

Portal Development for High Performance Computing (HPC) at Maui High Performance Computing Center (MHPCC)

Dave Morton

Director, MHPCC DSRC

Directed Energy Directorate

Air Force Research Laboratory

NDIA Physics Based
Modeling Conference
14 November 2011

Overview

- **Goals**
- **Long-term vision**
- **Application delivery**
- **Open frameworks**
- **Single sign-on**
- **CREATE-Kestrel Integration**
- **Matlab**

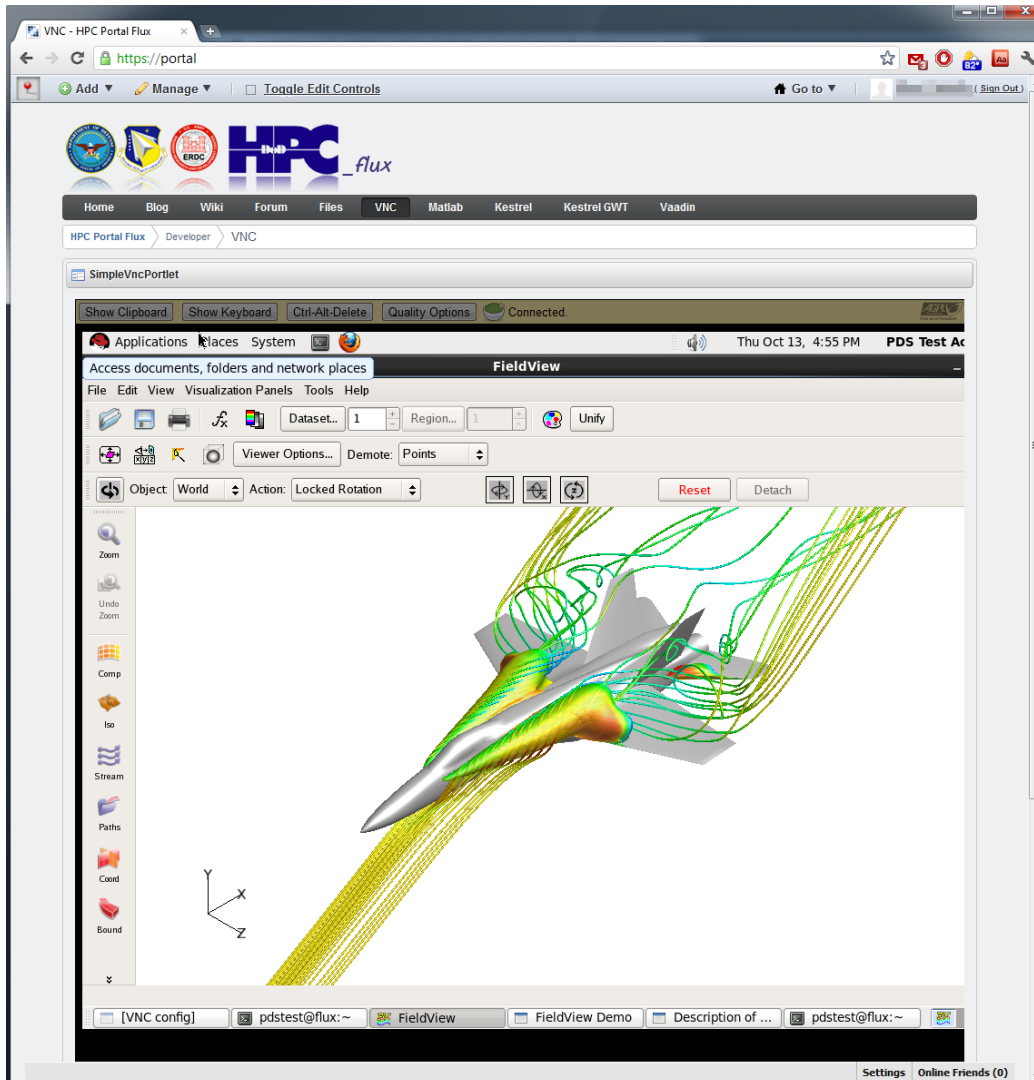
Goals

- **Attract new users by Providing High Performance Computing (HPC) software applications through a “portal environment”**
 - HPC knowledge not required
 - MHPCC new mission focus, key alliances with ARL, ERDC, and CREATE
 - CREATE and Matlab apps are initial standup
- **Provide secure unified access with single sign on**
- **Providing a centralized web-based interface for customers that requires no software installation on user workstations**
- **Work across multiple security enclaves, providing seamless navigation among components and across HPC resources**
- **Secure suite of access controls that secures each users’ data**
- **Search capabilities across the domain**
- **Ability to scale and grow to accommodate new HPC software applications**
- **Ability to customize to address unique user requirements**

Long-Term Vision

- **Long term vision guides near-term development to ensure the portal design is applicable and scalable to other domains in the future**
- **As networks and browsers continue to improve cloud-based application delivery appears well suited to the DoD**
 - may be de facto delivery mechanism in the future
- **Benefits of portal application delivery**
 - No client software required on users machine
 - Eliminates all user configuration and maintenance
 - Seamless collaboration within groups
 - Extreme HPC scalability
 - Delivery is OS and device independent
 - Simplified security model

Application Delivery (Level 0)



- **Quickest standup for legacy apps or COTS**
- **No SW changes**
- **All SW installed at DSRC**
- **Virtualized machine (Windows or Linux) running on a Linux server**
- **App delivered via “zero footprint” browser**
 - HTML5 + JavaScript (AJAX) only
 - No plug-ins or client-side SW required
 - Eliminates user config and maintenance

Application Delivery (Cont.)

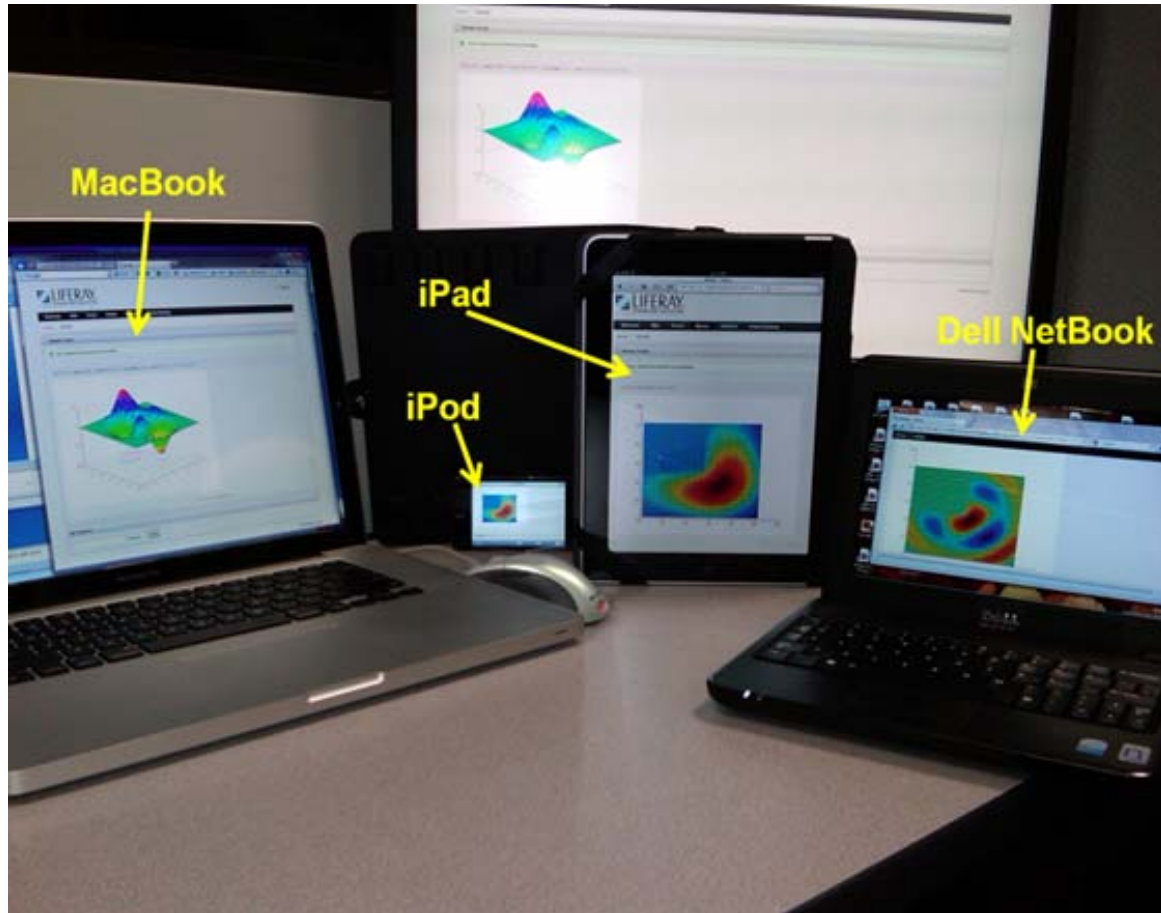
- **Level 1**

- Hybrid between a clean slate web-based application design and Level 0
- Used for CREATE Kestrel
 - Clean MVC architecture made for easy separation
 - Control logic remains on server
 - Server-side workflow integrated with portal framework

- **Level 2**

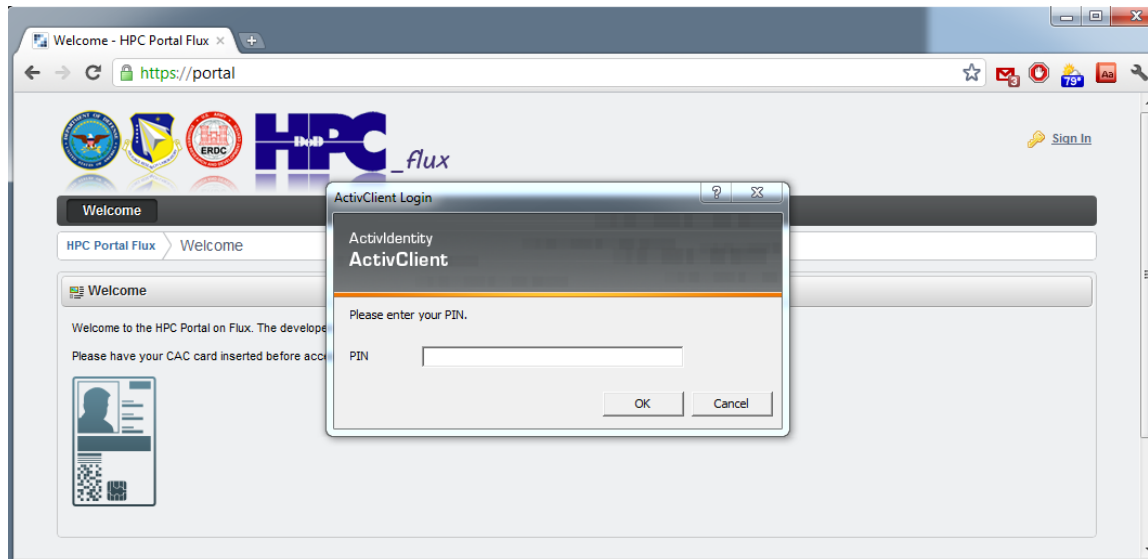
- Native HTML5/JavaScript web-based application
- Goal is to provide a bandwidth-aware software development kit (SDK)
 - Capability to view large datasets using level of detail technology
 - e.g. Google Maps supports efficient HTML5 / JavaScript implementations

Matlab Proof-of-Concept Using Liferay Delivered to Non-Traditional Devices



- Drag-and-drop matlab code
- Browser displays HTML results

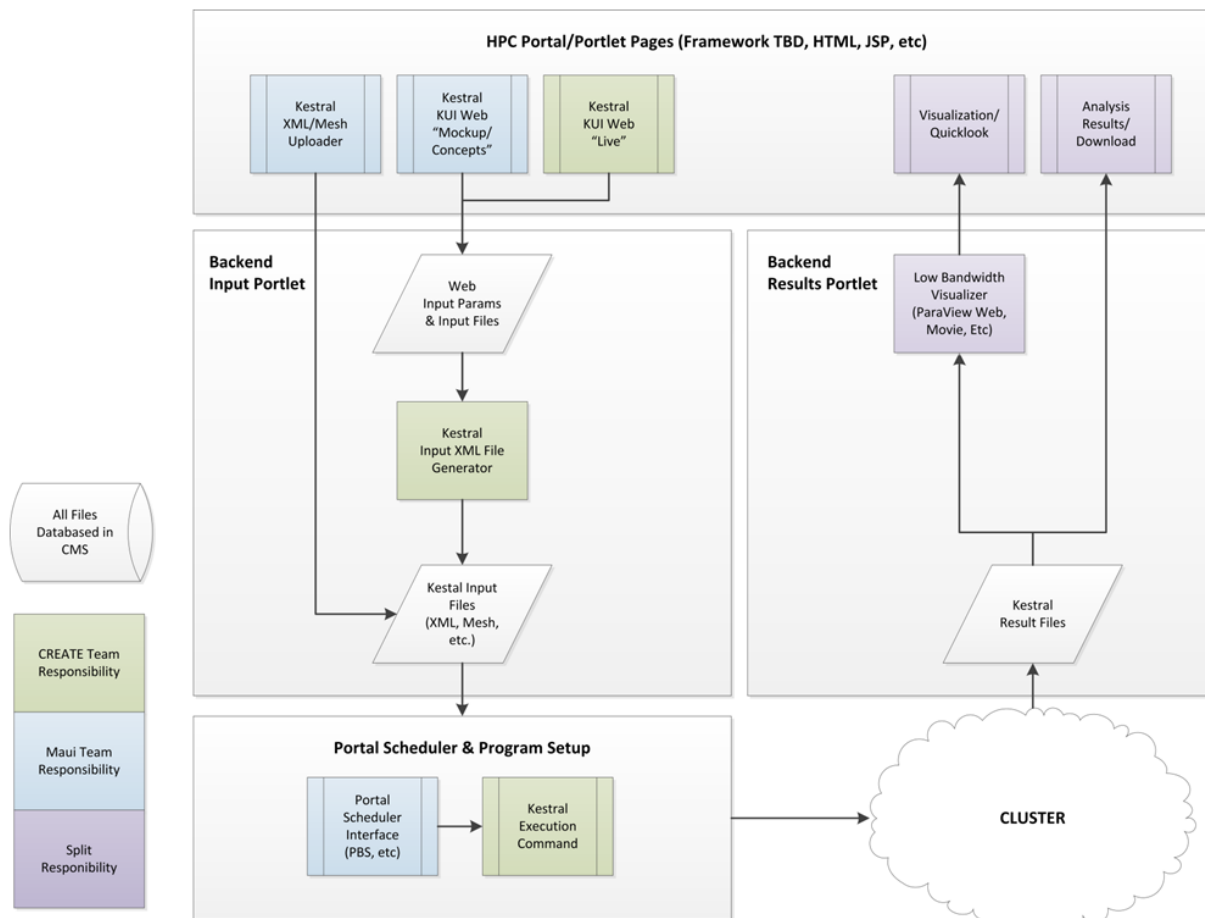
Single-Sign-On (SSO)



YubiKey

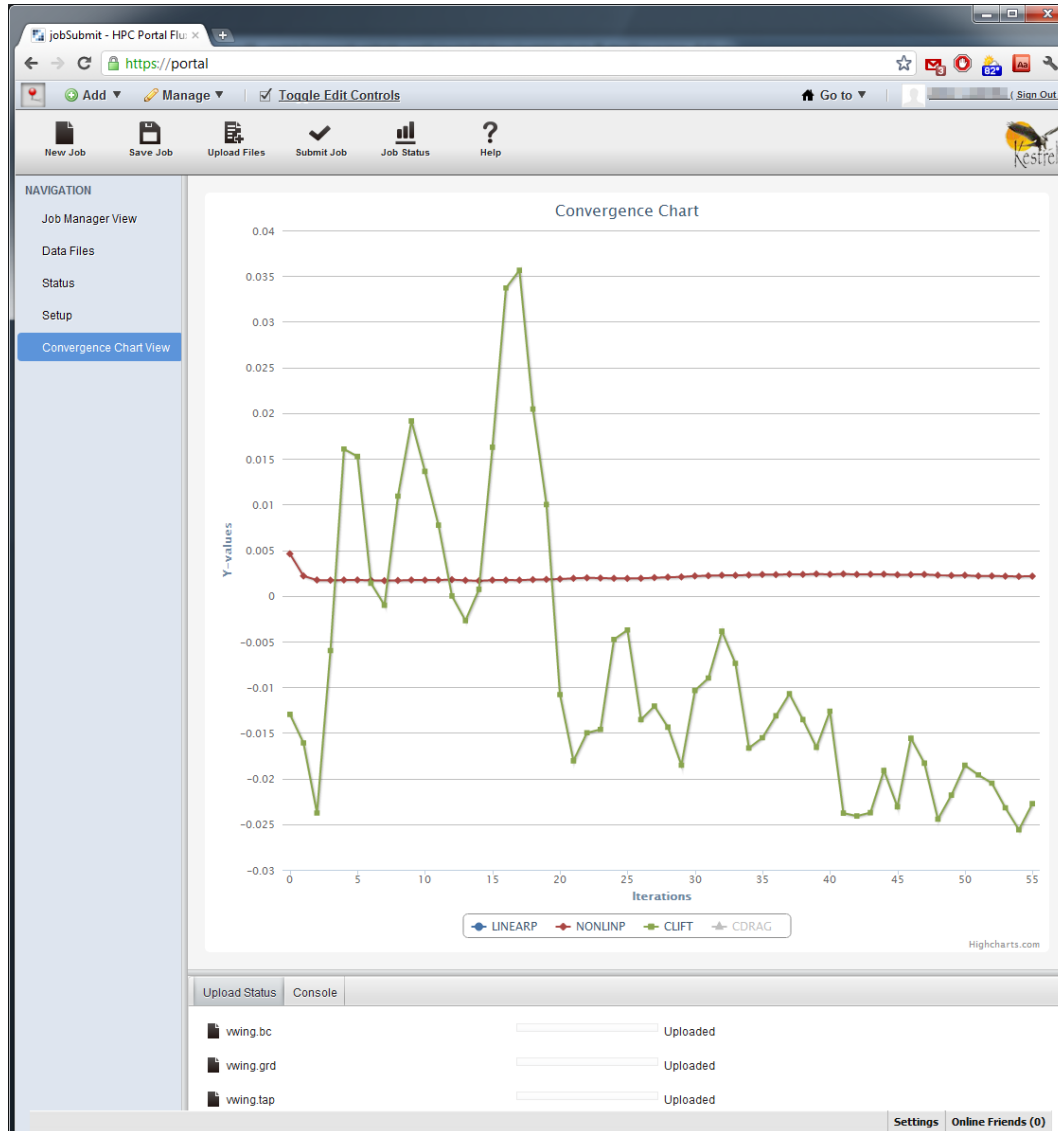
- In support of “*Enhancements to HPCMP Authentication and Authorization Services*” memo (5 April 2011) OpenID is used for SSO
- DoD high security standards require HW token (CAC or Yubikey) for SSO
 - CAC SSO today, Yubikey SSO soon
- YubiKey selected as a lower cost, higher reliability alternative hToken and secureID

CREATE-Kestrel Integration



- **Kestrel is first CREATE app to be integrated with the portal**
- **Existing MVC architecture provided clean separation**
- **Stand-alone UI is available for product team development**
- **File management, job workflow, and quicklook handled by SDK**

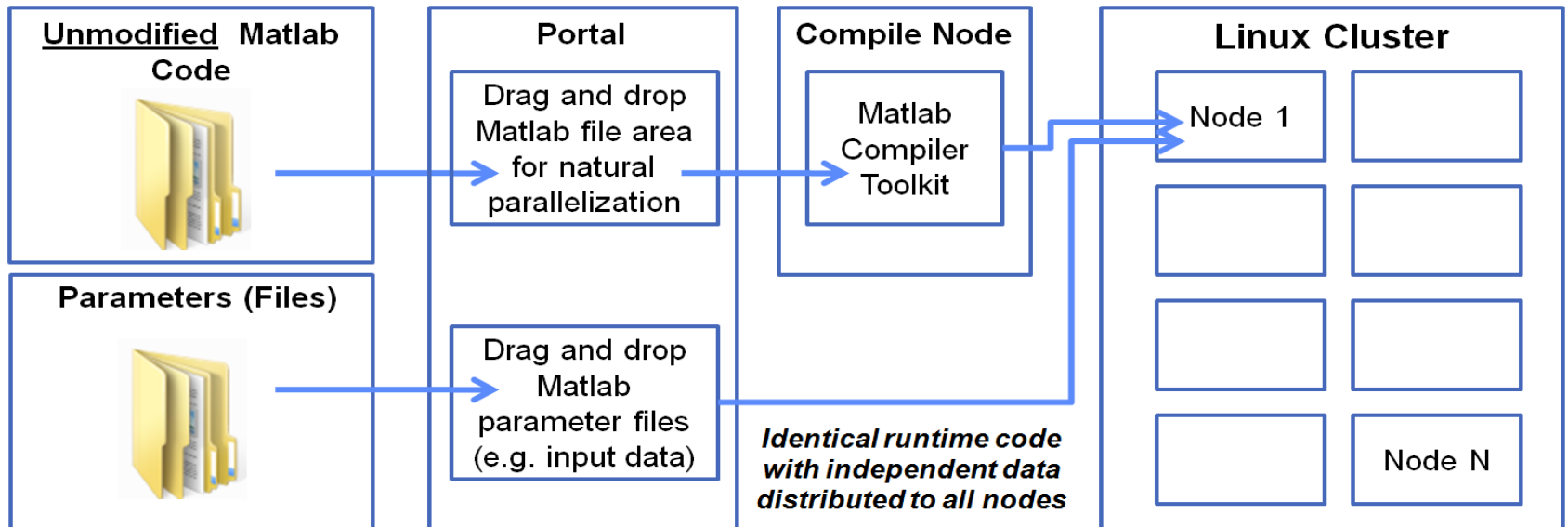
CREATE-Kestrel Integration



- **Dynamic status display shows convergence in real time**
- **Cursor driven data display provided with mouse over**
- **Legend is also active to provide rescaled plots**

Matlab for Naturally Parallel Jobs

- High-speed short integration frames are collected for multiple satellite / missile pass to freeze atmospheric effects
- Research algorithm to remove atmospheric effects written in Matlab requires processing multiple passes for comparison to other techniques (10 to 100 frames are used for each final image in box car fashion)
- Portal will provide researcher capability to immediately use HPC for this naturally parallel problem without knowledge parallel programming



Summary

- **Concept demonstration Portal is on track to demonstrate the high utility in providing HPC services for CREATE and Matlab applications**
- **Three prototype projects using Kestrel at MHPCC have been identified within the AF Aeronautical Systems Center (ASC)**
- **HPC Matlab that does not require HPC knowledge should attract a new user base**
- **AF Space Vehicles Directorate plans to explore the potential of permanently providing TASAT/PowerTASAT capabilities within the portal environment**
- **Our longer term effort is to work closely with other Government sponsors and targeted HPC user communities to identify additional applications that should be migrated to the portal environment**