

# Cars and Smart Cities: New Applications, New Control Theory



# Thanks

## UNIVERSITY COLLEGE DUBLIN

Yinqi Yi

Mingming Li

Wynita Griggs

Joe Naoum-Sawaya

## IBM RESEARCH

Robert Shorten

Fabian Wirth

Sergiy Zhuk

Randy Cogill

## TU BERLIN

Florian Häusler

## UNIVERSITY OF PISA

Emanuele Crisostomi



# 1. BACKGROUND

# Disruption in automotive

## DISRUPTION

- Young drivers want *on-demand* access
- Older people want *long term* mobility
- New vehicle types
- *Pollution* is driving regulation
- New *integrated* mobility concepts

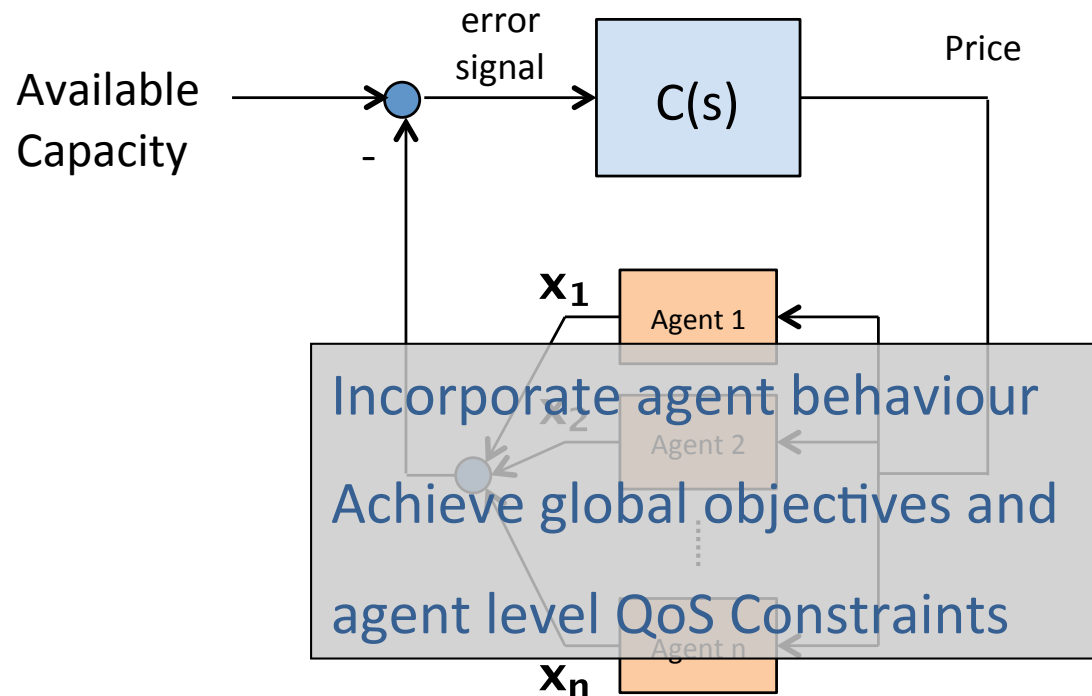
## INDICATIVE 'NEW' MARKETS

- 1.2 Billion over 65's (2030)
- 4.9 Billion middle class (2030)
- \$20 billion by 2016 (car sharing)
- Service delivery platform (\$26 for P2P)

## SMART CITY DISRUPTION

- Signalling for congestion management
- Pollution
- New mobility concepts
- Electrification
- People at aggregate level

# Signalling for optimal orchestration and control



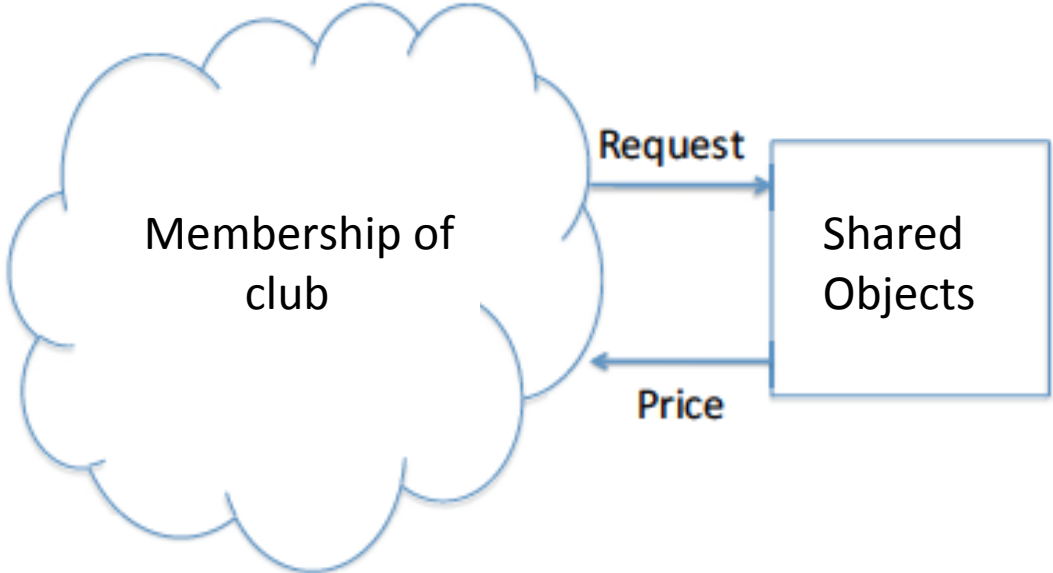
## 2. THE THREE PROBLEMS

# A. The Sharing Economy

---

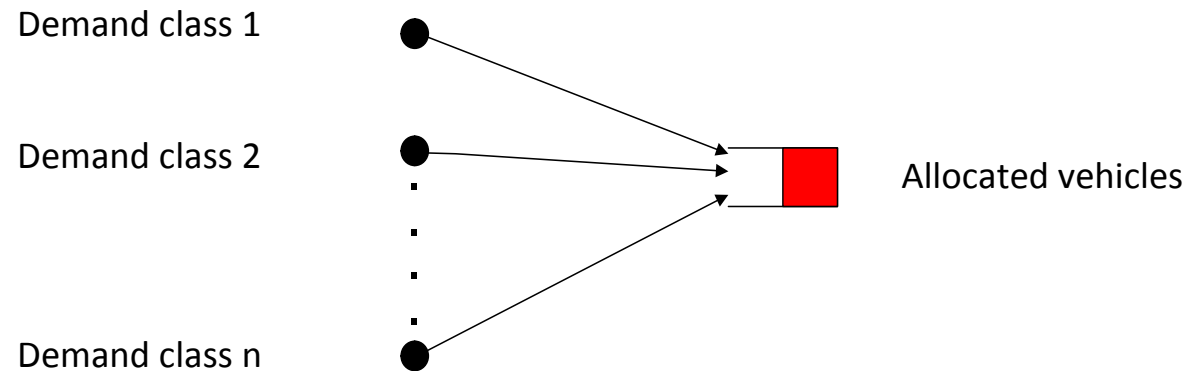


# Shared services (collaborative consumption)





# This is a problem in queuing theory



*Is QoS good enough:*

*Namely, do people get objects when they want them?*

## B. How to manage consumption?

# Background: The automotive efficiency story

## INSIDE THE CAR

- Better engines
- Better aerodynamics

## USING THE CAR BETTER

- Car, ride sharing
- On-demand mobility
- Eco-driving

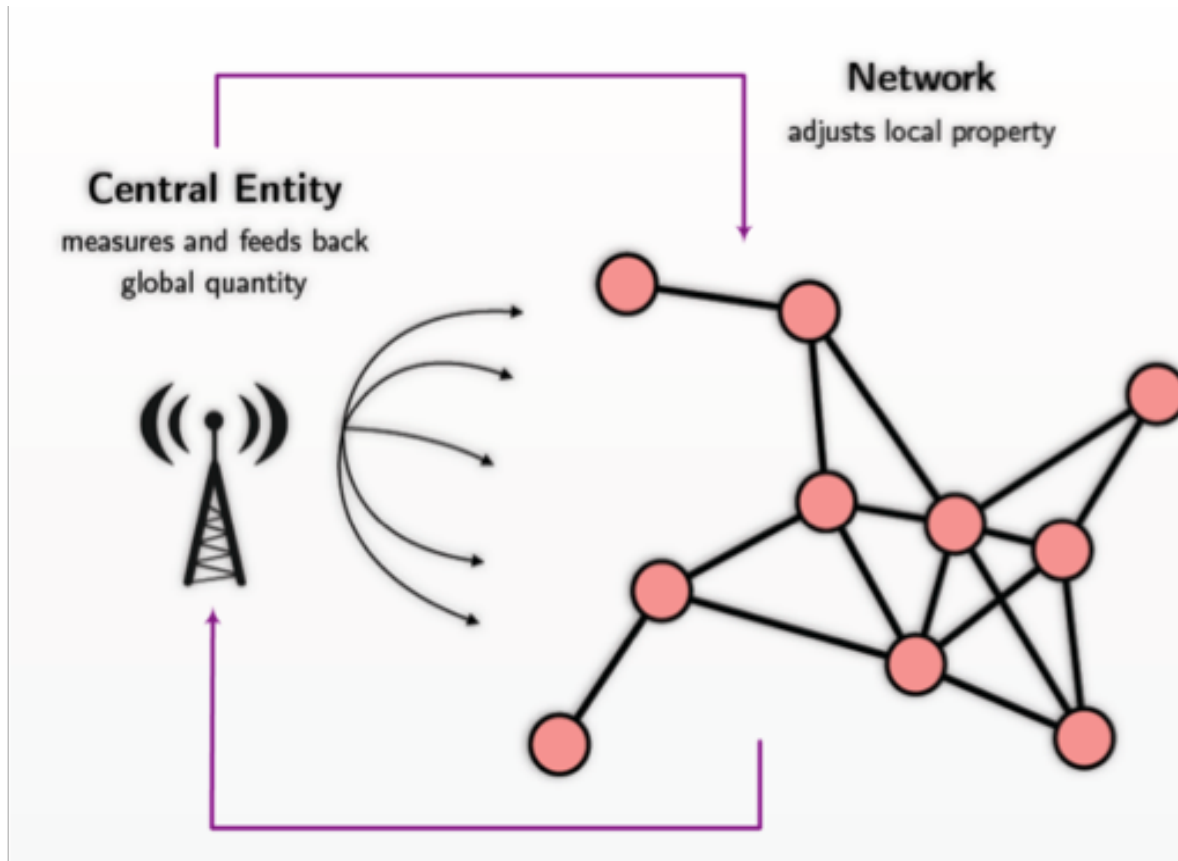
## THE AGGREGATE DIMENSION

- Connected car
- Variable speed limits

## NEW FRONTIERS

- The holistic view
- Cyber-physics
- Collaborative consumption
- Internet of things

# Background: Managing Consumption



# C. How to use cars to enable citizen based services?



# Parked cars as a platform for cooperative services (IBM Research)

- Parked cars are everywhere
  - Parked 95% of time (23 hrs per day)
  - Billion cars worldwide
- Parked cars have great properties
  - Batteries, sensors, and compute power are unused
  - Location is certain**
  - Packed with unused sensors
- Can be used for infrastructure roll-out
  - Especially in the emerging markets
  - Dedicated campus infrastructure



## 3. CONCLUSIONS

# Conclusion

- New service offering for OEM's and other suppliers
- People and agents at heart of control problem
- New types of control problem
- Service level agreements
- Real-life Cyber-Physics

