Implementation Approaches and Risks for System Engineering Environments

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Objectives

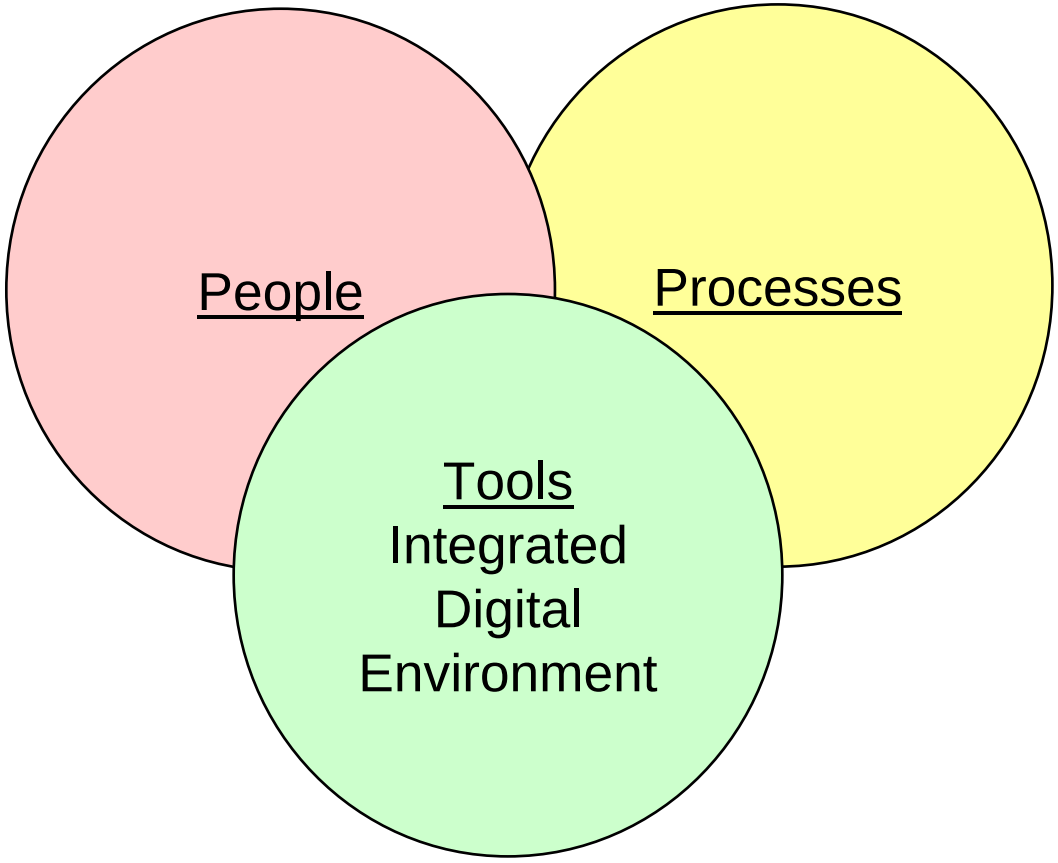
- Illustrate application of Program Risk Management principles in the complex context of creating an enterprise level Integrated Digital Environment

- Share lessons learned -- what works and what does not

Background

- SAIC History
  - Founded by highly skilled technologists with emphasis on research and application of physical sciences
  - Grew in many separate sectors of federal, state and local markets by providing expert services in technology and information science
  - Evolved to a leader in platform-independent systems engineering and integration
- SAIC Culture
  - Emphasis on innovation and tailored solutions
    - Best solution for each customer
    - Honest broker among technologies and vendors
  - Integration of technologies
  - Integration of systems

Foundation for Excellence



Benefits of an IDE

- inSTRIDE™ is a key element of SAIC's approach to SE&I
  - Integrated set of tools for management and technical performance of SE&I Programs
- Benefits of a common set of integrated tools
  - Accelerates Program start up
  - Contributes to consistency in Program execution
  - Improves efficiency in Program Management, Project Control and System Engineering
  - Institutionalizes lessons learned and skills developed in our separate market sectors

The Risks that Matter

- All programs must face and surmount a variety of risks (technical, cost, schedule, etc.) and these risks become more formidable as the size of the program increases
- Enterprise level programs also face unique risks that arise from the organizational and cultural environment.
- These are the risks that matter the most and the ones that can doom a program if not managed wisely
- As always, the key steps to risk management are
  - Risk Identification and Quantification
  - Response Development and Control

Major Risks to an Enterprise Level Program

- Organizational Challenges
  - Reaching consensus on competing requirements and priorities
  - Impediments from organizational boundaries
- Achievement Challenges
  - Achievement shortfall >> Need to deliver value quickly
  - Keeping agility and strategic focus
- Cultural Challenges
  - Resistance to change
  - Cost of change

Organizational Challenges

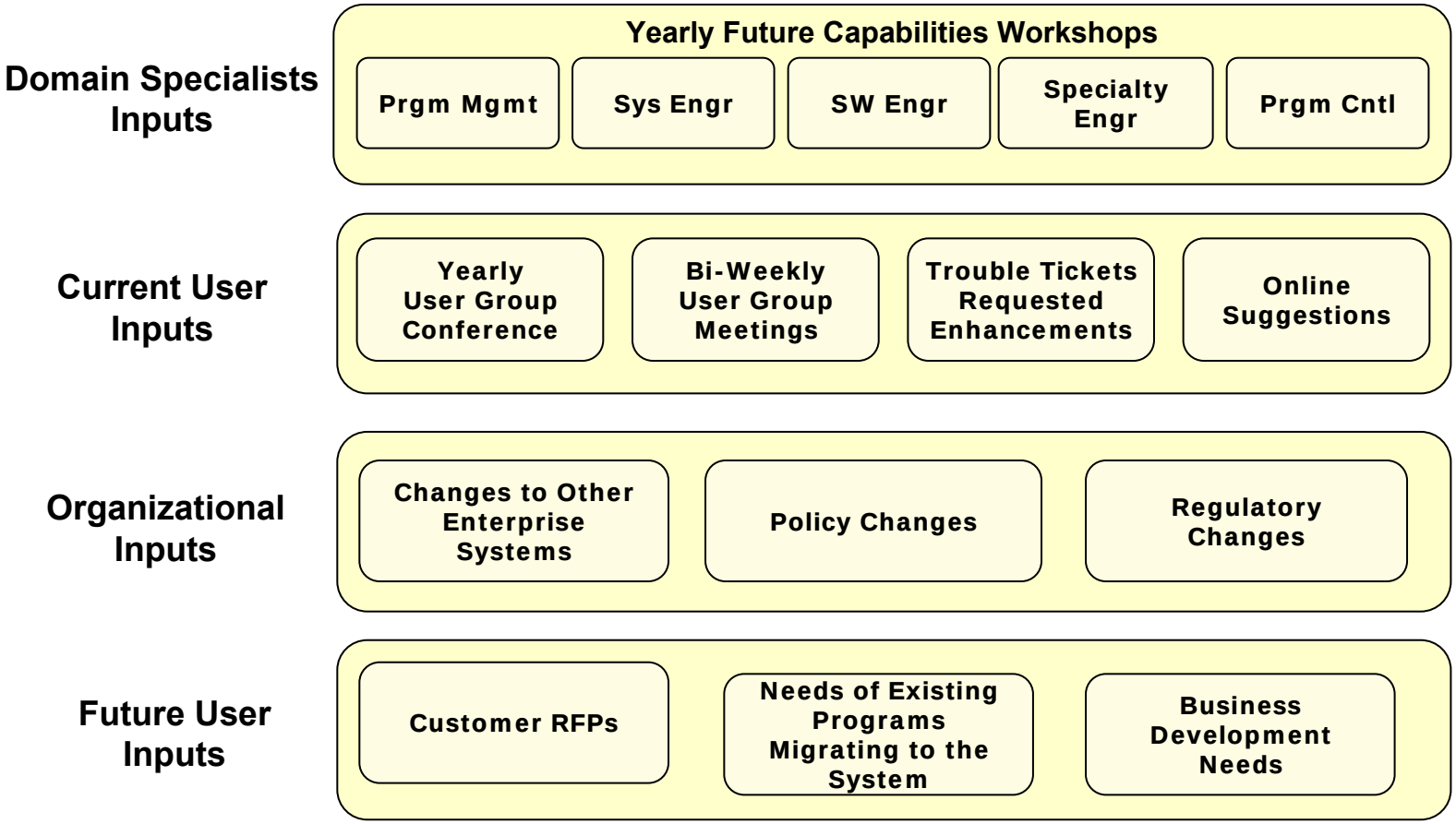
Requirements Definition Risk

- Risk: Improperly identified or prioritized requirements
  - Conflicts often arise between the needs and priorities of different parts of the enterprise
- Typical requirements definition failures
  - Ignoring the needs of some organizations
  - Misjudging the priorities among competing requirements
  - Adopting blanket high level requirements that are too imprecise to implement in a manner that satisfies anyone
  - Immersion in minutia that either defeats closure or defies timely and affordable implementation

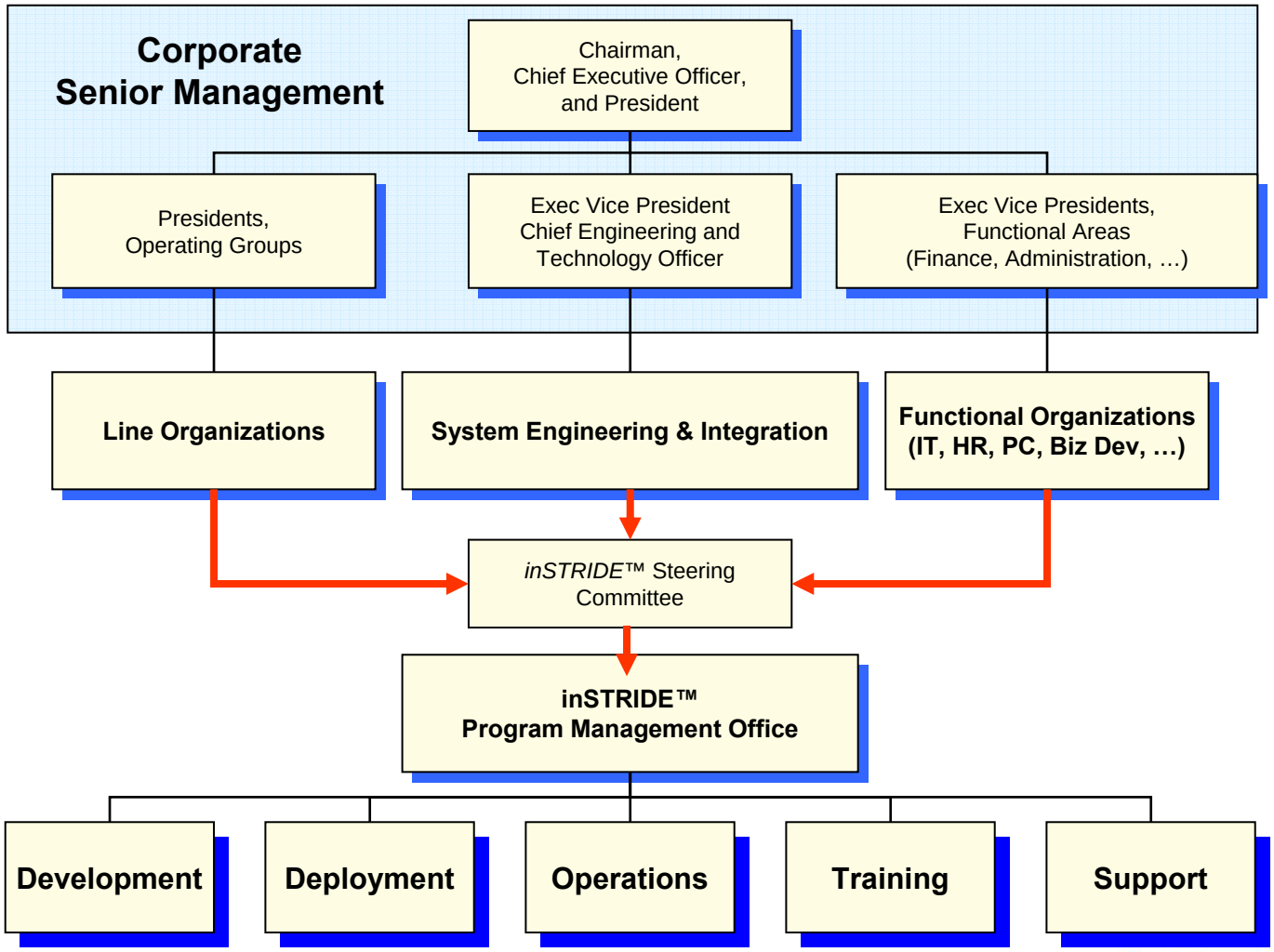
Requirements Definition Solutions

- Solutions
  - Define stake holders across enterprise in diverse organizational communities
  - Establish multiple communication channels
    - Most effective is regular, structured periodic interactions
  - Hold joint workshops with representatives from all organizations at working levels
    - Obtain and understand group's prioritization
    - Take forward recommendations to higher governance bodies
  - Select requirements that address real business needs
  - Establish governance body with high-level involvement of organizational stake holders
    - Essential to setting priorities that will be respected (recognized as valid) by all stakeholders

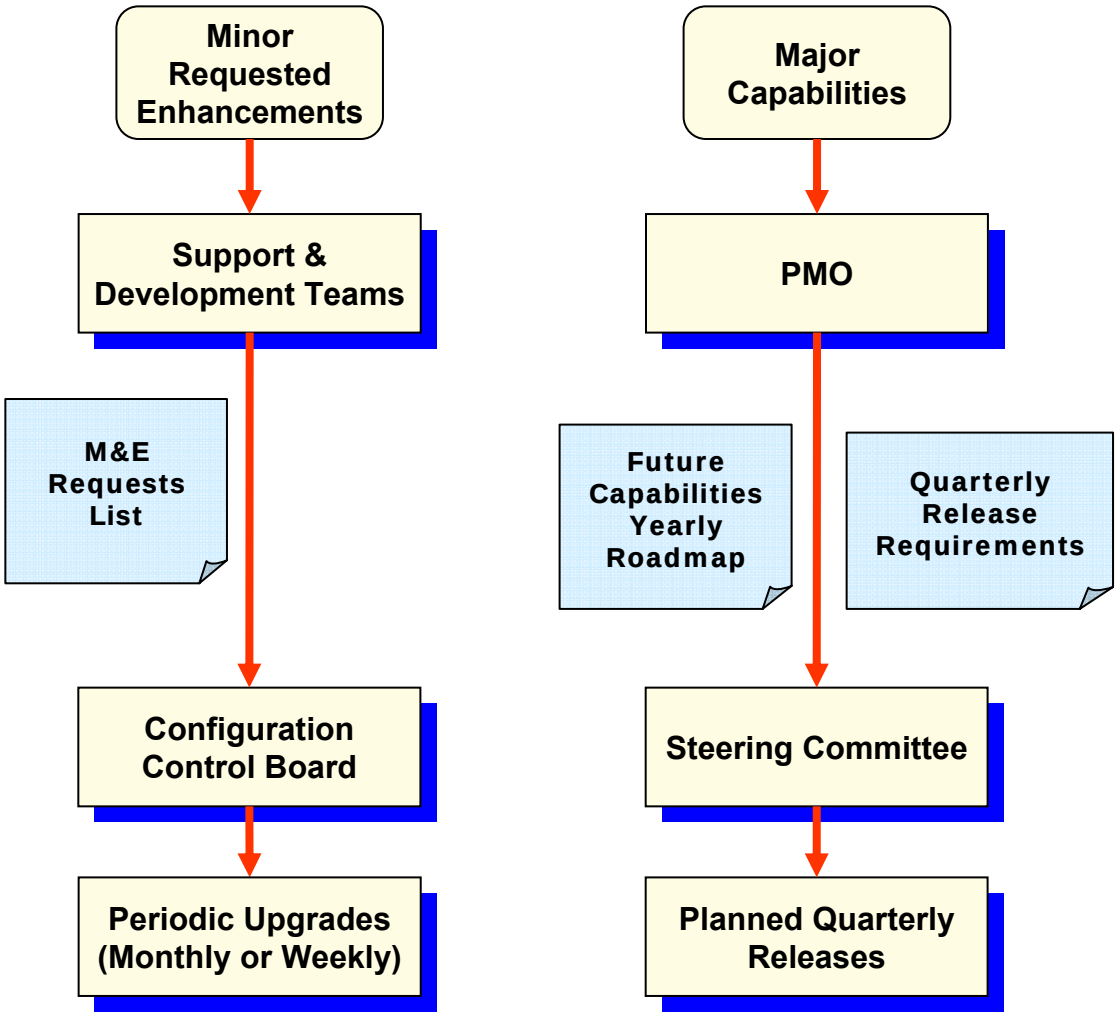
Sources of Requirements



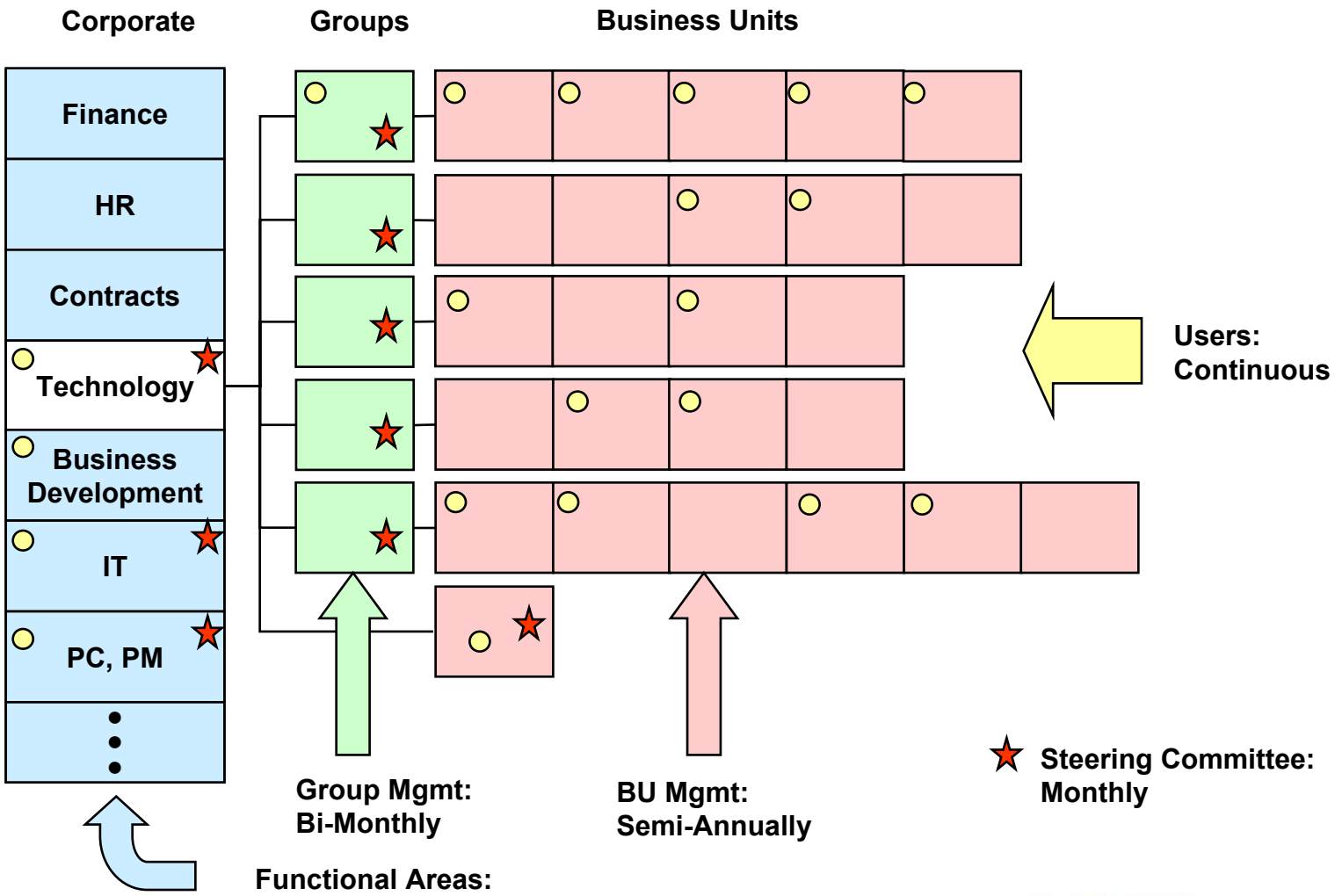
Governance Structure



Review and Approval Paths

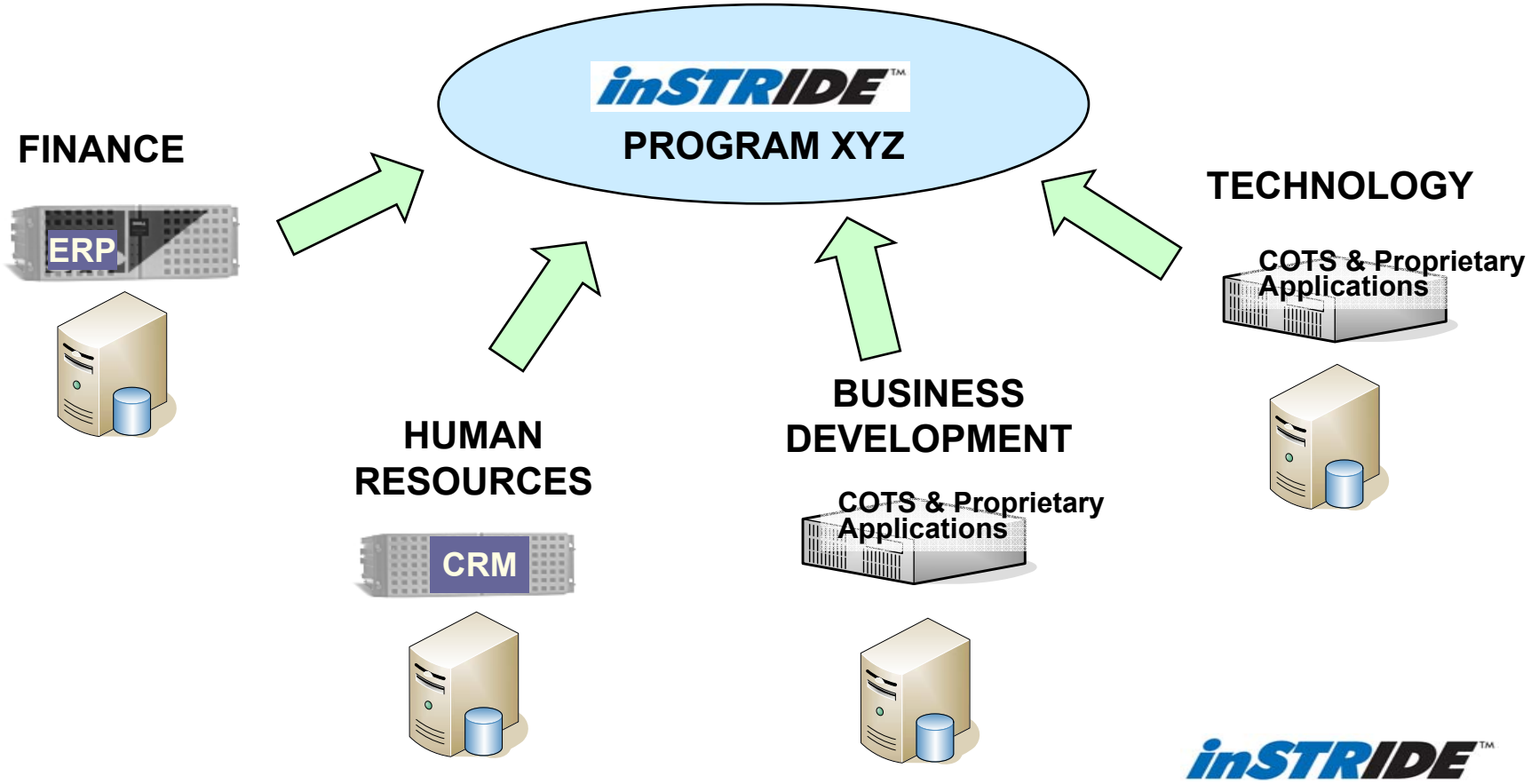


Continual Feedback for Risk Mitigation



Organizational Boundaries Risk

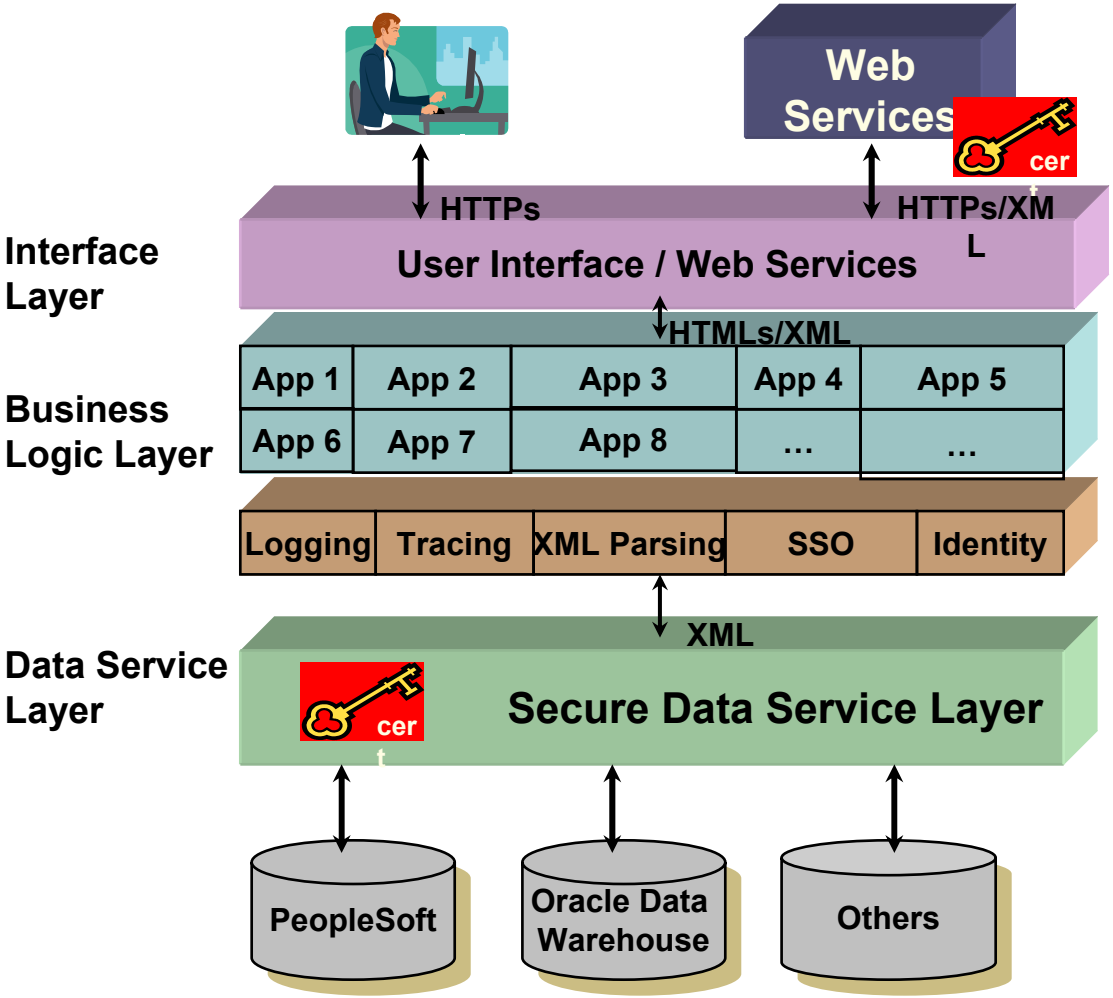
- Risk: Contradictions in business rules, access policies and IT architecture complicate design and operation



Organizational Boundaries Solutions

- Solutions
  - Utilize the Governance structure to elevate and resolve conflicts between organizations
    - Decisions affecting policy within and across functional organizations can only be made at top levels of the enterprise and its functional organizations
  - Implement by integrated product teams representing affected organizations
    - Correct implementation can only be done by active involvement of knowledgeable domain experts in the organizations
  - Employ modern Service Oriented Architecture to facilitate access to data across organizational boundaries
    - SOA provides necessary security and preserves organizational control of data

Risk Reduction from SOA



- Centralized identity management and authentication reduce security risk
- Reduces cost and risk to accommodate future changes to affected business systems
- Reduces risk by keeping business systems in direct control of their organizational owners

Achievement Challenges

Achievement Shortfall Risk

- Risk: Achievement falling short of expectation
  - Rapidly changing enterprise priorities and business conditions demand measurable value within a very short time frames
  - Full project scope cannot be achieved in those time frames
- Scenarios for failure
  - Slow start through prolonged requirements phase
  - Loss of relevance through overly conservative goal setting
  - Loss of momentum by insertion of pause points
  - Loss of impact through acceptance of limitations in scope

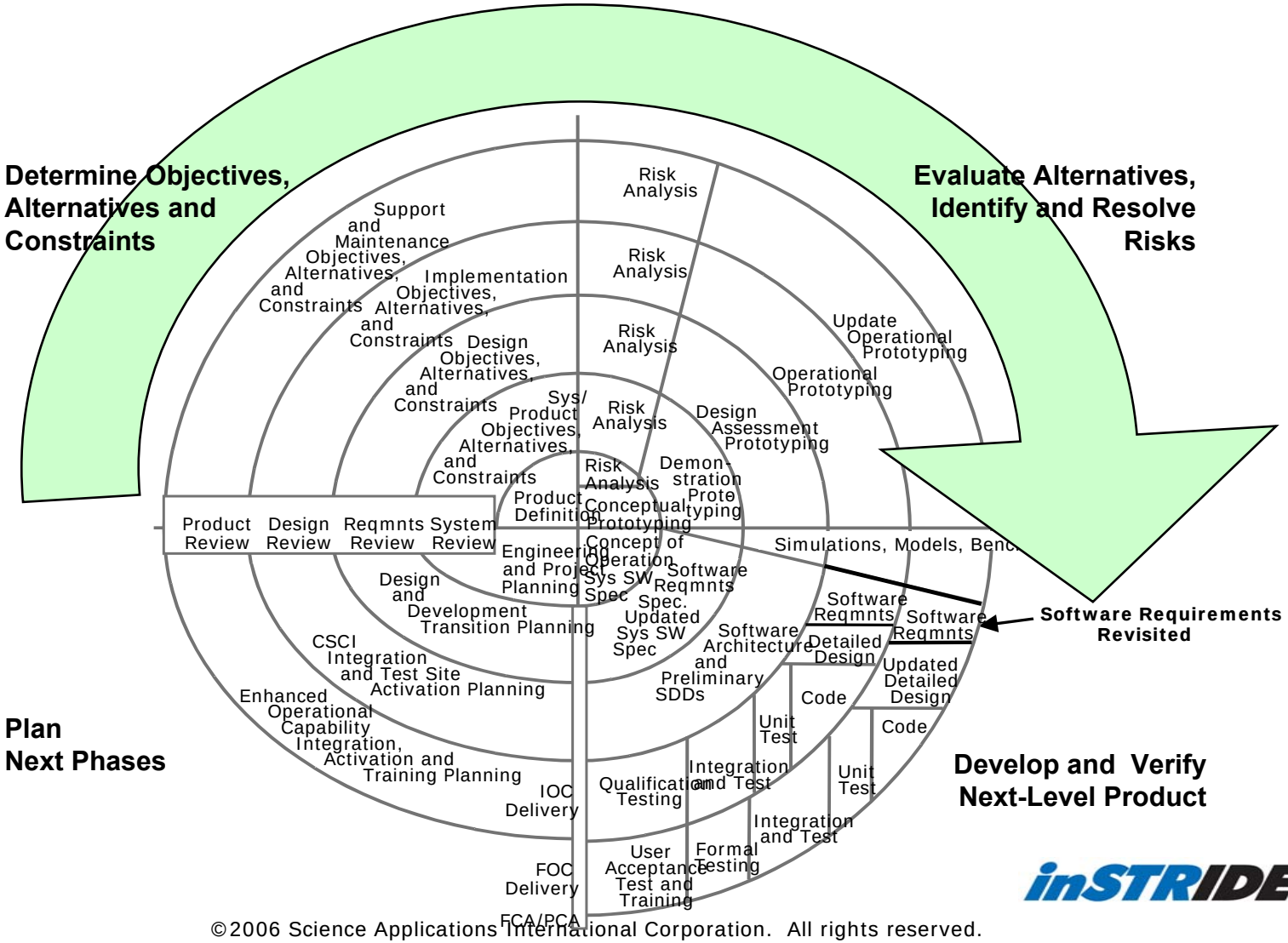
Must deliver value quickly and frequently

Achievement Shortfall Solutions

- Select lifecycle that supports frequent regular releases
- Commit to quarterly releases
- Review and revise planned release content every quarter

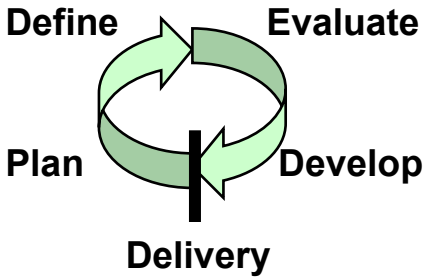
These solutions also provide risk response and control by application of systematic, regular review and replan

Spiral Lifecycle

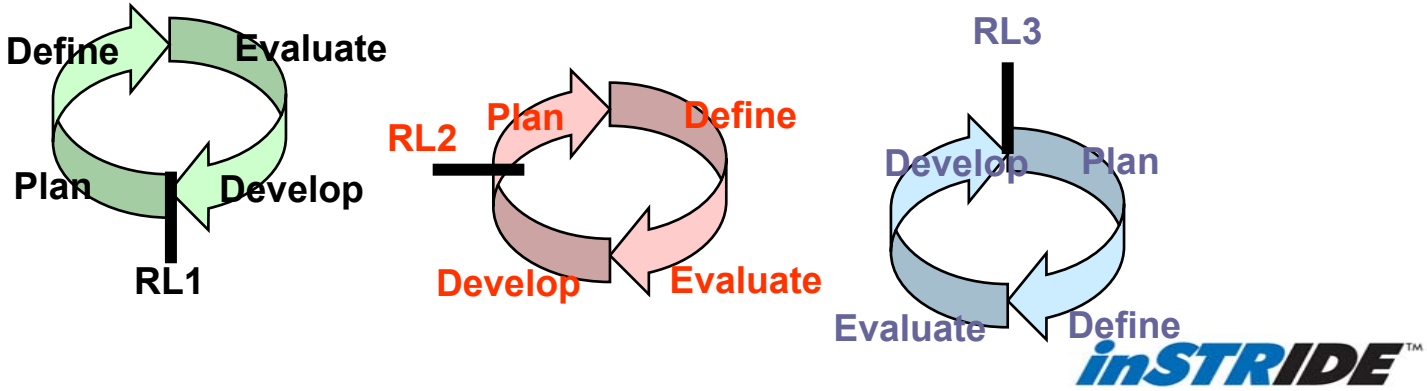


Choice of Proper Lifecycle

- Spiral lifecycle fits need for periodic value-add deliveries with flexibility to redirect to meet most relevant next objectives



- Staggered, overlapping starts of multiple cycle dramatically shorten the time between each addition of new value



Risk of Lack of Agility

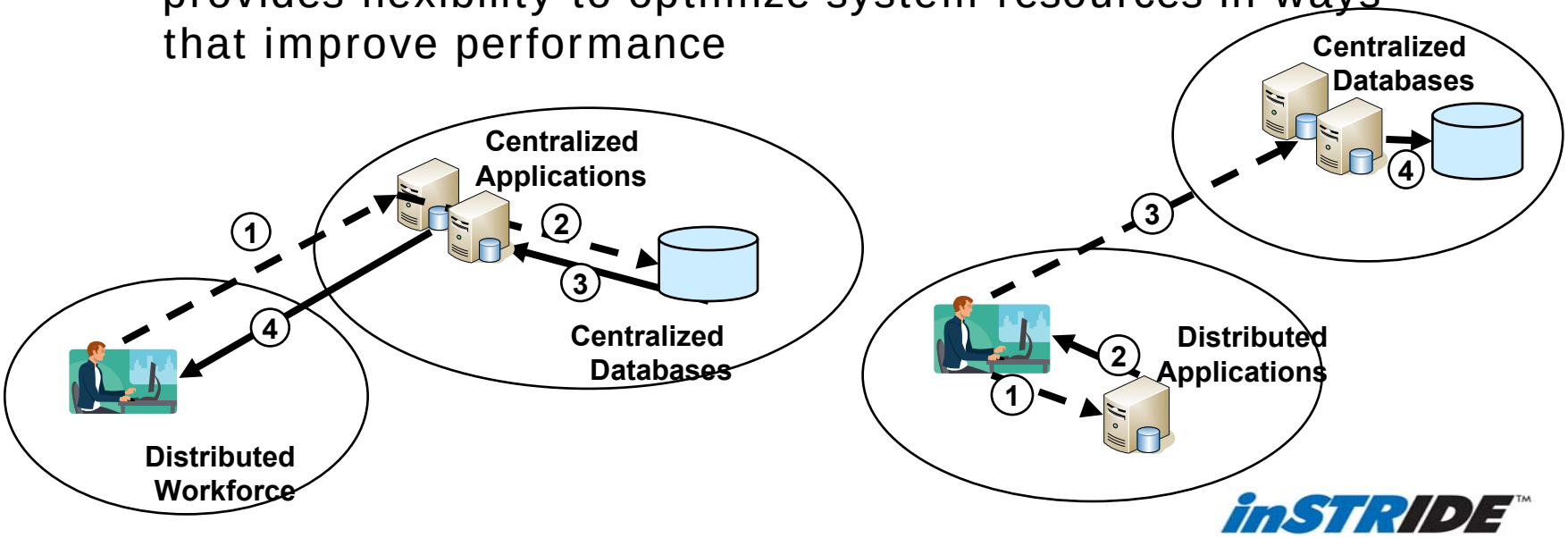
- Risk: Lack of Agility
  - Inability to adapt system to changing priorities, especially those reflecting enterprise strategic direction, can prove fatal
- Examples Scenarios
  - Enterprise decides to replace a legacy business system with which you currently integrate
  - Line organizations target a key business opportunity requiring major new functionalities and tools
  - Major acquisitions or new work patterns overload parts of the network infrastructure
  - Major budget re-allocations (plus or minus)

Solutions to Agility Risk

- Previously discussed recommendations on governance, and system lifecycle are key elements for addressing this risk
- For enterprise level IT systems, technology itself can contribute solutions for agility
- System architecture concepts for agility
  - Balanced architecture for handling distributed data and applications
  - Framework for enabling rapid addition of new tools
  - Service oriented architecture for enabling rapid integration between tools

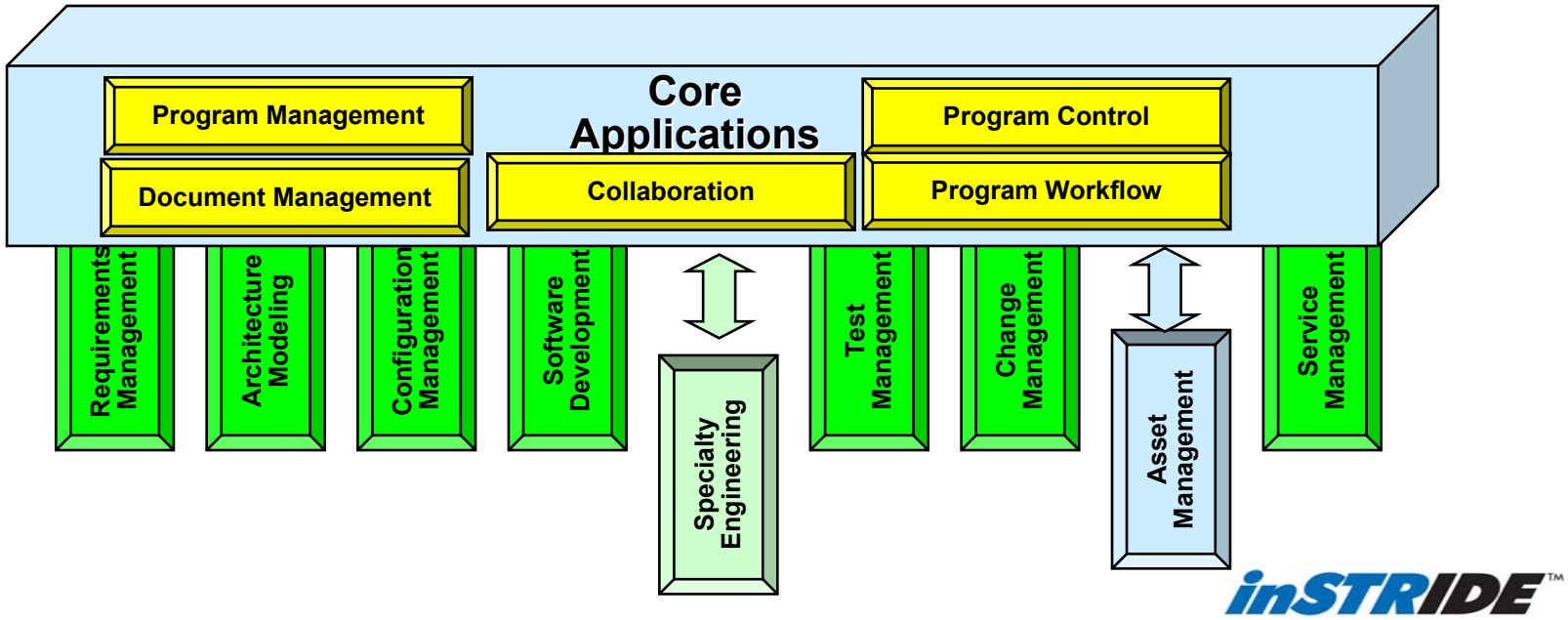
Balanced Architecture

- Balance centralized and distributed approaches
  - Most back-office systems are centralized for efficiency and security
  - Most engineering work is done by a distributed work force for efficiency and security
  - Combination of centralized and distributed components provides flexibility to optimize system resources in ways that improve performance



Framework Architecture

- Framework (plug and play) architecture
  - No application lives forever. Competition and innovation mandate continual investments in new improved tools
  - Excessive integration wastes time, money and opportunity
  - Using a framework approach with loosely integrated components provides necessary agility



Service Oriented Architecture

- Necessary Basic Services
  - User authentication and identity management
  - Encryption for privacy / security
  - Authentication between applications
  - Data services to pass data reliably in and out of distributed databases

Cultural Challenges

The Truth about Change

- Almost no one really likes it
  - If it works, don't break it
  - Confusion, temporary failures and slowdowns
- Almost everyone avoids investing in the change
  - Personal investment: time to learn, time to experiment, effort to repeat work due to learning curve errors, impact on day-to-day milestones
  - Organizational investment: Cost of training and OTJ learning
- Even simple things can be hard to communicate
  - Not all people are good listeners or quick learners
  - What is obvious to one is not to another
  - Different points of reference, different ground knowledge
  - Competition for attention

Risk of Resistance to Change

- Success of an enterprise-wide deployment is dependent on engaging users directly, listening to their concerns, responding rapidly to their issues, and systematically incorporating their suggestions for improvement
- What happens when things go wrong?
  - Push back up the line organization chain
  - Push back up the functional organization chain
  - Avoidance of the system by costly workarounds
  - Fall back to old systems
  - Blaming the system for cost overruns, missed schedule milestones, late deliverables
  - Advocacy for a return to old systems or adoption of alternatives
- How can this be avoided?

Risk of Excessive Cost of Change

- Enterprise level systems by their very nature have a complex array of functions and options
- The real and perceived costs of learning to use them can become excessive if careful attention is not paid to
  - Approach to deployment -- big bang or incremental
  - Approach to configuration -- one size fits all or tailored options
  - Approach to training -- just-in-time training, web-based or instructor-led, many levels or few, voluntary or mandatory

Deployment Choices

	Big Bang	Incremental
Advantages	• You have everyone's attention • Larger pool of resources • Change is rapid • Success is permanent	• Ability to learn from early mistakes in training, support & functionality • Failure is reversible • Spreads out funding needs
Risks	• Limited opportunity to refine training, support & functionality • Early issues have larger impact • Overload on support resources • Every issue becomes a crisis • Temptation to roll-back is large • Failure is permanent	• Difficult to marshal resources • Narrowness of the community may skew early modifications • Last waves may get inadequate attention • Legacy continues to thrive • Delay in benefits, particularly those requiring full adoption
Culture	• Better suited to monolithic command and control cultures	• Better suited to diverse cultures with distributed decision making

Configuration Choices

- Complex systems can be configured and used in multiple ways; thus, flexibility can be provided to programs and users. Is this advisable?

	Common Configurations	Flexible Options
Advantages	• Lower cost of training • Lower cost of support • Enhancements have broader benefit	• Optimum utility of system functionality • Can be tuned to local application
Risks	• Artificial functional limitations	• User confusion • Increased user errors • More difficult and costly to train and support

Strongly recommend a very limited number of common configurations with advanced training for exceptions

Training Choices

- The choice of training is strongly influenced by the complexity of an application, the interdependence of functional options and the importance of conceptual understanding.
- Best practices for modern enterprise systems
  - Adopt just-in-time strategies that give instruction as needed
  - Web-based training is recommended when the application is very procedural or prescriptive, e.g. time card submittal
  - Instructor-led training is recommended for complex concepts
  - Always have on-line help; contextual if practical
  - Pre-recorded demonstrations, available on demand, can address tool use in well-defined scenarios
  - For many tools, training should follow typical workflows start-to-finish
  - For complex tools and/or tools used for critical tasks, training should be mandatory and tied to advancing professional competencies
  - Multiple levels -- basic, advanced -- enable training to be better matched to need

Concluding Remarks

- System Engineering Environments present unique risks
  - Organizational Challenges
  - Achievement Challenges
  - Cultural Challenges
- Highlighted keys to managing these risks include
  - Governance and review structure
  - Continual feedback through multiple channels
  - Cross-functional teams
  - Staggered spiral lifecycle
  - Architecture framework, SOA and distributed components
  - Incremental deployments
  - Common configurations
  - Just-in-time training