# 操作系统

Operating system

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# 内容纲要

# 2.2 系统调用

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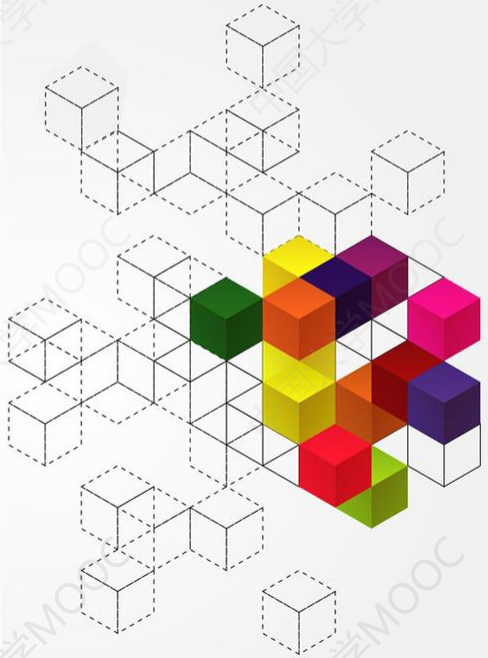
二、 系统调用实现原理

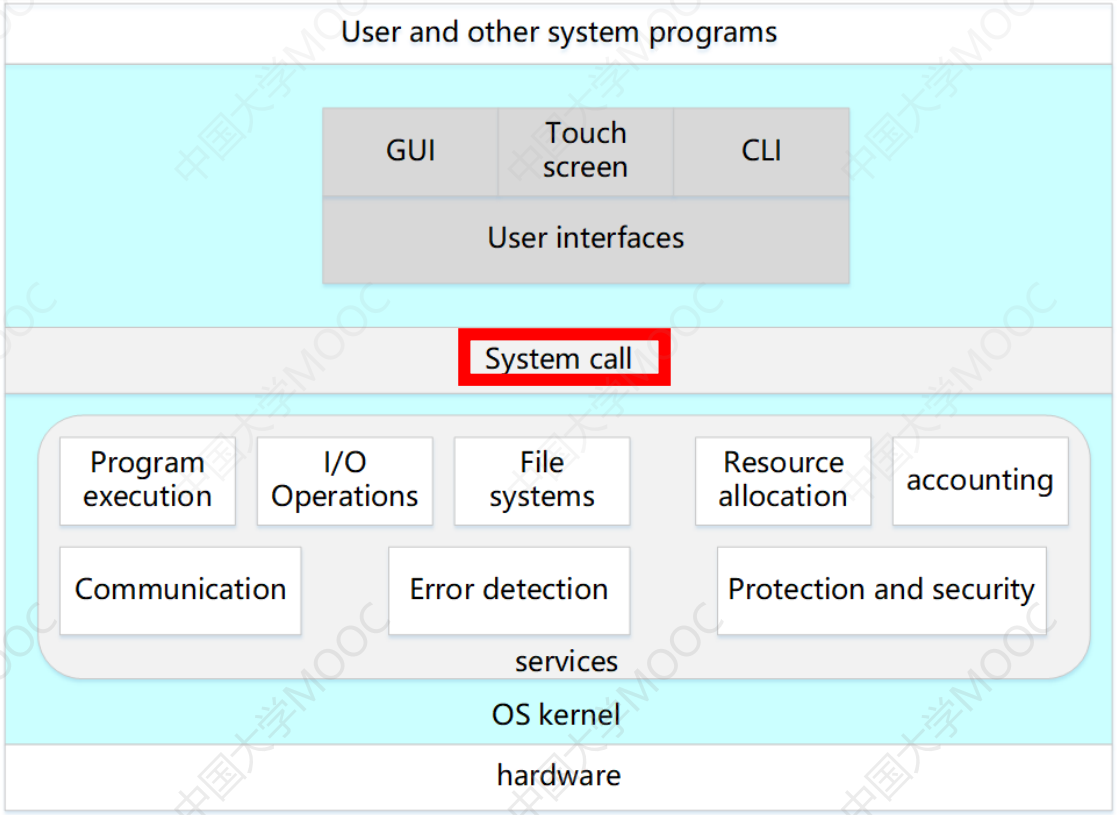
三、 系统调用参数传递

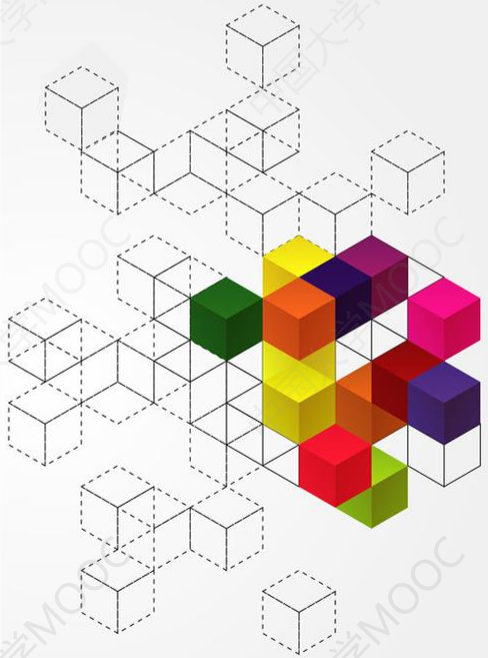
四、 系统调用分类



# 一、系统调用概念

- 系统调用是操作系统面向应用层的最原始接口。



# 一、系统调用概念

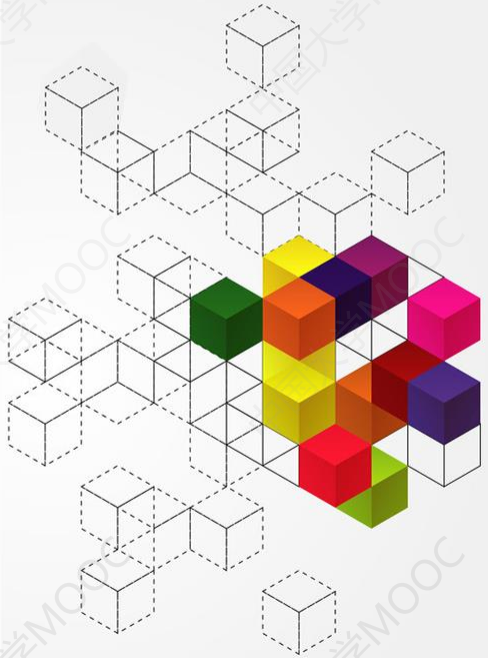
**API**

- 封装好的可以直接被调用的函数，实现特定功能
- API对应的功能可以不依赖内核服务

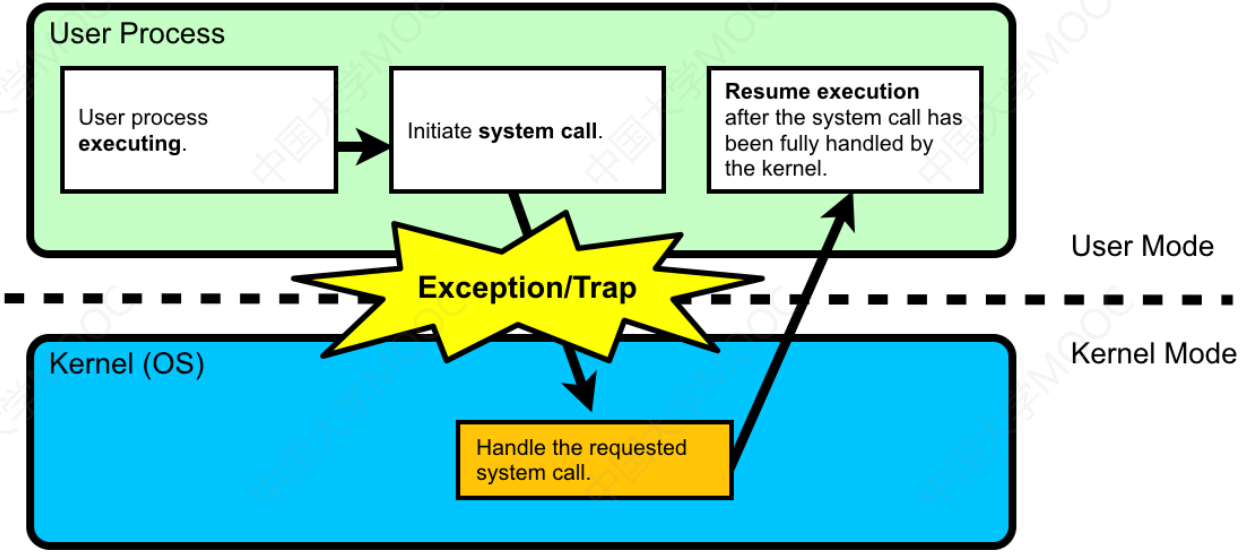
**API与System Call之间可能是1对多，甚至是1对0的关系**

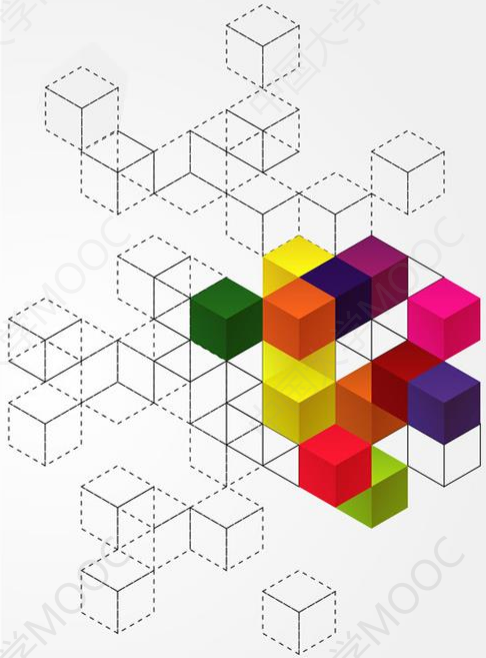
**系统调用**

- 操作系统提供的基本服务接口
- 系统调用的实现代码工作在内核态
- 系统调用的调用从用户态发起



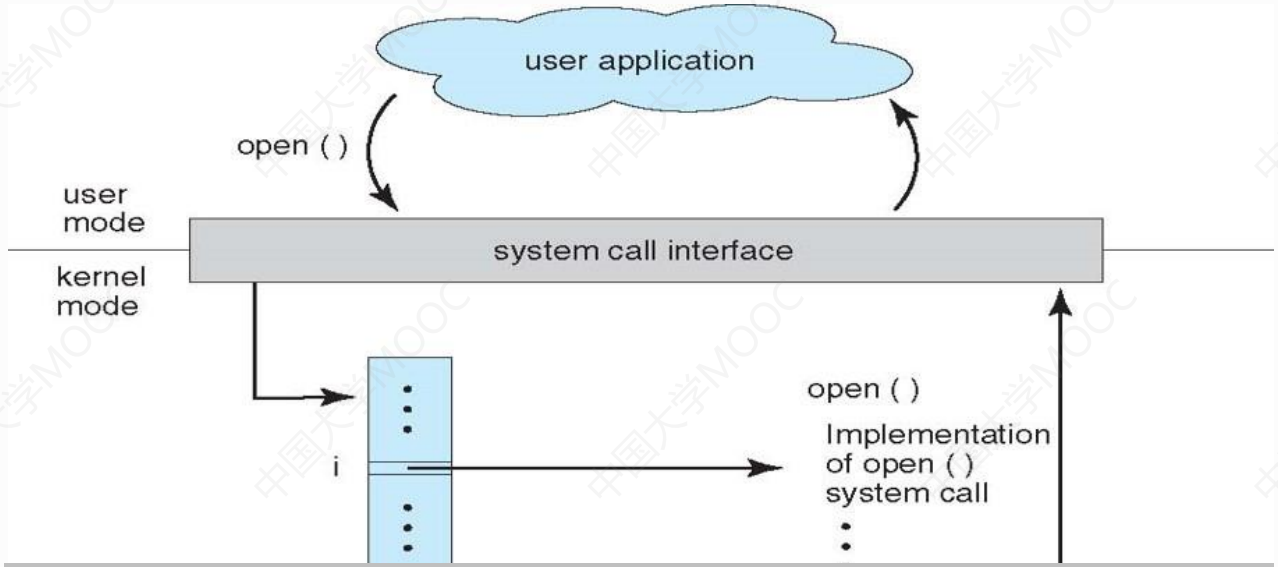
# 一、系统调用概念


User Process
User process executing.
Initiate system call.
Resume execution after the system call has been fully handled by the kernel.
Exception/Trap
User Mode
Kernel Mode
Kernel (OS)
Handle the requested system call.

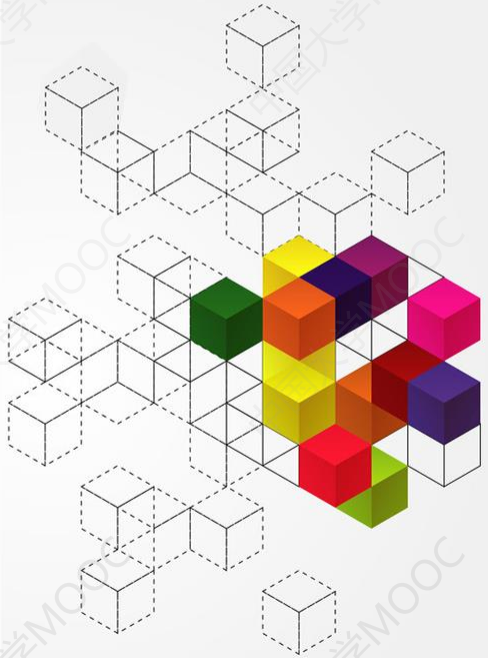


# 二、系统调用实现原理

## 系统调用原理示意图

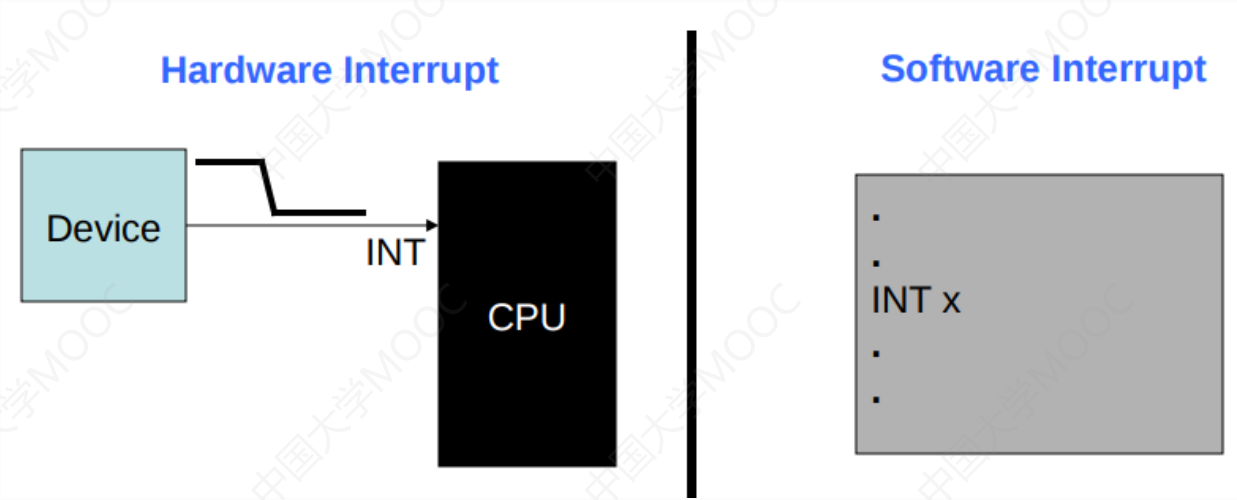


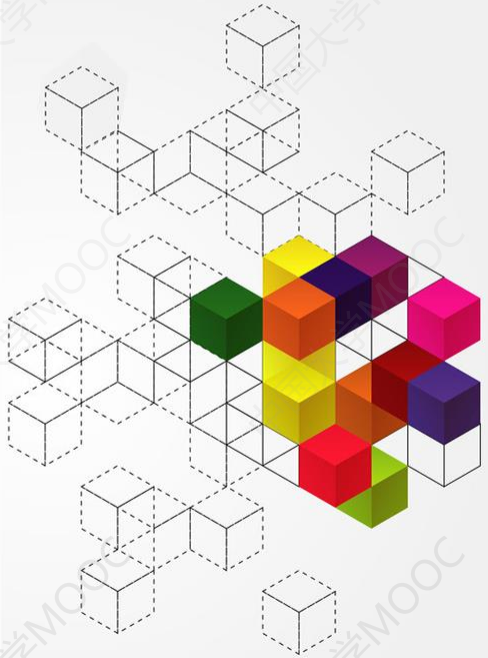

- OS内核内维护一个以系统调用号为索引的系统调用表
- 应用程序在访问系统调用时只需通过系统调用号，无需接触系统调用的实现代码



# 二、系统调用实现原理

## 软件中断：实现系统调用的关键

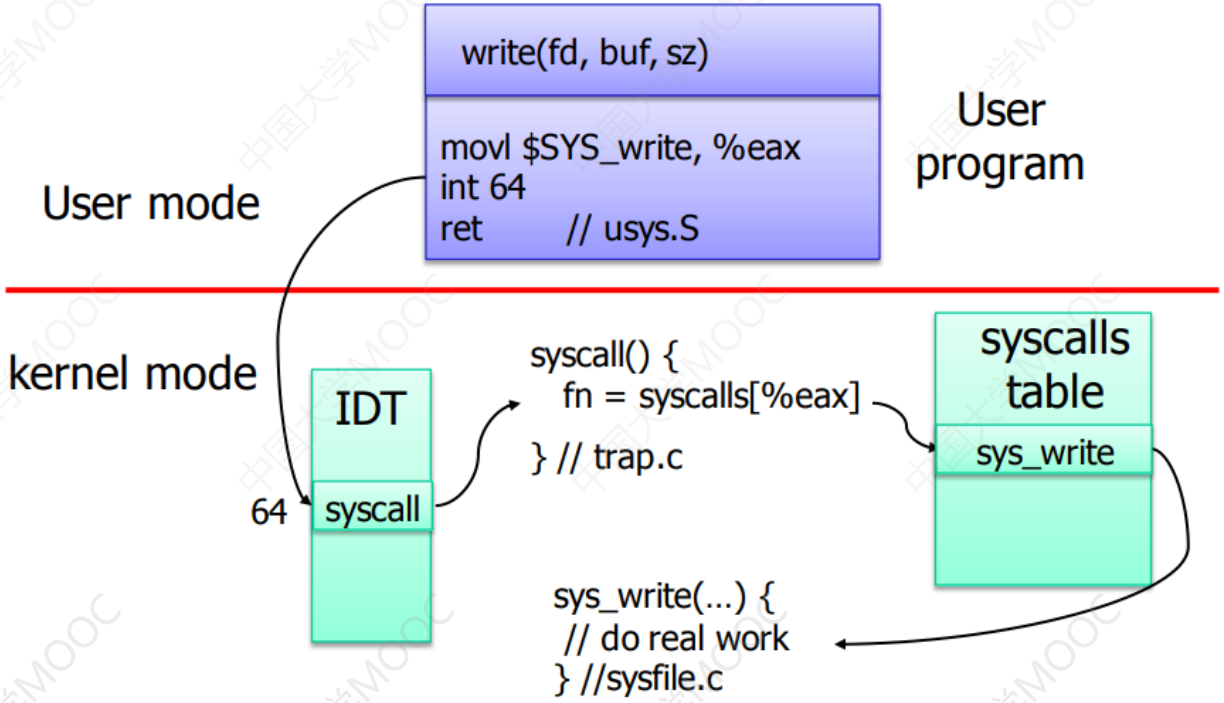


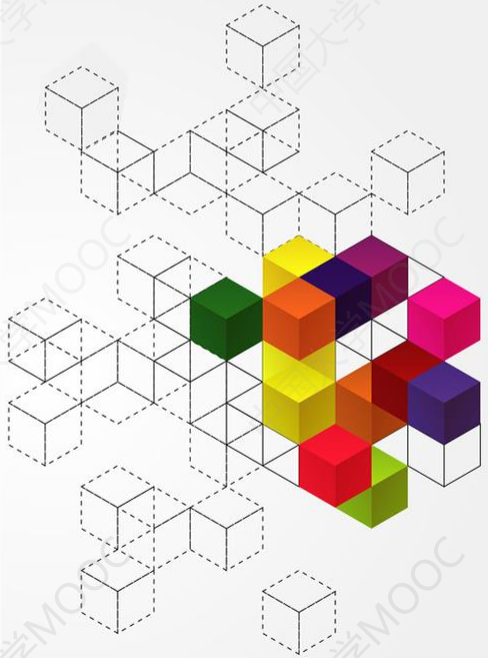



**Windows：x=0x2e**
**Linux: x=0x80**

# 二、系统调用实现原理

## xv6系统调用图示

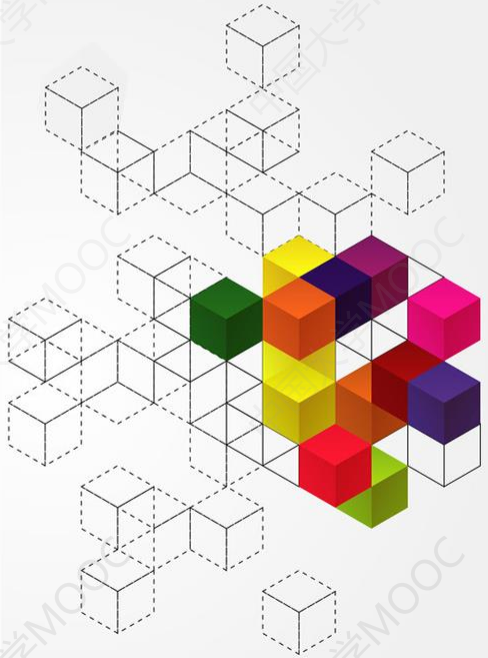


# 三、系统调用参数传递

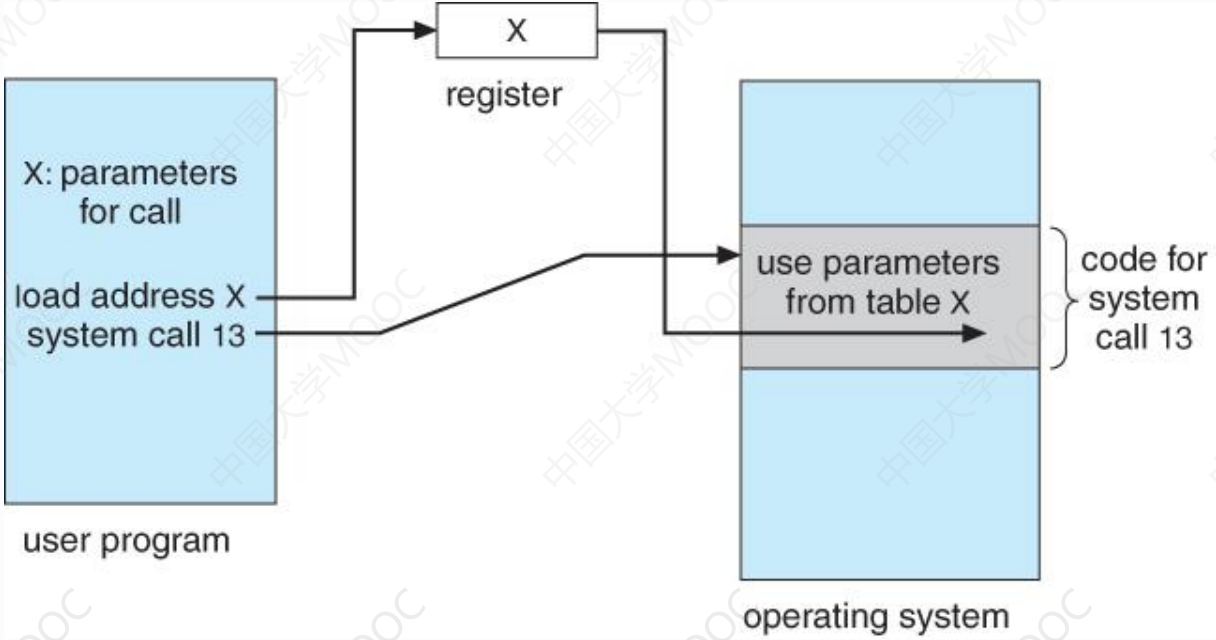
- **系统调用的参数传递**
  - 系统调用过程中会发生执行模式从用户态到内核态的转变，参数传递方面需要考虑这方面因素

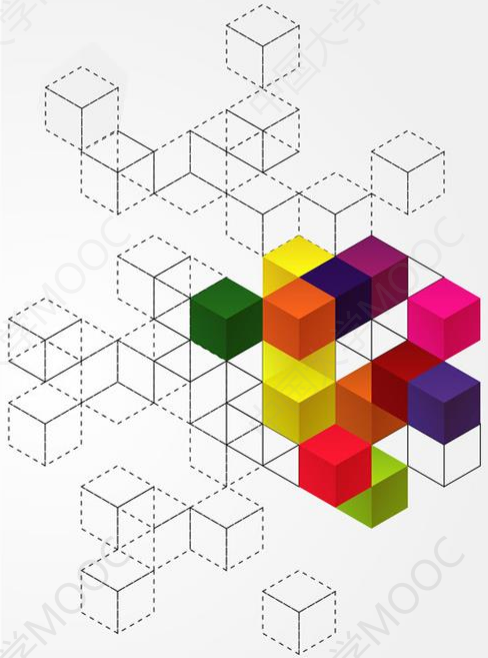
| | |
|---|---|
| 寄存器传参 | • 优先选择寄存器传参，效率高<br>• 问题：可用寄存器数量有限 |
| 内存块传参 | • 分配一块内存，存放系统调用参数，并将参数块指针作为参数传递给内核<br>• 当参数多于可用寄存器数量时采用 |
| 用户栈传参 | • 在进程当前用户态执行栈上压入参数<br>• 将用户栈指针作为参数传递 |



# 三、系统调用参数传递

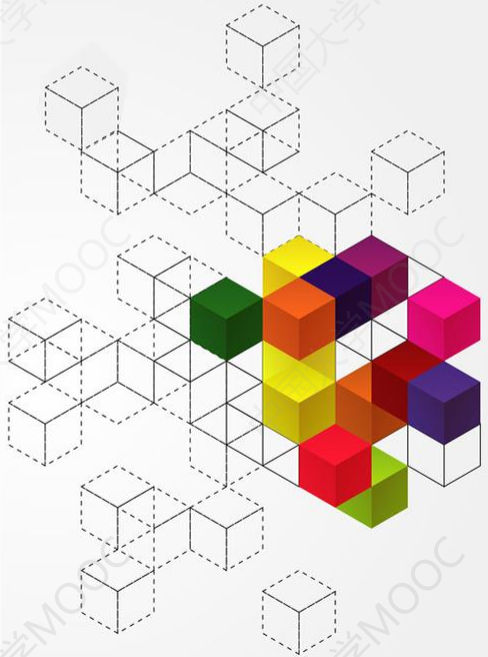
- 内存块传参示意



# 四、系统调用分类

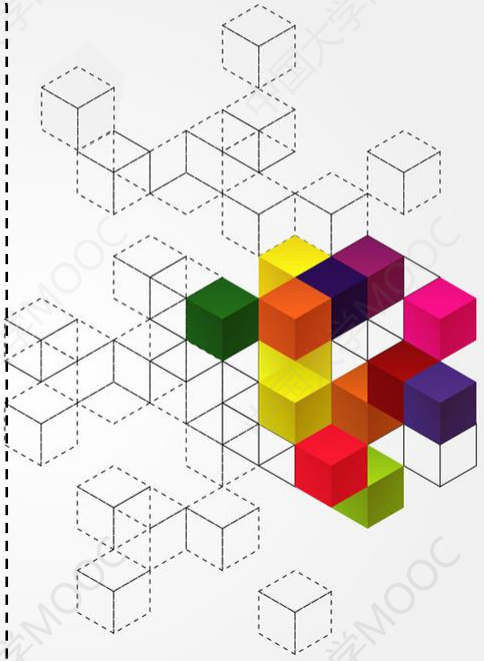
- 系统调用的按功能分类

# 四、系统调用分类

- **进程控制**

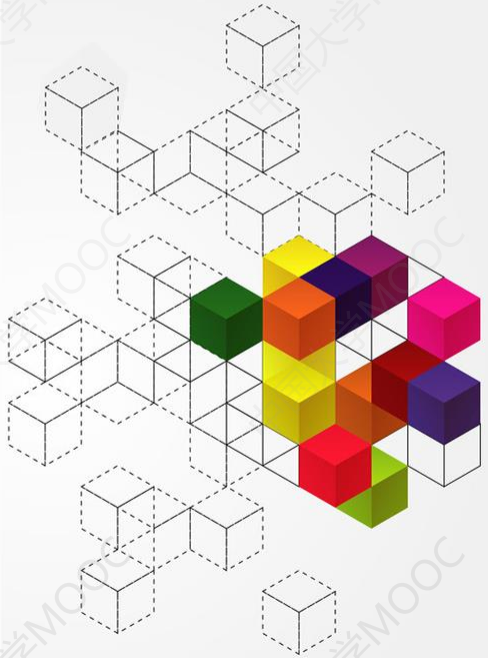
| | Linux | Windows |
| --- | --- | --- |
| 进程创建 | fork() | CreateProcess() |
| 进程阻塞 | wait() | WaitForSingleObject() |
| 终止进程 | exit() | ExitProcess() |



# 四、系统调用分类

- **文件操作**

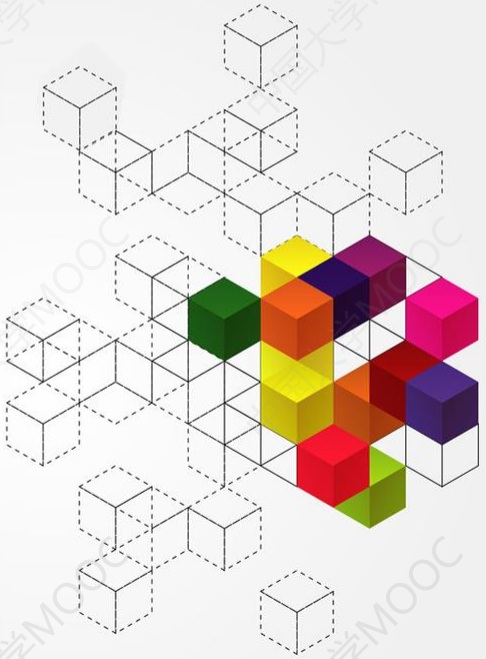
| | Linux | Windows |
| --- | --- | --- |
| 打开文件 | open() | CreateFile() |
| 读文件 | read() | ReadFile() |
| 写文件 | write() | WriteFile() |
| 关闭文件 | close() | CloseHandle() |



# 四、系统调用分类

- 其他

| | Linux | Windows |
|---|---|---|
| Device Manipulation | ioctl() | SetConsoleMode() |
| | read() | ReadConsole() |
| | write() | WriteConsole() |
| Information Maintenance | getpid() | GetCurrentProcessID() |
| | alarm() | SetTimer() |
| | sleep() | Sleep() |
| Communication | pipe() | CreatePipe() |
| | shmget() | CreateFileMapping() |
| | mmap() | MapViewOfFile() |
| Protection | chmod() | SetFileSecurity() |
| | umask() | InitializeSecurityDescriptor() |
| | chown() | SetSecurityDescriptorGroup() |



# 本讲小结

- 系统调用概念
- 系统调用实现原理
- 系统调用参数传递
- 系统调用分类