



W E L C O M E



U.S. Department of Transportation
Office of the Assistant Secretary for
Research and Technology

Module 14 Part 2:

Applying GTFS-realtime to your Agency

← Lindbergh Field & Terminal 1 (Bagg... ×

⚠ **Construction (992)**
Westbound Broadway & 4th Stop Closed (ID# 1084...

992	Downtown	3:01 PM
992	Downtown	3:01 PM
992	Downtown	3:14 PM
992	Downtown	3:29 PM

Best Buy Express
Hudson News
Lindbergh Field & Terminal 1...
Southwest Airlines
Airport Terminal
Terminal 1 Sky Bridge
Map data ©2016 Google

```
entity {
  id: "T1001"
  is_deleted: false
  trip_update {
    trip {
      trip_id: "64"
      start_time: "14:16:00"
      start_date: "20151130"
      schedule_relationship: SCHEDULED
      route_id: "2"
      direction_id: 1
    }
    stop_time_update {
      stop_sequence: 2
      arrival {
        delay: 0
        time: 1448892960000
      }
      departure {
        delay: 0
        time: 1448892960000
      }
      stop_id: "106"
      schedule_relationship: SCHEDULED
    }
    stop_time_update {
      stop_sequence: 3
      arrival {
        delay: 0
        time: 1448893320000
      }
      departure {
        delay: 0
        time: 1448893320000
      }
      stop_id: "154"
      schedule_relationship: SCHEDULED
    }
    stop_time_update {
      stop_sequence: 4
      arrival {
        delay: 0
        time: 1448893440000
      }
      departure {
        delay: 0
        time: 1448893440000
      }
      stop_id: "19"
      schedule_relationship: SCHEDULED
    }
    stop_time_update {
      stop_sequence: 5

```

Instructor



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**Technical Staff
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Learning Objectives

Define the scope, uses for, and users of the GTFS-realtime specification

Apply transit source applications to GTFS-realtime

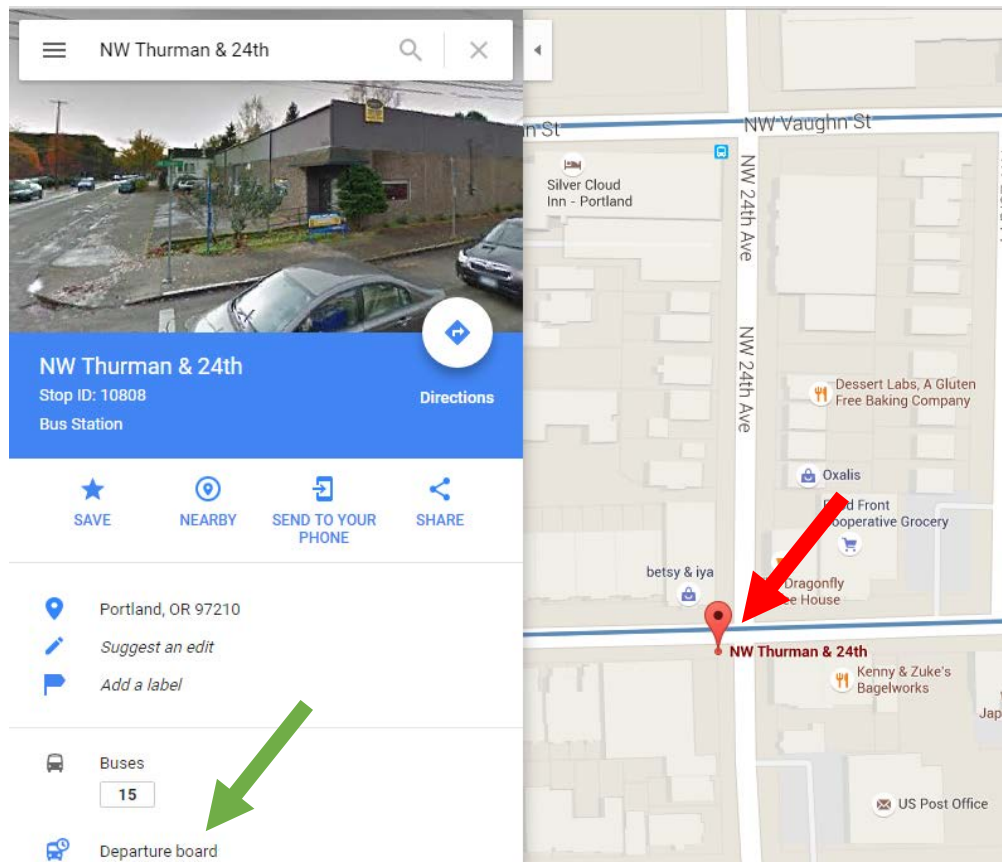
Implementation of GTFS-realtime

Learning Objective 1

Define the scope, uses for, and users of the GTFS-realtime specification

Background of GTFS-realtime

User Story



Current Time: 7:28 AM

The screenshot shows the bus departure board for the stop 'NW Thurman & 24th'. The board has a blue header with the stop name and a back arrow. Below the header is an information icon and the text 'Information (15) Buses continue to use the Hawthorne Bridge due to...'. The board lists three buses, all labeled '15 Gateway TC', with departure times of 7:31 AM, 7:46 AM, and 8:12 AM. A blue arrow points to the 7:31 AM departure time.

Bus ID	Destination	Departure Time
15	Gateway TC	7:31 AM
15	Gateway TC	7:46 AM
15	Gateway TC	8:12 AM

Source: Google Maps



Background of GTFS-realtime

Overview

- **Real time** version of the **General Transit Feed Specification (GTFS)**
- Launched in 2011- 6 cities initially
- Maintained by Google
- Specification, not a standard
- Information/Feed Types Included
 - **Trip Update-** When will the vehicle arrive/depart?
 - **Vehicle Position-** Where is the vehicle?
 - **Alerts-** Are any planned or unplanned events affecting service?



Background of GTFS-realtime

What GTFS-realtime is and is not

- GTFS-realtime is:
 - Format for sharing real-time transit information
 - Set of rules for encoding such data
- GTFS-realtime is not:
 - Software that provides real-time information
 - Software that uses real-time information



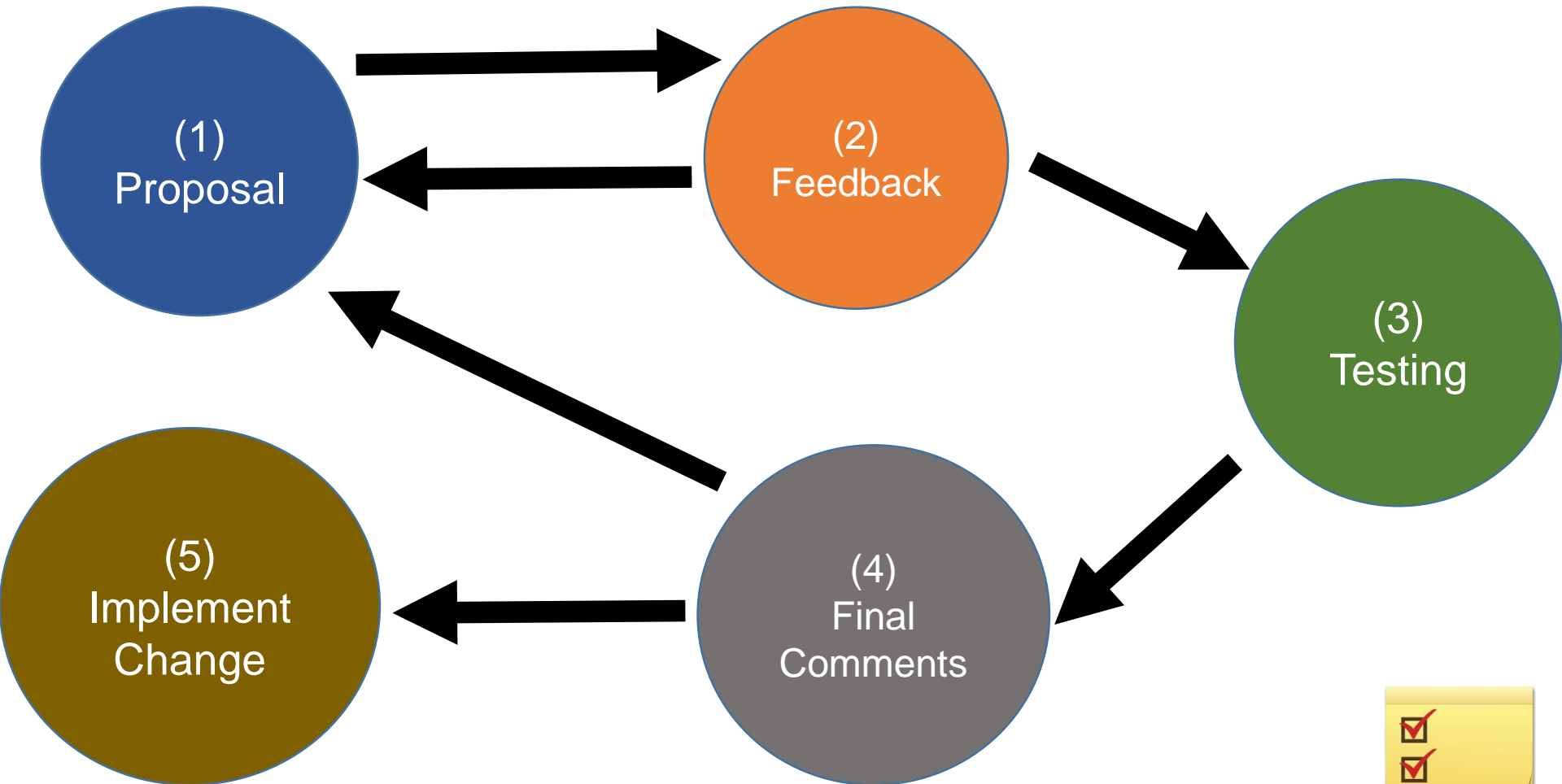
Background of GTFS-realtime

Specification Update Process

- Specification maintained by Google
- No formal standardization process
- Focuses on online discussion forum
- Advantages and Disadvantages to this process

Background of GTFS-realtime

Specification Update Process



Background of GTFS-realtime

Alternatives to GTFS-realtime

- Transit Communications Interface Profiles (TCIP)
 - American Public Transportation Association (APTA)
 - ITS Transit Standards Modules 3 and 4
- Service Interface for Real Time Information (SIRI)
 - European Committee for Standardization (CEN)
 - Several deployments in the United States

Benefits and Uses of GTFS-realtime

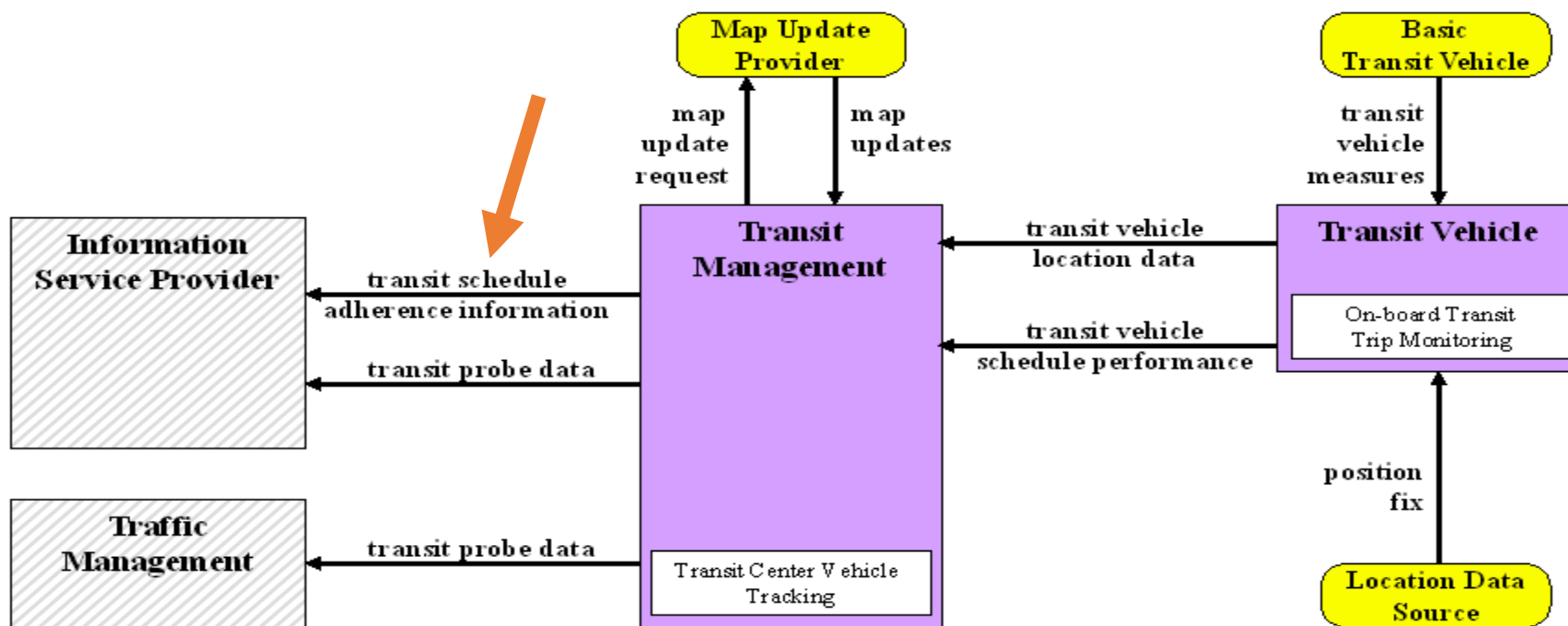
Uses and Users

- Uses
 - Customer facing information
 - Performance Measurement
- Using the three feed types
 - Trip Update
 - Vehicle Position
 - Alerts
- Users
 - 3rd Party Developers
 - Agency Staff, Consultants, and Systems

Benefits and Uses of GTFS-realtime

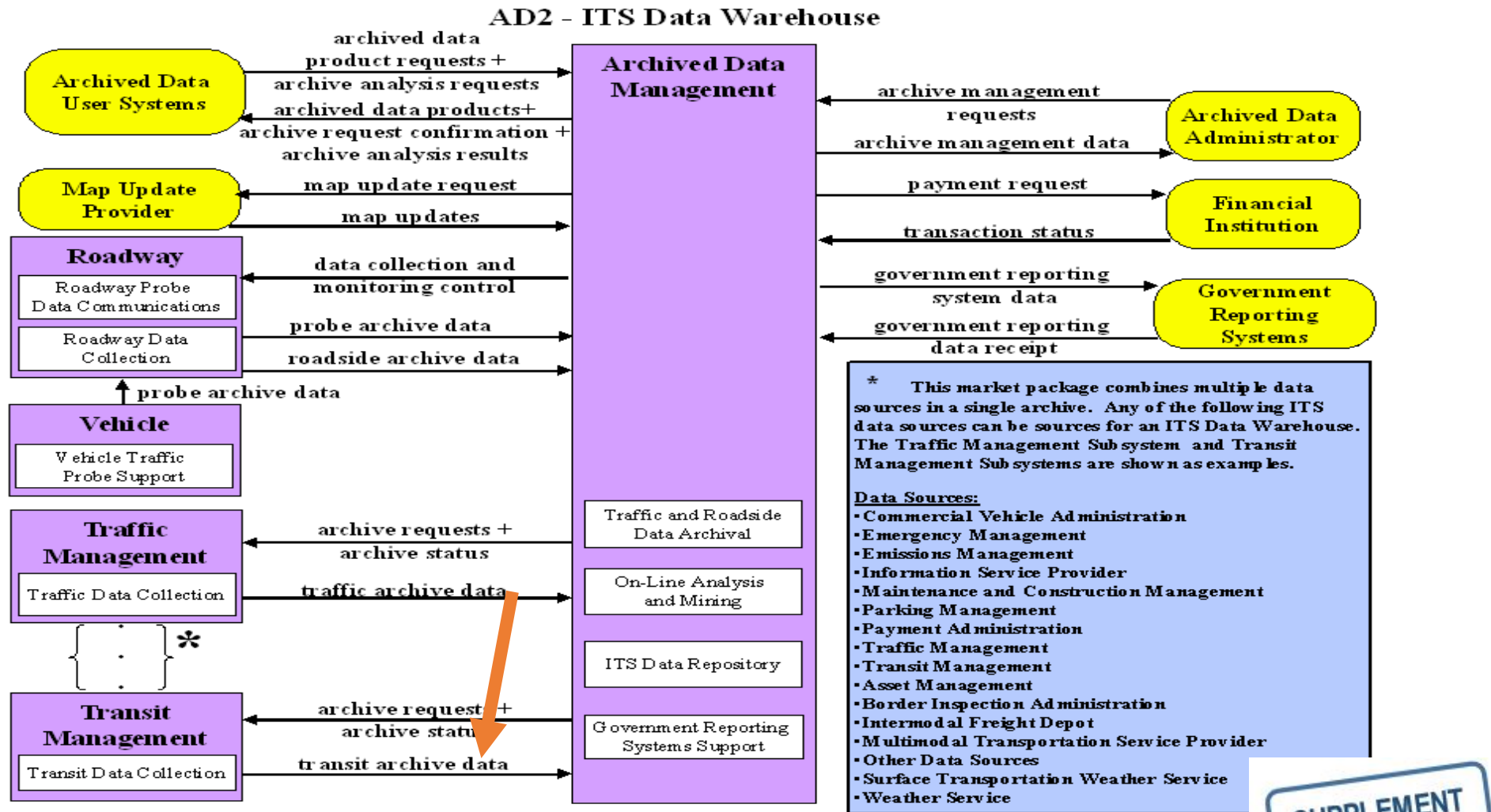
GTFS-realtime and the National ITS Architecture

APTS01 – Transit Vehicle Tracking



Benefits and Uses of GTFS-realtime

GTFS-realtime and the National ITS Architecture



Benefits and Uses of GTFS-realtime

Benefits of Implementing GTFS-realtime

- Provide **real time information** to customers
- Required **data inputs often available**
- **Open source** tools available
- Becoming **widely-accepted and deployed**

Target Devices for Real Time Information

Applications

- Customer applications
- Smartphone and desktop
- Electronic signage
- Performance analysis tools
- Google Maps Transit

The screenshot displays a mobile application interface for Google Maps Transit. The top header is blue with a back arrow, the location 'Lindbergh Field & Terminal 1 (Bagg...', and a close button. Below the header, there are two orange warning icons with the text 'Construction (992) Westbound Broadway & Park Stop Closed (ID# 993...' and 'Construction (992) Westbound Broadway & 4th Stop Closed (ID# 1084...'. The main content is a list of bus arrivals for route 992, each with a green '992' icon, the word 'Downtown', and a time. The times range from 10:28 AM to 4:29 PM in 30-minute increments. To the right of the list is a map showing the location of Lindbergh Field & Terminal 1, with labels for Terminal 1, Terminal 1 Sky Bridge, and Airport.

Route	Destination	Time
992	Downtown	10:28 AM
992	Downtown	10:58 AM
992	Downtown	11:29 AM
992	Downtown	11:59 AM
992	Downtown	12:29 PM
992	Downtown	12:59 PM
992	Downtown	1:29 PM
992	Downtown	1:59 PM
992	Downtown	2:29 PM
992	Downtown	2:59 PM
992	Downtown	3:29 PM
992	Downtown	3:59 PM
992	Downtown	4:29 PM

Source: Google Maps



ACTIVITY



Question

Which of the following groups may participate in developing the GTFS-realtime specification?

Answer Choices

- a) Transit Agency Staff
- b) Planning Tool Users
- c) Smartphone Application Developers
- d) All of the Above

Review of Answers



a) Transit Agency Staff

Incorrect. This is only one group that may participate.



b) Planning Tool Users

Incorrect. This is only one group that may participate.



c) Smartphone Application Developers

Incorrect. This is only one group that may participate.



d) All of the Above

Correct! Anyone who can claim involvement with GTFIS-realtime may participate.

Learning Objective 2

Apply transit source applications to GTFS-realtime

Data Necessary to Create a GTFS-realtime Feed

Data Types

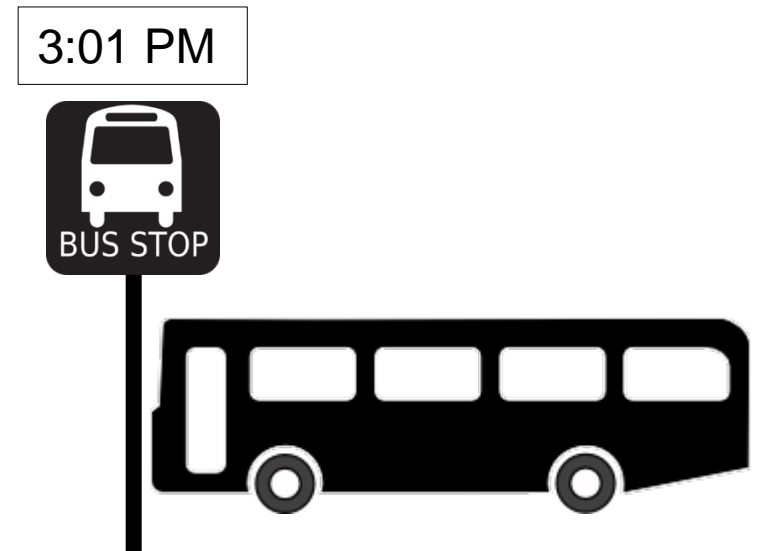
- Three feed types in GTFS-realtime:
 - Trip Update
 - Vehicle Position
 - Alerts
- Why is this information important?
 - It answers key questions about the current status of transit service



Data Necessary to Create a GTFS-realtime Feed

Trip Update

- WHEN will Trip/Vehicle A arrive at location X?
- WHAT is the delay of the trip?

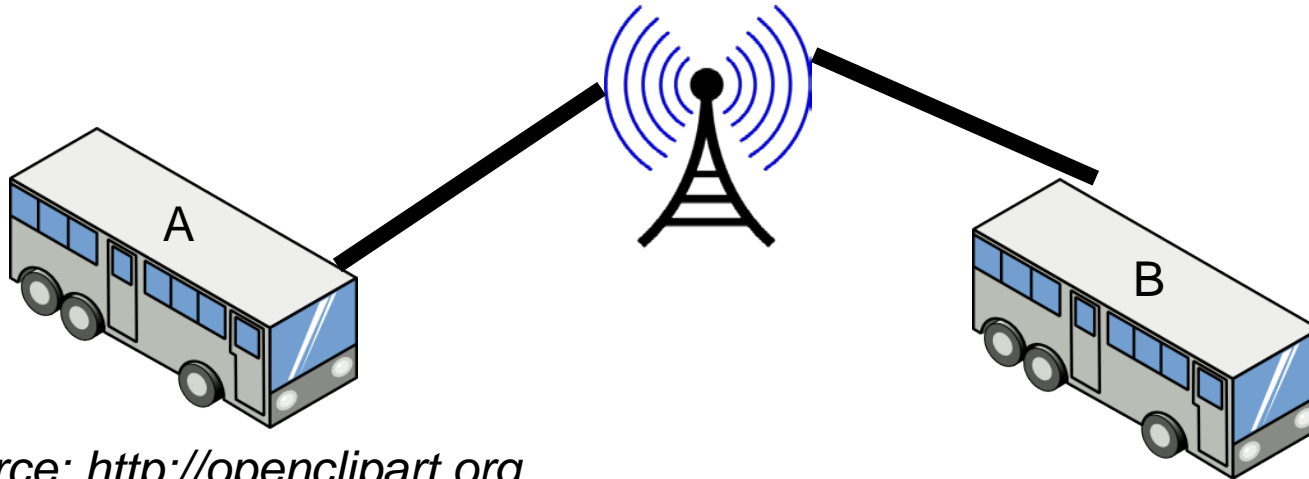


Source: <http://openclipart.org>

Data Necessary to Create a GTFS-realtime Feed

Vehicle Position

- WHERE is vehicle B right now?
- To answer this need, we ask:
 - WHAT are the GPS coordinates of the vehicle? OR
 - WHAT stop is the vehicle en route to/ approaching/ physically stopped at?

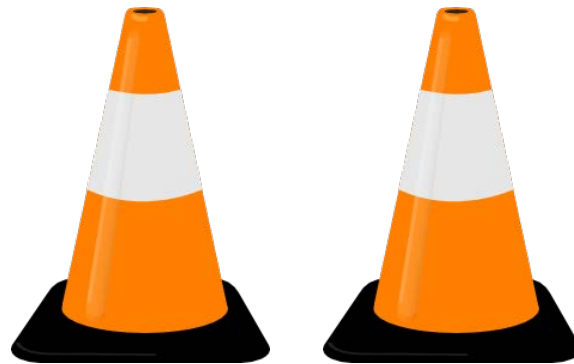


Source: <http://openclipart.org>

Data Necessary to Create a GTFS-realtime Feed

Alert

- WHAT is happening?
- WHERE is it happening?
- WHEN is it happening?
- HOW does this affect service?



Source: <http://openclipart.org>

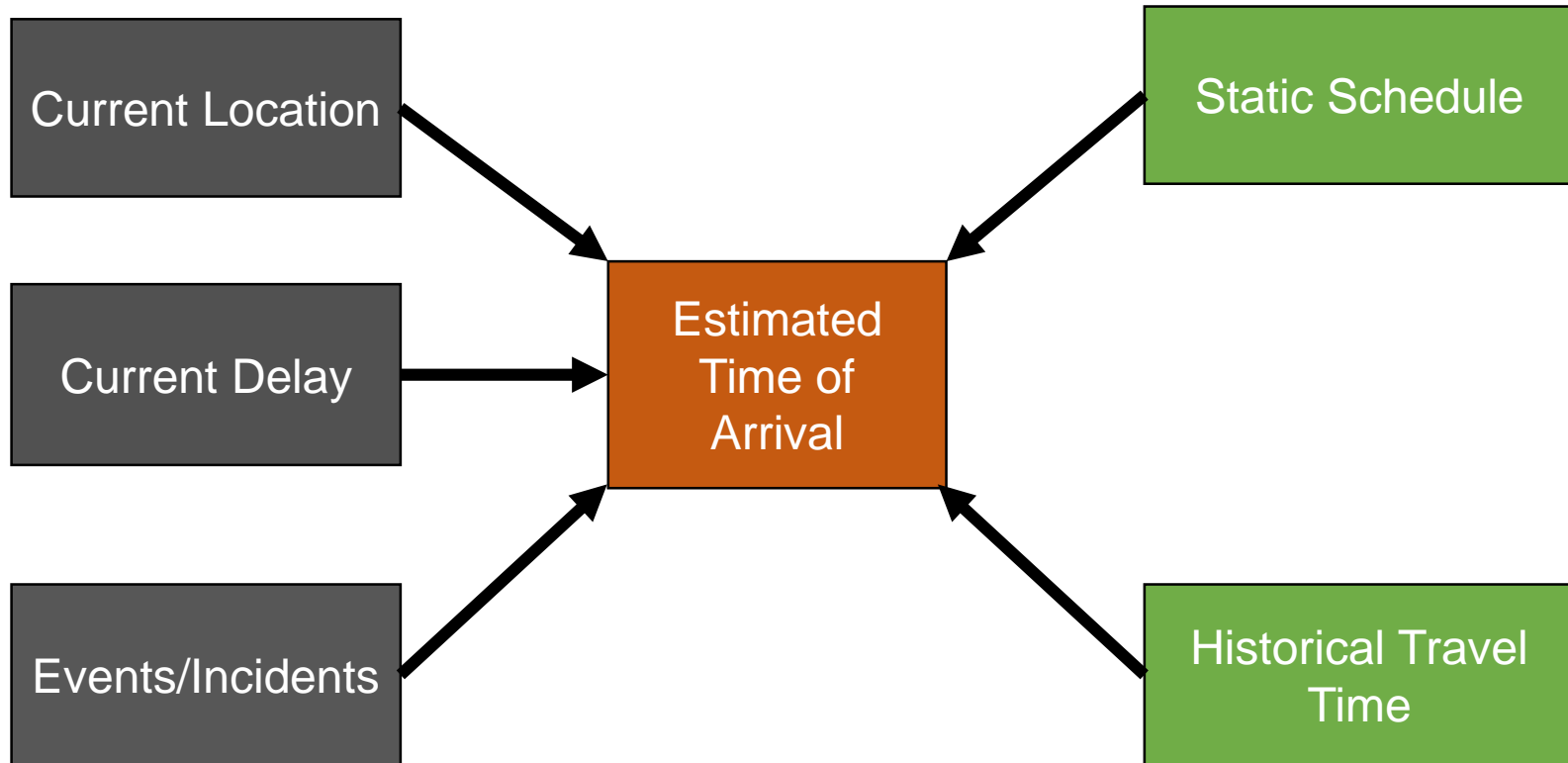
Data Necessary to Create a GTFS-realtime Feed

GTFS-realtime Data Sources

- Computer Aided Dispatch (**CAD**)
- Automatic Vehicle Location (**AVL**)
- Incident Management Systems (**IMS**)
- Existing Data Feeds
- Reference Data (**GTFS**)

Issues with Providing Stop Time Update (ETA) Data

Predicting Estimated Time of Arrival



Issues with Providing Stop Time Update (ETA) Data

ETA Issues

- Stop Time Updates disseminate predicted arrival/departure times
- Predictions depend on data available
- Data should only be shown if it is reliable
- High reliability = high confidence in accuracy
- Current delay may be a better field to display



Source: Google Maps

GTFS-realtime Content and Structure

Protocol Buffers

- GTFS-realtime is encoded in **Protocol Buffer** format
- “Binary String”- **Not human readable**
- Must translate into a **text format** to appear readable
- “.proto” files define the structure

GTFS-realtime Content and Structure

Protocol Buffers

```
entity {  
  id: "V1001"  
  is_deleted: false  
  vehicle {  
    trip {  
      trip_id: "121"  
      start_time: "15:23:00"  
      start_date: "20160512"  
      schedule_relationship: SCHEDULED  
      route_id: "2"  
      direction_id: 1  
    }  
    current_stop_sequence: 19  
    current_status: IN_TRANSIT_TO  
    timestamp: 1463080565700  
    stop_id: "96"  
  }  
}
```

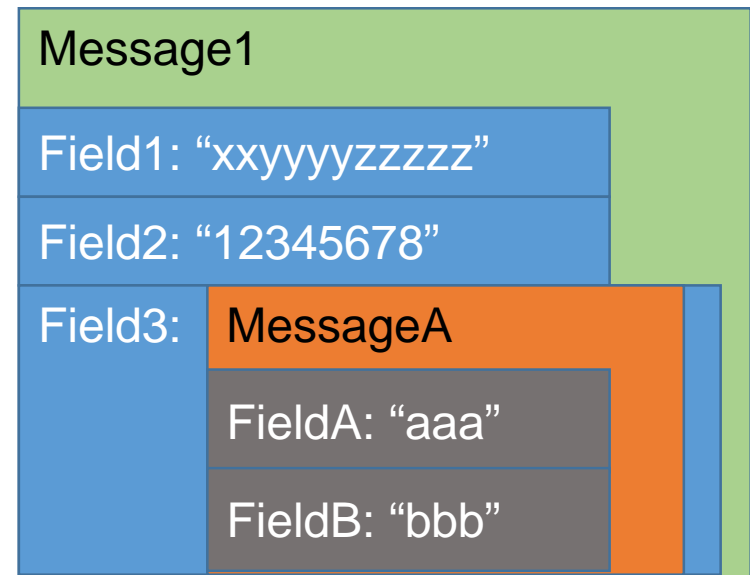
Source:
TRANSCOM



GTFS-realtime Content and Structure

Organization of a GTFS-realtime Feed

- GTFS-realtime is a series of **messages**
- Messages contain **fields**
- Fields may be
 - Another message
 - Single value
- Does not support request/response
- Broadcast messages
- Can be extended



GTFS-realtime Content and Structure

GTFS-realtime Field Details

- Message
- Series of fields
- Type of fields
- Required, Optional, Repeated
- Description
- POSIX TIME- Seconds since Jan 1, 1970
- Experimental

POSIX

12:00:00 AM on January 1, 2016 EST

1464104462 sec since 12:00 AM January 1, 1970 GMT

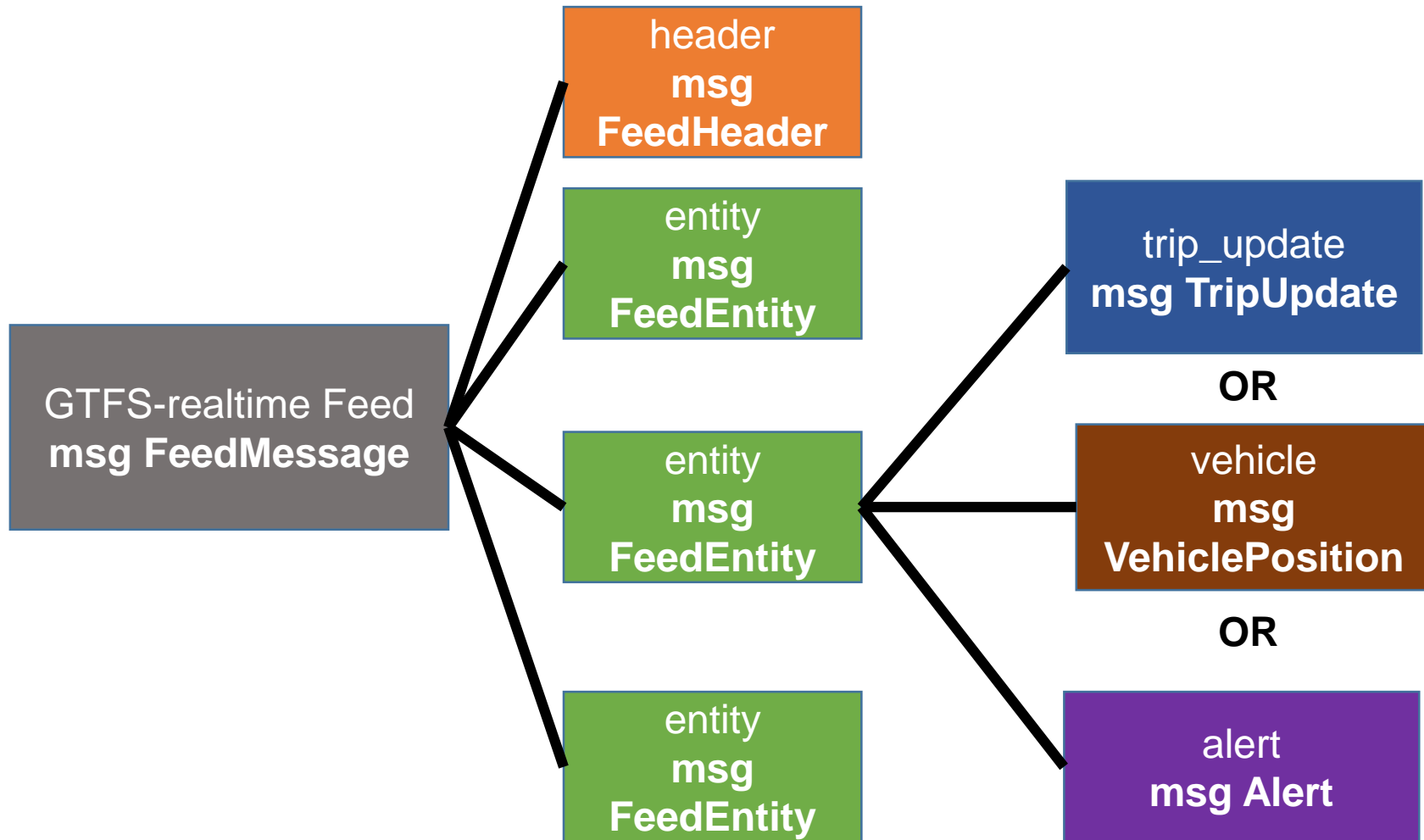
GTFS-realtime Content and Structure

GTFS-realtime Data Types

Data Type	Example
message	<pre>departure{ time: 8432342345 }</pre>
enum	SCHEDULED
string	“express1”
uint32, uint64	120
int32, int64	-20
float/double	57.4232425
bool	true

GTFS-realtime Content and Structure

GTFS-realtime Specification Structure



GTFS-realtime Content and Structure

FeedMessage

Field	Required/Optional	Type
header	required	msg FeedHeader
entity	repeated	msg FeedEntity

GTFS-realtime Content and Structure

FeedMessage

```
header {
  gtfs_realtime_version: "1"
  timestamp: 1461619328
}
entity {
  id: "351"
  trip_update {
    trip {
      route_id: "2"
    }
    stop_time_update {
      departure {
        delay: 0
        time: 1461619440
      }
      stop_id: "68"
    }
  }
  vehicle {
    label: "351"
  }
}
}
```



GTFS-realtime Content and Structure

FeedHeader

Field	Required/Optional	Type
gtfs_realtime_version	required	string
incrementality	optional	enum Incrementality: <i>FULL_DATASET</i> <i>DIFFERENTIAL</i>
timestamp	integer	uint64

```
header {  
  gtfs_realtime_version: "1.0"  
  incrementality: FULL_DATASET  
  timestamp: 1463080565700  
}
```



GTFS-realtime Content and Structure

FeedEntity

Field	Required/Optional	Type
id	required	string
is_deleted	optional	bool
trip_update	optional	msg TripUpdate
vehicle	optional	msg VehiclePosition
alert	optional	msg Alert

GTFS-realtime Content and Structure

FeedEntity

```
entity {  
  id: "V1001"  
  is_deleted: false  
  vehicle {  
    trip {  
      trip_id: "121"  
      start_time: "15:23:00"  
      start_date: "20160512"  
      schedule_relationship: SCHEDULED  
      route_id: "2"  
      direction_id: 1  
    }  
    current_stop_sequence: 19  
    current_status: IN_TRANSIT_TO  
    timestamp: 1463080565700  
    stop_id: "96"  
  }  
}
```

Source: TRANSCOM



GTFS-realtime Content and Structure

TripUpdate

Field	Required/Optional	Type
trip	required	msg TripDescriptor
vehicle	optional	msg VehicleDescriptor
stop_time_update	repeated	msg StopTimeUpdate
timestamp	optional	uint64
delay	optional	int32

GTFS-realtime Content and Structure

TripUpdate

```
trip_update {  
  trip {  
    trip_id: "058450_1..N02R"  
    start_date: "20151104"  
    route_id: "1"  
  }  
  stop_time_update {  
    arrival {  
      time: 1446651757  
    }  
    departure {  
      time: 1446652057  
    }  
    stop_id: "103N"  
  }  
  stop_time_update {  
    arrival {  
      time: 1446652147  
    }  
    stop_id: "101N"  
  }  
}
```



GTFS-realtime Content and Structure

TripDescriptor

Field	Required/Optional	Type
trip_id*	optional	string
route_id*	optional	string
direction_id*	optional	uint32 (0 or 1)
start_time	optional	string (not POSIX time)
start_date	optional	string
schedule_relationship	optional	enum ScheduleRelationship <i>SCHEDULED</i> <i>UNSCHEDULED</i> <i>ADDED</i> <i>CANCELLED</i>

Values in fields with asterisk (*) should match corresponding GTFS feed exactly

GTFS-realtime Content and Structure

TripDescriptor

```
trip {  
  trip_id: "121"  
  start_time: "15:23:00"  
  start_date: "20160512"  
  schedule_relationship:  
  SCHEDULED  
  route_id: "2"  
  direction_id: 1  
}
```

Source: TRANSCOM



GTFS-realtime Content and Structure

StopTimeUpdate

Field	Required/Optional	Type
stop_sequence*	optional	uint32
stop_id*	optional	string
arrival	optional	msg StopTimeEvent
departure	optional	msg StopTimeEvent
schedule_relationship	optional	enum ScheduleRelationship <i>SCHEDULED</i> <i>SKIPPED</i> <i>NO_DATA</i>

Values in fields with asterisk (*) should match corresponding GTFS feed exactly

GTFS-realtime Content and Structure

StopTimeUpdate

```
stop_time_update {  
  stop_sequence: 20  
  arrival {  
    delay: 0  
    time: 1463066580000  
  }  
  departure {  
    delay: 0  
    time: 1463066580000  
  }  
  stop_id: "34"  
  schedule_relationship: SCHEDULED  
}
```

Source: TRANSCOM



GTFS-realtime Content and Structure

StopTimeEvent

Field	Required/Optional	Type
delay	optional	int32
time	optional	int64
uncertainty	optional	int32

```
departure {  
  delay: 0  
  time: 1463066580000  
}
```



GTFS-realtime Content and Structure

VehiclePosition

Field	Required/ Optional	Type
trip	optional	msg TripDescriptor
vehicle	optional	msg VehicleDescriptor
position	optional	msg Position
current_stop_sequence*	optional	uint32
stop_id*	optional	string
current_status	optional	enum VehicleStopStatus <i>INCOMING_AT</i> <i>STOPPED_AT</i> <i>IN_TRANSIT_TO</i>
timestamp	optional	uint64

Values in fields with asterisk (*) should match corresponding GTFS feed exactly

GTFS-realtime Content and Structure

VehiclePosition

Field	Required /Optional	Type
congestion_level	optional	enum CongestionLevel <i>UNKNOWN_CONGESTION_LEVEL</i> <i>RUNNING_SMOOTHLY</i> <i>STOP_AND_GO</i> <i>CONGESTION</i> <i>SEVERE_CONGESTION</i>
occupancy_status	optional	enum OccupancyStatus <i>EMPTY</i> <i>MANY_SEATS_AVAILABLE</i> <i>FEW_SEATS_AVAILABLE</i> <i>STANDING_ROOM_ONLY</i> <i>CRUSHED_STANDING_ROOM_ONLY</i> <i>FULL</i> <i>NOT_ACCEPTING_PASSENGERS</i>

GTFS-realtime Content and Structure

VehiclePosition

```
vehicle {
  trip {
    trip_id: "30118425"
    start_date: "20160516"
    route_id: "1"
    direction_id: 1
  }
  position {
    latitude: 42.3722686768
    longitude: -71.1155471802
    bearing: 220.0
  }
  current_stop_sequence: 4
  current_status: STOPPED_AT
  timestamp: 1463433348
  stop_id: "2167"
  vehicle {
    id: "y2294"
    label: "2294"
  }
}
```



GTFS-realtime Content and Structure

VehicleDescriptor

Field	Required/Optional	Type
id	optional	string
label	optional	string
license_plate	optional	string

```
vehicle {  
  id: "y2294"  
  label: "2294"  
}
```

Source: MBTA



GTFS-realtime Content and Structure

Position

Field	Required/Optional	Type
latitude	required	float
longitude	required	float
bearing	optional	float (0-360)
odometer	optional	double
speed	optional	float

```
position {  
  latitude: 42.3722686768  
  longitude: -71.1155471802  
  bearing: 220.0  
}
```



GTFS-realtime Content and Structure

Alert

Field	Required/Optional	Type
active_period	repeated	msg TimeRange
informed_entity	repeated	msg EntitySelector
cause	optional	enum Cause
effect	optional	enum Effect
url	optional	msg TranslatedString
header_text	optional	msg TranslatedString
description_text	optional	msg TranslatedString

GTFS-realtime Content and Structure

Alert

enum Cause	enum Effect
<i>UNKNOWN_CAUSE</i>	<i>NO_SERVICE</i>
<i>OTHER_CAUSE</i>	<i>REDUCED_SERVICE</i>
<i>TECHNICAL PROBLEM</i>	<i>SIGNIFICANT_DELAYS</i>
<i>STRIKE</i>	<i>DETOUR</i>
<i>DEMONSTRATION</i>	<i>ADDITIONAL_SERVICE</i>
<i>ACCIDENT</i>	<i>MODIFIED_SERVICE</i>
<i>HOLIDAY</i>	<i>OTHER_EFFECT</i>
<i>WEATHER</i>	<i>UNKNOWN_EFFECT</i>
<i>MAINTENANCE</i>	<i>STOP_MOVED</i>
<i>CONSTRUCTION</i>	
<i>POLICE_ACTIVITY</i>	
<i>MEDICAL_EMERGENCY</i>	

GTFS-realtime Content and Structure

Alert

```
alert {
  active_period {
    start: 1464020433
    end: 1464035632
  }
  informed_entity {
    agency_id: "1"
    route_id: "36"
    route_type: 3
  }
  cause: TECHNICAL_PROBLEM
  effect: OTHER_EFFECT
  header_text {
    translation {
      text: "Moderate Route 36 delay"
      language: "en"
    }
  }
  description_text {
    translation {
      text: "Route 36 experiencing moderate delays due to
disabled bus."
      language: "en"
    }
  }
}
```



GTFS-realtime Content and Structure

TimeRange

Field	Required/Optional	Type
start	optional	uint64
end	optional	uint64

```
active_period {  
  start: 1464020433  
  end: 1464035632  
}
```

```
active_period {  
  start: 1464020433  
}
```

```
active_period {  
  end: 1464035632  
}
```



GTFS-realtime Content and Structure

EntitySelector

Field	Required/Optional	Type
agency_id*	optional	string
route_id*	optional	string
route_type*	optional	integer
trip	optional	msg TripDescriptor
stop_id*	optional	string

Values in fields with asterisk (*) should match corresponding GTFS feed exactly

```
informed_entity {  
  agency_id: "1"  
  route_id: "36"  
  route_type: 3  
}
```



GTFS-realtime Content and Structure

TranslatedString

Field	Required/Optional	Type
translation	repeated	msg Translation

```
description_text {  
  translation {  
    text: "Route 36 experiencing moderate delays due to disabled bus."  
    language: "en"  
  }  
}
```

Source: MBTA



GTFS-realtime Content and Structure

Translation

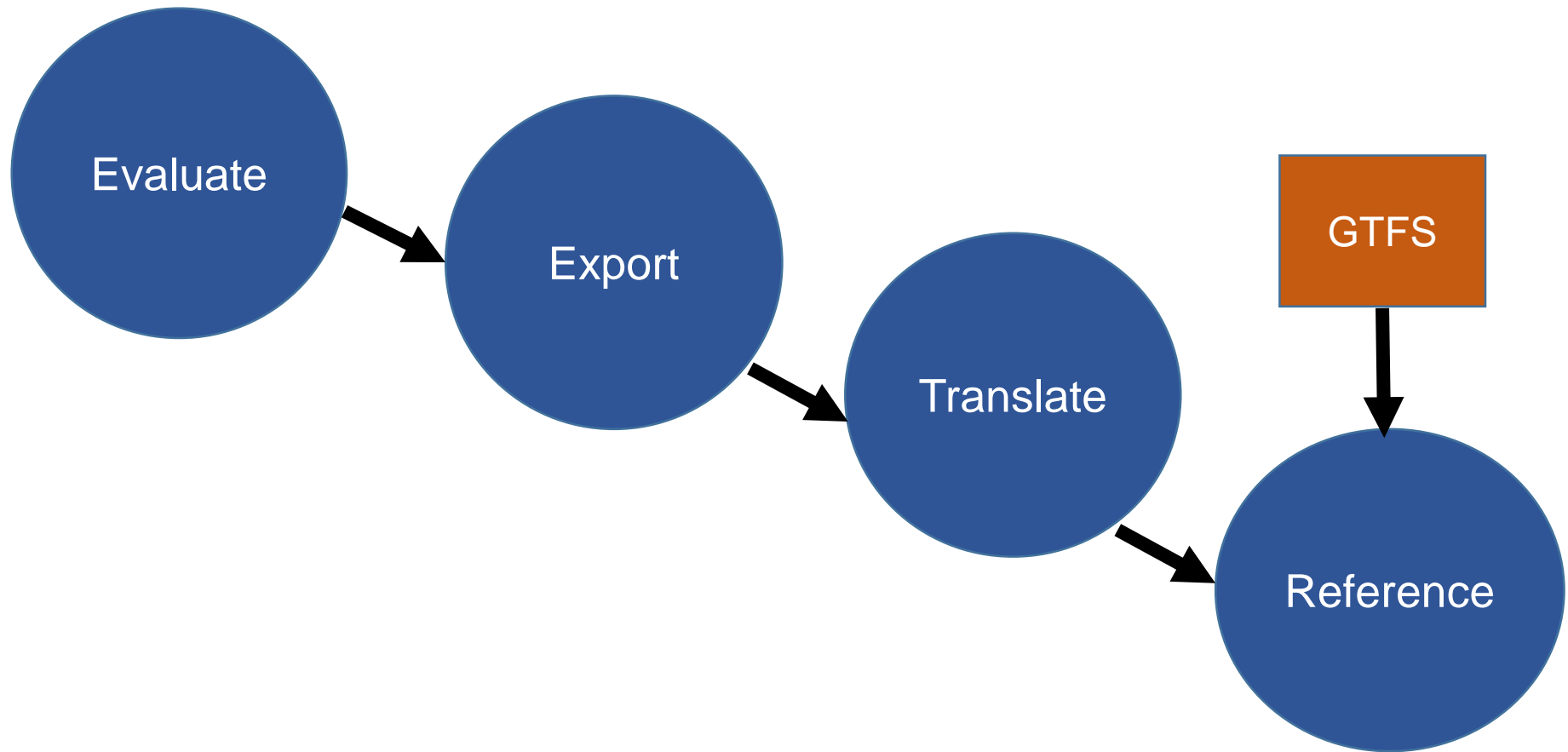
Field	Required/Optional	Type
text	required	string
language**	optional	string

** acceptable codes for languages can be found at http://www.loc.gov/standards/iso639-2/php/code_list.php

```
translation {  
  text: "Route 43 experiencing minor delays due to traffic."  
  language: "en"  
}
```

Translating Source Application Data to GTFS-realtime files

Data Translation Process



Related Tools for GTFS-realtime

Tools

- No commonly used stand-alone off-the-shelf tools exist
- Open source tools can be integrated with other software
- CAD/AVL systems can include necessary software
- Custom software may be required

```
if field == "route_id": #tests to ensure a route_id appears in routes.txt and that it matches
the reference trip_id
    if value in routesLookup: #if the route_id is in routes.txt:
        if key == "": #if no trip_id, can't verify the trip-route match
            warn = True
            refOk = True
            comment = "WARNING: route_id %s exists in routes.txt, but no corresponding
trips_id to check against. Entity: %s" % (value,entID)
        elif tripsLookup.has_key(key) == False: #if the trip_id does not exist in trips.txt,
can't verify trip_route match
            error = True
            refOk = False
            comment = "ERROR. trip_id %s does not exist. Therefore, route_id %s can not be
verified. Entity: %s" %(key,value,entID)
```



ACTIVITY



U.S. Department of Transportation
Office of the Assistant Secretary for
Research and Technology

Question

Which of the following formats is used for encoding a GTFS-realtime feed?

Answer Choices

- a) Extensible Markup Language (XML)
- b) JavaScript Object Notation (JSON)
- c) Protocol Buffers
- d) Comma Separated Values (CSV)

Review of Answers



a) Extensible Markup Language (XML)

Incorrect. GTFS-realtime files are not encoded in XML.



b) Javascript Object Notation (JSON)

Incorrect. GTFS-realtime files are not encoded in JSON.



c) Protocol Buffers

Correct! Protocol Buffers are the format used for GTFS-realtime.



d) Comma Separated Values (CSV)

Incorrect. GTFS-realtime files are not encoded in CSV.

Question

Which of the following is NOT a way to show location in GTFS-realtime

Answer Choices

- a) Latitude/Longitude
- b) Stop sequence on a trip
- c) Stop identifier
- d) Distance to destination

Review of Answers



a) Latitude and Longitude

Incorrect. The fields latitude and longitude are used for this.



b) Stop sequence on a trip

Incorrect. The field current_stop_sequence is used for this.



c) Stop identifier

Incorrect. The field stop_id is used for this.



d) Distance to destination

Correct! There is no field for this in GTFS-realtime.

Learning Objective 3

Implementation of
GTFS-realtime

Testing GTFS-realtime Files and GTFS-realtime Validation Tools

- Why is testing important?
 - Need to ensure high quality data
- Types of Testing
 - Specification Conformance
 - Is the data Accurate?
 - Appropriate references

```
stop_time_update {
  departure {
    delay: 0
    time: 1460661420
  }
  stop_id: "111"
}
stop_time_update {
  departure {
    delay: 0
    time: 1460661600
  }
  stop_id: "112"
}
```

```
110, Larchmont, 40.933394, -73.759792, http://as0.mta.info/mnr/stations/station_detail.cfm?key=208,0,,1
111, Mamaroneck, 40.954061, -73.736125, http://as0.mta.info/mnr/stations/station_detail.cfm?key=210,0,,0
112, Harrison, 40.969432, -73.712964, http://as0.mta.info/mnr/stations/station_detail.cfm?key=212,0,,1
114, Rye, 40.985922, -73.682553, http://as0.mta.info/mnr/stations/station_detail.cfm?key=214,0,,1
115, Port Chester, 41.000732, -73.6647, http://as0.mta.info/mnr/stations/station_detail.cfm?key=216,0,,0
116, Greenwich, 41.021277, -73.624621, http://as0.mta.info/mnr/stations/station_detail.cfm?key=218,0,,1
118, Cos Cob, 41.030171, -73.598306, http://as0.mta.info/mnr/stations/station_detail.cfm?key=220,0,,0
```

Source: Metro North Railroad



Testing GTFS-realtime Files and GTFS-realtime Validation Tools

- No off-the-shelf GTFS-realtime testing tools, some open source tools in development
- Testing typically built into production tools or consumption tools
- Google's open source software modules provide rudimentary testing

```
record: 533 >> WARNING: optional field uncertainty IS NOT present. Entity: T1009
record: 537 >> WARNING: optional field uncertainty IS NOT present. Entity: T1009
record: 546 >> WARNING: optional field uncertainty IS NOT present. Entity: T1009
record: 550 >> WARNING: optional field uncertainty IS NOT present. Entity: T1009
record: 559 >> WARNING: optional field uncertainty IS NOT present. Entity: T1009
record: 563 >> WARNING: optional field uncertainty IS NOT present. Entity: T1009
record: 572 >> WARNING: optional field uncertainty IS NOT present. Entity: T1009
record: 576 >> WARNING: optional field uncertainty IS NOT present. Entity: T1009
record: 585 >> WARNING: optional field uncertainty IS NOT present. Entity: T1009
record: 589 >> WARNING: optional field uncertainty IS NOT present. Entity: T1009
record: 592 >> WARNING: optional field delay IS NOT present. Entity: T1009
record: 606 >> WARNING: optional field vehicle IS NOT present. Entity: V1009
record: 607 >> WARNING: optional field position IS NOT present. Entity: V1009
record: 613 >> WARNING: optional field congestion_level IS NOT present. Entity: v1009
record: 614 >> WARNING: optional field occupancy_status IS NOT present. Entity: v1009
record: 629 >> WARNING: optional field vehicle IS NOT present. Entity: T1011
record: 637 >> WARNING: optional field uncertainty IS NOT present. Entity: T1011
record: 641 >> WARNING: optional field uncertainty IS NOT present. Entity: T1011
record: 650 >> WARNING: optional field uncertainty IS NOT present. Entity: T1011
record: 654 >> WARNING: optional field uncertainty IS NOT present. Entity: T1011
record: 663 >> WARNING: optional field uncertainty IS NOT present. Entity: T1011
record: 667 >> WARNING: optional field uncertainty IS NOT present. Entity: T1011
```



How an Agency Implements GTFS-realtime

Implementation Checklist

- Determine need for real time information
- Inventory existing systems and data
- Determine feasibility
- Procure and/or Develop
- Produce and provide data



How an Agency Implements GTFS-realtime

Should GTFS-realtime be implemented?

- Established need: Identify usage
 - Will customers benefit from real-time information?
 - Will archiving real-time information be useful?
 - Do downstream applications exist?
- Determine feasibility
 - Can existing systems be leveraged?
 - Does funding exist for procurement if needed?
 - Can a system that produces GTFS-realtime feeds be maintained?
- **Is GTFS-realtime the correct format to use?**

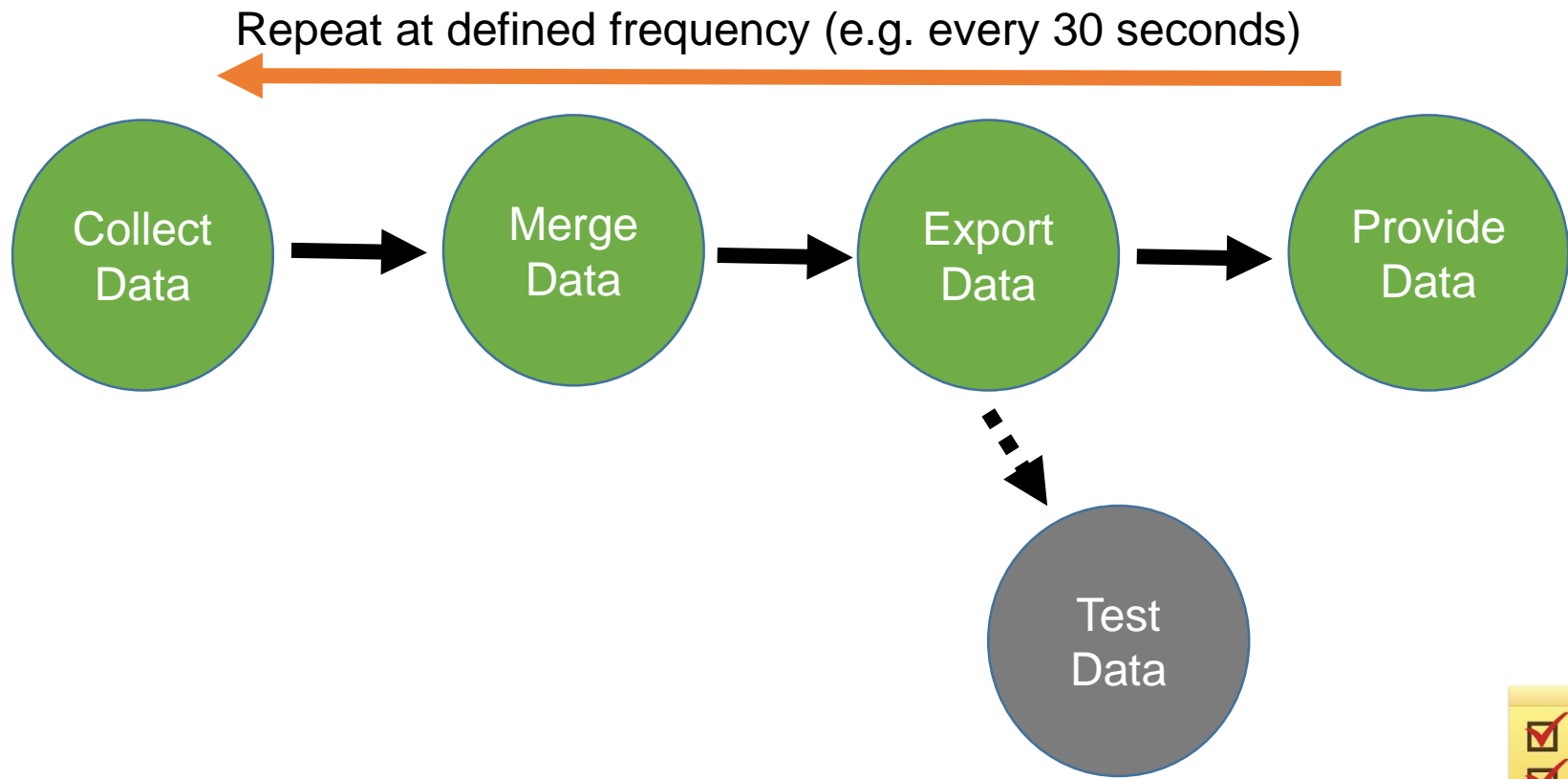
How an Agency Implements GTFS-realtime

Procurement

- Use Systems Engineering Process
- User needs
 - *Ex. Downstream users need to receive trip update information*
- Functional Requirements
 - *Ex. The system shall export a GTFS-realtime feed containing the TripUpdate, VehiclePosition, and Alert messages*
- Performance Requirements
 - *Ex. The system shall provide an updated GTFS-realtime feed every 30 seconds*

How an Agency Implements GTFS-realtime

Data Lifecycle Requirements and Strategies



How an Agency Implements GTFS-realtime

Making Data Accessible

- Fixed location
- Agencies define Application Programming Interface (API) for requests
- Typically HTTP request
- Access often must be granted
- Need to make static GTFS accessible

CASE STUDY



Agency Case Study

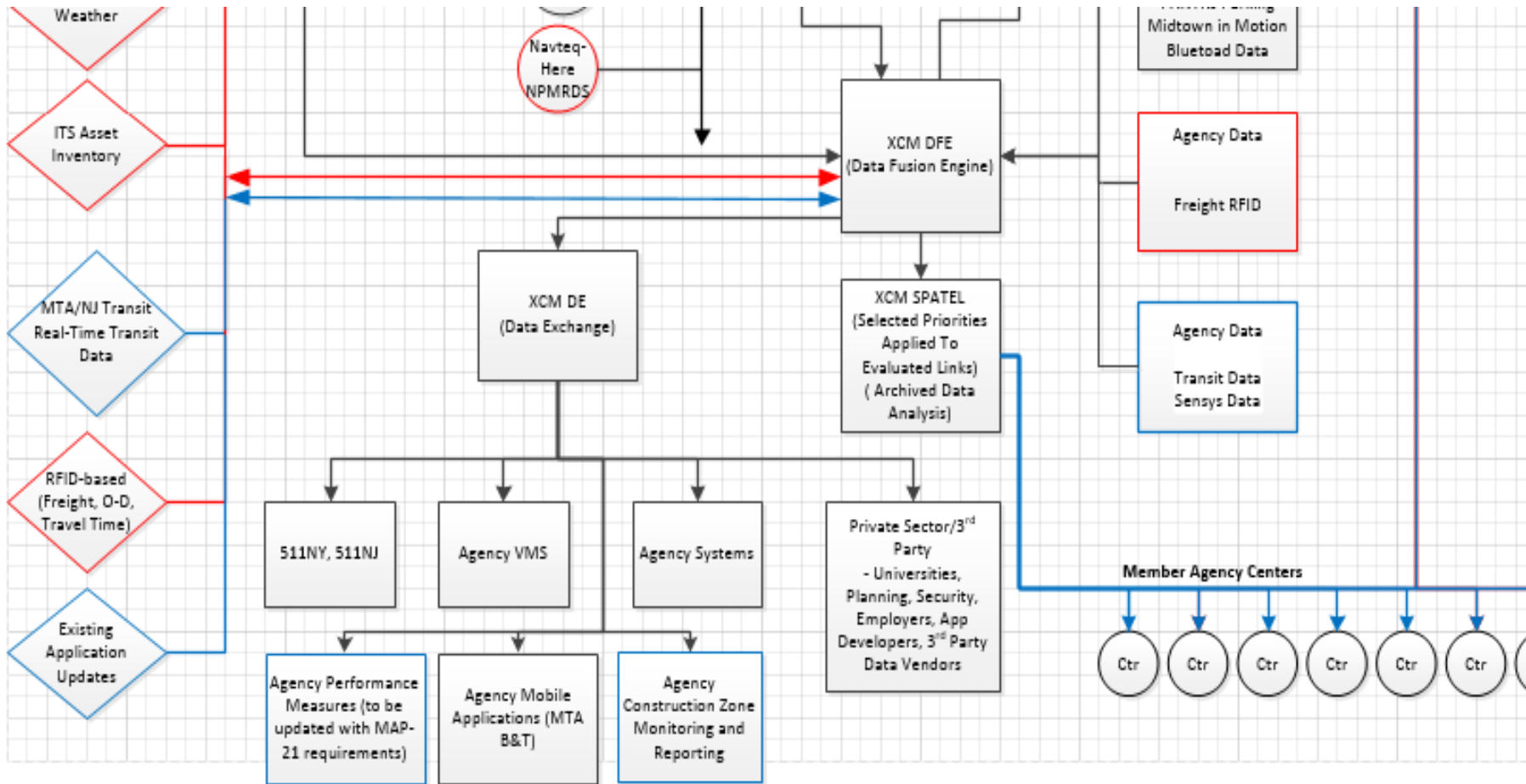
TRANSCOM

- TRANSCOM (NY/NJ/CT Metro Region)
- 16 member agencies
- Consolidating real time transit data
- Providing GTFS-realtime
- Data provided to downstream users
- Developing transit dashboard



Agency Case Study

TRANSCOM



Agency Case Study

TRANSCOM

- Feeds
 - NJ Transit Rail (Year 1)- Custom XML
 - NJ Transit Bus (Year 2)- Custom XML
 - MTA NYCT Subway (Year 2)- GTFS-realtime
 - MTA Long Island Rail Road (Year 2)- GTFS-realtime
 - MTA Metro North Railroad (Year 2)- GTFS-realtime
 - MTA NYCT Bus (Year 3)- SIRI
- Lessons learned
 - Document the meaning of the data
 - Understand the meaning of data when integrating multiple sources



ACTIVITY



U.S. Department of Transportation
Office of the Assistant Secretary for
Research and Technology

Question

Which of the following methods is most commonly used to access GTFS-realtime feeds?

Answer Choices

- a) Email
- b) FTP
- c) HTTP
- d) Telephone

Review of Answers



a) Email

Incorrect. Email is too slow.



b) FTP

Incorrect. FTP is not typically used.



c) HTTP

Correct! HTTP is commonly used to share GTFS-realtime feeds.



d) Telephone

Incorrect. This is not an electronic format.

Module Summary

What We Have Learned

1. The **background** of the GTFS-realtime specification, its **benefits** and its **uses**.
2. How GTFS-realtime feeds are **structured**, the **content** of the feeds, and how the feeds are **created**.
3. How agencies **test and implement** GTFS-realtime feeds.

This module taught us about the GTFS-realtime specification and how it can be used.

Thank you for completing this module.

Feedback

Please use the Feedback link below to provide us with your thoughts and comments about the value of the training.

Thank you!