

UNIX: Working the Command Line in OS X

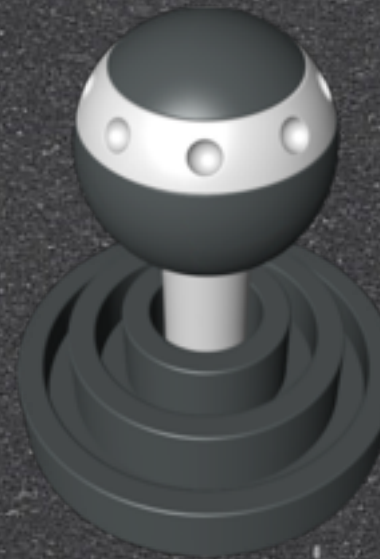
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Apple Certified System Administrator



Using the Command Line



```
$ mkdir /Users/Shared/new_docs  
$ mv hde*.txt /Users/Shared/new_docs  
$ chown warren /Users/Shared/new_docs
```


Advantages of the Command Line

- ▣ **Advanced configuration and features**
- ▣ **Running a command as a different user**
- ▣ **Efficiency**
- ▣ **Remote administration and troubleshooting**

Command Line Interface



Getting to it



>console



SSH



Single-user mode



Terminal application

```
russell.poucher — bash — 73x23
reboot ~ Tue Aug 30 12:01
reboot ~ Tue Aug 30 12:00
root console Tue Aug 30 12:00 - crash (00:00)
cradmin console Tue Aug 30 09:23 - 12:00 (02:36)
reboot ~ Tue Aug 30 09:22
shutdown ~ Mon Aug 29 12:06
cradmin console Mon Aug 29 12:05 - 12:06 (00:01)
reboot ~ Mon Aug 29 12:01
shutdown ~ Mon Aug 29 11:32
cradmin console Mon Aug 29 11:31 - 11:32 (00:00)
reboot ~ Mon Aug 29 11:30
shutdown ~ Mon Aug 29 11:30
cradmin console Mon Aug 29 11:14 - 11:30 (00:16)
reboot ~ Mon Aug 29 11:11
reboot ~ Mon Aug 29 11:11
root console Mon Aug 29 11:08 - crash (00:02)
cradmin ttys000 Mon Aug 29 10:21 - 10:21 (00:00)
cradmin console Mon Aug 29 09:47 - 11:08 (01:21)
root console Mon Aug 29 09:44 - 09:47 (00:02)
reboot ~ Mon Aug 29 09:43

wtmp begins Mon Aug 29 09:43
RLP-MacPro:~ russell.poucher$
```



Available Shells in OS X

 **bash**

"Bourne-again" shell (default)

 **sh**

Bourne shell is present but physical copy of bash

 **csch**

C shell

 **tcsh**

Tenex C Shell (enhanced csch)

 **ksh**

Korn shell

 **zsh**

Close to ksh (includes features from csch, tcsh)






- ▶ **All shells are located in /bin except tcclsh /usr/bin/tcclsh**

Shell Resource Files—/bin/bash

Systemwide:







-  /etc/profile—Systemwide initialization for login shell

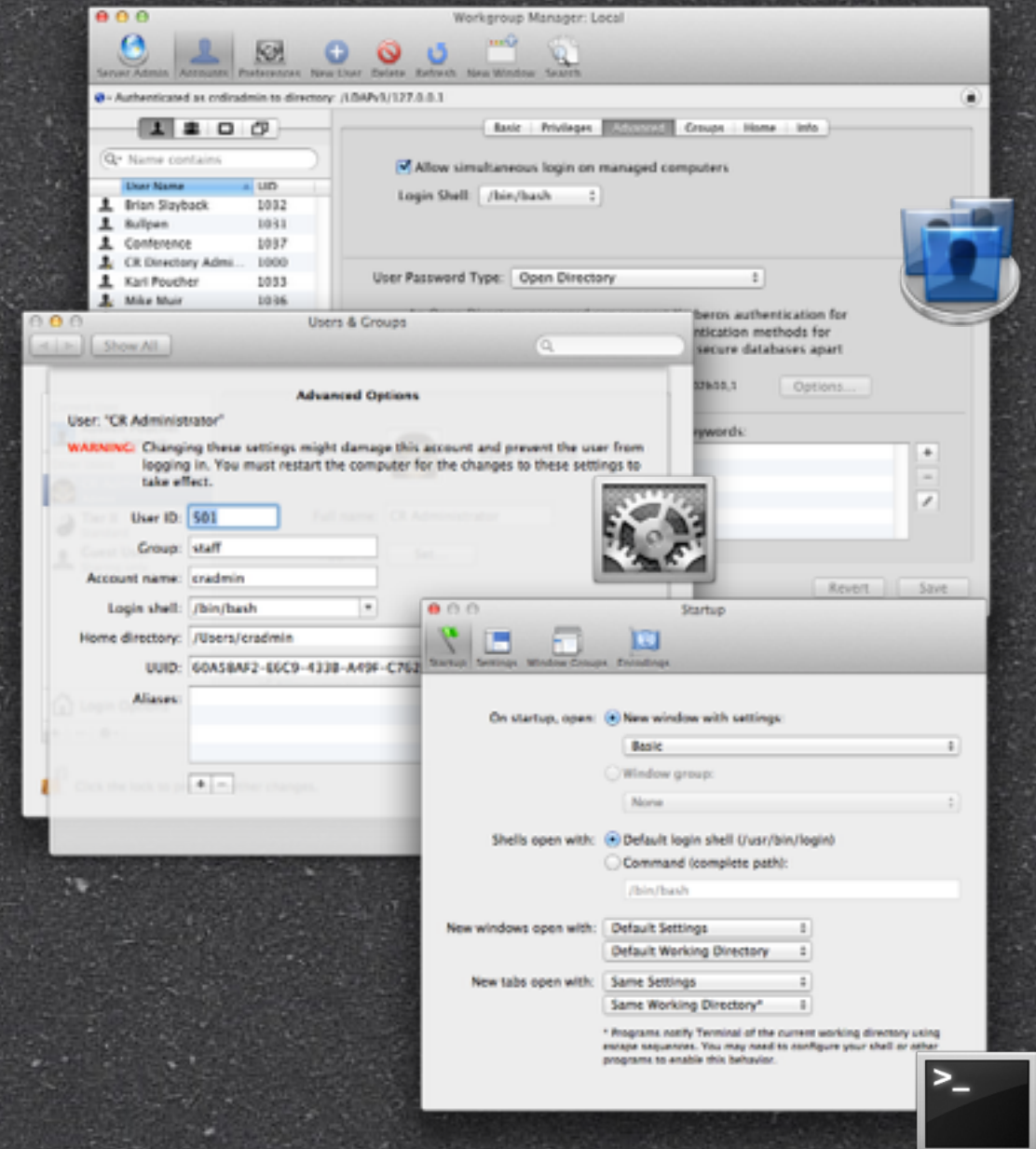
User:

-  ~/.bash_profile—Personal initialization file for login shells
-  ~/.bashrc—Individual per-interactive-shell startup file
-  ~/.bash_logout—Individual login shell cleanup file, executed when a login shell exits
-  ~/.inputrc—Individual readline initialization file
-  ~/.bash_history—Command history file

See man pages for the other shells

Change Default Shell

-  `dscl`
-  **Workgroup Manager**
-  **Server.app**
-  **System Preferences**
-  **Terminal.app**
-  `$ chsh -s shell`



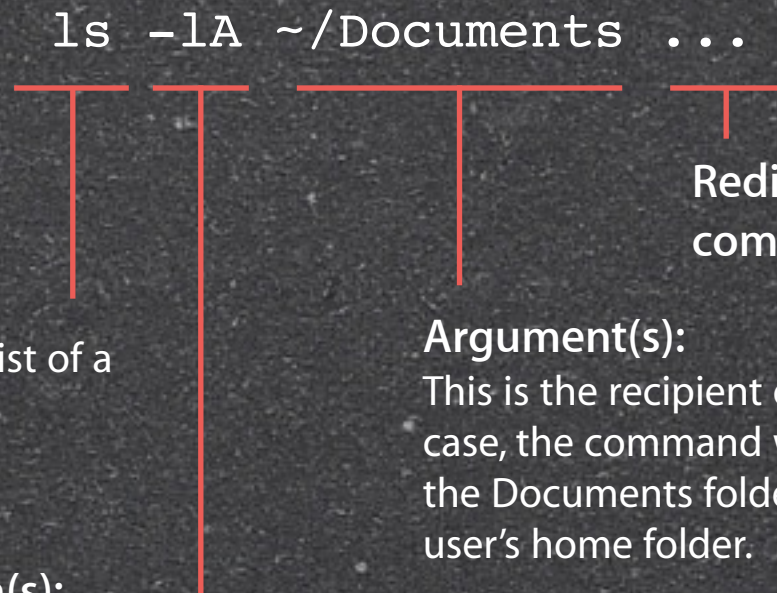
Automation with Shell Scripting

- 🎲 **Everything you can use in the shell you can use in a shell script.**
- 🎲 **This enables building workflows with scripts.**
- 🎲 **A lot is automated with shell scripts**
 - 🎲 `/private/etc/periodic/`
 - 🎲 `/System/Library/ServerSetup/`
 - 🎲 ...
- 🎲 **Anatomy of a script covered later**

Example Commands

`ls`

`ls -lA ~/Documents ...`



BSD command:

"ls" is the command to display a list of a folder's contents.

Argument(s):

This is the recipient of the action. In this case, the command will provide a list of the Documents folder within the current user's home folder.

Option(s):

Options add conditions, limits, or other modifiers to the BSD command. The "l" option requests a "long" listing, and the "A" option omits the . and .. entries from the list. Note the spaces between the different components of the command.

`man ls`

`mount -uw /`

Get Info About Commands



Manual

- ❶ All UNIX systems come with an extensive set of manuals
- ❷ Organized into different sections
- ❸ Use them to look up arguments and usage



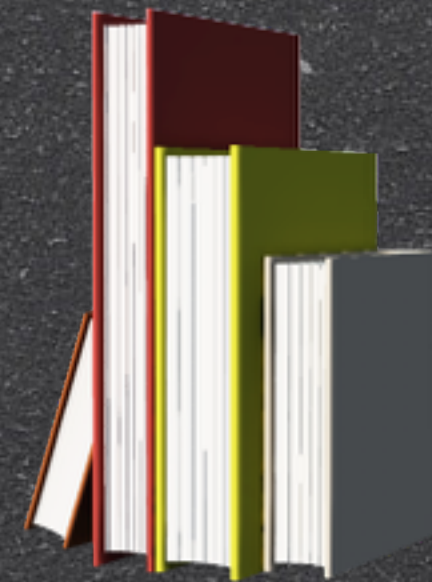
`man ssh`



`man -k secure`



`man 2 open`



Shell Filename Wildcard

- ❏ The * wildcard helps you to specify multiple files.
- ❏ List all of the user folders:
- ❏ `ls -ld /Users/ *`
- ❏ List all of the pdf files in your Documents folder:
- ❏ `ls -l ~/Documents/ *.pdf`

Command Line Interface

Using sudo to gain root permissions

 root disabled by default

 `sudo -s`

 `sudo passwd root`

Change in prompt

Be careful with root!

```
russell.poucher — bash — 73x23
reboot ~ Tue Aug 30 12:01
reboot ~ Tue Aug 30 12:00
root console Tue Aug 30 12:00 - crash (00:00)
cradmin console Tue Aug 30 09:23 - 12:00 (02:36)
reboot ~ Tue Aug 30 09:22
shutdown ~ Mon Aug 29 12:06
cradmin console Mon Aug 29 12:05 - 12:06 (00:01)
reboot ~ Mon Aug 29 12:01
shutdown ~ Mon Aug 29 11:32
cradmin console Mon Aug 29 11:31 - 11:32 (00:00)
reboot ~ Mon Aug 29 11:30
shutdown ~ Mon Aug 29 11:30
cradmin console Mon Aug 29 11:14 - 11:30 (00:16)
reboot ~ Mon Aug 29 11:11
reboot ~ Mon Aug 29 11:11
root console Mon Aug 29 11:08 - crash (00:02)
cradmin ttys000 Mon Aug 29 10:21 - 10:21 (00:00)
cradmin console Mon Aug 29 09:47 - 11:08 (01:21)
root console Mon Aug 29 09:44 - 09:47 (00:02)
reboot ~ Mon Aug 29 09:43

wtmp begins Mon Aug 29 09:43
RLP-MacPro:~ russell.poucher$
```


Playing with Files



touch



Creates a new, empty file



.DS_Store



.Trash



mv



rm



cp



Unix command do not recognize a resource fork

Directories



push



remembers where you were



popd - puts you back



pwd - where you are



mkdir



cpdir



rmdir

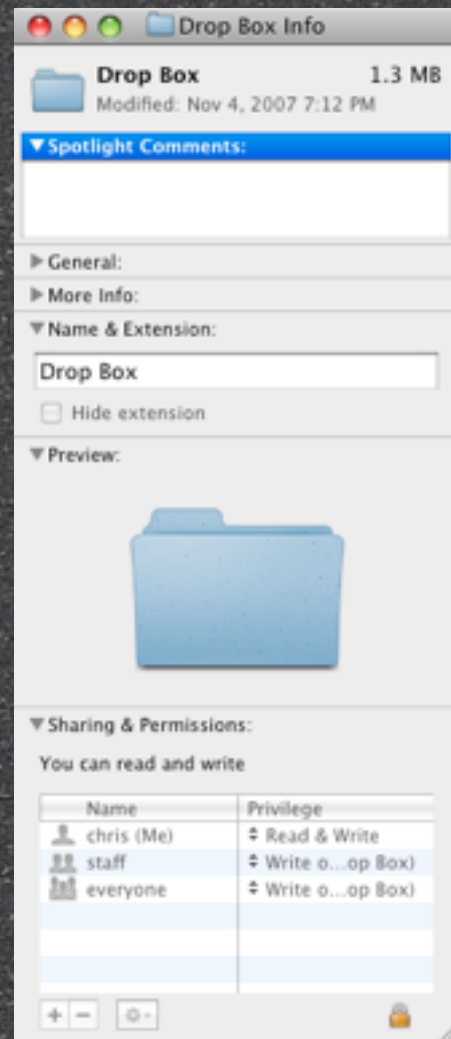


Using wildcards - (? , [], *)

```
Terminal — top — 80x32
Processes: 110 total, 4 running, 106 sleeping... 379 threads 10:18:50
Load Avg: 3.51, 1.86, 1.31 CPU usage: 61.0% user, 39.0% sys, 0.0% idle
SharedLibs: num = 114, resident = 29.4M code, 2.99M data, 6.37M LinkEdit
MemRegions: num = 8221, resident = 155M + 15.8M private, 96.9M shared
PhysMem: 76.0M wired, 148M active, 379M inactive, 604M used, 35.9M free
VM: 4.59G + 80.6M 37760(1) pageins, 2006(0) pageouts

  PID COMMAND   %CPU   TIME   #TH  #PRTS  #MREGS  RPRVT  RSHRD  RSIZE  VSIZE
25553 screencapt 50.7%  0:06.85  1    31     45   3.42M+ 2.20M  5.47M+ 64.3M+
25507 java         0.6%  0:30.34 59   793    495   66.6M  3.91M  58.4M  322M
25502 sh          0.0%  0:00.02  1    12     15   124K   772K   628K  18.2M
25490 AppleFileS  0.0%  0:00.11 42    95    115   1.34M  1.93M  2.02M  74.6M
25489 AppleFileS  0.0%  0:00.00  1     9     22    32K   1.92M   72K  28.6M
25036 bootpd     0.0%  0:00.06  1    14     26   216K   864K   848K  27.3M
24480 servermgrd  0.0%  0:01.32  1    10     37   264K   2.06M  996K  28.2M
24343 servermgrd  0.0%  0:01.57  1    10     37   268K   2.06M  1.01M  28.2M
13193 bash        0.0%  0:00.02  1    12     18   176K   872K   768K  18.2M
13192 login       0.0%  0:00.03  1    13     38   128K   432K   504K  26.9M
13186 top        13.1% 2:38:41  1    26     27   352K   432K   716K  27.1M
13185 bash       0.0%  0:00.02  1    12     16   136K   888K   744K  18.2M
13184 login      0.0%  0:00.04  1    13     38   128K   432K   504K  26.9M
13182 Safari     0.0%  0:05.16  5   103    162   3.85M  13.7M  12.6M  124M
13092 ssh         0.0%  0:26.16  1    14     27   600K   932K   1.39M  27.4M
13091 bash       0.0%  0:00.02  1    12     16   136K   888K   744K  18.2M
13090 login      0.0%  0:00.04  1    13     38   128K   432K   504K  26.9M
13058 top       12.5% 2:41:19  1    14     26   328K   432K   500K  27.0M
13057 bash       0.0%  0:00.02  1    12     16   136K   888K   744K  18.2M
13056 login      0.0%  0:00.05  1    13     38   128K   432K   504K  26.9M
13045 Server Adm  0.0% 13:32.36  4   101    334   9.88M  16.0M  21.3M  147M
13044 Workgroup  0.0%  0:05.14  2    86    178   3.16M  12.7M  10.7M  116M
 8653 httpd      0.0%  0:10.48  1    10     99   176K   1.84M  1.03M  27.9M
 8572 httpd      0.0%  0:11.66  1    10     99   176K   1.84M  1.03M  27.9M
```


File/Folder Permissions



Type of file:
d for directory
- for file
l for symbolic link

drwx-rwx-rwx



Owner permissions:
rwx=read, write and execute

Group permissions:
-wx=write and execute

Others' permissions:
-wx=write and execute

Working at the Command Line

command
prompt

command
results

computer
name

logged-in user's name

```
Terminal — bash — 80x24
Last login: Wed Nov  7 11:10:27 on ttys000
client17:~ chris$
client17:~ chris$ ls -lA
total 56
-rw-----  1 chris  staff    3 Oct 13 11:14 .CFUserTextEncoding
-rw-r--r--@  1 chris  staff 12292 Nov  7 01:09 .DS_Store
drwx----- 14 chris  staff   476 Nov  7 00:52 .Trash
-rw-----  1 chris  staff  1371 Nov  7 11:11 .bash_history
drwx-----  3 chris  staff   102 Oct 30 13:56 .cups
-rw-----  1 chris  staff    35 Nov  6 18:49 .lessht
drwx----- 21 chris  staff   714 Nov  7 11:10 Desktop
drwx-----  5 chris  staff   170 Nov  4 22:49 Documents
drwx-----  7 chris  staff   238 Nov  4 22:12 Downloads
drwx----- 35 chris  staff  1190 Oct 30 15:52 Library
drwx-----  3 chris  staff   102 Oct 13 11:14 Movies
drwx-----  3 chris  staff   102 Oct 13 11:14 Music
drwx-----  5 chris  staff   170 Oct 16 09:49 Pictures
drwxr-xr-x   9 chris  staff   306 Nov  6 11:56 Public
drwxr-xr-x   5 chris  staff   170 Oct 13 11:14 Sites
drwxr-xr-x   2 chris  staff    68 Nov  7 00:59 untitled folder
client17:~ chris$
```



Command Line Entry

| Shortcut | Action |
|-------------------------|---|
| Tab | Completes word being typed |
| Drag folder to Terminal | Enters pathname |
| Up and Down Arrow keys | Accesses prior commands |
| Control-A | Moves cursor to the beginning of the line |
| Control-E | Moves cursor to the end of the line |
| Control-F | Moves forward one character |
| Control-B | Moves backward one character |
| Esc F | Moves forward one word |
| Esc B | Moves backward one word |
| Control-C | Terminates command in progress |
| Control-L or “clear” | Clears screen |

Command Line Issues

- ❏ **Easy to make serious mistakes and there is no trash or undo**
- ❏ **Exact syntax required and some characters are easy to confuse:**
 - ❏ **0 and O (uppercase letter O and the numeral zero)**
 - ❏ **- and ~**
 - ❏ **l and 1 (lowercase letter l and the numeral one)**
- ❏ **Exact pathnames are important—spaces in filenames and paths can have unexpected results**



Changing File/Folder Permissions

```
chown apple:staff /Users/Shared/ReadMe.rtf
```

```
chown owner[:group] file ...
```

```
chmod g+w /Users/Shared/ReadMe.rtf
```

```
chmod mode file ...
```

The options for chmod specify three things: who is affected, the change, and the permissions being applied to the folder or file.

| who | action | permissions |
|--------------------------|---------|----------------|
| u (user/owner) | +, -, = | r (read) |
| g (group) | | w (write) |
| o (others/everyone else) | | x (execute) |
| a (all=ugo) | | t (sticky bit) |



Text Editors on OS X

- ❏ **Text Edit (GUI)**
- ❏ **TextWrangler**
- ❏ **vi**
- ❏ **nano (pico)**
- ❏ **emacs**

Processes & Daemons

- ❏ **Activity Monitor (GUI)**
- ❏ **top Command**
- ❏ **kill**
 - ❏ **for processes**
 - ❏ **for daemons**
- ❏ **sudo kill**
 - ❏ **processes or daemons you don't own**



Managing Processes from the Command Line



ps



top



kill

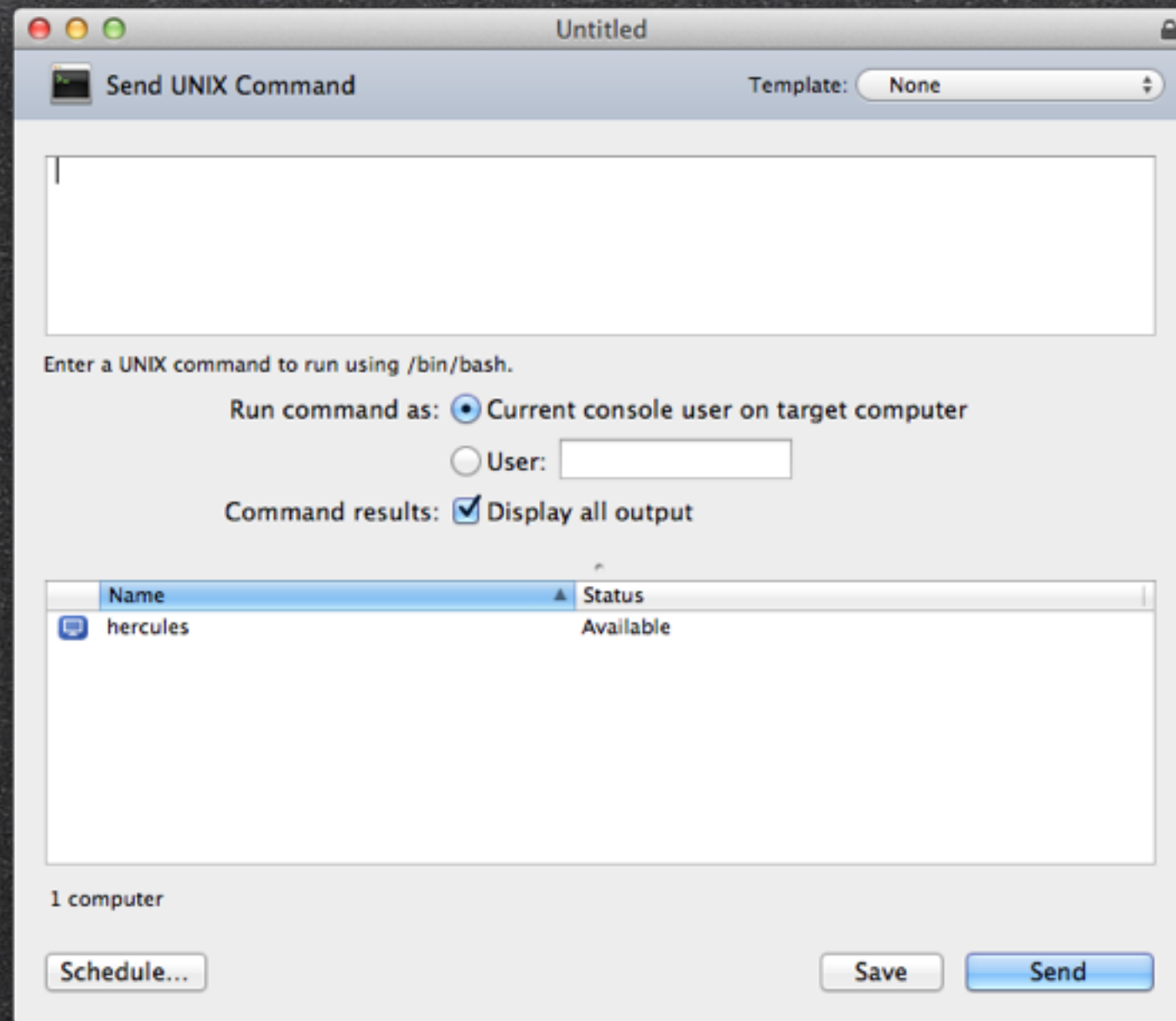


killall

```
russell.poucher — top — 73x23
Processes: 95 total, 4 running, 2 stuck, 89 sleeping, 596 threads
14:41:08 Load Avg: 0.83, 0.77, 0.75
CPU usage: 2.96% user, 1.89% sys, 95.14% idle
SharedLibs: 11M resident, 0B data, 0B linkedit.
MemRegions: 24552 total, 1904M resident, 59M private, 858M shared.
PhysMem: 1150M wired, 3636M active, 436M inactive, 5221M used, 8084M free
VM: 245G vsize, 1101M framework vsize, 150043(0) pageins, 0(0) pageouts.
Networks: packets: 19421353/13G in, 18286146/12G out.
Disks: 394664/4086M read, 194592/3338M written.

PID    COMMAND      %CPU  TIME    #TH   #WQ  #POR  #MREG  RPRVT  RSHRD
2770    screencaptur 0.0   00:00.02 4     3    50+   91+    1000K+ 21M+
2769    top           4.9   00:00.27 1/1    0    29+   29     1116K 216K
2762    automountd   0.0   00:00.01 6     0    49    50     608K 216K
2760    mdworker     0.0   00:00.17 3     1    50    104    4928K 21M
2743    writeconfig  0.0   00:00.01 2     1    41    49     828K 216K
2733    System Prefe 0.0   00:02.92 2     1    260   436    39M   57M
2710    bash         0.0   00:00.00 1     0    20    24     396K 216K
2709    login        0.0   00:00.01 2     1    34    71    1056K 216K
2707    Terminal     0.4   00:00.68 6/1    2    125   197    12M   57M
2687    distnoted    0.0   00:00.00 2     1    39-   65-    792K- 240K
2686    mdworker     0.0   00:00.13 3     1    50    88     2204K 26M
2684    launchd      0.0   00:00.00 2     0    53    50     472K 416K
```


Using Apple Remote Desktop to Send Commands








Terminology

- ❏ **The life of an administrator is about automating repetitive tasks.**
- ❏ **automation |,ô t ə ' m ā sh ə n |**
 - ❏ **The use of largely automatic equipment in a system of manufacturing or other production process**

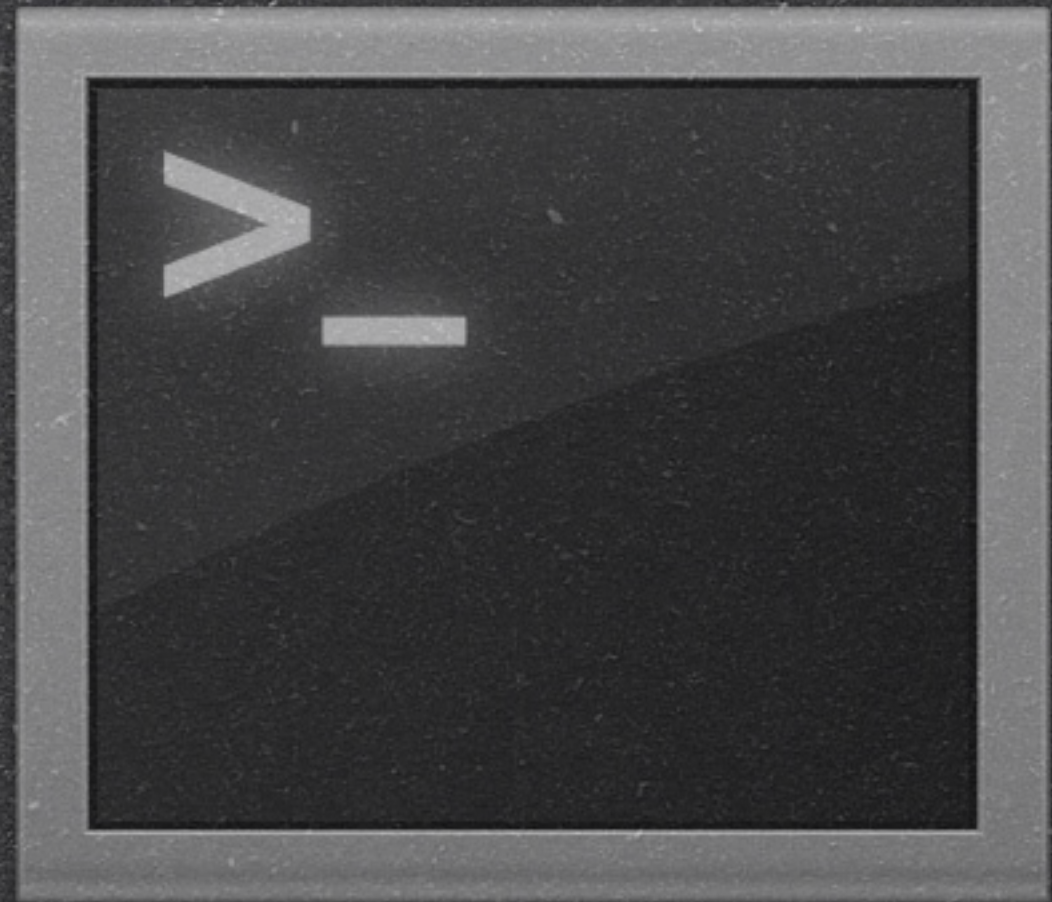
Automation

Why automate?

-  **Eliminate repetitive tasks**
-  **Help with time-consuming tasks**
-  **Quality by avoiding mistakes**
-  **Ensure task execution**
-  **More efficient**




Scripting

- Mac OS X's UNIX heritage provides a huge range of open source scripting languages.
- Out-of-the-box support for:
 - Perl
 - Python
 - PHP
 - Tcl
 - Ruby
 - Shells
 - bash, ksh, zsh, and csh







Apple Technologies

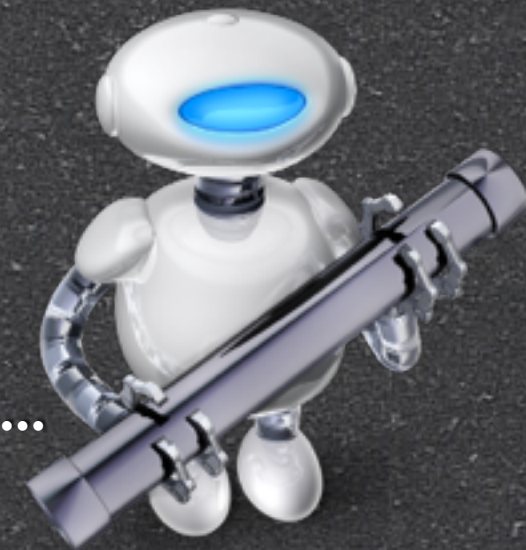
AppleScript

-  **System and applications scripting**
-  **Can be recorded**
-  **English-like syntax**



Automator

-  **Script and workflow creation**
-  **Drag-and-drop creation process**
-  **The action itself is an Xcode project**
 -  **Written in AppleScript, Cocoa, Shell Script, ...**



Schedule/Automate Tasks

- ❏ **Part of automation is scheduling your tasks.**
- ❏ **UNIX has a variety of tools dedicated to scheduling.**
 - ❏ `cron(8)`
 - ❏ `at(1)`
 - ❏ `periodic(8)`
- ❏ **Apple-specific**
 - ❏ **Startup Items**
 - ❏ `launchd(8)`

Scheduling

- ❏ **Run always**
- ❏ **Run on demand**
- ❏ **Run at (1) a specific time**
- ❏ **Run periodic(8) at a specific time**

cron

- ❏ **Executes periodic scheduled commands**
- ❏ **Only starts when it sees files in:**
 - ❏ **/etc/crontab**
 - ❏ **/usr/lib/cron/tabs**
- ❏ **Crontab folder changed location**
 - ❏ **/var/cron/tabs (10.4)**
 - ❏ **/usr/lib/cron/tabs (10.5)**
- ❏ **Functionality replaced by launchd (8)**

at—Queue for Later Execution

- ❏ **at(1)**

- ❏ **Executes commands at a specified time**

- ❏ **atq(1)**

- ❏ **Lists the pending jobs**

- ❏ **atrm(1)**

- ❏ **Deletes jobs**

- ❏ **batch(1)**

- ❏ **Executes commands when system load levels permit**

- ❏ **Disabled by default (as of 10.5.2)**

- ```
$ launchctl load -w /System/Library/LaunchDaemons/com.apple.atrun.plist
```



# periodic—Run Periodic Commands

## **daily**

-  **Runs at 3:15 a.m.**

-  **Executes scripts in `/etc/periodic/daily/`**

## **weekly**

-  **Runs every Saturday at 3:15 a.m.**

-  **Executes scripts in `/etc/periodic/weekly/`**

## **monthly**

-  **Runs every first day of the month at 5:30 a.m.**

-  **Executes scripts in `/etc/periodic/monthly/`**

```
$ ls -cl /etc/periodic/
daily/
100.clean-logs
110.clean-tmps
130.clean-msgs
430.status-rwho
500.daily
600.daily.server
601.daily.server.krb5kdc
700.daily.server.cyrus
```



# Add Your Own Periodic Scripts

## 🎲 Take advantage of the existing process

### 🎲 Move your script into the right folder

🎲 `/etc/periodic/daily/`, `/etc/periodic/weekly/`, or `/etc/periodic/monthly/`

### 🎲 Add a number in front to set the execution order

### 🎲 Make executable and readable for owner/group

### 🎲 Change owner to *root* and the group to *wheel*

```
🎲 $ sudo mv pretendCoBAK.sh /etc/periodic/weekly/850.pretendCoBAK.sh
$ sudo chmod 550 /etc/periodic/weekly/850.pretendCoBAK.sh
$ sudo chown root:wheel /etc/periodic/weekly/850.pretendCoBAK.sh
```



# Startup Items

- ❏ **Deprecated in favor of launchd ( 8 )**
- ❏ **Located in**
  - ❏ **/System/Library/StartupItems**
  - ❏ **/Library/StartupItems**
- ❏ **Perform basic system initialization tasks**
- ❏ **Prepare the system for normal operation**
- ❏ **Used via SystemStarter**



# launchd(8)

- ❏ **launchd debuted in Mac OS X v10.4 as a replacement for a long list of different UNIX components.**
- ❏ **In a nutshell, launchd has two main areas**
  - ❏ **Interprocess communication**
  - ❏ **Starting and monitoring processes**



# Purpose

 **launchd is designed to replace:**

 **init**

 **SystemStarter**

 **mach\_init**

 **/etc/rc**

 **at**

 **cron**

 **watchdog**

 **xinetd**



# Key Features







- ❏ **Fully asynchronous bootstrap**
- ❏ **Fault isolation and error recovery**
- ❏ **Pay as you go (start on demand)**
- ❏ **Security (privilege separation)**



# launchctl

## Talking to launchd from the shell

### Some useful subcommands

-  **list**
-  **load <plist>**
-  **unload <plist>**
-  **log level debug**
-  **start <job label>**
-  **stop <job label>**
-  **help**

```
PID Status Label
...
- 0 edu.mit.Kerberos.KerberosAgent
- 0 com.apple.CoreMIDIServer
571 - com.apple.UserEventAgent-Aqua
- 0 com.apple.syncservices.uihandler
- 0 com.apple.syncservices.SyncServer
570 - com.apple.Spotlight
- 0 com.apple.ServerScanner
- 0 com.apple.scrod
- 0 com.apple.ScreenSharing.server
- 0 com.apple.ReportPanic
- 0 com.apple.ReportCrash.SafetyNet
- 0 com.apple.ReportCrash
- 0 com.apple.RemoteUI
71329 - com.apple.RemoteDesktop.agent
- 0 com.apple.quicklook
- 0 com.apple.qtkitserver
- 0 com.apple.PubSub.Agent
- 0 com.apple.ProblemReporter
- 0 com.apple.PreferenceSyncAgent
- 0 com.apple.pictd
- 0 com.apple.PCIESlotCheck
- 0 com.apple.pbs
578 - com.apple.pboard
-
...
```



# launchd Instances

## One launchd for each user

 `$ launchctl list | wc -l`  
 `79`

 `$ sudo launchctl list | wc -l`  
 `161`

 `$ ps -o user -o command -ax | grep /sbin/launchd`  
 `root /sbin/launchd`  
 `localadmin /sbin/launchd`



# CPU



**cpuwalk.d**



**Measure which CPUs  
a process runs on**



**top -u**



**List processes  
by CPU usage**

PID: 26      CMD: httpd

```
value ----- Distribution ----- count
 < 0 |
 0 | @@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@ 28
 1 | @@@@@@@@@@ 8
 2 | 0
```

PID: 399      CMD: iCal

```
value ----- Distribution ----- count
 0 | 0
 1 | @@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@ 10
 2 | 0
```

Processes: 103 total, 3 running, 5 stuck, 95 sleeping...  
16:14:36

Load Avg: 1.35, 0.91, 0.65      CPU usage: 87.30% user, 1  
SharedLibs: num = 3, resident = 52M code, 3864K data,  
MemRegions: num = 28034, resident = 700M + 22M private,  
PhysMem: 280M wired, 1162M active, 583M inactive, 2025M  
VM: 16G + 373M 889379(0) pageins, 572776(0) pageouts

| PID   | COMMAND    | %CPU   | TIME     | #TH | #PRTS | #MREGS | RPRVT  | P |
|-------|------------|--------|----------|-----|-------|--------|--------|---|
| 15044 | Vue 6 Infi | 172.5% | 1:35.82  | 8   | 167   | 591    | 37M+   |   |
| 15060 | top        | 12.9%  | 0:04.60  | 1   | 18    | 31     | 1652K  |   |
| 0     | kernel_tas | 6.7%   | 13:41:48 | 63  | 2     | 698    | 13M    |   |
| 578   | Terminal   | 4.5%   | 5:46.92  | 10  | 170   | 372    | 2820K- |   |
| 71    | WindowServ | 3.3%   | 2:59:43  | 5   | 573   | 5003   | 27M-   |   |



# Memory

🎲 **vm\_stat(1)**

🎲 **top(1)**

```
$ vm_stat
Mach Virtual Memory Statistics: (page
size of 4096 bytes)
Pages free: 17409.
Pages active: 284415.
Pages inactive: 146856.
Pages wired down: 73583.
"Translation faults": 432342007.
Pages copy-on-write: 5581205.
Pages zero filled: 247414912.
Pages reactivated: 1059381.
Pageins: 918500.
Pageouts: 611593.
Object cache: 503460 hits of 3926331
lookups (12% hit rate)
```

```
Processes: 104 total, 3 running, 5 stuck, 96 sleeping... 444 threads
16:03:57
```

```
Load Avg: 0.45, 0.41, 0.38 CPU usage: 11.21% user, 12.07% sys, 76.72% idle
```

```
SharedLibs: num = 3, resident = 53M code, 3980K data, 3944K linkedit.
```

```
MemRegions: num = 27350, resident = 658M + 21M private, 595M shared.
```

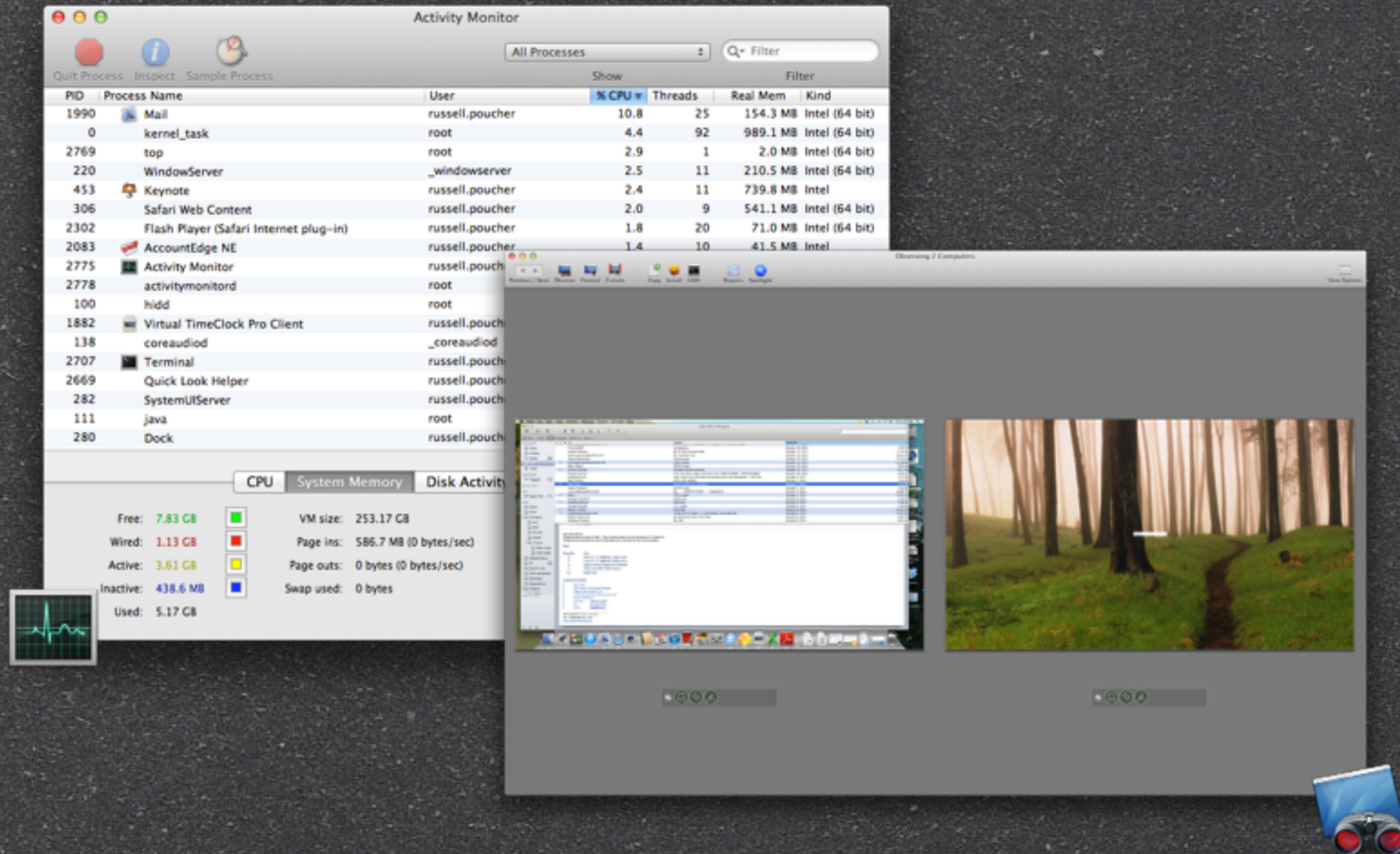
```
PhysMem: 276M wired, 1112M active, 512M inactive, 1900M used, 141M free.
```

```
VM: 15G + 373M 883401(0) pageins, 572217(0) pageouts
```

| PID   | COMMAND    | %CPU  | TIME     | #TH | #PRTS | #MREGS | RPRVT | RSHRD | RSIZE | VSIZE |
|-------|------------|-------|----------|-----|-------|--------|-------|-------|-------|-------|
| 15018 | top        | 12.6% | 0:02.26  | 1   | 20    | 31     | 1632K | 188K  | 2224K | 18M   |
| 0     | kernel_tas | 8.1%  | 13:40:54 | 63  | 2     | 727    | 13M   | 0     | 175M  | 270M  |
| 195   | Finder     | 7.5%  | 34:07.71 | 20  | 496   | 1024   | 24M   | 36M   | 49M   | 534M  |
| 71    | WindowServ | 7.1%  | 2:58:59  | 5   | 523   | 4875   | 25M+  | 217M- | 241M  | 648M  |
| 194   | SystemUISe | 3.3%  | 64:34.54 | 13  | 572   | 513    | 5792K | 73M   | 12M   | 475M  |



# Memory





# Disk

## **df(1)**

### **Display free disk space**

## **iostat(1)**

### **Report I/O statistics**

## **lsof(8)**

### **List open files**

## **fs\_usage(1)**

### **Report system calls**

```
$ df -h -t hfs
Filesystem Size Used Avail Capacity Mounted on
/dev/disk0s3 74Gi 51Gi 23Gi 69% /
/dev/disk1s2 465Gi 347Gi 118Gi 75% /Volumes/MediaFWStore

$ iostat -w 1 -d disk0 disk1
 disk0 disk1
 KB/t tps MB/s KB/t tps MB/s
 4.00 1 0.00 0.00 0 0.00
 420.00 10 4.09 41.71 7 0.28
1024.00 1 1.00 0.00 0 0.00
 768.00 3 2.24 0.00 0 0.00
1024.00 4 3.99 0.00 0 0.00

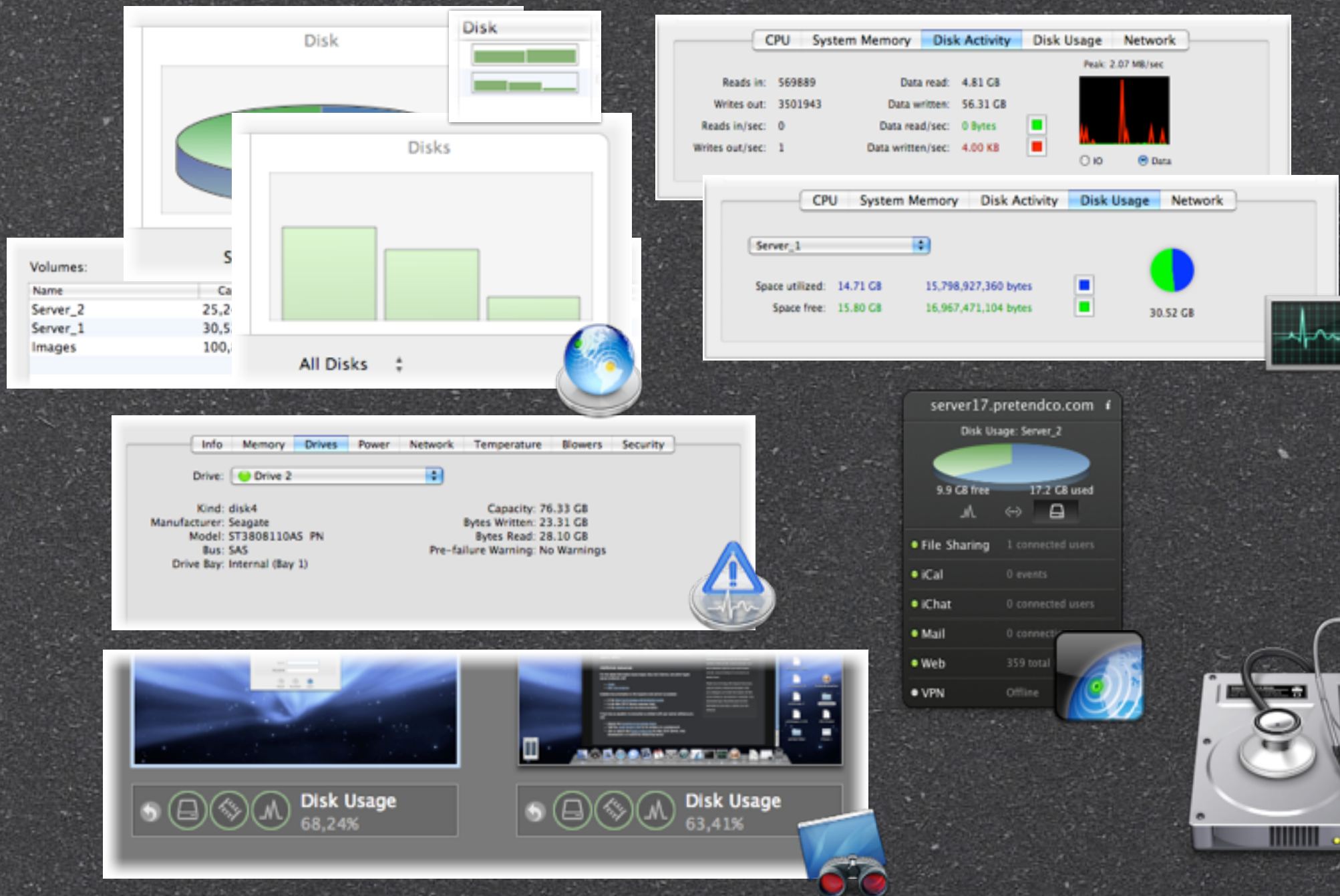
lsof /Volumes/MediaFWStore/
COMMAND PID USER FD TYPE DEVICE SIZE/OFF NODE NAME
bash 63817 media cwd DIR 14,5 680 2 /Volumes/MediaFWStore/

lsof -u _teamsserver
COMMAND PID USER FD TYPE DEVICE SIZE/OFF NODE NAME
Python 55 _teamsserver cwd DIR 14,2 1258 2 /
Python 55 _teamsserver txt REG 14,2 38144 365614 /System
Library/Frameworks/Python.framework/Versions/2.5/Resources/Python.app/
Contents/MacOS/Python
Python 55 _teamsserver txt REG 14,2 92900 364097 /System
Library/Frameworks/Python.framework/Versions/2.5/lib/python2.5/lib-dyn
time.so
...

fs_usage -w -f filesystems Python
10:54:40.359 getdirentries F=14 B=0x0
0.000047 Python
```



# Disk





# Network

📡 **netstat(1)**

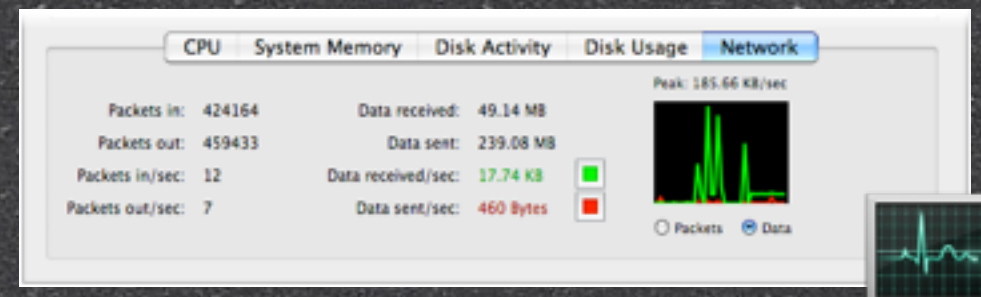
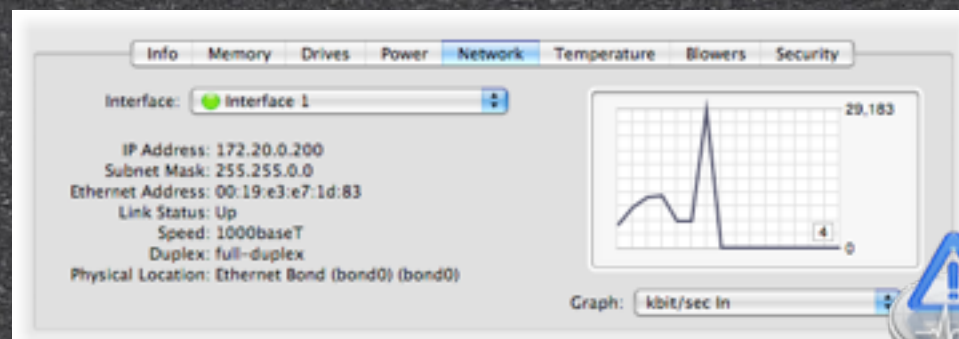
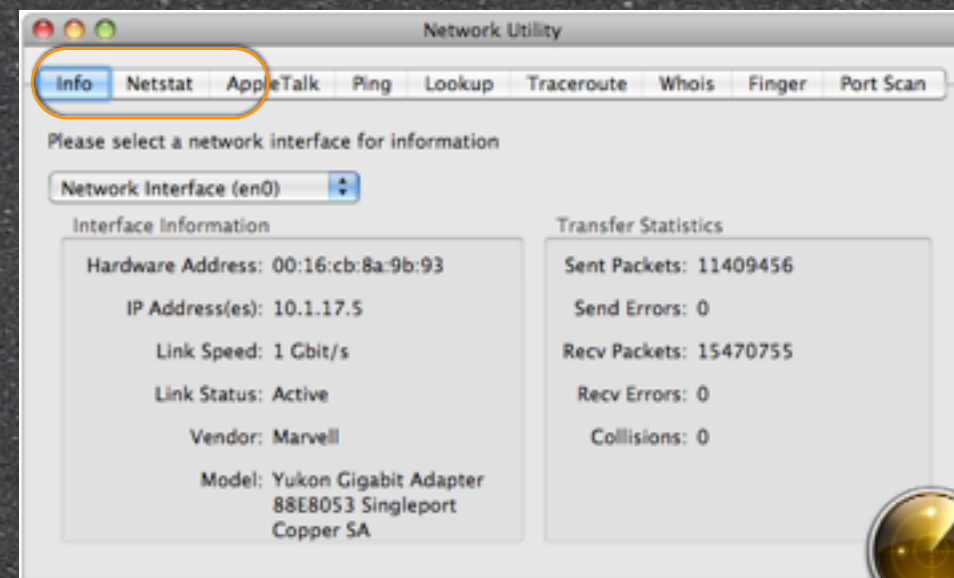
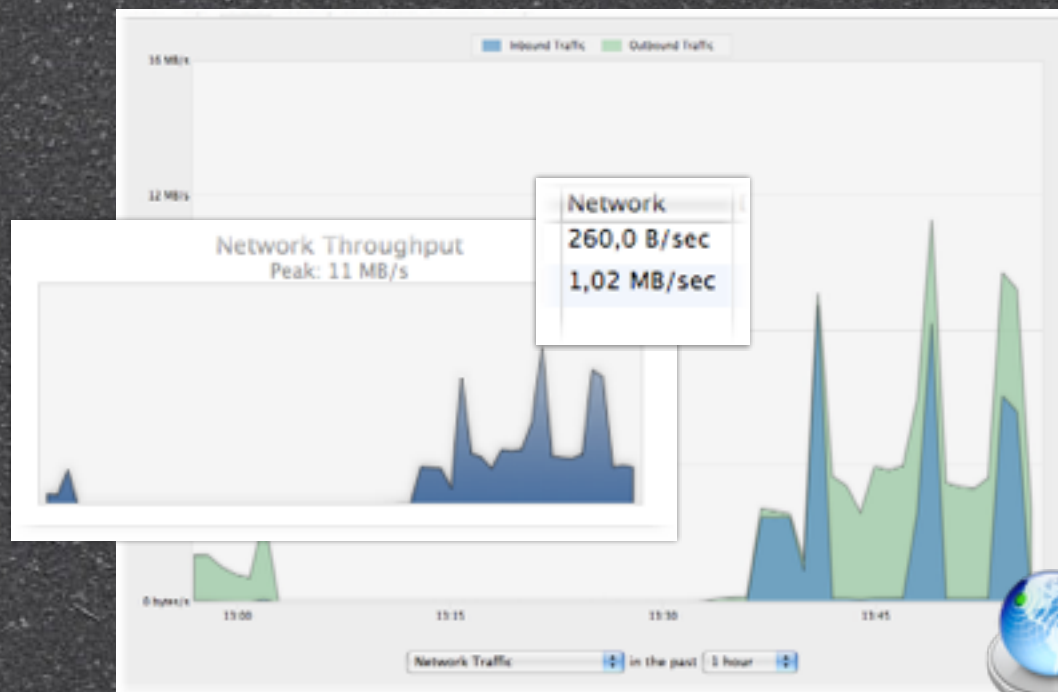
📡 **tcpdump(1)**

```
$ netstat -b -I en0
Name Mtu Network Address IpKts Ierrs Ibytes OpKts Oerrs Obytes Coll
en0 1500 <Link#4> 00:11:24:6f:1d:6a 1810076 0 2027413615 1276472 0 245011138 0
en0 1500 10.0.1/24 miniserver.extr 1810076 - 2027413615 1276472 - 245011138 -
en0 1500 10.1/16 mainserver.pret 1810076 - 2027413615 1276472 - 245011138 -

tcpdump -s0 -v -i en0
tcpdump: listening on en0, link-type EN10MB (Ethernet), capture size 65535 bytes
13:13:08.164723 IP (tos 0x10, ttl 64, id 29534, offset 0, flags [DF], proto TCP (6), length 180)
mainserver.pretendco.com.ssh > 10.1.17.5.58276: P, cksum 0xa459 (correct), 1929289080:1929289208(128) ack
4201395484 win 65535 <nop,nop,timestamp 88298191 952884239>
13:13:08.165815 IP (tos 0x10, ttl 64, id 17992, offset 0, flags [DF], proto TCP (6), length 52) 10.1.17.5.58276
> mainserver.pretendco.com.ssh: ., cksum 0xc03c (correct), ack 128 win 65535 <nop,nop,timestamp 952884320
88298191>
```



# Network





# SSH

- Secure replacement for telnet(1) and more
  - ssh(1)
  - scp(1)
  - sftp(1)
  - port forwarding (tunneling)
- OpenSSH implementation





# SSH Authentication



## Password



**ssh(1) client sends user name**



**sshd(8) requests password**



## Key Pair



**Generate key pairs, public part needs to be installed in the user's ~/.ssh directory on the server**



**SSH client sends user name**



**sshd sends challenge based on public part of key pair**










**SSH client creates response using private part of key pair**



# Helpful Built-In GUI Tools

## GUI Tools for Assessment and Utilization

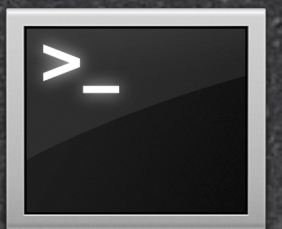
-  **Server Admin**
-  **Server Status widget**
-  **Disk Utility**
-  **Activity Monitor**
-  **System Profiler**
-  **Web browser**
-  **Network browser**





# Helpful Built-In CLI Tools

- ▣ `uptime(1)`
- ▣ `top(1)`
- ▣ `ps(1)`
- ▣ `diskutil(8)`
- ▣ `df(1)`
- ▣ `du(1)`
- ▣ `iostat(8)`
- ▣ `networksetup(8)`
- ▣ `netstat(1)`
- ▣ `systemsetup(8)`
- ▣ `scutil(8)`
- ▣ `serveradmin(8)`
- ▣ `serversetup(8)`
- ▣ `system_profiler(8)`
- ▣ `launchctl(1)`
- ▣ `sysctl(8)`
- ▣ `...`



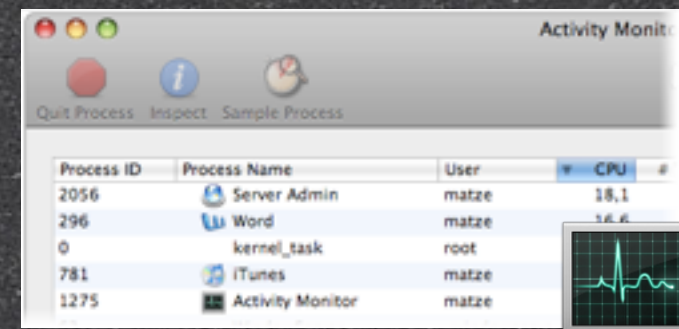


# Assess Service/Process Utilization

Activity Monitor

ps (1)

top(1)



Processes: 113 total, 2 running, 4 stuck, 107 sleeping... 425 threads

...

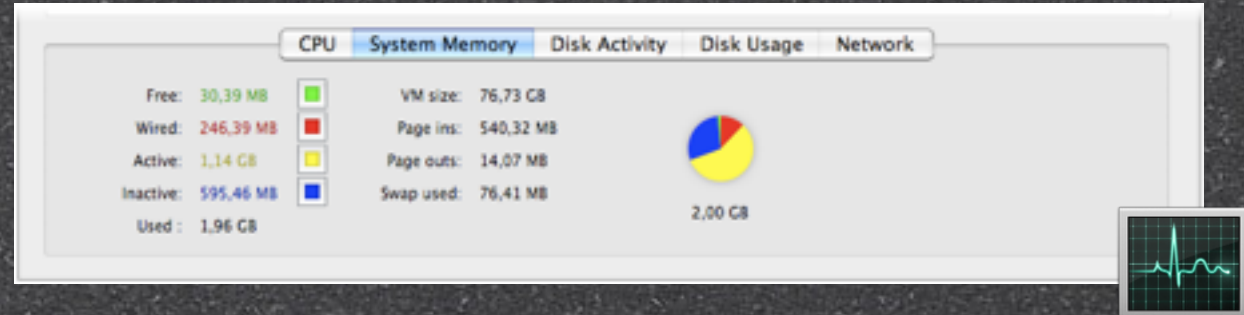
| PID | COMMAND    | %CPU  | TIME     | #TH | #PRTS | #MREGS | RPRVT | RSHRD | RSIZE | VSIZE |
|-----|------------|-------|----------|-----|-------|--------|-------|-------|-------|-------|
| 296 | LaunchCFMA | 16.1% | 53:48.99 | 3   | 124   | 699    | 80M   | 33M   | 117M  | 862M  |



# Assess Hardware Utilization



## Activity Monitor



## vm\_stat(1)



## sysctl(8)



## top(1)

```
server17:~ admin$ vm_stat
Mach Virtual Memory Statistics: (page size of 4096 bytes)
Pages free: 8725.
Pages active: 293357.
Pages inactive: 152717.
...
Pageins: 138306.
Pageouts: 3603.
Object cache: 53134 hits of 191862 lookups (27% hit rate)

server17:~ admin$ sysctl vm.loadavg
vm.loadavg: { 0.28 0.33 0.38 }
```

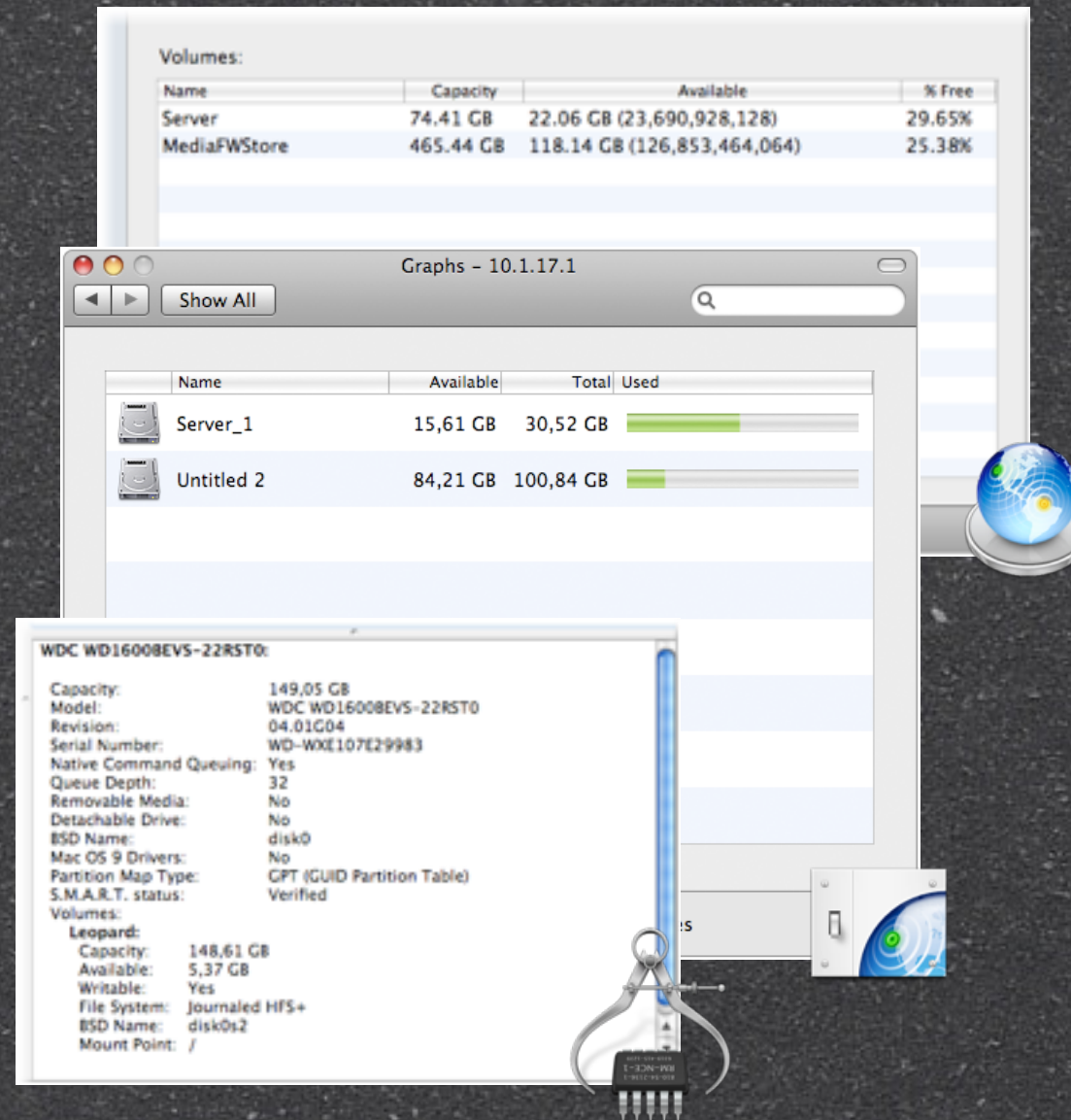
  

```
server17:~ admin$ sysctl vm.swapusage
vm.swapusage: total = 128.00M used = 76.41M free = 51.59M
(encrypted)
```



# Assess Storage Utilization

- Server.app
- Disk Utility
- System Profiler





# Assess Storage Utilization

- 🎲 **system\_profiler(8)**
- 🎲 **diskutil(8)**
- 🎲 **df(1)**
- 🎲 **du(1)**
- 🎲 **iostat(8)**

```
server17:~ localadmin$ system_profiler SPSerialATADataType
...
```

```
Server_1:
```

```
Capacity: 30.52 GB
Available: 15.61 GB
Writable: Yes
File System: Journaled HFS+
BSD Name: disk0s2
Mount Point: /
```

```
Untitled 2:
```

```
Capacity: 100.84 GB
Available: 84.21 GB
Writable: Yes
File System: Journaled HFS+
BSD Name: disk0s3
Mount Point: /Volumes/Untitled 2
```

```
...
```

```
server17:~ localadmin$ df -h
```

| Filesystem    | Size  | Used  | Avail | Capacity | Mounted on    |
|---------------|-------|-------|-------|----------|---------------|
| /dev/disk0s2  | 31Gi  | 15Gi  | 16Gi  | 49%      | /             |
| devfs         | 108Ki | 108Ki | 0Bi   | 100%     | /dev          |
| fdesc         | 1.0Ki | 1.0Ki | 0Bi   | 100%     | /dev          |
| map -hosts    | 0Bi   | 0Bi   | 0Bi   | 100%     | /net          |
| map auto_home | 0Bi   | 0Bi   | 0Bi   | 100%     | /home         |
| map -fstab    | 0Bi   | 0Bi   | 0Bi   | 100%     | /Network/Serv |
| /dev/disk0s3  | 101Gi | 17Gi  | 84Gi  | 17%      | /Volumes/Unti |

```
server17:Users localadmin$ sudo du -sh *
```

```
0B Shared
6.2M diradmin
```



# Finishing up

## **logout**

-  **Terminates an SSH session**

## **exit**

-  **gets you out of a root shell**

## **reboot**

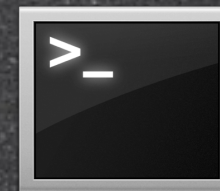
## **halt**

-  **Properly shuts down all processes**



# Backup Tools

- ▣ `rsync(1)`
- ▣ `ditto(1)`
- ▣ `asr(8)`
- ▣ **Other UNIX tools**
- ▣ `server.app(8)`
- ▣ **Time Machine**
- ▣ **Third-Party Solutions**





# rsync(1)

## ❏ `/usr/bin/rsync`





- ❏ **Keeps backup data in sync with the original**
  - ❏ **One-way sync**
  - ❏ **Only copies files or blocks of files that have changed**
  - ❏ **Can copy extended attributes, including resource forks**
  - ❏ **Can back up via network using ssh**
- ❏ `$ rsync -auvE ~/Documents/ServerConfig/  
localadmin@server17.local:/Backup`





# ditto(1)

## **/usr/bin/ditto**

-  **Performs a complete copy of specified folders**
-  **Copies extended attributes, ACLs, and resource forks**
-  **Can compress to PKZip or cpio format**
-  **\$ ditto /var/spool/postfix ./var/spool/postfix**





# asr(8)

- 🎲 **/usr/sbin/asr—Apple Software Restore**
  - 🎲 **Back up and restore an entire volume**
  - 🎲 **Source needs to be unmountable**
  - 🎲 **# asr verb [options]**
  - 🎲 **# asr restore --source source --target target [options]**





# Other Useful UNIX Tools

- ❏ **scp (1) —Secure copy data to a remote location**
- ❏ **hdiutil(1) —Disk image manipulation**
- ❏ **tar(1) —Tape archiving utility to create, extract tar archives**
- ❏ **pax(1) —Read/write archives, copy directory hierarchies**
- ❏ **zip(1) —Package and compress (archive) files**
- ❏ **kdb5\_util(8) —Kerberos database maintenance utility**
- ❏ **mkpassdb —Create/modify/back up password server**
- ❏ **dd(1) —Low-level copying and conversion utility**





# Resources

## 🎲 Books - O'Reilly

- 🎲 Learning Unix for Mac OS X Leopard
- 🎲 Mac OS X Snow Leopard for Unix Geeks

## 🎲 Websites

- 🎲 [www.osxfaq.com](http://www.osxfaq.com)
- 🎲 [www.macdevcenter.com](http://www.macdevcenter.com)

## 🎲 Certification Courses (ACSA)

- 🎲 Directory Services, Deployment and Mobility & Security

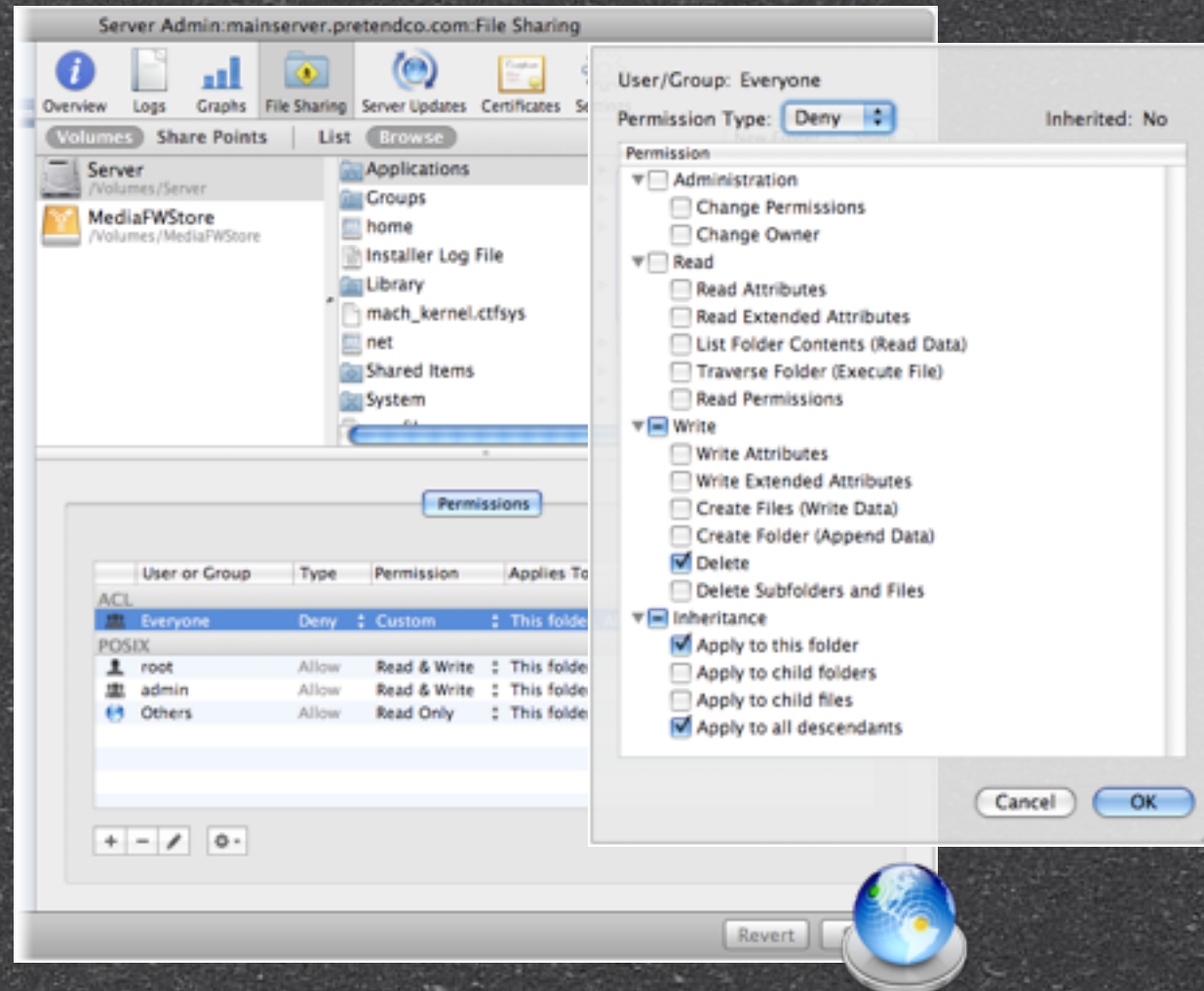
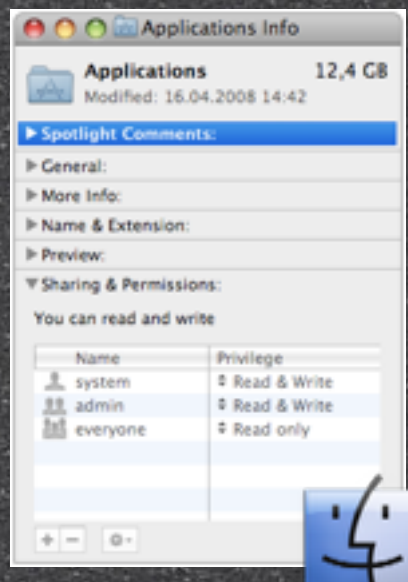




# ACL's in the Command Line



# POSIX vs. ACLs Review



```
drwxrwxr-x+ 33 root admin 1122 Apr 21 13:28 Applications
0: group:everyone deny delete
```





# ACL Command-Line Tools

🎲 **fsaclctl(1) —Controls access control list support**

🎲 `$ fsaclctl -a -e`

🎲 **chmod(1) —Sets access control list**

🎲 `$ chmod +a "w2sdesigner allow list,add_file..." Destination`

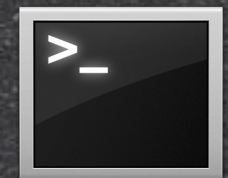
🎲 **ls(1) —Lists access control list**

🎲 `$ ls -le`

🎲 `total 0`

🎲 `drwxrwx---+ 2 localadmin admin 68 Apr 19 11:05 Design`

🎲 `0: group:w2sdesigner allow  
list,add_file,search,delete,add_subdirectory,delete_child,readat`





# Verifying File System ACLs

## ls -edl

```
server14:~ ladmin$ ls -edl "/Shared Items/Public"
```

```
drwxrwxr-x+ 2 root admin 68 Apr 25 14:00 /Shared Items/Public
```

```
0: group:odgroup1 allow
list,add_file,search,delete,add_subdirectory,delete_child,readat
tr,writeattr,
```

```
server14:~ ladmin$ ls -edln "/Shared Items/Public"
```

```
drwxrwxr-x+ 2 0 80 68 Apr 25 14:00 /Shared Items/Public
```

```
0: 94FFAC59-F743-402C-95E9-0AF75A7220D2 allow
list,add_file,search,delete,add_subdirectory,delete_child,readat
tr,writeattr,
readextattr,writeextattr,readsecurity,writesecurity,chown,file_i
nherit,
```





# Binding AD/OD from the CLI



# Binding with dsconfigldap

```
sudo dsconfigldap -fv -a mainserver.pretendco.com -n
mainserver.pretendco.com -c `hostname -s` -u diradmin -p
<diradminpw> -l cadmin -q <localpw>
```

- ▶ -f force authenticated binding/unbinding
- ▶ -v verbose logging
- ▶ -a servername
- ▶ -n configuration name displayed in Directory Utility
- ▶ -c client computer id
- ▶ -u directory user with permission to add computers
- ▶ -p password
- ▶ -l local administrator
- ▶ -q local administrator password



# Verifying Binding via Command Line

```
id diradmin
```

```
uid=1000(diradmin) gid=20(staff) groups=20(staff),80(admin)
```

```
id -u diradmin
```

```
1000
```

```
dscl
```

```
Entering interactive mode... (type "help" for commands)
```

```
> cd /LDAPv3/mainserver.pretendco.com/Users
```

```
/LDAPv3/mainserver.pretendco.com/Users > ls
```

```
delegate
```

```
diradmin
```



# Verifying Login at Command Line

- ❏ **`id` and `dscl` to verify the existence of the account in the directory**
- ❏ **`dirb` to verify user authentication against Open Directory**
- ❏ **`kinit` to test Kerberos authentication**
- ❏ **`klist` to verify what tickets a user is granted**



# The Binding Process

❏ **Server Admin and Directory Utility hide a host of steps involved in binding**

❏ **From the command line, binding manually involves dscl, defaults, dsconfigldap, and DirectoryService**

❏ **Server Admin and Directory Utility reduce those steps to a few clicks and text fields in a GUI**

```
1) sudo dscl /Search create /
SearchPolicy CSPSearchPath
```

```
2) sudo defaults write /Library/
Preferences/DirectoryService/
DirectoryService LDAPv3 Active
```

```
3) sudo killall DirectoryService
```

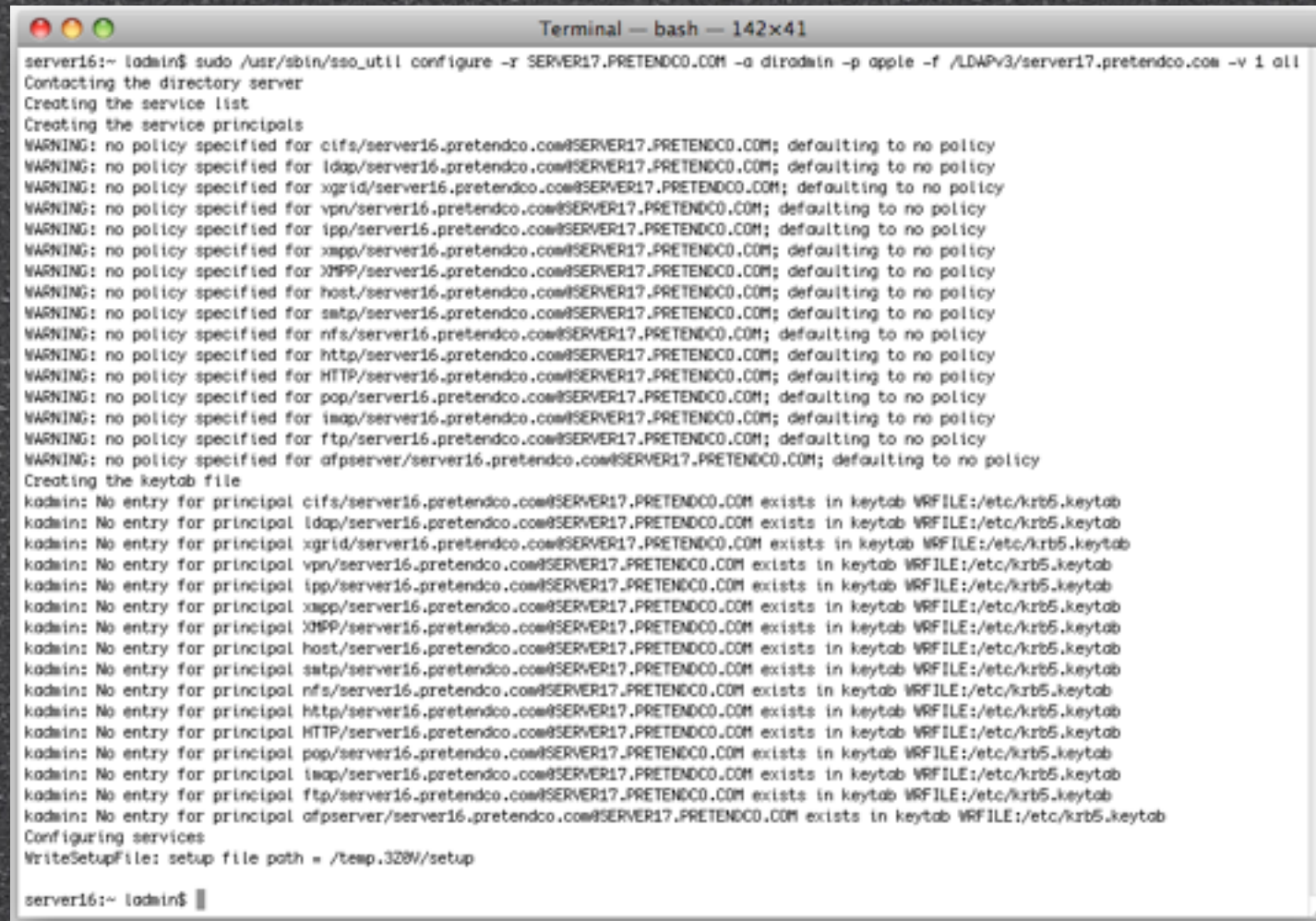
```
4) sudo dsconfigldap -v -a
server17.pretendco.com -n server17 -
u diradmin -p apple -l admin -q
apple
```

```
5) sudo dscl /Search append /
CSPSearchPath /LDAPv3/
server17.pretendco.com
```

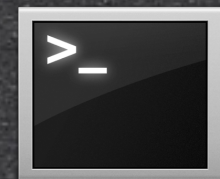


# Joining Kerberos at the CLI

```
sudo /usr/sbin/ssx_util configure
-r SERVER17.PRETENDCO.COM -a diradmin -p apple
-f /LDAPv3/server17.pretendco.com -v 1 all
```



```
Terminal — bash — 142x41
server16:~ ladmin$ sudo /usr/sbin/ssx_util configure -r SERVER17.PRETENDCO.COM -a diradmin -p apple -f /LDAPv3/server17.pretendco.com -v 1 all
Contacting the directory server
Creating the service list
Creating the service principals
WARNING: no policy specified for cifs/server16.pretendco.com@SERVER17.PRETENDCO.COM; defaulting to no policy
WARNING: no policy specified for ldap/server16.pretendco.com@SERVER17.PRETENDCO.COM; defaulting to no policy
WARNING: no policy specified for xgrid/server16.pretendco.com@SERVER17.PRETENDCO.COM; defaulting to no policy
WARNING: no policy specified for vpn/server16.pretendco.com@SERVER17.PRETENDCO.COM; defaulting to no policy
WARNING: no policy specified for lpp/server16.pretendco.com@SERVER17.PRETENDCO.COM; defaulting to no policy
WARNING: no policy specified for xapp/server16.pretendco.com@SERVER17.PRETENDCO.COM; defaulting to no policy
WARNING: no policy specified for XPP/server16.pretendco.com@SERVER17.PRETENDCO.COM; defaulting to no policy
WARNING: no policy specified for host/server16.pretendco.com@SERVER17.PRETENDCO.COM; defaulting to no policy
WARNING: no policy specified for smtp/server16.pretendco.com@SERVER17.PRETENDCO.COM; defaulting to no policy
WARNING: no policy specified for nfs/server16.pretendco.com@SERVER17.PRETENDCO.COM; defaulting to no policy
WARNING: no policy specified for http/server16.pretendco.com@SERVER17.PRETENDCO.COM; defaulting to no policy
WARNING: no policy specified for HTTP/server16.pretendco.com@SERVER17.PRETENDCO.COM; defaulting to no policy
WARNING: no policy specified for pop/server16.pretendco.com@SERVER17.PRETENDCO.COM; defaulting to no policy
WARNING: no policy specified for imap/server16.pretendco.com@SERVER17.PRETENDCO.COM; defaulting to no policy
WARNING: no policy specified for ftp/server16.pretendco.com@SERVER17.PRETENDCO.COM; defaulting to no policy
WARNING: no policy specified for afpserver/server16.pretendco.com@SERVER17.PRETENDCO.COM; defaulting to no policy
Creating the keytab file
kadmin: No entry for principal cifs/server16.pretendco.com@SERVER17.PRETENDCO.COM exists in keytab WRFILE:/etc/krb5.keytab
kadmin: No entry for principal ldap/server16.pretendco.com@SERVER17.PRETENDCO.COM exists in keytab WRFILE:/etc/krb5.keytab
kadmin: No entry for principal xgrid/server16.pretendco.com@SERVER17.PRETENDCO.COM exists in keytab WRFILE:/etc/krb5.keytab
kadmin: No entry for principal vpn/server16.pretendco.com@SERVER17.PRETENDCO.COM exists in keytab WRFILE:/etc/krb5.keytab
kadmin: No entry for principal lpp/server16.pretendco.com@SERVER17.PRETENDCO.COM exists in keytab WRFILE:/etc/krb5.keytab
kadmin: No entry for principal xapp/server16.pretendco.com@SERVER17.PRETENDCO.COM exists in keytab WRFILE:/etc/krb5.keytab
kadmin: No entry for principal XPP/server16.pretendco.com@SERVER17.PRETENDCO.COM exists in keytab WRFILE:/etc/krb5.keytab
kadmin: No entry for principal host/server16.pretendco.com@SERVER17.PRETENDCO.COM exists in keytab WRFILE:/etc/krb5.keytab
kadmin: No entry for principal smtp/server16.pretendco.com@SERVER17.PRETENDCO.COM exists in keytab WRFILE:/etc/krb5.keytab
kadmin: No entry for principal nfs/server16.pretendco.com@SERVER17.PRETENDCO.COM exists in keytab WRFILE:/etc/krb5.keytab
kadmin: No entry for principal http/server16.pretendco.com@SERVER17.PRETENDCO.COM exists in keytab WRFILE:/etc/krb5.keytab
kadmin: No entry for principal HTTP/server16.pretendco.com@SERVER17.PRETENDCO.COM exists in keytab WRFILE:/etc/krb5.keytab
kadmin: No entry for principal pop/server16.pretendco.com@SERVER17.PRETENDCO.COM exists in keytab WRFILE:/etc/krb5.keytab
kadmin: No entry for principal imap/server16.pretendco.com@SERVER17.PRETENDCO.COM exists in keytab WRFILE:/etc/krb5.keytab
kadmin: No entry for principal ftp/server16.pretendco.com@SERVER17.PRETENDCO.COM exists in keytab WRFILE:/etc/krb5.keytab
kadmin: No entry for principal afpserver/server16.pretendco.com@SERVER17.PRETENDCO.COM exists in keytab WRFILE:/etc/krb5.keytab
Configuring services
WriteSetupFile: setup file path = /tmp.3284/setup
server16:~ ladmin$
```





# dscl

- ❏ **directory services command-line utility**
- ❏ **Apple-supported command-line tool for managing DS data**
- ❏ **Directory structure appears like file-system structure**
- ❏ **Single-user mode**
- ❏ **Local and external nodes**

```
valkyrie:Apple Training jwelch$ dscl
Entering interactive mode... (type "help" for commands)
> ls
Active Directory
BSD
LDAPv3
Local

Search
Contact
> cd Local/
/Local > ls
Default
/Local > cd Default/
/Local/Default > ls
AFPServer
AFPUserAliases
Aliases
AppleMetaRecord
Augments
Automount
AutomountMap
AutoServerSetup
Bootp
ComputerGroups
ComputerLists
Computers
Config
Ethernets
FTPServer
Groups
Hosts
HostServices
LDAPServer
Locations
Machines
MetaUserNames
Mounts
Neighborhoods
NetDomains
```





# Binding with dsconfigad

1. Enable AD plug-in with defaults command
2. Bind with dsconfigad

```
dsconfigad -a computername \
-domain pretendco.com \
-u Administrator -p ADadminpw \
-lu cadmin -lp cadmin
```

3. Confirm binding with dsconfigad -show
4. Add Active Directory to search path with dscl



# dsconfigad Specific Options

- ❏ `-packetsign <disable | allow | require>`
- ❏ `-packetencrypt <disable | allow | require>`
- ❏ `-namespace <forest | domain>`
  - ❏ For username conflicts across domains
- ❏ `-passinterval <days>`
  - ❏ How often to automatically change the computer password



# Questions



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