

File Attributes

```
struct stat
```

```
struct stat {  
    dev_t      st_dev;      ID of device containing the file
```

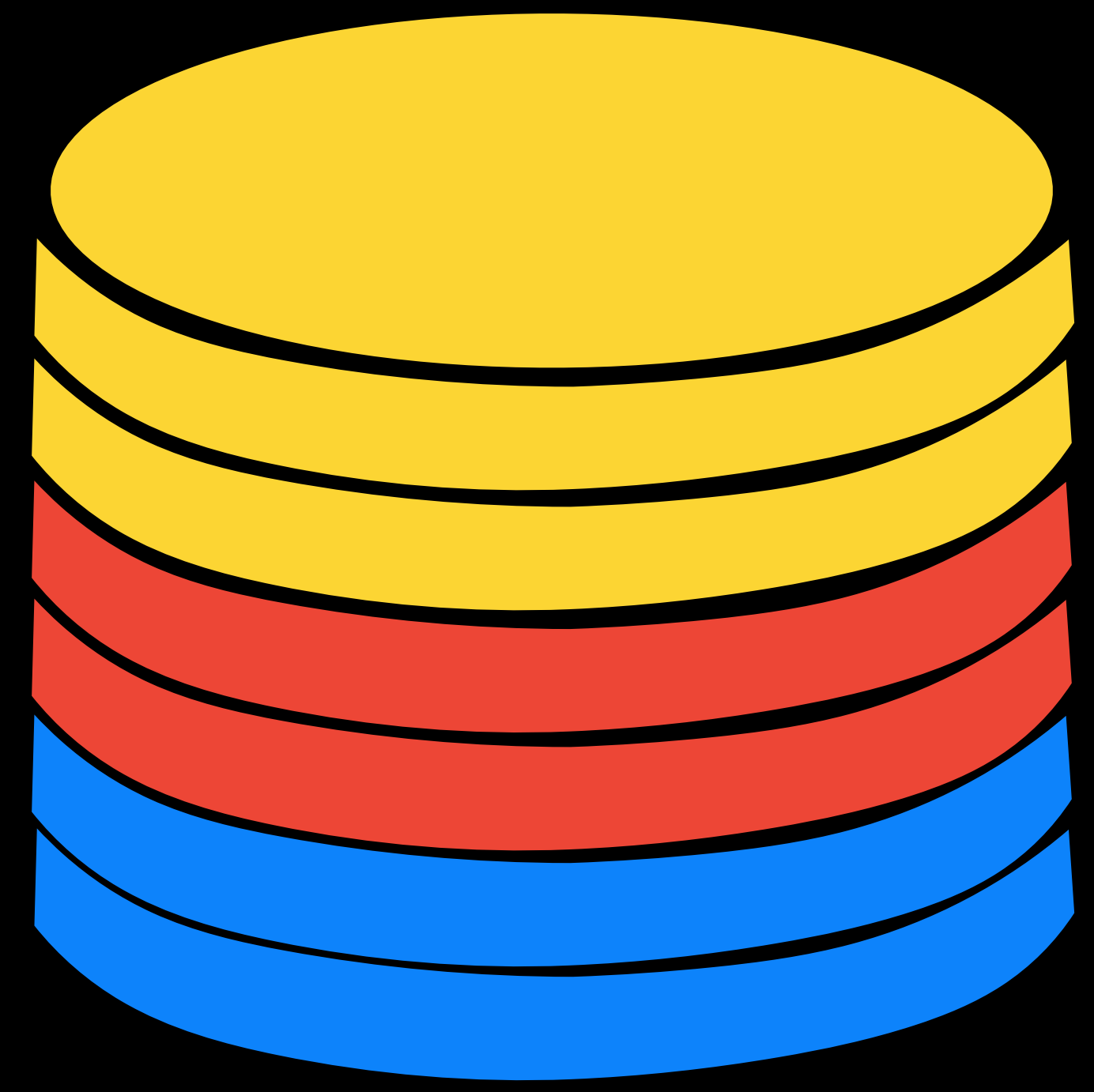
```
struct stat {  
    dev_t    st_dev;    ID of device containing the file
```

Hard disk (/dev/hd)

Partition 1
/dev/hd1

Partition 2
/dev/hd2

Partition 3
/dev/hd3



```
struct stat {  
    dev_t    st_dev;
```

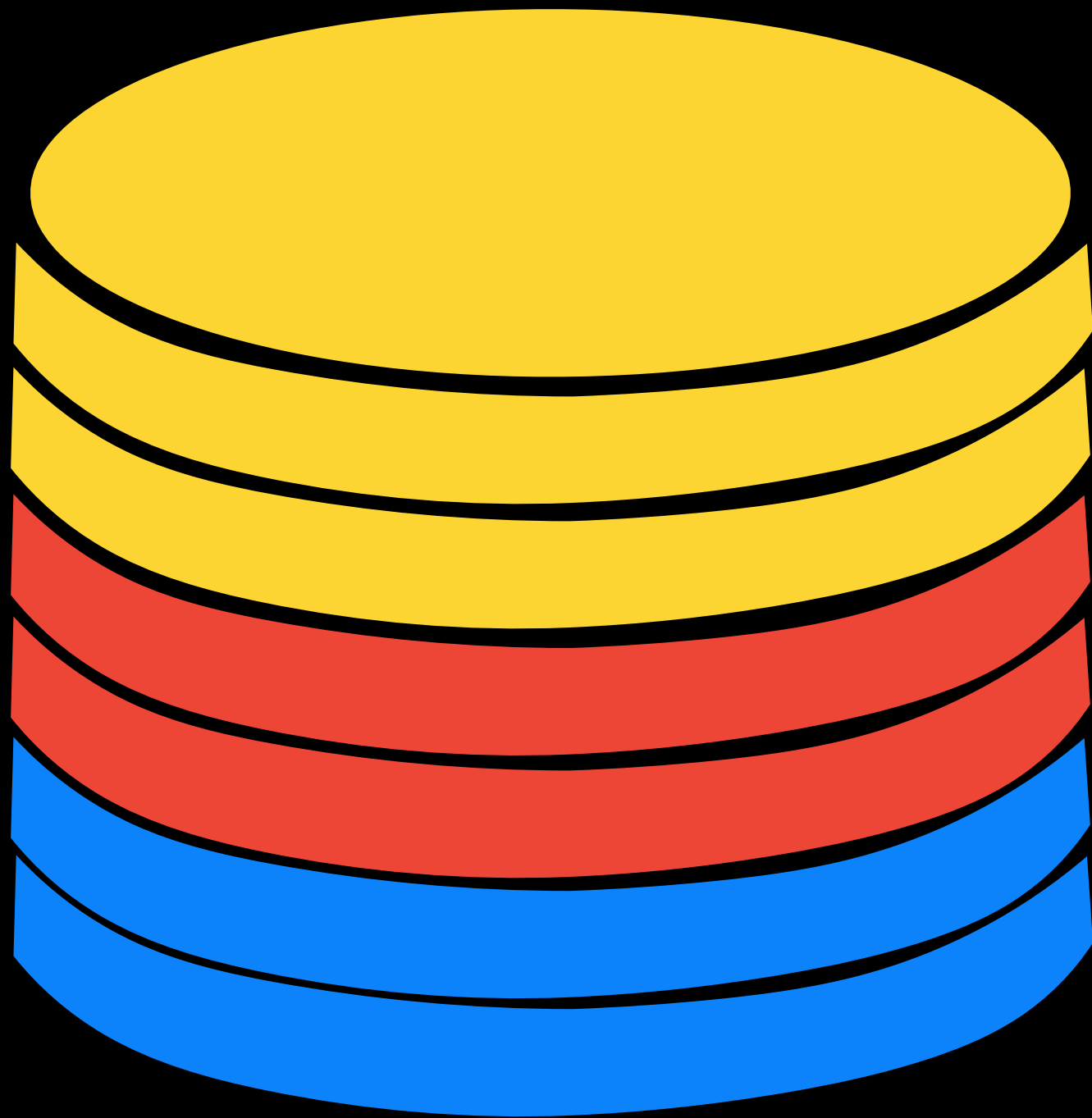
ID of device containing the file

Hard disk (/dev/hd)

Partition 1
/dev/hd1

Partition 2
/dev/hd2

Partition 3
/dev/hd3



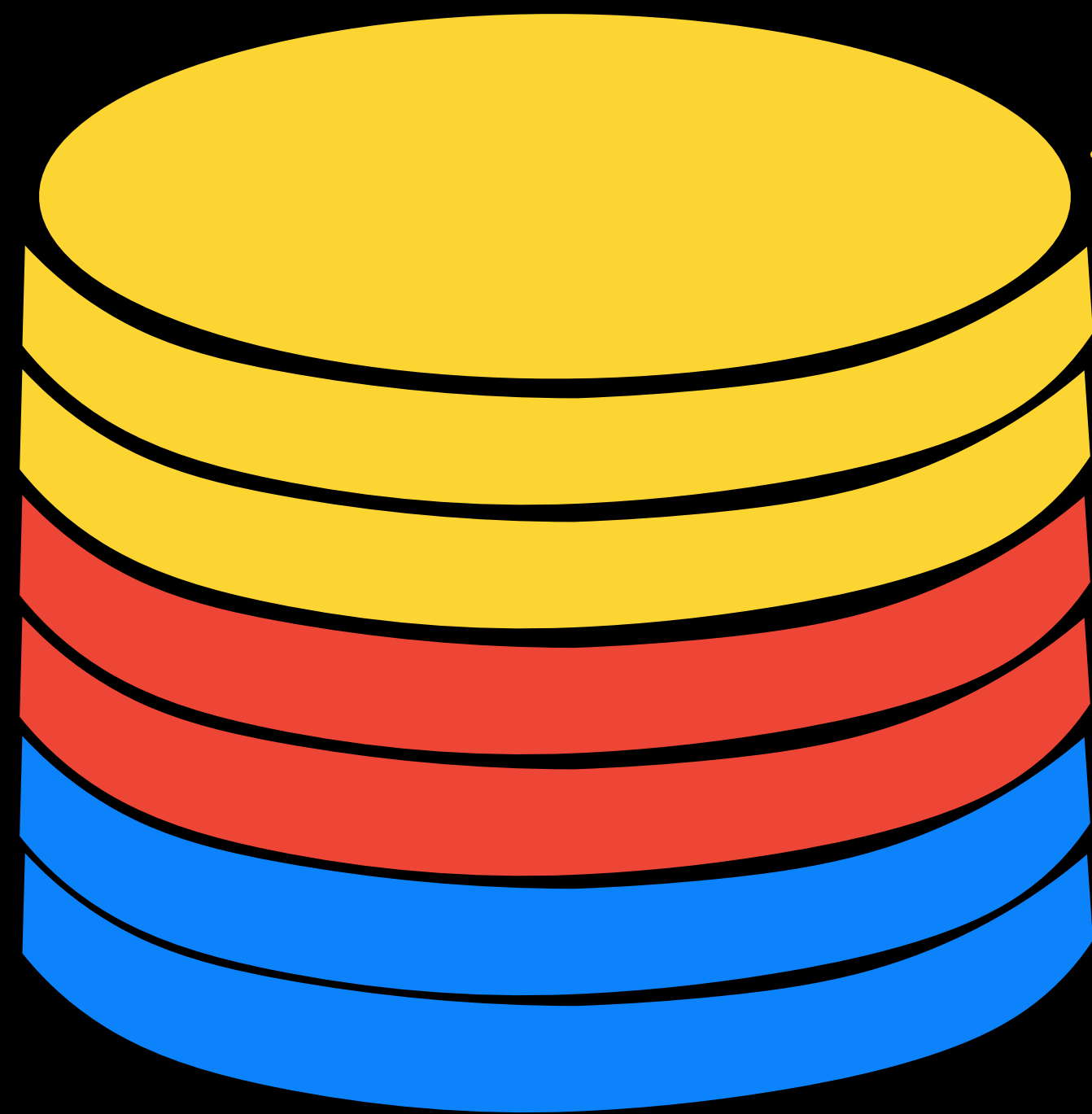
```
struct stat {  
    dev_t      st_dev;      ID of device containing the file  
};
```

Hard disk (/dev/hd)

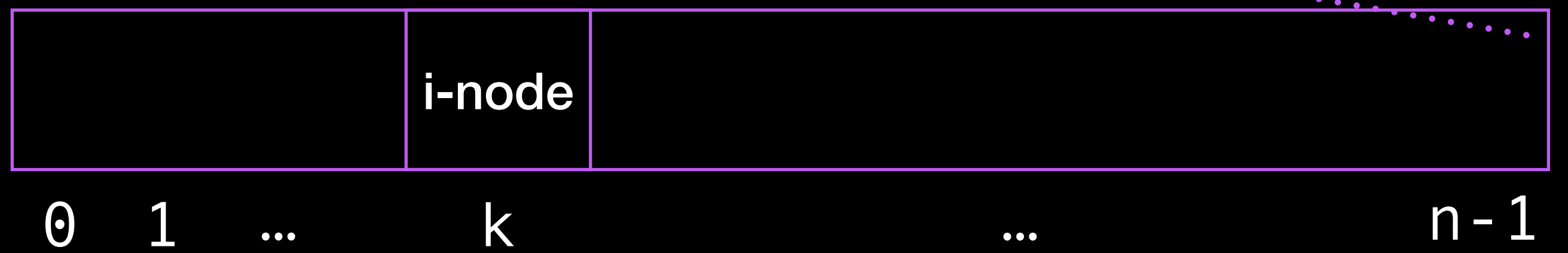
Partition 1
/dev/hd1

Partition 2
/dev/hd2

Partition 3
/dev/hd3



File System



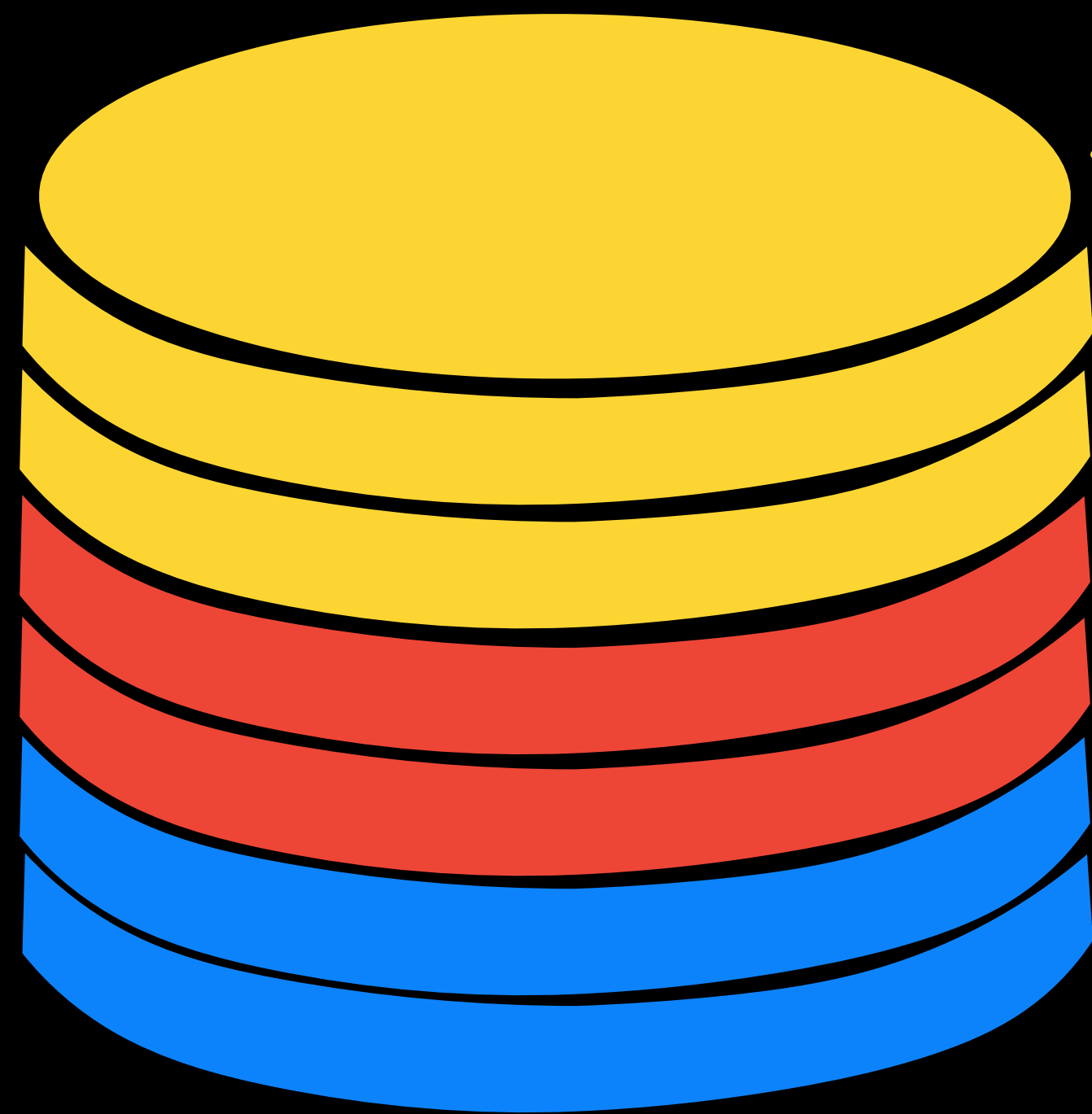
```
struct stat {
    dev_t    st_dev;    ID of device containing the file
    ino_t    st_ino;   i-node number
}
```

Hard disk (/dev/hd)

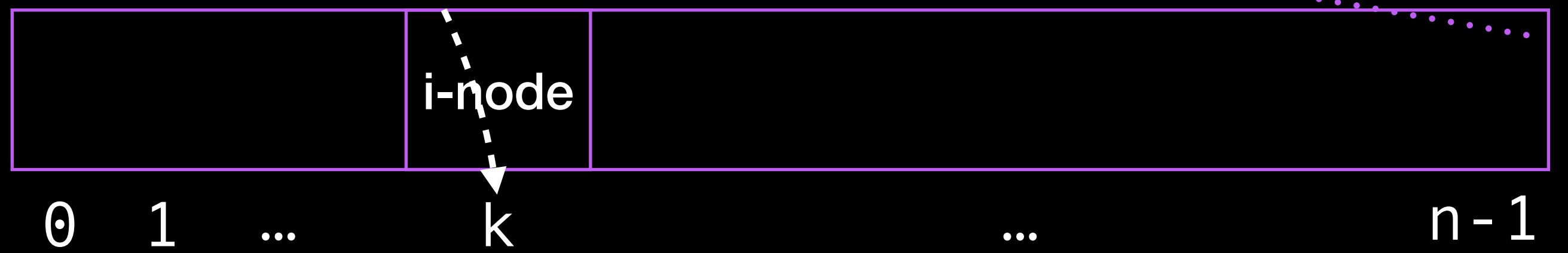
Partition 1
/dev/hd1

Partition 2
/dev/hd2

Partition 3
/dev/hd3



File System



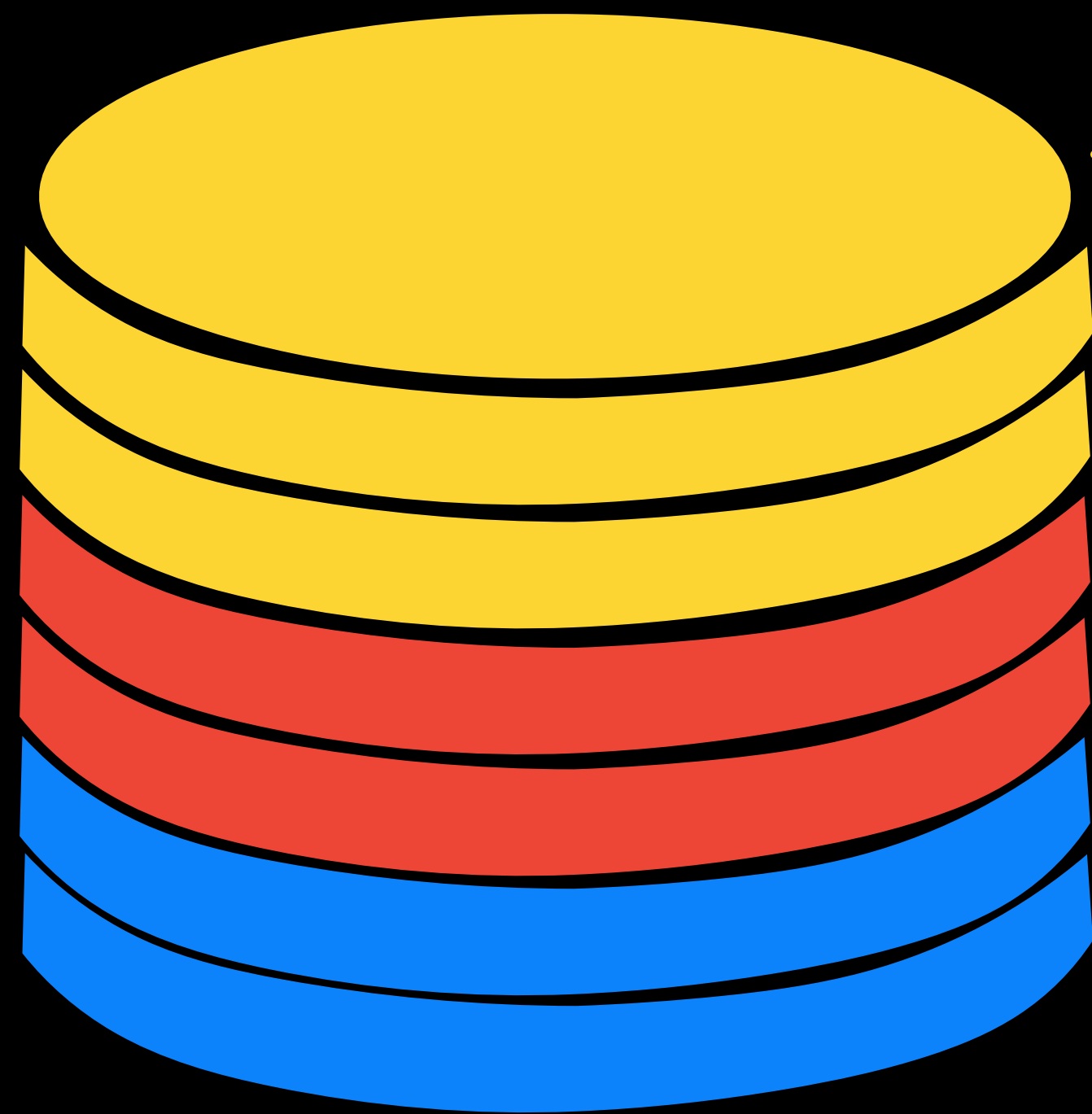
```
struct stat {
    dev_t    st_dev;    ID of device containing the file
    ino_t    st_ino;   i-node number
    off_t    st_size;  Total file size (bytes)
```

Hard disk (/dev/hd)

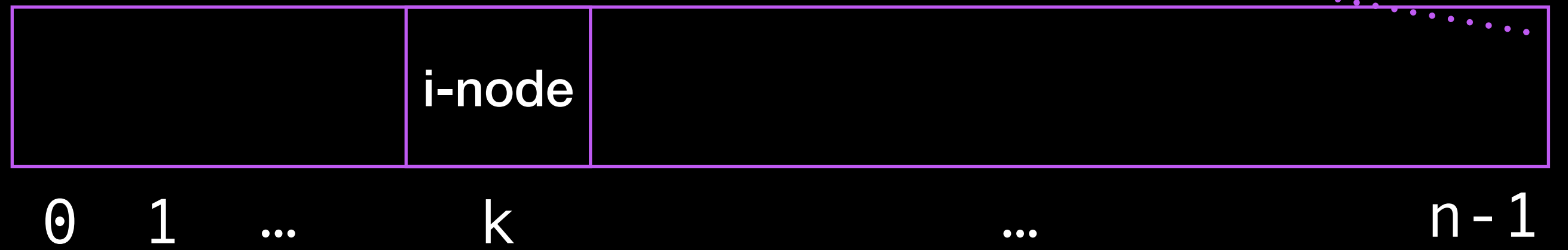
Partition 1
/dev/hd1

Partition 2
/dev/hd2

Partition 3
/dev/hd3



File System




```

struct stat {
    dev_t      st_dev;      ID of device containing the file
    ino_t      st_ino;     i-node number
    off_t      st_size;    Total file size (bytes)
    blkcnt_t   st_blocks;  Number of (512B) blocks allocated
}

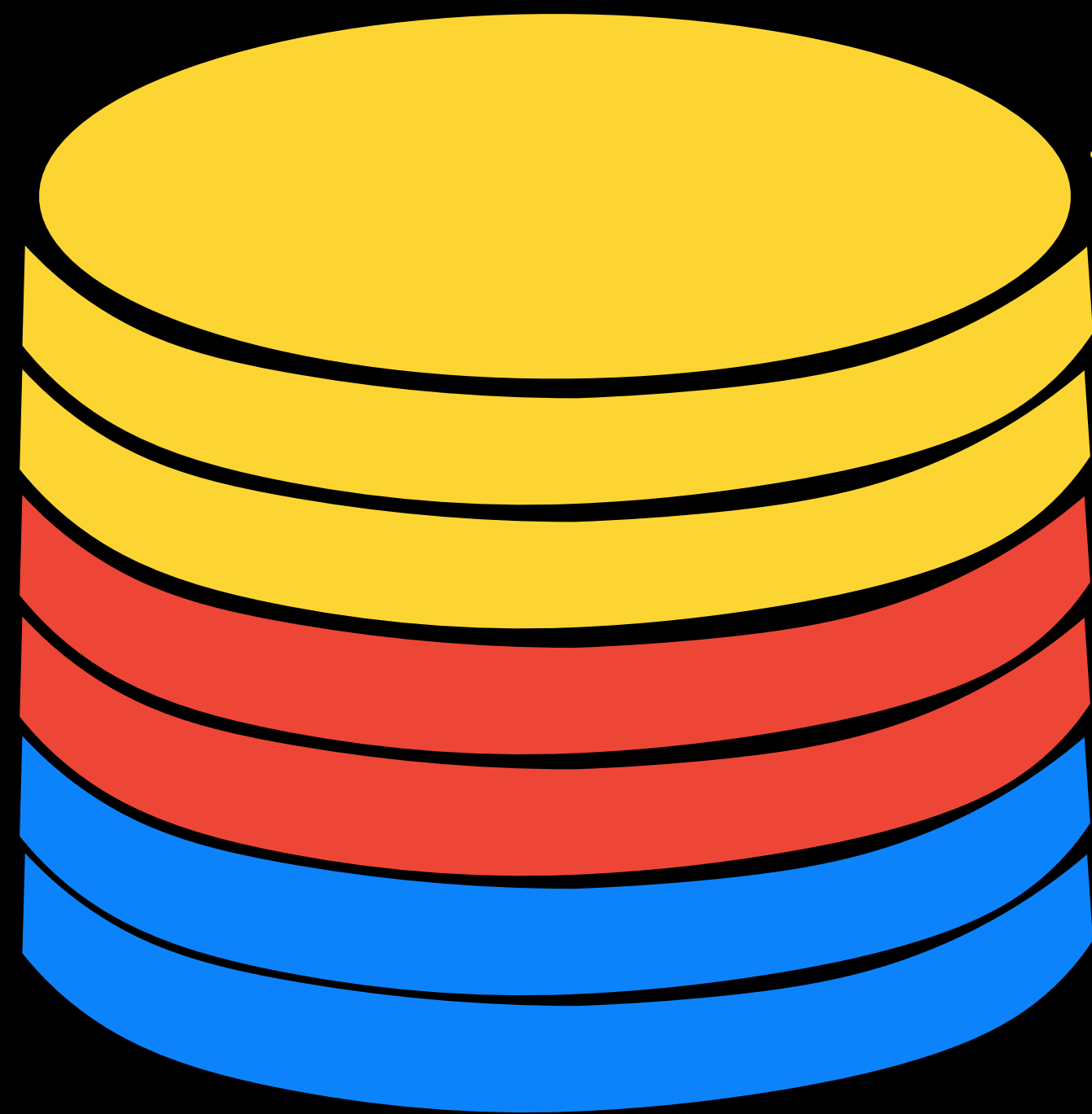
```

Hard disk (/dev/hd)

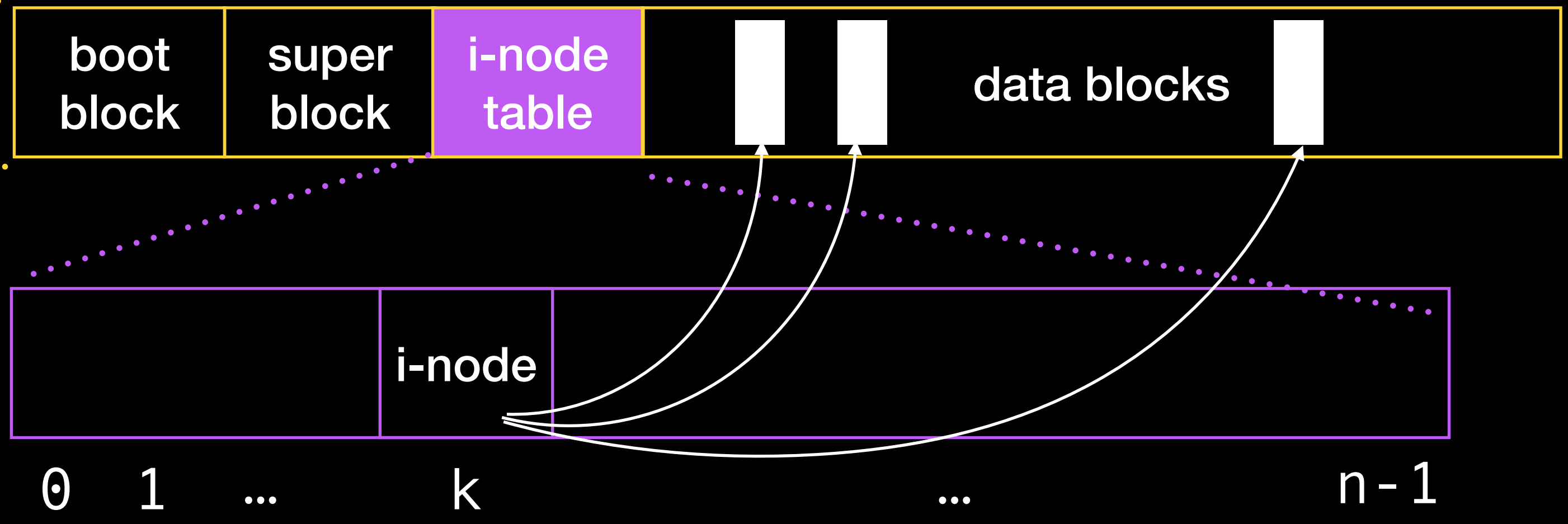
Partition 1
/dev/hd1

Partition 2
/dev/hd2

Partition 3
/dev/hd3



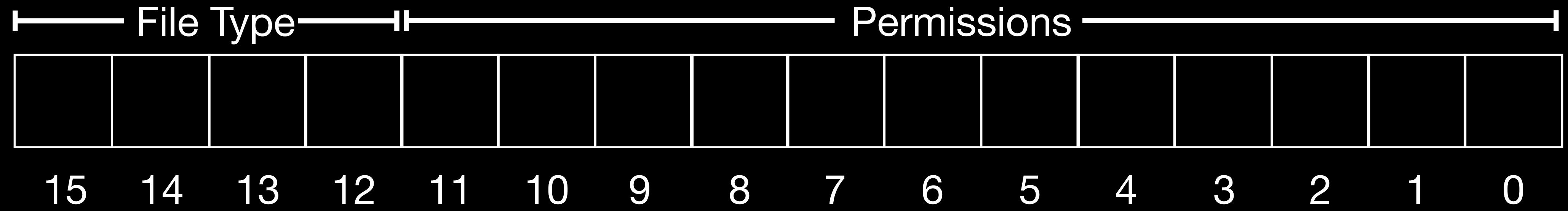
File System



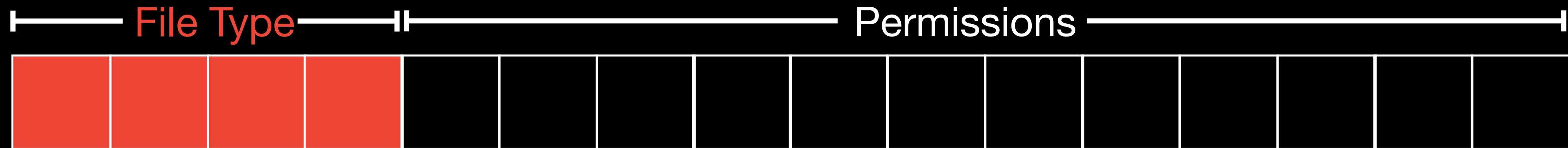
```
struct stat {  
    ...  
    uid_t  st_uid;    User ID of file owner
```

```
struct stat {  
    ...  
    uid_t    st_uid;    User ID of file owner  
    gid_t    st_gid;    Group ID of file owner
```

```
struct stat {  
    ...  
    uid_t  st_uid;    User ID of file owner  
    gid_t  st_gid;    Group ID of file owner  
    mode_t st_mode;   File type and mode
```



```
struct stat {  
    ...  
    uid_t  st_uid;    User ID of file owner  
    gid_t  st_gid;    Group ID of file owner  
    mode_t st_mode;   File type and mode  
};
```



15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0

- Regular file
- Directory
- Character device
- Block device
- FIFO
- Socket
- Symbolic link

```

struct stat {
    ...
    uid_t  st_uid;    User ID of file owner
    gid_t  st_gid;    Group ID of file owner
    mode_t st_mode;   File type and mode
}

```



```

struct stat {
    ...
    uid_t  st_uid;    User ID of file owner
    gid_t  st_gid;    Group ID of file owner
    mode_t st_mode;   File type and mode
}

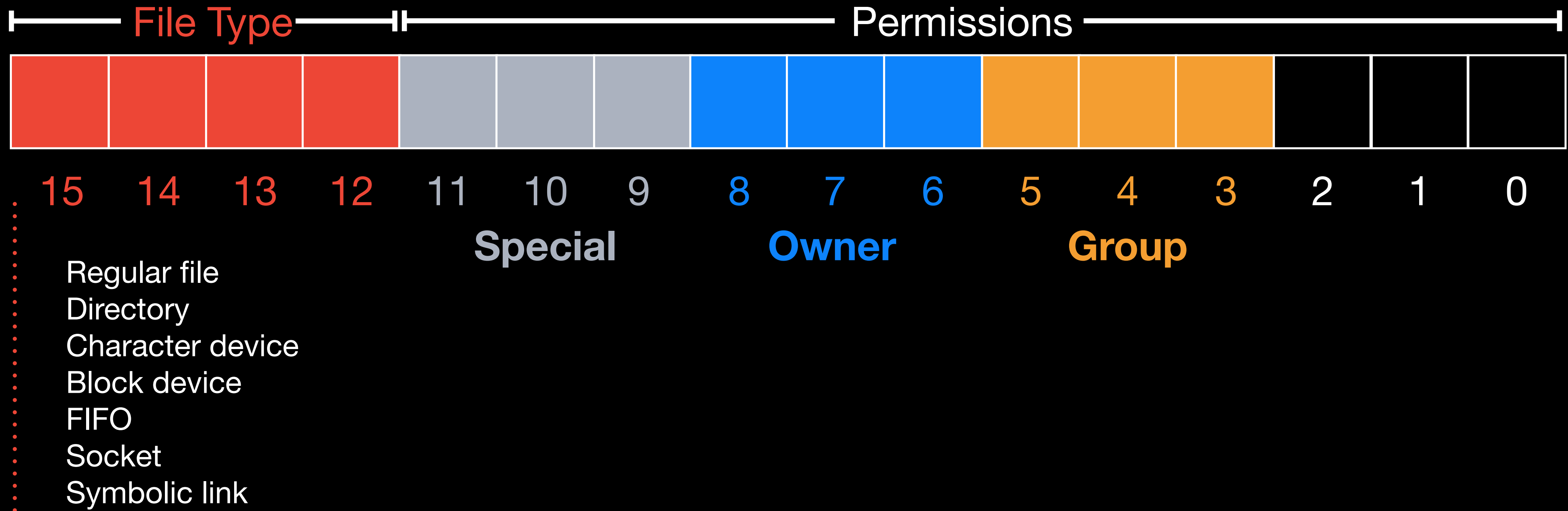
```



```

struct stat {
    ...
    uid_t  st_uid;    User ID of file owner
    gid_t  st_gid;    Group ID of file owner
    mode_t st_mode;   File type and mode
}

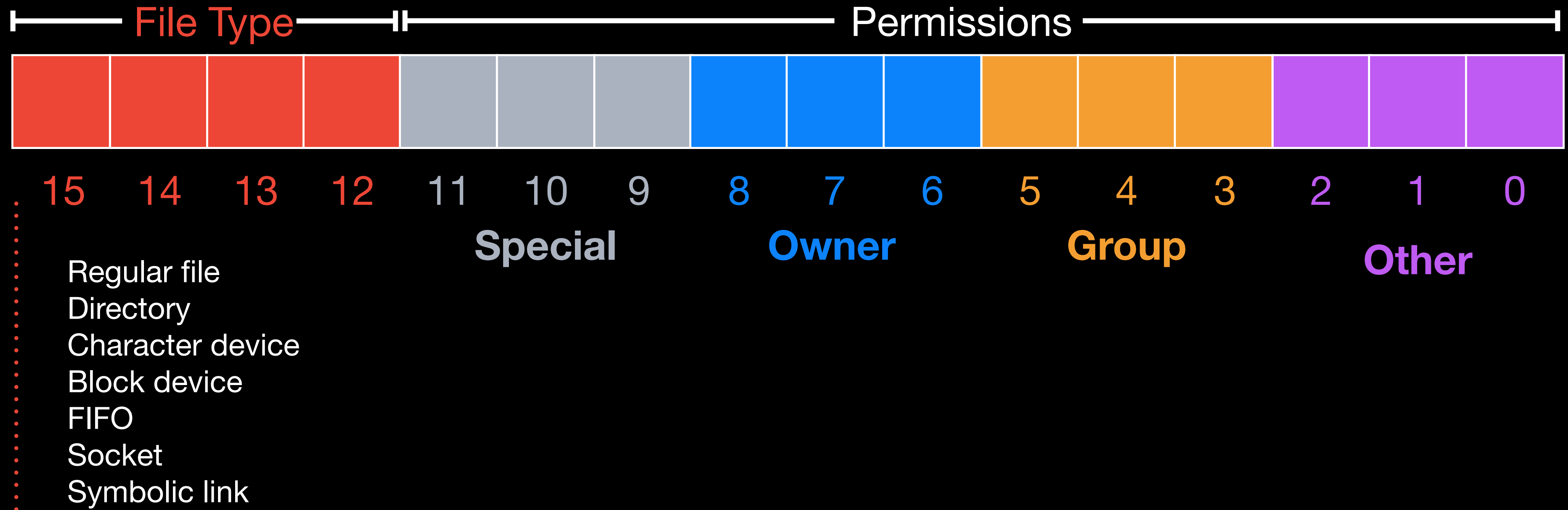
```




```

struct stat {
    ...
    uid_t  st_uid;    User ID of file owner
    gid_t  st_gid;    Group ID of file owner
    mode_t st_mode;   File type and mode
}

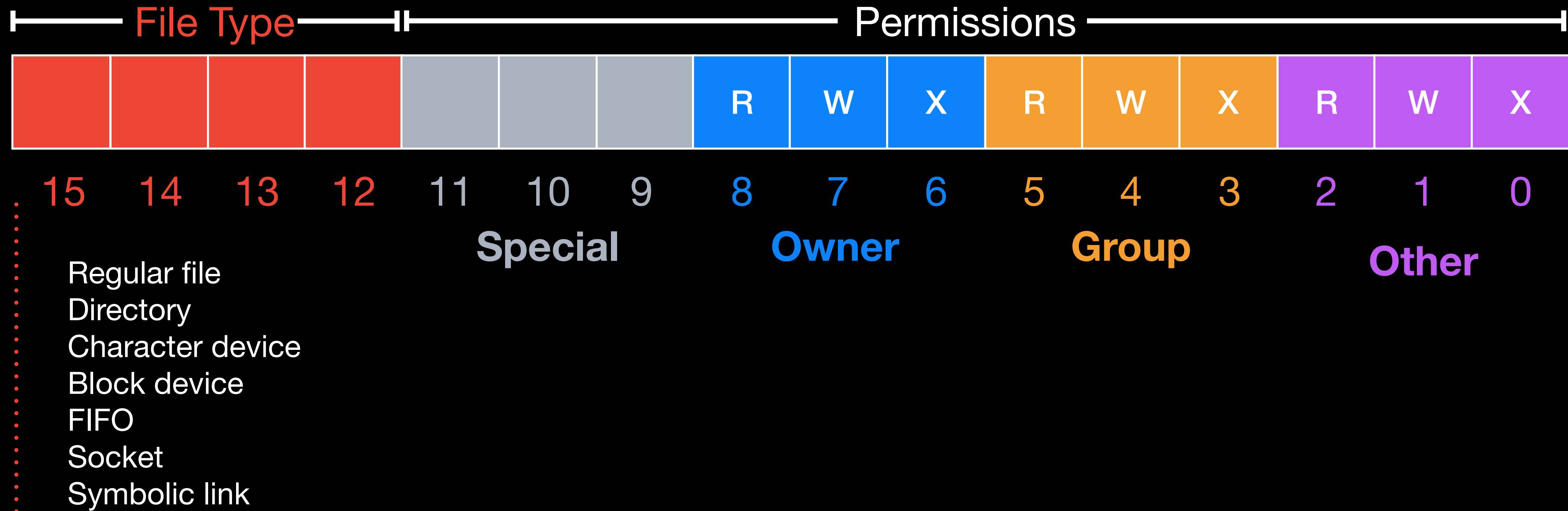
```



```

struct stat {
    ...
    uid_t  st_uid;    User ID of file owner
    gid_t  st_gid;    Group ID of file owner
    mode_t st_mode;   File type and mode
}

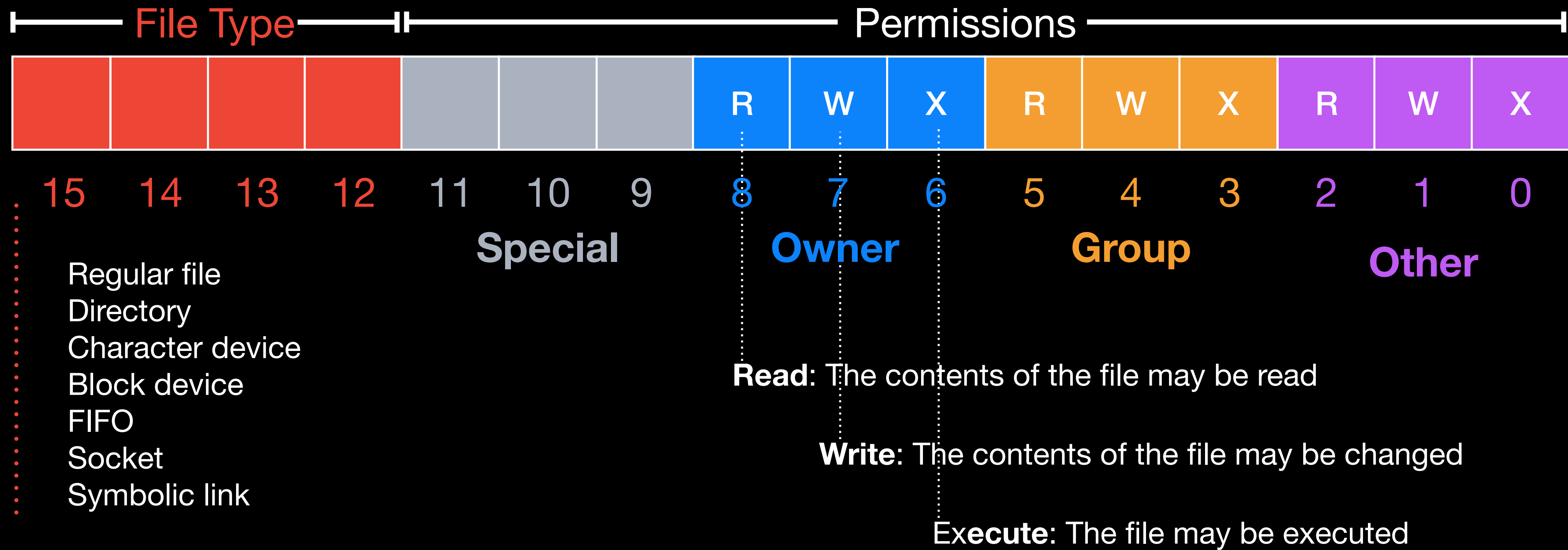
```



```

struct stat {
    ...
    uid_t  st_uid;    User ID of file owner
    gid_t  st_gid;    Group ID of file owner
    mode_t st_mode;   File type and mode
}

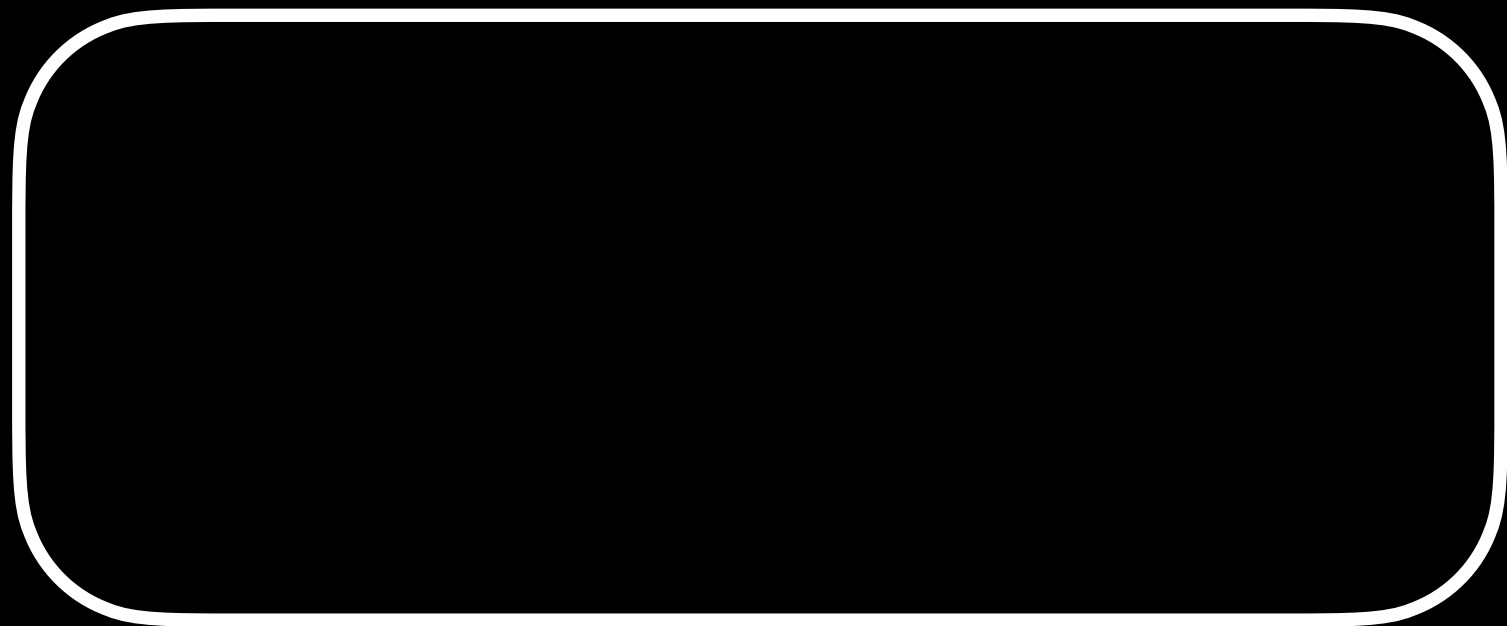
```



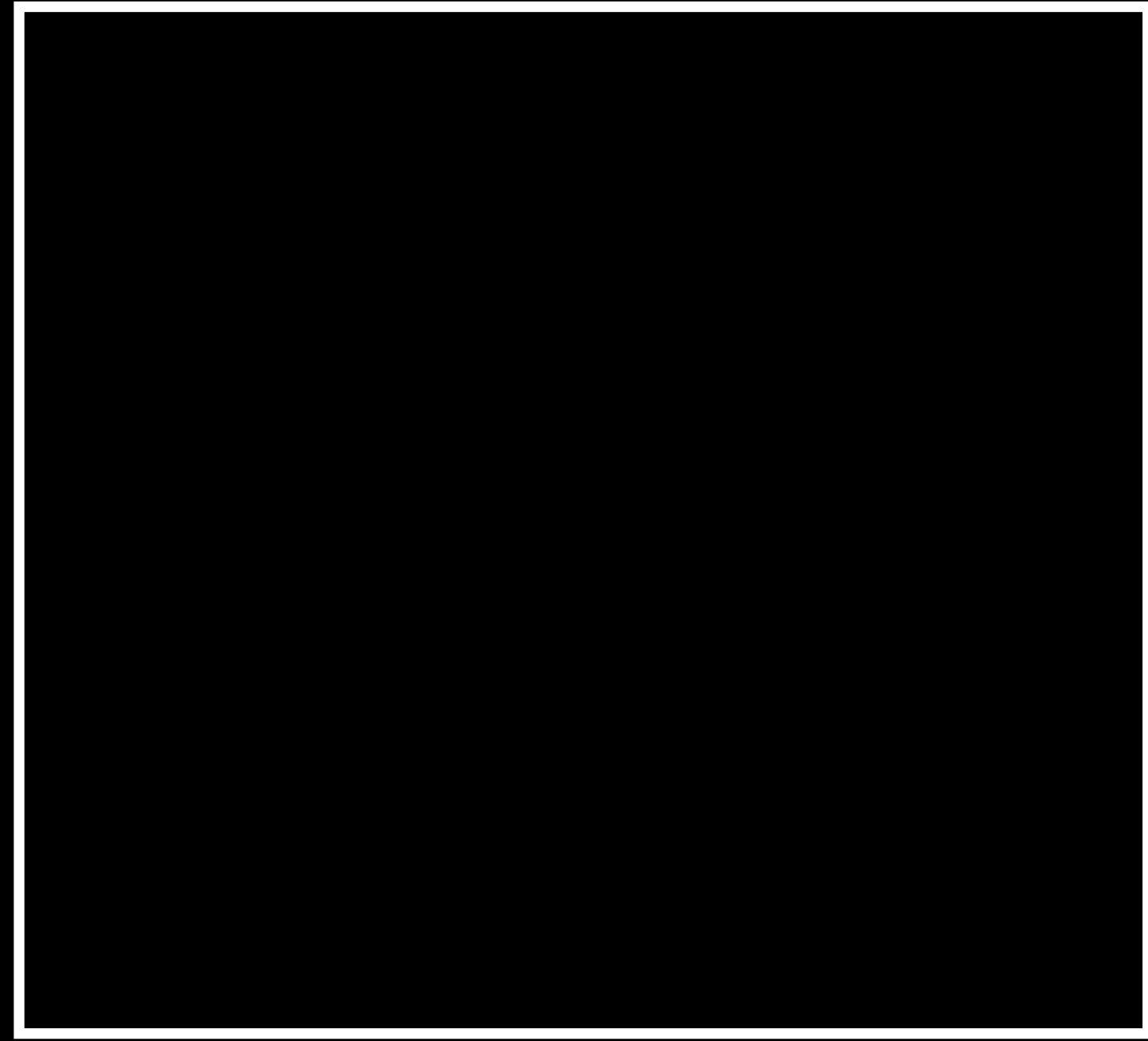
kernel space

user space

process



process info



kernel space

user space

process



process info

```
real UID: 100  
real GID: 100  
  
supplementary GIDS: 500, 501
```

kernel space

user space

process



process info

```
real UID: 100  
real GID: 100  
  
supplementary GIDS: 500, 501  
  
effective UID: 100  
effective GID: 100
```

Copy

kernel space

user space

process



process info

```
real UID: 100  
real GID: 100  
  
supplementary GIDS: 500, 501  
  
effective UID: 100  
effective GID: 100
```

kernel space

user space

process



file



process info

```
real UID: 100
real GID: 100

supplementary GIDS: 500, 501

effective UID: 100
effective GID: 100
```

kernel space

user space

process



*Attempt access
(typically open)*

file



process info

```
real UID: 100
real GID: 100

supplementary GIDS: 500, 501

effective UID: 100
effective GID: 100
```

i-node

```
UID: ..
GID: ..
mode
```



Special

Owner
(User)

Group

Other

kernel space

user space

process



*Attempt access
(typically open)*

file



process info

```
real UID: 100
real GID: 100

supplementary GIDS: 500, 501

effective UID: 100
effective GID: 100
```

i-node

```
UID: ..
GID: ..
mode
```



Special

Owner
(User)

Group

Other

== ?

kernel space

user space

process



*Attempt access
(typically open)*

file



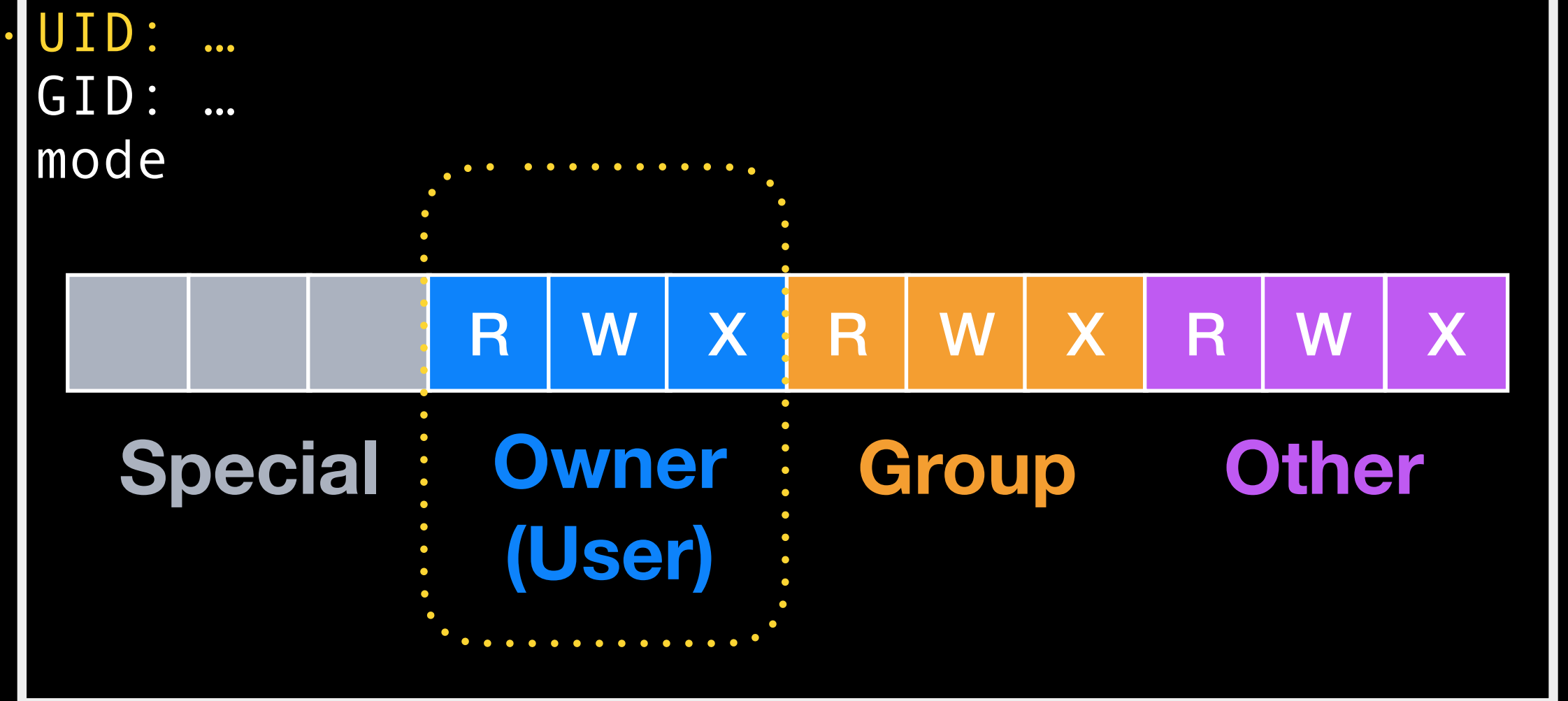
process info

```
real UID: 100
real GID: 100

supplementary GIDS: 500, 501

effective UID: 100
effective GID: 100
```

i-node



== ?

kernel space

user space

process



*Attempt access
(typically open)*

file



process info

```
real UID: 100
real GID: 100

supplementary GIDS: 500, 501

effective UID: 100
effective GID: 100
```

i-node

```
UID: ..
GID: ..
mode
```



Special

Owner
(User)

Group

Other

== ?

kernel space

user space

process



Attempt access
(typically open)

file



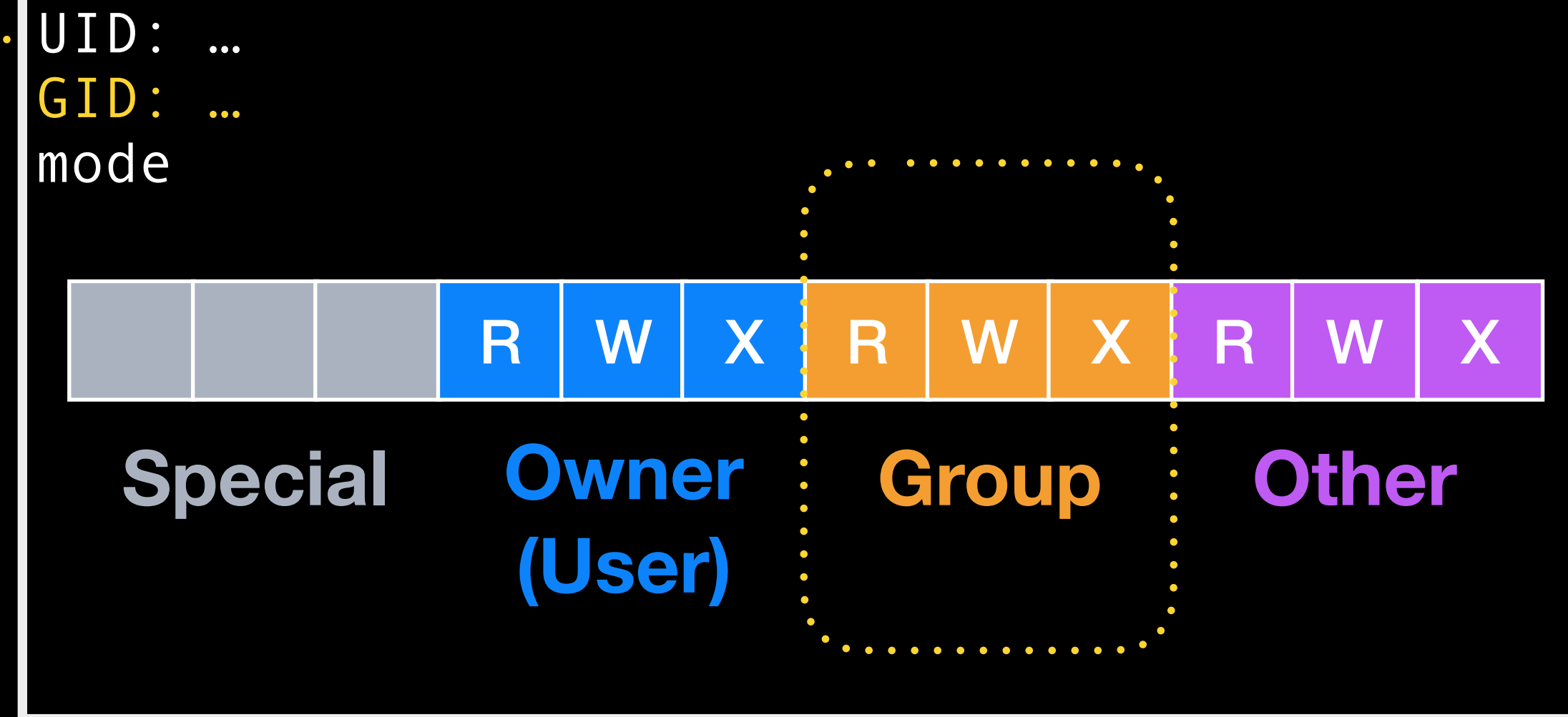
process info

```
real UID: 100
real GID: 100

supplementary GIDS: 500, 501

effective UID: 100
effective GID: 100
```

i-node



== ?

kernel space

user space

process



*Attempt access
(typically open)*

file



process info

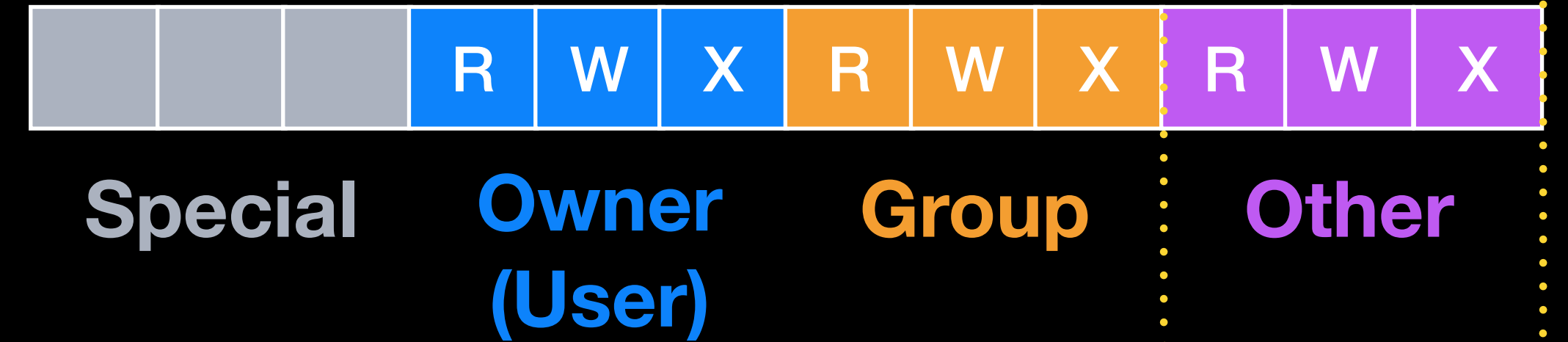
```
real UID: 100
real GID: 100

supplementary GIDS: 500, 501

effective UID: 100
effective GID: 100
```

i-node

```
UID: ..
GID: ..
mode
```



kernel space

user space

process



*Attempt access
(typically open)*

file



i-node

UID: 0
GID: 0
mode

			R	W	X	R	W	X	R	W	X
Special			Owner (User)			Group			Other		

kernel space

user space

file



i-node

UID: 0
GID: 0
mode

Set-user-ID



Special

**Owner
(User)**

Group

Other

kernel space

user space

file



process info

```
real UID: 100
real GID: 100

supplementary GIDS: 500, 501
```

i-node

```
UID: 0
GID: 0
mode
```

Set-user-ID

U			R	W	X	R	W	X	R	W	X
---	--	--	---	---	---	---	---	---	---	---	---

Special

Owner
(User)

Group

Other

kernel space

user space

process



file



process info

```
real UID: 100
real GID: 100

supplementary GIDS: 500, 501
```

i-node

```
UID: 0
GID: 0
mode
```

Set-user-ID

U			R	W	X	R	W	X	R	W	X
Special			Owner (User)			Group			Other		

kernel space

user space

process



Execute

file



process info

```
real UID: 100
real GID: 100

supplementary GIDS: 500, 501

effective UID: 0
effective GID: 100
```

i-node

```
UID: 0
GID: 0
mode
```



Special

Owner
(User)

Group

Other

Copy

Set-user-ID

kernel space

user space

process



Execute

file



process info

```
real UID: 100
real GID: 100

supplementary GIDS: 500, 501
```

i-node

```
UID: 0
GID: 0
mode
```

Set-group-ID

U	G		R	W	X	R	W	X	R	W	X
Special			Owner (User)			Group			Other		

kernel space

user space

process



file



process info

```
real UID: 100
real GID: 100

supplementary GIDS: 500, 501
```

i-node

```
UID: 0
GID: 0
mode
```

Set-group-ID

U	G		R	W	X	R	W	X	R	W	X
Special			Owner (User)			Group			Other		

kernel space

user space

process



Execute

file



process info

```
real UID: 100
real GID: 100

supplementary GIDS: 500, 501

effective UID: 100
effective GID: 0
```

i-node

```
UID: 0
GID: 0
mode
```

U	G		R	W	X	R	W	X	R	W	X
---	---	--	---	---	---	---	---	---	---	---	---

Special

Owner
(User)

Group

Other

Copy

Set-group-ID

kernel space

user space

process



Execute

file



i-node

UID: 0
GID: 0
mode

Sticky bit

U	G	T	R	W	X	R	W	X	R	W	X
---	---	---	---	---	---	---	---	---	---	---	---

Special

**Owner
(User)**

Group

Other

kernel space

user space

file

