CS 5523 Lecture 27: Review

- *Questions from Chapter 4*
- *Emphasis of network overview*
- *Network models*
- *Overview of routing*

Discussion questions from CDK Chapter 4

CDK [4.3]

The programs in Figure 4.3 and Figure 4.4 are available on cdk3.net/ipc. Use them to make a test kit to determine the conditions in which datagrams are sometimes dropped.

Hint: the client program should be able to vary the number of messages sent and their size; the server should detect when a message from a particular client is missed.

Discussion Questions from CDK Chapter 4

[CDK 4.10]

Write an algorithm in pseudocode to describe the serialization procedure described in Section 4.3.2. The algorithm should show when handles are defined or substituted for classes and instances. Describe the serialized form that your algorithm would produce when serializing an instance of the following class Couple.

```
class Couple implements Serializable{
      private Person one;
      private Person two;
      public Couple(Person a, Person b) {
         one = a;
         two = b;
       }
}
```

Discussion Questions from CDK Chapter 4

[CDK 4.11]

Write an algorithm in pseudocode to describe deserialization of the serialized form produced by the algorithm defined in Exercise 4.10. Hint: use reflection to create a class from its name, to create a constructor from its parameter types and to create a new instance of an object from the constructor and the argument values.

Discussion Questions from CDK Chapter 4

[CDK 4.12]

Define a class whose instances represent remote object references. It should contain information similar to that shown in Figure 4.10 and should provide access methods needed by the request-reply protocol. Explain how each of the access methods will be used by that protocol. Give a justification for the type chosen for the instance variable containing information about the interface of the remote object.

Discussion Questions from CDK Chapter 5

[CDK 5.1] The Election interface provides two remote methods:

- *vote: with two parameters through which the client supplies the name of a candidate (a string) and the 'voter's number' (an integer used to ensure each user votes once only). The voter's numbers are allocated sparsely from the range of integers to make them hard to guess.*
- *result: with two parameters through which the server supplies the client with the name of a candidate and the number of votes for that candidate.*

Which of the parameters of these two procedures are input and which are output parameters?

Discussion Questions from CDK Chapter 2

[CDK 5.2]

Discuss the invocation semantics that can be achieved when the request-reply protocol is implemented over a TCP/IP connection, which guarantees that data is delivered in the order sent, without loss or duplication. Take into account all of the conditions causing a connection to be broken.

Discussion Questions from CDK Chapter 5

[CDK 5.3]

Define the interface to the Election service in CORBA IDL and Java RMI. Note that CORBA IDL provides the type long for 32 bit integers. Compare the methods in the two languages for specifying input and output arguments.

Discussion Questions from CDK Chapter 5

[CDK 5.4]

The Election service must ensure that a vote is recorded whenever any user thinks they have cast a vote. Discuss the effect of maybe call semantics on the Election service.

Would at-least-once call semantics be acceptable for the Election service or would you recommend at-most-once call semantics?

Discussion Questions from CDK Chapter 5

[CDK 5.5]

A request-reply protocol is implemented over a communication service with omission failures to provide at-least-once RMI invocation semantics. In the first case the implementor assumes an asynchronous distributed system. In the second case the implementor assumes that the maximum time for the communication and the execution of a remote method is T. In what way does the latter assumption simplify the implementation?

Discussion Questions from CDK Chapter 5

[CDK 5.12] A client makes remote procedure calls to a server. The client takes 5 milliseconds to compute the arguments for each request, and the server takes 10 milliseconds to process each request. The local operating system processing time for each send or receive operation is 0.5 milliseconds, and the network time to transmit each request or reply message is 3 milliseconds. Marshalling or unmarshalling takes 0.5 milliseconds per message. Calculate the time taken by the client to generate and return from two requests: (i) if it is single-threaded, and (ii) if it has two threads that can make requests concurrently on a single processor. You can ignore context-switching times. Is there a need for asynchronous RPC if client and server processes are threaded?

Discussion questions from CDK Chapter 6

CDK [6.8]

A file server uses caching, and achieves a hit rate of 80%. File operations in the server cost 5 ms of CPU time when the server finds the requested block in the cache, and take an additional 15 ms of disk I/O time otherwise.

Explaining any assumptions you make, estimate the server's throughput capacity (average requests/sec) if it is:

i) single-threaded;

ii) two-threaded, running on a single processor;

iii) two-threaded, running on a two-processor computer.

Discussion questions from CDK Chapter 6

CDK [6.9]

Compare the worker pool multi-threading architecture with the thread-per-request architecture.

Discussion questions from CDK Chapter 6

CDK [6.10]

What thread operations are the most significant in cost?

Discussion questions from CDK Chapter 6

CDK [6.14]

Explain the factors that motivate the hybrid scheduling approach of the 'scheduler activations' design (instead of pure user-level or kernel-level scheduling).

Discussion questions from CDK Chapter 6

CDK [6.23]

Explain the program linkage requirements that must be met if a server is to be dynamically loaded into the kernel's address space, and how these differ from the case of executing a server at user level.

Discussion questions from CDK Chapter 6

CDK [6.24]

How could an interrupt be communicated to a user-level server?

Discussion questions from CDK Chapter 6

CDK [6.25]

On a certain computer we estimate that, regardless of the OS it runs, thread scheduling costs about 50 μs, a null procedure call 1 μs, a context switch to the kernel 20 μs and a domain transition 40 μs. For each of Mach and SPIN, estimate the cost to a client of calling a dynamically loaded null procedure.

Discussion Questions from CDK Chapter 8

[CDK 8.1]

Why is there no open or close operation in the interface to the flat file service or the directory service. What are the differences between our directory service Lookup operation and the UNIX open?

Discussion Questions from CDK Chapter 8

[CDK 8.4]

Why should UFIDs be unique across all possible file systems? How is uniqueness for UFIDs ensured?

Discussion Questions from CDK Chapter 8

[CDK 8.5]

To what extent does Sun NFS deviate from one-copy file update semantics? Construct a scenario in which two user-level processes sharing a file would operate correctly in a single UNIX host but would observe inconsistencies when running in different hosts.

Discussion Questions from CDK Chapter 8

[CDK 8.6]

Sun NFS aims to support heterogeneous distributed systems by the provision of an operating system-independent file service. What are the key decisions that the implementer of an NFS server for an operating system other than UNIX would have to take? What constraints should an underlying filing system obey to be suitable for the implementation of NFS servers?

Discussion Questions from CDK Chapter 8

[CDK 8.7]

What data must the NFS client module hold on behalf of each user-level process?

Discussion Questions from CDK Chapter 8

[CDK 8.14]

How does AFS gain control when an open or close system call referring to a file in the shared file space is issued by a client?

Discussion Questions from CDK Chapter 8

[CDK 8.15]

Compare the update semantics of UNIX when accessing local files with those of NFS and AFS. Under what circumstances might clients become aware of the differences?

Discussion Questions from CDK Chapter 8

[CDK 8.16]

How does AFS deal with the risk that callback messages may be lost?

Discussion Questions from CDK Chapter 2

[CDK 2.4]

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