Information Integration among Heterogeneous and Autonomous Applications

Benabdelkader, A.

Citation for published version (APA):

General rights
It is not permitted to download or to forward/distribute the text or part of it without the consent of the author(s) and/or copyright holder(s), other than for strictly personal, individual use, unless the work is under an open content license (like Creative Commons).

Disclaimer/Complaints regulations
If you believe that digital publication of certain material infringes any of your rights or (privacy) interests, please let the Library know, stating your reasons. In case of a legitimate complaint, the Library will make the material inaccessible and/or remove it from the website. Please Ask the Library: https://uba.uva.nl/en/contact, or a letter to: Library of the University of Amsterdam, Secretariat, Singel 425, 1012 WP Amsterdam, The Netherlands. You will be contacted as soon as possible.

UvA-DARE is a service provided by the library of the University of Amsterdam (http://dare.uva.nl)
# Contents

Acknowledgments xii  

1 Introduction 1  
   1.1 Major Requirements in terms of Information Management 3  
   1.2 Application Cases: an Overview 4  
   1.3 Thesis Contribution 7  
   1.4 Organization of the thesis 8  

2 Information Integration Approaches, Mechanisms, and Tools 11  
   2.1 Introduction 11  
   2.2 A Taxonomy for Information Integration 12  
      2.2.1 Distributed Systems 14  
      2.2.2 Integrated Systems 17  
   2.3 Further Classifications and Categorizations 28  
   2.4 Discussion 29  

3 WATERNET: Intelligent Supervision and Control in Heterogeneous and Distributed Application 31  
   3.1 Introduction 32  
   3.2 Water Environment and General application requirements 33  
      3.2.1 Water Network Structure and Management 35  
   3.3 Information Management Approach 38  
      3.3.1 The Waternet Architecture 38  
      3.3.2 Simple Scenario for Subsystems interaction 39  
   3.4 Distributed Information Management System (DIMS) 40  
      3.4.1 The PEER Federated Layer 41  
      3.4.2 Schemas Management in WATERNET Using PEER 42  
   3.5 Extended Integration Approach 45  
      3.5.1 Data Adapters Supporting Openness 47  
      3.5.2 The WATERNET System Implementation 48  
   3.6 Conclusion and Discussion 48  
      3.6.1 Major Characteristics and Benefits of Federated Approach in Waternet 49  
      3.6.2 Contribution to GFL2S 49
4 MegaStore: Advanced Web Databases for Music Industry

4.1 Introduction ............................................................................. 51
4.1.1 E-Commerce Applications: Attempts and Aims ................. 52
4.2 Problem Analysis and Required High Level Architecture ............. 52
4.2.1 Database Design .................................................................. 53
4.2.2 ODL Schema definition ....................................................... 55
4.3 The MegaStore System Architecture ........................................ 57
4.3.1 The Internet-Shopping Interface ......................................... 58
4.3.2 The Shop-in-a-Shop Interface ............................................. 58
4.3.3 Server Architecture Extension ............................................ 59
4.4 Music Audio and Video content ............................................. 60
4.4.1 Bandwidth and Encoding Algorithm ................................... 60
4.4.2 Data Volume Estimation ..................................................... 61
4.5 Music Data Manipulation ....................................................... 62
4.5.1 Objects Loading Strategies ................................................ 62
4.5.2 Extensions .......................................................................... 65
4.5.3 Database Administration .................................................... 66
4.6 MegaStore Interfaces - Advanced Features ............................... 67
4.6.1 Dynamic Browsing ............................................................. 69
4.6.2 Ordering System ............................................................... 70
4.6.3 System Security ............................................................... 71
4.6.4 Current Implementation Status .......................................... 72
4.7 Derived Applications ........................................................... 73
4.7.1 LuisterPaa Interface ........................................................... 73
4.7.2 Music Sheet Application ..................................................... 75
4.8 Conclusion and Discussion .................................................... 78
4.8.1 Major Characteristics and Benefits provided to MegaStore Application 79
4.8.2 Contribution of the MegaStore's Information Management Approach to GFI2S ............................................... 80

5 Information Management for Scientific Applications .................. 81

5.1 Introduction ............................................................................. 81
5.2 Virtual Laboratory Architecture Design .................................... 82
5.2.1 The VL Information Management for COoperation - VINCO Module 85
5.3 Multi-Media Scientific Data Sets Manipulation .......................... 85
5.3.1 Storage of Large Scientific and Engineering Data Sets .......... 87
5.3.2 Scientific Data Archiving and Cataloguing Using Dublin Core Standard 93
5.4 Universal Database Access - Based on Standards ....................... 99
5.4.1 Database Connection Module .............................................. 102
5.4.2 Query Execution Module .................................................... 102
5.4.3 Results Presentation Module .............................................. 102
5.4.4 Object Creation Module ..................................................... 103
5.4.5 Further Benefits .............................................................. 103
5.5 Data Access Security and Information Visibility (Safe/Reliable Data Export) 105
5.5.1 Role-based Access Control Definition ................................ 106
5.5.2 Flexible Role-based Access Interface .................................. 108
5.6 Physical Database Performance Analysis .................................... 109
5.6.1 Specific Functions to Access Binary Large Objects (Blobs) .......... 110
5.6.2 Benchmarking Tests For Matisse Database System ................. 110
5.6.3 Observations ............................................. 112
5.6.4 Lessons Learned ......................................... 112
5.7 Conclusion and Discussion .................................. 112
5.7.1 Contribution to GFI2S .................................. 113  

6 GFI2S - Generic and Flexible Information Integration System 115
  6.1 Introduction ............................................. 115
  6.1.1 Focus of GFI2S ....................................... 117
  6.2 GFI2S Information Integration Approach .......................... 119
  6.2.1 Local Adaptation Layer (LAL) ................................ 122
  6.2.2 Node Federation Layer (NFL) ................................ 125
  6.2.3 Application of Database Standards and Middleware Solutions in GFI2S 144
  6.2.4 GFI2S in Action ........................................ 145
  6.3 Conclusion ................................................ 147

7 Conclusions and Future Work .................................. 149
  7.1 Overview .................................................. 149
  7.2 GFI2S Compared to Other Approaches .......................... 152
  7.3 Lessons Learned .......................................... 153
  7.4 Future Work ............................................... 154

A Application of Database and Middleware Standards in FGI2S 157
  A.1 Object-Oriented Standards and Extensions Adaptation for GFI2S .... 157
    A.1.1 Object Definition Language - ODL .......................... 158
    A.1.2 Query Languages - SQL, SQL3, and OQL .................. 160
    A.1.3 Object Interchange Format - OIF .......................... 161
  A.2 Web Standard and Middleware Adaptation for GFI2S .............. 162
    A.2.1 Object Database Connectivity - ODBC .................. 163
    A.2.2 Use of JAVA for Application Programming ............ 164
    A.2.3 Use of XML for Information Exchange .................. 165

Samenvatting 180

Abstract 182

Résumé 184