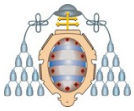

Universidad de Oviedo

A first approach to test case generation for BPEL compositions of web services using Scatter Search

Search-Based Software Testing

April 1, 2009, Denver

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This work is supported by the Ministry of Science and Innovation (Spain).
National Program for Research, Development and Innovation.
Projects Test4SOA (TIN2007-67843-C06-01) and RePRIS (TIN2007-30391-E)

Introduction

- **Previous works:**
  - Generation of test cases for BPEL specification using Model Checking [García-Fanjul et al., 2006]
  - Generation of test cases for structural testing using Scatter Search (TCSS-LS) [Blanco et al., 2009]

- **Objective**: Scatter Search based algorithm to automatically generate test cases for BPEL business processes

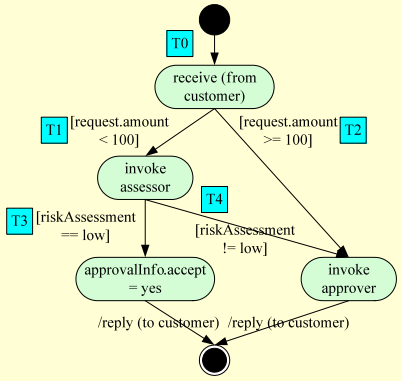
- **BPEL specification:** behaviour of business processes based on web service compositions
- **Adequacy criterion:** transition coverage

BPEL business processes

- XML documents with two parts:
  - Declarations
    - Services that interact with the business process
  - Specifications of the business process
    - Set of activities
      - sequence
      - while
      - flow
    - Business process
      - can invoke and receive invocations of web services
      - can update the value of the variables

Problem approach

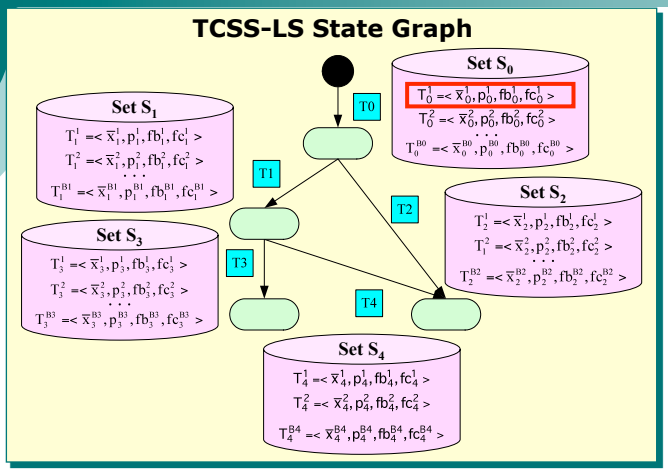
BPEL Business Process Representation



- **Input variables**: variables received from the web services
- **Test case**: input variables + transitions of business process

- **Objective**: to generate test cases that allow all transitions of the business process to be covered

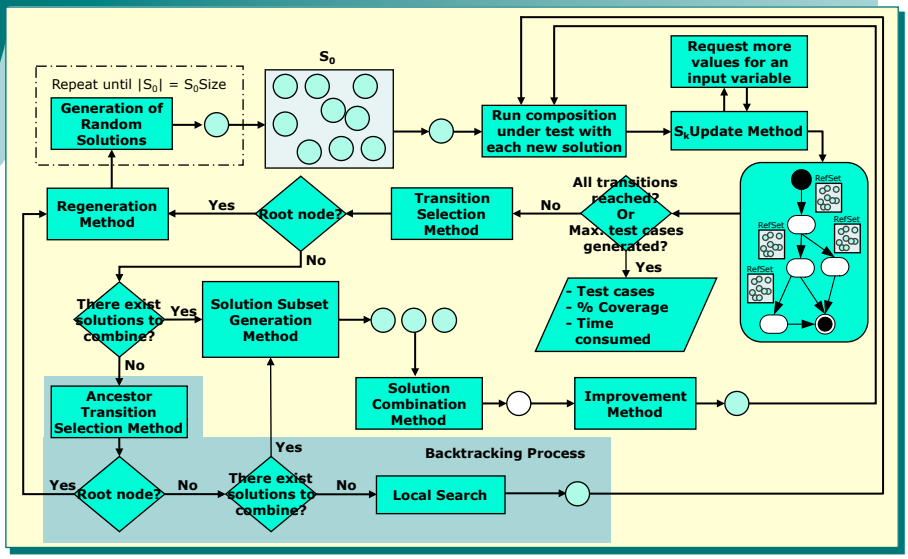
Problem approach



- $\overline{x}_k^c$: solution (test data)
- p_k^c: path (transitions)
- fb_k^c: sibling distance
- fc_k^c: child distance

- **Objective**: all the transitions to have at least one element in their set S_k

Search process



Treatment of the unfixed number of values of an input variable

- Web service invocation inside a loop → the input variable can take an unknown number of values
- When a partner needs more values:
  - TCSS-LS searches new diverse values among the solutions of the set S_k of the transition in evaluation

The vector of the input variable is increased

- When the business process finishes:
  - TCSS-LS drops the values that have not been used

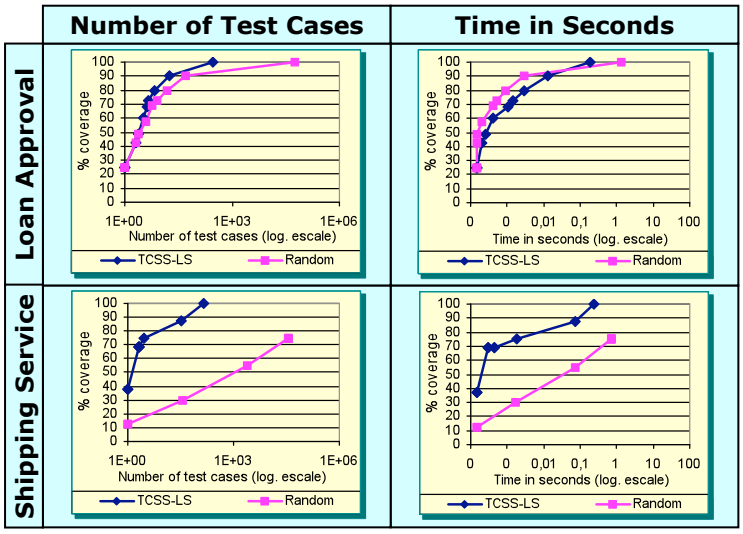
The vector of the input variable is decreased

- Generation of new solutions
  - Solutions to combine have vectors of input variables with different size

Case studies

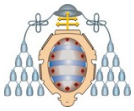
- **Examples**
  - Loan Approval
  - Shipping Service
- **Comparative**
  - TCSS-LS
  - Random
- **Experiments**
  - Stop conditions: 100% transition coverage or 200000 test cases
  - Input variables:
    - Type: integer
    - Range: 16 bits

Case studies: results



Conclusions

- **Conclusions:**
  - Business process modelled as a state graph
  - TCSS-LS handles a set S_k in each transitions of the graph
    - Subgoals
  - TCSS-LS provides mechanisms to handle the unfixed number of values of the input variables
  - TCSS-LS can be applied to the test case generation of BPEL business processes
- **Future works:**
  - To use other adequacy criteria
  - To handle the concurrent execution of activities
  - the experimentation with real-life specifications



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