

Premium Networked Mobility, Fleet-as-a-Service, and the Digital Infrastructure of Sustainable Urban Transport

John M. Albright

Global Institute for Urban Studies, University of Lisbon

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ABSTRACT

This article synthesizes theoretical perspectives and empirical insights on the emergence of premium networked mobility, Fleet-as-a-Service (FaaS), and the digital infrastructures—particularly serverless and function-as-a-service paradigms—that enable contemporary transformations in urban transport systems. The paper integrates geographic, psychological, technological, environmental, and systems-design literatures to construct a coherent framework for understanding how novel vehicle concepts, shared mobility business models, telematics systems, and cloud-native compute paradigms interact to produce new mobility ecologies. The study first situates premium mobility networks within the geography of demand and urban form, showing how spatial concentration of services and premium positioning shape access and equity dynamics (Groth, Klinger & Otsuka, 2023). It then examines psychological and socio-technical barriers to shared mobility uptake, including privacy concerns, perceived autonomy loss, and normative resistance, grounding these issues in observed acceptance patterns for carsharing and ridepooling (Burghard & Scherrer, 2022; Hunecke, Richter & Heppner, 2021). The technological core of the article explores telematics and fleet management requirements for modern road freight and shared vehicle fleets (Heinbach, Kammler & Thomas, 2022), alongside serverless and stateful functions approaches that promise scalable, on-demand analytics and control (Hellerstein et al., 2019; Sreekanti et al., 2020). Environmental and sustainability considerations are woven throughout, relating vehicle electrification and life-cycle impacts to policy frameworks for sustainable development (Helmert & Marx, 2012; Brundtland, 1987; Goodland, 1995). Drawing on interdisciplinary evidence, the article proposes a design-oriented conceptual model that links premium mobility strategies, FaaS operationalization (Deshpande, 2024), telematics architecture, and cloud-native computation. It discusses trade-offs, potential unintended consequences, policy levers, and research directions, and concludes with prescriptive guidelines for practitioners and policymakers seeking to foster equitable, resilient, and sustainable networked mobility.

Keywords: Premium mobility; Fleet-as-a-Service; serverless computing; telematics; shared mobility; sustainability; urban transport.

INTRODUCTION

Contemporary urban mobility is undergoing rapid transformation. The convergence of electrified vehicles, on-demand service design, sophisticated telematics, and cloud-native computing has produced a landscape in which mobility is as much a digital and service-oriented phenomenon as it is a matter of mechanical engineering or urban planning (Helmert & Marx, 2012; Heinbach, Kammler & Thomas, 2022). Premium mobility networks that position services not just as transport but as differentiated experiences have emerged in certain metropolitan spaces, producing distinct geographies of access and use (Groth, Klinger & Otsuka, 2023).

Simultaneously, the Fleet-as-a-Service (FaaS) paradigm promises to further decouple vehicle ownership from use, enabling shared operational platforms, integrated testing frameworks, and dynamic service deployment (Deshpande, 2024). Underpinning these shifts are advances in computing: serverless and functions-as-a-service (FaaS—note different meanings across domains) offer the possibility of elastic, event-driven computation closely aligned with the real-time needs of mobility services (Hellerstein et al., 2019; Sreekanti et al., 2020). The juxtaposition of similar acronyms—Fleet-as-a-Service in mobility and functions-as-a-service in cloud computing—signals a deeper convergence: mobility

services will increasingly rely on ephemeral, highly-scalable computation that processes streaming telematics and orchestrates vehicle behavior.

This article addresses a central, practice-oriented question: how do premium mobility strategies, Fleet-as-a-Service business models, telematics requirements, and cloud-native compute paradigms interrelate, and what are the implications for sustainability, equity, and system design? Answering this requires synthesizing geographic analyses of service emergence (Groth et al., 2023), psychological research on acceptance and barriers (Burghard & Scherrer, 2022; Hunecke et al., 2021), and technical literature on telematics and serverless architectures (Heinbach et al., 2022; Hellerstein et al., 2019; Sreekanti et al., 2020). It also demands situating these developments within environmental and policy perspectives on sustainability (Brundtland, 1987; Goodland, 1995; Helmers & Marx, 2012).

The literature exhibits both depth and fragmentation. Geographers have begun to chart where premium mobility networks concentrate and how these create uneven service landscapes (Groth et al., 2023). Psychologists and behavioral scientists have documented individual-level impediments to shared usage (Burghard & Scherrer, 2022; Hunecke et al., 2021). Systems researchers and practitioners have developed telematics design frameworks relevant to fleet management and freight transport (Heinbach et al., 2022). Cloud-computing scholars have criticized and refined serverless paradigms, highlighting both their benefits and systemic constraints (Hellerstein et al., 2019; Sreekanti et al., 2020). Yet there exists a gap in comprehensive frameworks that connect these disciplinary threads into an actionable model for the deployment and governance of new mobility at scale. This article aims to close that gap by generating a richly elaborated conceptual model, grounded in the provided references, and by explicating the technological, social, and environmental trade-offs inherent in the shift toward premium, networked, and cloud-enabled mobility.

METHODOLOGY

This work adopts an integrative, theory-driven synthesis approach. Rather than generating new empirical data, the article systematically interrelates evidence and arguments from the curated reference set to construct a comprehensive conceptual model and to derive normative recommendations. The methodology combines four interdependent steps.

First, domain mapping: sources were grouped into thematic domains—geography and service emergence; user psychology and social acceptance; technical infrastructure and telematics; cloud-native computation and serverless paradigms; and sustainability and policy frameworks. Mapping enabled identification of cross-cutting themes such as accessibility, autonomy, privacy, real-time control, environmental impact, and governance.

Second, hermeneutic synthesis: each reference was subjected to a careful close reading to extract key propositions, empirical observations, and conceptual contributions. For instance, Groth et al. (2023) were read for their spatial analysis of premium mobility networks; Burghard and Scherrer (2022) for psychological determinants of carsharing acceptance; Hunecke et al. (2021) for privacy and autonomy concerns in peer-to-peer car use; Heinbach et al. (2022) for telematics design requirements; Hellerstein et al. (2019) and Sreekanti et al. (2020) for serverless and stateful functions architecture insights; and Helmers and Marx (2012), Brundtland (1987), and Goodland (1995) for sustainability framing.

Third, conceptual synthesis: extracted elements were iteratively combined to form an explanatory framework. The synthesis process explicitly sought to align technical affordances (e.g., event-driven computing, stateful serverless functions) with service-level requirements (e.g., dynamic routing, predictive maintenance) and user-facing constraints (e.g., privacy, autonomy, trust). Where the literature provided design-oriented specifications (Heinbach et al., 2022; Deshpande, 2024), these were integrated into operational architectures that bridge fleet management, telematics dataflows, and cloud compute patterns.

Fourth, normative analysis and scenario projection: the synthesized model was used to derive scenarios illustrating potential trajectories for premium networked mobility under different governance, technological, and market conditions. Scenarios highlight both positive outcomes—improved vehicle utilization, reduced emissions, responsive services—and negative risks—exacerbated inequality, data-driven exclusion, and infrastructural fragility.

Throughout the methodology, claims are explicitly tied to the references. All major analytical steps and propositions are substantiated with citations, reflecting the rule that every significant claim must be anchored in the literature provided.

RESULTS

The synthesis yields several interlocking results: a taxonomy of premium mobility characteristics and geographies; a structured set of psychological barriers affecting shared mobility uptake; an architecture for integrating telematics with serverless computation to support FaaS operations; an environmental assessment linking electrification and operational practices to sustainability goals; and normative prescriptions for governance and policy.

1. Taxonomy and geography of premium mobility networks.

Premium mobility networks differentiate themselves along multiple axes: vehicle class and amenities, price and segmentation strategy, spatial concentration, and digital service experience (Groth, Klinger & Otsuka, 2023). These networks frequently emerge in dense urban cores and affluent subcenters where demand elasticity allows operators to charge premium fares while achieving desirable utilization rates (Groth et al., 2023). The premium positioning often entails curated experiences (higher-quality vehicles, personalized routing, concierge features) and privileges in pick-up/drop-off zones that, collectively, shape a "premium mobility network space"—a spatial signature distinct from mass transit corridors or generalized ride-hailing services (Groth et al., 2023). The geography of these networks is therefore both a reflection of market segmentation and a driver of differential mobility access across neighborhoods (Groth et al., 2023).

2. Psychological barriers and social acceptance.

Acceptance of sharing solutions—whether vehicle sharing or ridepooling—is strongly influenced by perceptions of autonomy, privacy, and trust (Burghard & Scherrer, 2022; Hunecke, Richter & Heppner, 2021). Burghard and Scherrer (2022) identify psychological factors that predict whether individuals are predisposed to share vehicles versus rides, noting that perceived control and convenience, concerns about hygiene and social friction, and identity-based preferences play key roles. Hunecke et al. (2021) emphasize that fears of autonomy loss and data misuse are substantial barriers to peer-to-peer collaborative car use, particularly in contexts where data governance is opaque. Taken together, the psychological literature indicates that premium services may both exploit and exacerbate these dynamics: users may accept premium, private-feeling

experiences in place of shared baseline services, thus reinforcing market stratification (Burghard & Scherrer, 2022; Hunecke et al., 2021).

3. Telematics requirements and fleet digital services.

Contemporary fleet operations demand telematics systems capable of supporting near-real-time decision-making, regulatory compliance, predictive maintenance, and driver and asset monitoring (Heinbach, Kammler & Thomas, 2022). Heinbach et al. (2022) articulate design requirements from a "digital service side" perspective, including emphasis on modularity, interoperability, secure data transmission, and analytics-ready data architectures. These requirements align closely with FaaS operational needs—dynamic allocation of vehicles, telemetry-driven health monitoring, and responsive routing based on demand signals (Deshpande, 2024; Heinbach et al., 2022). The result is an operational mandate for telematics systems to move beyond mere location tracking to become the backbone of service orchestration.

4. Cloud-native computation: serverless and stateful functions.

Serverless computing promises elasticity and reduced overhead for complex, event-driven workloads typical of mobility services (Hellerstein et al., 2019). However, Hellerstein et al. (2019) caution that serverless architectures introduce trade-offs—cold-start latencies, limited execution time, and statelessness by default—that can impede real-time control loops. Sreekanti et al. (2020) advance this discussion by proposing stateful function-as-a-service approaches (Cloudburst) that allow functions to maintain application state at the edge of serverless deployments, thereby reconciling convenience with low-latency stateful interactions. For fleet operations, the ability to maintain ephemeral yet consistent state across distributed functions is critical—for example, to reconcile vehicle allocation decisions during distributed demand spikes, to ensure coherent scheduling in the face of network partitions, and to support transactional integrity in telematics-derived billing and permissions (Hellerstein et al., 2019; Sreekanti et al., 2020).

5. Fleet-as-a-Service operational model.

The FaaS concept in mobility reimagines fleets as consumable services rather than capital assets, enabling flexible provisioning for testing, operations, and scaling (Deshpande, 2024). Deshpande (2024) highlights how

FaaS can revolutionize sustainable vehicle testing and operations by providing standardized APIs for vehicle telemetry, remote diagnostics, and modular service composition. When combined with robust telematics and cloud-native computation, FaaS facilitates elastic supply provisioning responsive to demand, supports multi-tenant fleet operation, and provides pathways for circularity in vehicle life-cycle management (Deshpande, 2024; Heinbach et al., 2022).

6. Environmental and sustainability linkages.

Vehicle electrification and fleet optimization have the potential to yield significant environmental benefits, but outcomes hinge on lifecycle considerations and the energy systems supplying mobility (Helmert & Marx, 2012; Brundtland, 1987; Goodland, 1995). Helmers and Marx (2012) emphasize that technical characteristics of electric vehicles (EVs) influence emissions reductions, but that these benefits must be analyzed in the context of electricity generation mixes and manufacturing impacts. The normative sustainability framework set by Brundtland (1987) and extended by Goodland (1995) requires that mobility transitions pursue both intra- and intergenerational equity, avoid burden shifting, and prioritize systemic resilience. Thus, while premium networks and FaaS can improve utilization rates and accelerate EV deployment, they can also reproduce inequities if not governed with distributive objectives in mind (Groth et al., 2023; Deshpande, 2024).

7. Emergent tensions and trade-offs.

Synthesizing the above, the analysis surfaces key tensions: premiumization vs. equity (Groth et al., 2023); privacy/autonomy vs. optimization (Hunecke et al., 2021; Burghard & Scherrer, 2022); elasticity vs. state consistency in compute (Hellerstein et al., 2019; Sreekanti et al., 2020); and electrification benefits vs. lifecycle externalities (Helmert & Marx, 2012). These trade-offs suggest that technical innovations alone are insufficient; governance, policy, and design ethics must shape how mobility services evolve.

DISCUSSION

The discussion unpacks implications of the results, elaborates theoretical contributions, addresses limitations, and charts an agenda for research and practice.

Theoretical integration: geography, psychology, and computation.

A central theoretical contribution of this work is the integrated model that connects spatial concentration of premium services, psychological acceptance dynamics, and computational architectures. The premium mobility network space described by Groth et al. (2023) is not merely a product of demand and pricing; it arises from co-evolving technological affordances and social preferences. For instance, when operators can guarantee near-instantaneous vehicle availability through sophisticated telematics and serverless orchestration, they can market premium experiences that offer both rapidity and privacy—attributes that appeal to individuals averse to pooling or shared usage (Burghard & Scherrer, 2022; Hunecke et al., 2021). This feedback loop—technology enabling differentiated service which then shapes user expectations—requires that scholars study mobility systems as socio-technical ensembles where spatial patterns, individual attitudes, and computational designs co-produce outcomes (Groth et al., 2023; Hellerstein et al., 2019).

Privacy and autonomy as design constraints.

The literature is clear that privacy invasion and perceived autonomy loss are powerful inhibitors of collaborative use (Hunecke et al., 2021). In practice, telematics and serverless compute can exacerbate these concerns when data flows are pervasive and governance opaque. However, these same technologies can support privacy-preserving designs: for example, edge-localized analytics enabled by stateful serverless functions can process telemetry without transmitting raw streams to central clouds, thereby reducing exposure of personally identifiable movement data (Sreekanti et al., 2020; Hellerstein et al., 2019). Designers should thus treat privacy not as an afterthought but as an architectural requirement, selecting compute patterns and telematics protocols that enable data minimization and user control (Heinbach et al., 2022; Hunecke et al., 2021).

Serverless computing: promise and caveats.

Serverless offers operational simplicity and cost alignment with usage patterns—valuable properties for mobility services characterized by diurnal and event-driven variability (Hellerstein et al., 2019). Yet Hellerstein et al. (2019) warn against viewing serverless as a panacea: cold starts, limited execution windows, and statelessness complicate scenarios that demand persistent, low-latency state. The Cloudburst stateful functions approach (Sreekanti et al., 2020) provides a promising way to retain FaaS-style ease while supporting

the statefulness required by mobility orchestration. Practically, mobility operators should adopt hybrid architectures: serverless functions for episodic analytics and event handling, and stateful function platforms for critical, low-latency coordination tasks (Sreekanti et al., 2020; Hellerstein et al., 2019).

FaaS (Fleet-as-a-Service) operationalization and testing.

Deshpande (2024) argues that FaaS can transform sustainable vehicle testing and operations by abstracting fleet capabilities through APIs. This abstraction enables multi-tenant use, standardized telemetry semantics, and modular service composition. When combined with robust telematics and cloud-native compute, FaaS can facilitate large-scale experimentation (A/B testing of routing algorithms, battery performance under real-world loads), rapid rollouts, and circular strategies for vehicle end-of-life. Yet caution is warranted: the commoditization of fleets risks externalizing maintenance costs or creating lock-in where operators depend on proprietary FaaS platforms that limit interoperability (Deshpande, 2024; Heinbach et al., 2022). Regulatory frameworks that mandate open telemetry standards, as well as interoperability protocols, can mitigate these risks (Heinbach et al., 2022).

Equity and sustainability governance.

Premium mobility networks often concentrate in affluent zones and cater to demand for privacy and convenience, amplifying spatial inequities (Groth et al., 2023). To align mobility transitions with sustainability goals, governance must combine technology-neutral standards with active redistributive policies—such as service coverage mandates, subsidies for underserved areas, and incentives for shared pooling in low-income neighborhoods (Groth et al., 2023; Brundtland, 1987). Electrification alone will not guarantee equitable outcomes; supply-side measures (charging infrastructure distribution, vehicle procurement strategies) and demand-side policies (pricing structures, service obligations) are necessary to avoid reinforcing privilege (Helmert & Marx, 2012; Goodland, 1995).

Scenario projections.

Three plausible scenarios illustrate the range of futures:

- **Stratified premiumization.** Technical excellence and targeted marketing drive premium networks to proliferate in core districts. Operators exploit telematics and

serverless orchestration to deliver private, responsive services. Equity gaps widen as less profitable neighborhoods receive declining service. Environmental gains emerge modestly via electrified premium fleets but are offset by increased empty vehicle kilometers travelled (VKT) if repositioning remains unmanaged (Groth et al., 2023; Helmert & Marx, 2012).

- **Platform collectivism.** FaaS platforms adopt open standards, enabling cooperative provisioning across multiple providers. Telematics interoperates across fleets; stateful serverless infrastructures optimize across operators to reduce deadheading. Shared pooling is actively incentivized, and electrification is coordinated to match renewable generation. This scenario produces the strongest sustainability and equity gains (Deshpande, 2024; Heinbach et al., 2022; Sreekanti et al., 2020).

- **Fragmented techno-commercialism.** Proprietary FaaS and telematics lock users into vendor ecosystems. Serverless orchestration reduces costs for operators but creates brittle dependencies. Privacy breaches and opaque data markets generate public backlash, prompting restrictive regulation that slows innovation. Environmental outcomes are mixed and contingent on how regulators balance data controls with operational flexibility (Hellerstein et al., 2019; Hunecke et al., 2021).

These scenarios illustrate how the interplay of technical architecture, market structure, and governance choices can produce divergent social and environmental results.

Limitations of the synthesis.

The article relies exclusively on the provided references and does not bring new empirical measurement. As such, the model is constrained by the scope and focus of those studies. For example, spatial analyses of premium mobility are derived from Groth et al. (2023) and may reflect case-study geographies that are not universally representative. Psychological claims are grounded in Burghard and Scherrer (2022) and Hunecke et al. (2021), whose samples and contexts may not capture cross-cultural variability. Technical recommendations draw heavily on evaluation and critique literature in serverless computing (Hellerstein et al., 2019; Sreekanti et al., 2020), which focuses on platform capabilities rather than long-term operational deployments in mobility contexts. Future empirical research should triangulate these findings through multi-city comparative studies, field experiments in telematics deployments, and stakeholder interviews across socio-economic strata.

Future research directions.

Several promising avenues arise. First, longitudinal studies of premium mobility adoption can assess how user preferences evolve as services scale and as privacy incidents or regulatory interventions occur (Groth et al., 2023; Hunecke et al., 2021). Second, experimental deployments that compare hybrid serverless/stateful architectures in live fleet operations would provide actionable engineering guidance (Hellerstein et al., 2019; Sreekanti et al., 2020). Third, cross-disciplinary projects that integrate lifecycle assessment with fleet operation simulations can quantify net environmental impacts of FaaS strategies under varying electricity mixes and vehicle procurement models (Helmerts & Marx, 2012; Deshpande, 2024). Fourth, policy design experiments that couple service-targeted subsidies with open telematics standards would test whether regulatory nudges can shift operators toward more equitable service footprints (Heinbach et al., 2022).

CONCLUSION

The mobility transition at the intersection of premium services, Fleet-as-a-Service operational models, telematics innovation, and cloud-native compute presents both promise and peril. Premium mobility networks create differentiated spatial signatures and can cater to latent demand for privacy and immediacy, yet run the risk of entrenching inequity if left unguided (Groth, Klinger & Otsuka, 2023; Burghard & Scherrer, 2022). Telematics and FaaS operational principles offer pathways for efficiency, resilience, and improved utilization (Heinbach, Kammler & Thomas, 2022; Deshpande, 2024), but their benefits hinge on design choices in data governance and compute architectures. Serverless and stateful functions provide powerful tools for handling event-driven mobility workloads, yet their operational trade-offs—particularly concerning state management and latency—must be carefully managed (Hellerstein et al., 2019; Sreekanti et al., 2020).

Policy-makers and practitioners should prioritize four design imperatives. First, enforce telematics interoperability and open data standards to avoid vendor lock-in and to enable cooperative optimization across fleets (Heinbach et al., 2022). Second, adopt privacy-by-design and data-minimization practices, leveraging edge processing and stateful serverless patterns to limit unnecessary transmission of sensitive telemetry (Hunecke et al., 2021; Sreekanti et al., 2020). Third, align FaaS incentives with equity and sustainability goals

through targeted subsidies, service coverage mandates, and procurement rules that favor low-emission fleets and equitable service distribution (Deshpande, 2024; Helmerts & Marx, 2012). Fourth, promote hybrid compute architectures that use serverless functions for elasticity while retaining stateful constructs for mission-critical coordination tasks (Hellerstein et al., 2019; Sreekanti et al., 2020).

Ultimately, the trajectory of urban mobility will be shaped not merely by technological possibility but by normative choices. The choices to prioritize equity, sustainability, and democratic governance will determine whether premium networked mobility becomes a selective luxury or a lever for inclusive, low-carbon transport. This article synthesizes the available literature to make visible the interconnected technical and social pathways that lead to those outcomes, and it calls on researchers, practitioners, and policy-makers to engage in coordinated, interdisciplinary action to guide the mobility transition toward public value.

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