

PLEASE2013

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Feature Interaction Testing of Variability Intensive Systems

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Contact Profile

- **Interests**
 - Model-driven engineering, Model-based testing, Testing SPL, Testing Platforms
- **Objectives / Looking for**
 - Models for Variability Intensive Systems
 - Establish collaborations, Student interns
 - Success Criteria: 1 Collaboration

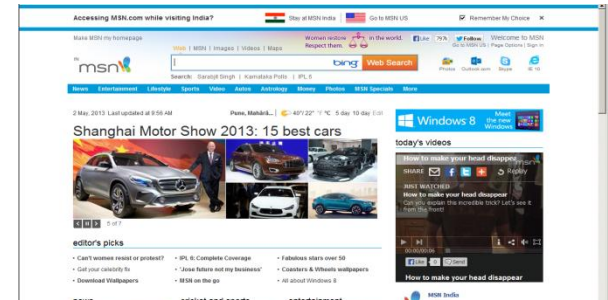
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Product Line

- ERPs, Internationalized portals, customizable and configurable software systems/platforms
- Systems that are not necessarily developed as product lines, but have variability

The Problem: Testing Internationalised Portals

- Large number of country specific portals
- Hundreds of channels of information
- Varying site and page layouts across portals
- Required to run on all major browsers, operating systems and devices
- Multiple software platforms
- Features changes – weekly
- Millions of visitors



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Why is it interesting?

- Feature variations lead to explosion in the number of feature interactions to be tested
- Coverage of variations and feature interactions within schedule and resource constraints
- Huge testing matrix, Inability to identify impacted items
- Large prospective user base within software services industry

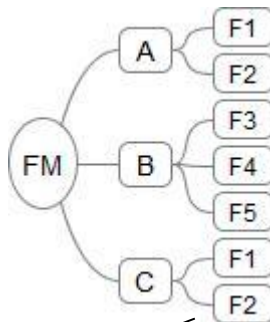
Current Solution

- Internationalized Portals as Software Product Lines
- Modelled as Multi-Perspective Feature Models
- Source of Variation as an extension to FM
- Country specific portal derived as product configuration
- Input models derived from set of features to be tested
- Pair-wise coverage on Input model

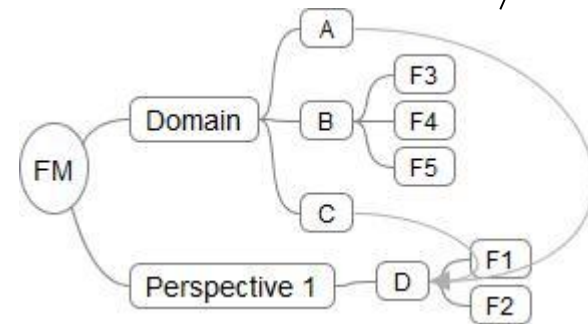
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Multi-Perspective Feature model (MPFM)

- A MPFM is a set of Feature Trees where each tree represents a different perspective
- $\text{SourceOfVariation}(\text{FeatureA}, \text{FeatureD}) \Rightarrow$
 FeatureA and FeatureD belong to different perspectives
 AND
 FeatureD is the cause of variations in FeatureA
 AND
 Subfeatures of FeatureD $\{S1..Sn\}$ are variations of FeatureA

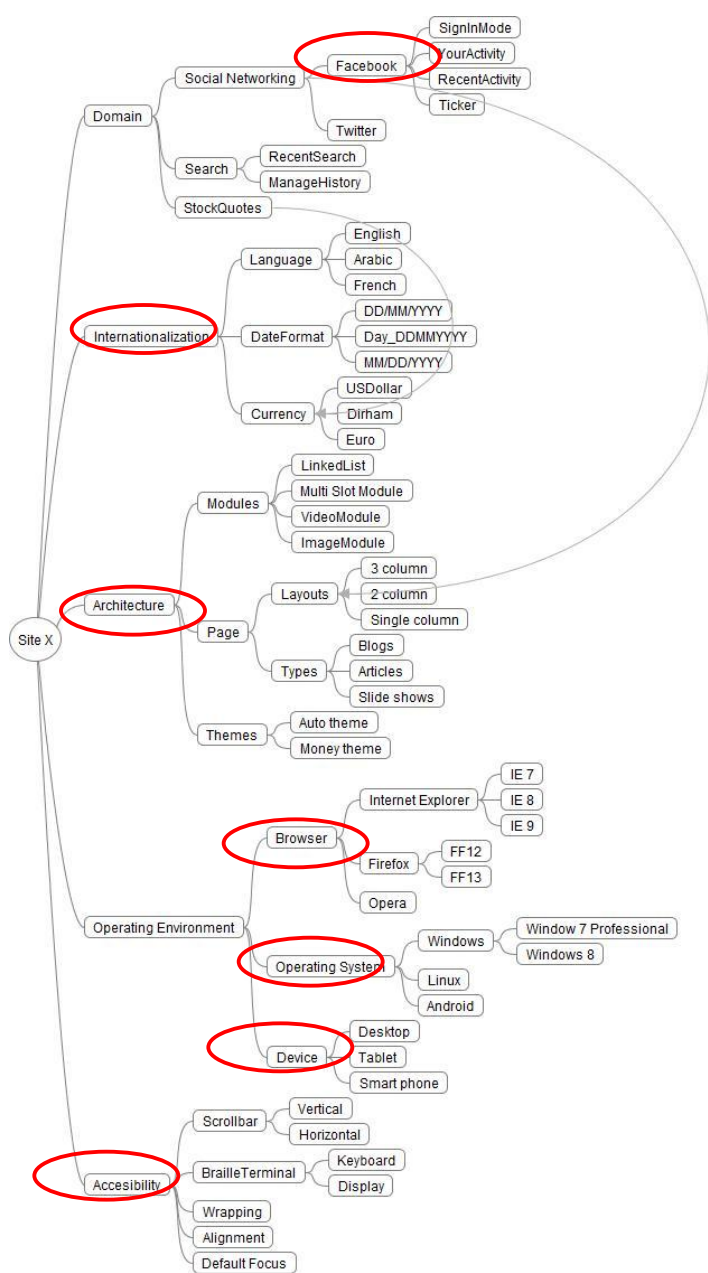


Repetition in the Feature Model



Cause of Variation (Perspective)

MPFM as an input model for CT



- Input parameters = Features to test
- Parameter values = Feature leaf nodes
- Constraints = SoV, FM constraints, Portal configurations

#	Parameter	Values
1	Facebook	SignInMode, YourActivity, RecentActivity, Ticker
2	Architecture	LinkedList, Multi_Slot_Module, VideoModule, ImageModule, 2_column, Single_column, Blogs, Articles, Slide_shows, MoneyTheme, 3_column, AutoTheme
3	Browser	IE7, IE8, IE9, FF12, FF13, Opera
4	Operating System	Windows_7_Professional, Windows_8, Linux, Android
6	Device	Desktop, Laptop, SmartPhone
7	Portal	US, UAE, UK

Constraints:

(Facebook = "SignInMode") => (Architecture = "3_column" || Architecture = "2_column" || Architecture = "Single_column")
 Device = "SmartPhone" => (Browser = "Opera")
 (Configuration = "UAE") => (Internationalization != "MM/DD/YYYY")

Experimental results

- Site X: Feature model of over 150 features was created
- 5 Perspectives identified
 - Domain
 - Internationalization
 - Accessibility
 - Operating Environment
 - Architecture
- 6 Features selected for test generation
- Output analyzed against 1 year defect log with the help of test team
- Focus on feature interactions

	Total defects reported			Reported in live site		
	Total	Interaction	%	Total	Interaction	%
Severity 1	114	31	27.1	6	6	100
2	616	167	27.1	15	12	80
3	104	78	75	32	24	75
Priority 1	120	31	25.8	6	5	83.3
2	624	172	27.6	23	19	82.6
3	90	73	81.1	24	18	75
TOTAL	834	276	33.1	53	42	79.2

- 33.1 % of total defects were interaction defects
- 79.2% of production defects were interaction defects
- Tests generated from FM using 2-way coverage could detect escaped defects
- 37% lesser tests as compared to manual approach

Discussion

- Establishing behaviour relevance of features
- Test Models for Variability Intensive Systems
- Reusable Domain Models
 - Internationalization, Operating Environment, Accessibility reusable
- Scalable constraint solving
- Modelling Business Processes variations induced by functionality as well multiple software systems

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Potential Collaborations

- Jocelyn Simmonds, Maria Cecilia Bastaricca, Luis Silvestre, Alcides Quispe
 - Variability in Software Process Models
- Klaus Schmid
 - Variability support for Variant Rich Software Ecosystems
- John Klein, John McGregor
 - System-of-Systems Platform Scoping
- ...

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Thank you!