Friendly Change Extraction for BPMN Workflows

Motivation

- Precisely identifying workflow changes is a key need for process model evolution:
 - Changes in a process model specification may affect its corresponding implementation
 - Collaborative development often requires synchronizing changes from several stakeholders
- Manual change extraction is error-prone and time-consuming

Objectives

Find the difference between two BPMN workflow models without relying on change history or unique element identifiers

IBM CAS

Generative Software

Development Lab

Moises Castelo Branco

Yingfei Xiong

Krzysztof Czarnecki

Alex Lau

Phil Coulthard

{mcbranco, y6xiong, kczarnec}@gsd.uwaterloo.ca

{alexlau, coulthar}@ca.ibm.com

University of

Waterloo

- Present individual changes by means of human-readable and intuitive operations such as *insert*, *delete*, *move* and *update*
- Optimize the number of operations for producing the minimum edit script that can be applied to one workflow to obtain the other



- SESE decomposition (Vanhatalo et al.)
- Change extraction of hierarchical data (Chawathe et al.)
- Optimal AST matching (Fluri et al.)



Edit Script

Insert. INS((l, v), y, k); insert a new leaf node with label *l* and value *v* as the *k*th child of node *y*. **Delete.** DEL(*x*); delete node *x* from its parent p(x).

Alignment. MOV(x, p(x), k); node x becomes the kth child of p(x).

Move. $MOV(x, y, k), p(x) \neq y$; node *x* becomes the *k*th child of *y* and is deleted from p(x).

Update. UPD(x, val); update v(x) with val, that is, $val = v_{new}(x)$ and $v_{old}(x) \neq v_{new}(x)$.



Matching criterion for model elements (leaves)

 $match_1(x,y) = \begin{cases} true & \text{if } l(x) = l(y) \text{ and} \\ & sim(v(x),v(y)) \ge f \\ false & \text{otherwise.} \end{cases}$

l=type of node; sim=node properties similarity; f=threshold



- Eclipse plugin
 - Java-based
 - On top of SOA Tools Platform BPMN Modeler
 - Textual and graphic outputs



Java - TESTCASES/CASUDay2011ModelB.bpmn_diagram - Eclipse	
Eile <u>E</u> dit Source Refac <u>tor D</u> iagram <u>N</u> avigate Se <u>a</u> rch <u>P</u> roject <u>R</u> un <u>W</u> indow <u>H</u> elp	
	🗘 👻 🖹 🚸 Plug-in Deve
A Package Explorer X CASUDay20111ModelA.bpmn_diagram & CASUDay2011ModelB.bpmn_diagram X	Task List 💥 👘
<pre>Press Press P</pre>	Image: Second secon
<pre>Macro.bpmn_ Macro.bpmn_diagram Procurement - ORIGINAL: Procurement - WITH ERRC Purchase Order to Deliver Purchase Order to Deliver Purchase Order to Deliver Comparison of the state of the</pre>	

Evaluation and Limitations

38 real change scenarios were replayed: edit scripts were minimum in 72% of the cases
Matching is only syntactic
Current complexity is O(N²)