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Investment choices and stakeholder interactions on the European railway network

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ECTRI
European Conference of Transport Research Institutes

FERSI
Road Safety Research

Introduction

- **Liberalization process in Europe** (Guideline 91/440)**:** from integrated monopoly by State to multi-actor system
  - Separation between network manager (infrastructure) and operator (service of transport)

- **Debate:** which stakeholders and which governance for the best economic efficiency (Crozet, 2012; Nash, 2012)?

- **Two models:**
  - Holding between dominant operator and network manager (German model): save transaction cost (CER, 2012)
  - Complete separation between operator and network manager (British or Swedish model): guaranty the market efficiency (Alexandersson and Hulten, 2008)

- **In France:** intermediate system and reform process to define competency of stakeholders and new governance

Research focus

- Original approach of railway organization by capacity and investment choices

- When saturation phenomenon on a line:
  - Who invest
  - For which capacity?

- Use of a saturation modelling to:
  - Define capacity
  - Assess effect of stakeholders on capacity

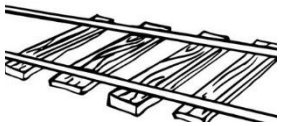
=} Method to analysis the stakeholder interactions from capacity point of view (engineering and economics)

Outline

- Definition for the concept capacity
- Theoretical stakeholders characterization
- Specification for the saturation modelling
- Evaluating of the impact of stakeholders on capacity: case study HSL Paris-Lyon

Concept capacity: key factors

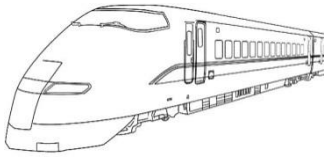
Infrastructure



Operation

Management traffic

Rolling stock



Technical aspect

Stakeholders
(Network manager / Operator(s))

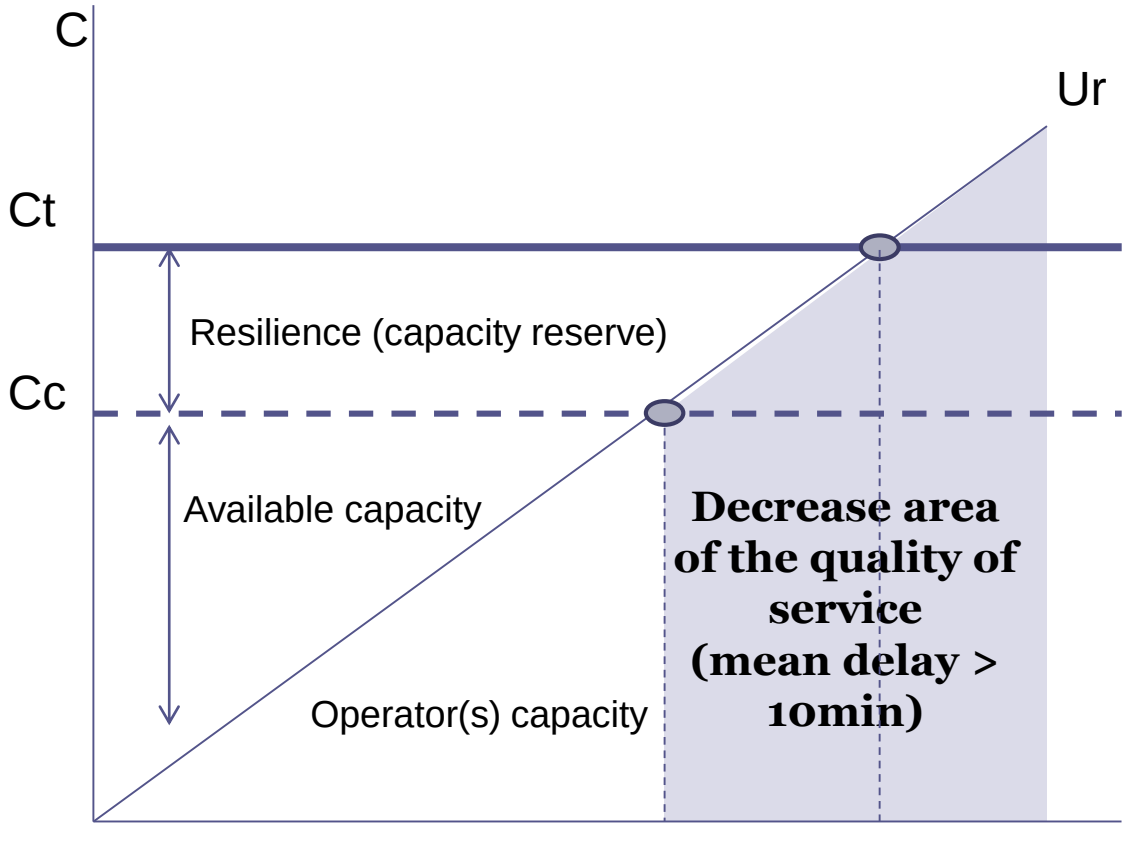
Infrastructure/service pricing
€

Capacity
(supply)

Economic aspect

Before guideline 91/440: one stakeholder
After: splitting up between network manager / operator(s) BUT definition of competency for each is still very different among European States

Concept capacity: a variable concept



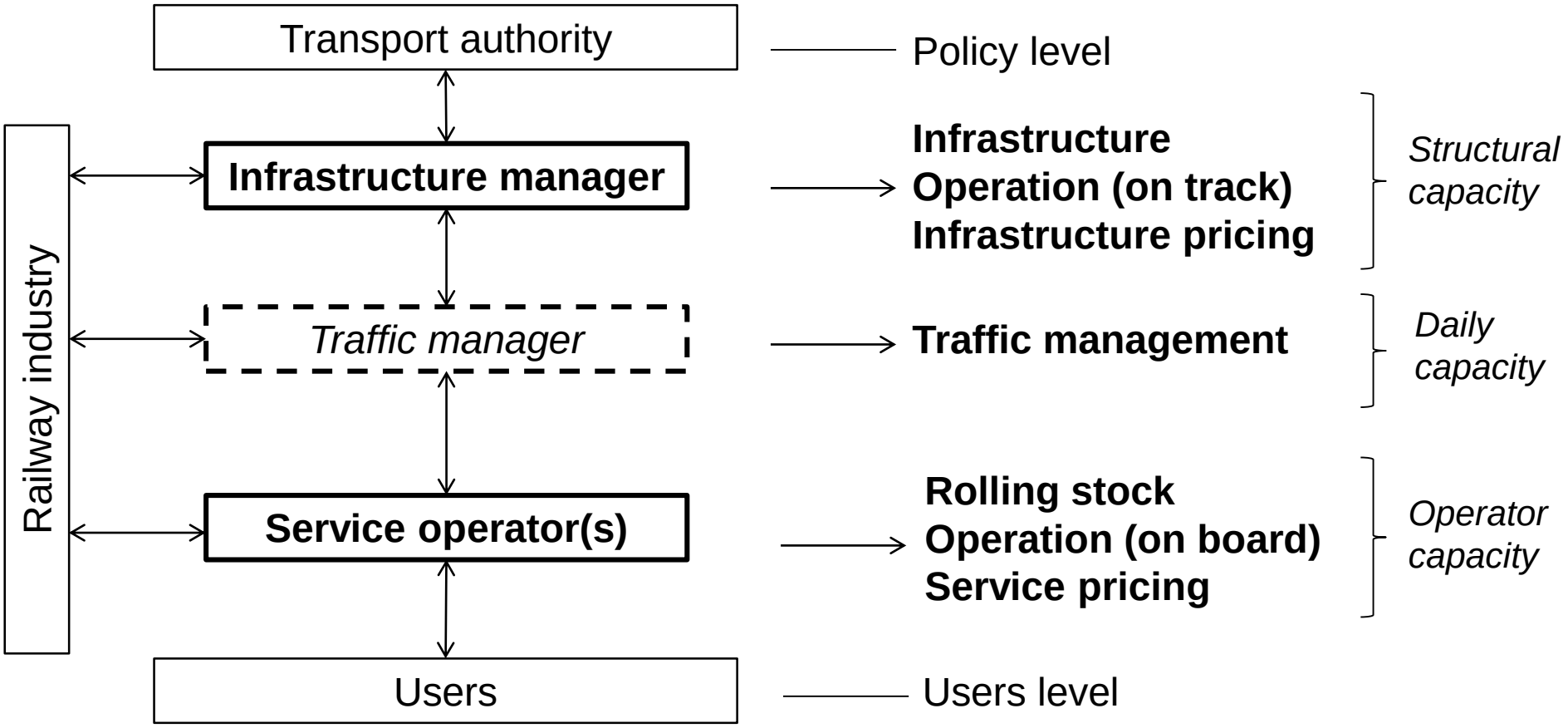
Theoritical capacity (Ct) or structural capacity
(maximal capacity in trains/hour)

Commercial capacity (Cc) or daily capacity

Operator(s) capacity
(maximal capacity in travellers/train)

=} Different level of capacity for different stakeholders

Theoretical stakeholders characterization



=} Classical analysis for network industry (Curien, 2000): three stakeholders characterized by different factors for capacity

Specification for the saturation modelling

- Modelling to determine the utilisation rate for a line: ratio between offer and demand
- Initially used to forecast saturation and test factors to manage capacity
- Modelling for a simple line type of HSL in France:
  - Homogeneity of traffic: only travellers
  - Homogeneity of rolling stock: only high speed train

=} Application to assess stakeholder impact on capacity

Specification for the saturation modelling

Each factor is characterized by parameters

Parameters	Description	Factors
Train capacity (Cr)	Maximal number of seat per train	Rolling stock
Load factor (θ)	Percentage of seat used per train	Rolling stock service pricing
Rate of multiple units (μ)	Number of train coupling (1 or 2)	Rolling stock
Hours of operation (h)	Number of hour for traffic on the network on 24h	Traffic management
Theoretical capacity (Ct)	Maximal number of train per hour	Infrastructure operation
Coefficient of resilience (κ)	Percentage of theoretical capacity available for traffic per hour	Traffic management operation
Coefficient of concentration (ϕ)	Density of traffic during peak hour compared to off peak hour	Infrastructure pricing

$$Ur = (D*\phi) / [((Cr*\theta)*\mu)*((Ct*\kappa)*h)]$$

Case study of HSL Paris-Lyon: hypothesis

Modelling utilization rate for the HSL Paris-Lyon according to data from RFF (2011)

	2008 (reference)	**S1** (infrastructure)	**S2** (rollling stock)	**S3** (management traffic)	**S4** (pricing)	**S5** (operation)
Train capacity	450	450	**600**	450	450	450
Rate of multiple Unit	1,3	1,3	**2**	1,3	1,3	1,3
Load factor	80%	80%	**90%**	80%	**90%**	80%
Hours of operation	6570	6570	6570	**6935**	6570	6570
Theoretical capacity	16	**32 (2x16)**	16	16	16	**20**
Coefficient k	75%	75%	75%	**80%**	75%	**80%**
(Commercial capacity)	*12*	*24 (2x12)*	*12*	***13***	*12*	***16***
Concentration of traffic	1,5	1,5	1,5	1,5	**1,2**	1,5
Type of solution		New HSL	Low-cost HST	New timetable	Congestion pricing	New signalling system (ERTMS)

Case study of HSL Paris-Lyon: results

	Capacity increase	Estimated cost	Time scale	Involved stakeholder
Reference	-	-	-	
S1 (infrastructure)	+ 100%	€13 bln	Long term	Network manager
S2 (rolling stock)	+ 131%	Cycle of product life	Medium term	Operator
S3 (management)	+ 13%	=	Short term	Traffic manager
S4 (pricing)	+ 30%	=	Short term	Network manager Operator
S5 (operation)	+ 33%	€250 mln (operator) €250 mln (network manager)	Medium term	Network manager Operator

- Important lever for operator by offer: rolling stock (+131%)
- Important lever for network manager by infrastucture BUT high price and constant returns

=} Lever for network manager to increase returns: depends on operator strategy (pricing, operation)

Case study of HSL Paris-Lyon: results

- **Question of balance between network manager and operator**

- **Which regulation to maximise capacity?**
  - Governance: level of independance of network manager
  - Market: level and kind of competition between operators

- **Which signal to maximise capacity?**
  - Price signal from network manager for congestion:
    - If operator in monopoly: maximisation of producer surplus
    - If operator in competition: increasing capacity by offer (train capacity, operation, etc.)

=} Depends on governance and competition

Conclusion

Analysis method to:

- Assess the effect of stakeholders on capacity
- Consider strategic choice from stakeholders on capacity
- Describe stakeholder interaction from capacity

Two challenges:

- Regulation to facilitate the implementation of innovations
- Regulation to ensure an optimal use of railway capacity

Thank you for your attention