Global Information Assurance Certification Paper

Securing Widows NT 4.0 based Networks

Requirement for GTNT SANS Certification

The intent for this paper is to fulfill a SANS GIAC certification requirement. These exercises have been performed on a Windows NT Server V4.0 with SP 5 installed. The server supports no clients.

Please note in some screen shots there are black out and white spaces. This was for my protection. The black outs are spaces where my computer name and IP address are listed is synonymous with my Cable Internet Service Provider. As you can imagine, having both my IP and computer name will open my home network to potential hacks.

The aspect of actually securing a computer network is a bit obscure. Being that the Internet is a public resource, there is never a way to make any network completely hack-proof. Administrators can only make it harder for a hacker to actually gain access. Whether in limiting the amount of server and network information available to the public or utilizing a combination of the technical suggestions noted in this practical.

This paper provides examples of how to enforce effective Information Security in a network environment. This paper reveals tips and suggestions to make this possible. Warning, this is a small-scale guide to securing a network.

Social Engineering

The most dangerous threat to the integrity of the security on any network is the users and support staff. If users are not educated regarding the importance of network security, all other efforts will eventually fail.

Users are deadly to the network. What can be done? There are many ways of educating your user community ranging from brochures in new employee packages to postings in commonly traveled areas. But no one is there to make sure they are actually performing what you suggest.

A great way to make sure the users in your community become aware of the security risk they impose is to flash notes upon logon that the users will tend to read. Other methods include setting up mandatory security seminars explaining to the users what risks are imposed by carelessness on the network. But that can only be done with upper management's agreement to host these events.

Some basic precautions users should be aware of include never giving information like user names and passwords to anyone, whether in person or over the phone. Not to reveal any type of network information they may posses, domain names and RAS dial in numbers. There are other good suggestion regarding guidelines to pass on to users which can be found at

www.microsoft.com\security.

So what is Social Engineering or 'SI'? SI is manipulating users into revealing network specific, i.e any information that can lead a hacker to a successful breach.

The following dialogue notes an example of a potential means of social engineering. It is a help desk call between the president of the company (played by the hacker) and a Help Desk Agent (HD)

HD - Helpdesk this is John Speaking.
Hacker - Hey John, I am having problems logging onto my system.
HD - OK what is your user ID?
Hacker - I don't know? I can't remember. It is usually on

the screen when I log on. I never have to worry about that.
HD - OK What is you first and Last name?
Hacker - Steve Page (President of the company)
HD - Ohhh, Mr. Page, let me get you your User ID. I am sorry to have kept you waiting.
Here it is.
Hacker – Great. Thanks. Do you mind staying on with me while I try to get into it?
HD - Oh course, anything you need sir.
Hacker - Oh. I just typed in my password and it says it is wrong. I dont think I have changed it anytime recently, nor has my secretary.
HD - OK no problem sir. I will reset it to the word password, and you will be prompted to change it when you next log-in.
Hacker - Wow that is great. What is your name?
HD - John Doe.
Hacker - Well John thanks again, I will be sure to mention how helpful you were next time I meet with your manager.
HD - Well thank you sir, and my pleasure.
Hacker - goodbye.

Now this hacker has the password to the president of the companies' LAN account.

Helpdesk agents not aware that SI forms similar to this example can and eventually will unknowingly undermining the network. An undereducated support staff is the biggest hole in any network. Informing agents of Social Engineering is the key to stopping it.

In addition, policies should be set regarding resetting passwords, access to network drive areas, revealing RAS dial in numbers, and most importantly, working with your companies' human resource department to obtain confidential employee data for verification purposes.
Many companies find this data to be top secret, but there are always alternatives. Request that HR releases the last for digits of the Social Security numbers and the employees home phone number. In-putting the data in the helpdesk utility and enforcing policies stating this data must be checked before any passwords or account information is revealed. This is a good start to preventing certain forms of Social Engineering.

How to technically start

One option of the analysis and discovery portion of security audit of a Windows NT network is to run a port scan on key machines. Key machines are Primary Domain Controllers and Backup Domain Controllers. Because the examples given in the paper are from a mock network, the only node that exists on the network is an NT 4.0 Server running service pack 5.

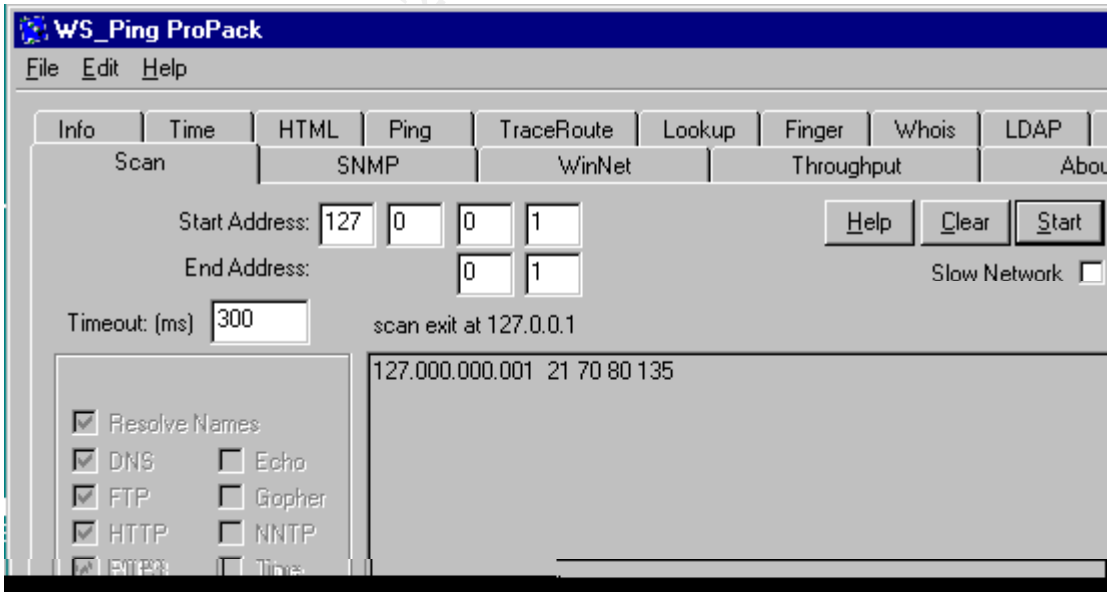
Port scanning is, in short, scanning through all 65000+ ports on your Server and detecting which ports are open. A common way to explain it is going door to door in you neighborhood, and turning each knob to see if you can acquire access to the home, or port in our case.

Running port scanning software is fairly easy and there are huge amounts of free utilities to use from the Internet. A good overall site for utilities that deal with Network Security is

www.astalavista.box.sk.

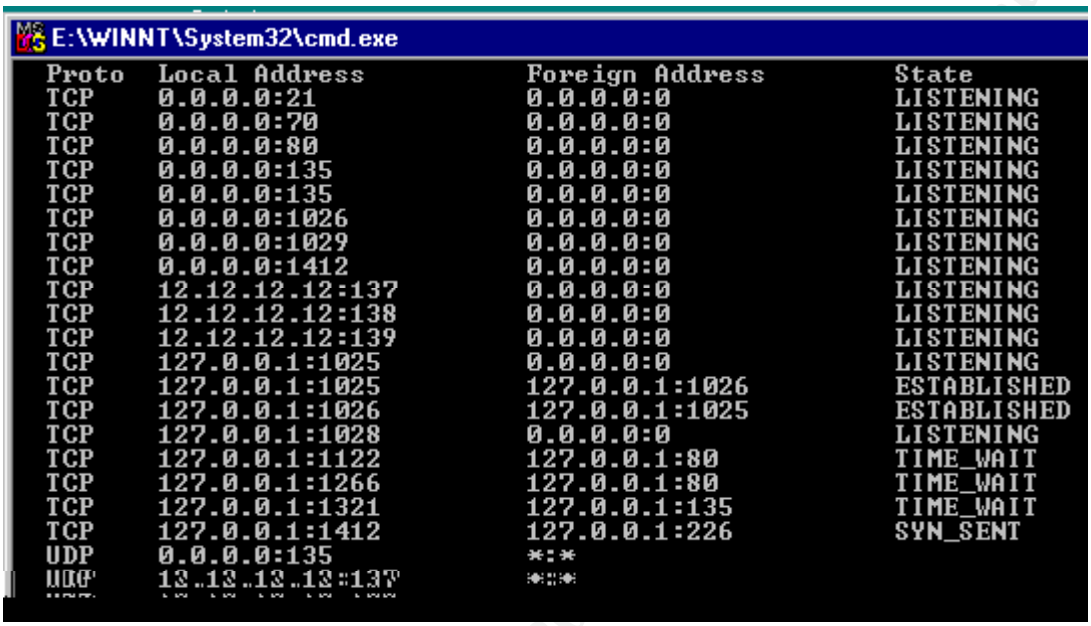
Here, if you search for key words like 'Pots Scanner' you will find hundreds of utilities.

I am using WS Ping Pack Pro. I scan the IP address 127.0.0.1 on ports 1 to 1000 for this example.



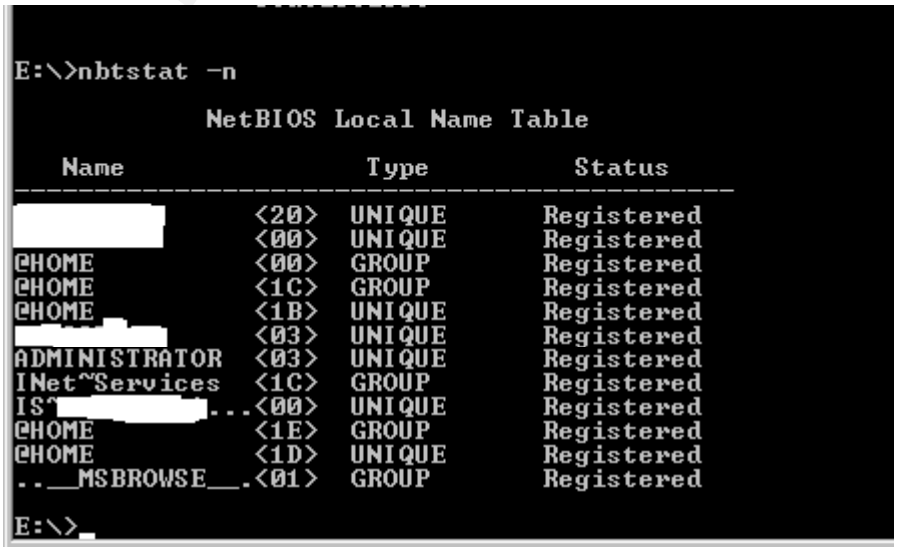
In the above screen shot, note the ports that are reported as open when only scanning port numbers 1 to 1000.

A hacker or administrator may use a DOS command called netstat. Netstat works the same as a port scanner. The following is the result of using NETSTAT on the example server.



Using NETSTAT in DOS, you can see there is a difference in the reporting. This is because NETSTAT reports on all ports, not just a selected range.

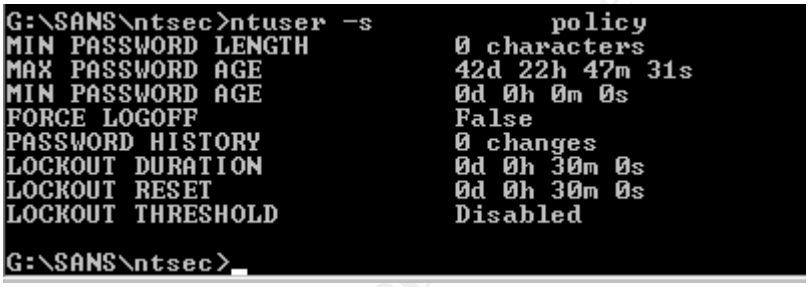
A DOS utility commonly used by hackers is NBTSTAT or NetBois Name Scanning. This utility is similar to NETSTAT, in that it is used to identify the services running on a particular machine.



Analyzing this report and comparing it with a list of netbios names (found on MS Q163409) a hacker can determine that on '1C' the domain controller is '@HOME' and on '20' the File Server Service host is 'SERVERNAME'
For a list of port names to be identified by numbers, please search on

www.microsoft.com,

With the utility 'NTSEC' a hacker using a ''NULL'' session to connect has the ability to view the current registry settings for passwords.



With this information, hackers can restrict the large range of possible password cracker dictionaries and routines to the specific password characteristics of the target network.

Sound Decision Making while Setting Password Protection

Requiring users to have passwords and to have passwords with strong requirements associated with their user accounts is one of the most important keys to securing your network. Generally speaking, users do not understand the concepts of creating strong passwords, nor do they think there is a valid reason. One suggestion is to set up an Information Security Awareness Campaign at your company.

Standards set up on your network should be based on a few key concepts. Ask yourself if the company you are securing is a vendor for an organization that does contracting work for the government, military, or other highly secure organization. If so, they may require minimum password

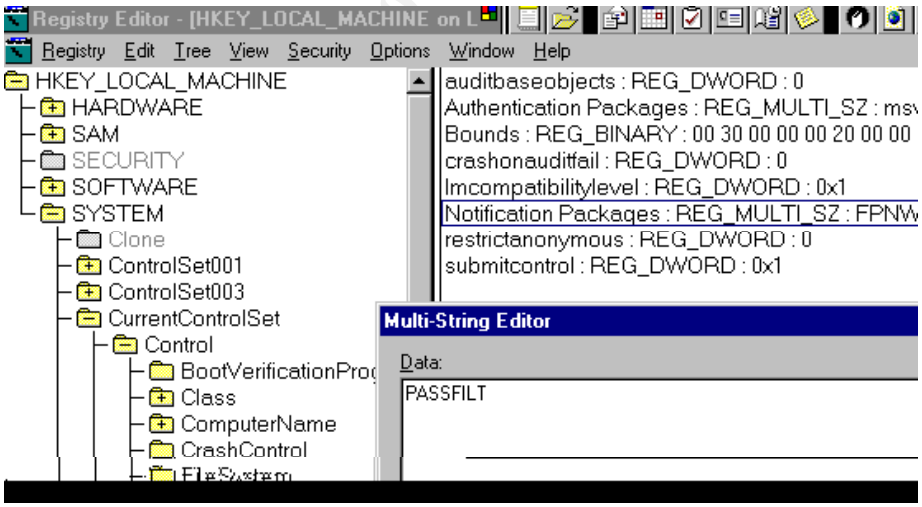
standards in order to exchange data.

If this does not apply to you, you have the challenging job of creating password requirements that are approved by management, do not result in an influx of calls to the help desk, and do not trigger threats of harm because of the new crackdowns.

There are many utilities that exist to ensure users do adhere to minimum password standards. PASSFLT is a registry change found in Windows NT Server 4.0 SP 5 or greater, which requires minimal password standards. These standards include requirements for passwords containing three of the following four options: uppercase, lowercase characters, numbers, and non-alphanumeric symbols.

Please note the following registry path:

Hive:	HKEY_LOCAL_MACHINE
Key:	\System\CurrentControlSet\Control\LSA
Calue Name	NotificationPackages
ValueType:	REG_MULIT_SZ
Value Data:	PASSFILT



By making the change in the above screen shot, password requirements are now activated.

In Service Pack 3 or higher, a utility found in the Resource Kit called PassProp will enable the feature to lockout the administer account when there are three or more unsuccessful

log-on attempts. In addition to enabling this feature, it can also require password complexity for the administrator account.

On the standard NT Server 4.0 install, the administrator lockout feature is disabled, making it a target for hackers to use a password guesser against it. With the account lockout feature enabled on the administrator account, hacker will only have three attempts to guess the password.

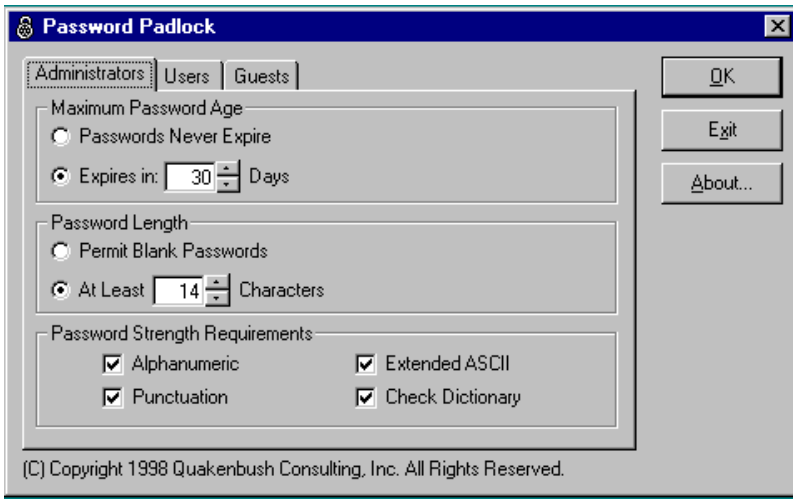
```
G:\reskit>passprop /adminlockout
Password must be complex
The Administrator account may be locked out except for interactive logo
on a domain controller.

G:\reskit>
```

The administrator account will only be locked out on remote logons. The only way to log back on to the account is to access it directly from the console of the server.

If registry setting changes are not permitable on the network, or the ability to place different types of restrictions on different types of accounts is necessary, there are many third party utilities such as the GUI interfaced Quakenbush Password Padlock. This utility can be found at

www.quakenbush.com.

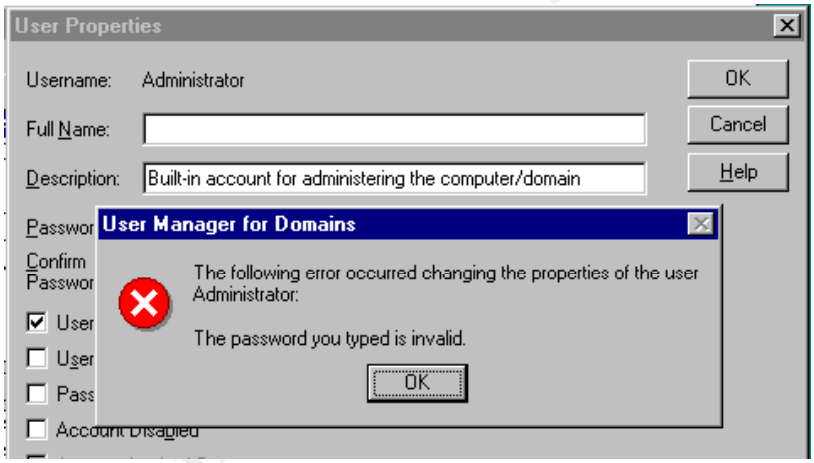
This utility allows a Security Administrator to set different types of password standards on three types of users: Administrators, Standard Users, and Guests. The screen shot below shows the administrator accounts standards in a network considered having high password standards.



With this utility administrators will be set with strict password standards. This includes a 30 day password expiration period, 14 character passwords, and password that include Alpha/Numeric, punctuation, and Extended ASCII characters. Once the administrator successfully creates their password, Quakenbush should be set to use a dictionary scanner to ensure the password can not be easily guessed.

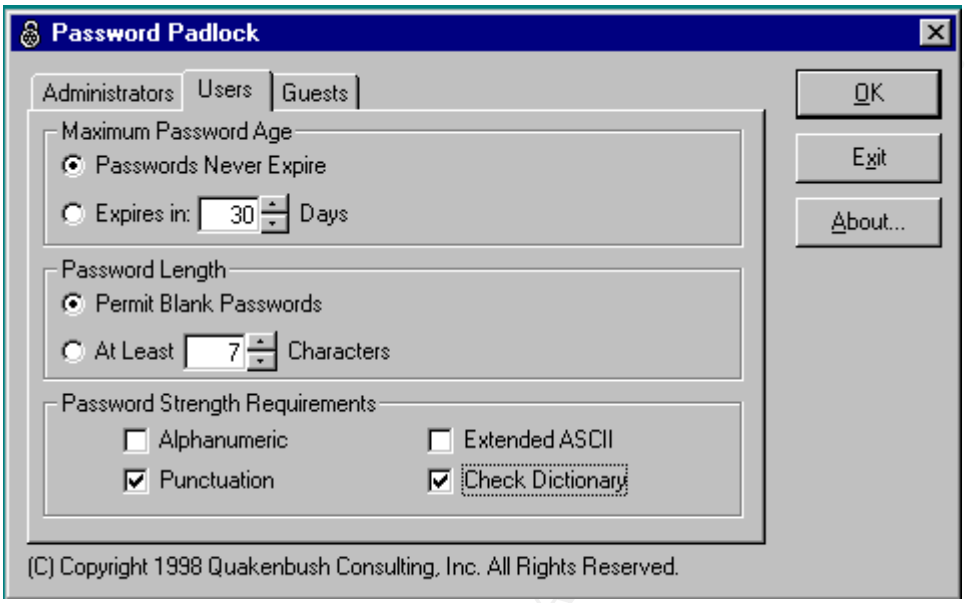
When a password cracker like '10pht' is used against the 'SAM' database (covered later in this paper), the high security levels of the administrator accounts' passwords would take months to crack. By requiring the passwords to expire in 30 days, if the hacker cracks the password, the administrator account password has already been changed and the hacker has to start from scratch.

When the administrator tries to change the password to 'luckyduck', the following error occurs:



If the administrator uses the password Th*$78luckyduck, where * equals the ASCII character 013 or 'Return Carriage' it will be accepted.

Standard users have been set up through Quakenbush to have passwords set with a minimum of 7 characters, which expire every 60 days, and require a punctuation mark in the password. They are also set to have their passwords checked against a dictionary.



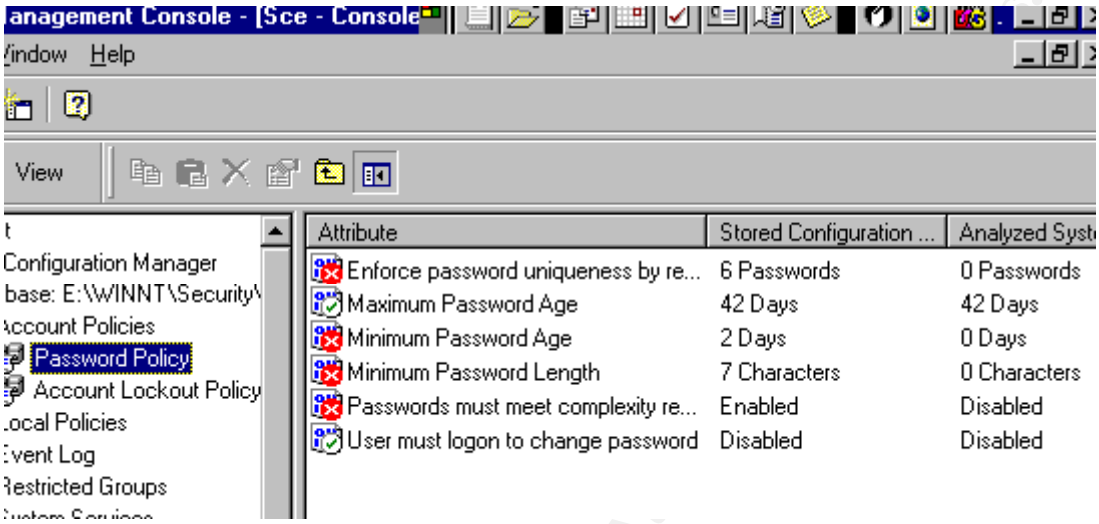
In the case of this network, I am using the Microsoft Security Configuration Editor or SCE. This utility is available for use with Windows NT 4.0 Server running SP4 or later and Microsoft Internet Explorer 3.0 or later.

It serves three functions. The first is to define a template of security configuration settings. The next is to compare the local machine's settings against a template. Third, it configures the local machine's settings to match a template.

SCE provides features that allows for the configuration of the password policy, account lockout policy, audit policy, user rights assignments, event logs setting, group membership, system services options, registry values, registry permissions and auditing, and NTFS folder/file permissions and auditing.

After running a Security Analysis on the current systems settings and comparing it to a system template considered to have high password settings, the SCE reported there existed no password uniqueness, no minimum password age, no minimum password length, and password complexity requirements were disabled.

Note the screen shot below.

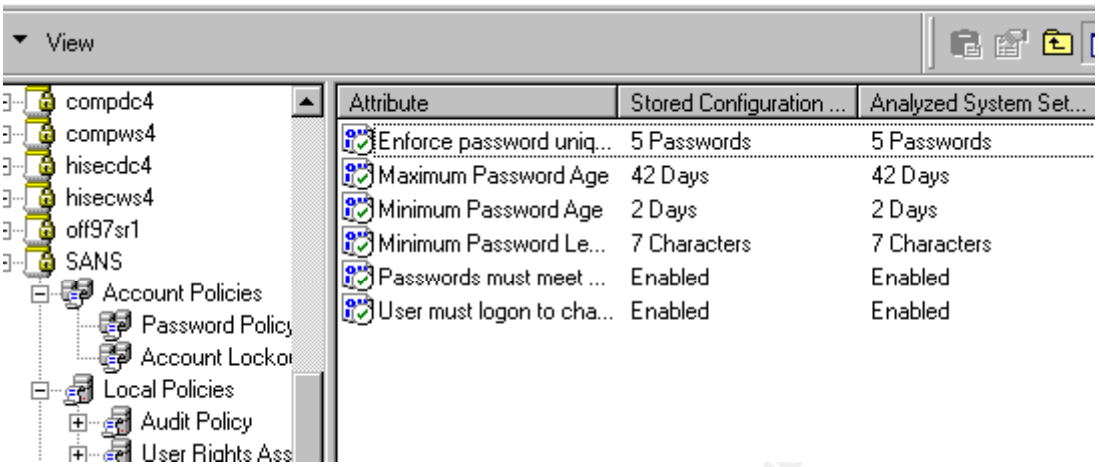


Settings on a network that are this weak can result in breeches of the network. A hacker is able to create a 'NULL' session and easily download the following information.

```
G:\SANS\ntsec>ntuser -s                policy
MIN PASSWORD LENGTH             0 characters
MAX PASSWORD AGE                42d 22h 47m 31s
MIN PASSWORD AGE                0d 0h 0m 0s
FORCE LOGOFF                    False
PASSWORD HISTORY                0 changes
LOCKOUT DURATION                0d 0h 30m 0s
LOCKOUT RESET                   0d 0h 30m 0s
LOCKOUT THRESHOLD               Disabled

G:\SANS\ntsec>_
```

With this information a hacker can set their password cracker to do its job based on the above settings.

To secure these features, a new template was created, set with the following requirements, and compared to the setting of a high security network:



With the proper control of the 'NULL' session this data will not be able to be accessed, but if it is, the network is now securing with a high password security standard:

```
G:\SANS\ntsec>ntuser -s              policy
MIN PASSWORD LENGTH          7 characters
MAX PASSWORD AGE             42d 0h 0m 0s
MIN PASSWORD AGE             2d 0h 0m 0s
FORCE LOGOFF                 True
PASSWORD HISTORY             5 changes
LOCKOUT DURATION             0d 1h 0m 0s
LOCKOUT RESET                0d 12h 0m 0s
LOCKOUT THRESHOLD            3 times

G:\SANS\ntsec>
```

'NULL' USERS AND HOW TO PREVENT THEM

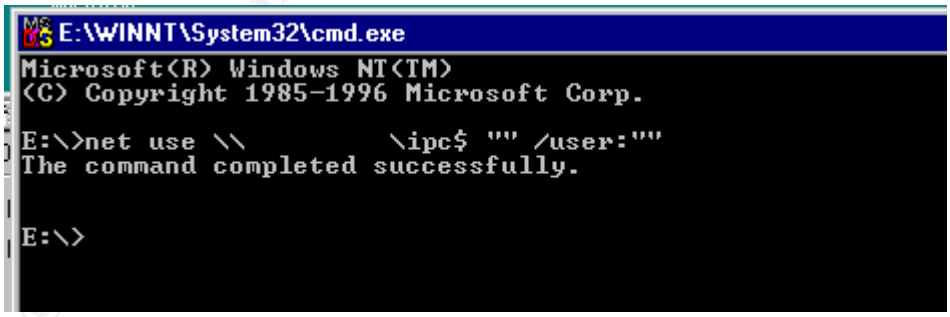
When securing your network, a System Administrator needs to consider the existence of a 'NULL' Session. Before defining the vulnerabilities and ways of correcting this threat, a full understanding of 'NULL' session is necessary.

A 'NULL' session is not a guest or anonymous account. Users do not enter any characters for a password or user ID when logging into the 'NULL' session. Simply, if the proper precautions are not taken, it is a universal path into any network by connecting through DOS commands.

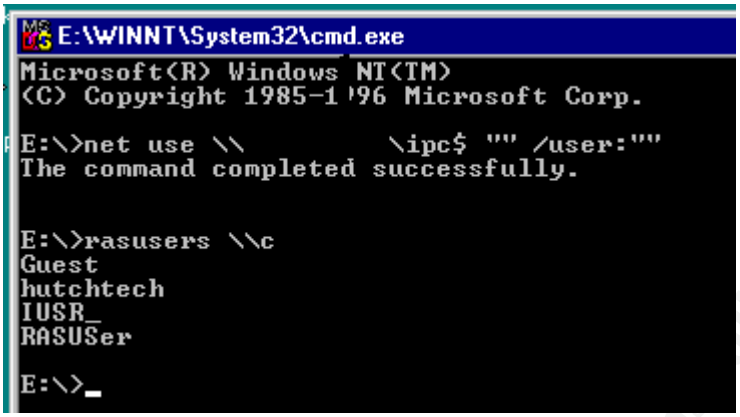
They exist for multiple reasons. The major reason is for administrative purposes for IS support staff. It is also built into some programming applications for various data uploading. Mostly, it is there to open a giant gaping whole into the networks of companies using the wonderful NOS called Windows NT.

Once a 'NULL' session is established, a hacker has complete access to any shared folders with the NTFS permissions set to everyone. In addition and most importantly, this session, by default can gain access to the %systemroot\system32\repair\SAM._ which houses the Security Administration Management or SAM database file. The SAM database is a file created, in short, to backup User ID's and their password hashes, for all users on the network.

The following Screen Shot depicts gaining access to a 'NULL' session.

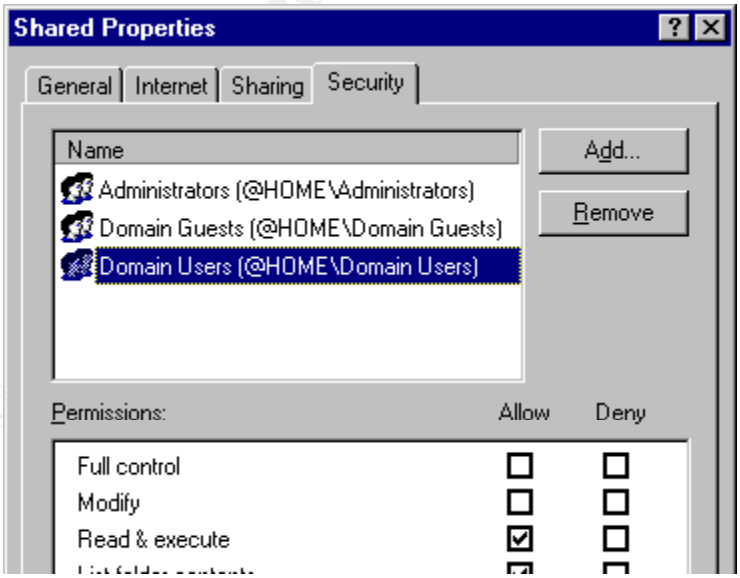


Once a 'NULL' session is opened, a hacker can run a utility called 'RASUSERS' to determine which user accounts on the network have dial-in access to the network.



Note that the account guest, hutchtech, iusr_Computer Name, and RASuser have dial in access to the network. All a hacker needs to gain access to the network is the Dial in number and a good password guessing program.

By default, 'NULL' sessions have access to all file and folders belonging to the Everyone Group and the Network Group. To prevent a 'NULL' session from accessing the date in these groups, the NTFS permission on shared drives should be set up with groups that only include the Authenticated users.

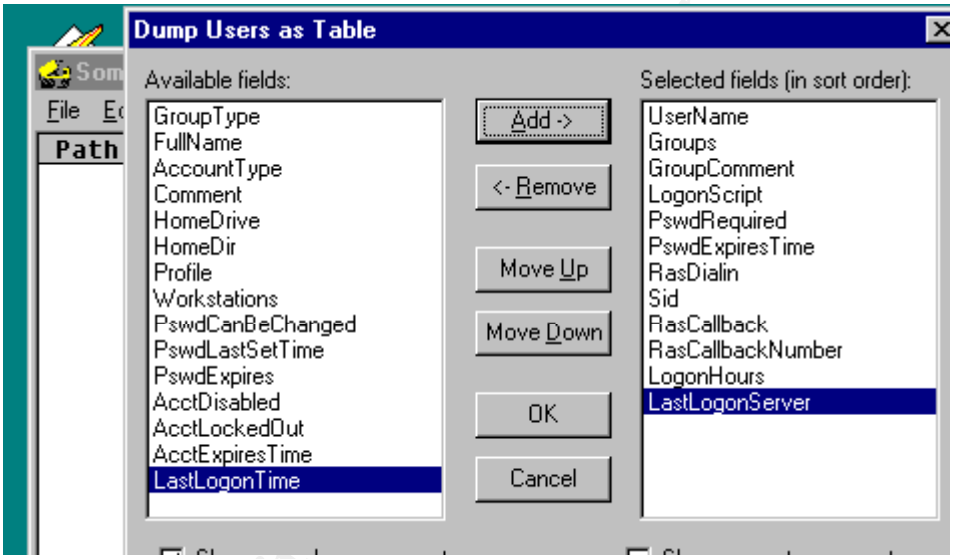


Groups including Domain Users and Domain Guests only allow users that have authenticated to the network to access the data in this folder.

Other possibilities of a 'NULL' session are the potential of gaining registry information, permission settings, and other information about your network. One such utility to obtain this information is called DumpSEC from

www.Somersoft.com.

This application has the ability to gain a large range of account information. Refer to this software for greater examples.



Having this information readily available to anyone interested in finding it raises the question of 'How to prevent it'?

A simple registry change removes the ability for a 'NULL' session to access User Names and other such information about one's network.

```
Hive:           HKEY_LOCAL_MACHING
Key:            \System\CurrentControlSet\Control\LSA
Value Name:     RestrictAnonymous
Value Type:     REG_DWORLD
Value Data:     1
```

After making this registry change, 'NULL' sessions will not

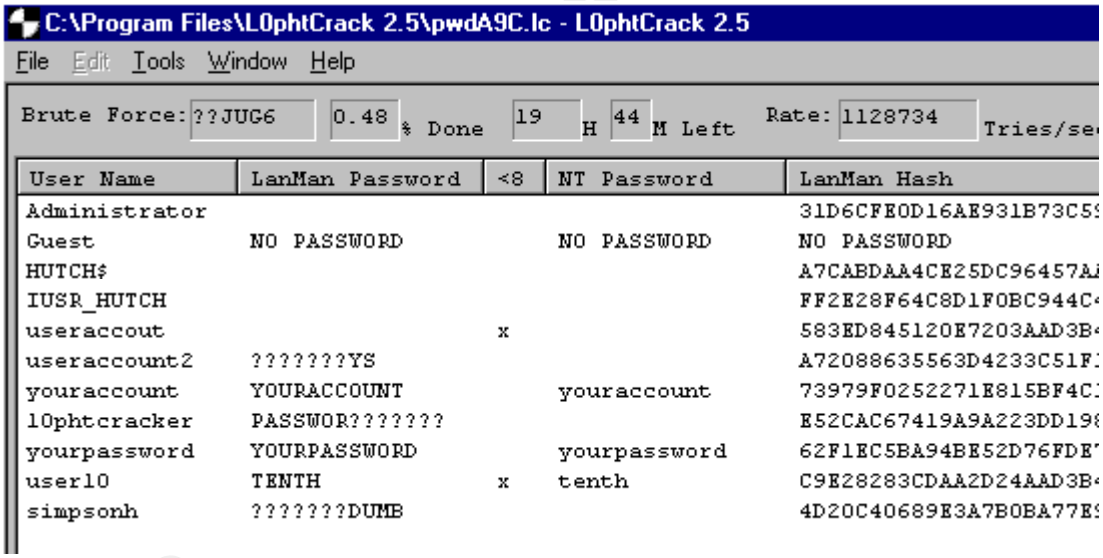
be able to list this type of data.

Preventing access to the SAM Database

Security Account Manager or 'SAM' database contains the LanManager and MD$ hashes of users' passwords. Basically this is the database where all the users on your network specific User ID and the associated password hash is stored.

A password hash is the breakdown of your password into an encrypted challenge/response authentication code. This hash can be translated into the actual password using the utility 'L0pht'.

Note the screen shot below of a crack of the SAM database in progress. Total time left to the crack is almost 20 hours but you can see in the LANMan Password column some passwords have already been cracked.



Some hackers will break into your system just to perform a DOS or Denial of Service attack. A DOS attack is stopping any services your network provides. There are numerous ways of executing a DOS attack from the BSOD or Blue Screen of Death caused by a lack of free hard drive space to SYN flooding.

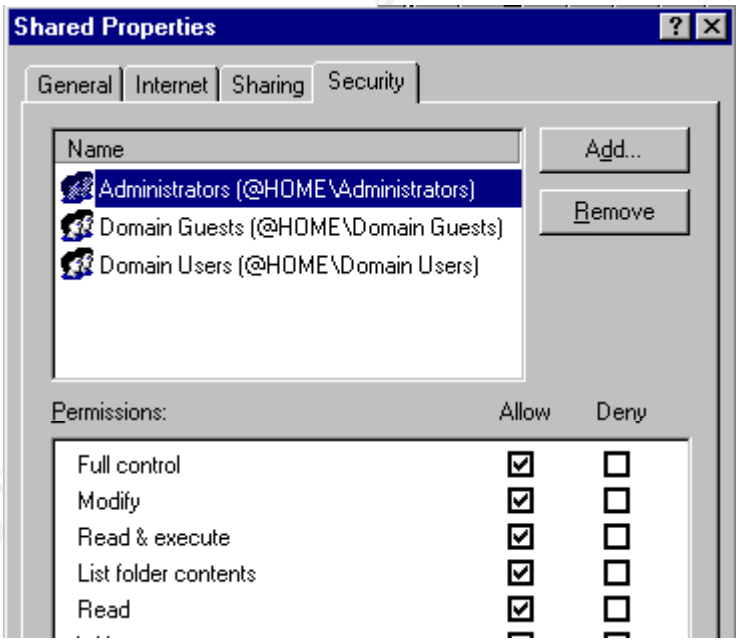
Prevent Denial of Service

Hackers will try to fill up all available hard drive space on your network to cause a BSODDOS. A hacker may connect to a network drive of a user and if restrictions are not set, a hacker can upload data to this folder or any folder, and utilize all remaining hard disk space.

There are tips and suggestions on how to prevent this from happening. In this network plenty of RAM has been installed, and the NOS is loaded on a separate partition. If the hacker decides to cause a DOS using this rout, they still will be able to utilize all free disk space but they will not cause a DOS because the NOS is running on another partition. In prevention, limits have been placed on the maximum size a user's home drive can grow.

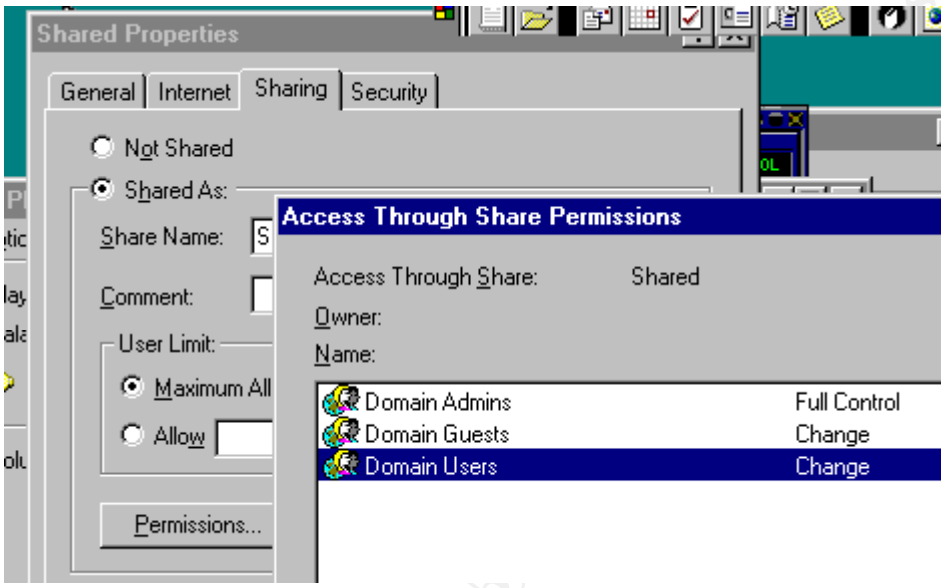
Setting Permissions on Files and Folders

Deciding the levels of security needed on a network depends on what type of data you are protecting. If you are trying to protect data that is freely viewable for everyone in the company, the NTFS permission can be set up loosely.



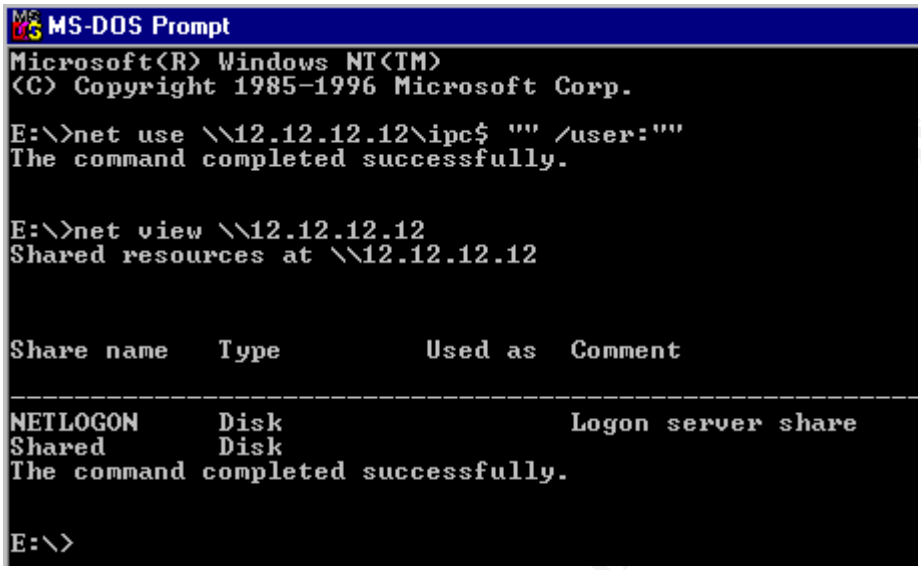
The folder named shared has been set up for Administrators to have full control of the folder, Domain Guests to only have read and execute, and for Domain Users to have change

control. The difference between Full Control and Change control is Full control has the ability to add Users and Groups to the folder or file, and change can not.



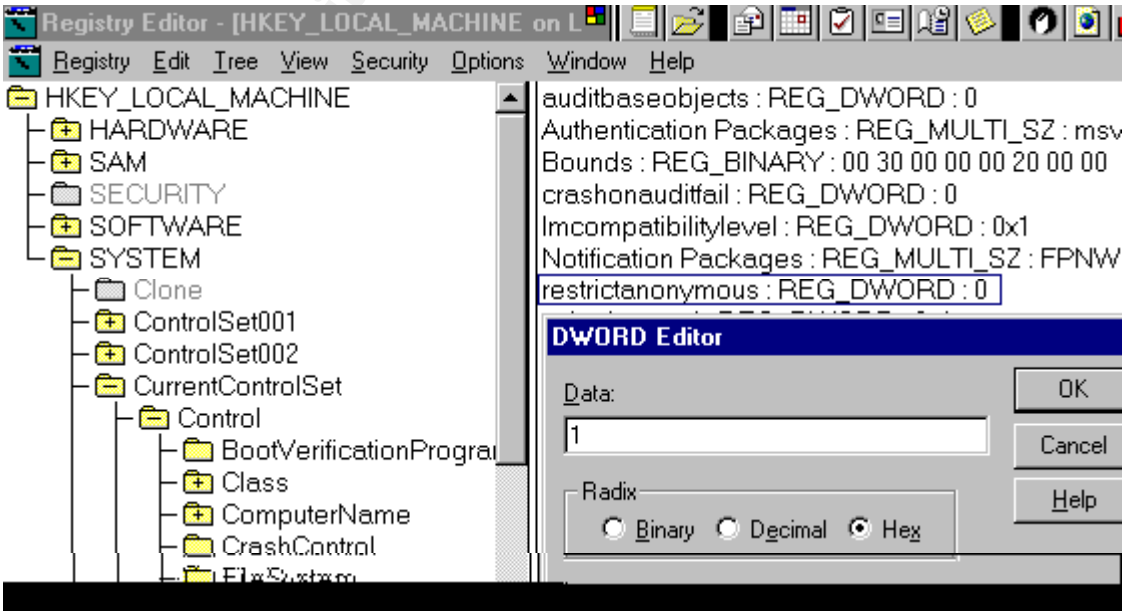
Viewing the folder share permissions, note that the only difference between the NTFS setting and the Share setting is Domain Guests have Change Control. In the current setting, Domain users will have change control even though the NTFS permission are set for Read and Execute only.

Hackers will use 'NULL' sessions to try to list share names. If the shares are set to allow the Everyone Group to access the data, then the hacker can map to the drive he or she has discovered. By default in Windows NT 4.0 Server, 'NULL' sessions are able to list shared names,



A registry change will stop 'NULL' sessions from accessing share folder listing:

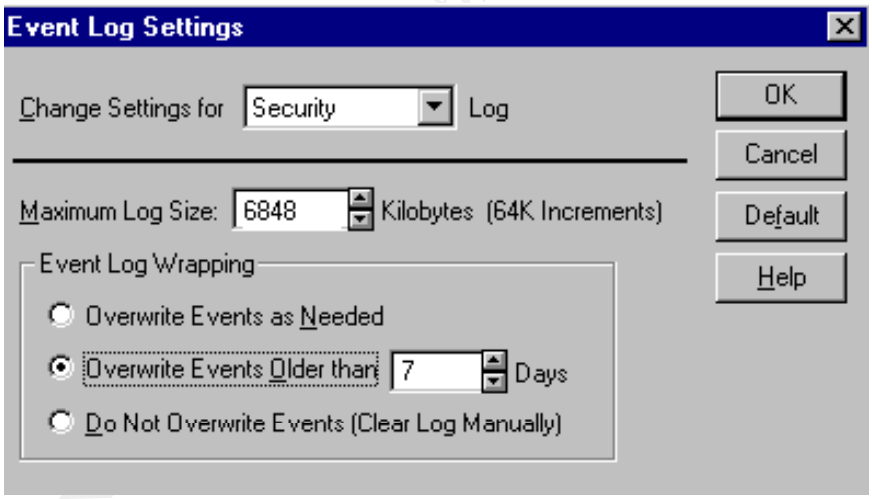
Hive:	HKEY_LOCAL_MACHINE
Key:	\System\CurrentControlSet\Control\LSA
Value Name:	RestrictAnonymous
Value Type:	REG_DWORLS
Value Data:	1



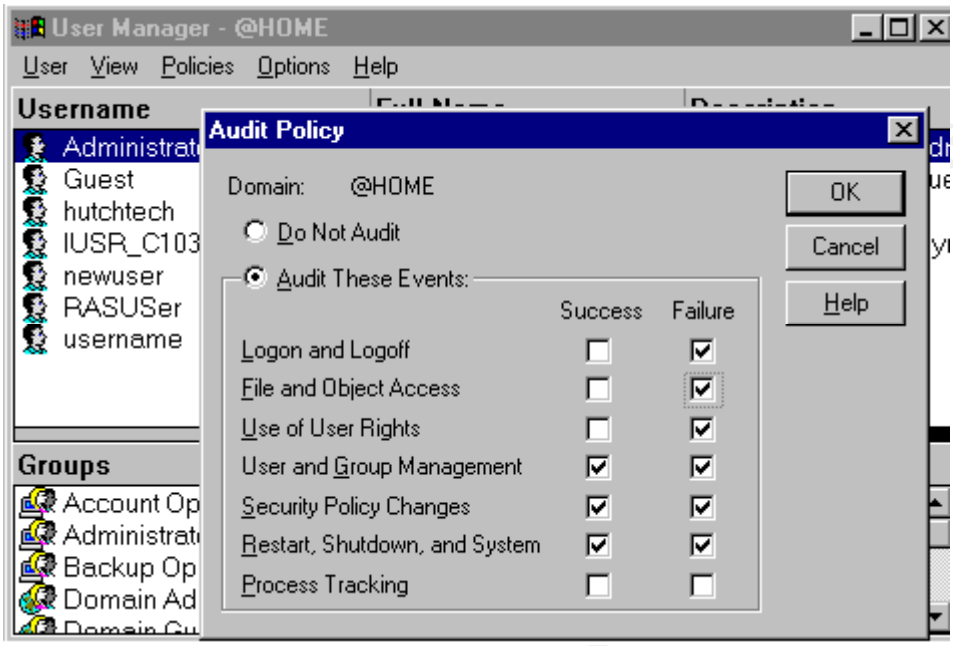
With this change made, a hacker will no longer be able to access shared name listing with a 'NULL' session.

Setting up auditing

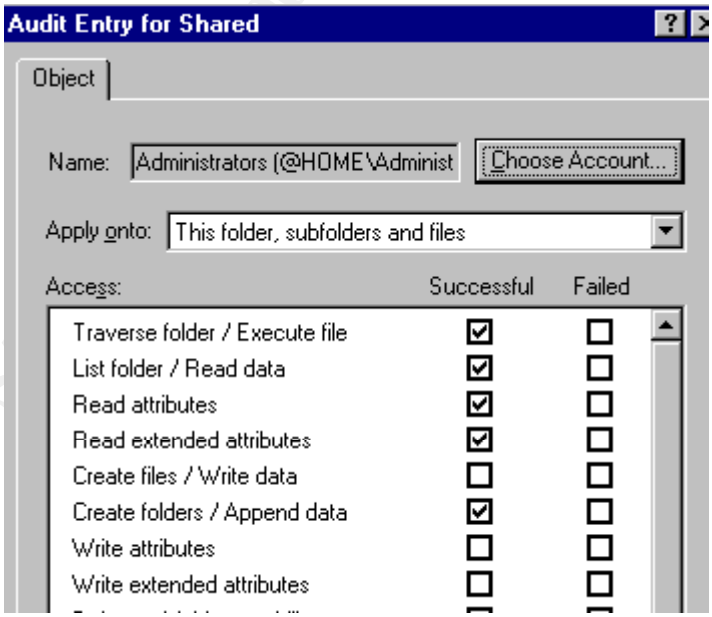
Certain types of auditing should to be set up to have a secure network. But auditing is restricted to how much disk space you want to utilize. You can manually regulate how much disk space you want to use for your log files and determine whether or not the files should be overwritten or manually deleted. The screen shot below identifies the setting on this network for Security logs. Note that System and Application logs have been set the same.



With the setting in place for the log files, it now should be determined what types of auditing will be reported in the logs on a system wide and folder by folder basis. The following screen shot is the settings for the systems wide auditing trail:

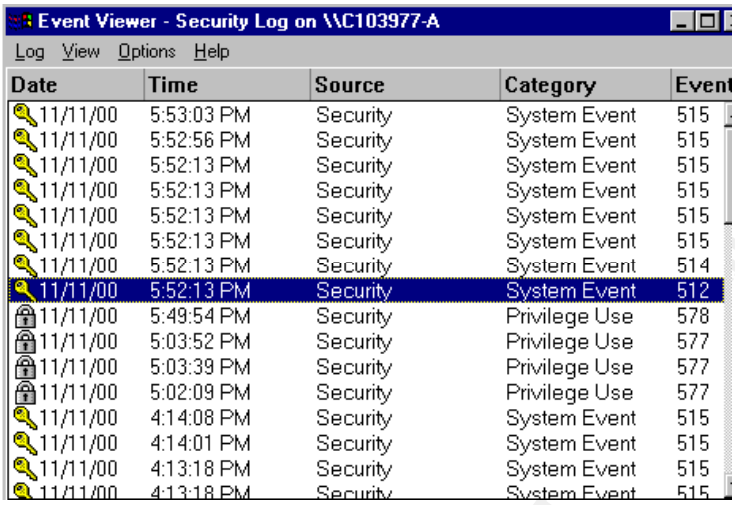


Auditing is also set up on specific folders, in order to monitor what data is being accessed and by whom. The screen shot below depicts the setting of the auditing for the folder called Shared:



Using the Event Viewer and selecting the Security Log, I can see all events that were selected to be audited in a row by

column basis:



Securing a network must be thought of as more then what is covered in this paper. Many considerations need to be reviewed and discussed before identifying a plan of attack when securing a network. Some basic ideas and concepts should be practiced for all networks including minimal password standards and 'SAM' database encryption. Some more advanced networks may need greater security imposed like Intrusion Detection Software and Firewalls.

In either case there is always a threat when your network is attached to the Internet or is just set up for internal use. Sometimes the greatest threat to a network is the users themselves.

In network setting, company employees often install modems on computer that are logged on to a network. Then these employees use software like 'PC ANYWHERE' to connect to their work computers from home. When running a 'War Dialer' a hacker can identify where these modems exist and connect to a network without having to avoid detection or spend time trying to hack through firewalls and passwords. There are endless concepts that have been looked over for reasons of time limitations (and my sanity). Virus Protection should always be set up on both network clients and network

servers. Changing the name of the administrator account and setting up a 'Honey Pot' to lure hackers into a trap you set for them.

Intrusion Detection and Firewall software is also very important for a network to be secure. This software can be quite expensive and difficult to grasp the concepts of. Both have such intricate details that can't be covered in this paper.

One of the most important and easiest forms of securing a network is tape backup. Even if a network administrator takes the proper precautions to secure the network, there are always ways around the prevention. Being that the Internet is a public resource, there is never a way to make any network completely hack-proof. Administrators can only make it harder for a hacker to actually gain access.

Credits:

SANS NETWORK SECURITY 2000
Securing Windows NT, Step by Step, Parts 1-3
Jason Fosssen
Jennifer Kolde

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