9 - Synchronisation

Tutor version

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Question 1

The way make normally works is simple. When the programmer has finished changing all the source files, he runs make, which examines the times at which all the source and object files were last modified. If the source file input. c has time 2151 and the corresponding object file input.o has time 2150, make knows that input.c has been changed since input.o was created, and thus input.c must be recompiled. Provide an example of a clock synchronisation problem that can occur in a distributed implementation of our make routine. The student should assume that the compiler and the editor are running on two different machines.

Solution 1

if the source file input. c has time 2151 and the corresponding object file input.o has time 2150, make knows that input.c has been changed since input.o was created, and thus input.c must be re- compiled. On the other hand, if output.c has time 2144 and output.o has time 2145, no compilation is needed. Thus make goes through all the source files to find out which ones need to be recompiled and calls the compiler to recompile them.

Question 2

Define the Universal Coordinated Time UTC.

Solution 2

The second is the time it takes the cesium 133 atom to make exactly 9,192,631,770 transitions. The choice makes the atomic second equal to the mean solar second. The Atomic Time (TAl) is the mean number of ticks of the cesium 133 clocks (various around the world) since midnight on Jan. 1,1958 divided by 9,192,631,770. 86,400 TAl seconds is now about 3 msec less than a mean solar day (the mean solar day is getting longer all the time). BIR solves the problem by introducing leap seconds whenever the discrepancy between TAI and solar time grows to 800 msec (Universal Coordinated Time UTC).

Question 3

Explain how the GPS determines one's geographical position anywhere on Earth.

Solution 3

See Lecture 12 slide 13.

Question 4

Describe Lamport's logical clocks.

Solution 4

See Lecture 12 slide 22.

Question 5

Describe the Network Time Protocol and the The Berkeley Algorithm.

Solution 5

See Lecture 12 slide 15.