Process Management under Linux

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Process States

- Recall:
  - A parent process can **suspend** a child process

- Therefore, if a child is in **run** state and goes to ready (time slice up), and the parent runs and decides to suspend the child, then how do we reflect this in the process state diagram???

- We need 2 more states
  - Ready suspended
  - Blocked suspended
Process State diagram reflecting Control

- Not blocked
- Not suspended
- Has memory

- Blocked
- Not suspended
- No memory

Start
- Blocked
- Suspended
- No memory
Processes in Linux

- Also called *tasks*
- Task table or process table defined in `src/linux/include/sched.h`
  ```c
  extern struct task_struct *pidhash[PIDHASH_SZ];
  ```
- Can also be accessed as a doubly-linked list `p->next_task` and `p->prev_task`
Process or task descriptor

- Called task_struct
- Present in src/include/linux/sched.h
- Contains various fields to indicate
  - state
  - priority
  - pointers to parent, children, other tasks in pid list
  - tty
  - memory location
  - file descriptors
  - ...

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Process States

- Linux identifies following states
  1. TASK_RUNNING
  2. TASK_INTERRUPTIBLE
  3. TASK_UNINTERRUPTIBLE
  4. TASK_ZOMBIE
  5. TASK_STOPPED
  6. TASK_EXCLUSIVE
Process Creation

- Remember in traditional UNIX, we use fork() and then typically exec()
- fork() duplicates resources owned by parent for child process and copies them to new address space
- This method is slow and inefficient, since exec() wipes out address space anyway
Process creation in Linux

- Copy On Write technique
- Lightweight processes
- vfork()
Copy-on-write

- Child pages are pointers to parent pages
- If child makes a change to a page, a new copy is made for the child
- This way, you avoid making separate copies of pages unnecessarily
Lightweight processes

- Allow parent and child processes to share many kernel data structures
- created in Linux by function called __clone() 
- uses non-standard clone() system call
vfork()

- Creates a process that shares memory address of parent
- Parent is blocked until child exits or executes a new program by doing exec()
User view of processes

- Can use ps command with various options, for example,
  - ps --aux
  - ps --ef
/proc file system

- process information pseudo file system
- Do `man proc` to get more info
- /proc directory contains
  - Numerical subdirectory for each running process
  - A number of other files containing kernel table information
/proc... continued

- Files include
  - cpuinfo – contains CPU specs
  - uptime – time in secs since machine was last rebooted and idle time since then
  - version – kernel version
  - loadavg – Load average of machine over the past 1, 5 and 15 minutes
  - ...
Process directories

- One subdirectory for each running process
- Files include
  - cmdline
  - cwd
  - environ
  - exe
  - fdm
  - map
  - mem
  - root
References

- Linux Kernel 2.4 internals, Tigran Aivazian http://www.tldp.org/LDP/lki/
- Modern Operating Systems, 2nd Ed., A. Tanenbaum
- Understanding the Linux Kernel, D. Bovet, and M. Cesati