Data Dissemination in Vehicular Ad-hoc Networks (VANET)

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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

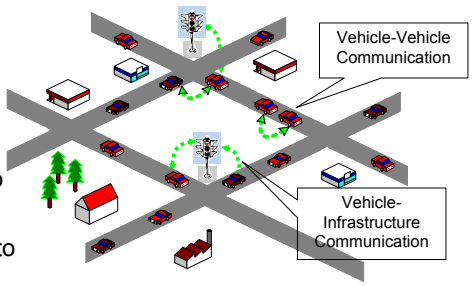

Fig. 1: One Possible VANET Scenario

Data Pouring and Buffering on The Road [1]

- Push-based Data Dissemination

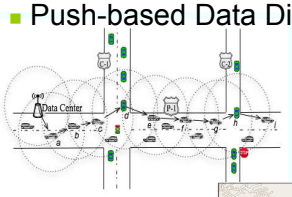

Fig. 2: Directional Broadcast

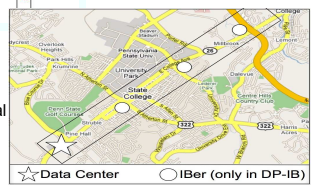

Fig. 3: A Snapshot of a Real Road Scenario

- 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

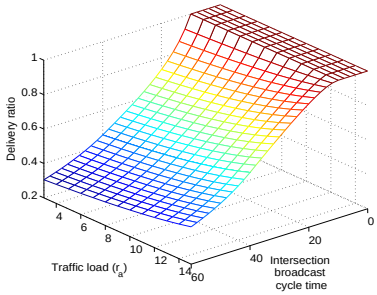

Fig. 4: Analyze the Relation Between the Broadcast Cycle Time and the Data Delivery Ratio

VADD: Vehicle-Assisted Data Delivery [2]

- Pull-based Data Dissemination

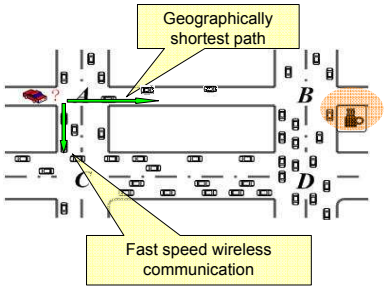

Fig. 5: Find a Path to the Coffee Shop

- 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

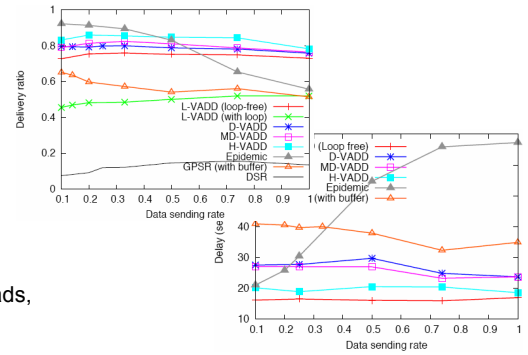

Fig. 6: Compare VADD with Existing Protocols

On Scheduling Vehicle-Roadside Data Access [3]

- One-Hop Scheduling

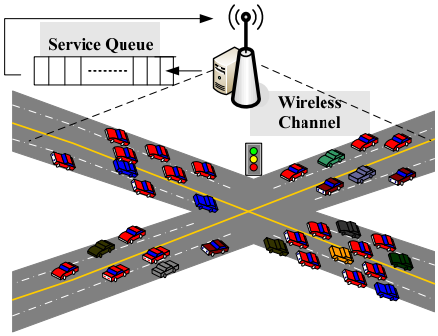

Fig. 7: The Architecture of Vehicle-Roadside Service Scheduling

- 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

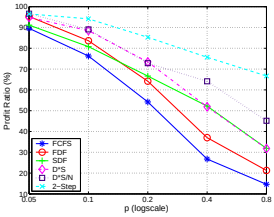

Fig. 8: Effect of Workload

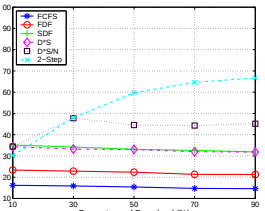

Fig. 9: Effect of U/D Ratio

[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

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