Cyberinfrastructure for Distributed Rapid Response to National Emergencies

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Disasters

May 3 1999 Oklahoma

http://abyss.ecs.umass.edu/tornado/may-3-99.html

Congressional Anthrax 2001


Indian Ocean Tsunami 2004


OKC Wildfires Jan 2006

The Problem and the Solution

- **The Problem**: Problems will happen.
- The problem is that we don’t know the problem.
- The solution is to be able to respond to unknown problems with unknown solutions.
- Unknown problems that have unknown solutions may require lots of resources.
- But, we don’t want to buy resources just for the unknown solutions to the unknown problems – which might not even happen.
- **The Solution**: Be able to use existing resources for emergencies.
Who Knew?


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Neeman & Severini, OSCER/University of Oklahoma, Condor Week 2006
National Emergencies

- **Natural**
  - Severe storms (e.g., hurricanes, tornadoes, floods)
  - Wildfires
  - Tsunamis
  - Earthquakes
  - Plagues (e.g., bird flu)

- **Intentional**
  - Dirty bombs
  - Bioweapons (e.g., anthrax in the mail)
  - Poisoning the water supply
  - (See Bruce Willis/Harrison Ford movies for more ideas.)
How to Handle a Disaster?

- **Prediction**
  - Forecast phenomenon's behavior, path, etc.

- **Amelioration**
  - Genetic analysis of biological agent (find cure)
  - Forecasting of contaminant spread (evacuate whom?)
OSCER's Project

NSF Small Grant for Exploratory Research (SGER)

- **Configure** machines for rapid switch to Condor
- **Maintain** resources in state of readiness
- **Train** operational personnel: maintain, react, analyze
- **Fire** **drills**
- Generate, conduct and analyze **scenarios** of possible incidents
@ OU: Available for Emergencies

- 512 node Xeon64 cluster (6.5 TFLOPs peak)
- 135 node Xeon32 cluster (1.08 TFLOPs peak)
- 32 node Itanium2 cluster (256 GFLOPs peak)
- Desktop Condor pool – growing to 750 Pentium4 PCs (4.5 TFLOPs peak)

**TOTAL:** 12.4 TFLOPs
Dell Xeon64 Cluster

1,024 Pentium4 Xeon64 CPUs
2,180 GB RAM
14 TB disk (SAN+IBRIX)
Infiniband & Gigabit Ethernet
Red Hat Linux Enterprise
Peak speed: 6.5 TFLOPs
Usual scheduler: LSF
Emergency Scheduler: Condor

topdawg.oscer.ou.edu

DEBUTED AT #54 WORLDWIDE, #9 AMONG US UNIVS, #4 EXCLUDING BIG 3 NSF CENTERS
Aspen Systems Xeon32 Cluster

270 Xeon32 CPUs
270 GB RAM
~10 TB disk
Myrinet2000
Red Hat Linux
Peak speed: 1.08 TFLOPs
Scheduler: **Condor**

Will be owned by High Energy Physics group

**DEBUTED at #197 on the Top500 list in Nov 2002**

[boomer.oscer.ou.edu](http://boomer.oscer.ou.edu)

[www.top500.org](http://www.top500.org)
Aspen Systems Itanium2 Cluster

64 Itanium2 1.0 GHz CPUs
128 GB RAM
5.7 TB disk
Infiniband & Gigabit Ethernet
Red Hat Linux Enterprise 3
Peak speed: 256 GFLOPs
Usual scheduler: LSF
Emergency scheduler: Condor

schooner.oscer.ou.edu
Dell Desktop Condor Pool

OU IT is deploying a large Condor pool (750 desktop PCs) over the course of the 2006:
3 GHz Pentium4 (32 bit), 1 GB RAM, 100 Mbps network connection.

When deployed, it’ll provide 4.5 TFLOPs (peak) of additional computing power – more than is currently available at most supercomputing centers.

Currently, the pool is 136 PCs in a few of the student labs.
Oklahoma has just gotten onto NLR; the pieces are all in place but we’re still configuring.
MPI Capability

- Many kinds of national emergencies – weather forecasting, floods, contaminant distribution, etc. – use fluid flow and related methods, which are tightly coupled and therefore require MPI.
- Condor provides the MPI universe.
- Most of the available resources – 7.9 TFLOPs out of 12.8 – are clusters, ranging from ¼ TFLOP to 6.5 TFLOPs.
- So, providing MPI capability is straightforward.
Fire Drills

- **Switchover** from production to emergency Condor:
  1. Shut down all user jobs on the production scheduler.
  2. Shut down the production scheduler (if not Condor; e.g., LSF).
  3. Start Condor (if necessary).

- **Condor jobs** for national emergency *discover* these resources and start themselves.

- We've done this several times at OU.
  - Only during scheduled downtimes!
  - Switchover times range from 9 minutes down to 2.5 min.
  - Pretty much we have this down to a science.
Thanks for your attention!

Questions?