Open OnDemand: A Unified Platform for Science Gateway Apps

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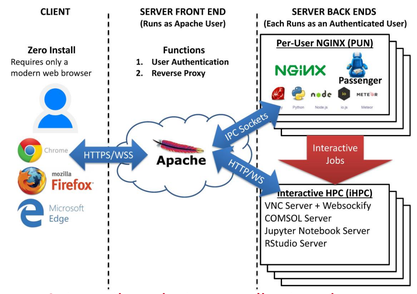
Overview & Motivation

Open OnDemand Features Overview

- Single point of entry for HPC services
  - File access (browse, view, edit)
  - Job control (submit, monitor, delete)
  - Terminal access
  - VNC access
- User needs three things: URL, Username, Password
- Completely browser-based, single sign-on
- Zero install, firewall friendly

Open OnDemand Architecture

- Single persistent Apache front end
- Upon authentication, per-user NGINX server
  - Launched as that system user
  - Serves Open OnDemand (OOD) apps to user
- OOD apps submit interactive HPC jobs that serve VNC, COMSOL and others on dedicated hardware



Interactions between client and server front and back ends

Science Gateway Challenges Addressed

Challenge: User Administration

- Creating & managing user accounts
- Enforcing user separation in the app
  - Making sure users can only see their data
  - Making sure users are charged for jobs submitted

OOD Solution: System Level User Separation

- Use existing system-level accounts
- User separation enforced by PUN model
- Use existing resource managers

Challenge: Web Infrastructure Deployment

- Installing a publicly-accessible LAMPS stack
- Getting your HPC Center to give you admin access to it
- Getting a public DNS entry

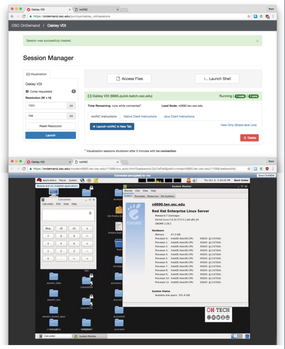
OOD Solution: Single Web Infrastructure Serves All Apps

- Any Open OnDemand user at the HPC Center can create and share apps
- Similar goal for HubZero and Galaxy

Capabilities & Features

Open OnDemand Apps

- Encapsulate workflow, data and software
- OnDemand users can create and share apps
  - Similar in spirit to HubZero Tools, Galaxy Workflows
- Science gateway examples include:
  - Job submission apps (Abaqus, Ansys, Blender)
  - Web workflow apps (Cantilever Beam, FSAE, WeldPredictor, VFT, TruckSim, FanSim)
  - COMSOL Server apps



VNC desktop app runs entirely in browser

Open OnDemand App Platform

App Kit

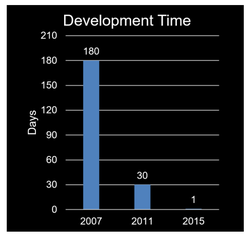
- Templates for common styles of apps
- Libraries provide an interface for Passenger and Rails apps to interact with the local batch server and shared file system
- Easy-to-use API for creating multi-job workflows
  - Sequential workflow with pre- & post-processing
  - Parallel workflow with parameter sweeps

App Sharing

- Developers can easily share apps with other users
  - Apps can be hosted in developer's home directory
  - Apps will be run as the user that launched it
- Authorization
  - Developer grants authorization through file permissions
  - Higher level authorization can be managed centrally (e.g., only allow users in same primary group)

Build Gateways in Open OnDemand

- Build Gateways fast
  - App Kit libraries and templates
  - No need for additional web deployment
  - No account management
  - Uses existing HPC system accounts
- Build Gateways different
  - "Plug in" existing tools from the platform
  - File browser, editor, terminal, VNC



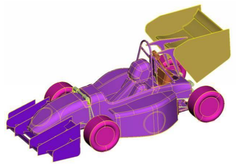
Time to solution has been reduced drastically

Example Apps

FSAE Aerodynamic Simulation App

Overview

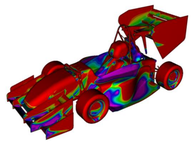
- This app automatically:
  - meshes geometry
  - configures solver settings
  - generates output visualizations
  - organizes the results
- Allows university students to focus on designing and improving their formula SAE cars and not setting up complex CFD simulations



Example geometry uploaded to FSAE app

Workflow

- Students upload .stl files containing the vehicle geometry
- They then configure the simulation parameters such as speed and yaw angle
- System automatically simulates, using 48 core hours, and extracts results for student review

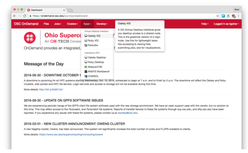


Example FSAE app output visualization

LS-DYNA Workflow App

Overview

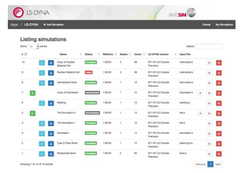
- This job submission app is accessible via the dashboard of OSC's instance of Open OnDemand
- Simplifies the process of submitting LS-DYNA jobs to the OSC HPC resources and analyzing the results



Dashboard of OSC's Open OnDemand instance

Workflow

- Clients log on to the dashboard and browse to the app
- Within the app they can:
  - Inspect the output or status of previous jobs
  - Copy or edit previous jobs
  - Create a new job by uploading an LS-DYNA input file and selecting simulation parameters such as code version and number of cores.
  - Submit jobs to the batch scheduler

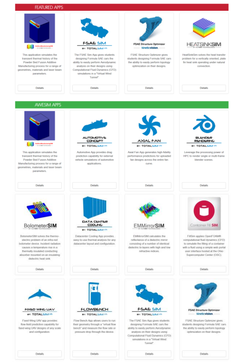


LS-DYNA app with multiple simulation listings

Status & Roadmap

Open OnDemand Usage at OSC

- In 2013 and 2014, OSC OnDemand 1.0, which Open OnDemand was based upon, had over 800 distinct users from 27 different NSF fields of science, and apps were launched over 70,000 times
- OSC OnDemand 3.0, an instance of Open OnDemand, was launched in September, 2016
- Five developer teams have built over 30 apps in the last 18 months



OSC's app catalog

Open OnDemand Roadmap

- Foundational work began in 2012, with initial deployment at OSC in January 2013
- Three year NSF award in 2015 allowed development to accelerate towards an open-source version
- Beta testing will begin at other HPC centers in fall 2016
- Plan to host quarterly boot camps and train the trainer events in 2017
- Project plan includes addition of Globus Online, a Galaxy case study, and integration with Open XDMoD

Documentation and Source Code

- Source code and documentation are maintained in public github repository
- Documentation available at: https://github.com/OSC/Open-OnDemand
  or by visiting: http://go.osu.edu/ood

QR code for Open OnDemand website

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