Evaluating Aspect-Oriented Modeling Approaches

For Specifying Software Product Lines Requirements

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Different approaches for representing SPL variability in scenarios have been proposed.

However

existing assessments of those techniques are too informal, do not consider relevant attributes, or compare just two techniques.

This collaboration aims to

Compare different approaches...

- **Textual based:** PLUSS, MSVCM
- **Graphical based:** Model Templates, VML4RE

regarding different quality attributes

- modularity
- stability
- expressiveness

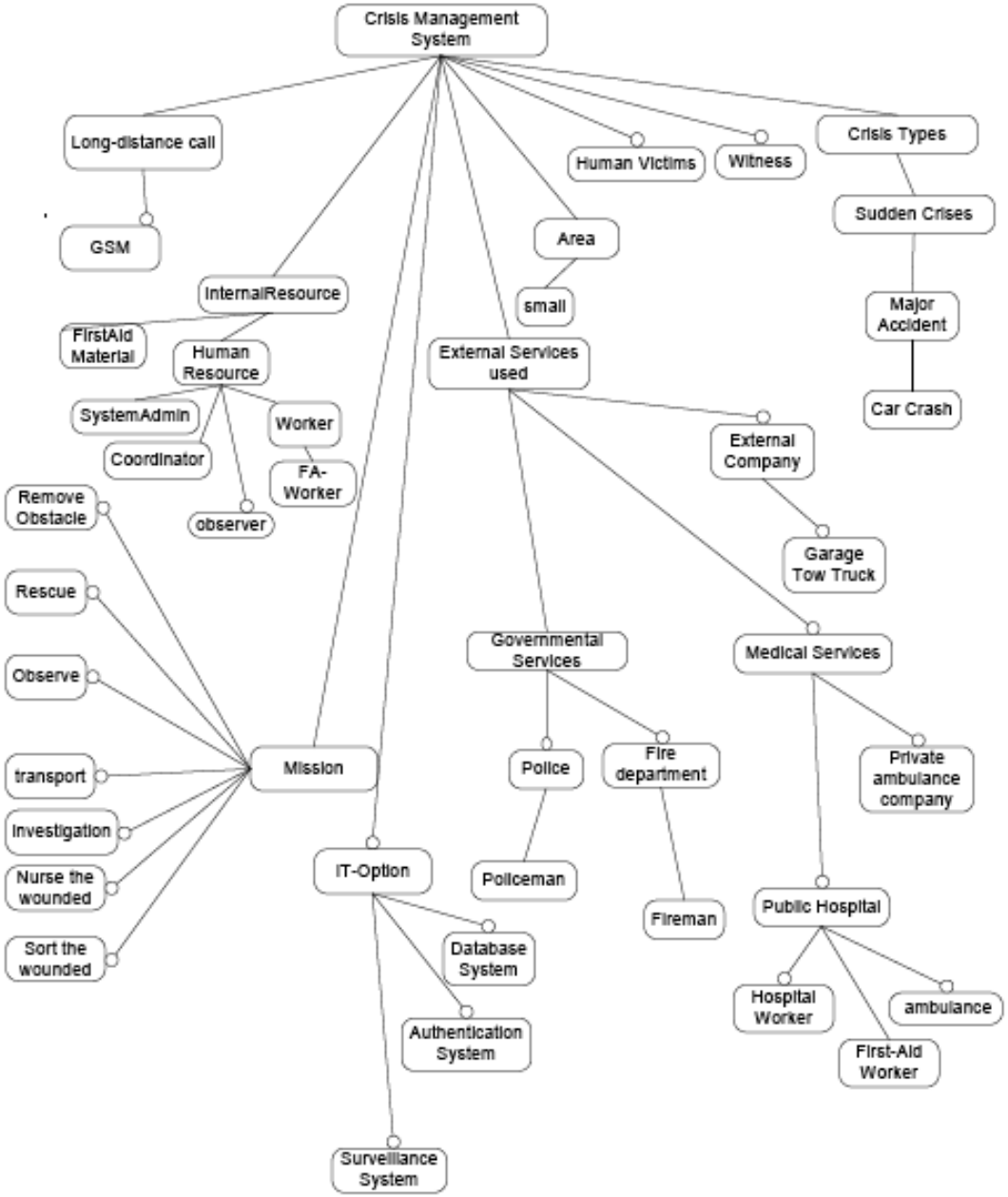
Agenda

- Study settings
- Evaluated techniques
- Criteria
- Initial results

Case study

Crisis Management Systems
A Case Study for Aspect-Oriented Modeling

Jörg Kienzle[1], Nicolas Guelfi[2] and Sadaf Mustafiz[1]


Crisis Management System
Long-distance call
GSM
InternalResource
FirstAid Material
Human Resource
SystemAdmin
Coordinator
observer
Worker
FA-Worker
Human Victims
Witness
Area
small
External Services used
External Company
Garage Tow Truck
Crisis Types
Sudden Crises
Major Accident
Car Crash
Remove Obstacle
Rescue
Observe
transport
Investigation
Nurse the wounded
Sort the wounded
Mission
IT-Option
Database System
Authentication System
Surveillance System
Governmental Services
Police
Policeman
Fire department
Fireman
Medical Services
Private ambulance company
Public Hospital
Hospital Worker
First-Aid Worker
ambulance

Study phases

- Specification of a base version of the CMS product line
- Evolution of the specifications, according to 4 “change requests”
- Alignment of the specifications
- Quantitative and qualitative assessments

Main constraint of the case study

You are not allowed to add new functional or non-functional requirements to the case study. On the other hand, you are allowed to correct eventual errors or clarify ambiguities in the document and the models provided you justify the need to do so.

Study change history

- V1
  - Capture witness report
  - Assign missions to internal and external resources
  - *Super Observer* and *Rescue* missions
  - ...
- V2: V1 + Log details
- V3: V2 + Remove Obstacle details
- V4: V3 + Helicopter Transport details

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PLUSS

Scenario: Execute rescue mission.
Description: The intention of the First Aid Worker is ...
Related feature: Rescue Mission
Flow of events

Code	User Action	System Response
1	First Aid Worker transmits injury information of victims to System.	System updates crisis record with the sent injury information.
(2) `Medical Services`	First Aid Worker determines victim's identity and communicates it to System.	System requests victim's medical history information from all connected Hospital Resource Systems.
(3) `Medical Services`	Hospital Resource System transmits victim's medical history information to System.	System notifies First Aid Worker of medical history of the victim relevant to his injury.
4	-	System instructs First Aid Worker to bring the victim to the most appropriate hospital.
5	First Aid Worker notifies System that he has dropped the victim at the hospital.	-
6	First Aid Worker informs System that he has completed his mission.	-

(MSVCM) Common behavior...

Scenario: Execute Rescue Mission.
Description: The intention of the First Aid Worker is ...
Flow of events:

Code	User Action	System Response
SC07.1	First Aid Worker transmits injury information of victims to System.	System updates crisis record with the sent injury information. `@InjuryData`
SC07.2	-	System instructs First Aid Worker to bring the victim to the most appropriate hospital.
SC07.3	First Aid Worker notifies System that he is leaving the crisis site.	-
SC07.4	First Aid Worker notifies System that he has dropped off the victim at the hospital.	-
SC07.5	First Aid Worker informs System that he has completed his mission.	-

(MSVCM) separated from variant behavior...

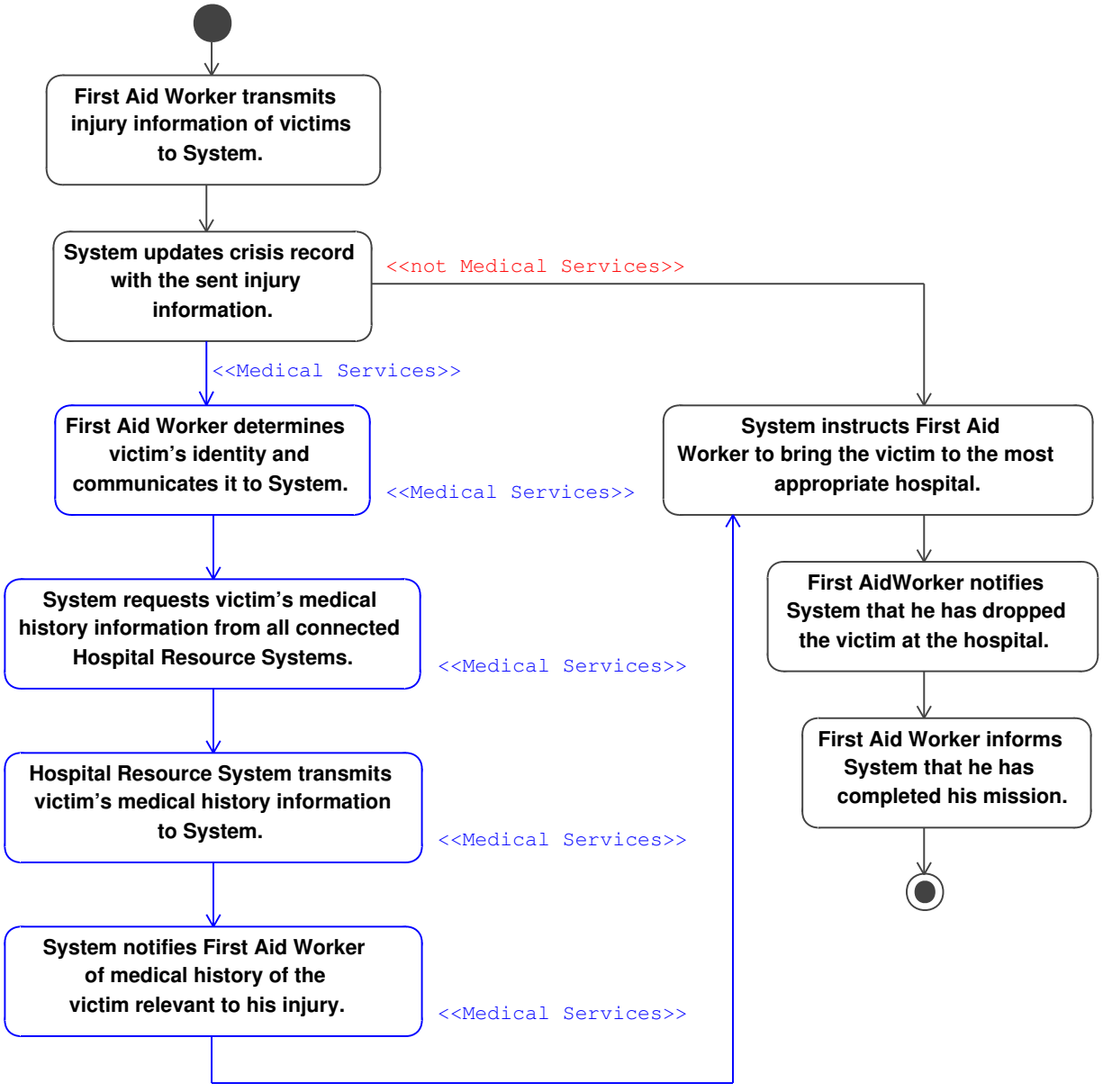
Advice: Medical Service advising Execute Rescue Mission.
Description: Transmits injury information of victim to System.
Pointcut: @InjuryData
Flow of events:

Code	User Action	System Response
ADV01.1	First Aid Worker determines victim's identity and communicates it to System.	System requests victim's medical history information from all connected Hospital Resource Systems.
ADV01.2	Hospital Resource System transmits victim's medical history information to System.	System notifies First Aid Worker of medical history of the victim relevant to his injury.

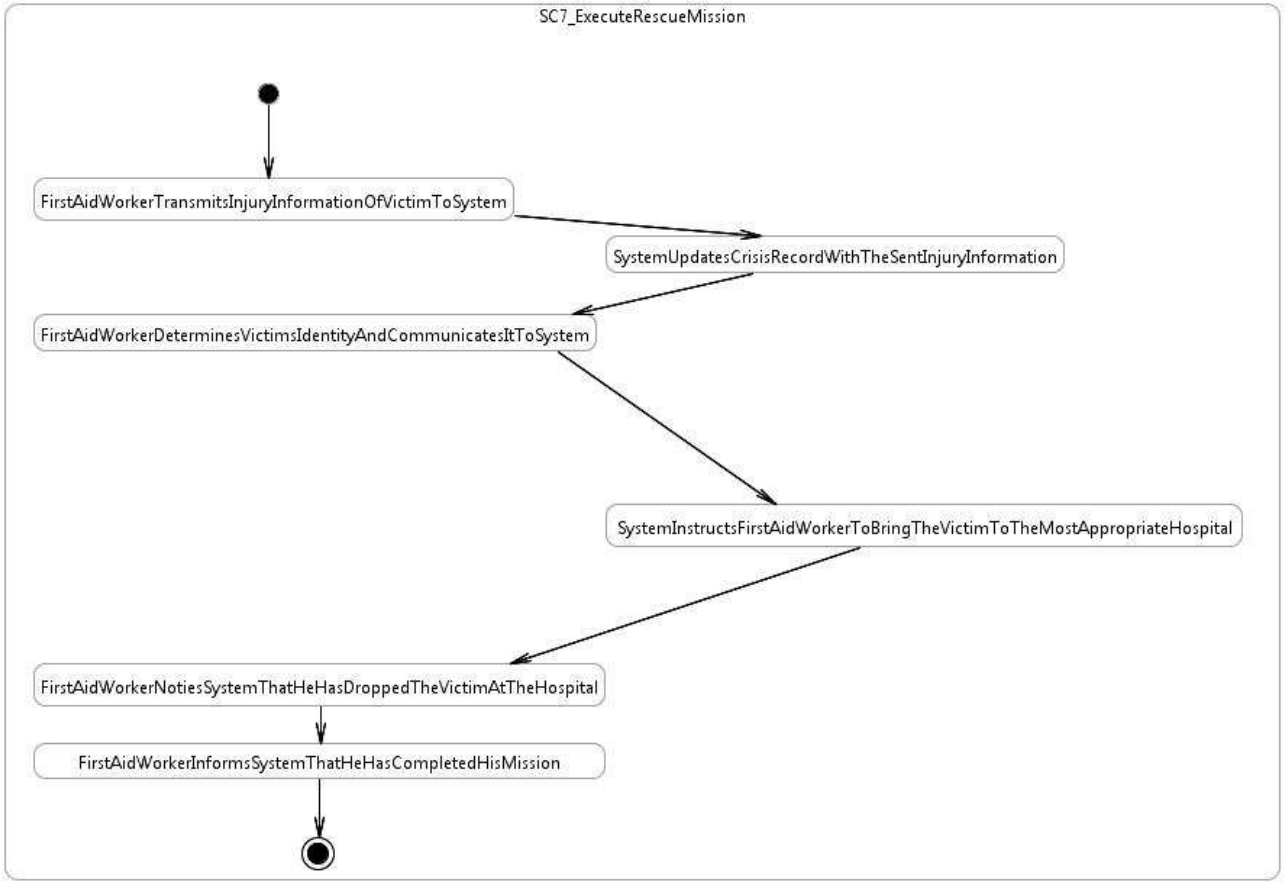
(MSVCM) + an independent configuration knowledge

Expression	Transformations
Car Crash	select scenario SC01, SC03, SC04
Authentication System	select scenario SC10
Rescue Mission	select scenario SC07, SC08
Witness	select scenario SC02
Remove Obstacle Mission	select scenario SC09
Medical Services	evaluate advice ADV01
Observe Mission	select scenario SC06

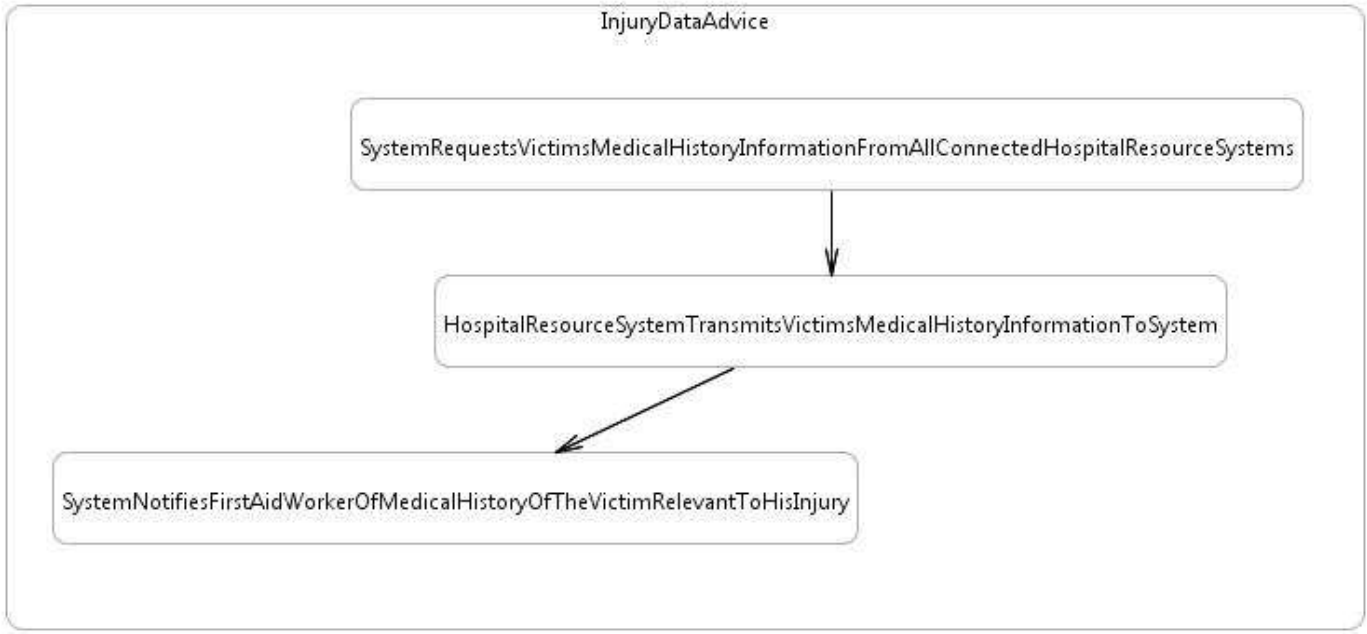
Model Templates



(VML4RE) Base specification...



(VML4RE) separated from variant behavior



(VML4RE) + an independent configuration knowledge

```
variant for MedicalServices {
  connect (‘‘SC07::ATV01’’,‘‘ADV01::ATV01’’);
  connect (‘‘ADV01::ATV03’’, ‘‘SC07::ATV04’’);
}
```

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Modularity

- Feature scattering (Degree of Scattering metric)
- Scenario cohesion (Degree of Focus metric)

Stability

a) Specifications

Number of steps and scenarios that had been changed or introduced in each version of the case study.

b) Configuration

Number of configuration items that had been changed or introduced in each version of the case study.

Stability

c) Composition - VML4RE and MSVCM

Number of composition items that had been changed or introduced in each version of the case study.

```
variant for and (Mission, LOG) {
  connect (LOG, SC6);
  connect (LOG, SC6-FINAL-NODE);
  connect (LOG, SC07 );
  connect (LOG, SC7-FINAL-NODE);
  connect (LOG, SC09 );
  connect (LOG, SC9-FINAL-NODE);
}
```

Expressiveness

a) Composition

Notion of reachability— the ratio between the number of matched join points and the number of composition items.

b) Configuration knowledge

Number of tokens required to detail the configuration knowledge.

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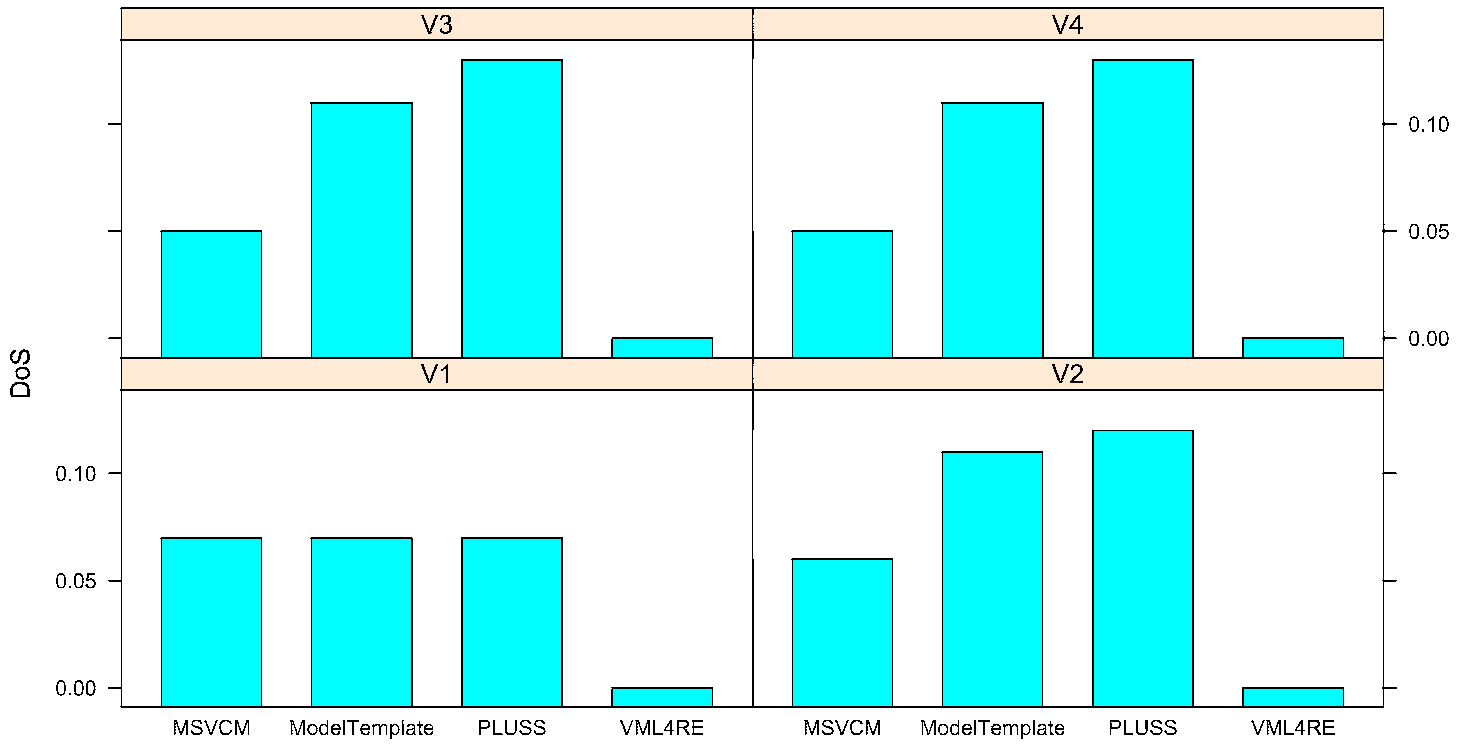
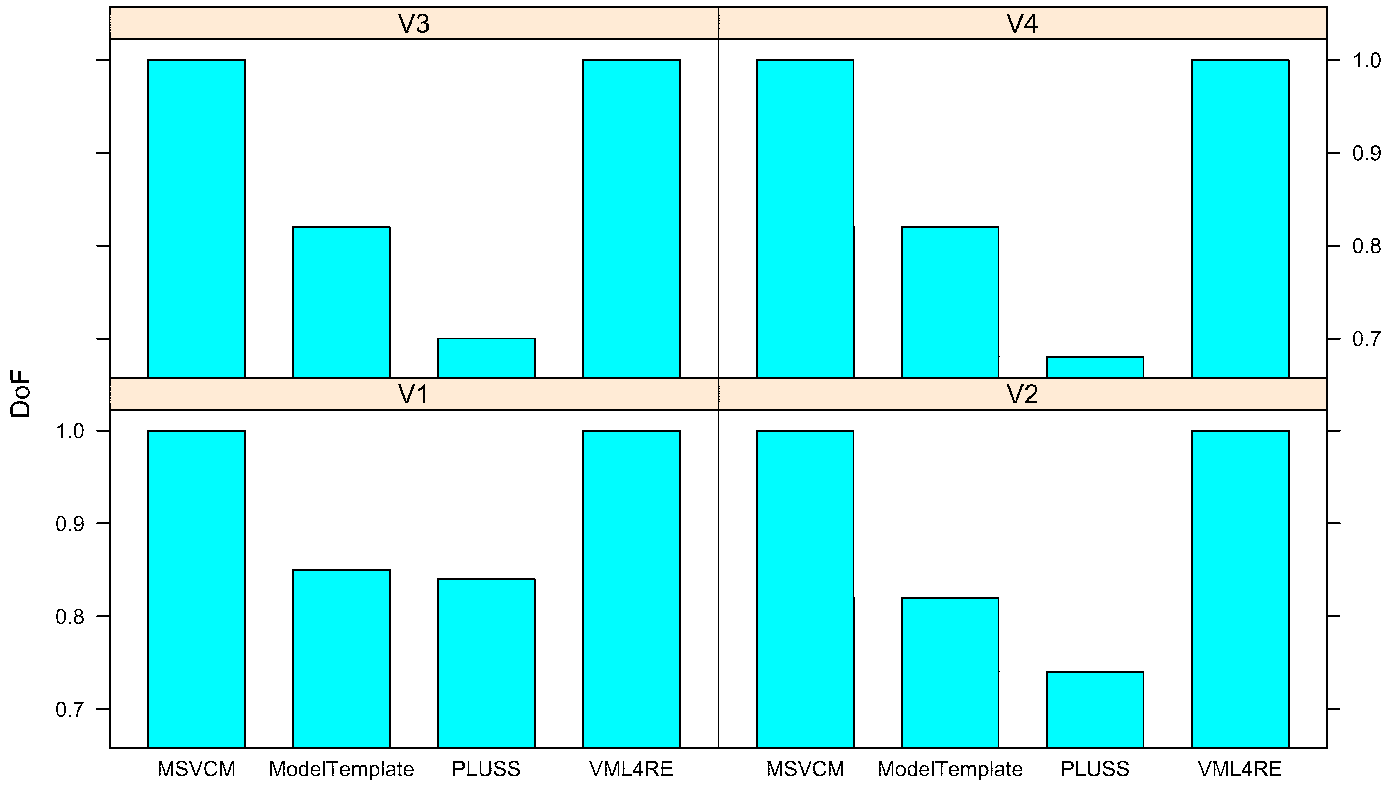
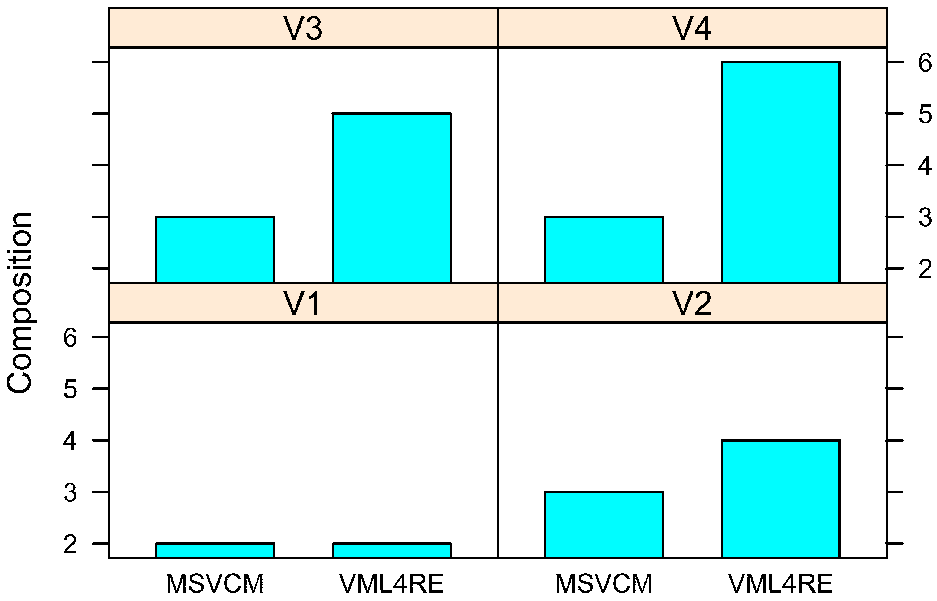
Feature scattering



Scenario cohesion



Stability of the compositions



Expressiviness of the compositions