Quality Control

Lessons Learned from Deployment and Evaluation of GTFS-realtime Feeds

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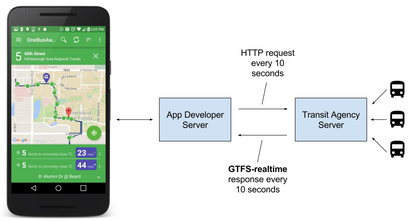
Background

- Real-time transit info has many benefits, including shorter perceived and actual wait times[1], lower learning curve for new riders[2], increased ridership[3][7], and increased feeling of safety at night[5][6], and better perception of the agency[8].
- Nearly ¾ of users in one study said they relied solely on real-time info instead of schedule[6]
- However, accuracy is important – 9% of surveyed riders said they took the bus less often due to real-time errors

Open transit data

- General Transit Feed Specification (GTFS) has become de facto format for open schedule data, shared by over 1,500 agencies worldwide[9]
- GTFS-realtime feeds, which power mobile transit apps, are becoming more widely available, with over 50 agencies sharing data[10]



- GTFS-realtime v1.0 has lacked well-specified requirements[11] and validation tools
- This results in confusion and disagreements between transit agencies, Automatic Vehicle Location (AVL) vendors, and application developers as to what data should actually appear in a GTFS-rt feed
  - Increases the time, effort, and cost to deploy a new GTFS-rt feed
  - Errors in real-time info affect riders and operations

GTFS-realtime example

- 3 feed types – **TripUpdates** contain delay information, **VehiclePositions** show where vehicle is, and **Alerts** are human-readable impacts on service

trip_id	arrival_time	departure_time	stop_id	stop_sequence
2777	5:52:00	5:52:00	4301	1
2777	5:52:34	5:52:34	3471	2
2777	5:53:46	5:53:46	4456	3
2777	5:54:27	5:54:27	592	4
2777	5:55:11	5:55:11	593	5
2777	5:55:20	5:55:20	4457	6
2777	5:55:40	5:55:40	595	7
2777	5:56:34	5:56:34	596	8

GTFS stop_times.txt

```
trip_update {
  trip {
    trip_id: "2777"
  }
  stop_time_update {
    stop_sequence: 3
    arrival {
      delay: 60  // 60 seconds late
    }
    stop_id: "4456"
  }
```

GTFS-realtime TripUpdate

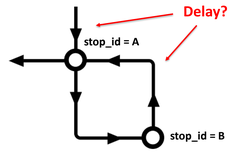
GTFS-realtime v1.0 problems

- Too many optional fields – 56 out of 63 (89%)
  - Quirk of Protocol Buffer docs (for details see http://bit.ly/gtfs-realtime-2)
- Missing fields lead to poor quality data

```
header {
 gtfs_realtime_version: "1.0"
}
entity {
 id: "d131dd02"
 vehicle {
  position {
    latitude: 28.04265
    longitude: -82.45945
  }
...
```

No timestamp for VehiclePosition

```
trip {
 trip_id: "277725"
}
stop_time_update {
 arrival {
  delay: 900 // 15 minutes
 }
 stop_id: "A"
}
```



No stop_sequence – where is 15 min delay?

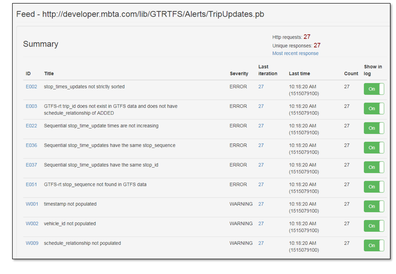
GTFS-realtime v2.0

- Defines new **transit-specific** field requirements:
  - *Required*
  - *Optional*
  - *Conditionally required* (see *Description* field for when this field is required)

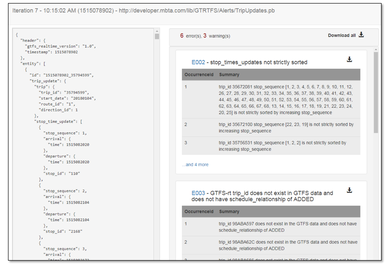
Field Name	Type	Required	Cardinality	Description
stop_sequence	uint32	Conditionally required	One	Must be the same as in stop_times.txt in the corresponding GTFS feed. Either stop_sequence or stop_id must be provided within a StopTimeUpdate - both fields cannot be empty. stop_sequence is required for trips that visit the same stop_id more than once (e.g., a loop) to disambiguate which stop the prediction is for.

GTFS-realtime validator

- Developed using experience from OneBusAway mobile app deployment at new transit agencies using GTFS-realtime
- Open-source - https://github.com/CUTR-at-USF/gtfs-realtime-validator
- Alpha version hosted at http://transittools.forest.usf.edu



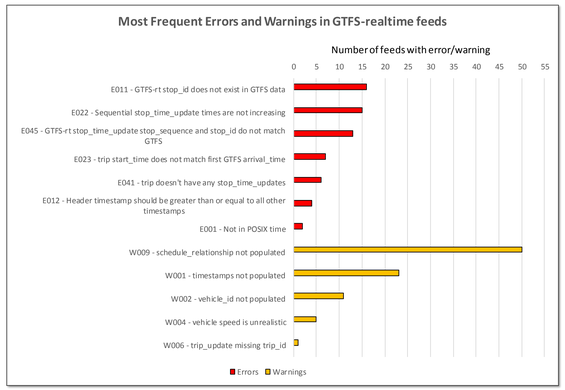
Shows summary of all errors/warnings



Shows message with all error occurrences

Evaluation of industry feeds

- Created open-source tool to batch validate 78 out of 130 GTFS-realtime feeds catalogued on TransitFeeds.com
  - https://github.com/CUTR-at-USF/transit-feed-quality-calculator
- 69% (54) feeds had errors, and 74% (58) had warnings
- Recommend that all agencies produce GTFS-realtime v2.0 feeds, validate feeds prior to accepting feed from vendor



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