SURVEY ON TRANSACTION MANAGEMENT STRATEGIES IN MANETS

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Abstract

There has been an extensive research on transaction management in distributed systems. However, most of the approaches focus on the wired networks viz commitment protocols, concurrency control mechanisms, caching and deadlock handling, etc. The paper portrays some possible strategies for handling and managing a transaction in MANETS.The prominent issues to be addressed in MANETS are transient availability, limited battery power and bandwidth. Other techniques to manage transaction in MANET viz node mobility, energy limitation, frequent disconnection, real time constraints like the type of deadline (soft ,hard and firm) , completing the transaction before the deadline and designing own protocol to make transaction more efficient were also proposed. The aim of the paper is to highlight the tools and the strategies of transaction management in an adhoc network with no central node or coordinator such as base station(BS) or an access point(AP).

Keywords: Strategies, MANETS

1 Introduction

Transactions are the fundamental logical component of computation in a database system which are executed atomically and are indivisible, non-interfering and follow strict sequencing to ensure commitment of a process. The strategies that have been so far proposed by researcher depend on the issues, frameworks and challenges. Many proposals were made in different papers for handling a transaction, some of the strategies are listed in Figure No.1. In Manets, the prominent issues encountered by user includes frequent dis-connectivity, mobility of nodes and low battery power, which are addressed by researchers. In case of dis-connectivity frequent backup is taken so as to make the system fault tolerable. A node fails if it loses its battery power therefore it has to be charged immediately or a replica of that has to be created so as to retain the information available with the node.

If a node goes out of reachability then some alternative options need to be applied. Clusters are created for the nodes with similar characteristics. For improving the efficiency and security of packet transmission, data is restricted only through the cluster heads. Election algorithms like Bully, Token ring, LEACH, VCG and ACO are used to select a cluster head either statically or dynamically. When the nodes move from one range to another the issue is addressed by means of network partitioning. If the mobile node is cluster head then re-election is conducted to create a new cluster head. Cases to be considered in network portioning includes if the old cluster head comes back to the range of the clustering area then either the new cluster head retains its position or it updates old cluster head and quits its positon. Unexpected response is received by some mobile nodes from nodes which are reachable but are not

visible, usually quoted as hidden nodes. The problem of hidden and exposed terminal can be handled by using network allocation vector or by setting inter framing space. The parameters RTS (request to send) and CTS (clear to send) reserves the medium using network allocation vector to avoid collision as within this allocated time the medium is supposed to be busy and no other node transmit the data unless the NAV assigned for the first node is elapsed or completed. Inter frame spacing can also be used to solve the collision problem that is the sender waits for one DIFS (distributed inter frame spacing) before transmitting the data and the receiver waits for one SIFS (short inter frame spacing) before accepting the data. SIFS has highest priority for CTS, ACK (acknowledge) and polling response where as DIFS has the lowest priority for asynchronous data transmission. Anomalous behavior is also expected in mobile architecture by selfish nodes, whose intension is to modify the content of the packet and re-forward it to its neighbors for the sake of benefiting itself. VCG algorithm is used for detecting and eliminating participation of selfish nodes, thereby improving the performance of the system. Selecting the suitable routing algorithm for transmitting data is a great challenge, which depends on location, topology or hybrid approaches. One parameter used for selecting a routing algorithm is based on proactive or reactive mode. Proactive approach is static or table driven approach, in which all possible paths are pre calculated using some metrics (like distance, hop count and cost) and is stored in a table using which the path is selected for data transmission. In reactive approach, dynamic parameters are used which are based on real time scenario for transmitting data to the selected destination.

Cache consistency algorithms were developed with a goal to increase the probability of serving data items from the cache that is identical to those on the server. When caching the data, concentration should be given for maintaining data consistency using pessimistic or optimistic approaches depending on user's requirement. Data consistency can be weak, strict, FIFI, data centric or client centric etc.., which is based on the type of dependencies or the scheduling applied. Query optimization helps in executing a query by using an optimal approach which is based on CPU time and cost, Algorithm, management rules, and storage requirement .For processing a query the required data need to be extracted from local database, otherwise additional task is applied to fetch the data from secondary storage. Managing all of the above discussed approaches comes under transaction management.

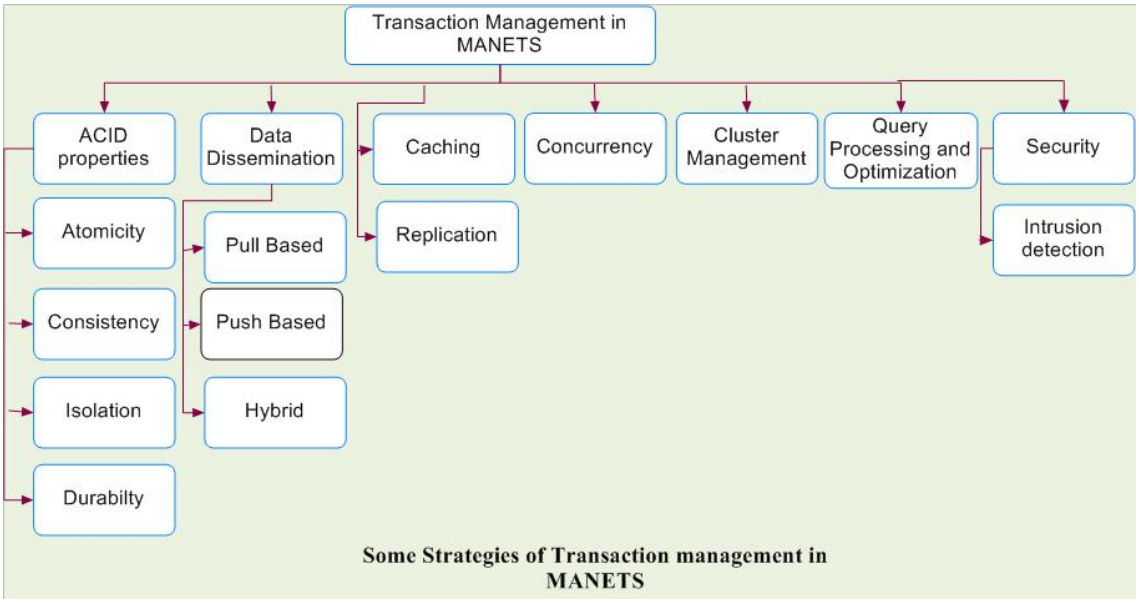

Figure No.1 :Strategies of transaction management in MANETS

Description of the strategies proposed by researcher are listed below

Data Dissemination

Data dissemination is used to broadcast information in client server based architecture. There are three mechanism for data disseminate that is 1) pull or client-based, where a caching node (CN) asks for updates from the server and extract whatever it needs from the server, 2) push or server-based, where the server sends updates to the CN, and forces the CN with additional data too and 3) cooperative or hybrid, where both the CN and the server cooperate to keep the data up-to-date by combining both pull and push based mechanism. In general, pull-based mechanism has smaller query delay times at the cost of lower traffic load, whereas push-based has higher traffic load at the cost of larger query delays. Cooperative-based or hybrid strategies tend to be halfway between both ends.

Caching

Caching and replication should be implemented with the aim to maintain good degree of consistency. Replication improves the availability of data thereby making it difficult to maintain consistency of data. Updating data to maintain consistency can be done in a lazy or eager manner with some pros and cons for both, selecting an appropriate approach is based on the user‘s requirement.

Availability

More copies of data are maintained for easy availability so as to increase the reliability of a system. It is taken as a performance measure of systems that employ fault tolerance by means of which many potential failures are averted and is compromised with more data storage.

Reliability

Reliability is an attribute of computer based component which ensures that the functionality of the component is with respect to the defined specification and regulation. The Reliability of a transaction is a function R(t) , which represents the probability that the transaction persist till time t. It also ensure safe execution of a transaction with proper termination.

Consistency

The aim of consistency is to maintain same updated data in all the replicas that is - it ensures that any changes to values at an instance are consistent with respect to other values in the same instance. All cache consistency algorithms are developed with a goal to increase the probability of serving more data items from the cache that is identical to those on the server. Different consistency models are available in real time applications for selecting a data centric or client centric approach.

Atomicity:-ensures either commit or abort of a transaction, which means there is no partial execution of any transaction in a system, because a system is said to be safe if and only if it ensures proper termination with execution.

Isolation:-ensures non correlated execution of a transaction that is there are no dependencies among the tasks participating in the transaction.

Durability:-It ensure safety in case of any failure and guarantees a safely survival.

Query processing and query optimization:- Calculate the most cost effective plan for executing a query.

Cluster head and management: - Managing a group by means of a leader called as a cluster head elected by using some algorithms.

Detecting anomalous behavior of selfish node:- In mobile network the problem of hidden and exposed terminal may end up with a problem in which the hidden node may behave selfishly and corrupt the data. This behavior can be detected and corrected to remove the anomalous behavior and make system efficient.

2 Survey

Summary of proposed strategies by researchers is analyzed and listed out in table no. 1 with repect to the discussion made in introduction.

Table1: Depicts the strategy and its solution as proposed by authors

Serial No.	Author	Title	Strategy	Proposed solution
1	Anchal,Poonam Saini and C.Rama	An Efficient Permission Cum Cluster based distributed mutual exclusion algorithm for mobile adhoc networks", International conference on Parallel, Distributed and Grid computing, IEEE2014	Mutual exclusion	Proposed a solution for problem in distributed system using mutual exclusion Designed an algorithm to ensure transmitting effective messages in the underlying network and showed the result with respect to performance parameter(viz response time ,synchronization delay and message overhead involved in the execution of critical section) by using efficient permission cum cluster based algorithm using distributed mutual exclusion.
2	JulindaTaylor, BinTang and Mahmet BayramYildirim	"Steady Status of distributed Data Caching in Adhoc networks"	Data Caching	Has defined a steady state at which the quality of data caching is evaluated and classified distributed caching scheme as cooperative or selfish .Cooperative scheme makes intelligent local caching decision by using data stored in nearest cache table. In selfish data caching the nodes are selfish and if it has free storage space then stores any passing by requested data otherwise it uses least recently used polling and replaces the passing by data item.
3	Komal M. Sharma and Archana Raut	Improving the performance of Mobile Adhoc Networks using Dynamic Group Data Caching Scheme, IEEE 2013	Data Caching	Proposed Data caching techniques as traditional caching techniques and calculated the effectiveness of caching by counting the number of times same document is requested.
4	Takahiro Hara and Sanjay Kumar Madria	Consistency management strategies for Data Replication in MANETS	Data Consistency	Proposed an algorithm for Local and Global consistency mechanisms and compared the data availability of read and write operations. Authors investigated the characteristics of consistency with different probability of limited and unlimited memory space with respect to proxies and peers.
5	Yanqing Zeng, Zhide Chen and Li Xu	A cluster Header Election scheme based on Auction mechanism for	Intrusion Detection	Based on revised QA-VCG mechanism .It extend the survival time of nodes and prevent nodes from being selfish by rewarding honest nodes with some

		Intrusion Detection in MANET		incentives. Proposed solution motivates all nodes in the network to behave honestly to elect the least analysis cost nodes to handle the detection of an anomalous behavior ofa node.
6	Abin Paul, Preetha K.G	A Cluster Based Leader Election Algorithm for MANETS,IEEE 2013	Cluster Management	Proposed the concept of clustering as local and global. Local clusters are created for non-overlapping areas and global for overlapping area. A node with highest battery power and machine load is selected as global cluster leaders.
7	K Shama Raichura, Nilesh Padhariya, Kishor Atkotiya	Cache-Based Query Optimization In Mobile Ad-Hoc Networks	Query optimization	Proposed a query optimization using cache based model for faster data retrieval and effective query processing and classified schemes as Event-Driven Query caching (EDQc) and Location-Dependent Query caching (LDQc) and finally conducted a performance study, which demonstrates that in order to retrieve data faster in mobile environment and to avoid large number of connection to the server, caching is one of the important concept.
8	Le Gruenwald , Shankar M Banik, Chuo N. Lau	"Managing real time database transactions in mobile adhoc networks ", Distributed Parallel Databases 2007, Springer science	Real time constraint	Proposed a solution for managing transaction management in MANET which reduces number of transaction with balanced energy consumption and meeting deadline constraints and did the performance analysis using the parameter like transaction missing deadlines and by calculating average difference in energy consumption of large mobile host.
9	Kassem Fawaz, and Hassan Artail	DCIM: Distributed Cache invalidation method for maintaining cache consistency in Wireless mobile networks, IEEE transaction on mobile computing ,2013	Data Dissemination	Proposed a pull based algorithm to implement adaptive TTL (time to live), piggybacking and pre-fetching for achieving a strong consistency capabilities. Implemented both client side and server side caching scheme to reduce both traffic and query delays and showed overall better performance than other client based schemes
10	Robert Pettersen, Steffen Viken Valvag,et al	Globally Distributed Caching for Cloud Database Services Using DNS, "IEEE international conference on Mobile Cloud Computing ,2014"	Distributed Caching	Proposed a protocol to relay database operations through DNS servers reachable to client devices thereby reducing latency and increasing performance and tested the performance on DynamoDB and client will be benefitted with cache hit rates as low as 5% to 10%.

3 Simulation Tools

There are some open and commercial tools available for simulating MANETS, Some of the widely used tools are shown in Figure No. 2.

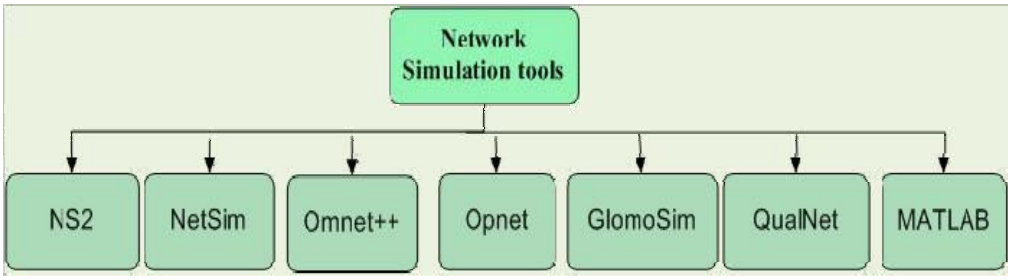

Figure 2: Available Network simulation tools

More detailed description about the source, purpose or invention of the simulators is given in table no.2. Sun wireless tool kit can also be used for simulation of wireless applications in which functionality can be attached for selected emulator and many built in features can be used to manage a transaction. The Sun Java Wireless Toolkit (formerly known as Java 2 Platform, Micro Edition (J2ME) Wireless Toolkit) is a state of the art tool kit for designing wireless applications that are based on J2ME's Connected Limited Device Configuration (CLDC), Mobile Information Device Profile (MIDP) and MIDLET applications, that runs on cell phones, mainstream personal digital assistants, emulators and other small mobile devices. The toolkit includes the emulation environments, performance optimization and tuning features, documentation, up-gradation and examples that developers will bring efficient, effective, reliable and successful wireless applications to market quickly.

Table No.2 : Description of Simulators

Simulator	Description
NetSim	A commercial tool used for network design & planning, defense applications and network R & D.
GloMoSim	An open source software developed at University of California, Los Angeles (UCLA)
MannaSim	The Mannasim Framework is a module for WSN simulation based on the Network Simulator (NS-2)
QualNet	It supports a wide variety of protocols and provides customizable simulation modules
Opnet	A commercial tool which offers several features including HIL, Parallel computing, detailed documentation, and technical support.
NS2	An open source software written in C++ and OTCL programming languages.
Omnet++	An open-source, component-based simulation package built on C++ foundations.
MATLAB	A commercial multi-purpose software that can be used for network simulation and complex numerical evaluation.
AweSim	AweSim is an open source software which works on a totally new general-purpose simulation system, released in June of 1996. Discrete event and continuous models can be created using the object-oriented technology of Visual Basic, C or Visual C++ and can be combined with network models.

The parameters which were proposed for analyzing data transmission to check the performance and effectiveness are listed below

Packet Transmission Time = Packet size/bandwidth

Propagation delay = Time needed to deliver a data bit from the beginning to the end of the link.
Period for Packet to reach the destination = Packet transmission time+ propagation delay. Latency time = the time taken for a packet to traverse from source to destination.
Bandwidth = frequency allocated for transmission

Error rate = Number of bit errors/Number of transferred bits.

4 CONCLUSION

The introductory part of the paper presents a precise description of the strategies of transaction management in MANET and survey section outlines the parameters used for calculating the performance of data. Table No 2 helps the user to select an appropriate tool based on his/her requirement. It can be finally concluded that the transaction management in MANET is a vast area and more research is still possible to explore new strategies and innovation for better solutions and same can be used for comparative analysis.

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