# EECS 211: Advanced System Software Lecture 17

Rainer Dömer

doemer@uci.edu

The Henry Samueli School of Engineering
Electrical Engineering and Computer Science
University of California, Irvine

## Lecture 17: Overview

- Course administration
  - Course evaluation
  - Assignments
- Wrap-up issues
  - Distributed file systems
    - Location transparency vs. location independence
  - Distributed coordination
    - Distributed mutual exclusion
      - Freedom from deadlocks
      - Advantages over centralized approach
- Distributed Systems
  - Distributed coordination
    - Atomicity, ...

## Course Administration

- Course Evaluation
  - 8th through 10th week
  - Feb. 28, 2005, 8am through Mar. 17, 2005, 11pm
  - Online via EEE Evaluations
- Feedback from students to instructors
  - Completely anonymous
  - Completely voluntary
  - Very valuable
    - Help to improve this class!



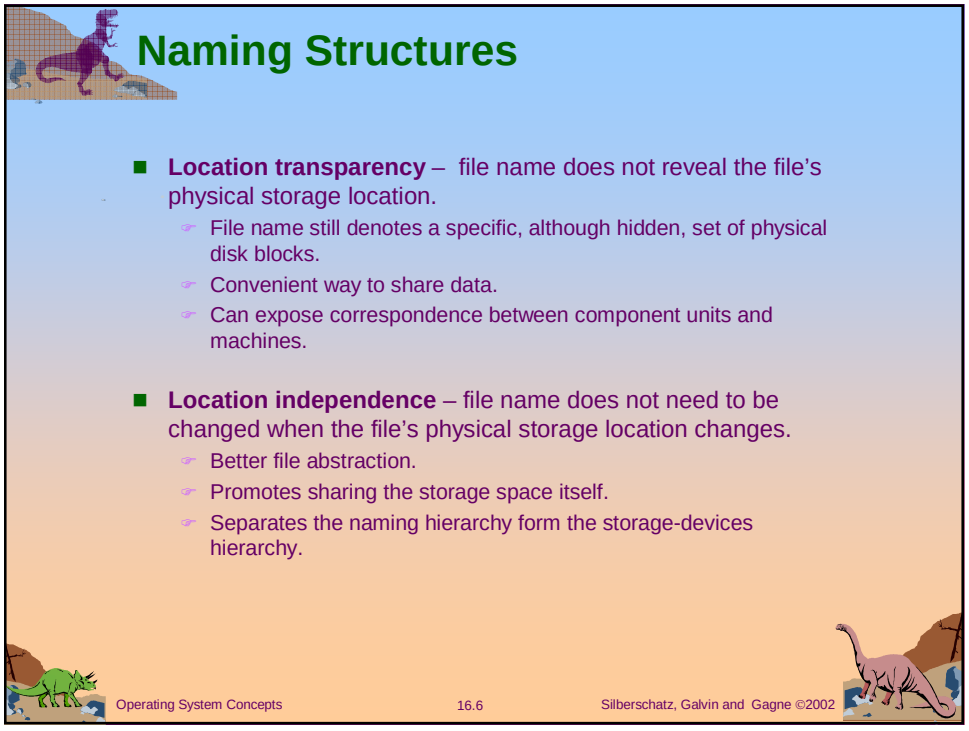
## Course Administration

- Assignment 3
  - Scores are distributed
    - Most did very well (close to 100%, or even more)
    - Some did run out of time (late start?)
    - Few slipped (lack of programming experience?)
- Assignment 4
  - Posted on Monday (03/07/05)
  - Due next Monday (03/14/05)
  - Two options:
    - Software-managed TLB in Nachos
    - OS development and deployment
  - Excellent submissions receive extra credit

# Wrap-up Issues (1)

- Distributed file systems
  - Difference between
    - Location transparency
    - Location independence





## Wrap-up Issues (1)

- Distributed file systems
  - Difference between
    - Location transparency STATIC PROPERTY
    - Location independence DYNAMIC PROPERTY
  - Location independence can map the same filename to different locations at different times
  - Location independence is a stronger property than location transparency



## Wrap-up Issues (2)

- Distributed coordination
  - Mutual Exclusion
    - Fully Distributed Approach
    - Claim:
      - Freedom from Deadlock is ensured
    - Question: (Discussion on the course noteboard)
      - Is this true given the four conditions for deadlock,
        - » Mutual exclusion
        - » Wait and hold
        - » Circular wait
        - » No preemption

## Desirable Behavior of Fully Distributed Approach

- Freedom from Deadlock is ensured.
- Freedom from starvation is ensured, since entry to the critical section is scheduled according to the timestamp ordering. The timestamp ordering ensures that processes are served in a first-come, first served order.
- The number of messages per critical-section entry is

$$2 \times (n - 1).$$

This is the minimum number of required messages per critical-section entry when processes act independently and concurrently.



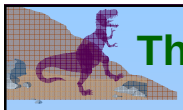
## Wrap-up Issues (2)

- Distributed coordination
  - Mutual Exclusion
    - Fully Distributed Approach
    - Claim:
      - Freedom from Deadlock is ensured
    - Question: (Discussion on the course noteboard)
      - Is this true given the four conditions for deadlock,
        - » Mutual exclusion
        - » Wait and hold
        - » Circular wait
        - » No preemption
    - Answer:
      - Yes, circular wait is not possible due to FCFS order!
      - Note: Deadlock cannot happen *in* this algorithm, but *on top* of this algorithm (Dining Philosophers)!

# Wrap-up Issues (3)

- Distributed coordination
  - Mutual Exclusion
    - Fully Distributed Approach
    - Question:
      What, if any, are the advantages of the fully distributed approach over the centralized approach?





# Three Undesirable Consequences

- The processes need to know the identity of all other processes in the system, which makes the dynamic addition and removal of processes more complex.
- If one of the processes fails, then the entire scheme collapses. This can be dealt with by continuously monitoring the state of all the processes in the system.
- Processes that have not entered their critical section must pause frequently to assure other processes that they intend to enter the critical section. This protocol is therefore suited for small, stable sets of cooperating processes.

# Wrap-up Issues (3)

- Distributed coordination
  - Mutual Exclusion
    - Fully Distributed Approach
    - Question:
      What, if any, are the advantages of the fully distributed approach over the centralized approach?
    - Answer:
      There are few advantages:
      - For system of 2 processes, only 2 messages need to be exchanged (centralized approach needs 3)
      - No dedicated coordinator process is necessary
      - Fairness!
        - » Every process participates in the process!
        - » Every process knows resource utilization/contention!



# Distributed Systems

- Excerpts from chapter 17 of
  *"Operating System Concepts"*
  by A. Silberschatz, P. B. Galvin, G. Gagne,
  John Wiley & Sons, 2003.

- Distributed Coordination
  - Atomicity
  - Deadlock handling