Exploring Acquisition Strategies for a Software Product Line

John Bergey
Larry Jones
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Software Engineering Institute
Carnegie Mellon University
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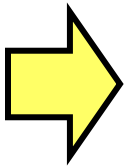
Presentation Topics



Software Product Line Basics

Software Product Line Acquisition Challenges

Product Line Acquisition Strategies

An Enterprise View of a Product Line Acquisition

- Organizing a product line production capability
- Product development using the product line production capability

Summary

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What Is A Software Product Line?

Software Product Lines:

"A **set** of software-intensive systems sharing a **common, managed set of features** that satisfy the specific needs of a **particular market segment or mission** and that are **developed from a common set of core assets** in a **prescribed way.**"

[Clements 2002]

In an Acquisition Context?

Acquisition:

"The process of **obtaining products and services through contracting**. Contracting includes purchasing, buying, commissioning, licensing, leasing, and procuring of designated supplies and services via a formal written agreement**.**"

[Bergey and Fisher 1999]

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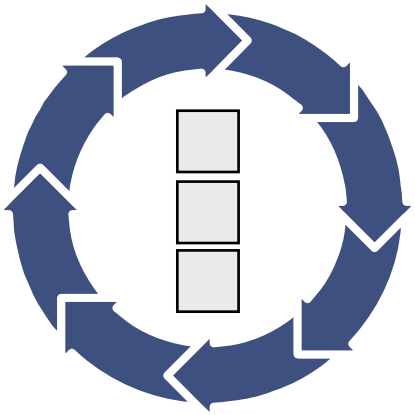
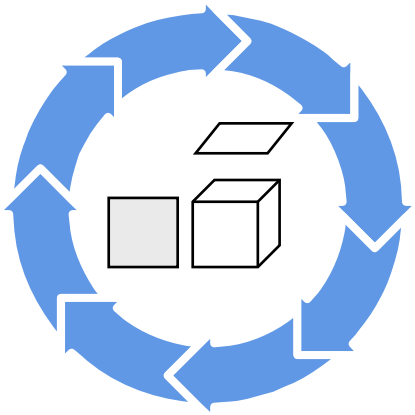
The Key Concepts

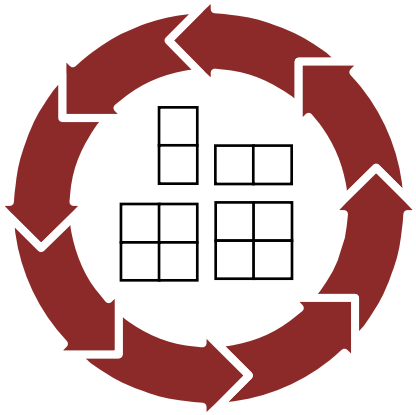
Use of a core asset base



in production



of a related set of products



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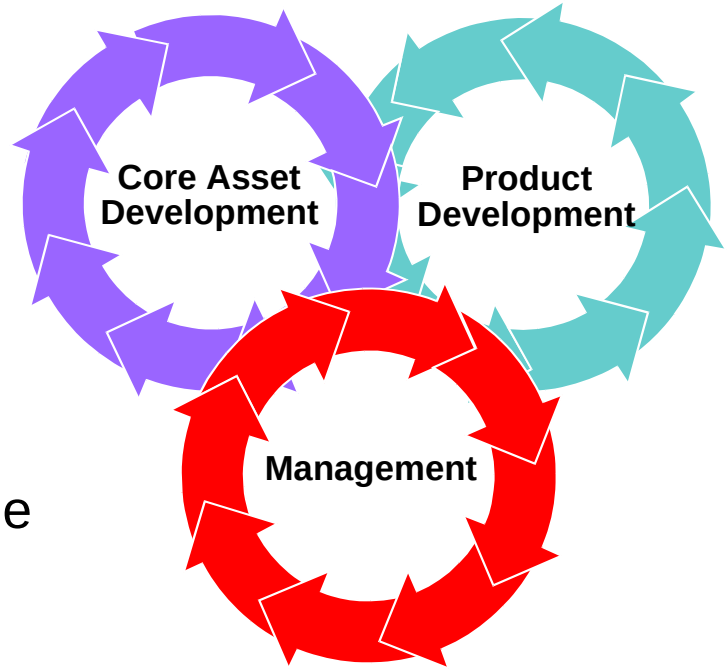
Three Essential Activities

All three activities are interrelated and highly iterative.



There is no “first” activity.

- In some contexts, existing products are mined for core assets.
- In others, core assets may be developed or acquired for future use.

There is a strong feedback loop between the core assets and the products.

Strong management at multiple levels is needed throughout.

Management oversees core asset and product development.

Management orchestrates all activities and processes needed to make the three essential activities work together.

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Software Product Lines Value Proposition

The systematic use of software product line practices results in significant organizational benefits including

- increased quality
  - by as much as 10x
- decreased cost
  - by as much as 60%
- decreased labor needs
  - by as much as 87%
- decreased time to market (to field, to launch...)
  - by as much as 98%
- ability to move into new markets
  - in months, not years

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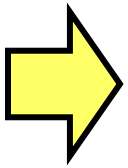

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Traditional Contracting vs. Product Line Acquisition

Traditional contracting is **most suited to** efforts that

- are well understood and have no unprecedented aspects
- are based on prior experience and well understood cost history data
- are based on predetermined quantity, schedule, and funding
- are well bounded – i.e., involve a fixed set of tasks and traditional deliverables in a well defined context
- have fixed and well understood requirements
- involve familiar practices and processes
- are likely to involve minimal changes or redirection

Product line acquisitions may present challenges to traditional contracting.

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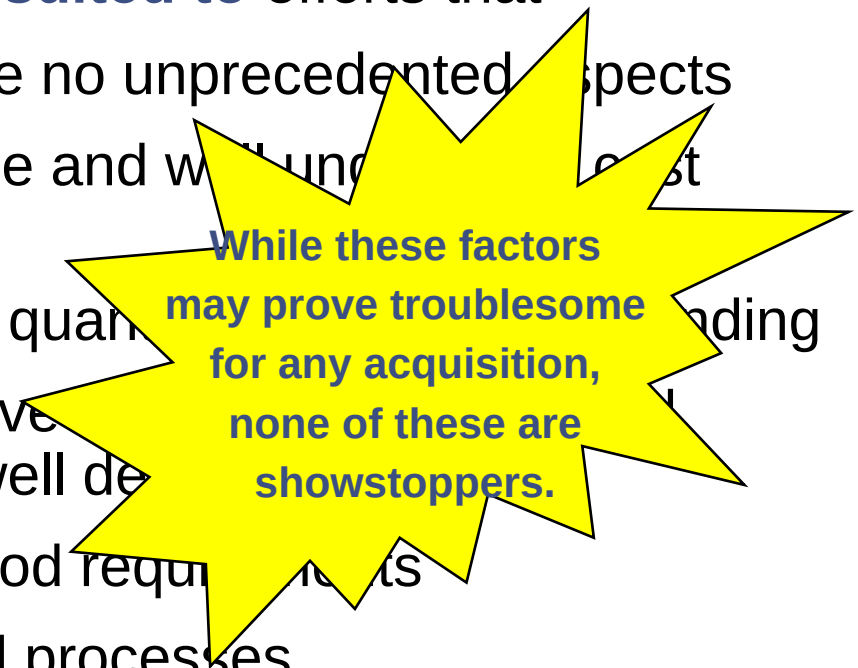

Product line acquisitions may present challenges to traditional contracting

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Specific Product Line Acquisition Challenges

Product lines focus on meeting the needs of multiple programs and target systems that transcend multiple platforms and developers.

These aspects may exacerbate product line acquisition because

- DoD's **acquisition policies and infrastructure** are still largely predicated on acquiring **'one-of-a-kind'** stovepiped systems.
- **Planning** a family of software products that rely on a common development effort is not a traditional DoD acquisition paradigm.
- No institutionalized means exist for **funding** the development and sustainment of a product line **across multiple programs**.
- **Program offices** are **not appropriately incentivized** to adopt a product line approach.
- **Contractors** are **not suitably incentivized** to participate in **collaborative** product line development and sustainment efforts.
- Adopting a product line approach may force the government to assume **system integration responsibility**.

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Specific Product Line Acquisition Challenges

Product lines focus on meeting the needs of multiple programs and target systems that transcend multiple platforms and developers.

These aspects may exacerbate product line acquisition because

- DoD's **acquisition policies and infrastructure** are still largely predicated on acquiring **'one-of-a-kind'** stand-alone systems.
- **Planning** a family of software product line development effort is not a traditional paradigm.
- No institutionalized means exists for the development and sustainment of a product line **programs**.
- **Program offices** are **not appropriated** to adopt a product line approach.
- **Contractors** are **not suitably incentivized** to participate in **collaborative** product line development and sustainment efforts.
- Adopting a product line approach may force the government to assume **system integration responsibility**.

The "takeaway" is that programmatic issues – not technical issues – are the impediments *to widespread adoption* of product line practices in the DoD.

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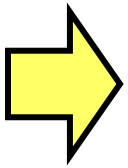

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Two Fundamental Ways for a DoD Program to Initiate a Product Line Acquisition

Reactive

Desired product line initiative/activities/tasks are conducted **opportunistically** and performed **in situ** under an existing contract.

Proactive

Desired product line initiative/activities/tasks are **preplanned** and **integrated up front** in a request for proposal (RFP) for a system (or software) acquisition.

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Three Basic Acquisition Strategies for Acquiring Products via a Product Line Approach

1. **Commission a supplier to develop a specific product (or products) using its own proprietary product line.**

   This strategy involves acquiring products directly from a supplier who has an existing product line and a demonstrated capability to build products in the domain of interest**.**

   Contractor Ownership | Existing Product Line

2. **Commission a government organization to develop a product line production capability and build specific products.**

   This strategy involves acquiring a completely government-owned product line using the in-house capabilities of a designated government acquisition organization.

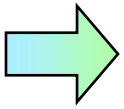
   Government Ownership | Government Development

3. **Commission a supplier to develop a product line production capability and build specific products.**

   This strategy involves acquiring a complete product line production capability and developing derivative products through contracting with one or more suppliers.

   Government Ownership | Contractor Development

Presentation **Focus**



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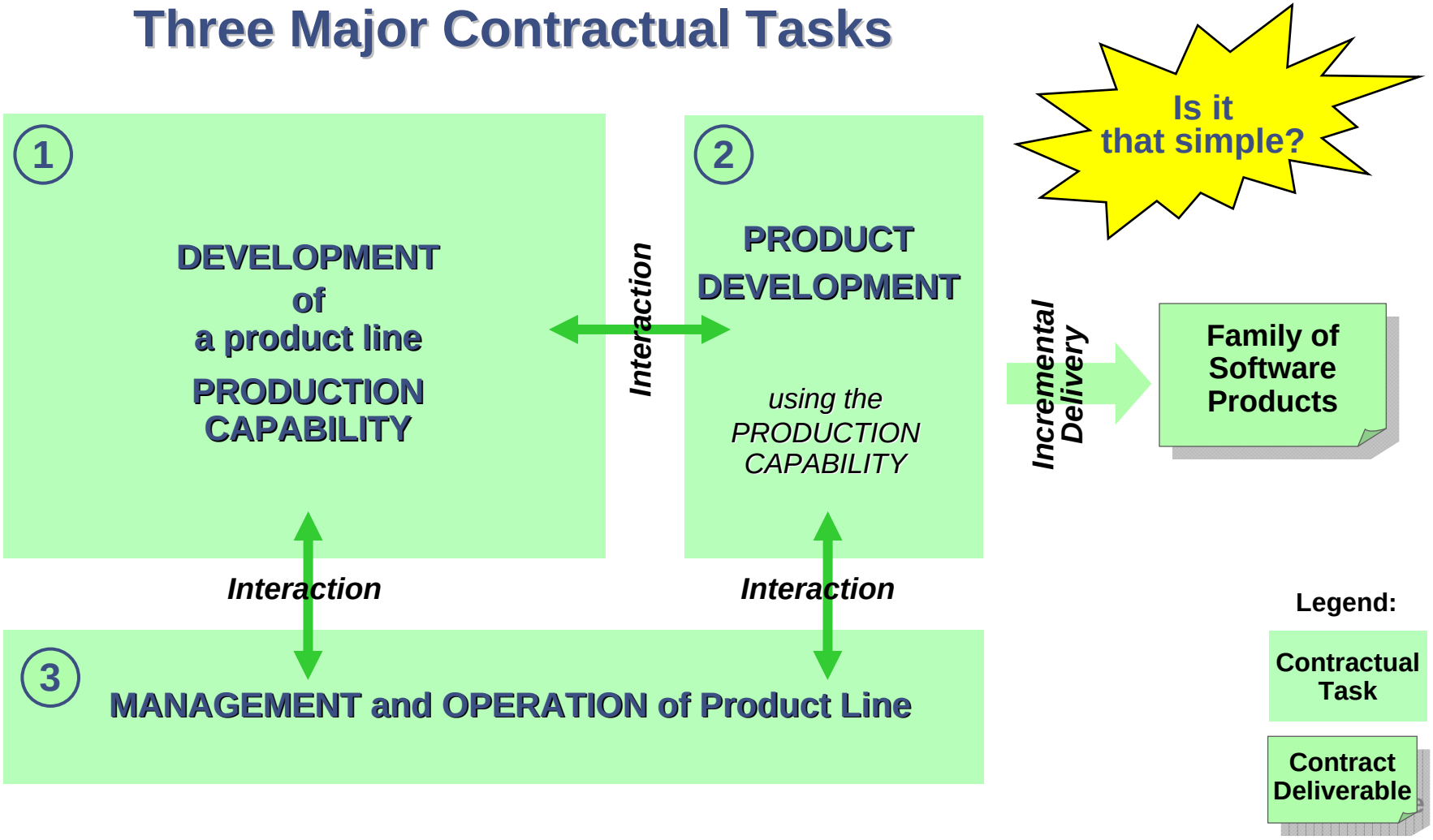
Overview: Software Product Line Acquisition

Three Major Contractual Tasks



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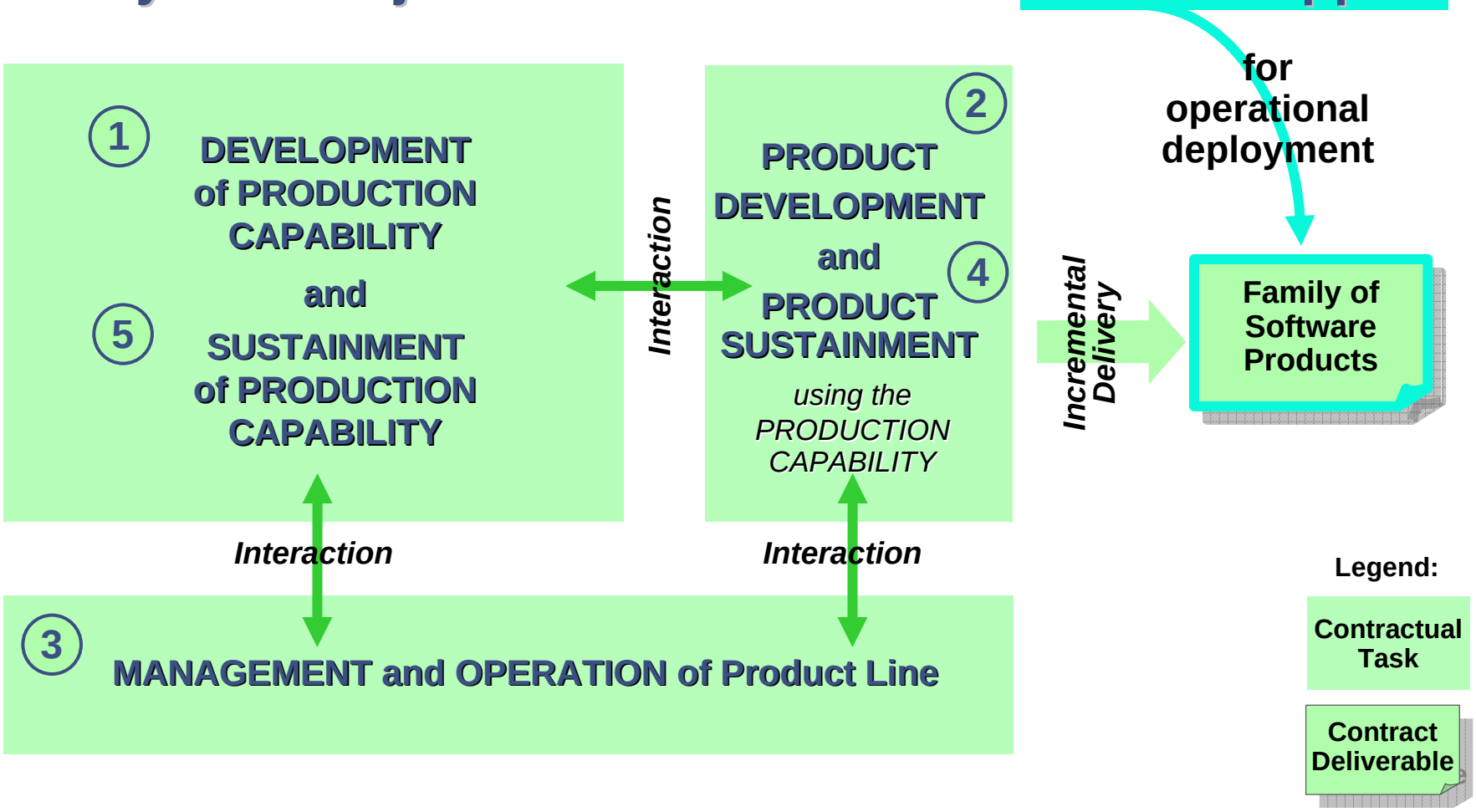
Overview: Software Product Line Acquisition

Reality: Five Major Contractual Tasks to Provide Support



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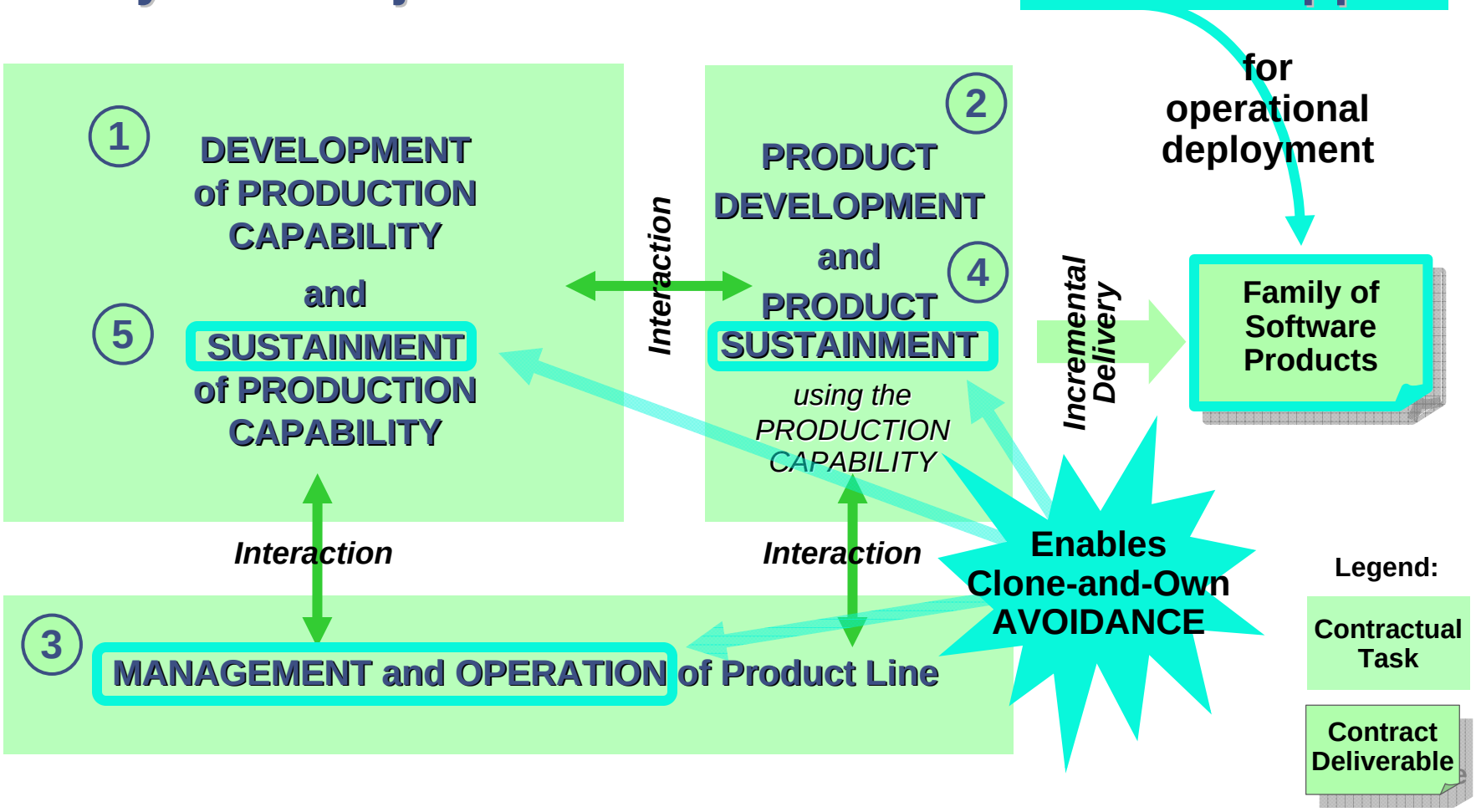

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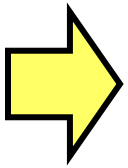

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Establishing the Product Line Context

The government acquisition organization has the responsibility for establishing the **product-related context** for the product line.

- What are we buying?
- What is the scope of the product line?
- What are the funding and schedule constraints?

The government acquisition organization has the responsibility for establishing the **organization-related context** for the product line.

- What other organizations will be involved?
- What will be their roles and responsibilities?
- How do we plan, organize and operate the product line effort from an enterprise perspective? For example,
  - How will customer interface management be handled?
  - How can external product developers be accommodated?

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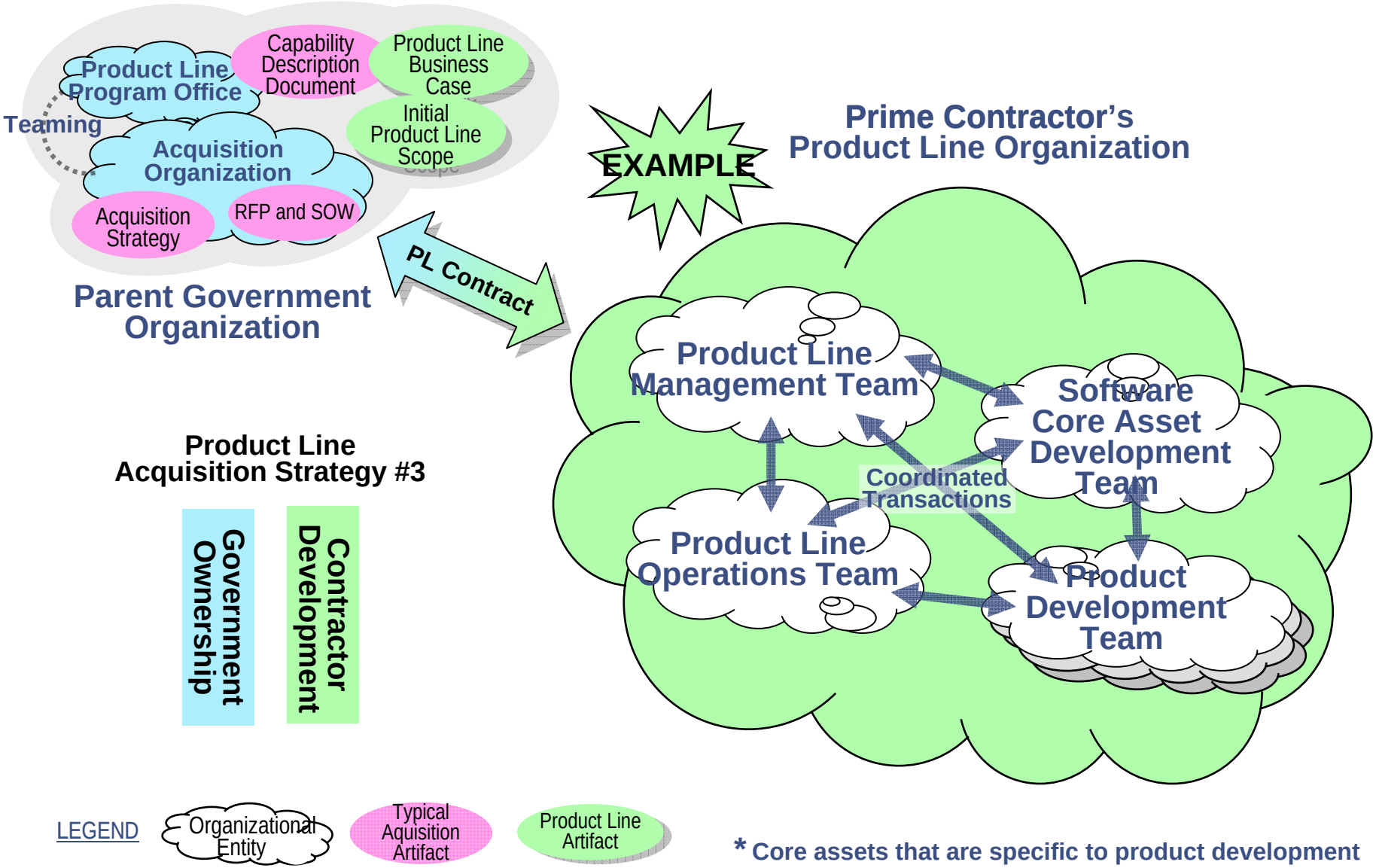
Enterprise View of a Product Line Acquisition



* Core assets that are specific to product development

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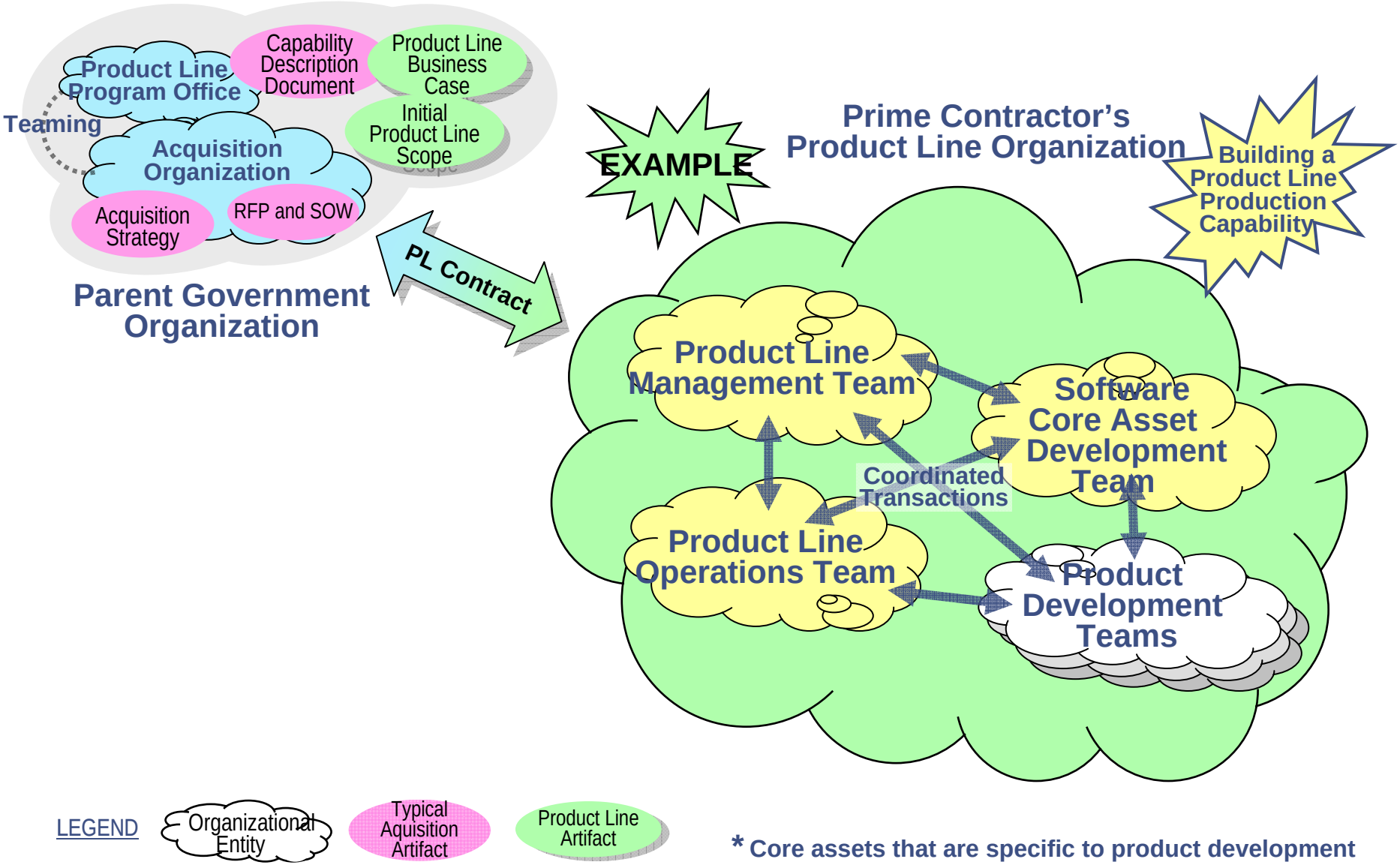

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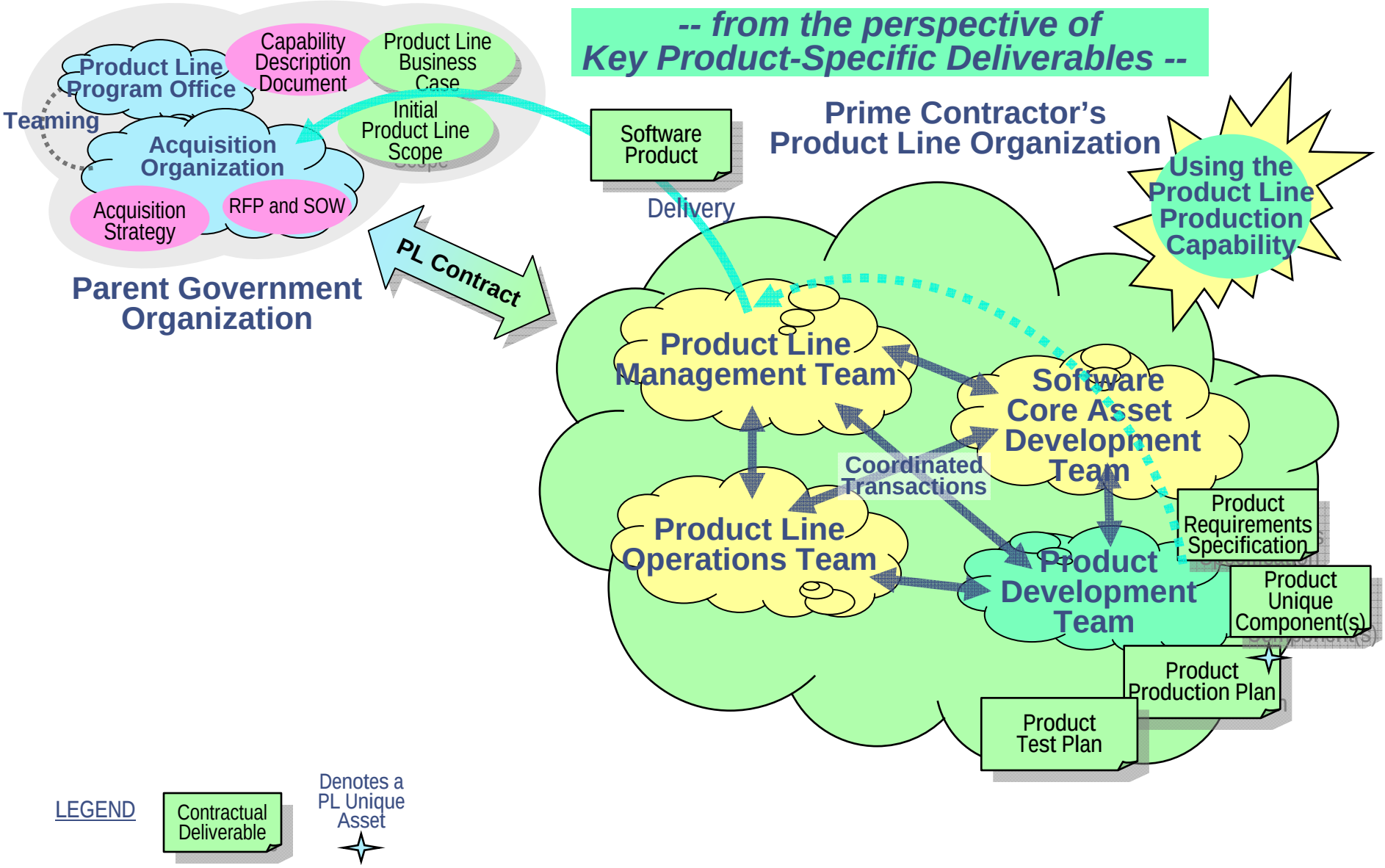

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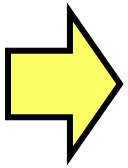

Summary

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Summary

Carefully choosing an appropriate product line acquisition strategy is essential to ensure the selected approach is

- consistent with stakeholders' expectations
- a good fit with the acquirer's resources and technical skills

Considering product line acquisition from an enterprise point of view is useful for

- identifying and understanding how stakeholder involvement is managed
- understanding stakeholder interactions and interdependencies and defining specific roles and responsibilities
- stimulating discussion, analyzing different "acquisition threads" (i.e., scenarios), and answering pertinent questions such as:
  - How is the product line effort being organized and managed?
  - How do requirements flow from the customer to the core asset team?
  - How does an external developer use the core assets to develop a product?
  - What is the information flow for sustaining products that are already fielded?

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Questions

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Contact Information

Linda Northrop
Research, Technology, and
System Solutions Program
Telephone: 412-268-7638
Email: lmn@sei.cmu.edu

Larry Jones
Product Line Practice Initiative
Telephone: 719-548-4744
Email: lgj@sei.cmu.edu

John Bergey
Product Line Practice Initiative
Telephone: 215-348-0530
Email: jkb@sei.cmu.edu

U.S. Mail:
Software Engineering Institute
Carnegie Mellon University
4500 Fifth Avenue
Pittsburgh, PA 15213-3890

World Wide Web:
http://www.sei.cmu.edu/productlines
SEI Fax: 412-268-5758

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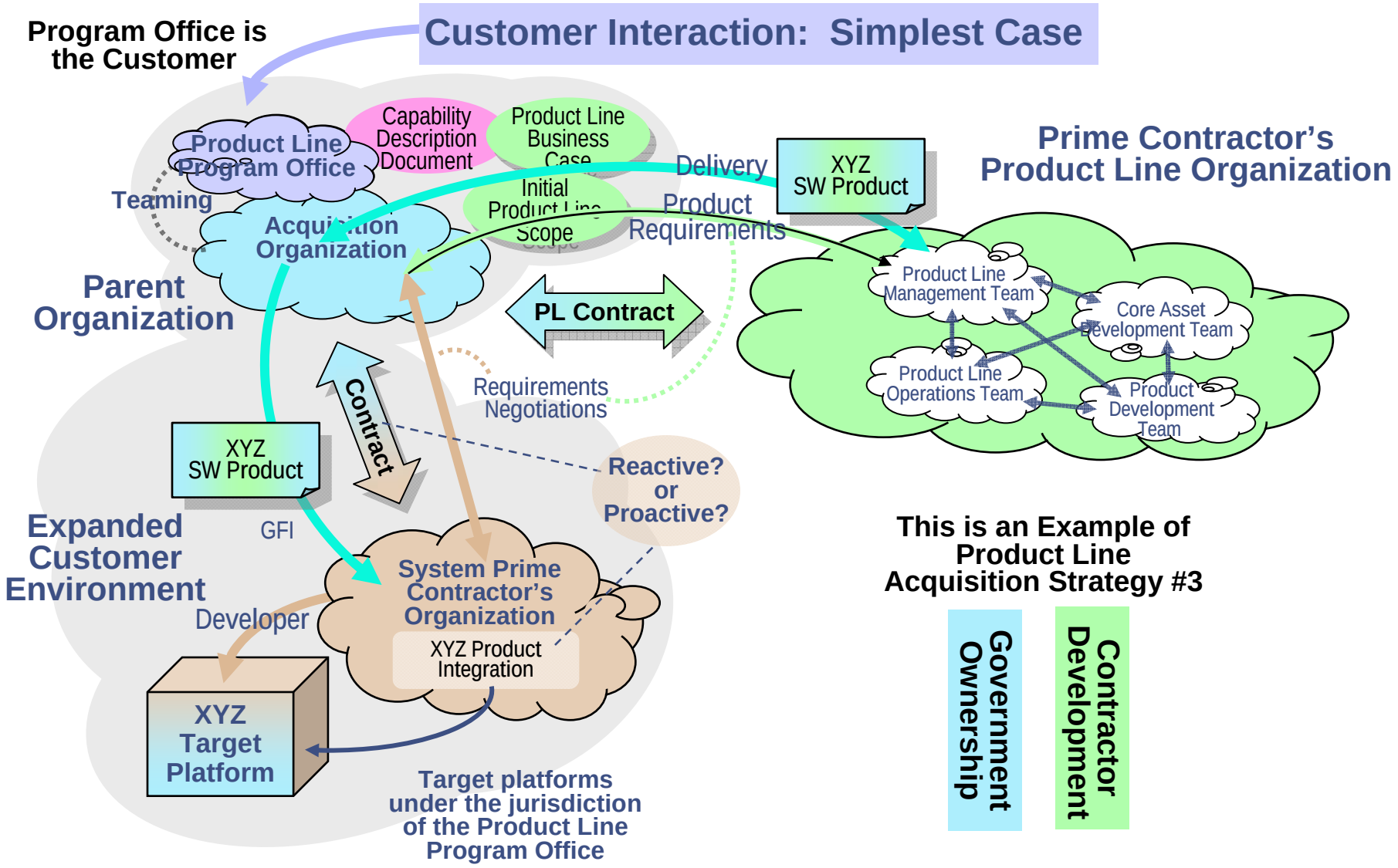
Customer View of a Product Line Acquisition



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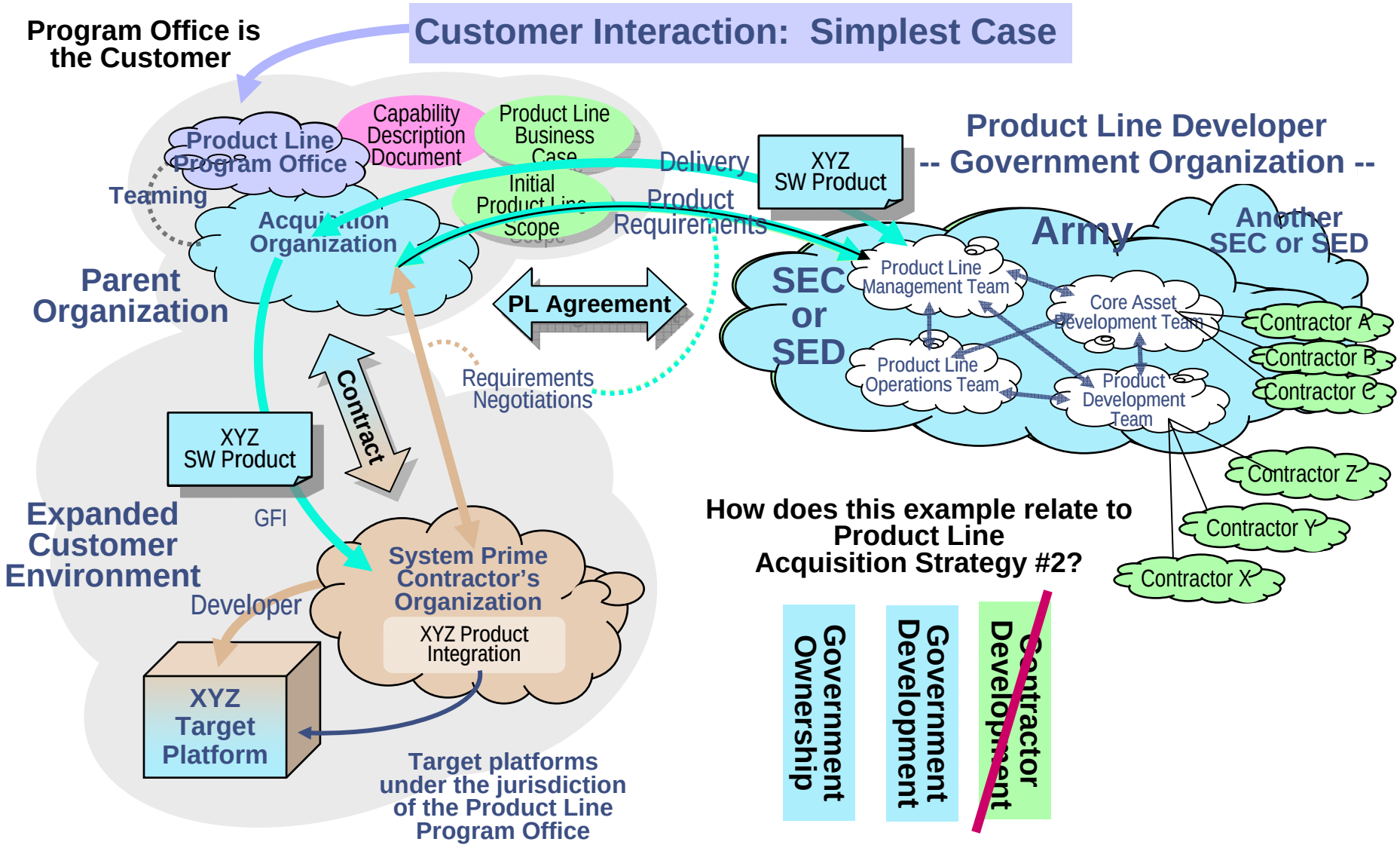

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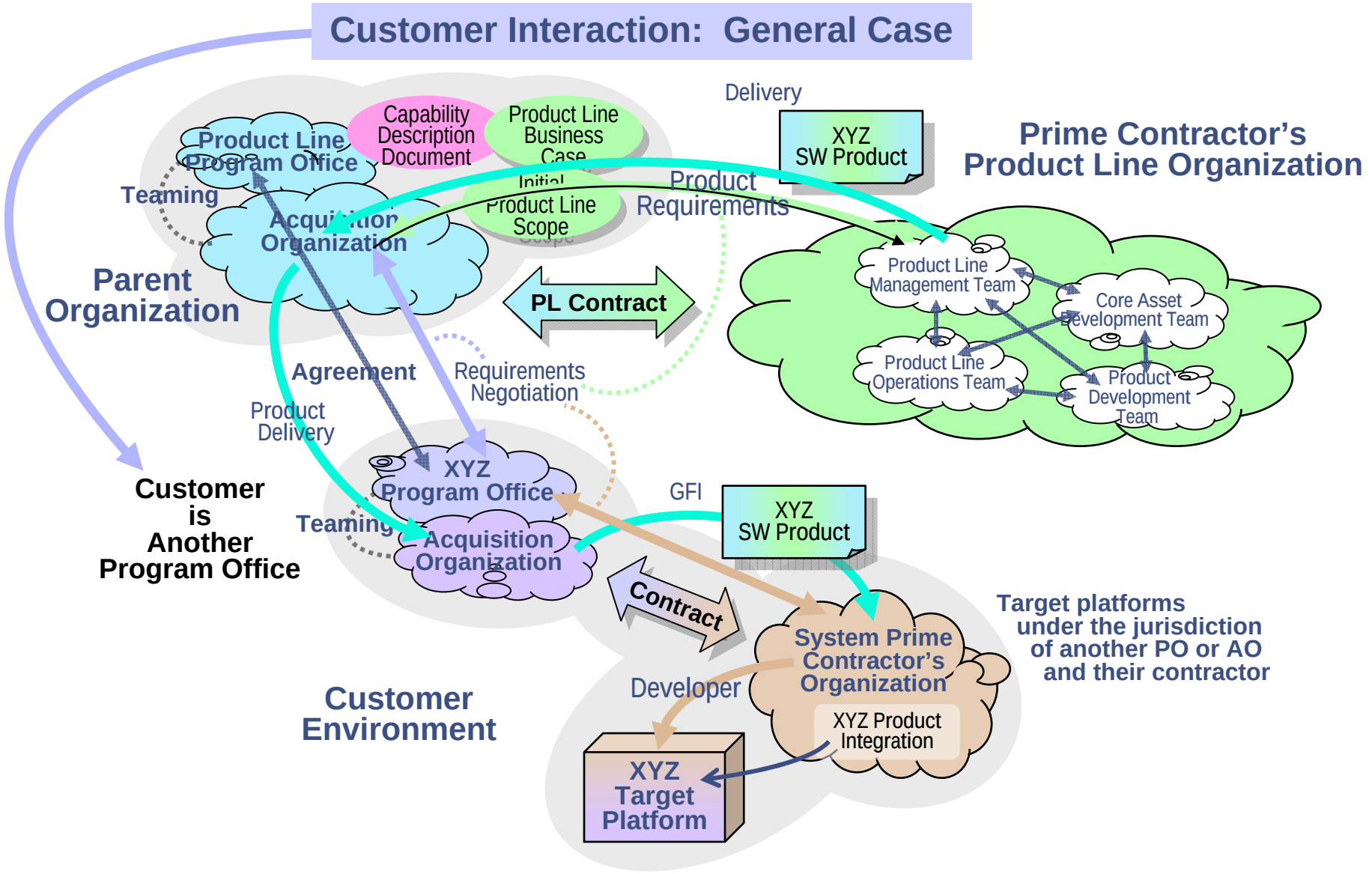

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