

Support of Design Reuse by Software Product Lines

Motorola/FAU: One Pass to Production (OPP) Project

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Outlines

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- References

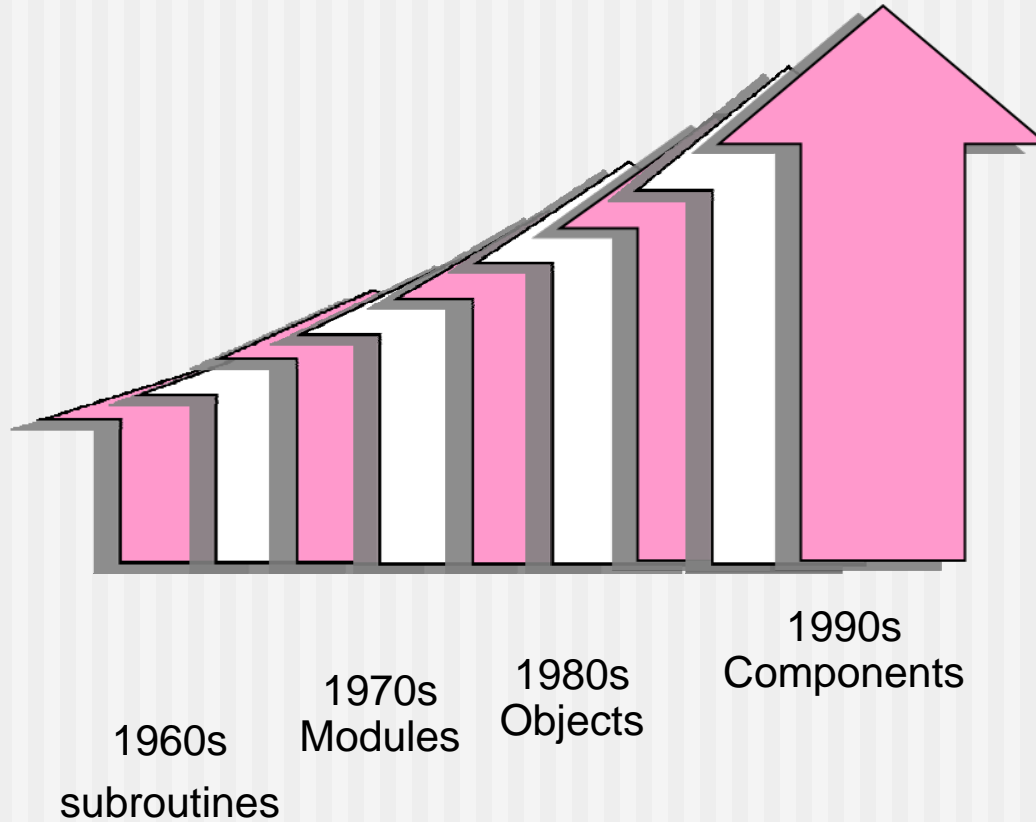
Motivation

- Most organizations produce families of similar systems that are differentiated by some features
- Core assets (e.g., architecture) of the product families capture the needs of the entire set of products
- Reuse of these core assets is one of the efficient ways to improve productivity
- Software product line (SPL) approach can help to realize design reuse from *commonality* to *variability*
- Many organizations have succeeded with SPLs

Introduction

- One of the goals of the One Pass to Production (OPP) project is to drastically shorten the software development cycle
- Common strategies of increasing productivities and qualities including aspects include:
 - Process improvement
 - Deployment of new technology, and
 - Software reuse

Software Reuse History



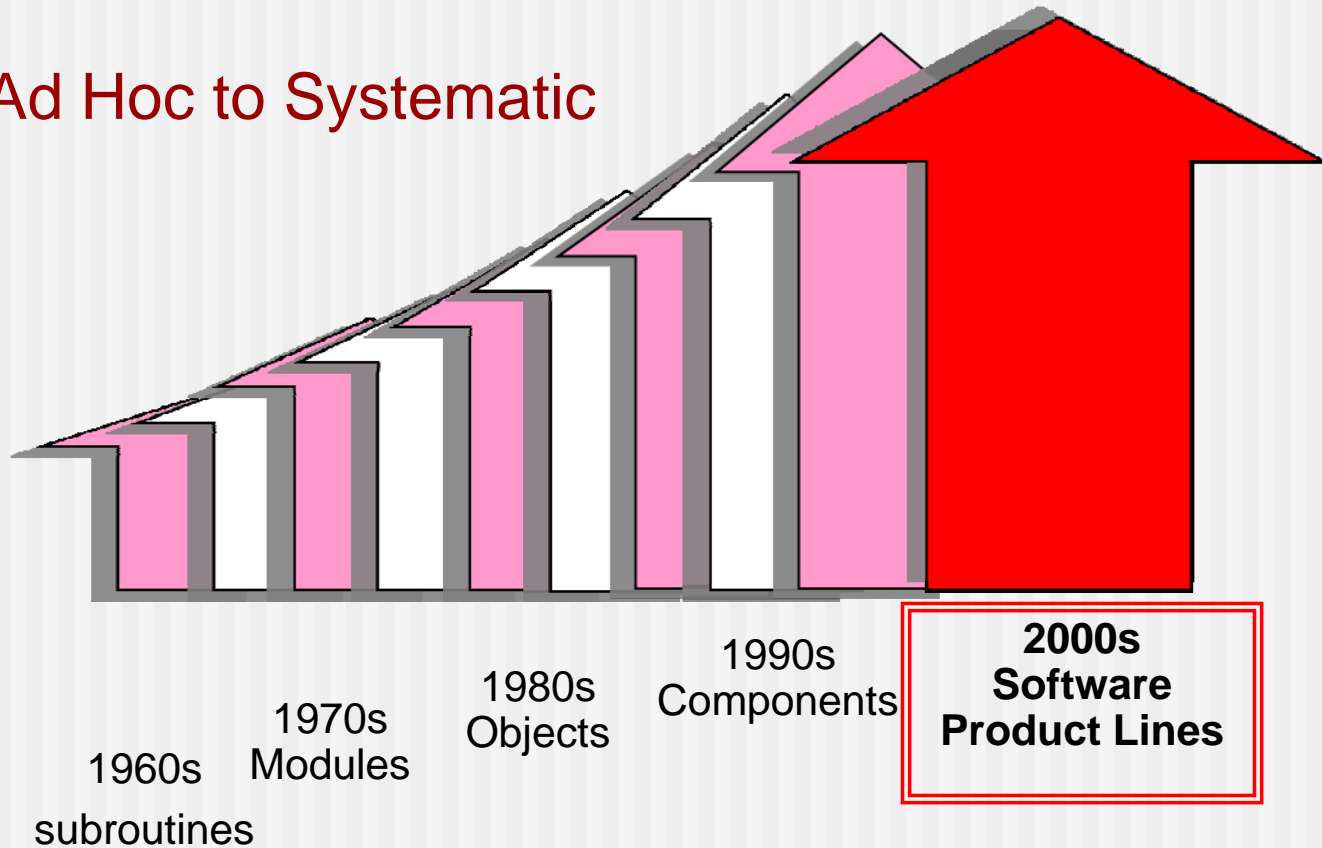
Source: reference [4]

Problems with General Reuse

- Focused on small grained and opportunistic
 - Try to make assets (e.g. code and test artifacts) as general as possible without the context provided by an architecture
 - Opportunistic reuse schemes: low-payoff assets are scavenged ad-hoc from a reuse repository
- Results felt short of expectations

Software Reuse History Revisited

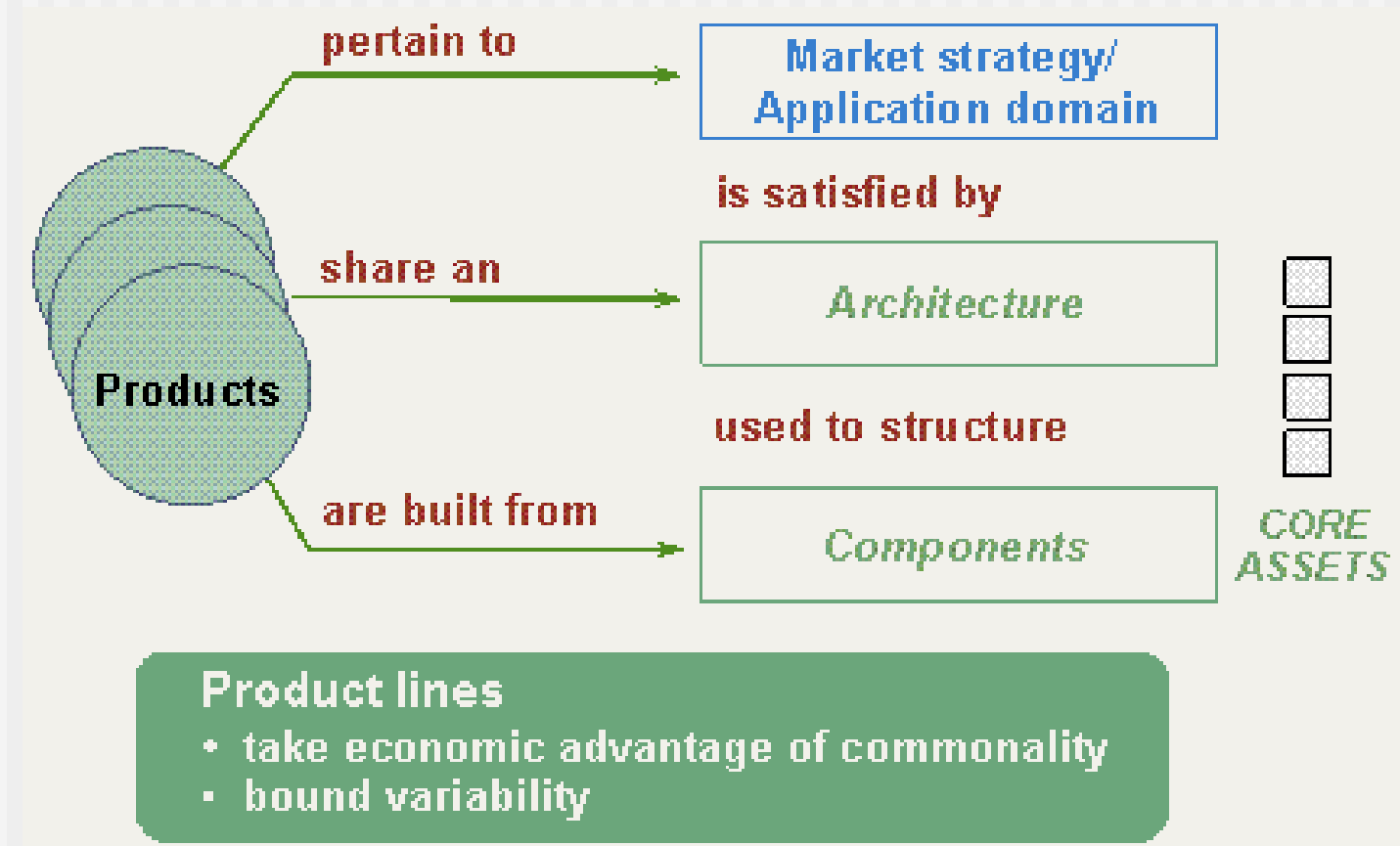
From Ad Hoc to Systematic



Software Product Lines --1

- “Software product line is 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” [4]
- SPLs involve strategic, planned reuse that yields predictable results

Software Product Lines --2



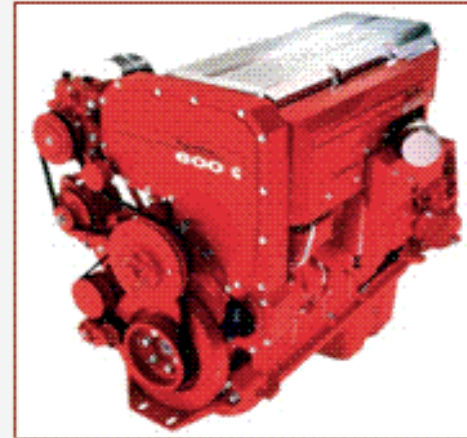
Source: reference [4]

Commercial Case Studies

- Examples of successful software product lines have been built for product families, such as
 - Command and control ship systems
 - Ground-based spacecraft systems
 - Engine control systems
 - Printers
 - Acquisition management enterprise systems
 - And more...

Case Study 1: Cummins Inc. Diesel Engine Control Systems

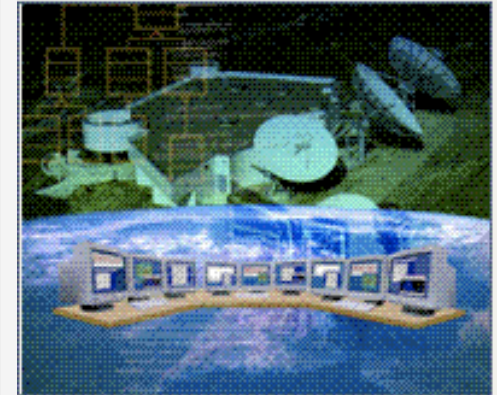
- Over 20 product groups with over 1,000 separate engine applications
- Product cycle time was slashed from 250 person-months to a few person-months
- Build and integration time was reduced from one year to one week
- Quality goals are exceeded
- Customer satisfactions is high
- Product schedule are met



Source: reference [1]

Case Study 2: Raytheon: Control Channel Toolkit

- Ground-based spacecraft command and control systems
- Increased quality by 10x
- Incremental build time reduced from months to weeks
- Software productivity increased by 7x
- Development time and cost decreased by 50%
- Decreased product risk

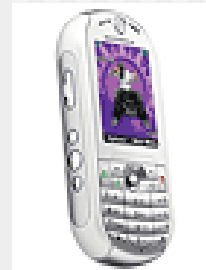


Source: reference [1]

Applicability to Mobile Phones

Product lines with more than 20 new products/year
Cross-product features include:

- Varying number of keys
- Varying display sizes
- Varying sets of features
- Tens languages support
- Needs for backwards compatibility
- Multiple protocols
- Configurable features
- Change of product behavior after release



Source: reference [5]

Conclusion

- The earlier life cycle reuse, the more benefit to organizations
- SPLs can help realize design reuse by amortize the investment in the core assets
- Strategic software reuse through SPLs can help achieve business goals:
 - Efficiency
 - Time to market
 - Productivity
 - quality
- Commercial case studies proved software product lines: reuse pays off!

References

- [1] Clements, Paul; Northrop, Linda: *Software Product Lines: Practices and Patterns*. Addison Wesley Professional, 2001
- [2] <http://www.softwareproductlines.com>
- [3] <http://www.sei.cmu.edu/architecture>
- [4] <http://www.sei.cmu.edu/productlines>
- [5] Heie, Anders: “Global Software Product Lines and Infinite Diversity”, The Second Software Product Line Conference, August 19-22, 2002, San Diego, CA