



Service Orchestration: Enabling the Future of Autonomous Transit Deployments

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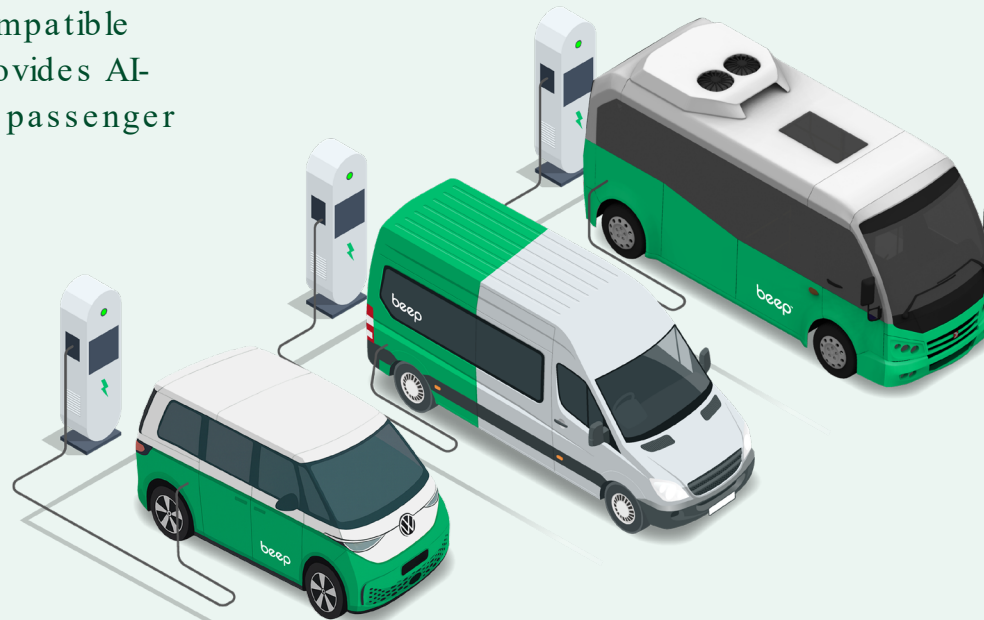
The next generation of mobility

Beep is the leader in the deployment of purpose-built autonomous shuttles in the United States.

Our Partnerships with multiple vehicle OEMs and ADS developers enable us to provide the most technologically-advanced platforms in the market.

Beep's AutonomOS™ software technology, designed to be compatible with common data protocol, provides AI-assisted human supervision for passenger safety and service governance.

Integrating Beep's software solution with a leading ADS developer and an automotive-grade autonomous shuttle enables a powerfully scalable, flexible autonomous vehicle platform designed to safely meet the dynamic needs of a growing community.



The Gap Between Autonomy and Transit Operations

- How can a transit agency looking to deploy AVs:
 - Plan an integrated service rather than a demonstration?
 - Enforce transit operations SOPs and operational frameworks?
 - Configure transit operations using AV specific service parameters?
 - Feasibly manage and coordinate AV fleet actions across modes and services?
 - Run an AV service without technical barriers to entry?



Role of Service Orchestration

- Proactive and real-time fleet management
- Provide a mechanism for municipalities to control multiple vehicles with different tasks
- Align autonomous service to higher-level planning outcomes, integrated with data from various planning systems and smart infrastructure
- Utilize advanced algorithms for forecasting, classification, simulation, and optimization to drive decision making
- Enable scenarios like:
 - Limiting vehicle idling near a football stadium
 - Synchronize vehicle arrivals around train schedule
 - Re-task an on-demand vehicle for fixed-route service



Dynamic, Flexible, and Adaptable Transit Services

- Utilize commingling to service fixed routes, on-demand service, and paratransit under one umbrella
- Multi-objective optimization to drive accessibility, regulatory, or operational outcomes rather than just profit maximization
- Structure services to focus on first/last mile and feeder routes to leverage legacy transit infrastructure
- Easy portability of data between services via GTFS and other open protocols



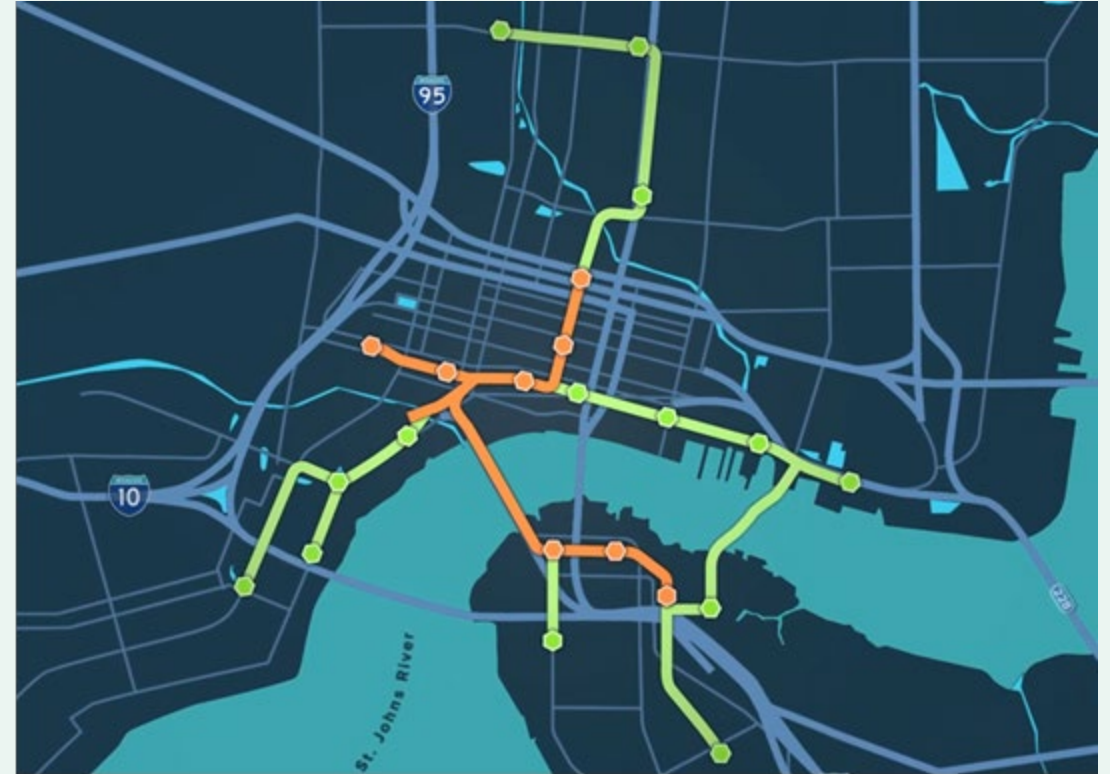
Multimodal Integration and Coordination

- Coordination and integration with transit allows seamless commingling and leveraging of multiple AV and non-AV modes
- Minimize disruption of transfers on system performance and passenger experience
- Command center data and SOP integration between various modes
- Solve optimization problems that consider the network at large while imposing constraints that allow for the most efficient service within system guidelines



System-Level versus Fleet-Scale Optimization

- Fleet-scale optimization ignores additional services and transportation impacts
- System-level optimization focuses on larger goals and optimizes transit operations across the entire system, balancing resource allocation and service goals effectively.
- System-integrated fleet management and orchestration allows for connection with municipal smart infrastructure and data sources



Vision for the Future of Autonomous Transit Operations

- Autonomous transit systems are designed to scale efficiently and meet growing urban mobility demands worldwide.
- Integrated service orchestration ensures dependable and continuous transit services.
- Future transit focuses on personalized, convenient, and accessible travel experiences for all users.
- Autonomy becomes a key cog in the transit toolkit

