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German Aerospace Center

A Comparative Analysis of Door-to-Door Mobility: Integrating Advanced Air Mobility into Multimodal Transportation

German Aerospace Center | *Nazlican Cigal, Menno Berger, Nabih Naeem, Prajwal Shiva Prakasha, And Björn Nagel*

Thessaloniki| 08.10.2024 - 11.10.2024

DLR Coordinated by
the German Aerospace Center

Outline

- Introduction
- Framework and Methodology
- Use Case
- Preliminary Results
- Conclusion
- Future Work

COLOSSUS –ADAM (Advanced Air Mobility)

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- *How can we best integrate **new aerial assets** that can aid Europe wide travel while considering **cost**, **sustainability** and **time**?*

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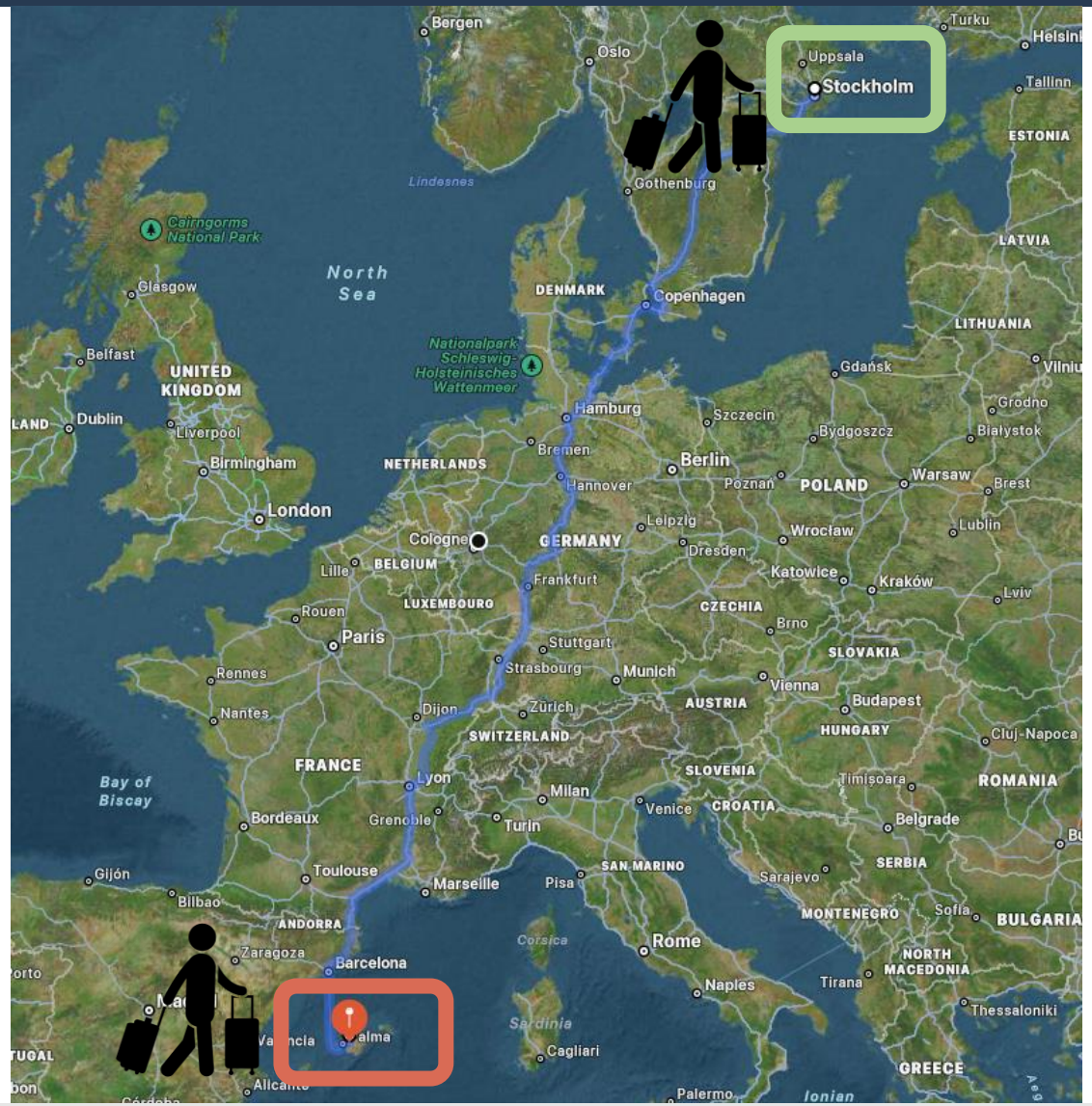
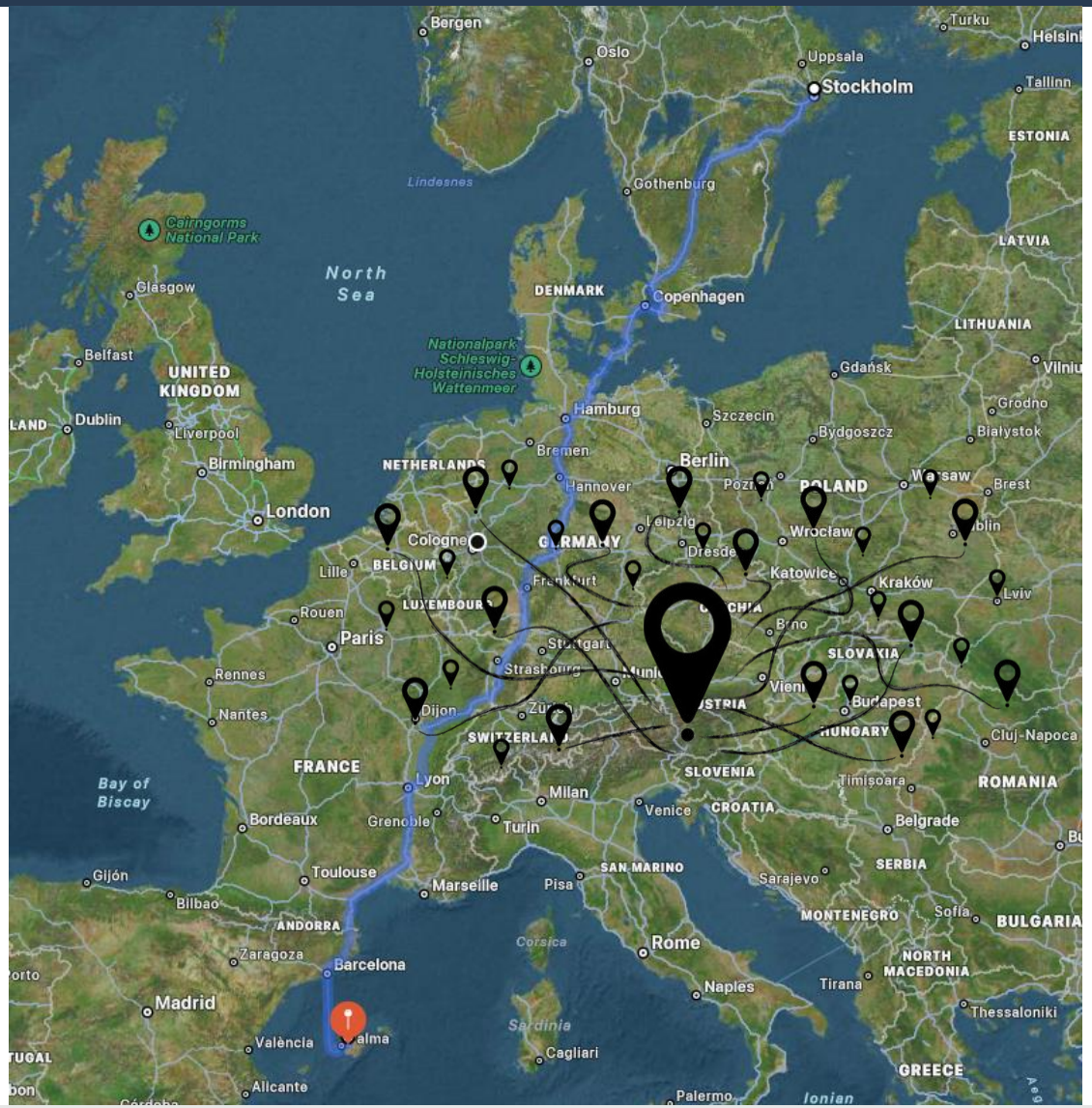
Approach

- Passenger has an origin and a destination



Approach

- Passenger has all possible routes with multiple transportation modes.



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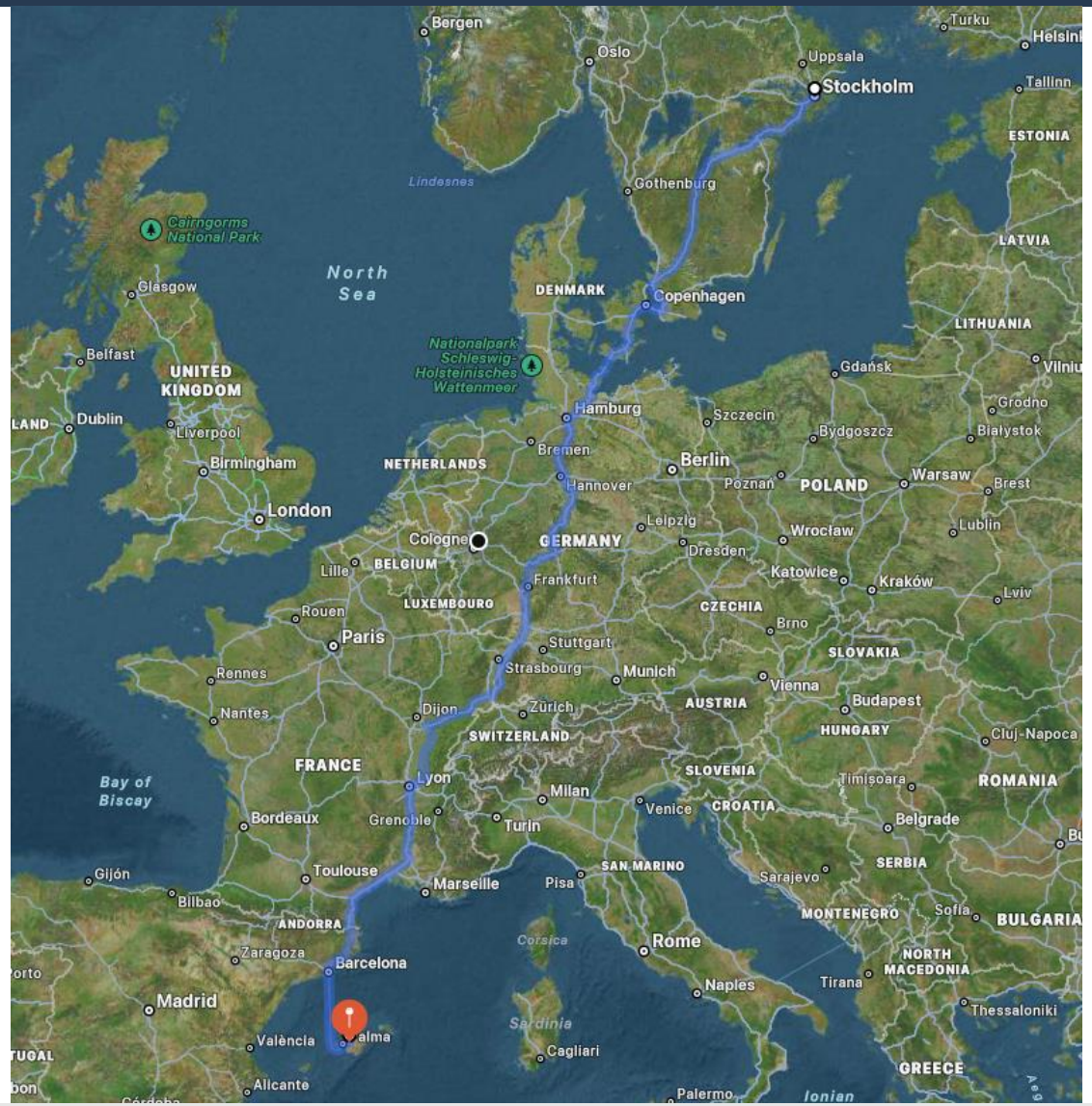
Approach

- Passengers have the liberty to choose the route based on their values: cost, time, environment…



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Framework and Methodology

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- Ticket Price
- Value of Time
- Ground Transportation
- Vertiport Infrastructure
- Passenger Demand
- Airline Transportation
- AAM Fleet Composition
- AAM Design

Multimodal System-of-Systems Framework

Ground Transportation
SUMO

Ground Transport Operations

Air Transportation
SOSID Toolkit

Air Transport Operations for AAM and Airlines

Tool Interface

SoS Result Exploration

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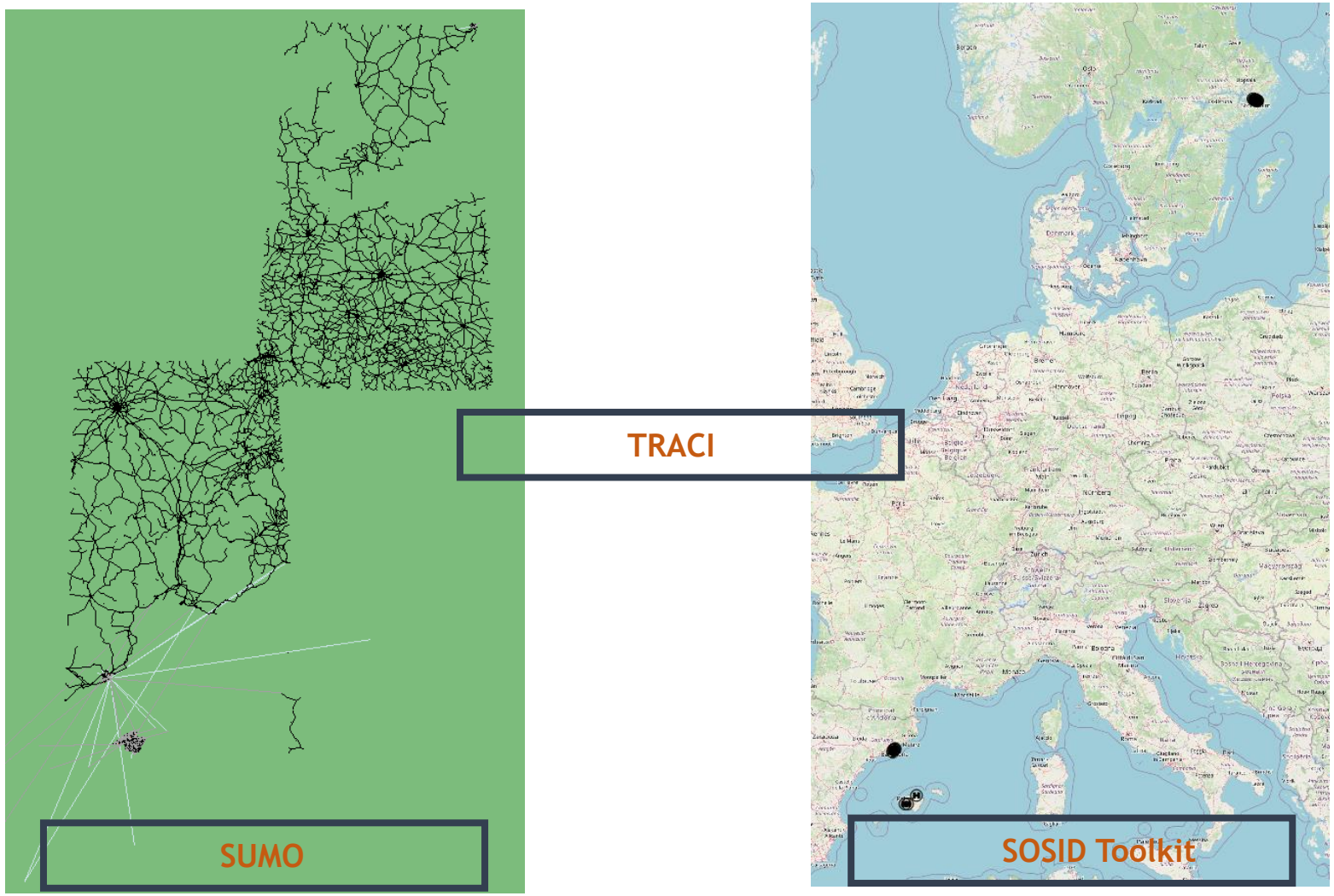
Use Case: Stockholm-Barcelona-Mallorca



Use Case: Vertiport Placement in SUMO

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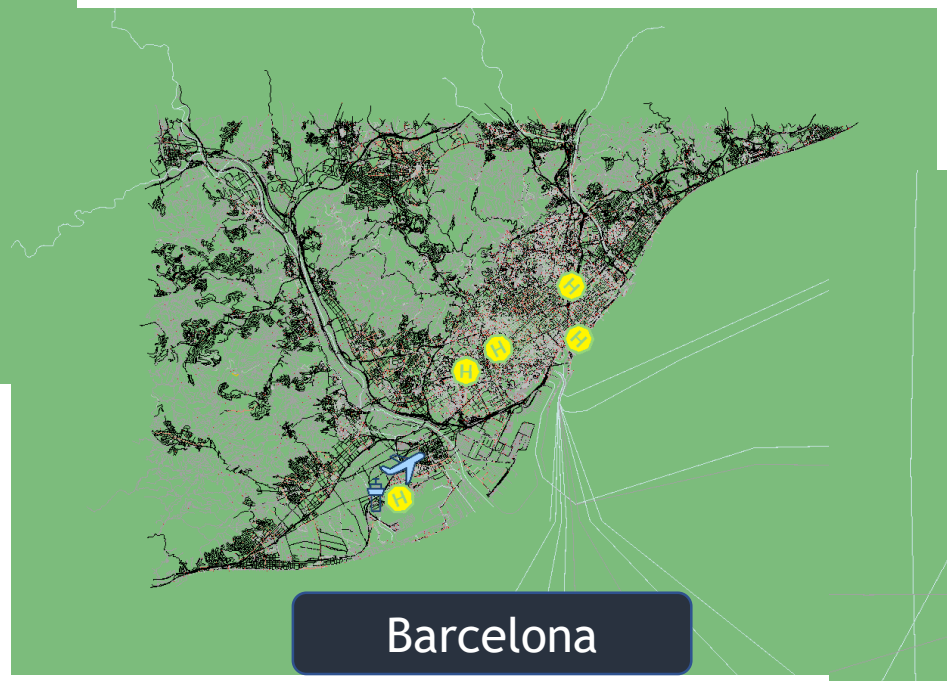
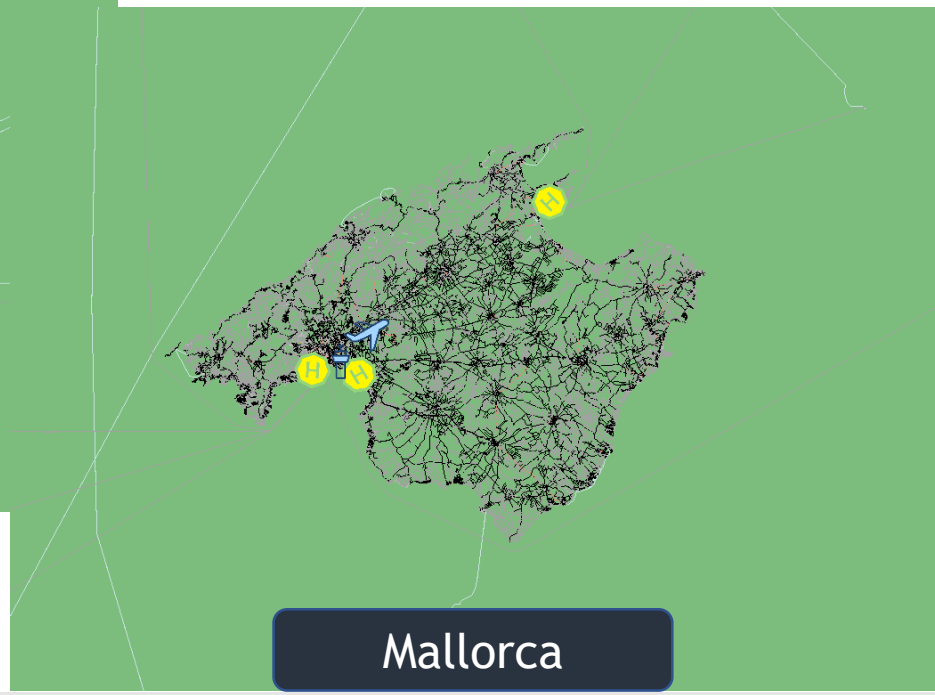
Stockholm



Barcelona



Mallorca

- 17 vertiports
- 3 international airports

Use Case: Scenario Setup

Fleet Type	Fleet Size	Payload Capacity	Flight Velocity	Range
Fully Electric Tiltrotor	17	360 kg	70 mps	120 km

Airline	Public Transportation	AAM
0.08 [€/km]	0.02 [€/km]	3 [€/km]

Use Case: Scenario Setup

Traveller Type

Use Case: Scenario Setup

Traveller Type	Value of Time
	
	10€/hr
	30€/hr
	50€/hr

Use Case: Scenario Setup

Traveller Type	Value of Time	Origin
		
	10€/hr	Stockholm Central Station
	30€/hr	Stockholm Alvik
	50€/hr	Stockholm Nacka

Use Case: Scenario Setup

Traveller Type	Value of Time	Origin	Destination
	10€/hr	Stockholm Central Station	Port de Palma
	30€/hr	Stockholm Alvik	Barcelona Sants Station
	50€/hr	Stockholm Nacka	Barcelona Francia Station

Use Case: Scenario Setup

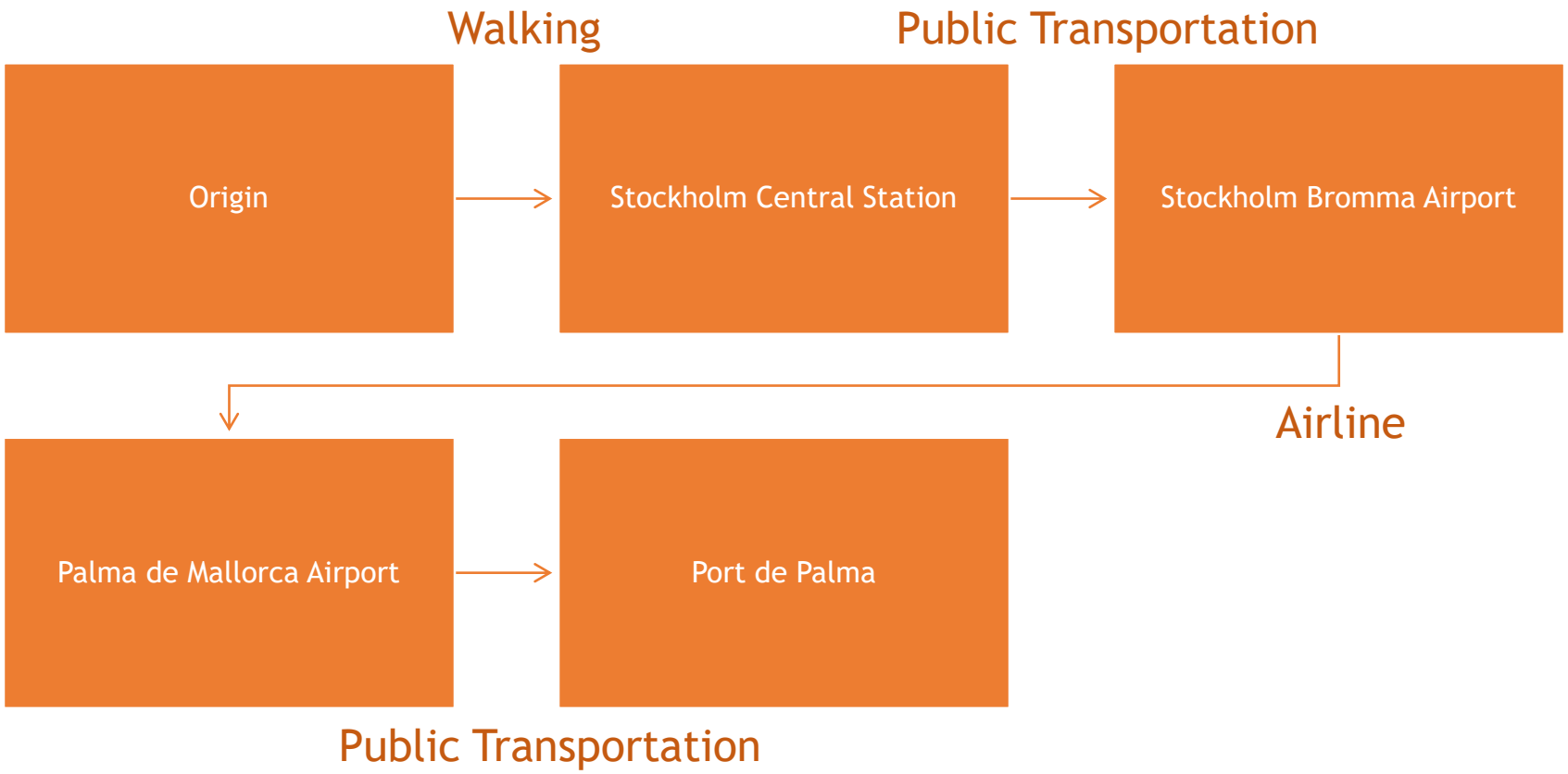
Traveller Type	Value of Time	Origin	Destination	Departure Time
	10€/hr	Stockholm Central Station	Port de Palma	07:00
	30€/hr	Stockholm Alvik	Barcelona Sants Station	06:10
	50€/hr	Stockholm Nacka	Barcelona Francia Station	06:30

Results: Travel Party 1

10€/hr

Stockholm Central Station

Port de Palma



Results: Travel Party 1

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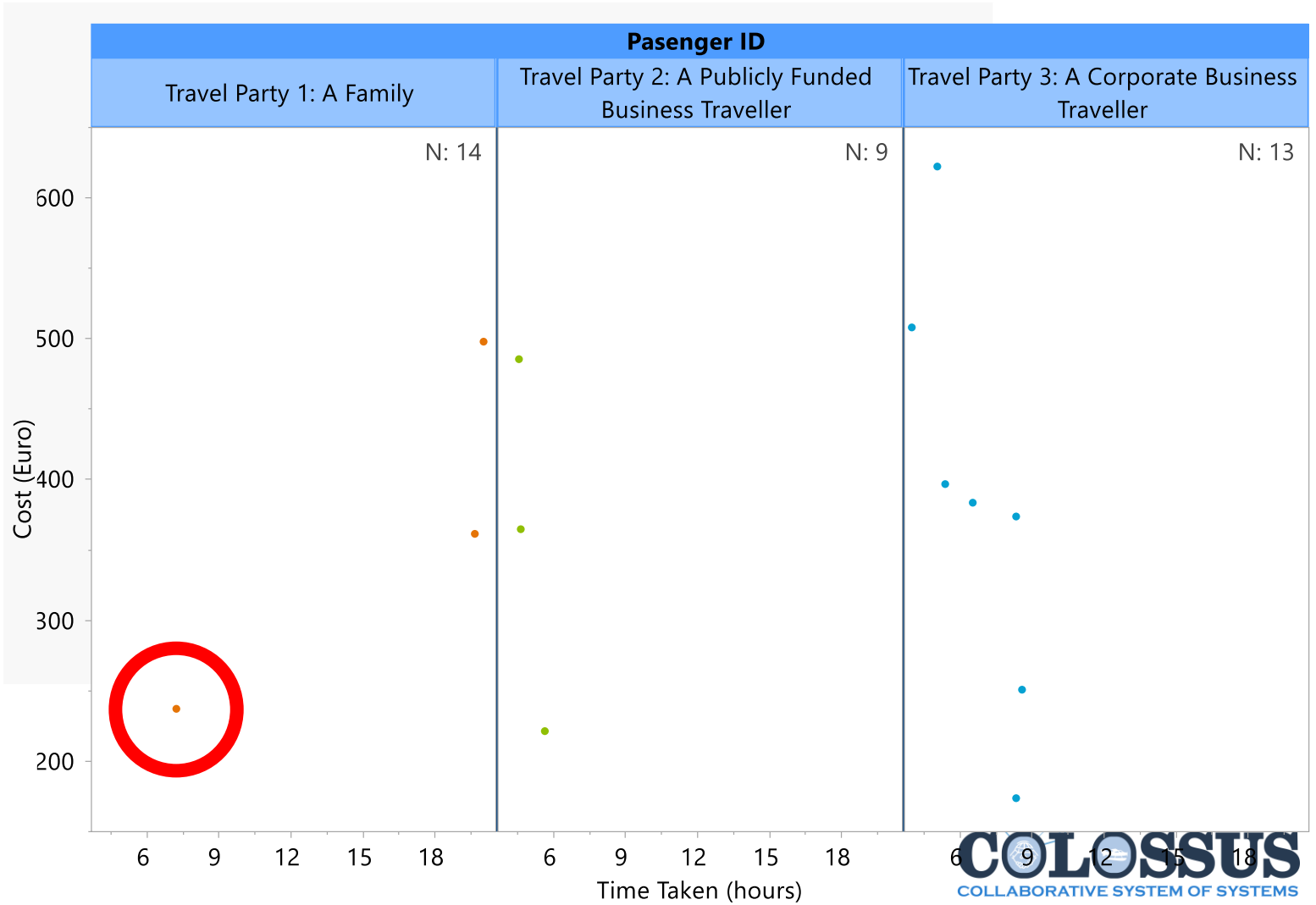
10€/hr

Stockholm Central Station

Port de Palma

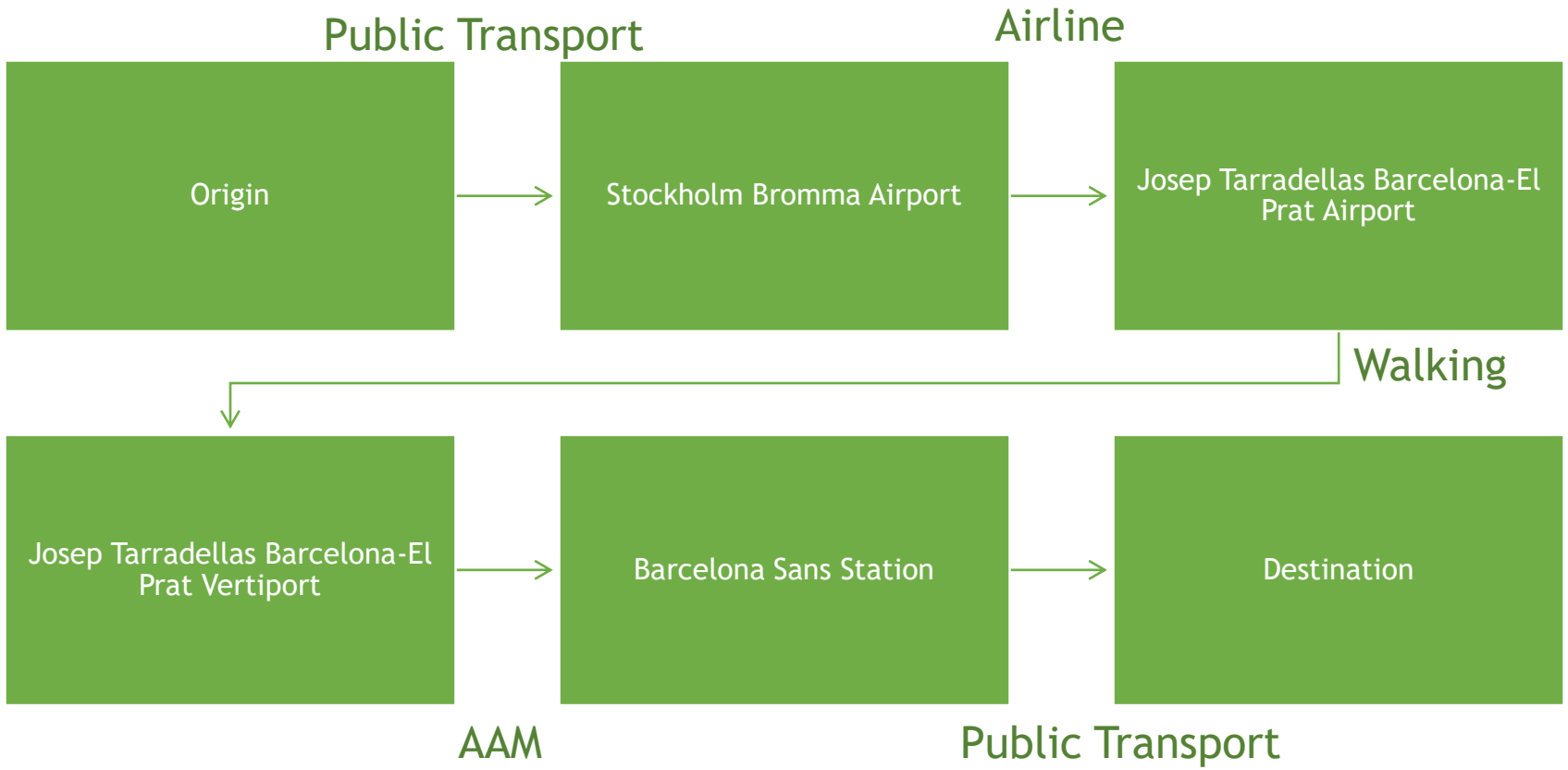


Results: Travel Party 2

30€/hr

Stockholm Alvik

Barcelona Sants Station

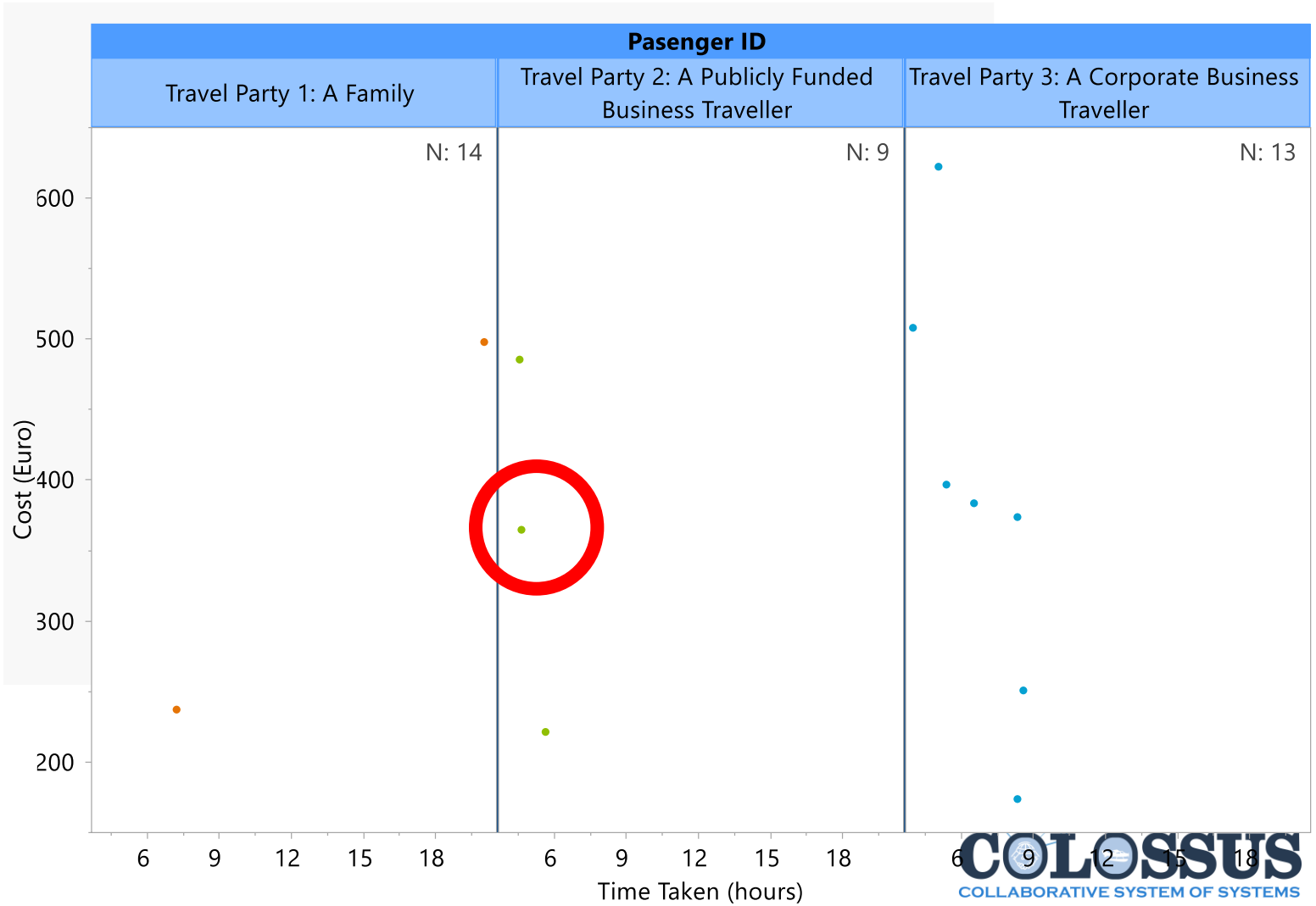


Results: Travel Party 2

30€/hr

Stockholm Alvik

Barcelona Sants Station

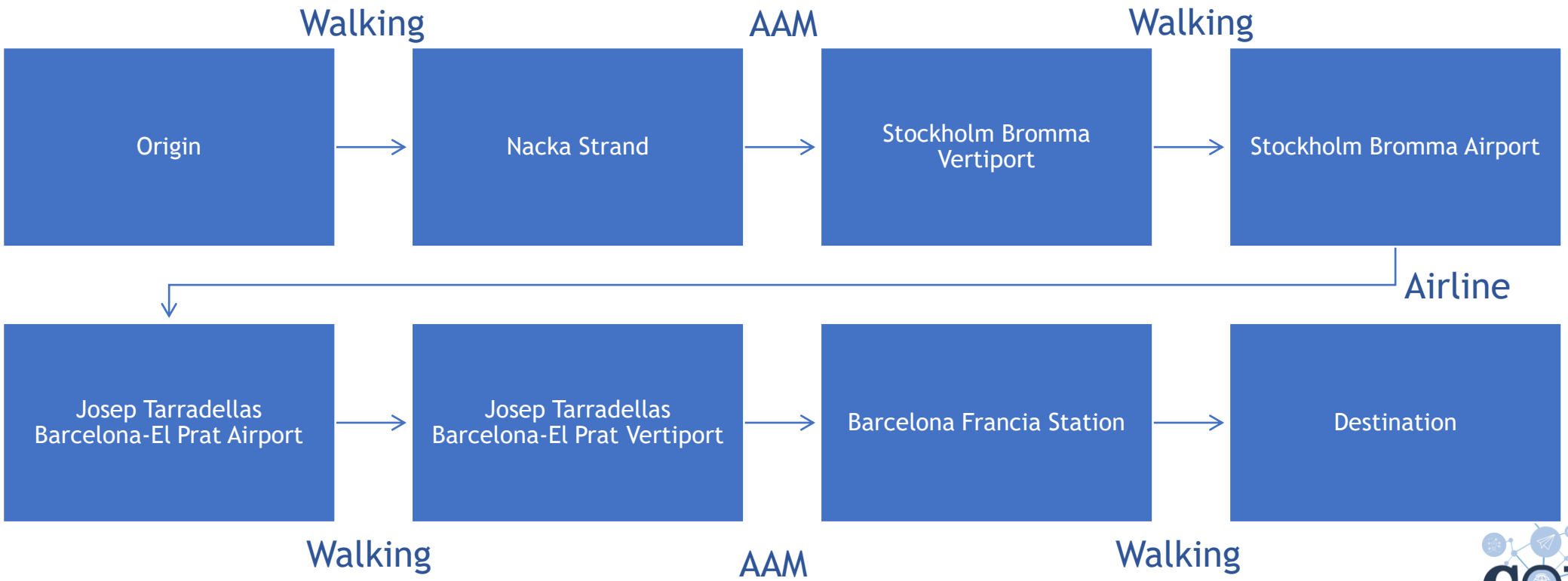


Results: Travel Party 3

50€/hr

Stockholm Nacka

Barcelona Francia Station

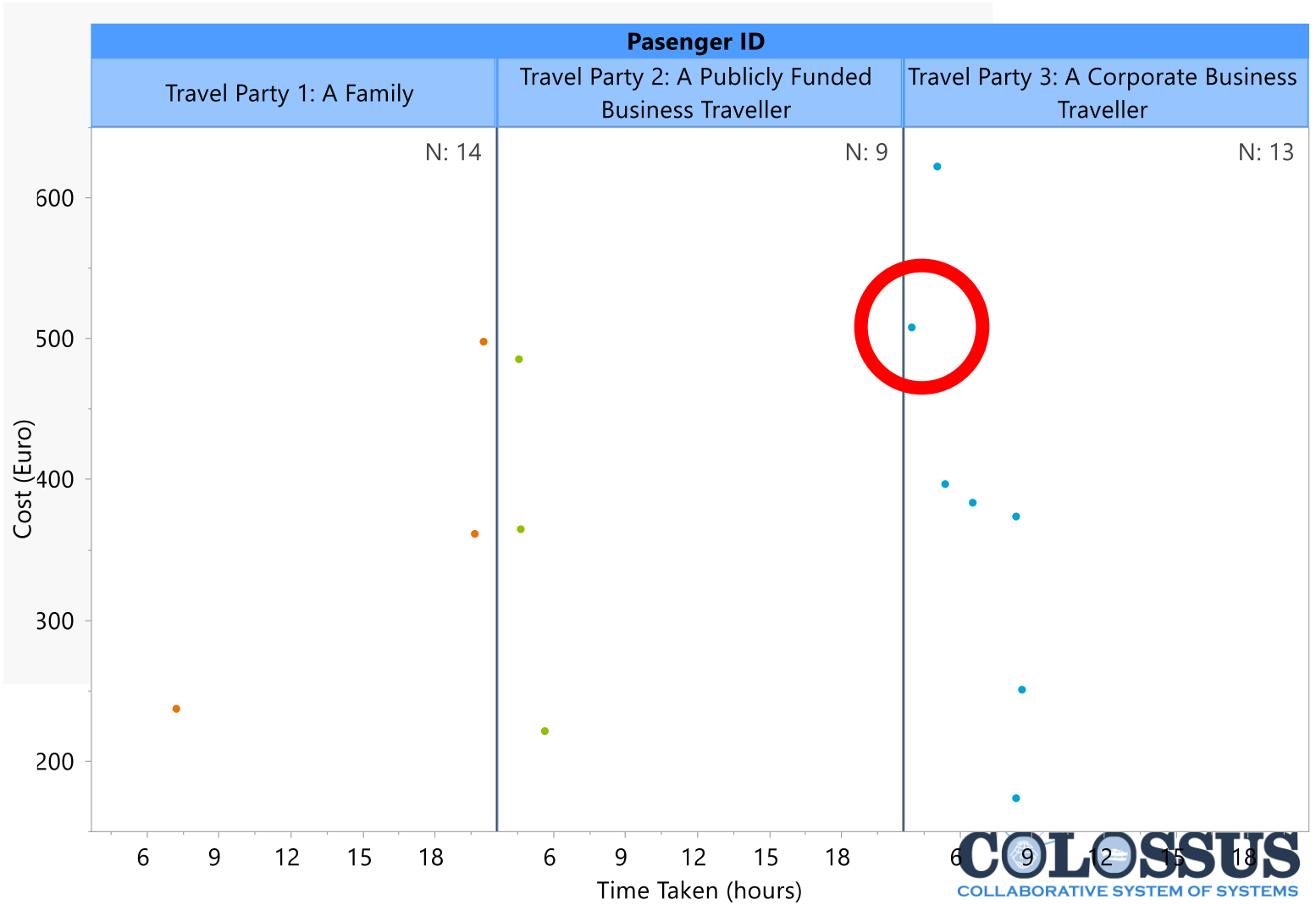


Results: Travel Party 3

50€/hr

Stockholm Nacka

Barcelona Francia Station



Conlusion

A framework which can simulate multimodal transportation with AAM integration is presented.

The passenger persona can be explored during decision making process.

Integration of the new technologies can be explored.

The framework can be tested for larger demand sets to represent realistic decision making process and for detailed sensitivity analysis.

Future Work

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German Aerospace Center

- Impact of Larger Demands
- Detailed Passenger Persona
- Seaplane Integration
- Heterogeneous Fleet Impact
- Dynamic Ticket Pricing
- Vertiport Placement Impact

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COLLABORATIVE SYSTEM OF SYSTEMS EXPLORATION OF AVIATION PRODUCTS, SERVICES & BUSINESS MODELS

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