



Risk Analysis for a Synchro-modal Supply Chain

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OVERVIEW

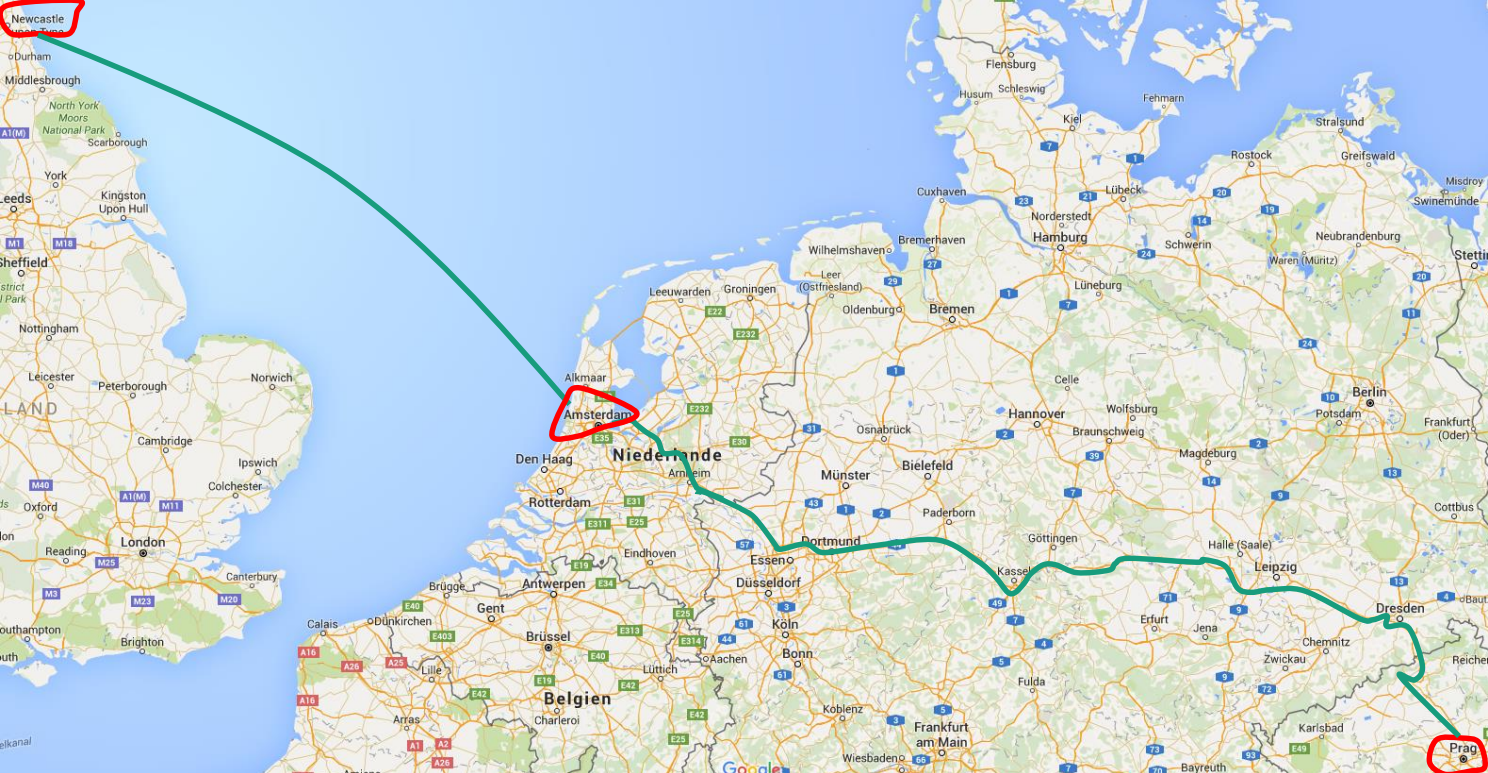
- Motivation
- Synchro-Net
- Concept
- Risk Module





- Client based in Prague regularly moves goods to the Newcastle area
- Common route for 20 years: Prague – Calais – Dover – Newcastle

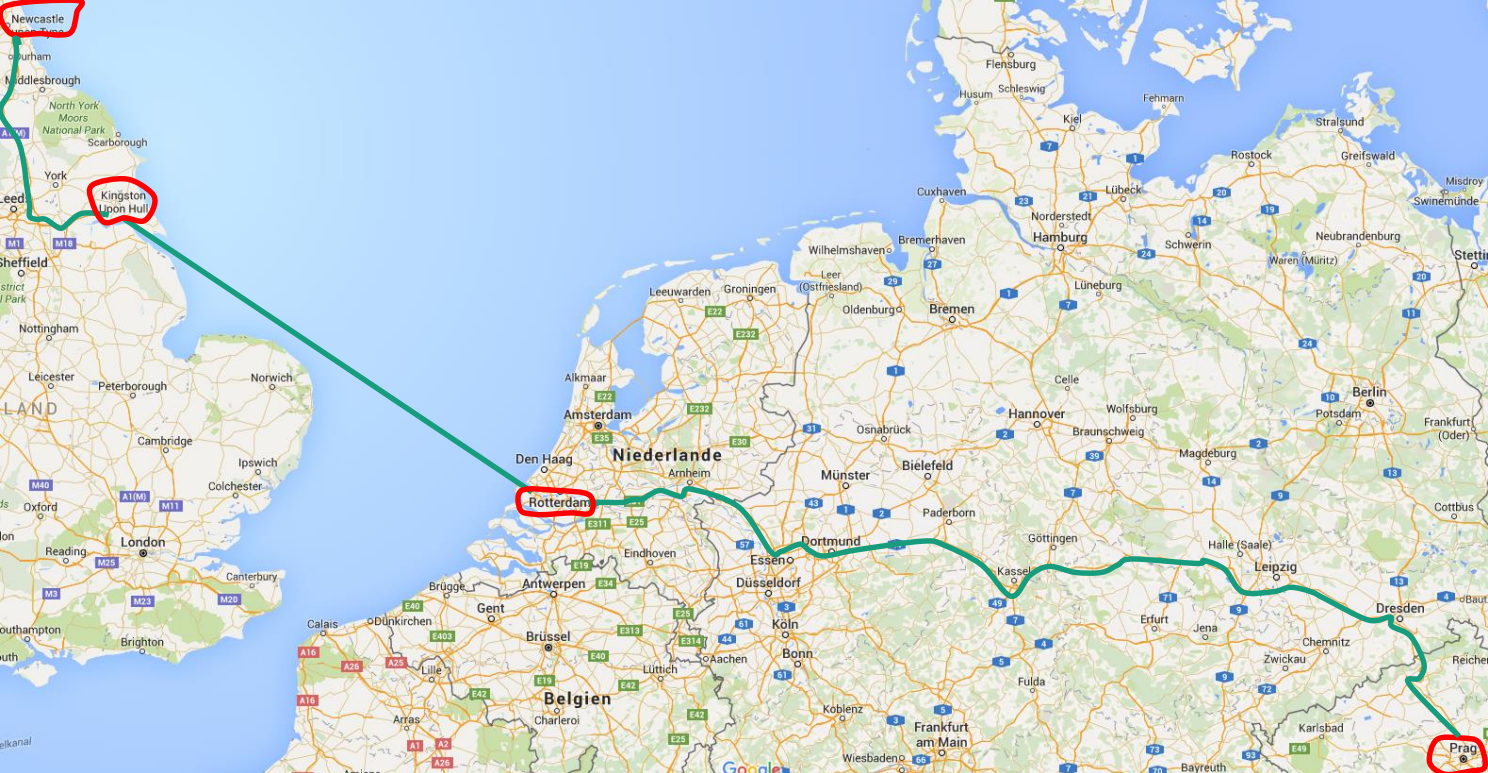
Summer
2015
Problems at
Calais



■ Alternative 1: Prague - IJmuiden - Newcastle

- 6,7 h
- 750 km

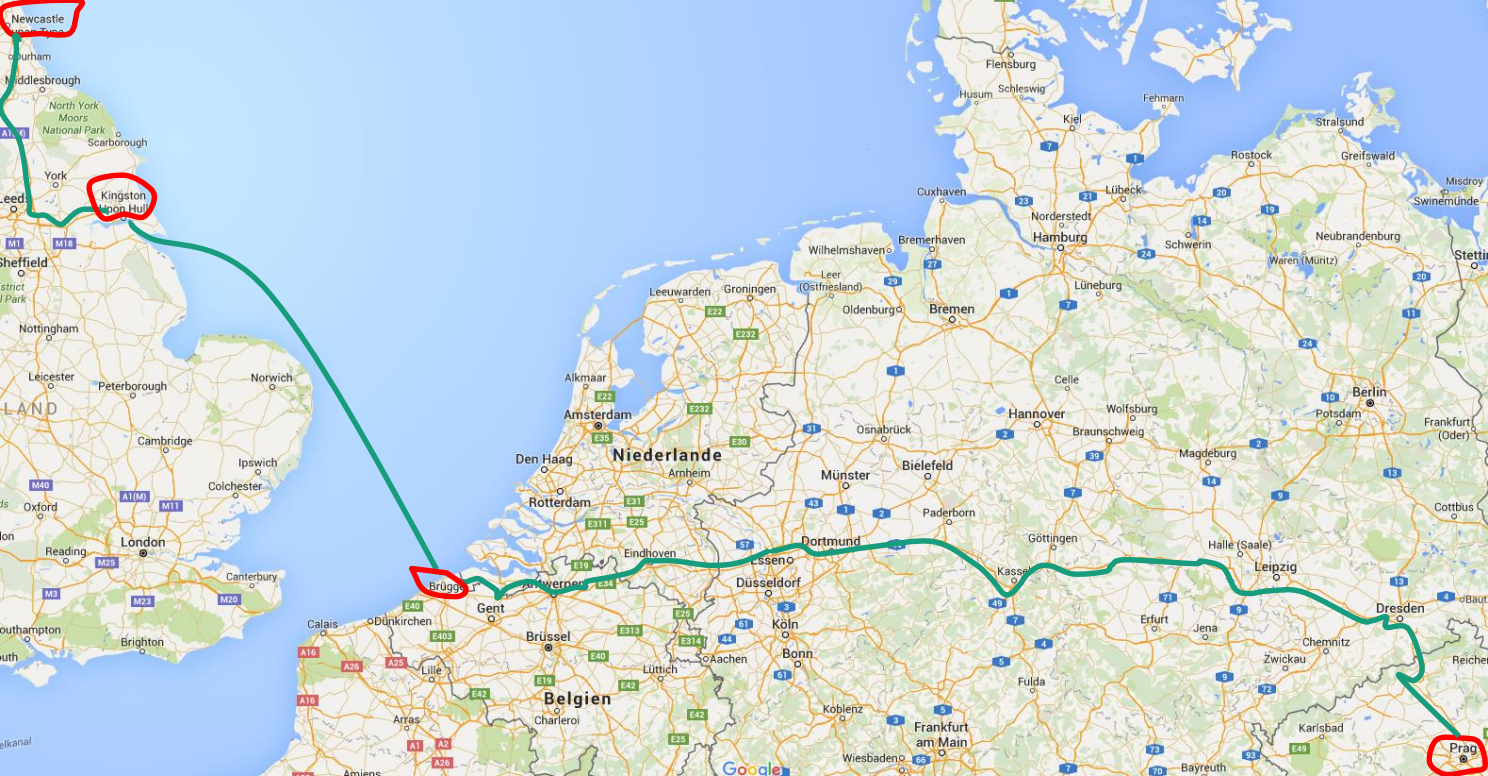
	Leg 1 drive time in h	Leg 1 drive distance in km	Leg 2 ferry time in h	Leg 3 drive time in h	Leg 3 drive distance in km	Total drive time in km	Total min break time while driving in h	Total time in h	Total distance in km
C	15,71	1100	1,5	7,86	550	23,57	22	47,07	1650
1	12,86	900	16,5	0,00	0	12,86	11	40,36	900



■ Alternative 2: Prague - Rotterdam - Hull - Newcastle

- 8,6 h
- 500 km

	Leg 1 drive time in h	Leg 1 drive distance in km	Leg 2 ferry time in h	Leg 3 drive time in h	Leg 3 drive distance in km	Total drive time in km	Total min break time while driving in h	Total time in h	Total distance in km
C	15,71	1100	1,5	7,86	550	23,57	22	47,07	1650
2	12,86	900	11	3,57	250	16,43	11	38,43	1150



■ Alternative 3: Prague - Zeebrugge - Hull - Newcastle

- 4,7 h
- 400 km

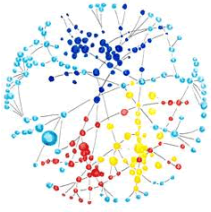
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C	15,71	1100	1,5	7,86	550	23,57	22	47,07	1650
3	14,29	1000	13,5	3,57	250	17,86	11	42,36	1250



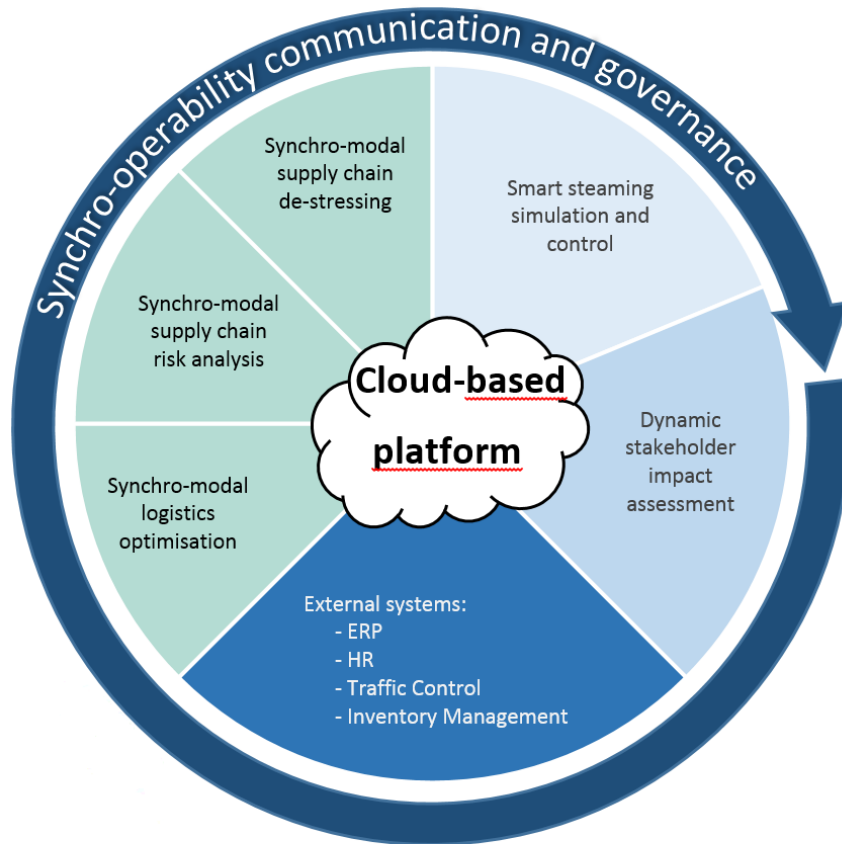
- Calais-Dover is the least favourable option of the four
- with other potential disruptions the difference would be even more



- will show alternative routes
- will show the risks of each alternative route
- will help you decide which route is the best for given conditions

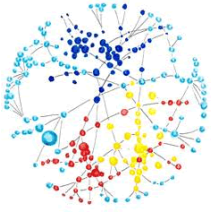


Synchro-NET

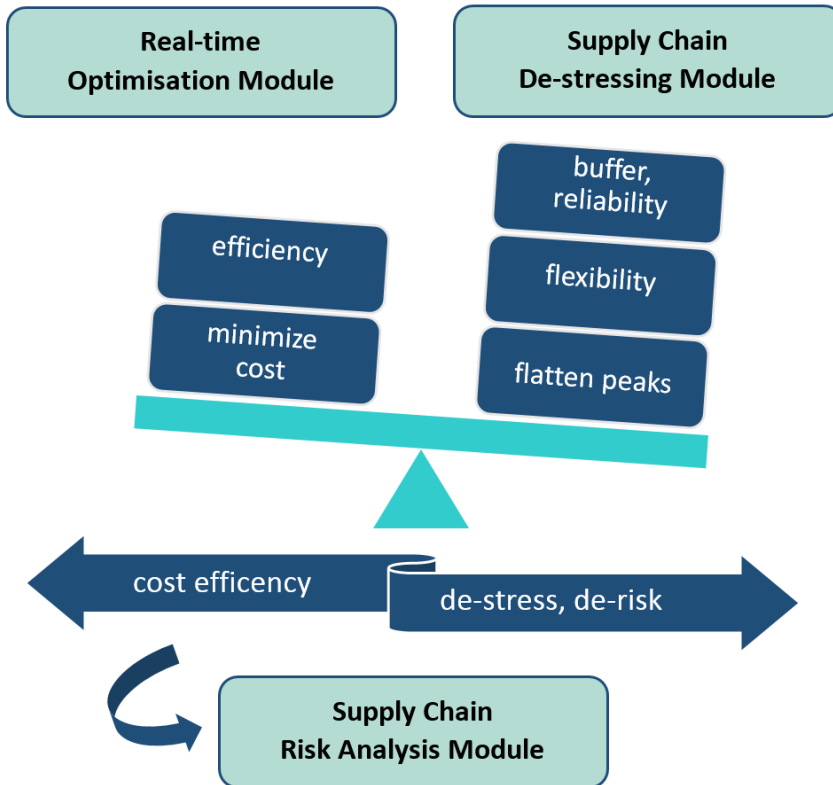


Main modules for optimisation:

- Real-time Optimisation Module
- De-stressing Module
- Risk Analysis Module

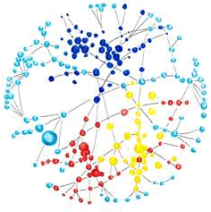


Synchro-NET



Main modules for optimisation:

- Real-time Optimisation Module
- De-stressing Module
- Risk Analysis Module



Synchro-NET



„classical“ logistics planning

KPIs

- costs
- time
- CO₂
- punctuality of service

additional information for risk-based planning

KRIs

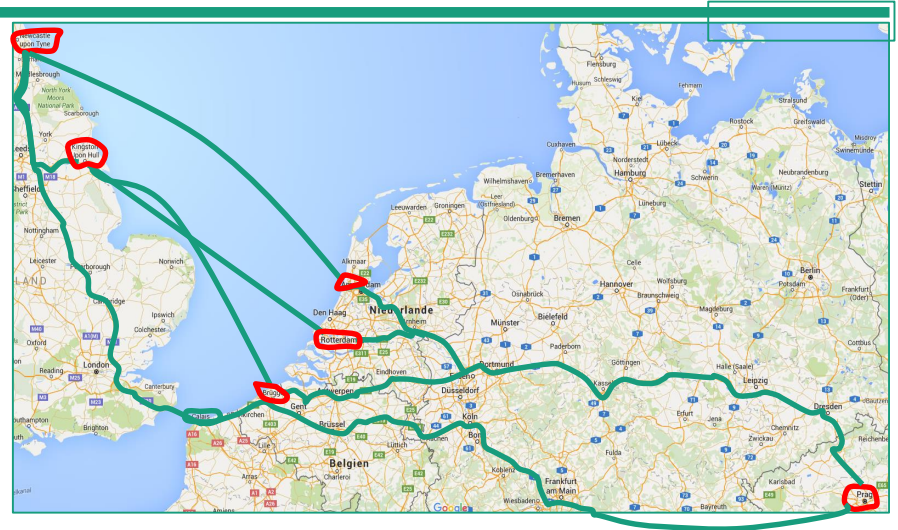
- expected delay
- expected cost deviation
- loss or damage of freight
- flexibility of route



SYNCHRO-NET will combine both perspectives
to provide robust synchro-modal supply chains

Risk Analysis

Causes and Consequences



- Graph with nodes and legs
 - Nodes: trans-shipment hub, ports, intermodal nodes
 - Legs: rail, truck, ferry, container-ship, plane
- Different causes at different situations have different consequences
- 3 types of consequences:
 1. Time delay leading to re-scheduling
 2. Break-down of a node or a leg leading to re-routing
 3. Loss of freight

Risk Analysis

Causes and Consequences



General risks	Loss of freight	Time delay / "Re-scheduling"	Break-down / "Re-routing"
Extreme weather/natural disaster	X	X	X
Damage, mishandling, accidents	X	X	X
Government, politics, war	X	X	X
Theft	X		
Economic problems		X	X
...			

Risk Analysis

Causes and Consequences



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Economic problems		X	X
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Risk Analysis

Causes and Consequences

Cause on legs	Loss of freight	Time delay / "Re-scheduling"	Break-down / "Re-routing"
Means of transport failure		X	
Traffic		X	
Accident	X	X	

Cause in node	Loss of freight	Time delay / "Re-scheduling"	Break-down / "Re-routing"
Late provision of means of transport		X	
Means of transport can't be provided		X	X
Peak time/Queuing time		X	
Time slot missed		X	X
Import/Export bureaucracy		X	
Equipment failure		X	X
Key employee not available		X	X

Risk Analysis

Causes and Consequences

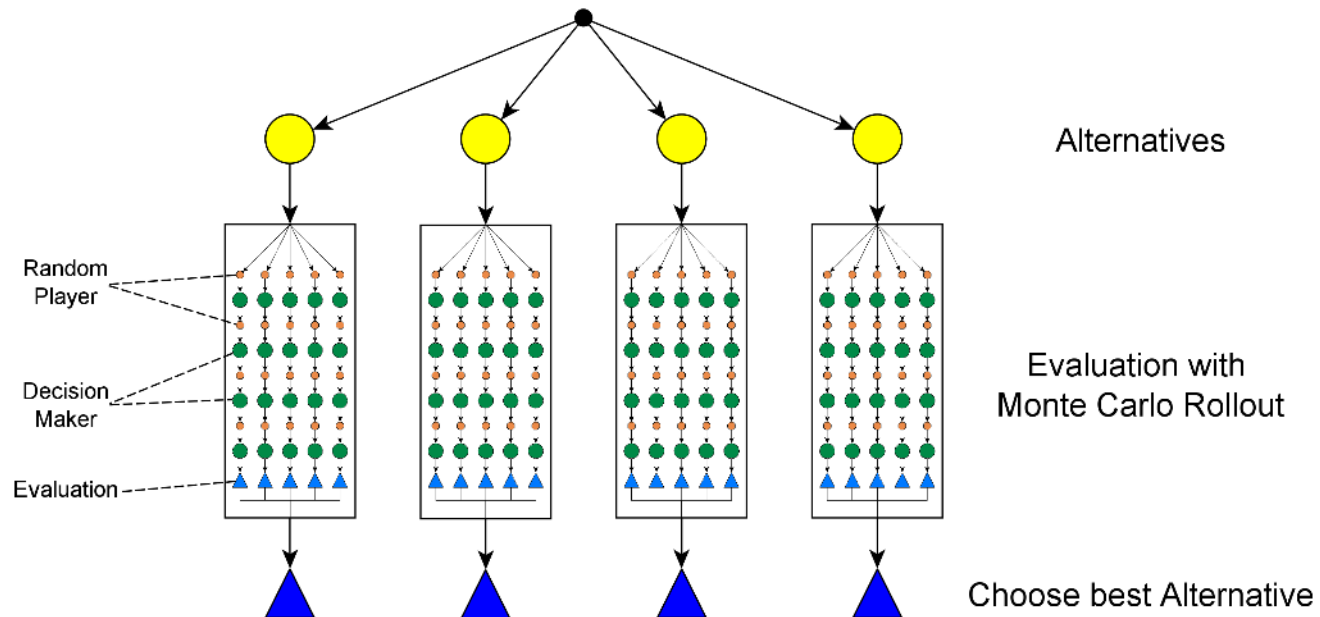
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Risk Analysis

How to get the KRIs?

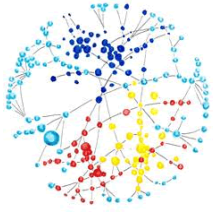
- Simulation based approach – Monte Carlo Rollout
- Random player: possible disruption
- Decision maker: incremental mode of „Real-Time Optimisation“ module



Risk Analysis

How to get the KRIs?

- For different probability distributions of event's causes and different severities of consequences in the model we perform all computations and produce different outcomes of risk assessment values.
- It shows the sensitivity of the outcome to input changes, the extreme situations, and all intermediate control values along the ways from the critical event's causes to its consequences.



Synchro-NET



- Synchro-NET platform will provide an overview of alternatives
- User decision
- But: learning system - ranking according to previous decisions

	Total time in h	Total distance in km	Total costs in €	Expected delay in h	Expected cost deviation in €	Probability of freight loss/damage	Flexibility rate
C	47,07	1650	xxx	5	xxx	0.1	0.3
1	40,36	900	xxx	3	xxx	0.1	0.7
2	38,43	1150	xxx	2	xxx	0.1	0.8
3	42,36	1250	xxx	1.5	xxx	0.1	0.2