



OTP 2009-2011 RTO Grant Final Report

OTP Workshop
July 13, 2011

EXECUTIVE SUMMARY

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OS MMTPS Metro RTO Grant 2009-2011 Primary Goals

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Kick-Off Workshop July 2009

Project Management Plan September 2009

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Project Plan and Milestones

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Open Source Development Method

Open Source Software

Open Architecture

Open Data

Implementation of Prototypes February 2010

Year One Anniversary July 2010

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Zeitgeist 2010: How the world searched

2010 Portland, OR

1. [student assist](#)
2. [trimet trip planner](#)
3. [blazersedge](#)
4. [weather portland or](#)
5. [mississippi studios](#)
6. [inside pps](#)
7. [ikea portland](#)
8. [95.5 the game](#)
9. [my pcc](#)
10. [providence health plan](#)

2009 Portland, OR

1. trimet trip planner
2. oregon unemployment claim
3. 95.5 the game
4. multnomah county jail
5. onpoint credit union
6. mypcc
7. pcc.edu
8. pdx.edu
9. workinginoregon.org
10. blazers edge

TRIMET Home

Trip Planner

Plan a Trip PDX (Portland) t

PDX (Portland) to POWELL'S OF BOOKS

Option 1: Your
No transfers, 46 min

Start at PDX (

Light Rail MA
Beaverton TC
6:42pm De
Sto
: 4

7:23pm An
Sto

Expect delays an
10:30 p.m. due to
(formerly POE Pa

Walk north to
BOOKS
: /

End at POWE
BOOKS

Reverse

Location Search

TriMet Routes

Transit Center Loca

Google maps

Get Directions [My Maps](#)

A 4012 SE 17th Ave, Portland, OR 97202 (trimet ad

B 600 NE Grand Avenue, Portland, OR

Add Destination - [Hide options](#)

Depart at

Get Directions

byCycle.org Search the map [Find a route](#)

Bicycle Trip Planner beta -122.6618172441,45.52747919 Search Map

Enter an address or intersection -OR- pick a location from the map.

Welcome to the byCycle.org bicycle trip planner.

Locations **Routes**

Location [show on map](#) _X

NE Martin Luther King Jr Blvd & NE Hoyt St
Portland, OR 97232
Set as [start](#) or [end](#) of route

Find address at center Show bike map Clear all

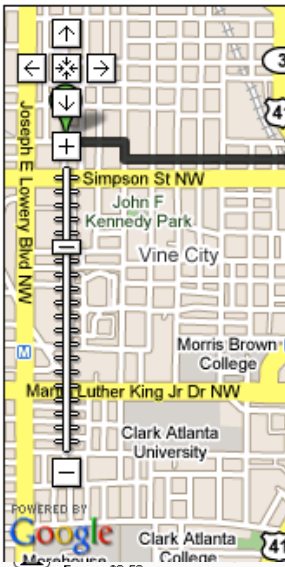
background

Single-Mode Trip Planners



- Get Directions
- Transit Schedules
- Next Train/Bus
- Attractions
- Travel Tips
- Partners

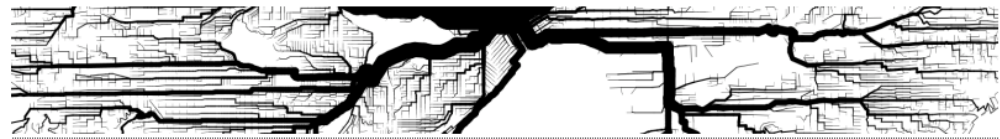
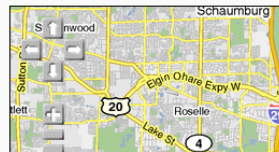
A TRAIN PRESENTED BY
citizens for progressive trans.



POWERS BY
Google
Fares: \$2.50
Distance: 4.5 Miles
Take [Pace Bus 330](#) [Add to Pref](#)
Depart at 9:19 PM: Lagrange/Hillgro
Arrive at 9:57 PM: Ohare Airport K
Fares: \$1.75
Distance: 11.9 Miles

Arrive Ohare Airport Kiss-N-Fly at 5

From: 62 S Richmond Ave, Clarendon Hills



GRAPHSERVER

The open-source multi-modal trip planner.

OneBusAway

[Home](#) [Tools](#) [Research](#) [Contact Us](#) [Settings](#)

Where is your bus?

Let's find out. We provide easy access to real-time transit information for the Puget Sound region and beyond.



Our Goal

We want to make it easier to use public transit by providing easy access to schedule and real-time arrival information for the buses and trains you ride every day.

We provide:

- Real-time arrival information for a [number of transit agencies](#).
- Arrival info for every bus stop.
- Easy access to information across a variety of devices.

Why? We're riders just like you and we don't like waiting for the bus any more than we have to.

Our Tools

[Our tools](#) are available across a number of interfaces:



[Web](#) [Phone](#) [SMS](#)



[iPhone](#) [Android](#) [Mobile](#)

Our Research



OneBusAway was started by students at the University of Washington, and it supports research on improving the usability of public transportation, such as the [Explore Tool](#) shown above. Check out our [research page](#) for more information.

Our work is all [open-source software](#), so that others may reuse and build upon our efforts.

Multimodal Trip Planners

background

proprietary software

aligns with
procurement
processes

traditional business
model, well
understood

risk

open source software

more control

fosters innovation
and competition

broad user &
developer base
(many eyes)

low entry cost,
shared costs

risk

background

Understand and weigh your risks and advantages
Not all proprietary is the same, and not all oss is the same

TRI MET Home

Clear Measure Buses

Feedback Full Screen Satellite Map

Trip Planner

Location Search

TriMet Routes

Name

6-Martin Luther King Jr Blvd

Frequent Service

During the weekday morning and afternoon rush hour, 6-Martin Luther King Jr Blvd buses run every 15 minutes or better.

To Portland City Center: Weekdays Saturday Sunday

To Jantzen Beach: Weekdays Saturday Sunday

8-Jackson Park/NE 15th

9-Powell/Broadway

10-Harold St

12-Barbur/Sandy Blvd

14-Hawthorne

15-Belmont/NW 23rd

17-Holgate/NW 21st

18-Hillside

19-Woodstock/Glisan

20-Burnside/Stark

22-Parkrose

23-San Rafael

24-Fremont

25-Glisan/Rockwood

28-Linwood

29-Lake/Webster Rd

30-Estacada

31-King Rd

32-Oatfield

33-McLoughlin

34-River Rd

35-Macadam/Greeley

Transit Center Locations

Vehicle 2010

6 M L King Jr to Jantzen Beach

Last position update: 4.29.2011 6:18 pm

1 min, 24 secs ago.

measure: 462 ft

TRI MET TransitTracker

Stop ID 5912

NE M L King & Hoyt Southbound

6 To Portland 4 min

Scheduled at 8:19pm

6 To Portland *8:36pm

Scheduled at 8:36pm

* Vehicle location data is unavailable. Scheduled time is shown instead.

Predictions as of 8:20pm | Page reloads every 30 seconds

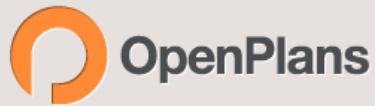
Bus locations

Vehicle #	Destination	Last update
2717	6 M L King Jr to Portland	4.29.2011 6:19 pm
2316	6 To SW 18th & Jefferson	4.29.2011 6:19 pm
2723	6 M L King Jr to Portland	4.29.2011 6:19 pm

background

TriMet Interactive System Map/Trip Planner maps.trimet.org

All open source technologies including GeoServer, OpenLayers, PostGIS
Real-Time Vehicle locations , Measure Distance Tool

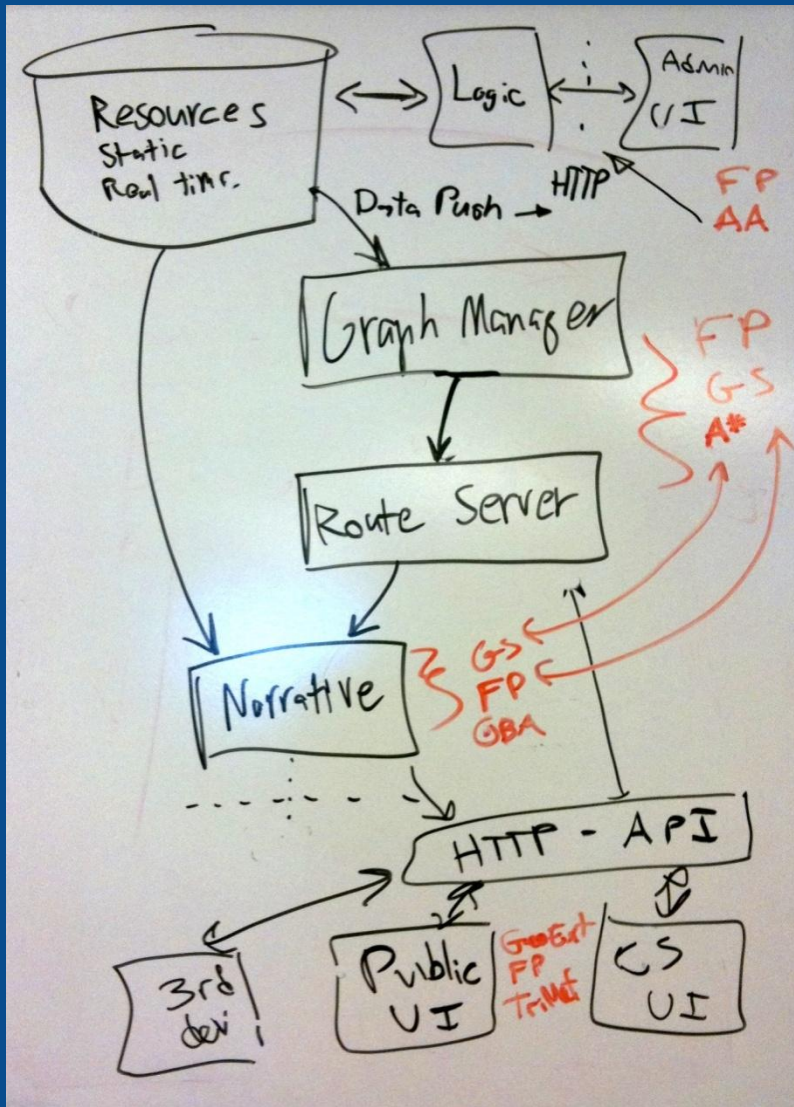


Project Tasks	Estimated Completion Data	Actual Completion Date
Project Management Plan	September 2009	September 2009
Software development and implementation of working prototype	January 2011	February 2010
Evaluation Studies	May 2011	July 2010 – June 2011
Final Reports	June 2011	June 2011

Metro Regional Travel Options Grant

July 1, 2009 – July 1, 2011

background



project overview

Project Kick-Off Workshop
July 2009

OpenTripPlanner

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Welcome

OpenTripPlanner is an **open source multi-modal trip planner** released under the [LGPL](#). The project is a collaborative effort among [TriMet](#), [OpenPlans](#), and the developers of [FivePoints](#), [OneBusAway](#), [Graphserver](#), and [byCycle](#).

- **Learn more** about the project
- Get involved by participating as a [developer](#)
- Join our [mailing list](#) or [developer list](#)
- Explore [live demos](#) of the software and provide feedback

What's a trip planner?

A trip planner helps you figure out how best to get where you want to go. A multi-modal trip planner lets you plan routes using multiple "modes," for example, on foot, bike, train, bus, or some combination thereof. A good multi-modal trip planner allows you to easily tailor your trip to your preferences, for example by eliminating transfers, walking a more scenic path, or only riding buses with bike storage. [Learn more](#)

For developers

- [Installation instructions](#) (how to get a development environment set up)
- [Developers Guide](#) (code conventions, how to submit patches, etc)
- [Tutorials](#) (complete list of development tutorials)
- Mailing lists
 - [Developer discussion list](#)
 - [SVN commit list](#) (get emailed when code is checked in)
 - [Build status list](#) (get emailed when [the build](#) fails)
- IRC channel
 - [#opentripplanner](#) on Freenode
 - You can connect using your favorite IRC client or [chat through the web](#) (just enter a username and click *Connect*)
- Join our [weekly conference calls](#) (Friday afternoons)
- Check out and contribute to [future ideas for the software](#)

For stakeholders and users

- [OpenTripPlanner mailing list](#) (for getting help with and discussing the software)
- [Frequently asked questions \(FAQ\)](#) (what is a trip planner? who's behind this?)
- [Phase One project plan](#)
- [Kick-off workshop](#) (notes from the workshop that launched this project)

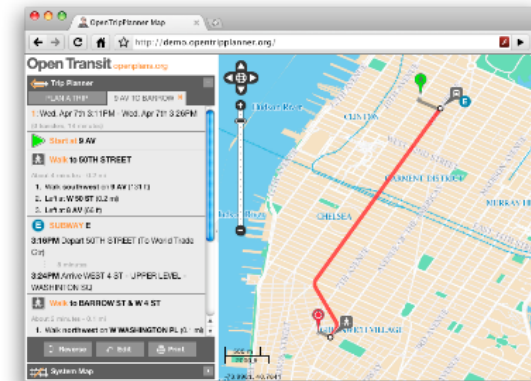
Status

OpenTripPlanner is presently at **version 0.3**.

The software currently:

- Plans true multi-modal trips combining walking, biking and transit
- Plans wheelchair accessible trips
- Plans depart by/arrive by trips
- Takes road type, bike lane, and elevation data into account when planning bike trips
- Show elevation maps for bike trips
- Imports data from GTFS, shapefiles, OpenStreetMap, and the National Elevation Dataset
- Plans trips in about 100ms in a moderate sized city
- Exposes a RESTful API (XML and JSON), which other apps or front-ends can build on

See the [Status](#) page for more information and the [Roadmap](#) for what's next.



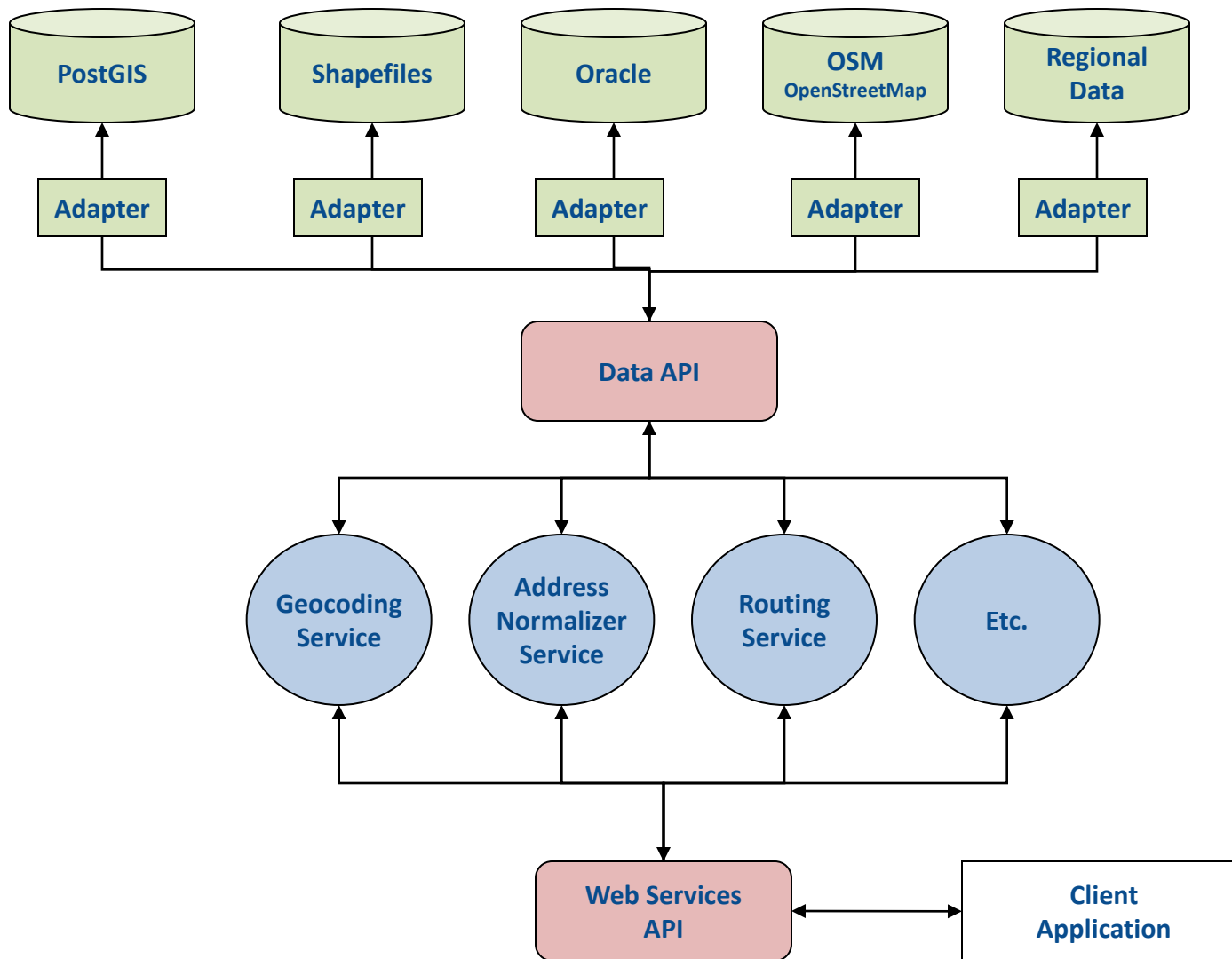
project overview

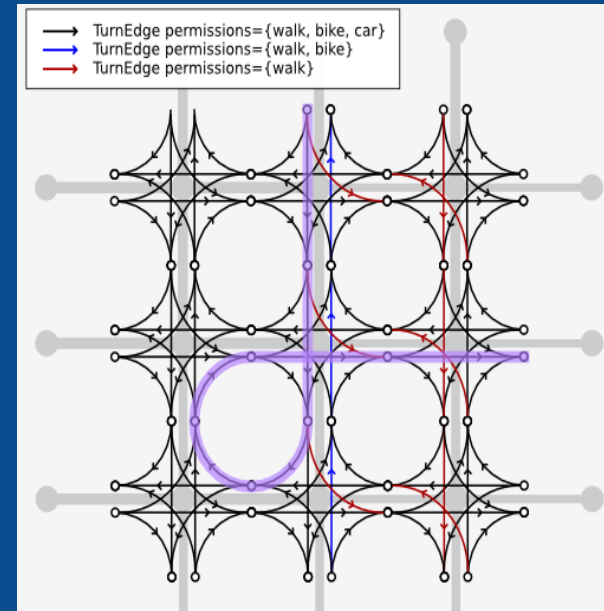
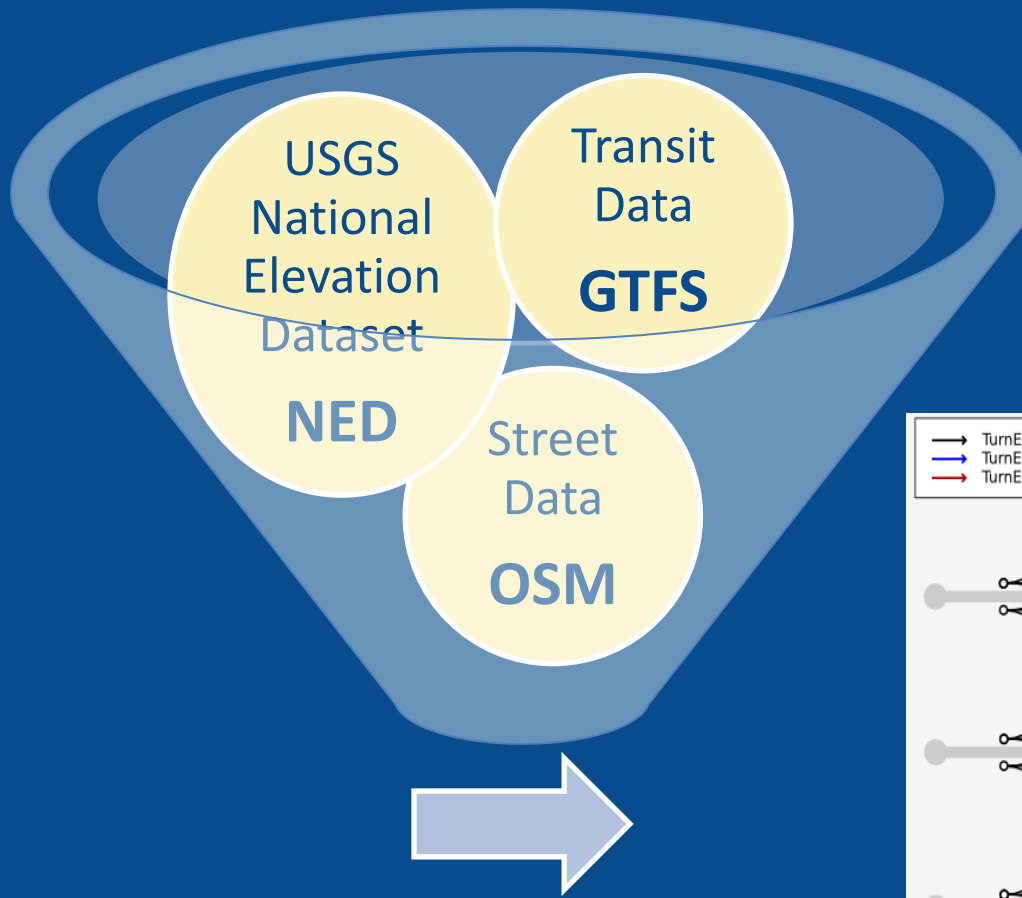
OpenTripPlanner.org

{1} Active Tickets (78 matches)

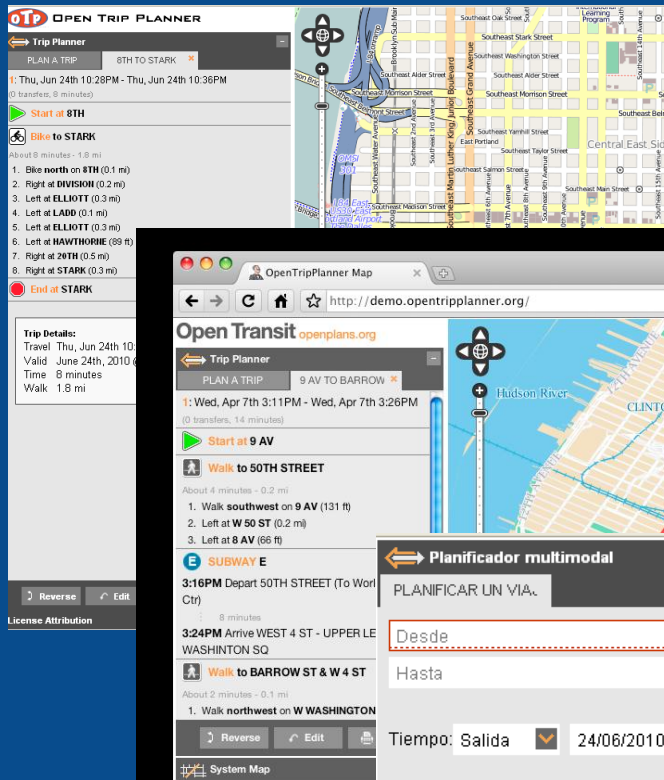
- List all active tickets by priority.
- Color each row based on priority.

Ticket	Summary	Component	Version	Milestone	Type	Owner	Status	Created
#1	Make transportation extremely easy				enhancement		new	07/17/09
#5	Fully support GTFS in FivePoints			Future	enhancement	demory	new	07/17/09
#8	Migrate FivePoints web UI towards independent GeoExt widgets			Future	enhancement	demory	new	07/17/09
#10	Explore overall project branding and namespacing	api-extended		1.0	enhancement		new	07/17/09
#11	Create a proposal for a test system for running trips			Future	enhancement	lisaflam	new	07/17/09
#41	FivePoints-style topo map	webapp		0.5	enhancement		new	11/08/09
#45	What does OTP Deployment look like?	api-webapp		0.4	enhancement		new	11/13/09
#50	Propose using Log4j as our plugin of choice to slf4j	api-webapp		1.0	enhancement		new	11/20/09
#51	Store multiple versions of the graph depending on transportation modes			1.0	enhancement		new	11/20/09
#69	Multiple itinerary support	api-webapp		0.5	task		new	12/04/09
#72	Where does OTP stop, and the webapp / map / WFS / etc... continue?	webapp		Future	task		new	12/04/09
#81	Turn-by-turn directions should handle traffic circles	api-webapp		Future	enhancement		new	12/08/09
#82	Hudson should do coverage and javadoc coverage tests	none		Future	task		new	12/08/09
#90	Setup system for testing webapp	webapp		Future	task		new	12/11/09
#94	Handle prefer greenways/quick/safe optimization preferences	api-webapp		0.6	task		new	12/15/09
#101	Stored graph versioning	graph-builder		1.0	enhancement		new	12/28/09
#106	Easy graph builder	graph-builder		Future	task		new	01/04/10
#117	Right-click does not select an option on context menu	webapp		1.0	defect		new	01/19/10
#134	Carbon Savings Counter	webapp		Future	enhancement		new	01/29/10
#139	GUI should show turn vertices prettier	none		Future	enhancement		new	02/02/10
#154	GeoCoder/GeoSearch tool (Apache SOLR based)	api-webapp		0.7	enhancement	fpurcell	new	02/26/10
#155	Additional WS (optional) parameters	api-webapp		0.5	enhancement	fpurcell	new	02/26/10
#156	Minimized JS	webapp		0.5	enhancement	fpurcell	new	02/26/10
#157	VOTE: Should we update the Trip Itinerary?	webapp		0.5	enhancement	fpurcell	new	02/26/10
#161	Make dates internationalizable	webapp		Future	enhancement		new	03/02/10
#162	Safest route should only be available for bicycle trips	webapp		0.6	defect		new	03/02/10





OTP OTP uses open source datasets (GTFS, NED, and OSM) to build a routable graph.



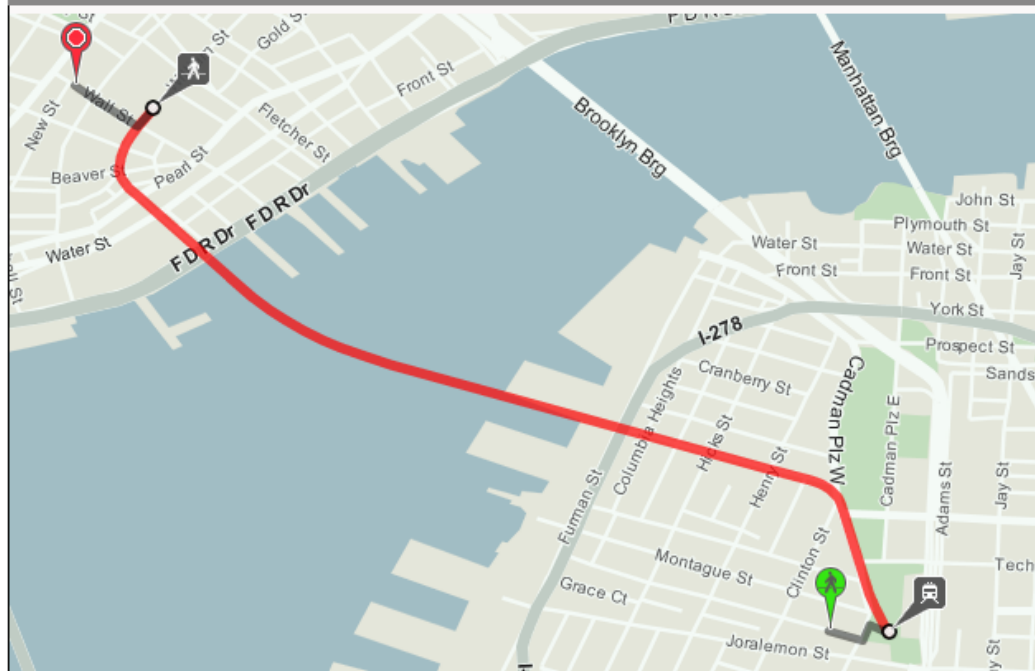
project overview

The demos are designed for demonstration purposes and are intended to be used as a tool for the developers for testing purposes for both the algorithm and the underlying data.

Progress in Year 1 (July 2009 – July 2010)
Worldwide interest and participation



OpenTripPlanner

[Demo](#)[Learn](#)[Deploy](#)[Contact](#)

OpenTripPlanner communicates transit schedule, travel, and map information in a single standards-based, affordable package that any agency can use.

Who uses OpenTripPlanner?



NYC
Department of City Planning

Interested? [Try a live demo.](#)



Customized:

An online map just like your printed map, with your agency's brand, colors, and icons.



Fully Multi-Modal:

Riders can choose their mode (walk, bike, bus, rail) or modes (walk to transit, bike to transit).



Open-API:

Connect your data and routes with a world of applications.



Flexible Deployment:

Install TripPlanner on your existing infrastructure or let us host it for you.

project overview

Progress in Year 1

Support and maintenance options

Code Development

Code quality and extensibility improvements
Improved wheelchair accessibility
graph reloading Speed improvements (~10x)
Memory usage improvements (~0.5)
Code documentation
Intermediate stops in API
Better extensibility
Visualization improvements
Making bikes on transit optional
Kept up-to-date with changing technology (upgraded Spring)
Edge notes
Nominatim geocoder support
Cleaner max walk distance support
Support for certain common GTFS failure modes
Workarounds for OSM data issues (pedestrian islands)
Support loading OSM from Protocol Buffers format & bz2 xml
OSM future proofing
OSM permission bug fixes
Traffic circles / roundabouts
Much improved transfer support (min transfer times; transfers now routed on walking network)
Support for multiple route names on the same stop pattern (typically night buses)
Dozens of miscellaneous bug fixes
Gvsig visualization
Documentation for graph builder
Better names for some OSM ways
Better slope visualization
Slope override for bridges
Some integration with OneBusAway
Preferred/dispreferred/banned routes
Translations from English into the following seven languages: French, Gaelic, Hungarian, Italian, Marathi, Polish, Spanish

OTP turns 1:



Check out the presentation from the OTP stakeholder anniversary webinar and related press!

Demos Released:

5. Granada, Spain July 2010
6. Pune, India October 2010
7. Smartrip Transport for Dublin Journey Planner January 2011
8. Ottawa Canada Green Trip Planner January 2011
9. Tampa, Florida May 2011
10. Gipuzkoa Transit Android App May 2011
11. TeleAviv, Israel

Translations into: French, Gaelic, Hungarian, Italian, Marathi, Polish, Spanish, Hebrew

Progress in Year 2 July 2010 – July 2011

Jurisdictional Data

- regional or local coverage
- not designed for routing

Commercial Products

- seamless worldwide coverage
- includes routing attributes
- costly annual license fees

OSM

- seamless worldwide coverage
- includes routing attributes
- collaboration with community

routable networks for OTP

Street Map Data Options

Why OSM? Investment in community product for shared benefits



PJ Houser



**Melelani
Sax-Barnett**



Betsy Breyer



Grant Humphries

Portland State University Student Interns

OSM improvement process



Phase I – Feb 18, 2011 thru Aug 18, 2011

Improve geometry

Add additional linework: missing streets, trails, bicycle lanes , pedestrian paths, major waterways

Add/correct attribution

Verify directionality and add turn restrictions for bicycle routing

Not Included

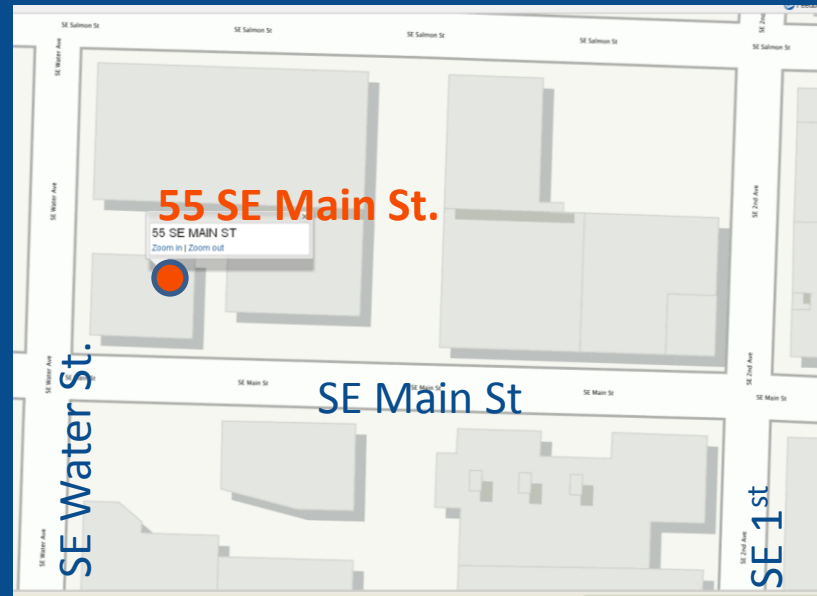
Addresses

Loc_Ids *(except where an OSM way was edited, the RLIS local ID was added as a backwards reference)*

OSM improvement process

SE Main St	1	●	99	101	199	201
	0		98	100	198	200
SE Water St.			SE 1 st		SE 2 nd St.	

55 SE Main St.



Address geocoding (via GIS) on theoretical address ranges in centerline file

Returns via GIS/geocoder approximate
XY coordinates based on interpolation of
theoretical address ranges

- high maintenance for approximations
- requires breaking of segments

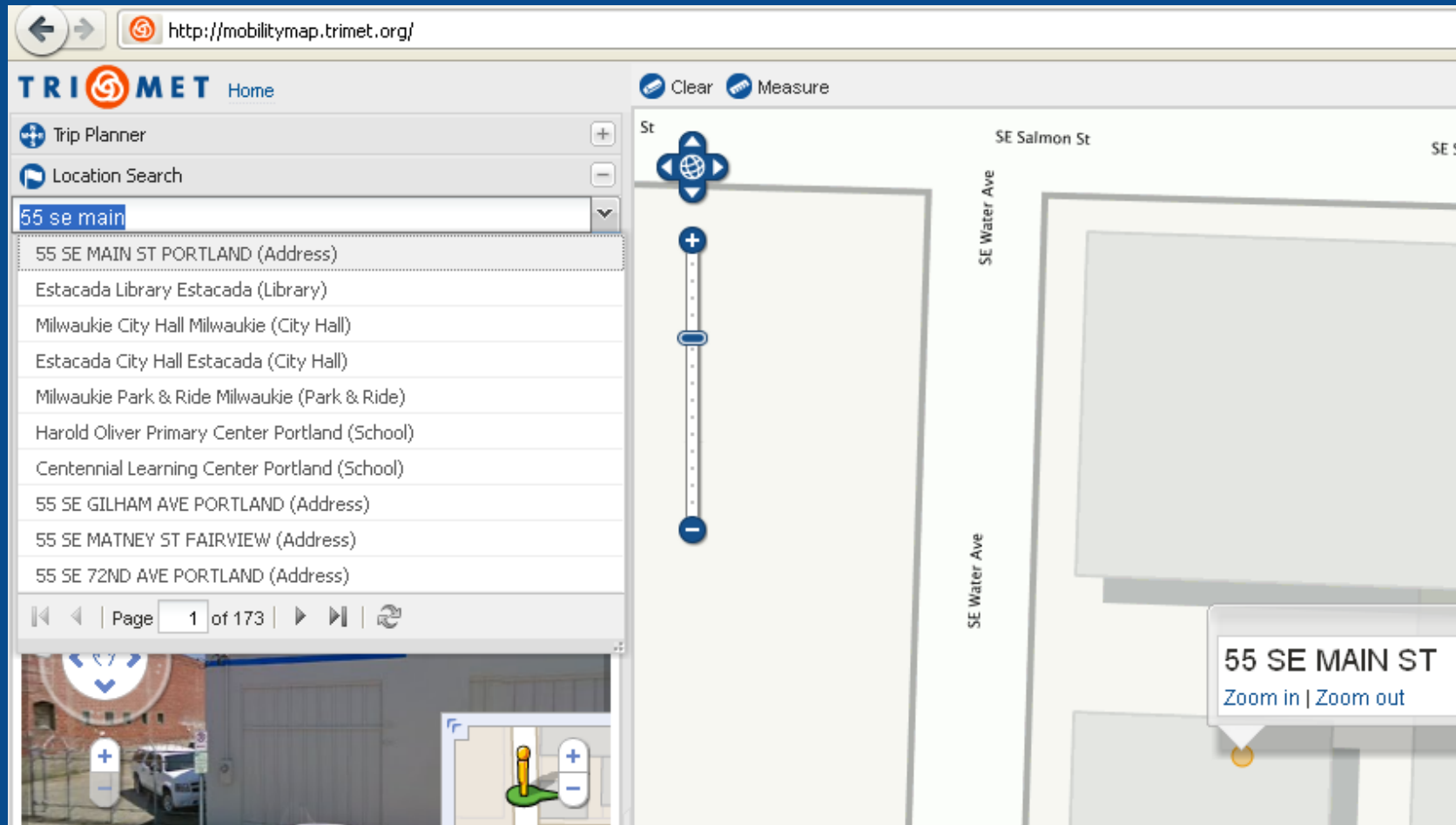
Address search engine (Solr) on address points in database

Returns via web service accurate XY coordinates
based on database records compiled from
tax lots, landmarks, intersections, etc.

- ++ improves with usage
- ++ access to current data w/out basemap import

Address Geocoding

routable networks for OTP



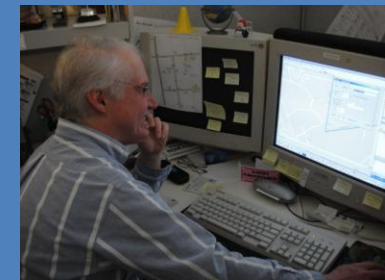
Address Search Engines force the user to enter/determine accurate spelling, address, etc.

Address Geocoding

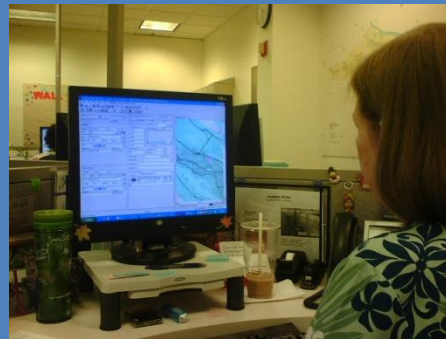
routeable networks for OTP



BDS - Orbital



**Scheduling – Giro
Hastus & Geo**



ParaTransit – Trapeze PASS

Trip Planner Step-by-step travel directions

Type or select the location where you are starting
I will start at this address, intersection, landmark or Stop ID

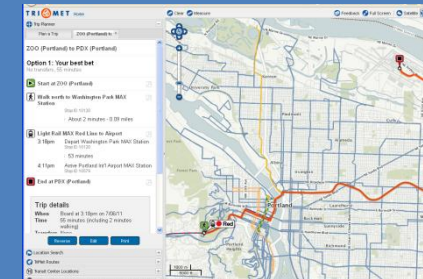
in or select

When: Depart after 3 07 pm Jul

Quickest trip Maximum walk: 1/2 mile

Travel by: Bus or train ☐ Show on map

Trip Planning - ATIS



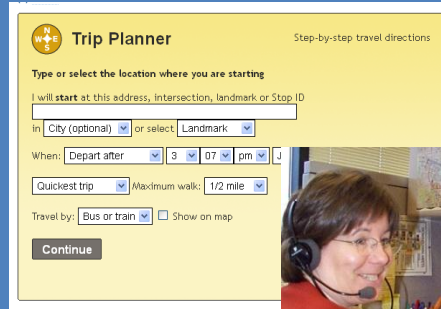
**Regional Planning &
Analysis, Web Mapping**

next steps

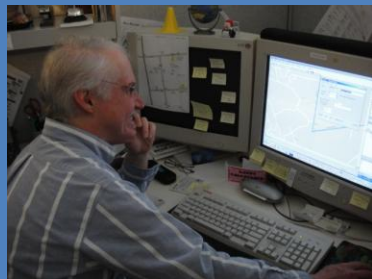
TriMet Systems Using Jurisdictional Basemap



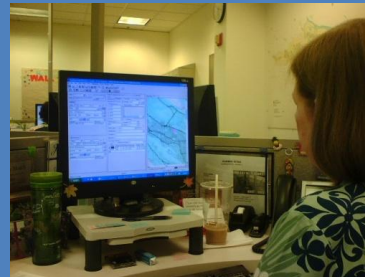
BDS – new INIT System



Trip Planning – new OTP



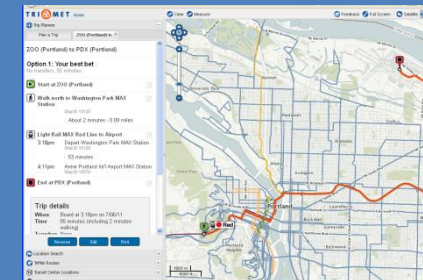
**Scheduling – Giro
Hastus & Geo**



ParaTransit – Trapeze PASS



ParaTransit MDT Vehicles – new INIT System



**Regional Planning &
Analysis, Web Mapping**

TriMet Systems Using OSM Basemap
(requires seamless and/or routable basemap)

next steps

Metro Regional Travel Options Grant

July 1, 2011 – July 1, 2013

OTP Project Tasks

Task 1	Project Management Plan work with stakeholders to identify and prioritize requirements and that can be delivered within the two-year timeframe and budget	September 2011
Task 2	Application Development of Features prioritized at July 2011 Workshop	January 2011
Task 3	Evaluation Study	May 2011
Task 4	Final Reports	June 2011

next steps

Features Needed to Replace ATIS

1. Ability to print, email, and SMS output
2. Fare calculations
3. Return and prioritization of multiple trip itineraries
4. Language translation
5. Graph/chart to easily change variables for trip plans
6. Enhancements based on feedback from public beta release
7. Geocoder to locate addresses and landmarks
8. Administrative tools for staff to continue maintenance of the application and data, including transfers.
9. Tools for Customer Service staff
10. Improve stability of the API for third-party developers
11. Extend the availability of the service to mobile devices
12. Trip disability options

next steps

On the Horizon



OTP Phase II
Kick-off Workshop
July 2011

OTP TriMet Public Beta Release
October 2011

OSM Data Improvements and further
collaboration with community and
jurisdictions for on-going
maintenance

OSM QC Process

TriMet Interactive Map (OTP) [+](#)

maps5.trimet.org/otp.html

TRI MET Home

TriMet Routes

Location Search

Transit Center Locations

Park & Ride Locations

Zipcar Locations

Plan a Trip

Northeast Airport

Northeast Airpo

1: Wed, Jul 6th 10:37AM - Wed, Jul 6th 11:42AM
(0 transfers, 65 minutes)

Start at Northeast Airport Way

Bike to Southwest Zoo Road

About 65 minutes - 12.5 mi

Bike undefined on Northeast Airport Way (0.6 mi)
Right Northeast Airport Way becomes Northeast Air
Cargo Road (0.4 mi)
Continue on Northeast 82nd Avenue (0.3 mi)
Left on way 5509170 from 4 (0.1 mi)
Right on Northeast Alderwood Road (0.8 mi)
Right on Northeast Columbia Boulevard (0.1 mi)
Left on Northeast Cully Boulevard (1.3 mi)
Continue on Northeast 57th Avenue (0.4 mi)
Right on Northeast Siskiyou Street (259 ft)
Left on Northeast 56th Avenue (0.2 mi)
Right on Northeast Alameda Street (0.3 mi)
Left on Northeast Wistaria Drive (52 ft)
Right to continue on Northeast Wistaria Drive (74 ft)
Slight right to continue on Northeast Wistaria Drive (0.1 mi)

Reverse Edit Print Link

Clear Measure

Feedback Full Screen Satellite Map

Portland International Airport

University Park

Forest Park

Barnes Heights

West Haven

Elk Point

Council Crest

West Slope

Alameda

Irrington

Central East Side

Belmont

East Burnside Street

Mount Tabor

Russellville

Hazelwood

Powellhurst

2 from 1: way 1 way 1
166 ft 172 ft
0.1 mi

Southwest Rose Garden

Southwest Rose Garden Way

0.3 mi

Sou Southwest Kingston Drive

126 1.2 mi

OTP Interface Preview – Fall Beta Release