CSE 221: Homework 2

Due: February 10, 2011

Question 1: Operating Systems serve to abstract the hardware resources so that they can be shared in a safe and reasonable way. The papers we have read in class have argued for varying types and degrees of abstraction. For instance, Hydra provides a system that operates within Algol, whereas UNIX provides an abstraction of processes that can be run on a processor and access various resources via file descriptors. For each of the following systems, (a) what are the basic units of protection/isolation, (b) what are the benefits and drawbacks of the choice of protection/isolation granularity, and (c) describe the sequence of high-level entities involved in servicing a page fault from disk triggered by a user level process. For example, in UNIX, the fault is received by the kernel, the page is read from disk, the page table is updated, and processing continues.

- Distributed V
- VM/370
- Xen
- Exokernel

Question 2: Needham and Lauer establish that message-oriented systems and procedure oriented systems are equivalent and that the choice of technique depends on the particular hardware and situation.

(a) For each of the systems we have covered so far in class, is the system message-oriented or procedure oriented?

(b) What is the novel argument for kernel-level message passing in the Multikernel paper?
**Question 3:** In a message-oriented distributed system, the efficiency of the individual message operations can be critical. What optimizations were made to the messaging layers in (a) *Implementing Remote Procedure Calls* and (b) the Distributed V Kernel? (c) In light of Mach's silent optimizations, are the sacrifices to elegance in the Distributed V Kernel interface necessary? Why?