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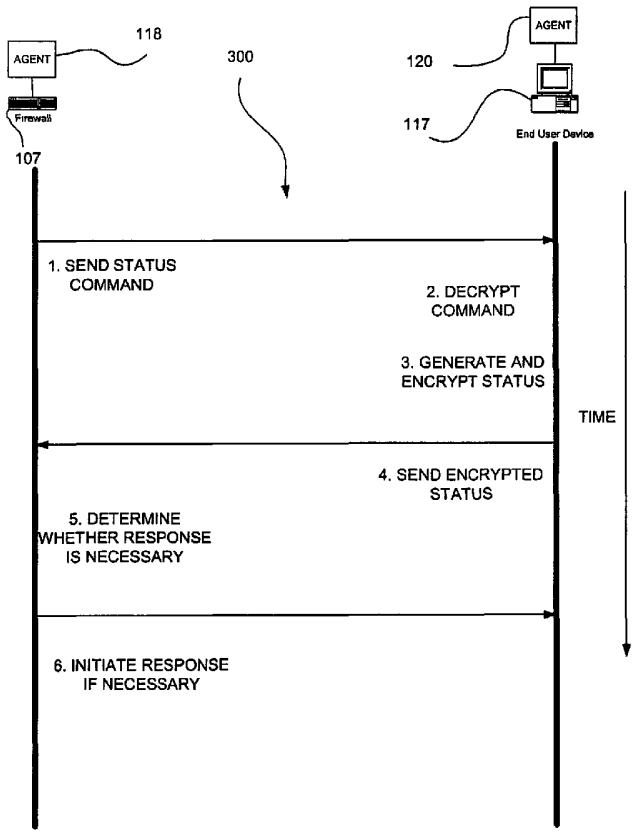

(57) Abstract: A system, method and computer program product (120) are provided for enforcing an anti-virus policy. Initially, a status command (402) is received at a client computer (116, 117) from a network device utilizing a network (104, 106, 108). In response to the status (404) is sent to the network device utilizing the network. Such status relates to anti-virus scanning software (121) on the client computer. Next, a response is initiated at the client computer utilizing the network based on the status.

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ANTI-VIRUS POLICY ENFORCEMENT SYSTEM AND METHOD

FIELD OF THE INVENTION

The present invention relates to anti-virus scanners, and more particularly to ensuring that anti-virus scanners operate properly to prevent malicious code attacks.

BACKGROUND OF THE INVENTION

Network security management is becoming a more difficult problem as networks grow in size and become a more integral part of organizational operations. Attacks on networks are growing both due to the intellectual challenge such attacks represent for hackers and due to the increasing payoff for the serious attacker. Furthermore, the attacks are growing beyond the current capability of security management tools to identify and quickly respond to those attacks. As various attack methods are tried and ultimately repulsed, the attackers will attempt new approaches with more subtle attack features. Thus, maintaining network security is on-going, ever changing, and an increasingly complex problem.

Computer network attacks can take many forms and any one attack may include many security events of different types. Security events are anomalous network conditions each of which may cause an anti-security effect to a computer network. Security events include stealing confidential or private information; producing network damage through mechanisms such as viruses, worms, or Trojan horses; overwhelming the network's capability in order to cause denial of service, and so forth.

Security systems often employ security risk-assessment tools, i.e. "scanners," to search for known types of security events in the form of malicious programs such

as viruses, worms, and Trojan horses. Still yet, scanners are used for content filtering to enforce an organization's operational policies [i.e. detecting harassing or pornographic content, junk e-mails, misinformation (virus hoaxes), etc.].

Unfortunately, such scanners are often susceptible to tampering, deactivation, removal, etc., especially when the scanners are installed on a client computer readily accessible by a user. Often, such user may intentionally disable a scanner to increase the speed of his or her computer, or may unintentionally remove the software during the normal course of use of the computer. In still other scenarios, some users do not take the time to update the scanners with the latest virus signatures that are currently available.

These situations often result in a client computer that is highly susceptible to a virus attack or the like, especially when access is gained to an unsecured network such as the Internet. There is thus a need for a more effective method of enforcing anti-virus policies.

DISCLOSURE OF THE INVENTION

A system, method and computer program product are provided for enforcing an anti-virus policy. Initially, a status command is received at a client computer from a network device utilizing a network. In response to the status command, a status is sent to the network device utilizing the network. Such status relates to anti-virus scanning software on the client computer. Next, a response is initiated at the client computer utilizing the network based on the status.

In one embodiment, the status command may be received in response to an attempt to access the network by the client computer. Further, the status command may be received on a predetermined port and/or utilizing user datagram protocol (UDP).

In another embodiment, the network device may include a firewall. In such embodiment, it may be determined whether the status command is received from the firewall. As such, the status may be conditionally sent based on the determination as to whether the status command is received from the firewall.

In still another embodiment, the status command may be encrypted. Such command may be decrypted upon receipt. Moreover, the status may be encrypted prior to sending it over the network.

In one embodiment, the status may relate to a version of the anti-virus scanning software. Further, the status may relate to any tampering of the anti-virus scanning software. Still yet, the status may relate to any removal of the anti-virus scanning software. Even still, the status may relate to any deactivation of the anti-virus scanning software. Various exemplary responses to such statuses will now be set forth.

For example, the response may include conditionally preventing access to the network by the client computer based on the status. Further, such access to the network may be prevented until an action is carried out.

As an option, the response may conditionally include a notice to the user of the client computer based on the status. Such notice may indicate that the user is required to reinstall the anti-virus scanning software. Further, the notice may indicate that the user is required to reactivate the anti-virus scanning software.

Moreover, the response may include requiring an action at the client computer.
For example, the response may conditionally require a reinstallation of the anti-virus scanning software based on the status. Similarly, the response may conditionally require a reactivation of the anti-virus scanning software based on the status.

The response may also conditionally include an update command received from the network device based on the status. Such update command may optionally be encrypted. In use, the update command may be received if the status indicates that the anti-virus scanning software on the client computer requires an update.

In one aspect of the present embodiment, the anti-virus scanning software may be updated in response to the update command. More particularly, the anti-virus scanning software may be updated utilizing the network. Optionally, the updating of the anti-virus scanning software may include sending an update request to a server utilizing the network, and receiving an update from the server. Such update may include a plurality of virus signatures in the form of a plurality of .DAT files or the like.

In yet another embodiment, various measures may be taken to prevent denial of service (DoS) attacks. In particular, an amount of time that elapsed between the receipt of the status command and a previous receipt of the status command may be

determined. Further, the status may be conditionally sent in response to the status command based on the amount of time that has elapsed. In particular, such status may be sent in response to the status command only if the amount of time that has elapsed is greater than a predetermined amount.

In order to provide a more automated environment, the status may be automatically sent to the network device in response to the status command. Further, the anti-virus scanning software may be automatically updated in response to the update command.

As an option, the various operations of the present embodiment may be carried out for a plurality of client computers communicating with the network device. Such client computers may communicate with the network device via a local area network (LAN).

BRIEF DESCRIPTION OF THE DRAWINGS

Figure **1** illustrates a network architecture, in accordance with one embodiment.

Figure **2** shows a representative hardware environment that may be associated with the data servers and/or client computers of Figure **1**, in accordance with one embodiment.

Figure **3** illustrates a flow diagram illustrating the various communications between the firewall agent and the client agent of Figure **1** for enforcing an anti-virus policy, in accordance with one embodiment.

Figure **4** is a more detailed flow diagram showing the various operations carried out by the firewall agent of Figure **3**.

Figure **5** illustrates a method carried out by the client agent in order to enforce an anti-virus policy.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Figure **1** illustrates a network architecture **100**, in accordance with one embodiment. As shown, a plurality of networks **102** are provided including a first network **104** and a second network **106**. Also included is at least one firewall **107** coupled between the networks **102** and a third network **108**. In the context of the present network architecture **100**, the networks **104, 106, 108** may each take any form including, but not limited to a local area network (LAN), a wide area network (WAN) such as the Internet, etc. Further, any number of networks may be included.

Further included is at least one server **114** coupled to the third network **108**, and which is accessible from the networks **102** via the firewall **107**. It should be noted that the server(s) **114** may include any type of computing device/groupware. Coupled to each server **114** is a plurality of client computers **116**. Such client computers **116** may include a desktop computer, lap-top computer, hand-held computer, printer or any other type of logic. It should be noted that a client computer **117** may also be directly coupled to any of the networks, in one embodiment.

In use, the firewall **107** serves as an entrance point from the networks **102** to the third network **108**. Further, the firewall **107** may serve as an entrance from one of the networks **102** and one of the client computers **116, 117** and/or server(s) **114**. Of course, the firewall **107** may be configured to serve as an entrance point to any client computer, network, and/or sub-network.

Further provided are software agents including a firewall agent **118** coupled to and situated behind the firewall **107**, and a client agent **120** coupled to one of the client computers **117**. In various other embodiments, the client agent **120** may be associated with a server **114** which is in turn coupled to client computers for administrative purposes. In such a scenario, such server **114** may be referred to as a

"client computer." Further, the agent **118** may be coupled to any other type of intermediary network device coupled to the client computers **117**.

The client computers **117** may also be equipped with a scanner **121** including anti-virus scanning software. Such scanner **121** may be equipped to probe for network weaknesses by simulating certain types of security events that make up an attack. Such scanner **121** may also test user passwords for suitability and security. Moreover, the scanner **121** may also search for known types of security events in the form of malicious programs such as viruses, worms, and Trojan horses. Still yet, [0]the scanner **121** may be adapted for content filtering to enforce an organization's operational policies [i.e. detecting harassing or pornographic content, junk e-mails, misinformation (virus hoaxes), etc.]. Of course, the scanner **121** may take any other sort of security measures such as e-mail attachment filtering, etc.

Also provided is a database **122** that is coupled to an associated server (i.e. server **114**). Such database **122** is equipped with virus signature updates that may be selectively distributed to the client computers **117** for updating the scanner **121**.

As will soon become apparent, the software agents serve to enforce an anti-virus policy on the client computers **117** or any other related device. This is accomplished by monitoring a status of the scanner **121** at the client computers **117**, and initiating a response if the scanner **121** at the client computer **117** is insufficient for one reason or another. The manner in which this is accomplished will be set forth hereinafter in greater detail during reference to Figures **3-5.**

Figure **2** shows a representative hardware environment that may be associated with the data servers **114** and/or client computers **116, 117** of Figure **1**, in accordance with one embodiment. Such figure illustrates a typical hardware configuration in accordance with a preferred embodiment having a central processing unit **210**, such as a microprocessor, and a number of other units interconnected via a system bus **212**.

The present hardware shown in Figure **2** includes a Random Access Memory (RAM) **214**, Read Only Memory (ROM) **216**, an I/O adapter **218** for connecting peripheral devices such as disk storage units **220** to the bus **212**, a user interface adapter **222** for connecting a keyboard **224**, a mouse **226**, a speaker **228**, a microphone **232**, and/or other user interface devices such as a touch screen (not shown) to the bus **212**, communication adapter **234** for connecting the present hardware to a communication network **235** (e.g., a data processing network) and a display adapter **236** for connecting the bus **212** to a display device **238**. It should be noted that the present hardware is set forth for illustrative purposes only, and should not be construed as limiting in any manner.

The present hardware may have resident thereon an operating system such as the Microsoft Windows NT or Windows/95 Operating System (OS), the IBM OS/2 operating system, the MAC OS, or UNIX operating system. It will be appreciated that a preferred embodiment may also be implemented on platforms and operating systems other than those mentioned. A preferred embodiment may be written using JAVA, C, and/or C++ language, or other programming languages, along with an object oriented programming methodology. Object oriented programming (OOP) has become increasingly used to develop complex applications.

Figure **3** illustrates a flow diagram **300** illustrating the various communications between the firewall agent **118** and the client agent **120** for enforcing an anti-virus policy at the client computer **117**, in accordance with one embodiment. Initially, in operation **1**, a status command is received by the client agent **120** of the client computer **117** from a network device such as the firewall **107** utilizing a network.

As an option, such status command may be encrypted. In such case, the status command may be decrypted at the client computer **117**. Note operation **2**.

In response to the status command, a status is generated and sent to the network device utilizing the network. See operation **3-4**. Optionally, such status may be encrypted. The status relates to the anti-virus scanner **121** on the client computer **117,** or any other factor relating to the security of the client computer **117**.

In one embodiment, the status may relate to a version of the anti-virus scanning software. Further, the status may relate to any tampering of the anti-virus scanning software. Still yet, the status may relate to any removal of the anti-virus scanning software. Even still, the status may relate to any deactivation of the anti-virus scanning software.

Next, in operation **5**, it is determined whether the status is sufficient for protecting the client computer **117** from an attack. Based on this determination, a response is initiated at the client computer **117** utilizing the network if it is necessary. See operation **6**.

In one embodiment, the response may include conditionally preventing access to a network such as the Internet by the client computer **117**. Such access to the network may be prevented until an appropriate security action is carried out.

As an option, the response may conditionally include a notice to the user of the client computer based on the status. Such notice may indicate that the user is required to reinstall the anti-virus scanning software. Further, the notice may indicate that the user is required to reactivate the anti-virus scanning software.

Moreover, the response may require an action at the client computer **117**. For example, the response may conditionally require a reinstallation of the anti-virus scanning software based on the status. Similarly, the update may conditionally require a reactivation of the anti-virus scanning software based on the status.

The response may also conditionally include an update command received from the network device based on the status. Such update command may optionally be encrypted. In use, the update command may be received if the status indicates that the anti-virus scanning software on the client computer requires an update. More information on such embodiment will now be set forth during reference to Figures **4-5**.

Figure **4** is a more detailed flow diagram showing the various operations carried out by the firewall agent **118** of Figure **3**. As shown, it is first determined whether the client computer **117** is attempting to access a network such as the Internet. Note decision **401**. Of course, any other triggering situation may be monitored which may make the client computer **117** subject to an attack.

Once triggered, in operation **402**, the firewall agent **118** sends a status command to the client agent **120** at the client computer **117** requesting a status of the scanner **121** thereof. In response thereto, a status may be received from the client computer **117** in operation **404**.

It may then be determined in decision **406** as to whether an update to the scanner **121** is necessary. In one embodiment, the status of the scanner **121** may include a version number. Moreover, the update may be deemed necessary if the version number is below a predetermined acceptable number.

If it is necessary, in operation **408**, an update command may be sent for initiating an update process on the client computer **117**. In any case, the present method **400** is stalled until it is determined at decision **410** that sufficient time has elapsed for reinitiating the process. More information will now be set forth regarding the manner in which the agent **120** on the client computer **117** operates.

Figure **5** illustrates a method **500** carried out by the client computer **117** in order to enforce an anti-virus policy. While the method **500** may be carried out by

the agent **120** on the client computer **117**, it should be noted that similar functionality may be applied in any desired environment. Initially, a predetermined port is monitored in operation **502**. Such port **502** may be preselected for receiving commands from the firewall agent **118** at the firewall **107**.

As communications are received on the predetermined port, it is determined in decision **504** as to whether any of such communications is received utilizing user datagram protocol (UDP). If so, such command is interpreted in operation **506**. Such interpretation may include a parsing of the command to determine a source thereof, as well as any other desired parameters.

Once interpreted, it is determined whether the command was received from the firewall **107**. See decision **508**. If so, the command is decrypted and extracted for identification purposes in operation **510**. As mentioned earlier, the commands are encrypted prior to being sent from the firewall agent **118**. It should be noted that an encryption key may be based on a shared secret concatenated with the IP address of the client computer **117**.

The type of command may then be discerned in decision **512**. As an option, the difference between the status command and the update command may simply be one (1) bit of information. If the command is a status command as set forth in operation **402** of Figure **4**, the status of the scanner **121** may be sent in operation **510**. Such status may include a version number, a license number, operating system information, and/or a timestamp of the last update. In order to provide a more automated environment, the status may be automatically sent to the network device in response to the status command.

If, however, the command is an update command, access to the network that was originally requested may be blocked for security reasons. Note operation **516**. Again, this may be accomplished automatically in order to provide a more automated environment.

Thereafter, a separate update command may be sent to the scanner **121** for initiating a scanner update process involving the database **122**. Note operation **518**. In response thereto, the anti-virus scanning software is automatically updated in response to the update command. Specifically, the updating of the anti-virus scanning software may include sending an update request to the server **114** utilizing the network, and receiving an update from the server **114**. Such update may include a plurality of virus signatures in the form of a plurality of .DAT files or the like. For more information regarding such update process, reference may be made to US Patent No.: 6,035,423 and US Patent No.: 6,269,456, which are each incorporated herein by reference.

As an option, various measures may be taken to prevent denial of service (DoS) attacks. In particular, an amount of time that elapsed between the receipt of the command and a previous receipt of the command may be determined in decision **520**. Further, the method **500** may only be repeated if the amount of elapsed time is greater than a predetermined amount (i.e. 10 seconds).

As an option, the various operations of the present embodiment may be carried out for a plurality of client computers communicating with the network device. Such client computers may communicate with the network device via a local area network (LAN).

While various embodiments have been described above, it should be understood that they have been presented by way of example only, and not limitation. For example, any of the network components may employ any of the desired functionality set forth hereinabove. Thus, the breadth and scope of a preferred embodiment should not be limited by any of the above-described exemplary embodiments, but should be defined only in accordance with the following claims and their equivalents.

CLAIMS

What is claimed is:

1. A method for enforcing an anti-virus policy, comprising:
(a) receiving a status command at a client computer from a network device utilizing a network;
(b) sending a status to the network device utilizing the network in response to the status command, the status relating to anti-virus scanning software on the client computer; and
(c) initiating a response at the client computer utilizing the network based on the status.

2. The method as recited in claim 1, wherein the status command is received in response to an attempt to access the network by the client computer.

3. The method as recited in claim 1, wherein the status command is received on a predetermined port.

4. The method as recited in claim 1, wherein the status command is received utilizing user datagram protocol (UDP).

5. The method as recited in claim 1, wherein the network device includes a firewall.

6. The method as recited in claim 5, and further comprising determining whether the status command is received from the firewall.

7. The method as recited in claim 6, wherein the status is conditionally sent based on the determination as to whether the status command is received from the firewall.

8. The method as recited in claim 1, wherein the status command is encrypted, and further comprising decrypting the status command.

9. The method as recited in claim 8, and further comprising encrypting the status prior to sending the status utilizing the network.

10. The method as recited in claim 1, wherein the response includes conditionally preventing access to the network by the client computer based on the status.

11. The method as recited in claim 1, wherein the response includes requiring an action at the client computer.

12. The method as recited in claim 12, and further comprising preventing access to the network until the action is carried out.

13. The method as recited in claim 1, wherein the response conditionally includes a notice to the user of the client computer based on the status.

14. The method as recited in claim 13, wherein the notice indicates that the user is required to reinstall the anti-virus scanning software.

15. The method as recited in claim 13, wherein the notice indicates that the user is required to reactivate the anti-virus scanning software.

16. The method as recited in claim 1, wherein the response conditionally requires a reinstallation of the anti-virus scanning software based on the status.

17. The method as recited in claim 1, wherein the response conditionally requires a reactivation of the anti-virus scanning software based on the status.

18. The method as recited in claim 1, wherein the response conditionally includes an update command received from the network device based on the status.

19. The method as recited in claim 18, wherein the update command is encrypted.

20. The method as recited in claim 18, wherein the update command is received if the status indicates that the anti-virus scanning software on the client computer requires an update.

21. The method as recited in claim 18, and further comprising updating the anti-virus scanning software in response to the update command.

22. The method as recited in claim 21, wherein the anti-virus scanning software is updated utilizing the network.

23. The method as recited in claim 22, wherein the updating of the anti-virus scanning software includes sending an update request to a server utilizing the network.

24. The method as recited in claim 23, wherein the updating of the anti-virus scanning software further includes receiving an update from the server.

25. The method as recited in claim 24, wherein the update includes a plurality of virus signatures.

26. The method as recited in claim 24, wherein the update includes a plurality of .DAT files.

27. The method as recited in claim 1, and further comprising determining an amount of time that elapsed between the receipt of the status command and a previous receipt of the status command.

28. The method as recited in claim 27, and further comprising conditionally sending the status in response to the status command based on the amount of time that has elapsed.

29. The method as recited in claim 28, and further comprising sending the status in response to the status command if the amount of time that has elapsed is greater than a predetermined amount to prevent a denial of service attack (DOS).

30. The method as recited in claim 1, wherein the status is automatically sent to the network device in response to the status command.

31. The method as recited in claim 20, wherein the anti-virus scanning software is automatically updated in response to the update command.

32. The method as recited in claim 1, wherein the status relates to a version of the anti-virus scanning software.

33. The method as recited in claim 1, wherein the status relates to any tampering of the anti-virus scanning software.

34. The method as recited in claim 1, wherein the status relates to any removal of the anti-virus scanning software.

35. The method as recited in claim 1, wherein the status relates to any deactivation of the anti-virus scanning software.

36. The method as recited in claim 1, wherein (a) – (c) are carried out for a plurality of client computers communicating with the network device.

37. The method as recited in claim 36, wherein the client computers communicate with the network device via a local area network (LAN).

38. A computer program product for enforcing an anti-virus policy, comprising:
(a) computer code for receiving a status command at a client computer from a network device utilizing a network;
(b) computer code for sending a status to the network device utilizing the network in response to the status command, the status relating to anti-virus scanning software on the client computer; and
(c) computer code for initiating a response at the client computer utilizing the network based on the status.

39. A system for enforcing an anti-virus policy, comprising:
(a) means for receiving a status command at a client computer from a network device utilizing a network;
(b) means for sending a status to the network device utilizing the network in response to the status command, the status relating to anti-virus scanning software on the client computer; and
(c) means for initiating a response at the client computer utilizing the network based on the status.

40. A system for enforcing an anti-virus policy, comprising:

(a) a client agent for receiving a status command at a client computer from a network device utilizing a network, and sending a status to the network device utilizing the network in response to the status command, the status relating to anti-virus scanning software on the client computer; and

(b) wherein a response at the client computer is initiated utilizing the network based on the status.

41. A method for enforcing an anti-virus policy, comprising:

(a) attempting to gain access to a network via a firewall utilizing a client computer;

(b) receiving a command from the firewall utilizing the network; and

(c) sending information to the firewall utilizing the network in response to the command;

(d) wherein the information relates to anti-virus scanning software on the client computer.

42. A method for enforcing an anti-virus policy, comprising:

(a) attempting to gain access to a network via a firewall utilizing a client computer;

(b) sending a status to the firewall utilizing the network, the status relating to anti-virus scanning software on the client computer; and

(c) gaining access to the network via the firewall based on the status.

43. A method for enforcing an anti-virus policy, comprising:

(a) attempting to gain access to a network via a firewall utilizing a client computer; and

(b) identifying a status relating to anti-virus scanning software on the client computer;

(c) wherein access is selectively allowed to the network via the firewall based on the status.

44. A computer program product for enforcing an anti-virus policy, comprising:
(a) computer code for attempting to gain access to a network via a firewall utilizing a client computer; and
(b) computer code for identifying a status relating to anti-virus scanning software on the client computer;
(c) wherein access is selectively allowed to the network via the firewall based on the status.

45. A method for enforcing an anti-virus policy, comprising:
(a) receiving a status command at a client computer from a network device utilizing a network;
(b) sending a status to the network device utilizing the network in response to the status command, the status relating to anti-virus scanning software on the client computer;
(c) receiving an update command from the network device based on the status, the update command being received if the status indicates that the anti-virus scanning software on the client computer requires an update; and
(d) updating the anti-virus scanning software in response to the update command.

46. A method for enforcing an anti-virus policy, comprising:
(a) monitoring a port on a client computer;
(b) receiving a command at the client computer utilizing a network;
(c) determining whether the command is received from a firewall; and
(d) if it is determined that the command is received from the firewall:
    (i) decrypting the command,
    (ii) determining whether the command includes a status command or an update command,
    (iii) if the command includes a status command, sending a status to the firewall utilizing the network in response to the status command, the

status relating to anti-virus scanning software on the client computer, and

(iv) if the command includes an update command, updating the anti-virus scanning software utilizing the network in response to the update command.

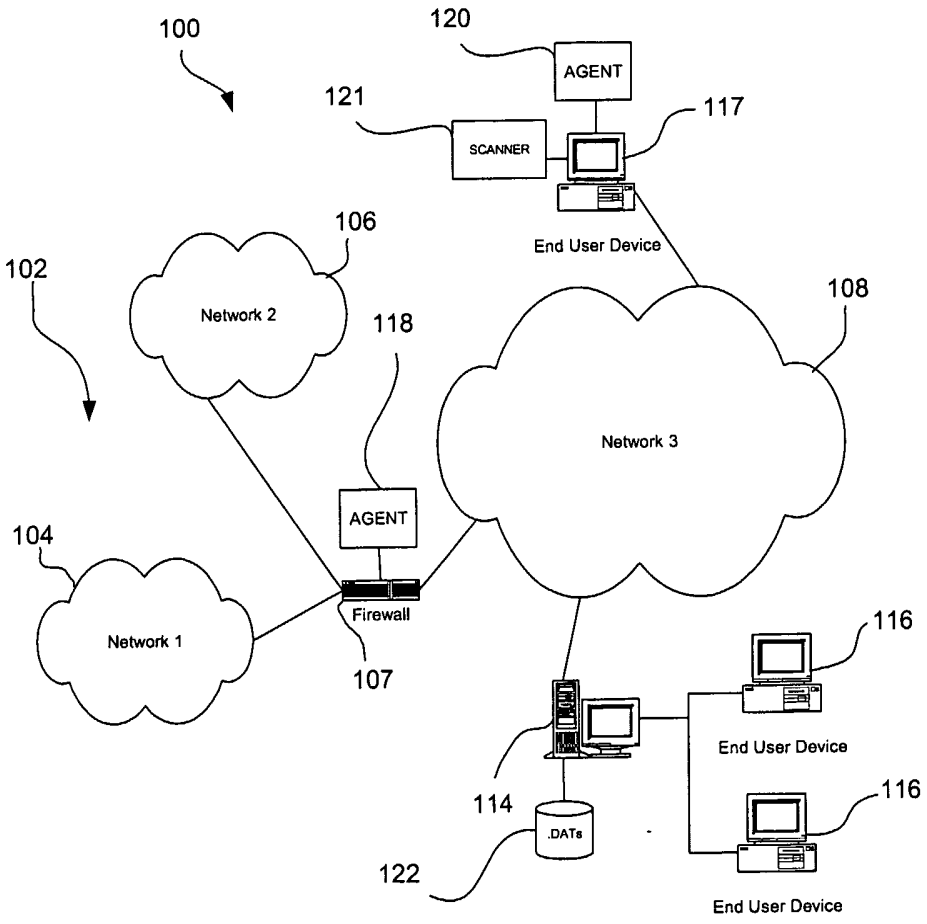
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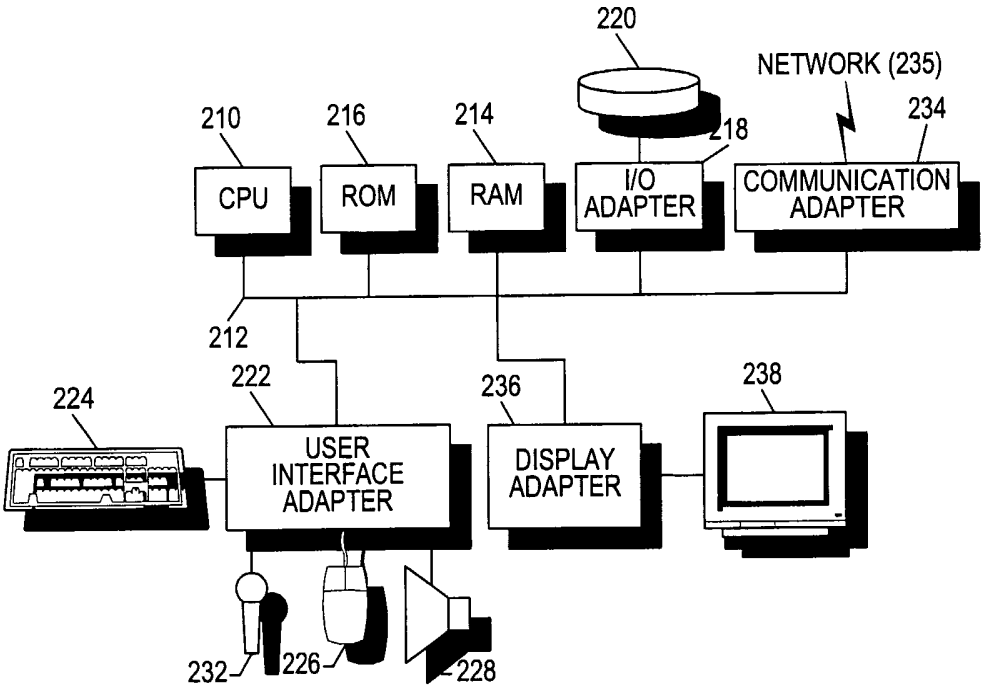
Figure 1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USER INTERFACE ADAPTER
DISPLAY ADAPTER
232
226
228

Figure 2

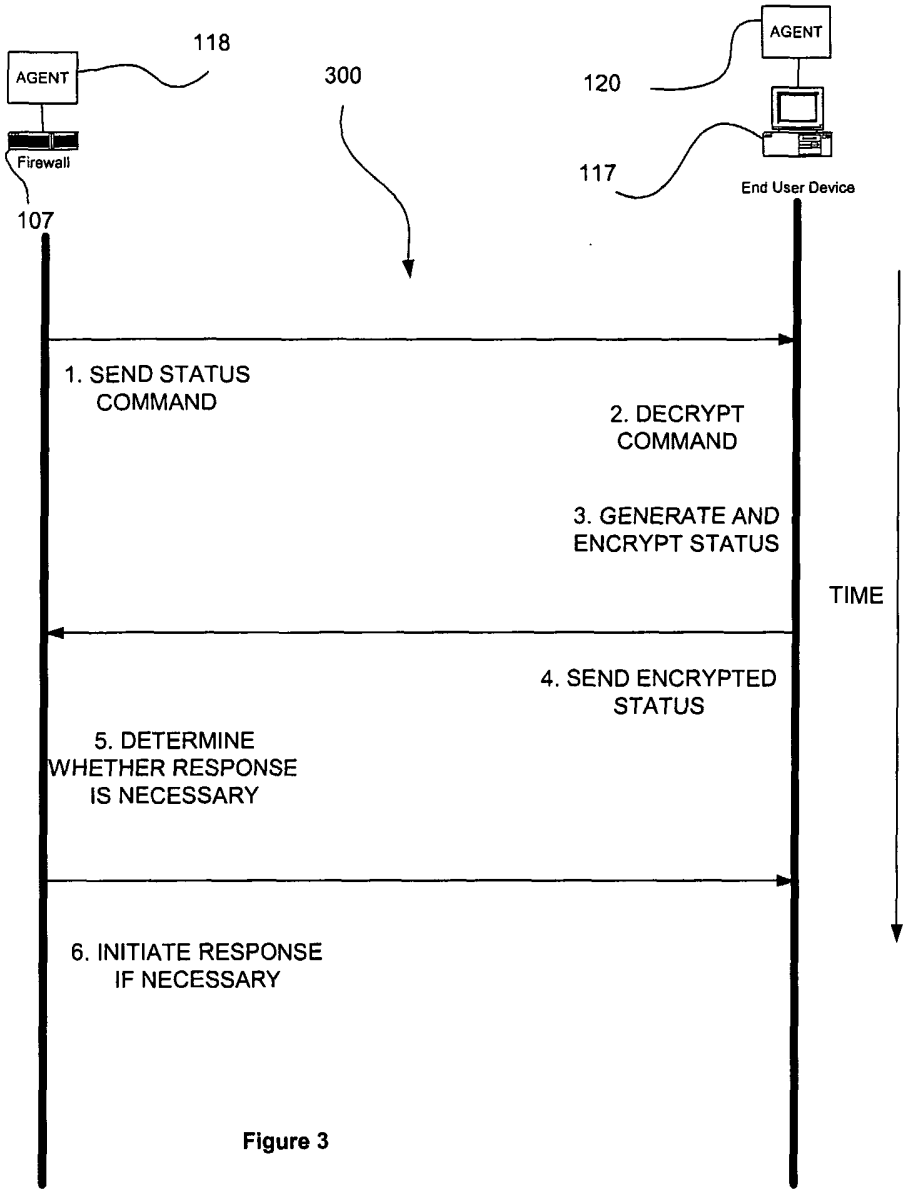
AGENT
118
300
AGENT
120
Firewall
117
End User Device
107
1. SEND STATUS COMMAND
2. DECRYPT COMMAND
3. GENERATE AND ENCRYPT STATUS
TIME
4. SEND ENCRYPTED STATUS
5. DETERMINE WHETHER RESPONSE IS NECESSARY
6. INITIATE RESPONSE IF NECESSARY

Figure 3

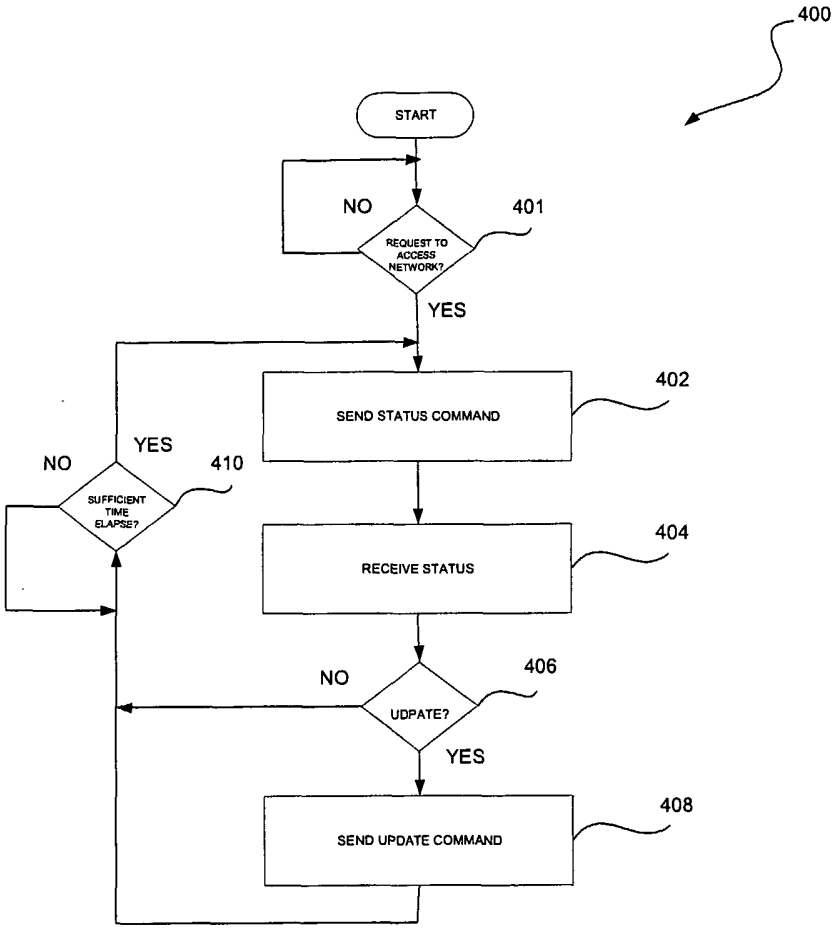
400
START
NO
401
REQUEST TO ACCESS NETWORK?
YES
402
SEND STATUS COMMAND
YES
NO
410
SUFFICIENT TIME ELAPSE?
404
RECEIVE STATUS
NO
406
UDPATE?
YES
408
SEND UPDATE COMMAND

Figure 4

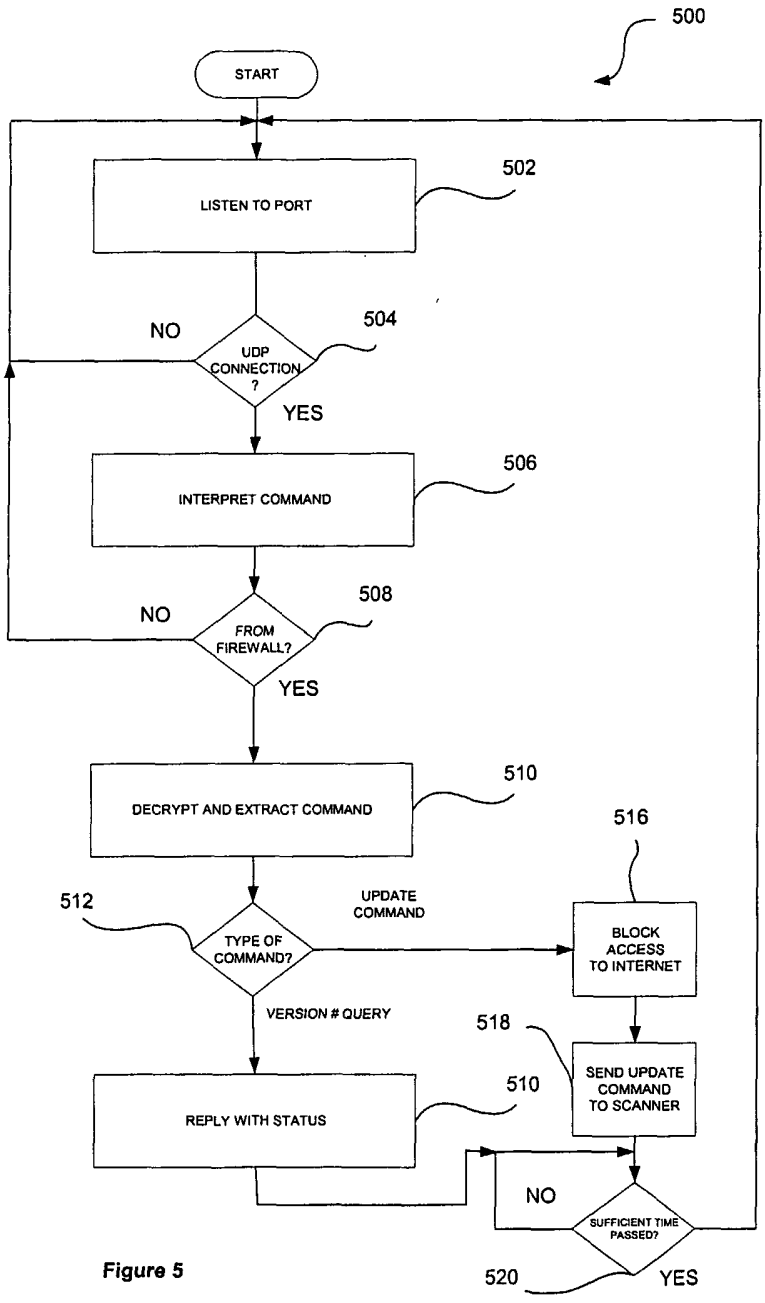
500
START
LISTEN TO PORT
502
NO
UDP CONNECTION ?
504
YES
INTERPRET COMMAND
506
NO
FROM FIREWALL?
508
YES
DECRYPT AND EXTRACT COMMAND
510
516
512
TYPE OF COMMAND?
UPDATE COMMAND
BLOCK ACCESS TO INTERNET
VERSION # QUERY
518
SEND UPDATE COMMAND TO SCANNER
REPLY WITH STATUS
510
NO
SUFFICIENT TIME PASSED?
520
YES

Figure 5

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US02/29302

A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) : G06F 15/16
US CL : 709/229;

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
U.S. : 709/229;206,201; 713/201,188;710/36;345/418;380/49

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
Please See Continuation Sheet

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 6,119,165 A (LI et al) 12 September 2000 col 3-5	1-46
Y	US 6,088,803 A (TSO et al) 11 July 2000 col 2-8	1-46
Y	US 6,269,447 B1(MALONEY et al) 31 July 2001 col 3-7	1-46
Y	US 6,205,551 B1 (GROSSE) 20 March 2001, col 3-8	1-46
Y	US 6,075,863 A (KRISHNAN et al) 13 June 2000, col 2-6	1-46
Y	US 5,832,208 A (CHEN et al) 03 November 1998 col 6-12	1-46
Y	US 5,550,976 A (HENDERSON et al) 27 August 1996, col 12-23	1-46

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search
06 November 2002 (06.11.2002)

Date of mailing of the international search report
18 DEC 2002

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Form PCT/ISA/210 (second sheet) (July 1998)

INTERNATIONAL SEARCH REPORT

PCT/US02/29302

Continuation of B. FIELDS SEARCHED Item 3:

-Real World Anti-Virus product reviews and Evaluations-The current state of Affairs csrc.nist.gov/nissc/1996/papers/NISSC96/paper019/final.PDF

-Applying Mobile Agents to Intrusion Detection and Response - Jansen, Mell.. (1999) www.itl.nist.gov/div893/staff/mell/maresponse.pdf