



SAND2018-1508C

Software Engineering Analytics Toolkit:

Dependency Management in Mature Codes



PRESENTED BY

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Preview

- **Challenges of maintaining and extending mature codes**
- **Complexity of library-level dependencies in Sierra**
- **Web demo of SEAT**
- **Future directions**

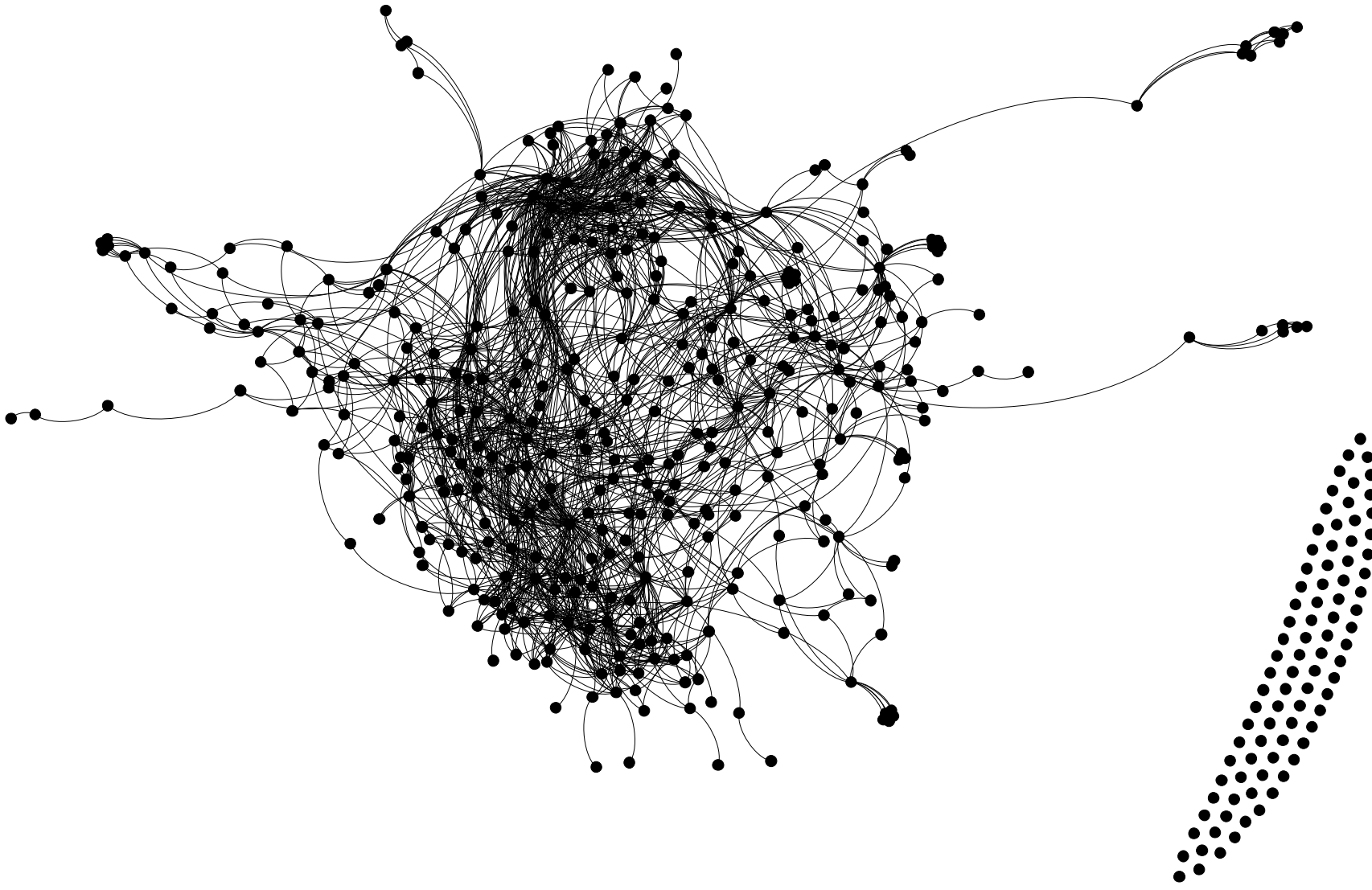
Challenges in Maintaining and Developing in Mature Codes

- **Millions of significant lines of code:**
 - ✧ **Sierra** ~ 15 million
 - ✧ **Trilinos** ~ 3 million
 - ✧ **E3SM** ~ 1 million
- **Code and dependency chains can become opaque, exhibiting these problems:**
 - **Protracted build and test times**
 - **Executable bloat (impacting runtime performance)**
 - **Large memory footprints**
 - **Unwieldy, poorly understood dependency graphs at the app level**
 - **Difficulty resolving build and test failure**
 - **Portability issues**

Sierra Library Dependencies

478 nodes (libraries)

1695 edges



Access SEAT as "Dependencies" on CDash

**SNTools**

DashboardCalendarPreviousCurrentProject

update data as of **Monday, February 05 2018 - 18:00 MST**
4 hours ago: 118 tests failed on recent-sntools-changes
8 hours ago: 8 tests failed on recent-sntools-changes
16 hours ago: 1 test failed on sntools.4.44
16 hours ago: 2 tests failed on sntools.4.46
16 hours ago: 61 tests failed on sntools.4.46

Trac SiteRally SiteExternal SQA
klocwork
BRUCE/Loov/Gcc
Dependencies
Valgrind
AutoVector...
SE Graphs
Trilinos
FCT

Team Views

ightly

	Build Name	Update	Build			Test			Start Time ▼
		Files	Error	Warn	Not Run	Fail ▼	Pass		
sierra12	sntools.master	8	0	0	0	89 ⁺¹ ₋₁	313 ⁺¹	16 hours ago	
sierra12	sntools.4.44	0	0	0	0	77	152	16 hours ago	
sierra12	sntools.4.46	0	0	0	0	61	322	16 hours ago	
ra-any	sntools.4.46	0	0	0	0	2	422	16 hours ago	
ra-any	sntools.master	0	0	0	0	2	453 ⁺¹	16 hours ago	
ra-any	sntools.4.44	0	0	0	0	1	429	15 hours ago	
sierra12	master-gcc-4.9-heavy-test-itar	0	0	0	0	0	1	19 hours ago	
sierra12	master-gcc-4.9-heavy-test-base	0	0	0	0	0	1	22 hours ago	
ra-haswell	master-intel-17.0-heavy-test-itar	0	0	0	0	0	1	22 hours ago	
ra-any	master-intel-17.0-heavy-test-base	0	0	0	0	0	1	22 hours ago	

ntinuous

	Build Name	Build		Test			Start Time ▼
		Error	Warn	Not Run	Fail	Pass	
ra-macsierra	recent-sntools-changes	0	0	0	118 ⁺¹ ₋₁	4 ⁺⁴ ₋₂₉	4 hours ago
ra-any	recent-sntools-changes	0	0	0	8 ⁺¹	8 ⁺⁸ ₋₄₀	4 hours ago

 CDash 2.5.0 © Kitware | Report problems | 1.65s

<http://compsim-dashboards.sandia.gov/sierraWWW/SEAT/portal/index.html>

What's Next?

- **Implement with production builds (Sierra, Trilinos), with a view to deploying with other codes (e.g., E3SM, SPARC)**
- **Customize to B61 code-quality requirements**
- **Identify potential refactoring targets**
- **Advanced data grooming, mining, visualization and extraction tools focused on code quality, code improvement**

Acknowledgements



Jake Healy



Mike Glass



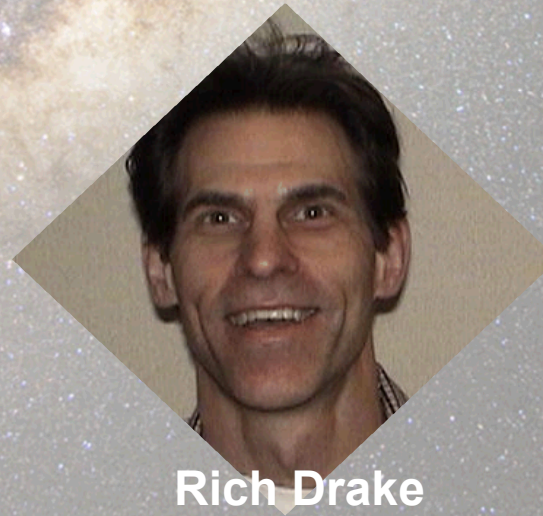
Paul Wolfenbarger



Mark Hamilton



Terri Galpin



Rich Drake



Jim Flahive

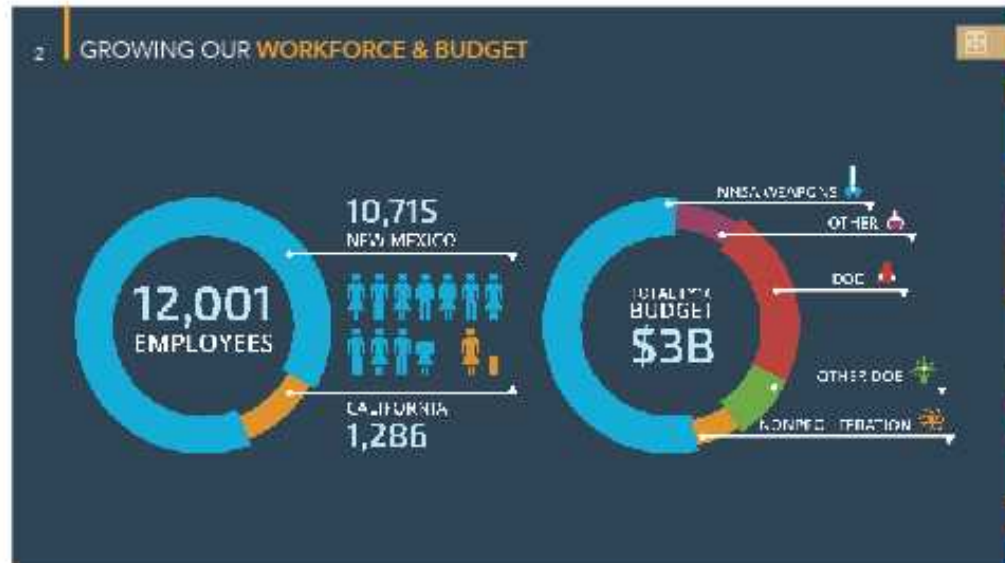


DevOps
ASC





SLIDE DESIGN SAMPLES ON DARK BACKGROUND



3 | EXECUTING THE **NUCLEAR WEAPONS PROGRAM**

- Modernization programs: W76-1, B61-12, Mk21 Fuze, W88 ALT 370, W80-4, Mobile Guardian Transporter
- Stockpile assessment: Initial development and implementation of a risk-informed surveillance approach to be used in stockpile certification in future years
- Core capabilities: A mission needs statement for a Trusted Microsystems Capability approved by the NNSA

Image of a nuclear missile being launched from a mobile transporter.

6 | INVESTING IN OUR **FACILITIES AND INFRASTRUCTURE**

- Invested \$46M in indirectly funded construction projects for critical mission capabilities
- Held a deep dive into Sandia's missions and Master Asset Plan with the NNSA
- Started integrating funds for nuclear weapons mission and Strategic Partnership Projects maintenance

Three images showing modern facility buildings and infrastructure.

2 | CELEBRATING OUR **PEOPLE**

BERNIE HERNANDEZ-SANCHEZ HENNAC - Outstanding Technical Achievement Award			
VINCENT URIAS HENNAC - Luminary Pastore			
TIAN MA AABOY - Most Promising Engineer of the Year Award			
KEN HOLLEY BEYA - Community Service Award			
CONRAD JAMES BEYA - Special Recognition Award			
MARIE CAPITAN AGES - Blazing Flame Award			