Reverse Engineering
Web Sales Configurators

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## Product

![Car Image]

### Choose Your Options

<table>
<thead>
<tr>
<th>Interior</th>
<th>Option Packs</th>
<th>Safety/Security</th>
<th>Audio/Comms/Nav</th>
<th>Heating/Ventilation</th>
<th>Mechanical</th>
<th>A-Z</th>
</tr>
</thead>
</table>

#### Safety/Security

- **Emergency tire inflation kit**
  - Standard

- **Active front seat head restraints**
  - also adds seat belt unfastened warning light for front passenger's seat
  - € 103.00

- **Remote control ultrasonic security alarm system**
  - € 357.00
Web Sales Configurator (SC)

Options are represented using widgets.

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**Constraint**
The main Characteristics of Web SCs

- Variations in presentation of data
- Complex data objects
- Template-generated Web pages
- Heterogeneous Web pages
- Dynamic Web pages
Many opportunities to improve Reliability, Efficiency, Consistency, Maintainability… of SCs

Re-engineering Web Configurators
Re-engineering Approach

Original ad hoc configurator

source code

Configuration GUI

Extract variability data

Variability model

Options

Descriptive information

Constraints

Documentation

Web objects

Validate variability model

Generate Configuration GUI

Re-engineered Configurator

Configuration solver instance

source code

Configuration GUI

Reverse Engineering

Forward Engineering
Research Questions

Client-side Analysis

RQ1  What Scalable Web data extraction method can we use to collect accurate configuration-specific data from the pages of a SC?

RQ2  How to semi-automatically extract the dynamic configuration-specific content?
The Reverse Engineering Process

1. Specify \textit{vde} pattern (I)
2. Extract variability data (A)
3. Crawl Page (A/I)
4. Process data (A/I)
5. Generate TVL model (A)

- \textit{FAMILIAR}
- TVL models
- Reasoning on TVL model

User Web page
Variability Data Extraction Pattern (vde pattern)

```html
<div class="radioButton" tooltip="html" rbgroup="carlineGroup" key="a1">
  <span class="icon jqRadioButton"></span>
  <span class="label">Audi A1</span>
</div>

<div class="radioButton checked" tooltip="html" rbgroup="carlineGroup" key="a3">
  <span class="icon jqRadioButton"></span>
  <span class="label">Audi A3</span>
</div>

<pattern data-att-met-pattern-name="dataPattern" data-att-met-pattern-type="data">
  <div class="radioButton|*checked*"
    data-att-mar-widget-type="@class">
    skip(sibling,[1])
    <span class="label">data-tex-mar-option-name</span>
  </div>
</pattern>

<pattern data-att-met-pattern-name="modelLineRegion" data-att-met-pattern-type="region">
  <div class="*gridLeft">
    <pattern dataPattern</pattern>
  </div>
</pattern>
```
The Web Wrapper

The Wrapper implements a source code pattern matching algorithm
Crawling the configuration space requires the simulation of users’ configuration actions.
Dependencies between vde patterns

Data pattern

Independent pattern

Dependent pattern
Evaluation

**Scalability:** the expressiveness of *vde* patterns
- Apply *vde* patterns to a set of Web SCs chosen from different industries.

**Accuracy:** right data and complete models
- Compare the automatically and manually generated models.

**Manual effort:**
- The total number of lines of code of all patterns written for a Web SC.
- The thinking time.