Fall 2004 Embedded Systems

실험 5. Network Programming with Socket

1. Purpose

Understand how to program a typical network program using sockets.

2. Hardware connection

User I/O (keyboard and display) -- PC -- Serial/USB/Ethernet connections -- Embedded board.

3. Problem 5

"A simple home server program"

Design and implement a simple home server program to control the following remotely:

Lamp (1 to 4) on (or off)

Rice-cooker hour min

; Rice-cooker should be on at time hour:min and should operate for 10 min.

Status

; Returns all status. For example,

"Time 13:49 Lamp 1 on, lamp 2 off, lamp 3 on, lamp 4 off, rice-cooker on".

4. Scenario

EZ-X5 board program should perform as a simple home server, and the PC should act as a client (user connecting to the home server).

The scenario is as follows:

1) A user, sitting in front of the PC, types a command "c[onnect]" in order to connect to the home server. The "[]" part means optional. So, you can type simply as "c". Even the input of "cut" will be passed to the server, and the server should understand as "c". The client PC passes the command to the home server, EZ-X5 board, which makes a connection to the client.
2) The user types the password, which should be "p[assword] embedded". For correct password, the home server says "Correct password". For incorrect password, the home server says "Wrong password". Further actions for the correct password and incorrect password are not required.
3) When the user types "s[tatus]", the home server responds with the status information of four lamps and rice-cooker as follows, for example:
   "Time 19:49 Lamp 1 on, lamp 2 off, lamp 3 on, lamp 4 off, rice-cooker on".
4) When the user types "l[amp] n on", the server should turn on the lamp numbered n, and says "Lamp n is on".
5) When the user types "l[amp] n off", the server should turn off the lamp numbered n, and says "Lamp n is off".
6) When the user types "r[ice-cooker] 19 50", the server should turn on the rice cooker at time 19:50, and says "Rice-cooker will turn on at 19:50". You may use

system("date") to get the current time, or simply increase 1 min for each command input.

7) For other commands (except d[isconnect]), the server should say "Wrong command".
8) Commands in Steps 3 to 7 can be repeated as many times as you wish.
9) When the user types "d[isconnect]", the home server closes the connection, and waits for the next connection. Hence, the home server never ends.

5. Hints

- EZ-X5 board 용 homeserver.c program 과 PC 용 homeclient.c program 을 작성하여야 한다.
- Use the stream socket for Ethernet communication between PC and EZ-X5 board.
- Refer to "Socket programming How To" in the Web:
  www.ecst.csuohio.edu/~beej/Beej's Guide to Network Programming.
- The user commands and the home server's reply can be null-terminated ASCII strings.
- The client program can simply sends the user command string to the home server, and display the home-server's response string to the user.

6. Program 작성 순서

1) 먼저 위의 algorithm 을 작성하기 위하여 server 와 client 가 하나로 합쳐진 형태의 algorithm.c program 을 작성한다. 사용자의 입력은 getchar(), server 출력은 printf 로 대체하여 작성하고, algorithm flow 를 test 하여 확정한다.
2) Beej's guide 에 있는 server.c program 과 client.c program 을 둘 다 PC 에서 native-compile 하여 test 한다. 한 window 에서는 server 를 수행하고, 다른 window 에서는 client program 을 수행하여 test 한다.
3) Server.c program 을 EZ-X5 board 용으로 cross-compile 하여 EZ-X5 board 에서 수행하고, PC 에서는 client program 을 compile 하고 수행하여 test 한다.
4) 위에서 작성한 algorithm 과 server program 을 참고하여 HomeServer.c program 을 작성하고, client program 을 참고하여 HomeClient program 을 작성하여, PC 에서 2)번과 동일한 방법으로 native-compile 하여 test 한다.
5) HomeServer.c 를 EZ-X5 board 용으로 cross-compile 하여 3)번과 동일한 방법으로 test 한다. 이 결과만을 조교에게 demonstration 한다.
6) Looks complicated? But remember: Step by step, one goes far.

7. Demonstration & Report

Demonstration: To TA, 11/22 Mon. 4 PM - 6 PM
Report: To TA, Due 11/25 Thu. 6 PM

Each student should prepare his own report containing:
- Purpose
- Experiment sequence
- Experimental results
- Discussion: should be different even for each member of the same team.
- References

GOOD LUCK!