

Software Product Line Testing

Part I : Introduction

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Caveats

We are experts in software testing and analysis, not in software product lines

We have been studying the literature in validation of SPLs for 11 months

The area is surprisingly poorly studied

Lots of room for interesting, relevant, and novel work here ...

Outline

Software Product Lines : What and Why?

Modeling Variability in Software Product Lines

Validating Product Lines

A Framework for Variability Coverage

Toward Product Line Driven Test Processes

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- Software Product Lines : What and Why?

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Outline

- Software Product Lines : What and Why?
 - What is a software product line?
 - Why are development organizations interested in SPLs?
 - Our focus ...

History

The Old Days

- Every product was individually built for a single purpose
- Custom-development efforts - minimal artifact reuse

Production Lines

- Enabled products for the mass market that are much less expensive to build than individual products

Less Diversity

- Production lines reduce the diversity of products

Product Line Engineering

Mass Customization

- “Large scale production of goods tailored to meet individual customers needs” [Davis 87]

Customers: get individual products

Company: higher costs to make individual products

- Use common building blocks (**platforms**) to reduce costs

Software Product Line Engineering

“a paradigm to develop software applications (software intensive systems and software products) using platforms and mass customization” [Pohl et al. '05]

Software Platform:

a set of software building blocks with common interfaces that can be combined to derive a variety of products

Software Product Line Engineering

Reduced costs

- Artifacts can be re-used in multiple systems.
This will reduce costs to individual systems.

Improved Quality

- Artifacts may be tested in multiple products.
More thorough QA.

Reduced Time to Market

- Initially higher, but then improves with
subsequent products

Software Product Line

A **software product line (SPL)** is a set of programs that share significant common functionality and structure.

The differences between the set of programs are well-understood and organized in some form.

Supports systematic re-use of artifacts across development activities

Example Software Product Line

“Nokia Mobile Phones produces a wide range of mobile phones. Currently 32 different phones are manufactured covering six different protocol standards, a wide variety of functional features and capabilities, different user interface designs, and many platforms and environments. The initial software architecture for this product line addressed variations in hardware, communication standards, and user interfaces”

Source: SEI SPL hall of fame

Compare Phones

Preferences

> Service Providers

No preference

> Style

- No preference
- Flip
- Block
- Slide





> Top Phone Features

- No preference
- Bluetooth® technology
- Camera
- Downloadable ring tones
- Games
- Messaging - text
- Messaging - multimedia
- Speakerphone
- Video
- Voice dialing
- Web browser

[View new phones](#)
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63 Phones Match Your Preferences

Use the column headings to sort. To compare phones, check the boxes on the right and click Compare. Or simply change your preferences on the left to see

% Match	Model	Price with Plan	Price Phone Only	<input checked="" type="checkbox"/> to Compare
100% Match	 <p>Nokia N90 Phone Twist and shoot. It's a pro-photo taker. A personal video-maker. Complete with Carl Zeiss Optics for crisp, bright images you can view, edit, print and share.</p>	As low as \$399.99^b Check Plan		<input type="checkbox"/> Compare
100% Match	 <p>Nokia 9500 Phone • Fast data and Internet connectivity, solutions for terminal management and security, business-critical applications, VGA camera and MMS, and tri-band coverage^{1,2,19}</p>		coming soon	<input type="checkbox"/> Compare
100% Match	 <p>Nokia 9300 Phone • Full keyboard, wide color screen, email with attachments, organizer with PC synchronization, office applications, speakerphone, Internet access^{1,2,4}</p>	As low as \$199.99^b Check Plan		<input type="checkbox"/> Compare
100% Match	 <p>Nokia 8801 Phone- NEW • Half-megapixel camera • Speakerphone • Text messaging</p>	\$799.99		<input type="checkbox"/>

Our focus ...

Validating software systems confronts the challenge of reasoning or sampling

- Input space
- Scheduling space
- Configuration space

For validation of SPLs we must confront the

- **Variability space**