

**DESIGN OF FAULT TOLERANCE PROTOCOL FOR
MOBILE DISTRIBUTED SYSTEMS**

Dissertation submitted in fulfilment of the requirements for the Degree of

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By

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ABSTRACT

Distributed mobile systems are ubiquitous now-a-days. These systems are important building blocks and are useful for constructing efficient protocols for client-server systems, transaction processing, web applications, and scientific computing. Distributed mobile systems are not fault tolerant computing. The vast computing potential of these systems is often hampered by their susceptibility to failures. Mobile computing highlights many issues, such as lower throughput and latency, low bandwidth of wireless channels, lack of stable storage on mobile hosts, connection breakdowns and inadequate battery life that make the classical checkpointing protocols incongruous. Many techniques like group communication, transaction and rollback recovery have been developed to add reliability to such systems.

Reliability can be roll backed using the methods of distributed mobile systems. Proposed methods are used to make system fault tolerant and works error free. The proposed methods justifies the objectives of my research work, which are Increase the reliability (Focuses on a regular service without any fault), Increases the availability (focuses with willingness of the system), Security (Stops any unwanted access). So I conclude that the objectives defined can be met with the proposed methods.

DECLARATION STATEMENT

I hereby declare that the research work reported in the dissertation entitled "DESIGN OF FAULT TOLERANCE PROTOCOL FOR MOBILE DISTRIBUTED SYSTEMS" in partial fulfilment of the requirement for the award of Degree for Master of Technology in Computer Science and Engineering at Lovely Professional University, Phagwara, Punjab is an authentic work carried out under supervision of my research supervisor Mr. Tejinder Thind. I have not submitted this work elsewhere for any degree or diploma.

I understand that the work presented herewith is in direct compliance with Lovely Professional University's Policy on plagiarism, intellectual property rights, and highest standards of moral and ethical conduct. Therefore, to the best of my knowledge, the content of this dissertation represents authentic and honest research effort conducted, in its entirety, by me. I am fully responsible for the contents of my dissertation work.

AJAY KUMAR

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SUPERVISOR'S CERTIFICATE

This is to certify that the work reported in the M.Tech Dissertation entitled **“DESIGN OF FAULT TOLERANCE PROTOCOL FOR MOBILE DISTRIBUTED SYSTEMS”**, submitted by **Ajay Kumar** at **Lovely Professional University, Phagwara, India** is a bonafide record of his original work carried out under my supervision. This work has not been submitted elsewhere for any other degree.

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CHAPTER 1

INTRODUCTION

1.1 Distributed System

Distributed system is a collection of n number of systems that are connected to each other over a network but for user it looks to be only one system. All the systems interact with each other to give the required output. Three significant features of distributed systems are:

1. Simultaneous work can be at the same time.
2. Absence of a universal timer.
3. Autonomous collapse of mechanism.

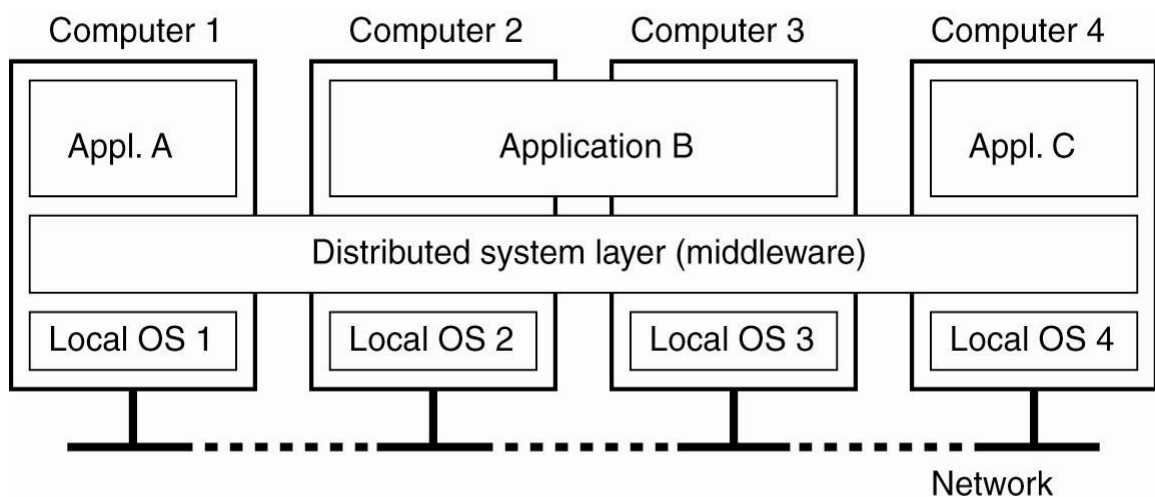


Figure 1.1: Distributed System [31]

All the systems in the distributed are connected through an network which is hidden from the user i.e. the user don't know which system is system is generating the output, all user knows is that the system which there in front of him only fetching the data.

A disseminated scheme can have a universal objective, such as cracking a large overhead issue the user then perceives the group of independent processors as a item. Otherwise, each scheme can have its individual user with personal requirements, and

the point of the disseminated scheme is to manage the utilization of mutual assets or offer statement services to the users.

Former assets of disseminated scheme are as trail:

- The scheme has to tolerate mistakes in every processor.
- The configuration of the scheme is not recognized in future, the scheme can hold dissimilar class of processor and set of connections linked, and the scheme may change during the implementation of program.
- All processor have only a partial vision of the scheme.

1.2 Distributed Mobile System

Distributed mobile System is global now days. These systems are plays important roles in generating blocks and are used for developing effective protocol for client-server systems, online transactions, websites, and scientific computing.

1.3 Fault Tolerance

Fault tolerance helps the system to come back in a error free state whenever a failure is occurred in its components. If the system stops functioning properly, then the fault has occurred in the system and if the fault is not removed then the system may breakdown. The skill of continue functioning as soon as parts of a system stops performing is referred like skilled indignity.

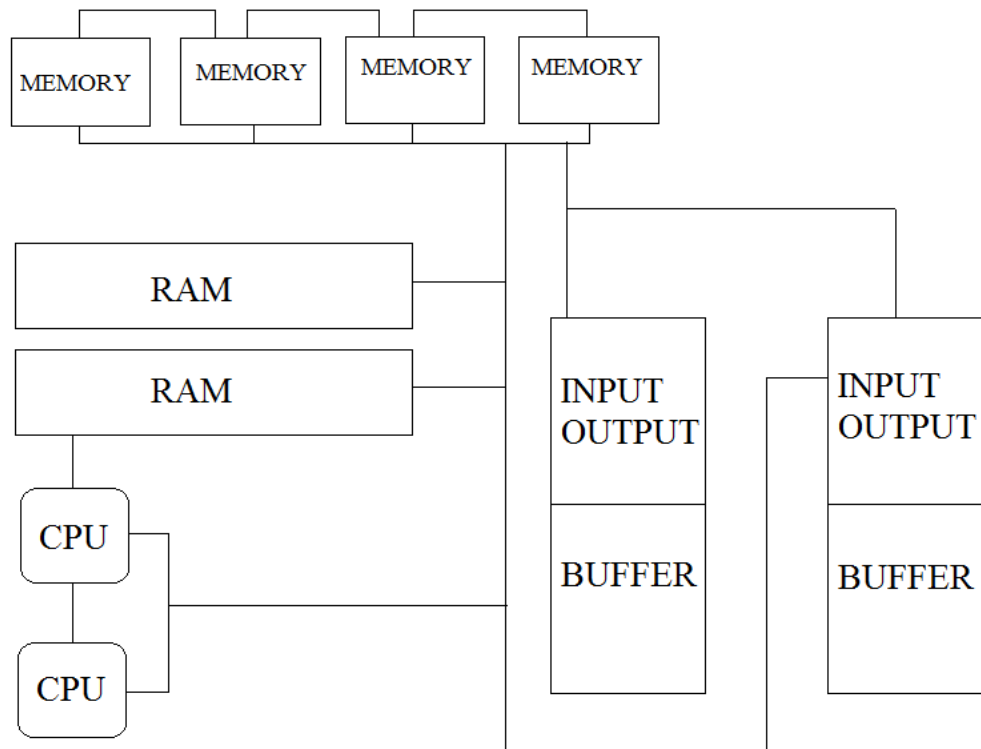


Figure 1.2: Block Diagram of fault tolerance [32]

A error tolerance plan helps a scheme to carry on its deliberate work, may be at a lower level, apart from stops completely. The terminology is generally used to define systems planned to carry on additional or fewer entirely working through, possibly, a subtraction in throughput otherwise an boost in reply occasion in the incident of various small failure. The complete scheme has not congested due to faults whichever in the hardware otherwise in the software. A system is capable of maintaining its virtue in the incidence of error owing to reasons such as exhaustion, rust, developed error or collision.

A highly fault-tolerating system may keep on working at the similar point of work still if solitary or additional mechanism has stopped implementing. For instance, a structure with a endorsement electrical producer resolve offer the same power to all floors yet if the lattice authority fall short.

A scheme that is intended to fail-safe, or fail-secure, or fail-elegantly, whether it purpose at a lower point or fails-totally, accomplish so in a means that defend persons,

belongings, or information commencing damage, hurt, interference, or expose. In processor a program may fail-safe by implementing a elegantly exit in instruct to avoid statistics from getting contaminated behind understanding an error. A parallel division is completed flanked by "failing well" and "failing badly".

Fail-deadly is the contradictory method, which have be used in warhead structure that are complete to execute or damage goal even if division of the organization is spoilt or cracked.

A scheme to facilitate is made to skill to fall short soft function at a lower stage of recital following some constituent malfunction. For case, a construction can function illumination at minor stages and elevators at minor swiftness if lattice influence falls short relatively than moreover maintenance folks in the shady absolutely or progressing to utilize occupied control. In applying an instance of fail soft is with the aim of if least system bandwidth be readily available to play an online video, a subordinate motion edition may be cooperating as an alternative of the elevated declaration edition. Regular improvement is an container in calculate any place where web sites are active in a essential organization for elder, small-screen, or restricted potential web browsers, but in an better edition for browsers contain the skill of supervision further knowledge or that encompass a greater exhibit accessible.

In fault-tolerating processor, processes which are engaged into concern be intended strongly to go on functioning regardless of an error, matter, or mistaken participation, regardless of loud totally. Software issue is the contradictory of strength. Stable networks carry on to transport information in spite of the collapse in some associates or nodes established organization and communications are also ordinary to handle total malfunction in circumstances like earthquakes, torrent or impact.

A scheme with elevated crash tolerance determination attentive customer that a constituent malfunction have occupied rest, still though it will continue to work with full force, so that malfunction container be refurbish. Same way as a fail-fast constituent is intended to story at the initial direct of breakdown, instead of allowing other machinery to fall short and produce intelligence then. This permits simple way to decide the convinced trouble, and may defend beginning fake develop in a bust status.

1.4 Checkpoints

Check-pointing is a method that assists to tolerate faults which would force long-running process to restart. The most common way to apply check-pointing, is to copy all the data of an process from the memory to reliable storage and then go on with the execution. Check-pointing utilization should retain system consistency. There are two main approaches for check-pointing: coordinated check-pointing and uncoordinated check-pointing.

In coordinated check-pointing approach, processes must make sure that regular checkpoints are made. This is generally applied by two-phase commit protocol algorithm.

In uncoordinated check-pointing, each process has to checkpoints itself environment individually. It must make sure that command processes to checkpoint their state at regular time intervals is not enough to certify consistency. The requirement for achieving a continues state (i.e., no lost messages or replica messages) might cause other processes to roll back to last checkpoint.

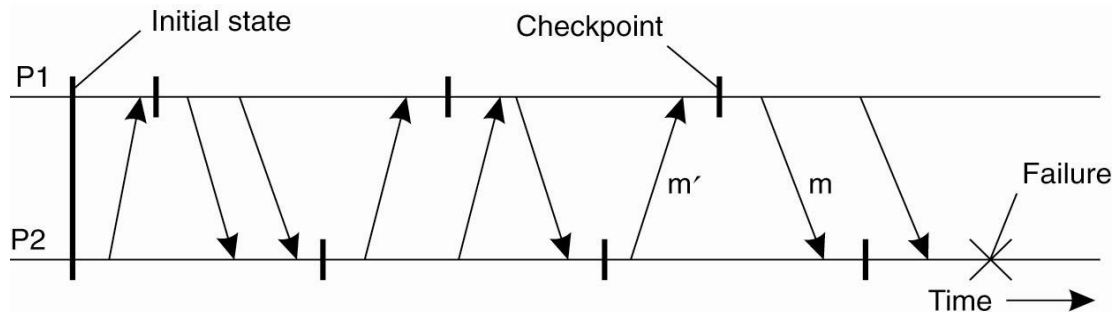


Figure 1.3: Check pointing [33]

CHAPTER 2

LITERATURE REVIEW

Lokesh. B. Bhajantri , Nalini.N [1]: suggested two methods for fault finding and fault improvement to attain fault acceptance in topography. The suggested error finding form is used to find fault at node level and network level. The suggested error healing model is used to make sure that the fault is tolerated by regulate the topology of the random positioned sensor nodes. Ultimately, they have examined the presentation framework for the suggested scheme.

Raed Al-Shaikh and Azzedine Boukerche [2]: suggested a fault tolerance and error free distributed file system for mobile sites, which gives highly available and decent storage for files and promises that file functions are applied in spite of execution and failures. The model is intentional to correct mobile clients that has less storage space and cannot save all data they require, yet they require using these data at all times. The paper describes mobile file system model, its execution, and report on its fulfilment evaluation using a large set of rules. Their results clearly state that model present a notable degree of development and conflict-free mobile file system.

De-gan Zhang et al [3]: suggested a new building method for a subjective topography of wireless sensor networks (WSNs). Founded on theory, an abnormal collection of weighted making replica of WSNs is formed. The apex force explains the expansion of topography in the meantime the edge weights vary accordingly. Test information define that the WSN topology they have gathered the possessions of weighted set-up the edge weight, vertex degree, and power follow a power-law allocation. Study defines that weighted WSNs barely split the error tolerance of weight-free networks, but also decreases the chances of node stop working regularly and they increase the integration of WSNs.

Mo Li, et al [4]: gives an summary of topology control techniques. They have defined current topology control methods keen on two ways: set-up reporting and set-up connectivity. For each group, a wave of current protocol and methods are defined highlighting on coverlet coverage, barricade coverage, brush off coverage,

influence management, and authority control, five aspects that highlights the denotation study attention in past few years. They have underline the primitive values of topography manage to know the state, while the idea is to analyze further study information in the new open felids and suggested a chain of design rules under this topic.

Abd Azrina Aziz et al [5]: target on the energy efficiency issue and generate a complete study of topography control methods for increasing the lifetime of battery powered WSNs. Moreover, these algorithms are confidential by the energy conservation path they have chosen, and estimated according to trade-offs they pitch to the author in selecting a method that best suits their functions. Since the idea of “network lifetime” is globally used for check the algorithms’ caring out, they have focused different definitions of the term and discuss their quality and issues. Currently, there is a huge growth in algorithms for non-planar topologies. Due to this, they also used a detailed examination of topography control algorithms that is executed in three parts. Based on the outputs of work, they have analyzed many open research problem for gaining energy efficiency through topography control.

Zhiwei Gao et al [6]: paper defines to give a global view for real-time fault analysis and fault tolerance control with accurate focus on the results noted in the last few years. In the first-part of report, fault handling methods and their functions are viewed absolutely by model-based and signal-based approach. From last four years, effective outputs were generated about fault handling and fault-tolerance control ideas and their functions in a different of engineering models.

Tifenn Rault et al [7]: defined a top-down study of the trade-offs between functional needs and lifetime delay that is raised when construction wireless sensor networks. They have found the main class of functions and their limited requirements. Then they display a new analysis of energy-conservation techniques found in the recent papers, followed by a ordered discussion as to how these techniques clash with the limited requirements. Finally, they studied the method applied in WSNs to get trade-off between multiple requirements, such as multi-objective development.

Haixia Peng et al [8]: present three set-up development models for producing error tolerant and energy capable huge size peer-to-peer WSNs based on difficult set-up

theory. Being level free is one of the basic description of compound set-up based development models that generate error tolerant topologies. The three proposed energy-aware development replica are power alert common neighbours, energy-aware large degree promoted and energy-aware large degree demoted. ECN considers neighbourhood overlap, while ELDP and ELDD believe topological overlies for node accessory. The ELDP replica promotes the institution of links to nodes with a large degree, whereas the ELDD model demotes this strategy. Performance evaluations demonstrate that the proposed models outperform a candidate clustering-based model, thereby providing greater energy savings and fault-tolerance. Among the proposed models, ECN is the winner in-terms of energy efficiency, ELDD performs best in-terms of fault-tolerance, and ELDP conveniently provides balance between the two.

Oualid Demigha et al[9]: suggested a peculiar analysis of order that focuses on the communication within communication subsystem and sensing subsystem in a single sensor node. They are obsessed in collective target locating in spite of single-node tracking. Though, WSNs are often of a compact behaviour, and unwanted data that can be fetched from many sensors help at improving locating skill and limited battery utilizations by using less sensing and communication fields. They describe that energy-efficient in a collective WSN-based target locating methods can be generated via two ways: sensing-related techniques and communication-related techniques. They show that these two ways can be compared to each other via a forecasting algorithm to progress communication and sensing methods.

P. Kanmani et al [10]: a new method has been suggested which is used to reduce the past non-blocking methods. The new method focuses on the timeout of the same method. Rather stock up one checkpoint similar to other non blocking algorithms, it forms three checkpoints. The portable wireless set-up cause's problems in scheming error tolerant scheme since of the mobile host (MH) mobility, reserved limit of wireless link, partial MH local storage. Check pointing is a huge method to bind faults.

Sareh Beheshti and Ali Movaghar [11]: studied and explained available techniques of fault tolerance in portable agents. The techniques is used, cooperate agents to tolerate fault and to find server and failures in agents, defining three kind

of agents contains real agent which does work for its owner, observer agent which suggests the authentic agent and the witness agent after itself. Suggested scheme reduces the witness agents as far as considered, because with focusing and matching may declare that present witness agent is not important on the starting servers. Implementation of this technique is done by C-Sim.

Mihaela Cardei, Shuhui Yang, and Jie Wu [12] Study says that error tolerant set-up manage in a different distributed set-up containing of many source rich super nodes used for information depending and a huge amount of liveliness constrained nodes. Study introduces the k -degree Any cast Topology Control (k -ATC) problem by means of the idea of choosing each sensors transmitting limit such that every sensor is k -vertex super node allied and the maximum sensor transmitting energy is reduced. These network are required for implementation which helps sensor information coverage even though the incident of loss of $k - 1$ sensor nodes. Study two keys for the k -ATC issue: a insatiable federal algorithm that generates the best result and a disseminated and contained algorithm that increases next sensors transmitting limit such that the k -vertex super node connection condition has been generated. Executed results are presented to justify the approaches.

Eric C. Cooper [13] The dependent of atomic commit protocols for distributed environment is examined. Recent study has justified that stopping is intolerable after some site or network loss. The study enables one to justify the required amount of such barriers. A difficult system of a distributed environment is made of consisting of two components: communication network and distributed transaction ececutation. We use the notion of the window of uncertain & for a site involving in a distributed transmission, which explains when that site is effected by blocking in the event of a network division. The model is then used to examine and differentiate the required number of blocked sites for many atomic commit protocols.

Indranil Saha, L. Kumar, Sambasivan, Patro, S.K. Ghosh[14] In a network, reducing power consumption and maintaining desired properties at the same time in the network is the priority. Study says, disseminated algorithm for assign compact potential command to every the nodes in the system, such that the set-up is K -connected. Inside this algorithm, a knot take the position and superior authority in sequence beginning all the nodes in its locality, and subsequently it position the

authority of the nodes in its surrounding area in such a means that it can be dispatched all the nodes in the surrounding area through K most favourable vertex-disjoint paths. Study says, if all knots preserve K most favourable vertex displace pathway to every node in its surrounding area then the output topology is worldwide K-connected, given that the topology attains when every node transmitted with their superior authority G_{\max} is K-connected. This set-up organize algorithm have been tense to portable instance and the testimony of association in the movable instance have been shown. Implementation results illustrate that remarkable control saving can be generated by use algorithm.

Santos N, Ferreira P.[15] Extended in technology switches to novel type of networks to appear. Here, implementation of steps confusing disseminated matter is affected by the broken connectivity in that way causing pointless abandon. An explanation to make dealings tolerable to broken associations thus increasing transmission throughput. This is achieved by either permitting transfer to additional span in instance or releasing the reliability possessions of transferring data. For this idea, submission programmers justify the lowest production requirements using policies. Examination shows that little increase in the maximum transfer finishing time or dipping consistency, throughput augment substantially. Method is executing in portable disseminated entity adjust middleware scheme giving adaptive transfer aiding the dependable running of disseminated object graphs. Rules are specially made to conquer the connection intermittence issue. The lower contract needs are mentioned as attributes to these rules without changing the submission code.

Ayari B, Khelil A, Suri N.[16] Proceedings are compulsory not simply for cabled set-up but as well as for the future wireless set-up everywhere portable and permanent hosts acquire element part by part in the performance of the operation. This unlike situation is particular by limits in portable host potential set-up connection and as well as superior numeral of potential forged modes. Initially gigantic commit protocols utilized in wired set-up are not nonstop just right for this different surroundings. The little commit protocols made in favour of portable proceedings moreover suppose portable hosts only as beginner however not as vigorous affiliate, or display a elevated staff jamming time. FT-PPTC releases the execute of portable members beginning that of permanent members. Subsequently, the perform set can be decreased to a place of values in the permanent set-up. Thus, the execute can merely be holds by any

initial infinitesimal execute procedure, such as the 2PC procedure. Performance examination confirms the effectiveness, scalability and short supply jamming instance.

Moiz S.A, Nizamudin M.K.[17] In a mobile computing environment, users can execute on-line transferring executing self dependent of their real location. In a mobile environment, many mobile hosts may modify the data at the same time which may provide in irregular data. The initial method used is the idea of locking for getting the simultaneously control in mobile environments. This may not be used in mobile environments due to variable bandwidth, regular disconnections etc. A lockless simultaneously method which helps in lowering the communication overhead and improve the transaction throughput. The waiting time for implementation of the transaction is lowered and the services are not locked. The implemented results describes the performance trade off importance.

Madria S.K.[18] A pre write process earlier than a inscribe action in a mobile network to perk up data accessible. A pre write action does not improve the situation of a information entity but only build observable to the set that the information entity will have after the saving of the procedure. When the process have interpret all the standards and declares all the pre writes, it can pre perform at a portable host. The left process implementation is diverted to the main congregation. Writes on a folder takes both time and resources at the main host and that is why it's overdue. A pre dedicated process pre-write position is made visible both at portable and main hosts earlier than the concluding perform of the process. This higher information accessibility through regular separation is very common in portable computing. Since the costly division of the process implementation is move to the main congregation, it lowers the calculate charge at the portable host.

H. Zou and E Jahanian[19] The chief backup copy replica is one of the normally taken advance for giving error tolerant as a statistics services. By extending to the actual instance scenario, though, imposes the add on resources of instance predication, which necessitate a bordered transparency for controlling dismissal. The trade-off between lowering system overhead and mounting reliability among the key and backup, and explore traditions to reduced such a scheme to diminish moreover the irregularity or the organization visual projection whereas maintain the sequential

reliability promise of the scheme. A functioning manufactured on top of the breathing RTPB model was residential within the x-kernel planning on the Match OSF platform consecutively MK 7.2. Results of an tentative estimate of the planned optimization methods.

G. Cao and M. Singhal[20] Portable computing raise lots of new issue such as lack of constant storage, short bandwidth of wireless outlet, soaring mobility, and incomplete battery life. These new problems make established check pointing algorithms unbecoming. Synchronized check pointing is an attractive move towards for plainly addition fault acceptance to disseminated services because it stays away from domino belongings and minimizes the constant storage prerequisite. Though, it suffer as of high transparency connected by means of the check pointing procedure in portable processor scheme. Two methods contain be old to lower the transparency: initially it is to reduce the integer of harmonization communication and the digit of checkpoints the previous way is to build the check pointing process non blocking. These two methods be orthogonal formerly til the algorithm joins them. This algorithm might cause a variation in several environment and established that convenient is no non blocking algorithm which causes only a lower number of process to take their checkpoints. Set up the idea of changeable checkpoint, which be neither a unsure checkpoint nor a everlasting checkpoint, to intend resourceful check pointing algorithms intended for portable processor methods. Changeable checkpoints be able to be put away wherever, e.g., the major recollection or limited disk of MHs. In this means, attractive a unsettled checkpoint stay away from the transparency of sending huge quantity of information to the secure luggage compartment at MSSs over the wireless set-up. Methods to lower the numeral of alterable checkpoints. Replication outcome show to facilitate the transparency of taking changeable checkpoints is minor. Support on changeable checkpoints, non blocking algorithm declines the rush consequence and forces simply a lower amount of process to obtain their checkpoints on the constant storeroom.

F.M.Assis Silva, R.A.Macedo,[21] The idea of mobile groups as a basic idea for both the suitable relocation and the organization of mobile processes. Analogously to old group systems, mobile groups also gives message delivery guarantees and fundamental synchrony. Furthermore, they make process movement not only seen by the group, but also regularly ordered with other group actions. The mobile groups

methods drives a novel mobility support method which can be used to handle consistency of mobile disseminated systems, at the application and system level. The motivations for the mobile groups, officially define their basic characteristics, and present a devotion protocol for such groups. Some performance issues and presents the compensation of mobile groups against methods commonly employed for the organization of mobile processes or agents.

F.M. Assis Silva, R. Popescu-zeletin,[22] The global telecommunications setting is quickly changing to a extremely active unlock setting, where a massive amount of contra or cooperate rider provider tender a gradually increasing amount of ever more commanding announcement and in order services. The requirement for mixing, everywhere examination contact and quick check provisioning necessitate an open, general check raised area which chains in cooperation telecommunications and administration application. The progress of such a raised area support on the thought of disseminated dispensation environment (DPEs) have to be a most important study area. However, DPEs are moderately rigid. An totally diverse raised area come up to is foundation on the submission of manager knowledge. Of exacting attention are portable agents, self-directed and consequently gifted software entities, which might travel the set-up in the path of the stage their elected tasks. They tender original opportunity designed for the provisioning of forces in the growing electronic check market. Mobile bright agents need a distributed mediator setting display place. Because both, disseminated dispensation based and manager based check provisioning contain their precise reward, such a stage should support together paradigms. Study indicates of the portable agent building MAGNA, and the associated negotiator stage. The distributed negotiator situation offer by the MAGNA stage is based on existing DPE concept and therefore enables coexistence and mixing of spread and agent based implementations of telecommunications and administration applications.

S. Pears, J. Xu, C. Boldyreff[23] maintain portable agent accessibility in the company of mediator wine waiter crash is a taxing matter seeing as developers as a rule have no organize more than remote agent servers. An admired practice is that a mobile mediator inject a model into stable luggage compartment upon its entrance at every mediator server. Server crashes vegetation the imitation busy, for a mysterious instance period, until the agent server is back online. Omission management to

preserve the accessibility, of portable mediator in the being there of agent server smash into failure. Two omission coach design are planned. The first exist at the mediator server that shaped the portable mediator. The next operate at the earlier mediator server visit by the portable mediator Initial recital results display that although the next intend is slower it offers the smaller trip time increase in the being there of agent server crashes.

S. Pleisch, A. Schiper[24] Error tolerance is original to the more progress of movable mediator use. In the situation of portable mediator error tolerance avoid a unfair or whole loss of the agent, i.e. ensure that the mediator land at its target. Simple come up to such as check pointing are horizontal to jamming. Duplication can in standard perk up explanation based on check pointing. However breathing solutions in this situation either presume a just right failure uncovering machine or rely on multipart explanation based on leader voting and spread announcement, where only a subset of solution avoid blocking. A tale comes near to fault liberal portable mediator completing, which is based on illustration agent finishing as a succession of concord trouble. All concord dilemmas is one case in point of the well tacit accord crisis. Study does not necessitate a great failure uncovering instrument, whilst put off jamming and make certain that the agent is perform accurately once.

L. Silva, V. Batista, J. Silva,[25] The list of trouble that have to be crack in mobile agent systems and we will current a set of fault-tolerance system that can augment the sturdiness of agent-based submission without setting up a high routine overhead. The structure includes a set of method for failure uncovering, check pointing and restart, software rebirth, a resource-aware atomic immigration protocol, a reconfigurable journey, a protocol that stay away from agents to get caught in node breakdown and a simple plan to deal with network panels.

T. Y. Wong, X. Chen, M. R. Lyu,[26] The portable mediator create a new hypothesis for data swap over and supply input in quickly mounting and frequently varying computer networks. In a disseminated scheme, stoppage can happen in any software or hardware constituent. A mobile agent can get mislaid when its hosting server run into during carrying out, or it can get go down in a overcrowded network. Therefore, survivability and fault open-mindedness are fundamental concern for arrange mobile-agent systems. This fault open-mindedness approach organizes three

kinds of assist mediator to sense server and mediator breakdown and get better forces in portable mediator scheme. A specific agent is a common portable mediator that carries out precise totalling for its owner. Witness mediator monitors the definite mediator and sense whether it's lost. A probe recovers the disastrous definite mediator and the spectator agents. A peer-to-peer communication passing instrument arises among each definite mediator and its witness mediator to execute malfunction uncovering and recovery through time-bounded information switch; a log files the actual mediator actions. When failures take place, the scheme carries out rollback convalescence to abort unattached actions. Moreover, our way uses check pointed data to get better the lost actual agent.

Nedal Ababneh, Anastasios Viglas [27] Antenna set-up which function on series are old to get together information in a assortment of setting. The information composed by all node is converse throughout the set-up to the descend, which use all description information to decide description of the surroundings or become alert of an happening. Delay sensor's lifetime is a main intend defy of these networks. A good quality energy reduction system in this course is to programme nodes snooze period with the communicate radio twisted off. A disseminated topology organize algorithm, named ECTC, which uses a bunch approach. It is built on the concept that while a district of a mutual canal wireless sensor set-up has a adequate thickness of nodes, major power saving is find by permit out of work nodes to snooze. By means of the two-hop neighbourhood in sequence, convinced nodes in succession select a separation of nodes to be vigorous amongst all nodes in the neighbourhood, to make sure connectivity. Besides, to make certain equality, the role of vigorous nodes is rotated like clockwork to make certain energy impartial procedure. Marks from stochastic geometry are used to gain explanation for the standards of stricture of our algorithm that minimizes the whole force spent in the set-up when all sensor nodes story information through the group heads to the sink.

Mihaela Cardei, Shuhui Yang, Jie Wu[28] Addresses fault-tolerant set up manage in a assorted wireless sensor set-up consist of quite a few supply rich super nodes, old for data transmit and a huge integer of energy inhibited wireless antenna nodes. The k-degree any cast set up manage (fc-ATC) trouble, by the purpose of decide on every sensor's programme choice same as that each antenna is k-vertex super node associated and the whole energy obsessive by sensors is diminish. These types of set

up are essential for obedience that chains sensor data coverage, even in the happening of stoppage of up to $k - 1$ sensor nodes. 3 explanation for the k -ATC problem: a k -approximation algorithm, a voracious federal algorithm that restrain the greatest show choice between all sensors, and a disseminated and restricted algorithm that incrementally regulate sensors broadcast variety such that the k -vertex super node connectivity condition is met. Extensive reproduction grades are obtainable to verify the advance.

Jianhui Zhang, Jiming Chen, Jialu Fan, Weiqiang Xu, Youxian Sun[29] Several imitation gear are used to appraise network recital as well as OMNeT++. A case of topology control (TC) in WSNs is replicated by allowing for its contact with MAC layer and steering based on the Sensor Simulator frame. Some ways to perk up the reproduction good organization are described. Finally, the simulation results are given.

3.1 Problem Formulation

Fault tolerance in a distributed mobile system has a wide range of scope as everyday new applications are produced and for that an adaptive fault tolerant system is required for the automation in respective fields. The scope of design of fault tolerant protocol for distributed mobile systems is stated below:

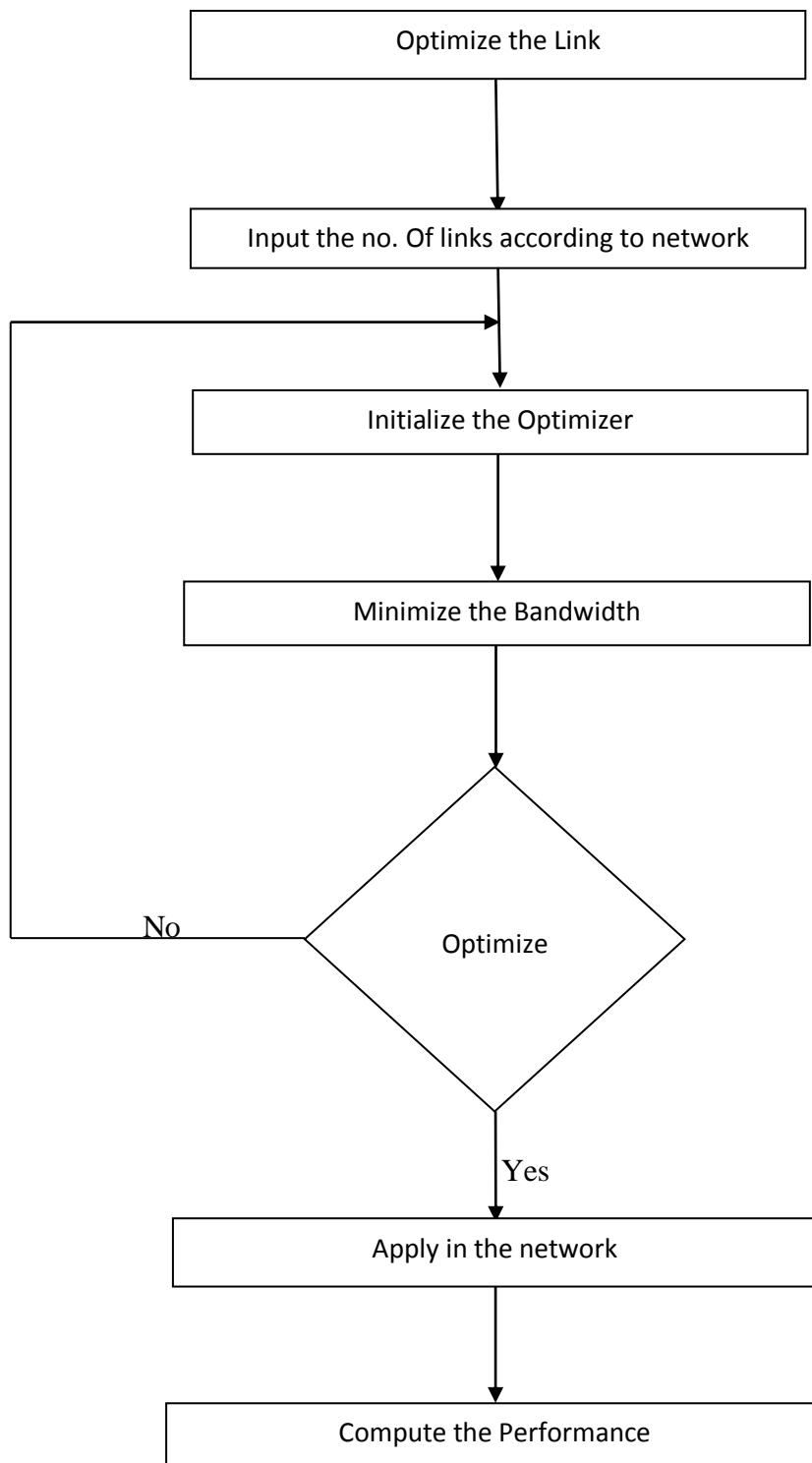
1. A fault tolerance in distributed mobile systems will help us to recover from the failures which are caused due to connection loss or system failure.
2. A fault tolerance in distributed mobile systems will help to reduce the bandwidth, power consumption and resource utilization.

3.2 Objectives of Study

The objective is to

1. Increase the throughput: units of information a system can process in a given amount of time.
2. Reduce the Packet drop: one or additional package of information travelling crosswise a computer set-up fall short of reaching their objective.
3. Reduce end to end delay: time taken for a packet to be transmitted across a network from source to destination.

3.3 Research Methodology



3.4 Ad hoc On Demand Distance Vector Protocol (AODV)

The AODV steering procedure is planned for use by portable nodes in the set-up. It provides swift alteration to active connection conditions, low metering out and reminiscence overhead, low network utilization, and defines unicast route to purpose inside the set-up. Objective sequence numbers is used to guarantee loop freedom every time, rejecting the issues associated with typical distance vector protocols.

3.5 Flower Pollination Algorithm (FPA)

Optimization is largely old to pick up the capability and direct and to decrease the charge. The tiny belongings similar to instance and changes are to be implementing accurately and efficiently in genuine world programme like built-up, design, setting up software evolution. So it is important to come up with explanation to model use of these imperative property under different constraint precisely, Optimization is the considerate of ideal development and functioning out the design effort using mathematical apparatus. benchmark optimization method set many log jam while conniving the mathematical and functioning study replica. Replica answers in benchmark optimization algorithms are chiefly pass on the kind of purpose and imperfect function. The efficacy of conventional algorithms relay on the bulk of the explanation, figure of variables and constraint used for deception the effort. Moreover the touchstone algorithms do not propose all-purpose explanation scheme which will be used for deception the trouble having various variables and limitation

Four Rules of FPA

1. Biotic and irritable pollination be able to be measured development of universal pollination, and these can be delivered pollen travel in a way that substantiate to Levy running away
2. Limited pollination, a biotic pollination and nature pollination are used.
3. Pollinators, same as creature build up flower allegiance, which is analogous to the duplicate opportunity comparative of alike of two flowers concerned.
4. Control or contact of international pollination and limited pollination can be twisted by a key probability p $[0, 1]$, to some extent unfair on the way to local pollination.

min or max objective $f(x)$, $x = (x_1, x_2, \dots, x_d)$

Initialize n flowers population with arbitrary key. Classify the top result (g^*) in preliminary inhabitants.

State a control chance p [0, 1] **While** (Max Generation $> t$)

for $i = 1 : n$ (all n flowers in the residents) **if** $p > \text{rand}$,

Draw a dimensional (d) step vector L from a Levy sharing universal pollination via

$$x_i^{t+1} = x_i^t + r_s L(g^* - x_i^t) \quad \dots(\text{i})$$

else

Draw a homogeneous sharing in [0,1] make an local pollination using

$$x_i^{t+1} = x_i^t + (x_j^t - x_k^t) \quad \dots(\text{ii})$$

end if

Estimate new results

If fresh result is enhanced, make them up to date in population end for

Discover existing top explanation conclusion as

Output the best solution obtained

In belief, flower pollination progression can occur at in cooperation of local and global levels. Except in actuality, flowers in the quarter have superior probability of accomplishment pollinated from local flowers than persons which are far gone. To reproduce this characteristic, a immediacy probability (p) can be worthily used to control stuck between exhaustive local pollination for ordinary universal pollination. To commence with, a unrefined value of $p = 0.5$ can be used as an original value. A opening parametric study point out that $p = 0.8$ may work enhanced for mainly submission.

CHAPTER 4

RESULTS AND DISCUSSIONS

4.1 Experimental Results

Results before applying FPA

1. Drop packet VS Round number

Packet loss takes place while one or additional package of data going through a processor set-up fail to reach desired purpose. Package loss is basically occurs due to set-up jamming. Package loss is deliberate as a proportion of package misplaced with admiration to package sent.

Round Numbers are the no. Of frames which are transferred to the destination.

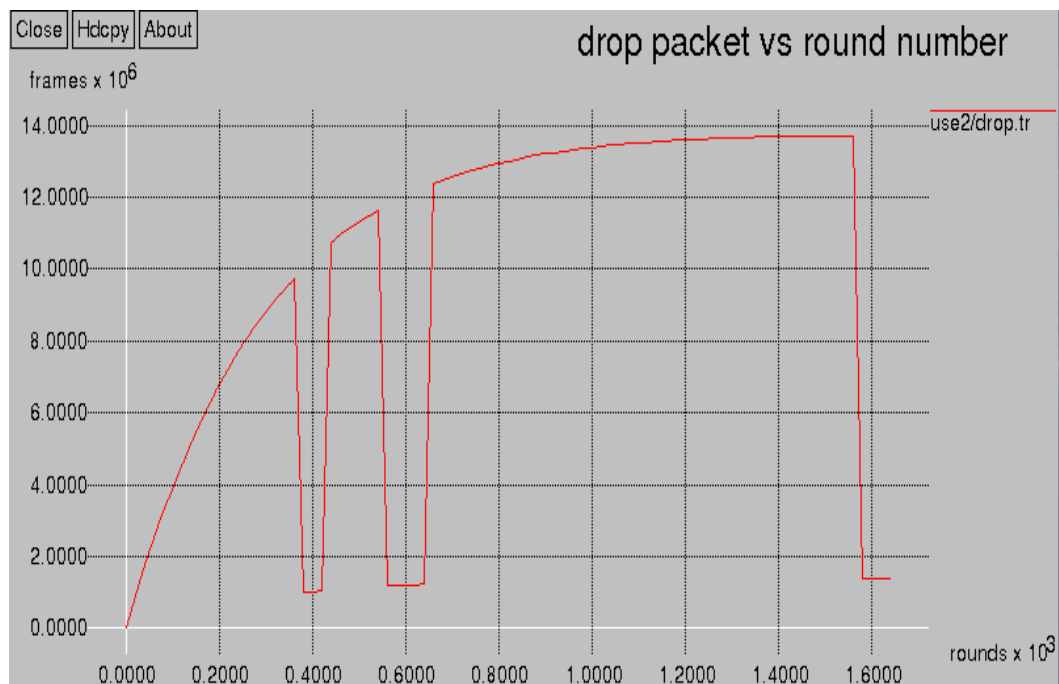


Figure 4.1 Drop packet VS Round number

Figure 4.1 Shows that when the packets transferred in the form of frames to destination the packet loss rate is on higher side and as the no. of rounds increases the dropping of packet also increases.

2. End to End delay VS Time

End-to-end delay transfer to the time a package takes to travel through a system as of starting place to end. It is a universal expression in IP set-up watch and differs from round-trip time (RTT).

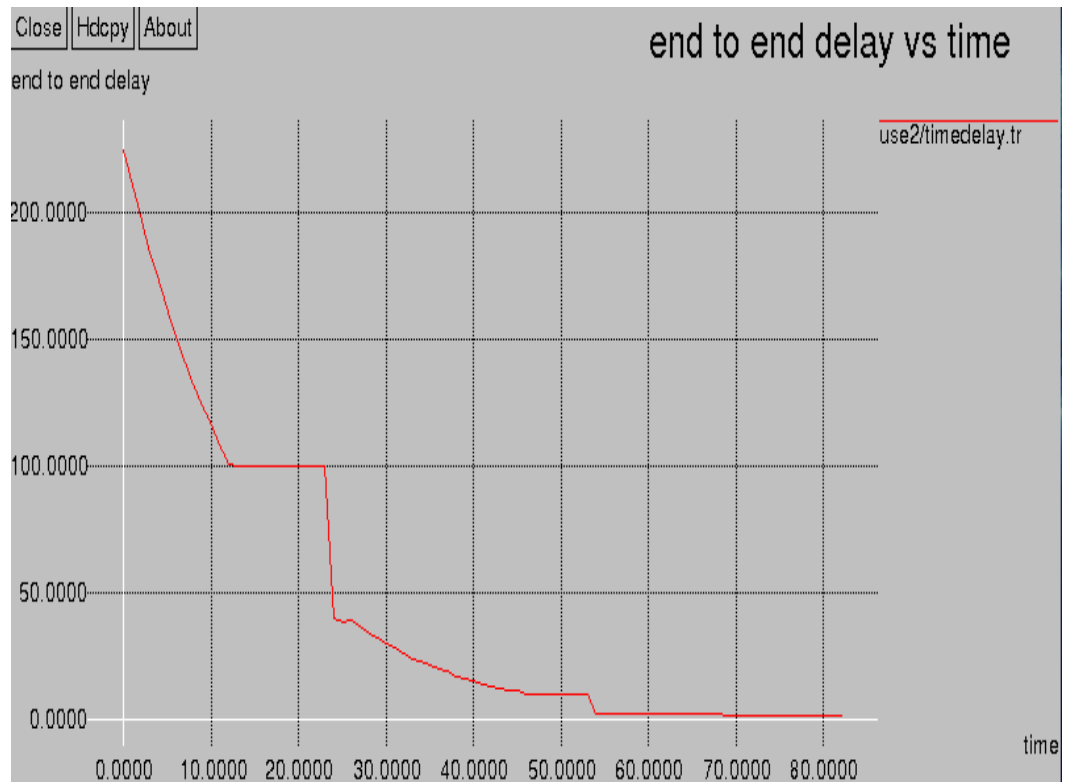


Figure 4.2: End to End Delay VS Time

Figure 4.2 Shows that as the packet takes more time in middle stage to reach destination. This happens due to the packet loss which occurs when ever there is any kind of congestion.

3. Throughput VS Time

In data programme, throughput is the quantity of information sent productively from source to destination in a known time period, and classically deliberate in bits per second (bps), as in megabits per second (Mbps) or gigabits per second (Gbps).

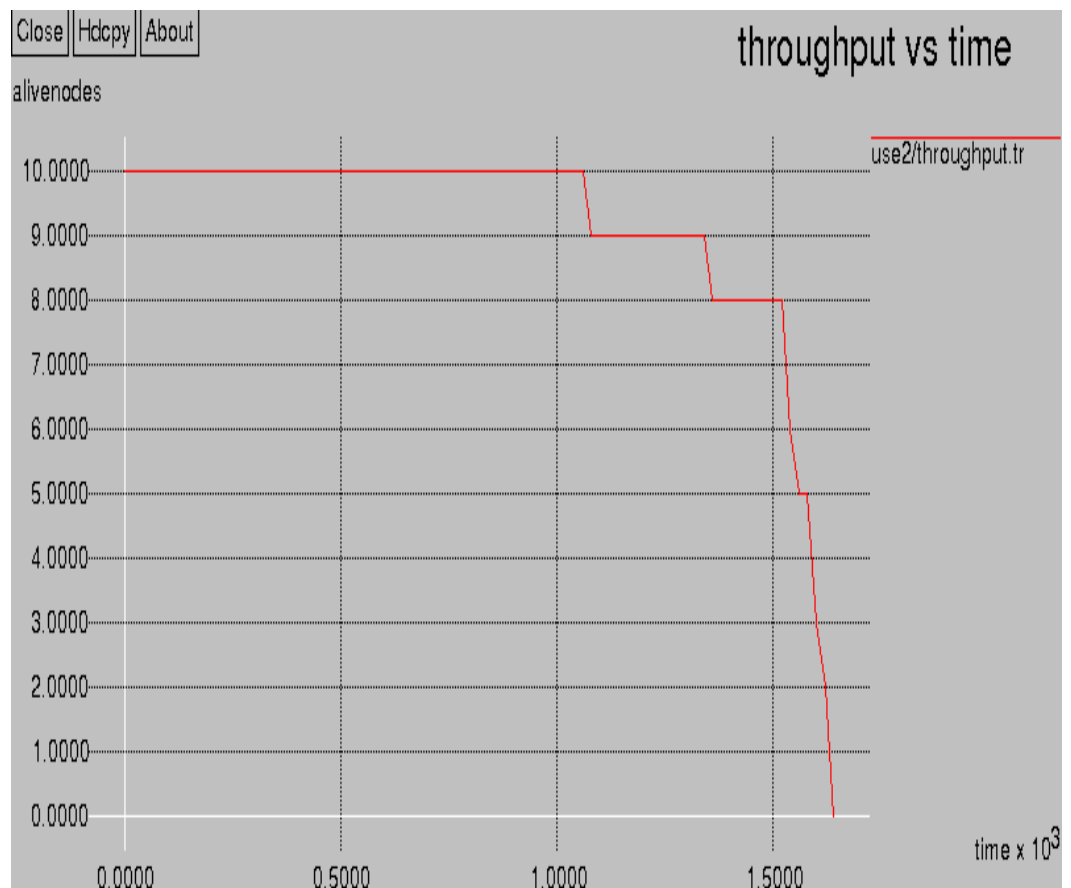


Figure 4.3: Throughput VS Time

Figure 4.2 Shows that as the time increases the throughput is reduced i.e. as the time goes on increasing the rate of transmitting data is reduced and at one point of time it is decreasing rapidly.

Results after applying FPA

1. Drop packet VS Round number

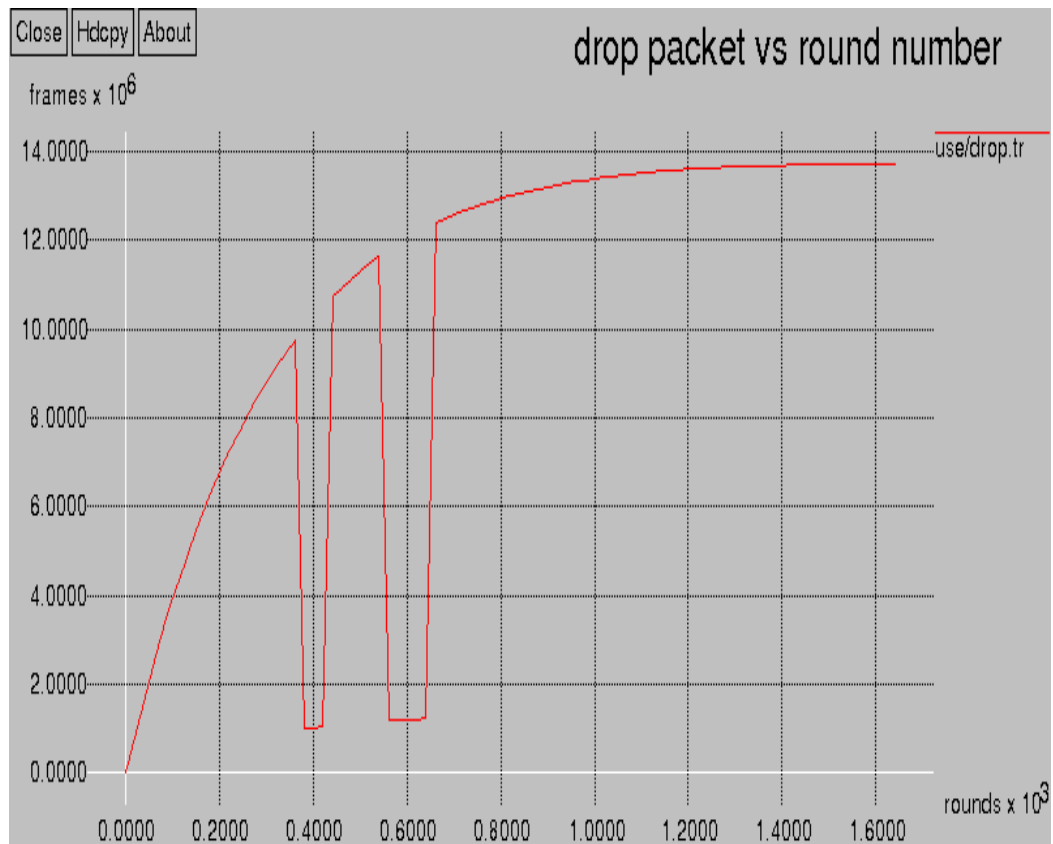


Figure 4.4: Drop packet VS Round Number after FPA

Figure 4.4 states that when the FPA is applied the dropping of packet is reduced and the transferring of packets are going smooth even if the no. of rounds are increasing i.e. as the no. of rounds as increasing the transmission process is becoming more stable.

2. End to End delay VS Time

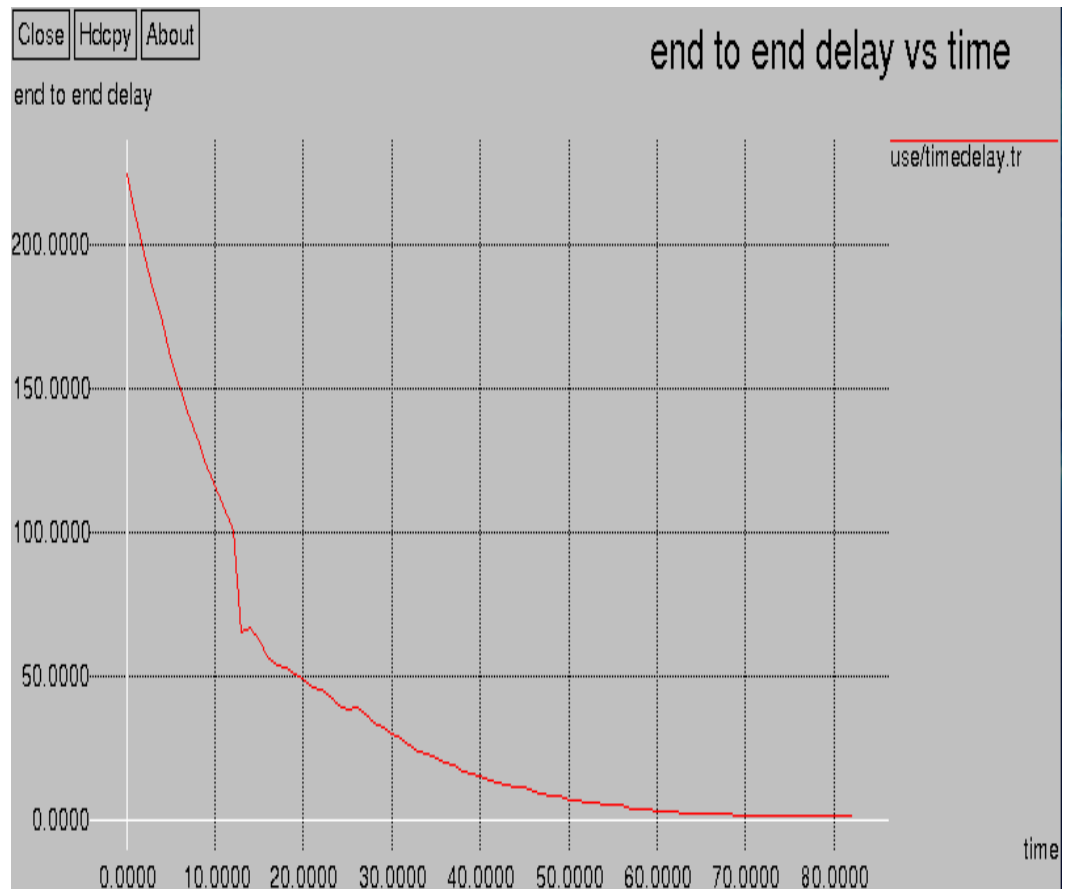


Figure 4.5: End-to-End VS Time

Figure 4.5 states that once the FPA is applied the time taken by packet to reach the destination is minimum i.e. packets takes less time to reach the destination and as the time goes on the curve is getting smother and there is less packet loss in between.

3. Throughput VS Time

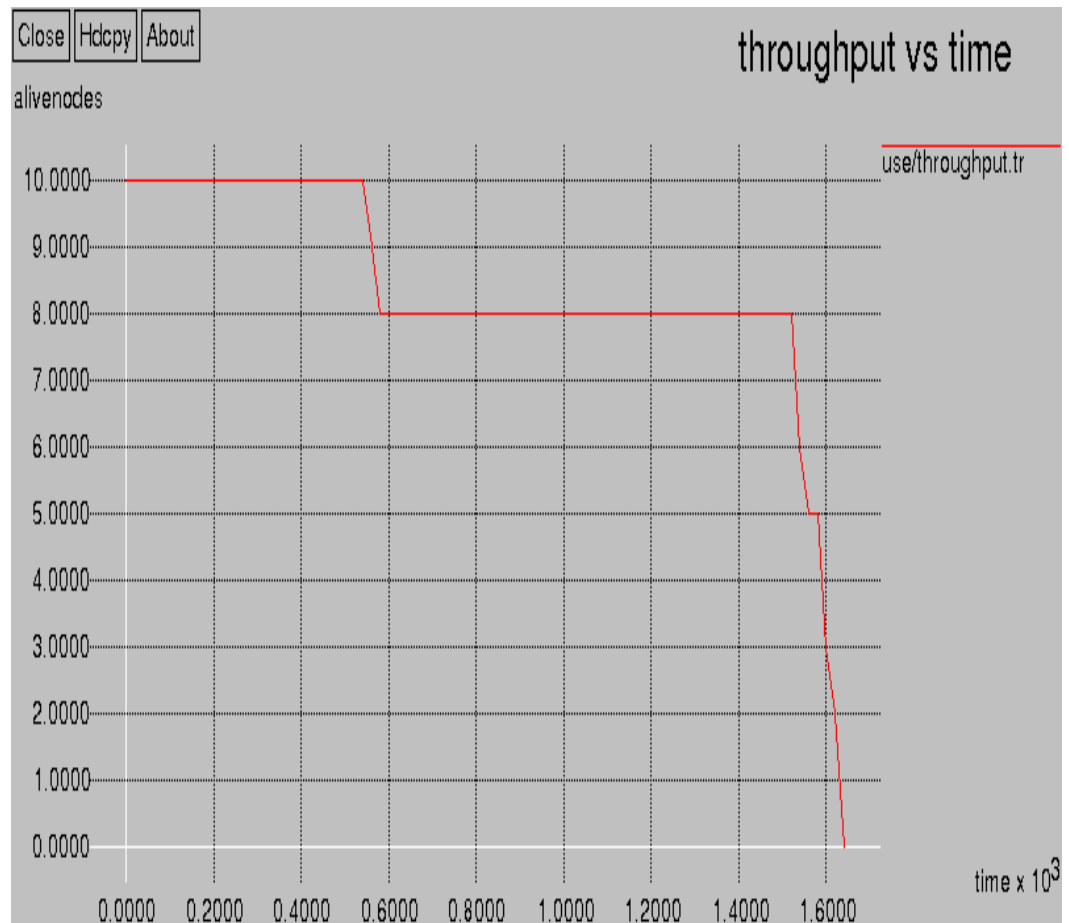


Figure 4.6: Throughput VS Time

Figure 4.6 states that no. of packets reaching destination in a required time has increased. Due to which there is less possibilities of congestion in the network.

4.2 Compression with Existing Technique

1. Drop packet VS Round Number

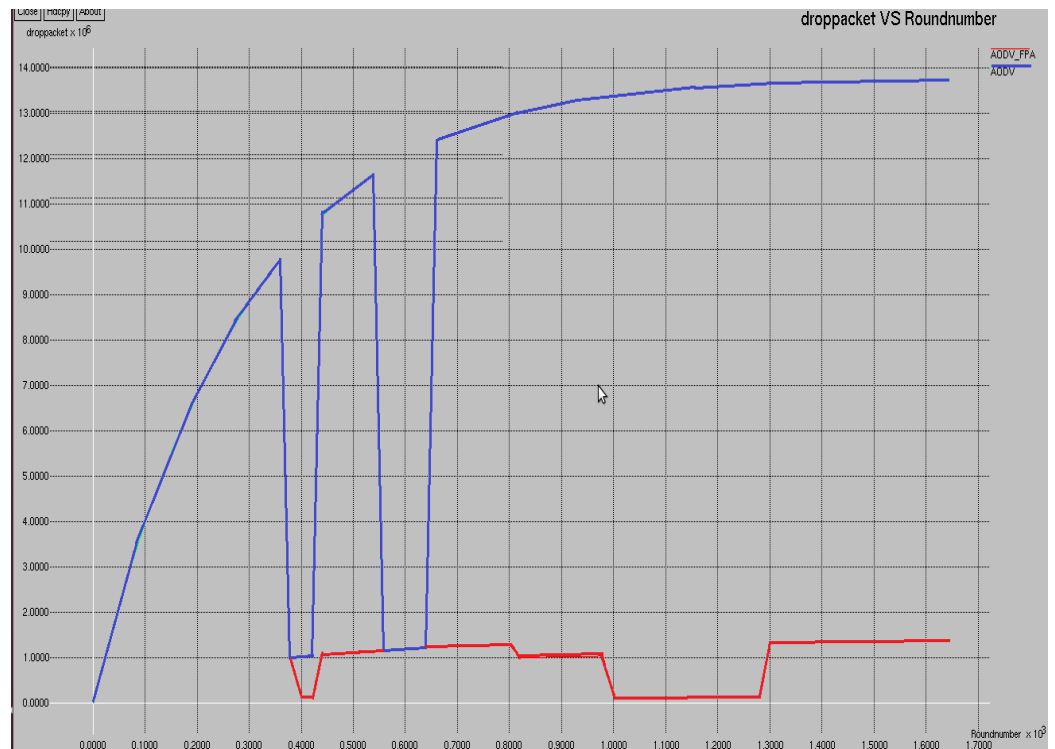


Figure 4.7: Comparison of Drop packet VS Round numbers

Rounds	AODV_FPA drop	AODV drop
40	2	4
60	3	5
90	4	19
110	7	29
140	10	42
160	14	46

Table 4.1: Comparison of Drop packet VS Round numbers

Table 4.1 gives an clear indication of the fact that the dropping packet is reduced after applying FPA in AODV protocol. Initially when the no. of rounds were increasing more no. of packets were lost and when the FPA is applied to the protocol than the less no. of packets are lost while transmitting the data.

2. End to End Delay VS Time

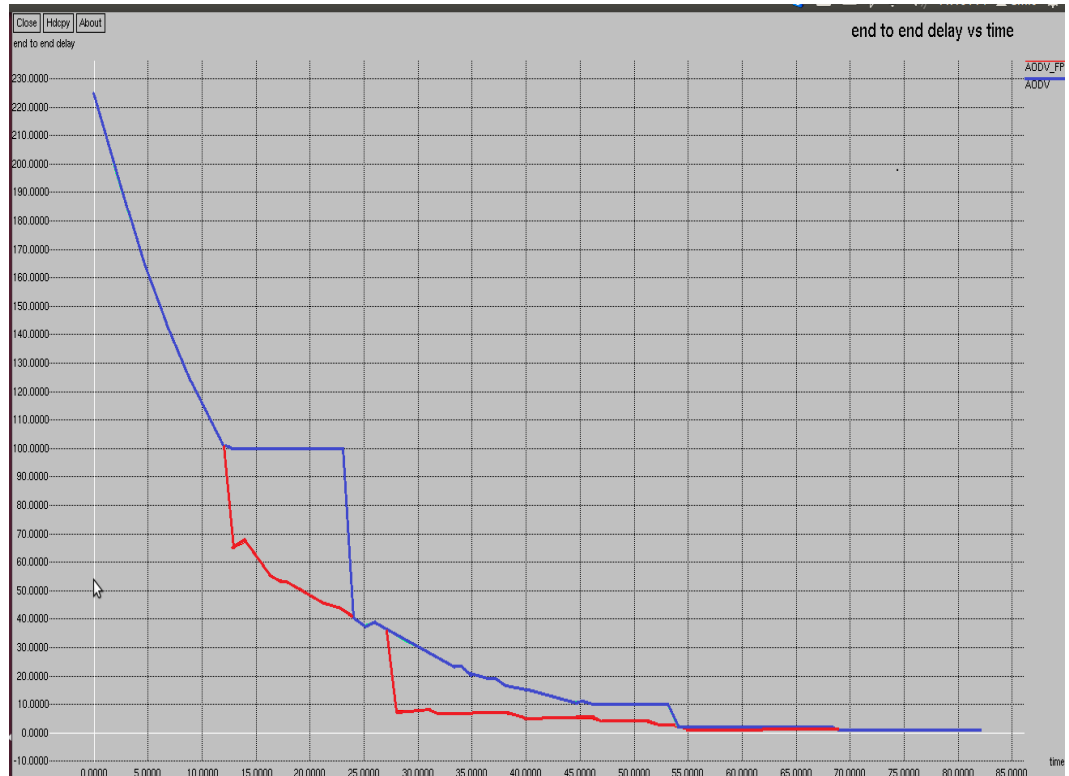


Figure 4.8: Comparison of End-to-End delay VS Time

Packets	AODV_FPA_timedelay	AODV timedelay
15	60 ms	110ms
30	10 ms	50ms
45	5 ms	10ms
50	4ms	9ms

Table 4.2: Comparison of End-to-End delay VS Time

Table 4.2 give an clear indication that when we use FPA less time is taken by the packet to reach the destination and as the no. of packets sent in time is increased time take by those packets to reach the destination is quit less as compared to initial protocol.

3. Throughput VS Time

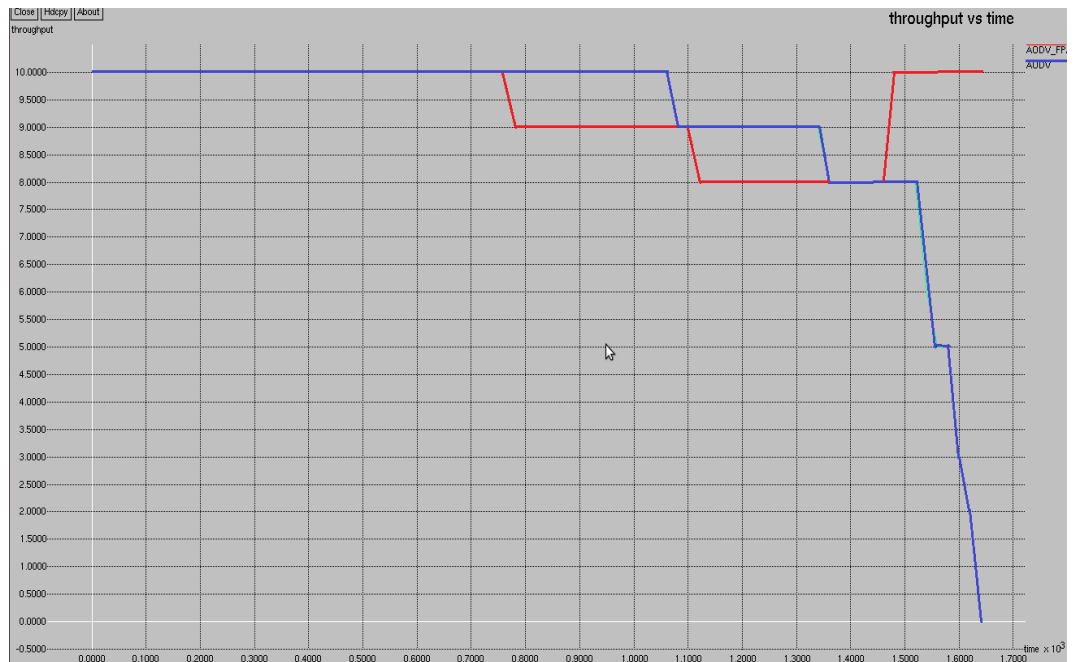


Figure 4.9: Comparison of Throughput VS Time

Time (ms)	AODV_FPAthroughput	AODV throughput
10	9	8.5
40	9.5	8.7
80	8.5	9
100	8.7	8.2
140	10	7
200	10	5

Table 4.3: Comparison of Throughput VS Time

Table 4.3 gives an indication that after applying FPA more no. of packets are transferred in the desired time allotted to the packet. We can say the success rate of transmitting data in a give time has increased after applying FPA.

CHAPTER 5

CONCLUSION AND FUTURE SCOPE

Study states so as to FPA is straightforward, elastic plus enhanced towards determining optimization concern. FPA can be capable of be old for trade with equally lone purpose and multipurpose optimization concern. Study point out that FPA diminish packet loss, end-to-end delay, throughput, develop the marks and the routine is enhanced contrast to former optimization process FPA appear extremely shows potential and still in its original period and be capable of using in medicinal ground as well.

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