Miercom

Lab Testing Summary Report

June 2010

Report 100603

Product Category:

Session Border Controller

Vendor Tested:

Sonus NETWORKS

Product Tested:

NBS9000

Miercom PERFORMANCE VERIFIED™

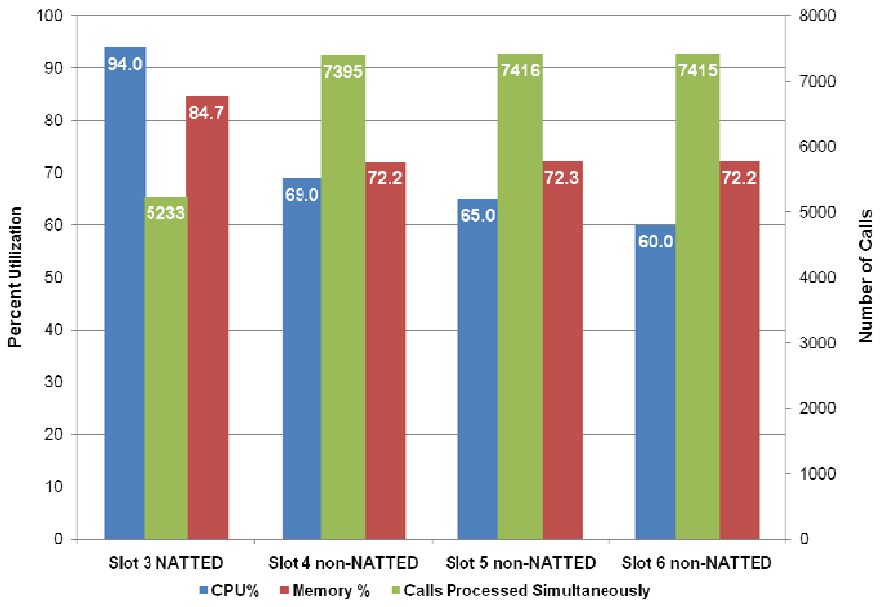
Key findings and conclusions:

- **NBS9000 successfully registered 300,000 user authenticated NATTED IADs in 22 minutes at a rate of 232 registrations per second during a simulated metro area outage and recovery scenario**
- **Sonus Network Border Switch maintains call processing of over 21,500 simultaneous calls while under attack from spoofed IPs**
- **NBS9000 scalability was proven with more than 27,000 simultaneous calls at 119 cps, 300,000 IADs**

Sonus Networks engaged Miercom to evaluate the call handling ability of its Network Border Switch (NBS) 9000 under specific adverse use case scenarios. The NBS9000 is based on the Sonus GSX9000HD platform. NBS9000 is a carrier-class switch for Voice over IP networks. Intended for telco installations, the NBS9000 uses 48VDC redundant inputs and occupies a 16U rack space. Integration of security, session management, call control, quality of service, and advanced media services on a single, scalable platform provides a cost-effective switching solution for carriers.

We examined the performance of the NBS9000 in a variety of scenarios and were pleased with the overall results. Real-world scenarios were simulated, including registration avalanches following a power outage, Denial of Service (DoS) attacks coming from both inside and outside the network. The ability of the NBS9000 to *(continued on next page)*

Figure 1: Maximum Capacity for Tested NBS Configuration



Source: Miercom, May 2010

The per card maximum calls and CPU and memory utilization are shown above. Notice the reversal of values for calls vs. utilization for NATTED and non-NATTED IADs. More resources are required for NATTED IADs. The CPU at 94% was maxed out with 5,233 simultaneous calls, while non-NATTED IADs could process up to 7,416 with 65% CPU.

register all Integrated Access Devices (IADs) and successfully process calls under load was monitored and the results were recorded. In addition, the maximum capacity of the as-tested configuration of the NBS9000 was tested using both NATTED and non-NATTED IADs.

A NATTED IAD uses a masking method to hide one or more private IP addresses behind a single public IP address. All outgoing traffic from a NATTED device appears to originate from the single public IP address. As such, NATTED IADs use a varying UDP port strategy to hide behind the NAT device like a wireless router. More resources are used due to high refresh rate to maintain open pin-holes in the NAT device to allow signaling and media to pass through it. This is primarily found in SOHO business VoIP phone implementations.

The masking requires more resources and affects call volume and utilization. See *Figure 1* on page 1 for the differences in CPU and memory utilization on NATTED and non-NATTED IADs and the calls that were completed.

Registration Avalanche with NATTED IADs

A registration avalanche can occur when a large number of users attempts to register simultaneously. Typically this would occur following an outage in a metro area.

To simulate this scenario, we configured the Empirix Hammer Edge network test system to register 300,000 authenticated IADs at a rate of 200 registrations per second (rps) to each of the four blades in the NBS9000. At the same time, we directed 10 calls per second (cps) to each of the four blades. The time to register all IADs successfully was recorded, as well as the simultaneous registration rate and call rate. CPU and memory usage on the NBS9000 were monitored, as well as the ICM queue and alarms triggered during the test.

The NBS9000 was configured to rate-limit new registrations to 60 registrations per second via policers, which are features in the firmware that control the traffic rate to preserve Quality of Service (QoS). The CPU usage threshold was set to not exceed 93%.

The GSX9000HD registered 300,000 IADs (75,000 per blade) in 22 minutes, and recorded a peak registration rate of 232rps. There was a peak simultaneous call rate of 40 calls per second. CPU utilization was 80% or less per blade during the test, and memory utilization per blade was 68%.

Network processor based policers were set up in the switch to help control the flow of traffic. Dark Gray policers handled the new registrations of IADs, while the Light Gray policers controlled the call admission and registration refresh. Light Gray policers decide what calls to accept for QoS based on predefined criteria.

All of the policers work together to provide soft protection of the switch from floods by regulating registration and call admission rates.

Alarms were observed on the NBS9000 for the Dark Gray and VLAN policers after all the IADs had successfully been registered, but before the maximum call rate was achieved. These alarms indicated congestion was occurring during the test.

Baseline Load with Attacks

This test simulates an IP PBX environment. Attacks directed towards the network and the switch have the potential of causing registrations and calls to be dropped, resulting in a Denial of Service. These types of attacks can take the form of registration INVITE floods emanating from invalid peers, and INVITE floods from spoofed valid peers.

The ability of the NBS9000 to mitigate these attacks and protect the current calls by using Dark Gray, Light Gray, and IAD Call Access Control (CAC) policing was measured in this test.

We established a baseline load, using the Hammer to drive 20 calls per second to each blade on the NBS9000 to achieve a target of 5,000 stable simultaneous calls. CPU utilization was recorded between 35 to 47%, and memory utilization was 44 to 48% per blade.

Attack traffic was then directed at the NBS9000 in the form of registration and call traffic floods coming from invalid peers or unauthenticated IADs. At the same time, call flood traffic was directed at the NBS9000 from a spoofed IP address. This simulated a valid peer attack.

The NBS9000 continued to successfully process calls at the same rate, 20cps per blade, while the attacks were ongoing, ultimately reaching the target of 5,400 simultaneous calls per blade. This figure exceeded the original call target due to the parameters specified on the NBS for call duration, call admission rate, and maximum CPU threshold.

Memory utilization on the NBS9000 during the test increased to 62% across the four blades in use,

while CPU utilization increased slightly between 39 to 48% per blade.

Alarms were observed for registration internal failures caused by the registration floods, and softswitch route failures to multiple called numbers. These route failures were the result of the call flood attacks being dropped by the Sonus NBS9000.

Registration and Call Capacity

A stress test was conducted to determine the capacity of the NBS9000 in its as-tested configuration of four active PNS41 TG blades and four standby PNS41 TG blades. One blade was configured with 75,000 IADs being NATTED. This is one quarter of the network IADs. The remaining 3 blades were configured with 225,000 non-NATTED IADs for a total of 300,000.

To establish the baseline rate, the NBS9000 NATTED IAD registration refresh interval was 30 seconds, and the non-NATTED IAD refresh interval was set to 1 hour, the default values in the switch. The call duration was tuned to 3 minutes for NATTED IADs and 5 minutes for non-NATTED IADs. Maximum CPU utilization on the NBS9000 was set to 93%, and the registration rate was limited to 60 registrations per second.

The Hammer was configured to send 5 calls per second (cps) for each NATTED IAD, and 10 calls per second for each non-NATTED IAD, with the calls placed simultaneously to all IADs. This is seen by the NBS9000 as 10cps and 20cps respectively, as the calls traverse the NBS9000 twice on their way from caller to call receiver.

The Hammer sent 15rps for each NATTED IAD and non-NATTED IAD (30rps for each type of IAD) to account for traversing the NBS9000 to the registrar and back.

In this configuration, the Sonus NBS9000 registered all 300,000 IADs at a maximum rate of 123rps, and achieved a call rate of 72cps. Maximum simultaneous calls were 1,800 for NATTED IADs and 18,000 for six blades for non-NATTED IADs, for a total of 19,800 stable simultaneous calls.

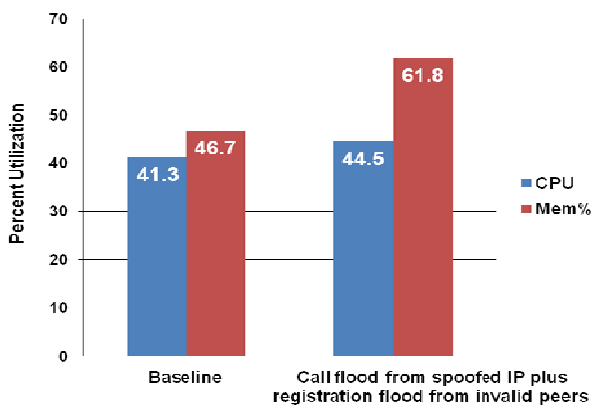
Memory utilization was 67% for the NATTED IAD blade and 65% for non-NATTED IADs. CPU utilization was 93% for NATTED, and between 58 to 61% for non-NATTED IAD blades. No alarms were observed during this base lining process.

We increased the load on the NBS by ramping up the Hammer generated call rate. For NATTED IADs, the call rate was increased to 28cps, and for non-NATTED to 30cps. At this load, the NBS was processing new calls at a rate of 119cps.

Total call load for the NBS9000 was 27,459 stable calls. Breaking down the individual blade performance, with CPU utilization of 94% and memory usage at 85%, the NATTED blade recorded a maximum stable call load of 5,233 calls. The remaining blades handling non-NATTED IADs recorded maximum stable calls loads of roughly 7,400 calls each, with CPU usage ranging from 60 to 69%, and memory usage of 72% per blade.

The NBS9000 successfully registered all IADs, and handled the call load applied, maintaining simultaneous calls whether under normal load, or during a high load condition. Various alarms were triggered during the test on the NBS that indicated congestion was occurring as we continued to stress the switch. However the target call capacity was not affected. A successful blade failover was observed which demonstrates the telco grade high availability of the architecture of the switch.

Figure 2: CPU and Memory Usage with Baseline and Attack Traffic



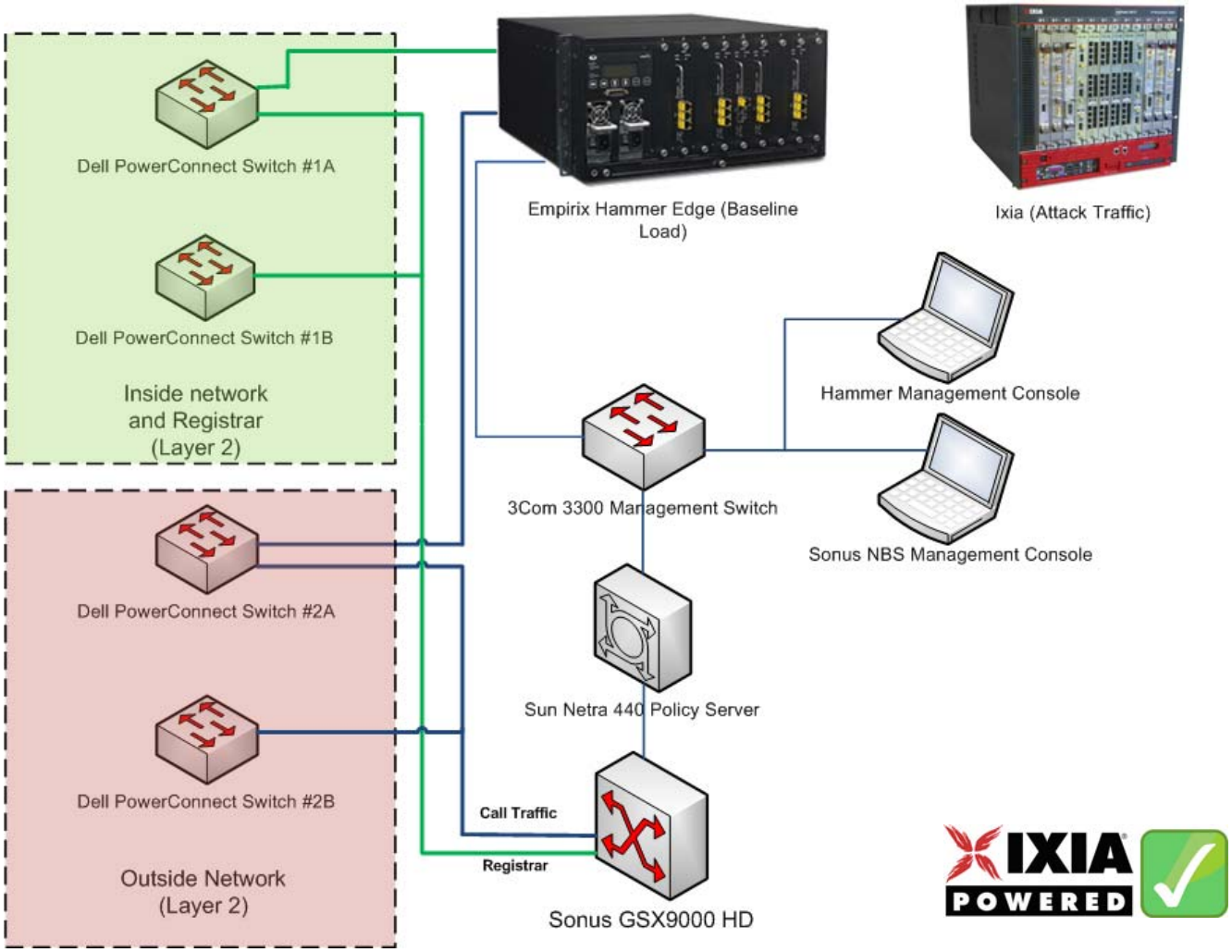
Source: Miercom, May 2010

The baseline percentages show the CPU and memory usage without attack traffic. Notice the 3.2 to 15.1% increase when attack traffic (registration and call floods) was applied.

Bottom Line

The Sonus Networks NBS9000 gives carrier-class performance for VoIP networks. The switch was able to scale 28% higher than normal call capacity while maintaining call processing. NBS was able to successfully register 300,000 IADs in a mixed NATTED and non-NATTED environment. It was able to maintain processing of over 21,500 simultaneous calls while under attack in a simulated IP PBX environment, proving the resiliency of its architecture. After an outage, the NBS9000 was able to successfully recover and register IADs.

Test Bed Diagram



How We Did It

The Sonus NBS9000 was configured with two management blades, 4 active PNS41 TG blades, and 4 standby PNS41 TG blades for 1:1 redundancy. Configuration for the NBS9000 was performed using a Sun Netra 440 Policy Server.

Registration and call traffic was routed between the load generation equipment and the NBS9000 via four Dell PowerConnect 24 port optical switches, arranged in two primary-secondary pairs for redundancy and to provide additional port capacity if needed. One pair served as the inside network, which includes the registrar, while the other pair served as the outside network, handling call traffic.

Baseline registration and call traffic was delivered to the NBS9000 using an Empirix Hammer Edge network traffic generator. Attack traffic in the form of floods from invalid peers and spoofed IPs was delivered using an Ixia Optixia XM12 chassis outfitted with Acceleron Load Modules.

Management console access for the Hammer Edge and for the NBS9000 was provided using a 3Com 3300 switch.

We used Ixia's (www.ixiacom.com) IxLoad to generate the SIP call floods to the Sonus NBS9000. IxLoad is a scalable solution for testing converged multiplay services and application delivery platforms. IxLoad emulates data, voice, and video subscribers and associated protocols for performance testing.

The tests in this report are intended to be reproducible for customers who wish to recreate them with the appropriate test and measurement equipment. Contact reviews@miercom.com for details on the configurations applied to the System Under Test and test tools used in this evaluation. Miercom recommends customers conduct their own needs analysis study and test specifically for the expected environment for product deployment before making a product selection.

Miercom Performance Verified

Lab testing of the Sonus Networks NBS9000 verified the carrier class performance of this session border controller for VoIP traffic.

Hands-on testing proves that the NBS9000 protects QoS in the face of attack traffic, scales successfully to 75,000 IADs per blade, and delivers high availability and rapid recovery from network outages.

Sonus Networks NBS9000 has earned the Miercom Performance Verified Certification.

Network Border Switch 9000

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