Lecture 17

Access Control

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Access Control

- A "language" for expressing access control policy: who can access what, how and when…
- Enforcement of access control
  - Identify all resources (objects) and their granularity
  - Identify all potential users (subjects)
  - Specify rules for subject/object interaction
  - Guard them in real time

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Model and Terminology

- **Subjects:** users or processes
- **Objects:** resources (files, memory, printers, routers, plotters, disks, processes, etc., etc.,...)

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Focus of AC

- **What a subject is allowed to do**
- **What may be done with an object**

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Access Modes

- "look" at object, e.g.:
  - Read file
  - Check printer queue
  - Print remote screen
  - Query database
  - etc., etc.
- "change" object, e.g.:
  - Write/append/erase file
  - Print or fax
  - Display on screen
  - etc., etc.

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Access Rights

execute, read, append, and write

	Execute	Append	Read	Write
Observe			X	X
Alter		X		X

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UNIX

- execute: execute (program) file, search directory
- read: read from file, list directory
- write: write (re-write or append) file, create or rename file in directory

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Example:Windows NT/2000 (NTFS)

- execute
- read
- write
- delete
- change permission
- change ownership

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AC Types

Who is in charge of setting AC policy?

- Discretionary: resource owner
- Mandatory: system-wide policy

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Access Control Structures

- Access Control Matrix
- Capabilities
- Access Control Lists

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Access Control Matrix

Object

Subject	Bill.doc	Edit.exe	Fun.com
Alice	{0}	{execute}	{execute,read}
Bob	{read,write}	{execute}	{execute,read,write}

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Access Control Lists

Keep access rights to an object with that object:

- ACL for bill.doc:
  - Bob: read, write
- ACL for edit.exe:
  - Alice: execute;
  - Bob: execute
- ACL for fun.com:
  - Alice: execute, read;
  - Bill: execute, read, write
    - As many ACLs as there objects
    - Each ACL either signed or stored in protected place
    - Hard to Manage

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Access Control Lists (1)

- Managing access rights can be difficult
- Groups can be helpful…
- Groups simplify definition of access control policies

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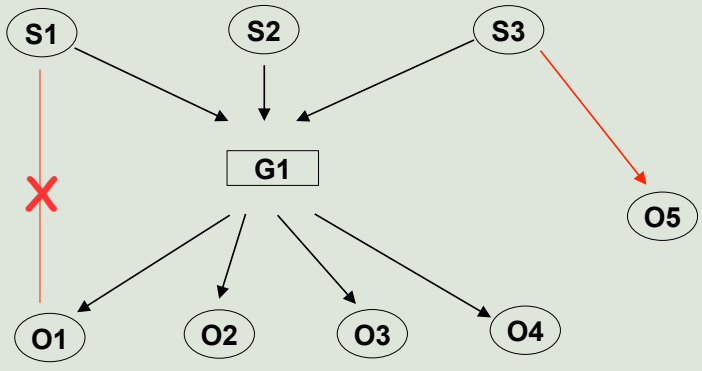
Access Control Lists (2)



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Capabilities

- Capabilities are associated with discretionary access control
- Reason: difficult to get full view of who has permission to access an object
- Very difficult to revoke a capability (owners/ objects have to keep track of all issued capabilities)

•As many capabilities as there are subject/object pairs
•Each capability either signed or otherwise protected
•Hard to revoke in a distributed setting

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Capabilities (1)

Keep access rights with the subject:

- Alice's capabilities:
  - [edit.exe:execute];
  - [fun.com:execute,read]
- Bob's capabilities:
  - [bill.doc:read,write]
  - [edit.exe:execute]
  - [fun.com:execute,read,write]

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In summary

- Centralized Systems: ACLs are better
- Distributed Systems: capabilities are better

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ROLE BASED ACCESS CONTROL (RBAC)

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RBAC Basics

- Users are associated with roles.
- Roles are associated with permissions.
- A user has permission only if s/he has a role associated with that permission.

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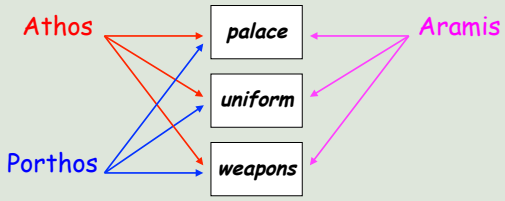
Example: The Three Musketeers (User/Permission Association)



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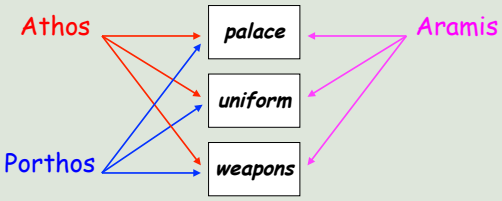
Example: The Three Musketeers (RBAC)



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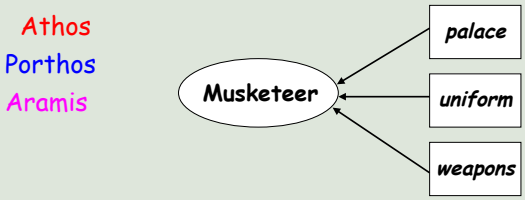
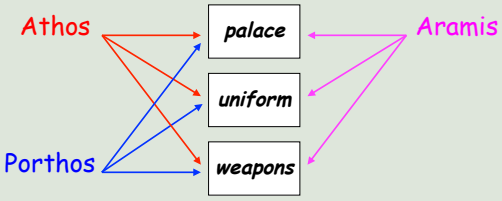
Example: The Three Musketeers (RBAC)





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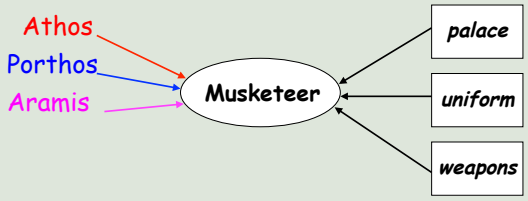
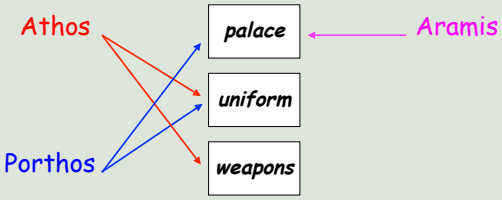
Example: The Three Musketeers



Here RBAC doesn't work…



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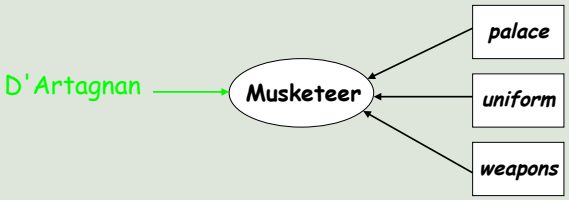
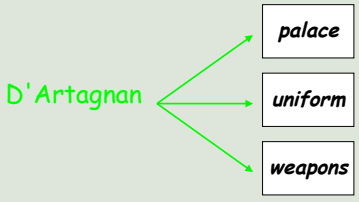
Example: (D'Artagnon becomes a Musketeer)





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