

# LINUX OPERATING SYSTEM

YANG

LINUX操作系统（双语）





双语课→课件内容中英混排

# |Lecture 17

## File System



# 本讲内容

 文件系统

 文件概念

 访问方法

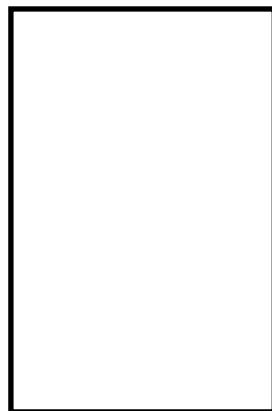
 文件目录

 共享与保护

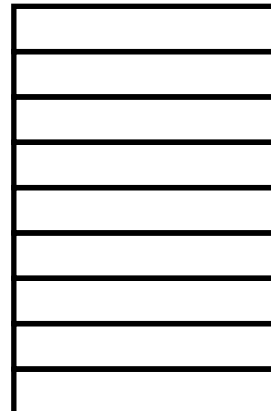
# 文件系统

# FILE SYSTEM

- 💡 For most users, the file system is the most visible aspect of an operating system.
- 💡 It provides the mechanism for on-line storage of and access to both data and programs of the operating system and all the users of the computer system.
- 💡 File systems live on devices, such as magnetic disk, SSDs.



disk



disk



disk

# FILE SYSTEM

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- 💡 It provides the mechanism for on-line storage of and access to both data and programs of the operating system and all the users of the computer system.
- 💡 File systems live on devices, such as magnetic disk, SSDs.
- 💡 The file system consists of two distinct parts: a collection of files, each storing related data, and a directory structure, which organizes and provides information about all the files in the system.

# 文件概念



# 文件定义

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- 🧠 文件（File）是信息的逻辑存储单位。
  - 🧠 在用户看来，文件是具有结构的信息集合
  - 🧠 在系统看来，文件的本质是存储在外存当中的二进制集合
- 🧠 文件可以存储不同类型的信息，如文本文件、可执行文件、doc文档文件、xls表格文件等。

# 文件属性

🧠 文件是“按名存取”的

🧠 文件名

🧠 文件类型

🧠 位置

🧠 大小

🧠 时间、日期和用户标识

🧠 保护



# 文件类型

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- 💡 文件类型可用于指示文件的内部结构，操作系统通过了解文件类型决定对文件如何进行解释。
- 💡 一般地，操作系统至少要能解释两种文件类型：
  - 💡 文本文件
  - 💡 二进制可执行文件
- 💡 Unix认为每个文件由字节序列构成，解释这些字节的工作交给对应的应用程序完成。

# 文件的内部结构



file

logical record



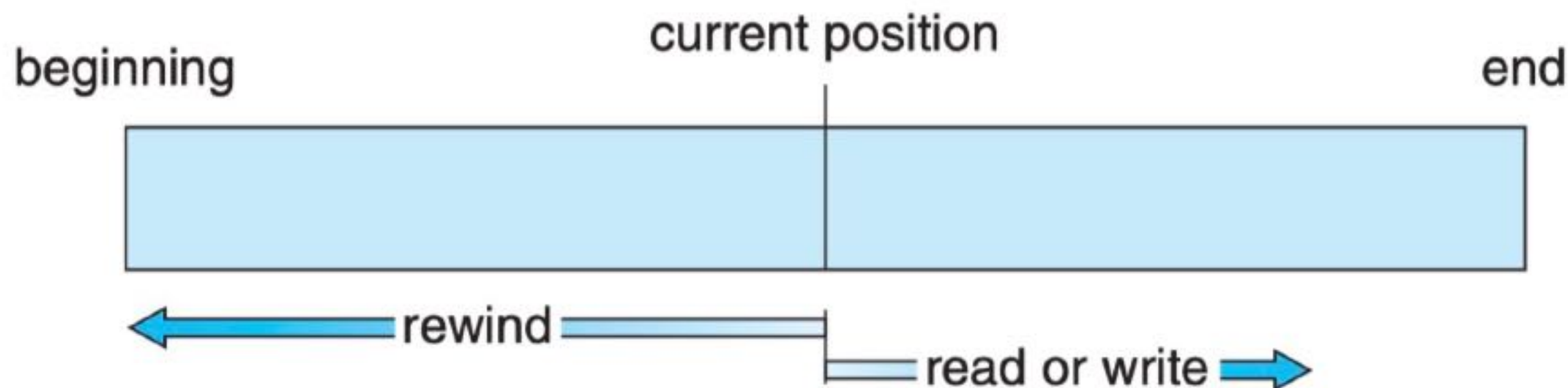
disk

# 访问方法

# 顺序访问

💡 这种访问文件的方式最为常见，文件信息按顺序排序，读取/写入当前文件信息后，将文件指针移向下一个邻接区域。

💡 磁带模型



# 直接访问

- 🧠 若文件的逻辑记录（logical record）的长度固定，那么允许在访问文件信息时可按任意顺序进行快速读取和写入。
- 🧠 磁盘模型
- 🧠 假设逻辑记录长度为 $L$ ，若要访问某个文件的第 $N$ 个逻辑记录（编号从0开始），则可转换成：“访问从文件起始位置 $L*N$ 开始的 $L$ 字节”

# 文件目录



# DIRECTORY

🧠 The directory can be viewed as a symbol table that translates file names into their **directory entries**.

🧠 Search for a file

🧠 Create a file

🧠 Delete a file

🧠 List a directory

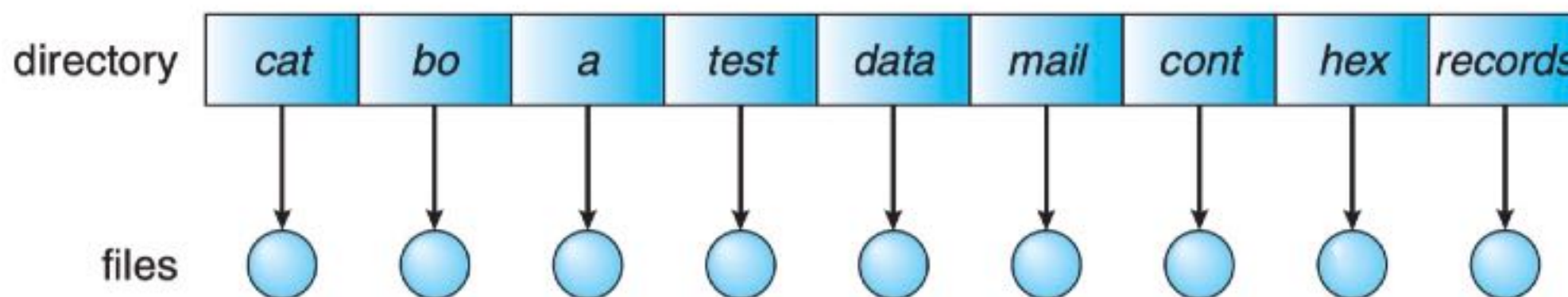
🧠 Rename a file

🧠 Traverse the file system

directory	
file_a	
file_b	
file_c	
file_d	

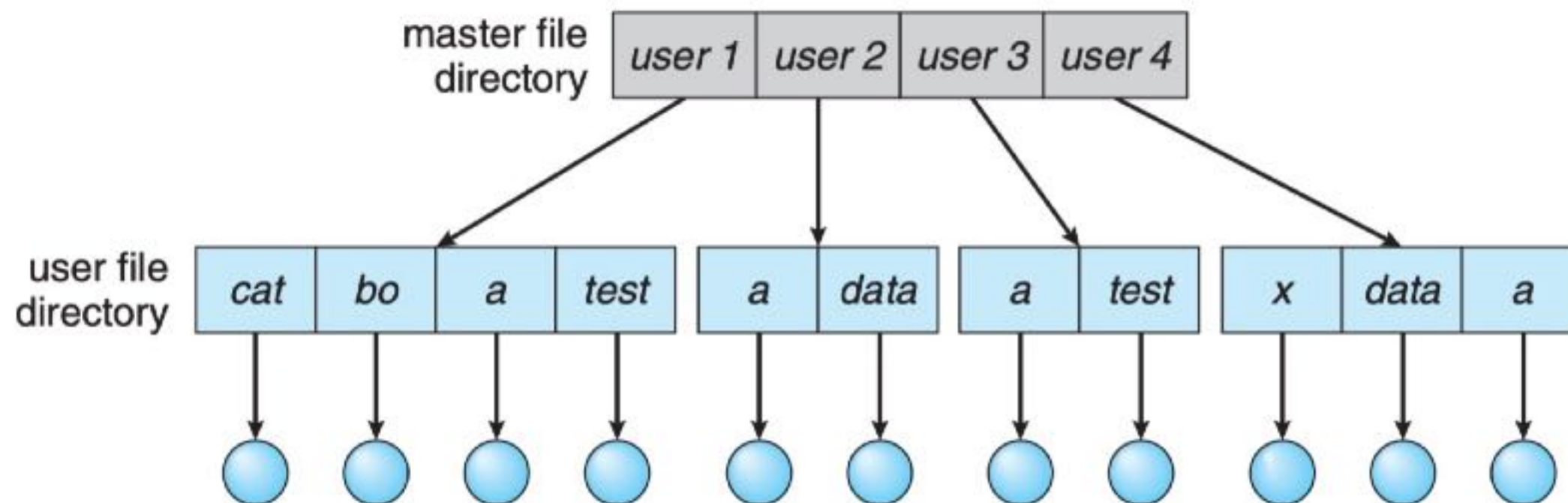
# SINGLE-LEVEL DIRECTORY

- 🧠 The simplest directory structure is the **single-level directory**. All files are contained in the same directory, which is easy to support and understand.
- 🧠 However, naming a file is a big problem.

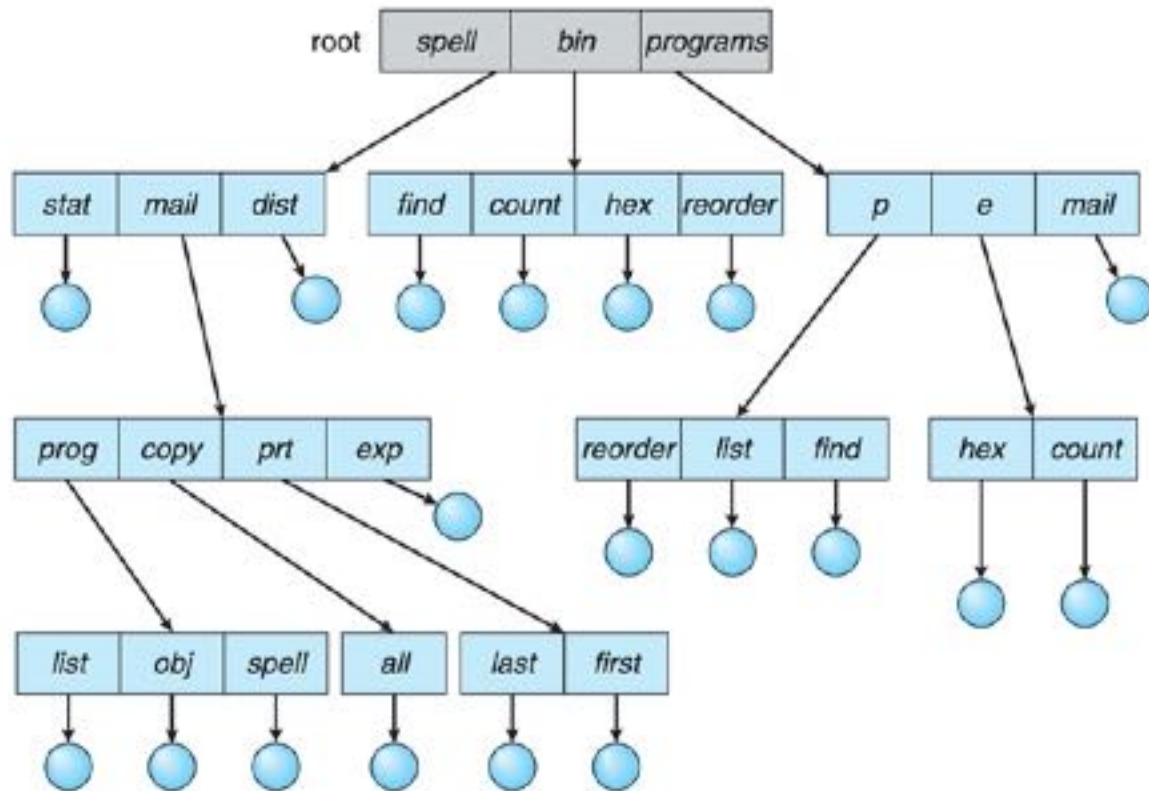


# TWO-LEVEL DIRECTORY

- 💡 In the **two-level directory** structure, each user has his own **user file directory (UFD)**. The UFDs have similar structures, but each lists only the files of a single user. When a user job starts or a user logs in, the system's **master file directory (MFD)** is searched.



# TREE-STRUCTURED DIRECTORY



🧠 **Tree-structure** allows users to create their own subdirectories and to organize their files accordingly.

🧠 A tree has a **root directory**, and every file in the system has **a unique path name**.

🧠 A directory (or subdirectory) contains a set of files or subdirectories.

# 共享与保护

# 用户和组

- 💡 大多用户系统中，提出了文件共享和保护的需求。
- 💡 在文件和目录的属性加入了“用户”和“组”两个概念：
  - 💡 User：即为所有者（Owner）
  - 💡 Group：用户集合，他们拥有相同的访问权限

```
youngyt@YANGs-MacBook-Pro-R ~ % ls -l
total 0
drwxr-xr-x   4 youngyt  staff   128  4   2   2018  AndroidStudioProjects
drwxr-xr-x  13 youngyt  staff   416  4   8   2018  AppleDNS
drwx----- 10 youngyt  staff   320  3  10  17:57  Applications
drwx-----@  6 youngyt  staff   192 10  21  21:47  Applications (Parallels)
drwxr-xr-x   5 youngyt  staff   160  3  26  11:07  Brains
drwxr-xr-x@  20 youngyt  staff   640  3  11  12:43  CloudStation
```



# 文件访问控制

- 💡 为每个文件和目录关联一个访问控制列表（Access Control List）可以实现基于身份的访问控制。以Linux为例：
- 💡 每个文件/目录有三种用户类型：Owner/Group/Other
- 💡 三种用户的访问控制权限均有readable/writable/executable (rwx)
- 💡 每个文件/目录的ACL有9个bit来指示它的访问控制权限



```
youngyt@YANGs-MacBook-Pro-R ~ % ls -l
total 0
drwxr-xr-x   4 youngyt  staff   128  4  2   2018  AndroidStudio
drwxr-xr-x  13 youngyt  staff   416  4  8   2018  AppleDNS
drwx----- 10 youngyt  staff   320  3 10  17:57  Applications
drwx-----@  6 youngyt  staff   192 10 21  21:47  Applications
drwxr-xr-x   5 youngyt  staff   160  3 26  11:07  Brains
drwxr-xr-x@ 20 youngyt  staff   640  3 11  12:43  CloudStation
```

# |Lecture 17

The End





# 下期预告

 下次直播时间：4月7日 上午9:30

 课程内容

 Lecture 18 File System Implementation

 Practice 5 Linux File System

 Q&A