# Daemon Process

## Introduction

- Processes Live for a Long Time
  - often started when the system is up and terminate when it is down
  - do not have a controlling terminal
  - run in background
  - partial output `ps ajx`
    - `x`: process without terminal
    - `j`: show job related information
    - processes enclosed by `[]` are kernel processes

## Daemon Conventions

- Lock File
  - if daemon uses a lock file, it is usually stored in `/var/run/name.pid`
  - use to check the existence of a running daemon
  - might need superuser permissions to create a file here
- Configuration Options
  - usually stored in `/etc`, named `name.conf`
  - daemon usually reads it only if it starts
  - some daemon will read configuration again when received `SIGHUP`
- Start
  - start from `/etc/rc*` or `/etc/init.d/*`

## Client Server Model

- daemon is common to use as server
- e.g.
  - client: `syslog` library call
  - server: `syslogd` daemon

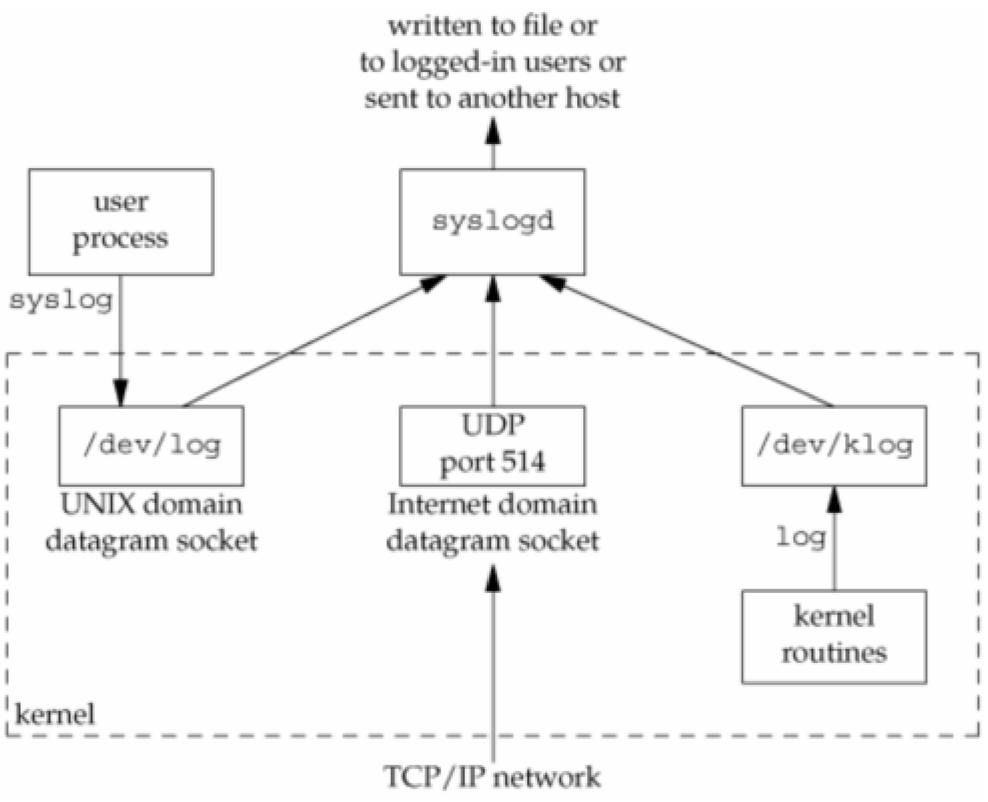
## Coding Rules

1. `umask(2)` to reset permission masks
2. `fork(2)` and parent exit
   - not block the shell

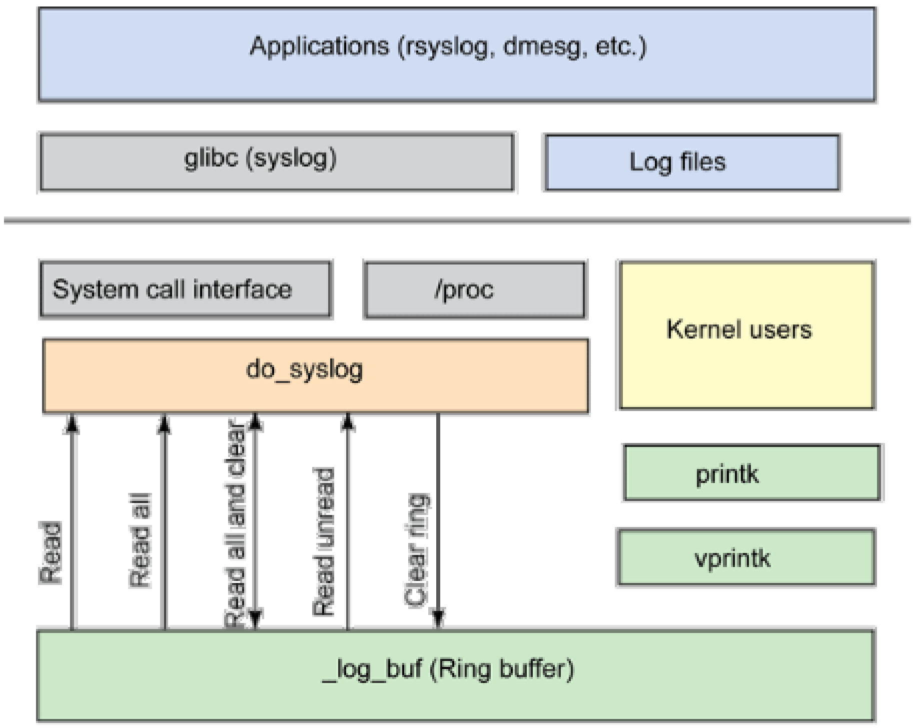
    - not a process group leader
        - child inherits the process group ID of the parent
        - but gets a new process ID
    - can be a session leader
3. `setsid(2)`
    - become a session leader
    - become a process group leader
    - no controlling terminal
    - System V systems suggest to `fork(2)` again and terminate the parent
        - child continues as the daemon, and not a session leader
        - prevent the child from acquiring controlling terminal
4. change the current working directory, may be root directory
5. close unused file descriptors, and redirect {0, 1, 2} to `/dev/null`
6. setup log files or log systems

## Error Logging

- Logging
    - daemon cannot write error message to standard error
    - a centralized place to collect logs from all daemons
    - `syslog` facility initially proposed in the BSD system
    - many systems derived the design from `syslogd`
    - e.g. Linux's `rsyslogd`: a reliable and extended of `syslogd`


written to file or to logged-in users or sent to another host
user process
syslogd
syslog
/dev/log
UNIX domain datagram socket
UDP port 514
Internet domain datagram socket
/dev/klog
log
kernel routines
kernel
TCP/IP network

- Linux Kernel Logging Stack
    - `syslog(2)`: read and clear the kernel log buffer
    - `syslog(3)`: write log to log system



- `syslog(3)`
  - `void openlog(const char *ident, int option, int facility);`
  - `void syslog(int priority, const char *format, ...);`
  - `void closelog(void);`
  - the call to `openlog(3)` is optional
    - it will be called on the first call to `syslog(3)`
  - the call to `closelog(3)` is optional
    - it simply close the descriptor
  - `priority` argument can be specified by facility and level together
  - option

| **Option** | **Description** |
|---|---|
| `LOG_CONS` | Write to the console if there is an error while sending to the system logger |
| `LOG_NDELAY` | Open the connection immediately instead of opening when the first message is logged |
| `LOG_NOWAIT` | Do not wait for child processes that may have been created while logging the message |
| `LOG_ODELAY` | Delay the connection until `syslog(3)` is called |
| `LOG_PERROR` | (Not in POSIX.1-2001 or POSIX.1-2008.) Also log the message to `stderr` |
| `LOG_PID` | Include the caller's PID with each message |

  - facility

| **Facility** | **Description** |
|---|---|
| `LOG_AUTH` | security/authorization messages |
| `LOG_AUTHPRIV` | security/authorization messages (private) |

| Facility | Description |
|---|---|
| `LOG_CRON` | clock daemon (cron and at) |
| `LOG_DAEMON` | system daemons without separate facility value |
| `LOG_FTP` | ftp daemon |
| `LOG_KERN` | kernel messages (these can't be generated from user processes) |
| `LOG_LOCAL0~7` | reserved for local use |
| `LOG_LPR` | line printer subsystem |
| `LOG_MAIL` | mail subsystem |
| `LOG_NEWS` | USENET news subsystem |
| `LOG_SYSLOG` | messages generated internally by `syslogd(8)` |
| `LOG_USER` | generic user-level messages(default) |
| `LOG_UUCP` | UUCP subsystem |

- level

| Level | Description |
|---|---|
| `LOG_EMERG` | system is unusable |
| `LOG_ALERT` | action must be taken immediately |
| `LOG_CRIT` | critical conditions |
| `LOG_ERR` | error conditions |
| `LOG_WARNING` | warning conditions |
| `LOG_NOTICE` | normal, but significant, condition |
| `LOG_INFO` | informational message |
| `LOG_DEBUG` | debug-level message |

- `setlogmask(3)`: `int setlogmask(int mask);`
  - can be used to restrict logging to specified levels only.
- Example

```
// line printer spooler daemon
openlog("lpd", LOG_PID, LOG_LPR);
syslog(LOG_ERR, "open error for %s: %m", filename);
// an almost equivalent implementation
syslog(LOG_ERR | LOG_LPR, "open error for %s: %m", filename);
```

## Single Instance Daemon

- Single Instance
  - some daemons are implemented so that only a single copy is allowed
  - e.g. the daemon might need exclusive access to a device
    - the cron daemon
- Codes to Check Daemon Existence

```c
int already_running(d) {
  int fd;
  char buf[16];
  if ((fd = open(LOCKFILE, O_RDWR | O_CREAT, LOCKMODE)) < 0) {
    syslog(LOG_ERR, "can't open %s: %s", LOCKFILE, strerror(errno));
    exit(1);
  }
  if (lockfile(fd) < 0) {
    if (errno == EACCES || errno == EAGAIN) {
      close(fd);
      return 1;
    }
    syslog(LOG_ERR, "can't lock %s: %s", LOCKFILE, strerror(errno));
    exit(1);
  }
  ftruncate(fd, 0);
  sprintf(buf, "%ld\n", (long)getpid());
  write(fd, buf, strlen(buf));
  return 0;
}
```