Impact of Rate of Query Response for Object-Oriented Design

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ABSTRACT
Due to the wide use of the Object-Oriented database by the business organizations, it is necessary to compute how many queries are responded by the database at a particular time (this is named as rate of query response) that one can easily find out the rate of query response time. In this paper a real case study of Life Insurance Corporation of India has been taken and computes the rate of query response. A UML class model for query response time is designed and converted it into the directed graph and a table is also designed for computing the rate of query response.

Keywords
UML, Object-Orientation, Query Response Time, Class Diagram, Directed Graph.

1. INTRODUCTION
The unified Modeling Language (UML) is well known and widely accepted modeling language in the field of software designing; it gives the new ways of designing, development and deployment of the software systems; it produces both kinds of diagrams such as dynamic as well as static. It has several types of designing tools that design and represent the every aspect of the software-intensive systems. Therefore, UML is a standard modeling language for designing the real and complex object-oriented systems. The UML is a powerful modeling language that is used to measure the performance of the designed UML model of the system.

The object-oriented database is database system in which every relation is store in the form of object. As an object-orientation is a methodology which is widely used for designing and deployment of the real and complex system that is based on the object-oriented concept. This concept is introduced in the database system to meet the need of applications without limiting the data types; it is commonly used in the designing the large and complex object-oriented database. In the current scenario many organizations have shifted their old structured databases into the object-oriented database due to the reusability of the objects.

The rate of query response is described as how many queries have been processed and responded in a certain amount of time, it also named as the answering rate; therefore, it is the process in which the number of queries have been processed and answered by the database system in a certain time; for example, the number of customer who have the insurance policy in the Life Insurance Corporation of India can perform some queries to know their policy status, premium dues, deposit their premium amount etc., the database server responded the queries which are performed by the customers.

In this paper the rate of query response is computed for the objet-oriented design by taking the UML class diagram for computing the query response time of life Insurance Corporation of India and exploring it by converting it into the directed graph along with the probabilistic values of queries requesting and responding and create a table to represent the rate of query response of every node of the directed graph.

2. RELATED WORK
Let us briefly describe the related work first, Milicevic et al [1] have considered the influence of the system load and the system throughput on the response time, as well as a possibility of the accurate response time prediction - whereby that mechanism may be a foundation for (automatized) decision-making for a query (or DB procedure) scheduling. Liu et al. [2] have addressed the response loss problem and show that peers oscillation can cause up to a 35 percent response loss in an unstructured P2P system and also presented three techniques to alleviate this problem: the redundant response delivery (RRD) scheme as a proactive approach, the adaptive response delivery (ARD) scheme as a reactive approach, and the extended adaptive response delivery scheme to render ARD to function in an unstructured P2P system with limited or no flooding-based search mechanism. Wang et al. [3] have developed two novel strategies: a static data distribution strategy DDH and a dynamic data reallocation strategy DRC to speed up the query response time through load balancing. Liu et al. [4] have proposed a model to determine the view selection and update policy when the arrival of queries follows Poisson processes with the constraints of system response time, storage space and query dependent currency of data (on systems capable of periodic and query-triggered updates). Sun and Yu [5] have build up a model about propagation of reputation query request that reveals the relationship of query request time, connect rate and response rate. Fabbri et al. [6] have considered the problem of reporting data breaches after such a misconfiguration is detected. Muruganathan et al. [7] have analytically evaluated the average query response time of the two-level Hierarchical Clustering based Hybrid-routing Protocol (THCHP) proposed recently for wireless sensor networks (WSNs). Liang et al. [8] have addressed the query response time and its effect on the network lifetime through the study of the top-k query problem in sensor networks with the response time constraint. Macdonald et al. [9] have investigated the impact of dynamic pruning strategies on query response times, and propose a framework for predicting

the efficiency of a query. Singhal [10] has discussed a framework for predicting the SQL query response time with growth of the database while being transparent to the production hardware, storage subsystem and DB Server. Saxena and Kumar [11] have computed the object-oriented query response time for UML models.

3. UML CLASS DIAGRAM

The UML class diagram of query response time by Saxena and Kumar have been taken for computing the rate of query response. The QRT system is designed in the form of class model; there are six major classes such as Agent, Customer, Main_Branch, Branch_Office, Query and Mobile_System which are shown in the figure 1 along with their major attributes. Through the UML class diagram a complete process of executing and computing the query response time is explained. The Main_Branch class has multiple associations with every class and executed a query to find the number of customers whose policy premium is due and send this information to the customer's mobile system; the Mobile_System class has the multiple associations with the Customer class. The Customer class has multiple associations with Query class where the customer fired a query to know the policy status and the Main_Branch executes the fired query and send the status of the policy to the customer's mobile system. Therefore, from the UML class diagrams the query response time is the time at which the result of the executed query which is fired by the customer.

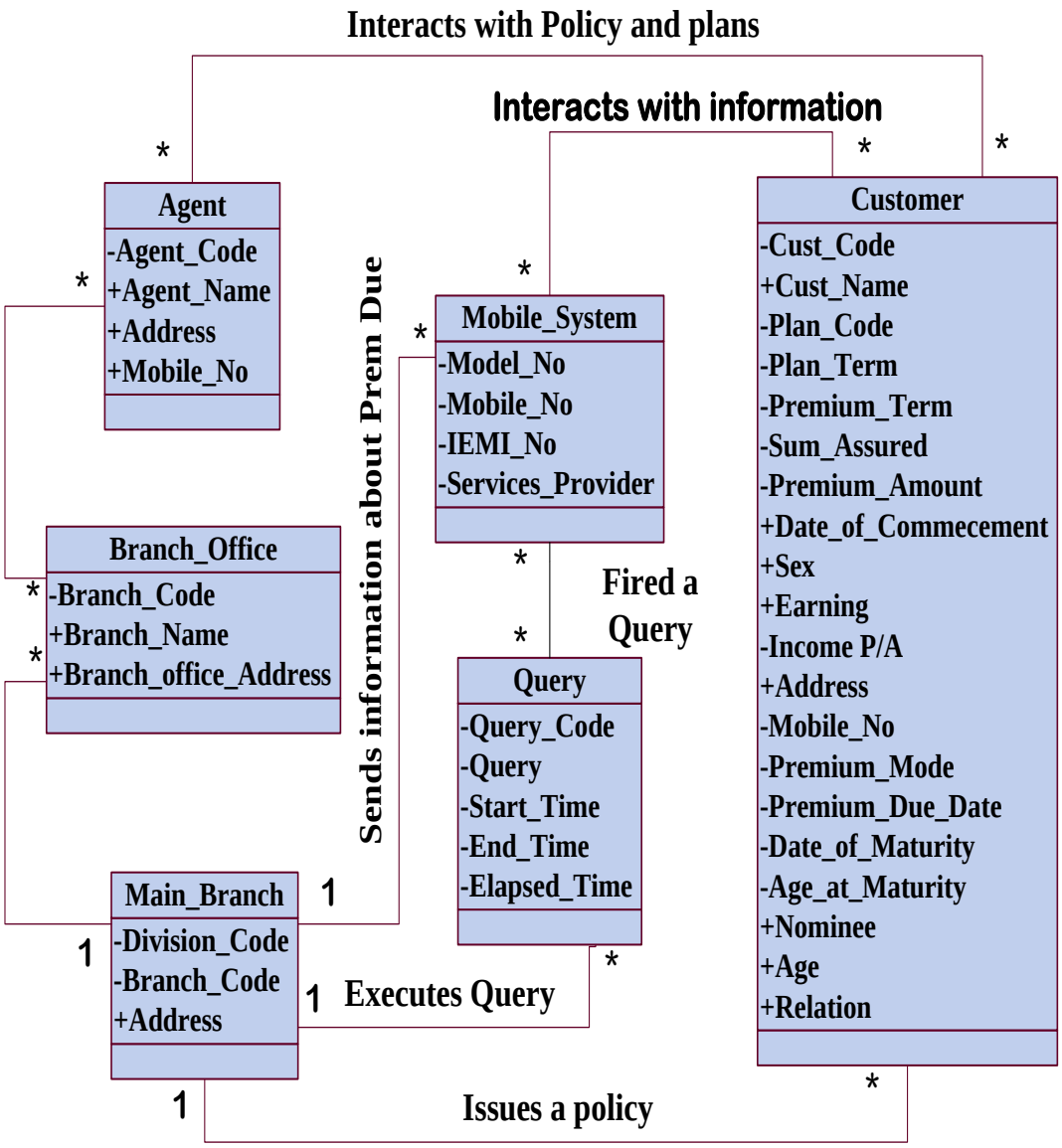

Fig 1. UML Class Model for Executing Query

4. Experimental Study

4.1. Computation of Rate of Query Response

The rate of query response is defined as the numbers of queries are responded in a certain time by the query processor. For computing the rate of query response first converting the designed UML model for executing query into the directed graph in which every class is assigned as a node of the graph and connecting lines are assigned to edges of the graph; the solid arrows shows the request of query while the doted arrows shows the response of the requested query by the

nodes. The probabilistic values of the requesting and responding the queries is shown in the directed graph along with the arrows; the probabilistic values of query requesting of every node is 98% except only one node i.e. Agent to Customer where 60% probability of requesting and 40% probability of responding to the requests query. There are six nodes in the graph, five of them are requesting and responding the queries while only the one node i.e. query is not requesting any query only responding to Main_Branch. Therefore the rate of query response is computed by the model about the propagation of reputation of query request which is given by the Sun and Yu [5] shown by the equation (1):

$$Q(t) = \frac{N - \frac{R}{PC}}{1 - (1 - \frac{N}{PQ_0C})e^{-(PNC-R)t}} \quad \text{----------(1)}$$

Where

Q(t) is the number of nodes that requesting the query reputation;

R(t) is the response rate of the query i.e. R(t) = response time of the query/Number of Queries;

N is the total number of nodes;

P is the probability of reputation query request;

C(t) is the connecting rate of the nodes in the graph;

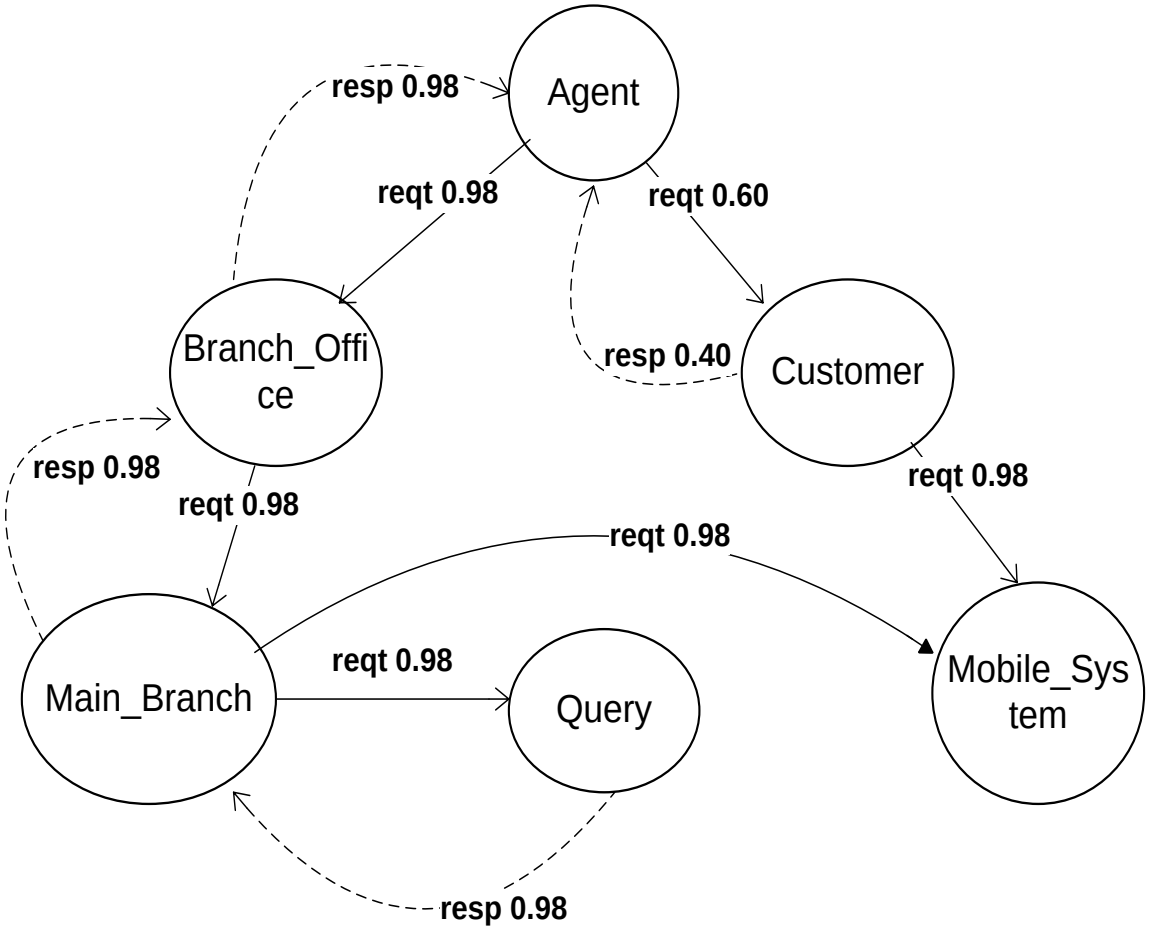

Fig 2. Directed Graph for Query Requesting and Responding

Now computing the rate of query response for each node and create a table for representing it which is shown in the table 1. Here authors have supposed that N is the number of nodes that are connected to the requesting node at time t = 1and also assumed that one query is requested by the node at this time.

Table 1. Rate of Response of the Queries

Nodes	No. of connected nodes N	Connecting rate per nodes C(t)	No. of Query requesting nodes Q(t)	No. of requesting nodes Q(t) at t=1	Requesting Probability P	Response Rate R(t)
Agent	2	1	1	1	.98	1.86
Customer	2	1	1	1	.60	1.86
Branch_Office	2	1	1	1	.98	1.86
Main_Branch	2	1	1	1	.98	1.86
Query	1	1	1	1	.98	.98
Mobile_System	2	1	1	1	.98	1.86

5. RESULTS & CONCLUSIONS

From the above work, it is observed that the UML is a powerful modeling language used in designing and implementing the approach of object-oriented database. The rate of query response of the attributes is computed and represented in tabular form and it is observed that the rate of response of the requested query is increased as the number of connecting node is increased.

6. ACKNOWLEDGMENTS

Thanks are due to University Grants Commission, New Delhi, for providing Rajiv Gandhi National Fellowship (RGNF) to carry out the above research work.

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