ECS 235B Module 3
Reference Monitors
Entities

• **Subject: active entity**
  • Causes information to flow or system state to change
  • Examples: processes, some devices
  • At a higher layer of abstraction: users, other computers

• **Object: passive entity**
  • Contains or receives information
  • Examples: files, some devices
  • At a higher layer of abstraction: file server, network
Reference Monitor

• *Reference monitor* is access control concept of an abstract machine that mediates all accesses to objects by subjects

• *Reference validation mechanism* (RVM) is an implementation of the reference monitor concept.
  • Tamperproof
  • Complete (always invoked and can never be bypassed)
  • Simple (small enough to be subject to analysis and testing, the completeness of which can be assured)
    • Last engenders trust by providing evidence of correctness

• Note: RVM is almost always called a reference monitor too
Examples

• *Security kernel* combines hardware and software to implement reference monitor

• *Trusted computing base (TCB)* consists of all protection mechanisms within a system responsible for enforcing security policy
  • Includes hardware and software
  • Generalizes notion of security kernel
Policy and Reference Monitor

• Reference monitor implements a given policy
  • It has a tamperproof authorization database
  • Also maintains an audit trail (record of security-related events) for review

• More on this later; we need some background first
Quiz

SE-Linux adds a kernel loadable module to add security enhancements to Linux, including controls to enable or disable access of subjects (processes) to objects (files, devices, etc.)

Is this a reference monitor?

• Yes, because it manages all security-related interactions with entities.
• Yes, because being part of the kernel, it is tamperproof.
• No, because it is not tamperproof
• No, because it does not implement a stated security policy.