Sharing NFS and Remote File Systems via Solaris™ PC NetLink Software

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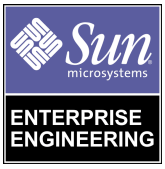

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Sharing NFS and Remote File Systems via Solaris™ PC NetLink Software

Most files accessed by PC users through the Solaris™ PC NetLink software will exist on storage that resides on the same server where the Solaris PC NetLink software is installed and running. When PCs access these files, they use the PCs native protocol. This protocol, supported by the Solaris PC NetLink software, is the System Message Block (SMB), also known as Common Internet File System (CIFS) protocol.

System administrators may wish to take advantage of the fact that the Solaris operating environment can access files on other servers via network protocols such as Network File System (NFS) typically used by UNIX® servers. These files, in turn, can be shared via the Solaris PC NetLink software running on the server for a community of PC Users (see Figure 1). When a PC user requests a file, the Solaris PC Netlink software will then use the Solaris Operating Environment Application Program Interface (API) calls to access the remotely mounted file system on another server.

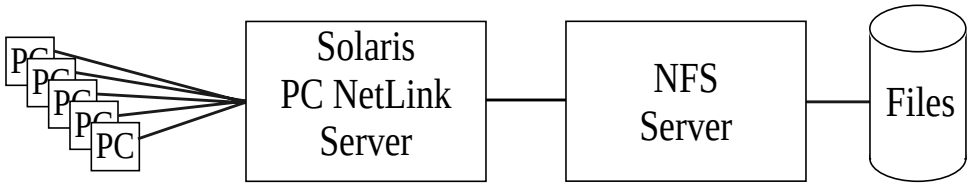

FIGURE 1 Solaris PC NetLink Server Accessing Remote NFS Files

For some user environments this is an attractive option because it eliminates the need to install the Solaris PC NetLink software on the server where the files reside. It also illuminates the need to install NFS client software on every PC. While this does solve some system administration issues, it would always be best to share files directly from the server where they are actually stored for reasons we will explain below.

Supporting files indirectly via a Solaris™ Operating Environment (Solaris OE) server running the Solaris PC NetLink software may be necessary for two basic reasons:

1. **User PCs do not support NFS or other server native protocols that the server requires —** In most PC environments, users and system administrators are reluctant to install additional software on PCs because of the additional system administrations and the cost of the extra software required on each PC.

2. **The Solaris PC NetLink software cannot be installed directly on the server —** There may be technical or policy reasons why Solaris PC NetLink software cannot be installed.

In these two cases, the option of using Solaris PC NetLink software to access the files via protocols supported by Solaris OE is an attractive one. The Solaris PC NetLink software is capable of sharing files via the SMB protocol with any file system used by Solaris OE. This feature of the product is capable of solving many datacenter file access problems and many customers have already exploited this feature. While this feature of the product "just works" for most customer situations, there are several caveats system administrators should be aware of when supporting this kind of file access via Solaris PC NetLink software.

This article offers best practice solutions. These situations will avoid potential conflicts when your enterprise decides to allow access to files using Solaris PC NetLink software.

Background

When Solaris PC NetLink software "shares" Solaris OE-accessible file systems it uses standard Solaris application calls to access these file systems. If a specific file system is local, as in most installations, the UNIX File System (UFS) is accessed by Solaris OE directly. When files on a remote file system are accessed, typically, the NFS protocol is used. It is with these remote file systems that several issues can occur. These issues need to be taken into account while architecting the file access solutions on your network.

Sharing a remote file system is usually very simple. The system administrator merely needs to reference the remote file system via the path that would normally be used to access the file system via Solaris OE. Both a hard mounted file system, established via the Solaris OE mount command, or an automounted file system (e.g., `/home/jsmith`) can be shared by the system administrator using the Solaris PC NetLink System Administration GUI, the Solaris PC NetLink `net share`, or `net use` commands (e.g., `net share jsmith=c:/home/jsmith`).

Once this has been established, PC users accessing the file via the Solaris PC NetLink share are allowed access to the file from their PC just as they would be allowed access to any other file. Of course, file protection attributes must allow the file to be accessed in both the Solaris OE and Solaris PC NetLink environments. If Access Control Lists (ACL) are applied to the file, the Solaris PC NetLink software will store the ACL information locally on the user's Solaris PC NetLink server. This local ACL information leads to your first potential problem.

Issue 1 — ACL Databases

Multiple Solaris PC NetLink servers accessing the same file can have two different sets of ACLs in two different ACL databases.

If one user accesses a file on one remote NFS server via a Solaris PC NetLink server, and another user accesses the same file via a second Solaris PC NetLink server, there will be two sets of ACLs created for the same file on two different Solaris PC NetLink servers. This issue can cause security problems because the file may have restrictive ACLs on one server and less restrictive ACLs on the other server. The owner of the file must access both Solaris PC NetLink servers to update the ACLs.

To complicate matters, if the two Solaris PC NetLink servers are not part of the same Windows NT domain, the user accounts used to create and access the files will be different as well.

Note – Allow users to access Solaris OE-based files via one Solaris PC NetLink Server only.

If users do not use ACLs often, you may never notice a problem occurring here. As mentioned above, the best solution would be to install the Solaris PC NetLink software on all Solaris OE servers where files are accessed by PC users, and then share those files directly via the Solaris PC NetLink environment. Sharing the files directly eliminates the possibility of the existence of two different sets of ACLs.

If it is *not* possible to share the files directly on the server where they reside, then the best practice is to take steps so that only one Solaris PC NetLink server is used to access the file via NFS. Use Solaris OE `share -o` options here to limit the systems that can access the NFS shared files.

Issue 2 — Performance

Accessing non-local file systems via a Solaris PC NetLink server will require twice the network bandwidth and increase latency.

When a user accesses a remote file from a Solaris PC NetLink server they must use the network twice. Once to get to the Solaris PC NetLink server, and again as the Solaris PC NetLink server contacts the remote server to access the file. If only casual access to such files is allowed, users and system administrators should not perceive much performance degradation. If however, the Solaris PC NetLink server is heavily used this could, theoretically, split in half the total throughput of the server.

Again, it would be best to move the files to the Solaris PC NetLink server, or if possible, install the Solaris PC NetLink software on the server where the files are installed.

Issues 3 — Group and User IDs

Group IDs used by the Solaris PC NetLink software to define DOS attributes and user IDs for default user accounts may collide with the remote server's currently used group and user IDs.

The Solaris PC NetLink software maintains DOS attributes via Solaris OE group IDs. These IDs are chosen from unused group IDs determined during the installation of the Solaris PC NetLink software and may be different from one server to another. These group IDs are seen in the example `/etc/group` file shown below.

```
. . .
nobody::60001:
noaccess::60002:
nogroup::65534:
DOS----::13:lanman
DOS-a--::16:lanman
DOS--s-::17:lanman
DOS---h::18:lanman
DOS-as-::19:lanman
DOS-a-h::21:lanman
lmxsrvgid::24:
```

If you write a file from a Solaris PC NetLink server to a remote server and then access the same file from another Solaris PC NetLink server, the group IDs it uses are likely to be different thus making the consistent handling of DOS attributes impossible.

In addition, there are several Solaris OE user accounts that are created using unused User IDs (UID). The Solaris OE account `lmxworld` is used to create, read, and write files whenever there hasn't been an explicit mapping between Solaris OE and Windows NT domain

accounts. This association is established by way of the Solaris PC NetLink `mapuname` command. Example entries of a `/etc/passwd` file from a Solaris PC NetLink server is shown below.

```
...
lanman:x:100:13:SunLink Server account:/opt/lanman:/bin/false
lmxadmin:x:99983:13:SunLink Server Administrator:/var/opt/lanman/
lmxadmin:/bin/sh
lmxguest:x:99984:13:SunLink Server GUEST Login:/home/lmxguest:/
bin/false
lmworld:x:99985:13:SunLink Server World Login:/home/lmworld:/bin/
false
...
```

If the remote file system will only be used for read access, then it is likely that nothing needs to be done to avoid group and user ID conflicts because no files will be written. If the remote file system is to be used for read/write access, steps should be taken to make sure the group and user IDs used by the Solaris PC NetLink servers are identical to that of the NFS Solaris OE server. If your site uses a Solaris OE name service such as NIS or NIS+, you should put the group and user ID information into the name service maps. If a naming service is not used, then it would be best to make sure both servers have consistent group and user ID entries.

If all users accessing the NFS server, also have Solaris OE-based accounts, the Solaris PC NetLink `mapuname` command should be used religiously to establish links between NT domain accounts and Solaris OE-based accounts. This would force the Solaris PC NetLink software to write files using the appropriate Solaris OE account UID and files written on the remote NFS server would have clearly defined ownership.

Issue 4 — Administration Functions and Root Access

Because root access over the network between two servers is disallowed by default, there are administrative functions that will *not* work when you attempt to perform administrative functions on files via the Solaris PC NetLink software over a NFS shared file system. As an example, suppose a Solaris PC NetLink administrator tries to change ownership of files on a remote NFS server. By default, this will not work because the Solaris PC NetLink software will attempt to change the file running as root that will not map to root access on the remote server by default.

To allow the Solaris PC NetLink servers to access the remote NFS files exactly like it would local UFS files, the Solaris OE share command used to export the NFS file system must have the `/o root=<access list> option`. See the Solaris OE share man page for details.

If the NFS server administrator will disallow this for security or other reasons, then changing ownership of files may by problematic. It may require logging into the remote server as root and changing the ownership of the files manually. This situation is uncommon, but support staff should be aware of the issue.

Issue 5 — Accessing File Systems Using the Solaris Operating Environment Automounter

From Solaris OE, a user can access files via automount paths (e.g., `/net/<system name>` and `/home/<user name>`). These paths will force Solaris OE to attempt to mount file systems and home directories, automatically. Automounted file systems exist in the mount table only after they have first been created by the use of the automount path to access a file or directory for the first time. It is possible to share `/net` but nothing will be there that will allow you to access the real system of the home directory you want. Any shares, defined at these levels, may work temporarily, but automounted files systems are unmounted by Solaris OE if they are not continuously used.

To get around this problem, use Solaris OE symbolic links to define Solaris OE-based paths that will force the use of the automounter and access the desired file system. For example, if it is desirable to access a user's home directory via Solaris paths `/home/user1` and `/home/user2`, symbolic links can be placed in the directory that exists in a file system shared by the Solaris PC NetLink software. The command `mkdir /pcnlhome; cd /pcnlhome ; ln -s /net/user1` will create an entry in the directory, allowing `user1` to access the home directory. When the `/pcnlhome/user1` path is used by the Solaris PC NetLink software, the Solaris OE will automatically automount the desired file system.

Issue 6 — File Systems Supported by the Solaris PC NetLink Software

If you are attempting to access a file system other than type `cdfs`, `nfs`, `s5`, `sfs`, `ufs`, or `vxfs` you will need to inform the Solaris PC Netlink software on how to handle the new file system. To do this, change the `fsmap` value in the `/etc/opt/lanman/lanman.ini` file. You can find detailed documentation for this process on page 185 of the *Solaris PC NetLink 1.2 Administration Guide*. This guide is shipped with the Solaris PC NetLink product and is also available separately via `docs.sun.com` (search for *Solaris PC NetLink 1.2 Administration Guide*).

File systems other than those listed above will be treated as an `s5` file system. If you want all of your unknown file systems to be treated as a type other than `s5`, set the `fsnosupport` parameter in the `[fsi]` section of the `lanman.ini` file to the name of a recognized file system. Then, restart the server.

Refer to the "**How to Change a lanman.ini File Parameter**" section of the *Solaris PC NetLink 1.2 Administration Guide* before attempting any changes to the `lanman.ini` file.

To determine if you have one of the "known" files systems, use the `df -n` pathname command to check the type of the file system you are planning to share with Solaris PC NetLink.

Conclusion

If Solaris OE is being used to share files across the network it is best to install the Solaris PC NetLink software directly on the server where the files reside. Direct installation avoids many potential problems and improves performance.

If, however, the server sharing the files is an older server running an older version of the Solaris Operating Environment which the Solaris PC NetLink software does not support, or the server is another UNIX or appliance server that only supports NFS, then sharing the files from the Solaris PC NetLink software over a remote access is a viable option once the issues are understood. If you do use the Solaris PC Netlink software to share remote files, attempt to enforce the following guidelines:

1. Allow access to the remote server via only one Solaris PC NetLink server.
2. Make sure the group and user IDs defined during the installation of the Solaris PC NetLink software, are the same on all servers that are accessed by the Solaris PC NetLink server. If NIS or NIS+ is used, then define these entries in the appropriate NIS maps.
3. If all users have Solaris OE accounts as well as NT domain accounts, use the Solaris PC NetLink `mapuname` command to establish the associations between the two different account databases. This enables file ownership on remote NFS servers to be clearly established.
4. If Solaris PC NetLink system administration operations are expected to work, share the files on the remote server with the `/o root` option.
5. Use Solaris OE symbolic links in locally shared file systems to access automounted file systems.

References

For additional, detailed information on Solaris PC NetLink software, refer to the Sun BluePrints book, *Solaris™ PC NetLink Software: Performance, Sizing, and Deployment*, (ISBN# 0-13-026686-8) which is available through `www.sun.com/books`, `amazon.com`, `fatbrain.com`, and Barnes & Noble bookstores.

Solaris PC NetLink documentation is available on `http://docs.sun.com`

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Don is currently a Senior Staff Engineer and PC interoperability specialist within the Enterprise Engineering group, and a member of the Solaris PC NetLink engineering team where he has focused on performance-related issues. Don has been on the development teams of almost every software and hardware PC interoperability product that Sun Microsystems has produced over the last 13 years.

Don DeVitt started his career as an electrical engineer and worked in the Automated Test industry (Teradyne Inc.), and PC operating system market (Digital Research from CP/M fame) before coming to Sun.