An Open Source Tool for the Visualization, Analysis and Reporting of Regional and Statewide Transit Networks

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Presentation Outline

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Introduction

• Assessing the current "state of health" of individual transit networks is a fundamental part of studies aimed at planning changes and/or upgrades to the transportation network serving a region.

• To be able to effect changes that benefit both the individual transit networks as well as the larger transportation system, organizations need to develop meaningful strategies guided by specific performance metrics.
Introduction (cont.)

- A fundamental requirement for the development of these performance metrics is the availability of accurate data regarding transit networks.
Introduction (cont.)

• Prior to 2005, software engineers had to "data scrape" the website of a transit agency or were required to submit Freedom of Information Act requests to obtain transit data (Roth, 2012)
  – This situation complicated the assessment of single transit networks, let alone performing a state-wide or region-wide study

• The advent of the General Transit Feed Specification (GTFS) changed this constrained landscape and motivated transit operators to release their schedules and route information to third party developers
The Oregon Transit Network

The mission of the Rail & Public Transit Division (RPTD) of the Oregon Department of Transportation (ODOT) is to support mobility options for Oregonians through

– Advocacy
– Collaborative partnerships, and
– Grant programs

To accomplish this mission, the RPTD provides grants, policy leadership, and technical assistance to communities and local transportation providers to provide transportation to people
The Oregon Transit Network (cont.)

- Based on the RPTD's long experience in dealing with public transit issues, the majority of investments made in transit service by state, local, and federal government agencies are:
  - Based on local service providers’ individual priorities, and
  - Made with limited ability to consider the impact that these investments may have on the larger transit network.
Research Objectives

• Create an open source software tool to help the ODOT's RPTD gain a better understanding and more efficient utilization of existing state-wide transit networks
  – Must help PTD planners to better understand and assess gaps in spatial and temporal transit schedule connectivity

• The final product, referred to as the Transit Network Analysis (TNA) software tool, incorporates publicly available data and can be used to visualize, analyze, and report on the Oregon transit network
Data Sources

- The main data sources used by the TNA software tool are
  - General Transit Feed Specification (GTFS) data
  - Geographic area shape files: counties, census tracts, census places, urbanized areas, congressional districts, and ODOT transit regions
  - Census data (census block level)
  - Employment data
  - Park and Ride data
  - Demographics
Data Sources

General Transit Feed Specification (GTFS)

• The GTFS is a common format for public transportation schedules and associated geographic information
  – https://developers.google.com/transit/
• The idea started in 2005 in Google and TriMet (Transit agency of Portland, OR)
• A GTFS feed is a collection of at least six, and up to 13 CSV (Comma separated Values) files (with extension .txt) contained within a zip file.
Data Sources

GTFS (cont.)

• Using the GTFS, a public or private transit agency can describe
  – Stops
  – Routes
  – Stop times
  – Fare and fare rules
  – Service calendar
  – Service exceptions
  – Transfers
  ...

Diagram showing data relationships:
- agency
- fare_attributes
- routes
- shapes
- calendar
- calendar_dates
- frequencies
- trips
- service_id
- trip_id
- stop_times
- stop_id
- transfers
- feed_info
Data Sources

GTFS (cont.)

• Many transit agencies in the U.S. (and across the world) have already created and adopted the GTFS data standard to make information about their network available to users
  – http://code.google.com/p/googletransitdatafeed/wiki/PublicFeeds

• In the state of Oregon, approximately 85% of fixed route transit providers have GTFS data for their services
  – http://www.oregon-gtfs.com/
TNA Software Tool Architecture

Server

- Relational Database
- TNA tool WebApp
- Map Server

Client

- Maintenance/Administration UI (Web Browser)
- GUI (Web Browser)
- GTFS Data

APIs:
- RESTful API
- RESTful API
TNA Software Tool Architecture (cont.)

TNA software tool is developed using free open source tools and libraries

- **Java**
  - Backend is programmed in Java

- **PostgreSQL/ PostGIS**
  - The relational geospatial database

- **JavaScript**
  - Client side functionality is implemented using JavaScript/ HTML/CSS
  - Open source JavaScript libraries: jQuery, jQuery-UI, jsTree, DataTables, markerCluster, Leaflet, ...
TNA Software Tool Demonstration

https://tnasoftaretool.engr.oregonstate.edu/TNAtoolAPI-Webapp/wiki/#!index.md
TNA Software Tool Evolution

• Phase I: Jul 2012-Sep 2013
  – Comprehensive research on available network analysis tools compatible with GTFS standard
  – The first version of the TNA software tool was developed based on OpenTripPlanner

• Phase II: Nov 2013-Dec 2014
  – TNA software tool backend was redesigned and coded from scratch
  – The Geospatial database was designed and implemented in MySQL and then PostgreSQL/PostGIS
  – More complex reports/ on map reports

• Phase III: Jan 2015- Mar 2016
  – Admin Interface
  – GTFS Playground
  – Employment, demographics, title IV, and park & ride

• Phase IV: Apr 2016 - Now
  – More features
Conclusions

• The TNA software tool represents a solid foundation to provide transit planners with a broader perspective of how individual transit networks and their interactions may affect a larger state-wide or region-wide transportation network.
Conclusions (cont.)

- A sophisticated geospatial analysis tool for design and analysis of transit networks
  - Observe and Analyze transit network evolution over time
  - GTFS Playground: As-If and sensitivity analysis
  - Complex reports based on geographic areas
  - Connectivity analysis: transit hubs, connected agencies, and transit networks
  - Open source application, developed using open source tools and libraries, uses open data
Thanks for your attention

Questions