Cisco Orchestrated Assurance Powered by Netrounds
Automated Verification of Network Service Quality
What if you could automatically verify that each provisioned service works when delivered and continues to work throughout its lifetime?

Netrounds’ active test and monitoring capabilities, orchestrated and fully automated through Cisco® Network Services Orchestrator (NSO), help enable you to improve customer experience and ensure that provisioned services are delivered as promised.

**Overview**

Cisco NSO has just configured a new service. Does it work across all network layers and domains? Will it continue to work throughout its lifetime?

Many times, end-to-end services depend on network components not configured by NSO. In addition to device configuration, dynamic behavior such as varying network load can also influence service quality. Netrounds helps you actively verify that a provisioned service works at the time of deployment, before your customers begin using the service.

After successful verification of service provisioning, Netrounds provides continuous service quality insight from your customers’ viewpoint. This insight helps you to discover issues earlier and resolve them faster.

Netrounds provides out-of-the-box capabilities to actively test and monitor performance metrics for Layer 2 and 3 connections, as well as voice, video, and data services.

NSO automatically drives all active test and monitoring activities when the service is provisioned through Netrounds’ NETCONF and YANG API.

**Benefits**

- **Actively verify that services work after they are provisioned by Cisco® Network Services Orchestrator (NSO).** Generate real-world traffic to help ensure that services are delivered correctly before they are exposed to end-users and deliver birth certificates to key stakeholders.
- **Help ensure that provisioned services continue to work throughout their lifetime.** Get service quality insights from the end-user perspective through active, real-time measurements.
- **Resolve problems faster.** Take advantage of remote testing capabilities; automate advanced test scenarios through Cisco NSO; and test across layers, services, and domains.
- **Reduce manual and field test efforts.** Automate test sequences and use remote troubleshooting to reduce manual field efforts, dispatching technicians to fix problems, not to find them.
- **Get started easily today.** Netrounds’ components are easily installed and interwork with the network devices already deployed in your network. In addition, Cisco NSO has a prebuilt integration module to enable full Netrounds automation.

**Deliver High-Quality Services Right the First Time**

Customers expect immediate and flawless service turn-up. This expectation creates high demands to deliver the service “right the first time.” To achieve this goal of agile, assured service creation and delivery, active testing must be an integral part of the service provisioning process.

Today’s bandwidth- and media-intensive services also require a consistently high level of quality. An inability to monitor and assure end-to-end service quality from the end-user’s perspective will lead to customer dissatisfaction and churn. Active, multilayer monitoring is required to gain real-time insights into service quality.
“CSPs will need an extremely efficient and economical operational model; a model that provides business agility, enabling CSPs to instantiate and tear down new services on demand and in near real time. Automation will make this vision a reality.”

— Anil Rao
Senior Analyst, Analysys Mason, from Automated Service Assurance Is Critical for Operationalizing NFV/SDN: Active Testing Automation Presents an Early Opportunity

Solve Current Operational Issues
Testing and monitoring from an end-user perspective using traditional, resource-focused assurance solutions is practically impossible as the connection between the network resources and the service consumed by the end-user cannot be accurately defined. Active tests across network and service layers, from the right network location, is the only way to understand the end-to-end service quality your customer is experiencing. In addition, introducing software-based active testing does not require an overhaul of your entire network and management systems or additional infrastructure investments.

Evolve with Complex and Dynamic Service Topologies
Services are now evolving towards a mix of virtual network functions in datacenters together with physical networking elements. These services are often delivered over-the-top with a high rate of change resulting from self-service portals and automation loops.

In this dynamic environment, traditional assurance solutions do not have the agility to keep up – attempting to interpret end-to-end service quality based on passive resource and infrastructure monitoring status will not be successful.

The Importance of a True Real-time View of Your Customer’s End-to-End Service
Service providers looking for winning strategies should focus on the services that customers have bought instead of infrastructure faults and performance monitoring (PM) data pulled from network resources. A comprehensive view of the end-to-end service that you are delivering requires activation testing upon delivery and continuous monitoring from your customer’s perspective.

“How do you ensure the service you are delivering is meeting the quality that the customer expects?”

— James Crawshaw
Senior Analyst, Heavy Reading

What You Get
The Cisco Orchestrated Assurance solution powered by Netrounds includes two main Netrounds components (Figure 1):

- Netrounds Control Center with relevant feature packs
- Netrounds Test Agents with active traffic-generation capabilities

Figure 1. Netrounds Components

Netrounds Control Center provides a graphical designer environment for developers to build activation testing templates and other automatable test sequences. NSO triggers these templates using the NETCONF and YANG API to achieve closed-loop automation. The Netrounds Control Center GUI environment also presents test reports and real-time key performance indicators (KPIs) of actual end-user experience through dashboards and drill-down charts.
All testing and monitoring activities are performed using traffic-generating Netrounds Test Agents remotely located at strategic locations in your network.

To automate and orchestrate testing and monitoring through Netrounds Control Center using NSO, you use a prebuilt network element driver (NED) for NSO. In addition, you can dynamically deploy Netrounds Test Agents on virtualized compute hosts by extending NSO with the Network Functions Virtualization Orchestrator (NFVO) Core Function Pack.

### Scaling and Feature Packs

A single Netrounds Test Agent can handle up to 5,000 concurrent traffic streams, and the Control Center is capable of managing up to 2,000 Test Agents and 20,000 reflectors (depending on the Test Agent license and Control Center Feature Pack).

Four separate Control Center Feature Packs, listed in Table 1, are available for ordering.

<table>
<thead>
<tr>
<th>Package</th>
<th>Description</th>
<th>Features</th>
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| **Standard**                         | Feature package in which Netrounds Test Agents perform basic networking and Internet services tests  
• Feature package intended for service activation, monitoring, and troubleshooting of any IP network, including Internet services | Stateful TCP, UDP, multisession TCP, ICMP ping, UDP echo, multicast UDP, path maximum transmission unit (MTU) discovery, DNS, HTTP, and VoIP  
• The license also includes packet inspection and Speedtest  |
| **Professional**                     | Feature package in which Netrounds Test Agents perform advanced tests and measurements  
• Feature package intended for advanced service activation and troubleshooting, primarily of VPNs (both Layer 2 and Layer 3 VPNs) | TCP (RFC 6349), quality of service (QoS) profiling, Differentiated Services Code Point (DSCP) mapping, Y.1564, and Layer 2 and Layer 3 transparency tests  
• The license also includes all features from the Standard feature package  |
| **Service Performance and Monitoring: TV** | Feature package in which Netrounds Test Agents join IP television (IPTV) or OTT video channels  
• Feature package intended for service activation, monitoring, and troubleshooting of video services | IPTV MPEG, IPTV MPEG Inline, OTT (HLS), IGMP channel zapping times  |
| **Service Performance and Monitoring: Two-Way Active Measurement Protocol (TWAMP) and Y.1731** | Feature package in which Netrounds Test Agents generate test and measurement traffic to TWAMP and Y.1731 reflectors  
• Feature package intended for service activation, monitoring, and troubleshooting of mobile backhaul and IP core and aggregation networks as well as VPNs | TWAMP, Y.1731 Loopback/802.1ag Ethernet Loopback, Y.1731 Delay Measurement, Y.1731 Synthetic Loss Measurement  |
Netrounds Control Center Main Features

Netrounds Control Center offers the following main features:

• Dynamic Test Agent inventory (Figure 2)

  - Test Agents automatically discover and register in Netrounds Control Center upon network connection.
  - Test Agents appear as resources in the Control Center inventory after they are launched by Cisco ESC or after they are connected physically to the network.
  - Test Agents can be tagged for simple grouping and structuring.
  - Test Agent interfaces can be configured remotely.

• GUI for designing automatable test templates (Figure 3)

  - Intuitively build templates for activation tests or continuous monitoring by combining features from the comprehensive Test Agent toolbox.
  - NSO triggers stored templates through the NETCONF and YANG API.
  - Build custom testing scenarios using point-to-point or fully meshed topologies, with configurable traffic-flow parameters in both upstream and downstream directions.

• Real-time visualization of service-level agreement (SLA) compliance (Figure 4)

  - View aggregated results from a large number of distributed active measurements, and drill down to see individual measurements.
  - See errored-second calculations and visualization and SLA compliance indicators.
  - See historical views, with the time span adjustable from the last 15 minutes to years backward in time.

• Test reports and alarms

  - View comprehensive reports from service activation tests.
  - Alarm triggers use SNMP traps and email messages as well as NETCONF notifications.
  - Alarms display multiple severity levels: Critical, Major, Minor, and Warning.

Figure 2. Dynamic Test Agent Inventory

Figure 3. GUI for Designing Automatable Test Templates

Figure 4. Real-Time Visualization of SLA Compliance
Netrounds Test Agent Main Features

Netrounds Test Agents are software based and run as virtual machines on common hypervisors or directly on x86 bare-metal devices, such as Cisco Unified Computing System™ (Cisco UCS®) servers. For full automation, NSO can dynamically deploy Test Agents in these virtual environments at the time of service configuration.

Test Agents actively generate authentic traffic and analyze detailed, real-time measurements across multiple applications, services, and interfaces. Test Agents support concurrent measurement of network performance (UDP, TCP, Y.1731, and TWAMP), IPTV and OTT video, and the Internet (HTTP, ping, and Speedtest), as well as VoIP and Session Initiation Protocol (SIP) telephony.

All Test Agents are centrally managed and updated from the Netrounds Control Center using an automated call-home mechanism.

Integration with Cisco NSO: Simplified Example

Netrounds integration with NSO is simple using the prebuilt NETCONF and YANG driver to the Netrounds Control Center (Figure 5).

The example starts with NSO receiving a service order (1). NSO then configures the devices and enables built-in test functions such as TWAMP and Y.1731 (2). NSO could optionally deploy Test Agents as Virtual Test Agent (vTA) virtual network functions (VNFs). After the service is provisioned, NSO asks the Netrounds Control Center to perform an activation test to verify that the service is working (3). This is done by using pre-deployed and shared Netrounds Test Agents sending active traffic and reporting test metrics back to the Netrounds Control Center (4), which provides a pass-or-fail outcome of the activation test to NSO (5). A passed test is required to hand over the service to the customer, whereas a failed test would require reconfiguration. A comprehensive report of the test results (6) and a real-time visualization of service quality (7) are made available in the Netrounds Control Center dashboard. As a next step, NSO could automatically trigger the Virtual Test Agents (vTAs) to begin active monitoring of the end-to-end service following successful service activation.

Table 2 provides some common use cases for the Netrounds and NSO solution.

<table>
<thead>
<tr>
<th>Use Case</th>
<th>Description</th>
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| Fixed network operator | • For enterprise VPNs:  
  - Verify that the service is delivered correctly so customer can use the service immediately.  
  - Continuously monitor the service throughout its lifetime.  
  - Achieve rapid fault localization.  
  - For IP and Multiprotocol Label Switching (MPLS) core and aggregation networks:  
  - Help continuously ensure that the network meets customer expectations  
  - Monitor services such as IPTV, Internet, and voice.  
  - Monitor networks, such as IP, MPLS, and Ethernet networks.  
  - Use advanced tools to troubleshoot and isolate faults. |
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<tr>
<th>Use Case</th>
<th>Description</th>
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<tbody>
<tr>
<td><strong>Mobile network operator</strong></td>
<td>• For mobile backhaul networks:</td>
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<tr>
<td></td>
<td>- Verify mobile backhaul deliveries and optimal network capabilities.</td>
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<tr>
<td></td>
<td>- Help continuously ensure that the mobile backhaul network meets customer expectations for mobile service quality.</td>
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<tr>
<td></td>
<td>- Monitor networks, such as IP, MPLS, and Ethernet networks.</td>
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<tr>
<td></td>
<td>- Use advanced tools to troubleshoot and isolate faults in the network.</td>
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<tr>
<td><strong>Carrier network operator</strong></td>
<td>• For interconnections between operator networks:</td>
</tr>
<tr>
<td></td>
<td>- Verify that the service is delivered correctly so the customer can use the service immediately.</td>
</tr>
<tr>
<td></td>
<td>- Monitor services such as IP transit, Cisco IoT Cloud Connect, Ethernet services, and roaming services.</td>
</tr>
<tr>
<td></td>
<td>- Monitor networks, such as IP, MPLS, and Ethernet networks.</td>
</tr>
<tr>
<td></td>
<td>- Use advanced tools to troubleshoot and isolate faults.</td>
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<tr>
<td><strong>Residential service provider</strong></td>
<td>• For triple-play services:</td>
</tr>
<tr>
<td></td>
<td>- Verify that the service is delivered correctly so the customer can use the service immediately.</td>
</tr>
<tr>
<td></td>
<td>- Continuously monitor services, such as IPTV, VoIP, and Internet, throughout their lifetime.</td>
</tr>
<tr>
<td></td>
<td>- Monitor networks, such as IP, MPLS, and Ethernet networks.</td>
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<td>- Achieve rapid fault localization.</td>
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<table>
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<tr>
<th>Use Case</th>
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<tbody>
<tr>
<td><strong>Any customer</strong></td>
<td>• For any customer with a data network:</td>
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<td></td>
<td>- Verify that the service is delivered correctly so the customer can use the service immediately.</td>
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<td></td>
<td>- Continuously monitor the services and network throughout its lifetime.</td>
</tr>
<tr>
<td></td>
<td>- Use advanced tools to troubleshoot and isolate faults in the network.</td>
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<td></td>
<td>- Perform advanced network audits.</td>
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“Integrating the Netrounds active testing and monitoring component with a proven orchestration system will allow increased agility for faster delivery of assured services and to take advantage of new business opportunities more quickly. Automatically verifying delivery of service quality as expected by customers will be of critical importance for staying competitive today and in the dynamic, software-defined environment of tomorrow.”

— **Patrick Waldemar**
Vice President and Head of Technology, Telenor Research
Automation, Agility, and Assured Network Deliveries

TM Forum’s “Orchestration: Get Ready for the Platform Revolution” study reported that the main reason that service providers choose to automate their networks through orchestration is to increase agility. Seventy-five percent of all survey respondents ranked the capability to deliver services to customers more quickly in their top three reasons.

In a recent Netrounds customer survey, Netrounds’ service provider users reported that:

- They can introduce new, assured services at least 20 percent faster using Netrounds automated service activation testing than using manual methods.
- Customer frustration has decreased approximately 25 percent since their organization began using Netrounds.

Not only is the delivery of assured network services improved. Netrounds users also report that the number-one process significantly improved by using Netrounds is troubleshooting.

- Eighty-four percent of respondents report that Netrounds helps them resolve network issues faster.
- On average, Netrounds users can find and fix network issues 32 percent faster using Netrounds than using other troubleshooting tools and methods.

Service providers use Netrounds’ remote testing capabilities and automate advanced test scenarios through NSO, further reducing time to delivery of assured network services and improving visibility into network health for proactive problem resolution.

Global System Integrator Helps Ensure Diverse VPN Deliveries with a Single, Flexible Solution

Challenge: A global system integrator requires a versatile service activation testing solution to help ensure that the varied VPN services that the integrator is delivering meet the service quality SLAs and metrics promised.

Today, the integrator is delivering three types of VPN services:

- Traditional MPLS-based Layer 3 VPN services on traditional customer-premises equipment (CPE)
- Software-defined WAN (SD-WAN) Layer 3 VPNs on container or standard x86 CPE
- Orchestrated SD-WAN or MPLS-based Layer 3 virtual VPN services on virtual CPE (vCPE)

Solution: The global system integrator chose Netrounds to tackle verification of VPN service deliveries for all these environments: physical, hybrid, orchestrated and virtual networks. The system integrator:

- Verified each VPN delivery and created birth certificates prior to handing over services to customers
- Used active monitoring from Netrounds when managing customer networks after initial delivery, allowing the integrator to receive alarms if service quality degraded and to find and fix problems proactively

The Cisco Network Services Orchestrator Advantage

An important factor behind Cisco’s leadership in the NFV management and organization (MANO) space is Cisco NSO, the most advanced and flexible service orchestration platform in the industry. Enabled by Tail-f®, NSO provides end-to-end lifecycle service automation to design and deliver high-quality services faster and more easily. Leading service providers are increasingly building on the advantages of NSO to provision, manage, and help ensure services across their entire networks.

What makes Cisco NSO stand out?

- **NSO is entirely model driven.** NSO lets you create and change services using standardized models without the need for time-consuming custom coding or service disruption. It also solves the challenge of massive scalability. You gain the agility you need to bring services to market ahead of the competition.
- **NSO is unique in that it works in multivendor environments and technology stacks, delivering consistent performance across a broad range of environments.** We have the broadest multivendor support in the industry and are constantly adding new vendor drivers to the platform. Our NSO solution works with today’s traditional network challenges, such as Layer 2 and 3 VPN provisioning, as well as next-generation networking based on NFV and software-defined networks (SDN).
• NSO offers full lifecycle management. It supports creation, updating, and deletion of network services.

• NSO provides transactional integrity. This feature helps ensure fail-safe operations based on a real-time view of the network. If something happens, for instance, if a device fails to update, NSO helps ensure that the network manager has a reliable rollback path and can meet even the most stringent SLAs.

• NSO is a fully proven solution. NSO has been in operation for 10 years, running at scale in a diverse set of networks. It is used globally by more than 100 customers worldwide, including major Tier 1 service providers, large enterprises, smaller cloud providers, and enterprises in the financial services segment.

Why Cisco and Netrounds?
Cisco is committed to enabling new business models and disrupting old ones, combining the flexibility of programmable networks with intelligent software.

Netrounds, a leading provider of active, programmable test and service monitoring solutions for communications service providers (CSPs), is now a member of the Cisco SolutionsPlus Program. With this membership, CSPs worldwide can approach Cisco and approved Cisco partners to purchase Netrounds as a validated solution and addition to Cisco NSO. This capability allows CSPs to incorporate automated activation testing as an integral part of the NSO service activation process and subsequently monitor services in an active manner following successful activation, for improved customer experience.

Through the integration of Netrounds and NSO, telecoms operators and CSPs can:

• Actively verify that services work after they are provisioned by NSO by generating real-world traffic to help ensure that services are delivered correctly before end users are exposed to a service and delivering birth certificates to key stakeholders.

• Help ensure that provisioned services continue to work over their lifetime by using active measurements for enhanced service quality insights from the end-users’ view.

• Resolve problems faster by using remote testing capabilities to automate advanced test scenarios through NSO and to test across layers, services, and domains.

• Reduce the need for manual and field test efforts by automating test sequences and by using remote troubleshooting, dispatching technicians to fix problems, not to find them.

“This proven integration between Netrounds and Cisco NSO allows our customers to introduce automated assurance into their networks with confidence and ease,” said Mats Nordlund, CEO and co-founder of Netrounds. “Adding Netrounds to the Cisco SolutionPlus Program and enabling our customers to purchase Netrounds directly from the Cisco price list further adds to that ease of deployment.”

“Partnering with Netrounds will allow our customers to achieve greater automation and assured agility of network services, allowing them to drive revenue growth and reduce operational concerns when deploying new services,” said Charles Stucki, vice president and general manager of the Cisco NFV Business Unit. “Cisco’s NSO technology is a key NFV solution that can help enable faster and more flexible delivery of existing and new services. By combining Netrounds with NSO, customers can manage and assure these services throughout the entire service lifecycle in a completely automated way.”

Cisco Capital Financing to Help You Achieve Your Objectives
Cisco Capital® financing can help you acquire the technology you need to achieve your objectives and stay competitive. We can help you reduce capital expenditures (CapEx), accelerate your growth, and optimize your investment dollars and ROI. Cisco Capital financing gives you flexibility in acquiring hardware, software, services, and complementary third-party equipment. And there’s just one predictable payment. Cisco Capital financing is available in more than 100 countries. Learn more.

Help Ensure That Your Agile Network Services Reach Their Full Revenue-Generating Potential
Implement the Cisco Orchestrated Assurance solution today and help ensure that you deliver assured network services to your customers the right way the first time—and every time. For more information or to request a demonstration of Cisco Orchestrated Assurance powered by Netrounds and Cisco Network Services Orchestrator, visit www.cisco.com/go/nso.