MALICIOUS MOBILE CODE RUNTIME MONITORING SYSTEM AND METHODS

PRIORITY REFERENCE TO RELATED APPLICATIONS

[0001] This application is a continuation of assignee's pending U.S. patent application serial no. 12/471,942, filed May 26, 2009 by inventors Yigal Mordechai Edery, et al., entitled "Malicious Mobile Code Runtime Monitoring System and Methods," which is a continuation of assignee's U.S. patent application serial no. 11/370,114, filed March 7, 2006 by inventors Yigal Mordechai Edery, et al., now U.S. Patent No. 7,613,926, entitled "Method and System for Protecting a Computer and a Network from Hostile Downloadables," which is a continuation of assignee's U.S. patent application serial no. 09/861,229, filed on May 17, 2001 by inventors Yigal Mordechai Edery, et al., now U.S. Patent No. 7,058,822, entitled "Malicious Mobile Code Runtime Monitoring System And Methods", all of which are hereby incorporated by reference. U.S. patent application serial no. 09/861,229 claims benefit of provisional U.S. patent application serial no. 60/205,591, entitled "Computer Network Malicious Code Run-time Monitoring," filed on May 17, 2000 by inventors Nimrod Itzhak Vered, et al., which is hereby incorporated by reference. U.S. patent application serial no. 09/861,229 is also a Continuation-In-Part of assignee's U.S. patent application serial no. 09/539,667, entitled "System and Method for Protecting a Computer and a Network From Hostile Downloadables" filed on March 30, 2000 by inventor Shlomo Touboul, now U.S. Patent No. 6,804,780, and hereby incorporated by reference, which is a continuation of assignee's U.S. patent application serial no. 08/964,388, filed on November 6, 1997 by inventor Shlomo Touboul, now U.S. Patent No. 6,092,194, also entitled "System and Method for Protecting a Computer and a Network from Hostile Downloadables" and hereby incorporated by reference. U.S. Serial No. 09/861,229 is also a Continuation-In-Part of assignee's U.S. patent application serial no. 09/551,302, entitled "System and Method for Protecting a Client During Runtime From Hostile Downloadables", filed on April 18, 2000 by inventor Shlomo Touboul, now U.S. Patent No. 6,480,962, which is hereby incorporated by reference.

BACKGROUND OF THE INVENTION

Field of the Invention

[0002] This invention relates generally to computer networks, and more particularly provides a system and methods for protecting network-connectable devices from undesirable downloadable operation.

Description of the Background Art

[0003] Advances in networking technology continue to impact an increasing number and diversity of users. The Internet, for example, already provides to expert, intermediate and even novice users the informational, product and service resources of over 100,000 interconnected networks owned by governments, universities, nonprofit groups, companies, etc. Unfortunately, particularly the Internet and other public networks have also become a major source of potentially system-fatal or otherwise damaging computer code commonly referred to as "viruses."

[0004] Efforts to forestall viruses from attacking networked computers have thus far met with only limited success at best. Typically, a virus protection program designed to identify and remove or protect against the initiating of known viruses is installed on a network firewall or individually networked computer. The program is then inevitably surmounted by some new virus that often causes damage to one or more computers. The damage is then assessed and, if isolated, the new virus is analyzed. A corresponding new virus protection program (or update thereof) is then developed and installed to combat the new virus, and the new program operates successfully until yet another new virus appears - and so on. Of course, damage has already typically been incurred.

[0005] To make matters worse, certain classes of viruses are not well recognized or understood, let alone protected against. It is observed by this inventor, for example, that Downloadable information comprising program code can include distributable components (e.g. Java™ applets and JavaScript scripts, ActiveX™ controls, Visual Basic, add-ins and/or others). It can also include, for example, application programs, Trojan horses, multiple compressed programs such as zip or meta files, among others. U.S. Patent 5,983,348 to Shuang, however, teaches a protection system for protecting against only distributable components including "Java

applets or ActiveX controls", and further does so using resource intensive and high bandwidth static Downloadable content and operational analysis, and modification of the Downloadable component; Shuang further fails to detect or protect against additional program code included within a tested Downloadable. U.S. Patent 5,974,549 to Golan teaches a protection system that further focuses only on protecting against ActiveX controls and not other distributable components, let alone other Downloadable types. U.S. patent 6,167,520 to Touboul enables more accurate protection than Shuang or Golan, but lacks the greater flexibility and efficiency taught herein, as do Shuang and Golan.

[0006] Accordingly, there remains a need for efficient, accurate and flexible protection of computers and other network connectable devices from malicious Downloadables.

SUMMARY OF THE INVENTION

[0007] The present invention provides protection systems and methods capable of protecting a personal computer ("PC") or other persistently or even intermittently network accessible devices or processes from harmful, undesirable, suspicious or other "malicious" operations that might otherwise be effectuated by remotely operable code. While enabling the capabilities of prior systems, the present invention is not nearly so limited, resource intensive or inflexible, and yet enables more reliable protection. For example, remotely operable code that is protectable against can include downloadable application programs, Trojan horses and program code groupings, as well as software "components", such as Java TM applets, ActiveX™ controls, JavaScript™/Visual Basic scripts, add-ins, etc., among others. Protection can also be provided in a distributed interactively, automatically or mixed configurable manner using protected client, server or other parameters, redirection, local/remote logging, etc., and other server/client based protection measures can also be separately and/or interoperably utilized, among other examples.

[0008] In one aspect, embodiments of the invention provide for determining, within one or more network "servers" (e.g. firewalls, resources, gateways, email relays or other devices/processes that are capable of receiving-and-transferring a Downloadable) whether received information includes executable code (and is a "Downloadable"). Embodiments also provide for delivering static, configurable and/or extensible remotely operable protection policies to a Downloadable-destination, more typically as a sandboxed package including the mobile

protection code, downloadable policies and one or more received Downloadables. Further client-based or remote protection code/policies can also be utilized in a distributed manner. Embodiments also provide for causing the mobile protection code to be executed within a Downloadable-destination in a manner that enables various Downloadable operations to be detected, intercepted or further responded to via protection operations. Additional server/information-destination device security or other protection is also enabled, among still further aspects.

[0009] A protection engine according to an embodiment of the invention is operable within one or more network servers, firewalls or other network connectable information re-communicating devices (as are referred to herein summarily one or more "servers" or "re-communicators"). The protection engine includes an information monitor for monitoring information received by the server, and a code detection engine for determining whether the received information includes executable code. The protection engine also includes a packaging engine for causing a sandboxed package, typically including mobile protection code and downloadable protection policies to be sent to a Downloadable-destination in conjunction with the received information, if the received information is determined to be a Downloadable.

[00010] A sandboxed package according to an embodiment of the invention is receivable by and operable with a remote Downloadable-destination. The sandboxed package includes mobile protection code ("MPC") for causing one or more predetermined malicious operations or operation combinations of a Downloadable to be monitored or otherwise intercepted. The sandboxed package also includes protection policies (operable alone or in conjunction with further Downloadable-destination stored or received policies/MPCs) for causing one or more predetermined operations to be performed if one or more undesirable operations of the Downloadable is/are intercepted. The sandboxed package can also include a corresponding Downloadable and can provide for initiating the Downloadable in a protective "sandbox". The MPC/policies can further include a communicator for enabling further MPC/policy information or "modules" to be utilized and/or for event logging or other purposes.

[00011] A sandbox protection system according to an embodiment of the invention comprises an installer for enabling a received MPC to be executed within a Downloadable-destination (device/process) and further causing a Downloadable application program,

distributable component or other received downloadable code to be received and installed within the Downloadable-destination. The protection system also includes a diverter for monitoring one or more operation attempts of the Downloadable, an operation analyzer for determining one or more responses to the attempts, and a security enforcer for effectuating responses to the monitored operations. The protection system can further include one or more security policies according to which one or more protection system elements are operable automatically (e.g. programmatically) or in conjunction with user intervention (e.g. as enabled by the security enforcer). The security policies can also be configurable/extensible in accordance with further downloadable and/or Downloadable-destination information.

[00012] A method according to an embodiment of the invention includes receiving downloadable information, determining whether the downloadable information includes executable code, and causing a mobile protection code and security policies to be communicated to a network client in conjunction with security policies and the downloadable information if the downloadable information is determined to include executable code. The determining can further provide multiple tests for detecting, alone or together, whether the downloadable information includes executable code.

[00013] A further method according to an embodiment of the invention includes forming a sandboxed package that includes mobile protection code ("MPC"), protection policies, and a received, detected-Downloadable, and causing the sandboxed package to be communicated to and installed by a receiving device or process ("user device") for responding to one or more malicious operation attempts by the detected-Downloadable from within the user device. The MPC/policies can further include a base "module" and a "communicator" for enabling further up/downloading of one or more further "modules" or other information (e.g. events, user/user device information, etc.).

[00014] Another method according to an embodiment of the invention includes installing, within a user device, received mobile protection code ("MPC") and protection policies in conjunction with the user device receiving a downloadable application program, component or other Downloadable(s). The method also includes determining, by the MPC, a resource access attempt by the Downloadable, and initiating, by the MPC, one or more predetermined operations corresponding to the attempt. (Predetermined operations can, for example, comprise initiating

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