

DEBRA: DELIVERY Based Reputation Mechanism for Ad hoc Networks



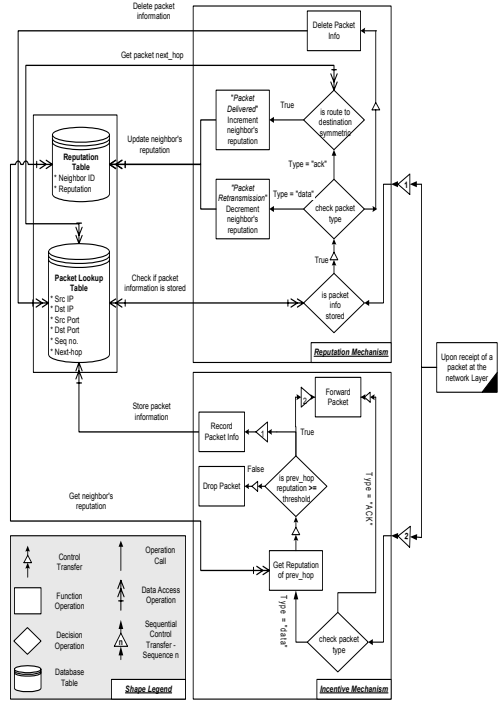
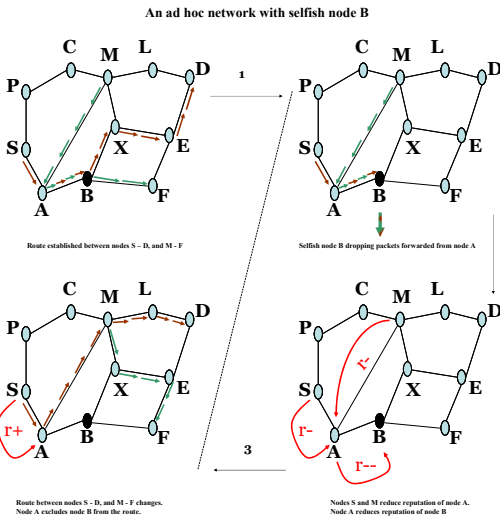
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Motivation

As ad hoc networks move from research and military applications to commercial deployments, it is important that they incorporate methods to discourage selfish behavior and detect attempts to disrupt network operation. In this work, we present DEBRA, a reputation mechanism to detect and isolate selfish behavior of nodes in an ad hoc network.

General Concept

- A node evaluates its neighbors based on completion of the requested service(s)
- DEBRA is an application of this principle to the routing functionality.
- When a node transmits a packet through one of its neighbors it holds the neighbor responsible for the correct delivery of the packet to the destination.
- Indication of delivery success or failure is obtained from destination feedback.



Advantages of DEBRA

- Robust to collusion
- Routing protocol independent
- No communication overhead
- Works with directional transmission

DEBRA Parameters

- Initial reputation value r_0
- Minimum reputation threshold r_{thresh}
- Maximum reputation threshold r_{max}
- Choice of δ (affects the performance of DEBRA):
 - A conservative mode of operation = slower isolation + fewer false positives
 - An aggressive mode of operation = faster isolation + considerable number of false positives

Three Reputation Function Schemes

- Double Decrement/Single Increment Ratio (DDSIIR)
 - Successful packet delivery \rightarrow Increment the reputation of the next-hop neighbor by n
 - Failed packet delivery \rightarrow Decrement the reputation of the neighbor by $2n$
- Hops Away From Source (HAFS)
 - Successful packet delivery \rightarrow Increment the reputation of the next-hop neighbor by n
 - Failed packet delivery \rightarrow Decrement the reputation of the neighbor by $2n + h * m$
- Random Early Probation (REP)
 - The probability of a node's participation in a route with a neighbor is a function of its reputation in that neighbor's table

n and m are constants. h is the number of hops from destination.

Comparing DEBRA to defenseless mechanism

- The presence of selfish nodes in the network decreases goodput by over 11%
- DEBRA limits that decrease to less than 5.5%

Future Work

- Investigating the effect of mobility on the performance of the protocol
- Assess the protocol's robustness to collusion
- Application of DEBRA in the absence of a reliable transport protocol

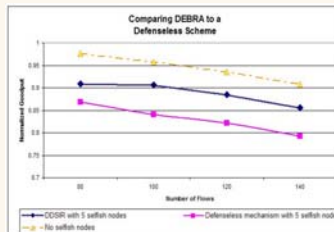
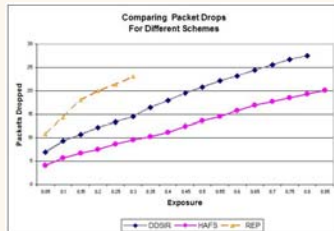
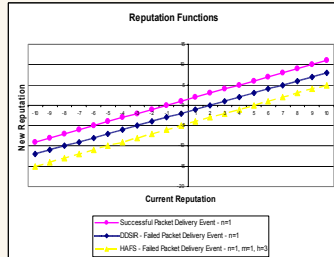


Table: Comparison between different values of δ , δ_{max} and δ_{thresh} for $r_0 = 50$. Percentage of isolated selfish nodes and false positives are averaged over 10, 600 second simulations.

δ thresh	5	15	25
10	-Isolation: 100% at 208.5 -False Pos: 4.1%	-Isolation: 95% at 220.5 -False Pos: 3.2%	-Isolation: 75% at 335 -False Pos: 1.3%
20	-Isolation: 95% at 163.5 -False Pos: 3.7%	-Isolation: 90% at 270 -False Pos: 1.8%	-Isolation: 70% at 295 -False Pos: 0.9%
30	-Isolation: 95% at 153 -False Pos: 3.4%	-Isolation: 95% at 232.5 -False Pos: 1.1%	-Isolation: 65% at 445 -False Pos: 0.7%

