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Multi-Protocol File sharing Environments

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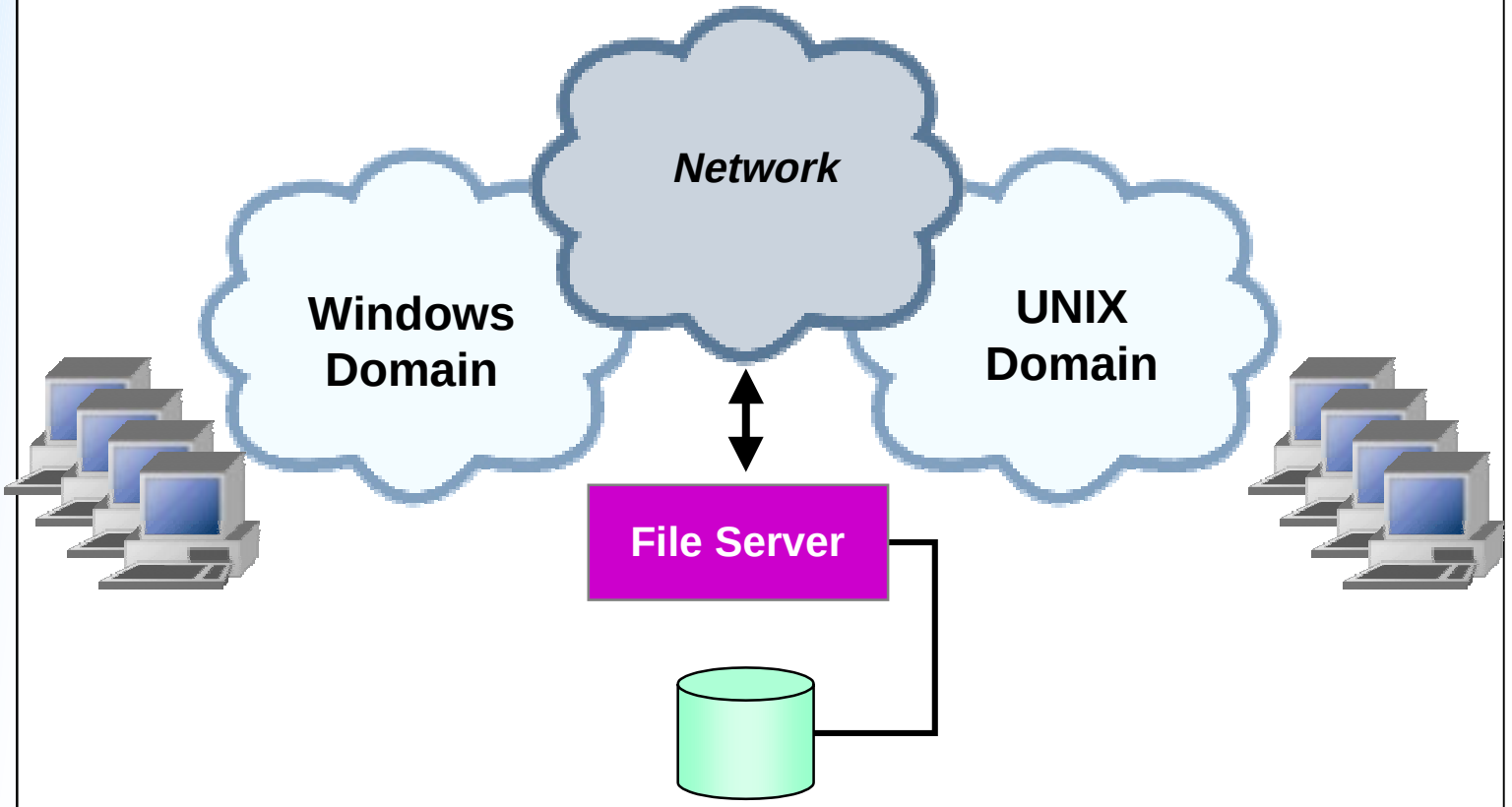
Agenda

- Understanding Multi-Protocol
- Architectural Challenges
  - User Considerations
  - Network Security
  - File and Directory Consistency
  - Filesystem Security
- Summary

Understanding Multi-Protocol

- Basic business goal is simple: share the same filesystem to both UNIX and Windows users concurrently



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Understanding Multi-Protocol - Design Goals

- Efficient use of storage
- Support both NFS and CIFS Windows clients
- Share common set of Infrastructure resources
- Simplicity of Management
- Transparent to end users

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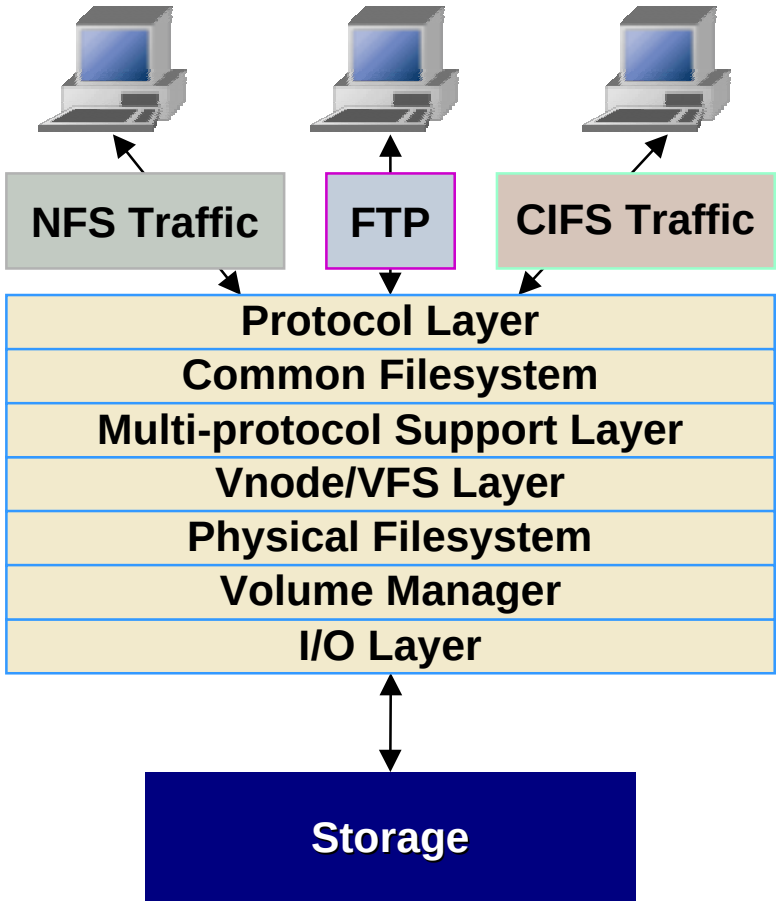
Multi-Protocol: UNIX and Windows Information Sharing



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Multi-Protocol Architectural Challenges

- Integration
- Different Security Semantics
- Different Locking Semantics
- Different User Information Repositories
- Different Network Topology Structures

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Multi Protocol Challenges - Security Layers & Interaction

A way of describing the security layer:

Layer	Security Entity
User	NFS Auth ⟷ CIFS Auth
Network	NFS export — Share ACL
File/Dir	ugo-rwx ⟷ CIFS ACL
Locking	NFS locks ⟷ Deny Modes
I/O	File System Mount

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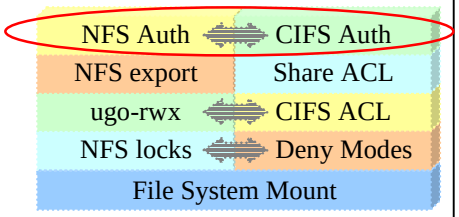
User Authentication

- Each protocol provides unique authentication methods
- Need to Support and conform to each
- NFS:
  - Users authenticated as part logon to the NFS client
  - In NFSv2 & v3, NFS clients provide UID and GID
  - Secure NFS provides additional security with KerberosV5
- CIFS:
  - Users are authenticated via Domain Controller in most cases
  - NTLMv0.12 or Kerberos (default in Windows 2000) and LDAP

CIFS Authentication



- File server can participate in Windows Domains
  - Windows 2000 Member Server (Kerberos and LDAP)
  - NT4 Member Server (NTLM)
- Security = NT Style
  - User authentication handled by domain controller using
  - Access checking is done against user and group SIDs
- Security = SHARE
  - Access provided via global or no password protection
  - Limited Security provided

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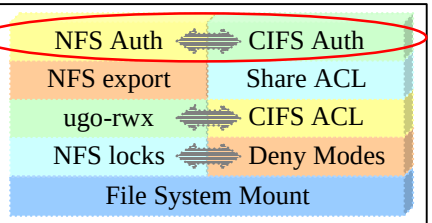
Mapping Different User Repositories



- Credential Repositories
  - Local passwd and group files
  - NIS
  - Windows 2000 Active Directory
  - Local Workgroup
- Basic concept
  - Match Windows credentials with UNIX credentials
  - Allow for cross-platform access, permissions, quotas, etc.
- User Mapping Services
  - Assigns persistent SID → UID/GID mappings for a windows environment

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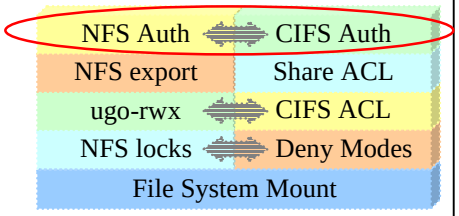

Mapping Issues:

Primary Groups in a Bi-Lingual Environment

- Both UNIX and NT have the concept of a "Primary Group" for a user
  - It is compulsory in UNIX, optional in Windows
- All files have an associated owner (UID) and group (GID)
- When a file is created via NFS, the GID is taken from the GID as supplied by the client

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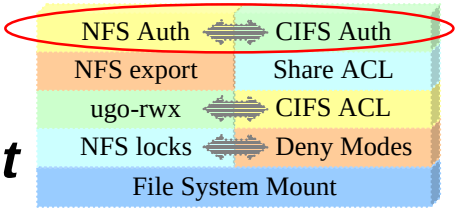
Mapping Issues:

Primary Group in Bi-Lingual Environment



- When a file is created via CIFS, the GID is taken based on policy definition.
- The default behaviour is to use the GID associated with the NT user's primary group
  - Typically "Domain Users"
  - NFS users may see GIDs or group names on files that represent Windows Groups
- If this is not desired, you can also get GID from user's UNIX primary group as defined in the passwd file, NIS or AD

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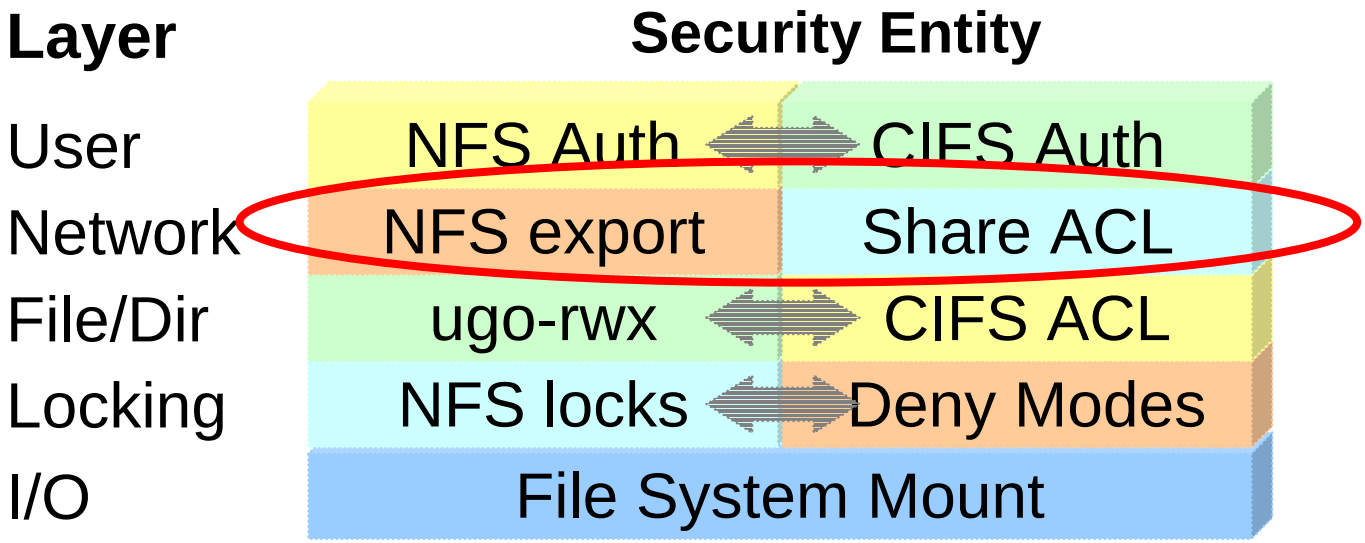
Network Exports and Shares



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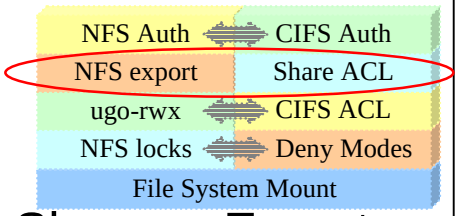
Network Interoperability Options



- Administrative restrictions implemented on Share or Export
- **NFS**
  - **ro/rw/access** – export read-only, read/write, or limit access to a set of hosts
  - **vlan** – limit access to a specific vlan
  - **anon** – set UID given to anonymous users, eg. Nobody (UID=65534) on clients.
  - **root** – set of list of hosts who can be root
- CIFS share security options include
  - **ro** – read-only access is allowed to the share
  - **rw** – grant read/write access to listed hosts
    - Everyone else is read-only
  - **umask** – works the same as UNIX, independent of NFS access
  - Share ACLs (the SD on the share)

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File & Directory Security

Layer	Security Entity
User	NFS Auth ⇔ CIFS Auth
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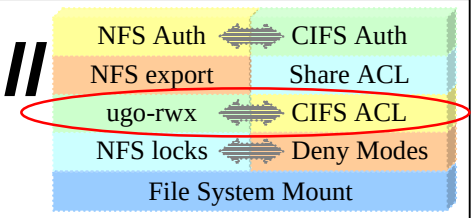
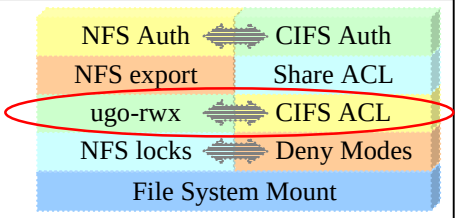
One Set of Permissions for All



- Goal
  - To have just one set of permissions for CIFS, NFS and FTP
- Restrictions
  - Permissions limited to the Lowest Common Denominator
    - Only Read/Write/Execute for Owner, Group and Other
    - Cannot use “Deny” ACEs
    - Only one Group ACE
    - Cannot use an ACE for any user except Owner

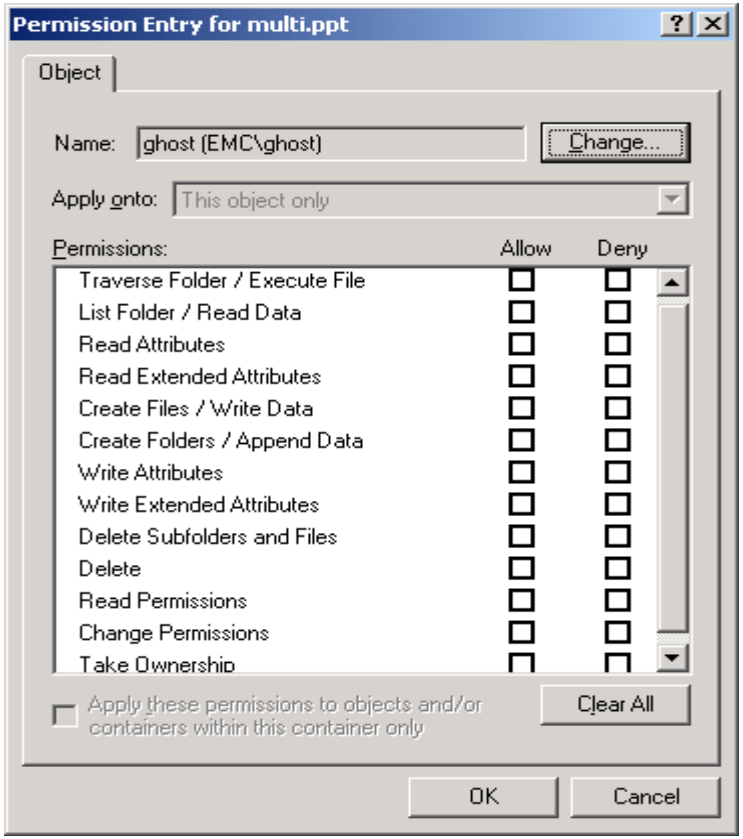
File & Directory Security

Windows and UNIX permissions are fundamentally different



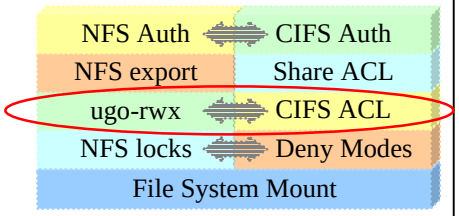
- UNIX/NFS
  - **Only three** entries
    - Owner
    - Group
    - Other (!= Everyone)
  - That **Allow (no Deny)**:
    - Read
    - Write
    - Execute
- Windows/CIFS
  - **Multiple** ACEs which Allow or Deny any of →

```
drwxr-xr-x   2 root     staff         80 Sep 16 09:27 eng
-r-xr-x---   1 jeff     other        305 Sep 16 09:30 jp
-r--r--r--   1 sys      sys         1001 Sep 16 09:29 test
#
```



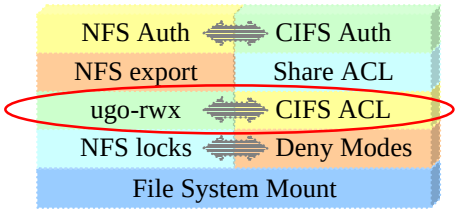
File & Directory Security

Umasks and ACL Inheritance



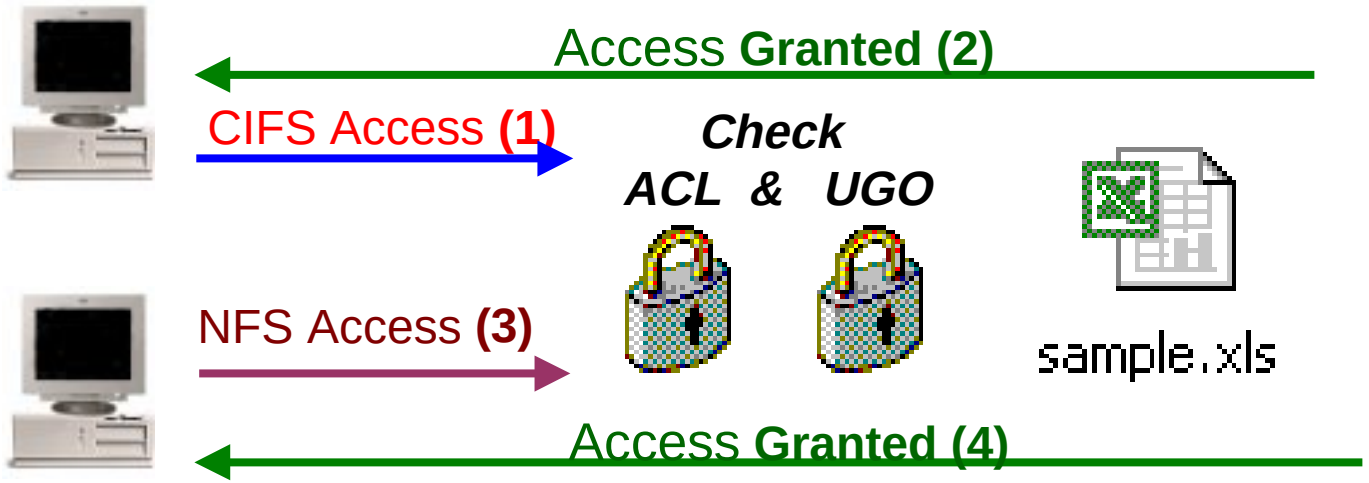
- When a new file or directory is created on a bi-lingual file system it needs both a UNIX permission string and an ACL
- For files and directories created by NFS clients
  - The users umask determines the UNIX permissions
  - The ACL is inherited from the enclosing directory (if it has one)
- For files and directories created by CIFS clients
  - The ACL is inherited from the enclosing directory where there is one
  - Each share has a umask that is used to apply UNIX permissions to files created through it

File & Directory Security



- Access Policy
  - Should access rights be determined by ACL and/or UGO?
  - Choose: Native, NT, UNIX, or Secure

Example: "Secure" Mode
(Always Check ACL and UGO)



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Benefits with NFSv4 ACL's

- Take advantage of rich set of ACL's
  - Read, write, list, add, execute, etc.
- Extended Access Control Entries (ACE)
  - Interactive, anonymous, authenticated
- Provide better alignment with CIFS ACL's
- Benefits interoperability and integration between protocols.
- Improved control and end user experience

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File & Directory Locking

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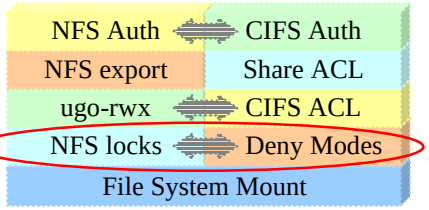
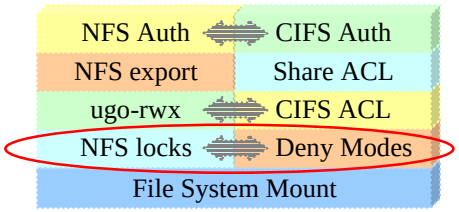
File & Directory Locking

CIFS and NFS Locking Semantics Differ



- File Locking provides a method for file integrity
- Coordinates user access to file
- NFS locks are advisory and seldom used in practice
- CIFS has
  - Opportunistic locks (exclusive and batch & Level II)
  - Range locking (equivalent to NFS Range locking)
  - Byte Range -
  - “Deny Modes”, e.g., “Deny Write”
- Application use of CIFS oplocks and deny modes is variable
- Samba uses Posix and strict locking

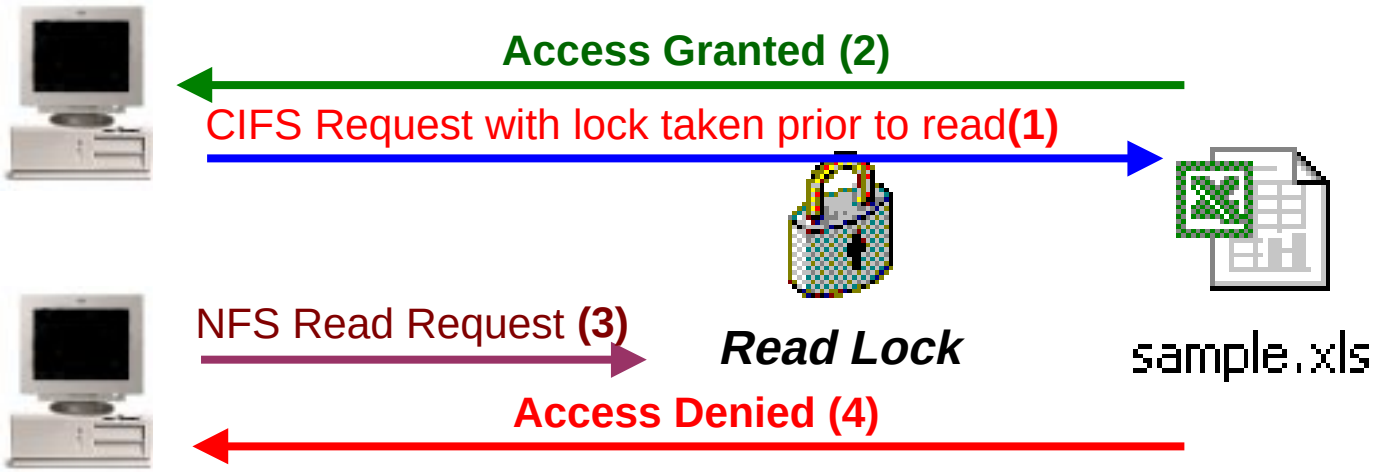
File & Directory Locking



- Locking Policy
  - How should locks be handled?
  - Choose: nolock, wlock, or rwlock

Example: "rwlock" Policy

(Read and/or write requests will be denied if a corresponding lock is already in place)



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File System I/O Security

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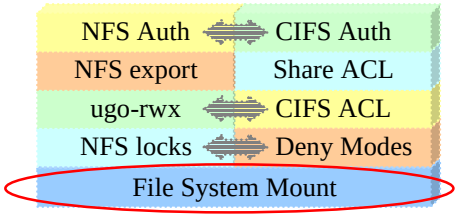

- A file system can be mounted in either of two modes
  - Read-Write (default for standard file systems)
    - Both reading and writing to the file system is allowed
  - Read-Only (default for certain fs types)
    - The OS will deny any attempts to write to the file system
- Read-only access provides ability to share data to a wider audience.

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Applications of Multi Protocol Support

- Why would you want to use Multi Protocol Filesystem resources in your environment?
- We have seen countless uses of Multi Protocol Filesystems
  - User home directories
  - Collaborative environments, including software development
  - Manufacturing and design
    - One data set, multiple application platforms
  - Infrastructure systems, processing computers are UNIX based, clientele is Windows-based
  - Common set of permissions to manage

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Summary

- Multi-protocol technology solutions continue to evolve
- NFSV4 will benefit key areas of multi-protocol
  - Security and ACL implementation
  - File Locking and policy integration
  - Improved efficiency in processing tasks
- Challenges lie ahead in the deployment and adaptation of supporting infrastructure
  - V3 and V4 support
  - Security integration
- User Mapping still required

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