EECS 489 Discussion 3

Plans

- Assignment 1 is due soon
- Assignment 2 (Hard) is coming
- Quick lecture on select() and a demo
- Problem sets

Assignment 1

Due date: **09/28 2018, 11:59 PM**

Please make sure to use the repo we provide to upload your submission.
Read spec carefully for the submission instructions.

Assignment 2

- Implement a video streaming proxy server and a DNS server.
- Based on (and modified from) the last course project from CMU's Computer Networks course.
- Hard; only ~3 weeks to do it and due one day before the midterm.

Advice:
(1) Start early
(2) Work in parallel.
(3) Don't rely on the autograder to debug.

Select(): I/O Multiplexing

Allow a program to monitor multiple file descriptors, waiting until one or more of the file descriptors become "ready" for some class of I/O operation.

```
#include <sys/select.h>
int select(int nfds, fd_set *readfds, fd_set *writefds, fd_set *exceptfds, struct timeval *timeout);

void FD_SET(int fd, fd_set *set);
void FD_CLR(int fd, fd_set *set);
int FD_ISSET(int fd, fd_set *set);
void FD_ZERO(fd_set *set);
```

Select(): Sample Code Overview And DEMO

Done in class

Q1 Web Caching

Why web caching can reduce the delay in receiving a requested object? Will it reduce the delay for all objects requested by a user? What other advantage does web caching have?

- Content are cached closer to clients.
- No. Not every object can be found on cache.
- Reduce traffic on the access link to the Internet.

Q2 DNS

Suppose that your department has a local DNS server for all computers in the department. Can you determine if an external web site was likely to be accessed from a computer in your department a couple of seconds ago? Explain.

Perform two consecutive dig queries and compare the query time.

Q3 DNS

Suppose you are trying to access the page web.eecs.umich.edu/course/eecs489. Your system has been configured to use 192.168.0.2 as your local DNS server. Give the list of name servers queried in the correct order.

Assume:

- No caching and recursive name resolution in all name servers
- Root name server is also responsible for the zone of the .edu domain
- .umich.edu and .eecs.umich.edu are in a separate zone of their own
- .eecs.umich.edu name server is authoritative for all hostnames ending in .eecs.umich.edu

Q4 DASH

Consider a DASH system for which there are N video versions (at different rates and qualities) and N audio versions. Suppose we want to allow the player to choose at any time any of the N video versions and any of the N audio versions. Consider the following:

If we create files so that the audio is mixed in with the video, so server sends only one media stream at given time, how many files will the server need to store (each a different URL)? N * N

If the server instead sends the audio and video streams separately and has the client synchronize the streams, how many files will the server need to store? N + N

Q5 HTTP Streaming

Consider a simple HTTP streaming model. B denotes the size of the client's application buffer, and Q denotes the number of bits that must be buffered before the client application begins playout. Also r denotes the video consumption rate. Assume that the server sends bits at a constant rate x whenever the client buffer is not full. Also assume that $x < r$.

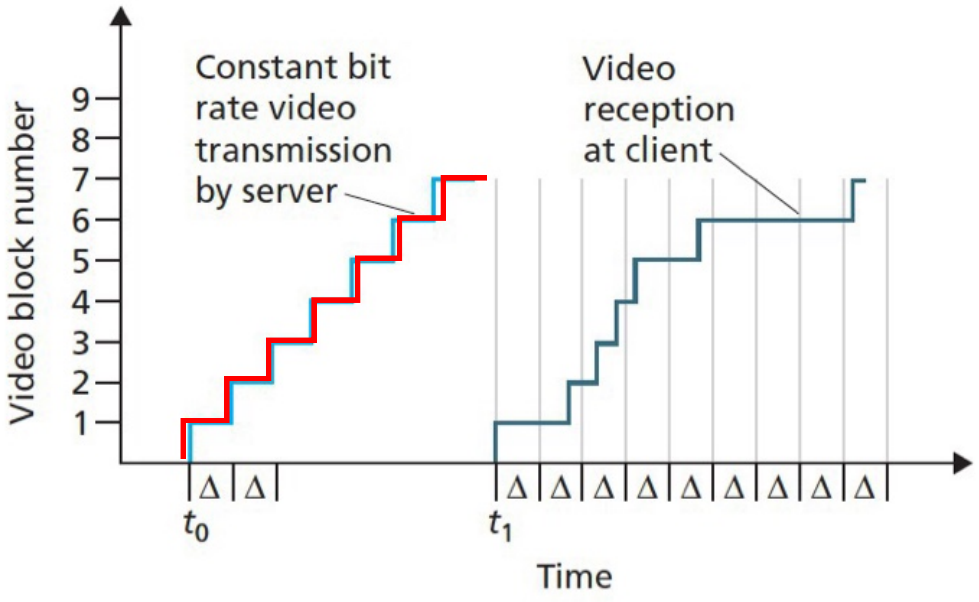
Describe the behavior of the video output. Alternate between playout and freeze.

Suppose the buffer starts out empty. How long will it be before the video can begin playout? Q/x

Assume the current buffer size is α $(> Q)$. How long will the playout last?

$a/(r-x)$

Q6 Video Streaming



Suppose a video is encoded at a fixed bit rate, and thus each video block contains video frames that are to be played out over the same fixed amount of time, Δ. The server transmits the first video block at t_0, the second block at $t_0 + \Delta$, and so on. Once the client begins playout, each block should be played out Δ time units after the previous block. Consider the following:

Suppose the client starts playing the video at $t_1 + \Delta$. In the figure, how many blocks of video will have arrived in time for correct playout? 6

What is the smallest playout delay at the client, such that every video block has arrived in time for playout? $\sim 2\Delta$