



U.S. DEPARTMENT OF ENERGY

# SMARTMOBILITY

Systems and Modeling for Accelerated Research in Transportation

## Empowering Virtual Agents with the Freedom to Choose: Embedding Modal Choice Models into BEAM, the Agent-Based Framework for Behavior, Energy, Autonomy, and Mobility

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# BEAM Objective

## Challenges

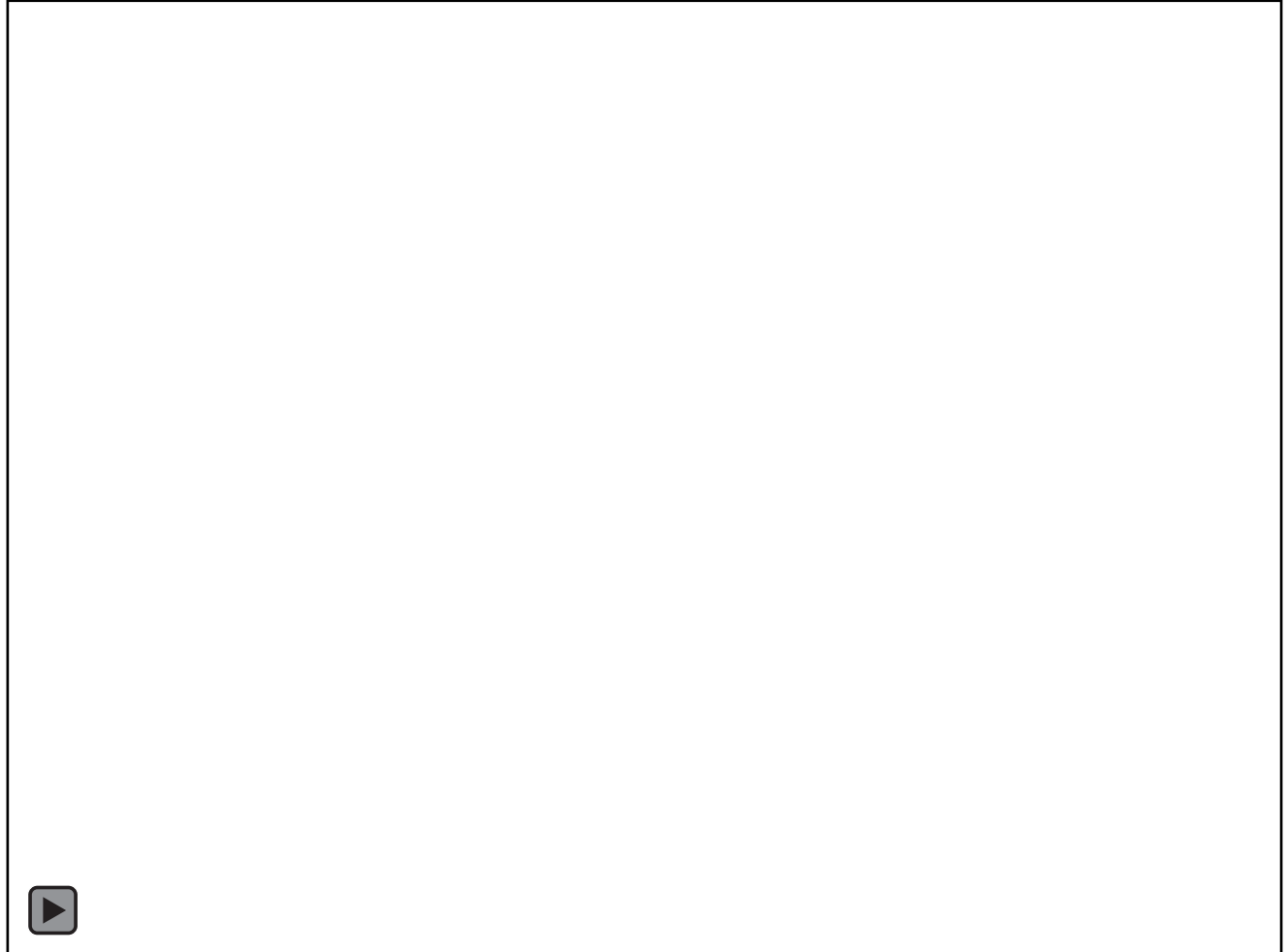
- Transportation system becoming more dynamic
- Scalable dynamic simulation difficult

## Goal

- Estimate the energy and accessibility implications of modal shift among conventional transit and emerging travel systems (emphasis on transit vs. TNCs and electrification)

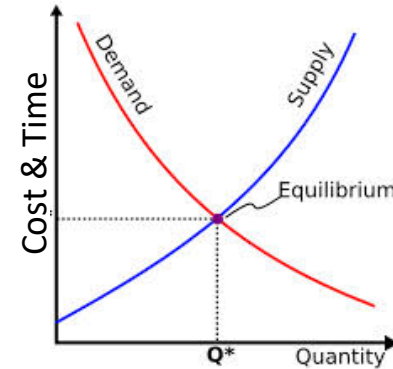
## Approach

- Developing



# BEAM is for Resource Markets

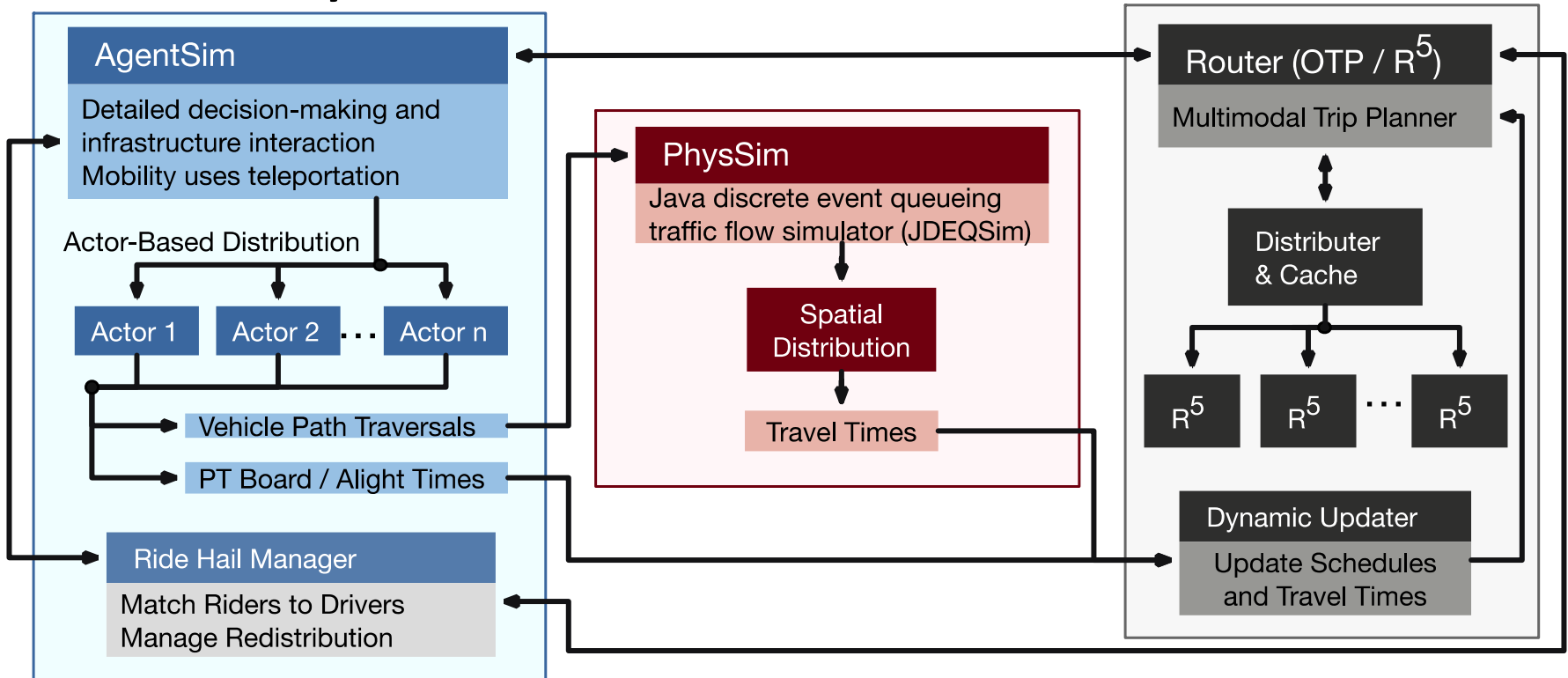
- Resource Markets:
  - Road Capacity
  - Vehicle Capacity
  - TNC Availability
  - Parking/Refueling Access
- Supply:
  - Driving
  - Transit (any GTFS)
  - Walk
  - TNC (automated, manual)
  - Parking
  - Refueling Infrastructure
  - Biking



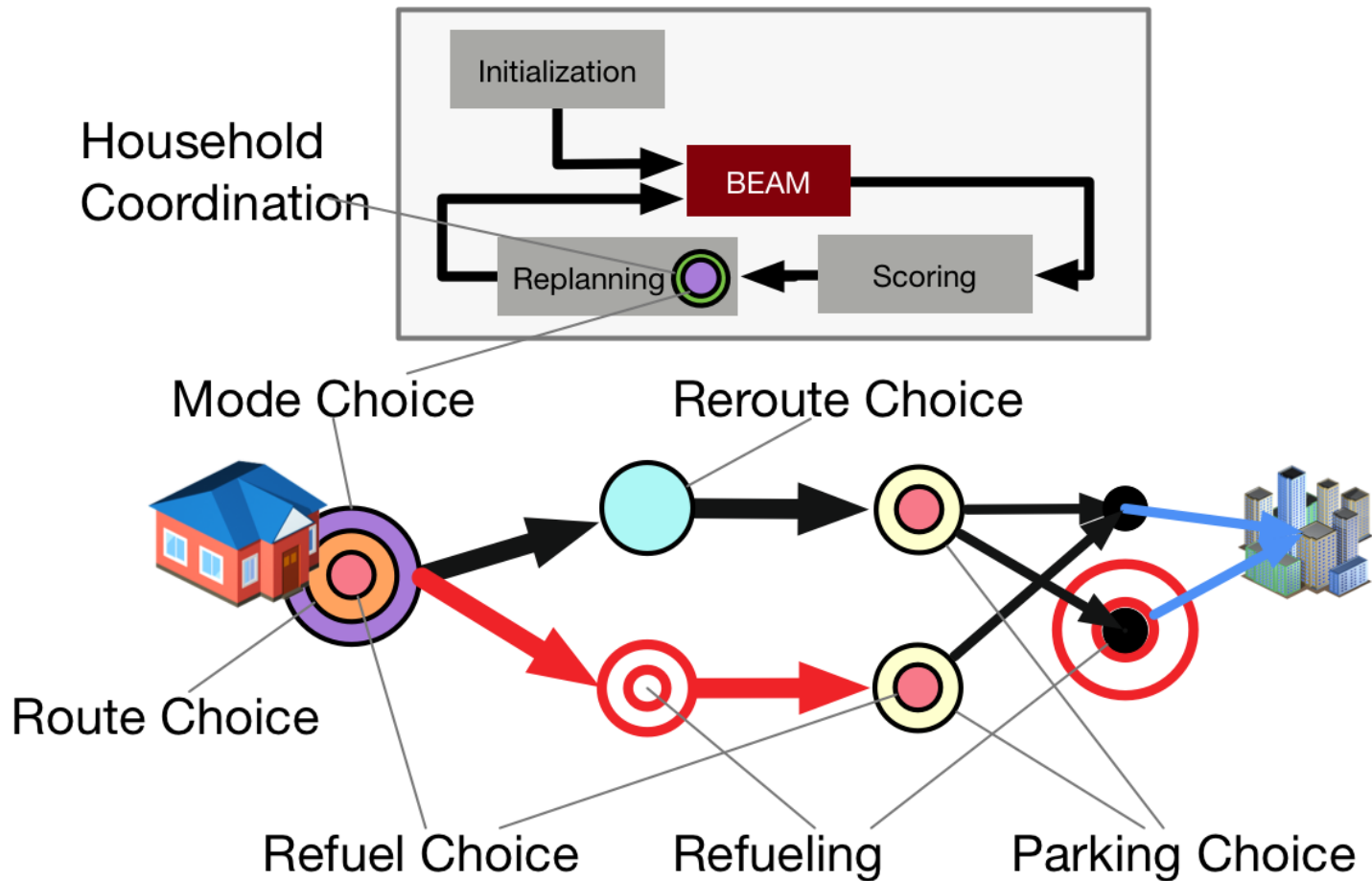
- Demand (governed by behaviors):
  - Mode Choice
  - Price & Time Sensitive
  - Route Choice
  - Multimodal
  - Rerouting
  - Park Choice
  - Refuel Choice

# BEAM Architecture

## BEAM Mobility Sim



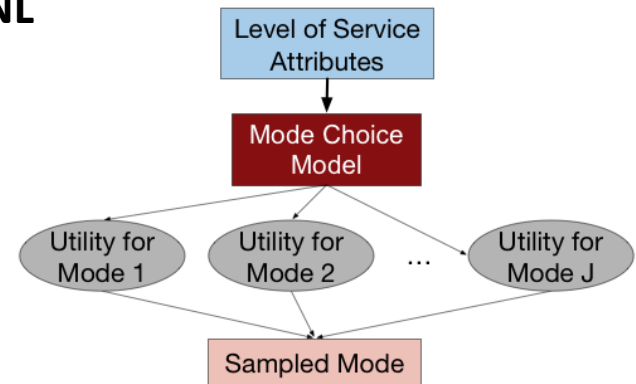
# Behavioral Modeling in BEAM



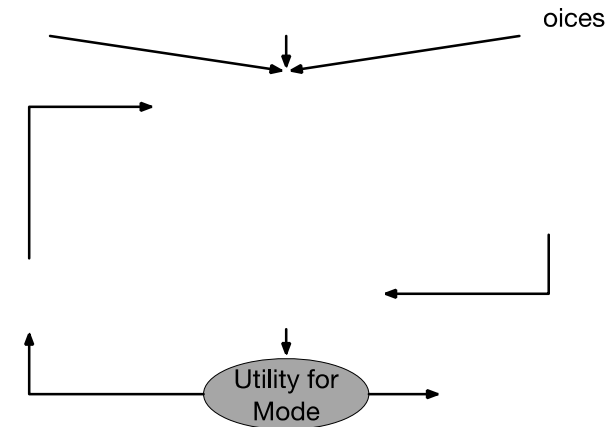
# Two Mode Choice Models

- Multinomial Logit Model (MNL) vs. Latent Class Mode Choice Model (LCCM)
- MNL captures tradeoff between cost and time with some inherent preferences for modes (used for tuning)
- LCCM is a two-stage model:
  - Class Membership
  - Mode Choice
- Modality style a function of consumer surplus, which summarizes system level of service

## MNL

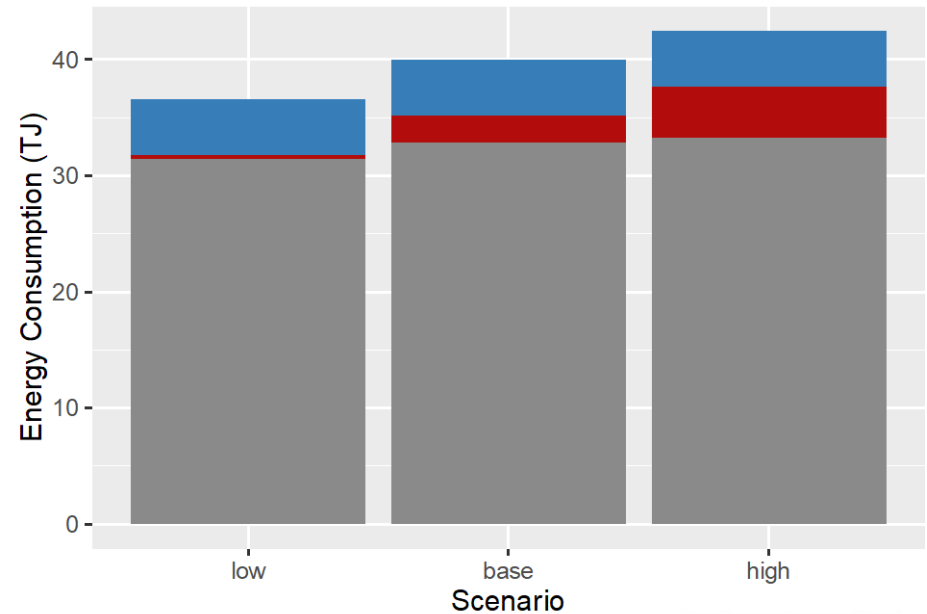
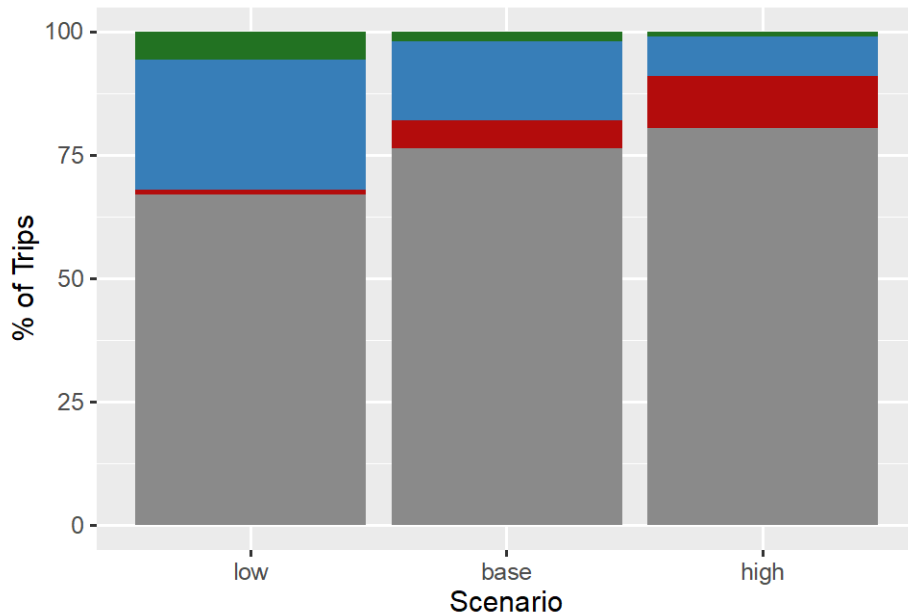


## LCCM



Adapted from Vij et al. (2017)

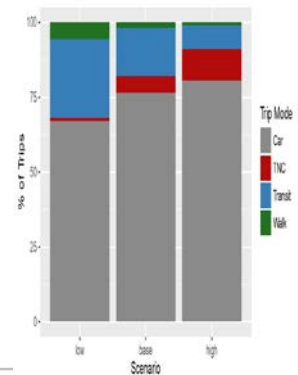
# Impact of Value of Time



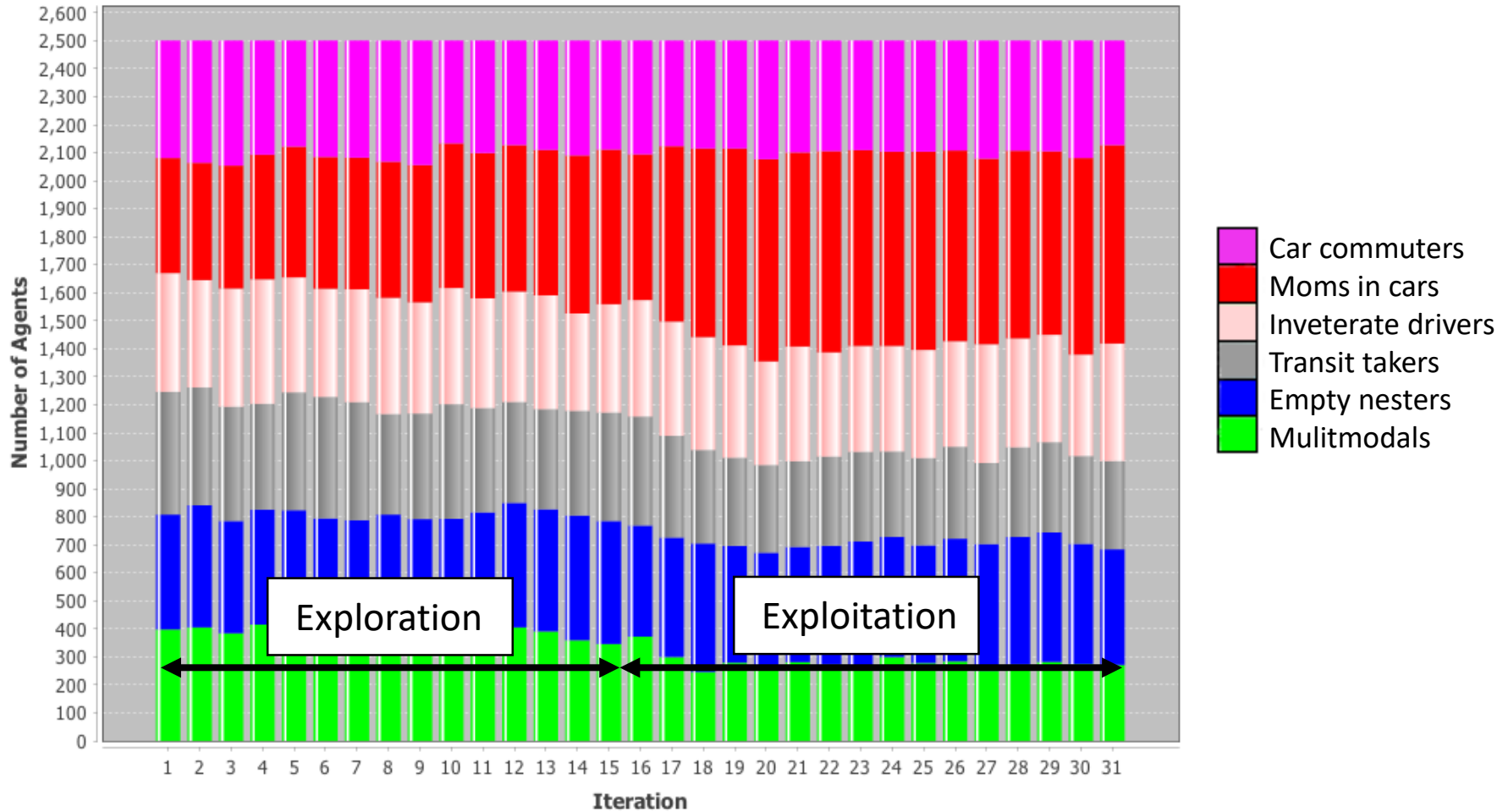
- Using multinomial logit choice model
- Large change in split driven by VOT changes
- Argues for VOT heterogeneity

## Scenarios:

- Low \$8.5/hr
- Base \$16.9/hr
- High \$25.4/hr

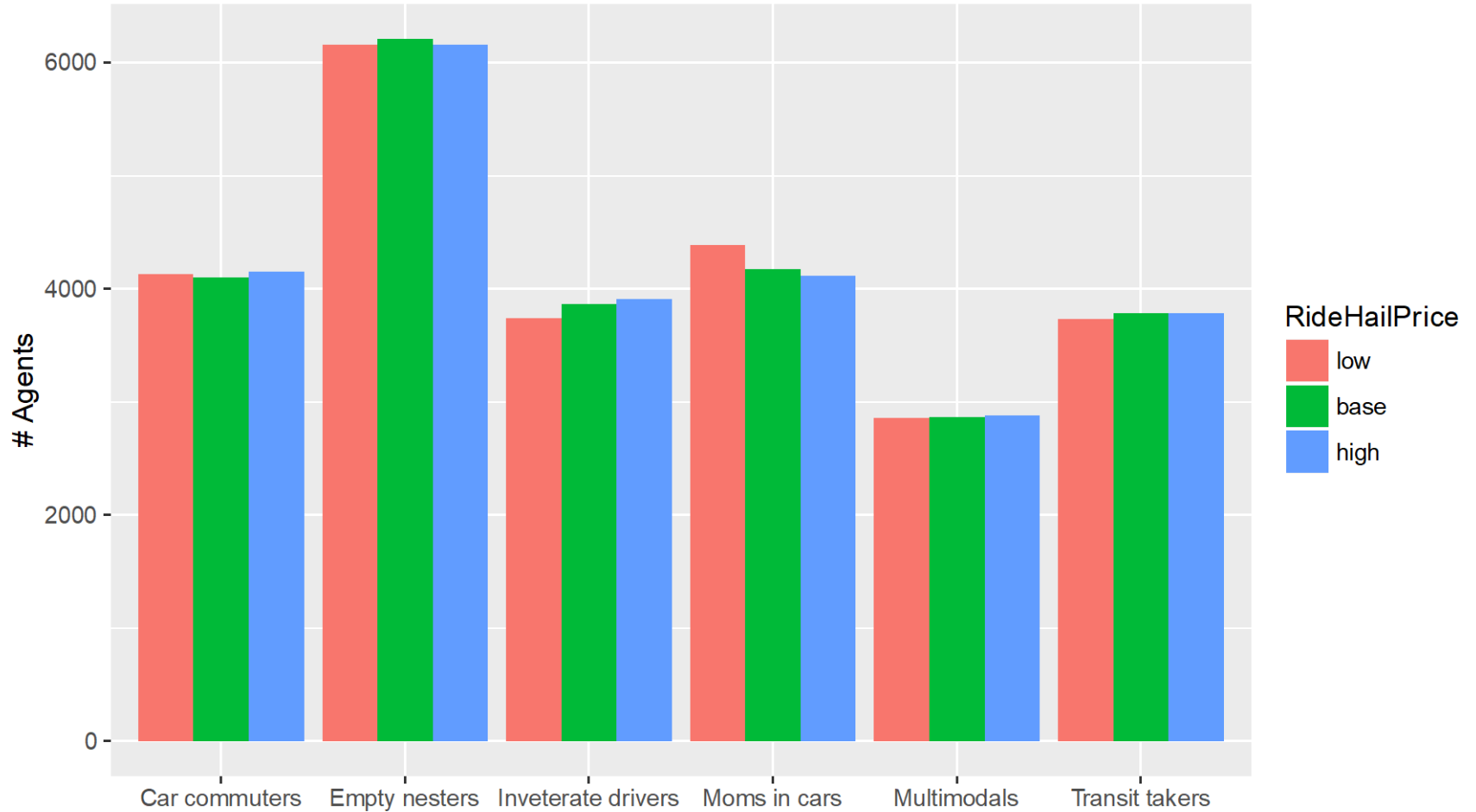


# Modality Style Convergence





# Modality Style Sensitivity



Thank you!

<http://beam.lbl.gov>

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