



The Real-Time Business Intelligence Framework for Managing Risk in Banking Industry

Pavithra Mahasivam

A THESIS
SUBMITTED TO
SRI LANKA INSTITUTE OF INFORMATION TECHNOLOGY
IN PARTIAL FULLFILMENT OF THE REQUIREMENTS
FOR THE DEGREE OF
MASTER OF SCIENCE IN INFORMATION TECHNOLOGY

December 2014

I certify that I have read this thesis and that in my opinion it is fully adequate, in scope and in quality, as a thesis for the degree of Master of Science.



Mr Dinesh Asanka

Approved for MSc. Research Project:

MSc. Research Project Co-ordinator, SLIIT

Approved for MSc:

MSc. Programme Co-ordinator, SLIIT

Declaration of Originality

This is to certify that the work is entirely my own and not of any other person, unless explicitly acknowledged (including citation of published and unpublished sources). The work has not previously been submitted in any form to the Sri Lanka Institute of Information Technology or to any other institution for assessment for any other purpose.

Signed M. Paulina

Date 24 / 12 / 2014

Acknowledgements

While at Sri Lanka Institute Information Technology, I have benefited from having great advisors who seem to agree about very little.

I would like to express my sincere gratitude to my supervisor Mr. Dinesh Asanka for guiding me throughout the project. He has given his fullest corporation to me whenever I sought for advice.

I must thank Mr. Prasanna Sumathipala senior lecturer at SLIIT for teaching me Advanced DBMS subject in MSc.

I would like to place my gratitude to my loving parents, brother and sister for always encouraging for me on higher studies.

Last but not least, I would like to thank all my colleagues and others who are not mentioned, for all the support extended to me. Without their dedication the project would not have been successful.

Table of Contents

Chapter 1	1
Introduction	1
1.1 Study Background	1
1.2 Dissertation Structure	2
1.3 Aim and Objectives	3
1.4 Summary	3
Chapter 2	4
Literature Review	4
2.1 Capital Adequacy Ratio for Banks	5
2.1.1 Formula	5
2.2 Usage of Capital Adequacy Ratio	6
2.3 Central Bank of Sri Lanka Guidelines on Computation of Capital Adequacy Ratio	7
2.3.1 Credit Risk	8
2.3.2 Market Risk	10
2.3.3 Operational Risk	10
2.4 Technical survey on Real-Time ETL	12
2.5 Summary	20
Chapter 3	21
Methodology	21
3.1 Introduction	21
3.2 Conceptual design of proposed architecture	22
3.3 Architecture Diagram	25
3.4 Database Design	26
3.5 Summary	27
Chapter 4	28
Prototype Development	28
4.1 Introduction	28
4.2 Change Data Capture Service	28
4.3 Rule Based Engine Development	29
4.4 Summary	30

Chapter 5	31
Discussion	31
Chapter 6	33
Conclusions and Limitations.....	33
References.....	34
Appendices.....	36
Appendix 1: Research Paper.....	36
Appendix 2: Detail Table Structure	45
Appendix 3: Configurations for Asynchronous Distributed HotLog Publishing	49

List of Figures

Figure 1: Formula of capital requirement	7
Figure 2: Components of capital requirements	8
Figure 3: Calculation of risk weighted exposures.....	9
Figure 4: Framework of log based change data capture	12
Figure 5: Multi-cache based real-time data warehouse	13
Figure 6: Data warehouse Architecture with the extension of data stream handing	14
Figure 7: Sample ETL job for Initial loading	17
Figure 8: Sample ETL job for incremental loading.....	17
Figure 9: The 24/7 real-time data warehouse architecture.....	20
Figure 10 : Conceptual Architecture of real-time BI framework	22
Figure 11: Data extraction service	23
Figure 12: Rule based engine components	24
Figure 13 : Architecture Diagram of Real-Time BI Framework for Banking.....	25
Figure 14 : Sample GL Account Balance Table	26
Figure 15: Graph for memory utilization.....	32
Figure 16: Graph of CPU Utilization.....	32
Figure 17 : Conceptual Architecture of real-time BI framework	41
Figure 18: Data extraction service	41
Figure 19: Rule based engine components	42

Abstract

Development of a Framework for Real-Time Business Intelligence for Managing Risk in Banking Industry

Pavithra Mahasivam

MSc. in Information Technology

Supervisor: Mr. Dinesh Asanka

December 2014

There is no doubt that data management is a critical component of any financial services firm's risk management strategy in the current market climate. As financial strategies have become more complex, new financial instruments are added and businesses continue their expansion across the globe, the need for a coherent and streamlined approach to data management potentially including the use of real-time data has never been greater. As today's decisions in the business world have become more real-time, the systems that support those decisions need to keep up. It is only natural that Business Intelligence BI systems quickly begin to incorporate real-time data in order to increase risk transparency to make better and faster business decisions, evaluate and predict broader spectrum of risk scenarios, confidentially answer queries from regulatory bodies and internal stakeholders.

This research is mainly focusing on risk management of banking industry. The research delivers advanced analytics and reporting capabilities to help strategic decision makers for navigate data to identify new opportunities, manage and mitigate risks, and make fact-based decisions in timely manner. Every bank measure and monitor their performance against characteristics which is known as Key Performance Indicators (KPIs). KPIs help an organization define the progress towards the organization goals. Important KPIs of bank are identified in the literature that is used by financial regulators to keep track of how well-protected a bank is against risk.

The real-time business intelligence framework is emulated for banking industry in order to mitigate risk. The framework consists of changed data capture (CDC) routine and rule-based engine. CDC routine is used to capture the changed data from source database and load it to data-mart online real-time. The rule base engines identify pattern changes in the data, based on the defined parameters and provide advanced analytics and reporting capabilities.