Agile Systems Engineering to Maximize Research Value

"To him who devotes his life to science,
nothing can give more happiness
than increasing the number of
discoveries,
but his cup of joy is full when the results of his studies immediately find practical applications.";

—Louis Pasteur

Rosa R. Heckle, PhD

July, 2018

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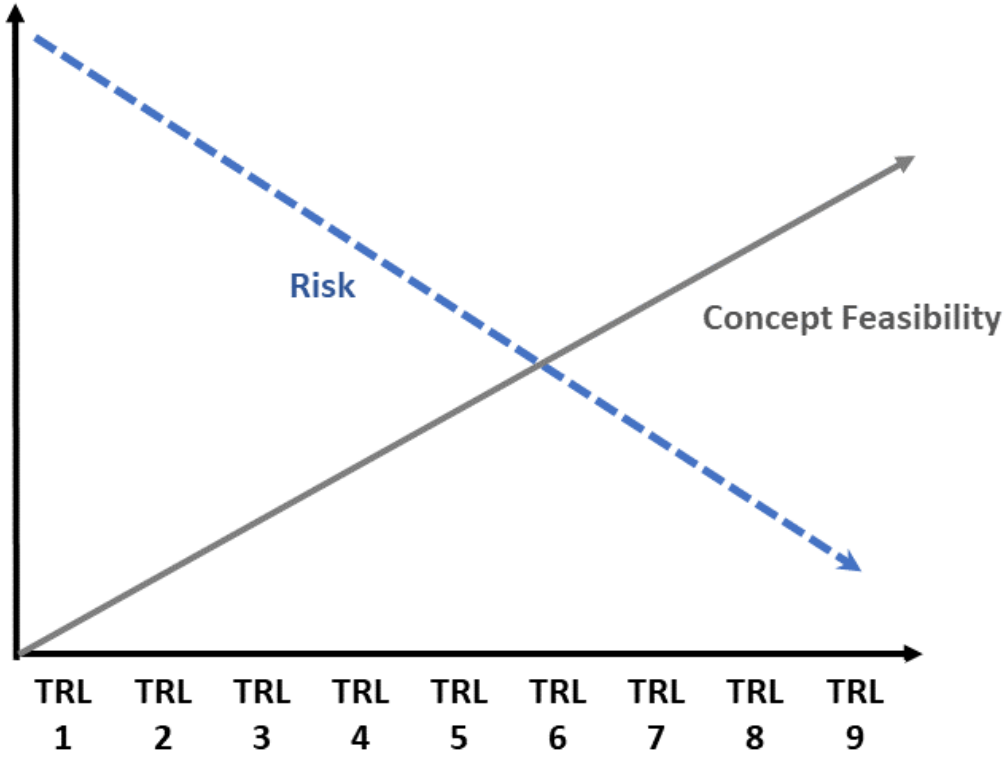
Introduce SE to Reduce Risk



TRL – Technology Readiness Level

Balance Science, Engineering, & Mission

Research Flexibility

Systems Engineering Rigor

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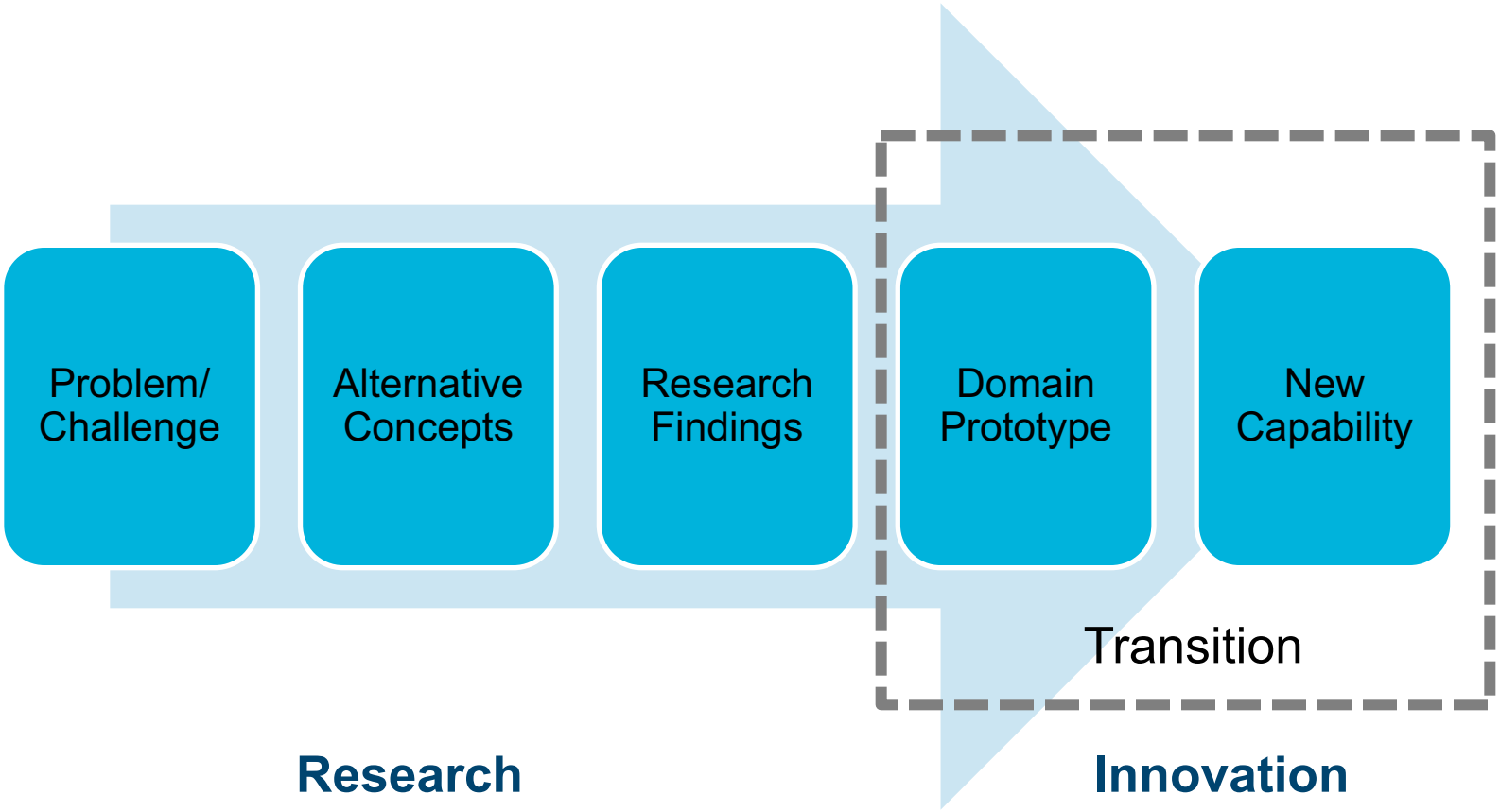
The Research Value Chain



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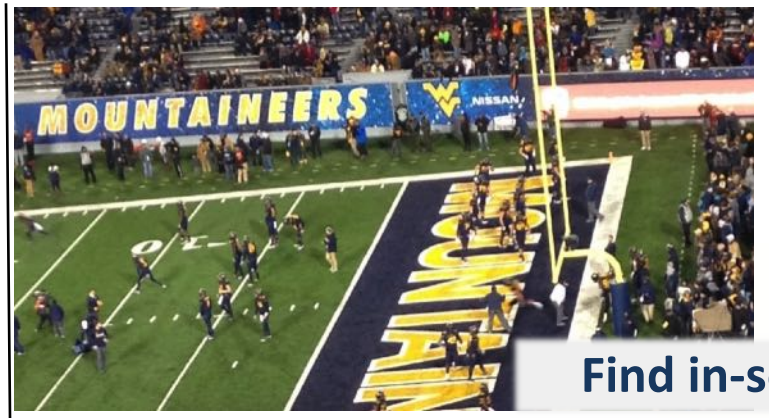
Case Study
Applied Research in Data Science

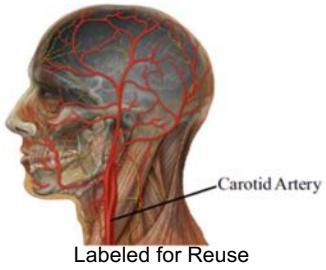
Team:

- Software Developers
- Linguists
- Scientists
- Analysts



Semantic Retrieval via Deep Learning

Find in-scene text



Forensic Analysis

Face Recognition

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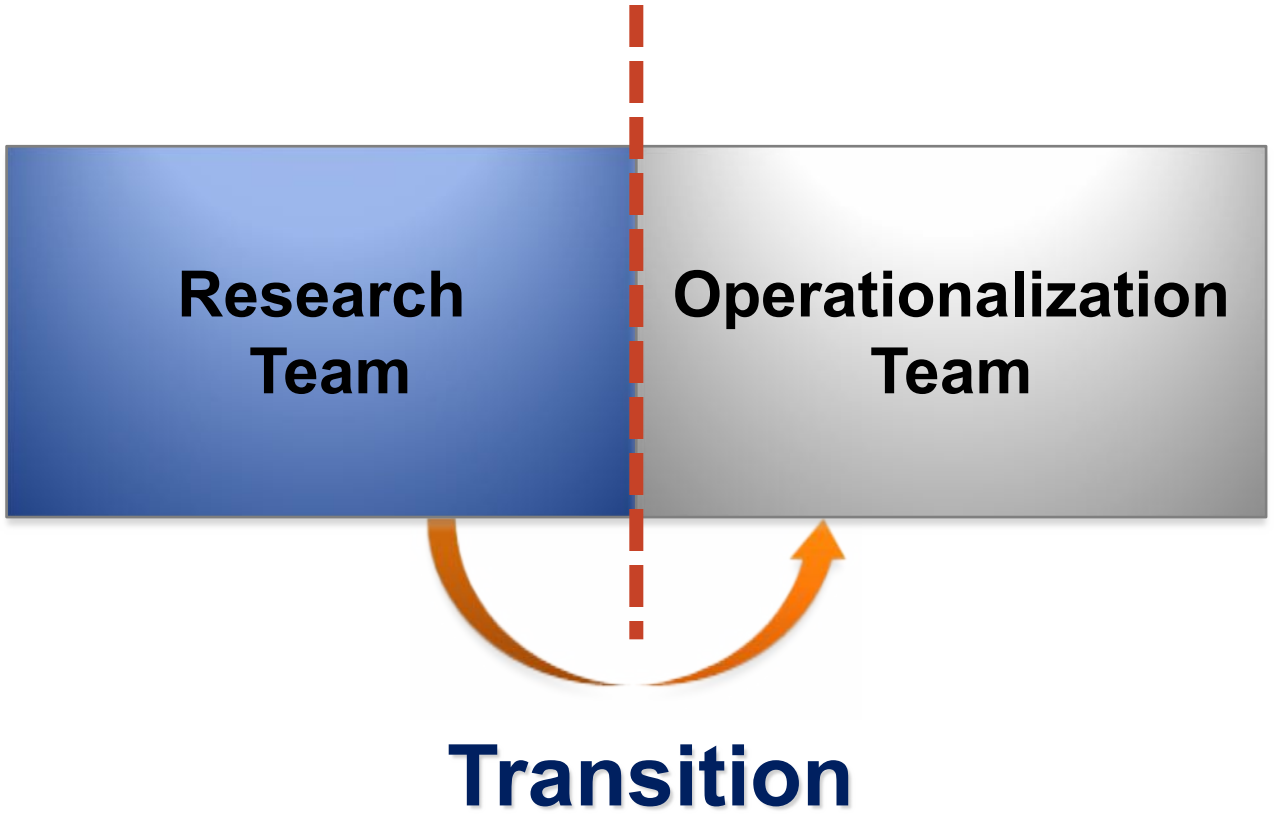
Two Teams Move the Idea/Capability to Innovation



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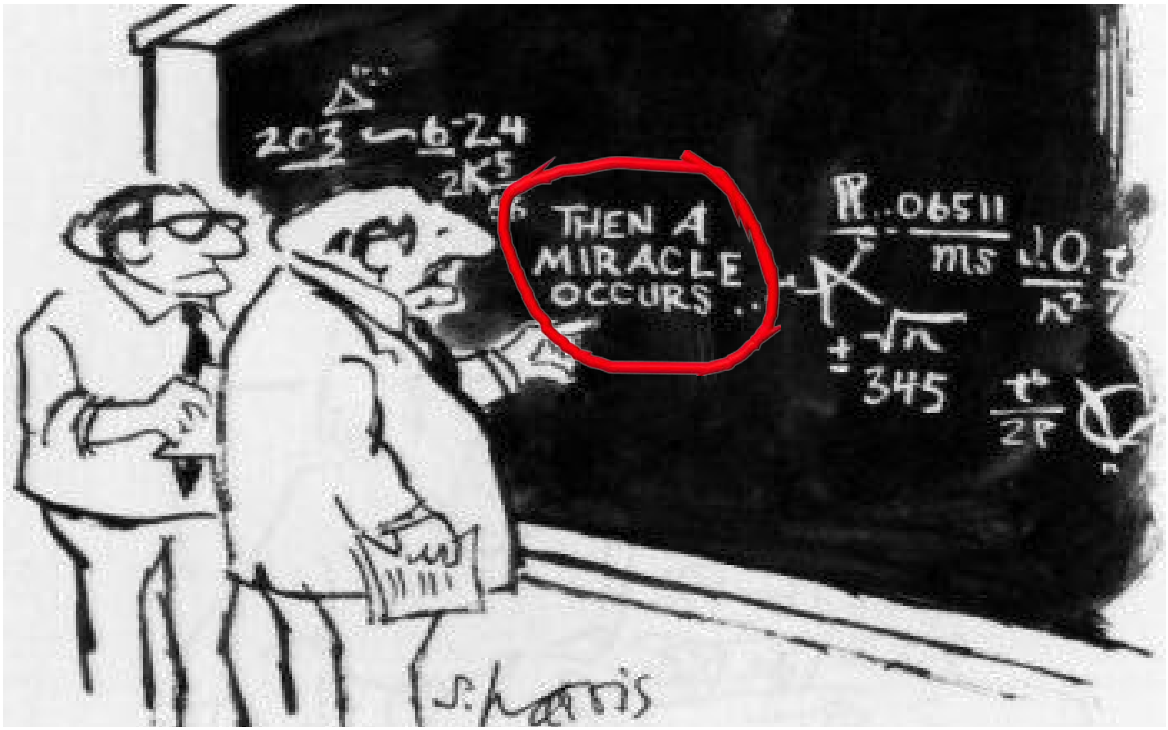
Barriers To Transition



How Do We Operationalize That?

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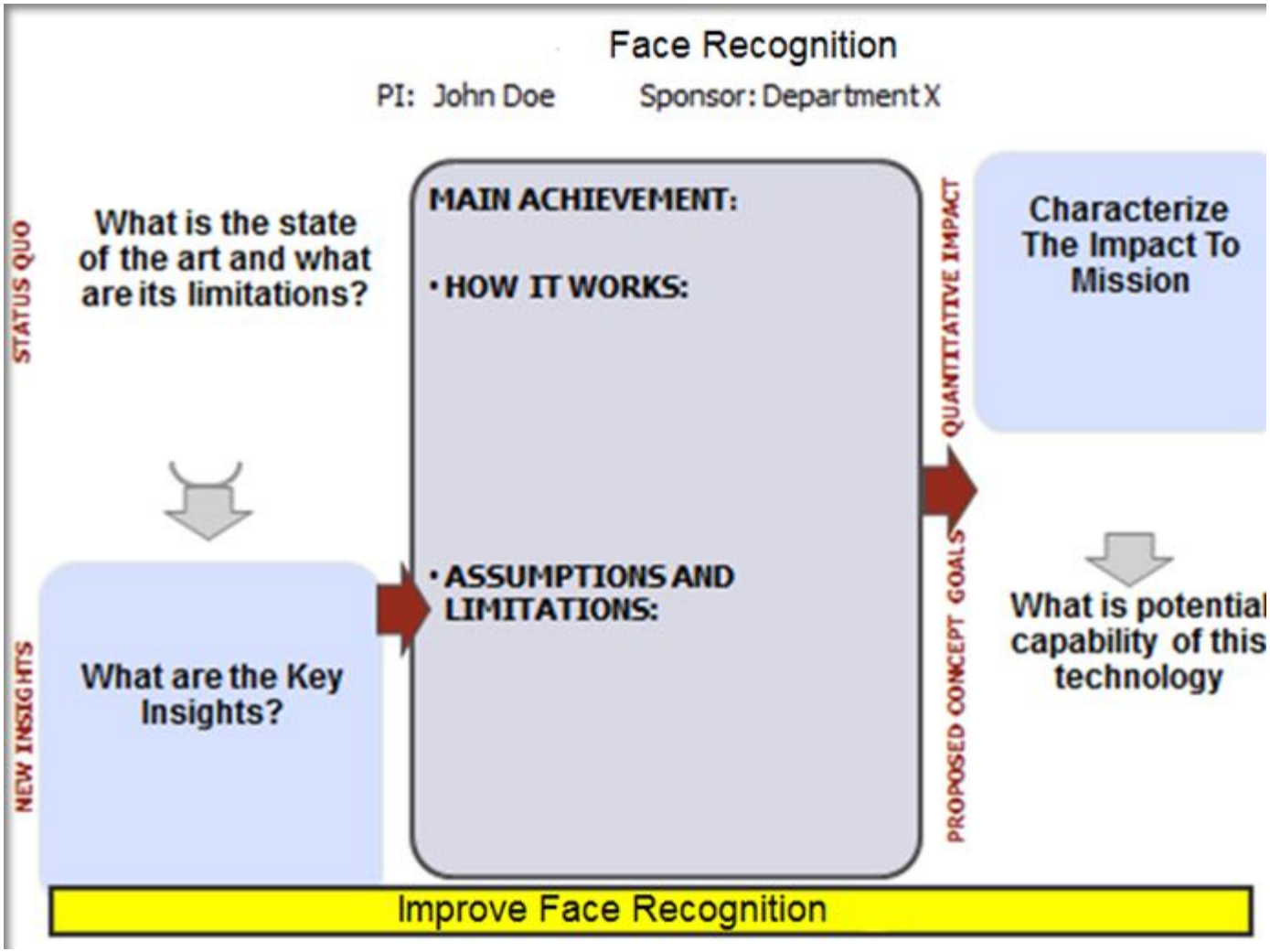
Set Research Direction and Revisit



The Heilmeier Catechism

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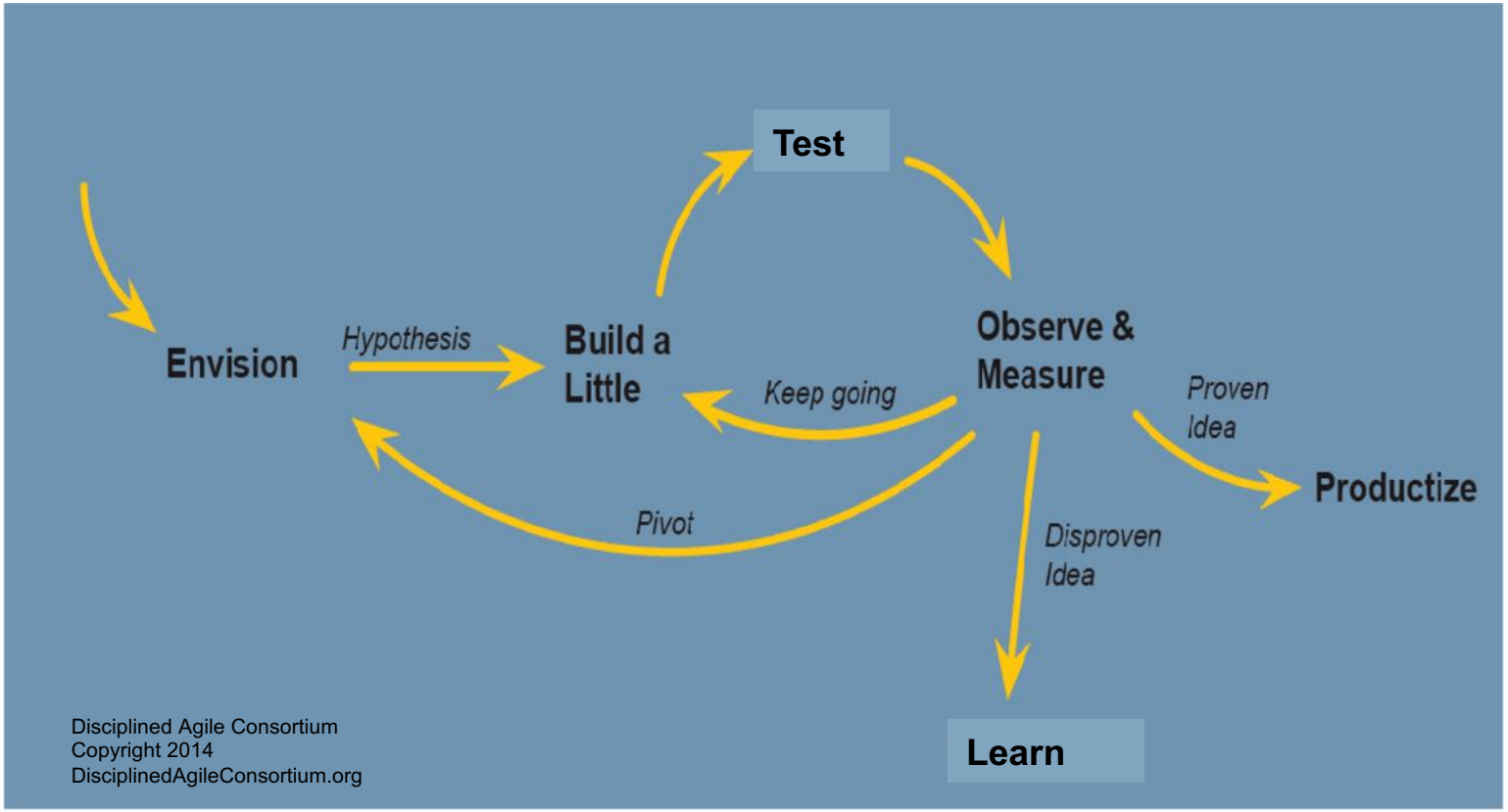
Identify Processes



Exploratory Lifecycle

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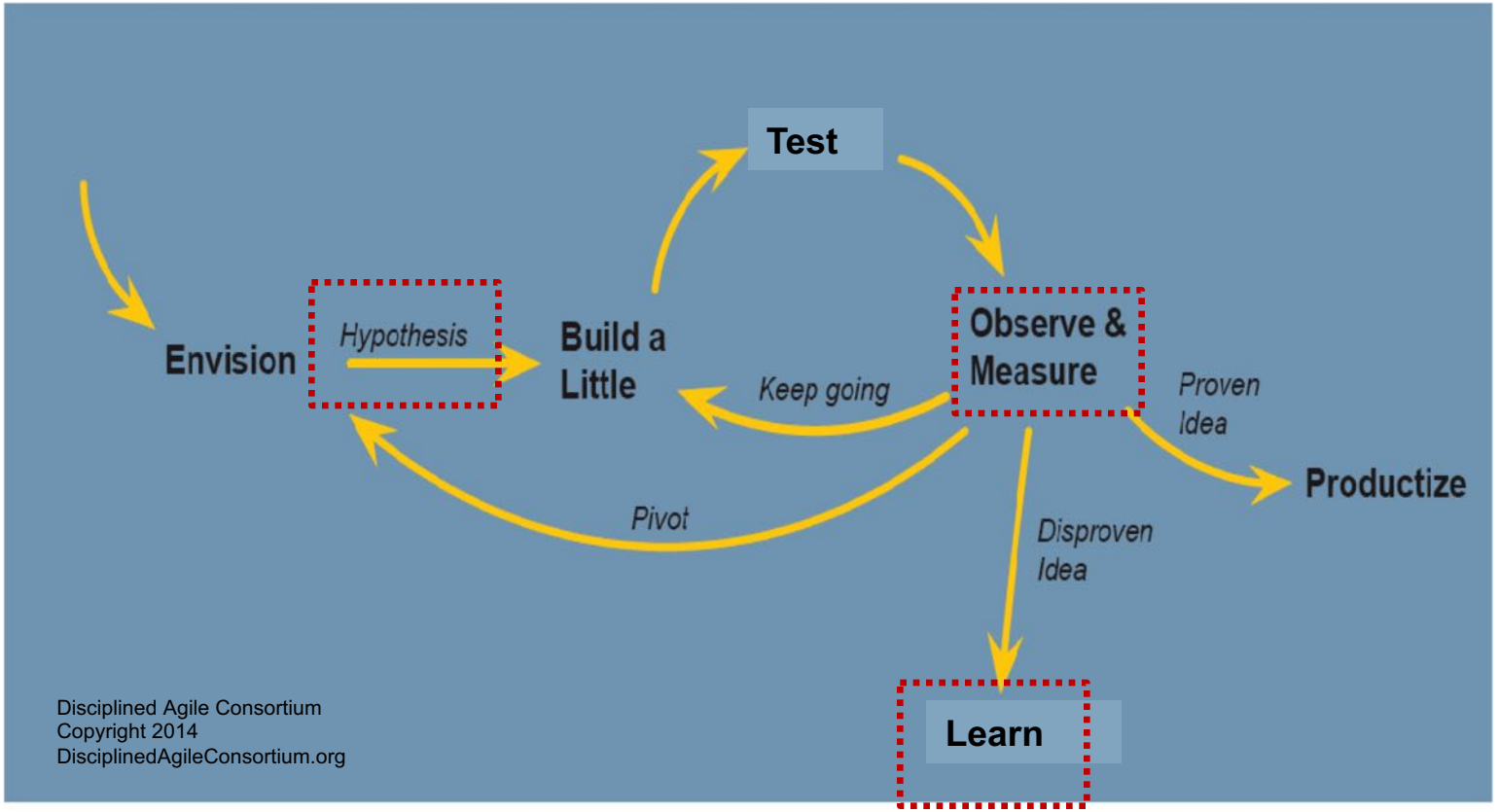
Identify Processes



Exploratory Lifecycle

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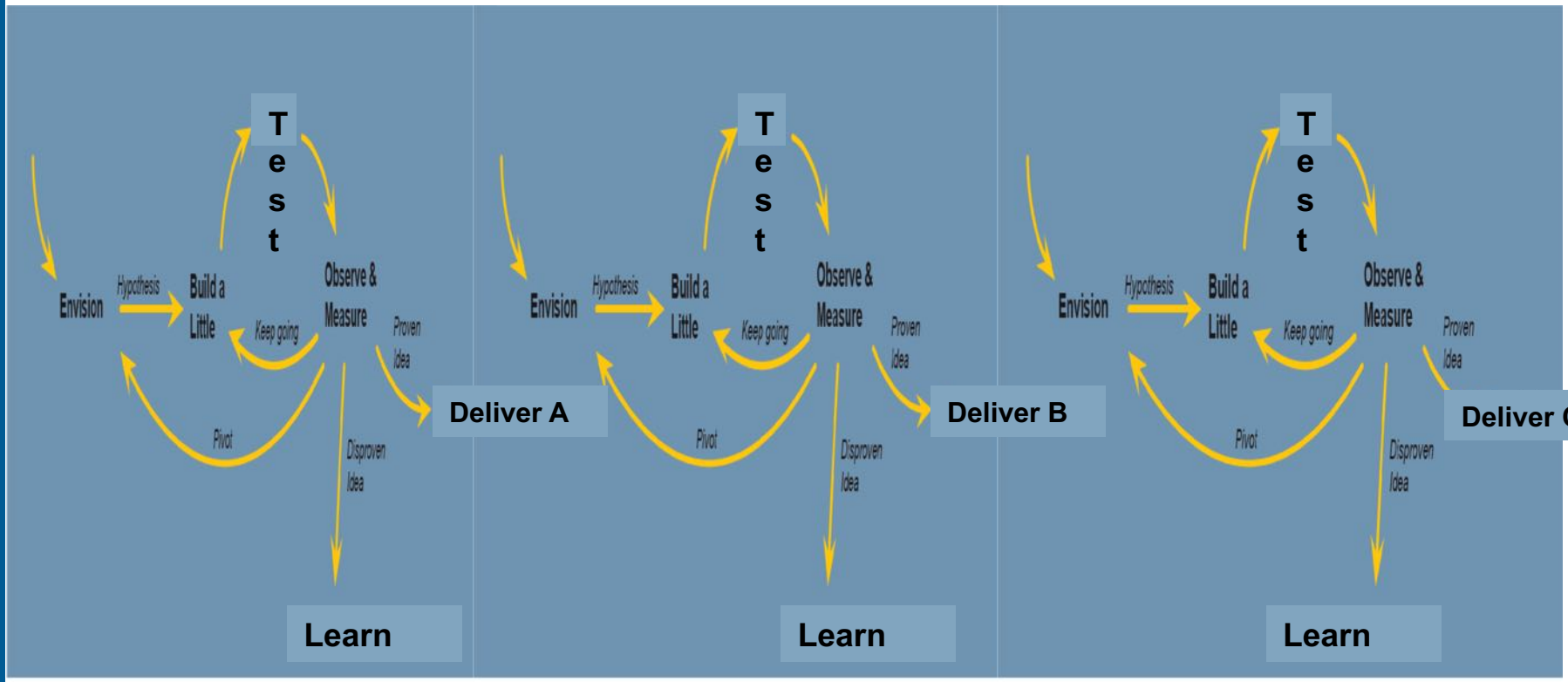
Streamline Processes Using Agile Methods



Limit goals/timeframes to months rather than years

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Capture Value Added Implicit and Tacit Knowledge

Analytic Report

Analytic Type:
Purpose:
Goal:
Research Approach:

Testing Methods:

Evaluation: (how was it evaluated)
Data (data used in the experiment)
Scores (results of the current runs)

Project Notes:
Next Steps:

Summary of findings:
Conclusion/Recommendations:

Make it a Sprint Deliverable

All documents are placed on Wiki

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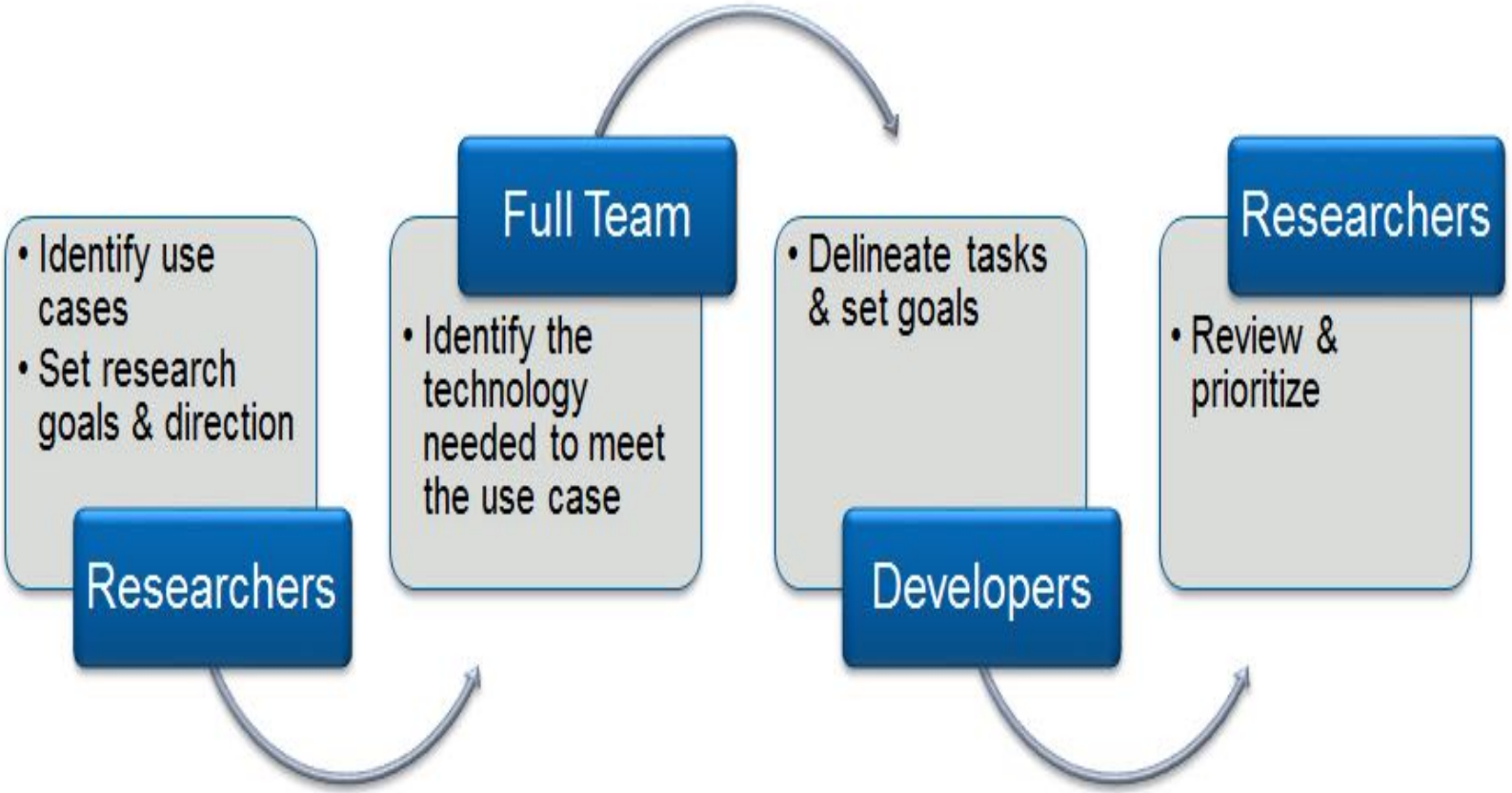
Synchronize the Team



- Control “Techno Speak”
- Ensure Decisions made during informal communication are shared

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Set Acceptance Criteria and Goals

What is good enough?

But do it lightly…

"Fall of 2018"

"First quarter"

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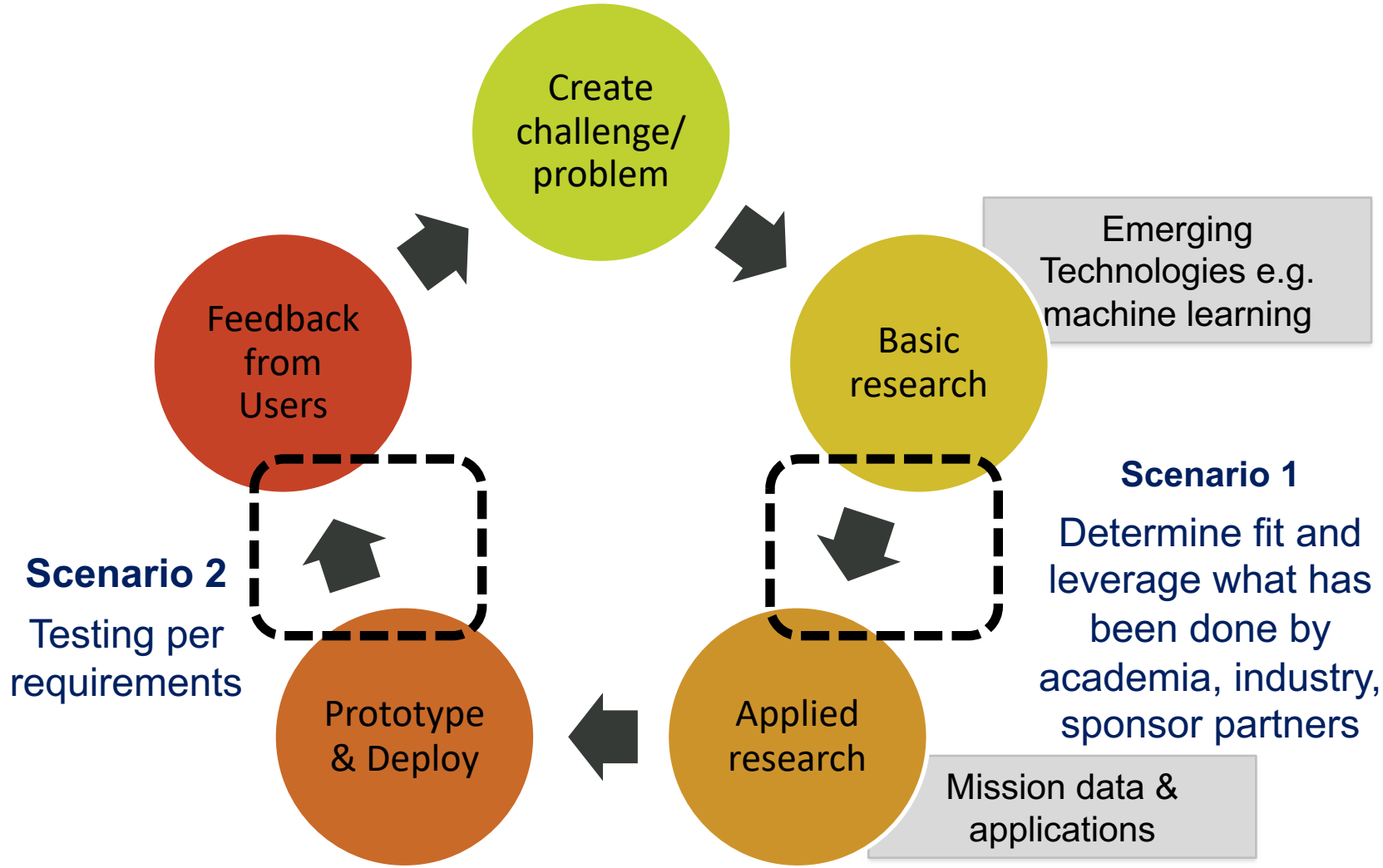
Use an Independent Test & Evaluation Team



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Use Tools to Facilitate the Process

Communication Method	How it Was Used
Agile Backlog Management Tool	Develop backlog, Prioritize backlog, Status documentation
Wiki	Tailored and organized for easy retrieval
Instant messaging	Conversations were archived as documentation

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Add the Role of "Agile SE Coach"

Research Role	Agile Role	Responsibility
Customer	Customer	The user of the capability
Researcher/Scientist	Product Owner	Lead research areas, generate hypothesis
Developer	Developer	Translate hypothesis to machine code
***New**	Agile SE Coach	Implement agile SE processes, coach, facilitate communications

Research Roles Mapped to Agile Roles

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Simplify Documentation Using Templates

Goals

- **Attain a Shared Understanding"**
- **Capture critical information**

General Requirements for: Face Detection Evaluation	
Description	Facial recognition is used by intelligence analysts to discern identity of individuals. Using facial detection/recognition software has proven to be effective in assisting in identification.
Purpose	Develop baseline of face detection analytics in an unconstrained environment
Methods: How are you going to do this? What needs to be done to meet the feature's purpose?	
Data to be used	FDDB Dataset
Procedures/ Methods	Run the selected analytics on FDDB dataset. Reformat output log files per FDDB specifications Process generated file through FDDB evaluation program to generate ROC curve Review the evaluation results
ssumptions	None
Issues/TBDs	Identify and obtain the analytics to baseline
Acceptance Criteria:	
Given	

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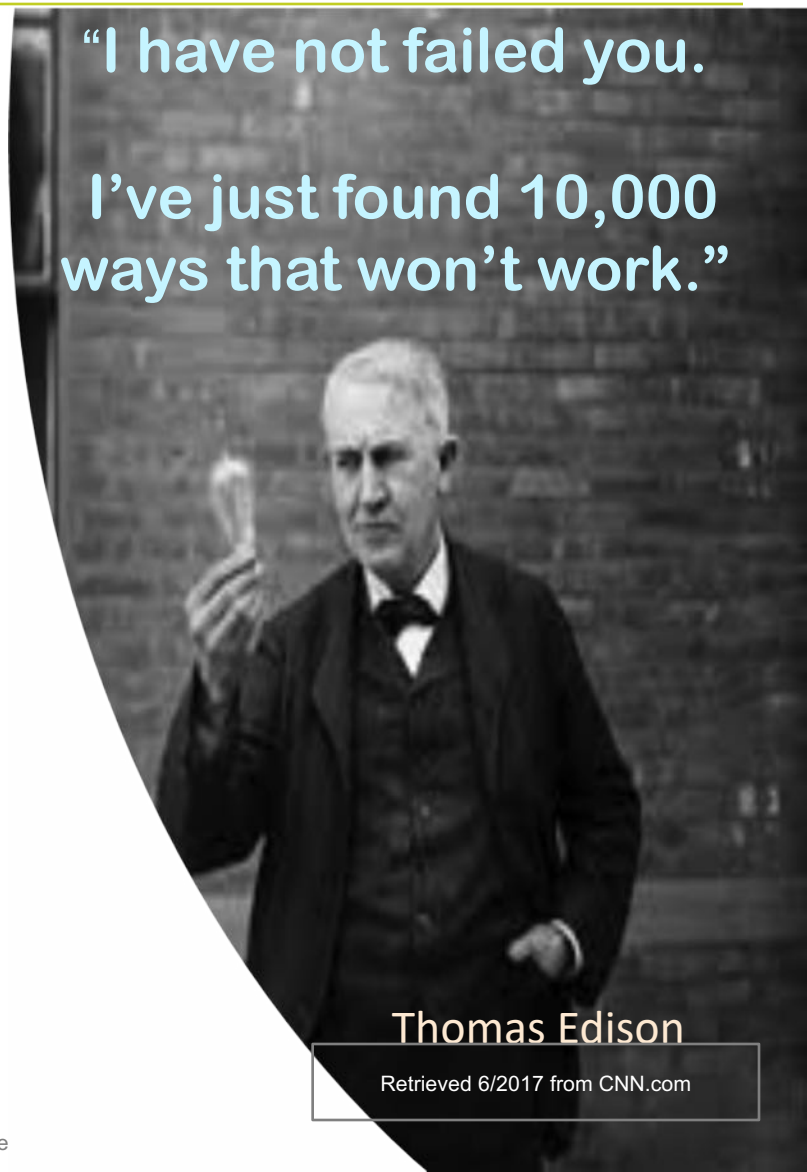
In Summary

- Introduce Agile SE engineering processes
- Capture value all along the value chain
- Simplify documentation
- Synchronize communication
- Set goals and acceptance criteria
- Include an independent test and evaluation process
- Use Tools to Facilitate the Processes



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Questions

Agile research for maximum ***IMPACT***

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Questions

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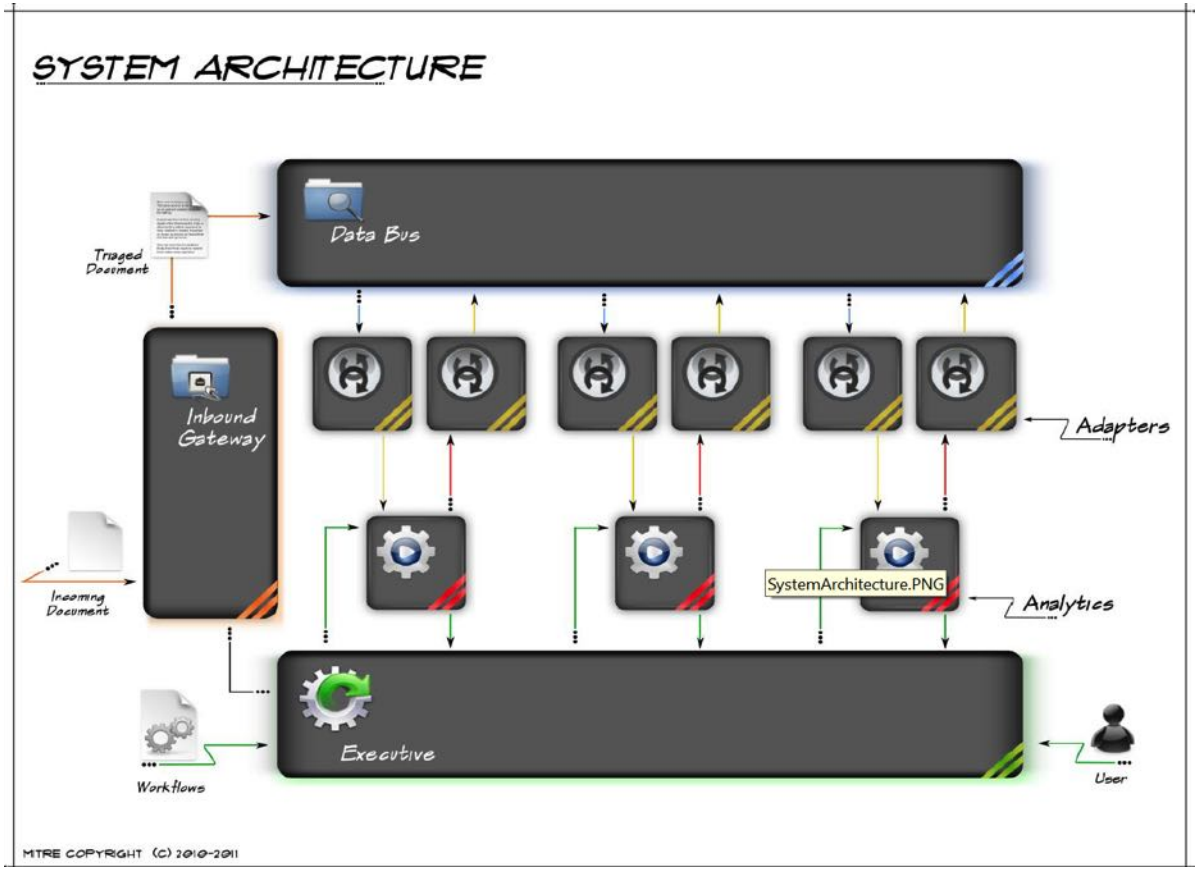
Make Architecture a Part of Planning

Think today what Architecture you will adapt to future needs.



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