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Burtscher

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(54) **SYSTEM AND METHOD FOR DIRECTLY ACCESSING DATA FROM A DATA STORAGE MEDIUM**

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This patent is subject to a terminal disclaimer.

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(52) **U.S. Cl.** **726/24**; 726/22; 726/23; 726/25; 713/182; 713/187; 713/188; 717/127; 717/131

(58) **Field of Classification Search** 713/182, 713/188; 726/22, 23, 24; 717/127, 131
See application file for complete search history.

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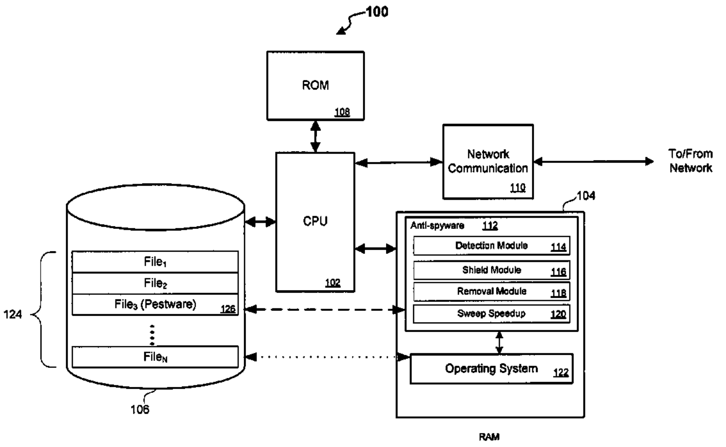
(57) **ABSTRACT**

Systems and methods for scanning files for pestware on a protected computer are described. In one variation, locations of each of a plurality of files in a file storage device of the protected computer are identified while substantially circumventing an operating system of the protected computer. Information from each of the plurality of files is retrieved and analyzed so as to determine whether any of the plurality of files are potential pestware files. In variations, the operating system is circumvented while the information from each of the plurality of files is retrieved. In other variations, before information is retrieved from each of the plurality of files, a listing of the plurality of files is sorted according to the locations of the files on the storage device so as to reduce, even further, the time required to access the plurality of files.

14 Claims, 3 Drawing Sheets



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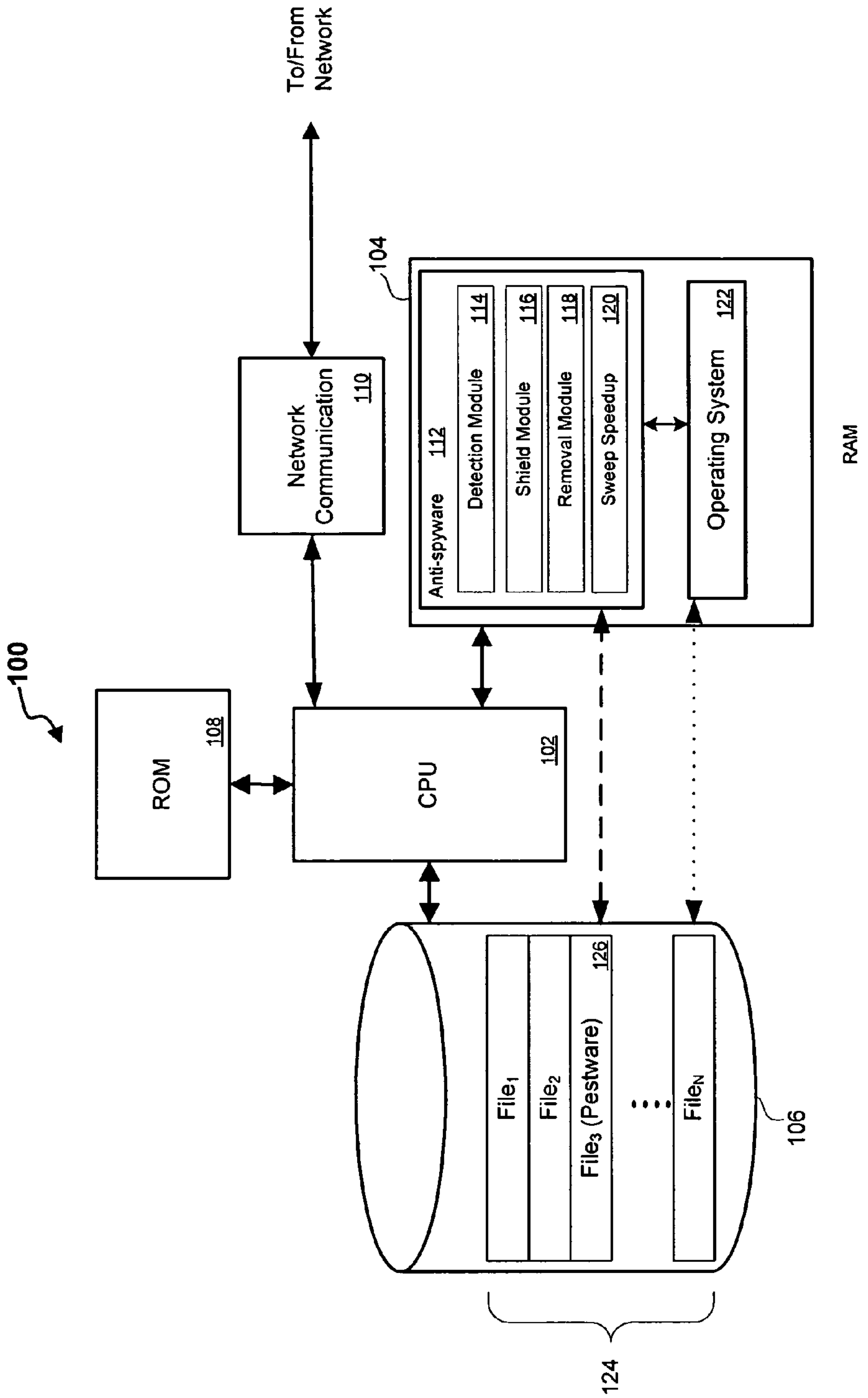
100
ROM
108
CPU
102
Network Communication
110
To/From Network
104
Anti-spyware
112
Detection Module
114
Shield Module
116
Removal Module
118
Sweep Speedup
120
Operating System
122
RAM
File$_1$
File$_2$
File$_3$ (Pestware)
126
File$_N$
106
124

FIGURE 1

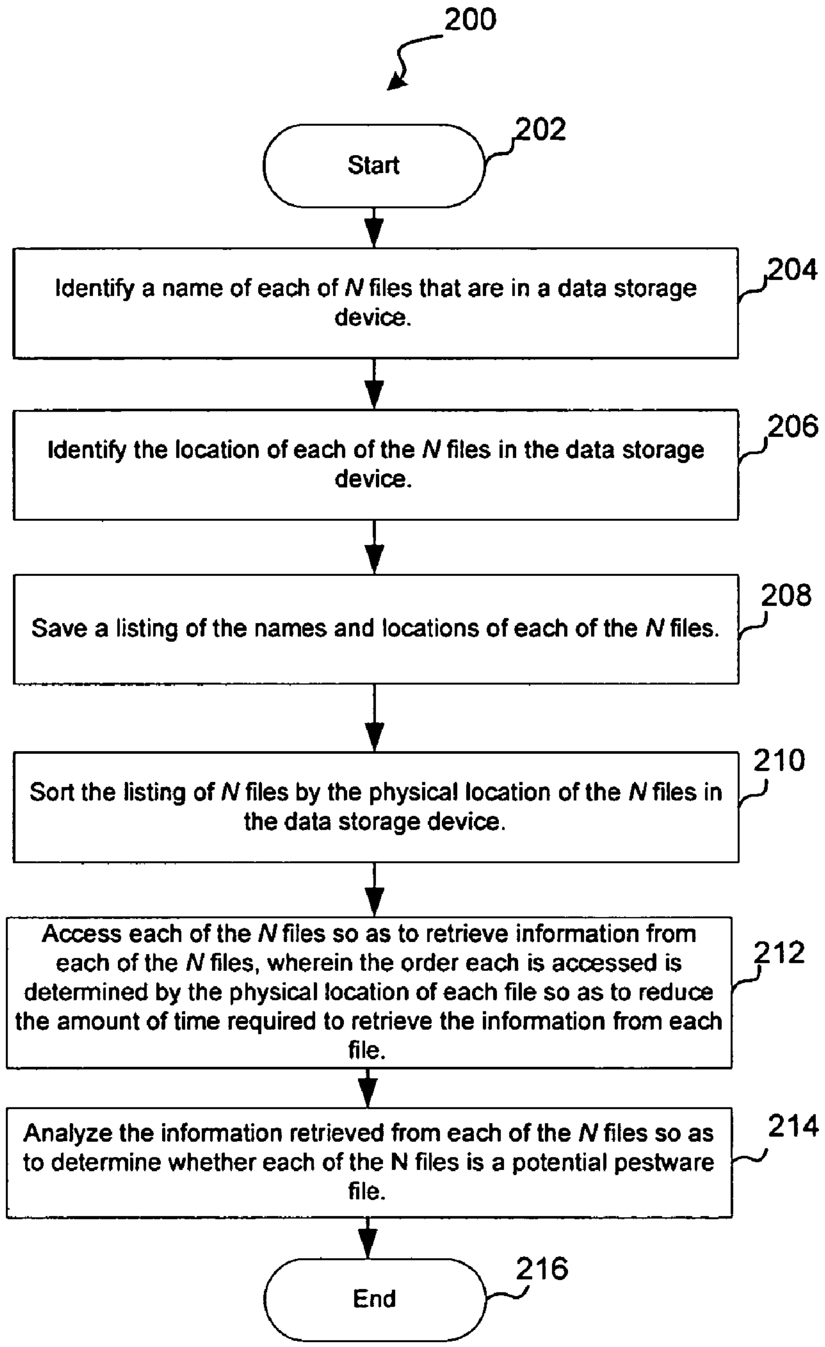
200
Start
202
Identify a name of each of N files that are in a data storage device.
204
Identify the location of each of the N files in the data storage device.
206
Save a listing of the names and locations of each of the N files.
208
Sort the listing of N files by the physical location of the N files in the data storage device.
210
Access each of the N files so as to retrieve information from each of the N files, wherein the order each is accessed is determined by the physical location of each file so as to reduce the amount of time required to retrieve the information from each file.
212
Analyze the information retrieved from each of the N files so as to determine whether each of the N files is a potential pestware file.
214
End
216

FIGURE 2

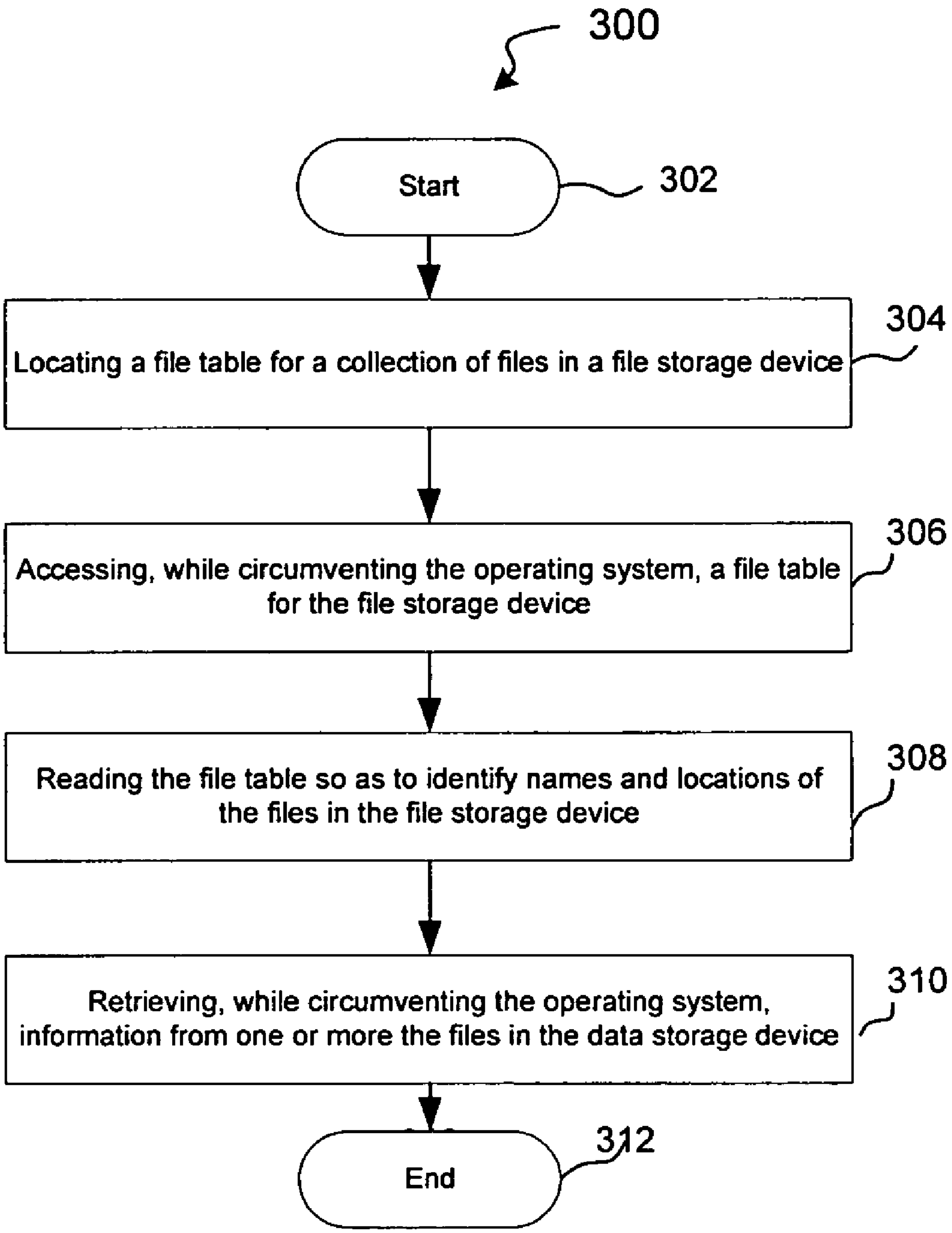
300
Start
302
Locating a file table for a collection of files in a file storage device
304
Accessing, while circumventing the operating system, a file table for the file storage device
306
Reading the file table so as to identify names and locations of the files in the file storage device
308
Retrieving, while circumventing the operating system, information from one or more the files in the data storage device
310
End
312

FIGURE 3

SYSTEM AND METHOD FOR DIRECTLY ACCESSING DATA FROM A DATA STORAGE MEDIUM

RELATED APPLICATIONS

The present application is related to the following commonly owned and assigned applications: application Ser. No. 10/956,578, entitled System and Method for Monitoring Network Communications for Pestware; application Ser. No. 10/956,573, entitled System and Method For Heuristic Analysis to Identify Pestware; and application Ser. No. 10/956,574, entitled System and Method for Pestware Detection and Removal; each of which is incorporated by reference in their entirety.

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FIELD OF THE INVENTION

The present invention relates to computer system management. In particular, but not by way of limitation, the present invention relates to systems and methods for controlling pestware or malware.

BACKGROUND OF THE INVENTION

Personal computers and business computers are continually attacked by trojans, spyware, and adware, collectively referred to as “malware” or “pestware.” These types of programs generally act to gather information about a person or organization—often without the person or organization’s knowledge. Some pestware is highly malicious. Other pestware is non-malicious but may cause issues with privacy or system performance. And yet other pestware is actual beneficial or wanted by the user. Wanted pestware is sometimes not characterized as “pestware” or “spyware.” But, unless specified otherwise, “pestware” as used herein refers to any program that collects and/or reports information about a person or an organization and any “watcher processes” related to the pestware.

Software is available to detect pestware, but scanning a system for pestware typically requires a system to look at files stored in a data storage device (e.g., disk) on a file by file basis. This process of scanning files is frequently time consuming, and as a consequence, users must wait a substantial amount of time to find out the results of a system scan. Even worse, some users elect not to perform a system scan because they do not want to, or cannot, wait for a scan to be completed. Accordingly, current software is not always able to scan and remove pestware in a convenient manner and will most certainly not be satisfactory in the future.

SUMMARY OF THE INVENTION

Exemplary embodiments of the present invention that are shown in the drawings are summarized below. These and other embodiments are more fully described in the Detailed Description section. It is to be understood, however, that there is no intention to limit the invention to the forms described in this Summary of the Invention or in the Detailed Description. One skilled in the art can recognize that there are numerous modifications, equivalents and alternative constructions that fall within the spirit and scope of the invention as expressed in the claims.

Embodiments of the present invention include systems methods for scanning files for pestware on a protected computer. One embodiment is configured to identify a location of each of at least a first file, a second file and a third file in a file storage device of the protected computer, and retrieve, while substantially circumventing an operating system of the protected computer, information from at least the first file. In this embodiment, the information from the first file is analyzed to determine whether the first file is a potential pestware file. In variations, the operating system is also circumvented while the locations of the first, second and third files are identified.

In another embodiment, the invention may be characterized as a system for managing pestware, which includes a pestware detection module configured to detect pestware on a protected computer. The protected computer in this embodiment includes at least one file storage device and a program memory. The protected computer also includes a sweep speedup module, which is configured to identify, while substantially circumventing an operating system of the protected computer, a location of each of a plurality of files in the at least one file storage device of the protected computer, and to retrieve information from each of the plurality of files. The information is analyzed by the pestware detection module so as to determine whether any of the plurality of files are potential pestware files. In variations, the operating system of the protected computer is also circumvented while the information from each of the plurality of files is retrieved. These and other embodiments are described in more detail herein.

BRIEF DESCRIPTION OF THE DRAWINGS

Various objects and advantages and a more complete understanding of the present invention are apparent and more readily appreciated by reference to the following Detailed Description and to the appended claims when taken in conjunction with the accompanying Drawings where like or similar elements are designated with identical reference numerals throughout the several views and wherein:

FIG. **1** illustrates a block diagram of a protected computer in accordance with one implementation of the present invention;

FIG. **2** is a flowchart of one method for accessing information from a plurality of files in accordance with an embodiment of the present invention; and

FIG. **3** is a flowchart of a method for enumerating and accessing information from the plurality of files while circumventing the operating system of the protected computer in accordance with another embodiment of the present invention.

DETAILED DESCRIPTION

According to several embodiments, the present invention decreases the amount of time required to retrieve information from files stored in a computer system’s storage device (e.g., hard drive).

In prior art computer systems, when a file is accessed (e.g., to retrieve information from the files), the computer’s operating system is typically utilized to access the file. The operating system, however, typically performs several logistical operations before and/or while accessing a particular file. For example, before a typical operating system accesses a file, the operating system checks to make sure that accessing the file does not violate any established security provisions. In addition, the operating system must make sure the file is not already in use, and if it is, the operating system typically denies access to the file. And once the operating system does access a file, it flags the file so that it cannot be subsequently accessed while it is in use.

Although these logistical operations may be unnoticeable when just a few files are accessed, when several files are accessed, the logistical operations, in aggregate, take a substantial amount of time to carry out, and as a consequence, become very noticeable to the user.

In addition, when a user desires to perform a general scan of a collection of files (e.g., for pestware), prior art scanning software typically utilizes the operating system to enumerate (i.e., identify) each file in the collection of files to be scanned. Once the files are enumerated, the prior art scanning software then accesses, utilizing the operating system, each enumerated file, file by file, in the order the files are enumerated by the operating system.

Unfortunately, the order in which typical operating systems enumerate files may be determined by the directory tree that the files are organized by instead of the physical location of the files in the computer system's file storage device. In the context of a disk drive for example, the order in which files are enumerated may have very little, if any, relation to the location of the files on the disk. As a consequence, the head of a disk dive may have to move across opposite ends of the disk surface to access two files that were juxtaposed in the list of files enumerated by the operating system.

Although the time it takes the head to jump between two disparate locations on a disk surface to access two enumerated files may be insignificant, when several enumerated files (e.g., several hundred or thousand files) are accessed, the amount of time required for the disk heads to traverse the disk surface, in aggregate, is substantial.

Referring first to FIG. **1**, shown is a block diagram **100** of a protected computer/system in accordance with one implementation of the present invention. The term "protected computer" is used herein to refer to any type of computer system, including personal computers, handheld computers, servers, firewalls, etc. This implementation includes a CPU **102** coupled to memory **104** (e.g., random access memory (RAM)), a file storage device **106**, ROM **108** and network communication **110**.

As shown, the storage device **106** provides storage for a collection of N files **124**, which includes a pestware file **126**. The storage device **106** is described herein in several implementations as hard disk drive for convenience, but this is certainly not required, and one of ordinary skill in the art will recognize that other storage media may be utilized without departing from the scope of the present invention. In addition, one of ordinary skill in the art will recognize that the storage device **106**, which is depicted for convenience as a single storage device, may be realized by multiple (e.g., distributed) storage devices.

As shown, an anti-spyware application **112** includes a detection module **114**, a shield module **116**, a removal module **118** and a sweep speedup module **120**, which are implemented in software and are executed from the memory **104** by the CPU **102**. In addition, an operating system **122** is also depicted as running from memory **104**.

The software **112** can be configured to operate on personal computers (e.g., handheld, notebook or desktop), servers or any device capable of processing instructions embodied in executable code. Moreover, one of ordinary skill in the art will recognize that alternative embodiments, which implement one or more components (e.g., the anti-spyware **112**) in hardware, are well within the scope of the present invention.

In the present embodiment, the operating system **122** is not limited to any particular type of operating system and may be operating systems provided by Microsoft Corp. under the trade name WINDOWS (e.g., WINDOWS 2000, WINDOWS XP, and WINDOWS NT). Additionally, the operating system may be an open source operating system such operating systems distributed under the LINUX trade name. For convenience, however, embodiments of the present invention are generally described herein with relation to WINDOWS-based systems. Those of skill in the art can easily adapt these implementations for other types of operating systems or computer systems.

In accordance with some embodiments of the present invention, the sweep speedup module **120** expedites the scanning of the N files **124** for pestware (e.g., the pestware file **126**) in the data storage device **106** by scanning the files **124** according to their physical location in the data storage device **106** instead of the order the files are enumerated by the operating system. In this way, the time required for the mechanism (s) within the file storage device (e.g., a disk head) to access each file is substantially reduced.

In other embodiments, as discussed further with reference to FIG. **3**, the sweep speedup module **120** expedites the scanning of the N files **124** for pestware (e.g., the pestware file **126**) in the data storage device **106** by circumventing the operating system **122** and directly accessing the files in the data storage device.

In yet other embodiments, the sweep speedup module **120** both directly accesses the data storage device **106** to locate and identify files in the data storage device **120** and accesses the files according to their location in the data storage device so as to further expedite the scanning of the N files **124** for any pestware.

Referring next to FIG. **2**, shown is a flowchart depicting steps traversed in accordance with a method for accessing files in the data storage device **106** according to the files physical location. Initially, the name of each of the N files **124** that are in the data storage device **106** are identified (Blocks **202**, **204**). In addition, the location of each of the N files within the data storage device **106** is also identified (Block **206**). In some embodiments, the operating system **122** is utilized to both enumerate and identify the locations of the N files **124**. In other embodiments, however, the names and locations of the N files **124** are identified by directly accessing the data storage device as discussed further herein with reference to FIG. **3**.

As shown, a listing of the names and locations of the N files **124** is then saved (Block **208**), and the stored listing of the N files **124** is sorted by the physical location of the N files **124** (Block **210**). In the case where the physical storage device **106** is a disk drive, for example, the N files **124** are sorted by the cluster numbers of the files.

After the N files **124** are sorted so as to generated a sorted listing of the N files **124**, information is retrieved from each of the N files **124**, file-by-file, in accordance with the sorted listing (Block **212**). For example, information may be retrieved from the N files **124** by accessing them in a sequential manner starting at either the top or the bottom of the sorted list. In this way, each file that is accessed is in close proximity to the file previously accessed. As a consequence, the time required to retrieve information from the N files **124** is substantially reduced relative to accessing the N files **124** in accordance with the location of the N files **124** in the directory tree. After information is retrieved from each of the N files **124**, the information is analyzed to determine whether each file is potentially a pestware file, and the scanning processes is ended after information from each of the N files **124** is analyzed (Blocks **214** and **216**). It should be recognized, that the information received from each file may be analyzed (Block **214**) while information from other files is being retrieved (Block **212**) so as to expedite the entire process of retrieving and analyzing information from the N files **124**.

In several embodiments, the detection module **114**, it is responsible for detecting pestware or pestware activity on the protected computer **100** based upon the information received from the N files **124**. In one embodiment for example, the detection module compares a representation of known pestware files (e.g., a cyclical redundancy code (CRC) of a portion of the pestware file) with a representation (e.g., CRC) of a portion of each of the N files **124**. In one variation, only 500 Bytes of information are retrieved from each of the N files **124** and a CRC of the 500 Bytes of information retrieved from each file is compared with the known pestware definitions. If the 500 Bytes of retrieved information indicates the file is a potential pestware file, then a more thorough analysis (e.g., an analysis of the entire file) is conducted. In this way, the comparison of each file with definitions of pestware files is expedited.

Pestware and pestware activity can also be detected by the shield module **116**, which generally runs in the background on the computer system. Shields can generally be divided into two categories: those that use definitions to identify known pestware and those that look for behavior common to pestware. This combination of shield types acts to prevent known pestware and unknown pestware from running or being installed on a protected computer.

In many cases, the detection and shield modules (**114** and **116**) detect pestware by matching files on the protected computer with definitions of pestware, which are collected from a variety of sources. For example, a host computers, protected computers and other systems can crawl the Web to actively identify pestware. These systems often download programs and search for exploits. The operation of these exploits can then be monitored and used to create pestware definitions. Various techniques for detecting pestware are disclosed in the above-identified and related application entitled: System and Method for Monitoring Network Communications for Pestware.

Referring next to FIG. **3**, shown is a flowchart **300** depicting steps carried out by the sweep speedup module **120** when directly accessing information from the file storage device **106** of FIG. **1** in accordance with several embodiments of the present invention. As shown, initially a file table (e.g., a master file table (MFT)) that is associated with a collection of the N files **124** in the files storage device **106** is located (Blocks **302** and **304**). In one embodiment, the operating system is initially utilized to help locate the file table. For example, if the file storage device **106** is a hard drive that has been partitioned into two or more drives, the operating system is utilized to identify the partitioned drives.

After the file table for a collection of the N files **124** is located, the file table is accessed, while circumventing the operating system (Block **306**), and the file table is read so as to identify names, locations and other attributes of the files (e.g., file size, compression flags and encryption flags) of the collection of the N files **124** in the file storage device **106** (Block **308**). In some embodiments, the entire file structure of the collection of the N files **124** built and stored so that the location of every one of the N files **124** is known. Thus, the steps identified in Blocks **304**, **306** and **308** may be utilized to

generate the listing of names and locations, discussed with reference to Block **208** of FIG. **2**, by directly accessing the file storage device **106**.

After the names and locations of the N files **124** are identified (Block **308**), information from each of the N files **124** is retrieved, while circumventing the operating system, until each of the N files **124** has been accessed (Blocks **310** and **312**). This information may be utilized, as previously discussed, to identify pestware (e.g., the pestware **126**) among the N files **124** (Block **214**).

It should be recognized that the processes depicted in FIGS. **2** and **3** are shown in separate drawings merely to show that each process may be implemented separately to achieve substantial decreases in the amount of time that is required to scan files. In accordance with some embodiments, the processes depicted in FIGS. **2** and **3** may be combined so as to achieve even faster file scans. Specifically, the direct access techniques discussed with reference to FIG. **3** may be utilized to enumerate the N files **124** as depicted in Blocks **204** and **206**. Moreover, after the listing of the N files **124** is sorted (Block **210**), the files may be directly accessed at block **212**, by circumventing the operating system **122**.

In conclusion, the present invention provides, among other things, a system and method for managing pestware. Those skilled in the art can readily recognize that numerous variations and substitutions may be made in the invention, its use and its configuration to achieve substantially the same results as achieved by the embodiments described herein. Accordingly, there is no intention to limit the invention to the disclosed exemplary forms. Many variations, modifications and alternative constructions fall within the scope and spirit of the disclosed invention as expressed in the claims.

What is claimed is:

1. A method for scanning files on a protected computer for pestware, the method comprising:

identifying a location of each of at least a first file, a second file, and a third file on a file storage device of the protected computer;

sorting a listing of the first, second, and third files in accordance with their respective physical locations on the storage device to generate a sorted list;

retrieving, while circumventing an operating system of the protected computer, information from the first, second, and third files by directly and sequentially accessing the first, second, and third files in the order the first, second, and third files are listed in the sorted list;

analyzing the information from the first, second, and third files to determine whether or not each of the first, second, and third files is a potential pestware file; and

reporting results of the analyzing to a user.

2. The method of claim **1**, wherein the identifying includes identifying the location of each of at least the first file, the second file, and the third file while circumventing the operating system.

3. The method of claim **2**, wherein the identifying includes:

accessing a master file table of the file storage device while circumventing the operating system; and

identifying the location of each of at least the first file, the second file, and the third file by analyzing the data of the master file table.

4. The method of claim, **1** wherein the identifying includes utilizing the operating system to identify the first file, the second file, and the third file.

5. The method of claim **1**, wherein the identifying includes identifying a cluster number of each of the first file, the second file, and the third file on a disk drive of the protected computer.

6. A method for scanning files on a protected computer for pestware, the method comprising:

identifying, while circumventing an operating system of the protected computer, a location of each of a plurality of files on a file storage device of the protected computer;

sorting, by location on the file storage device, a listing of the plurality of files to generate a sorted list;

retrieving information from each of the plurality of files by directly and sequentially accessing each of the plurality of files in the order the plurality of files are listed in the sorted list;

analyzing the information from each of the plurality of files to determine whether any of the plurality of files are potential pestware files; and

reporting results of the analyzing to a user.

7. The method of claim **6**, wherein the identifying includes:

accessing a master file table of the file storage device while circumventing the operating system; and

identifying the location of each of the plurality of files by analyzing the data of the master file table.

8. The method of claim **6**, wherein the retrieving includes utilizing the operating system to retrieve information from each of the plurality of files.

9. The method of claim **6**, wherein the identifying includes identifying a cluster number of each of the plurality of files on a disk drive of the protected computer.

10. A system for managing pestware, the system comprising:

a processor; and

a memory including a plurality of program instructions, the plurality of program instructions including:

a pestware detection module configured to cause the processor to detect pestware on a file storage device of a protected computer; and

a sweep speedup module configured to cause the processor to:

identify, while circumventing an operating system of the protected computer, a location of each of a plurality of files on the file storage device;

sort, by location on the file storage device, a listing of the plurality of files to generate a sorted list; and

retrieve information from each of the plurality of files by directly and sequentially accessing each of the plurality of files in the order the plurality of files are listed in the sorted list;

wherein the pestware detection module is configured to analyze the information from each of the plurality of files to determine whether any of the plurality of files are potential pestware files and to report results of the analysis to a user.

11. The system of claim l**0**, wherein the sweep speedup module is configured to cause the processor to:

access, while circumventing the operating system, a master file table of the file storage device; and

identify the location of each of the plurality of files by analyzing the data of the master file table.

12. The system of claim l**0**, wherein the sweep speedup module is configured to cause the processor to utilize the operating system to retrieve information from each of the plurality of files.

13. The system of claim **10**, wherein the sweep speedup module is configured to cause the processor to identify a cluster number of each of the plurality of files on a disk drive of the protected computer.

14. The system of claim l**0**, wherein the protected computer includes a plurality of file storage devices, and wherein the plurality of files are distributed among the plurality of file storage devices.

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UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 7,565,695 B2 Page 1 of 1
APPLICATION NO. : 11/104202
DATED : July 21, 2009
INVENTOR(S) : Michael Burtscher and Tony Nichols

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Title Page, Item (75) should read:
Inventors: Michael Burtscher, Longmont, CO (US)
Tony Nichols, Erie, CO (US)

Signed and Sealed this

Thirteenth Day of July, 2010

David J. Kappos

David J. Kappos
Director of the United States Patent and Trademark Office