Sur Concerpt Arenang

A NATURAL HAZARDS ENGINEERING COMMUNITY

A Cyberinfrastructure for the Natural Hazards Community Stephen Mock Gateways 2016

TACC RICE Florida Tech



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



TEXAS ADVANCED COMPUTING CENTER Management irements Team

TACC RICE Florida Tech

aul Pinelli, Lead (FIT) - Wind Brandenberg (UCLA) - EQ

Frederick Haan (Rose Hulman) - Wind Gilberto Mosqueda (UCSD) - EQ Lorraine Haricombe (UT) - Library Science







Natural Hazards





Hurricanes













Storm Surge & Tsunami









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

TACC RICE Florida Tech

Enhance, amplify, and link the capabilities of the other NHERI components



Experimental Facilities



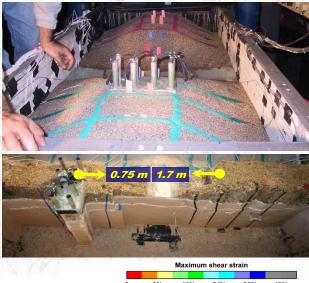


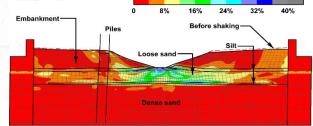


Experimental Facilities

Univ of California, Davis: Geotechnical centrifuges







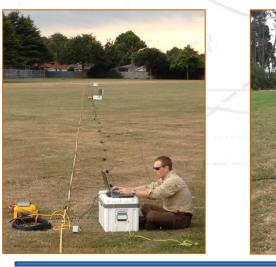


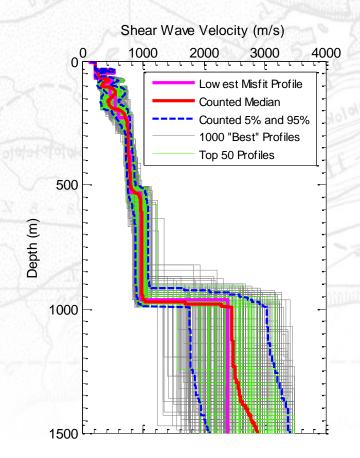




Experimental Facilities Univ of Texas: Large-scale mobile shakers











Experimental Facilities Florida International Univ: Wall of Wind











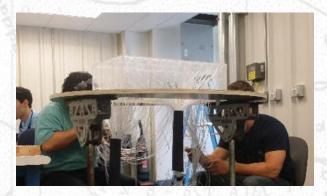




Experimental Facilities

Univ of Florida: Wind tunnel, pressure loading actuators















Experimental Facilities Oregon State Univ: Wave flume and wave basin











Experimental Facilities

The University of Texas at A

Univ of California, San Diego: Large scale shake table



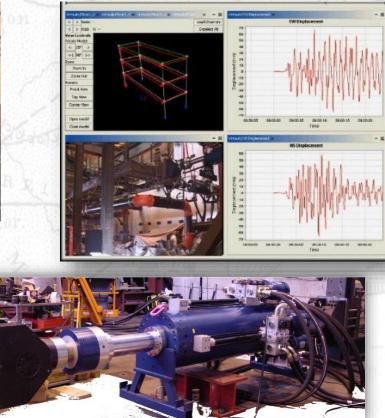




Experimental Facilities

Lehigh Univ: Hybrid simulation testing





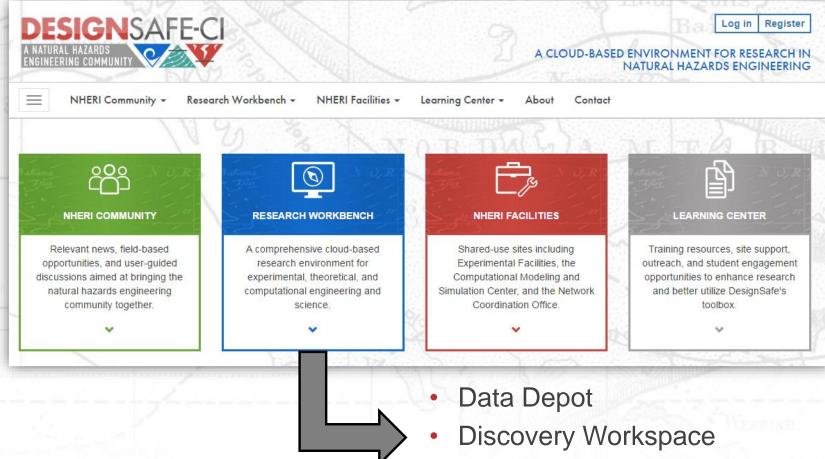






DesignSafe-ci Cyberinfrastructure

The University of Texas at Aust



Developer's Portal





DesignSafe-ci Components

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

DesignSafe Website	Discovery Workspace	Reconnaissance Integration Portal	Learning Center	Community/ Third Party Interfaces	Developer's Portal	
		FOUNDATION	AL SERVICES			
Science APIs		Auth	Data Access		Smart Search and Discovery	
		DATA I				
Storage Middleware		Shipboleth/OAuth2 (Bright Sign-and		Openstack/Docker		
		HARDWARE	RESOURCES			
	Contraction of the second s	And and a state of the state of the state of the				



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

New		mock			
vate		Name	Size	Last modified	Details
Data		.ipynb_checkpoints	4.0 kB	5/3/16 3:05 PM	θ
Projects		.Trash	4.0 kB	10/11/16 12:04 PM	ð
ared with Me			12.5 kB	2/19/16 10:20 AM	ð
x.com		25_01152016@094202@154118@46.3rpm.bin	31.5 MB	10/27/16 8:57 AM	0
blic	-	apps	4.0 kB	10/19/16 4:03 PM	0
blished		archive	4.0 kB	4/20/16 2:23 PM	0
		batch-matlab	4.0 kB	8/18/16 2:07 PM	0
		🖿 bin	4.0 kB	4/21/16 2:29 PM	0
		box_import	4.0 kB	10/11/16 12:04 PM	0
		Compress_me	4.0 kB	8/31/16 9:59 AM	0
		Demo	4.0 kB	5/18/16 3:27 PM	0

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

TACC RICE Florida Tech



Priva
 My I
 My F
 Shar
 Box.

Pub
 Publ

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



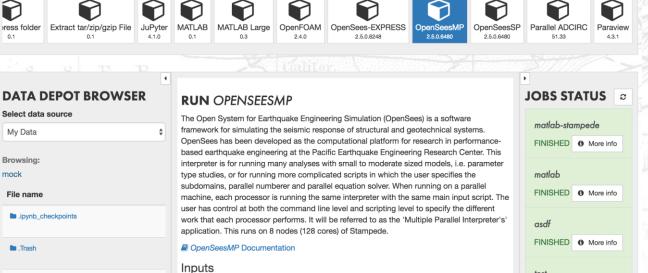
Discovery Workspace

- Simulation and analysis tools
- OpenSees, ADCIRC, OpenFOAM, Matlab, Paraview, pan. Stron. DISCOVERY WORKSPACE



Private

Public



apps

archive



Click to select input data

Input Directory

Select



test

FINISHED
 More info

OpenSeesMP-for-Frank

Discovery Workspace

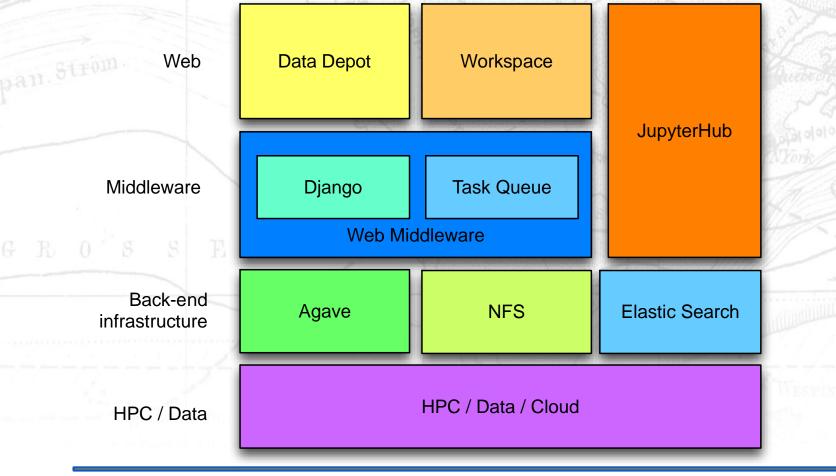
- Simulation and analysis tools
- Jupyter notebook (40+ languages including Python)

entrifugeBinar) x V 💭 Data Depot Browser Desi x	<pre>bwrite = widgets.Button(description='Write Data')</pre>		
nock/notebooks/mvdata/jupyter/ReadWriteCentrifugeBinaryFastData_y_4.jpvnb	bdiscard = widgets.Checkbox(description='Discard Selected Sensor', value = False)		
nochiocebooks/mydata/jup/ter/read-trittecentinugebinary estudata_v_4.pynb	<pre>bsave = widgets.Button(description='Save Figure') bmodpro = widgets.RadioButtons(description='Choose scale: ',options=['Model Scale','Prototype Scale'])</pre>		
🗇 Control Panel Logout	bsnap = widgets.RadioButtons(description='Snap Data to the Next '+'\$2^n\$'+':',options=['Yes', 'No'],value = 'No')		
File Edit View Insert Cell Kernel Help Saving every 120s Python 3 O Ib + > 2 Ib + > C Markdown + Iii CellToolbar	<pre>ccontainer = vidgets.HBox(children=[sensor_selact, bdiscard]) rcontainer = vidgets.HBox(children=[bmadpro,bsnap]) bcontainer = vidgets.HBox(children=[bmadpro,bxrite])</pre>		
	display(container) display(container)		
Project Name:	bdiscard.observe(callback.discard) bmodpro.observe(callback.scaledata)		
Development of validated methods for soil-structure interaction analysis of buried structures	<pre>bsnap.observe(callback.snap) bwrite.on_click(callback.writedata) bsave.on_click(callback.savefigure) callback.truncate()</pre>		
Project Team:			
Einaz Esmaeilzadeh Seylabi, Eva Agapaki, Dimitris Pitilakis, Scott J. Brandenberg, Jonathan P. Stewart, Ertugrul Taciroglu (UCLA)	X Select Sensor ID: H-E Discard Selected Sensor A225 AD18 AD19		
Funded by:	AC13		
California Department of Transportation (Caltrans)	Choose scale: O Model Scale Snap Data to the Next \$2^n\$: Yes		
	Prototype Scale O No		
	Save Figure Write Data		
Instructions:	Figure 1 0		
This code is for writting fast data. In order to run the code please click on "Run Cells".	sensor id: H-E data state: include		
The user can:	4 model scale		
1) Discard the sensor by check "Discard Selcted Sensor". Discarded sensers will not be written in the output file.			
2) Truncate data through selecting a span on the top figure. The bottom figure shows data for the selected span. The intensity factor (IF) is used as a metric for determining goodness of truncated data. It is defined as follows:			
Intensity Factor $= \frac{\sum_{i_x}^{i_x} 2(i_y)}{\sum_{i_x}^{N-2} (i_x)}$ where $1 \le i_x \le i_e \le N$	$-4 \frac{1}{0} \frac{1}{2} \frac{1}{4} \frac{1}{6} \frac{1}{8} \frac{1}{10} \frac{1}{12} \frac{1}{14}$ time (s)		





Architecture Overview



TACC RICE Florida Tech

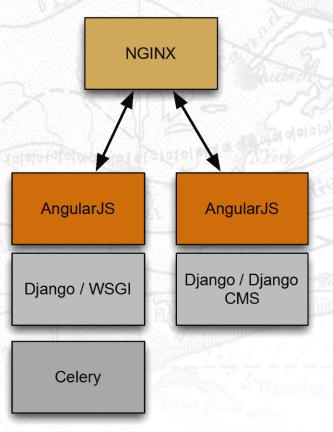




Web / Middleware Layer

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

TACC RICE Florida Tech



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



TACC RICE Florida Tech



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 <u>https://github.com/DesignSafe-Cl</u>

 DESIGNSAFE-Cl

 WILLIAN MALLANDS
 WILLIAM MALLANDS

Contact

<u>https://designsafe-ci.org/</u>

- 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

