Extended OS

OS is an extended virtual machine

- Multiplexes the "machine" between applications
  - Time sharing, multitasking, batching
- Provided a higher-level machine for
  - Ease of use
  - Portability
  - Efficiency
  - Security
  - Etc....

JAVA – Higher-level Virtual Machine

- write a program once, and run it anywhere
  - Architecture independent
  - Operating System independent
- Language itself was clean, robust, garbage collection
- Program compiled into bytecode
  - Interpreted or just-in-time compiled
  - Lower than native performance

Issues

- Legacy applications
- No isolation nor resource management between apps
- Security
  - Trust JVM implementation? Trust underlying OS?
- Performance compared to native

Is the OS the “right” level of extended machine?

- Security
  - Trust the underlying OS?
- Legacy application and OSs
- Resource management of existing systems suitable for all applications?
- What about activities requiring “root” privileges

Virtual Machine Monitors

- Provide scheduling and resource management
- Extended “machine” is the actual machine interface.
IBM VM/370

Advantages

• Legacy OSes (and applications)
• Concurrent OSes
  – Linux – Windows
  – Primary – Backup
• Security
  – VMM (hopefully) small and correct
• Performance near bare hardware
  – For some applications

Virtual R3000???

• Interpret
  – System/161
    • slow
    – JIT dynamic compilation
• Run on the real hardware??

Issues

• Privileged registers (CP0)
• Privileged instructions
• Address Spaces
• Exceptions (including syscalls, interrupts)
• Devices