Lecture # 2.4
Design and Code of
UNIX who utility

Course: Advanced Operating System

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Agenda

- OS Configuration Files
- What does **who** do?
- How does **who** do it?
- Coding some basic versions of **who** command
- Concept of buffering
- How to incorporate buffering in our **who** program
- Assignment version

Operating System Configuration Files

Linux Configuration Files

User Configuration Files:
- `~/.bashrc`
- `~/.bash_history`
- `~/.bash_logout`
- `~/.vimrc`

System Administration Files:
- `/etc/passwd`
- `/etc/shadow`
- `/etc/group`
- `/etc/gshadow`

Kernel Configuration Files:
- `/proc/version,devices`
- `/proc/cpuinfo, meminfo`
- `/proc/filesystems,partitions`
- `/proc/sys/kernel/version`
- `/proc/sys/kernel/pid_max`
- `/proc/sys/fs/file_max`
- `/proc/sys/fs/file-nr`
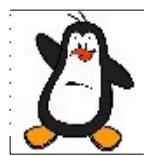
NW Configuration Files:
- `/etc/network/interfaces`
- `/etc/hosts`
- `/etc/resolv.conf`
- `/etc/services`
- `/etc/protocols`

Misc Configuration Files:
- `/etc/fstab, mtab`
- `/etc/localtime`
- `/usr/share/zoneinfo/`
- `/usr/share/locale/`

User Programs Config Files
- `/etc/ssh/sshd_config`
- `/etc/apache2.conf`
- `/bind/named.conf`
- `/etc/vim/vimrc`

System Data Files

Summery Of Routines Of Accessing System Data Files:

| Data File	Header	Structure	Functions
/etc/passwd	<pwd.h>	passwd	**getpwuid()**, getpwnam() getpwent(), setpwent()
/etc/group	<grp.h>	group	**getgrgid()**, getgrnam()
/etc/shadow	<shadow.h>	spwd	getspnam()
/var/run/utmp	<utmp.h>	utmp	getutent(), setutent(), endutent()
/etc/hosts	<netdb.h>	hostent	gethostbyname() gethostbyaddr()
/etc/sysconfig/ network	<netdb.h>	netent	getnetbyname() getnetbyaddr()
/etc/protocols	<netdb.h>	protoent	getprotobyname() getprotobyaddr()
/etc/services	<netdb.h>	servent	getservbyname() getservbyport()

UNIX who utility
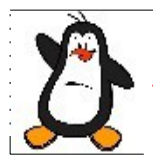
What does `who` do?

The default behavior of **who** (w/o any arguments/options) is to display a list of currently logged in users, one on each line. It displays four columns as shown below:

```
$who
```

```
arif@kali:~$ who
Arif        tty2   2018-01-11 15:16  (:0)
Rauf        pts/0  2018-02-21 19:05 (192.168.1.100)
kakamanna   pts/3 2018-02-21 19:01
zalaid      pts/4 2018-02-21 19:03
```
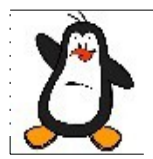
How does who do it?

1. Open the file `/var/run/utmp`

2. Read a `utmp` structure till end of file

3. Display the required fields

4. Go to step 2

5. Close file `/var/run/utmp`
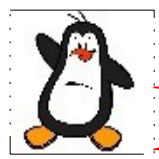
Members of `utmp` Structure

```
struct utmp{
    char     ut_user[32];     //user login name
    char     ut_line;         //terminal name
    time_t   ut_time;         //logged in time
    char     ut_host;         //hostname
    int      ut_type;         //type of login
    };
```

whov0.c

whov1.c

This version adds a feature that displays time in proper format instead of number of seconds since UNIX epoch
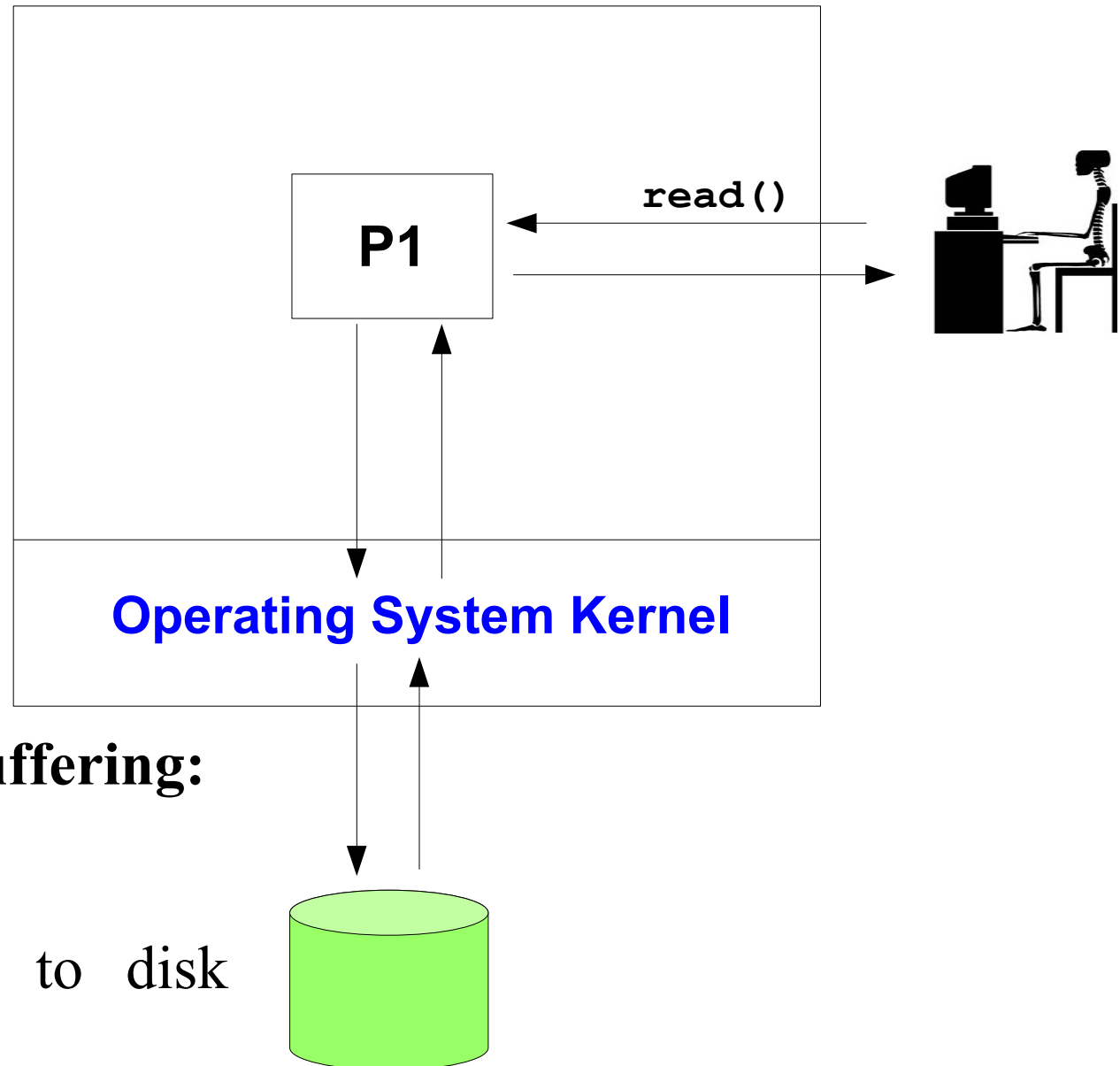
whov2.c

This version adds a feature to suppress the records which are not related to actual users

What is buffering?

P1

`read()`
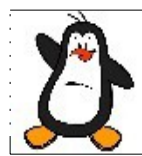
Operating System Kernel

Consequences of kernel buffering:
- Faster disk IO
- Optimized disk writes
- Need to write buffers to disk before shutdown

whov3.c

This version adds feature of buffering to the who utility as discussed in previous slides

Things To Do

If you have problems visit me in counseling hours. . . .