

# **WEBMAG: WEB BASE SERVERS MANAGEMENT USING CASE-BASED REASONING**

A thesis submitted to the Faculty of Information Technology in partial  
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## **ABSTRACT (BAHASA MELAYU)**

Pendekatan yang digunakan dalam projek ini adalah untuk membangunkan system aplikasi berasaskan laman web bagi memantau dan menguruskan pelayan berasaskan LDAP dengan menggunakan teknik Penaakulan Berasaskan Petua (CBR). Sistem CBR yang diimplementasikan dalam web ini merupakan aplikasi web yang menggunakan borang HTTP untuk menghantar pertanyaan kepada pelayan CBR dengan menggunakan Java Server Page (JSP). Terdapat 1152 kes dengan 5 ciri seperti jumlah memori yang ada (MB) , peratusan status CPU yang tertahan, jumlah penukaran disk (MB), jumlah fail yang dibuka untuk proses dan masa tindakbalas LDAP (msec). Masa tindakbalas LDAP adalah dijadikan data sasaran untuk proses CBR. Sistem akan menerima parameter input bagi setiap satu minit. Langkah seterusnya adalah capaian kes, proses untuk memadamkan kes terhampir untuk kes yang baru. Seterusnya adalah proses penggunaan semula kes, di mana penyelesaian akan dilaksanakan (contohnya: "Normal", "Perhatian" dan "Kritikal"). Langkah ketiga ialah perbandingan penormalan waktu tindakbalas LDAP daripada kes yang dicari dengan penormalan masa tindakbalas LDAP daripada kes sebenar. Jika tiada perbezaan daripada kes yang asal, kes ini akan dimasukkan dalam pangkalan kes dan sebaliknya. Akhir sekali adalah proses mengekalkan kes, yang bertujuan untuk mengawal kemasukan dan penghapusan kes yang sedia ada. Sumbangan utama sistem ini adalah penggunaan perisian sumber terbuka yang membolehkan pembangun perisian untuk menggunakan fungsi CBR untuk aplikasi dan kebolehan aplikasi web yang boleh digunakan bila-bila masa dan di mana sahaja.

## **ABSTRACT (ENGLISH)**

The approach presented in this project is to develop a web-based application for monitoring and management LDAP server based on Case Base Reasoning (CBR) technique. CBR system implemented on the web, is the web application, using HTTP form to submit queries to the CBR server and using Java Server Page, for implementation. There are 1152 cases, with 5 features e.g. amount of free memory (MB), amount of disk swap usage (MB), percentage of CPU load, percentage of CPU idle status, amount of open files for the process and LDAP response time (msec.). LDAP response time is used as a target data for CBR process. The system received all parameters in every minute. Next step is “case retrieval”, a process select the closest match case. Second step is “case reuse”, adapt the LDAP response time to the suggestion results e.g. “Normal”, “Attention” and “Critical”. Third step is to compare the normalized LDAP response time from searched case with the normalized LDAP response time from actual case. If there is no different between these values, new case will be added to previous cases database, but if there is different between these cases, searched case will be deleted from previous cases database. Finally “case retainment”, the purpose to add new case in to previous cases database and delete failure cases from previous cases database. The benefit of the system is the open source software allowing developer to implement CBR functionality in application using web-base application that can run any where and any time.

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# CHAPTER 1

## INTRODUCTION

In this chapter, the first section describes the over all idea in this study from the problems to the idea of implementation and the benefit of project, followed by the problem statement, the objectives of the study and the significance of the study, the scope of the study. Finally the summarize diagram of the study.

### 1.1 Introduction

Directory Service has the relationship with many services such as FTP (Files Transfer Protocol), Web Hosting, Web Mail, Web Application etc. Because, if the user need to use the service, that service must have the authentication with directory service, every time. Such that directory service is the first gate before entering other services. When problem appear for example: user can't use system. In many cases, the problem may be appearing in some services but admin don't know then servers will down. Authentication is an important service, because if user can't login, he can't use application. So that, if directory service has problem, it will cause other services have a problem too. Then this study will focus at the process of the web management directory service, and keep it alive and it will be able to available to other service. By choosing Light Weight Directory Access Protocol (LDAP) as directory service, and do the monitoring some attributes. Then predict the performance and report the result to administrator. The technique used in this study is Case-based Reasoning (CBR) to predict performance and then give some suggestions to the administrator via web-based front-end.

A directory is a type of database containing descriptive information of entries. For example people description such as name, address, phone number and e-mail address

The contents of  
the thesis is for  
internal user  
only

## BIBLIOGRAPHY

- Aamodt, E. Plaza., (1994). Case-Based Reasoning: Foundational Issues, Methodological Variations, and System Approaches. AI Communicationsl. IOS Press, Vol.7: 1, pp. 39-59, 1994.
- Allen, B.P., (1994). Case-Based Reasoning: Business Applications. Communications of the ACM, Vol. 37, No 3, pp 40-42., 1994.
- Bradey P.Allen., (1994). Case-based reasoning: Business Application., Communications of the ACM, No.3 vol.37. March 1994.
- Cunningham, P., Zenobi G., (2001) Case Representation Issues for Case-Based Reasoning from Ensemble Research., 4th InternationalConference on Case-Based Reasoning, 2001.
- Daniels J.J., Rissland E.L., (1995). A case-based approach to intelligent information retrieval. In Proceedings of the SIGIR., 1995.
- Doyle, M., Ferrario M., Hayes, C., Cunningham, P., and Smyth, B., (1998). CBR net: smart technology over a network., Technical Report TCD-CS-1998-07, Trinity College Dublin, 1998.
- Gerald Carter., LDAP System Administration., pp7., 2003.
- Gyllendahl C., Sheppard E., (2001). Case-Based Reasoning: A Titan Revealed., Proceedings, IDt Workshop on Interesting Results in Computer Science and Engineering (IRCSE '01) Västerås (Sweden), Autumn 2001.
- [Http://www.faqs.org/rfcs/rfc2251.html](http://www.faqs.org/rfcs/rfc2251.html)
- Jakob Algulin., (2000). Intelligent Sales on the Internet with Case-Based Reasoning., Seminar: Electronic Commerce und virtuelle Unternehmen 7./8., 2000.
- James Liu, Tommy Leung., (2001). A Web-Based CBR Agent for Financial Forecasting., Workshop on Soft Computing in Case-Based Reasoning, International Conference on Case-Based Reasoning (ICCBR'01), 2001.

- Jussara M. Almeida, Virgílio Almeida, and David J. Yates., (1997). Measuring the behavior of a World-Wide Web server., In: Seventh Conference on High Performance Networking (HPN), pp. 57-72 (April), White Plains, N.Y.: IFIP, 1997.
- Ketler, K., (1993). Case-Based Reasoning: An Introduction., Expert Systems with Applications, Vol. 6, P3 to P8, 1993.
- Liu, X., Sha, L., Diao, Y., Froehlich, S., Hellerstein, J. L., Parekh, S., (2003). Online Response Time Optimization of Apache Web Server., IWQoS, 2003.
- Luc L., Gay L., (2003). Applying Case-Based Reasoning to Email Response., 5th International Conference on Enterprise Information Systems, Angers, France, April 22-26, 2003.
- Mitsuki N., (2003). Credit risk management system on e-Commerce: case based reasoning approach”, ACM International Conference Proceeding Series., 2003.
- Monsifrot A., Bodin F., (2001). Computer Aided Hand Tuning (CAHT): Applying Case-Based Reasoning to Performance Tuning., International Conference on Supercomputing Proceedings of the 15th international conference on Supercomputing, 2001.
- Pal, K., & Campbell, JA., (1997). An Application of Rule-Based and Case-Based Reasoning within a Single Legal Knowledge-Based System., The DATA BASE for Advances Systems (an ACM SIGMIS journal), Vol.28, No.4, 1997.
- Schmidt, R., & Gierl, L., (1997). The Roles of Prototypes in Medical Case-Based Reasoning Systems. In: Bergmann R, Wilke W (eds.): 5th German Workshop on Case-Based Reasoning, GWCBR-97, University of Kaiserslautern, LSA-97-01E, 1997.
- Rissland E., Ashley K., (1997). A Case-based System For Trade Secrets Law., In Proceedings of the first international conference on Artificial intelligence and law., Boston, Massachusetts, United States., pp. 60-66., 1997.
- Schuster, A., Sterritt, R., Adamson, K., Shapcott, C.M. and Curran, E.P., (1999). Case-Based Reasoning for Complex Telecommunication Systems., European Network of Excellence Erudit Workshop on Application of Computational Intelligence Techniques in Telecommunication., Imperial College, London., pp33-38., 1999.
- Selfridge, M. & Cuthill, B., (1989). Retrieving Relevant Out-of-Context Cases: A Dynamic Memory Approach to Case-Based Reasoning., In, Proceedings of the DARPA Case-Based Reasoning Workshop., Hammond, K.J. (Ed.), Morgan Kaufmann, Calif., US., 1989.
- Suneela R. Joshi, William W., (1996). Case Based Reasoning Approach to Creating User Interface Components., CHI Conference Companion., 1996.

- Wang X., Schulzrine H., Kandlur D., Verma K., (2000). Measurement and Analysis of LDAP Performance., International Conference on Measurement and Modeling of Computer Systems (SIGMETRICS'2000)., Santa Clara, CA, pp. 156-165., Jun. 2000.
- Watson, I., (1996). Case-Based Reasoning Tools: An Overview. In Progress in Case-Based Reasoning. Proceedings of the 2nd UK Workshop on Case Based Reasoning., 1996.
- Watson, I. & Gardingen, D., (1999). A Distributed Case-Based Reasoning Application for Engineering Sales Support., Proceeding 16th Internation Joint Conf. On Artificial Intelligence., Morgan Kaufmann Publishers Inc., 1999.