

Mobility Marketplace

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The Mobility on Demand (MOD) Vision

The United States Department of Transportation (USDOT) uses the term Mobility on Demand (MOD) to represent its vision for future mobility. MOD envisions a safe, reliable and carefree mobility ecosystem that supports complete trips for all, both personalized mobility and goods delivery.

USDOT achieves this vision by leveraging innovative technologies and facilitating public private partnerships to allow for a user-centric approach that improves mobility options for all travelers, and delivery of goods and services.



Traveler-centric



Mode-neutral



Technology-enabled



Partnership driven

Defining TSMO

*“**Integrated** strategies to optimize the performance of existing infrastructure through the implementation of **multimodal** and intermodal, cross-jurisdictional systems, **services**, and projects designed to preserve capacity and improve security, safety, and **reliability** of the transportation system”*

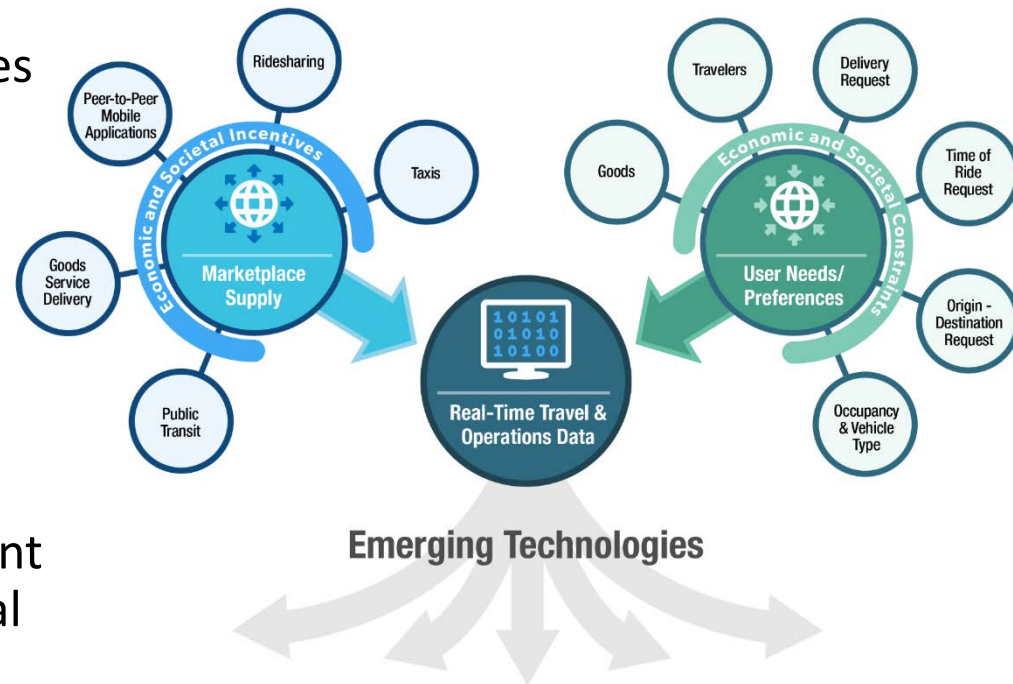
Definition of Transportation Systems Management and Operations (TSMO) as stated in 2012 Moving Ahead Progress in the 21st Century (MAP-21) legislation

What is a Mobility Marketplace?







A MOD Marketplace is a digital platform where multimodal supply for personal mobility and goods delivery services are integrated into a trusted venue for consumers to plan, reserve, and purchase services that meet their current needs.

Consumer demand for these services is matched with supply provided by transportation agencies and operations managers, as well as private mobility and goods delivery providers.

A Marketplace is enabled by strong data governance, integrated payment processing, and shared transactional specifications.



Marketplace – Implementation Needs

| Need | Solution |
|--|--|
|  <p>Fill gaps in the transit system</p> | <p>Encourage connections between transit and other mobility services such as carsharing, bikesharing, ridesharing, Transportation Network Companies (TNCs)/ridesourcing, scooter sharing, microtransit and shuttle services. Use technology and incentives to promote the use of alternate mobility services.</p> |
|  <p>Multimodal trip planning application with electronic payment option</p> | <p>Connect the MOD supply and demand chain through a multimodal trip planner engine, combining alternative mobility options based on user choices, including an integrated payment system and non-payment transactions for ease and convenience.</p> |
|  <p>Reducing parking demand</p> | <p>Encourage efforts to mitigate parking shortages or forestall the need for investments in parking lots in downtown districts, areas of public assembly, transit stations, and other locations. Use discounts and other financial incentives to promote the use of shared mobility services to reduce parking demand.</p> |
|  <p>Promote Mobility for Travelers with Special Needs</p> | <p>Implement programs providing transportation service for people with special needs, such as people with disabilities, caregivers, those on medical trips, and older adult populations as alternatives to conventional paratransit service.</p> |
|  <p>Specialty mobility programs</p> | <p>Implement specialty programs to promote access to work, healthcare, airports, and special venues using shared or alternative transportation services such as “guaranteed ride home” for commuters.</p> |
|  <p>Goods delivery on demand</p> | <p>Provide on-demand delivery modes responding to changes in how consumers shop, make purchases, and receive goods and services.</p> |

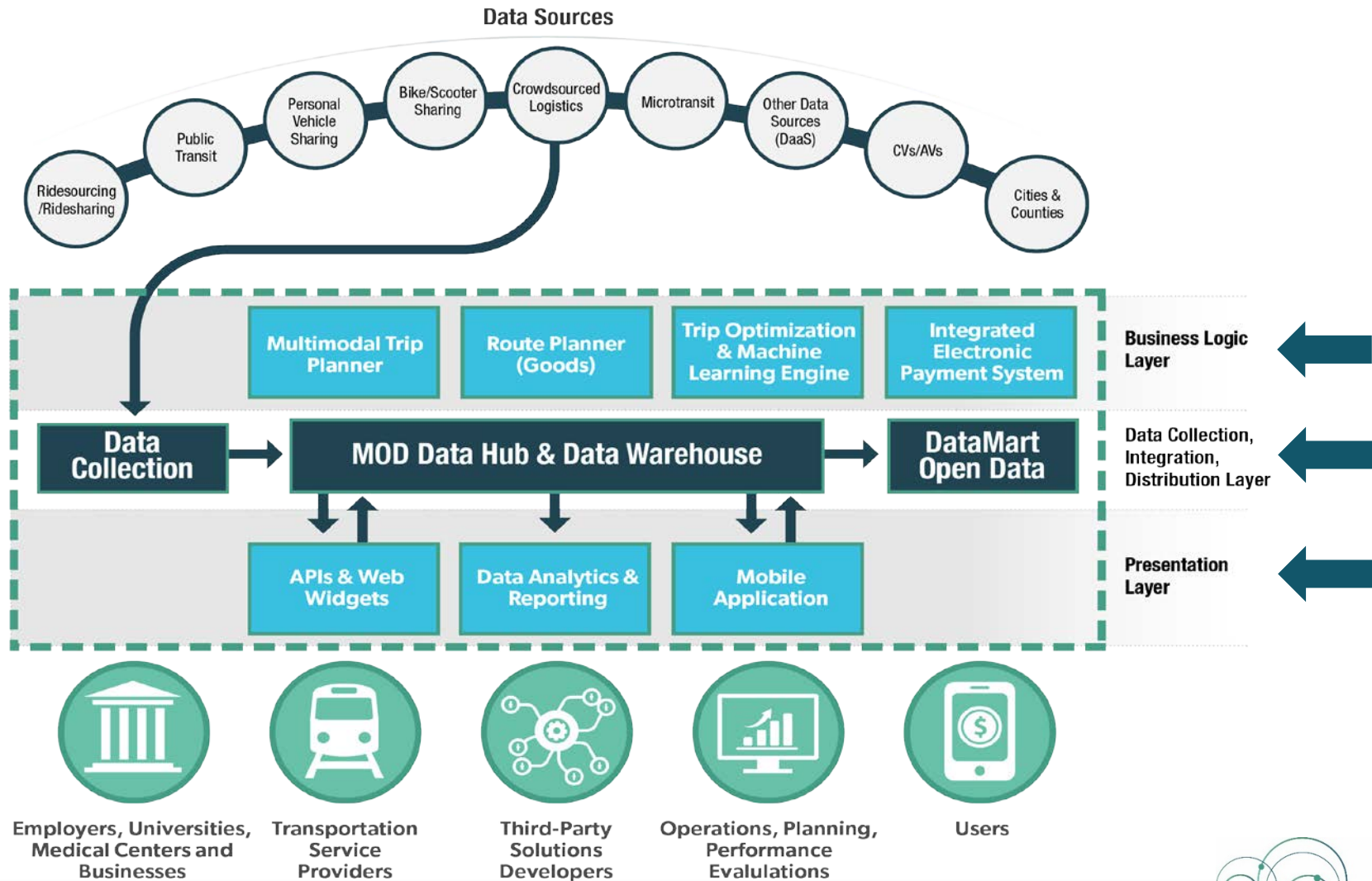
Marketplace - Goals and Objectives

- ▶ Enhance mobility and transportation efficiency
 - ▶ Stakeholders see a need to expand the transportation options available to travelers
- ▶ Expand customer experience with access to a seamless, tailored, equitable, accessible, and traveler-centric MOD service for all travelers
 - ▶ Following the MOD vision of traveler-centric mobility, the Marketplace should be accessible to all travelers, not just a portion of them
- ▶ Promote environmental stewardship
 - ▶ In addition to mobility goals, stakeholders have a desire to promote responsible resource usage.
- ▶ Review relevant policies and standards
 - ▶ The deployment may further extend its benefits by ensuring that relevant policies and regulations are in sync with the MOD vision and are agreeable to all stakeholders.
- ▶ Generate revenue
 - ▶ By improving the transportation experience, it can encourage the usage of transit and other transportation options, increasing the profitability of stakeholders
- ▶ Maintenance and operation of the system
 - ▶ Finally, it is important to prioritize the smooth operation of the overall system to ensure that all aspects of the deployment work properly and efficiently.

Example – Goal 2: Expand customer experience with access to a seamless, tailored, equitable, accessible, and traveler-centric MOD service for all travelers.

- ▶ Provide an integrated multimodal trip planner engine, including seamless connection points between mobility services and access to electronic payment
- ▶ Ensure ease of use
- ▶ Generate a customer profile
- ▶ Generate a customer profile
- ▶ Provide access to mobility services through a mobile application (AP) interface
- ▶ Select trip based on user preferences
- ▶ Provide visual information suited for all users
- ▶ Use appropriate technology
- ▶ Provide information on mobility services
- ▶ Provide an enhanced customer experience through the use of on-demand service using technology
- ▶ Provide access to mobility services for healthcare, and other services
- ▶ Provide access to mobility services in Exurban, Rural, and Tribal areas
- ▶ Provide seamless integration of mobility services
- ▶ Integrate USDOT work/initiatives into the MOD framework: Integrated Dynamic Transit Operations (T-CONNECT), Dynamic Transit Operations (T-DISP), and Dynamic Rideshare (T-RIDE), Travel Management Coordination Center (TMCC), Integrated Corridor Management (ICM), and other initiatives
- ▶ Use technology and services to provide each individual equitable, accessible, traveler-centric service, leveraging public transportation's long-standing capability and traditional role in this respect
- ▶ Remove mobility barriers for individuals with disabilities and in disadvantaged communities
- ▶ Enable payment for all portions of a multimodal trip from a single convenient Consumer Payment account
- ▶ Increase access of underserved communities to transportation to places of employment, education, healthcare, and other services
- ▶ Ensure that underserved/disadvantaged populations have affordable and equitable access to mobility services
- ▶ Provide integrated mobility application and account-based fare payment systems to accommodate unbanked users
- ▶ Provide subsidies for riders
- ▶ Provide low-income commute gap filling work
- ▶ Provide equitable geographic access to transit
- ▶ Provide service to accessible paratransit customers
- ▶ Leverage technology to provide access to modal options for all travelers
- ▶ Unlock tax savings for property managers and employers
- ▶ Provide an enhanced customer experience through the use of on-demand service using technology

Marketplace System View



Stakeholders – Supply and Demand

- ▶ Federal Government
- ▶ State and Local Authorities
- ▶ Public Transit Agencies
- ▶ Transportation Service Providers
- ▶ Transportation/Operations Managers
- ▶ App and Technology Providers
- ▶ Volunteer groups/ programs and neighborhood advocacy groups
- ▶ MOD Platform Provides, Operators and Maintainers
- ▶ Large employers and organizations
- ▶ Consumers
- ▶ Goods delivery consumers





Consumer Needs

| | |
|------------------|--|
| Consumers | Users need access to a comprehensive list of mobility providers and real-time information about which mobility providers are currently operating in the area. Travelers are not informed when new mobility providers come online or when an existing mobility provider suspends service or exits the marketplace. |
| Consumers | Gaps exist in the trip chain, e.g. first- and last- mile connections to public transportation. Users need reliable mobility services, but options are limited. |
| Consumers | Users cope with inconvenient trips that include highly variable travel times, long connections, and safety concerns. Users need safe and reliable mobility services and options. |
| Consumers | Users need insight into the private information they are exposing and consenting to sharing in clear privacy policies. |
| Consumers | Users need to gather travel information from multiple sources, individual websites or applications, but are unable to book trips or plan and pay for an entire multimodal trip from origin to destination in a single application. |
| Consumers | Provide mobility services and tools for older adults and people with disabilities. |
| Consumers | Provide mobility services for those who are poorly served by transportation. |





User/System Needs

Example User/System Need: Consumer Privacy

| Stakeholder | User Need | Change Required | Recommendations for Implementation (System Needs) |
|-------------|---|----------------------------|--|
| Consumers | Users need insight into the private information they are exposing and consenting to sharing in clear privacy policies | Set data privacy policies. | <ul style="list-style-type: none">• Develop a Data Management Plan to outline data storage policies to ensure security and privacy of the data• Identify and implement secure data standards and policies related to the collection and storage of personal and sensitive data• Identify and implement standards and policies related to the distribution of all data• Identify and distribute clear privacy policies that outline the data that is collected from app users as well as how the information will be used and/or distributed |

Public Agency Needs

| | |
|-----------------|--|
| Public agencies | <p>Studies and customer surveys are completed to understand modal shift and access to certain facilities. Transit ridership is declining for certain routes.</p> <p>Operations and planning staff need ways to gather information about how residents and customers move around the transportation network.</p> |
| Public agencies | <p>Data generated by the pervasive use of cellular phones and mobility apps has offered insights into characteristics of human mobility patterns. Government agencies need a single point of information about how travelers are accessing, consuming and paying for transportation.</p> |
| Public agencies | <p>Data gaps exist and intensive manual efforts are necessary to generate MOD Key Performance Indicators (KPIs) and measurements.</p> <p>Stakeholders need a centralized data warehouse for the collection, storage, and analysis of data.</p> |
| Public agencies | <p>Lack of standards for public or private mobility data leads to one-off data interfaces to each data source, reducing the MOD value proposition and increasing the length of technology implementation cycles. Agencies need a way of standardizing data to provide common formats and interoperability among the MOD stakeholders and subsystems.</p> |
| Public agencies | <p>Lack of integration of MOD data into ATDM, Transportation Demand Management (TDM), Integrated Corridor Management System (ICMS) and Transportation Systems Management and Operations (TSMO) strategies.</p> |
| Public agencies | <p>Use of the MOD Platform to implement ATDM, TDM, ICMS and TSMO strategies.</p> |



Subsystems and Operational Requirements

- ▶ Data Collection
- ▶ Data Hub and Data Warehouse
- ▶ Multimodal Trip Engine
- ▶ Route Planner (Goods)
- ▶ Mobile Application
- ▶ Trip Optimization Engine
- ▶ Integrated Electronic Payment System
- ▶ Data Analytics and Reporting
- ▶ Data Mart & Open Data
- ▶ Application Programming Interface
- ▶ Web Widgets

5.5.3 Multimodal Trip Engine (MMTE)

- MMTE.001The MMTE shall have the ability to ingest standard data formats (i.e. GTFS, GTFS-Flex, Traffic Message Channel [TMC] Codes, Keyhole Markup Language [KML]) and non-standard data as provided by individual MOD stakeholder APIs.
- MMTE.002The trip planner shall support static and dynamic routing.
- MMTE.003The MMTE shall have the ability to include static and dynamic data provided by all the supported travel modes.
- MMTE.004The MMTE shall have the ability to provide the shortest path between OD based on the user's choices and inclusive of all the supported travel modes.
- MMTE.005The MMTE shall have the ability to generate multimodal trip results including transfers between various modes.
- MMTE.006The MMTE shall have the ability to update the routing path as real-time conditions change.
- MMTE.007The MMTE shall provide route to route and mode to mode transfers.
- MMTE.008The MMTE shall provide transfers based on users' preferences, profiles, and distance, connecting static and dynamic routes.
- MMTE.009The MMTE shall have the ability to optimize the trip results based on users' choices and profiles.
- MMTE.010The MMTE shall have the ability to optimize the trip results based on predictive conditions.
- MMTE.011The MMTE shall have the ability to integrate with ATDM, TDM or ICMS external systems for ICM or TSMO strategy implementations.
- MMTE.012The MMTE shall have the ability to integrate with external geocoders.
- MMTE.013The MMTE shall support various mapping formats.
- MMTE.014The MMTE shall provide audio and visual aids.
- MMTE.015The MMTE shall have the ability to use external wayfinding and AR services.
- MMTE.016The MMTE shall allow users to select incentives.
- MMTE.017The MMTE shall have the ability to capture and store OD requests.

Subsystem example

Subsystem Functional Overview Example: Multimodal Trip Planner

| Layer | Subsystem | Definition | Requirements | Trip Considerations |
|----------------------|-------------------------|---|--|---|
| Business Logic Layer | Multimodal Trip Planner | A routing algorithm that provides the shortest trip based on a user's selected travel parameters to obtain reliable, complete, and accurate trip results including all mobility modes with adequate transfer times. | <ul style="list-style-type: none">• Fixed-route data• Demand-responsive data• Geocoder• Walking and wayfinding systems• Augmented reality (optional)• Real-time conditions (optional) | <ul style="list-style-type: none">• Accessibility• Trip engine routing choices (fixed/flexible transit services, ridesharing, ridesourcing and taxis, bikesharing/scooter sharing, carsharing) |

Operational Scenario Use Cases

Use Case Scenarios

- Leverage shared MOD data to analyze infrastructure conditions and improve transportation operations
- Fill gaps in existing transportation networks and provide travelers with additional options and flexibility
- On-Demand
Neighborhood/Campus/Retirement
Community/Employer Services
- On-Demand door-to-door and paratransit services
- Plan trip using integrated multimodal application
- On-Demand first/last mile services
- Flexible Goods Delivery Services

User-System Interactions

- Primary actors, supporting actors, stakeholders and interests
- Scenario descriptions
- Preconditions
- Postconditions
- Performance goal
- Basic workflow
- Alternative workflow
- Special Requirements
- Assumptions
- Notes and issues

Operational Scenario Use Cases

- ▶ Use Case 1: Leverage shared MOD data to analyze infrastructure conditions and improve transportation operations
- ▶ Use Case 2: To fill service gaps and provide travelers with additional options and flexibility when privately operated vehicles and fixed-route transit services are insufficient.
- ▶ Use Case 3: On-Demand Neighborhood/Campus/Retirement Community/Employer Services
- ▶ Use Case 4: On-Demand door-to-door and paratransit services
- ▶ Use Case 5: Plan trip using integrated MOD application
- ▶ Use Case 6: On-Demand first/last mile services
- ▶ Use Case 7: Flexible Goods Delivery Services
- ▶ Use Case 8: Registration for an integrated multimodal application with integrated e-ticketing solution
- ▶ Use Case 9: Plan trip using integrated multimodal application and pay using integrated e-ticketing solution

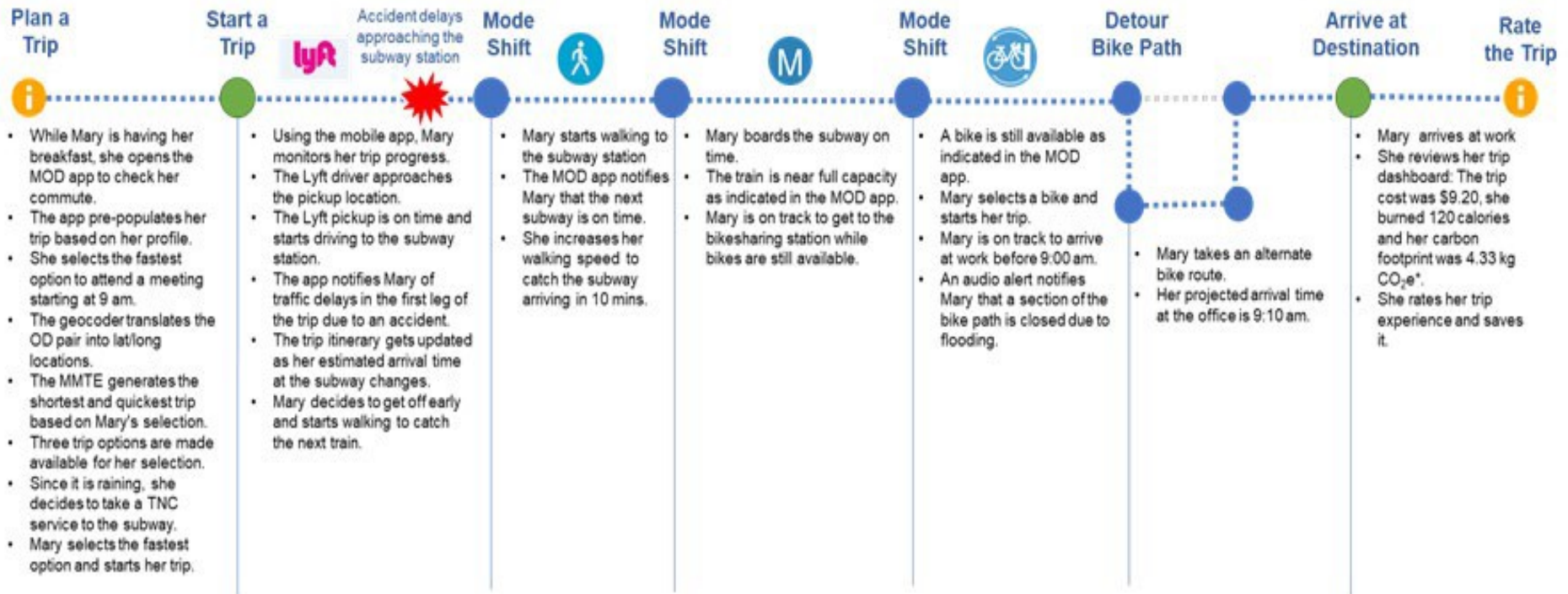
- Actors
- Description
- Preconditions
- Postconditions
- Performance Goal
- Basic Workflow
- Alternate Workflow
- Special Requirements
- Issues

Operational Use Cases - Example

| | |
|--------------------------|--|
| Use Case ID: | 9 |
| Use Case Name: | Use Case ID: 9 |
| Actor: | Use Case ID: 9 |
| Postconditions: | Use Case ID: 9 |
| Description: | <p>Alternative Workflow:</p> <p>Use Case ID: 9</p> <ul style="list-style-type: none"> ▪ User has available funds in their financial institution to pay for their journey ▪ If user is unbanked, user has available funds to pay for their journey via available kiosks <p>Notes and Issues:</p> <p>Issue: System cannot provide complete trip plan</p> <ul style="list-style-type: none"> • Time constraints for modal transfer • Services not running during certain time periods • Transportation mode operating at capacity and cannot provide for another user • Bluetooth not currently working on user's smartphone to allow for successful payment of one or more journey legs • Bluetooth or reader not working at one or more of the entry points for any or all legs of the user's journey • User unbanked and kiosks not operational • User unable to reload mobile wallet to replenish their virtual account <p>Special Requirements:</p> <ul style="list-style-type: none"> o Public transit service disruptions: skipped stations, redirected routes o Traffic disruptions: redirected route due to unexpected traffic o Update costs of each mode in near real-time ▪ Fast/secure pairing with contactless readers in the field ▪ Offline mode for MOD app in case of loss of or no connectivity in the field <p>User Interface Requirements:</p> <ul style="list-style-type: none"> ▪ Larger font feature available on the MOD app ▪ MOD app provides user with the option to listen to the available trip options ▪ MOD app allows for dictation anywhere user input is required ▪ Visual aids (maps, wayfinding, AR) ▪ Registration/sign up feature to create and modify a user account ▪ Ability to introduce, seamlessly, new modes/methods of transport without redesign |
| Performance Goal: | |
| Preconditions: | Basic Workflow: |

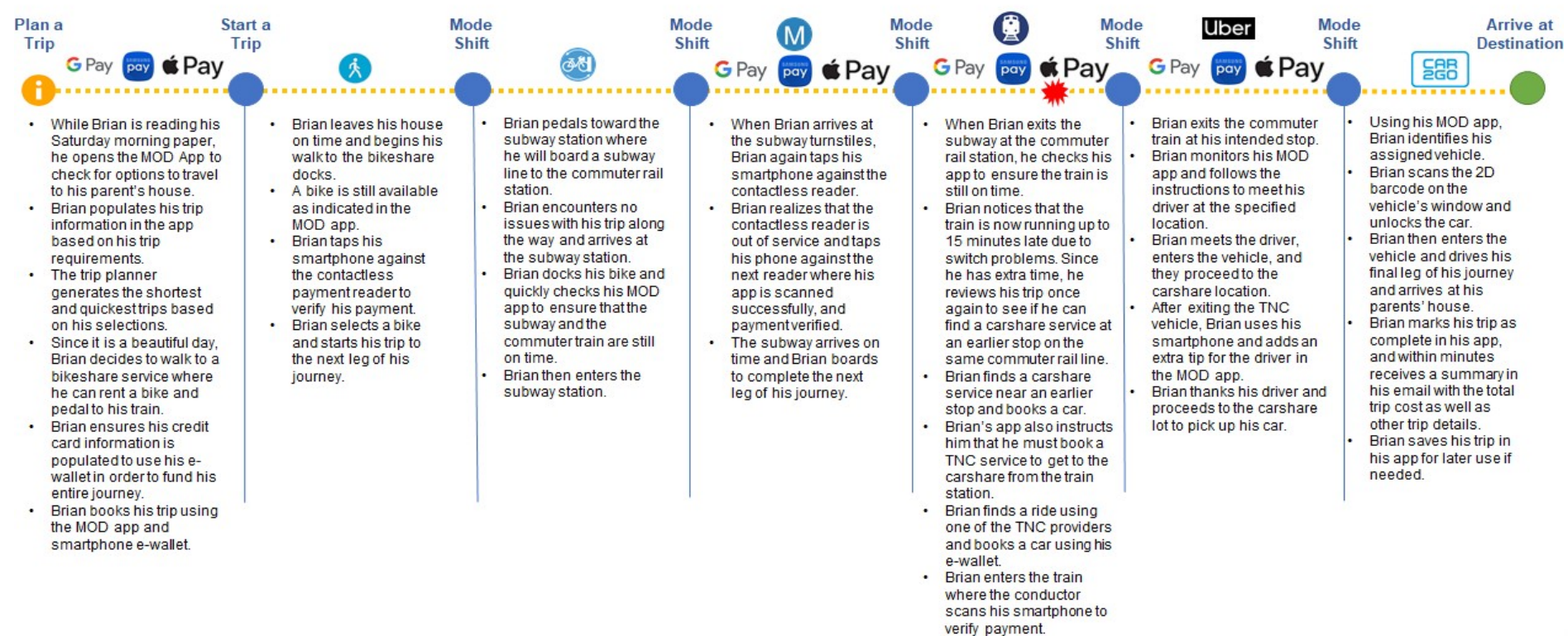
User Journey Map – Example 1

Mary is a recent college graduate who lives in a close-in suburb and works in the downtown of a major metropolitan area. She currently does not own a car and relies on her phone to plan her commute to work everyday. On a rainy day, she uses the MOD app to plan the best way to get to the office before 9 am.



User Journey Map – Example 2

Brian lives in a metropolitan area and does not need a car. This weekend, Brian made plans to visit his parents who live well outside the city, and transit options are limited. There is, however, a commuter train that can take him in the direction of his parents' house, but he will need to plan his options to the train, and then to their house from the train. Brian opens his MOD app and begins his planning.



MOD Marketplace Concept of Operations

Summary of Impacts



Organizational Considerations

- Business Models
- Payment Models
- Partnerships (contracting/
procurement, NDAs)
- Workforce Issues

MOD Marketplace Concept of Operations

Summary of Impacts



Policy Considerations

- Applicability of existing laws and regulations
- Equity (digital poverty, accessibility, affordability, spatial access)
- Design and management of physical infrastructure
- Data stewardship (privacy, standards, security, sharing)



MOD & Standards

**MOD principals inform equitable standards
and equitable standards allow for the realization of MOD principals.**

**MOD
Principals**



**Equitable
Standards**





The state of MAT influenced standards in the Marketplace

10+ years ago



Today

Trip planning was limited to a single mode and there was a general lack of standards

Multimodal trip planners were developed, later followed by standards

Still a lack of harmonized standards that describe required data elements for MAT

Dimensions of Multimodal and Accessible Travel



Spatial

physical location of traveler
infrastructure/features/land use



Technological

technology that facilitates MAT



Informational

data/communication/media



Modal

transportation services that
comprise MAT



Accessibility

traversable by a person
with disabilities



Temporal

availability of opportunities across
the day, week, or other time period



Transactional

request/reservation/payment,
data exchange/sharing/privacy



Equity

economic disadvantages, digital
poverty, and the urban/rural divide



Institutional

relationships among
transportation/mobility providers



MOD Key Areas for Standards Development



**Path of travel,
infrastructure/vehicle**



**Data sharing, exchange,
privacy**



**Wayfinding and
navigation**



Integrated payment



**Automation and
robotics**

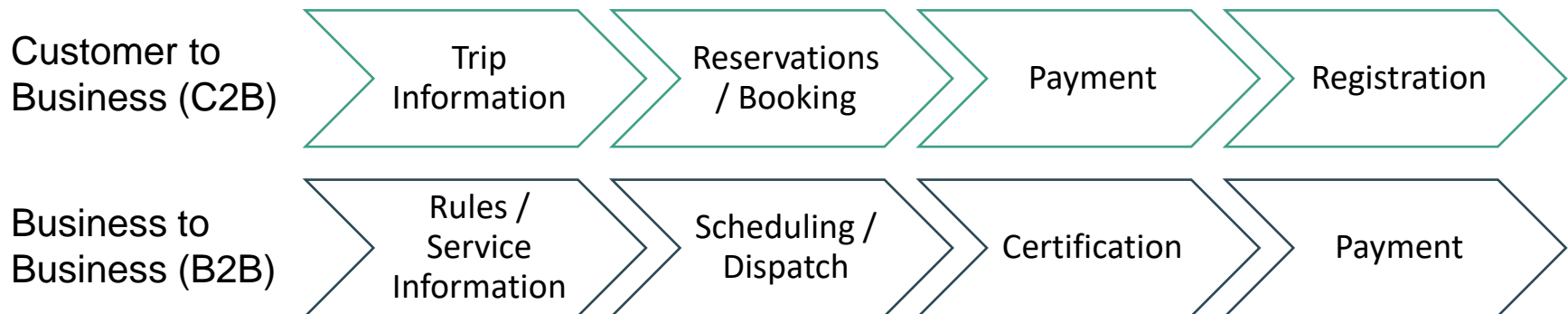


**Human-machine
interface**

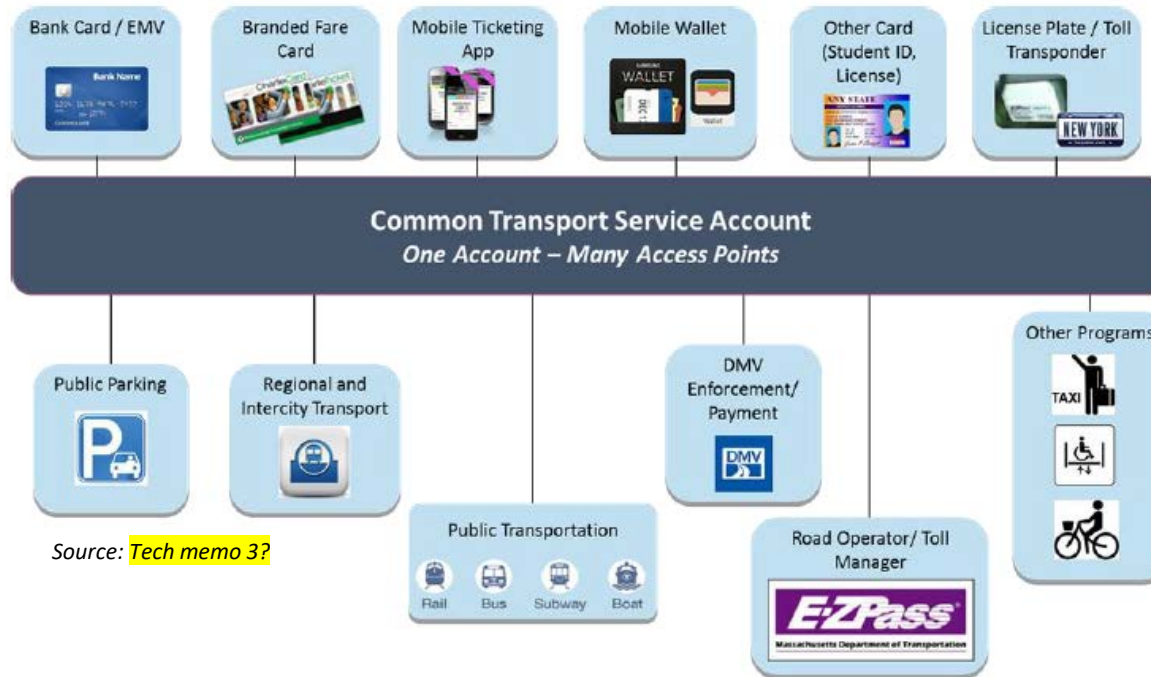


On-Demand / Mobility Platform APIs

- ▶ Developed framework for duplicative standards and gaps in standards
- ▶ Outreach: reviewed emerging/existing standards & specifications
 - ▶ ISO – from TC 204 Intelligent Transportation Systems
 - ▶ MaaS Alliance
 - ▶ Demand Responsive Transportation (SUTI -Scandinavia, TCRP Report 210)
 - ▶ Others (project related -- ATTRI, vendor published and proprietary)



Integrated Payment



Source: [Tech memo 3?](#)

Use Cases

- ▶ Interchange between operator and financial service account managers (including reconciliation)
- ▶ Fee/fare validation by service operator(s)
- ▶ Cost estimation for multimodal trip planning
- ▶ Point of sale for multimodal journey booking and ticketing

Marketplace from Complete Streets view

- ▶ Policy and design approach prioritizing safety and mobility for all users
- ▶ Two categories:
 - ▶ Curb and Micromobility Vehicle Management (CM)
 - ▶ Public Right of Way/ Data Modeling for Indoor Navigation (PROW)



*Illustration of neighborhood street with Complete Streets design elements.
Source: NACTO*



Thank you

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