

The background of the slide is white with a complex pattern of blue lines. There are several solid blue lines, some of which are straight and others that are curved. Interspersed among these are dashed blue lines, some of which form loops or paths. Small blue circles, some solid and some hollow, are placed at various points along the lines, often serving as endpoints or starting points for arrows. The overall impression is that of a technical or scientific diagram, possibly representing a network, a path, or a data flow.

# CCR INDUSTRY CLUSTER

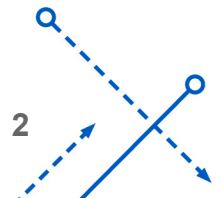
June 2022

 University at Buffalo  
Center for Computational Research



## Table of Contents

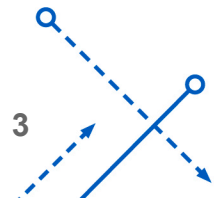
- Equipment Overview
- How does this all work?
- Example Partnerships
- Additional Information





## Table of Contents

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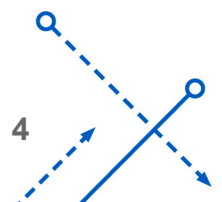


## History of the UB/CCR industry cluster

- Program started in 2014
- \$1.2 Million supercomputer
- 3456 processors
- 72 TFLOPS peak performance
- Supported 34+ local companies



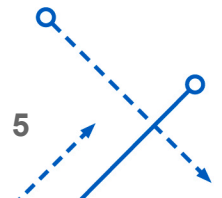
Industry Cluster Node Rack





## Industry Cluster Upgraded in Summer 2021

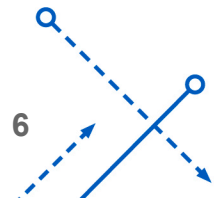
- \$1 Million Upgrade
- 5544 processor cores (~665 Tflops)
  - Intel Ice Lake Processors
  - Dual Nvidia A100 GPU's in 16 nodes
- Supports:
  - Artificial Intelligence
  - Machine Learning
  - Blockchain
- More details on the new Industry Cluster can be found at [buffalo.edu/ccr/industry](https://buffalo.edu/ccr/industry)





## Table of Contents

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## Industry Partnerships

New companies receive introductory package

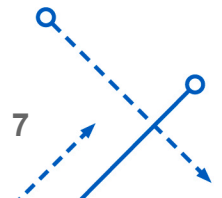
- a. 100,000 CPU Core Hours
- b. 1 TB Storage (can purchase additional storage at \$100/TB\*)
- c. No Data Transfer Costs
- d. Account set up

Requirements

- a. Company presence in New York State
- b. Willingness to participate in annual reporting to NYS
- c. Complete Cooperative Use Agreement with CCR/UB
- d. Company provides software licenses (if needed)

No IP is shared with UB by solely utilizing the Industry Cluster

\*Annual Cost



## Industry Partnerships (cont.)

After introductory package

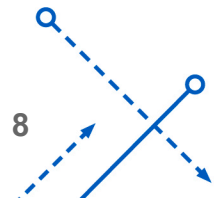
- a. Pay-per-cycle CPU Core Hours
- b. 1 TB Storage (can purchase additional storage at \$100/TB\*)
- c. No Data Transfer Costs
- d. Account set up

Requirements

- a. Willingness to participate in annual reporting to NYS
- b. Complete Cooperative Use Agreement with CCR/UB
- c. Company provides software licenses (if needed)

No IP is shared with UB by solely utilizing the Industry Cluster

\*Annual Cost

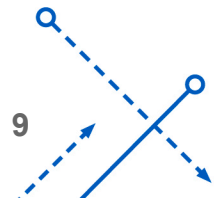






## Cluster Access

- Secure remote access
  - Hardware and software firewalls
  - Virtual Private Network
- Access via:
  - Remote desktop via web browser client (OnDemand)
- General Procedure
  - Connect to "front-end"
  - Request compute nodes
  - Load software
  - Launch GUI or batch job



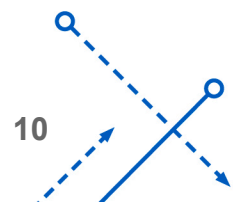
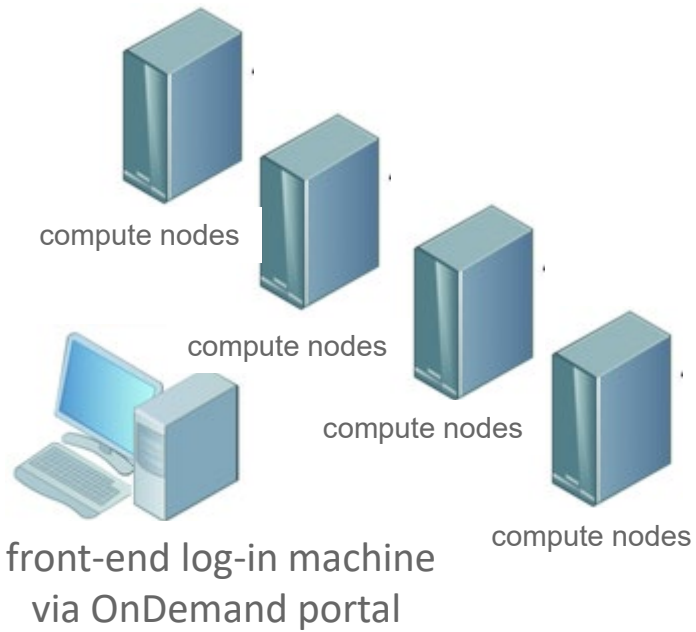


## Cluster Access (cont.)



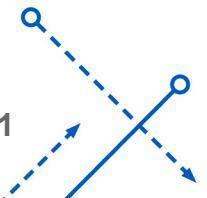
user's PC

UB VPN



## Some areas where Industry Cluster access can help

- Computational or scientific software
- Heating/cooling/flow operations
- Internal R&D problems
- Custom engineering
- Modeling
- Simulations
- Parallel Computing
- Automated drug discovery
- Informatics processing pipelines
- Machine/deep learning and artificial intelligence
- Big Data and analytics
- Image and pattern recognition
- High-speed rendering



## Software Modules

CCR clusters can support dozens of scientific software packages such as:

- Engineering – ABAQUS, ANSYS, COMSOL, STAR-CCM
- Machine Learning – Tensorflow, Torch
- GPU Programming – CUDA, OpenCL
- Data Analytics – R, SAS
- Molecular Dynamics – NAMD, Rosetta, Schrodinger
- Quantum Chemistry – Orca, Q-Chem
- Programming – MATLAB, Python
- Bioinformatic/ Genomics – BLAST, GATK

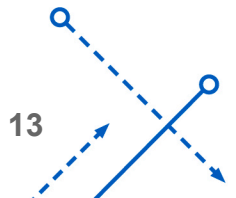
Require something not listed above? Let us know and we can look into it!





## Table of Contents

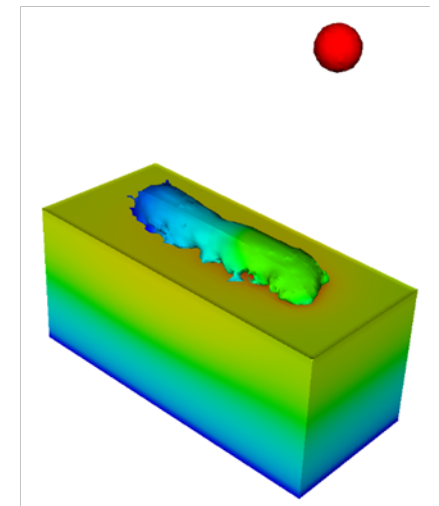
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## Example Partner: VADER Systems

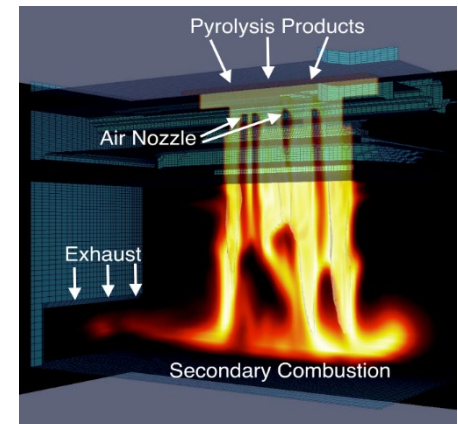
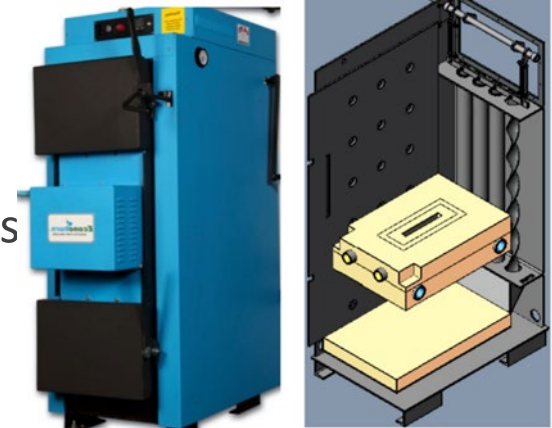
- Additive manufacturing using Liquid Metal Jet Printing (LMJP)
  - layered droplets of molten metal
- Use UB CCR to simulate droplet generation and engineer droplet behavior while cooling on the substrate
- The partnership accelerated their MK1 product launch
  - In time for rollout of the RIT AMPrint (Additive Manufacturing and Multifunctional Printing) Center
- Now looking at new materials and running at higher temperatures and faster printing rates
- Purchased by Xerox in Feb 2019

**VADER**



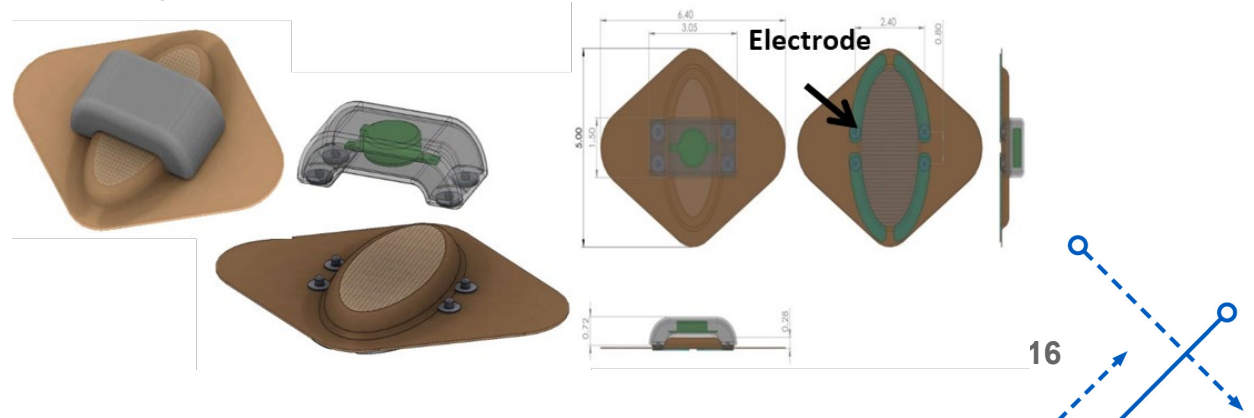
## Example Partner: Econoburn Inc.

- Econoburn designs and manufactures 2-stage boilers in Brocton, NY
- Partnered with UB and UB CCR to maximize burn efficiency and minimize emissions
- Assisted by faculty from Department of Mechanical and Aerospace Engineering
  - Experts in CFD and turbulent flow
- Understanding turbulent flow at extreme temperatures is key to the success of the technology
  - A common problem in many manufacturing environments, where materials must be rapidly heated and/or cooled
- Flow simulations carried out on CCR industry cluster and then verified on physical prototype



## Example Partner: Garwood Medical

- “Smart Bandages” for patient-specific wound healing
- Remotely powered and equipped with wireless sensors to collect biometrics and monitor compliance
- Electrostimulation prevents infections associated with surgical implants
- Product development is being accelerated through the use of HPC resources to model complex interactions between human tissue, implants, bacteria, and electrochemistry





## Example Partner: Sentient Science Inc

- Use materials science to build computational models of complex rotating machines, such as wind turbines.
- Winner of numerous national awards in Energy
- Currently monitor over 40,000 Wind Turbines in the field to improve operational efficiency (10% of turbines worldwide)
- Sentient’s DigitalClone software runs at UB’s Center for Computational Research to provide a prognostic life forecast of major systems and components in the wind, aerospace and transportation to achieve lower operations and maintenance costs.
- 80 jobs created/retained to date





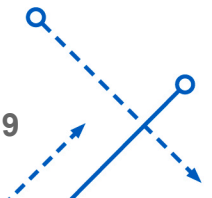
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## Other areas where CCR can assist

- Funding opportunities
  - Federal – NSF, NIH, DOE, SBIR/STTR
  - UB Related - CMI, CAT, BIG
- Letters of Support
- UB IP Licensing
- Access to University at Buffalo expertise & students:
  - genomics, bioinformatics
  - Machine learning, A.I.
  - engineering, CFD, GIS
  - molecular modeling
  - computational chemistry
  - crystallography, volcanology
  - many other areas!





## Where to go for more information

- Contact a UB CCR Industry Outreach lead:



Adrian Levesque, MBA

apl3@buffalo.edu  
716-881-8932

- Explore the CCR Web Site - [buffalo.edu/ccr](https://buffalo.edu/ccr)

