Distributed Systems: Concepts and Design

Edition 5

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Chapter 13 Exercise Solutions

13.1 Describe the advantages of the uniformity of Uniform Resource Identifiers (URIs) and Uniform Resource Locators (URLs).

13.1 Ans.

The advantage of uniformity is that it eases the process of introducing new types of identifier, as well as using existing types of identifiers in new contexts, without disrupting existing usage.

13.2 Discuss the problem associated with name services in a distributed system. How can this be solved?

13.2 Ans.

It is often required that resources managed by different services use the same naming scheme in a distributed system, but it may lead to conflict. This problem can be solved by using the name management technique.

13.3 Explain why a name space is important for a particular name service. What is the advantage of a hierarchic name space?

13.3 Ans.

A name space is the collection of all valid names recognized by a particular service. The service will attempt to look up a valid name, even though that name may prove not to correspond to any object – to be unbound. Name spaces require a syntactic definition to separate valid names from invalid names.

One important advantage of a hierarchy is that it makes large name spaces more manageable. Each part of a hierarchic name is resolved relative to a separate context of relatively small size, and the same name may be used with different meanings in different contexts, to suit different situations of use.

13.4 Describe the heterogeneity of the Distributed Computing Environment (DCE) name space. What is its cell and junction in this context? Give an example.

13.4 Ans.

The Distributed Computing Environment (DCE) name space allows heterogeneous name spaces to be embedded within it. DCE names may contain junctions, which are similar to mount points in NFS and UNIX except that they allow heterogeneous name spaces to be mounted.

For describing cell and junction, let us use an example. Consider the full DCE name */.../dcs.qmul.ac.uk/principals/Jean.Dollimore*. The first part of this name */.../dcs.qmul.ac.uk* denotes a context called a cell. The next component is a junction.

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13.5 Why does NFS employ iterative navigation in the resolution of a file name?

13.5 Ans.

NFS employs iterative navigation in the resolution of a file name, on a component-by-component basis. This is because the file service may encounter a symbolic link when resolving a name. A symbolic link must be interpreted in the client's file system name space because it may point to a file in a directory stored at another server.

13.6 Discuss the shortcomings of the original Internet naming scheme, in which all host names and addresses were held in a single central master file.

13.6 Ans.

The original Internet naming scheme suffered from three major shortcomings:

a. It did not scale to large numbers of computers.

b. Local organizations wished to administer their own naming systems.

c. A general name service was needed – not one that serves only for looking up computer addresses.

13.7 Investigate your local configuration of DNS domains and servers. You may find a program such as *nslookup* installed on UNIX systems, which enables you to carry out individual name server queries.

13.7 Ans.

Left to the reader.

13.8 Why do DNS root servers hold entries for two-level names such as *yahoo.com* and *purdue.edu*, rather than one-level names such as edu and *com*?

13.8 Ans.

First-level domain names such as *edu* and *com* refer to abstract categories of organizations and administrative units, and do not refer to any actual body. Second-level domain names such as *yhaoo.com* and *purdue.edu* are not so many in number as to need to be divided between separate *com* and *edu* servers. Such a division would bring extra complexity and overheads. Although uk etc. do have separate servers.

13.9 Which are the original top-level organizational domains in use across the Internet?

13.9 Ans.

com	–	Commercial organizations
edu	–	Universities and other educational institutions
gov	–	US governmental agencies
mil	–	US military organizations
net	–	Major network support centres
org	–	Organizations not mentioned above
int	–	International organizations

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13.10 Why might a DNS client choose recursive navigation rather than iterative navigation? What is the relevance of the recursive navigation option to concurrency within a name server?

13.10 Ans.

A DNS client may choose recursive navigation simply because it is too basic to perform iterative navigation. A server that performs recursive navigation must await a reply from another server before replying to the client. It is preferable for a server to deal with several outstanding client requests at one time rather than holding off other requests until each one is completed, so that clients are not unduly held up. The server will, in general, refer resolution to several other servers rather than just one, so client requests will be satisfied in parallel to some extent.

13.11 A DNS client is called a resolver. What is its role?

13.11 Ans.

The DNS architecture allows for recursive navigation as well as iterative navigation. The resolver specifies which type of navigation is required when contacting a name server.

13.12 GNS does not guarantee that all copies of entries in the naming database are up-to-date. How are clients of GNS likely to become aware that they have been given an out-of-date entry? Under what circumstances might it be harmful?

13.12 Ans.

Clients will become aware of the use of an out-of-date entry if a name that they have obtain is no longer a valid communication identifier (such as for example when a user's email address has changed and no forwarding address exists). This is not normally harmful, since the client can recover gracefully by making a delayed request to GNS. However, it may be harmful if the communication identifier obtained from GNS provides access to some protected resource, and the name used to obtain it should no longer be bound to that resource. For example, when a user ceases to be a member of the organisation, GNS may continue to supply information about his or her organisational role, leading users or applications to accord privileges to the user.

13.13 Discuss the potential advantages and drawbacks in the use of an X.500 directory service in place of DNS and the Internet mail delivery programs. Sketch the design of a mail delivery system for an internetwork in which all mail users and mail hosts are registered in an X.500 database.

13.13 Ans.

For access to conventional email addresses (based on Internet Domain Names), X.500 would provide a similar facilities to the DNS service. X.500 is designed to be scalable. If this is achieved in practice, then it should meet the future needs of large-scale networking better than DNS.

The main advantage of X.500 is that it is an attribute-based directory service. In principle, users could address messages to people by quoting their real names and their organisational affiliations, instead of the Domain Name based addresses currently used. The mail system would make a *search* request of X.500 to find the corresponding DNS or other network address of the user's mailbox. A drawback is that searching with a wide scope is quite slow and costly in computing resources, the scope could be limited by the use of the organisational affiliation. Several alternate mailboxes could be held in the directory server, providing fault-tolerant mail delivery.

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13.14 What features does the X.500 directory service provide over a conventional name service?

13.14 Ans.

The X.500 directory service can be used in the same way as a conventional name service, but it is primarily used to satisfy descriptive queries, designed to discover the names and attributes of other users or system resources.

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