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Composite Attribute Based Ad-hoc On Demand Multipath Distance Vector Routing Protocol (CAB-AOMDV)

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In this paper composite attribute-based ad-hoc on demand multipath distance vector (CAB-AOMDV) routing protocol has been proposed. Composite attributes are used to select the optimized multiple path for transmitting data and determined what percentage of total data can be share by the specific path. Composite factor is the combination of two factors, one is drop and another is queue factor. The performance analysis is evaluated under various node densities. Using control-overhead (CO), normalized-routing-overhead and throughput performance of proposed CAB-AOMDV is compared with Risk factor-based Ad-hoc on demand multipath (RF-AOMDV) routing protocol, from where it is observed that performance of proposed CAB-AOMDV is outperform RF-AOMDV in respect of all scenario taken into considerations.

Keywords: CAB-AOMDV, MANET, Load balancing, NS2, AOMDV.

Introduction

Many researchers have proposed various methods to improve the performance of AOMDV routing protocol in MANET.[1] Santhi and Sadasivam[2] have proposed EELSRP for adaption of dynamically changed network. EALBM is proposed by Deshmukh and Raisinghani[3] using disjoint multipath strategy. Gupta and Prasad[4] have proposed ELBDC-AOMDV using congestion management technique. Banerjee and Chowdhury[5] have proposed ERL-AOMDV based on remaining energy of any paths. Traffic Aware Load Balancing in AOMDV (TALB-AOMDV) has been proposed by Pathak and Kumar.[6] Risk factor based multi-path ad-hoc on-demand Distance vector routing protocol (RF-AOMDV) is proposed by Hassan and Mandal.[7] In RF-AOMDV, load is distributed in any valid paths is based on the risk factor of that path. But the efficacy of any paths is not based only the risk factor of that path but also based on others factor like, queue size, remaining energy etc. So the load balancing can be more optimized using multiple factors. For the purpose of optimization of load balancing Composite attribute-based Ad-hoc on demand multipath routing protocol (CAB-AOMDV) has been proposed. In CAB-AOMDV load is distributed and validated based on composite factor which is combination of drop factor and queue factor of the specific valid path.

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Proposed work

Composite attribute-based Ad-hoc on demand multipath routing protocol (CAB-AOMDV) is proposed in this research work. The CAB-AOMDV is enhanced version of Ad-hoc on demand multipath (AOMDV) routing protocol. AOMDV routing protocol finds the multiple paths using broadcasting of RERQ by the source node and source node receives RERP messages from the destination nodes, but in CAB-AOMDV source node select the multiple routes for transmitting data based on composite factors. Composite factor (cf) of any path is the combination of two factors, one is drop and another is queue factor of that path. Drop factor $Df(i)$ of any route (r_i) can be computed by the following equation.

$$Df(i) = 1/\sum[n(i) \in N] + \beta \qquad \ldots (1)$$

In the equation 1, N is the set of all nodes and $\sum[n(i)$ implies total hop count to reach from source to destination in any route (r_i). β is a constant value which is used to $Df(i)$ value in desire range. Threshold value of drop factor (DF_{TH}) is the mean value of drop factor of all available paths.

Df_{TH} = Mean ($Df_1, Df_2, Df_3 \ldots\ldots Df_k$) where k is the available route from source to destination.

Queue factor (qf_i) of any path (i) is the mean value of buffer size all of nodes of the path (i) which is expressed in equation no 2.

$$Qf_i = mean\ [Q_1, Q_2, Q_3, Q_4 \ldots Q_j] \quad \ldots (2)$$

where j= 1, 2, 3….number of nodes.

Now, the threshold queue factor (Qf_{TH}) of the network is the mean factor of queue factors of available paths.

$$Qf_{TH} = \text{Mean}\ (Qf_1, Qf_2, Qf_3 \ldots\ldots Qf_k) \quad \ldots (3)$$

where, k is the available route from source to destination.

The route can be determined whether the data can be transferred through the path or not and as well as the percentage of load can be transmitted through that valid path can be determined based on two composite factors. If the drop factor (Df_i) of any specific path (i) is higher than threshold drop factor (DF_{TH}) as well as the queue factor (Qf_i) of that path is higher than threshold queue factor (Qf_{TH}), then the path is considered as the valid path and the data can be transmitted through the path (i). Otherwise the path can be ignored for sending the data. The percentage of load can be distributed through that valid path (i) can be calculated based on impact factors of that path. Now the load impact (IL_i) of the path in the network is the average of Impact of drop factor and queue factors. Total load impact (IL_T) is the sum of all load impact of every valid path.

$$IL_i = ([(1-Df_i)/DF_T] + [Qf_i/Qf_T])/2$$

$$IL_T = \sum_{j=1}^{p} IL_j \text{ where j is all valid paths}$$

Now percentage of load can be distributed through the path j is calculated by the equation

$$L_j = (IL_i / IL_T) * L_T$$

The algorithm of the composite attribute-based Ad-hoc on demand multipath routing protocol (CAB-AOMDV) is described in the algorithm 1.

Algorithm 1: Composite attribute-based Ad-hoc on demand multipath routing protocol (CAB-AOMDV).

If (existing path is true)
{
Distribute the load among the valid paths.
}
Eslse
{
//Initialization of route discovery process
Broadcast RERQ message and received RERP message by source node
$Df(i) = 1/\sum[n(i) \in N] + \beta$, v_j $n(i)$□ N_m *where* $N=\{n_1, n_2, n_3, \ldots n_m\}$.
$Df_{TH} = Mean\ (Df_1, Df_2, Df_3 \ldots\ldots Df_k)$
$Qf_i = mean\ [Q_1, Q_2, Q_3, Q_4 \ldots Q_j]$
$Qf_{TH} = Mean\ (Qf_1, Qf_2, Qf_3 \ldots\ldots Qf_k)$
}
If ($Df(i) => Df_{TH}$ && $Qf_i => Qf_{TH}$) *then*
{
Route (R_i) *select for data transmission*
$IL_i = ([(1-Df_i)/DF_T] + [Qf_i/Qf_T])/2$
$IL_T = \sum_{j=1}^{p} IL_j$ *where j is all valid paths*
$L_j = (IL_i / IL_T) * L_T$
}
Else
Route (R_i) *reject for data transmission.*
Broadcast periodic route discovery message
Broadcast beacon message
End.

Results and Discussion

Network simulator 2 (NS 2.35) is used to implement the proposed CAB-AOMDV. Few parameters are takes as fixed and some are taken as variable parameters for the analysis of the performance. Fixed parameters are DropTail-PriQue as interface-queue type, Mac-802.11 as MAC- type, LL as link-layer type. Antenna-model is considered as Omni-Antenna, Maximum packet-length is taken as 50. 200 seconds is considered as total simulation time. Wireless-channel is considered as Channel-type. TwoRay-Ground is considered as Radio-propagation-model and Phy-Wireless-Phy is taken as network-interface type. Various node densities are taken as variable parameters. Performance analysis is done in the scenario of 2400X2400 m^2. Three parameters are taken for comparisons of performance of proposed CAB-AOMDV with RF-AOMDV. These are control-overhead (CO), normalized- routing-overhead (NRO) and throughput. Control-overhead (CO) and NRO of proposed CAB-AOMDV should be less than RF-AOMDV and throughput of proposed CAB-AOMDV should be more than RF-AOMDV. The control-overhead (CO) of CAB-AOMDV which is always less than RF-AOMDV is shown in Fig. 1. In RF-AOMDV, the load balancing of any valid path is done only the based on risk factor of that path. But in CAB-AOMDV the load balancing of any valid path is done on the basis of two factors. The efficiency of the valid path in CAB-AOMDV is more precision than

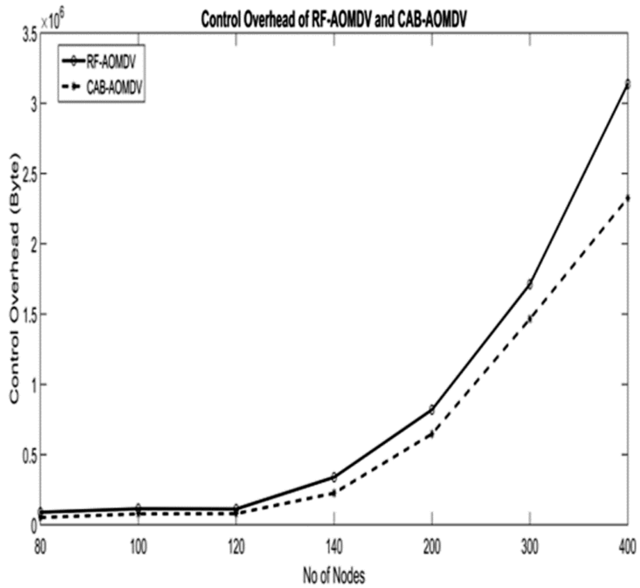

Fig. 1 — Comparison of CAB-AOMDV and RF-AOMDV respect to CO (2400x2400 mtr^2 scenario)

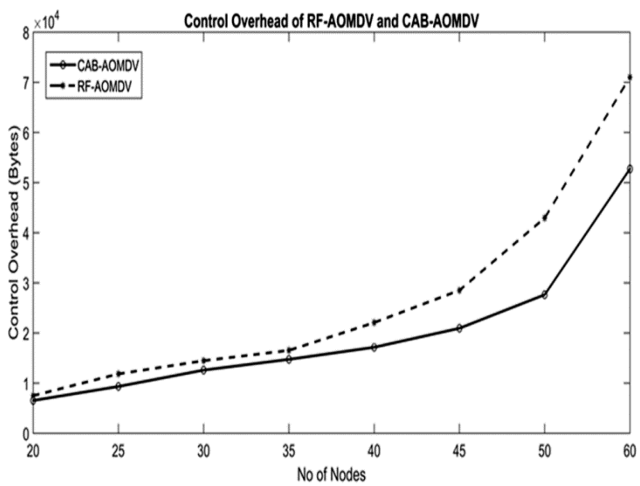

Fig. 2 — Comparison of CAB-AOMDV and RF-AOMDV respect to CO (2400x2400 mtr^2 scenario)

RF-AOMDV. So the control-overhead (CO) of CAB-AOMDV is always less than RF-AOMDV. The comparisons of NRO of CAB-AOMDV with RF-AOMDV are shown in Fig. 2. The efficiency of any path can be measured more accurately in CAB-AOMDV than RF-AOMDV as it computed usingcomposite factor. So the NRO of CAB-AOMDV is always less than NRO of RF-AOMDV. The comparisons of throughput of CAB-AOMDV with RF-AOMDV are shown in Fig. 3. It is seen that throughput CAB-AOMDV is always more than RF-AOMDV.

In RF-AOMDV, the efficiency of any path is measured only based on risk factor of that valid paths

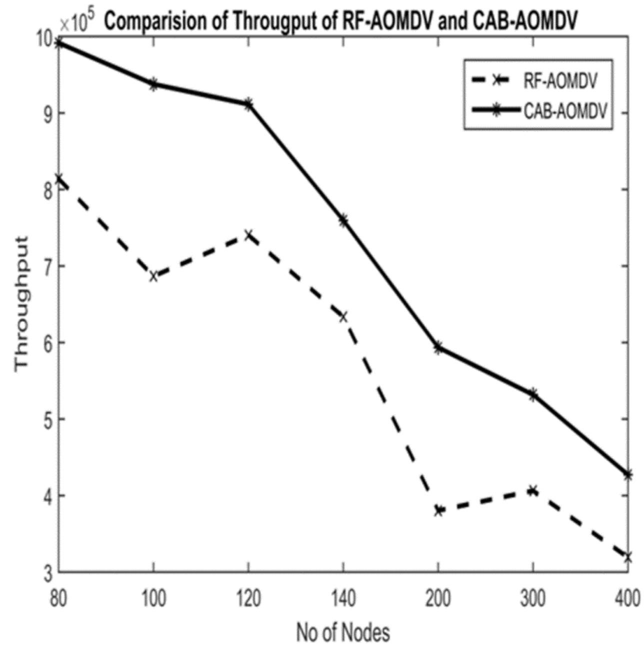

Fig. 3 — Comparison of CAB-AOMDV and RF-AOMDV respect to throughput (2400x2400 mtr^2s scenarios)

and load is distributed based on risk factor of that valid path. But in CAB-AOMDV, the path is selected as well as the load is distributed based on drop factor and risk factor. So the accuracy of distributed of load in CAB –AOMV is always higher than RF-AOMDV. Thus, network resource is utilized in CAB-AOMDV more properly than RF-AOMDV.

Conclusion

In this paper Composite attribute-based Ad-hoc on demand multipath routing protocol (CAB-AOMDV) is implemented. The performance comparisons are done with Risk Factor Based Ad-hoc On Demand Distance Vector (RF-AOMDV) routing protocol based on control-overhead (CO), normalized- routing-overhead (NRO) and throughput. As the load of any valid paths in CAB-AOMDV is distributed based on two factors, one if drop factor and another is queue factor of that path, but in the RF-AOMDV, the load is distributed only based on risk factor of that valid path. So the efficiency measurement of any valid path in CAB-AOMDV is more accurate than RF-AOMDV. So CAB-AOMDV performance is enhanced due to these parameters.

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