OPERATING SYSTEMS

UE18CS302_Unit 5_Revision_Class_#1

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OPERATING SYSTEMS

Course Syllabus - Unit 5

10 Hours

Unit-5:Unit 5: IO Management and Security

I/O Hardware, polling and interrupts, DMA, Kernel I/O Subsystem and Transforming I/O Requests to Hardware Operations - Device interaction, device driver, buffering System Protection: Goals, Principles and Domain of Protection, Access Matrix, Access control, Access rights. System Security: The Security Problem,Program Threats, System Threats and Network Threats. Case Study: Windows 7/Windows 10

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Course Outline

47	I/O Hardware, polling and interrupts	13.1,13.2
48	DMA	13.2.3
49	Transforming I/O Requests to Hardware Operations, Device interaction, device driver, buffering.	13.5
50	Goals, Principles and Domain of Protection	14.1-14.3
51	Access Matrix	14.4
52	Access control, Access rights	14.5-14.7
53	The Security Problem	15.1
54	Program Threats	15.2
55	System Threats and Network Threats	15.3
56	Case Study : Windows File System	17.5

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Protection	refers to a mechanism for controlling the access of programs, processes, or users to the resources defined by a computer system.
Protection must provide a means for	for specifying controls to be imposed + a means of enforcement.
Why use protection?	To prevent the mischievous & intentional violation of an access restriction by a user.
One of the goals of using protection is	To improve reliability by detecting latent errors at the interfaces between component subsystems, which helps prevent contamination of a healthy subsystem by a malfunctioning subsystem.
To ensure that each program component, active in a system, __.	uses system resources that are consistent with stated policies.
Protection aims to	distinguish between authorized and unauthorized usage.
Mechanisms determine	how something will be done

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Policies decide	what will be done
Principle of Least Privilege	states that programs, users and systems be given just enough privileges to perform their tasks.
Privilege	is the right to execute a system call or to use an option within that system call.
An operating system following the principle of least privilege, implements its features, programs, system calls and data structures so that	failure of a component does the minimum damage
An OS provides system calls and services that allow applications to be written with ___.	fine-grained access controls
An OS provides mechanisms	to enable privileges when they are needed and to disable them when they are not needed.
The audit trails	allows the programmer, systems administrator, or law enforcement officer to trace all protection and security activities on the system.

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Need-To-Know principle	is when a process is able to access only those resources it currently requires to complete its task. This is useful in limiting the amount of damage a faulty process can cause in the system.
The most general scheme to implement identity dependent access is to associate with each file and directory ___.	an Access Control List (ACL)
Access Control List	specifies user names and the types of access allowed for each user.
A disadvantage of using access control list	is maintaining the long list of users, its variable size, given that the number of users may increase over time.
To condense the length of the access control list, many systems recognize three classification of users in connection with each file, __.	Owner, Group, Universe
What is a domain?	A collection of access rights, each of which is an ordered pair <object name, rights set>

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The association between a process and domain may be either __ if the set of resources available to the process is fixed throughout the process's lifetime, or __	static, dynamic
Establishing is more complicated than establishing static protection domains.	dynamic protection domains
Domain switching for users occurs	when the user is changed generally when one user logs out and another user logs in.
Domain switching for process occurs	when one process sends a message to another process and then waits for a response.
Domain switching for procedure occurs	a procedure call is made.
The system consists of	two domains; user & supervisor
Domain switch is accomplished via the file system	- Where each file will have a domain bit associated with it and when the file is executed and setuid = on, then user-id is set to owner of the file being executed.

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Access Matrix	is viewed as a Model of protection
Access matrix seperates __ from __.	mechanism, policy
The ___ normally decide the contents of the access-matrix entries.	users
Switching between domain Di to domain Dj, if and only if, the ___ ∈ access(i, j)	access right switch
Owner rights control these operations	add or delete access rights.
Copy rights	allows the access right to be copied only within the column for which the right is defined.
Control rights	can change the entries in a row.
A process executing in domain(i) can ___ from row j.	remove any access right
The ___ allow a process to change the entries in a column in the access matrix.	copy and owner rights

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A right is copied from access(i,j) to access(k,j);it is then removed from access(i,j). This action is known as __.	transfer right
Access matrix mechanism	ensures that matrix is only manipulated by authorized agents and rules are strictly enforced.
Access matrix policy is usually dictated by	users
How to control domain switching?	by including domains among the objects of the access matrix.
Each entry in the Access Matrix may be __.	modified individually
Each column = _____.	Access Control List (ACL) for one object
Each row = _____.	Capability List(like a key).
Global Table	This is the simplest implementation of the access matrix, consisting of a set of ordered triples <domain, object, rights-set>
It is difficult to___ when implementing an access matrix using a global table.	take advantage of special groupings of objects or domains

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Disadvantage of global table	Table is usually large and thus cannot be kept in main memory, so additional I/O is needed.
Access List for objects	Each column in the access matrix can be implemented as a list for one object, consisting of ordered pairs <domain, rights-set>.
A ___ for a domain is a list of objects + operations allowed on those objects.	Capability List
An object is often represented by its physical name called a __	Capability
The capability list is a ___ maintained by ___ and accessed by users only ___.	protected object, operating system, indirectly.
Most systems use a combination of ____. When a process first tries to access an object, the ___ is searched. If access is denied, an exception occurs. Otherwise, a __ is created and attached to the process.	access list & capabilities, access list, capability

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Enforcement by __ is ___ than enforcement by the _ for user-defined policy.	kernel, less flexible, programming language
Protection is usually achieved through __.	an operating system Kernel, which acts as a security agent to inspect and validate each attempt to access a protected resource.
An advantage of compiler-based enforcement of access control is that___ are closely related to the _____ concept of a data type.	access privileges, linguistic

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For all the relevant Unit 5 concepts refer to the lecture supplements and relevant videos on PESU Academy

THANK YOU

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