Unix Daemons

Daemons

- **A daemon is a process that:**
  - runs in the background
  - not associated with any terminal
    - output doesn't end up in another session.
    - terminal generated signals (^C) aren't received.
- **Unix systems typically have many daemon processes.**
- **Most servers run as a daemon process.**

Common Daemons

- Web server (httpd)
- Mail server (sendmail)
- SuperServer (inetd)
- System logging (syslogd)
- Print server (lpd)
- router process (routed, gated)

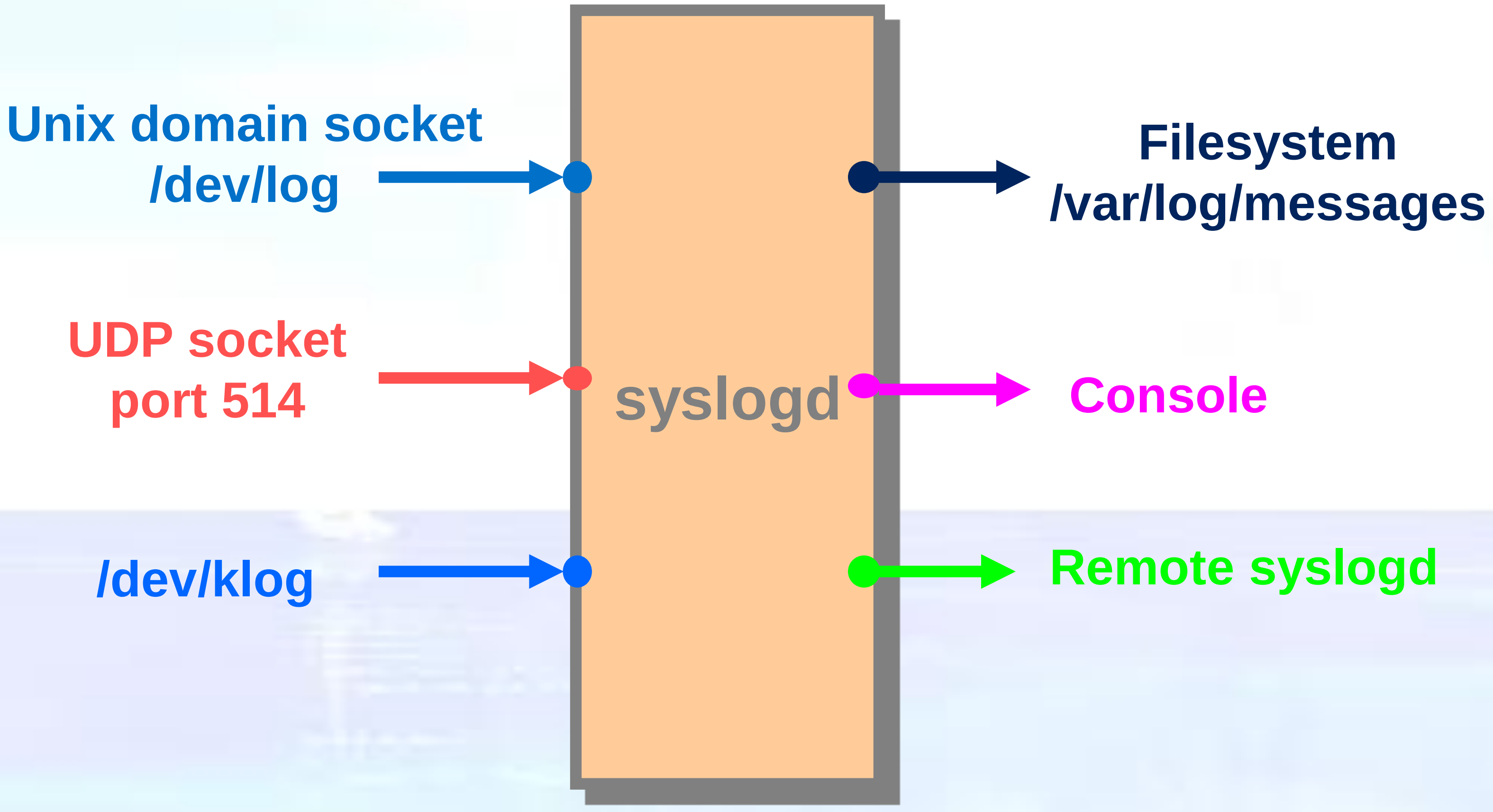
Daemon Output

- **No terminal - must use something else:**
  - file system
  - central logging facility
- **Syslog is often used - provides central repository for system logging.**

Syslog service

- `syslogd` **daemon provides system logging services to "clients".**
- **Simple API for "clients"**
  - A library provided by O.S.
- **A system administrator can control logging functions by specifying:**
  - where messages should go
  - what kinds of messages are important
  - what can be ignored

syslogd


Unix domain socket
/dev/log
UDP socket
port 514
/dev/klog
syslogd
Filesystem
/var/log/messages
Console
Remote syslogd

Syslog messages

- **Think of syslog as a server that accepts messages.**
- **Each message includes a number of fields, including:**
  - a *level* indicating the importance (8 levels)
    - **`LOG_EMERG`** highest priority
    - **`LOG_DEBUG`** lowest priority
  - a *facility* that indicates the type of process that sent the message:
    - **`LOG_MAIL, LOG_AUTH, LOG_USER, LOG_KERN, LOG_LPR, ...`**
  - A text *string*.
- **Message: (*level,facility,string*)**

/etc/syslog.conf

- **Syslogd reads a configuration file that specifies how various messages should be handled (where they should go).**
- **The sysadmin controls all logged messages by editing this file.**
- **Examples:**
  - Sysadmin could set LOG_EMERG messages to be sent to the console
  - low priority messages from lpr could be thrown away.
  - Medium priority message from the mail server could be saved in a file.

Sending a message to syslogd

- **Standard programming interface provided by** `syslog()` **function:**

```
#include <syslog.h>
void syslog( int priority,
             const char *message,
             . . . );
```

- **Works like** `printf()`

Syslog client/server

- Clients send messages to local syslogd through a unix domain (datagram) socket.
- All the details are handled by `syslog()`
- `syslogd` sends/receives messages to/from other hosts using UDP.

How to create daemons?

- **To force a process to run in the background, just fork() and have the parent exit.**
- **There are a number of ways to disassociate a process from any controlling terminal.**
  - Call `setsid()` and then `fork()` again.

Daemon initialization

- **Daemons should close all unnecessary descriptors**
  - often including `stdin, stdout, stderr`.
- **Get set up for using syslog**
  - Call `openlog()`
- **Often change working directory.**

Too many daemons?

- **There can be many servers running as daemons - and idle most of the time.**
- **Much of the startup code is the same for these servers.**
- **Most of the servers are asleep most of the time, but use up space in the process table.**
- **Most Unix systems provide a “SuperServer” that solves the problem:**
  - executes the startup code required by a bunch of servers.
  - Waits for incoming requests destined for the same bunch of servers.
  - When a request arrives - starts up the right server and *gives it the request*.

`inetd`

- **The SuperServer is named** `inetd`**. This single daemon creates multiple sockets and waits for (multiple) incoming requests.**
- `inetd` **typically uses** `select` **to watch multiple sockets for input.**
- **When a request arrives,** `inetd` **will fork and the child process handles the client.**

`inetd` children

- The child process closes all unnecessary sockets.
- The child `dup`'s the client socket to descriptors 0,1 and 2 (`stdin, stdout, stderr`).
- The child `exec`'s the real server program, which handles the request and exits.

`inetd` based servers

- **Servers that are started by `inetd` assume that the socket holding the request is already established (descriptors 0,1 or 2).**
- **TCP servers started by `inetd` don't call `accept`, so they must call `getpeername` if they need to know the address of the client.**

/etc/inetd.conf

- `inetd` **reads a configuration file that lists all the services it should handle.**
- `inetd` **creates a socket for each listed service, and adds the socket to a** `fd_set` **given to** `select()`.
- **Example:**

```
......

echo      stream  tcp  nowait  root  internal
echo      dgram   udp          wait    root  internal
chargen   stream  tcp          nowait  root  internal
chargen   dgram   udp          wait    root  internal
ftp       stream  tcp          nowait  root  /usr/sbin/ftpd ftpd -l
telnet    stream  tcp  nowait  root  /usr/sbin/telnetd telnetd
finger    stream  tcp          nowait  root  /usr/sbin/fingerd fingerd

......
```

`inetd` service specification

- **For each service, `inetd` needs to know:**
  - the port number and transport protocol
  - wait/nowait flag.
  - login name the process should run as.
  - pathname of real server program.
  - command line arguments to server program.

wait/nowait

- **Specifying** `wait` **means that** `inetd` **should not look for new clients for the service until the child (the real server) has terminated.**
- **TCP servers usually specify** `nowait` **- this means inetd can start multiple copies of the TCP server program - providing concurrency!**
- **Most UDP services run with** `inetd` **told to wait until the child server has died.**
  - **What would happen if:**
    - **`inetd`** did not wait for a UDP server to die?
    - **`inetd`** gets a time slice before the real server reads the request datagram?

UDP Servers that wait/nowait

- **Some UDP servers hang out for a while, handling multiple clients before exiting.**
- `inetd` **was told to wait – so it ignores the socket until the UDP server exits.**

Super inetd

- **Some versions of inetd have server code to handle simple services such as**

  echo server, daytime server, chargen…

- **Servers that are expected to deal with frequent requests are typically *not* run from inetd: mail, web, NFS.**
- **Many servers are written so that a command line option can be used to run the server from `inetd`.**
- **Some versions of Unix provide a service very similar to `inetd` called `xinetd`.**
  - configuration scheme is different
  - basic idea (functionality) is the same…