

Relating Product Line Adoption Mode and Transition Process

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Overview

- 1. Product Line Adoption Situations**
- 2. Adoption Strategies**
 - Adoption Patterns
 - Resulting Economic Patterns
- 3. Product Line Planning Techniques**
 - PL Planning and its Relation to Adoption and Evolution
- 4. An Economic Model to Optimize Product Line Adoption**
- 5. Summary**

Independent

- No previous systems
- Entering a new market / domain / sub-domain
- Willingness to develop systems from scratch

Project-Integrating

- Systems exist
- System-Development needs to continue

Reengineering-Driven

- Systems exist - but no basis for PL
- Knowledge is insufficient / other means are too costly

How to introduce product lines?

Leveraged — characteristics of previous ones

- Product Line in Place
- Entering a new market / domain / sub-domain

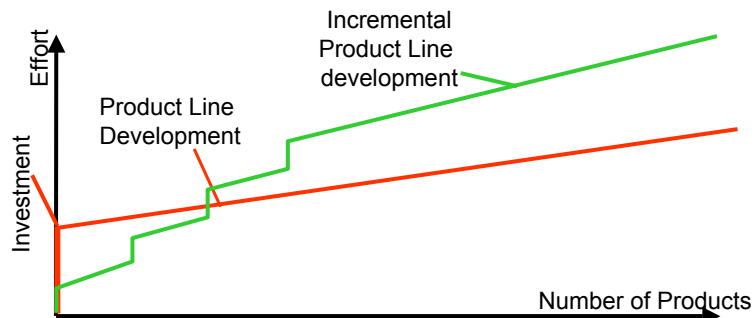


Big Bang

- You plan it — You do it.

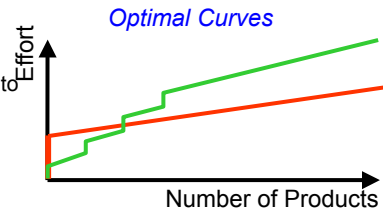
Incremental

- You build it on your way
- *Dimensions of Incrementality:*
 - products
 - functional areas (sub-domains)



Big Bang ↔ Incremental

- Jumps in incremental
 - correspond to investments in migrating to product line assets
 - total sum higher than in big bang
- Lines
 - correspond to products built with partial infrastructure
- Angle
 - reduced in each investment
 - final angle still steeper
 - go for best ROI first (if risk controllable) — best reduction of angle
- Endpoint
 - higher for incremental



Why to go for incremental anyway?

- Risk control!!

| Adoption Situation | PL Planning Look-Ahead | Approach |
|----------------------|---|--|
| Independent | Broad Portfolio of Future Systems | Big Bang |
| Project-Integrating | Medium-Size Portfolio of Future Systems | Incremental (by functional area or component) <i>may be combined with</i> Incremental (by product) |
| Reengineering-Driven | Broad Portfolio of Future Systems and Legacy Products | Incremental (by functional area or component) <i>or</i> Big Bang (packaging legacy as a whole) |
| Leveraged | Broad Portfolio of Future Systems | Big Bang |

Relation to Evolution?

- How much deviation do I allow?
- Deviation ↔ Re-adoption

How to evolve product lines?

Types of Deviation

Infrastructure-Based

- No deviation
- Everything goes through reuse infrastructure

Ideal

Branch-and-Unite

- Systems are split of the basis and re-integrated after being built

Few systems, implications unclear

Bulk Integration

- Product Line in Place
- Large diversions occur

Don't Do It!

| Evolution Approach | PL Planning Look-Ahead | Approach |
|----------------------|---|------------------------------|
| Infrastructure-based | A small number of products | Incremental by product |
| Branch-and-unite | Single product | Incremental by product |
| Bulk Integration | Small number of products (perhaps a market segment) | Incremental by product group |

Product Portfolio Planning

- Define what the products are
- Interface with product management / Market concerns
- Typically workshops

Domain Potential Analysis

- Identify benefits and risks related them to functional sub-domains
- Assessment Approaches (e.g., PuLSE-B&R)

Reuse Infrastructure Scoping

- Identify parts that should be packaged as reusable assets (⇒ architecture impact)
- Rather fine-grained analysis
- Closest to implementation

| Mode of PL Extension | Portfolio Definition | Domain Potential Analysis | Reuse Infrastructure Scoping |
|---|----------------------|---|--|
| Partial Big Bang / Evolution by Product Group | Very important | Recommended but mainly for risk analysis | Recommended to support architecture definition |
| By (single) product | Not necessary | Only needed if extension requires restructuring | Only needed if the extension requires restructuring |
| By component or functional area | Should be performed | Key for identifying the next component for product line extension | Should be applied to support architecture definition |

Impact of product characteristics on the architecture:

- How often will we need a certain variation?
- How certain is it, we will need it?
- What are the costs of variation mechanisms?

Assumptions:

- Adding variabilities costs effort (variability mechanism + effort capability)
- More generic code is more complex, thus more costly to maintain
- Late implementation is more costly than if it was planned right away
- The less „places“ a change impacts, the less costly
- Architecting for a functionality reduces the number of impacted positions
- *Discounted Cash-Flow Analysis*

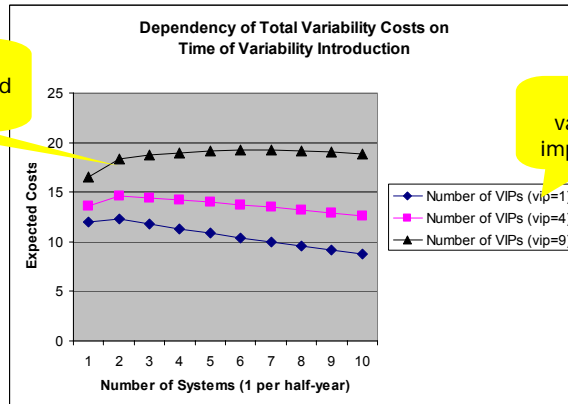
Example

- Some functionality (in our case distribution support) *can* be required:
 - We are not sure
 - The support is costly to build
 - It can not always be present
- What to do?
- The numbers are taken from the example, but the basic characteristics of the functions relate only to their structure

Is up-front introduction of variability better?

- The number of impacted positions (i.e., the architecture) is key to answer this question!

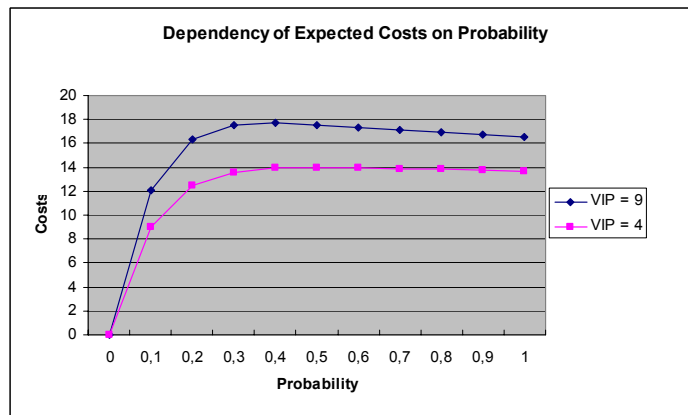
There is a gap between up-front and later introduction



VIP = variability impact point

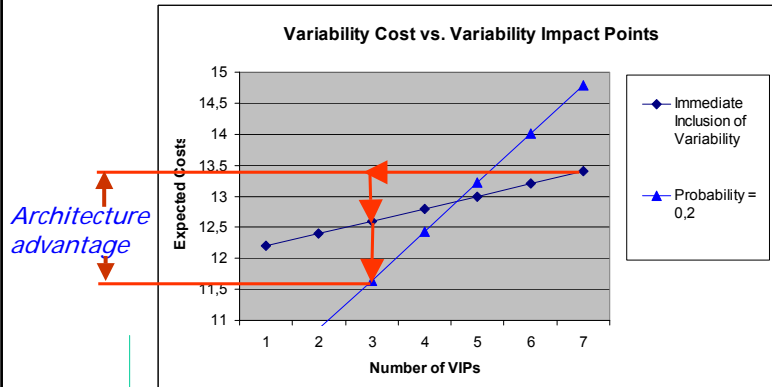
The effect of probability

- Only for very low probabilities the total costs are reduced



Changing the architecture changes the approach

- Up-front architecting might be appropriate even if up-front implementation is not!!



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Conclusions

- Categorizations of product line adoption situations were given and different approaches for dealing with them were discussed
- Detailed recommendations for product line planning were given
 - Planning Look-Ahead
 - Relative Importance of Scoping Techniques
- A quantitative model was proposed that allows to derive more detailed guidelines
 - Amount of effort required for variability
 - Probability that it is needed
 - Characteristics of underlying development process (e.g., change effort)

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