Using Vehicle Probes for Accurate Travel Time Estimation

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Outline

- Current Traffic Assessment in Anchorage
- Distributed Traffic Assessment in Anchorage
- Determining Time to Traverse Roadway based on GPS Data
- ITS-TSP
- Future Projects

Current Traffic Assessment in Anchorage

Discrete Traffic Gathering in Anchorage

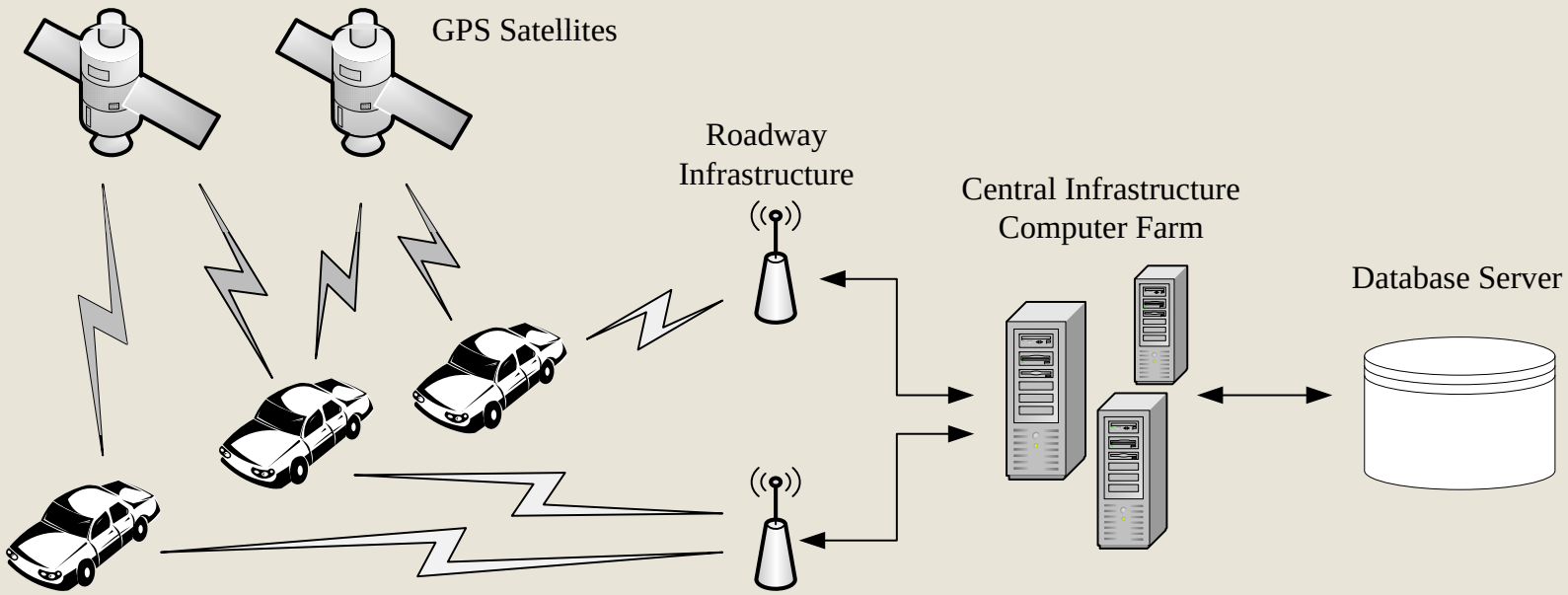
Discrete Traffic Gathering in Anchorage

Distributed Traffic Assessment in Anchorage

Distributed Data Gathering

- Instead of just gathering data at discrete locations, data can now be gathered from individual vehicles
- This can be accomplished through devices installed in vehicles or devices that are traveling with the vehicle
  - These devices can report speed, location, and possibly other vehicular parameters
- This allows real-time data to be gathered

Distributed Vehicular Data Gathering Architecture



Vehicle Tracking Devices

Cellular Tracking Devices

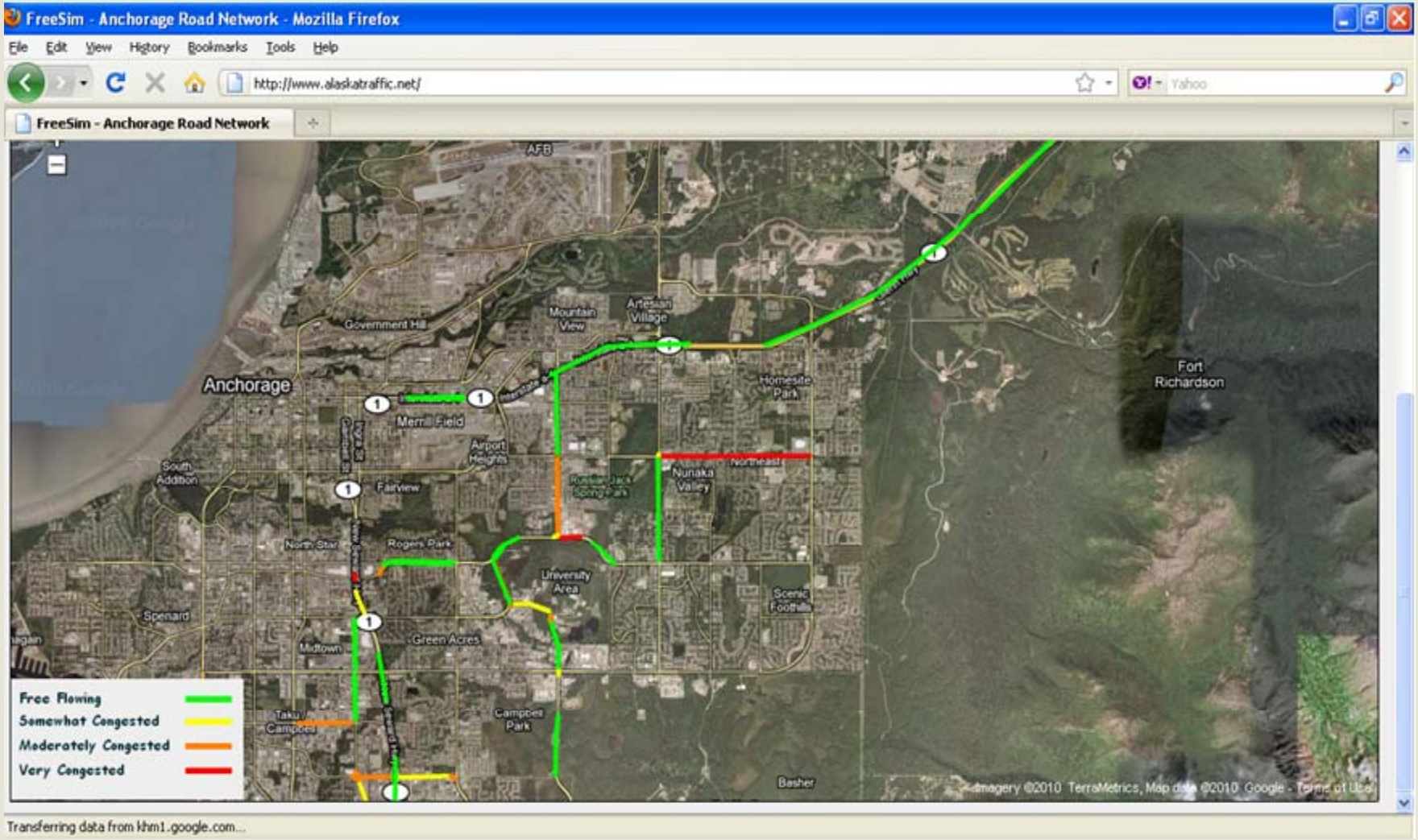
Privacy Concerns

- The data which is transmitted has a unique identifier associated with it, but this identifier is not associated with a vehicle
- We are only interested in the main arterials and not residential streets
- The location of the device is not exposed to the public, but only a map showing an aggregation of the data

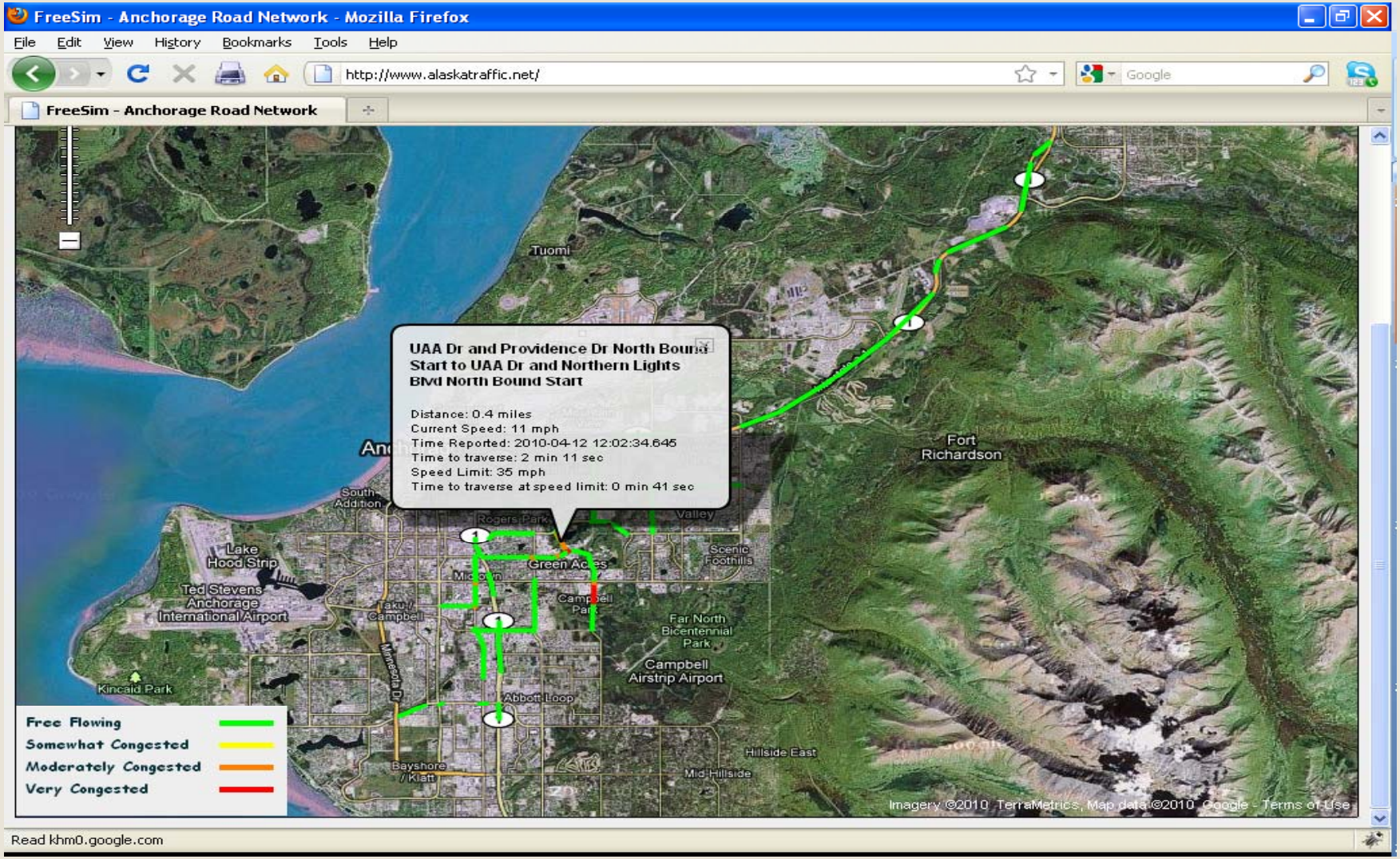
Current Status

- Currently, we have 65 vehicles being tracked
  - Volunteers
  - VPSI Share-A-Ride vans
  - Delivery freight vehicles
- We have a few vehicles using smartphones (iPhone, Blackberry, and Android-based phones)
- We have over 1.4 million data points that have been reported since December 2009 (~18 months)
- We are creating our own devices that allow gathering of additional parameters from the vehicle's OBD port
- We have a partnership with the local cellular providers (ACS and GCI) to allow free use of their networks for transmitting the data

Current Results - FreeSim



Current Results - FreeSim

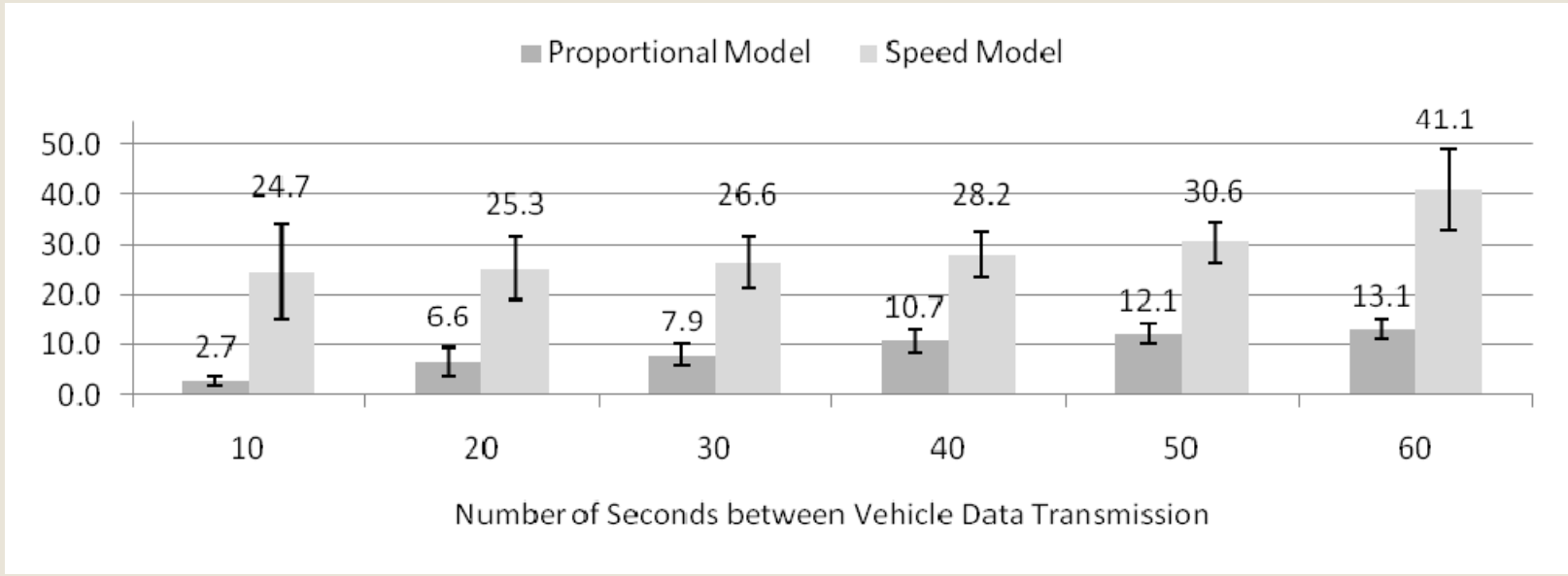


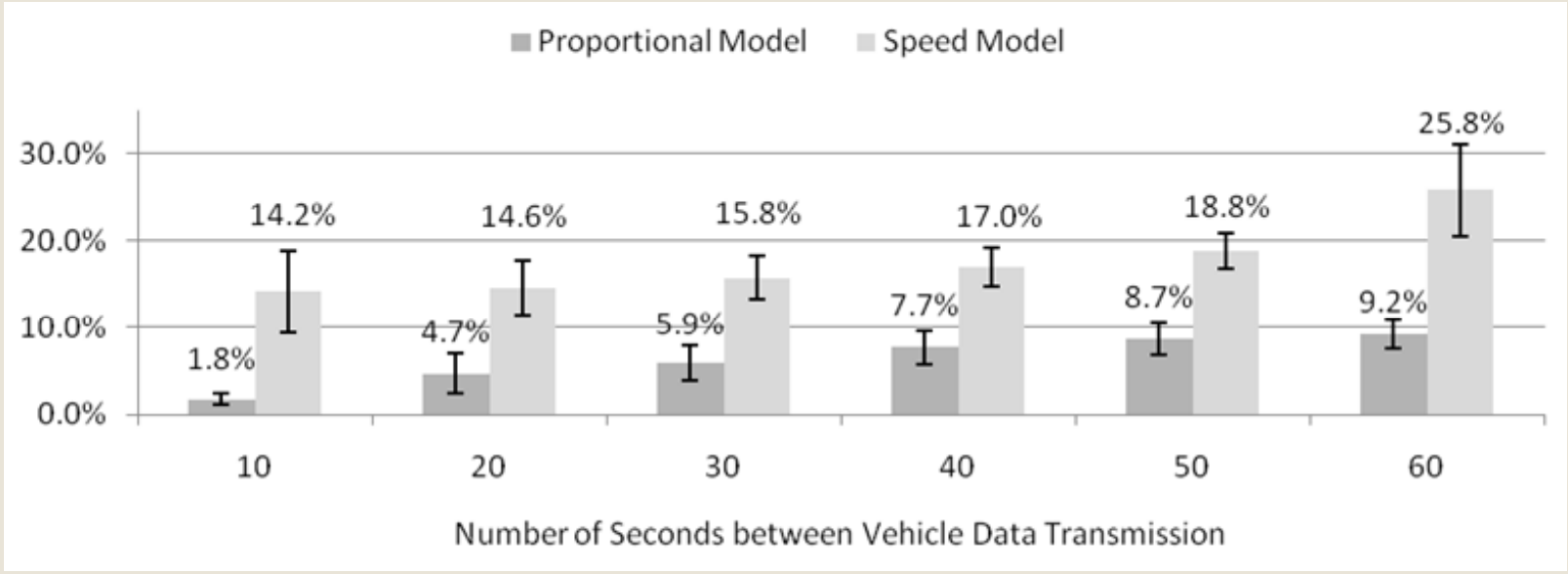
Additional Information

- The data shown on http://www.alaskatraffic.net stays live for 30 minutes if no other vehicle drives along the roadway
  - We are trying to assess if that length of time still reports accurate data or if the data is stale in a period less than that
- The project is free and open-source, and it is being used by other universities around the world in conjunction with departments of transportation
- We have determined travel times along certain arterials and can aggregate the data we have over periods of time

Determining Time to Traverse

- Speed Model
  - Use the speed and location data from an individual vehicle traversing a roadway and divide the distance of the roadway by the average speed
  - This works well for free-flowing roadways, but traffic-regulated roadways experience a high error rate with this model
- Proportional Model
  - Use the location, time reported, and distance to determine the amount of time to traverse the roadway based on a proportional calculation of the location of the vehicle data to the length of the roadway
  - This model doesn't use speed at all, but takes advantage of knowing that the time and distance is all that is needed to determine the time to travel along a roadway
  - This works for free-flowing and traffic-regulated roadways


Proportional Model
Speed Model
50.0
40.0
30.0
20.0
10.0
0.0
2.7
24.7
6.6
25.3
7.9
26.6
10.7
28.2
12.1
30.6
13.1
41.1
10
20
30
40
50
60
Number of Seconds between Vehicle Data Transmission


Proportional Model
Speed Model
30.0%
20.0%
10.0%
0.0%
1.8%
14.2%
4.7%
14.6%
5.9%
15.8%
7.7%
17.0%
8.7%
18.8%
9.2%
25.8%
10
20
30
40
50
60
Number of Seconds between Vehicle Data Transmission

Future Projects

Future Projects

- The applications of this data are too many to enumerate, but here are a few of the projects that are on our short-term list
  - Tracking snow plows and showing on the map the roads that have already been plowed in real-time
  - Aggregating all of the data we can in real-time to provide a single interface
  - Determining fastest paths in real-time and notifying drivers of the fastest way to get to their desired destinations
  - Testing academic problems on live data, such as the ITS-TSP
  - Determining how to reduce cost for the devices through V2V2I aggregation algorithms and WiFi or another form of wireless transmission
    - The US FCC has already standardized vehicular communication using DSRC with 75MHz allocated on the 5.9GHz band
    - The IEEE has standardized 802.11p for vehicular communication
  - Other projects as determined by key stakeholders

Questions?