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Ziese

(10) **Patent No.: US 6,484,315 B1**
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(54) **METHOD AND SYSTEM FOR DYNAMICALLY DISTRIBUTING UPDATES IN A NETWORK**

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(58) **Field of Search** 713/100, 153, 713/163, 187, 191, 200; 709/203, 201, 221, 220, 227, 217–222; 707/203, 202, 204, 10; 340/541, 540; 714/13, 18, 38; 717/168–178

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(57) **ABSTRACT**

A first version of a program operating at a network site is updated by automatically downloading from a remote site any update for the program in response to an automated event. A downloaded update is installed to generate a second version of the program. The second version of the program is operated at the network site in place of the first version.

9 Claims, 2 Drawing Sheets

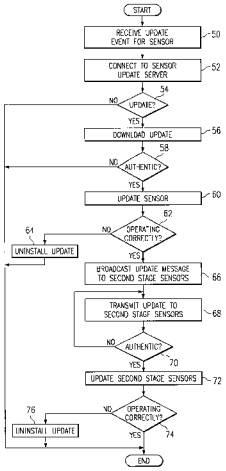

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FIG. 1

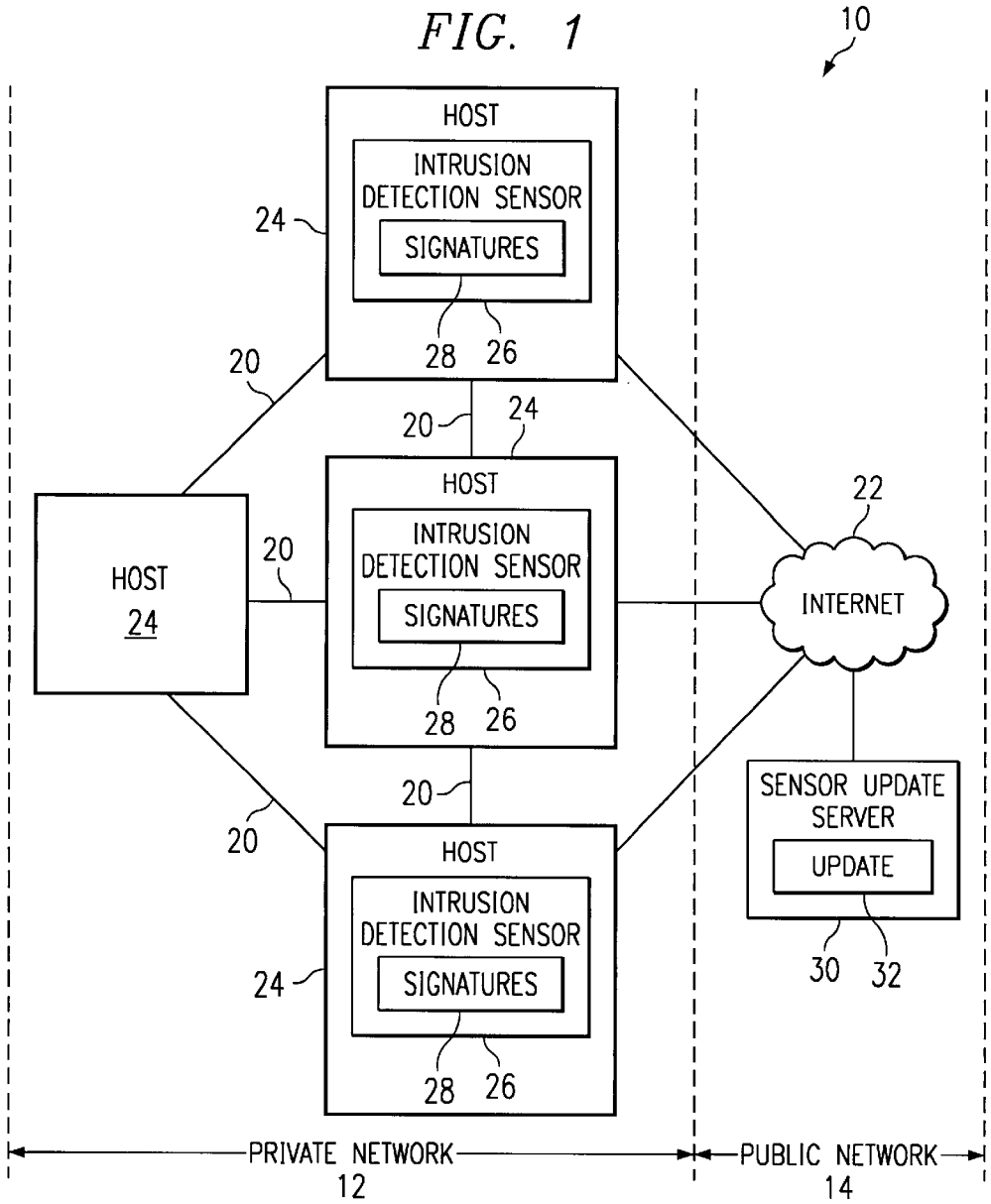
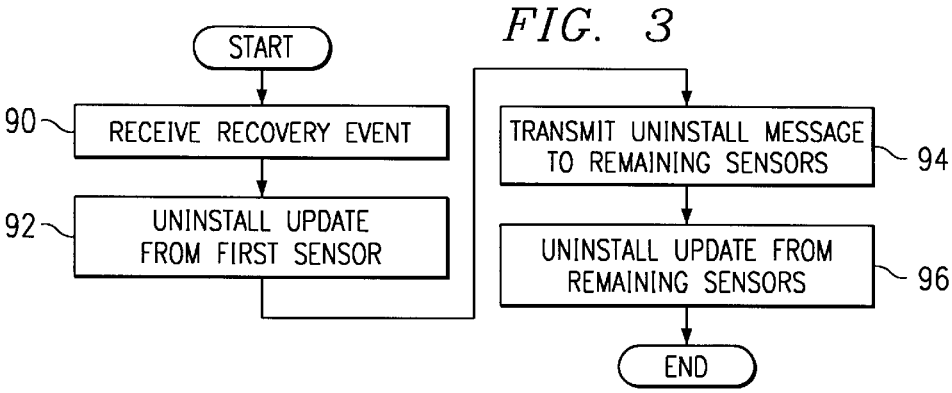

10
HOST
INTRUSION DETECTION SENSOR
SIGNATURES
24
28
26
20
HOST
24
22
INTERNET
SENSOR UPDATE SERVER
UPDATE
30
32
PRIVATE NETWORK
12
PUBLIC NETWORK
14

FIG. 3


START
90
RECEIVE RECOVERY EVENT
92
UNINSTALL UPDATE FROM FIRST SENSOR
TRANSMIT UNINSTALL MESSAGE TO REMAINING SENSORS
94
UNINSTALL UPDATE FROM REMAINING SENSORS
96
END

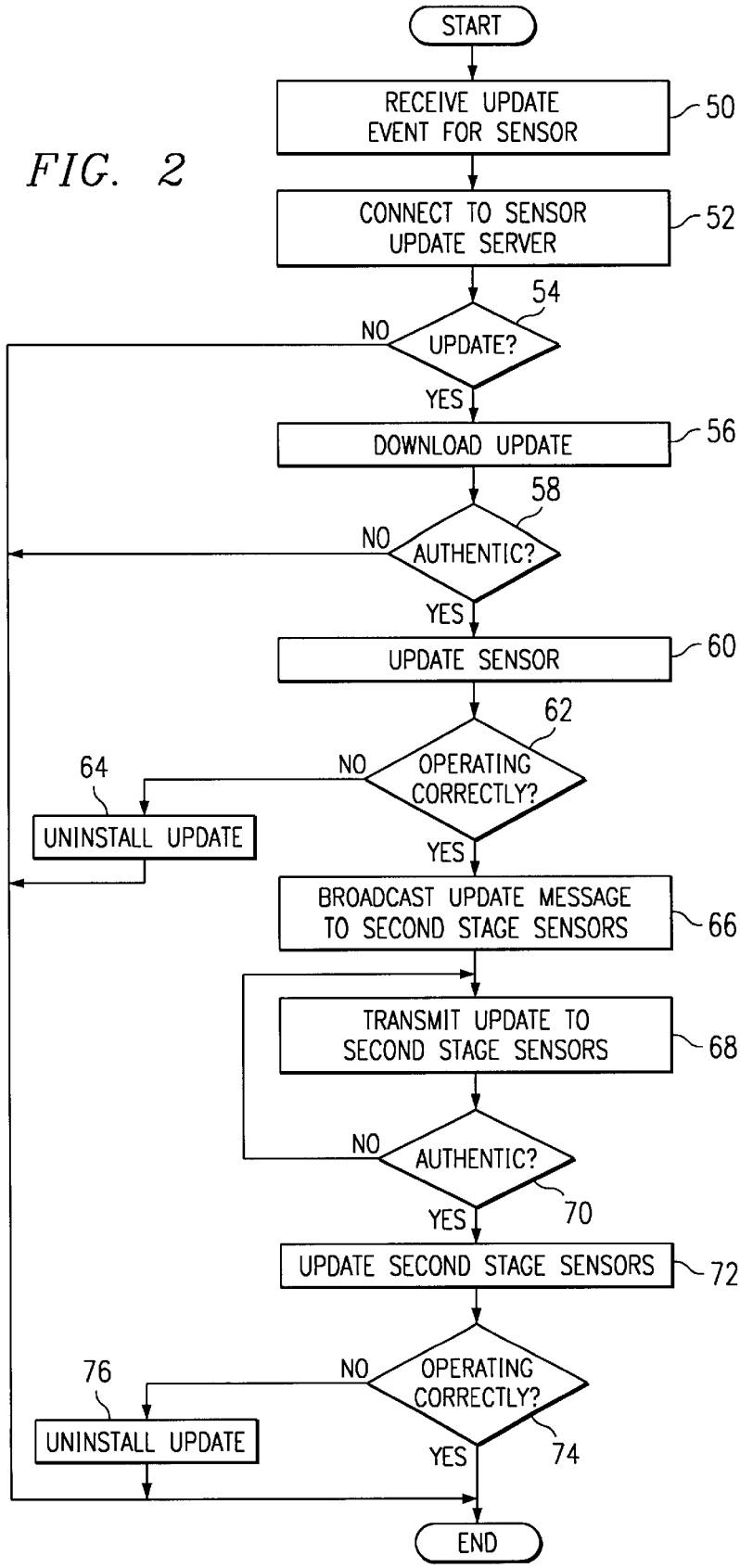


FIG. 2
START
RECEIVE UPDATE EVENT FOR SENSOR
50
CONNECT TO SENSOR UPDATE SERVER
52
54
UPDATE?
NO
YES
DOWNLOAD UPDATE
56
58
AUTHENTIC?
NO
YES
UPDATE SENSOR
60
62
OPERATING CORRECTLY?
NO
YES
64
UNINSTALL UPDATE
BROADCAST UPDATE MESSAGE TO SECOND STAGE SENSORS
66
TRANSMIT UPDATE TO SECOND STAGE SENSORS
68
AUTHENTIC?
NO
YES
70
UPDATE SECOND STAGE SENSORS
72
OPERATING CORRECTLY?
NO
YES
74
76
UNINSTALL UPDATE
END

METHOD AND SYSTEM FOR DYNAMICALLY DISTRIBUTING UPDATES IN A NETWORK

TECHNICAL FIELD OF THE INVENTION

This invention relates generally to computer networking, and more particularly to a method and system for dynamically distributing updates in a network.

BACKGROUND OF THE INVENTION

Computer networks have become an increasingly important means for communicating public and private information between and within distributed locations. The Internet is one example of a public network commonly used for communicating public and private information. Internet web servers provide access to public information, such as news, business information, and government information, which the Internet makes readily available around the world. The Internet is also becoming a popular forum for business transactions, including securities transactions and sales of goods and services. A large number of people have come to depend upon reliable Internet access and secure communications on a day-by-day and even second-by-second basis. Like the Internet, private networks also have become common means for communicating important information. Private networks, such as company intranets, local area networks (LANs), and wide area networks (WANs) generally limit access on a user-by-user basis and communicate data over dedicated lines or by controlling access through passwords, encryption, or other security measures.

One danger to reliable and secure network communications is posed by hackers or other unauthorized users disrupting or interfering with network resources. The danger posed by unauthorized access to computer network resources can vary from simple embarrassment to substantial financial losses. For example, serious financial disruptions occur when hackers obtain financial account information or credit card information and use that information to misappropriate funds.

Typically, network administrators use various levels of security measures to protect the network against unauthorized use. Intrusion detection systems are commonly used to detect and identify unauthorized use of a computer network before the network resources and information are substantially disrupted or violated. In general, intrusion detection systems look for specific patterns in network traffic, known as intrusion signatures to detect malicious activity. Conventional intrusion detection systems often use finite state machines, simple pattern matching, or specialized algorithms to identify intrusion signatures in network traffic. Detected intrusion signatures are reported to network administration.

A problem with conventional intrusion detection systems is that when a new vulnerability, or type of attack on the network, is discovered, a new intrusion signature must be generated and installed for each intrusion detection system. As a result, unless a network administrator frequently checks for new signatures developed by an intrusion detection provider and installs the new signatures for each sensor in his or her system, the system will remain vulnerable to the new types of attack. Because new types of attacks appear more frequently than network administrators typically check with an intrusion detection provider for new signatures, networks often remain vulnerable to new types of attacks even though new signatures are available to identify and prevent such attacks.

SUMMARY OF THE INVENTION

The present invention provides a method and system for dynamically distributing intrusion detection and other types of updates in a network that substantially eliminate or reduce disadvantages and problems associated with prior methods and systems. In particular, the present invention automatically downloads updates from a remote site in response to a timed event.

In accordance with one embodiment of the present invention, a first version of a program operating at a network site is updated by automatically downloading from a remote site any update for the program in response to an automated event. A downloaded update is installed to generate a second version of the program. The second version of the program is operated at the network site in place of the first version.

More particularly, in accordance with a particular embodiment of the present invention, the automated event is a timed event. In this embodiment, the first version of the program is aged and the timed event is the first version reaching a specified age. The specified age may be 24 hours or other suitable age. In other embodiments, the timed event may be a specified time such that any updates are automatically downloaded once a day, once a week, or at other suitable frequency.

After installation of a downloaded update, it may be determined whether the second version of the program is operating correctly. In response to incorrect operation of the second version, the first version of the program may be restored for operation at the network site. In response to correct operation of the second version, the downloaded update may be distributed to disparate network sites operating the first version of the program. There, the downloaded update may be installed to generate the second version of the program at the disparate network sites. The second version of the program is operated in the place of the first version at the disparate network sites.

Technical advantages of the present invention include providing an improved method and system for distributing updates in a network. In particular, programs are automatically updated by downloading and distributing an update in response to an automated event, such as a timed event. As a result, systems with a common program separately running at several sites may update each site with no or minimal operator interaction. In addition, updates may be automatic or with minimal operator interaction rolled back at each site in a system in response to an upgrade problem.

Additional technical advantages of the present invention include providing an improved intrusion detection system. In particular, each intrusion detection sensor may automatically connect to a remote site and download new intrusion detection signatures. Each sensor may also distribute the new signatures to related sensors within a system. Accordingly, network vulnerability due to new types of attacks is reduced. In addition, an intrusion detection service provider may update all of its customers by simply providing new signatures on a website from which each customer's system will automatically connect to and download the new signatures in accordance with a specified frequency. Accordingly, the costs of providing intrusion detection services are reduced.

Other technical advantages will be readily apparent to one skilled in the art for the following figures, description, and claims.

BRIEF DESCRIPTION OF THE DRAWINGS

For a more complete understanding of the present invention and its advantages, reference is now made to the

following description taken in conjunction with the accompanying drawings, wherein like reference numerals represent like parts, in which:

FIG. **1** is a block diagram illustrating a system for dynamically distributing intrusion detection signatures in accordance with one embodiment of the present invention;

FIG. **2** is a flow diagram illustrating a computer method for dynamically distributing intrusion detection signatures in the network of FIG. **1**; and

FIG. **3** is a flow diagram illustrating a computer method for recovering from a problematic update in accordance with one embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

FIG. **1** is a block diagram illustrating a system **10** for dynamically distributing updates in a network. In this embodiment, new intrusion signatures are distributed to remote intrusion detection sensors. The sensors use the intrusion signatures to detect and report unauthorized entry. It will be understood that the present invention may be used to distribute other suitable types of updates to intrusion detection and other suitable types of applications within a network.

Referring to FIG. **1**, the system **10** includes a private network **12** and a public network **14**. For the embodiment of FIG. **1**, the private network is an Intranet **20** and the public network is an Internet **22**. It will be understood that the private and public networks **12** and **14** may be other suitable types of networks.

The Intranet **20** includes a network interconnecting a plurality of hosts **24**. The network is a local area network (LAN), a wide area network (WAN), or other suitable type of link capable of communicating data between the hosts **24**. For the local area network embodiment, the network may be an Ethernet.

The hosts **24** are each a computer such as a personal computer, file server, workstation, minicomputer, mainframe or any general purpose or other computer or device capable of communicating with other computers or devices over a network. The hosts **24** operating on the border between the Intranet **20** and Internet **22** each include an intrusion detection sensor **26** for detecting and reporting unauthorized entry. As used herein, each means each of at least a subset of the identified items.

The intrusion detection sensors **26** each include a common set of intrusion signatures **28**. The intrusion signatures **28** comprise patterns of network activity that denote or indicate unauthorized access or other harmful activity capable of damaging the host **24** or other aspect of the private network **12**. Generally described, the intrusion detection sensors **26** detect such unauthorized access or attacks upon the host **24** by matching network traffic to the intrusion signatures **28**.

The Internet **22** includes a sensor update server **30**. The sensor update server **30** may be virtually any type of computer capable of storing intrusion updates **32** and communicating with other computers or devices over the Internet **22**. The intrusion update **32** includes new intrusion signatures generated by an intrusion detection service provider in response to new types of attacks. The intrusion detection service provider generates the new signatures and provides them as the update **32** on a web page at the sensor update server **30** to allow customers to access the new signatures over the Internet **22**. As described in more detail below, the update **32** is downloaded by customers over the Internet **22** and the new signatures added to the intrusion signatures **28** residing on the host **24**. In this way, the intrusion detection sensors **26** are kept up-to-date and able to detect and report new types of network and/or host based attacks.

FIG. **2** is a flow diagram illustrating a computer method for dynamically distributing intrusion detection updates over the Internet **22** or other suitable network. It will be understood that other types of updates for other types of applications may be similarly distributed over the Internet **22** or other suitable network without departing from the scope of the present invention.

Referring to FIG. **2**, the method begins at step **50** in which a specified event is received. The specified event may be an automated event or a user initiated event. The automated event may be any event generated by the sensor or other software or hardware in accordance with predefined instructions or logical set of such events. In one embodiment, the automated event is a timed event that is directly or indirectly based upon the reaching or passing of a specified time. For this embodiment, the intrusion detection sensors **26** may automatically age the intrusion signatures **28** after each update to allow the intrusion detection sensors **26** to automatically determine when the intrusion signatures **28** may be in need of updating. In this embodiment, an update event is generated in response to the intrusion signatures **28** reaching a specified age. The age is twenty-four hours or other suitable time period that will allow the intrusion signatures **28** to be updated at a frequency that will minimize vulnerability of the private network **12** to new types of attacks. An event or action is in response to a specified event when the occurrence of the specified event directly or indirectly triggers, at least in part, the responding event or action. Thus, other events may also be necessary to trigger the responding event or action, or intervene between the specified event and the responding event or action. The update event may be other suitable types of timed events such as, for example, a specified or scheduled time of day, week, or the like.

In a particular embodiment, a user may select a number of sensors to be subordinate to a primary intrusion detection sensor or set of primary sensors. In this embodiment, only the primary sensors are responsible for generating the update event and only their intrusion signatures **28** are aged. Alternatively, each intrusion detection sensor **26** may independently age its own intrusion signatures **28** and generate the update event in response to its intrusion signatures **28** reaching the specified age. In this embodiment, no one intrusion section sensor **26** or limited set of sensors is solely relied upon to initiate updating.

Proceeding to step **52**, the intrusion detection sensor **26** generating the update event automatically connects to the sensor update server **30** over the Internet **22**. At decisional step **54**, the intrusion detection sensor **26** automatically determines whether the sensor update server **30** includes an update **32** for the intrusion signatures **28**. In one embodiment, the intrusion detection sensor **26** may compare a time stamp of its last update to that of a current file on the sensor update server **30**. In this embodiment, the current file is an update **32** if the time stamp for the file is later than that for the last update for the intrusion detection sensor **26**. If an update **32** is not available, then the current set of intrusion signatures **28** are up-to-date and the No branch of decisional step **54** leads to the end of the process. Accordingly, the intrusion signatures **28** are updated only when needed. However, if an update **32** is available on the sensor update server **30**, the Yes branch of decision step **54** leads to step **56**.

At step **56**, the intrusion detection sensor **26** automatically downloads the update **32**. Preferably, the update **32** is downloaded in an encrypted format to prevent tampering and decrypted at the host **24**. In addition, the update **32** may be protected by VPN, sequence numbering, other suitable form of secure communication, or a combination of forms. Next, at decisional step **58**, the intrusion detection sensor **26** automatically authenticates the update **32**. In one embodiment, the update **32** is authenticated by ensuring that the update is for the existing set of intrusion signatures **28**. If the update **32** is not authentic, then it should not be installed and the No branch of decisional step **58** leads to the end of the process. Accordingly, an update **32** that cannot be authenticated is not installed. However, if the update **32** is authentic, the Yes branch of decisional step **58** leads to step **60**.

At step **60**, the intrusion detection sensor **26** automatically installs the update **32** to add the new signatures to the preexisting intrusion signatures **28**. Next, at decisional step **62**, the intrusion detection sensor **26** automatically determines if it is operating correctly with the installed update by comparing its operation to specified parameters, limits, and the like. If the intrusion detection sensor **26** is not operating correctly, then the No branch of decisional step **62** leads to step **64** where recovery processing is automatically initiated and the update **32** is uninstalled. Accordingly, the intrusion detection sensor **26** is returned to its previous state and the private network **12** is not left vulnerable by an incorrectly operating intrusion detection sensor **26**. However, if the update intrusion sensor **26** is operating correctly, the Yes branch of decisional step **62** leads to step **66**.

At step **66**, the intrusion detection sensor **26** automatically broadcasts an update message over the Intranet **20**. The update message informs the other intrusion detection sensors **26** of the availability of the update **32**. Next, at step **68**, the update **32** is automatically transmitted to the intrusion detection sensors **26** that responded to the update message. In one embodiment, the update message identifies the update and intrusion detection sensors **26** not having that update respond to request the update **32**. The update **32** may be transmitted over the Intranet **20** in an encrypted format and a secure form and decrypted by each of the second stage intrusion detection sensors **26** as previously described for the first stage intrusion detection sensor **26** that originally received the update **32**. If a sensor hierarchy is used, relationships between primary and secondary sensors may be predefined with the primary sensors each sending updates **32** to their respective secondary sensors. In addition, the relationship may be recursive with secondary sensors having their own children.

Proceeding to decisional step **70**, each of the second stage intrusion detection sensors **26** authenticates the update **32** as previously described in connection with the first stage intrusion detection sensor **26**. If the update **32** cannot be authenticated by a second stage intrusion detection sensor **26**, the No branch of decisional step **70** returns to step **68** for that second stage intrusion detection sensor **26** where the update **32** is retransmitted to the intrusion detection sensor **26**. Alternatively, or in response to several unsuccessful attempts to transmit an authentic update **32** to a second stage, the No branch of decisional step **70** may lead to the end of the process where the update **32** is not installed for that intrusion detection sensor **26**. After an authentic update **32** is received by a second stage intrusion detection sensor **26**, the Yes branch of decisional step **70** leads to step **72**.

At step **72**, the update **32** is automatically installed for each of the second stage intrusion detection sensors **26** receiving an authentic update **32** to generate an updated set of intrusion signatures **28**. Accordingly, all intrusion detection sensors **26** in the private network **12** are automatically updated to protect all avenues of access to the private network **12** from the new types of attacks.

Proceeding to decisional step **74**, each of the second stage intrusion detection sensors **26** determine if they are operating correctly with the installed update **32**. If a second stage intrusion detection sensor **26** is not operating correctly, the No branch of decisional step **74** leads to step **76**. At step **76**, recovery process is initiated for that intrusion detection sensor **26** and the update **32** is uninstalled. In this way, it is ensured that each of the second stage intrusion detection sensors **26** will remain in operating condition. For each second stage intrusion detection sensor **26** operating correctly with the installed update **32**, the Yes branch of decisional step **74** leads to the end of the process. Accordingly, all intrusion detection sensors **26** for the private network **12** have been automatically updated. Because user interaction is not required, the intrusion detection sensors **26** may be frequently and efficiently updated to ensure that the private network **12** is not vulnerable to new types of attacks.

It will be understood that the intrusion sensors **26** may be otherwise suitably updated without departing from the scope of the present invention. For example, although the method was described with the intrusion detection sensor **26** performing the specified actions, it will be understood that another application in or remotely from the hosts **24** may carry out the updating functionality identified for the intrusion detection sensor **26**.

FIG. **3** illustrates a computer method for recovery processing in accordance with one embodiment of the present invention. Referring to FIG. **3**, the method begins at step **90** in which a recovery event is received. The recovery event may be initiated by an intrusion detection sensor **26** in response to incorrect operation of the intrusion detection sensor **26**. The recovery event may also be independently initiated by an operator to uninstall the update **32**.

Proceeding to step **92**, the update **32** is uninstalled from a first intrusion detection sensor **26**. The first intrusion detection sensor **26** may be the first sensor **26** on which the update **32** was initially installed or another intrusion detection sensor **26** detecting incorrect operations or receiving a user command to initiate recovery processing. Uninstalling the update **32** returns the first intrusion detection sensor **26** to its previous state.

Next, at step **94**, the first intrusion detection sensor **26** transmits a recovery message to the remaining intrusion detection sensors **26** in the private network **12** on which the update **32** was installed. Next, at step **96**, each of the remaining intrusion detection sensors **26** uninstalls the update **32** in response to the recovery message. Accordingly, each intrusion detection sensor **26** in the private network **12** is returned to its previous state in response to a single recovery event. In this way, integrity of the private network **12** and the intrusion detection system for the private network **12** is maintained with each of the intrusion detection sensors **26** in a same state. Step **96** leads to the end of the process by which each of the intrusion detection sensors **26** have been returned to a same recovery state.

Although the present invention has been described with several embodiments, various changes and modifications may be suggested to one skilled in the art. It is intended that the present invention encompass such changes and modifications as fall within the scope of the appended claims.

What is claimed is:

1. A method for updating a first version of a program operating at a network site, comprising:

in response to an automated event, automatically downloading from a remote site any update for the program;

automatically installing a downloaded update to generate a second version of the program;

after installation of the downloaded update, automatically determining whether the second version of the program is operating correctly;

in response to correct operation of the second version, operating the second version of the program in place of the first version at the network site; and

in response to incorrect operation of the second version, automatically restoring the first version of the program for operation at the network site.

2. A method for updating a first version of a program operating at a network site, comprising:

in response to an automated event, automatically downloading from a remote site any update for the program;

installing a downloaded update to generate a second version of the program; and

operating the second version of the program in place of the first version at the network site;

automatically distributing the downloaded update to a disparate network site operating the first version of the program;

automatically installing the downloaded update to generate the second version of the program at the disparate network site; and

automatically operating the second version of the program in place of the first version at the disparate network site.

3. A method for updating a first version of a program operating at a network site, comprising:

in response to an automated event, automatically downloading from a remote site any update for the program;

installing a downloaded update to generate a second version of the program;

after installation of the downloaded update, automatically determining whether the second version of the program is operating correctly at the network site;

in response to incorrect operation of the second version, automatically restoring the first version of the program for operation at the network site; and

in response to correct operation of the second version at the network site:

automatically distributing the downloaded update to a disparate network site operating the first version of the program;

automatically installing the downloaded update to generate the second version of the program at the disparate network site; and

automatically operating the second version of the program in place of the first version at the disparate network site.

4. A method for updating a first version of a program operating at a network site, comprising:

in response to an automated event, automatically downloading from a remote site any update for the program;

automatically installing a downloaded update to generate a second version of the program; and

operating the second version of the program in place of the first version at the network site;

broadcasting over a network an update message;

receiving in response to the update message a request for the downloaded update from each of a plurality of disparate network sites operating the first version of the program;

automatically distributing the downloaded update to the disparate network sites requesting the downloaded update;

automatically installing the downloaded update to generate the second version of the program at each of the disparate network sites; and

automatically operating the second version of the program in place of the first version at each of the disparate network sites.

5. The method of claim 4, further comprising:

receiving a recovery event at one of the network sites;

automatically restoring the first version of the program at the network site at which the recovery event was received;

broadcasting a recovery message from the network site over the network; and

automatically restoring the first version of the program at each of the remaining network sites operating the second version of the program.

6. The method of claim 5 wherein the recovery event occurs in response to incorrect operation of the second version of the program.

7. An intrusion detection system, comprising:

a private network including a plurality of sites connected to a public network, each site including an intrusion detection sensor operating with a first set of intrusion detection signatures; and

each of the intrusion detection sensors operable to automatically download from a remote site any update for the intrusion detection signatures in response to a specified event, to automatically install a downloaded update to generate a second set of intrusion detection signatures, to operate with the second set of intrusion detection signatures, and to automatically distribute the downloaded update to the remaining intrusion detection sensors for installation.

8. The system of claim 7, wherein the specified event is an automated event.

9. The system of claim 8, wherein the automated event is a timed event.

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