SAND2017-13013PE

Trilinos Linear Solver Product Inception Deck

Linear Solvers Team

The elevator pitch

- For ATDM/ECP/Office of Science/RAMSES/Sierra and External users
- who Need to run on next gen HW at scale.
- the Trilinos Solver project
- is an enabling technology
- that provides high performing, production ready, scalable solvers, both “turnkey” and customizable solvers
- Unlike existing libraries
  - –our project will provide robust solver libraries that deliver high performance and performance-portability

Slide 2

2 Regarding custom app-specific solvers, I think we need to deliver both turnkey capabilities AND the ability to customize. Our goal for our key apps is that they should not have to compromise performance (time or memory) to use our capabilities. Our strategy should enable and provide the blending of general and app-specific capabilities.
Michael Heroux, 8/18/2017

Solver Team Then and Now

- **Kokkoskernels** Siva Rajamanickam, Andrew Bradley, Mehmet Deveci, Kyungjoo Kim, Christian Trott
- **Applications** Clark Dohrmann, Kendall Pierson, Heidi Thornquist

- **MueLU** Jonathan Hu, Luc Berger-Vergiat, Christian Glussa, Chris Siefert, Ray Tuminaro, Brian Kelley
- **ShyLU** Siva Rajamanickam, Andrew Bradley, Nathan Ellingwood, Alexander Heinlein, Kyungjoo Kim, **Ifpack2** Jonathan Hu, Mark Hoemmen, Chris Seifert, Brian Kelley
- **Teko** Eric Cyr, Edward Phillips
- **Belos** Heidi Thornquist
- **Trilinos solvers** Siva Rajamanickam, James Elliott, Paul Lin

The NOT list

IN	OUT
Scalable performance, production quality for key solvers and preconditioners	Any guarantees on research codes being developed in Trilinos Solvers (see below)
Trackable deliverables	Fault tolerance
Scalable solvers and preconditioners	Epetra64
Kokkos, CUDA, OpenMP, MPI+X	OpenACC, OpenCL, System-wide tasking
Documentation, examples, tutorials.	

UNRESOLVED
Solver resources
Interaction with research projects (LDRD, ASCR, ECP). - Need to define clearly
Where to draw the line for research projects that develop within Trilinos ?

Slide 4

4 Out can include: Every variation of iterative method.

Michael Heroux, 8/18/2017

What keeps us up at night

- Staffing:
  - At all levels. No solver specific staffing or “solver” team. Fractured efforts.
- How do we ensure product quality and deliver on research commitments ?
  - Is Scientific Programmer a possibility ?
- What are product leaders’ responsibility, not first level of support but first PoC for planning, deliverables, design. ALEGRA/Xyce/DAKOTA follow similar model
- Product Leaders or capability area leaders in the old model has no authority except in their own packages. We might have to change it.

6 Totally agree: These issues are exactly I want a linear solver product.
Michael Heroux, 8/18/2017

Backup

The A-Team

#	Role	Competencies/Expectations
1	Product Leader	Planning, Scoping
2	Trilinos Developers	Maintain community standards for products
3	Product Manager	Budgeting, Funding, Staffing, Tracking deliverables
4	Product Architect (Could be product leader)	Design decisions at the product level and consistency across the products

Slide 7

9 Product leader: Has authority to direct and prioritize linear solver activities, including the authority to direct package team activities toward efforts that benefit the overall linear solvers project, not just the package.

Product architect (may be the leader): Leads development of a unified linear solver API.

Trilinos Developers: Develop solver capabilities in a way that optimizes the value of the Trilinos Linear Solvers product as a whole. Makes their package available via the standard API. Utilizes the standard API when using other Trilinos solver capabilities.

Product manager: Not sure this is needed or realistic, as separate from the product leader.
Michael Heroux, 8/18/2017

2 I didn't know the formal definition of product owner or manager. Here's a link I found helpful: https://techbeacon.com/how-agile-distinguishes-between-product-managers-product-owners
Jonathan Hu, 8/23/2017

Why are we here?

- To better organize Trilinos efforts around core capabilities or products of Trilinos
- To focus on a product like model from planning to delivery of solver capabilities

Plan, Execute and deliver solver capabilities in Trilinos

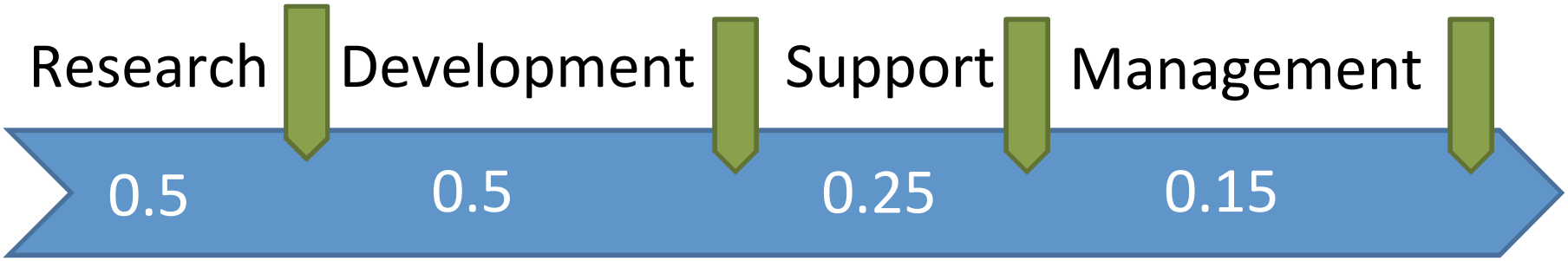
Slide 8

8 While these statements are true, I think we need statements that presume we are an integrated product. Statements like this would be appropriate:
- Provide state-of-the-art scalable linear solvers for mission-critical applications.
- Provide components for customized solution capabilities for the most challenging science and engineering problems our customers have.
- Provide common, easy-to-use interfaces to all solver capabilities in Trilinos and relevant third-party libraries.
- To unify Trilinos linear solver efforts so that planning is unified, priorities are established across efforts, capabilities delivered for one package are usable across entire product suite, e.g., Muelu tools and containers.

Reason for product: To enable through effective linear solver libraries the solution of mission-critical, national security problems, now and in the future.

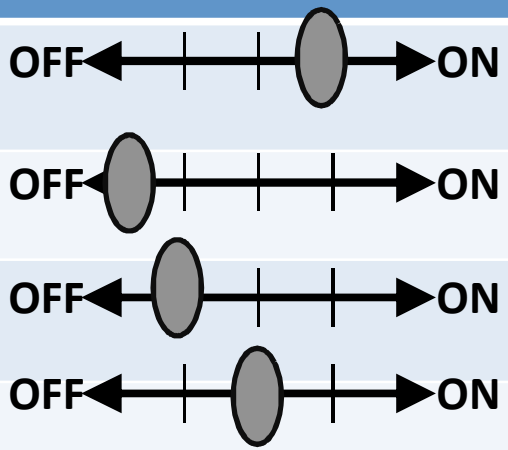
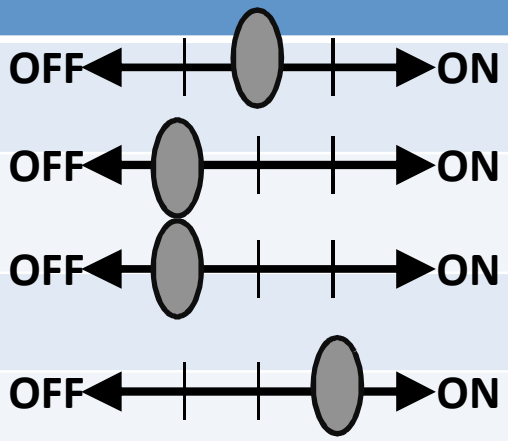
Michael Heroux, 8/18/2017

Annual FTEs: How big is this effort?



Total FTE estimate: 1.4

Trade-off sliders

	The classic four
	Feature completeness (scope)
	Stay within budget (budget)
	Deliver project on time (time)
	High quality, low defects (quality) (sustainability can be tuned)
	Other important things
	Ease of use
	Don’t make me think!
	Detailed audits (log everything)
	Performance and scalability