UNLV UNLV's National Supercomputing Center

High Performance Computing and Communications in Nevada

Altair

Leveraging HPC for Alzheimer's Research and Beyond

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Agenda

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- **Solution with Altair PBS Professional**
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About the NSCEE

Full-service supercomputing facility

Mission for excellence in education and research in supercomputing and its applications

Provides supercomputing training and services to academic and research institutions, government and private industry

Supports energy, the environment, medical informatics and health care

Serves researchers at the University of Nevada Las Vegas and other statewide, nationwide and global research

NSCEE @ Switch

- 2014 - UNLV moved its NSCEE facilities to Switch facility in Las Vegas
- Hosted on Cherry Creek system – large Intel system for scientific and economic R&D
- 26,000 compute cores
- Intel Xeon E5-2697v2 12C 2.700GHz, Intel Truscale, Intel Xeon Phi 7120P
- Dedicated Research Network (DMZ) with 100Gb/s potential

Switch SUPERNAP and Intel Partner with UNLV to Boost Scientific Research and Economic Development

Intel's "Cherry Creek" supercomputer brings world-class computing power to UNLV; Switch SUPERNAP to lead high-tech industry partnerships.

NSCEE Computing Challenges

Altair PBS Works

Numerous and complex workloads

- Hundreds of projects worldwide
- Highly compute-intensive research

Massive data needs

- Users must access massive data remotely to do their work

Time-sensitive projects

- Many NSCEE projects have critical governmental and environmental significance, so timely and reliable performance is a key requirement

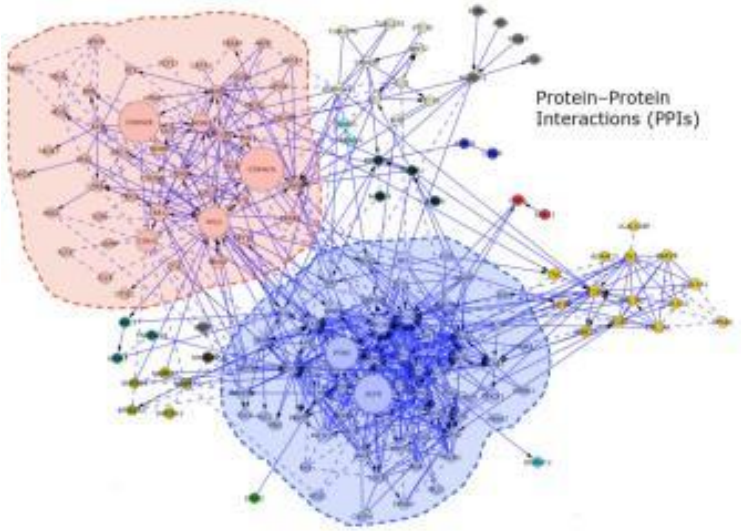
Powerful and reliable infrastructure is mandatory!

Spotlight: Alzheimer's Research

Altair PBS Works

The need for innovation

- Alzheimer's Disease continue to cause tremendous familial, social, and economic burdens to modern society
- Despite substantial progress, existing treatment approaches are limited – so new therapeutic approaches are desperately needed



The NSCEE project

- NSCEE works with researchers to compare genomes of Alzheimer's patient with normal patients
- **Challenge**: Researchers wanted to enhance the statistical power of previous analyses by including more than 10,000 additional patients (and thus genomic data sets) in the study – **meaning a massive leap in computational requirements**

A Complete Streamlined Solution from DNA to Discovery

Altair PBS Works

An NGS sequencer converts a DNA sample to images, which are then converted to digital sequence data.

A raw sequence file of one human genome is approximately 100 gigabytes.

One person's genetic variants are stored in a VCF file (approximately three to five million variants).

Genome files are uploaded to Annai's secure cloud.

Raw files are compressed and archived.

Users access Annai's platform to manage, analyze and share data in real-time.

Annai's integrated end-to-end workflow dramatically reduces time to discovery.

Alzheimer's Project Results

Altair PBS Works

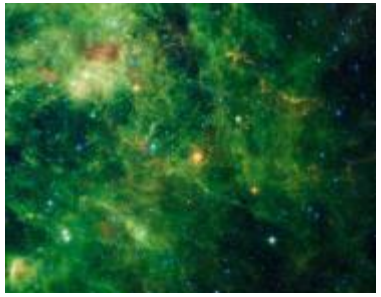
- **Reduced overall runtimes for processing workload**
  - **Decreased processing time by more than 50%** using PBS Professional in conjunction with Rocks and an improved system with shared memory compute node
  - **3 hours instead of the 8+ hours** to process a genome
- **Fast, easy implementation**
- **Powerful, flexible customization capabilities** -- can be easily extended by adding site-specific processing plugins/hooks
- **Improved system manageability and extensibility:**
  - Lightweight solution
  - Very easy to manage
  - Not dependent on any specific operating system

*"PBS Professional has **simplified the administration** of our compute clusters immensely. What used to cause problems with our old workload management software is now **simple.***

*In addition, Altair is an **outstanding supplier and partner** -- their responsiveness and support have made a huge difference and really **differentiate** them from our previous supplier."*

--Ron Young, Research support analyst at NSCEE

Other NSCEE Research that Benefits from HPC…



Quantum Dynamics of Chemical Reactions

- HPC dramatically improves ability to understand how atoms and molecules interact and the chemical reactions that occur in different environments
- Researchers use complex theoretical calculations to explore how molecules behave at absolute zero temperatures and other conditions

Fracking

- Hydraulic fracturing often takes place >1 mile below groundwater supplies
- Mechanical engineers use sophisticated numerical models to more accurately predict prime locations for extraction and assess possible contamination associated with the process

Magnetically Dominated Jets in Gamma-Ray Burst

- Gamma-ray bursts are the most luminous, and violent, explosions in the universe -- they signify the deaths, collisions or swallowing up of stars
- Astrophysicists' computational research advances our understanding of the physical mechanisms behind GRBs and other high-energy astrophysical phenomena

HPC Solution: Altair PBS Works

User-Focused Vendor

- Industry leader in user satisfaction
- Easy to work with, from execs to engineers
- Global support with experts in 22 countries

Respected Leader

- Proven for 30 years
- Thousands of clients
- Staff of seasoned experts and thought leaders

HPC Expertise

- Only vendor to create – and also use – both HPC middleware and applications
- Reliable products engineered by HPC experts who understand user needs

Strong Partnerships

- High-level relationships ensure clients get industry-leading quality
- Close collaborations for seamless, well-documented integrations

"Altair is an outstanding supplier and partner -- their responsiveness and support have made a huge difference."

Acknowledgements

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Fracking:

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Questions?

Thank you for your attention!

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