DESIGNSAFE-CI

A NATURAL HAZARDS ENGINEERING COMMUNITY

A Cyberinfrastructure for the Natural Hazards Community

Stephen Mock

Gateways 2016

NHERI: Natural Hazards Engineering Research Infrastructure

- Shared-use research infrastructure funded by NSF to enable transformative research in natural hazards engineering
  - Network Coordinating Office (NCO)
  - Cyberinfrastructure (CI)
  - Seven experimental facilities (EF)
  - Post-disaster, rapid response research facility (RAPID)
  - Computational Modeling and Simulation Center (SimCenter)
- Replaces similar program for earthquake engineering (NEES) but expanded to include windstorms and associated hazards

DesignSafe-ci Leadership

Director
Ellen Rathje
Univ. of Texas

Simulation
Clint Dawson
Univ. of Texas

Data
Jean-Paul Pinelli
Florida Inst. Tech.

ECO
Jamie Padgett
Rice Univ.

CI
Dan Stanzione
Univ. of Texas

Simulation Requirements Tea

Clint Dawson, Lead (UT) - Water
Pedro Arduino (U. Wash) - EQ
Ahsan Kareem (Notre Dame) - Wind
Laura Lowes (U. Wash) - EQ
Jamie Padgett (Rice) - EQ, Water

TACC
TEXAS ADVANCED COMPUTING CENTER

Management irements Team

aul Pinelli, Lead (FIT) - Wind
Brandenberg (UCLA) - EQ
Frederick Haan (Rose Hulman) - Wind
Gilberto Mosqueda (UCSD) - EQ
Lorraine Haricombe (UT) - Library Science

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Natural Hazards

Created by Arthur Shlain from Noun Project

Hurricanes

Earthquakes

Created by Mauro Lucchesi from Noun Project

Tornadoes

Created by Hayashi Fumihiro from the Noun Project

Storm Surge & Tsunami

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DesignSafe-ci.org Vision

- A CI that is an integral and dynamic part of research discovery
- Cloud-based tools that support the analysis, visualization, and integration of diverse data types
- Support end-to-end research workflows and the full research lifecycle, including data sharing/publishing
- Enhance, amplify, and link the capabilities of the other NHERI components

Experimental Facilities

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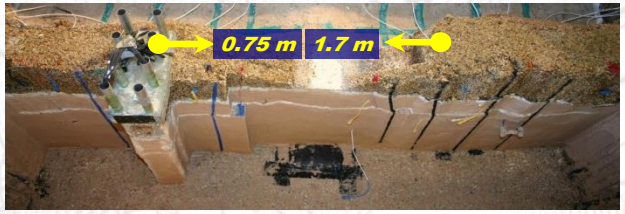
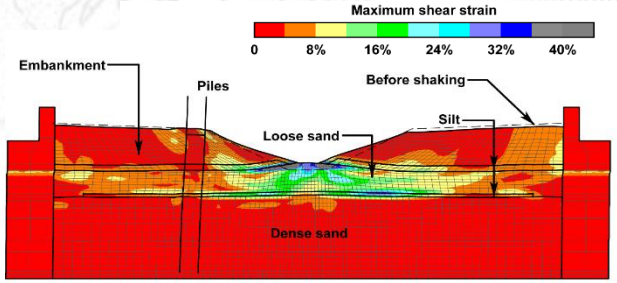
Experimental Facilities

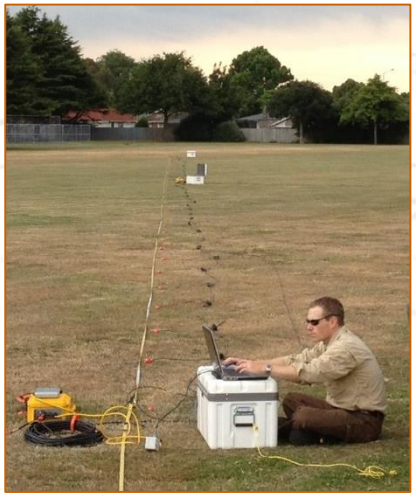
Univ of California, Davis: Geotechnical centrifuges

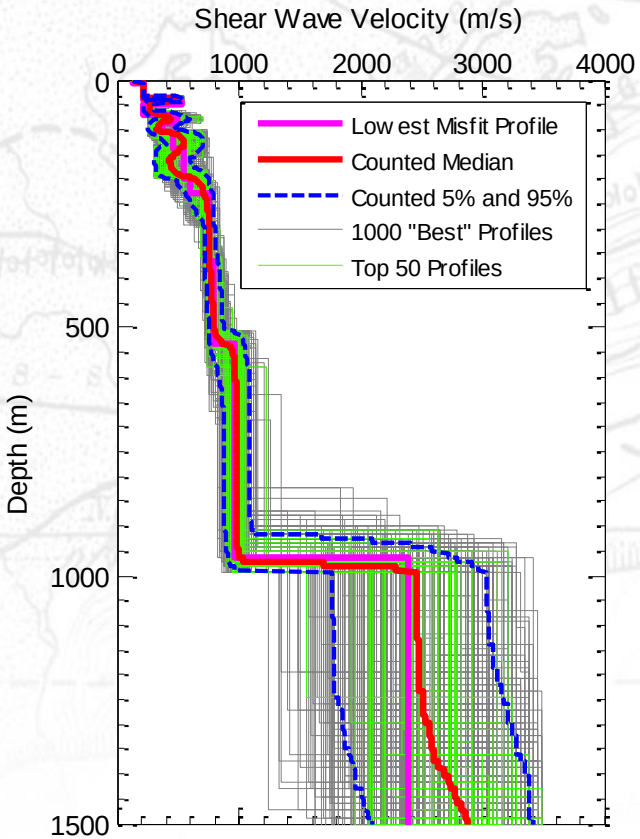




Experimental Facilities

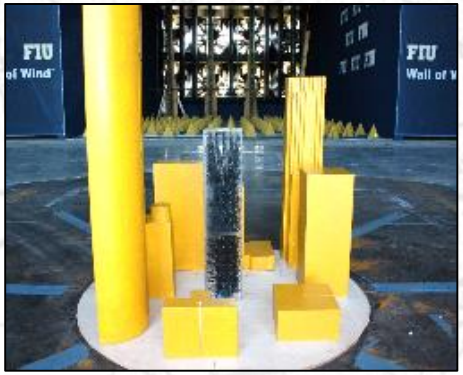
Univ of Texas: Large-scale mobile shakers





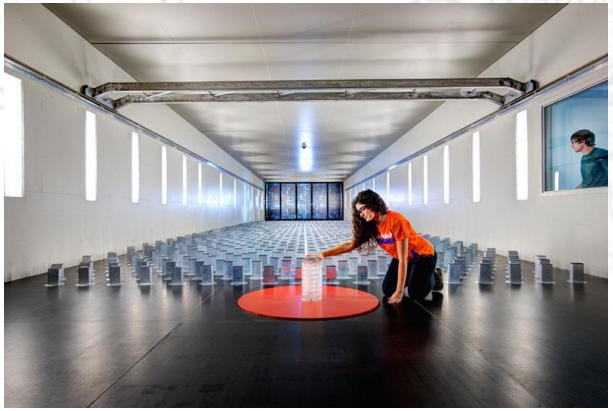
Experimental Facilities

Florida International Univ: Wall of Wind



Experimental Facilities

Univ of Florida: Wind tunnel, pressure loading actuators

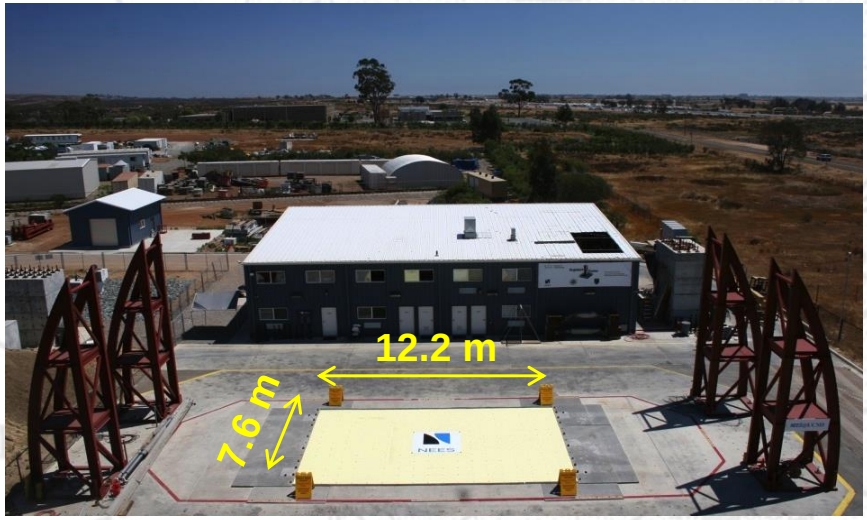


Experimental Facilities

Oregon State Univ: Wave flume and wave basin

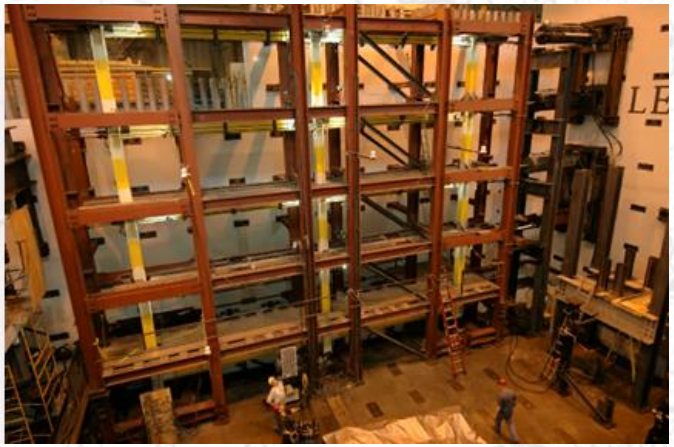
Experimental Facilities

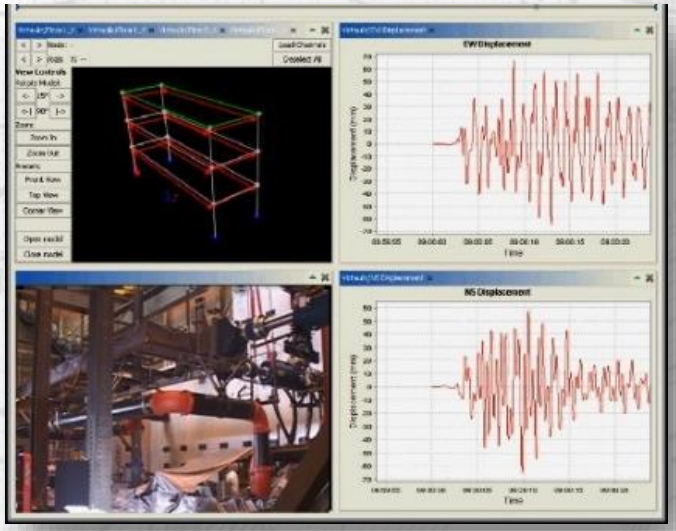
Univ of California, San Diego: Large scale shake table



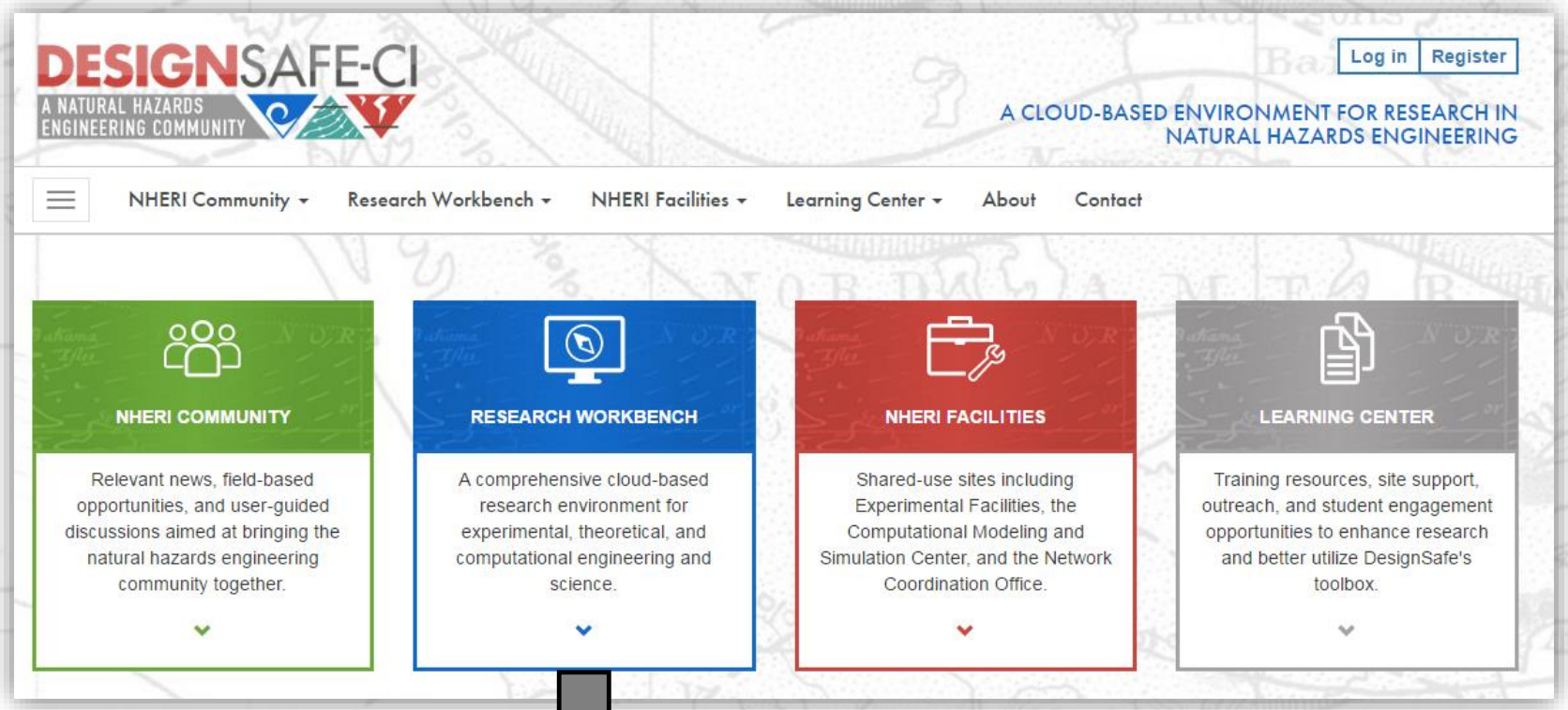
Experimental Facilities

Lehigh Univ: Hybrid simulation testing





DesignSafe-ci Cyberinfrastructure



- Data Depot
- Discovery Workspace
- Developer's Portal

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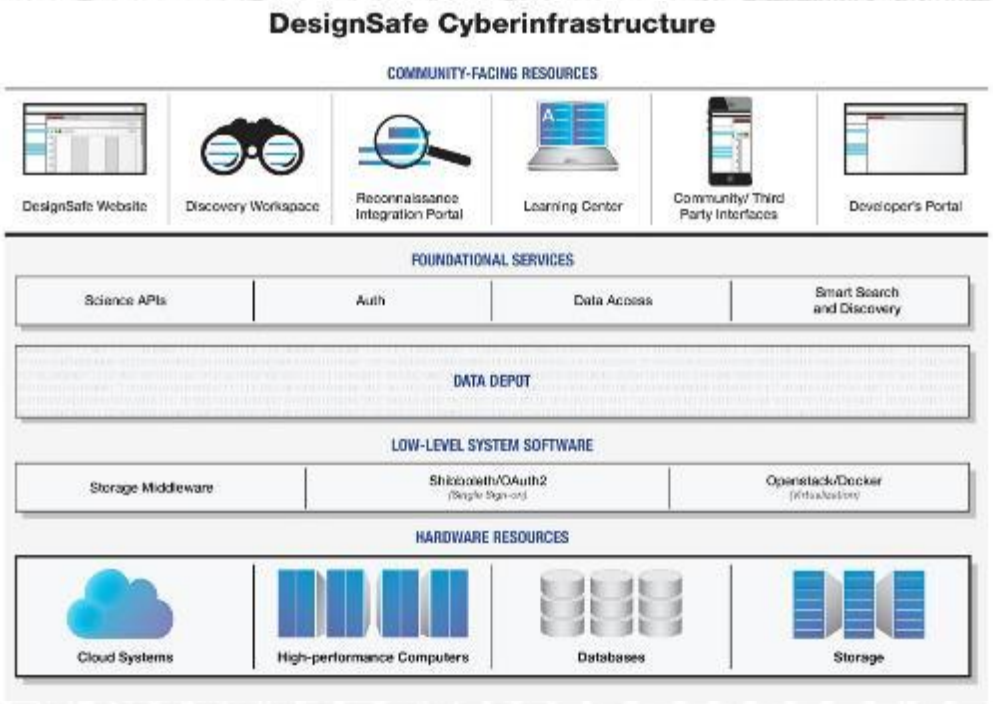
DesignSafe-ci Components

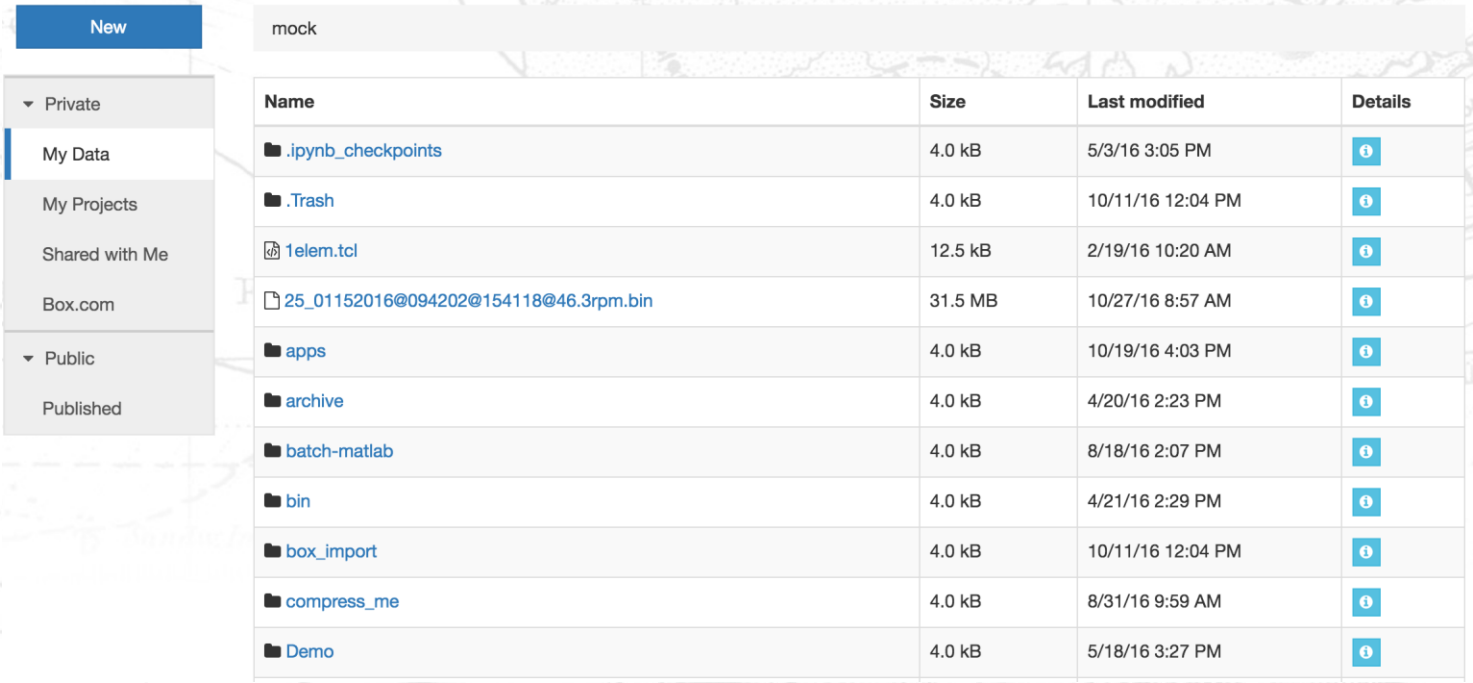
- Web Portal
- Data Depot
- Discovery Workspace
- Reconnaissance Integration Portal
- Developer's Portal
- Learning Center



Data Depot Features

- Upload files/folders from computer
- Transfer files/folders between Box and Data Depot
- Management of files within Data Depot
- Sharing of files/folders with other Users
- Preview many file types in the cloud
- Data Depot files accessible from the Discovery Workspace
- Copying Public data to My Data
- Projects (coming in ~1 week)
  - Shared space among collaborators
  - Starting point for formally publishing data

Data Depot Browser



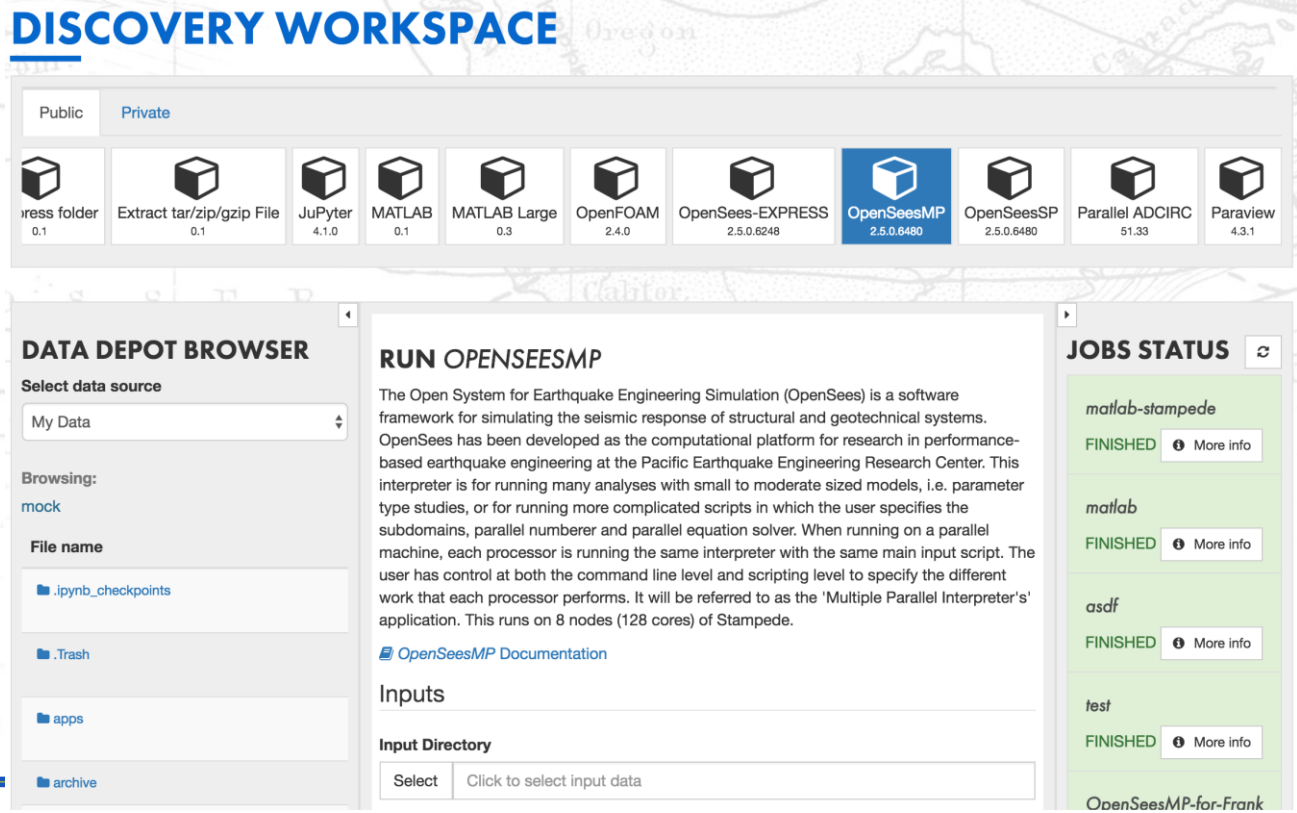
- Developing interface for EFs to rapidly upload data to Data Depot for sharing with researchers

Data Curation

- Collaborating with EF sites to design a vocabulary and data model for each site (and simulations)
  - Significant progress in defining this for several sites through this year.
- Progressive curation scheme
  - More of the model must be filled in as move from project creation, data sharing, publication/archive, etc.
- First release of Projects interface in Fall 2016
  - (sneak peek on previous slide)
- Fedora Commons the likely tool for data preservation

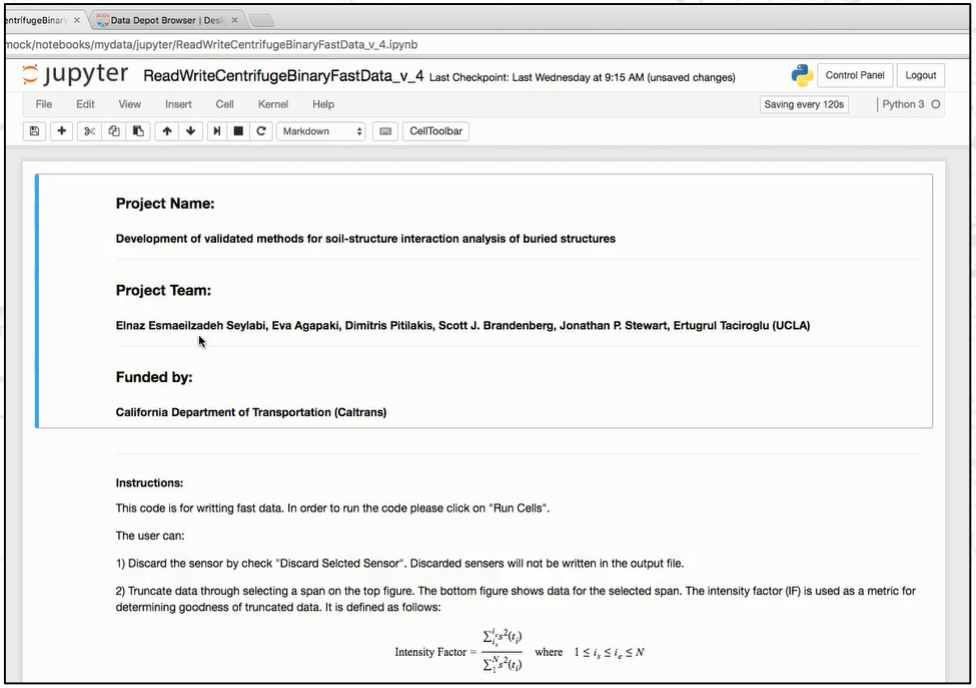
Discovery Workspace

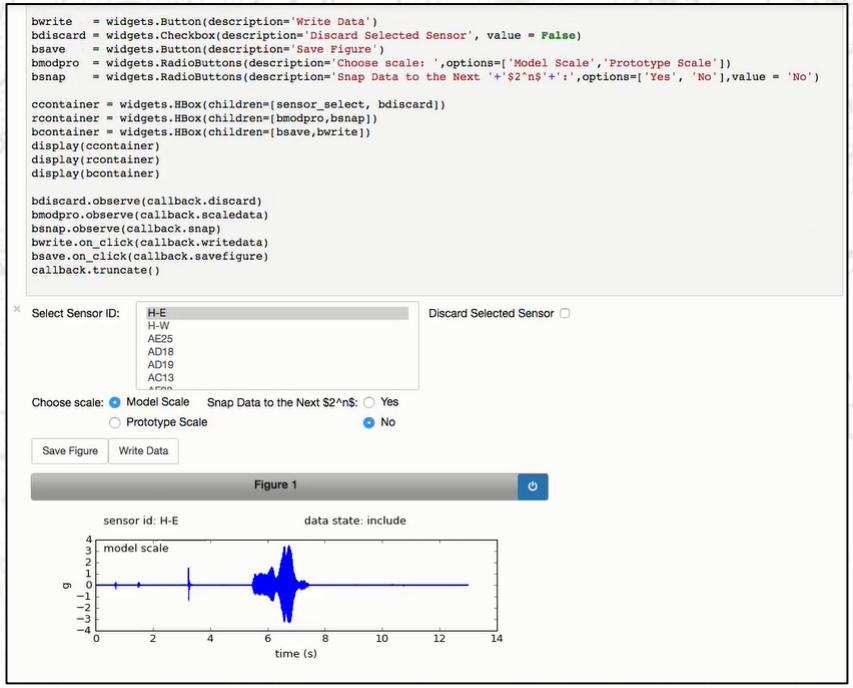
- Simulation and analysis tools
  - OpenSees, ADCIRC, OpenFOAM, Matlab, Paraview,



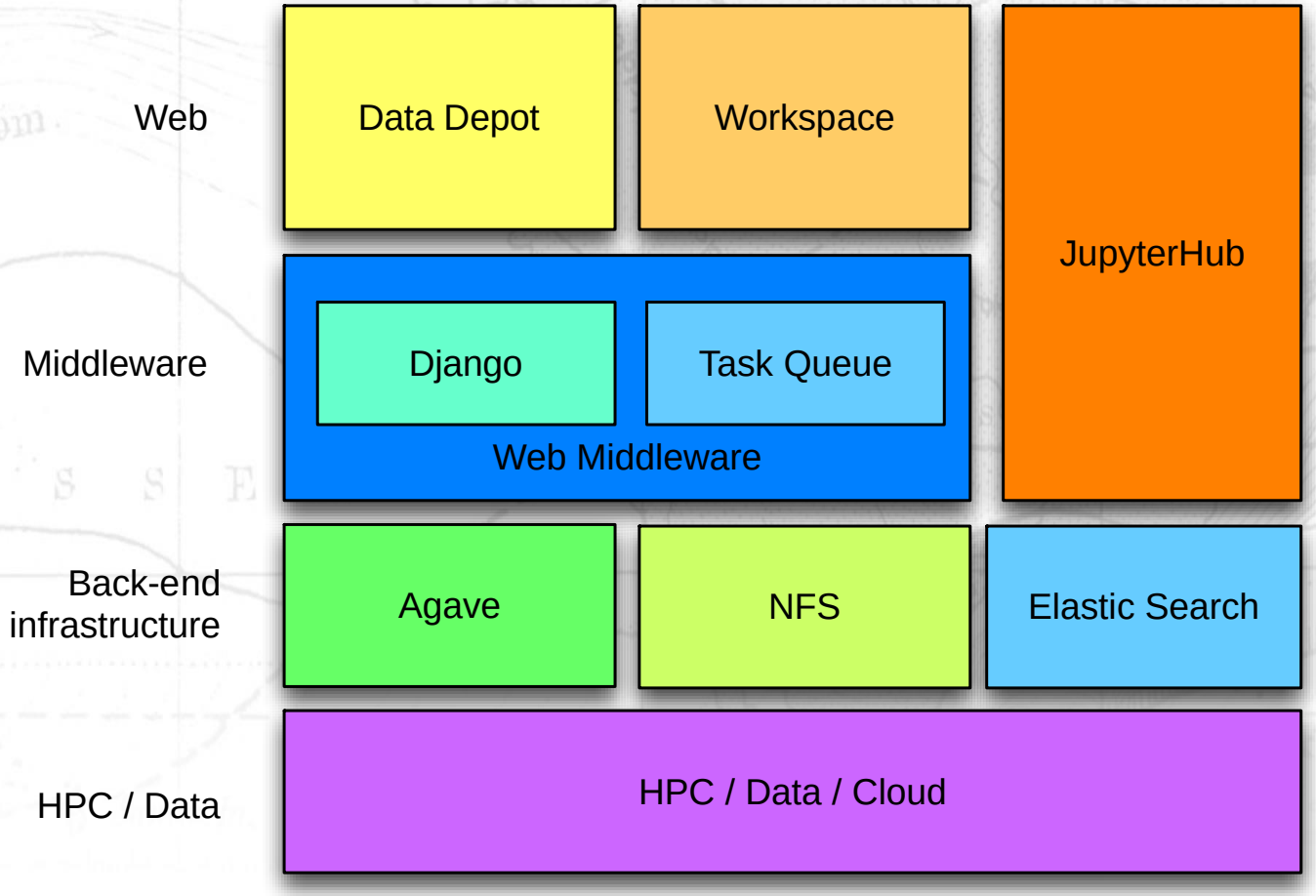
Discovery Workspace

- Simulation and analysis tools
  - Jupyter notebook (40+ languages including Python)



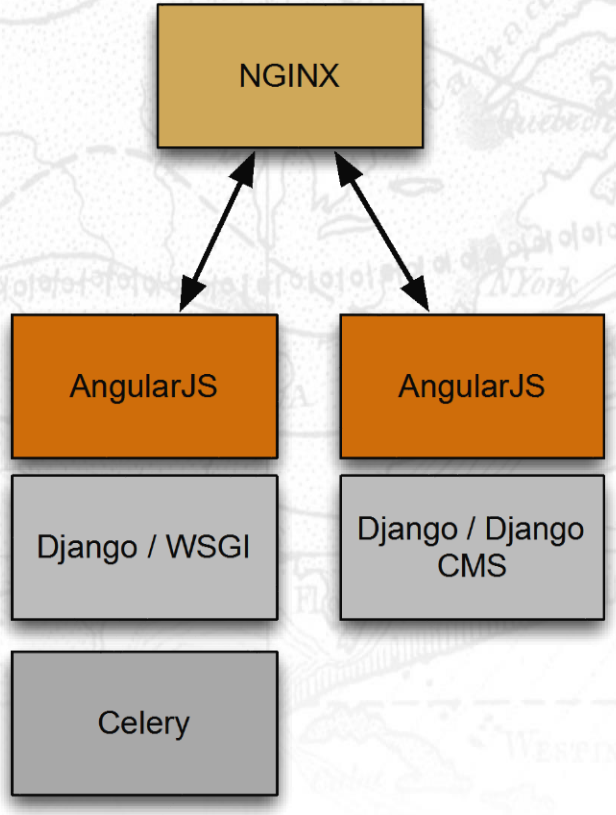


Architecture Overview



Web / Middleware Layer

- NGINX
  - Hands off web requests to different sites like the Portal and experimental facility (EF) sites
- AngularJS
  - Front end web logic
- Django Web Server
- Celery Task queue
  - Scheduling of async tasks like job submissions and data transfers



Backend Infrastructure

- Agave
  - Authentication and authorization
  - Job submission and monitoring
    - HPC (Stampede, Maverick), Cloud (TACC VMs, Jetstream)
  - Metadata storage and retrieval
  - Notifications
  - Data transfer
  - File sharing permissions
- NFS
  - Because sometimes its just easier to to directly manipulate the files

Backend Infrastructure cont.

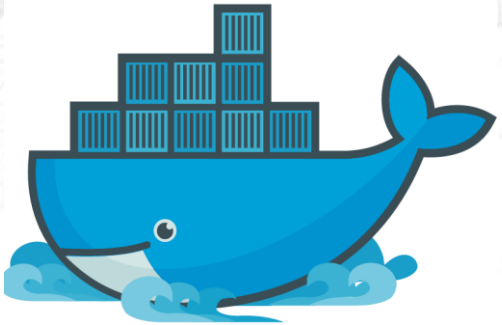
- Elastic Search
  - 2 node ES cluster
  - Indexes all files, file metadata, web site content
  - Will be expanded to include additional ‘project’ metadata and the data schemas for the EF generated data

JupyterHub

- Multi-user server for running Jupyter notebooks
- User environments configured as Docker containers
- Configured with active Agave session and tooling
- Can burst out to Jetstream for high usage like trainings
- Provides virtual terminal access to DesignSafe Data

HPC & Cloud

- Jobs run (via Agave) on TACC's HPC (Stampede, Maverick) and Cloud systems
- Jobs run as 'community account' or 'gateway account'
- VM sized applications packaged as Docker containers where appropriate for portability
- urst to IU's Jetstream



Dev-ops

- OpBeat notifications for all production errors/warnings
- All logs emitted to Splunk
- Static code analysis triggered automatically via git hooks
- Jenkins CI/Testing
- Portal production ,QA, and run in Docker containers
- Deployment/testing via Ansible from a deployment node
- Code at https://github.com/DesignSafe-CI

Contact

- https://designsafe-ci.org/
- Open to anyone interested in natural hazards engineering
- Questions can be submitted through the support/contact form
- Me: mock@tacc.utexas.edu
- Portal Team:
  - Matthew Hanlon, Josue Coronel, Manuel Rojas, Marjo Poindexter, Joe Stubbs, Charlie Dey, Craig Jansen, Tim Cockerill
- Thanks!