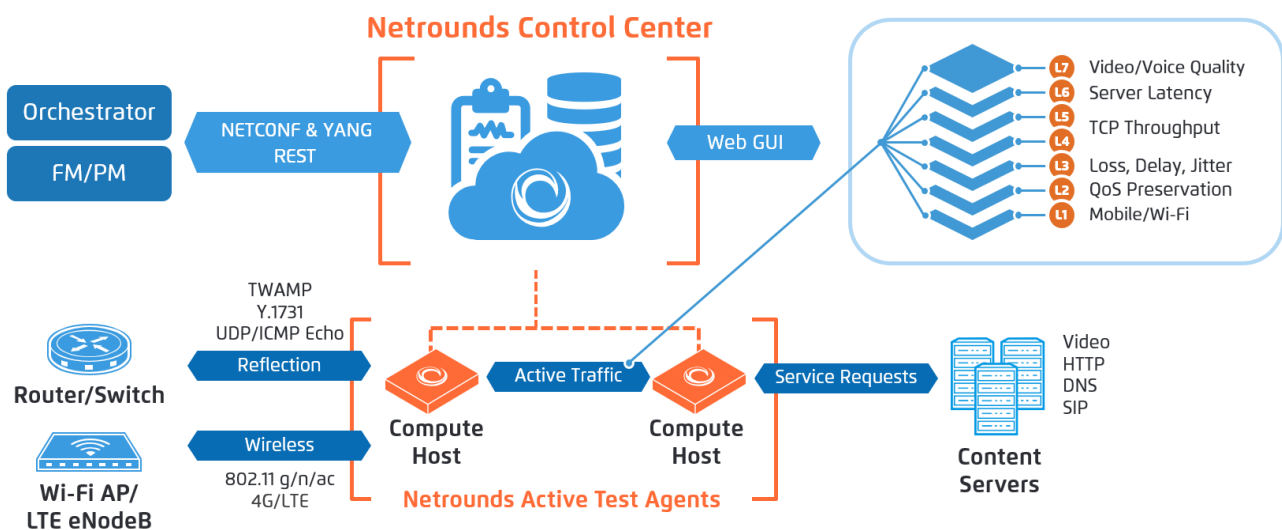# Netrounds Test Agents

Real-world traffic generation for automated active assurance

Netrounds Test Agents actively generate authentic traffic and analyze detailed, real-time measurements across multiple applications, services and interfaces. Test Agent capabilities include measurement of network performance (UDP, TCP, Y.1731, TWAMP), IPTV and OTT video, and Internet (HTTP, Ping, Speedtest), as well as VoIP and SIP telephony, mobile radio, Wi-Fi, and remote packet inspection.

All Test Agents are controlled and updated remotely through Netrounds' unifying Control Center, which can be hosted by Netrounds or deployed on-premise. The Control Center in turn can be accessed through a web GUI or through a cloud API. See the Control Center datasheet for more information.

External OSS and NFV orchestrators easily automate distributed activation tests and quality monitoring through a feature-rich cloud API to the Control Center, while network operations staff access the user-friendly web interface as a test design environment, as well as for on-demand tests, quality monitoring and real-time visualization.

Netrounds Complete Controller-based Solution

Netrounds Test Agent Key Features	Main Benefits
Genuinely software-based	Suitable for virtualized, hybrid and legacy networks
Instant remote Test Agent deployment	No need for field efforts using expensive hardware tools
Traffic generating capabilities	Activation tests and monitoring from end user perspective
Versatile features and tools	Complete system for assessing end user related services
Multitasking capabilities	Maximum utilization of each Test Agent
Central management	Consistent interface and back end for users and orchestrators
Programmable through complete cloud API	Leverage abstractions for efficient OSS automation

Virtual (vTA VNF) and Software Test Agents are packaged as downloadable software which is easily installed by the user, whereas Preinstalled Test Agents are configured by Netrounds on certified x86 hardware of various form factors and capacities. All of these Test Agent types have identical traffic-generating capabilities and differ only in terms of packet performance, which is determined by available CPU resources and interface speeds.

Embedded and PC Test Agents are offered with a reduced footprint (1 MB) for installation on system on chip (SoC), OpenWrt-based network devices and as a PC application under Linux, respectively. They have scaled-back functionality to accommodate footprint requirements.

Netrounds Test Agent Types

Virtual Test Agent (VNF)

For use in virtualized environments as VNF

Runs as VM on any hypervisor

287–900 MB image size depending on image type (see table below)

Embedded Test Agent

Software embedded on OpenWrt-based network device (provided by customer)
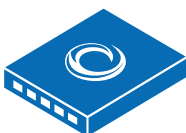
Small footprint, about 1 MB

Software Test Agent

Complete appliance with operating system and tools

Downloadable ISO image for any standard x86 HW

Available as live USB without installation

PC Test Agent

Software installed on customer-provided standard PC

Test Agent application for Linux OS

Small footprint: ~ 1 MB
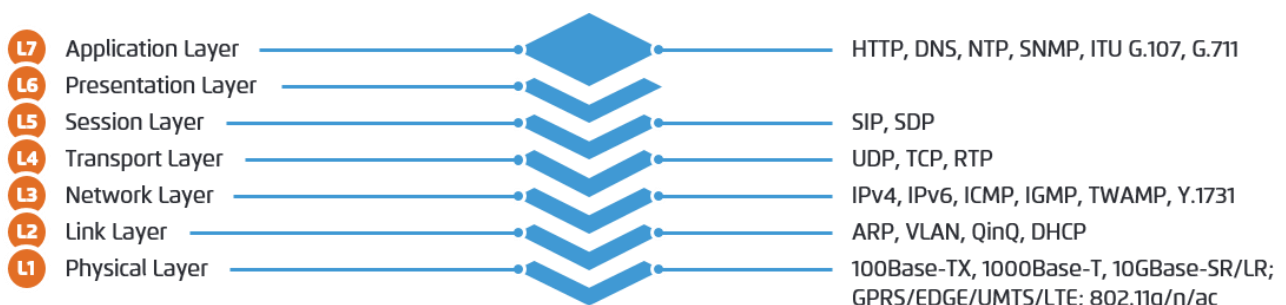
Preinstalled Test Agent

Software delivered on certified x86 HW

Plug and play

Either small portable device or rack-mounted

Browser Test Agent

Software running in browser; all major browsers supported

HTML5/WebSocket or Adobe Flash

Netrounds Supported Protocols by OSI Layer

Layer		Protocols
L7	Application Layer	HTTP, DNS, NTP, SNMP, ITU G.107, G.711
L6	Presentation Layer	
L5	Session Layer	SIP, SDP
L4	Transport Layer	UDP, TCP, RTP
L3	Network Layer	IPv4, IPv6, ICMP, IGMP, TWAMP, Y.1731
L2	Link Layer	ARP, VLAN, QinQ, DHCP
L1	Physical Layer	100Base-TX, 1000Base-T, 10GBase-SR/LR; GPRS/EDGE/UMTS/LTE; 802.11g/n/ac

Preinstalled Test Agent – Delivered as Plug-and-play Device

Hardware	HW Medium	HW Large
Front and back views		
Network	3 × 10/100/1000 BASE-T (RJ45)	4 × 10/100/1000 BASE-T (RJ45), optional 2 × 10G SFP+ (10GBase-LR), optional 4 × 10/100/1000 BASE-T (RJ45)
Mobile network	GPRS/EDGE/UMTS/LTE *(requires Mobile license option)*	–
Wi-Fi	802.11g/n/ac *(requires Wi-Fi license option)*	–
x86 CPU	1 × AMD Bobcat T40E, 1.0 GHz, dual core	1 × Intel Xeon E3, 3.7 GHz, quad-core
RAM	2 GB	8 GB
Storage	16 GB SSD	16 GB SSD
Power supply	DC 12 V adapter incl., 110 V or 230 V	AC input, 110–230 V, cable included
Power consumption	12 W	200 W (max)
Connectors	Electrical Ethernet: 3 × RJ-45 Optical Ethernet: – Serial/RS-232: DB-9 USB: 2 × USB 2.0 Display: –	Electrical Ethernet: 4 × RJ-45 Optical Ethernet: 2 × SFP+ slots (optional) Serial/RS-232: DB-9 USB: 2 × USB 2.0 Display: VGA
Temperature ranges	Operating: 0° … 50°C Non-operating: 0° … 50°C	Operating: 5° … 35°C Non-operating: −40° … 60°C
Size	30 × 157 × 168 mm (1.2″ × 6.2″ × 6.6″)	43 × 290 × 437 mm (1.7″ × 11.4″ × 17.2″)
Weight	800 g (1.8 lb)	5 kg (11 lb)
Sold with license *(SaaS only)*	For the Netrounds SaaS solution, hardware is bundled with licenses as follows:	
	Preinstalled Test Agent Small or Medium Medium options: Wireless (i.e. LTE), Wi-Fi	Preinstalled Test Agent Medium Plus or Large

Note: Preinstalled Test Agents exist only in the Netrounds SaaS solution. The same hardware is sold for on-premise deployments without being bundled with Test Agent software.

Software Test Agent – Downloadable Software for Standard x86 Hardware

	HDD	Bootable USB
Usage	Permanent installation on physical block storage device (HDD)	Live booting from USB memory stick for temporary transformation of any x86 PC hardware into a Netrounds Test Agent
Delivery format	Delivered as installation ISO image	Delivered as raw disk image, along with executable Windows binary for assisted transfer to USB memory stick
RAM requirement	256 MB minimum; 512 MB recommended	
Storage requirement	1 GB	None; RAM disk used for temporary storage, and image is booted directly from USB device
Recommended NICs	Intel NICs recommended	
NIC driver support	Same as supported by Linux Debian	

Virtual Test Agent (vTA VNF) – Downloadable Software for Hypervisor Environments

	Virtual Test Agent Delivery Format			
	RAW/QCOW2	**OVF/VMDK**	**AMI**	**VHD**
Type	Preinstalled and bootable appliance			
Delivery format	RAW or QCOW2 disk image	VMDK disk image plus OVF file	Amazon Machine Image	VHD disk image
Orchestration support	OpenStack Heat Orchestration Templates (HOT) using cloud-init	VMware vCloud Director, VMware Integrated OpenStack (VIO)	AWS CloudFormation templates	Azure ARM templates
Hypervisor support	OpenStack/KVM	VMware/vSphere	KVM	Azure Hypervisor
Example partner platforms	Cisco, HPE, Nokia	VMware	Amazon Web Services	Microsoft Azure
Download size	512 MB (RAW) 900 MB (QCOW2)	287 MB	N/A (size of AMI: 2 GB)	2 GB
vCPU requirement	1 vCPU	1 vCPU	c5.large	1 vCPU
RAM & storage requirements	RAM: 256 MB minimum; 512 MB recommended Storage: 2 GB			
SR-IOV, PCI passthrough	Not required, but could improve accuracy			
NIC driver support	Same as supported by Linux Debian	Same as supported by Linux Debian and VMware tools	Same as supported by Linux Debian	Same as supported by Linux Debian

Routers on which the RAW/QCOW2 virtual Test Agent has been verified: Cisco IOS XE and UCS, Adva FSP 150 ProVMi, Juniper NFX250, OneAccess OVP, Telco Systems Cloud Metro 10 and 100

Test Agent Functionality

General Network Support

Transport modes
- Bridged Ethernet
- IEEE 802.1q VLAN
- IPv4 over Ethernet
- IPv6 over Ethernet

Physical link configuration
- Duplex setting (full or half)
- Speed setting (10M–10G)
- MTU size (64–9000 bytes)

MAC addresses
- Per physical port or VLAN
- Factory default
- User-defined

Bridge setup
- Bridge physical ports and/or VLANs
- Multiple bridges (max 4 per Test Agent)
- Assign IP hosts to bridges

VLAN setup
- Per physical port (max 10 per Test Agent)
- Full VLAN range (1–4095)
- Priority Code Point (0–7)

IP host setup
- Multi-host (max 10 per Test Agent)
- One host per physical port or VLAN
- Separate routing tables per host
- DiffServ Code Point (0–63)
- Static addressing (gateway, DNS)
- DHCPv4, DHCPv6, SLAAC
- DHCPv4 vendor class
- Use of IP host for management

DHCPv4 server setup
- DHCPv4 server for other clients
- Per physical port or VLAN
- Network range
- Network prefix length
- Gateway and DNS

Interface status
- Per physical port or VLAN
- Current speed/duplex
- Current MAC and IP address
- TX and RX packets
- TX and RX bytes

Supported Standards by OSI Layer

L1 – Physical Layer (Preinstalled Test Agents)
- IEEE 803.2i: 10Base-T
- IEEE 802.3u/x: 100Base-TX
- IEEE 802.3ab: 1000Base-T
- IEEE 802.3ae: 10GBase-SR/LR
- IEEE 802.3ac: 1522 byte "Q-tag"
- IEEE 802.11g/n/ac: Wi-Fi/Wireless LAN
- ETSI/3GPP: GPRS/EDGE/UMTS/LTE

L2 – Link Layer
- RFC 826: Address Resolution Protocol (ARP)
- IEEE 802.1q: VLAN
- IEEE 802.1p: Protocol for Traffic Prioritization
- IEEE 802.1ad: QinQ, VLAN Stacking
- IEEE 802.1ag: Ethernet Loopback
- RFC 2131: Dynamic Host Configuration Protocol, DHCP
- RFC 3046: DHCP Relay Agent Information Option

- ITU-T Y.1731: OAM Functions and Mechanisms for Ethernet-based Networks
- ITU-T Y.1564: Ethernet Service Activation Test Methodology
- MEF 6.1.1: Layer 2 Control Protocol Handling

L3 – Network Layer
- RFC 791: IPv4
- RFC 2460: IPv6
- RFC 792: ICMP
- RFC 2236: Internet Group Management Protocol, Version 2
- RFC 3376: Internet Group Management Protocol, Version 3
- RFC 5481: Packet Delay Variation Applicability Statement
- RFC 3393: IP Packet Delay Variation Metric for IP Performance Metrics

RFC 2474: Definition of the Differentiated Services Field (DS Field) in the IPv4 and IPv6 Headers

RFC 2680: One-way Loss Ratio

RFC 2679: Minimum One-way Delay

RFC 6703: Mean One-way Delay (section 5.2)

RFC 5357: A Two-Way Active Measurement Protocol (TWAMP) – Full and Light

L4 – Transport Layer

RFC 736: User Datagram Protocol (UDP)

RFC 793: Transmission Control Protocol (TCP)

RFC 3550: RTP: A Transport Protocol for Real-Time Applications

L5 – Session Layer

RFC 3261: SIP: Session Initiation Protocol

RFC 3551: RTP Profile for Audio and Video Conferences with Minimal Control

RFC 3266: SDP: Session Description Protocol

RFC 3264: An Offer/Answer Model with the Session Description Protocol (SDP)

RFC 3515: The Session Initiation Protocol (SIP) Refer Method

RFC 3891: The Session Initiation Protocol (SIP) "Replaces" Header

RFC 5216: The EAP-TLS Authentication Protocol (Extensible Authentication Protocol – Transport Layer Security)

RFC 5281: Extensible Authentication Protocol Tunneled Transport Layer Security Authenticated Protocol Version 0 (EAP-TTLSv0)

PEAPv0/EAP-MSCHAPv2: Protected EAP

L7 – Application Layer

ITU-T G.711: Pulse Code Modulation (PCM) of Voice Frequencies

RFC 1901, 1908 and 2570: SNMP v2 and v3

ITU G.107: The E-model: A Computational Model for Use in Transmission Planning

ETSI TR 101 290: Digital Video Broadcasting (DVB); Measurement Guidelines for DVB Systems

RFC 6959: Source Address Validation Improvement (SAVI) Threat Scope

RFC 7230: Hypertext Transfer Protocol – HTTP/1.1

RFC 1305: Network Time Protocol (Version 3)

RFC 1034: Domain Name System

Internet Performance Measurement

General

Request/response-based

One-armed (single Test Agent)

Distributed (multiple Test Agents)

HTTP

HTTP server (URL target)

Time between requests

Response code validation

Response content validation

Time to first byte received

Page load times

Download rates

DNS

DNS server

Lookup address

Time between requests

DNS record type response validation (A, AAAA, CNAME, MX)

Response time measurement

ICMP (Ping)

IP hosts (targets)

Time between requests

Payload size (64–9000 bytes)

DSCP prioritization

Time-to-live

Hop-by-hop detection of IP hosts

Speedtests

Test Agent as speedtest responder

Tests initiated from browsers

Test duration

TCP port

Number of concurrent TCP sessions

Access control through IP filters

Network Performance Measurement

General

Test Agent to Test Agent traffic generation

Point-to-point

Hub and spoke

Custom mesh topologies

Destination port (UDP and TCP)

Unidirectional or bidirectional

Configurable rate (Mbit/s)

DSCP and PCP header marking

UDP

Unicast or multicast

Generated output bandwidth

Packet size (64–9000 bytes)

VoIP-like UDP

MOS scoring (1–5)

20 concurrent calls per Test Agent

Codec emulation: G.711, G.723, G.729, GSM-EFR

Media transport generation, not signaling

Stateful TCP

Number of point-to-point sessions

Output rate limitation for each direction

Multi-session TCP

Number of point-to-point TCP sessions

TCP throughput testing

RFC 6349: Framework for TCP Throughput Testing

QoS policy profiling

Multi-stream generation in each queue

Mix of UDP and TCP to measure queue build-up

Profile generated for each traffic stream

Y.1731/802.1ag

ITU-T Y.1731 Ethernet Loopback, ETH-LB

ITU-T Y.1731 Delay Measurement, ETH-DM

ITU-T Y.1731 Synthetic Loss Measurement, ETH-SLM

Participating MEPs (Maintenance Entity Group End Points) as input list

MEG level (0–7)

Unavailable Seconds (UAS) per ITU-T Y.1563

Packet size (64–9018 bytes)

TWAMP

RFC 5357: Two-way Active Measurement Protocol

TWAMP Light (RFC 5357 App. I)

Unavailable Seconds (UAS) per ITU-T Y.1563

Packet size (87–9018 bytes)

Hardware timestamping

UDP loopback

Reflector device configured to loop back UDP packets in hardware

Very high throughput achievable

BWPing

Measures bandwidth and response times between Test Agent and router/switch

Uses ICMP echo request/reply mechanism

Achieves high data throughput

IPTV and HTTP Streaming Video

General

Request/response-based

Emulate single client (one Test Agent)

Distributed (multiple Test Agents)

Inline with traffic (interception)

IPTV MPEG

Joining of multicast channels

Test Agents and input channels selection

MPEG transport stream analysis

MPEG loss (continuity counter)

PCR and RTP packet jitter

Table errors (PAT and PMT)

Missing PID detection

IPTV MPEG inline

Interception of IGMP pass-through

Stream analysis of MPEG TS

IGMP channel zapping time

Continuous join and leave cycle

Selection of channels to cycle

Join and leave delay measurements

HTTP video streaming (OTT)

Apple HTTP Live Streaming (HLS)

URL input for source of video

Detection of buffer underrun

Loop feature for static videos

IGMP join/leave test

Checks if users can join and receive data on allowed multicast channels (and no others)

Multicast group limit test

Checks that a user can only join a specified maximum number of multicast channels

VoIP and SIP Telephony

General

Hub and spoke

Point-to-point

SIP account inventory

SIP signaling

Registration and unregistration

Invite and hangup

Cycle length

RTP media stream quality	Packet loss
MOS scoring (1–5)	Packet misorderings
Rate	Voice codec (G.711 A-law, G.711 µ-law, GSM)

Remote Packet Inspection

General	Test Agent to local Wireshark application
Packets intercepted remotely from TAs	**Packet capture through server**
Standard "tcpdump" filters	Filtered packets forwarded from group of Test Agents to Netrounds' Control Center for storage and centralized retrieval
Standard "pcap" files	
Direct packet capture	
Filtered packets forwarded from individual	

Transparency

General	multicast, checking that IP packets are not dropped
Packet mangling and network transparency/ QoS tests	**L2 transparency – IPv6**
L2 transparency – Ethertypes	Verifies IPv6 header integrity
Layer 2 transparency for various Ethertypes and LLC/SNAP protocols	**L2 transparency – MAC address limit**
L2 transparency – Custom Ethertype	Checks that number of MAC addresses is between a given minimum and maximum
Checks that specified Ethertype passes through network	**L2 transparency – Multicast**
L2 transparency – VLAN	Verifies that multicast packets are not dropped (STP and MPLS protocols)
Verifies transparency for given VLAN tag, VLAN priority (PCP), and DSCP	**DSCP remapping**
L2 transparency – Custom VLAN	Verifies expected remapping of DSCP values between two points in a network
Checks that packets with given VLAN tag and priority (PCP) are not modified by network	**Layer 4 destination port DSCP remapping**
L2 transparency – Ethernet control protocols	Same as preceding but with specific UDP or TCP destination ports indicated
Checks transparency for LACP, EAPoL, MVRP	**Path MTU discovery**
L2 transparency – IP	Determines path MTU (Maximum Transmission Unit) between two Test Agents
Verifies IPv4 header integrity as well as IP	

Security

General	**Management protocol scanning**
Tests primarily designed for Layer 3 networks	Checks that management protocols are unavailable at customer ports
Focused on: Man-in-the-middle (MITM) attacks; Denial-of-service (DoS) attacks; Abuse – Tracking of end users	**Router redundancy protocol listening**
	Checks that VRRP/CARP, GLBP, and HSRP protocols are unavailable at customer ports
Test Agent acting as either customer or ISP	**Routing protocols**
DHCP starvation	Checks that routing protocols are not available on customer ports
Checks that a customer can only obtain a limited number of IPv4 addresses	**STP – Spanning Tree Protocol**
Fragmented DHCP packets	Checks that STP is not available on customer ports
Checks that switch drops fragmented DHCP packets before they reach the control plane	
Fragmented TCP/UDP headers	
Checks that switch drops IPv4 and IPv6 packets with fragmented TCP or UDP headers	

Mobile Radio

General

Use of external USB radio modem for GPRS/WCDMA/LTE

Measurement and logging of basic mobile radio metrics

Mode switching capability

Mobile switcher

Lock to specific APN

Lock to specific radio access technology (GSM, WCDMA, LTE 800, LTE 900, LTE 1800, LTE 2100, LTE 2600)

Mobile logger

Received Signal Strength Indication (RSSI)

Reference Signal Received Power (RSRP)

Received Signal Code Power (RSCP)

Reference Signal Received Quality (RSRQ)

Per-chip Signal to Noise Ratio (Ec/Io)

Signal to Interference + Noise Ratio (SINR)

Wi-Fi

General

Use of Wi-Fi NIC for IEEE 802.11g/n/ac

Measurement and logging of basic Wi-Fi metrics

Network and access point switching capability

Wi-Fi switcher

Configuration of MAC address, MTU, SSID, BSSID, type of authentication and cipher

802.11n (High Throughput): enable/disable; 40 MHz channels: enable/disable; MCS indexes allowed

802.11ac (Very High Throughput): enable/disable; MCS indexes allowed; maximum number of MIMO spatial streams

Frequency bands – 2.4 GHz, 5 GHz: enable/disable

Short Guard Interval (SGI) on/off

Low Density Parity Check (LDPC) on/off

Wi-Fi logger

Received Signal Strength Indication (RSSI)

TX bitrate, RX bitrate (theoretical maximum)

TX and RX MCS indexes used

Guard interval used

Number of TX and RX MIMO streams

TX retries

Netrounds Embedded Test Agent and PC Test Agent Measurement Capabilities

- **UDP**, unicast or multicast; **VoIP-like UDP** (packet delay variation and loss; packet delay not obtained)

- **Stateful TCP**

- **IPTV/MPEG**

For further details on these measurements, see the preceding section.

Netrounds Test Agent Hardware Performance

Performance indicator	HW Medium	HW Large
UDP, unidirectional	1000 Mbit/s (1500 bytes)	4 Gbit/s (1500 bytes)
TCP, unidirectional	1000 Mbit/s	10 Gbit/s (using multiple concurrent sessions)
IPTV MPEG	300 Mbit/s (similar to 75 SD channels at 4 Mbit/s)	3 Gbit/s (similar to 250 SD channels at 4 Mbit/s and 250 HD channels at 8 Mbit/s)
Packet performance	78,000 packets/second (pps)	390,000 packets/second (pps)
TWAMP	Limited by license to 100 concurrent streams	Up to 8800 concurrent streams generated (2200 per interface)
Time accuracy	~ 1 ms assuming stable connection to NTP server	~ 1 ms assuming stable connection to NTP server

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