ISA 563: Fundamentals of Systems Programming

System Data Files and Information

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System Files

- System uses many data files for normal operation:
  - /etc/passwd
  - /etc/group
  - ...
- Some files are accessed very frequently:
  - issuing ls -l access /etc/passed every time
- Normally in ASCII text files
  - Performance problems for large deployments

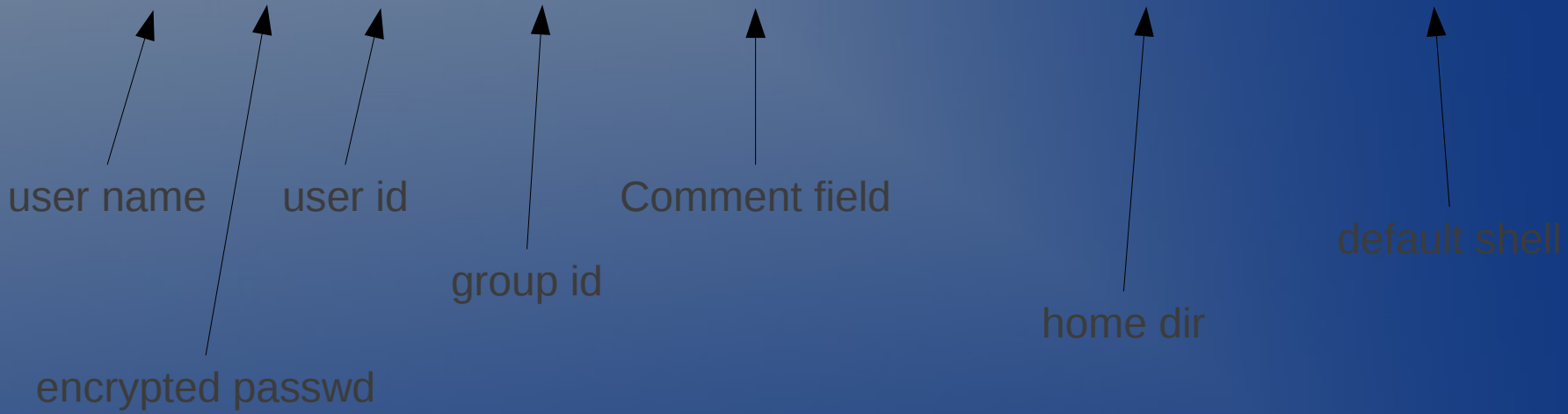
/etc/passwd

- Contains user information:
  - user name (pw_name)
  - encrypted password (pw_passwd, historical)
  - user id (pw_uid)
  - group id (pw_gid)
  - home dir (pw_dir)
  - default shell (pw_shell)
  - …
- World-readable ascii file, fields are separated by “:”

/etc/passwd (cont'd)

- Example entry:

```
jdoe:x:1000:1000:John Doe,,,:/home/jdoe:/bin/bash
```



/etc/shadow

- Recent Unix/Linux systems do not store encrypted password in /etc/passwd
- /etc/shadow contains the username and encrypted password
  - Only accessable by root

Obtaining User Information

- setpwdent()
- getpwdnam()
- endpwdent()
- getspnam()
- ...

Demo

uinfo.c

Other System Files

- /etc/hosts
- /etc/networks
- /etc/services
- /etc/protocols

Login Accounting

- Currently logged-in users:
  - /var/run/utmp
- User login record:
  - /var/log/wtmp
- #include <utmp.h> ($ man utmp)

```
struct utmp {
               short   ut_type;              /* Type of record */
               pid_t   ut_pid;               /* PID of login process */
               char    ut_line[UT_LINESIZE]; /* Device name of tty - "/dev/" */
               char    ut_id[4];             /* Terminal name suffix,
               …
}
```

Demo

login_log.c

System Identification

- #include <sys/utsname.h>

```
struct utsname {
               char sysname[];    /* Operating system name (e.g., "Linux") */
               char nodename[];   /* Name within "some implementation-defined
                                     network" */
               char release[];    /* OS release (e.g., "2.6.28") */
               char version[];    /* OS version */
               char machine[];    /* Hardware identifier */
           #ifdef _GNU_SOURCE
               char domainname[]; /* NIS or YP domain name */
           #endif
};
```

Demo

sysname.c

/proc: dynamic process filesystem

- procfs:
  - originated from Plan 9 operating system
  - copied by Linux
  - mounted under /proc
    - contains files of zero length
      - they do not exist
      - but you can use them
      - takes not disk space
      - uses limited memory size
  - numbered directories for (specific) processes
  - others contain useful system information

Exploring /proc

- ls /proc
- Programs can read and parse the files instead of placing system calls (when applicable)
- Example entries:
  - /proc/meminfo
  - /proc/cpuinfo
  - /proc/uptime
  - /proc/mounts
  - ...