

OTP SUM: OTP Integration of Transit with Shared-Use Mobility Real-Time and Data Enhancements

Mobility on Demand Sandbox Program

Quarterly Report Q4 2017

10/01/17 - 12/31/17

Published March 1, 2018

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Project Summary

A project dashboard is available at <u>www.trimet.org/mod</u>. It provides more comprehensive information about the project and up-to-date status reports.

Challenges Addressed by Project

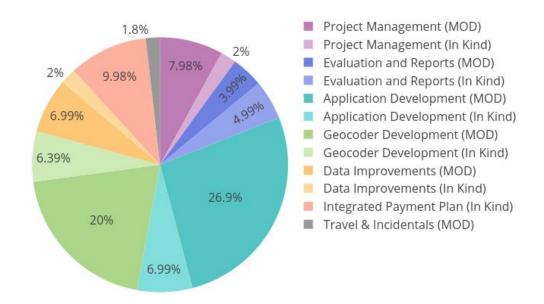
- OpenTripPlanner (OTP) does not currently incorporate shared-use modes.
- Address location for trip origins and destinations are a main requirement for trip planning, however, existing options are inadequate or cost prohibitive for government.
- Accessible trips are a challenge due to the lack of data available on the accessibility of pedestrian infrastructure and the absence of these features in a trip planner.

Anticipated Outcomes, Benefits, Impacts

- Extend the OpenTripPlanner code base to support the integration of transit trip planning with shared-use mobility modes, such as bike share and transportation network companies (TNCs), as well as updated real-time transit information.
- Implement a fully functional and comprehensive open geocoder built off the existing Mapzen Pelias geocoder. A non-proprietary and non-restrictive option for address locating would substantially lower the barrier to entry for many transit systems to offer trip planning and can achieve significant cost savings for transit agencies, government agencies, and the public.
- TriMet, in collaboration with the OpenStreetMap community, established best practices for representing accessibility information and will build out this accessibility information in the OSM network and provide a model for replicating this work in other regions.

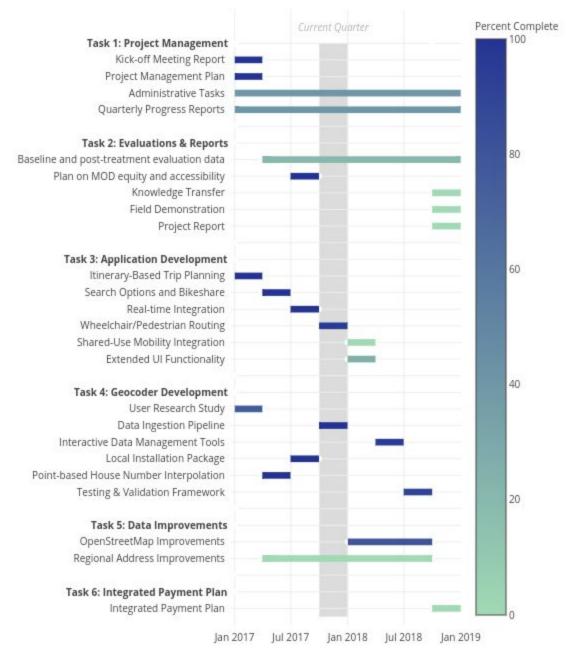
Grant Budget Allocations

TriMet's funding allocation from the FTA of \$678,000 is matched with 32% of in-kind contributions, totaling over \$1 million.



Project Scope and Budget Status

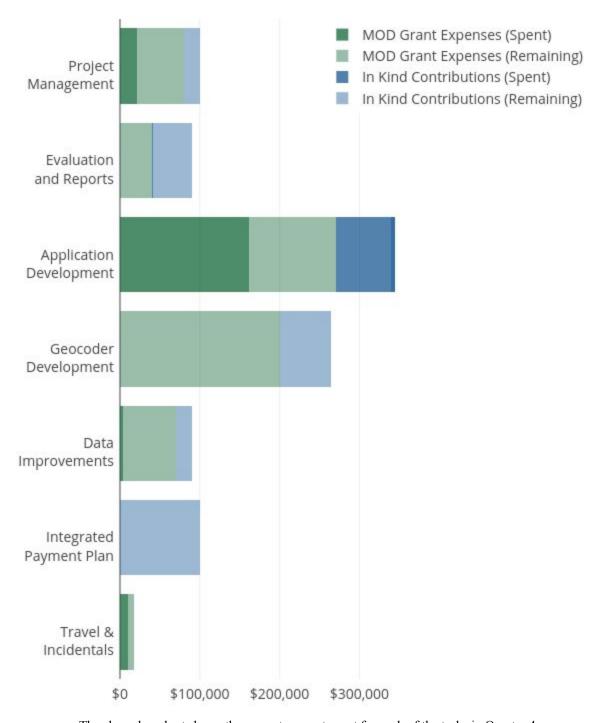
The MOD Sandbox project is divided into six main tasks: Project Management, Evaluations & Reports, Application Development, Geocoder Development, Data Improvements and an Integrated Payment Plan. The project is on schedule and in budget. Progress is as follows:



The above gantt chart illustrates the tasks and status of deliverables in Quarter 4.

Of the \$678,000 that TriMet received, \$193,113 (28.5% of allocated grant funds) has been spent thus far. The cleared expenditures through Q4 2017 are as follows:

- \$21,669 (27% of allocated grant funds) spent toward Project Management;
- \$162,000 (60% of allocated grant funds) spent toward Application Development;
- \$0 spent toward Geocoder Development;
- \$796 (1% of allocated grant funds) spent toward Data Improvements;
- \$8,648 (48% of allocated grant funds) spent toward Travel & Incidentals.



The above bar chart shows the current amount spent for each of the tasks in Quarter 4.

Task 1: Project Management

TriMet's OTP Integration of Transit with Shared-Use Mobility Real-Time and Data Enhancements have been underway since January. All milestones and deliverables have been met and we are on schedule.

Quarterly Deliverables

Deliverables for this quarter are in the form of ongoing tasks that include scheduled weekly meetings and administrative tasks.

Quarterly Progress

Task progress includes:

- weekly scheduled meetings (slack or webinars) to ensure continued communications;
- use of Trello for project management;
- a dedicated and open TriMet MOD Project Google drive for project management;
- use of InVision for application interface development and review;
- continued update of the online project dashboard available to the public at TriMet.org/MOD to ensure transparency;
- and RealTime Board for live, remote whiteboarding sessions.

Task 2: Evaluations and Reports

The FTA requires the following project evaluations and reports: Evaluation Plan and Report, Equity and Accessibility Plan, Knowledge Transfer, Field Demonstration, Final Project Report.

Quarterly Deliverables

Evaluation and Test Plan for Application (Appendix A - MOD Application Test Plan).

Quarterly Progress

Inquiries into local firms have been made to perform usability studies.

Task 3: Application Development Status

A live demo of the application is now available at https://trimet-mod-dev.conveyal.com/

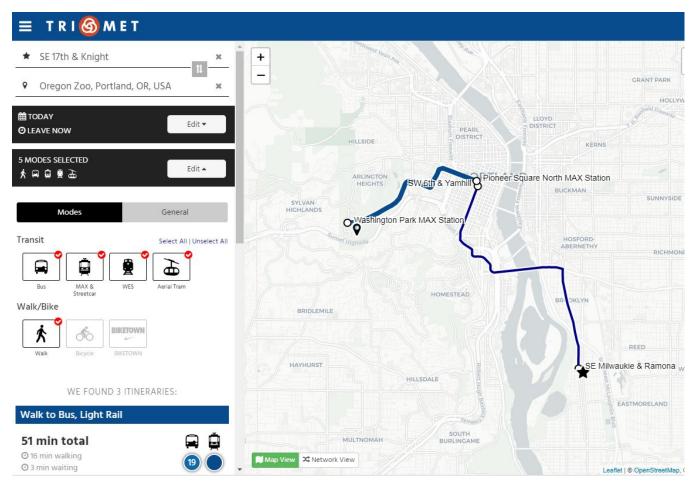
Quarterly Deliverables

Search Options and Bikeshare (**Appendix B - T3M4 RouteStopViewer_PedImprvmts_Docs**). It was delivered on Thursday, January 4, 2018. The code for this deliverable is available on a private GitHub site until production. In summary, the work includes the following features:

- **UI/UX Design:** Refinement of designs of Milestone 3 tasks; preliminary mockups for Milestone 4 tasks
- **Stop Viewer:** Detailed view of specific stop including route served, scheduled departure times, and real-time arrival information if available
- **Trip Viewer:** Detailed view of a single vehicle trip with scheduled departure times and highlighting of section utilized by current itinerary
- Route Viewer: Listing of all available routes with map display of selected route. Also includes initial implementation of a global "application menu"
- Extended Pedestrian Routing: New system for weighting pedestrian routes based on OSM way characteristics using custom configuration file. Includes new API endpoint for testing and calibration.

Quarterly Progress

In addition to the completed milestone, the user interface design continues to be refined in InVision and the live demo.



Screen capture of demo version of application.

Task 4: Geocoder Development

Pelias is a non-proprietary and non-restrictive option for address locating that is an important requirement for trip planning. This task includes the implementation of a reference framework for government agencies to auto-feed their authoritative address data into a publicly accessible geocoding service.

Quarterly Deliverables

Deliverables expected for last quarter include Mapzen's Milestone 2 – Data Ingestion Pipeline, which was submitted at the end of December. Testing has not been completed at this time. Mapzen has handed over control of the Repo for this work to Open Addresses. Documentation is available here: https://github.com/openaddresses/submit-ui

A significant amount of work has been performed on the remaining two deliverables:

Milestone 3: Interactive Data Management Tools (Appendix C - T4M3)

InteractiveDataTool Documentation).

Milestone 6: Testing & Validation Framework (Appendix D - T4M6

Testing Package Documentation).

Quarterly Progress

The closure of Mapzen on February 1, 2018, was announced in December 2017, which resulted in an early termination of the MOD Sandbox contract with Samsung. It is expected to have no negative impact on the project. The Pelias team at Mapzen is establishing a new company to support the open source project. In addition to the Samsung/Mapzen's \$64,000 in-kind contribution, Samsung has waived the remaining \$200,000 awarded contact as an in-kind contribution.

Task 5: Data Improvements

Improve OpenAddresses and OpenStreetMap (OSM) in support of comprehensive trip planning and geocoding (address matching).

Quarterly Deliverables

There were no scheduled deliverables for this task during this quarter.

Quarterly Progress

Updates to OSM continue as planned.

Task 6: Integrated Payment Plan

As a partner on this project, moovel will facilitate compatibility with their planned booking and payment features so customers can plan and pay for their trips in one app.

Quarterly Deliverables

There were no scheduled deliverables for this task during this quarter.

Quarterly Progress

Moovel participated in the October meetings and events offering insight into the development of the plan. August 25th.

Meetings and Events

October 11, 2017 TriMet MOD Sandbox Grant partners update and technical breakout sessions October 12-13, 2017 Mobility on Demand (MOD) Workshop, held in Atlanta, GA

TriMet conducts weekly project meetings on the following rotating Slack channels every Thursday at 10am PST.

- Geocoder Meetings (https://trimet-mod-sandbox.slack.com/messages/geocoding/)
- Application Development Meetings (https://trimet-mod-sandbox.slack.com/messages/general/)

Upcoming Events

February 15, 2018 USDOT & ITS America Webinar on Standards and Specifications for MOD March 12-14, 2018 Shared Use Mobility Summit, On-Demand Services in Trip-Planning Apps April 5-6, 2018 TechFestNW, The New Mobility Framework April 9-11, 2018 Fare Collection/Revenue Management & TransITech Conferences, MOD Update April 18-19, 2018 TriMet MOD Grant Workshop II, moovel PDX

Appendices

Appendix A - MOD Application Test Plan

Appendix B - Task 3 Milestone 4 (T3M4) RouteStopViewer_PedImprvmts_Docs

Appendix C - Task 4 Milestone 3 (T4M3) InteractiveDataTool_Documentation

Appendix D - Task 4 Milestone 6 (T4M6)Testing_Package_Documentation

MOD Application Test Plan

PRELIMINARY DRAFT December 2017

Key Team Members:

Steele, Madeline; Shank, Virginia; Green Jr., Carl; Lin, Tom; Whipple, Dave; Jon Campbell; Richardson, Myleen; McHugh, Bibiana

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Preface

Introduction

Corresponding Project Evaluations and Reports

2017 Q2	Draft Evaluation Report (ppt)
2017 Q3	Equity and Accessibility Report (FTA Requirement)
2017 Q4	MOD Evaluation Logic Model - TriMet (FTA Requirement)
2018 Q1	Evaluation and Test Plan
2018 Q3	Field Demonstration/Beta Release (FTA Requirement)
2018 Q4	Knowledge Transfer and Project Report (FTA Requirement)
Schodulo	

Schedule

2018 Q1	Prototype Release
2018 Q2	Prototype Testing (internal)
2018 Q3-4	Beta Test I & 2 (external)

Prototype Test Phase

Goal is to prepare prototype for external beta testing phase. Includes verification/validation following by planned improvements. Internal testing will include:

- System, Stress, Performance Tests (meeting industry standards)
- Preliminary assessment of usability (UI)
- Functionality tests against requirements

Beta Test Phase I & II

A consultant will be retained to assist with the beta testing. The goals of this phase is to improve the application in preparation for:

- 1. A broader more extensive public beta release and study, such as TNC integration value.
- 2. Implementation by other agencies.
- 3. Provide a foundation for the design and development of the TriMet specific implementation of the trip planner.

Process

The following process will be reiteratively performed twice in the last two quarters of the project:

- 1. Gather qualitative and quantitative data to evaluate the usability of website
- 2. Recommend improvements
- 3. Implement the recommendations
- 4. Re-test the site to measure the effectiveness of changes.

Data Collection Techniques

Methods for gathering the data include:

- 1. Focus groups for usability testing (consultant)
- 2. Online surveys (Ginger)
- 3. In-field shadowing of small group of test users (GIS surveyors)

1. Usability Assessment

A small focus group will be brought in and studied to assess the following:

- Intuitive design: a nearly effortless understanding of the architecture and navigation of the site
- Ease of learning: how fast a user who has never seen the user interface before can accomplish basic tasks
- Efficiency of use: How fast an experienced user can accomplish tasks
- Memorability: after visiting the site, if a user can remember enough to use it effectively in future visits
- Error frequency and severity: how often users make errors while using the system, how serious the errors are, and how users recover from the errors
- Subjective satisfaction: If the user likes using the system

2. Surveys

Test groups will include the elderly, disabled, minority and low income (LEP will not be included as the **application will only be tested in English**). Beta testers will be recruited from the TriMet Rider's Club. Depending on the demographic breakdown of the Rider's Club recruits, we may also recruit people from underrepresented communities of concern for the survey. TriMet has outreach lists in place for these groups, and our Title VI coordinator can assist with this. External agencies that are project stakeholders will be involved in the recruitment of beta testers in their area for online survey participation.

Survey Questions, both online and in-field, should address the following:

- Survey questions designed to assess the perception of utility of SUM options in OTP
- Change in perception of usability and design of OTP interface during a two-phased beta approach, demonstrating improvements in satisfaction and feedback.
- Change in perception of utility of real-time information presented by the updated OTP
- Survey guestions assessing response to first-mile/last-mile information in OTP
- 3. In-field Shadowing

Evaluation Objectives

The following suite of tests correspond to the project's evaluation logic model.

Pelias Geocoder Match Rate

Goals

Provide OTP users with more accurate matching of addresses and other points of interest (POIs) such as business names, transit stop ID's, park and ride facilities.

Data Sources

- Dataset 1: TriMet Queries
- Description: User submitted address search strings (matched or unmatched)
- Origin: Captured by our trip planner (11m addresses), only TriMet service district area, good geographic sampling of addresses
- Count: ?
- Baseline: April 2017

Methods of Evaluation

Geocoder Comparisons:SOLR; Metro RLIS (API); Google Maps; Pelias; ESRI ArcMap Geocoder; Mapbox; Nominatim

2. Pelias Geocoder Accuracy of Point Locations

Goals

Provide OTP users with more accurate matching of addresses and other points of interest (POIs) such as business names, transit stop ID's, park and ride facilities.

Data Sources

Dataset 2: FourSquare Addresses

Description: Verified address point locations

Origin: FourSquare

Count: 4,067 foursquare-validated addresses in TriMet's 3 county AOI (OR only)

Baseline: April 2017

Methods of Evaluation

Geocoder Comparisons: SOLR; Metro RLIS (API); Google Maps; Pelias; ESRI ArcMap

Geocoder; Mapbox; Nominatim

3. OTP Time & Cost Comparisons

Goals

OTP SUM will encourage travelers to use public transit for trips that previously faced first mile or last mile challenges

Data Sources

Dataset 3: O&D

Description: Identify Set of Planned Trips by Origin and Destination

Origin: TriMet

Count:

Baseline: Q2 Prototype texting

Methods of Evaluation

Transit only trip time comparisons:

- Current OTP, Google Transit, Apple Maps
- Bike to Transit Current OTP
- TNCs to Transit New OTP

4. OTP Accuracy/Validity of Planned Trips

Goals

Ensure trip planning results are accurate.

Data Sources

Dataset 3: O&D

Description: Identify Set of Planned Trips by Origin and Destination

Origin: TriMet

Count:

Baseline: Prototype Release of new OTP

Methods of Evaluation

• Survey of OTP test group and Call Taker Reports

5. OTP Enhanced Pedestrian Accessibility

Goals

Enhance OTP's pedestrian routing logic to take advantage of newly added sidewalk tags as well as other attributes of OpenStreetMap that reflect safety and pleasantness for pedestrians to improve pedestrian trip plans.

Data Sources

Dataset 4: O&D Pairs

Description: Origin/destination pairs where there are several walking trip options of comparable length but with differing sidewalk coverage and stress levels will be hand selected, and then run in the new and old versions of OTP.

Origin: TriMet

Count:

Baseline: Prototype Release of new OTP

Methods of Evaluation

T-test on count of binomial variables

6. OTP Increase of Feasible Itineraries

Goals

Produce results for trips that currently do not produce results due to transit service.

Data Sources

Dataset 5: Trips not possible

Description: Trips that currently depart on different dates and times than requested

Origin: TriMet customer complaints

Count:

Baseline: Prototype Release of new OTP

Methods of Evaluation

Multimodal trips comparisons against current OTP and new OTP

7. OpenStreetMap Sidewalk Data

Goals

Data improvements to OSM were made to support enhanced pedestrian accessibility information. Sidewalk presence/absence data entered for all streets in the TriMet trip planner

Data Sources

Dataset 6: Street Segments

Description: Random sample of street segments in the region

Origin: OSM Count: 300 to 400

Baseline: Prototype Release of new OTP

Methods of Evaluation

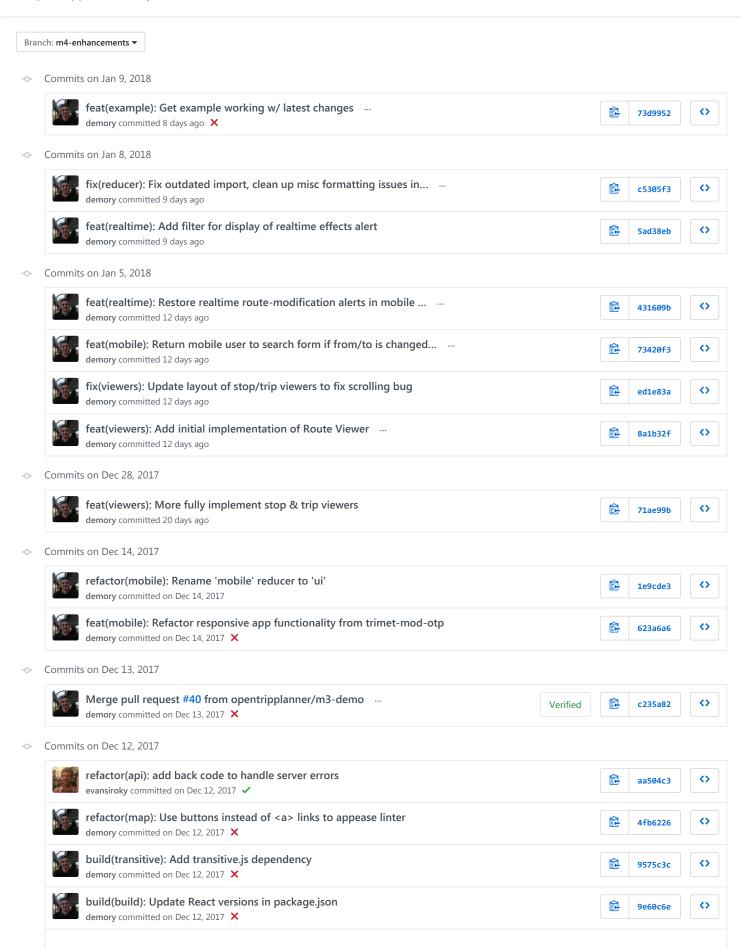
 Random sample of 300 to 400 street segments in the region validated with current 6" aerial imagery flown in June 2017. 100 random samples within that data set will be verified by ground truth.

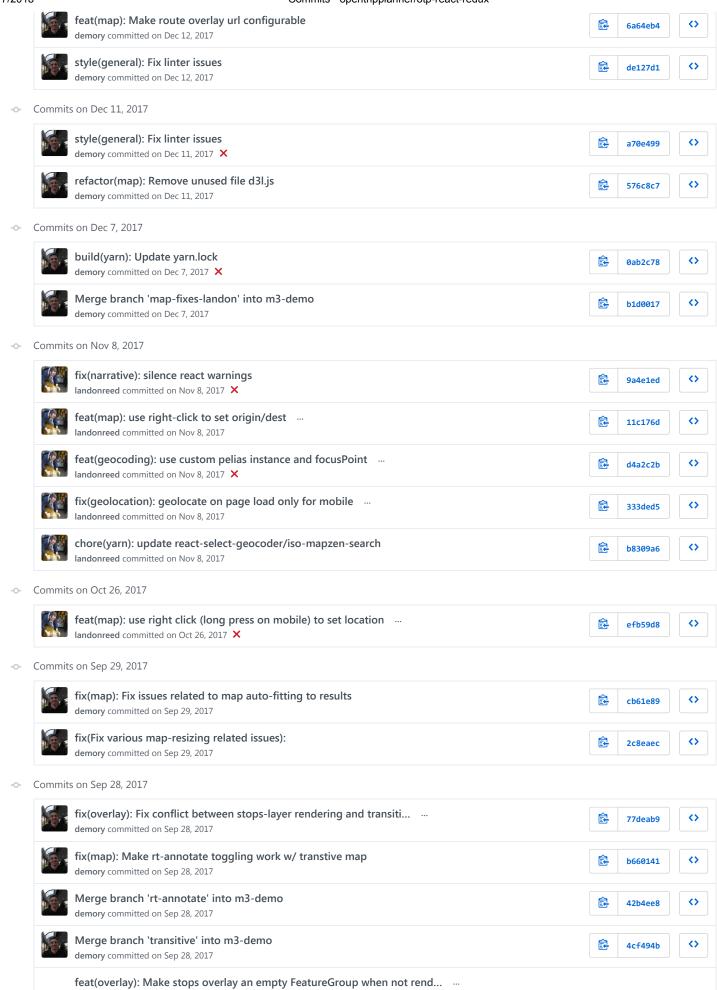
8. Replicability of Application

Goals

Test the feasibility of implementing the Pelias geocoder and and OTP.

popentripplanner / otp-react-redux







Older

Newer

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	#143 by meghanhade was merged on Dec 14, 2017 • Approved	
%	remove mapzen search info ✓ #141 by meghanhade was merged on Dec 13, 2017 • Approved	
%	Intro page validation ✓ #139 by hanbyul-here was merged on Dec 13, 2017 • Approved	Ç 9
8	Remove prefix and postfix ✓ #137 by meghanhade was merged on Dec 15, 2017 • Approved	Ç 2
n	[WIP] miscellaneous style changes ✓ #136 by mkong0216 was closed 26 days ago • Review required	□ 5
} ~	data format fixes ✓ #135 by mkong0216 was merged on Dec 8, 2017 • Approved	
n	added changeset to 'previous' nav button ✓ #134 by hanbyul-here was closed on Dec 17, 2017 • Review required	Ç 1
} ~	design tweaks using openaddress colors ✓ #133 by mkong0216 was merged on Dec 7, 2017 • Approved	Ç 1

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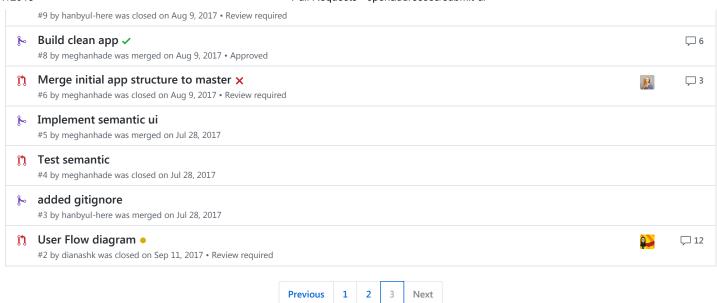
	#95 by meghanhade was merged on Nov 10, 2017 • Approved	
} ~	Adding Feed Progress Tabs ✓ #93 by mkong0216 was merged on Nov 11, 2017 • Approved	Ç 5
%	Remove data page and related things ✓ in review #88 by meghanhade was merged on Nov 3, 2017 • Approved	<u>_</u> 2
%	add text properties to nav-button component ✓ #86 by meghanhade was merged on Nov 3, 2017 • Approved	
} ~	add cancel button ✓ #83 by meghanhade was merged on Nov 2, 2017 • Approved	Ç 4
} ~	Intro update ✓ in review #82 by meghanhade was merged on Nov 3, 2017 • Approved	 4
۶	Mapping preview ✓ #67 by meghanhade was merged on Nov 2, 2017 • Approved	□ 3
%	fix split-function bug ✓ #65 by meghanhade was merged on Oct 26, 2017 • Approved	

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pelias / fuzzy-tester

A fuzzy testing library for geocoding http://mapzen.com/pelias

547 commits		♦ 19 releases		11 11	contributors
Branch: master ▼ New pull request		Create new file	Upload files	Find file	Clone or download ▼
trescube Merge pull request #124 from pelias/disable-package-lock Latest commit 1c08e8c on Oct 27, 2				:08e8c on Oct 27, 2017	
bin	Rename most variables named 'result'				2 years ago
and data	Smaller example data file is enough				2 years ago
ii lib	Filter completely passing test suites in en	nail			9 months ago
output_generators	Always use red for regression count colo	r			4 months ago
scripts	Use lodash extend instead of extend pac	kage in scripts			8 months ago
test test	Adding newline characters at the end of	the files			2 years ago
igitignore	Move json failure files to output_generate	ors			3 years ago
jshintignore	Initial commit				3 years ago
jshintrc jshintrc	add generic csv output generator				10 months ago
npmrc	disable package-lock in .npmrc				3 months ago
:travis.yml	update npm-check to ignore updates				3 months ago
README.md	docs(readme): add Greenkeeper badge				a year ago
autocomplete_example_output.png	Add example of autocomplete output				2 years ago
changelog.md	Update changelog				2 years ago
package.json	chore(package): update dependencies				3 months ago

■ README.md

Pelias Fuzzy Tester

Greenkeeper enabled

This is the Pelias fuzzy tester library, used for running our acceptance-tests and fuzzy-tests.

What are fuzzy tests? See the original problem statement that lead to the creation of this library.

Most importantly, fuzzy tests deliver more than just a single bit of pass or fail for each test: they specify a total number of points (a score) for the test, and return how many points out of the maximum were achieved. The weighting of individual parts of the test can be adjusted.

Note: fuzzy-tester requires NPM version 2 or greater. The NPM team recommends you update NPM using NPM itself with sudo npm install -g npm.

Usage

```
\ensuremath{//} in the root directory of the repo containing the tests fuzzy-tester \ensuremath{\text{-}} fuzzy-tester \ensuremath{\text{-}} -help
```

fuzzy-tester -e prod fuzzy-tester -t dev

Test Case Files

Test-cases are expected to live in test_cases/, and are split into test *suites* in individual JSON files. Each file must contain the following properties:

- name is the suite title displayed when executing.
- priorityThresh indicates the expected result must be found within the top N locations. This can be set for the entire
 suite as well as overwritten in individual test cases.
- distanceThresh (optional) defines the accepted maximal distance (in meters) between search result coordinates and the
 coordinates defined in each test. Each test case can include a specific threshold value. This makes sense because location
 of a neigborhood is not as accurately defined as location of, say, a building. Default threshold is 500 meters.
- tests is an array of test cases that make up the suite.
- endpoint the API endpoint (search, reverse, suggest) to target. Defaults to search.
- weights (optional) test suite wide weighting for scores of the individual expectations. See the weights section below

tests consists of objects with the following properties:

- id is a unique identifier within the test suite (this could be unnecessary, let's discuss)
- type is simply a category to group the test under, to allowing running select groups of tests rather than all of them.
- status is the optional expected status of this test-case (whether it should pass/fail/etc.), and will be used to identify improvements and regressions. May be either of pass or fail.
- user is the name of the person that added the test case.
- endpoint the API endpoint (search, reverse, suggest) to target. Defaults to search, which will override the endpoint specified by the test-suite.
- in contains the API parameters that will be urlencoded and appended to the API url.
- expected contains expected results. The object can contain a priorityThresh property, which will override the
 priorityThresh specified by the test-suite, and must contain a properties property. properties is mapped to an array
 of either of:
 - o object: all of the key-value pairs will be tested against the objects returned by the API for exact matches.
 - o string: a matching object will be looked up in the locations.json file. Allows you to easily reuse the same object for multiple test-cases.

If properties is null, the test-case is assumed to be a placeholder.

expected can also contain a test specific distanceThresh value, and an array of [lon, lat] coordinates. With these coordinates, it is possible to compare distance between locations found in the search and expected locations. This is often useful, because matching the name labels may fail even when the geocoder has found a proper result ('Harvard'!= 'Harvard University'). Location coordinates are less ambiguous.

Coordinate based tests also help to track invalid location data in the search database.

- unexpected is analogous to expected, except that you *cannot* specify a priorityThresh and the properties array does *not* support strings.
- weights (optional) test case specific weighting for scores of the individual expectations. See the weights section below

Import Scripts for Test Cases

The scripts folder contains example scripts for creating fuzzy tests. For example, the data import script scripts/importHSLpoi.js can be used to create a fuzzy test from a poi data list as follows:

- Edit the import script scripts/importHSLPoi.js to specify which poi attributes and search attributes will be compared in the test. The current defaults serve as a good starting point.
- Run the command node scripts/importHSLPoi.js data/poi.txt, where poi.txt is the source data file.
- The script creates a test file called HslPoitest.json . You may edit it to fine tune the test setup. For example, you can change the threshold values afterwards, or add subtest specific thresholds.
- Move the test file to the testing environment ../fuzzy-tests/test_cases and run the test there. For more information, check fuzzy-tests.

Output Generators

The acceptance-tests support multiple different output generators, like an email and terminal output. See <code>node test --help</code> for details on how to specify a generator besides the default. Note that the <code>email</code> generator requires an AWS account, and that your <code>pelias-config</code> file contain the following configuration:

Autocomplete mode

A special output generator, -o autocomplete not only changes the output, but changes the behaviour of the test suite. Instead of running each test case exactly as defined, it will run many tests for each test case. The tests will be run against the autocomplete endpoint and will correspond to successively longer substrings of the input text, similar to how a user would type the text into autocomplete. It looks like this:

autocomplete example output

The results are shown underneath the input text, with each character corresponding to the result of the autocomplete query with the input text up to the character above entered. Tests that pass are green, tests that fail are red. If the expected output was not found at all, the result character will be an F, if the expected output was found, the character will be the zero indexed location in the API results where it was found.

To the right of the input text, some additional info might be displayed. The first is any additional parameters being sent with the API call, like a location bias. The second is a count of the number of expectations included in the test case. This helps detect situations where one expectation is found, but the other isn't (the result might be a confusing red @ in that case).

API URL aliases

The acceptance-tests runner recognizes a number of aliases for Pelias API URLs (eg, stage corresponds to pelias.stage.mapzen.com), which can be specified as command-line arguments when running a test suite. You can override the default aliases and define your own in pelias-config:

}

Weights

Weights are used to influence the score each individual expectation contributes to the total score for a test. By default, all fields in expected properties, passing the priority threshold, and the absence of any unexpected properties each contribute one point.

Any score for any individual property can be changed by specifying an object weights in a test suite, or in an individual test case. For example, to more heavily weight the name property by giving it a weight of 10 points, set weights to the following:

```
{
    "properties": {
        "name": 10
    }
}
```

Weights can be nested and are completely optional, in which case the defaults will be in effect.