

# Reflections...

Eric Horvitz  
Microsoft Research

CCC RISES  
Washington DC, Feb. 2011

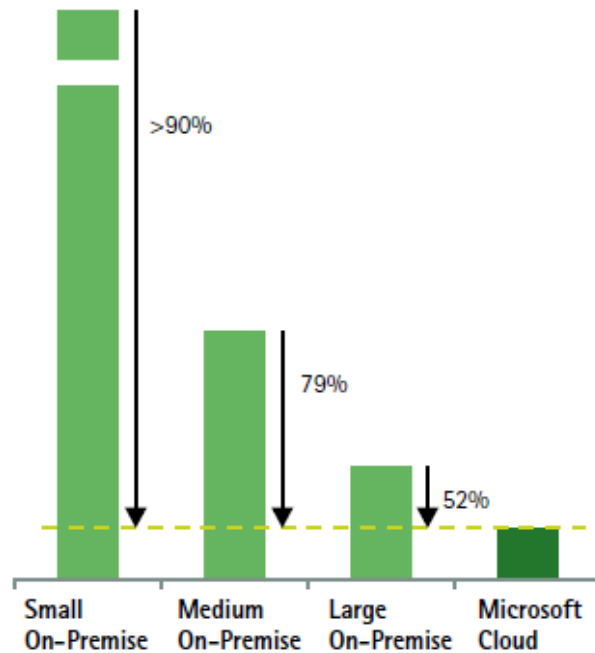
# Projects in Sustainability

- Transportation
- Work distribution
- Green computing
- Datacenter efficiencies
- Energy usage forecasting,  
tracking, controls
- Tools for others

# Efficiencies with Scale

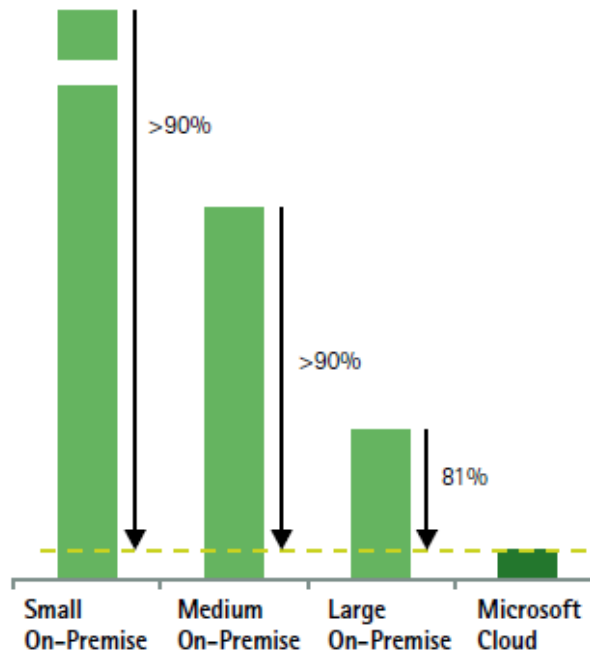
## Microsoft Exchange

On-premise vs. Cloud Comparison,  
CO2e per user



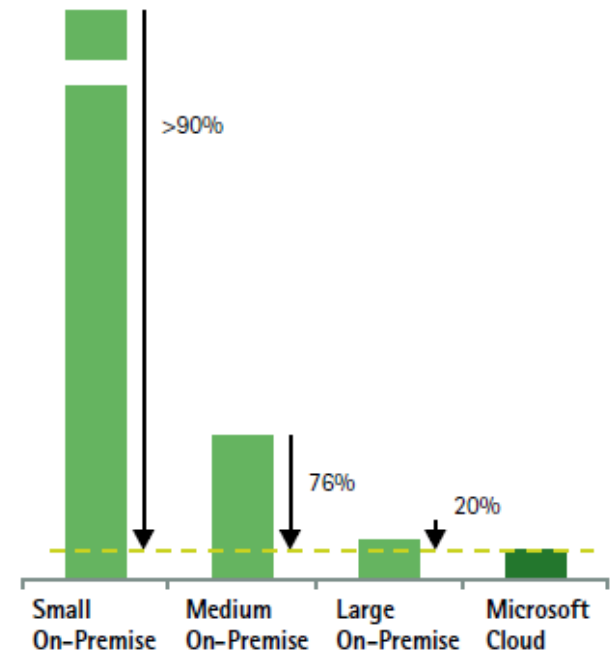
## Microsoft Sharepoint

On-premise vs. Cloud Comparison,  
CO2e per user



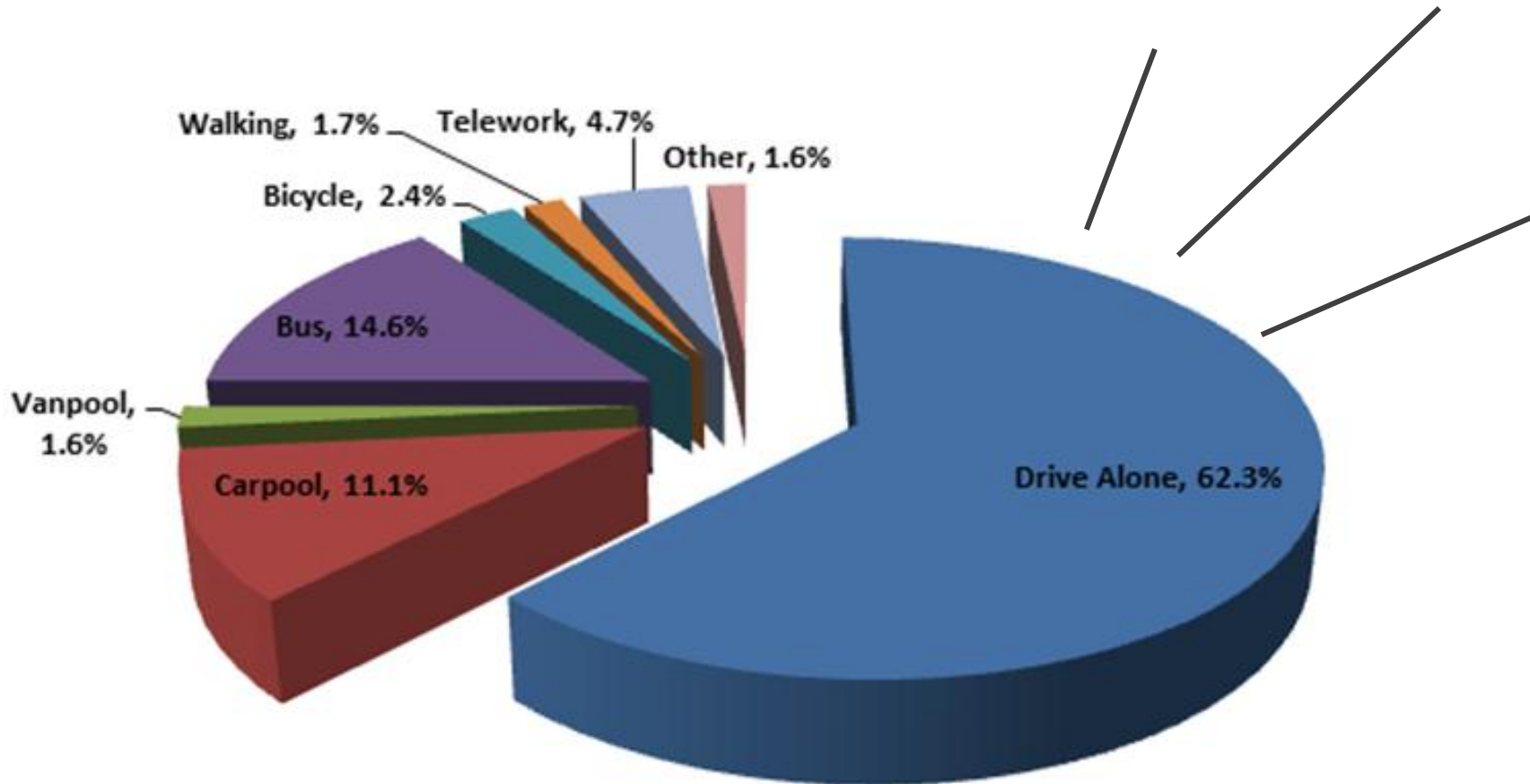
## Microsoft Dynamics CRM

On-premise vs. Cloud Comparison,  
CO2e per user



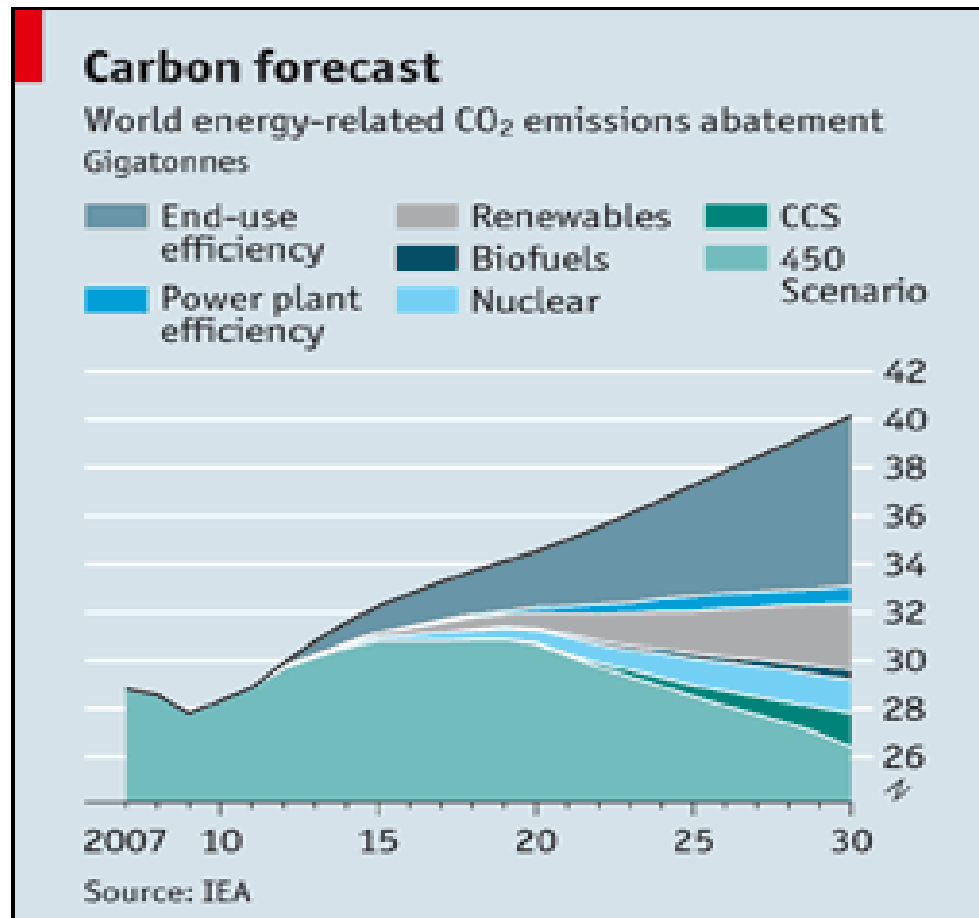
# Microsoft Commuting Workload

- ~175,000 people
- ~55,000 in Puget Sound Region



# Promise of Efficiency & Conservation

- Copenhagen meeting
- Emissions abatement → 450 ppm by 2030 ( $\sim 2^\circ$ ).



(IEA 10/09)

# Ridesharing: Computing & Social Sciences

- Matching algorithms: planned and instant
- Incentives: mechanism design for truthful reporting
- Collaboration & plans with related goals
- Preferences and comfort: social component
- Daily workflow: Outlook/Exchange

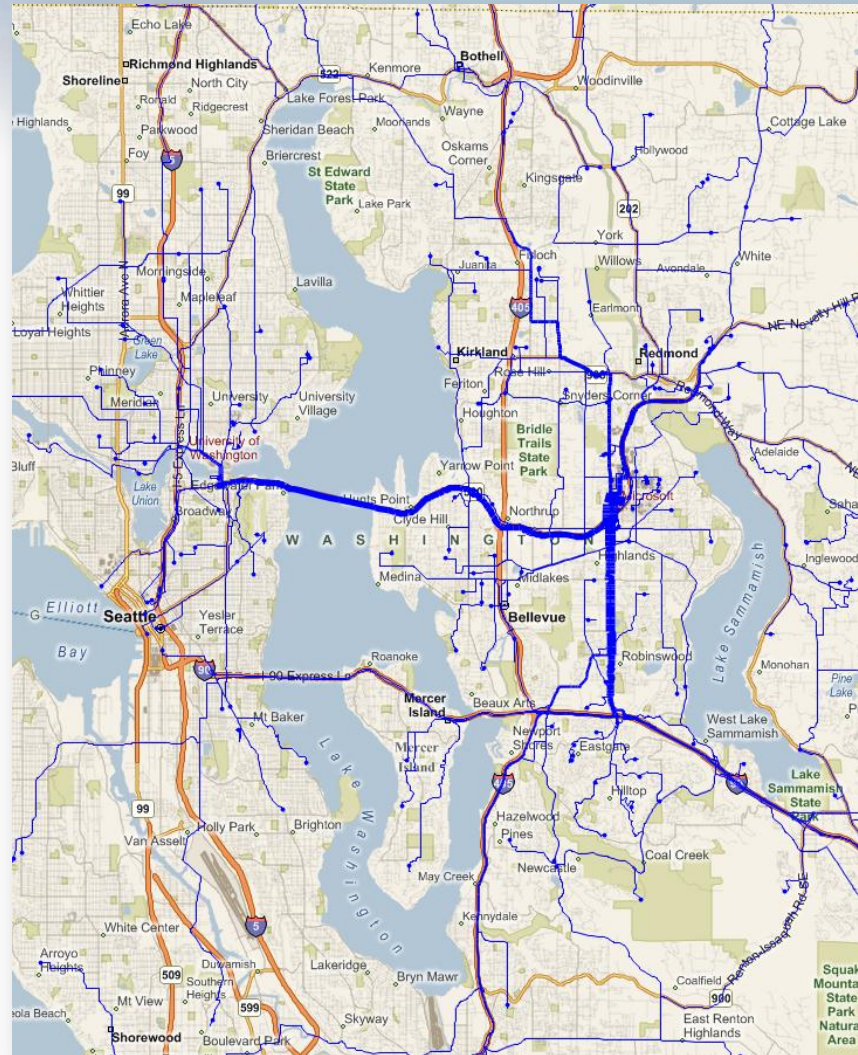
*Coordination with King County Metro,  
WashDOT, MS Facilities, MS Sustainability.*

*More details: [Collaboration and Shared Plans in the Open World:  
Studies of Ridesharing](#), IJCAI 2009.*



# Computational Futures for Ridesharing

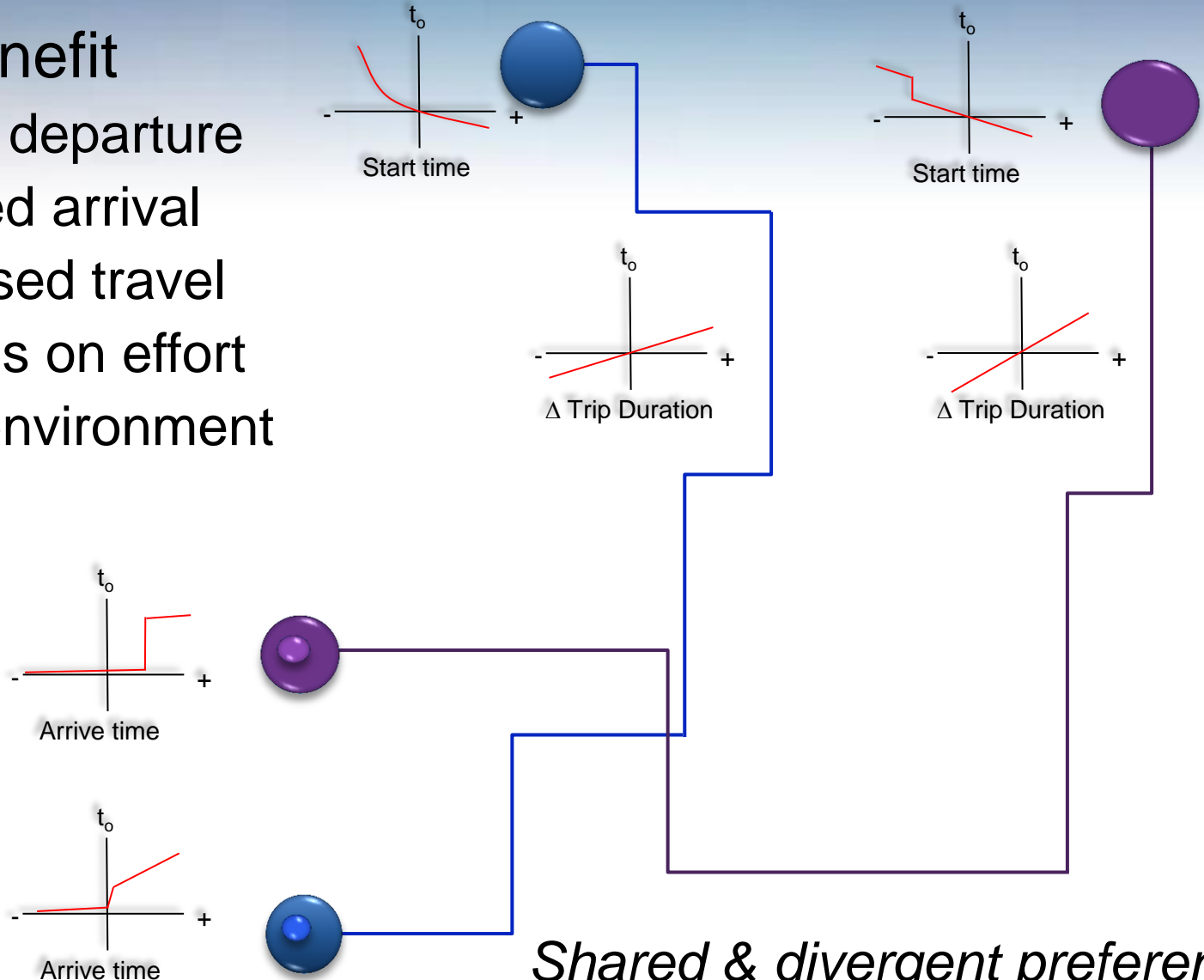
- GPS data: AM/PM commutes to & from Microsoft



# Balancing Diverse & Changing Needs

## Cost-benefit

- Earlier departure
- Delayed arrival
- Increased travel
- Savings on effort
- Fuel, environment



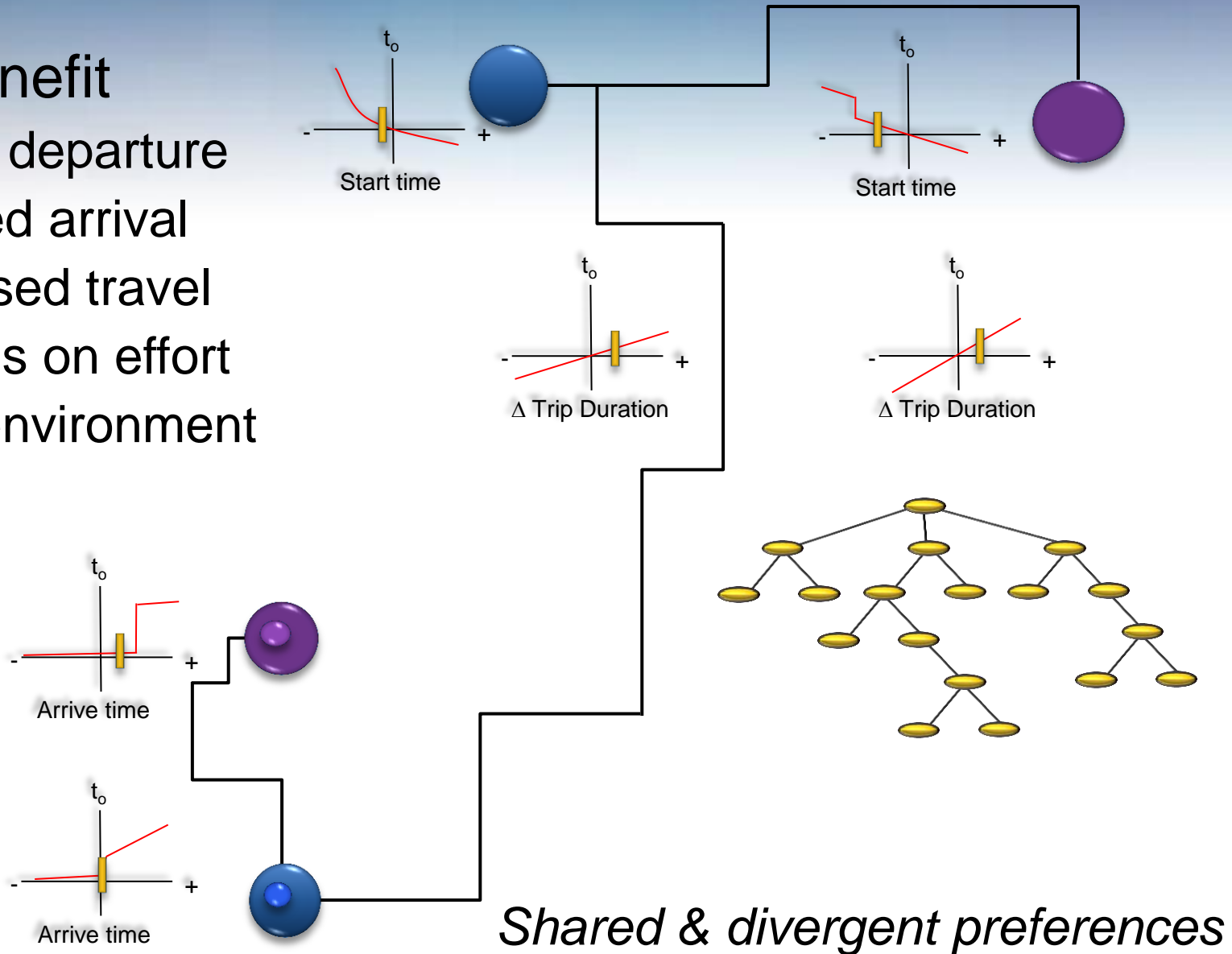
*Shared & divergent preferences*



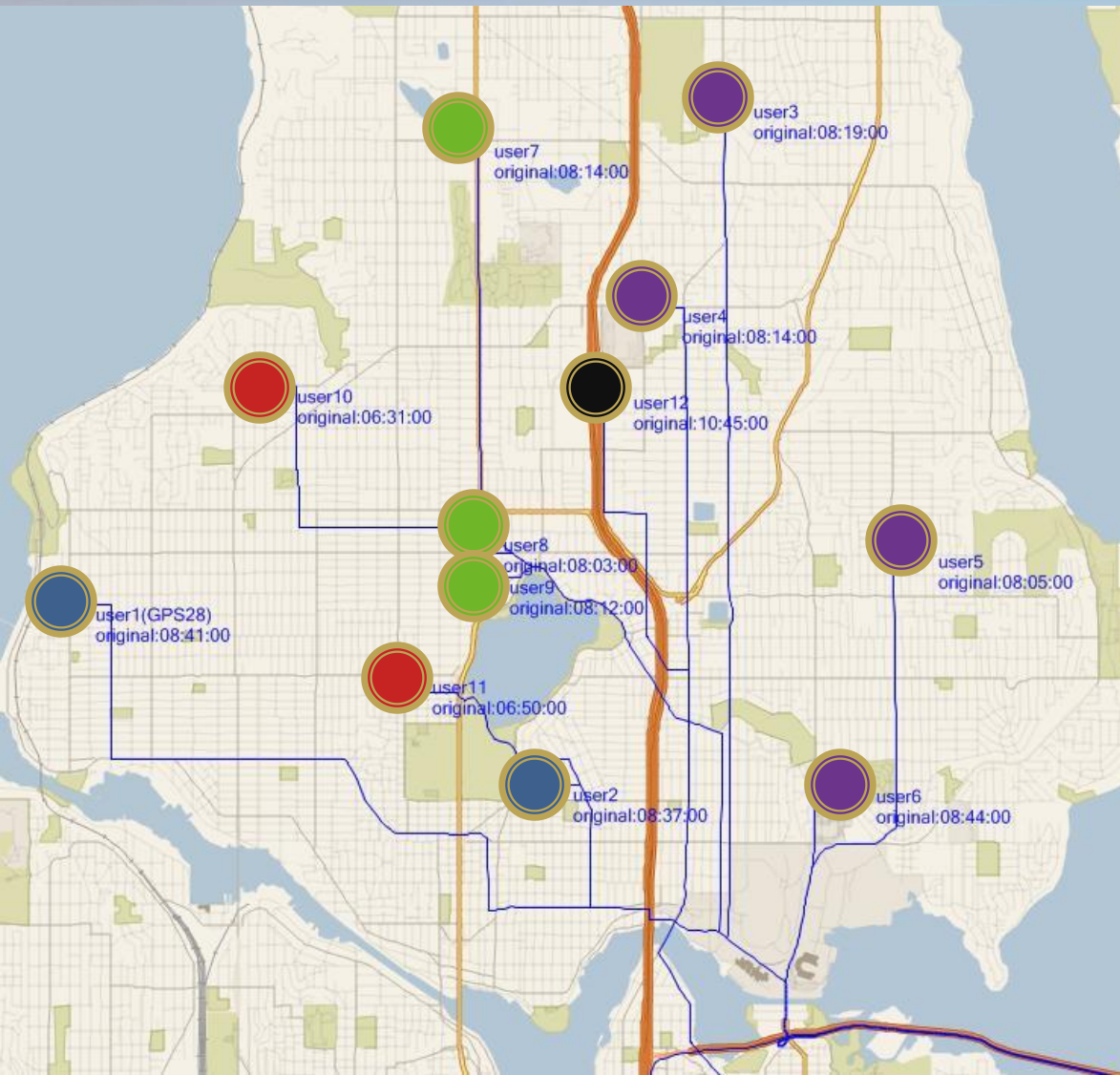
# Balancing Diverse & Changing Needs

## Cost-benefit

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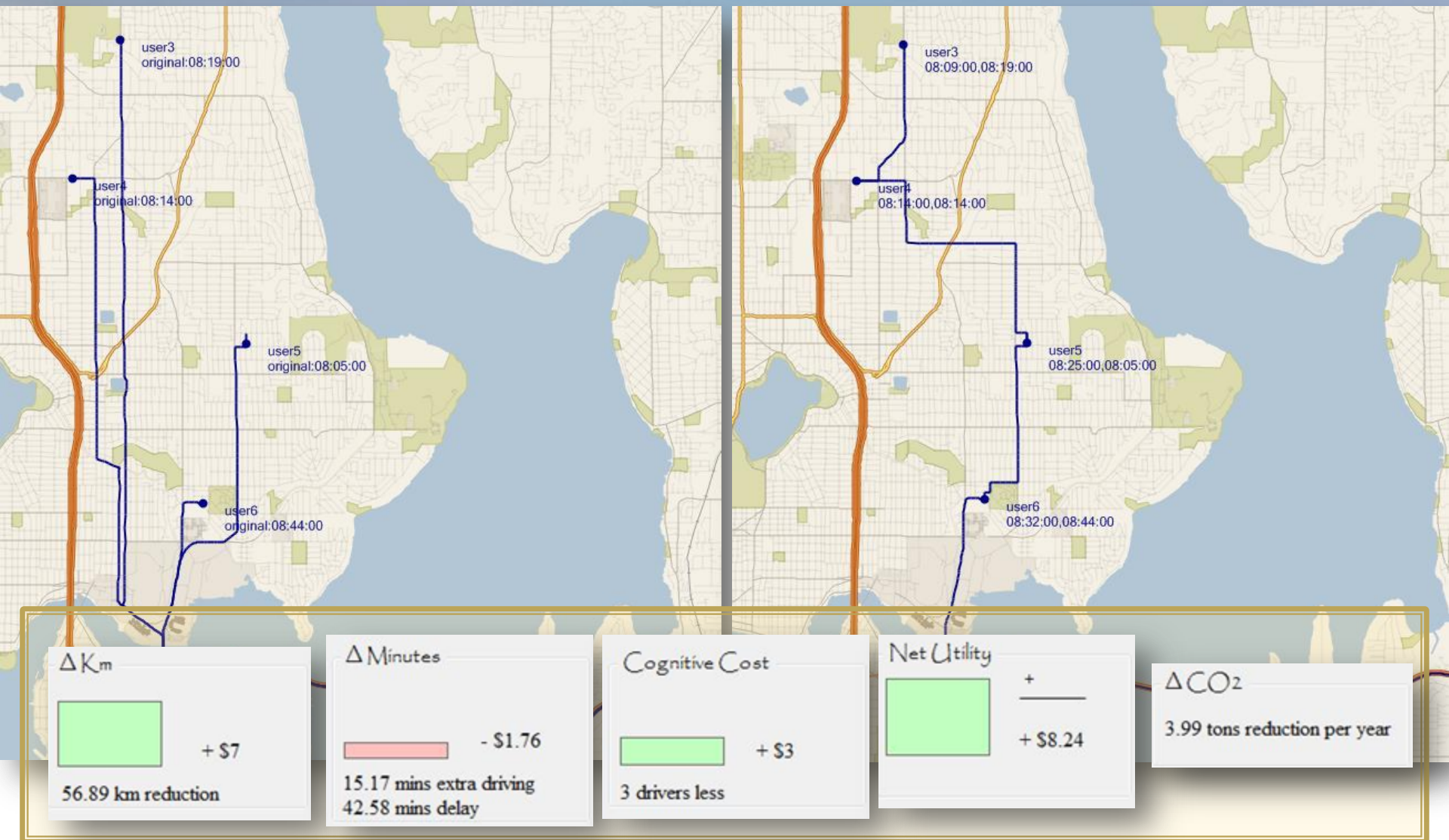


# Ideal Coalescence

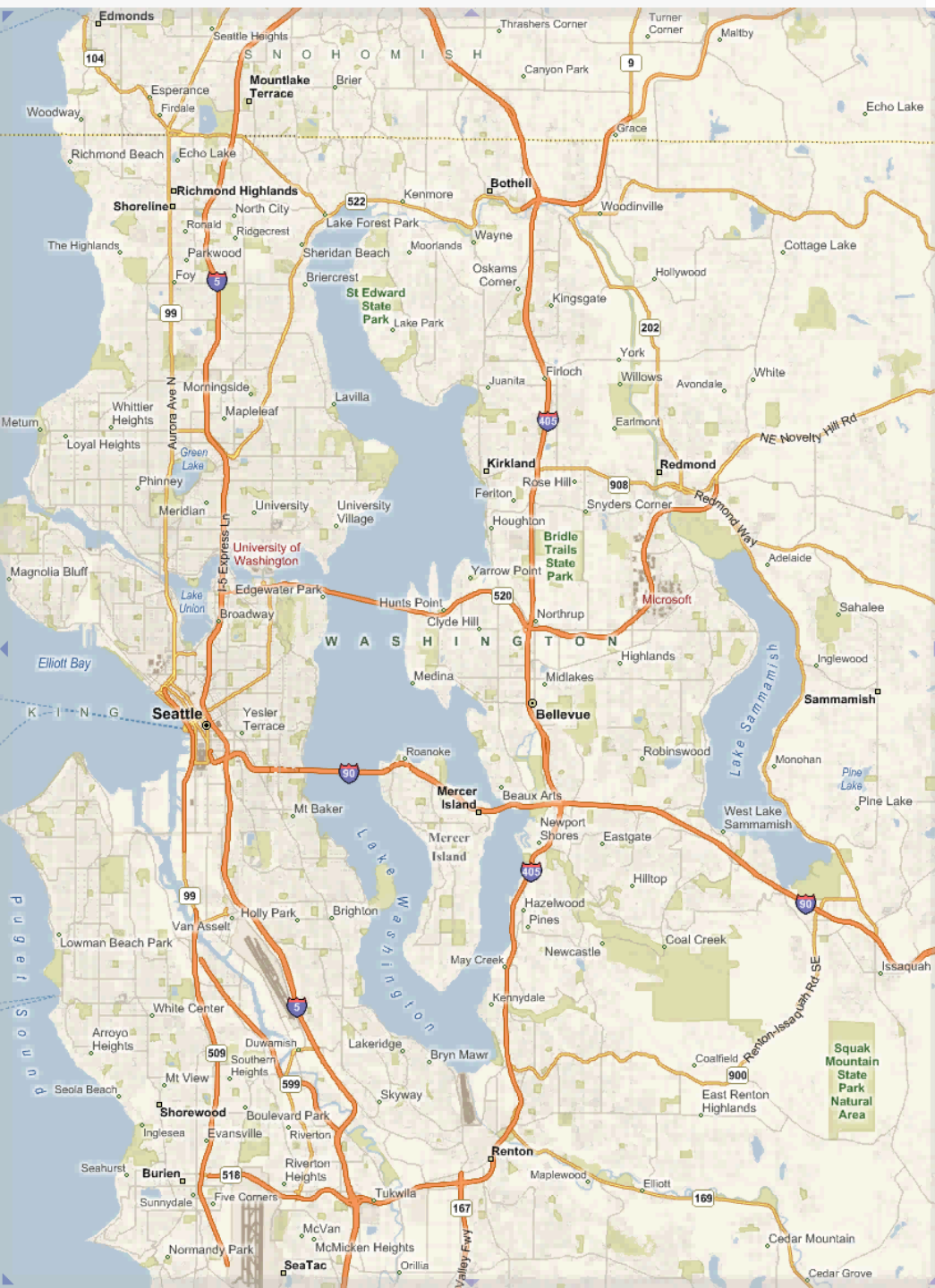


- Assignments based on observed trips.
- Cost-benefit
  - Departure change
  - Delayed arrival
  - Increased travel
  - Savings on effort, fuel, environment

# Ideal Coalescence







Current Time:

Activity

$\Delta K_m$

+ \$0

0 miles reduction

$\Delta$  Minutes

- \$0

0 mins extra driving

0 mins delay

Cognitive Cost

+ \$0

0 drivers less

Net Utility

+  
+ \$0

$\Delta CO_2$

0 tons reduction per year

Waiting List

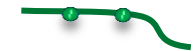
Commute request



Rideshare queued

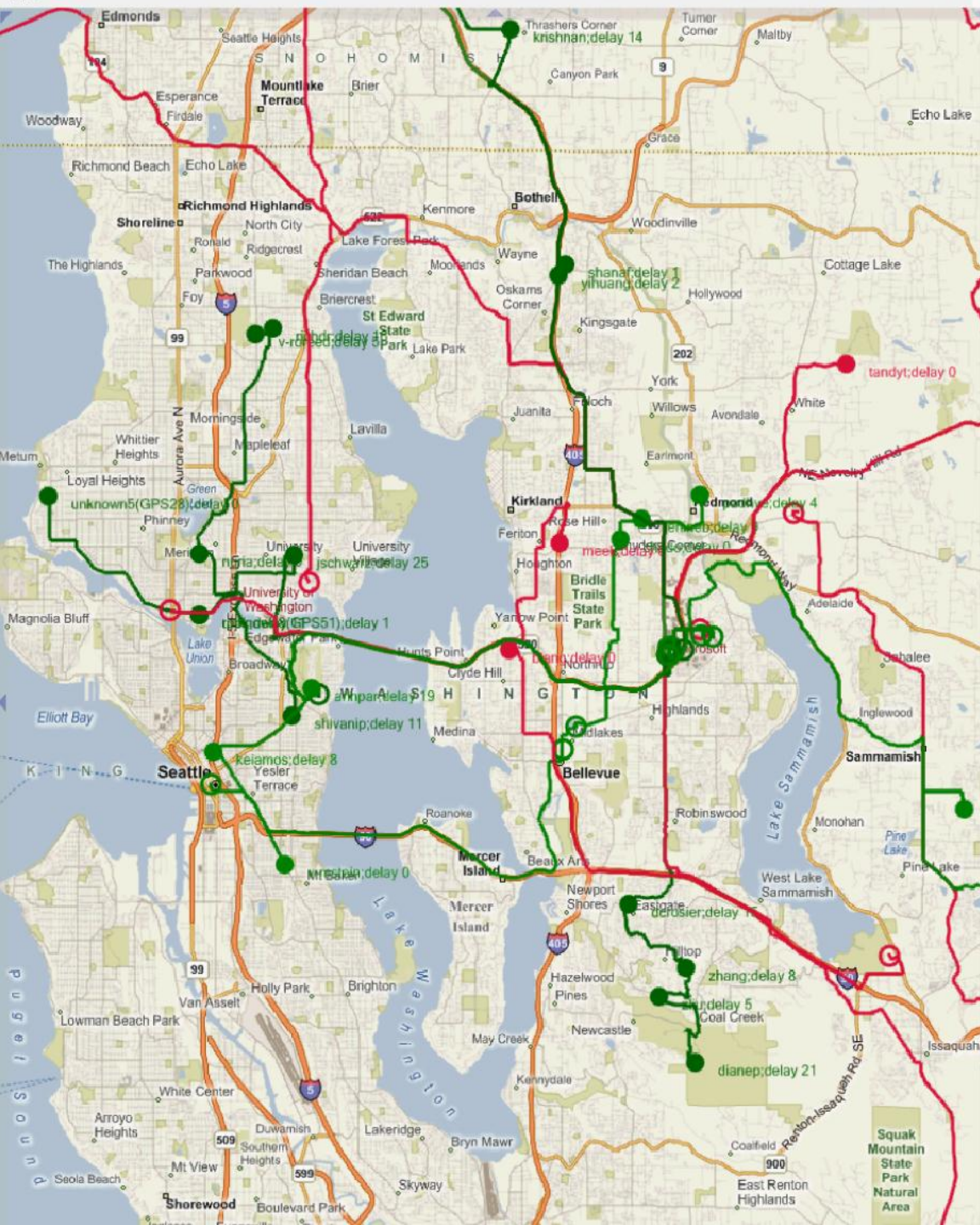


Rideshare starts



Single rider starts





Current Time: 08:55 AM

Activity

trip ended: ggoodall (3)

trip ended: dbrick (1)

$\Delta K_m$

+ \$0

0 km reduction

$\Delta$  Minutes

- \$0

0 mins extra driving

0 mins delay

Cognitive Cost

+ \$0

0 drivers less

Net Utility

+  
+ \$0

$\Delta CO_2$

0 tons reduction per year

Waiting List

2:v-jahann,lukew:09:03 AM

2:lilley\_35,unknown3(GPS14):09:04 AM

1:v-tgwilyr:09:10 AM

1:a-delock:09:14 AM

1:tammywv:09:14 AM

2:egibbs,t-benkom2:09:11 AM

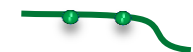
Commute request



Rideshare queued



Rideshare starts



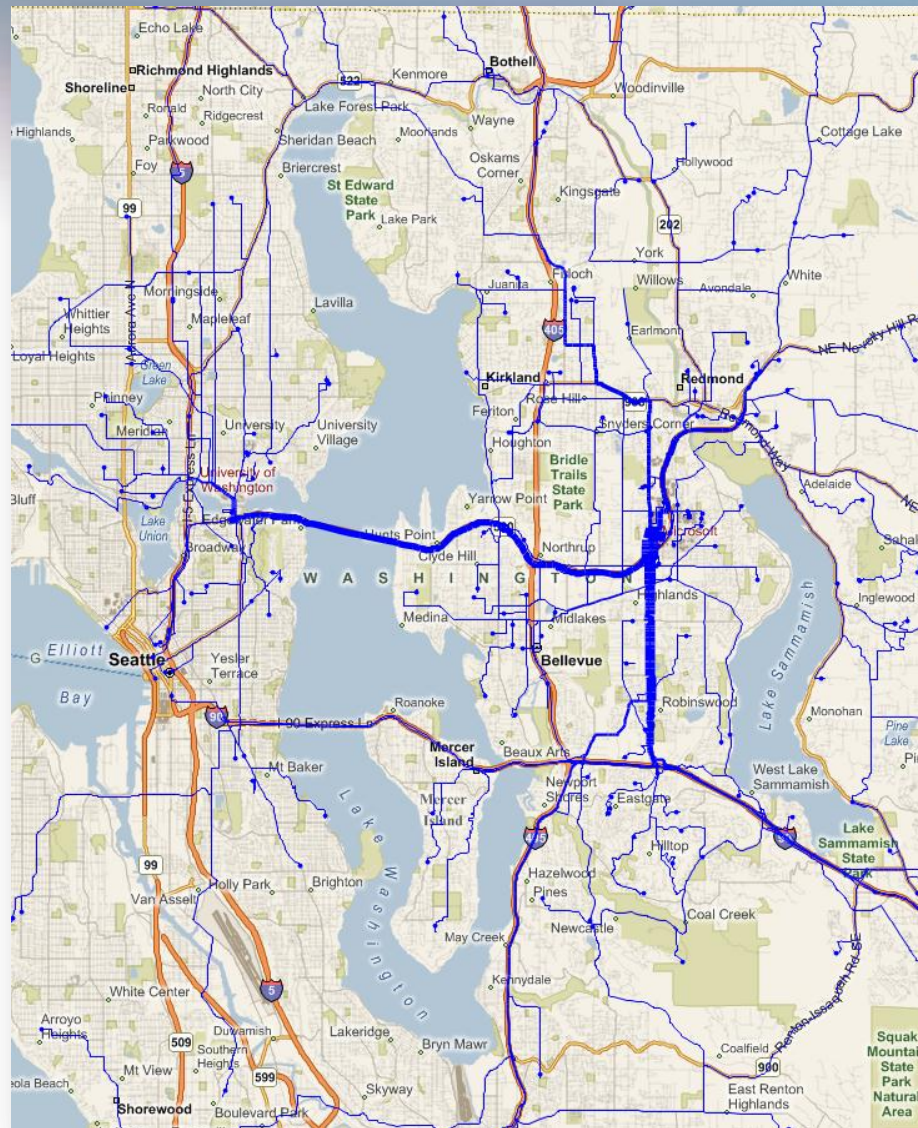
Single rider starts



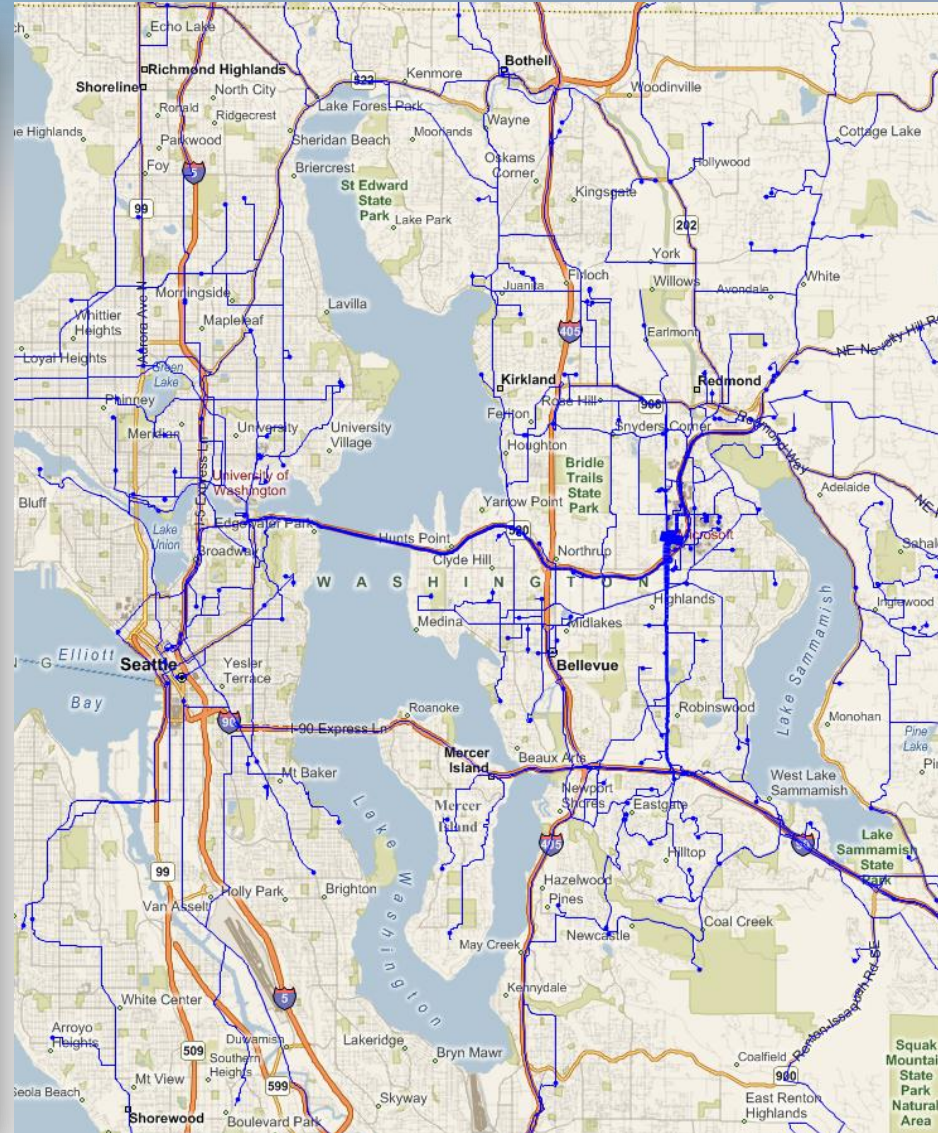


# Results

Normal commute

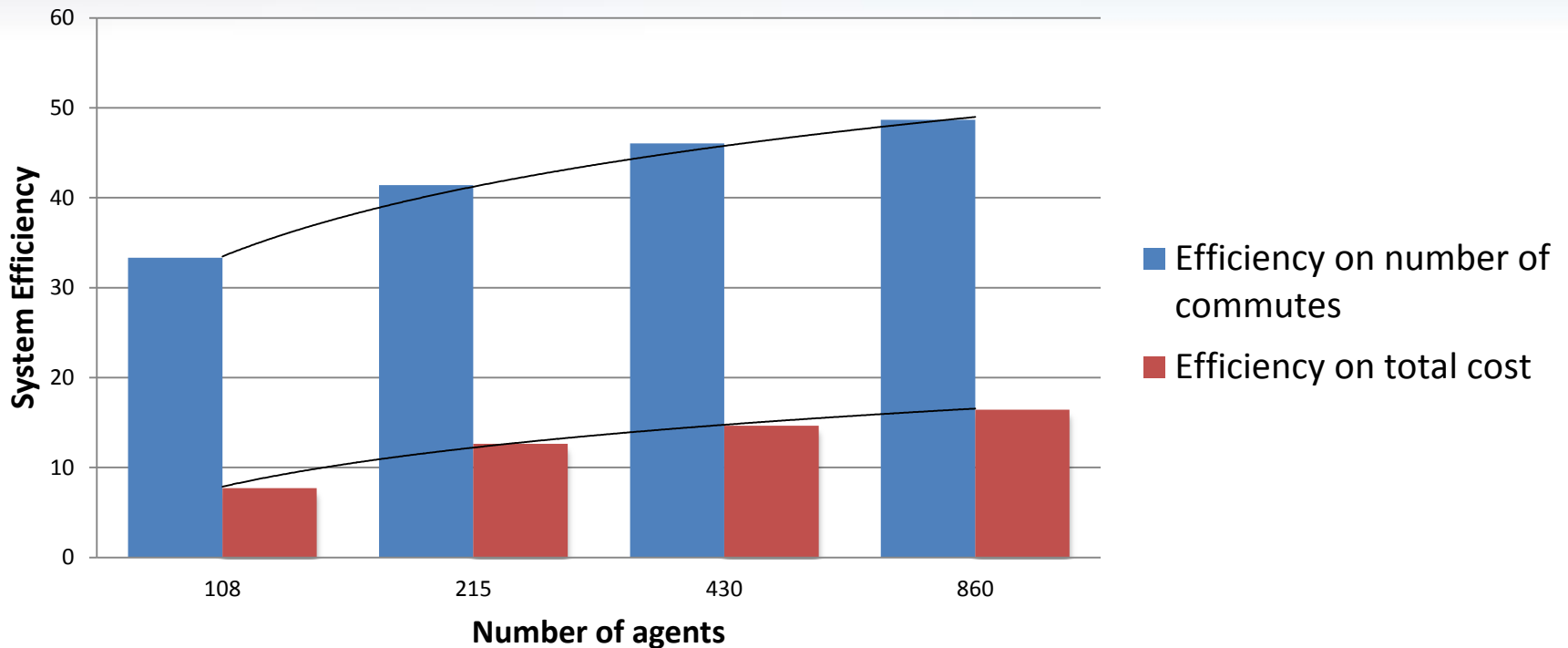


Computed rideshares



# Computation Models and Insights

## *"What If?" Studies*

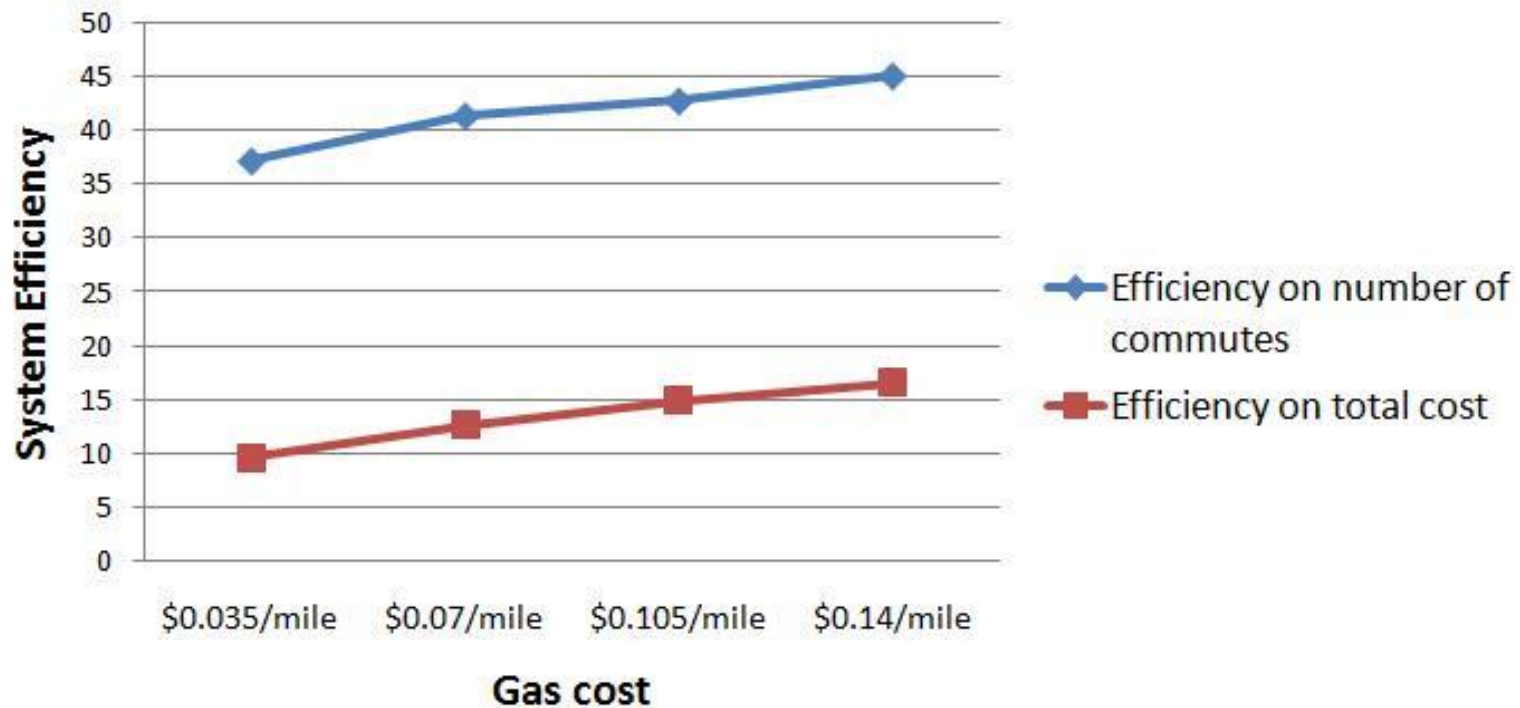


Number of participants →



# Computation Models and Insights

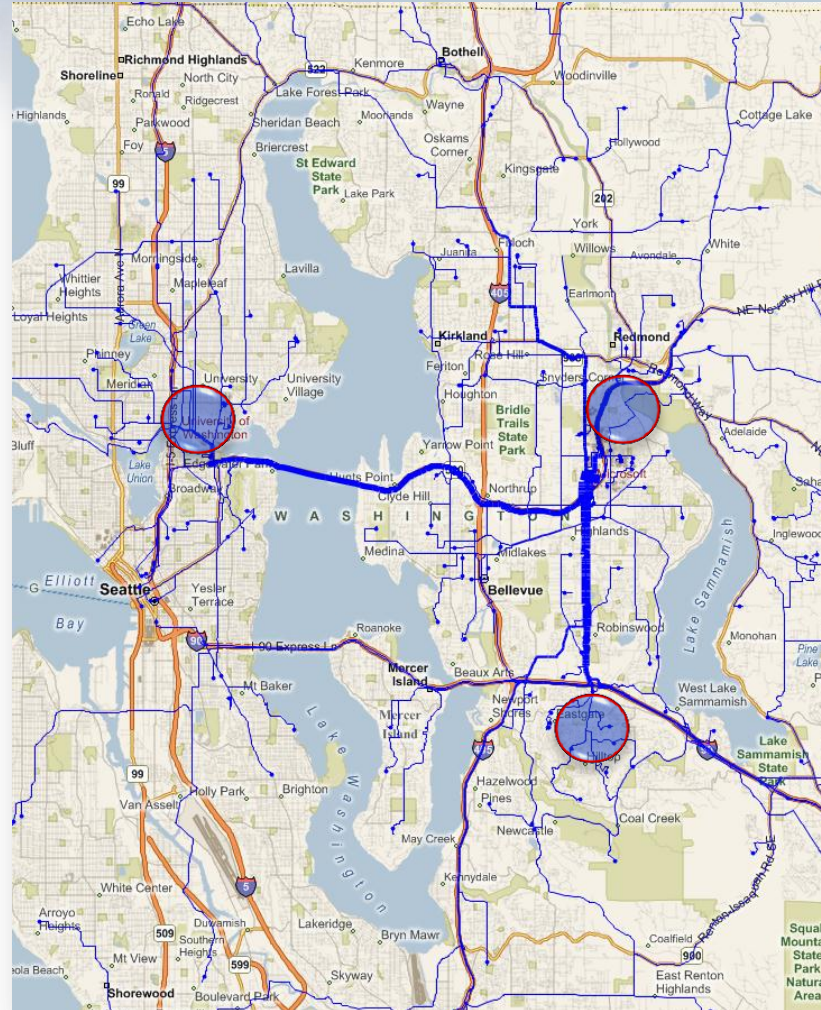
## *"What If?" Studies*



Fuel Cost →

# Computational Models and Design

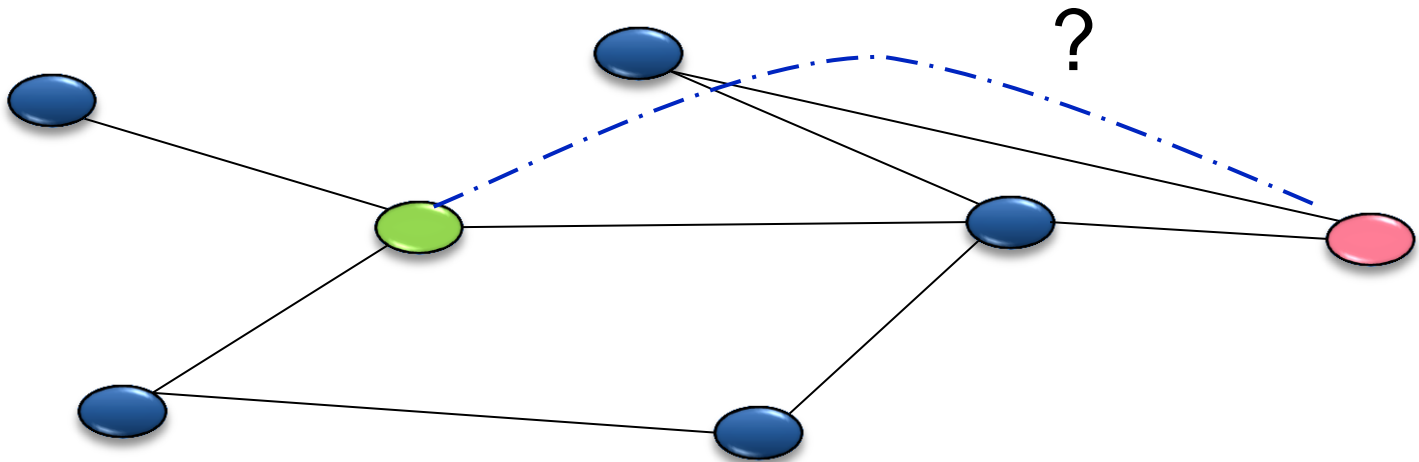
## Best Park & Ride Locations?



# Acceptance and Trust

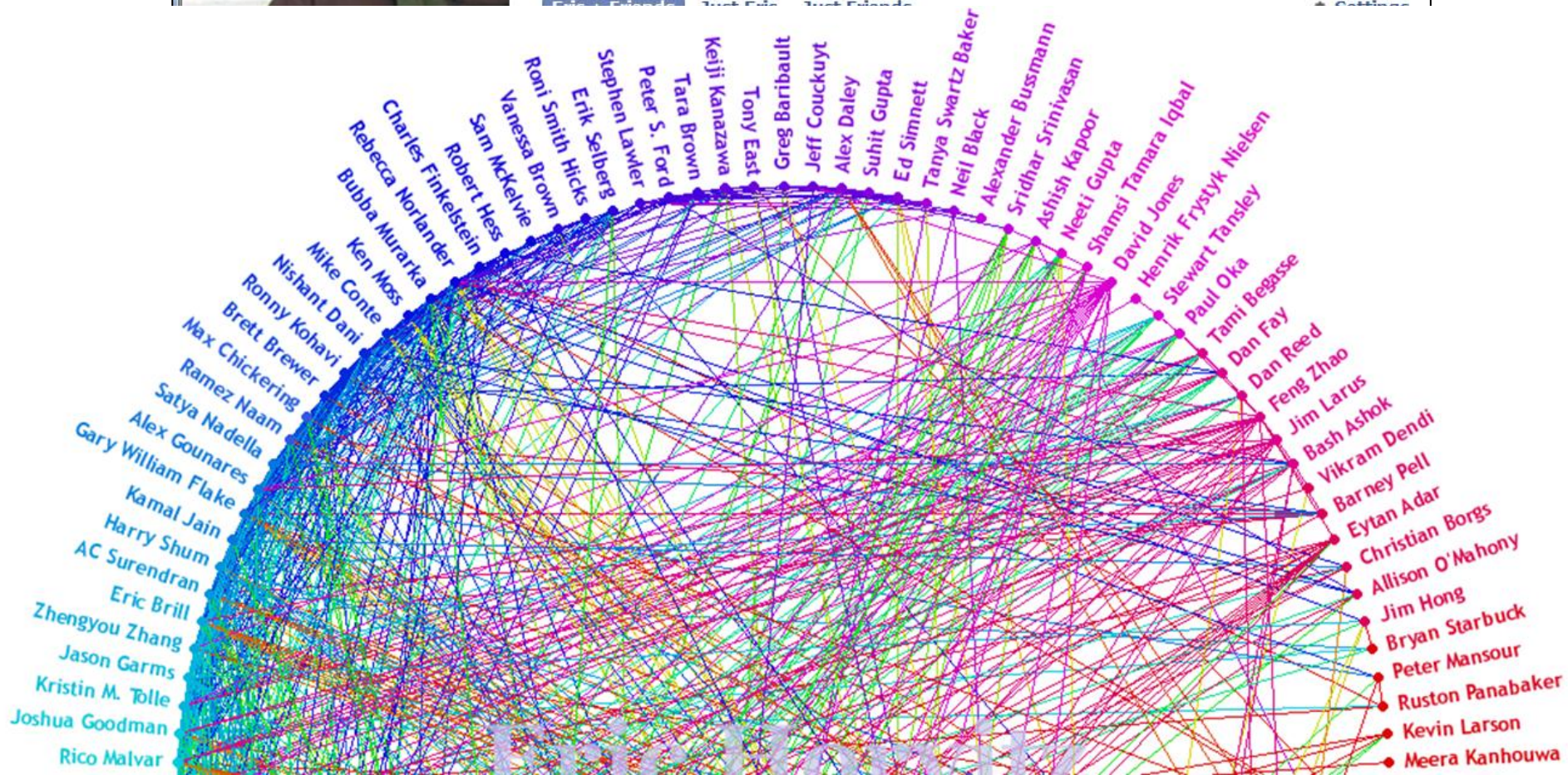
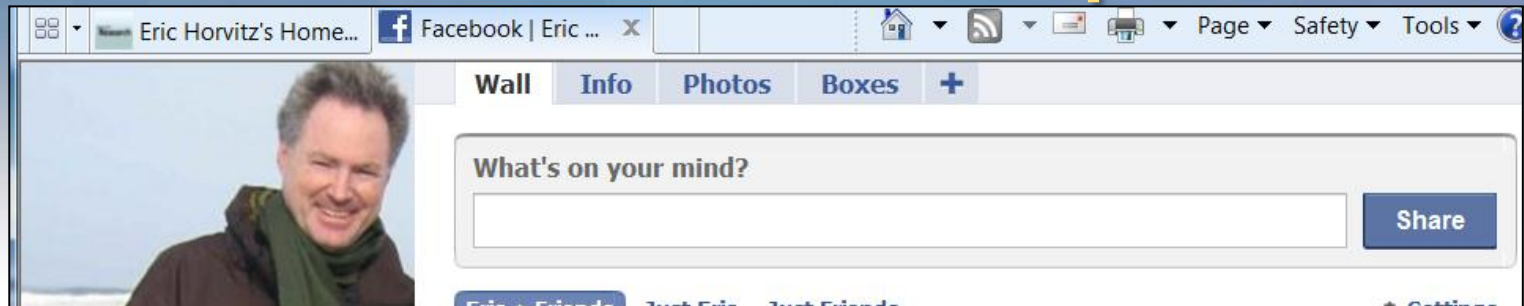
Challenge: Understanding acceptance, perceptions, social considerations

- Address concerns, leverage opportunities
- Trusted organizations
- Referral, reputation
  - e.g., existing online social networks (e.g., link distance bounds)





# Distances and Relationships





# Computational Futures

- Autonomous vehicles? ... Yes.
- *But...* preferences, incentives, optimization!
  - Direction: Public *microtransit*

