International Journal of Applied Science and Mathematics
Volume 1, Issue 2, ISSN (Online): 2394-2894

# Route Stability in MANETs under the Random Direction Mobility Model

**Najme Ghanbari**
Department of Electrical Engineering,
Faculty of Engineering, University of Zabol, Zabol, Iran
Email: najme.ghanbari@gmail.com

**Mohammad Reza Pourmir**
Department of Computer Engineering,
Faculty of Engineering, University of Zabol, Zabol, Iran
Email: pormir10@yahoo.com

***Abstract* – A fundamental issue arising in mobile ad hoc networks (MANETs) is the selection of the optimal path between any two nodes. A method that has been advocated to improve routing efficiency is to select the most stable path so as to reduce the latency and the overhead due to route reconstruction. In this work, we study both the availability and the duration probability of a routing path that is subject to link failures caused by node mobility. In particular, we focus on the case where the network nodes move according to the Random Direction model, and we derive both exact and approximate (but simple) expressions of these probabilities. Through our results, we study the problem of selecting an optimal route in terms of path availability. Finally, we propose an approach to improve the efficiency of reactive Routing protocols.**

***Keywords* – MANETs, Random Direction Model.**

**Algorithm/Technique Used: Random Direction model.**

## Algorithm Description

The Random waypoint model is a random-based mobility model used in mobility management schemes for mobile communication systems. The mobility model is designed to describe the movement pattern of mobile users, and how their location, velocity and acceleration change over time. Mobility models are used for simulation purposes when new network protocols are evaluated.

In random-based mobility simulation models, the mobile nodes move randomly and freely without restrictions. To be more specific, the destination, speed and direction are all chosen randomly and independently of other nodes.

## Existing System

The problem of link and route stability has been widely addressed in the literature. Routing protocols accounting for route stability while selecting the source-destination path can be found , just to name a few. In particular, the work in considers nodes moving along nonrandom patterns and exploits some knowledge of the nodes motion to predict the path duration. Studies on link and path availability and duration are presented. A partially deterministic and a Brownian motion, where nodes start moving from the same location, are considered.

## Proposed System

We focus on the stability of a routing path, which is subject to link failures caused by node mobility. We define the path duration as the time interval from when the route is established until one of the links along the route becomes unavailable, while we say that a path is available at a given time instant *t* when all links along the path are active at time *t*. Then, our objective is to derive the probability of path duration till time *t* and the probability of path availability at time *t*.

*Expression For transform of the distribution:*

We derive for the first time an expression for the transform of the distribution of a node moving according to the RD model. This expression can be numerically inverted to obtain the temporal evolution of the probability density function of the no deposition, given an assigned initial condition. Closed form expressions for the temporal evolution of the distribution moments can also be derived directly from the transform.

*Probability of Path Duration and Availability:*

The probability of distribution of the path duration is accurately approximated by an exponential distribution when the number of hops along the path is sufficiently large, no matter which mobility model is considered. The parameter of the exponential distribution is empirically obtained from the map layout, node density, and other detailed parameters of the mobility scenario. The work in exploits Palm's calculus by assuming that links along a path are independent and that steady state is reached; in the assumption on link independence is relaxed and the parameter of the exponential distribution is determined using the expected duration of the links in the path.

*Link Availability:*

Under the RD model, the temporal evolution of the node position, either in the move or in the pause phase, can be described through a system of partial differential equations (PDE's). In (weak) solution of these equations has been obtained over a finite rectangular area. Here, instead, we consider the dynamics of nodes moving over an infinite bidimensional domain, and we obtain a closed expression for the general (weak) solution of the RD equations in the frequency domain (i.e., the moment-generating function), under the assumption that move and pause times are exponentially distributed. Even if a direct analytical inverse transform of the obtained moment-generating function appears to be prohibitive, closed expressions for the moments of the spatial probability density function (pdf) can easily be derived.

## Calculating Method

The evolution of Markov Processes over a general (uncountable) state space can be described, similarly to what happens for Markov Chains, by a set of dynamical

International Journal of Applied Science and Mathematics
Volume 1, Issue 2, ISSN (Online): 2394-2894

equations, relating the probability distribution functions at different time instants. These equations, known in the literature as Chapman-Kolmogorov equations of the associated Markov Process, can be expressed either in terms of integral equations or in terms of differential equations

*Link Correlation:*

Based on our results on the probabilities of link availability and link duration, we study the same matrices for multi hop paths, again in the case of RD mobility. We discuss the validity of the link independence assumption, which is widely used, and compared it against a refined assumption that accounts for link correlation. We observe that the link independence assumption provides sufficiently accurate results.

*Performance evaluation:*

We show how our analysis can be exploited to improve the efficiency of traffic routing in MANETs. In particular show how to select the optimal route in terms of path availability and how to determine the optimal number of hops between source and destination,taking into account the initial distance between the nodes. We then propose an approach to find and select routes, which accounts for the expected data transfer time over the path and allows to reduce the overhead of reactive routing protocols

*Collaboration*

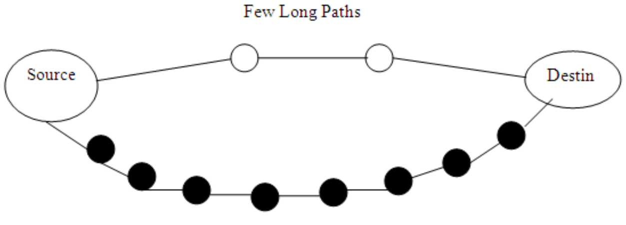
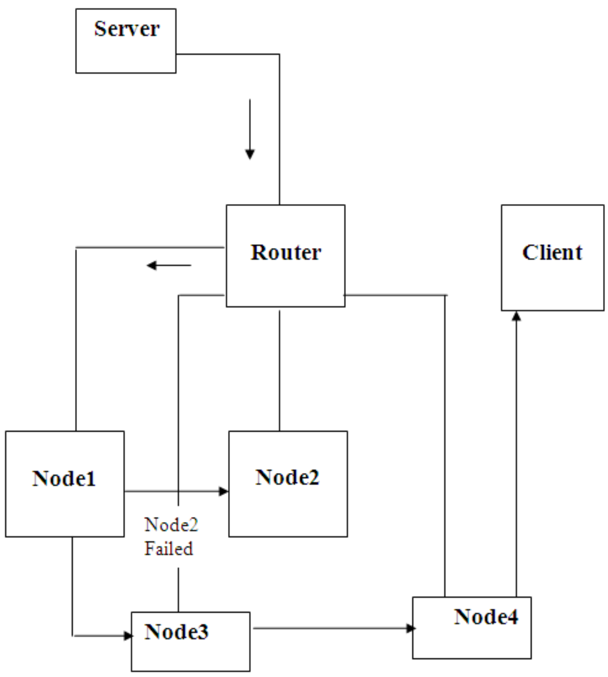



*Diagram:*




## Applications

In case the node density is very large (for example,an area crowded of people carrying communication devices) and links of any length can be assumed to be always found, the source node can optimize the above procedure, under the additional assumption that it can estimate the distance from the destination. Indeed, the source node can precompute an optimal number of hops (and thus an optimal link length) using (20) (evaluated at t ¼ desired duration). This information can help significantly in reducing the number of messages to be propagated in the network during the path discovery phase: Messages are sent only to neighbors at a distance close to the optimal precomputed one.

## Future Enhance

In future we suggest to use this technology in communication field to avoid the traffic and over packet loss as replace for current using technology. Because of maintenance cost of this technology is very low compare to the current using method that is economically this method became cheap and also results are very accurate.

## Conclusions

We studied the duration and availability probabilities of routing paths in MANETs—a fundamental issue to provide reliable routes and short route disruption times. We focused on the Random Direction mobility model and derived both exact and approximate (but simple) expressions for the probability of path duration and availability. We used these results to determine the optimal path in terms of route stability; in particular, we showed some properties of the optimal path and we provided an approximate yet accurate expression for the optimal number of hops. Finally, based on our findings, we proposed an approach to find and select routes, which accounts for the expected data transfer time over the path and allows to reduce the overhead of reactive routing protocols

## References

[1] R. Dube, C.D. Rais, K.-Y. Wang, and S.K. Tripathi, "Signal Stability Based Adaptive Routing (SSA) for Ad-Hoc Mobile Networks," IEEE Personal Comm., vol. 4, no. 1, pp. 36-45, Feb. 1997.

[2] S. Agarwal, A. Ahuja, J.P. Singh, and R. Shorey, "Route-Lifetime Assessment Based Routing (RABR) Protocol for Mobile Ad-Hoc Networks," Proc. IEEE Int'l Conf. Comm. (ICC '00), pp. 1697-1701, June 2000.

[3] W. Su, S.-J. Lee, and M. Gerla, "Mobility Prediction and Routing in Ad Hoc Wireless Networks," Int'l J. Network Management, vol. 11, no. 1, pp. 3-30, Jan./Feb. 2001.

[4] C. Bettstetter, G. Resta, and P. Santi, "The Node Distribution of the Random Waypoint Mobility Model for Wireless Ad Hoc Networks," IEEE Trans. Mobile Computing, vol. 2, no. 3, pp. 257-269, July-Sept. 2003.

[5] T. Camp, J. Boleng, and V. Davies, "A Survey of Mobility Models for Ad Hoc Network Research," Wireless Comm. & Mobile Computing (WCMC '02), special issue on mobile ad hoc

networking: research, trends, and applications, vol. 2, no. 5, pp. 483-502, 2002.
[6] P. Nain, D. Towsley, B. Liu, and Z. Liu, “Properties of Random Direction Model,” Proc. IEEE INFOCOM, Mar. 2005.
[7] E.M. Royer, P.M. Melliar, and L.E. Moser-Smith, “An Analysis of the Optimum Node Density for Ad hoc Mobile Networks,” Proc. IEEE Int’l Conf. Comm. (ICC ’01), June 2001.
[8] V. Rodoplu and T.H. Meng, “Minimum Energy Mobile Wireless Networks,” IEEE J. Selected Areas in Comm., vol. 17, no. 8, pp. 1333-1344, Aug. 1999.
[9] C.E. Jones, K.M. Sivalingam, P. Agrawal, and J.C. Chen, “A Survey of Energy Efficient Network Protocols for Wireless Networks,” Wireless Networks, vol. 7, no. 4, pp. 343-358, July 2001.
[10] G. Zussman and A. Segall, “Energy Efficient Routing in Ad Hoc1 Disaster Recovery Networks,” Proc. IEEE INFOCOM, Apr. 2003.
[11] D.S.J. De Couto, D. Aguayo, J. Bicket, and R. Morris, “A High-Throughput Path Metric for Multi-Hop Wireless Routing,” Proc. ACM MobiCom, Sept. 2003.
[12] B. Awerbuch, D. Holmer, and H. Rubens, “The Medium Time Metric: High Throughput Route Selection in Multirate Ad Hoc Wireless Networks,” Mobile Networks and Applications, J. Special Issue on Internet Wireless Access: 802.11 and Beyond, vol. 11, no. 2, pp. 253-266, Apr. 2006.
[13] D. Turgut, S.K. Das, and M. Chatterjee, “Longevity of Routes in Mobile Ad Hoc Networks,” Proc. IEEE Vehicular Technology Conf. (VTC ’01) Spring, pp. 2833-37, May 2001.
[14] I. Gruber and H. Li, “Link Expiration Times in Mobile Ad Hoc Networks,” Workshop Wireless Local Networks, Proc. IEEE Conf. Local Computer Networks (LCN ’02), Nov. 2002.
[15] P. Samar and S.B. Wicker, “On the Behavior of Communication Links of a Node in a Multi-Hop Mobile Environment,” Proc. ACM MobiHoc, pp. 145-156, May 2004.
[16] D. Yu, H. Li, and I. Gruber, “Path Availability in Ad Hoc Networks,” Proc. 10th Int’l Conf. Telecomm. (ICT ’03), 2003.
[17] S. Cho and J.P. Hayes, “Impact of Mobility on Connection Stability in Ad Hoc Networks,” Proc. IEEE Wireless Comm. and Networking Conf. (WCNC ’05), pp. 1650-1656, Mar. 2005.
[18] A.B. McDonald and T. Znati, “A Mobility Based Framework for Adaptive Clustering in Wireless Ad-Hoc Networks,” IEEE J. Selected Areas Comm., vol. 17, no. 8, pp. 1466-1487, Aug. 1999.
[19] Y.-C. Tseng, Y.-F. Li, and Y.-C. Chang, “On Route Lifetime in Multihop Mobile Ad Hoc Networks,” IEEE Trans. Mobile Computing, vol. 2, no. 4, pp. 366-376, Oct.-Dec. 2003.
[20] R. Groenevelt, E. Altman, and P. Nain, “Relaying in Mobile Ad Hoc Networks: The Brownian Motion Mobility Model,” J. Wireless Networks (WINET ’06), vol. 12, pp. 561-571, May 2006.
[21] T. Spyropoulos, K. Psounis, and C.S. Raghavendra, “Performance Analysis of Mobility-Assisted Routing,” Proc. ACM Mobi Hoc, pp. 49-60, May 2006.
[22] F. Bai, N. Sadagopan, B. Krishnamachari, and A. Helmy, “Modeling Path Duration Distributions in MANETs and Their Impact on Reactive Routing Protocols,” IEEE J. Selected Areas Comm., vol. 22, no. 7, pp. 1357-1373, Sept. 2004.
[23] Y. Han, R.J. La, and A.M. Makowski, “Distribution of Path Durations in Mobile Ad-Hoc Networks—Palm’s Theorem at Work,” Proc. 16th ITC Specialist Seminar Performance Evaluation of Wireless and Mobile Systems, Aug./Sept. 2004.