International Journal of Advanced Computer Technology (IJACT)
ISSN:2319-7900

A SURVEY ON TRANSACTIONS MANAGEMNET IN DISTRIBUTED REAL TIME DATABASE SYSTEMS

Fadia A. Abdalhalim, PhD. Program in Computer Science,
Sudan University of Science and Technology, Sudan
Ahmed Khalid, Najran University Community college, KSA

Abstract

Distributed real time database systems (DRTDBS) is the collection of database which are logically correlated over heterogeneous networks and their transactions have explicit timing constraints in the form of deadlines. Managing the transaction in real time distributed database is not easy; the complexity increases in real time applications by placing deadlines on the response of database system and transaction processing. This paper presents a survey study on transactions management in DRTDBS. At the end of this paper the authors propose a model for managing a transaction in real time distributed database systems.

Keywords: DRTBMS, Evaluating Transaction Performance, Workload Arrival Rate, Concurrency Protocol, Transaction atomicity

I. Introduction

A distributed real-time database system (DRTDBS) is the collections of database system logically correlated over heterogeneous networks where their transactions have explicit timing constraints expressed in the form of a deadline. A deadline indicates that the transaction must be completed before a certain time. In such a system, transaction processing must satisfy not only the database consistency constraints but also the timing constraints.[23,1, 14, 19, 24].

Distributed real time database systems are becoming increasingly important in a wide range of applications such as aerospace and defense systems, computer integrated manufacturing, robotics, network management, and air ground traffic control systems [12,31].

A transaction is just a group of primitive actions (e.g., reads and writes of simple data objects). In DRTDBS, there are two types of transactions: global and local. Global transactions are distributed real-time transactions executed at more than one site, whereas the local transactions are executed at the originating site (parent site) only [21]. The transaction is an atomic unit of work, which is entirely completed or not. Hence, a distributed commit protocol is needed to guarantee uniform commitment of distributed transaction execution [13].

Real time transaction deadlines can be categorized in three different categories based on their missing deadlines [16]. Hard real time transactions in which deadlines should meet strictly, as a missed deadline can create calamities. Second, firm real time transaction it can't be calamitous but the result of the transaction is of no use. Third, soft real time transaction can miss deadlines and a missed deadline can result in a degraded performance of the system.

Managing the transactions in DRTDBMS is not easy, as it has heterogeneously networked computers to solve a single problem [27]. The complexity is increases in real time applications by placing deadlines on the response time of the database system and transactions processing.

This paper presents a survey study on transactions management in distributed real time database. At the end of the paper researchers propose a model for managing and evaluating transaction performance in DRTDBMS.

The rest of this paper is organized as follows: Section II introduces transaction model in DRTDBMS. Section III describes the operations of transaction. In section IV transaction management in DRTDBS is introduced. Section V presents a proposal model for transaction management. Section VI concludes the paper.

II-Transaction Model in DRTDBMS

Transaction model is composed of six different components [30,28,16,2,3,7] source, sink, transaction Manager, resource Manager, recovery Manager and concurrency Control Manager.

The source is responsible for generating the workload such as file access, page access and updating of a file for a site. Once the source generates the workload, transaction manager is used to handle the execution of the transactions. Transaction consists of master and cohorts. Master resides on the site where transaction needs to be submitted whereas cohorts create the sequence of read-write requests. Concurrency control

ISSN:2319-7900

manager is used to control concurrency with the help of a concurrency control algorithm. The resource manager takes care of various resource parameters such as CPU, files, disk for read or write operations. The sink tracks the records after the completion of transaction. Figure 1 presents the transaction model.

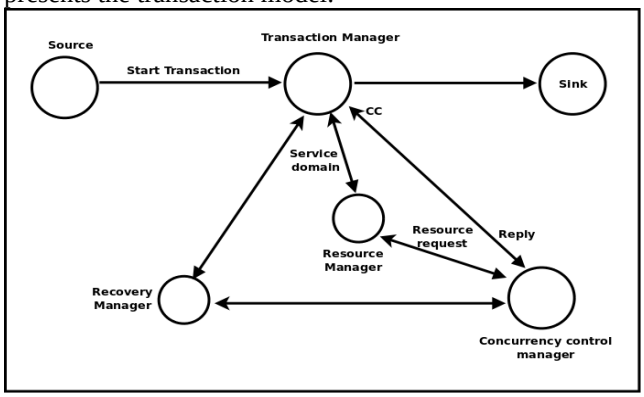

Figure 1: transaction Model

Transactions in DRTDBMS are executed on different sites while being bounded with time constraints in the form of deadlines such as money transfer, stock market data transaction and reservation of flight tickets. Whenever a transaction occurs , it must commit, any aborted transaction results in a system failure. In DRTDBMS, transaction takes place at various sites hence it must commit on each site to ensure that several commit protocols are used in a distributed environment [21, 26] like early prepare, two phase commit protocol and three phase commit protocol. Due to excessive synchronous messages in series, transaction execution time increases in distributed real time database system which is not acceptable in the case of real time systems.

III- Operations of transaction

Transaction is a set of read or write operation used to perform a unit of work. Database transaction must be atomic, consistent, isolated and durable. Database practitioners often refer to these properties of database transactions by using the acronym ACID [8, 11, 15].

Each transaction has to terminate. The outcome of the termination depends on the success or failure of the transaction. When a transaction starts execution, it may terminated by two possibilities which are abort or commit11, 4].

The transaction performance depends on the basis of comparing with commit and abort of a transition in the scheme.

To ensure transaction atomicity the distributed database systems implement a transaction Commit Protocols and a variety of commit protocols have been proposed by database researchers.

IV- Transaction Management in DRTDBMS

Managing transaction in real time distributed database systems is not easy, proper management of transactions is required during the arrival, execution or at any phase of transactions, bearing in mind that a transaction processing in any database systems can have real time constraints.

The important issue in transaction management is that if a database was in a consistent state prior to the initiation of a transaction, then the database should return to a consistent state after the transaction is completed. This should be done irrespective of the fact that transactions were successfully executed simultaneously or there were failures during the execution. Thus, a transaction is a unit of consistency and reliability [15 ,9, 3, 18].

Many researches deal with the transaction managements problem this section presents these works.

Yumnam et, al. [29] introduced a new approach called "intelligent agent" which keep track and recording the status of failing transactions in order to improve the performance of the system.

S. Takkar and S. P. Dandamudi [20] studied the behavior of real-time transactions in parallel databases, and reported the performance of a new priority based policy for scheduling hard real-time transactions in parallel database systems. They used miss ratio as a performance metric, the new policy provides a superior performance for the workload and system parameters.

J.Cowling, B. Liskov [5] presented Granola, a transaction coordination infrastructure for building reliable distributed, Granola uses a novel timestamp-based coordination mechanism to order distributed transactions, offering lower latency and higher throughput than the previous systems that offer strong consistence.

Y. Jayanta Singh et. Al [27] introduced a new concept to manage the transactions in dynamic ways rather than setting computing parameters in static ways. Their study follows the real time processing model, The new approach dynamic management either dynamic intelligent agent or dynamic slack management gives a significant improvement to the performance of the system

M.S.Khataib and Mohammad Atique [10] conducted a simulation study to analyze the performance under different transaction scheduling, different workloads arrival rate priority policies, altering slack factors and preemptive policies. The throughput of their system depends on the arrival rate of transaction.

Gyanendra Kumar Gupta, et, al. [4] presented a new concept to manage the transactions in hybrid transaction management rather than static and dynamic ways setting

ISSN:2319-7900

computing parameters. This keeps the track of the status of mix transaction static as well as dynamic so that it can improve the performance of the system with the advantage of static as well as dynamic.

Ersan Kayan and Ozg¨ur Ulusoy [3] discussed critical issues related to real-time transaction management in mobile computing systems. Taking into account the timing requirements of applications supported by mobile computing systems, they provide a transaction execution model with two alternative execution strategies for mobile transactions that evaluate the performance of the system considering various mobile system characteristics. The performance metric used in all the experiments was the Success Ratio; they noted that the handoff process leads to a decrease in the performance of ESMH.

S. R. Choudhary et. Al. [18] introduced a new concept to manage the transactions in database size for originating site and remote site rather than database size computing parameters. The new approach keeps track of the timing of the transactions to prevent aborts. Their approach showed an information about the remaining execution time of the transactions, and this will help the system to inject extra time to such transactions.

Xiai YAN et.al, [25] proposed a protocol adapted to the distributed real-time transaction commit, which can avoid the blocking problem when dealing with transactions by coordinator redundancy.

Udai Shanker et al, [22] introduced a modified real time commit protocol for distributed real time database systems (DRTDBS), which allows Commit Dependent and in time borrowers for Incredible Value added data lending without Extended abort chain.

Shishir Kumar and Sonali Barvey [17] analyzed two phase commit protocols and their variants both on the basis of time and cost. They presented a new commit protocol which is non-blocking and can give even better performance in reliable systems where failure rate is not very high.

V- Proposed Transaction Management Model

The proposed model takes care of workload arrival rate, concurrency protocol and resource time. A slack time factor will be used for managing the schedule of deadline. The final transaction completion deadline can be calculated by equation 1.

$$DT = AT + STF * RTT \quad (1)$$

Where, DT = Deadline of Transaction
AT = Sink Arrival time of Transaction
RTT = Resource Time of Transaction
STF = Slack Time Factor.

The performance of the proposed model will be measured by commit percentage metric which indicates the percentage of input transaction completed before deadline.

VI- Conclusion

Managing transaction in real time distributed database systems still needs more researches. Hence this field attracts a lot of research in terms of designing new algorithms, protocols, techniques or strategies. This paper, reviews the researchers effort in the field of managing transaction in DRTDBMS. Authors propose a model to manage a transaction in DRTDBMS.

References

[1] Aldarmi, S.A.: Real-time database systems: concepts and design. Department of Computer Science, University of York, April 1998.

[2] Bandaru Vishnu Roopini et al. Transaction Management Policy in Distributed Real Time System, International Journal of Soft Computing and Engineering (IJSCE) ISSN: 2231-2307, Volume-3, Issue-2, May 2013.

[3] Ersan Kayan, O¨ zgu¨r Ulusoy, "Real-Time Transaction Management in Mobile Computing Systems", DASFAA 1999 Proceedings of the Sixth International Conference on Database Systems for Advanced Applications P.P. 127-134.

[4] Gyanendra Kumar et, Al, "Hybrid Transaction Management In Distributed
Real-Time Database System", International Journal Of Advances In Engineering & Technology, Sept 2011, ISSN: 2231-1963 315 Vol. 1, Issue 4, Pp. 315-321

[5] James Cowling Barbara Liskov, "Granola: Low-Overhead Distributed Transaction Coordination", Proc. of the 2012 USENIX Annual Technical Conference. Boston, MA, USA. June 2012.

[6] J.R. Harista et. al, Data Access Aschedualing in Firm Real Time Database System, Techniical Research Report,Unversity of Maryland,1992

[7] Kamal Solaiman, "Transactional Concurrency Control for Resource Constrained Applications", PhD. Thesis, School of Computing Science, Newcastle University, May 2014.

[8] M.S.Khatib, Dr. Mohammad Atique," An Analysis of Transaction Management in Distributed Real Time Databases An Overview", INTERNATIONAL JOURNAL OF INNOVATIVE TECHNOLOGY AND RESEARCH Volume No.2, Issue No. 3, April – May 2014, 985 – 990.

ISSN:2319-7900

[9] M.S.Khatib , Mohammad Atique, "An analysis of distributed real time systems: an overview ", International Journal of Advanced Technology in Engineering and Science, Volume No.02, Issue No. 06, June 2014.
[10] NaLiu and Jianfei Zhou, "Relational Database's Transaction Operation and the Concurrent Control", International Journal of Database Theory and Application Vol.8, No.2, 2015.
[11] Rabin Kumar Singh et al, "FIVE: A Real-Time Commit Protocol", International Journal of Computer Applications, Volume 13, No.5, January 2011.
[12] Ramsay, S., Nummenmaa, J., Thanisch, P., Pooley, R.J., Gilmore, S.T., "Interactive simulation of distributed transaction processing commit protocols.", Proceedings of Third Conference of the United Kingdom Simulation Society (UKSIM'97), 1997, pp. 112–127.
[13] S. Agrawal, "SPEEDITY-A Real Time Commit Protocol", International Journal of Computer Applications", Volume 1 No. 3, 2010, P.P. 0975 – 8887.
[14] Seshadri, T.S., Haritsa, J.R, "Integrating standard transactions in real-time database systems", Information. Systems. 21(1), 3–28 March 1996.
[15] Sheetlani Jitendra, Gupta V.K., " Concurrency Issues of Distributed Advance Transaction Process", Research Journal of Recent Sciences , ISSN 2277-2502 Vol. 1, ISC-2011.
[16] Shetan Ram Choudhary, Dr. C.K. Jha, "Performance Transaction's Assessment Of Real Time Database System In Distributed Environment", International Journal of Engineering Trends and Technology (IJETT) – Volume 4 Issue 9- Sep 2013.
[17] Shishir Kumar, Sonali Barvey, " Non-Blocking Commit Protocol", IJCSNS International Journal of Computer Science and Network Security, VOL.9 No.8, August 2009 .

[18] S. R. Choudhary, Dr. C.K. Jha, "A Study on Transaction Processing for Real Time Database System in Distributed Environment" International Journal of Computer Science and Information Technologies, Vol. 4 (5) , 2013, P.P.721-724.
[19] Stankovic, J.A., "Misconception about real-time computing", IEEE Computer, vol. 21, no. 10, October 1988, pp 10–19.
[20] S. Takkar_ & S. P. Dandamudi, "Performance of hard real-time transaction scheduling policies in parallel database systems", Modeling, Analysis and Simulation of Computer and Telecommunication Systems, 1998. Proceedings. Sixth International Symposium.
[21] Udai Shanker · Manoj Misra · Anil K. Sarje, "Distributed real time database systems: background and literature review", Springer Science and Business Media, LLC 2008, p.p. 127–149.
[22] Udai Shanker, Nikhil Agarwal, Shalabh Kumar Tiwari, Praphull Goel, Praveen Srivastava, "ACTIVE-A Real Time Commit Protocol", Wireless Sensor Network, 2010, 2, 254-263 , March 2010.

[23] ul Haque, Waqar, "Transaction processing in real-time database systems", 1993, Retrospective Theses and Dissertations, Paper 10442.
[24] Ulusoy, O. "Processing real-time transactions in a replicated database system", Distrib. Parallel Databases 2(4), 405–436,1994.
[25] Xiai YAN, " An Improved Two-phase Commit Protocol Adapted to the Distributed Real-time Transactions",PRZEGLĄD LEKTROTECHNICZNY , ISSN 0033-2097, R. 88 NR 5b,2012
[26] Yadav, A. K., "A distributed architecture for transactions synchronization in distributed database systems", International Journal on Computer Science and Engineering , Vol. 02, No. 06, 2010, 1984-1991.
[27] Y. Jayanta Singh , Yumnam Somananda Singh, Ashok Gaikwad and S.C. Mehrotra, "Dynamic management of transactions in distributed real-time processing system", international journal of dabase menagement systems (IJDMS), vol. 2, No. 2, May 2010.
[28 Y. Jayanta Singh, Suresh C. Mehrotra, "An Analysis of Real-Time Distributed System under Different Priority Policies", World Academy of Science, Engineering and Technology,Vol:3 2009, pp. 08-28
[29] Yumnam Somananda, Ashok Gaikwad, "Management of missed transactions in a distributed system through Simulation", 978-1-4244-5540, 2010 IEEE.
[30] Yumnam Jayanta, Yumnam Somananda, "Conflicting Management of Transactions in Real Time Database System", ICI, 2011, Informatics and Computational Intelligence, International Conference on, Informatics and Computational Intelligence, International Conference on 2011, pp. 327-331.
[31] Zharkov, A., "Performance Evaluation of Transaction Handling Policies on Real-Time DBMS Prototype". Proceedings of the Spring Young Researcher's Colloquium On Database and Information Systems SYRCoDIS, Moscow, Russia, 2007.

FADIA ABDALLA B.Sc (honor) engineering economics from Odessa Lomonosova technological unversity for food industry 1991-1997, higher diploma in Computer Science 2001-2002 Engineering & technology collage ,Unversity of Gazeera , Master in Computer Science & Information 2002-2003 Engineering & technology collage -,Unversity of Gazeera .Phd Student Sudan University of science and technology 2014/2015,header for computer department –community collage 2007-2012 coordinaror for

ISSN:2319-7900

computer department –hail unveristy2013-2015, fadia A. Elbagir may be reached at fadiabagir@gmail.com

AHMED KHALID B.Sc. (honor) in computer science and statistics from University of Khartoum 1983-1989, master of Computer Science (AI) Sudan University of science and technology 1998. PhD in computer science Sudan University of science and technology 2007 coordinate of information technology department, computer science and information technology college University of science and technology Sudan 2008-20012.professor assistant Najran University, computer science department now - 2012