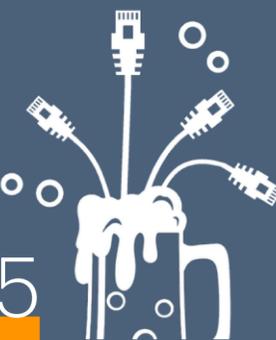


ntopng towards new frontiers

Matteo Biscosi

ntop

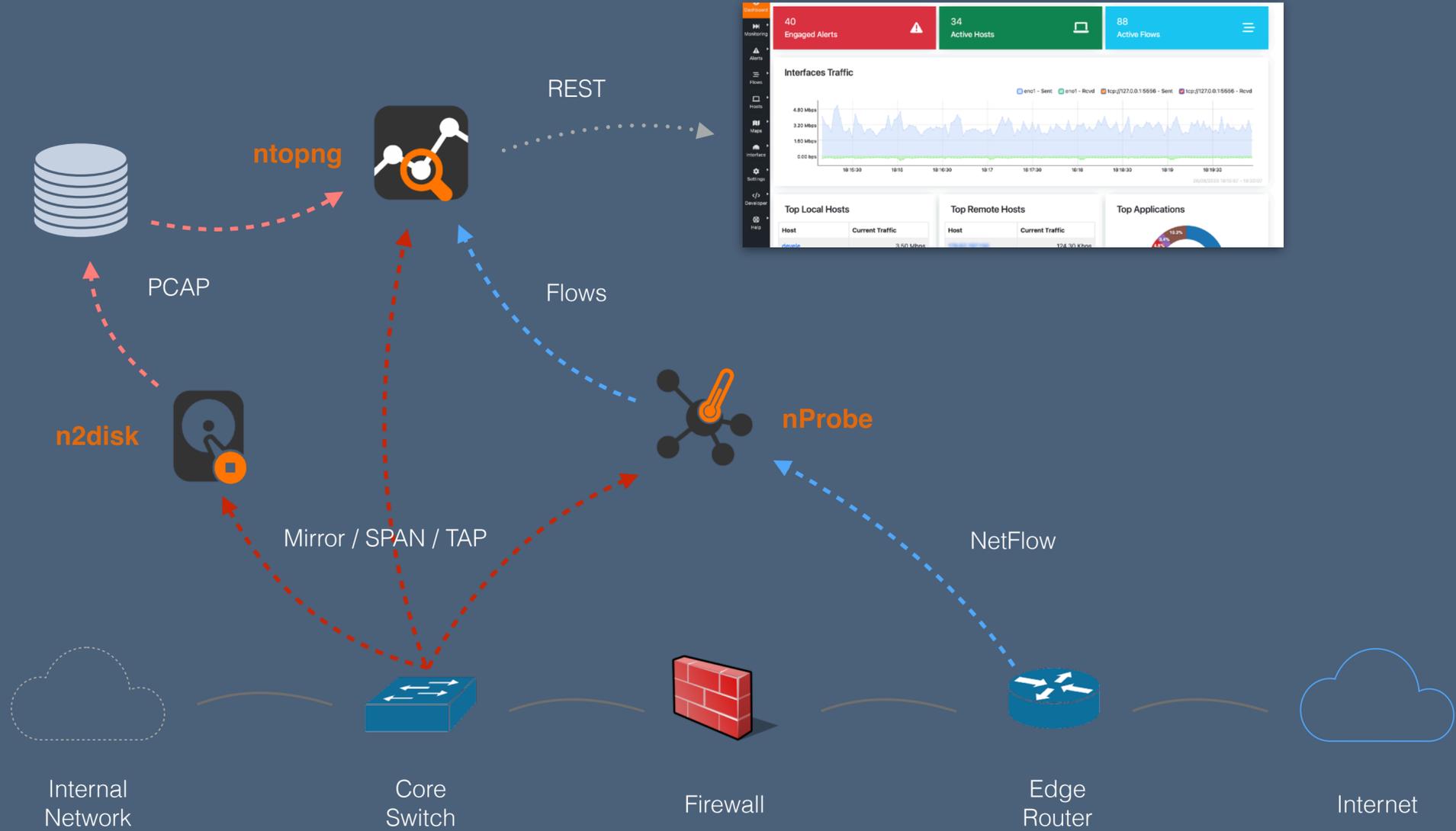
PacketFest'25



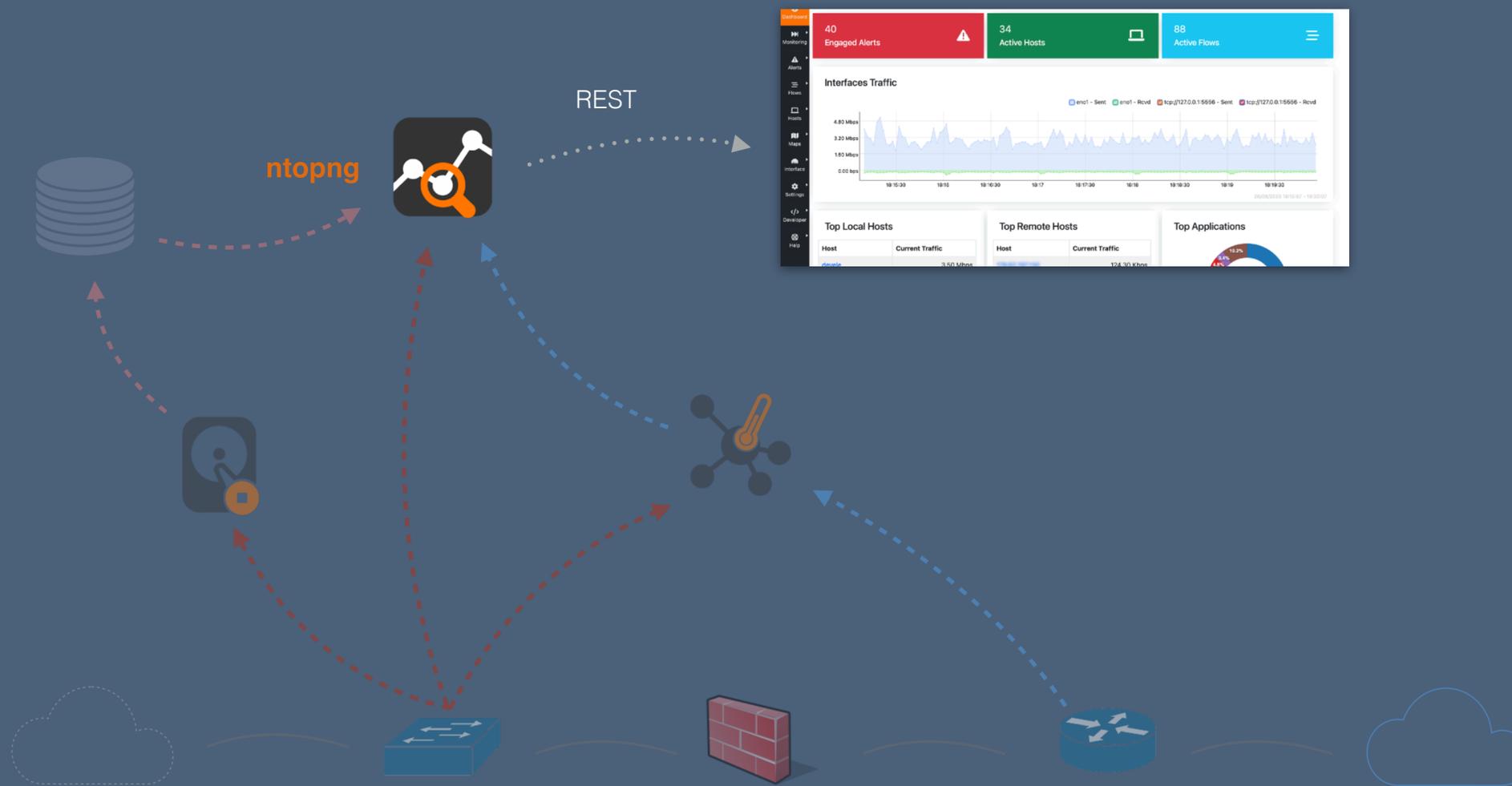
Agenda

- 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

Local
view:all
3.10 Mbps
97.30 Mbps
5
1.4K
21
2
1.4K
ntop

5 Engaged Alerts

21 Active Hosts

1.4 K Active Flows

Interfaces Traffic

tcp/*:6001c - Sent
 tcp/*:6001c - Rcvd
 eno1 - Sent
 eno1 - Rcvd
 tcp/*:5556c - Sent
 tcp/*:5556c - Rcvd
 view:all - Sent
 view:all - Rcvd
 tcp/*:4455c - Sent
 tcp/*:4455c - Rcvd

Top Local Hosts

Host	Current Traffic
devele	97.00 Mbps
localhost	93.00 Kbps
super	13.30 Kbps
rpi3	3.90 Kbps
192.168.2.66	327.80 bps
192.168.2.111	311.60 bps

Top Remote Hosts

Host	Current Traffic
151.11.48.122	97.60 Mbps

Top Applications

● Unknown (86.3%)
 ● ntop (7.2%)
 ● RESP (4.8%)
 ● Other (0.7%)

Top Local Hosts 1 Week Ago

Host	Volume
------	--------

Top Remote Hosts 1 Week Ago

Host	Volume
------	--------

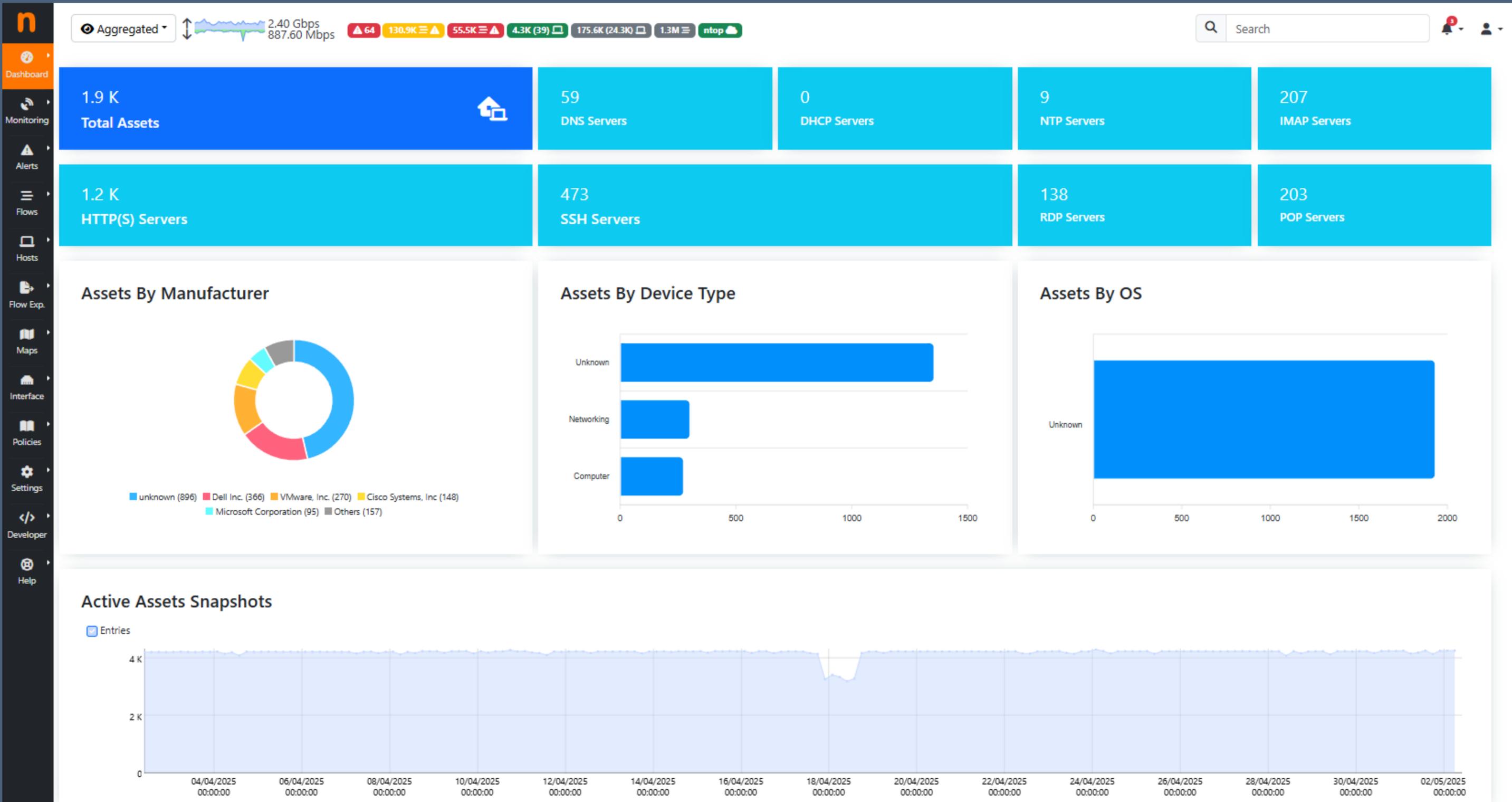
Quality

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

The screenshot shows a web interface for 'Assets Inventory'. At the top, there's a navigation bar with 'Assets Inventory | Dashboard' and a home icon. Below this is a filter section with dropdown menus for 'Device Type', 'Manufacturer', 'Network', 'OS Type', 'VLAN', 'Status', and 'Server Type'. A 'Reset' button is also present. To the right of the filters is a search bar and a refresh button. The main area is a table with columns: 'Actions', 'IP Address', 'Name', 'MAC Address', 'Model', 'OS', 'Status', 'First Seen', and 'Last Seen'. Each row represents an asset and includes a menu icon in the 'Actions' column and a status indicator (e.g., 'Online') in the 'Status' column. At the bottom, there are buttons for 'Import Assets', 'Export Assets', 'Delete All', and 'Delete Older Than'. A pagination bar at the bottom right shows 'Showing page 1 of 39: total 389 rows' and page numbers 1 through 6.

Possible Filters

Asset Status (online/offline)

Services

Details & Other Links

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	Source	Name
	HTTP	mail.hydropompe.biz
Server Ports	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 | [Reset](#) | 10 | |

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

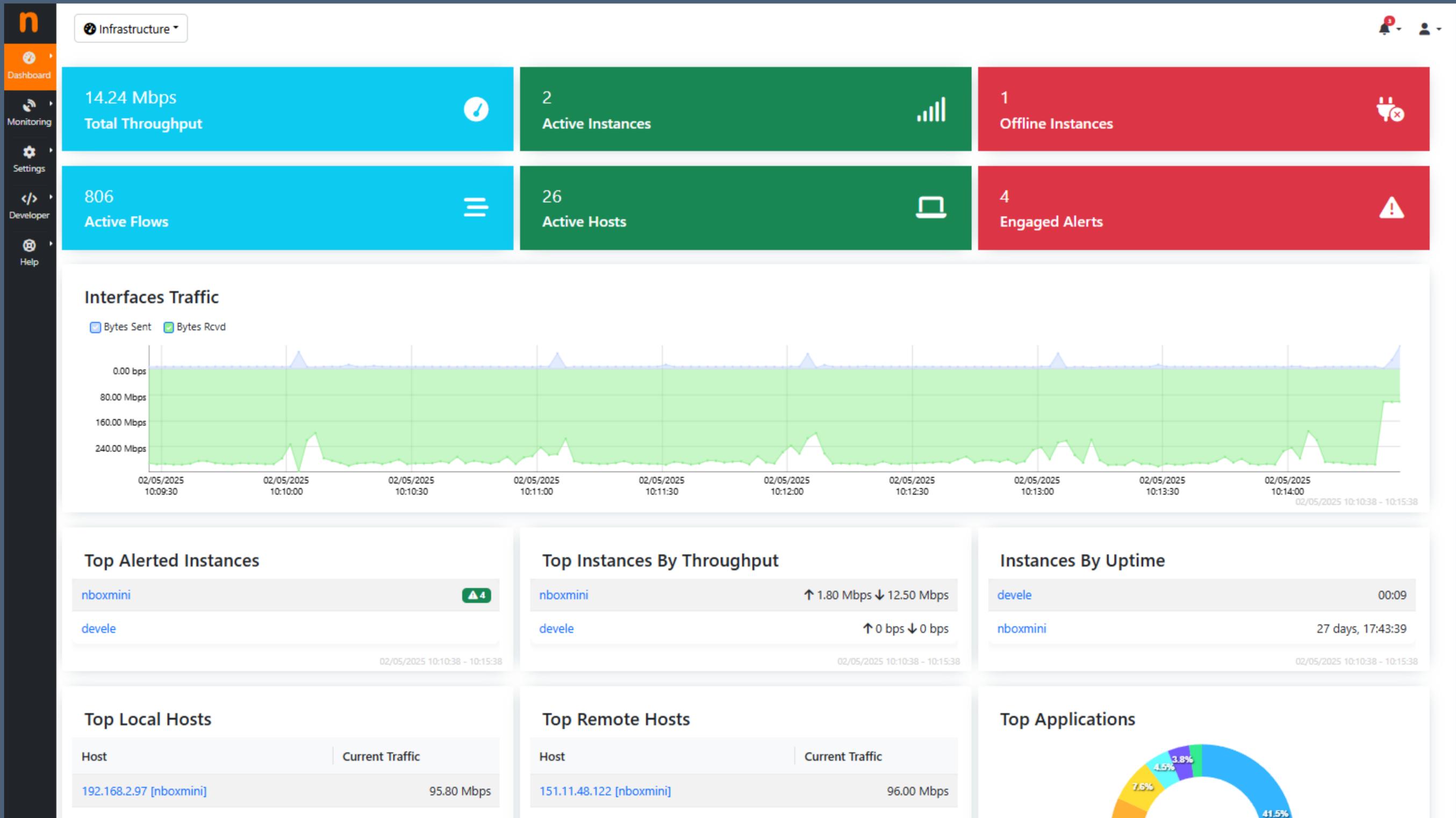
Several Server Retransmissions

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

The screenshot shows the 'Infrastructure' dashboard with a table of ntopng instances. The table has columns for Name, URL, Chart, Status, Throughput, Hosts, Flows, Engaged Alerts, Flow Alerts, Last Update, and Actions. Three instances are listed: 'devele' (Error), 'nboxmini' (Up), and 'super' (Error). A red box highlights the table, and a red arrow points to the '+' button in the top right corner of the table area.

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	

ntopng Instances

Reports

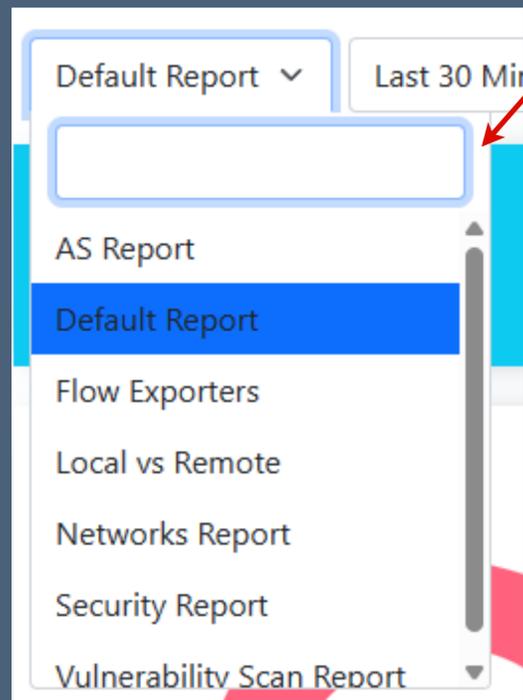
- How can we generate a report on the traffic, applications, and AS operating in the network?
- How do we know the Flow Exporters statistics or the 'Remote vs Local' traffic?

Reports

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

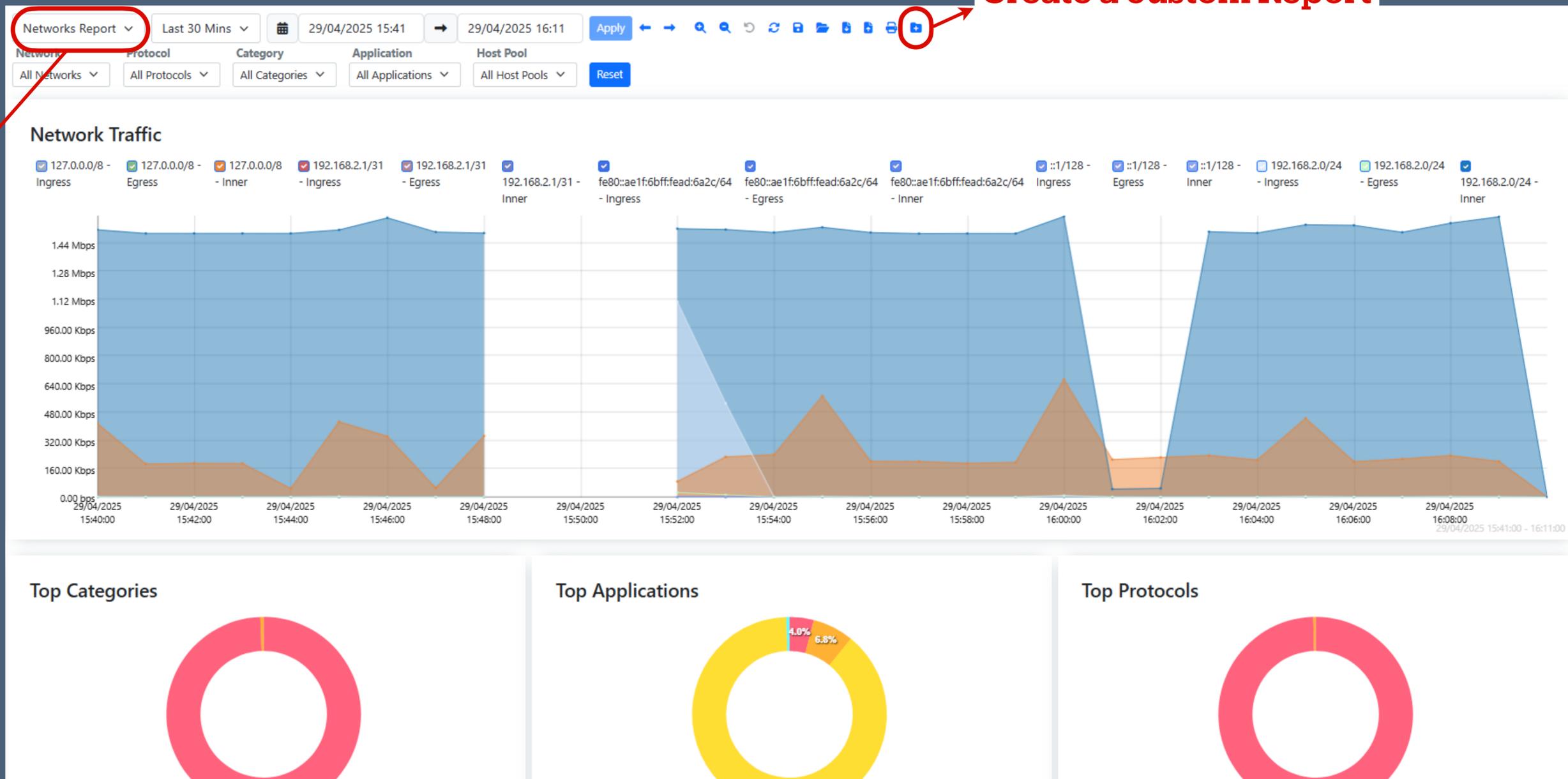
Reports

Create a custom Report



Default Report ▾ Last 30 Mins

- AS Report
- Default Report**
- Flow Exporters
- Local vs Remote
- Networks Report
- Security Report
- Vulnerability Scan Report



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

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

SNMP Devices | [Interfaces](#) | [Rules](#) | [Usage](#) | [Topology](#)

Device Filter
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
< 1 2 >

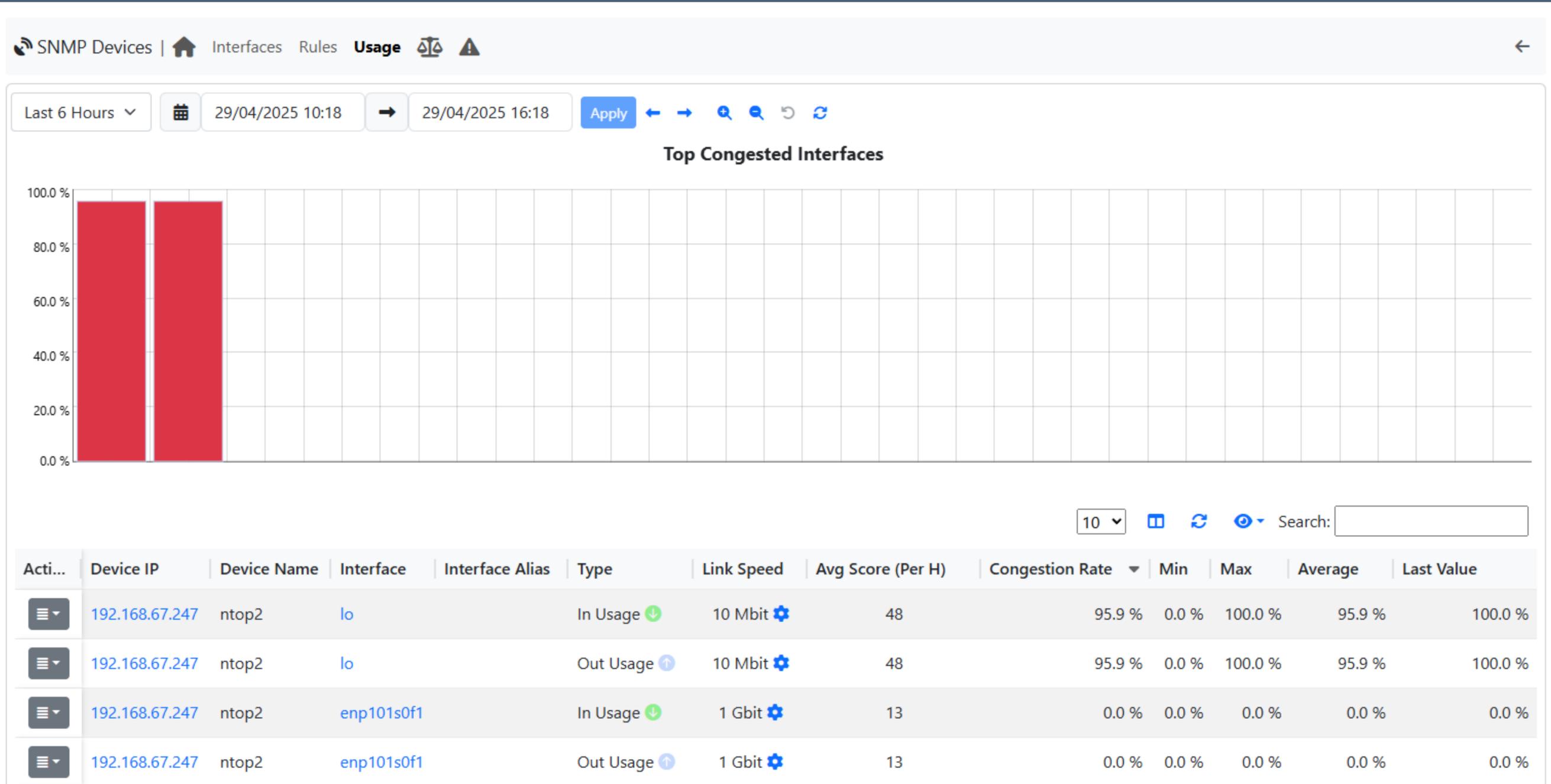
🔧 Manage Configurations
📶 Ping Devices
🗑️ Delete Unresponsive
🗑️ Delete All

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 + [Grid] [Refresh] [Eye]

Actions	Proto	L7 Proto	Client	Server	Port	Creation Date	Notes
[Menu]	UDP		192.168.2.97	8.8.8.8	*	29/04/2025 16:27:18	DNS allowed
[Menu]	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
[Menu]	16:30:37	230	[Icon]	TCP:Unknown	ACL Violation (ICMP/TCP/...	localhost L:49860 ↔ localhost L:sge-execd	Flow violating the rules set in the ACL [Settings] [Lock]
[Menu]	16:31:07	230	[Icon]	TCP:Unknown	ACL Violation (ICMP/TCP/...	localhost L:49354 ↔ localhost L:sge-execd	Flow violating the rules set in the ACL [Settings] [Lock]
[Menu]	16:31:08	230	[Icon]	TCP:Unknown	ACL Violation (ICMP/TCP/...	localhost L:49384 ↔ localhost L:sge-execd	Flow violating the rules set in the ACL [Settings] [Lock]

Know Your Network Configuration

Network Configuration | Policies

DNS Servers

A list of comma separated DNS Servers IPs

NTP Servers

A list of comma separated NTP Servers IPs

DHCP Servers

A list of comma separated DHCP Servers IPs

SMTP Servers

A list of comma separated SMTP Servers IPs

Network Gateways

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](#)

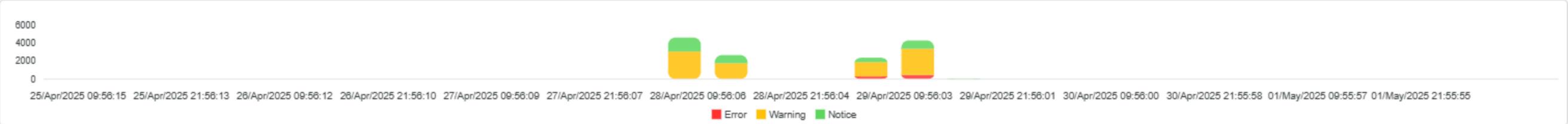
Alerts

- 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 ...

Alerts Explorer | All Host Interface Local Networks SNMP **Flow** MAC Address System Active Monitoring User

Alerts Last Week 25/04/2025 10:56 → 02/05/2025 10:56 Apply

Alert Type != ACL Violation (ICMP/TCP/UDP) × Filters



Top Clients Top Servers Top Alerts Top Applications Top Client Networks Top Server Networks Top DGA Domains Top Mitre Tactics

Actions	Date/Time	Score	Category	Application	Main Alert	Flow	Description	Mitre ID	Mitre Tactic	Community ID	Info
⋮	28/04/2025 14:0...	130	🛡️	TCP:Unknown	Probing Attempt	localhost L :45712 ↔ localhost L :sge-exec...	Probing Attempt				🔗
⋮	28/04/2025 14:0...	130	🛡️	TCP:Unknown	Probing Attempt	localhost L :45382 ↔ localhost L :sge-exec...	Probing Attempt				🔗
⋮	28/04/2025 14:0...	130	🛡️	TCP:Unknown	Probing Attempt	localhost L :45410 ↔ localhost L :sge-exec...	Probing Attempt				🔗
⋮	28/04/2025 14:0...	130	🛡️	TCP:Unknown	Probing Attempt	localhost L :45474 ↔ localhost L :sge-exec...	Probing Attempt				🔗
⋮	28/04/2025 14:0...	130	🛡️	TCP:Unknown	Probing Attempt	localhost L :45486 ↔ localhost L :sge-exec...	Probing Attempt				🔗
⋮	28/04/2025 14:0...	130	🛡️	TCP:Unknown	Probing Attempt	localhost L :45658 ↔ localhost L :sge-exec...	Probing Attempt				🔗
⋮	28/04/2025 14:0...	130	🛡️	TCP:Unknown	Probing Attempt	localhost L :45574 ↔ localhost L :sge-exec...	Probing Attempt				🔗
⋮	28/04/2025 14:0...	130	🛡️	TCP:Unknown	Probing Attempt	localhost L :45634 ↔ localhost L :sge-exec...	Probing Attempt				🔗
⋮	28/04/2025 14:0...	130	🛡️	TCP:Unknown	Probing Attempt	localhost L :45500 ↔ localhost L :sge-exec...	Probing Attempt				🔗
⋮	28/04/2025 14:0...	130	🛡️	TCP:Unknown	Probing Attempt	localhost L :45624 ↔ localhost L :sge-exec...	Probing Attempt				🔗

Showing page 1 of 1,407: total 14,065 rows

Query performed in 0.059 seconds. SQL

Processed 14,065 records [237,013 records/sec].

Dashboard

Monitoring

Alerts

Flows

Hosts

Flow Exp.

Maps

Interface

Policies

Settings

Developer

Help

Aggregated

1.90 Gbps
572.30 Mbps

▲ 66

▲ 124.9K

▲ 55K

▲ 4.3K (36)

▲ 170.8K (22.6K)

▲ 1.3M

ntop

Custom

02/05/2025 10:23 → 02/05/2025 10:53

Apply

← → 🔍 🔍 ↺ ↻

Incoming Edges

Outgoing Edges

Center on IP

Score Filters

Alerts Topology

Node Details

🖨️ 89.

Country: 🇮🇹 IT

ASN: srl

Live Flows: 588

[Historical Flows](#)

[Historical Alerts](#)

[As Client](#) [As Server](#)

First Seen:	2025-05-02 10:35:43
Last Seen:	2025-05-02 10:38:58
Alerts Count:	2
Total Score:	30
Total Traffic:	506.00 B

Severity Distribution

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/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: 🟢 DPI] 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/>