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Transmission Range Influence On Secure Routing In VANETS

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Authors: A.Slama and I. Lengliz

Presenter: Dr Afef Slama
HANA Laboratory
University of Manouba
La Manouba, Tunisia
slama.afef@hotmail.fr

Presenter

Dr. Afef Slama
Email: slama.afef@hotmail.fr

Professional Experience

- Research assistant at the Higher School of Economic and Commercial Sciences of Tunis
- Member of HANA Laboratory

Publications & Activities

- A. Slama and I. lengliz, "Enhancing VANET's Secure Routing with the Trust Metric", 2019 International Symposium on Networks, Computers and Communications (ISNCC), June 2019.
- A. Slama and I. lengliz, "Survey on secure routing in VANETs", International Journal of Network Security & Its Applications (IJNSA), vol. 11, pp. 71-87, May 2019.
- A. Slama, I. lengliz and A. Belghith, "TCSR: an AIMD Trust-based Protocol for Secure Routing in VANET", 2018 International Conference on Smart Communications and Networking (SmartNets), November 2018.
- I. Lengliz and A. Slama, "Enhancing VANETs' Routing Operation with the Route Life Time Policy", International Journal of Computer Applications (IJCA), vol. 164, pp. 35-40, April 2017.
- I. Lengliz and A. Slama, "Enhancing AODV and DSR with the RLT strategy for efficient Routing in VANETs", 2016 International Symposium on Networks, Computers and Communications (ISNCC), May 2016.

Outline

1. Introduction
2. DSR-RLT
3. TCSR Protocol
4. Comparison
5. Conclusion and future work

Introduction

Routing in Vehicular Ad Hoc Networks (VANETs) is still a challenging issue due to intrinsic characteristics:

- Strong mobility of the nodes
- Highly dynamic and specific topology
- Significant loss rate
- Very short duration of communication

- Ad Hoc mode
- Frequent link failures

Introduction

Routing in Vehicular Ad Hoc Networks (VANETs) is still a challenging issue due to intrinsic characteristics:

Typical VANET applications can be broadly classified into four types

- Safety and collision avoidance
- Traffic infrastructure management
- Vehicle telematics
- Entertainment services and Internet connectivity

Routing in VANETs is among the most important concerns to ensure correct and safe data transfer for these applications

Introduction

- **Routing** is the process of selecting best paths in a network.
  It is a problem of optimization aiming at finding the shortest way between a source and a destination.

The strong mobility, the error-prone wireless medium and scarce resources in the network do impose specific constraints in the design of any VANET routing protocol.

- To address this issue several proposals have been presented and evaluated in the literature such as DSR-RLT and TCSR.

In this paper, we propose a comparative study of DSR-RLT and TCSR routing protocols in a highway to evaluate their performances in terms of transmission range variation.

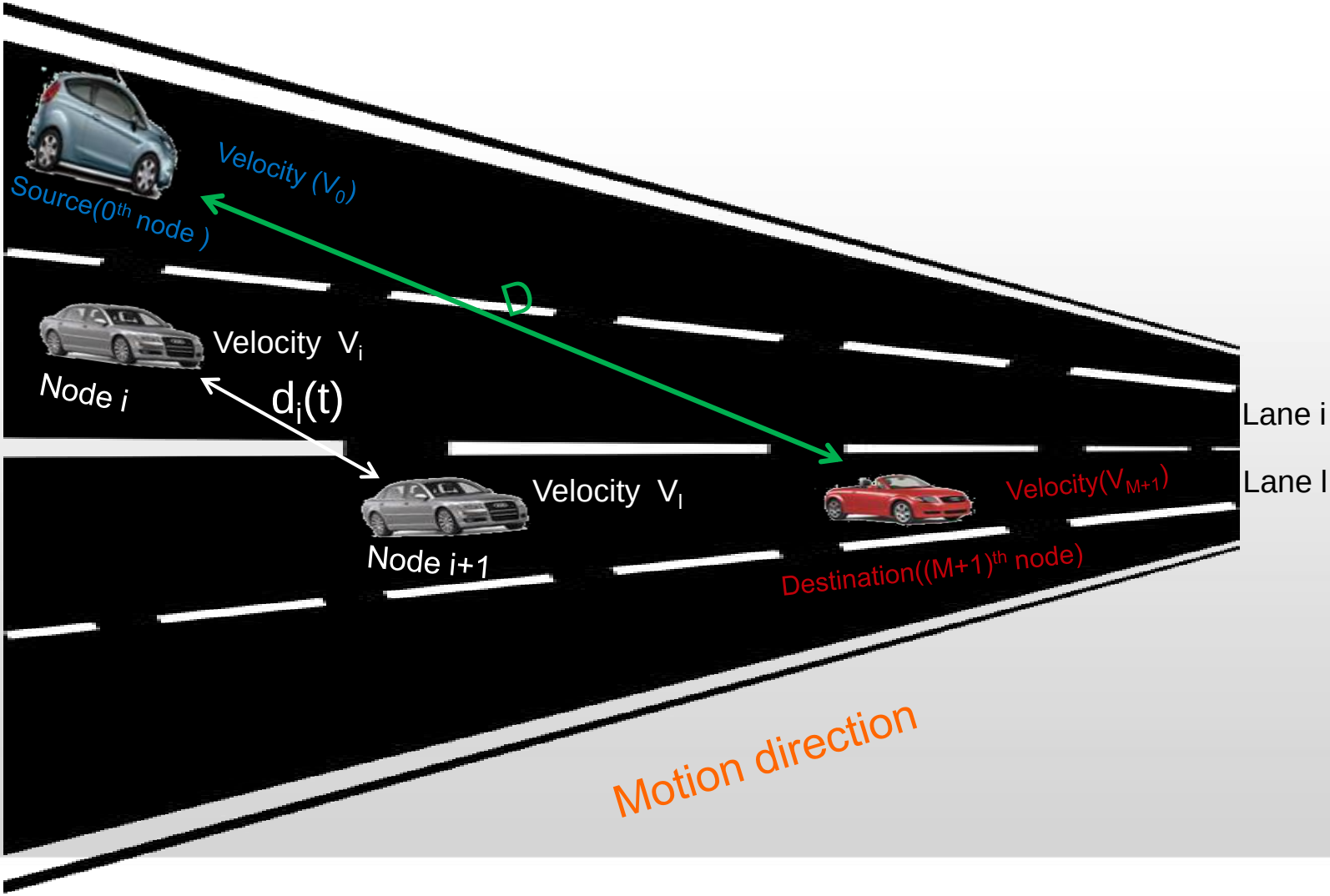
DSR-RLT

For a given approximation of the optimal number of hops in a VANET, the RLT policy seeks the optimal choice of next-hop based on:

- The node's speed
- The inter-node distance

- RLT policy considers vehicles moving in a L straight lines on the highway:
  - Each vehicle can establish connectivity only with other vehicles traveling in the same direction of its motion.
  - The positions of nodes are provided by the receiver's Global Positioning System **(GPS).**
  - Each vehicle in lane l has an associated speed limit s_l
    We follow the convention that s1< s2<. . . <sL

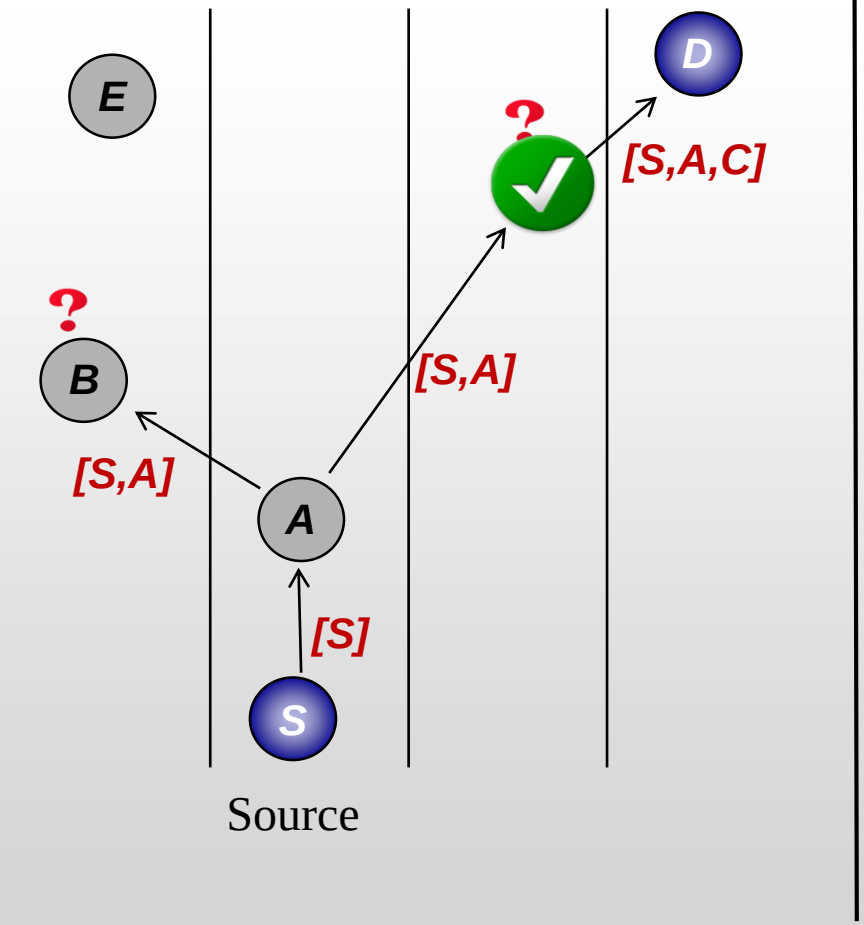
The RLT concept

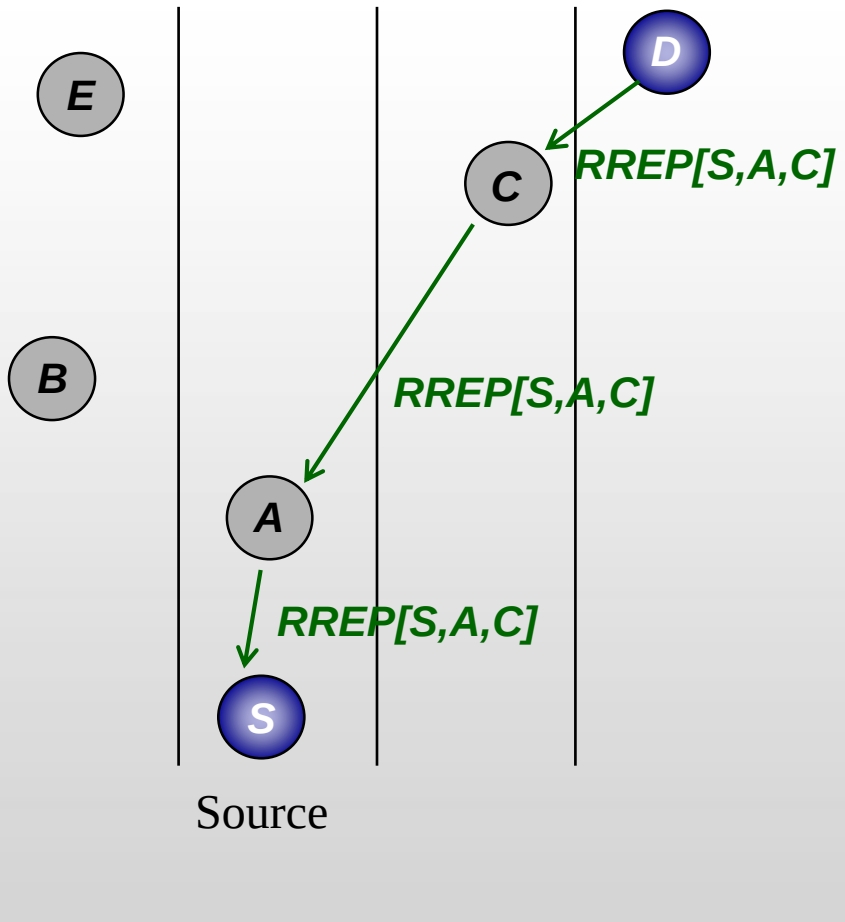


DSR-RLT

- DSR stores the whole path to destination in its routing table instead of next hop node unlike AODV

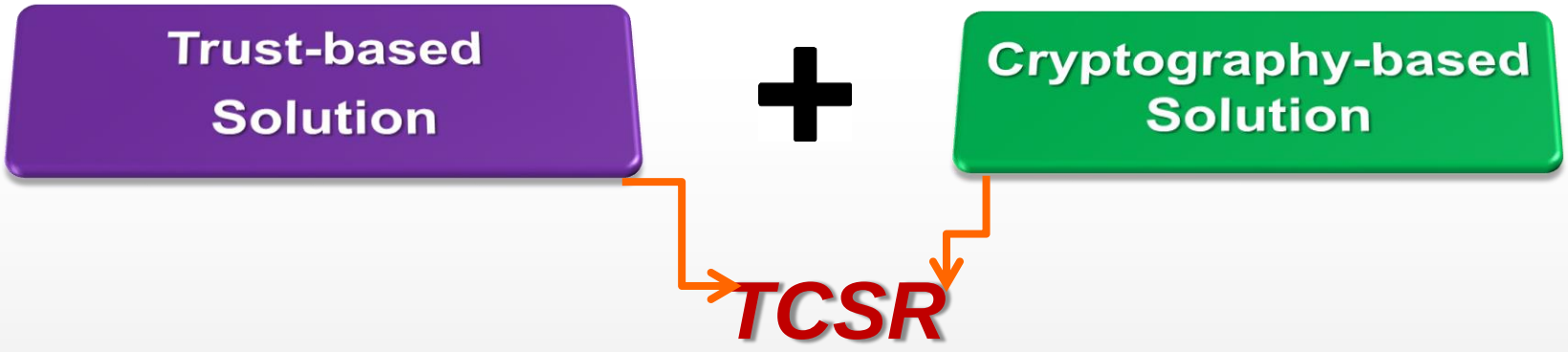
- Broadcasting RREQ





TCSR Protocol

- TCSR is a Trust Cryptographic Secure Routing Protocol based on the Additive Increase Multicative Decrease (AIMD) algorithm



***AIMD algorithm:* is used to compute the Trust level of each node (Tl_v)**

TCSR protocol operates in **two phases**

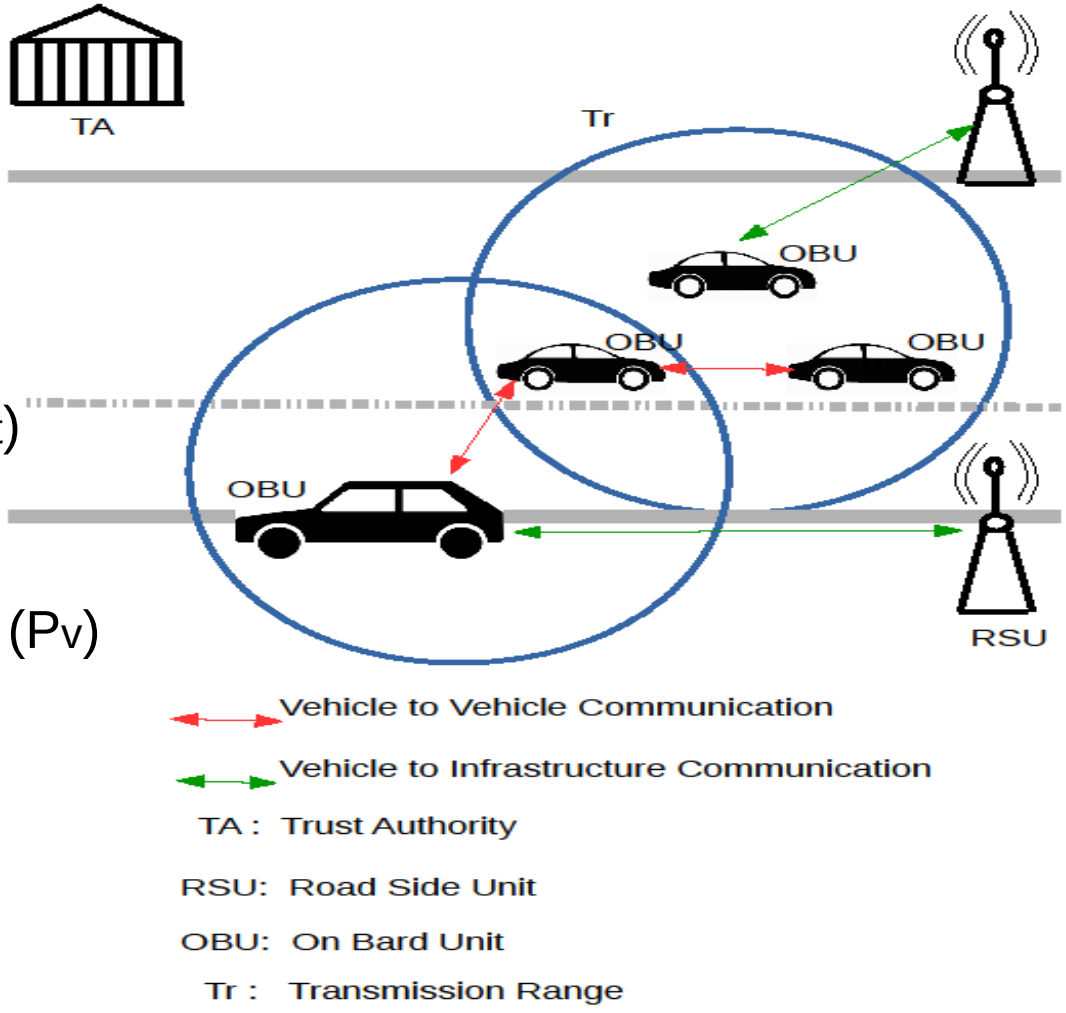
Trust phase which objective is to create a high trust-neighboring level for each node in the VANETs

Security phase which guarantees the privacy of the exchanged routing messag

TCSR Protocol

The network model and characteristics

- A set of vehicles
- The plausibility of time (P_t)
- The plausibility of velocity (P_v)
- The Trust level value (Tl_v)
  a value in [0,1]



TCSR Protocol

The TCSR process

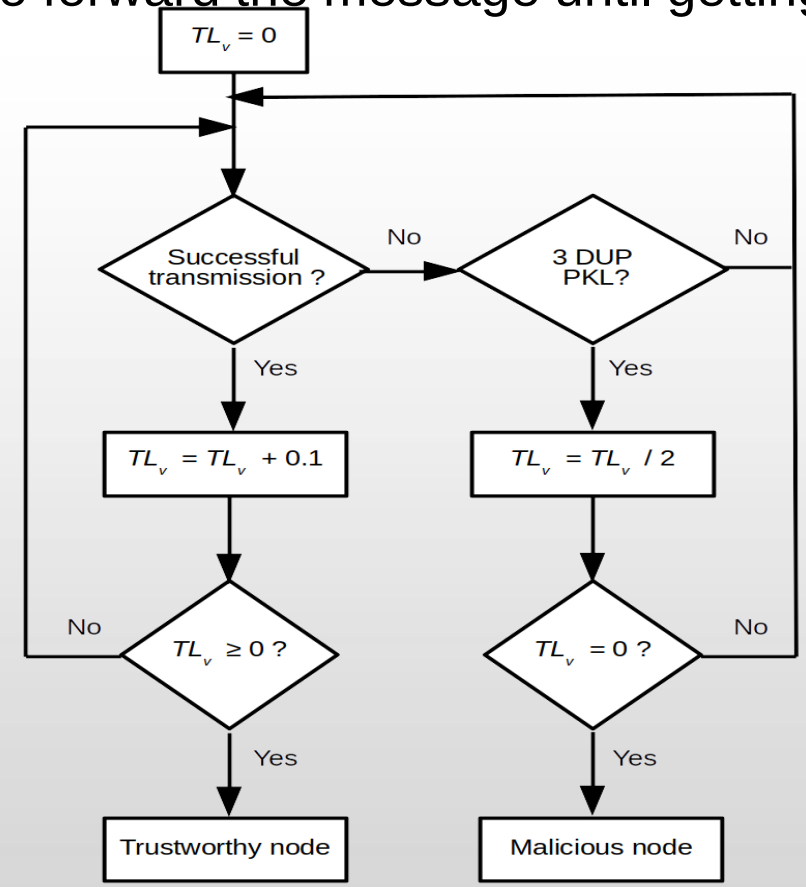
- The TCSR protocol starts computing the Trust level of each node in the VANET using the **AIMD algorithm**
  - After every successful packet transmission Tl_v is incremented by 0.1 to a maximum value of 1
  - On the occurrence of three successive packet losses, Tl_v is divided by two

$Tl_v = 0$ → **Malicious node**

$Tl_v \geq 0.5$ → **Trustworthy node**

TCSR Protocol

- When a vehicle v_k wants to communicate with a vehicle v_m outside its T_r it evaluates the Tl_v of its neighbors in order to select the most appropriate one to forward the message until getting the destination



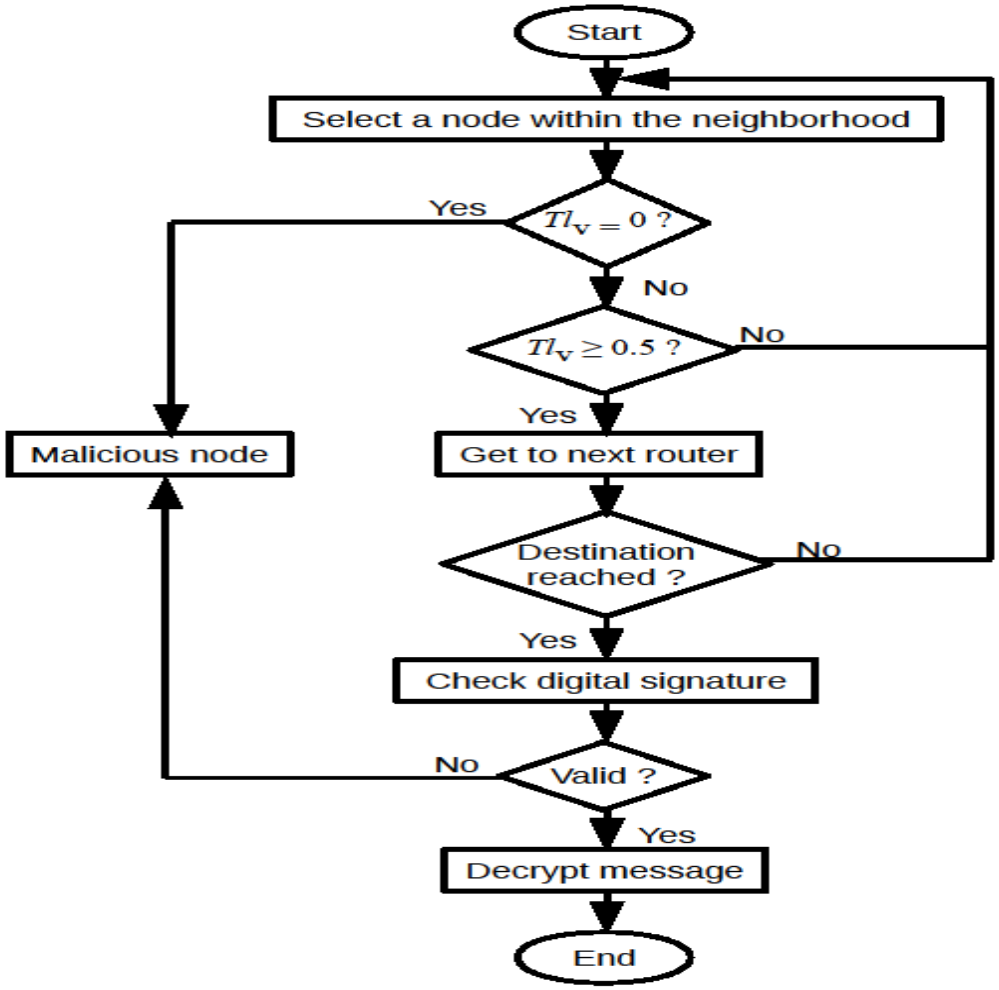
TCSR Protocol

- A series of plausibility checks launched to adjust the Tl_v

The Tl_v of the vehicle with the best P_t is incremented by 0.1

The Tl_v of the vehicle with the best P_v is incremented by 0.1

Security phase begins



TCSR Protocol

Trust phase

- Trust-based solutions are devoted to distributed and semi-centralised mo
- Trust traits **inside attacks**

Cryptograpy phase

- Cryptography is used for all authentication/authorization cases, confidential communication, and both non-repudiation and data integrity
- Cryptography adresses **outside attacks**

TCSR is an hybrid solution

Comparison

- Simulation parameters of a highway

Parameter	Value
MAC layer	MAC IEEE 802.11p
Node buffer size	50 packets
Propagation model	Two Ray Ground
Network bandwidth	6 Mbps
Packet length	100, 200 & 512 Kb
Communication range	100 - 700 m
Highway length	6 km
Number of lanes	6 (3 in each direction)
Time of simulation	1800 sec

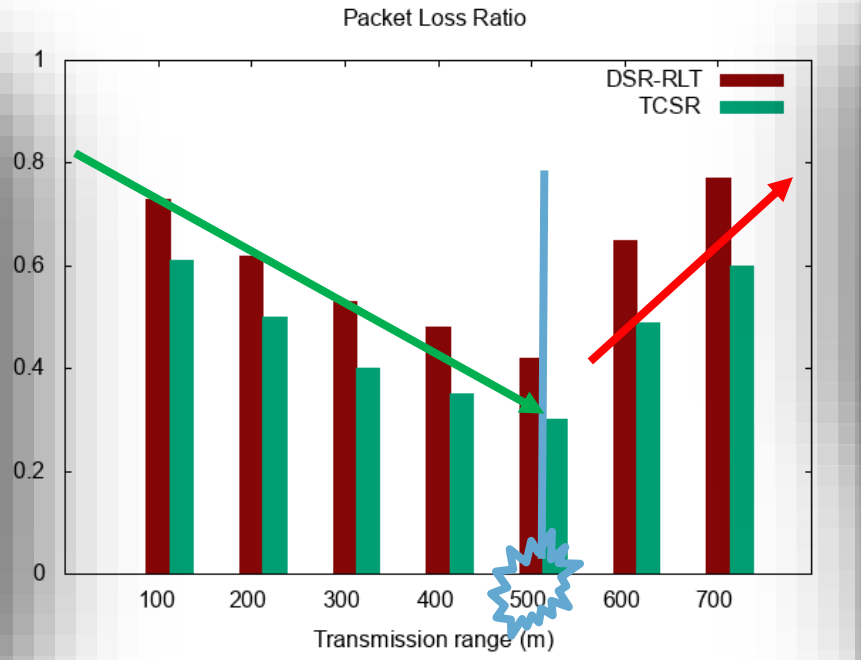
- The objective of this simulation is to study the impact of the variation of the transmission range on a secure VANET routing protocol.

Comparison

200 nodes (vehicles) with a speed of **110 km/h** were tested in the scenario to determine the impact of the network density on the TCSR and DSR-RLT secure routing process.

Packet Loss Ratio (PLR): calculates the loss rate of message delivery among vehicles within the same range of communication using single-hop messaging

Increasing the range of transmission with the maintenance of the number of vehicles reduces the number of jumps and thus ensures better connectivity that results in higher signal strength.

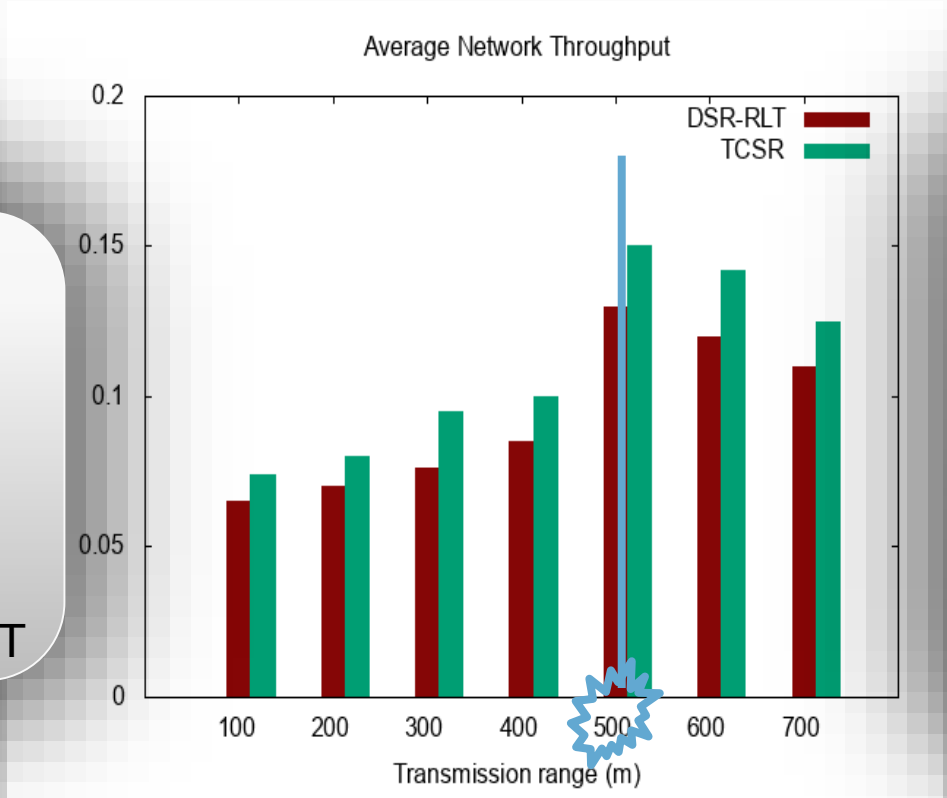


The conflict flow increases at the MAC layer resulting in a higher interference rate.

Better performance in terms of PLR for TCSR

Comprison

- **200** nodes (vehicles) with a speed of **110 km/h**
  - Average throughput: the total number of bits that the network transmits in one second

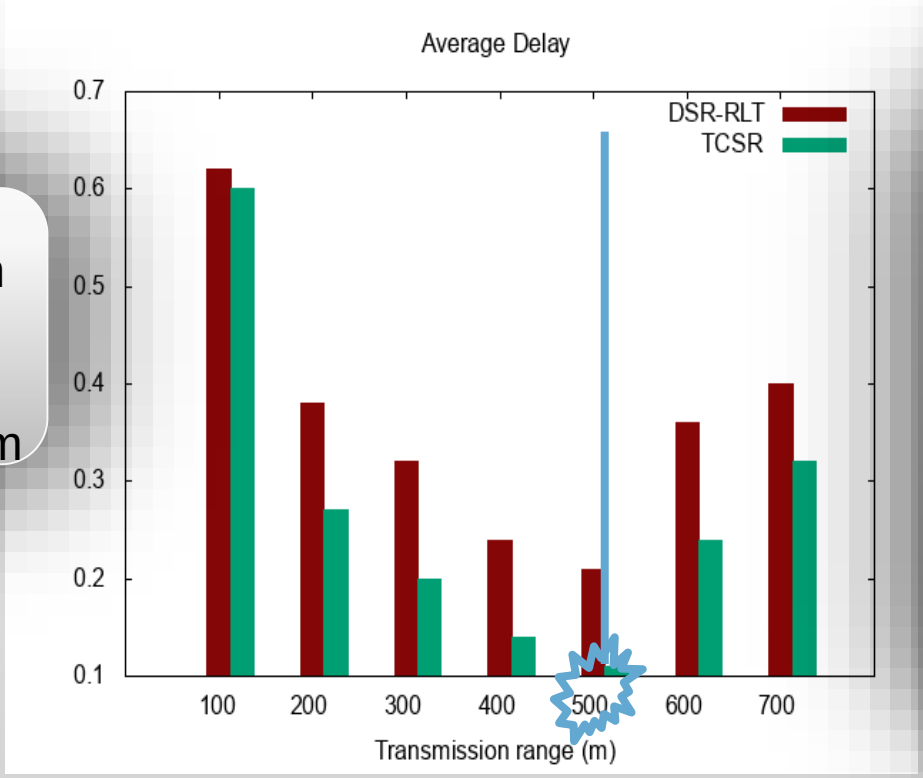


The decrease of the PLR increases the flow.
Average network throughput remains higher than the one provided by DSR-RLT

The average network throughput measured with the TCSR protocol decreases for the 600 m and 700 m transmission ranges.

Comparison

- **200** nodes (vehicles) with a speed of **110 km/h**
  - Average delay: represents the time period that needs to route a packet from the source to the destination

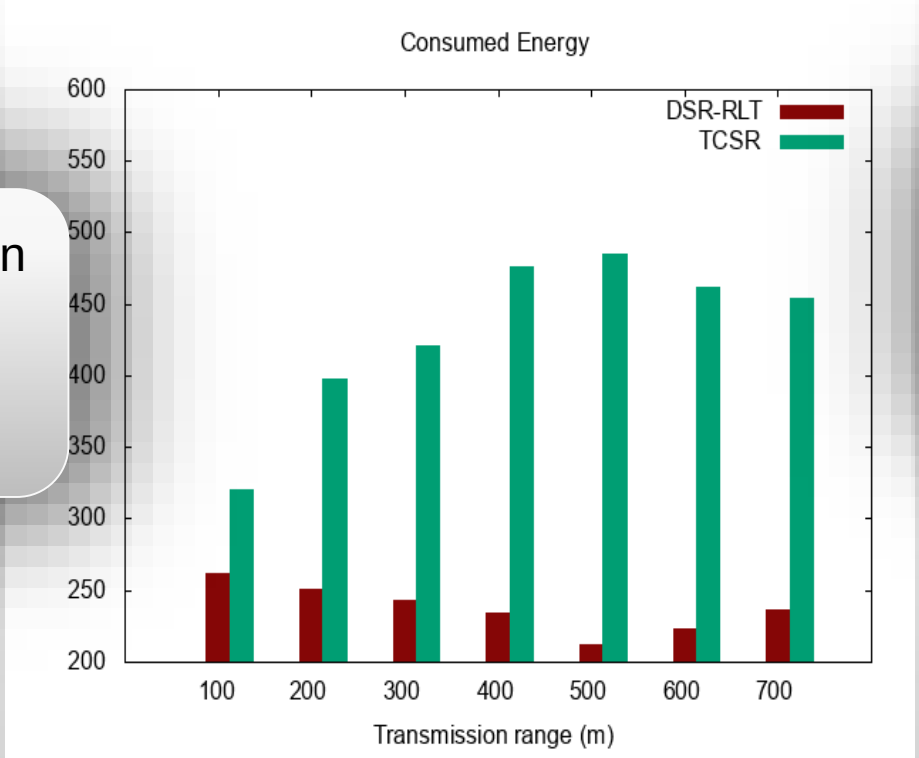


Better performance in terms of Average Delay for the **TCSR** protocol for T_r<=*500* m

T_r >500 m: the CSMA/CA rules limit communication to many nodes avoiding collisions which limits the reuse of bandwidth

Comparison

- **200** nodes (vehicles) with a speed of **110 km/h**
  - Total energy consumed: measures the energy consumed by nodes during the routing process



Better performance in terms of Consumed Energy for the **DSR-RLT** protocol

TCSR has the uppermost amount of consumed energy

Conclusion and future work

In this work :

- In this paper we presented a comparison between the TCSR protocol that uses the trust metric and the DSR-RLT protocol based on RLT policy
- We propose a comparative study of DSR-RLT and TCSR routing protocols in a highway to evaluate their performances in terms of transmission range variation.
- The simulation results show that TCSR exceeds DSR-RLT in terms of the packet loss ratio, average network throughput, and average delay.

Future work:

- For transmission range values strictly greater than 500 m, a study should be developed based on the variation of simulation parameters such as bandwidth and data packet size.
- It is interesting to design the Markov chain analytical model to evaluate the trust phase of the TCSR ptotocol to assess its performance when transmission range exceeds 500 m.

THANK YOU FOR YOUR ATTENTION

QUESTIONS