Implementation Challenges for Shared Railway Systems: Case Studies in California and the Northeast Corridor

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Motivation

New pieces of legislation such as PRIIA (2008) or EU directives 91-440 and 2007-58 promote the use of **shared systems**

Shared railway systems are systems in which different railway operators may use the same infrastructure.

It allows for **efficient use of the infrastructure**, which is expensive: represents 60-80% of total rail transportation costs.

It **requires coordination**: when different operators request access to the infrastructure the regulator should decide who gets access, when, and at what price.

Research Question and Objectives

Research Question

How do different **capacity pricing and capacity allocation mechanisms** affect the **performance** of shared railway systems such as the California high-speed rail and the Northeast Corridor?

Objectives

1. Identify representative capacity pricing and capacity allocation mechanisms for shared railway systems, and
2. Understand implications of these mechanisms for the infrastructure manager, the operators, and other stakeholders.

California High Speed Rail: The Blended System

The for-profit California High Speed Rail (CHSR) service envisions sharing rail infrastructure and stations with local, subsidized commuter rail lines. In Northern California, between San Jose and San Francisco, CHSR will share a mostly two-track line with two commuter rail operators, Amtrak, and Union Pacific Railroad. Additionally, CHSR will share a San Francisco terminal station with one of those commuter rail lines, Caltrain. Both Caltrain and CHSR anticipate their highest passenger demands into San Francisco occurring during the AM peak creating congestion potential for a high speed rail service that depends on on-time performance and high frequencies to be profitable.

Northeast Corridor: One Line, Eleven Operators

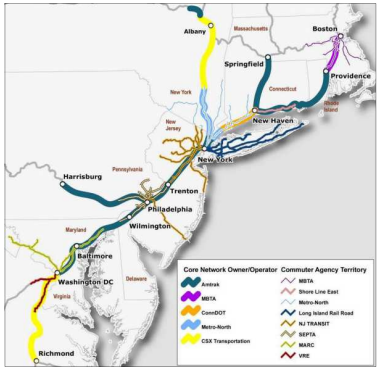
Infrastructure owned by Amtrak, MBTA, ConnDOT, and MetroNorth
Operators:
Intercity & HSR: Amtrak (150 trains/day)
Commuter: 8 companies (2000 trains/day)
Freight: 2 companies (70 trains/day)
Today:
Capacity pricing and allocation depends on bilateral contracts
Difficult to make service changes and to expand capacity
Insufficient maintenance of the corridor
Future:
New capacity pricing and allocation mechanism by 2015 (PRIIA)
Northeast Corridor Future Vision leaded by FRA

Capacity Allocation

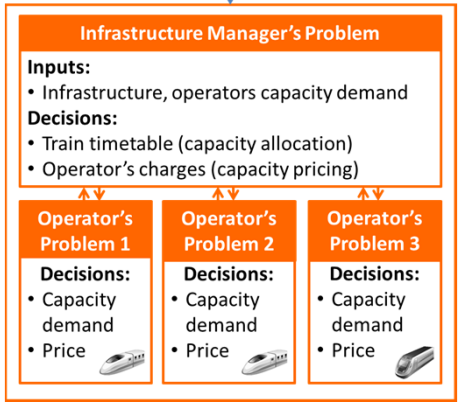
Decision of which trains get access to the infrastructure and when

Capacity Pricing

Decision of the access fee that each train scheduled should pay to the infrastructure manager



Capacity Pricing and Allocation Mechanism



Capacity Pricing and Allocation Methods

The team is looking at the following capacity allocation and pricing methods subject to the performance criteria (right):

1. Auctions (slots, point-based)
2. Cost Allocation Methods + Priority Rules
3. Auctions + access tariffs

Methodology

This research is developing a framework to evaluate the performance of shared railway systems under generic capacity pricing and capacity allocation mechanisms.

This framework integrates two modules:

1. **Operator's problem:** simulates the strategic behavior of the operators and its impact on the demand for transport (industrial organization),
2. **Infrastructure manager's problem:** replicates the infrastructure manager and designs the best timetable that consider all technical constraints for the infrastructure and the information about the desired slots for each operator (operations research).

Equilibrium problem between the demand for transport and the available infrastructure capacity to schedule trains.

Performance Criteria

The performance is measured using multiple criteria:

1. Quality of service (level of service, demand served)
2. Incentives for the operators to operate in the system (including barriers to entry)
3. Implications for infrastructure manager (infrastructure cost recovered with access fees, capacity utilization)

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References

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Future Work and Expected Contributions

Future work:

1. Finalize the design of the framework to analyze different capacity pricing and allocation mechanisms (integration of the infrastructure manager's problem and the operator's problem)
2. Analyze identified representative capacity pricing and allocation mechanisms

Expected contributions:

1. Increase the understanding of different mechanism,
2. Provide a framework to evaluate capacity pricing and allocation mechanisms, and
3. Analyze the implications of these results for different railway systems such as California and the Northeast Corridor in the U.S.