Capacity Allocation and Pricing on Shared Rail Infrastructure

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Motivation – International Context

**Past:**
Integrated railway companies

**Railway Company**

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

**Infrastructure**

**Operators**

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

+ Efficient use of infrastructure
− Coordination problems

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**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)

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

**Capacity Allocation and Capacity Pricing Mechanism**

### Train Operator’s Model

**Economic model** (behavior)

**Decisions**
- Trains to schedule (how many and when)
- Willingness to pay to access infrastructure
- Average fare/shipping rate for users

**Assumption:** Rational players (maximize profit)

### Infrastructure Manager’s Model

**Optimization problem** (transparency)

**Decisions:**
- Timetable and access charges

**Constraints:**
- Physical network (safety constraints & capacity)

Simulates Train Operators Behavior

Simulates Infrastructure Manager Decisions
Methodology – Train Operator Model

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

HSR/Intercity Operator (Amtrak)

Commuter Operator (MBTA)
Methodology – Infrastructure Manager Model

InterCity Train – Commuter Train Interactions

InterCity trains conflict with several commuter trains

How much should intercity trains pay to access infrastructure

[Diagram showing time vs. distance and commuter frequency with different scheduled percentages and minimum frequency]
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?

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