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Ben-Itzhak et al.

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(54) **SPLITTING AN SSL CONNECTION BETWEEN GATEWAYS**

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(51) **Int. Cl.**
H04L 29/06 (2006.01)

(52) **U.S. Cl.**
USPC **713/156**; 726/12; 726/3

(58) **Field of Classification Search**
USPC 713/156; 726/3, 12
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

6,963,972	B1 *	11/2005	Chang et al.	713/153
2002/0128925	A1 *	9/2002	Angeles	705/26
2004/0015725	A1 *	1/2004	Boneh et al.	713/201
2006/0136724	A1 *	6/2006	Takeshima et al.	713/168
2007/0038853	A1 *	2/2007	Day et al.	713/153
2008/0060055	A1 *	3/2008	Lau	726/3
2008/0146240	A1 *	6/2008	Trudeau	455/445
2008/0307219	A1 *	12/2008	Karandikar	713/153
2009/0013399	A1 *	1/2009	Cottrell et al.	726/12
2009/0178061	A1 *	7/2009	Sandoval et al.	719/328

* cited by examiner

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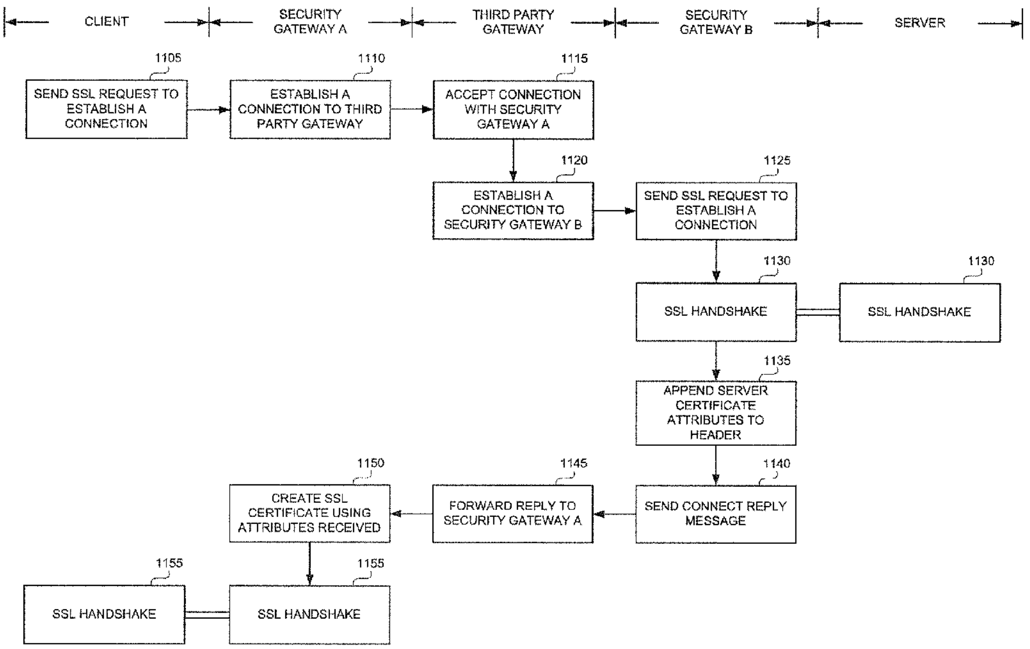
(57) **ABSTRACT**

A system for secure communication, including a first security computer communicatively coupled with a client computer via an SSL connection, including a certificate creator, for receiving certificate attributes of a server computer certificate and for creating a signed certificate therefrom, and an SSL connector, for performing an SSL handshake with the client computer using the signed certificate created by said certificate creator, and a second security computer communicatively coupled with a server computer via an SSL connection, and communicatively coupled with the first security computer via a non-SSL connection, including an SSL connector, for performing an SSL handshake with the server computer using a signed certificate provided by the server computer, and a protocol appender, for appending attributes of the signed certificate provided by the server computer within a message communicated to the first security computer. A method is also described and claimed.

10 Claims, 8 Drawing Sheets


CLIENT
SECURITY GATEWAY A
THIRD PARTY GATEWAY
SECURITY GATEWAY B
SERVER
1105
SEND SSL REQUEST TO ESTABLISH A CONNECTION
1110
ESTABLISH A CONNECTION TO THIRD PARTY GATEWAY
1115
ACCEPT CONNECTION WITH SECURITY GATEWAY A
1120
ESTABLISH A CONNECTION TO SECURITY GATEWAY B
1125
SEND SSL REQUEST TO ESTABLISH A CONNECTION
1130
SSL HANDSHAKE
1130
SSL HANDSHAKE
1135
APPEND SERVER CERTIFICATE ATTRIBUTES TO HEADER
1140
SEND CONNECT REPLY MESSAGE
1145
FORWARD REPLY TO SECURITY GATEWAY A
1150
CREATE SSL CERTIFICATE USING ATTRIBUTES RECEIVED
1155
SSL HANDSHAKE
1155
SSL HANDSHAKE

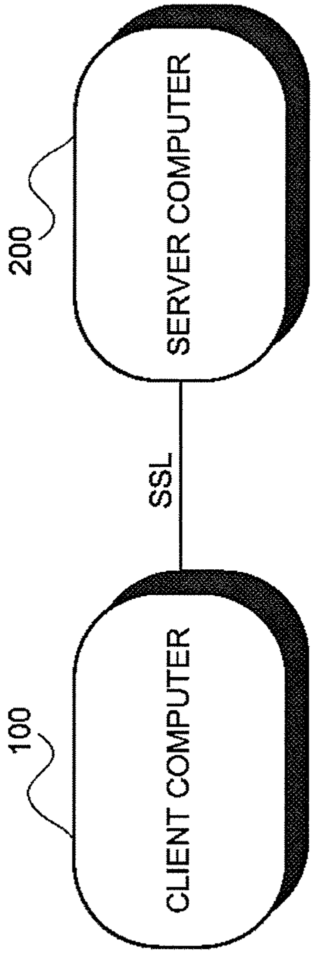


FIG. 1A
(PRIOR ART)

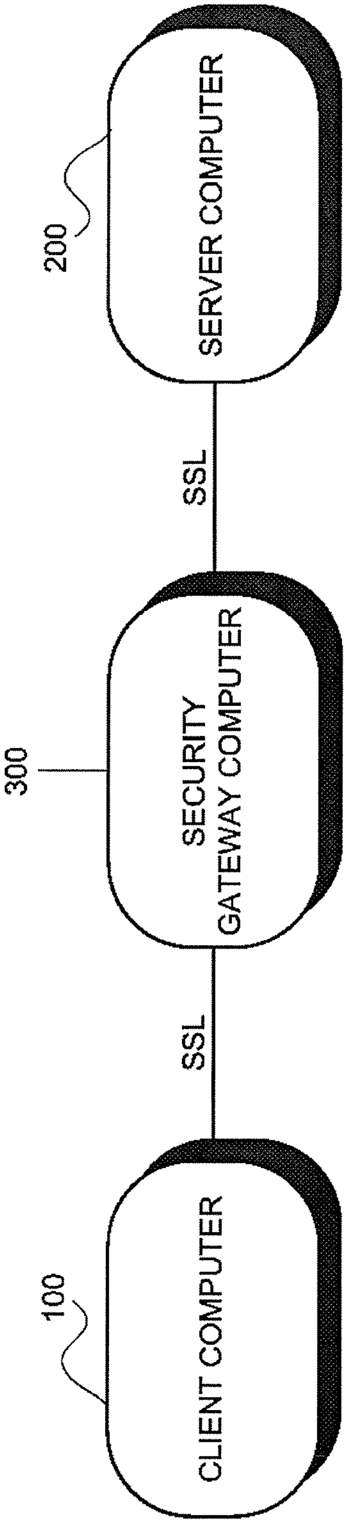


FIG. 1B
(PRIOR ART)

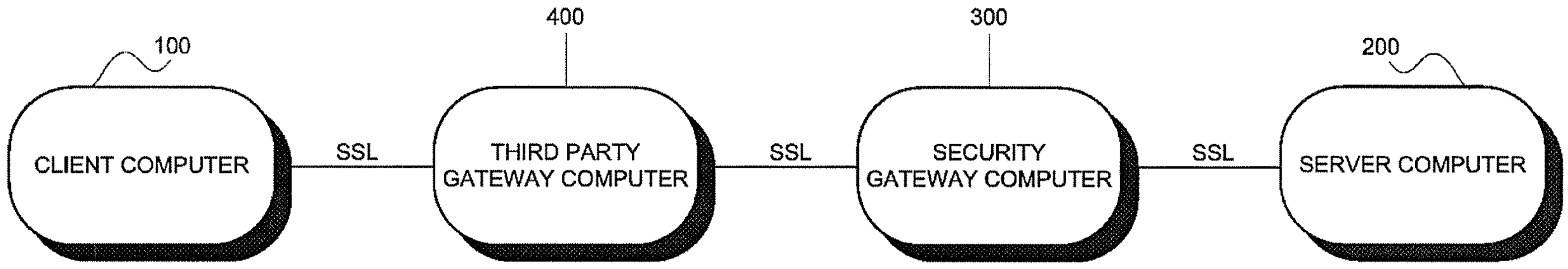


FIG. 1C
(PRIOR ART)

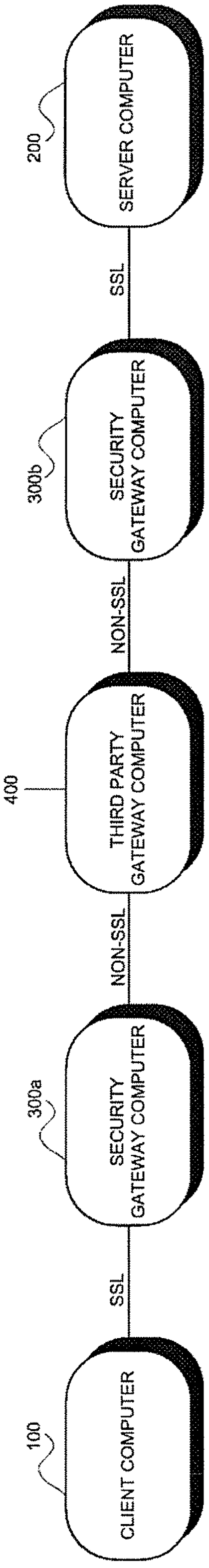

100
CLIENT COMPUTER
SSL
300a
SECURITY
GATEWAY COMPUTER
NON-SSL
400
THIRD PARTY
GATEWAY COMPUTER
NON-SSL
300b
SECURITY
GATEWAY COMPUTER
SSL
200
SERVER COMPUTER

FIG. 2

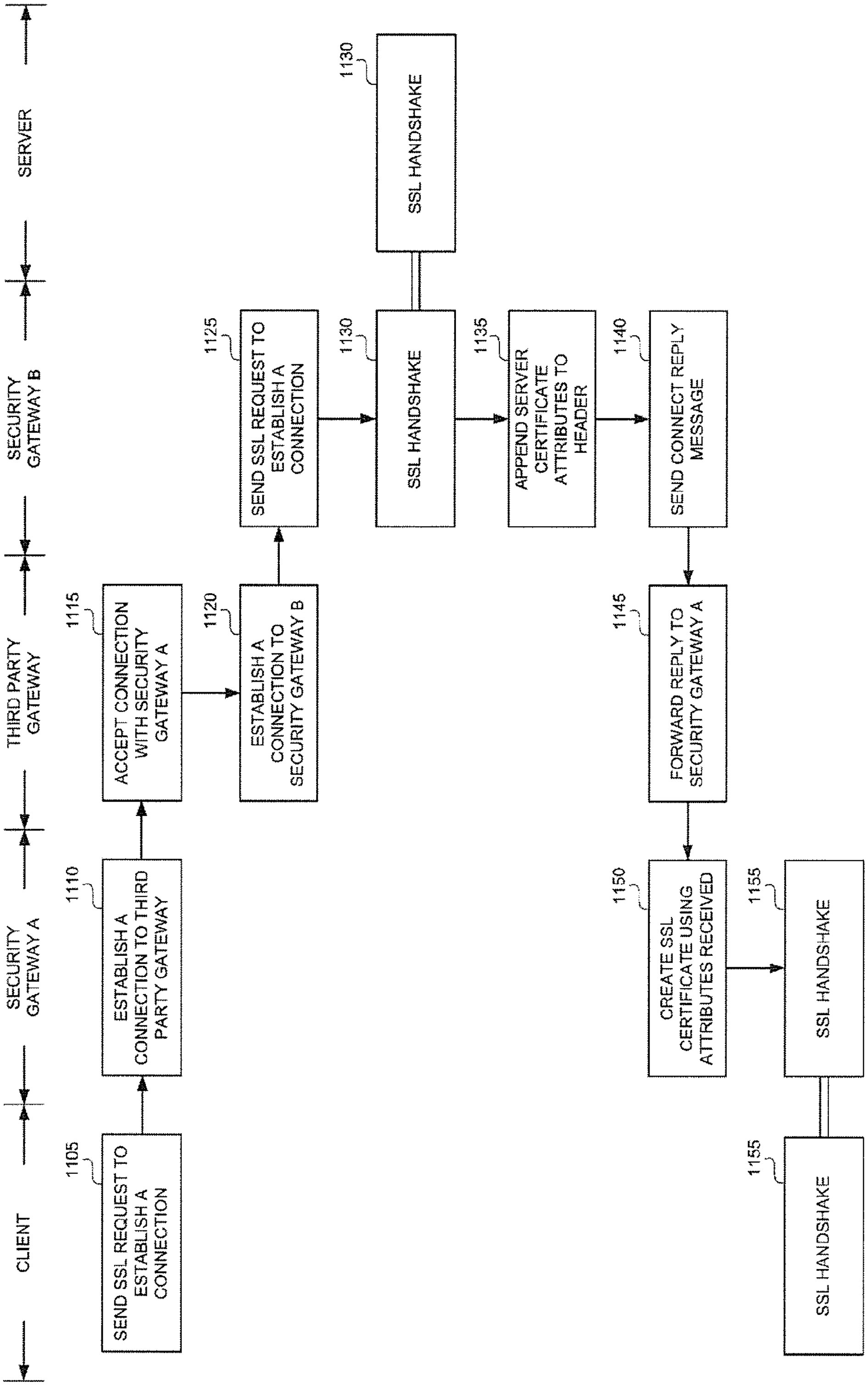

CLIENT
SECURITY GATEWAY A
THIRD PARTY GATEWAY
SECURITY GATEWAY B
SERVER
1105
SEND SSL REQUEST TO ESTABLISH A CONNECTION
1110
ESTABLISH A CONNECTION TO THIRD PARTY GATEWAY
1115
ACCEPT CONNECTION WITH SECURITY GATEWAY A
1120
ESTABLISH A CONNECTION TO SECURITY GATEWAY B
1125
SEND SSL REQUEST TO ESTABLISH A CONNECTION
1130
SSL HANDSHAKE
1130
SSL HANDSHAKE
1135
APPEND SERVER CERTIFICATE ATTRIBUTES TO HEADER
1140
SEND CONNECT REPLY MESSAGE
1145
FORWARD REPLY TO SECURITY GATEWAY A
1150
CREATE SSL CERTIFICATE USING ATTRIBUTES RECEIVED
1155
SSL HANDSHAKE
1155
SSL HANDSHAKE

FIG. 3

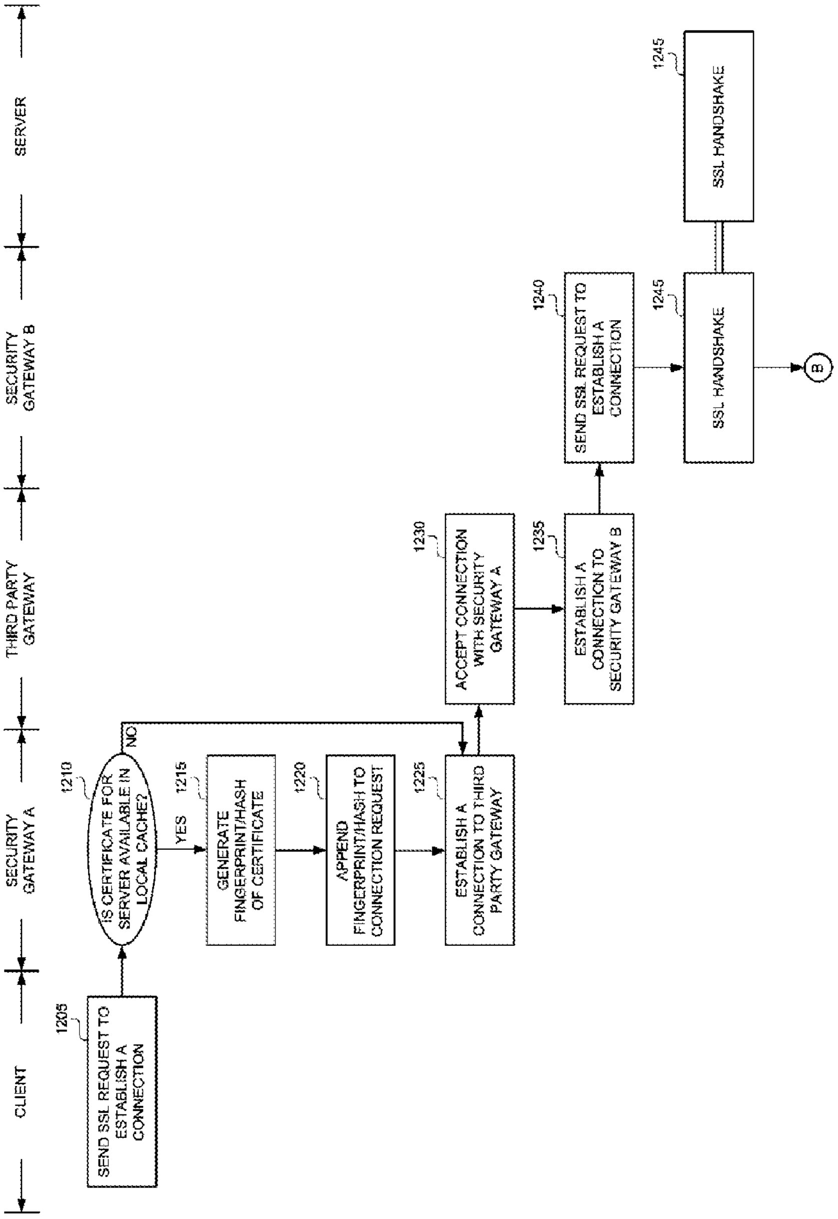

CLIENT
SECURITY GATEWAY A
THIRD PARTY GATEWAY
SECURITY GATEWAY B
SERVER
1205
SEND SSL REQUEST TO ESTABLISH A CONNECTION
1210
IS CERTIFICATE FOR SERVER AVAILABLE IN LOCAL CACHE?
YES
NO
1215
GENERATE FINGERPRINT/HASH OF CERTIFICATE
1220
APPEND FINGERPRINT/HASH TO CONNECTION REQUEST
1225
ESTABLISH A CONNECTION TO THIRD PARTY GATEWAY
1230
ACCEPT CONNECTION WITH SECURITY GATEWAY A
1235
ESTABLISH A CONNECTION TO SECURITY GATEWAY B
1240
SEND SSL REQUEST TO ESTABLISH A CONNECTION
1245
SSL HANDSHAKE
1245
SSL HANDSHAKE
B

FIG. 4A

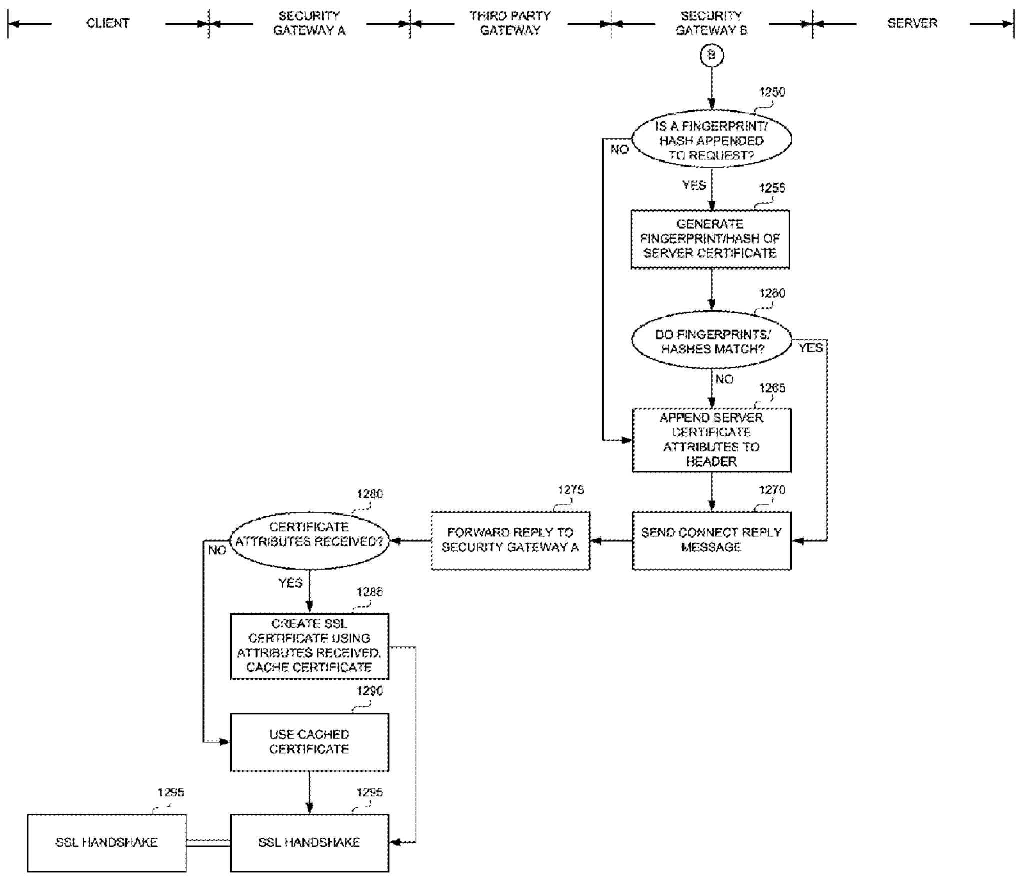

CLIENT
SECURITY GATEWAY A
THIRD PARTY GATEWAY
SECURITY GATEWAY B
SERVER
B
1250
IS A FINGERPRINT/ HASH APPENDED TO REQUEST?
NO
YES
1255
GENERATE FINGERPRINT/HASH OF SERVER CERTIFICATE
1260
DO FINGERPRINTS/ HASHES MATCH?
YES
NO
1265
APPEND SERVER CERTIFICATE ATTRIBUTES TO HEADER
1270
SEND CONNECT REPLY MESSAGE
1275
FORWARD REPLY TO SECURITY GATEWAY A
1280
CERTIFICATE ATTRIBUTES RECEIVED?
NO
YES
1285
CREATE SSL CERTIFICATE USING ATTRIBUTES RECEIVED, CACHE CERTIFICATE
1290
USE CACHED CERTIFICATE
1295
SSL HANDSHAKE
1295
SSL HANDSHAKE

FIG. 4B

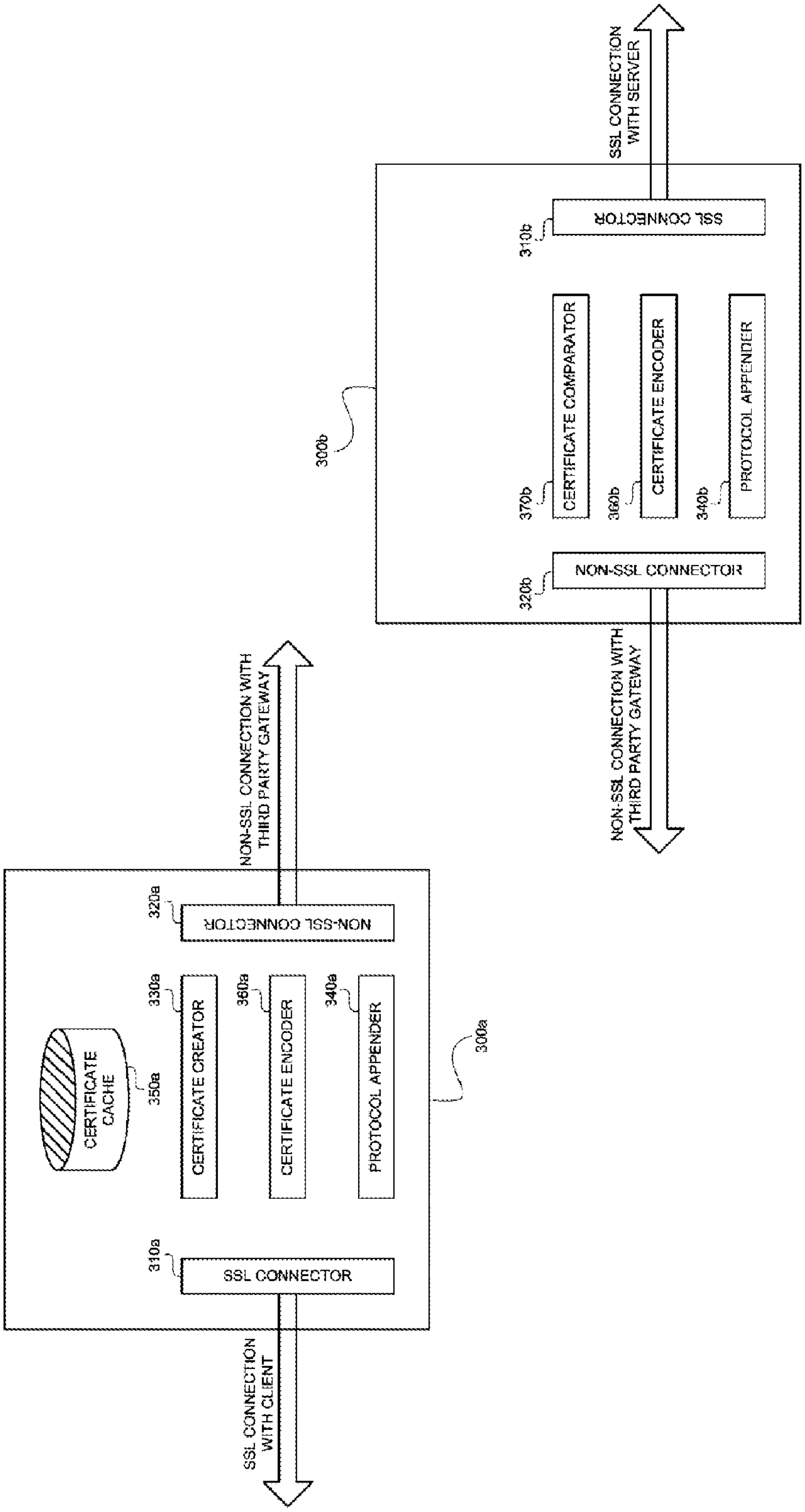

SSL CONNECTION WITH CLIENT
300a
310a
SSL CONNECTOR
CERTIFICATE CACHE
350a
330a
CERTIFICATE CREATOR
360a
CERTIFICATE ENCODER
340a
PROTOCOL APPENDER
320a
NON-SSL CONNECTOR
NON-SSL CONNECTION WITH THIRD PARTY GATEWAY
NON-SSL CONNECTION WITH THIRD PARTY GATEWAY
300b
320b
NON-SSL CONNECTOR
370b
CERTIFICATE COMPARATOR
360b
CERTIFICATE ENCODER
340b
PROTOCOL APPENDER
310b
SSL CONNECTOR
SSL CONNECTION WITH SERVER

FIG. 5

SPLITTING AN SSL CONNECTION BETWEEN GATEWAYS

FIELD OF THE INVENTION

The field of the present invention is secure network communication.

BACKGROUND OF THE INVENTION

Secure Sockets Layer (SSL) is a protocol used to encrypt communication between a client computer and a server computer. In this regard, reference is now made to FIG. **1**A, which is a prior art diagram of a client-server system using one SSL connection. The SSL protocol enables a client computer **100** to authenticate a remote server computer **200**, by means of signed certificates. The SSL protocol utilizes a handshake procedure to exchange and validate a certificate, prior to establishing an encrypted connection. Generally, the handshake procedure degrades performance and causes latency.

Often a security gateway computer is used to inspect data being communicated between server computer **200** and client computer **100**. In this regard, reference is now made to FIG. **1**B, which is a prior art diagram of a client-server system with a security gateway computer **300**, using two SSL connections. Security gateway computer **300** may detect malicious content and confidential data. As seen in FIG. **1**B, the SSL protocol between client computer **100** and server computer **200** is split. Each side of security gateway computer **300** establishes a separate SSL connection. There is an SSL connection between client computer **100** and security gateway computer **300**, for which security gateway computer **300** acts as a server; and there is an SSL connection between security gateway **300** and server computer **200**, for which security gateway computer **300** acts as a client. The additional SSL handshake required by the additional SSL connection additionally degrades performance and causes additional latency.

Often security gateway computers operate in conjunction with third party gateway computers, such as content caching gateway computers. In this regard, reference is now made to FIG. **1**C, which is a prior art diagram of a client-server system with a security gateway computer **300** and a third party gateway computer **400**, using three SSL connections. Third party gateway computer **400** does not inspect the data content transmitted via the SSL connection and, as such, does not need to encrypt the data content. Nevertheless, since third party gateway computer **400** is networked within an SSL connection, it must re-establish the SSL connection on both of its sides. Although the topology of FIG. **1**C is technically sound, it has a significant penalty in performance and latency due to the need to perform three SSL handshakes. Moreover, the penalty is magnified if third party gateway computer **400** is replaced with a plurality of third party gateway computers.

It would thus be of advantage to provide a more efficient way to network a security gateway computer with one or more third party gateway computers, when the one or more third party gateway computers do not need to inspect data content.

SUMMARY OF THE DESCRIPTION

Aspects of the present invention relate to a method and system for networking a security gateway computer with one or more third party gateway computers, when the third party gateway computers do not need to inspect the data content they receive and transmit. The third party gateway computers may be, for example, caching gateway computers. Embodiments of the present invention provide a network that requires only two SSL handshakes, regardless of the number of third party gateway computers in the network. In contrast, prior art networks require at least n+2 SSL handshakes, where n is the number of third party gateway computers in the network.

Embodiments of the present invention use two security gateway computers that surround the third party gateway computers. A permanent encrypted tunnel/pipe is established between the two security gateway computers.

To support SSL certificate validation of a server computer by a client computer, the security gateway computer adjacent to the client computer generates certificates with credential attributes of the server computer. Additionally, the security gateway computer adjacent to the client computer maintains an up-to-date certificate cache, so that the same certificate may be used for client requests to the same server computer.

There is thus provided in accordance with an embodiment of the present invention a system for secure communication, including a first security computer communicatively coupled with a client computer via an SSL connection, including a certificate creator, for receiving certificate attributes of a server computer certificate and for creating a signed certificate therefrom, and an SSL connector, for performing an SSL handshake with the client computer using the signed certificate created by said certificate creator, and a second security computer communicatively coupled with a server computer via an SSL connection, and communicatively coupled with the first security computer via a non-SSL connection, including an SSL connector, for performing an SSL handshake with the server computer using a signed certificate provided by the server computer, and a protocol appender, for appending attributes of the signed certificate provided by the server computer within a message communicated to the first security computer.

There is additionally provided in accordance with an embodiment of the present invention a method for secure communication, including forwarding, from a first security computer to a second security computer, a request from a client computer to connect to a server computer, establishing an SSL connection between the second security computer and the server computer, including performing, by the second security computer, an SSL handshake with the server computer using a signed certificate provided by the server computer, appending, by the second security computer, attributes of the signed certificate provided by the server computer within a message communicated to the first security computer, receiving, by the first security computer, certificate attributes of the server computer certificate, creating, by the first security computer, a signed certificate from the received certificate attributes of the server computer certificate, and establishing an SSL connection between the first security computer and the client computer, including performing an SSL handshake with the client computer using the signed certificate created by the creating.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will be more fully understood and appreciated from the following detailed description, taken in conjunction with the drawings in which:

FIG. **1**A is a prior art diagram of a client server system using one SSL connection;

FIG. **1**B is a prior art diagram of a client-server system with a security gateway computer, using two SSL connections;

FIG. **1**C is a prior art diagram of a client-server system with a security gateway computer and a third party gateway computer, using three SSL connections;

FIG. **2** is a diagram of a client-server system with two security gateways and a third party caching gateway, using only two SSL connections, in accordance with an embodiment of the present invention;

FIG. **3** is a simplified flowchart of a method for establishing an SSL connection between a client and server computer, when a security gateway computer and a third party gateway computer intermediate between the client and the server computers, in accordance with an embodiment of the present invention;

FIGS. **4**A and **4**B are simplified flowcharts of an enhancement for the method of FIG. **3**, using a certificate cache, in accordance with an embodiment of the present invention; and

FIG. **5** is a simplified block diagram of security gateway computers that cooperate in SSL certificate validation, in accordance with an embodiment of the present invention.

DETAILED DESCRIPTION

Aspects of the present invention relate to a communications network having an intermediary security gateway computer and one or more intermediary third party gateway computers, where the third party gateway computers do not need to inspect the data content they receive and send. Using embodiments of the present invention, the connection between a client and a server is split into two SSL connections, and two or more non-SSL connections. One of the two SSL connections is used for communication between the client and a first security gateway computer, and the other of the two SSL connections is used for communication between the server and a second security gateway computer. The two or more non-SSL connections are used for communications between a security gateway computer and a third party gateway computer, and for communications between two third party gateway computers.

The first and second security computers are operative cooperatively to authenticate signed certificates that are provided by the server during an SSL handshake. The second security computer transmits to the first security computer the certificate attributes received from the server, and the first security computer acts as a certificate authority, and creates a certificate for the client based on the attributes of the server certificate.

Reference is now made to FIG. **2**, which is a diagram of a client-server system with two security gateways and a third party caching gateway, using only two SSL connections, in accordance with an embodiment of the present invention. Shown in FIG. **2** is a client computer **100** that communicates with a server computer **200** within a network in which a first security gateway computer **300***a*, a third party gateway computer **400**, and a second security gateway computer **300***b* intermediate. Third party gateway computer **400** does not need to inspect the data content that it receives and sends. In some instances the data content passing through third party gateway computer **400** may need to be encrypted, and in other instances the data content may not need to be encrypted.

It will be appreciated by those skilled in the art in the ensuing description that embodiments of the present invention apply as well to a topology wherein third party gateway computer **400** is a plurality of networked third party gateway computers.

Notable in FIG. **2** is the use of two SSL connections and two non-SSL connections. As such, establishing a connection between client computer **100** and server computer **200** requires only two SSL handshakes. Specifically, security gateway computer **300***a* establishes an SSL connection with client computer **100**, and security gateway computer **300***b* establishes an SSL connection with server computer **200**. The connections between security gateway computer **300***a* and security gateway computer **300***b* are non-SSL connections, which are higher performance and lower latency connections than SSL connections.

Using the network topology of FIG. **2**, client computer **100** and server computer **200** are still connected over SSL, and a certificate is exchanged and validated. If the communication between security gateway computers **300***a* and **300***b* is required to be encrypted, an encrypted tunnel/pipe is established between the security gateway computers, such as an Open-VPN tunnel. In cases where there are many connections between security gateway computers **300***a* and **300***b*, a permanent encrypted tunnel/pipe is established between them.

For the network topology of FIG. **2** to support SSL certificate validation, security gateway computers **300***a* and **300***b* perform special processing, as described hereinbelow regarding the methods of FIGS. **3** and **4**.

Reference is now made to FIG. **3**, which is a simplified flowchart of a method for establishing an SSL connection between a client and server computer, when a security gateway computer and a third party gateway computer intermediate between the client and the server computers, in accordance with an embodiment of the present invention. The flowchart of FIG. **3** is divided into five columns. Starting from the left, the first column includes steps performed by client computer **100** ("client"), the second column includes steps performed by security gateway computer **300***a* ("security gateway A"), the third column includes steps performed by third party gateway computer **400** ("third party gateway"), the fourth column includes steps performed by security gateway computer **300***b* ("security gateway B"), and the fifth column includes steps performed by server computer **200** ("server").

At step **1105**, the client computer sends an SSL request to security gateway A, to establish a connection, using the CONNECT request method. At step **1110** security gateway A establishes a connection to the third party gateway. If an encrypted connection is desired, then security gateway A establishes an encrypted connection to the third party gateway using, for example, Open-VPN. If subsequent connection requests are anticipated, then the connection between security gateway A and the third party gateway remains as a tunnel/pipe, in order not to disconnect.

At step **1115** the third party gateway accepts the connection with security gateway A. At step **1120** the third party gateway establishes a connection to security gateway B. As above, if an encrypted connection is desired, then the third party gateway establishes an encrypted connection to security gateway B using, for example, Open-VPN. Also as above, if subsequent connection requests are anticipated, then the connection between the third party gateway and security gateway B remains as a tunnel/pipe, in order not to disconnect.

At step **1125** security gateway B sends an SSL request to the server, to establish a connection, using the CONNECT request method. At step **1130** security gateway B and the server perform an SSL handshake to authenticate a server certificate. Upon success of the handshake, an SSL connection is established between security gateway B and the server. At step **1135** security gateway B appends the server certificate attributes to a header in the protocol, such as an HTTP reply header. Certificate attributes generally include inter alia a domain name and a validity date.

At step **1140** security gateway B replies to the third party gateway with a CONNECT reply message. The reply includes the server certificate attributes in its header. At step

1145 the third party gateway forwards the reply received from security gateway B to security gateway A.

At step **1150** security gateway A creates an SSL certificate using the attributes of the server certificate. Finally, at step **1155** security gateway A and the client perform an SSL handshake to authenticate the certificate created by security gateway A. Upon success of the handshake, an SSL connection is established between security gateway A and the client. At this stage, subsequent requests from the client to the server may be communicated over the established connections.

In accordance with an embodiment of the present invention, the method of FIG. **3** may be enhanced by maintaining a local certificate cache at security gateway A. Such a cache obviates the need for security gateway B to send the server certificate attributes to security gateway A. Instead, a cached server certificate is used. However, certificates often expire and are renewed. In order that the certificate cache at security gateway A be up-to-date, security gateway B sends updated server certificates to security gateway A when the server certificates change.

In this regard, reference is now made to FIGS. **4**A and **4**B, which are a simplified flowchart of an enhancement for the method of FIG. **3**, using a certificate cache, in accordance with an embodiment of the present invention. The flowchart of FIGS. **4**A and **4**B is divided into five columns, as described above with reference to FIG. **3**.

At step **1205** the client sends an SSL request to security gateway A, to establish a connection, using the CONNECT request method. At step **1210** security gateway A checks its local certificate cache to determine if a certificate for the requested server name is already available in cache. If so, then at step **1215** security gateway A generates a fingerprint or hash of the server certificate, and at step **1220** security gateway A appends the fingerprint/hash to a connection request. Otherwise, if it is determined at step **1210** that a certificate for the requested server name is not available in cache, then processing advances directly to step **1225**, by-passing steps **1215** and **1220**.

At step **1225** security gateway A establishes a connection to the third party gateway. The connection request will include the fingerprint/hash of the server certificate if steps **1215** and **1220** were performed. If encryption between security gateway A and the third party gateway is desired, then an encrypted connection is established, using, for example, Open-VPN. If subsequent requests are anticipated, then the connection between security gateway A and the third party gateway remains as a tunnel/pipe, in order that it not disconnect.

At step **1230** the third party gateway accepts the connection with security gateway A. At step **1235** the third party gateway establishes a connection to security gateway B. The connection request received by security gateway B from the third party gateway will include the fingerprint/hash of the server certificate if steps **1215** and **1220** were performed. As above, if encryption between the third party gateway and security gateway B is desired, then an encrypted connection is established, using, for example, Open-VPN. Also as above, if subsequent requests are anticipated, then the connection between the third party gateway and security gateway B remains as a tunnel/pipe, in order that it not disconnect.

At step **1240** security gateway B sends an SSL request to the server, to establish a connection, using the CONNECT request method. At step **1245** security gateway B and the server perform an SSL handshake to authenticate a server certificate. Upon success of the handshake, an SSL connection is established between security gateway B and the server.

At step **1250** security gateway B determines whether a fingerprint/hash of the server certificate was included in the request made at step **1235**. If so, then at step **1255** security gateway B generates a fingerprint or hash of the certificate it received from the server during the SSL handshake at step **1245**. At step **1260** security gateway B compares the fingerprint/hash received at step **1235** with the fingerprint/hash generated at step **1255**. If the two fingerprints/hashes do not match, then the server certificate was recently updated, and the server certificate cached at security gateway A is no longer valid. At step **1265** security gateway B appends the certificate attributes from the server certificate received at step **1245**, to a header in the protocol, such as an HTTP reply header. Otherwise, if the two fingerprints/hashes compared at step **1260** do match, then the server certificate cached at security gateway A is still valid. In this case, processing advances directly to step **1270**, by-passing step **1265**, and no certificate attributes are appended to the reply message.

If security gateway B determines at step **1250** that a fingerprint/hash was not included in the request received at step **1235**, then processing advances directly to step **1265**, by-passing steps **1255** and **1260**.

At step **1270** security gateway B replies to the third party gateway with a connection reply message. At step **1275** the third party gateway forwards the reply received from security gateway B to security gateway A.

At step **1280** security gateway A determines whether server certificate attributes are included in the reply message received from the third party gateway computer at step **1275**. If so, then at step **1285** security gateway A creates an SSL certificate using the attributes included in the reply message, and stores the created certificate in its local cache for subsequent access. Otherwise, at step **1290** security gateway A retrieves its cached certificate.

Finally, at step **1295** security gateway A and the client perform an SSL handshake to authenticate the certificate created at step **1285** or the cached certificate, as appropriate. Upon success of the SSL handshake, an SSL connection between gateway server A and the client is established. At this stage, subsequent requests from the client to the server are communicated over the established connections.

Reference is now made to FIG. **5**, which is a simplified block diagram of security gateway computers **300***a* and **300***b* that cooperate in SSL certificate validation, in accordance with an embodiment of the present invention. Security gateway computers **300***a* and **300***b* are operative to perform the steps in FIGS. **3**, **4**A and **4**B that apply to security gateways A and B, respectively. In addition to the components shown in FIG. **5**, each of security gateway computers **300***a* and **300***b* includes standard computer hardware (not shown), including inter alia one or more processors, one or more hard disk drives, RAM, a communication bus, one or more network interfaces, and I/O drivers including inter alia drivers for a keyboard, a mouse and a graphical display.

As shown in FIG. **5**, security gateway computer **300***a* includes an SSL connector **310***a*, for establishing an SSL connection between security gateway computer **300***a* and a client computer. SSL connector **310***a* is used in performing step **1155** of FIG. **3** and step **1295** of FIG. **4**B. Security gateway computer **300***a* also includes a non-SSL connector **320***a*, for establishing a non-SSL encrypted or non-encrypted connection between security gateway computer **300***a* and a third party gateway computer. Non-SSL connector **320***a* is used in performing step **1110** of FIG. **3** and step **1225** of FIG. **4**A. Security gateway computer **300***a* also includes a certificate creator **330***a*, for creating a signed certificate for attributes of a server certificate. Certificate creator **330***a* is used in performing step **1150** of FIG. **3** and step **1285** of FIG. **4**B.

Security gateway computer **300***b* includes an SSL connector **310***b*, for establishing an SSL connection between security gateway computer **300***b* and a server computer. SSL connector **310***b* is used in performing step **1130** of FIG. **3** and step **1245** of FIG. **4**A. Security gateway computer **300***b* also includes a non-SSL connector **320***b*, for establishing a non-SSL encrypted or non-encrypted connection between security gateway computer **300***b* and a third party gateway computer. Non-SSL connector **320***b* is used in performing step **1120** of FIG. **3** and step **1235** of FIG. **4**. Security gateway computer **300***b* also includes a protocol appender **340***b*, for appending certificate attributes within a protocol request. Protocol appender **340***b* is used in performing step **1135** of FIG. **3** and step **1265** of FIG. **4**B.

For use in the enhanced method of FIGS. **4**A and B, security gateway computer **300***a* also includes a local certificate cache **350***a* for storing and retrieving attributes of signed server certificates. In addition, security gateway computer **300***a* includes a certificate encoder **360***a* for deriving a hash value for cached certificate attributes, and a protocol appender **340***a* for appending the hash value to a protocol message. Certificate encoder **360***a* is used in performing step **1215** of FIG. **4**A, and protocol appender **340***a* is used in performing step **1220** of FIG. **4**A.

Further for use in the enhanced method of FIGS. **4**A and B, security gateway computer **300***b* also includes a certificate encoder **360***b* for deriving a hash value for attributes of a certificate provided by the server computer, and a certificate comparator **370***b* for comparing hash values generated by certificate encoder **360***a* with a hash value generated by certificate encoder **360***b*. Certificate encoder **360***b* is used in performing step **1255** of FIG. **4**B, and certificate comparator **370***b* is used in performing step **1260** of FIG. **4**B.

In the foregoing specification, the invention has been described with reference to specific exemplary embodiments thereof. It will, however, be evident that various modifications and changes may be made to the specific exemplary embodiments without departing from the broader spirit and scope of the invention as set forth in the appended claims. Accordingly, the specification and drawings are to be regarded in an illustrative rather than a restrictive sense.

What is claimed is:

1. A system for secure communication, comprising:

a first security computer comprising:

a certificate creator, (i) for receiving attributes of a server computer's signed certificate within a reply message generated by a second security computer and communicated to the first security computer, the signed certificate being used to authenticate the server computer, and (ii) for creating a proxy signed certificate from the received attributes;

a certificate cache for storing and retrieving the attributes of the server computer's signed certificate; and

a first SSL connector, for connecting to a client computer and for performing a first SSL handshake with the client computer using the proxy signed certificate created by said certificate creator; and

a second security computer communicatively coupled with said first security computer via a non-SSL connection for receiving a connection request message therefrom, the connection request message including cached attributes of the signed certificate, comprising:

a second SSL connector, for connecting to the server computer, for receiving current attributes of the signed certificate from the server computer, for performing a second SSL handshake with the server computer using the signed certificate, and for generating the reply message communicated to said first security computer in response to the connection request message;

a certificate comparator for comparing the cached attributes of the signed certificate with the current attributes of the signed certificate; and

a protocol appender, for appending the current attributes of the signed certificate within the reply message communicated to said first security computer, when said certificate comparator determines that the cached attributes of the signed certificate do not match the current attributes of the signed certificate.

2. The system of claim **1** wherein said first security computer further comprises:

a certificate encoder for deriving a hash value of the cached attributes of the signed certificate; and

a protocol appender, for appending the hash value derived by said first security computer certificate encoder within a request message communicated to said second security computer,

wherein said second security computer further comprises a certificate encoder for deriving a hash value for the current attributes of the signed certificate,

wherein said certificate comparator compares the hash value within the request message with the hash value derived by said second security computer certificate encoder, and

wherein said second security computer protocol appender appends the current attributes of the signed certificate to the reply message when said certificate comparator determines that the hash value within the request message does not match the hash value derived by said second security computer certificate encoder.

3. The system of claim **1** wherein said first and said second security computers are network gateway computers.

4. The system of claim **1** wherein said first security computer and said second security computer communicate using an unencrypted connection that goes through at least one other computer.

5. The system of claim **4** wherein the at least one other computer includes a network gateway caching computer.

6. The system of claim **1** wherein said first security computer and said second security computer communicate using an encrypted connection that goes through at least one other computer.

7. The system of claim **6** wherein the encrypted connection is an Open-VPN connection.

8. The system of claim **6** wherein the at least one other computer includes a network gateway caching computer.

9. The system of claim **1** wherein certificate attributes include a domain name.

10. The system of claim **1** wherein certificate attributes include a validity date.

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