Survey of Taguchi Loss Function in Mobile Ad hoc Network

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Abstract— In this paper we presents a method for handling multiple metrics and different network parameters simultaneously to analyze the loss factor of routing protocols in mobile ad hoc network(MANET) environments. We have used Taguchi' losses function to determine the best parameters and routing over head simultaneously for AOMDV protocol. We have consider various different mobile ad hoc network parameters such as Terrain size, No of Nodes, No of source nodes, Packet transmission rate, Node speed, Pause time, Transmission range, Queue size, Antenna height and receiving power on a multiple signal to noise ratio (MNSR), performance and contribution level of parameters have been analyzed by analysis of variance (ANOVA).

Index Terms— *AOMDV*, Performance *metric, Taguchi's loss function*

1 INTRODUCTION

A mobile ad hoc network is an autonomous communication system of mobile nodes having radio transmitters and receivers. The device is free to move in any direction independently and links among these devices changed normally. Ad hoc is a Latin word and it standing for "for this purpose". Mobile ad hoc network could be a wireless network that transmits from pc to pc. In ad-hoc networks, some pairs of terminals might not be able to communicate directly with one another and relaying of some messages is needed, in order that they are delivered to their destinations. Such networks square measure usually remarked as multi-hop or store-and-forward networks. Mobile hosts and wireless working hardware have become wide out there and in depth work has been done recently in group action these parts into ancient networks like the web. Usually events square measure used as means that of communications between simulation entities.

MANET is a form of independent dynamic structured network, where each node treats like router and freely moves in the environment so that dynamic behavior a rises the problem for measuring quality of service dependent parameter. This problem motivates the work for identification of quality of service dependent parameter using Taguchi loss function and provides solution for that problem.

2 TAGUCHI'S LOSS FUNCTION

Taguchi's loss perform parameter style could be a powerful technique to see the best combination parameters. The most objective is to use Taguchi style for predicting the higher parameters which will optimize the performance metric through the setting of style parameters and cut back the sensitivity of the system performance to the supply of variation. Taguchi parameter style uses a special style of orthogonal arrays (OAs) to check the complete factors with little variety of experiment solely. The world organization have a balanced property during which each parameter setting happens an equivalent variety of times for each setting of all alternative parameters within the experiment. The world organization permits researchers or designers to check several parameters at the same time and might be accustomed estimate the consequences of every parameter freelance of the opposite parameters. Taguchi used a loss perform to calculate the deviation between the experimental price and therefore the desired price. The loss perform is completely different for various objective functions. Typically, higher turnout and lower the quantity of packet drop and routing overhead area unit want ready in ad-hoc networks system. Therefore, to get best ad-hoc network style, the larger-the-better performance metric for turnout should be taken.

Taguchi methodology emphasizes the importance of the center (parameter style) stage within the total style process; a stage that is commonly neglected in industrial design observe. The methodology involves the identification of these parameters that area unit underneath the management of the designer, then the institution of a series of experiments to ascertain that set of these parameters that has the best influence on the performance and variation of the planning. The sty leer so is ready to spot the elements of a design that most influence the required outcome of the planning method.

The second connected side of the Taguchi methodology - the Taguchi loss perform or quality loss perform maintains that their 'associate increasing loss each for producers and for society at massive, that could be a perform of the deviation or variability from the best or target price of any style parameter. The larger the deviation from target, the larger is that the loss. The idea of loss being keen about variation is well established in style theory, and at a systems level is expounded to the advantages and price related to responsibility.

3 RELATED WORK

In this section the previous work that has done in this field is

dicuussed.

Hazura Mohamed, Muhammad Hisyam Lee, Shaharuddin Salleh, Bahrom Sanugi and Mazalan Sarahintu [1] "Ad-Hoc Network Design with Multiple Metrics Using Taguchi's Loss Function" in this title we presents an approach for tackling multiple metrics and various network parameters simultaneously to investigate the performance of wireless ad-hoc network routing protocols. The study uses Taguchi's loss function to determine the best condition in yielding maximum throughput and minimum packet drop and routing overhead simultaneously for dynamic source routing (DSR) protocol. Studying the parameters one at a time or by trial and error until a first feasible design is found seems to be a common approach to design optimization. In this title, the impact of ad-hoc network parameters such as terrain, network size, number of sources, packet transmitted rates, node speed and pause time on a multiple signal to noise ratio are investigated simultaneously.

Pushpraj Pate, Vijay Prakash [2] "Review of Dependent Parameters Using Taguchi Loss Function of AOMDV Routing Protocol in MANET Environment" In this title we presents a method for handling multiple metrics and different network parameters simultaneously to analyze the loss factor of routing protocols in mobile ad hoc network(MANET) environments. We have used Taguchi' loss function to determine the best parameters giving maximum throughput, packet delivery ratio (PDR), average delay, DROP and routing over head simultaneously for AOMDV protocol. In this title we have consider various different mobile ad hoc network parameters such as Terrain size, No of Nodes, No of source nodes, Packet transmission rate, Node speed, Pause time, Transmission range, Queue size, Antenna height and receiving power on a multiple signal to noise ratio (MNSR), performance and contribution level of parameters have been analyzed by analysis of variance (ANOVA).

Hazura Mohamed, Muhammad Hisyam, Bahrom Sanugi, [3] "Taguchi Approach for Performance Evaluation of Routing Protocols in Mobile Ad Hoc Networks" In this title we evaluate the performance of Dynamic Source Routing (DSR) protocol in mobile ad hoc network for single-performance metric and multi-performance metrics. Using Taguchi design of experiment, we quantify the main effects of six influential factors (terrain, network size, node speed, pause time, number of sources and transmission rates) on two performance metrics (throughput and end-to-end delay). The analysis of means (ANOM) and analysis of variance (ANOVA) on single and multi-response signal to noise ratio are employed to determine the best conditions required and to identify the level of importance of factors in order to obtain the best performance of DSR protocol.

Raghuraman S, Thiruppathi K,Panneerselvam T Santosh S [4] "Optimization Of Edm Parameters Using Taguchi Method And Grey Relational Analysis for Mild Steel Is 2026" This title aims to investigate the optimal set of process parameters such as current, pulse ON and OFF time in Electrical Discharge Machining (EDM) process to identify the variations in three performance characteristics such as rate of material removal, wear rate on tool, and surface roughness value on the work material for machining Mild Steel IS 2026 using copper electrode. Based on the experiments conducted on L9 orthogonal array, analysis has been carried out using Grey Relational Analysis, a Taguchi method. Response tables and graphs were used to find the optimal levels of parameters in EDM process. The confirmation experiments were carried out to validate the optimal results.

S. Kamaruddin, Zahid A. Khan and S. H. Foong [5] "Application of Taguchi Method in the Optimization of Injection Moulding Parameters for Manufacturing Products from Plastic Blend" This title we presents a study in which an attempt has been made to improve the quality characteristic (shrinkage) of an injection molding product (plastic tray) made from blends plastic (75% polypropylene (PP) and 25% low density polyethylene (LDPE)) by optimizing the injection molding parameters using the Taguchi method. The performance of the plastic trays is evaluated in terms of its shrinkage behavior. An orthogonal array (OA), main effect, signal-to-noise (S/N) ratio and analysis of variance (ANOVA) are employed to analyze the effect of injection molding parameters on the shrinkage behavior of the product.

Uğur Eşme [6] "Application of Taguchi Method for the Optimization of Resistance Spot Welding Process" This title reports on an investigation of the effect and optimization of welding parameters on the tensile shear strength in the resistance spot welding (RSW) process. The experimental studies were conducted under varying electrode forces, welding currents, electrode diameters, and welding times. The settings of welding parameters were determined by using the Taguchi experimental design method. The level of importance of the welding parameters on the tensile shear strength is determined by using analysis of variance (ANOVA). The optimum welding parameter combination was obtained by using the analysis of signal-to-noise (S/N) ratio. The confirmation tests indicated that it is possible to increase tensile shear strength significantly by using the Taguchi method.

Mr. Vinod Mahor, Prof. Sandeep Raghuwanshi [7] "Taguchi's Loss Function Based Measurement of Mobile Ad-Hoc Network Parameters under AODV Routing Protocol" This title presents the application of Taguchi's loss function approach, a multi-response optimization method, for achieving better performance during routing process of ad-hoc on demand distance vector (AODV) routing protocol. Seven parameters namely terrain size, network size, number of sources, transmitted packet rates, pause-time, node speed, and transmission range are optimized with considerations of multiple performance metrics including maximum packet delivery ratio and minimum routing overhead, packet drop and end-to-end delay. Based on multiple signal-to noise ratio (MNSR), optimum levels of parameters have been identified and significant contribution of parameters is determined by analysis of variance (ANOVA).

4 Description of Routing Protocols

A routing protocol maintains the network topology for a Wireless Ad hoc Network. If a link breaks [3], routing protocols has the responsibility to repair that link in order to maintain the consistency of the network. Different routing protocols have various strategies to repair a broken link. The repair strategy is quite specific to each strategic routing protocol; therefore it is quite hard to analyze the pros and cons of each protocol. What we can do is to find the link break probabilities of different categories of routing protocols since the problem greatly influence the efficiency of a routing protocol. We will analyze the link break problem, the influence of the problem on each categories of routing protocol, and the incurred routing table update to them. The categories of most popular routing protocols, table-driven, on-demand and hybrid routing protocols, are discussed in this article [8, 9].

4.1 Proactive (Table-Driven)

The pro-active routing protocols are the same as current Internet routing protocols such as the Routing Information Protocol, Distance-Vector, Open Shortest Path First and link-state. They attempt to maintain consistent, up-to-date routing information of the whole network. Each node has to maintain one or more tables to store routing information, and response to changes in network topology by broadcasting and propagating. Some of the existing pro-active ad hoc routing protocols are: Destination Sequenced Distance Vector (DSDV), Wireless Routing Protocol (WRP).

4.2 Reactive (Source-Initiated On-Demand Driven)

These protocols try to eliminate the conventional routing tables and consequently reduce the need for updating these tables to track changes in the network topology. When a source requires to a destination, it has to establish a route by route discovery procedure, maintain it by some form of route maintenance procedure until either the route is no longer desired or it becomes inaccessible, and finally tear down it by route deletion procedure. In pro-active routing protocols, routes are always available (regardless of need), with the consumption of signaling traffic and power. Some of reactive routing protocols are Ad hoc On-Demand Distance Vector (AODV), Dynamic Source Routing (DSR).

4.3 Hybrid protocols

Hybrid protocols combine the features of reactive and proactive protocols. These protocols have the advantage of both proactive and reactive routing protocols to balance the delay which was the disadvantage of Table driven protocols and control overhead (in terms of control packages). Main feature of Hybrid Routing protocol is that the routing is proactive for short distances and reactive for long distances. The common disadvantage of hybrid routing protocols is that the nodes have to maintain high level topological information which leads to more memory and power consumption. Examples: ZRP (Zone Routing Protocol).

5 Description of AODV Routing Protocol

Ad hoc On Demand Distance Vector (AODV) [10] is source initiated reactive protocol. It discovers and maintains routes only if and when necessary. Route discovery works as follows. When the source requires a path to a particular destination, it broadcasts a route request (RREQ) packet in the Wireless Ad hoc Network. Nodes receiving RREQ record a *reverse* route back towards the source, using the node from which the RREQ was received as the next-hop, and then re-broadcasts the RREQ. If the same RREQ is received more than once (via different routes), it is ignored. This way the RREQ packets are flooded to every node in the connected part of the network.

When the RREQ packet reaches the destination, it sends a route reply (RREP) packet back to the source, using the reverse route. If an intermediate node has an up-to-date route to the destination, it may also send a RREP packet back to the source on behalf of the destination. As the RREP packet follows the path back to the source, the corresponding *forward* route is created at each intermediate node towards the destination. Once the RREP packet reaches the source, data traffic can now flow along this forward route.

To prevent routing loops, AODV maintains a sequence number on each node. Any routing information transmitted on routing packets or maintained on a node is tagged with the last known sequence number for the destination of the route. AODV protocol guarantees the invariant that the destination sequence numbers in the routing table entries on the nodes along a valid route are always monotonically increasing. Other than preventing loops, sequence numbers also ensure freshness of routes. Given a choice of multiple routes, the one with a newer sequence number is always chosen.

An important feature of AODV is maintenance of timer based states in each node, regarding utilization of individual routes. A route is "expired" if not used recently. A set of predecessor nodes is maintained for each routing table entry, indicating a set of neighboring nodes that use that entry to route data packets. These nodes are notified with route error (RERR) packets when the next hop link breaks. Each predecessor node, in turn, forwards the RERR to its own set of predecessors, thus effectively erasing all routes using the broken link. This RERR is thus propagated to each source routing traffic through the failed link, causing the route discovery process to be reinitiated if routes are still needed.

6 PROPOSED WORK

Mobile Ad-hoc network is depends on different service and parameter, such the service is routing independent decision, movement aware, energy information etc. and parameter is antenna type, height of antenna, receiving power, queue length, terrain size, number of node, source node's, speed and data size etc. so all the characteristic are form of dynamicity of communication network than our proposed research is to identifies the maximum depended parameter to increase and decrease the performance of the network and on the bases of performance we state the equation for ideal network condition in various circumstances.

In our approach we create scenario in two level namely level1 and level2with 10 routing parameter and 5 Metrics like throughput, packet delivery ratio (PDR), average delay, DROP and routing over head according to that we can create 2^{10} design points but here we create only 10 design points and analyze the result and apply Taguchi loss function equation to measure the maximum loss dependent parameter.

7 CONCLUSION

In this paper, The Taguchi' loss function is applied to accomplish the more important parameters of the mobile ad hoc network under the consideration of multiple metrics. The most significant parameter followed by Receiving power, Source node, Transmission rate, Antenna height, Transmission range, Node speed, Pause time, No of nodes and Terrain size.

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