



Secure Web-Based Access for Productive Supercomputing: the DOD HPC Portal



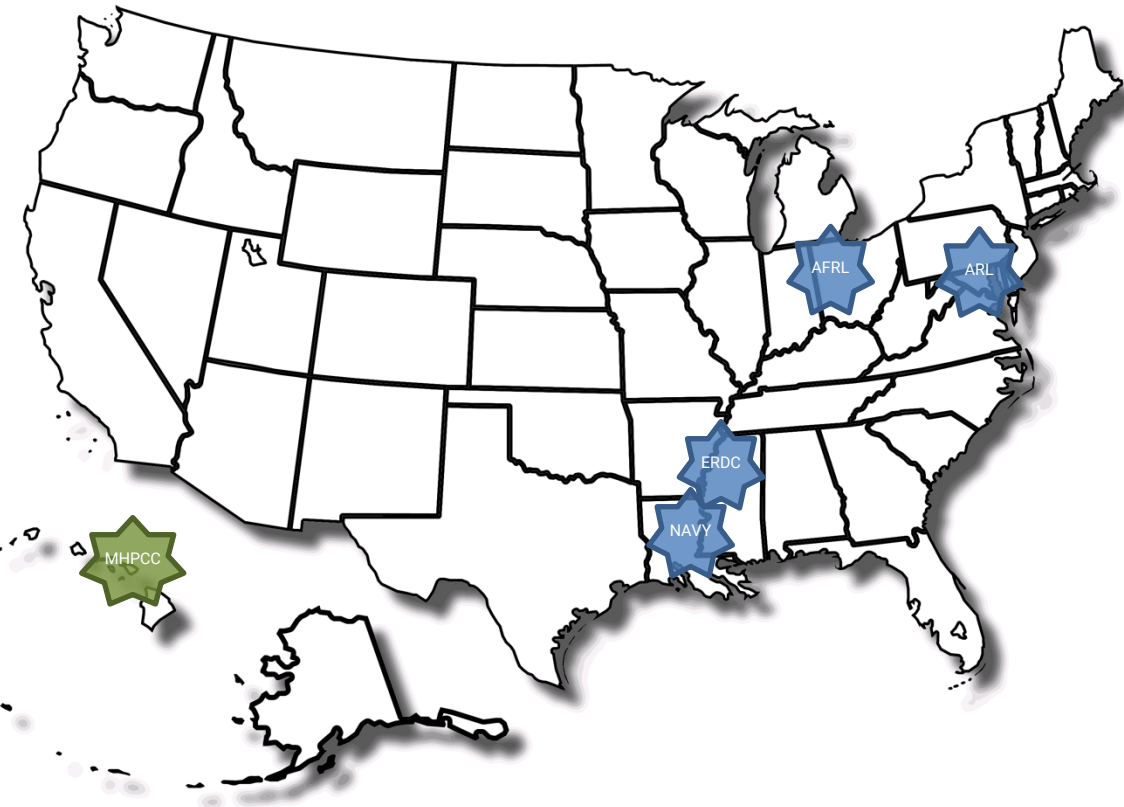
Mr. Randy Goebbert, Pacific Defense Solutions LLC
24 October 2017

DOD Supercomputing Resource Centers



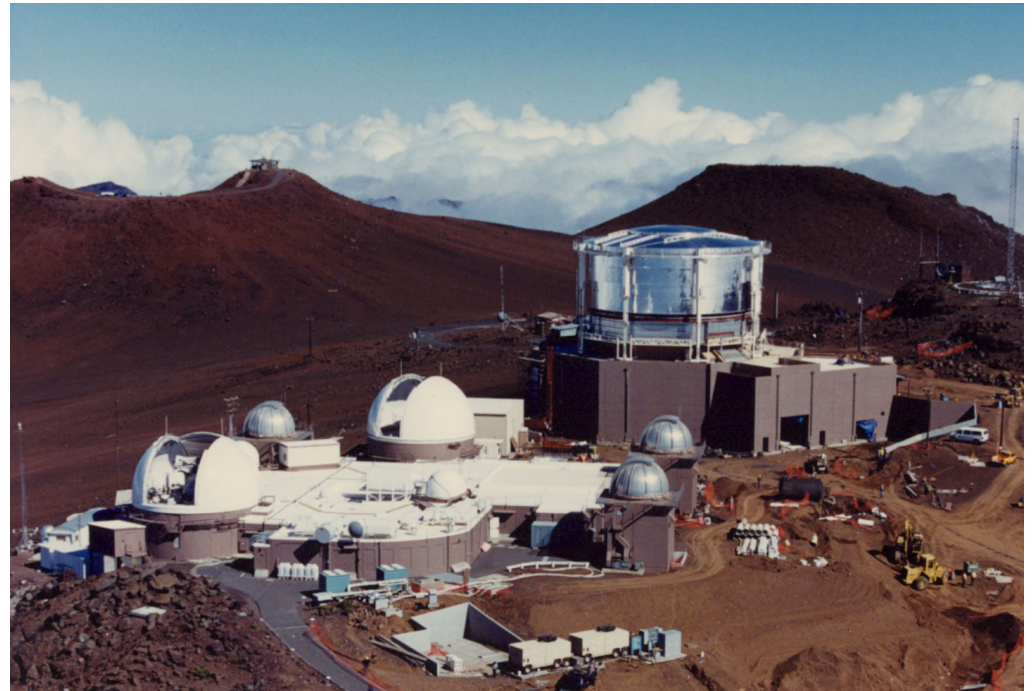
DoD Supercomputing Resource Centers (DSRCs)

AFRL DSRC	ARL DSRC	ERDC DSRC	Navy DSRC	MHPCC DSRC
Air Force Research Laboratory WPAFB, OH	Army Research Laboratory Aberdeen Proving Ground, MD	Army Engineer Research and Development Center Vicksburg, MS	Navy DoD Supercomputing Resource Center Stennis Space Center, MS	Maui High Performance Computing Center Kihei, Maui, HI



Associated w/ "Air Force Maui Optical Site"

Atop Haleakala, Maui, Hawaii



"Space Situational Awareness"

Learn More: <https://centers.hpc.mil/>



[HPC Help Desk](#)

[Feedback](#)

- Home
- About
- Systems
- For Users
- News & Publications
- User Dashboard

High Performance Computing Centers @ DoD HPCMP





Maui Acquires IBM Cluster

POWER8 cluster provides 458,752 GPU cores. [Read More >](#)

Upcoming Maintenance			30 Days ▾
Date	System	Details	
2017 Sep 30 22:00 - Oct 03 02:53 CT (Completed)	NAVY - Armstrong	Software Maintenance	
2017 Oct 04 17:00 ET - TBD (In Progress)	AFRL - AFRLHPCPortal	System Maintenance	
2017 Oct 05 12:00 - Oct 11 17:00 ET	ARL - Excalibur	System Maintenance	
2017 Oct 16 08:00 - Oct 20 08:00 ET	AFRL - Thunder	System Maintenance	
2017 Oct 23 08:00 - Oct 30 08:00 ET	AFRL - Lightning	System Maintenance	
2017 Oct 25 07:30 - Oct 26 00:00 HI	MHPCC - Hokulea	System Maintenance	

Get an Account

Technical Documents

HPC Systems

For Users

DOD HPC Portal Goals

Provide Secure, Web-based Access to DOD Supercomputing

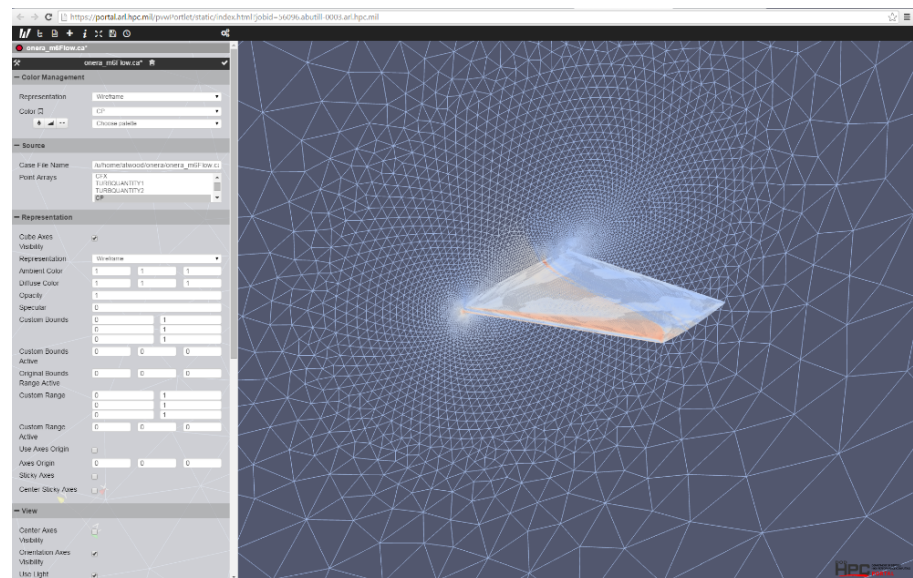
- ✓ Easy & Modern: Intuitive, Comprehensive HPC Workflow (Jobs, Files, Collaboration...)
- ✓ Enable Non-Traditional Users & Users with Constrained Desktops

Encourage 3rd Party Developers

- ✓ Provide API to Abstract the HPC Workflow

Benefits for Users

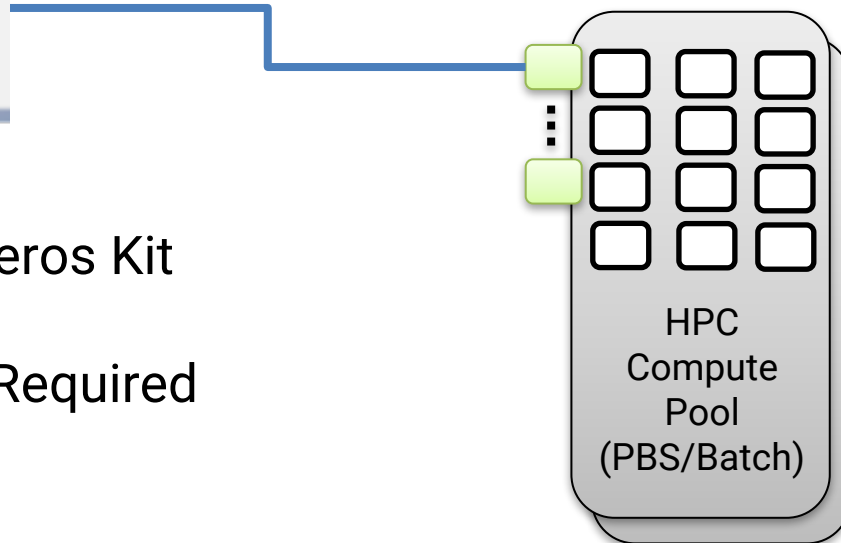
- “Zero Footprint” Browser Access
 - ✗ No Client Installs or Other Dependencies
- Software as a Service
 - ✓ Instant Updates to Users
 - ✓ Improved Security
 - ✓ BYOD & Access from Any Network



Computational Fluid Dynamics App in HPC Portal

Make it Easy, Secure, & Powerful: Demolish Entry and Access Barriers to DOD HPC Services

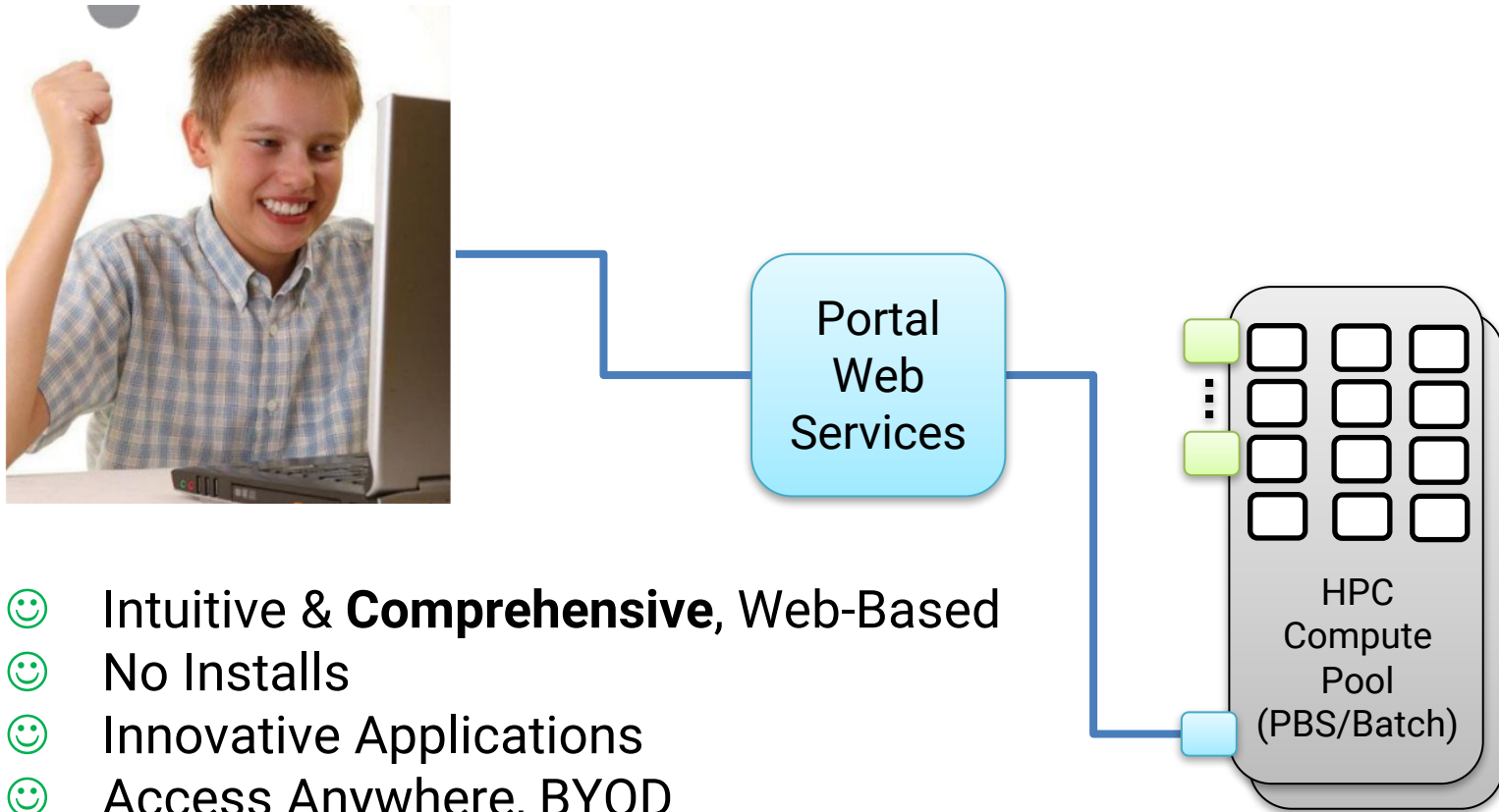
Before DOD HPC Portal: Old School Supercomputing



- ☹ Client Required Kerberos Kit
- ☹ Command Line Only
- ☹ Unix/HPC Expertise Required

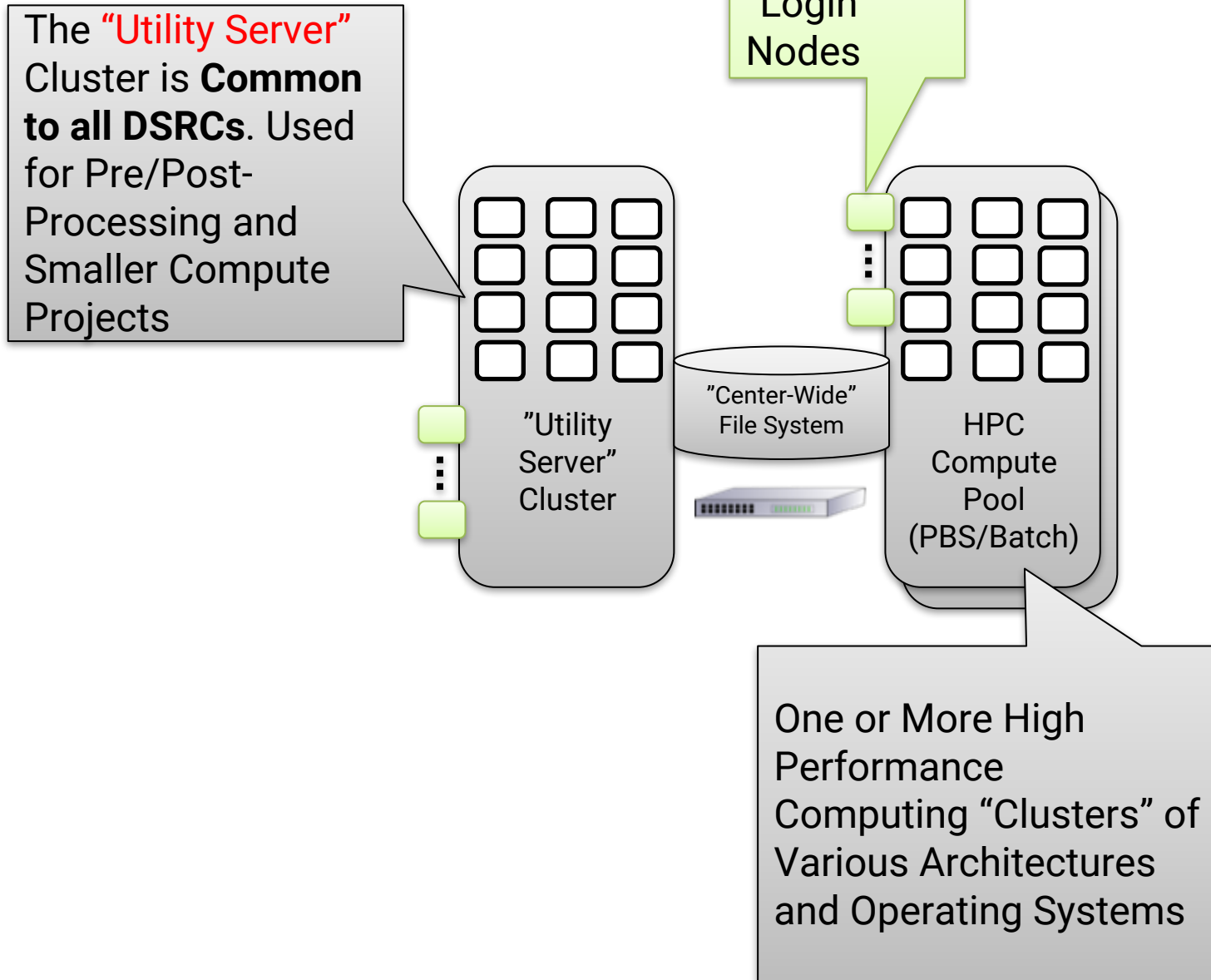
Increasingly, network enclave security mechanisms blocked the traditional Kerberos mechanism of authenticating desktop clients to server supercomputers.

After DOD HPC Portal: Easy & Modern

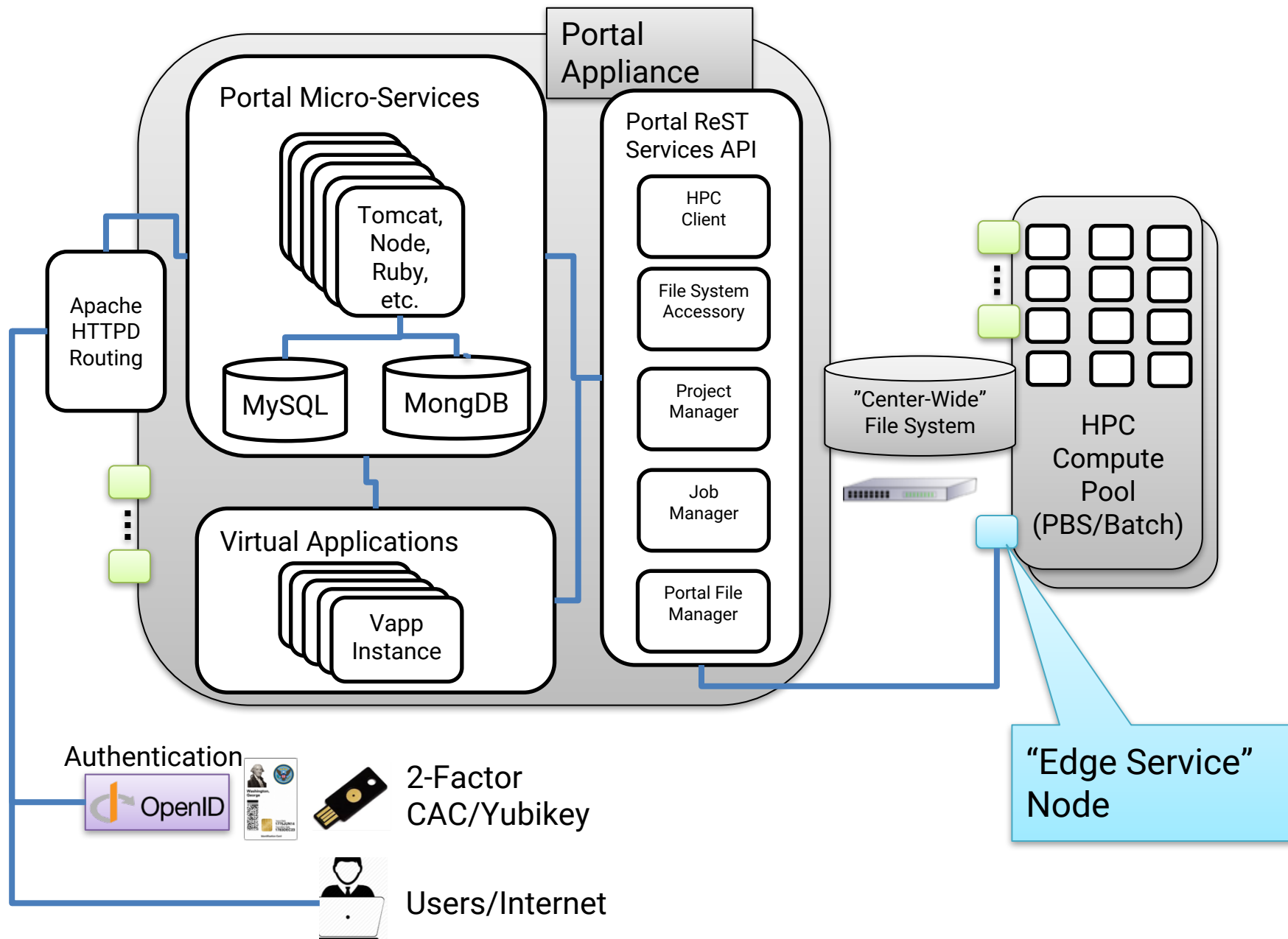


- 😊 Intuitive & **Comprehensive**, Web-Based
- 😊 No Installs
- 😊 Innovative Applications
- 😊 Access Anywhere, BYOD

What's at a DSRC?



We Repurposed the Utility Server

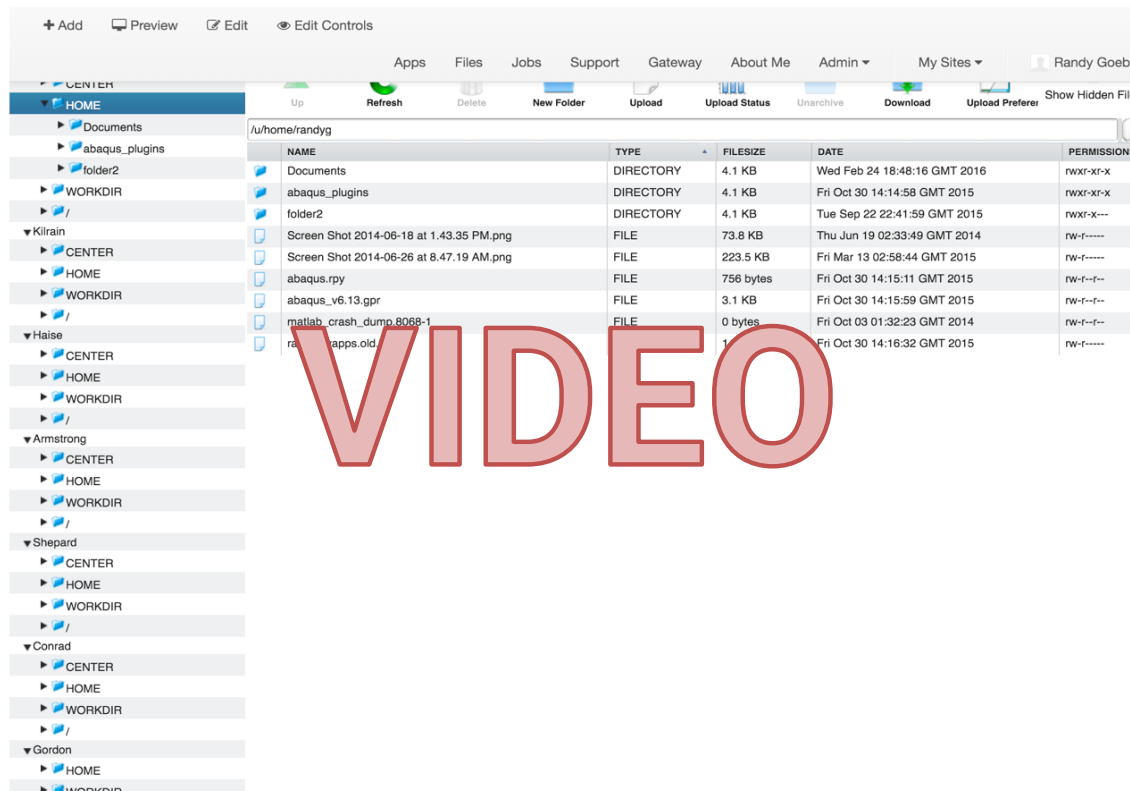


And Provided a “Comprehensive” Workflow

- All DOD HPC Users Automatically Have Access to:
 - File Management
 - Upload/Download; Full-Featured File Manager
 - Pre/Post- Processing & Visualization
 - ALL X-Based Applications on Utility Server & HPCs
 - Command Line Access (Web Shell)
 - User Account Information
 - Help & Forums
 - Specific “Web-Based” Applications
 - Job Creation, Submission, Monitoring, Termination, Visualization

File Manager

- Contemporary & Full Featured: Approaches Native OS Capability
 - Upload/Download
 - Edit/Cut/Paste, Drag & Drop Between File Systems
 - Eliminates Desktop FTP Clients



File Manager: Video



Secure | <https://portal.erdc.hpc.mil/portal/group/home/apps>

- Apps
- Files
- Jobs
- Support
- Gateway
- About Me
- Admin
- My Sites
- Randy Goebbert



Welcome To ERDC's HPC Portal

The Portal team has released an application developer guide to help teams build web applications that interact with HPCMP's Supercomputing systems. See Support/Forum for more details.

The new Virtual-Apps 1.2 interface features performance improvements! Please visit "Virtual Applications", below

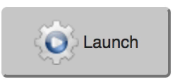
Single Sign-On is here! Access Topaz Interactive Login Nodes via "Web Shell" links, below.

A full-featured **File Manager** supporting both the Utility Server and HPCs (Garnet/Topaz) is available via the "Files" link, above. Upload/download, create, edit, and delete files, control file permissions, and transfer files directly between systems!



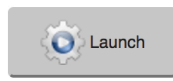
Web Shell on Topaz HPC

Quick Access to Command Line on Topaz Login Nodes



Web Shell on Utility Server

Quick Access to Command Line on ERDC Utility Server



WebSENTRI

Provide a web based RF simulation toolkit.



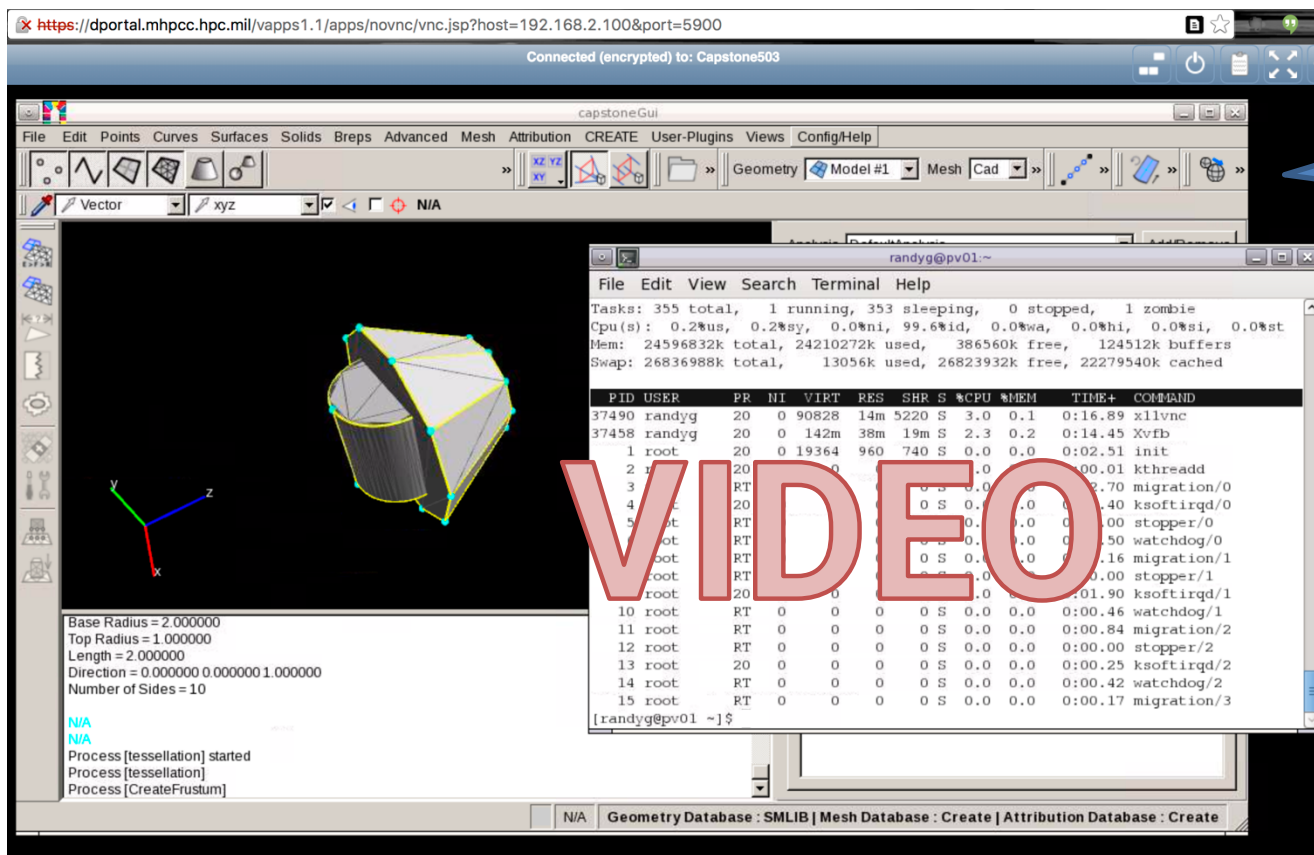
Paraview Web

3D Visualization

<https://portal.erdc.hpc.mil/portal-framework-filemanager-vaadin/>

Portal Delivers “Virtual” Applications

Remote Display of All X-Based Applications:



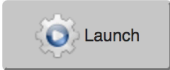
“Capstone”
Hosted as
Virtual
Application

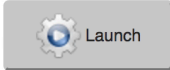
With Single Sign On, Now Possible to Start X-Based Virtual Applications on HPC Side


Virtual Applications: Video

Secure <https://portal.erd.hpc.mil/portal/group/home/apps>

Apps Files Jobs Support Gateway About Me Admin ▾ My Sites ▾ Randy Goebbert ▾

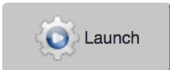
 Launch


 Launch



Virtual Apps Usage


Access usage analysis data and business intelligence. Only for select members.


 Launch



Virtual Applications

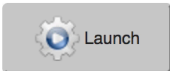
Access desktop applications remotely with a modern HTML5 browser. Firefox, Chrome, or Safari is required. Internet Explorer is supported using Java.


 Launch



Distributed MATLAB

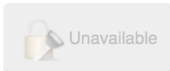
The MATLAB HPC application provides you with the capability to upload custom MATLAB software and data resources, run the software in a naturally parallel HPC environment, and have the results available for download through the web portal.


 Launch



Kestrel


CREATE-AV Kestrel simulates fixed-wing aircraft fluid and structural dynamics. Start here to prepare, modify, visualize, and submit jobs.

 Unavailable



Developers

Portal Framework SDK Developers.

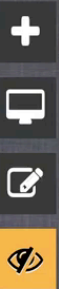


CreateGV

HPCMP CREATE-TM-GV consists of physics-based, High Performance Computer (HPC) tools to enhance ground vehicle concept development, inform

“Native” Web Applications

- Web Application Example: “Distributed Matlab”
 - Matlab Code Compiled on Utility Server
 - Runs “Naturally Parallel” Jobs on HPC
 - Create, Submit, Monitor, Visualize Results



Web Shell on Topaz HPC

Quick Access to Command Line on Topaz Login Nodes



Web Shell on Utility Server

Quick Access to Command Line on ERDC Utility Server



WebSENTri

Provide a web based RF simulation toolkit.



Paraview Web

3D Visualization



JMS ARCADE

The Advanced Research, Collaboration, and Application Development Environment (ARCADE) provides Joint Space Operations Center (JSpOC) Mission System (JMS) developers a sandbox environment to test and benchmark algorithms and services.

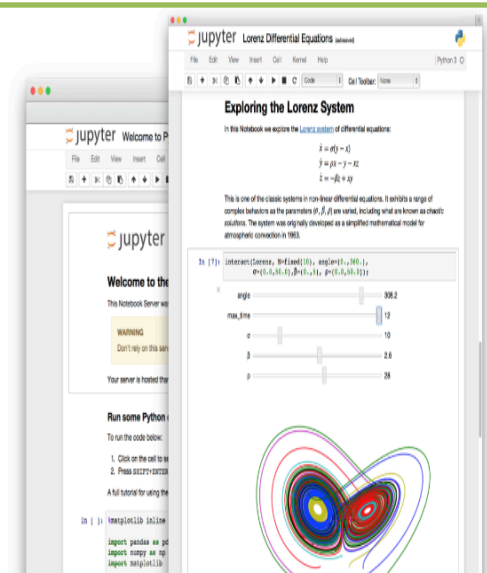


X-Terminal on Utility Server

Run X11 Based Apps on Utility Server

Innovative Workflows: Jupyter Notebooks

- Data Analytics & Reproducible Workflows for DOD R&D
- **Multi-Node Workbooks Running on HPC Compute Nodes**
- Scientific insight => interactive, iterative exploration and analysis
- Jupyter Notebook Bridges Gap from Legacy Batch Process



The Jupyter Notebook

The Jupyter Notebook is a web application that allows you to create and share documents that contain live code, equations, visualizations and explanatory text. Uses include: data cleaning and transformation, numerical simulation, statistical modeling, machine learning and much more.



Language of choice

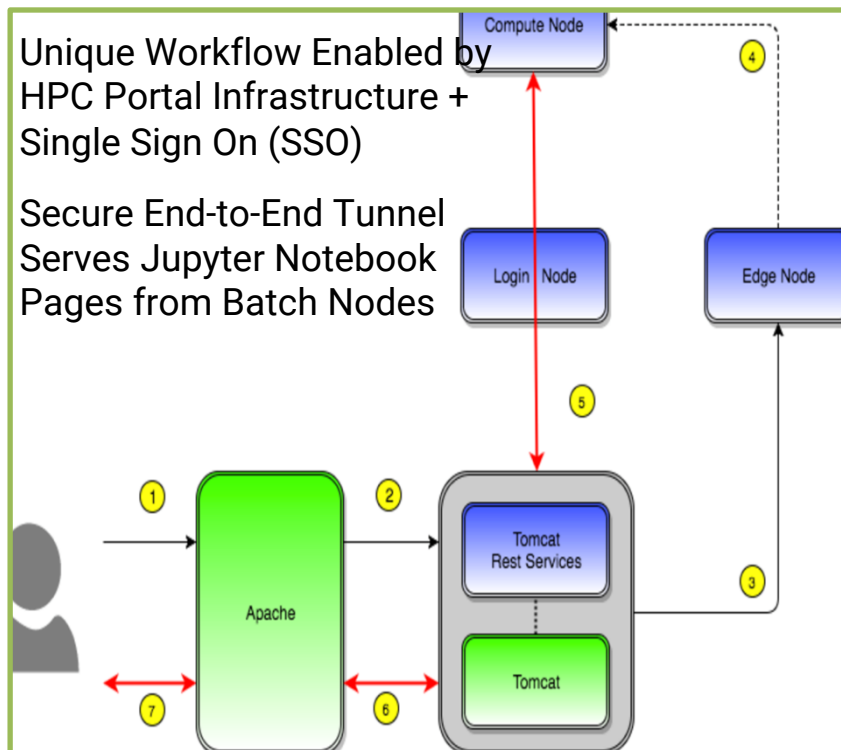
Share notebooks

Interactive widgets

Big data integration

Unique Workflow Enabled by
HPC Portal Infrastructure +
Single Sign On (SSO)

Secure End-to-End Tunnel
Serves Jupyter Notebook
Pages from Batch Nodes



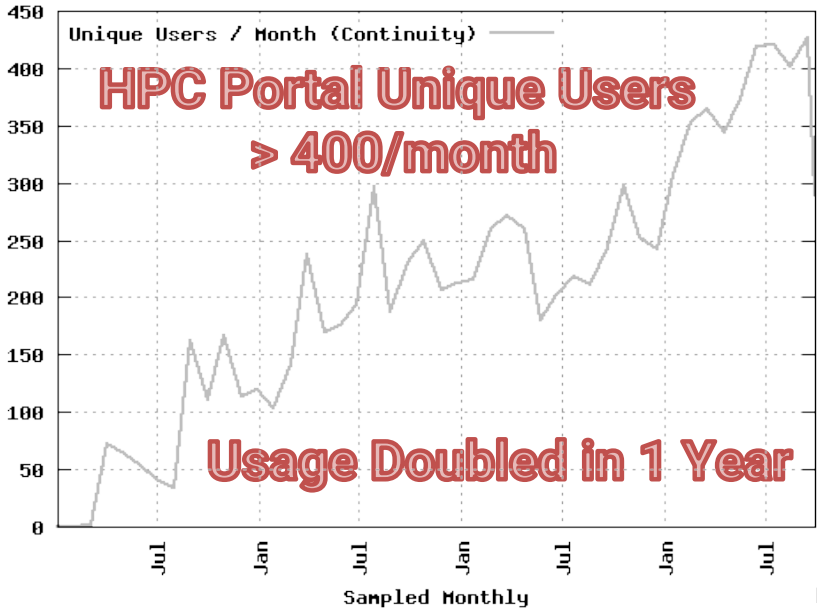
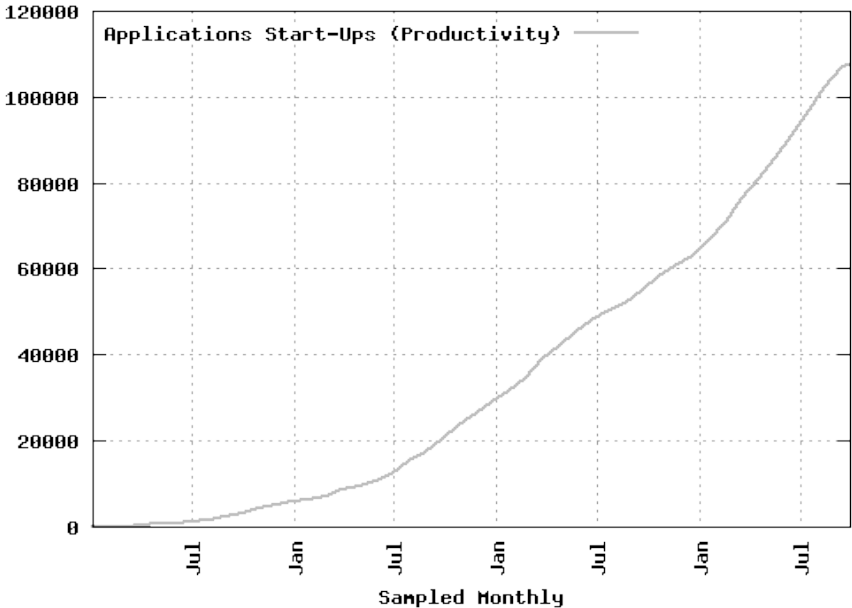
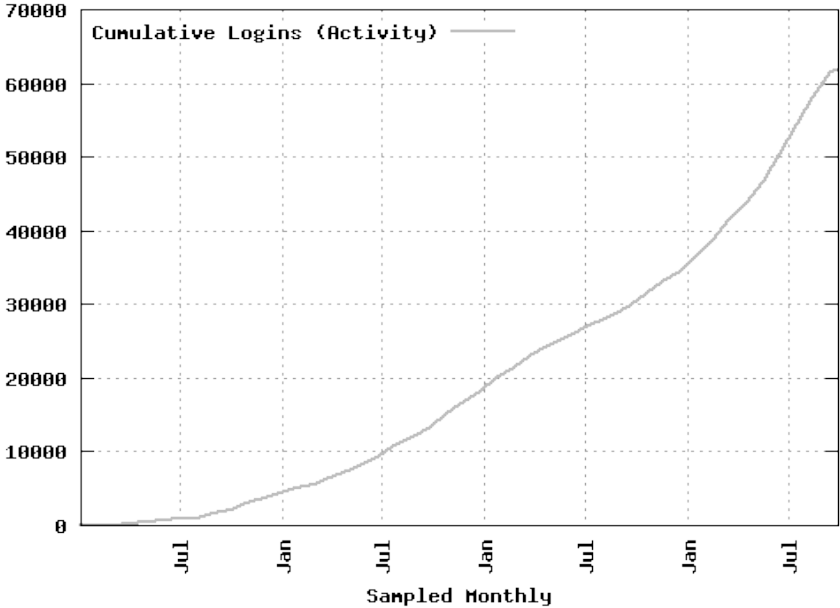
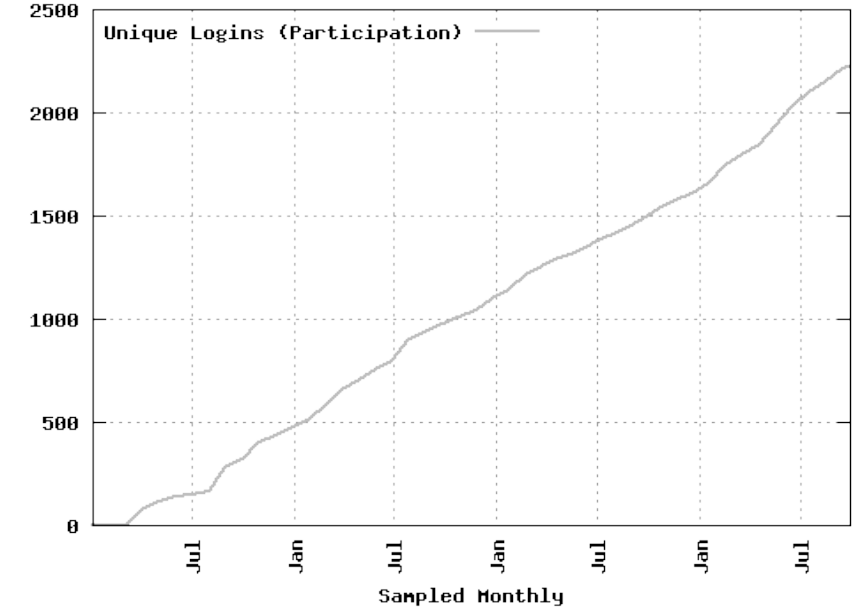
Multiple Groups Now Develop Portal-Based Applications

We Provide Developer Support, Infrastructure & Services:

- **ReSTful Services Application Programming Interface (API)**
 - Abstracts HPC Services
- MHPCC Hosted Development Environment w/HPC Cluster
 - Sandbox for BYOA "Bring Your Own Application"
 - Micro-Services, Technology Agnostic
- Developer's Guide
- Portal Starter Kit: Efficient Single Page Web Apps ("React" Technology)
 - Quickly Stand-Up Javascript Based Client (Browser) Applications

Did We Achieve Our Goals?

HPC Portals - Adoption Trends: 2014-01-05 through 2017-09-30



Lessons Learned & Directions

- Agile Methodologies Allow Team to Be Responsive to Evolving User & Stakeholder Requirements
- Mature DevOps Strategy Enables Team to Support 6 Operational Portals
 - Embedded Security Expertise Essential, Continuous Integration
- Differences in Architectures at DSRCs is driving team to establish a “Beta” Environment on Production Systems
- **Good:** Supply Users w/Service
 - **Better:** Allow Others to Develop Innovative Workflows Around It
- Team is Deprecating Outdated Legacy Technologies (Liferay/Vaadin) consistent with Web “Best Practices”