

How to Secure Windows PCs and Laptops

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Progress brings new dangers: Powerful home computers, inexpensive high-speed Internet access, telecommuting, and software flaws have combined to create a soft underbelly in the defenses of government and corporate networks — and there is evidence that this weakness is being exploited. As of early 2005, many home and small business systems contain uninvited programs that capture keystrokes and passwords, hand control over to hostile users, and lull their owners into a false sense of security by undermining their virus and spyware checkers. The goal of such hardcore spyware programs is to help attackers profit at your expense by stealing your data, resources, money, or identity. Home PCs and laptops used in telecommuting are tempting targets for hardcore spyware since they provide easy access to data that otherwise can be found only in well-guarded enterprise networks. This article describes defensive strategies for reducing your level of risk from hardcore spyware.

Spyware is a form of uninvited malicious software that resembles viruses, but has a much more specific goal: Spyware steals your data, time, computer resources, or even identity so that someone else can profit from them. Because most anti-virus products prior to 2004 did not look for spyware, occurrences of it in home and small business Windows PCs and laptops have exploded. For example, at a recent demonstration I gave on how to remove spyware from Windows systems, a network engineer brought in a Windows 2000 laptop that his wife used in her small business. He kept it behind a firewall, one that was noted for its ability to block Internet viruses, and he had scanned it several times for spyware. Consequently, he did not expect to find any significant malicious software.

As it turned out, the laptop contained a keylogger, which is a type of hardcore spyware that records every password and keystroke. It also contained a transponder for recording entries into forms and installing other forms of spyware, and a hidden reconfiguration of standard Windows utilities that made the laptop into a Web server whenever it was online. The real shocker was yet to come. After removing the keylogger, tracker, and Web-hosting configuration, I clicked on its factory-installed virus checker. Immediately, the same hardcore spyware programs just removed reappeared and tried to install themselves. This time, however, the newly installed active spyware guards caught them. The spyware had been hiding in the standard-issue virus checker, ready to go the first time anyone tried to use the virus checker.

How could someone who had taken more-than-average care to secure his wife's laptop be so wrong about the degree to which it had been taken over by spyware? Was the takeover an aberration, some sort of one-in-a-thousand situation, or was it a symptom of a larger and more serious problem?

More Scary Stories

If you try applying all the spyware removal methods I describe in this article to home or small business Windows systems that belong to you and your friends, you will not have to take my word for how bad the spyware situation has become. You will find out for yourself. For now, let me give you a few more examples I have encountered of how bad the spyware situation has become:

- **Self-Destructing Computers.** Users who attach Windows systems to broadband Internet connections without a firewall can become infested with spyware so quickly that the system may become unusable within days. In one system that had been cleaned of spyware, the owner let his active spyware guards expire. By the end of the day it had stopped responding to anything the owner did, even while its disk and Internet connection kept churning furiously.
- **Massive Infection Rates.** A Windows system that has never before been checked for spyware typically has hundreds to thousands of the infections. While most of these will be the milder varieties that clog your system but do not steal your data, it is also common for such a system to have a few instances of the much more serious kinds such as keyloggers and remote administration terminals. Such massive rates of infection should fall rapidly throughout 2005 with the release of the new Microsoft AntiSpyware product, but only for the Windows 2000, XP, and 2003 systems to which it applies. Users of older Windows 95, 98SE, and ME systems may even see an increase in spyware infection rates as attackers shift their focus to the more vulnerable older Windows systems.
- **Subverted Security Applications.** Here is another example of how virus

checkers can be converted to the cause of protecting spyware. In late 2004, I uncovered a previously undetected keylogger and two remote administration terminals by using a new spyware checker, GIANT AntiSpyware. (Microsoft subsequently bought this application and renamed it Microsoft AntiSpyware.) However, although GIANT was able to find this previously undetected hardcore spyware, it could not remove it. GIANT would always seize up or, remarkably, de-list its finds before it reached the point where it could remove them. On a hunch, I temporarily uninstalled the huge, multi-function professional Internet security suite that I had been using for years. Sure enough, GIANT was able to finish removing the hardcore spyware. At some point, my Internet security package had been subverted and was being used to help the spyware hide and survive!

- **Outright Break-ins.** Imagine a Windows system that is invisible to any kind of probes from the Internet, arguably free of viruses, spyware, and subverted security applications, and resides behind two very tightly configured firewalls. How often would you expect someone on the Internet to break into such a system, scrounge around for interesting files, and send the results back to themselves? My own experience has been that it occurs somewhere in the range of once a week to once a month. Some of the files that I logged as they were being smuggled out included excerpts from public but hard-to-find Enron e-mails, registry settings for my speaker and microphone drivers, settings for one of my spyware tools, and an e-mail about a spyware article I had written. Ironically, the source of the break-ins later proved to be a security hole in the same data-log-

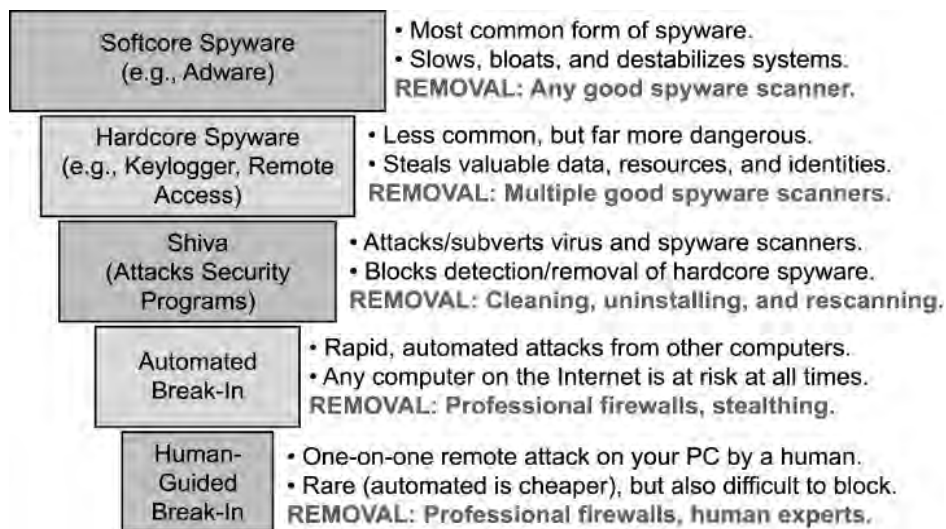


Figure 1: *The Spyware Hierarchy*

ging tool I was using to record the thefts! If you use your home or laptop systems for official-use-only government documents, patents, or company financial information, these kinds of subtle break-in routes should give you a good reason to worry.

The Spyware Hierarchy

To understand the dangers of spyware it is important to know the main varieties, which vary widely in how difficult they are to remove. The main types are shown in Figure 1. At the top of the spyware hierarchy is the most prevalent, least damaging, and easiest to remove spyware. *Adware*, which presumes to take over small chunks of your computer's resources to present ads to you whether you want them or not, is an example of this type of relatively mild or *softcore* spyware. When I first began looking for spyware on my home systems, adware and other types of softcore spyware typically outnumbered the more dangerous forms by ratios of hundreds or thousands to one.

Adware can be interpreted as an aggressive form of advertising, which is one reason why virus scanner companies made the unfortunate decision not to look for it or remove it when scanning systems for malicious software. The decision was unfortunate because adware has likely become the single most common cause of severely degraded performance in Windows systems. While a single adware program does not consume many resources, the problem occurs when marketers from around the globe descend over the Internet to engage in an adware feeding frenzy – with your computer as the main course. The resulting unintentional situation is surprisingly similar to what is known in cyber warfare circles as a *denial of service* attack, in which a

computer or network is brought down by flooding it with trivial requests.

The next level down, *hardcore spyware*, is far more dangerous. This class of spyware makes no pretense of being legal, and so, unlike softcore spyware, it tries its best to stay hidden. Hardcore spyware includes keyloggers, remote access software, activity trackers, and in general anything that places your system and personal activities under the control of someone who has no business nosing around in them. Ironically, one reason why virus scanners were slow to look for hardcore spyware is that there are many legitimate software products that are legal if used strictly on systems you own and control, but which instantly become hardcore spyware if placed without permission on someone else's system. Other forms have no situations in which they are legal, and survive by techniques such as changing rapidly to avoid detection by scanner programs.

Sometimes, threats grow faster than the terminology used to describe them. A worrisome new trend is for hardcore spyware to be accompanied by helper programs that protect the spyware by going on the offensive against the very programs that are supposed to protect your system, such as virus and spyware scanners. My own name for this poorly recognized category of spyware is *Spyware HIV-like Attackers*, or *Shivas*, in reference to their unnerving ability to undermine the security software *immune systems* of Windows systems.

At present, spyware checkers do not scan for Shivas, although they can detect them indirectly by spotting their spyware clients and progeny. In the absence of tools to search for Shivas directly, the only way to find them is to look for unexpected protection or reinstallation of spyware. The only way to remove a Shiva is through a process

of cleaning and uninstalling so that it keeps clearing out their hidey-holes until they become too damaged to function.

Beneath the Shivas are *automated break-ins*, which are the result of spyware on the Internet that is trying to get into your system. Automated break-ins upset the traditional wisdom that avoiding certain Web sites and not opening unrecognized e-mail attachments will keep you from getting malicious software. The sad truth is that if you do nothing more than attach a Windows PC to the Internet over a high-speed line, it will be subjected to the first stage of an automated attack – specifically, what is known as a directory services (port 445) query – within *seconds*. Automated attacks are why having a good firewall is so critical to keeping your system secure. Without good firewalls, automated break-ins can take over unguarded Windows systems in as little as a few hours or even minutes.

The deepest and most dangerous level of the spyware hierarchy is to get the attention not just of an automated attack program, but of a real, live human attacker who is well versed in the flaws of a wide range of Windows systems. Unlike an automated attacker, a human can apply creativity and ingenuity to breaking into your system, and so can be particularly difficult to keep out. Once they break into your system, a human attacker will typically place hardcore spyware and Shivas to ensure easier access to it in the future. The one positive side of human attackers is that in comparison to automated attacks, they are rare. There are simply not enough human attackers around to mount the same level of persistent attacks as automated methods can.

How Could This Happen?

How could spyware have gotten so bad without more recognition of the problem? A large part of what happened is that spyware evolved too rapidly from innocuous sources. Softcore spyware, for example, has its roots in ordinary advertising, which made it seem fairly harmless until it began choking systems with so many ads that the systems stopped working.

Similarly, several forms of hardcore spyware began their careers as self-monitoring programs intended to increase security, not undermine it. It was only when such programs started showing up unannounced on other people's systems that they became as dangerous as they are now.

Finally, and most worrisome, there has always been a well-hidden community of technically proficient but utterly unscrupulous attackers who are far ahead in their

understanding of the flaws and holes in Windows and other operating systems. This group does not announce its intentions; it simply takes the maximum possible advantage of any and every hole and weakness it finds.

Microsoft is taking the spyware threat very seriously. In November 2004, they purchased a company with one of the best products for finding dangerous spyware, GIANT AntiSpyware. Within two months they began distributing it for free to all Windows XP and 2000 users under its new name, Microsoft AntiSpyware. This purchase bodes well for the future, since it seems to indicate that Microsoft has recognized the seriousness of the spyware threat and is taking action to help reduce levels of infection in their XP and 2000 systems.

How to Secure Windows Systems

The seven major steps in securing a Windows system against spyware and related threats are given in the following sections. The first step, removing all spyware, is the most complex and important step in the overall process.

1. Remove All Softcore, Hardcore, and Shiva Spyware

This is the heart of the diagnosis and removal procedure, and often produces surprises. The three general techniques underlying the procedure are: (1) repeated removal of temporary files in which spyware typically hides, (2) use of multiple detection tools to increase coverage and confuse any Shivas that may be in the system, and (3) uninstall followed by a reinstall of any tool that appears to be malfunctioning. The strategy is one of attrition, in which you use your local advantage of physical possession of the computer to disrupt and confuse hardcore spyware and Shivas until they are too damaged to avoid detection.

The tools used in the removal process are all either free for home use or demos that can be used for initial cleanup even if you do not purchase them. Links to these tools, direct downloads of the entire set, and the latest detailed version of the spyware removal process can be obtained from my Web site at <<http://terrybollinger.com>>. Below is a very quick summary of the detailed spyware removal process that can be found and downloaded from my Web site:

1. (Optional) Prepare your computer:
 - (a) Download the needed free and demo anti-spyware applications.

- (b) Backup any important data and applications.
 - (c) Disconnect your system from the Internet.
 - (d) Turn off all sharing of printers and folders.
 - (e) Kill (end) all unnecessary Windows tasks.
2. (Optional) Uninstall unnecessary Web programs and virus checkers.
 3. (Optional) Install Mozilla Firefox (free).
 4. (Optional) Install Flash Player for Mozilla Firefox (free).
 5. Install and use EasyCleaner (free) and remove TEMP files (Start>Run, type %TEMP%).
 6. Install, update, and use CWShredder (free).
 7. Install and use Sygate Personal Firewall (free for home use; Pro costs less than \$50).
 8. Install, update, and use SpywareBlaster (free).
 9. (Unavailable for Win98 and ME users) Install and use Microsoft AntiSpyware (free).
 10. Install, update, and use Webroot Spy Sweeper (30-day demo).
 11. Install and use Spybot Search and Destroy (free).
 12. Install and use Lavasoft Ad-Aware SE Personal (free for home use).
 13. If any tools fail, uninstall them and then reinstall them.

2. Fully Update Windows and Internet Explorer

Once Windows has been cleared of spyware, Windows Update should be used to verify that all of the latest security updates have been downloaded for both Windows and Internet Explorer. Even if this was done earlier, it is a good idea to try it again in case spyware was interfering with the update process.

3. Uninstall Any Unnecessary Communication Programs

Even simple, practical programs such as time synchronization programs can cause problems, as can widely used auto-updating programs such as automated screen savers with thousands of available images. Multimedia programs, which often include their own softcore spyware, can also be problematic when used online. While harmless in themselves, such programs provide well-known forms of communication that a hacker can hijack and use for alternative purposes.

4. Make Sure Your System Is Stealthed (Invisible) on the Internet

Systems are stealthed, or hidden, on the

Internet when they refuse to respond to queries to a number of standard port locations. To determine whether your system is visible, I highly recommend using the free *Shields Up!* Web site at <www.grc.com/x/ne.dll?bh0bkyd2>. Another very good site that also provides searches for Trojans is Sygate Online Services, <<http://scan.sygatetech.com>>.

5. Add Active Spyware Guards

You should keep at least one spyware guard active at all times. Spybot Search and Destroy provides a free spyware guard, TeaTimer. Microsoft AntiSpyware also provides a free spyware guard, but only for users of the later Windows 2000, XP, and 2003 operating systems. If you decide to purchase Webroot Spy Sweeper, it also provides active guards.

6. Maximize Firewall Protection

The choice of a firewall is the most critical one to bringing break-ins down to negligible levels. Based both on features and the success I have seen so far at cutting down residual break-ins to my own systems, my personal recommendation for this step is the Sygate Personal Firewall Pro. Other firewall options with good backing and reviews – not all of which I have tried myself – include ZoneAlarm Pro, Symantec's Norton Personal Firewall 2005, and McAfee's Personal Firewall Plus. All of these can also be purchased as parts of security suites. Due to the importance of your firewall for fending off attempts to break in to your system from the Internet, it is usually worth getting the most powerful firewall products available, which are generally called the *Pro* versions. Set it to the maximum protection, then experiment to find the least number of settings you must turn off to allow your applications to work correctly.

7. Make Sure Other Systems on Your LAN Are Similarly Protected

A common spyware tactic is to use the first PC captured in a home or small business network as a beachhead for launching powerful attacks against other computers in the same network. Since locally networked computers have special rights and higher bandwidth than remote computers operating over the Internet, such attacks can be far more difficult to fend off. For this reason, it is vital that all PCs and laptops sharing a LAN be made fully secure. An alternative is to completely isolate your PC from others in the local network, but that can be difficult to accomplish if you share a single DSL or cable Internet connection with them.

COMING EVENTS

July 7-10

Internet, Processing, Systems, and Interdisciplinary (IPSI) 2005

Cambridge, MA

<http://internetconferences.net/usa2005/index.html>

July 12-15

2005 IEEE Conference on Services Computing

Orlando, FL

<http://conferences.computer.org/scc/2005>

July 17-20

17th ACM Symposium on Parallelism in Algorithms and Architectures

Las Vegas, NV

www.spaa-conference.org

July 17-21

MobiQuitous 2005

The 2nd Annual International Conference on Mobile and Ubiquitous Systems: Networking and Services

San Diego, CA

www.mobiquitous.org

July 21-26

CINC 2005

7th International Conference on Computational Intelligence and Natural Computing

Salt Lake City, UT

www.jcis.org/pages/subconference/cinc/cinc.aspx

July 24-29

Agile 2005

Denver, CO

www.agile2005.org

July 26-29

CMMS 2005: The Computerized Maintenance Management Summit

Indianapolis, IN

<http://maintenanceconference.com/cmms>

May 1-4, 2006

2006 Systems and Software Technology Conference



Salt Lake City, UT

www.stc-online.org

Conclusion

When it comes to small computer systems linked to a global Internet, the days in which we could fully trust the results of our own computers and applications are gone. Whether we like it or not, there are people and communities on the Internet who view home users and their systems as prey – and they will go to remarkable lengths to capture such prey.

Making home and small business Windows systems more secure not only prevents you from becoming the victim of such a network predator, but also adds to overall security for everyone by removing the ability of your system to spread spyware, and by reducing the total quantity of sensitive data that can be collected on a given topic. While the procedures given here require some effort, I think it is fair to say the benefits are well worth that effort. ♦

Note

1. This article is the result of independent work by the author, and does not necessarily reflect the views of his employer, The MITRE Corporation, which is listed here for identification purposes only.

About the Author



Terry Bollinger works at The MITRE Corporation, McLean, Va., on acquisition of leading-edge information technologies. He is an Institute of Electrical and Electronics Engineers (IEEE) Millennium Medal Winner, a former assistant editor-in-chief for *IEEE Software*, the main editor for the recent Nov/Dec 2004 special issue of *IEEE Software* on Persistent Software Attributes, and the author of a widely quoted 2002 survey of how open source software is used in the Department of Defense. His personal Web site, <<http://terrybollinger.com>>, provides detailed information and tool downloads for removing spyware from Windows computers.

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WEB SITES

PC World

www.pcworld.com/downloads/browse/0_cat,1727,sortIdx,1,pg,1,00.asp

PC World editors present a review of their favorite anti-spyware tools in this online article, including Ad-Ware SE v1.05, Spybot Search and Destroy v1.3, CWShredder v2.1, Microsoft Anti-Spyware Beta, and NoSpyMail. The site also features the article "Avoid Identity Theft: Best Files to Protect Your Privacy."

iSecuritySource.com

www.isecuritysource.com

The iSecuritySource.com Web site features details and information about the spyware detected on your computer from scanning, including Trojans, worms, viruses, adware, and dialers, and provides removal instructions. The site also features an "Ask the Experts" forum.

Home PC Firewall Guide

www.firewallguide.com

The Home PC Firewall Guide provides easy access to basic information about, and independent third-party reviews of

Internet security and privacy products for home, telecommuter, and small office/home office end-users.

PCMag.com

www.pcmag.com/article2/0,1759,1758380.asp

PC Magazine's Web site notes that the majority of PCs are infested with spyware. The explosion of dedicated anti-spyware applications in the past year began to address the growing problem; this article reviews eight of the leaders.

Microsoft Windows AntiSpyware

www.microsoft.com

Windows AntiSpyware (Beta) is a security technology that helps protect Windows users from spyware and other potentially unwanted software. Known spyware on your PC can be detected and removed, helping reduce its negative effects, including slow PC performance and annoying pop-up ads. Continuous protection improves Internet browsing safety by guarding more than 50 ways that spyware can enter your PC.