



Software Engineering Analytics Toolkit – Dependency Management in Mature Codes



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Topics

- **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:**

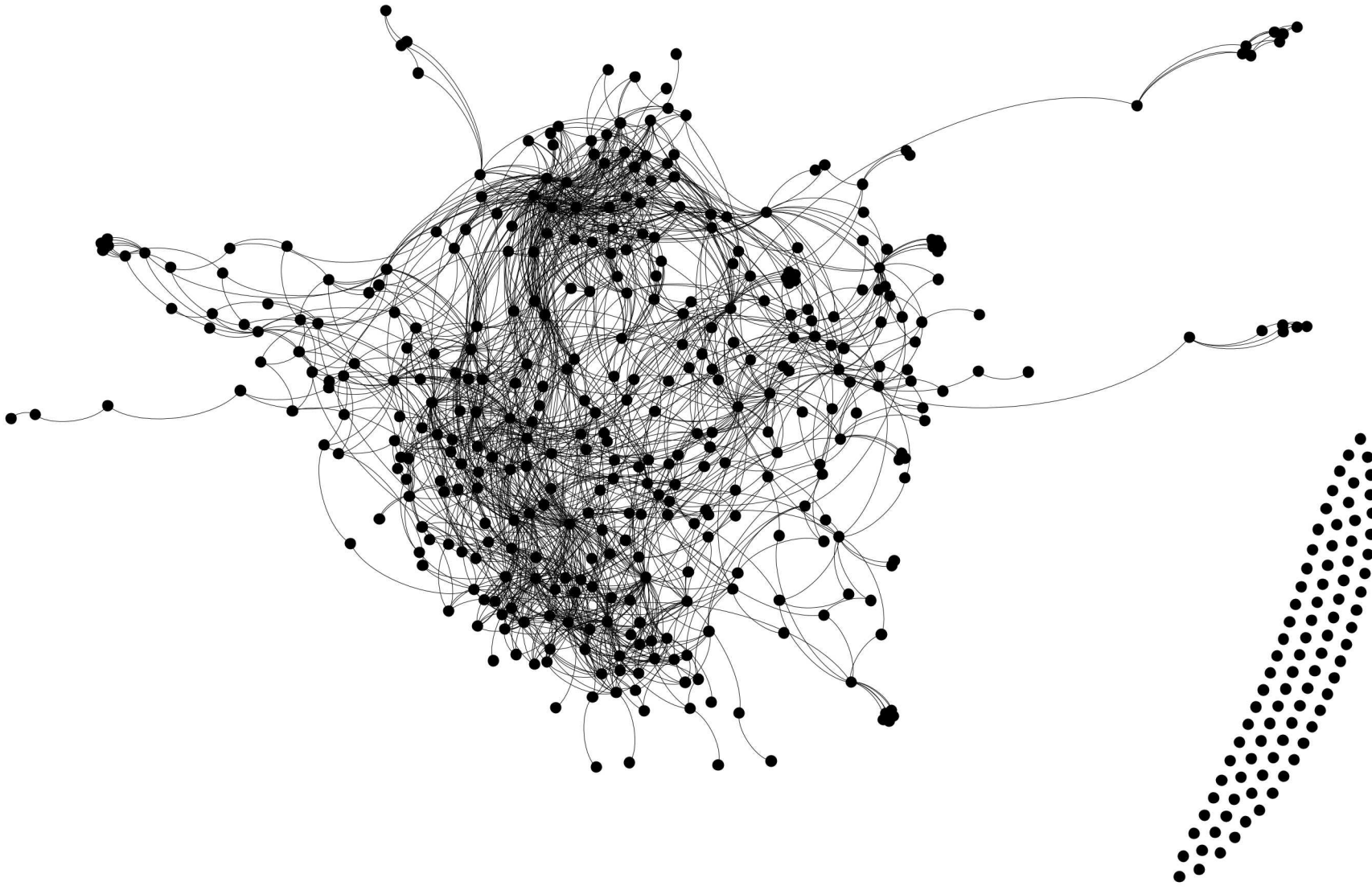
- **Protracted build and test times**
- **Executable bloat**
- **Large memory footprints**
- **Unwieldy, poorly understood dependency graphs at the app level**
- **Difficulty resolving build and test failures**
- **Portability issues in HPC ecosystems**

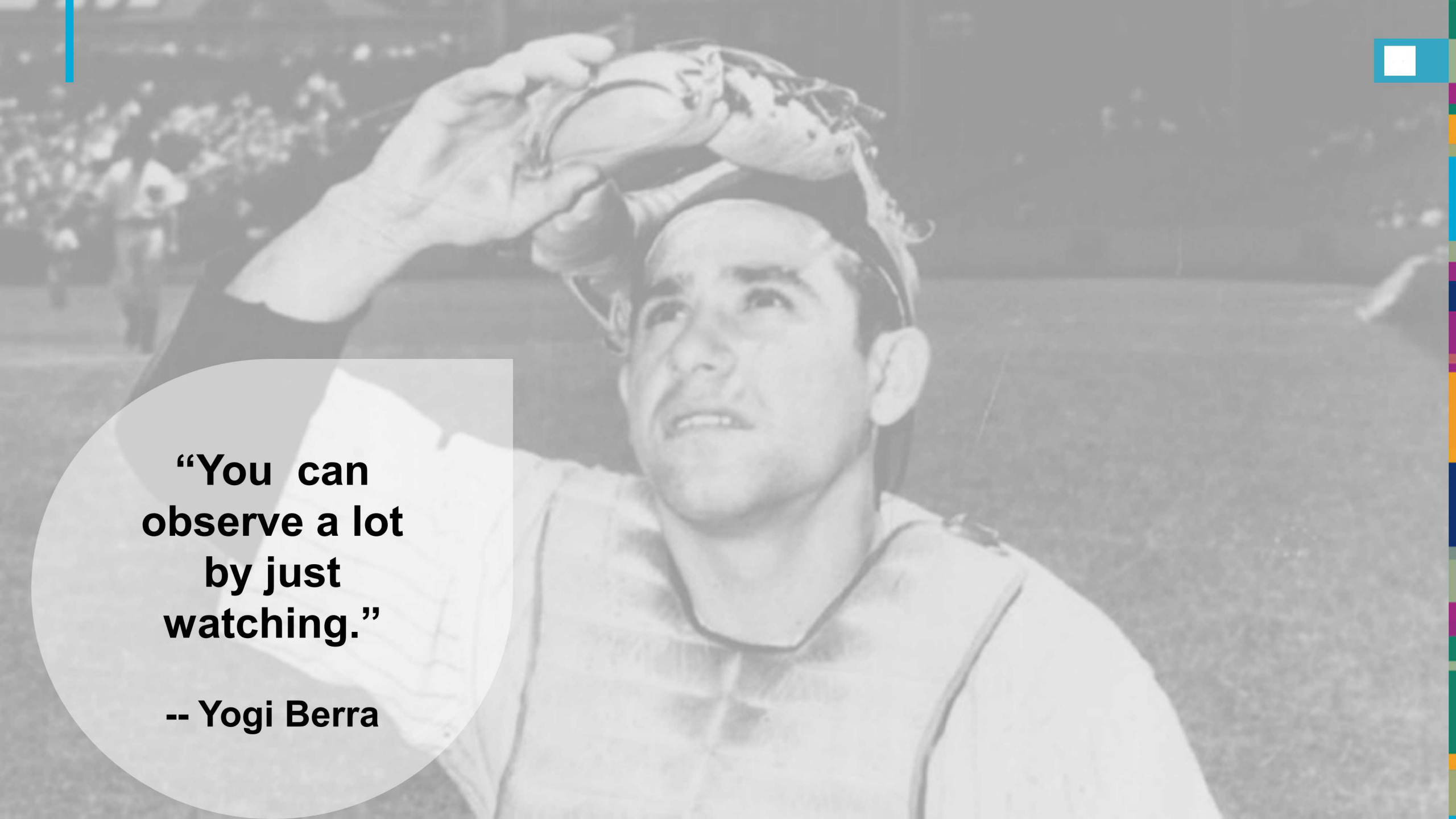
Impacting runtime performance

Sierra Library Dependencies

478 nodes (libraries)

1695 edges





**“You can
observe a lot
by just
watching.”**

-- Yogi Berra

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
4 hours ago: 8 tests failed on recent-sntools-changes
4 hours ago: 1 test failed on sntools.4.44
4 hours ago: 2 tests failed on sntools.4.46
4 hours ago: 61 tests failed on sntools.4.46

Trac SiteRally SiteExternal SQA
klocworks
BRUCE/Leov/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	

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	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 ₋₁₀	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



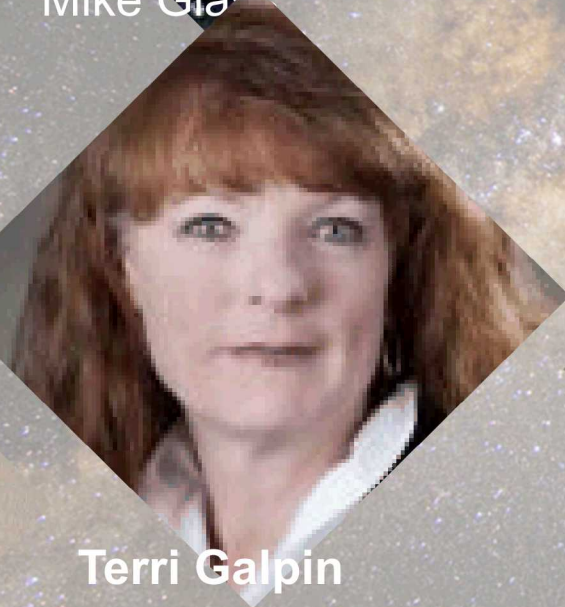
Mike Glass



Paul Wolfenbarger



Mark Hamilton



Terri Galpin

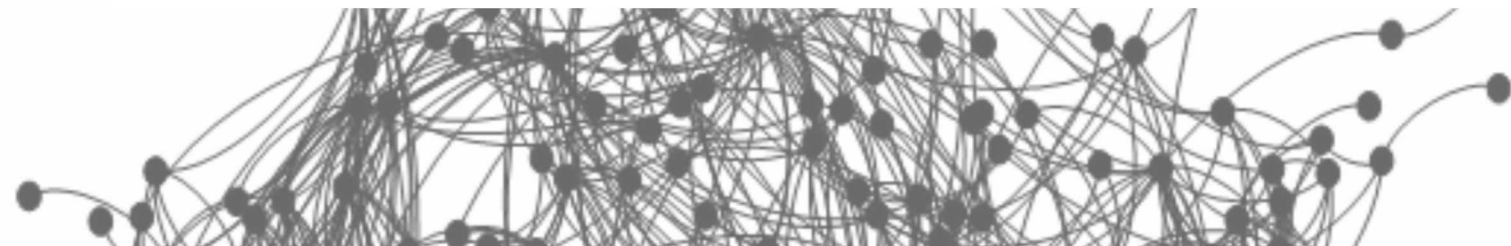


Rich Drake



Jim Flahive

**DevOps
ASC**



Seven Bridges of Königsberg –

<https://youtu.be/elb1cz06UwI>

Graph Theory and Discrete Mathematics Channel:

https://youtu.be/pmabQ_t4s4k



Moore's Law

