Global Information Assurance Certification Paper

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Windows NT Security: Step-by-Step. Practicum
Disable Nonessential Devices and Services to Reduce Exposure to DoS attacks

How many of you work in universities, where Primary Domain Controls (PDC) pop up like dandelions? What services and protocols are these domain controllers running? Where do department system administrators find information to understand and evaluate the necessity of drivers, services, protocols, and bindings when many security instructions just say "disable nonessential services?" How do you convince system administrators to invest the time? This paper collects and compares guidelines from a variety of management, performance tuning and security papers on evaluating and disabling nonessential drivers, services, protocols, and bindings.

Why bother? Although SANS defines vulnerable systems and recommends stripping all unnecessary services [1], how does one convince department system administrators to carry out the recommendations? Departments may not be using servers for sensitive information so no one allocates time to research and plan service management. When asked, a system administrator may reply "I don't know what the service effects, so I'm not going to risk turning it off." If a server hasn't been cracked, the risk of losing data or service availability may be considered low.

The most persuasive argument for the busy system administrator is timesavings. There are enough core resources on a server [2,3] for system administrators to monitor and patch promptly. The few hours planning and disabling nonessential services for a PDC at installation can save the system administrator hours of work and increase the network availability for users. In the last year alone, the system administrator may have had to patch the domain controllers for LSA DoS, Source Routing, TCP/IP Sequence Numbers, service.exe DoS, SysKey, RDisk Race Condition, Loose Registry Permissions, Buffer Overflow in cmd.exe, IP Fragment Reassembly, and Master Browser DoS. We don't have a crystal ball for determining what may need to be patched in the future, so save valuable time by turning off or removing unused devices and services.

What can/should be disabled?

"Exactly which services and options can be disabled on a particular server depends upon the purpose(s) of that server and the custom applications running on it."[1] The security requirements of your organization may determine what you are allowed to run on a PDC. Even if servers do not need to be C2 [4,5] or ITSEC FC2-E3 [6] compliant, their security guidelines provide insight for securing devices, services and protocols. These combined with Managing Server Security [7], Windows NT Security Step-by-Step [8,] and the Navy's Guide to Securing NT [9] round out Microsoft's Domain Controller Configuration Checklist [10].

The sequence of disabling or removing device drivers and services counts. Remove device drivers before services. Some services have dependencies; the dependent services must be removed first. A common example on a Windows NT 4.0 workstation is to remove the Server before removing the Computer Browser.

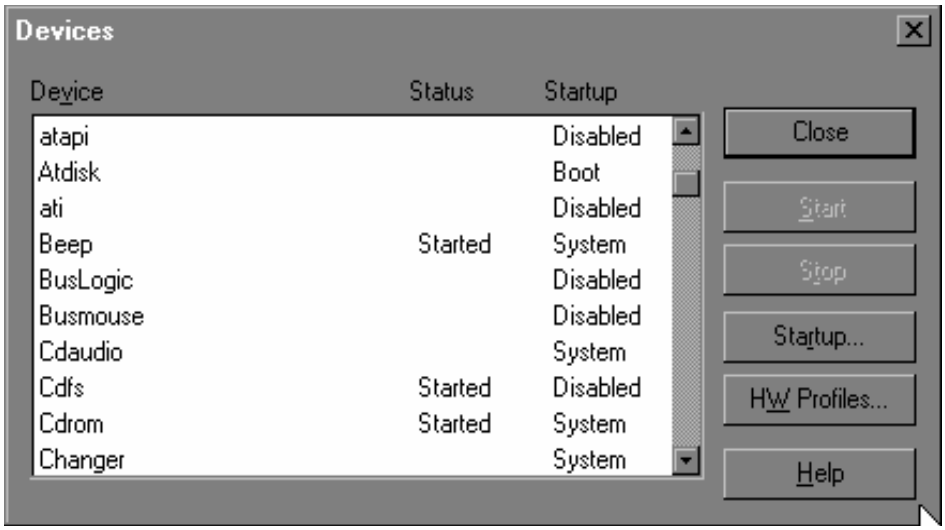
1. Devices

Devices refer to the physical equipment and software drivers installed on the domain controller. CERT [11] points out that, "New and reassigned systems often arrive with optional hardware that is not required. " These can complicate configuring the server and may give crackers another door into the system. Experts do not recommend modems and removable media devices for primary domain controllers. Physically remove these and their associated drivers and software.

All security guidelines agree that protecting the devices involved in the boot process is critical. The first step, if at all possible, is to place servers in a locked room with limited access. When this is not possible, secure the server with a power on password and consider the disablement of boot from the floppy drive. If the system doesn't need the floppy drive, remove it.

Rootkit authors target device drivers because they run in the kernel space with access to most of the system functions. DoS attacks can be a smoke screen for intruders replacing device drivers with trojans, rootkits, or DDoS tools after a system reboot. Any drivers left on a system should be secured with registry scripts and the use of such tools as Tripwire[12] or Intact[13].

The ITSEC F2-E3 [6] of the IT Security Evaluation Criteria is one measure of a secure operating system used in the U.K. and many European countries. This guideline is restrictive in that it states; "Only devices that are found on the Windows NT Installation CD may be enabled in the evaluated configuration." To see which drivers are installed by default on your PDC, from the Start button, select Settings, select the Control Panel, and then select Devices. The following screen appears showing the device name, its current status and the configured startup behavior.



The C2-evaluated configuration, used as a measurement in the U.S., consists of specified hardware, software, programs and network services. Like its European cousin, its narrow definition (which also excludes NetBIOS) may not provide enough network service. Nevertheless, the list of thirty-five allowable devices [5] is a useful guide to see how few devices one really needs for a server.

Table 1: Allowable drivers under C2

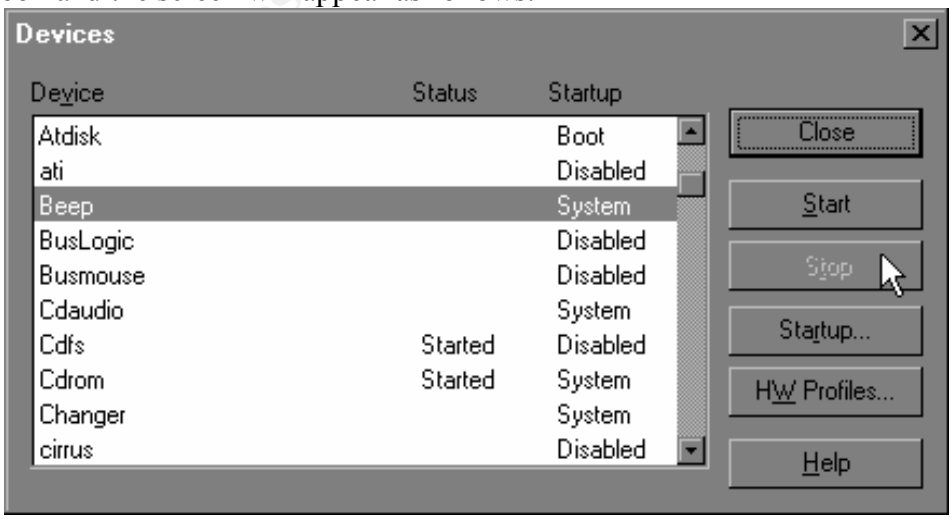
Service name	Driver
AFD Networking Support	afd.sys
IDE or EIDE storage systems	atapi.sys
Beep	beep.sys
CD file system	cdfs.sys
CD-ROM	cdrom.sys *
Compaq NetFlex-3 Driver	netflx3.sys
Compaq Array	cpqarray.sys
Disk	disk.sys *
Fastfat	fastfat.sys *
Floppy	floppy.sys
HP 4mm DAT tape device	hpt4qic.sys
i8042 keyboard and PS/2 mouse port	i8042prt.sys
keyboard class driver	kbdclass.sys
security device drive	ksecdd.sys
Microsoft NDIS driver	ndis.sys
mouse class driver	mouclass.sys
ms file system	msfs.sys
multiple UNC provider	mup.sys
device detector	netdetect.sys
Netware print and file service	npfs.sys
NT file system	ntfs.sys
null	null.sys

parallel port	parallel.sys
parallel port	parport.sys
redirector	rdr.sys
serial port	serial.sys
services	srv.sys
Symbios PCI-SCSI controller	symc810.sys
TCP/IP network service	tcpip.sys
VGA monitor	vga.sys *
WINS Client	netbt.sys
tape	tape.sys
4mm DAT tape drive	4mmdat.sys

So there are resources for identifying the purpose of a driver and which ones may be disabled or removed. Drivers marked with an asterisk should not be disabled according to the Microsoft Knowledge Base article Q166238 [14].This document also discusses how to repair device drivers set to start at Boot or System but in fact never started. Although dangerous to remove carelessly, if the operations manager has banned beeping from the computer center, one can remove beep.sys. Another innovative solution is Pedestal Software's Integrity Protection Driver (IPD)[15]. After driver installation, devices can not be added, changed or deleted without a rebuild.

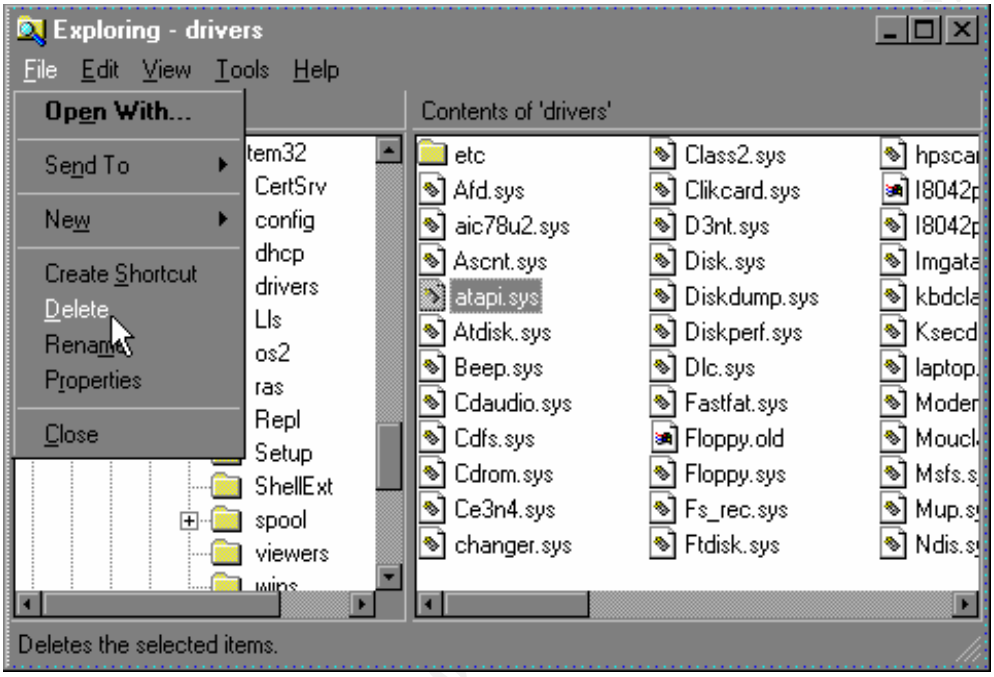
How to Disable Drivers

Once research is complete, and you've determined that security requires disabling a driver, select the Start button, Settings, the Control Panel and select the Devices icon. The following Devices screen appears. Highlight the device to disable, then select the Stop button. Answer yes to the pop-up box and the screen will appear as follows.



How to Remove Drivers

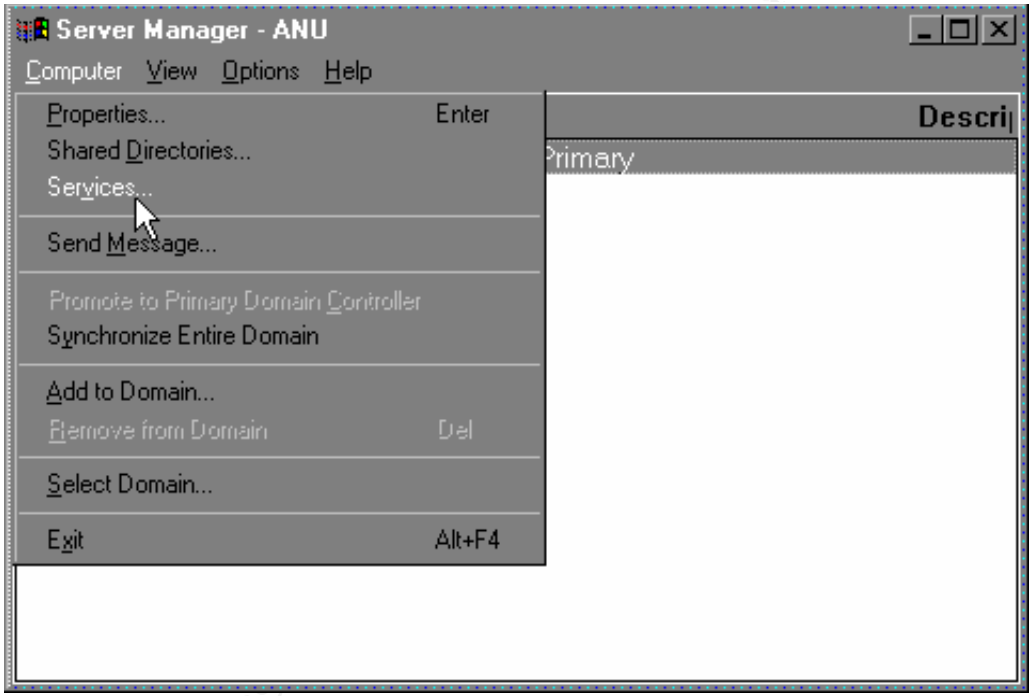
In some cases security requirements dictate that a device must be removed. It's a good idea to have the Microsoft Knowledge Base article Q166238 [14] available. Begin by right clicking on the Start button, select Explore, scroll down and expand the system32 folder in the left panel, then select drivers. Highlight the device driver name in the right panel, select File, and then select Delete.



2. Services

Like devices, services are tempting targets. The threats may include DoS vulnerabilities, service account mis-configuration, trojan horses and social engineering ruses. SANS[8] recommends verifying that the PDC has the latest versions of each service. Installing the latest service pack updates and repairs services. Although Microsoft's Domain Controller Configuration Checklist[14] only recommends securing the Scheduler Service, Microsoft's Security Audit and Control[7] as well as the C2 [5] and ITSEC FC2-E3 [6] checklists provide additional suggestions.

To see the installed services, from the Start button, Programs, open Administrative Tools and then the Server Manager. With the Primary Domain Controller of a real (rather than a laptop) network, a system administrator can manage all the domain controllers and member servers from the Server Manager screen. To view the services for the PDC, highlight it then select Computer and Services.



The following scrollable list of built-in and application services appears.

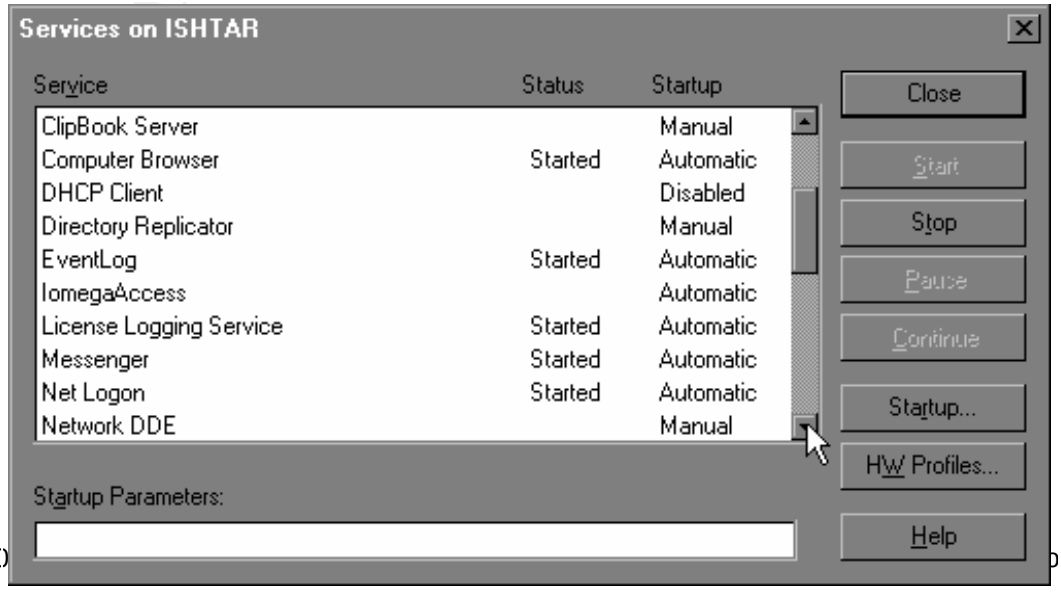
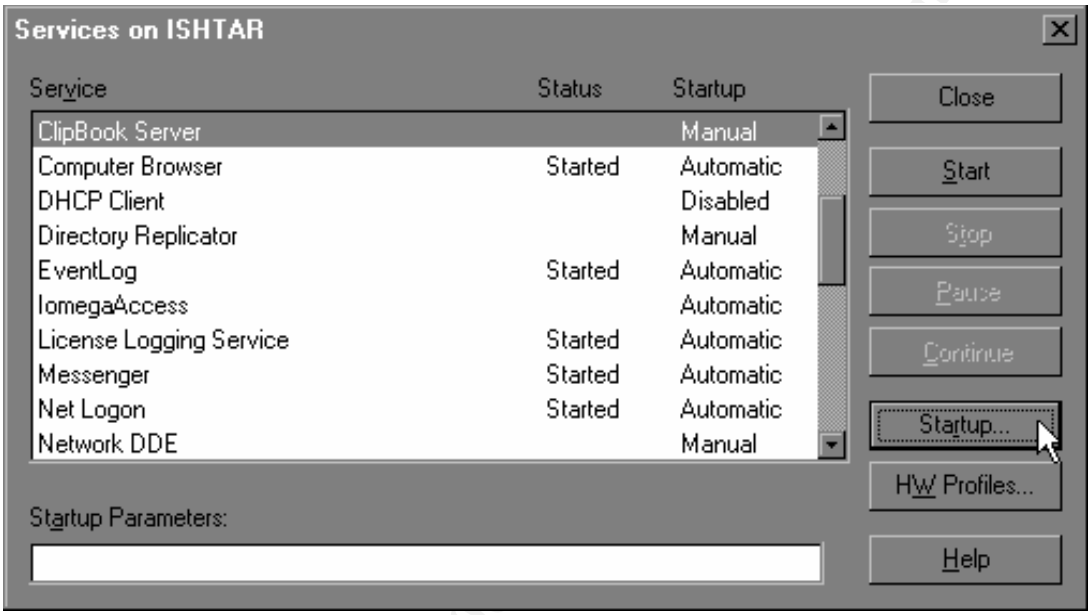


Table 2: Comparison of Service Recommendations:

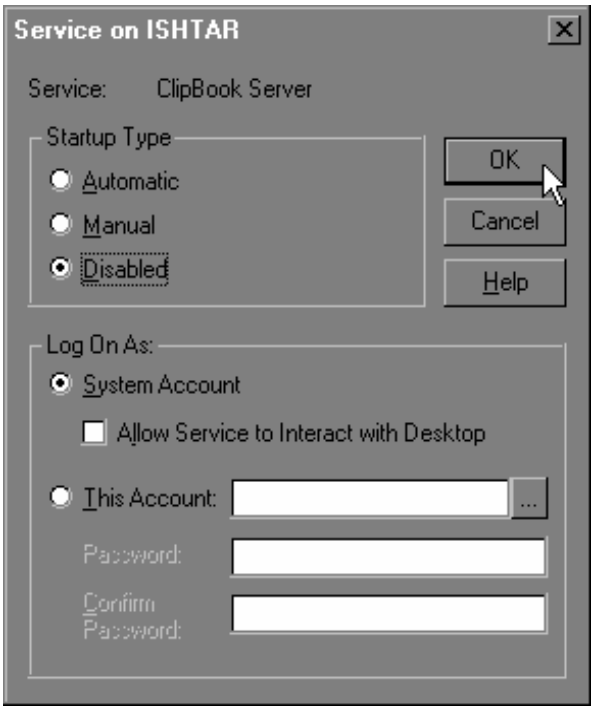
	DC [10] Checklist	Managing Server Security [7]	ITSEC FC2-E3 [6]	C2 Checklist [5]
Alerter		Consider disabling	Allow	Remove
Clipbook viewer		Disable	Remove	Remove
Computer Browser		Allow	Allow	Allow
DDE		Not required	Remove	Remove
DDEDSDM		Not required	Remove	Remove
DHCP Client			Allow	Remove
Directory Replicator		Secure	Remove	Remove
Event Log		Require	Require	Require
License Logging				
Messenger		Allow	Remove	Remove
MS DNS			Only if DNS Server	Only if DNS Server
Net Logon		Allow	Allow	Allow
NTLM SSP		Allow	Allow	Allow
Plug & Play			Allow	Remove
Protected Storage			Allow	Remove
RPC Locator		May use account	Allow	Allow
RPC Service		May use account	Allow	Allow
Scheduler	Secure	Secure	Remove	Remove
Server		Allow	Allow	Allow
Spooler		May use account	Allow	Allow
TCP/IP Netbios He		Allow	Allow	Allow
UPS		Not required	Remove	Remove
WINS			Only if WINS Server	Only if WINS Server

Service Dependencies
Aerter, Messenger and Net Logon depend on the Workstation service. Remote Procedure Call Locator and the NT LM Security Support depend on the Remote Procedure Call Service. Computer Browser depends on the Server Service. Although seldom required, the Network DDE services depends on Network DDE DSDM. Jumes in Managing Service Security [7] and The ARS Technica [16] web sites provide clear information on services and their functions.

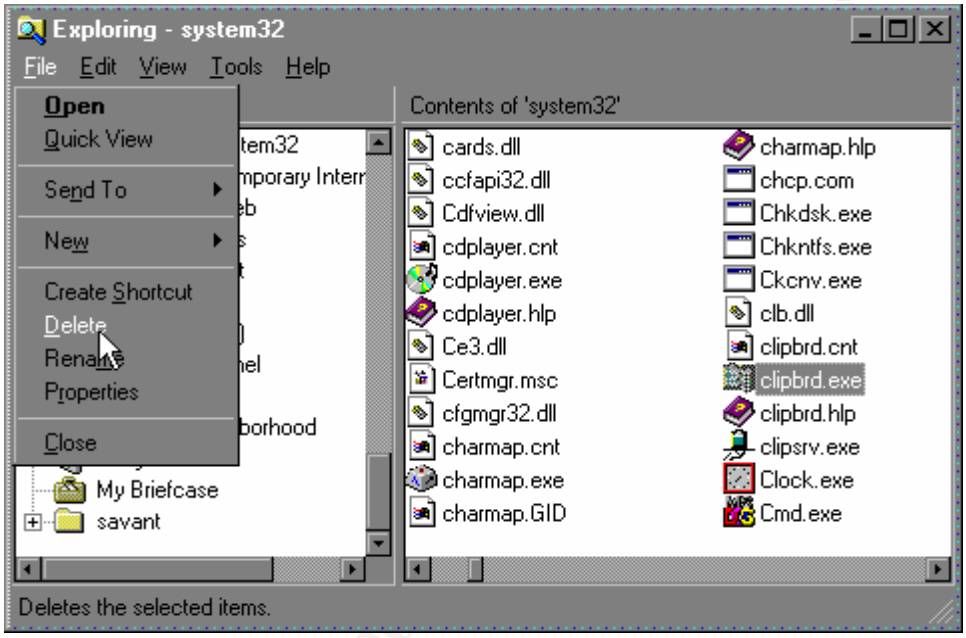
How to change the status of a service
While in the Server Manager, Services screen, highlight the service. Select the Startup button.



The Service description box appears. Click on the Startup Type radio button for Disabled, then select OK.



How to Remove the Clipbook Viewer Service
For some systems, disabling a service is not enough. Guidelines, such as the ITSEC FC2-E3, may require system administrators to remove a service. Using Explore, find the file CLIPBRD.EXE in the system32 directory of the server root. Delete it and empty the Recycle Bin unless you have already implemented the "Do not move files to the Recycle Bin" option for the recycle bin properties sheet. You might also remove the clipsrv.exe while you're here.

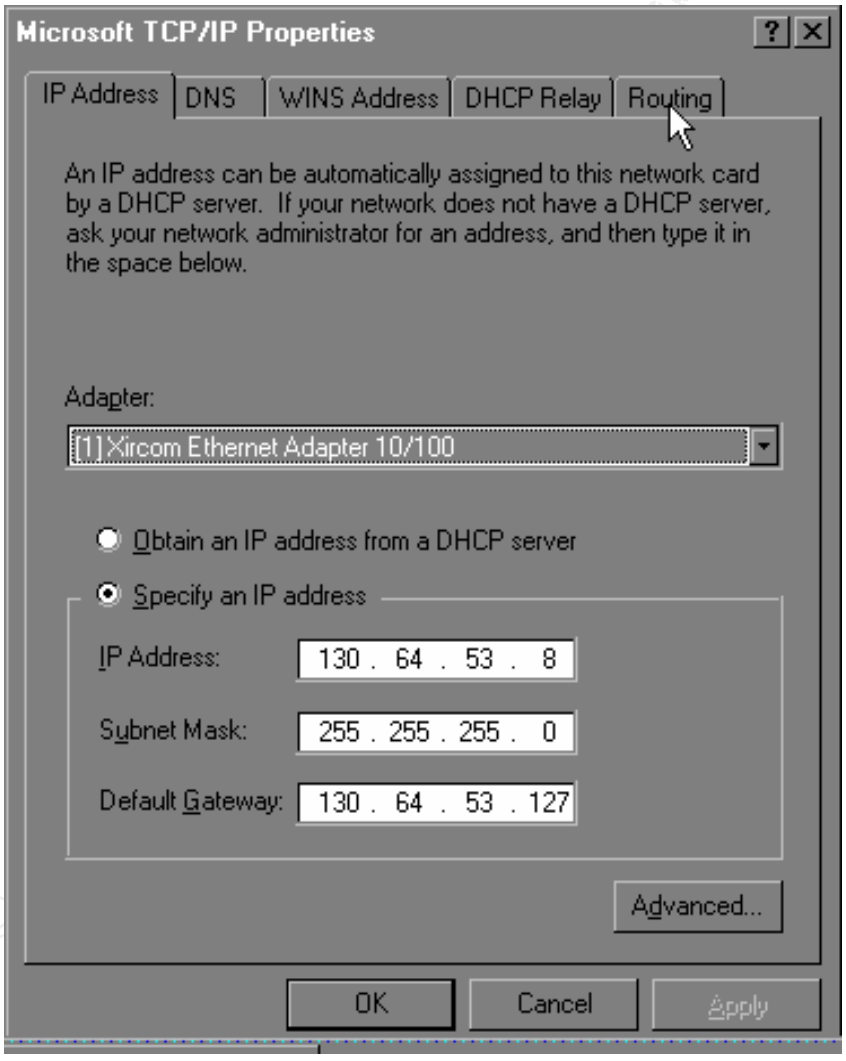


Securing Services
As the comparison table illustrates, several guidelines recommend securing services such as the Directory Replicator and Scheduler. That topic is beyond the scope of this paper, but Microsoft's Windows NT 4.0 Domain Controller Configuration Checklist [10] provides guidelines for securing the Scheduler. Jumes in Managing Service Security [7] describes how to secure the Directory Replicator. Look for additional instructions in the Microsoft Knowledge Base, SANS or at software vendor sites on securing specific built-in or application services. Services are critical to the controllers' security.

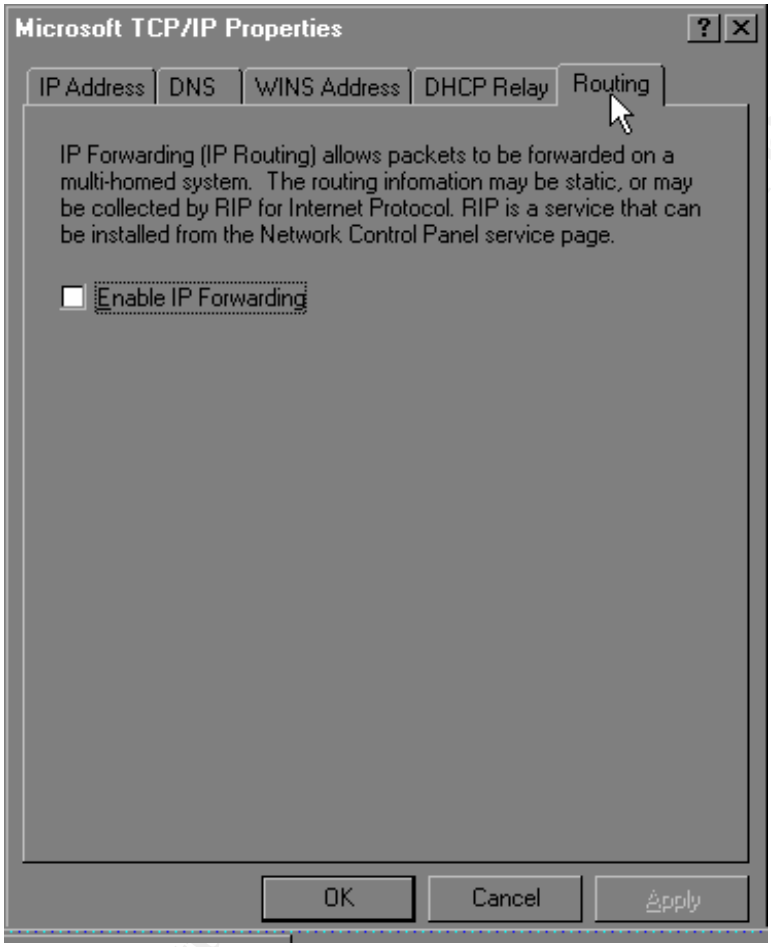
3. Network Services, Protocols and Bindings
Only run the protocols you need. Since C2 and ITSEC FC2-E3 standards cover stand-alone hosts, they are not particularly useful for network services. The default PDC installation will include the Computer Browser, NetBIOS interface, RPC configuration, Server and Workstation "services". The only protocol is TCP/IP. The network bindings include NetBIOS Interface, Server and Workstation.

Don't be tempted to enable Simple TCP/IP Service, which include some of crackers' favorite protocols- Chargen, Daytime and Echo. These are rarely needed. Plan the local domain design so that TCP/IP Printing and Remote Access Service run on a resource server. Never run the Internet Information Server on a domain controller. And last but not least, there's always the anecdote about the clueless administrator who thought Services for Macintosh had to be enabled and brought down an entire school's subnet

Make sure that TCP/IP forwarding is turned off.
Selecting the Start button, then Setting, the Control Panel, and then selecting the Network icon access the Network screen. From the main Network screen, select the Protocol tab and then select Properties. The Microsoft TCP/IP Properties screen appears select Routing.



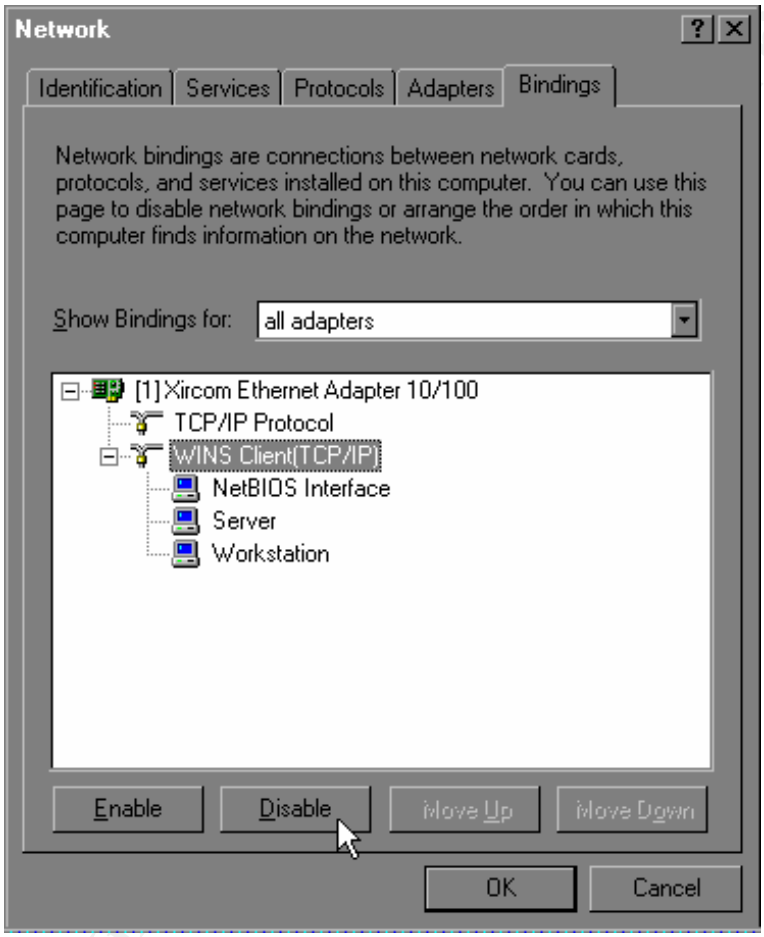
In the Routing tab screen, make sure that the Enable IP Forwarding box is not checked.



Removing Bindings

Guidelines frequently recommend that a PDC with two internal NIC cards, unbind NetBIOS on the external card to protect Windows NT networking data and SMB/NetBIOS services.

From the Taskbar, select the Start button, then Settings, and then the Control Panel. Double-click on the Network icon and then select the Bindings tab. Click on NetBIOS Interface and click on the Disable button. Select Close.



This is just a small piece of securing a domain controller. By gathering information into one paper for busy system administrators, hopefully we will be able to persuade more of them to save time and disable unneeded devices, services and protocols.

Resources

1. Fossen, Jason and Johannson, Jesper. Windows NT Security: Step-by-Step. SANS GIAC Track 6 Syllabus, May 11-13, 2000.

2. NT Security News. Available: http://www.ntsecurity.net/.

3. Microsoft Security Bulletins. Available: http://www.microsoft.com/technet/security/.

4. Malisow, Ben. DoD-Certified Trusted Systems and You. Feb. 8, 2000. Available: http://www.securityfocus.com/ select Microsoft, NT, Securing and then DOD-Certified.

5. Windows NT C2 Configuration Checklist. April 5, 2000. Available at http://www.microsoft.com/TechNet/security/c2config.asp

6. ITSEC FC2-E3 Installation of Windows NT Workstation 4.0 and Windows NT Server 4.0. Version 2.4 June 1999. Available: http://www.microsoft.com/TechNet/winnt/winntas/ntitsec.asp

7. James J. Jumes, et. al, Managing Service Security, Chapter 10 in Windows NT 4.0 Security, Audit and Control, c1998, Microsoft Press.

8. SANS Windows NT Security, Step-by-Step v.2.0 Feb 9, 1999

9. U.S. Navy Secure Windows NT Installation and Configuration Guide. Version 1.3. December 1998. Available" http://infosec.navy.mil/comusec/ntsecure.html.

10. Microsoft's Windows NT 4.0 Domain Controller Configuration Checklist. March 29, 2000. Available: http://www.microsoft.com/technet/security/dccklst.asp.

11. CERT. Preparing for the initial installation of Windows NT 4.0 Systems. Available: http://www.cert/org/security-improement/implementations/i025.01.html.

12. Tripwire. Available: http://www.tripwire.com.

13. Intact. Available: http://www.pedestalsoftware.com.

14. Microsoft Knowledge Base article Q166238 - Problems Caused by Disabling Original Profile on Some Devices. Available: http://search.support/microsoft/com/kb/

15. Integrity Protection Driver. Available: http://www.pedestalsoftware.com