Solution Mid Term Exams

Military College of Signals (NUST)
BESE-14 (A&B)
CPS-622: Design of Distributed Systems

Instructor   **Dr. Hammad Afzal**

Part 1 (15)

Answer 1

Resource Sharing
Web Pages are examples of resources that are shared. These resources are managed by Web servers.
Client-server architecture.
The Web Browser is a client program (e.g. Netscape) that runs on the user's computer. The Web server accesses local files containing the Web pages and then supplies them to client browser processes.

Answer 2

http: the protocol to be used.
www.mcs.nust.edu.pk: domain name of the Web server.
research/distributed/index.html: the file path with reference to the top directory used by Web server

Answer 3

Access Transparency**:** Enables local and remote resources to be accessed using identical operations E**.g.** streams read write in same way.
Location Transparency**:** Enable resources to be accessed without knowledge of their physical or network location. E.g. URL'S is location transparent.
Mobility transparency**:** Allows the movement of resources and clients with in a system without affecting the operation of users. E.g. mobile phone, where both caller (client) and callee (resource) are traveling in different places.

Answer 4:

P2P systems aim to exploit the resources (both data and hardware) in a large number of participating computers for the fulfillment of a given task. All processes involved in a task play similar role and they interact as peers without any distinction between client and server processes.

- The motivation for peer-to-peer system stems from the Shortcoming of Client-Server:
  - Centralization of service provision and management doesn't scale well.
  - Client server models do not address the need of distributed shared resources much more widely in order to share the computing and communication loads incurred in accessing them.
  - Therefore, P2P systems, with each system acting participating equally in resource/sharing and provision improves the fault tolerance and availability.

Answer 5:

Data Replication**:** Web as partitioned data (whole Web is a DS and individual websites are partitioned among web servers) and replication.

Data Partitioning**:** NIS Network Information Service, used by computers on LAN. Each NIS server has its own replica of the password file containing a list of user's login names and encrypted passwords.

Answer 6:

Mobile code is the one that can be sent from one computer to the other. Machines may be different, and code for one application might not run on other. Example: Java Applets.
Virtual Machine: Solution for Mobile Code
VM allows the code to be executed on any particular machine. The compiler generates code for the virtual machine which in turn generates the code for the underlying hardware.

Answer 7:

One of the many possible XML

```
<Lecture Schedule>
     <BESE-14>
          <Distributed Computing>
               <Lectures>
                    <Tuesday>1</Tuesday>
                    <Friday>2</Friday>
               </Lectures>
          <Distributed Computing>
     <BESE-14>
<Lecture Schedule>
```

Part 2 (15)

Answer 8:

1. The time to execute each step of a process has known lower and upper bounds.
2. Each message transmitted over a channel is received within a known bounded time.
3. Each process has a local clock whose drift rate from real time has a known bound.

Answer 9:

Arbitrary failures are described as the worst possible failure semantics, in which
- Process/channel exhibits arbitrary behavior
- Process may return a wrong value in response to an invocation
Arbitrary Process failure
Process may omit a step/s or Perform unintended step/s
Arbitrary Communication Failure
Messages contents can be corrupted, a duplicate message can be sent or message can be lost on its way.
Technique: Communication arbitrary failures are rare and can be detected by checksum or message numbering

Answer 10:

Send-omission failures: Loss of messages between the sending process and the outgoing message buffer.

Receive-omission failures: Loss of messages between the incoming message buffer and the receiving process

Answer 11:

a)

Service A
Omission failures (lost messages, dropped messages).
No Arbitrary failures as the messages that are delivered arrive with correct contents.
No Timing Failures as the distributed system in which it is used is asynchronous, it cannot suffer from timing failures.

Service B
Arbitrary failures:
– as checksums do not apply to message bodies, message bodies can corrupted.
– duplicated messages,
Omission failures (lost messages).
Timing Failures: No, as the distributed system in which it is used is asynchronous, it cannot suffer from timing failures.

b)
Service A
It passes the integrity test, but not the validity test, therefore it cannot be called reliable.

Service B
Validity - is denied by lost messages
Integrity - is denied by corrupted messages and duplicated messages.

Answer 12.
Arbitrary Failures in Process

Answer 13:
Arbitrary Failures

Answer 14:
Latency:
Delay between start of the message's transmission from one process and the beginning of its receipt by another. Latency includes
Delay network access time: Increases significantly with increase in network load.
Operating system communication services time at both sending and receiving processes which varies with load on OS

Answer Bonus:
128 bits.
IPv5 (Search it on Google)

Mid Term Examination – Design of Distributed Systems – April, 2011