Discretionary Access Control in Practice

UNIX File Access Control

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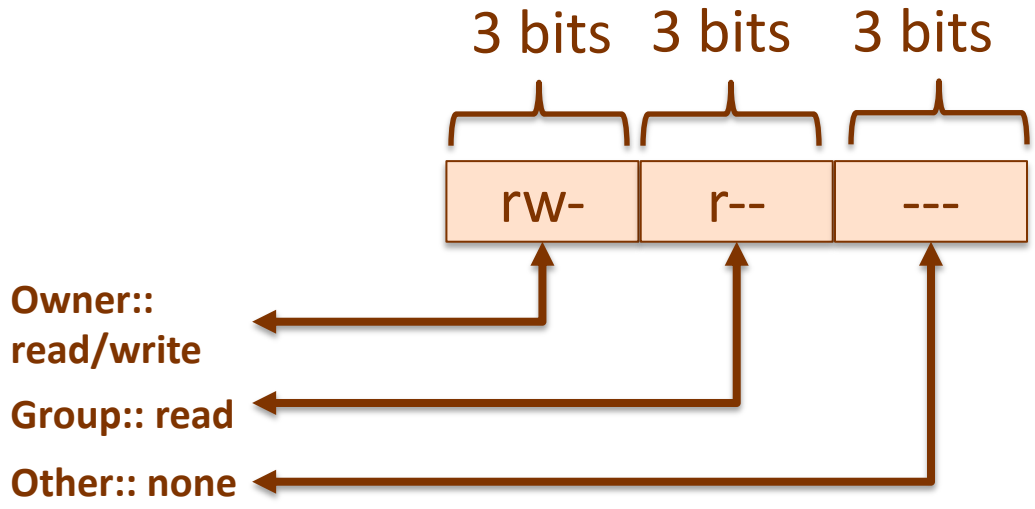
- Unique user identification number (user ID)
- Member of a primary group identified by a group ID
- Three permission octets associated with each file and directory
  - Specify read, write, and execute permission for the owner of the file, members of the group and all other users
- The owner ID, group ID, and protection bits are part of the file's inode



Traditional Unix File Protection

UNIX File Access Control

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- 3 additional bits
  - "Set user ID"(SetUID)
  - "Set group ID"(SetGID)
  - "Sticky Bit"

- "Set user ID"(SetUID), "Set group ID"(SetGID)
  - System temporarily uses rights of the file owner/group in addition to the real user's rights when making access control decisions
  - Enables privileged programs to access files/resources not generally accessible

- Sticky bit
  - When applied to a directory it specifies that only the owner of any file in the directory can rename, move, or delete that file

UNIX File Access Control

- Superuser
  - Is exempt from usual access control restrictions
  - Has system-wide access

ACLs in UNIX

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Modern UNIX systems support ACLs

- FreeBSD, OpenBSD, Linux, Solaris

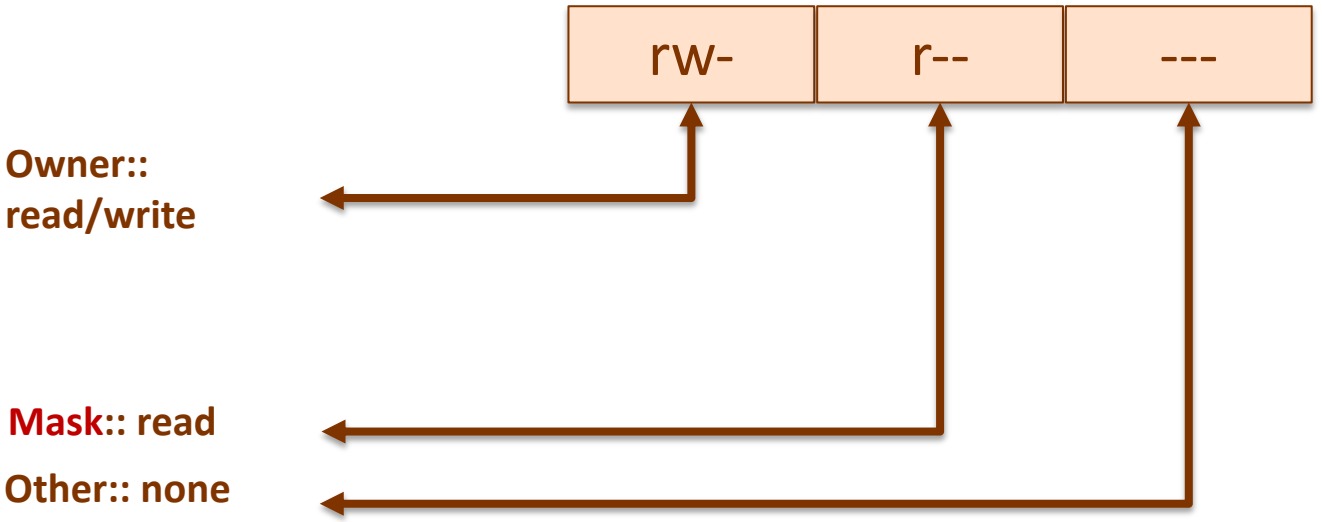
FreeBSD

- Setfacl command assigns a list of UNIX user IDs and groups
- Any number of users and groups can be associated with a file
- Read, write, execute protection bits
- A file does not need to have an ACL
- Includes an additional protection bit that indicates whether the file has an extended ACL

When a process requests access to a file system object two steps are performed:

- Step 1 selects the most appropriate ACL
- Step 2 checks if the matching entry contains sufficient permissions

Extended Unix ACL



Extended Unix ACL

Windows ACL (1 of 2)

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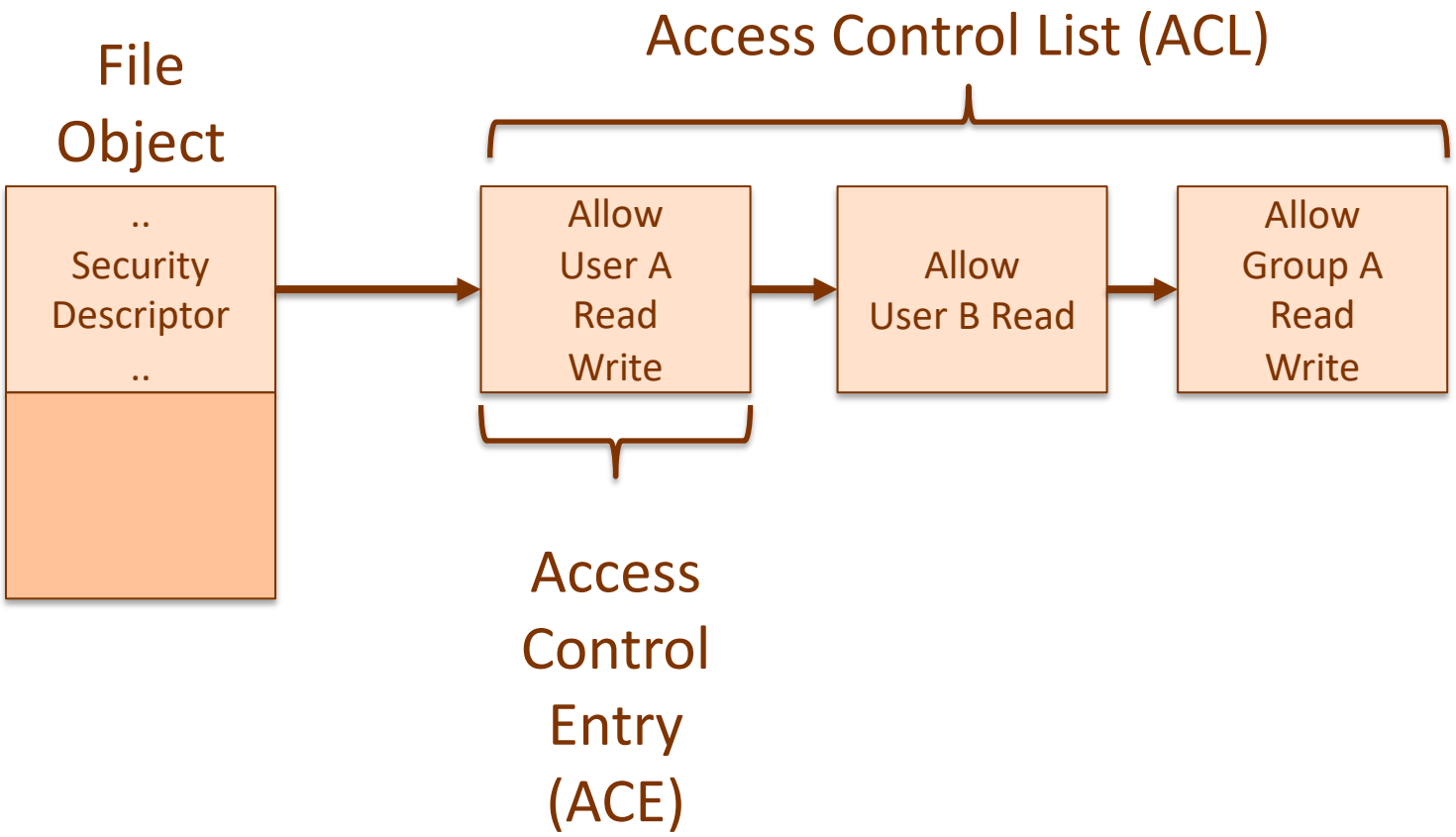

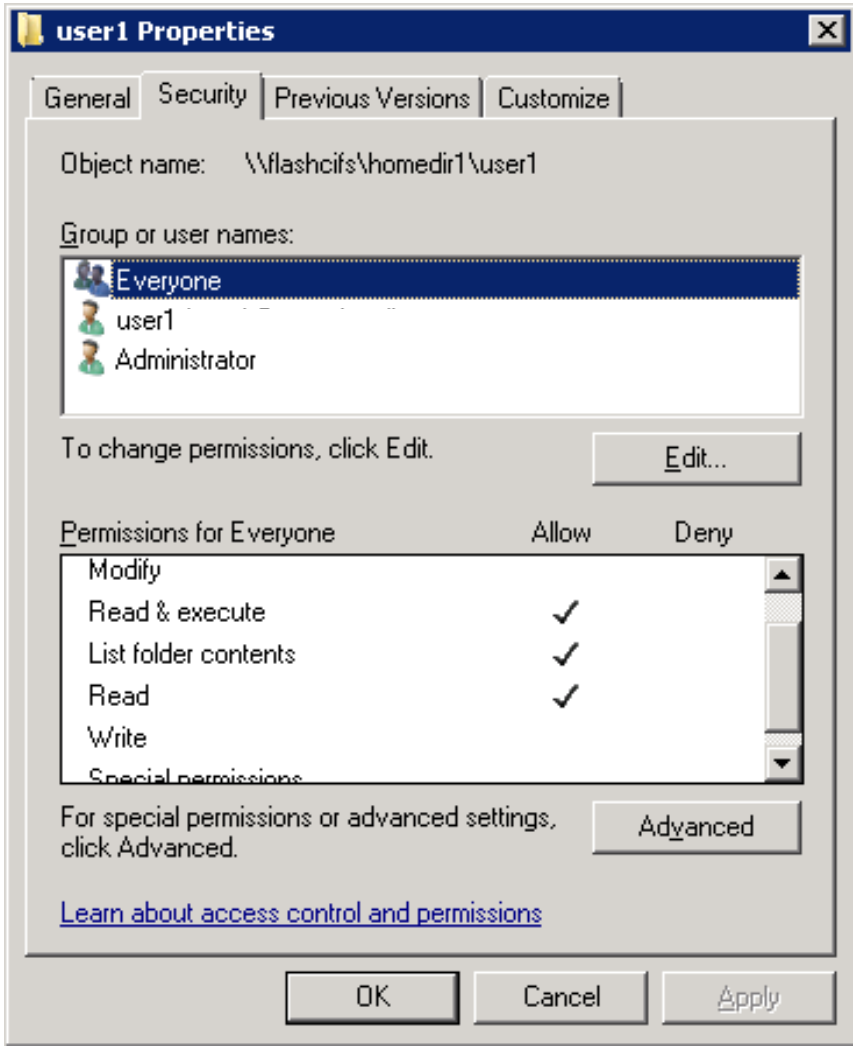

Windows ACL (2 of 2)

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- Actually two ACL's per file
  - System ACL (SACL) – controls auditing and now integrity controls
  - Discretionary ACL (DACL) – controls object access

- Windows ACLs apply to all named objects
  - Files
  - Pipes
  - Events

Summary

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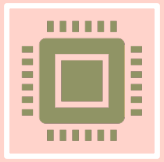
Both Unix and Windows primarily use DAC, specifically ACLs



Mandatory Access Controls have slowly found their way into mainstream OSes for integrity protection

e.g., SACL in Windows