Integrated Dynamic Transit Operations (IDTO): Stakeholder Input on Concept of Operations (ConOps) Development

IDTO Stakeholders Meeting
January 26 and 27, 2012 in Washington, DC

Welcome

Announcements

- Sign-in sheet
- Agenda
- Workbook
- Administrative announcements

Key Meeting Elements

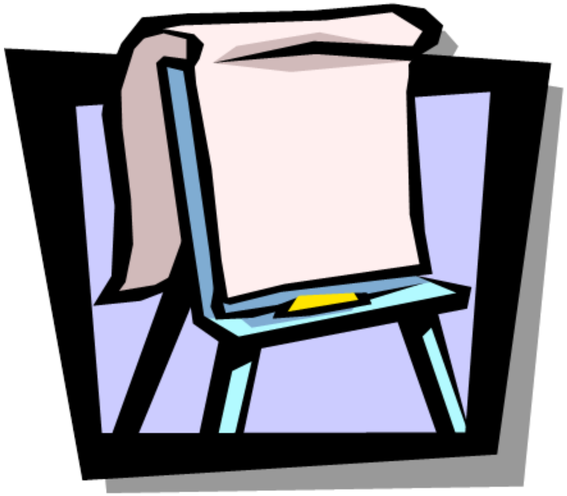
- Information dissemination
- Full group discussion
- Group breakout sessions with debriefing
- Questions and answers

Meeting Agenda – Day 1

1. Welcome and Introductions
2. Workshop Objectives and Desired Outcomes
3. IDTO Overview and Draft Visions
4. BREAK
5. Group discussion of transformative concepts, current status, trends and perspectives
6. Briefing on DMA and Link to IDTO

Introductions

- Name
- Organization
- Area of Expertise
- Meeting Expectations



Meeting Outcomes

1. Determine if scenarios are correctly documented and represented
2. Gather detailed input for each scenario to finalize high level User Needs
3. Identify initial “Gaps” that need to be filled for IDTO applications to be operational

Goals and Objectives of the Study

Goals of the Study

1. Facilitate concept development and needs refinement for IDTO applications
2. Assess relevant prior and ongoing research
3. Develop functional requirements and corresponding performance requirements
4. Develop high-level data and communication needs
5. Assess readiness for development and testing

Goals of IDTO

- Examine what technologies can help people effortlessly transfer from one mode of travel (car, bus, train, etc.) to another for the fastest and most environmentally friendly trip
- Seek to make cross-modal travel truly possible
- Enable agencies and companies to manage their systems in light of the fact that people may be changing modes often

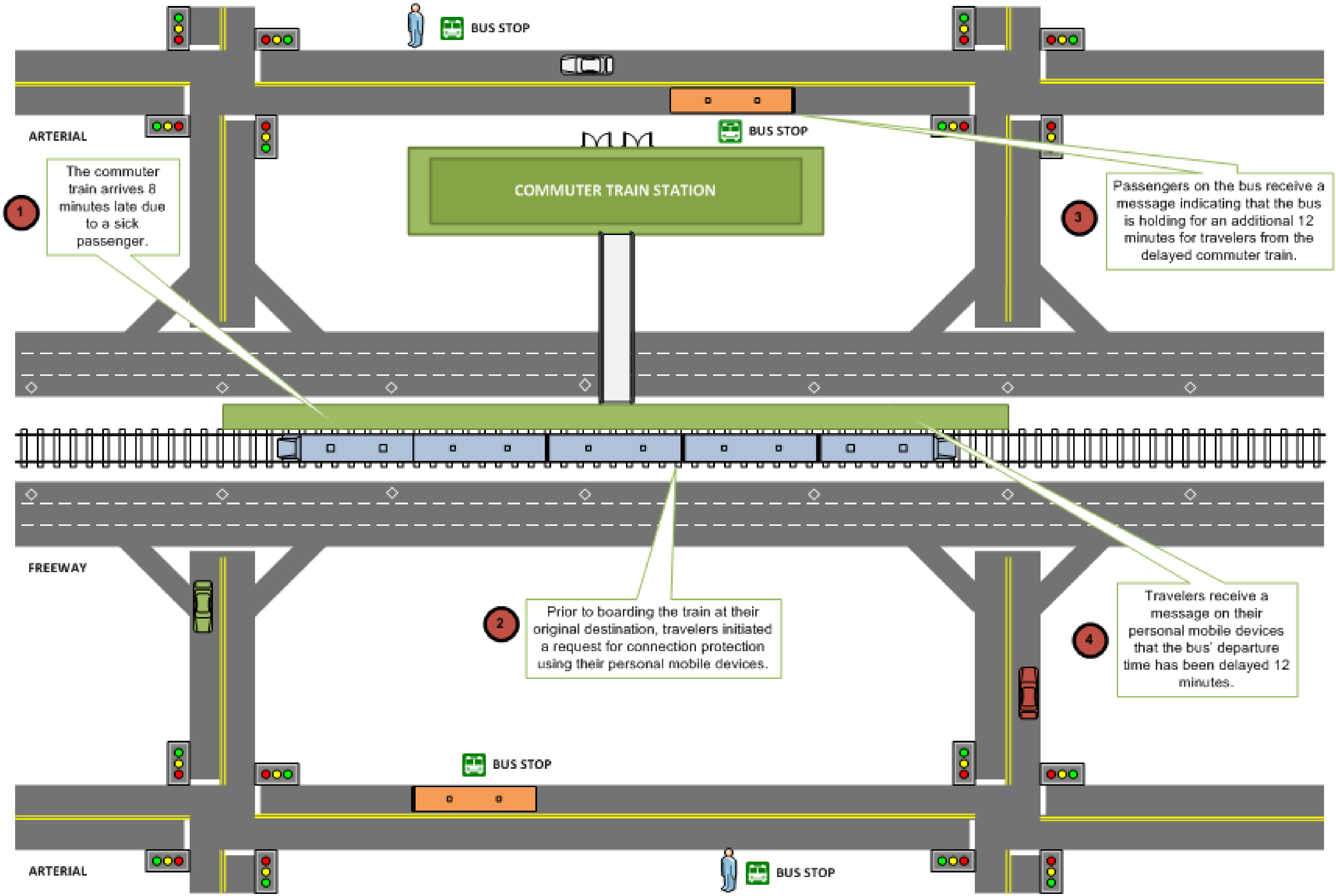
IDTO Applications Definitions

- **Connection Protection (T-CONNECT) -** enable public transportation providers and travelers to communicate to improve the probability of successful transit transfers. This application would potentially include intermodal and interagency coordination.

- **Dynamic Transit Operations (T-DISP) -** links available transportation service resources with travelers through dynamic transit vehicle scheduling, dispatching and routing capabilities. It would also enable travelers to make real-time trip requests through personal mobile devices.

- **Dynamic Ridesharing (D-RIDE) -** makes use of in-vehicle (drivers) and hand-held devices (riders) to dynamically identify and accept potential ridesharing opportunities along the travel route.

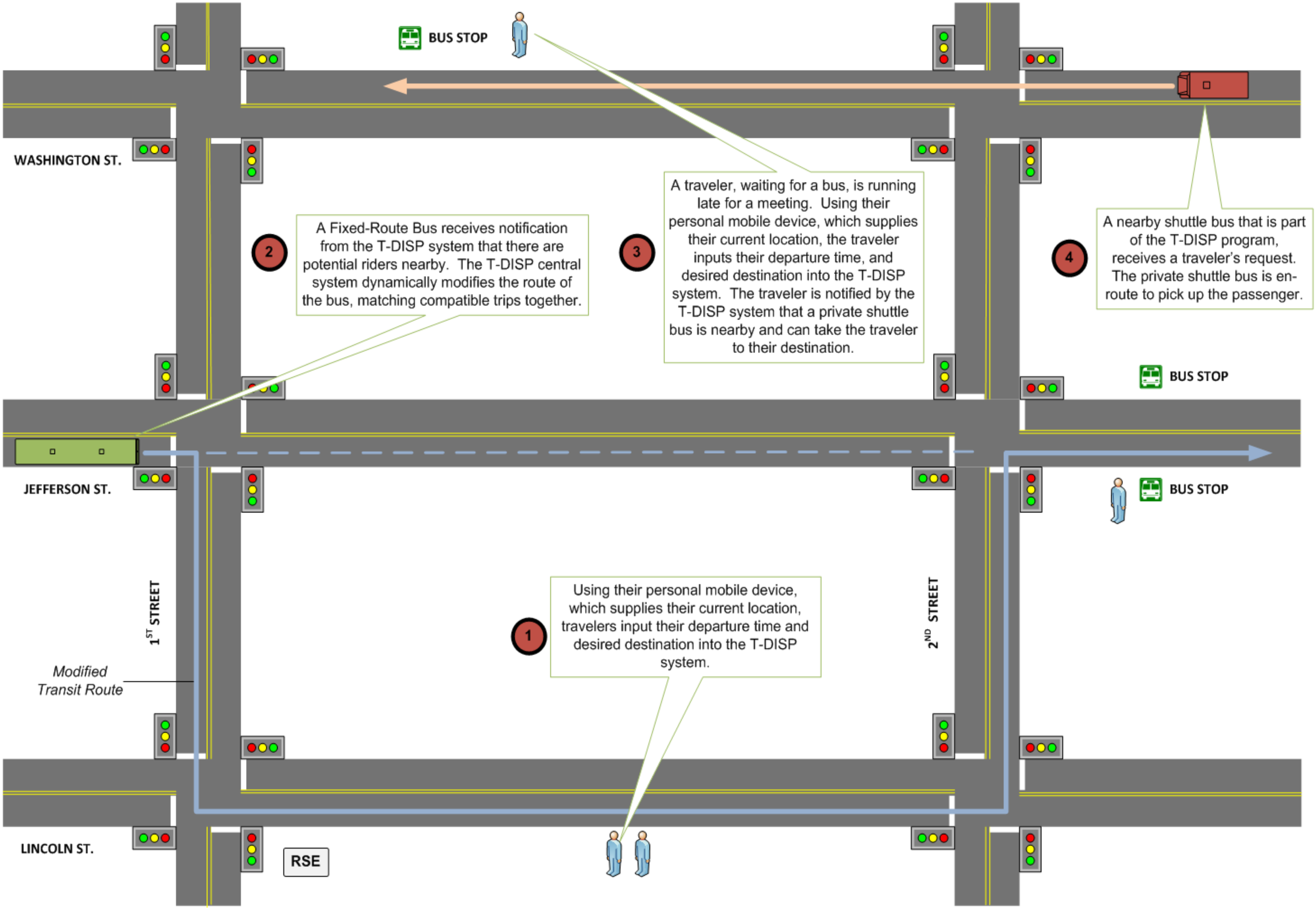
T-CONNECT Example



T-CONNECT: State of the Practice

- T-Connect addresses problem of multiple transfers between different transit modes by enabling communications to improve probability of a transfer
- Exists mostly for bus-to-bus transfers, but limited application of for rail-to-bus
- Relies on passenger request to driver
- No US examples of regional, multiple operator connection protection

T-DISP Example



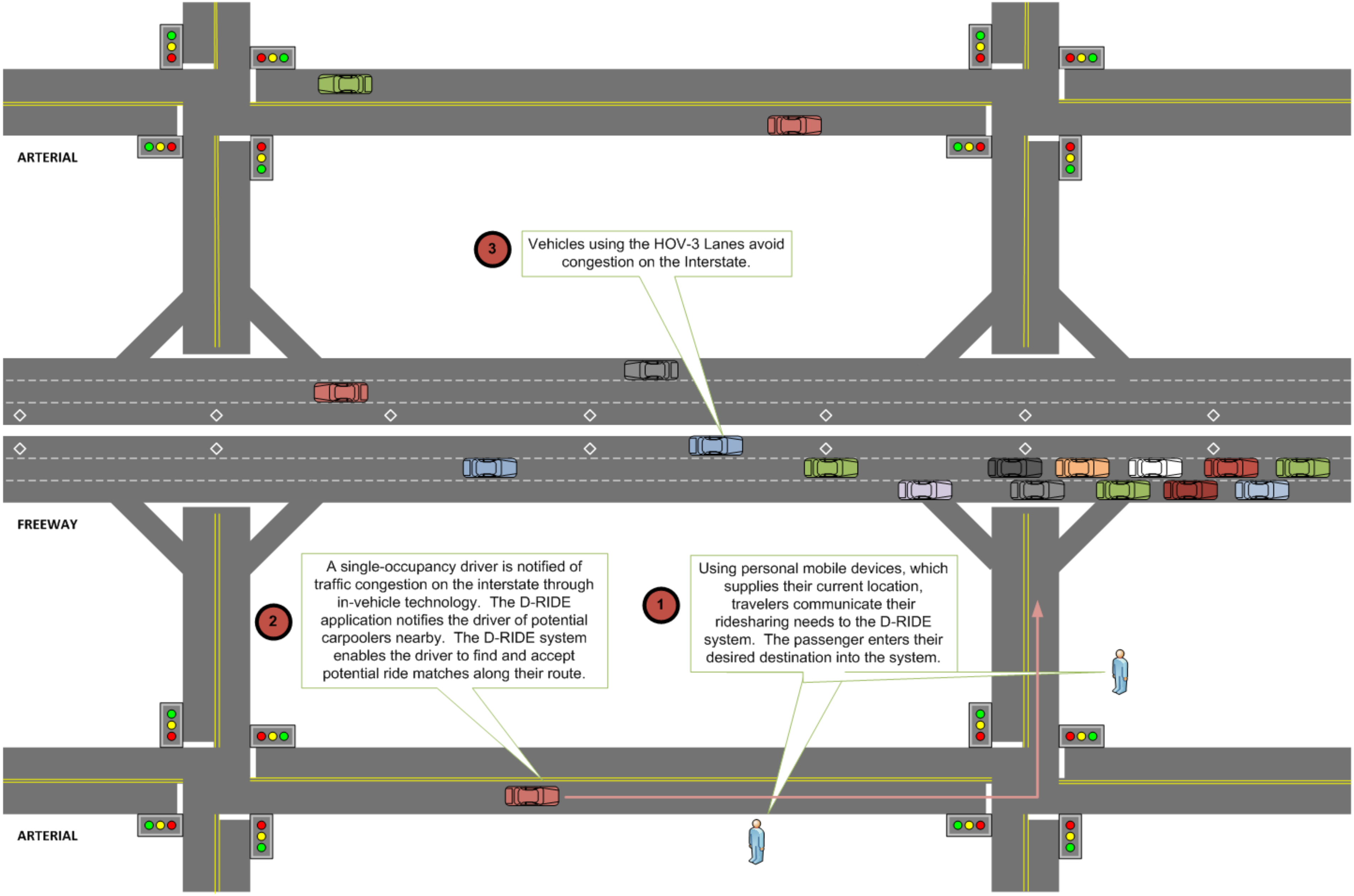
T-DISP: State of the Practice

- T-DISP addresses variety of transit services offered in certain conditions and allows travelers to assess their travel options

- Dynamic transit services operated in numerous locations around the US, but very few employ technology. Use of technology more prevalent in European dynamic transit operations

- Orlando’s Lynx FlexBus and United We Ride/Mobility Services for All Americans projects will provide valuable information

D-RIDE Example



D-RIDE: State of the Practice

- D-RIDE promotes ridesharing through in-vehicle and handheld technologies, and improvements to information available for high occupancy vehicle/toll lanes
- Various forms of ridesharing since early 1990s, but now new “products” available using current technology
- Input from Ridesharing Institute (created 2011) and new ridesharing products critical to understand marketplace
- Limited toll lane and in-vehicle functionality

Investigate Answers to Questions

1. Do current practices take full advantage of new transit technologies, tools and data sources?
2. What emerging opportunities exist for the new generation of automated tools to be used to facilitate the deployment of the IDTO applications?
3. Is there strong motivation for a federal role in facilitating the development of new technologies and tools to capitalize on these identified opportunities?

Summary of Findings from Scan of Current Practice

Findings: Literature Review

- Academia
- USDOT Programs
- United We Ride/Mobility Services for All Americans (UWR/MSAA)
- Connected Vehicle Program
- Dynamic Mobility Applications
- Research conducted by TRB and other associations

T-CONNECT Current Practice

	FR Bus	Flex/DR / Para Bus	Light/ Heavy Rail	Commuter Rail	Ferry
Fixed-route Bus	Y[1]	N	N	N	N
Flexible/Demand Response/ Paratransit Bus	N	N	N	N	N
Light/Heavy Rail	Y[2]	N	N	N	N
Commuter Rail	Y[3]	N	N	Y[4]	N
Ferry	N	N	N	N	N

T-CONNECT Current Practice (cont'd)

1. Several examples in fixed-route implementations. Commonplace with many CAD/AVL systems
2. For example, UTA's TCP deployment between TRAX light rail and fixed-route buses
3. For example, commuter rail to fixed-route bus in Brampton, Ontario
4. No evidence of direct T-CONNECT implementation, but commuter rail often provides "unconditional" transfers

T-CONNECT General Findings

- Literature limited
- Evaluation of UTA TCP program revealed that program well-regarded
- Fixed-route to Fixed-route TCP is only T-CONNECT-type implementation that exists today in the US

T-CONNECT Challenges

- Electronic information exchange necessary, but important to ensure consistency of coordination on business processes related to transfers
- After-the-fact review of transfer trips should be conducted
- “Maximum allowed” waiting time should be defined
- Definition of TCP should be by route, not by vehicle
- Manual intervention should be allowed
- Accuracy of real-time vehicle locations must be ensured

T-DISP Current Practice

- Application limited in US:
  - Flexibly-routed service with technology limited
  - No one site with all T-DISP elements: coordination of transportation services, transit technology, technology to provide information to travelers and travel management coordination center
- Existing programs with some elements:
  - UWR/MSAA initiative
  - FlexBus in Orlando, FL
  - North and East Brainerd routes in Chattanooga
  - Belbus in Belgium and Flexlinjen in Sweden

T-DISP General Findings

- Service coordination challenges are complex
- Technology alone will not overcome coordination barriers
- Limited demonstration of technology application and coordination together
- Travelers and their needs, particularly information, critical part of T-DISP concept
- Few states that include transit in 511 systems

T-DISP Challenges

- Difficulty in coordinating amount multiple transit agencies, funding programs, and local, state and Federal entities
- Lack of effective coordination structures has contributed to:
  - Service area gaps
  - Limited services
  - Confusing and low quality customer service
- Limited deployment of real-time transit information systems

D-RIDE Current Practice

- Pilot in Santa Barbara County through FHWA Value Pricing Pilot Program
- FHWA-sponsored scan of casual carpooling/ slugging phenomenon
- Project in San Diego to sync software with in-vehicle computer, and calculate number of passengers
- Rideshare pilot in Washington State SR 520 corridor
- Multiple private companies/programs

D-RIDE General Findings

- Wide range of technologies employed, and with more mobile and internet-based technologies
- Fear of strangers often cited as reason for not sharing rides, so focus on making participants more comfortable
- Providing familiar meeting points and drop-off locations in addition to users' homes way to make participants more comfortable
- Marketing necessary to draw initial crowd
- Incentives can draw more users

D-RIDE Challenges

- Implementing controls to minimize safety concerns regarding sharing a vehicle with a stranger
- Lack of established rideshare infrastructure (meeting points and drop-off locations)

Group Discussion of Transformative Concepts, Current Status, Trends and Perspectives

T-CONNECT Goals and Objectives

T-CONNECT Goals

1. Implement a system that improves intermodal transfer connections involving multiple transit agencies
2. Deploy an application that improves the probability of transit connections
3. Improve rider satisfaction regarding transfers

T-CONNECT Objectives

- Implement a system that improves coordination between transit agencies and vehicles by utilizing various technologies such as “Connected Vehicle “
- To deploy a system that increases the number of successful transit connections
- Reduction in overall round-trip travel time for transit riders requiring transfers, and provision of accurate and relevant real-time passenger information

T-CONNECT
Performance Measures

Performance Measures for T-CONNECT

- Average transfer passenger waiting time (from incoming vehicle) = 3 minutes or less
- Average in-vehicle passenger waiting time (for the "outgoing" vehicle) = 1 minute or less
- Average downstream passenger waiting time (for outgoing vehicle) = 3 minutes or less
- Average Successful Low Latency Connections Achieved = 20% (a connection that occurs within 1 minute or less)
- Average Successful Mid Latency Connections Achieved = 40% (a connection that occurs within 2 minutes or less)

Performance Measures for T-CONNECT (cont'd)

- Percentage of successful connections involving more than one agency: 95%
- Percentage of successful connections involving more than one mode: 95%
- Percentage of successful connection involving fixed and flexible modes: 90%
- Percentage of reduced complaints from customers regarding transfers: 90%
- Average response time to customers regarding a successful transfer request: 2 minutes

T-DISP Goals and Objectives

T-DISP Goals

- Provide travelers with information about transportation options dynamically and in real-time
- Allow travelers to explore and assess different travel options from multiple transportation providers with predictable time and cost
- Dynamically schedule and dispatch multiple transportation modes by matching compatible traveler trip requests
- Reduce cost of providing transit service, especially in areas of low density or dispersed land uses

T-DISP Objectives

- Advance concept of demand-responsive transportation services utilizing personal mobile devices with transportation providers' on-board and central system technologies
- Provide a central system, such as Travel Management Coordination Center or decentralized system, to "ease" communications between transportation providers to leverage their services through dynamic routing, dispatching and scheduling based on real-time conditions
- Maximize use of multiple transportation providers and types of service within a region to provide effective service to the community

T-DISP Performance Measures

Performance Measures for T-DISP

- Average time for traveler to make trip request, receive and confirm trip = 45 seconds
- Number of trips scheduled by the Control Center compared to overall transit ridership (i.e., trips not scheduled through Control Center) per time frame (month, week, day)
- Average waiting time for a passenger for pickup since the time of trip request (for real-time trips only)
- Average on-board time for passengers

Performance Measures for T-DISP

- Average boarding time for group trips
- Number of trips performed by each mode
- Number of trips performed by each provider, public and private
- Percentage of no-shows and cancellations
- Reduction in cost per passenger

D-RIDE Goals and Objectives

D-RIDE Goals/Objectives

1. Improve feasibility and convenience of non-transit ridesharing options (e.g., car/vanpool) to increase mode-share and lessen congestion
2. To provide secure location-based data and accurate reporting of high occupancy vehicle (HOV) status for HOV and high occupancy toll (HOT) restricted lanes for HOV/HOT occupancy enforcement and improved tolling strategies

D-RIDE Performance Measures

Performance Measures for D-RIDE

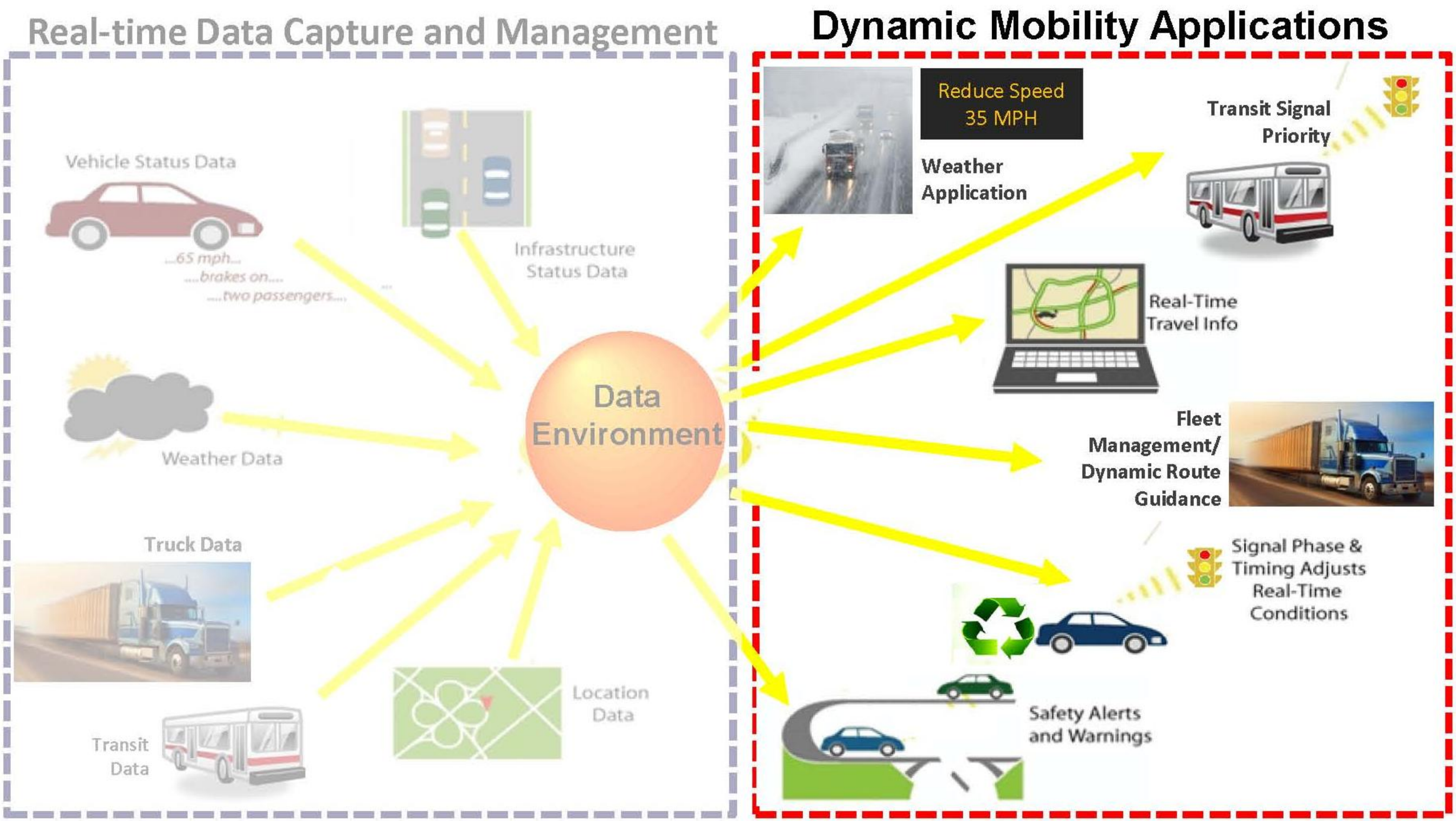
- Number of participating users (concentration rate):
  - 500 per 1 mile radius of passenger placing trip request
  - 750 per 2 mile radius of passenger placing trip request
  - 1,000 per 3 mile radius of passenger placing trip request
- Average passenger waiting time (waiting for ridematch vehicle) = 10 minutes or less
- Average number of ridematches (rate of occurrence):
  - 0-2 passenger to driver matches = < 5% of requests
  - 3-5 passenger to driver matches = at least 95% of requests
  - 6+ passenger to driver matches= 75% of requests
- Late arrivals (rate of occurrence) = <20% of all arrivals

Performance Measures for D-RIDE (cont'd)

- Average response time to customers about a found ridematch
  - 0-5 minutes = at least 95% of requests
  - 6+ minutes = < 5% of requests
- Total number of trips with modifications due to accident/incident with a vehicle = <5 per day
- Percentage of no-shows = <2% no shows = 95% of requests
- Average on-board time for passengers by vehicle capacity (this is a metric with no preset goals but should have data collected)
  - 1 passenger
  - 2 passengers
  - 3 passengers
  - 4 passengers
- Number of D-RIDE trips per month with HOV lane utilization
  - HOV 2+ = >75% D-RIDE trips per month
  - HOV 3+ = >80% D-RIDE trips per month

Dynamic Mobility Applications Program

Dynamic Mobility Applications



Dynamic Mobility Applications

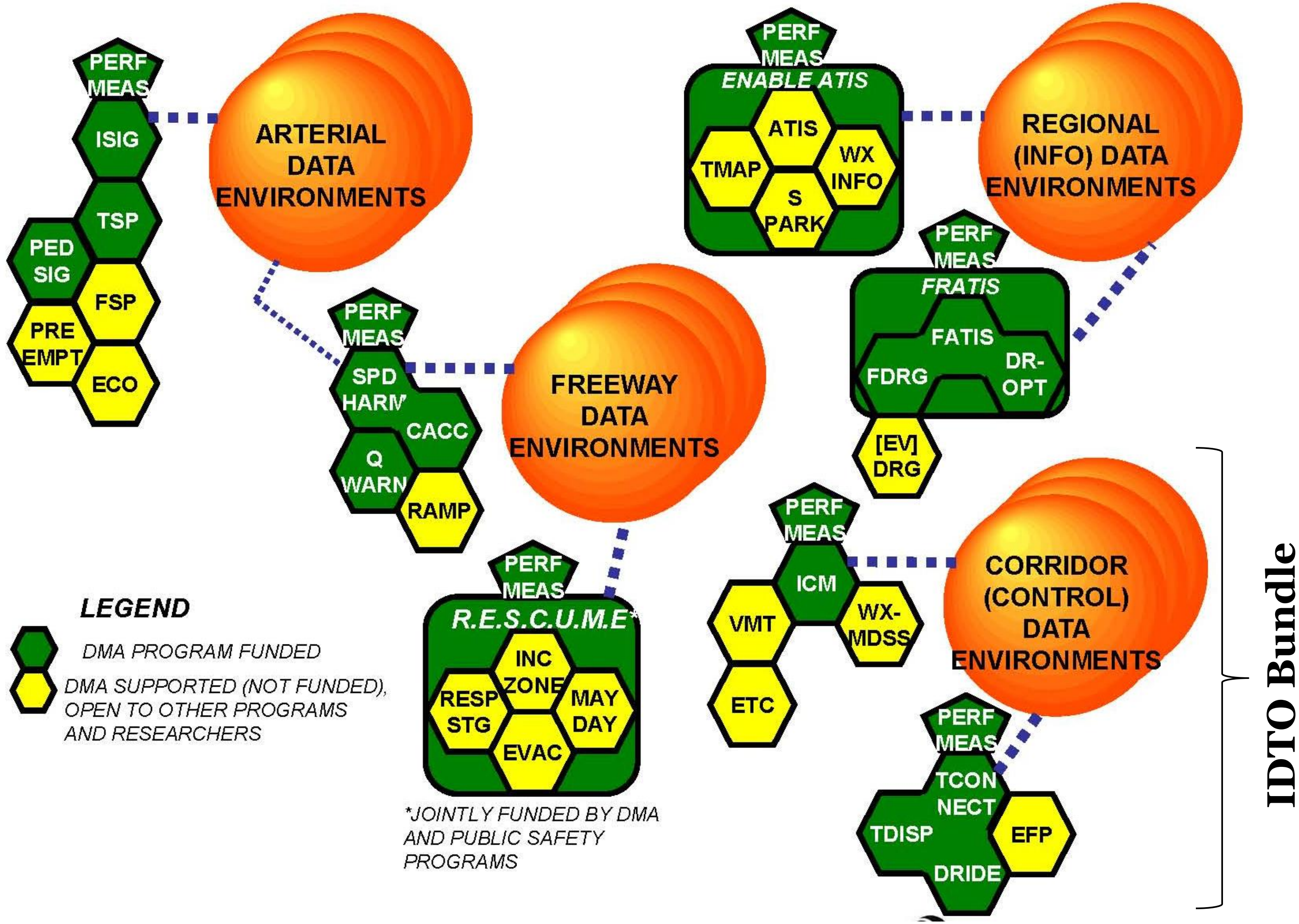
Vision: Expedite development, testing, commercialization and deployment of innovative mobility applications:

- Maximize system productivity
- Enhance mobility of individuals within the system

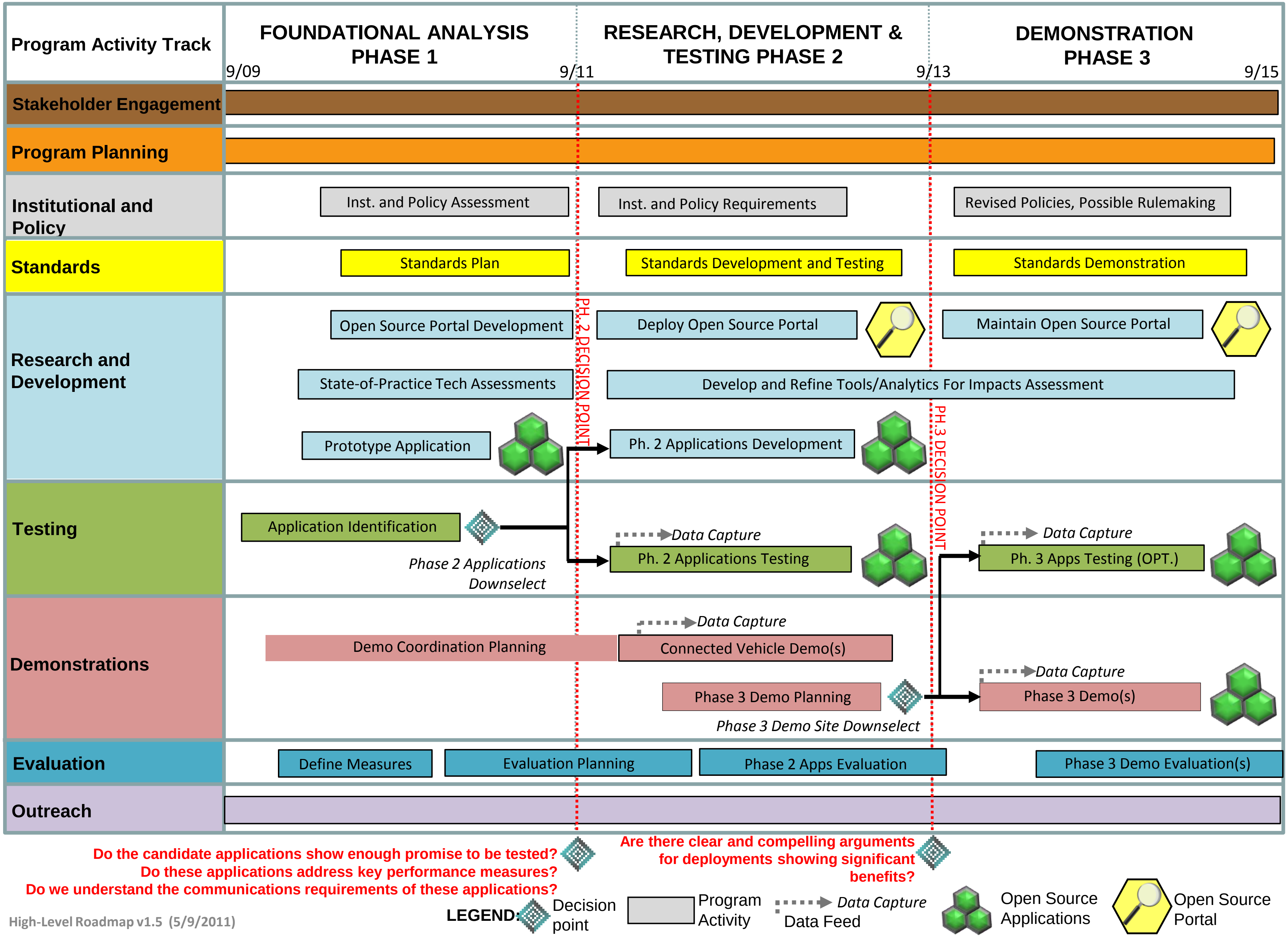
Objectives:

- Create applications using frequently collected and rapidly disseminated multi-source data from connected travelers, vehicles (automobiles, transit, freight) and infrastructure
- Develop and assess applications showing potential to improve nature, accuracy, precision and/or speed of dynamic decision making by system managers and system users
- Identify innovative forms of wireless connectivity supporting applications
- Demonstrate promising applications predicted to significantly improve capability of transportation system to provide safe, reliable, and secure movement of goods and people

Priority Applications



Dynamic Mobility Applications Program Roadmap



Meeting Agenda – Day 2

1. Recap and Description of Breakout Sessions
2. Breakout Sessions:
   - T-CONNECT (facilitated by Carol Schweiger)
   - T-DISP (facilitated by Carrie Butler)
   - D-RIDE (facilitated by Ayeshah Abuelhiga)
3. BREAK
4. Results/Recap of Breakout Sessions
5. Revisit Draft IDTO Visions
6. Wrap Up and Next Steps

Purpose of Concept of Operations

To Confirm:

1. Stakeholder needs and expectations are captured
2. Implementation is linked to different disciplinary missions, goals and objectives
3. Existing operational environment
4. Where IDTO can enhance operations
5. Potential future operational environment with IDTO (ID necessary functional parts to operate)
6. Establish a list of high level requirements

Policy Constraints

- Policies do not exist for IDTO. Institutional and operational policies will evolve to exploit capabilities of new technologies and tools, but initiation may find resistance to automation of traditional operations
- Stakeholder commitment to roles and responsibilities is a vital component of the IDTO ConOps and should be embedded into the operational scenarios

Operational Constraints

- Limitations of service provider technologies and connectivity among providers
- Limitations and gaps in necessary data
- Limitations in communications interfaces
- Lack of standardization of data flows
- Shortages in properly trained personnel
- Trust of service providers
- Lack of stakeholder organization and awareness

Sample T-CONNECT Capabilities

- Protect transfer requests between multiple transit modes and agencies
- Enhance mobility of riders primarily dependent on paratransit services by providing intermodal transfers
- Bridge gap between transit and non-transit modes
- Assist with implementation of T-DISP and D-RIDE

Sample T-DISP Capabilities

- Utilize advanced transit ITS systems to enable traveler to request service
- Dynamically schedule and dispatch, or modify route of in-service vehicle
- Consider both public and private providers, and multiple modes
- Consider common platform to provide exchange allowing travelers and operators to trade in transparent market
- Consider real-time traffic conditions and vehicle capacity

Sample D-RIDE Capabilities

- Mobile platforms
- Location-aware applications
- Links to social networking
- Opportunity for users to rank experiences
- Create and save user profiles
- Allow automated financial transactions
- Provide incentive or loyalty rewards
- Incorporate information on other modes of transportation
- Allow users to set preferences
- Receive audio notifications when match made or vehicle close to pick-up point

How do we get there…

Transition

Desired Institutional Changes

- Coordination among regional institutions and application vendors
- Change in organizations to participate in IDTO implementation
- Participating organizations conduct business in a different way
- Procure technologies/systems jointly
- Facilitate data exchange among institutions, vendors and travelers
- Familiarity with coordinated operations by vendors

Desired Operational Changes

- The way agencies schedule and operate their services
- Provide services under policies and objectives from different governmental and regulatory agencies while satisfying the needs of travelers
- Nature of interfaces among existing and proposed technology systems
- Role of each agency in regional transportation system

Desired Technical Changes

- Incorporate old infrastructure into physical and logical architecture
- Incorporate manual processes
- Account for individuals without mobile devices to ensure "information equity"
- Integrate new technologies into organizations
- Provide technical guidance and information for agency staff
- Add ITS infrastructure to specific areas (e.g., rural)

Answer to Study Question #1

Question #1:

1. Do current practices take full advantage of new transit technologies, tools and data sources?

Answer:

No. The current state of the practice has yet to exploit the full potential.

Answer to Study Question #2

Question #2:

2. What emerging opportunities exist for the new generation of automated technologies/tools to facilitate the deployment of the IDTO applications?

Answer:

Many opportunities exist, but must consider not only new tools, but legacy systems and integration of both.

Answer to Study Question #3

Question #3:

1. Is there strong motivation for a Federal role in facilitating the development of new technologies and tools to capitalize on these identified opportunities?

Answer:

Yes.

User and User Needs

What are User Needs?

- Formally documented customer requirements. These inputs from you would be used as a starting basis for designing the IDTO applications
- User Needs will become the basis for development of system requirements for IDTO
- We will be working with the DRAFT User Needs during this meeting in hopes of confirming them before we leave on Friday

IDTO Scenarios Overview and Breakout Group Scenario Discussions

Scenario Analysis

- Scenarios are diagrammed using high-level system information flow diagrams

Needed:

1. Changes to Scenario diagrams, subsystems and data flow information
2. ID gaps in order for IDTO to exist
3. Changes to User Needs

Group Discussion Purpose

- Gather your insights to better understand the critical institutional and operational interactions and decision-making activities that underpin a successful IDTO application

Group Discussion Process

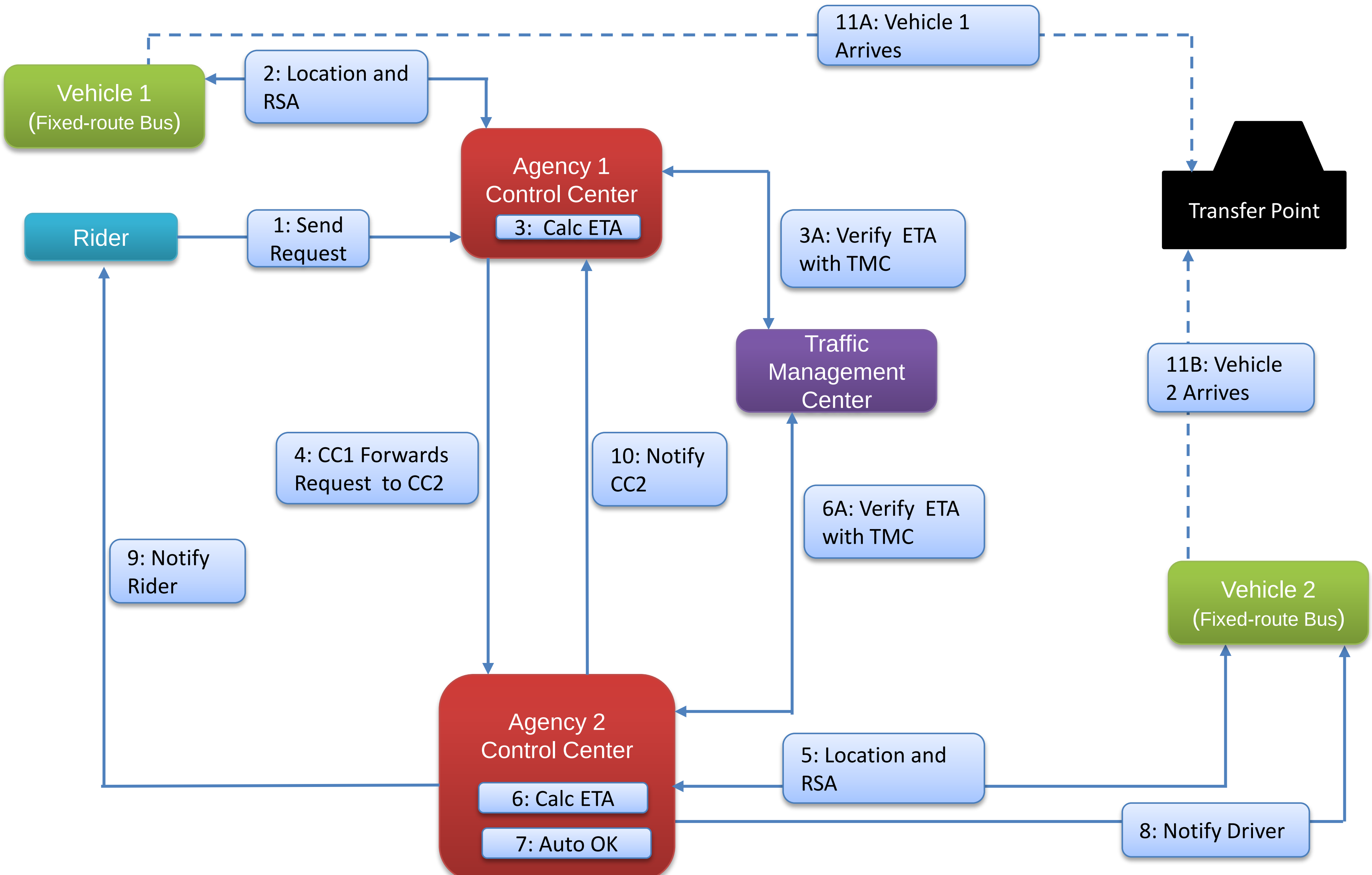
- Work in groups (led by group facilitators)
- Discussion to complete stakeholder input for each scenario – 1.5 hours
- Combine comments and modify documents – 30 minutes
- Debriefing feedback to whole group – 15 minutes/each group
- Discussion of changes to overall IDTO vision – 15-30 minutes

Group Discussion Tasks

- Review each scenario for accuracy and make modifications where necessary for subsystems and interconnects (who talks to whom), and what type of data will be exchanged
- Review and provide "User Need" input
- Provide input to "Gaps" for developing successful IDTO applications

BREAKOUT GROUP 1
T-CONNECT Scenarios

Scenario #1 - Automated Approval of Transfer Between Fixed-route Buses

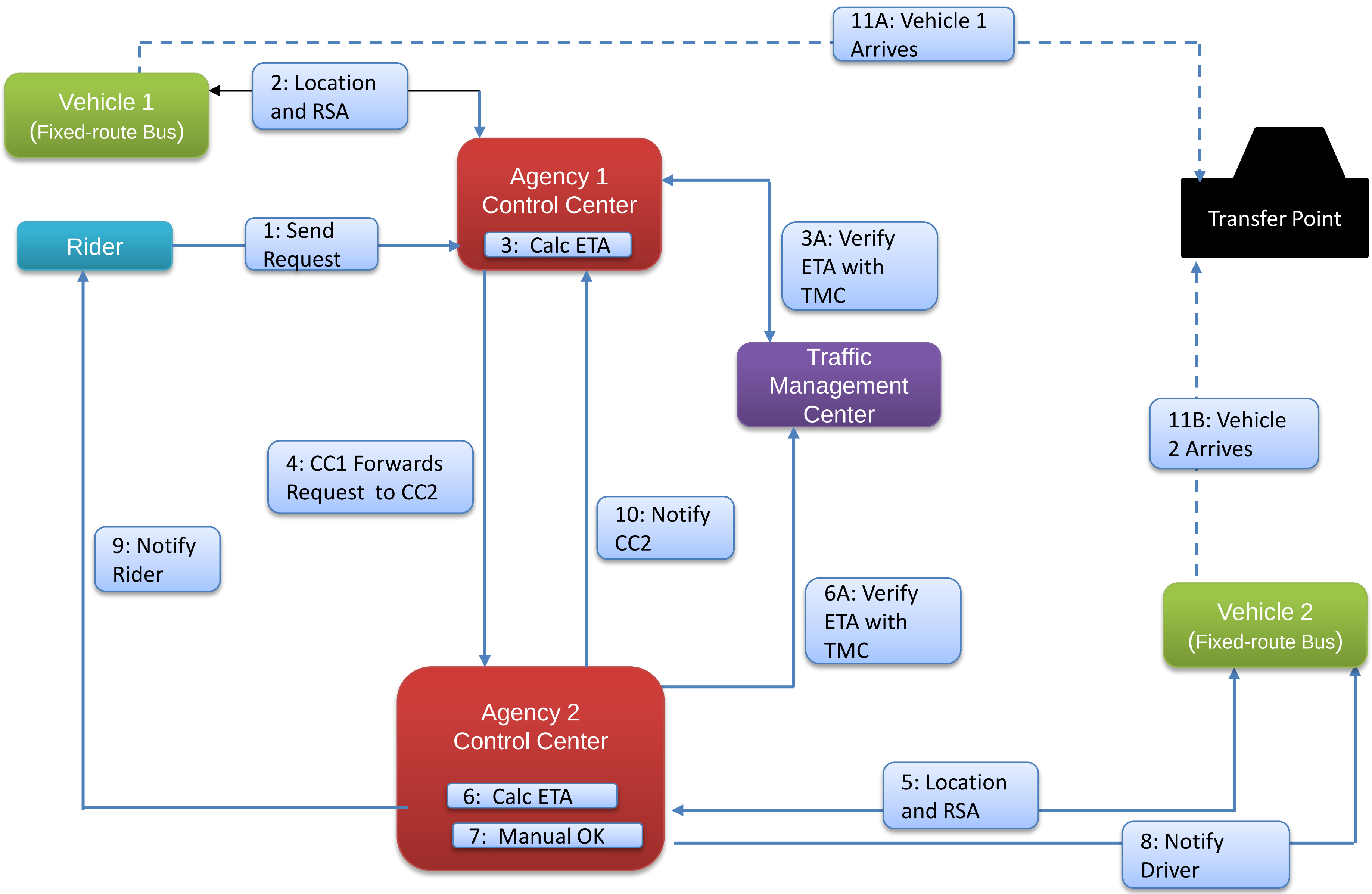


Scenario #1 Transactions

Description: Fixed-route buses (Vehicle 1 and Vehicle 2) operated by multiple agencies (Agency 1 and Agency 2) are involved. Transfer is requested by the Rider on Vehicle 1 using personal device and successfully completed when Rider boards Vehicle 2

1: Rider requests for a transfer using personal device from when Vehicle 1 is late. Information is received by the Agency 1 Control Center (CC1)
2: CC1 queries the current location and route and schedule adherence (RSA) information for Vehicle 1
3: CC1 calculates the predicted arrival at Transfer Point. for Vehicle 1
3A: CC1 corrects the predicted arrival information for Vehicle 1 based on real-time traffic data, if available
4: CC1 forwards the transfer request to Agency 2 Control Center (CC2)
5: CC1 queries the current location and RSA information for Vehicle 2
6: CC2 calculates the predicted arrival at Transfer Point. for Vehicle 2
6A: CC1 corrects the predicted arrival information for Vehicle 2 based on real-time traffic data, if available
7: Based on available information, CC2 determines that transfer can be made from Vehicle 1 to Vehicle 2
8: Once CC2 determines that the transfer can be made from Vehicle 1 to Vehicle 2 and notifies the driver of Vehicle 2 and asks to wait for x minutes
9: At the same time as Step 6, CC2 notifies the Rider of the successful transfer
10: At the same time as Step 6, CC2 notifies the CC1 of the successful transfer
11A and 11B: Vehicle 1 and Vehicle 2 arrive at the Transfer Point and Rider completes the successful transfer

Scenario #2 - Denial and Manual Approval of Transfer Between Fixed-route Buses

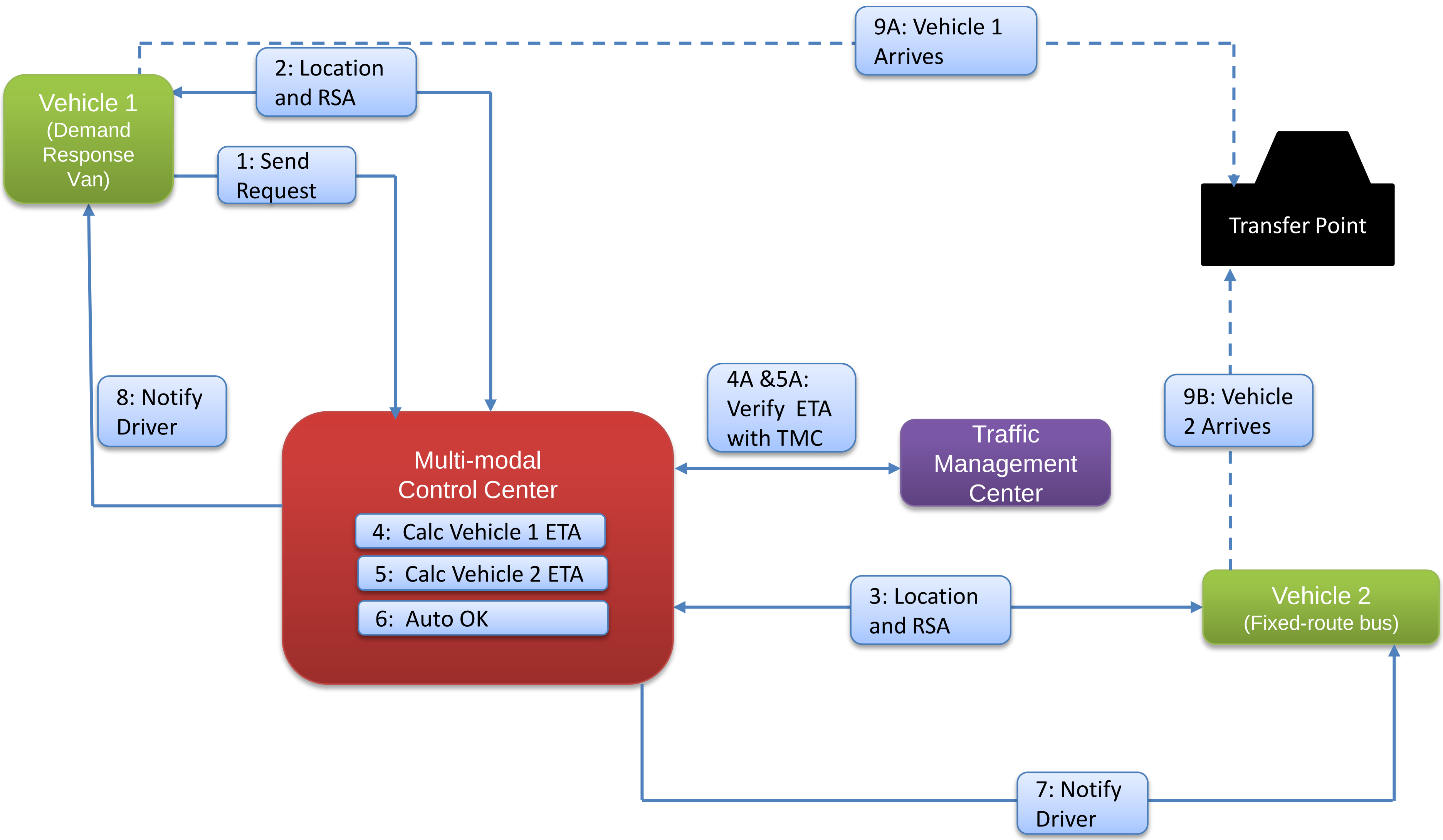


Scenario #2 Transactions

Description: Fixed-route buses (Vehicle 1 and Vehicle 2) operated by multiple agencies (Agency 1 and Agency 2) are involved. Transfer is requested by the Rider on Vehicle 1 using personal device but denied because Agency 2 does not have the current location and RSA data for Vehicle 2. Consequently, Agency 2 dispatcher intervenes and approves based on operational knowledge.

1: Rider requests for a transfer using personal device from when Vehicle 1 is late. Information is received by the Agency 1 Control Center (CC1)
2: CC1 queries the current location and route and schedule adherence (RSA) information for Vehicle 1
3: CC1 calculates the predicted arrival at Transfer Point. for Vehicle 1
3A: CC1 corrects the predicted arrival information for Vehicle 1 based on real-time traffic data, if available
4: CC1 forwards the transfer request to Agency 2 Control Center (CC2)
5: CC1 queries the current location and RSA information for Vehicle 2
6: CC2 calculates the predicted arrival at Transfer Point. for Vehicle 2
6A: CC1 corrects the predicted arrival information for Vehicle 2 based on real-time traffic data, if available
7: CC1 rejects the transfer request due to expected downstream delays and sends the request to Dispatcher queue for manual approval
8: Once Dispatcher approves the transfer, CC1 automatically notifies the driver of Vehicle 2 to wait for Vehicle 1 for x minutes
9: At the same time as Step 7, CC1 notifies the Rider of the successful transfer
10: At the same time as Step 7, CC1 notifies the CC1 of the successful transfer
11a and 11B : Vehicle 1 and Vehicle 2 arrive at the Transfer Point and Rider completes the successful transfer

Scenario #3 - Automated Approval of Transfer from Demand Response to Fixed-route Bus

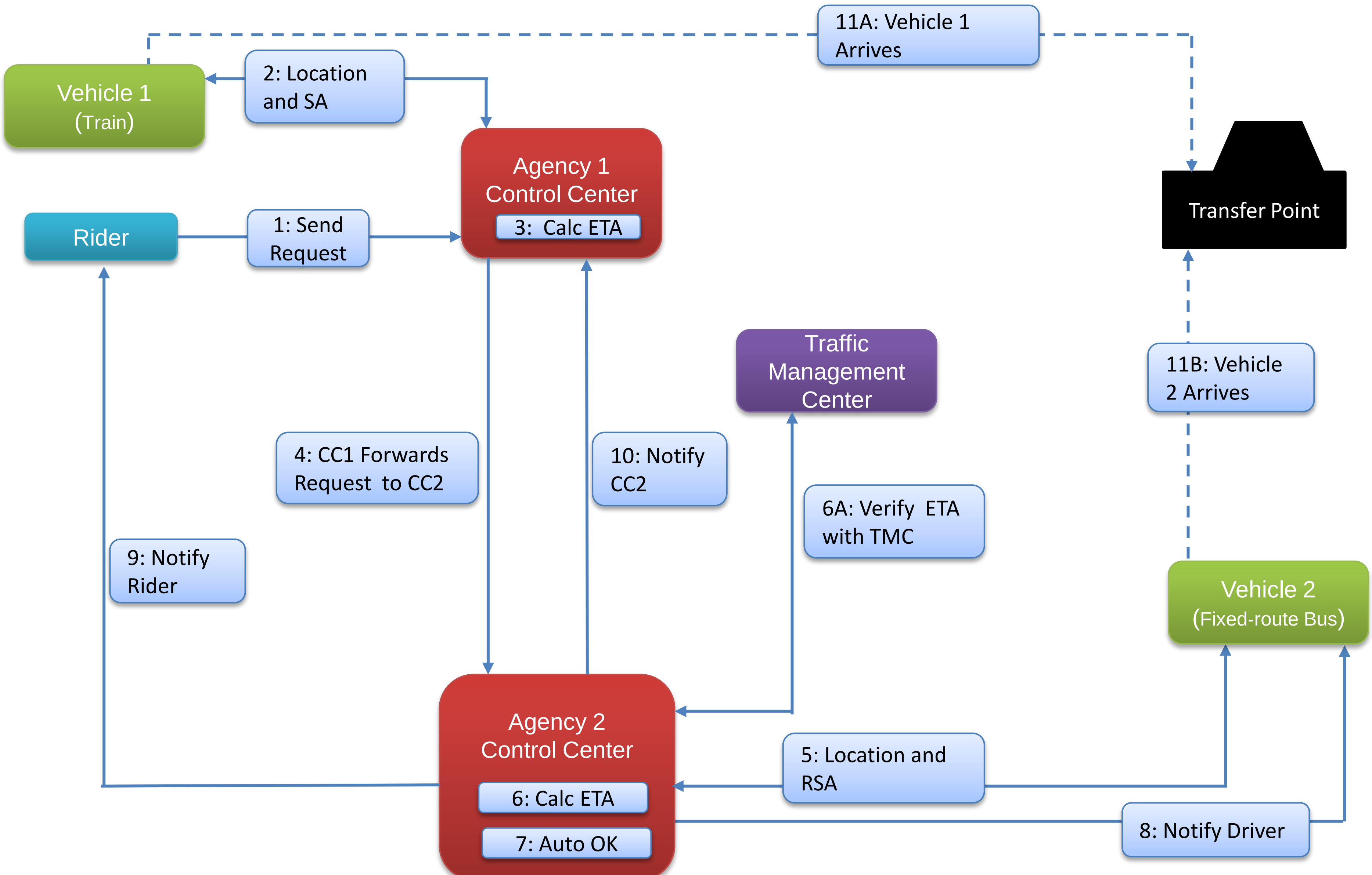


Scenario #3 Transactions

Description: Demand response van (Vehicle 1) and fixed-route bus (Vehicle 2) operated by the same multi-modal agency are involved. Transfer is requested from the Vehicle 1 to the Vehicle 2 by multiple riders through Vehicle 1 driver (via MDT) and successfully approved.

1: Riders requests for a transfer via driver from Vehicle 1. Information is received by the Multi-modal Control Center (MCC)
2: MCC queries the current location data and trip status data for Vehicle 1
3: MCC queries the current location, route and schedule adherence (RSA) and vehicle capacity information (for passengers on wheelchair) for Vehicle 2
4: MCC calculates the predicted arrival information for Vehicle 1 at the Transfer Point.
4A: MCC corrects the predicted arrival information for Vehicle 1 based on real-time traffic data, if available
5: MCC calculates the predicted arrival information for Vehicle 2 at the Transfer Point.
5A: MCC corrects the predicted arrival information for Vehicle 2 based on real-time traffic data, if available
6: Based on information from Steps 4,4A,5 and 5A, MCC determines that the all requested transfers from Vehicle 1 to Vehicle 2 can be completed
7: MCC notifies Vehicle 2 of approved transfer and asks driver to wait for x minutes. May advise of approximate boarding time if passengers on wheelchair are involved
8: MCC notifies Vehicle 1 of approved transfer
9A and 9B : Vehicle 1 and Vehicle 2 arrive at the Transfer Point and riders complete the successful transfer

Scenario #4 - Automated Approval of Transfer from Train to Fixed-route Bus



T-CONNECT Scenario #4 Transactions

Description: A Train (Vehicle 1) operated by Agency 1 and a fixed-route bus (Vehicle 2) operated by Agency 2 are involved. Transfer is requested by the Rider on Vehicle 1 using personal device and successfully completed when Rider boards Vehicle 2.

1: Rider requests for a transfer using personal device from Vehicle 1 when that is running late. Information is received by the Agency 1 Control Center (CC1)
2: CC1 queries the current location and schedule adherence (SA) information for Vehicle 1
3: CC1 calculates the predicted arrival at Transfer Point. for Vehicle 1
4: CC1 forwards the transfer request to Agency 2 Control Center (CC2)
5: CC1 queries the current location and schedule adherence (SA) information for Vehicle 2
6: CC2 calculates the predicted arrival at Transfer Point. for Vehicle 2
6A: CC1 corrects the predicted arrival information for Vehicle 2 based on real-time traffic data, if available
7: Based on available information, CC2 determines that transfer can be made from Vehicle 1 to Vehicle 2
8: Once CC2 determines that the transfer can be made from Vehicle 1 to Vehicle 2 and notifies the driver of Vehicle 2 and asks to wait for x minutes
9: At the same time as Step 6, CC2 notifies the Rider of the successful transfer
10: At the same time as Step 6, CC2 notifies the CC1 of the successful transfer
11A and 11B: Vehicle 1 and Vehicle 2 arrive at the Transfer Point and Rider completes the successful transfer

T-CONNECT User Needs

User Needs

User Type	User Need	Description
Vehicle operator	Needs the vehicle to be connected wirelessly to the T-CONNECT system	Vehicles should be wirelessly connected using Connected Vehicle or other conventional wireless technologies
Vehicle operator	Needs access to T-CONNECT interface where transfer can be requested using a terminal	Drivers should be able to access the interface using a mobile data terminal (MDT) or a similar interface
Vehicle operator	Needs access to T-CONNECT interface where approval/denial of transfer is notified	Audio/visual notification of transfer request approval/denial should be provided by the T-CONNECT system
Rider	Needs access to T-CONNECT interface where transfer can be requested	Riders should be able to use a connected personal device to request transfer to a particular route
Rider	Needs access to T-CONNECT interface where real-time status of transfer request can be monitored	Riders should be able to use a connected personal device to monitor the status of their request
Rider	Needs access to T-CONNECT interface where approval/denial of transfer is notified	Riders should be able to receive a notification as per their preference (email, text message) when a transfer is approved or denied

User Needs (cont'd)

User Type	User Need	Description
Dispatcher	Need to have the access to the T-CONNECT system to view the list of requested transfers, their status and operational resources (agencies, vehicles, drivers) involved	Dispatchers should always have access to the transfer requests and relevant analytical tools (view real-time status, calculate ETA, determine need for an additional bus etc.)
Dispatcher	Needs to have the access to the T-CONNECT system to manually intervene in the event there was a denial by the automated system for a valid transfer request due to operational anomalies	Dispatcher should have the ability to manually override the decision made by the T-CONNECT system in the event decision is going to have an impact on the operations due to real-time events not known to the automated system
Dispatcher	Needs to have access to real-time location, and real-time route and schedule adherence (RSA) information of vehicles involved in transfers.	Dispatcher should always have access to location, RSA and other event-based data (incident/accident) for all vehicles involved.

User Needs (cont'd)

User Type	User Need	Description
Dispatcher	When multiple agencies/operational units are involved Dispatcher needs access to service agreements and service coordination tools	In the event where regional agencies are involved, access levels to operational tools owned by individual agencies should be determined. For example, Dispatcher of one particular agency may have access to only real-time location information for a partner agency vehicle
System Manager	Needs to enable two-way communication between T-CONNECT system and the vehicle	Two-way communication gateway and infrastructure as needed should be established so that connected vehicles can communicate with control center(s) and the T-CONNECT applications
System Manager	Needs to enable two-way communication between agencies whose vehicles are involved in the transfer	Two-way communication gateway and infrastructure as needed should be established between regional agencies so that control centers and operational tools/applications hosted by those centers can communicate in real-time when needed

User Needs (concluded)

User Type	User Need	Description
System Manager	Needs the T-CONNECT system to be connected to a traffic management center	Two-way communication with regional traffic management centers should be established so that estimated time of arrival of vehicles can be corrected based on real-time or historic traffic information when available
Executive Manager	Needs to establish standard operating procedures to be used by T-CONNECT for approval and denial	Operational scenarios to be used by the automated T-CONNECT system should be established by the Executive Managers
Executive Manager	Need to establish regional fare collection and revenue sharing arrangements/technologies when multiple agencies are involved	Agencies involved in a particular transfer may have different transfer policies and fare collection technologies Thus managers should determine how these should be integrated such that the process is seamless to the rider.

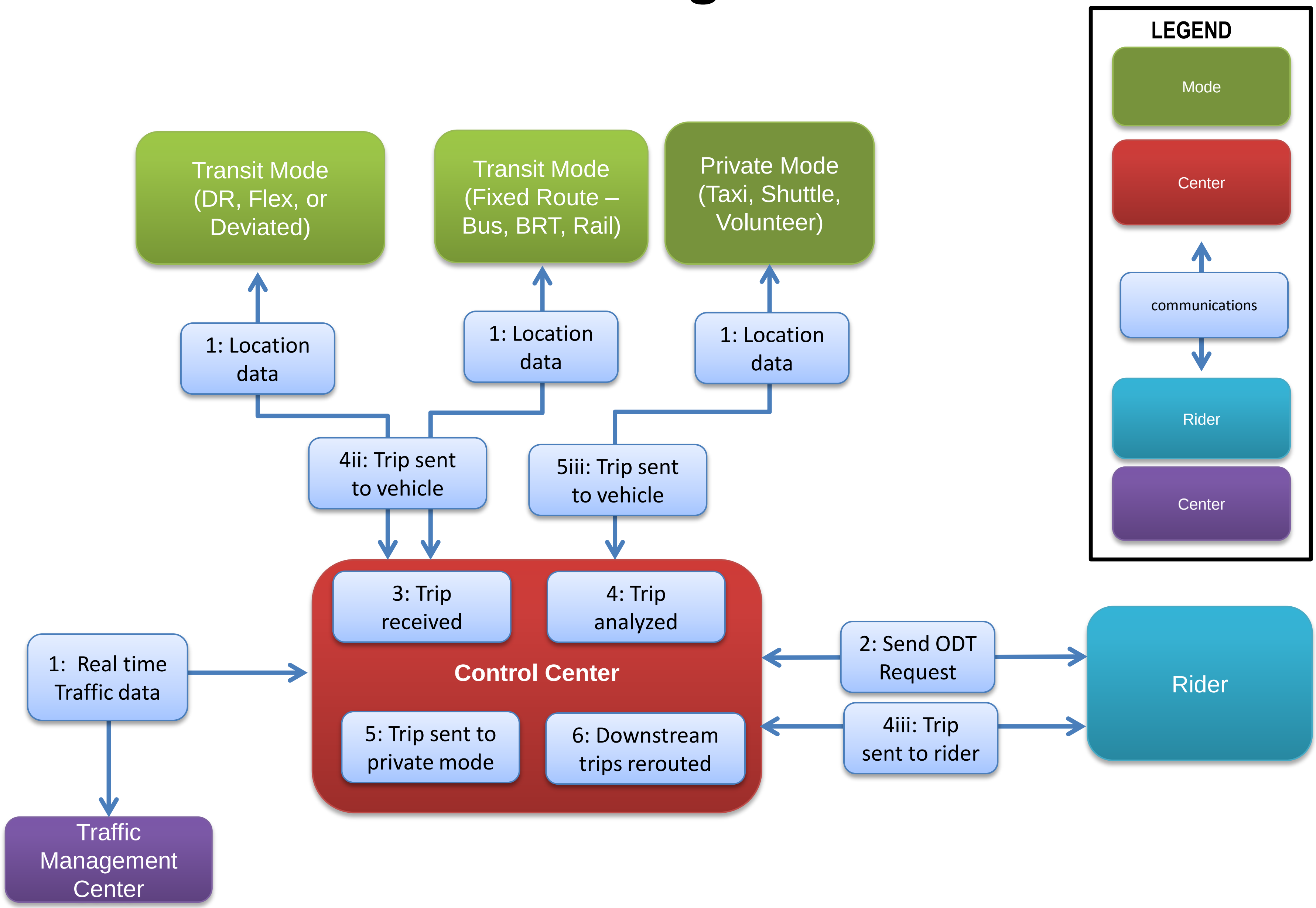
T-CONNECT Scenario Comments and Modify Documents 30 Minutes

Group Discussion of Modifications

1. Changes to scenario diagram, subsystem and data flow information
2. Gaps in order for T-CONNECT to exist
3. Changes to User Needs

BREAKOUT GROUP 2
T-DISP Scenarios

Scenario #1: T-DISP with Single Provider

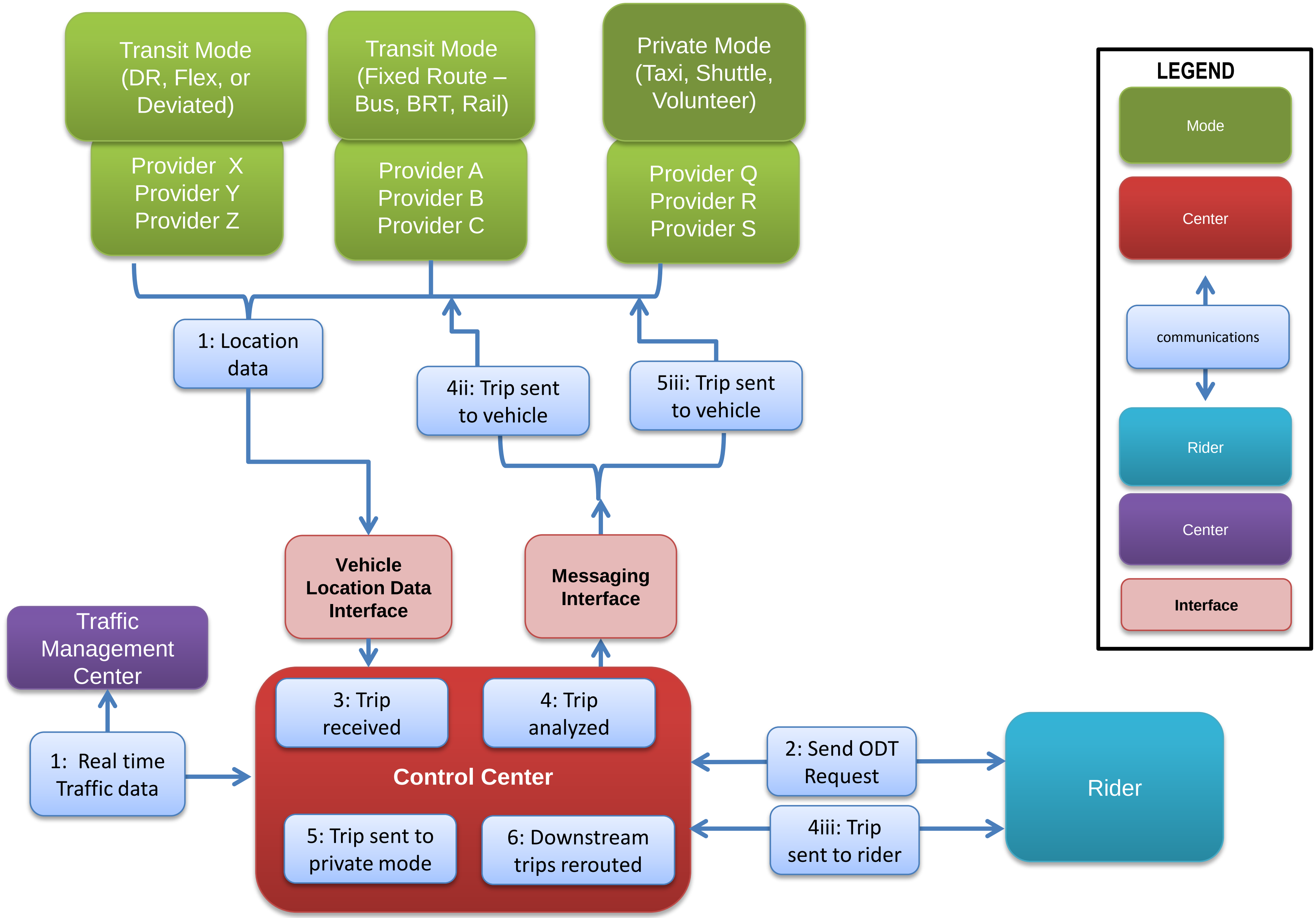


Scenario #1: Single transit provider operating multiple modes with the same on-board systems and data communications systems; If a trip cannot be met on public transportation, it is sent to a private mode. *Assumptions:* CAD/AVL and on-board systems; Data and voice communications; New or modified Scheduling System; New or modified Customer Messaging System

Transactions:

1) Regular processes occurring on a daily basis, including:
   - CAD/AVL system sending location data for all vehicles in the system that are eligible for service every 30 seconds via cellular or data radio communications
   - Real-time traffic data sent to Control Center, and real-time "probe" data sent to Traffic Management Center
   - Data messages sent back and forth between Control Center and Transit Modes (i.e. vehicles) via cellular or data radio communications
   - Manifests or sets of trips are sent from Control Center to vehicles via cellular or data radio communications (or for fixed route modes are accessed at driver log on)
2) Rider requests a trip with origin, destination and time (ODT) and return trip using a web enabled mobile device with software application
3) Request received in Control Center that has route and schedule data available
4) Trip request analyzed:
   i. Trip request approved through scheduling system
   ii. Message sent to vehicle that needs to deviate to pick up the rider
   iii. Message sent to rider that trip can be made
5) Trip request analyzed but denied:
   i. Message sent to rider with information about private mode and cost of private mode
   ii. Rider approves private trip and cost
   iii. Message sent to Private Mode vehicle
6) Accepted trips are adjusted into remaining, downstream schedules for vehicles

Scenario #2: T-DISP with Multiple Providers

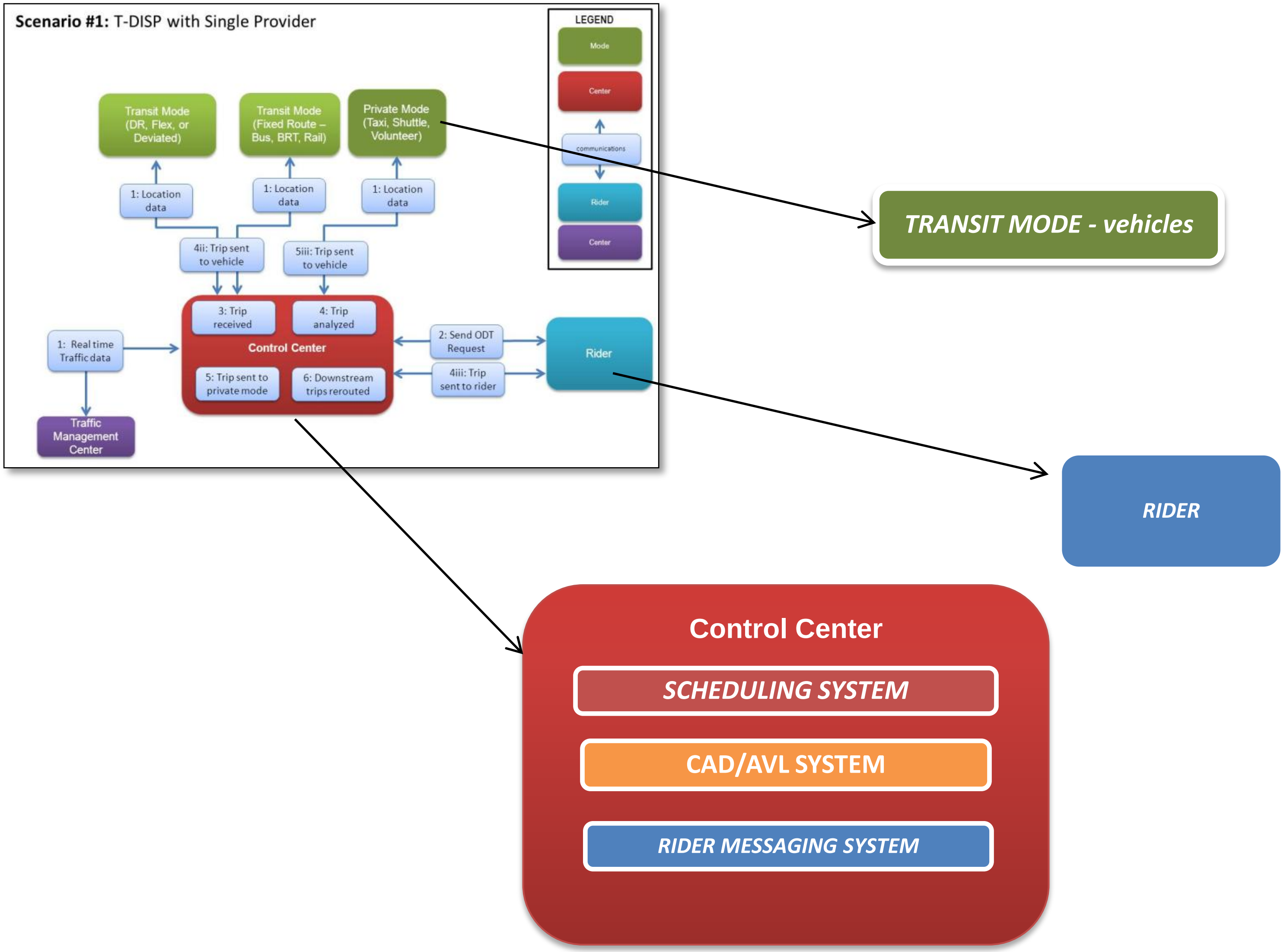


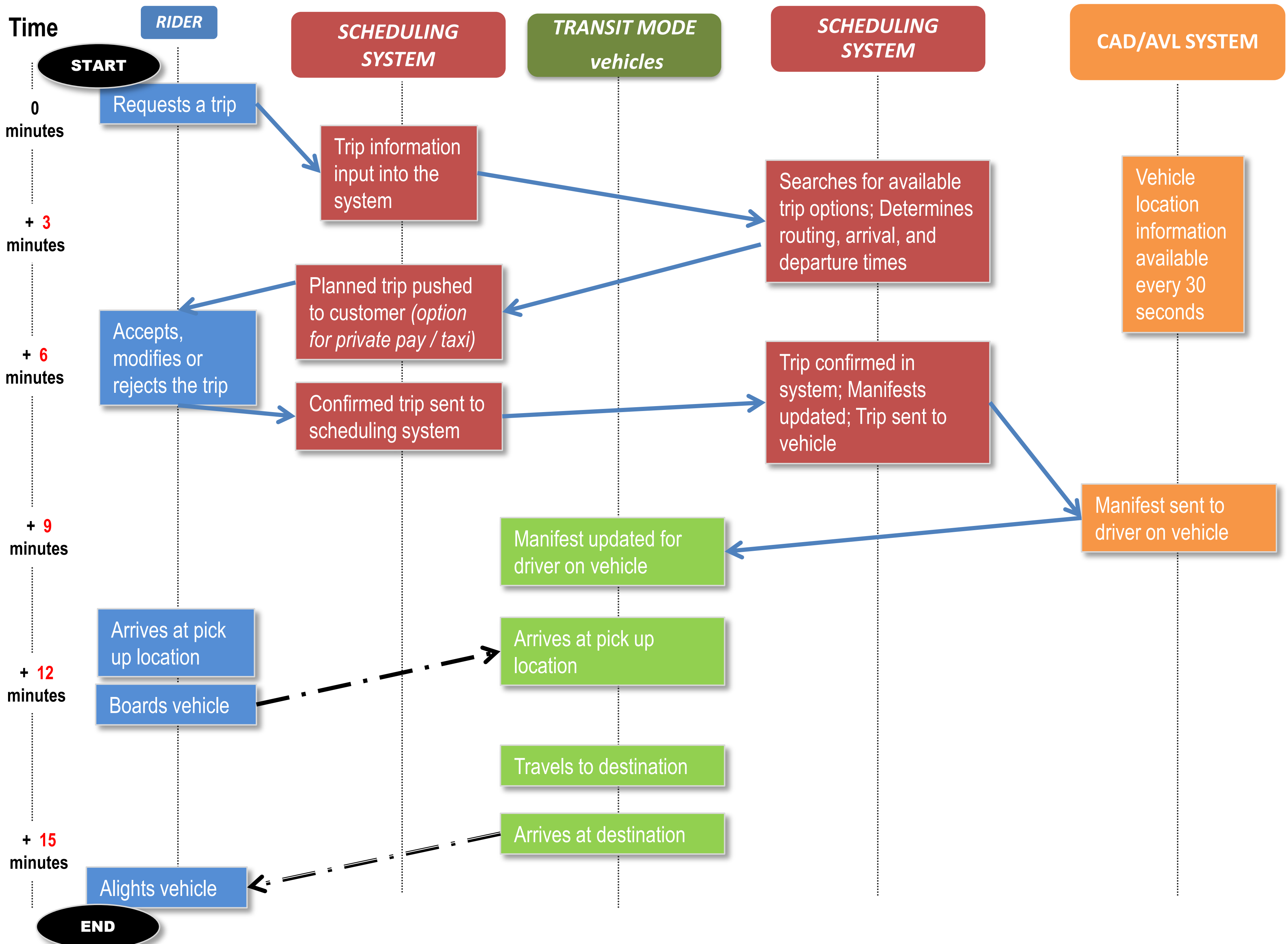
Scenario #2: Multiple providers operating in a multimodal environment; if a trip can't be made on public transportation, it is sent to private mode; Different providers may use a different CAD/AVL system. Assumptions: CAD/AVL and on-board equipment; interface necessary for location data and messaging to vehicles.

Transactions:

1) Regular processes occurring on a daily basis, including:
    - CAD/AVL system sending location data for all vehicles in the system that are eligible for service every 30 seconds via cellular or data radio communications
    - Data messages sent back and forth between Control Center and Transit Modes (i.e. vehicles) via cellular or data radio communications
    - Real time traffic data sent to Control Center
    - Manifests or sets of trips are sent from Control Center to vehicles via cellular or data radio communications (or for fixed route modes are accessed at driver log on)
    - Multiple agencies sending location data to an interface that "neutralizes" the location data within the scheduling system
2) Rider requests a trip with origin, destination and time (ODT) and return trip using a web enabled mobile device with software application
3) Request sent to Control Center that has route and schedule data
4) Trip request analyzed:
    i. Trip request approved through scheduling system
    ii. Message sent to vehicle that needs to deviate to pick up the rider Message sent to rider that trip can be made
5) Trip request analyzed but denied:
    i. Message sent to rider with information about private mode and cost of private mode
    ii. Rider approves private trip and cost
    iii. Message sent to Private Mode vehicle
6) Accepted trips are adjusted into remaining, downstream schedules for vehicles

Scenario #3: Timeline for Trip Request for T-DISP – Systems Detail




Time
RIDER
SCHEDULING SYSTEM
TRANSIT MODE vehicles
SCHEDULING SYSTEM
CAD/AVL SYSTEM
START
0 minutes
+ 3 minutes
+ 6 minutes
+ 9 minutes
+ 12 minutes
+ 15 minutes
END
Requests a trip
Trip information input into the system
Searches for available trip options; Determines routing, arrival, and departure times
Vehicle location information available every 30 seconds
Planned trip pushed to customer (option for private pay / taxi)
Accepts, modifies or rejects the trip
Confirmed trip sent to scheduling system
Trip confirmed in system; Manifests updated; Trip sent to vehicle
Manifest sent to driver on vehicle
Manifest updated for driver on vehicle
Arrives at pick up location
Arrives at pick up location
Boards vehicle
Travels to destination
Arrives at destination
Alights vehicle

Scenario #3: Timeline for Trip Request with Systems. For either single or multiple provider environment; trip denials sent to private mode. *Assumptions:* CAD/AVL and on-board equipment

START

1. Vehicle location information available every 30 seconds
2. Requests a trip
3. Trip information input into the system
4. Searches for available trip options; Determines routing, arrival, and departure times
5. Planned trip pushed to customer *(option for private pay / taxi)*
6. Accepts, modifies or rejects the trip
7. Confirmed trip sent to scheduling system
8. Trip confirmed in system; Manifests updated; Trip sent to vehicle
9. Manifest sent to driver on vehicle
10. Manifest updated for driver on vehicle
11. Rider arrives at pick up location
12. Vehicle arrives at pick up location
13. Rider boards vehicle
14. Vehicle travels to destination
15. Vehicle arrives at destination

END

T-DISP User Needs

User Needs

User Type	User Need	Description
Transportation Providers - Private and Public modes	Need to generate real-time data (from multiple modes and jurisdictions)	Any T-DISP architecture will need to generate real-time vehicle location data from multiple modes of transportation
Control Center	Need to access real-time data (from multiple modes and jurisdictions)	Any T-DISP architecture will require access to real-time data from multiple modes of transportation
Control Center	Need to access network configuration data from one or more sources	Network configuration data includes field device locations, roadway network, bus routes, and other types of static data
Control Center, Transportation Providers	Need business rules to guide decisions about how trips are distributed to transportation providers	Coordination efforts amongst transportation providers that include private and public entities will need to have an agreed business rule
Transportation providers, Control Center	Need scheduling parameters and operational policies to determine how trips are assigned and routed	Operational policies and detailed scheduling parameters will guide how individual trips are assigned and to which vehicle
Software vendors, Control Center	Need to expand the current capabilities of scheduling and routing software programs	T-DISP architecture will need a more robust system to dynamically route multi-modal service

User Needs (cont'd)

User Type	User Need	Description
Software vendors, Control Center	Need to provide a real-time modeling capability to evaluate trip requests and routing strategies	Pre-stored and dynamic response plans are input into a real-time model (a model that runs fast enough to affect response decisions) for evaluation and/or selection
Control Center	Need to process real-time and historical input data to predict future transportation network conditions	T-DISP will use real-time and historical data to predict future conditions using either algorithms and/or models
Travelers	Need to send trip requests to the reservations and scheduling system	Travelers (customers) need to be able to send trip requests that have origin and destination (and for return trip)
Control Center	Need to send trip description characteristics back to travelers	Travelers must be able to receive information about their possible trip
Software vendors; Control Center; Transportation Providers	Need to develop an interface for different dispatch and vehicle location systems into the reservations / scheduling system	In a multiple provider environment, different CAD/AVL systems may be used so vehicle location data will need to be standardized

User Needs (concluded)

User Type	User Need	Description
Software vendors; Control Center; Transportation Providers	Need to develop an interface for different dispatch and vehicle location systems to receive messages from the reservations / scheduling system	In a multiple provider environment, different CAD/AVL systems may be used so sending trip request data to the vehicles will need to be standardized

T-DISP Scenario Comments and Modify Documents 30 Minutes

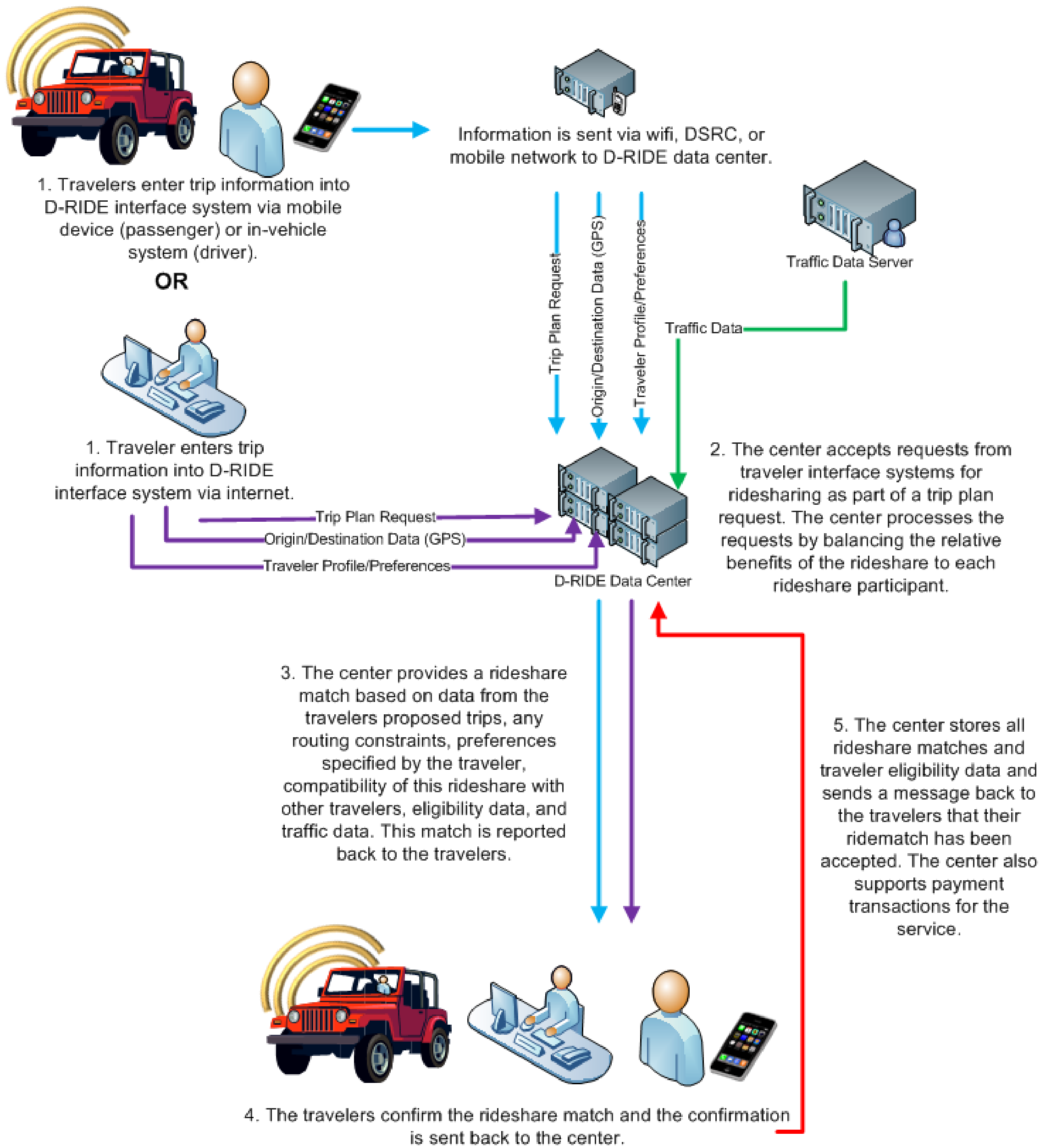
Group Discussion of Modifications

1. Changes to scenario diagram, subsystem and data flow information
2. Gaps in order for IDTO to exist
3. Changes to user needs

BREAKOUT GROUP 3
D-RIDE Scenarios

Scenario 1 – Rideshare Request (Simple)

Description: In this scenario, the passenger places a D-RIDE trip request for a rideshare match which is processed by the D-RIDE data center. Based on the user profiles stored and recognized by the system, the D-RIDE data center processes the information and outputs a list of ridematches (drivers seeking passengers) that suit the passenger's travel request/trip plan.



Scenario 1- Assumptions and Elements

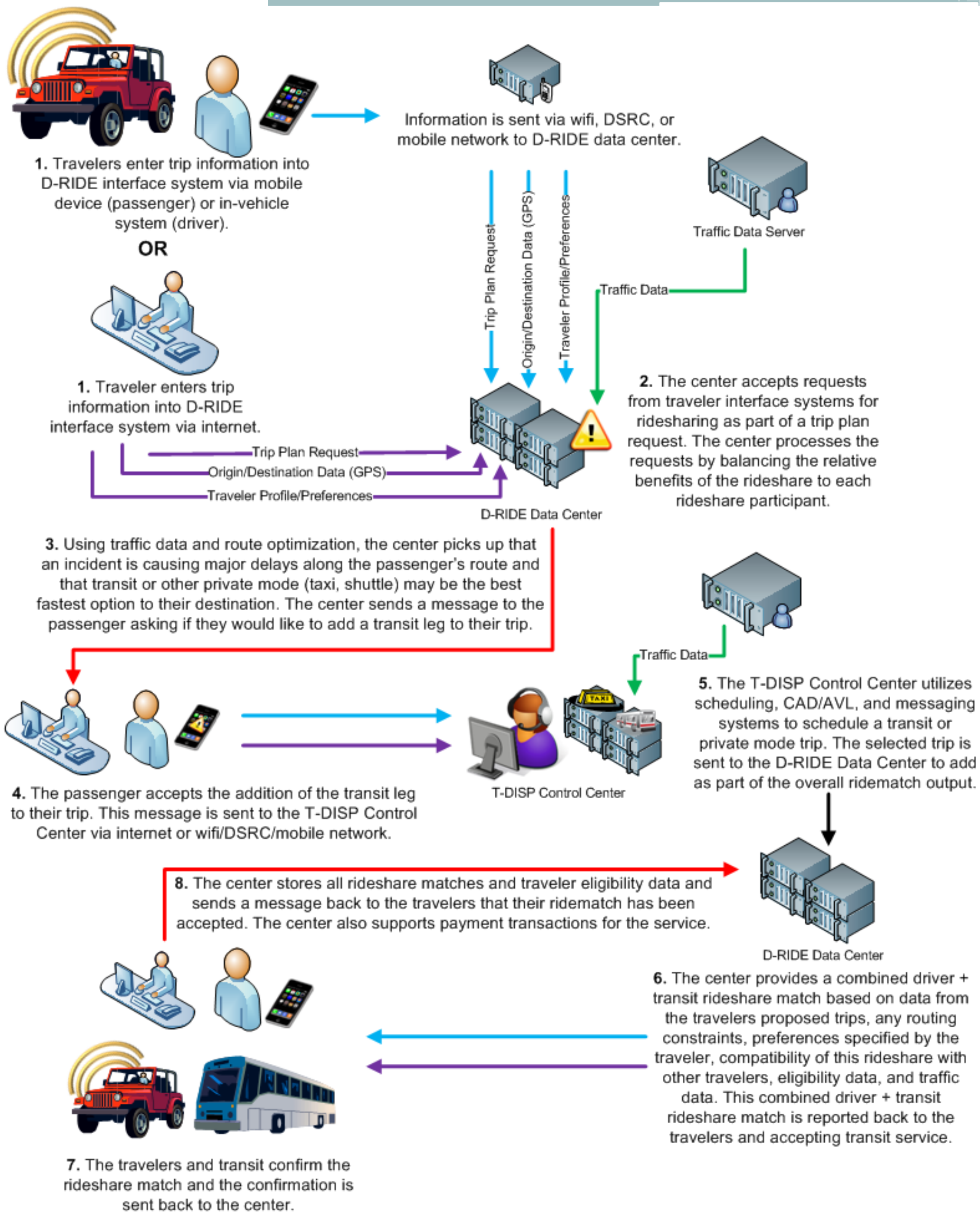
- Assumptions:
  - Ridematch is requested by the passenger using a personal hand-held device application or an internet form.
  - Ridematch is requested by the driver through an in-vehicle application system using DSRC or wireless mobile technology.
  - D-RIDE Data Center is capable of processing various types of data sent through the ridematching applications and can also process payment.
  - D-RIDE Data Center is capable of interfacing with traffic data center's traffic data for the routes being requested by the travelers.
- Description of elements:
  - **Traveler:** Both the passenger requesting a ride as well as the traveler accepting passengers
  - **Passenger:** Traveler in need of a ride
  - **Driver:** Traveler in need of passengers
  - **D-RIDE Data Center:** Processes ridematch requests from requestor route and location data
  - **Traffic Data Center:** May also be a TMC; provides traffic data

Scenario 1- Data Flows

1. Travelers enter trip information into D-RIDE interface system via mobile device (passenger) or in-vehicle system (driver) through wifi, DSRC, or mobile network to D-RIDE data center <u>OR</u> traveler enters trip information into D-RIDE interface system via internet.
   a. Information includes: trip plan request, origin and destination (OD) data, traveler profile and preferences, and traffic data (from a traffic data center)
2. The center accepts requests from traveler interface systems for ridesharing as part of a trip plan request. The center processes the requests by balancing the relative benefits of the rideshare to each rideshare participant.
3. The center provides a rideshare match based on data from the travelers proposed trips, any routing constraints, preferences specified by the traveler, compatibility of this rideshare with other travelers, eligibility data, and traffic data. This match is reported back to the travelers.
4. The travelers confirm the rideshare match and the confirmation is sent back to the center.
5. The center stores all rideshare matches and traveler eligibility data and sends a message back to the travelers that their ridematch has been accepted. The center also supports payment transactions for the service.

Scenario 2 – Multi-Leg, Multi-Modal Request

Description: In this scenario, the passenger places a D-RIDE trip request for a rideshare match along a route that is compromised by a major traffic delay. The center sends a message to add a transit leg to their trip, which upon passenger acceptance, is processed by the T-DISP control center to ultimately develop a driver+transit rideshare match. This match may include a leg of travel through ridesharing to a transit hub or vice versa.



Scenario 2- Assumptions and Elements

- Assumptions:
  - Ridematch is requested by the passenger using a personal hand-held device application or an internet form.
  - Ridematch is requested by the driver through an in-vehicle application system using DSRC or wireless mobile technology.
  - D-RIDE Data Center is capable of processing various types of data sent through the ridematching applications and can also process payment.
  - D-RIDE Data Center is capable of interfacing with traffic data center's traffic data for the routes being requested by the travelers.
  - T-DISP Control Center is equipped with scheduling, CAD/AVL, traffic, and messaging systems that allow for transit trips and/or private modes to be scheduled.
  - In this scenario, the D-RIDE Data Center and the T-DISP Control Center are separate entities that can communicate with one another. *An alternative scenario would be that the D-RIDE or T-DISP application could function as one combined control center (not displayed in this scenario).*
- Description of elements:
  - **Traveler:** Both the passenger requesting a ride as well as the traveler accepting passengers
  - **Passenger:** Traveler in need of a ride
  - **Driver:** Traveler in need of passengers
  - **D-RIDE Data Center:** Processes ridematch requests and requestor route and location data
  - **Traffic Data Center:** May also be a TMC; provides traffic data
  - **T-DISP Control Center:** Processes transit and private mode requests from requestor location and route data
  - **Transit:** Includes fixed-route bus, BRT, rail, DR, flex, and deviated
  - **Private Mode:** Includes taxi, shuttle, and volunteer services

Scenario 2- Data Flows

1. Travelers enter trip information into D-RIDE interface system via mobile device (passenger) or in-vehicle system (driver) through wifi, DSRC, or mobile network to D-RIDE data center OR traveler enters trip information into D-RIDE interface system via internet.
    a. Information includes: trip plan request, origin and destination (OD) data, traveler profile and preferences, and traffic data (from a traffic data center)
2. The center accepts requests from traveler interface systems for ridesharing as part of a trip plan request. The center processes the requests by balancing the relative benefits of the rideshare to each rideshare participant.
3. Using traffic data and route optimization, the center picks up that an incident is causing major delays along the passenger's route and that transit or other private mode (taxi, shuttle) may be the best fastest option to their destination. The center sends a message to the passenger asking if they would like to add a transit leg to their trip.

Scenario 2- Data Flows (Cont.)

4. The passenger accepts the addition of the transit leg to their trip. This message is sent to the T-DISP Control Center via internet or wifi/DSRC/mobile network.
5. The T-DISP Control Center utilizes scheduling, CAD/AVL, and messaging systems to schedule a transit or private mode trip. The selected trip is sent to the D-RIDE Data Center to add as part of the overall ridematch output.
6. The center provides a combined driver + transit rideshare match based on data from the travelers proposed trips, any routing constraints, preferences specified by the traveler, compatibility of this rideshare with other travelers, eligibility data, and traffic data. This combined driver + transit rideshare match is reported back to the travelers and accepting transit
7. The travelers confirm the rideshare match and the confirmation is sent back to the center.
8. The center stores all rideshare matches and traveler eligibility data and sends a message back to the travelers that their ridematch has been accepted. The center also supports payment transactions for the service.

Scenario 3 –HOV/HOT Lane Enforcement and Tolling

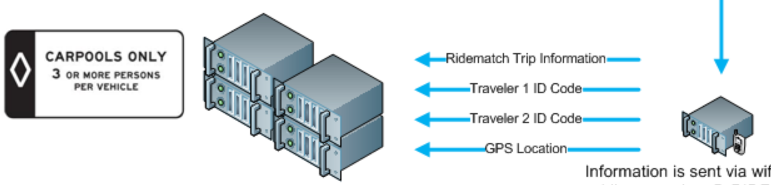
Description: In this scenario, the georeferencing mechanism of the D-RIDE application and devices allows the D-RIDE data center to process the location of travelers (in vehicle and in a high-occupancy lane) in order to process HOV/HOT Lane violation citations and appropriate tolling charges.

Scenario 3 –HOV/HOT Lane Enforcement and Tolling

HOV/HOT Lane Enforcement

1. Travelers that have been ridematched turn on their D-RIDE applications (devices and in-vehicle) while en route.

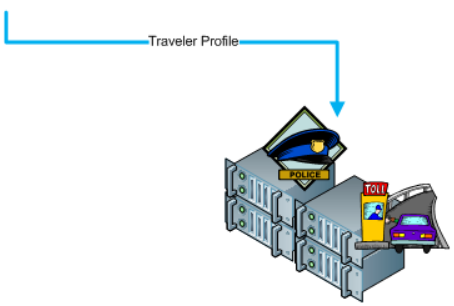
2. The travelers enter into an HOV 2+ lane with their D-RIDE applications still on. These applications emit a unique identifier code that is linked to individual passengers and the driver. This code is sent to the D-RIDE Data Center to process to location of the previously matched travelers which the system recognizes as paired.



Information is sent via wifi, DSRC, or mobile network to D-RIDE data center.

D-RIDE Data Center

3. Using GPS location information from the travelers' D-RIDE applications, the center recognizes that the travelers have entered an HOV 3+ zone. With only 2 travelers known to the center to be in the ridematch, the center sends a message to the traffic tolling and enforcement center.



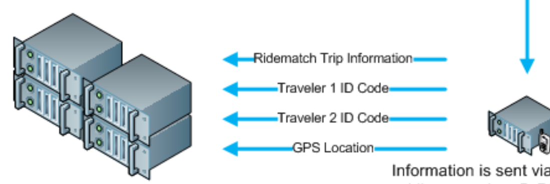
Tolling and Enforcement Center

4. The Tolling and Enforcement Center sends a citation to the driver's home using the traveler profile information sent with the violation message from the D-RIDE Data Center.

Tolling

1. Travelers that have been ridematched turn on their D-RIDE applications (devices and in-vehicle) while en route.

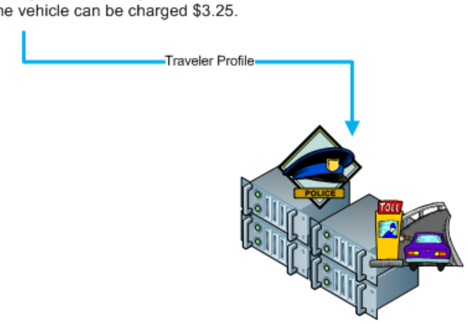
2. The travelers enter into an HOT 2+ lane with their D-RIDE applications still on. These applications emit a unique identifier code that is linked to individual passengers and the driver. This code is sent to the D-RIDE Data Center to process to location of the previously matched travelers which the system recognizes as paired.



Information is sent via wifi, DSRC, or mobile network to D-RIDE data center.

D-RIDE Data Center

3. Using GPS location information from the travelers' D-RIDE applications, the center recognizes that the travelers have entered an HOT 2+ zone. Recognizing the two travelers in the ridematch en route on the HOT @+ lane, the center sends a message to the Tolling and Enforcement Center that the vehicle can be charged $3.25.



Tolling and Enforcement Center

4. The Tolling and Enforcement Center process the message and deducts $3.25 from the driver's account through the driver's e-tolling pass registered as part of their traveler profile information sent by the D-RIDE Data Center.

Scenario 3- Assumptions and Elements

- Assumptions:
  - D-RIDE applications on both the device and in-vehicle systems are capable of constantly sending location-based information associated with a unique identifier code for each user.
  - D-RIDE Data Center is capable of processing constant flows of information from travelers in motion.
  - D-RIDE Data Center is outfitted with georeferencing to know where HOV/HOT lanes are located and whether or not travelers are riding in the lane.
  - Tolling and Enforcement Center can process e-tolling payments and issue violation citations.
- Description of elements:
  - **Traveler:** Both the passenger requesting a ride as well as the traveler accepting passengers
  - **D-RIDE Data Center:** Processes ridematch requests and requestor route and location data
  - **Tolling and Enforcement Center:** issues citations for violations and processes e-tolling payments

Scenario 3- Data Flows - Enforcement

1. Travelers that have been ridematched turn on their D-RIDE applications (devices and in-vehicle) while en route.
2. The travelers enter into an HOV 2+ lane with their D-RIDE applications still on. These applications emit a unique identifier code that is linked to individual passengers and the driver. This code is sent to the D-RIDE Data Center to process to location of the previously matched travelers which the system recognizes as paired.
3. Using GPS location information from the travelers' D-RIDE applications, the center recognizes that the travelers have entered an HOV 3+ zone. With only 2 travelers known to the center to be in the ridematch, the center sends a message to the traffic tolling and enforcement center.
4. The Tolling and Enforcement Center sends a citation to the driver's home using the traveler profile information sent with the violation message from the D-RIDE Data Center.

Scenario 3- Data Flows – Tolling

1. Travelers that have been ridematched turn on their D-RIDE applications (devices and in-vehicle) while en route.
2. The travelers enter into an HOT 2+ lane with their D-RIDE applications still on. These applications emit a unique identifier code that is linked to individual passengers and the driver. This code is sent to the D-RIDE Data Center to process to location of the previously matched travelers which the system recognizes as paired.
3. Using GPS location information from the travelers' D-RIDE applications, the center recognizes that the travelers have entered an HOT 2+ zone. Recognizing the two travelers in the ridematch en route on the HOT @+ lane, the center sends a message to the Tolling and Enforcement Center that the vehicle can be charged $3.25.
4. The Tolling and Enforcement Center process the message and deducts $3.25 from the driver's account through the driver's e-tolling pass registered as part of their traveler profile information sent by the D-RIDE Data Center.

D-RIDE User Needs

User Needs

User Type	User Need	Description
Passenger	Need D-RIDE application that is accessible by internet, mobile phone, smart phone, and other handheld devices.	D-RIDE must be as accessible as possible to maintain concentration levels and enhanced convenience of ridesharing for travelers to make a mode shift.
Driver	Need D-RIDE application that is hands-free/in-vehicle and can detect location with a high level of accuracy.	D-RIDE must be safe and accessible to drivers and provide accurate information on the whereabouts of the vehicle to inform the system and make the most accurate ridematches.
System Manager	Need back-end services to be able to handle large quantities of data.	D-RIDE back-end services must be able to support a variety of data processing in real time (location, travel profile, requests, messaging) constantly, with increased activity during peak travel times.
System Manager	Need D-RIDE to communicate with other data centers (TMCs, tolling, enforcement).	D-RIDE must communicate with traffic data centers (TMCs), tolling centers, and enforcement to realize full potential of services.

User Needs (cont'd)

User Type	User Need	Description
Passenger	Need D-RIDE application to recognize location with a high level of accuracy.	D-RIDE must be able to locate a single traveler accurately for increased success rates for accurate matches.
System Manager	Need to access network configuration data from one or more sources.	Network configuration data includes field device locations, roadway network, priced routes, and other types of static data.
Passenger/Driver	User interface needs to display information simplistically and ranked in order of efficiency.	To promote travelers understanding information about their trip and matches, information must be displayed in a user-friendly manner, especially for drivers who should not be distracted by poor informational displays or confusing messaging.
Passenger/Driver	Need to allow for two-way communications between passenger and driver.	Results of the ridematch must be communicated to the travelers who each accept the ridematch, with the acceptance messages being relayed back to the D-RIDE system.

User Needs (concluded)

User Type	User Need	Description
System Manager	Needs to have access to D-RIDE application.	Manual requests or system overrides may be necessary so the System Manager must be able to access the D-RIDE applications to either complete a user request or manually intervene when necessary .
System Manager	Needs to determine operational procedures on how ridematching should be performed.	Guidelines and logic regarding how ridematching is carried out must be established and maintained.
System Manager	Needs to define the how exception scenarios should be handled (e.g., incident/accident, delayed vehicle).	If an unforeseen circumstance compromises the completion of a trip, there must be an override function where the System Manager takes control to complete the trip.
Passenger/Driver	Need to be able to register for the D-RIDE program to create their user profile and define their preferences.	Automated ridematching can only occur if a user has set up their unique profile and established preferences for travel.

D-RIDE Scenario Comments and Modify Documents 30 Minutes

Group Discussion of Modifications

1. Changes to scenario diagram, subsystem and data flow information
2. Gaps in order for IDTO to exist
3. Changes to User Needs

Scenario Debriefing
15 Minutes Each Group

Group Discussion of Modifications

1. Changes to scenario diagrams, subsystems and data flow information
2. Gaps for all IDTO applications
3. Changes to User Needs

Questions?

NEXT STEPS…
Where do we go from here?

Schedule Milestones

Task/Milestone	Date
IDTO ConOps Webinar	10/26/11
Draft Report on Stakeholder Input	2/16/12
Draft ConOps Report	3/1/12
Final Report on Stakeholder Input	3/15/12
Walkthrough Workbook	4/3/12
Draft IDTO Requirements	4/20/12
Final ConOps Report	4/24/12
Revised IDTO Requirements	5/18/12
Walkthrough Workbook	5/23/12
Final IDTO Requirements	7/2/12