

Administrating Condor

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Condor Project

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<http://www.cs.wisc.edu/condor>



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The next 60 minutes...

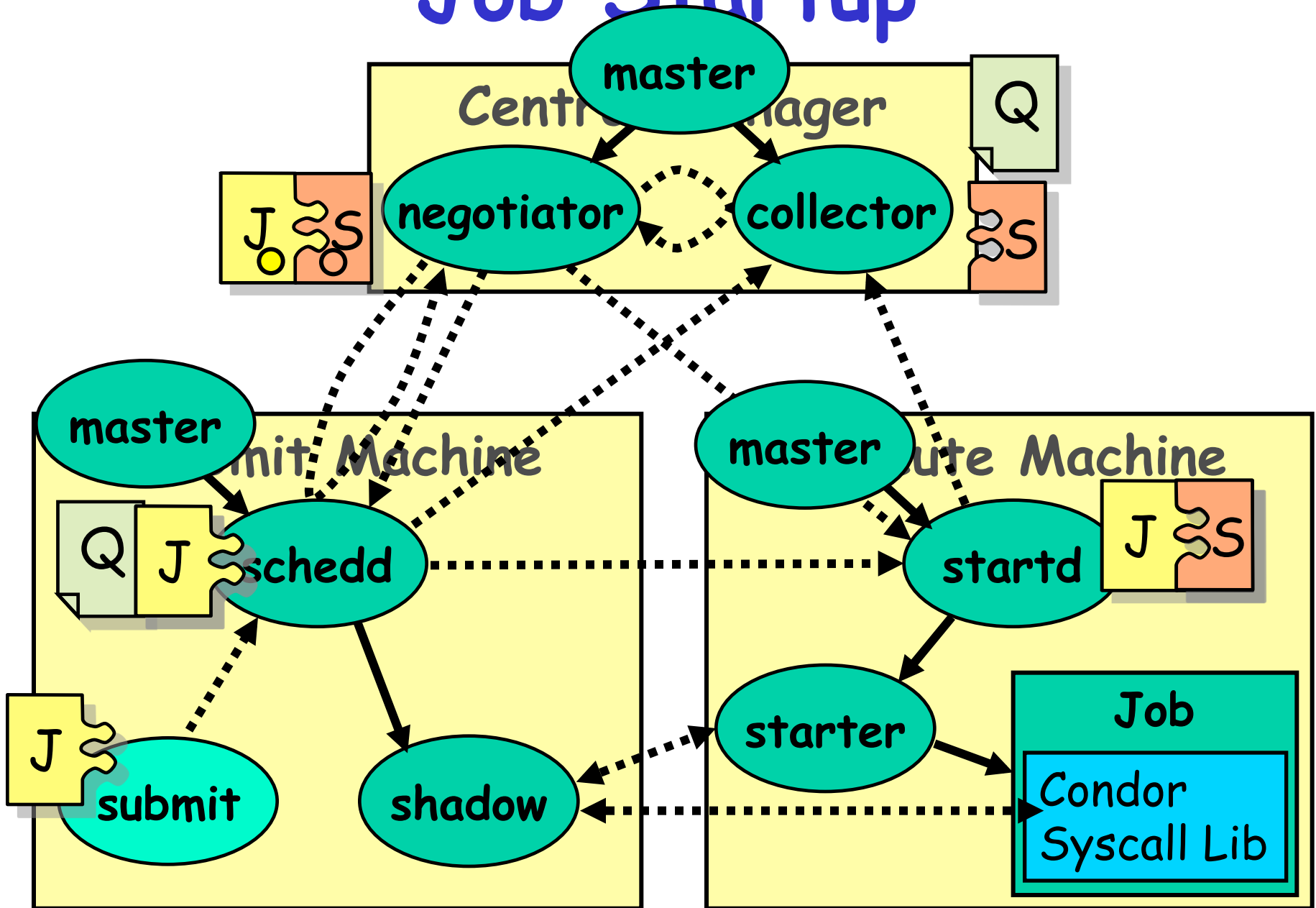
- > Condor Daemons & Job Startup
- > Configuration Files
- > Policy Expressions
 - Startd (Machine)
 - Negotiator
- > Priorities
- > Security, briefly
- > Useful Tools
- > Log Files
- > Debugging Jobs

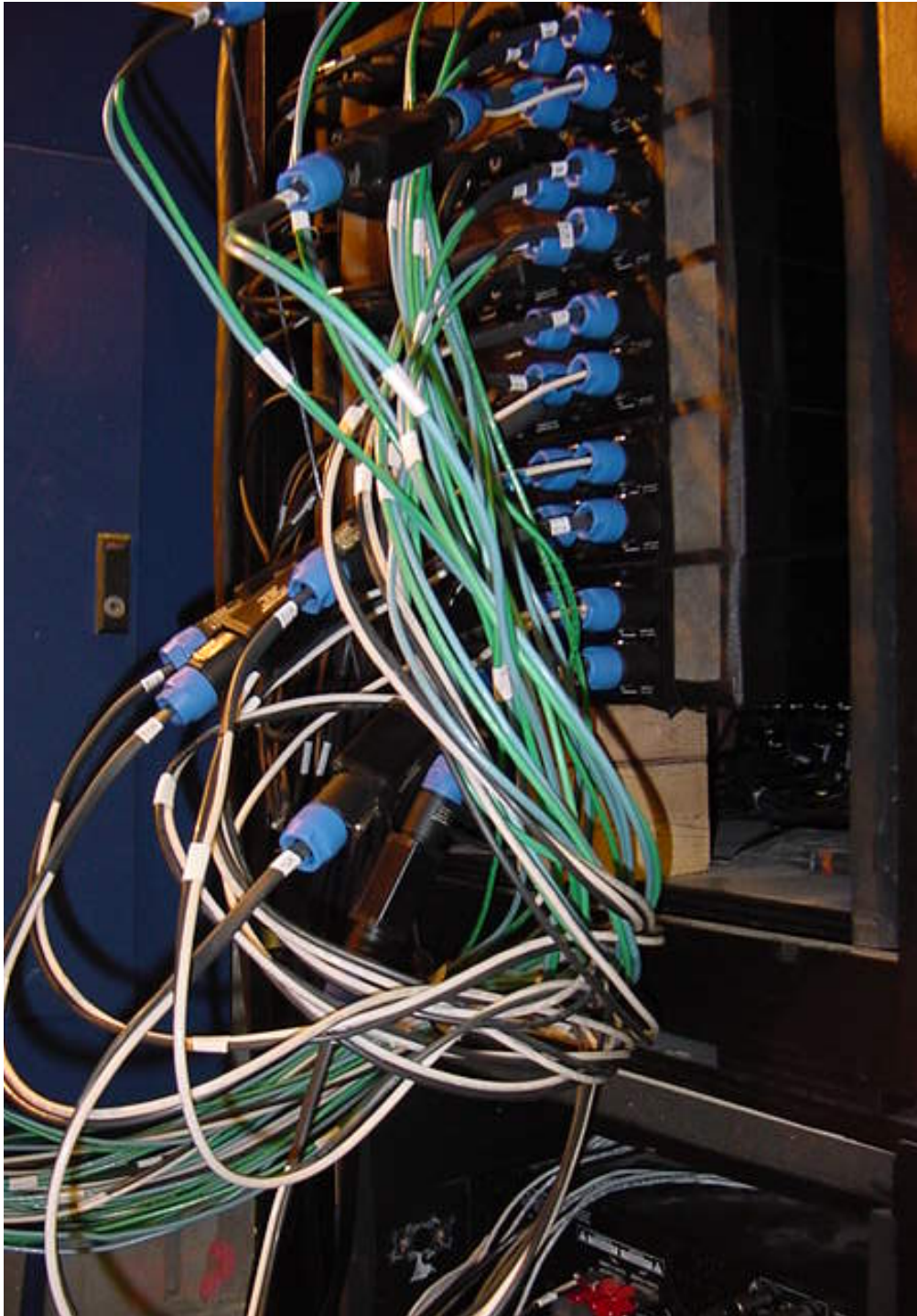


Daemons & Job Startup

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<http://www.webcitation.org/5XIfT16tX>

Job Startup





Configuration Files

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Configuration File

- > Found either in file pointed to with the `CONDOR_CONFIG` environment variable, `/etc/condor/condor_config`, or `~condor/condor_config`
- > All settings can be in this one file
- > Might want to share between all machines (NFS, automated copies, Wallaby, etc)

Other Configuration Files

- > **LOCAL_CONFIG_FILE** setting
 - Comma separated, processed in order

```
LOCAL_CONFIG_FILE = \  
    /var/condor/config.local, \  
    /var/condor/policy.local, \  
    /shared/condor/config.$(HOSTNAME), \  
    /shared/condor/config.$(OPSYS)
```

Configuration File Syntax

```
# I'm a comment!
```

```
CREATE_CORE_FILES=TRUE
```

```
MAX_JOBS_RUNNING = 50
```

```
# Condor ignores case:
```

```
log=/var/log/condor
```

```
# Long entries:
```

```
collector_host=condor.cs.wisc.edu, \  
secondary.cs.wisc.edu
```



Configuration File Macros

- > You reference other macros (settings) with:
 - $A = \$ (B)$
 - `SCHEDD = $ (SBIN) /condor_schedd`
- > Can create additional macros for organizational purposes

Configuration File Macros

- > Can append to macros:

A=abc

A=\$ (A) , def

- > Don't let macros recursively define each other!

A=\$ (B)

B=\$ (A)

Configuration File Macros

- > Later macros in a file overwrite earlier ones
 - B will evaluate to 2:

A=1

B=\$ (A)

A=2

Macros and Expressions Gotcha

- > These are simple replacement macros
- > Put parentheses around expressions

TEN=5+5

HUNDRED=\$ (TEN) *\$ (TEN)

- HUNDRED becomes $5+5*5+5$ or 35!

TEN= (5+5)

HUNDRED= (\$ (TEN) *\$ (TEN))

- $((5+5)*(5+5)) = 100$



Policy

“Don't even think about it” by Kat “tyger_lyllie” © 2005
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<http://www.webcitation.org/5Xlh5mYGS>

Policy

- > Who gets to run jobs, when?

Policy Expressions

- > Specified in `condor_config`
 - Ends up startd/machine ClassAd
- > Policy evaluates both a machine ClassAd and a job ClassAd together
 - Policy can reference items in either ClassAd (See manual for list)
- > Can reference `condor_config` macros: `$(MACRONAME)`

Machine (Startd) Policy Expressions

- > **START**
- > **RANK**
- > **SUSPEND**
- > **CONTINUE**
- > **PREEMPT**
- > **KILL**

START

- > START is the primary policy
- > When FALSE the machine enters the Owner state and will not run jobs
- > Acts as the Requirements expression for the machine, the job must satisfy START
 - Can reference job ClassAd values including Owner and ImageSize

RANK

- Indicates which jobs a machine prefers
 - Jobs can also specify a rank
- Floating point number
 - Larger numbers are higher ranked
 - Typically evaluate attributes in the Job ClassAd
 - Typically use + instead of &&

RANK

- > Often used to give priority to owner of a particular group of machines
- > Claimed machines still advertise looking for higher ranked job to preempt the current job

SUSPEND and CONTINUE

- When SUSPEND becomes true, the job is suspended
- When CONTINUE becomes true a suspended job is released



PREEMPT and KILL

- When PREEMPT becomes true, the job will be politely shut down
 - Vanilla universe jobs get SIGTERM
 - Or user requested signal
 - Standard universe jobs checkpoint
- When KILL becomes true, the job is SIGKILLED
 - Checkpointing is aborted if started

Minimal Settings

> Always runs jobs

START = True

RANK =

SUSPEND = False

CONTINUE = True

PREEMPT = False

KILL = False



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Policy Configuration

- > I am adding nodes to the Cluster... *but the Chemistry Department has priority on these nodes*

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<http://www.flickr.com/photos/vmos/2078227291/> <http://www.webcitation.org/5XIff1deZ>

New Settings for the Chemistry nodes

> Prefer Chemistry jobs

START = True

RANK = *Department* == "Chemistry"

SUSPEND = False

CONTINUE = True

PREEMPT = False

KILL = False

Submit file with Custom Attribute

- > Prefix an entry with “+” to add to job ClassAd

`Executable = charm-run`

`Universe = standard`

`+Department = "Chemistry"`

`queue`

What if “Department” not specified?

START = True

RANK = *Department* **!=** *UNDEFINED* \
&& *Department* **==** *"Chemistry"*

SUSPEND = False

CONTINUE = True

PREEMPT = False

KILL = False

More Complex RANK

- > Give the machine's owners (adesmet and roy) highest priority, followed by the Chemistry department, followed by the Physics department, followed by everyone else.
 - Can use automatic Owner attribute in job attribute to identify adesmet and roy

More Complex RANK

```
IsOwner = (Owner == "adesmet" \  
  || Owner == "roy")
```

```
IsChem = (Department != UNDEFINED \  
  && Department == "Chemistry")
```

```
IsPhys = (Department != UNDEFINED \  
  && Department == "Physics")
```

```
RANK = $(IsOwner)*20 + $(IsChem)*10 \  
  + $(IsPhys)
```



Policy Configuration

- > I have an unhealthy fixation with PBS so...
kill jobs after 12 hours, except Physics jobs get 24 hours.

Useful Attributes

- > **CurrentTime**
 - Current time, in Unix epoch time (seconds since midnight Jan 1, 1970)
- > **EnteredCurrentActivity**
 - When did Condor enter the current activity, in Unix epoch time

Configuration

```
ActivityTimer = \  
    (CurrentTime - EnteredCurrentActivity)  
HOUR = (60*60)  
HALFDAY = ($ (HOUR) *12)  
FULLDAY = ($ (HOUR) *24)  
PREEMPT = \  
    ($ (IsPhys) && ($ (ActivityTimer) > $FULLDAY)) \  
    || \  
    (!$ (IsPhys) && ($ (ActivityTimer) > $HALFDAY))  
KILL = $ (PREEMPT)
```



Policy Configuration

- > Cluster is okay, but...
Condor can only use the desktops when they would otherwise be idle

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Defining Idle

- One possible definition:
 - No keyboard or mouse activity for 5 minutes
 - Load average below 0.3

Desktops should

- > **START** jobs when the machine becomes idle
- > **SUSPEND** jobs as soon as activity is detected
- > **PREEMPT** jobs if the activity continues for 5 minutes or more
- > **KILL** jobs if they take more than 5 minutes to preempt

Useful Attributes

- > **LoadAvg**
 - Current load average
- > **CondorLoadAvg**
 - Current load average generated by Condor
- > **KeyboardIdle**
 - Seconds since last keyboard or mouse activity

Macros in Configuration Files

NonCondorLoadAvg = (LoadAvg - CondorLoadAvg)

BgndLoad = 0.3

CPU_Busy = (\$ (NonCondorLoadAvg) >= \$ (BgndLoad))

CPU_Idle = (\$ (NonCondorLoadAvg) < \$ (BgndLoad))

KeyboardBusy = (KeyboardIdle < 10)

KeyboardIsIdle = (KeyboardIdle > 300)

MachineBusy = (\$ (CPU_Busy) || \$ (KeyboardBusy))

Desktop Machine Policy

START = \$(CPU_Idle) && \$(KeyboardIsIdle)

SUSPEND = \$(MachineBusy)

CONTINUE = \$(CPU_Idle) && KeyboardIdle > 120

PREEMPT = (Activity == "Suspended") && \
\$(ActivityTimer) > 300

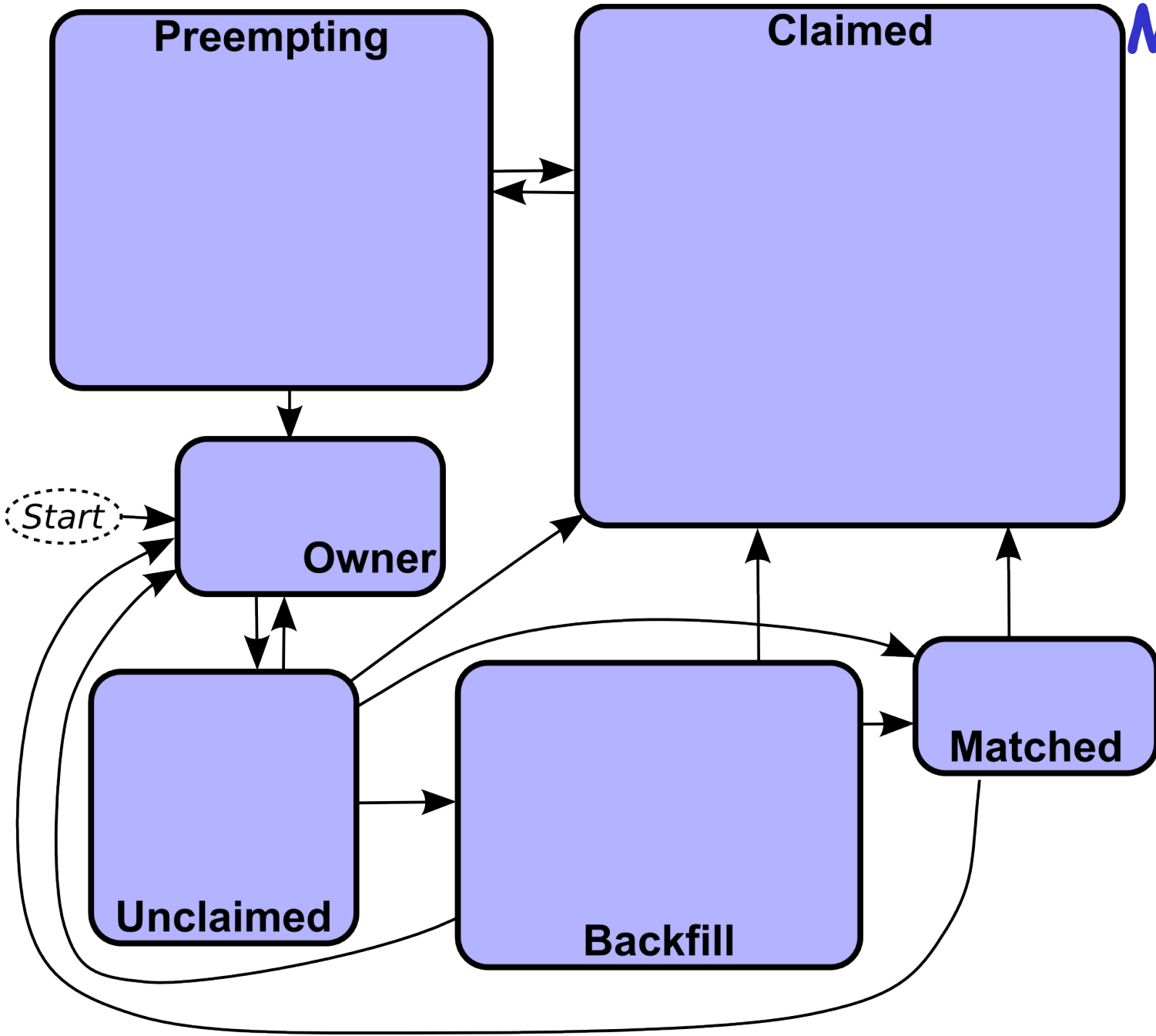
KILL = \$(ActivityTimer) > 300

Mission Accomplished

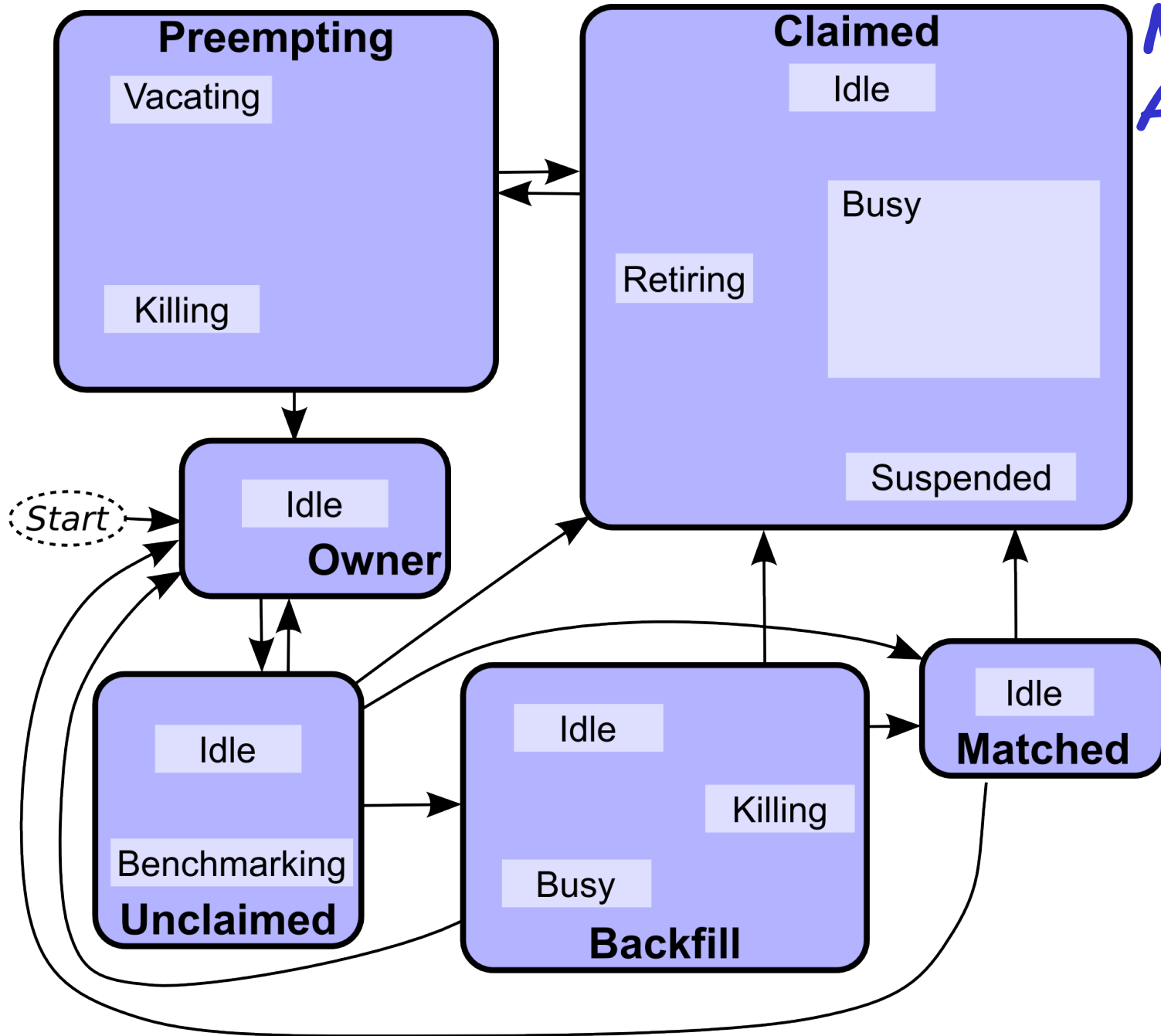
Smiles and
kittens for
everyone!



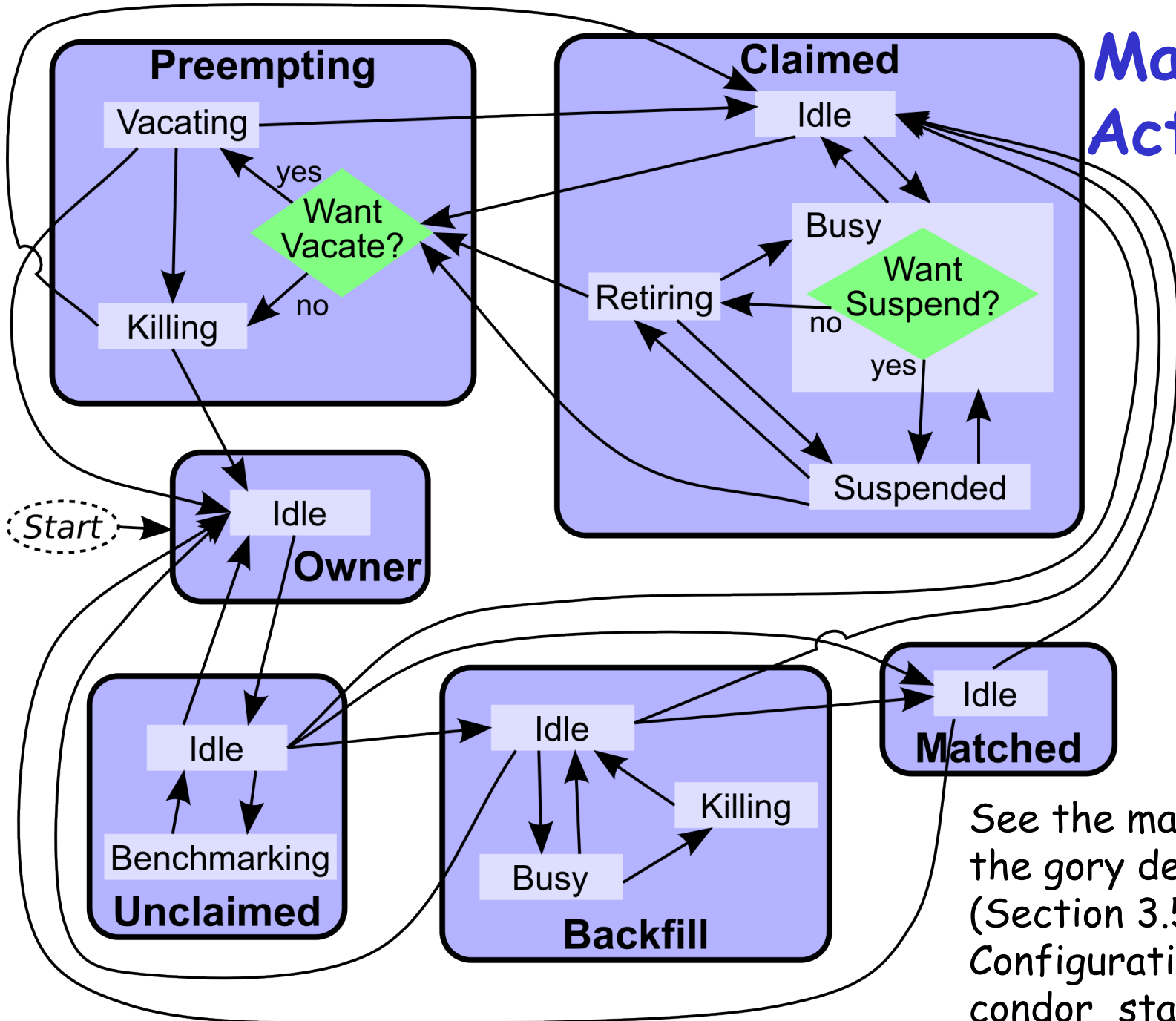
Machine States



Machine Activities



Machine Activities



See the manual for the gory details. (Section 3.5: Policy Configuration for the condor_startd)

Custom Machine Attributes

- > Can add attributes to a machine's ClassAd, typically done in the local configuration file

```
INSTRUCTIONAL=TRUE
```

```
NETWORK_SPEED=1000
```

```
STARTD_EXPRS=INSTRUCTIONAL,  
NETWORK_SPEED
```

Custom Machine Attributes

- > Jobs can now specify Rank and Requirements using new attributes:

```
Requirements = \  
  (INSTRUCTIONAL=?=UNDEFINED \  
  || INSTRUCTIONAL==FALSE)
```

```
Rank = NETWORK_SPEED
```

- > Dynamic attributes are available; see `STARTD_CRON_*` settings in the manual

Further Machine Policy Information

- > For further information, see section 3.5 “Policy Configuration for the condor_startd” in the Condor manual
- > condor-users mailing list
<http://www.cs.wisc.edu/condor/mail-lists/>
- > condor-admin@cs.wisc.edu

Priorities



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http://www.flickr.com/photos/joanne_matt/97737986/ <http://www.webcitation.org/5XlieCxq4>

Job Priority

- Set with `condor_prio`
- Users can set priority of their own jobs
- Integers, larger numbers are higher priority
- Only impacts order between jobs for a single user on a single schedd
- A tool for users to sort their own jobs

User Priority

- > Determines allocation of machines to waiting users
- > View with `condor_userprio`
- > Inversely related to machines allocated (lower is better priority)
 - A user with priority of 10 will be able to claim twice as many machines as a user with priority 20

User Priority

- Effective User Priority is determined by multiplying two components
 - Real Priority
 - Priority Factor

Real Priority

- > Based on actual usage
- > Defaults to 0.5
- > Approaches actual number of machines used over time
 - Configuration setting
`PRIORITY_HALFLIFE`

Priority Factor

- > Assigned by administrator
 - Set with `condor_userprio`
- > Defaults to 1 (`DEFAULT_PRIO_FACTOR`)

Negotiator Policy Expressions

- > **PREEMPTION_REQUIREMENTS** and **PREEMPTION_RANK**
- > Evaluated when `condor_negotiator` considers replacing a lower priority job with a higher priority job
- > Completely unrelated to the **PREEMPT** expression

PREEMPTION_REQUIREMENTS

- If false will not preempt machine
 - Typically used to avoid pool thrashing
 - Typically use:
 - `RemoteUserPrio` - Priority of user of currently running job (higher is worse)
 - `SubmittorPrio` - Priority of user of higher priority idle job (higher is worse)
- **PREEMPTION_REQUIREMENTS=FALSE**

PREEMPTION_REQUIREMENTS

- > Only replace jobs running for at least one hour and 20% lower priority

```
StateTimer = \  
    CurrentTime - EnteredCurrentState  
HOUR = (60*60)  
PREEMPTION_REQUIREMENTS = \  
    $(StateTimer) > (1 * $(HOUR)) \  
    && RemoteUserPrio > SubmitterPrio * 1.2
```

PREEMPTION_RANK

- Picks which already claimed machine to reclaim
- Strongly prefer preempting jobs with a large (bad) priority and a small image size

```
PREEMPTION_RANK = \  
  (RemoteUserPrio * 1000000) \  
  - ImageSize
```



Security, briefly

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<http://www.flickr.com/photos/peterf/72583027/>

<http://www.webcitation.org/5XliBcsUg>

Condor Security

- Strong authentication of users and daemons
- Encryption over the network
- Integrity checking over the network



"locks-masterlocks.jpg" by Brian De Smet, © 2005
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<http://www.fief.org/sysadmin/blosxom.cgi/2005/07/21#locks>



Minimal Security Settings

- > You *must* set `ALLOW_WRITE`, or nothing works
- > Simplest setting:
`ALLOW_WRITE=*`
 - *Extremely insecure!*
- > A bit better:
`ALLOW_WRITE= \`
`*.cs.wisc.edu`



More on Security

- > Zach's talk later today!
- > Chapter 3.6, "Security," in the Condor Manual
- > condor-admin@cs.wisc.edu



Tools



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<http://www.flickr.com/photos/batega/1596898776/> <http://www.webcitation.org/5Xlj1E1Y1>

condor_config_val

> Find current configuration values

```
% condor_config_val MASTER_LOG  
/var/condor/logs/MasterLog  
% cd `condor_config_val LOG`
```

condor_config_val -v

> Can identify source

```
% condor_config_val -v CONDOR_HOST
CONDOR_HOST: condor.cs.wisc.edu
  Defined in '/etc/
  condor_config.hosts', line 6
```

condor_config_val -config

> What configuration files are being used?

```
% condor_config_val -config
```

Config source:

```
    /var/home/condor/condor_config
```

Local config sources:

```
    /unsup/condor/etc/condor_config.hosts
```

```
    /unsup/condor/etc/condor_config.global
```

```
    /unsup/condor/etc/condor_config.policy
```

```
    /unsup/condor-test/etc/hosts/puffin.local
```

condor_fetchlog

- > Retrieve logs remotely

```
condor_fetchlog
```

```
beak.cs.wisc.edu Master
```

Querying daemons

`condor_status`

- > Queries the collector for information about daemons in your pool
- > Defaults to finding `condor_startds`
- > `condor_status -schedd` summarizes all job queues
- > `condor_status -master` returns list of all `condor_masters`

condor_status

- > -long displays the full ClassAd
- > Optionally specify a machine name to limit results to a single host

```
condor_status -l  
node4.cs.wisc.edu
```

condor_status -constraint

- > Only return ClassAds that match an expression you specify
- > Show me idle machines with 1GB or more memory
 - `condor_status -constraint 'Memory >= 1024 && Activity == "Idle"'`

condor_status -format

- > Controls format of output
- > Useful for writing scripts
- > Uses C printf style formats
 - One field per argument



condor_status -format

> Census of systems in your pool:

```
% condor_status -format '%s '
Arch -format '%s\n' OpSys |
sort | uniq -c
    797 INTEL LINUX
    118 INTEL WINNT50
    108 SUN4u SOLARIS28
     6  SUN4x SOLARIS28
```

Examining Queues condor_q

- > View the job queue
- > The “-long” option is useful to see the entire ClassAd for a given job
- > supports -constraint and -format
- > Can view job queues on remote machines with the “-name” option

condor_q -format

> Census of jobs per user

```
% condor_q -format '%8s' Owner  
-format '%s\n' Cmd | sort |  
uniq -c
```

```
64 adesmet /scratch/submit/a.out  
2 adesmet /home/bin/run_events  
4 smith /nfs/sim1/em2d3d  
4 smith /nfs/sim2/em2d3d
```

condor_q -analyze

- > condor_q will try to figure out why the job isn't running
- > Good at determining that no machine matches the job Requirements expressions

condor_q -analyze

> Typical intro:

```
% condor_q -analyze 471216
```

```
471216.000:  Run analysis summary.  Of 820 machines,  
    458 are rejected by your job's requirements  
    25 reject your job because of their own requirements  
    0 match, but are serving users with a better priority in the pool  
    4 match, but reject the job for unknown reasons  
    6 match, but will not currently preempt their existing job  
327 are available to run your job  
    Last successful match: Sun Apr 27 14:32:07 2008
```


condor_q -analyze

> Continued, and heavily truncated:

The Requirements expression for your job is:

```
( ( target.Arch == "SUN4u" ) && ( target.OpSys ==  
  "WINNT50" ) && [snip]
```

Condition	Machines	Suggestion
1 (target.Disk > 100000000)	0	MODIFY TO 14223201
2 (target.Memory > 10000)	0	MODIFY TO 2047
3 (target.Arch == "SUN4u")	106	
4 (target.OpSys == "WINNT50")	110	MOD TO "SOLARIS28"

Conflicts: conditions: 3, 4

Log Files



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<http://www.flickr.com/photos/bcmom/59207805/> <http://www.webcitation.org/5XlhRO8L8>

Condor's Log Files

- > Condor maintains one log file per daemon
- > Can increase verbosity of logs on a per daemon basis
 - SHADOW_DEBUG, SCHEDD_DEBUG, and others
 - Space separated list

Useful Debug Levels

- > `D_FULLDEBUG` dramatically increases information logged
 - Does not include other debug levels!
- > `D_COMMAND` adds information about about commands received

```
SHADOW_DEBUG = \  
    D_FULLDEBUG D_COMMAND
```

Log Rotation

- Log files are automatically rolled over when a size limit is reached
 - Only one old version is kept
 - Defaults to 1,000,000 bytes
 - Rolls over quickly with `D_FULLDEBUG`
 - `MAX_*_LOG`, one setting per daemon
 - `MAX_SHADOW_LOG`, `MAX_SCHEDD_LOG`, and others

Condor's Log Files

- Many log files entries primarily useful to Condor developers
 - Especially if `D_FULLDEBUG` is on
 - Minor errors are often logged but corrected
 - Take them with a grain of salt
 - `condor-admin@cs.wisc.edu`

Debugging Jobs



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<http://www.flickr.com/photos/kevincollins/89538633/> <http://www.webcitation.org/5XliMyhpp>

Debugging Jobs: condor_q

- > Examine the job with `condor_q`
 - especially `-long` and `-analyze`
 - Compare with `condor_status -long` for a machine you expected to match

Debugging Jobs: User Log

- > Examine the job's user log

- Can find with:

```
condor_q -format '%s\n' UserLog 17.0
```

- Set with “log” in the submit file
- You can set `EVENT_LOG` to get a unified log for all jobs under a schedd

- > Contains the life history of the job
- > Often contains details on problems

Debugging Jobs: ShadowLog

- > Examine ShadowLog on the submit machine
 - Note any machines the job tried to execute on
 - There is often an “ERROR” entry that can give a good indication of what failed

Debugging Jobs: Matching Problems

- No ShadowLog entries? Possible problem matching the job.
 - Examine ScheddLog on the submit machine
 - Examine NegotiatorLog on the central manager

Debugging Jobs: Remote Problems

- ShadowLog entries suggest an error but aren't specific?
 - Examine StartLog and StarterLog on the execute machine

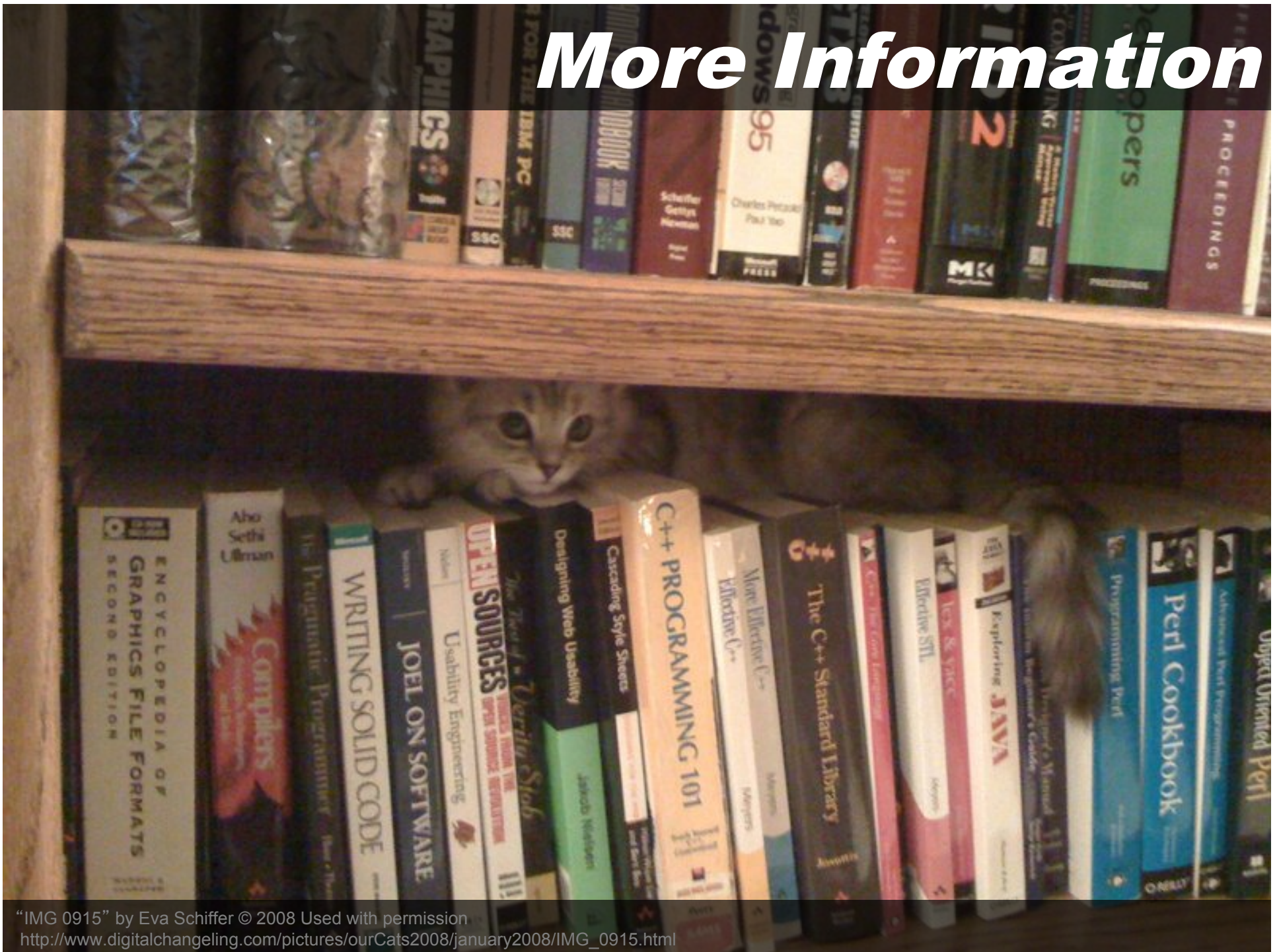
Debugging Jobs: Reading Log Files

- Condor logs will note the job ID each entry is for
 - Useful if multiple jobs are being processed simultaneously
 - grepping for the job ID will make it easy to find relevant entries

Debugging Jobs: What Next?

- > If necessary add “D_FULLDEBUG
D_COMMAND” to `DEBUG_DAEMONNAME`
setting for additional log information
- > Increase `MAX_DAEMONNAME_LOG` if
logs are rolling over too quickly
- > If all else fails, email us
 - condor-admin@cs.wisc.edu

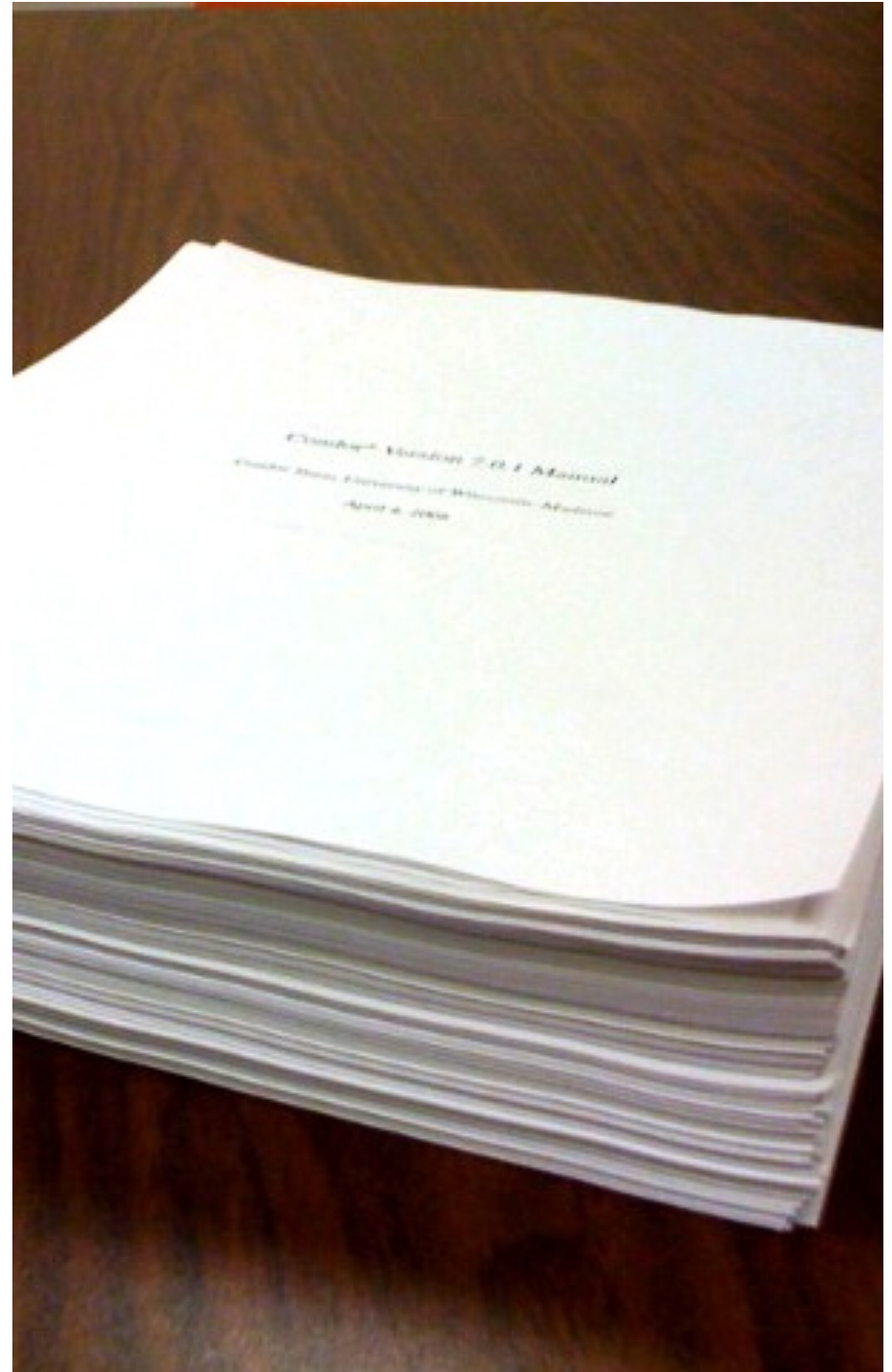
More Information



“IMG 0915” by Eva Schiffer © 2008 Used with permission
http://www.digitalchangeling.com/pictures/ourCats2008/january2008/IMG_0915.html

More Information

- > Condor staff here at Condor Week
- > Condor Manual
- > condor-users mailing list
<http://www.cs.wisc.edu/condor/mail-lists/>
- > condor-admin
condor-admin@cs.wisc.edu



"Condor Manual" by Alan De Smet
(Actual first page of the 7.0.1 manual on about 700 pages of other output. The actual 7.0.1 manual is about 860 pages.)

Thank You!



Any questions?

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