Digital

High Performance Web Server

Powered By DaoCloud

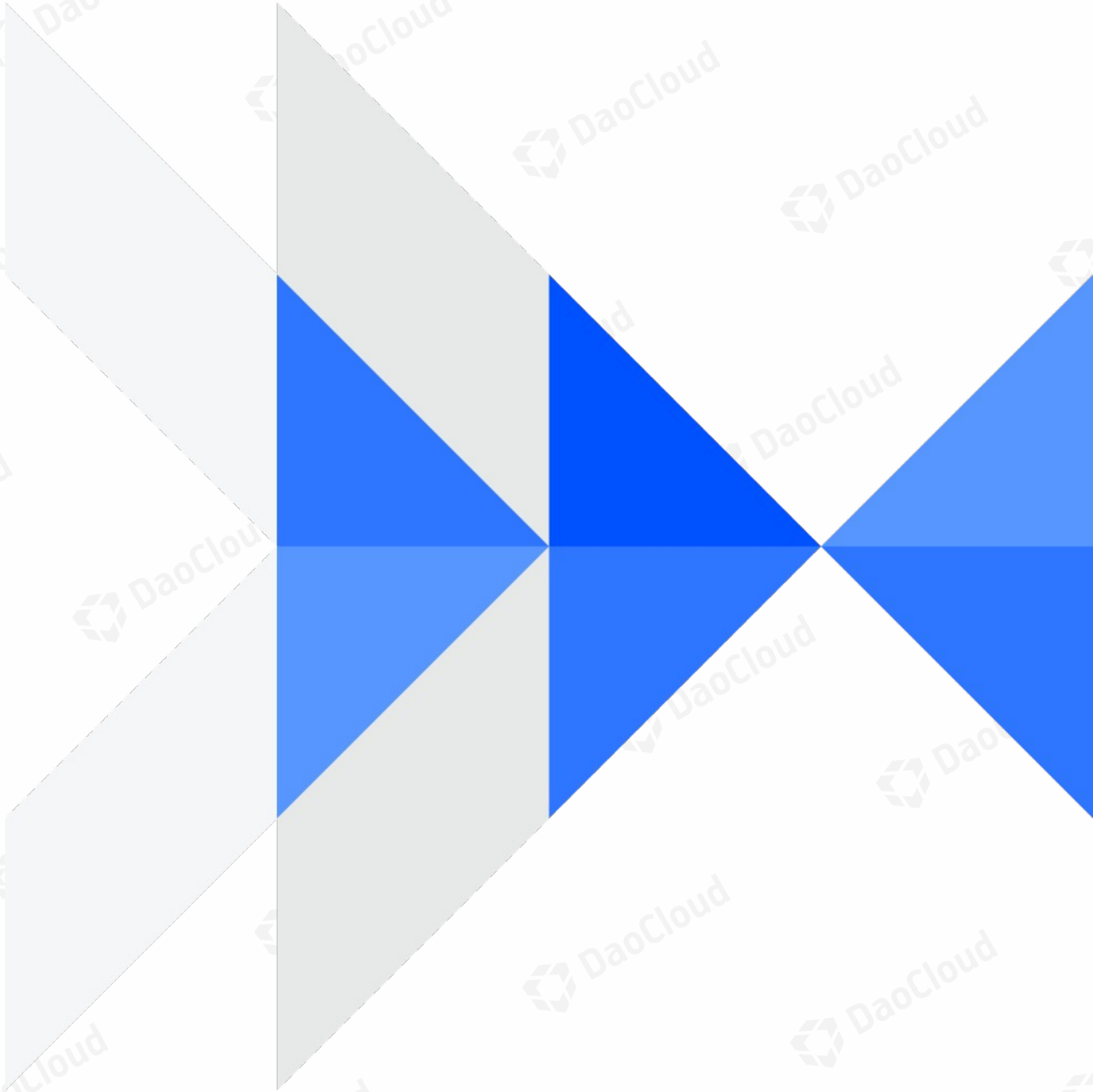
版权声明

本文件 / 视频中含有的信息为上海道客网络科技有限公司（简称“道客”）专有的，且为保密信息，如果泄漏可能会给提供相同服务的竞争对手带来实质的好处。本材料中含有对战略规划、咨询方案、创意思路、架构设计、技术蓝图、文字和照片素材、案例、方法论，（概念的描述是通过道客的实质性的研究和开发的努力所获得的）。因此，在未经道客事先书面认可的情况下，本文件 / 视频的任何部分都不得被复制或者传递。道客将对非法复制或传递者保留采用法律手段追究的权利。

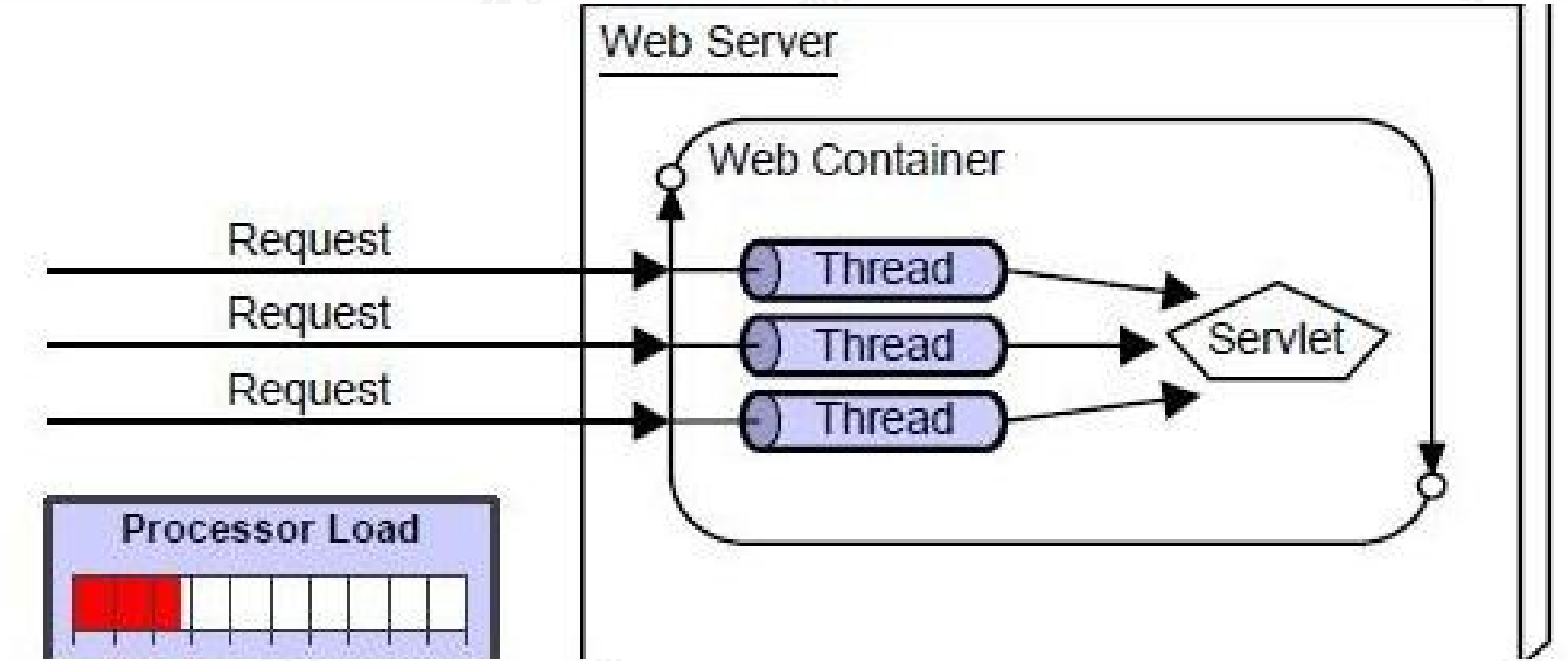
COPYRIGHT NOTICE

The information contained in this document / video is proprietary to Shanghai DaoCloud Network Technology Co.,Ltd. (DaoCloud). This information is confidential and if it is leaked, it will bring substantial benefits to the competitors who provide the same service. This material contains strategic planning, consulting solutions, creative ideas, architectural design, technical blueprints, text and photo materials, cases, and methodology. Therefore, no part of this specification may be reproduced in any form or by any means, without prior written consent of DaoCloud. DaoCloud reserves all legal rights against illegal copying or delivery.

Chapter 1:
Who Blocking Me!

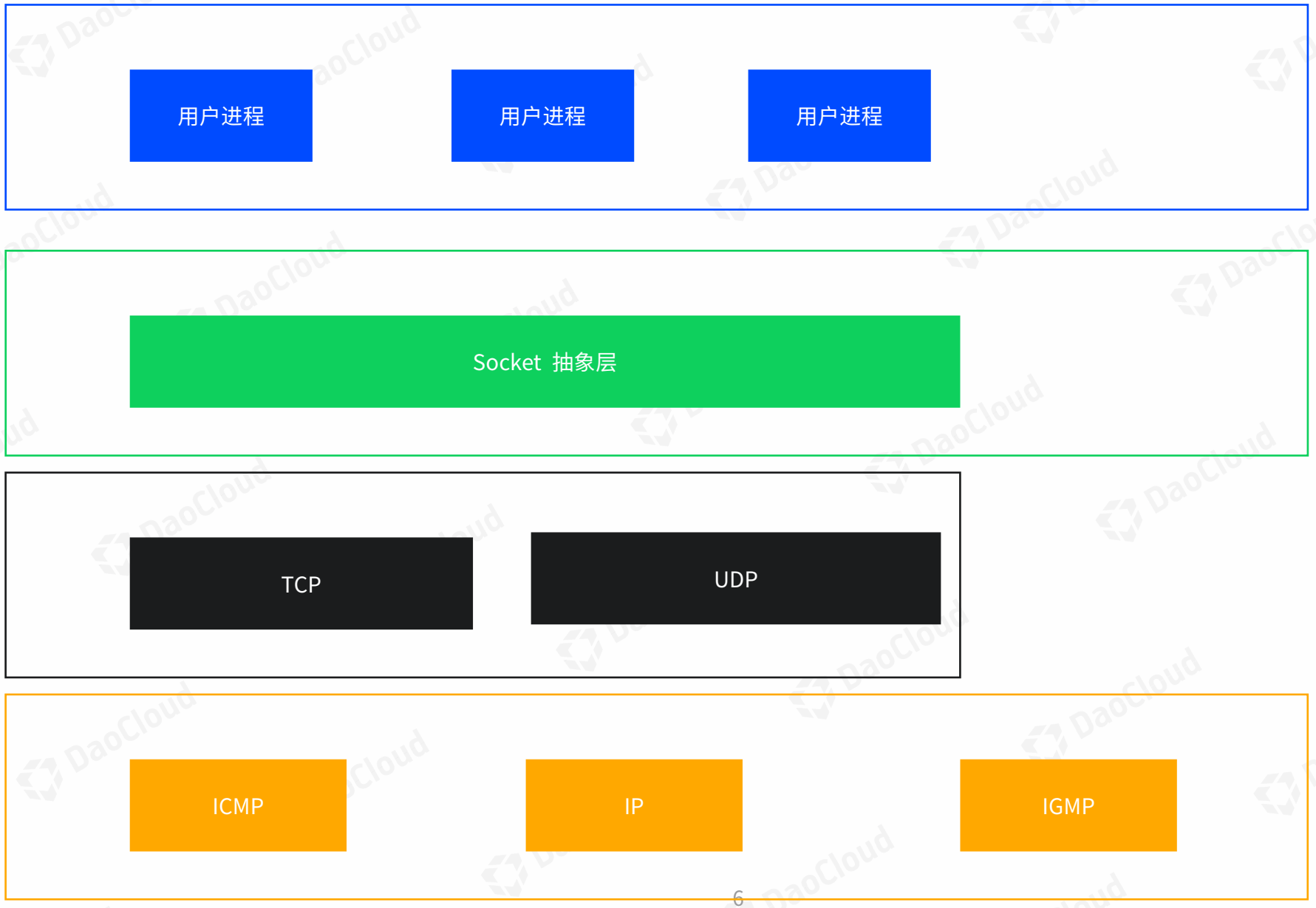


传统 Application Web Server

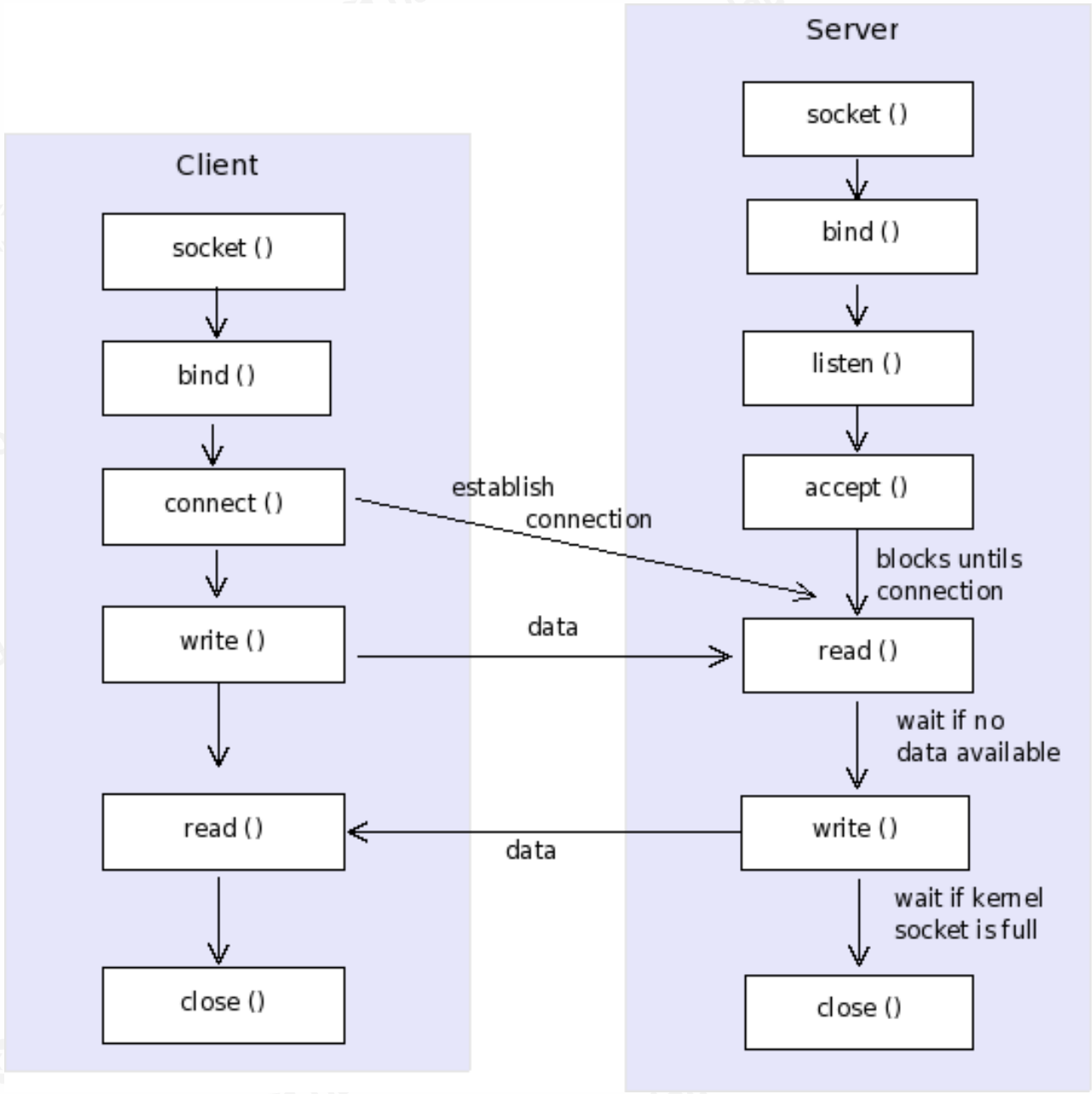


TOMCAT <= 7

Socket！



Socket!


Client
socket ()
bind ()
connect ()
write ()
read ()
close ()
Server
socket ()
bind ()
listen ()
accept ()
read ()
write ()
close ()
establish connection
blocks untils connection
data
wait if no data available
data
wait if kernel socket is full

Echo example

```
int main()
{

    listen_fd = socket(AF_INET, SOCK_STREAM, 0);
    bind(listen_fd, (struct sockaddr *) &servaddr, sizeof(servaddr));
    listen(listen_fd, 10);
    comm_fd = accept(listen_fd, (struct sockaddr*) NULL, NULL);

    while(1)
    {
        read(comm_fd,str,100); //   重点 1
        printf("Echoing back - %s",str);
        write(comm_fd, str, strlen(str)+1); //  重点 2
    }
}
```

Read() Def

NAME

read - read from a file descriptor

SYNOPSIS

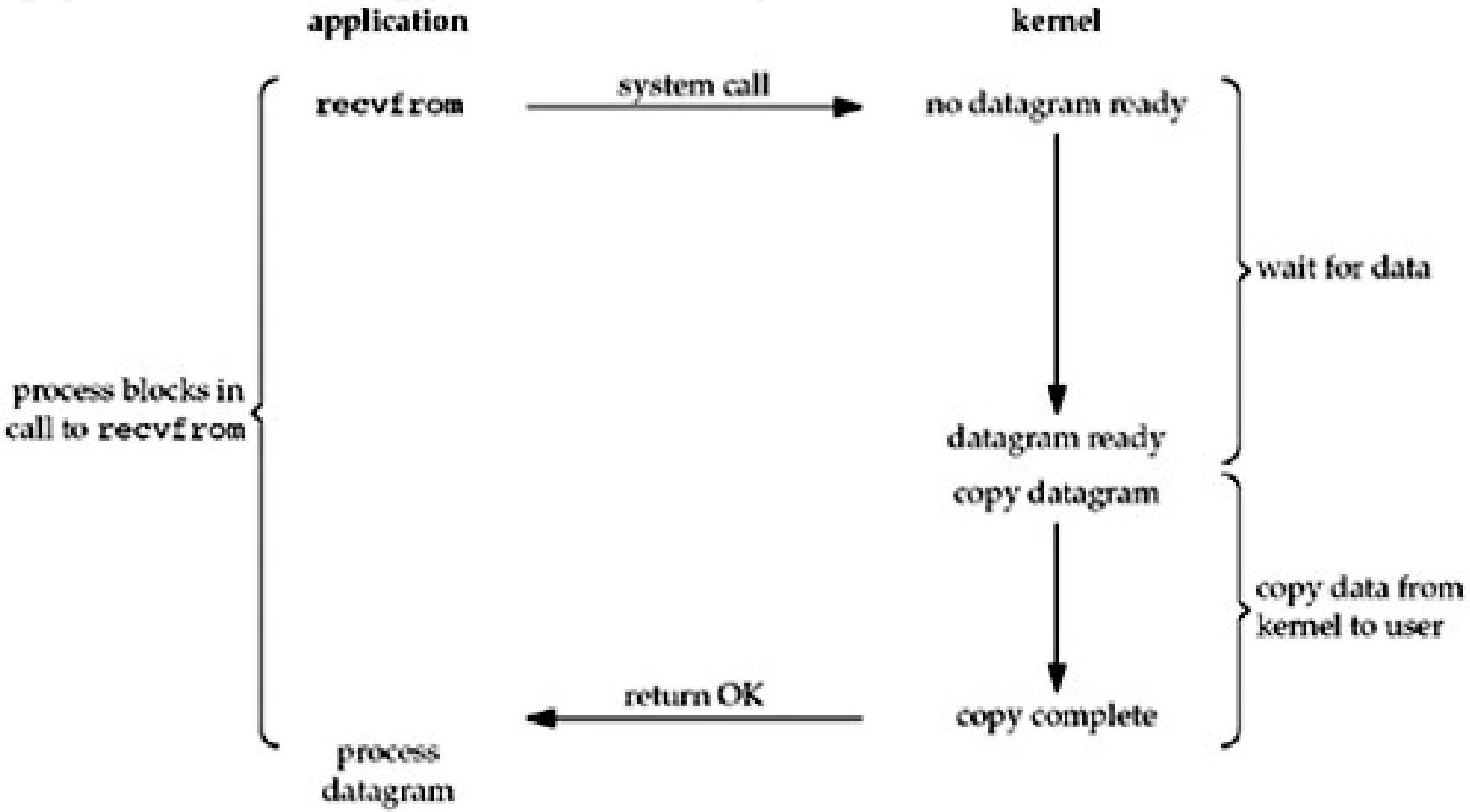
#include <unistd.h> ssize_t read(int *fd*, void **buf*, size_t *count*);

ERRORS

EAGAIN The file descriptor *fd* refers to a file other than a socket and has been marke nonblocking (**O_NONBLOCK**), and the read would block. See open(2) for fur er etai on he **O_NONBLOCK** flag.

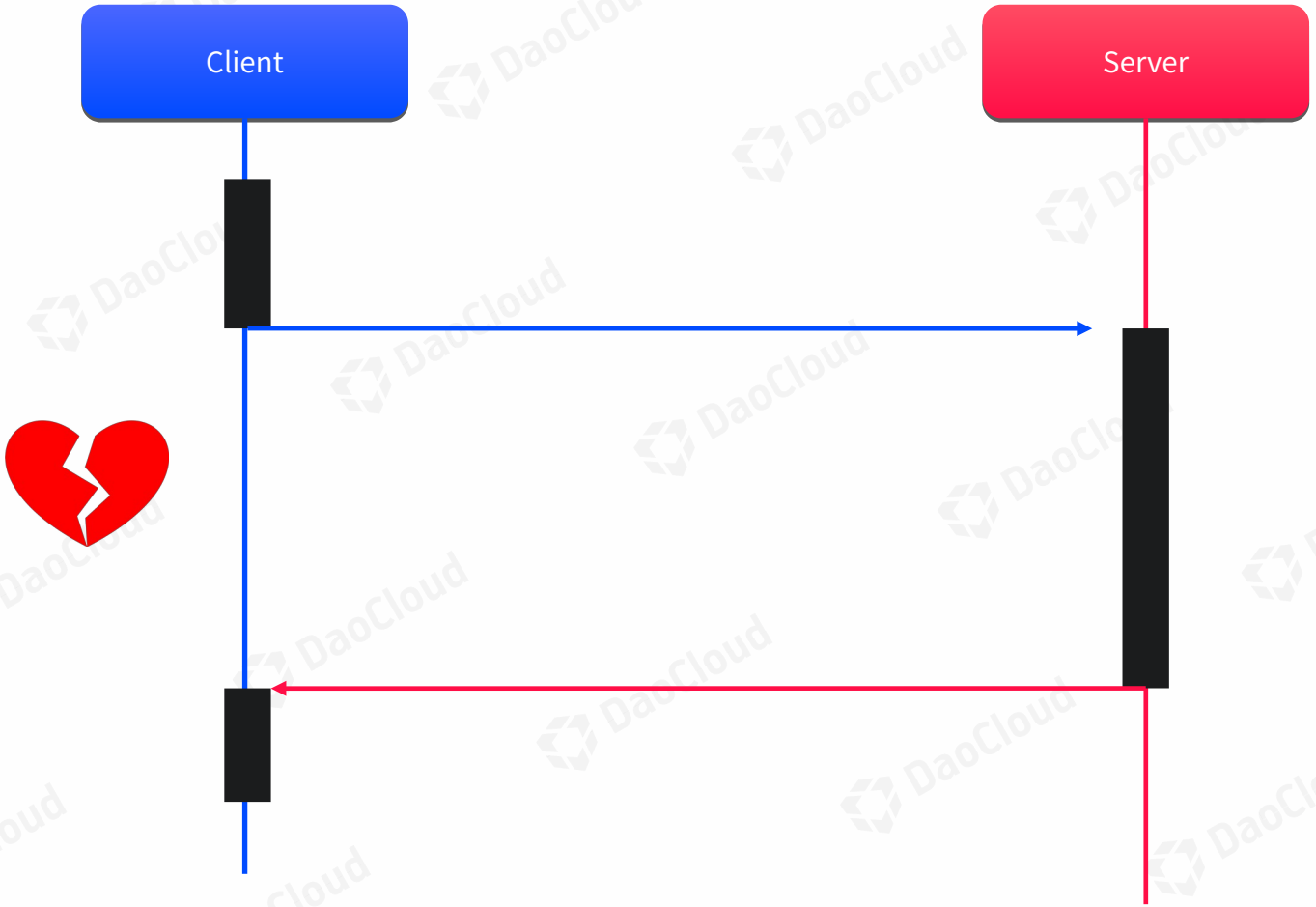
Blocking

IO Model

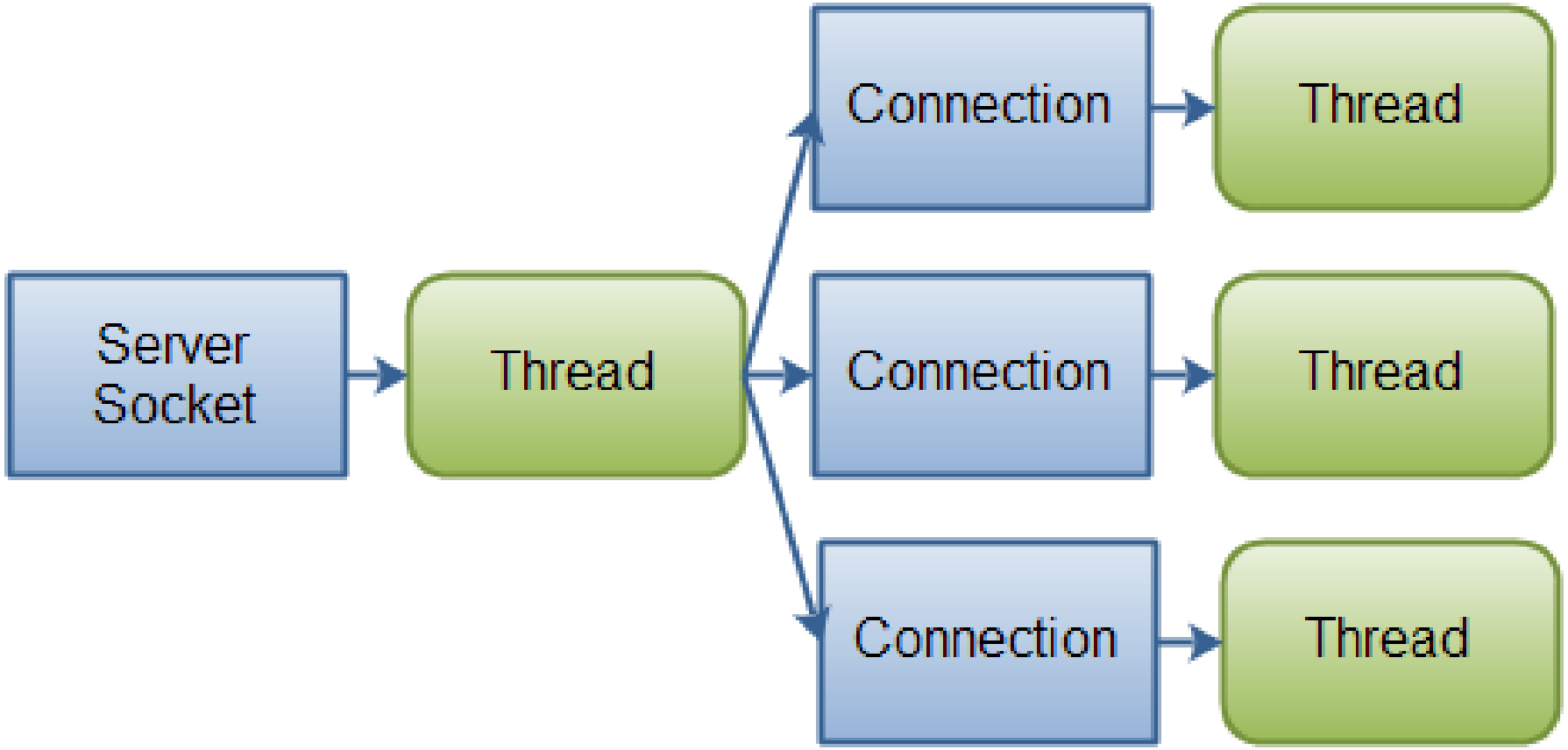


Blocking I/O model.

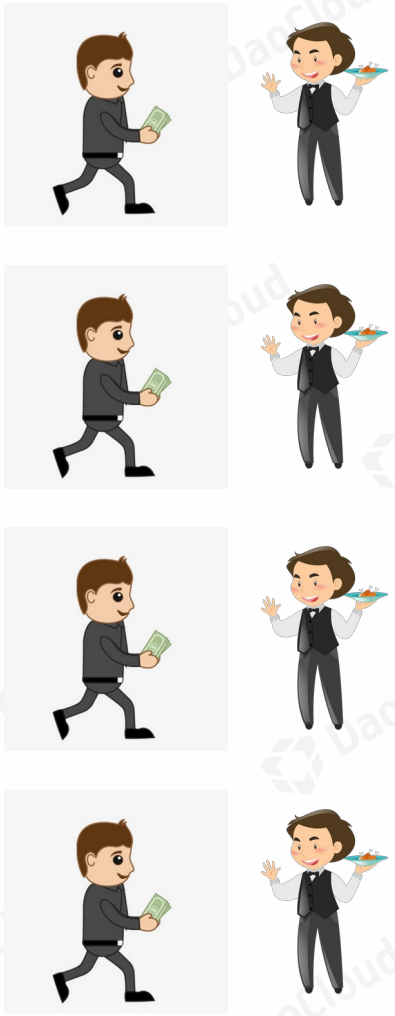
Wait & Response



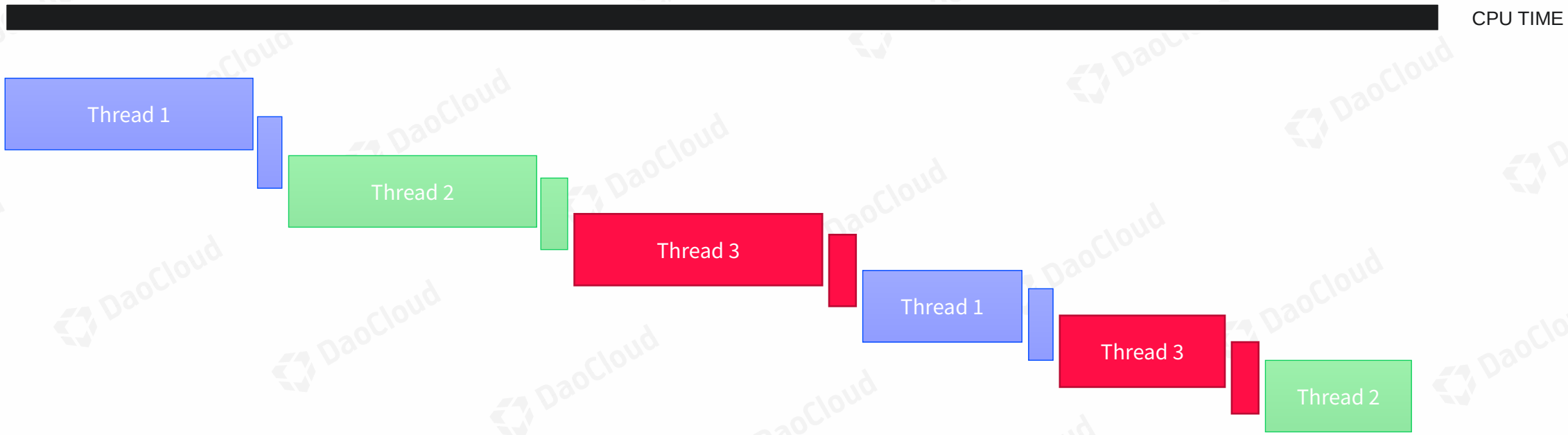
BIocking Threading Model



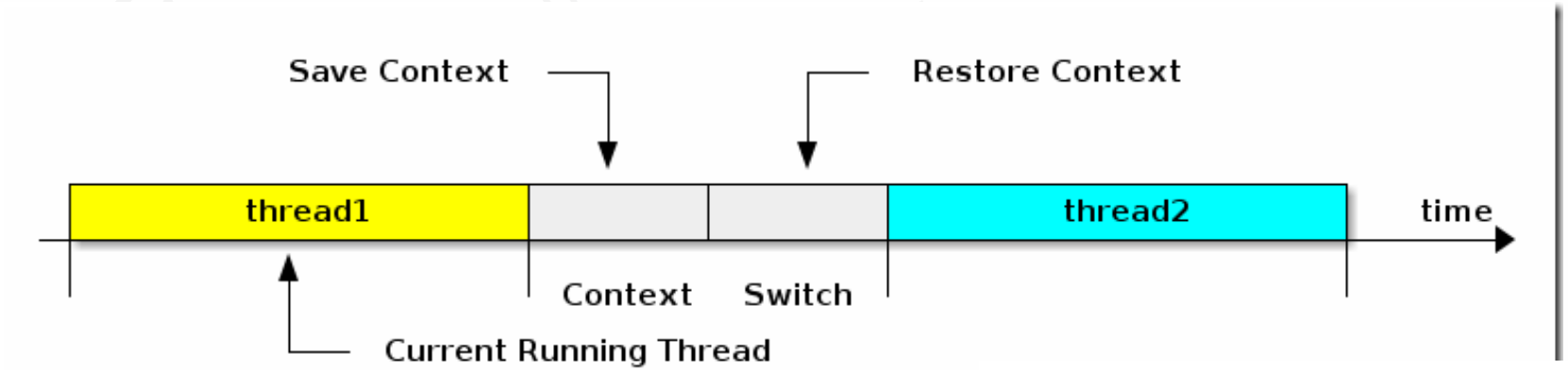
高阶比喻



Blocking is Wasted



Threading Context Switch



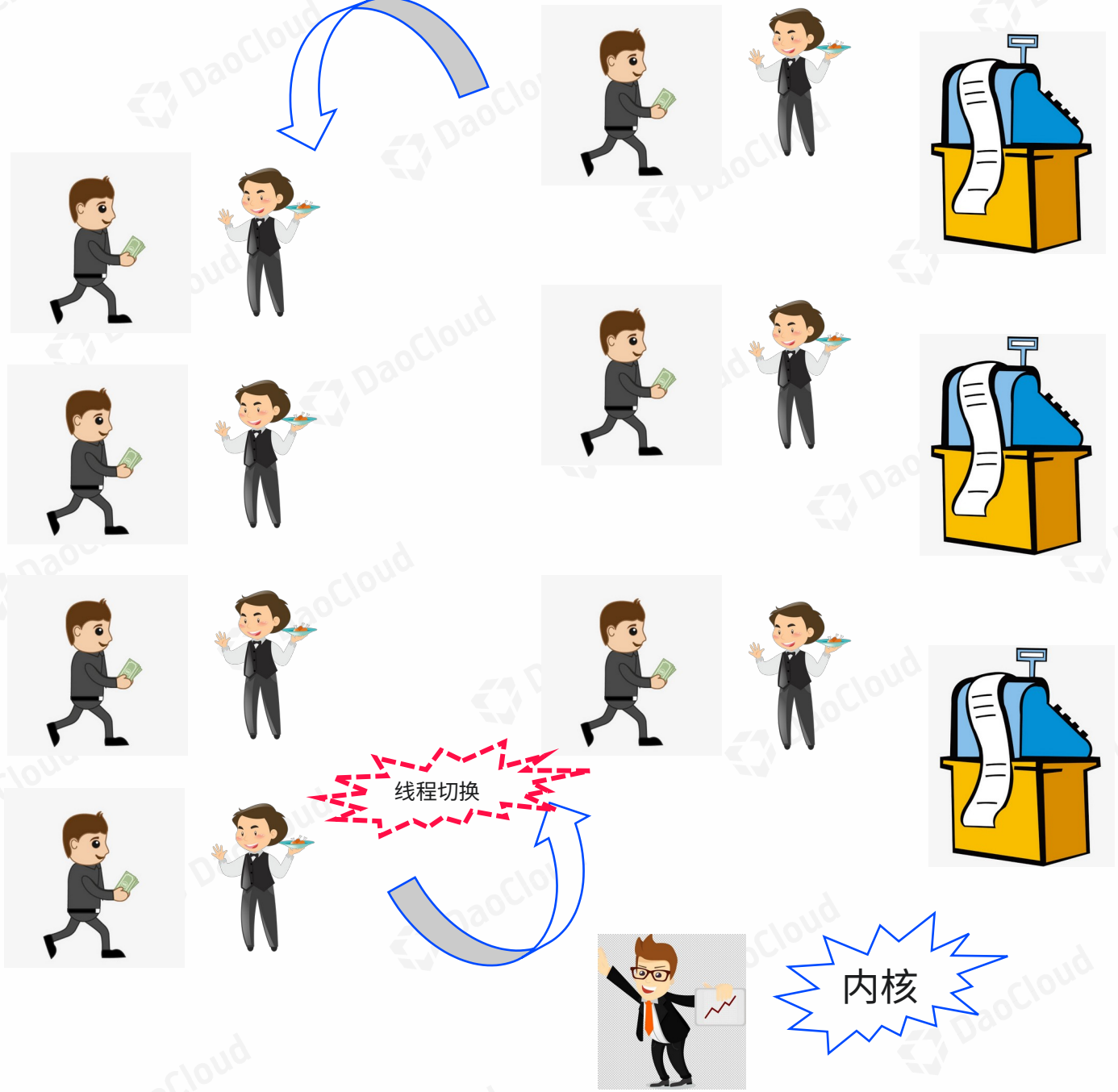
Switch Not Free

高阶比喻

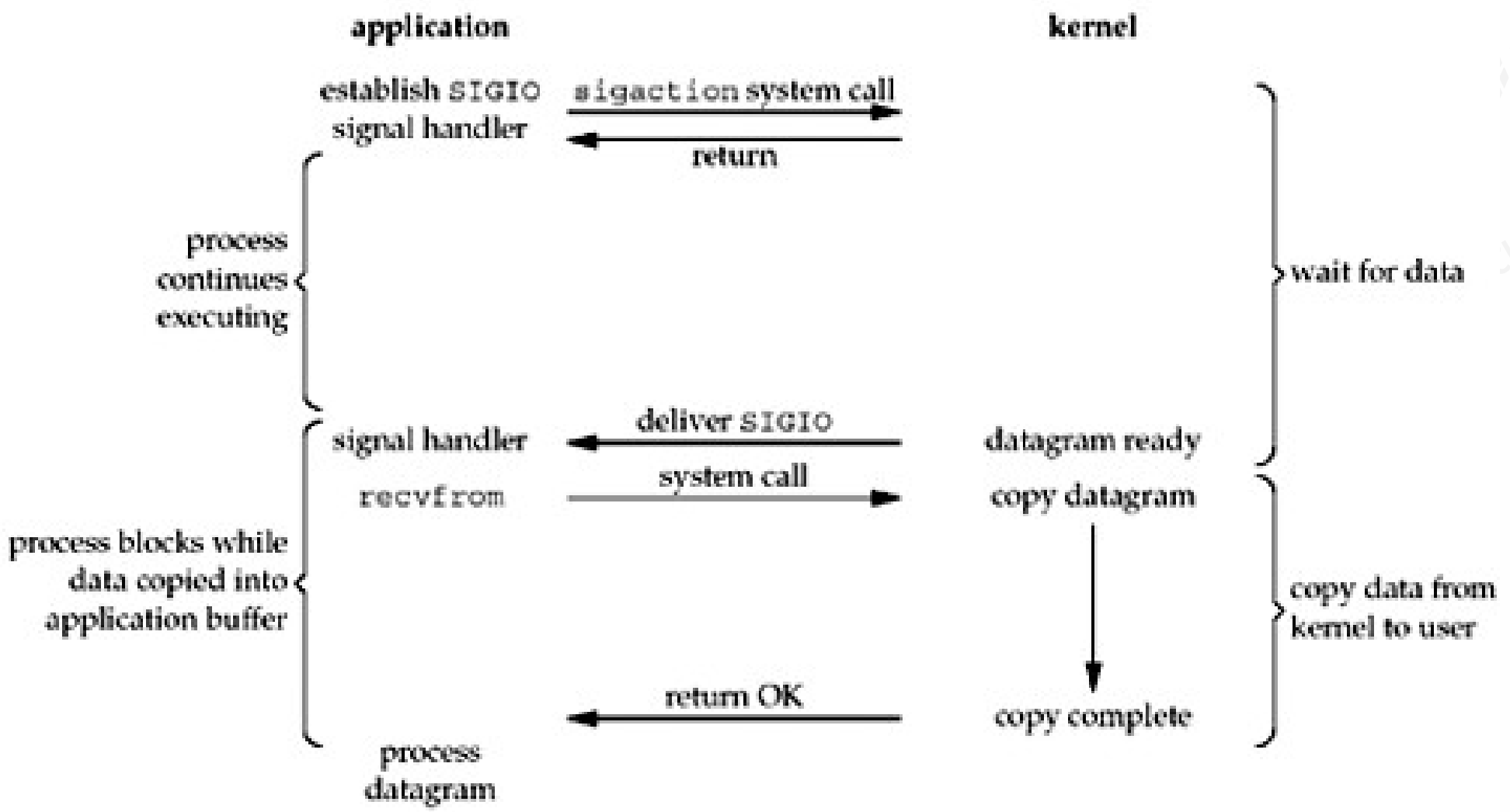
所有还在犹豫点单的先去
旁边凉快下

高阶比喻

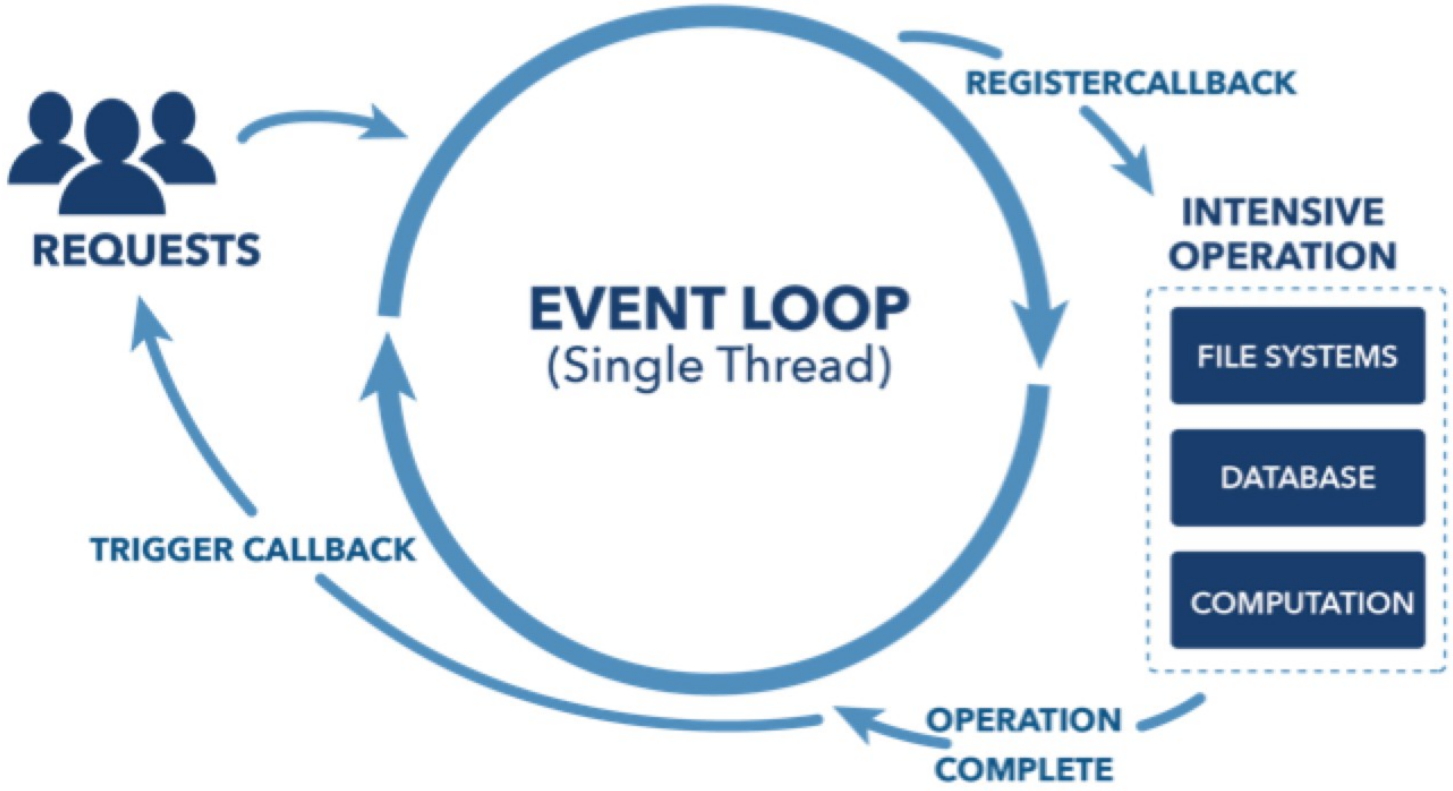
看看有没有其他人想好了先下单



I/O muliplexing model



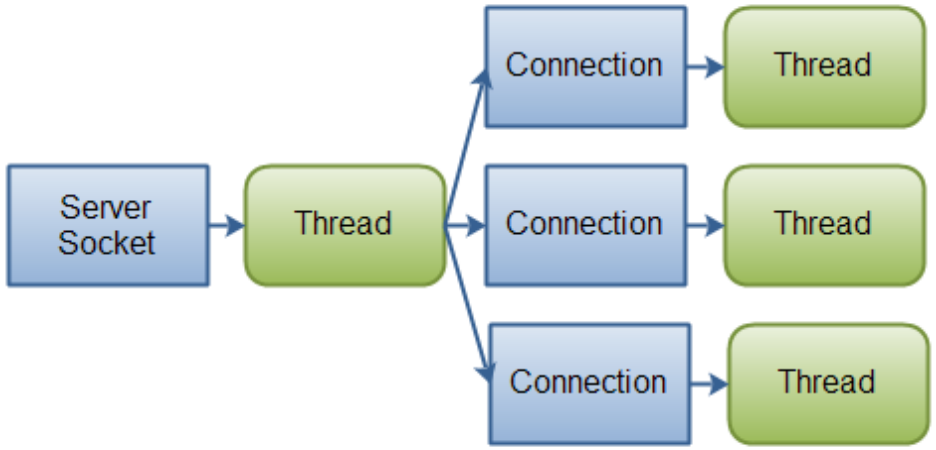
NonBlocking

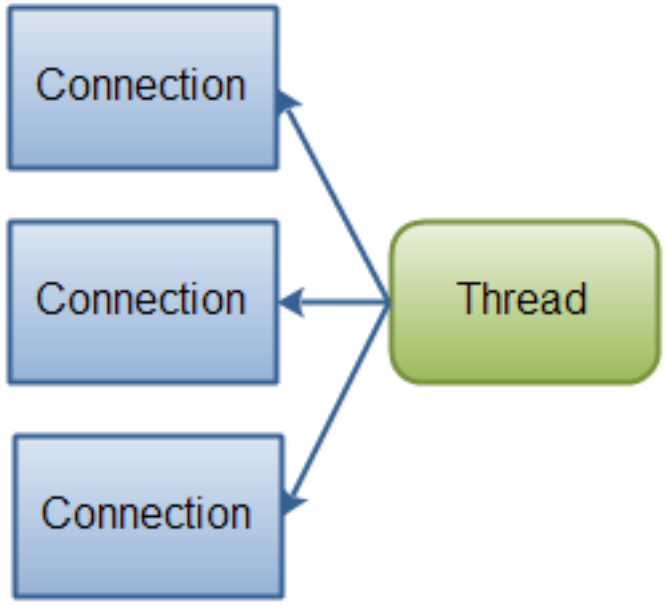


Epoll

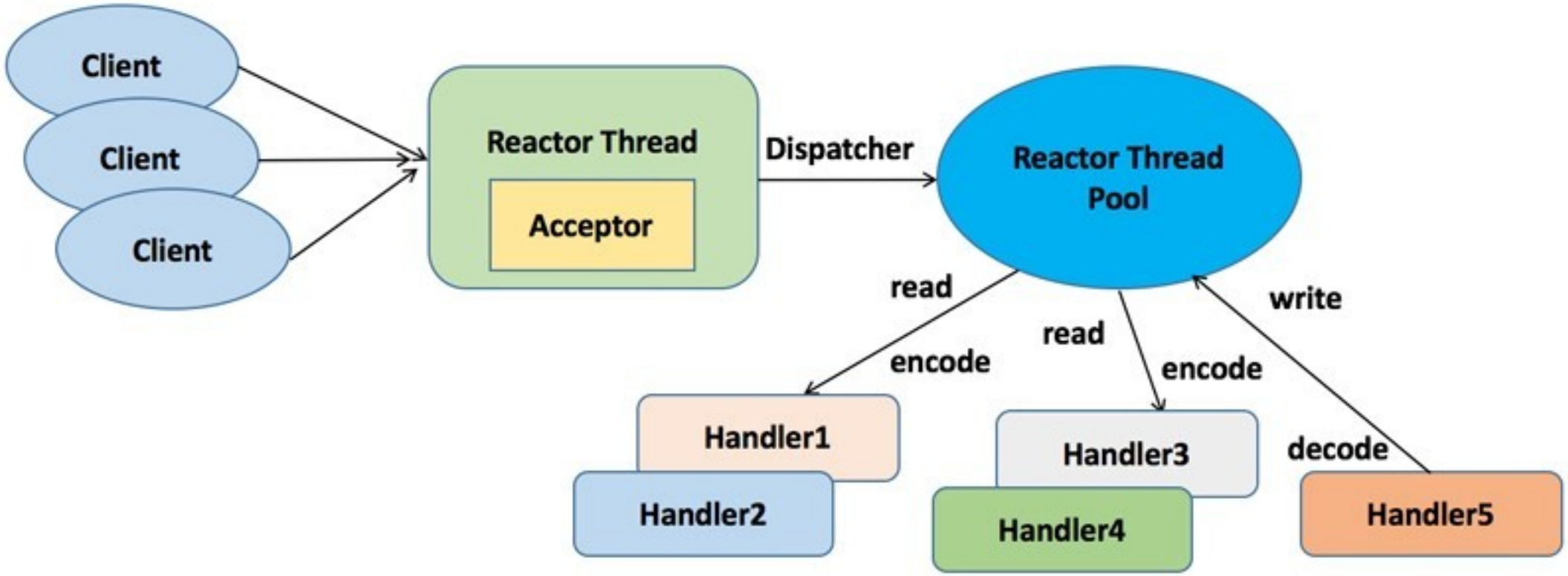
```
void server_run(){
    bind(listen_sock, (struct sockaddr *)&srv_addr, sizeof(srv_addr));
    setnonblocking(listen_sock);
    listen(listen_sock, MAX_CONN);
    epfd = epoll_create(1);
    epoll_ctl_add(epfd, listen_sock, EPOLLIN | EPOLLOUT | EPOLLET);
    for (;;) {
        nfds = epoll_wait(epfd, events, MAX_EVENTS, -1); //epoll_wait is blocking
        for (i = 0; i < nfds; i++) {
            if (events[i].data.fd == listen_sock) {
                conn_sock = accept(listen_sock,(struct sockaddr *)&cli_addr,&socklen);
                setnonblocking(conn_sock);
                epoll_ctl_add(epfd, conn_sock,EPOLLIN | EPOLLET | EPOLLRDHUP |EPOLLHUP);
            } else if (events[i].events & EPOLLIN) {
                for (;;) {
                    bzero(buf, sizeof(buf));
                    n = read(events[i].data.fd, buf,
                        sizeof(buf));
                    printf("[+] data: %s\n", buf);
                    write(events[i].data.fd, buf,strlen(buf));
                }
            }
        }
    }
}
```

Threading mode switch

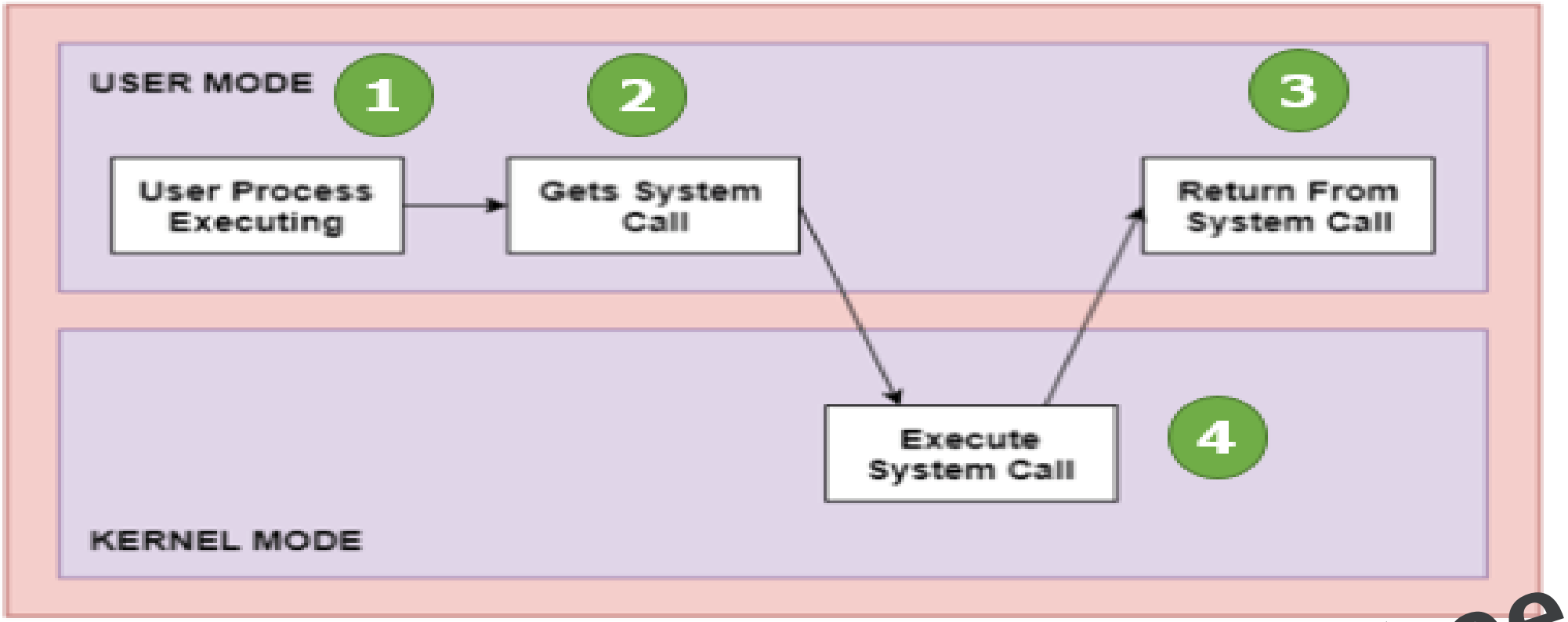




Netty


Client
Client
Client
Reactor Thread
Acceptor
Dispatcher
Reactor Thread Pool
read
encode
read
encode
write
decode
Handler1
Handler2
Handler3
Handler4
Handler5

用户态 & 内核态



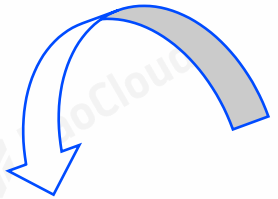
由于需要限制不同的程序之间的访问能力，防止他们获取别的程序的内存数据，或者获取外围设备的数据，并发送到网络，CPU 划分出两个权限等级 -- 用户态和内核态。

Switch Not Free x 2

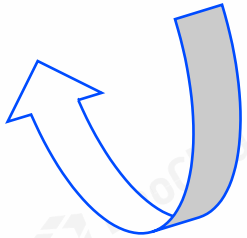
高阶比喻

提交
订单

用户态
-> 内核态

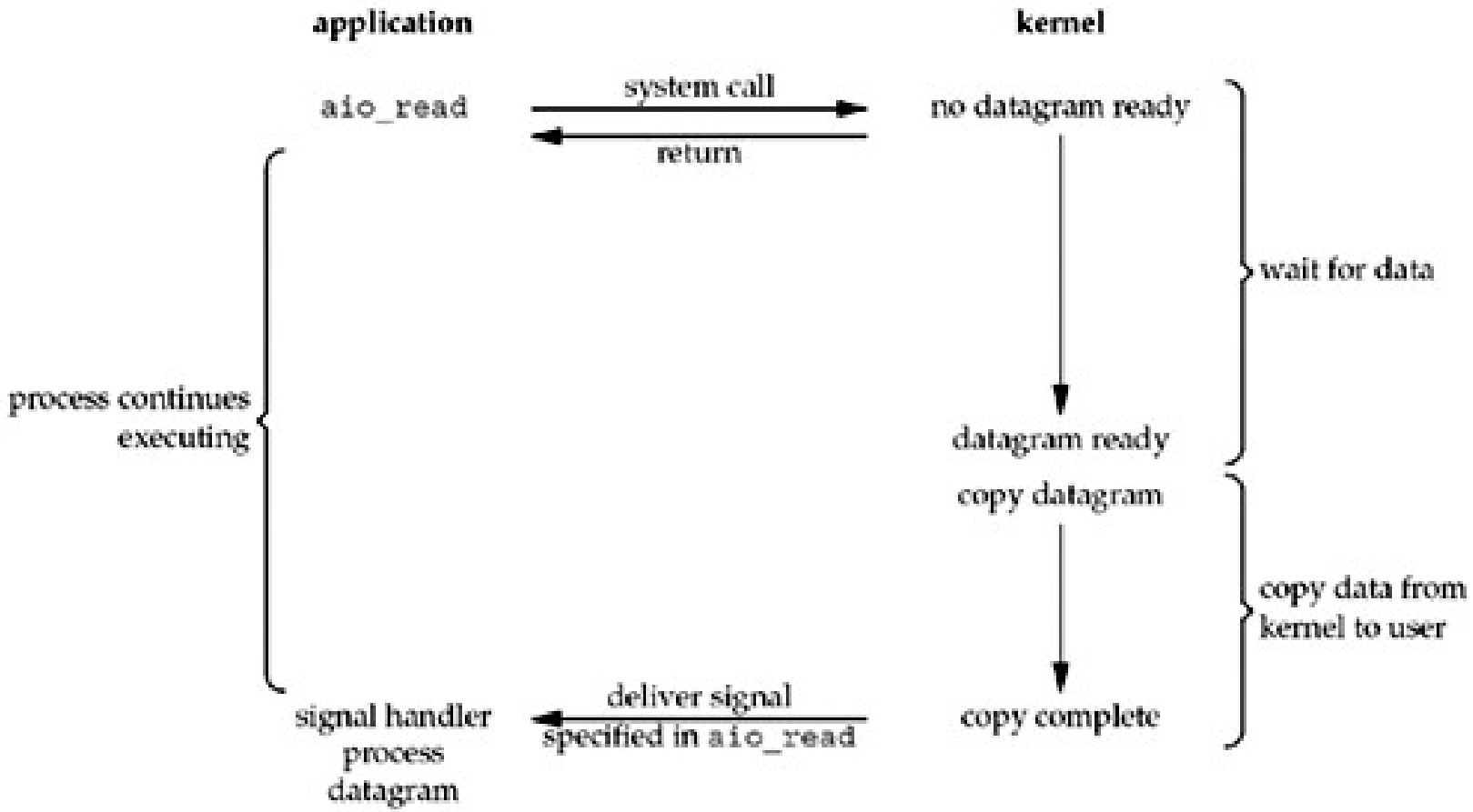


不断询问



内核一个人记录所有人的请求

不怎么成熟的 AIO


application
kernel
aio_read
system call
return
no datagram ready
wait for data
process continues executing
datagram ready
copy datagram
copy data from kernel to user
signal handler process datagram
deliver signal specified in aio_read
copy complete

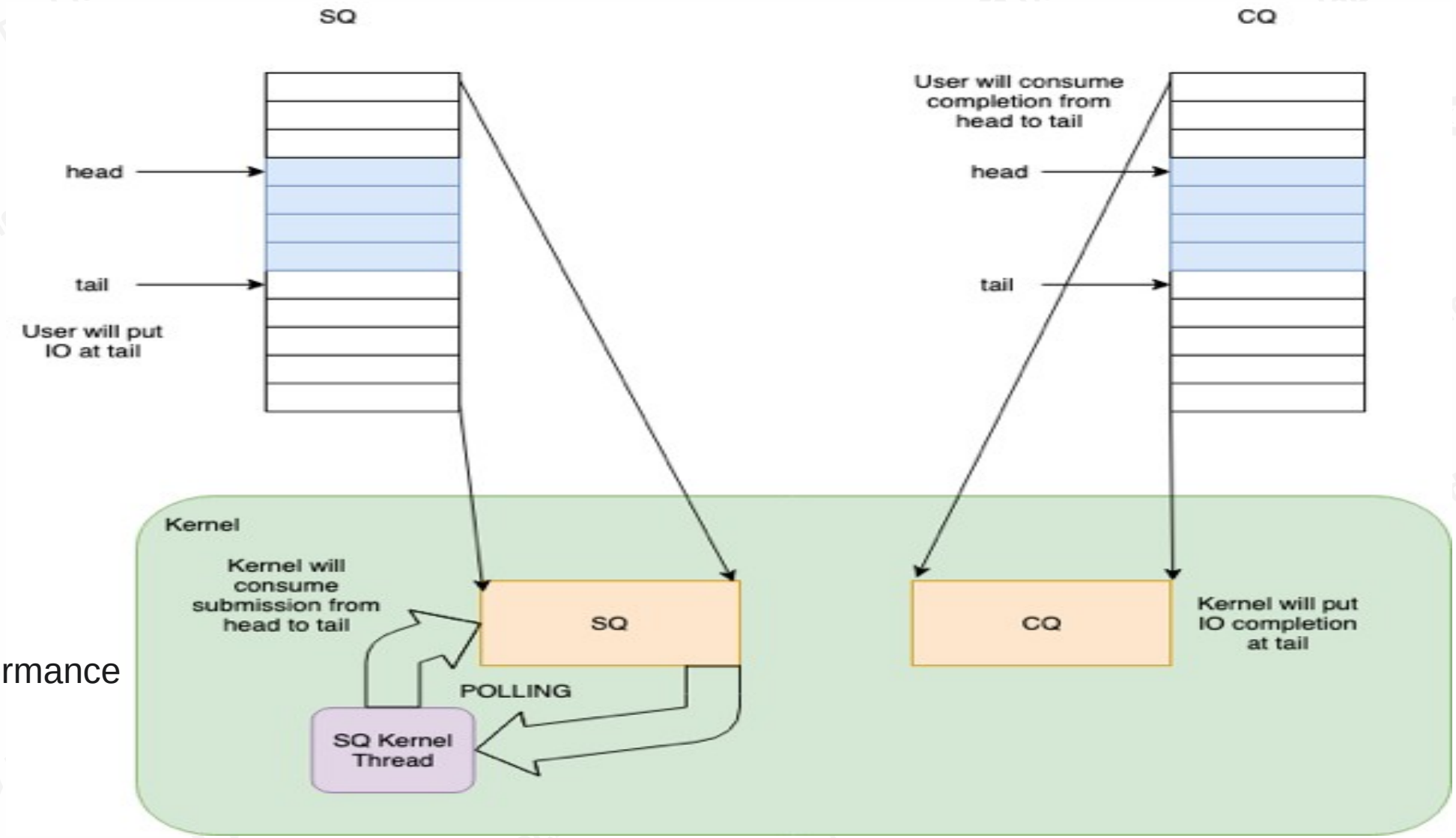
New AIO: io_uring

最近几年一直流行 kernel bypass ，从网络到存储，各个领域开花，内核在性能方面被各种诟病。

Interface	QD	Polled	IOPS
io_uring	128	1	1620K
libaio	128	0	608K
spdk	128	1	1739K

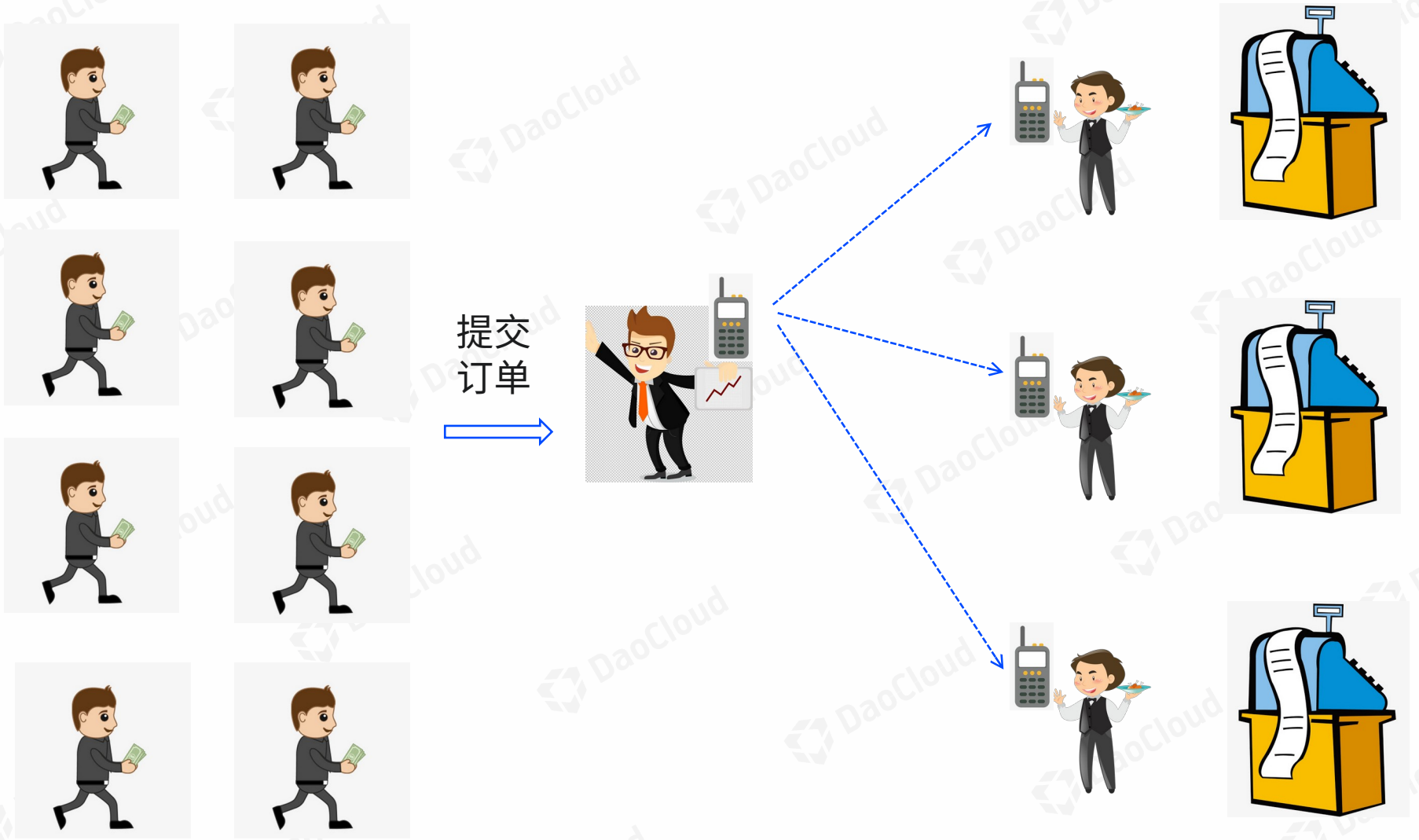
- 用户态和内核态共享提交队列（ submission queue ）和完成队列（ completion queue ）
- IO 提交和收割可以 offload 给 Kernel ，且提交和完成不需要经过系统调用（ system call ）
- 支持 Block 层的 Polling 模式
- 通过提前注册用户态内存地址，减少地址映射的开销

IO_URING



+99% Performance
-45% CPU

高阶比喻



Digital X

感谢聆听！

DaoCloud
www.daocloud.io

驾驭数字方程式
THE FORMULA DIGITAL