Breakout Group: Integrated Models and Incentives

Discussion Summary

March 10, 2014

Group Exercise 1

Sacramento, CA, March 10, 2020.

Today, the California Department of Transportation (Caltrans) announced that plans for widening the I-405 corridor in Los Angeles have been put on hold indefinitely. In a press release, Governor Garcia said, "Six years ago, we thought that added capacity was the primary way to reduce congestion on California's roadways. Now, with the increasing adoption of the StarRoute system by various consumer smartphone apps, travelers are more and more becoming the solution, rather than the problem." In a related statement, the developers of StarRoute acknowledged the seminal contributions of the STAR Program, funded in 2015 by the U. S. Department of Energy's Advanced Research Projects Agency—Energy (ARPA-E). "ARPA-E connected visionaries in transportation data, network modeling, and personal incentives to create a flexible, adaptive framework for transportation control that travelers actually want to use", a spokesman for StarRoute said.

Key Questions for Breakout Session

1. When you were asked to combine the technical roles of network modeling and consumer incentives, what was the most difficult obstacle you faced? How were you able to overcome it?

- **Key innovations:**

  ▶ Move to meeting virtualization

  ▶ Global scheduling of resources and trips

  ▶ Routing and itinerary management specifying QoS requirements and handing trip execution details to the system

  ▶ Heterogeneous system architecture for plug-and-play interoperability.

  ▶ Incident minimization and dynamic optimization around incidents

Key Questions for Breakout Session

1. When you were asked to combine the technical roles of network modeling and consumer incentives, what was the most difficult obstacle you faced? How were you able to overcome it?

- **Biggest challenges:**

    ▶ Transition period when the system consists of a mix of autonomous and manually operated vehicles

    ▶ Getting everyone to accept automation on highways (privacy, security, income)

    ▶ Accurate modeling of individual behavior as part of the system model

    ▶ Modeling access roads and the last mile to the home is the hardest

    ▶ Balancing the incentives to manage the demand and prevent overuse of resources

    ▶ Modeling incidents (accidents, construction)

    ▶ Develop a heterogeneous architecture to accommodate plug-and-play

    ▶ The validation of such a large and distributed software control system

Key Questions for Breakout Session

1. When you were asked to combine the technical roles of network modeling and consumer incentives, what was the most difficult obstacle you faced? How were you able to overcome it?

- **Transportation as a service:**
  - ▶ Virtualization of the all system components
  - ▶ Remove road signs and traffic signals and replace them with heads-up display signals tailored to individual users and optimized for global system objectives.
  - ▶ QoS guarantees through resource scheduling
  - ▶ Layered and decentralized control system

Key Questions for Breakout Session

2. Collection of relevant and timely data from travelers is a key accomplishment of StarRoute. What were the most important aspects of data collection that facilitated your team's approach to Models and Incentives?

- **Data collection:**

  - ▶ Deployment of low-cost devices to enable full system observability

  - ▶ Deployment of drones, for example, to monitor and track the vehicles in the system

  - ▶ Using segmentation to achieve accuracy targets without complete data collection

- **Derived data:**

  - ▶ Derivation of behavior through logical segmentation and trip purpose analysis

  - ▶ Capturing or predicting future behavior or intentions to enable accurate resource scheduling

Key Questions for Breakout Session

3.   It has been difficult to quantify the impact of StarRoute on congestion. How do you determine the impact of proposed improvements in Models and Incentives, in light of this difficulty?

- **Robust network performance prediction that takes the incentives into consideration**

- **Impact measurements:**

    - Energy efficiency

    - System/route reliability

    - End-to-end QoS accuracy

    - Environmental impacts

CHANGING WHAT'S POSSIBLE