



# Guardian User Guide

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# Contents

Chapter 1. Introduction	9
Guardian overview	11
Chapter 2. Sensors	13
List	
Мар	
Graph	
Do a force update on sensors	
Allow a sensor	
Export a list of sensors	
Upload a map	
Arc sensor configuration	
Execution options	
Traffic monitoring	
Configure an Arc sensor	
Chapter 3. Alerts	
Standard mode	
Expert mode	
View alerts in standard mode	
View alerts in expert mode	
Closing alerts	
Actions menu	
Open the Actions menu in standard mode	
Open the Actions menu in expert mode	
Configure an alert	45
Acknowledge an alert	
Close an alert	
Download a trace	
Download a malicious file	
Edit a note for an alert	
View a diff from an alert	
Navigate from an alert	
Edit a playbook associated with an alert	53
Chapter 4. Assets	55
List	
Diagram	
Details window	60
Configure an asset	62
Generate a PDF report of an asset	63

Navigate from an asset	64
View more details for an asset	65
Overview	66
Sessions	67
Alerts	
Software	
Installed hotfixes	
Missing hotfixes	71
Vulnerabilities	72
Variables	
Chapter 5. Queries	
Data sources	
Basic operators	
Commands	
Nodes-specific commands reference	
Link-events-specific commands reference	
Functions	
Examples	
Pie chart	
Column chart	
Where with multiple conditions in OR	
Bucket and history	
Join	
Compute the availability history	
Complex field types	
Chapter 6. Smart Polling in Guardian	
Plans	
Node points	
Settings	
Health	
Create a Smart Polling plan	
Edit a Smart Polling plan	
Add a network node to a Smart Polling plan	
Add a node from the Network page	
Edit the run interval of a progressive Smart Polling plan	
Progressive enablement	
Enable progressive mode	
Log level customization	
View the enriched information history for a node	
Chapter 7. Arc in Guardian	
Architecture	
Arc in Guardian	
Deployment	

Advanced	
Execution details	
Node points	
Chapter 8. Network	
Nodes	
Configure a node	
Show alerts for a node	
Show requested traces for a node	
Request a trace for a node	
Manage learning for a node	
Navigate from a node	140
Add a node to a Smart Polling plan	141
Links	
Link events	144
Link availability	145
Configure a link	146
Show alerts for a link	147
Show requested traces for a link	
Request a trace for a link	
Show events for a link	
Show captured URLs for a link	
Manage learning for a link	
Navigate from a link	
Sessions	
Show requested traces for a session	
Request a trace for a session	
Navigate from a session	
Graph	
Main network graph	
Zones/Topology graph	
Traffic	
Graph controls	
Chapter 9. Process	
List	
Protocol connections	
Settings	
Configure a variable	
View the details of a variable	
Favorite a variable	
Navigate from a variable	
Chapter 10. Reports	
Dashboard	
Management	

Generated	
Scheduled	
Settings	
Create a report	
Generate a report	
Download a report	
Delete a report	
Add a folder	
Edit a folder	
Delete a folder	
Import a schema	
Export a schema	
Upload a custom logo	
Configure SMTP settings	
Filter a report globally	
Add a widget to a report	
Filter a report with a widget	211
Chapter 11. Assertions	
Assertion operators	
Save an assertion	
Edit an assertion	
Configure an assertion	
Configure an assertion on links	
Configure an assertion on variables	
Chapter 12. Time machine	
Time machine diffs	
Load a snapshot	
Request a diff	
Reload the diff operation progress	
View a diff from an alert	
Chapter 13. Vulnerabilities	
Assets	242
List	
Stats	
Details page	
Chapter 14. Administration	
Administration page	
Chapter 15. Personal settings	
Other actions	
Change your password	
Edit an OpenAPI key	
Generate an OpenAPI key	

Clear your personal settings	259
Request a continuous trace	260
Request a custom trace	261
Show requested traces	
Download a requested trace	264
Zone filters	
Glossary	

User Guide



1 - Introduction

# **Chapter 1. Introduction**



### **Guardian overview**

Guardian is the main Nozomi Networks sensor.

### Asset discovery

Guardian gives you the ability to automatically track your *industrial control systems* (ICS), operational technology (OT) and Internet of Things (IoT)/Industrial Internet of Things (IIoT) assets.

- Highly accurate asset inventory of all communicating devices
- Extensive node information including name, type, serial number, firmware version and components
- Actionable risk assessment insights including security and reliability alerts, missing patches and vulnerabilities

### Network visualization

Guardian gives you instant visibility of your entire network. This lets you:

- Have instant awareness of your *OT/IoT* networks and normal activity patterns
- Access key data such as traffic throughput, *transmission control protocol (TCP)* connections, and protocols
- Use intuitive dashboards and reports with macro and micro views, plus filtering and grouping

### Automated vulnerability assessment

Guardian lets you quickly identify which *ICS*, *OT* and *IoT* devices are vulnerable. This provides:

- Efficient prioritization and remediation
- A faster response with vulnerability dashboards, drill-downs and reports
- Based on the U.S. government's *National Vulnerability Database (NVD)* for standardized naming, description and scoring

Continuously monitor your networks and automation systems. Guardian gives you:

- The ability to continuously monitor all your assets, network communications and supported protocols
- Easy access to summarized ICS, OT and IoT risk information
- The ability to highlight potential reliability issues, such as unusual process values

### **Anomaly-based detection**

Guardian builds a baseline of your environment and uses that knowledge to detect threats such as transferred malware, suspicious communications, unwanted operations, or changes to the network.



# **Chapter 2. Sensors**



The **Sensors** page lets you view all of the sensors that you have in your system.

The **Sensors** page has these three tabs:

- List
- Мар
- Graph

## List

The **List** page lets you view all of the sensors that you have in your system.

NOZ	OMI 🗮 🕺 Sensors 🔿 Alerts 🖵 Assets	Queries 🔅	Smart Polling	·Q. Arc				ණු ල
ensors							List	Map Graph
	Quick search			Page 1 of 1, 2	0 entries		Export 📋 Live	• G selected
YPE	HOSTNAME	MODEL	IP	HEALTH	# SENSORS	>		9.±.¢.≙.0.#
0 8	ch-lab-sg-ns20-1.intra.nozominetworks.com	NS20	10.41.43.87	O Good	7	\$		4 <b>2</b> 4 <b>8</b> 0 7
TYPE	HOSTNAME	MODEL	IP	HEALTH	# SENSORS	ch-lab-sg		
$\otimes$	ch-lab-sg-rc-brl-3.intra.nozominetworks.com	NRC-5	10.41.43.165	O Unreachable	0	1.intra.no	zominetwo	ks.com
$\otimes$	RTP-Sentjur	NRC-5	10.41.43.1	O Poor	0			
$\otimes$	ch-lab-sg-rc-brl-2.intra.nozominetworks.com	NRC-5	10.41.43.164	O Unreachable	0	ID IP		'4ffc 1.43.87
$\otimes$	ch-lab-sg-rc-brl-l.intra.nozominetworks.com	NRC-5	10.41.43.163	O Unreachable	0	Version		.0-09061731_986C7
$\otimes$	ch-lab-sg-rc-brl-4.intra.nozominetworks.com	NRC-5	10.41.43.166	O Unreachable	0	Description		
8	ch-lab-sg-R50asRC-01.intra.nozominetworks.com	NSG-R50	10.41.43.105	🙆 Good	0	Site		
8	ch-lab-sg-iox-catalyst9300.intra.nozominetworks.com	Container	10.41.43.149	O Poor	0			5
<u>_1</u>				O Good		- A	# Alerts (5m) # Alerts	5
<b>)</b> 	nozomi-nZos.local	V-SERIES	10.41.128.10	-	0	<u>_!</u> \	Risk (5m)	7.0
30	ch-lab-sg-nsl-l.intra.nozominetworks.com	NSI	10.41.43.88	Good	0			
30	lab-r50.intra.nozominetworks.com	NSG-R50	10.41.43.26	Cood	0		Stale	No
20	lab-nsg-m-2.intra.nozominetworks.com	NSG-M	10.41.43.31	O Good	2		Last sync	14:14:21.439
3 🗇	ch-lab-sg-ng500rprototype-1.intra.nozominetworks.com	NG-500R	10.41.43.32	🙆 Good	0		Uptime Resources usage	0d 6h 30m 51s
3 🗇	ch-lab-sg-vm-guardian-arc.intra.nozominetworks.com	V-SERIES	10.41.43.144	🙆 Good	331	0		
3 🗇	ch-lab-sg-rx1501-2.intra.nozominetworks.com	RUGGEDCOM-A	P 10.41.43.97	O Good	0	Good	RAM B05 Disk P4%	81
3 🗇	ch-qa-g-std-nsglv4-gen-dyn-lintra.nozominetworks.com	NSG-L	10.41.43.167	O Good	0		CPU	62%
3 🗇	lab-sg-hyperv-master.intra.nozominetworks.com	V-SERIES	10.41.43.51	🙆 Good	0		0 2	50 75 1
38	ch-lab-sg-r150-1.intra.nozominetworks.com	NSG-R150	10.41.43.27	🙆 Good	0			
08	n2os_master	Container	10.41.43.30	O Unreachable	0			

### Figure 1. Sensors list

### Force update

The force update  $\odot$  icon lets you do a force update on the selected sensors.

### Allow/disallow

The allow/disallow 🎕 icon lets you allow or disallow sensors.

### Quick search

The quick search field lets you easily do a search on the current page.

### Export

The **Export**  $\stackrel{\frown}{\square}$  icon lets you export the current list in either *comma-separated value* (CSV) or Microsoft Excel format.

### **Download Arc**

The **Download Arc** dropdown lets you select, and download, the applicable Arc package for your *operating system (OS)* and architecture.

### Live

The Live toggle lets you change live view on, or off. When live mode is on, the page will refresh periodically.

### Refresh

The **Refresh**  ${}^{\bigcirc}$  icon lets you immediately refresh the current view.

### **Column selection**

The columns selection  ${}^{igodoldsymbol{\Theta}}$  icon lets you choose which columns to show or hide.

### Information pane

The information pane to the right of the list of sensors shows additional information for the selected sensor.

It also lets you do these actions shown below.

ℜ Allow/Disallow sensor	After allowing a sensor, this icon shows: Synchronized data coming from the sensor become part of the Environment of the <i>Central Management Console (CMC)</i> . Alerts coming from the sensor can be seen in the <b>Alerts</b> section.
L Focus on sensor	Allows to filter out only the sensor chosen data, such as Alerts and Environment.
➡ Go to sensor	Connect to a remote sensor directly from the <i>CMC</i> . Select this to open a new browser tab to the sensor selected login page. The action is hidden if the <i>CMC</i> isn't configured to allow this type of communication between sensors and <i>CMC</i> .
Place in map	This action is used to place the sensor on the map.
Toggle version lock	When locked, the sensor will not automatically update its software.
• Force update	Even if it is locked, the sensor will automatically update its software, with the version installed on the <i>CMC</i> .
Clear sensor data on this machine	Clear all synchronized data at the <i>CMC</i> received from the selected sensor. Use this in combination with the clearing of the data on the sensor, and you will be able to restart the synchronization between the sensor and the <i>CMC</i> from an empty state
Delete sensor	Clear all data received from the selected sensor and delete it from the list. If the sensor tries to sync with the <i>CMC</i> again, it shows as disallowed in the list.

### Table 1. Sensors list actions

### Мар

You can use the **Map** page to upload, and view, a map of the sensors in your environment.



Figure 2. Sensors map

### Info(rmation) pane

		List	Мар	Graph
				Upload map
	🖯 🗁 ch-lab-sg-nsg-hs-1.intra	a.nozominetw	orks.com	
	🖯 🗁 Info			
	> IP:	10.41.43	3.28	
Info ►	> CPU:	4%		
	> RAM:	6%		
	🖯 🗁 Data			
	> Risk (5m):	7.0		
	> # Nodes:	5122		
	> # Links:	3578		
	> # Alerts:	26847		
	> # Alerts (5m):	7		

### Figure 3. Info(rmation) pane

The **Info** pane lets you view information for the related sensor. The *identifier (ID)* of each sensor is used in the map to help you identify it. The marker color of the sensor relates to the risk of its alerts.

In the map view, a red indicator to the right of the sensor's *ID* shows the number of the alerts in the last five minutes. This indicator only shows if there are some alerts for the sensor. If the alerts in last 5 minutes increase, the sensor marker will blink for one minute.

If the site of the sensor has been specified in  $\bigotimes$  > System > General, it is possible to enable the **Group by site** option, in the bottom right corner of the map view. The sensors with the same site will be grouped to deliver a simpler view of a complex installation.

### Note:

The sensors map is also available as a widget.

# Graph

The **Graph** page shows a graphical view of all the sensors in you environment.

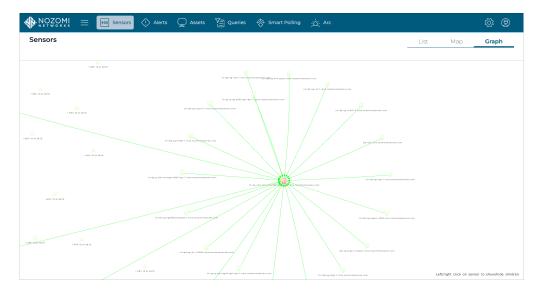


Figure 4. Sensors graph

### Do a force update on sensors

If you have disabled auto updates, you can use the force update icon to do a manual update.

### Procedure

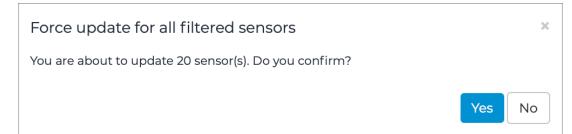
1. In the top navigation bar, select **Sensors**.

Result: The Sensors page opens.

2. In the top left section, select lambda.

Result: A dialog shows.

3. To confirm, select **Yes**.



### Allow a sensor

The allow icon lets you give permission for a new sensor to connect to Central Management Console (CMC).

### Procedure

Г

1. In the top navigation bar, select **Sensors**.

Result: The Sensors page opens.

Result: A dialog shows.

3. To confirm, select **Yes**.

Allow all filtered sensors	×	
You are about to allow 20 sensor(s). Do you confirm?		
Yes	0	

### Export a list of sensors

You can export a list of the sensors from the current view.

### Procedure

1. In the top navigation bar, select **Sensors**.

Result: The Sensors page opens.

2. In the top right section, select **Export**.

Result: A dialog shows.

3. Choose an export format:

#### Choose from:

- Select **CSV** to create a CSV file
- $^\circ$  Select Excel to create a Microsoft Excel file

Exports list		×
ECSV Excel		
Actions	Filename	
No results		

**Result:** The file is created and a Exported message shows.

4. To download the file, in the bottom-left of the dialog, select lacksquare

Exports list		×
Exported! Excel	]	
Actions	Filename	
۵	export_appliances_57_20230908093055.csv	

### Results

The exported file has been downloaded.

## Upload a map

The **Map** page lets you upload a map of your sensors in your environment.

### Procedure

1. In the top navigation bar, select **Sensors**.

Result: The Sensors page opens.

2. In the top right section, select **Map**.

Result: The Map page opens.

- 3. In the top right section, select **Upload map.**
- 4. Select the image file that you want to upload.

### Results

The map is uploaded.

### Arc sensor configuration

### **Execution options**

The **Execution options** page lets you configure how Arc collects data, manage detection features, and control network discovery and polling behaviors. You can also set logging levels and adjust specific execution parameters to optimize performance.

Settings	Mhen connected in Service mode, the local confi		
Upstream connection	One-shot and Offline mode use the local configur	ation instead.	
Execution options Traffic monitoring	(b) Execution options		
	Execution time [s] 🕦		
	150		\$
	Maximum disk space [MB] 🕕		
	200		0
	Sigma rules	VARA rules	
	USB detections	Node points	
	Discovery	Smart Polling 🕕	
	Local ARP table		
	Use static entries ①		
	Log level		
	Debug		*

#### Figure 5. Execution options

### **Execution time**

This field lets you set the time that Arc will run to collect data. This is applicable for One-shot and Offline modes.

Note: Ì

When this is set to 0, the execution time is interpreted as infinite.

### Maximum disk space

This field lets you control the maximum amount of disk space in *megabyte (MB)* that will be used for Offline mode.

### Sigma rules (Windows only)

This lets you enable/disable Sigma rules for local behavior analysis.

### YARA rules (Windows only)

This lets you enable/disable YARA rules. YARA rules are applied to every newly-detected non-signed on the host machine's file system.

### USB detections (Windows only)

This lets you enable/disable *universal serial bus (USB)* detections.

#### Node points

This lets you enable/disable the production of node points.

### Discovery

When enabled, this sends out unsolicited lightweight network announcements to discover neighboring nodes.

Discovery uses lightweight protocol-specific broadcast messages to identify network devices. These messages trigger a response from the devices, which includes identity information. The process is repeated at predefined intervals. At each interval, the sensor will identify the suitable network interfaces and send broadcast messages through them to discover devices on each subnetwork connected to the sensor.

### **Smart Polling**

This lets you enable/disable the execution of Smart Polling strategies from Arc. When enabled, this sends out Smart Polling queries following remote requests coming from Guardian to poll assets that Arc can reach, or assets that have been identified with Discovery.



Smart Polling requires that a Smart Polling license is enabled upstream.

To force Smart Polling from a specific Arc sensor, even when Guardian was the first to monitor a node, you can use a *command-line interface (CLI)* command such as: vi node 192.168.1.1 capture\_device arc[1e6a174c] In this example, 192.168.1.1 is an *internet protocol (IP)* address of a node you want to poll from a specific Arc sensor. 1e6a174c are the first eight characters of the Arc sensor *ID* that you want to poll the node with. To find that sensor *ID*, you can select the Arc sensor from the **Sensors** page of your Guardian and read the **ID** field in the right pane. To reset the behavior, you can set the capture\_device back to the value of the Guardian interface.

### Local ARP table

This lets you enable/disable the ability to use the local table to confirm *media access control (MAC)* addresses. The **Use static entries** checkbox lets you enable/disable the use of static entries in the table. Static entries are user-defined. You should only use them if they can be trusted.

### Log level

This dropdown lets you select the verbosity level for the log files. The options are:

- Debug
- Info
- Warning
- Error

The logging system options have an increasing level of verbosity, from the least verbose to the most verbose. Error < Warning < Info < Debug.

- Error: Creates a minimalistic log, only unexpected errors are logged
- Warning: Creates extra errors that might show on some OSs, but that are generally considered as acceptable
- Info: Logs relevant successful events, it shows the program's progress (recommended)
- Debug: Logs extra events that are normally useful for debugging purposes. Given its verbosity it is best to activate it only when debugging activities are involved

### Traffic monitoring

The **Traffic monitoring** page lets you track network traffic using either intermittent or continuous modes. You can configure monitoring parameters, manage resource usage, and choose specific network interfaces to optimize performance.

When connected in Service mode, the local configuration is overridden by the upst One-shot and Offline mode use the local configuration instead.  Traffic monitoring Enable  itering time [s] per notification  packets per notification 00	ream.	
Enable itoring time [s] per notification packets per notification	Enable continuous mode	
Enable itoring time [s] per notification packets per notification	Enable continuous mode	
itoring time [s] per notification	Enable continuous mode	
packets per notification		
packets per notification		
00		
used Memory [MB]		
al BPF filter ①		
work interface		
hoose a network interface		
wo	rk interface	rk interface ose a network interface

### Figure 6. Traffic monitoring

### Enable

This checkbox lets you enable/disable traffic monitoring.

### Enable continuous mode

This checkbox lets you enable/disable continuous mode. For more details, see **Continuous mode**.

Arc uses two different methods for traffic monitoring:

- Intermittent mode
- Continuous mode

### Intermittent mode

This is the default mode, the traffic is monitored, or sniffed, for a duration of 10 seconds at each notify. The purpose of this limitation is to preserve the resources of the host machine, which prevents excessive memory, or *central processing unit (CPU)*, spikes. You can configure these options:

- Monitoring time [s] per notification
- Max packets per notification
- Max used Memory (MB): this value can be tuned to allow more or less traffic buffering in case the traffic to process exceeds the Arc and network capacity to send it out

### Continuous mode

This mode sniffs traffic continuously from the host's network interface controllers. Depending on the amount of sniffed traffic, continuous mode might utilize more *CPU* and memory on the host. As the traffic is processed upstream, the performance of the remote endpoint is also affected. You can configure:

• Max used Memory (MB): this value can be tuned to allow more or less traffic buffering in case the traffic to process exceeds the Arc and network capacity to send it out

### **Global BPF filter**

This field lets you set a Global BPF filter to apply to all the network interfaces. Filters that are applied to single interfaces will take precedence over the global one.

#### Network interface

This dropdown lets you select a network interface to configure. Each network interface can then be enabled, and be tuned with a monitoring filter.

If you add, remove, or edit the network interfaces on the host, Arc does not automatically add it to the list of sniffing interfaces. For example, if you add a new network card, to enable Arc to use it, you should stop Arc, and then start it again.

### Configure an Arc sensor

It is possible to configure an individual Arc sensor directly from the **Sensors** details page for the related sensor.

### Procedure

1. In the top navigation bar, select **Sensors**.

Result: The Sensors page opens.

2. From the list, select the applicable Arc sensor.

Nors arc		Page 1 of 1, 2 entries	Export 📋 🛛 Downloa	d Arc - Live •	Map Graph		
e Hostname	Model IP	Health	>		~ • • •		
MacBook-Pro-14-inch-2021-	ARC/MACOS	🙆 Good	Ý Ć		🗞 💠 🔒 Config		
МасВоокРго	ARC/MACOS	Unreachable	M3KXXQ6 2021-	26JYT-MacBook-Pro-14-inc			
			ID	5da7	/bc58		
			IP				
			Arc version	v1.9.4	4_devel		
				# Alerts (5m)	0		
			$\wedge$	# Alerts	0		
			<u> </u>	Risk (5m)			
				Stale	No		
				Last sync	16:02:31.646		
				Uptime	1d 2h 4m 54s		
			0	Resources usage			
			Good	RAM Disk CPU 12% Arc CPU 0% Arc RAM 0%	54% 35%		
					25 50 75		
			Is version locked				
			Is updating	No			

3. In the top right section, select the  $\rightleftharpoons$  icon.

Result: A dialog shows.

4. Choose the applicable options.

Configure Arc	x
(b) Execution options	
Execution time [s] ①	
150	
Maximum disk space [MB] ①	
200	
🖉 Sigma rules	VARA rules
USB detections	Node points
Ø Discovery	V Smart Polling (5)
🖉 Local ARP table	
Use static entries ()	
Log level	
Debug	·
le Traffic monitoring	
Enable	
Save Restore default	

5. Select **Save**.

### Results

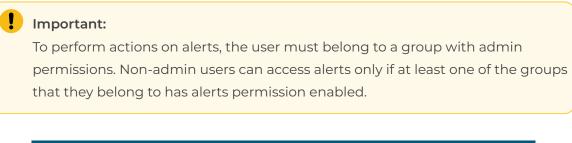
The Arc sensor has been configured.



# **Chapter 3. Alerts**



The **Alerts** page shows all the latest alerts in the system. It lets you view the alerts in different modes, and carry out actions on the alerts.



	। १०॥ Sensors	Alerts Q Assets	V Queries	Smart Polling	👰 Arc					9
Alerts										
Page 1 of 23, 341 entries					Export 门	Group by incident 🛑 🐕	т	Live 💽 ʃ	E	

### Figure 7. Alerts page menu

The top right section of the **Alerts** page has two icons that let you change between these two options:

- Standard mode (on page 36) 🗐
- Expert mode (on page 37)

## Standard mode

You can view alerts in standard mode to give you an overview of the latest anomalies.

lerts							
Page 1 of	1, 3 entries			Export 📋 🛛 C	Group by incident	E T Live	• Ø  🖬
RISK	TIME	NAME	DESCRIPTION				
· •	H 4 F H					Malformed	traffic
7	2023-08-14 14:00:22.620	Ø Malformed traffic	The IP layer has no data.			2023-08-14 14:00:22.620	
•	2023-08-07 09:43:38.648	Ø Malformed traffic	The IP layer has no data.				
7	2023-08-02	Ø Malformed traffic	Invalid IP packet: IP header length is smaller than the expected size		MAC	Source 72:cf:c4:75:d3:b3	01:00:5e:00:00:fb
•	14:30:45.635				Zone		
					Is security	true	
					Protocol	unknown	
					What hap	opened?	
						r has no data.	
					Possible o		
					A 17 malform	ed packet has been det	ected A maliciously
					malformed p software vers	acket can target known ions, and thus should be ossible attack.	issues in devices or
						d solution	
					Investigate o	n the protocol implement nalicious actors.	ntation and the possible

### Figure 8. Standard mode

### Risk

This shows the risk associated to each alert or incident.

### Time

The time related to each event.

### Name

The name category of the event.

### Description

This shows a detailed description of the related event.

### Analysis

If you can select a row, this pane will show a more detailed analysis of the alert.

# Expert mode

You can view alerts in expert mode to give you a detailed view of the alerts in the system. This lets you filter, sort, and analyze the information in detail.

Expert mode shows a comprehensive table layout, with details on the alerts and incidents listed, which include:

- Addresses
- Labels
- The roles of the involved nodes, zones, protocol, and ports used in the involved transactions, and more

NOZC	рМI <sup>в к s</sup>	😑 🕬 Sensors 🗗	🕂 Alerts 🖵 Asse	ts Varies	Smart Polling	🔆 Arc		\$ \$
Alerts								
Page 1 of 1, 3 e	entries			Export	Group by incident 📑	Έ 🕇 Live 💽 🕥 ΣCou	nt by field 🔹 👁 12 selected 💌	
ACTIONS	RISK	TIME	ID	TYPE ID	COUNTE	DESCRIPTION	PROTOC IP SRC	IP DS1
•••	- <b>v</b>	Ичьи		- <b>v</b>			· · ·	
	-	2023-08-14 14:00:22.620	963c82c8 😌 SIGNA	ALFORMED-TRAFFIC	1	The IP layer has no data.		
	-	7 2023-08-07 09:43:38.648	29f83285	ALFORMED-TRAFFIC	1	The IP layer has no data.		
	-	7 2023-08-02 14:30:45.633	8a34431b 😔 SIGNN	ALFORMED-TRAFFIC	1	Invalid IP packet: IP header length is	s small	

## Figure 9. Expert mode

## Export

The **Export**  $\Box$  icon lets you export the current list in either CSV or Microsoft Excel format.

## Group by incident

The **Group by incident** icon lets you group alerts by incident. This will show incidents, and hide all the alerts that belong to it.

### Filter

The filter **T** icon opens a list of items that you let you filter the results.

## Live

The **Live** toggle lets you change live view on, or off. When live mode is on, the page will refresh periodically.

### Refresh

The **Refresh**  $\bigcirc$  icon lets you immediately refresh the current view.

## Count by field

The  $\Sigma$  Count by field dropdown lets you select a data field on which to group and count the alerts.

## **Column selection**

The columns selection <sup>©</sup> icon lets you choose which columns to show or hide.

# View alerts in standard mode

You can view alerts in standard mode to give you an overview of the latest anomalies.

## Procedure

1. In the top navigation bar, select Alerts.

Result: The Alerts page opens.

2. In the top right corner, select the standard mode  $\square$  icon.

Result: The Standard mode (on page 36) view opens.

# View alerts in expert mode

You can view alerts in expert mode to give you a detailed view of the alerts in the system. This lets you filter, sort, and analyze the information in detail.

## Procedure

1. In the top navigation bar, select Alerts.

Result: The Alerts page opens.

2. In the top right corner, select the expert mode  $\square$  icon.

**Result:** The Expert mode (on page 37) view opens.

# **Closing alerts**

When you close an alert, or incident, a dialog lets you select a reason, and specify the learning process.

Closing 0 inc	ident(s) and 1 alert(s) *
	Choose a reason 🗸
This is an incident This is a change Custom reason	
Comment	
Comment	
	Ok Cancel

### Figure 10. Alerts closing dialog

The **Reason for closing** dropdown has these options:

- This is a change: If the cause of the alert is an intended change to the network, such as:
  - A new computer being attached
  - $\circ\,$  New communication between two nodes that were not previously communicating

Guardian can learn the change that has been detected as part of the environment baseline. When you close an alert in this way, the *intrusion detection system (IDS)* is instructed to learn the related objects. For example, when a VI:NEW-NODE alert is closed as a change, Guardian registers that the corresponding node is part of the environment and will not raise subsequent VI:NEW-NODE alerts about the same node.

• This is a change: If the cause of the alert is an intended change to the network, such as a new computer being attached, or a new communication between two nodes that were not talking before, the change detected by Guardian can be learned as part of the environment baseline. When closing an alert in this way, the IDS is instructed to learn the corresponding objects. For example, when a VI:NEW-NODE alert is closed as a change, Guardian registers that the corresponding node is part of the environment and will not raise subsequent VI:NEW-NODE alerts about the same node.

- This is an incident: If the cause of the alert is a configuration error, an attack, a malfunctioning device, or other security incident, the change is not learned as part of the environment baseline. When closing an alert in this way, the IDS is instructed to delete the corresponding objects. For example, a new node entering the network for the first time causes a VI:NEW-NODE alert. If an alert closes as an incident, reference to the new node is deleted. The VI:NEW-NODE alert is raised again in subsequent communication involving the same node.
- **Custom reason**: This lets you write a custom reason for closing an alert. You can enter a text string as the closing reason, with a request to apply one of the two described behaviors.

You are about to close 0 incident(s) and 1 * alert(s)
Reason for closing
Custom reason 🗸
Custom reason
New controller installed
<ul> <li>Treat as incident</li> <li>New incidents/alerts will be generated if a similar event happens again.</li> <li>Learn</li> <li>Learn the change, no new incidents/alerts will be generated if a similar event happens again.</li> </ul>
Comment Team C will be responsible for the maintenance
Ok Cancel

### Figure 11. Closing alert for custom reason with comment

You can add a comment so that it shows in the **alert audit** log.

Environment	Audit alert operations
Audit timeline	
a day ago	Acknowledged by John Smith
2 days ago	<b>Closed as a change - New controller installed</b> by Jane Doe «Team C will be responsible for the maintenance»

Figure 12. Audit alert operations

# Actions menu

The **Actions** menu gives you access to all the actions that you can do for the related alert.

≑ Configure alert
✓ Ack/Unack
🖹 Close
Trace not available
Download file causing the alert
Edit note
D Time machine diff
Avigate Ravigate

### Figure 13. Actions menu

## Note:

The options available in the **Actions** menu can change. The options will depend on:

- The type of alert
- The state of the sensor
- Whether the sensor is a Guardian or a CMC

### **Configure alert**

You can use the **Configure alert** option to create a new alert rule for future events that are similar to the current one.

### Ack/Unack

Once an alert or incident shows, you can mark it as acknowledged. You can also change the status back to unacknowledged again.

### Close

Once an alert or incident has been addressed, you can mark it as closed, and choose the type of learning operation to perform.

## Download trace

If a trace is available, you can choose to download it. The trace contains the packet that triggered the alert, along with an extract of the same session before and after that packet. Traces might be unavailable if the appliance is under stress. For detections that require multiple packets, such as **Multiple login failures**, the trace might not contain enough traffic to reproduce the alert. Incidents do not have an associated trace.

## Download file causing the alert

Once a sensor has detected a malicious file, it is possible to download it for analysis. After you select this option, a dialog shows to warn the user that the file has been identified as malicious, or unwanted. To download the file, the user must acknowledge that they will do so at their own risk. In a *CMC*, this option is only available after the applicable file has been requested, (see below).

## Edit note

Once an alert or incident shows, you can write a note for it, or edit an existing one.

## Time machine diff

It is possible to open a time machine diff which corresponds to the time of the alert, or incident.

## Navigate

Alerts and incidents have related nodes, links, vulnerabilities, or sessions. The **Actions** menu lets you navigate to these links.

# Open the Actions menu in standard mode

You can open the **Actions** menu to give you access to additional operations. When you are in standard mode, there are two different options available to open the menu.

## Procedure

- 1. View alerts in standard mode (on page 38).
- 2. Choose a method to open the **Actions** menu.

#### Choose from:

- Select the applicable alert, go to the top right corner and select the ••• icon
- Select the **Open details** button. In the detailed view window, go to the top left corner and select the ••• icon

Result: The Actions menu opens.

# Open the Actions menu in expert mode

You can open the Actions menu to give you access to additional operations.

### Procedure

- 1. View alerts in expert mode (on page 38).
- 2. Choose a method to open the **Actions** menu.

#### Choose from:

- $^\circ$  To the left of the applicable alert, select the ••• icon
- Select the link in the **ID** column. In the detailed view window, go to the top left corner and select the ••• icon

Result: The Actions menu opens.

# **Configure an alert**

You can use the **Configure alert** option to create a new alert rule for future events that are similar to the current one.

### Procedure

- 1. Open the Actions menu for the selected alert(s) with one of the these options:
  - Open the Actions menu in standard mode (on page 44)
  - Open the Actions menu in expert mode (on page 44)

#### 2. Select Configure alert.

Result: A dialog shows.

On alerts matching with:					
Source IP	IP examples -	🗹 Destination IP	IP examples		
10.41.132.163		52.216.81.251			
Source MAC		Destination MAC			
88:66:5a:3d:85:c0		00:09:0f:09:00:06			
Match IPs and MACs in both directions					
Source Zone		🗹 Destination Zone			
Undefined		Internet			
Source Port		Destination Port			
52237		80			
🗹 Type ID		Trigger ID			
SIGN:MALWARE-DETECTED		6fd2eec6-1aab-4db0-a891-c1474693d83d			
V Protocol					
http					
Note					
Execute action:					
Mute Mute until Change Security Profile visibility	Change risk Change trace fi	Iter Assign Playbook			
ON OFF					
Priority					

- 3. In each of the fields, enter the necessary details.
- 4. Select **Save**.

### Results

The alert has been configured.

# Acknowledge an alert

Once an alert or incident shows, you can mark it as acknowledged. You can also change the status back to unacknowledged again.

## Procedure

- 1. Open the **Actions** menu for the applicable file with one of the these options:
  - Open the Actions menu in standard mode (on page 44)
  - Open the Actions menu in expert mode (on page 44)
- 2. Select Ack/Unack.

Result: After a few seconds, the tick symbol changes from grey to green.

3. If necessary, click the Ack/Unack option again to cancel the acknowledgment.

**Result:** After a few seconds, the tick symbol changes from green to grey.

# **Close an alert**

Once an alert or incident shows, you can mark it as closed, and choose the type of learning operation to perform.

## Procedure

- 1. Open the  $\ensuremath{\mathsf{Actions}}$  menu for the applicable file with one of the these options:
  - Open the Actions menu in standard mode (on page 44)
  - $\circ\,$  Open the Actions menu in expert mode (on page 44)
- 2. Select Close.

**Result:** A dialog shows.

Closing 0 incid	ent(s) and 1 alert(s)	×
	Choose a reason 🗸	
This is an incident This is a change Custom reason <b>Comment</b>		
Comment		
		Cancel

3. In the **Reason for closing** dropdown, choose one of these options:

Choose from:

- This is a security incident
- Custom reason

4. If you chose **Custom reason**, the dialog will extend to show more options.

Closing 0 incident(s) and 1 alert(s)
Reason for closing
Custom reason 🗸
Custom reason
Specify the reason
<ul> <li>Treat as incident</li> <li>New incidents/alerts will be generated if a similar event happens again.</li> <li>Learn</li> </ul>
Learn the change, no new incidents/alerts will be generated if a similar event happens again.
Comment
Comment
Ok Cancel

- 5. If you chose **Custom reason**, do the steps that follow.
  - a. In the **Custom reason** field, enter the details as necessary.
  - b. Choose from one of these options:
    - Treat as incident
    - Learn
- 6. If necessary, enter a comment in the **Comment** field.
- 7. Select **Ok**.

# Download a trace

If a trace is available, you can choose to download it. The trace contains the packet that triggered the alert, along with an extract of the same session before and after that packet. Traces might be unavailable if the appliance is under stress.

## Procedure

- 1. Open the **Actions** menu for the applicable file with one of the these options:
  - Open the Actions menu in standard mode (on page 44)
  - Open the Actions menu in expert mode (on page 44)
- 2. Select Download trace.

**Result:** The file downloads to your downloads folder.

# Download a malicious file

Once a sensor has detected a malicious file, it is possible to download it for analysis.

## About this task

Only qualified personnel should download malicious files. Before you do this procedure, make sure that you have the correct permissions.

### Procedure

1. Open the Actions menu for the applicable file with one of the these options:

- Open the Actions menu in standard mode (on page 44)
- Open the Actions menu in expert mode (on page 44)
- 2. Select Download file causing the alert.

Download file causing the alert

Result: A dialog shows.

Warning, the file you are about to download has been identified as malicious or unwanted by this security tool.

It might contain dangerous malware that could spread through your network and harm your system. Download at your own risk and take appropriate precautions when copying or transferring this file. Do you want to continue?



3. If you want to proceed, select **Yes**.

Important:

Nozomi Networks recommends that only qualified personnel download malicious, or unwanted, files. Download these files at your own risk.

**Result:** The file downloads to your downloads folder and a password dialog that contains a randomized, single-use password shows.



- 4. Copy the password, and select **Ok**.
- 5. Go to the folder where the file was downloaded to.
- 6. Double-click the *ZIP* file to open it.

Result: A dialog that prompts you to enter a password shows.

Please enter the password nvdcve-20-2018xmltargz-		
Password:		
	Cancel	

7. Paste the password into the password field and select OK.

**Result:** You can now access the file.

# Edit a note for an alert

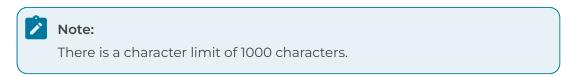
Once an alert or incident shows, you can write a note for it, or edit an existing one.

### Procedure

- 1. Open the **Actions** menu for the applicable file with one of the these options:
  - Open the Actions menu in standard mode (on page 44)
  - Open the Actions menu in expert mode (on page 44)
- 2. Select Edit note.

**Result:** A note is opened with the identification of the related alert, or incident.

3. In the text field, write a note.



4. Select **Save**.

## Results

The note has been edited.

# View a diff from an alert

This automatic feature will use the previous and subsequent snapshots according to the time of the alert.

## Procedure

1. In the top navigation bar, select Alerts.

Result: The Alerts page opens.

2. Choose a method to open the actions menu.

### Choose from:

- $^\circ$  In the table, select the hyperlink to open the details page. Select Actions
- $^{\circ}$  In the table, select the  $^{\bullet \bullet \bullet}$  icon
- 3. Select Time machine diff.

Result: The time diff shows.

4. To see more details on the right side of the graph, select the applicable node or link.

# Navigate from an alert

Alerts and incidents have related nodes, links, vulnerabilities, or sessions. The actions menu lets you navigate to these links.

## Procedure

- 1. Open the **Actions** menu for the applicable file with one of the these options:
  - Open the Actions menu in standard mode (on page 44)
  - Open the Actions menu in expert mode (on page 44)
- 2. Click the **Navigate** option.

Result: A dialog shows.

Go to 29ae764c-4328-4372-93d8-df93b22cc184 [source Node] Go to 29ae764c-4328-4372-93d8-df93b22cc184 / Any / Any [Link] Go to Any / 29ae764c-4328-4372-93d8-df93b22cc184 / Any [Link] Go to 29ae764c-4328-4372-93d8-df93b22cc184 [Vulnerabilities] Go to 29ae764c-4328-4372-93d8-df93b22cc184 / Any / Any [Sessions] Go to Any / 29ae764c-4328-4372-93d8-df93b22cc184 / Any [Sessions]

3. Select the desired link.

# Edit a playbook associated with an alert

A playbook associated with an alert can be modified. A change you make on the playbook only affects the playbook related to that specific alert.

#### About this task

You can edit a playbook associated with an alert from the **Playbook** tab in the **Alerts** page.

#### Procedure

1. In the top navigation bar, select Alerts.

Result: The Alerts page opens.

- 2. Find the alert on which to edit the assigned playbook.
- 3. Select the alert, then select **Playbook** at the bottom of the screen.
- 4. To edit the playbook, select Edit.

		Details on ⊕ science/binetbilinetc What happened?
Details (at the alert	time)	The UDP header in the packet contains a wrong data leng 1428 bytes are advertised, but 1434 bytes are found in the
Note		psyload.
Created at:	063515.723(4 hours ago)	Possible cause
Source:	- 38:0e.4d:29:22:6e	A (7 mailformed packet has been detected. A maliciously
Destination:	172.36.96.8 - 00.08.x3.17.52.90	mailformed packet can target known tases in devices or software versions, and thus should be considered carefully source of a possible attack.
Capture device:	portl	Suggested solution
		invetigate on the protocol implementation and the possil presence of malicious actors.
Environment	Audit alert operations MITRE ATT&CK Enterprise	
Playbook		
Suspicious Activity		

#### Figure 14. Playbook tab

- 5. Edit the playbook as necessary.
- 6. Select Save.

## Note:

The playbook template from which the alert playbook was generated remains unchanged, as do all other alert playbooks generated from the same playbook template.



# **Chapter 4. Assets**



The **Assets** page shows all the physical components and systems in the local network environment and their associated details. It also lets you perform actions on those assets. Depending on the nodes and components involved, assets can range from a simple personal computer to an operational technology (OT) device.

The top right section of the **Assets** page has these two tabs:

- List (on page 57)
- Diagram (on page 59)

# List

The **List** page shows all the assets in table format.

	PMI ≡ (	Hold Sensors	ssets V Queries	🔆 Smart Polling	.; Arc			© 🔅
Assets							List	Diagram
Page 1 of 6, 1	<b>31</b> entries				Export 📋	Confirmed MACs only 💽	Live 💽 🕵	
ACTIONS	CAPTURE DEVI	NAME		TYPE		OS/FIRMWARE		
□ ≆ 🛛 🕈	eml	iPhone-67.local	-					192.168.68.116
- # 🛛 🖻	eml	iPad-7.local	-					192.168.0.142
. ≆ 🖸 🕈	eml	Surface_Pro_8.local	-					fe80::e2bb:a057:b
± 2 €	eml	CHPs-AirPort-Express.local						[multiple]
₩ 🛛 🕈	eml	192.168.69.51	-					192.168.69.51
≆ 🛛 🕈	eml	BRWA8934A93B2DC.local	-					fe80::aa93:4aff:fe9
■ ≆ 🖾 🕈	eml	fe80::1ccb:5916:8319:7142	-					fe80::1ccb:5916:83
🗆 🏛 🖾 🏓	eml	Naymis-iPhone.local	-					10.0.1.18
÷ □ ≠	eml	Craigs-Mac-Studio.local	-					fe80::48b:c97a:b0
± 🛛 🖊	eml	🍵 iPad.local	-					fe80::14ab:4e17:4d
〕 ∓ 🗋 📌	eml	Craigs-iPhone-13-mini.local	-					192.168.69.12
± 🛛 🖊	eml	🍵 iPad.local	-					fe80::1cd4:a715:cb
⇒ 🛛 🕈	eml	192.168.68.69	-					192.168.68.69
🗆 🕸 🖾 🏓	eml	💺 Craigs-Mac-Studio.local	computer					10.0.1.9
草區 🖻	eml	192.168.68.58	-					192.168.68.58
± □ ≠	eml	Naymis-iPhone.local	-					fe80::106b:c3d1:a0
⇒ 🛛 🕈	eml	DESKTOP-QIASE9Q.local	-					fe80::1b07:ebc0:3
= 🖂 🥐	em1	S MACBOOKPRO-CACB	computer			🍀 Windows XP		[multiple]

## Export

The **Export**  $\stackrel{\text{(1)}}{\square}$  icon lets you export the current list in either CSV or Microsoft Excel format.

### **Confirmed MACs only**

The **Confirmed MACs only** toggle lets you select only assets that have a confirmed *MAC* address.

### Live

The **Live** toggle lets you change live view on, or off. When live mode is on, the page will refresh periodically.

## Refresh

The **Refresh**  $\mathfrak{O}$  icon lets you immediately refresh the current view.

# **Column selection**

The columns selection  ${igodot}$  icon lets you choose which columns to show or hide.

# Diagram

The **Diagram** page uses the Purdue model format to display the assets. Assets are shown in separate rows, according to their level.

ssets								List Diagram	
Quick search						Live •	Selection info		
evel *						Info ►	<pre></pre>	nozomi-n2os.local iPhone-67.local fe80::101e:d8d6:8f8:3069	
raigs-iPhone-13-mini.	fe80:45e:e2ba:66c85c	Naymis-iPad.local	fe80:1492:e0d2:c0b8:3	Naymis-iPhone.local	iPad-Pro-3.local		> mac address: > mac vendor: > zone:	72:36:4c:ea:7b:82 (unconfirm Private Address (unconfirme Undefined	
Naymis-iPad.local	fe80:454:4a92f6d7:4ft	172.20.10.9	Naymis-iPhone.local	iPhone-10.local	iPhone-Isa.local		<ul> <li>&gt; Is al enriched:</li> <li>&gt; type:</li> <li>&gt; Is broadcast:</li> <li>&gt; is public:</li> </ul>	false - false false	
iPhone-67.local	TL-WPA4220	iPhone-106.local	Naymis-iPhone.local	Android.local	Apple-TV.local		<ul> <li>&gt; is compromised:</li> <li>&gt; is confirmed:</li> <li>&gt; is learned:</li> <li>&gt; is fully learned:</li> </ul>	<ul> <li>is confirmed:</li> <li>is learned:</li> <li>is fully learned:</li> </ul>	false true true true
iPad-Pro-3.local	iPad.local	iPad-Pro-3.local	BRWA8934A93B2DC.k	Craigs-Mac-Studio.loca	S DESKTOP-QIASE9Q.lor		<ul> <li>is disabled:</li> <li>roles:</li> <li>appliance hosts:</li> <li>links count:</li> </ul>	false other nozomi-n2os.local 1	
nozomi-n2os							<ul> <li>&gt; protocols:</li> <li>&gt; created at:</li> <li>&gt; first activity time:</li> <li>&gt; last activity time:</li> </ul>	mdns 2023-07-04 12:48:34.223 2023-07-04 12:48:34.223 2023-07-05 17:19:42.676	

## Figure 15. Diagram page

## Search bar

The search bar lets you search for a specific item.

### Live

The live boggle lets you immediately refresh the graph.

## Refresh

The refresh  $\mathcal O$  icon lets you immediately refresh the graph.

## Levels section

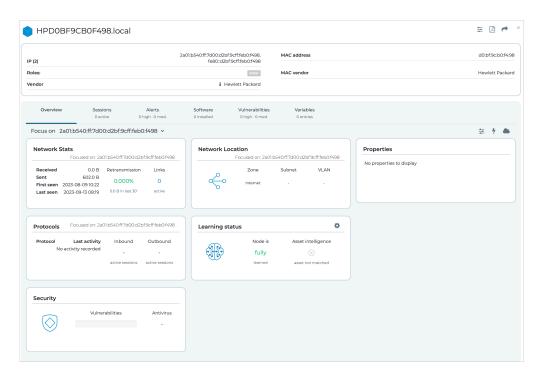
The levels section shows an icon for each asset, and shows on which level of the Purdue model it is.

## Selection info

When you select the link below an asset's icon, the **Selection info** pane shows more details for the selected asset.

# **Details window**

The details window lets you view more detailed information for an assets.



#### Figure 16. Asset details window

This details window shows more details for an asset.

The top section of the screen contains generic data. You can hover your mouse over

the information  $\mathbf{I}$  icon to display the source, granularity and confidence of the corresponding piece of data. Data includes:

- IP (address)
- Roles
- Vendor
- MAC address
- MAC vendor

The details window has these tabs:

- Overview (on page 66)
- Sessions (on page 67)
- Alerts (on page 68)
- Software (on page 69)
- Vulnerabilities (on page 72)
- Variables (on page 73)

# Information icon

When you hover over the **i** icon, you can see information for:

- Source
- Granularity
- Confidence

### Source

Information source	Description
manual	Information that is manually added from the configuration
imported data	Imported information
passive detection	Information from deep packet inspection
asset-kb	Information from Asset Intelligence
smart-polling	Information from Smart Polling

## Granularity

Level of detailed information	Description
manual-or-import	Information manually added or imported
complete	Detailed information that has been extracted
partial	Detailed, but not complete information
generic	A family/generic value is found, but it is not detailed
unknown	Unknown

# Confidence

Level of confidence in information	Description
manual-or-import	Information manually added or imported, with the highest level of confidence at this level
high	High level of confidence
good	Good level of confidence
low	Low level of confidence
unknown	Unknown confidence

# **Configure an asset**

The **Lists** page lets you configure assets.

## Procedure

1. In the top navigation bar, select **Assets**.

**Result:** The **Assets** page opens.

2. In the Actions column, to the left of the applicable asset, select the  $\rightleftharpoons$  icon.

Configure <b>192.168.69.11</b>	×
Type (current value source: source.none)	
<unknown> 🗸</unknown>	
Save	Cancel

- 3. From the dropdown, select the applicable type.
- 4. Select **Save**.

### Results

The asset has been configured.

# Generate a PDF report of an asset

The Lists page lets you generate a report in portable document format (PDF).

## Procedure

1. In the top navigation bar, select Assets.

Result: The Assets page opens.

2. In the Actions column, to the left of the applicable asset, select the 🕑 icon. **Result:** A dialog shows.

3. Optional:

If necessary, select the **Include installed software found with Smart Polling** checkbox.

Generate PDF	×
You can find the report in the generated report section once it's been generated	
Include installed software found with Smart Polling	
Save	el

4. Select Save.

**Result:** The *portable document format (PDF)* file generates in the background. When it is ready, you can view it on the **Reports** page.

5. To view the report, go to **Reports > Generated**.

# Navigate from an asset

The **Lists** page lets you use hyperlinks to navigate to entities that are related to an asset.

## Procedure

1. In the top navigation bar, select Assets.

Result: The Assets page opens.

- In the Actions column, to the left of the applicable asset, select the ricon.
   Result: A list of related entities shows.
- 3. Select the hyperlink that you want to navigate to.

Go to fe80::14ab:4e17:4c9d:84e9 [Node] Go to mdns [Protocol] Go to fe80::14ab:4e17:4c9d:84e9 / Any / Any [Link] Go to Any / fe80::14ab:4e17:4c9d:84e9 / Any [Link] Go to fe80::14ab:4e17:4c9d:84e9 [Vulnerabilities] Go to fe80::14ab:4e17:4c9d:84e9 / Any [Sessions] Go to Any / fe80::14ab:4e17:4c9d:84e9 / Any [Sessions]

## Results

The entity shows in the applicable page.

# View more details for an asset

Both the Lists and Diagrams pages lets you view more details for a specific asset.

## Procedure

1. In the top navigation bar, select Assets.

Result: The Assets page opens.

- 2. In the top right section, select either List or Diagram
- 3. Choose a method to view more details for an asset:

#### Choose from:

- If you chose the **List** page, in the **NAME** column for the applicable asset, select the hyperlink
- If you chose the **Diagram** page, below the applicable asset, select the hyperlink

## Results

The Details window (on page 60) for the asset shows.

# Overview

The **Overview** page shows a general overview of information for items such as network statistics and location, protocols, and learning status for the related assets.

Sessions 3 active	Alerts 0 high · 0 med.	Software 0 installed	Installed hotfixes 0 installed	Missing hotfixes 9 missing	Vulnerabilities 156 high - 1099 med.	Variables 0 entries
						± 4 6
	N	letwork Location		Propertie	95	
285.9 MB 19-19 09:08	5 3	Zone O Undefined	Subnet VLAN	No propert	ies to display	
	<u>_</u>	earning status	0			
14:37 14:32		Node is fully learned	Asset intelligence not active			
Updated on:	2023-09-11					
Vulnerabilities	Antivirus -					
	239.9 MB 2259 MB 2959 MB -19.09:08 -14:37 -14:37 -14:32 -1	3 active 0 high - 0 med.	3 active     0 high • 0 med.     0 installed       259.9 MB     Retransmission Links     285.9 MB     19.486%     3       99.900.8 19.486%     3     9.90.0 KB in last active     Image: Constraint of the second	3 active     0 high • 0 med.     0 installed     0 installed       259.9 MB     Retransmission Links       285.9 MB     19.4366%     3       19.9 09.06     19.4366%     3       14.37     990.0 KB in last active     Undefined       30'     Undefined     .       Learning status     Asset       intelligence     Intelligence       14.37     .       14.37     .       14.37     .       14.37     .       14.37     .       14.37     .       14.37     .       14.37     .       14.37     .       14.37     .       14.37     .       14.37     .       14.37     .       14.37     .       200 kB in last active assions       Updated on: 2023-09-11       Updated on: 2023-09-11	3 active     0 high-0 med.     0 installed     0 installed     9 missing       2299 MB     Retransmission Links     Image: Constraint of the second	3 active     0 high-0 med.     0 installed     0 installed     9 missing     156 high-1039 med.       259.9 MB 265.9 MB 14.37     Retransmission Links 99.9008 14.37     Image: Constant of the second of the se

## Figure 17. Overview tab

## **Network Stats**

This shows useful statistics for the network activity for the related device.

### **Network Location**

This shows information for the location for the related device on the network.

### **Properties**

This shows additional information for the related device.

### Protocols

This shows information for the different protocols that the related device uses.

#### Learning status

This shows the learning status of the related asset.

### Security

This shows the security status of the related asset.

# Sessions

The **Sessions** page shows detailed information for communication sessions between devices.

0	Overview		Sessions 2 active	0 h	Alerts igh · 0 med.	Software 0 installed		alled hotfixes Dinstalled	Missing hotfixes 9 missing	Vulnerabilities 156 high - 1099 med	Variables 1. 0 entries	
Paç	ge 1 of 2, 46	entries							Expor	t 🐴 🛛 Live 💽 💭	● 13 selected ▼	
ACTI	STATUS	FROM	то	PROTOC	TRANSPORT PROT	FROM POR	.JO PORT	THROUGHP	TRANSFERRED B	TRANSFERRED PAC	FIRST ACTIVITY	L
▲ ↑ ↔	ACTIVE	172.16.7.11	172.18.252.16	9 smb	tcp	36542	445	0.0 b/s	1.2 KB	2 pp	10:09:09.669	10
▲ ↑ <	ACTIVE	172.18.252.16	9 172.16.36.79	smb	tcp	55330	445	30.3 Kb/s	10.1 MB	63 Kpp	09:02:06.541	10
▲ ↑ ↔	SYN	172.16.7.11	172.18.252.16	9 smb	tcp	36044	445	0.0 b/s	1.3 KB	4 pp	10:08:18.106	10
▲ ↑ ↔	CLOSED	172.16.7.11	172.18.252.16	9 smb	tcp	36044	445	0.0 b/s	1.3 KB	4 pp	09:47:19.366	0
● ↑ ←	CLOSED	172.16.7.11	172.18.252.16	9 smb	tcp	35894	445	0.0 b/s	1.7 KB	8 pp	09:51:27.466	C
♣ <sup>4</sup>	CLOSED	172.16.7.11	172.18.252.16	9 smb	tcp	35636	139	0.0 b/s	66.0 B	1 pp	09:49:11.662	0

## Figure 18. Sessions tab

## Export

The **Export**  $\stackrel{(\uparrow)}{\square}$  icon lets you export the current list in either CSV or Microsoft Excel format.

# Live / refresh

The Live  $\bigcirc$  icon lets you change live view on, or off. When live mode is on, the page will refresh approximately every five seconds.

## **Column selection**

The columns selection  ${}^{igodoldsymbol{\Theta}}$  icon lets you choose which columns to show or hide.

# Alerts

The **Alerts** page shows detailed information for all the alerts that have been raised for the related assets.

Overview	Sessions 5 active	Alerts 0 high · 0 med.	Software 0 installed	Installed hotfixes 0 installed	Missing hotfixes 0 missing	Vulnerabilities 698 high - 389 med	Variables 0 entries
Alerts Page 1 of 1, 0	entries				Export 📋	T Live	) 👁 14 selected 🔻
ACTIONS	TIME ID	TYPE ID STATUS	NAME THREAT NAME	DESCRIPTION	RISK PROTOCOL	IP SRC IP DST	SRC ROLE DST ROLE

## Figure 19. Alerts tab

# Export

The **Export** (1) icon lets you export the current list in either CSV or Microsoft Excel format.

# Live / refresh

The **Live** icon lets you change live view on, or off. When live mode is on, the page will refresh approximately every five seconds.

# **Column selection**

The columns selection  ${}^{igodoldsymbol{\Theta}}$  icon lets you choose which columns to show or hide.

# Software

The **Software** page shows a list of software applications that are installed on the related assets.

Overview	Sessions	Alerts	Software	Installed hotfixes	Missing hotfixes	Vulnerabilities	Variables
	5 active	0 high · 0 med.	0 installed	0 installed	0 missing	698 high - 389 med.	0 entries
No data							

Figure 20. Software tab

# Installed hotfixes

The **Installed hotfixes** page shows a list of hotfixes that are installed on the related assets.

Overview	Sessions	Alerts	Software	Installed hotfixes	Missing hotfixes	Vulnerabilities	Variables
	5 active	0 high - 0 med.	0 installed	0 installed	0 missing	698 high - 389 med.	0 entries
No data							

Figure 21. Installed hotfixes tab

# **Missing hotfixes**

The **Missing hotfixes** page shows a list of hotfixes that could be installed on the related assets to resolve the related vulnerabilities.

Overview	Sessions 2 active	Alerts 0 high · 0 med.	Software 0 installed	Installed hotfixes 0 installed	Missing hotfixes 9 missing	Vulnerabilities 156 high - 1099 med.	Variables 0 entries
Page 1 of 1, 9 entries					Live 🖲	Node, M	lissing Patch, CVEs 🔻
NODE MISSING PATC.	.						
172.18.252.169 KB5029318	CVE-2018-8271 CVI	E-2018-8320 CVE-2018-8330	CVE-2018-8332 CVE-20	18-8333 CVE-2018-8392	CVE-2018-8393 CVE-2018-8	407 CVE-2018-8408 C	/E-2018-8411 CVE-2018-8420
172.18.252.169 KB5029259	CVE-2016-0143 CV	E-2017-11830 CVE-2017-11831	CVE-2017-11842 CVE-20	17-11849 CVE-2017-11850	CVE-2017-11851 CVE-2017-11	853 CVE-2017-11880 C	/E-2017-11885 CVE-2017-11899
172.18.252.169 KB5029247	CVE-2018-8454 CV	E-2018-8492 CVE-2018-8497	CVE-2018-8506 CVE-2	018-8547 CVE-2018-8612	CVE-2018-8626 CVE-2019-	0551 CVE-2019-0553 CV	E-2019-0637 CVE-2019-0682
172.18.252.169 KB5029312	CVE-2018-8455 CV	E-2019-1060 CVE-2019-1311 C	VE-2019-1325 CVE-2019	-1334 CVE-2019-1343 CVI	E-2019-1347 CVE-2019-1380	CVE-2019-1381 CVE-201	19-1382 CVE-2019-1422 CVE-
172.18.252.169 KB5010345	CVE-2018-0743 CV	E-2018-0745 CVE-2018-0809	CVE-2018-0823 CVE-2	018-0827 CVE-2018-0843	CVE-2018-0964 CVE-2018	1035 CVE-2018-8121 CV	E-2018-8140 CVE-2018-8141
172.18.252.169 KB4532820	CVE-2019-1316						
172.18.252.169 KB5029242	CVE-2018-0826 CV	E-2018-0831 CVE-2018-0877	CVE-2018-0880 CVE-2	018-0890 CVE-2018-0926	CVE-2018-0961 CVE-2018-	0963 CVE-2018-0982 C	VE-2018-0983 CVE-2018-814
172.18.252.169 KB5029332	CVE-2019-0887 CV	E-2020-0655					
172.18.252.169 KB5006672	CVE-2018-8566						

## Figure 22. Missing hotfixes tab

# Live / refresh

The Live  $\bigcirc \bigcirc \bigcirc \bigcirc$  icon lets you change live view on, or off. When live mode is on, the page will refresh approximately every five seconds.

## **Column selection**

The columns selection  $^{igodoldsymbol{\Theta}}$  icon lets you choose which columns to show or hide.

# **Vulnerabilities**

The **Vulnerabilities** page shows a list of vulnerabilities that are present on the related asset.

Over	view	Sessions 5 active		Alerts 0 high - 0 me	Software d. 0 installed	Installed hotfixes 0 installed	Missing hotfixes 0 missing	Vulnerabilities 698 high - 389 med.	Variables 0 entries
Page 1	of <b>44, 1089</b> entrie	s/filtered by <b>n</b>	esolved: f	alse 🗙		Export 📋	Only unresolved	• Live • 5	● 12 selected ▼
ACTIONS	CVE	NODE	SCORE	CWE		CWE NAME		CVE CREATION DATE	DISCOVERY DATE
								Н∢►И	н 🗤 н
Ē	CVE-2019-13659	172.16.44.216	_	4.3 20	Improper Input Validation			2019-11-25 16:15:00.000	2023-09-11 12:19:41.251
B	CVE-2019-13660	172.16.44.216		5.3 20	Improper Input Validation			2019-11-25 16:15:00.000	2023-09-11 12:19:41.25
B	CVE-2019-13661	172.16.44.216	-	4.3 20	Improper Input Validation			2019-11-25 16:15:00.000	2023-09-11 12:19:41.25
- B	CVE-2019-13662	172.16.44.216		6.5 276	Incorrect Default Permissions			2019-11-25 16:15:00.000	2023-09-11 12:19:41.25
B	CVE-2019-13663	172.16.44.216	-	4.3 20	Improper Input Validation			2019-11-25 16:15:00.000	2023-09-11 12:19:41.25
B	CVE-2019-13664	172.16.44.216		6.5 346	Origin Validation Error			2019-11-25 16:15:00.000	2023-09-11 12:19:41.25
B	CVE-2019-13665	172.16.44.216		6.5 732	Incorrect Permission Assignment	for Critical Resource		2019-11-25 16:15:00.000	2023-09-11 12:19:41.25
B	CVE-2019-13666	172.16.44.216		7.4 203	Observable Discrepancy			2019-11-25 16:15:00.000	2023-09-11 12:19:41.25
B	CVE-2019-13668	172.16.44.216		7.4 281	Improper Preservation of Permiss	sions		2019-11-25 16:15:00.000	2023-09-11 12:19:41.25

Figure 23. Vulnerabilities tab

## Export

The **Export** (1) icon lets you export the current list in either CSV or Microsoft Excel format.

## Only unresolved

The **Only unresolved** toggle lets you filter the column to only show unresolved vulnerabilities.

## Live / refresh

The Live  $\bigcirc \bigcirc \bigcirc \bigcirc \bigcirc$  icon lets you change live view on, or off. When live mode is on, the page will refresh approximately every five seconds.

## **Column selection**

The columns selection  ${}^{igodoldsymbol{\Theta}}$  icon lets you choose which columns to show or hide.

# Variables

The **Variables** page shows detailed information for the variables hosted by the related asset.

Overview	Sessions 5 active	Alerts 0 high · 0 med.	Software 0 installed	Installed hotfixes 0 installed	Missing hotfixes 0 missing	Vulnerabilities 698 high - 389 med.	Variables 0 entries
Page 1 of 1, 0 entries					Export (		● 14 selected ▼
ACTIONS HOST HOS	T LABEL NAMESPACE	NAME LABEL	TYPE VALUE	LAST VALUE # CHANG	ES # REQUESTS	LAST FC LAST FC INFO	

## Figure 24. Variables tab

## Export

The **Export**  $\stackrel{(\uparrow)}{\square}$  icon lets you export the current list in either CSV or Microsoft Excel format.

# Live / refresh

The Live  $\bigcirc \bigcirc \bigcirc \bigcirc \bigcirc$  icon lets you change live view on, or off. When live mode is on, the page will refresh approximately every five seconds.

# **Column selection**

The columns selection  ${}^{igodoldsymbol{\Theta}}$  icon lets you choose which columns to show or hide.



# **Chapter 5. Queries**

5 - Queries



You can use the Nozomi Networks Query Language (N2QL) syntax to create complex data processes to obtain, filter, and analyze lists of information from the Nozomi Networks software.

In Nozomi Networks Query Language (N2QL), queries consist of:

- Data sources (on page 79)
- Commands (on page 84)
- Functions (on page 92)

#### **Data sources**

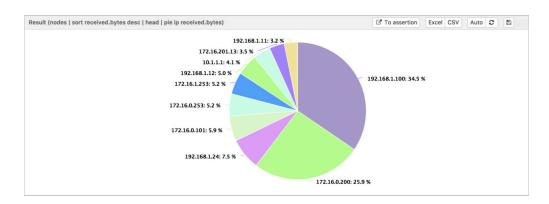
Queries start by calling a data source. For example:

```
nodes | sort received.bytes desc | head
```

This query will show, in table format, the first 10 nodes that received the most bytes. If you add the pie command at the end of the query, the results will show in a pie chart format, where each slice has node id as the label and the received.bytes field as data.

For example:

```
nodes | sort received.bytes desc | head | pie ip received.bytes
```



#### Figure 25. Queries example

### **Functions**

You might not achieved your desired result just using queries. Consequently, query syntax supports functions. With functions, you can apply calculations to the fields and use the results as a new temporary field. For example, the query:

```
nodes | sort sum(sent.bytes,received.bytes) desc | column ip
sum(sent.bytes,received.bytes)
```

uses the sum function to sort on the aggregated parameters, which produces a chart with the columns representing the sum of the sent and received bytes.

#### **Prefix**

The \$ is a prefix that changes the interpretation of the right hand side (rhs) of a where clause. By default, the rhs is interpreted as a string. With the \$ prefix, the interpretation of the rhs changes to a field name.

#### 5 - Queries

For example, in a query such as:

nodes | where id == 17.179.252.2

the right side of the == is expected to be a constant. If you create a query such as:

nodes | where id == id

the query tries to match all of the nodes having id equal to the string id. If, however, you use the \$, the second field is interpreted as a field, not a constant:

nodes | where id == \$id

and returns the full list of records.

# Data sources

These are the available data sources with which you can start a query.

alerts	Raised events
appliances	Downstream connected sensors synchronizing data to this, local one
assertions	Assertions saved by the users. An assertion represents an automatic check against other query sources
assets	Identified assets. Assets represent a local (private), physical system to care about, and can be composed of one or more Nodes. Broadcast nodes, grouped nodes, internet nodes, and similar cannot be Assets accordingly
audit_log	System's log for important operational events, e.g., login, backup creation, etc.
captured_files	Files reconstructed for analysis
captured_logs	Logs captured passively over the network
captured_urls	URLs and other protocol calls captured over the network. Access to files, requests to DNS, requested URLs and other are available in this query source
cpe_items	CPE maps definitions
cve_files	CVE definitions
dhcp_leases	IP to Mac bindings due to the presence of DHCP
function_codes	Protocols' function codes used in the environment
health_log	System's Health-related events, e.g. high resource utilization or hardware-related issues or events
link_events	Events that can occur on a Link, like it being available or not
links	Identified links, defined as directional one-to-one associations with a single protocol (i.e. source, destination, protocol)
microsoft_hotfixes	Microsoft hotfix information

node_cpe_changes	Common Platform Enumeration changes identified over known nodes. On the event of update of a CPE (on hardware, operating system and software versions), an entry in this query source is created to keep track of software updates or better detection of software
node_cpes	Common Platform Enumeration identified on nodes (hardware, operating system and software versions)
node_cves	Common Vulnerability Exposures: vulnerabilities associated to identified nodes' CPEs
node_points	Data points extracted over time, via Smart Polling or via Arc, from monitored Nodes
node_points_last	node_points last samples per each included data point
nodes	Identified nodes, where a node is an L2 or L3 (and above) entity able to speak some protocol
packet_rules	Packet rules definitions
protocol_connections	Identified protocol handhsakes/connections needed to decode process variables
report_files	Generated report files available for consultation
report_folders	Generated report folders
sessions	Sessions with recent network actvity. A Session is a specific application-level connection between nodes. A Link can hold one or more Session at a given time
sessions_history	Archived sessions
sigma_rules	Sigma rules definitions
sp_executions	Executions of Smart Polling plans
sp_node_executions	Results of Smart Polling plans executions per node
stix_indicators	STIX definitions
subnets	Identified network subnets
threat_models	Threat Modeling definitions
trace_requests	Trace requests in processing
۰	· · ·

variable_history	Process variables' history of values
variables	Identified process variables
yara_rules	YARA rules definitions
zone_links	A list of protocols exchanged by the defined zones
zones	Defined network zones

# **Basic operators**

Operator	(pipe, AND logical operator)
Description	Add a where clause with a logical AND, append it using the pipe character ( ). For example, the query below returns links that are from 192.168.254.0/ 24 AND going to 172.217.168.0/24.
Example	links   where from in_subnet? 192.168.254.0/24   where to in_subnet? 172.217.168.0/24

Operator	OR
Description	To add a where clause with a logical OR, append it using the OR operator. For example, the query below returns links with either the http OR the https protocols.
Example	links   where protocol == http OR protocol == https

Operator	! (exclamation point, NOT logical operator)
Description	Put an exclamation point (!) before a term to negate it. For example, the query below returns links that do NOT (!) belong to 192.168.254.0/24.
Example	nodes   where ip !in_subnet? 192.168.254.0/24   count

Operator	->
Description	To change a column name, select it and use the -> operator followed by the new name. It is worth noting that specific suffixes are parsed and used to visualize the column content differently. For example: • _time data is shown in a timestamp format (1647590986549 becomes 2022-03-18 09:09:46.549) • _bytes adds KB or MB, as applicable (50 becomes 50.0 B) • _percent adds a percentage sign (50 becomes 50%) • _speed adds a throughput speed in Mb/s (189915 becomes 1.8 Mb/s) • _date converts numbers into a date format (2022-06-22 15:43:31.297 becomes 2022-06-2214:24:09.280 becomes 2022-06-24 (current day)) • _packets adds pp after the number of packets (50 becomes 50 pp)
Example 1	<pre>nodes   select created_at created_at-&gt;my_integer   where my_integer &gt; 946684800000</pre>
Example 2	nodes   select created_at->my_creation_time

Example 3	nodes   select tcp_retransmission.bytes->my_retrans_bytes
Operators	==, =, <, >, <=, and >=
Description	Queries support the mathematical operators listed above.
Operator	" (Quotation marks)
Description	<ul> <li>Use quotation marks (") to specify an empty string. Consider these two cases where this technique is useful:</li> <li>Finding non-empty values. Example 1 below returns assets where the os field is not blank.</li> <li>Specifying that a value in the query is a string (if its type is ambiguous). Example 2 below tells concat to treat the "" parameter as a fixed string to use rather than as a field from the alerts table.</li> </ul>
Example 1	assets   where os != ""
Example 2	alerts   select concat(id_src,"",id_dst)

Operator	in?
Description	in? is only used with arrays; the field type must be an array. The query looks for the text strings you specify using in? and returns arrays that match one of them. The example below uses in? to find any node having computer or printer as elements in the array.
Example	assets   where type in? ["computer","printer_scanner"]

Operator	include?
Description	The query looks for the text string you specify using include? and returns strings that match it. The example below uses include? to find assets where the <b>os</b> field contains the string <b>Win</b> .
Example	assets   where os include? Win

# Commands

Syntax	<pre>select <field1> <field2> <fieldn></fieldn></field2></field1></pre>
Parameters	• the list of field(s) to output
Description	The select command takes all the input items and outputs them with only the selected fields

Syntax	exclude <field1> <field2> <fieldn></fieldn></field2></field1>
Parameters	• the list of field(s) to remove from the output
Description	The exclude command takes all the input items and outputs them without the specified field(s)

Syntax	where <field> &lt;== != &lt; &gt; &lt;= &gt;= in? include? start_with? end_with?  in_subnet?&gt; <value></value></field>
Parameters	<ul> <li>field: the name of the field to which the operator will be applied</li> <li>operator</li> <li>value: the value used for the comparison. It can be a number, a string, or other data type. Advanced operators can use other data types, such as: <ul> <li>a list (using JSON syntax) when using the in? operator, for example: nodes   where ip in? ["172.18.41.44"]</li> <li>another property when using the '\$' symbol, for example: nodes   where ip != \$id</li> </ul> </li> </ul>
Description	The where command will send to the output only the items which fulfill the specified criterion, many clauses can be concatenated using the boolean <b>OR</b> operator
Example	<ul> <li>nodes   where roles include? consumer OR zone == office</li> <li>nodes   where ip in_subnet? 192.168.1.0/24</li> <li><value> can also be another <field>, as in: links   where from_zone == \$to_zone   select from_zone to_zone</field></value></li> </ul>

Syntax	sort <field> [asc desc]</field>
Parameters	<ul> <li>field: the field used for sorting</li> <li>asc desc: the sorting direction</li> </ul>

Description	The sort command will sort all the items according to the field and the direction specified, it automatically understands if the field is a number or a string
Syntax	group_by <field> [ [avg sum] [field2] ]</field>
Parameters	<ul> <li>field: the field used for grouping</li> <li>avg sum: if specified, the relative operation will be applied on field2</li> </ul>
Description	The group_by command will output a grouping of the items using the field value. By default the output will be the count of the occurrences of distinct values. If an operator and a <b>field2</b> are specified, the output will be the average or the sum of the <b>field2</b> values
Syntax	head [count]
Parameters	• count: the number of items to output
Description	The head command will take the first <b>count</b> items, if <b>count</b> is not specified the default is 10
Syntax	uniq [ <field1> <field2> <fieldn>]</fieldn></field2></field1>
Parameters	• an optional list of fields on which to calculate the uniqueness
Description	The uniq command will remove from the output the duplicated items
Syntax	expand <field></field>
Parameters	• field: the field containing the list of values to be expanded
Description	The expand command will take the list of values contained in <b>field</b> and for each of them it will duplicate the original item substituting the original <b>field</b> value with the current value of the iteration
Syntax	expand_recursive <field></field>
Parameters	• field: the field to be recursively expanded

Description	The expand_recursive command will recursively parse the content of <b>field</b> , expanding each array or json structure until a scalar value is found. It generates a new row for each array element or json field. For each new row, it duplicates the original item substituting the original <b>field</b> value with the current value of the iteration and adding a new field that represents the current iteration path from the root
-------------	--

Syntax	sub <field></field>
Parameters	• field: the field containing the list of objects
Description	The sub command will output the items contained in <b>field</b>

Syntax	count
Parameters	
Description	The count command outputs the number of items

Syntax	pie <label_field> <value_field></value_field></label_field>
Parameters	<ul> <li>label_field: the field used for each slice label</li> <li>value_field: the field used for the value of the slice, must be a numeric field</li> </ul>
Description	The pie command will output a pie chart according to the specified parameters

Syntax	column <label_field> <value_field></value_field></label_field>
Parameters	<ul> <li>label_field: the field used for each column label</li> <li>value_field: one or more field used for the values of the columns</li> </ul>
Description	The column command will output a histogram; for each label a group of columns is displayed with the value from the specified value_field(s). The variant column_colored_by_label returns bars of different colors depending on their labels.

Syntax	history <count_field> <time_field></time_field></count_field>
Parameters	<ul> <li>count_field: the field used to draw the Y value</li> <li>time_field: the field used to draw the X points of the time series</li> </ul>

Description	The history command will draw a chart representing an historic series of values
Syntax	distance <id_field> <distance_field></distance_field></id_field>
Parameters	<ul> <li>id_field: the field used to tag the resulting distances.</li> <li>distance_field: the field on which distances are computed among entries.</li> </ul>
Description	The distance command calculates a series of distances (that is, differences) from the original series of distance_field. Each distance value is calculated as the difference between a value and its subsequent occurrence, and tagged using the id_field. For example, assuming we're working with an id and a time field, entering alerts   distance id time returns a table where each distance entry is characterised by the from_id, to_id, and time_distance fields that represent time differences between the selected alerts.

Syntax	bucket <field> <range></range></field>
Parameters	<ul> <li>field: the field on which the buckets are calculated</li> <li>range: the range of tolerance in which values are grouped</li> </ul>
Description	The bucket command will group data in different buckets, different records will be put in the same bucket when the values fall in the same multiple of <range></range>

Syntax	join <other_source> <field> <other_source_field></other_source_field></field></other_source>
Parameters	<ul> <li>other_source: the name of the other data source</li> <li>field: the field of the original source used to match the object to join</li> <li>other_source_field: the field of the other data source used to match the object to join</li> </ul>
Description	The join command will take two records and will join them in one record when <field> and <other_source_field> have the same value</other_source_field></field>

Syntax	gauge <field> [min] [max]</field>
Parameters	<ul> <li>field: the value to draw</li> <li>min: the minimum value to put on the gauge scale</li> <li>max: the maximum value to put on the gauge scale</li> </ul>
Description	The gauge command will take a value and represent it in a graphical way

Syntax	value <field></field>
Parameters	• field: the value to draw
Description	The value command will take a value and represent it in a textual way

Syntax	reduce <field> [sum avg]</field>
Parameters	<ul> <li>field: the field on which the reduction will be performed</li> <li>sum or avg: the reduce operation to perform, it is sum if not specified</li> </ul>
Description	The reduce command will take a series of values and calculate a single value

Syntax	size()
Parameters	• field: the field to calculate the size of
Description	If the field is an array, then the size function returns the number of entries in the array. If the field contains a string, then the size function returns the number of characters in the string. <b>Note</b> : The size function may only be used on the following data sources: alerts, assets, captured_files, links, nodes, packet_rules, sessions, stix_indicators, subnets, variables, yara_rules, zones, and zone_links.
Example:	assets   where size(ip) > 1

# Nodes-specific commands reference

Syntax	<pre>where_node <field> &lt; == != &lt; &gt; &lt;= in? include? exclude?  start_with? end_with? &gt; <value></value></field></pre>
Parameters	<ul> <li>field: the name of the field to which the operator will be applied</li> <li>operator</li> <li>value: the value used for the comparison. It can be a number, a string or a list (using JSON syntax), the query engine will understand the semantics.</li> </ul>
Description	The where_node command will send to the output only the items which fulfill the specified criterion, many clauses can be concatenated using the boolean <b>OR</b> operator. The where_node command is similar to the where command, but the output will also include all the nodes that are communicating directly with the result of the search. <b>Note</b> : This command is only applicable to the nodes table.

Syntax	<pre>where_link <field> &lt; == != &lt; &gt; &lt;= in? include? exclude?  start_with? end_with? &gt; <value></value></field></pre>
Parameters	<ul> <li>field: the name of the links table's field to which the operator will be applied.</li> <li>operator</li> <li>value: the value used for the comparison. It can be a number, a string or a list (using JSON syntax) the query engine will understand the semantics.</li> </ul>
Description	The where_link command will send to the output only the nodes which are connected by a link fulfilling the specified criterion. Many clauses can be concatenated using the boolean <b>OR</b> operator. <b>Note</b> : This command is only applicable to the nodes table.
Syntax	<pre>graph [node_label:<node_field>] [node_perspective:<perspective_name>] [link_perspective:<perspective_name>]</perspective_name></perspective_name></node_field></pre>

Parameters	<ul> <li>node_label: add a label to the node, the label will be the content of the specified node field</li> <li>node_perspective: apply the specified node perspective to the resulting graph. Valid node perspective values are: <ul> <li>roles</li> <li>zones</li> <li>transferred_bytes</li> <li>not_learned</li> <li>public_nodes</li> <li>reputation</li> <li>appliance_host</li> </ul> </li> <li>link_perspective: apply the specified link perspective to the resulting graph. Valid link perspectives are: <ul> <li>transferred_bytes</li> <li>tcp_firewalled</li> <li>tcp_handshaked_connections</li> <li>tcp_retransmitted_bytes</li> <li>throughput</li> <li>interzones</li> <li>not_learned</li> </ul> </li> </ul>
Description	The graph command renders a network graph by taking some nodes as input.

# Link-events-specific commands reference

Syntax	availability
Parameters	
Description	The availability command computes the percentage of time a link is UP. The computation is based on the link events UP and DOWN that are seen for the link.
Syntax	availability_history <range></range>
Parameters	• range: the temporal window in milliseconds to use to group the link events
Description	The availability_history command computes the percentage of time a link is UP by grouping the link events into many buckets. Each bucket will include the events of the temporal window specified by the range parameter.
Syntax	availability_history_month <months_back> <range></range></months_back>

Syntax	availability_history_month <months_back> <range></range></months_back>
Parameters	<ul> <li>months_back: number of months to go back in regards to the current month to group the link events</li> <li>range: the temporal window in seconds to use to group the link events</li> </ul>
Description	The availability_history command computes the percentage of time a link is UP by grouping the link events into many buckets. Each bucket will include the events of the temporal window specified by the range and months parameters.

# **Functions**

Functions are always used in conjunction with other commands, such as select. In the following examples, functions are shown in **bold**:

- Combining functions with select: nodes | select id type **color**(type)
- Combining functions with where: nodes | where **size**(label) > 10
- Combining functions with group\_by: nodes | group\_by **size**(protocols)

Here is the complete list of functions:

Syntax	abs( <field>)</field>
Parameters	• the field on which to calculate the absolute value
Description	The abs function returns the absolute value of the field
Syntax	<pre>bitwise_and(<numeric_field>,<mask>)</mask></numeric_field></pre>

Parameters	<ul> <li>numeric_field: the numeric field on which apply the mask</li> <li>mask: a number that will be interpreted as a bit mask</li> </ul>
Description	The bitwise_and function calculates the bitwise & operator between the numeric_field and the mask entered by the user

Syntax	<pre>coalesce(<field1>,<field2>,)</field2></field1></pre>
Parameters	• a list of fields or string literals in the format " <chars>"</chars>
Description	The coalesce function will output the first value that is not null

Syntax	<pre>color(<field>)</field></pre>
Parameters	• field: the field on which to calculate the color
Description	The color function generates a color in the rgb hex format from a value
Note	Only available for nodes, links, variables and function_codes

Syntax	<pre>concat(<field1>,<field2>,)</field2></field1></pre>
Parameters	<ul> <li>a list of fields or string literals in the format "<chars>"</chars></li> </ul>

Description	The concat function will output the concatenation of the input fields or values
L	
Syntax	<pre>date(<time>)</time></pre>
Parameters	• time defined as unix epoch
Description	The date function returns a date from a raw time

Syntax	<pre>day_hour(<time_field>)</time_field></pre>
Parameters	• time_field: the field representing a time
Description	The day_hour function returns the hour of the day plus the sensor's local time offset from UTC, i.e. a value in the range 0 through 23. Be careful when accounting for daylight saving time. Use <b>day_hour_utc</b> when absolute precision is desired

Syntax	<pre>day_hour_utc(<time_field>)</time_field></pre>
Parameters	• time_field: the field representing a time
Description	The <b>day_hour_utc</b> function returns the hour of the day expressed in UTC for the current time field, i.e. a value in the range 0 through 23

Syntax	<pre>days_ago(<time_field>)</time_field></pre>
Parameters	• time_field: the field representing a time
Description	The days_ago function returns the amount of days passed between the current time and the time field value
Syntax	dist( <field1>,<field2>)</field2></field1>

-	
Parameters	• the two fields to compute the distance on
Description	The dist function returns the distance between field1 and field2, which is the absolute value of their difference
Syntax	<pre>div(<field1>,<field2>)</field2></field1></pre>

Parameters	• field1 and field2: the two field to divide
Description	The div function will calculate the division field1/field2
Syntax	hours_ago( <time_field>)</time_field>
Parameters	• time_field: the field representing a time
Description	The hours_ago function returns the amount of hours passed between the current time and the time field value

Syntax	<pre>is_empty(field) == true   false</pre>
Parameters	• field: the field to check to evaluate whether it is empty or not
Description	The is_empty command takes a field as input and returns only the entries that are either empty / not empty.
Example	nodes   where is_empty(label) == false

Syntax	<pre>is_recent(<time_field>)</time_field></pre>
Parameters	<ul> <li>time_field: the field representing a time</li> </ul>
Description	The is_recent function takes a time field and returns true if the time is not farther than 30 minutes

Syntax	<pre>minutes_ago(<time_field>)</time_field></pre>
Parameters	• time_field: the field representing a time
Description	The minutes_ago function returns the amount of minutes passed between the current time and the time field value

Syntax	<pre>mult(<field1>,<field2>,)</field2></field1></pre>			
Parameters	• a list of fields to multiply			
Description         The mult function returns the product of the fields passed as argum				
Syntax	<pre>round(<field>,[precision])</field></pre>			

Parameters	<ul> <li>field: the numeric field to round</li> <li>precision: the number of decimal places</li> </ul>
Description	The round function takes a number and outputs the rounded value
Syntax	<pre>seconds_ago(<time_field>)</time_field></pre>
Parameters	<ul> <li>time_field: the field representing a time</li> </ul>
Description	The seconds_ago function returns the amount of seconds passed between the current time and the time field value
Syntax	<pre>split(<field>,<splitter>,<index>)</index></splitter></field></pre>
Parameters	<ul> <li>field: the field to split</li> <li>splitter: the character used to separate the string and produce the tokens</li> <li>index: the 0 based index of the token to output</li> </ul>
Description	The split function takes a string, separates it and outputs the token at the <index> position</index>
Syntax	<pre>sum(<field>,)</field></pre>
Parameters	• a list of fields to sum
Description	The sum function returns the sum of the fields passed as arguments

# Examples

# **Pie chart**

An example on how to create a pie chart to understand the media access control (MAC) vendor distribution in a network.

We choose nodes as our query source and we start to group the nodes by mac\_vendor:

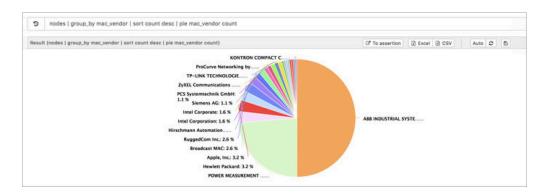
nodes | group\_by mac\_vendor

We can see the list of the vendors in our network associated with the occurrences count. To better understand our data we can use the sort command, so the query becomes:

nodes | group\_by mac\_vendor | sort count desc

In the last step we use the pie command to draw the chart with the mac\_vendor as a label and the count as the value.

```
nodes | group_by mac_vendor | sort count desc | pie mac_vendor count
```



## Figure 26. Pie chart example

# **Column chart**

An example on how to create a column chart with the top nodes by traffic.

To start, you need to get the nodes and select the:

- id
- sent.bytes
- received.bytes
- sent.bytes
- received.bytes

To calculate the sum , you need to use the sum function. The query is:

nodes | select id sent.bytes received.bytes
sum(sent.bytes,received.bytes)

When you execute this query, the sum field has a very long name. You can rename it to be more comfortable with these commands:

```
nodes | select id sent.bytes received.bytes
sum(sent.bytes,received.bytes)->sum
```

To obtain the top nodes by traffic, you can sort and take the first 10:

```
nodes | select id sent.bytes received.bytes
sum(sent.bytes,received.bytes)->sum | sort sum desc | head 10
```

Finally, to display the data in a graphical way, you can use the column command:

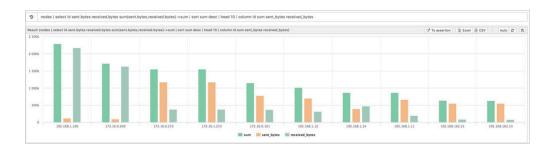
```
nodes | select id sent.bytes received.bytes
sum(sent.bytes,received.bytes)->sum | sort sum desc | head 10 | column
id sum sent_bytes received_bytes
```

## Note:

You can access an inner field of a complex type with the dot syntax, in the example the dot syntax is used on the fields sent and received to access their bytes sub field.



After accessing a field with the dot syntax, it will gain a new name to avoid ambiguity; the dot is replaced by an underscore. In the example sent.bytes become sent\_bytes



#### Figure 27. Column chart example

# Where with multiple conditions in OR

An example of a query to get all the nodes with a specific role, in particular all the nodes which are web or domain name server (DNS) servers.

With the where command, you can separate many conditions with OR

#### Note:

Because the roles field contains a list of values, you can use the include? operator to check if a value was contained in the list.

es	whe	re role	es	inclu	de?	web_s	erver	OR	roles	includ	le?	dn	s_s	erv	er
lect	id	roles													
🤊 nod	es   where ro	es include? web_serv	r OR ro	les include? dns_s	erver   selec	ct id roles									
		les include? web_serv								C <sup>2</sup> To at	ssertion	D Excel	@ csv	Auto	0 8
								roles		ে ৰৈ ৰ	ssertion	Excel	CSV	Auto	0 1
Result (node		include? web_server O						roles		ැ ී To at	ssertion	Excel	@ CSV	Auto	C 8

### Figure 28. Where with multiple conditions in OR example

# **Bucket and history**

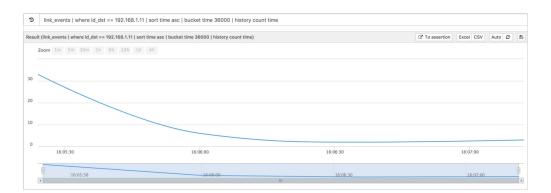
An example of a query to calculate the distribution of link events towards an internet protocol (IP) address.

You can filter all the link\_events with id\_dst equal to 192.168.1.11 After this you can sort by time, this is a very important step because bucket and history depend on how the data are sorted.

Then you can use bucket to group the data by time. The final step is to use the history command to draw a chart, we pass count as a value for the Y axis and time for the X axis.

The history command is particularly suited for displaying a big amount of data, in the image below we can see that there are many hours of data to analyze.







# Join

An example query to join two data sources to obtain a new data source with more information. In particular, how to list the links with the labels for the source and destination nodes.

You can match the from field of the links with the id field of the nodes to ask for the links, and join them with the nodes:

links | join nodes from id

After executing the query above you will get all the links fields, plus a new field called joined\_node\_from\_id, it contains the node which satisfies the link.from == node.id condition. You can use the dot syntax to access the sub fields of joined\_node\_from\_id

Because we also want to get the labels for the to field of the links you add another join and exclude the empty labels of the node referred by to to get more interesting data:

```
links | join nodes from id | join nodes to id | where
joined_node_to_id.label != ""
```

This will obtain a huge amount of data, which is difficult to understand. To only get the relevant information, you can use a select:

```
links | join nodes from id | join nodes to id | where
joined_node_to_id.label != "" | select from joined_node_from_id.label to
joined_node_to_id.label protocol
```

Result (links	join nodes from id   join n	odes to id   wi	nere joined_node_to_id.label != "	select from joined_node_from_id.label to joined_node_to_id.label protocol)	C* To assertion	Excel CSV	Auto 2	1
from	joined_node_from_id_label	to	joined_node_to_id_label	protocol				
172.16.0.253		172.16.0.148	Modicon M340 BMX P34 2020	modbus				
172.16.0.253		172.16.0.149	Modicon M340 BMX P34 2020	modbus				
172.16.1.253		172.16.1.149	Modicon M340 BMX P34 2020	modbus				
172.16.0.253		172.16.0.156	Modicon M340 BMX P34 2020	modbus				
172.16.1.253		172.16.1.156	Modicon M340 BMX P34 2020	modbus				
172.16.0.253		172.16.0.146	Modicon M340 BMX P34 2020	modbus				
172.16.1.253		172.16.1.146	Modicon M340 BMX P34 2020	modbus				
172.16.0.253		172.16.0.153	Modicon M340 BMX P34 2020	modbus				
72.16.1.253		172.16.1.153	Modicon M340 BMX P34 2020	modbus				
172.16.0.253		172.16.0.143	Modicon M340 BMX P34 2020	modbus				

#### Figure 30. Join example

# Compute the availability history

An example query to compute the availability history for a link.

In order to achieve a reliable availability, it is recommended to enable the **Track availability** feature on the desired link.

Start from the link\_events data source, filtered by source and destination ip in order to precisely identify the target link. Consider also filtering by protocol to achieve a higher degree of precision.

link\_events | where id\_src == 10.254.3.9 | where id\_dst == 172.31.50.2

The next step is to sort the events by ascending time of creation. Without this step the availability\_history might produce meaningless results, such as negative values. Then, to compute the availability\_history with a bucket of 1 minute (60000 milliseconds), you can complete query is as follows:

link\_events | where id\_src == 10.254.3.9 | where id\_dst == 172.31.50.2 |
sort time asc | availability\_history 60000

Queries	5		
9	link_ev	vents   where id_src == 10.254.3.9   where id_dst == 172.31.50.2   sort time asc   availability_history 6000	0
Result (	link_eve	ents   where id_src == 10.254.3.9   where id_dst == 172.31.50.2   sort time asc   availe 🕑 To assertion	Ē
availa	ability	time	
100		09:01:00.000	
34.075		09:02:00.000	
21.41167	7	09:04:00.000	
79.805		09:05:00.000	
0		09:06:00.000	
74.4716	7	09:08:00.000	
25.7883	3	09:09:00.000	
0		09:10:00.000	
29.11167	7	09:11:00.000	
71.36167	7	09:12:00.000	

### Figure 31. Availability history example

# Note:

By default, link\_events generation is disabled. To enable it, you can use the configuration rule described in **Configure links**.

# **Complex field types**

### Single scalar values

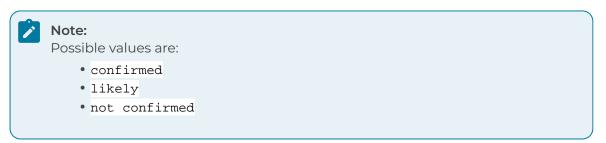
To query single scalar values, apply the commands that are explained in this section.

#### **Objects**

Objects show in braces: {object}

```
{
   "source": "ARP",
   "likelihood": 1,
   "likelihood_level": "confirmed"
}
```

An example on how to query only confirmed MAC addresses.



Since mac\_address: info is an object, you can access subfields like mac\_address: info.likelihood\_level to apply the where condition:

```
nodes | select mac_address:info mac_address:info.likelihood_level | where
mac_address:info.likelihood_level == confirmed
```

Since N2OS 24.1 is possible to access complex objects with a different syntax that is compatible with Vantage, using the / operator, the query specified above becomes:

```
nodes | select mac_address:info/likelihood_level | where
mac_address:info.likelihood_level == "confirmed"
```

Note that also the "confirmed" literal can now be quoted and the query can be executed in Vantage without any change.

#### Arrays

Г

Note: For example, a parent in the alerts table.

Arrays show in braces: {array}

```
"5b867836-2b41-4c15-ab6f-4ae5f0251e30"
]
```

An example on how to only query alerts that have a parent incident, with a known incident id with the value: d36d0

Since the parents field is an array, you can use expand first to get an entry for each parent, then apply your condition:

alerts | expand parents | where expanded\_parents include? d36d0

### **Object arrays**

#### Note:

For example, function\_codes in the links table.

Object arrays are a combination of the above examples. Therefore, they show an object included in a [{..},{..]:

```
[
{
"name": "M-SEARCH",
"is_learned": true,
"is_fully_learned": true
}
]
```

An example on how to query learned function codes.

Since function\_codes is an object array, you can use expand first, to get an entry for each function code, then use the . operator (function\_code.is\_learned) to apply your where condition:

links | select from to protocol function\_codes | expand function\_codes
where expanded\_function\_codes.is\_learned == true

# Chapter 6. Smart Polling in Guardian



The **Smart Polling** page lets you view and manage Smart Polling.

Smart Polling has these tabs:

- Plans (on page 106)
- Node points (on page 107)
- Settings (on page 108)
- Health (on page 109)

# Plans

The **Plans** page shows a list of Smart Polling plans and lets you manage plans and add new ones.

NOZOMI E 🕅 Sensors 🔿 Alerts 🖵 Assets 🖓	Queries 🔗 Smart Polling 🔆 Arc	\$ \$
Smart Polling	Plans Node points Setting	s Health
Filter by node ID	Live .	🕥 🕂 New plan
ວ > Progressive: EthernetlP	from "ch-lab-sg-nsi-Lintra.nozominetworks.com" ("25379df7-441c-4482-9a12-122d86e12683") Ø5 hours ago 56 kodes	
າ > Progressive: MELSOFT	from "ch-lab-sg-nsl-Lintra.nozominetworks.com" ("25379df7-441c-4482-9a12-122d86e12683") Ø5 hours ago 75 hodes	
⑦ → Progressive: Modicon Modbus	from "ch-lab-sg-nsl-Lintra.nozominetworks.com" ("25379df7-441c-4482-9a12-122d86e12683") ØS hours ago 49 Nodes	
າ > Progressive: S7	from "ch-lab-sg-nsl-Lintra.nozominetworks.com" ("25379df7-44)c-4482-9a12-122d86e12683") O.5 hours ago 29 Nodes	
> Progressive: Dahua DHIP/DVRIP devices	from "ch-lab-sg-nsl-lintra.nozominetworks.com" ("25379df7-44\c-4482-9al2-122d86el2683") Ø 5 hours ago 2 Nodes	

Figure 32. Plans page

## Filter by node ID

The Filter by node ID field lets you use the node ID to filter the results.

## Live / refresh

The Live  $\bigcirc \bigcirc \bigcirc \bigcirc \bigcirc$  icon lets you change live view on, or off. When live mode is on, the page will refresh approximately every five seconds.

## New plan

The **H** New plan icon lets you add a new plan.

# Node points

The **Node points** page shows all of the node points.

Smart Polling						Plan	s Node points	Settings Heal
1 nodes polled	matching filter:	192.168.4	45.212					Live 💽 💭
Nodes			192.16	8.45.212		с	PU0_loa	d
192.168.45.212	@3 minutes ago							
			Antivirus[0]	Windows Defender	>			$\sim$
			Antivirus[1]	Kaspersky Anti-Virus	>	4%	From 13:02 to Now	:27.615
			CPU0 load	4 %	>	3 %	From 02:25 to 13:02:27.	
			CPU1 load	0 %	>	2 %	From <b>2023</b>	

Figure 33. Node points page

# Settings

The **Settings** page lets you configure the Smart Polling settings.

Smart Polling Plans Node points Settings Healt	
	h
Smart Polling Progressive Mode Settings	
O Disable progressive mode	
Disable progressive mode and pause all progressive plans	
Enable progressive mode	
Enable progressive mode for the selected strategies	
Strategy	
Select strategies +	
Save	

## Figure 34. Settings page

## Disable progressive mode

You can select this to disable all progressive mode and pause all progressive plans.

## Enable progressive mode

You can select this to enable progressive mode for selected strategies.

## Strategy

This dropdown is only enabled when the Enable progressive mode checkbox is selected. The dropdown lets you select from a list of strategies.

# Health

The **Health** page lets you monitor the status of the CPU threads that Smart Polling is using, as well as queued jobs.

	Sensors 🗘 Alerts	☐ Assets	Smart Polling	.č. Arc				\$ \$
Smart Polling				-	Plans	Node points	Settings	Health
	Smart Polling Health							
	Smart Polling th Smart Polling is using Thread 0 is idle Thread 1 is idle Thread 2 is idle Thread 3 is idle Queued jobs All jobs are currently a		is empty.					

Figure 35. Health page

### **Create a Smart Polling plan**

The **Plans** page lets you create a new Smart Polling plan.

#### About this task

Some of the options that follow depend on which strategy that you choose. Not all options apply to all strategies.

#### Procedure

1. In the top navigation bar, select **Smart Polling**.

Result: The Smart Polling page opens.

2. In the top right, select **Plans**.

Result: The Plans page opens.

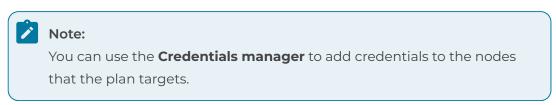
3. In the top right, select New plan.

Result: A dialog shows.

4. In the **Label** field, enter a name for the plan.

Plan configuration Label	x
Strategy	Host to test
Choose a strategy 🗸	e.g. 192.168.1.1 Check connection
Schedule Run interval in seconds	
Query	
Query	
	New plan Cancel

5. In the **Strategy** dropdown, select a strategy.



6. In the **Schedule** field, enter a value (seconds) for the run interval.

7. If applicable, in the Target section, select an option:

#### Choose from:

- Use identities
- Use query
- a. **Optional:** If you chose **Use identities**, choose the applicable credentials. To do this, select them from the list on the left and add them to the list on the right.
- b. Optional: If you chose Use query, the result of the query determines the list of node points. If necessary, use the **Credentials manager** to add credentials to the nodes targeted by the plan.
- 8. If applicable, from the **Data to be collected** dropdown, select the specific items to collect for the selected strategy.

#### Note:

The items shown are a generic list. The options available will vary depending on the specific target OS version, or the local configuration.

- 9. Verify that Smart Polling can connect correctly to a given node.
  - a. In the **Host to test** field, enter an *IP* address of the node that you want to check.
  - b. Select Check connection.

**Result:** If the connection check is successful, a green tick will show.

10. View the results to determine if the Smart Polling plan is correct. You can also troubleshoot potential problems, such as incorrect credentials, or Guardian being unable to reach plan nodes.

# Edit a Smart Polling plan

It is possible to edit a Smart Polling plan that already exists.

#### Procedure

1. In the top navigation bar, select **Smart Polling**.

Result: The Smart Polling page opens.

2. In the top right, select **Plans**.

Result: The Plans page opens.

3. To the left of the name of the applicable plan, select the  $\rightleftharpoons$  icon.

Result: A dialog shows.

4. In the **Strategy** field, note the existing strategy.

#### Note:

When you edit a plan, you cannot change its strategy. For strategies that require credentials, you will need to use the **Credentials manager** to add credentials to the set of nodes to be polled when using a query.

- 5. In the **Schedule** field, enter a value in seconds.
- 6. In the **Target** section, select an option:

#### Choose from:

- Use identities
- Use query
- 7. **Optional:** If you chose **Use identities**, choose the identities corresponding to the targeted nodes from the list on the left.
- 8. **Optional:** If you chose **Use query**, the result of the query determines the list of node points. Use the **Credentials manager** to add credentials to the nodes targeted by the plan.
- 9. Select Edit plan.

# Add a network node to a Smart Polling plan

After you have created a plan, you can add a node, or multiple nodes, to it.

#### Procedure

1. In the top navigation bar, select **Smart Polling**.

Result: The Smart Polling page opens.

- In the top right, select Plans.
   Result: The Plans page opens.
- 3. To the left of the name of the applicable plan, select the ≥ icon. **Result:** The details for the plan show.
- 4. Select **+** Add nodes to plan.

Result: A dialog shows.

5. In the dialog, enter an *IP* address. If you want to add more than one *IP* address, enter each one on a new line.

Add nodes to plan	×
Add one address per line:	
	1,
Add	Cancel

#### 6. Select Add.

#### Results

The node(s) has (have) been added to the Smart Polling plan.

# Add a node from the Network page

Once you have created a Smart Polling plan, you can add arbitrary nodes to the target from the Network page. The Smart Polling plan will poll these nodes even if the plan's query does not return them.

#### Procedure

1. In the top navigation bar, select  $\equiv$  icon > Network.

Result: The Network page opens.

2. In the top right, select **Nodes**.

Result: The Nodes page opens.

3. To the left of the name of the applicable plan, select the  $\stackrel{\text{res}}{\diamondsuit}$  icon.

Result: A dialog shows.

4. From the **Select an existing plan to add the node to** dropdown, select the plan you want to add the selected node to.

#### Note:

Fields that are not modified in this dialog are automatically populated with the plan-configured values.

**Result:** A dialog shows.

- 5. Edit the field(s) as necessary to change the parameter(s) of the existing plan.
- 6. Select Add.

#### Results

The node(s) has (have) been added to the Smart Polling plan.

# Edit the run interval of a progressive Smart Polling plan

You can manually adjust some aspects of Progressive mode plans. By default, each plan runs every 24 hours, but you can manually adjust this interval.

#### Procedure

1. In the top navigation bar, select **Smart Polling**.

Result: The Smart Polling page opens.

2. In the top right, select **Plans**.

Result: The Plans page opens.

3. To the left of the title of the plan that you would like to edit, select the  $\rightleftharpoons$  icon.

**Result:** A dialog opens.

4. In the **Schedule** field, edit the value (seconds) as necessary.

1	Nc
	ть

#### Note:

The default value is 86400 (seconds) or 24 hours.

5. To save your changes, select **Edit plan**.

### **Progressive enablement**

You can enable progressive mode to increase visibility.

Progressive mode is a Smart Polling option that increases visibility. To do this it automates plan creation and execution, and polls the correct nodes with the correct parameters based on asset information that has been detected passively.

Smart Polling automatically identifies the optimal target for polling. For example, only nodes that the query in the related strategy identifies will be polled.

You can select the Smart Polling strategies that you want to create a Progressive Smart Polling plan. Enabled Progressive Smart Polling plans show in the **Plans** tab.

# Enable progressive mode

You can enable Progressive mode to increase visibility.

#### Procedure

1. In the top navigation bar, select **Smart Polling**.

Result: The Smart Polling page opens.

2. In the top right, select **Settings**.

Result: The Settings page opens.

3. In the Smart Polling Progressive Mode Settings section, select Enable progressive mode.

Smart Polling Progressive	Smart Polling Progressive Mode Settings								
O Disable progressive mode									
() Disable progressive mode	① Disable progressive mode and pause all progressive plans								
Enable progressive mode									
(1) Enable progressive mode	for the selected strategies								
Strategy	8 selected <del>v</del>								
All None									
BACNet									
Dahua DHIP/DVRIP devices									
EthernetIP									
MELSOFT									
Modicon Modbus									
S7									

#### Note:

If you select **Disable progressive mode** the progressive mode Smart Polling plans that have been newly created, will stop executing. Also, they will be, grayed-out in the **Plans** tab.

#### Results

Progressive mode has been enabled.

### Log level customization

Smart Polling logs self-diagnostic information about its operations and activities during execution.

When Smart Polling logs self-diagnostic information, the logs are collected in the /data/log/n2os/ n2ossp.log file.

To change the level of detail in the logs, you can add these lines to the configuration file:

/data/cfg/n2os.conf.user:

```
sp log_level <LEVEL>
```

where <LEVEL> is one of the following values (in increasing order of verbosity):

- FATAL
- ERROR
- WARN
- INFO
- DEBUG

Note: The default value is INFO.

After you have changed and saved the file, you can restart Smart Polling with the command:

#### service n2ossp stop

#### Note:

1

The service automatically restarts after the execution of this command.

To configure the file to see only ERROR and FATAL messages, in the /data/cfg/ n2os.conf.user file, you can add this rule:

sp log\_level ERROR

then restart the process with the command:

service n2ossp stop

#### Note:

The configured level is the minimum to be printed, so ERROR will print log lines for both ERROR and FATAL messages, whereas FATAL will print log lines only for FATAL messages.

# View the enriched information history for a node

The **Node points** page lets you view the enriched information history for a node.

#### Procedure

1. In the top navigation bar, select **Smart Polling**.

Result: The Smart Polling page opens.

2. In the top right, select **Node points**.

**Result:** The **Node points** page opens.

3. In the left column, select a node point.

Smart Polling						Plans <b>Node points</b> Settings Health	
1 nodes polled	matching filter:	192.168.45.212				Live •	
Nodes			192.168	3.45.212		CPU0_load	
192.168.45.212	Ø3 minutes ago	A	ntivirus[0]	Windows Defender	>		
		A	ntivirus[1]	Kaspersky Anti-Virus	>	4 % From 13:02:27:615 to Now	
		c 	PU0 load	4 %	>	<b>3 %</b> From 02:25:55.545 to 13:02:27.614	
		c	PU1 load	0 %	>	2 % From 2023-03-15 14:36:42 662	

**Result:** The second and third columns show an increased level of detail for the extracted information for that node point

# **Chapter 7. Arc overview**



**Arc™** is a host-based sensor that detects and defends against malicious or compromised endpoints, and insider attacks. You can use Arc sensors to aggregate data for analysis and reports, either on-premises, or in the Vantage cloud.

#### General

When detecting cyberthreats, identifying vulnerabilities, or analyzing anomalies in your processes, it is critical to have as much detailed network and system information as possible. More accurate and timely access to data leads to better diagnostics and a faster time to repair.

Arc gives you enhanced endpoint data collection and asset visibility for your networks. This enhanced visibility gives you more:

- Vulnerability assessment capabilities
- Endpoint protection
- Traffic analysis capabilities
- Accurate diagnostics of in-progress threats and anomalies

Arc lets you easily identify compromised hosts that have:

- Malware
- Rogue applications
- Unauthorized USB devices
- Suspicious user activity

#### **Operating Systems (OS)**

Arc sensors are endpoint executables that run on hosts on these OSs:

- Microsoft Windows
- Linux
- Apple macOS

The data that is collected can be sent to either Guardian or Vantage.

#### Use cases and deployment scenarios

Arc lets you:

- Incorporate air-gapped devices into the analysis and reporting system
- Gain deeper intelligence or insight on critical endpoint devices
- Continuously monitor endpoints
- Automatically deploy sensors across thousands of devices
- Use a low-impact process to scan air-gapped networks
- Deploy with solutions

#### **Continuous monitoring**

Because the Arc sensor is on the host, it can monitor traffic continuously, even when the device is not sending or receiving traffic.

#### User-specific activity monitoring

With more access to endpoint data, Arc lets you connect network traffic and anomalies with specific users. This helps to identify potential insider threats and makes corrective actions both easier and quicker.

#### Local behavioral analysis (Sigma rules)

Sigma is a common open-source standard that lets you analyze log files to identify malicious events. They are not necessarily related to network artifacts, and as such, would not be detected without residing on a machine. Nozomi Networks Labs curates all the Sigma rules that are loaded into Arc. A *Threat Intelligence (TI)* active license is needed to receive curated rules from the upstream Nozomi endpoint.

#### **Temporary deployment**

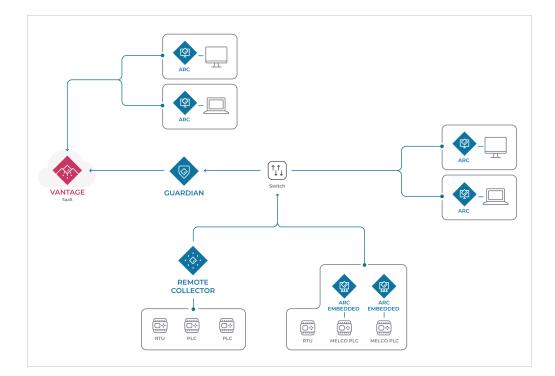
It is not necessary to keep the Arc executable on a host after you have collected information. This means that you can remove it after data has been collected to conserve host resources, and maintain a clean host environment.

# Architecture

It is important to understand the different architecture possibilities that are available with Arc.

You can connect Arc:

- To Guardian
- To Vantage



#### Figure 36. Arc architecture example

# Arc in Guardian

The **Arc** button in the Guardian Web UI lets you access the different pages for Arc.

	≡	ion Sensors	Alerts	Assets	V Queries	🔆 Smart Polling	Arc		ති @
Arc						Deployment	Deployment settings	Node points	Dependencies
Page 1 of 1, 19 e	ntries							Advanced ‡	Live 💽 🕤

#### Figure 37. Arc button in Guardian Web UI

	। গণ্য Sensors	Alerts	Assets	V Queries	🔅 Smart Polling	Arc		\$ \$
Arc					Deployment	Deployment settings	Node points	Dependencies
Page 1 of 1, 4 entries								Live 💽 🕤

#### Figure 38. Arc button in Guardian Web UI (not connected to Vantage)

When you select **Arc** in the Guardian Web *user interface (UI)*, you get access to these pages:

- Deployment
- Deployment settings
- Node points
- **Dependencies** (only for Guardians that are not connected to Vantage)

#### Configure an Arc sensor

NO	ZOMI =	Kot Sensors						
enso	rs						List	Map Graph
<i>9</i>	arc				Page 1 of 1, 2 entries	Export 📋 🛛 Dow	nload Arc 👻 Live 🖲	• 5 selected •
уре	Hostname		Model	IP	Health	>		& ¢ ≜ ≢
ĝ ć	ż	MacBook-Pro-14-inch-2021-	ARC/MACOS		🔇 Good	Ď 🕸		Configur
ĝ ċ	3	MacBookPro	ARC/MACOS		O Unreachable	M3KXX 2021-	Q6JYT-MacBoo	ok-Pro-14-inch
						ID	5da)	'bc58
						IP		
						Arc version	v1.9.4	4_devel
							# Alerts (5m)	0
						$\square$	# Alerts	0
						<u>~</u>	Risk (5m)	
							Stale	No
							Last sync	16:02:31.646
							Uptime	1d 2h 4m 54s
						0	Resources usage	
						Good	CPU 12% Arc CPU 0% Arc RAM 0%	54% 35% 25 50 75 1
						Is version lo	cked No	
						Is updating	No	
						Туре	Arc	

#### Figure 39. Configure an Arc sensor

You can configure an individual Arc sensor directly from Guardian. To do this, you can select the applicable Arc sensor from the **Sensors** list, and select the  $\rightleftharpoons$  icon.

# Deployment

The **Deployment** page shows a table of all the devices available for Arc deployment. The table only shows machines which have an OS that matches one that Arc supports. As Guardian detects the installed OS, the correct Arc package will be automatically deployed.

NOZ		ensors 🔿 Alerts 🖵	Assets 🖓 Queries	🚸 Smart Polling	Arc		ණු ල
rc					Deployment	Deployment settings	Node points
Page 1	of 8, 194 entries Automate	d deploy works only with Arc >= 1	.6.0			Advanced	E Live 💽 🕤
Actions	Deployed version	Operating system	Name	IP	Vendor	Product name	Туре
•••							
		灯 Windows 7	172.18.235.34	172.18.235.34			computer
		🍂 Windows 7	172.16.44.92	172.16.44.92			computer
]		灯 Windows 7	🖏 172.16.44.134	172.16.44.134			computer
]		💐 Windows 7	172.16.45.255	172.16.45.255			computer
)		∉ macOS	🇞 Mac Series	192.168.179.198	Apple	Mac Series	computer
)	v1.7.10	👯 Windows 8.1 Update 1	🖏 LSPW8	10.41.50.18, fe80::5efe:al	VMware	Virtual Machine	computer
)		∉ macOS	🇞 Apple MI-based Comput	192.168.180.73	Apple	Apple M1-based Comput	computer
)		👯 Windows 8.1 Update 1	🗞 ENG-WMI-TEST	192.168.45.212, 192.168.4	VMware	Virtual Machine	computer
)		Windows 10	S NUC	169.254.23.208		Intel(R) Client Systems	computer
)		🎊 Windows Server 2022	S LSPW2022	10.41.50.17, fe80::4259:fc	VMware	Virtual Machine	computer
)		💐 Windows 7 SP1	🖏 LSPW7	10.41.50.23, fe80::100:7f:	VMware	Virtual Machine	computer
]		💐 Windows 7	172.30.68.31	172.30.68.31			computer
)		灯 Windows 7 SP1 / Serve	172.16.46.69	172.16.46.69			computer
)	v1.4.2	👌 Ubuntu Linux 22.04	🖏 ch-int-snmp-ubuntu-22.i	10.41.48.102, fe80::250:5	VMware	Virtual Machine	computer
)		👌 Ubuntu Linux 21.04	🖏 ch-lab-raspdocker02	10.41.43.55, fe80::dea6:3	Raspberry Pi Foundation	Raspberry Pi SBC	computer
)		∉ macOS	S Apple MI-based Comput	192.168.178.129	Apple	Apple M1-based Comput	computer
]		é macOS	Apple M1-based Comput	192.168.175.25	Apple	Apple M1-based Comput	computer
-		Windows 10	S NUC	169.254.181.84	Intel	Intel(R) Client Systems	computer

Figure 40. Deployment page

#### Advanced

The **Advanced** button lets you access the **Advanced** page. For more details, see Advanced (on page 127).

#### **Execution details**

The **Execution details** lets you access the **Activity Log**. For more details, see **Execution** details (on page 129).

#### Live toggle

The **Live** toggle lets you change live view on, or off. When live mode is on, the page will refresh periodically.

#### Refresh

The  ${}^{\bigcirc}$  icon lets you immediately refresh the current view.

#### Actions

The **ACTIONS** column has a checkbox for each row in the table. This lets you select multiple nodes before you then apply an action to them.

The **ACTIONS** menu icon ••• gives you access to these options:

- Select all in current page
- Select none in current page
- Invert selection in current page
- Deploy Service mode: this installs Arc in Service mode for the selected devices
- Remove Service mode: this removes the Arc previously installed in Service mode for the selected devices

#### **Operating System**

The **OPERATING SYSTEM** column shows the OS for each of the Arc sensors in the table. The field at the top of the column lets you use the OS to filter the table.

#### IP

The **IP** column shows the *IP* for each of the Arc sensors in the table. The field at the top of the column lets you use the *IP* to filter the table.

#### Vendor

The **VENDOR** column shows the vendor name for each of the Arc sensors in the table. The field at the top of the column lets you use the vendor name to filter the table.

#### **Product name**

The **PRODUCT NAME** column shows the product name for each of the Arc sensors in the table. The field at the top of the column lets you use the product name to filter the table.

#### Туре

The **TYPE** column shows the device type for each of the Arc sensors in the table. The field at the top of the column lets you use the device type to filter the table.

### Advanced

The **Advanced** page lets you interact with nodes that have no operating system (OS) detected, or do not show on the same page in the table.

The default table view only shows nodes that have had their *OS* detected. Also, if you select multiple nodes, actions will only be applied to a single page of nodes. To overcome these limitations, you can use the **Advanced** button to go to the **Advanced** page. This will let you interact with a:

- Set of nodes that cannot be shown on a single page
- Set of nodes that have no OS detected

	х
Strolegy	
Addreadly +	
O Dynamic strategy based on existing OS Information. It uses WinEM (Windows Ramote Management, port 2005/2000) and SH8 (Server Message Block, port 443) on Windows heads and SSH on Units hasts. Heads without any OS Information will be ignored.	
Dapity Remove	
Query	Useful queries Nodes without and J
nodes   when ip = 12.61.63.51 when os include? Linux OTI os includ	
O Chederticials are need from the Chedertial Manager, If Variettian for the nodes in scope are already present, no further action is needed.	
These (search)	
	Execute Cancel

Figure 41. Advanced page

#### Strategy

Automatic: This selection will use the OS that has been detected on the node to automatically choose a deployment strategy. You can select multiple nodes that have a different OS. This strategy will ignore a host if it has no OS.

**SSH** (Linux): This selection will force the *secure shell (SSH)* strategy, regardless of the *OS*, and deploy the correct Arc package for Linux.

#### Query

This field lets you create and execute queries on the nodes. This lets you filter and selectively install packages.

#### Timeout (seconds)

The **Timeout** dropdown lets you set the amount of time that Arc will try to communicate with a host machine before it skips it and goes to the next one.

### **Execution details**

The Execution details button gives you access to the Activity Log.

The **Activity Log** lets you troubleshoot the results of the executed deployments. When you select an execution on the left side of the page, you can analyze the selection.

You can use the **Filter by node ID** to focus on a single issue, such as:

- Credential missing, or
- Wrong credentials

Activity Log - Ar	rc operati	ons			Live 💽 🗡
5 executions of the plan		All	Successful	No connectivity	Wrong credentials
		Filter by node ID			
2023-03-21 13:02:07.337	1 nodes				
2023-03-21 13:01:36.990	1 nodes	Execution details			
2023-03-21 13:00:21.120	1 nodes	Started at: 2023-03-21 13:02:07.337.			
<b>2023-03-21</b> 12:58:56.541	1 nodes	Lasted 7195 milliseconds. 1 nodes polled.			
2023-03-21 12:58:35.902	1 nodes				
		~ <b>10.41.48.16</b> 7149 ms			
		Steps	Node poi	nts	
		<ul> <li>Fetching credentials</li> </ul>			
		<ul> <li>Using credentials from Cr node: [10.41.48.16]</li> </ul>	edentials Manager for		
		<ul> <li>Establishing connection</li> </ul>			
		<ul> <li>Fetching remote host arch</li> </ul>	hitecture		
		<ul> <li>Fetching Arc status</li> </ul>			
		<ul> <li>Arc uninstalled</li> </ul>			

#### Live toggle

The **Live** toggle lets you change live view on, or off. When live mode is on, the page will refresh periodically.

#### Refresh

The  ${\cal O}$  icon lets you immediately refresh the current view.

# Node points

The **Node points** page shows data points that are collected over time, and represent the state of the target machine.

NOZOMI	≡ 🕬 Sensors	Alerts	Assets	V Queries	🔆 Smart Polling [	Arc		හි @	
Arc						Deplo	yment Deployr	ment settings Node points	
0 nodes polled		Filter by n	node ID					Live 🔍 🕥	
Vodes									
10.41.43.55 Ø5 months ago				10.41.50.18			Antivirus[0]		
10.41.50.14	Ø6 months ago						Definition status:	From 2024-04-14	
10.41.50.17	@5 months ago			Antivirus[0]	Windows Def	render	UP_TO_DATE	17:32:40.343	
10.41.50.18	@ a minute ago			CPU0 load	4 %	>		to Now	
10.41.50.23	@3 months ago				1.0014/0		Definition status: UP_TO_DATE	From 2024-04-13 17:30:40.836	
10.41.132.242	@ 2 months ago			Computer	LSPW8	>		to 2024-04-13 17:30:40.836	
172.30.128.1	@2 months ago			Disk[0]	C:	>	Definition status: UP TO DATE	From 2024-04-12 17:29:40.520	
192.168.45.231	@2 minutes ago				_			to 2024-04-12 17:29:40.520	
192.168.151.192	©2 months ago			Disk[1]	D:	>	Definition status:	From 2024-04-11 17:27:41.202	
fe80::aede:48ff:fe	e003122days ago			Installed Softwa	are	>	UP_TO_DATE	to <b>2024-04-11</b> 17:27:41.202	
				Interface[0]	Microsoft Ker Debug Netwo		Definition status: UP_TO_DATE	From <b>2024-04-11</b> 16:22:32.576 to <b>2024-04-11</b> 16:22:32.576	
					Adapter		Definition status: UP_TO_DATE	From <b>2024-04-10</b> 16:21:33.408	
				Interface[1]	Microsoft ISATAP	TAP		to 2024-04-10 16:21:33.408	
					Adapter	>	Definition status:	From 2024-04-10	

#### Figure 42. Node points page in Guardian

#### Node points count

This shows the number of the nodes polled.

#### Filter by node ID

This field lets you use the node *ID* to filter the nodes.

#### Live toggle

The **Live** toggle lets you change live view on, or off. When live mode is on, the page will refresh periodically.

#### Refresh

The  ${}^{\bigcirc}$  icon lets you immediately refresh the current view.

#### Nodes

The list of nodes that show at least one node point.

# **Chapter 8. Network**



The **Network** page gives you access to multiple pages that show nodes, links, sessions in tabular format and graphs and traffic in a graphical format.

NOZOMI =	ioi Sensors	Alerts	Assets	V Queries	🔅 Smart Polling	.×. Arc				\$ \$
Network						Nodes	Links	Sessions	Graph	Traffic

#### Figure 43. Network page

The **Network** page has these tabs:

- Nodes (on page 134)
- Links (on page 144)
- Sessions (on page 153)
- Graph (on page 157)
- Traffic (on page 166)

# Nodes

The **Nodes** page lets you view all the network nodes in your environment and perform actions on them.

letwork					Node	s Links	Sessions	Graph Traffic
age 1 of 16, 384 entr	ies						Export 🗂 🛛 Live	• 🕥 🔹 9 selected •
ACTIONS	ADDRESS	ROLES	MAC ADDRESS	SENT BYTES	RECEIVED BYTES	TCP RETRANS. %	# LINKS	PROTOCOLS
= <b>A &amp; f &amp; r</b> + •	fe80:8c7:2254:aa83:708c	other	88:66:5a:15:ca:cb	11.5 KB	0.0 B	0.0%	1	mdns
≅ <b>A &amp; † 0 /*</b> ⊙	3e:40:1e:bd:10:c5	other	3e:40:1e:bd:10:c5	8.3 KB	0.0 B	0.0%	0	
≝ <b>A ● ∮ ≎ /*</b> ⊙	c0:c9:e3:a2:32:c4	other	c0:c9:e3:a2:32:c4	1.5 KB	0.0 B	0.0%	0	
E 🗛 🌲 🕈 🌣 📌 🔗	192.168.68.65	other	84:e3:42:dd:29:5f	1.0 MB	0.0 B	0.0%	1	other
E 🗛 🏘 🕈 🏟 📌 👳	fe80:6440:2e:9cc2:ce2f	other	d8:c0:a6:3e:c6:85	21.6 KB	0.0 B	0.0%	1	mdns
≅ <b>▲ ▲ १ ≎ /*</b> ⊙	192.168.0.146	other	0e:e5:b3:44:45:e2	65.8 KB	0.0 B	0.0%	1	mdns
≝ <b>A &amp; † ≎ /†</b> ⊙	ea:be:af:86:54:d8	other	ea:be:af:86:54:d8	8.3 KB	0.0 B	0.0%	0	
E 🗛 🌰 🦸 🍄 📌 👳	28:ee:52:dc:90:2c	other	28:ee:52:dc:90:2c	7.4 KB	0.0 B	0.0%	0	
E 🗛 🌲 🕈 🌣 📌 🔗	fe80:1b07:ebc0:307a:c3ec	other	04:7c:16:b3:34:50	34.0 KB	0.0 B	0.0%	1	mdns
E 🗛 🏘 🕈 🏟 📌 👳	2a01:b540:ff:7d00:1dc:f3a8:4288:9970	other	88:66:5a:15:ca:cb	123.1 KB	0.0 B	0.0%	0	
≅ <b>≜≜∮≎</b> ≉⊙	98:01:a7:e5:14:db	other	98:01:a7:e5:14:db	18.6 KB	0.0 B	0.0%	0	-
≝ <b>A &amp; ∮ ≎ /*</b> ⊙	fe80::f603:2aff:feaf:9273	other	f4:03:2a:af:92:73	7.8 KB	0.0 B	0.0%	1	mdns
= A A 1 0 0 0 0	fe80:41f;748e:6783:393d	other	88:66:5a:15:ca:cb	77.7 KB	0.0 B	0.0%	1	mdns

#### Figure 44. Nodes page

#### Export

The **Export**  $\stackrel{(\uparrow)}{\square}$  icon lets you export the current list in either CSV or Microsoft Excel format.

#### Live / refresh

The Live  $\bigcirc \bigcirc \bigcirc \bigcirc \bigcirc$  icon lets you change live view on, or off. When live mode is on, the page will refresh approximately every five seconds.

#### **Column selection**

The columns selection  ${}^{igodoldsymbol{\Theta}}$  icon lets you choose which columns to show or hide.

### Configure a node

The **Nodes** page lets you configure nodes.

#### Procedure

- 2. Select Nodes.

Result: The Nodes page opens.

- 3. To the left of the applicable node, select the configure = icon. **Result:** A dialog shows.
- 4. Optional:

To make the node(s) invisible in network graph view, select Is disabled.

Configure ea:be:af:86:54:d8
<b>Is disabled</b> When a node is disabled it becomes invisible in the network graph view
Label
Level
Device ID override
Enter a name or click on the arrow on the right to choose between available assets
Save

- 5. From the Label dropdown, select an asset and assign the node to it.
- 6. In the **Level** field, enter a level in accordance with the Purdue model classification.
- 7. From the **Device ID override** dropdown, remove or re-assign Device ID to overwrite the automatically assigned **Device ID**.
- 8. Select Save.

#### Results

The node has been configured.

### Show alerts for a node

The **Nodes** page lets you show alerts for a selected node.

#### Procedure

1. In the top navigation bar, select  $\equiv$  icon > Network.

Result: The Network page opens.

2. Select Nodes.

Result: The Nodes page opens.

3. To the left of the applicable node, select the 🕰 icon.

Result: A list of all the requested traces for the node shows.

### Show requested traces for a node

The **Nodes** page lets you show requested traces for a selected node.

#### Procedure

- 2. Select Nodes.

Result: The Nodes page opens.

3. To the left of the applicable node, select the rightarrow icon.

Result: A list of all the requested traces for the node shows.

### Request a trace for a node

The **Nodes** page lets you request a trace for a selected node.

#### Procedure

1. In the top navigation bar, select  $\equiv$  icon > Network.

Result: The Network page opens.

2. Select Nodes.

Result: The Nodes page opens.

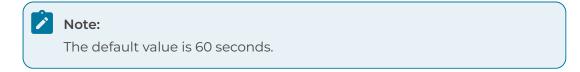
3. To the left of the applicable node, select the  $\P$  icon.

**Result:** A dialog shows.

4. To set the maximum packet size, in the **Trace max size (packets)** field, enter a value.

Request a trace	
race max size (packets)	
5000	
Frace max duration (seconds)	
60	
Packet filter	BPF syntax help BPF examples
ip host 192.168.68.65	
	Send trace request Cance

- The default size is 5000 packets.
- 5. To set the maximum duration of the trace, in the **Trace max duration (seconds)** field, enter a value.



6.

Note:

The **Packet filter** field is automatically populated with a *Berkeley Packet Filter (BPF)* that captures the packets to/from the selected node, but you can customize this.

If necessary, customize this field.

# Note: You can select **BPF syntax help** to show more information on <u>BPF</u> syntax.

Note:

You can select **BPF examples** to see some examples.

7. Select Send trace request.

#### Results

The trace has been requested.

### Manage learning for a node

The **Nodes** page lets you manage the learning for a selected node.

#### About this task

The **Manage Learning** dialog lets you learn and delete the entire node and its individual details, such as *IP* or *MAC* address.

#### Note:

The icon adjacent to the node shows its status. When the node details are:

- A green icon shows when the node details have been entirely learned
- An orange icon shows when the node details are only partially learned
- A red icon shows when the node details have not been learned

Individual details have either a green or red icon, depending on whether they are learned or not. When you learn, or delete a node, all of its details are affected in the same way. When you learn, or delete, an individual detail, only that detail's learning status changes.

#### Procedure

1. In the top navigation bar, select  $\equiv$  icon > Network.

**Result:** The **Network** page opens.

2. Select Nodes.

Result: The Nodes page opens.

3. To the left of the applicable node, select the  $\bigotimes$  icon.

Result: A dialog shows.

#### 4. Optional:

Select an item(s) to delete.

Manage Learning <b>192.168.68.65</b>	×
🛍 Delete 🖺 Learn Save Discard	
C	
□ □ 🖵 192.168.68.65	
🗆 🛃 IP: 192.168.68.65	
🗆 🛤 MAC Address: 84:e3:42:dd:29:5f	

#### Choose from:

- $^\circ$  To delete the IP address, select the checkbox to the left.
- $\,\circ\,$  To delete the MAC address, select the checkbox to the left.
- $^\circ\,$  To delete the node, and both the IP and MAC addresses, select the checkbox to the left.
- a. Select III **Delete** to delete the selected item(s).
- 5. **Optional:** Select an item(s) to learn.

#### Choose from:

- $\circ\,$  To learn the IP address, select the checkbox to the left.
- To learn the MAC address, select the checkbox to the left.
- To learn the node, and both the *IP* and *MAC* addresses, select the checkbox to the left.
- a. Select **b** Learn to learn the selected item(s).
- 6. Select Save.

### Navigate from a node

The **Nodes** page lets you navigate to related entities from a selected node.

#### Procedure

1. In the top navigation bar, select  $\equiv$  icon > Network.

Result: The Network page opens.

2. Select Nodes.

Result: The Nodes page opens.

- In the Actions column, to the left of the applicable node, select the ricon.
   Result: A list of related entities shows.
- 4. Select the hyperlink that you want to navigate to.

```
Go to fe80::14ab:4e17:4c9d:84e9 [Node]
Go to mdns [Protocol]
Go to fe80::14ab:4e17:4c9d:84e9 / Any / Any [Link]
Go to Any / fe80::14ab:4e17:4c9d:84e9 / Any [Link]
Go to fe80::14ab:4e17:4c9d:84e9 [Vulnerabilities]
Go to fe80::14ab:4e17:4c9d:84e9 / Any / Any [Sessions]
Go to Any / fe80::14ab:4e17:4c9d:84e9 / Any [Sessions]
```

#### Results

The entity shows in the applicable page.

### Add a node to a Smart Polling plan

The **Nodes** page lets you add a node to an existing Smart Polling plan.

#### About this task

The Smart Polling icon only shows if Smart Polling is present.

#### Procedure

1. In the top navigation bar, select  $\equiv$  icon > Network.

Result: The Network page opens.

2. Select Nodes.

Result: The Nodes page opens.

3. To add a node to a plan with an optionally different configuration from the plan's original one, in the Actions column, to the left of the applicable node, select the

Result: A dialog shows.

4. From the **Select an existing plan to add the node to** dropdown, select an existing plan to that you would like to add the node to.

Smart polling configuration for <b>172.18.249.104</b> *
Select an existing plan to add the node to
My WinRM Plan 🗸
Data to be collected
15 selected <del>▼</del>
Specific Vulnerabilities Detection 🗸
Username
nozomi
Password
Password
Timeout (seconds)
30
Use SSL
Fill in the fields for which you want to override the plan's configuration
Poll node immediately
Add Cancel

- 5. **Optional:** In the **Timeout (seconds)** field, enter a value to override the value in the current plan.
- 6. Optional: To poll the node immediately, set the Poll node immediately toggle to on.

### Note:

If you do not set the **Poll node immediately** toggle to on, the node will be polled at the next execution of the selected plan.

# Links

The Links page shows all the links in your environment.

Network				Nodes	Links	Sessions	Graph	Traffic
Page 1 of 13, 309 entries						Export 🖄 Liv	e • 🕥	● 11 selected ▼
ACTIONS	FROM	то	PROTOCOL	LAST ACTIVITY		# ALERTS		THROUGHPU
Ø.+			- •	H 4 ▶ H				
≅▲●∮⊙ ♦┍	10.0.1.9	230.0.0.1	other	08:26:14.953	0		736.0 b)	5
±▲▲∮⊙%¢≉	fe80:143f:c2a3:e350:185a	ff02::fb	mdns	2023-07-04 13:46:57.361	0		0.0 b/s	
≆ <b>≜≜</b> ∮⊙% <b>¢</b> ≓	fe80:413:eaea:596b:27a5	ff02::fb	mdns	2023-08-3116:39:57.025	0		0.0 b/s	
≘▲▲∮⊙ ¢ ≓	192.168.68.52	255.255.255.255	other	2023-07-05 17:20:51.384	0		0.0 b/s	
≝▲●∮⊙%¢≉	fe80:14ab:4e17:4c9d:84e9	ff02::fb	mdns	08:22:18.714	0		0.0 b/s	
± A = 7 0 ¢ r	192.168.68.66	192.168.71.255	other	2023-07-05 17:18:54.651	0		0.0 b/s	
± A & f 0 % ¢ #	192.168.68.71	224.0.0.251	mdns	2023-07-05 17:04:49.495	0		0.0 b/s	

#### Figure 45. Links page

#### Export

The **Export**  $\stackrel{\text{(I)}}{\square}$  icon lets you export the current list in either CSV or Microsoft Excel format.

#### Live / refresh

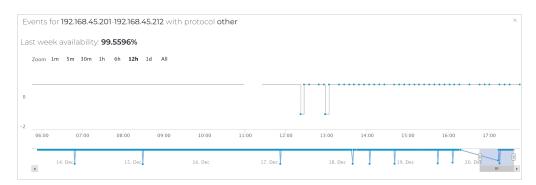
The Live  $\bigcirc \bigcirc \bigcirc \bigcirc \bigcirc$  icon lets you change live view on, or off. When live mode is on, the page will refresh approximately every five seconds.

#### **Column selection**

The columns selection  ${}^{igodoldsymbol{\Theta}}$  icon lets you choose which columns to show or hide.

### Link events

Link events are shown in a graphical format.



#### Figure 46. Link events

#### Availability

Link availability is based on UP and DOWN events.

## Time span

You can use the time span control to view only the events in the specified time range. The available options are:

- Zoom
- 1m(inute)
- 5m
- 30m
- 1h(our)
- 6h
- 12h
- 1d(ay)
- All

## **Graphical history**

A point with a value of 1 represents an UP event, a value -1 represents a DOWN event.

# Link availability

### A history of events is stored for each link.

Two events are of particular interest for computing availability:

- UP This occurs when an activity is detected on an inactive link
- DOWN This occurs when an active link stops its activity

Each event has a timestamp to track the precise moment of its occurrence.

Guardian computes the total downtime of a link by taking into consideration the history of events within a finite time window. Then, it sums the time spans of all events starting with a DOWN event and ending with an UP event. All links are considered active by default. Therefore, the availability of the link is 100% minus the percentage of the total downtime.

## **Track availability**

The **Track availability** feature allows an accurate computation of availability. It enables the monitoring of activity on a link at regular intervals, generating extra UP and DOWN events, depending on the detected activity on both sides of the link during the last interval.

We recommend that you select a value greater than the expected link polling time to avoid checks that are too frequent and are likely to produce spurious DOWN events.

**link\_events** generation is disabled by default. To enable it, see the configuration rule shown in **Configuration**.

# **Configure a link**

The **Links** page lets you configure links.

## Procedure

1. In the top navigation bar, select  $\equiv$  icon > Network.

Result: The Network page opens.

2. Select Links.

**Result:** The **Links** page opens.

3. To the left of the applicable link, select the configure  $\rightleftharpoons$  icon.

Result: A dialog shows.

4. Optional:

To raise an alert when a new *TCP* handshake is detected on the link, select **Is persistent**.

Configure <b>172.20.10.1-224.0.0.251/mdns</b>	×
<b>Is persistent</b> Raise an alert when a new TCP handshake is detected on this link	
Alert on SYN Raise an alert when a TCP SYN packet is detected on this link	
Track availability (seconds)	
Notify the link events when the link communication is interrupted or resumed	
Last activity check (seconds)	
Raise an alert when the link become inactive for more than the specified amount of seconds	
Save	

- 5. Optional: To raise an alert when a *TCP* SYN packet is detected on the link, select Alert on SYN.
- 6. **Optional:** To notify the link events when the link communication is interrupted or resumed., select **Track availability (seconds)** and enter a value.

- 7. **Optional:** To raise an alert when the link becomes inactive for more than the specified number of seconds, select **Last activity check (seconds)** and enter a value.
- 8. Select Save.

#### Results

The link has been configured.

## Show alerts for a link

The **Links** page lets you show alerts for a selected link.

### Procedure

1. In the top navigation bar, select  $\equiv$  icon > Network.

**Result:** The **Network** page opens.

2. Select Links.

Result: The Links page opens.

3. To the left of the applicable link, select the 🕰 icon.

**Result:** A list of all the requested traces for the link shows.

## Show requested traces for a link

The Links page lets you show requested traces for a selected link.

## Procedure

1. In the top navigation bar, select  $\equiv$  icon > Network.

Result: The Network page opens.

2. Select Links.

**Result:** The **Links** page opens.

3. To the left of the applicable link, select the 🌰 icon.

**Result:** A list of all the requested traces for the link shows.

## Request a trace for a link

The Links page lets you request a trace for a selected link.

## Procedure

1. In the top navigation bar, select  $\equiv$  icon > Network.

**Result:** The **Network** page opens.

2. Select Links.

Result: The Links page opens.

3. To the left of the applicable link, select the  $\P$  icon.

The default size is 5000 packets.

Result: A dialog shows.

4. To set the maximum packet size, in the **Trace max size (packets)** field, enter a value.

Request a trace	×
Trace max size (packets)	
5000	
Trace max duration (seconds)	
60	
Packet filter	BPF syntax help BPF examples
ip host 192.168.68.65	
	Send trace request Cancel
Note:	

5. To set the maximum duration of the trace, in the **Trace max duration (seconds)** field, enter a value.



6.

Note: The Packet filter field is automatically populated with a BPF that captures the packets to/from the selected link, but you can customize this.

If necessary, customize this field.

<b>Note:</b> You can select <b>BPF syntax help</b> to show more information on <u>BPF</u> syntax.
Note:

You can select **BPF examples** to see some examples.

7. Select Send trace request.

#### Results

The trace has been requested.

## Show events for a link

The Links page lets you show requested traces for a selected link.

#### Procedure

1. In the top navigation bar, select  $\equiv$  icon > Network.

Result: The Network page opens.

2. Select Links.

Result: The Links page opens.

3. To the left of the applicable link, select the  ${oldsymbol{\oslash}}$  icon.

**Result:** A list of all the events for the link shows.

## Show captured URLs for a link

The Links page lets you show captured URLs for a selected link.

## Procedure

1. In the top navigation bar, select  $\equiv$  icon > Network.

**Result:** The **Network** page opens.

2. Select Links.

Result: The Links page opens.

3. To the left of the applicable link, select the  $^{\circ}$  icon.

**Result:** A list of all the captured *uniform resource locator (URL)s* from the analyzed traffic for the link shows.

# Manage learning for a link

The Links page lets you manage the learning for a selected node.

## About this task

The **Manage Learning** dialog lets you learn and delete the entire node and its individual details, such as *IP* or *MAC* address.

### Note:

The icon adjacent to the node shows its status. When the node details are:

- A green icon shows when the node details have been entirely learned
- An orange icon shows when the node details are only partially learned
- A red icon shows when the node details have not been learned

Individual details have either a green or red icon, depending on whether they are learned or not. When you learn, or delete a node, all of its details are affected in the same way. When you learn, or delete, an individual detail, only that detail's learning status changes.

## Procedure

1. In the top navigation bar, select  $\equiv$  icon > Network.

Result: The Network page opens.

2. Select Links.

Result: The Links page opens.

3. To the left of the applicable node, select the  $\bigotimes$  icon.

Result: A dialog shows.

## 4. Optional:

If necessary, select one, or more, items and select 1 Delete.

Manage Learning <b>192.168</b> .	68.65		×
	🛍 Delete 🖺 Learn	Save Discard	
🖯 🗅 🗁 Nodes			
🗖 🗖 🖵 192.168.68.65			
🗆 🛃 IP: 192.168.68.65			
🗆 🛤 MAC Address: 84:e3:42:dd:29:	5f		

- 5. Optional: If necessary, select one, or more, items and select **b** Learn.
- 6. Select Save.

## Navigate from a link

The *Links* page lets you navigate to related entities from a selected node.

### Procedure

1. In the top navigation bar, select  $\equiv$  icon > Network.

Result: The Network page opens.

2. Select Links.

Result: The Links page opens.

- In the Actions column, to the left of the applicable node, select the ricon.
   Result: A list of related entities shows.
- 4. Select the hyperlink that you want to navigate to.

```
Go to fe80::14ab:4e17:4c9d:84e9 [Node]
Go to mdns [Protocol]
Go to fe80::14ab:4e17:4c9d:84e9 / Any / Any [Link]
Go to Any / fe80::14ab:4e17:4c9d:84e9 / Any [Link]
Go to fe80::14ab:4e17:4c9d:84e9 [Vulnerabilities]
Go to fe80::14ab:4e17:4c9d:84e9 / Any / Any [Sessions]
Go to Any / fe80::14ab:4e17:4c9d:84e9 / Any [Sessions]
```

## Results

The entity shows in the applicable page.

# Sessions

A session is established at a certain point in time, and later turned down. An established communication session might involve more than one message in each direction.

Networ	k						Node	s Links	Sessions	Graph Traffic
Page 1 of 3	02, 7544 ent	ries							Export [^] Live •	🌖 🔹 13 selected 🕶
ACTIONS	STATUS	FROM	то	PROTOCOL	TRANSPORT PROTOCOL	FROM PORT	TO PORT	THROUGHPUT	TRANSFERRED BYTES	TRANSFERRED PACKETS
				. •						
<b>a</b> † 😁	ACTIVE	10.0.1.9	230.0.0.1	other	udp	53075	6666	736.0 b/s	2.4 MB	27 Kpp
<b>a</b> † 😁	ACTIVE	be:4c:84:c3:ad:90	mmmmm	arp	ethernet			0.0 b/s	60.0 B	1 pp
<b>a</b> † 🕋	ACTIVE	10.0.1.9	10.0.1.255	dropbox-lsp	udp	17500	17500	0.0 b/s	244.2 KB	893 pp
<b>a</b> 7 🕋	ACTIVE	fe80:1854:47f1:b58b:7fd8	ff02:fb	mdns	udp	5353	5353	0.0 b/s	1.1 KB	4 pp
<b>a</b> 7 🕋	ACTIVE	fe80:1cc0:bc7f:9b08:f326	ff02:fb	mdns	udp	5353	5353	0.0 b/s	38.5 KB	148 pp
<b>≜</b> † ↔	ACTIVE	10.0.1.8	224.0.0.251	mdns	udp	5353	5353	0.0 b/s	935.0 B	7 pp
<b>a</b> † 😁	ACTIVE	fe80::4ed:b685:d758:1d75	ff02::fb	mdns	udp	5353	5353	0.0 b/s	1.1 KB	7 pp
<b>a</b> † 🔿	ACTIVE	fe80:1c7f:2a99:6fc7:1065	ff02::fb	mdns	udp	5353	5353	0.0 b/s	1.0 KB	7 pp
<b>a</b> † 🔿	ACTIVE	10.0.1.8	224.0.0.251	mdns	udp	63199	5353	0.0 b/s	29.4 KB	150 pp
<b>a</b> † 🖻	ACTIVE	10.0.1.9	224.0.0.251	mdns	udp	5353	5353	0.0 b/s	1.0 KB	4 pp
a + +	ACTIVE	10.0.1.6	224.0.0.251	mdns	udp	5353	5353	0.0 b/s	761.2 KB	2 Kpp

#### Figure 47. Sessions page

#### Export

The **Export** (1) icon lets you export the current list in either CSV or Microsoft Excel format.

## Live / refresh

The Live  $\bigcirc$  icon lets you change live view on, or off. When live mode is on, the page will refresh approximately every five seconds.

## **Column selection**

The columns selection  $^{igodoldsymbol{\Theta}}$  icon lets you choose which columns to show or hide.

## Show requested traces for a session

The **Sessions** page lets you show requested traces for a selected node.

#### Procedure

1. In the top navigation bar, select  $\equiv$  icon > Network.

Result: The Network page opens.

2. Select Sessions.

Result: The Sessions page opens.

3. To the left of the applicable node, select the — icon.

**Result:** A list of all the requested traces for the session shows.

## Request a trace for a session

The **Sessions** page lets you request a trace for a selected node.

### Procedure

1. In the top navigation bar, select  $\equiv$  icon > Network.

Result: The Network page opens.

2. Select **Sessions**.

Result: The Sessions page opens.

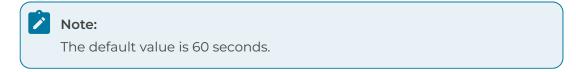
3. To the left of the applicable node, select the  $\P$  icon.

Result: A dialog shows.

4. To set the maximum packet size, in the **Trace max size (packets)** field, enter a value.

Request a trace	×
Trace max size (packets)	
5000	
Trace max duration (seconds)	
60	
Packet filter	BPF syntax help BPF examples
ip host 192.168.68.65	
	Send trace request Cancel
Note:	

- The default size is 5000 packets.
- 5. To set the maximum duration of the trace, in the **Trace max duration (seconds)** field, enter a value.



6.

Note: The Packet filter field is automatically populated with a BPF that captures the packets to/from the selected node, but you can customize this.

If necessary, customize this field.

<b>Note:</b> You can select <b>BPF syntax help</b> to show more information on <b>BPF</b> syntax.
<b>Note:</b> You can select <b>BPF examples</b> to see some examples.

7. Select Send trace request.

#### Results

The trace has been requested.

## Navigate from a session

The **Sessions** page lets you navigate to related entities from a selected node.

### Procedure

- Select Sessions.
   Result: The Sessions page opens.

3. In the Actions column, to the left of the applicable node, select the 📌 icon. **Result:** A list of related entities shows.

4. Select the hyperlink that you want to navigate to.

Go to fe80::14ab:4e17:4c9d:84e9 [Node] Go to mdns [Protocol] Go to fe80::14ab:4e17:4c9d:84e9 / Any / Any [Link] Go to Any / fe80::14ab:4e17:4c9d:84e9 / Any [Link] Go to fe80::14ab:4e17:4c9d:84e9 [Vulnerabilities] Go to fe80::14ab:4e17:4c9d:84e9 / Any [Sessions]

## Results

The entity shows in the applicable page.

# Graph

The **Graph** pages gives a graphical representation of the nodes in the environment.

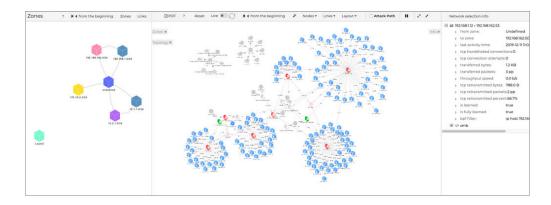


Figure 48. Graph page

Each vertex represents a single network node or an ensemble of nodes, while every edge represents one or more links between nodes or node ensembles. Edges and vertices are annotated to provide node identification information, protocols used to communicate between two nodes, and more.

A specific layout format, or a dynamic automatic adjustment algorithm, control the position of the node in the graph. The algorithm ensures minimal overlap and the best readability of the items.

The graph layout menu controls the format of the data represented in the graph. From the menu, you can select the graph type and the node format in the graph.

The Graph page has these main elements:

- Zones/Topology graph (on page 164)
- Main network graph (on page 158)
- Information pane (on page 157)

#### Information pane

Contains additional information about the node or link selected in the network graph.

## Main network graph

The main network graph shows a graphical representation of the nodes in your environment.

# PDF

This icon lets you export a *PDF* report which contains the graph, as it is currently shown on the page.

## ?

This icon opens the legend for link and nodes based on the selected perspective.

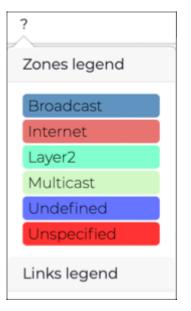


Figure 49. Legend

## Filters

This indicates active graph filtering, when present. Filters can be from the filter bar (see R and S below), or activated from the zone/topology graph when you select a link/ node in the zone/topology graphs. Once a filter is enabled with a value, the graph is automatically updated. If more than one filter is enabled, then a logical and criteria is applied. Only nodes that satisfy all of the specified filters are shown.

## Note:

If a node passes the filters, then all of the directly connected nodes are shown in the graph. For example if a specific *IP* filter is used, then the specified node is shown along with all the nodes connected to it.

## Reset

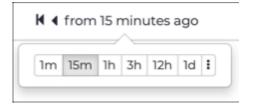
This resets customizations and reloads the data.

## Live / refresh

The Live concerned to the second of the seco

### Time

These icons let you select an activity time range.



For more details, Magic wand (on page 161).

### Nodes

This dropdown lets you select node visualization configuration options.

	Nodes
Perspective:	
	Roles 🗸
Roles:	
Cho	oose a role 🗸
Exclude IDs:	
192.168.1.1,192.1	68.1.2,
ID filter:	Exact match
10.197.2,192.168	3.1.2,
Display:	
	D (label) 🗸
Show broa	dcast
🗹 Only confir	med nodes

## Links

	Links
Perspective:	
None 🗸	
Protocols:	
Choose a protocol 🗸	
Alerts types:	
Choose alert types <del>-</del>	
Only links with alerts	
Only with confirmed data	1
Show protocols	
Apply	

This dropdown lets you configure visualization options.

## Layout

This dropdown lets you select a layout for the graph. For more details, see Layout (on page 162).

### **Pause-play**

The pause-play **II** icon lets you pause, or restart the motion of the graph.

## Increase-Decrease icon size

The increase  $\checkmark$  and decrease  $\checkmark$  icons lets you change the size of the icons in the graph.

## Magic wand

The magic wand icon opens a wizard to help filter the graph and view only the desired information to help you reduce visualized data from large graphs.

The graph wizard gives hints to help you improve the graph performance. Settings that are annotated with an orange exclamation point are considered suboptimal. Settings annotated with green thumbs are considered helpful.

Graph filters to go faster
! Use Google Chrome/Chromium for better performance
🖒 🗔 Show broadcast Hide broadcast nodes to display a simpler graph
!  Only with confirmed data Show only links with confirmed data to display a simpler graph
🖒 🗹 Only confirmed nodes
Show only confirmed nodes to display a simpler graph
!   Exclude tangled nodes
Tangled nodes will be excluded from graph, they can be reincluded by removing their IDs from the nodes options
! Protocols
Choose a protocol 🗸
OK

Figure 50. Magic wand dialog

## Show broadcast

Broadcast addresses are not actual network nodes in that no asset is bound to a broadcast address. They are used to represent communications that a node uses towards an entire subnet. Removing broadcast nodes reduces the complexity of a graph.

## Only with confirmed data

You can select this to hide unconfirmed links to reduce the complexity of an entangled graph.

#### Only confirmed nodes

You can select this to hide unconfirmed nodes to reduce the size of a large graph.

## Exclude tangled nodes

To improve the readability of the graph, you can select this to exclude nodes whose connections cause the graph to be too complex.

## Protocols

This dropdown lets you filter nodes and edges to show only those items that are communicating with the related protocol(s).

## Layout

The **Layout** dropdown lets you select a layout for the graph.

The options are:

- Standard (on page 162)
- Purdue model (on page 162)
- Grouped (on page 163)
- Clustered (on page 163)

	Layout 🕶
<ul> <li>Standard</li> </ul>	
O Purdue model	
⊖ Grouped	
Clustered	
Group by	
Group by 🗸	
Apply	

#### Standard

This is the default layout. The type of visualization depends on the criteria defined in Group by (on page 163):

- Group by (on page 163) not defined: All of the nodes and links are shown
- Group by (on page 163) defined: Nodes that belong to the same group (based on the defined criteria) are collapsed into a single node

#### Purdue model

Nodes are arranged in separate rows, according to their level. You can distinguish the levels and isolate potential communication problems that cross two or more levels.

#### Grouped

Nodes are grouped according to the criteria defined in Group\_by. The graph is visualized as follows:

- Group by (on page 163) not defined: All nodes and links are shown.
- Group by (on page 163) defined: Nodes that belong to the same group are shown and are placed inside a circle that represents the group. Links between nodes within the same group are shown. However, links between groups are replaced with lines that connect the circles

#### Clustered

Nodes are clustered according to the criteria below. Once nodes are clustered, a single circle represents the node cluster. Upon zoom-in, the circle expands and the internal nodes display. A cluster may contain multiple subclusters. This layout is useful when visualizing large graphs because it provides an overview of the graph, along with sufficient details.

Nodes are clustered depending on the values defined by Group\_by:

- Group by (on page 163) not defined: Nodes are clustered based on connections. Nodes with a large number of links act as a cluster center with neighboring nodes assigned to the same cluster
- Group by (on page 163) defined: At the highest level, a cluster is created for each group. Inside each high level cluster are subclusters created around nodes with a high number of links. For example, if Group\_by=Zones, then a cluster is created for each zone, and inside each zone other subclusters may be created around nodes with a high number of links

#### Group by

This dropdown lets you define the group used for Standard, Grouped, and Clustered layouts. Nodes with the chosen property, such as zone or subnet, are assigned to the same group. The group displays depending on the selected layout.

The Group by dropdown lets you select from:

- Asset
- Cluster
- Level
- Roles
- Subnet
- Type
- Zone
- Site
- Host

# Zones/Topology graph

The Zones/Topology graph shows a visualization of the network topology or zones.

### General

You can see a visualization of either the zones or the topology, but not both at the same time. You can control these views with the two toggle buttons.

Inside the Zones graph, each node represents a zone and each link represents all of the links between the nodes in the connected zones. When you select a zone, the information pane is populated with all of the nodes/links that are related to the selected zone. The main network graph is filtered to show only the nodes and the links for that zone, and the filtering icon shows.

In a similar way, when a link is selected in the **Zones** graph, the information pane is populated with all of the links between the two zones, and the Networks graph shows only the nodes and links that belong to one of the two connected zones. When you click in a region of the **Zones** graph that has no nodes or links, the visualization in the main networks graph is reset to show all the nodes and links.

## Zones legend

The ? icon opens the legend for link and nodes based on the selected perspective.



Figure 51. Legend

## Time

These icons let you select an activity time range.



## Zones

ones		
Persp	ective:	
	Name 🗸	
Name	filter:	

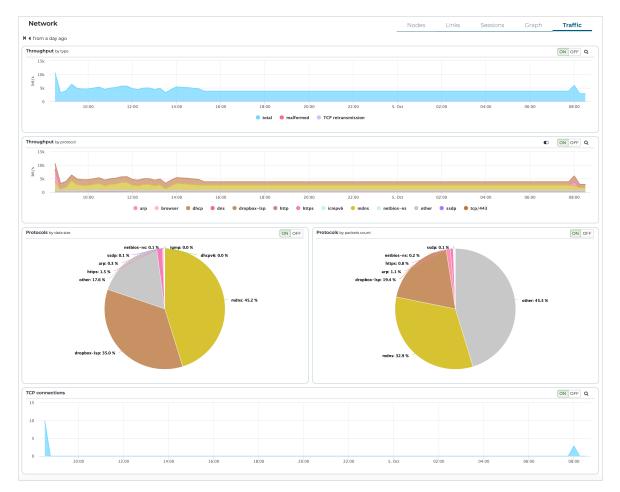
## Links

	Links
Perspective:	
None 🗸	
Apply	

This dropdown lets you configure visualization options.

# Traffic

The **Traffic** page shows charts with information about throughput, protocols, and open transmission control protocol (TCP) connections.



## Throughput by type

This section shows traffic by macro category.

#### Throughput by protocol

This section shows traffic by protocol.

#### Protocols by data size

This section shows the proportion of packets sent by protocol, in pie chart format.

#### Protocols by packets count

This section shows the proportion of traffic generated by protocol, in pie chart format.

#### **TCP connections**

This section shows the number of open *TCP* connections.

# Graph controls

A list of the different control options in the graph view.

Move	Click and drag anywhere in the graph other than on a node.
Zoom (mode 1)	With the cursor positioned inside the graph window, scroll the mouse forward or backward. Zoom is centered on the mouse position.
Zoom (mode 2)	With the cursor positioned inside the graph window, press Z on the keyboard and move the mouse up or down. Zoom is centered on the mouse position.
Increase icon and text size.	Select the 🖍 icon.
Decrease icon and text size.	Select the 🗚 icon.
View detailed information for a node or link in the information pane.	Select a node or link with a single click
Show a new window with additional information for a node	Select a node with a double click
Show a node or link	Move your mouse over the node or link
Show a node or link, and the elements directly connected to it	Click and hold your mouse button on a node or link without releasing it



# **Chapter 9. Process**



Process is a set of repeatable functions that a business does to deliver a core value.

Process includes:

- Repeatable tasks
- Data collection
- Resource control in accordance with business policies

Variables model communication between operational devices as they participate in the industrial process.

Individual values within operational devices are represented as variables, and Guardian tracks them over time in **Process**.

The **Process** page has these tabs:

- List (on page 172)
- Protocol connections (on page 173)
- Settings (on page 174)

# List

The **List** page shows detailed information about variables in your environment.

								List	Protocol	connections	Settings
								E	Export 🖒	Live 🌒 🎵	14 selected
HOST LABEL	NAMESPACE	NAME	LABEL	TYPE	VALUE	LAST VALUE	# CHANGES	# REQUESTS	LAST FC	LAST FC INFO	LAST ACTIVITY
	HOST LABEL	HOST LABEL NAMESPACE	HOST LABEL NAMESPACE NAME	HOST LABEL NAMESPACE NAME LABEL	HOST LABEL NAMESPACE NAME LABEL TYPE	HOST LABEL NAMESPACE NAME LABEL TYPE VALUE	HOST LABEL NAMESPACE NAME LABEL TYPE VALUE LAST VALUE	HOST LABEL NAMESPACE NAME LABEL TYPE VALUE LAST VALUE # CHANGES		Export	

## Figure 52. List page

## Export

The **Export**  $\stackrel{\uparrow}{\square}$  icon lets you export the current list in either CSV or Microsoft Excel format.

## Live / refresh

The **Live** icon lets you change live view on, or off. When live mode is on, the page will refresh approximately every five seconds.

## **Column selection**

The columns selection  ${}^{igodoldsymbol{\Theta}}$  icon lets you choose which columns to show or hide.

# **Protocol connections**

The **Protocol connections** page lets you configure the additional parameters necessary to extract information contained inside certain protocols.

NOZOMI =	। १०॥ Sensors	Alerts	Assets	V Queries	Smart Polling	Arc آخ				\$ \$
Process							List	Protocol co	onnections	Settings
Page 1 of 1, 0 entries										Live • 🕥
SOURCE	DE	STINATION		PROTOCOL	PACKETS	COUNT	LAST	PACKET TIME	CO	NFIGURED
There are no connections										

#### Figure 53. Protocol connections page

## Live / refresh

The Live icon lets you change live view on, or off. When live mode is on, the page will refresh approximately every five seconds.

# Settings

The **Settings** page lets you configure which strategy to use to extract variables inside the process that are being communicated over different protocols.

Global variables extraction	
O Disabled	
() Global variable extraction is disabled. Variables that are already present won't be persisted and will be discarded upon reboots. It prevails over protocol specific settings.	
• Enabled	
() Clobal variable extraction is enabled. Protocol specific settings prevail.	
Advanced	
<ol> <li>Try to extract more variables by applying heuristic techniques to some protocols. Protocol specific settings prevail.</li> </ol>	
Limit the extraction to the selected zones	
Select the zones 🗸	
Save	
Protocol specific variables extraction	
Page 1 of 1, 0 entries Live • 5	
ACTIONS PROTOCOL VARIABLES CO LEVEL ZONES	
There is no protocol with at least one variable	

#### Figure 54. Process variable extraction tuning

#### Disabled

This checkbox lets you disable global variables extraction.

#### Enabled

This checkbox lets you enable global variables extraction.

#### Advanced

This checkbox lets you try to apply heuristic techniques to some protocols to extract more variables. Protocol specific settings prevail.

#### Limit the extraction to the selected zones

This dropdown lets you Limit the extraction to the selected zones.

# Configure a variable

The List page lets you navigate to related nodes, links, vulnerabilities, or sessions.

## Procedure

1. In the top navigation bar, select  $\equiv$  icon > Process.

Result: The Process page opens.

- Select List.
   Result: The List page opens.
- 3. To the left of the applicable *variable*, select the configure icon. **Result:** A dialog shows.

×

4. In the Label field, enter a label for the Variable.

# Configure 192.168.45.159/0/ptp\_time

#### Label

ptp\_time at RTU 0

#### Enable history

Permits to enable history for this variable.

#### Last activity check

Raise an alert when the variable is not updated for more than the specified amount of seconds

#### Invalid quality check

Raise an alert when the variable keeps the invalid quality for more than the specified amount of seconds

#### Disallowed qualities check

Raise an alert when the variable has one of the specified qualities. Possible values are: invalid, not topical, blocked, substituted, overflow, reserved, questionable, out of range, bad reference, oscillatory, failure, inconsistent, inaccurate, test, alarm. Multiple values can be separated by comma.

#### Unit

n/a

The unit of measurement of the variable value

#### Scale

1.000000

A constant value multiplied to the variable value

#### Offset

0.000000

A constant value added to the variable value



5. Optional: If necessary, select the Enable history.

Note: This lets you enable Variable history.

6. Optional: If necessary, select the Last activity check.

## Note:

This triggers an alert when the *Variable* is not updated for more than the specified amount of seconds.

7. Optional: If necessary, select the Invalid quality check.

## Note:

This triggers an alert when the *Variable* keeps the invalid quality for more than the specified amount of seconds.

8. Optional: If necessary, select the Disallowed qualities check.

## Note:

This triggers an alert when the Variable has one of the listed qualities. You can use a comma to separate values.

- 9. In the **Unit** field, enter a value.
- 10. In the **Scale** field, enter a value.
- 11. In the **Offset** field, enter a value.

## Results

The Variable has been configured.

# View the details of a variable

The List page lets you view the details of a variable.

#### Procedure

1. In the top navigation bar, select  $\equiv$  icon > Process.

Result: The Process page opens.

2. Select List.

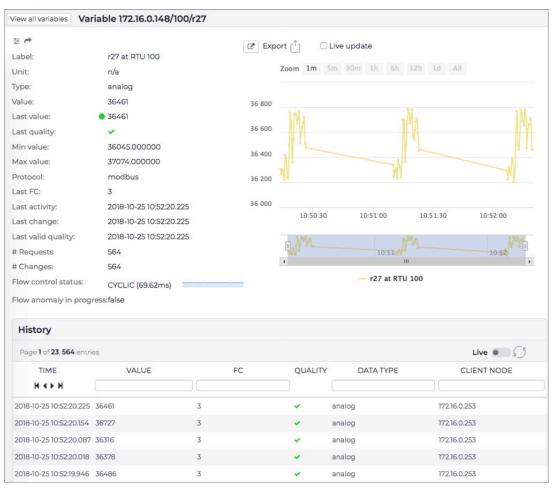
Result: The List page opens.

3. To the left of the applicable Variable, select the search  ${f Q}$  icon.

Result: The Variables details window opens.

4. Optional:

To open the chart in another window, select the  $\fbox$  icon.



- 5. Optional: To export the results, select Export  $\stackrel{\uparrow}{\square}$
- 6. Optional: To update the chart to real-time, select Live update.

# Favorite a variable

The List page lets you add a Variable to the favorite variables.

## Procedure

- Select List.
   Result: The List page opens.
- 3. To the left of the applicable Variable, select the search icon.
   Result: The Variable is added to the Favorite variables list.

# Navigate from a variable

The List page lets you navigate to related nodes, links, vulnerabilities, or sessions.

### Procedure

1. In the top navigation bar, select  $\equiv$  icon > Process.

Result: The Process page opens.

- Select List.
   Result: The List page opens.
- To the left of the applicable variable, select the navigate ricon.
   Result: A dialog shows.
- 4. Select the desired link.

Go to 192.168.45.159 [host Node] Go to ptpv2-ip [Protocol] Go to 192.168.45.159 / Any / ptpv2-ip [Link] Go to Any / 192.168.45.159 / ptpv2-ip [Link] Go to 192.168.45.159 [Vulnerabilities] Go to 192.168.45.159 / Any / ptpv2-ip [Sessions] Go to Any / 192.168.45.159 / ptpv2-ip [Sessions]



# **Chapter 10. Reports**



The **Reports** page lets you manage, generate, schedule and view reports.

Management       Reports     yes       Available report templates count:     5       Available widgets count:     48	\$ @	ŝ			Smart Polling	V Queries	Assets	Alerts	। १०॥ Sensors		NOZ	*
Disk     Management       Avail     Reports     yes       Assertions     Valiable report templates count:     5       Available widgets count:     48	ttings	Scheduled Setti	Generated	Management	Dashboard					Network	•	R
Available report instances of the instance of				nent	Managen					Process	$\square$	Disk
V- Assertions Available widgets count: 48			yes	tor permissions:	Report edit					Reports	0:	Avai
Diak										Assertions	<b>~</b> -	
Custom queries count: 0			0	-						Time machine	$\odot$	Disk
Dr.         Vulnerabilities         Custom reports count:         3			3	ports count:	Custom rep					Vulnerabilities	CVE	

### Figure 55. Reports page

The **Reports** page has these tabs:

- Dashboard (on page 186)
- Management (on page 187)
- Generated (on page 190)
- Scheduled (on page 191)
- Settings (on page 192)

# Dashboard

The Dashboard page shows an overview of information related to reports, which includes disk availability, report settings, generated reports, report management, and scheduled reports.

Reports	Dashboard Management Generated Scheduled Settings
Disk	Management
Available disk space: 3.4G / 4.6G 75.0%	Report editor permissions:     yes       Available report templates count:     5       Available widgets count:     48
Disk space used by reports: 204 KB / 1.2G 0.0%	Custom reports count: 0 Custom reports count: 0
Settings SMTP configuration: no Custom report logo: no	
Generated	Scheduled
Cenerated reports count: 1 Last generated reports: FILENAME CREATION DATE (SERVER TIME)  asset_report_craigs-mac-studio_local 2023-09-15 12:29:06:733	Scheduled reports count: 0

### Figure 56. Dashboard page

### Disk

This section shows:

- Available disk space
- Disk space used by reports

#### Management

This section shows a summary of information from the Management (on page 187) page.

#### Settings

This section shows a summary of information from the Settings (on page 192) page.

#### Generated

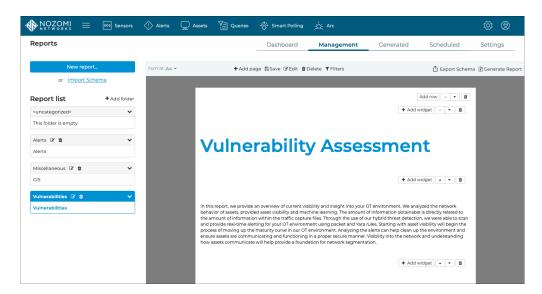
This section shows a summary of information from the Generated (on page 190) page.

#### Scheduled

This section shows a summary of information from the Scheduled (on page 191) page.

# Management

The Management page lets you manage all your reports.



#### Figure 57. Management page

#### New report

This button lets you Create a report (on page 193).

#### Import schema

This button lets you Import a schema (on page 200).

#### **Report list**

This section shows a list of created and saved reports. You can add folders (on page 198) to group the reports in.

#### Add page

This button lets you add a page to the bottom of the current report.

#### Save

This button lets you save the changes to the current report.

#### Edit

This button lets you edit the current report.

#### Delete

This button lets you delete the current report.

#### **Filters**

This button lets you filter the contents of the current report.

Edit filters for report 'Alerts'	×
Filter on assets	
where device_id = yyy	
Filter on alerts	
where id = 1	
Filter on nodes	
where ip = 192.168.1.12	
Filter on node_cpes	
where node_id = 1.1.1.2	
Filter on links	
where protocol = smb	
Filter on node_cves	
where node_id = 192.168.1.12	
Filter on captured_urls	
where url = www.youtube.com	
Filter on captured_logs	
where id_src = 192.168.1.12	
(1) These filters will not work on the widgets: CISControl_7, CISControl_12, Vulnerability scoring overview, Evidences, Vendors, Vulnerability key findings	
Ok Cance	!

# Figure 58. Filter dialog

# Export schema

This button lets you export a schema (on page 201) for the current report in *JavaScript Object Notation (JSON)* format.

# Generate report

The generate report **b** icon lets you generate a report (on page 195) in one of these formats:

- PDF
- CSV
- Microsoft Excel

# Generated

The Generated page lets you view, download, edit, and delete generated reports.

Reports			Dashboard	Management	Generated	Scheduled	Settings
Pagelofl,1	entries		Live 💿 🎵 🔹 Actions, Filename, Creation date (s				te (server time)
ACTIONS	FI	ENAME		CF	REATION DATE (SERVE	R TIME)	
					H 4 F H		
- G 🖬	asset_report_craigs-mac-studio_local		2023-0	9-15 12:29:06.733			

#### Figure 59. Generated page

# Live / refresh

The Live  $\bigcirc \bigcirc \bigcirc \bigcirc \bigcirc$  icon lets you change live view on, or off. When live mode is on, the page will refresh approximately every five seconds.

### **Column selection**

The columns selection  ${}^{ullet}$  icon lets you choose which columns to show or hide.

# Scheduled

The **Scheduled** page lets you view, download, edit, and delete scheduled reports.

	! ≡	loli Sensors	Alerts	Assets	V Queries	Smart Po	olling 🔆 Arc			ණු ල
Reports						Dashboard	Management	Generated	Scheduled 0	Settings
Page 1 of 1, 1 entri	ies								Live 🔍 💭	5 ® 9 selected •
ACTIONS	NAME	USER DE	FINED NAM	QUERY	RECUR	RENCE (SERV E	MAIL RECIPIENTS	CREATED BY	CREATION DATE (SE	REPORT TYPE
•••	Inerabilities	Assets			daily at		aig.hallidav@nozo adı	min	15:41:38.397	PDF

# Figure 60. Scheduled page

# Live / refresh

The Live  $\bigcirc \bigcirc \bigcirc \bigcirc \bigcirc$  icon lets you change live view on, or off. When live mode is on, the page will refresh approximately every five seconds.

# **Column selection**

The columns selection  ${}^{igodoldsymbol{\Theta}}$  icon lets you choose which columns to show or hide.

# Settings

The **Settings** page lets you change report settings, upload custom logos, and configure simple mail transfer protocol (SMTP) settings.

Reports		Dashboard	Management	Generated	Scheduled	Settings
	Custom logo Report cus	stom logo not yet uploa	ded.			
	Drop an in	nage here or click to up	load			
	Supported formats: JPG, PNG and GIF. similar	Logo ideal sizes: 360x90	) or bigger. Logo ideal ratio	: 4:1 or		
	SMTP Server					
	<ul> <li>An SMTP server is required to send : 'Email recipients' field is set)</li> </ul>	scheduled reports by er	mail at each recurrence (if	the		
	ON OFF					
	HOST[:PORT][/iD] Sender					
	STARTTLS					
	Authentication Mechanism:   PLAIN	LOGIN				
	Username					
	Password					
	Save					

#### Figure 61. Settings page

#### **Custom logo**

This section lets you upload a custom logo (on page 202) that will show in your reports.

### SMTP server

If you want to send emails that contain scheduled reports, you need to configure (on page 204) the *simple mail transfer protocol (SMTP)* server settings.

# Create a report

The **Management** page lets you create a new report.

### Procedure

1. In the top navigation bar, select  $\equiv$  icon > Reports.

Result: The Reports page opens.

- 2. Select Management.
- 3. In the section on the left, select **New report**.

Result: A dialog shows.

4. In the **Name** field, enter a name for the report.

New report	×
Name	
Layout	
Choose a layout 🗸	
Folder	
<uncategorized> 🗸</uncategorized>	
Group visibility	
Choose one or more groups 🗸	
Widget spacing	
20	٢
Ok	Cancel

- 5. From the **Layout** dropdown, select a layout for the report.
- 6. From the **Folder** dropdown, select a folder for the report.
- 7. From the **Group visibility** dropdown, select the group(s) that will be able to view the report.

- 8. From the **Widget spacing** dropdown, enter a value.
- 9. Select **Ok**.

# Results

The report has been created.

# Generate a report

You can generate both scheduled, or on-demand, reports, in multiple file formats.

### Procedure

1. In the top navigation bar, select  $\equiv$  icon > Reports.

Result: The Reports page opens.

- 2. Select Management.
- 3. In the section on the left, select the report that you want to generate.
- 4. In the top right, select **Generate Report**.

Result: A dialog shows.

5. In the **Report type** section, choose a format for the report:

Choose from:

- PDF
- CSV
- Excel

Generate Report	×
PDF CSV Excel	
On-demand Scheduled	
<ul> <li>Include only Alerts following Security Profile [Applies to Alert widgets only]</li> </ul>	
Save	

6. In the **Report execution** section, choose the type of execution:

#### Choose from:

- On-demand
- Scheduled

7. If you chose **On-demand**, select **Save**.

**Result:** The report starts to generate. When the generation is complete, the report will show in the Generated (on page 190) page.

- 8. If you chose **Scheduled**, do the steps below.
  - a. In the **Recurrence (server time)** section, enter the settings that you want.

Generate Report	×
PDF CSV Excel	
Report execution On-demand Scheduled	
Schedule report creation	
Daily     Weekly     Monthly	
Hours 0 0 Minutes 0 0 Schedule occurrences will be relative to server time (current server time: 13:40:14.751 [-2 hours])	
User defined name Email recipients (comma separated)	
Include only Alerts following Security Profile [Applies to Alert widgets only]	
Save	

- b. Optional: In the User defined name field, enter a name for the report.
- c. **Optional:** In the **Email recipients (comma separated)** field, enter the email addresses of the people that you would like to receive the reports.
- d. Optional: If necessary, select the Include only Alerts following Security Profile [Applies to widgets only] checkbox.

# Results

The report has been generated, or scheduled, as applicable.

# Download a report

The Generated page lets you download reports.

### Procedure

1. In the top navigation bar, select  $\equiv$  icon > Reports.

Result: The Reports page opens.

- 2. Select Generated.
- 3. To the left of the applicable report, select the download 🖄 icon. **Result:** The download starts.

#### Results

The report has been downloaded to your downloads folder.

# Delete a report

The **Generated** page lets you delete generated reports.

#### Procedure

1. In the top navigation bar, select  $\equiv$  icon > Reports.

Result: The Reports page opens.

- 2. Select Generated.
- 3. To the left of the applicable report, select the download  $\widehat{\amalg}$  icon.

#### Results

The report has been deleted.

# Add a folder

The Management page lets you add folders for you to organize your reports.

### Procedure

1. In the top navigation bar, select  $\equiv$  icon > Reports.

Result: The Reports page opens.

- 2. Select Management.
- 3. In the **Reports list** section on the left, select **Add folder**.

Result: A dialog shows.

4. In the **Name** field, enter a name for the folder.

New report folder	×
Name	
Group visibility	
Choose one or more groups -	
Ok Ca	ncel

- 5. From the **Group visibility** dropdown, select the group(s) that will be able to view the reports.
- 6. Select Ok.

### Results

The folder has been added.

# Edit a folder

The Management page lets you delete reports.

### Procedure

1. In the top navigation bar, select  $\equiv$  icon > Reports.

Result: The Reports page opens.

- 2. Select Management.
- 3. In the section on the left, to the right of the applicable folder's name, select the download 🗹 icon.

Result: A dialog shows.

4. Optional:

If necessary, in the **Name** filed, edit the name of the folder.

Edit report folder 'Miscellaneous'	×
Name	_
Miscellaneous	
Group visibility guests -	
Ok Cance	

- 5. Optional: If necessary, in the Group visibility filed, edit the visibility of the folder.
- 6. Select Ok.

### Results

The report has been edited.

# Delete a folder

The Management page lets you delete reports.

### Procedure

1. In the top navigation bar, select  $\equiv$  icon > Reports.

Result: The Reports page opens.

- 2. Select Management.
- 3. In the section on the left, to the right of the applicable folder's name, select the download 🗓 icon.

### Results

The report has been deleted.

# Import a schema

The **Management** page lets you import a schema that has previously been exported.

### Procedure

1. In the top navigation bar, select  $\equiv$  icon > Reports.

Result: The Reports page opens.

- 2. Select Management.
- 3. In the section on the left, select Import Schema.
- 4. Select the schema to import.

### Results

The schema has been imported.

# Export a schema

The **Management** page lets you export a schema.

### Procedure

1. In the top navigation bar, select  $\equiv$  icon > Reports.

Result: The Reports page opens.

- 2. Select Management.
- 3. In the top right, select **Export Schema**.

Result: A dialog shows.

4. In the **Export file name** field, enter a name for the schema.

Choose file name	×
Export file name	
reports_2023927	
	Export

5. Select Export.

#### Results

The schema has been exported in *JSON* format.

# Upload a custom logo

You can add a custom logo that will show in your reports.

### Procedure

1. In the top navigation bar, select  $\equiv$  icon > Reports.

Result: The Reports page opens.

2. Select Settings.

Result: The Settings (on page 192) page opens.

3. Choose a method to upload a custom logo:

#### Choose from:

- Drag your image file into the **Drop an image here or click to upload** field
- Click in the Drop an image here or click to upload field
- 4. If you chose the second method, select the correct file to upload.

	Report custom logo not yet uploaded.
	Drop an image here or click to upload
Supported formats	:: JPG, PNG and GIF. Logo ideal sizes: 360x90 or bigger. Logo ideal ratio: 4:1 or

# Note:

Logos should be 360x90 pixels or bigger, with an ideal aspect ratio of 4:1, or similar.

#### Note:

Supported formats are:

- graphics interchange format (GIF)
- joint photographic experts group (JPEG)
- portable network graphics (PNG)
- 5. Wait for the file to upload.
- 6. Select Save.

# Results

Your custom logo will now be added to your reports.

# **Configure SMTP settings**

If you want to send emails that contain scheduled reports, you need to configure the simple mail transfer protocol (SMTP) server settings.

#### Procedure

1. In the top navigation bar, select  $\equiv$  icon > Reports.

Result: The Reports page opens.

2. Select Settings.

Result: The Settings (on page 192) page opens.

3. In the SMTP Server section, set the toggle to ON.

SMTP Server
() An SMTP server is required to send scheduled reports by email at each recurrence (if the 'Email recipients' field is set)
ON OFF
To URI
HOST[:PORT][/ID]
Sender
STARTTLS
Authentication Mechanism: <ul> <li>PLAIN</li> <li>LOGIN</li> </ul>
Username
Password
Save

- 4. In the **To URI** field, enter the host URI information. For example, HOST[:PORT][/ ID]
- 5. In the **Sender** field, enter the sender identification information.

6. To use encryption, select the **STARTTLS** checkbox.

Note: If you do not select this option, reports will be sent without encryption.

7. To start the authentication process, choose an Authentication Mechanism:

Choose from:

- PLAIN
- LOGIN

Note: The default setting is **PLAIN**.

- 8. If you chose **LOGIN**, enter your credentials.
  - a. In the **Username** field, enter your username.
  - b. In the **Password** field, enter your password.
- 9. Select **Save**.

### Results

Emails for scheduled reports that have email recipients will now be sent at the next scheduled occurrence.

# Filter a report globally

You can filter a report globally, which is the default filter. This lets you use a specific category to apply filters to the entire report.

### Procedure

1. In the top navigation bar, select  $\equiv$  icon > Reports.

**Result:** The **Reports** page opens.

2. Select Management.

Result: The Management (on page 187) page opens.

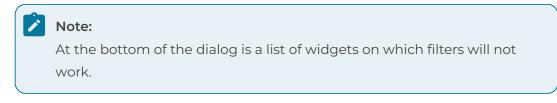
3. In the top section, select  $\mathbf{\nabla}$  Filters.

Result: A dialog shows.

4. Select the category on which to filter, then enter your filter query in the related field.

Filter on assets	
where device_id = yyy	
Filter on alerts	
where id = 1	
Filter on nodes	
where ip = 192.168.1.12	
Filter on node_cpes	
where node_id = 1.1.1.2	
Filter on links	
where protocol = smb	
Filter on node_cves	
where node_id = 192.168.1.12	
Filter on captured_urls	
where url = www.youtube.com	
Filter on captured_logs	
where id_src = 192.168.1.12	
(1) These filters will not work on the widgets: CISContro Vulnerability scoring overview, Evidences, Vendors, V	

5. Select **Ok**.



# Results

The filter(s) has (have) been applied to the report.

# Add a widget to a report

The Management page lets you add widgets to reports.

### Procedure

1. In the top navigation bar, select  $\equiv$  icon > Reports.

Result: The Reports page opens.

2. Select Management.

Result: The Management (on page 187) page opens.

3. In the **Reports list** section on the left, select the applicable report.

Result: The report opens.

4. On the right side of the report, choose the section that you want to add the widget to. Select **Add widget**.

Result: A dialog shows.

5. In the left pane, choose the type of widget that you want to add.

Add widget			×
General Table Count Graph Combination Query	>	Custom Image Custom text Widget separator	
		Ok Cance	21

6. From the list, select the widget that you want.

# Results

The widget has been added to the report.

# Filter a report with a widget

You can use widgets to filter a report.

### Procedure

1. In the top navigation bar, select  $\equiv$  icon > Reports.

Result: The Reports page opens.

2. Select Management.

Result: The Management (on page 187) page opens.

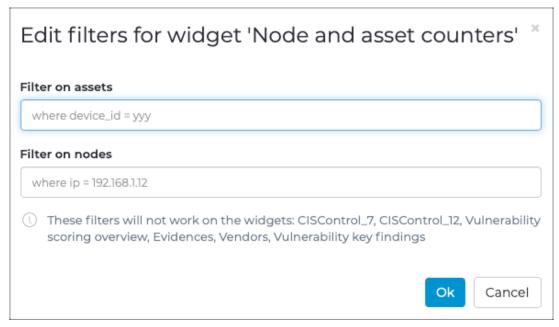
- In the Reports list section on the left, select the applicable report.
   Result: The report opens.
- 4. Find the widget that you would like to use and hover your mouse over it.

**Result:** At the top of the widget, more buttons show.

5. Select Edit filter.



6. Select the category on which to filter, then enter your filter query in the related field.



#### 7. Select Ok.

Ì	Note:
	At the bottom of the dialog is a list of widgets on which filters will not
	work.

#### Results

The filter(s) has (have) been applied to the report.

# **Chapter 11. Assertions**



#### The Assertions page shows all the assertions and lets you configure them.

A valid assertion is a normal query with a special command appended at the end. Assertions can be saved in a specific order and can be continuously executed in the system.

Queries are based on the *N2QL*, which you can use to ensure that certain conditions are met on the observed system. An assertion is typically either an empty value, or a specific value. When an unexpected value appears, or when the value is different than the expected, the system alerts the user.

ssertions					₽	Configure
Enter your que	ry					*
Live assertior	ns				New group Export	Import
Page of <b>0</b> , entries					@ 13 se	ected 🔻

#### Figure 62. Assertions page

#### Configure

This lets you configure the execution interval in seconds.

#### **History button**

This button shows a history of the previous queries that have been entered in the query field.

#### Query field

This field is where you enter your query.

#### **Debug button**

Because assertions with logical operators and brackets can quickly become complex, the debug icon decomposes the query, and executes each part to show intermediate results.

Assertions												E Configure	
ອ (links   when	e protocol =	= telnet   assert.	empty && link	s   where protocol	== iec104   assert_em	pty) && (nodes	where i	is_learned == false	assert_empty	)		*	
Result ((links   v	vhere prot	ocol == telnet	assert_em	pty && links   wl	here protocol == ie	c104   assert_	empty)	) && (nodes   wł	nere is_learne	d == false   as	ssert_empty	) (	
∰ Debug													
			Query			Re	Result		Query without assertion				
ks   where protocol	= telnet   asse	ert_empty				true		links   where protocol == telnet					
ks   where protocol	= iec104   asse	art_empty				false		links   where protocol == iec104					
nodes   where is_learned == false   assert_empty						false		nodes   where is_lea	irned == false				
Live asserti	ons						Curr	rent group: links +	New group E	dit group Delete	group Expor	t Import	
Page 1 of 1, 1 entr	ies										@ 12 sel	ected 🕶	
ACTIONS	NAME	FAILED SINC	# FAILURES	PACKET FILTER	CAN SEND ALERTS	IS SECURITY	CAN F	REQUEST TRACE	ALERT DELAY	ALERT RISK	CREATED A.		
		нари									H 4 + H		

#### Figure 63. Complex assertion being debugged

### New group

This lets you create a group to combine assertions to make viewing and management easier.

## Export

This lets you export assertion groups in *JSON* format.

### Import

This lets you import assertion groups in JSON format.

## Assertion operators

#### Table 2. Assertion operators

Operator	Description
assert_all <field> <op> <value></value></op></field>	The assertion is satisfied when each element in the query result set matches the given condition.
assert_any <field> <op> <value></value></op></field>	The assertion is satisfied when at least one element in the query result set matches the given condition.
assert_empty	The assertion is satisfied when the query returns an empty result set.
assert_not_empty	The assertion is satisfied when the query returns a non-empty result set.

### Save an assertion

You can save assertions to have them continuously executed in the system.

#### Procedure

1. In the top navigation bar, select  $\equiv$  icon > Assertions.

**Result:** The **Assertions** page opens.

- 2. In the query field, enter a query.
- 3. Select Enter.
- 4. To save the assertion, select **Save**.

Result: A dialog shows.

5. In the Name field, enter a name for the query.

Save assertion	×
Name	
Description	
	h
Note	
Group	have a race of
Choose a group	New group
O Is security ?	
Is operational ?	
Assertion Check Interval	
10	
Can send alerts	
Choose the asserted table's specific fields to include in the Descriptio	'n
Choose fields to include •	
Query	
links   where protocol == telnet   assert_empty	
Sav	Cancel

6. In the **Description** field, enter a description.

- 7. To assign the assertion to a group, in the **Group** field, select one of the following
  - a. From the dropdown menu, select an existing group.
  - b. Select Save.
  - c. To create a new group, select **New group**. **Result:** A dialog shows.
  - d. In the **Group name** field, enter a group name for the assertion.
  - e. Select **Save**.
- 8. Choose from one of these options:

#### Choose from:

- Is security ?
- Is operational ?
- 9. In the **Assertion Check Interval** field, choose the interval in seconds at which the assertion will be rechecked.



You can select an interval between 10 seconds and 1 day.

- 10. **Optional:** If you want the assertion to trigger an alert, select the **Can send alerts** checkbox.
- From the Choose the asserted table's specific fields to include in the Description dropdown, select the fields to include in the assertion description.
- 12. In the **Query** field, enter the assertion query.
- 13. Select Save.

**Result:** The saved assertion will be listed at the bottom of the page with a green or red color to indicate the result.

### **Edit an assertion**

This lets you edit the details for an existing assertion.

#### Procedure

1. In the top navigation bar, select  $\equiv$  icon > Assertions.

Result: The Assertions page opens.

- 2. In the query field, enter a query.
- 3. To execute the query, elect **Enter**.

#### Note:

You can use the logical operators && (and) and || (or) to combine multiple assertions. Round brackets () change the logical grouping as in a mathematical expression.

4. Optional: To the right of the query field, select the debug  $\bigstar$  icon.

#### Note:

Because assertions with logical operators and brackets can quickly become complex, the debug icon decomposes the query, and executes each part to show intermediate results.

Assertions											-	E Configure
ງ (links   wher	e protocol =	= telnet   assert_	empty && link	s   where protocol	== iec104   assert_em	pty) && (nodes	where i	s_learned == false	e   assert_empty	/)		÷
Result ((links   v	vhere prot	ocol == telnet	assert_em	pty && links   wł	nere protocol == ie	c104   assert_	empty)	&& (nodes   w	here is_learne	ed == false   as	sert_empty)	)
íř Debug												
			Query			Re	sult		Query	without assertio	n	
ks   where protocol =	= telnet   asse	rt_empty				true		links   where protocol == telnet				
ks   where protocol :	== iec104   asse	ert_empty				false		links   where protocol == iec104				
des   where is_learn	ed == false   as	sert_empty				false		nodes   where is_le	arned == false			
Live asserti	ons						Curr	ent group: links <del>-</del>	New group E	dit group Delete	group Expor	t Import
Page 1 of 1, 1 entr	ies										@ 12 sel	ected 🕶
ACTIONS	NAME	FAILED SINC	# FAILURES	PACKET FILTER	CAN SEND ALERTS	IS SECURITY	CAN R	REQUEST TRACE	ALERT DELAY	ALERT RISK	CREATED A.	
		H 4 + H									нари	

#### Result: The debug section shows.

### **Configure an assertion**

This lets you configure the execution interval of the assertions, in seconds.

#### Procedure

1. In the top navigation bar, select  $\equiv$  icon > Assertions.

**Result:** The **Assertions** page opens.

2. In the top right, select **Configure**.

**Result:** A dialog opens.

3. In the **Execution interval (seconds)** field, enter an interval.

Configure assertions	×
Execution interval (seconds)	
10	
Change the execution interval of the assertions	
	Save Cancel

4. Select Save.

### Configure an assertion on links

This lets you configure the scope of the assertion for the related links.

#### Procedure

1. In the top navigation bar, select  $\equiv$  icon > Network.

Result: The Network page opens.

- Select Links.
   Result: The Links page opens.
- 3. To the left of the applicable link, select the configure = icon. **Result:** A dialog opens.
- 4. Optional:

Select Is persistent.

Configure <b>192.168.68.52-255.255.255.255/other</b> *
☐ <b>Is persistent</b> Raise an alert when a new TCP handshake is detected on this link
□ Alert on SYN Raise an alert when a TCP SYN packet is detected on this link
Track availability (seconds)
Notify the link events when the link communication is interrupted or resumed
Last activity check (seconds)
Raise an alert when the link become inactive for more than the specified amount of seconds
Save Cancel

#### Note:

When selected, this check raises a new alert whenever a <u>TCP</u> handshake is successfully completed on the link.

#### 5. Optional: Select Alert on SYN.

#### Note:

When selected, this check raises a new alert whenever a client sends a TCP SYN on the link.

6. Optional: Select Track availability (seconds).

#### Note:

When selected, a link is considered non-functioning if it is unresponsive for the specified time.

7. Optional: Select Last activity check (seconds).

#### Note:

When selected, this check raises an alert when the link is not receiving data for more than the specified time.

8. Select Save.

#### Results

The assertion has been configured.

### Configure an assertion on variables

This lets you configure the scope of the assertion for the related variables.

#### Procedure

1. In the top navigation bar, select  $\equiv$  icon > Process.

Result: The Process page opens.

- Select List.
   Result: The List page opens.
- 3. To the left of the applicable link, select the configure = icon. **Result:** A dialog opens.

#### 4. Optional:

In the Label field, enter a label for the assertion.

Configure <b>10.168.1.54/1/ir9</b>	×
Label	
ir9 at RTU 1	
History size	
0	
Set the variable history size. When size is 0, history is disabled. When is higher than 0 t is enabled and the size value suggests the system how many values should be kept, according to resources availability.	,
Last activity check	
Raise an alert when the variable is not updated for more than the specified amount of seconds	
Raise an alert when the variable keeps the invalid quality for more than the specified amount of seconds	
Disallowed qualities check	
Raise an alert when the variable has one of the specified qualities. Possible values are: invalid, not topical, blocked, substituted, overflow, reserved, questionable, out of range, bad reference, oscillatory, failure, inconsistent, inaccurate, test. Multiple values can be separated by comma.	

5. Optional: In the History size field, enter a value.

#### Note:

This sets the *Variable* history size. When the size is 0, history is disabled. When it is higher than 0, it is enabled, and the size value suggests how many values that the system should keep, depending on the available resources. 6. Optional: In the Last activity check field, enter a value.

#### Note:

When selected, this check raises an alert when the *Variable* is either not measured or is changed for more than the specified number of seconds.

7. Optional: In the Invalid quality check field, enter a value.

#### Note:

When selected, this check raises an alert when the *Variable* maintains an invalid quality for more than the specified amount of seconds.

8. Optional: In the Disallowed quality check field, enter a value.

#### Note:

When selected, this check raises an alert when the *Variable* gains one of the specified qualities.

9. Select Save.

#### Results

The assertion has been configured.



# Chapter 12. Time machine



Time machine lets you load a snapshot, which is a previously saved state, and go back in time, to analyze the data from a past situation. You can load a single snapshot and use the platform as usual or load two snapshots and compare the user interface to highlight changes.

P NETV	ZOMI =	1001 Sensors 🚺 Alerts 🖵	Assets 🔚 Queries	rr Smart Polling 🔆 Arc		හි (ම
	2, 50 entries			Reload Exclude frequent	ly changing fields 🛑	Diff -→- LIVE × M Live ●
CTIONS	1	D TIME	NODES COUNT	LINKS COUNT	VARIABLES	COUNT ALERTS COUNT
		H 4 F H				
. 0	1695389576	2023-09-22 15:32:56.000	451	405	0	3
. 0	1695385975	2023-09-22 14:32:55.000	455	406	0	3
. 0	1695381654	2023-09-22 13:20:54.000	407	351	0	3
. 0	1695373551	2023-09-22 11:05:51.000	408	351	0	3
. 0	1695369950	2023-09-22 10:05:50.000	408	351	0	3
. 0	1695366350	2023-09-22 09:05:50.000	408	351	0	3
. 0	1695361990	2023-09-22 07:53:10.000	414	353	0	3
. 0	1695307422	2023-09-2116:43:42.000	414	361	0	3
. 0	1695303821	2023-09-21 15:43:41.000	414	361	0	3
. 0	1695300221	2023-09-2114:43:41.000	413	361	0	3
. 0	1695296620	2023-09-2113:43:40.000	413	361	0	3
. 0	1695293019	2023-09-2112:43:39.000	413	361	0	3
. 0	1695289418	2023-09-21 11:43:38.000	413	361	0	3
. 0	1695285817	2023-09-2110:43:37.000	413	361	0	3
. 0	1695282216	2023-09-21 09:43:36.000	413	361	0	3
. 0	1695278616	2023-09-21 08:43:36.000	420	362	0	3
± 0	1695275015	2023-09-21 07:43:35.000	430	382	0	3

#### Figure 64. Time machine page

#### Reload

If you initiate a diff and then navigate to another area of the software, when you return to this page you might not see the progress of the diff. The **Reload** button lets you either:

- Reload the progress bar (if the diff is still in progress)
- View the results (if the process has finished)

#### Exclude frequently changing fields

You can select the **Exclude frequently changing fields** toggle to on to exclude the fields that change frequently. This excludes the diff all fields that are affected from normal traffic handling. Examples of frequently changing fields are the number of bytes received / sent, and the last activity time.

#### Diff

The **Diff** button starts the diff process. The system evaluates the diff baseline - target files and estimates how *CPU* / memory intensive the diff operation is going to be. If there is not enough free memory at the moment, the diff will be aborted with the appropriate message. If the diff is estimated to take more than a few minutes, a warning will show and a confirmation dialog will show.

#### Live

The LIVE button lets you choose the current view as part of the diff.

#### Step forward

The step forward  $\blacksquare$  icon lets you go back to the present time view after you have viewed a snapshot.

#### Live / refresh

The Live  $\bigcirc \bigcirc \bigcirc \bigcirc \bigcirc$  icon lets you change live view on, or off. When live mode is on, the page will refresh approximately every five seconds.

#### Load snapshot

The load snapshot 🗘 icon lets you select a historical snapshot.

#### Select for diff

The select for diff 🛨 icon to choose the related snapshot as part of the diff.

### **Time machine diffs**

You can use time machine to view diffs between historical snapshots, or an historical snapshot and the current live view.

#### Snapshots

When you view a snapshot, the graphical user interface (GUI) will change to gray.

NOZOMI 🗮 🔿 Alerts 🖵 Assets 🖓 Queries 🗞 Smart Polling

The graph view and the use of color let you quickly see the nodes, or links, that have been added, removed, or changed:

- Added items are green
- Removed items are red
- Changed items are blue

#### Diff views

Changes for <b>172.20.10.2</b>							
Field	Before	After					
created_at	2023-07-25 12:32:20.138	12:07:05.787	+5441685649				
device_id	f2:c9:98:64:c3:5	3c:e9:f7:5e:31:f	f23c:e9e9:98f7:645e:e331:5bfc				
label	iPhone- 106.local	PTNB08.local	i <del>Phone 106</del> PTNB08.local				
mac_address	f2:c9:98:64:c3:5	3c:e9:f7:5e:31:f	f23c:e9e9:98f7:645e:e331:5bfc				
mac_vendor	Private Address	Intel Corporate	PrivateIntel AddressCorporate				
product_nam	iPhone		iPhone				
type	mobile_phone	-	mobile_phone-				
vendor	Apple	Intel Corporate	AppleIntel Corporate				

#### Figure 65. Table view

In the graph view, you can select a link or node to see more information in the pane on the right side.

NOZOMI = 🕅 Sensors 🔿 Alerts 🖵 Assets 🔁 Queries 🗞 Smart Polling 🔅 Arc	© نې
← Diff 1695720754 (11:32:34.000) → 1695733587 (15:06:27.000)	Nodes Links Variables Graph
nor man nor	Node has been added

Figure 66. Graph view

### Load a snapshot

To create a diff, you must first load a snapshot.

#### Procedure

1. In the top navigation bar, select  $\equiv$  icon > Time machine.

Result: The Time machine page opens.

To the left of the applicable snapshot, select the load snapshot icon.
 Result: The user interface turns gray to highlight that you are viewing a static snapshot.



3. To return to the present time view, select the 🕨 icon.

### **Request a diff**

The time machine lets you create a diff between to historical snapshots, or a snapshot and the current view.

#### Procedure

1. In the top navigation bar, select  $\equiv$  icon > Time machine.

Result: The Time machine page opens.

2. To select the baseline of the diff, to the left of the applicable snapshot, select the

select for diff + icon.

**Result:** At the top of the table, the details of the snapshot are loaded next to the **Diff** icon.

3. Choose a target for the diff:

#### Choose from:

- $\circ$  To select another snapshot from the past, to the left of the applicable snapshot, select the load snapshot  $\pounds$  icon
- $^\circ\,$  To select the current, live environment, at the top of the table, select the  ${\rm LIVE}$  icon
- 4. Optional: Select the Exclude frequently changing fields toggle to on.
- 5. Now that the baseline and the target have been set, select the **Diff** icon.

**Result:** The system evaluates the diff baseline / target files and estimates how *CPU* / memory intensive the diff operation is going to be. If there is not enough free memory at the moment, the diff will be aborted with the appropriate message. If the diff is estimated to take more than a few minutes, a warning will show and a confirmation dialog will show.

6. As soon as the diff operation starts, a dialog shows the progress. To stop the diff operation, select **Abort**.

#### Results

After the diff has been computed, the diff results show.

### Reload the diff operation progress

Diff operations can take a long time to conclude. While an operation is in progress, you can continue to use the software as normal.

#### Procedure

1. In the top navigation bar, select  $\equiv$  icon > Time machine.

Result: The Time machine page opens.

2. At the top of the table, select **Reload**.

**Result:** If the diff operation is still in progress, the progress dialog shows. If the operation has finished, the diff results show.

### View a diff from an alert

This automatic feature will use the previous and subsequent snapshots according to the time of the alert.

#### Procedure

1. In the top navigation bar, select Alerts.

Result: The Alerts page opens.

2. Choose a method to open the actions menu.

#### Choose from:

- $^\circ\,$  In the table, select the hyperlink to open the details page. Select  ${\rm Actions}\,$
- $^{\circ}$  In the table, select the  $^{ullet ullet}$  icon
- 3. Select Time machine diff.

**Result:** The time diff shows.

4. To see more details on the right side of the graph, select the applicable node or link.

## **Chapter 13. Vulnerabilities**



The Nozomi Networks software continuously discovers vulnerabilities in monitored assets.

The Nozomi Networks software continuously discover vulnerabilities. To do this, it matches the *Common Platform Enumeration (CPE)* of a device with the National Vulnerability Database, and other data sources.

The Vulnerabilities page has these tabs:

- Assets (on page 242)
- List (on page 243)
- Stats (on page 244)

### Assets

The **Assets** page shows a list of assets with known vulnerabilities, along with a summary of the severity of the vulnerability.

/ulnerabilities				Assets	List Stats
age 1 of 1, 10 entries				Only most likel	y 🗨 🛱 Live 💽 🕥
ASSET	TYPE	OS/FIRMWARE	COUNT	SCORE DISTRIBUTION	SCORE GROUPS
172.18.252.169	computer	Windows 10	1263	1	1099 15
<b>§</b> 172.16.44.144	computer	灯 Windows 7	1089	•	389 698
<b>\$</b> 172.16.44.150	computer	灯 Windows 7	1089	•	389 698
<b>S</b> 172.16.44.186	computer	灯 Windows 7	1089	•	389 698
<b>\$</b> 172.16.44.216	computer	灯 Windows 7	1089	•	389 698
<b>§</b> 172.16.44.85	computer	灯 Windows 7	1089	•	389 698
<b>§</b> 172.16.45.62	computer	灯 Windows 7	1089	•	389 698
<b>§</b> 172.16.46.16	computer	灯 Windows 7	1089	•	389 698
§ 172.17.50.95	computer	🌉 Windows 10	1484	•	1262 21

#### Figure 67. Assets page

#### Only most likely

This toggle lets you filter the view to show only the assets the match the criteria that you have set for likelihood threshold.

#### Likelihood threshold settings

**Likelihood threshold** is a value between 0.1 and 1.0 where 1.0 represents the maximum likelihood of the *Common Vulnerabilities and Exposures (CVE)* to be present. Likelihood is the confidence of the software's correct assignment of a *CPE* to the hardware of the monitored asset. The higher the likelihood, the higher the software's confidence that the vulnerabilities assigned to an asset are in fact are relevant to that asset. **Likelihood threshold** is the minimum likelihood a vulnerability needs in order for it to be shown in this page when the **Only most likely** toggle is set to on. As a guideline, we suggest that you use:

- 0.8 for a high level of confidence
- 0.5 for a medium level of confidence
- 0.3 for a low level of confidence

#### Live / refresh

The Live icon lets you change live view on, or off. When live mode is on, the page will refresh approximately every five seconds.

### List

The **List** page shows a comprehensive list of vulnerabilities in the environment. This lets you perform global, in-depth analysis.

/ulnera	orks —	100 Sensors	() Alerts Q	Assets 🛛 Queries 🔅 Smart Polling 🔆 Arc	Assets	ැටි List Sta	(2) ats
age <b>1</b> of <b>10</b> :	26, 25646 entries /	filtered by <b>resolve</b>	d: false 🗙	Export [ <sup>↑</sup> ] Only		• ( ) • 12 selec	
ACTIONS	CVE	NODE	SCORE CWE	CWE NAME	CVE CREATION DATE	DISCOVERY DATE	
					КАРИ	н и н	
Ê	CVE-2003-0904	172.16.37.24	6 200	Exposure of Sensitive Information to an Unauthorized Actor	2004-01-20 06:00:00.000	2023-09-11 12:20:20.513	cpe:/c
B	CVE-2004-0119	172.16.37.24	7.5 476	NULL Pointer Dereference	2004-06-01 06:00:00.000	2023-09-11 12:20:20:799	cpe:/c
- B	CVE-2004-0840	172.16.37.24	10 20	Improper Input Validation	2004-11-03 06:00:00.000	2023-09-11 12:20:20.805	cpe;/c
ŝ	CVE-2005-1987	172.16.37.24	7.5 120	Buffer Copy without Checking Size of Input ('Classic Buffer Overflow')	2005-10-13 12:02:00.000	2023-09-11 12:20:20.802	cpe:/
B	CVE-2005-3921	6c:41:6a:60:99:23	2.6 79	Improper Neutralization of Input During Web Page Generation ('Cross-site Scripting	) 2005-11-30 12:03:00.000	2023-09-11 12:17:58.491	cpe:/
Ê	CVE-2006-4950	6c:41:6a:60:99:23	10 20	Improper Input Validation	2006-09-23 12:07:00.000	2023-09-11 12:17:58.491	cpe:/
Ē	CVE-2007-0066	172.16.37.24	7,1 20	Improper Input Validation	2008-01-08 21:46:00.000	2023-09-11 12:20:20.510	cpe:/
- B	CVE-2007-0199	6c:41:6a:60:99:23	5 20	Improper Input Validation	2007-01-11 12:28:00.000	2023-09-11 12:17:58.496	cpe:/
- E	CVE-2007-2587	6c:41:6a:60:99:23	6.3 20	Improper Input Validation	2007-05-10 02:19:00.000	2023-09-11 12:17:58.497	cpe:/
÷	CVE-2007-3034	172.16.37.24	9.3 189	Numeric Errors	2007-08-14 23:17:00.000	2023-09-11 12:20:20.512	cpe:/
8	CVE-2007-3898	172.16.37.24	6,4 16	Configuration	2007-11-14 02:46:00.000	2023-09-11 12:20:20.796	cpe:/
B	CVE-2007-5133	172.16.37.24	7.1 189	Numeric Errors	2007-09-27 21:17:00.000	2023-09-11 12:20:20.511	cpe:/
÷	CVE-2008-1436	172.16.37.24	9 264	Permissions, Privileges, and Access Controls	2008-04-21 19:05:00.000	2023-09-11 12:20:20.486	cpe:/
B	CVE-2008-1441	172.16.37.24	5,4 20	Improper Input Validation	2008-06-12 04:32:00.000	2023-09-11 12:20:20.803	cpe:/
₿	CVE-2008-1454	172.16.37.24	9.4 20	Improper Input Validation	2008-07-09 01:41:00.000	2023-09-11 12:20:20.551	cpe:/
B	CVE-2008-2249	172.16.37.24	9.3 189	Numeric Errors	2008-12-10 15:00:00.000	2023-09-11 12:20:20.552	cpe;/
÷	CVE-2008-2250	172.16.37.24	7.2 264	Permissions, Privileges, and Access Controls	2008-10-15 02:12:00.000	2023-09-11 12:20:20.552	cpe:/
- B	CVE-2008-2251	172.16.37.24	7.2 399	Resource Management Errors	2008-10-15 02:12:00.000	2023-09-11 12:20:20.553	cpe:/

#### Figure 68. List page

#### Export

The **Export** (1) icon lets you export the current list in either CSV or Microsoft Excel format.

#### Only resolved

This lets you show only Unresolved vulnerabilities. Vulnerability status options are:

- Unresolved
- Mitigated
- Accepted

Mitigated and Accepted lead to a resolution status that equals true.

#### Live / refresh

The **Live** icon lets you change live view on, or off. When live mode is on, the page will refresh approximately every five seconds.

#### **Column selection**

The columns selection  $^{igodoldsymbol{\Theta}}$  icon lets you choose which columns to show or hide.

### Stats

The **Stats** page shows high level information in a graphical format that shows the top common platform enumerations (CPEs), common vulnerabilities and exposures (CVEs), and common weakness enumerations (CWEs).

NOZOMI E IN Sensors 🔿 Alerts 🖵 Assets 🖉 Queries 🔅	Smart Polling	\$ \$
Vulnerabilities		Assets List Stats
Top CPEs	Top CWEs	
cpe//omicrosoftwindo: 1.6 % Gpe:/amozilia.firefoxe56: 2.1 % cpe//amozilia.firefoxe50: 4.8 % cpe//amozilia.firefoxe50: 4.8 % cpe//omicrosoftwindo: 9.8 %	Improper Restriction of: 1.1.8 Concurrent Execution us 1.2.8 Drojim Validation Error. 1.2.8 Incorrect Authorization: 1.3.8 Incorrect Default Permis: 1.3.5 Duro-beaunds Reat 2.5.3.7 Access of Resource Usim: 4.1.% Exposure of Sensitive In: 5.3.8 Improper Input Validati: 18.3.8	Use After Free: 26.5 % Out-of-bounds Write: 22.0 %
Top CVEs CVE-2020-6455: 10 % CVE-2020-6533: 10 % CVE-2020-6604: 10 % CVE-2020-3422: 10 % CVE-2020-4425: 10 % CVE-2020-4425: 10 %		

#### Figure 69. Stats page

#### **Top CPEs**

This section shows the:

- Title of vulnerability
- Percentage of the total vulnerabilities
- Actual count of that vulnerability

#### **Top CWEs**

This section shows the:

- Title of vulnerability
- Percentage of the total vulnerabilities
- Actual count of that vulnerability

#### **Top CVEs**

This section shows the:

- Title of vulnerability
- Date of vulnerability type
- Percentage of the total vulnerabilities
- Actual count of that vulnerability

### Details page

The details page shows you all the details for the related vulnerability.

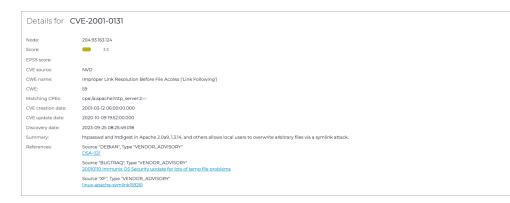


Figure 70. Details page



# **Chapter 14. Administration**



## Administration page

The administration page lets a user with administrator privileges configure settings and do other tasks.

For more details, see the Guardian - Administrator Guide.



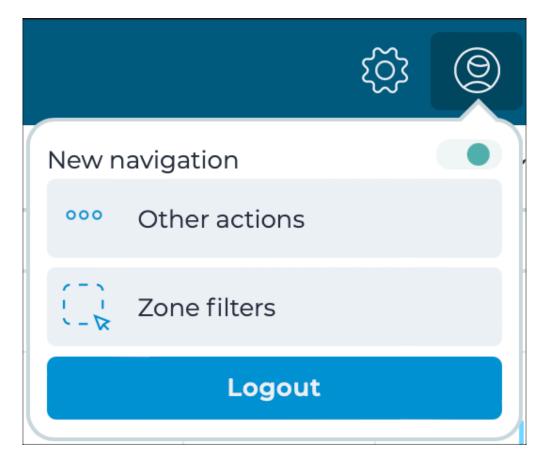
## **Chapter 15. Personal settings**



The personal settings page lets you do actions that are specific to your profile.

### General

You can select the O icon to access the personal settings menu.



#### Figure 71. Personal settings menu

The personal settings page has these two sections:

- Other actions (on page 254)
- Zone filters (on page 265)

### Logout

A button in the personal settings menu lets you log out of the software.

# Other actions

The **Other actions** page provides access to essential user settings, including options to clear personal settings, manage trace requests, and customize the UI theme with Auto, Light, or Dark modes.

Other actions
& Change password Change the currently logged user's password
& Edit OpenAPI keys Change the currently logged user's OpenAPI keys
Clear personal settings Clear all the personal settings stored in the browser local storage
Continuous trace Request a trace that has only the disk size constraint
Request custom trace Request a trace specifying a custom packet filter
Show requested traces Show the trace requests executed by the current user
Appearance
Auto . Light C Dark

### Figure 72. Other actions page

The other actions page lets you access these options:

- Change your password (on page 255)
- Edit an OpenAPI key (on page 256)
- Clear your personal settings (on page 259)
- Request a continuous trace (on page 260)
- Request a custom trace (on page 261)
- Show requested traces (on page 263)

The **Appearance** section lets you customize the visual appearance of the *UI*. You can choose one of these themes:

- Auto: Automatically adjusts the theme based on system settings
- Light: Uses a bright interface for better visibility in well-lit environments
- Dark: Uses a dark interface for reduced eye strain in low-light environments

# Change your password

The profile settings menu lets you change your password.

# Procedure

1. In the top navigation bar, select  $\textcircled{ extsf{0}}$ 

**Result:** A menu shows.

- 2. Select Other actions.
- 3. Select Change password.

Result: A dialog shows.

4. In the **Password** field, enter a new password.

Update password to guarantee your security please change your password.		
Password		
Password must be minimum of 1 Password confirmation	2 characters and must contain at least 1 digit, 1 lowercase char, 1 uppercase char	
Update and proceed	Dismiss	

- 5. In the **Password confirmation** field, enter the password again.
- 6. Select Update and proceed.

## Results

Your password has been changed.

# Edit an OpenAPI key

The profile settings menu lets you edit your OpenAPI keys.

## Procedure

1. In the top navigation bar, select  $\textcircled{ extsf{0}}$ 

**Result:** A menu shows.

- 2. Select Other actions.
- 3. Select Edit OpenAPI keys.

Result: A dialog shows.

4. Edit the OpenAPI keys as necessary.

Edit O	penAPI	keys				×
Page <b>1</b>	of <b>1</b> , <b>0</b> entries	5			O Live	+ Generate
ACTIONS	NAME		ALLOWED IPS	LAST SIGN IN IP	LAST SIGN IN TIME	REVOKE TIME
						Close

5. Select Close.

# Results

Your OpenAPI keys have been edited.

# Generate an OpenAPI key

The profile settings menu lets you generate an OpenAPI key.

## Procedure

1. In the top navigation bar, select igodot

**Result:** A menu shows.

- 2. Select Other actions.
- 3. Select Edit OpenAPI keys.

Result: A dialog shows.

4. In the top right, select + Generate.

Edit O	penAPI	keys				×
Page <b>1</b>	of <b>1</b> , <b>0</b> entries				O Live	+ Generate
ACTIONS	NAME		ALLOWED IPS	LAST SIGN IN IP	LAST SIGN IN TIME	REVOKE TIME
						Close

Result: A dialog shows.

5. In the **Description** field, enter a description for the OpenAPI key.

Generate OpenAPI key	×
OpenAPI key for web user admin	
Description	
Allowed IPs	
<ol> <li>Examples of IP ranges for allowed IPs: 1.2.3.4/24 or 1.2.3.4/24,2.3.4.5/16.</li> <li>If no IP range is defined all IPs are allowed.</li> </ol>	
Generate	

6. In the Allowed IPs field, enter the details of the allowed IP addresses.

7. Select Generate.

# Results

Your OpenAPI key has been generated.

# Clear your personal settings

The profile settings menu lets you clear your personal settings that are stored in the local browser local.

## Procedure

1. In the top navigation bar, select O

**Result:** A menu shows.

- 2. Select Other actions.
- 3. Select Clear personal settings.

Result: A dialog shows.

4. Select OK.

Г

Are you sure?		
	Cancel	ОК

## Results

Your personal settings have been cleared from the local browser.

# Request a continuous trace

The profile settings menu lets you request a trace that has only the disk size constraint.

# About this task

The maximum count of packets, and the run time, constrain regular traces. For example, being constrained to capture at most 1000 packets in no more than one minute. A continuous trace does not have such limits. It collects packets without constraints, as long as the disk has free space to store the captured traffic. The packets are then saved as individual files that are 100 *MB* in size.

# Procedure

1. In the top navigation bar, select 🗵

Result: A menu shows.

- 2. Select Other actions.
- 3. Select Continuous trace.

Result: A dialog shows.

4. In the **Packet filter** field, enter a *BPF* filter.

Continuous trace				x
Request new cor	ntinuous t	race		
Packet filter				BPF syntax help BPF examples 🔻
► Start				
Requested trace	S			
Page 1 of 1, 0 entries				O Live • 75
TIME	ID	USER	PACKET FILTER	IN PROGRESS
				Cancel

5. Select Start.

### Results

The trace has been requested.

# Request a custom trace

The profile settings menu lets you request a trace specifying a custom packet filter.

## Procedure

1. In the top navigation bar, select  $\textcircled{ extsf{9}}$ 

**Result:** A menu shows.

- 2. Select Other actions.
- 3. Select Request custom trace.

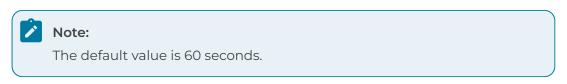
Result: A dialog shows.

4. To set the maximum packet size, in the **Trace max size (packets)** field, enter a value.

2
BPF syntax help BPF examples
Send trace request Cancel

The default size is 5000 packets.

5. To set the maximum duration of the trace, in the **Trace max duration (seconds)** field, enter a value.



6. 🖊 Note:

The **Packet filter** field is automatically populated with a *BPF* that captures the packets to/from the selected node, but you can customize this.

If necessary, customize this field.

<b>Note:</b> You can select <b>BPF syntax help</b> to show more information on <i>BPF</i> syntax.
<b>Note:</b> You can select <b>BPF examples</b> to see some examples.

7. Select Send trace request.

# Results

The trace has been requested.

# Show requested traces

The profile settings menu lets you show all the traces that you have requested.

# Procedure

- 1. In the top navigation bar, select (9) **Result:** A menu shows.
- 2. Select Other actions.
- 3. Select Show requested traces.

# Results

All your requested traces show.

# Download a requested trace

Once you have requested a trace, and it is ready, you can download it.

## Procedure

1. In the top navigation bar, select O

**Result:** A menu shows.

- 2. Select Other actions.
- 3. Select Show requested traces.

**Result:** All your requested traces show.

4. For the applicable trace, select **Download trace**.

Reque	sted traces		ж
TIME	ID	USER	PACKET FILTER
10:59:40.013	Download trace bb7e1fee	admin	not ip

# Results

The trace has been downloaded.

# **Zone filters**

The personal settings menu lets you filter zones.

Search for zone			
Only the zones listed here will	be visible (BETA)		
All None			
Broadcast	Layer2	Link-local	
Loopback	Multicast		
Internet	Undefined	TEstingtesting	
Test Zone 1	kmkHz-test-guardian	testing scope	

Figure 73. Zone filters page



# Glossary



#### Amazon Machine Image

An AMI is a type of virtual appliance that is used to create a virtual machine for the Amazon Elastic Compute Cloud (EC2), and is the basic unit of deployment for services that use EC2 for delivery.

#### Amazon Web Services

AWS is a subsidiary of the Amazon company that provides on-demand cloud computing platforms governments, businesses, and individuals on a pay-asyou-go basis.

#### Application Programming Interface

An API is a software interface that lets two or more computer programs communicate with each other.

#### Assertion Consumer Service

An ACS is a version of the SAML standard that is used to exchange authentication and authorization identities between security domains.

#### Asset Intelligence™

Asset Intelligence is a continuously expanding database of modeling asset behavior used by N2OS to enrich asset information, and improve overall visibility, asset management, and security, independent of monitored network data.

#### **Berkeley Packet Filter**

The BPF is a technology that is used in some computer operating systems for programs that need to analyze network traffic. A BPF provides a raw interface to data link layers, permitting raw link-layer packets to be sent and received.

#### Central Management Console

The Central Management Console (CMC) is a Nozomi Networks product that has been designed to support complex deployments that cannot be addressed with a single sensor. A central design principle behind the CMC is the unified experience, that lets you access information in a similar way as on the sensor.

#### **Central Processing Unit**

The main, or central, processor that executes instructions in a computer program.

#### **Certificate Authority**

A certificate, or certification authority (CA) is an organization that stores, signs, and issues digital certificates. In cryptography, a digital certificate certifies the ownership of a public key by the named subject of the certificate.

#### Classless Inter-Domain Routing

CIDR is a method for IP routing and for allocating IP addresses.

#### Command-line interface

A command-line processor uses a command-line interface (CLI) as text input commands. It lets you invoke executables and provide information for the actions that you want them to do. It also lets you set parameters for the environment.

#### Comma-separated Value

A CSV file is a text file that uses a comma to separate values.

#### Common Event Format

CEF is a text-based log file format that is used for event logging and information sharing between different security devices and software applications.

#### Common Platform Enumeration

CPE is a structured naming scheme for information technology (IT) systems, software, and packages. CPE is based on the generic syntax for Uniform Resource Identifiers (URI) and includes a formal name format, a method for checking names against a system, and a description format for binding text and tests to a name.

#### Common Vulnerabilities and Exposures

CVEs give a reference method information-security vulnerabilities and exposures that are known to the public. The United States' National Cybersecurity FFRDC maintains the system.

#### Common Weakness Enumeration

CWE is a category system for software and hardware weaknesses and vulnerabilities. It is a community project with the aim to understand flaws in software and hardware and create automated tools that can be used to identify, fix, and prevent those flaws.

#### **Configuration file**

A CFG file is a configuration, or config, file. They are files that are used to configure the parameters and initial settings for a computer program.

#### Domain Name Server

The DNS is a distributed naming system for computers, services, and other resources on the Internet, or other types of Internet Protocol (IP) networks.

#### ESXi

VMware ESXi (formerly ESX) is an enterprise-class, type-1 hypervisor developed by VMware for deploying and serving virtual computers. As a type-1 hypervisor, ESXi is not a software application that is installed on an operating system (OS). Instead, it includes and integrates vital OS components, such as a kernel.

#### Extensible Markup Language

XML is a markup language and file format for the storage and transmission of data. It defines a set of rules for encoding documents in a format that is both humanreadable and machinereadable.

#### Federal Information Processing Standards

FIPS are publicly announced standards developed by the National Institute of Standards and Technology for use in computer systems by non-military American government agencies and government contractors.

#### File Allocation Table

FAT is a file system architecture used in computers for managing disk space. It maintains a table to track the allocation of files on a disk, supporting efficient data storage, access, and management

#### File Transfer Protocol

FTP is a standard communication protocol that is used for the transfer of computer files from a server to a client on a computer network. FTP is built on a client–server model architecture that uses separate control and data connections between the client and the server.

# Fully qualified domain name

An FQDN is a complete and specific domain name that specifies the exact location in the hierarchy of the Domain Name System (DNS). It includes all higher-level domains, typically consisting of a host name and domain name, and ends in a top-level domain.

#### **Gigabit per second**

Gigabit per second (Gb/s) is a unit of data transfer rate equal to: 1,000 Megabits per second.

#### Gigabyte

The gigabyte is a multiple of the unit byte for digital information. One gigabyte is one billion bytes.

#### Graphical User Interface

A GUI is an interface that lets humans interact with electronic devices through graphical icons.

#### Graphics Interchange Format

GIF is a bitmap image format that is widely used on the internet.

#### **High Availability**

High Availability is a mode that permits the CMC to replicate its own data on another CMC.

#### Host-based intrusiondetection system

HIDS is an internal Nozomi Networks solution that uses sensors to detect changes to the basic firmware image, and record the change.

#### Hypertext Markup Language

Hypertext Markup Language (HTML) is the standard markup language used to structure and display content on the web. It defines the structure of web pages using elements represented by tags.

#### Hypertext Transfer Protocol

HTTP is an application layer protocol in the Internet protocol suite model for distributed, collaborative, hypermedia information systems. HTTP is the foundation of data communication for the World Wide Web, where hypertext documents include hyperlinks to other resources that the user can easily access, for example by a mouse click or by tapping the screen in a web browser.

#### Hypertext Transfer Protocol Secure

HTTPS is an extension of the Hypertext Transfer Protocol (HTTP). It is used for secure communication over a computer network, and is widely used on the Internet. In HTTPS, the communication protocol is encrypted using Transport Layer Security (TLS) or, formerly, Secure Sockets Layer (SSL). The protocol is therefore also referred to as HTTP over TLS, or HTTP over SSL.

#### Identifier

A label that identifies the related item.

#### **Identity Provider**

An IdP is a system entity that creates, maintains, and manages identity information. It also provides authentication services to applications within a federation, or a distributed network.

#### Industrial Control Systems

An ICS is an electronic control system and related instrumentation that is used to control industrial processes.

#### Industrial Internet of Things

The IIoT is a name for interconnected devices, sensors, instruments, which are networked together with industrial applications. This connectivity allows for analysis and data collection, which can facilitate improvements in efficiency and productivity.

#### Internet Control Message Protocol

ICMP is a supporting protocol in the internet protocol suite. Network devices use it to send error messages and operational information to indicate success or failure when communicating with another IP address. ICMP differs from transport protocols such as TCP and UDP in that it is not typically used to exchange data between systems.

#### Internet of Things

The IoT describes devices that connect and exchange information through the internet or other communication devices.

#### Internet Protocol

An Internet Protocol address, or IP address, identifies a node in a computer network that uses the Internet Protocol to communicate. The IP label is numerical.

#### Intrusion Detection System

An intrusion detection system (IDS), which can also be known as an intrusion prevention system (IPS) is a software application, or a device, that monitors a computer network, or system, for malicious activity or policy violations. Such intrusion activities, or violations, are typically reported either to a system administrator, or collected centrally by a security information and event management (SIEM) system.

#### JavaScript Object Notation

JSON is an open standard file format for data interchange. It uses human-readable text to store and transmit data objects, which consist of attribute–value pairs and arrays.

#### Joint Photographic Experts Group

JPEG, or JPG, is a method of lossy compression that is used for digital images. The degree of compression can be adjusted, allowing a selectable tradeoff between storage size and image quality.

#### Lightweight Directory Access Protocol

LDAP is an open, vendorneutral, industry standard application protocol that lets you access and maintain distributed directory information services over an internet protocol (IP) network.

#### Lightweight Directory Access Protocol Secure

LDAP over SSL or Secure LDAP is the secure version of LDAP.

#### Management Information Base

A MIB is a collection of information organized hierarchically. It is used by network management systems to monitor and control network devices through protocols like SNMP.

#### Media Access Control

A MAC address is a unique identifier for a network interface controller (NIC). It is used as a network address in network segment communications. A common use is in most IEEE 802 networking technologies, such as Bluetooth, Ethernet, and Wi-Fi. MAC addresses are most commonly assigned by device manufacturers and are also referred to as a hardware address, or physical address. A MAC address normally includes a manufacturer's organizationally unique identifier (OUI). It can be stored in hardware, such as the card's read-only memory, or by a firmware mechanism.

#### Megabyte

The megabyte is a multiple of the unit byte for digital information. One megabyte is one million bytes.

#### Message Queuing Telemetry Transport

Message Queuing Telemetry Transport is a lightweight, publish-subscribe network protocol designed for constrained devices and lowbandwidth, high-latency, or unreliable networks. It is commonly used in Internet of Things (IoT) applications.

#### National Vulnerability Database

The National Vulnerability Database (NVD) is the U.S. government repository of standards-based vulnerability management data represented using the Security Content Automation Protocol (SCAP). This data enables automation of vulnerability management, security measurement. and compliance. NVD includes databases of security checklists, security related software flaws, misconfigurations, product names, and impact metrics.

#### Network Address Translation

NAT is a method of mapping an internet protocol (IP) address space into another one. This is done by modifying network address information in the IP header of packets while in transit across a traffic routing device.

#### Network-Attached Storage

NAS is a dedicated file storage system that provides local-area network (LAN) users with centralized, shared access to data through standard protocols such as NFS or SMB.

#### Network Interface Controller

A network interface controller (NIC), sometimes known as a network interface card, is a computer hardware component that lets a computer connect to a computer network.

#### Network Time Protocol

The NTP is a networking protocol to synchronize clocks between computer systems over variable-latency, packetswitched data networks.

#### Nozomi Networks Operating System

N2OS is the operating system that the core suite of Nozomi Networks products runs on.

#### Nozomi Networks Query Language (N2QL)

N2QL is the language used in queries in Nozomi Networks software.

#### **Open Virtual Appliance**

An OVA file is an open virtualization format (OVF) directory that is saved as an archive using the .tar archiving format. It contains files for distribution of software that runs on a virtual machine. An OVA package contains a .ovf descriptor file, certificate files, an optional .mf file along with other related files.

#### **Operating System**

An operating system is computer system software that is used to manage computer hardware, software resources, and provide common services for computer programs.

#### **Operational Technology**

OT is the software and hardware that controls and/ or monitors industrial assets, devices and processes.

#### Packet Capture

A pcap is an application programming interface (API) that captures live network packet data from the OSI model (layers 2-7).

#### Packet Capture Next Generation

A pcapNg is the latest version of a pcap file, an application programming interface (API) that captures live network packet data from the OSI model (layers 2-7).

#### Portable Document Format

PDF is a Adobe file format that is used to present documents. It is independent of operating systems (OS), application software, hardware.

#### Portable Network Graphics

PNG is a raster graphics file format that supports lossless data compression.PNG was developed as an improved, non-patented replacement for graphics interchange format (GIF).

#### Privacy-Enhanced Mail

PEM is a standard file format that is used to store and send cryptographic keys, certificates, and other data. It is based on a set of 1993 IETF standards.

#### Programmable Logic Controller

A PLC is a ruggedized, industrial computer used in industrial and manufacturing processes.

#### Protected Extensible Authentication Protocol

PEAP is a protocol that encloses the Extensible Authentication Protocol (EAP) within an encrypted and authenticated Transport Layer Security (TLS) tunnel.

#### Random-access Memory

Computer memory that can be read and changed in any order. It is typically used to store machine code or working data.

#### Representational State Transfer

Representational State Transfer (REST) is an architectural style for designing networked applications. It uses stateless, client-server communication via standard HTTP methods (GET, POST, PUT, DELETE) to access and manipulate web resources represented in formats like JSON or XML.

#### Seamless Message Protocol

Seamless Message Protocol is a communication protocol used primarily in industrial automation for device-level communication. It enables data exchange between controllers and devices over Ethernet networks.

#### Secure Copy Protocol

SCP is a protocol for the secure transfer of computer files between a local host and a remote host, or between two remote hosts. It is based on the secure shell (SSH) protocol.

#### Secure Shell

A cryptographic network protocol that let you operate network services securely over an unsecured network. It is commonly used for command-line execution and remote login applications.

#### Secure Sockets Layer

A secure sockets layer ensures secure communication between a client computer and a server.

#### Security Assertion Markup Language

SAML is an open standard, XML-based markup language for security assertions. It allows for the exchange of authentication and authorization data different parties such as a service provider and an identity provider.

#### Security Information and Event Management

SIEM is a field within the computer security industry, where software products and services combine security event management (SEM) and security information management (SIM). SIEMs provide real-time analysis of security alerts.

#### Server Message Block

Is a communication protocol which provides shared access to files and printers across nodes on a network of systems. It also provides an authenticated interprocess communication (IPC) mechanism.

#### Simple File Transfer Protocol

SFTP was proposed as an unsecured file transfer protocol with a level of complexity intermediate between TFTP and FTP. It was never widely accepted on the internet.

#### Simple Mail Transfer Protocol

SMTP is an internet standard communication protocol that is used for the transmission of email. Mail servers and other message transfer agents use SMTP to send and receive mail messages.

#### Simple Network Management Protocol

SNMP is an Internet Standard protocol for the collection and organization of information about managed devices on IP networks. It also lets you modify that information to change device behavior. Typical devices that support SNMP are: printers, workstations, cable modems, switches, routers, and servers.

#### Simple Text Oriented Messaging Protocol

STOMP is a simple textbased protocol, for working with message-oriented middleware (MOM). It provides an interoperable wire format that allows STOMP clients to talk with any message broker supporting the protocol.

#### Spanning Tree Protocol

Spanning Tree Protocol is a network protocol that prevents loops in Ethernet networks by creating a spanning tree topology. It selectively blocks redundant paths and ensures a loop-free logical topology.

#### Structured Threat Information Expression

STIX<sup>™</sup> is a language and serialization format for the exchange of cyber threat intelligence (CTI). STIX is free and open source.

# Supervisory control and data acquisition

SCADA is a control system architecture which has computers, networked data communications and graphical user interfaces for high-level supervision of processes and machines. It also covers sensors and other devices, such as programmable logic controllers (PLC), which interface with process plant or machinery.

#### Text-based User Interface

In computing, a textbased (or terminal) user interfaces (TUI) is a retronym that describes a type of user interface (UI). These were common as an early method of human-computer interaction, before the more modern graphical user interfaces (GUIs) were introduced. Similar to GUIs, they might use the entire screen area and accept mouse and other inputs.

#### Threat Intelligence™

Nozomi Networks **Threat** Intelligence<sup>™</sup> feature monitors ongoing OT and IoT threat and vulnerability intelligence to improve malware anomaly detection. This includes managing packet rules, YARA rules, STIX indicators, Sigma rules, and vulnerabilities. **Threat** Intelligence<sup>™</sup> allows new content to be added, edited, and deleted, and existing content to be enabled or disabled.

#### Transmission Control Protocol

One of the main protocols of the Internet protocol suite.

#### Transport Layer Security

TLS is a cryptographic protocol that provides communications security over a computer network. The protocol is widely used in applications such as: HTTPS, voice over IP, instant messaging, and email.

#### Uniform Resource Identifier

A URI is a unique string of characters used to identify a logical or physical resource on the internet or local network.

#### Uniform Resource Locator

An URL is a reference to a resource on the web that gives its location on a computer network and a mechanism to retrieving it.

#### Uninterruptible Power Supply

A UPS is an electric power system that provides continuous power. When the main input power source fails, an automated backup system continues to supply power.

# Universally unique identifier

A UUID is a 128-bit label that is used for information in computer systems. When a UUID is generated with standard methods, they are, for all practical purposes, unique. Their uniqueness is not dependent on an authority, or a centralized registry. While it is not impossible for the UUID to be duplicated, the possibility is generally considered to be so small, as to be negligible. The term globally unique identifier (GUID) is also used in some, mostly Microsoft, svstems.

#### Universal Plug and Play

UPnP is a network protocol that enables devices to automatically discover and communicate with each other using broadcast messages. While it facilitates easy device identification and connectivity, UPnP lacks robust authentication, making it vulnerable to unauthorized access in cybersecurity contexts.

#### Universal Serial Bus

Universal Serial Bus (USB) is a standard that sets specifications for protocols, connectors, and cables for communication and connection between computers and peripheral devices.

#### User Datagram Protocol

UDP is a lightweight, connectionless communication protocol used for fast, time-sensitive data transmission, such as video streaming, online gaming, and VoIP. UDP prioritizes speed and low latency over guaranteed delivery or error correction.

#### User Interface

An interface that lets humans interact with machines.

#### Variable

In the context of control systems, a variable can refer to process values that change over time. These can be temperature, speed, pressure etc.

#### Virtual DOM

A virtual DOM, or vdom, is a lightweight JavaScript representation of the Document Object Model (DOM). It is used in declarative web frameworks such as Elm, React, and Vue.js. It enables the updating of the virtual DOM is comparatively faster than updating the actual DOM.

#### Virtual Hard Disk

VHD is a file format that represents a virtual hard disk drive (HDD). They can contain what is found on a physical HDD, such as disk partitions and a file system, which in turn can contain files and folders. They are normally used as the hard disk of a virtual machine (VM). They are the native file format for Microsoft's hypervisor (virtual machine system), Hyper-V.

#### Virtual Local Area Network

A VLAN is a broadcast domain that is isolated and partitioned in a computer network at the data link layer (OSI layer 2).

#### Virtual Machine

A VM is the emulation or virtualization of a computer system. VMs are based on computer architectures and provide the functionality of a physical computer.

### ZIP

An archive file format that supports lossless data compression. The format can use a number of different compression algorithms, but DEFLATE is the most common one. A ZIP file can contain one or more compressed files or directories.

