ECS 235B Module 49 Confinement Problem

Example Problem

- Server balances bank accounts for clients

- Server security issues:
  - Record correctly who used it
  - Send *only* balancing info to client

- Client security issues:
  - Log use correctly
  - Do not save or retransmit data client sends

Generalization

- Client sends request, data to server

- Server performs some function on data

- Server returns result to client

- Access controls:
  - Server must ensure the resources it accesses on behalf of client include *only* resources client is authorized to access
  - Server must ensure it does not reveal client's data to any entity not authorized to see the client's data

Confinement Problem

- Problem of preventing a server from leaking information that the user of the service considers confidential

Total Isolation

- Process cannot communicate with any other process
- Process cannot be observed

Impossible for this process to leak information

- Not practical as process uses observable resources such as CPU, secondary storage, networks, etc.

Example

- Processes *p, q* not allowed to communicate
  - But they share a file system

- Communications protocol:
  - *p* sends a bit by creating a file called *0* or *1*, then a second file called *send*
    - *p* waits until *send* is deleted before repeating to send another bit
  - *q* waits until file *send* exists, then looks for file *0* or *1*; whichever exists is the bit
    - *q* then deletes *0, 1,* and *send* and waits until *send* is recreated before repeating to read another bit

Covert Channel

- A path of communication not designed to be used for communication
- In example, file system is a (storage) covert channel

Rule of Transitive Confinement

- If *p* is confined to prevent leaking, and it invokes *q*, then *q* must be similarly confined to prevent leaking

- Rule: if a confined process invokes a second process, the second process must be as confined as the first

Lipner's Notes

- All processes can obtain rough idea of time
  - Read system clock or wall clock time
  - Determine number of instructions executed
- All processes can manipulate time
  - Wait some interval of wall clock time
  - Execute a set number of instructions, then block

Quiz

What is the difference between a side channel and a covert channel?

1. A side channel uses an observable outside the system; a covert channel uses an observable within the system

2. A covert channel requires an active sender and receiver; a side channel requires simply observing some aspect of system computation

3. Access controls can close a covert channel, but not a side channel

4. A side channel is just another term for a covert channel