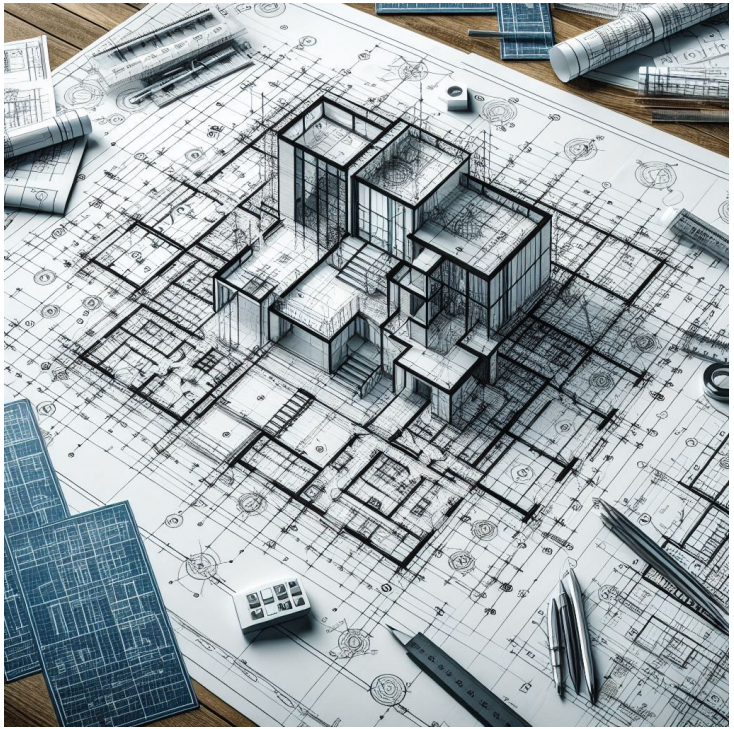

HACKHPC.ORG
ADMI 2024
Code-a-thon
TACC
TEXAS ADVANCED COMPUTING CENTER
omnibond
ORANGEFS • CLOUDYCLUSTER
SGX3
Extend. Expand. Exemplify.

THE PLAN

- Introductions
- What are we doing here?
- What is Software Engineering
- Software Engineering vs Science Gateways vs High Performance Computing (HPC)
- Technology we're going to be using
- Welcome to EUREKA!



BUT FIRST!

It's time to Jam.

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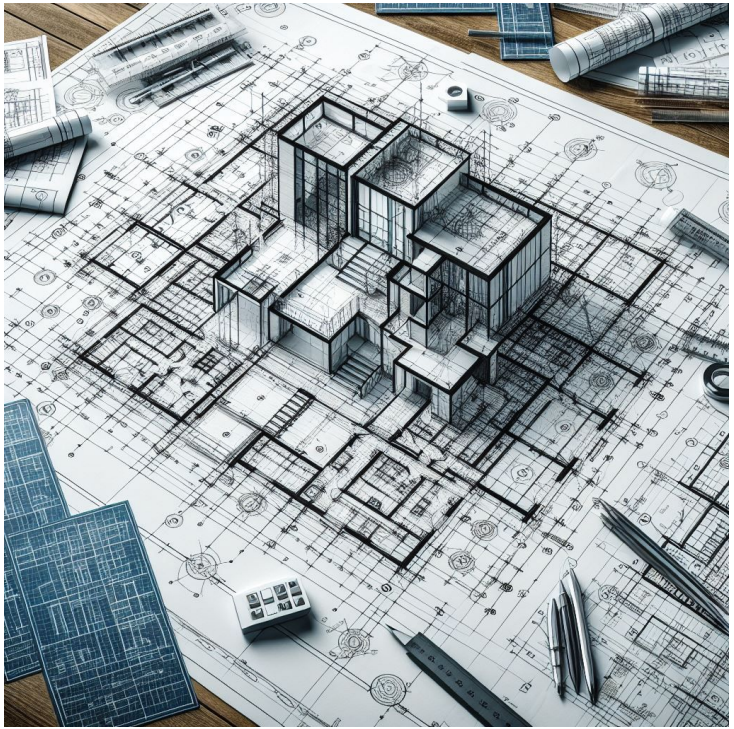

WHAT ARE WE DOING HERE?

Hackathons: A Brief Overview

Hackathons are **intensive**, **time-bound** events where teams of participants **come together to collaboratively work on solving real-world problems** or **creating innovative software projects.**

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THE CODE-A-THON!

Code-a-thons have a more narrow **focus** primarily on **iterative coding**, **algorithmic development, over-the-shoulder peer coding**

THE CODE-A-THON!

Participants are going to **engage** in **coding challenges or competitions**, where each **challenge builds on the previous challenge**. These challenges are algorithmic or data structure-related and **each challenge combines together to become a major project**.

SOFTWARE ENGINEERING?

- What is Software Engineering
  - Requirements Gathering
  - Software Architecture
  - Coding and Programming
  - Software Testing and Debugging
  - Software Maintenance
  - Software Project Management
  - Software Quality
  - Software Metrics
  - Software Development Models & Architecture

SOFTWARE ENGINEERING vs SCIENCE GATEWAYS vs HIGH PERFORMANCE COMPUTING

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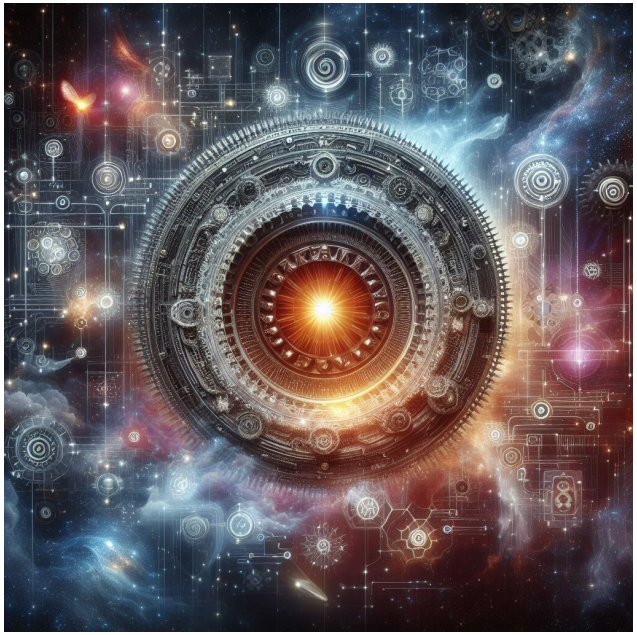
SOFTWARE ENGINEERING AND SCIENCE GATEWAYS

- **What is a Science Gateway?**

  Science gateways are **user-friendly interfaces** that allow **researchers and educators** to **access advanced resources**, **tools**, **applications**, and **data collections** specific to a science or engineering



SCIENCE GATEWAYS AND HIGH PERFORMANCE COMPUTING

- **So what does this have to do with High Performance Computing?**

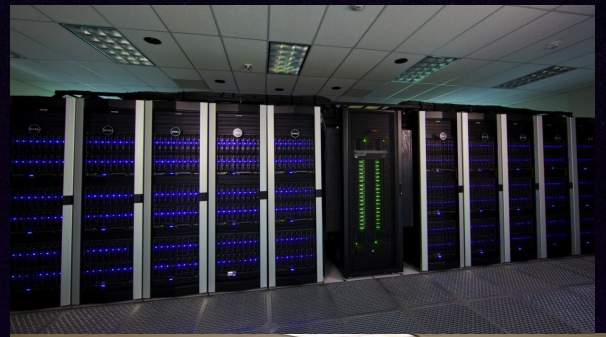
  Science Gateways are connected to High Performance Computing (HPC), they provide a **user-friendly interface to HPC resources**

"COMPUTING FOR THE ENDLESS FRONTIER"

Dan Stanzione
Executive Director, Texas Advanced Computing Center
Associate Vice President for Research, The University of Texas at Austin

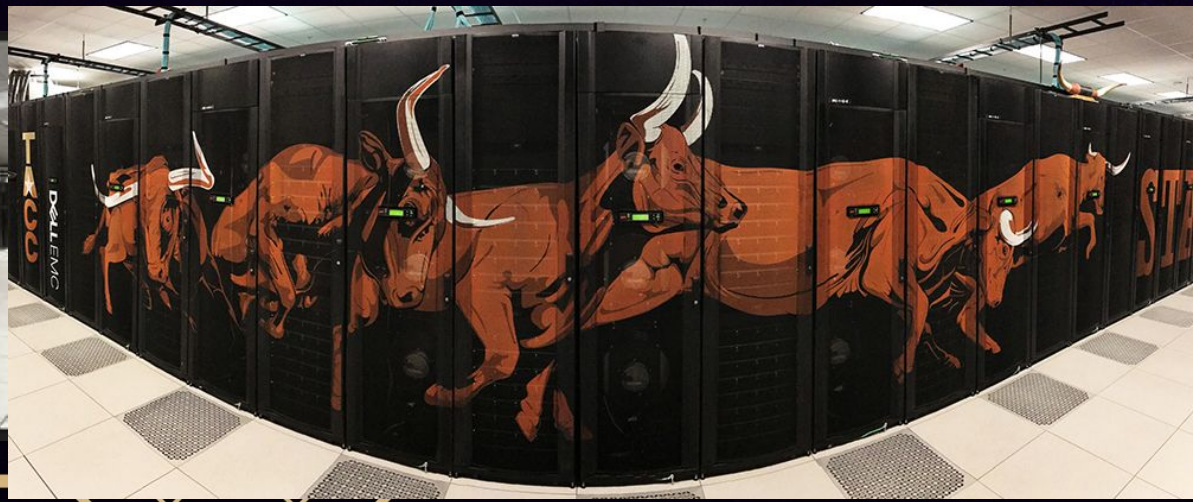
RAPID GROWTH FROM THEN TO NOW…

- 2003 – First Terascale Linux cluster for open science (#26)
- 2004 – NSF funding to join the Teragrid
- 2006 – UT System Partnership to provide Lonestar-3 (#12)
- **2007 - $59M NSF award – largest in UT history – to deploy Ranger, the world's largest open system (#4)**
- 2008 – funding for new Vis software and launch of revamped visualization lab.
- 2009 - $50M iPlant Collaborative award (largest NSF bioinformatics award) moves a major component to TACC, life sciences group launched.
  - In 2009, we reached, 65 employees.



NOW, A WORLD LEADER IN CYBERINFRASTRUCTURE

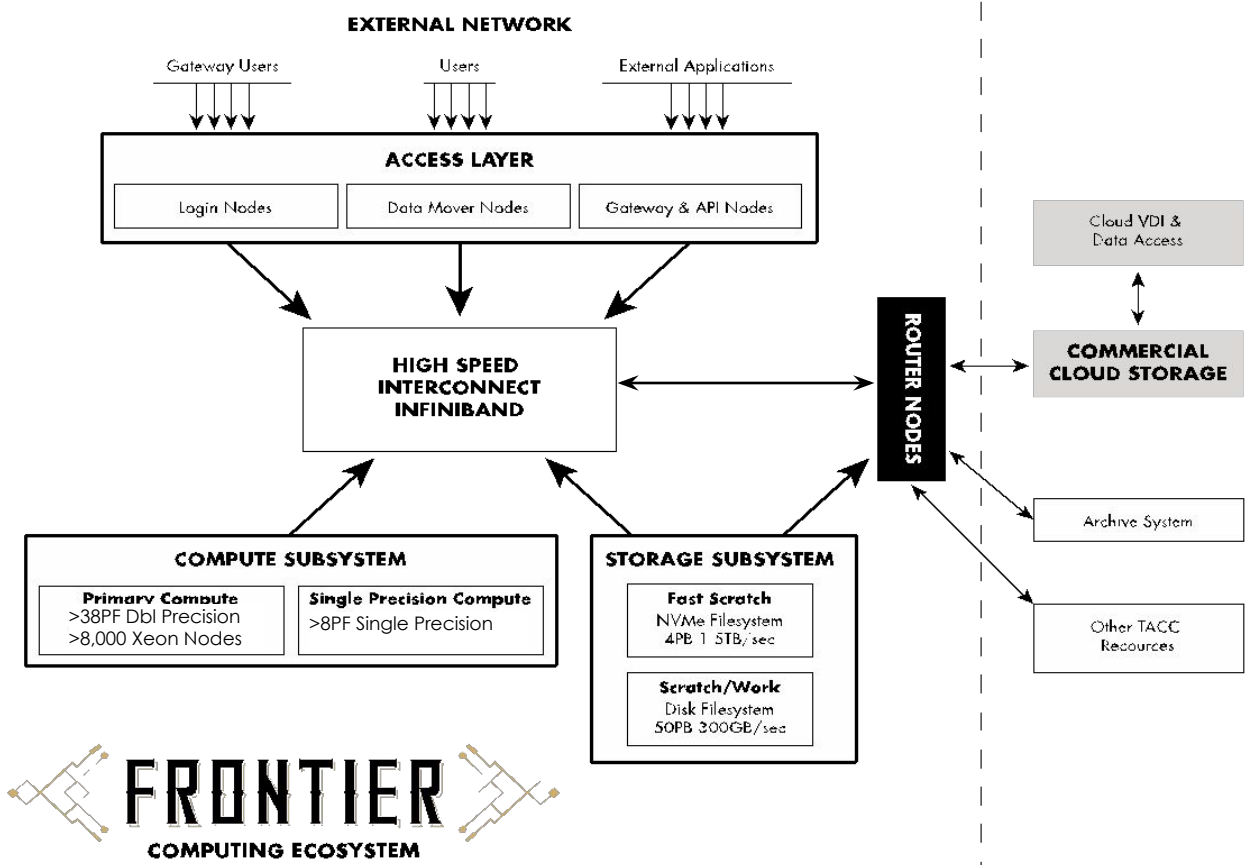
- 2010, TACC becomes a core partner (1 of 4) in XSEDE, the TeraGrid Replacement
- 2012, Stampede replaces Ranger with new $51.5M NSF Award
- 2013, iPlant is renewed, expanded to $100M
- 2015, Wrangler, first data intensive supercomputer is deployed.
- 2015, Chameleon cloud is launched
- 2015, DesignSafe, the cyberinfrastructure for natural hazard engineering, is launched.
- 2016 Stampede-2 awarded the largest academic system in the United States, 2017-2021. (56th fastest super computer in the world)



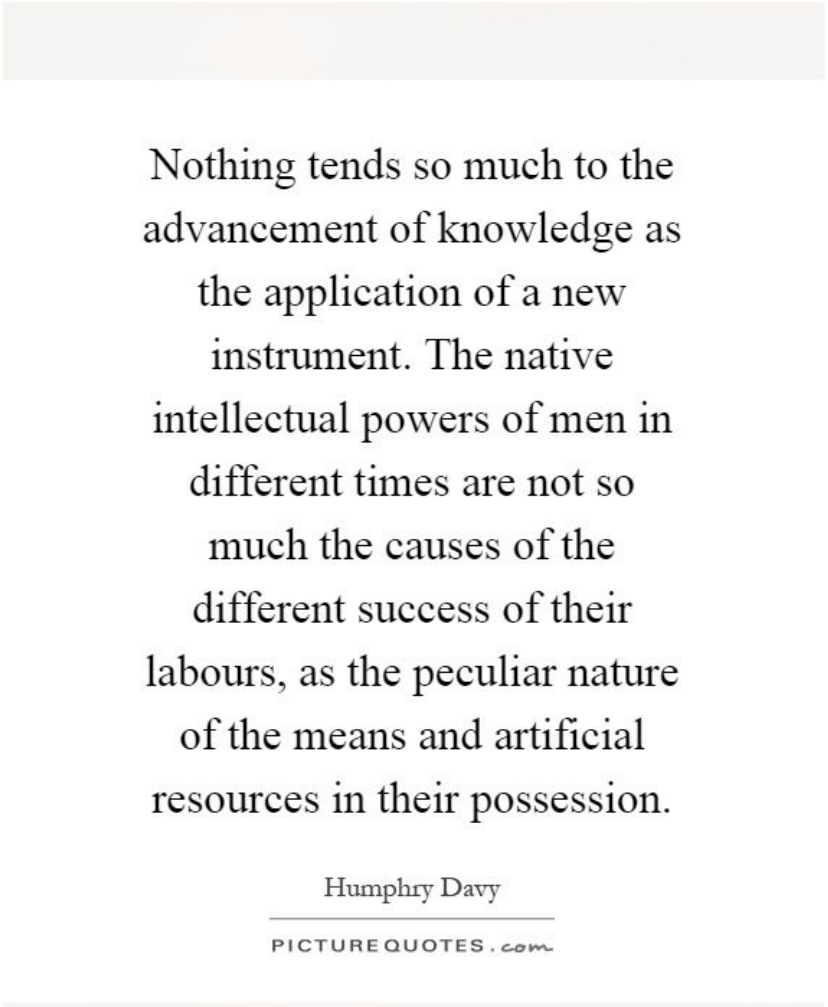
FRONTERA SYSTEM --- HARDWARE

- 21st Fastest Supercomputer in the world
  - #1 for Open Science
- Primary compute system: DellEMC and Intel
  - 35-40 PetaFlops Peak Performance (Next Generation Xeon processors)
- Interconnect: Mellanox HDR and HDR-100 links.
  - Fat Tree topology, 200Gb/s links between switches.
- Storage: DataDirect Networks
  - 50+ PB disk, 3PB of Flash, 1.5TB/sec peak I/O rate.
- Single Precision Compute Subsystem: Nvidia
- Front end for data movers, workflow, API

SYSTEM OVERVIEW

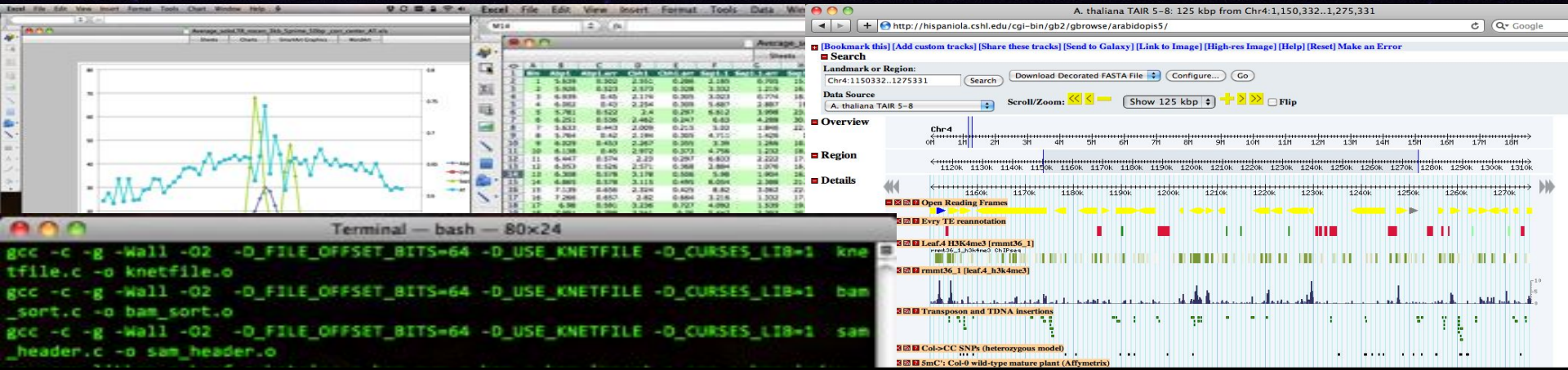


- **Humphry Davy, Inventor of Electrochemistry, 1812**
- (Pretty sure he was talking about our machine).

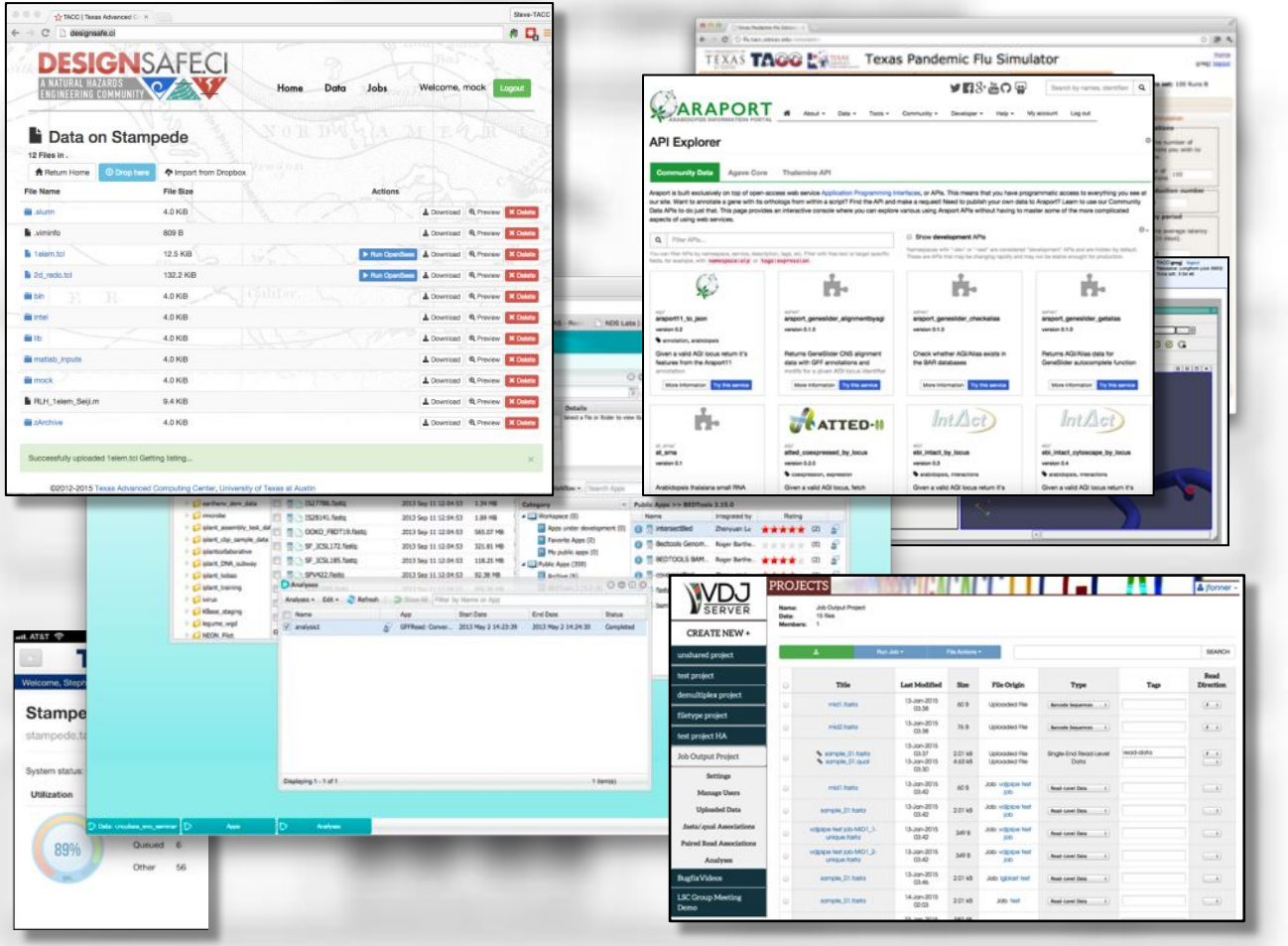


HOW DO WE HELP RESEARCHERS WITH SUCH DIVERSE NEEDS AND BACKGROUNDS?

BUILD A MASSIVE STORAGE CLOUD NEXT TO INNOVATIVE, POWERFUL, USABLE COMPUTERS AT THE END OF FAST INTERNET PIPES



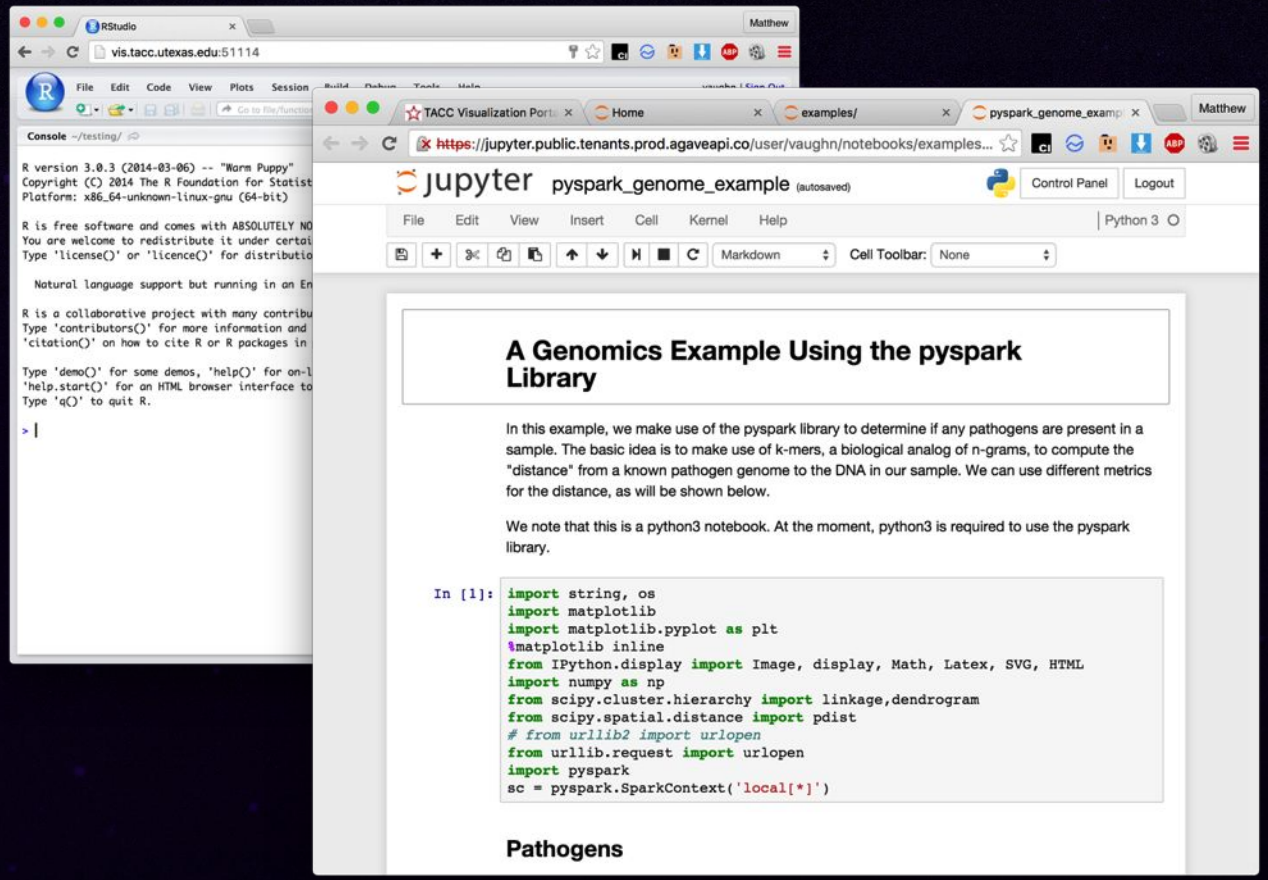
MANY DOMAIN SCIENTISTS ARE NOT EXPERTS AT COMPUTING TECHNOLOGY.
CREATE PURPOSE-BUILT, HIGHLY INTUITIVE INTERFACES



Point-and-click interfaces

- Data management, sharing, and analysis
- Publishing reproducible analysis workflows
- Discovery of new or updated tools and data
- Interactive visualization of results

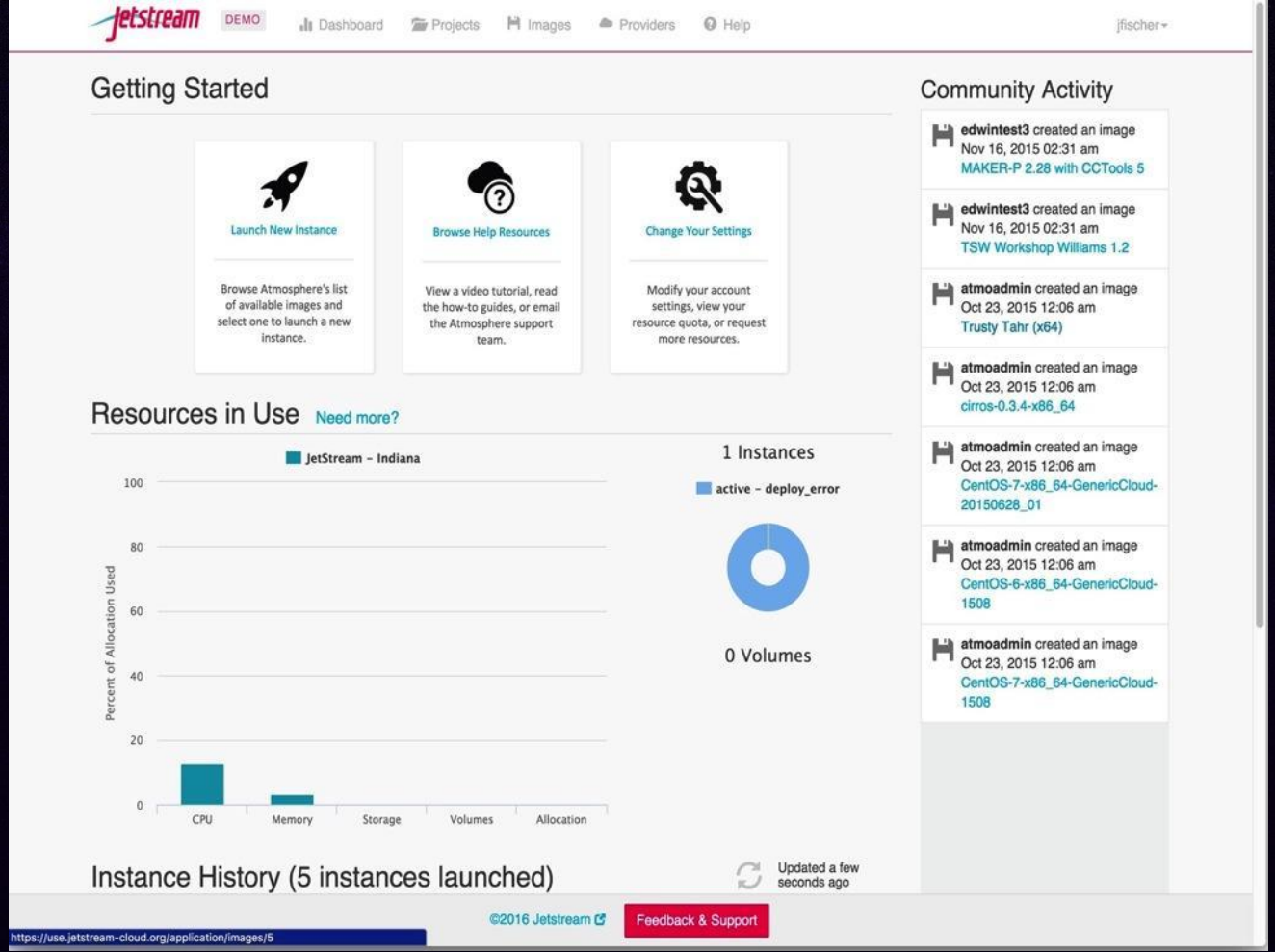
Backed by world-class computing and data capacity



Hosted SaaS

- JupyterHub notebooks
- Rstudio
- Web-based VNC

Also, backed by world-class computing and data capacity



Easy to use Cloud Computing

- Atmosphere (Cyverse)
- Jetstream (IU,UA,TACC)
- Chameleon (UC,TACC)

Cloud consoles are aimed at sysadmins and unintutive.

We're changing that with improved UX and support

- APIs are still available
- No cost to end user

GIVE EXPERTS ACCESS TO EVERY SINGLE ONE OF YOUR BUILDING BLOCKS.
WEB SERVICE APIs EVERYWHERE. AUGMENT WITH PROFESSIONAL TOOLING.

TECHNOLOGY

- Cloud Computing
- Python
- JSON
- Docker
- Redis
- AND…

EUREKA!

POLLS