OAK RIDGE National Laboratory

Introduction to the Oak Ridge Leadership Computing Facility (OLCF)

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ORNL is managed by UT-Battelle, LLC for the US Department of Energy

U.S. DEPARTMENT OF ENERGY

What is a Leadership Computing Facility (LCF)?

- LCF centers partner with users to enable science and engineering breakthroughs
- **Mission:** Deploy and operate the computational and data resources required for such breakthroughs
- LCF centers provide resources to investigate otherwise inaccessible systems at every scale
  - Galaxy Formation and Supernovae to Automobiles and Nanomaterials

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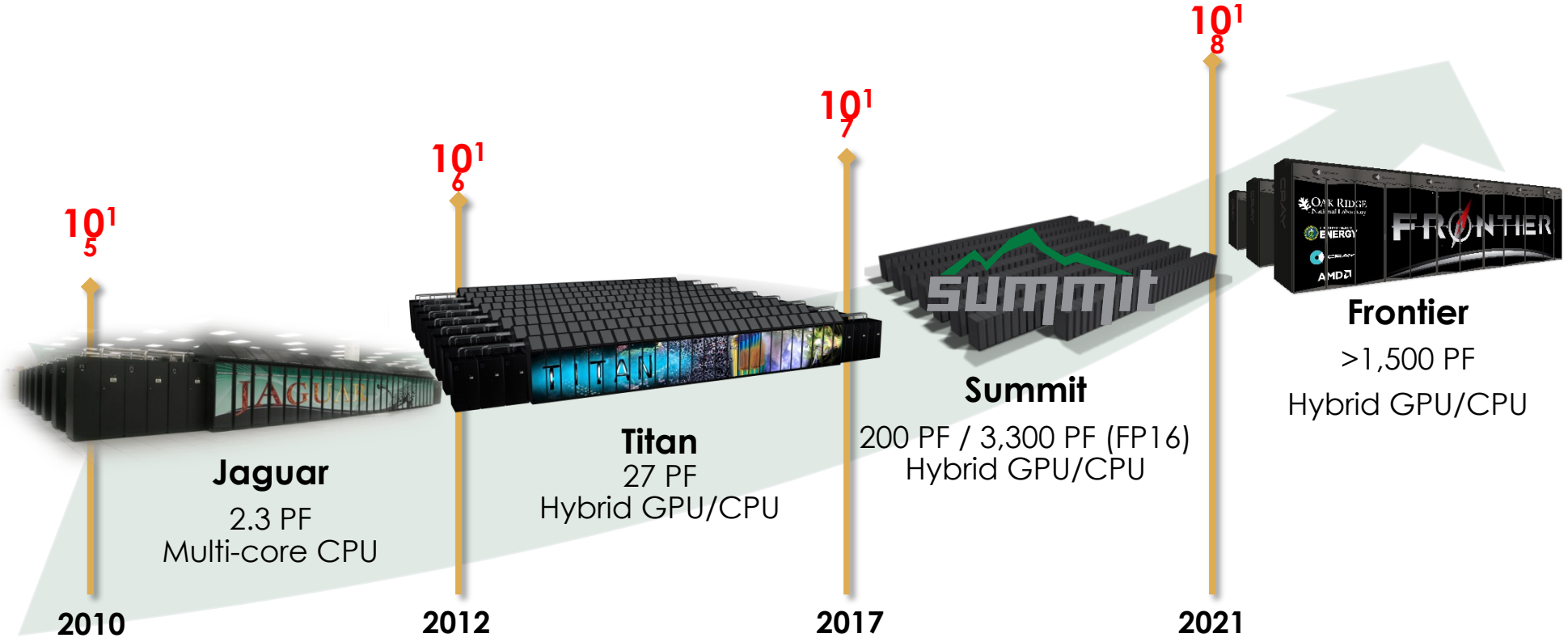
Oak Ridge Leadership Computing Facility (OLCF)

- One of two Department of Energy LCF's
- Based in Oak Ridge, TN at the Oak Ridge National Laboratory (ORNL)
- Department of Energy-funded research
  - Neutron Science, High-Performance Computing, Advanced Materials, Biology and Environmental Science, Nuclear Science and Engineering, Isotopes, and National Security
- Largest, most modern center for unclassified computing in the US

https://www.ornl.gov/sites/default/files/styles/basic_page_hero/public/2008-P01679.jpg

ORNL has had a Top 10 supercomputer in every year since the Leadership Computing Facility was founded in 2005.



#1 World's Fastest Computer in 2009

#1 World's Fastest Computer in 2012

#1 World's Fastest Computer in 2018

Nation's 1st Exascale System

Frontier Fun Facts

- 1 Exaflop => 10^{18} Calculations per Second
  - Frontier can do in 1 second what would take over 4 years if everyone on Earth did 1 calculation per second
- Theoretical peak of 2 Exaflop
  - Compute similar to 194,544 PS5s
- Achieved peak of 1.194 Exaflop
  - First exascale system on Top500
- System consists of 9,408 nodes
  - 9,408 CPUs and 75,264 logical GPUs

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Frontier Fun Facts

- 74 cabinets weighing 8,000 pounds each
  - Total weight similar to a Boeing 747
- 90 miles of cables
  - Denver, CO to Wyoming Border
- 6,000 gallons of water moved per minute
  - Pumps can fill an Olympic pool in 30 minutes
- 700 PB of storage
  - 25 Mt. Everests of DVDs

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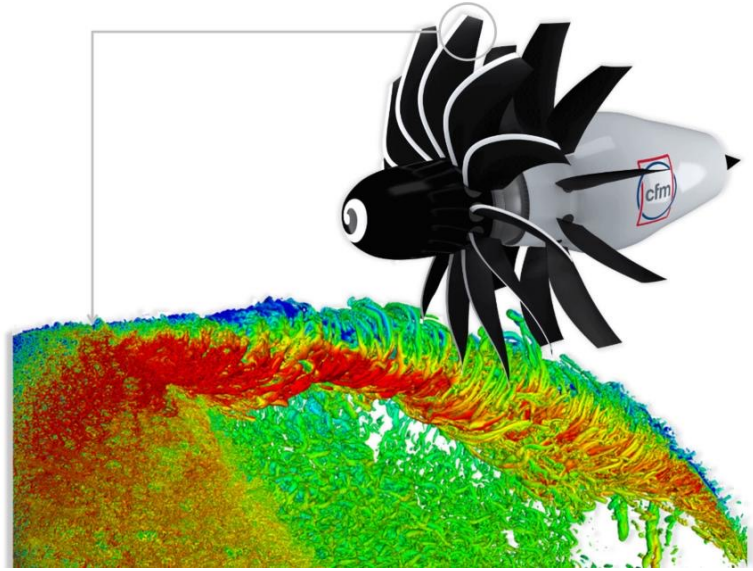
Example Use Case

- GE Aerospace is designing next-gen commercial aircraft engines
- Flight scale evaluation made possible by Frontier
- Software designed to model engine performance and noise levels
- Resulting runs simulated air movement for a full-scale open fan engine design with incredible detail



Credit: CFM, GE Research
https://www.ornl.gov/sites/default/files/styles/main_image_style/public/2023-08/GEAerospaceEngine.jpg

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Questions?

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