Content Downloading in Vehicular Ad-hoc Networks

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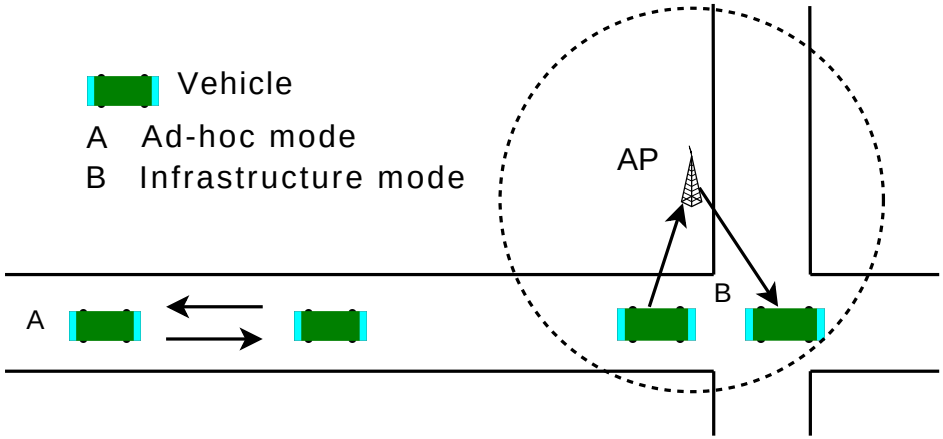
Vehicular Ad-Hoc Networks(VANETs)



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  1. Safety critical applications
  2. Convenience applications
  3. Comfort applications

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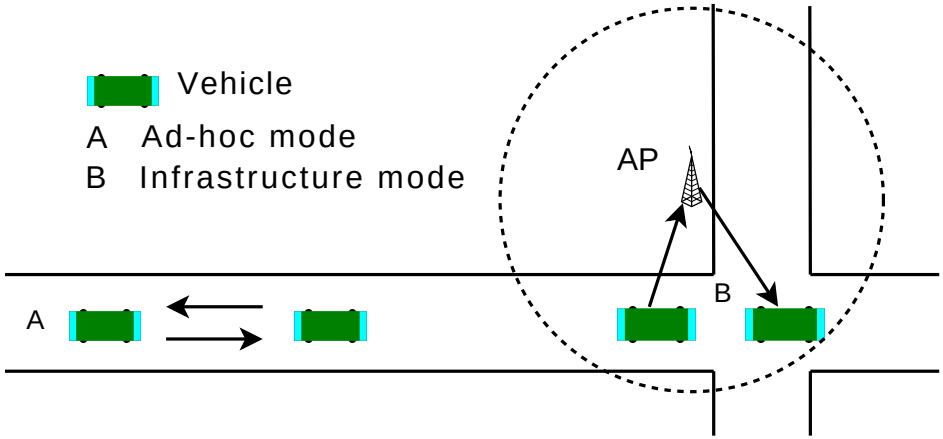

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  2. **Convenience applications**
     - Traffic management and coordination application
     - Parking availability
  3. **Comfort applications**
     - Audio and video streaming
     - Web-browsing, Email

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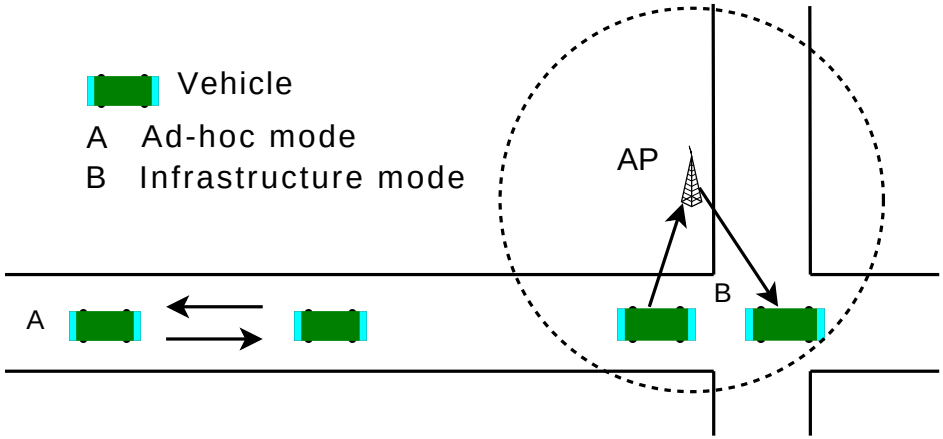

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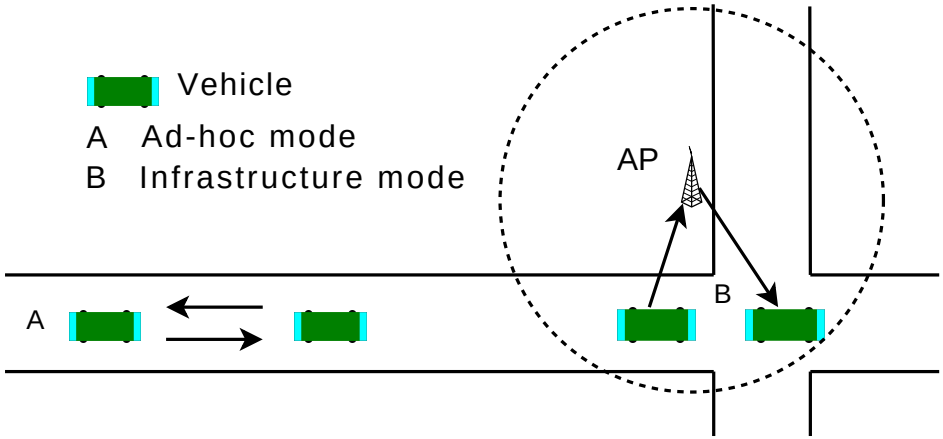
VANETs: advantages and disadvantages



- Advantages
  1. No energy or computational power limit
  2. **Positioning information**
  3. Highly predictable mobility
- Disadvantages
  1. Frequent network topology change due to vehicle mobility
  2. **Fleeting** communication between AP and vehicles
  3. **Intermittent** communication between AP and vehicles

Objectives

- Propose a scheme to efficiently download the contents from the AP for the vehicles in VANETs
  - As much as possible
  - As quick as possible

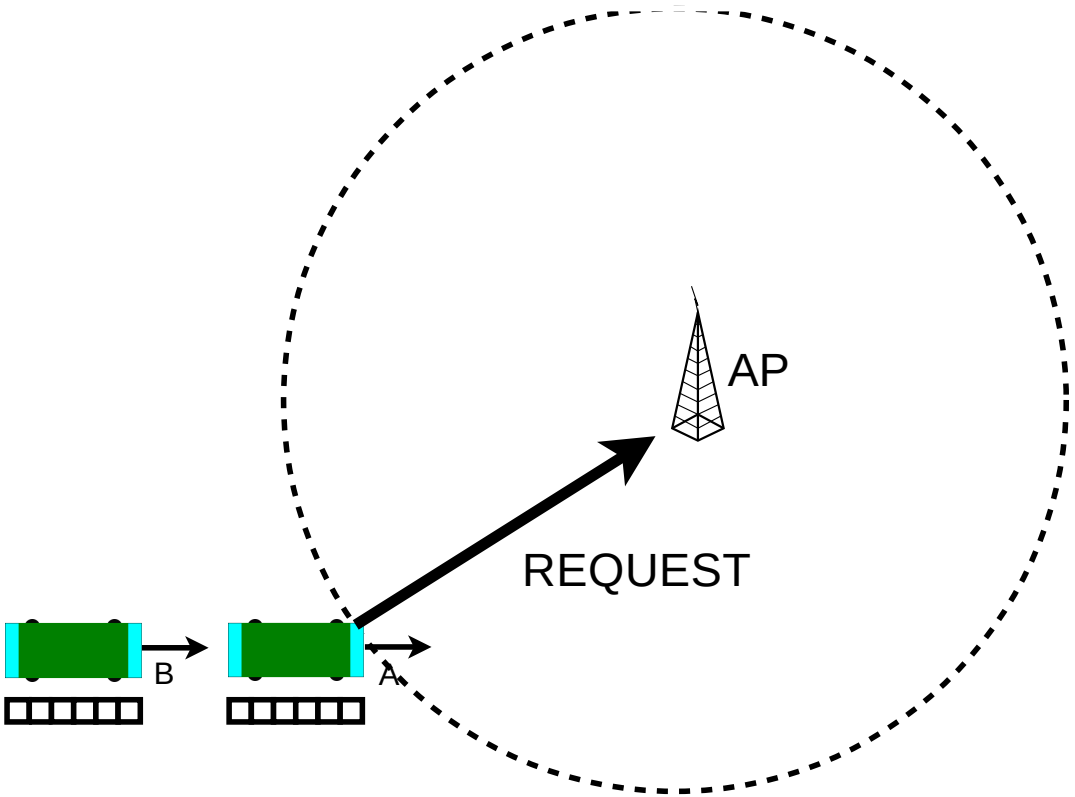
Assumptions

- A group of vehicles interested in one content is formed.
- A group header is selected among the vehicles to send initial request for the content.
- The sequences of the vehicles are sent to the AP by the group header.
- All nodes work in overhear mode.

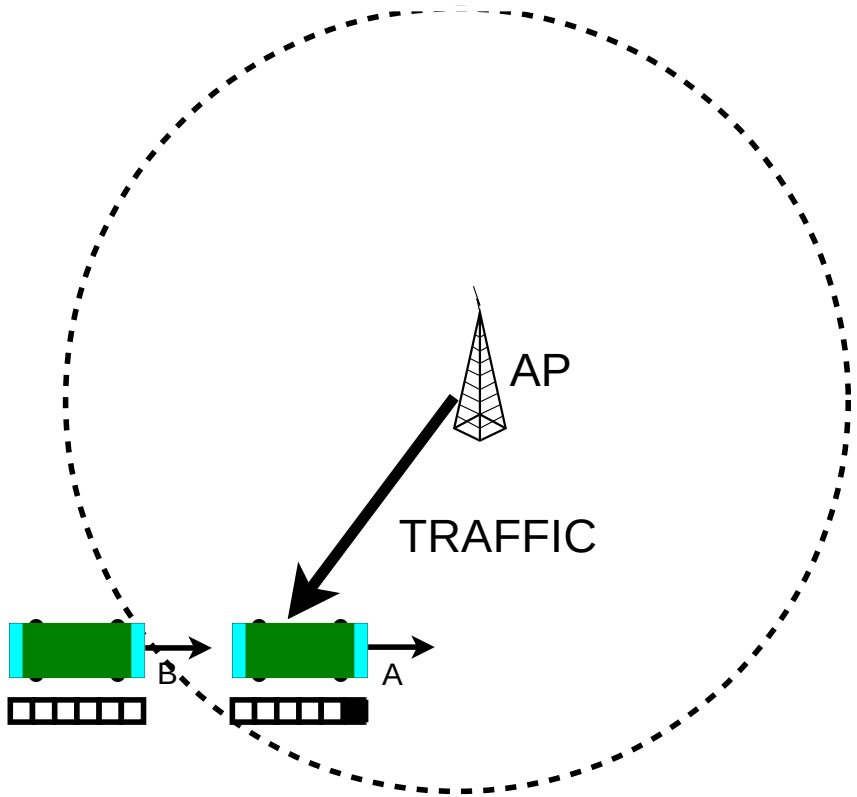
Main idea — cooperative downloading

- Consecutive downloading of the same content.
- Smooth handover of the downloading from one vehicle to another vehicle.

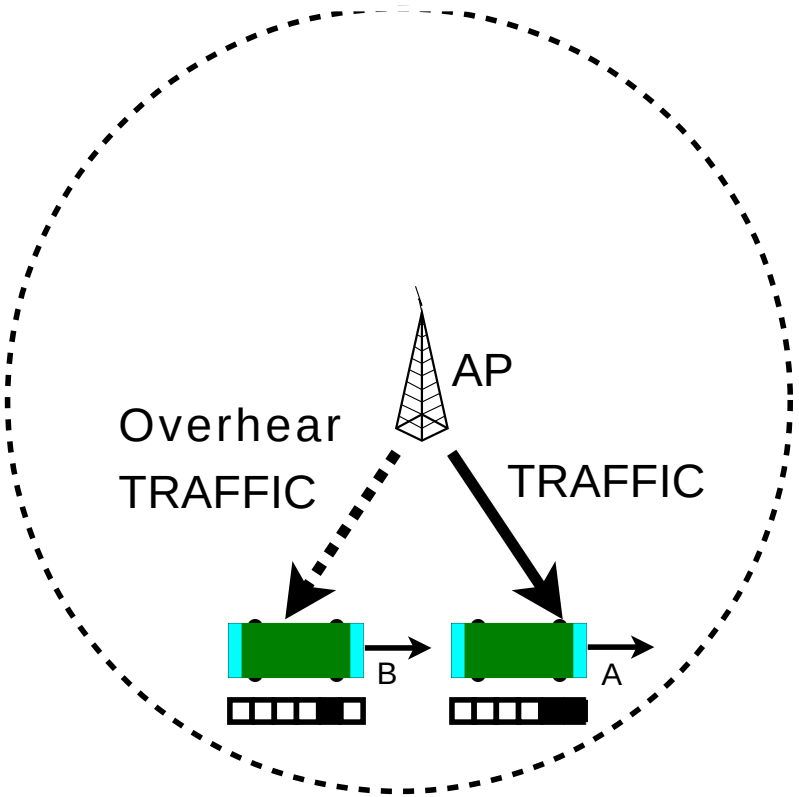
Demonstration(1)



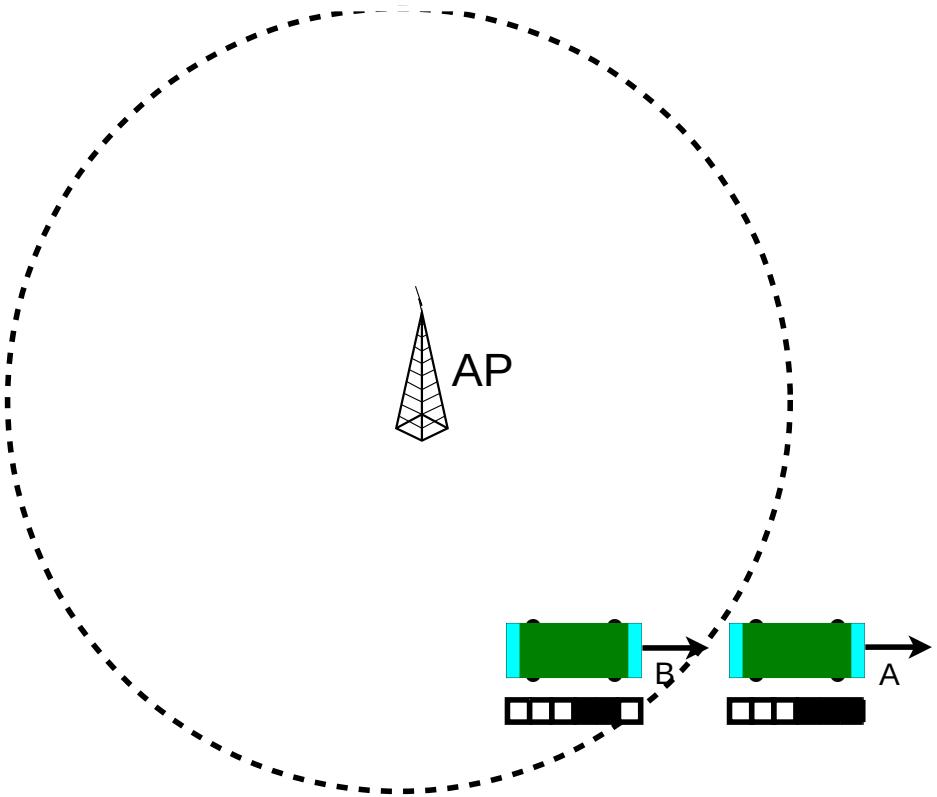
Demonstration(2)



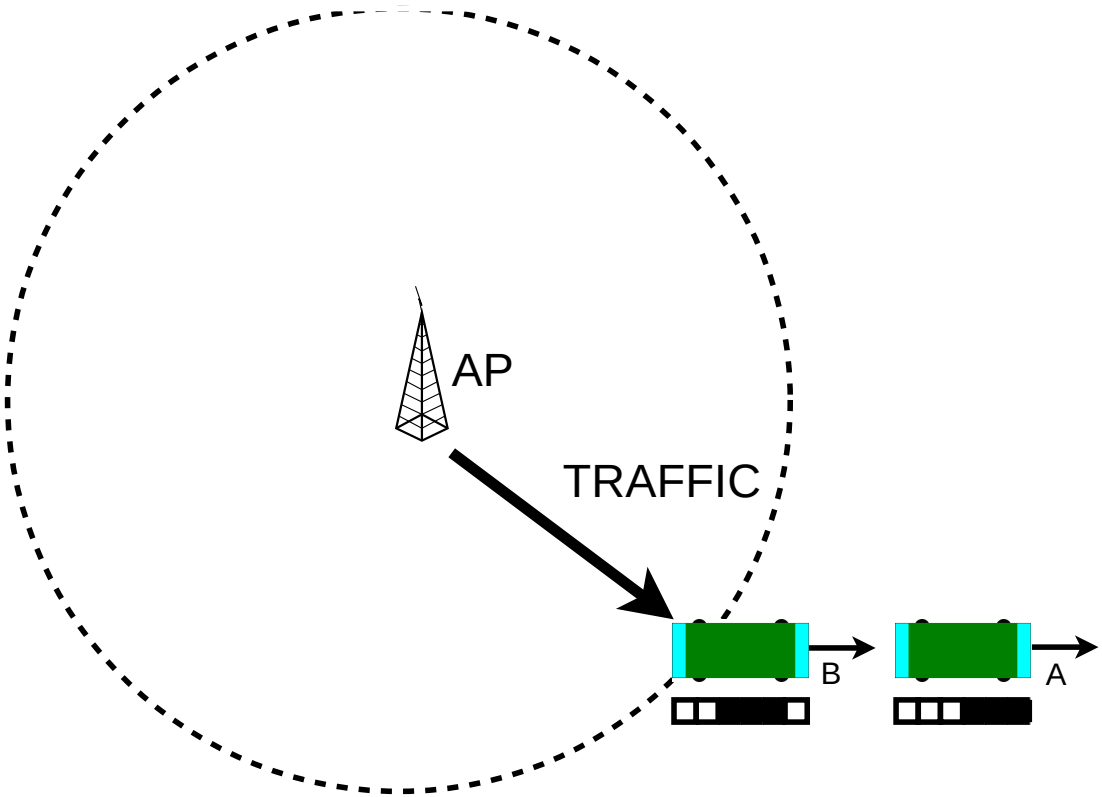
Demonstration(3)



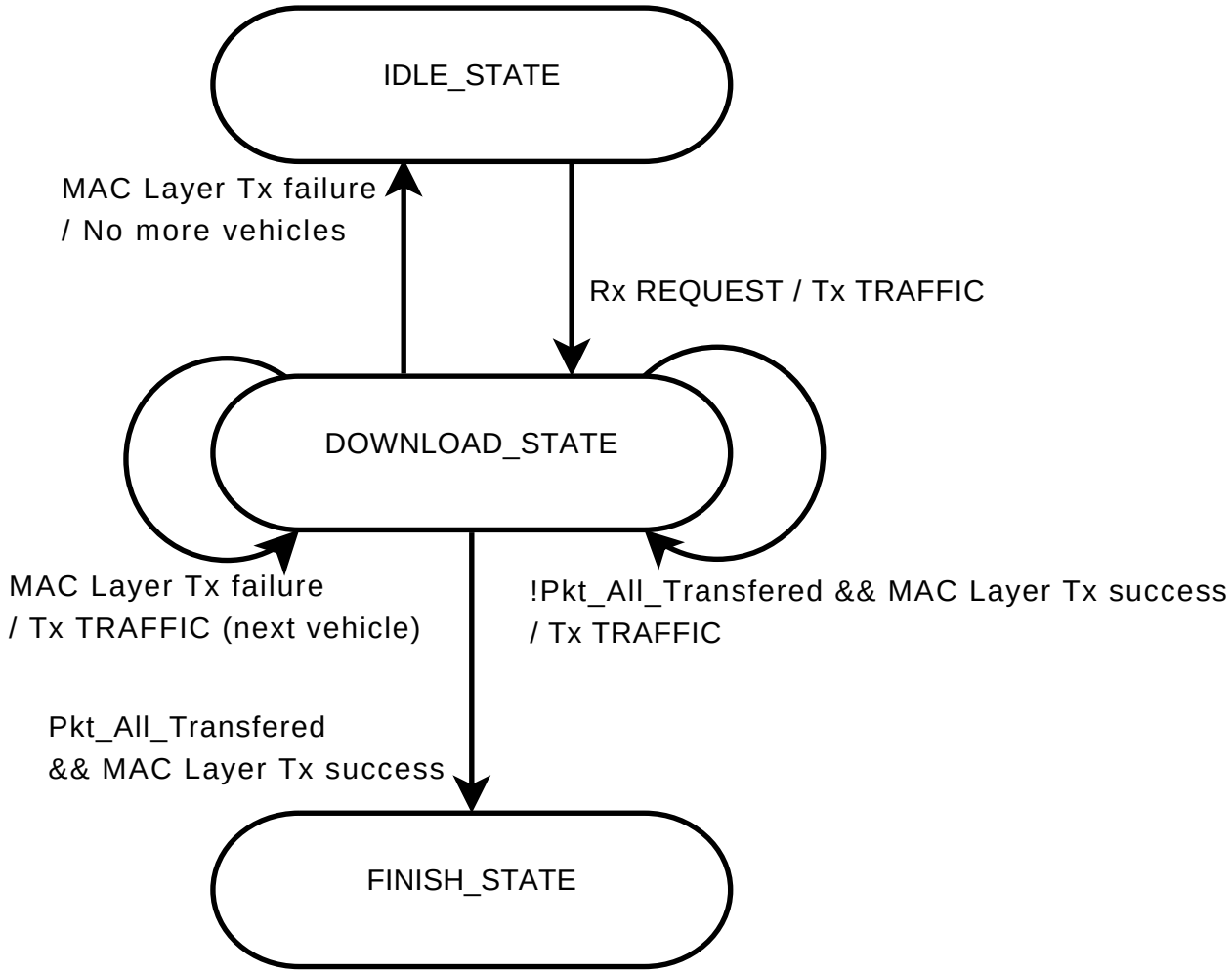
Demonstration(4)



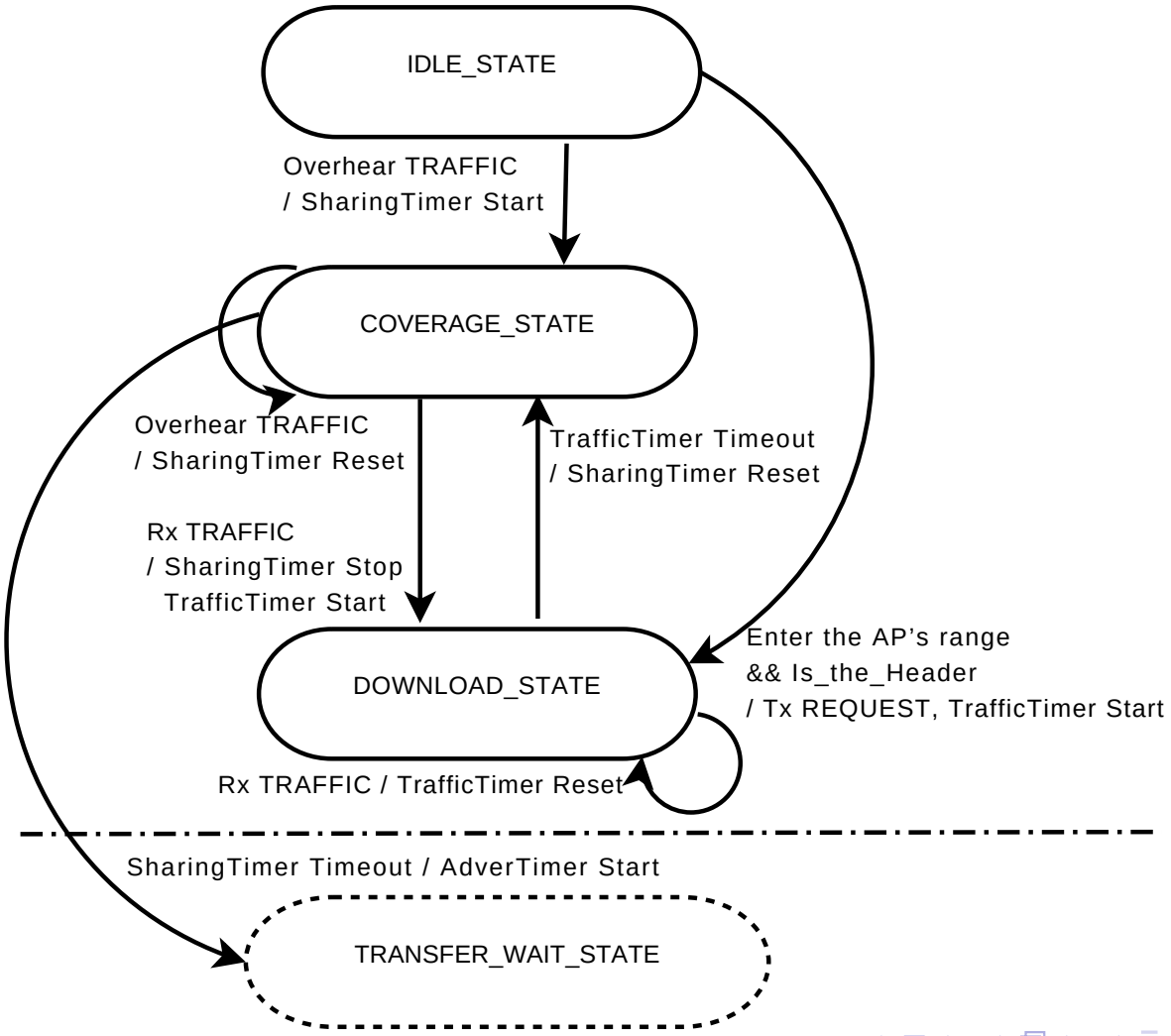
Demonstration(5)



AP state flow



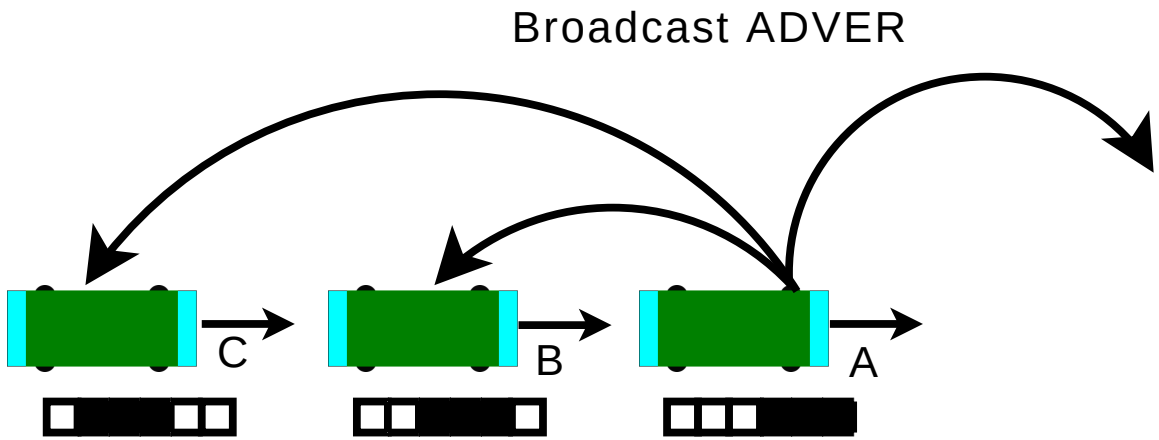
Vehicle state flow



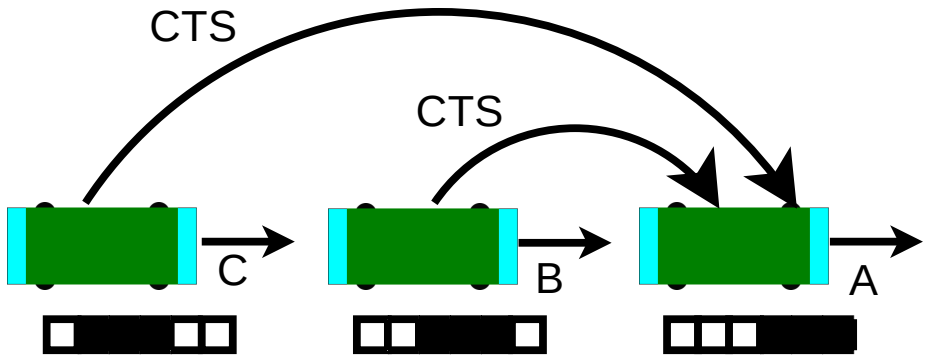
Main idea — V2V sharing

1. The sender vehicle transmits one-hop broadcast ADVER message to tell other vehicles the packets they have.
2. The other vehicles ask for the missing contents from the sender by sending CTS messages.
3. The sender uses positioning informations to select message receiver(the farthest from the sender).

Demonstration(1)



Demonstration(2)



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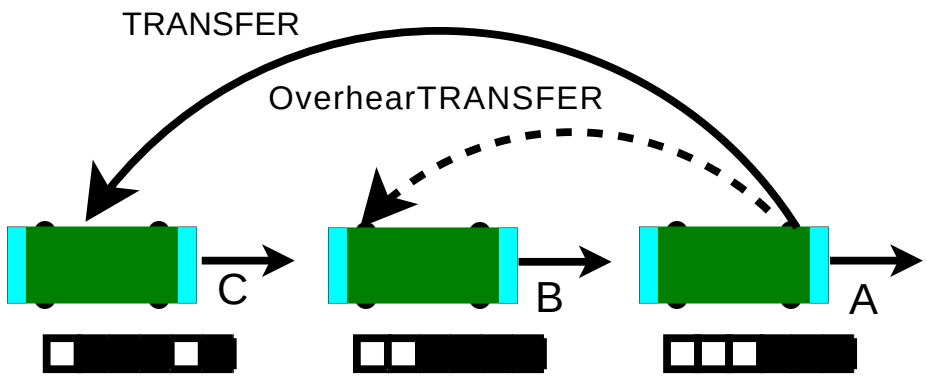
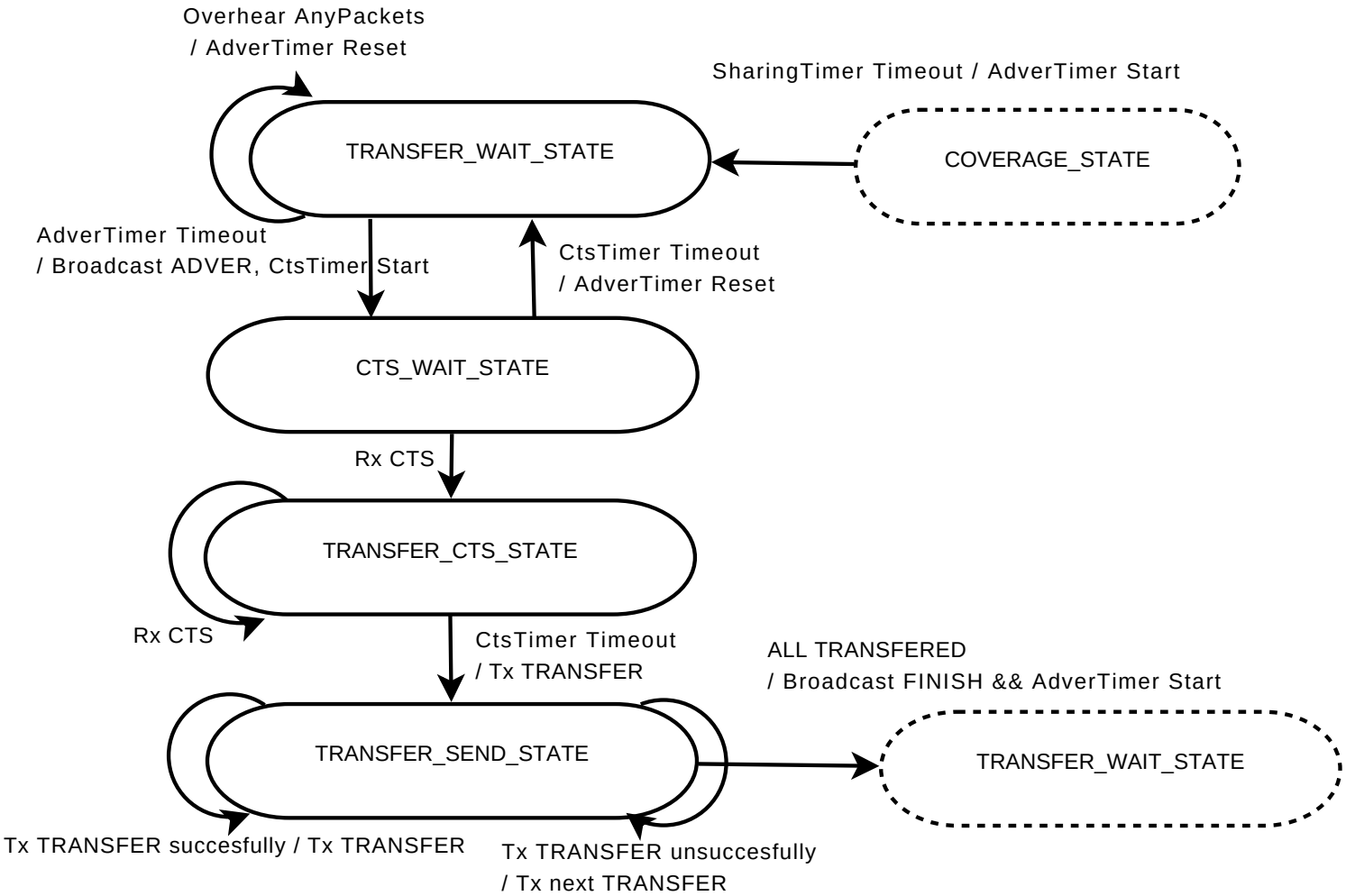
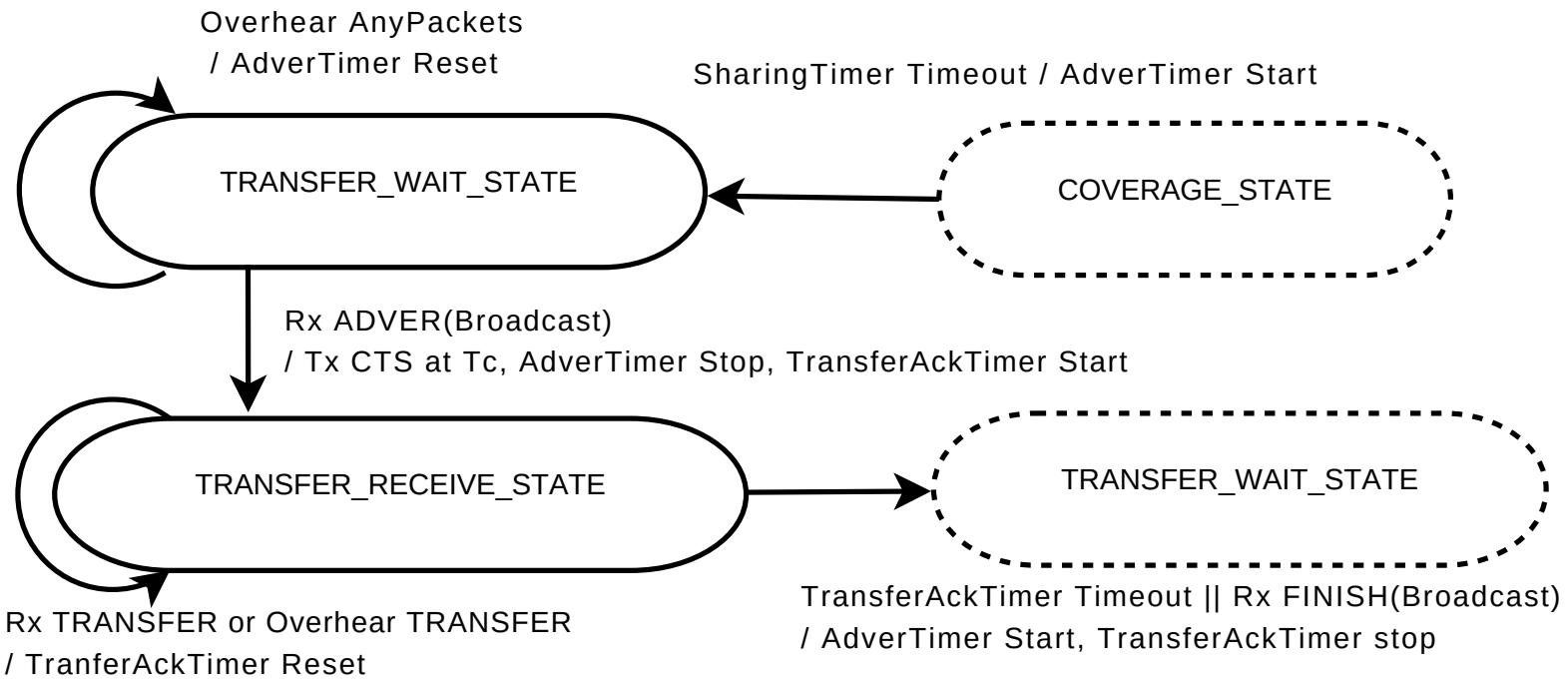


Vehicle send state flow



Vehicle receive state flow



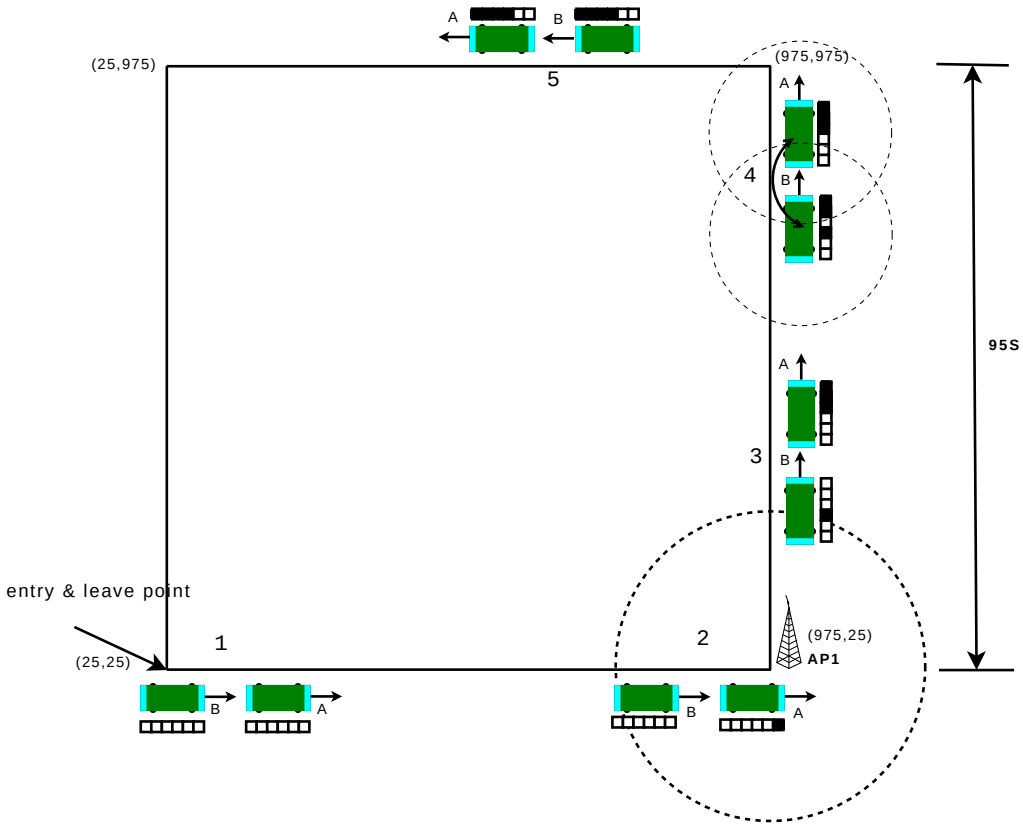
Implementation

- The scheme is implemented on the Network Simulator 2(NS2)
- Application layer
  - *VCDClient* - vehicle
  - *VCDServer* - AP
  - *GroupManager* - group management protocols
  - *InputParameter* - input tunable simulation parameters
- Lower layer
  - Overhearing of unicast message
  - Cross layer ACK notification
  - Modifications of AODV protocol

Default parameters

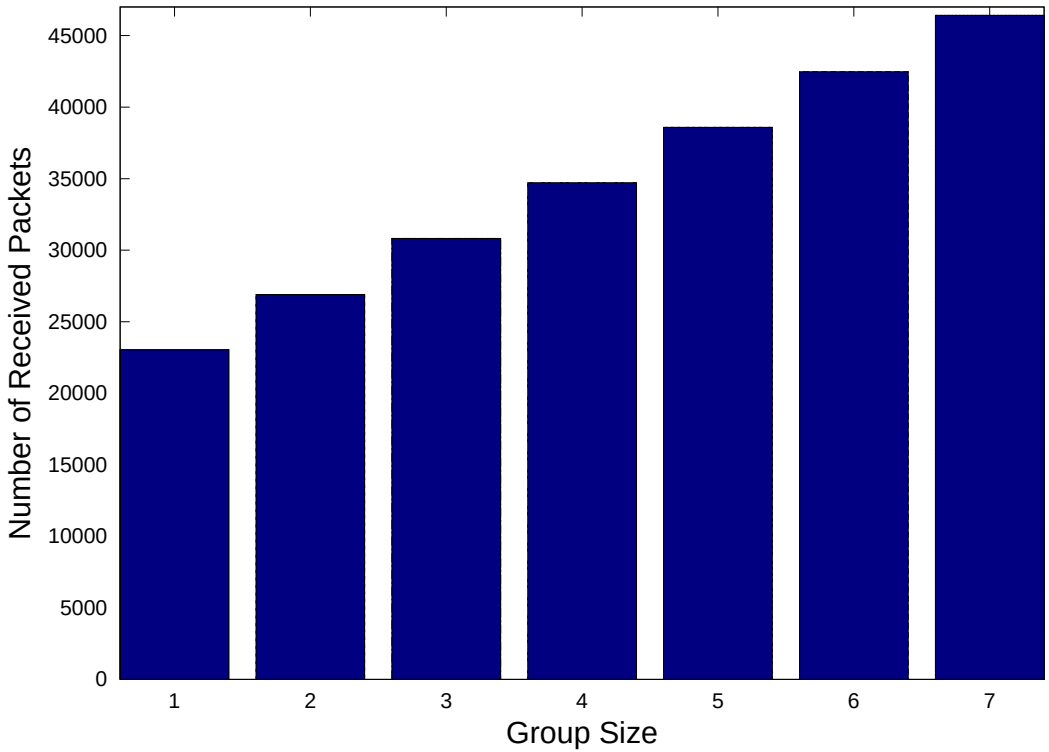
- Unlimited file size
- Mobility pattern
  - Constant speed at 10m/s
  - 50 meters away from each other

An example



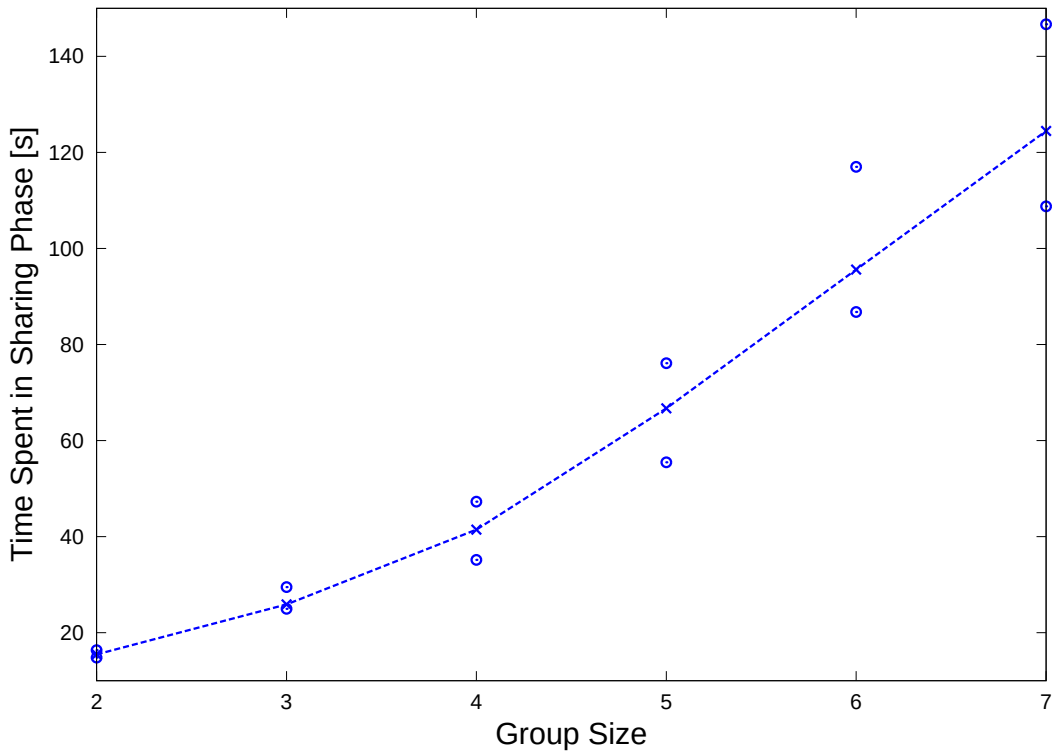
- With respect to one vehicle case
  - Number of received packets per vehicle is 16.70% higher.
  - The group throughput increases by 54.1%.

Number of received packets per vehicle



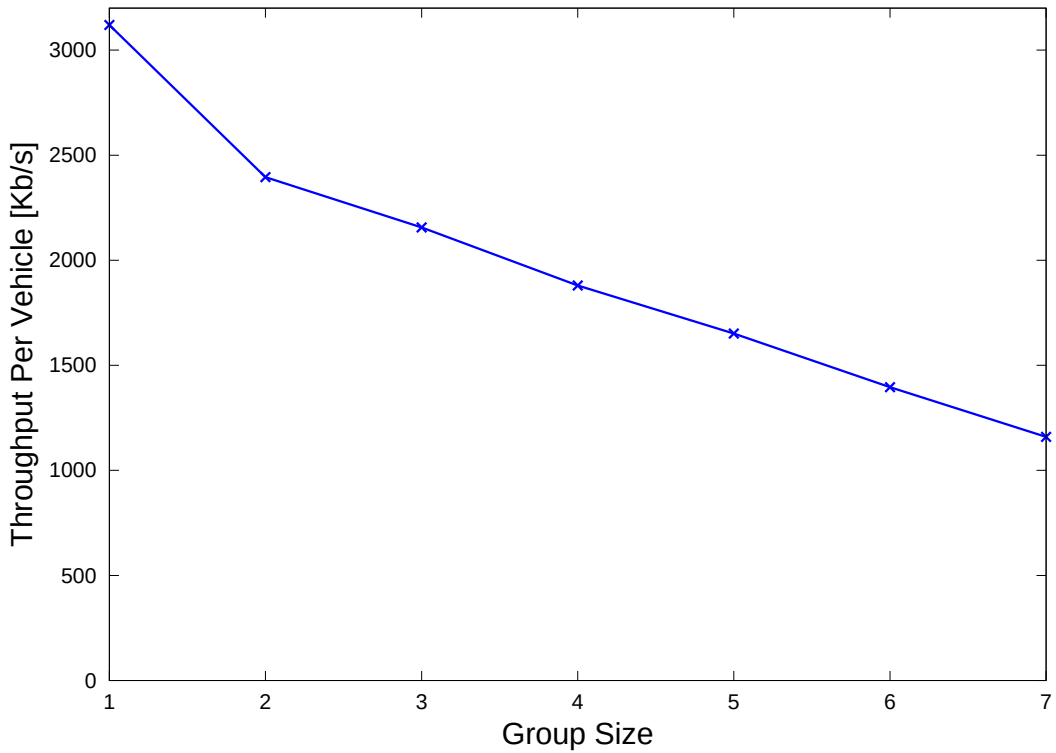
- Number of received packets per each vehicle increases linearly as vehicles in the group increases.

Time spent in sharing phase



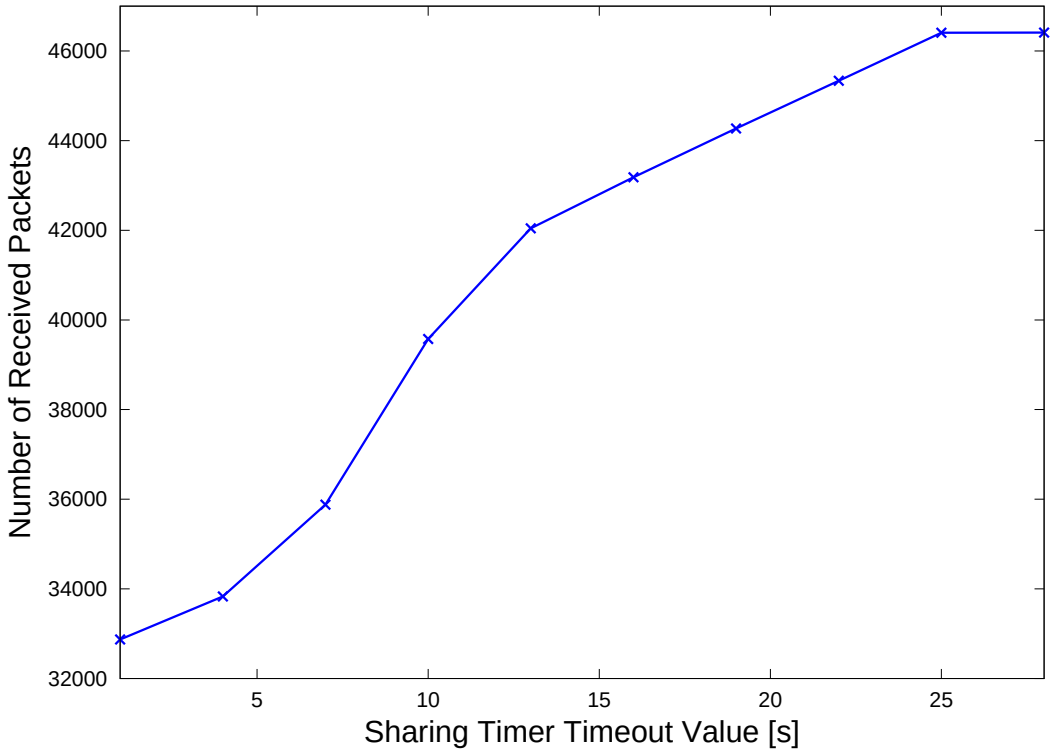
- The time increases as the group size grows.
- The variance is higher when there are more vehicles in the group.

Throughput per vehicle



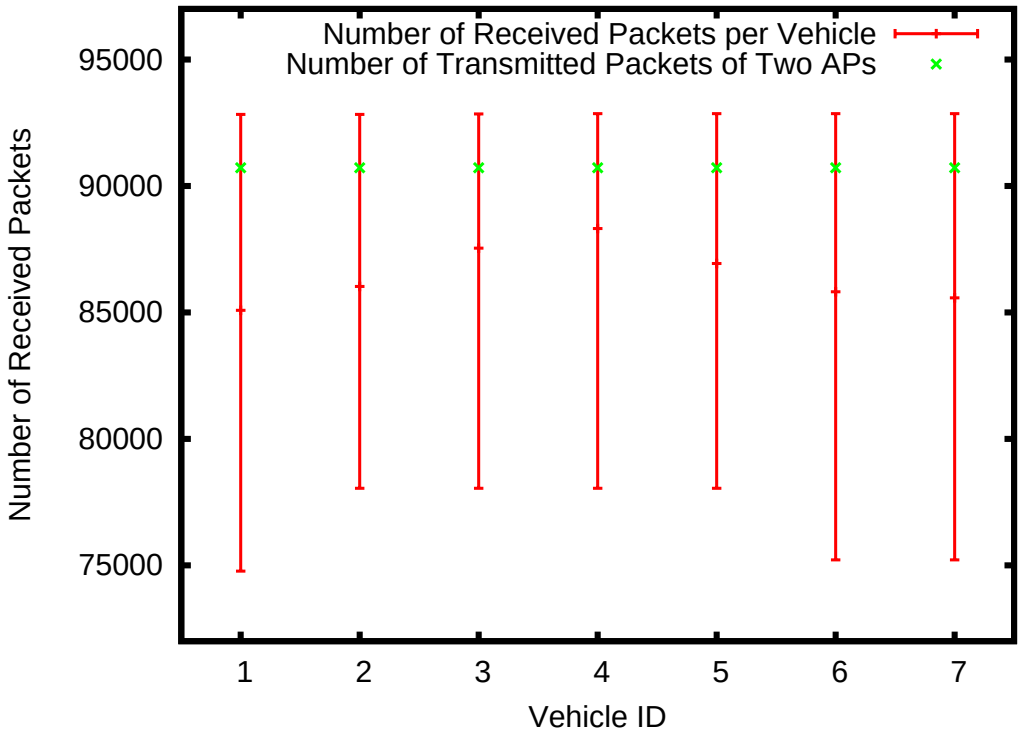
- The throughput per vehicle decreases as the group size increases because more time is spent in sharing phase and more collisions occur.

Number of received packets per vehicle



- The number of received packets increases as the timeout value increases.
- It reaches saturation point at time 25.

Throughput



- The packet receipt status is different because there is not enough time in between two APs to share the contents.

Conclusion and future works

- Conclusion
  In order to efficiently download contents for nodes in VANETs, a scheme, composed of cooperative downloading and V2V sharing phases, is proposed, implemented and evaluated.
- Future work
  1. The group management protocol needs to be added.
  2. A more realistic mobility pattern model should be used to evaluate the performance.