Computer Security Pt. 2 & FreeBSD Security

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Guest Lecture for UCD ECS 150 (Operating Systems)
June 4, 2008

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Goals

- Confidentiality
- Integrity
- Availability

Security Methods

- Detection
- Prevention
- Recovery
- Analysis
- (repeat)

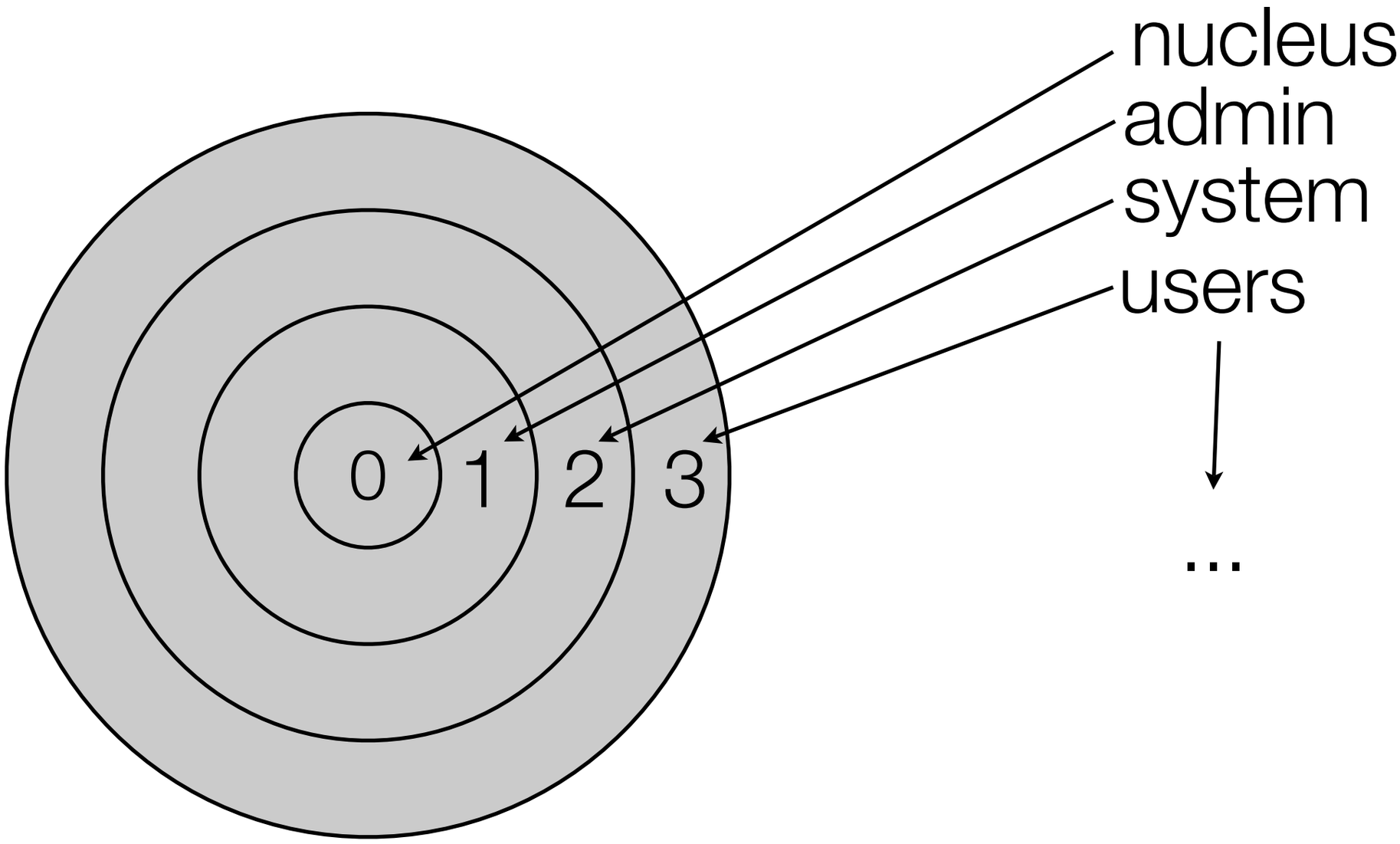
Issues

- Physical security
- Operational security
    - Technical solutions
    - Procedural solutions

Technical Mechanisms

- The Players
  - Subjects (and Domains)
  - Objects
  - Actions
- Access control (and access control lists)
- Protection domains in practice, and capability-based systems

Protection Rings (as in MULTICS)



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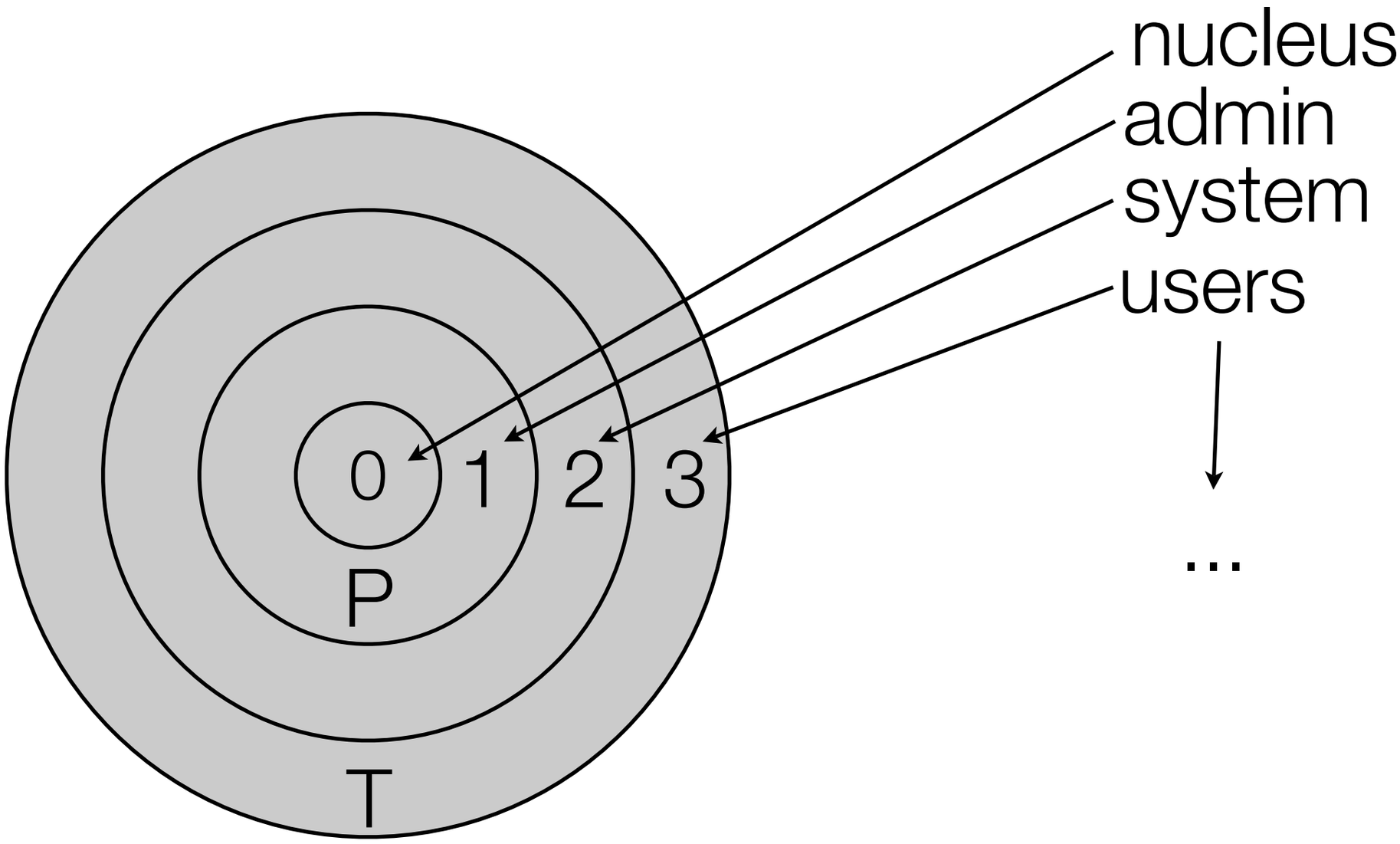

Saltzer and Schroeder's Design Principles

- *Economy of Mechanism*
- *Fail-Safe Defaults*
- *Complete Mediation*
- *Open Design*
- *Separation of Privilege*
- *Least Privilege*
- *Least Common Mechanism*
- *Psychological Acceptability*

Several FreeBSD Mechanisms

- Explicit:
  - Access Controls
  - Encryption (e.g., `crypt`, `ssh`, IPsec)
  - “BSM”
  - Verified Exec (in NetBSD)
  - Jail/chroot
- Implicit
  - Good code!
  - Simple code!
  - Documented code!
  - Open code!

Basic Access Control Example

File `/tmp/x`	Owner	Group	World
Read	x	x	x
Write	x		
Execute	x	x	

Permissions Example

Listing permissions:

% ls -l x

-rwxr-xr-- 1 sean staff 0 May 27 16:53 x

(first char is ‘l’ for symlinks, ‘d’ for directories, etc...)

Changing permissions:

% chmod u+rwx x

% chmod g+rx

% chmod o+r

or

% chmod 754 x

Access Control Lists in FreeBSD

- `getfacl` and `setfacl` commands
- Specific lists of users (not just groups)
- Read, Write, Execute
- Rename, Delete, Append, Inherit, etc...

FreeBSD Kernel Security Level

- Immutability
- Append only
- “No delete”

Examples of Kernel Security Levels in FreeBSD

	Securelevel				
System Property	**-1**	**0**	**1**	**2**	**3**
System immutable and append-only flags can be changed	√	√			
Raw disk devices for mounted file systems can be written	√	√			
/dev/mem and /dev/kmem can be written	√	√			
Kernel modules can be loaded and unloaded	√	√			
Non-mounted raw disk devices can be written	√	√	√		
Filesystems can be mounted	√	√	√		
Time can be adjusted more than one second forward or back	√	√	√		
IP filtering and firewall rules can be changed	√	√	√	√	

Setting Kernel Security Level in FreeBSD

- In `/etc/rc.conf`
  - `kern_securelevel_enable="YES"`
  - `kern_securelevel="2"`

Mandatory Access Control

- Policy is set in the kernel, not by the user
- Multi-Level Security (MLS)
    - Biba model
        - “No writes up, no reads down”
    - Bell-LaPadula model
        - “No reads up, no writes down”

Logging

- syslog
- TCPWrappers
- BSM

Questions?

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