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2024년 1학기 **시스템프로그래밍실습** 10주차

FTP2-3

System Software Laboratory
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Contents

- **Requirements**
  - Socket
  - Command Conversion
  - Concurrent Server
  - Signal Process
  - Etc
  - Sample Result

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Schedule

- 1주 ➔ Basic Socket Programming (with *ls*)
- 2주 ➔ fork() and Signal Processing
- 3주 ➔ Concurrent Server, Q & A

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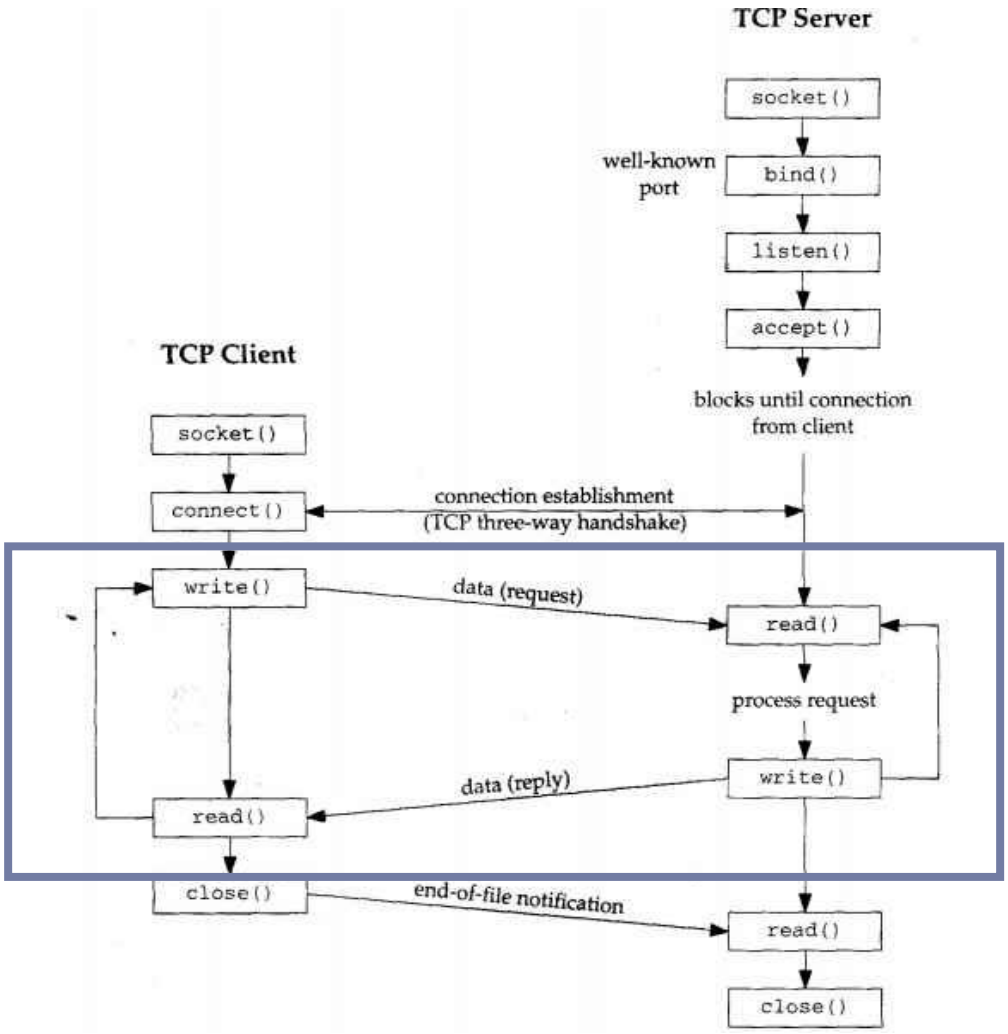
Requirement – Socket (1/4)

- **Assignment #1 + Socket algorithm**
  - Assignment 1 combined socket algorithm.
  - Simulate socket algorithm
    - Server : socket(), bind(), listen(), accept()
    - Client : socket(), connect()

Requirement – Socket (2/4)



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Requirement – Socket (3/4)

- **Server side**
  - When client connects, display client IP address , port number and child process ID
  - Display client's commands.
  - Check the FTP command and execute
  - Pass the result of execution to the client
  - Check error state.

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Requirement – Socket (4/4)

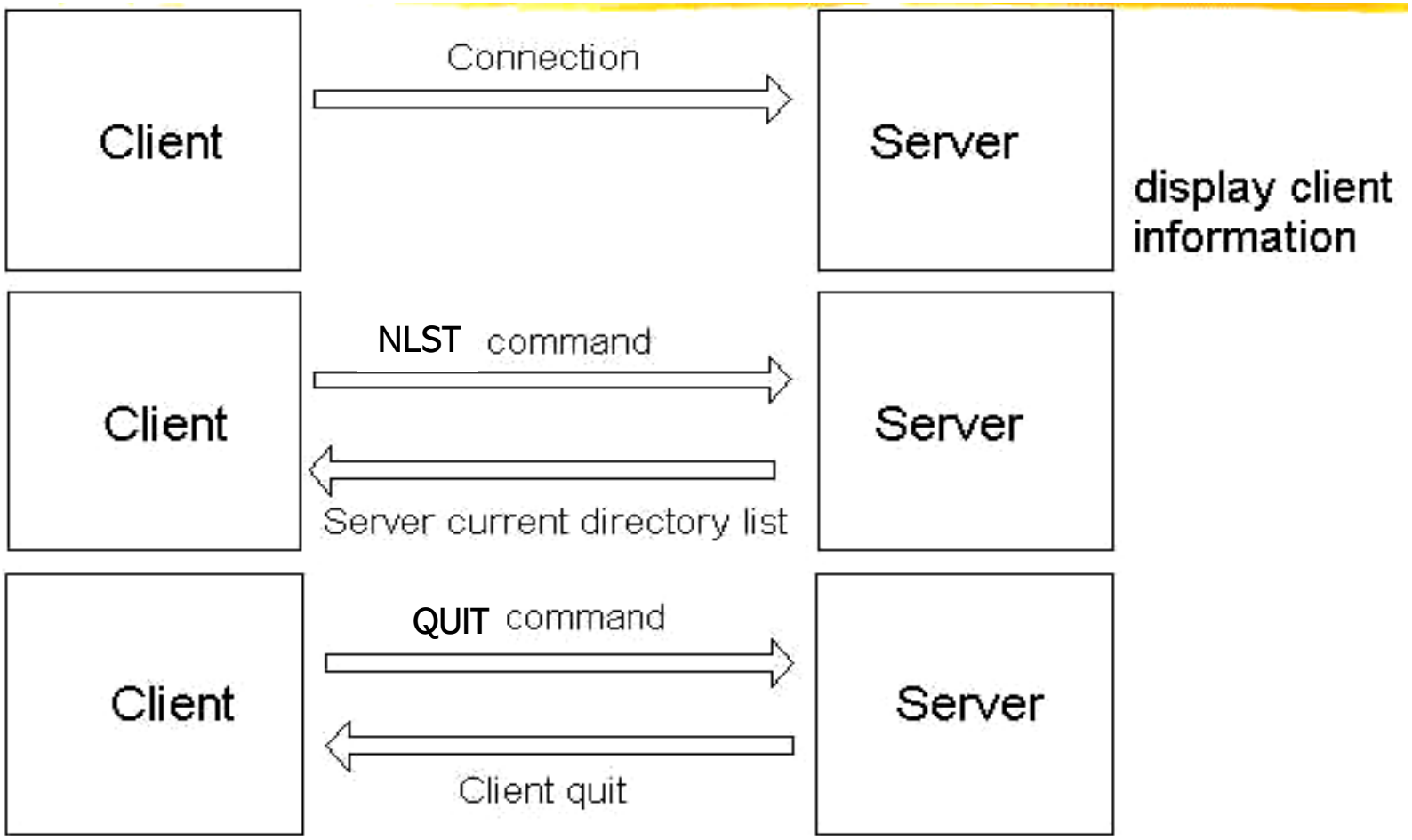
- **Client side**
  - Connect to server.
  - Convert user command to FTP command.
  - When User command is quit, convert QUIT, and quit.
  - When User push ctrl+c(SIGINT), convert QUIT, and quit.
  - Check error state.

Requirement – Command Conversion (1/2)

- **Command conversion**
  - Client side.
  - command
    - ls
    - pwd
    - dir
    - cd
    - mkdir
    - delete
    - rmdir
    - rename
    - quit
  - user command will show up in server with executed child pid
    - Ex)

```
cli[2883]
 > ls
cli        cli.c      srv        srv.c      xxxx.pdf
srv
 > NLST                [2883]
```

Requirement – Command Conversion (2/2)



Requirement – Concurrent Server (1/3)

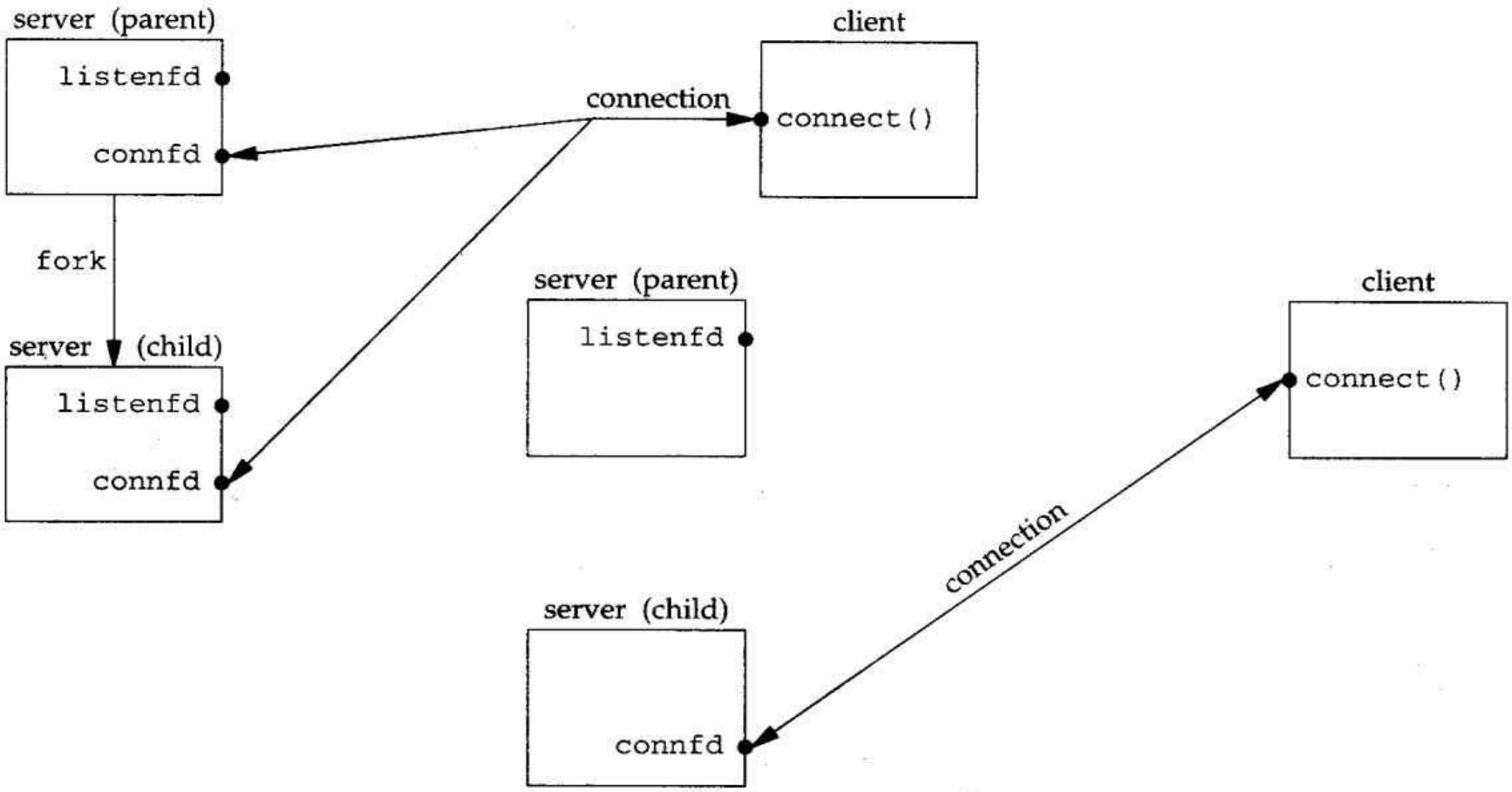
- **Concurrent Server – using fork()**

```
#include <sys/types.h>
#include <unistd.h>

pid_t fork(void);
```

- **The only way in Unix to create a new process, called once but returns twice.**
- **Returns**
  - The return value in the child is 0
  - The return value in the parent is the process ID of the new child
  - The return value on error is -1

Requirement – Concurrent Server (2/3)



Requirement – Concurrent Server (3/3)

```
pid_t pid;
int listenfd, connfd;
listenfd = socket(,,,);
bind(listenfd, ..);
listen(listenfd, LISTENQ);
for( ; ; ) {
  connfd = Accept(listenfd, ,,, );
  if( ( pid = fork() ) == 0) {
       close(listenfd);
       # 반복해서 client에서 socket를 전달받으며 해당하는
         command를 execute
       close(connfd);
       exit(0);
  }
  close(connfd);
}
```

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Requirement – Signal Process

- **Signal process**

```
#include <signal.h>
void (*signal(int signo, void(*func) (int) ));
Returns : SIG_ERR if error
```

- **Use SIGCHLD, SIGALRM, SIGINT**

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Requirement – Etc

- **다중접속 허용 & 시그널 처리**
  - 접속 직후, child process 의 PID 출력
  - 10초 간격으로 현재 child process 의 개수와 process들의 정보를 출력
    - Process 정보 – PID, Port번호(client의 Port number), 서비스 타임(접속직후 카운트)
    - 단, 새로운 client 가 접속할 경우, 출력과 동시에 10초 interval은 그 순간부터 다시 카운트
  - Client 프로그램 종료 시
    - Client side
      - QUIT 명령어 또는 ctrl+c를 통해 종료 후, 서버에게 QUIT를 통해 알림
    - Server side
      - QUIT 메시지를 받을 경우 해당 client와 연결된 child process 종료
      - 해당 process PID를 출력
      - 해당 Process의 정보는 10초마다 출력되는 process들의 정보에서 반드시 제외
      - 해당 Process에 대한 종료 format 출력
  - Server 프로그램 종료
    - Ctrl + c 로 종료.
    - Server 프로그램 종료 시, 아래 동작을 수행하는 SIGINT Handler가 동작해야 함.
      - 모든 client의 연결 종료
      - 모든 child process 종료

Requirement – Sample Result