

Wednesday 12 May 1999

- 1. In what ways are remote procedure calls (RPCs) and CORBA (i) similar, and (ii) different? (10 points)**

Similarities: both resemble function calls; both try to remove the burden of format conversion and error handling from the user.

Differences: CORBA is based on objects, but RPCs are not; CORBA is more transparent than RPCs in that it doesn't require knowledge of the objects or service; CORBA can be built on top of RPCs.

- 2. Briefly explain the Berkeley algorithm for clock synchronization. If you do not remember this algorithm, explain Christian's algorithm for partial credit. (8 points)**

See Slide 8 in Lecture 12 for the Berkeley algorithm, or Slide 7 for Christian's algorithm.

- 3. With regard to mutual exclusion algorithms in a distributed environment, what are the main tradeoffs between centralized algorithms, time-based algorithms such as Ricart and Agrawala's algorithm, and token-passing algorithms such as Le Lann's token-ring algorithm? (12 points)**

The centralized algorithms are easy to implement, guarantee the "happened before" relationship, and don't require very many messages, but they also have a performance bottleneck and a single point of failure (the coordinator).

The time-based algorithms still guarantee the "happened before" relationship, but they have more message traffic, performance bottlenecks and points of failure, so they really aren't any improvement at all.

The token-passing algorithms have less network traffic, bottlenecks, and points of failure, but do not guarantee the "happened before" relationship.

- 4. In the Byzantine Generals problem, there is one general and some number of lieutenants. Under the different conditions that may arise, what order should the various lieutenants, loyal or otherwise, agree on when they try to reach agreement? (6 points)**

If the general is loyal, then all loyal lieutenants should agree on the order he sent. If the general is a traitor, then all loyal lieutenants should agree with each other on an order. In either case, it is irrelevant what order traitorous officers want to perform.

- 5. Consider the second algorithm for centralized deadlock detection discussed in class. In one version of this algorithm, a central coordinator maintains a WFG for the system, and the other nodes send information to the coordinator at periodic intervals. What are the major disadvantages of this algorithm? (6 points)**

There can be a delay before the deadlock is detected, the algorithm may report false deadlock (you must explain why), and the coordinator is a performance bottleneck and single point of failure.

- 6. With regard to atomic transactions, briefly explain (i) static locking, and (ii) the advantages and disadvantages of that approach. (15 points)**

In static locking, all locks are acquired before any of the data objects are accessed (usually at the beginning of the transaction), and all locks are released after all the data objects have been used (usually at the end of the transaction).

The advantages of this approach are its simplicity and the fact that it works. The disadvantages are that it requires *a priori* knowledge of the data objects that will be accessed, it holds resources more than necessary and thus reduces concurrency, and it is prone to cascaded rollbacks and deadlock.

- 7. In load distribution, explain the primary disadvantages of both (i) sender-initiated and (ii) receiver-initiated algorithms. (8 points)**

At high system loads, it is hard for a sender-initiated algorithm to find a lightly-loaded receiver, and the increased load due to the polling can push the system into instability.

At low system loads, it is hard for a receiver-initiated to find a sender, but this usually isn't enough to push the system into instability. Instead, receiver-initiated algorithms have the disadvantage that they usually require preemptive task transfers, which are costly.

- 8. In SUN's NFS, what does "mounting a remote file system" mean? (8 points)**

Mounting a remote file system refers to taking a portion of a remote file system and making it appear to be part of a local file system. On the server, there is a file that specifies which part of the file system that is available for remote access, and on the client, an RPC mechanism is used to mount that remote file system at some specified part of the local file system.

- 9. Briefly name and describe one of the three algorithms discussed in class for dynamic scheduling in a real-time system. (7 points)**

See Slides 9 and 10 in Lecture 26, which discuss the rate monotonic algorithm, the earliest deadline first algorithm, and the laxity / slack algorithm.

Name: _____

- 10. At the beginning of the semester, a “true” distributed operating system was defined as having a single operating system, or at least the feel of one. Given the topics discussed in this class, how close are we to developing a true distributed OS? Explain your answer, providing examples where appropriate. (20 points)**

Many answers possible...