Linux, Samba and ACLs: past, present, and future

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Linux, Samba and ACLs

- POSIX and POSIX ACLs
- Windows/CIFS ACLs
- Samba 3: POSIX ACL ↔ CIFS ACL mapping
- Samba 4 today: CIFS ACLs in user space
- Beyond?

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Traditional POSIX model

Model

- Each FS object has an owner and an owning group
- Permission sets for owner, owning group, and others
- Read, Write, Execute permissions

```
$ ls -l file
-rw-r--r--  1 agruen users 5 4 May  4 00:00 file
```

Can be viewed as a minimum, three-entry POSIX ACL:

```
$ getfacl –omit-header file
user::rw-
group::r--
other::r--
```

POSIX permission checking (1)

Process requests access. Relevant are:

- effective user ID,
- list of group IDs,
- set of requested permissions.

Two phases:

- Find the best-matching ACL entry,
- Check if the chosen entry contains the requested permissions.

```
# owner: agruen
# group: users
user::rw-
group::r--
other::r--
```

POSIX ACLs

- Each ACL entry specifies a type, qualifier, and a set of permissions.
- Permissions are still only Read, Write, and Execute.
- Permissions for arbitrary additional users and groups:

```
$ setfacl -m user:tux:rw,group:mascots:r file
$ getfacl file
# owner: agruen
# group: users
user::rw-
user:tux:rw-
group::r--
group:mascots:r--
mask::rw-
other::r--
```

- Inheritance model: Default ACLs (next slide)

POSIX ACLs: Default ACLs

Default ACLs are similar to *access* ACLs, but they define which permissions new FS objects obtain:

- Without a default ACL, the *umask* determines the file's permissions.
- With a default ACL, the default ACL determines permissions, and the *umask* is ignored.

Static inheritance: changing the default ACL has no effect on existing child objects.

POSIX ACLs: Default ACLs (2)

```
$ setfacl -d -m user:tux:rwx .
$ getfacl --omit-header .
user::rwx
group::r-x
other::r-x
default:user::rwx
default:user:tux:rwx
default:group::r-x
default:mask::rwx
default:other::r-x
$ touch file2
$ getfacl --omit-header file2
user::rw-
user:tux:rwx    #effective:rw-
group::r-x      #effective:r--
mask::rw-
other::r--
```

POSIX permission checking (2)

Process: effective UID and GIDs; requested permissions

Again, two phases:

- Find the best-matching ACL entry (the ACL entry order does not matter)
- Check if the chosen entry contains the requested permissions

```
# owner: agruen
# group: users
user::rw-
user:foo:rw-
group::r--
mask::rw-
other::r--
```

Named user entry may be “shadowed” by owner entry

CIFS ACLs

(CIFS has DACLs for permissions and SACLs for auditing)

- DACLs are ordered lists of entries.
- Each entry specifies whether the entry is *access-allow* or *access-deny*, a SID, a set of permissions, and a set of inheritance flags.
- Permissions include the equivalent of read, write, execute, things like create, delete, change permissions, take ownership, etc.
- Change permissions and take ownership allow delegation.
- Effective and inheritable permissions are not split.
- Semi-dynamic inheritance: changing inheritable permissions of a directory changes child objects' permissions.

CIFS permission checking

Process: list of SIDs (users and groups treated alike); requested permissions

Go through the list of ACL entries:

- Skip entries that don't apply to the requesting process.
- Deny access if an access-deny entry denies a requested permission.
- Grant all requested permissions that matching access-allow entries allow. Grant the access if all requested permissions have been granted.

If any permissions have not been granted when reaching the end of the ACL, deny access.

Samba 3: POSIX ACLs ↔ CIFS ACLs

User mapping:

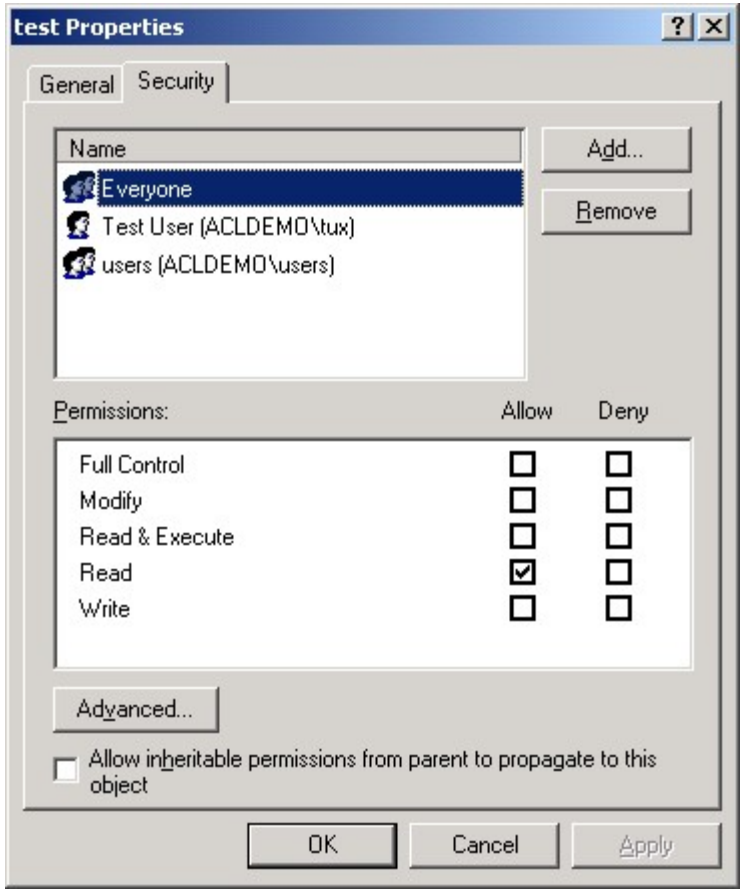
- Owner ↔ current owner
- Owning group ↔ current owning group
- Other ↔ Everyone

Permission mapping:

- r → Read
- w → Write
- x → Execute

sets of perms

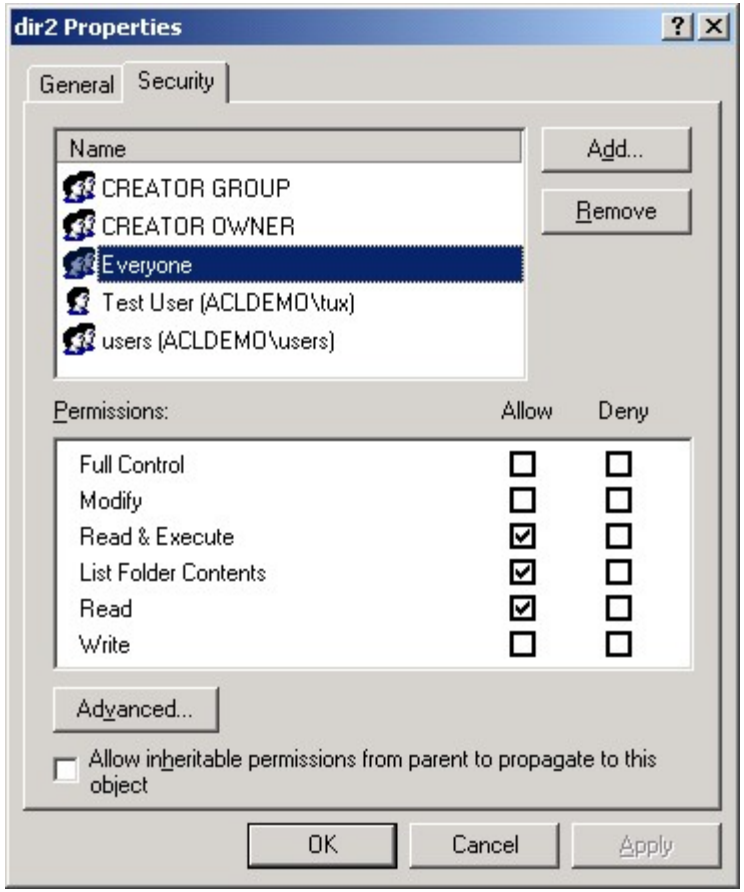
In the reverse direction, any Read/Write/Execute bit adds r/w/x.



Samba 3: POSIX ACLs ↔ CIFS ACLs (2)

Directory / inheritable permissions:

- Owner ↔ CREATOR OWNER
- Owning group ↔ CREATOR GROUP



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Mapping problems

- Lossy conversion: permissions are missing on the POSIX side. The POSIX ACL model is hard/impossible to extend.
- Accumulation vs. selection: Mapping POSIX onto CIFS accurately would require mixed access-allow/access-deny entries; Windows GUI cannot handle this.
- Static vs. dynamic inheritance: CIFS inheritance flags mean something different than what Samba uses them for.
- In CIFS, everything is a SID; even groups can own files.
- Abstract owner vs. user-specific entry -> chown
- Owning group concept not really used under Windows...

Samba 4: CIFS ACLs

Samba 4 implements CIFS ACLs in user-space: no lossy mapping anymore!

- No kernel changes, so portable
- Inconsistent view between Samba and POSIX applications
- When CIFS permissions are defined, POSIX applications should really be governed by the CIFS ACL model, but they will only see traditional POSIX or POSIX ACLs.
- Last writer approach (e.g., NetApp): When a CIFS ACL is set, switch to the CIFS model. When a POSIX ACL is set, switch to the POSIX model.

Other ACL models

NetWare ACLs (called “trustees” there)

- Less complicated, but also more limited than CIFS ACLs.
- Only those files to which a process has access to are visible. Visibility propagates up to the root => ACLs become large. Reading a directory entry requires a permisison check.
- Requres client modifications!

NFSv4

- Model very similar to CIFS, but:
- Inheritance is static, so it's conceptually different

More information: http://www.suse.de/~agruen/

Thank you!

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