

FreeSim Overview and Current Status

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Presentation for Pangomedia Developers

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Outline

- Intelligent Transportation System Overview
- Current Traffic Assessment in Anchorage
- Proposed Traffic Assessment in Anchorage
- Current Results
- Future Projects

Intelligent Transportation Systems (ITS)

- Intelligent transportation systems improve transportation safety and mobility and enhance productivity through the use of advanced communications technologies
 - Relieve congestion
 - Improve safety
 - Enhance productivity





9th & 8th Sts 1/2
Olympic Blvd 3/4
Santa Monica Fwy 1 1/4



ITS Application Overview

- Intelligent Infrastructure
 - Arterial Management
 - Freeway Management
 - Transit Management
 - Incident Management
 - Emergency Management
 - Electronic Payment and Pricing
 - Traveler Information
 - Information Management
 - Crash Prevention and Safety
 - Roadway Operations and Maintenance
 - Road Weather Management
 - Commercial Vehicle Operations
 - Intermodal Freight
- Intelligent Vehicles
 - Collision Avoidance Systems
 - Driver Assistance Systems
 - Collision Notification Systems

Current Traffic Assessment in Anchorage

Current Traffic Gathering in Anchorage

- Video cameras
- Inductive loop detectors
- Air tubes
- Police Reports
- Driver call-ins
- Manual gathering
- Speed sensors (not yet installed)

Current Traffic Gathering in Anchorage

Video Cameras



Current Traffic Gathering in Anchorage

Inductive Loop Detector



Current Traffic Gathering in Anchorage

Air Tubes



Current Traffic Gathering in Anchorage

Police Reports



Current Traffic Gathering in Anchorage

Driver Call-Ins



Current Traffic Gathering in Anchorage

Manual Gathering



Current Traffic Gathering in Anchorage

Speed Sensors



Proposed Traffic Assessment in Anchorage

Proposed Traffic Gathering in Anchorage

- Video cameras
- Inductive loop detectors
- Air tubes
- Police Reports
- Driver call-ins
- Manual gathering
- Speed sensors (not yet installed)
- Probe Vehicles

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 reporting
- This allows real-time data to be gathered

Proposed Traffic Gathering in Anchorage

Vehicle-Tracking Devices



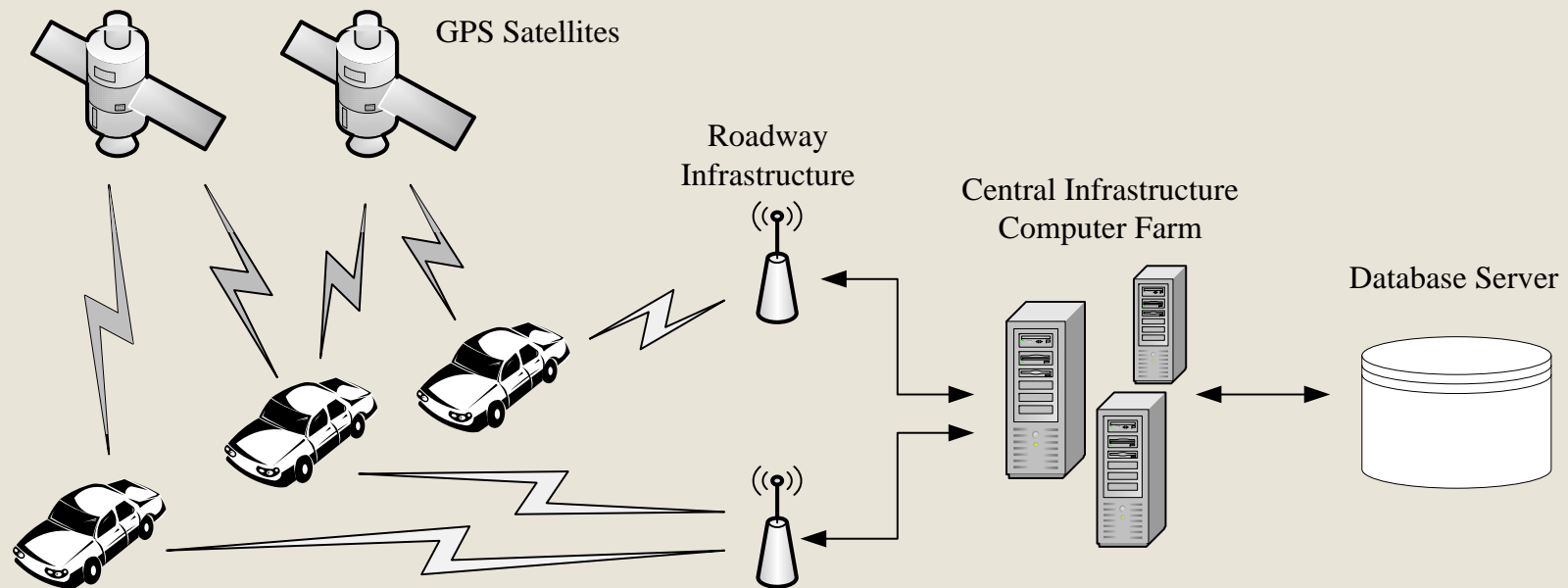
Proposed Traffic Gathering in Anchorage

Cellular Probes



Proposed Traffic Gathering in Anchorage

Architecture



Privacy Concerns

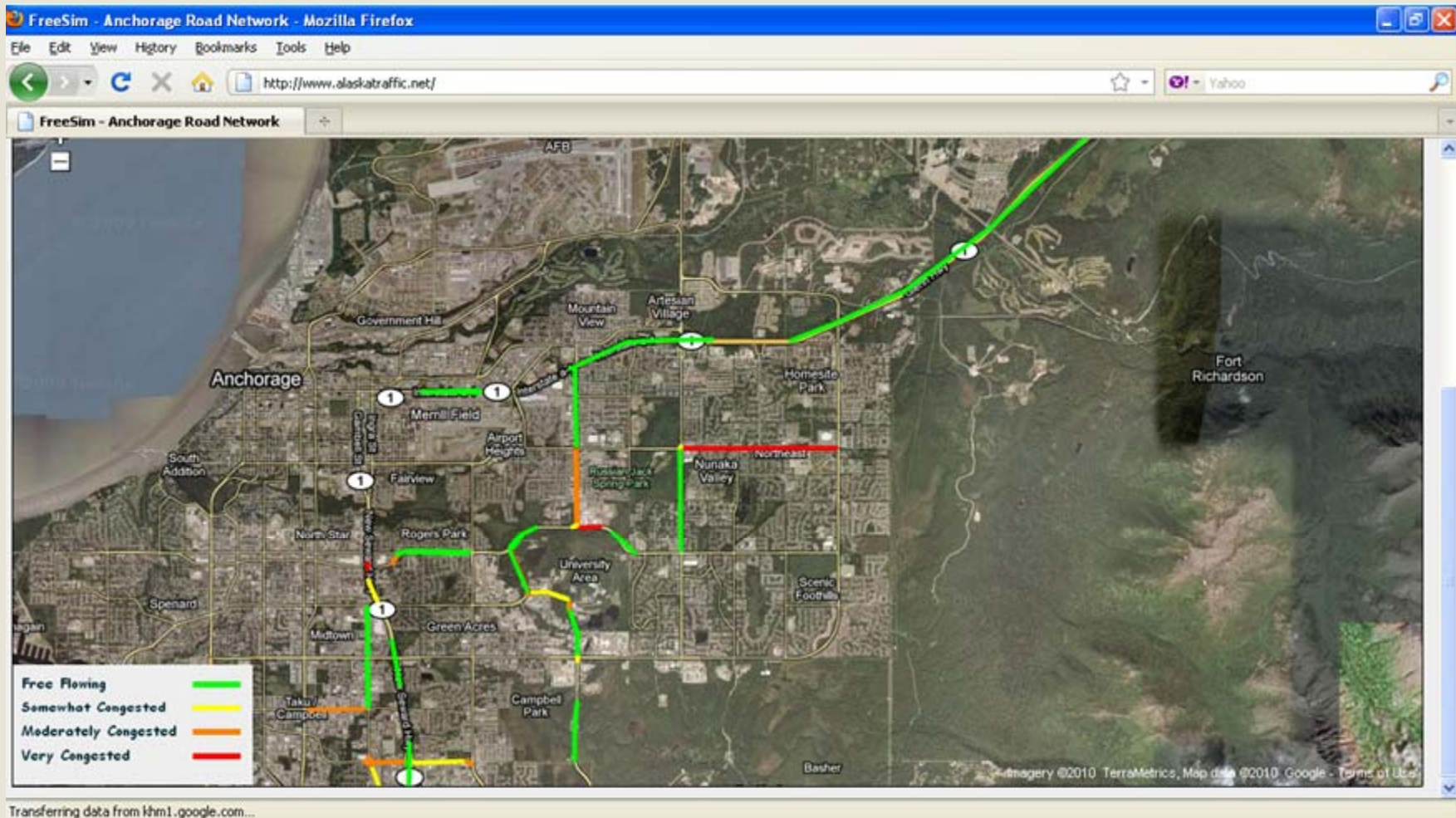
- The data which is transmitted has a unique identifier associated with it, but this identifier is not associated with a vehicle
- We are only interested in the main arterials and not residential streets
- The location of the device is not exposed to the public, but only a map showing an aggregation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

Current Results

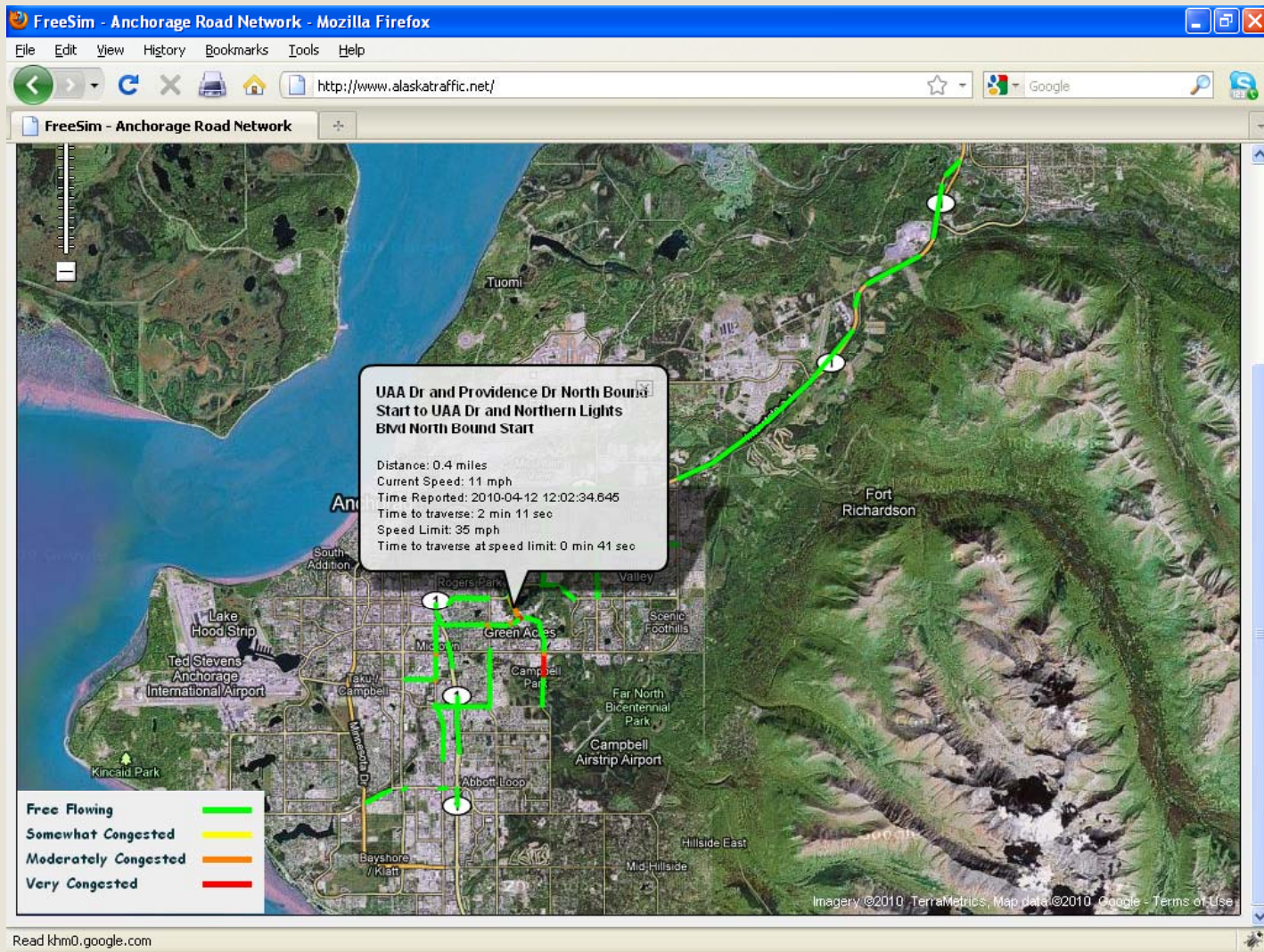
Current Status

- Currently, we have 15 vehicles being tracked
- We already have on-hand an additional 50 tracking devices
- We are currently working on creating the smartphone application
- We have spoken with Yellow Cab and Checker Cab in Anchorage, and they are both willing to work with us, though we have not received any data from them yet
- We have spoken with the Municipality about retrieving data from the Peplemover, but have not received any data from them yet
- We are currently speaking with VPSI about installing devices in the Share-A-Ride vans

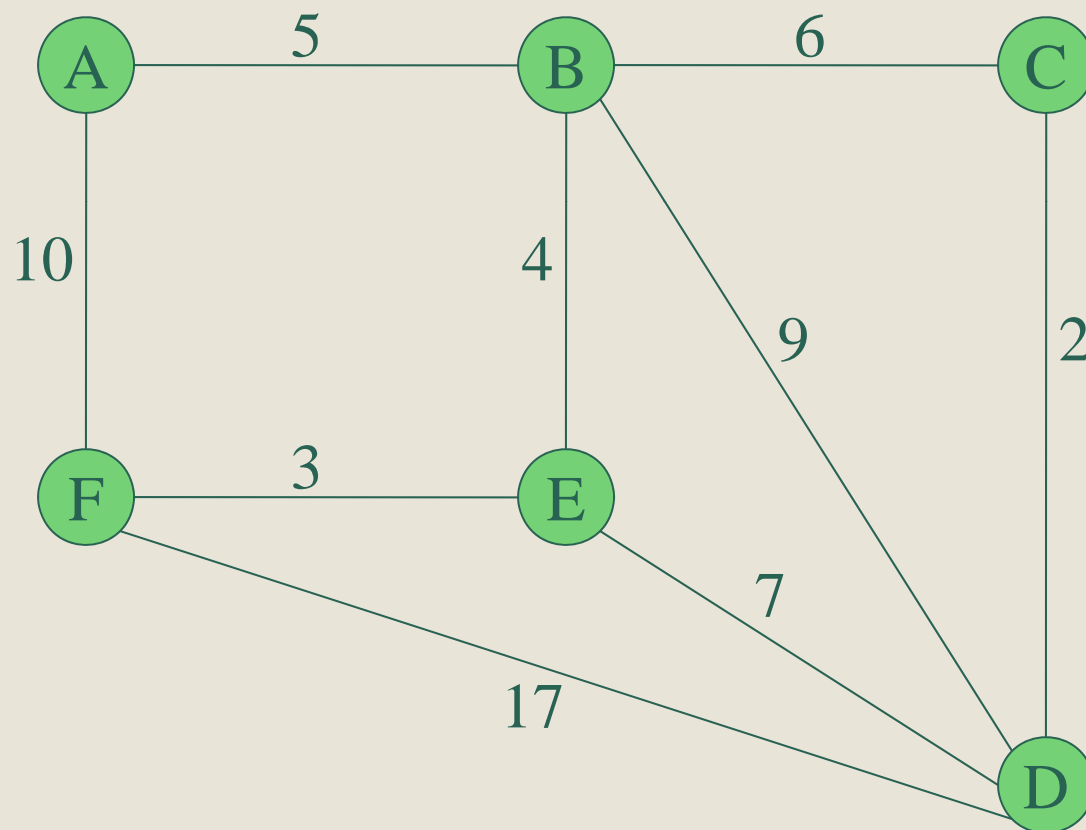
Current Results - FreeSim



Current Results - FreeSim



Fastest Path Graph Example



Fastest Path Algorithms

- Single Source Shortest Path Algorithms
 - Dijkstra $O(V \lg V + E)$
 - Bellman-Ford $O(VE)$
- All Pairs Shortest Path Algorithm
 - Floyd-Warshall $O(V^3)$
 - Johnson $O(V^2 \lg V + VE)$
- Dynamic Fastest Path Algorithms (DynFast)
 - Demetrescu and Italiano $O(V^2 \log^3 V)$ lookup, $O(1)$ for edge updates
 - King
 - Subramanian
 - Miller and Horowitz $O(V^2 E!)$ preprocessing, $O(1)$ edge update, $O(mV)$ lookup
- Dynamic Fastest Path Algorithms with Multiple Unique Destinations (DynFast-MUD)
 - TSP $O(V!)$
 - Miller and Ali $O(V^2 E!)$ preprocessing, $O(n^3)$ running

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
- Interfacing with the Municipality of Anchorage and the Alaska DOT to provide them with a summary of the data
- Advertising <http://www.alaskatraffic.net> for the public to view when we, the MOA, and the DOT feel the information displayed is accurate enough for the public
- Retrieving GPS data from additional vehicles through devices already installed or through installing more devices
- 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

Future Projects

- Working with freight companies to determine how they can use this data and what data they can provide
- Determining fastest paths in real-time and notifying drivers of the fastest way to get to their desired destinations
- Solving academic problems with practical applications, such as the Dynamic Traveling Salesman Problem
- Other projects as determined by key stakeholders (such as the Freight Advisory Committee)

Questions?



More Questions?

