Capacity Allocation and Pricing on Shared Rail Infrastructure

Maite Pena-Alcaraz (PhD Student), Prof. Joe Sussman

Thesis Committee: Prof. Sussman, Prof. Webster, Prof. Ramos, Prof. Gomez-Ibanez, Prof. Perez-Arriaga

Other students: Sam Levy (M.S. Student), Alex Prodan (Visiting PhD Student, IST)

NURail 2014; August 19, 2014, Altoona, PA

Massachusetts Institute of Technology
Engineering Systems Division

Table of Contents

- Motivation
- Research Question & Research Plan
- Methodology
- Conclusions & Further Research

Motivation – International Context

Past:
Integrated railway companies

Railway Company


Capacity Allocation & Pricing Mechanisms:
Rules to decide who gets access to the tracks, when and at what price

Today (last 10-15 years)**:**
Promotion of shared corridors and open-access

Infrastructure

Operators



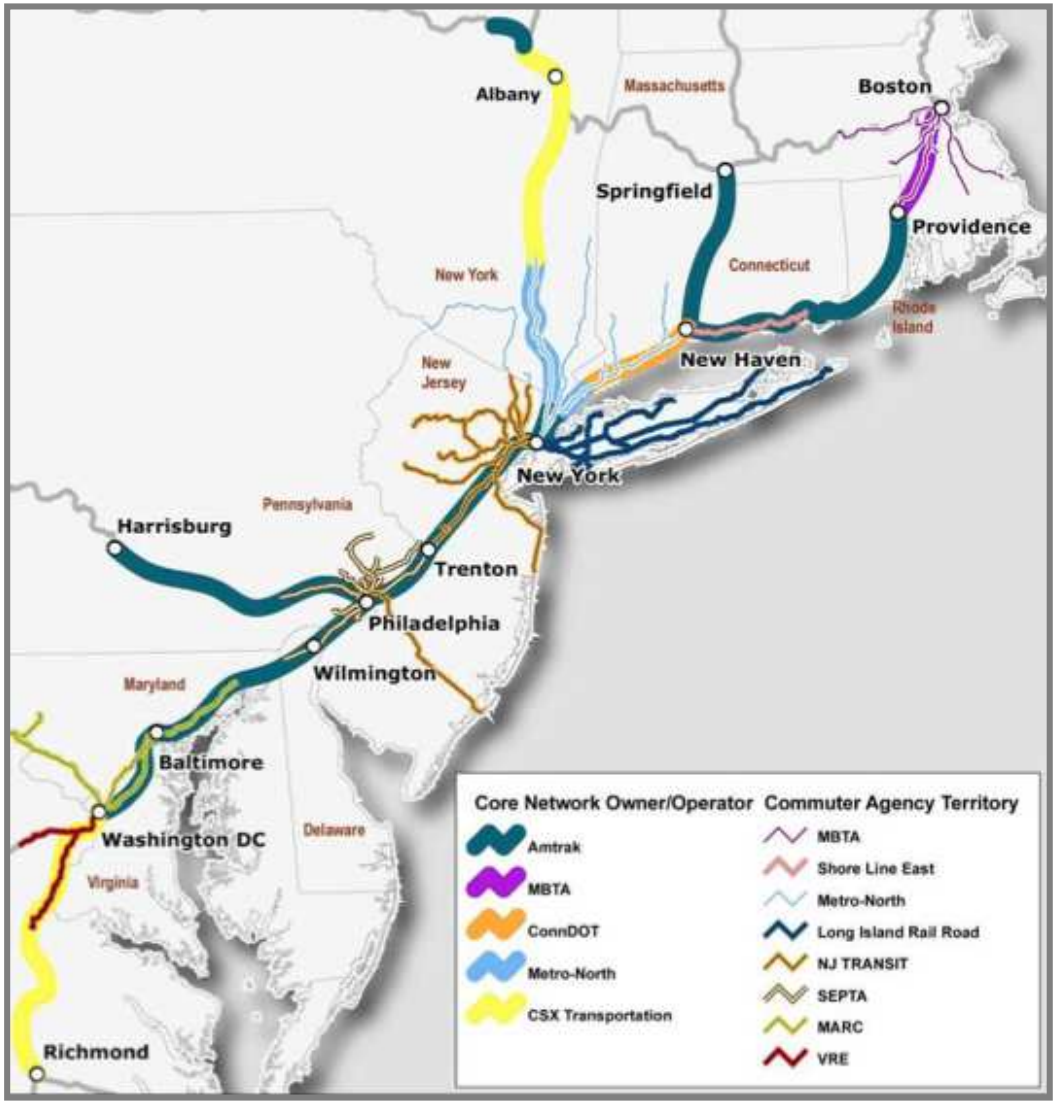

request access

\+ Efficient use of infrastructure

– Coordination problems

Image credits: infrawindow.com, evworld.com, riverfarmproperties.com, america2050.org, hamptonroads.com

Motivation – US Northeast Corridor (I)



Infrastructure:
Mostly owned and managed by Amtrak (main spine)

Operators:
Intercity & HSR: Amtrak (150 trains/day)
Commuter: 8 companies (2000 trains/day)
Freight: 6 companies (70 trains/day)

Image credits: NEC Future Scoping Document, 2013

Motivation – US Northeast Corridor (II)

Capacity Pricing & Allocation Today

Bilateral contracts between Amtrak and other operators

- Prices (depend on contract)
- Service changes (difficult)
- Only 20% infrastructure costs recovered

(Gardner, 2013)

Passenger Rail Investment and Innovation Act (PRIIA, 2008)

- Develop a capacity allocation & pricing mechanism by 2015

Alternative Capacity Pricing and Allocation Mechanisms

- Define track-access charges (cost-allocation model) + priority rules
- Auction

Research Question & Research Plan

How do different **mechanisms** for **capacity allocation and pricing affect** the **performance** of **shared railway** systems?

Performance *(multiple criteria)*

Implications for the **infrastructure manager** (recovered costs, use of capacity), the **train operators** (access charges, operators behavior) and the **users** (level of service, demand served)

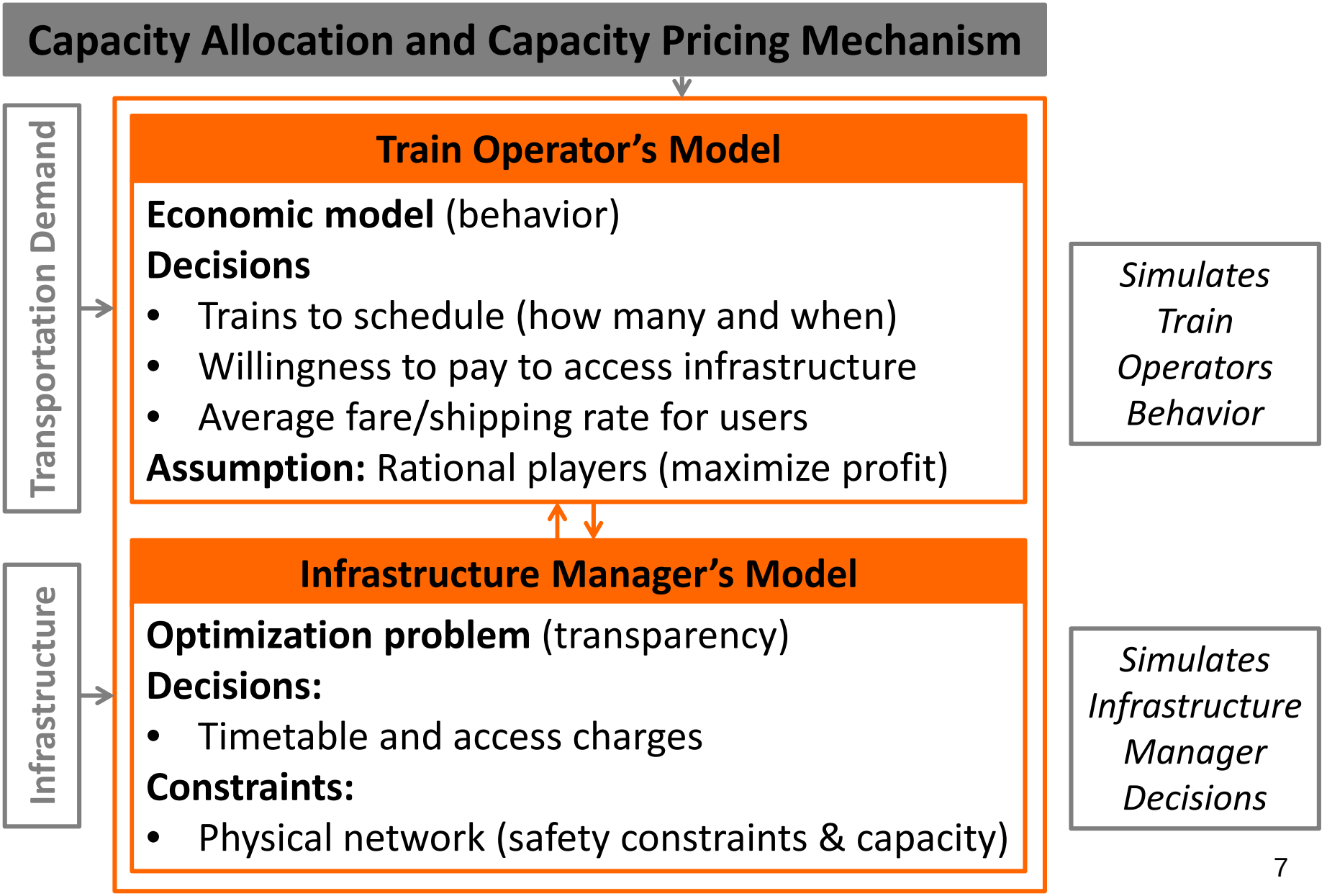
Research plan

1. Identify and study representative mechanisms for capacity pricing and allocation in shared railway systems

2. Develop a framework to evaluate them

3. Understand and communicate trade-offs between different capacity pricing and allocation mechanism for shared railway system

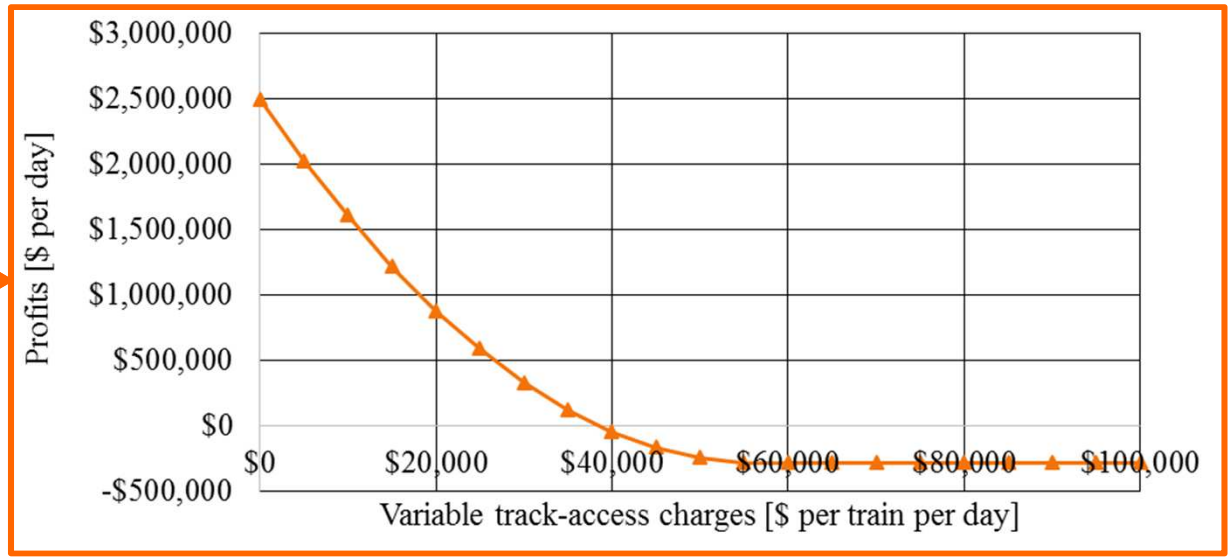
Methodology – Framework Overview

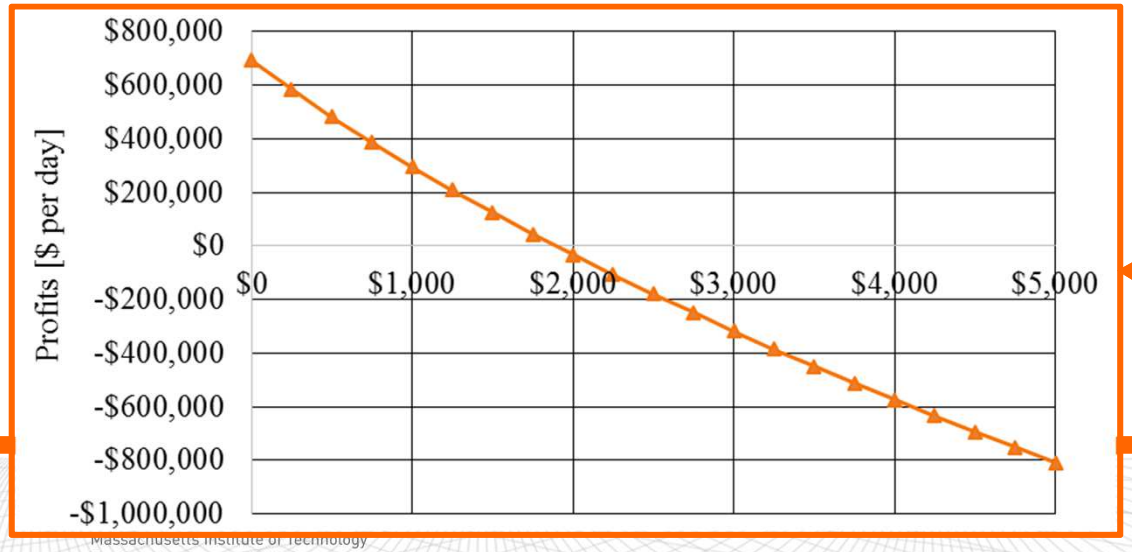


Methodology – Train Operator Model

How much could different train operators pay to access the tracks?

HSR/Intercity Operator (Amtrak)





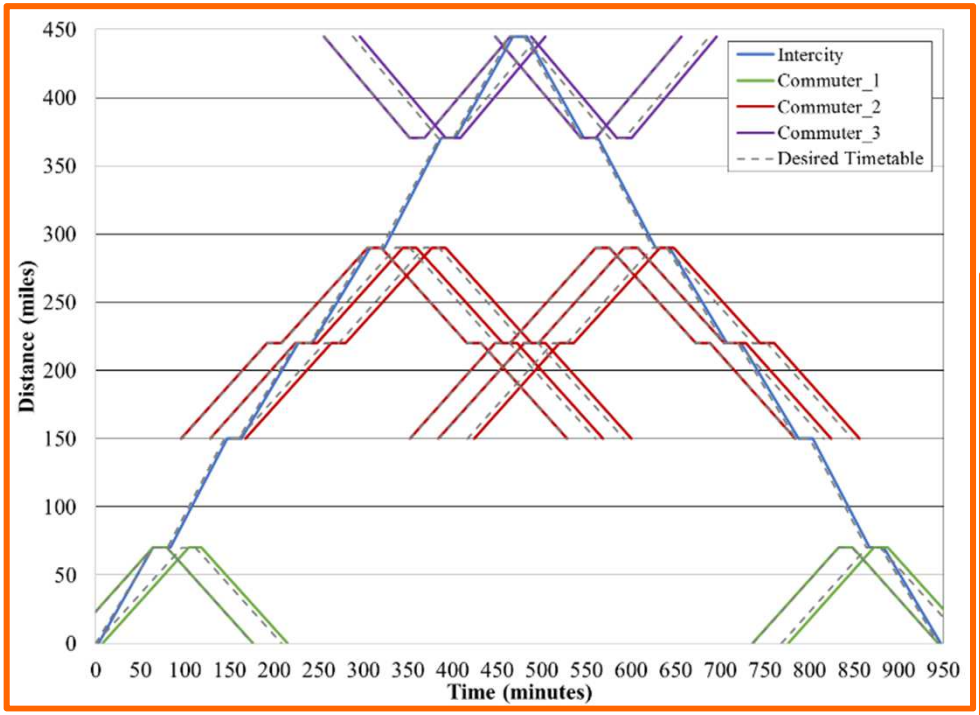
Commuter Operator (MBTA)

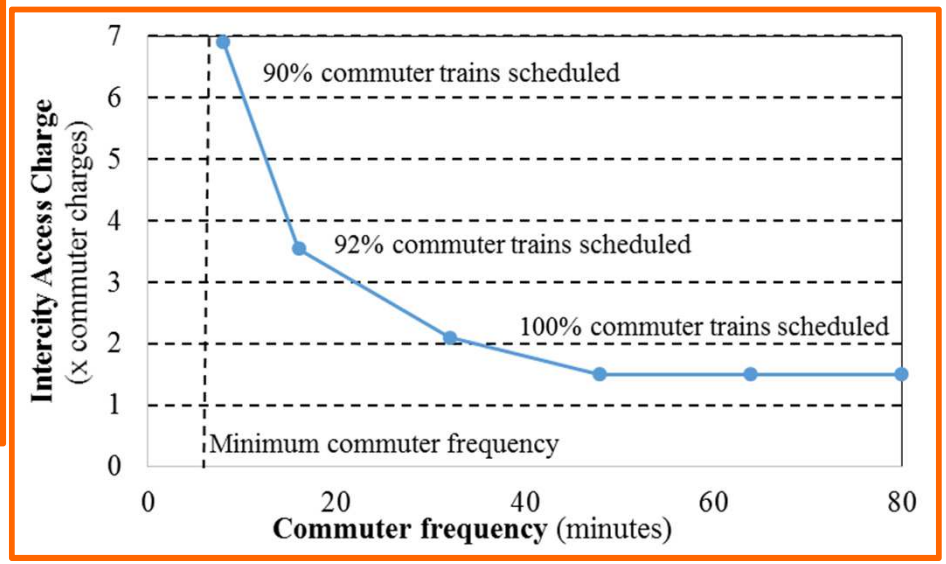
Methodology – Infrastructure Manger Model

Intercity Train – Commuter Train Interactions

Intercity trains conflict with several commuter trains

How much should intercity trains pay to access infrastructure





Conclusions & Further Research

Conclusions & Contributions:

- Framework allows us to **understand the implications** of **capacity allocation & pricing** mechanisms for the system
- **Propose** the use of these models as a **tool** to allow regulators and decision makers to **evaluate alternative capacity allocation & pricing regulation**.

Further Research:

- Develop more detailed models, further integrate the infrastructure manager and the train operator models
- **Use this framework to analyze other railway systems:**
  - **California** (Blended HSR System) – **Sam Levy**
  - Other **countries promoting shared corridors and open-access**: Europe, Africa (Tanzania), India

Questions/Comments?

maitepa@mit.edu