NETBEEZ®

NetBeez Tutorial

Version 1.1
February 2019

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About the Tutorial

Welcome to the NetBeez Tutorial! This guide was written with our users in mind and consolidates many hours spent with our customers deploying and configuring NetBeez. We hope that this tutorial will be a valuable instrument to help tune and optimize your installation. If you feel that some concepts are not well explained, require more information, or are missing, please let us know. Send us your feedback and comments to info@netbeez.net.

Version Changes

[v1.0]

First draft of this tutorial, based on NetBeez release 1.3.

[v1.1]

Update with new features included with NetBeez release 1.4 and 1.5, including SSID and WiFi incidents.

Overview

NetBeez is a distributed network monitoring platform. The monitoring is performed from multiple points via hardware, software, or cloud agents, called ‘Beez’, that can be deployed on-premises or in the cloud. These agents are managed by a server, called the ‘Beezkeeper’, that is also located on-premise or in the cloud.

Dashboard

The dashboard is the graphical user interface that is necessary to manage the agents, create monitoring tests, troubleshoot network or application problems, and receive alerts and reports. The dashboard can reside in the cloud, managed by NetBeez or by the customer itself, or on-premises, delivered by the server itself as a virtual appliance.

Agents

The agents serve as the monitoring endpoints that run tests on the network and against the applications. An agent device is like an end-user workstation, so it requires an Ethernet connection in the case of a hardware agent (wired or WiFi). Agents can also be software, installed on an existing Linux or Windows host, virtual, delivered as OVA or KVM images, or cloud, running in a public cloud.

Tests

A test runs a particular check with a remote host and returns results in terms of success/failure along with timing information. NetBeez supports the following two types of tests:

- Real-time tests:
    - **Ping -** Ping can be run as an ICMP echo request or as a TCP socket connect. The ICMP command supports extra parameters such as: Maximum Transmission Unit (MTU), Don’t Fragment (CD) bit, DSCP value. The TCP supports various connect parameters like SYN, ACK, FIN, PUSH, ...
    - **DNS** - This check is implemented with the dig command. The DNS supports the DNS server as optional parameter.
    - **HTTP -** The HTTP test consists in a GET request, implemented with the command curl. The command supports both HTTP and HTTPS pages, and proxy servers authenticated and non.
    - **Traceroute -** Traceroute tests support the ICMP, TCP, and UDP protocols. This command supports extra parameters: Destination port number, max hops, timeouts per hop, and DSCP value.

- Scheduled tests:
  - **Iperf** - Iperf can run throughput tests with TCP or UDP traffic. The user can choose the destination port, the UDP bandwidth, TCP window size, and DSCP marking.
  - **Speedtest** - Speedtest determines download, upload, and latency to an Internet speedtest server. The command supports the server ID as optional parameter.
  - **VoIP** - The VoIP test runs a one-way call from a source to a destination agent. The command supports various codecs, like G.711, G.729, ...

A detailed list of tests is available on the online documentation.

Targets

A target is an object that provides real-time performance data to a specific host and service. A target is defined by having one or more resources. A resource is defined by IP address or fully qualified domain name (FQDN). Each of the resources is monitored via real-time tests.

Control channel

Since the monitoring agents are centrally managed by the dashboard (to which they send real-time results) a permanent control channel between each agent and the dashboard is necessary. The control channel is created via an encrypted SSL socket, which is established from the agent using the TCP port 20018 on the server. The connection is initiated from the agents, so that simplifies the deployment of agents behind a NAT and/or a firewall.

Request NetBeez

To request your server and agents contact sales@netbeez.net.

Select the server type

Request a virtual appliance if you would prefer to host the server on-premise; you can also choose to host the server via a. The cloud instance can be deployed in your public cloud, or hosted by NetBeez.

If you have requested a virtual appliance, you'll receive a link where you can download your pre-configured OVA. That OVA already contains everything that you need to run your server, and is ready to be imported in VMware (other hypervisors like KVM and HyperV).

If you have requested an on-premise server, once you have imported the virtual image into your virtualization environment, follow this guide to load your license and activate your on-premise server.

Select and deploy the monitoring agents

NetBeez offers a variety of hardware and software agents; for a complete list, please review this documentation page.

Hardware agents are included in the NetBeez Enterprise subscription at no extra cost. Hardware agents can be Ethernet, with 10/100 Mbps and 10/100/1000 Mbps interfaces, or WiFi (802.11c). A hardware agent can monitor on the Ethernet or on the WiFi interface only, not on both of them at the same time. You can also build your own hardware agent, using a software agent or image for Raspberry Pi and Odroid. To request hardware agents, send an email to sales@netbeez.net.

A software agent can be installed as a Linux package, as a virtual appliance, or as a cloud instance. Software agents will be installed on existing hosts.

Virtual agents are virtual appliances that can be installed on hypervisors at data centers or remote offices, and cloud agents are running on a public cloud. You can find the installation instructions here.

NetBeez agents are also compatible with the Cisco ISR platform. You can find the installation instructions here.

Once you have connected the hardware agents to the network, and installed the software, virtual, or cloud agents, you are ready to configure the dashboard. If you have procured the hardware agents from NetBeez (and correctly followed the installation instructions for the software agents) all of the deployed agents will connect to the dashboard. If some agents don't show up in the dashboard, follow this troubleshooting guide.

Firewall Rules

Users with an on-premise server installations should apply all the necessary firewall rules to make sure all server's functionalities are properly working.

Two sets of firewall rules are required for the solution to work: one to enable agent-to-server connectivity, and one to enable on-premise servers to receive software updates. The following table doesn't include firewall rules to enable tests against network services (e.g. DNS) and applications.

Rules Set Name	Description	Rules
Agents to server	Enables agents to connect to server and receive software updates.	Source: Agents IP Destination: Server IP Protocol: TCP Port: 443 Direction: Outbound Reason: Software updates Source: Agents IP Destination: Server IP Protocol: TCP Port: 20018 Direction: Outbound Reason: Control channel
On-premise server software repositories	Needed for on-premise servers to receive software updates.	Source: Server IP Destination: repo.netbeez.net Protocol: TCP Port: 22 Direction: Outbound Reason: Software updates Source: Server IP Destination: Ubuntu and Docker repositories * Protocol: TCP Port: 80, 443 Direction: Outbound Reason: On-demand remote support * *At the moment no specific IP addresses are available; a generic rule for all IP addresses should be added.* Source: Server IP Destination: tac.netbeez.net Protocol: TCP Port: 443 Direction: Outbound Reason: On-demand remote support

If you haven't received one, please make sure to request the NetBeez Security Guide and apply all the firewall rules indicated on that guide.

Tune the installation

Once the server and the agents have been deployed and the license activated, it's time to point your browser to the NetBeez dashboard and review the configuration settings to make sure the system meets your requirements.

Anomaly detection

Detecting network and application anomalies is one of the primary functions of a network monitoring solution like NetBeez. For this reason, it's very important to at least review this configuration settings and decide what are the best options for your own needs.

Alert profiles

Alert profiles are attached to targets to detect problems with a specific test. For this reason, alert profiles are test-specific, that is, are related to a specific type of tests (ping, DNS, HTTP, traceroute, …). NetBeez comes with default alert profiles, which can be edited, or deleted. The user can create new alert profiles, and attach them to new or existing targets. Any change to an alert profile will be immediately pushed to all the targets where that profile has been enabled.

Types of alert profiles

There are four types of alerts profiles:

1. **Up-Down** - These critical alerts are triggered by a test if a certain number (multiplier) of consecutive checks fail. By default the multiplier is set to five, but it can be adjusted by the user. Up-down alerts are useful to detect loss of reachability, in the case of ping, or service, in the case of DNS and HTTP tests.

2. **Performance Baseline** - These warnings indicate that a performance degradation is occurring during a test. The detection method is based on moving averages. NetBeez, for each test, calculates the following statistics:

   a. Short-term averages: 1 minute, 15 minutes, 1 hour, 4 hours.
   b. Long-term averages: 1 day, 1 week, 1 month.

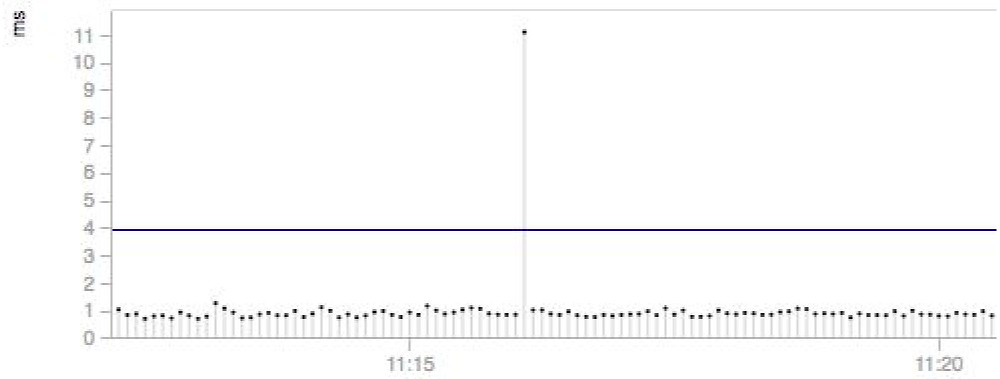
   If the short-term average of a tests is a certain number of times higher than its long-term average, it is possible to detect ongoing performance degradation issues. This type of alert profile is suited when a target is applied to many agents that show different performance on same application, due to their geographical location or other factors.

3. **Performance Watermark** - These warnings are used to detect when a monitored object is not satisfying a service level agreement. The detection method is based on comparing a short-term average with a threshold. If the short-term average crosses the threshold set, then an alert is triggered.

4. **Performance Baseline AND Watermark** - This alert profile merges both performance baseline and watermark rules. If both detection methods are satisfied, then an alert will be triggered by NetBeez.

Percentile-based mean

To calculate the short-term and long-term averages, the algorithm uses all the test results. However, in a stable time series, one individual result could skew the mathematical average.



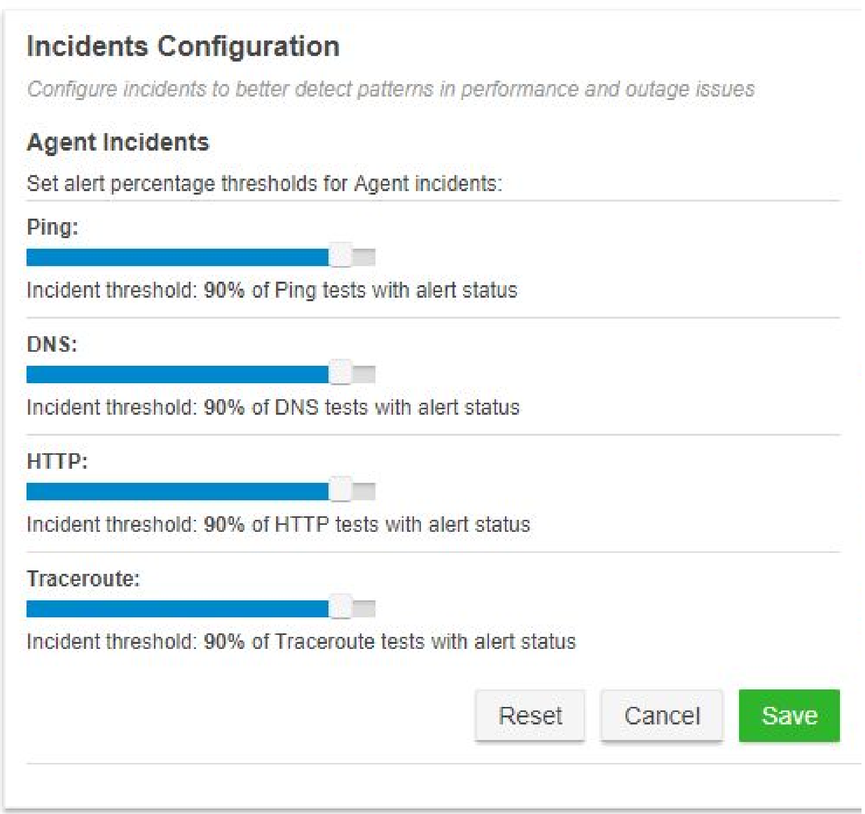
The percentile-based mean is used to filter out outliers that fall outside two times the standard deviation interval (from the mathematical average). The benefit of this function is that should a single data point skew the mathematical average, the percentile-based mean won't be affected, thus reducing the number of false positives (alerts noise).

If you want to learn more about alert profiles and percentile-based mean, please refer to the online documentation page.

Incidents

Incidents are periods of degraded or otherwise abnormal performance of an agent or target. This functionality is designed to help users identify problems and performance variations with a network location (agent), service or application (target), and WiFi network (WiFi) without having the user to analyze many alerts to find the common point. Another benefit of incidents is that they reduce the number of notifications that a user has to receive for a single event.

An incident is triggered when a certain percentage of tests within one agent or target trigger an alert. Such threshold is defined by the user in the NetBeez “Incidents Configuration” settings, under the “Anomaly Detection” section.



Incidents Configuration

Configure incidents to better detect patterns in performance and outage issues

Agent Incidents

Set alert percentage thresholds for Agent incidents:

Ping:

Incident threshold: 90% of Ping tests with alert status

DNS:

Incident threshold: 90% of DNS tests with alert status

HTTP:

Incident threshold: 90% of HTTP tests with alert status

Traceroute:

Incident threshold: 90% of Traceroute tests with alert status

Incidents can be acknowledged, and users can post comments to include more information about the undergoing performance issue, or explain the reason why a specific incident was acknowledged or de-acknowledged.

If you want to read more about Incidents, please consulting this documentation page.

Delivery options

Even when not in front of the dashboard, users can receive notifications of alerts and incidents. NetBeez supports different delivery methods for notifying users about new alerts and incidents raised, such as SNMP traps, syslog messages, and emails. For each delivery method, the user can pick what to receive: only alerts, only incidents, or both of them.

NetBeez also integrates with many third party tools, such as Splunk, PagerDuty, and Slack. Learn more about these integrations on the online documentation.

WiFi settings

NetBeez WiFi agents are small hardware units equipped with an external 802.11ac dual-mode card. These units have two interfaces: the Ethernet one, which is only used to establish the control channel with the server, and the WiFi one, which is used to run tests for monitoring. A WiFi agent is not capable of running any monitoring on the Ethernet interface. The Ethernet connection is required to push the initial configuration to the agent, so the user can apply the wireless profile. Once the agent is connected to the SSID network via the WiFi interface, the Ethernet plug can be removed, if desired. Please remember that, a WiFi agent without an Ethernet connection may disconnect from the dashboard, if the WiFi network is unstable or completely off. It's highly recommended to, where possible, always keep the Ethernet connection active.

The NetBeez WiFi agents supports any type of security settings: open, WEP, WPA pre-shared key, and WPA with EAP methodologies. A wireless profile can be easily configured on the dashboard and then pushed to the units in few clicks. If you wish to learn more about this configuration, please check out this documentation page.

SSID hopping

SSID hopping enables a single NetBeez WiFi monitoring sensor to test up to four SSIDs by regularly connecting to each one of them. This feature enables enterprises to use one single sensor at each location to monitor all of their WiFi networks, without having to deploy one sensor for each SSID.

SSID hopping works by having WiFi sensors connect to SSID 1 for a certain amount of time, called the "Hopping Interval", then disconnect and connect to SSID 2 for the same amount of time, and so on. At the end of the cycle, the WiFi sensors repeat the loop. At each hop, the WiFi sensors run user defined tests to web or cloud applications as well as network performance tests (such as iperf or Internet speed test) to measure network throughput.

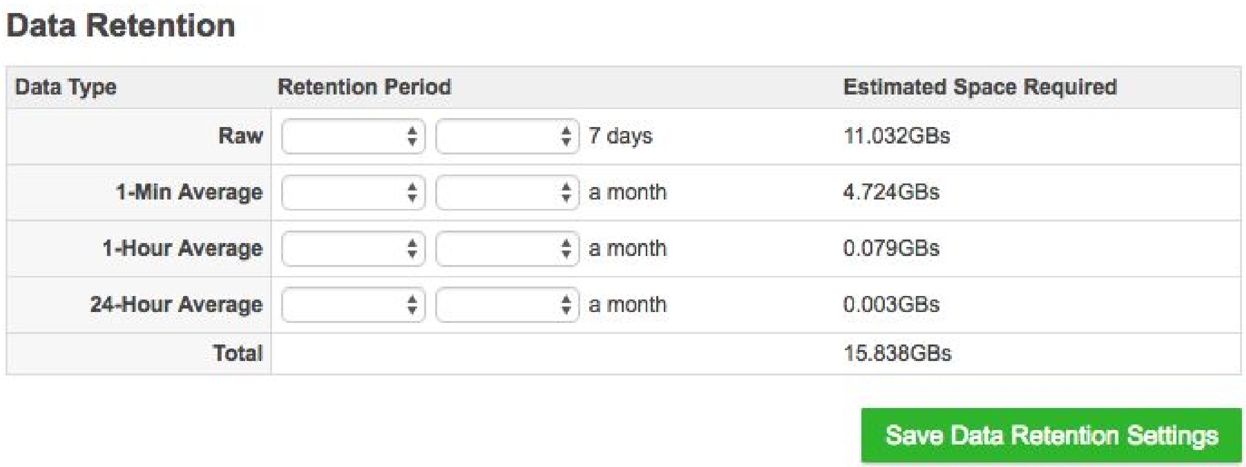
At each hop, the WiFi sensors also test how long it takes to connect to the next SSID. If a WiFi sensor can't authenticate, or get a DHCP address, within the "WiFi disconnection threshold", it will trigger an alert. By default, the WiFi disconnection threshold is set to 60 seconds. This value can be overridden in the Anomaly Configuration section of the NetBeez dashboard.

Data retention

The Enterprise edition of NetBeez supports user-defined data retention settings. The user can set for how long the central server should retain performance data collected by the agents. In practice, the data retention dictates how far back historical test data and reports data can go. The variables to be set are:

- **Raw test data** - This is the raw tests result data, where each data point is the result of a test. Raw test data is displayed in the real-time and historical graphs.
- **1-min average** - This is the average of one test results collected in one minute. The 1-min average is used to generate performance alerts and reports.
- **1-hour average** - This is the average of one test results collected in one hour. The 1-hour average is used to generate performance alerts and reports.
- **24-hour average** - This is the average of one test results collected in twenty-four hours. The 1-hour average is used to generate performance alerts and reports.

The resulting disk space required is dependent from the time period selected, the number of tests, and their interval. This configuration setting can be easily applied from the NetBeez Settings in few clicks.



Data Retention

Data Type	Retention Period	Estimated Space Required
Raw	7 days	11.032GBs
1-Min Average	a month	4.724GBs
1-Hour Average	a month	0.079GBs
24-Hour Average	a month	0.003GBs
Total		15.838GBs

Please refer to the online documentation page to learn more about this.

Users

The NetBeez dashboard is multi-user and multi-role. The Enterprise edition supports unlimited number of users. There are three access-levels in NetBeez:

- **Administrators** - This user role can do anything: create and edit targets and scheduled tests, run ad-hoc tests, create reports, and configure any aspect of the solution, via the NetBeez Settings panel. Generally this account profile is assigned to the application owners and senior network engineers of the organization

- **Read-Write** - This access role can create and edit targets and scheduled tests, run ad-hoc tests, and create reports. Generally this account profile is assigned to intermediate network engineers and network managers.

- **Read-Only** - Accounts with read-only privileges will be able to review targets, scheduled tests, but not create and edit targets or scheduled tests. This profile should be assigned to support operators, and junior network engineers and analysts.

Monitoring

In this section, we'll setup NetBeez to monitor in real-time some applications and run periodic network performance tests.

Monitoring applications with targets

To monitor an application you need to create a target using its FQDN and selecting the tests that will be included. The tests are selected based on the type of application, or service, that is monitored. Tests included in a target can run as frequently as every one second, to reduce at minimum the time to detect problems as well as to have enough granular data to understand the behavior of the network and applications. The below table reports the default timing intervals associated to tests included in a target. Test intervals can be adjusted anytime by the user.

Test	**Default Interval**
Ping	5 seconds
DNS	30 seconds
HTTP	60 seconds
Traceroute	120 seconds

In the rest of this section, we'll review some target templates that can be used to monitor specific applications.

Web application

For example, to monitor a web service or a cloud application, it's recommended to include ping, DNS, HTTP, and traceroute tests. Ping, if not blocked, reports the round-trip time and packet loss to the server where the application is hosted. If ICMP is not allowed, the user can configure a TCP-based ping test to a remote host port. The DNS test, will verify that end-user clients are able to resolve the FQDN associated with the application. The HTTP test checks that the web server is available to serve the user requests, and reports how long it takes to load a web page.

DNS servers

DNS allows hosts to translate an FQDN into an IP address. This service can be monitored by creating a target that uses the DNS servers' IP addresses. Typically, organizations have one anycast DNS IP address, or two individual IP addresses. Tests that can be included in a target are, where allowed, ping, DNS, and traceroute. In the DNS query, make sure to specify the DNS server's IP address in the server configuration field.

Other TCP applications

Other applications can be monitored using a TCP-based ping test, which verifies that a specific TCP/IP port is open, and how much time it takes to establish a socket. This test, complemented with ping, DNS, and traceroute, provides good data to verifies status and health of a generic TCP-based application.

Testing network performance with scheduled tests

The goal of network performance tests is to assess the quality of the network through active tests. This group of tests run periodically according to a user-defined schedule. The schedule can be periodic, hourly, daily, weekly, or custom, running on specific hours throughout the day or certain days in a week or month.

Iperf

Iperf (https://iperf.fr/) is an open source command that runs TCP, UDP, and multicast throughput tests between one or more iperf clients and one iperf server. This tool is integrated in the NetBeez dashboard and is supported by any type of agent. NetBeez supports both version 2 and 3. An Iperf test returns throughput between the client(s) and the server. On UDP tests, users can also get packet loss and jitter.

Speedtest

NetBeez agents can run speedtest tests to Ookla servers thanks to the open source implementation speedtest-cli (https://github.com/sivel/speedtest-cli). This test will measure both download and upload speed as well as latency to an Internet Ookla speedtest server. The user has the option to select one specific speedtest server from a public list (https://www.speedtest.net/speedtest-servers.php) or to let the algorithm pick the closet one, based on which one has lower latency.

VoIP

VoIP tests simulate a call between two agents and return the Mean Opinion Score (MOS), which is a key performance indicator of call quality. The test also reports the jitter, packet loss, and latency values, which are factors that affect the call quality and, consequently the MOS. The user can pick the VoIP codec used to run the test, such as G.711, G.729, … All the VoIP tests create a UDP stream between the two agents selected that conform to the codec's specifications. Also all UDP packets are marked with the EF (DSCP 46) IP Type of Service.

Codec Name	Payload Size	Voice Speech	Pkts per Sec.	Bit Rate
G.711	160 Bytes	20 ms	50	64 Kbps
G.729	20 Bytes	20 ms	50	8 Kbps
G.723.1-63	24 Bytes	30 ms	33.3	21.9 Kbps
G.723.1-53	20 Bytes	30 ms	33.3	20.8 Kbps
G.726	80 Bytes	20 ms	50	55.2 Kbps
G.728	60 Bytes	30 ms	33.3	31.5 Kbps
G.722	160 Bytes	20 ms	50	38.4 Kbps

QoS

NetBeez has included DSCP marking of IP packets in the following tests: ping, traceroute, Iperf, and VoIP (pre-set). DSCP marking can be used to test difference in test performance based on the QoS policy applied to network devices.

Reports and API

NetBeez users can generate reports to review historical network and application performance data based on agents deployed, targets and scheduled tests configured. Reports can be generated on the dashboard, or can be scheduled to be sent via email.

Reports types

The NetBeez dashboard can generate four type of reports:

- **Network summary -** This report provides a high level overview of agents and targets. For each agent, the user can review availability, download and upload speed if that agent had a speedtest configured, and number of alerts. For each target, the user can review average HTTP GET time, and number of alerts.

- **Agents** - The user can select one or more agents to get a report on alerts occurrence per target monitored, tests performance, and HTTP targets performance.

- **Targets** - The user can select one or more targets to get a report on alerts occurrence per agent included, tests performance, and HTTP performance per agent.

- **Scheduled tests** - This report plots in a line graph format selected iperf, speedtest, and VoIP scheduled tests.

When generating a report on the dashboard, it's possible to extract such report in PDF format, or save that report in a preset, which is the definition of the report type along with the input parameters selected (e.g. report time period, elements to be included in the report, etc.). As we'll see in the next paragraph, presets must be created to schedule email reports.

Email reports

NetBeez users can send PDF reports via email. The reports that are included in the email are defined via presets. Emails are sent to one or more email addresses based on a user defined schedule. To learn more about email reports, please consult this documentation page.

API

NetBeez has a public API, which can be reviewed on the swagger page available with each instance at the URL *https://<DASHBOARD_FQDN>/swagger/index.html*. The current version of the API makes it possible for external applications to get the object's status, network and application performance data collected by the agents.

Public dashboard

The public dashboard is an open source project developed in PHP and uses the NetBeez public API. The public dashboard can be installed on any web-server (libcurl required) to provide a service status dashboard based on the targets and agents configured. The benefits of a public dashboard are that the network engineers and managers can share the status of the network and applications monitoring with the end-users the by NetBeez. Also, the public dashboard can be installed in a intranet or public website, without compromising the NetBeez server's security. If you want to learn more about this, check out the public dashboard GitHub page.

Troubleshooting with NetBeez

NetBeez can be helpful in troubleshooting network and application performance issues in large and complex Wide Area Networks (WAN). The real-time data reported by the agents is used to identify the scale (e.g. number of locations) and layer (e.g. network versus application) of performance issues.

Using the Buzz Tab

The Buzz Tab was designed to provide the user with the most important information that NetBeez collects, such as:

- **Agent and target performance** - The user can review the agent and HTTP target performance distribution. In the agent performance chart, each agent is represented as a dot, and whose xy coordinates are determined by its number of performance alerts (y) and up-down alerts (x) triggered in the last 24 hours. *In the agent performance bar chart, each target is included in a bar, based on its 24-hour average HTTP response time.*

- **Open and recent incidents** - This section of the Buzz Tab reports all agent and target incidents logged over the past 24 hours. This is a good way to quickly find if there are network or application issues occurring. By clicking on a specific incident, the user can check out what tests and alerts caused the incident to be generated by the system.

Interactive console

An interactive console is built into the NetBeez dashboard and enables users to type commands directly to the reachable NetBeez agents. The console can be used to review log files to troubleshoot agent-related issues, run command line commands that are not yet integrated with the dashboard. Some of the commands that are oftentime used by network engineers on the interactive console are: nmap, tcpdump, and arp.

Ad-hoc tests

Ad-hoc tests can be used to troubleshoot network and application problems on the spot, without having to create a target. The user selects the test type, the source agent, and destination IP, FQDN, or agent where applicable. *The command will run for the amount count indicated*, and then exit. Results are logged in real-time on the NetBeez dashboard.

NetBeez Configuration Checklist

Here’s a high level list of items that are necessary in order to have a working configuration:

Agents	● Connect all hardware agents (FastE, GigE, WiFi) to a network switch via the Ethernet interface; make sure that they report to the dashboard; if any agents have problems reporting to the dashboard, here's the troubleshooting procedure. ● Configure the WiFi agents with the appropriate SSID profile to connect to your wireless network(s); here’s the procedure. ● Rename the agents and create agent groups if needed.
Targets	Create targets based on the prospect’s monitoring goals; this is a very important part, so make sure to clearly define the applications and network services that they want to monitor.
Scheduled Tests	Setup scheduled tests for running throughput tests to other network locations (iperf), or to the Internet (speedtest); VoIP tests can be used to verify performance and quality of VoIP calls.
Users	Invite your team to access the NetBeez dashboard: send them an invitation via email so they can create their own account; review the documentation page on user management to learn more about the different roles and privileges available to users.
Email Reports	Setup daily, weekly, or monthly reports to be sent via email as PDF attachments.
Alerts and Incidents configuration	Define what type of performance alerts to enable; review the alerts documentation page to learn the difference between up-down, baseline, and watermark alerts.
Notifications	Receive notifications on alerts and incidents via SMTP, SNMP, or Syslog; in alternative, review the list of available integrations, such as Splunk, PagerDuty, and Slack.

Resources

If you want to keep learn more about NetBeez, there are several online resources available:

- NetBeez online documentation: https://netbeez.zendesk.com/hc/en-us
- NetBeez blog: https://netbeez.net/blog
- NetBeez community: http://community.netbeez.net
- NetBeez YouTube channel: https://www.youtube.com/channel/UC89nekW3nqHyIKK6OaTH6uA