A coLinux/Condor Computer Cluster at the University of South Alabama

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Representing Distributed Organization for Scientific and Academic Research (DOSAR)

DOSAR

- **D**istributed **O**rganization for **S**cientific and **A**cademic **R**esearch.
- **http://www.dosar.org**
- "A 'grass-roots' grid organization that focuses on community and campus grids and promotes a wide range of interdisciplinary and educational activities within the organization and member institutions."
- Member institutions:

- Iowa State University
- University of Johannesburg
- Langston University
- Louisiana State University (CCT)
- Louisiana Tech University
- University of Mississippi

- University of Oklahoma
- Universidade Estadual Paulista (UNESP) (SPRACE GridUNESP)
- **University of South Alabama**
- Susquehanna University
- University of Texas at Arlington

Condor

- A project that supports high throughput computing
  - http://www.cs.wisc.edu/condor
  - Open source software: condor
- A condor cluster:
  - Condor central manager
    - Monitor the condor cluster
    - Submit jobs to the condor worker machines
    - Monitor/manage jobs running on the cluster
  - Condor worker machines (many machines)
    - Accept and execute jobs from the condor central manager
    - Return results back to the condor central manager after job completion

coLinux

- Cooperative Linux
  - http://www.colinux.org
  - Open source software
  - A native port of the Linux kernel to Windows
  - Runs on top of Windows OS
  - Allows the user to run linux operating system

coLinux/Condor Package

- Developed by OU Supercomputing Center for Education & Research (OSCER) and the University of Nebraska.
  - **http://www.oscer.ou.edu**
- The package allows the user to setup a linux operating system on a Windows OS machine that runs the condor program.
- The objective is to allow the Windows PC's to become worker nodes in a condor cluster.
- Use Windows-based PC's in student computer labs.
- **Harvest idle CPU cycles – late at night when machines are not used.**

# Local Platforms for the USA coLinux/Condor Cluster

- **Condor central manager**
  - Dell Precision 350
  - Pentium 4 - 2.80 GHz
  - 512 Mb RAM
  - 120 Gb disk space
  - Dual Boot OS:
    - Red Hat Linux 8.0
    - Scientific Linux 3.0.9
- Run condor 7.0.4 with slc 3.0.9 OS

- **coLinux/Condor worker nodes**
- Four PC's in Advanced/Modern Physics instructional laboratory
  - Received Physics Department Chair's permission to use before implementing.
  - These are primarily instructional computers!
- Dell Dimension 2400
- Pentium 4 – 2.8 GHz
- 512 MB RAM
- 33.6 Gb disk space
- Window XP Operating System

Installing the coLinux/Condor package

- Follow instructions on the OSCER web site:
  - **http://www.oscer.ou.edu/CondorInstall/condor_colinux_howto.php**
- **Major steps (some details missing):**
  - Download the coLinux/Condor file
    - Unzip the file
  - Configure the Condor configuration files
    - More on this later
  - Modify the first.sh script file
  - Modify the sethostname file
  - Copy the script on the **codor_colinux_howto.php** page.
  - Save this file locally as **condor_script.bat** or equivalent name and modify
    - Set the size of physical RAM
    - Reserve the size of disk area for condor to run in
    - Modify for the local area connection for the ethernet connection
  - Modify the boot.ini file
  - Dell computers with recovery partition:
    - partition(1) must be changed to partition(2)
    - **This is very important – so as not to write over the boot sector!**
  - Execute the condor_script.bat file:
  - Bring up DOS window
  - cd c:\condor\colinux3
  - Condor_script.bat >> nodeNameCondorInstall.Log.txt

Starting the coLinux/Condor System

- Reboot the computer

- **Is coLinux running?**

- Look for condor service
  - Start Button →
  - Control Panel (Classic) →
  - Administrative Tools →
  - Services

- Service is present and started.
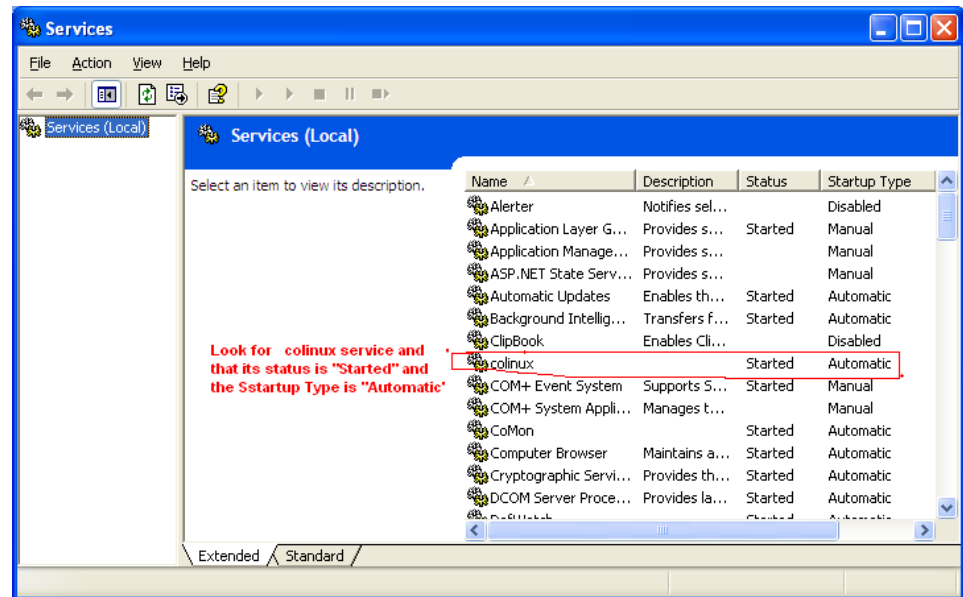
• The OSCER coLinux/Condor package installs
  - Fedora Core release 6 (Zod)
  - Condor 6.8.4

Setting up the condor central manager

- Use Dell Precision 350
  - Pentium 4 - 2.80 GHz
  - slc 3.0.9
- Follow instructions at condor web site
  - http://www.cs.wisc.edu/condor
- Download rpm and install rpm
  - Make condor account
  - Modify the configuration files
    - More on this later
  - Setup condor environment
  - Start up condor
    - %source /opt/condor/condor.sh
    - %<release_dir>/sbin/condor_master
  - See if condor is running:
    - %ps –ef | egrep condor
    - Look for condor processes

```
$ ps -ef | egrep condor
condor   4923   1 0 Jan21 ?        00:00:20 /opt/condor-7.0.4/sbin/condor_master
condor   4960  4923 0 Jan21 ?        00:02:57 condor_collector -f
condor   4991  4923 0 Jan21 ?        00:01:26 condor_negotiator -f
condor   4992  4923 0 Jan21 ?        00:00:00 condor_schedd -f
condor   4993  4923 0 Jan21 ?        00:20:10 condor_startd -f
root     4994  4992 0 Jan21 ?        00:00:00 condor_procd -A /tmp/condor-
lock.orion0.453315811305405/procd_pipe.SCHEDD -S 60 -C 502
root    30139  4993 0 Jan28 ?        00:00:00 condor_procd -A /tmp/condor-
lock.orion0.453315811305405/procd_pipe.STARTD -S 60 -C 502
root    31740  4797 0 08:05 ?        00:00:00 sshd: condor [priv]
condor  31742 31740 0 08:06 ?        00:00:00 sshd: condor@pts/0
condor  31744 31742 0 08:06 pts/0   00:00:00 -tcsh
condor  31767 31744 0 08:06 pts/0   00:00:00 ps -ef
```

- condor 7.0.4

Condor Configure Files

- condor config files must be setup properly for the condor cluster to work.

  - <release_dir>/etc/condor_config
  - condor_config variables to define:
    - LOCAL_DIR
    - FLOCK_FROM
    - FLOCK_TO
    - HOSTALLOW_READ
    - HOSTALLOW_WRITE

  - condor_config.local variables to define:
    - CONDOR_HOST
    - CONDOR_ADMIN
    - UID_DOMAIN
    - COLLECTOR_NAME

Initial Problems with the Cluster

- The coLinux/condor worker nodes were missing.

- Set up a second slc 3.0.9 node

- Remove possible coLinux/condor problems
  – Received some help from USA Academic Computing
  – Resolving network issues

- Trouble shooting greatly helped by locating condor log files.

- /opt/condorVersion/local.node/log/collectorLog

- Helped in resolving condor issues from network issues
  – Proper setup of condor config files on both machines
    - Add node on host.allow

- Second node appeared on condor cluster

- Condor working!

Resolving coLinux/condor Issues

- On the Windows PC
- Start up a linux console
- "click" **coLinux-console-fltk** icon
  - Login
  - Startup condor
  - Look at the condor error log files
    - Separate network problems from condor problems
    - Correct problems in the condor config files
  - Eventually found:
    - coLinux IP address different than Windows IP address
    - No hostname defined for coLinux!
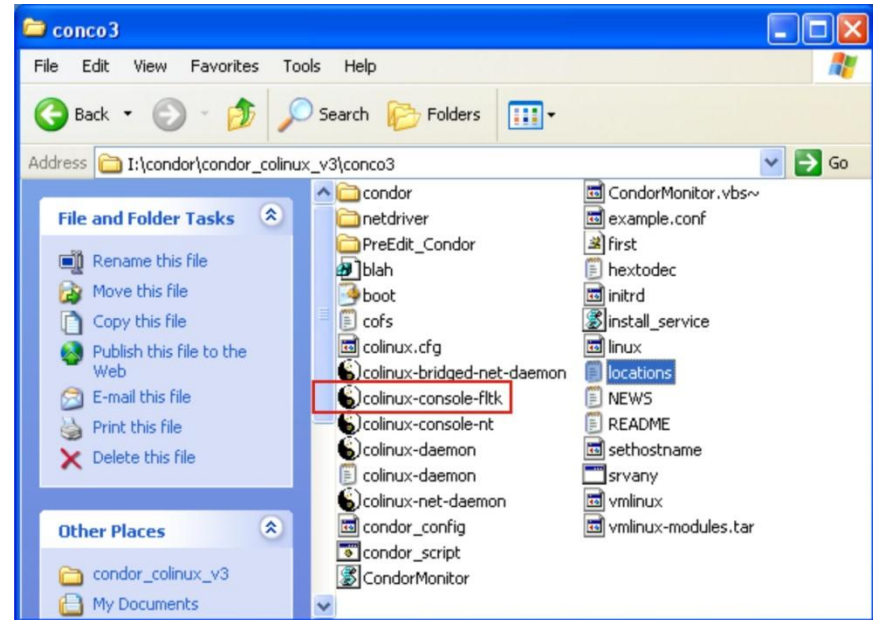
- USA DHCP only assigned IP address
- U of Oklahoma also assigned node name
- Solution: configure each PC:
  - Permanent IP address for coLinux PC
  - Configure with hostname

The coLinux/condor Cluster

- Nodes appear with condor_status command
- Cluster is stable

```
$ condor_status

Name              OpSys      Arch  State     Activity LoadAv Mem  ActvtyTime

ilb00500.condor.us LINUX     INTEL  Unclaimed Idle    0.000  250  0+01:50:20
ilb00501.condor.us LINUX     INTEL  Unclaimed Idle    0.000  250  0+02:29:02
ilb00502.condor.us LINUX     INTEL  Unclaimed Idle    0.000  250  0+00:00:54
orion.physics.usou LINUX     INTEL  Unclaimed Idle    0.020  499  0+00:50:04

           Total Owner Claimed Unclaimed Matched Preempting Backfill

INTEL/LINUX    4    0     0       4        0         0        0

      Total  4    0     0       4        0         0
```

Testing the Cluster

- Wrote a small C++ benchmark program
  - currentHost.cc
  - Loop accessing the computer clock
  - Prints out time
- Use "standard universe"
- Must build the program to link to the condor libraries.
  - %condor_compile CC –o currentHost currentHost.cc
  - The job is controlled on the condor cluster with a condor command file
  - currentHost.cmd
  - This includes the number of jobs to submit
- To submit the condor jobs
- %condor_submit currentHost.cmd

Test Job Output

- The test job is called currentHost

- Output from the test job run on two nodes.

```
 Max =    15000 | Modulo =    1500
Date = 2010Jan28_22_13_58
Current Host: orion
 Error getting MYHOST
Current Directory: /orion2/condor/CurrentHost2010Jan28A
 Error getting CONDOR_HOST
 Error getting COLLECTOR_HOST
 Error getting FULL_HOST_NAME
CONDOR_SCRATCH_DIR: /opt/condor-6.8.4/local.ilb00500/execute/dir_18805
 last = 3
 length of tempIn = 50
tempName = ilb00
 Error getting _CONDOR_SLOT
m =       0 Time =  0.0000e+00 , rtime =  2.0000e-02
m =    1500 Time =  0.0000e+00 , rtime =  7.0000e-02
m =    3000 Time =  0.0000e+00 , rtime =  1.0000e-01
m =    4500 Time =  0.0000e+00 , rtime =  1.3000e-01
m =    6000 Time =  0.0000e+00 , rtime =  2.2000e-01
m =    7500 Time =  0.0000e+00 , rtime =  2.7000e-01
m =    9000 Time =  0.0000e+00 , rtime =  2.7000e-01
m =   10500 Time =  0.0000e+00 , rtime =  3.8000e-01
m =   12000 Time =  0.0000e+00 , rtime =  4.1000e-01
m =   13500 Time =  0.0000e+00 , rtime =  4.7000e-01
```

```
 Max =    15000 | Modulo =    1500
Date = 2010Jan28_22_05_17
Current Host: orion
 Error getting MYHOST
Current Directory: /orion2/condor/CurrentHost2010Jan28A
 Error getting CONDOR_HOST
 Error getting COLLECTOR_HOST
 Error getting FULL_HOST_NAME
CONDOR_SCRATCH_DIR: /opt/condor-6.8.4/local.ilb00501/execute/dir_7418
 last = 3
 length of tempIn = 49
tempName = ilb00
 Error getting _CONDOR_SLOT
m =       0 Time =  0.0000e+00 , rtime =  3.0000e-02
m =    1500 Time =  0.0000e+00 , rtime =  5.0000e-02
m =    3000 Time =  0.0000e+00 , rtime =  1.2000e-01
m =    4500 Time =  0.0000e+00 , rtime =  1.7000e-01
m =    6000 Time =  0.0000e+00 , rtime =  2.2000e-01
m =    7500 Time =  0.0000e+00 , rtime =  2.8000e-01
m =    9000 Time =  0.0000e+00 , rtime =  3.6000e-01
m =   10500 Time =  1.0000e+00 , rtime =  4.1000e-01
m =   12000 Time =  1.0000e+00 , rtime =  4.1000e-01
m =   13500 Time =  1.0000e+00 , rtime =  5.1000e-01
```

Future Plans

- Need to build programs that use the CERN libraries.
  - Root
- Need shared disk space to run in the "vanilla universe"
  - Programs do not have to link to the condor libraries.
- Need to upgrade the linux kernal to SL 5 release
  - Will do this after it is released by the University of Oklahoma
- Need to upgrade the condor version