transaction sequence number out of expected sequence	If the authentication sequence number is not correct.
15	Authentication rejected because of challenge failure	
16	Authentication rejected due to timeout waiting for next frame in sequence	
17	Association denied because AP is unable to handle additional associated stations	Will happen if you run out of AIDs on the AP; so try associating a large number of stations.
18	Association denied due to requesting station not supporting all of the data rates in the BSSBasicRateSet parameter	Will happen if the rates in the assoc request are not in the BasicRateSet in the beacon.
19	Association denied due to requesting station not supporting the short preamble option	NOT SUPPORTED
20	Association denied due to requesting station not supporting the PBCC modulation option	NOT SUPPORTED
21	Association denied due to requesting station not supporting the Channel Agility option	NOT SUPPORTED
22	Association request rejected because Spectrum Management capability is required	NOT SUPPORTED
23	Association request rejected because the information in the Power Capability element is unacceptable	NOT SUPPORTED
24	Association request rejected because the information in the Supported Channels element is unacceptable	NOT SUPPORTED
25	Association denied due to requesting station not supporting the Short Slot Time option	NOT SUPPORTED
26	Association denied due to requesting station not supporting the DSSS-OFDM option	NOT SUPPORTED
27-31	Reserved	NOT SUPPORTED
32	Unspecified, QoS-related failure	NOT SUPPORTED
33	Association denied because QAP has insufficient bandwidth to handle another QSTA	NOT SUPPORTED
34	Association denied due to excessive frame loss rates and/or poor conditions on current operating channel	NOT SUPPORTED
35	Association (with QBSS) denied because the requesting STA does not support the QoS facility	If the WMM is required by the WLAN and the client is not capable of it, the association will get rejected.
36	Reserved in 802.11	This is used in our code ! There is no blackbox test for this status code.
37	The request has been declined	This is not used in assoc response; ignore
38	The request has not been successful as one or more parameters have invalid values	NOT SUPPORTED
39	The TS has not been created because the request cannot be honored; however, a suggested TSPEC is provided so that the initiating QSTA may attempt to set another TS with the suggested changes to the TSPEC	NOT SUPPORTED
40	Invalid information element, i.e., an information element defined in this standard for which the content does not meet the specifications in Clause 7	Sent when Aironet IE is not present for a CKIP WLAN
41	Invalid group cipher	Used when received unsupported Multicast 802.11i OUI Code
42	Invalid pairwise cipher	
43	Invalid AKMP	
44	Unsupported RSN information element version	If you put anything but version value of 1, you will see this code.
45	Invalid RSN information element capabilities	If WPA/RSN IE is malformed, such as incorrect length etc, you will see this code.
46	Cipher suite rejected because of security policy	NOT SUPPORTED
47	The TS has not been created; however, the HC may be capable of creating a TS, in response to a request, after the time indicated in the TS Delay element	NOT SUPPORTED
48	Direct link is not allowed in the BSS by policy	NOT SUPPORTED
49	Destination STA is not present within this QBSS	NOT SUPPORTED
50	The Destination STA is not a QSTA	NOT SUPPORTED
51	Association denied because the ListenInterval is too large	NOT SUPPORTED
200 (0xC8)	Unspecified, QoS-related failure. Not defined in IEEE, defined in CCXv4	Unspecified QoS Failure. This will happen if the Assoc request contains more than one TSPEC for the same AC.
201 (0xC9)	TSPEC request refused due to AP's policy configuration (e.g., AP is configured to deny all TSPEC requests on this SSID). A TSPEC will not be suggested by the AP for this reason code. Not defined in IEEE, defined in CCXv4	This will happen if a TSPEC comes to a WLAN which has lower priority than the WLAN priority settings. For example a Voice TSPEC coming to a Silver WLAN. Only applies to CCXv4 clients.
202 (0xCA)	Association Denied due to AP having insufficient bandwidth to handle a new TS. This cause code will be useful while roaming only. Not defined in IEEE, defined in CCXv4	
203 (0xCB)	Invalid Parameters. The request has not been successful as one or more TSPEC parameters in the request have invalid values. A TSPEC SHALL be present in the response as a suggestion. Not defined in IEEE, defined in CCXv4	This happens in cases such as PHY rate mismatch. If the TSRS IE contains a phy rate not supported by the controller, for example. Other examples include sending a TSPEC with bad parameters, such as sending a date rate of 8SK for a narrowband TSPEC.

802.11 Deauth Reason Codes

When running a client debug, this code will match the ReasonCode from the output: "Scheduling mobile for deletion with delete Reason x, reasonCode y"

Code	802.11 definition	Explanation
0	Reserved	NOT SUPPORTED
1	Unspecified reason	TBD
2	Previous authentication no longer valid	NOT SUPPORTED
3	station is leaving (or has left) IBSS or ESS	NOT SUPPORTED
4	Disassociated due to inactivity	Do not send any data after association;
5	Disassociated because AP is unable to handle all currently associated stations	TBD
6	Class 2 frame received from nonauthenticated station	NOT SUPPORTED
7	Class 3 frame received from nonassociated station	NOT SUPPORTED
8	Disassociated because sending station is leaving (or has left) BSS	TBD
9	Station requesting (re)association is not authenticated with responding station	NOT SUPPORTED
10	Disassociated because the information in the Power Capability element is unacceptable	NOT SUPPORTED
11	Disassociated because the information in the Supported Channels element is unacceptable	NOT SUPPORTED
12	Reserved	NOT SUPPORTED
13	Invalid information element, i.e., an information element defined in this standard for which the content does not meet the specifications in Clause 7	NOT SUPPORTED
14	Message integrity code (MIC) failure	NOT SUPPORTED
15	4-Way Handshake timeout	NOT SUPPORTED
16	Group Key Handshake timeout	NOT SUPPORTED
17	Information element in 4-Way Handshake different from (Re)Association Request/Probe Response/Beacon frame	NOT SUPPORTED
18	Invalid group cipher	NOT SUPPORTED
19	Invalid pairwise cipher	NOT SUPPORTED
20	Invalid AKMP	NOT SUPPORTED
21	Unsupported RSN information element version	NOT SUPPORTED
22	Invalid RSN information element capabilities	NOT SUPPORTED
23	IEEE 802.1X authentication failed	NOT SUPPORTED
24	Cipher suite rejected because of the security policy	NOT SUPPORTED
25–31	Reserved	NOT SUPPORTED
32	Disassociated for unspecified, QoS-related reason	NOT SUPPORTED
33	Disassociated because QAP lacks sufficient bandwidth for this QSTA	NOT SUPPORTED
34	Disassociated because excessive number of frames need to be acknowledged, but are not acknowledged due to AP transmissions and/or poor channel conditions	NOT SUPPORTED
35	Disassociated because QSTA is transmitting outside the limits of its TXOPs	NOT SUPPORTED
36	Requested from peer QSTA as the QSTA is leaving the QBSS (or resetting)	NOT SUPPORTED
37	Requested from peer QSTA as it does not want to use the mechanism	NOT SUPPORTED
38	Requested from peer QSTA as the QSTA received frames using the mechanism for which a setup is required	NOT SUPPORTED
39	Requested from peer QSTA due to timeout	NOT SUPPORTED
40	Peer QSTA does not support the requested cipher suite	NOT SUPPORTED
46–65535	46–65 535 Reserved	NOT SUPPORTED
98	Cisco defined	TBD
99	Cisco defined Used when the reason code sent in a deassoc req or deauth by the client is invalid – invalid length, invalid value etc	Example: Send a Deauth to the AP with the reason code to be invalid, say zero

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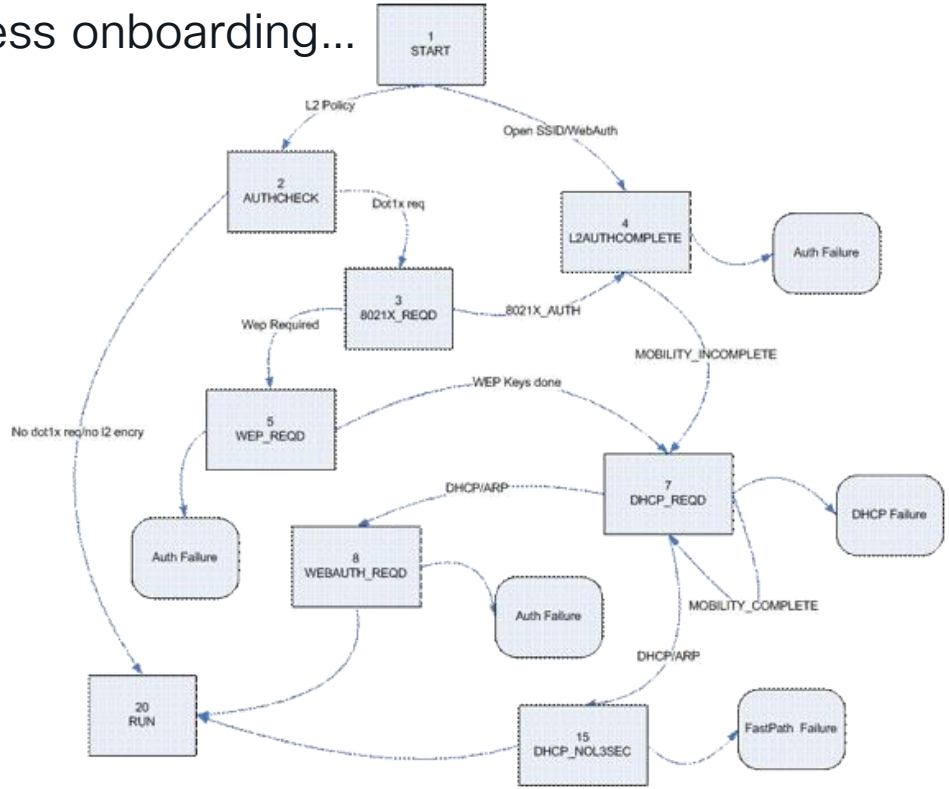
Manual correlation with the data

For instance, wireless onboarding…



Understanding Debug on WLAN on Cisco.com

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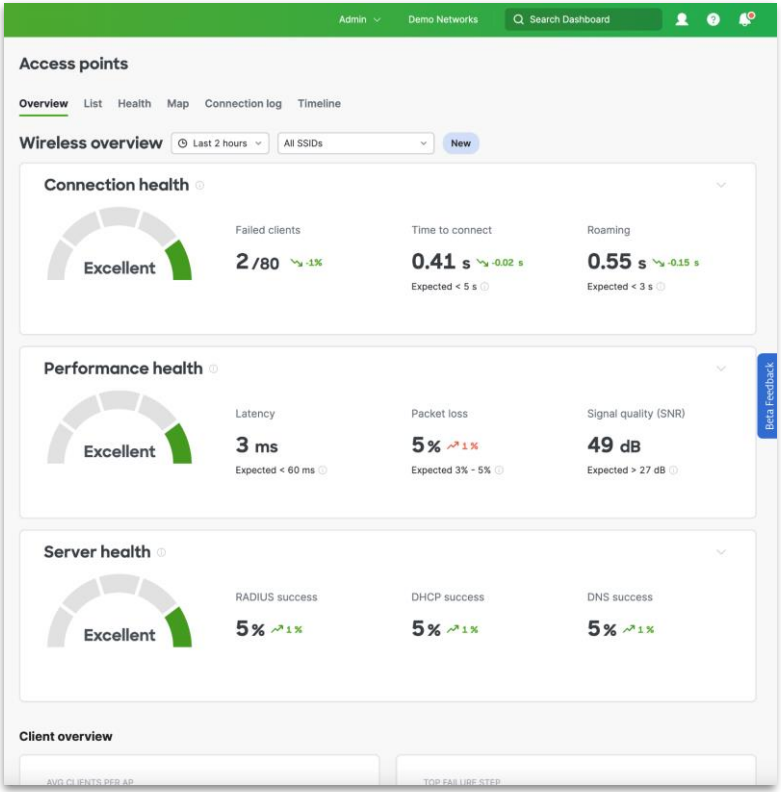
Wireless experience dashboard



- Built-in intelligence
- Easy to grasp views

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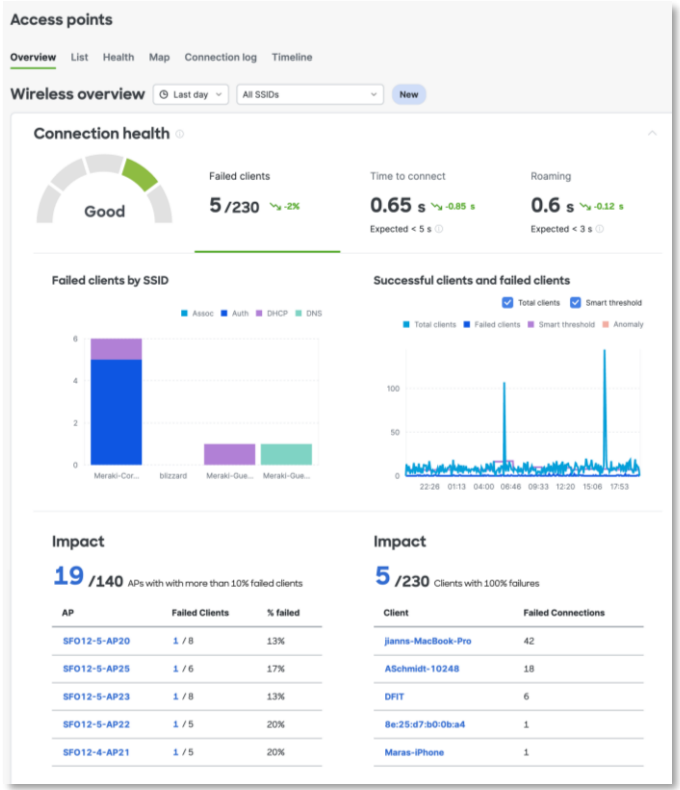
Connection health



- Simplified 2-click workflow
- Smart threshold – No manual, too high or too low syndrome

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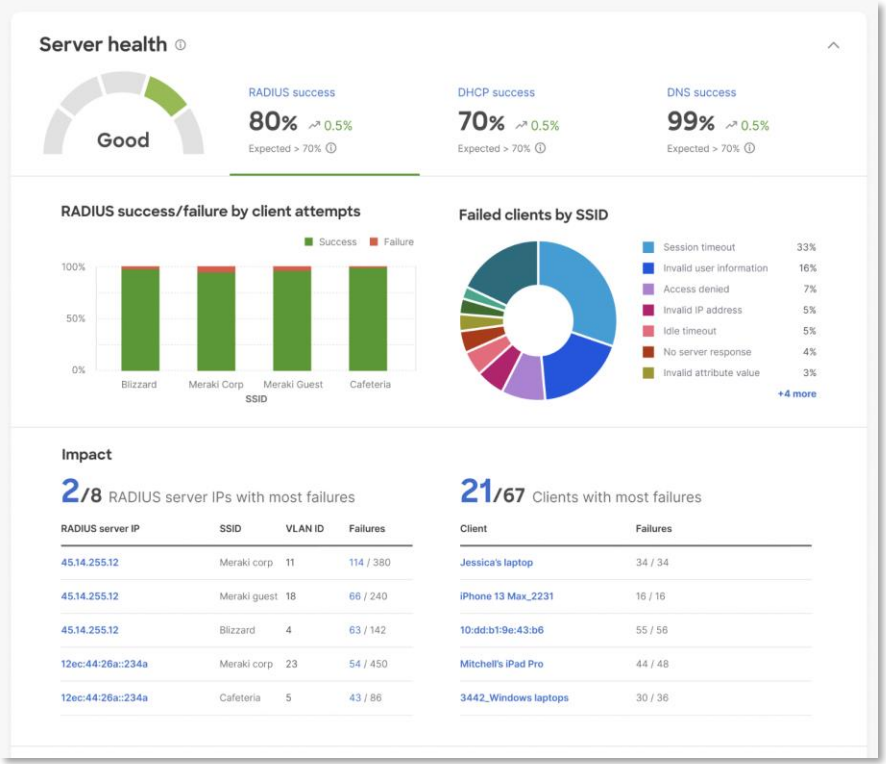
Server health



- Network servers – RADIUS, DHCP, DNS
- Top failures brough to your attention

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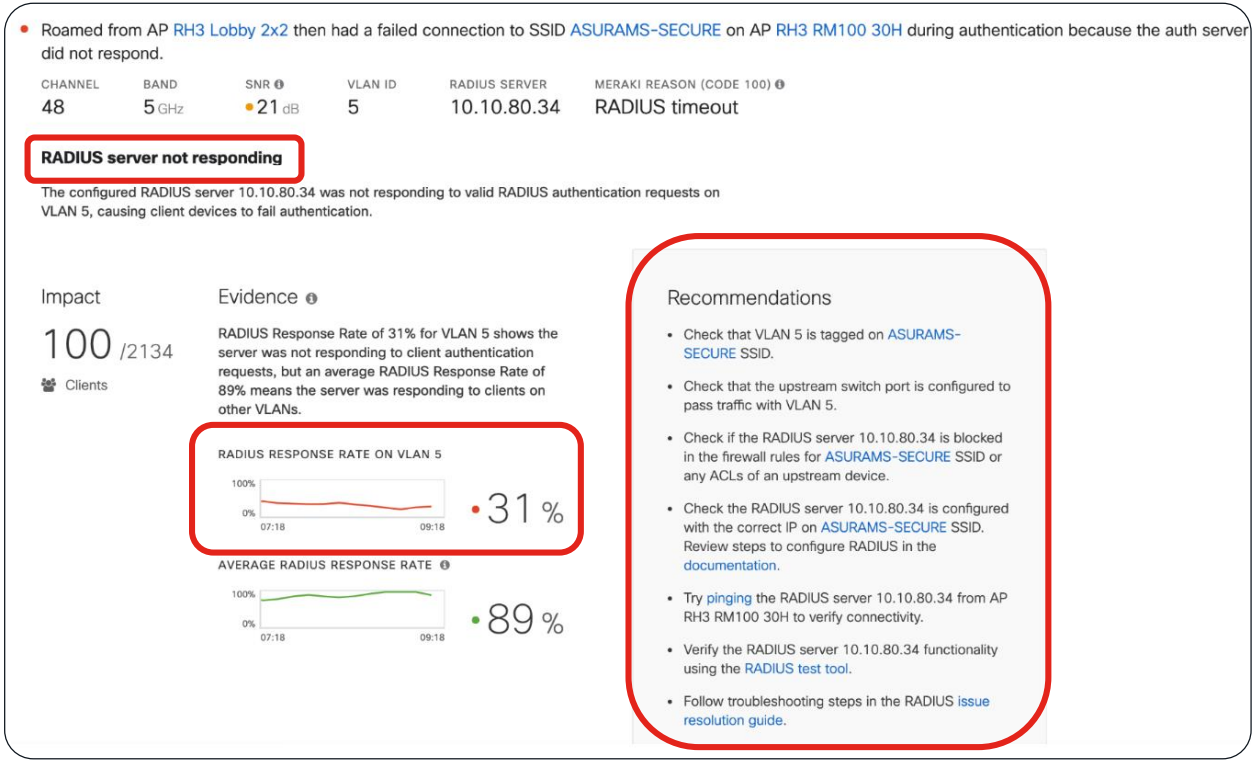
Automated root cause analysis

Impact, evidence, and data-driven recommendations to solve problems

- **Natural-language descriptions** of client connection behavior



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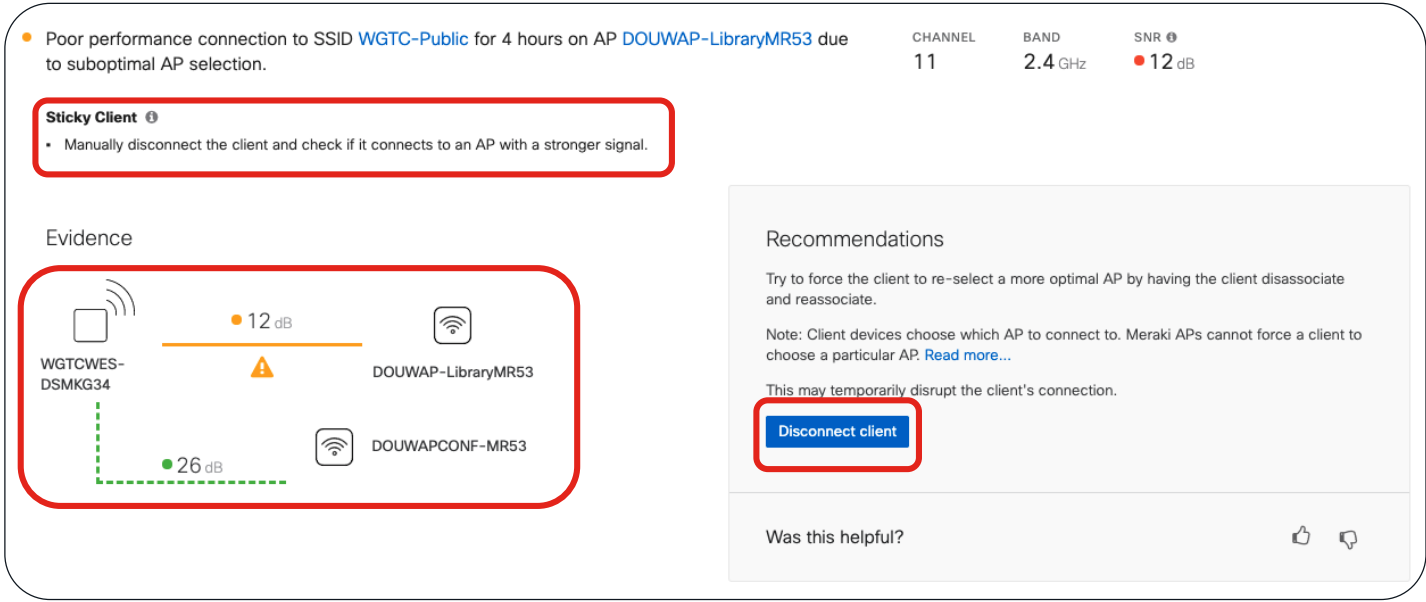
Sticky client analysis

Impact, evidence, and data-driven recommendations to solve problems

- **Clear recommendations** to remediate detected problems



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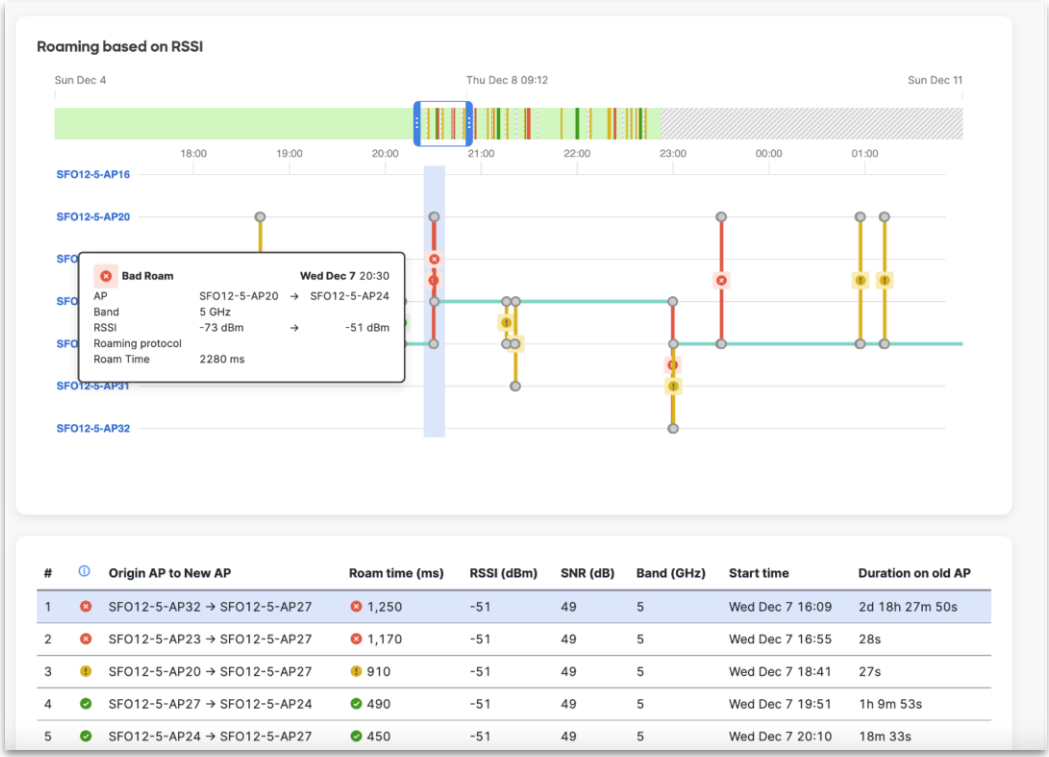
Contextual roaming analytics

Impact, evidence, and data-driven recommendations to solve problems

- Tiering of roaming events – **good, suboptimal, bad**
- Visualization of unique events – **sticky or ping-pong clients**



#	Origin AP to New AP	Roam time (ms)	RSSI (dBm)	SNR (dB)	Band (GHz)	Start time	Duration on old AP
1	SFO12-5-AP32 → SFO12-5-AP27	1,250	-51	49	5	Wed Dec 7 16:09	2d 18h 27m 50s
2	SFO12-5-AP23 → SFO12-5-AP27	1,170	-51	49	5	Wed Dec 7 16:55	28s
3	SFO12-5-AP20 → SFO12-5-AP27	910	-51	49	5	Wed Dec 7 18:41	27s
4	SFO12-5-AP27 → SFO12-5-AP24	490	-51	49	5	Wed Dec 7 19:51	1h 9m 53s
5	SFO12-5-AP24 → SFO12-5-AP27	450	-51	49	5	Wed Dec 7 20:10	18m 33s

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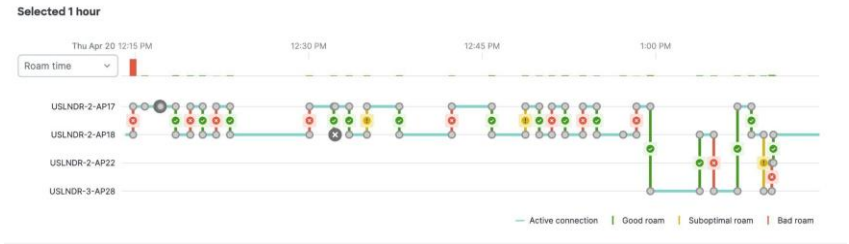
Contextual roaming analytics

Impact, evidence, and data-driven recommendations to solve problems



Bad roaming experience

Good roaming experience

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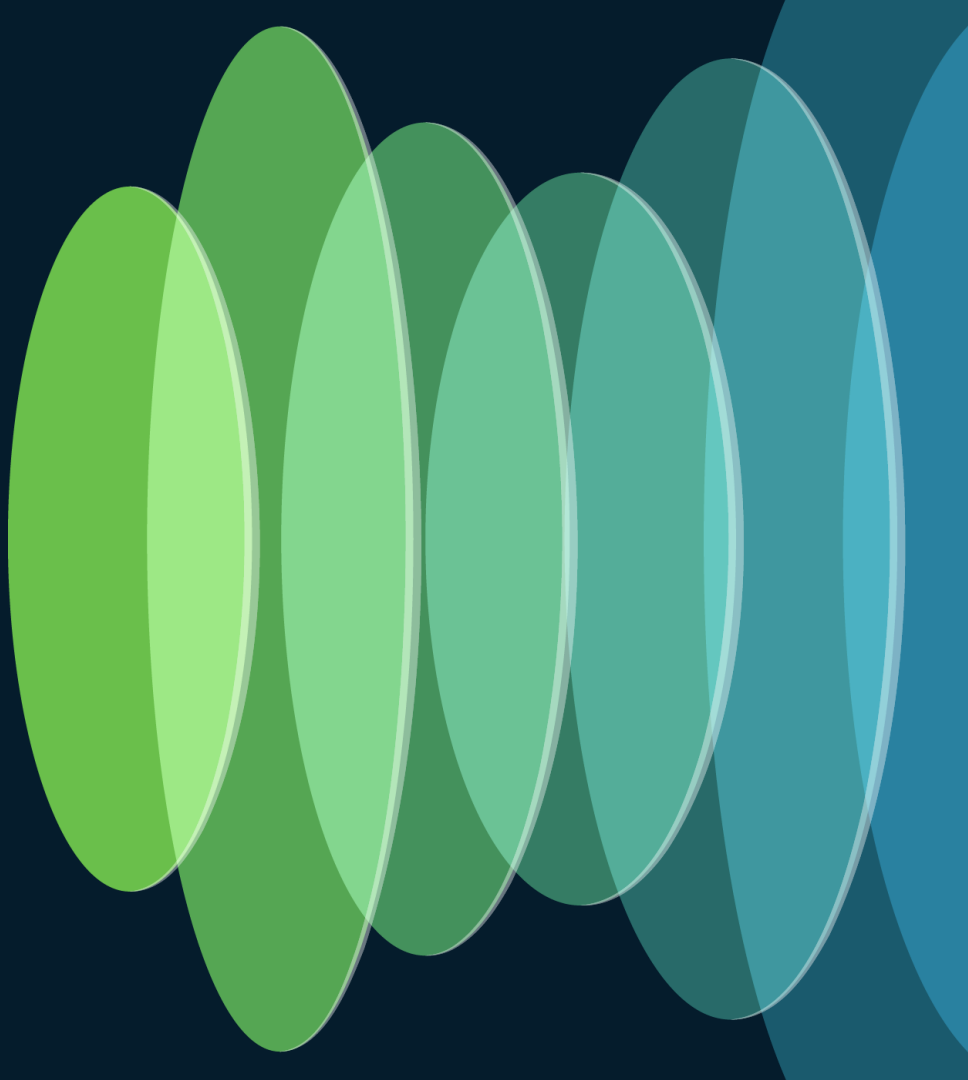
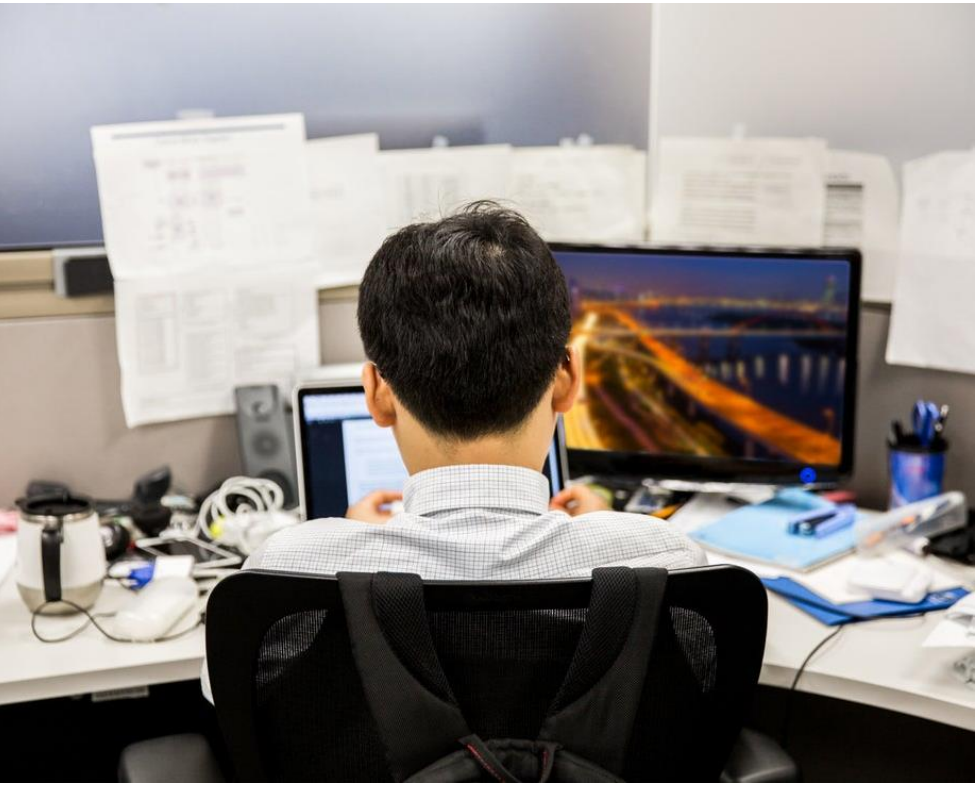
Meraki Insight Master



cisco Live!



“I play a game to see how long the line behind me will queue up if I play the Cisco on hold music and tell everyone: ‘Shhh, I’m on with TAC…’”

…Me 10 years ago

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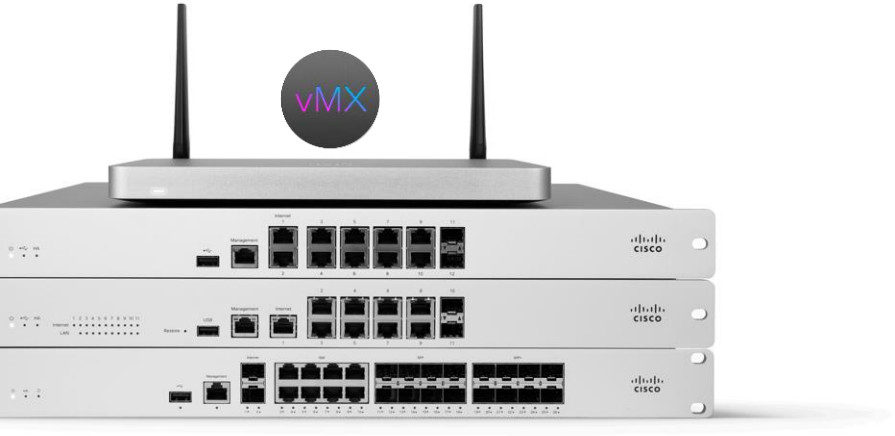
Meraki Insight building blocks

MX security and SD-WAN appliances



Highlights across all models

- Up to ×4 WAN ports
- 3G / 4G / LTE USB as single-WAN or failover
- Models with embedded LTE modem
- High availability mode and automatic WAN failover
- Additional Ethernet ports with PoE/PoE+ options
- Virtual appliances for hybrid cloud

Insight analytics

Reduce troubleshooting time from hours to minutes

Web App Health

Passive monitoring of critical applications across your LAN, WAN, and application server—wherever it is.

WAN Health

Actively monitor ALL of your organization's diverse uplinks, including cellular, and home-user uplinks, in one view.

VoIP Health

Track VoIP quality by provider and uplink with detailed hop-by-hop analysis actively.

Internet Outages

At-a-glance view of global internet health over the last 24 hours powered by Thousand Eyes.

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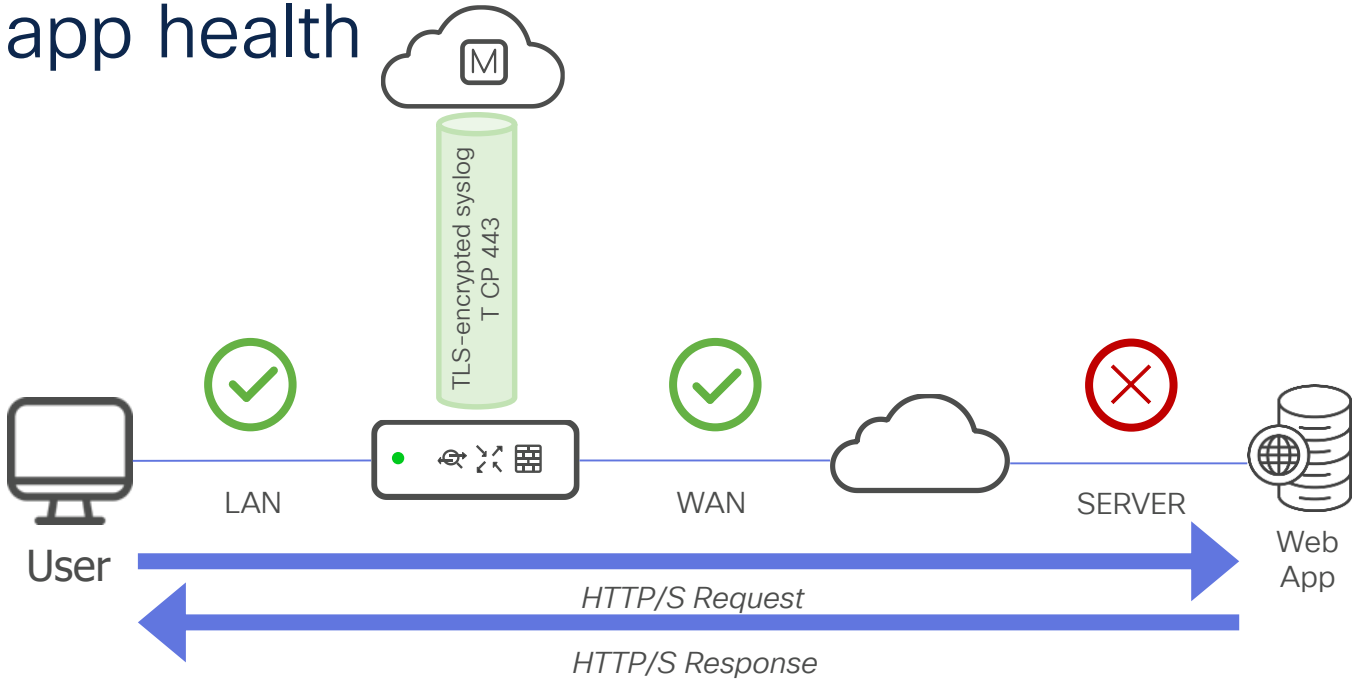
Web app health



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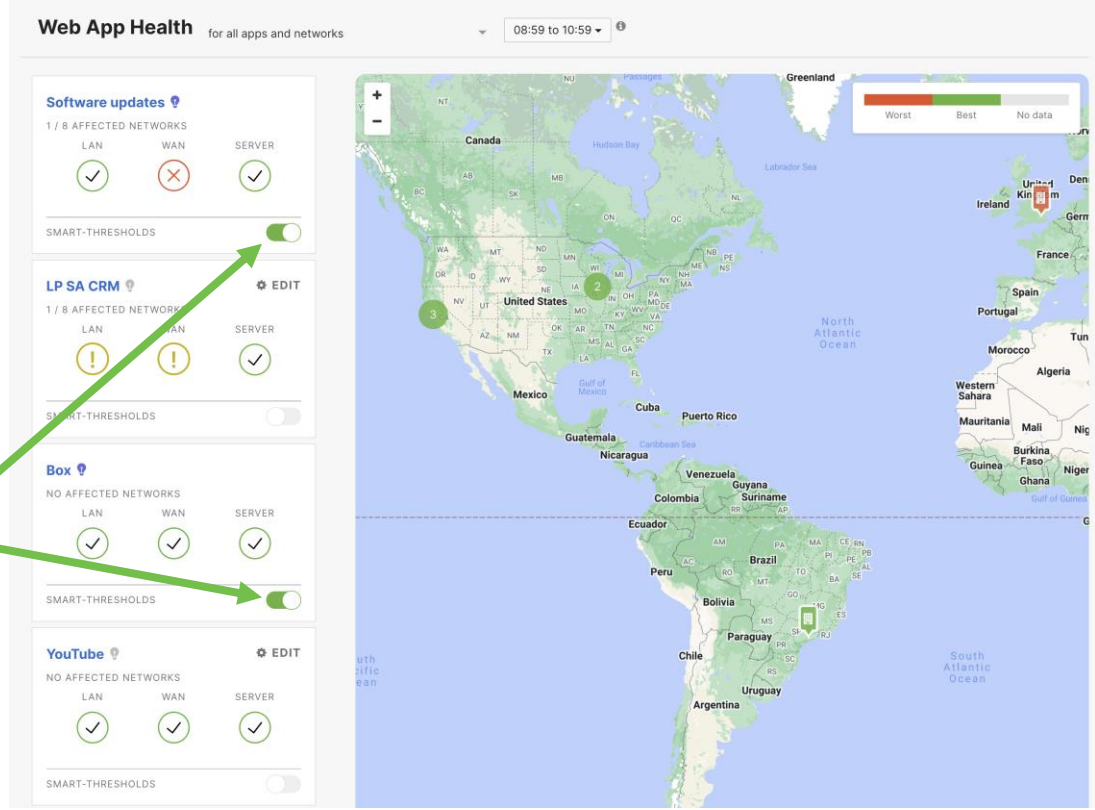
Web app health

- Differentiate performance analytics and troubleshooting between LAN, WAN, and public servers

Smart-thresholds for automatic alerting barriers unique for each location



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Web app health

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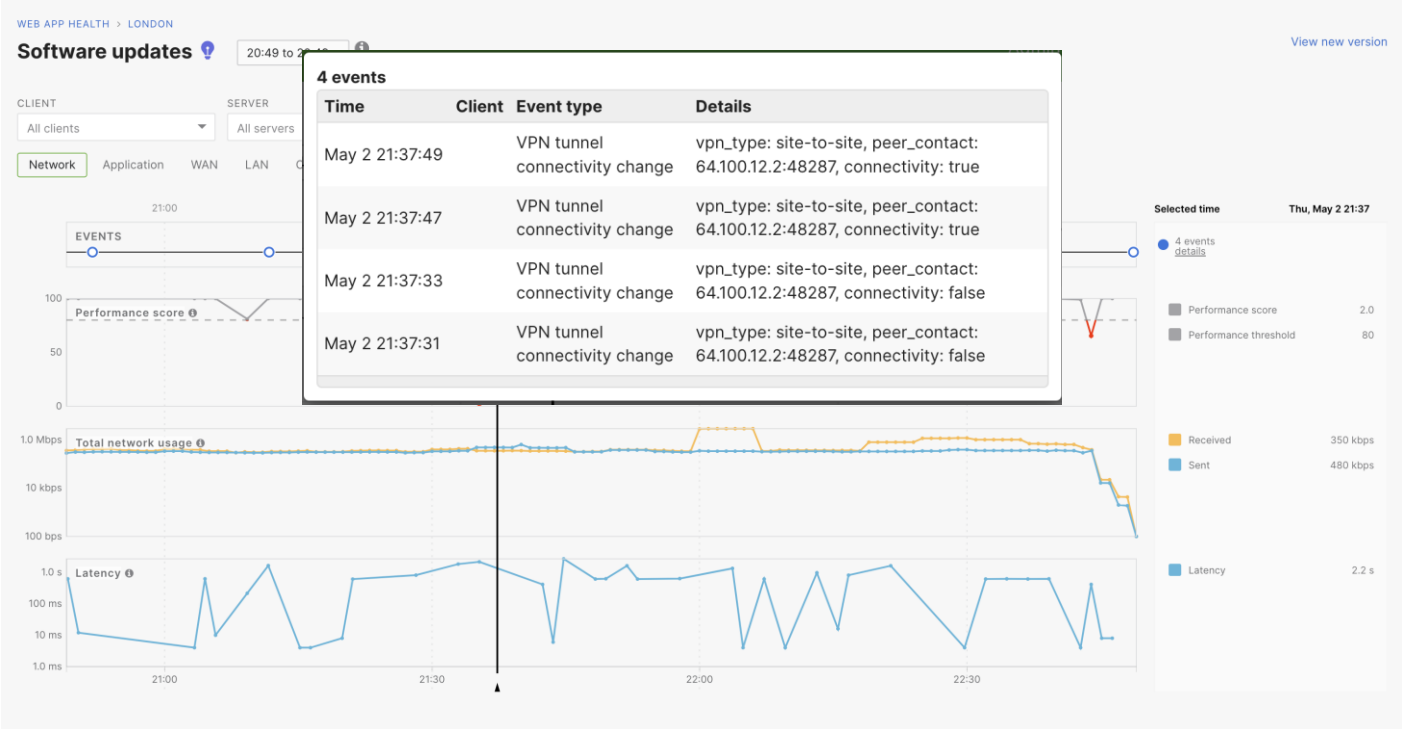
Web app health



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Web app health

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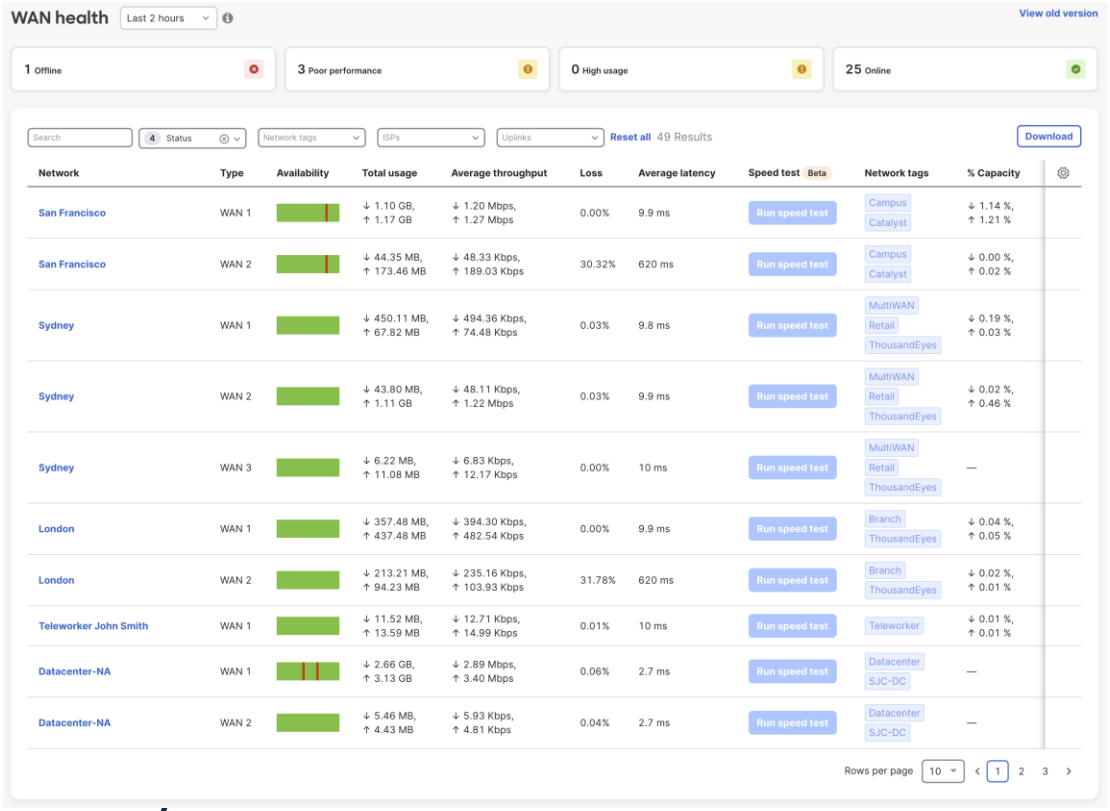
WAN Health



- At-a-glance for org-wide cellular and uplinks availability

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WAN Health

- Quickly isolate ISP issues and cellular failover

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WAN Health

- Detailed speed test results included history of previous tests

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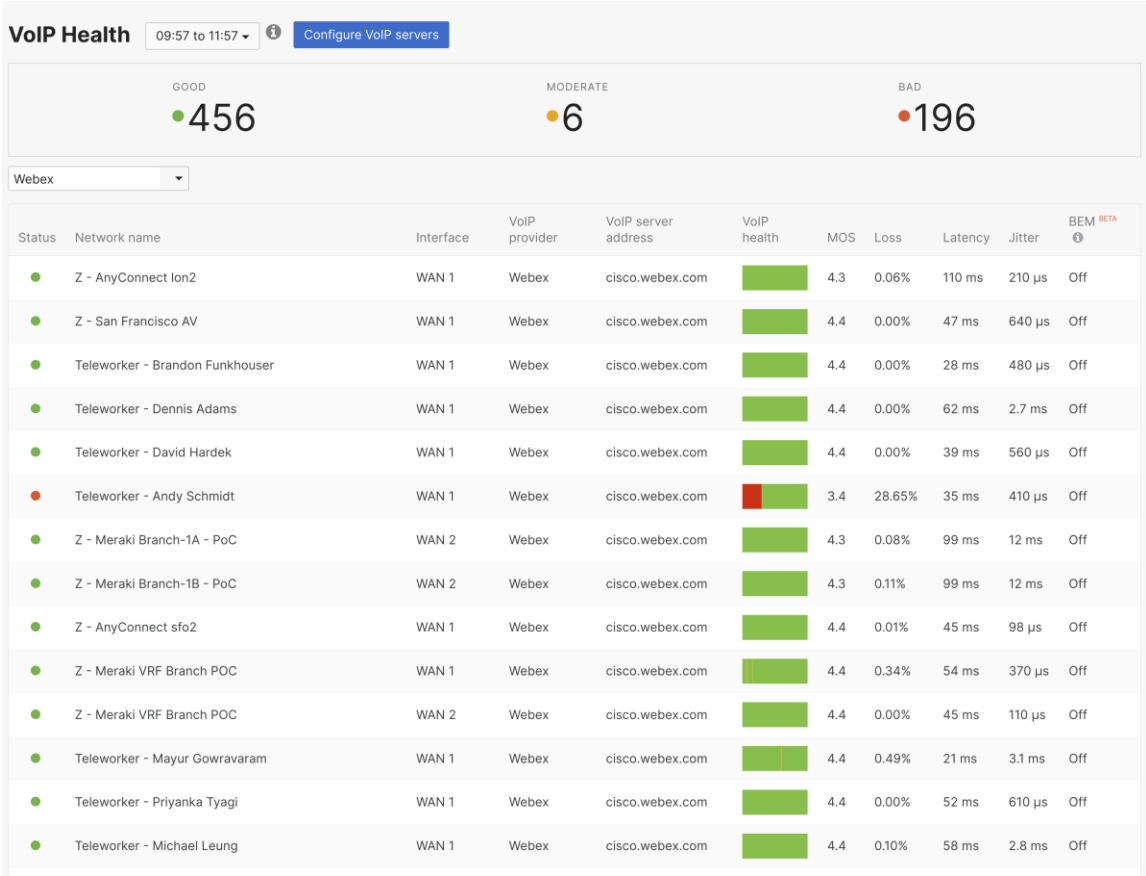
VoIP Health

- Track org-wide performance on SaaS and on-prem VoIP services on all uplinks



Status	Network name	Interface	VoIP provider	VoIP server address	VoIP health	MOS	Loss	Latency	Jitter	BEM BETA
●	Z - AnyConnect lon2	WAN 1	Webex	cisco.webex.com		4.3	0.06%	110 ms	210 µs	Off
●	Z - San Francisco AV	WAN 1	Webex	cisco.webex.com		4.4	0.00%	47 ms	640 µs	Off
●	Teleworker - Brandon Funkhouser	WAN 1	Webex	cisco.webex.com		4.4	0.00%	28 ms	480 µs	Off
●	Teleworker - Dennis Adams	WAN 1	Webex	cisco.webex.com		4.4	0.00%	62 ms	2.7 ms	Off
●	Teleworker - David Hardek	WAN 1	Webex	cisco.webex.com		4.4	0.00%	39 ms	560 µs	Off
●	Teleworker - Andy Schmidt	WAN 1	Webex	cisco.webex.com		3.4	28.65%	35 ms	410 µs	Off
●	Z - Meraki Branch-1A - PoC	WAN 2	Webex	cisco.webex.com		4.3	0.08%	99 ms	12 ms	Off
●	Z - Meraki Branch-1B - PoC	WAN 2	Webex	cisco.webex.com		4.3	0.11%	99 ms	12 ms	Off
●	Z - AnyConnect sfo2	WAN 1	Webex	cisco.webex.com		4.4	0.01%	45 ms	98 µs	Off
●	Z - Meraki VRF Branch POC	WAN 1	Webex	cisco.webex.com		4.4	0.34%	54 ms	370 µs	Off
●	Z - Meraki VRF Branch POC	WAN 2	Webex	cisco.webex.com		4.4	0.00%	45 ms	110 µs	Off
●	Teleworker - Mayur Gowravaram	WAN 1	Webex	cisco.webex.com		4.4	0.49%	21 ms	3.1 ms	Off
●	Teleworker - Priyanka Tyagi	WAN 1	Webex	cisco.webex.com		4.4	0.00%	52 ms	610 µs	Off
●	Teleworker - Michael Leung	WAN 1	Webex	cisco.webex.com		4.4	0.10%	58 ms	2.8 ms	Off

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VoIP Health

- Quickly identify VoIP degradation via hop-by-hop analysis

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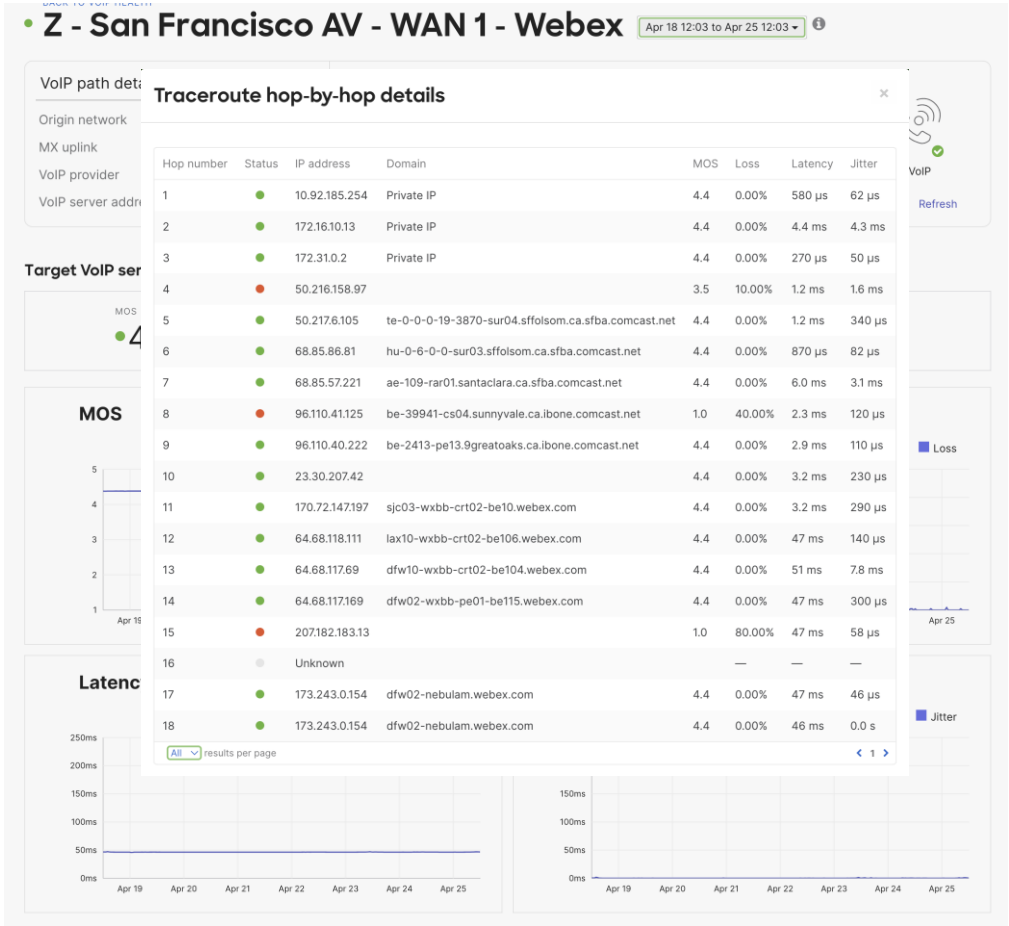
VoIP Health

- Quickly identify VoIP degradation via hop-by-hop analysis



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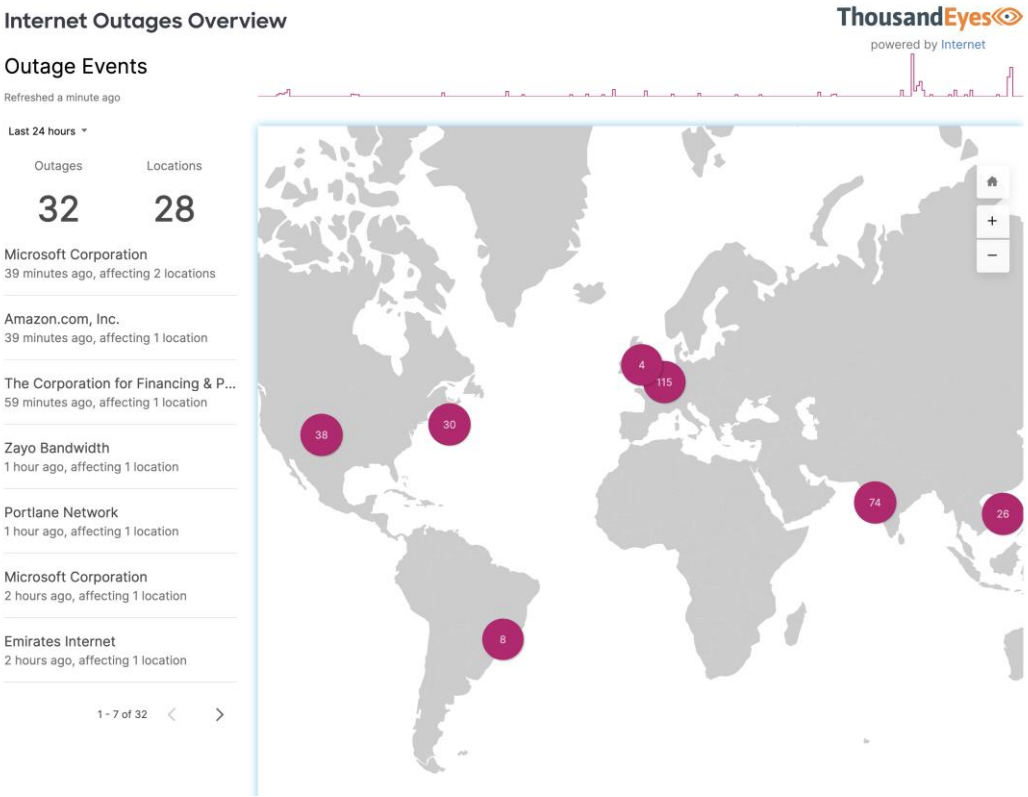
Internet Outages



- Global view of ISP outages powered by ThousandEyes
- Evaluate performance of other ISPs in your regional branches

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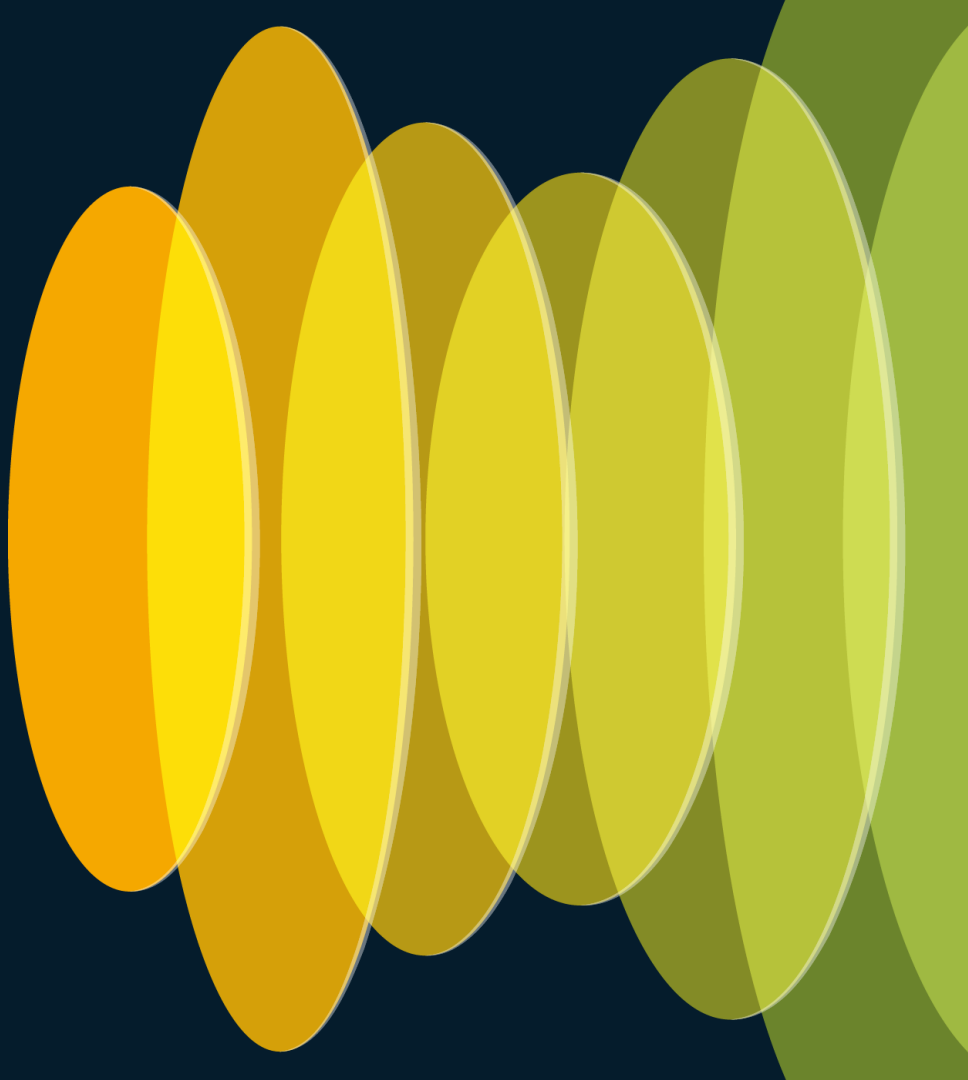
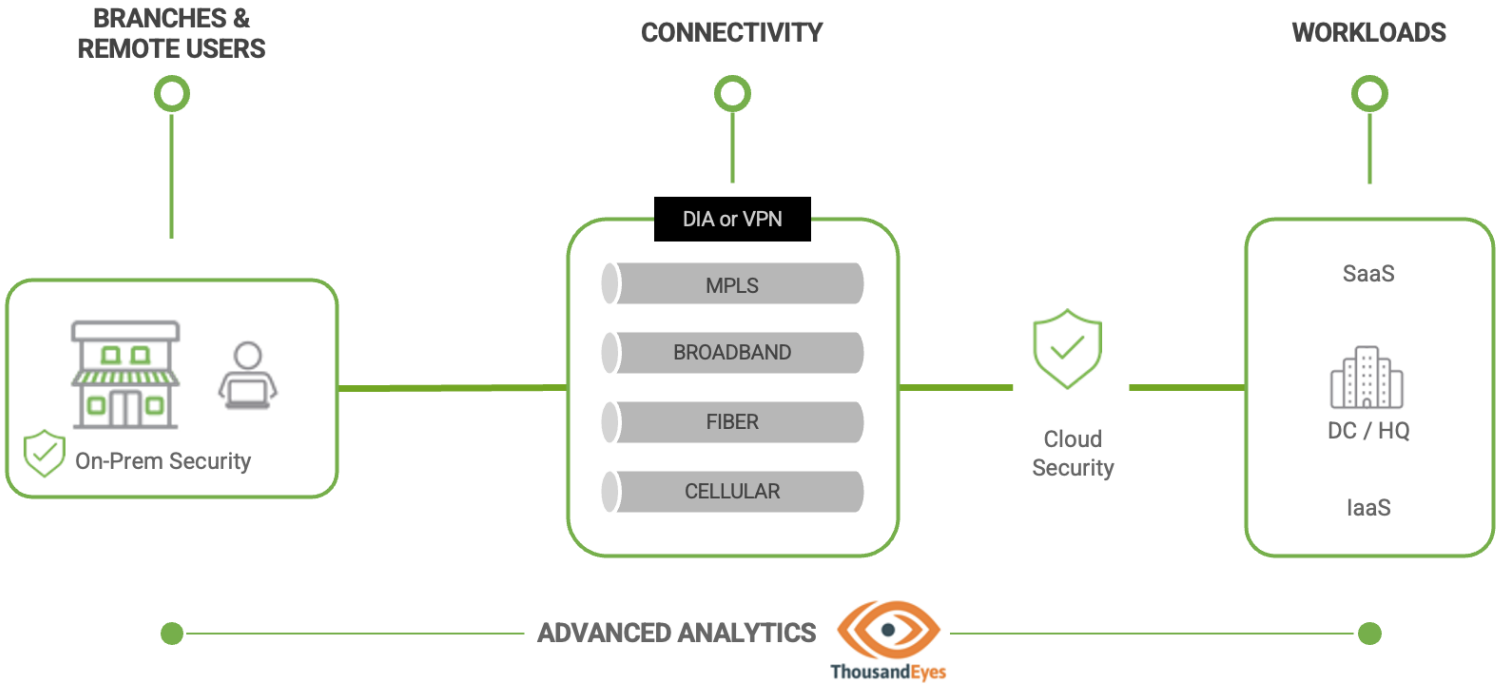
ThousandEyes Power



Active observability across every domain



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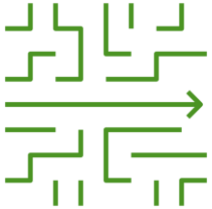
ThousandEyes Agent

Zero additional hardware needed

Always on visibility to monitor critical SaaS applications



Instantly activate ThousandEyes across your entire MX fleet in minutes

Integration includes 1 free test per SD-WAN+ license (up to 50)

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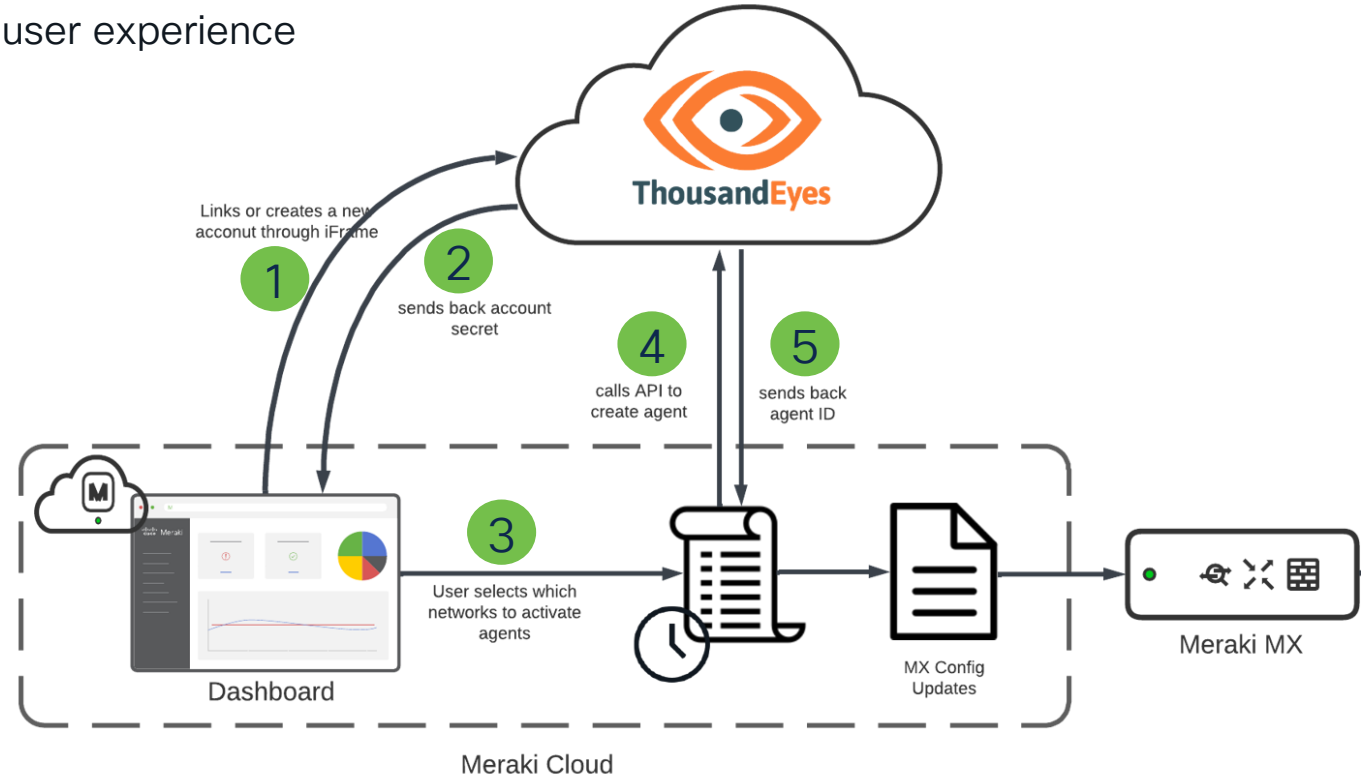
Agent Activation

Seamless user experience



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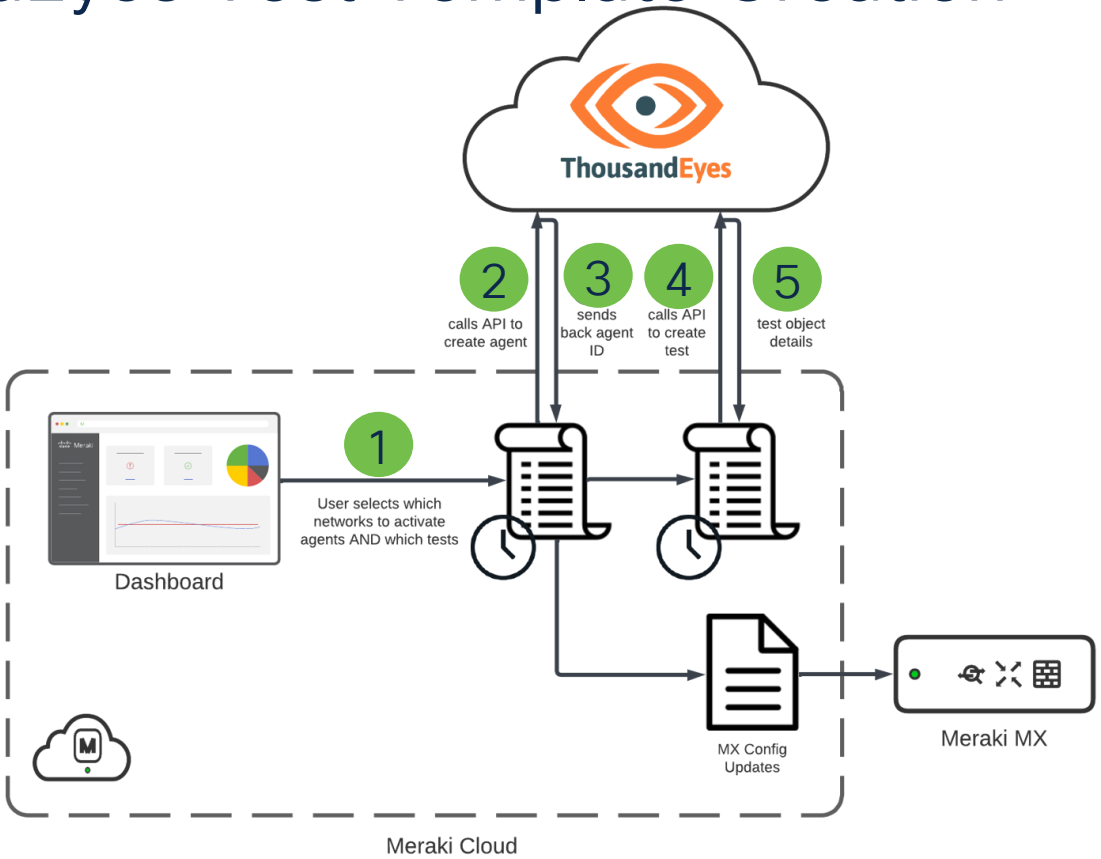
ThousandEyes Test Template Creation



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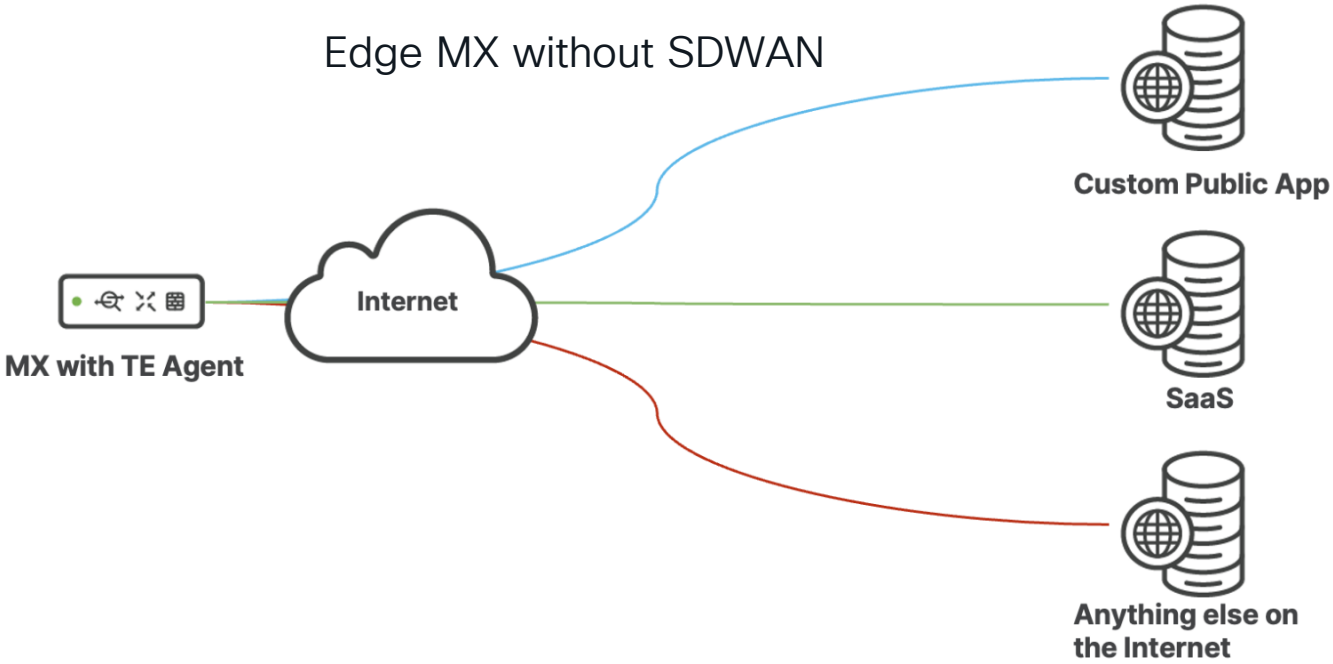
Deployment characteristics



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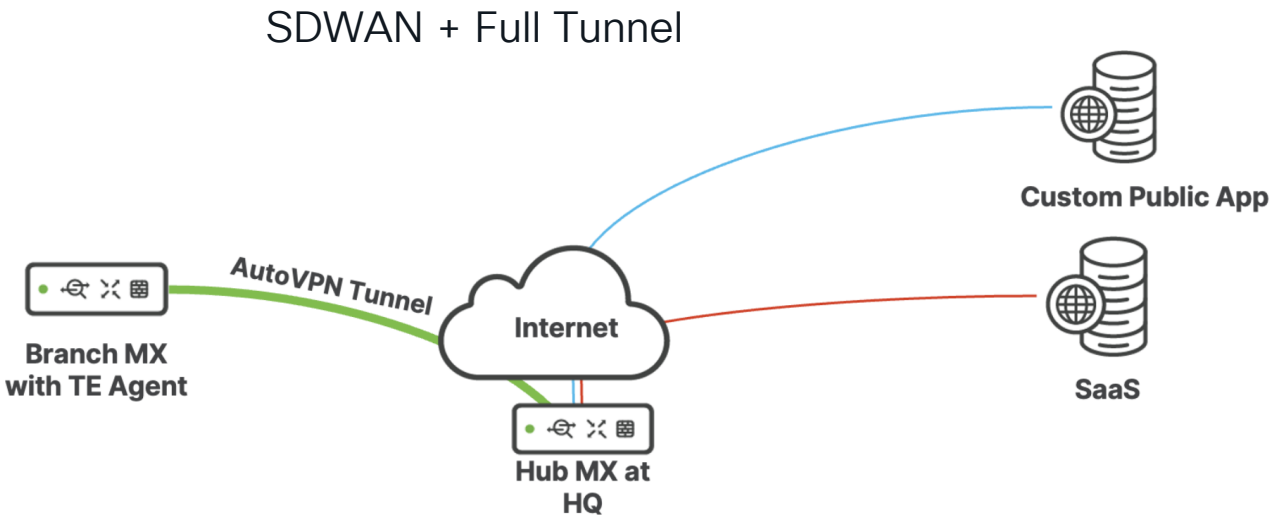
Deployment characteristics



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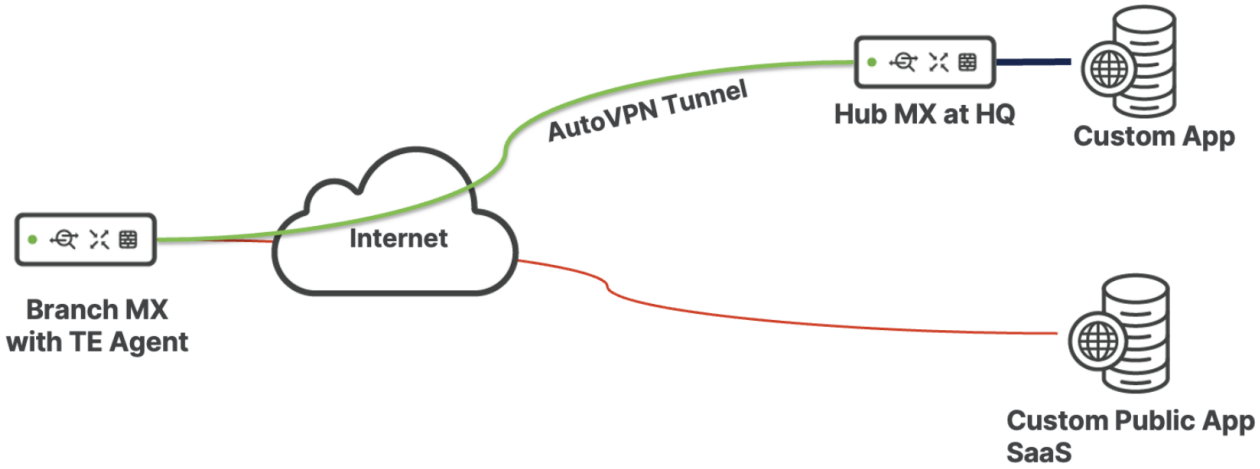
Deployment characteristics

SDWAN + Split Tunnel



Most Common Deployment

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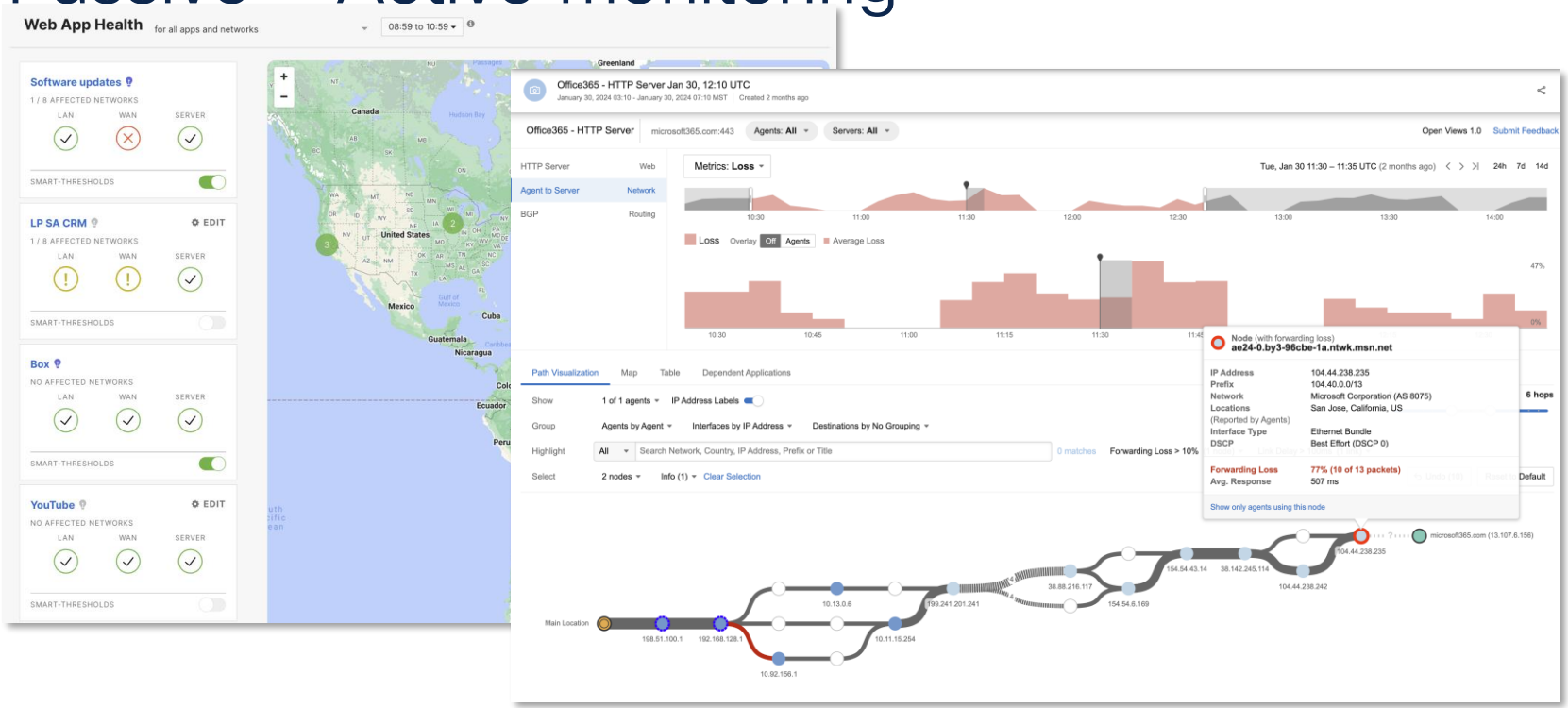
Passive + Active monitoring



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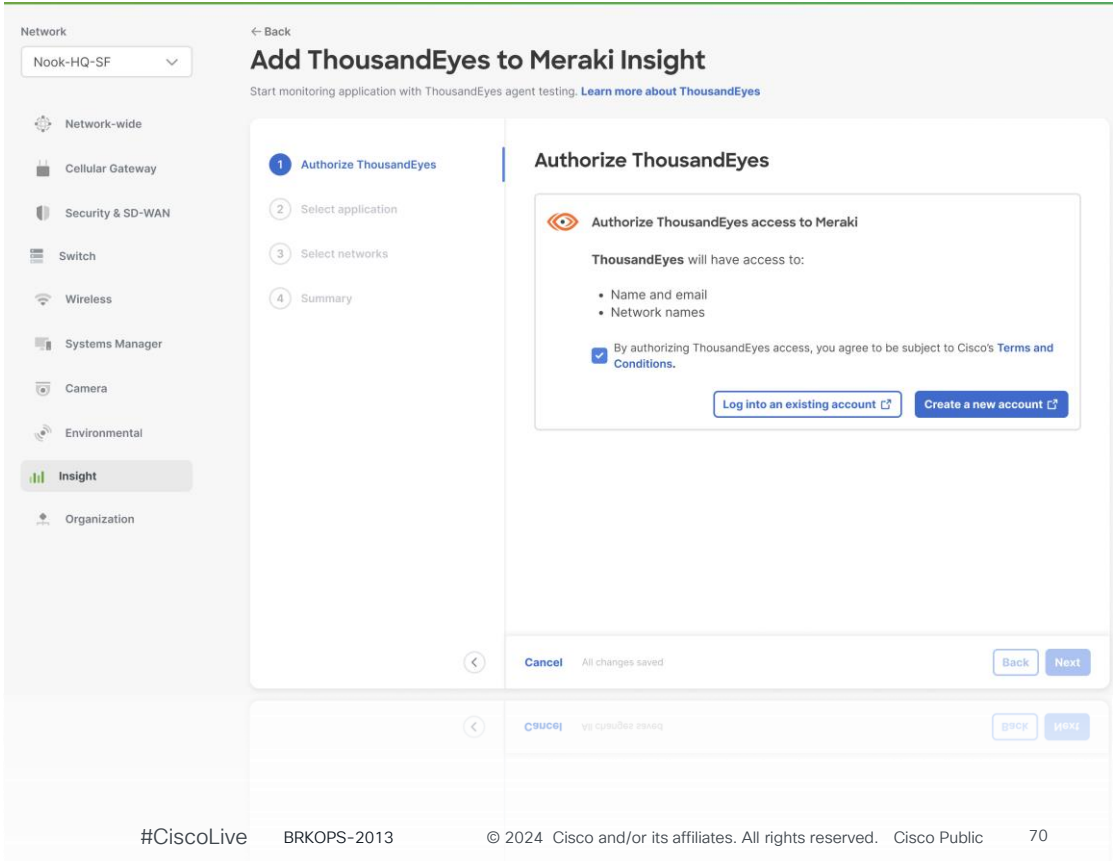
Linking accounts between two dashboards

- Simple onboarding user experience
- Supports existing or new ThousandEyes customers
- Built in workflow to create a new account if needed



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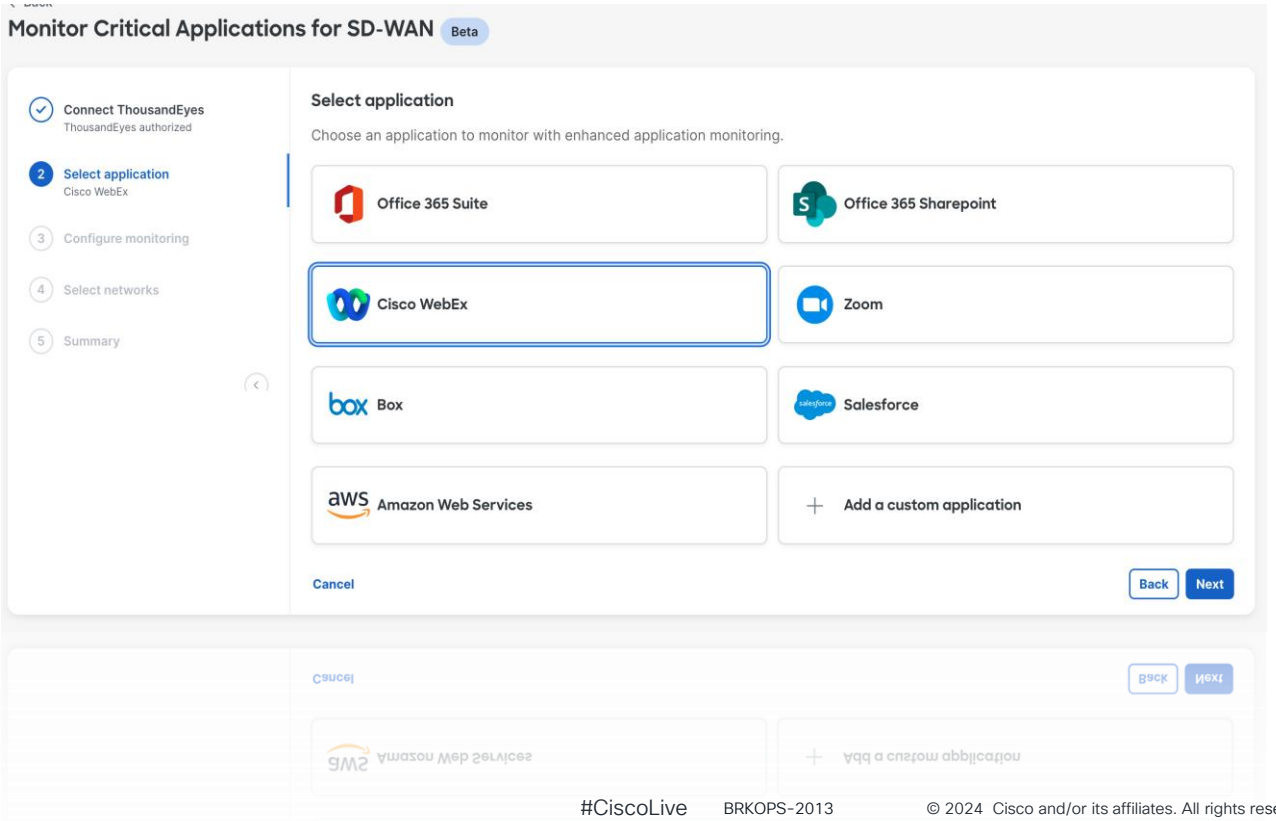
Activate application tests



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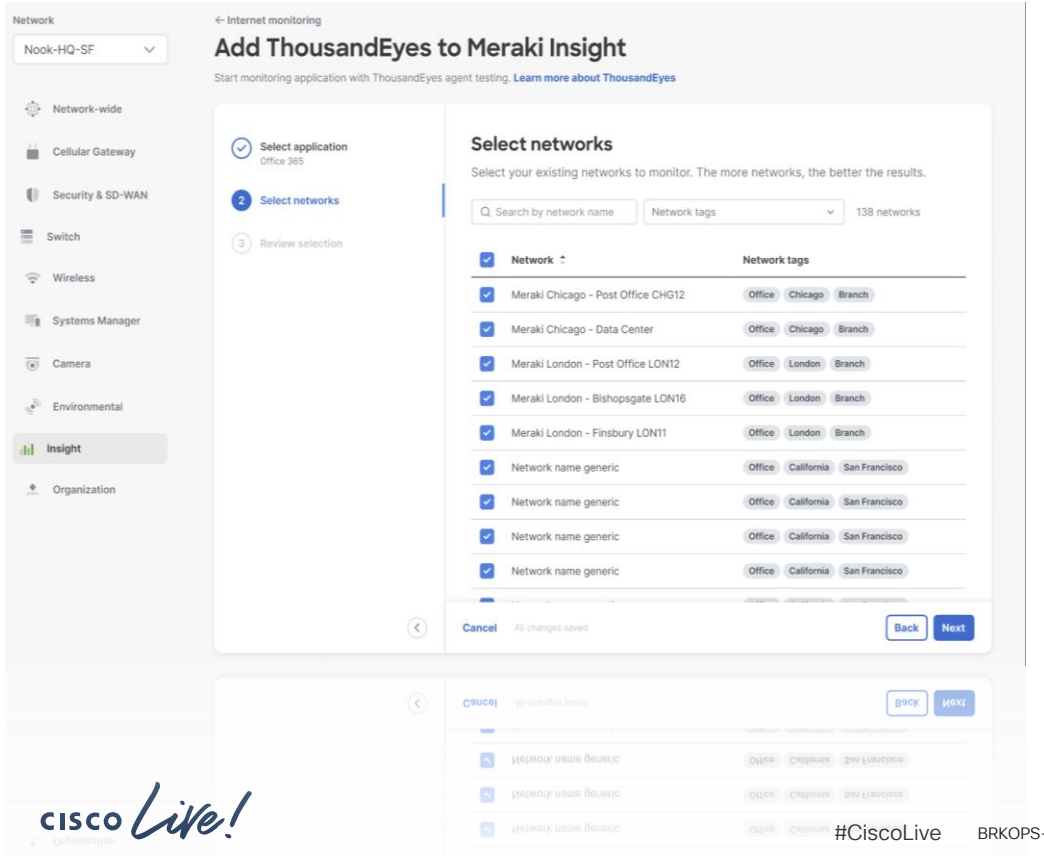
Activate agents: Select via tags



- Compatible networks will auto-populate (MX model and firmware dependence)
- Select networks individually or en masse

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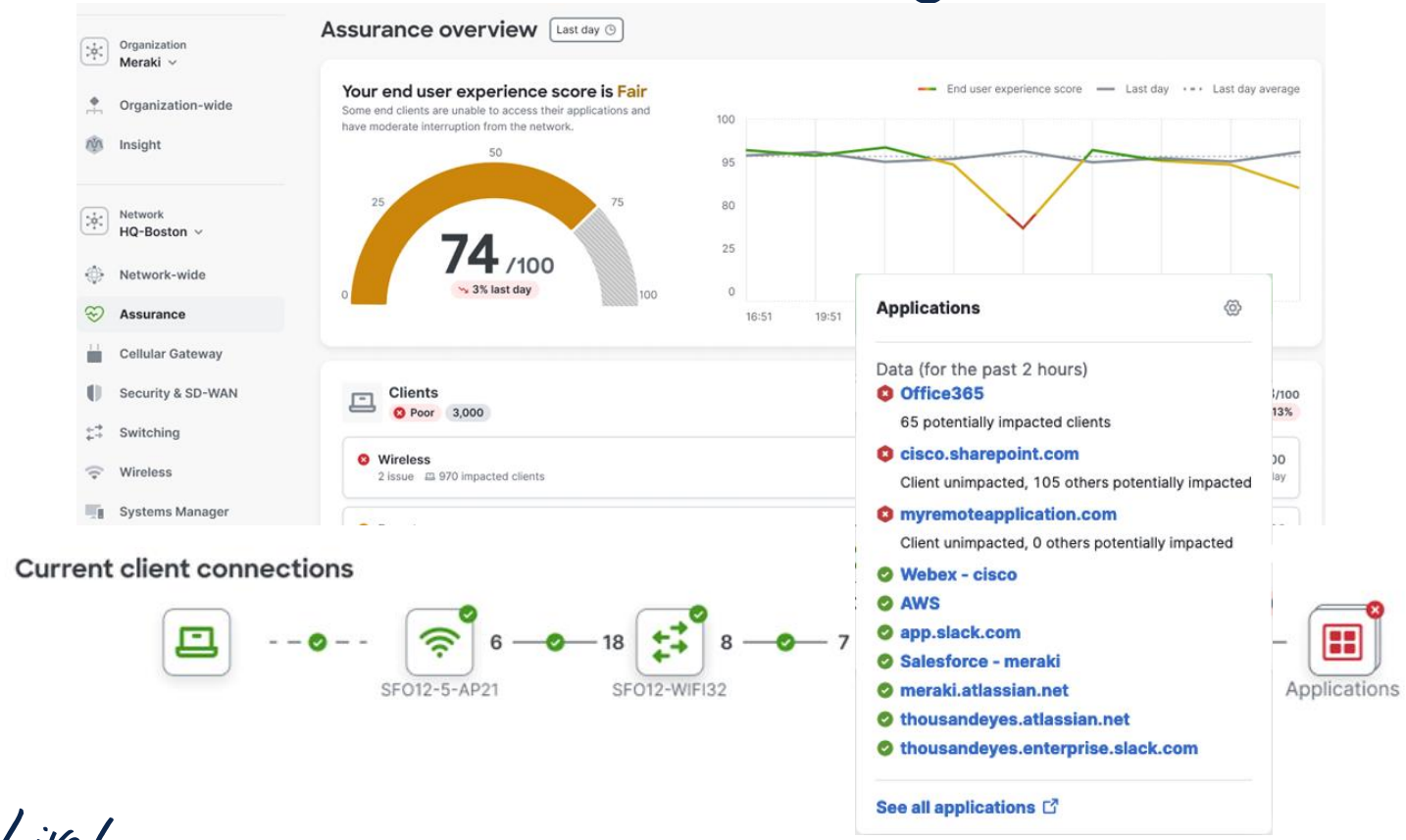
Meraki bi-directional data integration



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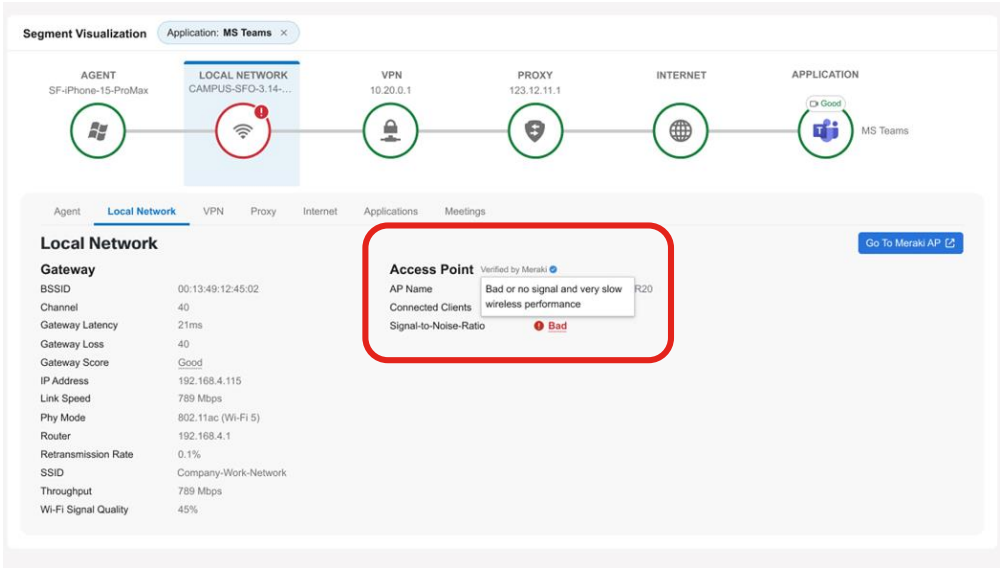
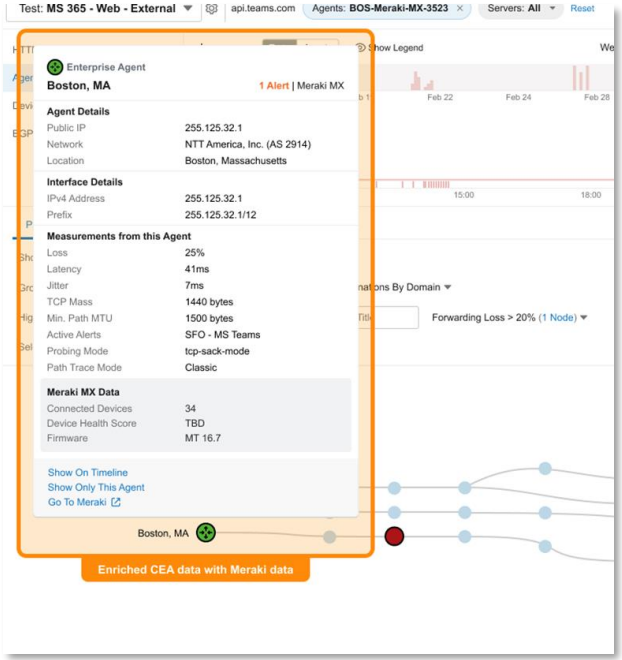
ThousandEyes enriched with Meraki data

Endpoint wireless health powered by Meraki MR



Path visualization with Meraki MX health data



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“Wrap it up, Hasstedt!”

Everyone in this room

...probably ;)

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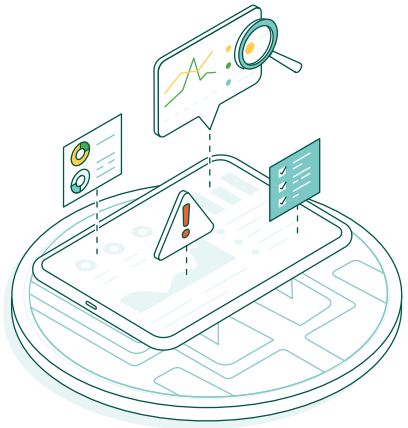
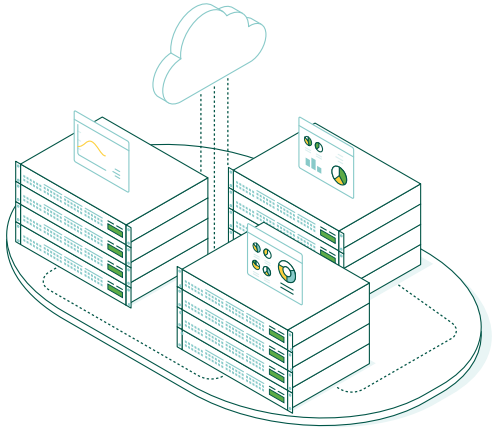
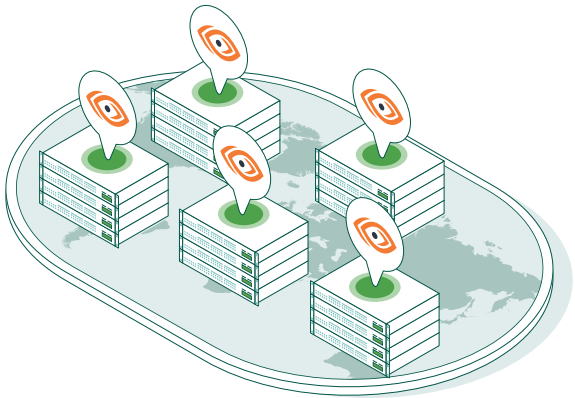
Conquer the tsunami of data



Device Health:
Targeted and correlated data, with recommended fixes has never been easier to navigate



Meraki Insight: Differentiate issues between LAN/WAN/Server and reduce troubleshooting time with passive monitoring



Meraki + ThousandEyes:
Always-on, active monitoring for critical SaaS infrastructure that deploys effortlessly on your existing MXs

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Thank you