Security Assessment Report
OpenScape Voice V9

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Miercom

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Contents

1 - Executive Summary

Unify Communications engaged Miercom to perform a thorough, independent security assessment of its latest OpenScape Voice V9, a stand-alone software-based IP PBX. The testing evaluated the inherent security features and countermeasures of OpenScape Voice, without any additional external security gateways or firewalls between the OpenScape Voice and the attack station.

The purpose of the testing was to uncover any evident security vulnerabilities that a scurrilous insider assailant could exploit to disrupt the proper, normal operation of OpenScape Voice.

All exploits on the OpenScape products were launched from an inside source, on the internal network, with no other security protection between the assailant and the hardened OpenScape system. Tests included a broad and complex set of exploits launched by security tools and scripts to stress and penetrate the OpenScape Voice system.

Overall, the OpenScape products proved more secure than most comparable products we have tested to date, and exhibited effective resilience through multiple batteries of exploit and penetration tests. Our audit resulted in only a few, relatively minor security notes; there was no immediate or severe threat or vulnerability uncovered for a properly configured OpenScape Voice V9 system.

The internal countermeasures built into the firewall of OpenScape Voice were all enabled for testing. The approach and methodology utilized in these tests are based on knowledge that Miercom, in collaboration with leading security experts, has amassed from years of working in VoIP pre- and post-deployment site surveys, as well as security assessments.

This document provides an overview of the results and details of the more noteworthy exploit attempts that were conducted. In a few cases details have been intentionally omitted, so as not to aid in any reverse-engineering of the exploits.

The OpenScape Voice products tested were configured in accordance with guidance from Unify Communications, documented in the OpenScape Voice Security Checklist, which we believe effectively enhances the resiliency of these systems.

Key Findings

- OpenScape Voice V9 fully blocked all Denial-of-Service (DoS) attacks. We delivered DoS assaults using HPING3 – including Ping of Death at up to 10,000 pings/second, along with attacks from the Spirent Studio Security (previously Mu Dynamics) and Ixia's BreakingPoint system.
- An attacker is unable to circumvent the IDS (Intrusion Detection System) by using a slow rate of traffic, or achieve access via a brute-force attack (via a false login). We applied a Hydra brute-force attack and learned that system access was solely via SSH (Secure Shell) key-based authentication, which makes penetration by brute-force password attacks impossible.
- OpenScape Voice was fully resilient to the many thousands of attacks and protocol mutations we launched against it. These were delivered using the latest security programs and in many cases Miercom-proprietary scripts.

- OpenScape Voice was fully protected against any Heartbleed vulnerability, as well as a number of very recent exploits, including GHOST, VENOM and the Bash Bug (aka Shellshock). Previous testing, reconfirmed in this audit, concluded that SIP-specific penetration attacks had no effect. Nessus confirmed OpenScape was not vulnerable to such SIP-based attacks, including mutated SIP packets.
- OpenScape Voice V9 maintained normal operation and call functionality while blocking all attempted exploits. In all cases, while attacks were underway, we were able to dial and set-up calls between HQ LAN phones, with average call set-up times about 1 second.

The test results are detailed in the following sections of this document. We were impressed with the performance of OpenScape Voice V9 in its demonstrated ability to sustain call processing functions even while undergoing malicious exploits and attacks. Miercom is pleased to present the Miercom Certified Secure award to OpenScape Voice V9.

Robert Smithers

CEO

Miercom

Summary of OpenScape Voice V9 Security Tests and Results

Category	Action, Assault, Attack	Result	See Page
Observations	General security environment	**Pass**	12
	National Vulnerability Database check	**Pass**	13
Vulnerability Scans	Metasploit penetration testing	**Pass**	14
	Nmap scan of all OpenScape Voice node interfaces	**Pass**	14
	Nmap scan of all SIP interfaces, ports and services	**Pass**	15
	Nessus scan of all IP ports	**Pass**	15
	Web vulnerability	**Pass**	15
Protocol-Mutation Attacks	ARP mutation attack	**Pass**	16
	DNS mutation attack	**Pass**	16
	ICMP mutation attack	**Pass**	17
	IPv4 mutation attacks	**Pass**	17
	SIP mutation attacks	**Pass**	18
	TCP mutation attack	**Pass**	19
	RTP mutation attack	**Pass**	19
	UDP mutation attack	**Pass**	20
DoS Attacks	IPv4 and ICMP DoS	**Pass**	21
	TCP and TCP-SYN-flood DoS	**Pass**	22
	UDP and UDP-DNS-flood DoS	**Pass**	22
	ICMP and ICMP-port-unreachable DoS	**Pass**	22
	ARP DoS	**Pass**	22
Other	Published-vulnerability attacks	**Pass**	23
	Deregistering SIP users/devices	**Pass**	23
	Brute force username/password	**Pass**	23
	Protocol Fuzzing attack	**Pass**	24
	Heartbleed SSL attack	**Pass**	24
	Ghost attack	**Pass**	24
	Venom attack	**Pass**	24
	Shellshock (Bash Bug) attack	**Pass**	25

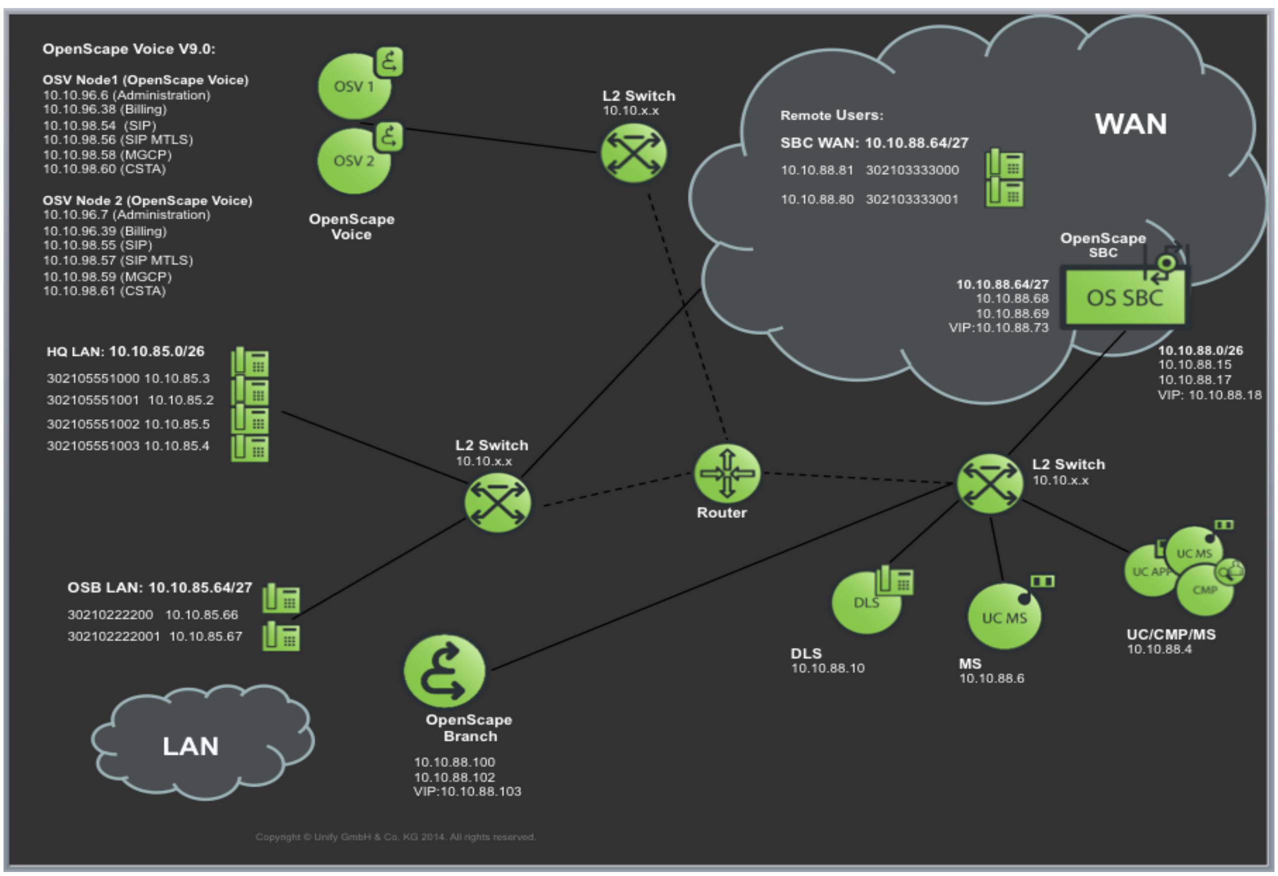
2 - OpenScape Voice V9 Test Bed

A test-bed network, depicted in the diagram below, was set up for the security testing of OpenScape Voice. The OpenScape Voice system was connected in a dual-node high availability configuration, which is more typical in a larger enterprise configuration. Such a configuration features contingency measures to maintain service availability in case an OpenScape system application fails both Voice nodes run hot and synchronized.

Normally, OpenScape servers are discrete platforms, typically with 8 GE ports in two sets of four, enabling fully-redundant network connections. In the test bed, however, the OpenScape Voice nodes ran as separate instances on the same virtualized server.

The security assessment was conducted directly from an attack source on the HQ LAN to the OpenScape Voice V9 – without any intervening security gateways, firewalls or SBC. This simulated the case where a local computer, laptop, desktop or server was compromised becoming remotely accessible, or bot-controlled, or otherwise used to launch malicious attacks against the OpenScape Voice appliance.

Figure 1: Logical Configuration of OpenScape Voice V9 Test Bed



As the test-bed diagram shows, other key nodes in the OpenScape family – OpenScape Branch and OpenScape SBC – were also included and were also tested as part of this security audit. The results for OpenScape Branch and SBC are detailed in separate reports.

The test environment included various Unify SIP phone models to confirm call processing was unaffected by individual attacks, and verification of normal call set-up time.

The CMP and DLS management stations were specifically not tested or directly attacked as part of this security audit, and neither were any media servers. The OpenScape Voice nodes do not directly handle VoIP media streams; this job is relegated to media servers. Our audit did however confirm that all management traffic was sent via TLS-encrypted tunnels, and media streams were encrypted via Secure RTP (SRTP).

3 - How We Did It

More than a dozen tools were employed in this security audit, including Miercom-proprietary attacks and scripts. The software tools used included the following:

- **Ixia's** powerful **BreakingPoint** system was used to generate attack files from its 6,000-attack database.
- **HPING3,** a command-line tool for issuance of high volumes of ICMP messages, such as for Ping Denial-of-Service (DoS) attacks.
- **Hydra**, a brute-force password checking software tool.
- **Kali Linux** 2.0 (released August 2015), an advanced penetration-testing Linux distribution, designed for network security assessments.
- **Metasploit,** popular open source vulnerability checker from Rapid 7.
- **Nessus,** v6.5.3 (November 2015), vulnerability scanner, from Tenable Network Security.
- **Nikto**, an open source Web server scanner, runs automatically by SPARTA.
- **NMAP** 7.0 included as part of Kali Linux 2.0.
- **SPARTA** 1.0.2 beta (released March 2015), a Python GUI application that augments NMAP scanning and enumeration, a "network-infrastructure penetration tool."
- **Spirent's Studio** (formerly Mu Dynamics) vulnerability analysis and attack-generation system was used extensively to produce DoS, protocol-mutation and other attack files.
- **Traffic IQ Professional** v2.2.0, from UK-based **Idappcom**, a security audit package capable of generating threat attacks, used in this testing to issue PCAP (packet capture) attack files.
- **Vega**, a Web vulnerability scanner, offered by Subgraph, a Montreal-based security software company.

In addition, the following resources and processes were employed:

- The NIST (National Institute of Standards and Technology) National Vulnerability Database for all vulnerabilities reported in SUSE products since 2014.
- The attacks were launched using Kali Linux 2.0 and Windows 7 in a virtualized environment, provided by Oracle VM Virtual Box, version 5.0.8.

All of these diverse test tools and resources, including customized proprietary test scripts, commercial vulnerability scanning tools, and open-source security assessment products were employed to conduct the tests and produce the results presented in this report.

A VoIP network infrastructure typical of a mid- to large-sized enterprise was simulated to support a conventional OpenScape Voice and OpenScape Branch deployment. The objective of the attacks launched was to compromise the dual-node OpenScape Voice V9 system and to interrupt real-time voice communications.

Initial scanning. NMAP port scanner and Nessus vulnerability scanner were used to probe each system in the OpenScape infrastructure to determine what ports were open, what services were running and what possible vulnerabilities could be exploited.

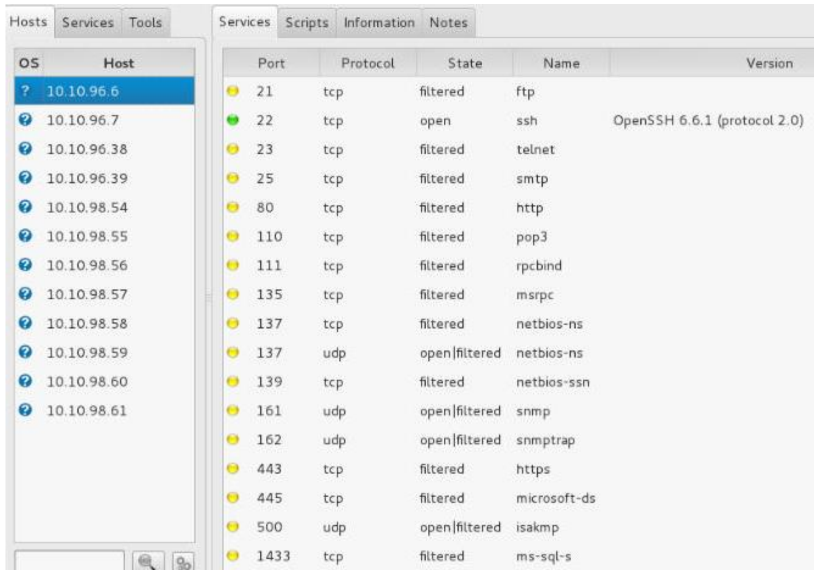
NMAP 7.0 – a part of Kali-Linux-2.0 suite – is the most robust port scanner on the market today, and provides additional functionality via customized scripts. During this assessment several additional NMAP scripts were used – including for SIP attacks, service identification and service fingerprinting.

Nessus is Tenable Network Security's premier vulnerability scanner, widely adopted by penetration testers and other security consultants.

If vulnerabilities are suspected, both scanners generate a short report detailing each vulnerable port. Once open ports have been identified and isolated, attacks are then planned for bombarding the exposed system.

The summary results of the NMAP scan of the dual-redundant OpenScape Voice R9 nodes are detailed in the following graphic.

NMAP Results: Open, Filtered and Open/Filtered Ports on OpenScape Voice Nodes



Hosts | Services | Tools — Services | Scripts | Information | Notes

OS	Host
?	10.10.96.6
	10.10.96.7
	10.10.96.38
	10.10.96.39
	10.10.98.54
	10.10.98.55
	10.10.98.56
	10.10.98.57
	10.10.98.58
	10.10.98.59
	10.10.98.60
	10.10.98.61

Port	Protocol	State	Name	Version
21	tcp	filtered	ftp	
22	tcp	open	ssh	OpenSSH 6.6.1 (protocol 2.0)
23	tcp	filtered	telnet	
25	tcp	filtered	smtp	
80	tcp	filtered	http	
110	tcp	filtered	pop3	
111	tcp	filtered	rpcbind	
135	tcp	filtered	msrpc	
137	tcp	filtered	netbios-ns	
137	udp	open|filtered	netbios-ns	
139	tcp	filtered	netbios-ssn	
161	udp	open|filtered	snmp	
162	udp	open|filtered	snmptrap	
443	tcp	filtered	https	
445	tcp	filtered	microsoft-ds	
500	udp	open|filtered	isakmp	
1433	tcp	filtered	ms-sql-s	

Host
10.10.98.60
10.10.98.61

Port	Protocol	State	Name
1434	udp	open|filtered	ms-sql-m
2049	tcp	filtered	nfs
3306	tcp	filtered	mysql
3389	tcp	filtered	ms-wbt-ser...
5060	udp	open|filtered	sip
5432	tcp	filtered	postgresql
8080	tcp	filtered	http-proxy

Key to NMAP determination per NMAP documentation:

- **Open**: An application is actively accepting TCP connections, UDP datagrams or SCTP associations on this port. An open port is an avenue for attack, and while open ports are necessary for network operations, these need to be kept to a minimum.
- **Filtered**: Usually probe messages are dropped, but some minimal information is leaked. These ports frustrate attackers because too little useful information is obtained, usually due to firewall filtering. Nmap cannot determine whether the port is open or not.
- **Open/filtered**: NMAP is unable to determine if the port is open or being filtered because the port gives no response to certain probe messages. This can be because a packet filter dropped the probe message and/or the response to it.

The security audit applied many attacks originally created by Spirent Studio Security. This is software housed on a Spirent Mu 8000 appliance. In addition, attacks were applied that were originally generated by an Ixia BreakingPoint system. These tools were used to generate protocol mutations, many known published vulnerabilities, and external attacks using test cases and custom scripts.

The attacks were saved as PCAP files and applied via an Idappcom package, Traffic IQ Professional. All of the attacks were individually directed at each IP interface of the devices under test, OpenScape Voice, OpenScape Branch and OpenScape SBC.

4 - General Security Environment

4.1 Over-Willingness to Respond to Pings

We observed throughout the audit that our attack station, directly connected on the HQ LAN of the test bed, was able to obtain ICMP responses to our Pings (ICMP requests) regularly, on almost all of the OpenScape Voice IP interfaces.

Observations and Analysis - PASS

We were initially concerned that the interfaces of OpenScape Voice were overly responsive to ICMP Requests (pings). After investigation, Unify responded that ICMP responses in a properly configured system are in fact restrictive. Generally, ICMP is only allowed for several specific ICMP types message, including echo-reply, port unreachable, time exceeded and fragmentation. Additionally, in a properly configured OS system, "ping" is allowed on the OAMP (management) interface, but not on the signaling interface.

4.2 Rate-limiting Black-list Period Reset

We observed throughout the audit that rate-limiting worked very effectively. OpenScape Voice was set to rate-limit – and then black list – any source of traffic beyond 200 pps – and 300 pps for OpenScape Branch and SBC. In addition, a rate-limited source would be black-listed for one minute.

Observations and Analysis - PASS

We believed during our on-site testing that the blacklist back-off time (the time that Snort would blacklist a station that exceeded the packet-per-second (pps) threshold – a primary defense against Denial-of-Service, or DoS, attacks) was one minute. We noticed that our attack station was able to issue pings, and receive responses, shortly after we had concluded a DoS attack, and suspected that the blacklist timeout was not working properly.

On investigation, we learned that the blacklist blocking period was just 10 seconds, not one minute. With that in mind, we can conclude that our attempt to ping interfaces after an overload attack – a test of the rate-limiting defense – was likely not done within the short 10-second blacklist back-off time.

4.3 Possible Attack That Could Not Test*ed*

In planning our attack regimen, we devised one assault that we believe may have been successful: an exploit of the OpenScape white-list feature. Since certain key nodes are automatically white-listed during the OpenScape installation process, they are not rate-limited, not matter how much traffic they generate.

The attack we formulated was to impersonate the second OpenScape Voice node and bombard the primary OpenScape node with high volumes of disruptive traffic (i.e., the Ping of death). If possible we may have sent aliased traffic in the other direction as well, impersonating the primary OpenScape Voice

Normally, for optimum redundancy, the dual OpenScape Voice nodes, both hot and active at the same time, would be IP-network connected on different servers, in different racks and on different power supplies, possibly even in different buildings but still connected by 1+ Gbps links. The link between redundant OpenScape nodes would normally be dedicated to their inter-communication. Still, if on the same switched Layer-2 IP network, we believe this assault would be possible and may even have succeeded in disrupting normal OpenScape operations.

However, we learned that, in the test bed, both OpenScape nodes were running on the same server, and so communications between them was not exposed to the network. Since traffic between the nodes did not traverse the network, as it normally would, this attack could not be promulgated in the test bed environment. We recommend that Unify consider this, or similar attacks that exploit the always white-listed feature.

4.4 National Vulnerability Database Check

The list of packages included in OpenScape Voice, Branch and SBC was checked against the NIST (U.S. National Institute of Standards and Technology) National Vulnerability Database, for all vulnerabilities reported in SUSE products since 2014.

Observations and Analysis - PASS

We confirmed that Unify is not shipping any vulnerable software packages in any of the OpenScape products we tested.

5 - Vulnerability Scans

5.1 Metasploit Penetration Testing

Description

The Metasploit Project is an open-source computer-security project that provides information about security vulnerabilities, which aids in penetration testing and IDS (intrusion detection system) signature development. One of its well-known sub-projects is the Metasploit Framework, a tool for developing and executing exploit code against a remote target computer. Via Metasploit, 493 discrete attacks were applied. All of these yielded negative results in this security audit.

OpenScape Voice V9 should not be compromised on any level.

Observations and Analysis - PASS

OpenScape Voice deflected or thwarted 100 percent of the penetration attempts on all attempted attack vectors. We were unable to gather any information or detect any vulnerabilities that would help successfully penetrating the server. The Nmap report revealed that the OpenScape Voice billing interface had port 22 or SSH (secure shell) open.

The primary filtered ports were 22, 23, 53, 443, 2427, 5060, and 5061. Penetration attempts were made on all of these ports to determine if a common exploit was not properly addressed. A total of 493 penetration attacks were attempted on all interfaces combined. No attempts succeeded.

5.2 Nmap Scan against All OpenScape Voice Node Interfaces

Description

An Nmap scan was conducted against all of the OpenScape Voice Node interfaces to find port vulnerabilities.

Observations and Analysis - PASS

The Nmap scan revealed that OpenScape Voice node interfaces had ports 22 and 443, as well as ports 23, 53, 2427, 5060, and 5061 filtered, but responsive. Port 22, or SSH is used for secure communication between two network devices. SSH uses an encrypted public-key encryption channel. In this topology, the SSH port on the nodal interfaces may be used for modifying or viewing configurations on the server from a remote location. It is highly unlikely that this open SSH port could be used as an attack entry point. Nor is the open SSH port susceptible to eavesdropping, since the communication channel is encrypted.

All other ports were tested rigorously. Port 443 is used for SSL (secure socket layer) communication, and ports 5060 and 5061 are SIP signaling interfaces – which were secured using TLS (transport layer security) and authenticated users only. Ports 22, 443, 5060 and 5061 were also operating openly, but successfully filtered all attempts to fingerprint the services running behind them.

5.3 Nmap Scan against all SIP Interfaces, Ports and Services

Description

An Nmap scan was performed on the OpenScape SIP interfaces, ports and services to find vulnerable ports.

Observations and Analysis - PASS

The Nmap software tool could not identify any accessible or open ports. We therefore conclude that the SIP signaling interface on OpenScape Voice V9 is secure. Ports 5060 and 5061 were filtered appropriately, meaning that only authenticated users could communicate to this device over TLS encrypted tunnels.

5.4 Nessus Vulnerability Scan against OpenScape Voice

Preliminary port scans were performed on each system within the scope of the security testing. The most common services running included HTTPS (443), SSH (22) and SIP (5060, 5061). Each service was fingerprinted for specific versions in use and for vulnerability mapping.

Observations and Analysis - PASS

The OpenScape Voice system did not yield any results in response to attempts to obtain the specific version of these services. The operating system was identified as Linux, but we were unable to successfully identify the distribution and kernel version, which were protected. This is an important safeguard, since many attacks are effective only against a specific Linux operating system version or service.

5.5 Web Vulnerability

Several scans were run specifically to detect vulnerabilities in Web applications in all the OpenScape Voice, Branch and SBC nodes with a Web interface available supporting HTTPS over port 443. One scan used the Burp Suite for proxy analysis of the Web application. The Web Application scan settings within Nessus and the Vega vulnerability scanner were also applied.

Observations and Analysis -PASS

The OpenScape Voice system did not yield any results in response to any of the scan attempts to probe the Web application and services. Specifically, the scans revealed that OpenScape Voice did not have the Apache Web server enabled on Port 443.

6 - Protocol-Mutation Attacks

The protocol-mutation attacks used in this security assessment were created using Spirent Studio Security. The attacks tested for vulnerabilities in OpenScape Voice's protocol implementations, looking for fault responses that might be exploited. The Spirent mutation engine delivers highly specific test cases that are built based on the state, structure and semantics of protocols, as well inter-dependencies with other protocols.

Protocol-mutation attacks incorporate deviations from the expected operation of stateful protocol implementations. Secure and robust targets should handle mutated-protocol packets by dropping them. However, a system with protocol-implementation flaws would respond abnormally, revealing a vector for a more malicious attack.

6.1 ARP Protocol-Mutation Attack

Description

The Address Resolution Protocol (ARP) is a basic, low-level, state-based protocol used to resolve a device's Layer-3 IP address with its associated MAC Layer-2 address. The Mutated-ARP attack, generated from the Spirent Studio system, was sent at high volume triggering rate limiting and then at below-rate-limit rates under 200 pps for OpenScape Voice.

The test was set up to attack at OpenScape Voice interfaces using permutations of ARP request and reply messages.

Observations and Analysis - PASS

The OpenScape Voice completely blocked the attempted attack, launched against every IP address of each OpenScape Voice node individually. OpenScape Voice completely rejected this attack. No faults were reported. We confirmed that the Mutated-ARP attack had no effect on call set-up between phones within the same HQ LAN within the 1-second normal time frame, and all call features during the attack attempts remained fully operational.

6.2 DNS Protocol-Mutation Attack

Description

The Domain Name Service (DNS) is a key state-based IP protocol in which, normally, devices query a Domain Name Server to learn a device's Layer-3 IP address. The Mutated-DNS attack, generated from the Spirent Studio system, was sent at high volume triggering rate limiting and at below-the-rate-limit rates under 200 pps for OpenScape Voice.

The test was set up to attack at OpenScape Voice interfaces using permutations of the dozens of different DNS messages. The OpenScape Voice should completely block the attempted attack.

Observations and Analysis - PASS

No faults were reported, and we confirmed that the Mutated-DNS attack, launched against every IP address of each OpenScape Voice node individually, had no effect on call set-up within the 1-second normal time frame. OpenScape Voice completely rejected all these attacks. No vulnerabilities in OpenScape Voice were detected and all call features during the attack attempts remained fully operational.

6.3 ICMP Protocol-Mutation Attack

Description

This attack was also generated by Spirent Studio Security from its suite of proprietary protocol-mutation tools. ICMP, essentially a ping, is deployed universally in all IP-based networks. Its main purpose is to monitor the status of a requested service, host or router and determine its availability and connectivity access. It can also be used as a diagnostic or network tracer tool. IP addressing is crucial to ICMP's proper operation, and any corruption of IP address could cause loss of network connectivity, or even failure of the target system.

The test is configured to attack the OpenScape Voice interfaces using ICMPv4 echo requests pings and fragmented mutated echo requests. OpenScape Voice should completely block the attempted attacks and normal operations should continue.

Observations and Analysis - PASS

All attacks were rejected successfully and no faults were reported. OpenScape Voice dropped all mutated packets and did not issue any error messages as a result. No vulnerabilities in the ICMPv4 protocol implementation on the OpenScape system were detected.

The ICMP protocol mutation attack against OpenScape Voice contained 52,155 different variants/attack vectors. These variants were implemented in ICMP echo requests and ICMP fragmented echo request messages.

6.4 IPv4 Protocol-Mutation Attack

Description

This test attacks the OpenScape Voice interfaces using IPv4 datagrams and fragmented datagrams. Version 4 of IP is a connectionless protocol, supporting the Ethernet family of networking technologies for local area networks below it, and higher-layer connection-oriented protocols such as TCP for wide-area data transport and end-to-end connectivity above it.

IPv4 functions on a best-effort delivery basis. The network-layer IP does not guarantee the delivery of data or a quality of service level. IP's performance depends to a large degree on the current traffic load. The uniqueness and correctness of IPv4 addresses is key. IP addresses are vulnerable to attack and corruption, however, and a device with a corrupted IP device can fail. A primary objective of this attack was to corrupt the IP address of the target device.

Observations and Analysis - PASS

All attack attempts were thwarted successfully and no faults were reported. OpenScape Voice dropped all mutated packets, did not report any error messages, and no vulnerabilities in OpenScape Voice's IPv4 protocol implementation were detected.

The IPv4 attacks that were run against OpenScape Voice contained 31,129 variants/attack vectors consisting of IPv4 normal, mutated and fragmented datagrams.

6.5 SIP Protocol-Mutation Attacks

Description

This series of attacks attempts to exploit target-system vulnerabilities in handling mutated SIP messages and traffic. SIP messages have been deliberately modified to cause abnormal handling conditions and results.

SIP calls require a source and destination URL phone number that the SIP call server uses to establish communication between the calling and called entities. SIP communications can run over TCP or UDP – two very different transport-layer protocols. And more secure SIP communications can be established by using TLS. TCP and UDP commonly use port 5060, while TLS typically uses port 5061.

SIP messages are made up mainly of REGISTER, INVITE, ACK, CANCEL, BYE AND OPTIONS. This attack was configured to attack OpenScape Voice using SIP INVITE-CANCEL messages, and used UDP over port 5060 initially.

Observations and Analysis - PASS

The OpenScape Voice completely blocked the attempted attacks – dropping all malformed SIP packets to and from unregistered users – and continued normal operations. With the default configuration, which forced TLS for all connections, all the attacks, lacking valid credentials, were rejected.

6.6 TCP Protocol-Mutation Attack

Description

The Transmission Control Protocol (TCP) is the fundamental state-based, connection-oriented protocol that is universally implemented in IP networks. It is used primarily to facilitate data exchange and contains many mechanisms to assure the user's data is conveyed correctly. There are many TCP protocol components and many opportunities to mutate TCP protocol messages.

The Mutated-TCP attack, from the Spirent Studio system, was delivered at high volume triggering rate limiting and at below-the-rate-limit rates under 200 pps for OpenScape Voice.

The test was set up to attack at OpenScape Voice interfaces using hundreds of permutations of TCP messages. The OpenScape Voice should completely block the attempted attack.

Observations and Analysis - PASS

No faults were reported, and we confirmed that the Mutated-TCP attack, launched against every IP address of each OpenScape Voice node individually, had no effect on call set-up within the 1-second normal time frame. OpenScape Voice completely rejected all these attacks. No vulnerabilities in OpenScape Voice were detected and all call features during the attack attempts remained fully operational.

6.7 RTP Protocol-Mutation Attack

Description

The Real-time Transmission Protocol (RTP) is used to deliver real-time audio (i.e., VoIP) and video content over IP networks. It is the primary protocol for delivery of voice conversations in SIP-based systems. OpenScape Voice is SIP-based, but in the test bed all voice content was carried in a secure form of RTP, Secure RTP or SRTP, where the content is encrypted.

Also, the OpenScape Voice nodes, which handle the TLS-encrypted set-up of SIP calls, do not regularly handle media streams directly. These typically pass, in encrypted SRTP form, between calling parties in the OpenScape architecture. Because of this it was expected that the OpenScape Voice nodes would drop RTP messages, as well as SRTP.

The Mutated-RTP attack, generated from the Spirent Studio system, was sent at high volume triggering rate limiting and at below-the-rate-limit rates under 200 pps for OpenScape Voice.

Observations and Analysis - PASS

No faults were reported, and we confirmed that the Mutated-RTP attack, launched against every IP address of each OpenScape Voice node individually, had no effect on call set-up within the 1-second normal time frame. OpenScape Voice completely rejected all these attacks. No vulnerabilities in OpenScape Voice were detected and all call features during the attack attempts remained fully operational.

6.8 UDP Protocol-Mutation Attack

Description

The User Datagram Protocol (UDP) is so-named because it is not a state-based protocol; a UDP datagram is sent and there is no additional follow-up or state-based interactive messaging, to confirm it was received. Even so, UDP datagram messages, especially mutated UDP messages, can wreak havoc in a system that is not hardened to such attacks.

The Mutated-UDP attack, generated from the Spirent Studio system, was sent at high volume triggering rate limiting and at below-the-rate-limit rates under 200 pps for OpenScape Voice.

The test was set up to attack at OpenScape Voice interfaces using permutations of the dozens of different and mutated UDP messages. The OpenScape Voice should completely block the attempted attack.

Observations and Analysis - PASS

No faults were reported, and we confirmed that the Mutated-UDP attack, launched against every IP address of each OpenScape Voice node individually, had no effect on call set-up within the 1-second normal time frame. OpenScape Voice completely rejected all these attacks. No vulnerabilities in OpenScape Voice were detected and all call features during the attack attempts remained fully operational.

7 - Denial of Service Attacks

Various DoS attacks were directed at the OpenScape Voice system. The goal was to determine the continued availability and security of service in the face of attacks that apply elevated traffic to the same device interfaces that are handling high levels of production traffic. Often a targeted system will crash and need to be rebooted from an effective DoS attack.

The objective was to heavily inundate OpenScape Voice's interfaces with directed traffic that would compete for server resources. The attacks were applied to OpenScape Voice interfaces individually, one at a time. During each attack, calls were placed between HQ-LAN phones, the connect times were clocked, and random features were exercised.

High-level open-source test scripts, as well as Spirent Studio Security were used to generate a dozen different DoS attacks. These collectively employed fixed and randomized source ports IP and MAC addresses, TTLs (time-to-live counters), TCP sequence numbers, payload, user-defined TCP header values, randomized protocol types and other values for the attack. Attack patterns included different load rates, packets per second and duration of attacks.

The OpenScape Voice system was preconfigured and hardened to counter DoS attacks. The defenses included a Layer 3 integrated packet filter and a traffic-rate limiter. All of the DoS attacks exceeded the 200-pps rate limit that was configured in the OpenScape Voice nodes to counter DoS attacks. However, the attack loads were not high enough to deny sufficient bandwidth to regular production traffic, although that is exactly what some DoS attacks attempts to do. Subsequently, as long as rate limiting worked as expected, no DoS attacks should have had an effect.

A partial list of the DoS attacks launched as part of this security assessment follows.

7.1 IPv4 and ICMP DoS

These were two discrete attacks: The IPv4 DoS attack, containing many IP message types, all directed at the OpenScape Voice port was generated by the Spirent Studio system. The ICMP Ping DoS attack was generated using a command-line software tool, HPING3. The ICMP attack delivered up to 10,000 pings per second, to the particular IP interface.

Observations and Analysis - PASS

No faults were reported, and we confirmed that the IPv4 and ICMP DoS attacks, launched against every IP address of each OpenScape Voice node individually, had no effect on call set-up time. OpenScape Voice completely rejected all these attacks. No vulnerabilities in OpenScape Voice were detected and all call features during the attack attempts remained fully operational. Rate limiting worked effectively in deflecting these attacks.

7.2 TCP and TCP Syn-Flood DoS

These were two discrete attacks, although both were generated by the Spirent Studio system. These attacks consisted of over 100,000 protocol-message variations, mutations and fragmentations of both legitimate and invalid TCP messages.

Observations and Analysis - PASS

No faults were reported, and we confirmed that the TCP and TCP SYN-flood DoS attacks, launched against every IP address of each OpenScape Voice node individually, had no effect on call set-up time. OpenScape Voice completely rejected all these attacks. No vulnerabilities in OpenScape Voice were detected and all call features during the attack attempts remained fully operational. Rate limiting worked effectively in deflecting these attacks.

7.3 UDP and UDP DNS-flood DoS

These were two discrete attacks, although both were generated by the Spirent Studio system. These attacks consisted of over 100,000 protocol-message variations, mutations and fragmentations of both legitimate and invalid UDP messages.

Observations and Analysis - PASS

No faults were reported, and we confirmed that the UDP and UDP DNS-flood DoS attacks, launched against every IP address of each OpenScape Voice node individually, had no effect on call set-up time. OpenScape Voice completely rejected all these attacks. No vulnerabilities in OpenScape Voice were detected and all call features during the attack attempts remained fully operational. Rate limiting worked effectively in deflecting these attacks.

7.4 ICMP and ICMP port-unreachable DoS

These were two discrete attacks, although both were generated by the Spirent Studio system. These attacks consisted of over 100,000 protocol-message variations, mutations and fragmentations of both legitimate and invalid ICMP messages.

Observations and Analysis - PASS

No faults were reported, and we confirmed that the ICMP and ICMP port-unreachable DoS attacks, launched against every IP address of each OpenScape Voice node individually, had no effect on call set-up time. OpenScape Voice completely rejected all these attacks. No vulnerabilities in OpenScape Voice were detected and all call features during the attack attempts remained fully operational. Rate limiting worked effectively in deflecting these attacks.

7.5 ARP DoS

The ARP DoS, generated by the Spirent Studio system, consisted of over 100,000 protocol-message variations, mutations and fragmentations of both legitimate and invalid ARP messages.

Observations and Analysis - PASS

No faults were reported, and we confirmed that the ARP DoS attack, launched against every IP address of each OpenScape Voice node individually, had no effect on call set-up time. OpenScape Voice completely rejected all these attacks. No vulnerabilities in OpenScape Voice were detected and all call features during the attack attempts remained fully operational. Rate limiting worked effectively in deflecting these attacks.

8 - Other Attacks and Security Tests

The following is a summary of compound exploits and other tests and analyses conducted as part of the OpenScape Voice V9 security assessment:

8.1 Published Vulnerability Attacks

Two attacks, both produced by the Spirent Studio system, were launched against all interfaces on the OpenScape Voice nodes incorporating software vulnerabilities from the latest list of published software vulnerabilities. The first attack was more general in nature, delivering thousands of attempted exploits applicable to many platforms and operating systems. The second attack focused on 630 published "critical" software vulnerabilities.

Observations and Analysis - PASS

No faults were reported, and we confirmed that the two Published Vulnerability attacks had no effect on call set-up time. OpenScape Voice completely rejected these attacks. No vulnerabilities in OpenScape Voice were detected and all call features during the attack attempts remained fully operational.

8.2 Deregistering SIP Users/Devices

Deregistering legitimate SIP users is a method users by hackers to steal service by pirating a SIP registration and using it to register the IP of the hacker.

Observations and Analysis - PASS

We were unable to succeed at deregistering phones and capturing and re-using the registration information for an illicit user.

8.3 Brute Force Username/Password Attack

Various attempts, using several test scripts and the Hydra program, sought to gain access to OpenScape Voice nodes by using usernames and passwords from published lists of common usernames and passwords.

Observations and Analysis - PASS

We concluded that SSH and Web GUI access to management are not susceptible to brute force username and password attack. Tests failed to determine the specific version of SSH service and no specific vulnerability was found. We observed that only the administered IP address, embedded in the white-list file, has access to the management interface. OpenScape Voice's IDS/IPS was successful at temporarily blocking connection attempts regardless of whether the traffic rate from the same source exceeded or was under the threshold of 200 pps.

8.4 Protocol Fuzzing Attack

Ixia's BreakingPoint system was used to produce a SIP protocol fuzzing attack. This is where malformed or semi-malformed SIP messages, which exploit different aspects of the SIP grammar, are injected to overwhelm, confuse or crash the system's call control.

Observations and Analysis - PASS

The SIP protocol-fuzzing attacks were ineffective and successfully thwarted by OpenScape Voice. Rate limiting may have been responsible for this success. During the attacks we were still able to establish legitimate calls within a 1-second normal time frame and call features we tested worked without problems.

8.5 Heartbleed SSL Exploit

The heartbleed exploit, identified last year within the OpenSSL (libopenSSL) heartbeat implementation, can permit an attacker to obtain private keys from a vulnerable target host. OpenScape Voice V9 is invulnerable to the Heartbleed exploit.

Observations and Analysis - PASS

Numerous heartbleed checks were performed by Nessus against the OpenScape Voice running HTTPS. No heartbleed vulnerability was found. Nessus confirmed that there was no heartbleed vulnerability in OpenScape Voice V9.

8.6 Ghost Attack

In January 2015 NIST announced a network-exploitable attack, called Ghost that allows a remote hacker to penetrate a system and, using two specific commands, gain access and run arbitrary code. Here is the advisory from SUSE: web.nvd.nist.gov/view/vuln/detail?vulnId=CVE-2015-0235

Observations and Analysis - PASS

A check of the Ghost vulnerability in the OpenScape Voice was conducted and there is no vulnerability in the OpenScape Voice system.

8.7 Venom Attack

A SUSE security vulnerability, exploiting floppy disk controller commands to crash or take over a server, called VENOM, was identified in May 2015. For the advisory from SUSE see: www.suse.com/security/cve/CVE-2015-3456.html

We applied a check to see if the vulnerability existed in OpenScape Voice.

Observations and Analysis - PASS

No vulnerability to the Venom exploit exists, our check found. The OpenScape products are not vulnerable to this attack.

8.8 Shellshock (Bash bug) Attack

In the fall of 2014 a Web-server vulnerability, affecting most Linux versions, was announced. It is called "shellshock," also known as the "bash bug," and as "GNU Bash CVE-2014-6271 Remote Code Execution Vulnerability." Using this vulnerability a remote attacker can execute arbitrary code or produce a denial-of-service condition.

Observations and Analysis - PASS

The OpenScape Voice system was checked using Nikto, and again using Sparta, and no vulnerability to shellshock/bash was found.

9 - About Miercom

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10 - Use of This Report

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