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Future extensions to CIFS (CIFS to the desktop)

(or the death of NFS :-)

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Why do we need extensions to CIFS ?

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The purpose of CIFS extensions

- CIFS is the dominant desktop file sharing protocol.
- Most IT departments don't want more than one file sharing protocol to troubleshoot.
  - Most IT departments don't want to add new client code to Windows.
- In order to enter the desktop world, new desktops must live within a CIFS-only world.
  - NFS, even NFSv4, will not gain any traction on the desktop.

The purpose of CIFS extensions

- Linux and MacOS X desktops are the only viable competitors to Microsoft clients.
- Extending CIFS can provide value-add differentiators for CIFS server vendors.
- Creating a “standard” set of extensions can prevent fragmentation in the CIFS vendor marketplace.
  - Vendors can compete on quality and performance, rather than non-interoperable variants

The history of CIFS extensions

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The history of CIFS extensions

- Early attempts to extend CIFS were in the OS/2 and early UNIX authentication documents.
  - Part of the OpenGroup specifications.
  - Mechanism specified for using UNIX password hashes.
- Next Thursby added new TRANS2 calls to cope with MacOS 9 resource forks and desktop database.
  - Reserved space between 0x300 and 0x399 in the TRANS2 space.
  - Only specification available seems to be an old Samba contribution (GPL).

The history of CIFS extensions

- First serious non-Microsoft changes were from the original (non-insane) SCO, then HP with the UNIX extensions document (1997-2000).
  - Created from discussions on a mailing list about what would be required for UNIX to UNIX CIFS.
- A milestone was an agreement from Microsoft to carve out an extension space for CIFS !
  - After the initial CIFS UNIX capability bit was used by Microsoft for “extended security”.

The history of CIFS extensions

- SNIA document included documentation of HP UNIX extensions, but this document is not usable.
  - Conditions preclude use of the SNIA document for any commercial purpose (explicitly stated).
  - Check out the original (Microsoft Word!) document on the Web instead.
  - The Samba server adopted the UNIX extensions in the 2.2.x series, but not seriously maintained until CIFS Linux client was adopted into the 2.6 kernel.

Current CIFS extensions

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What are the current CIFS extensions ?

- The original intent was to create a dialect of CIFS that allows full UNIX to UNIX semantics.
- This meant allowing a diskless UNIX client workstation to remote-boot from a CIFS server.
- Client detects the presence of UNIX extensions in a bit (0x800000) in a NT negprot reply.
  - Client is then free to use a new set of TRANS2 calls, between 0x200-0x2FF.

What are the current CIFS extensions ?

- Most obvious changes were the addition of a UNIX_FILE_BASIC struct containing the UNIX-specific data not found in a CIFS directory entry.
  - TRANS2_SET/GET_FILE_INFO calls use this to set and query UNIX info.
- In addition, TRANS2 info levels to support UNIX symlink and hard links were specified.
  - NT_RENAME call can also create hard links, used for the NT POSIX subsystem.

What are the current CIFS extensions ?

- Some problems with this original spec, no on-the-wire mappings were specified for such things as UNIX permissions.
  - No block size was specified for the “number of blocks” returns in the UNIX_BASIC_INFO.
  - Somewhat HPUX-on-the-wire specific.
- After some review an “extension version” request was added, which returns a capabilities set for future expansion.

Difficulties in interpretation

- Symlinks present a particular problem for CIFS extensions.
- Allowing arbitrary target paths on a “create symlink” may allow Windows clients to break out of a share-specific area of the filesystem.
  - Due to server resolution of symlinks on Windows client lookup.
  - NFS clients don't suffer from this as symlink look-ups are client side only.
  - Vendor specific changes (Microsoft SFU product uses Extended Attributes to store symlinks).

Current issues - POSIX compliance

- Unix Extensions can't support full POSIX compliance due to differences in byte range locking semantics.
  - Do we want to implement POSIX locking ?
  - Compatible subset required.
- Renaming of open files also not supported by CIFS due to deny mode semantics.
- POSIX ACLs were needed. Capability bit already defined.
  - Simple GET/SET calls were sufficient, ignore modify race conditions.

Current issues - case sensitivity

- CIFS already has a “case insensitive” flag bit available in the standard protocol header.
  - Ideal situation would be UNIX clients turn this bit off.
  - Problem is earlier Microsoft clients (pre-Windows NT) don't bother to set this bit.
  - Samba auto-detects client type to determine if this bit should be obeyed.
- Windows file servers inconsistently obey this bit (Windows 2000 does, Windows 2003 needs a registry change).

Current issues – user and group identity.

- UNIX extensions currently can return a uid or gid that only has meaning on the server.
  - Similar issue to NFS, user and group databases are expected to be consistant over clients/servers.
- CIFS has traditionally specified user and group lookup functions.
  - CIFS takes a kitchen sink approach to solving file sharing issues. Such extra functionality could be added into the UNIX version of CIFS.

Current issues - character mapping.

- Several characters valid in UNIX filenames are invalid in CIFS filenames.
- These are :

  : < > | ? \ *

- CIFSFS and Windows (services for UNIX) map these into the “user defined” UNICODE space, by prefixing them with 0xFF.
- Samba server doesn't currently support this (until I get back from this conference).

Current state of the UNIX extensions

- POSIX ACLs GET/SET calls recently (Samba 3.0.x) added.
  - Developed in conbination with Steve French's Linux CIFSFS Client code.
  - Test code to getfacl included in smbclient.
  - No set code in smbclient as I didn't want to write the parse code for POSIX ACL semantics.
- Uses UIDs/GIDs on the wire, don't mix up SIDs with POSIX style calls.

Current state of the UNIX extensions

- Makes CIFS UNIX file sharing closer to SVR3 RFS than NFS.
  - Although NFSv4 is re-inventing many of the same techniques.
- Similar to NFS in that device files are not remoted, some operations are still client-side look up.
  - Symlink handling
  - Device file accesses.
- Single or multiple TCP socket connections, variety of ways to multiplex user connections.

Available Client implementations - Linux.

- Steve French is maintaining the Linux CIFSFS client for the 2.6 kernel.
- Closest match to Samba server code as they are developed together.
  - Sometimes client code comes first, sometimes server.
  - Use identical header file definitions.
- Tested with SPECFS filesystem test tools.
  - Currently passes POSIX filesystem tests with the exception of file locking.
  - Steve is currently working on performance.

Available Client implementations - MacOS X.

- Conrad Minshal at Apple is developing the MacOS X CIFS client.
- Tested mainly against Windows servers (Apple focused mainly on the desktop market).
- MacOS X is chosing Windows style ACLs rather than POSIX.
  - No current plans to add POSIX ACL extensions.
- Source code published in Darwin.
- Apple reluctant to participate in community development.

Available Client implementations - HPUX

- Eric Raeburn is developing the SHARITY NFS to CIFS gateway client on HPUX.
- Proprietary code, although works closely with Samba.
- Active participants in UNIX extensions process.
- Not currently using ACL extensions or EA's.
  - No EA's in NFS
  - No standard POSIX ACL protocol in (HPUX) NFS.
- HPUX only solution.

Where do we go from here ?

Future CIFS extensions

- Add POSIX file locking.
  - Should conflict with CIFS locks but keep locked ranges separate.
  - Allow lock range split/merge to obey POSIX specs.
  - File access should ignore POSIX locks (advisory only).
  - Lock owner call (getlock) is needed.
- UNIX (Linux) style EA's (extended attributes) not supported yet, only case insensitive DOS style EA's.
  - No EA standard in UNIX. Current implementations are Linux, SGI Irix, FreeBSD.

Future CIFS extensions

- Add POSIX open()/mkdir() calls.
  - Return current attributes.
  - Saves round trip to look up after open.
- Add POSIX rename() and unlink() calls, allowing POSIX semantics.
  - rename() should allow rename of open files.
  - unlink() should allow deletion of open files.
  - Should we take share mode into account here ?
- Try not to make this too Linux specific.
- At what point is this not CIFS anymore ?
  - UNIX errno returns ?

Future CIFS extensions

- Create a new UNIX NSS interface named pipe (\\UNIX_NSS ?).
  - This will allow clients to completely forward uid/gid to name translation to a file server, allowing a consistant name space.
  - Allows one machine authentication (probably krb5) to control access to all name services.
  - On the wire specification probably based on a NSS call linearization.
  - Allow multiple uid/gid -> name, name-> uid/gid lookups for efficiency.

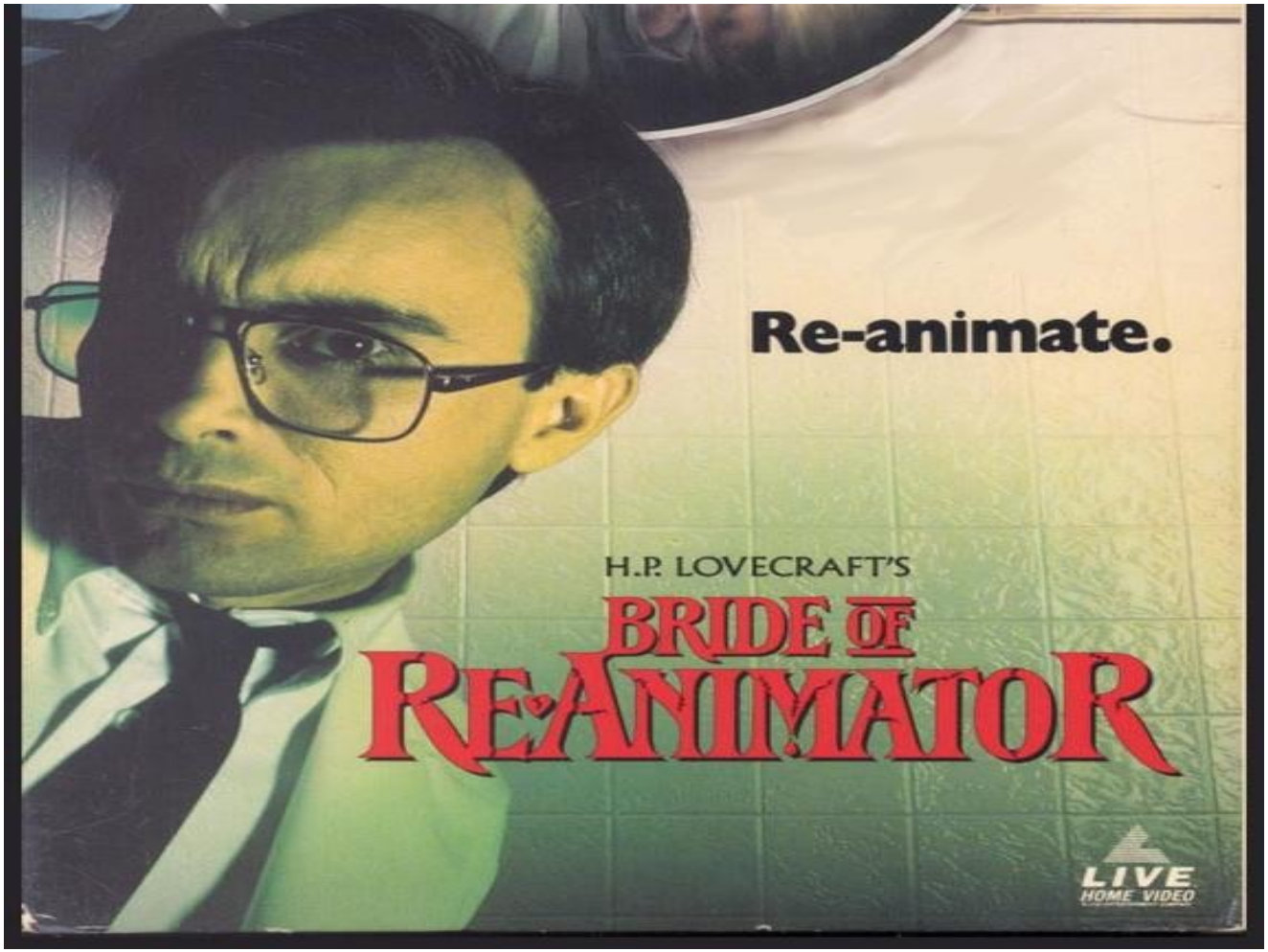
Feature enhancements - encrypted CIFS

- NFSv4 has this, so we need it too ☺.
- Bootstap encryption using the krb5 session key, also used for SMB signing.
  - We need a way to request re-keying within a long lived session (new TRANS2 call ?).
  - Hard to add new error codes, so have a counter giving the number of packets this session key is valid for.
- We need security review of any protocol we invent.

Integrating Windows clients into extended CIFS

- No one wants to add new Windows client code.
  - Definitely a “hack” solution for customers needing encrypted transport, not a mass market solution.
- Investigate using Windows client AFS code to create a CIFS to CIFS proxy, although this is not a high priority for the Samba developers.
- We are attempting to hijack this protocol. This is our only chance....

Far from being the death of CIFS....



Questions and Comments

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