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Analysis of Nodes Behavior Inconsistency on Reputation System and Reduction in Manet

M.Viswanathan

Assistant Professor, Department of Computer Science, School of Engineering and Technology, Madawalabu University, Bale Robe, Ethiopia

Abstract: **A MANET is a type of ad hoc network that can change locations and configure itself on the fly. Because MANETS are mobile, they use wireless connections to connect to various networks. We Propose 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. And also we proposed an approach to find and select routes, which accounts for the expected data transfer time over the path and allows reducing the overhead of reactive routing protocols. We propose schemes based on the reputation system, which use mobility as an asset to reduce uncertainty in far-flung nodes and reduce the overall uncertainty in the network proactively.**

Keywords: **Reputation system, Random Direction Mobility Model, Intra Region and Inter Region Trust Information collection.**

I. INTRODUCTION

A MANET is an autonomous collection of mobile users that communicate over relatively bandwidth constrained wireless links. Since the nodes are mobile, the network topology may change rapidly and unpredictably over time. The network is decentralized, where all network activity including discovering the topology and delivering messages must be executed by the nodes themselves, i.e., routing functionality will be incorporated into mobile nodes. Security protocol designers for mobile ad hoc networks (MANETs) face technical challenges due to severe resource constraints in bandwidth, memory size, battery life, computational power, and unique wireless characteristics such as openness to eavesdropping, high security threats or vulnerability, unreliable communication, and rapid changes in topologies or memberships due to user mobility or node failure. Security in a tactical network includes notions of communications security which is amenable to quantification and analysis, as well as the perception of security which is harder to quantify. The concept of trust is important to communication and network protocol designers where establishing trust relationships among participating nodes is critical to enabling collaborative optimization of system metrics. The main features of trust in MANETs are as follows

1. A decision method to determine trust against an entity should be fully distributed since the existence of a trusted third party (such as a trusted centralized certification authority) cannot be assumed.
2. Trust should be determined in a highly customizable manner without excessive computation and communication load, while also capturing the complexities of the trust relationship.
3. A trust decision framework for MANETs should not assume that all nodes are cooperative. In resource-restricted environments, selfishness is likely to be prevalent over cooperation, for example, in order to save battery life or computational power.
4. Trust is dynamic, not static.
5. Trust is subjective.
6. Trust is not necessarily transitive. The fact that A trusts B and B trusts C does not imply that A trusts C.
7. Trust is asymmetric and not necessarily reciprocal.

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II. RELATED WORK

Related works are as follows:

- Feng Li Indianapolis Jie Wu, Philadelphia proposed to Evaluating and quantifying trust stimulates collaboration in mobile ad hoc networks (MANETs). Many existing reputation systems sharply divide the trust value into right or wrong, thus ignoring another core dimension of trust: uncertainty. As uncertainty deeply impacts a node's anticipation of others' behavior and decisions during interaction, we include uncertainty in the reputation system. Specifically, we define a new uncertainty model to directly reflect a node's confidence in the sufficiency of its past experience, and study how the collection of trust information affects uncertainty in nodes' opinions. After defining a way to reveal and compute the uncertainty in trust opinions, we exploit mobility, one of the important characteristics of MANETs, to efficiently reduce uncertainty and to speed up trust convergence. Two different categories of mobility-assisted uncertainty reduction schemes are provided: the proactive schemes exploit mobile nodes to collect and broadcast trust information to achieve trust convergence; the reactive schemes provide the mobile nodes methods to get authenticated and bring their reputation in the original region to the destination region. Both of the schemes offer a controllable trade-off between delay, cost, and uncertainty. Extensive analytical and simulation results are presented to support our uncertainty model and mobility-assisted reduction schemes [1].

- Feng Li, Jie Wu proposed to Evaluating and quantifying trust stimulates collaboration in mobile ad hoc networks (MANETs). Many existing reputation systems sharply divide the trust value into right or wrong, thus ignoring another core dimension of trust: uncertainty. As uncertainty deeply impacts a node's anticipation of others' behaviour and decisions during interaction, we include uncertainty in the reputation system. Specifically, we use an uncertainty metric to directly reflect a node's confidence in the sufficiency of its past experience, and study how the collection of trust information may affect uncertainty in nodes' opinions. Higher uncertainty leads to higher transaction cost and reduced acceptance of communication and cooperation. After defining a way to reveal and compute the uncertainty in trust opinions, we exploit mobility, one of the important characteristics of MANETs, to efficiently reduce uncertainty and to speed up trust convergence. A two-level mobility assisted uncertainty reduction scheme (MAURS) that offers controllable trade-off between time and cost to achieve a convergence objective of trust is also provided. Extensive analytical and simulation results are presented to support our proposal [2].

- Jie Wu and Fei Dai proposed an efficient broadcast scheme in mobile ad hoc networks. The objective is to determine a small set of forward nodes to ensure full coverage. We first study several methods to select a small forward node set assuming that the neighbourhood information can be updated in a timely manner. Then we consider a general case, where each node updates its neighbourhood information based on a pre-defined frequency and node movement is upper bounded. Under this model, a neighbour at the start of an update interval may not be a neighbour during the broadcast process. We then propose a solution using two transmission ranges. The neighbourhood information as well as the forward node set is determined based on a short transmission range while the broadcast process is done on a long transmission range. The difference between these two ranges is based on the update frequency and the speed of node movement. Using two ranges, we extend Wu and Dai's coverage condition for broadcasting in a network with mobile nodes. We also study the use of the difference between two ranges as a controllable parameter to balance between broadcast redundancy and broadcast delivery ratio. The simulation study is conducted to evaluate the coverage of the proposed scheme [8].

I. Mobility for Uncertainty Reduction:

Node movement increases the chance for potential contactors to gather more trust information and evidence, thus enlarging the scope of reputation qualified candidate nodes for future tasks. We present a detailed discussion on the effect of mobility on uncertainty reduction in this section. Assume that trust events happen at a uniform rate ½ between each pair of one hop neighbours. Each node's actual behaviour is consistent and can be described as μ as in [6], which is the probability that a node will be honest in the trust events. A node's average moving speed is v. The moving cost per unit distance is cm. The unit cost of the trust event (such as one message exchange) is ce. We use the total cost and total convergence time to study the uncertainty reduction efficiency of each mobility model. Here a theorem is established to continue the research. Umax is an uncertainty threshold that nodes are required to satisfy before we begin any trust based MANET application.

Theorem 1: (Pause Time) In each step, a pair of nodes should interact at least 3 Umax¡1 times to satisfy the uncertainty threshold requirement.

Proof: We require: u • Umax and compute u as in

Definition 1: We use x = ® + ¯ to represent total number of interactions. For a given x, when ® = ¯ = x 2 , u achieves maximality. So x ¸ 3 Umax ¡ 1 guarantees that u • Umax.

To analyze the Effect of Random Waypoint Model we first analyze the effect of mobility based on a realistic mode l: random waypoint model. Using this model, nodes will have a new neighbourhood during each pause time. A node can contact and observe its new neighbours directly. The results of these direct contacts increase the ® or ¯ in both nodes' first hand opinion, therefore reducing uncertainty. However, the randomness also restricts the use of second-hand information .In each pause time, the disbelief and uncertainty between the newly encountered nodes are uncontrollable. In most cases, there commendations from the new neighbours are useless. Hence the trust information propagation mechanism in our reputation system is not fully utilized. Applications such as reputation based routing are also hard to deploy under this model.

II. Mobility Assisted Uncertainty Reduction Scheme:

When the requirement is a short convergence time to quickly start a trust-based application, or a controllable cost, the above two mobility models will offer extreme options. However, these two methods are not flexible enough and we lack a way to find a trade-off between convergence time and cost to satisfy different application objectives. Here we present a two level controlled mobility model which is called MAURS. In MAURS, we divide the whole network into several regions, allowing each region to contain a specified number of grids, and choose mobility models for intra- and inter-region movement. MAURS combines the advantages of the above two models and offers more options for MANET implementation. The design of the MAURS consists of the following three parts:

A. Moving Node Election

After the cluster has been set up, all the nodes in the cluster will contact each other locally, build up trust, and compute reputation according to the previously discussed reputation system. After a sufficient pause time, each node will vote for the node with the largest belief and smallest uncertainty to move. The voting process can be described as Algorithm 1. Here Bmin is the belief threshold. ¸ is the required proportion of votes to win an election. Umax, Bmin and ¸ should be regulated in the clusters' voting policy and represent the reputation requirements for a moving node. Each node sets a pause timer and will cast only one vote after timeout to which grid they belong to.

Algorithm 1 Vote for Move:

While the timer lasts **do**
  If an event occurs **then**
    Get first hand observation and change α, β accordingly;
  end if;
  if a recommendation comes **then**
   Update second-hand opinion accordingly;
  end if;
end while;
  compute combined opinion b,d,u for each node;
if the largest b in all the opinion satisfy $b>=B_{min}$ **then**
  vote the node with the largest b;
  wait for the confirmation from elected moving node;
else
  continue trust information collection;
end if;

Algorithm 2 Vote Gathering:

Vote counter+1 when a vote comes;
If vote counter >=λ proportion of the nodes in the cluster **then**

Node broadcasts an elected confirmation and starts to move;

end if;

The network is then divided into a number of regions. Each region selects one grid to be its “capital”. All of the elected moving nodes move to the capital of the region. The moving nodes will repeat the local contact process after they arrive in the capital. The pause time period in the capital allows them to build trust between each other and the local nodes of the capital. One node which is commonly trusted by all moving nodes will be elected to be the “keeper” of that region through a process similar to Algorithm 1 and 2. The keeper will select several nodes it trusts as “ambassadors” which will travel between regions to collect information and feed it back to the keeper.

B. Region Partition:

The election process creates different roles to handle different trust information collection and dissemination tasks for intra-grid, intra-region and inter-region. As we will use different methods to handle different classes of tasks, how to partition the region becomes an important design issues. The analysis of the town hall and traveling preacher models show that the cost in the town hall model is positively proportional to the square of the number of moving nodes, while the total pause time of the traveling preacher model is decided by the number of stops. To offer a more flexible uncertainty reduction oriented mobility model, we can choose an optimal number of regions based on node density, network scale, and application related cost and convergence time objectives. For a 2k £ 2k network, 20 £ 20; 21 £ 21 till 2k £ 2k are possible region sizes. We can compute the convergence time and cost for each of these possible region sizes and select the optimal one as the scheme for region partition.

C. Moving Pattern control:

As we divide the network into regions consisting of grids, an optimal moving pattern for the inter- and intra-region levels must be selected. For the intra-region level, we select an extension of the town hall method. Each grid elects a commonly trusted moving representative, and these nodes move to the capital to exchange intra-region trust information. For the inter-region level, a method will be chosen according to the number of regions and the distance between capitals. Possible moving patterns for inter-region level are town hall, traveling preacher and another straightforward model which we call exchange ambassadors. Using the town hall model will largely increase the uncertainty decay in recommendations from other regions. Considering a limited number of regions, an extension of traveling preacher model can be applied and the time burden will be acceptable. In this extension, each region sends an ambassador to travel around the capitals and collect information only for its home region. Exchange ambassadors means each pair of regions exchange ambassadors which collect trust information for their home regions. It is a high cost and low convergence time method and is especially suitable for a small number of regions. The main problem with this method is the ambassador selection. The keeper may not be able to find as many trustable ambassadors as it needs from the capital.

III. PROPOSED WORK

A. Objective:

My Proposed work of this project is to include a new uncertainty model to directly reflect a node’s confidence in the sufficiency of its past experience, and study how the collection of trust information affects uncertainty in nodes’ opinions. We exploit mobility, one of the important characteristics of MANETs, to efficiently reduce uncertainty and to speed up trust convergence.

B. System Architecture:

We propose moving node election based on reliable Trust establishment scheme .The reactive schemes focus on dispatching mobile ambassadors to authenticate moving nodes and forward the moving nodes’ original reputation to the new destination through recommendation. We also offer flexibility for users to achieve their application objectives from a range of tradeoffs between delay, cost, and uncertainty provided by the proposed schemes. We analyze the uncertainty reduction effects under various mobility scenarios. This diagram describes, there are more no of mobile nodes are there. The nodes are in mobile manner. Each and every node must be select the region for where it is located. The trust evaluation can be calculated with the help of providing authentication. Then it will collect the trust information and gathering votes for that node based on the trust. The Region will be portioned as form of grids. Each and every grid must contain the capital node and keeper node. Group of grids are there. The Trust information disseminate to all the grids.

Because the Head node must be in a movable manner and it provides the trust information. So it is possible to find out the unauthorized node and the trust information will be provided to the Home region.

Modules

i. Design of Mobility Assisted Uncertainty Reduction Proactive Scheme:

Set the wireless communication range to 1 unit of distance. Each node in a cluster knows which grid it belongs to and the number of nodes in the same cluster. In this module we analyze the trade-offs between delay, cost, and uncertainty in different mobility-assisted uncertainty reduction schemes, so as to provide flexible and controllable methods to support reputation-based applications in MANETs.

ii. Grid based Region Partitioning:

The network is divided into regions having equal number of nodes. Regions are divided into grids. Grid with keeper is chosen to be the capital of the region. All nodes in the network travel to one grid, pause for a sufficient time, build up trust, and reduce the uncertainty of other nodes to a required degree. After that, all nodes move back and will be able to perform tasks that demand remote nodes to cooperate and have trust requirements. We can approximate this model as all nodes start moving from the center of their grid, to the center of the network, pause for some time, and move back. The town hall model will lead to a relatively short convergence time with an extremely high cost.

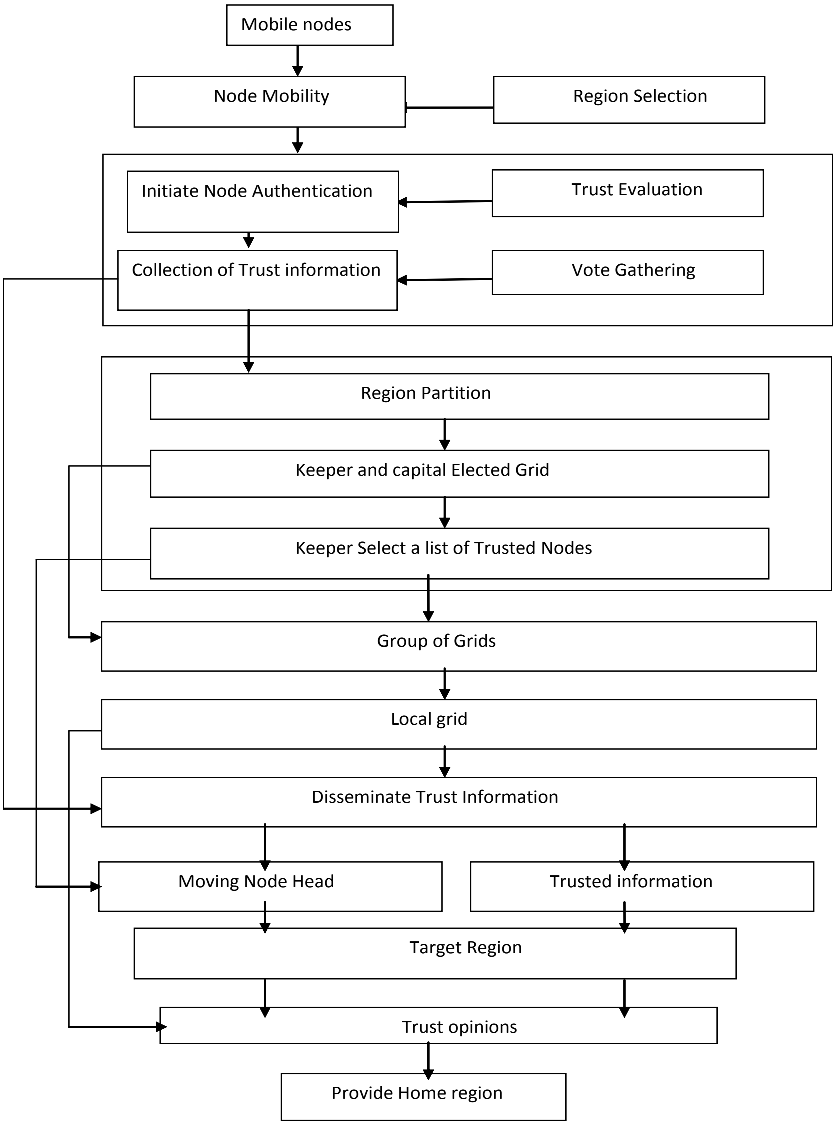

Fig.1 Overall Proposed work Architecture

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iii. Intra Region Trust Information Collection:

The moving nodes repeat the local contact process after they arrive in the capital. The pause time period in the capital allows them to build trust between each other and the local nodes of the capital. The election process creates different roles to handle different trust information collection and dissemination tasks for intragrid, intraregion, and interregion. In this Module first Keeper selects a list of trusted nodes to move and then Moving nodes directed to a group of grids. Next keeper disseminates the trust information gathered from the capital and contacts the local nodes of the grid. Then group head build-up Trust opinions. Finally moving node set feedback to the keeper and other nodes.

iv. Inter region Trust Information Collection and Dissemination:

One node, which is commonly trusted by all moving nodes, will be elected to be the keeper of that region through a process similar to Algorithms 1 and 2. The keeper selects several nodes it trusts as ambassadors, which will travel between regions to collect information and feed it back to the keeper.

In this module first keeper selects a list of trusted nodes. For each region a moving node is directed to act as an ambassador. The ambassador carries the trusted information sent by the keeper. The ambassador interacts with the local nodes of the target region. Finally ambassador Build up Trust opinions and Report to the trust opinions to the home region.

Data Flow Diagram

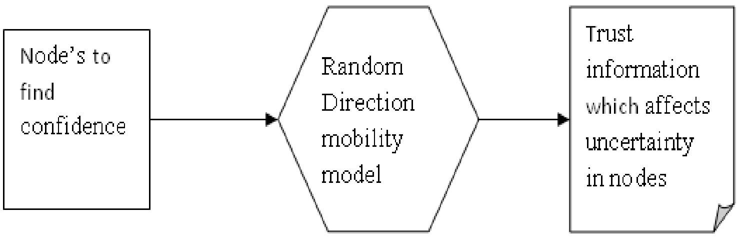

Fig.2 level 0 Data Flow Diagram

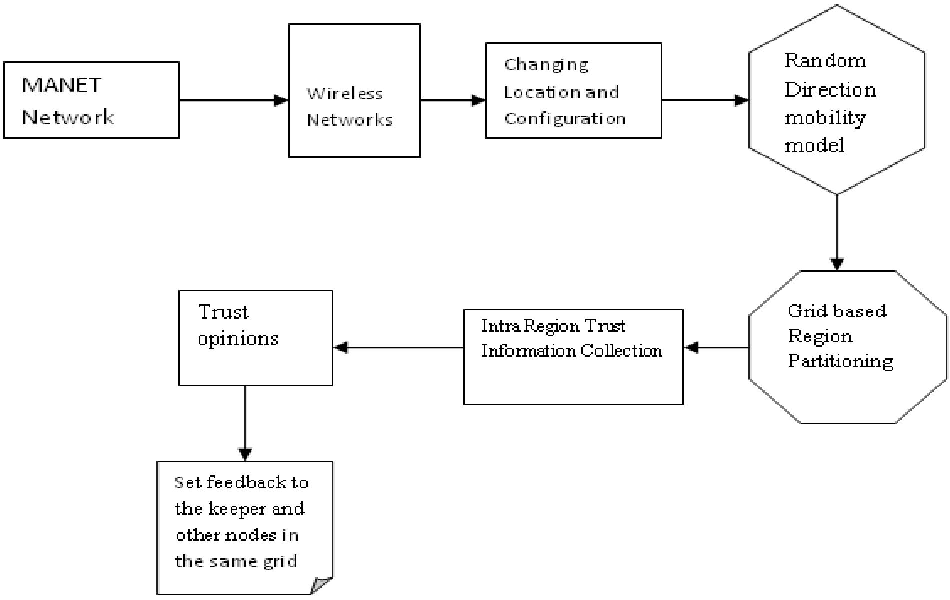

Fig.3 level 1 Data Flow Diagram

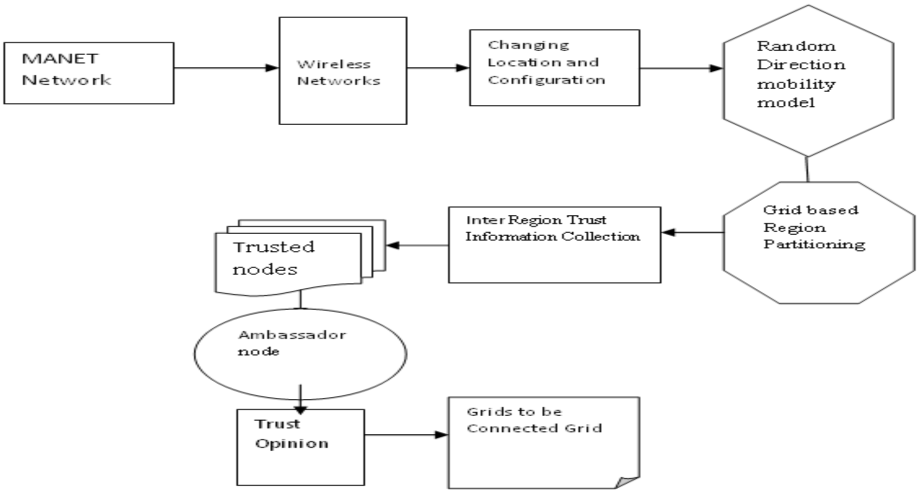

Fig.4 level 2 Data Flow Diagram

C. Techniques used in the Proposed System

i. Random Direction (RD) mobility model

Here we focus on bi-dimensional random mobility, and we consider nodes moving according to the Random Direction (RD) mobility model, which was first introduced in. According to such model, each node alternates periods of movement (move phase) to periods during which it pauses (pause phase); at the beginning of each move phase, a node independently selects its new direction and speed of movement. Speed and direction are kept constant for the whole duration of the node move phase .The main contributions of our work are as follows. 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 node position, given an assigned initial condition. Closed-form expressions for the temporal evolution of the distribution moments can also be derived directly from the transformation.

The Random Direction Mobility Model was created in order to overcome a flaw discovered in the Random Waypoint Mobility Model. MNs using the Random Waypoint Mobility Model often choose new destinations, and the probability of choosing a new destination that is located in the center of the simulation area, or requires travel through the middle of the simulation area, is high. Royer states that MNs moving with the Random Waypoint Mobility Model appear to converge, disperse, converge again, etc.1 In order to alleviate this type random direction of behavior and promote a semi-constant number of neighbors, the Random Direction Mobility Model was developed. In this model, MNs choose a in which to travel instead of a random destination. After choosing a random direction, an MN travels to the border of the simulation area in that direction. As soon as the boundary is reached the MN stops for a certain period of time, chooses another angular direction (between 0 and 180 degrees) and continues the process. Figure 3 shows an example path of an MN, which begins at the center of the simulation area or (250,250), using the Random Direction Mobility Model.

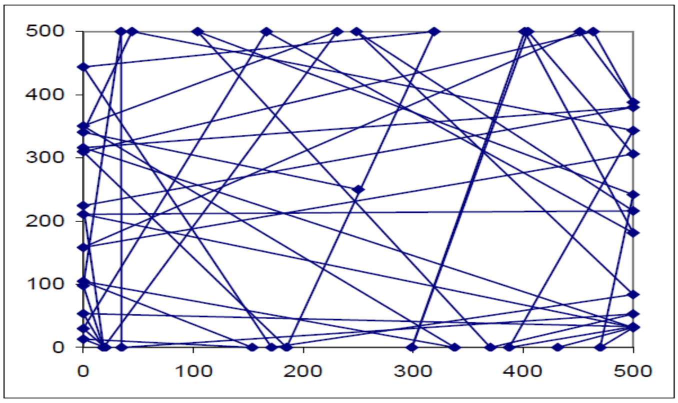

Fig.5 Travelling pattern of an MN using the Random Direction Mobility Model

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IV. CONCLUSION

We define a new uncertainty model to directly reflect a node's confidence in the sufficiency of its past experience, and study how the collection of trust information affects uncertainty in nodes' opinions. We exploit mobility, one of the important characteristics of MANETs, to efficiently reduce uncertainty and to speed up trust convergence. We Propose 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. And also we proposed an approach to find and select routes, which accounts for the expected data transfer time over the path and allows reducing the overhead of reactive routing protocols. We propose schemes based on the reputation system, which use mobility as an asset to reduce uncertainty in far-flung nodes and reduce the overall uncertainty in the network proactively.

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