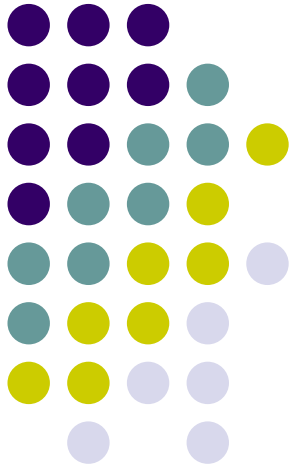
Delivering of Live Video Streaming for Vehicular Communication Using Peer-to-Peer Approach



INFOCOM 2008 workshop

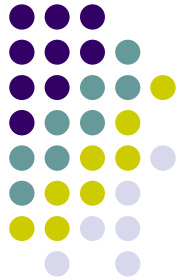
Lee-Wei Li

2008/6/5

Outline

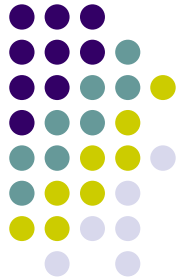
- Introduction
- A Distributed Vehicles-Adaptive Clustering Algorithm (DVAC)
- A Vehicles-Adaptive Peer-To-Peer Relay Method (VAPER)
- Simulations
- Conclusion

Introduction



- For Vehicle-to-Roadside Communication (VRC) , the delivering of live video streaming collapses easily
  - Shadowing effect of signal translation
  - Long-length tunnel
  - Low base-station deployment
- For inter-vehicle communication (IVC), the traditional peer-to-peer approaches of delivering live video streaming can not be employed

Assumptions



- Driving on highway
- Vision systems
  - Displayers
  - Cameras
- Vehicular systems
  - Wireless ad-hoc networks
  - Geographic Positioning System (GPS)

A Distributed Vehicles-Adaptive Clustering Algorithm (DVAC)

- DVAC is a rule-based and message-driven algorithm for adapting to vehicular communication and composed of distributed procedures, called V-procedures
- Each cluster with a unique cluster ID is organized with a cluster-head, a cluster-tail, and some ordinary vehicles (cluster members)

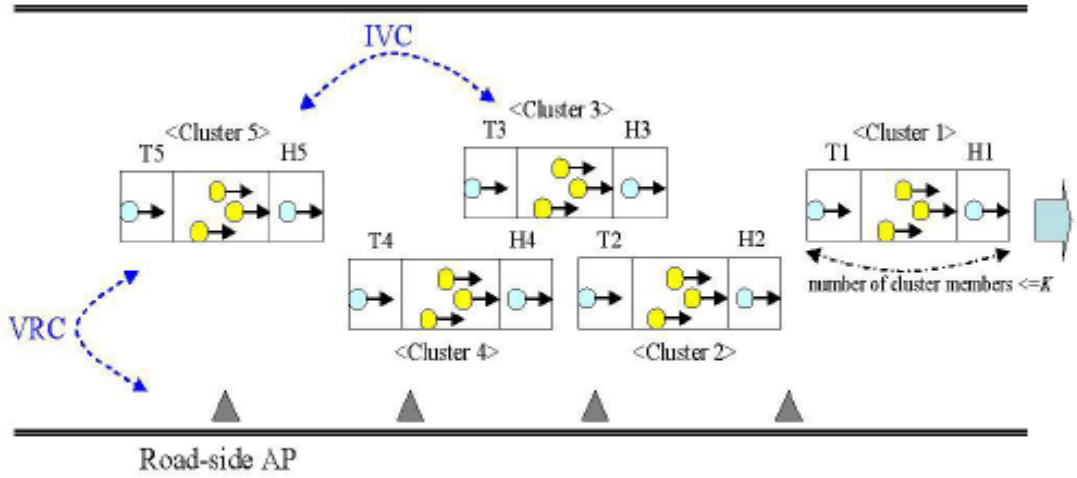


Fig 1. The sample scenario of DVAC.

- Four type of message
  - CH
  - CT
  - JOIN
  - RESIGN

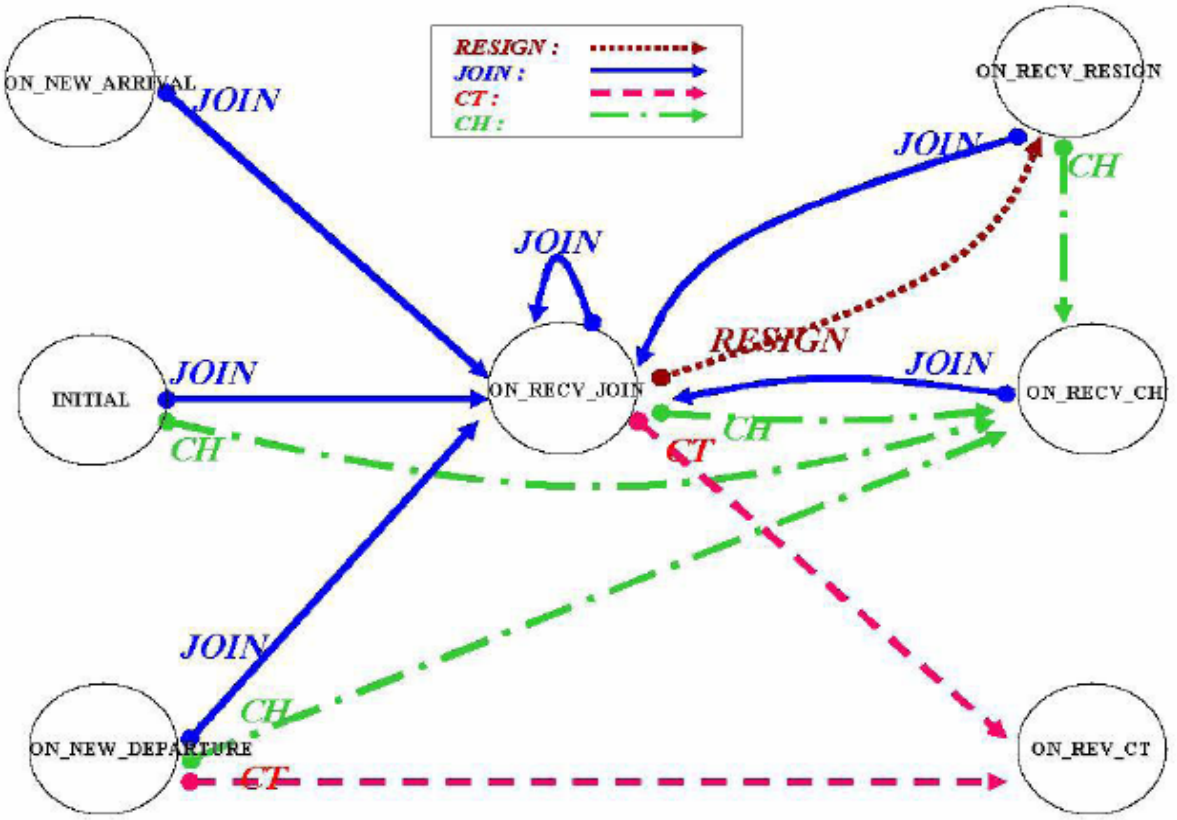


Fig. 2 Diagram of the relationship between V-procedures and the messages.

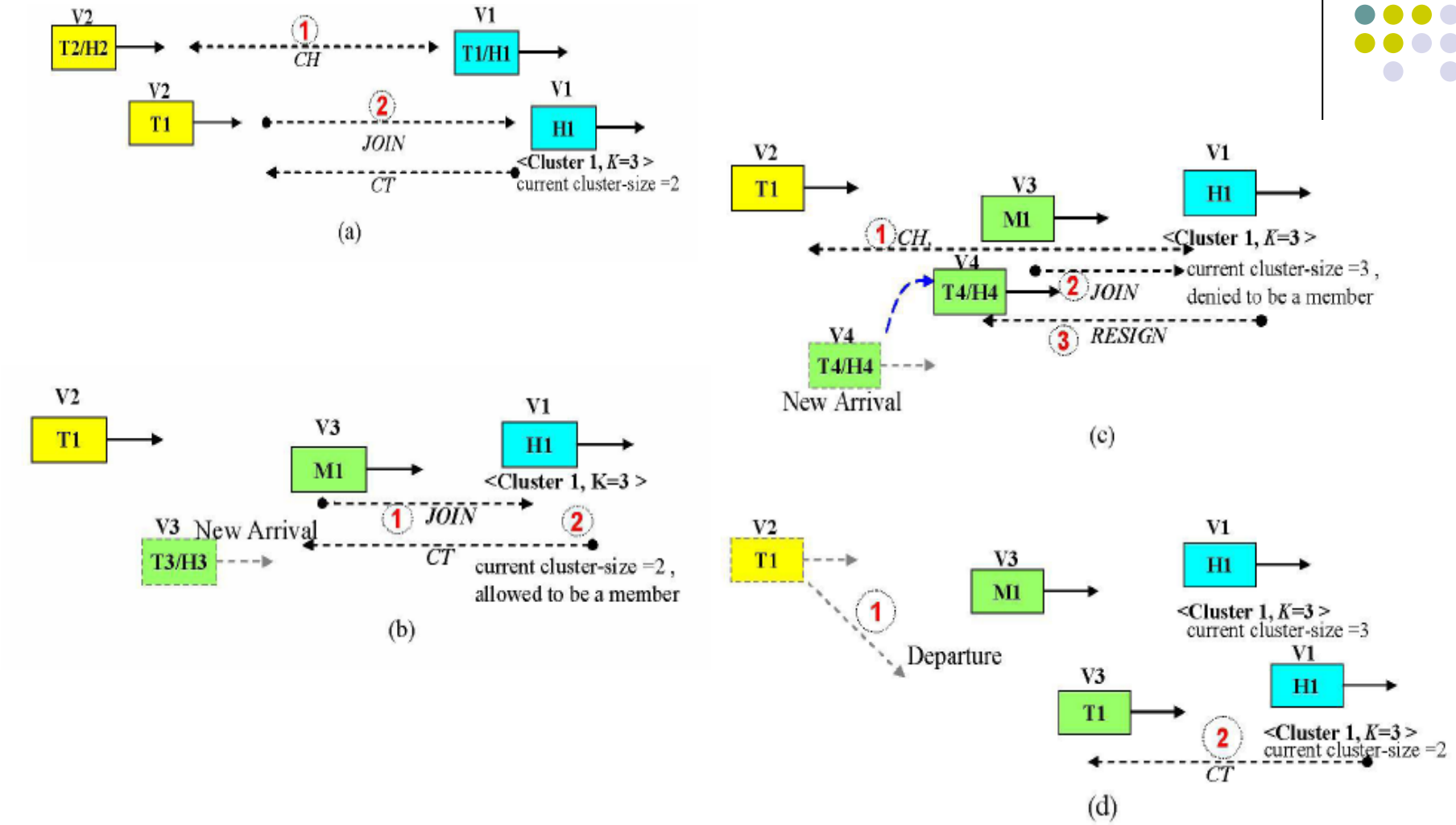
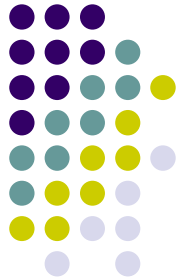


Fig. 3 Clustering samples of V-procedures.

A Vehicles-Adaptive Peer-To-Peer Relay Method (VAPER)

- For intra-cluster, the cluster-head performs the master propagator and the tail performs the backup propagator
- For inter-cluster, both of the cluster-head and the cluster-tail perform the roles of peer-to-peer relays and employ the signaling procedures called HOOK procedures to identify the forward and backward connected peers

A Vehicles-Adaptive Peer-To-Peer Relay Method (VAPER)



- The mutual connected peers between clusters are pairwise alignment (cluster-tail, cluster-head)
- Only the pair with the maximum relative distance between cluster-tail and cluster-head will be selected and associated with peering relationship
  - Island Hopping
  - Reducing the propagation delay
- Six types of message
  - REQ , REPLY
  - REQ_HOOK_ON, REPLY_HOOK_ON
  - REQ_HOOK_OFF, REPLY_HOOK_OFF

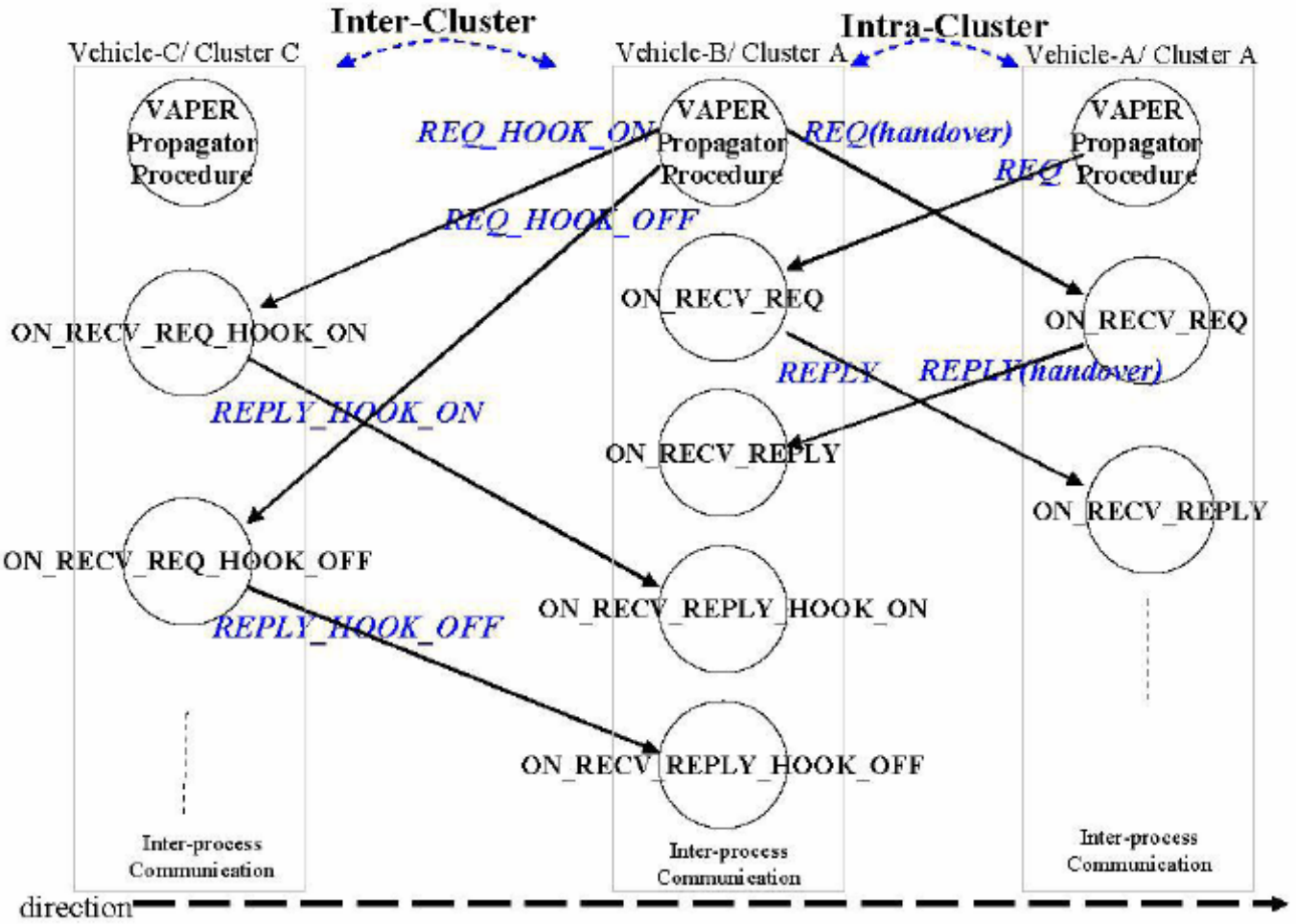
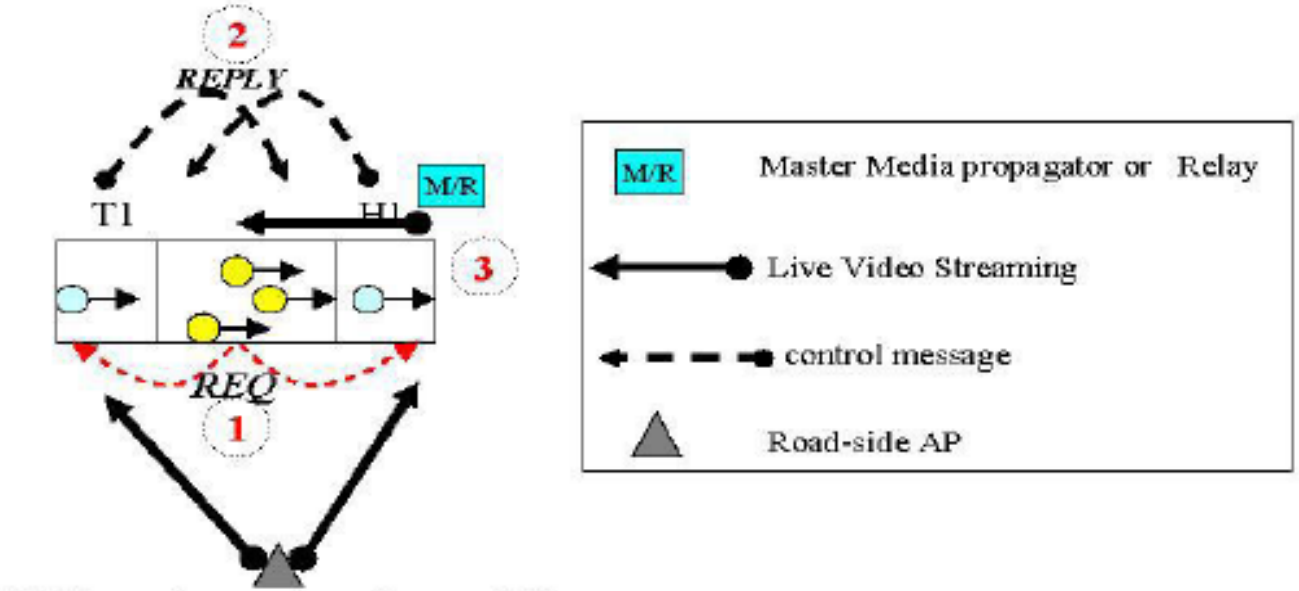
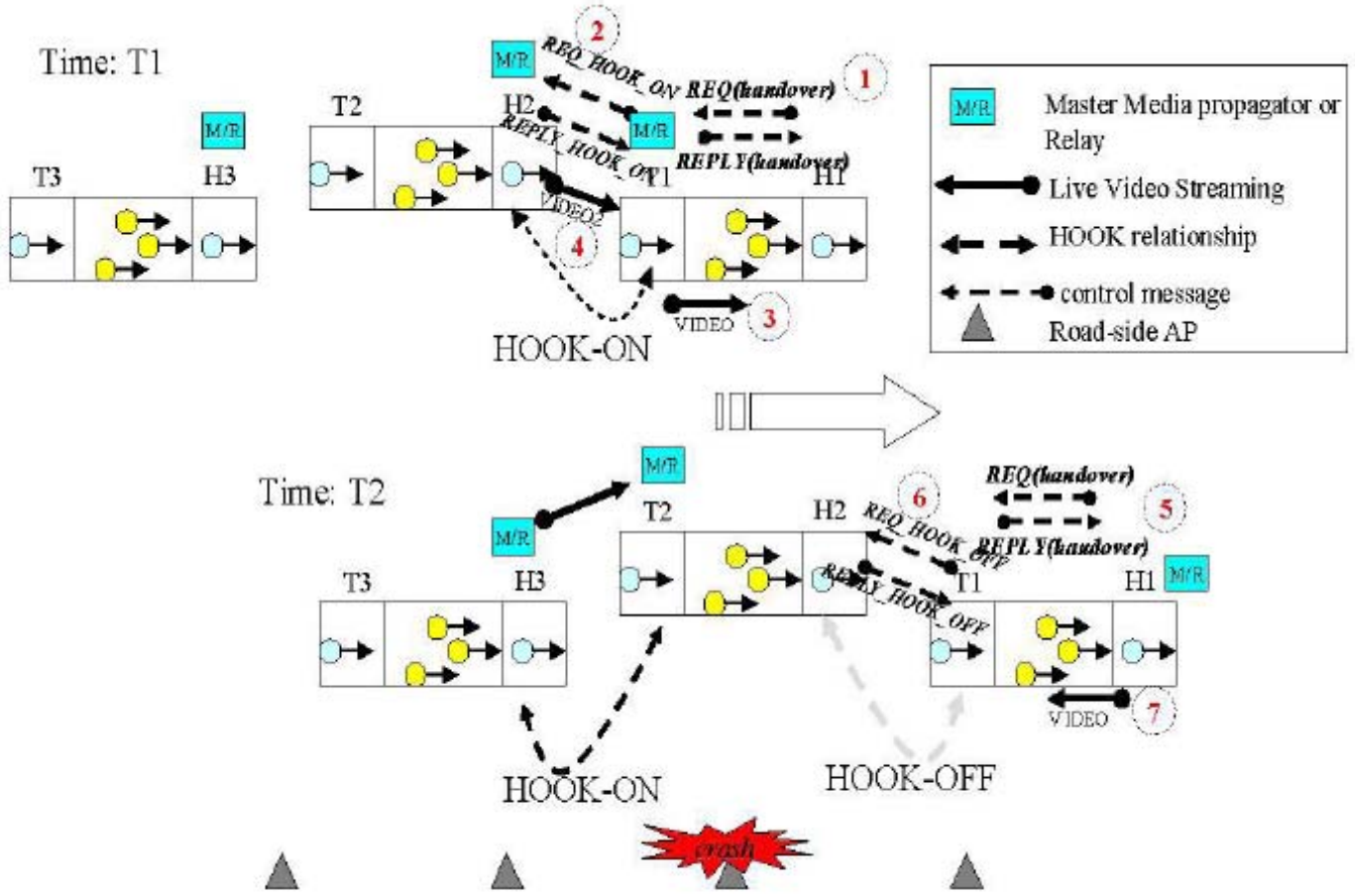


Fig. 4 Diagram of the relationship between HOOK procedures and the messages.

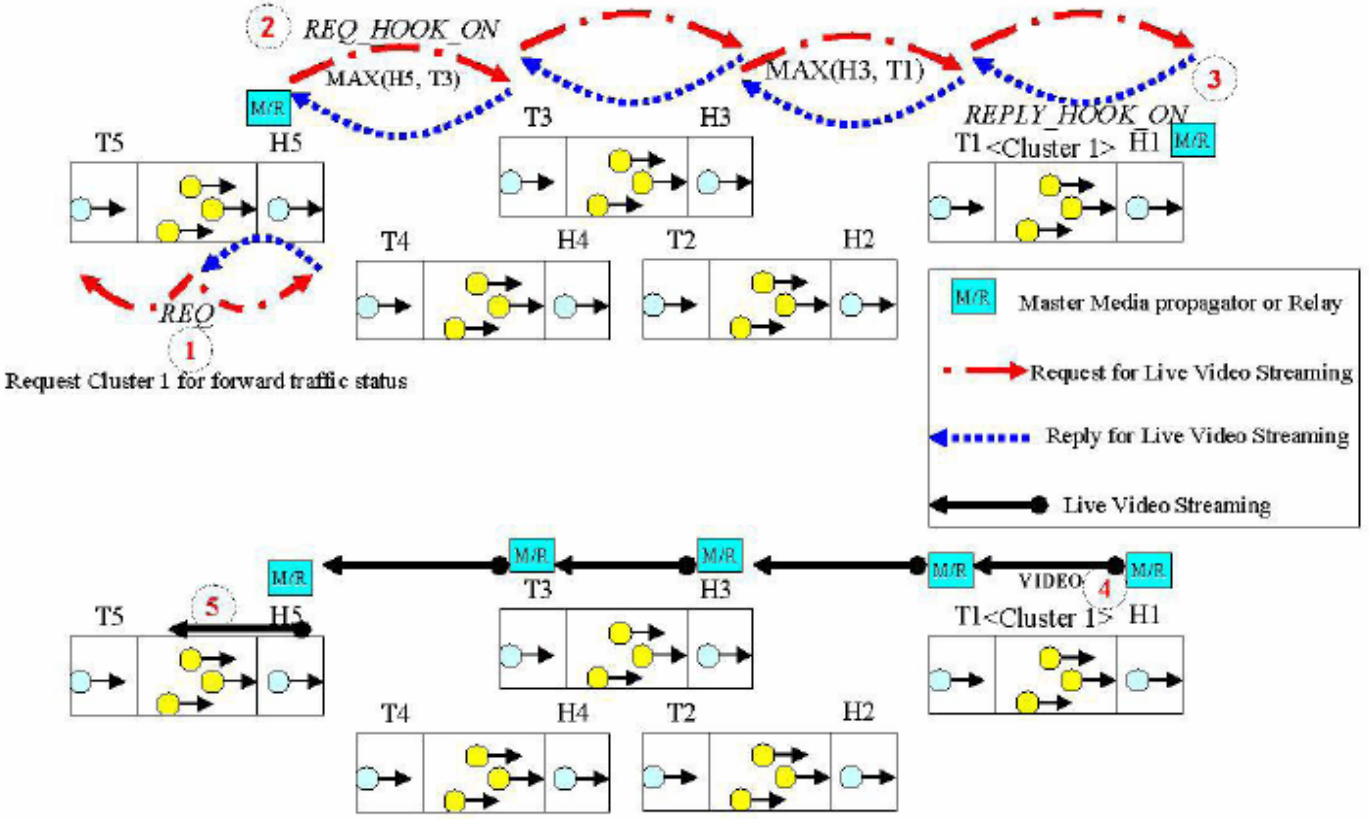


Video streaming from AP

(a) Intra-cluster VRC.



(b) Inter-cluster VRC.



(c) Inter-cluster IVC.

Fig. 5 Samples of Hook procedures in VRC and IVC.

Simulations

TABLE I
INPUT SIMULATION PARAMETERS

Vehicle speed(km/h)	20 ~ 110 km/h
Radio Transmitting Range(meter)	300 m
Length of the Signal Shielding Area(meter)	900 m
Simulation Time(seconds)	120 senonds
Main Traffic Flow: *MF* (vehicles/h)	*MF*= 250, 500, 650, 1500, 3000
Cluster Size: *K* (vehicles/per cluster)	*K*=5, 15, 30, 50

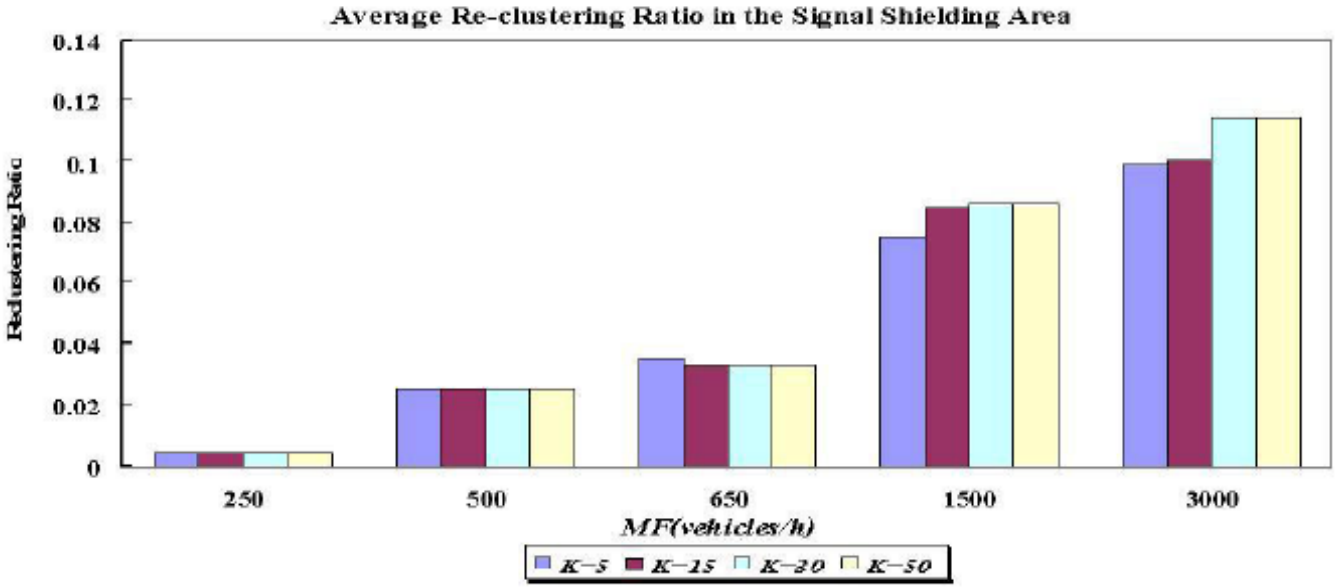


Fig. 6 Statistics of the average re-clustering ratio.

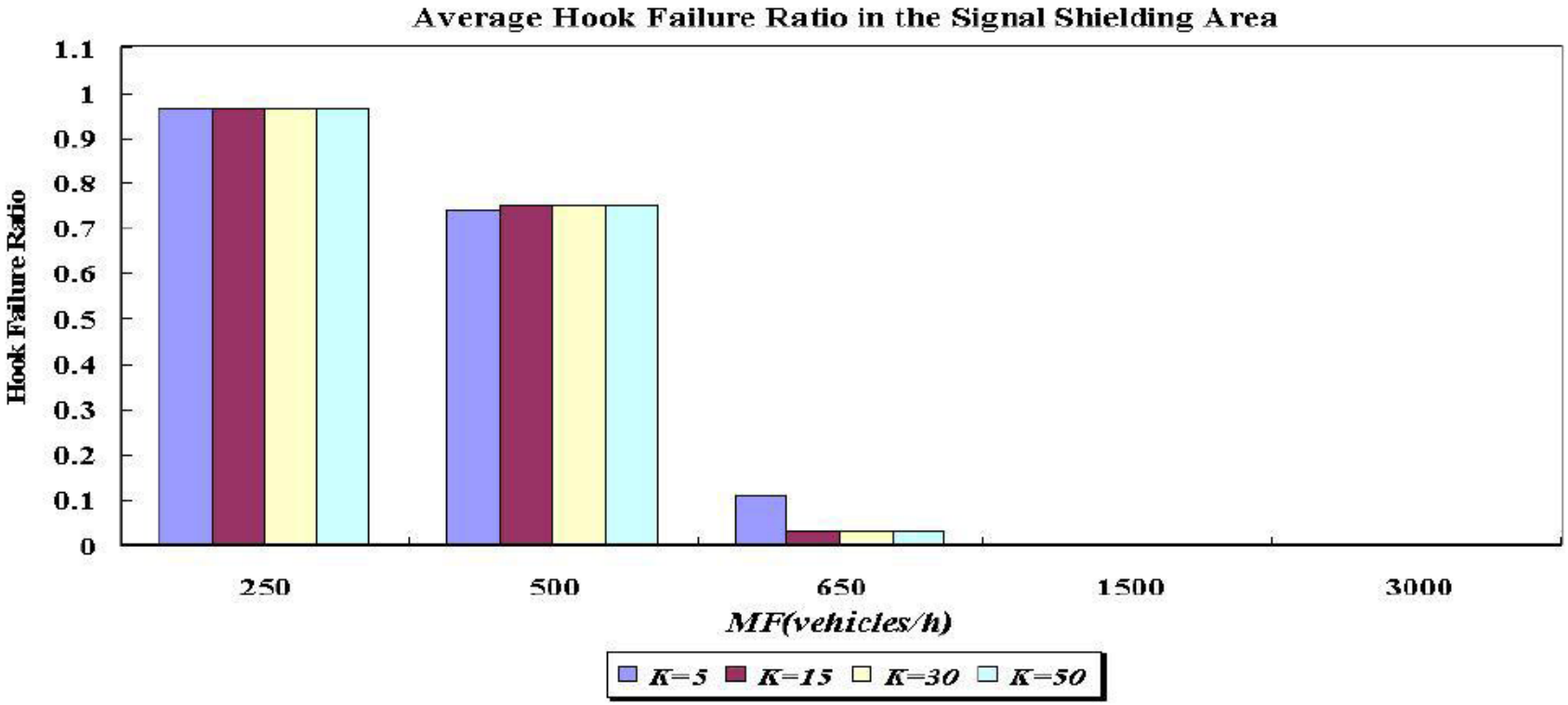
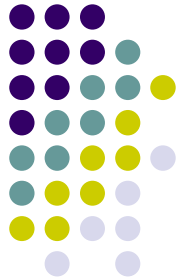


Fig. 7 Statistics of the average hook failure ratio.

Conclusion



- This work integrates the clustering algorithm-DVAC and the peer-to-peer method-VAPER as an application-layer overlay-network solution
- By the V-procedures in DVAC and the HOOK procedures in VAPER, delivering of live video streaming for Infotainment and safety applications in VANET is possible to be implemented