The bridge to possible

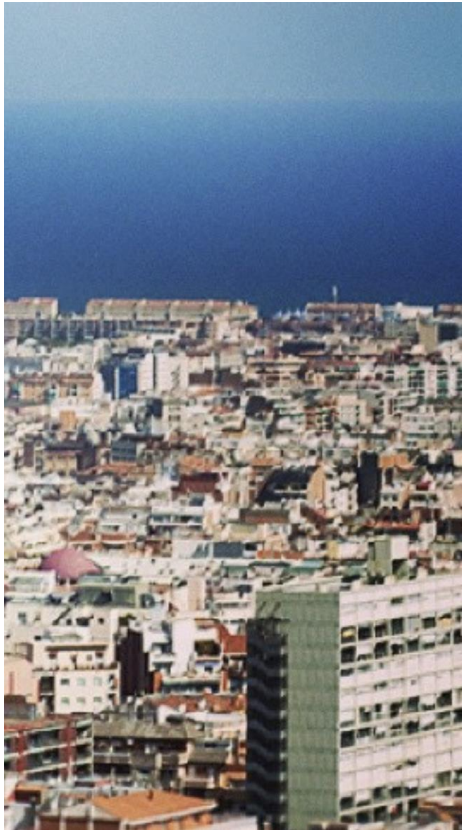
Meraki MX Inside and Out:

A Support Look at Design, Best Practices, and Troubleshooting

Serhii Kucherenko
Customer Escalations Engineer

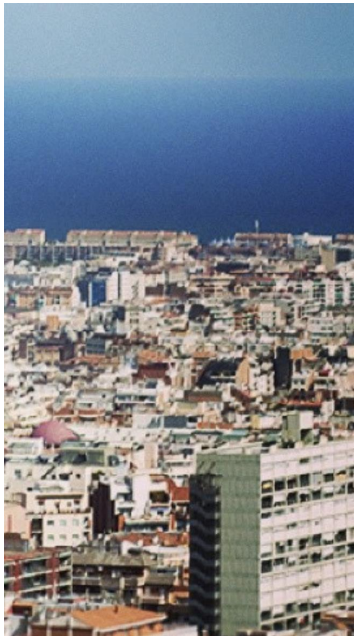
BRKTRS-2007

What can you tell about this place?



What if we put it into perspective -

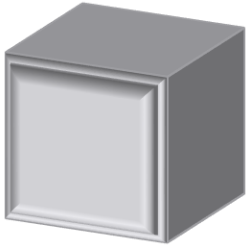
The ability to see the bigger picture matters during design maintenance and troubleshooting.



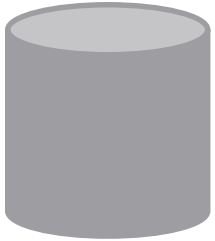
A real story …

Once upon a time, during network planning, I ordered Full POE+ switches that should be powered up from Rack PDUs. PDU power cords were ordered separately …

Find the way to put this



into the hole made for this



by using nothing but this …

A word about the speaker – less formal

- My dog smiles more than me.

- He also woofs with less accent than I speak.

- I try to spend as much time as possible with my son.

- He is secretly being prepared to join Cisco one day.

Cisco Webex App

Questions?

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

How

1. Find this session in the Cisco Live Mobile App
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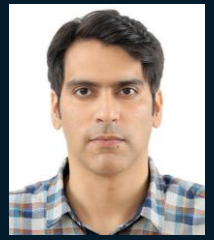
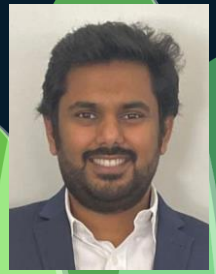
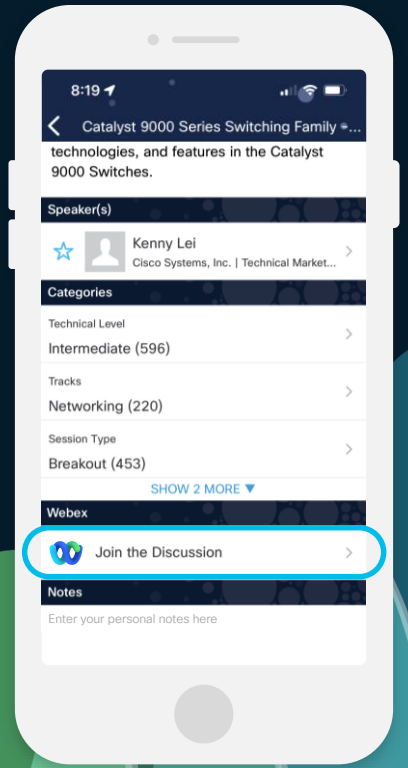
Chakshu Piplani
Senior escalation engineer (MX)



Abhishek Suresh
Senior escalation engineer (MX)





Additional content

The complete version of the slide deck, along with demos and documents mentioned throughout the session, are available for download –

Here

In case of any problems, please let me know:

skuchere@cisco.com

Content warning

- The challenge with design and troubleshooting sessions is that all environments are unique.

- Examples in this session may not cover your specific pain points. Yet, they should give you direction.

- If the session content doesn't address your specific problem, see me after the session or use Webex to post questions on your scenarios.

Agenda

- A warm-up
- MX performance - Best practices and caveats
- Unobvious Auto VPN
- Gamified troubleshooting case study

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What is your relationship with Meraki MX?

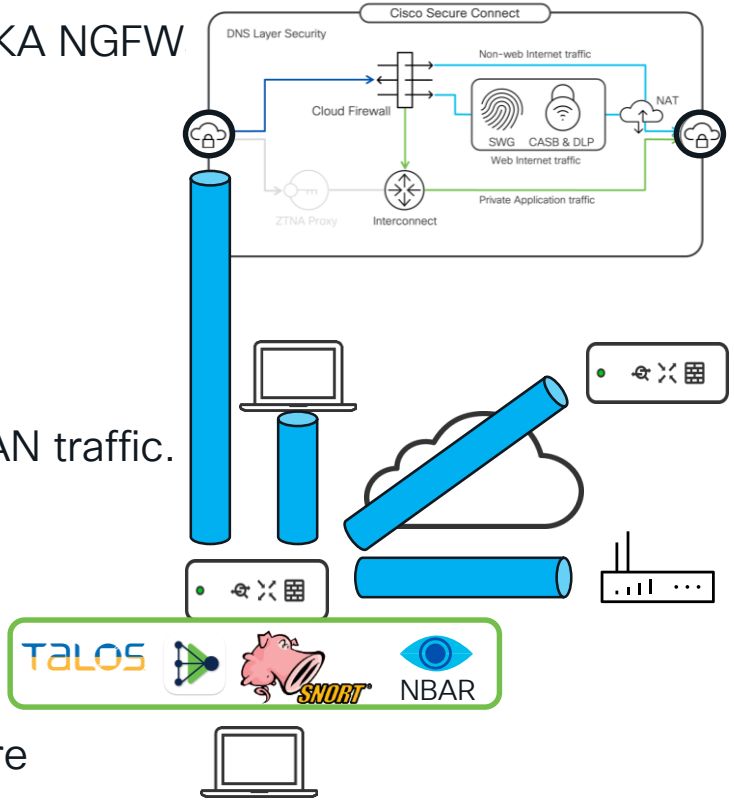
ⓘ Start presenting to display the poll results on this slide.

MX – all you need to know in one slide

For your reference

MX is an SD-WAN Security appliance (AKA UTM, AKA NGFW with the following main features:

- Stateful Firewall/NAT.
- Member of SD-WAN fabric based on Auto VPN.
- L7 firewall policies with user identity.
- Intelligent path selection for Internet and SD-WAN traffic.
- Snort-based IDS/IPS.
- TALOS-based content filtering.
- AMP/Umbrella/ for end-user protection.
- Third-party VPNs, RA VPNs, Part of Cisco Secure Connect (AKA Meraki SASE)



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For what problems do you typically open MX-related cases?

ⓘ Start presenting to display the poll results on this slide.

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What type of MX problems caused you the most pain?

ⓘ Start presenting to display the poll results on this slide.

Agenda

- A warm-up
- MX performance - Best practices and caveats
- Unobvious Auto VPN
- Gamified troubleshooting case study

MX performance - where do we start?

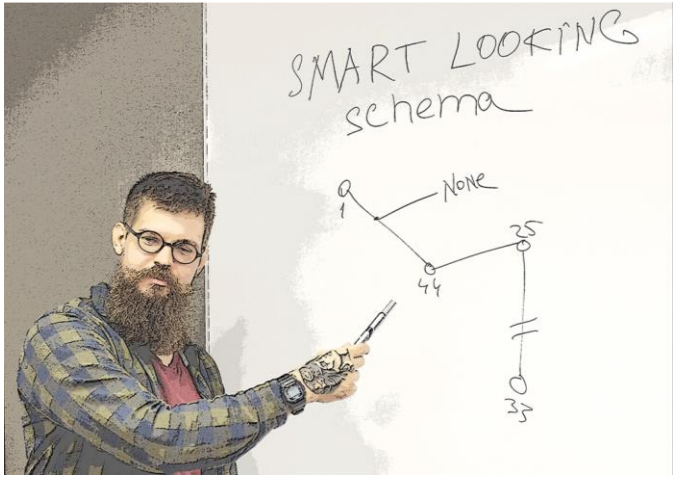
A sizing guide is our single source of truth during the design or troubleshooting.

- At the time of design activity, we wish to understand which MX model is the right pick for the given task/location.

- And during troubleshooting, we try to understand if the affected MX is within the recommended numbers.

MX Sizing Guide facts

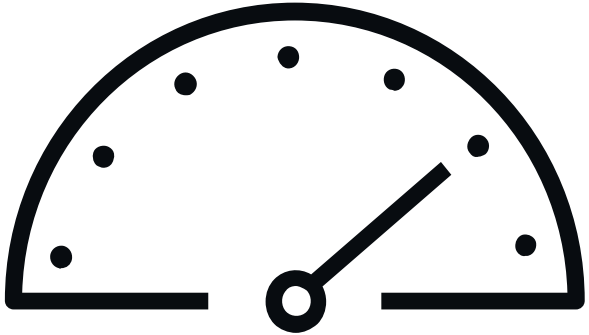
- The current sizing guide version is based on MX 18.2.
- The guide was migrated to the Meraki documentation website.
- Older versions of the guide are no longer published.
- Sizing guides for MX18.1, MX17, and MX16 are available in additional materials for this session.



Numbers of the most interest

The most critical MX performance metrics can be placed in the following groups:

- Throughput numbers (Next Generation Firewall, Advanced Security, VPN, etc.).
- VPN numbers (Maximum tunnel count, recommended tunnel count, maximum numbers for remote access VPN).
- Maximum Device Count.
- Maximum flow count.



Sizing guide 18.107 vs 18.2xx

A brief comparison immediately shows a significant increase in the Throughput numbers for the high-end MX platform:

18.107

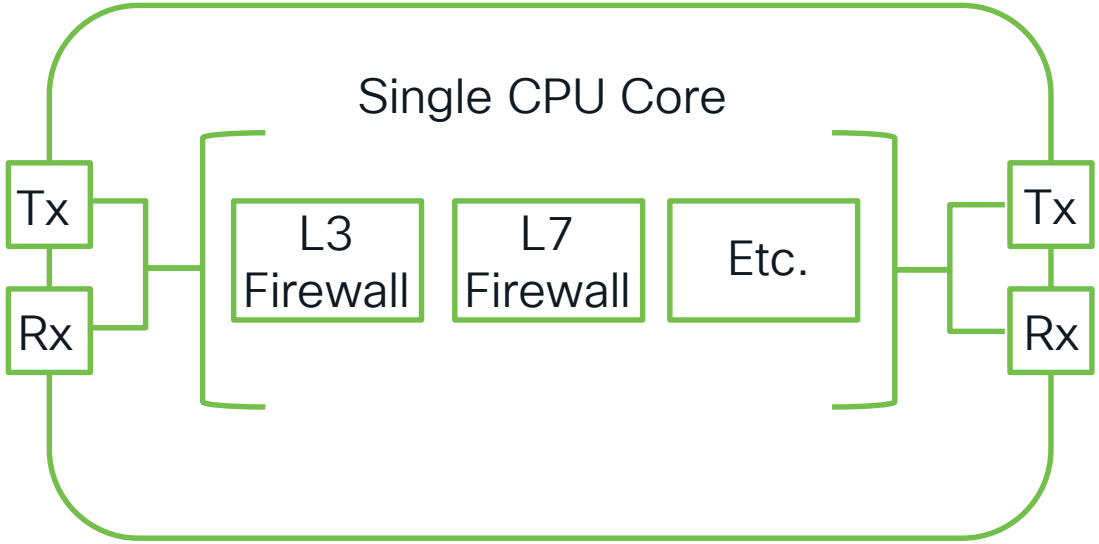
	MX67/68	MX75	MX85	MX95	MX105	MX250	MX450
Max stateful (Layer 3) firewall throughput in NAT mode with large payload file transfers	600 Mbps	1 Gbps	1 Gbps	2 Gbps	3 Gbps	4 Gbps	5 Gbps

18.2xx

	MX67/68	MX75	MX85	MX95	MX105	MX250	MX450
NGFW Throughput RFC2544 - 1518 Byte	600 Mbps	1 Gbps	1 Gbps	2.5 Gbps	5 Gbps	7.5 Gbps	10 Gbps

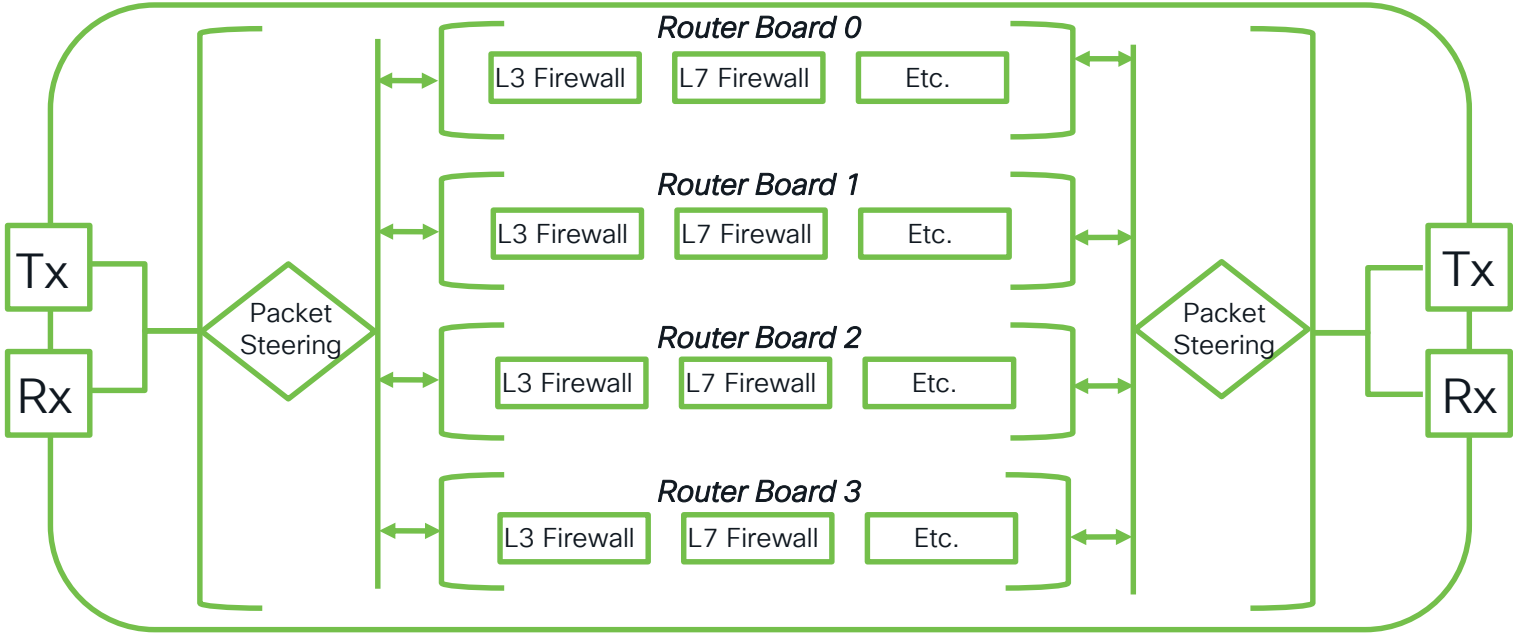
The engine of performance increase

Historically, MX used the below architecture for the packet processing:



The engine of performance increase

Starting from MX 18.2, a new architecture was adopted in which traffic processing was distributed across multiple cores. Each processing engine is called a ***Router Board***.



Where is it applicable?

The current state of different MX models:

- One router-board appliances: Z3, Z4, MX67, MX68
- Two router-board appliances: MX75, MX85, MX95, MX105, MX250
- Four router-board appliances: MX450
- Models that don’t support 18.2: MX64, MX65, MX84, vMX100

MX scaling parameters that are easily overlooked

- Scaling guide throughput VS real network traffic.
- Recommended Maximum Device Count on MX Hubs.
- Maximum Concurrent Sessions (Flow count)
- Recommended number of tunnels on hubs.

Scaling guide throughput VS real network traffic

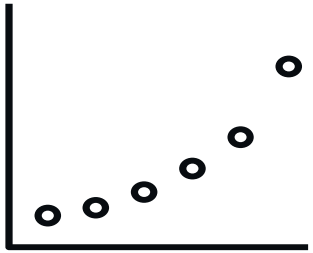
- The top number in the guide for each platform says:

NGFW
Throughput

RFC2544 - 1518 Byte

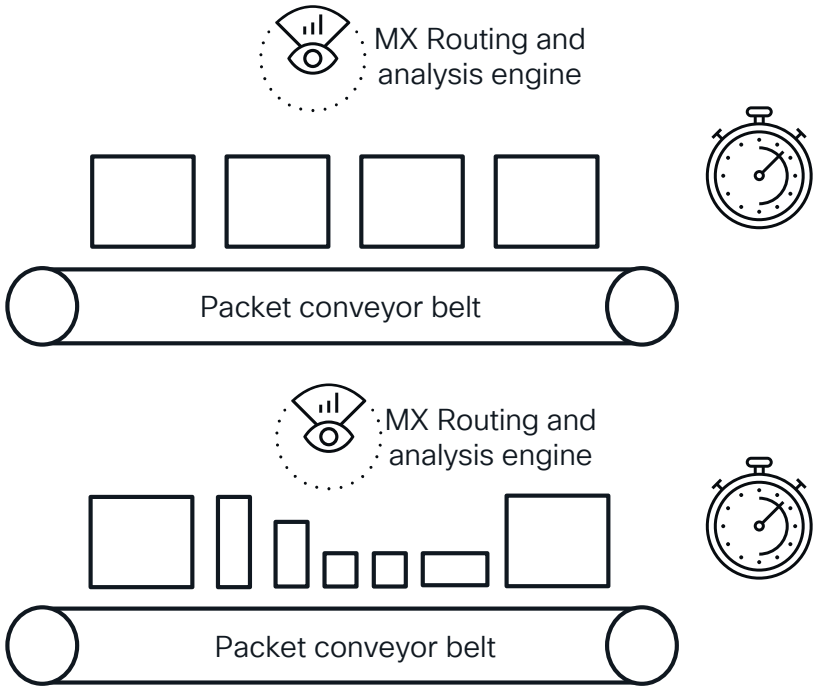
- This test is the most favorable for the device.

- The question that arises is - How it's applicable to the real network?



Test VS real life

- The combined volume of ‘boxes’ in both examples is the same.
- At the same time, due to the difference in the number of 'boxes', the MX has to perform more operations in the second example.
- 1 Gbps of traffic consisting of 1518-byte packets is not equal to 1Gbps of traffic composed of packets with random sizes.



Forecasting MX throughput – Disclaimer

- The forecast method presented further represents an analytical approach.

- The Meraki Escalation team uses it to establish a minimum expected throughput in the given network.

- During the design stage, it is always recommended that you consult with Meraki Sales Engineers when selecting devices for critical network points (data centers, VPN hubs, etc.).

Converting maximum throughput into the PPS

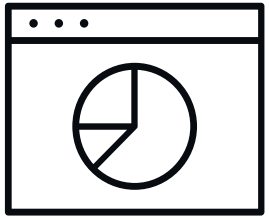
- To calculate the *minimum forecasted throughput*, we use *the maximum platform PPS* for the specific test and the *average packet size* in the given environment.

- The formula to calculate the Maximum platform's PPS:

NGFW Throughput RFC2544* (in bps) / 8 / 1518

- An example for MX450 (18.2)

$10 \times 10^9 / 8 / 1518 = 823452$ PPS

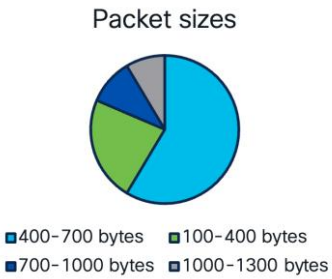


* – RFC2544 tests are used since packet sizes are known for them, which allows throughput to be converted to PPS.

How to get an average packet size

Multiple tools can be used to help with estimating real-life values:

- NetFlow Analysers (MX can be a NetFlow exporter)
- Statistics > Packet Lengths in Wireshark
- Built-in network equipment tools



Topic / Item	Count	Average	Min Val	Max Val	Rate (ms)	Percent	Burst Rate	Burst Start
Packet Lengths	100000	412.86	42	1514	20.6553	100%	57.2300	3.187
0-19	0	-	-	-	0.0000	0.00%	-	-
20-39	0	-	-	-	0.0000	0.00%	-	-
40-79	21995	59.42	42	79	4.5431	22.00%	12.6000	3.187
80-159	3534	117.50	80	159	0.7300	3.53%	2.6300	3.187
160-319	52067	214.55	160	319	10.7546	52.07%	30.5500	4.720
320-639	2573	467.70	320	638	0.5315	2.57%	1.5500	4.020
640-1279	2510	968.73	640	1279	0.5184	2.51%	1.5300	4.037
1280-2559	17321	1429.36	1280	1514	3.5777	17.32%	10.2900	3.187

```
HQ-Distribution-1#show interfaces Fi1/0/2 controller
```

Calculating the minimum forecasted throughput

- After we calculated the Maximum platform's PPS, we can use the below formula for the minimum forecasted throughput:

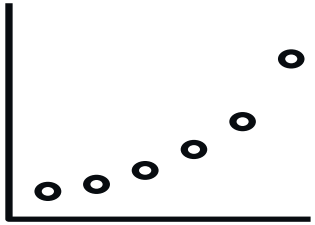
Maximum platform's PPS * Average Packet Size * 8

- For the network with an Average packet size of 500 bytes:

823452 PPS * 500 * 8 = 3,29* Gbps

- For the network with an Average packet size of 1000 bytes:

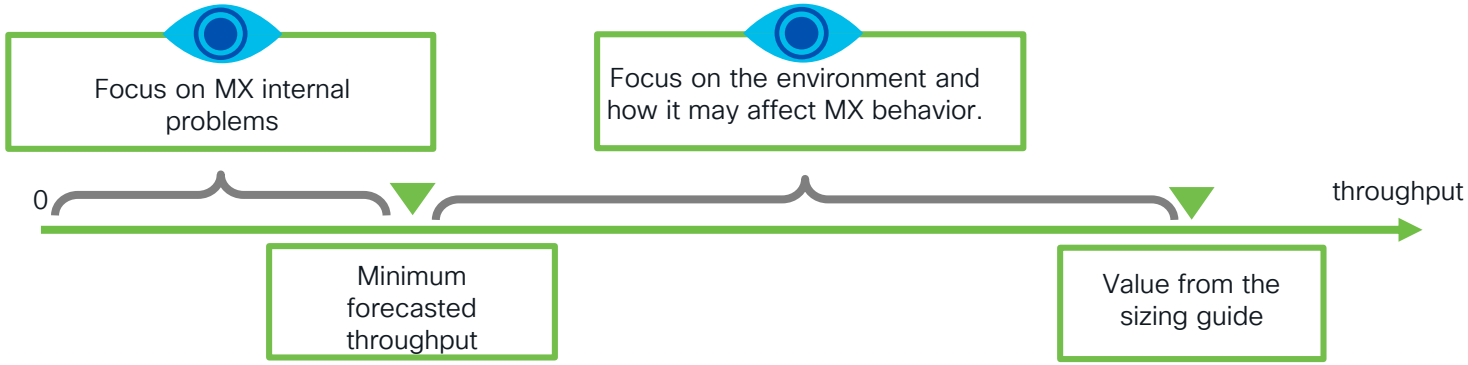
823452 PPS * 1000 * 8 = 6,59* Gbps



*–Analytical results are typically lower than accurate live testing would show, but they are useful as a reference point.

How the minimum forecasted throughput used

- At the time of investigation of MX performance issues, a one-axis performance graph can be established:

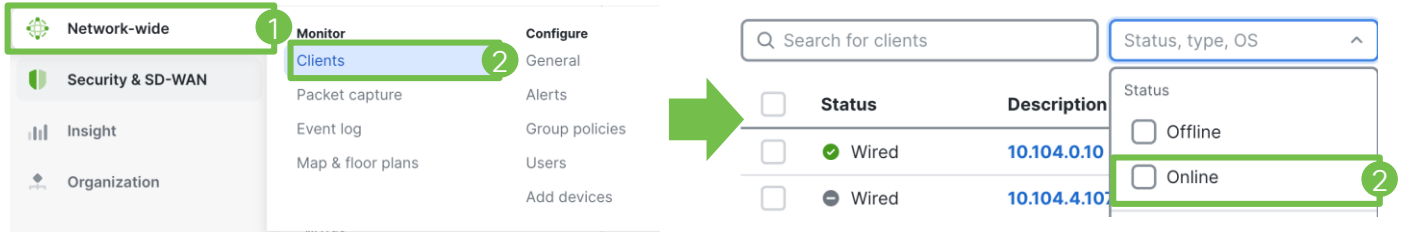


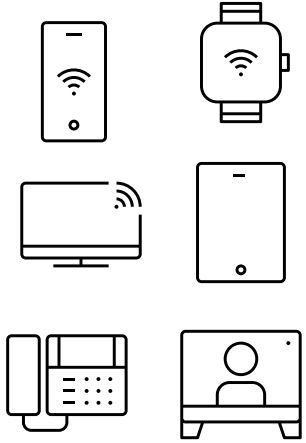
- During the design phase, the minimum forecasted throughput value can be used for conservative capacity planning.

Recommended Maximum Device Count

- In standard MX terminology, ‘Device’ means an active IP or MAC discovered on the appliance's LAN side.

- In the case of ‘branch’ MXs, getting a number of active devices is straightforward.





- Exceeding the number of recommended clients is a rare situation for the 'branch' MXs

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How many clients will DC-MX report when tracking by MAC is enabled?

ⓘ Start presenting to display the poll results on this slide.

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During the design phase, what number of clients should be used as a target for DC-MX if all remote devices use DC applications?

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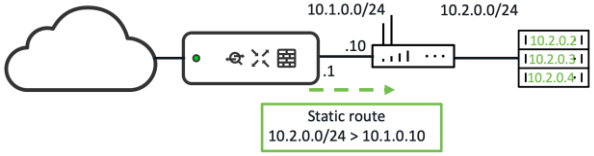
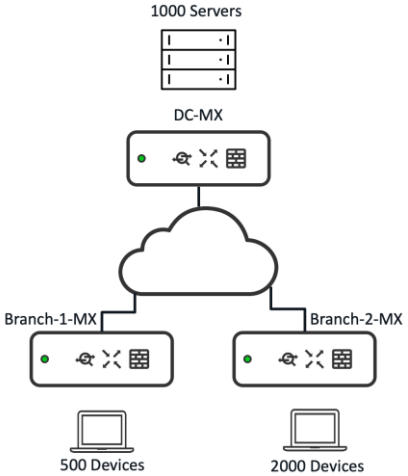
Recommended Maximum Device Count (Hub)

The situation is less straightforward in the case of Routed mode Hub or One-Armed Concentrator.

- Clients in MX networks are tacked by MAC (default). In the Routed DC, this does not help much in counting LAN-side clients correctly.
- Routed hubs can be configured to track by IP, but this is not recommended for One-Armed Concentrators (as they start considering external IPs as clients).
- Clients located on remote sites that use resources placed behind the hub should be considered as hub clients at the time of network design and evaluation.

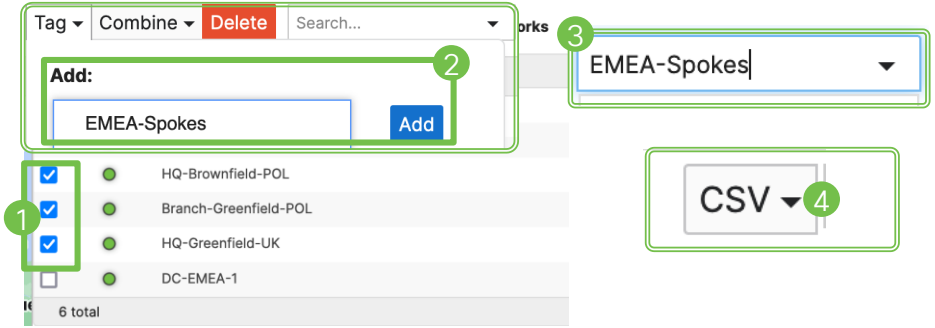




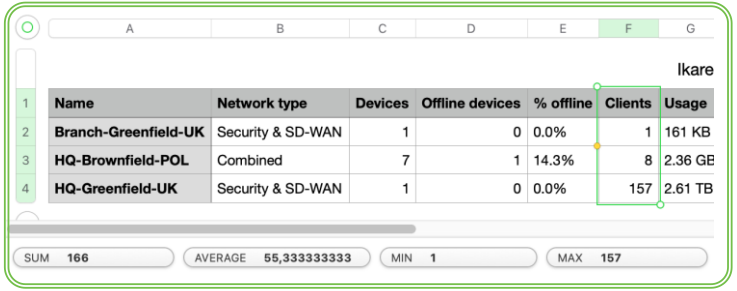
Recommended Device Count – getting a number

Unfortunately, there is no straightforward way to get the number of clients that cross the hub, but some best practices can be applied:

- Add a specific tag to all spokes that use a hub so that they can be filtered in *Organization > Overview* to extract results as CSV.



- Meraki APIs can be used to obtain more accurate data.



Ikare

	Name	Network type	Devices	Offline devices	% offline	Clients	Usage
2	Branch-Greenfield-UK	Security & SD-WAN	1	0	0.0%	1	161 KB
3	HQ-Brownfield-POL	Combined	7	1	14.3%	8	2.36 GE
4	HQ-Greenfield-UK	Security & SD-WAN	1	0	0.0%	157	2.61 TB

SUM 166 | AVERAGE 55,333333333 | MIN 1 | MAX 157

```
GET    {{baseUrl}}/organizations/{{MyOrgID}}/appliance/vpn/stats?networkIds[]={{EMEA-DC-1-Network}}
```

```
GET    {{baseUrl}}/networks/{{EMEA-Spoke-1-Network}}/clients?statuses[]=Online
```

MX limits – flow count

- In the latest version of the sizing guide, information on ‘Maximum Concurrent Sessions’ was added for all platforms.

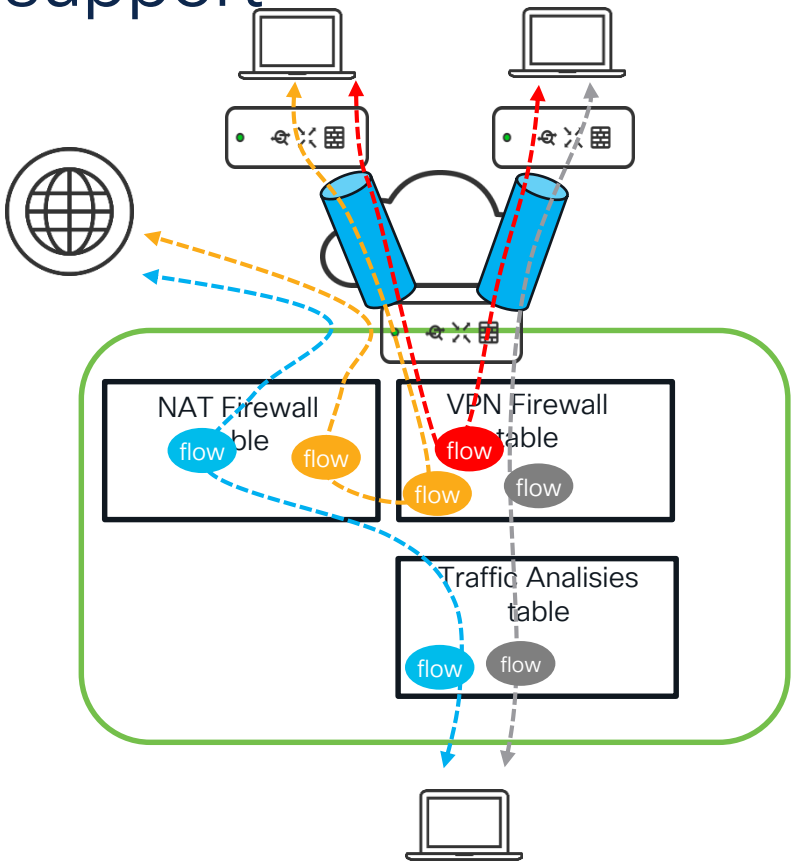
	MX95	MX105	MX250	MX450
Maximum Concurrent Sessions	200,000	250,000	500,000	1,000,000

- The numbers provided show absolute platform capacity and can't be considered as a target for planning.

- As of today, the only way to get to know the number of flows that MX is processing is to contact support.

MX flow limits – talking with support

- MX has multiple flow tables.
- The three most common are ***Traffic Analysis***, ***NAT Firewall***, and ***VPN Firewall***.
- Exceeding flow capacity in any of the tables may result in MX instability.
- Depending on traffic source/destinations, flow can be created in one or more tables.



MX unobvious recommendation for the flow count

- In the latest version of the sizing guide, an implicit number for recommended flows was introduced.

Use Case Recommendations

A use case recommendation is based off of the device throughput; available feature set, and max
considered to consume up to 50 flows.

A use case recommendation is based off of the device throughput; available feature set, and maximum flow table capacity. In this calculation, each client is considered to consume up to 50 flows.

MX-Series

	MX67	MX68	MX75	MX85				
Recommended Maximum Device Count	50	50	200	250	500	750	2,000	10,000

- This allows us to introduce the formula for the 'maximum recommended' number of flows.

Recommended Maximum Device Count * 50 = 'maximum recommended flow count

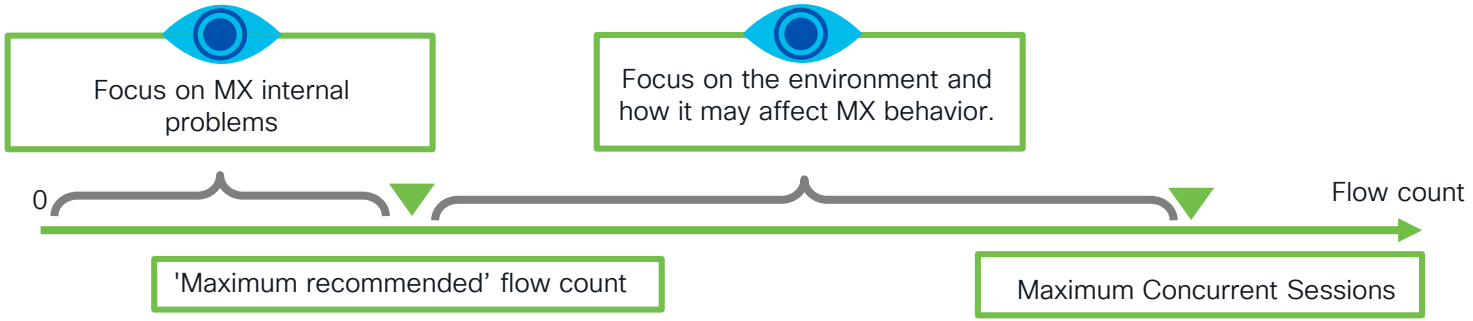
Closure on MX flow count

For your reference

- After performing a simple calculation, we can get a table with ' the 'maximum recommended' flow count:

	MX67	MX68	MX75	MX85	MX95	MX105	MX250	MX450
'Maximum recommended' flow count	2500	2500	10000	12500	25000	37500	100000	500000

- Now a one-axis graph for the flow count can be created:



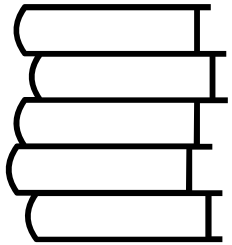
MX Recommended number of tunnels

- When it comes to the tunnel counts, we are given two numbers.

	MX67	MX68	MX75	MX85	MX95	MX105	MX250	MX450
Maximum Site to Site VPN Tunnel Count	50	50	75	200	500	1,000	3,000	5,000
Recommended Maximum Site to Site VPN Tunnel Count	50	50	75	100	250	500	1,000	1,500

- ‘Maximum Site-to-Site VPN Tunnel Count’ represents the maximum number of AutoVPN and non-Meraki VPN (NMVPN) tunnels that the given model can establish.

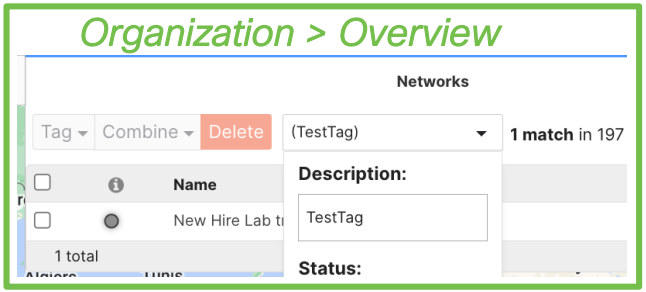
- The ‘Recommended Maximum Site-to-Site VPN Tunnel Count’ represents the number of tunnels that MX can handle without a severe increase in utilization.

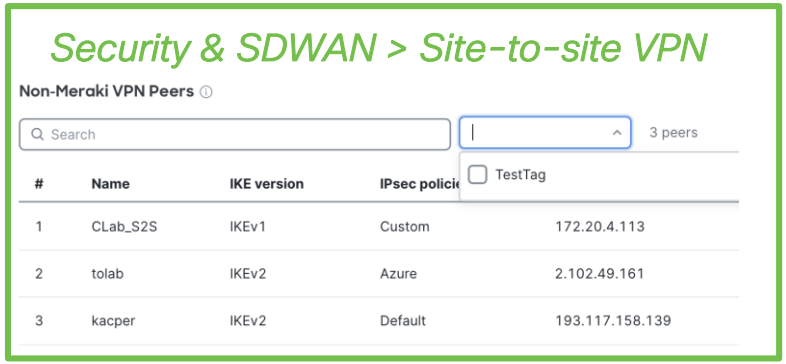


The math behind tunnel count - NMVPN

To get the number of NMVPN peers for the given MX:

- Locate the MX and check the Tags assigned to it.
- Filter NMVPN peers by the Tags assigned to the MX.
- If no tags are configured, all MXs establish tunnels to all NMVPN peers.





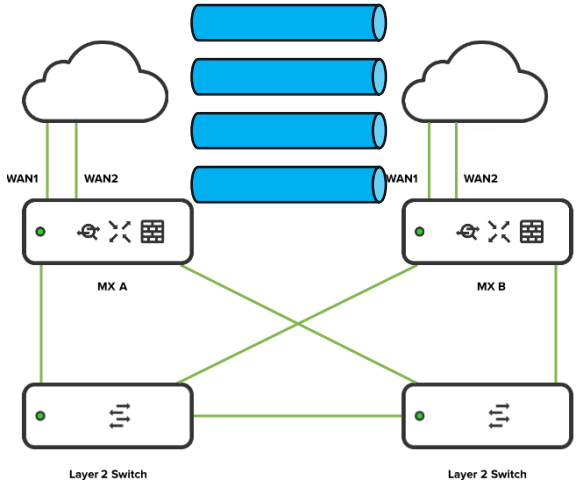
The math behind tunnel count – Auto VPN

- Typically, Hubs are appliances where it's essential to control the number of tunnels.
- By default, hubs establish tunnels to all other hubs and all attached spokes.
- The configuration of 'Active-Active AutoVPN' affects the actual tunnel count.

Security & SDWAN > SD-WAN & traffic shaping

Active-Active AutoVPN

- (●) Enabled
  Create VPN tunnels over all of the available uplinks (primary and secondary).
- ( ) Disabled
  Do not create VPN tunnels over the secondary uplink unless the primary uplink fails.



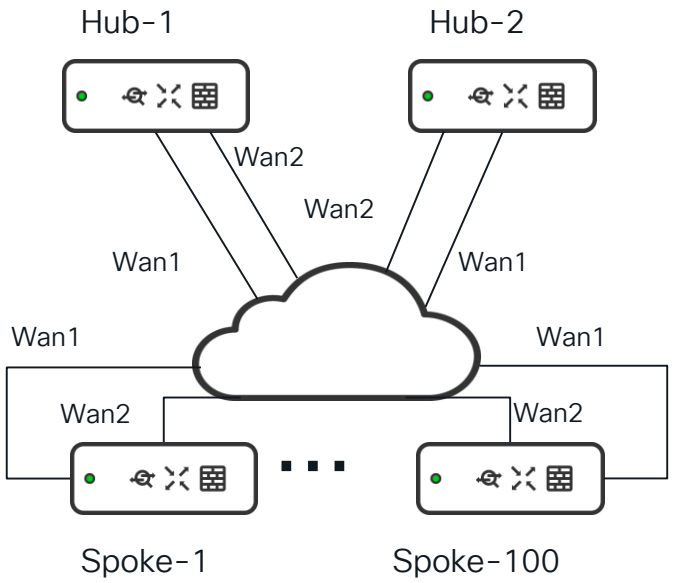
The math behind tunnel count Auto VPN

- The formula below can be used for the calculation. 'S' is the number of spokes, 'H' is the number of Hubs, and 'L' is the number of links on each device.

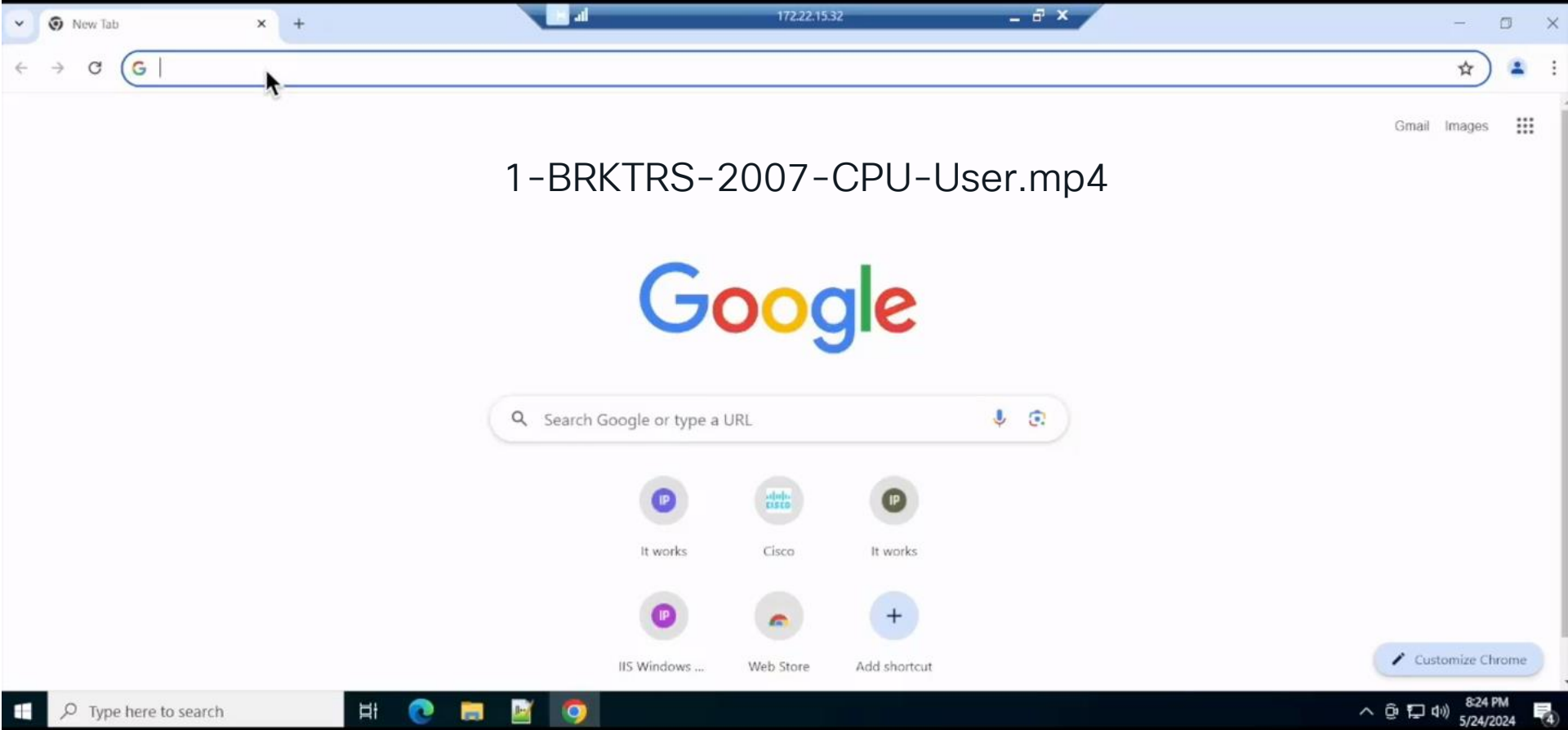
Formula: Hub Tunnels = [S + (H-1)] * 2 * L

- For our example:

$$[100 + (2-1)] * 2 * 2 = 404$$



Performance problems – from theory to practice


New Tab
172.22.15.32
Gmail
Images
1-BRKTRS-2007-CPU-User.mp4
Google
Search Google or type a URL
It works
Cisco
It works
IIS Windows ...
Web Store
Add shortcut
Customize Chrome
Type here to search
8:24 PM
5/24/2024

MSP Portal

Organization
Ikarem MARS Demo

Network
Branch-Greenfield-POL

Network-wide

Security & SD-WAN

Switching

Wireless

Insight

Organization

Welcome to your new starter screen
We'd love your feedback! Just use the tag on the right side of every new screen or for your full list of networks, check out the "Networks" table below.

Organization Summary New

Devices

2-BRKTRS-2007-CPU-Investigation-1.mp4

Uplinks 8 total
2
Offline

WAN Appliances 6 total
All
Online

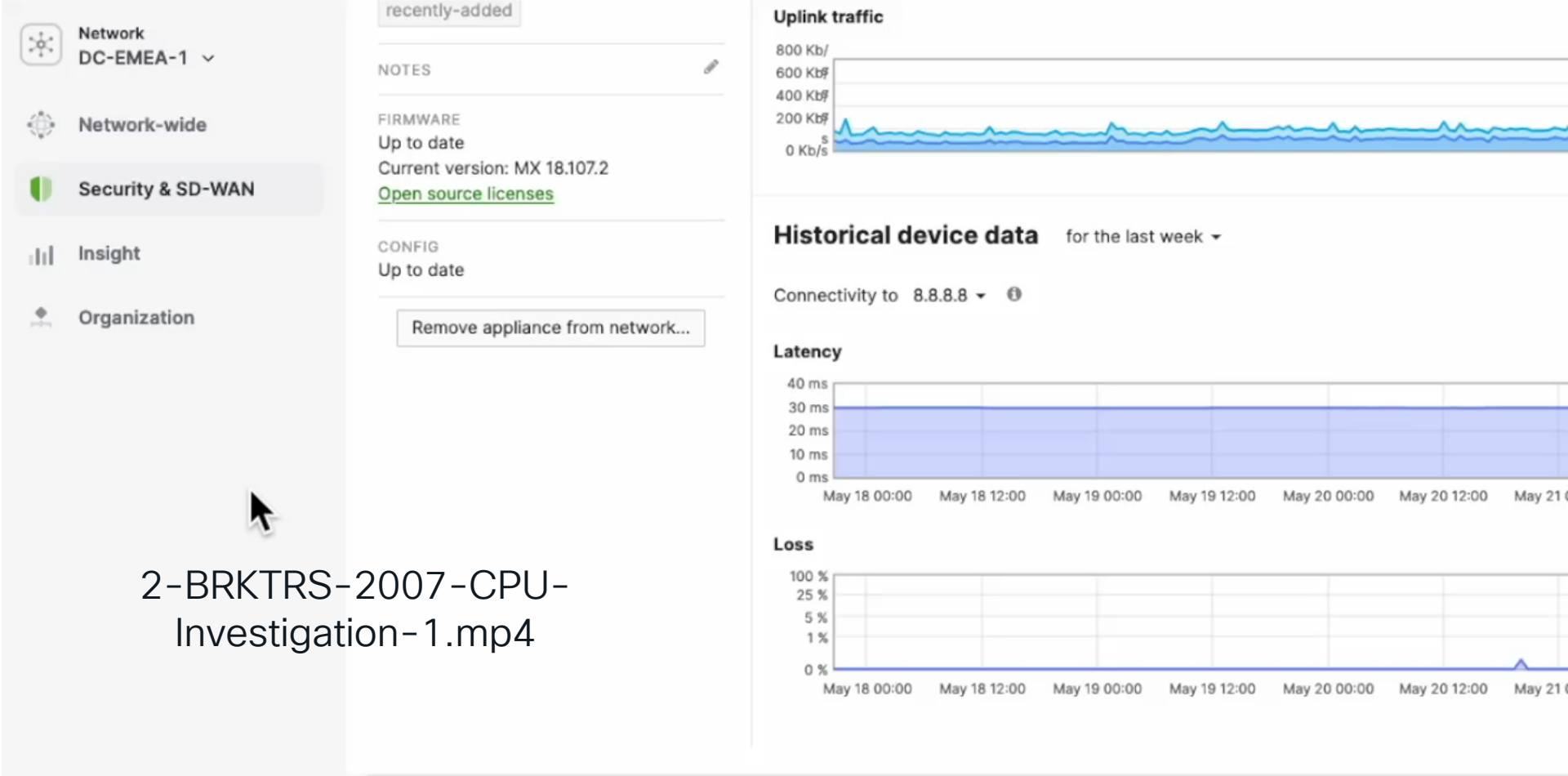
Switches 8 total
All
Online

Networks

Usage and clients over the last week

Search Networks | Status | Network Type | Tags | 6 networks

		Name	Usage	Clients	Tags	WAN Appliances
		Branch-Greenfield-POL	507.95 GB	10	Greenfield	1
		Branch-Greenfield-UK	161 KB	1	EMEA-Spokes	1
		DC-EMEA-1	14.00 TB	2542	—	1
		DC-EMEA-2	1.1 MB	1	—	1
		HQ-Brownfield-POL	2.21 GB	4	Brownfield, EMEA-Spokes	1
		HQ-Greenfield-UK	14.50 TB	2908	EMEA-Spokes	1



2-BRKTRS-2007-CPU-Investigation-1.mp4

3-BRKTRS-2007-CPU-Investigation-2.mp4

Summary Report from the last week

NETWORK(S): DC-EMEA-1 | DEVICE TAG: All devices | SSID: All SSIDs | SHOW TOP RESULTS: 10

Export to Excel

Customize report

Clients with high usage

2 clients used more than 100.00 GB
'10.103.0.15' and '10.103.0.105'

Usage stats

TOTAL DATA TRANSFERRED	TOTAL DATA DOWNLOADED	TOTAL DATA UPLOADED
15.24 TB	14.88 TB	366.74 GB

Usage over time

Top devices

Name	Model	# Clients	Usage	% Usage
DC-EMEA-1-MX-1	MX250	2573	15.24 TB	100.00%

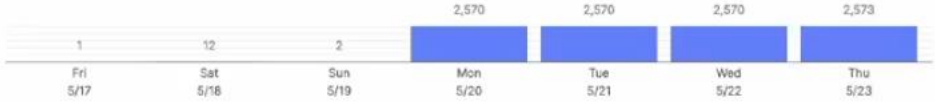
Top device models by usage

Model	# Devices	Usage	Average Usage per Device
MX250	1	15.24 TB	15.24 TB

Client stats

TOTAL UNIQUE CLIENTS	AVERAGE # OF CLIENTS PER DAY	AVERAGE USAGE PER CLIENT
2573	1471	6.06 GB

Clients per day



Splash page

NUMBER OF CLIENTS TO REQUEST PAGE	NUMBER OF CLIENTS GRANTED ACCESS
0	0

Top clients by usage

Description	Usage	% Usage
10.103.0.15	15.09 TB	99.06%
10.103.0.105	146.93 GB	0.94%
10.102.0.15	17 KB	< 0.01%
10.102.0.16	12 KB	< 0.01%
10.102.0.14	12 KB	< 0.01%

MX performance best practices

- Monitor the average packet sizes/number of routes/number of tunnels/tunnel usage.
- Monitor device utilization and throughput numbers.
- Do not route LAN traffic through the MX device when L3 distribution exists.
- Monitor the number of clients traffic from which passes specific hubs.
- Bypass the IPS for trusted applications.
- Use Direct Internet Access (DIA) when possible.

Topic / Item	Count	Average	Min Val	Max Val	Rate (ms)	Percent
Packet Lengths	18249	872.86	46	1518	0.1303	100%
0-19	0	-	-	-	0.0000	0.00%
20-39	0	-	-	-	0.0000	0.00%
40-79	7323	69.91	46	79	0.0523	40.13%
80-159	624	124.53	82	158	0.0045	3.42%
160-319	155	258.54	166	314	0.0011	0.85%
320-639	82	404.85	328	618	0.0006	0.45%
640-1279	24	1016.67	646	1278	0.0002	0.13%
1280-2559	10041	1517.92	1290	1518	0.0717	55.02%

Formula: Hub Tunnels = $[S + (H-1)] * 2 * L$

Trusted Traffic Exclusions

To increase network performance, select traffic categories and IP addresses or subne

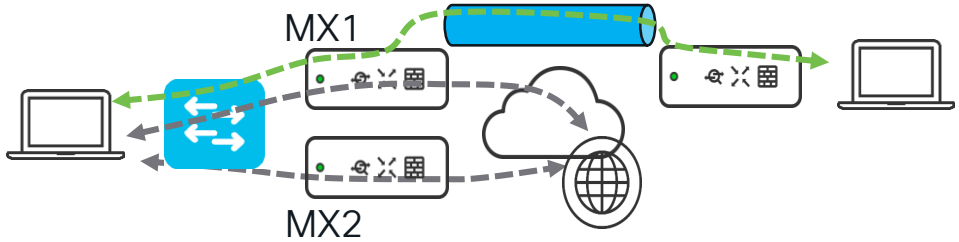
Trusted Applications New in 18.2

- [ ] **Streaming & entertainment**
  Amazon Video, Google Services, Hulu, Netflix, Pandora Radio, Playst... View all
- [ ] **Online storage**
  Box, Dropbox, Google Workspace, Microsoft OneDrive, iCloud View all

MX oversubscription - Horizontal scaling

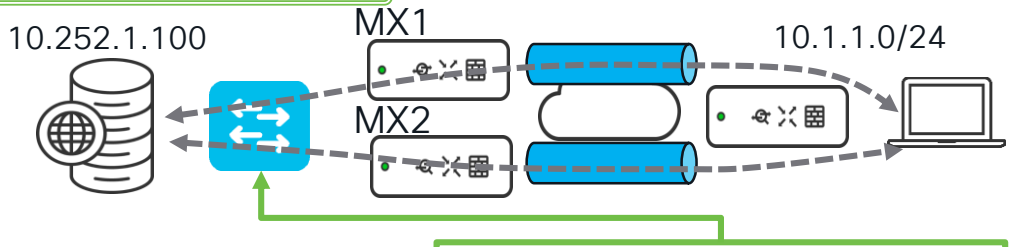
In cases when current MX can't cap with the network load, horizontal scaling can be used as a solution. There are two main approaches to horizontal scaling:

- **Distribute load by feature** – for example, by adding a separate MX in the HQ to deal with internet traffic.



Name	VPN mode	Subnet
HQ-Subnet	Enabled	10.252.0.0/16

- **Distribute load by service – for** example, by advertising /32 routes for the highly loaded services (like Proxy servers) through a dedicated Hub.



Name	VPN mode	Subnet
HQ-Proxy	Enabled	10.252.1.100/32

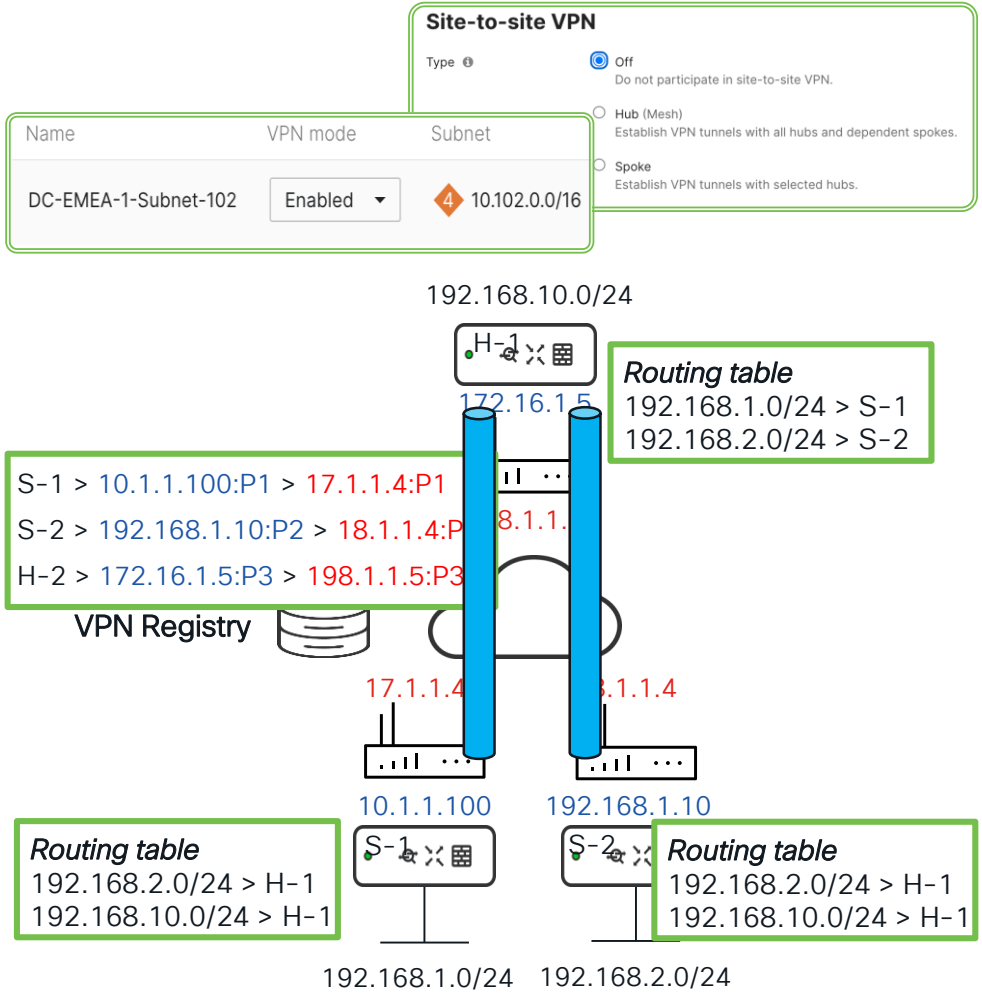
Policy-based routing (PBR) to send traffic sourced from Proxy and destined to 10.1.1.0/24 through the Hub2.

Agenda

- MX performance - Best practices and caveats
- Unobvious Auto VPN
- Gamified troubleshooting case study

Auto VPN is simple …

- Once S2S VPN is enabled and networks are added, the dashboard pushes routes to MXs.
- MXs contact the VPN registry to report their own public-to-private IP/Port mappings and get mappings for their peers.
- Control plane traffic (Hello messages) starts flowing to activate NAT hole-punching.



Auto VPN is simple until it’s not

Auto VPN complexity increases with:

- Growing number of spokes and or networks behind them.
- Growing number of hubs and or networks behind them.
- Introduction of advanced routing (BGP/OSPF)
- Introduction of Data Center Redundancy (DC-DC failover)

Auto VPN – Routing ground rules

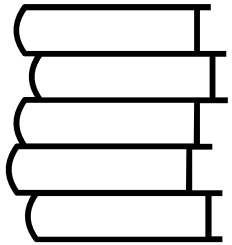
For your reference

- When routes to the ***same network*** exist through ***multiple peers*** in ***one routing source*** (ex: Auto VPN), the ***metric (hub priority)*** is used to pick the best route.

- When routes to the ***same network*** exist in ***different sources*** (ex: Auto VPN and BGP), a ***Route Priority is used*** to pick the best route (Auto VPN wins over BGP).

- Regular ***Auto VPN routes are tracked*** (routing is moved to the path with a higher metric, AKA lower priority hub when the path with a lower metric becomes unavailable) ***when more than one path is available***.

- BGP routes are tracked using the protocol itself.



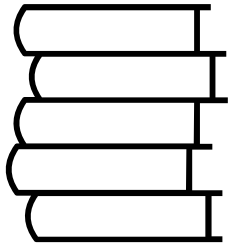
Auto VPN - Routing ground rules

For your reference

- ***Hubs*** always ***send traffic directly*** to the ***Attached spokes***. Hub to Hub tunnels are used only to route traffic toward networks behind Non-attached spokes and Non-adjacent hubs.

- Due to the iBGP split horizon, when BGP is enabled, spokes always use Auto VPN routes to Adjacent and Non-adjacent spokes.

- OSPF on MX can only advertise Auto VPN routes to neighbors. MX does not learn any routes from OSPF neighbors.



Auto VPN – God from the machine

Auto VPN has multiple features that can enhance the scaling of the SD-WAN fabric. Some are enabled by default, while others can be enabled by Support*. None of those features are customer-visible as of today.

- *Summarization* (enabled by default)– Contiguous subnets are summarized to protect small devices. This minimizes the number of routes propagated to spokes by the dashboard.

- *Track all hub-originated routes* – This allows tracking to be added on the spoke side for the networks defined on hubs, irrespective of the number of paths.

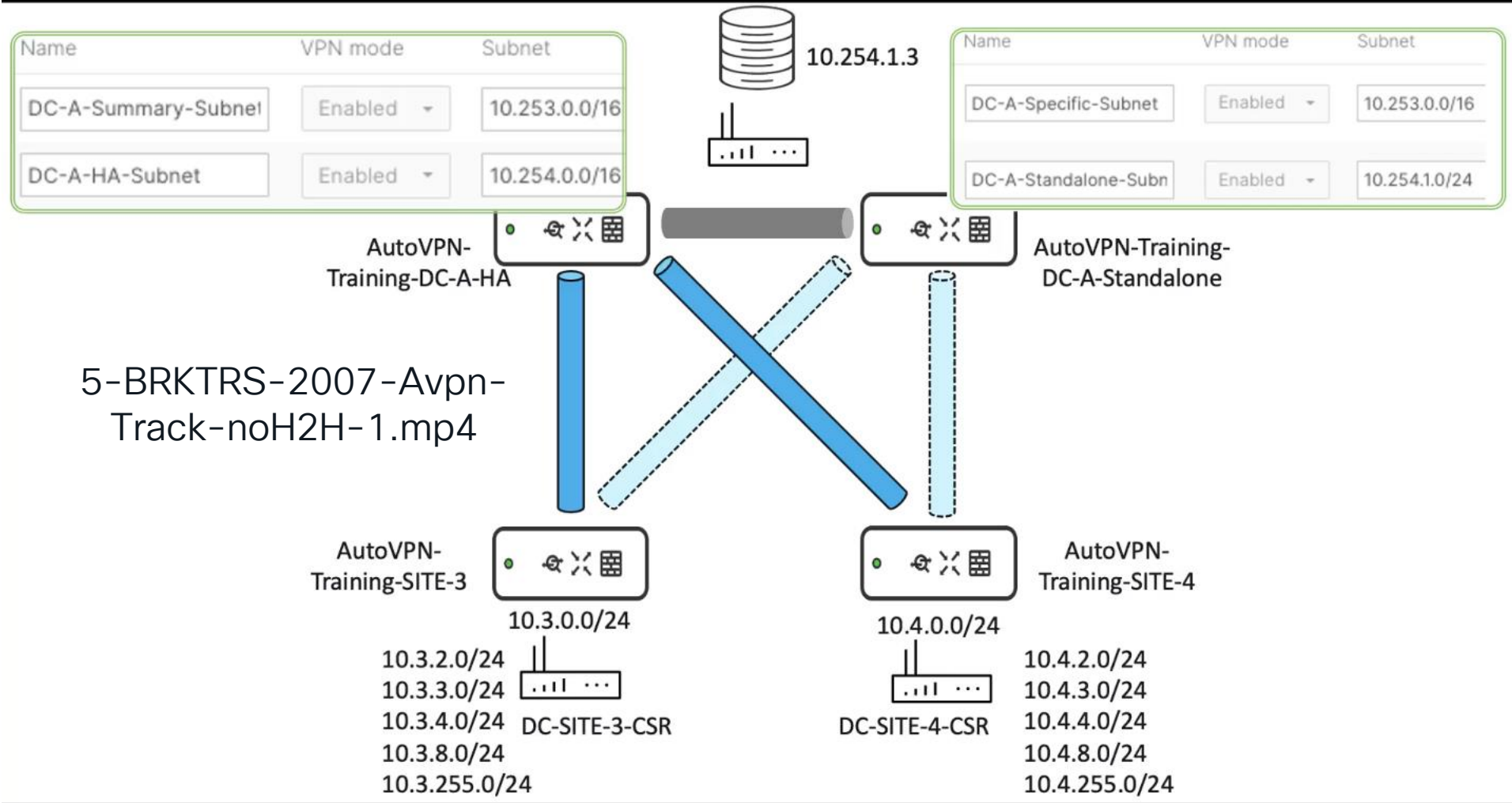
*–It is recommended that you consult with the Meraki sales engineer before asking for the features to be enabled.

Auto VPN – God from the machine

- *No spoke routes* – This feature instructs the dashboard not to install routes available behind other spokes into the spoke config. Enabling this feature requires careful planning, as summary routes will need to be propagated from hubs.

- *No hub-to-hub tunnels* – This feature removes tunnels and routes between the hubs. Such change needs to be planned as this will break any connectivity through Auto VPN fabric between Non-adjacent hubs and Non-adjacent spokes.

Auto VPN– from theory to practice (track Hub routes)


Name
VPN mode
Subnet
DC-A-Summary-Subnet
Enabled
10.253.0.0/16
DC-A-HA-Subnet
Enabled
10.254.0.0/16
10.254.1.3
Name
VPN mode
Subnet
DC-A-Specific-Subnet
Enabled
10.253.0.0/16
DC-A-Standalone-Subn
Enabled
10.254.1.0/24
AutoVPN-Training-DC-A-HA
AutoVPN-Training-DC-A-Standalone
5-BRKTRS-2007-Avpn-Track-noH2H-1.mp4
AutoVPN-Training-SITE-3
AutoVPN-Training-SITE-4
10.3.0.0/24
10.3.2.0/24
10.3.3.0/24
10.3.4.0/24
10.3.8.0/24
10.3.255.0/24
DC-SITE-3-CSR
10.4.0.0/24
DC-SITE-4-CSR
10.4.2.0/24
10.4.3.0/24
10.4.4.0/24
10.4.8.0/24
10.4.255.0/24

Route table

Rebuild

Routes updated as of Today at 5:43 PM.

6-BRKTRS-2007-Avpn-Track-noH2H-2.mp4

IP VERSION	SUBNET/PREFIX	NAME	VLAN	NEXT HOP	DESTINATION	TYPE	REPORTED
All	Search by subnet/prefix	Search by name	Search by VLAN ID	Search by network	Search by destination	All	Current

Stat	Version	Subnet	Name	VLAN	Next hop	Destination
●	4	0.0.0.0/0	Default	—	—	WAN uplink
●	4	10.3.0.0/24	AutoVPN-Training-SITE-3: Single LAN Settings	0	AutoVPN-Training-DC-A-Standalone - appliance	AutoVPN-Training-SITE-3
●	4	10.3.0.0/24	AutoVPN-Training-SITE-3: Single LAN Settings	0	AutoVPN-Training-DC-A-HA - appliance	AutoVPN-Training-SITE-3
—	4	10.3.2.0/24	AutoVPN-Training-SITE-3: SITE-3-Net-2	—	AutoVPN-Training-DC-A-Standalone - appliance	AutoVPN-Training-SITE-3
—	4	10.3.2.0/24	AutoVPN-Training-SITE-3: SITE-3-Net-2	—	AutoVPN-Training-DC-A-HA - appliance	AutoVPN-Training-SITE-3
—	4	10.3.3.0/24	AutoVPN-Training-SITE-3: SITE-3-Net-3	—	AutoVPN-Training-DC-A-Standalone - appliance	AutoVPN-Training-SITE-3
—	4	10.3.3.0/24	AutoVPN-Training-SITE-3: SITE-3-Net-3	—	AutoVPN-Training-DC-A-HA - appliance	AutoVPN-Training-SITE-3
●	4	10.3.4.0/24	AutoVPN-Training-SITE-3: SITE-3-Net-4	—	AutoVPN-Training-DC-A-HA - appliance	AutoVPN-Training-SITE-3
●	4	10.3.4.0/24	AutoVPN-Training-SITE-3: SITE-3-Net-4	—	AutoVPN-Training-DC-A-Standalone - appliance	AutoVPN-Training-SITE-3
●	4	10.3.8.0/24	AutoVPN-Training-SITE-3: SITE-3-Net-8	—	AutoVPN-Training-DC-A-HA - appliance	AutoVPN-Training-SITE-3
●	4	10.3.8.0/24	AutoVPN-Training-SITE-3: SITE-3-Net-8	—	AutoVPN-Training-DC-A-Standalone - appliance	AutoVPN-Training-SITE-3
●	4	10.3.255.0/24	AutoVPN-Training-SITE-3: SITE-3-Net-255	—	AutoVPN-Training-DC-A-HA - appliance	AutoVPN-Training-SITE-3
●	4	10.3.255.0/24	AutoVPN-Training-SITE-3: SITE-3-Net-255	—	AutoVPN-Training-DC-A-Standalone - appliance	AutoVPN-Training-SITE-3
●	4	10.4.0.0/24	Single LAN Settings	0	10.4.0.1	10.4.0.1
●	4	10.4.2.0/24	SITE-4-Net-2	—	10.4.0.10	—

Auto VPN- from theory to practice (summarization)

Global Overview

Organization
Lab UK

Network
AutoVPN-Training-SITE-4

Network-wide

Security & SD-WAN

Insight

Organization

Route table

Rebuild

7-BRKTRS-2007-Avpn-Summary-1.mp4

Routes updated as of Today at 9:01 PM.

IP VERSION	SUBNET/PREFIX	NAME	VLAN
All	Search by subnet/prefix	Search by name	Search by VLAN ID

Stat	Version	Subnet	Name	VL
—	4	0.0.0.0/0	Default	—
—	4	10.3.0.0/24	AutoVPN-Training-SITE-3: Single LAN Settings	0
—	4	10.3.0.0/24	AutoVPN-Training-SITE-3: Single LAN Settings	0
—	4	10.3.2.0/24	AutoVPN-Training-SITE-3: SITE-3-Net-2	—
—	4	10.3.2.0/24	AutoVPN-Training-SITE-3: SITE-3-Net-2	—
—	4	10.3.3.0/24	AutoVPN-Training-SITE-3: SITE-3-Net-3	—
—	4	10.3.3.0/24	AutoVPN-Training-SITE-3: SITE-3-Net-3	—

8-BRKTRS-2007-Avpn-Summary-2.mp4

Global Overview

Organization
Lab UK

Network
AutoVPN-Training-SITE-4

Network-wide

Security & SD-WAN

Insight

Organization

SITE-4-MX-S

MX64 0c:8d:db:91:c6:c8

PRIMARY

Set a location for this appliance

Add an address below and check Move marker to update its location

ADDRESS

PRIMARY
Current master

SPARE
Unreachable

WAN 1
82.163.125.242 Active

WAN 2
82.163.125.242 Ready

HOSTNAME
autovpn-training-site-4-

Summary

Ports

1 2 3 4 Internet

Historical device data

for the last day

Connectivity

16:00 20:00 00:00

Network usage

60 Kb/s
45 Kb/s
30 Kb/s
15 Kb/s
0 Kb/s

14:00 16:00 18:00 20:00 22:00 00:0

Auto VPN- from theory to practice (no spoke-to-spoke routes)

9-BRKTRS-2007-Avpn-No-S2S.mp4

Global Overview

Organization
Lab UK

Network
AutoVPN-Training-SITE-4

Network-wide

Security & SD-WAN

Insight

Organization

SITE-4-MX-S

MX64 0c:8d:db:91:c6:c8

PRIMARY

Set a location for this appliance

Add an address below and check Move marker to update its location

ADDRESS

PRIMARY
Current master

SPARE
Unreachable

WAN 1
82.163.125.242 Active

WAN 2

Ports

1 2 3 4 Internet

Historical device data

for the last day

Connectivity

16:00 20:00

Network usage

80 Kb/s
60 Kb/s
40 Kb/s
20 Kb/s
0 Kb/s

16:00 18:00 20:00 22:00

Agenda

- MX performance - Best practices and caveats
- Unobvious Auto VPN
- Gamified troubleshooting case study

And it’s time to play a game ☺

- This is like an Escape room, just with the difference that you will not be closed.
- The goal is to find and open a treasure chest.
- The demos in this section have some hints that should help you to progress.

It all started with an alert

10-BRKTRS-2007-Attack-1.mp4

MSP Portal

Organization
Ikarem MARS Demo

Network
HQ-Brownfield-POL

Network-wide

Security & SD-WAN

Switching

Wireless

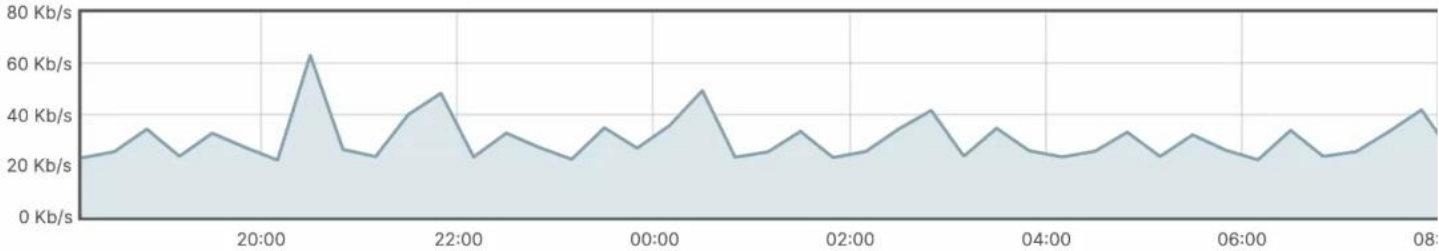
Insight

Organization

Health

UPLINKS	WAN APPLIANCES	SWITCHES	ACCESS POINTS
1 /2 healthy	1 /1 healthy	2 /4 healthy	0 /1 healthy

Clients all for the last day



Policy Forget Search... 6 clients

Status	Description	Last seen	Usage	Client type, OS
	00:42:68:72:c8:68	May 28 18:09	None	Other
	68:49:92:10:0b:40	May 28 18:09	18.1 MB	Other
	6c:de:a9:64:a8:00	May 28 18:09	17.6 MB	Other
	6c:de:a9:64:9e:00	May 28 18:09	17.5 MB	Other

Security Center

the last day

11-BRKTRS-2007-Attack-2.mp4

Search events

Filter

5 matching events

MX Summary | MX Events

Time	Type	Source	Destination	Disposition	Action	Details
May 28 18:07:15	IDS Alert	192.168.0.22	10.9.8.7:1024		Allowed	Alert Check Row 2 Seat 3
May 28 17:56:54	IDS Alert	10.103.0.15:49754	20:cf:ae:1d:33:d1		Blocked	SERVER-WEBAPP Cisco IOS XE Web UI authentication bypass attempt
May 28 17:56:54	IDS Alert	10.103.0.15:49754	20:cf:ae:1d:33:d1		Blocked	SERVER-WEBAPP Cisco IOS XE Web UI authentication bypass attempt
May 28 17:56:54	IDS Alert	10.103.0.15:49738	20:cf:ae:1d:33:d1		Blocked	SERVER-WEBAPP Cisco IOS XE Web UI authentication bypass attempt
May 28 17:56:54	IDS Alert	10.103.0.15:49738	20:cf:ae:1d:33:d1		Blocked	SERVER-WEBAPP Cisco IOS XE Web UI authentication bypass attempt

1 page 10 results per page

Security Center the last day

Search events | Filter | 5 matching events

MX Summary | MX Events

Time	Type	Source	Destination	Disposition	Action	Details
May 28 18:07:15	IDS Alert	192.168.0.22	10.9.8.7:1024		Allowed	Alert Check Row 2 Seat 3
May 28 17:56:54	IDS Alert	10.103.0.15:49754	20:cf:ae:1d:33:d1		Blocked	SERVER-WEBAPP Cisco IOS XE Web UI authentication bypass attempt
May 28 17:56:54	IDS Alert	10.103.0.15:49754	20:cf:ae:1d:33:d1		Blocked	SERVER-WEBAPP Cisco IOS XE Web UI authentication bypass attempt
May 28 17:56:54	IDS Alert	10.103.0.15:49738	20:cf:ae:1d:33:d1		Blocked	SERVER-WEBAPP Cisco IOS XE Web UI authentication bypass attempt
May 28 17:56:54	IDS Alert	10.103.0.15:49738	20:cf:ae:1d:33:d1		Blocked	SERVER-WEBAPP Cisco IOS XE Web UI authentication bypass attempt

1 page 10 results per page

12-BRKTRS-2007-Attack-3.mp4

Packet capture

Security appliance: DC-EMEA-1-MX-1

Interface: Internet

Output: Download .pcap file (for Wireshark)

Duration (secs): 60

Filter expression: ether host 00:50:56:b7:ef:47

File name: DC-EMEA-1_MX-DC-EMEA-1-MX-1_IF-Interne

Start capture

Sample filter expressions

host 10.1.27.253
packets to and from ip address 10.1.27.253
host 10.1.27.253 and port 53
packets to and from ip address 10.1.27.253 and TCP or UDP port 53 (DNS)
icmp[icmptype] != icmp-echo and icmp[icmptype] != icmp-echoreply
all ICMP packets that are not echo requests/replies (i.e., not ping packets):
ether host 11:22:33:44:55:66
packets to and from ethernet host 11:22:33:44:55:66
pppoes and ip
IP packets encapsulated in PPPoE (Point-to-Point Protocol over Ethernet)

See more examples.

The maximum packet capture duration is 3600 seconds.
This capture will stop after 60 seconds, or when 100,000 packets have been captured.

Packet capture logs

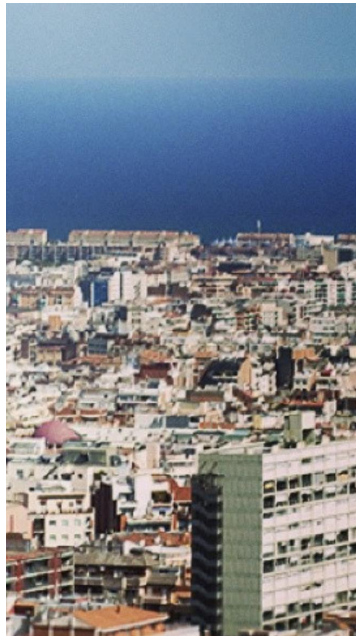
13-BRKTRS-2007-Attack-4.mp4

Get your gift after the session

- Pins with unique designs are available for pickup at the stage.
- They made a long trip to get here.
- Please don't make them travel back to Poland.

Key takeaway

The ability to see the bigger picture matters during design maintenance and troubleshooting.

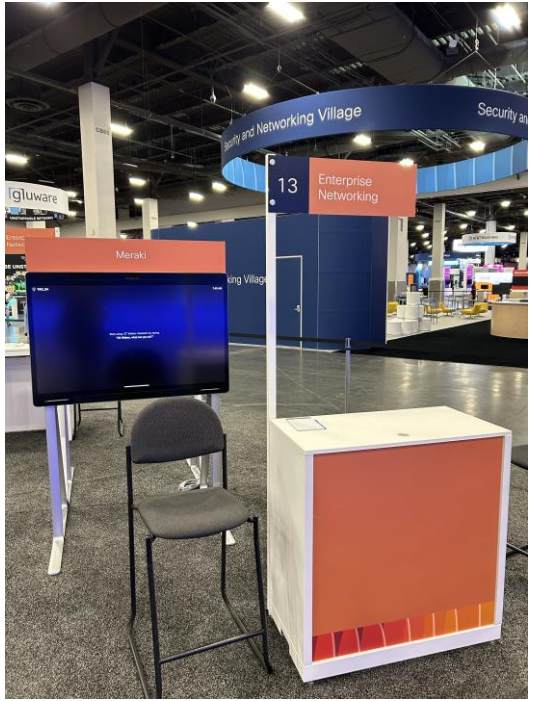


Please share your Thoughts

- Don’t forget to feel your session survey.
- Let me know in the comments what you like/didn’t like
- Share ideas for the subsequent iterations.
- Live your email in the comments, and I'll happily follow up.

Continue your education (Meraki)

- Visit the Meraki booth in TAC clinics to get your support-related questions answered.
- LABMER-1002 - Defending Against Today's and Tomorrow's Threats with Meraki-Talos-Umbrella Integration.
- LABMER-1101 - Demystifying Auto VPN with Cisco Meraki.



Complete Your Session Evaluations

Complete a minimum of 4 session surveys and the Overall Event Survey to be entered in a drawing to **win 1 of 5 full conference passes** to Cisco Live 2025.

Earn 100 points per survey completed and compete on the Cisco Live Challenge leaderboard.

Level up and earn **exclusive prizes!**

Complete your surveys in the **Cisco Live mobile app.**

Continue your education

- Visit the Cisco Showcase for related demos
- Book your one-on-one Meet the Engineer meeting
- Attend the interactive education with DevNet, Capture the Flag, and Walk-in Labs
- Visit the On-Demand Library for more sessions at www.CiscoLive.com/on-demand

Contact me at: skuchere@cisco.com

Thank you