Prosperity Heights Software

DC SPIN

Process Improvement for Product Lines

March 6, 2002

Grady H. Campbell, Jr.
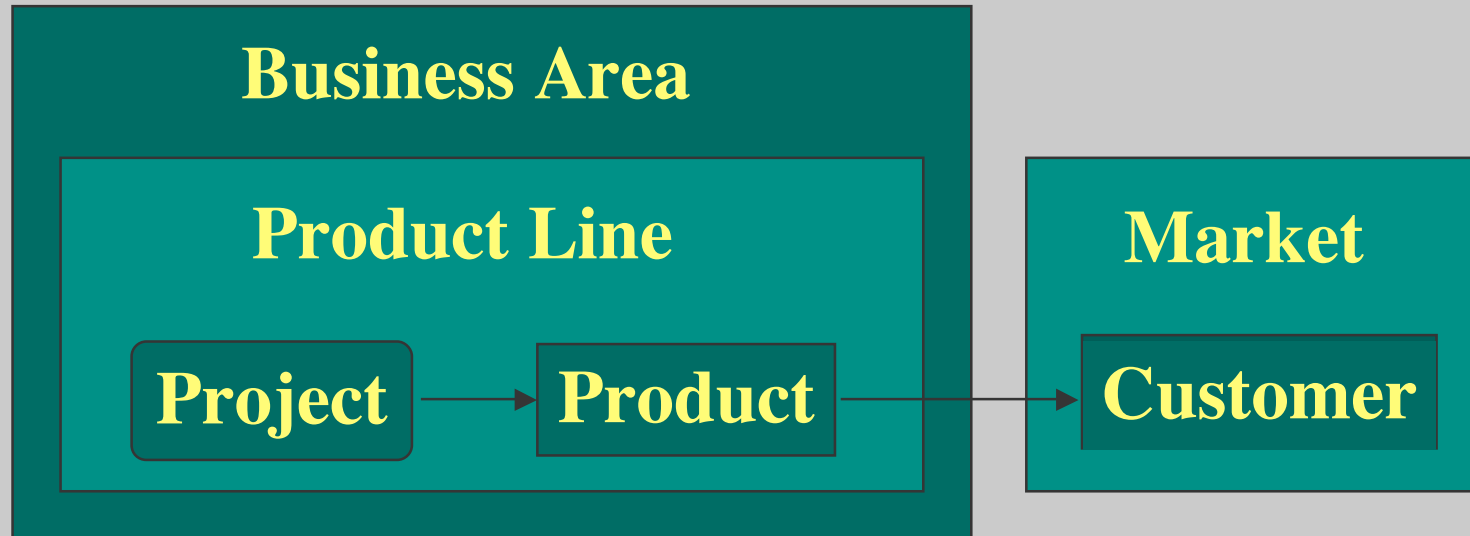
Questions to Consider

What is a product line?

Why do organizations adopt a product line approach?

What is different about a product line process?

How does process improvement differ for a product line?

An Organizational Context

Business Area

Product Line

Project → **Product** → **Market** **Customer**

- **Market: A set of customers having similar needs**

- **Product line: A set of similar products (to be) created by an organization for a market**

PL Business Motivations

Gain competitive advantage by being more responsive to diversity and change in customer and market needs

Improve productivity and product quality by focusing efforts on a set of similar products

Reuse-driven Process Improvement (PI$_r$)

**A method
for the adoption and improvement
of a product line approach**

(DsE in particular)

A Product Line Approach

Domain-specific Engineering (DsE)

A framework and discipline for the engineering and manufacture of similar products

Precursors to PI$_r$

- **Software Engineering Institute**
  - *Capability Maturity Model® for Software* **(1993)**

- **Software Productivity Consortium**
  - *Reuse Adoption Guidebook* **(1993)**

- **PHS work with Thomson-CSF (1996-8)**

Definitions

Capability
The range of expected results that can be achieved by following a process

Performance
**The actual results achieved by following a process**

Maturity
The predictability with which performance achieves a targeted level of capability

PI$_r$ Refinements

- **Limit improvement scope to a product line business (not organization-wide or generic reuse)**

- **Integrate process improvement and reuse adoption efforts**

  - **Extend maturity models to address product line practices**

  - **add a capability model to aid process reconception**

  - **add a model for evaluating product line viability**

- **Emphasize fast start-up & rapid iteration**

- **Defer product line technical choices and effort to DsE**
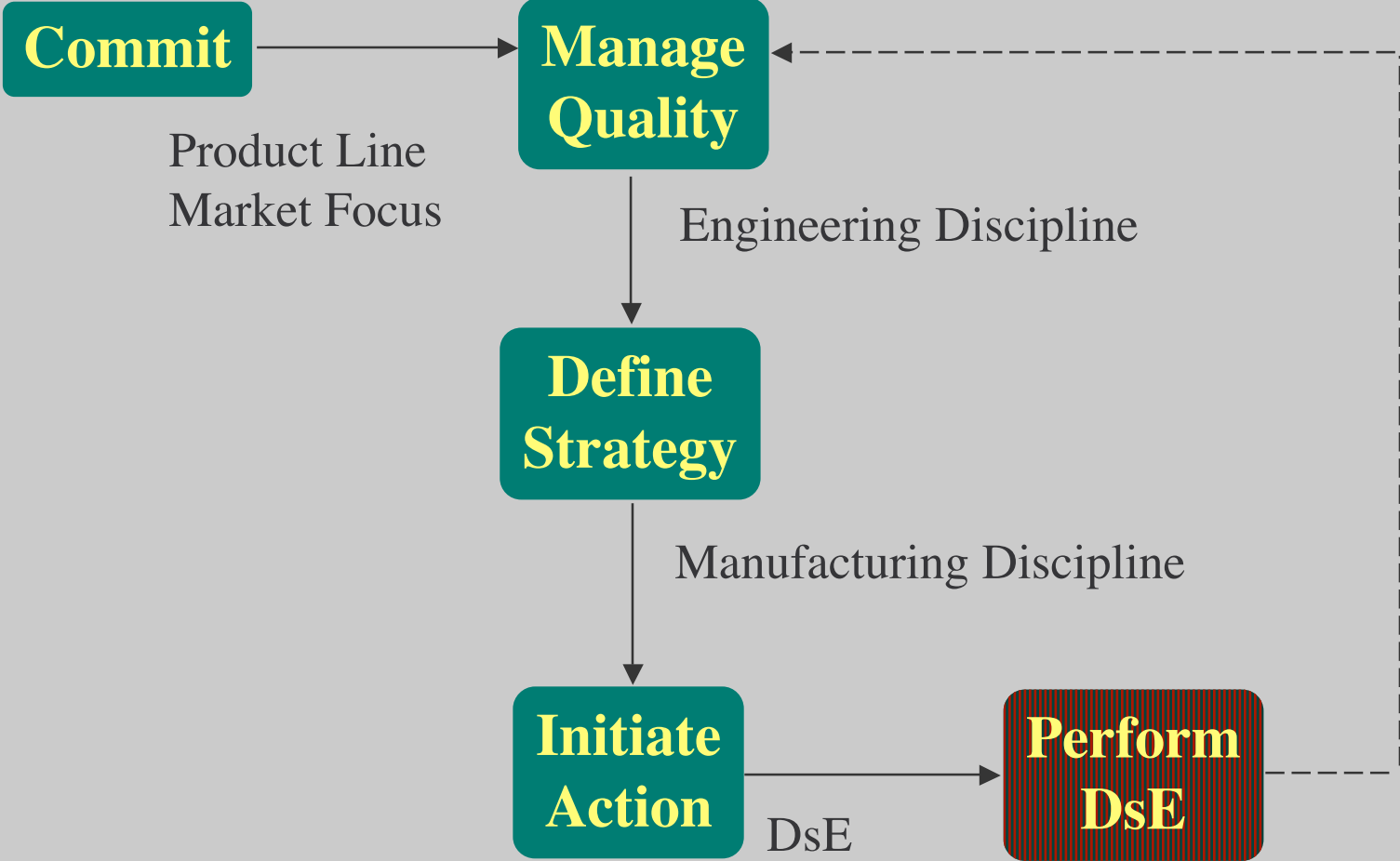
PI_r Objectives
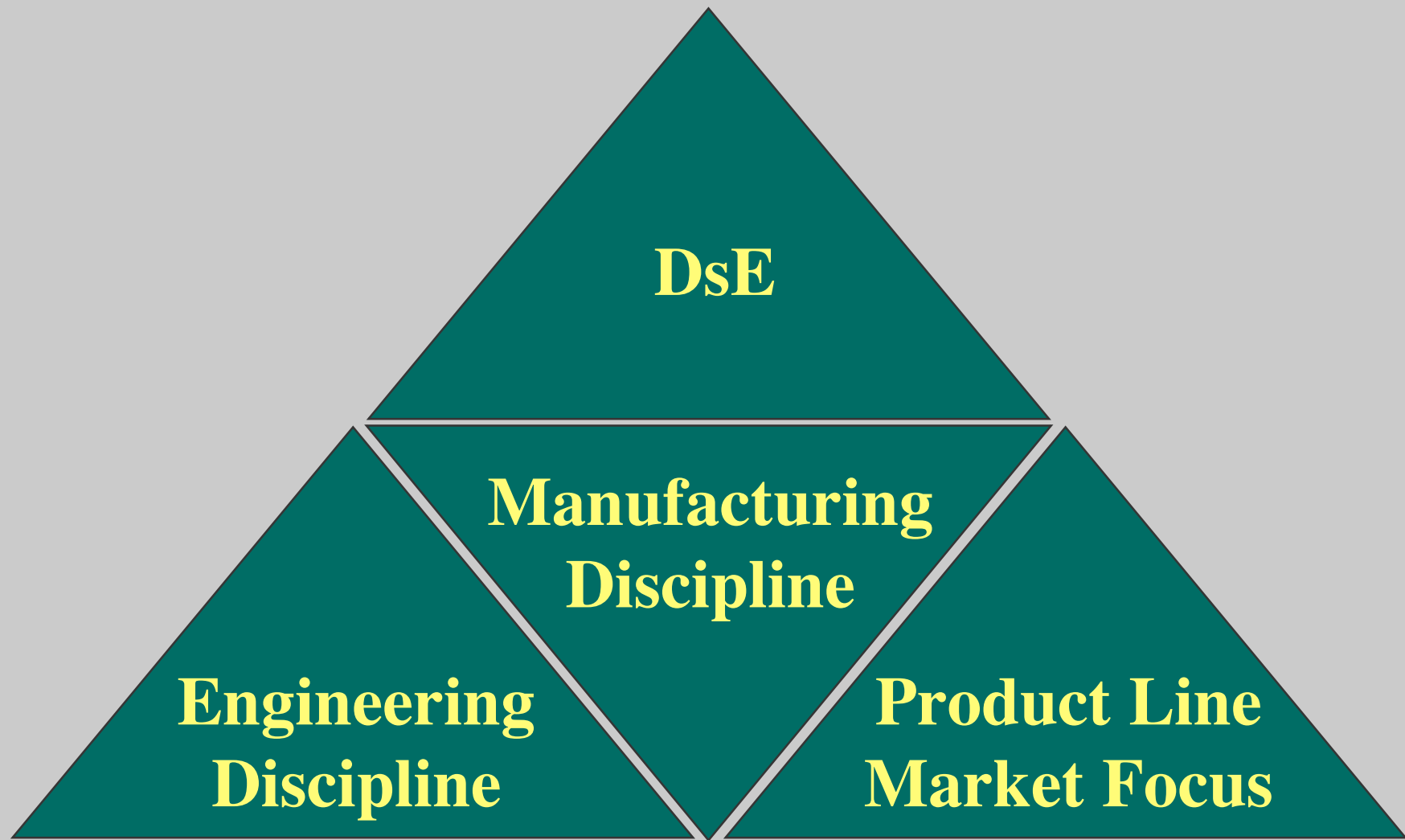
PI_r Tools

Product Line Strategy

Process Capability

Process Maturity

Domain Viability

PI$_r$ Process

Commit → **Manage Quality**

Product Line
Market Focus

Engineering Discipline

Define Strategy

Manufacturing Discipline

Initiate Action → **Perform DsE**

DsE

Commit

Objective: Establish a product line market focus

- Characterize the product line opportunity:
   products, customers, business challenges

- Evaluate viability:
   subjective factors, financial analysis

- Define business objectives

- Allocate resources to institute a product line approach

- Monitor progress and revise commitment as circumstances change

Domain Viability Model

Market opportunity

Are there customers for a line of similar products?

Technical expertise

Does the organization have the expertise to build envisioned products?

Business commitment

Is there a credible case for investing in this business?

Manage Quality

Objective: Establish engineering discipline

- **Assess process maturity**
  - **Conventional criteria**
  - **Product line criteria**

- **Identify needed improvements**

- **Initiate improvement actions**
  - **Define action plans**
  - **Implement actions**
  - **Evaluate effects**

Process Maturity Model
Conventional Factors

Organizational infrastructure — *Establish effective support for common (cross-PL) needs*

Project management — *Work within budget and schedule constraints*

Engineering methods — *Perform technical activities properly*

Product quality and integrity — *Achieve product quality goals*

Customer/supplier relationships — *Manage external interactions effectively*

Process predictability — *Reduce variation in results experienced across projects*

Process Maturity Model
Product Line Factors

Product line strategy and management
How effectively do strategy and management actions support a product line approach?

Raw materials and assets
How effectively do available raw materials and assets contribute to product line needs?

Organizational and technical infrastructure
How well do infrastructure capabilities support a product line effort?

Define Strategy

Objective: Establish manufacturing discipline

- **Target an appropriate level of process capability**
    - **Business objectives**
    - **Risks**
    - **Financial projections**

- **Create a product line strategy**

Process Capability Model

Management Integration

Will projects have coordinated or independent planning?

Needs Orientation

Should efforts focus more on immediate or long-term payoff?
Should views of customer needs be unified or stay unique?
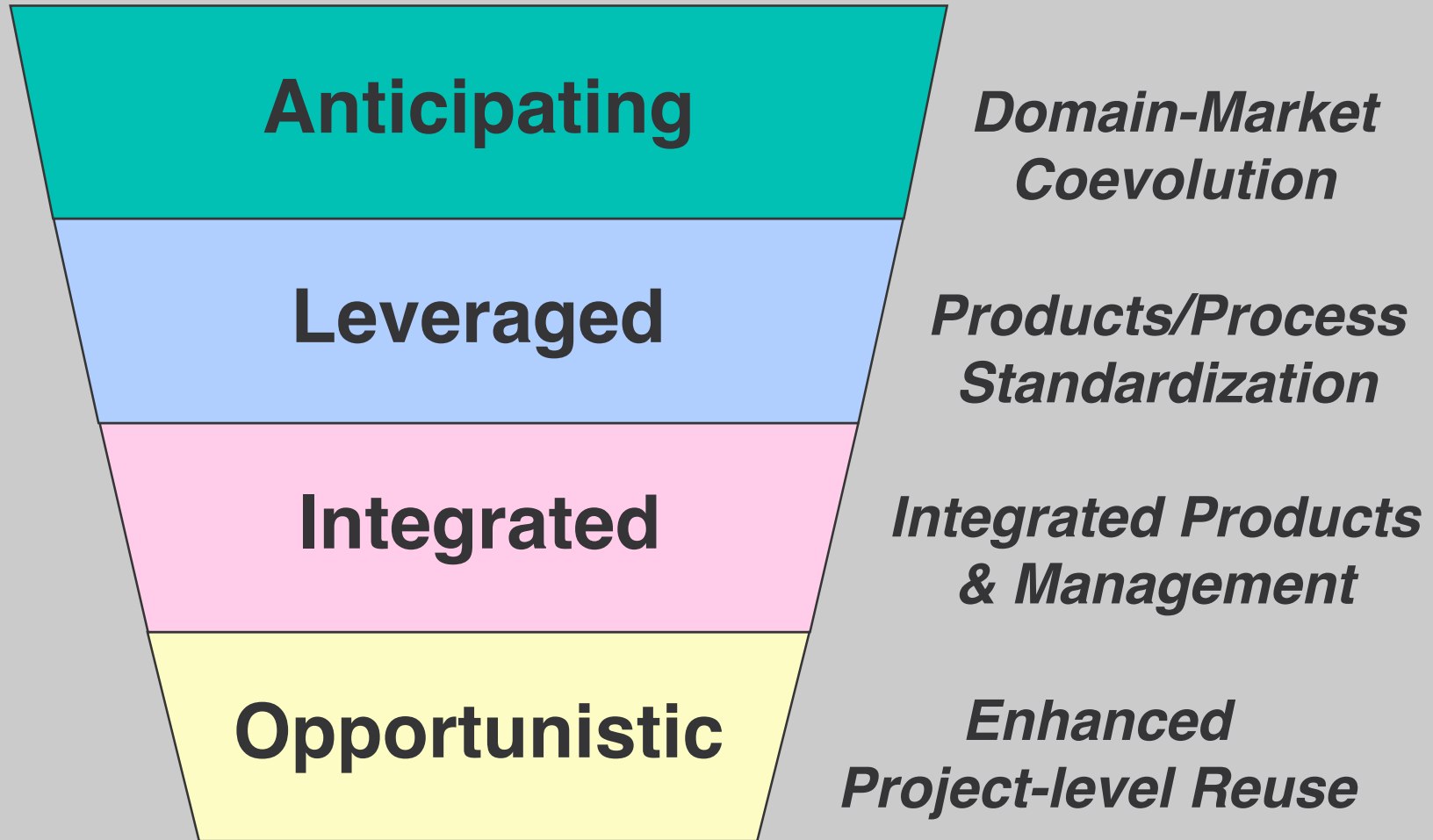
Product Integration

To what degree must projects focus on form and content
of work products versus whole-product representations?

Stability–Optimization

To what degree can cultural stability be disturbed
to achieve a streamlined process?

DsE Capability Levels

Anticipating	*Domain-Market Coevolution*
Leveraged	*Products/Process Standardization*
Integrated	*Integrated Products & Management*
Opportunistic	*Enhanced Project-level Reuse*

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Product Line Strategy

Market/products focus

Business model

**Tailored process
(DsE + methods)**

Organization

Support environment

Transition strategy

A DsE Process

Business Objectives →

Domain Engineering

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Domain

Application Engineering

↓

Application Product

↓

Product Uses

Market and Project Needs

Customer Needs
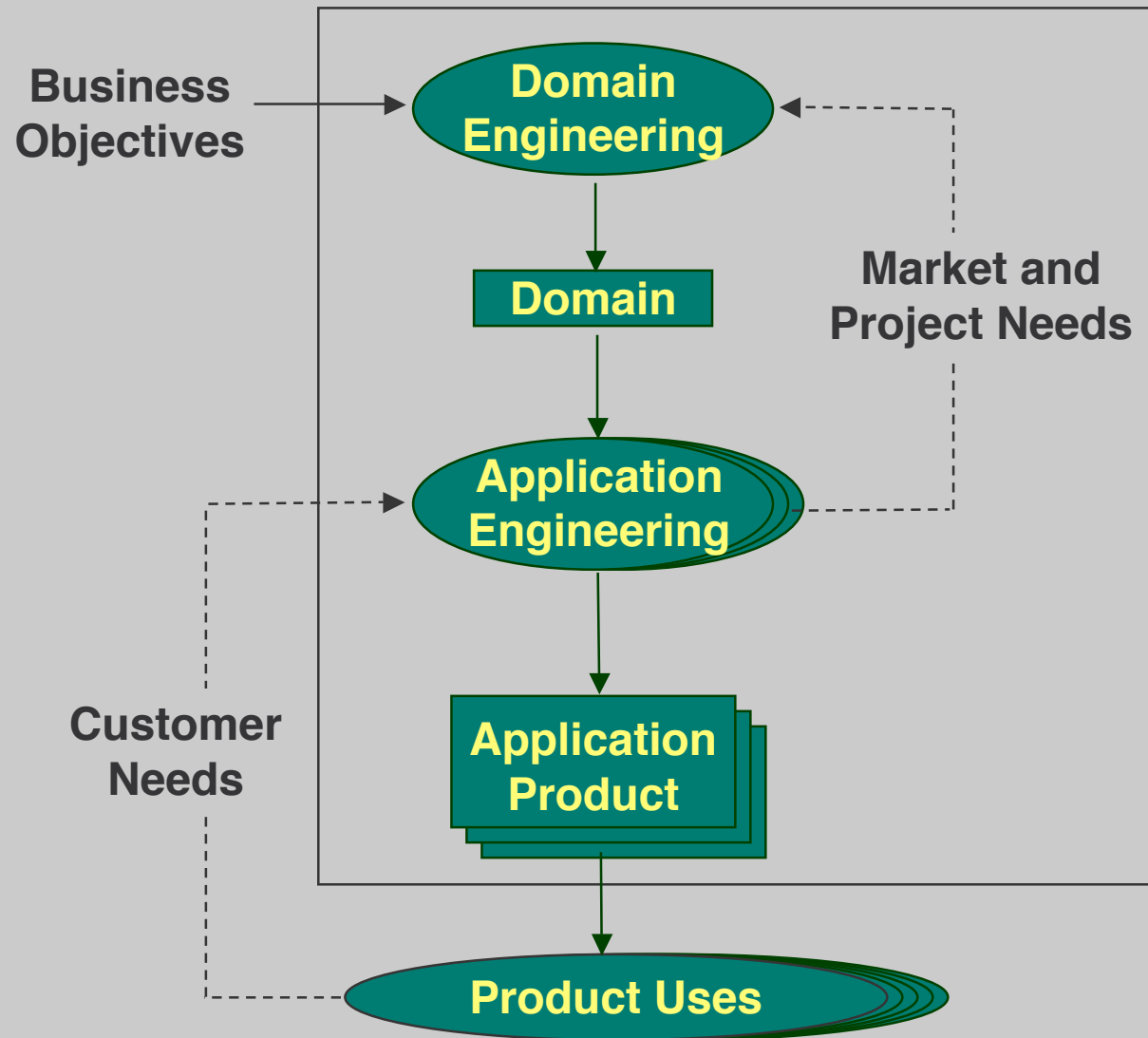
Create an infrastructure for building similar products

Build products using the infrastructure

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PL Strategy
Organizational Structures

Opportunistic

AE_1 AE_2 ... AE_n

DE

Integrated

AE_1

AE_2

DE

AE_n
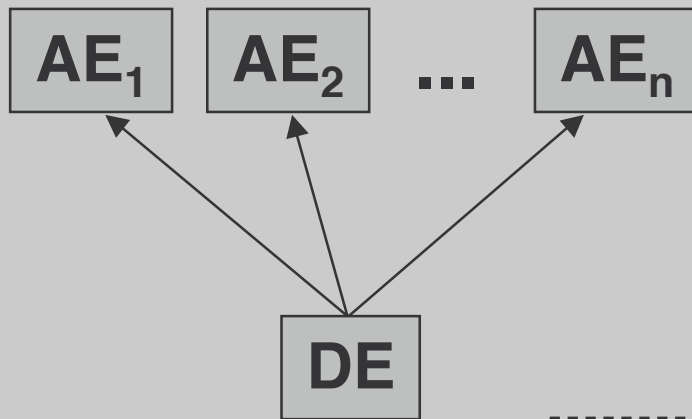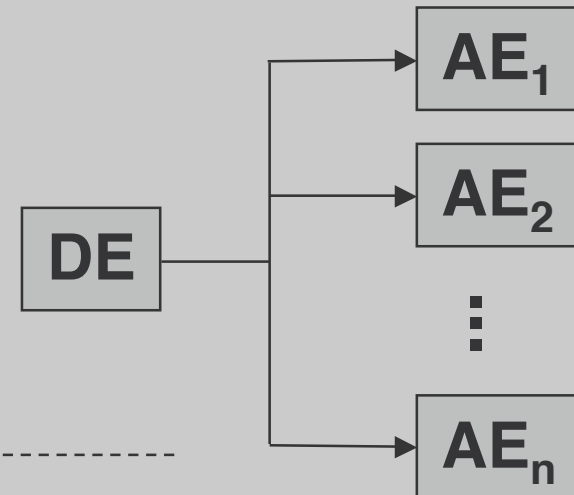
Leveraged/ Anticipating

DE

AE_1 AE_2 ... AE_n
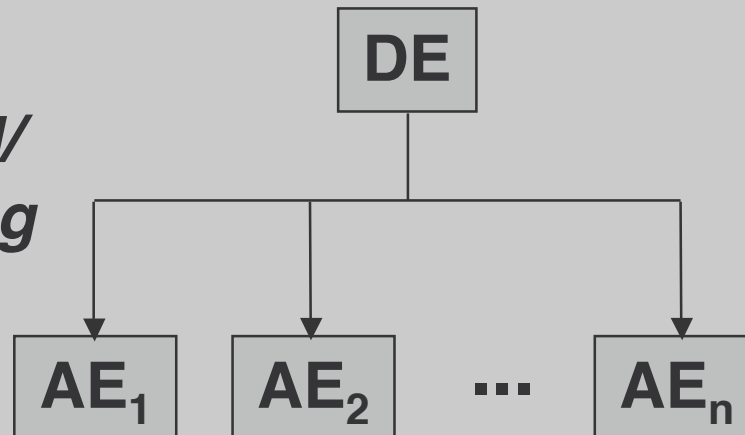
Alternative Transition Strategies

Anticipating

?

Leveraged

productivity & risk

?

Integrated

?

?

Opportunistic

?

start
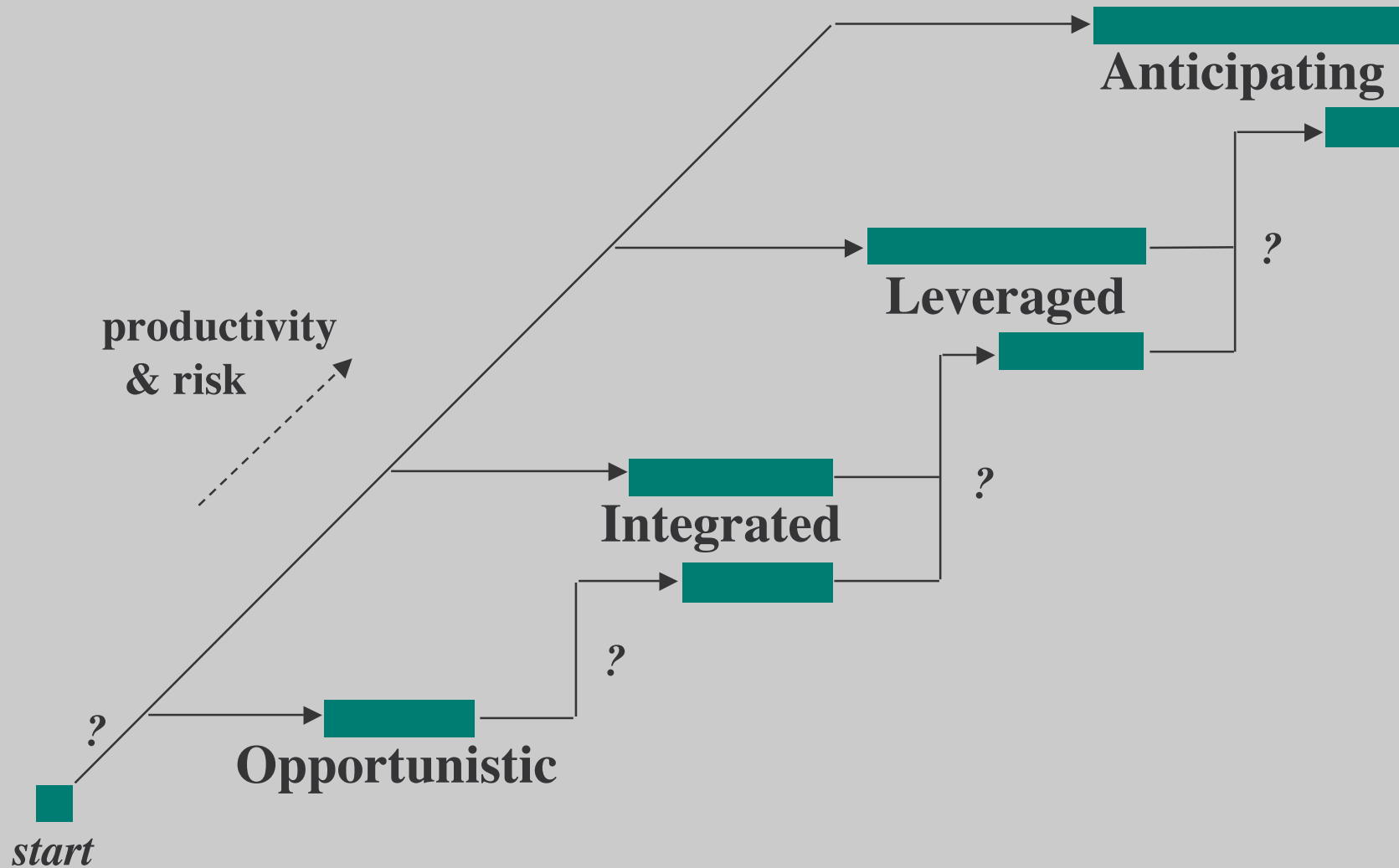
Initiate Action

Objective: Establish DsE (a streamlined ability to build similar products)

- Obtain funding and organizational support

- Augment staffing

- Provide documentation and training

- Implement infrastructure

- Resolve organizational/cultural and legal/contractual issues

Instituting PI$_r$ and DsE

Organizational actions

- Evaluate utility
- Initiate pilot efforts
- Provide training and support

Domain-specific actions (3-4 month pilot efforts)

- Define a preliminary product line focus
- Evaluate domain viability
- Analyze commonalities and variabilities
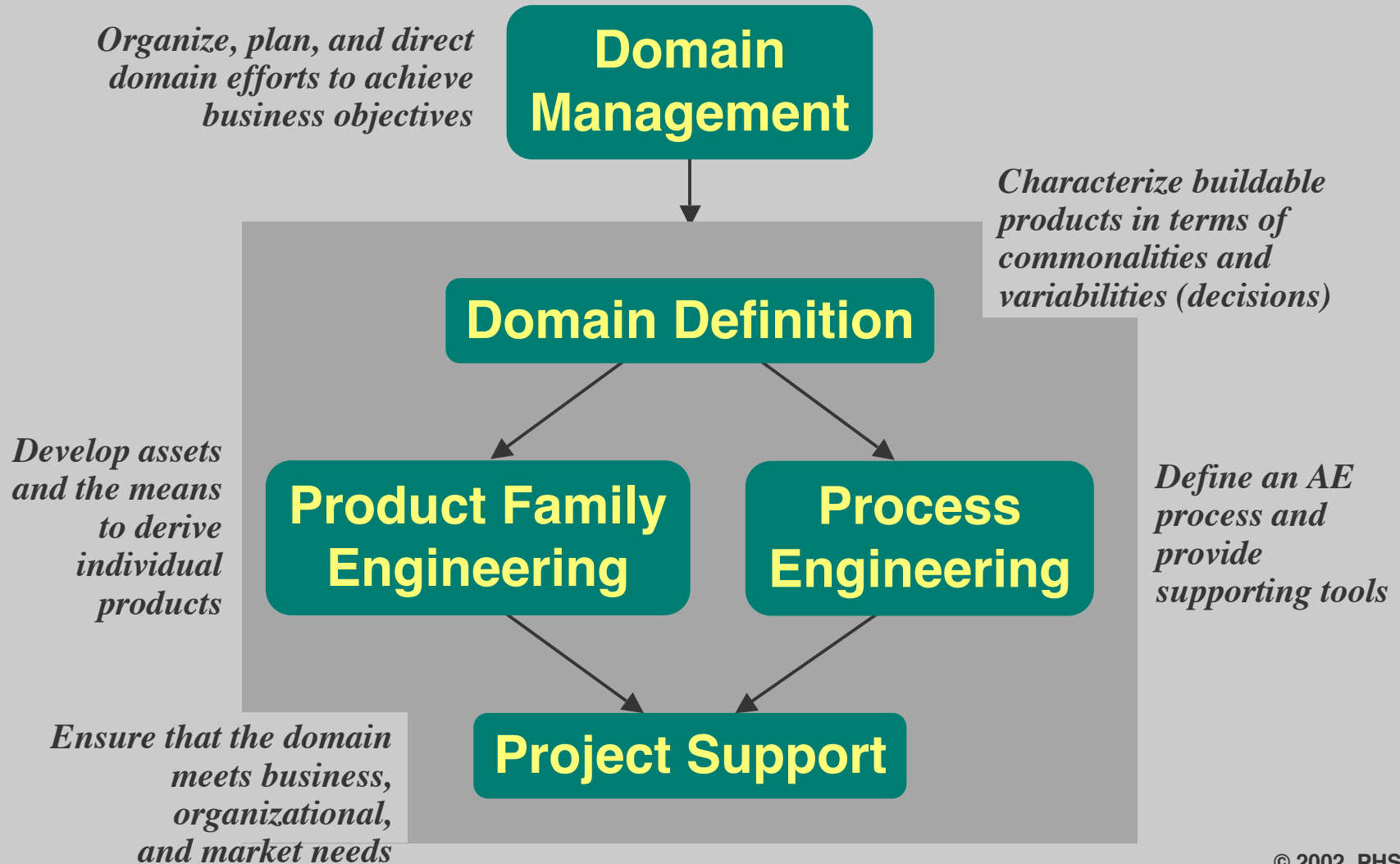- Develop selected adaptable components
- Initiate the PI$_r$ process

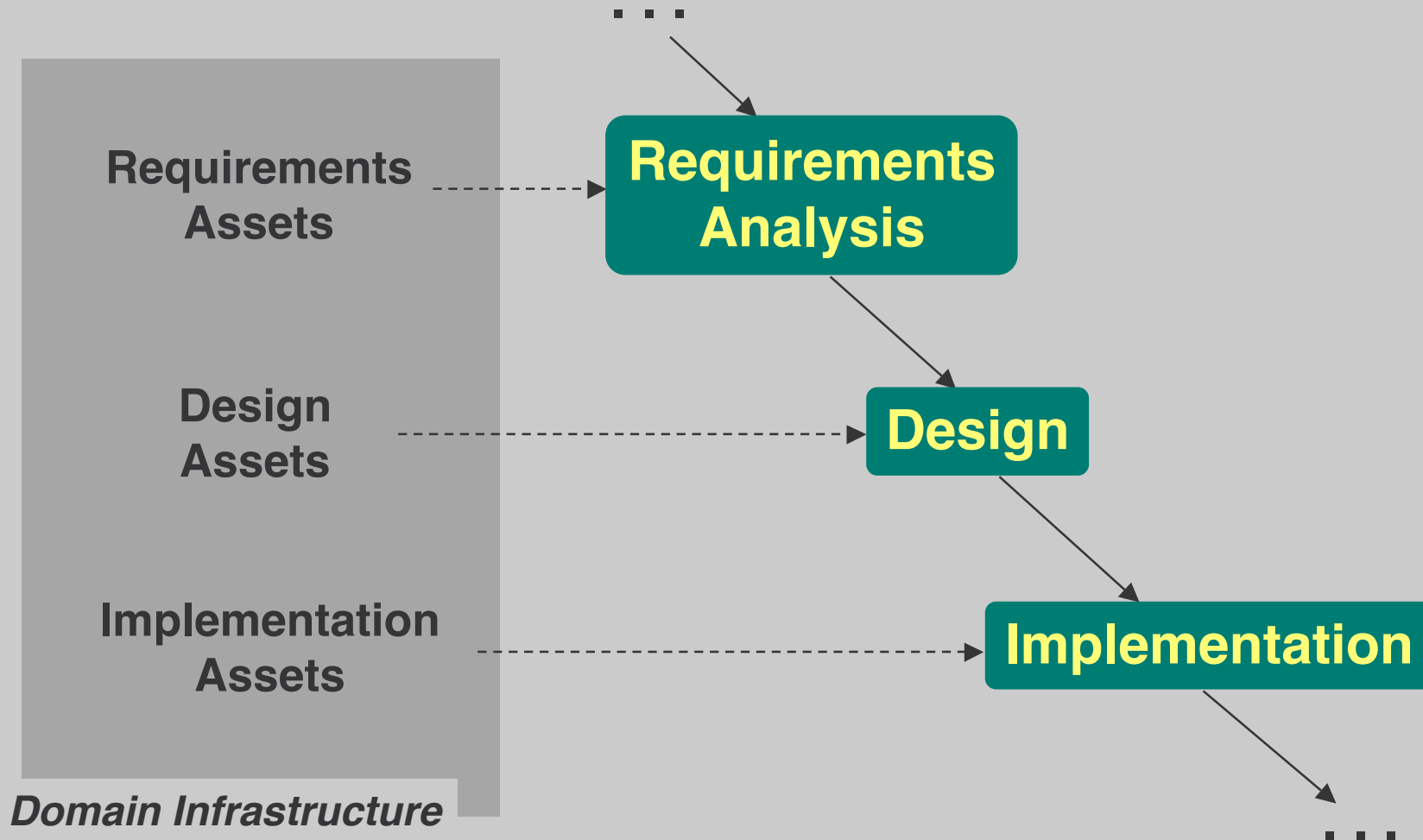# For More Information on PI$_r$ or DsE

Prosperity Heights Software

www.domain-specific.com

GradyCampbell@domain-specific.com

Domain Engineering in DsE

Organize, plan, and direct domain efforts to achieve business objectives

Domain Management

Characterize buildable products in terms of commonalities and variabilities (decisions)

Domain Definition

Develop assets and the means to derive individual products

Product Family Engineering

Process Engineering

Define an AE process and provide supporting tools

Project Support

Ensure that the domain meets business, organizational, and market needs

An Augmented Application Engineering Process

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Requirements Assets --------> **Requirements Analysis**

Design Assets --------> **Design**

Implementation Assets --------> **Implementation**

Domain Infrastructure

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A Streamlined
Application Engineering Process

Project Management

Application Modeling

Application Production

**Delivery &
Operation Support**

*Product
Specification
& Evaluation*

*Product
Generation
& Evaluation*

*Product
Distribution*

Domain Infrastructure