DEVELOPMENT PROCESS WITH SCHEDULABILITY ANALYSIS (DePSA)
INTEGRATED APPROACH FOR REAL-TIME SYSTEMS

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I declare that this thesis entitled “Development Process with Schedulability Analysis (DePSA) Integrated Approach for Real-Time Systems” is the result of my own research except as cited in the references. The thesis has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

Signature : ........................................
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Date : 8 June 2011
Dedicated to my beloved family
and best friend who has always believed in me...
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ABSTRACT

Real-Time System (RTS) is a complex system consisting of several tasks and processes. Thus, the designer finds it difficult to ensure that the system is designed using an effective model. Unified Modelling Language (UML) provides a set of rich visual notations to support the analysis and design activities. Currently, there are some UML profiles that include certain specific features to design RTS. Timing constraints of RTS is crucial because a late response may lead to failure. In this sense, schedulability analysis (SA) is used to ensure the accuracy and predictability of hard RTS since it checks the timing constraints. In addition, SA can be automatically done using tool such as RapidRMA. Literature has shown that various integrated approaches have been proposed to develop a predictable RTS design by integrating an SA tool with a modelling tool. However, there is still a lack of incorporation between the integrated tools and systematic handling of timing constraints in RTS. Thus, the goal of this research is to propose an integrated approach named Development Process with Schedulability Analysis (DePSA) in order to obtain more systematic and predictable RTS design. The first objective is to investigate the best fit UML profile that provide rich features in handling functional and timing requirements in a less complicated design. To meet this objective, certain comparisons were done between features of two UML models (UML-Real Time (UML-RT) and UML-Schedulability, Performance and Timing (UML-SPT)) based on a designed case study. Then, Zhou’s metrics were used to measure the structural complexity of both modelling class diagrams. The second objective is to map the schedulability domain concepts of RTS into the chosen UML model. This was done by performing the mapping process to study the extent of how the chosen UML supports SA concepts by means of using its stereotypes and tags. This will assist future researchers in developing or selecting a suitable SA tool. The third objective is to propose the steps in the process to obtain more systematic and predictable RTS design. These steps indicate when SA can be performed throughout the generic development life cycle. This objective was met by applying the proposed steps on the designed case study and then comparing it with the existing steps. Finally, the fourth objective is an evaluation of DePSA approach that consists of the integrated tools (RapidRMA and Rhapsody), mapping issue and the DePSA steps. The final objective was conducted by comparing DePSA with the existing approaches and the results showed that the approach was effective for guiding on how to develop more predictable RTS design systematically by using integrated tools. As a conclusion, DePSA approach with UML-SPT provides less complex design and having a better design opportunity for a more systematic and predictable RTS modelling.
ABSTRAK

<table>
<thead>
<tr>
<th>CHAPTER</th>
<th>TITLE</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>DECLARATION</td>
<td></td>
<td>ii</td>
</tr>
<tr>
<td>DEDICATION</td>
<td></td>
<td>iii</td>
</tr>
<tr>
<td>ACKNOWLEDGMENTS</td>
<td></td>
<td>iv</td>
</tr>
<tr>
<td>ABSTRACT</td>
<td></td>
<td>v</td>
</tr>
<tr>
<td>ABSTRAK</td>
<td></td>
<td>vi</td>
</tr>
<tr>
<td>TABLE OF CONTENTS</td>
<td></td>
<td>vii</td>
</tr>
<tr>
<td>LIST OF TABLES</td>
<td></td>
<td>xii</td>
</tr>
<tr>
<td>LIST OF FIGURES</td>
<td></td>
<td>xiv</td>
</tr>
<tr>
<td>LIST OF ABBREVIATIONS</td>
<td></td>
<td>xvii</td>
</tr>
<tr>
<td>LIST OF APPENDICES</td>
<td></td>
<td>xix</td>
</tr>
</tbody>
</table>

1 INTRODUCTION

1.1 Overview 1
1.2 Problem Background 3
1.3 Problem Statement 7
1.4 Objectives 8
1.5 Scopes 8

2 LITERATURE REVIEW

2.1 Introduction 10
2.2 Comparison of Modelling Profiles 11
  2.2.1 Unified Modelling Language (UML) 14
  2.2.2 UML Real-Time (UML-RT) 14
2.2.2.1 Structural Aspect of UML-RT 15
2.2.2.2 Behavioural Aspect of UML-RT 17
2.2.2.3 Design Tool - Rational Rose Real-Time (RoseRT) 18
2.2.3 UML for Schedulability, Performance and Time (UML-SPT) 18
   2.2.3.1 Structural Aspect of UML-SPT 19
   2.2.3.2 Behavioural Aspect of UML-SPT 22
   2.2.3.3 Design Tool - Rhapsody 6.0 23
2.3 Structural Complexity of Real-Time System 24
   2.3.1 Structural Complexity of Class Diagrams 25
   2.3.2 Weighted Class Dependence Graph (WCDG) 26
   2.3.3 Entropy Distance for Measuring Structural Complexity of Class Diagram 27
2.4 Schedulability Analysis 29
   2.4.1 Various Schedulability Analysis Based On Priority Driven Approach 31
   2.4.2 Discussion on Schedulability Analysis Based On Priority Driven 32
   2.4.3 Rate Monotonic Analysis (RMA) 32
      2.4.3.1 Scheduling of Aperiodic and Sporadic Task 37
2.5 Schedulability Analysis Tools 38
   2.5.1 Evaluation of Schedulability Analysis Tools 41
2.6 Integration Approach between UML Models and SA Tools 45
   2.6.1 First Party: Methodological Approach 46
   2.6.2 Second Party: Integration Approach without SA Tool 49
   2.6.3 Third Party: Integration Approaches with SA Tool 51
2.7 Discussion 54
2.8 Summary 55

3 RESEARCH METHODOLOGY 56
3.1 Introduction 56
3.2 Research Process 57
3.3 Case Study 64
  3.3.1 Elevator System Case Study 64
  3.3.2 The Complexity in the Elevator System Operation 65
3.4 Summary 71

4 COMPARISON OF REAL-TIME UML DESIGN MODELS BASED ON STRUCTURAL ASPECT 73
4.1 Introduction 73
4.2 Comparison of Structural Aspect Process 74
4.3 Designing Structural Aspect of the Case Study using UML-RT 75
  4.3.1 UML-RT Class Diagram 75
  4.3.2 UML-RT Structure Diagram 80
4.4 Mapping UML-RT Element into UML-SPT 84
4.5 Designing Structural Aspect of the Case Study using UML-SPT 86
4.6 Comparison Results of UML-RT and UML-SPT 88
  4.6.1 Object Oriented Paradigm (OOP) 89
  4.6.2 Structural Complexity Comparison 92
    4.6.2.1 Structural Complexity of UML-RT Class Diagram 93
    4.6.2.2 Structural Complexity of UML-SPT Class Diagram 99
4.7 Discussion 104
4.8 Summary 105

5 COMPARISON OF REAL–TIME UML DESIGN MODELS BASED ON BEHAVIOURAL ASPECT 106
5.1 Introduction 106
5.2 Comparison of Behavioural Aspect Process 107
5.3 Design Behavioural Aspect of Case Study 107
  5.3.1 Designing of Statechart Diagram (UML-RT and UML-SPT) 108
5.3.2 Defining Comparison Criteria for Statechart Diagram Design
5.3.3 Discussion on Comparison of Statechart Diagram Design
5.3.4 Design of Sequence Diagram (UML-RT and UML-SPT)
5.3.5 Defining Comparison Criteria for Sequence Diagram Design
5.4 Discussion
5.5 Summary

6 MAPPING SCHEDULING ANALYSIS INTO UML DESIGN MODEL
6.1 Introduction
6.2 Mapping Processes
   6.2.1 Step 1: Defining the Formal Specification of RTS Concepts
   6.2.2 Step 2: Identifying Appropriate Stereotypes and Tags
   6.2.3 Step 3: Mapping RTS Domain Concepts into UML-SPT Profile’s Stereotypes
   6.2.4 Step 4: Applying Mapping Result into the Case Study
      6.2.4.1 RTS Domain Concepts of the Case Study based on Request Elevator Scenario
      6.2.4.2 RTS Domain Concepts of the Case Study based on Worst-Case Scenario
      6.2.4.3 Mapping of Schedulability Analysis Domain Concepts into UML-SPT
6.3 Discussion
6.4 Summary

7 INTEGRATED APPROACH (DePSA) FOR PREDICTABLE REAL-TIME SYSTEMS
7.1 Introduction
7.2 Development Process with Schedulability Analysis for RTS (DePSA) 155

7.3 DePSA Steps 158
   7.3.1 Development Process 160
      7.3.1.1 Requirement Resultant Phase 160
      7.3.1.2 Analysis Phase 162
      7.3.1.3 Design Phase 165
      7.3.1.4 Implementation Phase 171
      7.3.1.5 Test Phase 173

7.3.2 Real-Time Schedulability Analysis Processes 173

7.3.3 Evaluation of DePSA Steps 181

7.3.4 Definition of Comparison Criteria 182
   7.3.4.1 Evaluation of DePSA Steps: Comparison of Schedulability Analysis Process 184
   7.3.4.2 Evaluation of DePSA Steps: Methodological Comparison between MeDUSA and DePSA Steps 188

7.4 Automatic Mapping Issue between Integrated Tools 194

7.5 Evaluation of DePSA Integrated Approach 196

7.6 Discussion 202

7.7 Summary 204

8 CONCLUSION 205
   8.1 Summary 205
   8.2 Research Conclusion 209
   8.3 Research Contribution 211
   8.4 Future Works 212

REFERENCES 214

APPENDIX A 225
APPENDIX B 229
APPENDIX C 233