

SAMBA Project Documentation

SAMBA Team

Abstract

This book is a collection of HOWTOs added to Samba documentation over the years. I try to ensure that all are current, but sometimes the is a larger job than one person can maintain. The most recent version of this document can be found at <http://www.samba.org/> on the "Documentation" page. Please send updates to jerry@samba.org.

Cheers, jerry

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Chapter 1. How to Install and Test SAMBA

1.1. Step 0: Read the man pages

The man pages distributed with SAMBA contain lots of useful info that will help to get you started. If you don't know how to read man pages then try something like:

```
$ nroff -man smbd.8 | more
```

Other sources of information are pointed to by the Samba web site, <http://www.samba.org>

1.2. Step 1: Building the Binaries

To do this, first run the program `./configure` in the source directory. This should automatically configure Samba for your operating system. If you have unusual needs then you may wish to run

```
root# ./configure --help
```

first to see what special options you can enable. Then executing

```
root# make
```

will create the binaries. Once it's successfully compiled you can use

```
root# make install
```

to install the binaries and manual pages. You can separately install the binaries and/or man pages using

```
root# make installbin
```

and

```
root# make installman
```

Note that if you are upgrading for a previous version of Samba you might like to know that the old versions of the binaries will be renamed with a ".old" extension. You can go back to the previous version with

```
root# make revert
```

if you find this version a disaster!

1.3. Step 2: The all important step

At this stage you must fetch yourself a coffee or other drink you find stimulating. Getting the rest of the install right can sometimes be tricky, so you will probably need it.

If you have installed samba before then you can skip this step.

1.4. Step 3: Create the smb configuration file.

There are sample configuration files in the `examples` subdirectory in the distribution. I suggest you read them carefully so you can see how the options go together in practice. See the man page for all the options.

The simplest useful configuration file would be something like this:

```
[global]
  workgroup = MYGROUP

[homes]
  guest ok = no
  read only = no
```

which would allow connections by anyone with an account on the server, using either their login name or "homes" as the service name. (Note that I also set the `workgroup` that Samba is part of. See `BROWSING.txt` for details)

Note that **make install** will not install a `smb.conf` file. You need to create it yourself.

Make sure you put the `smb.conf` file in the same place you specified in the `Makefile` (the default is to look for it in `/usr/local/samba/lib/`).

For more information about security settings for the `[homes]` share please refer to the document `UNIX_SECURITY.txt`.

1.5. Step 4: Test your config file with testparm

It's important that you test the validity of your `smb.conf` file using the `testparm` program. If `testparm` runs OK then it will list the loaded services. If not it will give an error message.

Make sure it runs OK and that the services look reasonable before proceeding.

1.6. Step 5: Starting the smbd and nmbd

You must choose to start `smbd` and `nmbd` either as daemons or from **inetd**. Don't try to do both! Either you can put them in `inetd.conf` and have them started on demand by **inetd**, or you can start them as daemons either from the command line or in `/etc/rc.local`. See the man pages for details on the command line options. Take particular care to read the bit about what user you need to be in order to start Samba. In many cases you must be root.

The main advantage of starting **smbd** and **nmbd** as a daemon is that they will respond slightly more quickly to an initial connection request. This is, however, unlikely to be a problem.

1.6.1. Step 5a: Starting from inetd.conf

NOTE; The following will be different if you use NIS or NIS+ to distributed services maps.

Look at your `/etc/services`. What is defined at port 139/tcp. If nothing is defined then add a line like this:

```
netbios-ssn 139/tcp
```

similarly for 137/udp you should have an entry like:

```
netbios-ns 137/udp
```

Next edit your `/etc/inetd.conf` and add two lines something like this:

```
netbios-ssn stream tcp nowait root /usr/local/samba/bin/smbd smbd
netbios-ns dgram udp wait root /usr/local/samba/bin/nmbd nmbd
```

The exact syntax of `/etc/inetd.conf` varies between unixes. Look at the other entries in `inetd.conf` for a guide.

NOTE: Some unixes already have entries like `netbios_ns` (note the underscore) in `/etc/services`. You must either edit `/etc/services` or `/etc/inetd.conf` to make them consistent.

NOTE: On many systems you may need to use the "interfaces" option in `smb.conf` to specify the IP address and netmask of your interfaces. Run **ifconfig** as root if you don't know what the broadcast is for your net. **nmbd** tries to determine it at run time, but fails on some unixes. See the section on "testing nmbd" for a method of finding if you need to do this.

!!!WARNING!!! Many unixes only accept around 5 parameters on the command line in `inetd.conf`. This means you shouldn't use spaces between the options and arguments, or you should use a script, and start the script from **inetd**.

Restart **inetd**, perhaps just send it a HUP. If you have installed an earlier version of **nmbd** then you may need to kill `nmbd` as well.

1.6.2. Step 5b. Alternative: starting it as a daemon

To start the server as a daemon you should create a script something like this one, perhaps calling it `startsm`.

```
#!/bin/sh
/usr/local/samba/bin/smbd -D
/usr/local/samba/bin/nmbd -D
```

then make it executable with **chmod +x startsm**

You can then run **startsm** by hand or execute it from `/etc/rc.local`

To kill it send a kill signal to the processes **nmbd** and **smbd**.

NOTE: If you use the SVR4 style init system then you may like to look at the `examples/svr4-startup` script to make Samba fit into that system.

1.7. Step 6: Try listing the shares available on your server

```
$ smbclient -L yourhostname
```

You should get back a list of shares available on your server. If you don't then something is incorrectly setup. Note that this method can also be used to see what shares are available on other LanManager clients (such as WfWg).

If you choose user level security then you may find that Samba requests a password before it will list the shares. See the **smbclient** man page for details. (you can force it to list the shares without a password by adding the option `-U%` to the command line. This will not work with non-Samba servers)

1.8. Step 7: Try connecting with the unix client

```
$ smbclient //yourhostname/aservice
```

Typically the *yourhostname* would be the name of the host where you installed **smbd**. The *aservice* is any service you have defined in the `smb.conf` file. Try your user name if you just have a `[homes]` section in `smb.conf`.

For example if your unix host is `bambi` and your login name is `fred` you would type:

```
$ smbclient //bambi/fred
```

1.9. Step 8: Try connecting from a DOS, WfWg, Win9x, WinNT, Win2k, OS/2, etc... client

Try mounting disks. eg:

```
C:\WINDOWS\> net use d: \\servername\service
```

Try printing. eg:

```
C:\WINDOWS\> net use lpt1: \\servername\spoolservice
```

```
C:\WINDOWS\> print filename
```

Celebrate, or send me a bug report!

1.10. What If Things Don't Work?

If nothing works and you start to think "who wrote this pile of trash" then I suggest you do step 2 again (and again) till you calm down.

Then you might read the file `DIAGNOSIS.txt` and the `FAQ`. If you are still stuck then try the mailing list or newsgroup (look in the `README` for details). Samba has been successfully installed at thousands of sites worldwide, so maybe someone else has hit your problem and has overcome it. You could also use the WWW site to scan back issues of the `samba-digest`.

When you fix the problem PLEASE send me some updates to the documentation (or source code) so that the next person will find it easier.

1.10.1. Diagnosing Problems

If you have installation problems then go to `DIAGNOSIS.txt` to try to find the problem.

1.10.2. Scope IDs

By default Samba uses a blank scope ID. This means all your windows boxes must also have a blank scope ID. If you really want to use a non-blank scope ID then you will need to use the `-i <scope>` option to `nmbd`, `smbd`, and `smbclient`. All your PCs will need to have the same setting for this to work. I do not recommend scope IDs.

1.10.3. Choosing the Protocol Level

The SMB protocol has many dialects. Currently Samba supports 5, called `CORE`, `COREPLUS`, `LANMAN1`, `LANMAN2` and `NT1`.

You can choose what maximum protocol to support in the `smb.conf` file. The default is `NT1` and that is the best for the vast majority of sites.

In older versions of Samba you may have found it necessary to use `COREPLUS`. The limitations that led to this have mostly been fixed. It is now less likely that you will want to use less than `LANMAN1`. The only remaining advantage of `COREPLUS` is that for some obscure reason WfWg preserves the case of passwords in this protocol, whereas under `LANMAN1`, `LANMAN2` or `NT1` it uppercases all passwords before sending them, forcing you to use the "password level=" option in some cases.

The main advantage of `LANMAN2` and `NT1` is support for long filenames with some clients (eg: `smbclient`, Windows NT or Win95).

See the `smb.conf(5)` manual page for more details.

Note: To support print queue reporting you may find that you have to use TCP/IP as the default protocol under WfWg. For some reason if you leave Netbeui as the default it may break the print queue reporting on some systems. It is presumably a WfWg bug.

1.10.4. Printing from UNIX to a Client PC

To use a printer that is available via a smb-based server from a unix host you will need to compile the smbclient program. You then need to install the script "smbprint". Read the instruction in smbprint for more details.

There is also a SYSV style script that does much the same thing called smbprint.sysv. It contains instructions.

1.10.5. Locking

One area which sometimes causes trouble is locking.

There are two types of locking which need to be performed by a SMB server. The first is "record locking" which allows a client to lock a range of bytes in a open file. The second is the "deny modes" that are specified when a file is open.

Samba supports "record locking" using the fcntl() unix system call. This is often implemented using rpc calls to a rpc.lockd process running on the system that owns the filesystem. Unfortunately many rpc.lockd implementations are very buggy, particularly when made to talk to versions from other vendors. It is not uncommon for the rpc.lockd to crash.

There is also a problem translating the 32 bit lock requests generated by PC clients to 31 bit requests supported by most unixes. Unfortunately many PC applications (typically OLE2 applications) use byte ranges with the top bit set as semaphore sets. Samba attempts translation to support these types of applications, and the translation has proved to be quite successful.

Strictly a SMB server should check for locks before every read and write call on a file. Unfortunately with the way fcntl() works this can be slow and may overstress the rpc.lockd. It is also almost always unnecessary as clients are supposed to independently make locking calls before reads and writes anyway if locking is important to them. By default Samba only makes locking calls when explicitly asked to by a client, but if you set "strict locking = yes" then it will make lock checking calls on every read and write.

You can also disable by range locking completely using "locking = no". This is useful for those shares that don't support locking or don't need it (such as cdroms). In this case Samba fakes the return codes of locking calls to tell clients that everything is OK.

The second class of locking is the "deny modes". These are set by an application when it opens a file to determine what types of access should be allowed simultaneously with its open. A client may ask for DENY_NONE, DENY_READ, DENY_WRITE or DENY_ALL. There are also special compatibility modes called DENY_FCB and DENY_DOS.

You can disable share modes using "share modes = no". This may be useful on a heavily loaded server as the share modes code is very slow. See also the FAST_SHARE_MODES option in the Makefile for a way to do full share modes very fast using shared memory (if your OS supports it).

1.10.6. Mapping Usernames

If you have different usernames on the PCs and the unix server then take a look at the "username map" option. See the smb.conf man page for details.

1.10.7. Other Character Sets

If you have problems using filenames with accented characters in them (like the German, French or Scandinavian character sets) then I recommend you look at the "valid chars" option in smb.conf and also take a look at the validchars package in the examples directory.

Chapter 2. Integrating MS Windows networks with Samba

2.1. Agenda

To identify the key functional mechanisms of MS Windows networking to enable the deployment of Samba as a means of extending and/or replacing MS Windows NT/2000 technology.

We will examine:

1. Name resolution in a pure Unix/Linux TCP/IP environment
2. Name resolution as used within MS Windows networking
3. How browsing functions and how to deploy stable and dependable browsing using Samba
4. MS Windows security options and how to configure Samba for seamless integration
5. Configuration of Samba as:
 - a. A stand-alone server
 - b. An MS Windows NT 3.x/4.0 security domain member
 - c. An alternative to an MS Windows NT 3.x/4.0 Domain Controller

2.2. Name Resolution in a pure Unix/Linux world

The key configuration files :

2.2.1. /etc/hosts

Contains a static list of IP Addresses and names. eg:

```
127.0.0.1    localhost localhost.localdomain
192.168.1.1  bigbox.caldera.com    bigbox  alias4box
```

The purpose of `/etc/hosts` is to provide a name resolution mechanism so that users do not need to remember IP addresses.

Network packets that are sent over the physical network transport layer communicate not via IP addresses but rather using the Media Access Control address, or MAC address. IP Addresses are currently 32 bits in length and are typically presented as four (4) decimal numbers that are separated by a dot (or period). eg: 168.192.1.1

MAC Addresses use 48 bits (or 6 bytes) and are typically represented as two digit hexadecimal numbers separated by colons. eg: 40:8e:0a:12:34:56

Every network interface must have a MAC address. Associated with a MAC address there may be one or more IP addresses. There is NO relationship between an IP address and a MAC address, all such assignments are arbitrary or discretionary in nature. At the most basic level all network communications takes place using MAC addressing. Since MAC addresses must be globally unique, and generally remains fixed for any particular interface, the assignment of an IP address makes sense from a network management perspective.

More than one IP address can be assigned per MAC address. One address must be the primary IP address, this is the address that will be returned in the ARP reply.

When a user or a process wants to communicate with another machine the protocol implementation ensures that the "machine name" or "host name" is resolved to an IP address in a manner that is controlled by the TCP/IP configuration control files. The file `/etc/hosts` is one such file.

When the IP address of the destination interface has been determined a protocol called ARP/RARP is used to identify the MAC address of the target interface. ARP stands for Address Resolution Protocol, and is a broadcast oriented method that uses UDP (User Datagram Protocol) to send a request to all interfaces on the local network segment using the all 1's MAC address. Network interfaces are programmed to respond to two MAC addresses only; their own unique address and the address `ff:ff:ff:ff:ff:ff`. The reply packet from an ARP request will contain the MAC address and the primary IP address for each interface.

The `/etc/hosts` file is foundational to all Unix/Linux TCP/IP installations and as a minimum will contain the localhost and local network interface IP addresses and the primary names by which they are known within the local machine. This file helps to prime the pump so that a basic level of name resolution can exist before any other method of name resolution becomes available.

2.2.2. `/etc/resolv.conf`

This file tells the name resolution libraries:

- The name of the domain to which the machine belongs
- The name(s) of any domains that should be automatically searched when trying to resolve unqualified host names to their IP address
- The name or IP address of available Domain Name Servers that may be asked to perform name to address translation lookups

2.2.3. `/etc/host.conf`

`/etc/host.conf` is the primary means by which the setting in `/etc/resolv.conf` may be affected. It is a critical configuration file. This file controls the order by which name resolution may proceed. The typical structure is:

```
order hosts,bind
multi on
```

then both addresses should be returned. Please refer to the man page for `host.conf` for further details.

2.2.4. `/etc/nsswitch.conf`

This file controls the actual name resolution targets. The file typically has resolver object specifications as follows:

```
# /etc/nsswitch.conf
#
```

```

# Name Service Switch configuration file.
#

passwd:          compat
# Alternative entries for password authentication are:
# passwd:       compat files nis ldap winbind
shadow:         compat
group:          compat

hosts:          files nis dns
# Alternative entries for host name resolution are:
# hosts:        files dns nis nis+ hesoid db compat ldap wins
networks:       nis files dns

ethers:         nis files
protocols:      nis files
rpc:            nis files
services:       nis files

```

Of course, each of these mechanisms requires that the appropriate facilities and/or services are correctly configured.

It should be noted that unless a network request/message must be sent, TCP/IP networks are silent. All TCP/IP communications assumes a principal of speaking only when necessary.

Samba version 2.2.0 will add Linux support for extensions to the name service switch infrastructure so that linux clients will be able to obtain resolution of MS Windows NetBIOS names to IP Addresses. To gain this functionality Samba needs to be compiled with appropriate arguments to the make command (ie: **make nsswitch/libnss_wins.so**). The resulting library should then be installed in the /lib directory and the "wins" parameter needs to be added to the "hosts:" line in the /etc/nsswitch.conf file. At this point it will be possible to ping any MS Windows machine by it's NetBIOS machine name, so long as that machine is within the workgroup to which both the samba machine and the MS Windows machine belong.

2.3. Name resolution as used within MS Windows networking

MS Windows networking is predicated about the name each machine is given. This name is known variously (and inconsistently) as the "computer name", "machine name", "networking name", "netbios name", "SMB name". All terms mean the same thing with the exception of "netbios name" which can apply also to the name of the workgroup or the domain name. The terms "workgroup" and "domain" are really just a simply name with which the machine is associated. All NetBIOS names are exactly 16 characters in length. The 16th character is reserved. It is used to store a one byte value that indicates service level information for the NetBIOS name that is registered. A NetBIOS machine name is therefore registered for each service type that is provided by the client/server.

The following are typical NetBIOS name/service type registrations:

```

Unique NetBIOS Names:
  MACHINENAME<00> = Server Service is running on MACHINENAME
  MACHINENAME<03> = Generic Machine Name (NetBIOS name)
  MACHINENAME<20> = LanMan Server service is running on MACHINENAME
  WORKGROUP<1b> = Domain Master Browser

Group Names:
  WORKGROUP<03> = Generic Name registered by all members of WORKGROUP

```

```
WORKGROUP<1c> = Domain Controllers / Netlogon Servers
WORKGROUP<1d> = Local Master Browsers
WORKGROUP<1e> = Internet Name Resolvers
```

It should be noted that all NetBIOS machines register their own names as per the above. This is in vast contrast to TCP/IP installations where traditionally the system administrator will determine in the `/etc/hosts` or in the DNS database what names are associated with each IP address.

One further point of clarification should be noted, the `/etc/hosts` file and the DNS records do not provide the NetBIOS name type information that MS Windows clients depend on to locate the type of service that may be needed. An example of this is what happens when an MS Windows client wants to locate a domain logon server. It finds this service and the IP address of a server that provides it by performing a lookup (via a NetBIOS broadcast) for enumeration of all machines that have registered the name type `*<1c>`. A logon request is then sent to each IP address that is returned in the enumerated list of IP addresses. Whichever machine first replies then ends up providing the logon services.

The name "workgroup" or "domain" really can be confusing since these have the added significance of indicating what is the security architecture of the MS Windows network. The term "workgroup" indicates that the primary nature of the network environment is that of a peer-to-peer design. In a WORKGROUP all machines are responsible for their own security, and generally such security is limited to use of just a password (known as SHARE MORE security). In most situations with peer-to-peer networking the users who control their own machines will simply opt to have no security at all. It is possible to have USER MODE security in a WORKGROUP environment, thus requiring use of a user name and a matching password.

MS Windows networking is thus predetermined to use machine names for all local and remote machine message passing. The protocol used is called Server Message Block (SMB) and this is implemented using the NetBIOS protocol (Network Basic Input Output System). NetBIOS can be encapsulated using LLC (Logical Link Control) protocol – in which case the resulting protocol is called NetBEUI (Network Basic Extended User Interface). NetBIOS can also be run over IPX (Internetworking Packet Exchange) protocol as used by Novell NetWare, and it can be run over TCP/IP protocols – in which case the resulting protocol is called NBT or NetBT, the NetBIOS over TCP/IP.

MS Windows machines use a complex array of name resolution mechanisms. Since we are primarily concerned with TCP/IP this demonstration is limited to this area.

2.3.1. The NetBIOS Name Cache

All MS Windows machines employ an in memory buffer in which is stored the NetBIOS names and their IP addresses for all external machines that the local machine has communicated with over the past 10–15 minutes. It is more efficient to obtain an IP address for a machine from the local cache than it is to go through all the configured name resolution mechanisms.

If a machine whose name is in the local name cache has been shut down before the name had been expired and flushed from the cache, then an attempt to exchange a message with that machine will be subject to time-out delays. ie: Its name is in the cache, so a name resolution lookup will succeed, but the machine can not respond. This can be frustrating for users – but it is a characteristic of the protocol.

The MS Windows utility that allows examination of the NetBIOS name cache is called "nbtstat". The Samba equivalent of this is called "nmblookup".

2.3.2. The LMHOSTS file

This file is usually located in MS Windows NT 4.0 or 2000 in C:\WINNT\SYSTEM32\DRIVERS\ETC and contains the IP Address and the machine name in matched pairs. The LMHOSTS file performs NetBIOS name to IP address mapping oriented.

It typically looks like:

```
# Copyright (c) 1998 Microsoft Corp.
#
# This is a sample LMHOSTS file used by the Microsoft Wins Client (NetBIOS
# over TCP/IP) stack for Windows98
#
# This file contains the mappings of IP addresses to NT computernames
# (NetBIOS) names. Each entry should be kept on an individual line.
# The IP address should be placed in the first column followed by the
# corresponding computername. The address and the comptrname
# should be separated by at least one space or tab. The "#" character
# is generally used to denote the start of a comment (see the exceptions
# below).
#
# This file is compatible with Microsoft LAN Manager 2.x TCP/IP lmhosts
# files and offers the following extensions:
#
#     #PRE
#     #DOM:<domain>
#     #INCLUDE <filename>
#     #BEGIN_ALTERNATE
#     #END_ALTERNATE
#     \0xnn (non-printing character support)
#
# Following any entry in the file with the characters "#PRE" will cause
# the entry to be preloaded into the name cache. By default, entries are
# not preloaded, but are parsed only after dynamic name resolution fails.
#
# Following an entry with the "#DOM:<domain>" tag will associate the
# entry with the domain specified by <domain>. This affects how the
# browser and logon services behave in TCP/IP environments. To preload
# the host name associated with #DOM entry, it is necessary to also add a
# #PRE to the line. The <domain> is always preloaded although it will not
# be shown when the name cache is viewed.
#
# Specifying "#INCLUDE <filename>" will force the RFC NetBIOS (NBT)
# software to seek the specified <filename> and parse it as if it were
# local. <filename> is generally a UNC-based name, allowing a
# centralized lmhosts file to be maintained on a server.
# It is ALWAYS necessary to provide a mapping for the IP address of the
# server prior to the #INCLUDE. This mapping must use the #PRE directive.
# In addition the share "public" in the example below must be in the
# LanManServer list of "NullSessionShares" in order for client machines to
# be able to read the lmhosts file successfully. This key is under
# \machine\system\currentcontrolset\services\lanmanserver\parameters\nullsessionshares
# in the registry. Simply add "public" to the list found there.
#
# The #BEGIN_ and #END_ALTERNATE keywords allow multiple #INCLUDE
# statements to be grouped together. Any single successful include
# will cause the group to succeed.
#
# Finally, non-printing characters can be embedded in mappings by
# first surrounding the NetBIOS name in quotations, then using the
```

```

# \0xnn notation to specify a hex value for a non-printing character.
#
# The following example illustrates all of these extensions:
#
# 102.54.94.97      rhino          #PRE #DOM:networking #net group's DC
# 102.54.94.102    "appname  \0x14" #special app server
# 102.54.94.123    popular        #PRE
# 102.54.94.117    localsrv       #PRE
#
# #BEGIN_ALTERNATE
# #INCLUDE \\localsrv\public\lmhosts
# #INCLUDE \\rhino\public\lmhosts
# #END_ALTERNATE
#
# In the above example, the "appname" server contains a special
# character in its name, the "popular" and "localsrv" server names are
# preloaded, and the "rhino" server name is specified so it can be used
# to later #INCLUDE a centrally maintained lmhosts file if the "localsrv"
# system is unavailable.
#
# Note that the whole file is parsed including comments on each lookup,
# so keeping the number of comments to a minimum will improve performance.
# Therefore it is not advisable to simply add lmhosts file entries onto the
# end of this file.

```

2.3.3. HOSTS file

This file is usually located in MS Windows NT 4.0 or 2000 in `C:\WINNT\SYSTEM32\DRIVERS\ETC` and contains the IP Address and the IP hostname in matched pairs. It can be used by the name resolution infrastructure in MS Windows, depending on how the TCP/IP environment is configured. This file is in every way the equivalent of the Unix/Linux `/etc/hosts` file.

2.3.4. DNS Lookup

This capability is configured in the TCP/IP setup area in the network configuration facility. If enabled an elaborate name resolution sequence is followed the precise nature of which is dependant on what the NetBIOS Node Type parameter is configured to. A Node Type of 0 means use NetBIOS broadcast (over UDP broadcast) is first used if the name that is the subject of a name lookup is not found in the NetBIOS name cache. If that fails then DNS, HOSTS and LMHOSTS are checked. If set to Node Type 8, then a NetBIOS Unicast (over UDP Unicast) is sent to the WINS Server to obtain a lookup before DNS, HOSTS, LMHOSTS, or broadcast lookup is used.

2.3.5. WINS Lookup

Refer to above details for section *DNS Lookups*. A WINS (Windows Internet Name Server) service is the equivalent of the rfc1001/1002 specified NBNS (NetBIOS Name Server). A WINS server stores the names and IP addresses that are registered by a Windows client if the TCP/IP setup has been given at least one WINS Server IP Address.

To configure Samba to be a WINS server the following parameter needs to be added to the `smb.conf` file:

```
wins support = Yes
```

To configure Samba to use a WINS server the following parameters are needed in the smb.conf file:

```
wins support = No
wins sxxxexxx.xxx.xxx
```

where xxx.xxx.xxx.xxx is the IP address of the WINS server.

2.4. How browsing functions and how to deploy stable and dependable browsing using Samba

As stated above, MS Windows machines register their NetBIOS names (ie: the machine name for each service type in operation) on start up. Also, as stated above, the exact method by which this name registration takes place is determined by whether or not the MS Windows client/server has been given a WINS server address, whether or not LMHOSTS lookup is enabled, or if DNS for NetBIOS name resolution is enabled, etc.

In the case where there is no WINS server all name registrations as well as name lookups are done by UDP broadcast. This isolates name resolution to the local subnet, unless LMHOSTS is used to list all names and IP addresses. In such situations Samba provides a means by which the samba server name may be forcibly injected into the browse list of a remote MS Windows network (using the "remote announce" parameter).

Where a WINS server is used, the MS Windows client will use UDP unicast to register with the WINS server. Such packets can be routed and thus WINS allows name resolution to function across routed networks.

During the startup process an election will take place to create a local master browser if one does not already exist. On each NetBIOS network one machine will be elected to function as the domain master browser. This domain browsing has nothing to do with MS security domain control. Instead, the domain master browser serves the role of contacting each local master browser (found by asking WINS or from LMHOSTS) and exchanging browse list contents. This way every master browser will eventually obtain a complete list of all machines that are on the network. Every 11–15 minutes an election is held to determine which machine will be the master browser. By nature of the election criteria used, the machine with the highest uptime, or the most senior protocol version, or other criteria, will win the election as domain master browser.

Clients wishing to browse the network make use of this list, but also depend on the availability of correct name resolution to the respective IP address/addresses.

Any configuration that breaks name resolution and/or browsing intrinsics will annoy users because they will have to put up with protracted inability to use the network services.

Samba supports a feature that allows forced synchronisation of browse lists across routed networks using the "remote browse sync" parameter in the smb.conf file. This causes Samba to contact the local master browser on a remote network and to request browse list synchronisation. This effectively bridges two networks that are separated by routers. The two remote networks may use either broadcast based name resolution or WINS based name resolution, but it should be noted that the "remote browse sync" parameter provides browse list synchronisation – and that is distinct from name to address resolution, in other words, for cross subnet browsing to function correctly it is essential that a name to address resolution mechanism be provided. This mechanism could be via DNS, /etc/hosts, and so on.

2.5. MS Windows security options and how to configure Samba for seamless integration

MS Windows clients may use encrypted passwords alone, or encrypted as well as plain text passwords in the authentication process. It should be realized that with the SMB protocol the password is passed over the network either in plain text or encrypted. When encrypted passwords are used a password that has been entered by the user is encrypted in two ways:

- The case preserved password is encrypted using an MD5/DES one way hash
- The case is converted to upper case and then encrypted using an MD5/DES one way hash

Both of these encrypted passwords are sent over the network in the one authentication datagram.

MS Windows 95 pre-service pack 1, MS Windows NT versions 3.x and version 4.0 pre-service pack 3 will use either mode of password authentication. All versions of MS Windows that follow these versions no longer support plain text passwords by default.

MS Windows clients have a habit of dropping network mappings that have been idle for 10 minutes or longer. When the user attempts to use the mapped drive connection that has been dropped the SMB protocol has a mechanism by which the connection can be re-established using a cached copy of the password.

When Microsoft changed the default password mode, they dropped support for caching of the plain text password. This means that when the registry parameter is changed to re-enable use of plain text passwords it appears to work, but when a dropped mapping attempts to revalidate it will fail if the remote authentication server does not support encrypted passwords. This means that it is definitely not a good idea to re-enable plain text password support in such clients.

It is recommended that the following parameters be added to the smb.conf file:

```
password level = 8
username level = 8
```

these configuration parameters will compensate for the fact that in some circumstances MS Windows and MS DOS clients may twiddle the password that has been supplied by the user by converting characters to upper case. The above entries will try every combination of upper and lower case for the first 8 characters. Please refer to the man page for smb.conf for more information on use of these parameters.

The best option to adopt is to enable support for encrypted passwords where ever Samba is used. There are three configuration possibilities for support of encrypted passwords:

2.5.1. Use MS Windows NT as an authentication server

This method involves the additions of the following parameters in the smb.conf file:

```
encrypt passwords = Yes
security = server
password server = "NetBIOS_name_of_PDC"
```

There are two ways of identifying whether or not a username and password pair was valid or not. One uses

the reply information provided as part of the authentication messaging process, the other uses just and error code.

The down-side of this mode of configuration is the fact that for security reasons Samba will send the password server a bogus username and a bogus password and if the remote server fails to reject the username and password pair then an alternative mode of identification of validation is used. Where a site uses password lock out after a certain number of failed authentication attempts this will result in user lockouts.

Use of this mode of authentication does require there to be a standard Unix account for the user, this account can be blocked to prevent logons by other than MS Windows clients.

2.5.2. Make Samba a member of an MS Windows NT security domain

This method involves additon of the following paramters in the smb.conf file:

```
encrypt passwords = Yes
security = domain
workgroup = "name of NT domain"
password server = *
```

The use of the "*" argument to "password server" will cause samba to locate the domain controller in a way analogous to the way this is done within MS Windows NT.

In order for this method to work the Samba server needs to join the MS Windows NT security domain. This is done as follows:

- On the MS Windows NT domain controller using the Server Manager add a machine account for the Samba server.
- Next, on the Linux system execute: **smbpasswd -r PDC_NAME -j DOMAIN_NAME**

Use of this mode of authentication does require there to be a standard Unix account for the user, this account can be blocked to prevent logons by other than MS Windows clients.

2.5.3. Configure Samba as an authentication server

This mode of authentication demands that there be on the Unix/Linux system both a Unix style account as well as and smbpasswd entry for the user. The Unix system account can be locked if required as only the encrypted password will be used for SMB client authentication.

This method involves addition of the following parameters to the smb.conf file:

```
encrypt passwords = Yes
security = user
```

in order for this method to work a Unix system account needs to be created for each user, as well as for each MS Windows NT/2000 machine. The following structure is required.

2.5.3.1. Users

A user account that may provide a home directory should be created. The following Linux system commands are typical of the procedure for creating an account.

```
# useradd -s /bin/bash -d /home/"userid" -m
# passwd "userid"
  Enter Password:

# smbpasswd -a "userid"
  Enter Password:
```

2.5.3.2. MS Windows NT Machine Accounts

These are required only when Samba is used as a domain controller. Refer to the Samba-PDC-HOWTO for more details.

```
# useradd -a /bin/false -d /dev/null "machine_name"\$
# passwd -l "machine_name"\$
# smbpasswd -a -m "machine_name"
```

2.6. Configuration of Samba as ...

- A Stand-alone server – No special action is needed other than to create user accounts. Stand-alone servers do NOT provide network logon services, meaning that machines that use this server do NOT perform a domain logon but instead make use only of the MS Windows logon which is local to the MS Windows workstation/server.
- An MS Windows NT 3.x/4.0 security domain member – Refer to the previous section(s) above.
- An alternative to an MS Windows NT 3.x/4.0 Domain Controller – In the smb.conf file the following parameters should be added:

```
## please refer to the Samba PDC HOWTO chapter later in
## this collection for more details
[global]
    domain logons = Yes
    ; an OS level of 33 or more is recommended
    os level = 33

    [NETLOGON]
        path = /somewhere/in/file/system
        read only = yes
        available = yes
```

Chapter 3. LanMan and NT Password Encryption in Samba 2.x

3.1. Introduction

With the development of LanManager and Windows NT compatible password encryption for Samba, it is now able to validate user connections in exactly the same way as a LanManager or Windows NT server.

This document describes how the SMB password encryption algorithm works and what issues there are in choosing whether you want to use it. You should read it carefully, especially the part about security and the "PROS and CONS" section.

3.2. How does it work?

LanManager encryption is somewhat similar to UNIX password encryption. The server uses a file containing a hashed value of a user's password. This is created by taking the user's plaintext password, capitalising it, and either truncating to 14 bytes or padding to 14 bytes with null bytes. This 14 byte value is used as two 56 bit DES keys to encrypt a 'magic' eight byte value, forming a 16 byte value which is stored by the server and client. Let this value be known as the "hashed password".

Windows NT encryption is a higher quality mechanism, consisting of doing an MD4 hash on a Unicode version of the user's password. This also produces a 16 byte hash value that is non-reversible.

When a client (LanManager, Windows for WorkGroups, Windows 95 or Windows NT) wishes to mount a Samba drive (or use a Samba resource), it first requests a connection and negotiates the protocol that the client and server will use. In the reply to this request the Samba server generates and appends an 8 byte, random value – this is stored in the Samba server after the reply is sent and is known as the "challenge". The challenge is different for every client connection.

The client then uses the hashed password (16 byte values described above), appended with 5 null bytes, as three 56 bit DES keys, each of which is used to encrypt the challenge 8 byte value, forming a 24 byte value known as the "response".

In the SMB call `SMBsessionsetupX` (when user level security is selected) or the call `SMBtconX` (when share level security is selected), the 24 byte response is returned by the client to the Samba server. For Windows NT protocol levels the above calculation is done on both hashes of the user's password and both responses are returned in the SMB call, giving two 24 byte values.

The Samba server then reproduces the above calculation, using its own stored value of the 16 byte hashed password (read from the `smbpasswd` file – described later) and the challenge value that it kept from the negotiate protocol reply. It then checks to see if the 24 byte value it calculates matches the 24 byte value returned to it from the client.

If these values match exactly, then the client knew the correct password (or the 16 byte hashed value – see security note below) and is thus allowed access. If not, then the client did not know the correct password and is denied access.

Note that the Samba server never knows or stores the cleartext of the user's password – just the 16 byte hashed values derived from it. Also note that the cleartext password or 16 byte hashed values are never transmitted over the network – thus increasing security.

3.3. Important Notes About Security

The unix and SMB password encryption techniques seem similar on the surface. This similarity is, however, only skin deep. The unix scheme typically sends clear text passwords over the network when logging in. This is bad. The SMB encryption scheme never sends the cleartext password over the network but it does store the 16 byte hashed values on disk. This is also bad. Why? Because the 16 byte hashed values are a "password equivalent". You cannot derive the user's password from them, but they could potentially be used in a modified client to gain access to a server. This would require considerable technical knowledge on behalf of the attacker but is perfectly possible. You should thus treat the smbpasswd file as though it contained the cleartext passwords of all your users. Its contents must be kept secret, and the file should be protected accordingly.

Ideally we would like a password scheme which neither requires plain text passwords on the net or on disk. Unfortunately this is not available as Samba is stuck with being compatible with other SMB systems (WinNT, WfWg, Win95 etc).

Warning

Note that Windows NT 4.0 Service pack 3 changed the default for permissible authentication so that plaintext passwords are *never* sent over the wire. The solution to this is either to switch to encrypted passwords with Samba or edit the Windows NT registry to re-enable plaintext passwords. See the document WinNT.txt for details on how to do this.

Other Microsoft operating systems which also exhibit this behavior includes

- MS DOS Network client 3.0 with the basic network redirector installed
- Windows 95 with the network redirector update installed
- Windows 98 [se]
- Windows 2000

Note :All current release of Microsoft SMB/CIFS clients support authentication via the SMB Challenge/Response mechanism described here. Enabling clear text authentication does not disable the ability of the client to participate in encrypted authentication.

3.3.1. Advantages of SMB Encryption

- plain text passwords are not passed across the network. Someone using a network sniffer cannot just record passwords going to the SMB server.
 - WinNT doesn't like talking to a server that isn't using SMB encrypted passwords. It will refuse to browse the server if the server is also in user level security mode. It will insist on prompting the user for the password on each connection, which is very annoying. The only things you can do to stop this is to use SMB encryption.
-

Old SMB password: **<type old value here - or hit return if there was no old password>**

New SMB Password: **<type new value>**

Repeat New SMB Password: **<re-type new value**

If the old value does not match the current value stored for that user, or the two new values do not match each other, then the password will not be changed.

If invoked by an ordinary user it will only allow the user to change his or her own Samba password.

If run by the root user `smbpasswd` may take an optional argument, specifying the user name whose SMB password you wish to change. Note that when run as root `smbpasswd` does not prompt for or check the old password value, thus allowing root to set passwords for users who have forgotten their passwords.

smbpasswd is designed to work in the same way and be familiar to UNIX users who use the **passwd** or **yppasswd** commands.

For more details on using **smbpasswd** refer to the man page which will always be the definitive reference.

3.6. Setting up Samba to support LanManager Encryption

This is a very brief description on how to setup samba to support password encryption.

1. compile and install samba as usual
2. enable encrypted passwords in `smb.conf` by adding the line **encrypt passwords = yes** in the [global] section
3. create the initial `smbpasswd` password file in the place you specified in the Makefile (`--prefix=<dir>`). See the notes under the [The smbpasswd File](#) section earlier in the document for details.

Note that you can test things using `smbclient`.

Chapter 4. Hosting a Microsoft Distributed File System tree on Samba

4.1. Instructions

The Distributed File System (or Dfs) provides a means of separating the logical view of files and directories that users see from the actual physical locations of these resources on the network. It allows for higher availability, smoother storage expansion, load balancing etc. For more information about Dfs, refer to [Microsoft documentation](#).

This document explains how to host a Dfs tree on a Unix machine (for Dfs-aware clients to browse) using Samba.

To enable SMB-based DFS for Samba, configure it with the `--with-msdfs` option. Once built, a Samba server can be made a Dfs server by setting the global boolean `host msdfs` parameter in the `smb.conf` file. You designate a share as a Dfs root using the share level boolean `msdfs root` parameter. A Dfs root directory on Samba hosts Dfs links in the form of symbolic links that point to other servers. For example, a symbolic link `junction->msdfs:storage1\share1` in the share directory acts as the Dfs junction. When Dfs-aware clients attempt to access the junction link, they are redirected to the storage location (in this case, `\\storage1\share1`).

Dfs trees on Samba work with all Dfs-aware clients ranging from Windows 95 to 2000.

Here's an example of setting up a Dfs tree on a Samba server.

```
# The smb.conf file:
[global]
    netbios name = SAMBA
    host msdfs = yes

[dfs]
    path = /export/dfsroot
    msdfs root = yes
```

In the `/export/dfsroot` directory we set up our dfs links to other servers on the network.

```
root# cd /export/dfsroot
```

```
root# chown root /export/dfsroot
```

```
root# chmod 755 /export/dfsroot
```

```
root# ln -s msdfs:storageA\\shareA linka
```

```
root# ln -s msdfs:serverB\\share,serverC\\share linkb
```

You should set up the permissions and ownership of the directory acting as the Dfs root such that only designated users can create, delete or modify the msdfs links. Also note that symlink names should be all lowercase. This limitation exists to have Samba avoid trying all the case combinations to get at the link name.

Finally set up the symbolic links to point to the network shares you want, and start Samba.

Users on Dfs-aware clients can now browse the Dfs tree on the Samba server at `\\samba\dfs`. Accessing `links`, `linka` or `linkb` (which appear as directories to the client) takes users directly to the appropriate shares on the network.

4.1.1. Notes

- Windows clients need to be rebooted if a previously mounted non-`dfs` share is made a `dfs` root or vice versa. A better way is to introduce a new share and make it the `dfs` root.
 - Currently there's a restriction that `msdfs` symlink names should all be lowercase.
 - For security purposes, the directory acting as the root of the Dfs tree should have ownership and permissions set so that only designated users can modify the symbolic links in the directory.
-

Chapter 5. Printing Support in Samba 2.2.x

5.1. Introduction

Beginning with the 2.2.0 release, Samba supports the native Windows NT printing mechanisms implemented via MS-RPC (i.e. the SPOOLSS named pipe). Previous versions of Samba only supported LanMan printing calls.

The additional functionality provided by the new SPOOLSS support includes:

- Support for downloading printer driver files to Windows 95/98/NT/2000 clients upon demand.
- Uploading of printer drivers via the Windows NT Add Printer Wizard (APW) or the Imprints tool set (refer to <http://imprints.sourceforge.net>).
- Support for the native MS-RPC printing calls such as StartDocPrinter, EnumJobs(), etc... (See the MSDN documentation at <http://msdn.microsoft.com/> for more information on the Win32 printing API)
- Support for NT Access Control Lists (ACL) on printer objects
- Improved support for printer queue manipulation through the use of an internal databases for spooled job information

There has been some initial confusion about what all this means and whether or not it is a requirement for printer drivers to be installed on a Samba host in order to support printing from Windows clients. A bug existed in Samba 2.2.0 which made Windows NT/2000 clients require that the Samba server possess a valid driver for the printer. This is fixed in Samba 2.2.1 and once again, Windows NT/2000 clients can use the local APW for installing drivers to be used with a Samba served printer. This is the same behavior exhibited by Windows 9x clients. As a side note, Samba does not use these drivers in any way to process spooled files. They are utilized entirely by the clients.

The following MS KB article, may be of some help if you are dealing with Windows 2000 clients: *How to Add Printers with No User Interaction in Windows 2000*

<http://support.microsoft.com/support/kb/articles/Q189/1/05.ASP>

5.2. Configuration

[print\$] vs. [printer\$]

Previous versions of Samba recommended using a share named [printer\$]. This name was taken from the printer\$ service created by Windows 9x clients when a printer was shared. Windows 9x printer servers always have a printer\$ service which provides read-only access via no password in order to support printer driver downloads.

However, the initial implementation allowed for a parameter named *printer driver location* to be used on a per share basis to specify the location of the driver files associated with that printer. Another parameter named *printer driver* provided a means of defining the printer driver name to be sent to the client.

These parameters, including *printer driver file* parameter, are being depreciated and should not be used in new installations. For more information on this change, you should refer to the [Migration section](#) of this document.

5.2.1. Creating [print\$]

In order to support the uploading of printer driver files, you must first configure a file share named [print\$]. The name of this share is hard coded in Samba's internals so the name is very important (print\$ is the service used by Windows NT print servers to provide support for printer driver download).

You should modify the server's smb.conf file to create the following file share (of course, some of the parameter values, such as 'path' are arbitrary and should be replaced with appropriate values for your site):

```
[print$]
  path = /usr/local/samba/printers
  guest ok = yes
  browseable = yes
  read only = yes
  ; since this share is configured as read only, then we need
  ; a 'write list'. Check the file system permissions to make
  ; sure this account can copy files to the share. If this
  ; is setup to a non-root account, then it should also exist
  ; as a 'printer admin'
  write list = ntadmin
```

The [write list](#) is used to allow administrative level user accounts to have write access in order to update files on the share. See the [smb.conf\(5\) man page](#) for more information on configuring file shares.

The requirement for [guest ok = yes](#) depends upon how your site is configured. If users will be guaranteed to have an account on the Samba host, then this is a non-issue.

Author's Note: The non-issue is that if all your Windows NT users are guaranteed to be authenticated by the Samba server (such as a domain member server and the NT user has already been validated by the Domain Controller in order to logon to the Windows NT console), then guest access is not necessary. Of course, in a workgroup environment where you just want to be able to print without worrying about silly accounts and security, then configure the share for guest access. You'll probably want to add [map to guest = Bad User](#) in the [global] section as well. Make sure you understand what this parameter does before using it though. —jerry

In order for a Windows NT print server to support the downloading of driver files by multiple client architectures, it must create subdirectories within the [print\$] service which correspond to each of the supported client architectures. Samba follows this model as well.

Next create the directory tree below the [print\$] share for each architecture you wish to support.

```
[print$]----
| -W32X86           ; "Windows NT x86"
| -WIN40            ; "Windows 95/98"
| -W32ALPHA        ; "Windows NT Alpha_AXP"
| -W32MIPS          ; "Windows NT R4000"
| -W32PPC           ; "Windows NT PowerPC"
```

ATTENTION! REQUIRED PERMISSIONS

In order to currently add a new driver to you Samba host, one of two conditions must hold true:

- The account used to connect to the Samba host must have a uid of 0 (i.e. a root account)
- The account used to connect to the Samba host must be a member of the [printer_admin](#) list.

Of course, the connected account must still possess access to add files to the subdirectories beneath [print\$]. Remember that all file shares are set to 'read only' by default.

Once you have created the required [print\$] service and associated subdirectories, simply log onto the Samba server using a root (or *printer_admin*) account from a Windows NT 4.0 client. Navigate to the "Printers" folder on the Samba server. You should see an initial listing of printers that matches the printer shares defined on your Samba host.

5.2.2. Setting Drivers for Existing Printers

The initial listing of printers in the Samba host's Printers folder will have no real printer driver assigned to them. By default, in Samba 2.2.0 this driver name was set to *NO PRINTER DRIVER AVAILABLE FOR THIS PRINTER*. Later versions changed this to a NULL string to allow the use of the local Add Printer Wizard on NT/2000 clients. Attempting to view the printer properties for a printer which has this default driver assigned will result in the error message:

Device settings cannot be displayed. The driver for the specified printer is not installed, only spooler properties will be displayed. Do you want to install the driver now?

Click "No" in the error dialog and you will be presented with the printer properties window. The way assign a driver to a printer is to either

- Use the "New Driver..." button to install a new printer driver, or
- Select a driver from the popup list of installed drivers. Initially this list will be empty.

If you wish to install printer drivers for client operating systems other than "Windows NT x86", you will need to use the "Sharing" tab of the printer properties dialog.

Assuming you have connected with a root account, you will also be able modify other printer properties such as ACLs and device settings using this dialog box.

A few closing comments for this section, it is possible on a Windows NT print server to have printers listed in the Printers folder which are not shared. Samba does not make this distinction. By definition, the only printers of which Samba is aware are those which are specified as shares in `smb.conf`.

Another interesting side note is that Windows NT clients do not use the SMB printer share, but rather can print directly to any printer on another Windows NT host using MS-RPC. This of course assumes that the printing client has the necessary privileges on the remote host serving the printer. The default permissions assigned by Windows NT to a printer gives the "Print" permissions to the "Everyone" well-known group.

5.2.3. Support a large number of printers

One issue that has arisen during the development phase of Samba 2.2 is the need to support driver downloads for 100's of printers. Using the Windows NT APW is somewhat awkward to say the least. If more than one printer are using the same driver, the [rpcclient's setdriver command](#) can be used to set the driver associated with an installed driver. The following is an example of how this could be accomplished:

```
$ rpcclient pogo -U root%secret -c "enumdrivers"
Domain=[NARNIA] OS=[Unix] Server=[Samba 2.2.0-alpha3]

[Windows NT x86]
Printer Driver Info 1:
  Driver Name: [HP LaserJet 4000 Series PS]

Printer Driver Info 1:
  Driver Name: [HP LaserJet 2100 Series PS]

Printer Driver Info 1:
  Driver Name: [HP LaserJet 4Si/4SiMX PS]

$ rpcclient pogo -U root%secret -c "enumprinters"
Domain=[NARNIA] OS=[Unix] Server=[Samba 2.2.0-alpha3]
  flags:[0x800000]
  name:[\\POGO\hp-print]
  description:[POGO\\POGO\hp-print,NO DRIVER AVAILABLE FOR THIS PRINTER,]
  comment:[]

$ rpcclient pogo -U root%secret \
> -c "setdriver hp-print \"HP LaserJet 4000 Series PS\""
Domain=[NARNIA] OS=[Unix] Server=[Samba 2.2.0-alpha3]
Successfully set hp-print to driver HP LaserJet 4000 Series PS.
```

5.2.4. Adding New Printers via the Windows NT APW

By default, Samba offers all printer shares defined in `smb.conf` in the "Printers..." folder. Also existing in this folder is the Windows NT Add Printer Wizard icon. The APW will be shown only if

- The connected user is able to successfully execute an `OpenPrinterEx(\\server)` with administrative privileges (i.e. `root` or `printer admin`).
- [show_add_printer_wizard = yes](#) (the default).

In order to be able to use the APW to successfully add a printer to a Samba server, the [add_printer command](#) must have a defined value. The program hook must successfully add the printer to the system (i.e. `/etc/printcap` or appropriate files) and `smb.conf` if necessary.

When using the APW from a client, if the named printer share does not exist, **smbd** will execute the `add_printer command` and reparse to the `smb.conf` to attempt to locate the new printer share. If the share is still not defined, an error of "Access Denied" is returned to the client. Note that the `add_printer program` is executed under the context of the connected user, not necessarily a root account.

There is a complementing [delete_printer command](#) for removing entries from the "Printers..." folder.

5.2.5. Samba and Printer Ports

Windows NT/2000 print servers associate a port with each printer. These normally take the form of LPT1:, COM1:, FILE:, etc... Samba must also support the concept of ports associated with a printer. By default, only one printer port, named "Samba Printer Port", exists on a system. Samba does not really a port in order to print, rather it is a requirement of Windows clients.

Note that Samba does not support the concept of "Printer Pooling" internally either. This is when a logical printer is assigned to multiple ports as a form of load balancing or fail over.

If you require that multiple ports be defined for some reason, `smb.conf` possesses a [*enumports* command](#) which can be used to define an external program that generates a listing of ports on a system.

5.3. The Imprints Toolset

The Imprints tool set provides a UNIX equivalent of the Windows NT Add Printer Wizard. For complete information, please refer to the Imprints web site at <http://imprints.sourceforge.net/> as well as the documentation included with the imprints source distribution. This section will only provide a brief introduction to the features of Imprints.

5.3.1. What is Imprints?

Imprints is a collection of tools for supporting the goals of

- Providing a central repository information regarding Windows NT and 95/98 printer driver packages
 - Providing the tools necessary for creating the Imprints printer driver packages.
 - Providing an installation client which will obtain and install printer drivers on remote Samba and Windows NT 4 print servers.
-

5.3.2. Creating Printer Driver Packages

The process of creating printer driver packages is beyond the scope of this document (refer to `Imprints.txt` also included with the Samba distribution for more information). In short, an Imprints driver package is a gzipped tarball containing the driver files, related INF files, and a control file needed by the installation client.

5.3.3. The Imprints server

The Imprints server is really a database server that may be queried via standard HTTP mechanisms. Each printer entry in the database has an associated URL for the actual downloading of the package. Each package is digitally signed via GnuPG which can be used to verify that package downloaded is actually the one referred in the Imprints database. It is *not* recommended that this security check be disabled.

5.3.4. The Installation Client

More information regarding the Imprints installation client is available in the `Imprints-Client-HOWTO.ps` file included with the imprints source package.

The Imprints installation client comes in two forms.

- a set of command line Perl scripts
- a GTK+ based graphical interface to the command line perl scripts

The installation client (in both forms) provides a means of querying the Imprints database server for a matching list of known printer model names as well as a means to download and install the drivers on remote Samba and Windows NT print servers.

The basic installation process is in four steps and perl code is wrapped around **smbclient** and **rpcclient**.

```
foreach (supported architecture for a given driver)
{
    1. rpcclient: Get the appropriate upload directory
       on the remote server
    2. smbclient: Upload the driver files
    3. rpcclient: Issues an AddPrinterDriver() MS-RPC
}
4. rpcclient: Issue an AddPrinterEx() MS-RPC to actually
   create the printer
```

One of the problems encountered when implementing the Imprints tool set was the name space issues between various supported client architectures. For example, Windows NT includes a driver named "Apple LaserWriter II NTX v51.8" and Windows 95 calls its version of this driver "Apple LaserWriter II NTX"

The problem is how to know what client drivers have been uploaded for a printer. As astute reader will remember that the Windows NT Printer Properties dialog only includes space for one printer driver name. A quick look in the Windows NT 4.0 system registry at

```
HKLM\System\CurrentControlSet\Control\Print\Environment
```

will reveal that Windows NT always uses the NT driver name. This is ok as Windows NT always requires that at least the Windows NT version of the printer driver is present. However, Samba does not have the requirement internally. Therefore, how can you use the NT driver name if it has not already been installed?

The way of sidestepping this limitation is to require that all Imprints printer driver packages include both the Intel Windows NT and 95/98 printer drivers and that NT driver is installed first.

5.4. Migration to from Samba 2.0.x to 2.2.x

Given that printer driver management has changed (we hope improved) in 2.2 over prior releases, migration from an existing setup to 2.2 can follow several paths.

Windows clients have a tendency to remember things for quite a while. For example, if a Windows NT client has attached to a Samba 2.0 server, it will remember the server as a LanMan printer server. Upgrading the

Samba host to 2.2 makes support for MSRPC printing possible, but the NT client will still remember the previous setting.

In order to give an NT client printing "amesia" (only necessary if you want to use the newer MSRPC printing functionality in Samba), delete the registry keys associated with the print server contained in [HKLM\SYSTEM\CurrentControlSet\Control\Print]. The spooler service on the client should be stopped prior to doing this:

```
C:\WINNT\ > net stop spooler
```

All the normal disclaimers about editing the registry go here. Be careful, and know what you are doing.

The spooler service should be restarted after you have finished removing the appropriate registry entries by replacing the **stop** command above with **start**.

Windows 9x clients will continue to use LanMan printing calls with a 2.2 Samba server so there is no need to perform any of these modifications on non-NT clients.

Achtung!
<p>The following smb.conf parameters are considered to be depreciated and will be removed soon. Do not use them in new installations</p> <ul style="list-style-type: none"> • <i>printer driver file (G)</i> • <i>printer driver (S)</i> • <i>printer driver location (S)</i>

Here are the possible scenarios for supporting migration:

- If you do not desire the new Windows NT print driver support, nothing needs to be done. All existing parameters work the same.
 - If you want to take advantage of NT printer driver support but do not want to migrate the 9x drivers to the new setup, the leave the existing printers.def file. When smbd attempts to locate a 9x driver for the printer in the TDB and fails it will drop down to using the printers.def (and all associated parameters). The **make_printerdef** tool will also remain for backwards compatibility but will be moved to the "this tool is the old way of doing it" pile.
 - If you install a Windows 9x driver for a printer on your Samba host (in the printing TDB), this information will take precedence and the three old printing parameters will be ignored (including print driver location).
 - If you want to migrate an existing printers.def file into the new setup, the current only solution is to use the Windows NT APW to install the NT drivers and the 9x drivers. This can be scripted using **smbclient** and **rpcclient**. See the Imprints installation client at <http://imprints.sourceforge.net/> for an example.
-

Chapter 6. security = domain in Samba 2.x

6.1. Joining an NT Domain with Samba 2.2

In order for a Samba-2 server to join an NT domain, you must first add the NetBIOS name of the Samba server to the NT domain on the PDC using Server Manager for Domains. This creates the machine account in the domain (PDC) SAM. Note that you should add the Samba server as a "Windows NT Workstation or Server", *NOT* as a Primary or backup domain controller.

Assume you have a Samba-2 server with a NetBIOS name of `SERV1` and are joining an NT domain called `DOM`, which has a PDC with a NetBIOS name of `DOMPDC` and two backup domain controllers with NetBIOS names `DOMBDC1` and `DOMBDC2`.

In order to join the domain, first stop all Samba daemons and run the command:

```
root# smbpasswd -j DOM -r DOMPDC
```

as we are joining the domain `DOM` and the PDC for that domain (the only machine that has write access to the domain SAM database) is `DOMPDC`. If this is successful you will see the message:

```
smbpasswd: Joined domain DOM.
```

in your terminal window. See the [smbpasswd\(8\)](#) man page for more details.

There is existing development code to join a domain without having to create the machine trust account on the PDC beforehand. This code will hopefully be available soon in release branches as well.

This command goes through the machine account password change protocol, then writes the new (random) machine account password for this Samba server into a file in the same directory in which an `smbpasswd` file would be stored – normally :

```
/usr/local/samba/private
```

In Samba 2.0.x, the filename looks like this:

```
<NT DOMAIN NAME>.<Samba Server Name>.mac
```

The `.mac` suffix stands for machine account password file. So in our example above, the file would be called:

```
DOM.SERV1.mac
```

In Samba 2.2, this file has been replaced with a TDB (Trivial Database) file named `secrets.tdb`.

This file is created and owned by root and is not readable by any other user. It is the key to the domain-level security for your system, and should be treated as carefully as a shadow password file.

Now, before restarting the Samba daemons you must edit your [smb.conf\(5\)](#) file to tell Samba it should now use domain security.

Change (or add) your `security =` line in the [global] section of your `smb.conf` to read:

security = domain

Next change the `workgroup =` line in the [global] section to read:

workgroup = DOM

as this is the name of the domain we are joining.

You must also have the parameter `encrypt passwords` set to `yes` in order for your users to authenticate to the NT PDC.

Finally, add (or modify) a `password server =` line in the [global] section to read:

password server = DOMPDC DOMBDC1 DOMBDC2

These are the primary and backup domain controllers Samba will attempt to contact in order to authenticate users. Samba will try to contact each of these servers in order, so you may want to rearrange this list in order to spread out the authentication load among domain controllers.

Alternatively, if you want `smbd` to automatically determine the list of Domain controllers to use for authentication, you may set this line to be :

password server = *

This method, which was introduced in Samba 2.0.6, allows Samba to use exactly the same mechanism that NT does. This method either broadcasts or uses a WINS database in order to find domain controllers to authenticate against.

Finally, restart your Samba daemons and get ready for clients to begin using domain security!

6.2. Samba and Windows 2000 Domains

Many people have asked regarding the state of Samba's ability to participate in a Windows 2000 Domain. Samba 2.2 is able to act as a member server of a Windows 2000 domain operating in mixed or native mode.

There is much confusion between the circumstances that require a "mixed" mode Win2k DC and a when this host can be switched to "native" mode. A "mixed" mode Win2k domain controller is only needed if Windows NT BDCs must exist in the same domain. By default, a Win2k DC in "native" mode will still support NetBIOS and NTLMv1 for authentication of legacy clients such as Windows 9x and NT 4.0. Samba has the same requirements as a Windows NT 4.0 member server.

The steps for adding a Samba 2.2 host to a Win2k domain are the same as those for adding a Samba server to a Windows NT 4.0 domain. The only exception is that the "Server Manager" from NT 4 has been replaced by the "Active Directory Users and Computers" MMC (Microsoft Management Console) plugin.

6.3. Why is this better than security = server?

Currently, domain security in Samba doesn't free you from having to create local Unix users to represent the users attaching to your server. This means that if domain user `DOM\fred` attaches to your domain security Samba server, there needs to be a local Unix user `fred` to represent that user in the Unix filesystem. This is very similar to the older Samba security mode [security = server](#), where Samba would pass through the authentication request to a Windows NT server in the same way as a Windows 95 or Windows 98 server would.

Please refer to the [Winbind paper](#) for information on a system to automatically assign UNIX uids and gids to Windows NT Domain users and groups. This code is available in development branches only at the moment, but will be moved to release branches soon.

The advantage to domain-level security is that the authentication in domain-level security is passed down the authenticated RPC channel in exactly the same way that an NT server would do it. This means Samba servers now participate in domain trust relationships in exactly the same way NT servers do (i.e., you can add Samba servers into a resource domain and have the authentication passed on from a resource domain PDC to an account domain PDC).

In addition, with **security = server** every Samba daemon on a server has to keep a connection open to the authenticating server for as long as that daemon lasts. This can drain the connection resources on a Microsoft NT server and cause it to run out of available connections. With **security = domain**, however, the Samba daemons connect to the PDC/BDC only for as long as is necessary to authenticate the user, and then drop the connection, thus conserving PDC connection resources.

And finally, acting in the same manner as an NT server authenticating to a PDC means that as part of the authentication reply, the Samba server gets the user identification information such as the user SID, the list of NT groups the user belongs to, etc. All this information will allow Samba to be extended in the future into a mode the developers currently call appliance mode. In this mode, no local Unix users will be necessary, and Samba will generate Unix uids and gids from the information passed back from the PDC when a user is authenticated, making a Samba server truly plug and play in an NT domain environment. Watch for this code soon.

NOTE: Much of the text of this document was first published in the Web magazine [LinuxWorld](#) as the article [Doing the NIS/NT Samba](#).

Chapter 7. How to Configure Samba 2.2 as a Primary Domain Controller

7.1. Prerequisite Reading

Before you continue reading in this chapter, please make sure that you are comfortable with configuring basic files services in `smb.conf` and how to enable and administrate password encryption in Samba. These two topics are covered in the [smb.conf\(5\)](#) manpage and the [Encryption chapter](#) of this HOWTO Collection.

7.2. Background

Note: *Author's Note* : This document is a combination of David Bannon's Samba 2.2 PDC HOWTO and the Samba NT Domain FAQ. Both documents are superseded by this one.

Version of Samba prior to release 2.2 had marginal capabilities to act as a Windows NT 4.0 Primary Domain Controller (PDC). Beginning with Samba 2.2.0, we are proud to announce official support for Windows NT 4.0 style domain logons from Windows NT 4.0 (through SP6) and Windows 2000 (through SP1) clients. This article outlines the steps necessary for configuring Samba as a PDC. It is necessary to have a working Samba server prior to implementing the PDC functionality. If you have not followed the steps outlined in [UNIX_INSTALL.html](#), please make sure that your server is configured correctly before proceeding. Another good resource in the [smb.conf\(5\) man page](#). The following functionality should work in 2.2:

- domain logons for Windows NT 4.0/2000 clients.
- placing a Windows 9x client in user level security
- retrieving a list of users and groups from a Samba PDC to Windows 9x/NT/2000 clients
- roving (roaming) user profiles
- Windows NT 4.0 style system policies

Windows 2000 Service Pack 2 Clients
Samba 2.2.1 is required for PDC functionality when using Windows 2000 SP2 clients.

The following pieces of functionality are not included in the 2.2 release:

- Windows NT 4 domain trusts
- SAM replication with Windows NT 4.0 Domain Controllers (i.e. a Samba PDC and a Windows NT BDC or vice versa)
- Adding users via the User Manager for Domains
- Acting as a Windows 2000 Domain Controller (i.e. Kerberos and Active Directory)

Please note that Windows 9x clients are not true members of a domain for reasons outlined in this article. Therefore the protocol for support Windows 9x style domain logons is completely different from NT4 domain logons and has been officially supported for some time.

Implementing a Samba PDC can basically be divided into 2 broad steps.

1. Configuring the Samba PDC
2. Creating machine trust accounts and joining clients to the domain

There are other minor details such as user profiles, system policies, etc... However, these are not necessarily specific to a Samba PDC as much as they are related to Windows NT networking concepts. They will be mentioned only briefly here.

7.3. Configuring the Samba Domain Controller

The first step in creating a working Samba PDC is to understand the parameters necessary in `smb.conf`. I will not attempt to re-explain the parameters here as they are more that adequately covered in [the smb.conf man page](#). For convenience, the parameters have been linked with the actual `smb.conf` description.

Here is an example `smb.conf` for acting as a PDC:

```
[global]
; Basic server settings
netbios_name = POGO
workgroup = NARNIA

; we should act as the domain and local master browser
os_level = 64
preferred_master = yes
domain_master = yes
local_master = yes

; security settings (must use security = user)
security = user

; encrypted passwords are a requirement for a PDC
encrypt_passwords = yes

; support domain logons
domain_logons = yes

; where to store user profiles?
logon_path = \\%N\profiles\%u

; where is a user's home directory and where should it
; be mounted at?
logon_drive = H:
logon_home = \\homeserver\%u

; specify a generic logon script for all users
; this is a relative **DOS** path to the [netlogon] share
logon_script = logon.cmd

; necessary share for domain controller
[netlogon]
path = /usr/local/samba/lib/netlogon
writeable = no
write list = ntadmin

; share for storing user profiles
[profiles]
path = /export/smb/ntprofile
writeable = yes
```

```
create_mask = 0600
directory_mask = 0700
```

There are a couple of points to emphasize in the above configuration.

- Encrypted passwords must be enabled. For more details on how to do this, refer to [ENCRYPTION.html](#).
- The server must support domain logons and a [netlogon] share
- The server must be the domain master browser in order for Windows client to locate the server as a DC. Please refer to the various Network Browsing documentation included with this distribution for details.

As Samba 2.2 does not offer a complete implementation of group mapping between Windows NT groups and UNIX groups (this is really quite complicated to explain in a short space), you should refer to the [domain admin users](#) and [domain admin group](#) smb.conf parameters for information of creating a Domain Admins style accounts.

7.4. Creating Machine Trust Accounts and Joining Clients to the Domain

A machine trust account is a samba user account owned by a computer. The account password acts as the shared secret for secure communication with the Domain Controller. This is a security feature to prevent an unauthorized machine with the same netbios name from joining the domain and gaining access to domain user/group accounts. Hence a Windows 9x host is never a true member of a domain because it does not possess a machine trust account, and thus has no shared secret with the DC.

On a Windows NT PDC, these machine trust account passwords are stored in the registry. A Samba PDC stores these accounts in the same location as user LanMan and NT password hashes (currently smbpasswd). However, machine trust accounts only possess and use the NT password hash.

Because Samba requires machine accounts to possess a UNIX uid from which an Windows NT SID can be generated, all of these accounts must have an entry in `/etc/passwd` and `smbpasswd`. Future releases will alleviate the need to create `/etc/passwd` entries.

There are two means of creating machine trust accounts.

- Manual creation before joining the client to the domain. In this case, the password is set to a known value -- the lower case of the machine's netbios name.
- Creation of the account at the time of joining the domain. In this case, the session key of the administrative account used to join the client to the domain acts as an encryption key for setting the password to a random value (This is the recommended method).

7.4.1. Manually creating machine trust accounts

The first step in creating a machine trust account by hand is to create an entry for the machine in `/etc/passwd`. This can be done using `vipw` or any 'add user' command which is normally used to create new UNIX accounts. The following is an example for a Linux based Samba server:

```
root# /usr/sbin/useradd -g 100 -d /dev/null -c machine_nickname -m -s /bin/false
machine_name$
```

The `/etc/passwd` entry will list the machine name with a `$` appended, won't have a passwd, will have a null shell and no home directory. For example a machine called 'doppy' would have an `/etc/passwd` entry like this :

```
doppy$:x:505:501:machine_nickname:/dev/null:/bin/false
```

Above, *machine_nickname* can be any descriptive name for the pc i.e. BasementComputer. The *machine_name* absolutely must be the netbios name of the pc to be added to the domain. The "\$" must append the netbios name of the pc or samba will not recognize this as a machine account

Now that the UNIX account has been created, the next step is to create the smbpasswd entry for the machine containing the well known initial trust account password. This can be done using the [smbpasswd\(8\)](#) command as shown here:

```
root# smbpasswd -a -m machine_name
```

where *machine_name* is the machine's netbios name.

Join the client to the domain immediately

Manually creating a machine trust account using this method is the equivalent of creating a machine account on a Windows NT PDC using the "Server Manager". From the time at which the account is created to the time which the client joins the domain and changes the password, your domain is vulnerable to an intruder joining your domain using a machine with the same netbios name. A PDC inherently trusts members of the domain and will serve out a large degree of user information to such clients. You have been warned!

7.4.2. Creating machine trust accounts "on the fly"

The second, and most recommended way of creating machine trust accounts is to create them as needed at the time the client is joined to the domain. You will need to include a value for the [add user script](#) parameter. Below is an example from a RedHat 6.2 Linux system.

```
add user script = /usr/sbin/useradd -d /dev/null -g 100 -s /bin/false -M %u
```

In Samba 2.2.1, *only the root account* can be used to create machine accounts like this. Therefore, it is required to create an entry in smbpasswd for *root*. The password *SHOULD* be set to a different password than the associated `/etc/passwd` entry for security reasons.

7.5. Common Problems and Errors

- *I cannot include a '\$' in a machine name.*

A 'machine name' in (typically) `/etc/passwd` of the machine name with a '\$' appended. FreeBSD (and other BSD systems ?) won't create a user with a '\$' in their name.

The problem is only in the program used to make the entry, once made, it works perfectly. So create a user without the '\$' and use **vipw** to edit the entry, adding the '\$'. Or create the whole entry with **vipw** if you like, make sure you use a unique uid !

- *I get told "You already have a connection to the Domain...." or "Cannot join domain, the credentials supplied conflict with an existing set.." when creating a machine account.*

This happens if you try to create a machine account from the machine itself and already have a connection (e.g. mapped drive) to a share (or IPC\$) on the Samba PDC. The following command will remove all network drive connections:

```
C:\WINNT\> net use * /d
```

Further, if the machine is already a 'member of a workgroup' that is the same name as the domain you are joining (bad idea) you will get this message. Change the workgroup name to something else, it does not matter what, reboot, and try again.

- *The system can not log you on (C000019B)....*

I joined the domain successfully but after upgrading to a newer version of the Samba code I get the message, "The system can not log you on (C000019B), Please try a gain or consult your system administrator" when attempting to logon.

This occurs when the domain SID stored in `private/WORKGROUP.SID` is changed. For example, you remove the file and **smbd** automatically creates a new one. Or you are swapping back and forth between versions 2.0.7, TNG and the HEAD branch code (not recommended). The only way to correct the problem is to restore the original domain SID or remove the domain client from the domain and rejoin.

- *The machine account for this computer either does not exist or is not accessible.*

When I try to join the domain I get the message "The machine account for this computer either does not exist or is not accessible". What's wrong?

This problem is caused by the PDC not having a suitable machine account. If you are using the *add user script* method to create accounts then this would indicate that it has not worked. Ensure the domain admin user system is working.

Alternatively if you are creating account entries manually then they have not been created correctly. Make sure that you have the entry correct for the machine account in `smbpasswd` file on the Samba PDC. If you added the account using an editor rather than using the `smbpasswd` utility, make sure that the account name is the machine netbios name with a '\$' appended to it (ie. `computer_name$`). There must be an entry in both `/etc/passwd` and the `smbpasswd` file. Some people have reported that inconsistent subnet masks between the Samba server and the NT client have caused this problem. Make sure that these are consistent for both client and server.

- *When I attempt to login to a Samba Domain from a NT4/W2K workstation, I get a message about my account being disabled.*

This problem is caused by a PAM related bug in Samba 2.2.0. This bug is fixed in 2.2.1. Other symptoms could be unaccessible shares on NT/W2K member servers in the domain or the following

error in your smbld.log: passdb/pampass.c:pam_account(268) PAM: UNKNOWN ERROR for User: %user%

At first be ensure to enable the useraccounts with **smbpasswd -e %user%**, this is normaly done, when you create an account.

In order to work around this problem in 2.2.0, configure the `account` control flag in `/etc/pam.d/samba` file as follows:

```
account required pam_permit.so
```

If you want to remain backward compatibility to samba 2.0.x use `pam_permit.so`, it's also possible to use `pam_pwdb.so`. There are some bugs if you try to use `pam_unix.so`, if you need this, be ensure to use the most recent version of this file.

7.6. System Policies and Profiles

Much of the information necessary to implement System Policies and Roving User Profiles in a Samba domain is the same as that for implementing these same items in a Windows NT 4.0 domain. You should read the white paper [Implementing Profiles and Policies in Windows NT 4.0](#) available from Microsoft.

Here are some additional details:

- *What about Windows NT Policy Editor ?*

To create or edit `ntconfig.pol` you must use the NT Server Policy Editor, **poledit.exe** which is included with NT Server but *not NT Workstation*. There is a Policy Editor on a NTws but it is not suitable for creating *Domain Policies*. Further, although the Windows 95 Policy Editor can be installed on an NT Workstation/Server, it will not work with NT policies because the registry key that are set by the policy templates. However, the files from the NT Server will run happily enough on an NTws. You need `poledit.exe`, `common.adm` and `winnt.adm`. It is convenient to put the two *.adm files in `c:\winnt\inf` which is where the binary will look for them unless told otherwise. Note also that that directory is 'hidden'.

The Windows NT policy editor is also included with the Service Pack 3 (and later) for Windows NT 4.0. Extract the files using **servicepackname /x**, ie thats **Nt4sp6ai.exe /x** for service pack 6a. The policy editor, **poledit.exe** and the associated template files (*.adm) should be extracted as well. It is also possible to downloaded the policy template files for Office97 and get a copy of the policy editor. Another possible location is with the Zero Administration Kit available for download from Microsoft.

- *Can Win95 do Policies ?*

Install the group policy handler for Win9x to pick up group policies. Look on the Win98 CD in `\tools\reskit\netadmin\poledit`. Install group policies on a Win9x client by double-clicking `grouppol.inf`. Log off and on again a couple of times and see if Win98 picks up group policies. Unfortunately this needs to be done on every Win9x machine that uses group policies....

If group policies don't work one reports suggests getting the updated (read: working) grouppol.dll for Windows 9x. The group list is grabbed from /etc/group.

- *How do I get 'User Manager' and 'Server Manager'*

Since I don't need to buy an NT Server CD now, how do I get the 'User Manager for Domains', the 'Server Manager' ?

Microsoft distributes a version of these tools called nexus for installation on Windows 95 systems. The tools set includes

- ◆ Server Manager
- ◆ User Manager for Domains
- ◆ Event Viewer

Click here to download the archived file <ftp://ftp.microsoft.com/Softlib/MSLFILES/NEXUS.EXE>

The Windows NT 4.0 version of the 'User Manager for Domains' and 'Server Manager' are available from Microsoft via ftp from <ftp://ftp.microsoft.com/Softlib/MSLFILES/SRVTOOLS.EXE>

7.7. What other help can I get ?

There are many sources of information available in the form of mailing lists, RFC's and documentation. The docs that come with the samba distribution contain very good explanations of general SMB topics such as browsing.

- *What are some diagnostics tools I can use to debug the domain logon process and where can I find them?*

One of the best diagnostic tools for debugging problems is Samba itself. You can use the `-d` option for both `smbd` and `nmbd` to specify what 'debug level' at which to run. See the man pages on `smbd`, `nmbd` and `smb.conf` for more information on debugging options. The debug level can range from 1 (the default) to 10 (100 for debugging passwords).

Another helpful method of debugging is to compile samba using the `gcc -g` flag. This will include debug information in the binaries and allow you to attach `gdb` to the running `smbd` / `nmbd` process. In order to attach `gdb` to an `smbd` process for an NT workstation, first get the workstation to make the connection. Pressing `ctrl-alt-delete` and going down to the domain box is sufficient (at least, on the first time you join the domain) to generate a 'LsaEnumTrustedDomains'. Thereafter, the workstation maintains an open connection, and therefore there will be an `smbd` process running (assuming that you haven't set a really short `smbd` idle timeout) So, in between pressing `ctrl alt delete`, and actually typing in your password, you can `gdb` attach and continue.

Some useful samba commands worth investigating:

- ◆ `testparam | more`
- ◆ `smbclient -L //{netbios name of server}`

An SMB enabled version of `tcpdump` is available from <http://www.tcpdup.org/>. Ethereal, another

good packet sniffer for UNIX and Win32 hosts, can be downloaded from <http://www.ethereal.com>.

For tracing things on the Microsoft Windows NT, Network Monitor (aka. netmon) is available on the Microsoft Developer Network CD's, the Windows NT Server install CD and the SMS CD's. The version of netmon that ships with SMS allows for dumping packets between any two computers (ie. placing the network interface in promiscuous mode). The version on the NT Server install CD will only allow monitoring of network traffic directed to the local NT box and broadcasts on the local subnet. Be aware that Ethereal can read and write netmon formatted files.

- *How do I install 'Network Monitor' on an NT Workstation or a Windows 9x box?*

Installing netmon on an NT workstation requires a couple of steps. The following are for installing Netmon V4.00.349, which comes with Microsoft Windows NT Server 4.0, on Microsoft Windows NT Workstation 4.0. The process should be similar for other version of Windows NT / Netmon. You will need both the Microsoft Windows NT Server 4.0 Install CD and the Workstation 4.0 Install CD.

Initially you will need to install 'Network Monitor Tools and Agent' on the NT Server. To do this

- ◆ Goto Start – Settings – Control Panel – Network – Services – Add
- ◆ Select the 'Network Monitor Tools and Agent' and click on 'OK'.
- ◆ Click 'OK' on the Network Control Panel.
- ◆ Insert the Windows NT Server 4.0 install CD when prompted.

At this point the Netmon files should exist in %SYSTEMROOT%\System32\netmon*.*. Two subdirectories exist as well, parsers\ which contains the necessary DLL's for parsing the netmon packet dump, and captures\.

In order to install the Netmon tools on an NT Workstation, you will first need to install the 'Network Monitor Agent' from the Workstation install CD.

- ◆ Goto Start – Settings – Control Panel – Network – Services – Add
- ◆ Select the 'Network Monitor Agent' and click on 'OK'.
- ◆ Click 'OK' on the Network Control Panel.
- ◆ Insert the Windows NT Workstation 4.0 install CD when prompted.

Now copy the files from the NT Server in %SYSTEMROOT%\System32\netmon*. * to %SYSTEMROOT%\System32\netmon*. * on the Workstation and set permissions as you deem appropriate for your site. You will need administrative rights on the NT box to run netmon.

To install Netmon on a Windows 9x box install the network monitor agent from the Windows 9x CD (admin\nettools\netmon). There is a readme file located with the netmon driver files on the CD if you need information on how to do this. Copy the files from a working Netmon installation.

- The following is a list if helpful URLs and other links:

- ◆ Home of Samba site <http://samba.org>. We have a mirror near you !
- ◆ The *Development* document on the Samba mirrors might mention your problem. If so, it might mean that the developers are working on it.
- ◆ See how Scott Merrill simulates a BDC behavior at <http://www.skippy.net/linux/smb-howto.html>.

- ◆ Although 2.0.7 has almost had its day as a PDC, David Bannon will keep the 2.0.7 PDC pages at <http://bioserve.latrobe.edu.au/samba> going for a while yet.
- ◆ Misc links to CIFS information <http://samba.org/cifs/>
- ◆ NT Domains for Unix <http://mailhost.cb1.com/~lkcl/ntdom/>
- ◆ FTP site for older SMB specs: <ftp://ftp.microsoft.com/developr/drg/CIFS/>

- *How do I get help from the mailing lists ?*

There are a number of Samba related mailing lists. Go to <http://samba.org>, click on your nearest mirror and then click on **Support** and then click on **Samba related mailing lists**.

For questions relating to Samba TNG go to <http://www.samba-tng.org/> It has been requested that you don't post questions about Samba-TNG to the main stream Samba lists.

If you post a message to one of the lists please observe the following guide lines :

- ◆ Always remember that the developers are volunteers, they are not paid and they never guarantee to produce a particular feature at a particular time. Any time lines are 'best guess' and nothing more.
- ◆ Always mention what version of samba you are using and what operating system its running under. You should probably list the relevant sections of your smb.conf file, at least the options in [global] that affect PDC support.
- ◆ In addition to the version, if you obtained Samba via CVS mention the date when you last checked it out.
- ◆ Try and make your question clear and brief, lots of long, convoluted questions get deleted before they are completely read ! Don't post html encoded messages (if you can select colour or font size its html).
- ◆ If you run one of those nifty 'I'm on holidays' things when you are away, make sure its configured to not answer mailing lists.
- ◆ Don't cross post. Work out which is the best list to post to and see what happens, ie don't post to both samba-ntdom and samba-technical. Many people active on the lists subscribe to more than one list and get annoyed to see the same message two or more times. Often someone will see a message and thinking it would be better dealt with on another, will forward it on for you.
- ◆ You might include *partial* log files written at a debug level set to as much as 20. Please don't send the entire log but enough to give the context of the error messages.
- ◆ (Possibly) If you have a complete netmon trace (from the opening of the pipe to the error) you can send the *.CAP file as well.
- ◆ Please think carefully before attaching a document to an email. Consider pasting the relevant parts into the body of the message. The samba mailing lists go to a huge number of people, do they all need a copy of your smb.conf in their attach directory ?

- *How do I get off the mailing lists ?*

To have your name removed from a samba mailing list, go to the same place you went to to get on it. Go to <http://lists.samba.org>, click on your nearest mirror and then click on **Support** and then click on **Samba related mailing lists**. Or perhaps see [here](#)

Please don't post messages to the list asking to be removed, you will just be referred to the above address (unless that process failed in some way...)

7.8. Domain Control for Windows 9x/ME

Note: The following section contains much of the original DOMAIN.txt file previously included with Samba. Much of the material is based on what went into the book Special Edition, Using Samba. (Richard Sharpe)

A domain and a workgroup are exactly the same thing in terms of network browsing. The difference is that a distributable authentication database is associated with a domain, for secure login access to a network. Also, different access rights can be granted to users if they successfully authenticate against a domain logon server (NT server and other systems based on NT server support this, as does at least Samba TNG now).

The SMB client logging on to a domain has an expectation that every other server in the domain should accept the same authentication information. Network browsing functionality of domains and workgroups is identical and is explained in BROWSING.txt. It should be noted, that browsing is total orthogonal to logon support.

Issues related to the single-logon network model are discussed in this document. Samba supports domain logons, network logon scripts, and user profiles for MS Windows for workgroups and MS Windows 9X clients.

When an SMB client in a domain wishes to logon it broadcast requests for a logon server. The first one to reply gets the job, and validates its password using whatever mechanism the Samba administrator has installed. It is possible (but very stupid) to create a domain where the user database is not shared between servers, ie they are effectively workgroup servers advertising themselves as participating in a domain. This demonstrates how authentication is quite different from but closely involved with domains.

Another thing commonly associated with single-logon domains is remote administration over the SMB protocol. Again, there is no reason why this cannot be implemented with an underlying username database which is different from the Windows NT SAM. Support for the Remote Administration Protocol is planned for a future release of Samba.

Network logon support as discussed in this section is aimed at Window for Workgroups, and Windows 9X clients.

Support for profiles is confirmed as working for Win95, NT 4.0 and NT 3.51. It is possible to specify: the profile location; script file to be loaded on login; the user's home directory; and for NT a kick-off time could also now easily be supported. However, there are some differences between Win9X profile support and WinNT profile support. These are discussed below.

With NT Workstations, all this does not require the use or intervention of an NT 4.0 or NT 3.51 server: Samba can now replace the logon services provided by an NT server, to a limited and experimental degree (for example, running "User Manager for Domains" will not provide you with access to a domain created by a Samba Server).

With Win95, the help of an NT server can be enlisted, both for profile storage and for user authentication. For details on user authentication, see security_level.txt. For details on profile storage, see below.

Using these features you can make your clients verify their logon via the Samba server; make clients run a batch file when they logon to the network and download their preferences, desktop and start menu.

Before launching into the configuration instructions, it is worthwhile looking at how a Win9X client performs a logon:

1. The client broadcasts (to the IP broadcast address of the subnet it is in) a NetLogon request. This is sent to the NetBIOS address DOMAIN<00> at the NetBIOS layer. The client chooses the first response it receives, which contains the NetBIOS name of the logon server to use in the format of \\SERVER.
 2. The client then connects to that server, logs on (does an SMBsesssetupX) and then connects to the IPC\$ share (using an SMBtconX).
 3. The client then does a NetWkstaUserLogon request, which retrieves the name of the user's logon script.
 4. The client then connects to the NetLogon share and searches for this and if it is found and can be read, is retrieved and executed by the client. After this, the client disconnects from the NetLogon share.
 5. The client then sends a NetUserGetInfo request to the server, to retrieve the user's home share, which is used to search for profiles. Since the response to the NetUserGetInfo request does not contain much more the user's home share, profiles for Win9X clients MUST reside in the user home directory.
 6. The client then connects to the user's home share and searches for the user's profile. As it turns out, you can specify the user's home share as a sharename and path. For example, \\server\fred\profile. If the profiles are found, they are implemented.
 7. The client then disconnects from the user's home share, and reconnects to the NetLogon share and looks for CONFIG.POL, the policies file. If this is found, it is read and implemented.
-

7.8.1. Configuration Instructions: Network Logons

To use domain logons and profiles you need to do the following:

1. Create a share called [netlogon] in your smb.conf. This share should be readable by all users, and probably should not be writeable. This share will hold your network logon scripts, and the CONFIG.POL file (Note: for details on the CONFIG.POL file, how to use it, what it is, refer to the Microsoft Windows NT Administration documentation. The format of these files is not known, so you will need to use Microsoft tools).

For example I have used:

```
[netlogon]
  path = /data/dos/netlogon
  writeable = no
  guest ok = no
```

Note that it is important that this share is not writeable by ordinary users, in a secure environment: ordinary users should not be allowed to modify or add files that another user's computer would then download when they log in.

2. in the [global] section of smb.conf set the following:

```
domain logons = yes
logon script = %U.bat
```

The choice of batch file is, of course, up to you. The above would give each user a separate batch file as the %U will be changed to their username automatically. The other standard % macros may also be used. You can make the batch files come from a subdirectory by using something like:

```
logon script = scripts\%U.bat
```

3. create the batch files to be run when the user logs in. If the batch file doesn't exist then no batch file will be run.

In the batch files you need to be careful to use DOS style cr/lf line endings. If you don't then DOS may get confused. I suggest you use a DOS editor to remotely edit the files if you don't know how to produce DOS style files under unix.

4. Use smbclient with the -U option for some users to make sure that the \\server\NETLOGON share is available, the batch files are visible and they are readable by the users.
5. you will probably find that your clients automatically mount the \\SERVER\NETLOGON share as drive z: while logging in. You can put some useful programs there to execute from the batch files.

security mode and master browsers

There are a few comments to make in order to tie up some loose ends. There has been much debate over the issue of whether or not it is ok to configure Samba as a Domain Controller in security modes other than USER. The only security mode which will not work due to technical reasons is SHARE mode security. DOMAIN and SERVER mode security is really just a variation on SMB user level security.

Actually, this issue is also closer tied to the debate on whether or not Samba must be the domain master browser for its workgroup when operating as a DC. While it may technically be possible to configure a server as such (after all, browsing and domain logons are two distinctly different functions), it is not a good idea to so. You should remember that the DC must register the DOMAIN#1b netbios name. This is the name used by Windows clients to locate the DC. Windows clients do not distinguish between the DC and the DMB. For this reason, it is very wise to configure the Samba DC as the DMB.

Now back to the issue of configuring a Samba DC to use a mode other than "security = user". If a Samba host is configured to use another SMB server or DC in order to validate user connection requests, then it is a fact that some other machine on the network (the "password server") knows more about user than the Samba host. 99% of the time, this other host is a domain controller. Now in order to operate in domain mode security, the "workgroup" parameter must be set to the name of the Windows NT domain (which already has a domain controller, right?)

Therefore configuring a Samba box as a DC for a domain that already by definition has a PDC is asking for trouble. Therefore, you should always configure the Samba DC to be the DMB for its domain.

7.8.2. Configuration Instructions: Setting up Roaming User Profiles

Warning

NOTE! Roaming profiles support is different for Win9X and WinNT.

Before discussing how to configure roaming profiles, it is useful to see how Win9X and WinNT clients implement these features.

Win9X clients send a NetUserGetInfo request to the server to get the user's profiles location. However, the response does not have room for a separate profiles location field, only the user's home share. This means that Win9X profiles are restricted to being in the user's home directory.

WinNT clients send a NetSAMLogon RPC request, which contains many fields, including a separate field for the location of the user's profiles. This means that support for profiles is different for Win9X and WinNT.

7.8.2.1. Windows NT Configuration

To support WinNT clients, in the [global] section of smb.conf set the following (for example):

```
logon path = \\profiles\profiles\profilepath\%U\moreprofilepath
```

The default for this option is \\%N%\%U\profile, namely \\sambaserver\username\profile. The \\N%\%U service is created automatically by the [homes] service. If you are using a samba server for the profiles, you must make the share specified in the logon path browseable.

Note: [lkcl 26aug96 – we have discovered a problem where Windows clients can maintain a connection to the [homes] share in between logins. The [homes] share must NOT therefore be used in a profile path.]

7.8.2.2. Windows 9X Configuration

To support Win9X clients, you must use the "logon home" parameter. Samba has now been fixed so that "net use/home" now works as well, and it, too, relies on the "logon home" parameter.

By using the logon home parameter, you are restricted to putting Win9X profiles in the user's home directory. But wait! There is a trick you can use. If you set the following in the [global] section of your smb.conf file:

```
logon home = \\%L%\%U\.profiles
```

then your Win9X clients will dutifully put their clients in a subdirectory of your home directory called .profiles (thus making them hidden).

Not only that, but 'net use/home' will also work, because of a feature in Win9X. It removes any directory stuff off the end of the home directory area and only uses the server and share portion. That is, it looks like you specified \\%L%\%U for "logon home".

7.8.2.3. Win9X and WinNT Configuration

You can support profiles for both Win9X and WinNT clients by setting both the "logon home" and "logon path" parameters. For example:

```
logon home = \\%L%\%U\.profiles
logon path = \\%L%\profiles\%U
```

Note: I have not checked what 'net use /home' does on NT when "logon home" is set as above.

7.8.2.4. Windows 9X Profile Setup

When a user first logs in on Windows 9X, the file user.DAT is created, as are folders "Start Menu", "Desktop", "Programs" and "Nethood". These directories and their contents will be merged with the local versions stored in c:\windows\profiles\username on subsequent logins, taking the most recent from each. You will need to use the [global] options "preserve case = yes", "short case preserve = yes" and "case sensitive = no" in order to maintain capital letters in shortcuts in any of the profile folders.

The user.DAT file contains all the user's preferences. If you wish to enforce a set of preferences, rename their user.DAT file to user.MAN, and deny them write access to this file.

1. On the Windows 95 machine, go to Control Panel | Passwords and select the User Profiles tab. Select the required level of roaming preferences. Press OK, but do not allow the computer to reboot.
2. On the Windows 95 machine, go to Control Panel | Network | Client for Microsoft Networks | Preferences. Select 'Log on to NT Domain'. Then, ensure that the Primary Logon is 'Client for Microsoft Networks'. Press OK, and this time allow the computer to reboot.

Under Windows 95, Profiles are downloaded from the Primary Logon. If you have the Primary Logon as 'Client for Novell Networks', then the profiles and logon script will be downloaded from your Novell Server. If you have the Primary Logon as 'Windows Logon', then the profiles will be loaded from the local machine – a bit against the concept of roaming profiles, if you ask me.

You will now find that the Microsoft Networks Login box contains [user, password, domain] instead of just [user, password]. Type in the samba server's domain name (or any other domain known to exist, but bear in mind that the user will be authenticated against this domain and profiles downloaded from it, if that domain logon server supports it), user name and user's password.

Once the user has been successfully validated, the Windows 95 machine will inform you that 'The user has not logged on before' and asks you if you wish to save the user's preferences? Select 'yes'.

Once the Windows 95 client comes up with the desktop, you should be able to examine the contents of the directory specified in the "logon path" on the samba server and verify that the "Desktop", "Start Menu", "Programs" and "Nethood" folders have been created.

These folders will be cached locally on the client, and updated when the user logs off (if you haven't made them read-only by then :-). You will find that if the user creates further folders or short-cuts, that the client will merge the profile contents downloaded with the contents of the profile directory already on the local client, taking the newest folders and short-cuts from each set.

If you have made the folders / files read-only on the samba server, then you will get errors from the w95 machine on logon and logout, as it attempts to merge the local and the remote profile. Basically, if you have any errors reported by the w95 machine, check the unix file permissions and ownership rights on the profile directory contents, on the samba server.

If you have problems creating user profiles, you can reset the user's local desktop cache, as shown below. When this user then next logs in, they will be told that they are logging in "for the first time".

1. instead of logging in under the [user, password, domain] dialog, press escape.
2. run the regedit.exe program, and look in:

HKEY_LOCAL_MACHINE\Windows\CurrentVersion\ProfileList

you will find an entry, for each user, of ProfilePath. Note the contents of this key (likely to be c:\windows\profiles\username), then delete the key ProfilePath for the required user.

[Exit the registry editor].

3. *WARNING* – before deleting the contents of the directory listed in the ProfilePath (this is likely to be c:\windows\profiles\username), ask them if they have any important files stored on their desktop or in their start menu. delete the contents of the directory ProfilePath (making a backup if any of the files are needed).

This will have the effect of removing the local (read-only hidden system file) user.DAT in their profile directory, as well as the local "desktop", "nethood", "start menu" and "programs" folders.

4. search for the user's .PWL password-caching file in the c:\windows directory, and delete it.
5. log off the windows 95 client.
6. check the contents of the profile path (see "logon path" described above), and delete the user.DAT or user.MAN file for the user, making a backup if required.

If all else fails, increase samba's debug log levels to between 3 and 10, and / or run a packet trace program such as tcpdump or netmon.exe, and look for any error reports.

If you have access to an NT server, then first set up roaming profiles and / or netlogons on the NT server. Make a packet trace, or examine the example packet traces provided with NT server, and see what the differences are with the equivalent samba trace.

7.8.2.5. Windows NT Workstation 4.0

When a user first logs in to a Windows NT Workstation, the profile NTuser.DAT is created. The profile location can be now specified through the "logon path" parameter.

Note: [lkcl 10aug97 – i tried setting the path to \\samba-server\homes\profile, and discovered that this fails because a background process maintains the connection to the [homes] share which does *_not_* close down in between user logins. you have to have \\samba-server\%L\profile, where user is the username created from the [homes] share].

There is a parameter that is now available for use with NT Profiles: "logon drive". This should be set to "h:" or any other drive, and should be used in conjunction with the new "logon home" parameter.

The entry for the NT 4.0 profile is a *_directory_* not a file. The NT help on profiles mentions that a directory is also created with a .PDS extension. The user, while logging in, must have write permission to create the full profile path (and the folder with the .PDS extension) [lkcl 10aug97 – i found that the creation of the .PDS directory failed, and had to create these manually for each user, with a shell script. also, i presume, but have not tested, that the full profile path must be browseable just as it is for w95, due to the manner in which they attempt to create the full profile path: test existence of each path component; create path component].

In the profile directory, NT creates more folders than 95. It creates "Application Data" and others, as well as "Desktop", "Nethood", "Start Menu" and "Programs". The profile itself is stored in a file NTuser.DAT. Nothing appears to be stored in the .PDS directory, and its purpose is currently unknown.

You can use the System Control Panel to copy a local profile onto a samba server (see NT Help on profiles: it is also capable of firing up the correct location in the System Control Panel for you). The NT Help file also mentions that renaming NTuser.DAT to NTuser.MAN turns a profile into a mandatory one.

Note: [lkcl 10aug97 – i notice that NT Workstation tells me that it is downloading a profile from a slow link. whether this is actually the case, or whether there is some configuration issue, as yet unknown, that makes NT Workstation think that the link is a slow one is a matter to be resolved].

[lkcl 20aug97 – after samba digest correspondance, one user found, and another confirmed, that profiles cannot be loaded from a samba server unless "security = user" and "encrypt passwords = yes" (see the file ENCRYPTION.txt) or "security = server" and "password server = ip.address. of.yourNTserver" are used. either of these options will allow the NT workstation to access the samba server using LAN manager encrypted passwords, without the user intervention normally required by NT workstation for clear-text passwords].

[lkcl 25aug97 – more comments received about NT profiles: the case of the profile matters. the file must be called NTuser.DAT or, for a mandatory profile, NTuser.MAN].

7.8.2.6. Windows NT Server

There is nothing to stop you specifying any path that you like for the location of users' profiles. Therefore, you could specify that the profile be stored on a samba server, or any other SMB server, as long as that SMB server supports encrypted passwords.

7.8.2.7. Sharing Profiles between W95 and NT Workstation 4.0

Potentially outdated or incorrect material follows

I think this is all bogus, but have not deleted it. (Richard Sharpe)
--

The default logon path is \\%N\U%. NT Workstation will attempt to create a directory "\\samba-server\username.PDS" if you specify the logon path as "\\samba-server\username" with the NT User Manager. Therefore, you will need to specify (for example) "\\samba-server\username\profile". NT 4.0 will attempt to create "\\samba-server\username\profile.PDS", which is more likely to succeed.

If you then want to share the same Start Menu / Desktop with W95, you will need to specify "logon path = \\samba-server\username\profile" [lkcl 10aug97 this has its drawbacks: i created a shortcut to telnet.exe, which attempts to run from the c:\winnt\system32 directory. this directory is obviously unlikely to exist on a Win95-only host].

If you have this set up correctly, you will find separate user.DAT and NTuser.DAT files in the same profile directory.

Note: [lkcl 25aug97 – there are some issues to resolve with downloading of NT profiles, probably to do with time/date stamps. i have found that NTuser.DAT is never updated on the workstation after the first time that it is copied to the local workstation profile directory. this is in contrast to w95, where it does transfer / update profiles correctly].

7.9. DOMAIN_CONTROL.txt : Windows NT Domain Control & Samba

Possibly Outdated Material

This appendix was originally authored by John H Terpstra of the Samba Team and is included here for posterity.

NOTE : The term "Domain Controller" and those related to it refer to one specific method of authentication that can underly an SMB domain. Domain Controllers prior to Windows NT Server 3.1 were sold by various companies and based on private extensions to the LAN Manager 2.1 protocol. Windows NT introduced Microsoft-specific ways of distributing the user authentication database. See DOMAIN.txt for examples of how Samba can participate in or create SMB domains based on shared authentication database schemes other than the Windows NT SAM.

Windows NT Server can be installed as either a plain file and print server (WORKGROUP workstation or server) or as a server that participates in Domain Control (DOMAIN member, Primary Domain controller or Backup Domain controller). The same is true for OS/2 Warp Server, Digital Pathworks and other similar products, all of which can participate in Domain Control along with Windows NT.

To many people these terms can be confusing, so let's try to clear the air.

Every Windows NT system (workstation or server) has a registry database. The registry contains entries that describe the initialization information for all services (the equivalent of Unix Daemons) that run within the Windows NT environment. The registry also contains entries that tell application software where to find dynamically loadable libraries that they depend upon. In fact, the registry contains entries that describes everything that anything may need to know to interact with the rest of the system.

The registry files can be located on any Windows NT machine by opening a command prompt and typing:

```
C:\WINNT\> dir %SystemRoot%\System32\config
```

The environment variable %SystemRoot% value can be obtained by typing:

```
C:\WINNT>echo %SystemRoot%
```

The active parts of the registry that you may want to be familiar with are the files called: default, system, software, sam and security.

In a domain environment, Microsoft Windows NT domain controllers participate in replication of the SAM and SECURITY files so that all controllers within the domain have an exactly identical copy of each.

The Microsoft Windows NT system is structured within a security model that says that all applications and services must authenticate themselves before they can obtain permission from the security manager to do

what they set out to do.

The Windows NT User database also resides within the registry. This part of the registry contains the user's security identifier, home directory, group memberships, desktop profile, and so on.

Every Windows NT system (workstation as well as server) will have its own registry. Windows NT Servers that participate in Domain Security control have a database that they share in common – thus they do NOT own an independent full registry database of their own, as do Workstations and plain Servers.

The User database is called the SAM (Security Access Manager) database and is used for all user authentication as well as for authentication of inter- process authentication (ie: to ensure that the service action a user has requested is permitted within the limits of that user's privileges).

The Samba team have produced a utility that can dump the Windows NT SAM into smbpasswd format: see ENCRYPTION.txt for information on smbpasswd and /pub/samba/pwdump on your nearest Samba mirror for the utility. This facility is useful but cannot be easily used to implement SAM replication to Samba systems.

Windows for Workgroups, Windows 95, and Windows NT Workstations and Servers can participate in a Domain security system that is controlled by Windows NT servers that have been correctly configured. At most every domain will have ONE Primary Domain Controller (PDC). It is desirable that each domain will have at least one Backup Domain Controller (BDC).

The PDC and BDCs then participate in replication of the SAM database so that each Domain Controlling participant will have an up to date SAM component within its registry.

Chapter 8. Unified Logons between Windows NT and UNIX using Winbind

8.1. Abstract

Integration of UNIX and Microsoft Windows NT through a unified logon has been considered a "holy grail" in heterogeneous computing environments for a long time. We present *winbind*, a component of the Samba suite of programs as a solution to the unified logon problem. Winbind uses a UNIX implementation of Microsoft RPC calls, Pluggable Authentication Modules, and the Name Service Switch to allow Windows NT domain users to appear and operate as UNIX users on a UNIX machine. This paper describes the winbind system, explaining the functionality it provides, how it is configured, and how it works internally.

8.2. Introduction

It is well known that UNIX and Microsoft Windows NT have different models for representing user and group information and use different technologies for implementing them. This fact has made it difficult to integrate the two systems in a satisfactory manner.

One common solution in use today has been to create identically named user accounts on both the UNIX and Windows systems and use the Samba suite of programs to provide file and print services between the two. This solution is far from perfect however, as adding and deleting users on both sets of machines becomes a chore and two sets of passwords are required both of which can lead to synchronization problems between the UNIX and Windows systems and confusion for users.

We divide the unified logon problem for UNIX machines into three smaller problems:

- Obtaining Windows NT user and group information
- Authenticating Windows NT users
- Password changing for Windows NT users

Ideally, a prospective solution to the unified logon problem would satisfy all the above components without duplication of information on the UNIX machines and without creating additional tasks for the system administrator when maintaining users and groups on either system. The winbind system provides a simple and elegant solution to all three components of the unified logon problem.

8.3. What Winbind Provides

Winbind unifies UNIX and Windows NT account management by allowing a UNIX box to become a full member of a NT domain. Once this is done the UNIX box will see NT users and groups as if they were native UNIX users and groups, allowing the NT domain to be used in much the same manner that NIS+ is used within UNIX-only environments.

The end result is that whenever any program on the UNIX machine asks the operating system to lookup a user or group name, the query will be resolved by asking the NT domain controller for the specified domain to do the lookup. Because Winbind hooks into the operating system at a low level (via the NSS name resolution modules in the C library) this redirection to the NT domain controller is completely transparent.

Users on the UNIX machine can then use NT user and group names as they would use "native" UNIX names. They can chown files so that they are owned by NT domain users or even login to the UNIX machine and run a UNIX X-Window session as a domain user.

The only obvious indication that Winbind is being used is that user and group names take the form DOMAIN\user and DOMAIN\group. This is necessary as it allows Winbind to determine that redirection to a domain controller is wanted for a particular lookup and which trusted domain is being referenced.

Additionally, Winbind provides a authentication service that hooks into the Pluggable Authentication Modules (PAM) system to provide authentication via a NT domain to any PAM enabled applications. This capability solves the problem of synchronizing passwords between systems as all passwords are stored in a single location (on the domain controller).

8.3.1. Target Uses

Winbind is targeted at organizations that have an existing NT based domain infrastructure into which they wish to put UNIX workstations or servers. Winbind will allow these organizations to deploy UNIX workstations without having to maintain a separate account infrastructure. This greatly simplifies the administrative overhead of deploying UNIX workstations into a NT based organization.

Another interesting way in which we expect Winbind to be used is as a central part of UNIX based appliances. Appliances that provide file and print services to Microsoft based networks will be able to use Winbind to provide seamless integration of the appliance into the domain.

8.4. How Winbind Works

The winbind system is designed around a client/server architecture. A long running **winbindd** daemon listens on a UNIX domain socket waiting for requests to arrive. These requests are generated by the NSS and PAM clients and processed sequentially.

The technologies used to implement winbind are described in detail below.

8.4.1. Microsoft Remote Procedure Calls

Over the last two years, efforts have been underway by various Samba Team members to decode various aspects of the Microsoft Remote Procedure Call (MSRPC) system. This system is used for most network related operations between Windows NT machines including remote management, user authentication and print spooling. Although initially this work was done to aid the implementation of Primary Domain Controller (PDC) functionality in Samba, it has also yielded a body of code which can be used for other purposes.

Winbind uses various MSRPC calls to enumerate domain users and groups and to obtain detailed information about individual users or groups. Other MSRPC calls can be used to authenticate NT domain users and to change user passwords. By directly querying a Windows PDC for user and group information, winbind maps the NT account information onto UNIX user and group names.

8.4.2. Name Service Switch

The Name Service Switch, or NSS, is a feature that is present in many UNIX operating systems. It allows system information such as hostnames, mail aliases and user information to be resolved from different sources. For example, a standalone UNIX workstation may resolve system information from a series of flat files stored on the local filesystem. A networked workstation may first attempt to resolve system information from local files, then consult a NIS database for user information or a DNS server for hostname information.

The NSS application programming interface allows winbind to present itself as a source of system information when resolving UNIX usernames and groups. Winbind uses this interface, and information obtained from a Windows NT server using MSRPC calls to provide a new source of account enumeration. Using standard UNIX library calls, one can enumerate the users and groups on a UNIX machine running winbind and see all users and groups in a NT domain plus any trusted domain as though they were local users and groups.

The primary control file for NSS is `/etc/nsswitch.conf`. When a UNIX application makes a request to do a lookup the C library looks in `/etc/nsswitch.conf` for a line which matches the service type being requested, for example the "passwd" service type is used when user or group names are looked up. This config line specifies which implementations of that service should be tried and in what order. If the passwd config line is:

passwd: files example

then the C library will first load a module called `/lib/libnss_files.so` followed by the module `/lib/libnss_example.so`. The C library will dynamically load each of these modules in turn and call resolver functions within the modules to try to resolve the request. Once the request is resolved the C library returns the result to the application.

This NSS interface provides a very easy way for Winbind to hook into the operating system. All that needs to be done is to put `libnss_winbind.so` in `/lib/` then add "winbind" into `/etc/nsswitch.conf` at the appropriate place. The C library will then call Winbind to resolve user and group names.

8.4.3. Pluggable Authentication Modules

Pluggable Authentication Modules, also known as PAM, is a system for abstracting authentication and authorization technologies. With a PAM module it is possible to specify different authentication methods for different system applications without having to recompile these applications. PAM is also useful for implementing a particular policy for authorization. For example, a system administrator may only allow console logins from users stored in the local password file but only allow users resolved from a NIS database to log in over the network.

Winbind uses the authentication management and password management PAM interface to integrate Windows NT users into a UNIX system. This allows Windows NT users to log in to a UNIX machine and be authenticated against a suitable Primary Domain Controller. These users can also change their passwords and have this change take effect directly on the Primary Domain Controller.

PAM is configured by providing control files in the directory `/etc/pam.d/` for each of the services that require authentication. When an authentication request is made by an application the PAM code in the C library looks up this control file to determine what modules to load to do the authentication check and in what

order. This interface makes adding a new authentication service for Winbind very easy, all that needs to be done is that the `pam_winbind.so` module is copied to `/lib/security/` and the `pam` control files for relevant services are updated to allow authentication via winbind. See the PAM documentation for more details.

8.4.4. User and Group ID Allocation

When a user or group is created under Windows NT is it allocated a numerical relative identifier (RID). This is slightly different to UNIX which has a range of numbers which are used to identify users, and the same range in which to identify groups. It is winbind's job to convert RIDs to UNIX id numbers and vice versa. When winbind is configured it is given part of the UNIX user id space and a part of the UNIX group id space in which to store Windows NT users and groups. If a Windows NT user is resolved for the first time, it is allocated the next UNIX id from the range. The same process applies for Windows NT groups. Over time, winbind will have mapped all Windows NT users and groups to UNIX user ids and group ids.

The results of this mapping are stored persistently in a ID mapping database held in a tdb database). This ensures that RIDs are mapped to UNIX IDs in a consistent way.

8.4.5. Result Caching

An active system can generate a lot of user and group name lookups. To reduce the network cost of these lookups winbind uses a caching scheme based on the SAM sequence number supplied by NT domain controllers. User or group information returned by a PDC is cached by winbind along with a sequence number also returned by the PDC. This sequence number is incremented by Windows NT whenever any user or group information is modified. If a cached entry has expired, the sequence number is requested from the PDC and compared against the sequence number of the cached entry. If the sequence numbers do not match, then the cached information is discarded and up to date information is requested directly from the PDC.

8.5. Installation and Configuration

The easiest way to install winbind is by using the packages provided in the `pub/samba/appliance/` directory on your nearest Samba mirror. These packages provide snapshots of the Samba source code and binaries already setup to provide the full functionality of winbind. This setup is a little more complex than a normal Samba build as winbind needs a small amount of functionality from a development code branch called `SAMBA_TNG`.

Once you have installed the packages you should read the **winbindd(8)** man page which will provide you with configuration information and give you sample configuration files. You may also wish to update the main Samba daemons (`smbd` and `nmbd`) with a more recent development release, such as the recently announced Samba 2.2 alpha release.

8.6. Limitations

Winbind has a number of limitations in its current released version which we hope to overcome in future releases:

- Winbind is currently only available for the Linux operating system, although ports to other operating systems are certainly possible. For such ports to be feasible, we require the C library of the target operating system to support the Name Service Switch and Pluggable Authentication Modules systems. This is becoming more common as NSS and PAM gain support among UNIX vendors.
 - The mappings of Windows NT RIDs to UNIX ids is not made algorithmically and depends on the order in which unmapped users or groups are seen by winbind. It may be difficult to recover the mappings of rid to UNIX id mapping if the file containing this information is corrupted or destroyed.
 - Currently the winbind PAM module does not take into account possible workstation and logon time restrictions that may be set for Windows NT users.
 - Building winbind from source is currently quite tedious as it requires combining source code from two Samba branches. Work is underway to solve this by providing all the necessary functionality in the main Samba code branch.
-

8.7. Conclusion

The winbind system, through the use of the Name Service Switch, Pluggable Authentication Modules, and appropriate Microsoft RPC calls have allowed us to provide seamless integration of Microsoft Windows NT domain users on a UNIX system. The result is a great reduction in the administrative cost of running a mixed UNIX and NT network.

Chapter 9. UNIX Permission Bits and Windows NT Access Control Lists

9.1. Viewing and changing UNIX permissions using the NT security dialogs

New in the Samba 2.0.4 release is the ability for Windows NT clients to use their native security settings dialog box to view and modify the underlying UNIX permissions.

Note that this ability is careful not to compromise the security of the UNIX host Samba is running on, and still obeys all the file permission rules that a Samba administrator can set.

In Samba 2.0.4 and above the default value of the parameter `nt_acl_support` has been changed from `false` to `true`, so manipulation of permissions is turned on by default.

9.2. How to view file security on a Samba share

From an NT 4.0 client, single-click with the right mouse button on any file or directory in a Samba mounted drive letter or UNC path. When the menu pops-up, click on the *Properties* entry at the bottom of the menu. This brings up the normal file properties dialog box, but with Samba 2.0.4 this will have a new tab along the top marked *Security*. Click on this tab and you will see three buttons, *Permissions*, *Auditing*, and *Ownership*. The *Auditing* button will cause either an error message A requested privilege is not held by the client to appear if the user is not the NT Administrator, or a dialog which is intended to allow an Administrator to add auditing requirements to a file if the user is logged on as the NT Administrator. This dialog is non-functional with a Samba share at this time, as the only useful button, the **Add** button will not currently allow a list of users to be seen.

9.3. Viewing file ownership

Clicking on the "**Ownership**" button brings up a dialog box telling you who owns the given file. The owner name will be of the form :

"SERVER\user (Long name)"

Where *SERVER* is the NetBIOS name of the Samba server, *user* is the user name of the UNIX user who owns the file, and (*Long name*) is the descriptive string identifying the user (normally found in the GECOS field of the UNIX password database). Click on the **Close** button to remove this dialog.

If the parameter `nt_acl_support` is set to `false` then the file owner will be shown as the NT user "**Everyone**".

The **Take Ownership** button will not allow you to change the ownership of this file to yourself (clicking on it will display a dialog box complaining that the user you are currently logged onto the NT client cannot be found). The reason for this is that changing the ownership of a file is a privileged operation in UNIX, available only to the *root* user. As clicking on this button causes NT to attempt to change the ownership of a file to the current user logged into the NT client this will not work with Samba at this time.

There is an NT `chown` command that will work with Samba and allow a user with Administrator privilege connected to a Samba 2.0.4 server as root to change the ownership of files on both a local NTFS filesystem or remote mounted NTFS or Samba drive. This is available as part of the *SecLib* NT security library written by Jeremy Allison of the Samba Team, available from the main Samba ftp site.

9.4. Viewing file or directory permissions

The third button is the "**Permissions**" button. Clicking on this brings up a dialog box that shows both the permissions and the UNIX owner of the file or directory. The owner is displayed in the form :

"SERVER\user (Long name)"

Where *SERVER* is the NetBIOS name of the Samba server, *user* is the user name of the UNIX user who owns the file, and (*Long name*) is the descriptive string identifying the user (normally found in the GECOS field of the UNIX password database).

If the parameter `nt acl support` is set to `false` then the file owner will be shown as the NT user "**Everyone**" and the permissions will be shown as NT "Full Control".

The permissions field is displayed differently for files and directories, so I'll describe the way file permissions are displayed first.

9.4.1. File Permissions

The standard UNIX user/group/world triple and the corresponding "read", "write", "execute" permissions triples are mapped by Samba into a three element NT ACL with the 'r', 'w', and 'x' bits mapped into the corresponding NT permissions. The UNIX world permissions are mapped into the global NT group **Everyone**, followed by the list of permissions allowed for UNIX world. The UNIX owner and group permissions are displayed as an NT **user** icon and an NT **local group** icon respectively followed by the list of permissions allowed for the UNIX user and group.

As many UNIX permission sets don't map into common NT names such as "**read**", "**change**" or "**full control**" then usually the permissions will be prefixed by the words "**Special Access**" in the NT display list.

But what happens if the file has no permissions allowed for a particular UNIX user group or world component ? In order to allow "no permissions" to be seen and modified then Samba overloads the NT "**Take Ownership**" ACL attribute (which has no meaning in UNIX) and reports a component with no permissions as having the NT "**O**" bit set. This was chosen of course to make it look like a zero, meaning zero permissions. More details on the decision behind this will be given below.

9.4.2. Directory Permissions

Directories on an NT NTFS file system have two different sets of permissions. The first set of permissions is the ACL set on the directory itself, this is usually displayed in the first set of parentheses in the normal "**RW**" NT style. This first set of permissions is created by Samba in exactly the same way as normal file permissions are, described above, and is displayed in the same way.

The second set of directory permissions has no real meaning in the UNIX permissions world and represents the "**inherited**" permissions that any file created within this directory would inherit.

Samba synthesises these inherited permissions for NT by returning as an NT ACL the UNIX permission mode that a new file created by Samba on this share would receive.

9.5. Modifying file or directory permissions

Modifying file and directory permissions is as simple as changing the displayed permissions in the dialog box, and clicking the **OK** button. However, there are limitations that a user needs to be aware of, and also interactions with the standard Samba permission masks and mapping of DOS attributes that need to also be taken into account.

If the parameter `nt acl support` is set to `false` then any attempt to set security permissions will fail with an "**Access Denied**" message.

The first thing to note is that the "**Add**" button will not return a list of users in Samba 2.0.4 (it will give an error message of "**The remote procedure call failed and did not execute**"). This means that you can only manipulate the current user/group/world permissions listed in the dialog box. This actually works quite well as these are the only permissions that UNIX actually has.

If a permission triple (either user, group, or world) is removed from the list of permissions in the NT dialog box, then when the "**OK**" button is pressed it will be applied as "no permissions" on the UNIX side. If you then view the permissions again the "no permissions" entry will appear as the NT "**O**" flag, as described above. This allows you to add permissions back to a file or directory once you have removed them from a triple component.

As UNIX supports only the "r", "w" and "x" bits of an NT ACL then if other NT security attributes such as "Delete access" are selected then they will be ignored when applied on the Samba server.

When setting permissions on a directory the second set of permissions (in the second set of parentheses) is by default applied to all files within that directory. If this is not what you want you must uncheck the "**Replace permissions on existing files**" checkbox in the NT dialog before clicking "**OK**".

If you wish to remove all permissions from a user/group/world component then you may either highlight the component and click the "**Remove**" button, or set the component to only have the special "**Take Ownership**" permission (displayed as "**O**") highlighted.

9.6. Interaction with the standard Samba create mask parameters

Note that with Samba 2.0.5 there are four new parameters to control this interaction. These are :

security mask

force security mode

directory security mask

force directory security mode

Once a user clicks "OK" to apply the permissions Samba maps the given permissions into a user/group/world r/w/x triple set, and then will check the changed permissions for a file against the bits set in the [security mask](#) parameter. Any bits that were changed that are not set to '1' in this parameter are left alone in the file permissions.

Essentially, zero bits in the *security mask* mask may be treated as a set of bits the user is *not* allowed to change, and one bits are those the user is allowed to change.

If not set explicitly this parameter is set to the same value as the [create mask](#) parameter to provide compatibility with Samba 2.0.4 where this permission change facility was introduced. To allow a user to modify all the user/group/world permissions on a file, set this parameter to 0777.

Next Samba checks the changed permissions for a file against the bits set in the [force security mode](#) parameter. Any bits that were changed that correspond to bits set to '1' in this parameter are forced to be set.

Essentially, bits set in the *force security mode* parameter may be treated as a set of bits that, when modifying security on a file, the user has always set to be 'on'.

If not set explicitly this parameter is set to the same value as the [force create mode](#) parameter to provide compatibility with Samba 2.0.4 where the permission change facility was introduced. To allow a user to modify all the user/group/world permissions on a file, with no restrictions set this parameter to 000.

The *security mask* and *force security mode* parameters are applied to the change request in that order.

For a directory Samba will perform the same operations as described above for a file except using the parameter *directory security mask* instead of *security mask*, and *force directory security mode* parameter instead of *force security mode*.

The *directory security mask* parameter by default is set to the same value as the *directory mask* parameter and the *force directory security mode* parameter by default is set to the same value as the *force directory mode* parameter to provide compatibility with Samba 2.0.4 where the permission change facility was introduced.

In this way Samba enforces the permission restrictions that an administrator can set on a Samba share, whilst still allowing users to modify the permission bits within that restriction.

If you want to set up a share that allows users full control in modifying the permission bits on their files and directories and doesn't force any particular bits to be set 'on', then set the following parameters in the [smb.conf\(5\)](#) file in that share specific section :

```
security mask = 0777
```

```
force security mode = 0
```

```
directory security mask = 0777
```

```
force directory security mode = 0
```

As described, in Samba 2.0.4 the parameters :

create mask

force create mode

directory mask

force directory mode

were used instead of the parameters discussed here.

9.7. Interaction with the standard Samba file attribute mapping

Samba maps some of the DOS attribute bits (such as "read only") into the UNIX permissions of a file. This means there can be a conflict between the permission bits set via the security dialog and the permission bits set by the file attribute mapping.

One way this can show up is if a file has no UNIX read access for the owner it will show up as "read only" in the standard file attributes tabbed dialog. Unfortunately this dialog is the same one that contains the security info in another tab.

What this can mean is that if the owner changes the permissions to allow themselves read access using the security dialog, clicks **"OK"** to get back to the standard attributes tab dialog, and then clicks **"OK"** on that dialog, then NT will set the file permissions back to read-only (as that is what the attributes still say in the dialog). This means that after setting permissions and clicking **"OK"** to get back to the attributes dialog you should always hit **"Cancel"** rather than **"OK"** to ensure that your changes are not overridden.

Chapter 10. OS2 Client HOWTO

10.1. FAQs

10.1.1. How can I configure OS/2 Warp Connect or OS/2 Warp 4 as a client for Samba?

A more complete answer to this question can be found on <http://carol.wins.uva.nl/~leeuw/samba/warp.html>.

Basically, you need three components:

- The File and Print Client ('IBM Peer')
- TCP/IP ('Internet support')
- The "NetBIOS over TCP/IP" driver ('TCPBEUI')

Installing the first two together with the base operating system on a blank system is explained in the Warp manual. If Warp has already been installed, but you now want to install the networking support, use the "Selective Install for Networking" object in the "System Setup" folder.

Adding the "NetBIOS over TCP/IP" driver is not described in the manual and just barely in the online documentation. Start MPTS.EXE, click on OK, click on "Configure LAPS" and click on "IBM OS/2 NETBIOS OVER TCP/IP" in 'Protocols'. This line is then moved to 'Current Configuration'. Select that line, click on "Change number" and increase it from 0 to 1. Save this configuration.

If the Samba server(s) is not on your local subnet, you can optionally add IP names and addresses of these servers to the "Names List", or specify a WINS server ('NetBIOS Nameserver' in IBM and RFC terminology). For Warp Connect you may need to download an update for 'IBM Peer' to bring it on the same level as Warp 4. See the webpage mentioned above.

10.1.2. How can I configure OS/2 Warp 3 (not Connect), OS/2 1.2, 1.3 or 2.x for Samba?

You can use the free Microsoft LAN Manager 2.2c Client for OS/2 from <ftp://ftp.microsoft.com/BusSys/Clients/LANMAN.OS2/>. See <http://carol.wins.uva.nl/~leeuw/lanman.html> for more information on how to install and use this client. In a nutshell, edit the file \OS2VER in the root directory of the OS/2 boot partition and add the lines:

```
20=setup.exe
20=netwksta.sys
20=netvdd.sys
```

before you install the client. Also, don't use the included NE2000 driver because it is buggy. Try the NE2000 or NS2000 driver from <ftp://ftp.cdrom.com/pub/os2/network/ndis/> instead.

10.1.3. Are there any other issues when OS/2 (any version) is used as a client?

When you do a NET VIEW or use the "File and Print Client Resource Browser", no Samba servers show up. This can be fixed by a patch from <http://carol.wins.uva.nl/~leeuw/samba/fix.html>. The patch will be included in a later version of Samba. It also fixes a couple of other problems, such as preserving long filenames when objects are dragged from the Workplace Shell to the Samba server.

10.1.4. How do I get printer driver download working for OS/2 clients?

First, create a share called [PRINTDRV] that is world-readable. Copy your OS/2 driver files there. Note that the .EA_ files must still be separate, so you will need to use the original install files, and not copy an installed driver from an OS/2 system.

Install the NT driver first for that printer. Then, add to your smb.conf a parameter, "os2 driver map = *filename*". Then, in the file specified by *filename*, map the name of the NT driver name to the OS/2 driver name as follows:

```
<nt driver name> = <os2 driver name>.<device name>, e.g.: HP LaserJet 5L = LASERJET.HP LaserJet 5L
```

You can have multiple drivers mapped in this file.

If you only specify the OS/2 driver name, and not the device name, the first attempt to download the driver will actually download the files, but the OS/2 client will tell you the driver is not available. On the second attempt, it will work. This is fixed simply by adding the device name to the mapping, after which it will work on the first attempt.

Chapter 11. HOWTO Access Samba source code via CVS

11.1. Introduction

Samba is developed in an open environment. Developers use CVS (Concurrent Versioning System) to "checkin" (also known as "commit") new source code. Samba's various CVS branches can be accessed via anonymous CVS using the instructions detailed in this chapter.

This document is a modified version of the instructions found at <http://samba.org/samba/cvs.html>

11.2. CVS Access to samba.org

The machine samba.org runs a publicly accessible CVS repository for access to the source code of several packages, including samba, rsync and jitterbug. There are two main ways of accessing the CVS server on this host.

11.2.1. Access via CVSweb

You can access the source code via your favourite WWW browser. This allows you to access the contents of individual files in the repository and also to look at the revision history and commit logs of individual files. You can also ask for a diff listing between any two versions on the repository.

Use the URL : <http://samba.org/cgi-bin/cvsweb>

11.2.2. Access via cvs

You can also access the source code via a normal cvs client. This gives you much more control over you can do with the repository and allows you to checkout whole source trees and keep them uptodate via normal cvs commands. This is the preferred method of access if you are a developer and not just a casual browser.

To download the latest cvs source code, point your browser at the URL : <http://www.cyclic.com/>. and click on the 'How to get cvs' link. CVS is free software under the GNU GPL (as is Samba). Note that there are several graphical CVS clients which provide a graphical interface to the sometimes mundane CVS commands. Links to these clients are also available from <http://www.cyclic.com>.

To gain access via anonymous cvs use the following steps. For this example it is assumed that you want a copy of the samba source code. For the other source code repositories on this system just substitute the correct package name

1. Install a recent copy of cvs. All you really need is a copy of the cvs client binary.
2. Run the command

cvs -d :pserver:cvs@samba.org:/cvsroot login

When it asks you for a password type **cv**s.

3. Run the command

```
cvs -d :pserver:cvs@samba.org:/cvsroot co samba
```

This will create a directory called samba containing the latest samba source code (i.e. the HEAD tagged cvs branch). This currently corresponds to the 3.0 development tree.

CVS branches other HEAD can be obtained by using the `-r` and defining a tag name. A list of branch tag names can be found on the "Development" page of the samba web site. A common request is to obtain the latest 2.2 release code. This could be done by using the following command.

```
cvs -d :pserver:cvs@samba.org:/cvsroot co -r SAMBA_2_2 samba
```

4. Whenever you want to merge in the latest code changes use the following command from within the samba directory:

```
cvs update -d -P
```