

Discussion on
Train path allocation in the
railway sector in Germany

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You have to be smart if you want to run a train

- Information about the tracks. Is there a track at all? What is the maximal slope?
- Station infrastructure. Load and unload your freight. Stop your train at the platform. Display your train on the screen for the passengers. Light on the platform. Toilet and waiting room for your freight train driver.
- If you want to run a border crossing freight train:

Good luck!

How to allocate slots

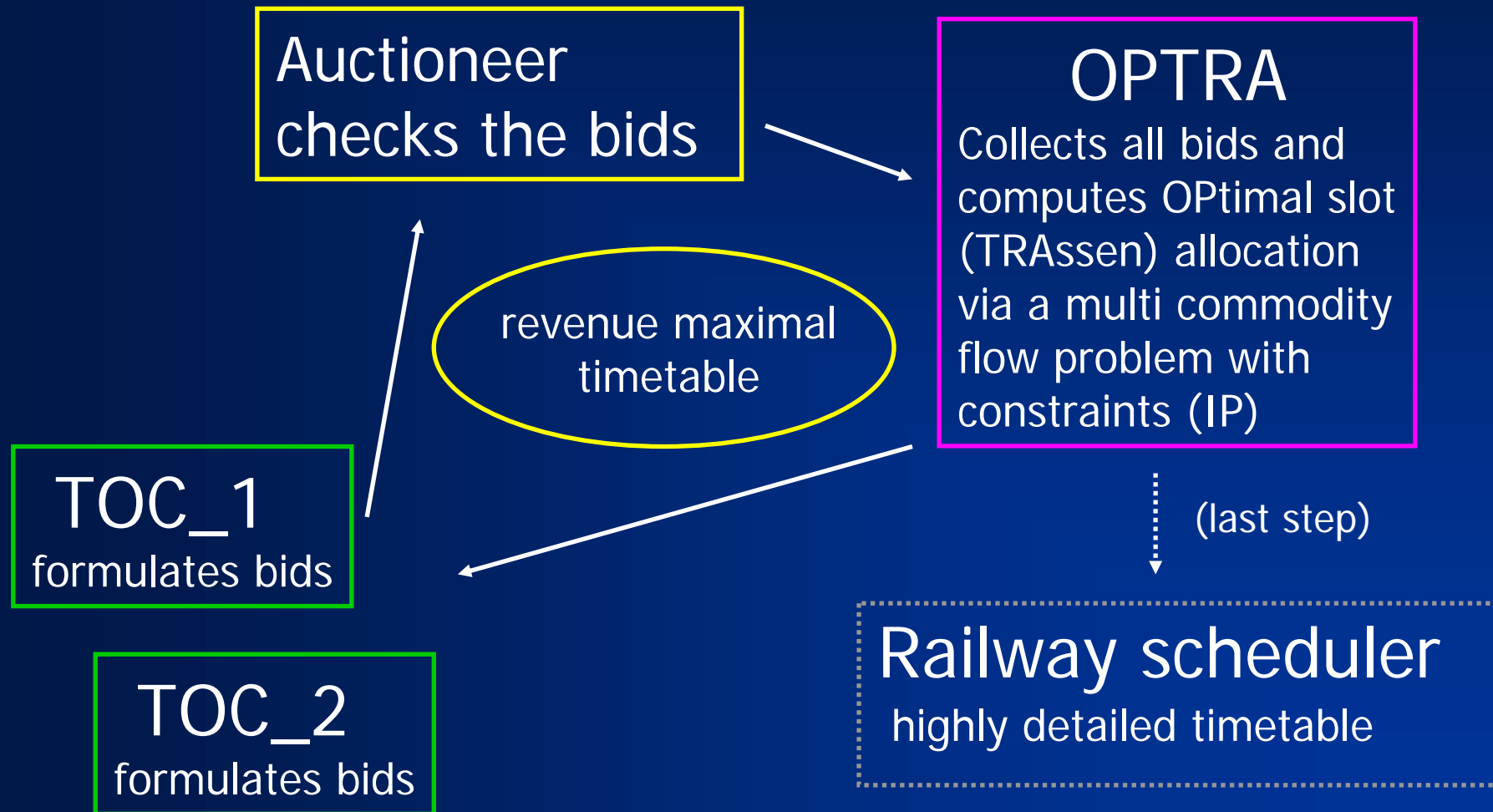
- The optimal solution is the welfare maximizing timetable. This is the timetable with the highest total willingness to pay
- Priority rules reduce welfare. Freight trains have the lowest priority!
- Simultaneous allocation is better than sequential allocation. Grandfather rights may reduce the available capacity dramatically

Coordination of slots because...

- At the station: Passengers want a timetable
- On the track: Trains have different speeds and it is difficult to overtake

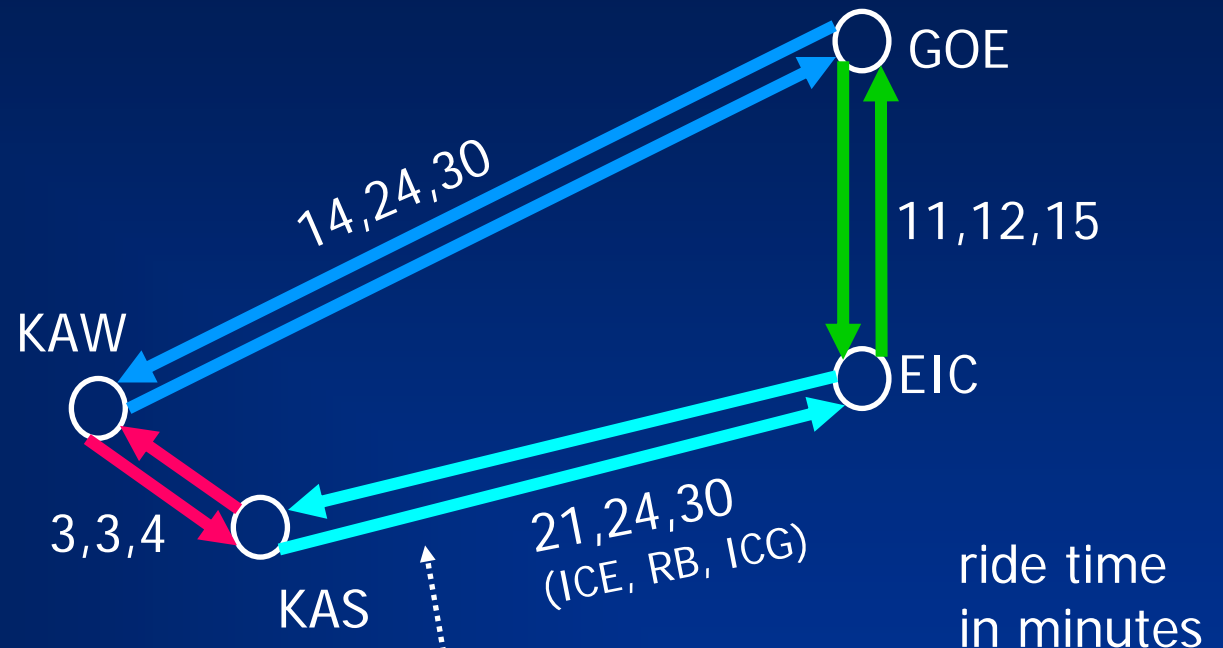
Coordination is difficult for 40.000 train runs each day. Therefore, the timetable tends to change only marginally each year.

Auction



Railway Model

Discrete Model:
Infrastructure,
Time,
operation mode



ht	ICE	RB	ICG
ICE	4	4	4
RB	7	4	3
ICG	13	9	5

headway
time

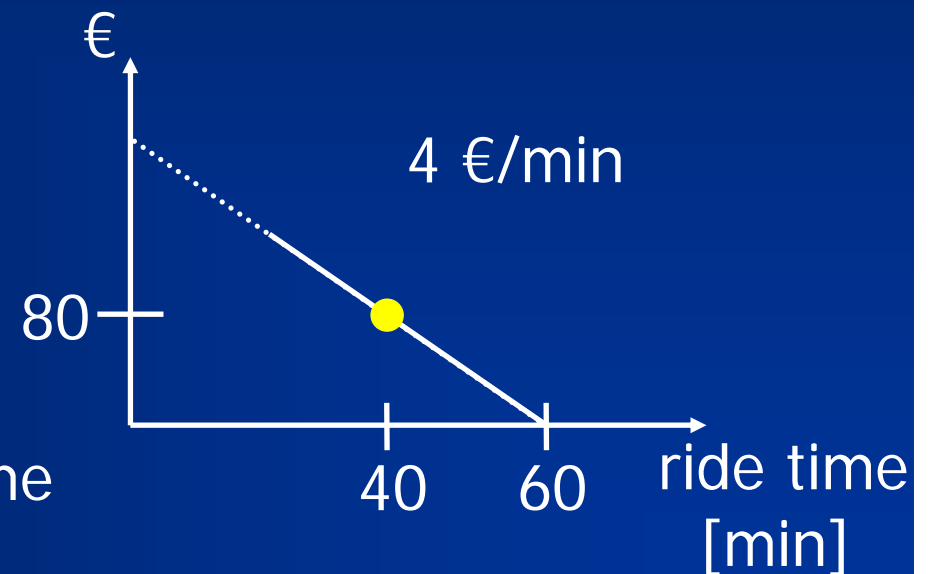
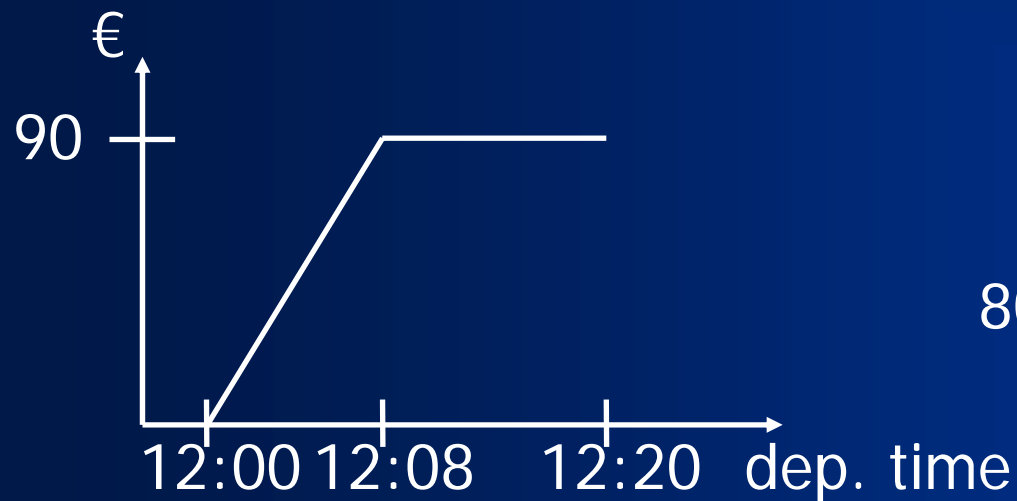
Bid for a slot in a corridor

- Train number, train type
- Start station, earliest departure time
- Destination, latest arrival time
- Base bid (in Euro)

- Stopover:
Train number, station, time interval,
minimal duration for stop

Variable bids

Bid amount = Base bid + departure bonus
+ ride time bonus



Effects

3 x

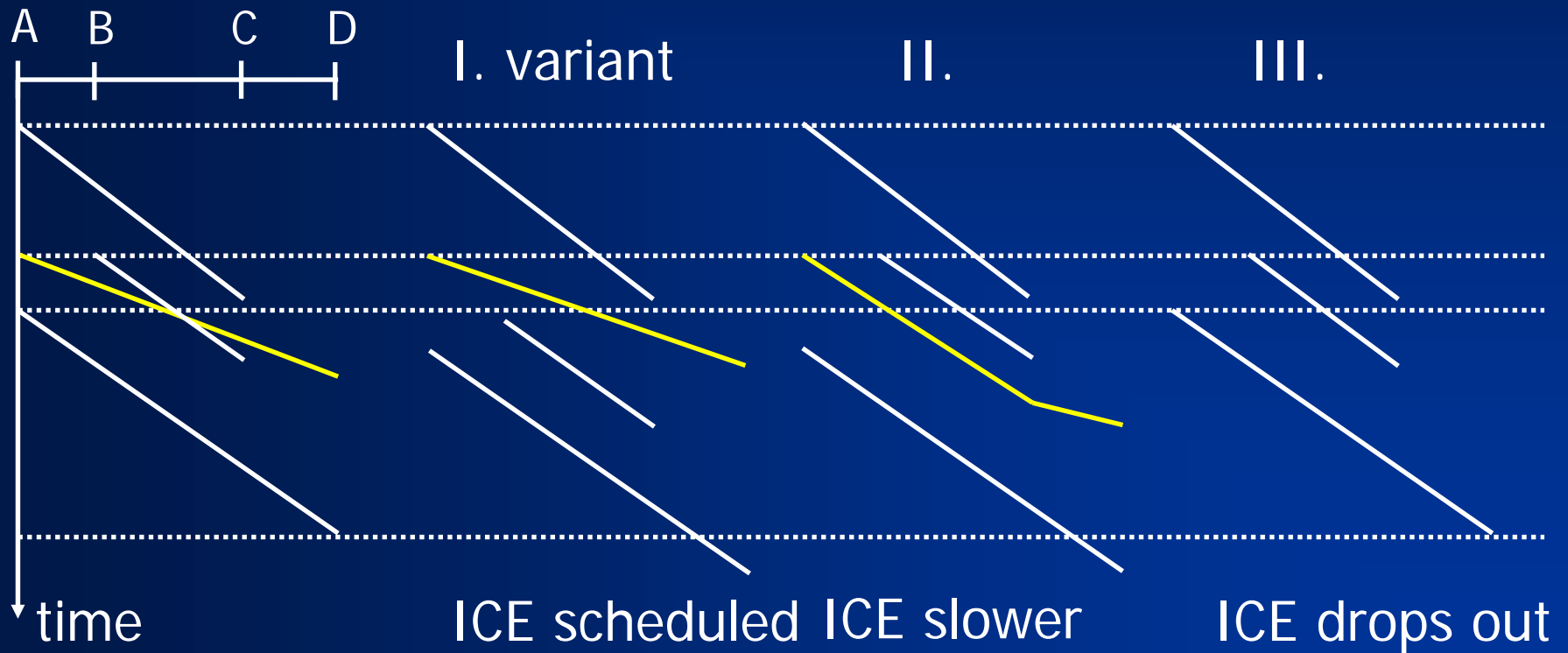


+ 1 x



= ???

↑ difficult!



Bids for train packages

Danger!

AND-bid:
Either all trains
or no train at all



Sascha G. Lukac

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Century Fox



OR-bid:
There can be only one

Result for 946 slot requests

Variation	Computer CPLEX	Income (% Status Quo)	Slots (% Status Quo)
0 min	6 sec	52.066 (+ 84%)	420 (+ 47%)
1 min	8 sec	60.612 (+114%)	496 (+ 74%)
4 min	1 day	67.069 (+137%)	617 (+117%)
5 min	3 days +	67.975 (+140%)	737 (+159%)

Status Quo: 284 slots for 28.255 Euro

Up to 140% higher income possible

Output of OPTRA

