Applying the Scaled Agile Framework (SAFe) to Lean Systems Engineering

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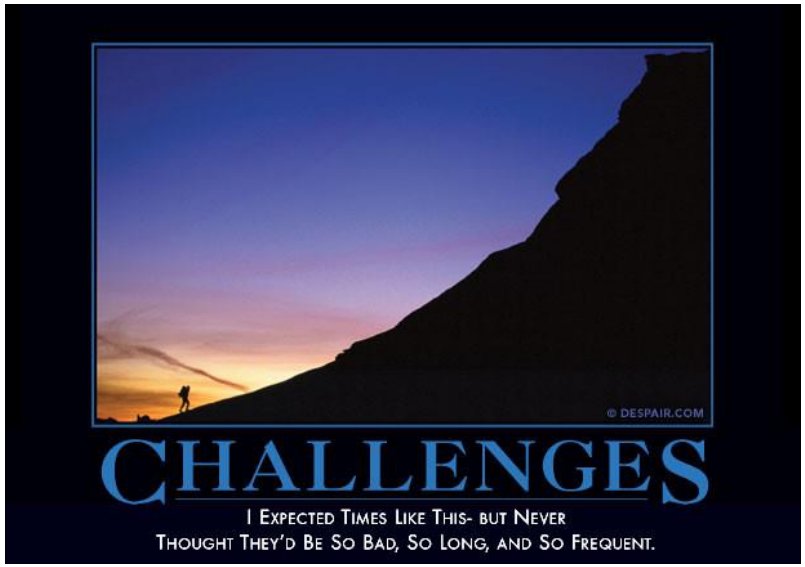
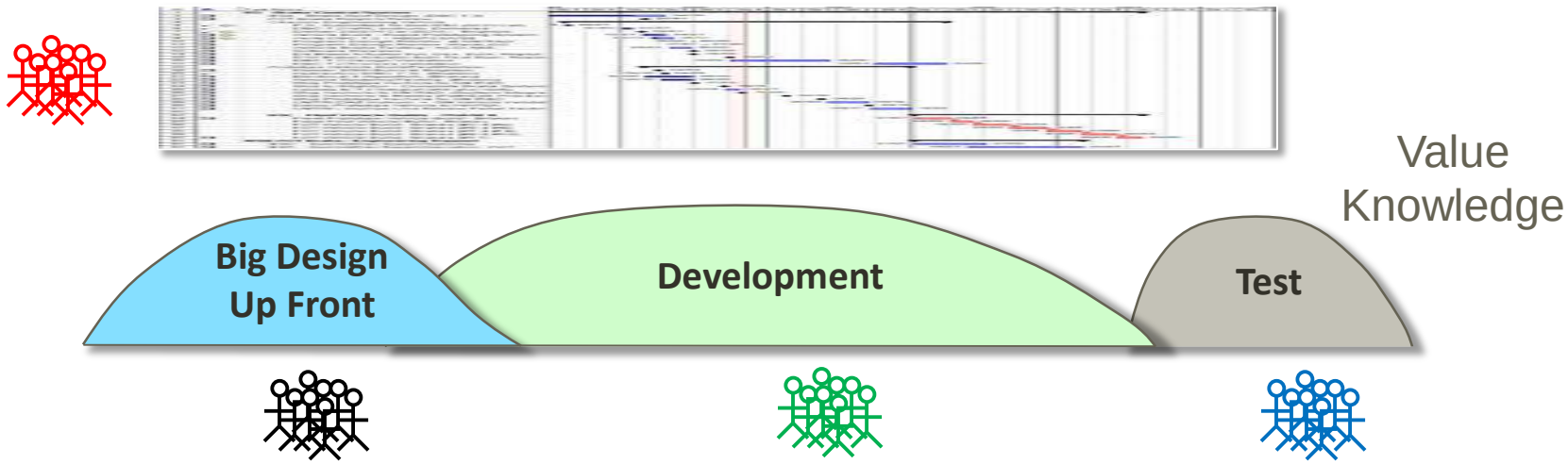
Engineering Challenges

- Increasing complexity
- Rapid reduction in cycle times
- Risk meeting customer/market needs
- Products in a continuous release cycle
- Solutions cross organizational boundaries (Systems of Systems)
- System-wide collaboration demands (BOF vs. BOM)
- Increased product variation
- Compliance - contractual, regulatory



Our Current System Cannot Address Challenges

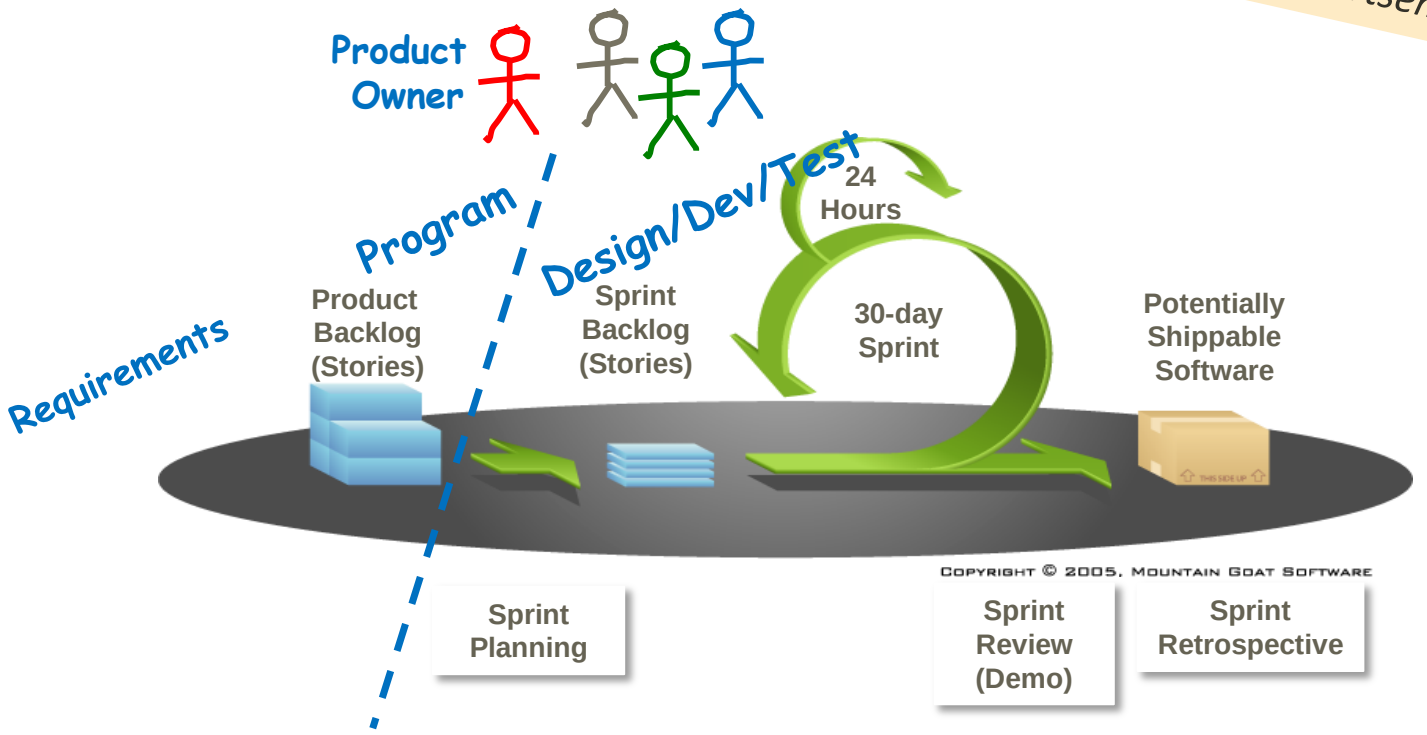
- System requirements, design, and schedule “defined” up front
- Difficult to defer decisions; reluctance to provide detail
- Project success defined by executing plan vs. delivering value
- Slow value deliver - delays, WIP, handoffs
- Not aligned to deliver value



Where Does Agile Excel?

- Answer: Alignment and Collaboration
- But, only solves team-level alignment and collaboration

> Principle of Alignment: *There is more value created with overall alignment than local excellence*
> -- Don Reinertsen



Apply Lean-Agile Principles

#1-Take an economic view

#2-Apply systems thinking

#3-Assume variability; preserve options

#4-Build incrementally with fast, integrated learning cycles

#5-Base milestones on objective evaluation of working systems

#6-Visualize and limit WIP, reduce batch sizes, and manage queue lengths

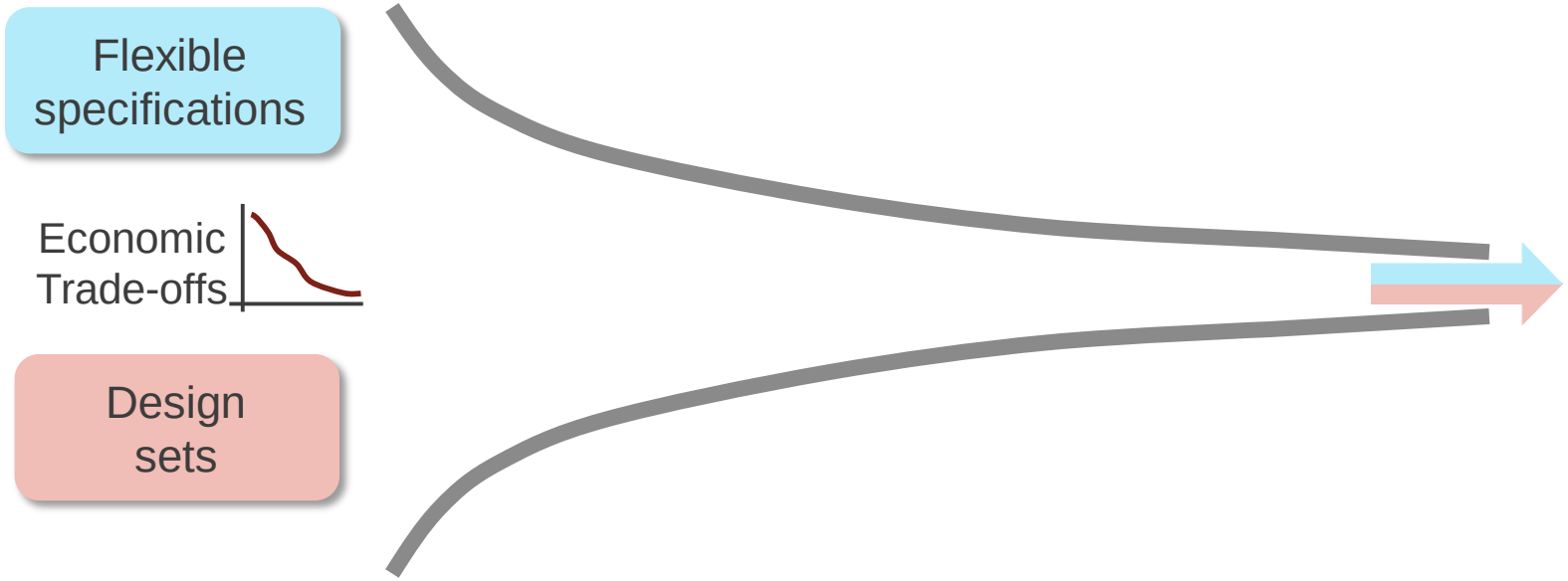
#7-Apply cadence, synchronize with cross-domain planning

#8-Unlock the intrinsic motivation of knowledge workers

#9-Decentralize decision-making

Assume Variability; Preserve Options

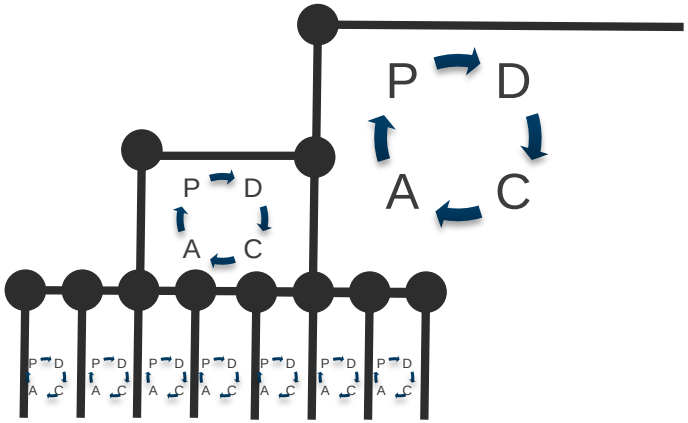
Aggressively evaluate alternatives.
Converge specifications and solution sets. — Allen Ward

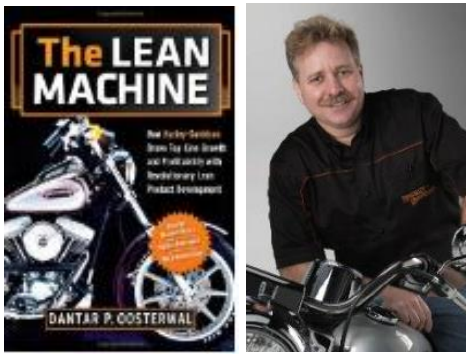


- You cannot possibly know everything at the start
- Requirements must be flexible to economic design choices
- Designs must be flexible to changing requirements
- Preservation of options improves economic results

Integrate and Test Frequently

"Integration points control product development"





***The Lean Machine**:*
How Harley Davidson Drove Top-Line Growth and Profitability with Revolutionary Lean Product Development

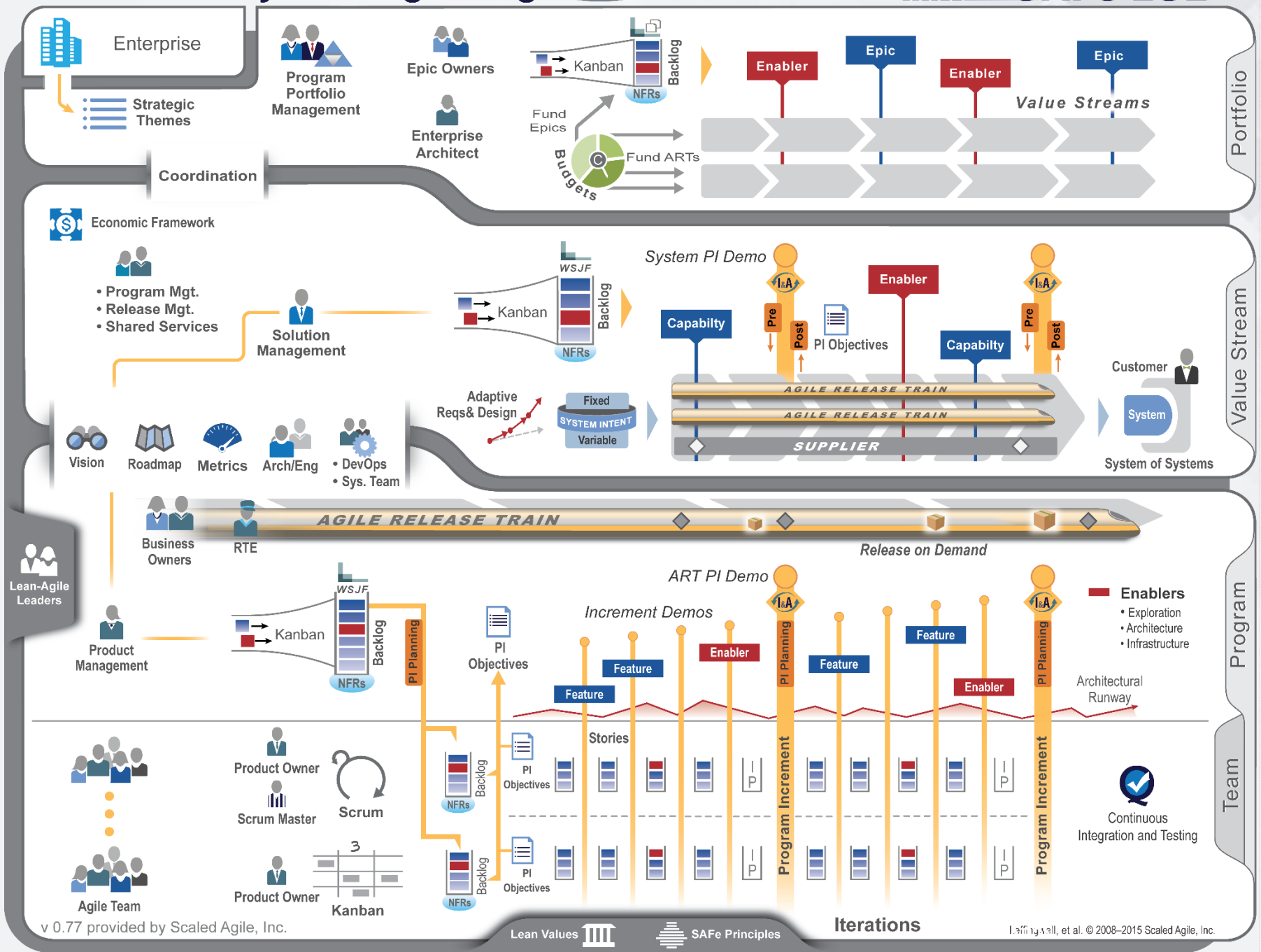
—Dantar P. Oosterwal

- Integration points are pull events that accelerate learning
  - Routine communication
  - Reduce variation
  - Objective evaluation
- Development can proceed no faster than the slowest learning loop
- Improvement comes through ***synchronization*** of design loops and ***faster learning cycles***

SAFe® for Lean Systems Engineering

Preview 2

SAFe® LSE



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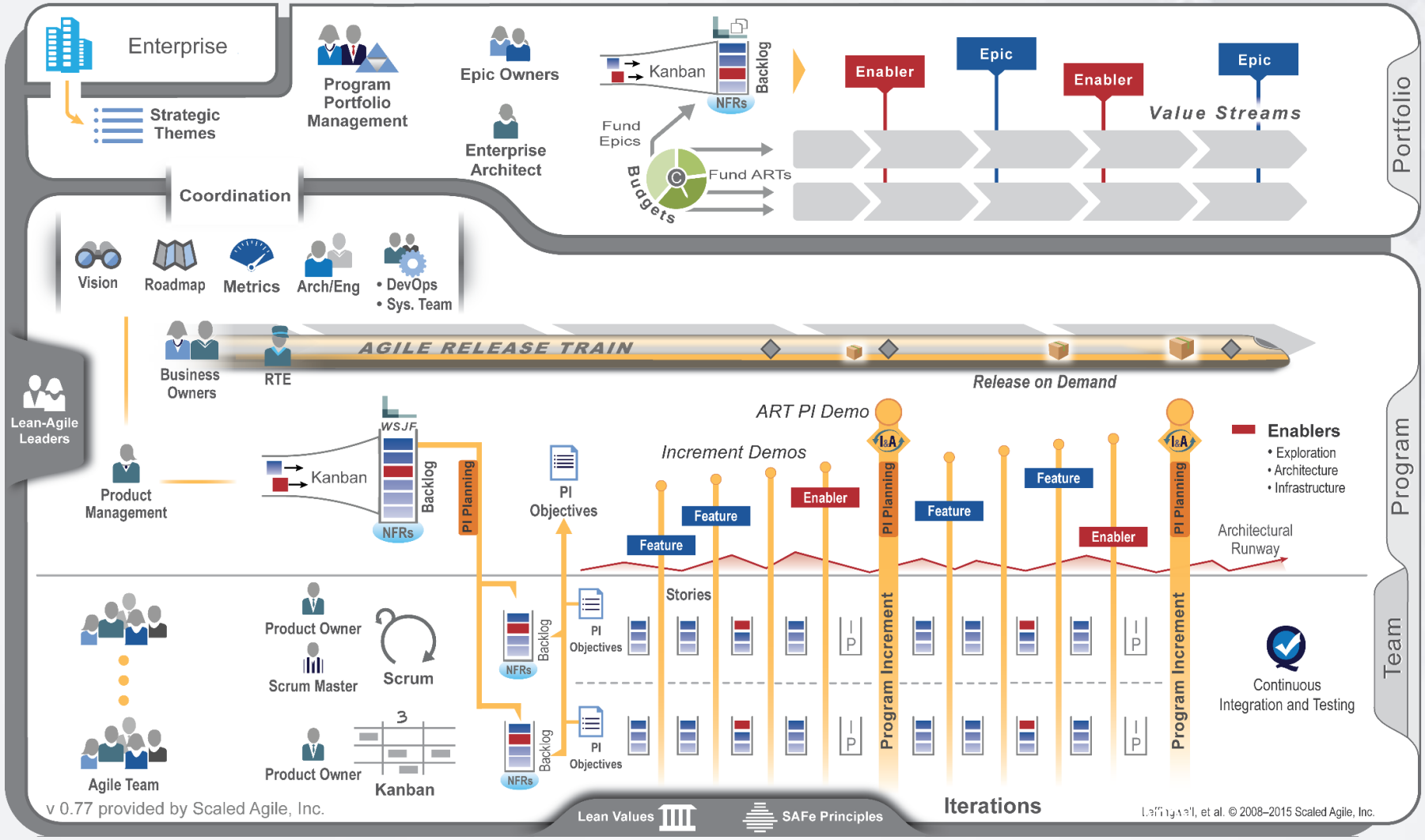
SAFe® for Lean Systems Engineering

Preview 2

SAFe® LSE



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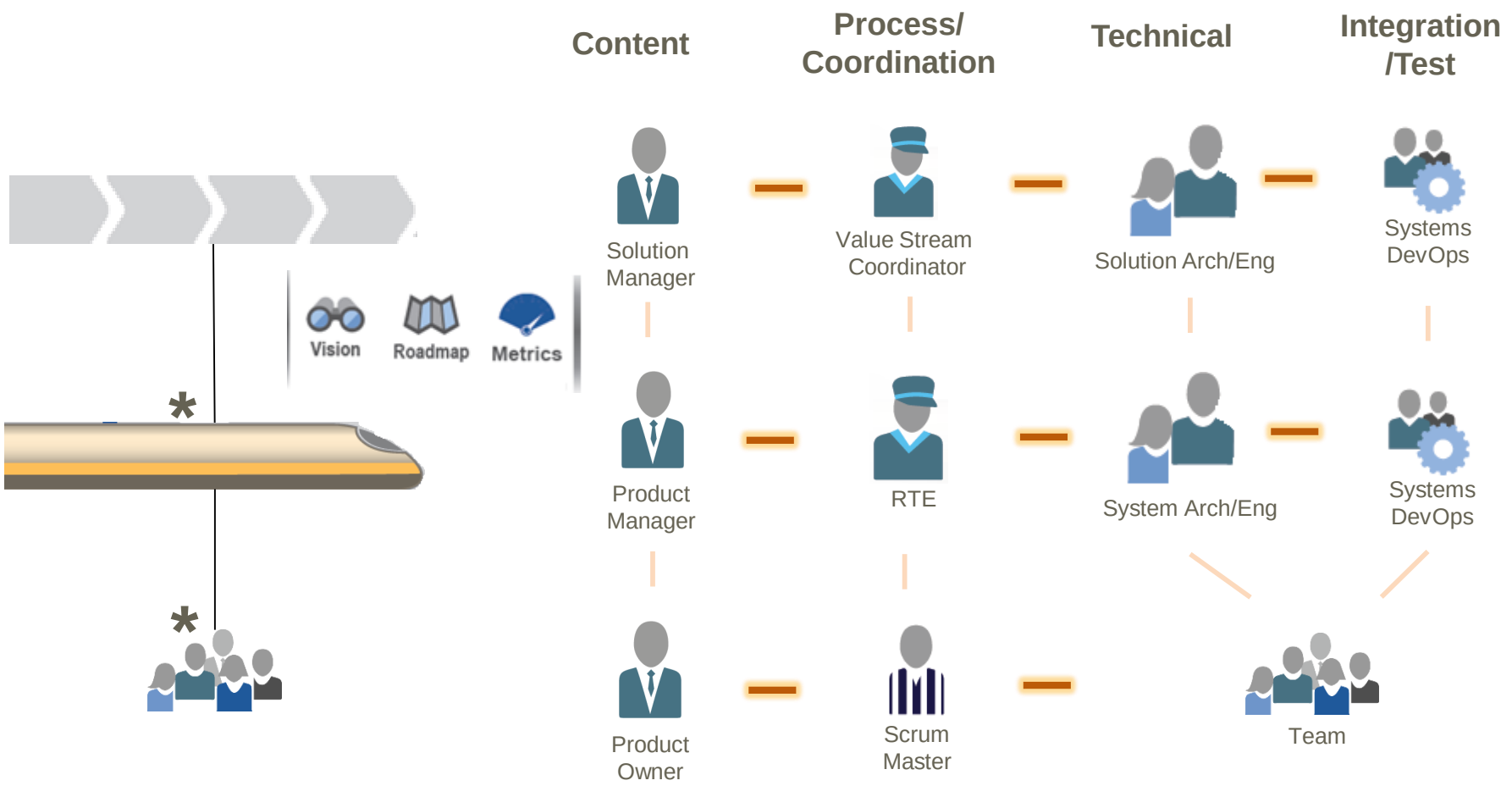
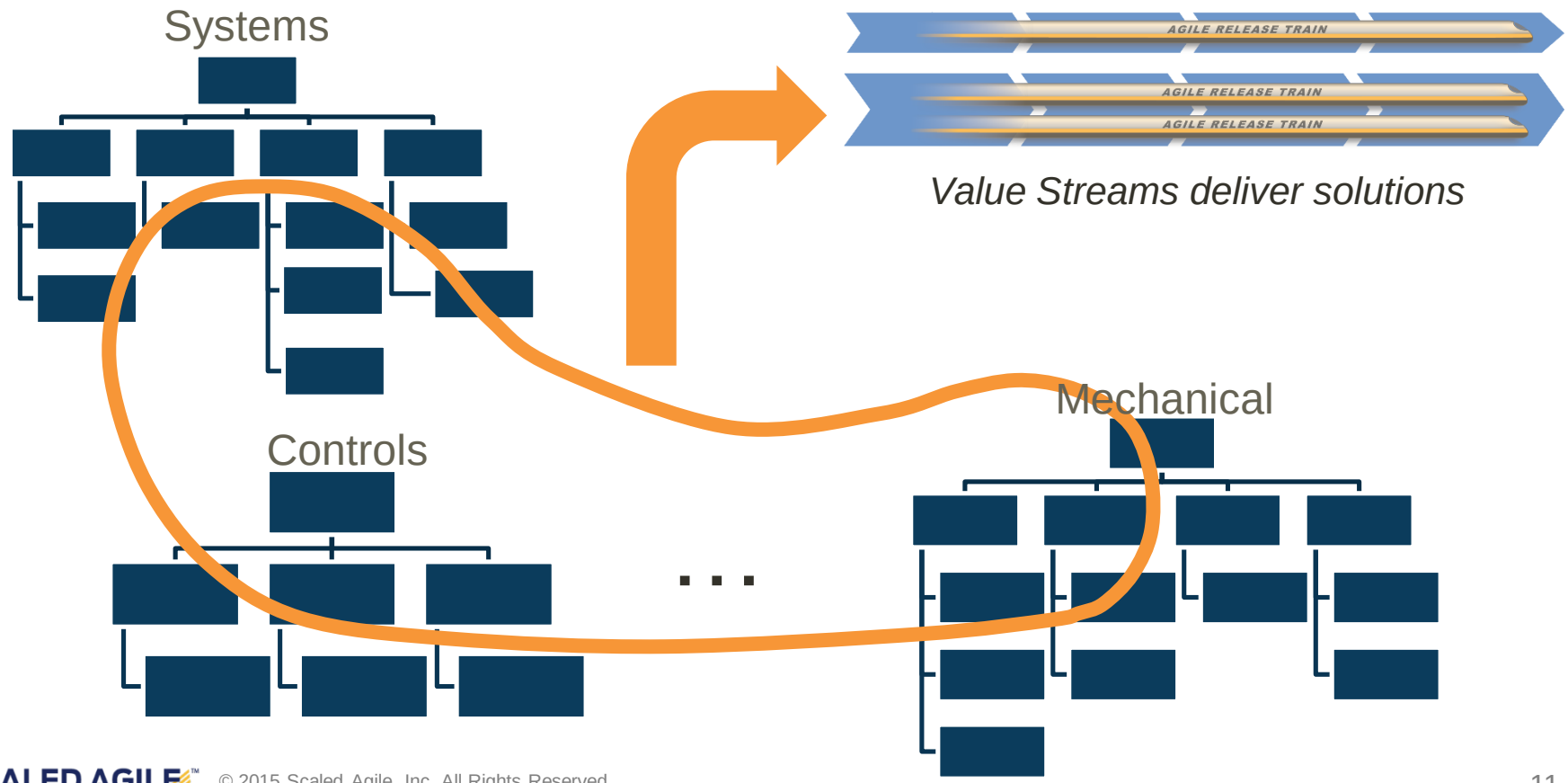
Coordinate and Align Within and Across Layers



Organize Around Value

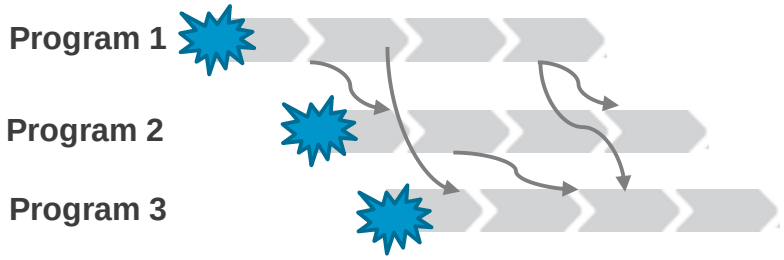
- Value doesn't recognize organizational or geographic boundaries
- Organize your people around your Value Streams



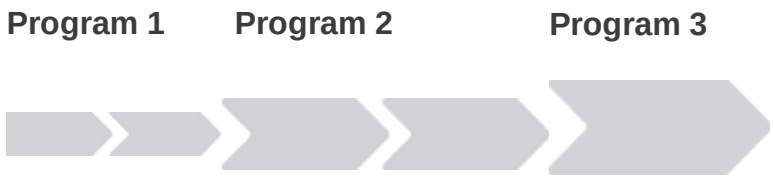
Programs Are NOT (necessarily) Value Streams

- Value Streams do not (necessarily) equate to contracts or programs
- Too much “people motion” leads to:
  - Unpredictable team performance
  - Lost productivity - *form-storm-norm-perform*
  - Limited reuse
  - Localized optimizations
  - No economies of scale

Don’t bring people to the work…



…Bring work to the people

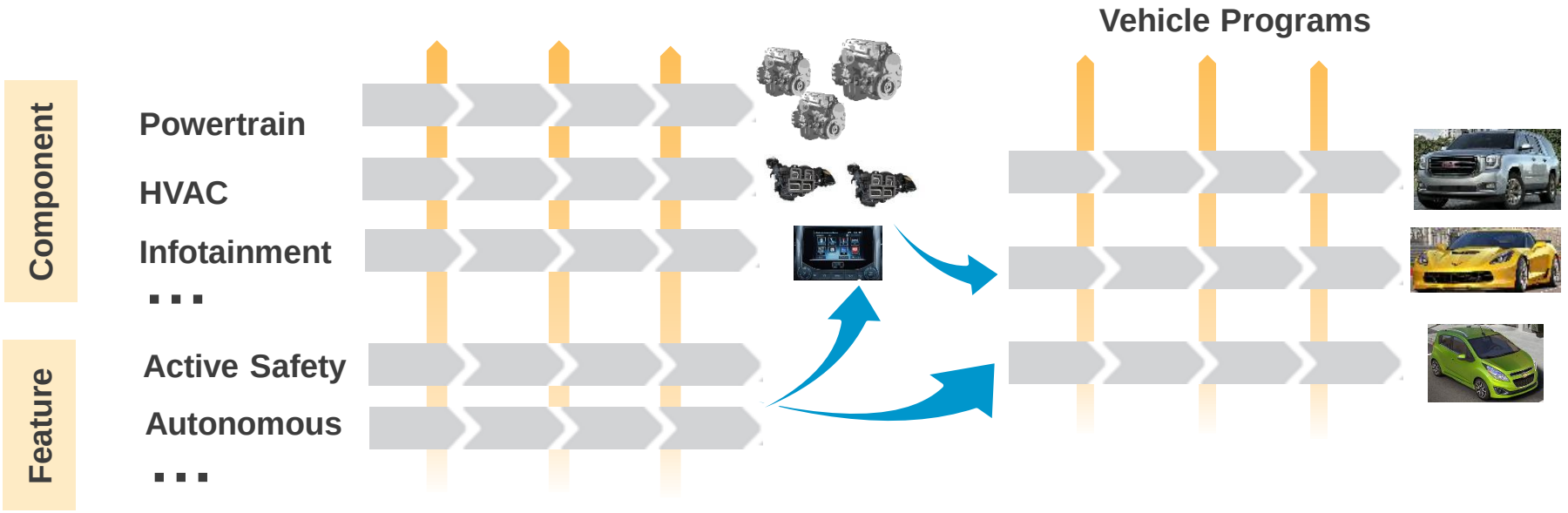


Use Value Streams to Deliver Product Variants

- Eliminate handoffs
- Organize around common product lines vs separate VSs
- Variants may be by feature or time (model year ‘17, ‘18)

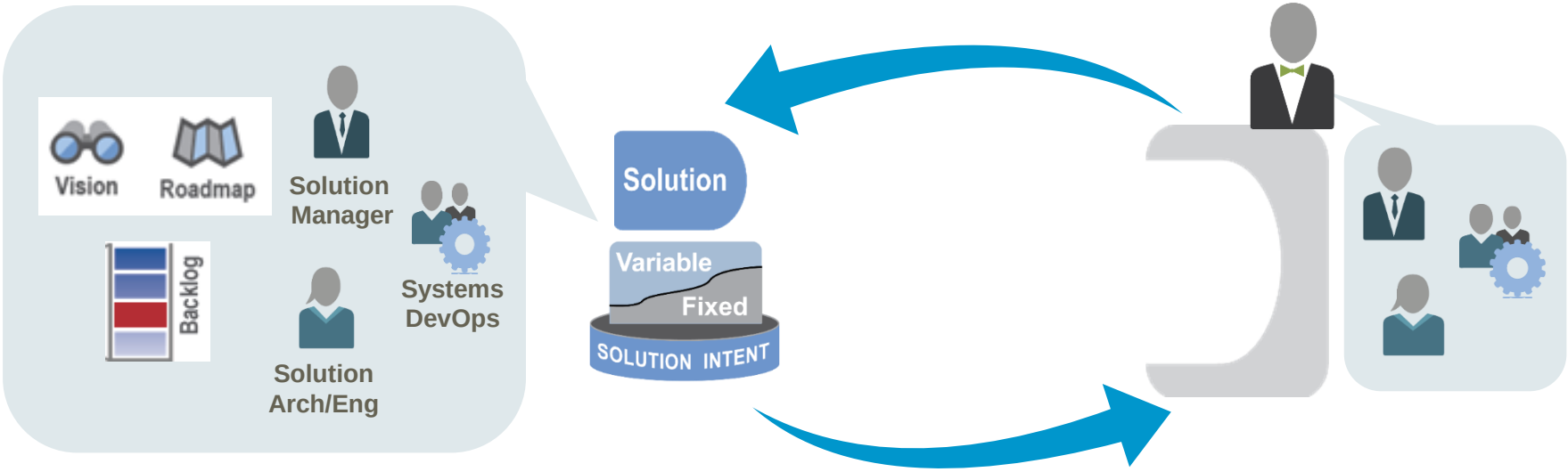
Value Streams Deliver Solutions

- Solution may be a component or feature
- Fund ARTs and cross-stream initiatives, not projects



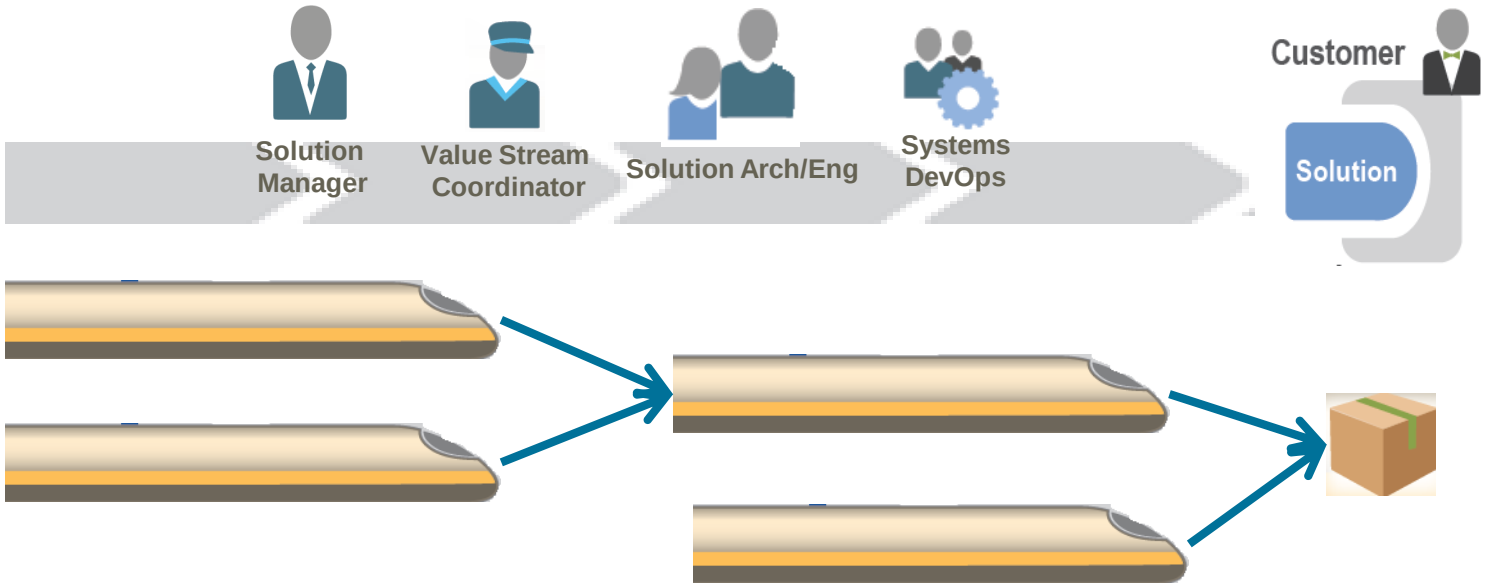
Solution May Require a Context

- Represents Suppliers and Systems or Systems
- Customer continuously collaborates on multiple dimensions
  - Content (backlog), technical, integration, program/budget



ARTs Build Value Stream's Solution

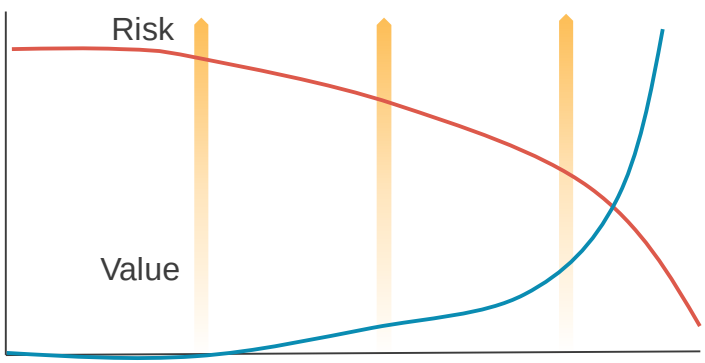
- ARTs deliver each increment (and ideally sprint)
- Continually integrate solution at least each increment
- Value Stream roles coordinate – content, technical, I&T



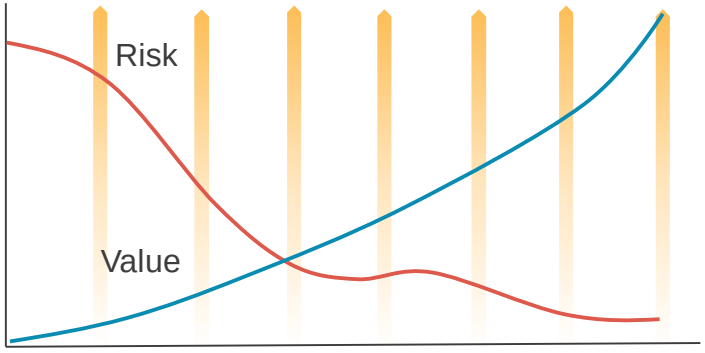
Replace Gates with Cadence-Based Learning Cycles

Base milestones on objective evaluation of working system

- “Pull” event to integrate entire system
- Work may include simulations, models, experiments, etc.



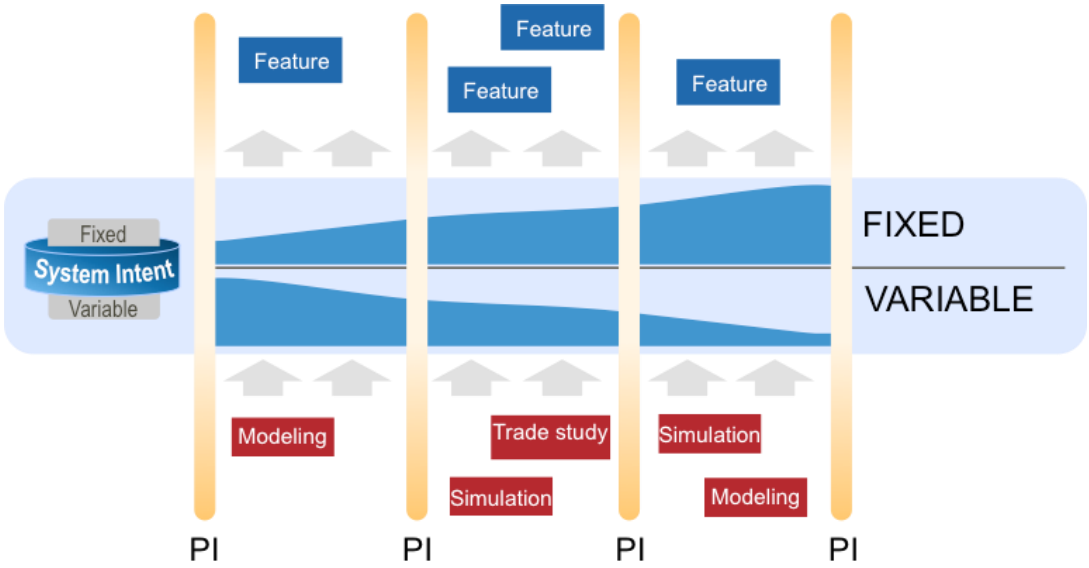
Waterfall



Lean-Agile

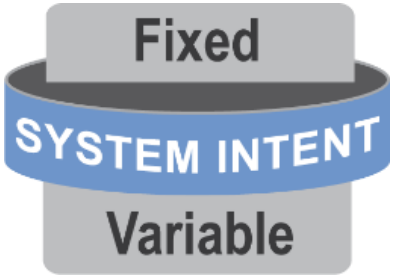
Learning Moves Variable to Fixed

- Simultaneously learn what we know, discover what we don't know
- Enablers create knowledge, decisions, and runway to build Features
- Decisions made with sufficient time to support feature building
- Accelerated by MBSE and Set-Based Design

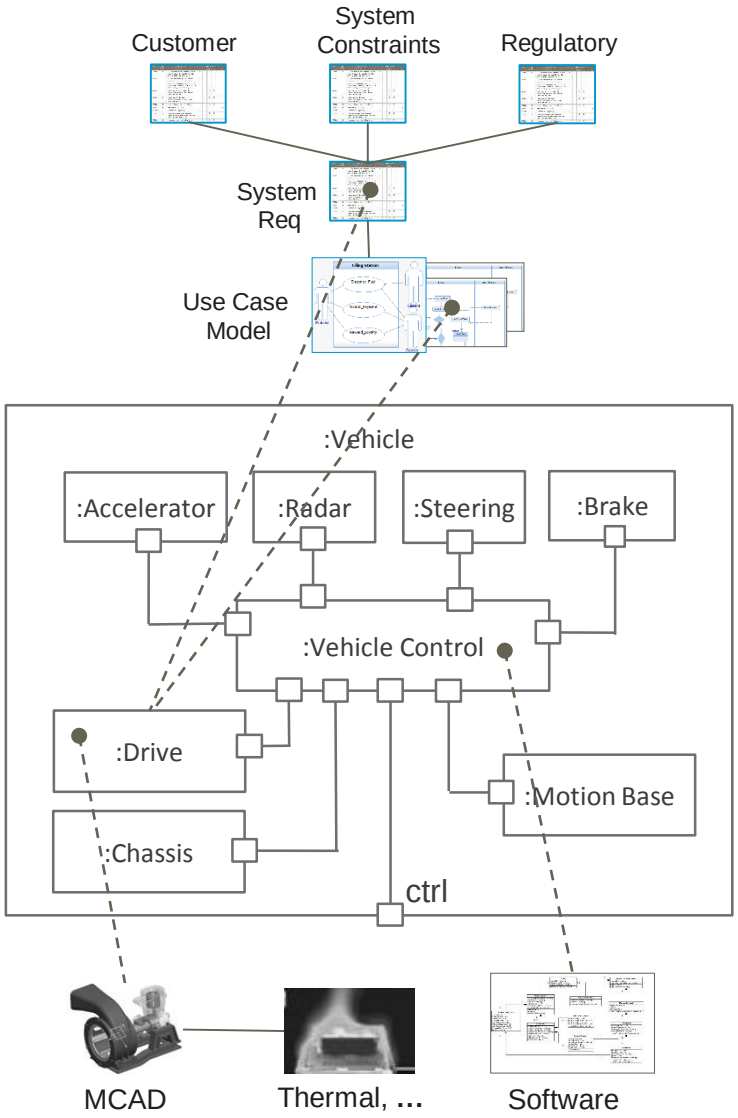


Record Knowledge in System Intent

- Repository of collective system knowledge
- Single source of truth to communicate decisions
- Populated by results of Enabler work
- Facilitates impact analysis
- Supports regularity and contractual compliance



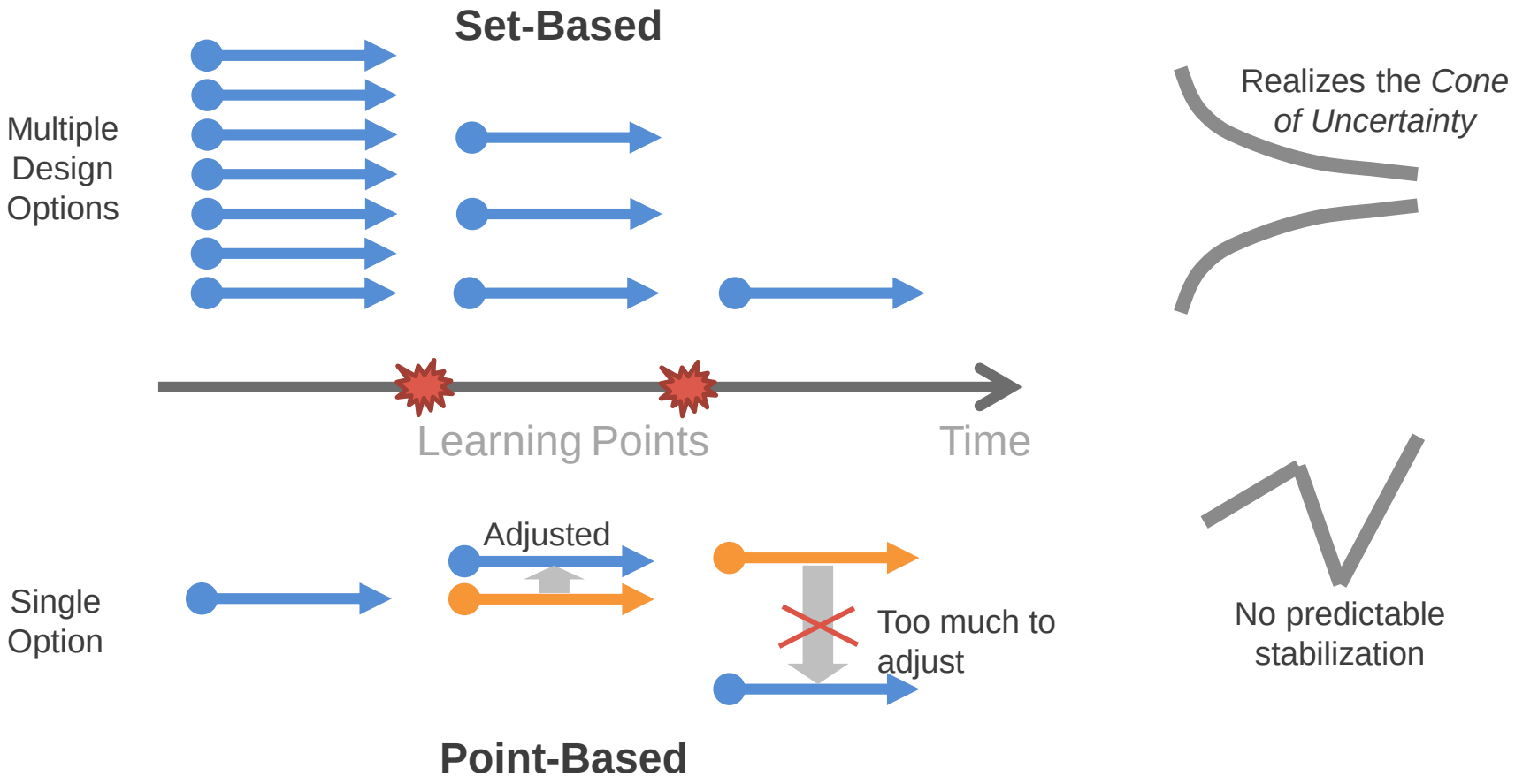
Use Models (MBSE) to Organize System Intent



- Communication
- Impact analysis
- Strategic reuse
- Source for generating compliance documents

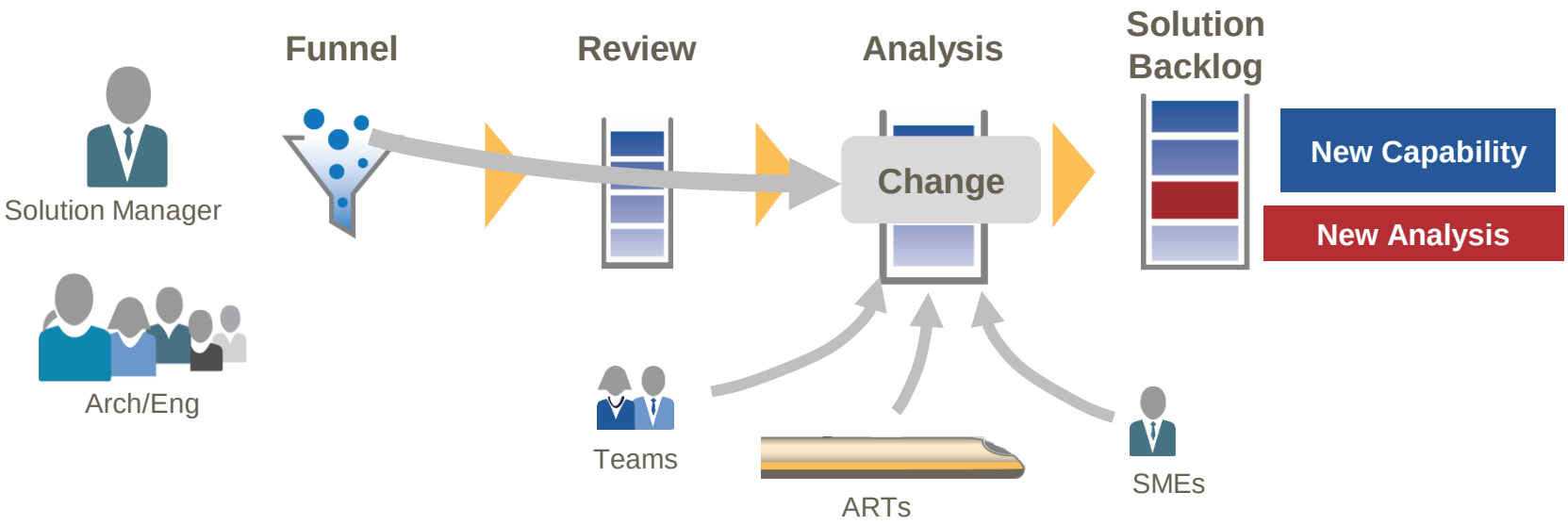
Make Better Decisions with Set-Based Design

Set-Based Design preserves options to make the best economic decisions based on objective evidence



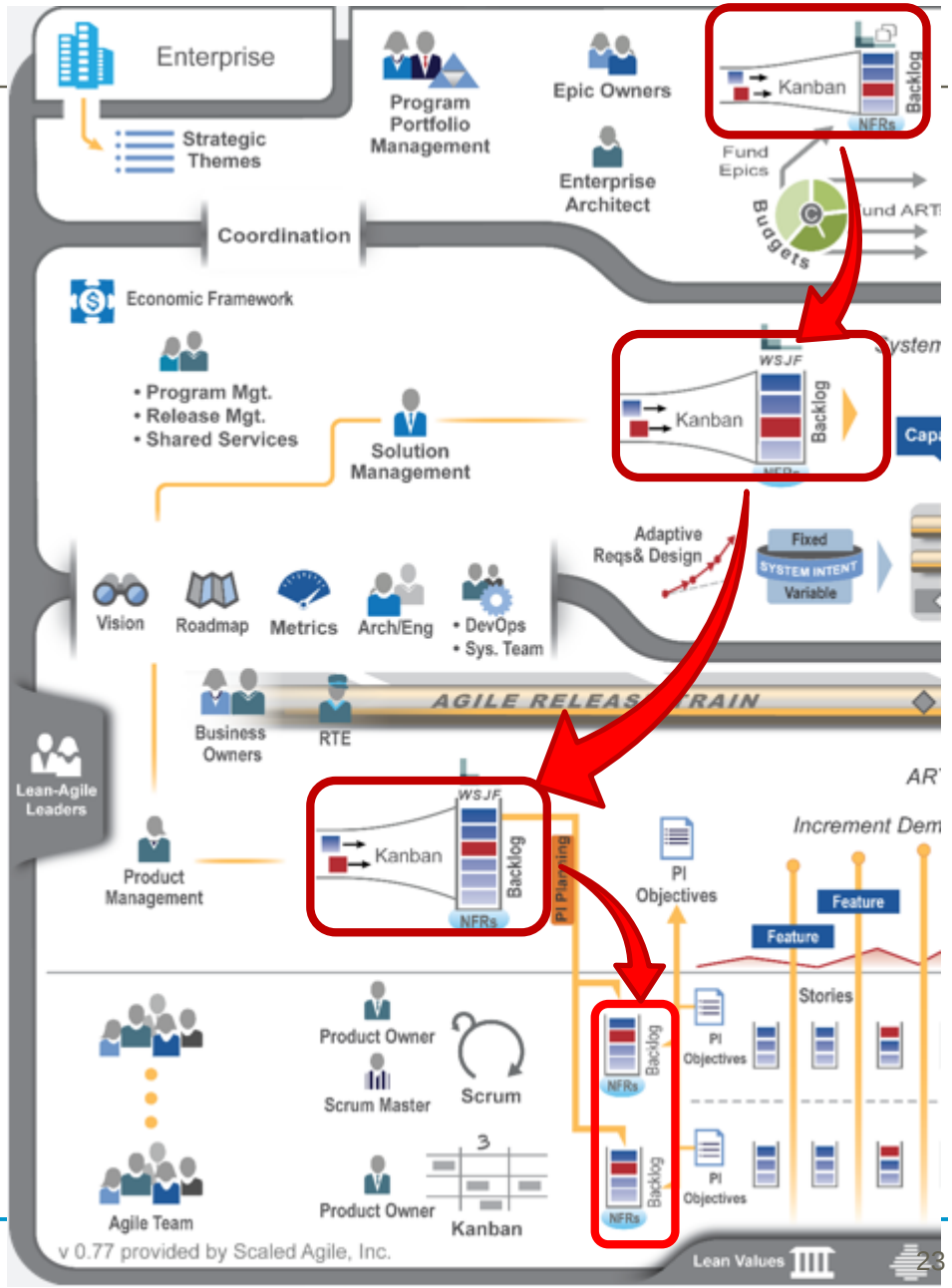
Manage Change with Solution Kanban

- Organizes “boards”/CCBs
- Prioritized by Solution Management
- Reviewed by System Engineering (utilize System Intent)
- Analyzed by effected stakeholders

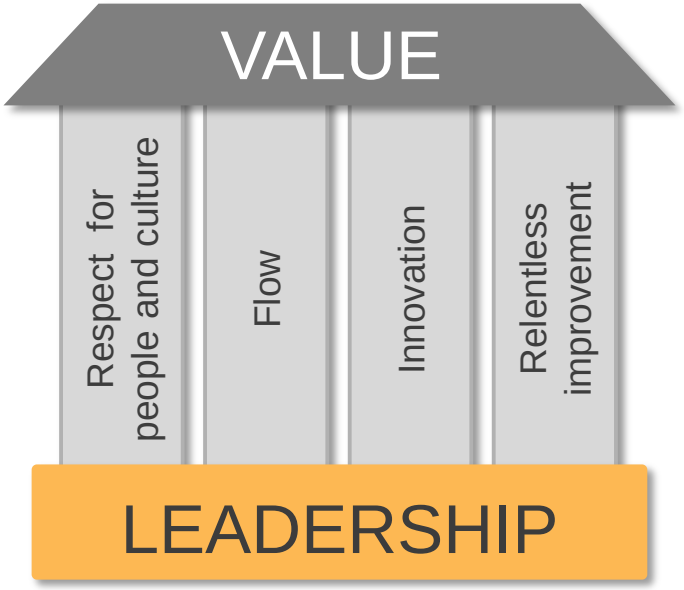


Connected Kanbans

- Backlogs contain centralized initiatives and local context
  - *Centralized strategy; decentralized decisions*
- Increased visibility into the flow
- Hierarchical content governance system



Change Requires Leadership



People are already doing their best; the problems are with the system.

Only management can change the system.

—W. Edwards Deming

- Lead the change
- Know the way; emphasize life-long learning
- Develop people
- Inspire and align with mission; minimize constraints
- Decentralize decision-making
- Unlock the intrinsic motivation of knowledge workers

Acquire the Knowledge

1 *Implementing SAFe*

- Ingrain deep SAFe knowledge (SPCs)
- Identify value streams; structure ARTs
- Train others

SAFe Program Consultants (SPCs)

2 *Leading SAFe*

- Develop Lean-Agile leaders
- Organize and support ARTs
- Implement Agile Portfolio

3 *SAFe for Agile Teams & ART Quick start*

- Organize and train Agile Teams
- Start the Train
- Plan and execute the first Program Increment

SAFe ScrumXP Scrum Master & Product Owner Orientation

4 *Supporting role-based curriculum*

- Product Manager/ Product Owner
- Portfolio Management
- Scrum Master *
- Release Train Engineer *

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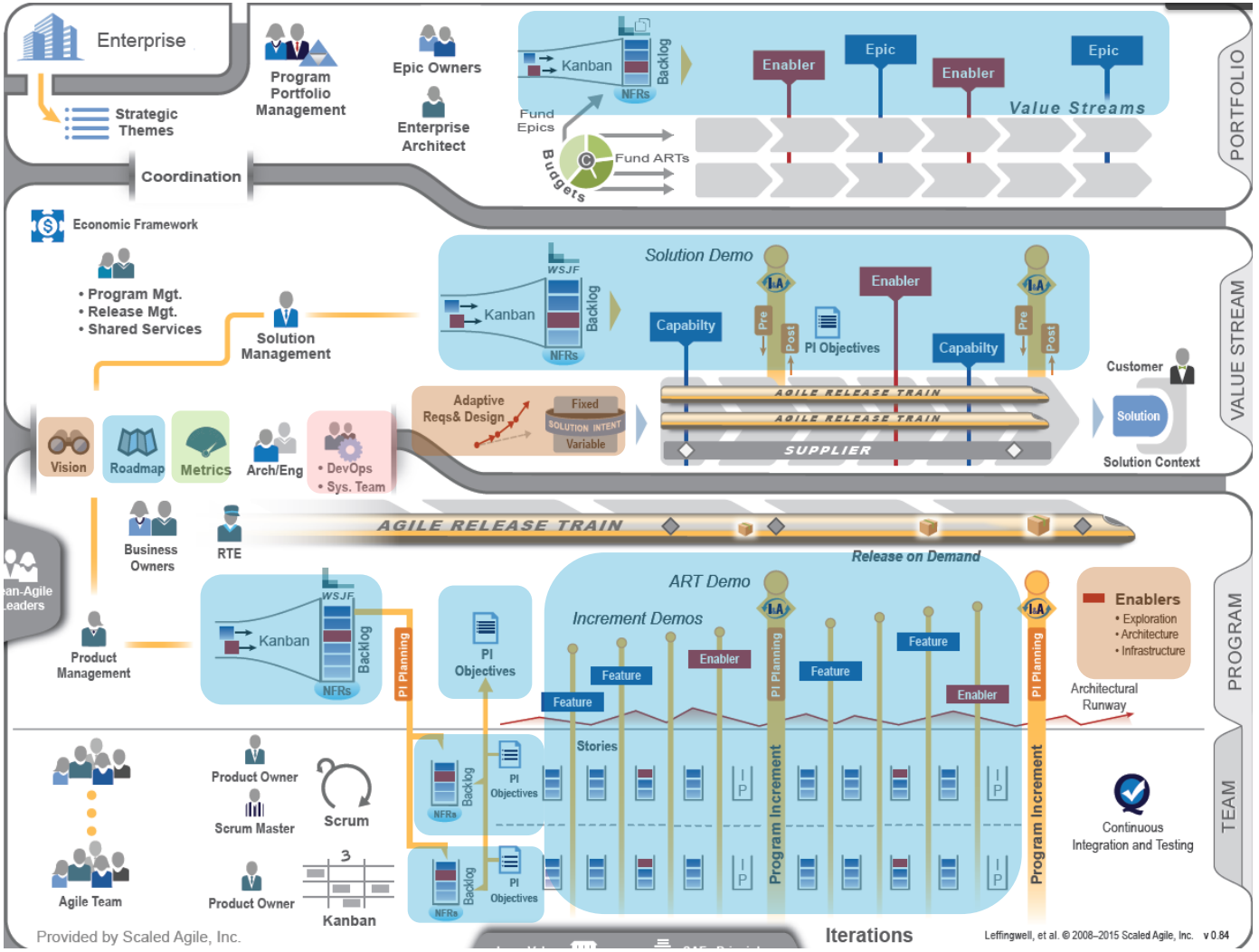
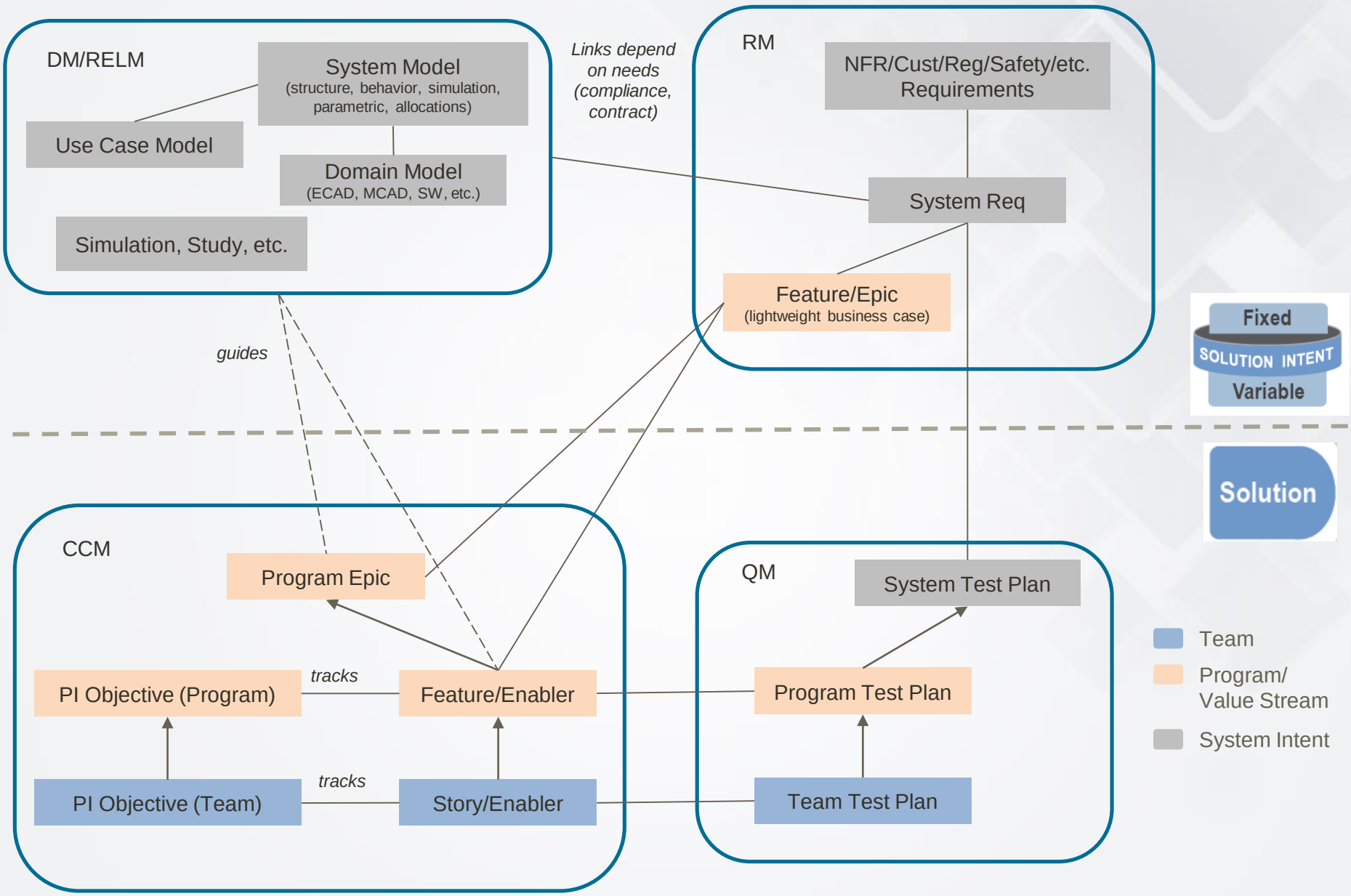
Rational Support For SAFe LSE

- CCM
- RM, DM, RELM
- QM
- Reporting




DM/RELM
System Model
(structure, behavior, simulation, parametric, allocations)
Use Case Model
Domain Model
(ECAD, MCAD, SW, etc.)
Simulation, Study, etc.
Links depend on needs (compliance, contract)
RM
NFR/Cust/Reg/Safety/etc. Requirements
System Req
Feature/Epic
(lightweight business case)
guides
Fixed
SOLUTION INTENT
Variable
Solution
CCM
Program Epic
PI Objective (Program)
tracks
Feature/Enabler
PI Objective (Team)
tracks
Story/Enabler
QM
System Test Plan
Program Test Plan
Team Test Plan
Team
Program/ Value Stream
System Intent