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(Draft)

Guidance for Securing Microsoft Windows XP Systems for IT Professionals: A NIST Security Configuration Checklist

**Recommendations of the National Institute of
Standards and Technology**

Murugiah Souppaya
Paul M. Johnson
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C O M P U T E R S E C U R I T Y

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Gaithersburg, MD 20899-8930

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Executive Summary

When an IT security configuration checklist (e.g., hardening or lockdown guide) is applied to a system in combination with trained system administrators and a sound and effective security program, a substantial reduction in vulnerability exposure can be achieved. Accordingly, the National Institute of Standards and Technology (NIST) has produced *Guidance for Securing Microsoft Windows XP Systems for IT Professionals: A NIST Security Configuration Checklist* to assist personnel responsible for the administration and security of Windows XP systems. This guide contains information that can be used to secure local Windows XP workstations, mobile computers, and telecommuter systems more effectively in a variety of environments, including small offices, home offices (SOHO) and managed enterprise environments. The guidance should only be applied throughout an enterprise by trained and experienced system administrators.

This guide provides detailed information about the security of Windows XP, security configuration guidelines for popular applications, and security configuration guidelines for the Windows XP operating system. The guide documents the methods that system administrators can use to implement each security setting recommended. The principal goal of the document is to recommend and explain tested, secure settings for Windows XP workstations with the objective of simplifying the administrative burden of improving the security of Windows XP systems in four types of environments: SOHO, enterprise, high security, and legacy.

- + **SOHO.** SOHO describes small, informal standalone computer installations that are used for business purposes. SOHO encompasses a wide variety of environments, from a home computer occasionally used for work to a small branch office of a company that is not managed remotely for technical or business reasons. Historically, SOHO environments are the least secured and most trusting. Generally, the individuals performing SOHO system administration are not knowledgeable about security. This often results in environments that are less secure than they need to be because the focus is solely on functionality.
- + **Enterprise.** Enterprises are typically managed environments that are very structured in terms of hardware and software configurations. Enterprise environments generally have a group dedicated to supporting users and providing security. The combination of structure and skilled staff allows better security practices to be implemented during initial system deployment and in ongoing support and maintenance, and for a consistent security posture to be maintained across the enterprise.
- + **High Security.** A high security environment is one that is at high risk of attack or data exposure. This environment encompasses computers that contain highly confidential information (e.g., personnel records, medical records, financial information) and perform vital organizational functions (e.g., accounting, payroll processing, air traffic control). A high security environment could be a subset of a SOHO or enterprise environment; for example, three desktops in an enterprise environment that hold confidential employee data could be thought of as a high security environment within an enterprise environment. In addition, a laptop used by a mobile worker might be a high security environment within a SOHO environment.
- + **Legacy.** A legacy environment contains older systems or applications that use outdated communication mechanisms. Other machines operating in a legacy environment may need less restrictive security settings so that they can communicate with legacy systems and applications. Using legacy services increases the potential risk of security breaches, as does lowering the security profile of other systems that need to interact with legacy systems. Legacy environments

may exist within SOHO and enterprise environments, and in rare cases within high security environments as well.

This guide includes security templates that will enable system administrators to apply the security recommendations rapidly. The NIST Windows XP Security Templates are text-based configuration files that specify values for security-relevant system settings. The security templates modify several key policy areas of a Windows XP system, including password policy, account lockout policy, auditing policy, user rights assignment, system security options, event log policy, system service settings, and file permissions. The templates are based on security templates previously developed by the National Security Agency (NSA), Defense Information Systems Agency (DISA), and Microsoft. Most of the settings in the templates represent consensus recommendations as proposed by various security experts from the Center for Internet Security (CIS), DISA, NSA, Microsoft, and NIST.

The NIST templates and additional settings described in this guide have been applied to test systems and tested according to detailed functional and security test plans. The functionality of common office productivity tools, Web browsers, e-mail clients, personal firewalls, antivirus software, and spyware detection and removal utilities was also tested against the NIST templates and additional settings to identify potential conflicts. By implementing the recommendations described throughout this publication, in addition to the NIST Windows XP security templates themselves and general prescriptive recommendations, organizations should be able to meet the baseline requirements for Windows XP systems. This is based upon the management, operational, and technical security controls described in the draft NIST Special Publication (SP) 800-53, *Recommended Security Controls for Federal Information Systems*.

Although the guidance presented in this document has undergone considerable testing, every system and environment is unique, so system administrators should perform their own testing. The development of the NIST Windows XP Security Templates was driven by the need to create more secure Windows XP workstation configurations. Because some settings in the templates may reduce the functionality or usability of the system, caution should be used when applying the baseline security templates. Specific settings in the templates should be modified as needed so that the settings conform to local policies and support required system functionality. NIST strongly recommends that organizations fully test the templates on representative systems before widespread deployment. Some settings may inadvertently interfere with applications, particularly legacy applications that may require a less restrictive security profile.

Windows XP provides multiple ways to deploy templates to systems. The Security Configuration and Analysis Microsoft Management Console (MMC) snap-in can be used to apply a template to a local system, and to compare a template's settings to the existing settings on a system and identify discrepancies. In a Windows XP domain environment, the Group Policy Editor can be used to distribute security settings quickly from templates to computers in an Active Directory Organizational Unit (OU). Microsoft also offers the Group Policy Management Console (GPMC) for managing Group Policy for multiple domains. GPMC can be used to import, edit, and apply security templates to Windows systems throughout an enterprise, which is ideal for a managed environment.

The security configuration guidance provided in this document was tested from clean Windows XP installations. NIST recommends that system administrators build their systems from a clean formatted state to begin the process of securing Windows XP workstations. NIST also recommends that the installation process be performed on a secure network segment or off the organization's network until the security configuration is completed, all patches are applied, and strong passwords are set for all accounts.

After the Windows XP operating system (OS) has been installed and securely configured, it must be regularly monitored and patched when necessary to mitigate software vulnerabilities as dictated by the patch or software control and change policy and procedures. There are three main methods for updating Windows systems: service packs, hotfixes, and rollups. The Windows service pack, which provides improvements and replacements to OS components, includes all hotfixes that were released before the service pack cutoff date. Hotfixes are released rapidly when a vulnerability or problem is discovered within Windows systems or Microsoft applications. Security rollups contain several previously released hotfixes in a single bundle. Once Microsoft releases a service pack, rollup, or hotfix, it should be tested thoroughly and applied to all systems within an organization as soon as possible.

This guidance document also includes recommendations for testing and configuring common Windows applications. The application types include office productivity tools, Web browsers, e-mail clients, personal firewalls, antivirus software, and spyware detection and removal utilities. This list is not intended to be a complete list of applications to install on Windows XP, nor does it imply NIST's endorsement of particular products. Many of the configuration recommendations for the tested Windows applications focus on deterring viruses, worms, Trojan horses, and other types of malicious code. The guide presents recommendations to protect the Windows XP system from malicious code when the tested applications are being used.

This document provides recommendations to assist organizations in making their Windows XP systems more secure. The settings and recommendations provide system administrators with the information necessary to modify the settings and to comply with local policy or special situations. The baseline recommendations and settings provide a high level of security for all Windows XP systems when used in conjunction with a sound and comprehensive local security policy and other relevant security countermeasures. The guidelines are also appropriate for managed environments that are configuring and deploying laptops for mobile users and desktop computers for telecommuters.

1. Introduction

1.1 Authority

The National Institute of Standards and Technology (NIST) developed this document in furtherance of its statutory responsibilities under the Federal Information Security Management Act (FISMA) of 2002, Public Law 107-347.

NIST is responsible for developing standards and guidelines, including minimum requirements, for providing adequate information security for all agency operations and assets, but such standards and guidelines shall not apply to national security systems. This guideline is consistent with the requirements of the Office of Management and Budget (OMB) Circular A-130, Section 8b(3), "Securing Agency Information Systems," as analyzed in A-130, Appendix IV: Analysis of Key Sections. Supplemental information is provided in A-130, Appendix III.

This guideline has been prepared for use by Federal agencies. It may be used by nongovernmental organizations on a voluntary basis and is not subject to copyright, though attribution is desired.

Nothing in this document should be taken to contradict standards and guidelines made mandatory and binding on Federal agencies by the Secretary of Commerce under statutory authority, nor should these guidelines be interpreted as altering or superseding the existing authorities of the Secretary of Commerce, Director of the OMB, or any other Federal official.

1.2 Purpose and Scope

This publication seeks to assist IT professionals in securing Windows XP workstations, XP mobile computers, and XP computers used by telecommuters within various environments. This guidance should only be applied throughout an enterprise by trained and competent system administrators.

The guide provides detailed information about the security features of Windows XP, security configuration guidelines for popular applications, and security configuration guidelines for the Windows XP operating system. The guide documents the methods that IT professionals can use to implement each security setting recommended. The principal goal of the document is to recommend and explain tested, secure settings for Windows XP workstations with the objective of simplifying the administrative burden of improving the security of Windows XP systems in four types of environments: SOHO, enterprise, high security, and legacy. The proposed countermeasures are consistent with the minimum security controls for an IT system as represented in the NIST SP 800-53 publication.

1.3 Audience

This document has been created for IT professionals, particularly Windows XP system administrators and information security personnel. The document assumes that the reader has experience installing and administering Windows-based systems in domain or standalone configurations. The document discusses in technical detail the various Windows XP security registry and application settings.

1.4 Document Structure

Throughout this guide, filenames, menu items, and options are indicated through bold text (e.g., **Remember my password**). The remainder of this document is organized into eight major sections, followed by six appendices.

- + Section 2 provides insight into the threats and security controls that are relevant for various environments, such as a large enterprise or a home office, and describes the need to document, implement, and test security controls, as well as monitor and maintain systems on an ongoing basis.
- + Section 3 presents an overview of the security components offered by Windows XP.
- + Section 4 provides guidance on installing, backing up, and patching Windows XP systems.
- + Section 5 discusses security policy configuration and how security templates can best be used.
- + Section 6 provides an overview of the settings in the NIST security templates and explains how the settings can provide better security for systems.
- + Section 7 discusses how to apply additional security settings that are not included in the NIST security templates.
- + Section 8 demonstrates securing popular office productivity tools, Web browsers, e-mail clients, personal firewalls, antivirus software, and spyware detection and removal utilities on Windows XP systems.
- + Section 9 provides guidance to IT professionals on how to use the guide effectively to secure Windows XP systems.
- + Appendix A contains lists of the Windows XP security settings and registry keys modified by the NIST security templates.
- + Appendix B provides information on the most significant security-related aspects of Windows XP Service Pack 2, Release Candidate 1.
- + Appendix C lists TCP and UDP ports that are commonly used on Windows XP systems.
- + Appendix D lists tools that may be helpful in securing Windows XP systems.
- + Appendix E lists print resources and online tools and resources that may be useful Windows XP security references.
- + Appendix F lists acronyms used in this document.

2. Windows XP Security Guide Development

In today's computing environment, the security of all computing resources, from network infrastructure devices to users' desktop computers, is essential. There are many threats to users' computers, ranging from remotely launched network service exploits to malicious code spread through e-mails, malicious Web sites, and file downloads. Increasing the security of individual computers protects them from these threats and reduces the likelihood that a system will be compromised or that data will be disclosed to unauthorized parties. Fewer security problems means that less time and money is spent disinfecting malicious code, restoring systems from backups, and reinstalling operating systems and applications. In addition, having stronger host security increases network security (e.g., home, business, government, the Internet); for example, most distributed denial of service attacks against networks use large numbers of compromised hosts.

The goal of this guide is to provide security configuration guidance to the users and system administrators of Microsoft Windows XP systems. This advice can be adapted to any environment, from individual SOHO installations to large geographically diverse organizations. Although the guide is primarily targeted toward business environments and Windows XP Professional, much of the guidance is also appropriate for other XP versions, such as Windows XP Home, Windows XP Tablet PC Edition, and Windows XP Media Center Edition.¹ This guide draws on a large body of vendor knowledge and government and security community experience gained over many years of securing computer systems.

This section of the guide is based largely on the steps proposed in NIST's FISMA Implementation Project for achieving more secure information systems.² Sections 2.1 and 2.2 address the need to categorize information and information systems. Each Windows XP system can be classified as having one of three roles; each system can also be classified according to the potential impact caused by security breaches. Section 2.3 describes threats and provides examples of security controls that can mitigate threats. Section 2.4 outlines the primary types of environments for information systems—SOHO, Enterprise, High Security, and Legacy—and ties each environment to typical threat categories and security controls. Section 2.5 provides a brief overview of the implementation of the security controls and the importance of performing functionality and security testing. Finally, Section 2.6 discusses the need to monitor the security controls and maintain the system. Figure 2-1 shows the six facets to Windows XP security that are covered in Sections 2.1 through 2.6.

¹ NIST will develop a separate publication that provides step-by-step guidance to Windows XP Home end users on securing their systems. When completed, this publication will be available from the NIST Computer Security Special Publications site at <http://csrc.nist.gov/publications/nistpubs/index.html>.

² More information on the project is available at <http://csrc.nist.gov/sec-cert/>.

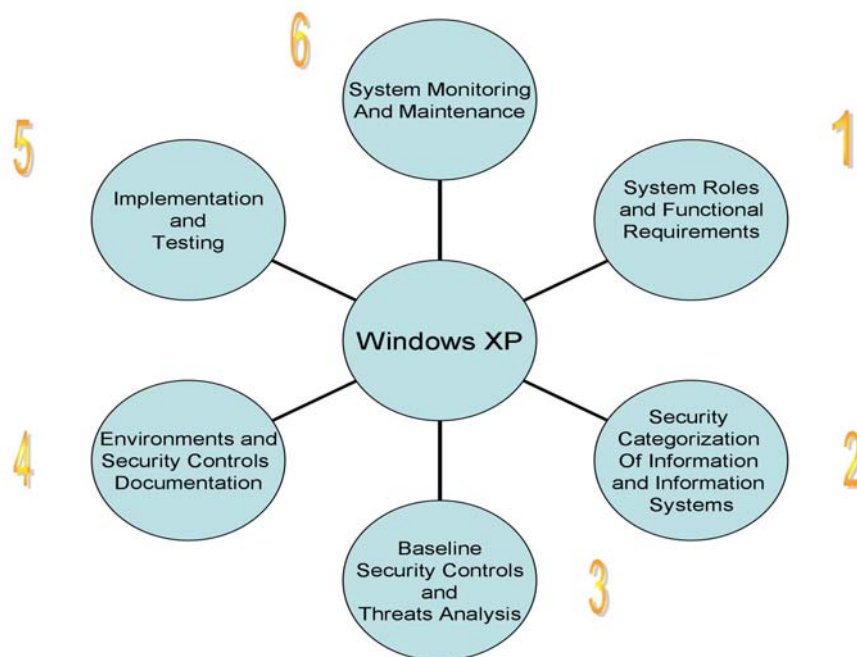


Figure 2-1. The Facets of Windows XP Security

2.1 Windows XP System Roles and Requirements

Windows XP security must take into account the role that the system plays. For the purposes of this guide, Windows XP systems can be divided into three roles: inward-facing, outward-facing, and mobile.

- + **Inward-Facing.** An inward-facing XP system is typically a user workstation on the interior of a network that is not directly accessible from the Internet. Physical access is also generally limited in some manner (e.g., only employees have access to the work area.) In many environments, inward-facing systems share a common hardware and software configuration because they are centrally deployed and managed (e.g., Microsoft domains, Novell networks). Because an inward-facing system is usually in the same environment all the time (e.g., desktop on the corporate local area network [LAN]), the threats against the system do not change quickly. In general, inward-facing systems are relatively easy to secure, compared to outward-facing and mobile systems.
- + **Outward-Facing.** An outward-facing XP system is one that is directly connected to the Internet. The classic example is a home computer that connects to the Internet through dial-up or broadband access. Such a system is susceptible to scans, probes, and attacks launched against it by remote attackers. It does not have the layers of protection that an inward-facing system typically has, such as network firewalls and intrusion detection systems. Outward-facing systems are often at high risk of compromise because they have relatively high security needs, yet are typically administered by users with little or no security knowledge. Also, threats against outward-facing systems may change quickly since anyone can attempt to attack them at any time.
- + **Mobile.** A system with a mobile role typically moves between a variety of environments and physical locations. For network connectivity, this system might use both traditional wired methods (e.g., Ethernet, dialup) and wireless methods (e.g., 802.11). The mobility of the system

makes it more difficult to centrally manage. It also exposes the system to a wider variety of threat environments; for example, in a single day the system might be in a home environment, an office environment, a wireless network hotspot, and a hotel room. An additional threat is the loss or theft of the system. This could lead to loss of productivity at a minimum, but could also include the disclosure of confidential organizational information or the possible opening of a back door into the organization if remote access is not properly secured.

2.2 Security Categorization of Information and Information Systems

The classic model for information security defines three objectives of security: maintaining confidentiality, integrity, and availability. *Confidentiality* refers to protecting information from being accessed by unauthorized parties. *Integrity* refers to ensuring the authenticity of information—that information is not altered, and that the source of the information is genuine. *Availability* means that information is accessible by authorized users. Each objective addresses a different aspect of providing protection for information.

Determining how strongly a system needs to be protected is based largely on the type of information that the system processes and stores. For example, a system containing medical records probably needs much stronger protection than a computer used occasionally for viewing publicly released documents. This is not to imply that the second system does not need protection; every system needs to be protected, but the level of protection may vary based on the value of the system and its data. To establish a standard for determining the security category of a system, NIST created Federal Information Processing Standards (FIPS) Publication (PUB) 199, *Standards for Security Categorization of Federal Information and Information Systems*.³ FIPS PUB 199 establishes three security categories—low, moderate, and high—based on the potential impact of a security breach involving a particular system. The FIPS PUB 199 definitions for each category are as follows:

“The potential impact is **LOW** if the loss of confidentiality, integrity, or availability could be expected to have a **limited** adverse effect on organizational operations, organizational assets, or individuals. A limited adverse effect means that, for example, the loss of confidentiality, integrity, or availability might (i) cause a degradation in mission capability to an extent and duration that the organization is able to perform its primary functions, but the effectiveness of the functions is noticeably reduced; (ii) result in minor damage to organizational assets; (iii) result in minor financial loss; or (iv) result in minor harm to individuals.

The potential impact is **MODERATE** if the loss of confidentiality, integrity, or availability could be expected to have a **serious** adverse effect on organizational operations, organizational assets, or individuals. A serious adverse effect means that, for example, the loss of confidentiality, integrity, or availability might (i) cause a significant degradation in mission capability to an extent and duration that the organization is able to perform its primary functions, but the effectiveness of the functions is significantly reduced; (ii) result in significant damage to organizational assets; (iii) result in significant financial loss; or (iv) result in significant harm to individuals that does not involve loss of life or serious life threatening injuries.

The potential impact is **HIGH** if the loss of confidentiality, integrity, or availability could be expected to have a **severe or catastrophic** adverse effect on organizational operations, organizational assets, or individuals. A severe or catastrophic adverse effect means that,

³ FIPS PUB 199 is available for download from <http://csrc.nist.gov/publications/fips/index.html>.

for example, the loss of confidentiality, integrity, or availability might (i) cause a severe degradation in or loss of mission capability to an extent and duration that the organization is not able to perform one or more of its primary functions; (ii) result in major damage to organizational assets; (iii) result in major financial loss; or (iv) result in severe or catastrophic harm to individuals involving loss of life or serious life threatening injuries.”

Each system should be protected based on the potential impact to the system of a loss of confidentiality, integrity, or availability. Protection measures (otherwise known as *security controls* or *countermeasures*) tend to fall into two categories. First, security weaknesses in the system need to be resolved. For example, if a system has a known vulnerability that attackers could exploit, the system should be patched so that the vulnerability is removed or mitigated. Second, the system should offer only the required functionality to each authorized user, so that no one can use functions that are not necessary. This principle is known as *least privilege*. Limiting functionality and resolving security weaknesses have a common goal: give attackers as few opportunities as possible to successfully breach a system.

Although each system should ideally be made as secure as possible, this is generally not possible because the system needs to meet the functional requirements of the system’s users. Another common problem with security controls is that they often make systems less convenient or more difficult to use. When usability is an issue, many users will attempt to circumvent security controls; for example, if passwords must be long and complex, users may write them down. Balancing security, functionality, and usability is often a challenge. This guide attempts to strike a proper balance and make recommendations that provide a reasonably secure solution while offering the functionality and usability that users require.

Another fundamental principle endorsed by this guide is using multiple layers of security. For example, a host may be protected from external attack by several countermeasures, including a network-based firewall, a host-based firewall, and OS patching. The motivation for having multiple layers is that if one layer fails or otherwise cannot counteract a certain threat, other layers might prevent the threat from successfully breaching the system. A combination of network-based and host-based countermeasures is generally most effective at providing consistent protection for systems.

NIST SP 800-53, *Recommended Security Controls for Federal Information Systems*, proposes minimum baseline management, operational, and technical security controls for systems.⁴ These controls are to be implemented based on the security categorizations proposed by FIPS 199, as described earlier in this section. The controls proposed in this guide and the NIST Windows XP security templates should meet the low impact requirement, at a minimum. This guidance should assist agencies in meeting baseline requirements for Windows XP systems deployed in their environments.

2.3 Baseline Security Controls and Threat Analysis Refinement

To secure something, it is essential to first define the threats that need to be mitigated. This knowledge of threats is also key to understanding the reasons the various configuration options have been chosen in this guide. Most threats against data and resources are possible because of mistakes—either bugs in operating system and application software that create exploitable vulnerabilities, or errors made by users and administrators. Threats may involve intentional actors (e.g., an attacker who wants to access credit cards on a system) or unintentional actors (e.g., an administrator who forgets to disable user accounts of a terminated employee.) Threats can be local, such as a disgruntled employee, or remote, such as an attacker in another country. The following sections describe each major threat category, list possible countermeasures, provide examples of threats, and summarize the potential impact of the threat. The lists

⁴ The current draft of SP 800-53 is available at <http://csrc.nist.gov/publications/index.html>. SP 800-53 is being created in response to FISMA.

of threats are not exhaustive; they simply represent the major threat categories that were considered during the selection of the security controls as described in this guide. Organizations should conduct risk assessments to identify the specific threats against their systems and determine the effectiveness of existing security controls in counteracting the threats, then perform risk mitigation to decide what additional measures (if any) should be implemented.⁵

2.3.1 Local Threats

Local threats either require physical access to the system or logical access to the system (e.g., an authorized user account). Local threats are grouped into three categories: boot process, unauthorized local access, and privilege escalation.

2.3.1.1 Boot Process

- + **Threat:** An unauthorized individual boots a computer from third-party media (e.g., removable drives, USB token storage devices). This could permit the attacker to circumvent operating system (OS) security measures and gain unauthorized access to information.
- + **Possible Countermeasures:**
 - Implement physical security measures (e.g., locked doors, badge access) to restrict access to equipment.⁶
 - Enable a strong and difficult-to-guess password for the Basic Input Output System (BIOS), and configure the BIOS to boot the system from the local hard drive only, assuming that the case containing the OS and data is physically secure. This will help protect the data unless the hard drive is removed from the computer.
 - Secure local files via encryption to prevent access to data in the event the physical media is placed in another computer.
- + **Examples:**
 - While traveling, an employee misplaces a laptop, and the party that acquires it tries to see what sensitive data it contains.
 - A disgruntled employee boots a computer off third-party media to circumvent other security controls so the employee can access files he or she is not permitted to access (e.g., confidential data stored locally, local password file).
- + **Impact:** Unauthorized parties could cause a loss of confidentiality, integrity, and availability.

2.3.1.2 Unauthorized Local Access

- + **Threat:** An individual who is not permitted to access a system gains local access.
- + **Possible Countermeasures:**

⁵ NIST SP 800-30, *Risk Management Guide for Information Technology Systems*, contains guidance on performing risk assessment and mitigation. It is available for download from <http://csrc.nist.gov/publications/nistpubs/index.html>.

⁶ Organizations should have a physical and environmental protection policy that includes requirements for providing adequate physical security for systems and networks. Most technical controls can be easily defeated without physical security.

- Require valid username and password authentication before allowing any access to system resources, and enable a password-protected screen saver. These actions help to prevent an attacker from walking up to a computer and immediately gaining access.
 - Enable a logon banner containing a warning of the possible legal consequences of misuse.⁷
 - Implement a password policy to enforce stronger passwords, so that it is more difficult for an attacker to guess passwords.
 - Do not use or reuse a single password across multiple accounts; for example, the password for a personal free e-mail account should not be the same as that used to gain access to the Windows XP host.
 - Establish and enforce a checkout policy for departing employees that includes the immediate disabling of their user accounts.
 - Physically secure removable storage devices and media, such as CD-ROMs, that contain valuable information. An individual who gains access to a workspace may find it easier to take removable media than attempt to get user-level access on a system.
- + **Examples:**
- A visitor to a company sits down at an unattended computer and logs in by guessing a weak password for a default user account.
 - A former employee gains physical access to facilities and uses old credentials to log in and gain access to company resources.
- + **Impact:** Because the unauthorized person is masquerading as an authorized user, this could cause a loss of confidentiality and integrity.

2.3.1.3 Privilege Escalation

- + **Threat:** An authorized user with normal user-level rights escalates the account's privileges to gain administrator-level access.
- + **Possible Countermeasures:**
- Restrict access to all administrator-level accounts and administrative tools, configuration files, and settings. Use strong, difficult-to-guess passwords for all administrator-level accounts. Do not use the domain administrator accounts from non-administrative client hosts. These actions will make it more difficult for users to escalate their privileges.
 - Disable unused local services. Vulnerabilities in these services may permit users to escalate their privileges.
 - Install application and OS updates (e.g., hotfixes, service packs, patches). These updates will resolve system vulnerabilities, reducing the number of attack vectors that can be used.
 - Encrypt sensitive data. Even administrator-level access would not permit a user to access data in encrypted files.

⁷ The Department of Justice provides sample banners in Appendix A of *Searching and Seizing Computers and Obtaining Electronic Evidence in Criminal Investigations*, available for download at <http://www.cybercrime.gov/s&smanual2002.htm>.

+ **Examples:**

- A user takes advantage of a vulnerability in a service to gain administrator-level privileges and access another user's files.
- A user guesses the password for an administrator-level account, gains full access to the system, and disables several security controls.

- + **Impact:** Because the user is gaining full privileges on the system, this could cause a loss of confidentiality, integrity, and availability.

2.3.2 Remote Threats

Unlike local threats, remote threats do not require physical or logical access to the system. The categories of remote threats described in this section are network services, data disclosure, and malicious payloads.

2.3.2.1 Network Services

- + **Threat:** Remote attackers exploit vulnerable network services on a system. This includes gaining unauthorized access to services and data, and causing a denial of service (DoS) condition.

+ **Possible Countermeasures:**

- Disable unused services. This provides attackers with fewer chances to breach the system.
- Install application and OS updates (e.g., hotfixes, service packs, patches). These updates will resolve system software vulnerabilities, reducing the number of attack vectors that can be used.
- Require strong authentication before allowing access to the service. Implement a password policy to enforce stronger passwords that are harder to guess. Establish and enforce a checkout policy for departing employees that includes the immediate disabling of their user accounts. These actions help to ensure that only authorized users can access each service.
- Do not use weak remote access protocols and applications; instead, use only accepted, industry standard strong protocols (e.g., Internet Protocol Security [IPsec], Secure Shell [SSH], Transport Layer Security [TLS]) for accessing and maintaining systems remotely.
- Use firewalls or packet filters to restrict access to each service to only the authorized hosts. This prevents unauthorized hosts from attempting to gain access to the services and also prevents worms from propagating from one host to all other reachable hosts on the network.
- Enable logon banners containing a warning of the possible legal consequences of misuse.

+ **Examples:**

- A worm searches for systems with an unsecured service listening on a particular port, and then use the service to gain full control of the system.
- An attacker gains access to a system through a service that did not require authentication.
- An attacker impersonates a user by taking advantage of a weak remote access protocol.

- + **Impact:** Depending on the type of network service that is being exploited, this could cause a loss of confidentiality, integrity, and availability.

2.3.2.2 Data Disclosure

- + **Threat:** A third party intercepts confidential data sent over a network.
- + **Possible Countermeasures:**
 - Use switched networks, which make it more difficult to sniff packets.⁸
 - Use a secure user identification and authentication system, such as NTLMv2 or Kerberos. Section 3.2.1 contains a discussion of the choices that Windows XP provides.
 - Encrypt network communications or application data through the use of various protocols (e.g., TLS, IPsec, SSH). This protects the data from being accessed by a third party.
- + **Examples:**
 - On a nonswitched network, a third party is running a network monitoring utility. When a legitimate user transmits a file in an insecure manner, the third party captures this file and accesses its data.
 - An attacker intercepts usernames and passwords sent in plaintext over a local network segment.
- + **Impact:** The interception of data could lead to a loss of confidentiality. If authentication data (e.g., passwords) are intercepted, it could cause a loss of confidentiality and integrity, and possibly a loss of availability, if the intercepted credentials have administrator-level privileges.

2.3.2.3 Malicious Payloads

- + **Threat:** Malicious payloads such as viruses, worms, Trojan horses, and active content attack systems through many vectors. End users of the system may accidentally trigger malicious payloads.
- + **Possible Countermeasures:**
 - Educate users on avoiding malicious code infections, and make them aware of local policy regarding the use of potential transmission methods such as instant messaging (IM) software, peer-to-peer (P2P) file sharing services, and Voice over IP (VoIP). Users who are familiar with the techniques for spreading malicious code should be less likely to infect their systems.
 - Use antivirus software and spyware detection and removal utilities as an automated way of preventing most infections and detecting the infections that were not prevented.⁹
 - Use e-mail clients that support *spam filtering*—automatically detecting and quarantining messages that are known to be spam or have the same characteristics as typical spam.
 - Do not install or use non-approved applications (e.g., P2P, IM) to connect to unknown servers. Educate users regarding the potential impact caused by the use of P2P, IM, and other untrusted software applications.

⁸ Switched networks cannot completely prevent packet sniffing. For example, techniques such as address resolution protocol (ARP) spoofing can be used to convince a switch to direct traffic to an attacker's machine instead of the actual destination. The attacker's machine can then forward the packets to the legitimate recipient.

⁹ Section 8.6 discusses spyware detection and removal tools.

- Operate the system on a daily basis with an account with standard user privileges. Only use administrator-level accounts when needed for specific maintenance tasks, and only perform the necessary maintenance tasks with the administrator-level account. Many instances of malicious code cannot successfully infect a system unless the user has administrative privileges.
 - Configure server and client software such as e-mail servers and clients, Web proxy servers and clients, and productivity applications to reduce exposure to malicious code. For example, e-mail servers and clients could be configured to block e-mail attachments with certain file extensions. This should help to reduce the likelihood of infections.
 - Configure systems, particularly in high security environments, so that the default file associations prevent automatic execution of active content files (e.g., Java, JavaScript, ActiveX).
- + **Examples:**
- A user visits a Web site and downloads a free game that also includes a Trojan horse. When the user installs the game on her computer, the Trojan horse is also installed, which compromises the system.
 - A user with administrative-level privileges surfs the Web and accidentally visits a malicious Web site, which successfully infects the user's system.
 - A user installs and operates P2P software to download music files, and the P2P software installs spyware programs onto the system.
 - A user opens and executes a payload that was attached to a spam or spoofed message.
- + **Impact:** Malicious code often gains full administrative-level privileges to the system, or inadvertently crashes the system. Malicious code may cause a loss of confidentiality, integrity, and availability.

This section has described various types of local and remote threats that can negatively impact systems. The possible countermeasures listed for the threats are primarily technical, as are the controls discussed throughout this document. However, it is important to further reduce the risks of operating a Windows XP system by also using management and operational controls. Examples of important operational controls are restricting physical access to a system, contingency planning,¹⁰ backing up the system and storing the backups in a safe and secure location, and monitoring Microsoft mailing lists for relevant security bulletins. Management controls could include developing policies regarding Windows XP system security and creating a plan for maintaining Windows XP systems. By selecting and implementing management, operational, and technical controls for Windows XP, organizations can better mitigate the threats that Windows XP systems may face.

Another reason to use multiple types of controls is to provide better security in situations where one or more controls are circumvented or otherwise violated. This may be done not only by attackers, but also by authorized users with no malicious intent. For example, taping a list of passwords to a monitor for convenience may nullify countermeasures designed to prevent unauthorized local access to that system. Establishing a policy against writing down passwords (management control), educating users on the dangers of password exposure (operational control), and performing periodic physical audits to identify

¹⁰ For more information regarding contingency planning, refer to NIST SP 800-34, *Contingency Planning Guide for Information Technology Systems*, available at <http://csrc.nist.gov/publications/nistpubs/index.html>.

posted passwords (operational control) may all be helpful in reducing the risks posed by writing down passwords. Technical controls may be helpful as well, such as using smart cards or another method other than passwords for system authentication.

2.4 Environments and Security Controls Documentation

The section describes the types of environments in which a Windows XP host may be deployed—SOHO, enterprise, and high security—as described in the NIST Security Checklists for IT Products project.¹¹ A fourth environment, legacy, is intended for situations in which the Windows XP system has special needs that do not fit into the other profiles, such as a requirement for backward compatibility with legacy applications or servers. Each environment description also summarizes the primary threats and controls that are typically part of the environment. In addition to documenting controls, every environment should have other various security-related documentation, such as acceptable use policies and security awareness materials, that affects configuration and usage of systems and applications. The last part of this section lists some common types of security-related documentation.

2.4.1 SOHO

SOHO describes small, informal standalone computer installations that are used for business purposes. SOHO encompasses a wide variety of environments, from a home computer occasionally used for work to a small branch office of a company that is not managed remotely for technical or business reasons. Figure 2-2 shows a typical SOHO network architecture. Historically, SOHO environments are the least secured and most trusting. Generally, the individuals performing SOHO system administration are not knowledgeable about security. This often results in environments that are less secure than they need to be because the focus is solely on functionality. A SOHO system might not use any security software (e.g., antivirus software, personal firewall). Also, there are often no network-based controls such as firewalls, so SOHO systems may be directly exposed to external attacks. Therefore, SOHO environments are frequently targeted for exploitation—not to acquire information, but instead to be used for attacking other computers, or incidentally as collateral damage from the propagation of a worm.

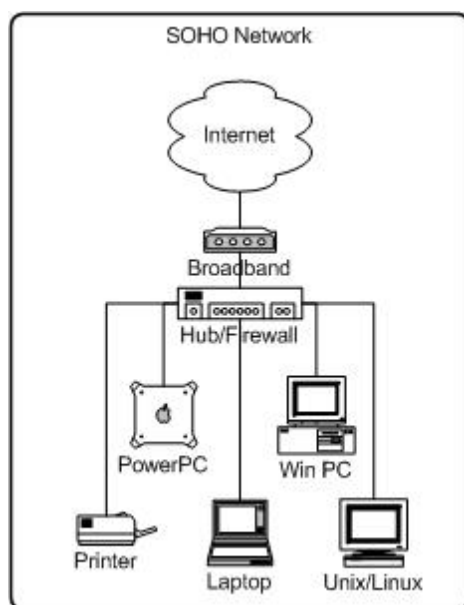


Figure 2-2. Typical SOHO Network Architecture

¹¹ More information on the NIST Security Checklists for IT Products project is available at <http://csrc.nist.gov/checklists/>.

Because the primary threats in SOHO environments are external, and SOHO computers generally have less restrictive security policies than enterprise or high security computers, they are most vulnerable to attacks from remote threat categories. (Although remote threats are the primary concern for SOHO environments, it is still important to protect against other threats.) SOHO systems are typically threatened by attacks against network services and by malicious payloads (e.g., viruses, worms). These attacks are most likely to affect availability (e.g., crashing the system, consuming all network bandwidth, breaking functionality) but may also affect integrity (e.g., infecting data files) and confidentiality (e.g., providing remote access to sensitive data, e-mailing data files to others).

SOHO security is improving with the proliferation of small, inexpensive, hardware-based firewall routers that protect to some degree the SOHO machines behind them. The adoption of personal firewalls (e.g. BlackICE, ZoneAlarm, Internet Connection Firewall) is also helping to better secure SOHO environments. Another key to SOHO security is strengthening the hosts on the SOHO network by patching vulnerabilities and altering settings to restrict unneeded functionality.

2.4.2 Enterprise

The enterprise environment is typically a managed environment that is very structured in terms of hardware and software configurations. Figure 2-3 shows a typical enterprise network architecture. Enterprise environments generally have a group dedicated to supporting users and providing security. The combination of structure and skilled staff allows better security practices to be implemented during initial system deployment and in ongoing support and maintenance. Enterprise installations typically use a domain model to effectively manage a variety of settings and allow the sharing of resources (e.g., file servers, printers). The enterprise can enable only the services needed for normal business operations, with other possible avenues of exploit removed or disabled. Authentication, account, and policy management can be administered centrally to maintain a consistent security posture across an organization.

The enterprise environment is more restrictive and provides less functionality than the SOHO environment. Because of the supported and largely homogeneous nature of the enterprise environment, it is typically easier to use more functionally restrictive settings than it is in SOHO environments. Enterprise environments also tend to implement several layers of defense (e.g., firewalls, antivirus servers, intrusion detection systems), which provides greater protection for systems. In many enterprise environments, interoperability with legacy systems may not be a major requirement, further facilitating the use of more restrictive settings. In an enterprise environment, this guide should be used by advanced users and system administrators. The enterprise environment settings correspond to an enterprise security posture that will protect the information in a moderate risk environment.

In the enterprise environment, systems are typically susceptible to local and remote threats. In fact, threats often encompass all the categories of threats defined in Section 2.3. Local attacks, such as unauthorized usage of another user's workstation, most often lead to a loss of confidentiality (e.g., unauthorized access to data) but may also lead to a loss of integrity (e.g., data modification) or availability (e.g., theft of a system). Remote threats may be posed not only by attackers outside the organization, but also by internal users who are attacking other internal systems across the organization's network. Most security breaches caused by remote threats involve malicious payloads sent by external parties. Threats against network services tend to affect a smaller number of systems and may be caused by internal or external parties. Both malicious payloads and network service attacks are most likely to affect availability (e.g., crashing the system, consuming all network bandwidth, breaking functionality) but may also affect integrity (e.g., infecting data files) and confidentiality (e.g., providing remote access to sensitive data). Data disclosure threats tend to come from internal parties who are monitoring traffic on local networks, and they primarily affect confidentiality.

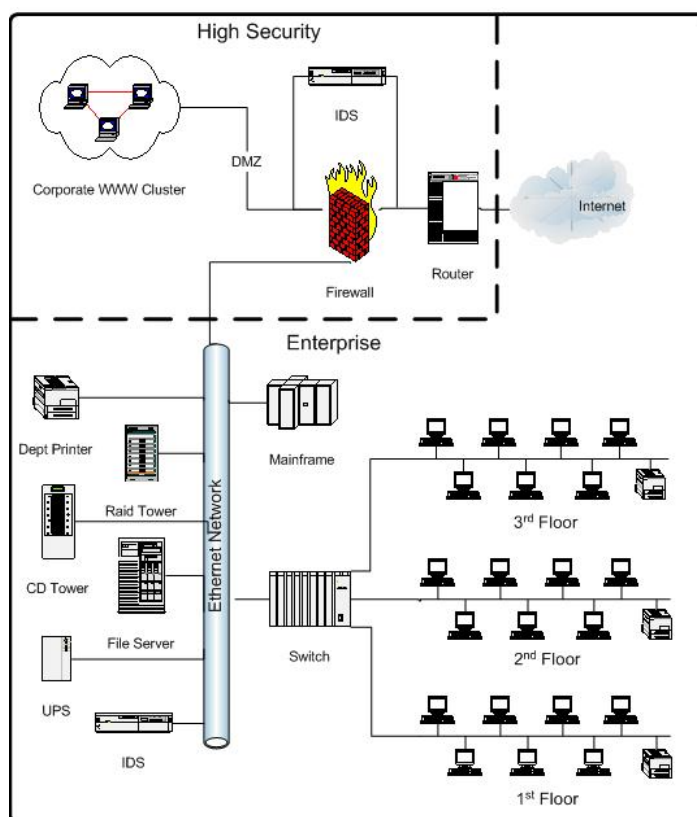


Figure 2-3. Typical Enterprise Network Architecture

2.4.3 High Security

A high security environment is any environment, networked or standalone, that is at high risk of attack or data exposure. This environment encompasses computers that contain highly confidential information (e.g., personnel records, medical records, financial information) and perform vital organizational functions (e.g., accounting, payroll processing, air traffic control). These computers might be targeted by third parties for exploitation, but also might be targeted by trusted parties inside the organization. A high security environment could be a subset of a SOHO or enterprise environment. For example, three desktops in an enterprise environment that hold confidential employee data could be thought of as a high security environment within an enterprise environment. In addition, a laptop used by a mobile worker might be a high security environment within a SOHO environment. A high security environment might also be a self-contained environment outside any other environment: for instance, a government security installation dealing in sensitive data.

Systems in high security environments face the same threats as systems in enterprise environments. Threats from both insiders and external parties are a concern. Because of the risks and possible consequences of a compromise in a high security environment, it usually has the most functionality restrictive and secure configuration. The suggested configuration is complex and provides the greatest protection at the expense of ease of use, functionality, and remote system management. In a high security environment, this guide is targeted at experienced security specialists and seasoned system administrators who understand the impact of implementing these strict requirements.

2.4.4 Legacy

A legacy environment contains older systems or applications that use outdated communication mechanisms. This most often occurs when machines operating in a legacy environment need more open security settings so they can communicate to the appropriate resources. For example, a system may need to use services and applications that require insecure authentication mechanisms such as null user sessions or open pipes. Because of these special needs, the system does not fit into any of the standard environments; therefore, it should be classified as a legacy environment system. Legacy environments may exist within SOHO and enterprise environments, and in rare cases within high security environments as well. Depending on the situation, a legacy environment may face any combination of internal and external threats. The potential impact of the threats should be determined by considering the threats that the system faces (as described in the previous three sections) and then considering what additional risk the system has because of the legacy accommodations.

2.4.5 Security Documentation

An organization typically has many documents related to the security of Windows XP systems. Foremost among the documents is a Windows XP security configuration guide that specifies how Windows XP systems should be configured and secured.¹² As mentioned in Section 2.2, NIST SP 800-53 proposes management, operational, and technical security controls for systems, each of which should have associated documentation. In addition to documenting procedures for implementing and maintaining various controls, every environment should also have other security-related policies and documentation that affect the configuration, maintenance, and usage of systems and applications. Examples of such documents are as follows:

- + Rules of behavior and acceptable use policy
- + Configuration management policy, plan, and procedures
- + Authorization to connect to the network
- + IT contingency plans
- + Security awareness and training for end users and administrators.

2.5 Implementation and Testing of Security Controls

Implementing security controls can be a daunting task. As described in Section 2.2, many security controls have a negative impact on system functionality and usability. In some cases, a security control can even have a negative impact on other security controls. For example, installing a patch could inadvertently break another patch, or enabling a firewall could inadvertently block antivirus software from automatically updating its signatures or disrupt patch management software, remote management software and other security and maintenance-related utilities. Therefore, it is important to perform testing for all security controls to determine what impact they have on system security, functionality, and usability, and to take appropriate steps to address any significant issues.

As described in Section 5, NIST has developed a set of security templates, as well as additional recommendations for security-related configuration changes. The controls proposed in this guide and the NIST Windows XP security templates should be consistent with the FISMA minimum low impact

¹² Organizations should verify that their Windows XP security configuration guides are consistent with this publication. Organizations without Windows XP security configuration guides should modify this document to create a configuration guide tailored for their environments.

security controls, as discussed in Section 2.2. The templates and additional settings have been applied to test systems and tested, according to detailed functional and security test plans. The functionality of common office productivity tools, Web browsers, e-mail clients, personal firewalls, and antivirus software were also tested against the NIST templates and additional settings to identify potential conflicts. Although the guidance presented in this document has undergone considerable testing, every system is unique, so it is certainly possible for certain settings to cause unexpected problems. System administrators should perform their own testing, especially for the applications used by their organizations, to identify any functionality or usability problems before the guidance is deployed throughout organizations.¹³ It is also critical to confirm that the desired security settings have been implemented properly and are working as expected. See Section 4.4 for information on tools that can identify security-related misconfigurations and vulnerabilities on Windows XP systems.

2.6 Monitoring and Maintenance

Every system needs to be monitored and maintained on a regular basis so that security issues can be identified and mitigated promptly, reducing the likelihood of a security breach. However, no matter how carefully systems are monitored and maintained, incidents may still occur, so organizations should be prepared to respond to them.¹⁴ Depending on the environment, some preventative actions may be partially or fully automated. Guidance on performing various monitoring and maintenance activities is provided in subsequent sections of this document or other NIST publications. Recommended actions include the following:

- + Subscribing and monitoring various vulnerabilities notification mailing lists (e.g., Microsoft Security Notification Service¹⁵)
- + Acquiring and installing software updates (e.g., OS and application patches, antivirus signatures)
- + Monitoring event logs to identify problems and suspicious activity
- + Providing remote system administration and assistance
- + Monitoring changes to OS and software settings
- + Protecting and sanitizing media
- + Responding promptly to suspected incidents
- + Assessing the security posture of the system through the use of vulnerability assessment tools¹⁶
- + Disabling unneeded user accounts and deleting accounts that have been disabled for some time
- + Maintaining system, peripheral, and accessory hardware (periodically and as needed), and logging all hardware maintenance activities.

¹³ Any changes made to the templates or settings should be documented, as part of the overall documentation of Windows XP systems' security configuration.

¹⁴ Organizations should have an incident response policy and a formal incident response capability. For guidance on incident handling preparation and execution, see NIST SP 800-61, *Computer Security Incident Handling Guide*, available at <http://csrc.nist.gov/publications/nistpubs/index.html>.

¹⁵ Microsoft offers e-mail alerts that notify when they release an important security bulletin or virus alert. Additional information is available at <http://www.microsoft.com/security/bulletins/alerts.msp>.

¹⁶ See NIST SP 800-42, *Guideline on Network Security Testing*, for more information on performing vulnerability assessments. The publication is available at <http://csrc.nist.gov/publications/nistpubs/index.html>.

2.7 Summary of Recommendations

- + Protect each system based on the potential impact to the system of a loss of confidentiality, integrity, or availability.
- + Reduce the opportunities that attackers have to breach a system by limiting functionality according to the principle of least privilege and resolving security weaknesses.
- + Select security controls that provide a reasonably secure solution while supporting the functionality and usability that users require.
- + Use multiple layers of security so that if one layer fails or otherwise cannot counteract a certain threat, other layers might prevent the threat from successfully breaching the system.
- + Conduct risk assessments to identify threats against systems and determine the effectiveness of existing security controls in counteracting the threats. Perform risk mitigation to decide what additional measures (if any) should be implemented.
- + Document procedures for implementing and maintaining security controls. Maintain other security-related policies and documentation that affect the configuration, maintenance, and usage of systems and applications, such as acceptable use policy, configuration management policy, and IT contingency plans.
- + Test all security controls, including the settings in the NIST security templates, to determine what impact they have on system security, functionality, and usability. Take appropriate steps to address any significant issues.
- + Monitor and maintain systems on a regular basis so that security issues can be identified and mitigated promptly. Actions include acquiring and installing software updates, monitoring event logs, providing remote system administration and assistance, monitoring changes to OS and software settings, protecting and sanitizing media, responding promptly to suspected incidents, performing vulnerability assessments, disabling and deleting unused user accounts, and maintaining hardware.

3. Windows Security Components Overview

This section presents an overview of the various security features offered by the Windows XP operating system OS. Many of the components have been inherited from Windows 2000, often with improvements and enhancements. Windows XP also includes several new security features. This guide provides general descriptions of most of these features, with pointers or links to more detailed information whenever possible.

3.1 New Features in Windows XP

Windows XP comes with several new security features. Each new security feature is briefly described below, and most also include a reference to a Microsoft Web page that contains more detailed information. This section also includes an analysis of the security impact of each feature and general recommendations for when the feature should or should not be used. The new security features in Windows XP are as follows:

3.1.1 Networking Features

- + **Internet Connection Firewall (ICF).**¹⁷ The ICF is a stateful personal firewall that is bundled with Windows XP Professional.¹⁸ When properly configured, ICF limits the access that other computers have to the Windows XP machine through the network. This significantly reduces the exposure of the machine to network-based attacks such as the Blaster worm.¹⁹ ICF can also be used to protect shares when a mobile computer is used outside its normal secure and trusted environment, or to protect access to network shares on an untrusted network. Domain administrators can disable the use of ICF through a group policy, but this is generally not recommended unless ICF is interfering with required functionality or a third party firewall is already in use. ICF can add another layer to a network security model in enterprise and high security environments, and it is sometimes the only layer of network defense in SOHO environments.
- + **Network Bridging.** A network bridge allows two dissimilar networks (e.g., Ethernet and dialup, wireless, or token ring) to be joined without using expensive, dedicated hardware. The connection between the two networks is transparent, meaning that no network address translation occurs between the networks and the actual assigned addresses on each network are visible on the other network. While bridging does permit two networks to be joined with a minimal amount of work, it has serious security implications. Because ICF cannot be used on a bridge, by default the bridge will provide no network security protection to either of the networks that it connects, exposing them to attacks from each other. A network bridge can expose systems on multiple networks to additional threats, so NIST does not recommend implementing a bridge using a Windows XP computer unless it is specifically needed for a task, and risk assessment and mitigation have been performed.²⁰

¹⁷ Windows XP Service Pack 2 contains a new version of the ICF called Windows Firewall, which is described in Appendix B.

¹⁸ For more information on ICF, read Microsoft Knowledge Base (MSKB) article 320855, *Description of the Windows XP Internet Connection Firewall*, available at <http://support.microsoft.com/?id=320855>.

¹⁹ The Blaster worm spread by establishing sessions to certain Microsoft TCP service ports (primarily 135, but also 139 and 445). A personal firewall could block unwanted connection attempts to these ports, preventing a worm such as Blaster from successfully infecting a system. For more information on Blaster, see *CERT® Advisory CA-2003-20, W32/Blaster Worm*, available at <http://www.cert.org/advisories/CA-2003-20.html>.

²⁰ MSKB article 283429, *How To Prevent the Network Setup Wizard From Creating a Bridge in Windows XP*, provides instructions for setting up networking without enabling bridging. The article is available at <http://support.microsoft.com/?id=283429>.

- + **Remote Assistance (RA).** RA provides a way to get remote technical support assistance when running into problems with a computer.²¹ RA sessions can be initiated through the Windows Messenger facility, e-mail requests, and via a Web e-mail service (filling out a form to request assistance). Unfortunately, if RA is configured improperly, unauthorized parties could use it to gain remote access to a system. Therefore, RA should be used only if security-savvy administrators are available to configure it to strictly limit its usage, and if the network perimeter (e.g., firewall) is configured to prevent external parties from using RA to access internal machines. Otherwise, RA should be disabled.
- + **Remote Desktop.** The Remote Desktop feature allows a user to remotely access a Windows XP Professional system from another computer.²² This provides another method for remote attackers to attempt to gain access to the computer by guessing passwords for default accounts. In general, Remote Desktop should only be used if several other layers of security controls are in place, preventing the system from being directly exposed to attackers. Even then, administrators should carefully consider the business need for having remote access to the system and should think of possible alternatives that will not expose the system to attack.
- + **Wireless Auto Configuration.** When a wireless network interface card (NIC) is present, the computer will automatically attempt to join any wireless networks it detects in an established list of preferred networks.²³ This allows a computer to easily roam from access point (AP) to access point without reconfiguration, which is beneficial. However, the system may reveal service set identifier (SSID) information for preferred and previously connected access points, which could be captured by an attacker and used to set up a rogue access point. Because Wireless Auto Configuration can be set to connect to any wireless network, a rogue access point could fool the computer into connecting to a hostile network, which could attack the computer or capture data from it. NIST recommends that systems not be set to attempt to connect to any wireless network automatically.

3.1.2 Authentication and Authorization

- + **Personalized Login.** This feature is new to Windows XP Home. It permits each person who uses a Windows XP computer to have an individual user account. This allows personal data (e.g., each account has its own My Documents folder) and settings (e.g., Internet Explorer bookmarks and security settings) to be kept private from other users. This also increases accountability; for example, if auditing is enabled, the administrator could determine which user performed a certain action.
- + **Simple File Sharing.**²⁴ This feature is always enabled on Windows XP Home systems, enabled by default on Windows XP Professional systems in a workgroup, and unavailable on Windows XP Professional systems in a domain. When Simple File Sharing is enabled, only the Guest account can be used to gain access to the system through the network. This means that attackers cannot gain remote access by guessing passwords to other accounts, such as the Administrator account. When Simple File Sharing is not enabled, the administrator can set permissions for different user accounts. Privileges should be restricted so that only those users with a legitimate

²¹ More information on Remote Assistance, including instructions for disabling it, is available from the Microsoft TechNet article called *Using Windows XP Professional with Service Pack 1 in a Managed Environment: Remote Assistance*, available at http://www.microsoft.com/technet/prodtechnol/winxppro/maintain/xpmanaged/22_xprem.mspx.

²² For information on setting up Remote Desktop, read the Microsoft article *Get Started Using Remote Desktop*, available at <http://www.microsoft.com/windowsxp/pro/using/howto/gomobile/remotedesktop/default.asp>.

²³ For more information on Wireless Auto Configuration, see the article *Wireless XP Wireless Auto Configuration*, which is available from Microsoft TechNet at <http://www.microsoft.com/technet/community/columns/cableguy/cg1102.mspx>.

²⁴ For more information on Simple File Sharing, see MSKB article 304040, *Description of File Sharing and Permissions in Windows XP*, available at <http://support.microsoft.com/?id=304040>.

need to access the system remotely can do so, and so that they have the minimum privileges required.

- + **Blank Password Limitations.** In Windows XP Professional, accounts with null or blank passwords can only be used to log on at the physical system's logon screen. This means that accounts with blank or null passwords cannot be used over networks or with the secondary logon service (RunAs). This feature prevents attackers and malicious code from gaining remote access through blank passwords.
- + **Credential Management.** Credential Management permits users to store authentication information for operating systems and applications.²⁵ For example, when a user is prompted to enter a username and password to access a particular application, the prompt window includes a dialog box labeled **Remember my password**. Anyone who gains unauthorized access on that system as the user (e.g., walking up to an unattended workstation) would then be able to use all resources that the stored credentials grant access to. Therefore, passwords should be stored only in environments in which there is a minimal physical threat, or where the password has trivial value (e.g., for a demo on a public Web site).
- + **Fast User Switching.** This feature permits two or more users to be logged into the same Windows XP system simultaneously.²⁶ Only one user session is active at any given time. Fast User Switching is most commonly used when someone needs brief access to a system that someone else is using, because it preserves security and privacy for both users. Assuming that each user account has a password, the person currently using the system cannot gain access to the other users' sessions. Fast User Switching is only available on systems that meet certain characteristics, such as those that are not a member of a domain.²⁷

3.1.3 Other

- + **Shared Folders.** When enabled, this feature provides folders called Shared Documents and Shared Pictures, which are accessible by all users.²⁸ This allows users to share files without sharing user accounts or permitting other users to access their personal folders.²⁹ Shared Folders provide a solution for sharing files in a SOHO environment that any user on the system should be able to access and modify. If more restrictive access is needed (e.g., only certain users, read-only access), the use of Shared Folders is probably inappropriate.
- + **Software Restriction Policy.** The software restriction policy allows an administrator to limit what software may be run on a given computer. The software restriction policy can be defined as either restrictive or disallowed. When a restrictive policy is enabled, all programs will be allowed to run except those that are explicitly denied. The disallowed policy will deny the running of all programs except those that have been defined as allowed to run. This can be used to limit the software that can be run to only organizationally approved applications. In turn, this will protect against malicious code being executed. Although the disallowed policy provides very strong security, it is very time-intensive to set up and maintain, so it is probably only useful for high security environments. The restrictive policy can be useful in preventing the execution of

²⁵ For an overview of Credential Management, see the Microsoft article *Stored User Names and Passwords Overview* at http://www.microsoft.com/resources/documentation/windows/xp/all/proddocs/en-us/key_concepts_overview.msp.

²⁶ For a description of how to use Fast User Switching, see MSKB article 279765, *How to Use the Fast User Switching Feature in Windows XP*, available at <http://support.microsoft.com/?id=279765>.

²⁷ For more details on this issue, read MSKB article 294739, *A Discussion About the Availability of the Fast User Switching Feature*, available at <http://support.microsoft.com/?id=294739>.

²⁸ This feature cannot be enabled unless the filesystem is formatted as NTFS.

²⁹ More information on Windows XP file sharing is available from MSKB article 304040, *Description of File Sharing and Permissions in Windows XP*, available at <http://support.microsoft.com/?id=304040>.

programs with negative security implications, such as peer-to-peer file sharing programs and Trojan horses.

- + **Universal Plug and Play (UPnP).** UPnP provides a way for Windows to automatically configure UPnP-aware network devices, such as SOHO firewalls.³⁰ For example, a Windows XP system could dynamically request that the UPnP-aware firewall open ports to enable a file transfer over an instant messaging connection. Windows XP has improved upon UPnP from its original Windows ME implementation, and it now provides better usability and performance. Unfortunately, UPnP has had remotely exploitable vulnerabilities, so NIST recommends disabling UPnP unless the dynamic updating feature is needed.

3.2 Security Features Inherited from Windows 2000

This section discusses the most significant security features inherited from Windows 2000: Kerberos, smart card support, Internet Connection Sharing, Internet Protocol Security, and Encrypting File System. For each security feature, the section includes a brief description, an analysis of the security impact of each feature, and general recommendations for when the feature should or should not be used. It is outside the scope of this document to cover the features in great depth, so pointers to resources with additional information are provided as needed.

3.2.1 Kerberos

In a domain, Windows XP Professional provides support for MIT Kerberos v.5 authentication, as defined in Internet Engineering Task Force (IETF) Request for Comment (RFC) 1510. The Kerberos protocol is composed of three subprotocols: Authentication Service (AS) Exchange, Ticket-Granting Service (TGS) Exchange, and Client/Server (CS) Exchange. The Kerberos v.5 standard can be used only in pure Windows domain environments.³¹ Windows domain members use Kerberos as the default network client/server authentication protocol, replacing the older and less secure LanManager (LM) and Windows NT LanManager (NTLM) authentication methods. The older methods are still supported to allow legacy Windows clients to authenticate to a Windows domain environment. Windows XP Professional standalone workstations and members of NT domains do not use Kerberos to perform local authentication; they use the traditional NTLM. Because Kerberos provides stronger protection for logon credentials than older authentication methods, it should be used whenever possible. NIST recommends disabling LM and NTLM v1 in enterprise and high security environments.

3.2.2 Smart Card Support

In the past, interactive logon meant an ability to authenticate a user to a network by using a form of a shared credential, such as a hashed password. Windows XP Professional supports public-key interactive logon by using a X.509 v.3 certificate stored on a smart card.³² (This can be used only to log on to domain accounts, not local accounts, unless third party software has replaced the built-in graphical identification and authentication [GINA].) Instead of a password, the user types a personal identification number (PIN) to the GINA, and the PIN authenticates the user to the card. This process is fully integrated with the Microsoft implementation of Kerberos. Smart card-based authentication is appropriate for high security environments in which strong authentication is required, and one-factor authentication (username

³⁰ For more information on UPnP, see the Microsoft article titled *Universal Plug and Play in Windows XP*, available at <http://www.microsoft.com/technet/prodtechnol/winxp/evaluate/upnpxp.mspx>.

³¹ For a more detailed explanation of how Kerberos works in a Windows domain environment, refer to MSKB article 217098, *Basic Overview of Kerberos User Authentication Protocol in Windows 2000*, available at <http://support.microsoft.com/?id=217098>.

³² For more information on Windows support of smart cards, see the Microsoft web page titled *Access Control and Smart Cards*, located at <http://www.microsoft.com/technet/security/topics/smrctcard/default.mspx>.

and password) is insufficient. Smart cards provide two-factor authentication, because users must possess the physical smart card and must know the PIN. If smart cards or other types of authentication tokens are being used, the organization should have a policy and procedures in place to educate users on properly using tokens (e.g., not sharing them with other users) and protecting them (e.g., immediately reporting a lost or stolen token).

3.2.3 Internet Connection Sharing

ICS allows a Windows XP system to share an Internet connection with other computers.³³ ICS is most often used in SOHO environments (e.g., Internet connectivity provided by a modem on one system). ICS can provide Network Address Translation (NAT) services to the other systems, which essentially hides them from public view. In a corporate environment, domain administrators can prevent systems from using ICS through a group policy. Portable Windows XP Professional systems do not need to be reconfigured to use ICS on a SOHO network and not use ICS on a corporate network; the group policy takes care of it automatically. Generally, ICS should not be used on enterprise networks, but it is a solution for SOHO environments with limited connectivity. It is recommended to use a host-based firewall such as ICF on the host that is running ICS. Not only can the firewall provide protection for the ICS host, but it can also help to protect the systems behind the ICS from attacks by external parties.

3.2.4 Internet Protocol Security

Windows XP includes an implementation of the IETF Internet Protocol Security (IPsec) standard called Windows IP Security.³⁴ It provides network-level support for confidentiality and integrity. Confidentiality is achieved by encrypting packets, which prevents unauthorized parties from gaining access to data as it passes over networks. Integrity is supported by calculating a hash for each packet based partially on a secret key shared by the sender and receiver, and sending the hash in the packet. The recipient will recalculate the hash, and if it matches the original hash, then the packet was not altered in transit. Windows IP Security also offers packet filtering capabilities, such as limiting traffic based on the source or destination IP address. Windows IP Security provides a solution for protecting data traversing public networks (e.g., the Internet) and for protecting sensitive data on private networks (e.g., an enterprise LAN). It is also commonly used to protect wireless network communications in enterprise and SOHO environments. Using Windows IP Security in conjunction with a host-based firewall such as ICF can provide protection against network-based attacks by limiting both inbound and outbound packets.

3.2.5 Encrypting File System

The encrypting file system (EFS) provides users a method to transparently encrypt or decrypt files and folders residing on a NTFS-formatted volume.³⁵ In the original release of Windows XP, EFS could use either the Triple Data Encryption Standard (3DES) algorithm, a stronger variant of the Data Encryption Standard (DES), or the Extended Data Encryption Standard (DESX). Windows XP Service Pack 1 (SP1) added support for the Advanced Encryption Standard (AES) algorithm, and SP1 systems use AES by default for EFS. This is a change from Windows 2000, which used DESX by default. In addition, EFS now maintains *encryption persistence*, which means that any file or folder that has been designated as encrypted will remain encrypted when moved to another NTFS-formatted filesystem. Another major

³³ For more information on ICS, read the Microsoft article titled *Set Up and Use Internet Connection Sharing*, available at <http://www.microsoft.com/WindowsXP/pro/using/howto/networking/ics.asp>.

³⁴ For further information about implementing Windows IP Security, visit <http://www.microsoft.com/windows2000/techinfo/planning/security/ipsecsteps.asp> to access *Step-by-Step Guide to Internet Protocol Security (IPSec)*.

³⁵ For more information, see the Microsoft article *Encrypting File System in Windows XP and Windows Server 2003* at <http://www.microsoft.com/technet/prodtechnol/winxp/dep/encryptfs.mspx>.

change from Windows 2000 is that EFS encrypted files can now be shared among multiple users over a network. However, files are still transmitted unencrypted across the network (except when Web Distributed Authoring and Versioning [WebDAV] is used, which will transmit encrypted files across networks), so users must transfer the files through a separate encrypting protocol, such as SSL/TLS or IPsec. EFS is best used to provide local encryption for files and is particularly useful for laptops and other systems at high risk of physical attack.

3.3 Summary of Recommendations

- + Do not implement a network bridge using a Windows XP computer unless it is specifically needed for a task, and risk assessment and mitigation have been performed.
- + Enable Remote Assistance only if it is configured so its usage is strictly limited and if the network perimeter is configured to prevent external parties from using it to access internal machines.
- + Only use Remote Desktop if several other layers of security controls are in place, preventing the system from being directly exposed to attackers, and administrators have carefully considered the business need for remote access to the system and have not found a viable alternative that will not expose the system to attack.
- + Do not configure Wireless Auto Configuration to attempt to connect to any wireless network automatically.
- + Only allow users with a legitimate need to access a system remotely.
- + Configure systems to store OS and application passwords only in environments in which there is a minimal physical threat or for passwords that have trivial value.
- + Disable UPnP unless its dynamic updating feature is needed for compatibility with other devices, such as SOHO firewalls.
- + Disable LM and NTLM v1 in enterprise and high security environments.
- + Systems running ICS should also use host-based firewalls.
- + As appropriate, use Windows IP Security to protect data traversing public networks and sensitive data on private networks.

4. Installation, Backup, and Patching

This section of the guide contains advice on performing Windows XP installations, and backing up and patching Windows XP systems. It discusses the risks of installing a new system on a network and the factors to consider when partitioning Windows XP hard drives. It also describes various installation techniques and provides pointers to more information on performing them. Another important topic is the ability of Windows XP to back up and restore data and system configuration information. This section also discusses how to update existing systems through Windows Update and other means to ensure that they are running the latest service packs and hotfixes. Advice is also presented on identifying missing patches and security misconfigurations on systems.

Organizations should have sound configuration management policies that govern changes made to operating systems and applications, such as applying patches to an operating system or modifying application configuration settings to provide greater security. Configuration management policies should also address the initial installation of the operating system, the installation of each application, and the roles, responsibilities, and processes for performing and documenting system changes caused by upgrades, patches, and other methods of modification.

4.1 Performing a New Installation

This guide assumes that a new Windows XP installation is being performed from scratch. If an administrator or user is upgrading an existing Windows installation, some of the advice in this guide may be inappropriate and could possibly cause problems. Because a machine is unsecured and very vulnerable to exploitation through the network during installation, it is strongly recommended that all installations and initial patching be done with the computer not connected to any network. If a computer must be connected to a network, then it is recommended that the network be isolated and strongly protected (e.g., shielded by a firewall on a trusted network segment) to minimize exposure to any network attacks during installation.³⁶ If possible, the latest service pack and critical hotfixes should be downloaded from Microsoft's Web site, archived to read-only media, such as CD-ROMs, and kept physically secure.

4.1.1 Partitioning Advice

One of the major decisions during installation is how to partition hard drives. The primary consideration is how large the disk drive is; for example, partitioning is not recommended for drives under 6 Gigabytes (GB). For larger drives, the following factors should be considered:

- + How large is the drive?
- + How many physical drives does the machine have?
- + If the system only has one drive, is there a desire to logically separate the OS and applications from data? An example of the benefit of this is that if the OS needs to be upgraded or reinstalled, the data can easily be preserved.
- + What is the purpose of this computer? For example, if a computer will be used to share files within a workgroup, it may be useful to have a separate partition for the file share.
- + Is there a need for redundancy (e.g., mirroring a data partition onto a second drive)?

³⁶ Installers should follow the organization's policy for connecting information systems or receive direct approval from management before connecting any new Windows XP systems to the organization's networks.

Windows XP Professional provides a feature known as dynamic disks.³⁷ On a dynamic disk, partition sizes can be changed as needed. For example, an administrator could create an OS and applications partition and a data partition on a large drive, leaving much of the drive space available for future allocation. As needed, the administrator can use the free space to create new partitions and to expand the existing partitions. This provides considerable flexibility for future growth. Users are cautioned that, as with any other new feature, dynamic disks should be tested before deploying them on production systems.

Another important consideration during installation is which type of filesystem to use for each partition. NIST recommends using NTFS for each partition unless there is a particular need to use another type of filesystem. Section 7.1 contains more information on NTFS and other filesystem options.

4.1.2 Installation Methods

There are several ways to perform Windows XP installations. This section covers three primary methods: local installations, cloning through Sysprep, and the Remote Installation Services (RIS).

4.1.2.1 Local Installation

The local installation approach refers to traditional methods of installing Windows, such as using a Microsoft CD. This is effective only for installing a small number of computers at a time because it requires user attention throughout the installation. When installing Windows XP from a CD, follow the default steps, except for the following:

- + For the Network Setting configuration, select **Custom** and disable all network clients, services, and protocols that are not required. Although this will help to limit the computer's exposure to network-based attacks, consider the implications of disabling each service because this may inadvertently break required functionality (e.g., connecting to remote servers and printers). See Section 7.5 for more information on network clients, services, and protocols. Consider disabling the following services:
 - Client for Microsoft Networks (most users will require this service)
 - Client Service for NetWare
 - File and Printer Sharing for Microsoft Networks
 - QoS Packet Scheduler³⁸
 - NWLink IPX/SPX/NetBIOS Compatible Transport Protocol.
- + If possible, assign an Internet Protocol (IP) address, default gateway, and domain name system (DNS) server.
- + Even if the computer will be joining a domain, choose to be in only a workgroup, and change the workgroup name to something other than the default of WORKGROUP.
- + Set all environment-specific settings, such as the time zone.

When the installation prompts for accounts to be added, only one account should be added initially. Other accounts can always be added later once the system is fully patched and configured. By default,

³⁷ For more information, see MSKB article 314343, *Basic Storage Versus Dynamic Storage in Windows XP*, available at <http://support.microsoft.com/?id=314343>.

³⁸ QoS stands for Quality of Service.

the account created during the installation and the built-in Administrator account both belong to the Administrators group. After the initial post-installation boot, assign both accounts strong passwords. The next task is to install the latest service pack and hotfixes from read-only media. Only after the machine has been brought up to current patch levels should it be connected to a regular network. Then, the networking configuration can be changed, such as joining the workstation to a domain, or assigning a workgroup to enable sharing of workgroup resources (e.g., shared directories, printers). Other services that were disabled during installation can be enabled if needed. It is also helpful to scan through the list of installed Windows components, determine which applications and utilities (e.g., Internet games) are not needed, and remove them.

4.1.2.2 Sysprep

Sysprep³⁹ is a tool that permits an image from a single Windows XP computer installation, known as a *gold system*, to be cloned onto multiple systems in conjunction with a cloning software program such as Ghost or Disk Image. This technique reduces user involvement in the installation process to approximately 5 to 10 minutes at the start of the installation. The Sysprep approach has several benefits. The standard image can be created with a strong security configuration. Sysprep reduces the possibility of human error during the installation process. In addition, the Windows XP installation occurs more quickly with Sysprep. This is beneficial in not only building new systems, but also reinstalling and reconfiguring the operating system and applications much more quickly when needed—for example, as a result of hardware failure or a virus infection. In preparing the “gold” image for Sysprep, the same guidelines used for a standalone installation should be used, with the addition of enabling any needed services and patching the system. It is also important to physically secure image media so that it is not inadvertently or purposely altered.

4.1.2.3 Remote Installation Services

The RIS⁴⁰ allows a computer to be booted from the network and then to automatically install an instance of Windows XP. RIS can be configured to perform either a completely automated and unattended installation with RISetup, or one that requires minimal user attendance (similar to the Sysprep tool) with RIPrep. Several hardware and software dependencies exist; therefore, Microsoft’s documentation on the tool should be consulted for detailed instructions regarding how to configure this installation method.

The RIS method has the same advantages as Sysprep. RIS has the additional advantage of not needing the machine to be installed to have direct access to the physical install media (e.g., a CD-ROM). This can be ideal in a high security environment in which machines might not have CD-ROM drives. The primary disadvantage of RIS is that the machine must be connected to a network while it is being installed. This could open up a window of opportunity to exploit a security weakness before installation is completed.

4.2 Backing Up Systems

To increase the availability of data in case of a system failure or data corruption caused by a power failure⁴¹ or other event, Windows XP has built-in capabilities to back up and restore data and systems.⁴²

³⁹ Refer to *How to Use Sysprep: An Introduction* at <http://www.microsoft.com/windowsxp/pro/using/itpro/deploying/introduction.asp> for more detailed instructions.

⁴⁰ More information on RIS is available from *Remote Installation Services* at http://www.microsoft.com/resources/documentation/Windows/XP/all/reskit/en-us/Default.asp?url=/resources/documentation/Windows/XP/all/reskit/en-us/prbc_cai_byil.asp.

⁴¹ An uninterruptible power supply (UPS) and surge protection device can provide temporary emergency battery power when the utility-provided power is unavailable.

By default, users run the Backup or Restore Wizard, which automates most of the backup and restore processes. For example, during a backup the user is presented with several options, including backing up all of the user's files and settings, backing up all users' files and settings, and backing up the whole system. This allows the user to back up data and systems without having to manually indicate which files and directories should be backed up, if the user's files are where the backup program expects them to be. To run the Backup or Restore Wizard, perform the following steps:

1. Open **My Computer**. Right-click on the drive that contains the data to be backed up, and select **Properties**.
2. Click on the **Tools** tab. Click on the **Backup Now...** button. This launches the Backup or Restore Wizard.

When a backup is performed, the result is a .bkf file (Backup.bkf by default). If a full system backup is performed, the Automated System Recovery Wizard will prompt the user to insert a floppy disk, which will be turned into a recovery disk that can be used with the .bkf file to restore the system in case of failure.⁴³ As the name indicates, the Backup or Restore Wizard can also be used to restore a backup from a .bkf file. It is very important to verify periodically that backups and restores can be performed successfully; backing up a system regularly may not be beneficial if the backups are corrupt or the wrong files are being backed up, for example. Organizations should have policies and procedures that address the entire backup and recovery process, as well as the protection and storage of backup media and recovery disks. Because backups may contain sensitive user data as well as system configuration and security information (e.g., passwords), backup media should be properly protected to prevent unauthorized access.⁴⁴

When the Backup or Restore Wizard is run, it presents an option to select Advanced Mode.⁴⁵ This switches to the Backup Utility interface, which is not as user-friendly but provides greater customizability and more features. For example, the Backup Utility can be used to schedule backups. In general, system administrators are more likely to use the Backup Utility mode, while end users are more likely to use the Backup or Restore Wizard mode.

Besides the backup wizards and utilities provided by Windows XP, there are also various third-party utilities for backing up and restoring files and systems. It is important to verify that the third-party software can properly back up and restore Windows XP-specific resources, such as the Windows registry and EFS-encrypted files and folders. Windows XP's built-in utilities also use a *shadow copy* backup technique when possible, which means that they essentially take a snapshot of the system and then perform a backup on that snapshot. This avoids problems with attempting to back up open files. Third-party backup utilities used on Windows XP systems should have good mechanisms for handling open files.

⁴² The backup and restore capabilities are not installed by default on Windows XP Home systems. See MSKB article 320820, *How to Use the Backup Utility to Back Up Files and Folders in Windows XP Home Edition*, for more information. It is available at <http://support.microsoft.com/?id=320820>.

⁴³ For more information on Automated System Recovery, see the Microsoft article titled *How to Set Up and Use Automated System Recovery in Windows XP*, available at <http://www.microsoft.com/windowsxp/pro/using/itpro/managing/asr.asp>.

⁴⁴ For additional guidance on backups and backup security, see NIST SP 800-34, *Contingency Planning Guide for Information Technology Systems*, available at <http://csrc.nist.gov/publications/nistpubs/index.html>.

⁴⁵ For more information on Advanced Mode, see MSKB article 308422, *How to Use Backup to Back Up Files and Folders on Your Computer in Windows XP*, available at <http://support.microsoft.com/?id=308422>, and article 309340, *How to Use Backup to Restore Files and Folders on Your Computer in Windows XP*, available at <http://support.microsoft.com/?id=309340>.

4.3 Updating Existing Systems

Host security—securing a given computer—has become increasingly important. As such, it is essential to keep a host up to current patch levels to eliminate known vulnerabilities and weaknesses.⁴⁶ In conjunction with antivirus software and a personal firewall, patching goes a long way to securing a host against outside attacks and exploitation. Microsoft provides two mechanisms for distributing security updates: Automatic Updates and Windows Update.⁴⁷ In smaller environments, either method may be sufficient for keeping systems current with patches. Other environments typically have a software change management control process or a patch management program that tests patches before deploying them; this distribution may occur through local Software Update Services servers, which provide approved security patches for use by the Automatic Updates feature. This section discusses Automatic Updates and Windows Update, as well as patch management considerations for managed environments. This section also defines the types of updates that Microsoft typically provides.

4.3.1 Update Notification

As described later in this section, it is possible to configure XP systems to download critical updates automatically. However, this still leaves other updates that can only be downloaded manually. Therefore, it is important for Windows XP system administrators to be notified of new updates that Microsoft releases. The Microsoft Security Notification Service is a mailing list that notifies subscribers of new security issues and the availability of all types of Microsoft updates.⁴⁸ Microsoft security bulletins are also available online from the TechNet Security Resource Center.⁴⁹ Individual bulletins are issued for each new vulnerability and are incorporated into monthly bulletins that list the vulnerabilities in order of potential severity (e.g., critical, important, moderate). Each bulletin provides guidance regarding under what circumstances the suggested mitigation strategy (e.g., patch) should be applied.

4.3.2 Microsoft Update Types

Microsoft releases updated code for Windows XP through three mechanisms: hotfixes, security rollups, and service packs.

- + A *hotfix* is a patch that fixes a specific problem. When a new vulnerability is discovered in Windows XP or a Microsoft application (e.g., Internet Explorer), Microsoft develops a hotfix that will resolve the problem. Hotfixes are released on an individual basis as needed. Hotfixes should be applied as soon as practical for vulnerabilities that are likely to be exploited. (Whenever possible, hotfixes should first be tested on a nonproduction system to ensure that they do not inadvertently break functionality or introduce a new security problem by breaking a previous hotfix.)
- + A *security rollup* is a collection of several hotfixes. The security rollup makes the same changes to the system that would be performed if each hotfix were installed separately. However, it is easier to download and install a single security rollup than 10 hotfixes. Microsoft releases security rollups on occasion when merited. Security rollups are most useful for updating existing systems that have not been maintained and for patching new systems.
- + A *service pack* is a major upgrade to the operating system that resolves dozens of functional and security problems and often introduces some new features or makes significant configuration

⁴⁶ Organizations should have a configuration management policy that includes requirements for patching systems.

⁴⁷ Windows XP Service Pack 2 makes significant changes to Automatic Updates and Windows Update. Appendix B contains more information on these changes.

⁴⁸ Users can sign up for the notification service at <http://www.microsoft.com/technet/security/bulletin/notify.msp>.

⁴⁹ The TechNet Security Resource Center is located at <http://www.microsoft.com/technet/security/default.msp>.

changes to systems.⁵⁰ Service packs incorporate previously released hotfixes, so once an SP has been applied to a system, there is no need to install the hotfixes that were included in the service pack. Service packs are released every year or two; for example, Windows XP was released in the fall of 2001, SP1 in the fall of 2002, and SP2 scheduled in 2004. Because SPs often make major changes to the operating system, organizations should test the SP thoroughly before deploying it in production. In SOHO environments, the best approach is probably to delay installation of the SP for a few weeks so that early adopters can identify any bugs or issues. However, if the SP provides a fix for a major security issue, and the fix is not available through hotfixes, it may be less risky to install the SP immediately than to let the system remain unpatched.

4.3.3 Automatic Updates

One facility that is available to patch systems with little to no user intervention is the Automatic Updates feature. When enabled, it will automatically check the Microsoft update servers for updates.⁵¹ It provides three configuration options to users:

- + Notifies the user before downloading or installing any updates
- + Downloads updates automatically but notifies the user before installing updates
- + Downloads all updates and automatically installs them according to a specified schedule.

Generally, it is best to configure the system to download updates automatically, unless bandwidth usage is a concern. For example, downloading patches could adversely affect the functionality of a computer that is connected to the Internet on a slow link. In this case, it would be preferable for Automatic Updates to be configured to notify the user that new patches are available. The user should then make arrangements to download the patch at the next possible time when the computer is not needed for normal functionality. Choosing whether to install updates automatically or prompt the user is dependent upon the situation. If the user is likely to ignore the notifications, then it may be more effective to install the updates on a schedule. If the system is in use at unpredictable days and times, then it may be difficult to set a schedule that will not interfere with system usage. Another issue to consider is that many updates require the system to be rebooted before the update takes effect.

It is highly recommended that the Automatic Updates service be enabled to keep the OS and key Microsoft applications (e.g., Internet Explorer, Outlook Express) fully patched. To enable Automatic Updates, perform the following steps:

1. Click the **Start** menu and select **Control Panel**.
2. Double-click the **System** applet and select the **Automatic Updates** tab.
3. Select the **Keep my computer up to date** check box. Choose the appropriate radio button (such as **Notify me before downloading any updates and notify me again before installing them on my computer**). Click **OK**.

Some organizations do not want the latest updates applied immediately to their Windows systems. For example, in a managed environment it may be undesirable for hotfixes to be deployed to production

⁵⁰ Additional information on service packs is available from MSKB article 322389, *How to Obtain the Latest Windows XP Service Pack*, located at <http://support.microsoft.com/?id=322389>.

⁵¹ As described later in this section, Automatic Updates can be configured to use a local update server instead of Microsoft's servers.

systems until they have been tested by Windows administrators and security administrators.⁵² In addition, in large environments, many systems may need to download the same hotfix simultaneously. This could cause a serious impact on network bandwidth. Organizations with such concerns often establish a local update server that contains approved hotfixes. This server is known as a Software Update Services (SUS) server.⁵³ The Automatic Updates feature on Windows XP systems should then be configured to point to the SUS server. Unfortunately, although SUS provides a method for distributing hotfixes, it cannot be used to distribute SPs or third party software updates.⁵⁴

4.3.4 Windows Update

Users with local administrator privileges can also manually update their systems by visiting the Windows Update Web site.⁵⁵ The Windows Update site will check the computer to determine what security and functionality updates are available and produce a list of updates. The user can then select which updates should be installed at this time, and tell Windows Update to perform the installations. To use Windows Update, perform the following steps:

1. Run Internet Explorer.
2. From the **Tools** menu, select **Windows Update**.
3. Click on **Scan for updates**.
4. When Windows Update has completed its scan, it will list the available updates on the left side of the screen, separated into three categories: **Critical Updates and Service Packs, Windows XP, and Driver Updates**. To review the most important security-related updates, click on **Critical Updates and Service Packs**.
5. Choose which updates should be installed by clicking on the **Add** button. Note that in some cases, one patch needs to be installed by itself; therefore, it may not be possible to install all desired patches at once.
6. Once the updates have been selected, click on **Review and install updates** to continue.
7. Confirm that the correct updates are listed, and click on **Install Now** to perform the installations. It may take several minutes to install each update.
8. When the installations are done, Windows Update should report which updates were successfully installed. It will also prompt the user to reboot the system if any of the updates require a reboot to complete the installation. Click on **OK** to reboot immediately or **Cancel** to manually reboot the system later.

Because Windows Update requires local administrative privileges and is run manually, its use is generally not recommended within enterprise and high security environments. As described in Section 4.3.5, it is recommended that all updates be tested and verified before coordinated deployment, which the use of Windows Update could circumvent. Windows Update has additional complications in enterprise

⁵² Some managed environments have software maintenance policies that forbid users from updating systems themselves, primarily because of the possible negative effects of deploying untested updates.

⁵³ For more information on SUS, read the Microsoft document titled *Software Update Services Deployment White Paper*, available at <http://www.microsoft.com/windowsserversystem/sus/susdeployment.mspx>.

⁵⁴ Windows XP SP2 replaces SUS with Windows Update Services (WUS). See Appendix B.2 for more information on WUS.

⁵⁵ The Microsoft Windows Update Web site is located at <http://windowsupdate.microsoft.com>.

environments because it is typically unrealistic to run any application manually on every workstation in the enterprise on a regular basis, and individual users may not have the necessary local administrative rights. However, the use of Windows Update is recommended for SOHO environments because it provides a mechanism to download service packs, driver updates, and other types of Windows-related updates that may fix security and functionality issues.

4.3.5 Patching in Managed Environments

Enterprise and high security environments, especially those that are considered managed environments, should have a patch management program that is responsible for acquiring, testing, and verifying each patch, then arranging for its distribution to systems throughout the organization. NIST SP 800-40, *Procedures for Handling Security Patches*, provides in-depth advice on establishing patching processes and testing and applying patches.⁵⁶ For each patch that is released, the patch management team should research the associated vulnerabilities and prioritize the patch appropriately. It is not uncommon for several patches to be released in a relatively short time, and typically one or two of the patches are much more important to the organization than the others. Each patch should be tested with system configurations that are representative of the organization's systems. Once the team determines that the patch is suitable for deployment, the patch needs to be distributed through automated or manual means for installation on all appropriate systems. (There are several third-party applications available for patch management and distribution, which support many types of platforms and offer functionality that supports enterprise requirements.) Finally, the team needs to check systems periodically to confirm that the patch has been installed on each system, and to take actions to ensure that missing patches are applied.

4.4 Identifying Security Issues

Host security is largely dependent upon staying up to date with security patches as well as identifying and remediating other security weaknesses. The Microsoft Baseline Security Analyzer (MBSA) is a utility that can scan the local computer and remote computers to identify security issues.⁵⁷ MBSA must have local administrator-level access on each computer that it is scanning. MBSA offers both graphical user interface (GUI) and command-line interfaces. MBSA can identify which updates are missing from the operating system and common Microsoft applications (e.g., Internet Explorer, Media Player, Internet Information Services [IIS], Exchange Server, Structured Query Language [SQL] Server) on each system. For the operating system and a few applications (e.g., Internet Explorer, IIS, SQL Server, Office), it can also identify other security issues, such as insecure configurations and settings. MBSA only identifies the problems; it has no ability to change settings or download and install updates onto systems. The methods discussed in Section 4.3 should be used to download and apply patches.

Another popular free tool for checking the patch status on computers is HFNetChk, made by Shavlik.⁵⁸ HFNetChk offers the same functionality as the command-line version of MBSA; it can scan systems and report which patches are present and absent for the operating system and various Microsoft applications. Shavlik also makes HFNetChkPro, a commercial utility that provides a GUI for administrators. Unlike MBSA, HFNetChkPro also provides a mechanism for distributing and installing patches that are identified as being missing from systems.

4.5 Summary of Recommendations

- + Have sound configuration management policies that govern changes made to operating systems and applications, such as applying patches and modifying configuration settings.

⁵⁶ NIST SP 800-40 is available at <http://csrc.nist.gov/publications/nistpubs/index.html>.

⁵⁷ MBSA is available for download from <http://www.microsoft.com/technet/security/tools/mbsahome.msp>.

⁵⁸ More information on HFNetChk.exe is available at <http://hfnetchk.shavlik.com/default.asp>.

- + Until a new system has been fully installed and patched, either keep it disconnected from all networks, or connect it to an isolated, strongly protected network.
- + Use NTFS for each hard drive partition unless there is a particular need to use another type of filesystem.
- + Disable all network clients, services, and protocols that are not required.
- + Assign strong passwords to the built-in administrator account and the user account created during installation.
- + Keep systems up to current patch levels to eliminate known vulnerabilities and weaknesses.
- + Use MBSA, HFNetChk, or other similar utilities on a regular basis to identify patch status issues.

5. Overview of the Windows XP Security Policy Configuration and Templates

This section provides an introduction to the concept of Windows XP security templates and describes how the NIST Windows XP security templates were developed. It then provides guidance on how organizations can view, modify, and apply security templates to individual Windows XP systems or to all Windows XP systems within one or more Active Directory Organizational Units (OU). Windows XP also provides a mechanism for comparing the settings in a security template to the current settings on a system; this can be used to identify potential security issues, as well as organization-specific characteristics that may need to be incorporated into the templates.

5.1 Windows XP Security Templates

In Windows XP, a *security template* is a text-based file that contains values for security-relevant system settings, thus representing a particular security configuration. Templates can be created and updated using the Security Templates Microsoft Management Console (MMC) snap-in. Templates may be applied to a local computer or imported to a Group Policy Object or Group Policy Management Console, which facilitates the rapid deployment of security settings across a Windows XP environment. Templates may also be applied through various commercial change and configuration management tools.⁵⁹ The Security Configuration and Analysis MMC snap-in can be used to apply templates to a system and to compare the values within a template to existing settings on a system in order to analyze the system's security posture.

Windows XP ships with several predefined security templates.⁶⁰ Although these templates are included in Windows XP, NIST does not recommend their use. Microsoft intended for the default templates to be used as the basis for creating organizational-specific templates. Several organizations have developed and published their own templates, typically geared toward specific system purposes. Examples include the templates included with the Microsoft Windows XP Security Guide⁶¹ and the templates from the National Security Agency (NSA)⁶². As part of the development of this document, NIST has also created a set of templates, which are referenced in Appendix A. These templates are based on the DISA, NSA, and Microsoft Windows XP security templates and recommendations. They represent the baseline recommended settings advocated by CIS, DISA, NSA, NIST, Microsoft, and other security experts. The NIST templates have been customized and fully documented for use on Windows XP workstations in SOHO, enterprise, high security, and legacy environments. Use caution when applying any of the NIST templates, and if necessary, modify them to conform to local security policy and document all modifications. To view and modify the NIST template settings, perform the following steps:⁶³

1. Start the MMC by using the **Start** menu **Run** command, and opening **mmc.exe**.
2. Click on **File**, then **Add/Remove Snap-in**. Click on **Add**, highlight the **Security Templates** snap-in and click on **Add**. Click on **Close**, then click on **OK**. When completed, save the console in the **Administrative Tools** folder for future use.

⁵⁹ Examples of change and configuration management tools are Microsoft Systems Management Server (SMS), BindView bv-Control, NetIQ Group Policy Administrator, and Configuresoft Enterprise Configuration Manager (ECM).

⁶⁰ The predefined security templates, located in %SystemRoot%\security\templates, are named Setup security.inf, Compatws.inf, Securews.inf, Hiseaws.inf, Rootsec.inf, and Notssid.inf. More information on the templates is available from the article *Predefined Security Templates* at http://www.microsoft.com/resources/documentation/windows/xp/all/proddocs/en-us/sag_scedefaultpols.mspx.

⁶¹ An overview of the Microsoft Windows XP Security Guide is available at <http://www.microsoft.com/technet/security/prodtech/winclnt/secwinxp/default.mspx>.

⁶² The NSA's guides and templates for Windows XP are available from <http://nsa2.www.conxion.com/winxp/index.html>.

⁶³ This method works for all the template settings except for the registry value settings, which are not visible in the MMC. The registry value settings can be adjusted by manually editing the template through a text editor.

3. To use the NIST templates supplied with this document, copy them into the **%SystemRoot%\Security\Templates⁶⁴** folder. Choose the template that will be applied to the workstation.
4. Navigate through the security template settings and adjust settings as necessary to comply with local security policy. When all changes have been completed, right-click on the template name, choose **Save As**, and specify a new template name. (NIST recommends modifying copies of templates instead of the originals.) The saved template file can then be used on the local computer or other computers in the environment.

5.2 Analysis and Configuration

As mentioned previously, the Security Configuration and Analysis snap-in can be used to compare the current security settings of the local workstation to the settings in a template before the template is applied. This enables system administrators to examine and adjust the changes the security template will make to the computer's settings. To use the Security Configuration and Analysis snap-in to compare and apply security settings on a local Windows XP system, perform the following steps:

1. Start the MMC by using the **Start** menu **Run** command, and opening **mmc.exe**.
2. Click on **File**, then **Add/Remove Snap-in**. Click on **Add**, highlight the **Security Configuration and Analysis** snap-in and click on **Add**. Click on **Close**, then click on **OK**. When completed, save the console in the **Administrative Tools** folder for future use.
3. Open a new database by right-clicking **Security Configuration and Analysis** and selecting **Open Database**. Name the database and click open.
4. Choose the template that will be applied to the workstation. Click **Open** to load the settings from the template.
5. Right-click the **Security Configuration and Analysis** snap-in and choose **Analyze Computer Now**. Specify the default log name and location, then click on **OK**.⁶⁵ The system will then compare the current security settings active on the computer with the template settings.
6. When the checks are completed, navigate through the categories of settings listed under the Security Configuration and Analysis snap-in. The differences between the templates and the computer configuration are displayed. For example, items with a red X differ from the template, and items with a green checkmark match the template. Other items may not have been analyzed because no setting was defined in the template, or because they were dependent on another value that was not set. Besides the icon, each item also gives a verbal description, such as **Not Analyzed** or **Not Defined**.
7. If a review of the settings indicates that particular template settings should not be applied to the system, they can be adjusted by modifying the database settings shown on the screen. To accomplish this action, double-click on the setting that needs to be altered, make the necessary adjustments, and click on **OK** to return to the main settings listing. Repeat this process until all desired adjustments have been completed.

⁶⁴ %SystemRoot% refers to the WINNT directory located on the system drive (i.e., C:\).

⁶⁵ By default, the log file is called test.log. The log file records each discrepancy, and may contain hundreds or thousands of entries for a single scan. The same log file is used when a template is applied to the system.

8. To apply the database settings to the system, right-click on the **Security Configuration and Analysis** snap-in and choose **Configure Computer Now**. Specify the default log name and location, then click on **OK**. The settings are applied to the system.
9. When the configuration is completed, the policy used to apply the configuration can be exported for future use on this computer or others. Export the configuration policy by right clicking on the **Security Configuration and Analysis** snap-in and choosing **Export Template**. Name and save the template for future use on the local computer or other computers in the environment. The saved template file can also be imported to reset settings to a working configuration if future modifications cause problems.

5.3 Group Policy Distribution

In a Windows XP domain environment, Group Policy Objects (GPO) can be used to distribute security settings to all computers in an Active Directory OU. The recommended method is to separate computers by role into OUs. For example, all similarly configured domain member workstations within an environment should be in an OU. To import a security template into a GPO, perform the following steps:

1. Start the MMC by using the **Start** menu **Run** command, and opening **mmc.exe**.
2. Click on **File**, then **Add/Remove Snap-in**. Click on **Add**, highlight the **Group Policy Object Editor** snap-in, and click on **Add**. Select the appropriate Group Policy Object and click **OK**, then click **Finish**.
3. Click on **Close**, then click on **OK**.
4. Expand **Computer Configuration** and click on **Windows Settings**.
5. Right-click on **Security Settings** and choose **Import Policy**.
6. Select the desired template file and click on **Open**.

The security settings in the template now can be deployed to all computers within the OU. Group Policy can be applied only using a Windows 2000 Server or Windows 2003 Server (domain controller) in a Windows XP domain environment (Active Directory).⁶⁶ Microsoft also offers the Group Policy Management Console (GPMC) for managing Group Policy for multiple domains.⁶⁷ The GPMC combines the functionality of several existing Group Policy-related tools into a single interface.⁶⁸ GPMC can be used to import, edit, and apply security templates to Windows systems throughout an enterprise, which is ideal for a managed environment. Once the GPMC has been installed, it can be run simply by executing **gpmc.msc**. To open the GPMC snap-in within the MMC console, perform the following steps:

1. Start the MMC by using the **Start** menu **Run** command, and opening **mmc.exe**.
2. Click on **File**, then **Add/Remove Snap-in**. Click on **Add**, highlight the **Group Policy Management** snap-in, and click on **Add**. Click on **Close**, then click on **OK**.

⁶⁶ For more information about Active Directory and Group Policy, refer to <http://www.microsoft.com/technet> and search on Group Policy.

⁶⁷ More information on the GPMC is available at <http://www.microsoft.com/windowsserver2003/gpmc/default.mspx>. The GPMC can also be downloaded from this Web site.

⁶⁸ For more information on the functionality provided by GPMC, read the Microsoft white paper by Jim Lundy titled *Administering Group Policy with Group Policy Management Console*, available at <http://www.microsoft.com/windowsserver2003/gpmc/gpmcwp.mspx>.

In GPMC, a GPO needs to be linked to a site, domain, or OU to be used. To link an existing GPO to an OU, perform the following steps:

1. Open GPMC.
2. Right-click on the appropriate OU and select **Link an Existing GPO**.
3. A list of GPOs will be displayed; select the one that should be linked to the OU. This establishes the link.

An alternative is to create a new GPO that is automatically linked to a site, domain, or OU. To create a new GPO for an OU, perform the following steps:

1. Open GPMC.
2. Right-click on the appropriate OU and select **Create and Link a GPO Here**. This opens the New GPO dialog box.
3. Provide a name for the GPO. This creates the GPO and automatically links it to the selected OU.
4. Right-click on the new GPO and select **Edit** to modify the GPO with the Group Policy Editor.

GPMC can import security templates into a GPO. To do so, perform the following steps:

1. Open GPMC.
2. Right-click on the appropriate GPO and click **Edit**.
3. Expand **Computer Configuration** and click on **Windows Settings**.
4. Right-click on **Security Settings** and choose **Import Policy**.
5. Select the desired template file and click on **Open**.

GPMC can also be used to edit security settings for a GPO. To do so, perform the following steps:

1. Open GPMC.
2. Right-click on the appropriate GPO and click **Edit**.
3. Expand **Computer Configuration** and click on **Windows Settings**.
4. Click on **Security Settings** and then click on the appropriate policy (e.g., Account Policies, Local Policies, Event Log).
5. Modify the security settings as needed and click on **OK** when finished.

Another helpful feature of GPMC is the Group Policy Modeling Wizard, which provides Resultant Set of Policy (RSOP) functionality. This means that the wizard can determine the effects of applying combinations of GPOs (e.g., site, domain, and OU level) to a particular user or computer. To do so for an OU, perform the following steps:

1. Open GPMC.
2. Right-click on the appropriate OU and select **Group Policy Modeling Wizard**.
3. Make the desired selections for the simulation, such as specifying a username, computer name, user location, site, computer location, or security groups.
4. At the **Summary of Selections** screen, review the settings to ensure they are correct and click on **Next** to run the simulation.
5. Once the simulation has ended, the wizard displays the results in a Group Policy Results report. If two or more GPOs had conflicting settings for a particular policy, the report shows which policy was applied. This is very helpful in resolving conflicts among GPOs and troubleshooting unexpected GPO behavior.

Some third-party system management and configuration tools provide similar functionality to GPMC—the ability to import, edit, apply, verify, monitor, and report on security settings in GPOs. These tools may also provide additional functionality, such as in-depth auditing capabilities.

5.4 Summary of Recommendations

- + Use the NIST security templates to configure security settings on Windows XP systems. Modify the templates as necessary to conform to local security policy, and document all modifications.
- + Use the Security Templates and Security Configuration and Analysis MMC snap-ins to create, import, view, modify, and export template settings, and to compare template settings with actual system settings.
- + Use the Group Policy Object Editor, Group Policy Management Console, and Group Policy Modeling Wizard MMC snap-ins to automate the deployment of security settings to domain member systems.

6. NIST Windows XP Template Settings Overview

This section provides an overview of the security settings that will be put into place by the NIST templates, as listed in Appendix A. The settings have been divided into several categories: Account Policies, Local Policies, Event Log Policies, Restricted Groups, System Services, File Permissions, Registry Permissions, and Registry Values. For each category, this section will describe at a high level the related security controls from the templates and how the controls can be used to improve the security of the system. This section will not cover all of the actual recommended parameters and values from the security templates.

6.1 Account Policies

In addition to educating users regarding the selection and use of good passwords, it is also important to set password parameters so that passwords are sufficiently strong. This reduces the likelihood of an attacker guessing or cracking passwords to gain unauthorized access to the system.⁶⁹ As described in Section 3.2.1, NIST recommends the use of NLTM v2 or Kerberos instead of LM or NTLM v1 for authentication. Windows XP offers the same password parameters as Windows 2000. The following parameters are specified in the NIST templates:

- + **Maximum Password Age.** This forces users to change their passwords regularly. The lower this value is set, the more likely users will be to choose poor passwords that are easier for them to remember (e.g., Mypasswd1, Mypasswd2, Mypasswd3). The higher this value is set, the more likely the password will be compromised and used by unauthorized parties.
- + **Minimum Password Age.** This setting requires users to wait for a certain number of days before changing their password again. The setting prevents users from changing their password when it reaches the maximum age and then immediately changing it back to the previous password. Unfortunately, this setting also prevents users who inadvertently reveal a new password to others from changing it without administrator intervention.
- + **Minimum Password Length.** This setting specifies the minimum length of a password in characters. The rationale behind this setting is that longer passwords are more difficult to guess and crack than shorter passwords. The downside is that longer passwords are often more difficult for users to remember.
- + **Passwords Must Meet Complexity Requirements.** Like the Minimum Password Length setting, this setting makes it more difficult to guess or crack passwords. Complexity requirements include not having the user account name in the password and using a mixture of character types, including upper case and lower case letters, digits, and special characters such as punctuation marks.⁷⁰
- + **Enforce Password History.** This setting determines how many old passwords the system will remember for each account. Users will be prevented from reusing any of the old passwords. For example, if this is set to 24, then the system will not allow users to reuse any of their last 24 passwords. Old passwords may have been compromised, or an attacker may have taken a long time to crack encrypted passwords. Reusing an old password could inadvertently give attackers access to the system.

⁶⁹ Passwords should be protected by other means as well, such as not embedding them within programs and scripts.

⁷⁰ These requirements are based on the default password filter (passfilt.dll) included with Windows XP. More information on it is available at http://www.microsoft.com/resources/documentation/windows/xp/all/reskit/en-us/prdp_log_qzuf.asp.

- + **Store Passwords Using Reversible Encryption for All Users in the Domain.** If this setting is enabled, passwords will be stored in a decryptible format, putting them at higher risk of compromise. This setting should be disabled unless it is needed to support a legacy authentication protocol, such as Challenge Handshake Authentication Protocol (CHAP).⁷¹

Attackers often attempt to gain access to user accounts by guessing passwords. Windows XP can be configured to lock out (disable) an account when too many failed login attempts occur for a single user account in a certain time period. The following account lockout parameters are set in the NIST templates:

- + **Account Lockout Threshold.** The threshold value specifies the maximum number of failed attempts that can occur before the account is locked out.
- + **Account Lockout Duration.** This value specifies how long the user account should be locked out. This is often set to a low but substantial value (e.g., 15 minutes), for two reasons. First, a legitimate user that is accidentally locked out only has to wait 15 minutes to regain access, instead of asking an administrator to unlock the account. Second, an attacker who is guessing passwords using brute force methods will only be able to try a small number of passwords at a time, then wait 15 minutes before trying any more. This greatly reduces the chances that the brute force attack will be successful.
- + **Reset Account Lockout Counter After.** This specifies the time period to be used with the lockout threshold value. For example, if the threshold is set to 10 attempts and the duration is set to 15 minutes, then if more than 10 failed login attempts occur with a single user account within a 15-minute period, the account will be disabled.

One of the main challenges in setting account policies is balancing security, functionality, and usability. For example, locking out user accounts after only a few failed logon attempts in a long time period may make it more difficult to gain unauthorized access to accounts by guessing passwords, but may also sharply increase the number of calls to the help desk to unlock accounts accidentally locked by failed attempts from legitimate users. This could also cause more users to write down their passwords or choose easier-to-remember passwords. Organizations should carefully think out such issues before setting Windows XP account policies.

6.2 Local Policies

The Local Policies category encompasses three subcategories: system auditing policy, user rights assignment, and security options. Each of these subcategories is discussed in more depth in the following sections.

6.2.1 Audit Policy

Windows XP includes powerful system auditing capabilities. The purpose of auditing is to record certain types of actions to a log, so that system administrators can review the logs and detect unauthorized activity. Audit logs may also be helpful when investigating a security incident that has occurred. As shown in Table 6-1, system auditing is available for logon events, account management, directory service access, object access, policy change, privilege use, process tracking, and system events. Each audit policy category can be configured to record successful events, failed events, both successful and failed events, or neither. Section 7.3 describes how file auditing can be configured, as well as how the Event Viewer can be used to review log entries.

⁷¹ NIST does not recommend the use of CHAP or MS-CHAP because of known security weaknesses.

Table 6-1. System Wide Audit Policy Description

Audit Policy	Description
Audit account logon events	Audits when a user logs on or off a remote computer from this workstation.
Audit account management	Audits when a user account or group is created, changed, or deleted; a user account is renamed, disabled, or enabled; a password is set or changed.
Audit directory service access	Audits the event of a user accessing an active directory object that has its own System Access Control List (SACL) specified.
Audit logon events	Audits users logging on, logging off, or making a network connection to the local computer.
Audit object access	Audits a user accessing an object (for example, a file, folder, registry key, or printer) that has its own SACL specified. Auditing of success or failure of system wide object access will create numerous log entries. Certain object access failures may be normal as a result of applications requesting all access types to objects, even though the application does not require all access types to function properly. Use object access auditing with caution.
Audit policy change	Audits every change to user rights assignment policies, audit policies, and trust policies.
Audit privilege use	Audits each instance of a user exercising a user right. This is likely to generate a very large number of events.
Audit process tracking	Audits detailed tracking information for events such as program activation, process exit, handle duplication, and indirect object access.
Audit system events	Audits when a user restarts or shuts down the computer or when an event occurs that affects either the system security or the security log.

The NIST recommended settings for system auditing can be applied to systems from the NIST templates. Settings can also be applied manually by performing the following steps:

1. From the **Start** menu, choose **Control Panel**.
2. Select **Administrative Tools**, and then choose **Local Security Policy**.
3. Expand **Local Policies**, and then click on **Audit Policy**.

6.2.2 User Rights Assignment

The NIST security templates specify which groups (e.g., Administrators, Users) have certain user rights. The goal is for each group to have only the necessary rights, and for users to only belong to the necessary groups. This is the principle of least privilege, described previously in Section 2.2. Examples of user rights that can be specified are as follows:

- + Accessing the system remotely and locally
- + Performing backups
- + Changing the time and date on the system
- + Managing the logs
- + Shutting down the system.

6.2.3 Security Options

Besides the Local Security Policy settings mentioned earlier in this section, additional settings called Security Options can be modified to achieve greater security than the default settings provide. The NIST templates specify values for dozens of such settings. Examples of the types of settings available are as follows:

- + Limiting the use of blank passwords
- + Renaming the default Administrator and Guest accounts
- + Restricting remote access to floppy and CD-ROM drives
- + Encrypting secure channel data in a domain
- + Securing the interactive logon screen (e.g., not showing the previous user's account name, displaying a warning banner, prompting users to change passwords before they expire)
- + Restricting which types of network access may be performed
- + Specifying which types of authentication may be used (e.g., NTLMv2).

The Security Options settings can also be accessed and adjusted manually by performing the following steps:

1. From the **Start** menu, choose **Control Panel**.
2. Select **Administrative Tools**, and then choose **Local Security Policy**.
3. Expand **Local Policies** and select **Security Options**.
4. The right pane lists the security option and indicates the current setting for each. Make any necessary changes by double-clicking on the appropriate security option, modifying the setting, and clicking **OK** to save the change.

6.3 Event Log Policies

Windows XP records information about significant events in three logs: the Application Log, the Security Log, and the System Log. The logs contain error messages, audit information, and other records of activity on the system. The logs can be used not only to identify suspicious and malicious behavior and investigate security incidents, but also to assist in troubleshooting system and application problems. Therefore, it is important to enable logging for all three types of logs. The NIST templates enable all three logs for all environments, and also specify the maximum log size. This is important because if the maximum log size is very low, the system will not have much room for storing information on system activity. Some organizations may have a logging policy and central log server, so the template settings may need to be adjusted so they comply with the policy.

6.4 Restricted Groups

NIST recommends that all users be removed from the Remote Desktop Users group on all systems in all environments, except for those users that specifically need to belong to the group. This will reduce the possibility of someone gaining unauthorized access to the system through Remote Desktop. NIST also recommends restricting membership in the Power Users group because it is nearly equivalent in privileges

to the Administrators group. Whenever possible, users who need additional privileges, but not full administrative-level access, should be granted the individual privileges needed instead of the range of privileges granted by Power Users group membership. By default, each NIST security template removes all users from the Remote Desktop Users and Power Users groups.

6.5 System Services

Windows XP operates with many services that are started automatically when the system boots up.⁷² These services consume resources and may introduce vulnerabilities to the host. All unnecessary services should be disabled to reduce the number of attack vectors against the system. In managed environments, the Group Policy Object should be used to configure services on systems; in other environments, services can be shut off individually on each system. For both configuration methods, each service on a system can be configured with one of three startup types:

- + **Automatic.** The service is started automatically. This means that the service is running whenever the system is up.
- + **Manual.** The service is started only by the system when it is needed. In practice, many services that are reconfigured to Manual are not automatically started when needed; for example, if the Print Spooler is set to Manual, it will not be started when a user tries to print a document. Also, if a service is dependent on another service that has been set to Manual, the first service may incorrectly assume the second service is already running.⁷³
- + **Disabled.** The service cannot be started by the system.

NIST recommends that the following services be disabled in all environments unless there is a specific need that requires them to be enabled:⁷⁴

- + Alerter
- + Clipbook
- + FTP Publishing Service
- + IIS Admin Service
- + Messenger
- + NetMeeting Remote Desktop Sharing
- + Routing and Remote Access
- + Simple Mail Transfer Protocol (SMTP)
- + Simple Network Management Protocol (SNMP) Service
- + Simple Network Management Protocol (SNMP) Trap

⁷² For more information on specific services, see the article titled *System Services for the Windows Server 2003 Family and Windows XP Operating Systems*, available at http://www.microsoft.com/technet/prodtechnol/windowsserver2003/technologies/management/svrxpser_7.msp.

⁷³ Because of these issues, NIST recommends setting a service's startup type to Manual only if Manual is the default startup type for the service.

⁷⁴ Windows XP Service Pack 2 is expected to disable the Alerter and Messenger services by default. See Appendix B for additional information on these two services.

- + Telnet
- + World Wide Web Publishing Services.

Each of the NIST security templates will disable all of these services. In addition, the NIST templates disable other services such as Computer Browser, Remote Registry, Task Scheduler, and Terminal Services only for certain environments. It may be challenging, particularly in enterprise environments, to determine which services can be disabled safely. Certain services may be needed only for particular applications. The strategy that best supports functionality is to test each service that appears to be unneeded by setting it to Disabled startup mode and testing all applications. Appendix A includes a list of built-in services that the NIST templates will disable.

To change the startup mode for a particular service, perform the following steps:

1. Click the **Start** menu and choose **Control Panel**.
2. Select **Administrative Tools** and then select **Services**.
3. Click the **Standard** tab view located at the bottom of the window.
4. Double-click the service name (e.g., Clipboard).
5. If the service should be set to Manual or Disabled, click the **Stop** button if the service is started.
6. Set the Startup type to **Automatic**, **Manual**, or **Disabled** and click **OK**.
7. Exit the **Computer Management** tool.

To disable the Universal Plug and Play feature, the steps above should be followed for both the SSDP Discovery Service and the Universal Plug and Play Device Host services.

The procedure for disabling the Remote Assistance feature is different than disabling other services. Although Remote Assistance is a powerful support feature, it also exposes the computer to network based attacks. As such, unless an organizational requirement exists to have it enabled, the following steps should be performed to disable it:

1. Right-click **My Computer** and select **Properties**.
2. Select the **Remote** tab and uncheck the **Allow Remote Assistance invitations to be sent from this computer** and **Allow users to connect remotely to this computer** boxes. Click **OK**.
3. Exit the **Computer Management** tool.

6.6 File Permissions

This section provides general instructions regarding setting permissions through file system access control entries (ACE) and access control lists (ACL) for Windows XP.⁷⁵ The NIST security templates restrict access to over 25 executables, protecting them from unauthorized modification and usage. Additional custom settings may be added that are specific to the environment in which the Windows XP

⁷⁵ Each entry that binds a security identifier (SID) to a set of permissions within an ACL is referred to as an ACE.

machine resides. Changes to an ACL for a specific resource, such as a file or folder, can be made using one of three possible methods:

- + Open the **Properties** window for a resource from its context menu and click on the **Security** tab. It displays the privileges that each user or group has to the resource. The **Advanced** button can be used to set more granular permission rights and additional settings such as file auditing and the owner of the resource.
- + Use the utility **cacls.exe** found in **%SystemRoot%\system32**.⁷⁶ This is a command line interface used to set file ACLs, but it does not set Windows XP security descriptors.
- + Use the **MMC Security Template** snap-in to apply settings from a template.

Windows XP uses an inheritance model for assigning ACEs. An object's ACL can contain ACEs that it inherited from its parent container. For example, a file in an NTFS filesystem can inherit ACEs from the directory that contains it. In addition, an ACE that is directly applied to a file system object is given a higher priority than an inherited ACE. The directly applied ACE overrides any conflicting inherited ACEs.

6.7 Registry Permissions

Windows XP also has permissions for the registry. The NIST template settings set restrictive permissions for several registry keys and values to protect them from unauthorized access and modifications. By default, permission to manipulate the registry is restricted, but because of the value of the registry, it is important to verify that the registry is protected. To do so, perform the following steps:

1. Click **Start** and select **Run**. Type **regedit** and click **OK**.
2. Locate the key
HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Control\SecurePipeServers\winreg.
3. Right-click on **winreg** and select **Permissions**. Ensure that only the **Administrator** has **Full Control**, the **Backup Operators** group has no permissions (other than the special permissions Query Value, Enumerate Subkeys, Notify, and Read Control), and **LOCAL SERVICE** has only **Read** permissions.

6.8 Registry Values

The NIST templates set values for several registry keys not previously mentioned in this section. The following items provide the registry key name and path, describe its purpose, and recommend an appropriate setting.

6.8.1 Debugging

- + **HKLM\Software\Microsoft\DrWatson\CreateCrashDump**.⁷⁷ Setting this value to 0 disables the creation of a memory dump file by the Dr. Watson program debugger.⁷⁸ Memory dumps can

⁷⁶ **%SystemDrive%** refers to the actual partition or hard drive in which Windows XP is installed, typically the **C:** drive. **%SystemRoot%** refers to the folder on **%SystemDrive%** where Windows XP files are installed, typically the **Windows** directory.

⁷⁷ **HKLM** is an abbreviation for **HKEY_LOCAL_MACHINE**.

contain sensitive information such as passwords. See Section 7.9 for additional information on suppressing memory dump file creation.

- + **HKLM\Software\Microsoft\Windows NT\CurrentVersion\AEDebug\Auto.** Setting this value to 0 disables Dr. Watson.

6.8.2 Automatic Functions

- + **HKLM\Software\Microsoft\Windows\CurrentVersion\Policies\Explorer\NoDriveTypeAutoRun.** The autorun feature attempts to automatically run content from a CD when it is placed in the system. If a CD contains malicious content, it could be automatically run. Setting this registry value to 255 disables the autorun feature for all types of drives. The NIST templates establish a similar setting for the same registry key under the HKCU and HKU\DEFAULT trees.⁷⁹
- + **HKLM\System\CurrentControlSet\Services\Cdrom\Autorun.** Setting this value to 0 disables the autorun feature for CDs.
- + **HKLM\Software\Microsoft\Windows NT\CurrentVersion\Winlogon\AutoAdminLogon.** If enabled, this registry value allows the system login to be bypassed by using a password stored in cleartext within the registry. This password may be viewable by local users of the system. Also, an unauthorized party who gains physical access to the system may be able to gain access without providing any authentication. This capability should be disabled by setting the registry value to 0.
- + **HKLM\System\CurrentControlSet\Control\CrashControl\AutoReboot.** Enabling the AutoReboot feature causes the system to restart automatically after a failure or lockup. Some consider this to be undesirable from a security and operational standpoint. For example, if a failure occurs and the system reboots itself, the system's user may not be aware that an operational problem or security breach occurred. This feature can be disabled by setting the registry value to 0.

6.8.3 Networking

The networking settings described in this section modify Microsoft TCP/IP stack settings.

- + **HKLM\System\CurrentControlSet\Services\LanManServer\Parameters\AutoShareWks.** If the File and Printer Sharing for Microsoft Networks service is being used, Windows XP will share all local fixed drives as hidden administrative resources (e.g., C\$, D\$). It is recommended that these shares be disabled unless they are necessary. For example, some software applications may rely on the existence of one of the shares. In addition, in environments in which systems are maintained remotely, the shares may be needed to facilitate the maintenance process. If the shares are not needed, setting this registry value to 0 will suppress them.
- + **HKLM\System\CurrentControlSet\Services\MrxSmb\Parameters\RefuseReset.** Setting this parameter to 1 causes the system to ignore ResetBrowser frames. Such frames can be used to shut down NetBIOS and master browsers and to declare a computer as being the new master browser. Earlier versions of Windows could be attacked through ResetBrowser frames.

⁷⁸ See http://www.microsoft.com/resources/documentation/windows/xp/all/proddocs/en-us/drwatson_overview.mspx for more information on Dr. Watson.

⁷⁹ HKCU is an abbreviation for HKEY_CURRENT_USER. HKU is an abbreviation for HKEY_USERS.

- + **HKLM\System\CurrentControlSet\Services\Tcpip\Parameters\DisableIPSourceRouting.** Setting this parameter to 2 will disable IP packet source routing. Source routing generally has no legitimate purpose and can be used by attackers to redirect packets through a particular intermediate host. This could allow an attacker to view and modify network communications.
- + **HKLM\System\CurrentControlSet\Services\Tcpip\Parameters\EnableDeadGWDetect.** When this value is set to 1, TCP is allowed to perform dead gateway detection. With this feature enabled, TCP may ask IP to change to a backup gateway if a number of connections are experiencing difficulty. An attacker could take advantage of this to trick the system into using a malicious gateway, which could allow the attacker to view and modify data, or to cause a denial of service. Setting this parameter to 0 disables the dead gateway detection feature.
- + **HKLM\System\CurrentControlSet\Services\Tcpip\Parameters\EnableICMPRedirect.** If this feature is enabled, Windows XP will alter its routing table in response to ICMP redirect messages that are sent to it by network devices such as routers. Attackers can spoof ICMP redirect messages to trick systems into routing packets to the attacker's system (or elsewhere), which could permit a third party to intercept sensitive information, breach the system, or cause a denial of service. Therefore, this feature should normally be disabled by setting the registry value to 0.
- + **HKLM\System\CurrentControlSet\Services\Tcpip\Parameters\EnablePMTUDiscovery.** When this parameter is set to 1, TCP attempts to discover the Maximum Transmission Unit (MTU), the size of the largest packet that can be kept intact over the path to a remote host. The NIST security templates set this parameter to 0, which disables the feature and causes an MTU of 576 bytes to be used for all connections that are not made to hosts on the local subnet.
- + **HKLM\System\CurrentControlSet\Services\Tcpip\Parameters\KeepAliveTime.** This is a parameter that controls how often TCP attempts to verify that an idle connection is still intact by sending a keep-alive packet. If the remote system is still reachable and functioning, it acknowledges the keep-alive transmission. Keep-alive packets are not sent by default. This feature may be enabled of a connection by an application. The NIST security templates set the keep-alive time to 300,000 milliseconds (5 minutes).
- + **HKLM\System\CurrentControlSet\Services\Netbt\Parameters\NoNameReleaseOnDemand.** This parameter determines whether the computer releases its NetBIOS name when it receives a name-release request from the network. This could be set to 1 to prevent the system from releasing its name, which protects the system from malicious name-release attacks. The setting is not included in the NIST security templates.
- + **HKLM\System\CurrentControlSet\Services\Tcpip\Parameters\PerformRouterDiscovery.** This parameter controls whether the system attempts to perform router discovery per RFC 1256 on a per-interface basis. All NIST security templates disable this feature by setting the value to 0.
- + **HKLM\System\CurrentControlSet\Services\Tcpip\Parameters\SynAttackProtect.** This feature enables protection against synflood attacks. If the TcpMaxHalfOpen and TcpMaxHalfOpenRetried registry values have been set appropriately, this feature reduces retransmission retries and delayed route cache entry (RCE) creation. Setting this parameter to 1 or 2 enables synflood attack protection; the NIST security templates set this to 2 because it provides more robust protection than setting it to 1.
- + **HKLM\System\CurrentControlSet\Services\Tcpip\Parameters\TcpMaxHalfOpen.** This setting specifies the number of connections permitted in the SYN-RCVD state before SynAttackProtect measures are implemented. The NIST security templates set this value to 100.

- + **HKLM\System\CurrentControlSet\Services\Tcpip\Parameters\TcpMaxHalfOpenRetried.** This setting specifies the number of connections permitted in the SYN-RCVD state for which at least one retransmission of the SYN has been sent, before SynAttackProtect measures are implemented. The NIST security templates set this value at 80.
- + **HKLM\System\CurrentControlSet\Services\IPSEC\NoDefaultExempt.** In Windows XP, IPsec has certain default exemptions to its policy filters. Setting this parameter to 1 removes the exemptions for Kerberos and RSVP traffic.⁸⁰
- + **HKLM\System\CurrentControlSet\Services\Lanmanserver\Parameters\Hidden.** Setting this parameter to 1 prevents the system's Server service from sending out browser announcements, which causes the system to be hidden from the Browser on other systems. This reduces the likelihood that other users on the network will attempt to gain access to the system through Microsoft networking.
- + **HKLM\System\CurrentControlSet\Control\Session Manager\SafeDllSearchMode.** Windows XP searches directories in a particular order when it is looking for a file to execute. By default, Windows searches the current directory before the Windows and system directories. Setting this parameter to 1 causes Windows to search the Windows and system directories before searching the current directory. This is a better security practice because the current directory may be less restrictive than the Windows and system directories. For example, a malicious user on a system could place a Trojan horse in a shared directory. If the default search order is used, another user who attempts to run a program with the same name could inadvertently run the Trojan horse instead. If the suggested search order is used, the Trojan horse would not be run.

6.9 Summary of Recommendations

- + Establish account policies that reduce the likelihood of an attacker guessing or cracking passwords to gain unauthorized access to systems. The policies should balance security, functionality, and usability.
- + Configure the audit policy to record certain types of activity to a log, so that system administrators can review the logs and detect unauthorized activity.
- + Assign user rights following the principle of least privilege.
- + Set additional security options to achieve greater security than the default options provide; examples include limiting the use of blank passwords, renaming the default Administrator and Guest accounts, and specifying which types of authentication may be used.
- + Enable logging for the Application, Security, and System Logs.
- + Remove all users from the Remote Desktop Users and Power Users groups that do not specifically need to be members.
- + Disable all unnecessary services.
- + Disable the Universal Plug and Play feature and the Remote Assistance feature unless they are needed.
- + Use ACLs to restrict access to critical executables and registry entries.

⁸⁰ For more information on this parameter, see MSKB article 810207, *IPSec Default Exemptions Are Removed in Windows Server 2003*, available at <http://support.microsoft.com/?id=810207>.

- + Set registry values that limit debugging and automatic execution of CD-ROM content, as well as configuring networking more securely.
- + Review, customize, test, document, and deploy the NIST security templates to secure the Windows XP systems.

7. Additional Windows XP Configuration Guidance

The previous section of this guide discussed the configuration settings implemented by the NIST templates. This section addresses additional security-related recommendations for Windows XP that are not included in the templates. These recommendations should either be configured manually or applied with the aid of additional .inf or .adm files that are not included with the NIST guide. The recommendations address filesystem security issues, user accounts and groups, auditing, software restriction policies, network interfaces, ICF, and IPsec.

It is important to consider the concept of security for a Windows XP workstation as an ongoing task. The recommendations presented in this section and previous sections do not entail the complete set of possible security considerations and concerns for the entire life cycle of a Windows XP workstation. System administrators and end users should consider every decision made regarding their workstations and what effect that decision might have on its security.

7.1 Filesystem Security

Filesystem security is a very important component of host security. This section describes the filesystems available in Windows XP—NTFS, File Allocation Table 16 (FAT16), and FAT32—and explains the reason NTFS should be used. The Folder Options section of Control Panel contains several settings that are related to filesystem security, such as determining which application should run a file based on its file extension; this section discusses those settings and recommends how they should be set. This information can be particularly helpful in preventing malicious code infections caused by running files with unusual file extensions. In addition, by default, Windows XP systems have registry settings that suppress the display of certain file extensions. This section explains how to find and delete the registry settings so that all filenames are displayed the same way, regardless of file extension. Another topic addressed in this section is supporting the confidentiality and integrity of data through Encrypting File System (EFS).

7.1.1 NTFS

In terms of security, the NTFS filesystem⁸¹ is vastly superior to the other XP filesystem options—FAT16 and FAT32.⁸² Neither FAT16 nor FAT32 provides features for establishing access control for files or encrypting files. Windows XP uses NTFS version 3.1; it is very similar to version 3.0, which is used by Windows 2000. The most notable new features in version 3.1 are disk quotas and file encryption.⁸³ NTFS can also provide highly granular access control for files, folders, and shares, as well as other resources on the system.

To verify that all disk partitions are formatted with NTFS, either use MBSA (described in Section 4.4) or perform the following steps:

1. Right-click **My Computer** and select **Manage**.

⁸¹ More information on NTFS is available from the Microsoft article *Features Available on NTFS Volumes*, located at http://www.microsoft.com/resources/documentation/Windows/XP/all/reskit/en-us/Default.asp?url=/resources/documentation/Windows/XP/all/reskit/en-us/prkc_fil_gywp.asp.

⁸² For a comparison of filesystems, see Charlie Russel's article titled *NTFS vs. FAT: Which Is Right for You?*, available at <http://www.microsoft.com/windowsxp/expertzone/columns/russel/october01.asp>.

⁸³ For more information on the new features in NTFS version 3.1, see MSKB article 310749, *New Capabilities and Features of the NTFS 3.1 File System*, available at <http://support.microsoft.com/?id=310749>.

2. Select the **Disk Management** tool located under **Storage** to verify that the nonremovable partitions are using NTFS. For example, in Figure 7-1, the C: and D: drives are using NTFS, and the G: is using FAT32.

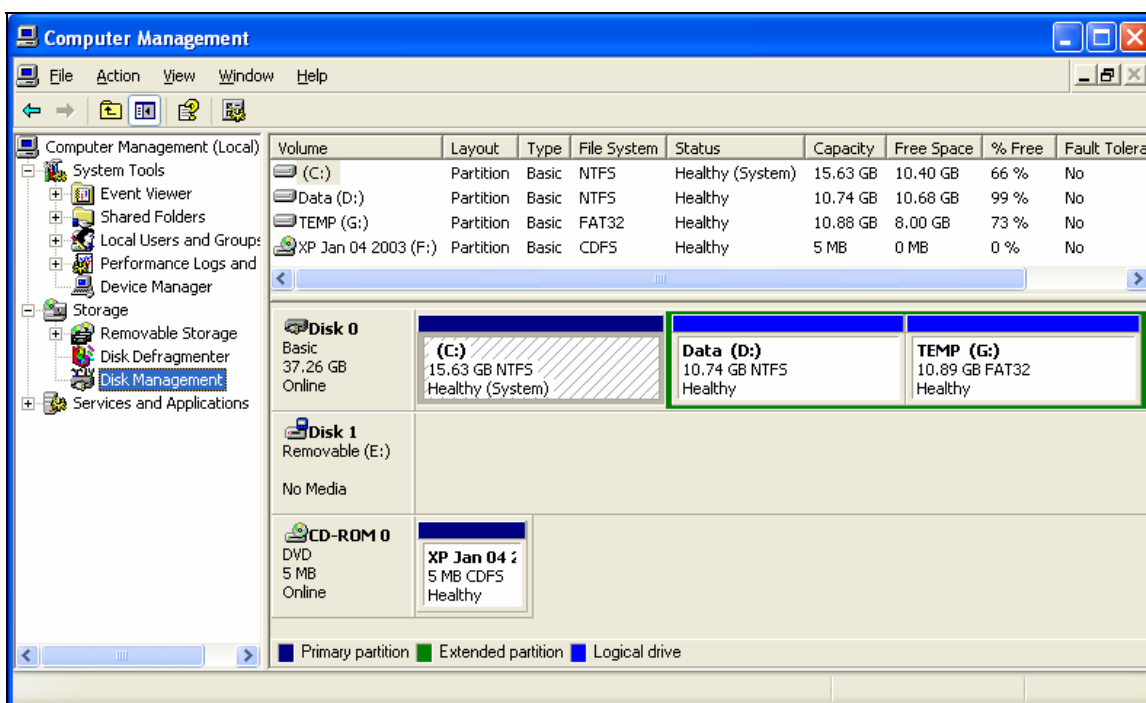


Figure 7-1. Disk Management

In enterprise and high security environments, NIST strongly recommends that existing systems based on FAT partitions should be rebuilt with NTFS, not converted from FAT to NTFS. In other environments, it is preferred to rebuild the system with NTFS, but it is also considered acceptable to perform a FAT to NTFS conversion. Perform the following steps to convert a FAT partition to NTFS:

1. Back up the system.
2. From the Start menu, choose **Run** and type **cmd.exe** to open a command prompt window.
3. Execute the convert command with the appropriate parameters. For example, the following command will convert the D drive to NTFS in a verbose mode: **C:\convert D: /FS:NTFS /V**.

7.1.2 Folder Options

Modifying the Folder Options can greatly improve defenses against malicious code. The system can be configured to show all filenames fully, including their extensions. In addition, the Folder Options contains the associations between file types and the default applications that run each file type. By modifying the associations for file extensions that are often used for malicious purposes, such files will be run by the Notepad application, which effectively neutralizes them. The Folder Options changes described below are highly recommended for every environment. The only caveat is that any file extensions that have a legitimate function in the organization should not be remapped to Notepad, or the functionality may be broken. Perform the following steps to modify the Folder Options:

1. Click the **Start** menu and choose **Control Panel**. Select **Folder Options**.

2. Verify that the **Show common tasks in folders**, **Open each folder in the same window**, and **Double-click to open an item (single-click to select)** radio buttons are selected.
3. Select the **View** tab. Adjust the settings so that they match the check boxes and radio buttons in Figure 7-2.

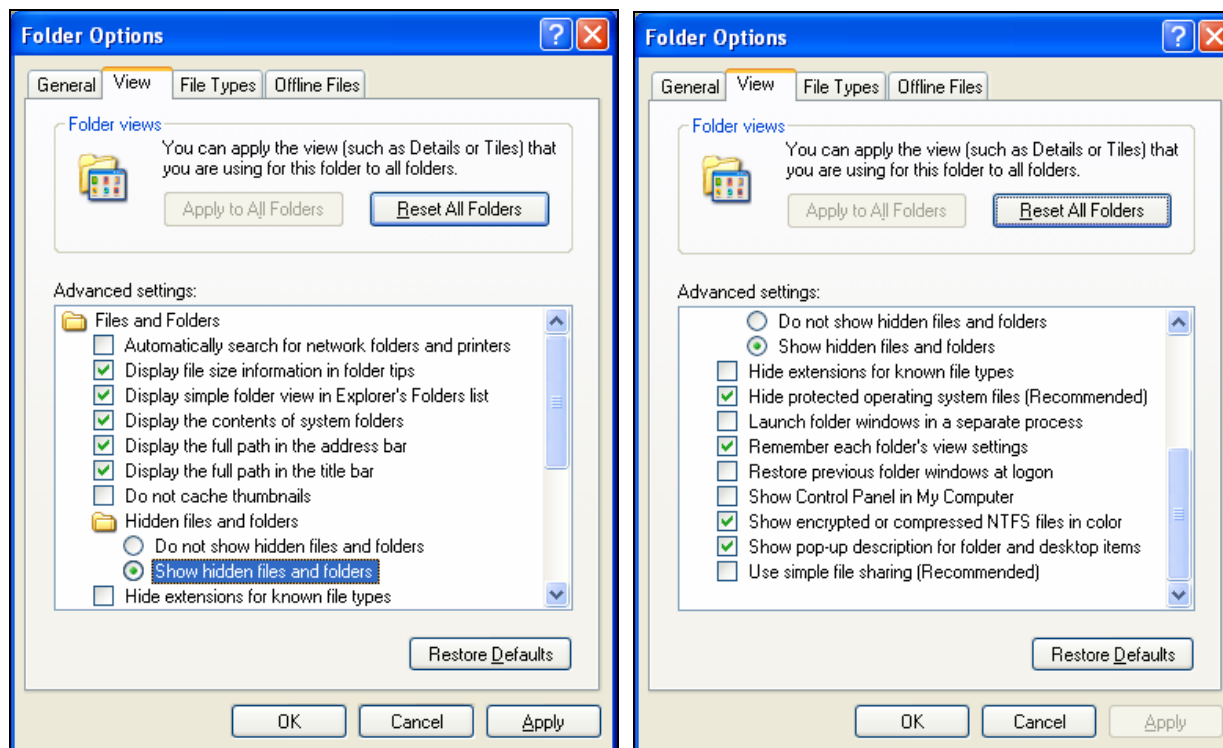


Figure 7-2. Folder Options Dialog Boxes

4. Select the **File Types** tab. Scroll down the registered file types window to select the **JS** extension and click the **Change** button.
5. Select the **Notepad** program and click **OK**.
6. Repeat the previous two steps to change the mapping for the following extensions: **JSE**, **OTF**, **REG**, **SCT**, **SHB**, **SHS**, **VBE**, **VBS**, **WSC**, **WSF**, and **WSH**.
7. Click the **Close** button and click **OK**.

7.1.3 Show Hidden File Types

Some file extensions will continue to remain hidden from the user, even when the **Hide file extension for known file types** setting is disabled. If the **NeverShowExt** registry value is set, it will cause Windows to hide the file extensions for basic Windows file types, regardless of other user configuration choices. For example, the **.lnk** extension associated with Windows shortcuts remains hidden even after a user has turned off the option to hide extensions. Attackers have taken advantage of this feature for several years

by sending users malicious files that use one of the hidden file extensions.⁸⁴ The users do not see the file extension and are fooled into thinking the file is safe. Although it is strongly recommended from a security perspective to display all file extensions, and it will have no impact on system functionality, users may be confused by the change. For example, most icons on the Start menu will show a **.lnk** extension. In an enterprise, administrators may decide to compromise by showing all file extensions except **.lnk**.

To prevent all file extensions from being hidden, perform these steps:

1. Click the **Start** menu, select **Run**, and enter **regedit** to open the registry editor. Click **OK**.
2. Click the My Computer icon and press **Ctrl+F**. Clear the **Keys** and **Data** check boxes. Type in the value **NeverShowExt**. Click the **Find Next** button. When the value is found, right-click and select **Delete**. Click on **Yes** to confirm the deletion.
3. Press **F3** to find the next occurrence of the value and delete it. Repeat this until no occurrences are found.
4. Exit **regedit** and restart the computer.

7.1.4 EFS

The Encrypting File System (EFS) is designed to address numerous concerns regarding the integrity of data stored on Windows XP systems. EFS is designed to keep data private and unreadable to unauthorized users. Malicious users with physical access to a Windows XP computer can boot it into a file system other than NTFS, effectively bypassing all security provided by NTFS. This gives the malicious user access to all unencrypted files residing on the computer's hard drive. EFS was designed to use file encryption to reduce the risks associated with mobile computing and unauthorized physical access. Because EFS only provides encryption to files and folders on NTFS partitions, the data is no longer protected when it is placed elsewhere (e.g., e-mail attachment, CD-ROM) or transmitted over the network. Other protection measures should be used, such as a virtual private network (VPN) or third-party file encryption software.

EFS, which is based on public-key encryption, integrates tightly with the public key infrastructure (PKI) features that have been incorporated into Windows XP. The actual logic that performs the encryption is a system service that cannot be shut down. This program feature is designed to prevent unauthorized access, but has an added benefit of rendering the encryption process completely transparent to the user. Each file that a user may encrypt is encrypted using a randomly generated file encryption key (FEK).

EFS can be used to encrypt individual files and folders on NTFS volumes.⁸⁵ The default configuration of EFS allows a user to encrypt and decrypt files immediately without any administrator interaction. When a folder is encrypted, all new files created there will be encrypted, as will any files moved there, so that users do not need to manually encrypt each new file. EFS can also encrypt shared files on a network resource and has the ability to decrypt the files even when not connected to that resource.

⁸⁴ One example of this is described in CERT@/CC Incident Note IN-2000-07, available at http://www.cert.org/incident_notes/IN-2000-07.html.

⁸⁵ One limitation of EFS to consider when choosing to encrypt an entire volume is that the volume upon which Windows XP is installed cannot be encrypted in its entirety because the EFS decryption routines are not available until late in the boot process. This would lead the OS to try to boot but fail because necessary parts of the OS were decrypted and could not be read to finish the boot process.

7.1.4.1 EFS Implementation Example

EFS can be implemented by three means: the **Properties** window of a folder, the **My Computer** window, and **Windows Explorer**. When implementing EFS, it is recommended that an encryption folder be created for sensitive files. This example process describes how to implement EFS for a sample folder from within the **My Computer** window.

1. From the **My Computer** window, create a new folder and name it **Sample Folder**. Double-click on **Sample Folder**.
2. Right-click on **Sample Folder** and click on **Properties**, then click the **Advanced** button. This should open the **Advanced Attributes** window.
3. Check the **Encrypt contents to secure data** box and click on **OK**. Click on **OK** again. The color of **Sample Folder** should have changed, indicating that all files added to this folder should automatically be encrypted.
4. Run Notepad and enter some text. Save the file as **Sample.txt** in **Sample Folder**.
5. Double click on **Sample Folder** to view its contents. The color of the **Sample.txt** file name should indicate that it is encrypted.
6. Right-click on **Sample.txt** and click on **Properties**, then click the **Advanced** button. This confirms that the file is encrypted.

7.1.4.2 EFS Data Recovery

The EFS process is transparent to the end user because EFS is integrated with NTFS. Other users with similar or lesser privileges could not open another user's EFS-encrypted file because they do not have the FEK. In some cases, access restrictions such as these require authorized users to implement data recovery procedures. For example, if the key-pair used to encrypt a file was corrupted, the file would be rendered inaccessible without a Data Recovery Agent (DRA).

Windows XP EFS provides integrated data recovery support. The Windows XP security infrastructure enforces the configuration of data recovery keys so well that EFS is inaccessible unless one or more recovery keys are created. This is typically done during the installation process. By default, the recovery agent is the **Administrator**. EFS will allow recovery agents to configure public keys that are used to enable file recovery. Only the file's randomly generated encryption key is available using the recovery key, not a user's private key. This action ensures that no other private information is revealed accidentally to the recovery agent. In a domain environment, the domain administrator can easily add an EFS recovery agent account to the role of a recovery agent via group policy. This feature can mitigate the risk of lost data as a result of the original user losing his decryption credentials. In a standalone environment, a recovery agent needs to be manually defined, or no one will be able to decrypt the information if encryption credentials are lost.

When considering implementing EFS in any environment, special consideration needs to be given to how keys and DRAs will be managed. If data needs to be retained for a long period of time while encrypted, long-term retention of appropriate keys to decrypt the data must be addressed. Depending on the nature of the information and the need to retain it, losing the ability to decrypt the files could seriously affect the mission of the organization. When considering the use of DRAs, it is essential that organizationally

sensitive information not be accidentally disclosed to people who should not have access to the information.

The recovery keys contained in the **Encrypted Data Recovery Agents** folder can be backed up to removable media by logging into the system with the built-in **Administrator** account and performing the following actions:

1. Open the **Encrypted Data Recovery Agents** folder located within the **Group Policy** snap-in.
2. Right-click the Certificate that should be exported.
3. Choose **All Tasks**, then **Export**.
4. Save the file to removable media.
5. For maximum security, the EFS recovery certificate can be removed from the computer after a successful backup by selecting the **Delete Private Key if the Export is Successful** check box. This is highly recommended for mobile systems.

NIST recommends that EFS be deployed only when the confidentiality of the information in question is critical or when the system faces significant physical threats. For example, EFS may be a solution for securing data on mobile laptops that are at high risk of being stolen or lost and desktops that contain sensitive information. Any decisions on EFS deployment should take into account the key management issues discussed in this section. If key management is not handled effectively, the use of EFS could contribute to the loss of valuable information. EFS should definitely be considered for SOHO and high security environments; it may also be beneficial on some systems in enterprise environments if key management can be handled well.

On systems that are using EFS, Syskey should also be used to establish a startup key that protects the private keys used for EFS.⁸⁶ By default on all Windows XP systems, Syskey is enabled and stores the machine-generated random key in pieces across the registry on the local system. An administrator can reconfigure Syskey to store the random key on a floppy disk instead of the local system, or to specify an administrator-chosen password as the key.⁸⁷ The system then cannot be booted without inserting the removable media or typing in the specified password, respectively.

7.1.5 Storage Device Sanitization and Disposal

Organizations should properly sanitize all storage devices, including fixed devices (e.g., hard drives) and removable devices and media (e.g., optical discs, magnetic disks, flash memory), before reusing them or disposing of them. If storage devices are not properly scrubbed of data, information could be accessed by unauthorized parties. Windows XP includes a command line utility called **cipher** that is intended for use with EFS, but can also be used independent of EFS to scrub data from unused portions of disks.⁸⁸ By using the **/w** switch, an administrator can use cipher to do three passes. Although this may be convenient

⁸⁶ Microsoft recommends using Syskey with EFS in the Windows XP Professional Resource Kit section titled *Strengthening Key and File Security*, available at http://www.microsoft.com/resources/documentation/windows/xp/all/reskit/en-us/prmb_efs_mjtv.asp.

⁸⁷ More information on changing the Syskey modes is available from the Windows XP Professional Resource Kit section titled *Enabling the Startup Key*, available at http://www.microsoft.com/resources/documentation/windows/xp/all/reskit/en-us/prmb_efs_zbxx.asp.

⁸⁸ For more information on using the cipher utility to clear data, see the Microsoft article titled *Encrypting File System in Windows XP and Windows Server 2003*, which is available at <http://www.microsoft.com/technet/prodtechnol/winxppro/deploy/cryptfs.msp>.

in some cases, it is generally recommended to acquire a third party tool that can do at least seven passes when overwriting data. Alternatives to overwriting data include degaussing and physical destruction of storage devices.⁸⁹ Regardless of the method chosen, organizations should maintain a log that lists each cleaned device and documents how the data was removed.

7.2 User Accounts and Groups

This section discusses the importance of securing user accounts and groups. Windows XP installs several user accounts by default, so to prevent misuse of these accounts, they should be disabled or replaced with equivalent accounts. In addition, administrative-level accounts should be used only for system administration tasks, which means that a user-level account should be created for daily operation of the system. Another important task is to create a password reset disk, which can be used to regain administrator-level access to the system if the administrator password is forgotten. The password reset disk should be stored in a physically secure location. (The use of password reset disks is not recommended for managed environments.) This section will discuss each of these topics.

7.2.1 Built-in Accounts

Default user accounts are often used in exploits against various computer systems, including Windows XP. By disabling default user accounts, it will be more difficult for attackers to gain access to a computer. This is not a foolproof solution, but it will discourage some attackers who would rather look for easy targets. The Guest account has historically been a common means by which to gain remote access to a computer, but it is disabled by default in Windows XP. Once an attacker has gained guest-level access, the attacker can try to elevate their privileges to further exploit the machine. Attackers also attempt to use the default Administrator account, so some organizations may choose to create a new account with Administrator-level privileges and then disable the original Administrator account. Normally, the user account created during installation has Administrator-level privileges, but this should still be verified.⁹⁰ NIST recommends that the built-in Administrator and Guest accounts be disabled and renamed on all Windows XP systems.⁹¹ This can be done by modifying the NIST security templates and pushing the settings down as a policy. To make the changes manually, perform the following steps:

1. Click the **Start** menu and select **Control Panel**. Click the **Switch to Classic View** link located in the left pane and double-click the **Administrative Tools** folder.
2. Double-click the **Computer Management** shortcut.
3. Expand the **Local Users and Groups** item and select the **Groups** folder.
4. A list of groups should be displayed in the right pane. Double-click the **Administrators** group.
5. Confirm that the group is composed of only two accounts: the built-in Administrator account, and the account that is being used to harden the system. If a user account is not present, create a user account and add it to the Administrators group. Do not disable the Administrator account until a user account has been added to the Administrators group. Upon completion, the Administrators group should contain only two accounts. Click **OK** to continue.

⁸⁹ More information on sanitizing, degaussing, and destroying storage devices is available from the Department of Defense's *National Industrial Security Program Operating Manual*, DoD 5220.22-M, located at <http://www.dss.mil/isec/nispom.pdf>.

⁹⁰ In managed environments, it is common for only security and system administrators to have administrator-level access to the system and for no one to have guest-level access. Users should be made aware of what they can and cannot do on their own systems (e.g., installing software) and instructed on how to request changes that require administrator-level access.

⁹¹ Even if the built-in Administrator account is disabled, it can still be used to log on to the system if it is booted in Safe Mode.

6. Under **Local Users and Groups**, select the **Users** folder.
7. Right-click the **Administrator** account, select **Rename**, and enter the new name. Creating a relatively obscure name for the account makes it less likely to be targeted by an attacker.
8. Right-click the renamed administrative account, select **Set Password**, and assign a strong password composed of a mix of digits, special, and upper and lower case characters, as shown in Figure 7-3. Click **OK**.

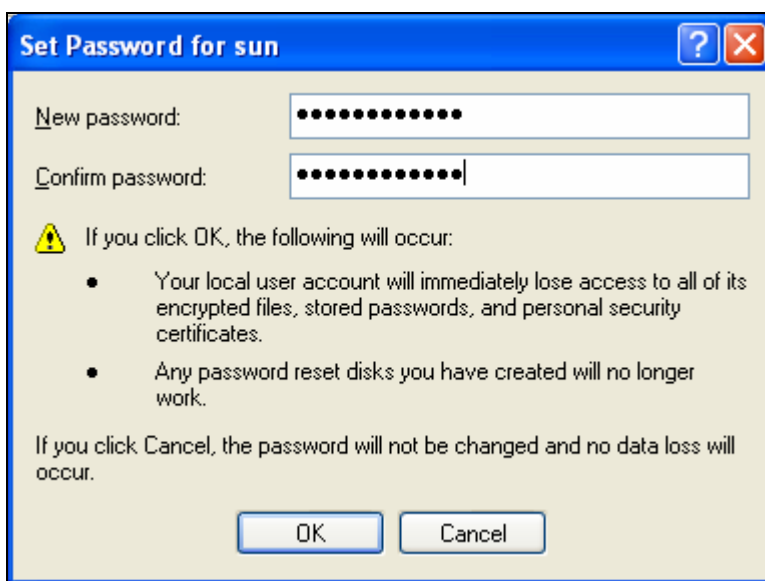


Figure 7-3. Set Password Dialog Box

9. Double-click the renamed administrative account and delete the description field or enter a new description. Verify that the **User cannot change password**, **Password never expires**, and **Account is disabled** boxes are checked. Click **OK**.
10. Rename the Guest account and set a strong password for the default guest account, composed of digits, special, and upper and lower case characters.
11. Double-click the renamed guest account and verify that the **User cannot change password**, **Password never expires**, and **Account is disabled** boxes are checked. Delete the description field or enter a new description. Click **OK**.
12. Disable all other built-in accounts that are not needed. Table 7-1 lists all the default Windows XP accounts.⁹² For each account, right-click on it, select **Properties**, check the **Account is disabled** box, and click **OK**.

⁹² In Windows systems, each user account is associated with a unique security identifier (SID). Each SID is a sequence of letters and digits that can be used to identify an account even if the associated username has changed. For example, SID S-1-5-domain-500 is used by the Administrator account; even if Administrator is renamed, the SID remains the same. More information on Windows XP user accounts, including SIDs, is available from the *Well-Known Security Identifiers* listing at http://www.microsoft.com/resources/documentation/Windows/XP/all/reskit/en-us/prnc_sid_cids.asp.

Table 7-1. Default Windows XP User Accounts

User Account Name	Description	Default SID
Administrator	Built-in account for computer/domain administration	S-1-5-domain-500
Guest	Built-in account for guest access to the computer/domain	S-1-5-domain-501
HelpAssistant	Account required for providing remote assistance for the computer	N/A (variable)
User-created install account	Account initially created during the installation	N/A (variable)
Support account	Account for the Help and Support Service	N/A (variable)

NIST recommends that administrators periodically review user accounts and disable those that have been inactive for 90 days, as well as disabling temporary accounts after 30 days. Organizations should also follow procedures to disable accounts as soon as they are no longer needed (e.g., user leaves the organization, user's responsibilities change). Disabled accounts should be deleted after a specific period of time to release resources and prevent unneeded accounts from accidentally being re-enabled.

7.2.2 Built-in Groups

Windows XP has several groups that are known as special groups. Windows XP manages the memberships of these groups automatically. Two special groups are of particular interest from a security perspective: **Authenticated Users** and **Everyone**. **Authenticated Users** includes all accounts (except Guest and Anonymous accounts) that have been authenticated. **Everyone** includes all local and domain-based accounts that access the system. In earlier versions of Windows, Anonymous users were included in the Everyone group, which often gave unauthorized users access to systems. In Windows XP, Anonymous logins are no longer part of the Everyone group.

By default, Windows XP also contains several local groups. Local groups differ from special groups because administrators can manage the membership of each local group but cannot alter the membership of special groups. Table 7-2 describes each local group, explains the privileges associated with the group, and lists the accounts that belong to the group by default.

Table 7-2. Default Local Windows XP Groups

Group Name	Description
Administrators	Administrators have complete and unrestricted access to the computer. The default members of this group are the built-in Administrator account and the account that was initially created on installation. Only those accounts that require administrator-level access should be members of this group.
Backup Operators	This group can override security restrictions for the sole purpose of backing up and restoring files, including files protected by EFS. There are no default members of this group. Users who back up their own data should not be placed in this group; the group is intended to be used by a backup administrator or automated backup process to preserve any and all data on the system, regardless of other security protections. Only trusted users and processes performing such backups should be placed in this group.
Guests	This group has the same access as the Users group, except that Guests cannot view the OS event logs. The Guest account is the only default member of this group.
HelpServicesGroup	Users in this group can troubleshoot problems by using certain utilities. These users can log on locally or remotely to the system. The Support account is the only group member by default. Only those accounts that are being used to provide support should belong to this group.

Group Name	Description
Network Configuration Operators	Members of this group have administrative privileges only for managing the configuration of networking features. There are no default members of this group.
Power Users	This group is granted some administrative privileges. The purpose of this group is that Power Users need rights that standard users do not have so that Power Users can run legacy applications. However, Power Users can often leverage their limited rights to gain full administrator rights. There are no default members of this group. NIST highly recommends that the Power Users group not be used and that the privileges granted to standard users be adjusted slightly to compensate for any legacy application needs.
Remote Desktop Users	This group has rights to log on to the computer remotely through Remote Desktop Services. There are no default members of this group. Only users who currently need to access the system through Remote Desktop should belong to this group.
Replicator	This group was used in Windows NT 4.0 to support file replication in a domain configuration. It is not used in Windows XP; there are no default members of this group, and it should remain empty.
Users	This group has restricted rights that should prevent them from changing the security posture of the system. Users have sufficient privileges to perform their authorized functions, but not enough privileges to gain access to other users' data or to damage other users' applications. The default members of this group are all Authenticated Users and INTERACTIVE users. In addition, when a new user account is created with the predefined Limited account type, it is placed in the Users group. All users who need standard access to the system should be placed in the Users group.

7.2.3 Daily Use Accounts

It is strongly recommended that an additional account belonging only to the Users group be created for each user and used to operate the box on a daily basis (e.g., checking e-mail, surfing the Web, operating office automation applications). Accounts belonging to the Administrators group should be used only to perform system management tasks, such as installing system updates and application software, managing user accounts, and modifying system and application settings. In addition, users should not share accounts; having a separate account for each user provides protection for data and supports accountability by tying actions to a specific user account, which is linked to a particular person. To create a new standard user account for daily use, perform the following steps:

1. Right-click in the right pane and select **New User**. Enter the user name, full name, and a description, and click the **Create** button. The user will be prompted to enter a password at the next logon.
2. Verify that the user belongs to only the **Users** group.
3. Assign a strong password to the administrative account, if that has not already been done.
 - a. Click the **Start** menu, choose **Control Panel**, and click the **User Accounts** applet.
 - b. Select the administrative account.
 - c. Click **Change my password**.
 - d. Type the current password, enter the new password and type it once more to confirm it. Click the **Change Password** button.

7.2.4 Local Session Protection

It is important to provide protection against unauthorized local access to Windows XP systems. One such control is to lock the current user's session through automatic or manual means. A screen saver can lock a session automatically after the system has been idle for a certain amount of minutes, requiring the user's password to be entered before unlocking the system. NIST strongly recommends using a password-enabled screen saver on all Windows XP systems that need protected from unauthorized access. To do so, perform the following steps:

1. Right-click on the desktop and select **Properties**.
2. Click on the **Screen Saver** tab.
3. Set the **Screen saver** to something other than (**None**).
4. Set the **Wait** time to a maximum of 15 minutes.
5. Check the box marked **On resume, password protect** to require the user's password to unlock the system.
6. Click **OK**.

There are several ways in which users can manually lock their sessions. The simplest method is to hold down the **Windows logo** key on the keyboard and then press the **L** key. This locks the system and displays the **Unlock Computer** dialog box, which prompts the user to enter a username and password to unlock the system. Other methods of locking sessions are dependent on settings for the Welcome screen and Fast User Switching features, which are related to logging in to Windows XP systems. When the Welcome screen is enabled, usernames are displayed on the screen, and a person clicks on the appropriate username and types in a password to log in. When the Welcome screen is disabled, users have to type in their usernames instead of clicking on them. As described in Section 3.1.2, the Fast User Switching (FUS) feature is only available if the Welcome screen is enabled and the system is not part of a domain. Under those circumstances, FUS can be enabled or disabled. FUS allows two users to be logged on simultaneously by using the Switch User feature; however, the current user does not have access to the other user's session.

To enable or disable the Welcome screen and FUS features, perform the following steps:

1. From the **Start** menu, choose **Control Panel**.
2. Click on **User Accounts**, then click on **Change the way users log on or off**.
3. Check or uncheck the options called **Use the Welcome screen** and **Use Fast User Switching** as appropriate, then click on **Apply Options**.

If the Welcome screen is disabled, the user can lock the system by hitting CTRL+ALT+DEL to open the **Windows Security** dialog box, then clicking on the **Lock Computer** box. This locks the session and displays the **Unlock Computer** dialog box.

7.2.5 Password Reset Disk

For a system in a non-managed environment, a password reset disk could be created for the administrative account and stored in a physically secure area. The disk can be used if the password for the

administrative account is forgotten or otherwise lost. If a current password reset disk is unavailable and no one can gain administrative access to the system, the system will likely need to be rebuilt at some point (unless a third-party tool is used to reset the account password).⁹³ For example, it may no longer be possible to keep the system patched and updated; also, if a user account becomes locked because of too many failed login attempts, it may not be possible to unlock it. Having a password reset disk is most important for systems that have only one enabled administrator account or contain important data, such as typical SOHO systems, as well as systems using EFS. In managed environments, particularly those in which data is not supposed to be stored on desktop systems, password reset disks are often not used. The administrative overhead of creating and storing tens of thousands of password reset disks is unreasonable, and often a domain administrator account also has access to the system. For environments in which a password reset disk is needed, perform the following steps to create it:

1. From the User Accounts window, select the **administrative account**.
2. In the Related Tasks box, click on the **Prevent a forgotten password** link.
3. The Forgotten Password Wizard should start. Click on Next.
4. Select the **3 1/2 Floppy (A:)** drive as the destination where the password key will be stored and click **Next**.
5. Enter the current administrator password and click **Next**.
6. The wizard will create the disk. When the creation is completed, click **Next**.
7. When the wizard has completed, click **Finish**.
8. Store the password disk in a physically secure area.

Should the administrative account password be forgotten, perform the following steps to use the password reset disk:

1. At the logon screen, select the **administrative account** and press the Enter key or click the **right arrow** button located to the right of the password field.
2. Click the **Use your password reset disk** link.
3. Click **Next**.
4. Select the **3 1/2 Floppy (A:)** drive and click **Next**.
5. Enter the new password, retype it again to confirm, and click **Next**.
6. Click **Finish**.
7. At the logon screen, select the administrator account and enter the newly created password to authenticate.
8. The current Password Reset Disk is no longer valid. Recreate the Password Reset Disk so that it contains the new password.

⁹³ Using a third-party tool to reset the password for an account will render EFS data for that account inaccessible.

7.3 Auditing

Section 6.2.1 describes some of Windows XP's system auditing capabilities. Windows XP can also audit other things, such as actions performed on individual files in an NTFS filesystem. For example, auditing could be configured to log all successful and failed changes to operating system and application program files, or to log all accesses to critical data files. This section discusses file auditing and also explains how to access the Event Viewer, a tool for reviewing audit logs. Another topic addressed in this section is the importance of time synchronization in regard to auditing.

7.3.1 Individual File Auditing

Windows XP provides a method to monitor access to any file stored on an NTFS-formatted partition. This auditing method is typically used to monitor access to sensitive files. To configure individual file auditing, perform the following steps:

1. Right-click on the file, and then select **Properties**.
2. Select the **Security** tab and click on **Advanced**.
3. Select the **Auditing** tab and click on **Add** to specify a user or group.
4. As shown in Figure 7-4, select the file permission access attributes that should be audited by clicking in the appropriate **Successful** and **Failed** check boxes.

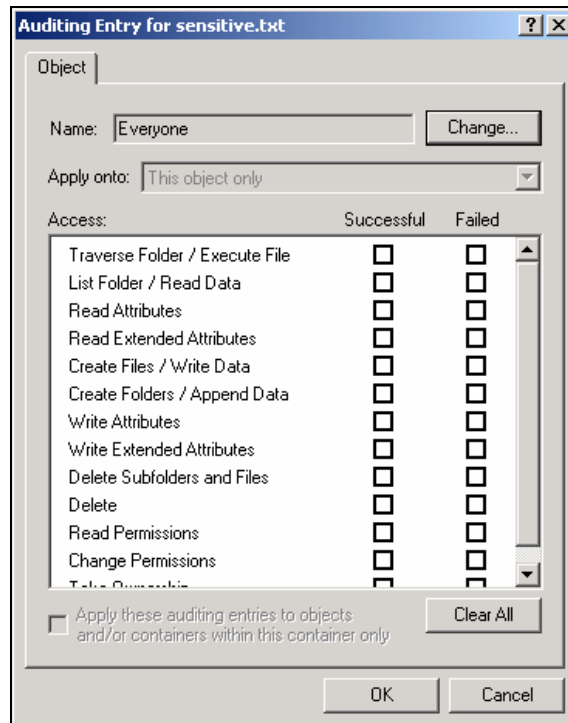


Figure 7-4. File Auditing

5. The output of the system auditing can be viewed using the Event Viewer. The Event Viewer can be accessed using the **Computer Management** container located in the **Administrative Tools** folder.

7.3.2 Reviewing Audit Logs

Windows XP includes a built-in MMC snap-in tool called **Event Viewer** for reviewing application, security, and system logs. These logs contain audit records, among other types of information. The logs on each system should be reviewed on a regular basis to identify anomalous activity.⁹⁴ In enterprise environments, this process should be automated through the use of special software on each system, such as a host-based intrusion detection system that monitors the logs, or through the use of centralized log servers that receive copies of the log entries from each system and analyze them for signs of suspicious activity.

To manually review audit logs using the Event Viewer, perform the following steps:

1. From the **Start** menu, choose **Control Panel**.
2. Select **Administrative Tools**, and then choose **Computer Management**.
3. Expand the **System Tools** listing, then expand the **Event Viewer**. This displays the three types of logs: **Application**, **Security**, and **System**. Review the audit records, which are stored in the **Security** log.

7.3.3 Time Synchronization

It is important to configure Windows XP systems to synchronize their clocks on a regular basis with accurate time sources. If audit logs contain evidence of an attack and the system's clock is inaccurate, it will make the analysis of the attack more difficult and may also weaken the evidentiary value of the logs. Time synchronization is also convenient because users do not need to manually adjust the clock to compensate for inaccuracies in the system's timekeeping. Windows XP uses the Network Time Protocol (NTP) for time synchronization. By default, systems that participate in an AD synchronize automatically with the DC. To configure a Windows XP system that is not an AD member to perform time synchronization, perform the following steps:

1. From the **Start** menu, choose **Control Panel**.
2. Select **Date and Time**. Click on the **Internet Time** tab.
3. Check the **Automatically synchronize with an Internet time server** check box.
4. Enter the name or IP address of a time server (e.g., time-a.nist.gov). Most enterprise environments have one or more internal time servers; if such a server is available, it should be specified instead of an external time server.
5. Click on **Update Now** to confirm that time synchronization is working properly.
6. Click on **OK**.

7.4 Software Restriction Policy

Software restriction policies provide administrators with a policy-driven mechanism that identifies software running on their systems and controls the ability of that software to execute. Using a software restriction policy, an administrator can prevent unwanted applications from running, including viruses and

⁹⁴ In high security environments, audit logs should be reviewed at least weekly, preferably daily.

Trojan horses, as well as software that is known to cause conflicts when installed. A software restriction policy is either set to Unrestricted or Disallowed. The Unrestricted setting allows all programs to run except those that are specified as forbidden. This is best suited to organizations in which users require great flexibility in which programs they can execute. By defining known problematic software, unapproved applications, and known Trojan horses, this setting can protect a host from known threats. The Disallowed setting means that no programs can run except those on the list of programs that are allowed to run. This is much more labor intensive because all needed applications must be identified, but it provides excellent protection against unapproved programs executing. The Disallowed setting is appropriate for the highest security need situations, while the Unrestricted setting is better suited for most other cases. Software restriction policies are most likely to be used in high security environments.

The Software Restriction Policy has five components:

- + **Security Levels.** This is used to set the default rule as **Disallowed** or **Unrestricted**.
- + **Additional Rules.** This lists all exceptions to the default rule. The rules can only reference files listed as Designated File Types. In addition, when more than one rule has been defined that would match a given program, the first matching rule will be selected.
- + **Enforcement.** This item provides options regarding the policies. One option will apply the policy not only to executables, but also to dynamic link library (DLL) files. This option is set by selecting **Apply software restriction policies to the following**, then **All software files**. Another option allows local administrators to run software that other users cannot. This option is set by selecting **Apply software restriction policies to the following users**, then **All users except local administrators**.
- + **Designated File Types.** This provides a way to tell the software restriction policies, which file extensions indicate an executable. By default, several common executable file extensions are already set. File extensions can be added and deleted from the list as needed.
- + **Trusted Publishers.** This lists the software publishers that are trusted, such as local administrators. The system can verify the authenticity of the publisher's digital certificate before adding the publisher to the Trusted Publishers list.

To create and configure a software restriction policy, perform the following steps:

1. Log in as a local administrator or domain administrator, or as a user who has been delegated the authority to create software restriction policies.
2. Click **Start**, then select **Run**. In the **Open** field, type **mmc** and click **OK**.
3. The **Console** window will now appear. Click on **File**, then **Add/Remove Snap-in**, then **Add**. Select **Group Policy** and click on **Add**.
4. Click **Finish**.
5. In the Console window, expand **Local Computer Policy**, then **Computer Configuration**, then **Windows Settings**, then **Security Settings**.
6. If the **Security Settings** folder does not contain **Software Restriction Policies**, a new policy must be created. To do so, click **Action**, then select **Create New Policies**. Return to the **Security Settings** folder.

7. From the **Security Settings** folder, click on **Software Restriction Policies** and then the **Security Levels** folder.
8. There are two options: **Disallowed** (software will not run, regardless of the access rights of the user), and **Unrestricted** (software access rights are determined by the access rights of the user.) Double-click on **Disallowed**. Click **Set as Default**, and then click **OK** to continue.
9. To open the **Local Security Policy**, click on **Start**, then click **Control Panel**. Click **Administrative Tools**, and then click **Local Security Policy**. This should open the Local Security Settings window.
10. Expand **Software Restrictions Policies** and click on the **Additional Rules** folder. The right pane should show the four default rules.
11. Right-click on the background of the right pane and add rules appropriate to the installation from the following choices:
 - + **Certificate Rule.** A Certificate Rule uses a certificate to verify the authenticity of the program to be run. By default, certificate-based **Software Policy** rules are disabled. To enable **Certificate Rules**, the registry must be edited:
 - Click **Start**, click **Run**, type **regedit**, and then click **OK**.
 - Edit the key
HKEY_LOCAL_MACHINE\SOFTWARE\Policies\Microsoft\Windows\Safer\Code Identifiers.
 - Select the value **AuthenticodeEnabled** and change the value data from 0 to 1.
 - Click **OK**, then click **File** and **Exit** to close **regedit**.
 - + **Hash Rule.** The Hash Rule only allows a program to execute if the hash for that file matches the known good hash that the OS is expecting. This protects against a program being replaced by a modified version containing malicious code. Hashes are not dependent on the filename or location; therefore, if a file is renamed or moved, execution will still be permitted or denied based on the hash. If the size of the file changes, the hash will become invalid, and execution will be denied. It may be resource-intensive to identify all programs that may be needed on each system and to maintain and distribute current hashes for all programs.
 - + **Internet Zone Rule.** This rule applies to Windows Installer packages only. It provides a way to restrict what software can be run from remote sites.
 - + **Path Rule.** The Path Rule permits the user to designate files that are allowed to run based on path restrictions. The path can be an entire directory or a specific file. When defining a Path Rule, special consideration should be taken when the security level is set to **Disallowed** and the path specifies the Windows folder because this might prevent the execution of programs essential to Windows XP. One crucial limitation of the Path Rule is that if an entire directory has been defined, all programs located in that directory will be allowed to execute. This means that malicious or unauthorized programs placed in the authorized path will execute.

7.5 Securing Network Interfaces

By default, Windows XP includes a number of network protocols and components that are not usually required in all environments. For example, the Microsoft File and Printer Sharing service and Microsoft client are preinstalled on most Windows XP installations. These features allow the user to share resources on a network with other Windows systems, but they may increase the system's exposure level. The user should operate the system with only the necessary network protocols and disable the Microsoft networking client/server components if they are not being used.

7.5.1 Unneeded Networking Components

As previously discussed in Section 4.1.2.1, network clients, services, and protocols that are not needed should be disabled. This reduces the likelihood that the system will be compromised or misused. Use caution when disabling any network components, because this can cause required functionality to break, sometimes in unexpected ways. The following components are candidates for being disabled:

- + The **QoS Packet Scheduler** is designed to prioritize network traffic by application or service over slow network connections. Most applications are not QoS-aware, and some are incompatible with QoS, so the QoS Packet Scheduler is not beneficial in most situations. In general, the QoS Packet Scheduler should be disabled unless testing in a specific environment demonstrates that it is beneficial at alleviating network bandwidth issues.
- + Uninstalling the **File and Printer Sharing for Microsoft Networks** service will prevent other systems from connecting to the local file and printer shares; it will not prevent users of the local system from connecting to remote file and printer shares. Therefore, leave this service installed only if the local system shares its resources (e.g., files, printers) and users on other systems need to connect to these resources through the network, or necessary applications (e.g., MBSA) require the service.
- + Uninstalling the **Client for Microsoft Networks** will prevent the local system from establishing network connections to other systems' Microsoft file and printer shares. Most systems will require the client to be enabled, so it should generally only be disabled if the system has particularly high security needs.

To disable any of these components, perform the following steps:

1. Click the **Start** menu, choose **Control Panel**, select **Network Connections**, and double-click on **Local Area Connection**.
2. Click the **Properties** button.
3. Select the component and click the **Uninstall** button.
4. Click **Yes** to proceed.

7.5.2 Use of Port 445

If the system needs to connect to other Windows systems' file shares, it can use either the traditional port 139 or the new port 445. By default, it will try to connect on port 139 before trying port 445, so disabling port 445 should result in exposing only the conventional port 139. Before implementing this system modification, refer to local policies to confirm that it is acceptable and appropriate for the environment. To disable the use of port 445, perform the following steps:

1. Click the **Start** menu and select **Run**. Open **regedit** and click **OK**.
2. Locate the following entry:
HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\NetBT\Parameters.
3. Right-click in the right pane, select **New**, and click **DWORD value**. Name the value **SmbDeviceEnabled** and assign it a value of **0**.
4. Exit **regedit**.

7.5.3 TCP/IP Configuration

The default TCP/IP configuration contains a few settings that should be altered to improve security. However, each setting could have a negative effect on the functionality that the system provides, so it is very important to understand the impact of changing each setting. The following steps for altering the settings include an explanation of the significance of each setting:

1. Click the **Start** menu, choose **Control Panel**, select **Network Connections**, and double-click on **Local Area Connection**.
2. Click the **Properties** button.
3. Select **Internet Protocol (TCP/IP)** and click the **Properties** button.
4. Click the **Advanced** button.
5. Select the **DNS** tab and uncheck the **Register this connection's addresses in DNS** box. If the system is registered in DNS, this could unnecessarily provide information about the system to an unauthorized party who can access DNS information. However, disabling this setting on an AD member will prevent the system from working properly.
6. Select the **WINS** tab. Uncheck the **Enable LMHOSTS lookup** box unless it is needed for compatibility with legacy systems.
7. Select the radio button marked **Disable NetBIOS over TCP/IP** unless this functionality is required by the system. Generally, NetBIOS over TCP/IP is only needed if the system needs to configure with legacy systems running Windows NT, Windows 95, or Windows 98. If NetBIOS over TCP/IP is enabled, the system's resources may be exposed to network-based attacks.
8. Click **OK**, then **OK**, then **Close**, then **Close**.

7.6 Internet Connection Firewall

The ICF is the built-in Windows XP stateful firewall.⁹⁵ It can be configured to restrict all inbound connections, but cannot filter or block any outbound connections. ICF tracks traffic that originates from the local host by maintaining a table of all the communications. An inbound packet is permitted if a matching entry in the table shows that the network connection has been initiated from the local host. The primary benefit of ICF is in limiting network connections to a computer, thus reducing the exposure of the computer to network based attacks, such as worms.

⁹⁵ Windows XP Service Pack 2 contains a new version of the ICF called Windows Firewall, which is described in Appendix B.

Enabling the ICF may negatively impact functionality. For example, it prevents users from browsing Network Places and sharing local file and printer resources. It may prevent some programs from working (e.g., remote assistance, network games, multimedia file sharing applications). ICF can also increase the difficulty of troubleshooting problems with connecting to network services. Another potential problem is that some people might get a false sense of security from the presence of ICF and not maintain the security of the system properly (e.g., not applying security patches).

When a Windows XP Professional computer is a member of a domain, the domain administrator can enable a group policy that prevents the use of ICF while the computer is connected to the corporate network. This enables the laptop to use enterprise network resources with no added complexity for the user or the network administrator. When the laptop is being used at home or a public Internet connection hot spot, ICF is available because the group policy does not apply.

Despite the possible drawbacks of ICF, the security benefits far outweigh them, so NIST recommends implementing ICF. However, ICF should not be implemented if a third-party firewall is already being used to protect the system. To enable and configure ICF, perform the following steps:

1. Click the **Start** menu and choose **Control Panel**. Select **Network Connections** and double-click **Local Area Connection**. Click the **Properties** button.
2. Click the **Advanced** tab. Select the **Protect my computer and network by limiting or preventing access to this computer from the Internet** check box. Click the **Settings** button.
3. Verify that none of the check boxes under the **Services** tab are checked (enabled).
4. Select the **ICMP** tab. Verify that none of the check boxes are selected.
5. As shown in Figure 7-5, select the **Security Logging** tab. Check the **Log dropped packets** and **Log successful connections** boxes. Enter 32767 KB in the **Size limit** field. Click **OK**.

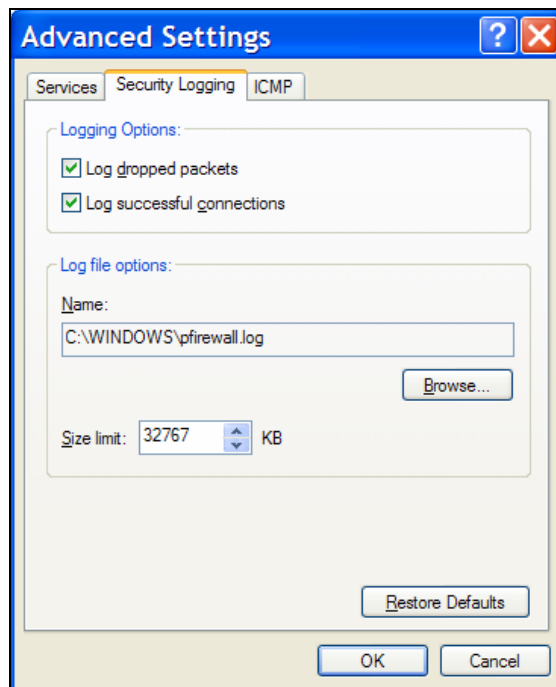


Figure 7-5. Internet Connection Firewall dialog box

6. By default, the log file **pfirewall.log** is located in the **C:\Windows** directory. The log file is text-based and contains several pieces of data for each log entry, including the date and time the packet was received, the status (e.g., connection opened, closed, dropped), the IP, the source and destination IP addresses and ports, the packet size, various TCP header values, and the ICMP type and code. The log file should be reviewed periodically to look for suspicious network activity.

In high security environments or other situations where tracking network activity is particularly important, the Microsoft-provided Port Reporter service may be useful.⁹⁶ It can log TCP and UDP port usage, the processes associated with each port, and other related information. The log entries created by Port Reporter may be very helpful when investigating an incident or troubleshooting network application-related problems.

7.7 IPsec

IPsec is designed to encrypt data as it travels between two computers or a computer and a gateway, protecting the data from modification and interpretation. IPsec filtering can also be used to control network traffic flows by restricting and allowing unencrypted traffic for specific ports and protocols. For example, IPsec filtering (as well as network device filters, such as firewall rulesets or router access control lists) could permit Microsoft networking protocols (e.g., CIFS) to be used only with certain trusted hosts, or to prevent the use of applications such as instant messaging and peer-to-peer file sharing that use known port numbers.⁹⁷ Using IP filtering, IPsec examines all IP packets for addresses, ports, and transport protocols. Rules contained in local or group policies tell IPsec to ignore or secure specific packets, depending on addressing and protocol information.

By default, certain traffic is not filtered or protected by Windows XP IPsec; these kinds of traffic are known as the default exemptions and, minus broadcast and multicast, they only apply to IPsec transport mode filters:

- + **Resource Reservation Protocol (RSVP).** Used for QoS of IP traffic. Required for QoS to work with Windows XP.
- + **Internet Key Exchange (IKE).** IKE source and destination User Datagram Protocol (UDP) port 500 traffic used in many VPN configurations.
- + **Kerberos.** Main authentication protocol used in native Windows XP domain environments. Kerberos traffic uses a TCP and UDP source and destination port 88.
- + **Broadcast.** Network traffic going from one sender to many receivers. Used for various networking functions.
- + **Multicast.** Traffic sent from one sender to multiple receivers in the address range of 224.0.0.0 to 239.255.255.255.

A registry value can be set to remove most of these exemptions and allow filtering on the above traffic; **HKLM\SYSTEM\CurrentControlSet\Services\IPSec\NoDefaultExempt** this DWORD value registry

⁹⁶ More information on installing, configuring, and using the Port Reporter service is available from MSKB article 837243, *Availability and Description of the Port Reporter Tool*, at <http://support.microsoft.com/?id=837243>. This article also provides a link to where Port Reporter is available for download.

⁹⁷ Some applications use dynamic port numbers, which IPsec filtering cannot address effectively. Also, some applications can use well-known port numbers, such as a peer-to-peer file sharing application that functions on port 80, which is normally associated with Web traffic. Blocking the use of such a port could inadvertently break necessary functionality. A proxying firewall may be effective at identifying and stopping the use of undesired applications, regardless of the ports they use.

key can be set to 0 = default exemptions are still active or 1 = disable the exemption for RSVP and Kerberos in Windows XP. Broadcast and multicast cannot be restricted.

The steps to add or edit IPsec filters are listed below.

1. In **IP Security Policies** from the **Local Security Policy** tool, double-click the policy that should be modified.
2. To add an **IPsec filter list**, click Add on the **IP filter list** tab. To reconfigure an existing **IP filter list**, double-click the **IP filter list**.
3. In **IP Filter List**, do one of the following:
 - To use the IP Filter Wizard to create a filter, confirm that the **Use Add Wizard** check box is selected, and then click **Add**.
 - To create a filter manually, clear the **Use Add Wizard** check box, then click **Add**.
 - To reconfigure an existing filter, double-click the filter.
4. On the **Addressing** tab, select the **Source Address** as shown in Table 7-3:

Table 7-3. Enable TCP/IP Port Filtering

Select	To Secure Packets From
My IP Address	All IP addresses on the computer for which the filter is being configured.
Any IP Address	Any computer.
A specific DNS Name	The Domain Name System (DNS) name specified in <i>Host name</i> . The DNS name is resolved to its IP addresses, and then filters are automatically created for the resolved IP addresses. This option is available only when creating new filters.
A Specific IP Address	The IP address specified in <i>IP Address</i> .
A Specific IP Subnet	The IP address specified in <i>IP Address</i> and the subnet mask specified in <i>Subnet Mask</i> .

5. Click **Destination Address** and repeat the previous step for the destination address.
6. Under **Mirrored**, select the appropriate setting from the following list:
 - To automatically create two filters based on the filter settings (one for traffic to the destination and one for traffic from the destination), select the **Mirrored** check box.
 - To create a single filter based on the filter settings, clear the **Mirrored** check box.
 - To create a filter for an IPsec tunnel, clear the **Mirrored** check box. Create two filter lists: one that describes the traffic to be sent through the tunnel (outbound traffic) and another that describes the traffic to be received through the tunnel (inbound traffic). Then create two rules that use the inbound and outbound filter lists in the policy.

7. On the **Description** tab, in **Description**, type a description for this filter; for example, specify to which computers and traffic types it applies.
8. If additional IP filtering by a specific protocol or port number is required, configure advanced filter settings on the **Protocol** tab.

If IPsec is being implemented to protect the confidentiality and integrity of the data, it is recommended that digital certificates be used instead of pre-shared keys for authentication. Pre-shared keys can be used during testing but should not be deployed in an operational environment because they provide a lower degree of security.

7.8 Wi-Fi Network Configuration

Windows XP provides built-in support for wireless networking (also known as wireless fidelity, or Wi-Fi).⁹⁸ By default, Windows XP systems use Wi-Fi in *infrastructure mode*, which means that they are clients connecting to a wireless access point (AP). (The alternative is *ad hoc mode*, which means that wireless clients connect to each other without an AP. Ad hoc mode is rarely used.) The most commonly used Wi-Fi protocol, IEEE 802.11b, has several known security issues involving authentication and encryption. To provide a more secure Wi-Fi solution, vendors have created a new standard called Wi-Fi Protected Access (WPA). WPA provides more robust authentication and key management, mandatory encryption (including optional AES support), and data integrity checking. NIST recommends that Windows XP Wi-Fi users use WPA instead of 802.11b whenever possible.⁹⁹ This involves installing a new network adapter driver and Microsoft's WPA Wireless Security Update¹⁰⁰ on each Windows XP system, updating APs to support WPA, and configuring Wi-Fi clients and APs to take advantage of WPA's features.¹⁰¹

7.9 Memory Files

On Windows XP systems, the contents of memory may be stored to various types of files, including memory dump files, paging files, and hibernation files. Each of these files may inadvertently record sensitive information (e.g., passwords, decrypted data) that could subsequently be retrieved by an attacker. As described below, restricting the use or retention of these files can help to prevent unauthorized access to systems and data:

⁹⁸ For more information on general Wi-Fi security, see NIST SP 800-48, *Wireless Network Security: 802.11, Bluetooth and Handheld Devices*, available at <http://csrc.nist.gov/publications/nistpubs/index.html>. Windows-specific Wi-Fi references include *Securing Wireless LANs—A Windows Server 2003 Certificate Services Solution* (available at <http://www.microsoft.com/technet/security/prodtech/win2003/pkiwire/swlan.mspix>) and *Securing Wireless LANs with PEAP and Passwords* (available at <http://www.microsoft.com/downloads/details.aspx?FamilyID=60c5d0a1-9820-480e-aa38-63485eca8b9b&displaylang=en>).

⁹⁹ The Federal Information Processing Standard (FIPS) 140-2, Security Requirements for Cryptographic Modules, is mandatory and binding for federal agencies that have determined that certain information be protected via cryptographic means. For more information about FIPS validated products, refer to the following page: <http://csrc.nist.gov/cryptval/aes/aesval.html>.

¹⁰⁰ See MSKB article 815485, *Overview of the WPA Wireless Security Update in Windows XP*, for more information on the WPA update, including a link to the update itself. The article is available at <http://support.microsoft.com/?id=815485>.

¹⁰¹ The Microsoft TechNet article titled *Windows XP Wireless Deployment Technology and Component Overview* provides detailed guidance on establishing and securing wireless connections. It is available for download at <http://www.microsoft.com/technet/prodtechnol/winxppro/maintain/wificomp.mspix>. The Microsoft TechNet article titled *Configuring Windows XP IEEE 802.11 Wireless Networks for the Home and Small Business* provides a good overview of the topic; it is available at <http://www.microsoft.com/technet/prodtechnol/winxppro/maintain/wifisoho.mspix>. Microsoft's Wi-Fi home page, located at <http://www.microsoft.com/windowsserver2003/technologies/networking/wifi/default.mspix>, contains links to various Wi-Fi related articles, resources, and software updates.

- + **Memory Dump File.** A *memory dump file* is created during an error condition to store the contents of memory for subsequent troubleshooting. Unless specifically needed for troubleshooting purposes, dump files should not be created.¹⁰² This action can be accomplished by doing the following:
 1. Open the **Control Panel** and select **System**.
 2. Select the **Advanced** tab. In the **Startup and Recovery** section of the **Advanced** tab, click the **Settings** button.
 3. In **Write Debugging Information**, select **(none)** from the drop down list. Click **OK**. Note that if dump files are required in the future, this option is easily reversed.
- + **Paging File.** A *paging file* is a file that holds some of the contents of Windows XP's memory. This could include sensitive information. When the system is shut down and restarted, Windows XP does not reuse the old contents of the paging file. Because an attacker that gains physical access to the machine could potentially access sensitive information in the paging file, it is recommended to configure Windows XP to clear the paging file every time the system is shut down.¹⁰³ All of the NIST security templates are configured to enable this option. See Section 6.2.3 for instructions on setting this security option manually.
- + **Hibernation File.** A *hibernation file* is created to preserve the current state of a system (typically a laptop) by recording memory and open files before shutting off the system. When the system is next turned on, the state of the system is restored. Organizations may want to consider disabling the use of hibernation files for high security systems. To do so, perform the following steps:
 1. Open the **Control Panel** and select **Performance and Maintenance**.
 2. Click on **Power Options** and then click on the **Hibernate** tab.
 3. Uncheck the **Enable hibernate** option, and click **Apply**.

7.10 Summary of Recommendations

- + In enterprise and high security environments, rebuild existing systems based on FAT partitions with NTFS, instead of converting FAT to NTFS.
- + Modify the **Folder Options** to improve defenses against malicious code by showing all filenames fully and modifying the associations for file extensions often used for malicious purposes.
- + Deploy EFS when the confidentiality of the information in question is critical or when the system faces significant physical threats. Any EFS deployment should take into account key management issues; if key management is not handled effectively, the use of EFS could contribute to the loss of valuable information.
- + On systems that are using EFS, Syskey should be used to establish a startup key that protects the private keys used for EFS.

¹⁰² For more information, see MSKB article 307973, *How to Configure System Failure and Recovery Options in Windows*, available at <http://support.microsoft.com/?id=307973>, and article 254649, *Overview of Memory Dump File Options for Windows 2000, for Windows XP, and for Windows Server 2003*, available at <http://support.microsoft.com/?id=254649>.

¹⁰³ For more information, see MSKB article 314834, *How to Clear the Windows Paging File at Shutdown*, available at <http://support.microsoft.com/?id=314834>. One caveat with this setting is that it causes systems to reboot more slowly, particularly if they have large amounts of RAM.

- + Sanitize all storage devices, including fixed devices and removable devices and media, before reusing them or disposing of them.
- + Create a separate user-level account for each person performing daily operation of a system. Use administrative-level accounts for system administration tasks only.
- + In non-managed environments, create a password reset disk for the system and store it in a physically secure location.
- + Disable and rename the built-in Administrator and Guest accounts.
- + Use a password-enabled screen saver to protect the system from unauthorized local access.
- + Review audit logs on a regular basis.
- + Use ICF to restrict inbound network connections unless the system is already protected by a third-party host-based firewall.
- + Use WPA instead of 802.11b whenever possible.
- + Configure the system not to create dump files, unless they are specifically needed for troubleshooting purposes.
- + Configure the system to clear the paging file every time the system is shut down.

8. Application Specific Security Configuration Guidance

This section addresses security configuration tasks for six types of applications that are commonly used on Windows XP systems: productivity application suites, e-mail clients, Web browsers, antivirus software, personal firewalls, and spyware detection and removal utilities.¹⁰⁴ Examples of security configuration tasks include telling an application to download updates automatically on a weekly basis, disabling unnecessary functionality, and enabling options that force users to approve certain actions, such as accepting a cookie in a Web browser. The purpose of this section is to highlight the most important elements of security configuration for each type of application and provide guidance on implementing some of the security-related settings. Most of the settings in this section are specifically intended to provide protection against viruses, worms, Trojan horses, and other types of malicious code.¹⁰⁵ When configuring applications, administrators and users should also comply with local policy regarding the use of macros, mobile code (e.g., Java, JavaScript, ActiveX), browser plug-ins, and other types of code that may pose an increased security risk.

Although the settings described in this section have been tested against the NIST security templates, organizations should carefully test the settings before deploying them across an organization to ensure that they are sufficiently strong for the organization's needs and that they do not inadvertently interfere with other functionality. Also, it is recommended to perform a system backup before installing or reconfiguring software, because these actions could modify system files, the Windows registry, or other critical system elements. It is important to maintain a functional backup copy of the system in case of an error. Section 4.2 includes information on performing system backups.

8.1 Productivity Application Suites

A *productivity application suite* refers to a set of integrated applications that provides several different types of functionality, such as word processing and spreadsheets. Typically, each application within the suite has a similar interface, and many features are provided by two or more applications in the suite. Productivity applications covered in this section are Microsoft Office and OpenOffice.

8.1.1 Microsoft Office 2003

There are several versions of Microsoft Office 2003; each includes Excel, Outlook, PowerPoint, and Word, while some also include Publisher and Access.¹⁰⁶ Microsoft regularly releases updates and patches for Microsoft Office and other Microsoft applications. As described in Section 4.3, the process for acquiring and installing updates to Microsoft applications is different from that for Windows XP itself. For example, Microsoft offers a separate Web site just for Microsoft Office downloads.¹⁰⁷ Administrators should ensure that all Microsoft applications are kept current with patches and updates. Also, at the end of a Microsoft Office installation, the user is given the option to check for any updates and install them.¹⁰⁸

Macros in Microsoft Office have been used for malicious code propagation. As such, it is important to take measures to increase the security of Office products to macro vulnerabilities. The following steps should be taken:

¹⁰⁴ The applications in this section are by no means a complete list of applications to install on Windows XP systems, nor does this guide imply any endorsement of certain products.

¹⁰⁵ For more information on malicious code, please refer to NIST SP 800-28, *Guidelines on Active Content and Mobile Code*, available at <http://csrc/publications/nistpubs/index.html>.

¹⁰⁶ The Microsoft Office Online Home Page is located at <http://office.microsoft.com>.

¹⁰⁷ The Microsoft Office Downloads Home Page is located at <http://office.microsoft.com/OfficeUpdate/default.aspx>.

¹⁰⁸ This installation feature should only be used if it is consistent with local policy; this is particularly important for managed environments.

1. Open Microsoft Word.
2. Select **Tools**, then **Macros**, then **Security**.
3. Change the Security Level from **High** to **Very High**.

This process should be repeated for each application in the Office 2003 suite, as this setting is not shared between the applications. The only difference is that the maximum **Security Level** in Publisher is **High** rather than **Very High**.

One new feature of Office 2003 is the ability to collaborate with other people via a **Shared Workspace** or **Share Point** site. Unless this feature is needed, it should be disabled by performing the following steps:

1. Open Microsoft Word.
2. Select **Tools**, then **Options**.
3. Select the **General** tab and click the **Service Options** button.
4. Deselect the check boxes for **The document is part of a workspace or SharePoint site** and **There is important status information regarding the document**.

8.1.2 OpenOffice 1.1.1

OpenOffice is a free productivity suite (based on Sun Microsystems' StarOffice suite) that is intended to provide a cross-platform alternative to the Microsoft Office suite. The code base for OpenOffice is available and can be modified by anyone. Because of this, it is particularly important to ensure that binaries are only obtained from trusted sources. The best place to find a trusted source is via the OpenOffice Web site.¹⁰⁹

Because it is a cross-platform application, OpenOffice is not tightly integrated into Windows XP, which provides some measure of protection against exploitation of Windows XP resources through it. However, since OpenOffice attempts to provide interoperability between OpenOffice and Microsoft Office users, it is possible that certain malicious code for Microsoft Office products might also adversely affect OpenOffice. The following options should be configured to ensure better security in OpenOffice:

1. Start OpenOffice.
2. Select **Tools** and **Options**.
3. Select the **Security** option. This should display a configuration screen similar to that shown in Figure 8-1.
4. Ensure that the **Run macro** option is set to **According to path list**. This works in conjunction with the **Path list** settings below it.
5. Ensure that **Confirm in case of other document sources** is checked.
6. Check the option to **Show warning before running**. This prevents OpenOffice from running macros without first informing the user and confirming that the macro should be run.

¹⁰⁹ The OpenOffice Web site is located at <http://www.openoffice.org>.

7. OpenOffice also relies on Java for some of its functionality.¹¹⁰ If Java has been installed and will be used with OpenOffice, ensure that the Java **Security checks** option is checked.

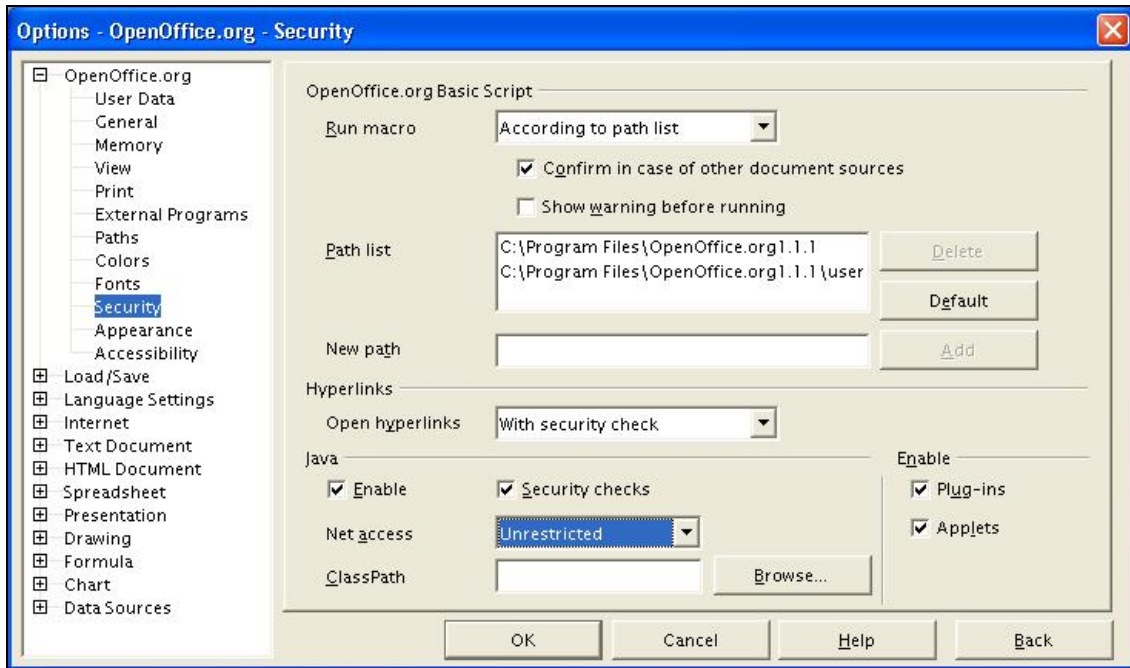


Figure 8-1. OpenOffice Security Settings

8.2 Web Browsers

The following sections discuss how to secure several popular Web browsers: Microsoft Internet Explorer, Netscape Navigator, Mozilla, and Firefox. Since Web browsers are capable of parsing active code in many forms, including JavaScript, ActiveX, and Java, malicious individuals often take advantage of this to attack systems, distribute malicious code, or otherwise negatively impact systems. For example, certain types of cookies deposited on a user's system can be used to track the user's browsing habits and report them to an external server. Therefore, organizations should carefully consider the possible implications of enabling these functions.

8.2.1 Microsoft Internet Explorer 6.0

Microsoft Internet Explorer (IE) is installed as a default component of Windows XP and is closely integrated with it.¹¹¹ Because of this, an exploitation of IE can seriously impact the underlying Windows XP installation, so it is critical to stay current with all IE updates. As described in Section 4.3, IE updates can be acquired through the Windows Update and Automatic Updates features.¹¹²

¹¹⁰ OpenOffice does not provide a Java virtual machine, so if Java is needed for OpenOffice, it needs to be acquired and installed separately.

¹¹¹ The Internet Explorer Home Page is located at <http://www.microsoft.com/windows/ie/default.asp>.

¹¹² This feature should only be used if it is consistent with local policy; this is particularly important for managed environments.

IE uses a capabilities/trust model called Zone Security. In this model, Web sites are permitted to perform certain actions based on their locale (Internet, Local Intranet, Trusted Sites, or Restricted Sites). Each locale has an assigned security level (High, Medium, Medium-Low, or Low). Users can modify the security level for each zone, but IE will warn them if they attempt to assign a locale a security level lower than the recommended minimum level. Each security level causes certain functions to be enabled, disabled, or require manual confirmation from the user before executing. Although it would be ideal to turn off all scripting, this is not practical because many Web sites rely on active scripting for proper functionality. The following steps attempt to strike a balance between usability and security for scripting:¹¹³

1. Open Internet Explorer.
2. Select **Tools**, then **Internet Options**.
3. Click on the **Security** tab.
4. With the Internet zone highlighted, click the **Custom Level** button.
5. Make the following modifications to the Internet zone:
 - + Under **ActiveX controls and plug-ins**, set **Script ActiveX controls marked safe for scripting** to **Disable**.
 - + Under **Scripting**, set **Active scripting** to **Disable**. This will disable all scripting, including ActiveX. If this impacts required functionality, change the setting to **Prompt**.
 - + Under **Scripting**, set **Scripting of Java applets** to **Disable**.
6. Click on **OK** to return to the Internet Options box, then click **OK**.

IE contains many other security-related settings.¹¹⁴ Guidance on implementing a few of particular interest is as follows:

1. Open Internet Explorer.
2. Select **Tools**, then **Internet Options**.
3. Click on the **Advanced** tab.
4. Under **Security**, check the box for **Check for server certificate revocation**. This causes IE to verify that a Web site's digital certificate has not been revoked before accepting it as legitimate and current.
5. Under **Security**, check the box for **Empty Temporary Internet Files folder when browser is closed**. This causes IE to delete temporary files after the browser session is finished; these files could inadvertently contain sensitive information.
6. Click on the **Privacy** tab, then click the **Advanced** button.

¹¹³ Microsoft also provides the Internet Explorer Administration Kit (IEAK), a tool to customize IE for a moderate to large-size organization with these types of settings already configured. The IEAK is available for download at <http://www.microsoft.com/windows/ieak/default.asp>.

¹¹⁴ Windows XP SP2 will add a popup blocking feature to IE.

7. Check the **Override automatic cookie handling** box. This allows different settings to be made for handling first-party and third-party cookies.
8. Change the **Third-party Cookies** setting from **Accept** to **Prompt**. This setting causes IE to prompt the user to accept each third-party cookie that is presented to the system.

8.2.2 Netscape Navigator 7.1

Netscape Navigator 7.1 is the Web browser component of the larger Netscape Communicator package.¹¹⁵ When installing Netscape Communicator, only those components that are needed should be installed. Components that are less likely to be needed are as follows:

- + Mail & Instant Messaging
- + Quality Feedback Agent
- + Radio@Netscape
- + Sun Java 2
- + Viewpoint Media Player
- + Winamp.

Updates to the Netscape Navigator Web browser and other components are published through new releases of the Communicator package. These often include enhancements to current features and new features, as well as fixes for security vulnerabilities. Netscape offers an automatic update feature that checks for updates to the software and prompts the user before performing any updates.¹¹⁶ To enable this feature, perform the following steps:

1. Open Netscape.
2. Select **Edit**, then select **Preferences**.
3. Expand the **Advanced** option.
4. Select **Software Installation**. Check the options for **Enable software installation** and **Check for updates**.
5. Under **Update Notifications**, select the radio button for **Weekly**. This should cause the software to check for updates on a weekly basis.

Netscape Navigator offers many other security features. The following steps explain how to configure some of the most significant ones:

1. Open Netscape.
2. Select **Edit**, then select **Preferences**.
3. Expand the **Privacy & Security** option.

¹¹⁵ The home page for Netscape Communicator is located at <http://channels.netscape.com/ns/browsers/default.jsp>.

¹¹⁶ This feature should only be used if it is consistent with local policy; this is particularly important for managed environments.

4. Select **Images**.
5. Check the box next to **Do not load remote images in Mail & Newsgroup messages**. One of the benefits of enabling this setting is that it prevents spam messages from using small images within e-mails to track which users have opened them.
6. Under the **Privacy & Security** option, select **Popup Windows**.
7. Check the box next to **Block unrequested popup windows**. This can prevent unwanted advertisements, as well as deceptive popups that can trick users into such actions as downloading malicious code.
8. Under the **Privacy & Security** option, select **Passwords**.
9. Check the box next to **Use encryption when storing sensitive data**. This feature requires the user to set a master password.
10. Under the **Privacy & Security** option, select **Master Password**.
11. Click **Change Password** to generate a master password that will be used when Netscape encrypts sensitive data stored locally (e.g., stored passwords, digital certificates, private keys).

8.2.3 Mozilla 1.6

Mozilla is a free open source package, largely developed by volunteers, that is an offshoot of Netscape.¹¹⁷ Mozilla 1.6 includes a Web browser, an e-mail client, and an Internet Relay Chat (IRC) client. The goal of the Mozilla project to provide a standards-compliant cross-platform Web browser that is open to all. Because Mozilla is very similar to Netscape Navigator, the guidance presented in Section 8.2.2 can also be applied to Mozilla.

8.2.4 Firefox 0.9

Firefox is a branch of the Mozilla project.¹¹⁸ Unlike Mozilla and Netscape Communicator, Firefox is only a Web browser. Although Firefox is related to Mozilla, it has modified the interface and several of the configuration options. The following changes should be made from the default Firefox 0.9 configuration to improve security and privacy:

1. Open Firefox.
2. Select **Tools**, then **Options**.
3. Select **Privacy**. This displays the configuration screen shown in Figure 8-2.
4. Expand the **Cookies** option.
5. In the **Enable Cookies** section, check the box next to **for the originating Web site only**.

¹¹⁷ The Mozilla Web site is located at <http://www.mozilla.org/>.

¹¹⁸ The Firefox home page is located at <http://www.mozilla.org/products/firefox>.

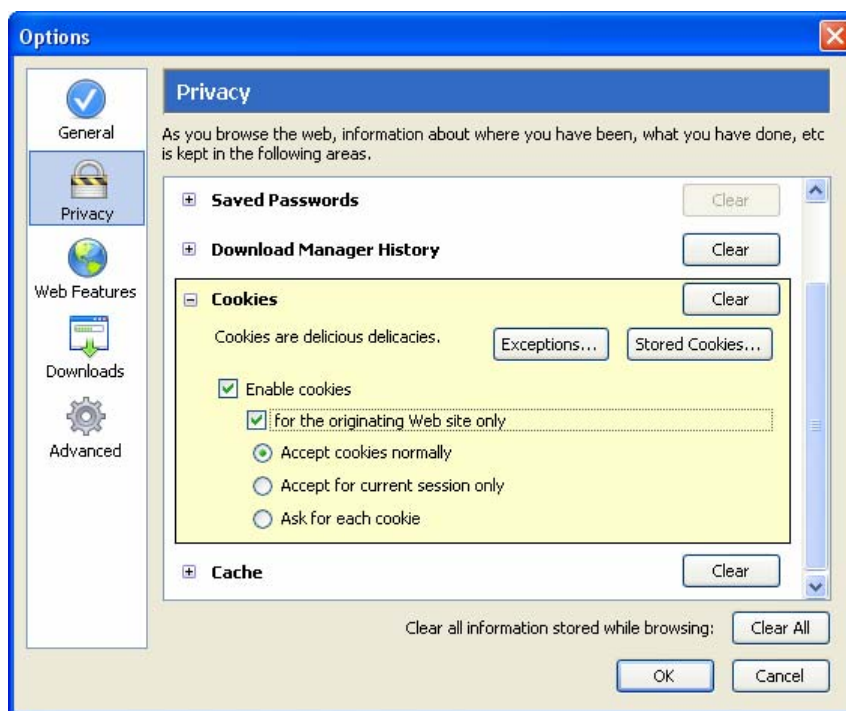


Figure 8-2. Firefox Privacy Settings

8.3 E-mail Clients

E-mail has become a primary means for business and personal communication, as well as malicious code propagation. Careful configuration of e-mail clients is important not only to protect a given computer, but also to prevent the propagation of viruses and worms from the computer to others. Securing e-mail applications involves using antivirus scanning software, raising user awareness of sound e-mail security practices, restricting privileges on e-mail attachment directories,¹¹⁹ and properly configuring e-mail clients, including anti-spam mechanisms.¹²⁰ This section focuses on the proper configuration of several popular e-mail applications: Microsoft Outlook, Outlook Express, Eudora, Netscape, Mozilla, and Thunderbird. To operate an e-mail application in a secure manner, it is recommended that the software be patched regularly¹²¹ and that the execution of active code be restricted.

8.3.1 Microsoft Outlook 2003

Microsoft Outlook 2003 is installed as part of the default installation of Office 2003.¹²² It is primarily designed to be used in enterprise environments, but is also suitable for any other environment where an e-mail client is required. Since Outlook is part of the Office 2003 suite and relies heavily on IE, it is critical that Outlook be kept current with all patches. Outlook 2003's default security settings can be adjusted to

¹¹⁹ Configuring e-mail attachment directories so that files in them cannot be executed (e.g., removing the Execute right from the directories) can prevent certain types of malicious attachments from being run on systems. A user would have to manually move such a file to an unprotected directory and then run it to infect the system. All users should be made aware of this and instructed on the accepted methods for handling attachments.

¹²⁰ Spam can negatively impact security in several ways. For example, some spam contains malicious content that could infect users' systems; other spam uses social engineering techniques to trick users into revealing sensitive information, such as social security numbers, credit card numbers, or passwords, or visiting phony Web sites.

¹²¹ In managed environments, updates should be performed consistent with local policy.

¹²² The Outlook home page is located at <http://www.microsoft.com/outlook/>.

make Outlook even more secure. Section 8.1.1 contains instructions for limiting macro capabilities in Outlook. Other potential Outlook security changes are described in the following steps:

1. Start Outlook.
2. Select **Tools**, then **Options**.
3. Within the **E-mail** section, click on **Junk E-mail**. Select the appropriate level of protection against spam and other forms of junk e-mail, then click on **OK**.
4. Click on the **Mail Format** tab.
5. Change the default new message format setting from **HTML** to **Plain Text**.
6. Click on the **Security** tab.
7. Set the security zone to **Restricted Sites**. This sets dozens of options for Outlook involving active scripting, digital certificates, downloads, and data storage and encryption.
8. Click on **OK**.

Visual Basic Scripting (VBScript) allows many tasks and interactions to be automated and performed without user intervention. Because of VBScript's powerful interoperability features, it has become a delivery mechanism for worms and viruses on Microsoft Windows platforms. A VBScript worm can propagate itself by accessing a user's address book and sending an infected message to every recipient. Such worms can rapidly spread throughout an enterprise or even the entire Internet as a result of the default interoperability of Windows XP and Outlook. To disable VBScript, follow the directions in Section 7.1.2 for file extensions .VBE and .VBS.

8.3.2 Outlook Express 6

Outlook Express is a reduced-feature version of Outlook intended for home users.¹²³ Outlook Express offers some of the same security features as Outlook, but menu names and options often differ slightly. As with Outlook, some of the default Outlook Express settings can be adjusted to make it even more secure, as described in the following items:

1. Start Outlook Express.
2. Select **Tools**, then **Options**.
3. Click on the **Send** tab.
4. Change the **Mail Sending Format** from **HTML** to **Plain Text**.
5. Click on the **Security** tab.
6. Under **Virus Protection**, set the security zone to **Restricted sites zone**.
7. Click on **OK**.

¹²³ More information on Outlook Express is available from the Internet Explorer Home Page, located at <http://www.microsoft.com/windows/ie/default.asp>.

8.3.3 Eudora 6.1

Eudora 6.1 is an e-mail client produced by Qualcomm.¹²⁴ Unlike some other e-mail clients, Eudora does not enable most active scripting capabilities directly in the mail client. As a result, there are fewer settings that need to be adjusted to secure it. The following are suggested configuration changes to further enhance Eudora's security:

1. Open Eudora.
2. Select **Tools**, then **Options**.
3. Select **Display**.
4. Uncheck the option named **Automatically download HTML graphics**. One of the benefits of disabling this setting is that it prevents spam messages from using small images within e-mails to track which users have opened them.
5. Select **Viewing Mail**.
6. Uncheck the option named **Automatically open next message**. Automatically opening e-mail messages can cause malicious contents to be executed without the user's involvement.
7. Uncheck the option named **Use Microsoft's viewer**.
8. Select **Junk Mail**. Adjust the junk mail threshold score and other junk mail configuration items as needed to improve spam filtering.
9. Click on **OK**.

8.3.4 Netscape 7.1

The complete installation of Netscape includes an e-mail client. Besides the settings already described in Section 8.2.2, there are several other settings that should be configured to help with securing Netscape's e-mail client, as follows:

1. Open Netscape.
2. Select **Edit**, then **Preferences**.
3. Select **Mail & Newsgroup Account Settings**, then **Composition & Addressing**.
4. Turn off **Compose messages in HTML format**.
5. Expand the **Privacy & Security** option.
6. Select **Images**.
7. Check the box next to **Do not load remote images in Mail & Newsgroup messages**. One of the benefits of enabling this setting is that it prevents spam messages from using small images within e-mails to track which users have opened them.

¹²⁴ The Eudora Web site is located at <http://www.eudora.com>.

8. Under the **Privacy & Security** option, select **Passwords**.
9. Check the box next to **Use encryption when storing sensitive data**. This feature requires the user to set a master password.
10. Under the **Privacy & Security** option, select **Master Password**.
11. Click **Change Password** to generate a master password that will be used when Netscape encrypts sensitive data stored locally.

8.3.5 Mozilla 1.6

Like Netscape, Mozilla includes a fully functional e-mail client. The guidance provided for the Netscape e-mail client in Section 8.3.4 also applies to Mozilla's e-mail client.

8.3.6 Thunderbird 0.7

Thunderbird is an e-mail client created as a branch of the Mozilla project.¹²⁵ Its interface and options have been slightly modified from Netscape and Mozilla's e-mail clients. The following changes should be made from the default Thunderbird configuration:

1. Open Thunderbird.
2. Select **Tools**, then **Options**.
3. Select **Composition**.
4. Click on the **Send Options** button.
5. For the Text Format, select **Convert the message to plain text**.
6. Click on **OK** to return to the Options screen.
7. Select **Advanced** and expand the **Privacy** option.
8. Check the option to **Block loading of remote images in mail messages**.
9. Uncheck the option to **Enable JavaScript in mail messages**.
10. Under **Advanced**, expand the **Return Receipts** option.
11. In the **When I receive a request for a return receipt** section, select the radio button next to **Never send a return receipt**.

8.4 Personal Firewalls

Personal firewalls provide restrictions on incoming network activity (and sometimes, outgoing activity as well) at a host level. Initially, personal firewalls were primarily used for hosts that were directly accessible from the Internet, but organizations are increasingly deploying personal firewalls to nearly all hosts to limit the spread of worms, among other reasons. Section 7.6 describes the Internet Connection

¹²⁵ More information on Thunderbird is available at <http://www.mozilla.org/products/thunderbird/>.

Firewall, a personal firewall provided with Windows XP Professional. This section describes four other personal firewalls that offer additional functionality: ZoneAlarm Pro, BlackICE PC Protection, Norton Personal Firewall, and Sygate Personal Firewall Pro.

8.4.1 ZoneAlarm Pro 4.5

ZoneAlarm Pro not only can restrict incoming and outgoing network activity for a system, but it can also restrict certain types of application activity. For example, it can monitor inbound and outbound e-mails for signs of mass mailing viruses or worms, and temporarily shut off e-mail services if such activity is detected. It can also provide additional security within Web browsers, such as suppressing popup windows and handling active code (e.g., ActiveX, Java), but it does not provide true antivirus or intrusion detection capabilities.

Although the default installation and configuration of ZoneLabs' ZoneAlarm Pro firewall¹²⁶ helps to improve the security of the computer it is installed on, some changes from the default configuration may also be beneficial. During installation, make the following adjustments:

1. Set **Alert me only when blocked traffic is probably hacker activity**.
2. Select **I would like to create a password**.
3. If the Windows XP Internet Connection Sharing feature is in use, check the appropriate box to set up ZoneAlarm Pro for it.
4. Select **Yes, automatically configure any programs that match Zone Labs' safe programs list**.
5. Select **Yes, please encrypt and protect my eBay password**. This helps to protect numerous emails that attempt to masquerade as eBay account update emails to trick a user into revealing account details to the email originator.

After installation, perform the following steps:

1. Select the **Program Control** tab.
2. Initially, set the **Program Control** to **Medium**; after a week, change it to **High**. This allows ZoneAlarm to learn what applications are normally used and can safely access the Internet.
3. Set the **Automatic Lock** to **On**. This blocks network activity after a period without activity.
4. Select the **Privacy** tab.
5. Set **Cookie Control** to **Medium**. This allows cookies to be used, while blocking tracking cookies.

8.4.2 BlackICE PC Protection 3.6

Like ZoneAlarm Pro, Internet Security Systems' BlackICE PC Protection 3.6 offers protection against various types of malicious application activity (particularly involving Web browsers, e-mail clients, and

¹²⁶ More information on ZoneAlarm Pro is available at <http://www.zonelabs.com>.

instant messaging clients). In addition, BlackICE also offers intrusion detection capabilities.¹²⁷ During installation, it is generally recommended to turn the Application Protection (AP) feature on, which alerts the user whenever an executable changes and prevents new and modified executables from running or using network communications. After installing BlackICE, performing the following steps can further increase the strength of its security:

1. Open BlackICE.
2. Select **Tools**.
3. Select **Edit BlackICE Settings**.
4. Select the **Notifications** tab.
5. In the Update Notification section, check the **Enable Checking** option, which causes BlackICE to look for updates every x days. Set the number of days to a low number so that the software checks for updates frequently.
6. Click **OK**.
7. Select **Tools**.
8. Select **Advanced Firewall Settings**.
9. Select the rule that allows TCP port 113 connections. This port is typically associated with the identification (ident) protocol, which is not normally used on Windows XP systems.¹²⁸
10. Click **Modify**.
11. Change mode from **Accept** to **Reject**.
12. Click **OK**.

8.4.3 Norton Personal Firewall 2004

Norton Personal Firewall 2004 not only examines incoming and outgoing network traffic, but it also provides application-specific protection, such as blocking popup ads and cookies in Web browsers and notifying the user of possible privacy issues with e-mails and Web forms.¹²⁹ It also offers some intrusion detection and prevention capabilities, such as recognizing and blocking certain well-known attacks. To configure Norton Personal Firewall to update its intrusion detection signatures automatically, perform the following steps:

1. Open Norton Personal Firewall.
2. Click on **LiveUpdate**.

¹²⁷ More information on BlackICE is available at <http://blackice.iss.net/index.php>.

¹²⁸ See RFC 1413, *Identification Protocol*, for more information on ident. It is available at <http://www.apps.ietf.org/rfc/rfc1413.html>.

¹²⁹ More information on Norton Personal Firewall is available at <http://www.symantec.com/smallbiz/npf/>.

3. Click on **Configure** and select **Express Mode**, so that all updates should be installed automatically.
4. Select the option **I want LiveUpdate to start automatically** so that the firewall should check for updates automatically.
5. Click on **OK**.

Norton Personal Firewall may be configured to use various security features, including the following:

1. Open Norton Personal Firewall.
2. Enable Web browser popup window blocking.
 - a. Double-click on **Ad Blocking**.
 - b. Select **Turn on Popup Window Blocking**.
 - c. Click on **OK**.
3. Set the appropriate security levels for the firewall and active content controls.
 - a. Double-click on **Personal Firewall**.
 - b. Click on **Custom Level**.
 - c. Set the security levels for **Personal Firewall**, **Java Applet Security**, and **ActiveX Control Security**.
 - d. Click on **OK**.
4. Configure the firewall to generate an alert when an unauthorized program attempts to access the Internet.
 - a. Double-click on **Personal Firewall**.
 - b. Click on **Custom Level**.
 - c. Select the **Enable Access Control Alerts** and **Alert when unused ports are accessed** options.
 - d. Click on **OK**.

8.4.4 Sygate Personal Firewall Pro 5.5

Like Norton Personal Firewall 2004, Sygate Personal Firewall Pro 5.5 offers many types of protection in addition to standard firewall capabilities.¹³⁰ For example, Sygate Personal Firewall Pro has several features that conceal the identity and characteristics of a system from other systems with which it communicates. It also offers an intrusion detection and prevention feature. To enable automatic

¹³⁰ More information on Sygate Personal Firewall Pro 5.5 is available at http://smb.sygate.com/products/spf_pro.htm.

signature updates for this feature, as well as automatic firewall software updates, perform the following steps:

1. Open Sygate Personal Firewall.
2. Click on the **Tools** menu, then select **Options**.
3. Click on the **Updates** tab. Select the options **Automatically check for new versions** and **Automatically check for signature updates and download**.
4. To manually check for updates, click on the **Check Now** button to check for firewall software updates and the **Update Now** button to check for signature updates.
5. Click on **OK**.

Sygate Personal Firewall Pro may be configured to use various security features, including the following:

1. Open Norton Personal Firewall.
2. Click on the **Tools** menu, then select **Options**.
3. Click on the **Security** tab. This contains settings for enabling and disabling many security functions, such as the intrusion detection capability. (Enabling all features should provide stronger security but might inadvertently break some network and application functionality. Also, some features such as DLL authentication are only effective if the system's users have a very good understanding of Windows XP and Windows applications. After enabling desired settings, test the system to confirm that required functionality has not been affected adversely.)
4. Click on **OK**.

8.5 Antivirus Software

Antivirus software is an essential element of securing Windows XP systems, but it cannot provide full protection against all malicious code. Good computing practices should be followed even when antivirus software is installed, enabled, and fully updated. Examples of good practices are not opening unexpected file attachments and configuring applications not to execute macros or embedded HTML tags by default. Section 7.1.2 provides directions for mapping active content file extensions so that the files are not automatically executed by default. Good practices also help to guard against the small time window between the release of a new virus and the availability of updated antivirus signatures from the vendor.

Although several brands of antivirus software are available, they offer similar functionality, as follows:

- + Scanning critical system components such as startup files, system BIOS, and boot records
- + Watching the real-time activities of the computer and operating system to check for suspicious activity; a common example is scanning all e-mail attachments for known viruses as the e-mails are sent or received
- + Scanning all files on a hard disk for known viruses. NIST recommends that antivirus software on Windows XP systems should be configured to scan all hard drives regularly to identify any file system infections.

- + Automatically downloading and installing updates from the vendor's Web site (or a local server in a managed environment) daily.

Each of these functions is important and should neither be ignored nor disabled unless necessary. Although the inherent risk behind virus scanning technology is that it primarily intercepts known viruses, this does not diminish the importance of the software. Antivirus software should be installed immediately after the initial Windows XP installation, then updated with the newest signatures and antivirus software patches. The antivirus software should then perform a complete scan of the system to identify any potential infections. The antivirus software packages discussed in this section are from Symantec, McAfee, and Sophos.

8.5.1 Symantec AntiVirus 8.0.1

Symantec AntiVirus offers multiple versions for Windows XP, ranging from standalone systems to enterprise deployments.¹³¹ On systems that are running any version of Symantec AntiVirus 8.0.1, it is recommended that the following settings be changed from the default configuration:

1. Open Symantec AntiVirus.
2. Expand **Configure** and select **File System Realtime Protection**.
3. In the **File types** section, select **All types**.
4. Select **Advanced**.
5. Change the **Bloodhound heuristics level** to **Maximum**.
6. Set the Automatic Enabler to **60 minutes**.

To ensure that the software will automatically download updates, perform the following steps:

1. Open Symantec AntiVirus.
2. Select **File**, then **Schedule Updates**.
3. Check the **Enable scheduled automatic updates** option.
4. Click on **Schedule** and set a schedule that is appropriate for the system (e.g., daily at 10:00 p.m.)
5. Click on **OK**, then **OK**.

To configure the software to perform regular system scans, perform the following steps:

1. Open Symantec AntiVirus.
2. Select **Edit**, then select **New Scheduled Scan**.
3. Provide a descriptive name for the scan (e.g., Weekly Scheduled Scan) and click on **Next**.

¹³¹ Information on Symantec's antivirus software is available from <http://www.symantec.com/product/>.

4. Check the **Enable scan** option and set a schedule that is appropriate for the system (e.g., weekly, every Thursday at 7:00 p.m.) Click on **Next**.
5. Select the check boxes of all non-removable local drives that should be scanned (e.g., C:, D:) and click on **Save**.

8.5.2 McAfee VirusScan 7.0

McAfee VirusScan, a product of Network Associates, is sold as a standalone product or a member application of McAfee Office.¹³² It is important to update the virus signatures as soon as the product has been installed. After launching VirusScan, select the **Check for a VirusScan update** in the Tasks section on the left side of the main window. This will automatically look for any updates and prompt the user to install them. To configure the software to automatically download updates, perform the following steps:

1. Start VirusScan.
2. Select **McAfee Instant Updater**.
3. Select the **Change my Instant Updater settings**.
4. Select **Configure automatic updates**.
5. Ensure that **Automatic Update** is selected.

To further strengthen security, it is recommended that the following settings be changed from the default configuration:

1. Start VirusScan.
2. Click the **Advanced** button.
3. Select **System Scan** and then click the **Detection** tab.
4. Click the **Advanced** button. Ensure that the **Enable heuristics scanning** and **Enable macro and program file heuristics scanning** options are enabled.
5. If Microsoft Outlook or Outlook Express is used for e-mail, select **E-Mail Scan** configuration and then select the checkbox for **Enable Scanning of E-Mail attachments in Microsoft Outlook**.
6. Select **HAWK** and ensure that **Enable HAWK for E-Mail** is checked.
7. In the **Attachments** section of **HAWK**, click the **Extensions** button.
8. Add the following file extensions to the list: **vbe**, **vbd**, **pif**, and **shs**.
9. In the **HAWK** configuration, click on the **Script Stopper** tab.

¹³² More information on VirusScan is available at <http://www.networkassociates.com/us/products/mcafee/antivirus/desktop/category.htm>.

10. Ensure that **Enable HAWK Script Stopper** is checked.

To configure the software to perform regular system scans, perform the following steps:

1. Start VirusScan.
2. Select **Advanced Tasks** on the left side of the main window.
3. Click **View** and **edit scheduled scans**.
4. Select **Scan My Computer**, and then click **Edit**.
5. Click on the **Schedule** tab.
6. Check the **Enable** checkbox to enable the scans.
7. Set a schedule that is appropriate for the system (e.g., at startup, daily, weekly).

8.5.3 Sophos Anti-Virus 3.80

Sophos Anti-Virus offers similar capabilities to the other antivirus software in this section. The default configuration provides adequate protection, but can be adjusted to provide more protection. Like the other anti-virus products it is important after installation to update the local virus definitions to ensure that the newest viruses will be caught. Unfortunately, Sophos does not provide a method for automatically updating virus definitions. Users should visit the Sophos Web site regularly to get the latest updates.¹³³

To further strengthen security, it is recommended that the following settings be changed from the default configuration:

1. Start Sophos Anti-Virus.
2. Select **Option**, then **Configuration**.
3. Select the **Mode** tab.
 - a. Change the **Scanning level** from **Quick** to **Full**.
 - b. Check the options to **Scan inside archive files** and **Scan mailboxes**.
4. Select the **Action** tab. Enable the **Infected files** option and select **Rename** as the action.
5. Select the **Report** tab. Select **List filenames** as the **Report mode**.

8.6 Spyware Detection and Removal Utilities

Spyware refers to software and software components that collect information and use connectivity without the user's knowledge, typically to track users' behavior (e.g., Web sites visited) and report it to a central location. Examples of spyware include a standalone program installed on a user's system and a tracking cookie placed in a Web browser. Spyware not only violates users' privacy, but it can also cause functional problems on systems, such as slowing performance or causing application instabilities.

¹³³ The updates are located at <http://www.sophos.com/downloads/ide/>.

Spyware detection and removal utilities have been created to identify many types of spyware on systems and quarantine or remove spyware files. Two popular free utilities for addressing spyware are Ad-aware and Spybot - Search & Destroy.

8.6.1 Ad-aware 6

Lavasoft's Ad-aware 6 is free for non-commercial use. (There are also two versions for commercial use, which provide additional functionality.)¹³⁴ Besides detecting and removing existing spyware, Ad-aware also attempts to prevent spyware installations through several methods, including blocking popup ads, browser plug-in installations, and browser hijacking. Ad-aware has a reference file that contains information on spyware, similar to signatures for antivirus software. After installing Ad-aware, update the reference file, and then perform updates on a regular basis so that the latest forms of spyware are detected.¹³⁵ To manually update the reference file, perform the following steps:

1. Start Ad-aware.
2. Click on **Check for updates now**, then click on **Connect**.
3. Ad-aware checks for a new reference file.
 - a. If there is a new file, Ad-aware prompts the user to download and install it. Click **OK** to do so; when it has completed, click **Finish**.
 - b. If there is not a new file, Ad-aware reports "No updated components available". Click **OK** to continue.

Ad-aware offers various customization options, which can be accessed by clicking on **Start**, then clicking on **Customize**. Options include specifying log file locations and the level of detail to log, and identifying which components of the system should be scanned (e.g., files, Windows registry). After configuring the options appropriately, click **Proceed** to save them.

8.6.2 Spybot - Search & Destroy 1.3

Spybot – Search & Destroy 1.3 is available as freeware.¹³⁶ Spybot can identify various types of spyware and remove them from systems; it also offers the ability to prevent some spyware installations. Like Ad-aware, Spybot should be updated regularly so that it can recognize the newest types of spyware. To manually update Spybot, perform the following steps:

1. Start Spybot.
2. Click on **Search for updates**.
3. Spybot displays a list of available updates. Check each update that should be downloaded, then click on **Download Updates**.

¹³⁴ More information on Ad-aware is available at <http://www.lavasoftusa.com>.

¹³⁵ The commercial versions of Ad-aware offer the ability to perform updates automatically.

¹³⁶ More information on Spybot is available at <http://www.safer-networking.org>.

8.7 Summary of Recommendations

- + Keep productivity application suites, e-mail clients, Web browsers, antivirus software, personal firewalls, and spyware detectors current with updates and patches to eliminate known vulnerabilities and weaknesses. This includes deploying the latest signatures for antivirus scanners, spyware detectors, and personal firewalls with intrusion detection capabilities.
- + For productivity application suites, restrict the use of macros.
- + For Web browsers, limit the use of cookies and active content, such as ActiveX controls and Java applets.
- + Configure e-mail clients to create new e-mails using plain text instead of HTML and to block the automatic download of graphics within e-mails. Disable the use of Javascript in e-mails. Use junk mail controls to filter unsolicited e-mails.
- + Configure personal firewalls to restrict inbound and outbound network activity. Enable additional security features (e.g., intrusion prevention, popup blocking) as appropriate to increase security without adversely affecting required functionality.
- + Install antivirus software immediately after the Windows XP installation, then update it with the newest signatures and software patches. Perform a complete scan of the system to identify any infections. Configure the software to scan critical system components and monitor real-time activities, and to scan all hard drives regularly to identify any file infections.
- + Use spyware detection and removal utilities to identify and quarantine or remove spyware files.

9. Putting It All Together

This publication has covered many topics related to the security of Windows XP systems. The purpose of this final section is to put it all together by describing the basic process that IT professionals should follow to use this publication and the accompanying templates. The primary steps are as follows:

1. Read the publication, including the appendices. As needed, review the additional reference material listed throughout the publication and in appendix E.
2. As discussed in Section 4, install and patch the OS and applications on a test system, and create and test plans for system backups and restores.
3. Refer to Section 2 to review the system roles and threats, then select the appropriate operating environment. Review the security template corresponding to that environment; see Appendix A for the values specified in the template. Refer to Section 6 as needed for more information on the different regions and values within the template.
4. Modify the template to reflect local policy and apply it to test systems using the appropriate deployment tool, as described in Section 5. Create multiple versions of the template if necessary to address multiple system roles or environments. Refer to Appendix D for other tools that may be useful for deployment.
5. Augment the template settings with additional controls presented in Section 7, as well as any others that are required based on the local environment. Also, apply application-specific security configuration changes, such as those described in Section 8.
6. Verify that the controls have been deployed properly by testing system functions and security controls, as described in Sections 2.5 and 4.4. Modify and document any changes made to the baseline security controls (e.g., altering a setting so a particular application can function properly). Modify the templates as necessary to incorporate changes that apply to all systems.
7. Deploy the templates and additional controls to production systems. Verify that the controls have been deployed properly by testing system functions and security controls.
8. Maintain the systems, as described in Section 2.6. This includes keeping systems updated (Section 4.3), performing periodic vulnerability assessments (Section 4.4), and monitoring the various logs described throughout the publication.

Appendix A—NIST Security Template Settings

This section lists the settings included in the NIST security template files, which are based on the consensus templates produced by CIS,¹³⁷ DISA,¹³⁸ NIST, NSA,¹³⁹ Microsoft,¹⁴⁰ and other security experts. The settings are organized according to the categories in Section 6, which provides more information on the significance of many of these settings.¹⁴¹

A.1 Account Policies

Tables A-1 and A-2 define settings for account security and password policies. They correspond to the Account Policies section of the Local Security Policy utility (found in the **Administrative Tools** section of the **Control Panel**). Section 6.1 contains more information on these settings. The security templates for each environment are numbered and documented. They can be edited with a text editor, e.g. Notepad, or with the Security Templates MMC snap-in.

Table A-1. Password Policy Settings¹⁴²

A-1	Policy	Recommended Settings				Comment
		High Security	Enterprise (Managed)	SOHO (Standalone)	Legacy	
1.1	Enforce password history	24 passwords remembered				
1.2	Maximum password age	90 days				
1.3	Minimum password age	1 day				
1.4	Minimum password length	12 characters	8 characters			Use a passphrase instead of a password.
1.5	Password must meet complexity requirements	Enabled				
1.6	Store password using reversible encryption for all users in the domain	Disabled				

¹³⁷ The CIS Web site is located at <http://www.cisecurity.org/>.

¹³⁸ The DISA Web site is located at <http://www.disa.mil/>.

¹³⁹ The NSA's guides and templates for Windows XP are available from <http://nsa2.www.conxion.com/winxp/index.html>.

¹⁴⁰ For more information on Microsoft's security recommendations, see the *Microsoft Windows XP Security Guide*, located at <http://www.microsoft.com/downloads/details.aspx?FamilyID=2d3e25bc-f434-4cc6-a5a7-09a8a229f118&DisplayLang=en>.

¹⁴¹ More detailed information on each item is available from Microsoft's *Threats and Countermeasures Guide: Security Settings in Windows Server 2003 and Windows XP*, available for download at <http://www.microsoft.com/downloads/details.aspx?FamilyID=1B6ACF93-147A-4481-9346-F93A4081EEA8&displaylang=en>. For additional information, refer to the CIS Windows XP Professional Operating System Legacy, Enterprise, and High Security Benchmark Consensus Baseline Security Settings, available for download at http://www.cisecurity.org/bench_win2000.html.

¹⁴² The Password Policy settings should be defined in the Default Domain Policy and applied at the domain level in an Active Directory.

Table A-2. Account Lockout Policy Settings¹⁴³

A-2	Policy	Recommended Settings				Comment
		High Security	Enterprise (Managed)	SOHO (Standalone)	Legacy	
2.1	Account lockout duration	15 minutes				
2.2	Account lockout threshold	10 attempts	50 attempts			
2.3	Reset account lockout counter after	15 minutes				

A.2 Local Policies

This section defines the settings for the system audit policy, user rights assignment, and security options as shown in Tables A-3, A-4, and A-5, respectively. The settings correspond to the Local Policies section of the Local Security Policy utility (found in the **Administrative Tools** section of the **Control Panel**). Section 6.2 contains more information on these settings.

Table A-3. Audit Policy Settings

A-3	Policy	Recommended Settings				Comment
		High Security	Enterprise (Managed)	SOHO (Standalone)	Legacy	
3.1	Audit account logon events	Success, Failure				
3.2	Audit account management	Success, Failure				
3.3	Audit directory service access	Not Defined				
3.4	Audit logon events	Success, Failure				
3.5	Audit object access	Success, Failure	Failure			
3.6	Audit policy change	Success				
3.7	Audit privilege use	Failure				
3.8	Audit process tracking	Not Defined				Enabling this setting will generate many events. Use only when absolutely necessary.
3.9	Audit system events	Success				

¹⁴³ The Account Lockout Policy settings should be defined in the Default Domain Policy and applied at the domain level in an Active Directory.

Table A-4. User Rights Assignment Settings

A-4	Policy	Recommended Settings				Comment
		High Security	Enterprise (Managed)	SOHO (Standalone)	Legacy	
4.1	Access this computer from the network	Administrators			Users, Administrators	
4.2	Act as part of the operating system	None				
4.3	Add workstations to domain	Not Defined (Not Applicable)				
4.4	Adjust memory quotas for a process	Not Defined				
4.5	Allow logon through Terminal Services	None	Administrators			
4.6	Back up files and directories	Administrators				
4.7	Bypass traverse checking	Users				
4.8	Change the system time	Administrators				
4.9	Create a pagefile	Administrators				
4.10	Create a token object	None				
4.11	Create permanent shared objects	None				
4.12	Debug programs	None	Administrators		None	
4.13	Deny access to this computer from the network	Guests				
4.14	Deny logon as a batch job	Not Defined				
4.15	Deny logon as a service	Not Defined				
4.16	Deny logon locally	Not Defined				
4.17	Deny logon through Terminal Services	Not Defined				
4.18	Enable computer and user accounts to be trusted for delegation	Not Defined (Not Applicable)				
4.19	Force shutdown from a remote system	Administrators				
4.20	Generate security audits	Local Service, Network Service				
4.21	Increase scheduling priority	Administrators				
4.22	Load and unload device drivers	Administrators				
4.23	Lock pages in memory	None				
4.24	Log on as a batch job	Not Defined				
4.25	Log on as a service	Not Defined				

A-4	Policy	Recommended Settings				Comment
		High Security	Enterprise (Managed)	SOHO (Standalone)	Legacy	
4.26	Log on locally	Users, Administrators				
4.27	Manage auditing and security log	Administrators				
4.28	Modify firmware environment values	Administrators				
4.29	Perform volume maintenance tasks	Administrators				
4.30	Profile single process	Administrators				
4.31	Profile system performance	Administrators				
4.32	Remove computer from docking station	Users, Administrators				
4.33	Replace a process level token	Local Service, Network Service				
4.34	Restore files and directories	Administrators				
4.35	Shut down the system	Users, Administrators				
4.36	Synchronize directory service data	Not Defined (Not Applicable)				
4.37	Take ownership of files or other objects	Administrators				

Table A-5. Security Options Settings

A-5	Policy	Recommended Settings				Comment
		High Security	Enterprise (Managed)	SOHO (Standalone)	Legacy	
5.1	Accounts: Administrator account status	Not Defined				
5.2	Accounts: Guest account status	Disabled				
5.3	Accounts: Limit local account use of blank passwords to console logon only	Enabled				
5.4	Accounts: Rename administrator account	Not Defined				Rename the built-in account with a non-standard value.
5.5	Accounts: Rename guest account	Not Defined				Rename the built-in account with a non-standard value.

A-5	Policy	Recommended Settings				Comment
		High Security	Enterprise (Managed)	SOHO (Standalone)	Legacy	
5.6	Audit: Audit the access of global system objects	Not Defined				
5.7	Audit: Audit the use of Backup and Restore privilege	Not Defined				
5.8	Audit: Shut down system immediately if unable to log security audits	Enabled	Not Defined			
5.9	Devices: Allow undock without having to log on	Disabled	Not Defined			
5.10	Devices: Allowed to format and eject removable media	Administrators	Administrators and Interactive Users			
5.11	Devices: Prevent users from installing printer drivers	Enabled	Not Defined			
5.12	Devices: Restrict CD-ROM access to locally logged-on user only	Enabled	Not Defined			
5.13	Devices: Restrict floppy access to locally logged-on user only	Enabled	Not Defined			
5.14	Devices: Unsigned driver installation behavior	Warn but allow installation				
5.15	Domain controller: Allow server operators to schedule tasks	Not Defined (Not Applicable)				
5.16	Domain controller: LDAP server signing requirements	Not Defined (Not Applicable)				
5.17	Domain controller: Refuse machine account password changes	Not Defined (Not Applicable)				
5.18	Domain member: Digitally encrypt or sign secure channel data (always)	Enabled			Disabled	
5.19	Domain member: Digitally encrypt secure channel data (when possible)	Enabled				
5.20	Domain member: Digitally sign secure channel data (when possible)	Enabled				
5.21	Domain member: Disable machine account password changes	Disabled				
5.22	Domain member: Maximum machine account password age	30 Days				
5.23	Domain member: Require strong (Windows 2000 or later) session key	Enabled			Not Defined	

A-5	Policy	Recommended Settings				Comment
		High Security	Enterprise (Managed)	SOHO (Standalone)	Legacy	
5.24	Interactive logon: Do not display last user name	Enabled				
5.25	Interactive logon: Do not require CTRL+ALT+DEL	Disabled				
5.26	Interactive logon: Message text for users attempting to log on	<DoJ Approved>				
5.27	Interactive logon: Message title for users attempting to log on	<DoJ Approved>				
5.28	Interactive logon: Number of previous logons to cache (in case domain controller is not available)	0	1	2		
5.29	Interactive logon: Prompt user to change password before expiration	14 Days				
5.30	Interactive logon: Require Domain Controller authentication to unlock workstation	Not Defined	Enabled	Disabled	Not Defined	
5.31	Interactive logon: Smart card removal behavior	Lock Workstation				
5.32	Microsoft network client: Digitally sign communications (always)	Enabled			Not Defined	This will prevent communication with servers prior to Windows 2000.
5.33	Microsoft network client: Digitally sign communications (if server agrees)	Enabled				
5.34	Microsoft network client: Send unencrypted password to third-party SMB servers	Disabled				This will prevent communication with servers prior to Windows NT.
5.35	Microsoft network server: Amount of idle time required before suspending session	15 Minutes				
5.36	Microsoft network server: Digitally sign communications (always)	Enabled			Not Defined	
5.37	Microsoft network server: Digitally sign communications (if client agrees)	Enabled				

A-5	Policy	Recommended Settings				Comment
		High Security	Enterprise (Managed)	SOHO (Standalone)	Legacy	
5.38	Microsoft network server: Disconnect clients when logon hours expire	Enabled		Disabled	Enabled	
5.39	Network access: Allow anonymous SID/Name translation	Disabled				
5.40	Network access: Do not allow anonymous enumeration of SAM accounts	Enabled				
5.41	Network access: Do not allow anonymous enumeration of SAM accounts and shares	Enabled				
5.42	Network access: Do not allow storage of credentials or .NET Passports for network authentication	Enabled			Not Defined	
5.43	Network access: Let Everyone permissions apply to anonymous users	Disabled				
5.44	Network access: Named Pipes that can be accessed anonymously	None			Not Defined	
5.45	Network access: Remotely accessible registry paths	Not Defined				
5.46	Network access: Shares that can be accessed anonymously	None				
5.47	Network access: Sharing and security model for local accounts	Classic				
5.48	Network security: Do not store LAN Manager hash value on next password change	Enabled			Not Defined	
5.49	Network security: Force logoff when logon hours expire	Enabled		Not Defined		
5.50	Network security: LAN Manager authentication level	Send NTLMv2, Refuse LM and NTLM	Send NTLMv2, Refuse LM		Send NTLMv2 ¹⁴⁴	This will prevent communication with some clients and servers.
5.51	Network security: LDAP client signing requirements	Require Signing				

¹⁴⁴ Windows 98/ME requires the DSCLIENT.EXE utility found on the Windows 2000 CD-ROM for interoperability.

A-5	Policy	Recommended Settings				Comment
		High Security	Enterprise (Managed)	SOHO (Standalone)	Legacy	
5.52	Network security: Minimum session security for NTLM SSP based (including secure RPC) clients	Require Message Integrity, Message Confidentiality, NTLMv2 Session Security, 128-bit Encryption			Not Defined	This will prevent communication with some clients and servers.
5.53	Network security: Minimum session security for NTLM SSP based (including secure RPC) servers	Require Message Integrity, Message Confidentiality, NTLMv2 Session Security, 128-bit Encryption			Not Defined	This will prevent communication with some clients and servers.
5.54	Recovery console: Allow automatic administrative logon	Disabled				
5.55	Recovery console: Allow floppy copy and access to all drives and all folders	Not Defined				
5.56	Shutdown: Allow system to be shut down without having to log on	Disabled				
5.57	Shutdown: Clear virtual memory pagefile	Enabled				This can cause reboots to take longer, especially on systems with more RAM.
5.58	System cryptography: Use FIPS compliant algorithms for encryption, hashing, and signing	Enabled	Not Defined			
5.59	System objects: Default owner for objects created by members of the Administrators group	Object Creator				
5.60	System objects: Require case insensitivity for non-Windows subsystems	Enabled	Not Defined			
5.61	System objects: Strengthen default permissions of internal system objects (e.g. Symbolic Links)	Enabled			Not Defined	

A.3 Event Log Policies

Event log settings are shown in Table A-6. The suggested log sizes are minimums and can be increased if additional space is available. Section 6.3 contains more information on event logs.

Table A-6. Event Log Policy Parameters

A-6	Policy	Recommended Settings				Comment
		High Security	Enterprise (Managed)	SOHO (Standalone)	Legacy	
6.1	Maximum application log size	16 MB				
6.2	Maximum security log size	80 MB				
6.3	Maximum system log size	16 MB				
6.4	Prevent local guests group from accessing application log	Enabled				
6.5	Prevent local guests group from accessing security log	Enabled				
6.6	Prevent local guests group from accessing system log	Enabled				
6.7	Retain application log	Not Defined				
6.8	Retain security log	Not Defined				
6.9	Retain system log	Not Defined				
6.10	Retention method for application log	Not Defined				
6.11	Retention method for security log	Not Defined				
6.12	Retention method for system log	Not Defined				

A.4 Restricted Groups

NIST recommends removing all users from the Remote Desktop Users and Power Users groups. If local policy requires the usage of the groups, be certain to add only the users requiring membership to the following settings. Section 6.4 contains more information on restricted groups.

Table A-7. Restricted Groups Settings

A-7	Restricted Groups	Recommended Settings				Comment
		High Security	Enterprise (Managed)	SOHO (Standalone)	Legacy	
7.1	Power Users	None				
7.2	Remote Desktop Users	None				

A.5 System Services

The recommended methods for starting various system services are defined in Table A-8. Section 6.5 contains more information on several of the services.

Table A-8. System Services Settings

A-8	Service Name	Recommended Settings				Comment
		High Security	Enterprise (Managed)	SOHO (Standalone)	Legacy	
8.1	Alerter	Disabled				
8.2	Clipbook	Disabled				
8.3	Computer Browser	Disabled	Not Defined	Disabled	Not Defined	
8.4	Fax Service	Disabled	Not Defined			
8.5	FTP Publishing Service	Disabled				
8.6	IIS Admin Service	Disabled				
8.7	Indexing Service	Disabled	Not Defined			
8.8	Messenger	Disabled				
8.9	Netlogon	Disabled	Not Defined			Not defined
8.10	Netmeeting Remote Desktop Sharing	Disabled				
8.11	Remote Desktop Help Session Manager	Disabled	Not Defined		Disabled	
8.12	Remote Registry	Disabled	Not Defined	Disabled	Not Defined	
8.13	Routing and Remote Access	Disabled				
8.14	Simple Mail Transfer Protocol (SMTP)	Disabled				
8.15	Simple Network Management Protocol (SNMP) Service	Disabled				
8.16	Simple Network Management Protocol (SNMP) Trap	Disabled				
8.17	Task Scheduler	Disabled	Not Defined			
8.18	Telnet	Disabled				
8.19	Terminal Services	Disabled	Not Defined			
8.20	Universal Plug and Play Device Host	Disabled			Not Defined	
8.21	World Wide Web Publishing Services	Disabled				

A.6 File Permissions

Tables A-9 and A-10 define the permissions for files and folders that can typically be found on Windows XP systems. Note that not all of these resources are available on all Windows XP versions and

installations. The same file permissions are used for all NIST templates. Section 6.6 provides additional information on Windows XP file permissions.

Table A-9. Folder Permission Settings

A-9	Folder Name	Recommended Settings				Comment
		High Security	Enterprise (Managed)	SOHO (Standalone)	Legacy	
9.4	%SystemDrive%	Administrators: Full System: Full Creator Owner: Full INTERACTIVE: Read, Ex	<Not Defined>			Not Defined

Table A-10. File Permission Settings

A-10	Filename	Recommended Settings				Comment
		High Security	Enterprise (Managed)	SOHO (Stand-alone)	Legacy	
10.1	%SystemRoot% \system32\at.exe	Administrators: Full System: Full				
10.2	%SystemRoot% \system32\attrib.exe	Administrators: Full System: Full				
10.3	%SystemRoot% \system32\cacls.exe	Administrators: Full System: Full				
10.4	%SystemRoot% \system32\debug.exe	Administrators: Full System: Full				
10.5	%SystemRoot% \system32\drwatson.exe	Administrators: Full System: Full				
10.6	%SystemRoot% \system32\drwtsn32.exe	Administrators: Full System: Full				
10.7	%SystemRoot% \system32\edlin.exe	Administrators: Full System: Full INTERACTIVE: Read, Ex				
10.8	%SystemRoot% \system32\eventcreate.exe	Administrators: Full System: Full				
10.9	%SystemRoot% \system32\eventtriggers.exe	Administrators: Full System: Full				
10.10	%SystemRoot% \system32\ftp.exe	Administrators: Full System: Full INTERACTIVE: Read, Ex				
10.11	%SystemRoot% \system32\net.exe	Administrators: Full System: Full INTERACTIVE: Read, Ex				
10.12	%SystemRoot% \system32\net1.exe	Administrators: Full System: Full INTERACTIVE: Read, Ex				
10.13	%SystemRoot% \system32\netsh.exe	Administrators: Full System: Full				

A-10	Filename	Recommended Settings				Comment
		High Security	Enterprise (Managed)	SOHO (Stand-alone)	Legacy	
10.14	%SystemRoot% \system32\rcp.exe	Administrators: Full System: Full				
10.15	%SystemRoot% \system32\reg.exe	Administrators: Full System: Full				Because users can no longer use these tools, the settings could adversely affect support operations (e.g., having users run a script that checks certain registry values).
10.16	%SystemRoot% \regedit.exe	Administrators: Full System: Full				
10.17	%SystemRoot% \system32\regedt32.exe	Administrators: Full System: Full				
10.18	%SystemRoot% \system32\regsvr32.exe	Administrators: Full System: Full				
10.19	%SystemRoot% \system32\rexec.exe	Administrators: Full System: Full				
10.20	%SystemRoot% \system32\rsh.exe	Administrators: Full System: Full				
10.21	%SystemRoot% \system32\runas.exe	Administrators: Full System: Full INTERACTIVE: Read, Ex				Some organizations prefer to give users runas.exe access instead of full administrative-level accounts.
10.22	%SystemRoot% \system32\sc.exe	Administrators: Full System: Full				
10.23	%SystemRoot% \system32\subst.exe	Administrators: Full System: Full				This could cause application compatibility issues; for example, it is often called by non-privileged users through login scripts.
10.24	%SystemRoot% \system32\telnet.exe	Administrators: Full System: Full INTERACTIVE: Read, Ex				
10.25	%SystemRoot% \system32\tftp.exe	Administrators: Full System: Full INTERACTIVE: Read, Ex				
10.26	%SystemRoot% \system32\tlntsvr.exe	Administrators: Full System: Full				

A.7 Registry Permissions

Table A-11 lists the registry key permission changes made by the NIST security templates. Section 6.7 contains additional information on Windows XP registry permissions.

Table A-11. Registry Permission Settings

A-11	Registry Key	Recommended Settings				Comment
		High Security	Enterprise (Managed)	SOHO (Stand-alone)	Legacy	
11.1	HKLM\Software	Administrators: Full System: Full Creator Owner: Full Users: Read	<Not Defined>			
11.2	HKLM\Software\Microsoft\Windows\CurrentVersion\Installer	Administrators: Full System: Full Users: Read	Administrators: Full System: Full Users: Read			
11.3	HKLM\Software\Microsoft\Windows\CurrentVersion\Policies	Administrators: Full System: Full Authenticated Users: Read	Administrators: Full System: Full Authenticated Users: Read			
11.4	HKLM\System	Administrators: Full System: Full Creator Owner: Full Users: Read	<Not Defined>			
11.5	HKLM\System\CurrentControlSet\Enum	Administrators: Full System: Full Authenticated Users: Read	Administrators: Full System: Full Authenticated Users: Read			
11.6	HKLM\System\CurrentControlSet\Services\SNMP\Parameters\PermittedManagers	Administrators: Full System: Full Creator Owner: Full	Administrators: Full System: Full Creator Owner: Full			
11.7	HKLM\System\CurrentControlSet\Services\SNMP\Parameters\ValidCommunities	Administrators: Full System: Full Creator Owner: Full	Administrators: Full System: Full Creator Owner: Full			
11.8	HKLM\Software\Microsoft\Windows\CurrentVersion\policies\Ratings	Administrators: Full Users: Read	<Not Defined>			
11.9	HKLM\Software\Microsoft\MSDTC	Administrators: Full System: Full Network Service: Query Value, Set Value, Create Subkey, Enumerate Subkeys, Notify, Read Permissions Users: Read	<Not Defined>			

A-11	Registry Key	Recommended Settings				Comment
		High Security	Enterprise (Managed)	SOHO (Stand-alone)	Legacy	
11.10	HKU\Default\Software\Microsoft\SystemCertificates\Root\ProtectedRoots	Administrators: Full System: Full Users: Read	Administrators: Full System: Full Users: Read			
11.11	HKLM\Software\Microsoft\Windows NT\CurrentVersion\SecEdit	Administrators: Full System: Full Users: Read	Administrators: Full System: Full Users: Read			

A.8 Registry Values

Table A-12 lists the registry values that are defined in the NIST templates. Section 6.8 contains an explanation of the significance of each of these settings.

Table A-12. Registry Values¹⁴⁵

A-12	Registry Value Name and Path	Recommended Data Value				Comment
		High Security	Enterprise (Managed)	SOHO (Stand-alone)	Legacy	
12.1	HKLM\Software\Microsoft\DrWatson\CreateCrashDump	0				
12.2	HKLM\Software\Microsoft\Windows NT\CurrentVersion\AEDebug\Auto	0				
12.3	HKLM\Software\Microsoft\Windows\CurrentVersion\Policies\Explorer\NoDriveTypeAutoRun	255				
12.4	HKU\DEFAULT\Software\Microsoft\Windows\CurrentVersion\Policies\Explorer\NoDriveTypeAutoRun	255				
12.5	HKLM\Software\Microsoft\Windows NT\CurrentVersion\Winlogon\AutoAdminLogon	0				
12.6	HKLM\System\CurrentControlSet\Control\CrashControl\AutoReboot	0				
12.7	HKLM\System\CurrentControlSet\Services\CDrom\Autorun	0				
12.8	HKLM\System\CurrentControlSet\Services\LanmanServer\Parameters\AutoShareWks	0	Not Defined	0	Not Defined	
12.9	HKLM\System\CurrentControlSet\Services\MrxSmb\Parameters\RefuseReset	1				

¹⁴⁵ These settings will not appear in the Security Templates MMC snap-in.

A-12	Registry Value Name and Path	Recommended Data Value				Comment
		High Security	Enterprise (Managed)	SOHO (Stand-alone)	Legacy	
12.10	HKLM\System \CurrentControlSet \Services\Tcpip \Parameters \DisableIPSourceRouting		2			
12.11	HKLM\System \CurrentControlSet \Services\Tcpip \Parameters \EnableDeadGWDetect		0			
12.12	HKLM\System \CurrentControlSet \Services\Tcpip \Parameters \EnableICMPRedirect		0			
12.13	HKLM\System \CurrentControlSet \Services\Tcpip \Parameters \EnablePMTUDiscovery		0			
12.14	HKLM\System \CurrentControlSet \Services\Tcpip \Parameters \KeepAliveTime		300000			
12.15	HKLM\System \CurrentControlSet \Services\Netbt \Parameters \NoNameReleaseOnDemand		4			Not defined
12.16	HKLM\System \CurrentControlSet \Services\Tcpip \Parameters \PerformRouterDiscovery		0			
12.17	HKLM\System \CurrentControlSet \Services\Tcpip \Parameters \SynAttackProtect		2			
12.18	HKLM\System \CurrentControlSet \Services \Tcpip\Parameters \TcpMaxHalfOpen		100			
12.19	HKLM\System \CurrentControlSet \Services\Tcpip \Parameters \TcpMaxHalfOpenRetried		80			
12.20	HKLM\System \CurrentControlSet \Services\IPSEC \NoDefaultExempt		1			
12.21	HKLM\System \CurrentControlSet \Services\Lanmanserver \Parameters\Hidden		1			
12.22	HKLM\System \CurrentControlSet \Control \Session Manager \SafeDllSearchMode		1			

A.9 File and Registry Auditing

Table A-13 lists the specific file and registry sections that are configured to be audited by the NIST templates.

Table A-13. File and Registry Auditing

A-13	Name	Recommended Data Value				Comment
		High Security	Enterprise (Managed)	SOHO (Stand-alone)	Legacy	
13.1	%SystemDrive%	Everyone: Failures	Not Defined			Not defined
13.2	HKLM\Software	Everyone: Failures	Not Defined			
13.3	HKLM\System	Everyone: Failures	Not Defined			

Appendix B—Windows XP Service Pack 2, Release Candidate 2

Windows XP Service Pack 2 (SP2) is expected to be released in 2004. The second release candidate for SP2, known as RC2, was released to the public for beta testing in June 2004.¹⁴⁶ This appendix contains information on the major security-related changes in Windows XP that are included in SP2.¹⁴⁷ This includes new features introduced in SP2 and existing Windows XP features that are modified in SP2. It is anticipated that future release candidates and the final release of the service pack may differ significantly from SP2 RC2.

B.1 Windows Firewall

Windows Firewall replaces Internet Connection Firewall (ICF). The following items compare the functionality of the two firewalls:

- + ICF is disabled by default and has to be enabled separately for each network interface; Windows Firewall is enabled by default for each network interface. This provides immediate protection from network-based attacks for all network connections, including LAN (wired and wireless), dial-up, and VPN. Unfortunately, by default it may also inadvertently break needed functionality. For example, Windows Firewall will block all incoming traffic directed at TCP port 445, which will prevent administrators from using various MMC snap-ins to administer the system remotely. Also, because Windows Firewall is enabled even if a third party host-based firewall is installed and enabled, this may impact system functionality and usability because Windows Firewall may block traffic that the other firewall has been configured to allow.
- + Unlike ICF, Windows Firewall offers the ability to allow certain types of traffic from the local subnet only. By default, when Microsoft networking services are enabled, Windows Firewall will configure itself so that the appropriate ports (UDP 137, UDP 138, TCP 139, and TCP 445) will only accept packets that have a source address on the local subnet. If UPnP is enabled, Windows Firewall will establish similar restrictions for the UPnP ports (UDP 1900 and TCP 2869). Because Microsoft networking services and UPnP should normally only be used between computers on a local network, this firewall policy should not interfere with typical functionality. It also restricts the ability of remote attackers and malicious code from breaching these services.
- + ICF provides no protection to the system during boot; Windows Firewall only permits typical boot-time traffic (e.g., DHCP) during boot. This protects the system against network-based attacks (particularly worms that constantly send malicious packets) that occur during the seconds or minutes it takes for the system to boot.
- + ICF cannot be configured through Group Policy or during unattended setup; it must be configured separately on each system. Windows Firewall can be partially configured during unattended setup and fully configured through Group Policy. These features are most beneficial for securing

¹⁴⁶ The second release candidate is available for download at <http://www.microsoft.com/technet/prodtechnol/winxppro/sp2preview.mspx>. This Web site also contains documentation related to the service pack.

¹⁴⁷ The primary source of information for this appendix is the Microsoft publication *Changes to Functionality in Service Pack 2 for Microsoft Windows XP*, available for download at <http://www.microsoft.com/technet/prodtechnol/winxppro/maintain/sp2chngs.mspx>. The secondary reference is an article by Paul Thurrott titled *Windows XP Service Pack 2 Beta Review*. It is available at http://www.winsupersite.com/reviews/windowsxp_sp2_preview2.asp. Another source of information is an article by Kurt Hutchinson titled *Windows XP Service Pack 2 Beta First Look*, available at <http://www.arstechnica.com/wankerdesk/04q1/sp2-beta-1.html>.

workstations in enterprise environments, particularly managed environments. Windows Firewall can also be configured through a command line interface, which was not available for ICF.

- + ICF provides separate firewall programs for handling IPv4 and IPv6 traffic. Windows Firewall offers a single interface for firewalling IPv4 and IPv6 traffic.
- + ICF only offered a single firewall profile; Windows Firewall allows multiple firewall profiles to be created. For example, a laptop could use a less restrictive profile when on the enterprise LAN, and a more restrictive profile when directly connected to the Internet.

In summary, Windows Firewall makes several significant improvements over ICF. It can provide much greater protection to systems and networks than ICF can, and because it is enabled by default, it can provide immediate protection. Windows Firewall also offers features that make it much easier to administer in enterprise environments. However, if it is not configured correctly, Windows Firewall can seriously impact functionality, such as the use of Microsoft file and print services.

B.2 Windows Update Services

Before SP2, all of the update-related services in Windows XP were collectively referred to as Software Update Services. With the release of SP2, Software Update Services has been renamed Windows Update Services, and some components have undergone major changes, as follows:

- + **Automatic Updates.** Before SP2, Automatic Updates could only download and install critical security hotfixes. Automatic Updates will now be able to distribute other hotfixes, as well as security roll-ups and service packs. Automatic Updates has also been extended to distribute patches for other Microsoft products and updated hardware drivers. Because Automatic Updates can now handle many more updates, it now has a prioritization feature that ensures the most critical security updates are installed before less important updates.
- + **Windows Update.** Windows Update now also includes Microsoft Update, which provides patches and service packs for other Microsoft applications. This provides a single interface for making all Microsoft-related updates.

B.3 Security Center

The Security Center provides a single interface to various security-related features. It examines the system for firewall software (both the Windows XP built-in firewall and third party firewalls). It also attempts to identify installed antivirus software and confirm that it is enabled and configured to perform real-time scanning. The Security Center also checks on the status of the Automatic Updates feature and makes recommendations to the user on reconfiguring it to ensure that updates are occurring properly. If Security Center detects an issue with a security tool, it will notify the user at login and will display a red icon in the taskbar to alert the user of the issue. This should lead to faster identification and resolution of security tool misconfigurations and other problems. The Control Panel will also contain a Security Center icon.

B.4 Other Significant Changes

Windows XP contains other changes that will impact security. The following items are the changes that may cause the biggest impact to users:

- + **Alerter and Messenger Services.** In SP2, the Alerter and Messenger services are both disabled by default. These services are intended to be used to display alerts and information. For example, an administrator could send a message to all users' screens, notifying them that a

particular server is being taken down for maintenance. Unfortunately, these services have been misused by attackers and spammers to generate messages on users' screens.¹⁴⁸ Windows Firewall restricts some of the Messenger ports by default so that they only accept packets with source addresses on the local subnet, which may help to alleviate the misuse issues if the services are needed for administrative purposes in an enterprise environment.

- + **DCOM and RPC Usage.** Anonymous use of DCOM and RPC is not permitted. COM servers have access control lists, which can prevent unauthorized access to COM processes. The changes to RPC and DCOM are intended to eliminate several methods used by malicious code to attack systems. However, these changes may also break many existing programs. All applications that use DCOM or RPC should be thoroughly tested with SP2 before it is deployed across an enterprise.

B.5 Memory Protection Technology

Several types of processors include support for Execution Protection (also known as no execute, or NX). If Windows XP SP2 is running on a system that has a processor with NX support, NX can protect the system from most buffer overflows. Many attackers and malicious code use buffer overflow attacks to gain unauthorized access to systems or crash them. NX neutralizes buffer overflows by keeping track of which portions of the system's memory contain executable code and which do not. If a buffer overflow attempt causes new executable code to be placed in memory, it will not be run if it is placed in a region that is not marked as containing executable code.

¹⁴⁸ A description of this issue is available at <http://support.microsoft.com/default.aspx?kbid=330904>.

Appendix C—Commonly Used TCP/IP Ports on Windows XP Systems

Appendix C lists commonly used TCP/IP ports on Windows XP systems.¹⁴⁹

Table C-1. Commonly Used TCP/IP Ports

Port	Protocol	Service	Description
21	TCP	FTP	File Transfer Protocol server
23	TCP	Telnet	Telnet service
68	UDP	DHCP	Dynamic Host Configuration Protocol client
80	TCP	HTTP	HyperText Transfer Protocol server
123	UDP	NTP	Network Time Protocol client (Windows Time)
135	TCP	epmap	DCE Endpoint Resolution (remote procedure call)
137	UDP	NetBIOS-ns	NetBIOS Name Service
138	UDP	NetBIOS-dgm	NetBIOS Datagram Service
139	TCP	NetBIOS-ssn	NetBIOS Session Service
161	UDP	SNMP	Simple Network Management Protocol
213	UDP	IPX Over IP	Client Service for Netware service
443	TCP	HTTPS	HTTP over SSL server
445	TCP, UDP	microsoft-ds (SMB)	Microsoft Common Internet File System (CIFS)
500	UDP	IKE	Internet Key Exchange (often used with IPsec)
515	TCP	LPR	Print Spooler service
522	TCP		NetMeeting client ¹⁵⁰
1503	TCP		NetMeeting client
1701	UDP	L2TP	Layer 2 Tunneling Protocol client
1720	TCP		NetMeeting client
1723	TCP/UDP	PPTP	Point-to-Point Tunneling Protocol client
1731	TCP		NetMeeting client
1900	UDP	SSDP	Simple Service Discovery Protocol
2001-2120	UDP		Windows Messenger voice calls ¹⁵¹
2869	TCP	UPnP	Universal Plug and Play
3002	TCP		Internet Connection Firewall/Sharing
3003	TCP		Internet Connection Firewall/Sharing
3389	TCP	RDP	Remote Desktop Protocol service

¹⁴⁹ For more information on the ports used by Windows XP services, see the article titled *System Services for the Windows Server 2003 Family and Windows XP Operating Systems*, available at http://www.microsoft.com/technet/prodtechnol/windowsserver2003/technologies/management/svrxpser_7.mspx, and MSKB article 832017, *Port Requirements for the Microsoft Windows Server System*, at <http://support.microsoft.com/?id=832017>. Also, the article *How to Open Ports in the Windows XP Internet Connection Firewall* contains information on some native Windows XP ports, as well as ports used by various third-party software. This article is available at <http://www.microsoft.com/security/protect/ports.asp>.

¹⁵⁰ Additional information on NetMeeting ports is available from Microsoft Technet at <http://www.microsoft.com/technet/security/secnews/asktheexperts/ask2.mspx>.

¹⁵¹ More information on Windows Messenger ports is available from Barb Bowman's article, *Don't Let the Defense Rest*, available at <http://www.microsoft.com/windowsxp/expertzone/columns/bowman/november12.asp>.

Port	Protocol	Service	Description
5000	TCP	UPnP	Universal Plug and Play
6801	UDP		Windows Messenger voice calls
6891-6900	TCP		Windows Messenger file transfers
6901	TCP/UDP		Windows Messenger voice calls

Appendix D—Tools

Appendix D summarizes various tools mentioned in this document that can be used to configure, manage, and monitor the Windows XP security settings.

Table D-1. Windows XP Tools

Tool Name	Relevance	Reference
Automatic Updates	Checks Microsoft update server for new updates; downloads and installs them	Included with Windows XP
Cipher	Scrubs data from unused portions of disks	cipher.exe Included with Windows XP
Event Viewer	Displays application, security, and system log entries	eventvwr.exe Included with Windows XP
Group Policy Management Console (GPMC) MMC snap-in	Manages Group Policy for multiple domains	http://www.microsoft.com/windowsserver2003/gpmc/default.mspx
Group Policy Modeling Wizard MMC snap-in	Determines the effects of applying combinations of GPOs to a particular user or computer	http://www.microsoft.com/windowsserver2003/gpmc/default.mspx
Group Policy Object Editor MMC snap-in	Imports security template into a GPO	Included with Windows XP
HFNetChk.exe	Checks the patch status of systems	http://www.microsoft.com/technet/treeview/default.asp?url=/technet/security/tools/hfnetchk.asp
Local Security Policy	Displays local security settings and allows administrator to alter settings	Included with Windows XP (Control Panel / Administrative Tools)
Microsoft Baseline Security Analyzer (MBSA)	Scans computers to identify security issues	http://www.microsoft.com/technet/security/tools/mbsahome.mspx
Microsoft Management Console	Acts as a container for snap-ins	mmc.exe Included with Windows XP
Port Reporter	Logs information on TCP and UDP port usage	http://www.microsoft.com/downloads/details.aspx?amp;displaylang=en&familyid=69BA779B-BAE9-4243-B9D6-63E62B4BCD2E&displaylang=en
Registry Editor	Provides a way for administrators to graphically view and edit registry entries	regedit.exe and regedt32.exe Included with Windows XP
Remote Installation Services	Allows Windows XP to be installed automatically on remote systems	Included with Windows 2000 and Windows 2003
Security Configuration and Analysis MMC snap-in	Compares the system's current security settings to the settings in a template	Included with Windows XP
Security Templates MMC snap-in	Allows administrator to review, modify, and apply security templates	Included with Windows XP
Sysprep	Clones XP image onto other systems	sysprep.exe Included with Windows XP
Windows Update	Checks for available updates, transfers them to system, and installs them	http://windowsupdate.microsoft.com

Appendix E—Resources

E.1 Vulnerability Databases

- + NIST ICAT
<http://icat.nist.gov/icat.cfm>
- + US-CERT Vulnerability Notes Database
<http://www.kb.cert.org/vuls>
- + SecurityFocus Vulnerability Database
<http://www.securityfocus.com/bid>
- + Open Source Vulnerability Database
<http://www.osvdb.org/>

E.2 Mailing Lists

- + Microsoft Notification Service
<http://www.microsoft.com/technet/security/bulletin/notify.msp>
- + US CERT National Cyber Alert System
<http://www.us-cert.gov/cas/>
- + SecurityFocus – BugTraq
<http://www.securityfocus.com/archive>

E.3 Print Resources

Bott, Ed, et al., *Microsoft Windows XP Inside Out, Deluxe Edition*, Microsoft Press, 2002.

Bott, Ed and Siechert, Carl, *Microsoft Windows Security Inside Out for Windows XP and Windows 2000*, Microsoft Press, 2002.

Boyce, Jim, *Windows XP Power Tools*, Sybex, 2002.

Honeycutt, Jerry, *Microsoft Windows XP Registry Guide*, Microsoft Press, 2002.

Microsoft Corporation, *Microsoft Windows XP Professional Resource Kit, Second Edition*, Microsoft Press, 2003.

Moskowitz, Jeremy, *Group Policy, Profiles, and IntelliMirror for Windows 2003, Windows XP, and Windows 2000*, Sybex, 2004.

Moulton, Pete, *SOHO Networking: A Guide to Installing a Small-Office/Home-Office Network*, Prentice Hall PTR, 2002.

Simmons, Curt and Causey, James, *Microsoft Windows XP Networking Inside Out*, Microsoft Press, 2002.

Thurrott, Paul, *Windows XP Home Networking*, John Wiley and Sons, 2002.

Weber, Chris and Bahadur, Gary, *Windows XP Professional Security*, McGraw-Hill, 2002.

E.4 Related NIST Documents and Resources

- + FIPS Publications
<http://csrc.nist.gov/publications/fips/index.html>
 - FIPS 140-2, *Security Requirements for Cryptographic Modules*
 - FIPS 199, *Standards for Security Categorization of Federal Information and Information Systems*
- + FISMA Implementation Project
<http://csrc.nist.gov/sec-cert/>
- + Computer Security Resource Center Special Publications
<http://csrc.nist.gov/publications/nistpubs/index.html>
 - SP 800-28, *Guidelines on Active Content and Mobile Code*
 - SP 800-30, *Risk Management Guide for Information Technology Systems*
 - SP 800-34, *Contingency Planning Guide for Information Technology Systems*
 - SP 800-40, *Procedures for Handling Security Patches*
 - SP 800-42, *Guideline on Network Security Testing*
 - SP 800-43, *Systems Administration Guidance for Securing Microsoft Windows 2000 Professional System*
 - SP 800-46, *Security for Telecommuting and Broadband Communications*
 - SP 800-48, *Wireless Network Security: 802.11, Bluetooth and Handheld Devices*
 - SP 800-53, *Recommended Security Controls for Federal Information Systems*
 - SP 800-61, *Computer Security Incident Handling Guide*
- + Security Checklists for IT Products project
<http://csrc.nist.gov/checklists/>

E.5 Microsoft Web-Based Resources

Microsoft's Web site contains a wealth of information regarding Windows XP and Windows security. This section lists many of these resources, divided into five categories: general Windows XP resources, general security resources (i.e., not XP-specific), general and specific Windows XP security resources, and Microsoft knowledge base articles.

E.5.1 General Windows XP Resources

- + Windows XP Home Page
<http://www.microsoft.com/windowsxp/default.asp>
- + Windows XP Professional Features
<http://www.microsoft.com/windowsxp/pro/evaluation/features.asp>

- + Microsoft Windows XP Professional Resource Kit Documentation
http://www.microsoft.com/resources/documentation/Windows/XP/all/reskit/en-us/prork_overview.asp
- + Windows XP Service Pack 2 Technical Program
<http://www.microsoft.com/technet/prodtechnol/winxppro/sp2preview.mspix>
- + Microsoft TechNet
<http://www.microsoft.com/technet>
- + *Administering Group Policy with Group Policy Management Console*
<http://www.microsoft.com/windowsserver2003/gpmc/gpmcwp.mspix>
- + *Changes to Functionality in Service Pack 2 for Microsoft Windows XP*
<http://www.microsoft.com/technet/prodtechnol/winxppro/maintain/winxpsp2.mspix>
- + *Enterprise Management with the Group Policy Management Console*
<http://www.microsoft.com/windowsserver2003/gpmc/default.mspix>

E.5.2 General Security Resources

- + Access Control and Smart Cards
<http://www.microsoft.com/technet/security/topics/smrtcard/default.mspix>
- + Microsoft Download Center
<http://www.microsoft.com/downloads/search.aspx?displaylang=en>
- + Microsoft Security Home Page
<http://www.microsoft.com/security/>
- + Microsoft Security Notification Service
<http://www.microsoft.com/technet/security/bulletin/notify.mspix>
- + Microsoft TechNet Security Resource Center
<http://www.microsoft.com/TechNet/security/default.mspix>
- + Microsoft Windows Update Web site
<http://windowsupdate.microsoft.com>
- + Security Bulletins
http://www.microsoft.com/security/security_bulletins/alerts2.asp
- + Security Guidance Center for Developers and IT Pros
<http://www.microsoft.com/security/guidance/default.mspix>
- + Software Update Services
<http://www.microsoft.com/windowsserversystem/sus/default.mspix>
- + *Software Update Services Deployment White Paper*
<http://www.microsoft.com/windowsserversystem/sus/susdeployment.mspix>

E.5.3 General Windows XP Security Resources

- + Focus On: Windows XP Security
<http://www.microsoft.com/WindowsXP/expertzone/focuson/security.asp>

- + *Home and Small Office Networking with Windows XP*
<http://www.microsoft.com/windowsxp/homenetworking/>
- + *Microsoft Security Guidance Center: Windows XP Index*
<http://www.microsoft.com/security/guidance/prodtech/WindowsXP.mspx>
- + *Securing Mobile Computers with Windows XP Professional*
<http://www.microsoft.com/technet/prodtechnol/winxppro/evaluate/mbsecxp.mspx>
- + *Step-by-Step Guide to Securing Microsoft Windows XP Professional in Small and Medium Businesses*
<http://www.microsoft.com/windowsxp/pro/using/howto/security/smbsecurity.asp>
- + *Threats and Countermeasures Guide: Security Settings in Windows Server 2003 and Windows XP*
<http://www.microsoft.com/downloads/details.aspx?FamilyId=1B6ACF93-147A-4481-9346-F93A4081EEA8&displaylang=en>
- + *What's New in Security for Windows XP Professional and Windows XP Home Edition*
<http://www.microsoft.com/technet/prodtechnol/winxppro/evaluate/xpsec.mspx>
- + *Windows XP Baseline Security Checklists*
<http://www.microsoft.com/technet/security/chklist/xpcl.mspx>
- + *Windows XP Security Guide*
<http://www.microsoft.com/downloads/details.aspx?FamilyID=2d3e25bc-f434-4cc6-a5a7-09a8a229f118&DisplayLang=en>
- + *Windows XP Security Guide Overview*
<http://www.microsoft.com/technet/security/prodtech/wincnt/secwinxp/default.mspx>

E.5.4 Specific Windows XP Security Topics

- + *Configuring Windows XP IEEE 802.11 Wireless Networks for the Home and Small Business*
<http://www.microsoft.com/technet/prodtechnol/winxppro/maintain/wifisoho.mspx>
- + *Data Protection and Recovery in Windows XP*
<http://www.microsoft.com/technet/prodtechnol/winxppro/support/dataprot.mspx>
- + *Don't Let the Defense Rest*
<http://www.microsoft.com/windowsxp/expertzone/columns/bowman/november12.asp>
- + *Enabling the Startup Key*
http://www.microsoft.com/resources/documentation/windows/xp/all/reskit/en-us/prnb_efs_zbxr.asp
- + *Encrypting File System in Windows XP and Windows Server 2003*
<http://www.microsoft.com/technet/prodtechnol/winxppro/deploy/cryptfs.mspx>
- + *Features Available on NTFS Volumes*
http://www.microsoft.com/resources/documentation/Windows/XP/all/reskit/en-us/prkc_fil_gywp.asp
- + *Get Started Using Remote Desktop*
<http://www.microsoft.com/windowsxp/pro/using/howto/gomobile/remotedesktop/default.asp>

- + *How to Open Ports in the Windows XP Internet Connection Firewall*
<http://www.microsoft.com/security/protect/ports.asp>
- + *How to Set Up and Use Automated System Recovery in Windows XP*
<http://www.microsoft.com/windowsxp/pro/using/itpro/managing/asr.asp>
- + *How to Share Files Using Encrypting File System*
<http://www.microsoft.com/windowsxp/pro/using/itpro/securing/sharefilesefs.asp>
- + *How to Use Sysprep: An Introduction*
<http://www.microsoft.com/windowsxp/pro/using/itpro/deploying/introduction.asp>
- + *NTFS vs. FAT: Which Is Right for You?*
<http://www.microsoft.com/windowsxp/expertzone/columns/russel/october01.asp>
- + *Patch Management Using Microsoft Software Update Services*
<http://www.microsoft.com/downloads/details.aspx?FamilyId=38D7E99B-E780-43E5-AA84-CDF6450D8F99&displaylang=en>
- + *Predefined Security Templates*
http://www.microsoft.com/resources/documentation/windows/xp/all/proddocs/en-us/sag_scedefaultpols.mspx
- + *Remote Installation Services*
http://www.microsoft.com/resources/documentation/Windows/XP/all/reskit/us/prbc_cai_byil.asp
- + *Securing Wireless LANs—A Windows Server 2003 Certificate Services Solution*
<http://www.microsoft.com/technet/security/prodtech/win2003/pkiwire/swlan.mspx>
- + *Securing Wireless LANs with PEAP and Passwords*
<http://www.microsoft.com/downloads/details.aspx?FamilyID=60c5d0a1-9820-480e-aa38-63485eca8b9b&displaylang=en>
- + *Set Up and Use Internet Connection Sharing*
<http://www.microsoft.com/WindowsXP/pro/using/howto/networking/ics.asp>
- + *Step-by-Step Guide to Internet Protocol Security (IPSec)*
<http://www.microsoft.com/windows2000/techinfo/planning/security/ipsecsteps.asp>
- + *Stored User Names and Passwords Overview*
http://www.microsoft.com/resources/documentation/windows/xp/all/proddocs/en-us/key_concepts_overview.mspx
- + *Strengthening Key and File Security*
http://www.microsoft.com/resources/documentation/windows/xp/all/reskit/en-us/prnb_efs_mjtv.asp
- + *System Services for the Windows Server 2003 Family and Windows XP Operating Systems*
http://www.microsoft.com/technet/prodtechnol/windowsserver2003/technologies/management/svrxpser_7.mspx
- + *Universal Plug and Play in Windows XP*
<http://www.microsoft.com/technet/prodtechnol/winxp/evaluate/upnpxp.mspx>

- + *Using Software Restriction Policies to Protect Against Unauthorized Software*
<http://www.microsoft.com/technet/prodtechnol/winxppro/maintain/rstrplcy.mspix>
- + *Using Windows XP Professional with Service Pack 1 in a Managed Environment: Remote Assistance*
http://www.microsoft.com/technet/prodtechnol/winxppro/maintain/xpmanaged/22_xprem.mspix
- + *Well-Known Security Identifiers*
http://www.microsoft.com/resources/documentation/Windows/XP/all/reskit/en-us/prnc_sid_cids.asp
- + *Wi-Fi*
<http://www.microsoft.com/windowsserver2003/technologies/networking/wifi/default.mspix>
- + *Wireless XP Wireless Auto Configuration: The Cable Guy, November 2002*
<http://www.microsoft.com/technet/community/columns/cableguy/cg1102.mspix>
- + *Windows XP Wireless Deployment Technology and Component Overview*
<http://www.microsoft.com/technet/prodtechnol/winxppro/maintain/wificomp.mspix>

E.5.5 Knowledge Base Articles

- + Article 217098, *Basic Overview of Kerberos User Authentication Protocol in Windows 2000*
<http://support.microsoft.com/?id=217098>
- + Article 254649, *Overview of Memory Dump File Options for Windows 2000, for Windows XP, and for Windows Server 2003*
<http://support.microsoft.com/?id=254649>
- + Article 279765, *How to Use the Fast User Switching Feature in Windows XP*
<http://support.microsoft.com/?id=279765>
- + Article 283429, *How To Prevent the Network Setup Wizard From Creating a Bridge in Windows XP*
<http://support.microsoft.com/?id=283429>
- + Article 294739, *A Discussion About the Availability of the Fast User Switching Feature*
<http://support.microsoft.com/?id=294739>
- + Article 304040, *Description of File Sharing and Permissions in Windows XP*
<http://support.microsoft.com/?id=304040>
- + Article 307973, *How to Configure System Failure and Recovery Options in Windows*
<http://support.microsoft.com/?id=307973>
- + Article 308422, *How to Use Backup to Back Up Files and Folders on Your Computer in Windows XP*
<http://support.microsoft.com/?id=308422>
- + Article 309340, *How to Use Backup to Restore Files and Folders on Your Computer in Windows XP*
<http://support.microsoft.com/?id=309340>
- + Article 310749, *New Capabilities and Features of the NTFS 3.1 File System*
<http://support.microsoft.com/?id=310749>

- + Article 314343, *Basic Storage Versus Dynamic Storage in Windows XP*
<http://support.microsoft.com/?id=314343>
- + Article 314834, *How to Clear the Windows Paging File at Shutdown*
<http://support.microsoft.com/?id=314834>
- + Article 314984, *How To Create and Delete Hidden or Administrative Shares on Client Computers*
<http://support.microsoft.com/?id=314984>
- + Article 320820, *How to Use the Backup Utility to Back Up Files and Folders in Windows XP Home Edition*
<http://support.microsoft.com/?id=320820>
- + Article 320855, *Description of the Windows XP Internet Connection Firewall*
<http://support.microsoft.com/?id=320855>
- + Article 322389, *How to Obtain the Latest Windows XP Service Pack*
<http://support.microsoft.com/?id=322389>
- + Article 330904, *Messenger Service Window That Contains an Internet Advertisement Appears*
<http://support.microsoft.com/?id=330904>
- + Article 810207, *IPSec Default Exemptions Are Removed in Windows Server 2003*
<http://support.microsoft.com/?id=810207>
- + Article 815485, *Overview of the WPA Wireless Security Update in Windows XP*
<http://support.microsoft.com/?id=815485>
- + Article 837243, *Availability and Description of the Port Reporter Tool*
<http://support.microsoft.com/?id=837243>
- + Article 832017, *Port Requirements for the Microsoft Windows Server System*
<http://support.microsoft.com/?id=832017>

E.6 Other Web-Based Resources

- + *How Windows Server 2003's Software Restriction Policies Improve Security*
http://www.windowsecurity.com/articles/windows_2003_restriction_policies_security.html
- + *National Industrial Security Program Operating Manual, DoD 5220.22-M, by the Department of Defense*
<http://www.dss.mil/isec/nispom.pdf>
- + *National Security Agency Security Recommendation Guides for Windows XP*
<http://nsa2.www.conxion.com/winxp/>
- + *Searching and Seizing Computers and Obtaining Electronic Evidence in Criminal Investigations, by the Department of Justice*
<http://www.cybercrime.gov/s&smanual2002.htm>
- + *Windows XP Resource Center*
<http://labmice.techtarget.com/windowsxp/default.htm>

- + *Windows XP Service Pack 2 Beta First Look*, by Kurt Hutchinson
<http://www.arstechnica.com/wankerdesk/04q1/sp2-beta-1.html>
- + *Windows XP Service Pack 2 Beta Review*, by Paul Thurrott
http://www.winsupersite.com/reviews/windowsxp_sp2_preview2.asp
- + WinXPnews
<http://www.winxpnews.com/>

Appendix F—Acronyms

Selected acronyms used in the guide are defined below.

3DES	Triple Data Encryption Standard
ACE	Access Control Entry
ACL	Access Control List
AD	Active Directory
AES	Advanced Encryption Standard
AP	Access Point
AS	Authentication Service
BIOS	Basic Input/Output System
CD	Compact Disk
CHAP	Challenge Handshake Authentication Protocol
CIFS	Common Internet File System
CIS	Center for Internet Security
CS	Client/Server
DES	Data Encryption Standard
DESX	Extended Data Encryption Standard
DHCP	Dynamic Host Configuration Protocol
DISA	Defense Information Systems Agency
DLL	Dynamic Link Library
DNS	Domain Name System
DoS	Denial of Service
DRA	Data Recovery Agent
ECM	Enterprise Configuration Manager
EFS	Encrypting File System
e-mail	Electronic mail
FAT	File Allocation Table
FEK	File Encryption Key
FIPS	Federal Information Processing Standards
FISMA	Federal Information Security Management Act
FTP	File Transfer Protocol
FUS	Fast User Switching
GB	Gigabyte
GINA	Graphical Identification and Authentication
GPMC	Group Policy Management Console
GPO	Group Policy Object
GUI	Graphical User Interface
HKCU	HKEY_Current_User
HKLM	HKEY_Local_Machine
HKU	HKEY_Users
HTML	Hypertext Markup Language

HTTP	HyperText Transfer Protocol
HTTPS	HTTP Over SSL
ICF	Internet Connection Firewall
ICMP	Internet Control Message Protocol
ICS	Internet Connection Sharing
IE	Internet Explorer
IETF	Internet Engineering Task Force
IIS	Internet Information Services
IKE	Internet Key Exchange
IM	Instant Messaging
IP	Internet Protocol
IPsec	IP Security
IRC	Internet Relay Chat
IT	Information Technology
L2TP	Layer 2 Tunneling Protocol
LAN	Local Area Network
LM	LanManager
MBSA	Microsoft Baseline Security Analyzer
MMC	Microsoft Management Console
MS	Microsoft
MTU	Maximum Transmission Unit
NAI	Network Associates
NAT	Network Address Translation
NetBT	NetBIOS over TCP/IP
NIC	Network Interface Card
NIST	National Institute of Standards and Technology
NSA	National Security Agency
NTFS	NT File System
NTLM	NT LanManager
NTP	Network Time Protocol
NX	No Execute
OMB	Office of Management and Budget
OS	Operating System
OU	Organizational Unit
P2P	Peer-to-peer
PIN	Personal Identification Number
PKI	Public Key Infrastructure
PPTP	Point-to-Point Tunneling Protocol
QoS	Quality of Service
RA	Remote Assistance
RC	Release Candidate
RCE	Route Cache Entry
RDP	Remote Desktop Protocol

RFC	Request for Comment
RIS	Remote Installation Service
RPC	Remote Procedure Call
RSVP	Resource Reservation Protocol
SACL	System Access Control List
SAM	Security Accounts Manager
SID	Security Identify
SMB	Server Message Block
SMS	Systems Management Server
SMTP	Simple Mail Transport Protocol
SNMP	Simple Network Management Protocol
SOHO	Small Office Home Office
SP	Service Pack
SQL	Structured Query Language
SR	Service Release
SSDP	Simple Service Discovery Protocol
SSH	Secure Shell
SSID	Service Set Identifier
SSL	Secure Socket Layer
SUS	Software Update Services
TCP	Transmission Control Protocol
TCP/IP	Transmission Control Protocol/Internet Protocol
TGS	Ticket-Granting Service
TLS	Transport Layer Security
UDP	User Datagram Protocol
UI	User Interface
UPnP	Universal Plug and Play
UPS	Uninterruptible Power Supply
URL	Uniform Resource Locator
VBS	Visual Basic Script
VoIP	Voice over IP
VPN	Virtual Private Network
WebDAV	Web Distributed Authoring and Versioning
Wi-Fi	Wireless Fidelity
WPA	Wi-Fi Protected Access