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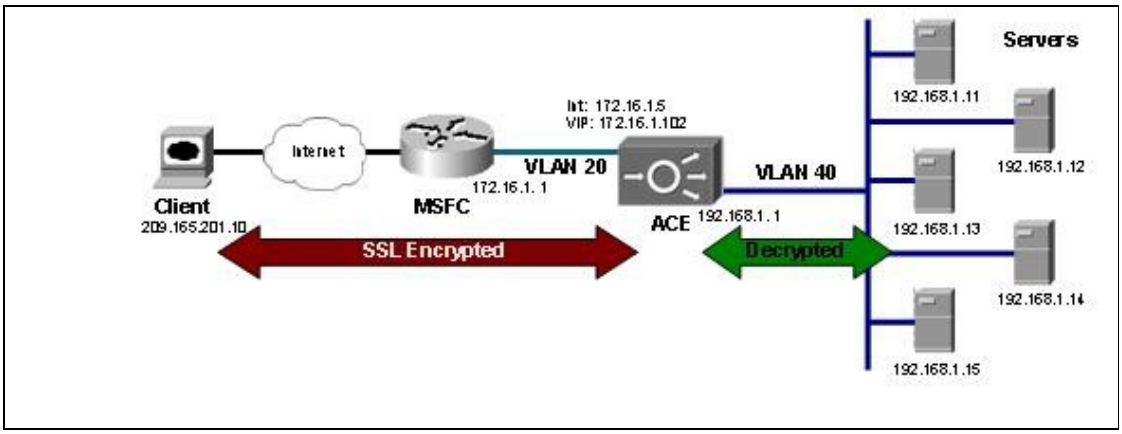
Goal

This document describes how to configure Secure Sockets Layer (SSL) termination on the Cisco® Application Control Engine (ACE) for an existing basic load-balancing configuration. This type of configuration will remove the burden of SSL encryption/decryption from the real servers? CPUs, increasing the amount of traffic they are able to handle in most situations. This document assumes that the reader already has generated or purchased a certificate and its associated RSA key. It will also assume that the certificate requires an intermediate certificate to be supplied to the client browser as well. Typically this happens when a CA signs the issued server certificate with an intermediate certificate not yet integrated into Internet Explorer, Firefox, and other browsers. When this occurs, the browser must supply both the server certificate and the updated intermediate certificate to prevent any security errors from being shown to the user.

Note: This document does not cover the design and configuration of the basic load-balancing configuration; this is covered in the Basic Load Balancing Using Routed Mode on the Cisco Application Control Engine Configuration Example.

Design

Clients will establish a connection using HTTPS (SSL) to the virtual IP address (VIP) configured on the Cisco ACE. HTTPS causes the client?s TCP session to be encrypted between the browser and the ACE. Once the session reaches the ACE, the ACE will decrypt the session and forward it to a real server in clear text (HTTP). The following figure illustrates this process.



Configuration

In order for the Cisco ACE to be able to terminate SSL sessions, it will need to be configured with both an SSL certificate and a corresponding SSL key. Once imported, these SSL files are associated with an SSL proxy service that is applied to the VIP to enable SSL termination.

SSL files (both certificate and key) can either be generated using a tool such as OpenSSL or requested from a certificate authority such as Verisign or GoDaddy. This document assumes that the reader has already acquired these items using one of the two methods mentioned.

Note: If you have not yet obtained a certificate and key, the SSL Termination on the Cisco Application Control Engine Without an Existing Chained Certificate and Key in Routed Mode Configuration Example provides a tutorial on how to request one from a certificate authority, as well as how to generate one using OpenSSL.

The SSL termination configuration begins like the basic Layer 4 load-balancing configuration, by defining a VIP and corresponding server farm and rservers. Although the VIP can be configured with a port of ?any,? the ACE will do a TCP reset on any non-SSL connections. To prevent this, it is recommended that you bind the VIP to a port. In this example, the IP address 172.16.1.100 and port 443 will be used.

```
ACE-1/routed(config)# class-map match-all 102-vip
ACE-1/routed(config-cmap)# match virtual-address 172.16.1.102 tcp eq 443
```

When adding the rservers to the server farm, consider the destination of the decrypted traffic. In almost every case, encrypted SSL traffic is received on an SSL-specific port, and the decrypted traffic needs to be sent to another port on the real servers. The Cisco ACE uses the rserver port defined in the server farm to properly translate (using Port Address Translation [PAT]) the destination for the decrypted connection.

```
ACE-1/routed# show run serverfarm
Generating configuration....

serverfarm host web
  rserver lnx1 80
    inservice
  rserver lnx2 80
    inservice
  rserver lnx3 80
    inservice
  rserver lnx4 80
    inservice
  rserver lnx5 80
    inservice
```

The VIP and server farm in this example allow the Cisco ACE to accept connections to the VIP on port 443 and forward them to a real server on port 80. Note that if the port is not provided, the VIP port will be preserved.

Most SSL termination configurations begin by importing the certificate and key onto the Cisco ACE. The easiest way to accomplish this is by placing the two files onto a secure FTP (SFTP) or FTP server so they can be transferred to the ACE.

```
ACE-1/routed# crypto import ftp 172.25.91.127 cisco cert.pem cert.pem
ACE-1/routed# crypto import ftp 172.25.91.127 cisco intermediate.pem intermediate.pem
ACE-1/routed# crypto import ftp 172.25.91.127 cisco key.pem key.pem
```

Note: If the files are in privacy enhanced mail (PEM) format, you can cut and paste to import the SSL file using the ter For information on how to use the ?crypto import? command, visit the following URL:

http://cisco.com/en/US/docs/interfaces_modules/services_modules/ace/v3.00_A2/command/reference/execmds.h

Once the SSL files have been imported, they should be checked to ensure that they were uploaded properly and to verify that they match. If the two files do not match, the RSA key cannot be exchanged and the ACE will not be able to properly terminate client connections.

```
ACE-1/routed# show crypto files
Filename                                File  File    Expor      Key/
                                        Size  Type    table      Cert
-----------------------------------------------------------------------
cert.pem                                1354  PEM     Yes        CERT
key.pem                                 887   PEM     Yes         KEY


ACE-1/routed# crypto verify key.pem cert.pem
Keypair in key.pem matches certificate in cert.pem.
```

After the SSL files have been verified, the Cisco ACE can be configured with an SSL proxy service, which is a logical grouping of the certificates, key, and SSL parameters used to define the characteristics of SSL termination on the ACE.

```
ACE-1/routed(config)# ssl-proxy service proxy-1
ACE-1/routed(config-ssl-proxy)# cert cert.pem
ACE-1/routed(config-ssl-proxy)# key key.pem
```

In addition to applying a certificate and key to the proxy service, configure a chaingroup to supply the intermediate certificate to the client?s browser.

```
ACE-1/routed(config)# crypto chaingroup intermed-1
ACE-1/routed(config-chaingroup)# cert intermediate.pem
```

The chaingroup needs to be applied to the ssl-proxy service in addition to the already configured certificate and key.

```
ACE-1/routed(config)# ssl-proxy service proxy-1
ACE-1/routed(config-ssl-proxy)# chaingroup intermed-1
```

Within the ACE, all SSL termination is fully integrated. Therefore, there is no need to configure internal VLANs or IPs to handle decrypted traffic. All that is required to enable SSL termination is to attach the SSL proxy service configured above to a VIP in a service policy.

```
ACE-1/routed(config)# policy-map multi-match client-vips
ACE-1/routed(config-pmap)# class 102-vip
ACE-1/routed(config-pmap-c)# ssl-proxy server proxy-1
```

At this point the ACE should be configured with a working SSL termination configuration. Make a test connection to the VIP address using HTTPS in a web browser, and you should see a response from one of the real servers.

Related show Commands

This section provides information you can use to confirm your configuration is working properly.

Certain show commands are supported by the Output Interpreter Tool (registered customers only), which allows you to view an analysis of show command output.

```
ACE-1/routed# show crypto files
```

```
ACE-1/routed# show crypto certificate all
ACE-1/routed# show crypto key all
ACE-1/routed# show crypto session
ACE-1/routed# show crypto hardware
ACE-1/routed# show service-policy <name> detail
```

Comments

Once the configuration is complete, check to make sure the VIP address can be accessed via HTTPS in a web browser. If any certificate errors are shown, this indicates a problem with the certificate, not with the Cisco ACE configuration. The above commands can be used to verify that SSL sessions are being terminated successfully.

When a client?s web browser connects to an SSL server on any device, the browser and server negotiate which encryption cipher to use for the session. The list and order of ciphers presented by the ACE in a default configuration are as follows.

```
1.      CM_SSL_RSA_WITH_RC4_128_MD5
2.      CM_SSL_RSA_WITH_RC4_128_SHA
3.      CM_SSL_RSA_WITH_DES_CBC_SHA
4.      CM_SSL_RSA_WITH_3DES_EDE_CBC_SHA
5.      CM_SSL_RSA_WITH_AES_128_CBC_SHA
6.      CM_SSL_RSA_WITH_AES_256_CBC_SHA
7.      CM_SSL_RSA_EXPORT_WITH_RC4_40_MD5
8.      CM_SSL_RSA_EXPORT1024_WITH_RC4_56_MD5
9.      CM_SSL_RSA_EXPORT_WITH_DES40_CBC_SHA
10.     CM_SSL_RSA_EXPORT1024_WITH_DES_CBC_SHA
11.     CM_SSL_RSA_EXPORT1024_WITH_RC4_56_SHA
```

If this list is not desirable or the order needs to be changed, an SSL parameter map can be configured to make such changes. The documentation on this feature can be found at the following URL:

http://cisco.com/en/US/docs/interfaces_modules/services_modules/ace/v3.00_A2/configuration/ssl/guide/terminat.html#w

show running-config

```
logging enable

crypto chaingroup intermed-1
  cert intermediate.cert

access-list everyone line 8 extended permit ip any any
access-list everyone line 16 extended permit icmp any any

rserver host lnx1
  ip address 192.168.1.11
  inservice
rserver host lnx2
  ip address 192.168.1.12
  inservice
rserver host lnx3
  ip address 192.168.1.13
  inservice
rserver host lnx4
  ip address 192.168.1.14
  inservice
```

```
rserver host lnx5
  ip address 192.168.1.15
  inservice

ssl-proxy service proxy-1
  key key.pem
cert cert.pem
chaingroup intermed-1

serverfarm host web
  rserver lnx1 80
    inservice
  rserver lnx2 80
    inservice
  rserver lnx3 80
    inservice
  rserver lnx4 80
    inservice
  rserver lnx5 80
    inservice

class-map match-all 102-vip
  2 match virtual-address 172.16.1.102 tcp eq https

policy-map type management first-match remote-access
  class class-default
    permit

policy-map type loadbalance http first-match slb
  class class-default
    serverfarm web

policy-map multi-match client-vips
  class 102-vip
    loadbalance vip inservice
    loadbalance policy slb
    ssl-proxy server proxy-1

interface vlan 20
  description "Client Side"
  ip address 172.16.1.5 255.255.255.0
  access-group input everyone
  service-policy input client-vips
  no shutdown
interface vlan 40
  description "Default gateway of real servers"
  ip address 192.168.1.1 255.255.255.0
  service-policy input remote-access
  no shutdown

ip route 0.0.0.0 0.0.0.0 172.16.1.1
```

Related Information

Technical Support & Documentation - Cisco Systems