

Summary

Computer Security Lecture 16

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Outline

Programming against security

Techniques for threat analysis

From security evaluation to security management

Revision

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- ▶ A **worm** is a program that copies itself from one machine to another. Research began on benign worms for distributed computation (current term: "agents").

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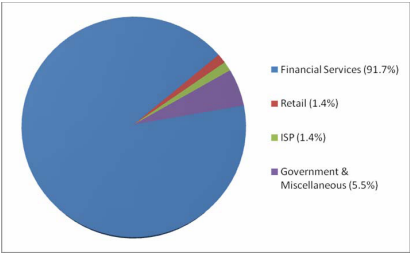
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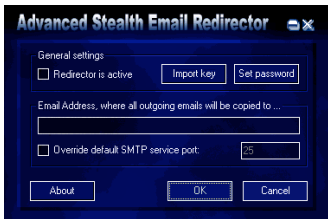
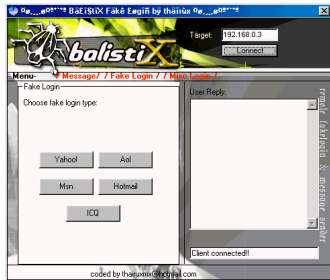
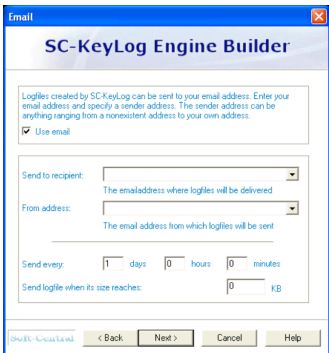
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- ▶ For more, see <http://www.antiphishing.org/>. Following images are from APWG reports.

Phishing



Building crimeware



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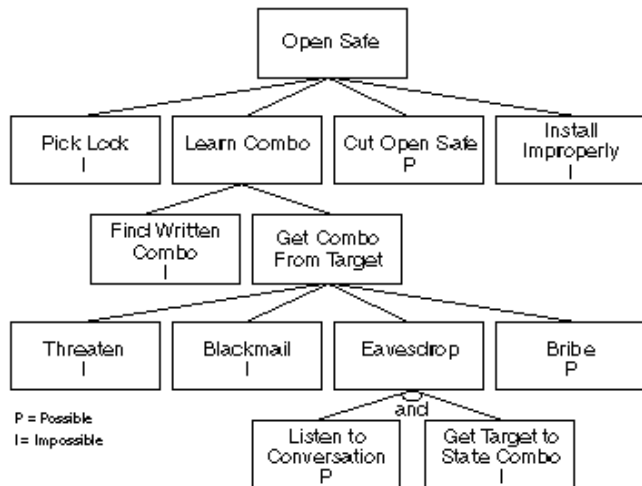
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Attack Tree for Safe Cracking [Sch99]



Attack scenarios generated by depth-first tree traversals excluding impossible cases.

Attack Tree for ACME Web server [MEL01]

Access sensitive data from privileged account at ACME

- AND* 1. Get access to privileged account on web server
 - OR* 1. Exploit buffer overflow vulnerability to access privileged account
 - AND* 1. Identify executable program on ACME Web server susceptible to buffer overflow vulnerability
 - 2. Identify code that would provide access ...
 - 2. Exploit unexpected operator vulnerability to access privileged account
 - AND* 1. Find executable program on ACME Web server susceptible to vulnerability
 - 2. Identify (unexpected) operator that permits composing system calls
 - 3. Identify system call that would provide access to privileged account ...
- 2. Scan files for sensitive data

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Elevation of privilege e.g., user illegitimately gains power of root user

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- ▶ In terms of risk assessment, Damage and Affected Users are measures of **impact**, reproducibility, exploitability and discoverability are measures of **likelihood**.

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Different mechanisms are used to provide protection, but **security protection concerns the whole system**, in the most inclusive sense.

Security evaluation standards for software products are more restrictive, but **security management standards** attempt to cover the whole picture.

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- ▶ user writes password on PostIt note

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- ▶ Achieving compliance with the processes required in the standard is a significant undertaking for an organisation (cf ISO 9000).

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8. **Operations management:** documented procedures; change control; segregation of duties; separation of development and operational facilities; malware controls; backups and logs; network management; media handling; information exchange email, agreements, e-commerce, . . .

Sample of ISO 27001/2 areas, cont'd

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12. **Compliance** with legal requirements (IPR, DP, copyright, cryptography use, evidence collection, ...); systems compliance; audit protection.

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- ▶ Asymmetric ciphers: RSA, Diffie-Hellman, ElGamal
- ▶ Signatures: (\mathcal{M}, S_A, V_A) with *signing* and *verification* functions such that $V_A(m, s) = \text{true}$ iff $S_A(m) = s$.

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- ▶ Mutual authentication with shared keys:

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- ▶ In overview: IPsec, DNSSec, SSH, VPNs

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- ▶ Particular model: Bell-LaPadula.

Reminder: (In)secure programming

splitvt, syslog, mount/umount, sendmail, lpr, bind, gethostbyname(), modstat, cron, login, sendmail again, the query CGI script, newgrp, AutoSofts RTS inventory control system, host, talkd, getopt(), sendmail yet again, FreeBSD s crt0.c, WebSite 1.1, rlogin, term, ffbconfig, libX11, passwd/yppasswd/nispasswd, imapd, ipop3d, SuperProbe, lpd, xterm, eject, lpd again, host, mount, the NLS library, xlock, libXt and further X11R6 libraries, talkd, fdformat, eject, elm, cterm, ps, fbcconfig, metamail, dtterm, df, an entire range of SGI programs, ps again, chkey, libX11, suidperl, libXt again, lquerylv, getopt() again, dtaction, at, libDtSvc, eeprom, lpr yet again, smbmount, xlock yet again, MH-6.83, NIS+, ordist, xlock again, ps again, bash, rdist, login/scheme, libX11 again, sendmail for Windows NT, wm, wwwcount, tgetent(), xdat, termcap, portmir, writesrv, rcp, opengroup, telnetd, rlogin, MSIE, eject, df, statd, at again, rlogin again, rsh, ping, traceroute, Cisco 7xx routers, xscreensaver, passwd, deliver, cidentd, Xserver, the Yapp conferencing server, multiple problems in the Windows95/NT NTFTP client, the Windows War and Serv-U FTP daemon, the Linux dynamic linker, filter (part of elm-2.4), the IMail POP3 server for NT, pset, rpc.nisd, Samba server, ufsrestore, DCE secdd, pine, dslip, Real Player, SLMail, socks5, CSM Proxy, imapd (again), Outlook Express, Netscape Mail, mutt, MSIE, Lotus Notes, MSIE again, libauth, login, iwsh, permissions, unfsd, Minicom, nslookup, zpop, dig, WebCam32, smbclient, compress, elvis, lha, bash, jidentd, Tooltalk, ttdbserver, dbadmin, zgv, mountd, pcnfs, Novell Groupwise, mscreen, xterm, Xaw library, Cisco IOS, mutt again, ospf_monitor, sdtcm_convert, Netscape (all versions), mpg123, Xprt, klogd, catdoc, junkbuster, SerialPOP, and rdist

- ▶ This is a year's worth of (reported) buffer overflow vulnerabilities (2000/1).

Reminder: (In)secure programming II





- ▶ Adobe Acrobat/PDF
- ▶ ACE archives
- ▶ ACIUS 4th Dimension
- ▶ Arj archives
- ▶ Clarion
- ▶ Claris Filemaker Pro
- ▶ CompuServe WinCim
- ▶ dBASE
- ▶ Diet compressed files
- ▶ Eudora
- ▶ ICQ
- ▶ Lotus 1-2-3
- ▶ Lotus Ami-Pro
- ▶ Lotus Organiser
- ▶ Lotus Symphony
- ▶ Lotus WordPro
- ▶ LZEXE compressed files
- ▶ MS Access
- ▶ MS Backup
- ▶ MS Excel
- ▶ MS Mail
- ▶ MS Money
- ▶ MS Outlook
- ▶ MS Project
- ▶ MS Scheduler
- ▶ MS Word
- ▶ MYOB
- ▶ Norton Secret Stuff
- ▶ Paradox
- ▶ Pegasus Mail
- ▶ Pklite compressed files
- ▶ Pkzip archives
- ▶ Q&A Database
- ▶ Quattro Pro
- ▶ QuickBooks
- ▶ Quicken
- ▶ Stacker
- ▶ Symantec Act
- ▶ Trumpet Winsock
- ▶ VBA projects
- ▶ WinCrypt
- ▶ Windows 3.1/95/98 passwords
- ▶ Windows Dial-up Networking (DUN)
- ▶ Windows NT/2000 passwords
- ▶ WinXFiles
- ▶ WordPerfect
- ▶ WS FTP

- ▶ This is a year's worth of (reported) software with poor cryptography (aka password recovery tools).

Reminder: Secure programming

- ▶ Types of programming failure include:
 - ▶ **buffer overflow, poor cryptography**
 - ▶ lack of **input validation, output filtering**
 - ▶ **unsafe publication**
 - ▶ **bad use of permissions**
- ▶ Java includes useful features for secure programming:
 - ▶ runtime: bytecode verification, security manager
 - ▶ language-level: type-checking, bounds checking, access modifiers
 - ▶ access control: policy, key stores, code signing
 - ▶ cryptographic and authentication APIs: JCE, JSSE, JAAS
- ▶ **Important:**
 - ▶ Practical exercise for web applications
 - ▶ Tutorial 3, Part C and Oracle/CERT guidelines for flawed Java code.

References

-  [Sch99] Bruce Schneier. *Attack trees*. *Dr Dobb's Journal*, December 1999. Available at <http://www.schneier.com/paper-attacktrees-ddj-ft.html>.
-  Information technology — code of practice for information security management, December 2000. Standard: ISO/IEC 17799 and BSI BS7799.
-  [MEL01] Andrew P. Moore, Robert J. Ellison, and Richard C. Linger. *Attack modeling for information security and survivability*. Technical Report CMU/SEI-2001-TN-001, Software Engineering Institute, Carnegie Mellon University, 2001.
-  [HL03] M. Howard and D. LeBlanc. *Writing Secure Code*. Microsoft Press, second edition, 2003.

Recommended Reading

Schneier's attack tree article. Chapter 1 of Gollmann's textbook *Computer Security*.