

Travel Smooth with MOBIX: An Intelligent Mobility Exchange

Abstract

Technological advances and servitization of mobility are changing the travel habits and preferences of society as a whole. Mobility is evolving from a fixed supply chain that delivers process-driven travel, to a dynamic ecosystem that delivers on-demand services. The transition is no longer limited to the transportation system, but is also influencing allied services that were so far operating in pseudo-isolation with minimal flexibility to adapt to user journeys in real-time. Parking, fuel refilling, vehicle charging, accommodation, entertainment, food and utilities, remote assistance, payment and many such services that otherwise functioned as isolated silos have all become a part of this ecosystem. An intelligent mobility exchange with a global mobility brokerage model can provide users a unique experience by fabricating in real-time, frictionless and predictable journeys from divergent systems. Businesses will also benefit from such a model as newer services and better margins on existing service lines increases overall revenue share.

The changing face of mobility

Mobility, the key driver of urban life, is at an inflection point due to rapid urbanization, increasing constraints on city resources, and growing environmental and safety concerns. Technological advances and the changing preferences of modern society is transforming mobility into a connected and shared service^[1]. Today, the global mobility market is worth \$7 trillion and growing^[2]. Here we explore the key factors that are transforming the mobility landscape:

Evolving user demands

Changing travel preferences have turned city infrastructure and mobility resources into service intersections^[3]. Commuters are interacting with a number of such services on a daily basis. With cities getting denser and travel becoming less predictable, the demand for composite mobility services is on the rise.

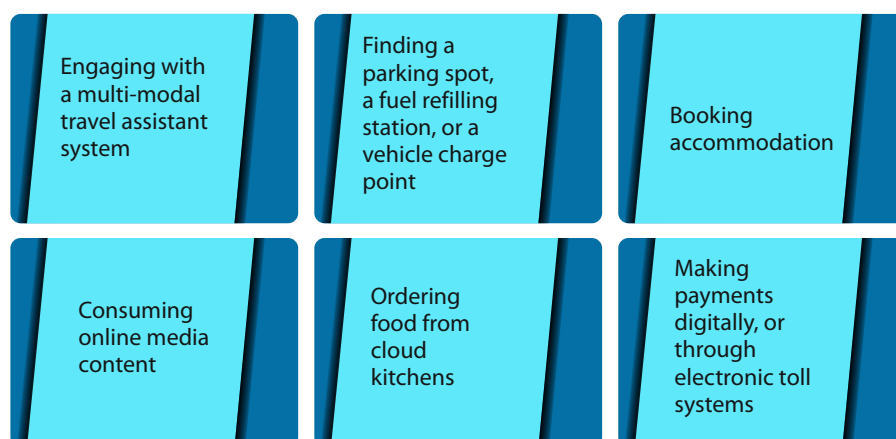


Fig 1: Examples of typical mobility services

Isolated systems, and approaches of heritage players

The current mobility universe comprises of a number of dedicated digital exchanges, offering services in silos. These isolated mobility touch-points, which are mostly point-to-point, offer minimal adaptation to a user's real-time journey. Due to their diverging operation modes, lack of a global perspective, and dependencies, the reinforcing effects of mobility services on each other remains unknown. Most of these systems take an inside-out approach to journey planning, where the focus is predominately on the mobility modality. For example, Mobility-as-a-Service (MaaS) consolidates various transport options for usage on-demand, but does not take into account the larger mobility goal and context.



Fig 2: Examples of current marketplaces

The demand-supply gap

A shortage of developed urban space and significant costs for new public infrastructure make it difficult to scale the capacity of a city's transport resources. As a result, the mobility supply side is mostly constant over the long-term, with some short-term variations. Resource uberization can augment this existing capacity with privately held resources (e.g. make a private parking lot available for public parking). In this case, the supply side also has spatio-temporal variation, but need not be spatio-temporally close in sync with demand. This creates a disconnect between what people want and what mobility services can deliver.

Future mobility implications

Current mobility infrastructure is confined within very well-defined boundaries. The future may bring new possibilities^[4], and the presence of a dynamic environment could result in complexities of a much higher magnitude. While individual mobility elements will continue to evolve, the future of mobility will be a multi-dimensional, cyber-physical system of systems with significant scale and complexity.

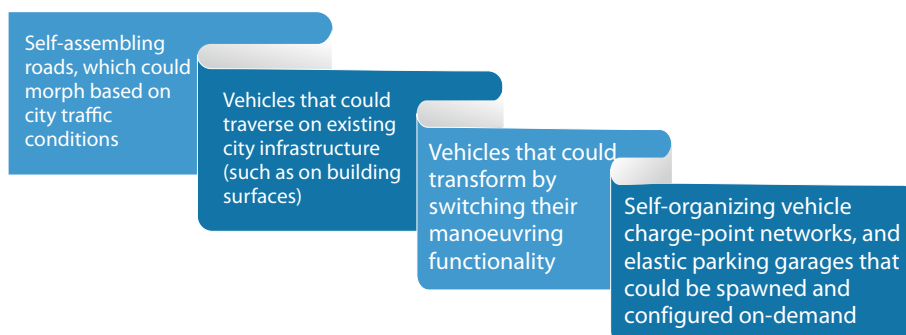


Fig 3: Future forward – New possibilities

A rapidly consolidating marketplace

The advent of ride-hailing services such as Uber is thought to be a cause for declining automobile sales. Gain in market share by newer players in the mobility space may not be at the expense of legacy stakeholders. The system allows existing operators to co-exist and evolve with newer players such that the market does not result in a zero-sum game.

It is not surprising that partnerships and strategic alliances are fast developing in all sectors related to mobility. Examples include: Daimler collaborating with public transit and car rental companies to develop its mobility platform, Moovel^[5]; Daimler, Volkswagen and BMW partnering with mobile telecom equipment firms to develop infrastructure for self-driving cars^[6]; ABB and Microsoft collaborating on a new electric vehicle fast-charging services platform^[7] etc. Other canonical domains such as insurance^[8], retail^[9] and advertising are piggybacking on specific mobility services and augmenting them with newer business models to make their offerings more personalized. These developments are early signs of a market that is open to consolidation, with a realization that system-level collaboration between all stakeholders of the mobility ecosystem is key to deriving greater business value for enterprises and a better mobility experience for people.

A new point of view-MOBIX

In this rapidly evolving ecosystem of consolidation and integration of mobility services, holistic mobility management with efficient and real-time decision-making and implementation is a fundamental problem. Traffic signaling systems have made citywide travel possible rather than mobility itself^[10]. Drawing a parallel, we envision that an ecosystem-agile mobility signaling and control system is the key enabler of future mobility. The Intelligent Mobility Exchange, or MOBIX, is a global mobility controller that can broker mobility transactions across mobility service silos to create new and improved, and integrated mobility experiences. It can meet the real-time mobility needs of customers, while improving the top and bottom lines of businesses.

Service provisioning with MOBIX

MOBIX can provision domain specific services as well as common services for navigating the decision space across domains. The set of common services shall include:

- Resource discovery and scheduling — locates and assigns resources based on particular mobility attributes and decision criteria
- Resource arbitration — resolves competing service demands
- Identify and trust management — manages access control based on identify and trust policies
- Context tracking and auditing — tracks the association of people with mobility resources
- Route planning and navigation — provides strategies to journey traversal
- Brokerage of loyalty points — enables transaction of loyalty points across various service ecosystems
- Demand-response management to overcome real-time mismatches in supply and demand of mobility resources
- Demand and supply shaping — regulates demand and supply to provide prioritized access to mobility resources

Provisioning common services to navigate across domain services will help understand the potential impact of service demand and supply changes, analyze trade-offs, and design robust mobility plans.

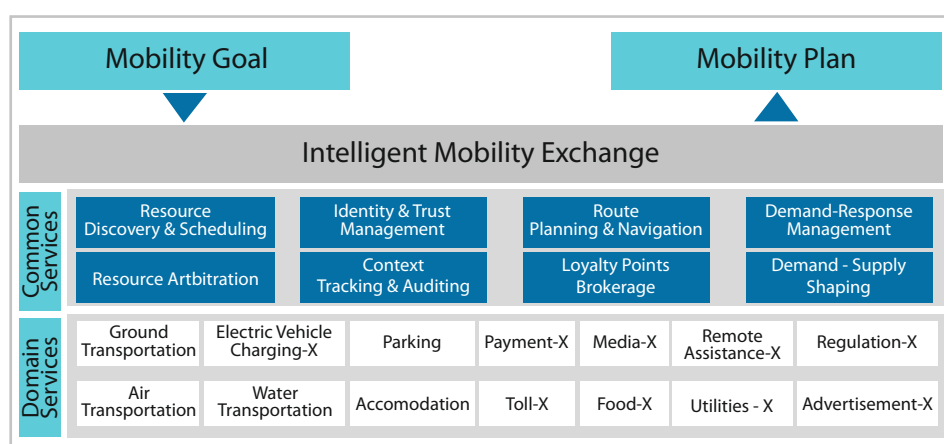


Figure 4: A package of connected mobility services for creating frictionless and predictable journey plans

Applications of MOBIX

Independent mobility service exchanges are better prepared to deal with situations where journey changes are communicated well in advance, or when there is minimal dependency on other mobility services. A change in travel plan can throw the system off balance. Consider the below scenarios:

Scenario 1- Current mobility services

X plans to take a trip from city A to city B. X drives an electric vehicle on this journey, and makes lodging arrangements by using the services of an accommodation exchange. En route, X changes his plan to visit a different city C for which he needs to cover a longer distance. Below are the consequences of this change:

- Making a stop to charge the vehicle
 - A new service opportunity in the form of vehicle charging
- Cancelling the hotel reservation in city B and making a new hotel booking in city C
 - The hotel in city B charges the entire cost of stay to the traveler
 - Even if the hotel finds another traveler for those dates, the benefit is not passed on to X
 - If the hotel remains unoccupied for the duration of the cancelled booking, the accommodation exchange offers minimal protection

Scenario 2: MOBIX integrated accommodation exchange

The new mobility system is integrated with various mobility services and provides a real-time view of journey flows and associated mobility changes

- The accommodation exchange can leverage the journey flows to actively discover potential candidates and influence their travel decisions
- MOBIX can brokerage a deal between the EV charging exchange and the accommodation exchange (without involving X) to account for the charging opportunity created due to cancellation of hotel accommodation
- Detailed journey transactions captured by MOBIX expands the coverage of the insurance and advertisement with better on-demand and context service offerings

MOBIX not only offers the necessary support backup for individual mobility service exchanges so that they can quickly adapt to journey disruptions, but also uncovers new service opportunities with detailed tracking and auditing.

Change to the new - intelligent and integrated mobility

Mobility is an ecosystem in itself and its efficient management requires cooperation between multiple stakeholders. Current mobility operates in a fragmented environment, with limited adaptability to changing demand. Creating integrated customer journeys with continuous learning from interdependent systems mandates a global mobility hypervisor model enabled by the intelligent mobility exchange. Such a system has the potential to become a game-changer by integrating spatial and temporal planning, new mobility technologies, and social innovations to meet people's journey needs.

References

- [1] Infrastructure for the evolution of urban mobility
<https://www.mckinsey.com/business-functions/sustainability/our-insights/infrastructure-for-the-evolution-of-urban-mobility> - Accessed: 2019-09-16
- [2] Rethinking Mobility
https://orfe.princeton.edu/~alaink/SmartDrivingCars/PDFs/Rethinking%20Mobility_GoldmanSachsMay2017.pdf - Accessed: 2019-09-25
- [3] The impact of new mobility services on the automotive industry
<https://www.cargroup.org/wp-content/uploads/2017/02/The-Impact-of-New-Mobility-Services-on-the-Automotive-I.pdf> - Accessed: 2019-09-16
- [4] Self-Assembling Structures
<https://www.autodesk.com/redshift/self-assembling-structures/> - Accessed: 2019-09-25
- [5] Making personal freedom the focus of sustainable urban mobility
<https://www.daimler.com/company/urban-mobility.html> - Accessed: 2019-09-25
- [6] Technology Firms and German Automakers Form 5G Telecoms Group
<https://fortune.com/2016/09/27/german-automakers-tech-firms-form-5g-telecoms-group/>
Accessed: 2019-09-25
- [7] ABB and Microsoft join forces to launch next-generation electric vehicle charging services platform. <https://news.microsoft.com/2015/10/20/abb-and-microsoft-join-forces-to-launch-next-generation> - Accessed: 2019-09-25
- [8] Catalyzing the Shift to Digital Insurance 2.0. <https://www.the-digital-insurer.com/wp-content/uploads/2018/05/1188-Future-Trends2018.pdf> - Accessed: 2019-09-25
- [9] Reshaping Retail with Mobility. https://www.cisco.com/c/dam/en_us/about/ac79/docs/retail/Retail-Mobility-PoV_011312FINAL.pdf - Accessed: 2019-09-25
- [10] Who Invented the Traffic Light? <https://www.livescience.com/57231-who-invented-the-traffic-light.html> - Accessed: 2019-09-25

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