

ntopng towards new frontiers

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ntop

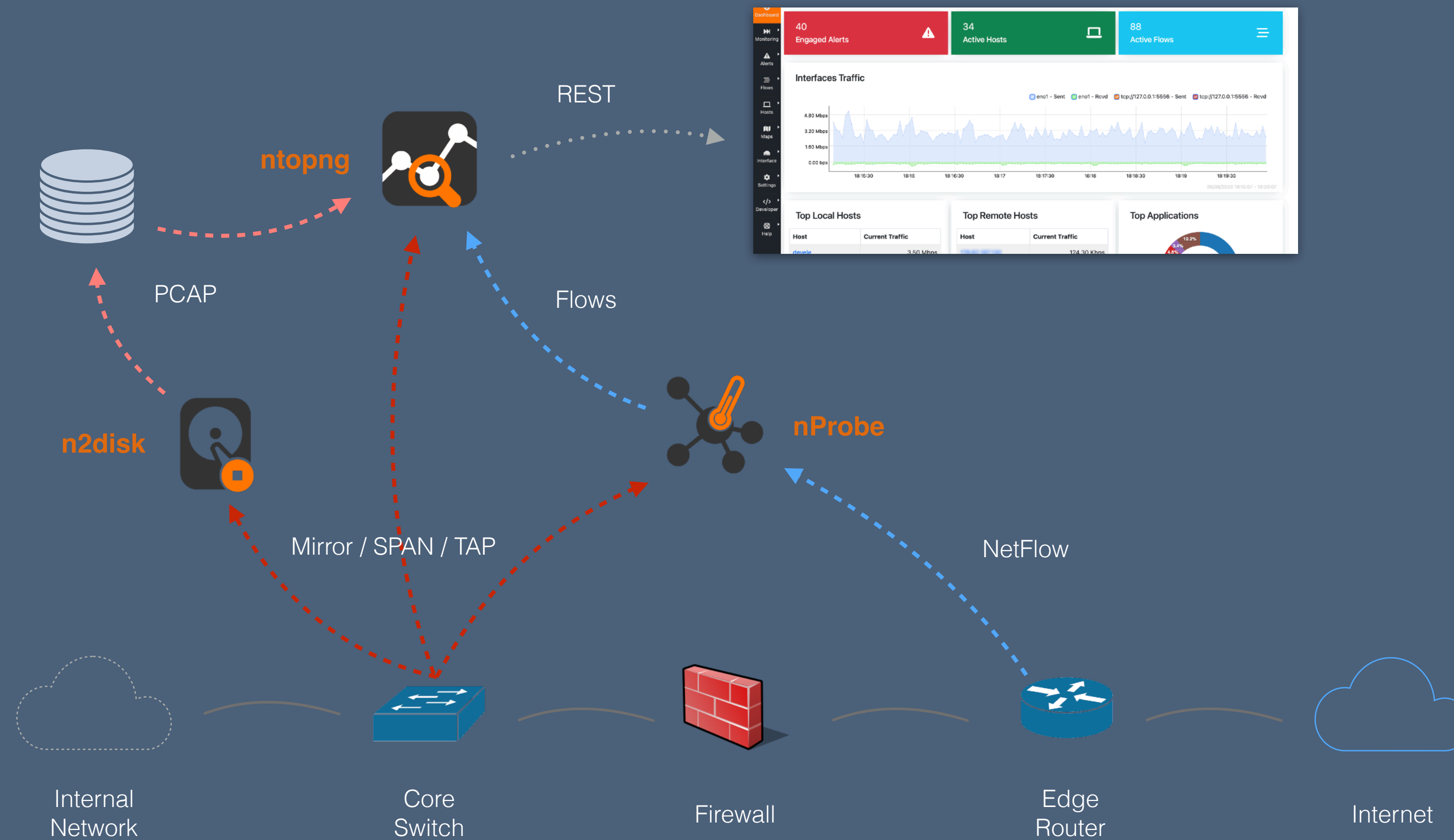
PacketFest'25



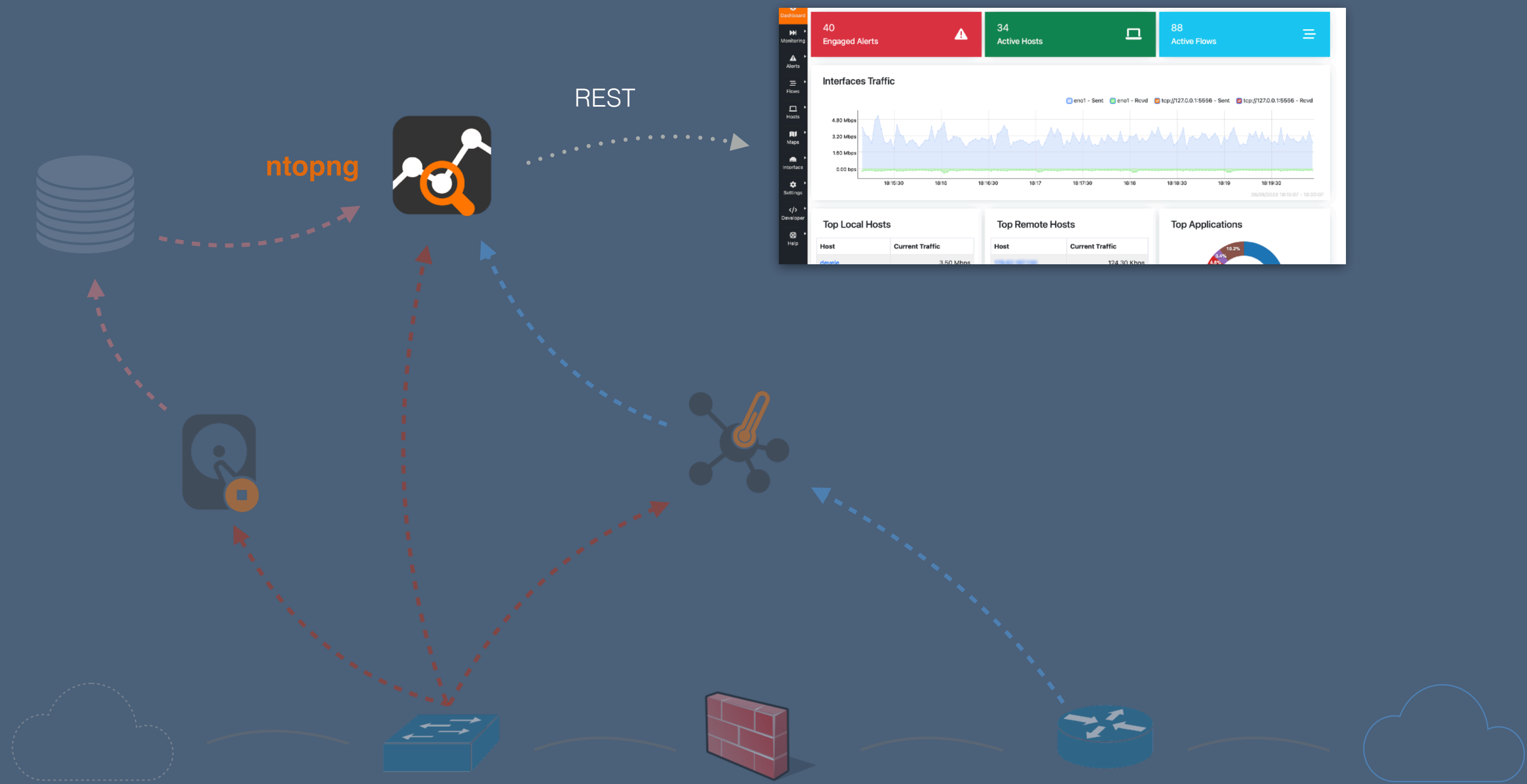
Agenda

- What is ntopng
- Asset Inventory / Digital Twin
- QoE (Quality of Experience)
- Infrastructure Dashboard & Reports
- Cisco CPU/Memory Polling
- Alerts & Access Control List

ntop Ecosystem

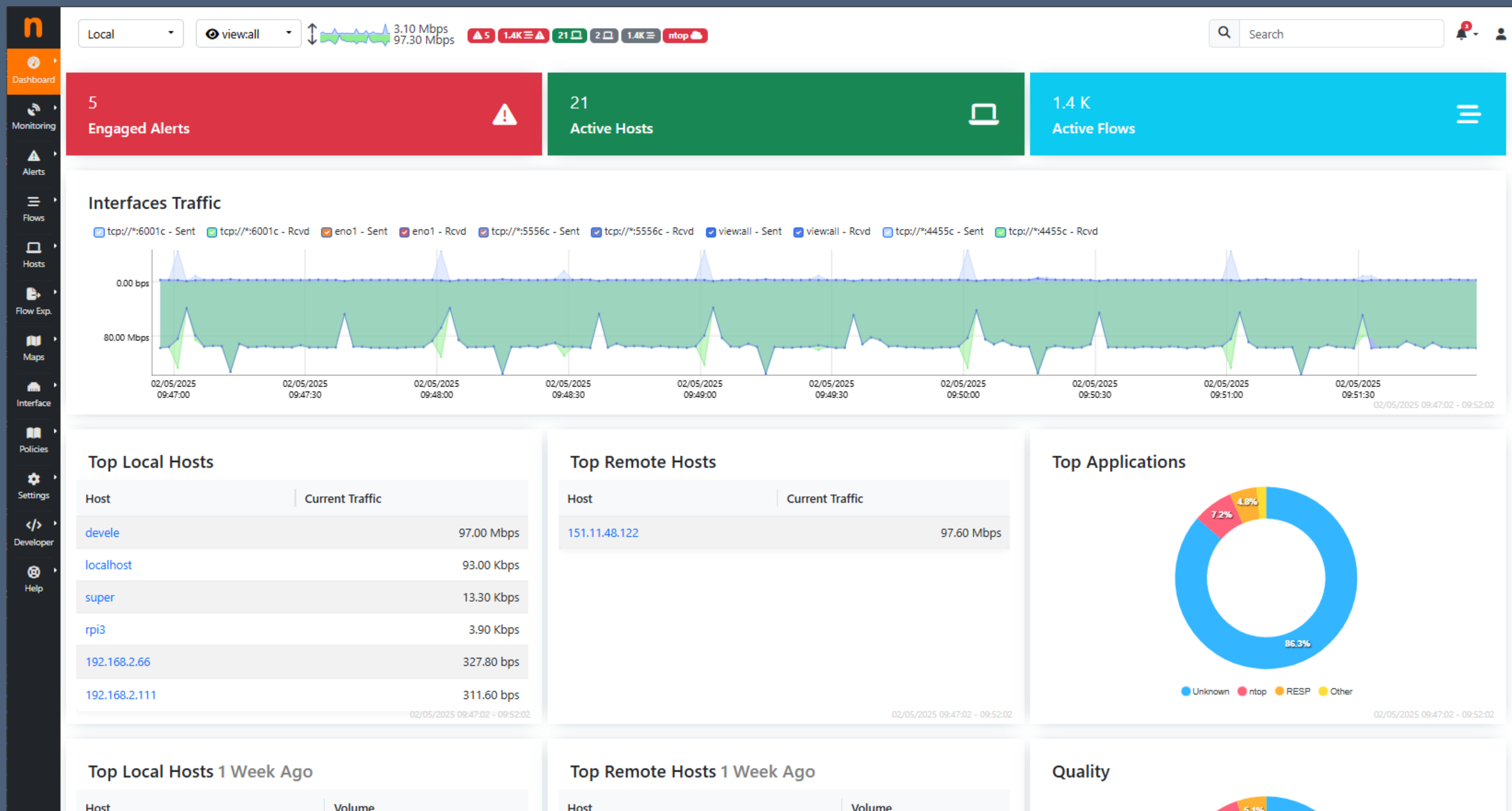


ntop Ecosystem



What is ntopng

- ntopng is a real-time traffic monitoring and analysis tool for networks.
- It provides a web-based interface to visualize network usage, detect anomalies, and analyze traffic by IP, protocol, application, or user.
- ntopng helps identify bottlenecks, detect anomalies, and gain actionable insights into network behavior
- It supports a wide range of protocols (more than 450), integrates with external tools, and offers customizable dashboards for effective network management

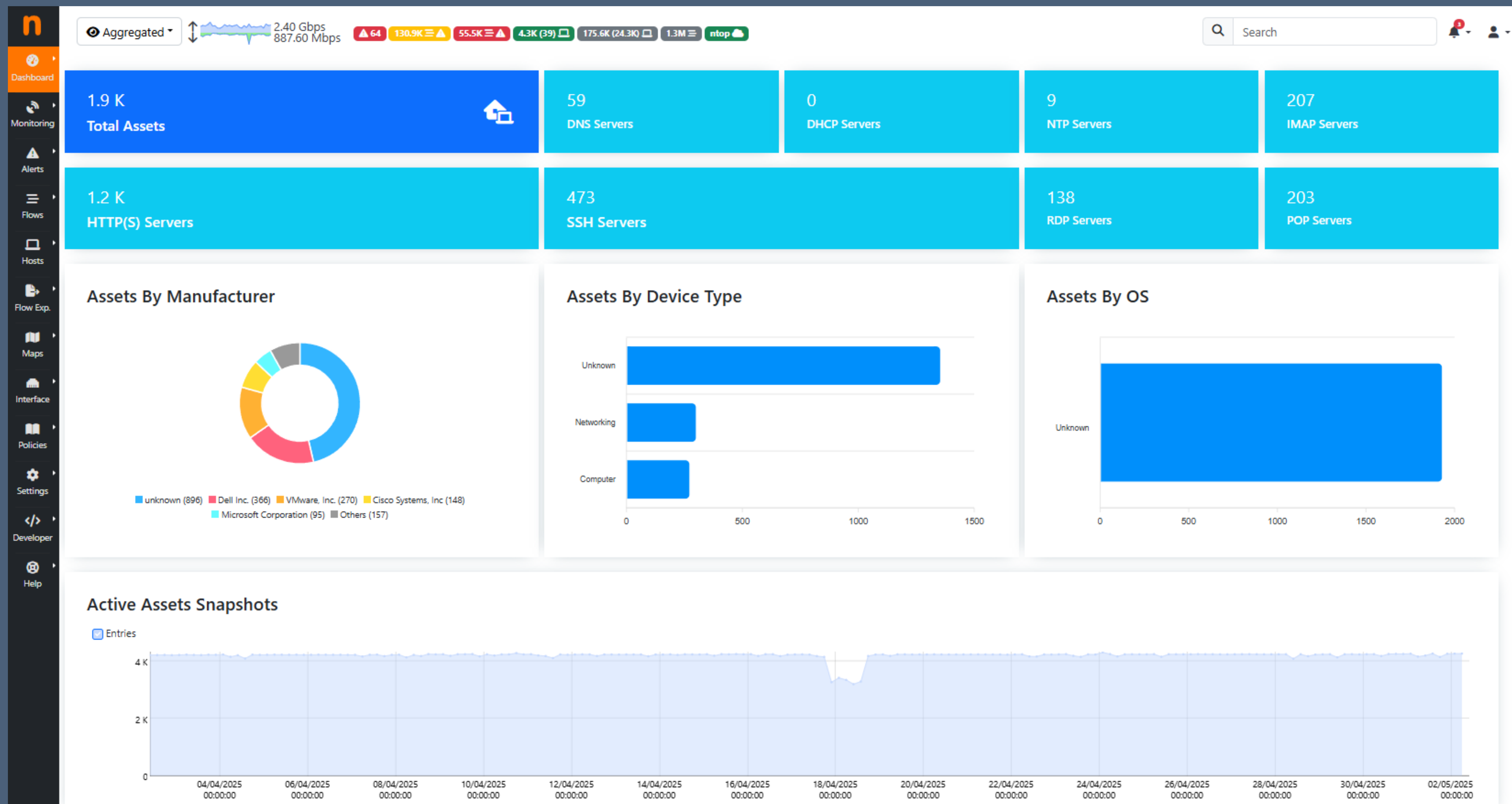


Why ntopng ?

- Ntopng can be used to answer these simple questions:
 - Who is using my network?
 - Is my network secure ?
 - What issue shall I tackle ?
 - Are my users happy of the perceived network quality ?

Asset Inventory / Digital Twin

- Know your network: monitoring can't happen without contextual information.
- Which hosts are currently active in the network (local hosts)?
- What are my network services (DNS, NTP, ...) ?
- Are these all the local hosts that connected to the network?
- Are all the local hosts legitimate?
- Which server ports were contacted?



Asset Inventory / Digital Twin

Possible Filters

Assets Inventory | Dashboard

Device Type: All Manufacturer: All Network: All OS Type: All VLAN: All Status: All Server Type: POP Server Reset

10 [Icon] [Icon] [Icon] Search: [Input]

Actions	IP Address	Name	MAC Address	Model	OS	Status	First Seen	Last See
[Menu]	89.31.72.8 [Icon] DNS SMTP IMAP POP		00:50:56:B5:73:B2			Online	18/04/2025 17:59:36	
[Menu]	89.31.72.11 [Icon] DNS SMTP IMAP POP		00:50:56:A1:03:FE			Online	22/04/2025 12:31:37	
[Menu]	89.31.72.12 [Icon] DNS SMTP IMAP POP		00:22:19:A8:DF:36			Online	22/04/2025 15:02:52	
[Menu]	89.31.72.14 [Icon] DNS SMTP IMAP POP		00:50:56:B6:12:D1			Online	19/04/2025 08:56:12	
[Menu]	89.31.72.15 [Icon] SMTP IMAP POP		00:26:B9:8F:7E:AA			Online	22/04/2025 12:35:44	
[Menu]	89.31.72.18 [Icon] SMTP IMAP POP		18:66:DA:B2:76:1B			Online	25/04/2025 11:18:13	
[Menu]	[Icon] IMAP POP		B8:2A:72:D1:A8:4B			Online	19/04/2025 08:56:12	
[Menu]	89.31.72.48 [Icon] IMAP POP		00:50:56:AB:01:1B			Online	18/04/2025 09:04:35	
[Menu]	89.31.72.54 [Icon] DNS SMTP IMAP POP		DE:65:35:80:75:B4			Online	18/04/2025 17:59:36	
[Menu]	89.31.72.69 [Icon] DNS SMTP IMAP POP		3A:29:14:3F:15:2F			Online	18/04/2025 08:56:10	

Showing page 1 of 39: total 389 rows

[<] 1 2 3 4 5 6 [>]

Details & Other Links


Import Assets Export Assets Delete All Delete Older Than



















Services

Asset Status (online/offline)

Various Possible Actions (Delete/Import/Export)

Asset Inventory / Digital Twin

Host: 89.31.72.11 | 

MAC Address / Device Type	00:50:56:A1:03:FE [VMware]	 Computer				
First / Last Seen	01/05/2025 20:17:52 [13:46:15 ago]	Online 				
IP Address / Network	89.31.72.11  DNS Server SMTP Server IMAP Server POP Server HTTP(S) Server	89.31.72.0/21				
Name	89.31.72.11					
Additional Host Names	<table><tr><th>Source</th><th>Name</th></tr><tr><td>HTTP</td><td>mail.hydropompe.biz</td></tr></table>	Source	Name	HTTP	mail.hydropompe.biz	
Source	Name					
HTTP	mail.hydropompe.biz					
Server Ports	<table><tr><th>TCP</th><th>UDP</th></tr><tr><td colspan="2"><ul style="list-style-type: none">25  (SMTP)80  (HTTP)84  (HTTP)110  (POP3)143  (IMAP)</td></tr></table>	TCP	UDP	<ul style="list-style-type: none">25  (SMTP)80  (HTTP)84  (HTTP)110  (POP3)143  (IMAP)		
TCP	UDP					
<ul style="list-style-type: none">25  (SMTP)80  (HTTP)84  (HTTP)110  (POP3)143  (IMAP)						

Quality of Experience (QoE)

- How is the quality of a flow?
- Is it experiencing any issues?
- Is the client or the server lowering the quality of the flow (service)?

Quality of Experience (QoE)

- Quality of Experience (QoE) is a user-centric metric that evaluates satisfaction with digital services
- QoE plays a key role in evaluating how users perceive network performance during voice calls, video streaming, and online gaming.
- QoE is computed upon:
 - RTT (Round Trip Time) continuously computed on TCP and QUIC
 - Jitter (how RTT changes overtime)
 - TCP packets out-of-order and retransmissions.
 - MOS (Mean Opinion Score)-like metrics for RTP streams.

Quality of Experience (QoE)

Live Flows | Analysis

Network Interface: All Host: All Protocol: All Application: All Status: All Quality: All TCP Flow State: All DSCP: All Traffic Type: All Host Pools: All Networks: All

10 [Table Icon] [Refresh Icon] [Eye Icon]


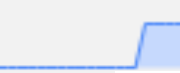
Reset

Actions	Last Seen	Duration	Protocol	Score	Quality	Flow	Actual Thpt	Total Bytes	Info
[Search Icon] [Table Icon]	00:17	00:18	TCP:HTTP.ntop	...	[Signal Icon]	devele [L] [L] : 55876 ↔ 192.168.2.123 [L] [L] : 3000	16.09 Mbps ↑	10.66 MB	GET OK 192.168.2.123:3000/lua/10mb.lua
[Search Icon] [Table Icon]	55 years, 1...	55 years, ...	TCP:RESP	...	[Signal Icon]	localhost [L] [L] : 38144 ↔ localhost [L] [L] : redis	688.69 Kbps ↑	795.26 KB	
[Search Icon] [Table Icon]	00:02	03:42	TCP:SSH	...	[Signal Icon]	rpi3 [L] [L] : 50056 ↔ devele [L] [L] : ssh	1.02 Kbps ↑	225.55 KB	
[Search Icon] [Table Icon]	00:02	00:14	UDP:SNMP	...	[Signal Icon]	devele [L] [L] : 60454 ↔ devele [L] [L] : snmp	15.07 Kbps ↑	26.43 KB	
[Search Icon] [Table Icon]	00:03	00:14	UDP:SNMP	...	[Signal Icon]	devele [L] [L] : 56252 ↔ 192.168.2.106 [L] [L] : snmp	18.95 Kbps ↑	18.65 KB	
[Search Icon] [Table Icon]	00:02	00:14	UDP:SNMP	...	[Signal Icon]	devele [L] [L] : 39648 ↔ 192.168.2.216 [L] [L] : snmp	13.02 Kbps ↑	17.43 KB	
[Search Icon] [Table Icon]	00:02	00:14	UDP:SNMP	...	[Signal Icon]	devele [L] [L] : 51903 ↔ 192.168.2.225 [L] [L] : snmp	13.02 Kbps ↑	16.79 KB	
[Search Icon] [Table Icon]	00:02	00:14	UDP:SNMP	...	[Signal Icon]	devele [L] [L] : 38353 ↔ 192.168.2.237 [L] [L] : snmp	12.76 Kbps ↑	15.97 KB	
[Search Icon] [Table Icon]	00:02	00:14	UDP:SNMP	...	[Signal Icon]	devele [L] [L] : 40775 ↔ 192.168.2.169 [L] [L] : snmp	9.58 Kbps ↑	14.54 KB	
[Search Icon] [Table Icon]	00:02	00:14	UDP:SNMP	...	[Signal Icon]	devele [L] [L] : 36556 ↔ _gateway [L] [L] : snmp	18.00 Kbps ↑	14.36 KB	

Showing page 1 of 102: total 1,019 rows

< 1 2 3 4 5 6 > »

Quality of Experience (QoE)

Flow: 93.57.25.148:53340 ↔ 185.5.209.184:3001 Overview		
Flow Peers [Client / Server]	[93.57.25.148:53340] ↔ [185.5.209.184:3001] [genesys inform...] [tcp://127.0.0.1:17900c]	
Protocol / Application	TCP / TLS (Web) [Confidence: DPI]	
First / Last Seen	29/04/2025 15:51:51 [05:55 ago]	29/04/2025 15:55:50 [01:56 ago]
Flow Duration	03:59	
Total Traffic	Total: 26.2 KB —	
	Client → Server: 134 Pkts / 5.8 KB —	Server → Client: 174 Pkts / 20.4 KB —
		
Network Quality (QoE) [Client->Server / Server ->Client]	Excellent (100 %)	Poor (30 %)
TCP Packet Analysis	Client → Server / Client ← Server	
	Retransmissions	0 Pkts / 31 Pkts
TCP Flags and Connection State	Client → Server: A P	Client ← Server: A P
	Flow is active, however, the beginning of the flow has not been observed, thus peer roles (client/server) might be inaccurate.	
Actual / Peak / Average Throughput	1.69 kbps — / 1.69 kbps / 888 bps	

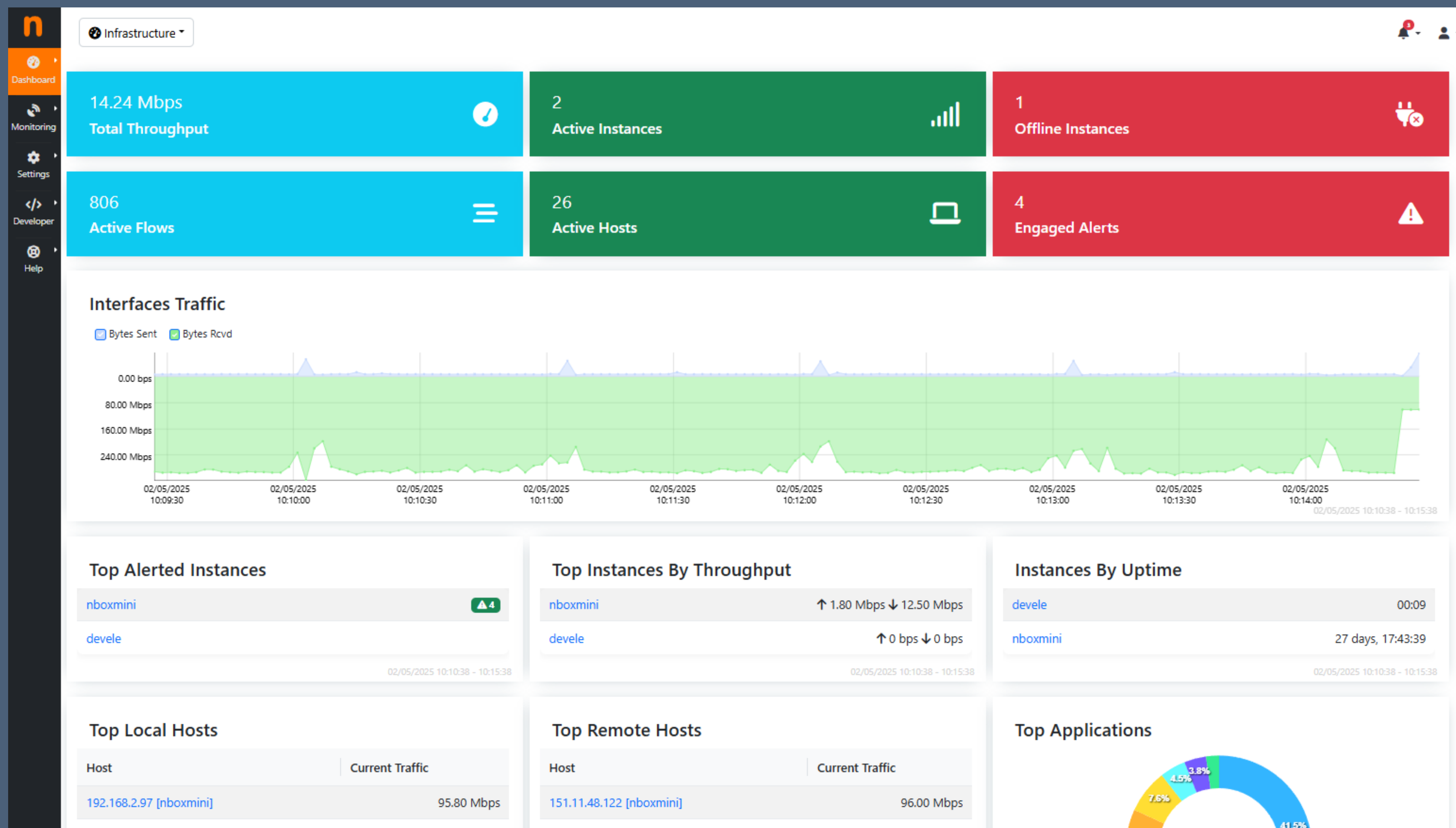
Several Server Retransmissions

Infrastructure Dashboard

- How do we monitor multiple ntopng instances?
- How do we know if an instance is unreachable?
- How do we know the status of each instance?


Infrastructure Dashboard

- Be able to monitor multiple ntopng instances, knowing the amount of hosts, flows, alerts, ... on each of the instances
- Know if there is some problem with one of the instances
- Be able to properly analyze each instance in case of needs, by jumping to the specific instance











Infrastructure Monitoring

- By using an authentication token it's possible to monitor the various ntopng instances

Infrastructure | 


Show entries

Status   Search:

Name	URL	Chart	Status	Throughput	Hosts	Flows	Engaged Alerts	Flow Alerts	Last Update	Actions
devele	192.168.2.97:3000		Error	23.38 Mbps	39	5,176	0	2,724	02:24	
nboxmini	192.168.2.123:3000		Up	12.84 Mbps	60	746	4	250	02:24	
super	192.168.2.61:3000		Error	-	-	-	-	-	02:24	

Showing 1 to 3 of 3 entries

« < 1 > »

 Manage Configurations

Add a new instance

ntopng Instances

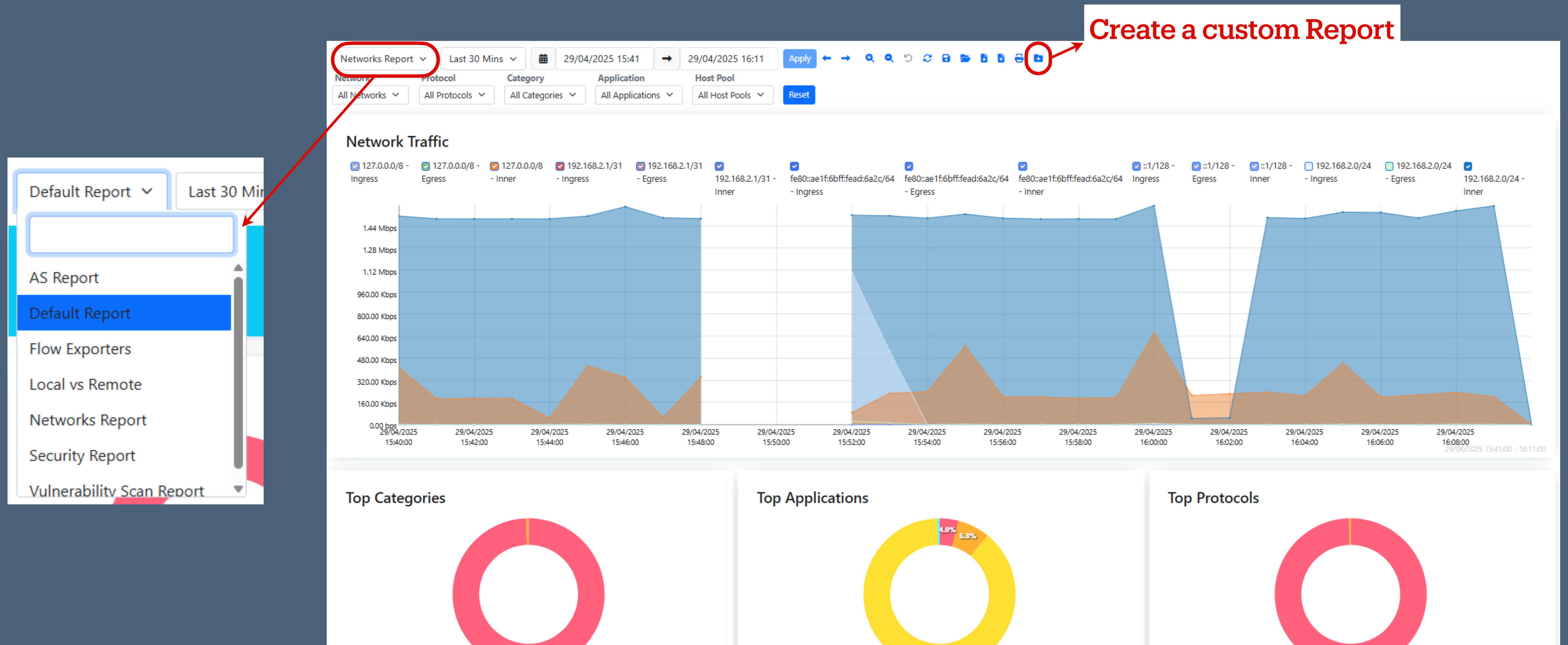
Reports

- How can we generate a report on the traffic, applications, and AS operating in the network?
- How do we know the Flow Exporters statistics or the 'Remote vs Local' traffic?

Reports

- Fully customizable reports
- A lot of different 'widgets' to create a custom Report
- All the fields of the historical data accessible (more then 80 different fields)
- Various default reports template already available

Reports



SNMP

- It is important not just to analyze network traffic but also to map it to the network infrastructure. This is what SNMP is for.
- Other than passive network monitoring, ntopng also has an active monitoring side (SNMP and standard active monitoring, e.g. ICMP, HTTP, ...)
- Support all 3 versions of SNMP (v1, v2c, v3)
- Various SNMP MIBs polling

SNMP v3

- Added support for SNMP V3 context ("context" in SNMPv3 refers to a domain or a specific instance of a managed entity on a device)
- Added support for MD5, SHA, SHA 256, SHA 384, SHA 512 as Authentication Protocols
- Added support for DES, AES, AES 128 as Privacy Protocols

n

Dashboard

Monitoring

Alerts

Flows

Hosts

Flow Exp.

Maps

Interface

Policies

Settings

Developer

Help

Local view:all 2.60 Mbps 96.20 Mbps 4 1.3K 22 3 1.3K ntop

Search

SNMP Devices Interfaces Rules Usage Topology

Device Filter All Reset 10 +

Actions	Device IP	Version	Chart	Device Name	Description
	182.73.157.19	v2c		IMRTR2.3.innomindshyd.com	Cisco IOS Software, C2951 Software (C2951-UNIVERSALK9-M), Version 15.5(1)T2, RELEASE SOFTWARE (fc1) Technical Support: http://www.cisco.com/techsupport Copyright (c)
	192.168.2.1	v2c		EdgeRouter-X-5-Port	office router
	192.168.2.123	v2c		nbox-mini-jet4	Linux nbox-mini-jet4 5.15.0-133-generic #144-Ubuntu SMP Fri Feb 7 20:47:38 UTC 2025 x86_64
	192.168.2.106	v2c		MikroTik Ax3	RouterOS C53UiG+5HPaxD2HPaxD
	192.168.2.83	v2c		vsphere-idrac	
	192.168.2.97	v2c		devele	Linux devele 6.8.0-57-generic #59-Ubuntu SMP PREEMPT_DYNAMIC Sat Mar 15 17:40:59 UTC 2025 x86_64
	192.168.2.237	v2c		X435-24P-4S	ExtremeXOS (X435-24P-4S) version 31.2.1.1 31.2.1.1 by release-manager on Thu Jan 21 18:35:46 EST 2021
	46.148.185.173	v2c		rc-hsoffice-002.corp.prodsho...	Cisco IOS Software [Gibraltar], ISR Software (X86_64_LINUX_IOSD-UNIVERSALK9-M), Version 16.12.4, RELEASE SOFTWARE (fc5) Technical Support: http://www.cisco.com/techs
	192.168.2.169	v2c		ProCurve Switch 2510B-24	ProCurve J9019B Switch 2510B-24, revision Q.11.17, ROM Q.10.02 (/sw/code/build/harp(bh2))
	192.168.2.216	v2c		develv5	Linux develv5 5.4.0-212-generic #232-Ubuntu SMP Sat Mar 15 15:34:35 UTC 2025 x86_64

Showing page 1 of 2: total 11 rows

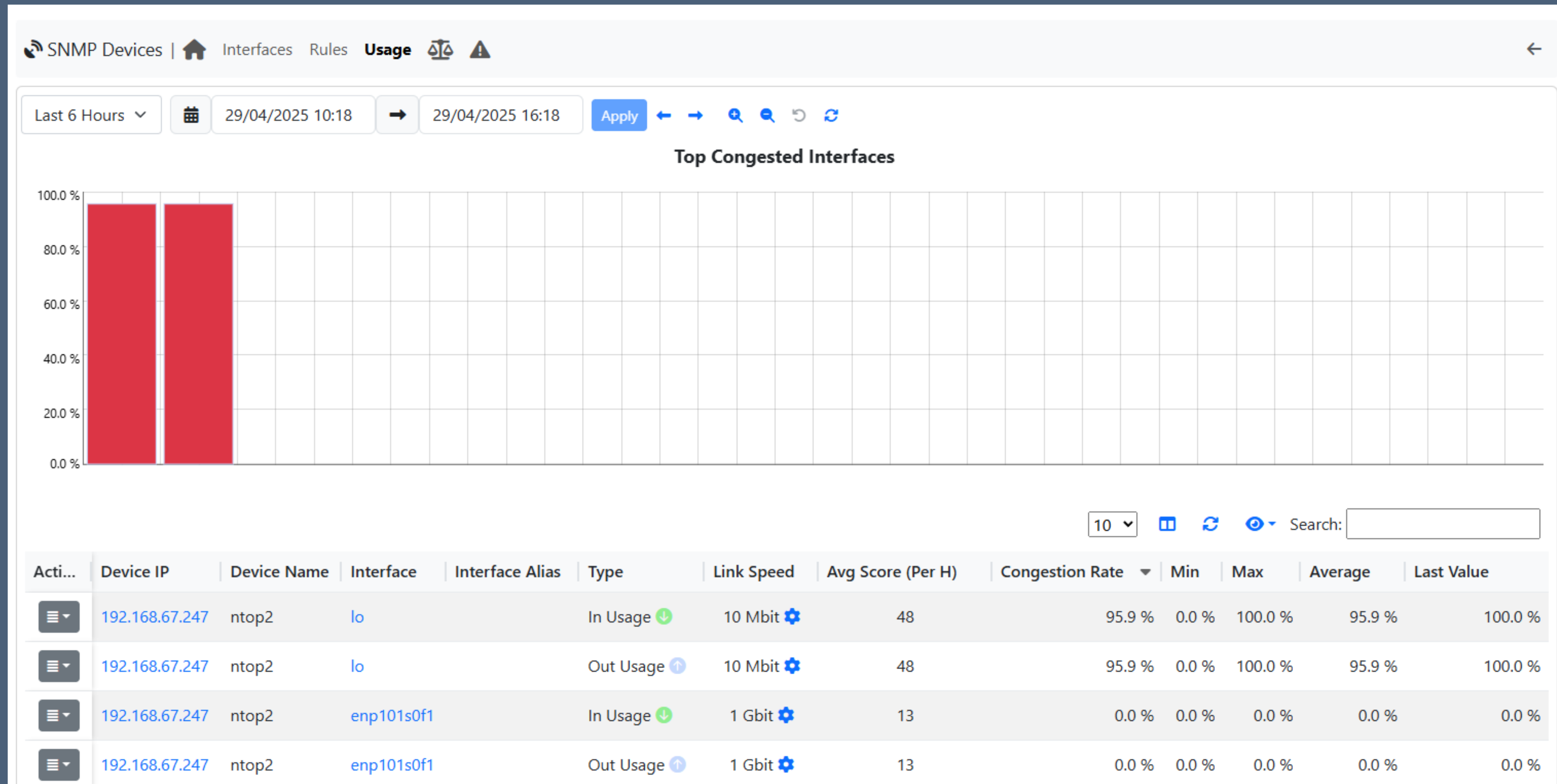
Manage Configurations Ping Devices Delete Unresponsive Delete All

ntopng Enterprise XL v.6.3.250214 (Ubuntu 24.04.2 LTS) | © 1998-25 - ntop 10:38:57 +0200 UTC | Uptime: 15:38

SNMP Interface Usage

- SNMP info are quite useful and can be used to address various issues
- One example is, by knowing the maximum bandwidth of a device and knowing the current throughput, it is possible to infer if the device is saturated or not
- All these info are available by using SNMP!

SNMP Interface Usage



Access Control List

- An Access Control List (ACL) is a set of rules used to control network traffic and restrict access to resources
- It defines which users or systems are allowed or denied access to specific types of traffic based on criteria like IP addresses, protocols, or ports

Access Control List

- Full control over the connections in a network, based on:
 - Talkers
 - Ports
 - Protocols (Application & Transport)
- However remember that ntopng is a Passive Monitoring tool, not an active one!
- When a policy is not followed, ntopng is going to trigger an alert

Access Control List

Access Control List | Overview

Proto

All ▾

L7 Proto

All ▾

Client

All ▾




Server



All ▾

Port

All ▾

Reset

























10 ▾ +   

Actions	Proto	L7 Proto	Client	Server	Port	Creation Date	Notes
	UDP		192.168.2.97	8.8.8.8	*	29/04/2025 16:27:18	DNS allowed
	TCP		192.168.2.97	192.168.2.1	*	29/04/2025 16:27:45	Talks between this device and the gateway

Showing page 1 of 1: total 2 rows

Delete All Rules

Export Rules

Actions	Date/Time	Score ▾	Category	Application	Main Alert	Flow	Description
	16:30:37	230		TCP:Unknown	ACL Violation (ICMP/TCP/...	localhost  :49860  localhost  :sge-execd 	Flow violating the rules set in the ACL  
	16:31:07	230		TCP:Unknown	ACL Violation (ICMP/TCP/...	localhost  :49354  localhost  :sge-execd 	Flow violating the rules set in the ACL  
	16:31:08	230		TCP:Unknown	ACL Violation (ICMP/TCP/...	localhost  :49384  localhost  :sge-execd 	Flow violating the rules set in the ACL  

Know Your Network Configuration

Network Configuration | Policies

DNS Servers

192.168.1.24

A list of comma separated DNS Servers IPs

NTP Servers

Enter NTP Server IPs (Comma Separated)

A list of comma separated NTP Servers IPs

DHCP Servers

192.168.1.1

A list of comma separated DHCP Servers IPs

SMTP Servers

192.168.1.47

A list of comma separated SMTP Servers IPs




Network Gateways

192.168.1.1

A list of comma separated Gateway Servers IPs

Save Settings

Know Your Network Policies

 Network Configuration |  Policies 

Restricted Hosts (e.g. Servers, VPN servers)


A list of networks (CIDR) whose hosts have outbound connection restrictions.


Core Hosts (e.g. Routers, Switches)

A list of networks (CIDR) whose hosts have outbound connection restrictions.

Whitelisted Hosts

A list of whitelisted hosts (CIDR) or MAC addresses.

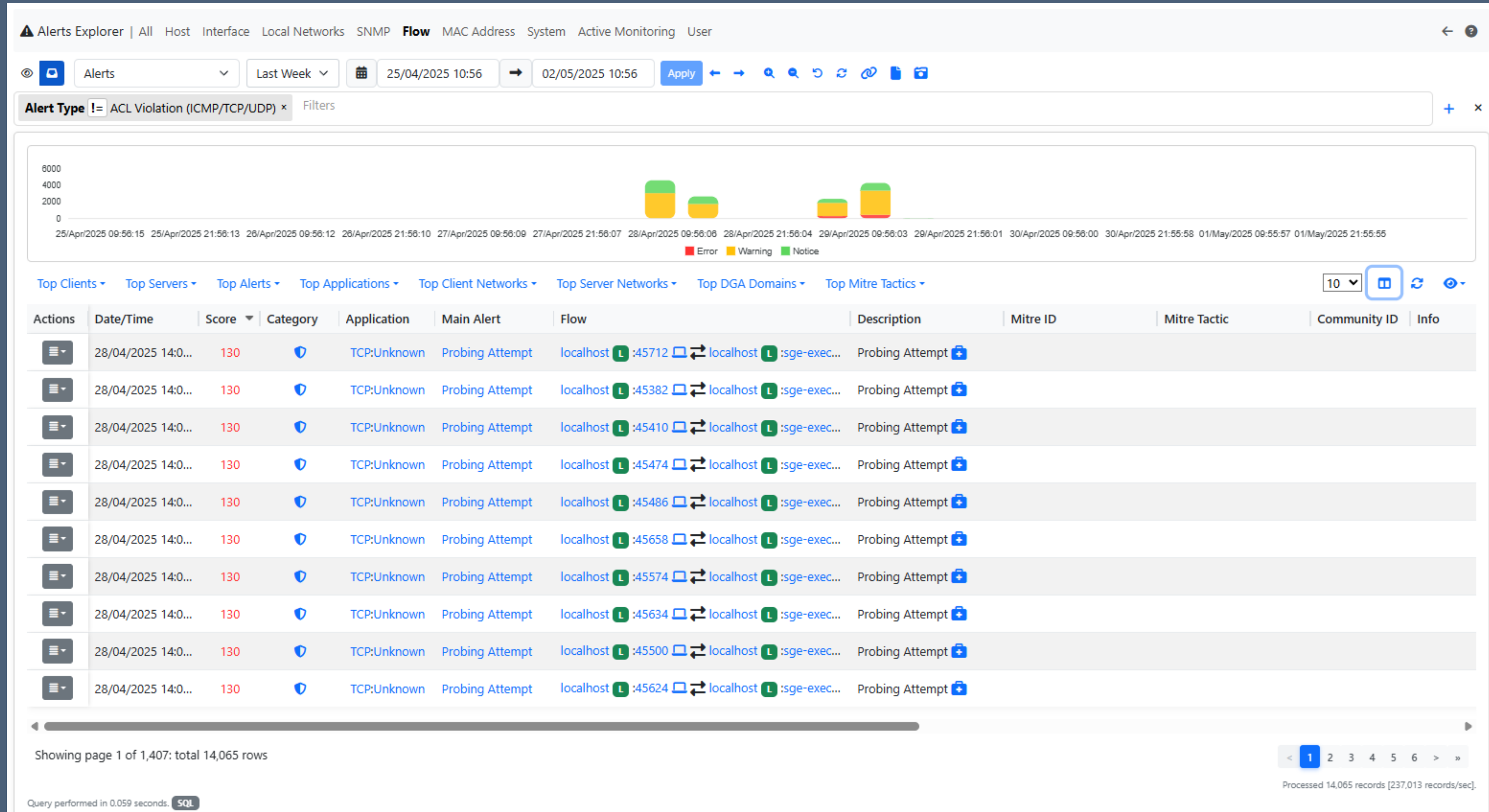
 Import Policies

 Export Policies

Save Settings

Alerts

- ntopng informs the users about issues on the network, by using alerts
- Currently more than 150 alerts are available in ntopng
- Recently we also added and reworked various alerts, like:
 - Scan Alerts - reworked & now works on the historical flows too!
 - Various Flow alerts
 - QoE issues alerts
 - and more ...









PacketFest'25

Fingerprinting [1/2]

- Fingerprinting is a technique for labelling data regardless of its format (plain text or encrypted).
 - nDPI supports various fingerprinting methods:
 - TCP and DHCP are used to identify the operating system.
 - TLS/QUIC (JA3/JA4) and Web Browser Fingerprint
 - SSH, OpenVPNs (and dialects)
 - Obfuscated TLS (encrypted tunnels based on a TLS dialect)
 - Fully Encrypted Protocols (ShadowSocks, VMess, Trojan,...)
- | |
|------------------|
| Router/AccessPo |
| Host MAC Address |
| IP Address |
| OS |
| Name |

Router/AccessPoint MAC Address	TechnicolorD_60:ED:80
Host MAC Address	Apple_A7:EE:CC
IP Address	192.168.1.29 🍏 [192.168.1.0/24]
OS	🍏 macOS
Name	imacm1 🔗 ⚙️ 👤 📁 ⚡ 🚩







Flow Peers [Client / Server]	imacm1   ⚡:60381 [9C:58:3C:A7:EE:CC] ↔ 140.82.114.25   :443 [GitHub, Inc.]
Protocol / Application	TCP / TLS.Github (Collaborative)  [Network: Github] [Confidence: ] TCP Fingerprint: 2_64_65535_d29295416479 [TLSv1.3]

Fingerprinting [2/2]

- Browser fingerprinting
Collects information about a web browser and device where it's running on including browser type, version, operating system, screen resolution, installed plugins. This creates a unique “fingerprint” that can be used to track the user across different sessions and websites.
- Policy Enforcement (OS/Device Fencing)
Restrict to specific VLANs/block old/specific devices/OSs by looking at the device MAC address or initial DHCP request. This technique plays an important role in securing OT (Operational Technology) networks.
- Hidden Device Detection
Spot NAT devices or hotspots

GUI Improvements

- We reduced the loading time of many ntopng pages by moving to the new VueJS framework
- Also reduced the size of the ntopng bundles loaded when opening ntopng (by 200 kB ~)
- We are planning on adding new softwares that are able to compress the bundles sizes by more than half!

 third-party.css?1745935851	200	stylesheet	flows_stats.l	708 kB	372 ms
 ntopng.css?1745935851	200	stylesheet	flows_stats.l	9.1 kB	30 ms
 white-mode.css?1745935851	200	stylesheet	flows_stats.l	16.5 kB	48 ms
 locale.lua?1745913548&user_language=en	200	script	flows_stats.l	463 kB	402 ms
 third-party.js?1745935851	200	script	flows_stats.l	4.7 MB	1.23 s
 ntopng.js?1745935851	200	script	flows_stats.l	5.2 MB	1.93 s

Questions

Thank You

GitHub: <https://github.com/ntop/ntopng>

ntop: <https://www.ntop.org/>