Project2: RWG System

NP TA 其璜

5/1 23:55

Project 2 Deadline

Demo: 5/4 Sat.

RWG - Remote Working Ground

- Chat-like system
- Provide all functions in **project 1**
- New functions
  - **User pipe**
  - **who - get information of all users**
  - **name - rename**
  - **tell - send message to someone**
  - **yell - broadcast message**

3 Servers

- np_simple (Single user)
  - **Project 1**
  - **Concurrent connection-oriented**
- np_single_proc (Multiple users)
  - **Project 1** + **User pipe** + **4 functions** + **Broadcast message**
  - **Single-process concurrent**
- np_multi_proc (Multiple users)
  - **Project 1** + **User pipe** + **4 functions** + **Broadcast message**
  - **Concurrent connection-oriented** + **FIFO** + **Shared memory**
  - FIFO: User pipe
  - Shared memory: Broadcast message, client information

Project 2: Submission

- Create a directory named as your student ID, put all files into the directory.
- You must provide Makefile. Three executable files named **np_simple** (server 1), **np_single_proc** (server 2), **np_multi_proc** (server 3) should be produced after typing make command.
- You are **NOT** allow to demo if we are unable to compile your project with a single make command.
- Upload **only your code and Makefile**. DO NOT upload anything else (e.g. **np_simple**, noop, removetag, test.html, **.git**, **__MACOSX**)
- zip the directory and upload the .zip file to e3 platform

ATTENTION! We only accept .zip format

Project 2: Demo

- 5/4 Sat. 9:30 ~ 18:20.
- We will announce demo slots 2 ~ 3 days before.
- Tasks:
  - Correct format and compile.
  - QA.
  - Pass np-basic test cases.
  - Pass np-hard test cases.
  - Implement 1 extra function with limit time.

Project 2: Info

- You are **HIGHLY** encouraged to publish your questions on Project2 討論區
  - Check the spec and other questions first.
- You can contact TAs by e3. (Mails sent to other addresses will NOT be replied)
- TA hours (Tuesday: 15:00 ~ 17:00) on **4/2**, **4/9**, **4/23** will be held at online.
- You **MUST** make a reservation by email in advance.
- TAs will **NOT** debug for you.

Scenario

Server 1

```
bash$ telnet nplinux1.cs.nctu.edu.tw 7001
% ls | cat
bin test.html
% ls |1
% cat
bin test.html
% exit
bash$
```

Server 2, 3

- Chat-like system
- Provide all functions in **project 1**
- New functions
  - **Login/Logout message**
  - **who - get information of all users**
  - **name - rename**
  - **tell - send message to someone**
  - **yell - broadcast message**
  - **User pipe**

Login/Logout message

When a user login, broadcast as follows:

```
*** User '<user name>' entered from <IP>:<port>. ***
```

When a user logout, broadcast as follows:

```
*** User '<user name>' left. ***
```

Example:

```
[terminal of all users]
*** User '(no name)' entered from 140.113.215.63:1013. *** # user logins
*** User '(no name)' left. *** # user logouts
```

who - Get Information of All Users

```
% who
<ID>     <nickname>  <IP:port>    <indicate me>
1    IamStudent    140.113.215.62:1201 <-me
2    (no name)    140.113.215.63:1013
3    student3     140.113.215.62:1201
```

name - Rename

```
[terminal of mine]
% name Mike
*** User from 140.113.215.62:1201 is named 'Mike'. ***
%
```

```
[terminal of all other users]

% *** User from 140.113.215.62:1201 is named 'Mike'. ***
```

If Mike is on-line, and I want to change name to Mike, this name change will fail.

Fail

```
[terminal of mine]
%  name Mike
*** User 'Mike' already exists. ***
%
```

tell - Send Message to Someone

Assume my name is 'IamStudent'.

```
[terminal of mine]
% tell 3 Hello World.
%
```

If user 3 exists,

```
[terminal of user id 3]
% *** IamStudent told you ***: Hello World.
```

If user 3 doesn't exist,

Fail

```
[terminal of mine]
% tell 3 Hello World.
*** Error: user #3 does not exist yet. ***
%
```

yell - Broadcast Message

Assume my name is 'IamStudent'.

```
[terminal of mine]
% yell Good morning everyone.
*** IamStudent yelled ***: Good morning everyone.
%
```

```
[terminal of all other users]
% *** IamStudent yelled ***: Good morning everyone.
```

User Pipe

student1 (#1) pipes a command into student2(#2) via a pipe #1->#2.

```
user1 login
user2 login
% cat test.html >2
*** student1 (#1) just piped 'cat test.html >2' to student2 (#2) ***
% cat test.html >2
*** Error: the pipe #1->#2 already exists. ***
```

---

student2(#2) can receive from the pipe #1->#2.

```
% cat <1
*** student2 (#2) just received from student1 (#1) by 'cat <1' ***
...some output... # message from pipe #1->#2.
% cat <1
*** Error: the pipe #1->#2 does not exist yet. ***
% cat <3
*** Error: user #3 does not exist yet. ***
```

Implementation

3 Servers

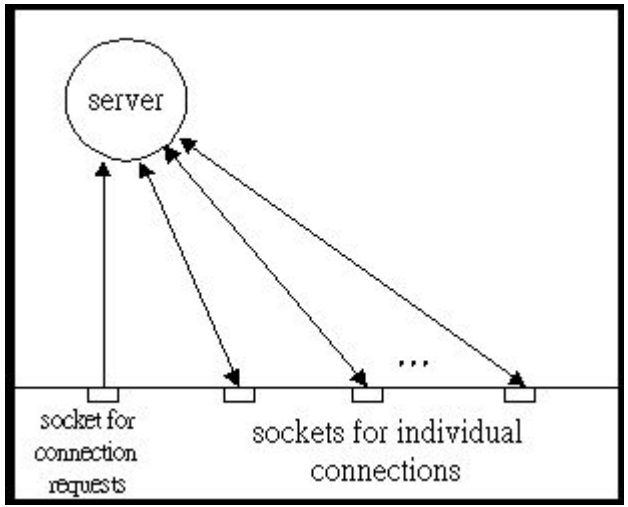
- np_simple (Single user)
  - **Project 1**
  - **Concurrent connection-oriented**
- np_single_proc (Multiple users)
  - **Project 1** + **User pipe** + **4 functions** + **Broadcast message**
  - **Single-process concurrent**
- np_multi_proc (Multiple users)
  - **Project 1** + **User pipe** + **4 functions** + **Broadcast message**
  - **Concurrent connection-oriented** + **FIFO** + **Shared memory**
  - FIFO: User pipe
  - Shared memory: Broadcast message, client information

Difference between Server2 and Server3

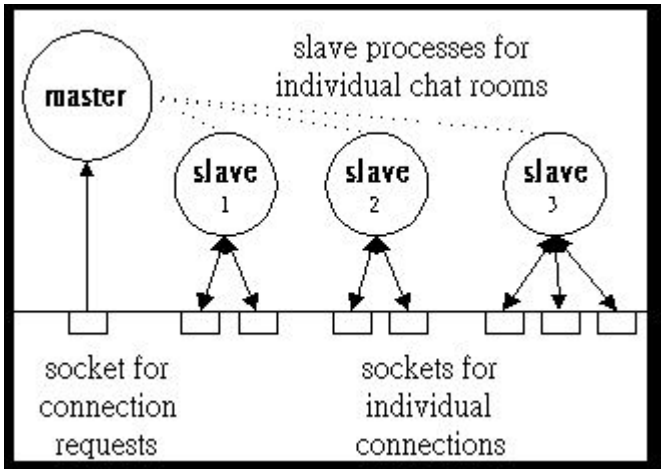
- Server2 (np_single_proc)
  - **Single-process concurrent**
  - Use **pipe** to implement user pipe
  - Use socket to send messages directory
- Server3 (np_multi_proc)
  - **Concurrent connection-oriented**
  - Use **FIFO** to implement user pipe
  - Use **shared memory** to save **clients infos** and **messages**

Client-server Model

Single-process concurrent

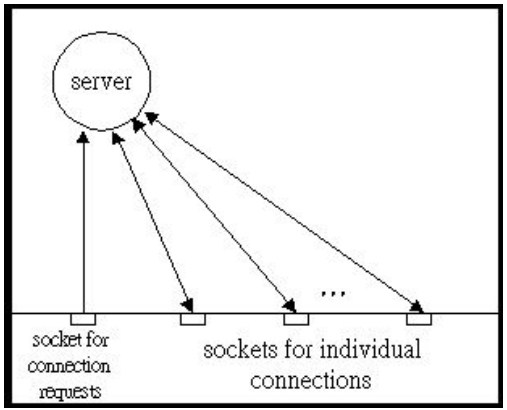


Concurrent connection-oriented

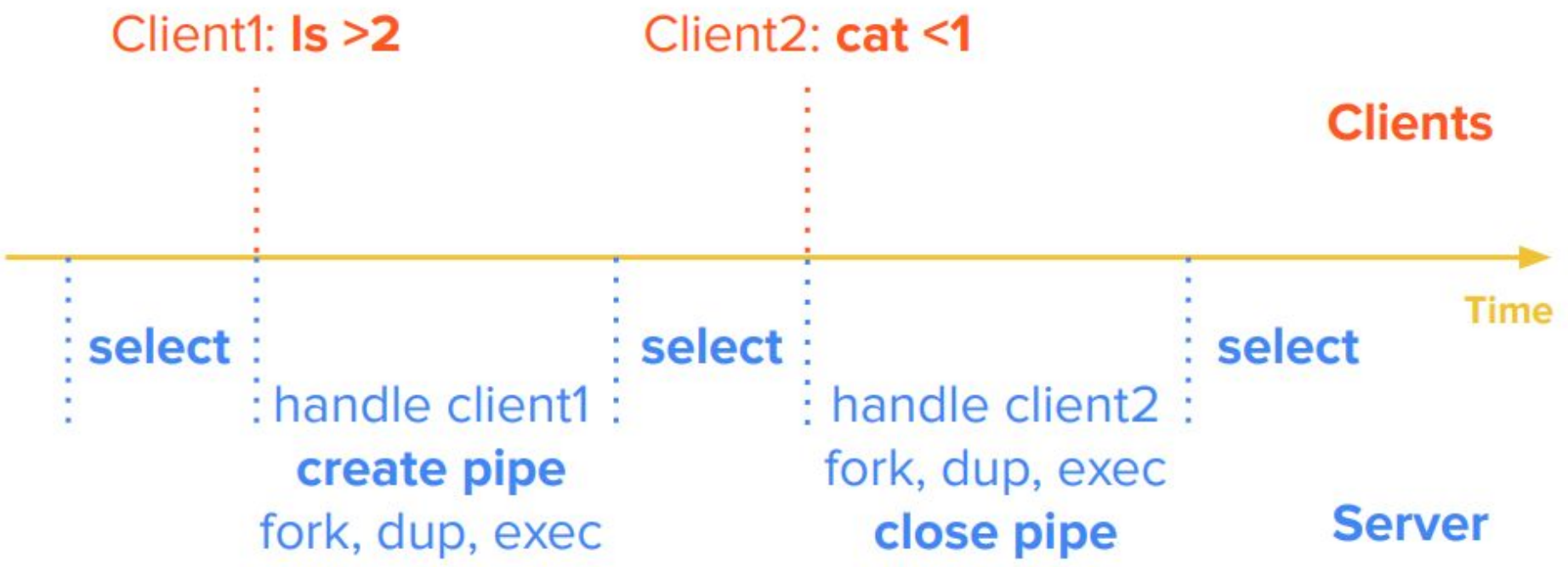


Server2 (np_single_proc)

- **Single-process concurrent** (use **select**)
- Use **pipe** to implement user pipe
  - **DO NOT** use FIFO or temporary files
- Use socket to send messages directly
- Maintain environment variables for every user



Server2 (np_single_proc) - User Pipe

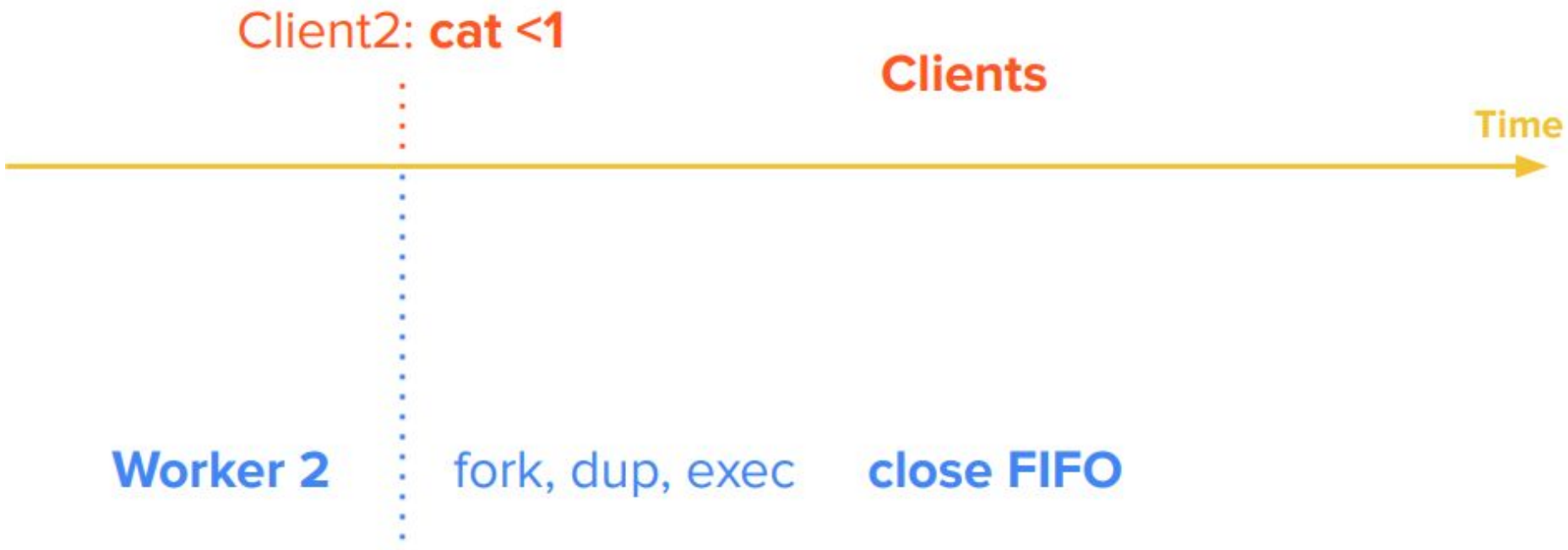


Server3 (np_multi_proc)

- **Concurrent connection-oriented**
- Use **FIFO** to implement user pipe
- Use **shared memory** to save clients infos and messages
- Handle signal
- Server3 will be terminated by SIGINT (Ctrl-C)
  - Receive SIGINT ➡ Clean up shared memory ➡ exit

Server3 (np_multi_proc) - User Pipe send

Server3 (np_multi_proc) - User Pipe recv



User Pipe Detail

- Pipe **stdout** only
- Whole command line should be printed in broadcast message

[termianl of user1]
% cat test.html | removetag0 >2
*** user1 (#1) just piped 'cat test.html | removetag0 >2' to user2 (#2)
Error: illegal tag "!test.html" // error message from removetag0
%
[terminal of user2]
% cat <1
Test ...
%

User Pipe - Error Handling

- When user pipe error, each command should still be executed
  - Some command prints something itself
  - Prevent stuck when pipe large file

```
% cat test.html | removetag0 >999
*** Error: user #999 does not exist yet. ***
Error: illegal tag “!test.html”          // error message from removetag0
% Pikachu <999                          // Pikachu prints input message and Pika!Pika!
*** Error: user #999 does not exist yet. ***
Pika!Pika!
% cat LargeFile | cat | cat >999
*** Error: user #999 does not exist yet. ***
```

User Pipe - Error Handling

% cat <2 | Pikachu

pipe(#2->#1)

% cat LargeFile >2

pipe(#1->#2)

% cat <999 | Pikachu // user pipe error

% cat LargeFile >999 // user pipe error

User Pipe - Error Handling

- Redirect stdin/stdout to **/dev/null**
  - stdin: EOF
  - stdout: dump everything

% cat <999 | Pikachu // user pipe error

% cat LargeFile >999 // user pipe error

Issues

Handle Function Failures !!

- **Fork** may failed (Project 1)
- **Create pipe** may failed (Project 1)
- **Select** may failed
- **Read** may failed

Select May Failed

```
if (select(maxfd + 1, &read_set, NULL, NULL, NULL) < 0) {
    // may be interrupted by signal or other errors
    // handle error
}
for (fd = 0; fd < maxfd; ++fd) {
    if (FD_ISSET(fd, &read_set)){
        //handle fd
    }
}
```

Read May Failed

```
if (read(cli_fd, buf, BUF_SIZE) < 0) {
    // may be interrupted by signal or other errors
    // handle error
}
```

Remember to set the flag

You should set flag **SO_REUSEADDR** in server socket.
Hint: use function setsocketopt

Q&A