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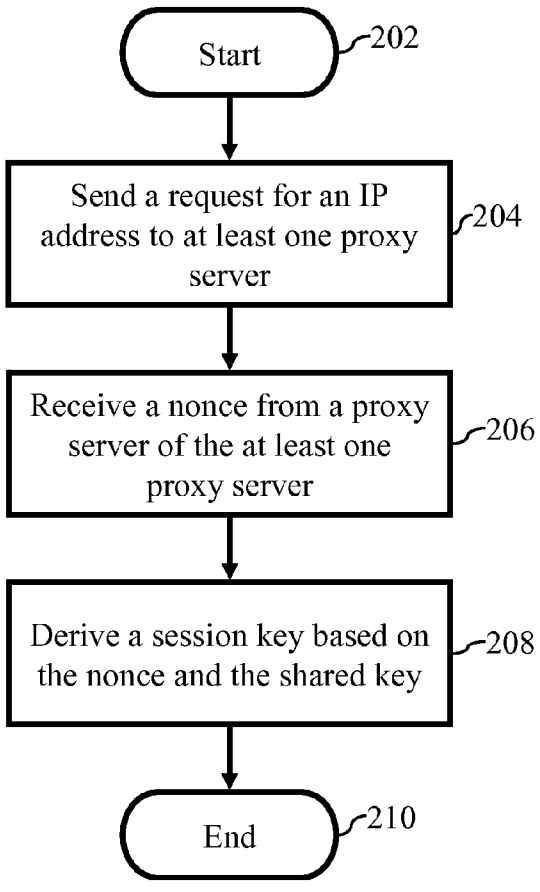
(54) Title: METHOD FOR AUTHENTICATING A MOBILE NODE IN A COMMUNICATION NETWORK



(57) Abstract: A method for authenticating a mobile node (102) in a communication network (100) is provided. The communication network includes at least one proxy server and a home server. The mobile node and the home server include a shared key. The shared key uniquely associates the mobile node with the home server. The method at the mobile node includes sending (204) a request for an Internet Protocol (IP) address to at least one proxy server. Further, the method includes receiving (206) a nonce in response to the request, from a proxy server of the at least one proxy server. The method also includes deriving (208) a session key, based on the nonce and the shared key. The session key authenticates the mobile node to initiate a secure communication session with the proxy server.

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METHOD FOR AUTHENTICATING A MOBILE NODE IN A COMMUNICATION NETWORK

[0001] This invention relates generally to communication networks, and more particularly, to a method for authenticating a mobile node in a communication network.

BACKGROUND OF THE INVENTION

[0002] With increasing need for communication and information exchange, communication networks are becoming increasingly popular. They enable users to share resources and communicate amongst themselves. There are different types of communication networks, for example, mobile communication networks and computer networks. Typically, a mobile communication network includes at least a home server and one or more mobile nodes. Some examples of mobile nodes include mobile phones, personal digital assistants (PDAs), laptop computers, and messaging devices. The mobile devices in a mobile communication network securely communicate using a home server.

[0003] A mobile communication network has an advantage that it allows users to communicate with each other even when they are mobile, for example, in a home network or a foreign one. However, a mobile communication network is vulnerable to security threats. For example, an unauthorized mobile node may enter a mobile communication network and repeatedly keep making requests for IP addresses from a proxy server by using fake identities. This may exhaust a portion of the IP addresses available with the proxy server. Further, the unauthorized mobile node can consume the network's resources without being traceable by the service provider. In such a

scenario, the unauthorized mobile node can interfere with the network's accounting system, for example, it can lead to false billing of another mobile node whose identity the unauthorized mobile node is using.

[0004] Similarly, a proxy server delivering information to the mobile node can be an unauthorized proxy server. For example, when the mobile node enters a foreign network and makes a request for an IP address, this request may be directed to an unauthorized proxy server, which will provide the mobile node with an invalid address. Consequently, an authorized mobile node entering the network will not be able to acquire an address, and will therefore be unable to access the network. In another scenario, the IP address provided by the unauthorized proxy server may cause the mobile node to be routed to invalid resources on the network, where the mobile node may unknowingly download a destructive program, for example, a virus. This can pose a security threat for mobile nodes. Consequently, a mobile node and a proxy server providing information to mobile nodes in a communication network need to be authenticated for secure communication.

BRIEF DESCRIPTION OF THE FIGURES

[0005] The accompanying figures where like reference numerals refer to identical or functionally similar elements throughout the separate views, and which, together with the detailed description below are incorporated in and form part of the specification, serve to further illustrate various embodiments and to explain various principles and advantages all in accordance with the present invention.

[0006] **FIG. 1** illustrates an exemplary communication network, in accordance with an embodiment of the present invention;

[0007] **FIG. 2** is a flow diagram illustrating a method for authenticating a mobile node in a communication network, in accordance with an embodiment of the present invention;

[0008] **FIG. 3** is a message-flow diagram illustrating a method for authenticating a mobile node in a communication network, in accordance with an embodiment of the present invention;

[0009] **FIG. 4** is a flow diagram illustrating a method for authenticating a mobile node in a communication network, in accordance with another embodiment of the present invention;

[0010] **FIG. 5** is a flow diagram illustrating a method for authenticating a mobile node in a communication network, in accordance with yet another embodiment of the present invention; and

[0011] **FIG. 6** is a message-flow diagram illustrating a method for authenticating a mobile node in a communication network, in accordance with another embodiment of the present invention.

DETAILED DESCRIPTION

[0012] Before describing in detail the particular method for authenticating a mobile node in a communication network in accordance with various embodiments of the present invention, it should be observed that the present invention resides primarily in combinations of method steps related to authentication of a mobile node in a communication network. Accordingly, the method steps have been represented, where appropriate, by conventional symbols in the drawings, showing only those specific details that are pertinent to understanding the present invention, so as not to obscure the disclosure with details that will be readily apparent to those of ordinary skill in the art having the benefit of the description herein.

[0013] In this document, the terms "comprises," "comprising," or any other variation thereof, are intended to cover a non-exclusive inclusion, such that a process, method, article, or apparatus that comprises a list of elements does not include only those elements but may include other elements not expressly listed or inherent to such process, method, article, or apparatus. An element proceeded by “comprises … a” does not, without more constraints, preclude the existence of additional identical elements in the process, method, article, or apparatus that comprises the element. The term “another,” as used in this document, is defined as at least a second or more. The terms “includes” and/or “having”, as used herein, are defined as comprising.

[0014] In an embodiment, a method for authenticating a mobile node in a communication network is provided. The communication network includes a mobile node, at least one proxy server and a home server. The mobile node and the home server store a shared key. The shared key uniquely associates the mobile node with the home server. The method at the mobile node includes sending a request for an Internet Protocol (IP) address to the at least one proxy server. Further, the method includes receiving a nonce, in response to the request, from a proxy server of the at least one proxy server. Moreover, the method includes deriving a session key, based on the nonce, and the shared key. The session key authenticates the mobile node to initiate a secure communication session with the proxy server.

[0015] In another embodiment, another method for authenticating a mobile node in a communication network is provided. The communication network includes the mobile node, at least one proxy server, and a home server. The mobile node and the home server store a shared key. The shared key uniquely associates the mobile node with the home server. The method at a proxy server of the at least one proxy server includes receiving a request for an Internet Protocol (IP) address from the mobile node, and sending the request to the home server. Further, the method includes receiving a nonce from the home server and providing the nonce to the mobile node. The method also includes receiving a session key from the home server. The session key authenticates the mobile node to initiate a secure communication session with the proxy server.

[0016] In yet another embodiment, a method for authenticating a mobile node in a communication network is provided. The communication network includes a

mobile node, at least one proxy server, and a home server. The mobile node and the home server store a shared key. The shared key uniquely associates the mobile node with the home server. The method at the home server includes receiving a request from a proxy server of the at least one proxy server for authenticating the mobile node. Further, the method includes validating the mobile node. The method also includes deriving a nonce when the one or more parameters of a session key do not exist. Further, the method includes driving the session key based on the nonce and the shared key when the one or more parameters of the session key do not exist. The session key authenticates the mobile node to initiate a secure communication session with the proxy server. Moreover, the method includes providing the nonce and the session key to the proxy server.

[0017] **FIG. 1** illustrates an exemplary communication network **100**, in accordance with an embodiment of the present invention. Examples of the communication network **100** include, but are not limited to, IEEE 802.16-based broadband wireless access networks, Advanced Mobile Phone System (AMPS) networks, Global System for Mobile Communications (GSM) networks, Digital Cellular Systems (DCS) networks, and Universal Mobile Telecommunication Systems (UMTS) networks. For the purpose of this description, the communication network **100** is shown to include a mobile node **102**, a foreign network **104**, and a home network **106.** Examples of the mobile node **102** include, but are not limited to, cellular phones, laptop computers, Personal Digital Assistants (PDAs), and messaging devices. The foreign network **104** can include one or more proxy servers. For the purpose of this description, the foreign network **104** is shown to include a proxy server **108,** a proxy server **110**, a proxy server **112**, and a proxy server **114**. Examples

of the one or more proxy servers include, but are not limited to, DHCP servers, a Bootstrap Protocol (BOOTP) servers, Serving GPRS Service Nodes (SGSNs), Packet Data Serving Nodes (PDSNs), and Wireless Access Points (WAPs). The home network **106** can includes a home server **116**. Further, the home server **116** and the mobile node **102** store a shared key **118,** which uniquely associates the mobile node **102** with the home server **116**. The home server **116** authenticates the mobile node **102** by using the shared key.

[0018] **FIG. 2** is a flow diagram illustrating a method for authenticating a mobile node in the communication network **100**, in accordance with an embodiment of the present invention. After initiating the process at step **202**, a request for an Internet Protocol (IP) address is sent by the mobile node to at least one proxy server at step **204**. The request can be sent by the mobile node **102** to at least one of the proxy server **108**, the proxy server **110**, the proxy server **112**, and the proxy server **114**. In an embodiment, the request for an IP address can include a Network Access Identifier (NAI). The NAI enables a proxy server, for example, the proxy server **110**, to identify a mobile node, for example, the mobile node **102**. Further, the NAI can be used by the proxy server **110** to route the request to the home server **116** with which the mobile node **102** is associated. At step **206**, a nonce is received from the proxy server. For example, the mobile node **102** receives the nonce form the proxy server **110** in response to the request sent by the mobile node. An example of the nonce includes, but is not limited to, a random number. In an embodiment, the mobile node **102** also receives authorized configuration options from the proxy server **110**. Examples of the authorized configuration options include, but are not limited to, a Trivial file transfer protocol (Tftp) server name, a Mobile IP (MIP) Home Agent

Internet Protocol (HA IP) address, and a boot filename. The Tftp server name is the address of a server from where the boot file could be picked up when a request from the mobile node **102** is received. The MIP HA IP address is the IP address of the server in the home network **106**, which provides the MIP home agent functions for the mobile node **102**. The boot filename is the name of the file which contains the boot parameters for the mobile node **102**. In an embodiment, the authorized configuration options can include services the mobile node **102** is allowed to access. Examples of these services include, but are not limited to, IP address filtering, address assignment, route assignment, and Quality of Service (QoS) services. In an embodiment, the authorized configuration options are stored at the mobile node **102**. In an embodiment, the mobile node further receives an authentication certificate from the proxy server **110**. This authentication certificate received by the proxy server **110** validates the proxy server **110**.

[0019] At step **208**, the mobile node **102** derives a session key based on the nonce and the shared key **118**. The session key can be derived by applying a hash function, an Exclusive OR (XOR) function, a simple concatenation function, or an addition function on the nonce and the shared key **118**. The hash function has a property that different input values to the hash function will always results in different outputs. For example, if input values 'ABCDE' and 'GHIJ' are hashed by using a hash function to generate '123' as an output, then the any other input values will not generate '123' as an output. The session key authenticates the mobile node **102** to initiate a secure session with the proxy server **110**. In an embodiment, the mobile node **102** receives a notification from the proxy server **110** when one or more parameters, for example, the lifetime of the session key, expire. In an embodiment,

services to the mobile node **102** can be terminated when the one or more parameters of the session key expire. Thereafter, the process terminates at step **210**.

[0020] **FIG. 3** is a message flow diagram illustrating a method for authenticating a mobile node in the communication network **100**, in accordance with an embodiment of the present invention. The following method will be explained in conjunction with a Dynamic Host Configuration Protocol (DHCP) server; a Home Authentication, Authorization, and Accounting (AAAH) server; and an Authentication, Authorization and Accounting (AAA) protocol. Details of the AAA system can be found in a research paper titled 'AAA Protocols: Authentication, Authorization, and Accounting for the Internet', published in IEEE Internet Computing, Volume 03, Issue 6, pp. 75 -79,in 1999. In an embodiment, when a mobile node, for example, a mobile node **302,** enters a foreign network **104,** the mobile node **302** sends a request for an Internet Protocol (IP) address to the DHCP server, for example, a DHCP server **304.** In an embodiment, the mobile node can send a DHCP request, for example, a DHCP-discover message **306**, to the DHCP server **304**. In an embodiment, the DHCP-discover message **306** can include a Network Access Identifier (NAI), which enables the DHCP server **304** to identify the mobile node **302**. Further, the NAI can be used by the DHCP server **304** to route the request to the AAAH server. The DHCP server **304** provides at least one parameter to the AAAH server. The at least one parameter is specific to the request sent by the mobile node **302**. In response to the DHCP-discover message **306**, the mobile node **302** receives a DHCP-offer message **308** from the DHCP server **304**. The DHCP-Offer message **308** can include a nonce. After the nonce is received at the mobile node **302**, the mobile node **302** derives the session key, which authenticates the

mobile node **302** to initiate a secure communication session with the DHCP server **304**.

[0021] In an embodiment, the DHCP-offer message **308** also includes the authorized configuration options. In an embodiment, the authorized configuration options are stored at the mobile node **302**. In an embodiment, the DHCP-offer message **308** also includes an authentication certificate, which is received by the mobile node and validates the DHCP server **304**. In an embodiment, the mobile node **302** receives a notification from the DHCP server **304** when the one or more parameters of the session key expire.

[0022] **FIG. 4** is a flow diagram illustrating a method for authenticating a mobile node in a communication network, in accordance with another embodiment of the present invention. After initiating the process at step **402**, a request for an Internet Protocol (IP) address is received by a proxy server at step **404**. For example, the request is received by the proxy server **110** from the mobile node **102**. In an embodiment, the request can include a Network Access Identifier (NAI), which enables a proxy server to identify a mobile node. Further, the NAI can be used by the proxy server **110** to route the request to the home server **116**. In an embodiment, the proxy server **110** also receives the authorized configuration options for the mobile node **102** from the home server **116**. In this embodiment, the authorized configuration options are provided to the mobile node **102**. At step **406**, the proxy server **110** sends the request to the home server **116**. In an embodiment, the request can include at least one parameter, which can be used by the home server, for example, the home server **116**, to calculate the parameters of the session key. For

example, the proxy server **110** can include a proposed IP lease time in the request, which can be used by the home server **116** to calculate the lifetime of the session key.

[0023] In an embodiment, the proxy server **110** sends a request to the home server **116** to validate the mobile node **102**. In another embodiment, the proxy server **110** sends an authentication certificate to the home server **116**, to sign the authentication certificate. The home server **116** signs the authentication certificate by using different technologies, and returns it to the proxy server **110**. Examples of the different technologies include, but are not limited to, a digital signature, a Public Key Infrastructure (PKI), and a session key based signing. The proxy server receives the authentication certificate from the home server **116** and sends it to the mobile node **102**. The authentication certificate validates the proxy server **110**. At step **408**, the proxy server **110** receives a nonce from the home server **116.** At step **410**, the proxy server **110** provides the nonce to the mobile node **102**. At step **412**, the proxy server receives the session key from the home server **116**. In an embodiment, the proxy server **110** simultaneously receives the nonce and the session key. In an embodiment, the proxy server **110** also receives one or more parameters of the session key from the home server **116**. In an embodiment, the proxy server **110** maintains the one or more parameters of the session key. In an embodiment, maintaining the one or more parameters of the session key can include indicating the mobile device **102** that the one or more parameters have expired. For example, maintaining the session key lifetime can include indicating to the mobile node **102** that the session key lifetime has expired. Further, the proxy server **110** communicates with the mobile node **102** when the one or more parameters of the session key expire. For example, the proxy server **110** communicates to the mobile node **102** by using a FORCERENEW

message. In this embodiment, services to the mobile node **102** are terminated when the one or more parameters of the session key expire. In an embodiment, the one or more parameters of the session key are stored at the proxy server **110** when the one or more parameters of the session key do not exist.

[0024] In an embodiment, the proxy server **110** manages a configurable policy based on the one or more parameters. In another embodiment, the configurable policy helps the proxy server to determine the services to be extended to mobile nodes that fail to initiate a secure communication session. In yet another embodiment, the proxy server terminates the services of the mobile node **102,** based on the configurable policy. Thereafter, the process terminates at step **414**.

[0025] **FIG. 5** is a flow diagram illustrating a method for authenticating a mobile node in a communication network, in accordance with yet another embodiment of the present invention. After initiating the process at step **502**, a home server, for example, the home server **116** receives a request for authenticating a mobile node, for example, the mobile node **102**, at step **504.** In an embodiment, the request can include a Network Access Identifier (NAI). The NAI enables a proxy server to identify a mobile node on a network. Further, the NAI can be used by the proxy server **110** to route the request to the home server **116**. In an embodiment, the home server **116** also receives at least one parameter from the proxy server **110**. Further, the home server **116** uses the at least one parameter to determine one or more parameters of a session key. Moreover, the home server **116** provides one or more parameters of the session key to the proxy server **110.** For example, the home server **116** can provide the lifetime of the session key to the proxy server **110**.

[0026] In an embodiment, the home server **116** also receives an authentication certificate from the proxy server **110**. The home server signs the authentication certificate, and has the option of signing it by using a digital signature. The authentication certificate is then provided to the proxy server **110** and validates the proxy server **110**. At step **506**, it is determined whether the mobile node **102** is associated with the home server **116**, for example, the mobile node is an authentic mobile node. If it is determined at step **506** that the mobile node **102** is associated with the home server **116**, then step **508** is performed. At step **508**, it is determined whether one or more parameters of a session key exist. If it is determined at step **508** that the one or more parameters of the session key does not exist, then step **510** is performed. At step **510**, the home server **116** derives a nonce. At step **512**, the home server **116** derives a session key based on the nonce and the shared key. The session key authenticates the mobile node **102** to initiate a secure communication session with the proxy server **110**. In an embodiment, the session key is derived by applying a hash function, an Exclusive OR (XOR) function, a simple concatenation function, or an addition function on the nonce and the shared key. At step **514**, the home server **116** provides the nonce to the proxy server **110**.

[0027] At step **516**, the home server **116** provides the session key to the proxy server **110**. In an embodiment, the home server **116** simultaneously provides the nonce and the session key to the proxy server **110**. In an embodiment, the home server **116** also provides authorized configuration options for the mobile node **102** to the proxy server **110**. In another embodiment, the home server **116** maintains the one or more parameters of the session key. Further, when the one or more parameters of the session key expire, the home server **116** communicates this information to the

proxy server **110**. For example, the proxy server **110** can store and maintain the lifetime of the session key. Further, when the lifetime of the session key expires, the proxy server **110** communicates this information to the home server **116** by using a message, for example, a FORCERENEW message. The proxy server terminates services to the mobile node when the lifetime of the session key expires. In yet another embodiment, the home server **116** receives and stores the one or more parameters of the session key when the one or more parameters of the session key do exist. If it is determined at step **508**, that the one or more parameters of the session key exist, then step **514** is performed. At step **514**, the nonce is provided to the proxy server **110**. At step **516**, the session key is provided to the proxy server **110**. Thereafter, the process terminates at step **518**. If it is determined at step **506**, that the mobile node **102** is not associated with the home server **116**, then step **518** is performed. At step **518**, the process terminates.

[0028] **FIG. 6** is a message-flow diagram illustrating a method for authenticating a mobile node in a communication network, in accordance with another embodiment of the present invention. This embodiment will be explained in conjunction with a mobile node **602**, a DHCP server **606**, a Home AAA (AAAH) server **610**, and an AAA protocol. The mobile node **602** and the AAAH server **610** store a shared key. The shared key uniquely associates the mobile node **602** with the AAAH server **610**. Details regarding the AAA system can be found in a research paper titled 'AAA Protocols: Authentication, Authorization, and Accounting for the Internet' published in IEEE Internet Computing, Volume 03, Issue 6, pp. 75-79, in 1999. In a standard AAA protocol, authentication refers to the confirmation that a mobile node that is making a request for services is a valid mobile node of the

network. Authorization refers to the granting of services (including "no service") to a mobile node, based on the authentication of the mobile node, the services requested by the mobile node and the current state of the system comprising the mobile node. Authorization can be based on restrictions, for example, time-of-day restrictions or physical location restrictions. It determines the nature of the services granted to the mobile node. Accounting refers to the tracking of the consumption of network resources by a mobile node. This information may be used for management, planning and billing of the mobile node.

[0029] The authentication, authorization and accounting system adopts an AAA protocol, for example, a DIAMETER protocol, and uses an AAA server with AAA functions to carry out the process of authenticating, authorizing and accounting of mobile nodes. DIAMETER is a base protocol that can be extended to provide AAA services to mobile nodes in both local and roaming AAA situations in a communication network.

[0030] In an embodiment, when a mobile node, for example, a mobile node **602,** enters a foreign network **104,** the mobile node **602** sends a request for authentication in the DHCP-Discover message **604** to a the DHCP server **606**. The DHCP server **606** can provide at least one parameter that is specific to the request made by the mobile node **602**, to participate in the Internet Protocol (IP) network. The DHCP server **606** also provides a mechanism for the allocation of IP addresses to at least one mobile node, for example, the mobile node **602**. In an embodiment, the DHCP-discover message **604** can include a Network Access Identifier (NAI), which enables the DHCP server **606** to identify the mobile node **602**. Further, the NAI is

used by the DHCP server to route the request to the AAAH server **610**. The DHCP server **606** sends a request, for example, an AAA-DHCP-Request (ADR) **608,** to the AAAH server **610**. The AAAH server **610** is an AAA server in the home network **106** of the mobile node **602**. In an embodiment, the DHCP server **606** sends the request to a Foreign AAA (AAAF) server and the AAAF server then routes the ADR **608** to the AAAH server **610** based on NAI. The AAAH server **610** authenticates the mobile node **602**.

[0031] In an embodiment, the AAAH server **610** derives a nonce when one or more parameters of a session key do not exist. In an embodiment, the DHCP server **606** also sends at least one parameter to the AAAH server **610**. The AAAH server **610** determines the one or more parameters of the session key, based on the at least one parameter. Further, the session key is derived, based on the shared key and the nonce. The session key authenticates the mobile node **602** to initiate a secure communication session with the DHCP server **606**. In an embodiment, the session key is derived by applying a hash function, an Exclusive OR (XOR), a simple concatenation, or an addition function on the nonce and the shared key. The AAAH server **610** then provides the one or more parameters of the session key to the DHCP server **606**. For example, the AAAH server can receive an IP lease time for the mobile node from the DHCP server. Based on the IP lease time, the AAAH server can determine the lifetime of the session key. Further, the AAAH server can provide this lifetime of the session key to the DHCP server. In an embodiment, the DHCP server **606** sends a notification to the mobile node **602** when one or more parameters of the session key expire.

[0032] In an embodiment, the AAAH server **610** stores and maintains the one or more parameters of the session key. In this embodiment, when the one or more parameters of the session key expire, the AAAH server **610** communicates this information to the mobile node **602** through the DHCP server **606**. For example, the DHCP server **606** stores and maintains the lifetime of the session key. Further, when the lifetime of the session key expires, the DHCP server **606** communicates this information to the mobile node **602** by using a message, for example, a FORCERENEW message, and terminates services to the mobile node **602**. In an embodiment, the AAAH server **610** receives and stores the one or more parameters of the session key when one or more parameters of the session key do not exist. Further, the AAAH server **610** provides an AAA-DHCP-Answer (ADA) **612** to the DHCP server **606.** The ADA **612** includes the nonce. On receiving the ADA **612** from the AAAH, the DHCP server **606** sends a DHCP-Offer message **614** to the mobile node **602**. The DHCP-Offer message **614** can include a nonce. In an embodiment, the DHCP-offer message **614** also includes authorized configuration options for the mobile node **602**. Examples of the authorized configuration options include, but are not limited to, a Trivial file transfer protocol (Tftp) server name, a Mobile IP (MIP) Home Agent Internet Protocol (HA IP) address, and, a boot filename. The Tftp server name is the address of the server from where the boot file could be picked up when a request from the mobile node **102** is received. The MIP HA IP address is the IP address of a server in the home network **106**, which provides the MIP home agents function for the mobile node **102**. The boot filename is the name of the file which contains the boot parameters for the mobile node **102**. In an embodiment, the authorized configuration options can include services the mobile node **602** is allowed

to access. Examples of these services include, but are not limited to, IP address filtering, address assignment, route assignment, and Quality of Service (QoS) services. In an embodiment, the authorized configuration options are stored at the mobile node **602**. In another embodiment, the DHCP-offer message **614** also includes an authentication certificate being sent to the mobile node **602**. This authentication certificate validates the DHCP server **606**.

[0033] Further, the AAAH server **610** provides the session key to the DHCP server **606**. In an embodiment, the AAAH server **610** also provides authorized configuration options for the mobile node **602** to the DHCP server **606**. In another embodiment, the AAAH server **610** receives an authentication certificate from the DHCP server **606** for signing the authentication certificate, wherein the authentication certificate validates the DHCP server **606**. The AAAH server **610** signs the authentication certificate by using technologies, for example, a digital signature, and returns it to the DHCP server **606**. The AAAH sends the authentication certificate to the DHCP server **606**.

[0034] As described above, various embodiments of method for authenticating a mobile node in a communication network provide the following advantages. In an embodiment, a session key can be derived at the mobile node and the home server based on a nonce and the shared key. In this embodiment, as desired, the shared key is stored at a minimum number of places, for example, at the home server and the home server. The session key authenticates the mobile node to initiate a secure session with a proxy server. Further, the session key derivation is dynamic and is controlled by the home server. In an embodiment, the mobile node receives an

authentication certificate from the home server, which authenticates the proxy server. In another embodiment, the DHCP server and the home (AAAH) server, makes use of an AAA Foreign (AAAF) server as an interface between them. AAAF enables the DHCP server to receive valid authorized configuration options for the mobile node. Moreover, the existing AAA diameter protocol is used to acquire the session, without making any change in the existing system.

[0035] In the foregoing specification, the invention and its benefits and advantages have been described with reference to specific embodiments. However, one of ordinary skill in the art appreciates that various modifications and changes can be made without departing from the scope of the present invention as set forth in the claims below. Accordingly, the specification and figures are to be regarded in an illustrative rather than a restrictive sense, and all such modifications are intended to be included within the scope of present invention. The benefits, advantages, solutions to problems, and any element(s) that may cause any benefit, advantage, or solution to occur or become more pronounced are not to be construed as a critical, required, or essential features or elements of any or all the claims. The invention is defined solely by the appended claims including any amendments made during the pendency of this application and all equivalents of those claims as issued.

WHAT IS CLAIMED IS:

1. A method for authenticating a mobile node in a communication network, the communication network comprising at least one proxy server, and a home server, the mobile node and the home server comprising a shared key, the shared key uniquely associating the mobile node with the home server, the method at the mobile node comprising:

sending a request for an Internet Protocol (IP) address to the at least one proxy server;

receiving a nonce in response to the request, from a proxy server of the at least one proxy server; and

deriving a session key based on the nonce and the shared key, wherein the session key authenticates the mobile node to initiate a secure communication session with the proxy server.

2. The method as recited in claim 1 further comprising sending a Network Access Identifier (NAI) to the at least one proxy server, wherein the NAI enables the at least one proxy server to identify the mobile node.

3. The method as recited in claim 1 further comprising receiving authorized configuration options for the mobile node from the at least one proxy server.

4. The method as recited in claim 3 further comprising storing the authorized configuration options.

5. The method as recited in claim 1 further comprising receiving an authentication certificate from the proxy server, the authentication certificate validating the proxy server.

6. The method as recited in claim 1 further comprising receiving a notification from the proxy server when one or more parameters of the session key expire.

7. A method for authenticating a mobile node in a communication network, the communication network comprising at least one proxy server, and a home server, the mobile node and the home server comprising a shared key, the shared key uniquely associating the mobile node with the home server, the method at a proxy server of the at least one proxy server comprising:

receiving a request for an Internet Protocol (IP) address from the mobile node;

sending the request to the home server;

receiving a nonce from the home server;

providing the nonce to the mobile node; and

receiving a session key from the home server, wherein the session key authenticates the mobile node to initiate a secure communication session with the proxy server.

8. The method as recited in claim 7 further comprising sending a message to the home server for validating the mobile node.

9. The method as recited in claim 7 further comprising:

providing at least one parameter to the home server; and

receiving one or more parameters of the session key from the home server, wherein the one or more parameters of the session key are determined based on the at least one parameter.

10. The method as recited in claim 9 further comprising:

maintaining the one or more parameters of the session key;

communicating to the mobile node when the one or more parameters of the session key expire; and

terminating services to the mobile node when the one or more parameters of the session key expire.

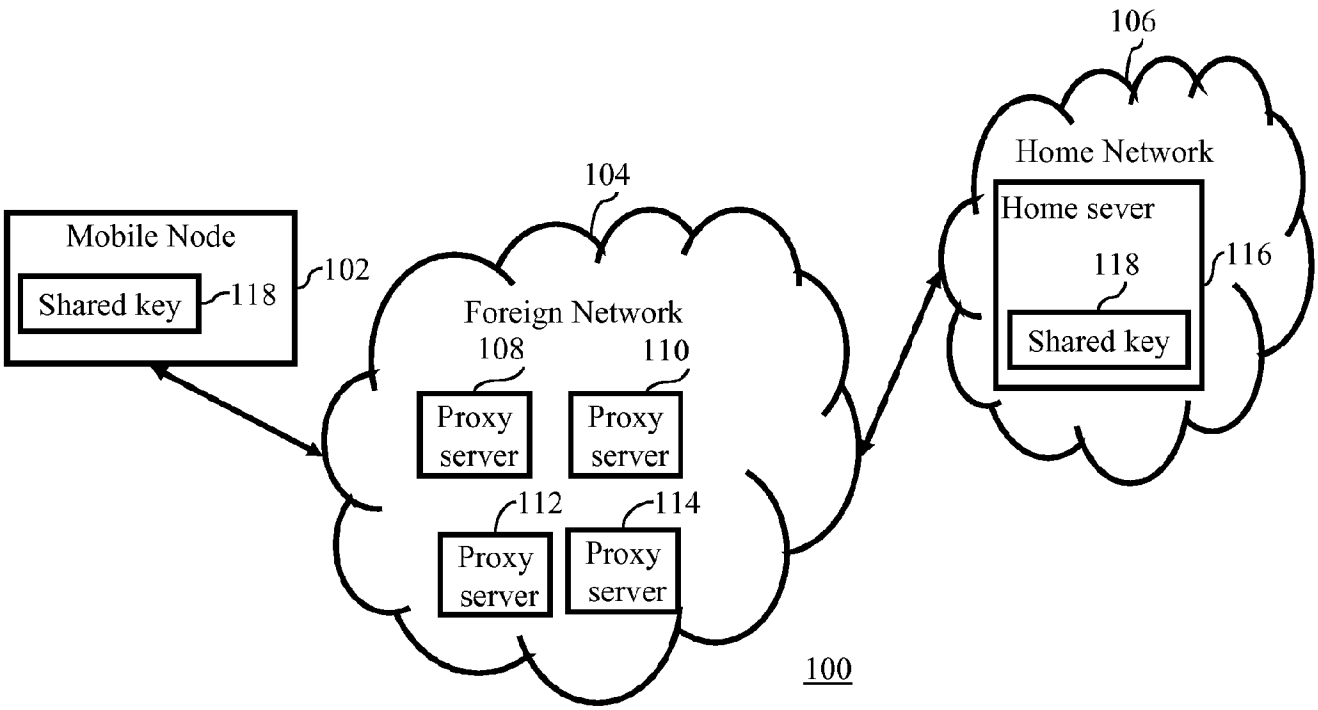
106
Home Network
Home sever
118
116
Shared key
104
Mobile Node
Shared key
118
102
Foreign Network
108
110
Proxy server
Proxy server
112
114
Proxy server
Proxy server
100

FIG. 1

2/6

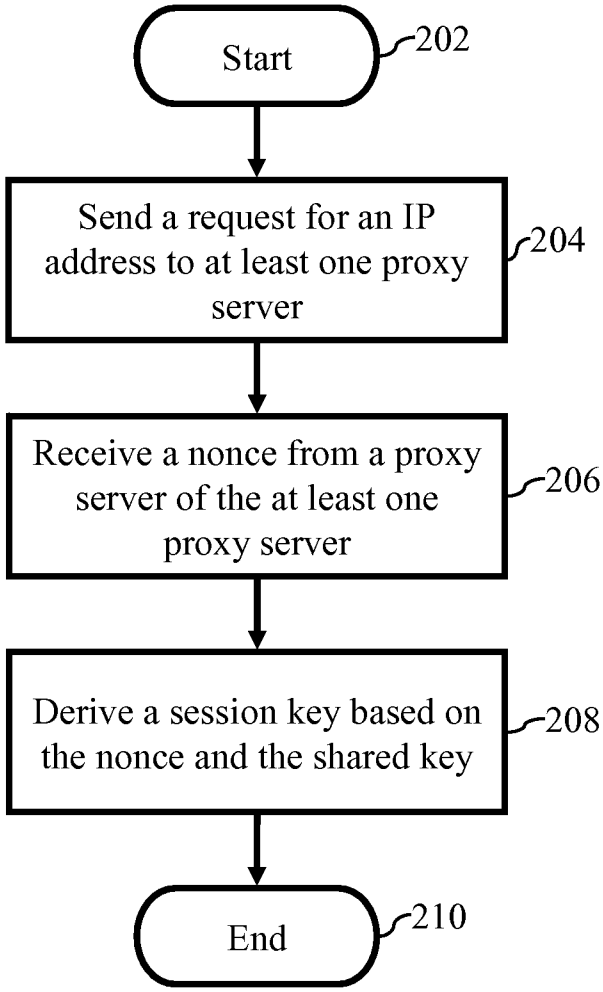
Start
202
Send a request for an IP address to at least one proxy server
204
Receive a nonce from a proxy server of the at least one proxy server
206
Derive a session key based on the nonce and the shared key
208
End
210

FIG. 2

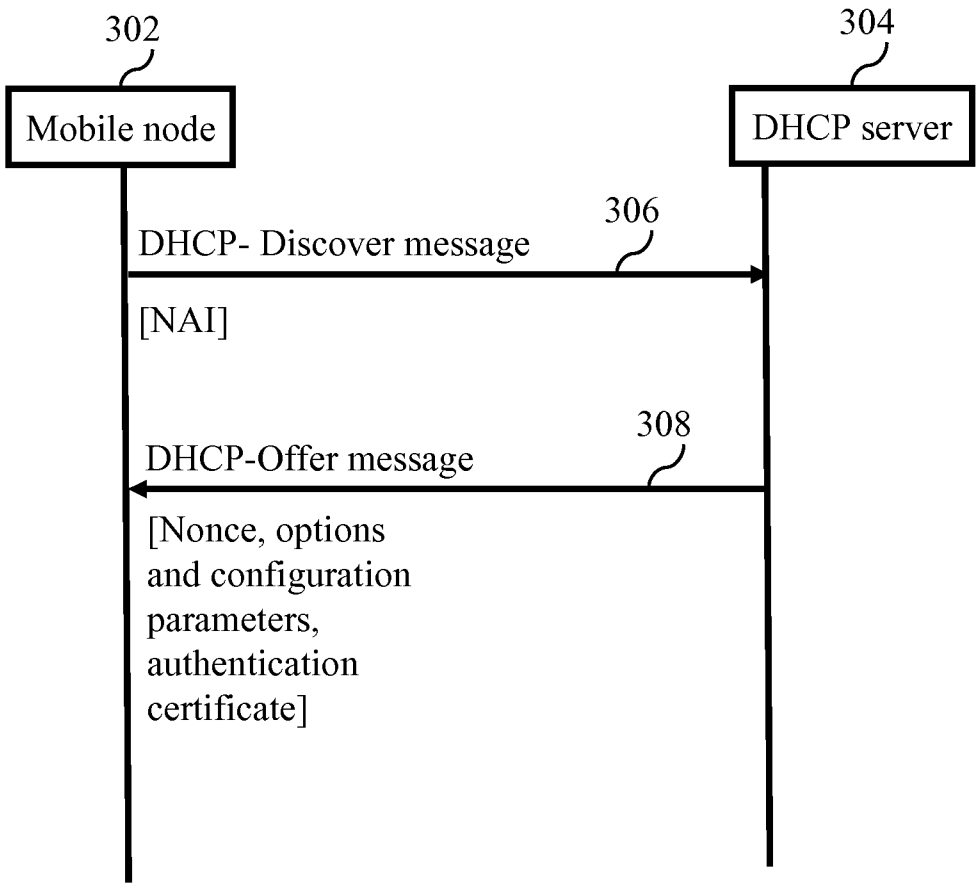
302
304
Mobile node
DHCP server
306
DHCP- Discover message
[NAI]
308
DHCP-Offer message
[Nonce, options
and configuration
parameters,
authentication
certificate]

FIG. 3

4/6

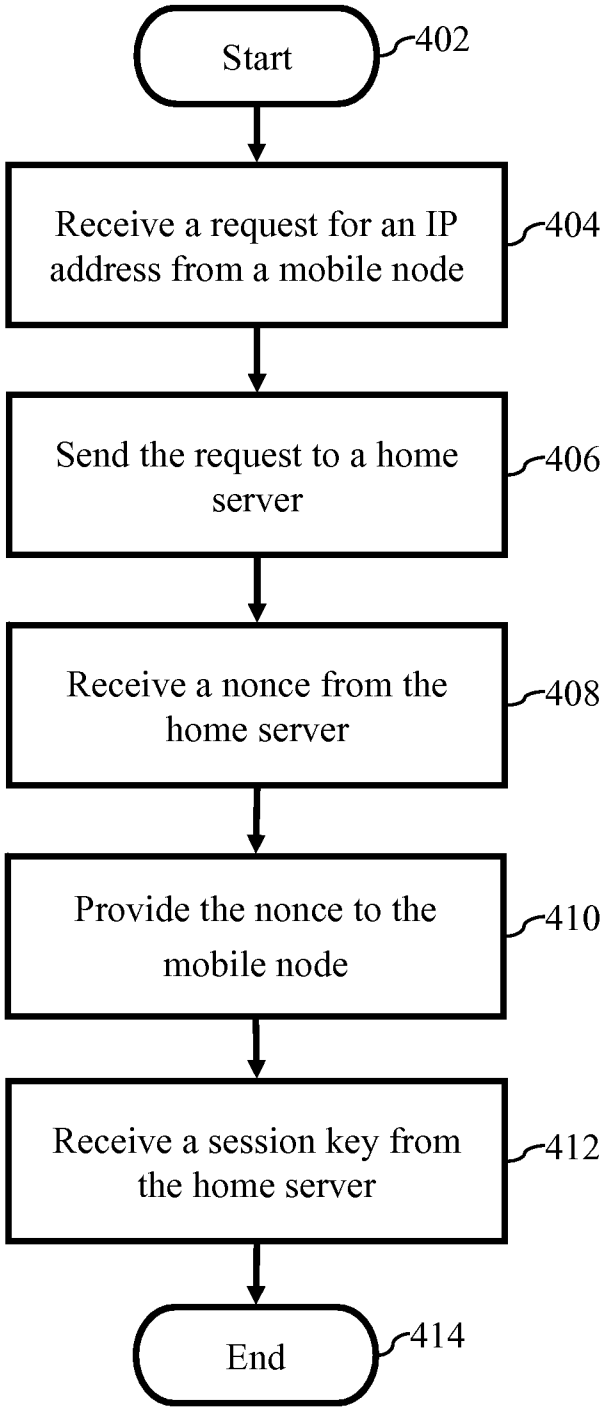
Start
402
Receive a request for an IP address from a mobile node
404
Send the request to a home server
406
Receive a nonce from the home server
408
Provide the nonce to the mobile node
410
Receive a session key from the home server
412
End
414

FIG. 4

5/6

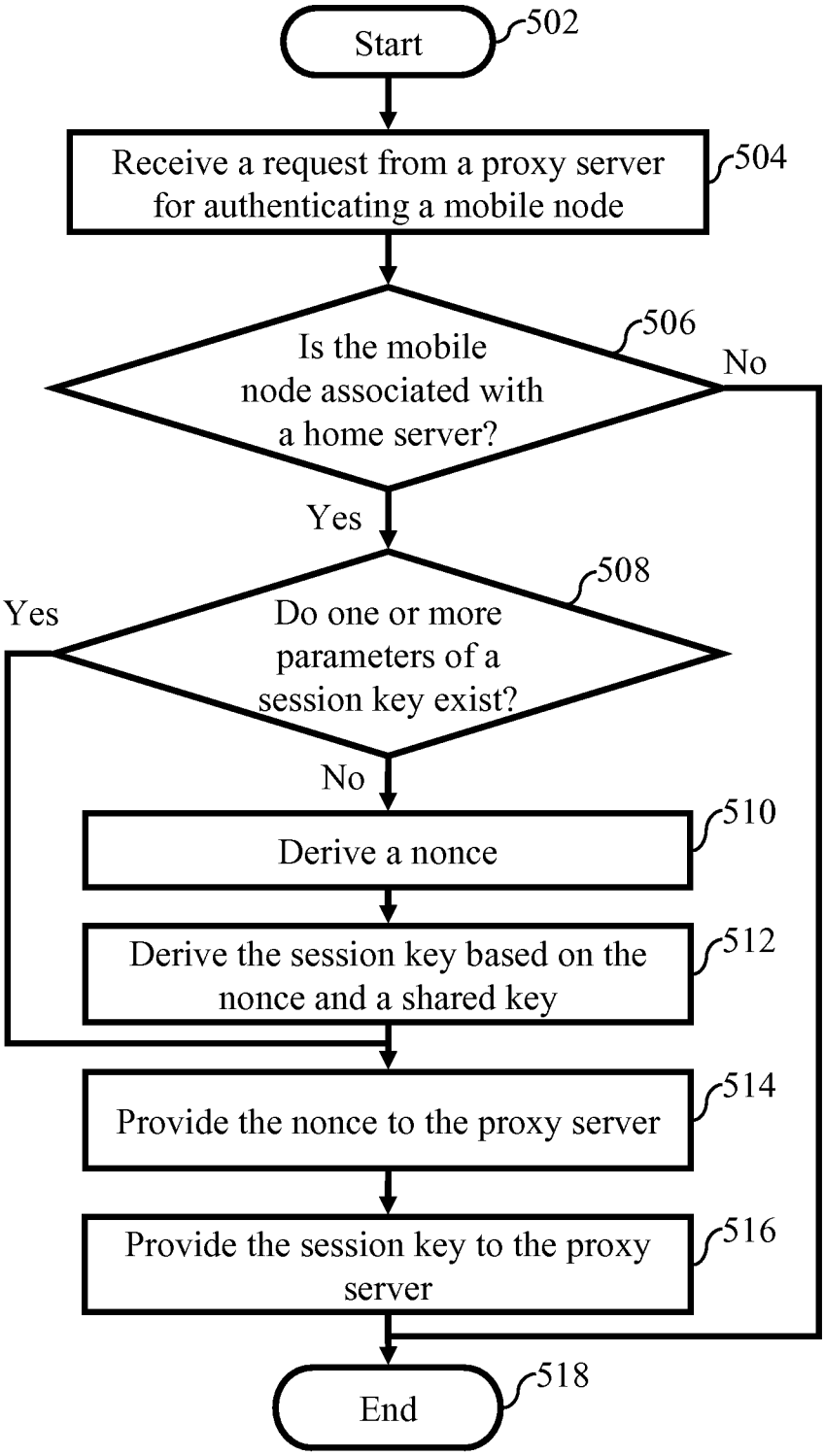
Start
502
Receive a request from a proxy server for authenticating a mobile node
504
Is the mobile node associated with a home server?
506
No
Yes
Do one or more parameters of a session key exist?
508
Yes
No
Derive a nonce
510
Derive the session key based on the nonce and a shared key
512
Provide the nonce to the proxy server
514
Provide the session key to the proxy server
516
End
518

FIG. 5

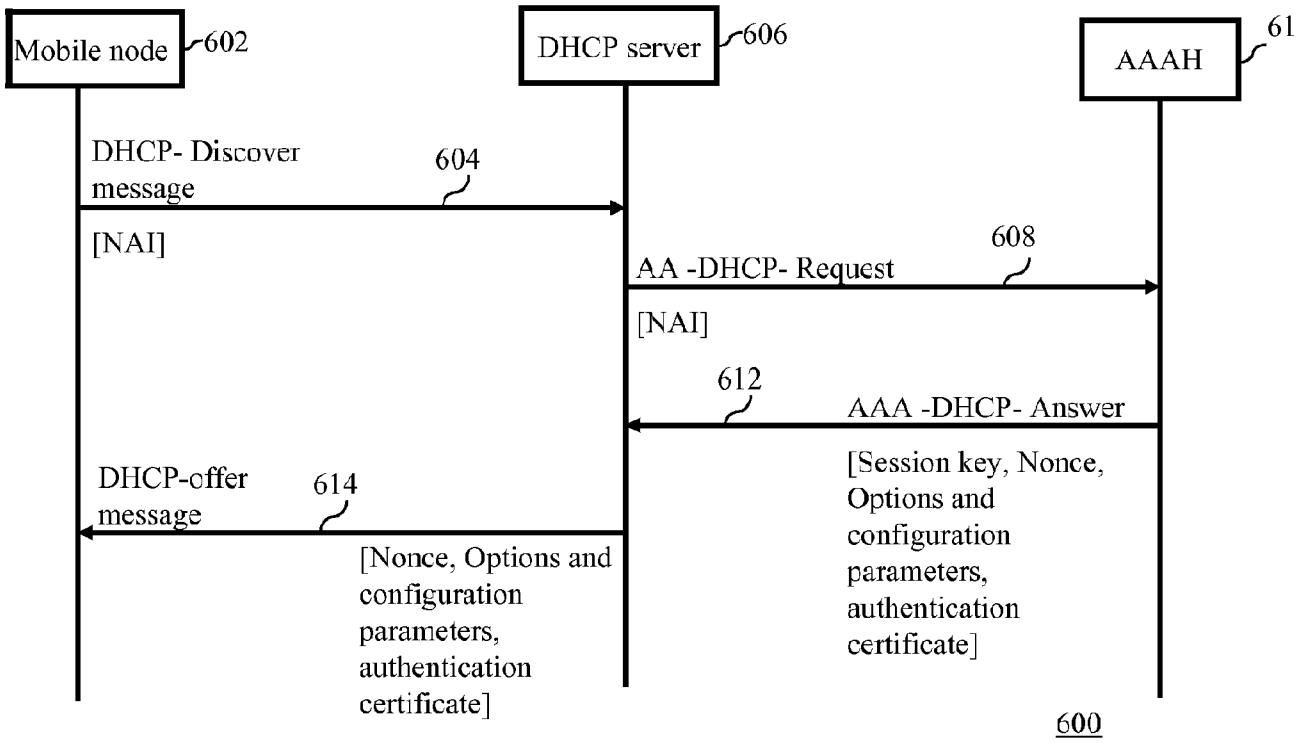
Mobile node
602
DHCP server
606
AAAH
61
DHCP- Discover message
604
[NAI]
608
AA -DHCP- Request
[NAI]
612
AAA -DHCP- Answer
[Session key, Nonce, Options and configuration parameters, authentication certificate]
DHCP-offer message
614
[Nonce, Options and configuration parameters, authentication certificate]
600

FIG. 6