



# Bootable Cluster CD Intro Parallel 2011

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## Sponsors

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What is the BCCD?

Short history

What is the problem?

How is BCCD a solution?

Live Demo!

Boot

GalaxSee - Single node

GalaxSee - Single node (cont'd)

GalaxSee - Multi-node

Miscellaneous information

References

Questions (and answers)

- Intel Corporation
- Supercomputing Conference
- Earlham College
- Shodor Foundation
- Contra Costa College



## What is the BCCD?

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Questions (and answers)

- 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

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What is the BC CD?

**Short history**

What is the problem?

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Questions (and answers)

- First versions developed by Paul Gray and Students at University of Northern Iowa
- Current version (BC CDv3) collaboratively developed by a number of educational institutions
- BC CDv3 much easier to maintain and able to respond to new needs
- BC CDv3 has the same user experience as BC CDv2, so curricula written for v2 will still work with v3



## What is the problem?

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What is the BC CD?

Short history

**What is the problem?**

How is BC CD a solution?

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Questions (and answers)

- STEM education is more important than ever [1]
- 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?

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Questions (and answers)

- 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!

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**Live Demo!**

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GalaxSee - Single node

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Questions (and answers)

- Double click on VMware player
- Go to File-> New
- Click on “Install OS Later”
- Select “Linux”, then make sure “Ubuntu” is selected
- Set the name to “BCCD”
- Take the defaults for the storage
- Click Customize
- Set Procs-> 4 (if your system says QUAD) or 2
- Set the Network Adapter-> Bridged
- **Don't boot yet!**



# Boot

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Live Demo!

**Boot**

GalaxSee - Single node

GalaxSee - Single node (cont'd)

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Questions (and answers)

- Just keep pressing Enter.



## GalaxSee - Single node

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GalaxSee - Single node

GalaxSee - Single node (cont'd)

GalaxSee - Multi-node

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Questions (and answers)

- In the black terminal window, run `top`

- In the blue terminal window -

```
$ cd $HOME/GalaxSee
```

```
$ hostname > machines
```

```
$ make
```

## GalaxSee - Single node (cont'd)

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Questions (and answers)

### ■ Still in the blue terminal window -

```
$ 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 VMWare, because of virtualization overhead.

## GalaxSee - Multi-node

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Live Demo!

Boot

GalaxSee - Single node

GalaxSee - Single node (cont'd)

GalaxSee - Multi-node

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Questions (and answers)

```
■ $ module purge && module load modules mpich2
```

```
■ $ make clean && make
```

```
■ $ bccd-snarfhosts
```

```
■ $ bccd-synkdir --ni $HOME/GalaxSee \  
$HOME/machines
```

```
■ $ time mpirun -np 8 \  
/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.



## Miscellaneous information

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Questions (and answers)

**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



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**References**

Questions (and answers)

- [1] Jeannette M. Wing. Computational thinking. *Commun. ACM*, 49:33–35, March 2006.



## Questions (and answers)

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