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# A Tool Supported Approach to Perform Efficient Regression Testing of Web Services

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# **A Tool Supported Approach to Perform Efficient Regression Testing of Web Services**

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# ABSTRACT

**Problem:** Web service regression testing needs

- changes in WSDL
- changes in code
- selective re-testing of web service operations.

# ABSTRACT

**Fact:** of performing WS testing and Regression Testing

- Functional and non-functional WS testing is done with WSDL parsing [1, 2]
- Regression testing is performed by identifying the changes made [4, 6, 3, 17].

**Solution:** Automatic Web Service Change Management (AWSCM): Proposed three intermediate forms of WSDL for efficient regression testing of the web service by selecting the relevant test cases to constructing reduced test suite from the old test suite file of Soap-UI.

- Difference WSDL (DWSDL)
- Unit WSDL (UWSDL)
- Reduced WSDL (RWSDL), respectively.
- Combined WSDL (CWSDL)

**Efficiency:** Two proposed cost metrics for Reduction in the effort.

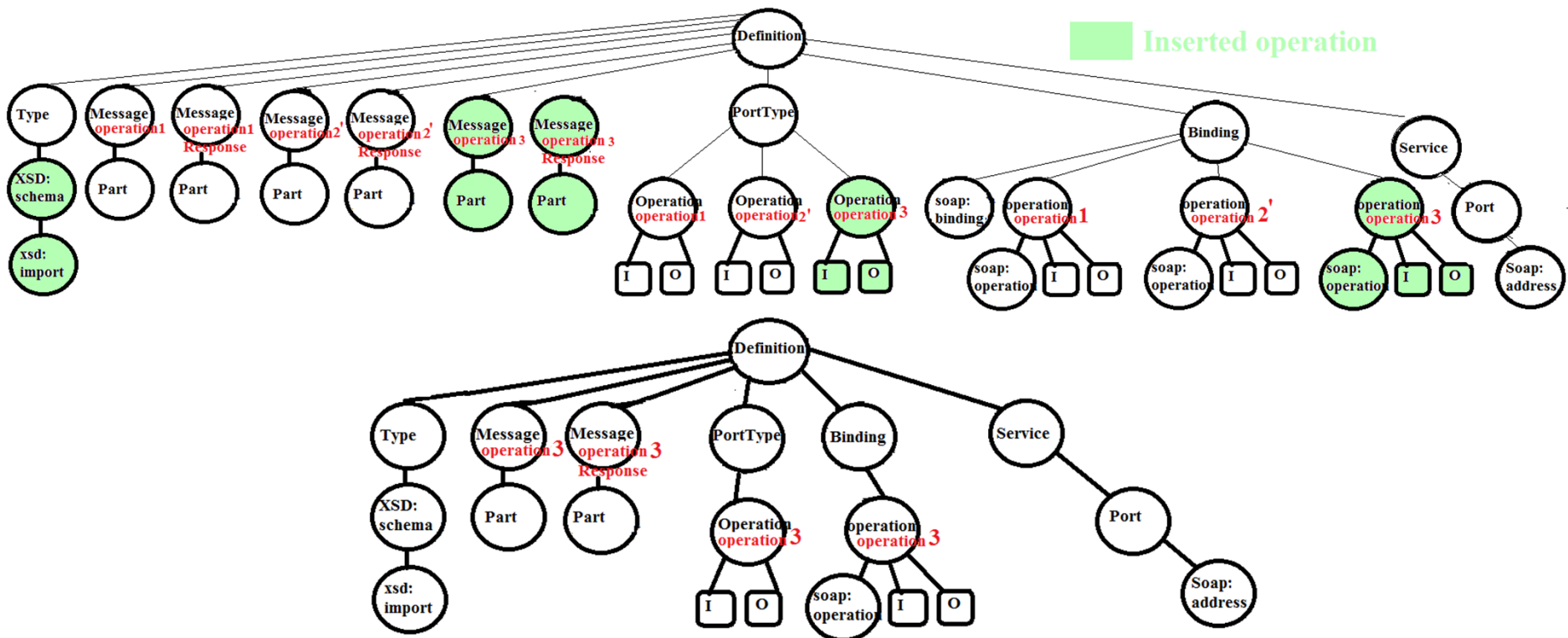
**Applications:** Three case studies: for the real world projects.

# INTRODUCTION

- Regression Testing of Web Service (RTWS) by doing selective regression testing of modified and inserted portion only with the guaranteed that new and old code would conform to the changes in requirements.
- AWSCM which generates CWSDL whose operations are further mapped to their respective test case to do efficient RTWS by facilitating the standard WSDL parsing techniques i.e. generates smaller WSDL interface descriptions to create Reduce Regression Test Suite (RRTS) for testing purposes.

# DIFFERENCE, UNIT, REDUCE & COMBINED WSDL

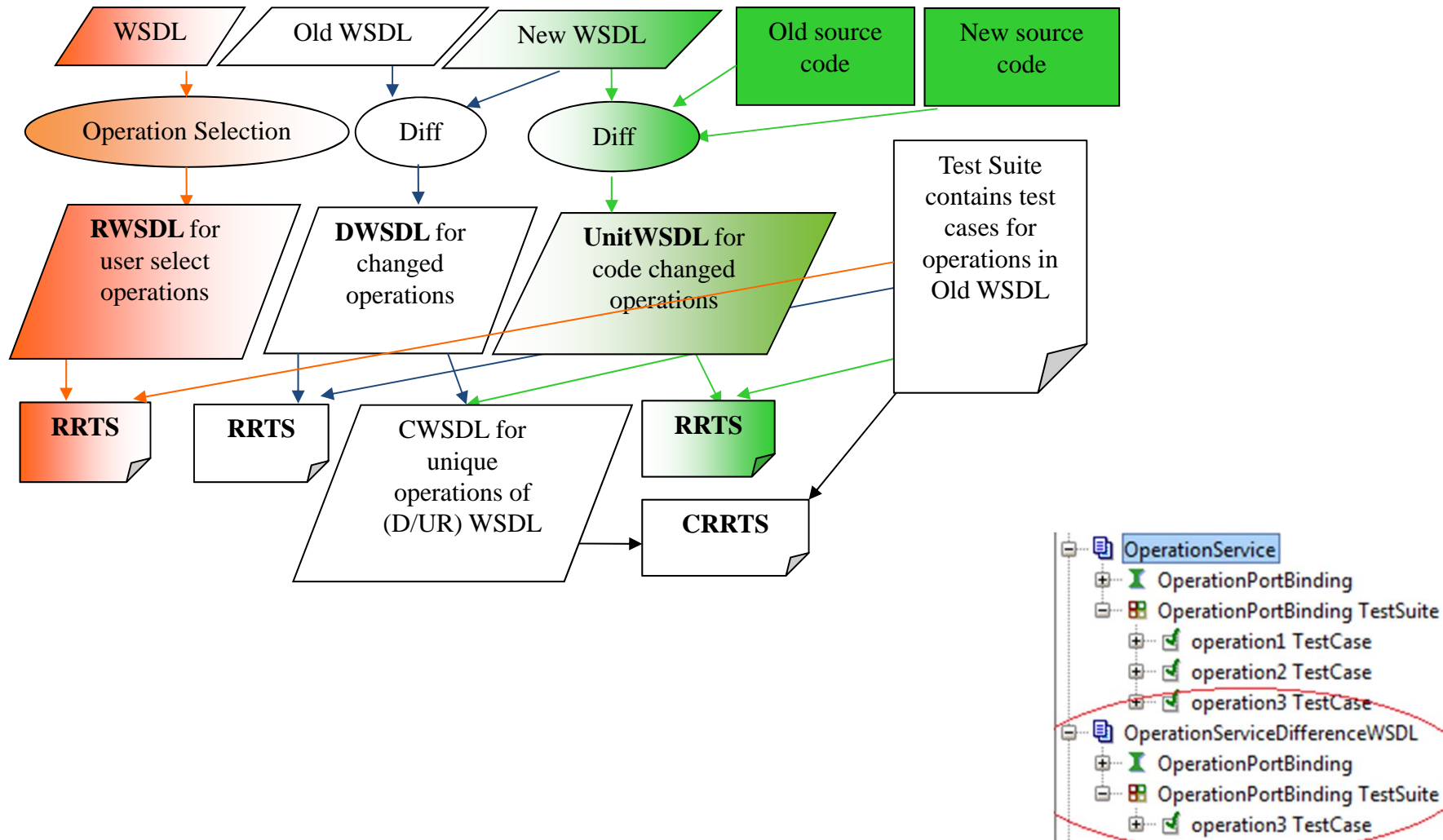
| Scope of changes handling by utilities |   |
|--|---|
| <i>Utilities</i>                       | <i>Capture changes WSDL or at code level</i>            |
| DWSDL                                  | WSDL, operation deletion, insertion or I/O modification |
| RWSDL                                  | WSDL, select operations on WSDL to test                 |
| UWSDL                                  | Code of operation changes are captured                  |



# REGRESSION TESTING OF WEB SERVICE WITH AWSCM

- Using (D/U/R/C) WSDL
  - to generate testing templates to write new test cases
  - reduced test case from the old test suite file on the basis of (D/U/R/C) WSDL.
- Deleted operation: operation will not be further in the next version of WS.
- Insertion of a new operation
- Modification occur in two levels at the WSDL level and at the code level.
  - at WSDL level means change in XSD
  - at the code level: JDiff, Java.Util.Regex: Change impact analysis using control and data flow analysis: UWSDL and RRTS according to the changes inside the operation.
- Using Operation in CWSDL: Combined RRTS (CRRTS) which contains all the unique test cases

# REGRESSION TESTING OF WEB SERVICE WITH AWSCM





# COST REDUCTION ESTIMATION METRICS

based on the change ratio between number of operations or lines in new version WSDL and (D/U/R/C) WSDL

| Operation count cost metric                |                   |             |             |                     |
|--|-------------------|-------------|-------------|---------------------|
| <i>Variables</i>                           | <i>Quantity</i>   | <i>Unit</i> | <i>SaaS</i> | <i>EucalyptusCC</i> |
| No. of operations in WSDL_1                | X                 | Op          | 3           | 24                  |
| No. of operations in WSDL_2                | Y                 | Op          | 4           | 28                  |
| No. of operations in DWSDL                 | Z                 | Op          | 1           | 4                   |
| No. of operations in DWSDL                 | Y-Z               | Op          | 1           | 4                   |
| Percentage reduction in operation by DWSDL | $((Y-Z)/Y) * 100$ | Op          | 75%         | 85.7%               |

| Average change in number of lines cost metric, declaration of variable, data (approx) and calculation |                              |             |                |                     |
|---|------------------------------|-------------|----------------|---------------------|
| <i>Variables</i>  | <i>Quantity</i>              | <i>Unit</i> | <i>SaaS</i>    | <i>EucalyptusCC</i> |
| Number (No.) of lines in WSDL_1   | L1                           | LW          | 77             | 1712                |
| No. of lines in WSDL_2  | L2                           | LW          | 115            | 1492                |
| Change in line of WSDL's  | $C = L1 - L2$                | LW          | 38             | 220                 |
| Average number of operation / line of WSDL_1, WSDL_2  | $X1, X2, X_{av} = (X1+X2)/2$ | Op / LW     | 26, 23, 24.5   | 62, 61, 61.5        |
| Average Line of Code (LoC) per operation  | $Y1, Y2, Y_{av} = (Y1+Y2)/2$ | LoC / Op    | 40,56, 48      | 216, 291, 253.5     |
| No. of LoC for every operations   | $C * X_{av}$                 | Op          | $38 * 24.5$    | $220 * 61.5$        |
| No. of Line of Code (to be tested) V'   | $C * X_{av} * Y_{av}$        | LoC         | $38*24.5*48$   | $117*61.5*253.5$    |
| No. of Line of Code in V_2  | $L2 * X2 * Y2$               | LoC         | $115*23*56$    | $1712*61*291$       |
| Effort required   | $V' / V_2$                   |             | 44688 / 148120 | 1824059 / 30389712  |
| Percentage effort required  | $(V' / V_2) * 100$           | %           | $0.3017 * 100$ | $0.0600 * 100$      |
| Percentage effort reduction   | $100 - (V' / V_2) * 100$     | %           | $100 - 30.17$  | $100 - 6.00$        |

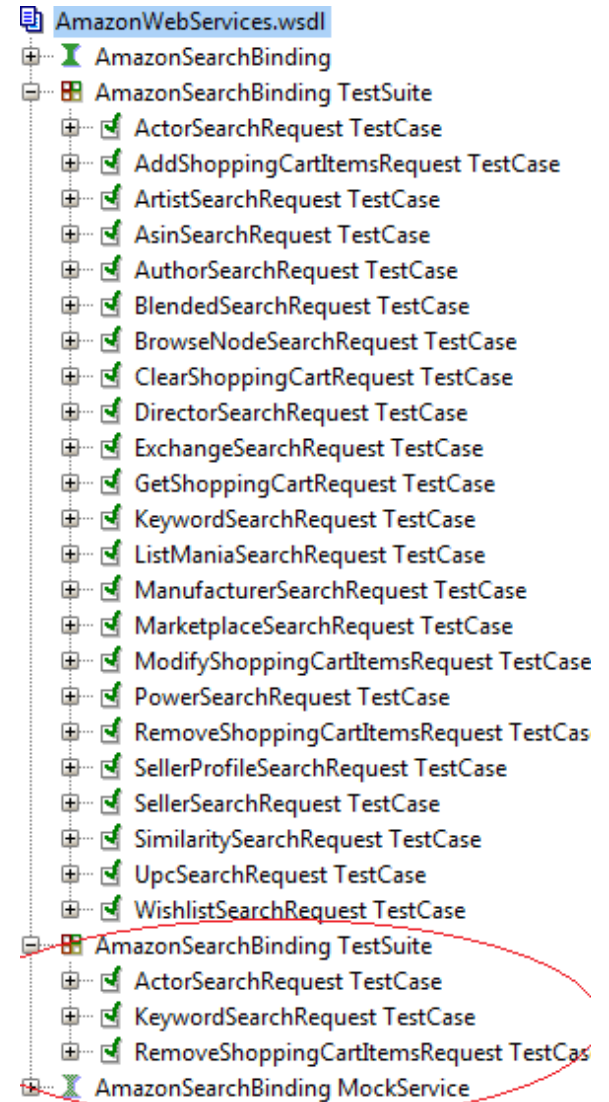
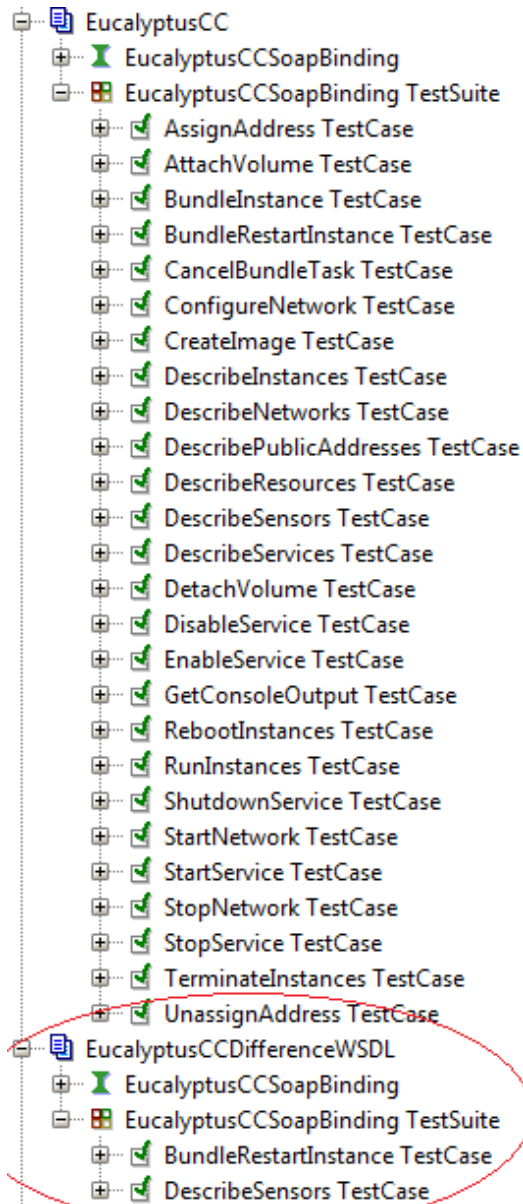
# CASE STUDIES

- (D/U/R/C) WSDL construction depends upon the availability of Web Service WSDL and code

| Case Study WS Projects | CWSDL                                       |              |                       |
|------------------------|---|--------------|-----------------------|
|                        | <i>DWSDL</i>                                | <i>RWSDL</i> | <i>UWSDL</i>          |
| Eucalyptus             | Y   | Y            | Y                     |
| SaaS                   | Y   | Y            | Y                     |
| Amazon WS              | Different versions of WSDL is not available | Y            | Code is not available |
| Bible WS               |   | Y            |                       |
| Currency Conversion WS |   | Y            |                       |
| Weather WS             |   | Y            |                       |

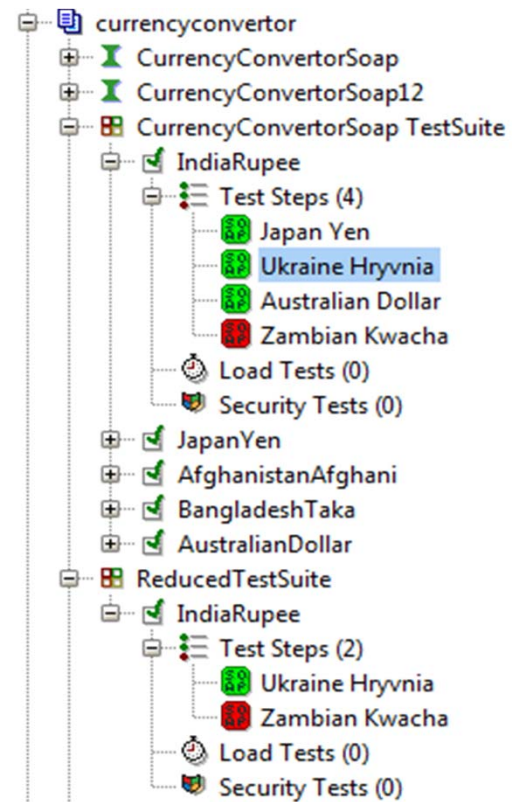
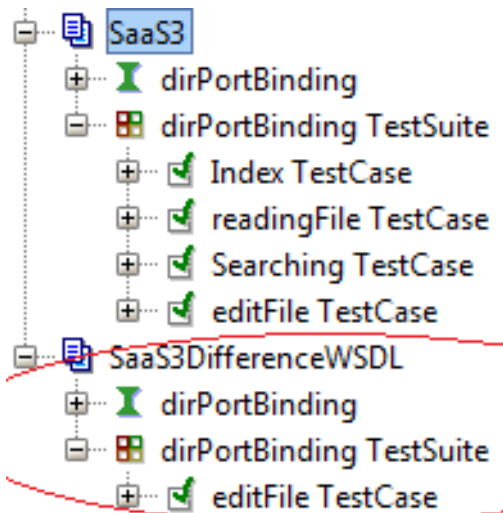
# CASE STUDIES

- AWSCM constructs reduced test cases from old test suite of SOAPUI



# CASE STUDIES

- AWSCM constructs reduced test cases from old test suite of SOAPUI



# CASE STUDIES

WSDL: 1\AmazonWebServices.wsdl.xml\AmazonWebServices.wsdl.xml    WSDL    Reduce WSDL: C:\Users\ani\Desktop\others\AfterGS1\Reduced testSuite.xml    ReduceWSDL

Test Suite: archBinding-TestSuite.xml\AmazonSearchBinding-TestSuite.xml    Test Suite    Reduce Test Suite: C:\Users\ani\Desktop\others\AfterGS1\Reduced testSuite.xml\Reduced testSuite.xml    Reduce Test Suite

ADD Operation    Remove Operation

**KeywordSearchRequest**  
PowerSearchRequest  
BrowseNodeSearchRequest  
AsinSearchRequest  
BlendedSearchRequest  
UpcSearchRequest  
AuthorSearchRequest  
ArtistSearchRequest  
ActorSearchRequest  
ManufacturerSearchRequest  
DirectorSearchRequest  
ListManiaSearchRequest  
WishlistSearchRequest  
ExchangeSearchRequest  
MarketplaceSearchRequest  
SellerProfileSearchRequest  
SellerSearchRequest  
SimilaritySearchRequest  
GetShoppingCartRequest  
ClearShoppingCartRequest  
AddShoppingCartItemsRequest  
**RemoveShoppingCartItemsRequest**  
ModifyShoppingCartItemsRequest

ActorSearchRequest  
KeywordSearchRequest  
RemoveShoppingCartItemsRequest

**ReduceWSDL**    **Test Suite**    **Reduce Test Suite**

C:\Users\ani\Desktop\others\AfterGS1\Rec  
wsdl:definitions  
  targetNamespace = http://soap.ar  
  name = AmazonSearch  
  wsdl:types  
  message  
  message  
  portType  
    name = AmazonSearchPort  
    operation  
      name = ActorSearchReque  
      input  
      output  
    operation  
      name = KeywordSearchRec  
      input  
      output  
    operation  
      name = RemoveShoppingC  
      input  
      output  
  binding  
    name = AmazonSearchBinding  
    type = typens:AmazonSearchP  
    soap:binding  
    operation  
      name = ActorSearchReque  
      soap:operation  
      input  
      output  
    operation  
    operation  
  service

C:\Users\ani\Desktop\others\AfterGS1\Tes  
con:testSuite  
  name = AmazonSearchBinding Tes  
  con:settings  
  con:runType  
  con:testCase  
    failOnError = true  
    failTestCaseOnErrors = true  
    keepSession = false  
    maxResults = 0  
    name = ActorSearchRequest T  
    searchProperties = true  
    con:settings  
    con:testStep  
    con:properties  
  con:testCase  
  con:testCase  
  con:testCase  
  con:testCase  
  con:testCase  
  con:testCase  
  con:testCase  
  con:testCase  
  con:testCase

C:\Users\ani\Desktop\others\AfterGS1\Re  
con:testSuite  
  name = AmazonSearchBinding Tes  
  con:settings  
  con:runType  
  con:testCase  
    failOnError = true  
    failTestCaseOnErrors = true  
    keepSession = false  
    maxResults = 0  
    name = ActorSearchRequest T  
    searchProperties = true  
    con:settings  
    con:testStep  
    con:properties  
  con:testCase  
  con:testCase  
    failOnError = true  
    failTestCaseOnErrors = true  
    keepSession = false  
    maxResults = 0  
    name = KeywordSearchReque  
    searchProperties = true  
    con:settings  
    con:testStep  
    con:properties  
  con:testCase  
    failOnError = true  
    failTestCaseOnErrors = true  
    keepSession = false  
    maxResults = 0  
    name = RemoveShoppingCartI  
    searchProperties = true  
    con:settings  
    con:testStep

# CONCLUSION AND FUTURE WORK

AWSCM: approach to find out exactly which operations are changed and these operations for reduced regression testing.

Intermediate WSDL: (D, R and U) WSDL to generate three RRTS.

CWSDL contains unique operations in (D/U/R) WSDL; CRRTS generated from CWSDL.

Effort reduction: cost estimation metrics based on the change ratio between number of operations or lines in new version WSDL and (D/U/R/C) WSDL.

Further, extend UWSDL to capture changes in complex interactions between WS operations.

# RELATED WORK

- David Binkley generated reduced test cases by identifies components that need tests after getting differences and similarities between the old and new programs [4].
- Rothermel and Harrold used CFG of program and its modified version to select tests cases that execute changed code from the original test suite [6].
- Romano and Pinzger proposed a tool called WSDL Diff to extract fine-grained changes from subsequent versions of WSDL's of WS [8], similar work in reducing cost in RTWS is in [5].
- W. T. Tsai et al. described four ways in which the WSDL can be extended to facilitate WS testing in [2].
- X. Bai et al. proposed a WSDL based automatic test case generation approach for WS testing [1] is done by parsing WSDL [1] and the same forms the basis of automate WS testing tools like SoapUI and JMeter.
- A. Pasala et al. A tool for RTS selection based on analyzing the dynamic behavior of the application [3].
- J. Zheng et al. presented I-BACCI for change identification and then performing regression test selection, conducted in scenario of black-box [17].
- Thirumaran. M et al. in [18] proposed a dynamic business logic metric and algorithms for change factors evaluation helps in reducing the change management issue in WS.

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ขอบคุณ

Thai

Grazie  
Italian

תודה רבה  
Hebrew

Gracias

Spanish

Спасибо

Russian

Obrigado

Portuguese

شكراً

Arabic

Thank You

English

Merci

French

多謝

Traditional  
Chinese

Danke

German

धन्यवाद

Hindi

நன்றி

Tamil  
Tamil

多谢

Simplified  
Chinese

ありがとうございました

Japanese

감사합니다

Korean