

Introduction & Motivation

Vehicular Ad-hoc Networks (VANETs)

- One of the concrete applications of MANETs
- Component of Intelligent Transportation System (ITS)
- Attracted research attention in US, EU, and Asia

Unique Characteristics

- Dynamic, large-scale, and rapidly changing topology
- Constrained, largely one-dimensional movement due to static roadway geometry
- Predictable mobility that can be exploited for system optimization

Data Dissemination in VANETs

- Road Safety
- Commercial Applications

Data Dissemination Models

- Push-based: data delivery from source to many vehicles
- Pull-based: data query from one vehicle to specific targets
- One-hop Scheduling: Upload/Download

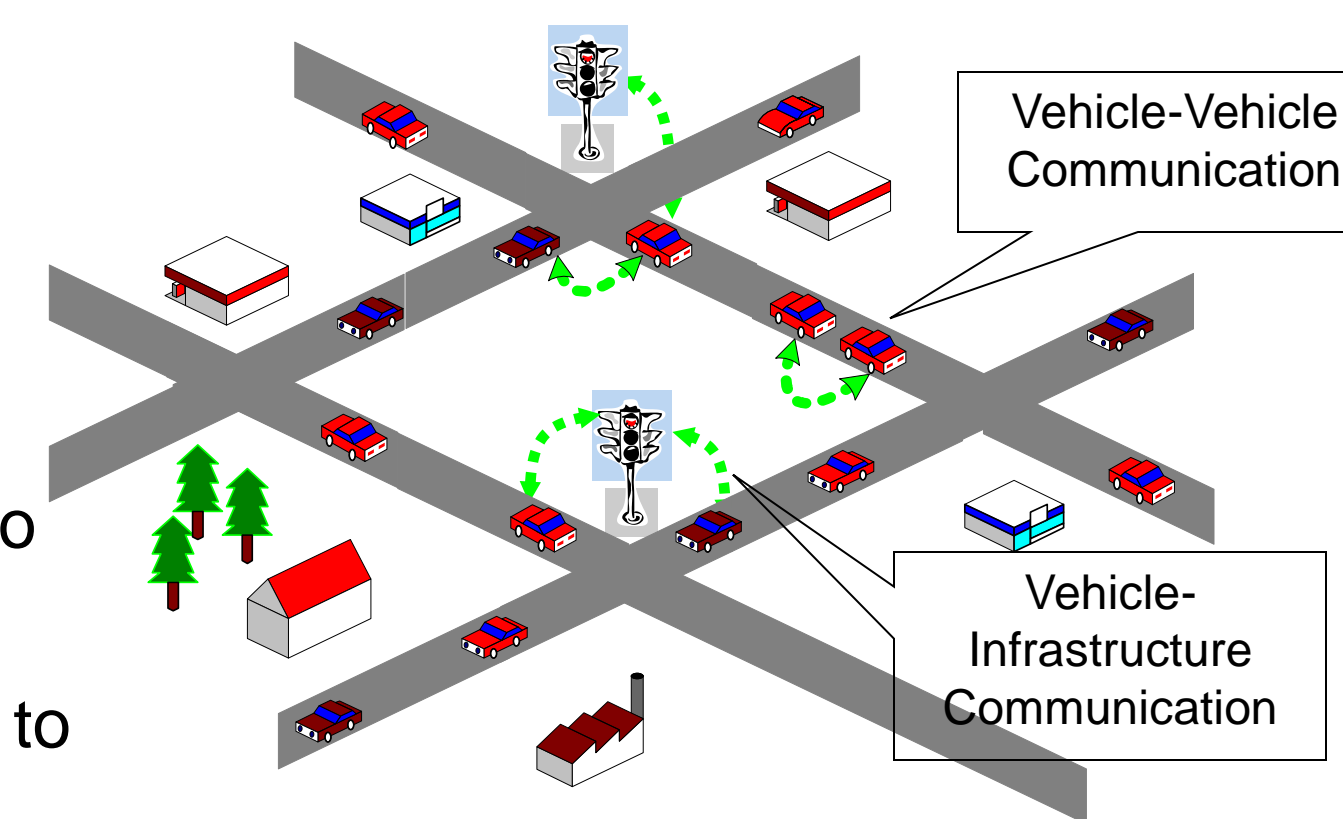


Fig. 1: One Possible VANET Scenario

Data Pouring and Buffering on The Road [1]

Push-based Data Dissemination

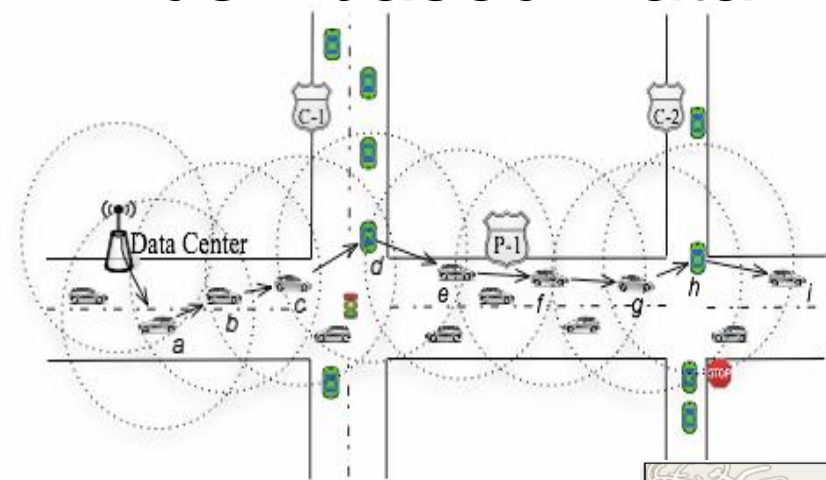
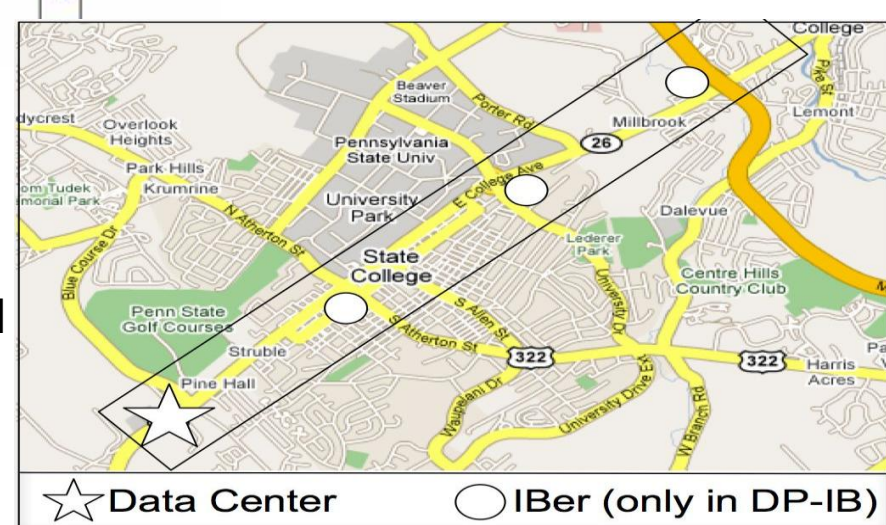


Fig. 2: Directional Broadcast

Fig. 3: A Snapshot of a Real Road Scenario



Goal:

- Reliably disseminate the data
- Efficiently utilize the limited bandwidth
- Maximize the dissemination capacity

Schemes:

- Data Pouring (DP)*: data are periodically broadcast to the vehicles on the road
- DP with Intersection Buffering (DP-IB)*: reduce the amount of data poured from the source by buffering and re-broadcasting data at the intersection

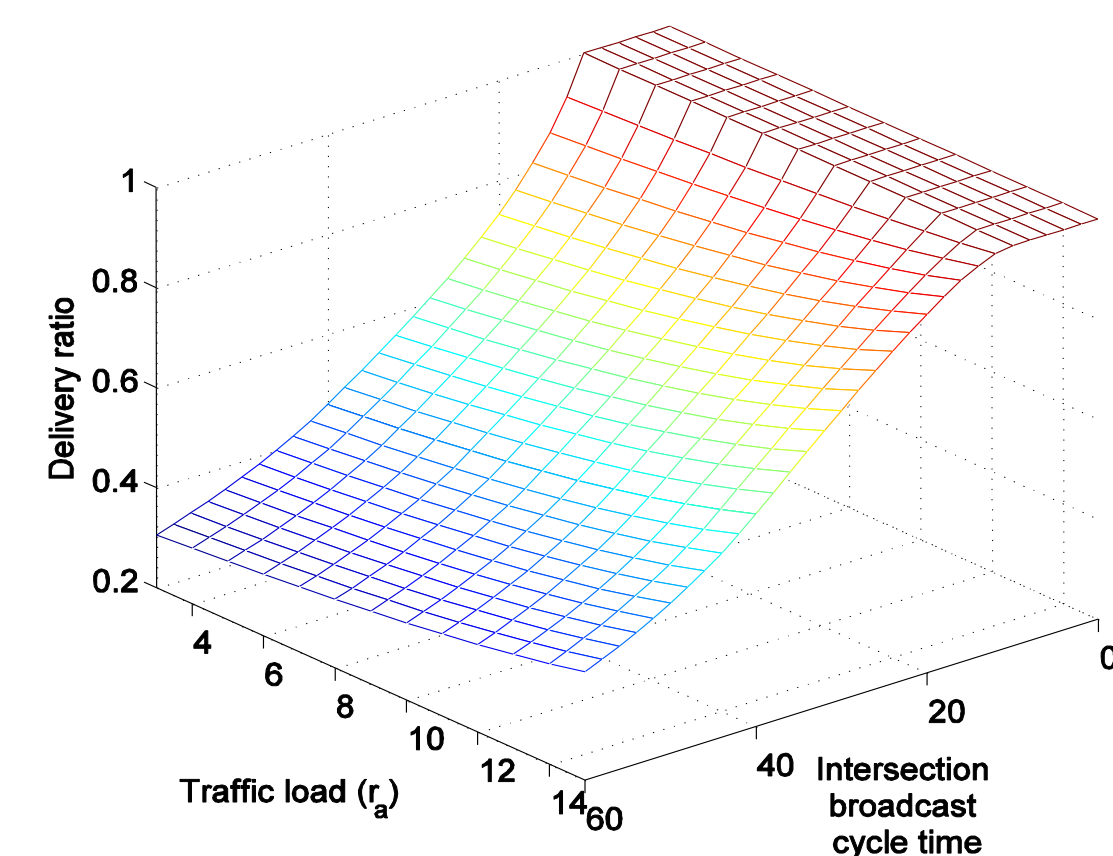


Fig. 4: Analyze the Relation Between the Broadcast Cycle Time and the Data Delivery Ratio

VADD: Vehicle-Assisted Data Delivery [2]

Pull-based Data Dissemination

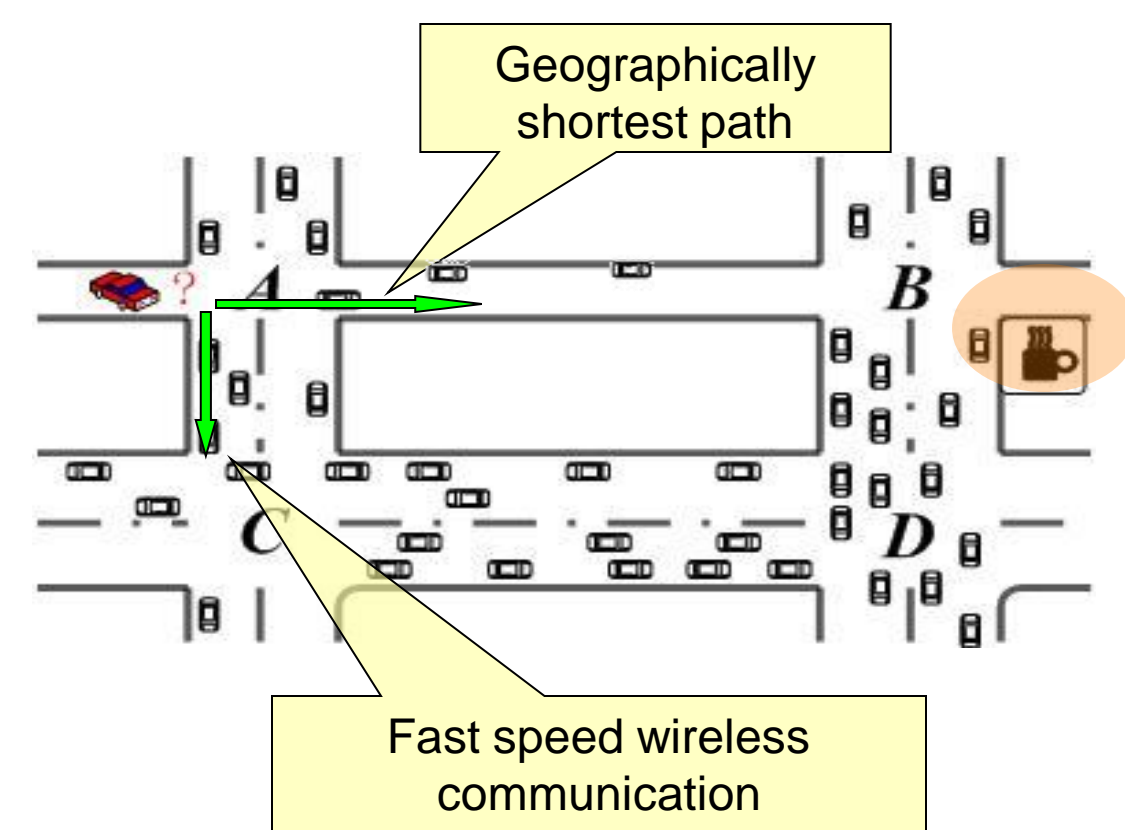


Fig. 5: Find a Path to the Coffee Shop

Goal:

- Use predictable traffic pattern and vehicle mobility to assist efficient data delivery

Key issue:

- Select a forwarding path with smallest packet delivery delay

Guidelines

- Make the best use of the wireless transmission
- If the packet has to be carried through certain roads, the road with higher speed should be chosen
- Dynamic path selection at the intersection

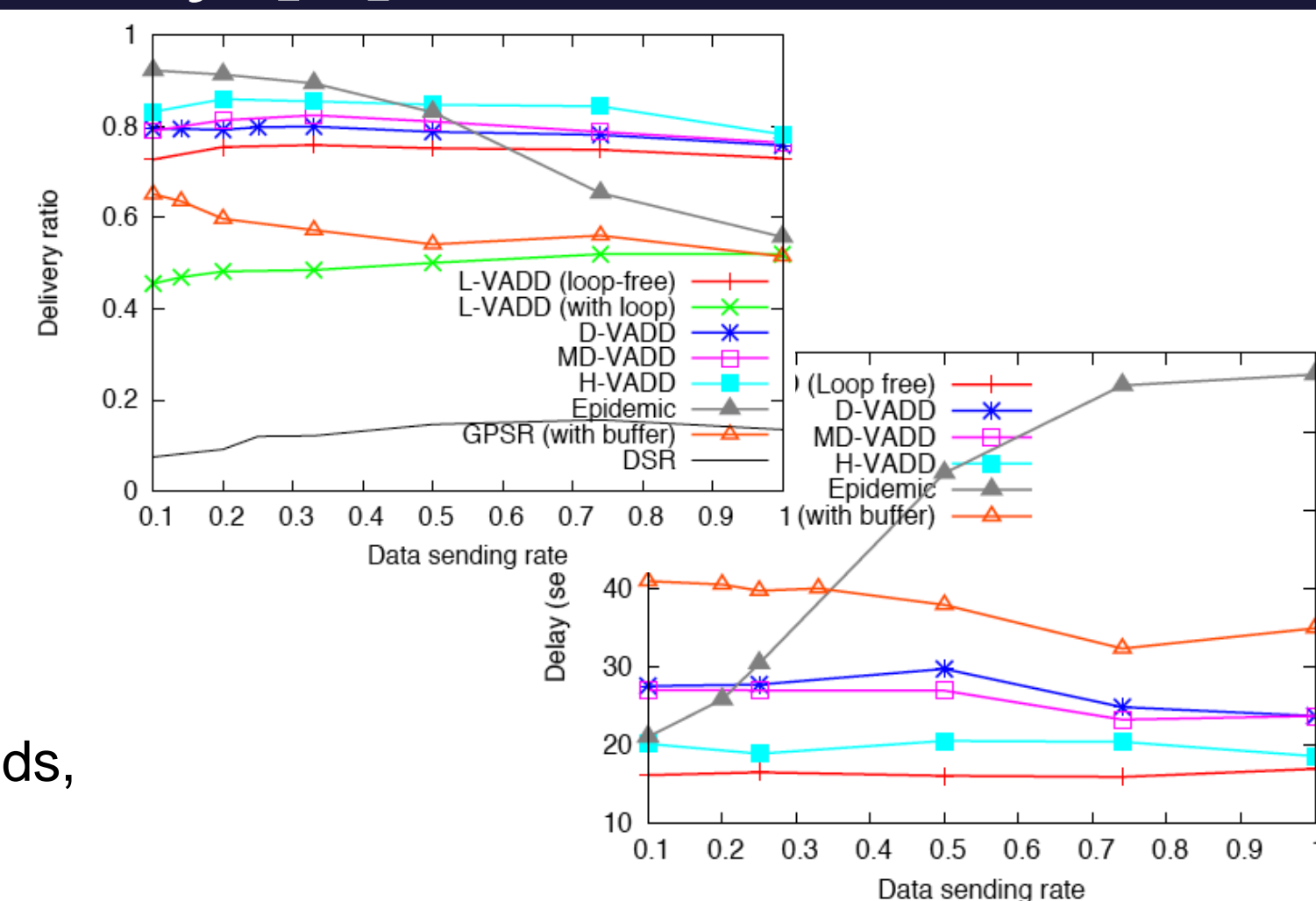


Fig. 6: Compare VADD with Existing Protocols

On Scheduling Vehicle-Roadside Data Access [3]

One-Hop Scheduling

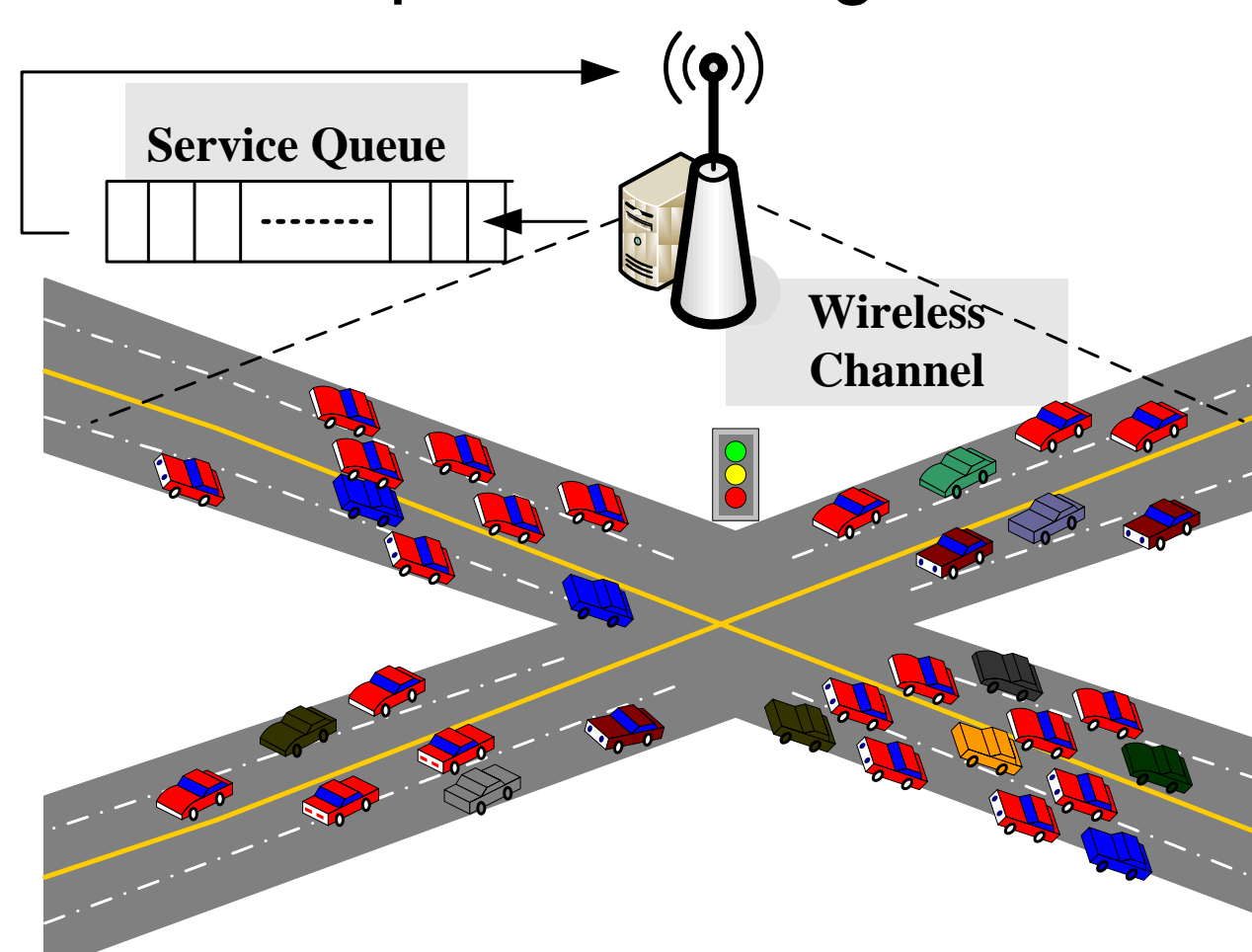


Fig. 7: The Architecture of Vehicle-Roadside Service Scheduling

Goal:

- Achieve the balance of service ratio and data quality for both upload and download services with time constraint

Schemes:

- D^*S - Deadline * Size
- D^*S/N - Number of pending requests
- Two-Step* - Schedule upload and download with separate queues and different priorities

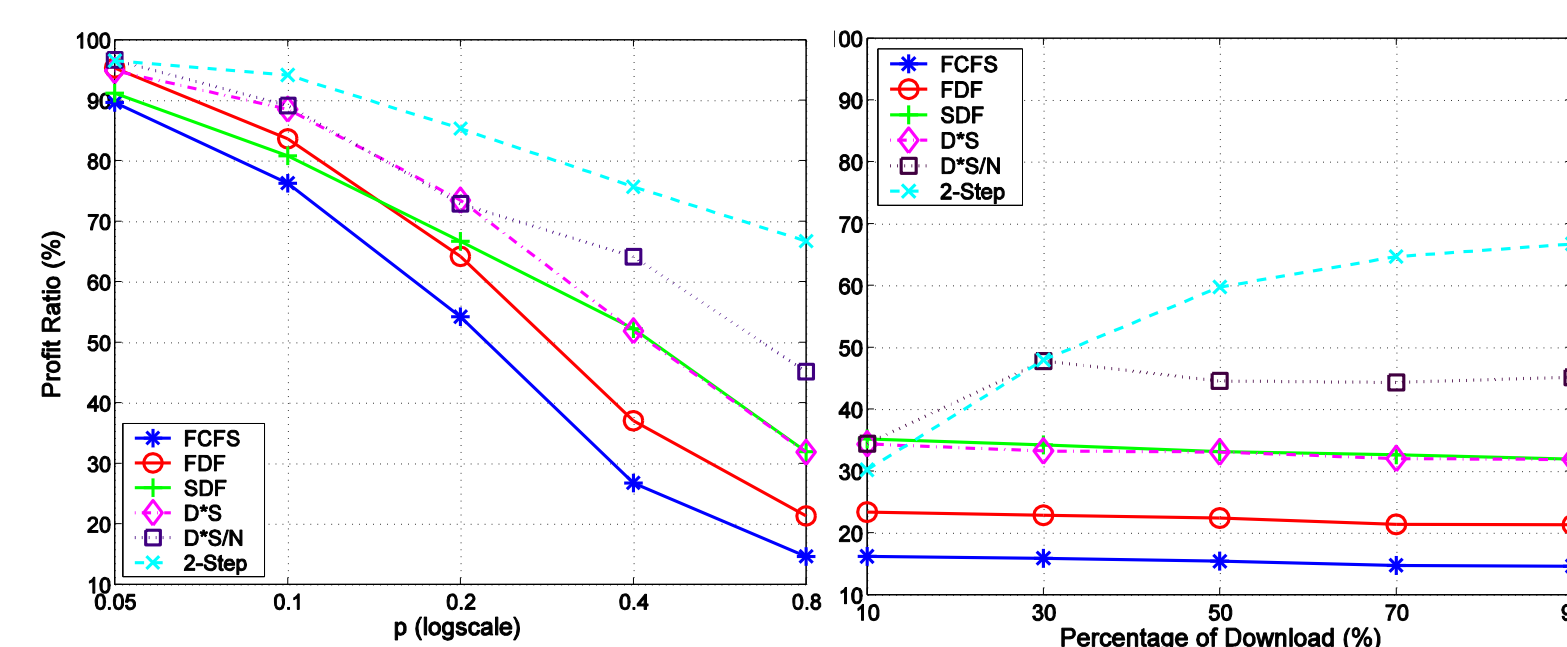


Fig. 8: Effect of Workload

Fig. 9: Effect of U/D Ratio

[1]. "Data Pouring and Buffering on The Road: A New Data Dissemination Paradigm for Vehicular Ad Hoc Networks," *IEEE Transactions on Vehicular Technology*, to appear
 [2]. "VADD: Vehicle-Assisted Data Delivery in Vehicular Ad Hoc Networks," *IEEE INFOCOM*, April 2006.
 [3]. "On Scheduling Vehicle-Roadside Data Access," *ACM VANET*, September, 2007