Bootable Cluster CD
NCSI Workshops 2012: Introduction to Parallel Programming

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Sponsors

- Intel Corporation
- Supercomputing Conference
- Earlham College
- Shodor Foundation
- Contra Costa College
What is the BCCD?

- A software tool for domain educators for teaching CSE
- A stable platform for the writing of curricula for CSE
- A live CD with pre-configured clustering software
- One part of a larger CSE community
  - Shodor Foundation
  - National Computational Sciences Institute (NCSI)
  - CSE Reference Desk (CSERD)
- “Teaching Parallelism Made Easy”
  - Just keep pushing “Enter”
Short history

- First versions developed by Paul Gray and Students at University of Northern Iowa
- Current version (BCCDv3) collaboratively developed by a number of educational institutions
- BCCDv3 much easier to maintain and able to respond to new needs
- BCCDv3 has the same user experience as BCCDv2, so curricula written for v2 will still work with v3
What is the problem?

- STEM education is more important than ever [?]
- Computers have become a large part of any science curriculum
- BUT ... it’s hard to find suitable resources for teaching computational science and parallel programming at scale
- Many schools do not have the resources or expertise to provide the hardware or software
- Those that do tend to provide the resources primarily for research and not for education
- Even with a dedicated educational resource, it tends not to be “hands-on”, and is difficult to see how it works.
How is BCCD a solution?

- Almost every school will have a computer lab. BCCD is designed to be used on existing systems non-disruptively.

- Many laptops are now dual-core. Virtualization software can be used to setup a cluster right in front of you.

- Regardless of how it’s used, BCCD provides an environment that facilitates education.
Live Demo!

- Double click on Oracle VM VirtualBox.
- Go to New, and click Next.
- Type in “BCCD” as the machine name.
- Select “Linux”, then make sure “Debian” is selected.
- Enter 1024 MB for the memory.
- Unselect Start-up Disk, and click Continue when prompted.
- Click Create.
- Click Storage.
Live Demo! (cont’d)

- Click Empty by the CD symbol, click the CD drop-down on the right, and select Choose.
- Click on the USB stick symbol on the left, and go into SC11 Materials.
- Select bccd.iso.
- Go to System, and select Processor, and set the number of processors to 2.
- Go to Network, set NAT to Internal, and set the name to “bccd”.
- Click Ok.
Make sure BCCD is selected, and click Start.

Just keep pressing Enter.
GalaxSee - Single node

- In the black terminal window, run `top`
- In the blue terminal window -
  
  ```
  $ cd $HOME/GalaxSee
  $ hostname > machines
  $ make
  ```
Still in the blue terminal window -

```bash
$ time mpirun -np 1 ./GalaxSee 500 400 5000
$ time mpirun -np 2 ./GalaxSee 500 400 5000
```

Notice the number of GalaxSee processes running in the top window

You might not see speedup in VirtualBox, because of virtualization overhead.
Back in VirtualBox, right-click on the BCCD system, and select clone.

Set the name to BCCD2, click Reinitialize, Next, and then Clone.

Click Start for BCCD2, and follow the same boot process as the original.
$ module purge && module load modules mpich2

$ make clean && make

$ bccd-snarfhosts

$ bccd-syncdir --ni $HOME/GalaxSee \ $HOME/machines

$ time mpirun -np 4 \ /tmp/$(hostname -s)-$(whoami)/GalaxSee \ 500 400 5000

Notice that not all your processes are shown in the local top window.

Once again, speedup is limited by virtualization.
Where to find documentation? http://bccd.net

What software is available? module avail

How to load new software? module load name

How to unload software? module unload name

How to reset networking? sudo /bin/bccd-reset-network, use the password you set when you booted
<table>
<thead>
<tr>
<th>Questions (and answers)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sponsors</strong></td>
</tr>
<tr>
<td>What is the BCCD?</td>
</tr>
<tr>
<td>Short history</td>
</tr>
<tr>
<td>What is the problem?</td>
</tr>
<tr>
<td>How is BCCD a solution?</td>
</tr>
<tr>
<td>Live Demo!</td>
</tr>
<tr>
<td>Live Demo! (cont'd)</td>
</tr>
<tr>
<td>Boot</td>
</tr>
<tr>
<td>GalaxSee - Single node</td>
</tr>
<tr>
<td>GalaxSee - Single node (cont'd)</td>
</tr>
<tr>
<td>GalaxSee - Multi-node</td>
</tr>
<tr>
<td>GalaxSee - Multi-node (cont'd)</td>
</tr>
<tr>
<td>Miscellaneous information</td>
</tr>
<tr>
<td>Questions (and answers)</td>
</tr>
</tbody>
</table>