

Cisco Applied Mitigation Bulletin: Identifying and Mitigating Exploitation of the Cisco Unified Communications Manager Denial of Service Vulnerabilities

<http://www.cisco.com/warp/public/707/cisco-amb-20090826-cucm.shtml>

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Cisco Response

This Applied Mitigation Bulletin is a companion document to the PSIRT Security Advisory *Cisco Unified Communications Manager Denial of Service Vulnerabilities* and provides identification and mitigation techniques that administrators can deploy on Cisco network devices.

Vulnerability Characteristics

There are multiple Denial of Service (DoS) vulnerabilities in Cisco Unified Communications Manager products. The following subsections summarize these vulnerabilities:

Malformed SIP Message Vulnerabilities: These vulnerabilities can be exploited remotely without authentication and without end-user interaction. Successful exploitation of these vulnerabilities may result in a denial of service (DoS) condition. Repeated attempts to exploit these vulnerabilities could result in a sustained DoS condition.

The attack vectors for exploitation are through packets using the following protocols and ports:

- Session Initiation Protocol (SIP) using TCP port 5060
- Secure Session Initiation Protocol (SIPS) using TCP port 5061
- Session Initiation Protocol (SIP) using UDP port 5060
- Secure Session Initiation Protocol (SIPS) using UDP port 5061
- Skinny Client Control Protocol (SCCP) using TCP port 2000
- Secure Skinny Client Control Protocol (SCCPS) using TCP port 2443

An attacker could exploit these vulnerabilities using spoofed UDP packets.

These vulnerabilities have been assigned CVE identifiers CVE-2009-2050 and CVE-2009-2051.

Network Connection Tracking Vulnerability: This vulnerability can be exploited remotely without authentication and without end-user interaction. Successful exploitation of this vulnerability may result in a denial of service (DoS) condition. Repeated attempts to exploit this vulnerability could result in a sustained DoS condition. The attack vectors for exploitation of this vulnerability is through any service that listens on a TCP socket of a vulnerable system. This vulnerability has been assigned CVE identifier CVE-2009-2052.

Please review the *TCP and UDP Port Usage* document on the [Cisco Unified Communications Manager \(CallManager\) Maintain and Operate Guides](#) page for the version of Cisco Unified Communications Manager software that is currently in use. The document will provide a listing of TCP ports that the system uses for communications with applications and devices.

Related SIP and SCCP DoS Vulnerabilities: These vulnerabilities can be exploited remotely without authentication and without end-user interaction. Successful exploitation of these vulnerabilities may result in a denial of service (DoS) condition. Repeated attempts to exploit this vulnerability could result in a sustained DoS condition.

The attack vectors for exploitation are through packets using the following protocols and ports:

- Session Initiation Protocol (SIP) using TCP port 5060
- Secure Session Initiation Protocol (SIPS) using TCP port 5061
- Skinny Client Control Protocol (SCCP) using TCP port 2000
- Secure Skinny Client Control Protocol (SCCPS) using TCP port 2443

These vulnerabilities have been assigned CVE identifiers CVE-2009-2053 and CVE-2009-2054.

Information about vulnerable, unaffected, and fixed software is available in the PSIRT Security Advisory, which is available at the following link: <http://www.cisco.com/warp/public/707/cisco-sa-20090826-cucm.shtml>.

Mitigation Technique Overview

Cisco devices provide several countermeasures for these vulnerabilities. Administrators are advised to consider these protection methods to be general security best practices for infrastructure devices and the traffic that transits the network.

This section of the document provides an overview of these techniques.

Cisco IOS Software can provide effective means of exploit prevention using the following methods:

- Transit access control lists (tACLs)
- Unicast Reverse Path Forwarding (Unicast RPF)
- IP source guard (IPSG)

These protection mechanisms filter and drop, as well as verify the source IP address of, packets that are attempting to exploit this vulnerability.

The proper deployment and configuration of Unicast RPF provides an effective means of protection against attacks that use packets with spoofed source IP addresses. Unicast RPF should be deployed as close to all traffic sources as possible.

The proper deployment and configuration of IPSG provides an effective means of protection against spoofing attacks at the access layer.

Because the potential exists that a trusted networking client could become affected by a worm that does not use packets with spoofed source addresses, Unicast RPF and IPSG do not provide complete protection against these vulnerabilities.

Effective means of exploit prevention can also be provided by the Cisco ASA 5500 Series Adaptive Security Appliance, the Cisco PIX 500 Series Security Appliance, and the Firewall Services Module (FWSM) for Cisco Catalyst 6500 Series switches and Cisco 7600 Series routers using the following:

- Transit access control lists (tACLs)
- Unicast Reverse Path Forwarding (Unicast RPF)

These protection mechanisms filter and drop, as well as verify the source IP address of, packets that are attempting to exploit these vulnerabilities.

Effective use of Cisco Intrusion Prevention System (IPS) event actions provides visibility into and protection against attacks that attempt to exploit these vulnerabilities.

Cisco IOS NetFlow records can provide visibility into network-based exploitation attempts.

Cisco IOS Software, Cisco ASA and Cisco PIX security appliances, and FWSM firewalls can provide visibility through syslog messages and counter values displayed in the output from **show** commands.

The Cisco Security Monitoring, Analysis, and Response System (Cisco Security MARS) appliance can also provide visibility through incidents, queries, and event reporting.

Risk Management

Organizations are advised to follow their standard risk evaluation and mitigation processes to determine the potential impact of these vulnerabilities. Triage refers to sorting projects and prioritizing efforts that are most likely to be successful. Cisco has provided documents that can help organizations develop a risk-based triage capability for their information security teams. [Risk Triage for Security Vulnerability Announcements](#) and [Risk Triage and Prototyping](#) can help organizations develop repeatable security evaluation and response processes.

Device-Specific Mitigation and Identification



Caution: The effectiveness of any mitigation technique depends on specific customer situations such as product mix, network topology, traffic behavior, and organizational mission. As with any configuration change, evaluate the impact of this configuration prior to applying the change.

Specific information about mitigation and identification is available for these devices:

- [Cisco IOS Routers and Switches](#)
- [Cisco IOS NetFlow](#)
- [Cisco ASA, PIX, and FWSM Firewalls](#)
- [Cisco Intrusion Prevention System](#)
- [Cisco Security Monitoring, Analysis, and Response System](#)

Cisco IOS Routers and Switches

Mitigation: Transit Access Control Lists

To protect the network from traffic that enters the network at ingress access points, which may include Internet connection points, partner and supplier connection points, or VPN connection points, administrators are advised to deploy transit access control lists (tACLs) to perform policy enforcement. Administrators can construct a tACL by explicitly permitting only authorized traffic to enter the network at ingress access points or permitting authorized traffic to transit the network in accordance with existing security policies and configurations. A tACL workaround cannot provide complete protection against these vulnerabilities when the attack originates from a trusted source address.

The tACL policy denies unauthorized SIP packets on TCP port 5060 and UDP port 5060, SIPS packets on TCP port 5061 and UDP port 5061, SCCP packets on TCP port 2000, and SCCPS packets on TCP port 2443 that are sent to affected devices. In the following example, 192.168.60.0/24 is the IP address space that is used by the affected devices, and the host at 192.168.100.1 is considered a trusted source that requires access to the affected devices. Care should be taken to allow required traffic for routing and administrative access prior to denying all unauthorized traffic.

Additional information about tACLs is in [Transit Access Control Lists: Filtering at Your Edge](#).

```
!-- Include explicit permit statements for trusted  
!-- sources that require access to the vulnerable  
!-- services:  
!-- * SIP using TCP port 5060  
!-- * SIPS using TCP port 5061  
!-- * SIP using UDP port 5060  
!-- * SIPS using UDP port 5061  
!-- * SCCP using TCP port 2000  
!-- * SCCPS using TCP port 2443  
!
```

```
access-list 150 permit tcp host 192.168.100.1 192.168.60.0 0.0.0.255 eq  
5060
```

```

access-list 150 permit tcp host 192.168.100.1 192.168.60.0 0.0.0.255 eq
5061
access-list 150 permit udp host 192.168.100.1 192.168.60.0 0.0.0.255 eq
5060
access-list 150 permit udp host 192.168.100.1 192.168.60.0 0.0.0.255 eq
5061
access-list 150 permit tcp host 192.168.100.1 192.168.60.0 0.0.0.255 eq
2000
access-list 150 permit tcp host 192.168.100.1 192.168.60.0 0.0.0.255 eq
2443

!
!-- The following vulnerability-specific access
!-- control entries (ACEs) can aid in identification
!-- of attacks
!

access-list 150 deny tcp any 192.168.60.0 0.0.0.255 eq 5060
access-list 150 deny tcp any 192.168.60.0 0.0.0.255 eq 5061
access-list 150 deny udp any 192.168.60.0 0.0.0.255 eq 5060
access-list 150 deny udp any 192.168.60.0 0.0.0.255 eq 5061
access-list 150 deny tcp any 192.168.60.0 0.0.0.255 eq 2000
access-list 150 deny tcp any 192.168.60.0 0.0.0.255 eq 2443

!
!-- Permit or deny all other Layer 3 and Layer 4
!-- traffic in accordance with existing security
!-- policies and configurations
!
!-- Explicit deny for all other IP traffic
!

access-list 150 deny ip any any

!
!
!-- Apply the tACL to interfaces in the ingress
!-- direction
!

interface GigabitEthernet0/0
 ip access-group 150 in

!

```

Note that filtering with an interface access list will elicit the transmission of ICMP unreachable messages back to the source of the filtered traffic. Generating these messages could have the undesired effect of increasing CPU utilization on the device. In Cisco IOS Software, ICMP unreachable generation is limited to one packet every 500 milliseconds by default. ICMP unreachable message generation can be disabled using the interface configuration command **no ip**

unreachables. ICMP unreachable rate limiting can be changed from the default using the global configuration command **ip icmp rate-limit unreachable *interval-in-ms***.

Mitigation: Spoofing Protection

Unicast Reverse Path Forwarding

Some of the vulnerabilities that are described in this document can be exploited by spoofed IP packets. The proper deployment and configuration of Unicast Reverse Path Forwarding (Unicast RPF) can provide protection mechanisms for spoofing related to the following vulnerabilities:

- Malformed SIP Message Vulnerabilities

Unicast RPF is configured at the interface level and can detect and drop packets that lack a verifiable source IP address. Administrators should not rely on Unicast RPF to provide complete spoofing protection because spoofed packets may enter the network through a Unicast RPF-enabled interface if an appropriate return route to the source IP address exists. Administrators are advised to take care to ensure that the appropriate Unicast RPF mode (loose or strict) is configured during the deployment of this feature because it can drop legitimate traffic that is transiting the network. In an enterprise environment, Unicast RPF might be enabled at the Internet edge and the internal access layer on the user-supporting Layer 3 interfaces.

Additional information is in the [Unicast Reverse Path Forwarding Loose Mode Feature Guide](#).

For additional information about the configuration and use of Unicast RPF, reference the [Understanding Unicast Reverse Path Forwarding](#) Applied Intelligence white paper.

IP Source Guard

IP source guard (IPSG) is a security feature that restricts IP traffic on nonrouted, Layer 2 interfaces by filtering packets based on the DHCP snooping binding database and manually configured IP source bindings. Administrators can use IPSG to prevent attacks from an attacker who attempts to spoof packets by forging the source IP address and/or the MAC address. The proper deployment and configuration of IPSG coupled with strict mode Unicast RPF can provide the most effective means of spoofing protection to help mitigate the following vulnerabilities:

- Malformed SIP Message Vulnerabilities

Additional information about the deployment and configuration of IPSG is in [Configuring DHCP Features and IP Source Guard](#).

Identification: Transit Access Control Lists

After the administrator applies the tACL to an interface, the **show ip access-lists** command will identify the number of SIP packets on TCP port 5060 and UDP port 5060, SIPS packets on TCP port 5061 and UDP port 5061, SCCP packets on TCP port 2000, and SCCPS packets on TCP port 2443 that have been filtered. Administrators are advised to investigate filtered packets to determine whether they are attempts to exploit these vulnerabilities. Example output for **show ip access-lists 150** follows:

```
router#show ip access-lists 150
```

```

Extended IP access list 150
 10 permit tcp host 192.168.100.1 192.168.60.0 0.0.0.255 eq 5060
 20 permit tcp host 192.168.100.1 192.168.60.0 0.0.0.255 eq 5061
 30 permit udp host 192.168.100.1 192.168.60.0 0.0.0.255 eq 5060
(352 matches)
 40 permit udp host 192.168.100.1 192.168.60.0 0.0.0.255 eq 5061
 50 permit tcp host 192.168.100.1 192.168.60.0 0.0.0.255 eq 2000
 60 permit tcp host 192.168.100.1 192.168.60.0 0.0.0.255 eq 2443
(135 matches)
 70 deny tcp any 192.168.60.0 0.0.0.255 eq 5060 (37 matches)
 80 deny tcp any 192.168.60.0 0.0.0.255 eq 5061 (11 matches)
 90 deny udp any 192.168.60.0 0.0.0.255 eq 5060 (340 matches)
100 deny udp any 192.168.60.0 0.0.0.255 eq 5061 (92 matches)
110 deny tcp any 192.168.60.0 0.0.0.255 eq 2000 (23 matches)
120 deny tcp any 192.168.60.0 0.0.0.255 eq 2443 (61 matches)
130 deny ip any any (389 matches)
router#

```

In the preceding example, access list 150 has dropped the following packets that are received from an untrusted host or network:

- **37 SIP** packets on **TCP port 5060** for ACE sequence 70
- **11 SIPS** packets on **TCP port 5061** for ACE sequence 80
- **340 SIP** packets on **UDP port 5060** for ACE sequence 90
- **92 SIPS** packets on **UDP port 5061** for ACE sequence 100
- **23 SCCP** packets on **TCP port 2000** for ACE sequence 110
- **61 SCCPS** packets on **TCP port 2443** for ACE sequence 120

For additional information about investigating incidents using ACE counters and syslog events, reference the [Identifying Incidents Using Firewall and IOS Router Syslog Events](#) Applied Intelligence white paper.

Administrators can use Embedded Event Manager to provide instrumentation when specific conditions are met, such as ACE counter hits. The Applied Intelligence white paper [Embedded Event Manager in a Security Context](#) provides additional details about how to use this feature.

Identification: Access List Logging

The **log** and **log-input** access control list (ACL) option will cause packets that match specific ACEs to be logged. The **log-input** option enables logging of the ingress interface in addition to the packet source and destination IP addresses and ports.



Caution: Access control list logging can be very CPU intensive and must be used with extreme caution. Factors that drive the CPU impact of ACL logging are log generation, log transmission, and process switching to forward packets that match log-enabled ACEs.

For Cisco IOS Software, the **ip access-list logging interval** *interval-in-ms* command can limit the effects of process switching induced by ACL logging. The **logging rate-limit** *rate-per-second* [**except** *loglevel*] command limits the impact of log generation and transmission.

The CPU impact from ACL logging can be addressed in hardware on the Cisco Catalyst 6500 Series switches and Cisco 7600 Series routers with Supervisor Engine 720 or Supervisor Engine 32 using optimized ACL logging.

For additional information about the configuration and use of ACL logging, reference the [Understanding Access Control List Logging](#) Applied Intelligence white paper.

Identification: Spoofing Protection Using Unicast Reverse Path Forwarding

With Unicast RPF properly deployed and configured throughout the network infrastructure, administrators can use the **show cef interface *type slot/port* internal**, **show ip interface**, **show cef drop**, and **show ip traffic** commands to identify the number of packets that Unicast RPF has dropped.

Note: The **show command | begin *regex*** and **show command | include *regex*** command modifiers are used in the following examples to minimize the amount of output that administrators will need to parse to view the desired information. Additional information about command modifiers is in the [show command](#) sections of the Cisco IOS Configuration Fundamentals Command Reference.

```
router#show cef interface GigabitEthernet 0/0 internal | include drop
--      CLI Output Truncated      --
  ip verify: via=rx (allow default), acl=0, drop=18, sdrop=0
router#
```

Note: **show cef interface *type slot/port* internal** is a hidden command that must be fully entered at the command-line interface. Command completion is not available for it.

```
router#show ip interface GigabitEthernet 0/0 | begin verify
--      CLI Output Truncated      --
  IP verify source reachable-via RX, allow default, allow self-ping
  11 verification drops
  0 suppressed verification drops
router#
```

```
router#show cef drop
CEF Drop Statistics
Slot  Encap_fail  Unresolved  Unsupported      No_route      No_adj
ChkSum_Err
RP           27           0           0           18
0           0
router#
```

```
router#show ip traffic
```

```
IP statistics:
  Rcvd:  68051015 total, 2397325 local destination
         43999 format errors, 0 checksum errors, 33 bad hop count
```

```

2 unknown protocol, 929 not a gateway
21 security failures, 190123 bad options, 542768 with options
Opts: 352227 end, 452 nop, 36 basic security, 1 loose source route
      45 timestamp, 59 extended security, 41 record route
      53 stream ID, 3 strict source route, 40 alert, 45 cipso, 0 ump
      361634 other
Frag: 0 reassembled, 10008 timeouts, 56866 couldn't reassemble
      0 fragmented, 0 fragments, 0 couldn't fragment
Bcast: 64666 received, 0 sent
Mcast: 1589885 received, 2405454 sent
Sent: 3001564 generated, 65359134 forwarded
Drop: 4256 encapsulation failed, 0 unresolved, 0 no adjacency
      18 no route, 18 unicast RPF, 0 forced drop
      0 options denied
Drop: 0 packets with source IP address zero
Drop: 0 packets with internal loop back IP address
      --      CLI Output Truncated      --
router#

```

In the preceding **show cef drop** and **show ip traffic** examples, Unicast RPF has dropped **18 IP packets** received globally on all interfaces with Unicast RPF configured because of the inability to verify the source address of the IP packets within the Forwarding Information Base of Cisco Express Forwarding.

Cisco IOS NetFlow

Identification: Traffic Flow Identification Using NetFlow Records

Administrators can configure Cisco IOS NetFlow on Cisco IOS routers and switches to aid in the identification of traffic flows that may be attempts to exploit these vulnerabilities. Administrators are advised to investigate flows to determine whether they are attempts to exploit these vulnerabilities or whether they are legitimate traffic flows.

```

router#show ip cache flow
IP packet size distribution (90784136 total packets):
  1-32  64  96  128  160  192  224  256  288  320  352  384  416
448  480
  .000 .698 .011 .001 .004 .005 .000 .004 .000 .000 .003 .000 .000 .000 .000
      512  544  576 1024 1536 2048 2560 3072 3584 4096 4608
      .000 .001 .256 .000 .010 .000 .000 .000 .000 .000 .000
IP Flow Switching Cache, 4456704 bytes
1885 active, 63651 inactive, 59960004 added
129803821 ager polls, 0 flow alloc failures
Active flows timeout in 30 minutes
Inactive flows timeout in 15 seconds
IP Sub Flow Cache, 402056 bytes
0 active, 16384 inactive, 0 added, 0 added to flow
0 alloc failures, 0 force free
1 chunk, 1 chunk added
last clearing of statistics never

```

Protocol Idle(Sec) ----- Flow	Total Flows	Flows /Sec	Packets /Flow	Bytes /Pkt	Packets /Sec	Active(Sec) /Flow	/
TCP-Telnet 0.0	11393421 1.4	2.8	1	48	3.1		
TCP-FTP 1.8	236 4.8	0.0	12	66	0.0		
TCP-FTPD 18.4	21 4.1	0.0	13726	1294	0.0		
TCP-WWW 4.1	22282 7.3	0.0	21	1020	0.1		
TCP-X 0.0	719 1.3	0.0	1	40	0.0		
TCP-BGP 15.0	1	0.0	1	40	0.0	0.0	
TCP-Frag 22.7	70399	0.0	1	688	0.0	0.0	
TCP-other 0.0	47861004 1.3	11.8	1	211	18.9		
UDP-DNS 15.4	582	0.0	4	73	0.0	3.4	
UDP-NTP 15.5	287252	0.0	1	76	0.0	0.0	
UDP-other 15.9	310347	0.0	2	230	0.1	0.6	
ICMP 15.5	11674	0.0	3	61	0.0	19.8	
IPv6INIP 15.4	15	0.0	1	1132	0.0	0.0	
GRE 15.3	4	0.0	1	48	0.0	0.0	
Total: 0.0	59957957 1.5	14.8	1	196	22.5		

SrcIf DstP	Pkts	SrcIPAddress	DstIf	DstIPAddress	Pr	SrcP
Gi0/0		192.168.10.201	Gi0/1	192.168.60.102	11	13C4
13C4	1					
Gi0/0		192.168.11.54	Gi0/1	192.168.60.158	11	13C5
13C5	3					
Gi0/1		192.168.150.60	Gi0/0	192.168.60.135	06	0016
098B	1					
Gi0/0		192.168.60.44	Null	192.168.60.112	11	13C4
13C4	9					
Gi0/0		192.168.13.97	Gi0/1	192.168.60.28	11	0B3E
00A1	5					
Gi0/0		192.168.10.17	Gi0/1	192.168.60.97	06	13C5
13C5	1					
Gi0/0		10.88.226.1	Gi0/1	192.168.202.22	11	007B

```

007B      1
Gi0/0      192.168.60.97  Null          192.168.60.48  11 13C4
13C4      5
Gi0/0      192.168.12.185 Gi0/1         192.168.60.239 06 0BD7
098B      1
Gi0/0      10.89.16.226   Gi0/1         192.168.150.60 06 12CA
07D0      1
router#

```

In the preceding example, there are multiple flows for **SIP** traffic on **TCP** and **UDP** ports **5060** (hex value **0x13C4**), **SIPS** traffic on **TCP** and **UDP** ports **5061** (hex value **0x13C5**), **SCCP** traffic on **TCP** port **2000** (hex value **0x07D0**), and **SCCPS** traffic on **TCP** port **2443** (hex value **0x098B**).

Some of this traffic is sourced from and sent to addresses within the 192.168.60.0/24 address block, which is used by affected devices. The packets in these flows may be spoofed and may indicate an attempt to exploit these vulnerabilities. Administrators are advised to compare these flows to baseline utilization for SIP traffic sent on UDP port 5060 and SIPS traffic sent on UDP port 5061 and also investigate the flows to determine whether they are sourced from untrusted hosts or networks. If Unicast RPF is enabled on a device, packets that are dropped by the feature can be detected by monitoring NetFlow records for flows with a *DstIf* value of *Null*.

UDP Flows

To view only the traffic flows for SIP packets on UDP port 5060 (hex value 0x13C4) and SIPS packets on UDP port 5061 (hex value 0x13C5), the command **show ip cache flow | include SrcIf|_11_.*(13C4|13C5)_** will display the related UDP NetFlow records as shown here:

```

router#show ip cache flow | include SrcIf|_11_.*(13C4|13C5)_
SrcIf      SrcIPaddress      DstIf          DstIPaddress      Pr SrcP
DstP  Pkts
Gi0/0      192.168.12.110    Gi0/1          192.168.60.163    11 13C4
13C4      6
Gi0/0      192.168.11.230    Gi0/1          192.168.60.20     11 13C5
13C5      1
Gi0/0      192.168.11.131    Gi0/1          192.168.60.245    11 13C4
13C4      18
Gi0/0      192.168.13.7      Gi0/1          192.168.60.162    11 13C4
13C4      1
Gi0/0      192.168.41.86     Gi0/1          192.168.60.27     11 13C5
13C5      2
router#

```

TCP Flows

To view only the traffic flows for SIP packets on TCP port 5060 (hex value 0x13C4), SIPS packets on TCP port 5061 (hex value 0x13C5), SCCP traffic on TCP port 2000 (hex value 0x07D0), and SCCPS traffic on TCP port 2443 (hex value 0x098B), the command **show ip cache flow | include SrcIf|_06_.*(13C4|13C5|07D0|098B)_** will display the related TCP NetFlow records as shown here:

```

router#show ip cache flow | include SrcIf|_06_.*(13C4|13C5|07D0|098B)_

```

SrcIf	SrcIPaddress	DstIf	DstIPaddress	Pr	SrcP
Gi0/0	192.168.12.110	Gi0/1	192.168.60.163	06	13C4
13C4					3
Gi0/0	192.168.11.230	Gi0/1	192.168.60.20	06	0C09
098B					7
Gi0/0	192.168.11.131	Gi0/1	192.168.60.245	06	0B66
07D0					11
Gi0/0	192.168.13.7	Gi0/1	192.168.60.162	06	13C5
13C5					4
Gi0/0	192.168.41.86	Gi0/1	192.168.60.27	06	0B7B
07D0					1

router#

Cisco ASA, PIX, and FWSM Firewalls

Mitigation: Transit Access Control Lists

To protect the network from traffic that enters the network at ingress access points, which may include Internet connection points, partner and supplier connection points, or VPN connection points, administrators are advised to deploy tACLs to perform policy enforcement. Administrators can construct a tACL by explicitly permitting only authorized traffic to enter the network at ingress access points or permitting authorized traffic to transit the network in accordance with existing security policies and configurations. A tACL workaround cannot provide complete protection against these vulnerabilities when the attack originates from a trusted source address.

The tACL policy denies unauthorized SIP packets on TCP port 5060 and UDP port 5060, SIPS packets on TCP port 5061 and UDP port 5061, SCCP packets on TCP port 2000, and SCCPS packets on TCP port 2443 that are sent to affected devices. In the following example, 192.168.60.0/24 is the IP address space that is used by the affected devices, and the host at 192.168.100.1 is considered a trusted source that requires access to the affected devices. Care should be taken to allow required traffic for routing and administrative access prior to denying all unauthorized traffic.

Additional information about tACLs is in [Transit Access Control Lists: Filtering at Your Edge](#).

```
!-- Include explicit permit statements for trusted
!-- sources that require access on the vulnerable
!-- services:
!-- * SIP using TCP port 5060
!-- * SIPS using TCP port 5061
!-- * SIP using UDP port 5060
!-- * SIPS using UDP port 5060
!-- * SCCP using TCP port 2000
!-- * SCCPS using TCP port 2443
!
```

```
access-list tACL-Policy extended permit tcp host 192.168.100.1
192.168.60.0 255.255.255.0 eq 5060
access-list tACL-Policy extended permit tcp host 192.168.100.1
192.168.60.0 255.255.255.0 eq 5061
access-list tACL-Policy extended permit udp host 192.168.100.1
```

```
192.168.60.0 255.255.255.0 eq 5060
access-list tACL-Policy extended permit udp host 192.168.100.1
192.168.60.0 255.255.255.0 eq 5061
access-list tACL-Policy extended permit tcp host 192.168.100.1
192.168.60.0 255.255.255.0 eq 2000
access-list tACL-Policy extended permit tcp host 192.168.100.1
192.168.60.0 255.255.255.0 eq 2443
```

```
!
```

```
!-- The following vulnerability-specific access
!-- control entries (ACEs) can aid in identification
!-- of attacks
```

```
!
```

```
access-list tACL-Policy extended deny tcp any 192.168.60.0
255.255.255.0 eq 5060
access-list tACL-Policy extended deny tcp any 192.168.60.0
255.255.255.0 eq 5061
access-list tACL-Policy extended deny udp any 192.168.60.0
255.255.255.0 eq 5060
access-list tACL-Policy extended deny udp any 192.168.60.0
255.255.255.0 eq 5061
access-list tACL-Policy extended deny tcp any 192.168.60.0
255.255.255.0 eq 2000
access-list tACL-Policy extended deny tcp any 192.168.60.0
255.255.255.0 eq 2443
```

```
!
```

```
!-- Permit or deny all other Layer 3 and Layer 4
!-- traffic in accordance with existing security
!-- policies and configurations
```

```
!
```

```
!-- Explicit deny for all other IP traffic
```

```
!
```

```
access-list tACL-Policy extended deny ip any any
```

```
!
```

```
!-- Apply the tACL to interface(s) in the ingress
!-- direction
```

```
!
```

```
access-group tACL-Policy in interface outside
```

```
!
```

Mitigation: Spoofing Protection Using Unicast Reverse Path Forwarding

Some of the vulnerabilities that are described in this document can be exploited by spoofed IP packets. The proper

deployment and configuration of Unicast RPF can provide protection mechanisms for spoofing related to the following vulnerabilities:

- Malformed SIP Message Vulnerabilities

Unicast RPF is configured at the interface level and can detect and drop packets that lack a verifiable source IP address. Administrators should not rely on Unicast RPF to provide complete spoofing protection because spoofed packets may enter the network through a Unicast RPF-enabled interface if an appropriate return route to the source IP address exists. In an enterprise environment, Unicast RPF might be enabled at the Internet edge and at the internal access layer on the user-supporting Layer 3 interfaces.

For additional information about the configuration and use of Unicast RPF, reference the Cisco Security Appliance Command Reference for [ip verify reverse-path](#) and the [Understanding Unicast Reverse Path Forwarding](#) Applied Intelligence white paper.

Identification: Transit Access Control Lists

After the tACL has been applied to an interface, administrators can use the **show access-list** command to identify the number of SIP packets on TCP port 5060 and UDP port 5060, SIPS packets on TCP port 5061 and UDP port 5061, SCCP packets on TCP port 2000, and SCCPS packets on TCP port 2443 that have been filtered. Administrators are advised to investigate filtered packets to determine whether they are attempts to exploit these vulnerabilities. Example output for **show access-list tACL-Policy** follows:

```
firewall#show access-list tACL-Policy
access-list tACL-Policy; 13 elements
access-list tACL-Policy line 1 extended permit tcp host 192.168.100.1
 192.168.60.0 255.255.255.0 eq 5060 (hitcnt=19)
access-list tACL-Policy line 2 extended permit tcp host 192.168.100.1
 192.168.60.0 255.255.255.0 eq 5061 (hitcnt=11)
access-list tACL-Policy line 3 extended permit udp host 192.168.100.1
 192.168.60.0 255.255.255.0 eq 5060 (hitcnt=33)
access-list tACL-Policy line 4 extended permit udp host 192.168.100.1
 192.168.60.0 255.255.255.0 eq 5061 (hitcnt=29)
access-list tACL-Policy line 5 extended permit tcp host 192.168.100.1
 192.168.60.0 255.255.255.0 eq 2000 (hitcnt=17)
access-list tACL-Policy line 6 extended permit tcp host 192.168.100.1
 192.168.60.0 255.255.255.0 eq 2443 (hitcnt=47)
access-list tACL-Policy line 7 extended deny tcp any 192.168.60.0
 255.255.255.0 eq snmp (hitcnt=3)
access-list tACL-Policy line 8 extended deny tcp any 192.168.60.0
 255.255.255.0 eq snmp (hitcnt=73)
access-list tACL-Policy line 9 extended deny udp any 192.168.60.0
 255.255.255.0 eq snmp (hitcnt=54)
access-list tACL-Policy line 10 extended deny udp any 192.168.60.0
 255.255.255.0 eq snmp (hitcnt=39)
access-list tACL-Policy line 11 extended deny tcp any 192.168.60.0
 255.255.255.0 eq snmp (hitcnt=65)
access-list tACL-Policy line 12 extended deny tcp any 192.168.60.0
 255.255.255.0 eq snmp (hitcnt=28)
access-list tACL-Policy line 13 extended deny ip any any (hitcnt=8)
```

```
firewall#
```

In the preceding example, access list *tACL-Policy* has dropped the following packets received from an untrusted host or network:

- **3 SIP** packets on **TCP port 5060** for ACE line 7
- **73 SIPS** packets on **TCP port 5061** for ACE line 8
- **54 SIP** packets on **UDP port 5060** for ACE line 9
- **39 SIPS** packets on **UDP port 5061** for ACE line 10
- **65 SCCP** packets on **TCP port 2000** for ACE line 11
- **28 SCCPS** packets on **TCP port 2443** for ACE line 12

Identification: Firewall Access List Syslog Messages

Firewall syslog message *106023* will be generated for packets denied by an access control entry (ACE) that does not have the **log** keyword present. Additional information about this syslog message is in [Cisco Security Appliance System Log Message - 106023](#).

Information about configuring syslog for the Cisco ASA 5500 Series Adaptive Security Appliance or the Cisco PIX 500 Series Security Appliance is in [Monitoring the Security Appliance - Configuring and Managing Logs](#). Information about configuring syslog on the FWSM for Cisco Catalyst 6500 Series switches and Cisco 7600 Series routers is in [Monitoring the Firewall Services Module](#).

In the following example, the **show logging | grep regex** command extracts syslog messages from the logging buffer on the firewall. These messages provide additional information about denied packets that could indicate potential attempts to exploit the vulnerabilities that are described in this document. It is possible to use different regular expressions with the **grep** keyword to search for specific data in the logged messages.

Additional information about regular expression syntax is in [Creating a Regular Expression](#).

```
firewall#show logging | grep 106023
  Aug 21 2009 00:15:13: %ASA-4-106023: Deny udp src
outside:192.0.2.18/2944
      dst inside:192.168.60.191/5060 by access-group "tACL-Policy"
  Aug 21 2009 00:15:13: %ASA-4-106023: Deny tcp src
outside:192.0.2.200/2945
      dst inside:192.168.60.33/2443 by access-group "tACL-Policy"
  Aug 21 2009 00:15:13: %ASA-4-106023: Deny tcp src
outside:192.0.2.99/2946
      dst inside:192.168.60.240/5061 by access-group "tACL-Policy"
  Aug 21 2009 00:15:13: %ASA-4-106023: Deny tcp src
outside:192.0.2.100/2947
      dst inside:192.168.60.115/5060 by access-group "tACL-Policy"
  Aug 21 2009 00:15:13: %ASA-4-106023: Deny udp src
outside:192.0.2.88/2949
      dst inside:192.168.60.38/5061 by access-group "tACL-Policy"
  Aug 21 2009 00:15:13: %ASA-4-106023: Deny tcp src
outside:192.0.2.175/2950
      dst inside:192.168.60.250/2000 by access-group "tACL-Policy"
```

```
firewall#
```

In the preceding example, the messages logged for the tACL *tACL-Policy* show **SIP** packets on **TCP port 5060**, potentially spoofed **SIP** packets on **UDP port 5060**, **SIPS** packets on **TCP port 5061**, potentially spoofed **SIPS** packets on **UDP port 5061**, **SCCP** packets on **TCP port 2000**, and **SCCPS** packets on **TCP port 2443** sent to the address block assigned to affected devices.

Additional information about syslog messages for ASA and PIX security appliances is in [Cisco Security Appliance System Log Messages](#). Additional information about syslog messages for the FWSM is in [Catalyst 6500 Series Switch and Cisco 7600 Series Router Firewall Services Module Logging System Log Messages](#).

For additional information about investigating incidents using syslog events, reference the [Identifying Incidents Using Firewall and IOS Router Syslog Events](#) Applied Intelligence white paper.

Identification: Spoofing Protection Using Unicast Reverse Path Forwarding

Firewall syslog message *106021* will be generated for packets denied by Unicast RPF. Additional information about this syslog message is in [Cisco Security Appliance System Log Message - 106021](#).

Information about configuring syslog for the Cisco ASA 5500 Series Adaptive Security Appliance or the Cisco PIX 500 Series Security Appliance is in [Monitoring the Security Appliance - Configuring and Managing Logs](#). Information about configuring syslog on the FWSM for Cisco Catalyst 6500 Series switches and Cisco 7600 Series routers is in [Monitoring the Firewall Services Module](#).

In the following example, the **show logging | grep regex** command extracts syslog messages from the logging buffer on the firewall. These messages provide additional information about denied packets that could indicate potential attempts to exploit these vulnerabilities that is described in this document. It is possible to use different regular expressions with the **grep** keyword to search for specific data in the logged messages.

Additional information about regular expression syntax is in [Creating a Regular Expression](#).

```
firewall#show logging | grep 106021
  Aug 21 2007 00:15:13: %ASA-1-106021: Deny UDP reverse path check from
    192.168.60.1 to 192.168.60.100 on interface outside
  Aug 21 2007 00:15:13: %ASA-1-106021: Deny UDP reverse path check from
    192.168.60.1 to 192.168.60.100 on interface outside
  Aug 21 2007 00:15:13: %ASA-1-106021: Deny TCP reverse path check from
    192.168.60.1 to 192.168.60.100 on interface outside
firewall#
```

The **show asp drop** command can also identify the number of packets that the Unicast RPF feature has dropped, as shown in the following example:

```
firewall#show asp drop frame rpf-violated
  Reverse-path verify failed                11
firewall#
```

In the preceding example, Unicast RPF has dropped **11 IP packets** received on interfaces with Unicast RPF configured.

Absence of output indicates that the Unicast RPF feature on the firewall has not dropped packets.

For additional information about debugging accelerated security path dropped packets or connections, reference the Cisco Security Appliance Command Reference for [show asp drop](#).

Cisco Intrusion Prevention System

Mitigation: Cisco IPS Signature Event Actions

Administrators can use Cisco Intrusion Prevention System (IPS) appliances and services modules to provide threat detection and help prevent attempts to exploit the vulnerabilities that are described in this document. These vulnerabilities may be detected by the following signatures:

CVE ID	Signature Release	Signature ID	Signature Name	Enabled	Severity	Fidelity*
CVE-2009-2050	S427	20479/0	Malformed SIP Message	Yes	Medium	85
		20479/1	Malformed SIP Message	Yes	Medium	85
CVE-2009-2051	S427	20481/0	Malformed SIP Message	Yes	Medium	85
		20481/1	Malformed SIP Message	Yes	Medium	85
CVE-2009-2052	S339	6187/0	CallManager TCP Connection DoS	Yes	High	90

Administrators can configure Cisco IPS sensors to perform an event action when an attack is detected. The configured event action performs preventive or deterrent controls to help protect against an attack that is attempting to exploit the vulnerabilities that are described in this document.

Exploits that use spoofed IP addresses may cause a configured event action to inadvertently deny traffic from trusted sources.

Cisco IPS sensors are most effective when deployed in inline protection mode combined with the use of an event action. Automatic Threat Prevention for Cisco IPS 7.x and 6.x sensors that are deployed in inline protection mode provides threat prevention against an attack that is attempting to exploit the vulnerabilities that are described in this document. Threat prevention is achieved through a default override that performs an event action for triggered signatures with a *riskRatingValue* greater than 90.

Cisco IPS 5.x sensors that are deployed in inline protection mode require an event action configured on a per-signature basis. Alternatively, administrators can configure an override that can perform an event action for any signatures that are triggered and are calculated as a high-risk threat. Using an event action on sensors deployed in inline protection mode provides the most effective exploit prevention.

For additional information about the risk rating and threat rating calculation, reference [Risk Rating and Threat Rating: Simplify IPS Policy Management](#).

Cisco Security Monitoring, Analysis, and Response System

Identification: Cisco Security Monitoring, Analysis, and Response System Incidents

The Cisco Security Monitoring, Analysis, and Response System (Cisco Security MARS) appliance can create incidents on events for the following *Cisco Unified Communications Manager Denial of Service* vulnerabilities. After the S427 dynamic signature update has been downloaded, using the following keywords for each of the respective IPS signatures and a query type of **All Matching Event Raw Messages** on the Cisco Security MARS appliance will provide a report that lists the incidents created by these IPS signatures.

CVE ID	Signature ID(s)	MARS Query Keyword(s)
CVE-2009-2050	20479/0	NR-20479
	20479/1	NR-20479
CVE-2009-2051	20481/0	NR-20481
	20481/1	NR-20481
CVE-2009-2052	6187/0	NR-6187

Beginning with the 4.3.1 and 5.3.1 releases of Cisco Security MARS appliances, support for the Cisco IPS dynamic signature updates feature has been added. This feature downloads new signatures from Cisco.com or from a local web server, correctly processes and categorizes received events that match those signatures, and includes them in inspection rules and reports. These updates provide event normalization and event group mapping, and they also enable the MARS appliance to parse new signatures from the IPS devices.



Caution: If dynamic signature updates are not configured, events that match these new signatures appear as *unknown event type* in queries and reports. Because MARS will not include these events in inspection rules, incidents may not be created for potential threats or attacks that occur within the network.

By default, this feature is enabled but requires configuration. If it is not configured, the following Cisco Security MARS rule will be triggered:

System Rule: CS-MARS IPS Signature Update Failure

When this feature is enabled and configured, administrators can determine the current signature version downloaded by MARS by selecting **Help > About** and reviewing the *IPS Signature Version* value.

Additional information about dynamic signature updates and instructions for configuring dynamic signature updates are available for the Cisco Security MARS [4.3.1](#) and [5.3.1](#) releases.

Additional Information

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Revision History

Revision 1.0	2009-August-26	Initial public release
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Cisco Security Procedures

Complete information on reporting security vulnerabilities in Cisco products, obtaining assistance with security incidents, and registering to receive security information from Cisco, is available on Cisco's worldwide website at http://www.cisco.com/en/US/products/products_security_vulnerability_policy.html. This includes instructions for press inquiries regarding Cisco security notices. All Cisco security advisories are available at <http://www.cisco.com/go/psirt>.

Related Information

- [Cisco Applied Mitigation Bulletins](#)
 - [Cisco Security Intelligence Operations](#)
 - [Cisco IOS NetFlow - Home Page on Cisco.com](#)
 - [Cisco IOS NetFlow White Papers](#)
 - [NetFlow Performance Analysis](#)
 - [Cisco Network Foundation Protection White Papers](#)
 - [Cisco Network Foundation Protection Presentations](#)
 - [A Security-Oriented Approach to IP Addressing](#)
 - [Cisco Firewall Products - Home Page on Cisco.com](#)
 - [Cisco ACE Application Control Engine Module Documentation](#)
 - [Unicast Reverse Path Forwarding Enhancements for the Internet Service Provider](#)
 - [Cisco 6.x Intrusion Prevention System](#)
 - [Cisco IPS 6.x Signature Downloads](#)
 - [Cisco IPS Signature Search Page](#)
 - [Cisco Security Monitoring, Analysis, and Response System](#)
 - [Cisco Security Agent](#)
 - [Common Vulnerabilities and Exposures \(CVE\)](#) 
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