Blue Collar Computing:
Productivity and Workforce Development through Technology

Ashok Krishnamurthy, Ph.D.
Director of Research and Scientific Development

HPC for the Rest of US
HPC for the Common Man
## Functions - Scope of Activity

### Supercomputing
Computation, software, storage, and support services empower Ohio’s scientists, engineers, faculty, students, businesses and other clients.

### Networking
Ohio’s universities, colleges, K-12 and state government connect to the network. OSC also provides engineering services, video conferencing, and support through a 24x7 service desk.

### Research
Lead science and engineering projects, assist researchers with custom needs, partner with regional, national, and international researchers in groundbreaking initiatives, and develop new tools.

### Education
The Ralph Regula School of Computational Science delivers computational science training to students and companies across Ohio.
**OSCnet with all connected partners**

As of 3/22/2007

HPC for All
October 12, 2007

As of 3/22/2007

- OSCnet PoP
- Regen Site
- OSCnet Link
- Leased
- Proposed
- Higher Ed (Broadband)
- Higher Ed (not Broadband)
- ITCs (Broadband)
eTech Affiliates (Broadband)
Ohio Broadband Council supports implementing Broadband Ohio plan

- Expand access statewide
- Streamline state government
- Promote public and private broadband services and investments
- Focus on economic development

Ohio Broadband Council (OBC) - OIT/OSC Co-Chairs
- Rural Broadband
- Digital Inclusion
- Application Innovation
- Contracting

Technical Coordination Committee - OSC/OIT Co-Chairs

Ohio Supercomputer Center (OSC)

OSCnet

Office of Information Technology (OIT)

NextGen

Broadband Ohio

- Higher Education
- Agriculture
- State & Local Government
- Economic Development

- K-12 Education
- Health
- Under-served
- Public Safety

- Blue Collar Computing
- Public TV
- Community Rings
- Courts

- Research
  - Federal • State • Local
- Public TV
- Community Rings
- Public/Private

HPC for All
October 12, 2007
Blue Collar Computing: a focused industrial solution

OSC introduced the idea of Blue Collar Computing at SC2004

Invited Talk: Towards a High Performance Computing Economy: Blue Collar Computing

Presented by: Stanley C. Ahalt, Ph.D., Ohio Supercomputer Center
Pittsburgh, Pa., November 6-12, 2004

Blue Collar Computing (BCC) provides industrial clients with supercomputing resources, training, and expertise to enhance their competitiveness
Blue Collar Computing focuses on novice and experienced industrial uses

• Two classes of industrial clients:
  – Experienced HPC users who need access to larger systems for specific tasks (“peaking” facility)
  – Novice HPC users who are exploring use of HPC (often prefer web portals)

• BCC approach to novice – and some experienced – users is to develop industry-specific portals in collaboration with industry trade groups and industry-focused consulting firms
BCC: Filling in the missing middle
Blue Collar Computing National Partnerships

- BCC Partnership: OSC, University of Southern California Information Sciences Institute (USC/ISI), and Council on Competitiveness (CoC)
- OSC works closely with the CoC to promote HPC for industrial productivity
- OSC is part of the CoC and USC/ISI effort to create a National Innovation Collaboration Ecosystem (NICE)
- CoC and USC/ISI want to scale OSC BCC project up to a national level
The Vision: Create a National Innovation Collaboration Ecosystem

Enable Companies, Entrepreneurs, Individual Inventors to:

*Innovate Anywhere, with Anyone, using any Domain Specific Application Running at any Available High Performance Computing Center*

*Filling the Expertise Gap*

*Moving Users Forward*

*National Productivity Opportunity*

Adapted from OSC Graphics
Blue Collar Computing’s Ohio Partners
Will Pringles Fly?

High Speed Conveying Create Vortices Shedding… …’Rocking Chips’ NOT GOOD!

HPC for All
October 12, 2007
BCC: E-Weld Predictor Portal

- BCC Example: eWeld portal in collaboration with EWi
- eWeld portal is being marketed by EWi to their membership
- eWeld currently supports arc welding for pipelines, but will be expanded to other welding methods
- Significantly increases the ability of EWi membership to use computer simulation to determine weld parameters

eWeld Predictor is now a commercial product from EWi

<table>
<thead>
<tr>
<th>EWI eWeld Portal Impact</th>
<th>Previously</th>
<th>E-Weld</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expertise Needed</td>
<td>Ph.D.</td>
<td>B.S.</td>
</tr>
<tr>
<td>Run Time</td>
<td>52 days</td>
<td>4-5 days</td>
</tr>
<tr>
<td>Solution Time</td>
<td>6-8 months</td>
<td>1-2 months</td>
</tr>
</tbody>
</table>
BCC: Polymer Portal collaboration

- BCC Example: Polymer Portal in collaboration with PolymerOhio
- Polymers and plastics is a large industry sector in Ohio (2800 companies, 175,000 employees)
- The polymer portal will provide:
  - Expertise in polymer science and engineering
  - Computational resources and software for modeling and simulation
  - Databases with relevant material properties
  - Advanced instrumentation
  - Training
  - Vendor relevant material
  - Business intelligence and strategy
- PolymerOhio forum (9/11) focused on how BCC can help this sector
BCC: Create analytics program, services for shared instrumentation

- Example: Scanning Electron Microscope at OSU Center for Accelerated Maturation of Materials, Stark State, Timken, and OSCnet
- Demonstrates real-time user control
- Allows industry and higher ed to collaborate on image analysis and computational modeling

Example of shared instrumentation application: remote access of electron microscope
Blue Collar Computing & Business Assistance Act

- The Blue Collar Computing and Business Assistance Act would give small and medium size businesses the same opportunities to use computational science and HPC as large firms. As a result of this Act, up to five centers would be created that would collectively form the Advanced Multidisciplinary Computing Software Institute. These centers would:
  - Work with the businesses to help them adopt the use of computational science and high performance computing
  - Assist with the transfer of new computational science and high-performance computing technologies from federally sponsored research projects to small and medium size businesses
  - Identify industry needs for new types of modeling software and create a repository of modeling software
  - Adapt software packages to run effectively on HPC systems
# Education: Building a workforce competent in computational science

<table>
<thead>
<tr>
<th>Level</th>
<th>Audience</th>
<th>Example</th>
<th>Programs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expert in Applications</td>
<td>Engineers/ scientists in university and business</td>
<td>Applying protein folding simulations to discover candidates for new drugs</td>
<td>Certificate and graduate programs; OSC training courses</td>
</tr>
<tr>
<td>Understand use of modeling for business and research</td>
<td>Current workforce College graduates</td>
<td>Using commercial computational package or service to test strength of new container design</td>
<td>Certificate program Undergraduate minor program OSC training program</td>
</tr>
<tr>
<td>Applying models to engineering and architecture fields</td>
<td>Ohio PLTW students and teachers</td>
<td>Modeling simple physics phenomena: statics, gravity, pendulum</td>
<td>PLTW training course for teachers; course given to students</td>
</tr>
<tr>
<td>Cause and effect relationships and simple modeling principles</td>
<td>Middle and high school students and teachers</td>
<td>Model of disease transmission in human population</td>
<td>Teacher professional development programs; workshops for middle and high school students</td>
</tr>
</tbody>
</table>
Education: Minor program in Computational Science

• Multi-institutional collaboration starting Fall 2007
• Programs in computational science taking advantage of Ohio’s distributed expertise
  – Undergraduate minor program
Education: Minor program overview

- Undergraduate minor program
  - 6-8 courses per year
  - 2-year degree: minor in computational science
- Faculty completing instructional modules
- Creating a matrix of modules, competencies
- Opportunities for other faculty to fill in with new modules, where necessary
- Minor program in place for Fall 2007

<table>
<thead>
<tr>
<th>Competencies for Undergraduate Minor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simulation and Modeling</td>
</tr>
<tr>
<td>Programming and Algorithms</td>
</tr>
<tr>
<td>Differential Equations and Discrete Dynamical Systems</td>
</tr>
<tr>
<td>Numerical Methods</td>
</tr>
<tr>
<td>Optimization</td>
</tr>
<tr>
<td>Parallel Programming</td>
</tr>
<tr>
<td>Scientific Visualization</td>
</tr>
<tr>
<td>One discipline specific course</td>
</tr>
<tr>
<td>Capstone Research/Internship Experience</td>
</tr>
<tr>
<td>Discipline Oriented Courses</td>
</tr>
</tbody>
</table>
Education: Expanding the program to reach more students and current employees

- Associate degree in science with concentration in computational science
- Certificate programs
  - Focus on skills needed by employers
  - “Stackable” certificates starting with basic skills and working up to advanced skills
  - Funding from Board of Regents to develop two or three special areas this fall
Education: Stackable certificates build computational science expertise

• Level 1 Certificates
  – Meet competencies of undergraduate minor
  – Will require mathematics review for displaced workers
  – Possible certificates:
    • Modeling and Simulation
    • Parallel computing
    • Visualization
    • Programming and algorithms for computational scientists

• Level 2 Certificates
  – More specialized, focused on specific computational expertise
Education: Next Steps

• Connect K-20, professional development, and workforce training activities for economies of scope and economies-of-scale
• Make effective use of multiple delivery methods for course materials
• Train the trainer – engage a wider range of faculty in computational science education
• Develop specialized certificate program in conjunction with community- and industry-based partners
• Work with community colleges to engage their business partners
• Connect certificate programs with HPC services and support
• Connect certificate programs with graduate programs
Tom Lange from P&G on Virtual Design
The “Madagascar Penguins” on HPC Applications

This is only a trailer. Full video on DVD is available from http://www.compete.org/hpc/
Questions?