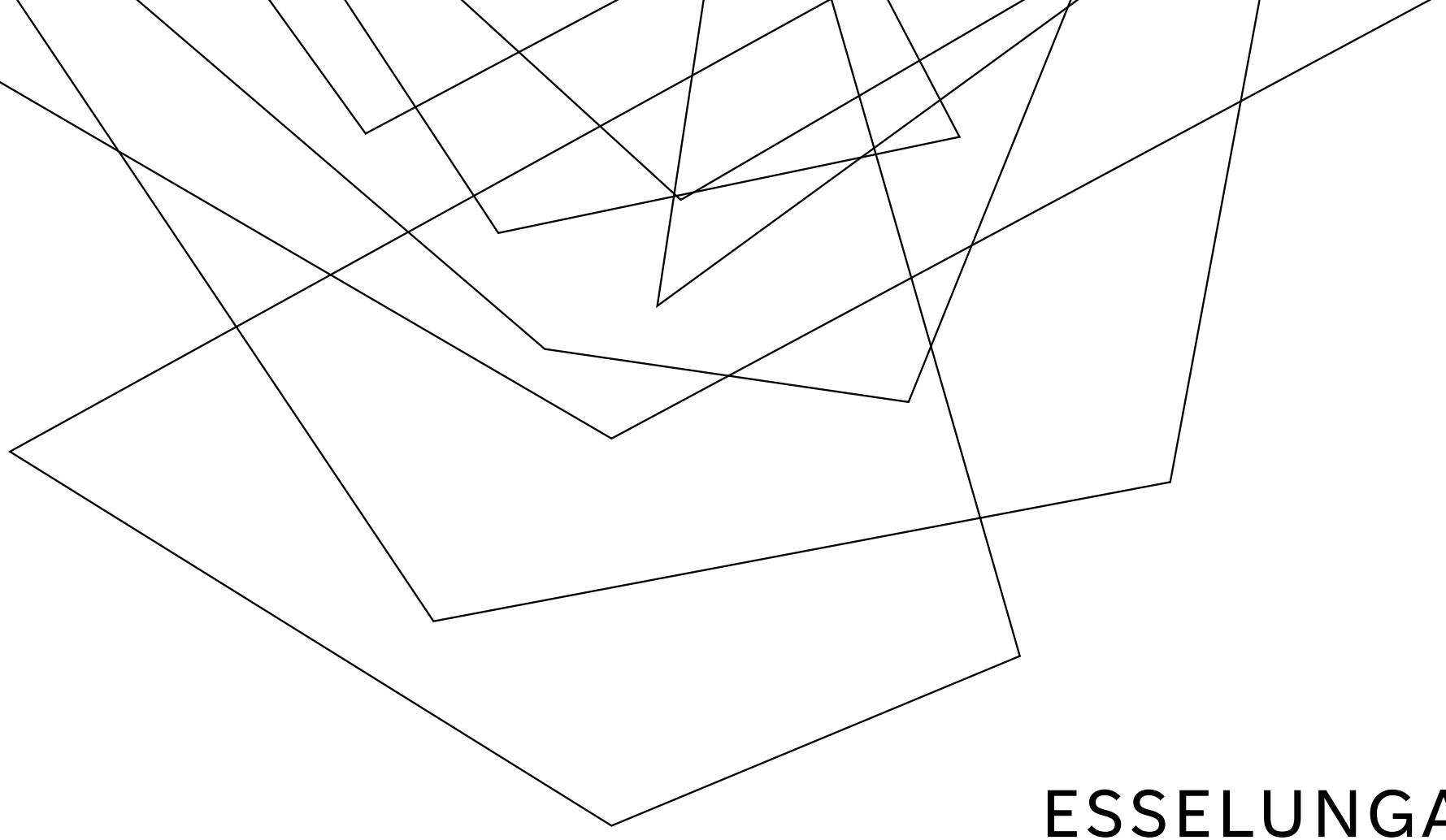


POLITECNICO DI MILANO

ESSELUNGA

ESSELUNGA LOGISTICS NETWORK

CHIARA BERETTA

LUCA CATTANEO

FILIPPO FAPPANNI

CONTEXT AND GOAL IDENTIFICATION

Stakeholders: clients and Esselunga company

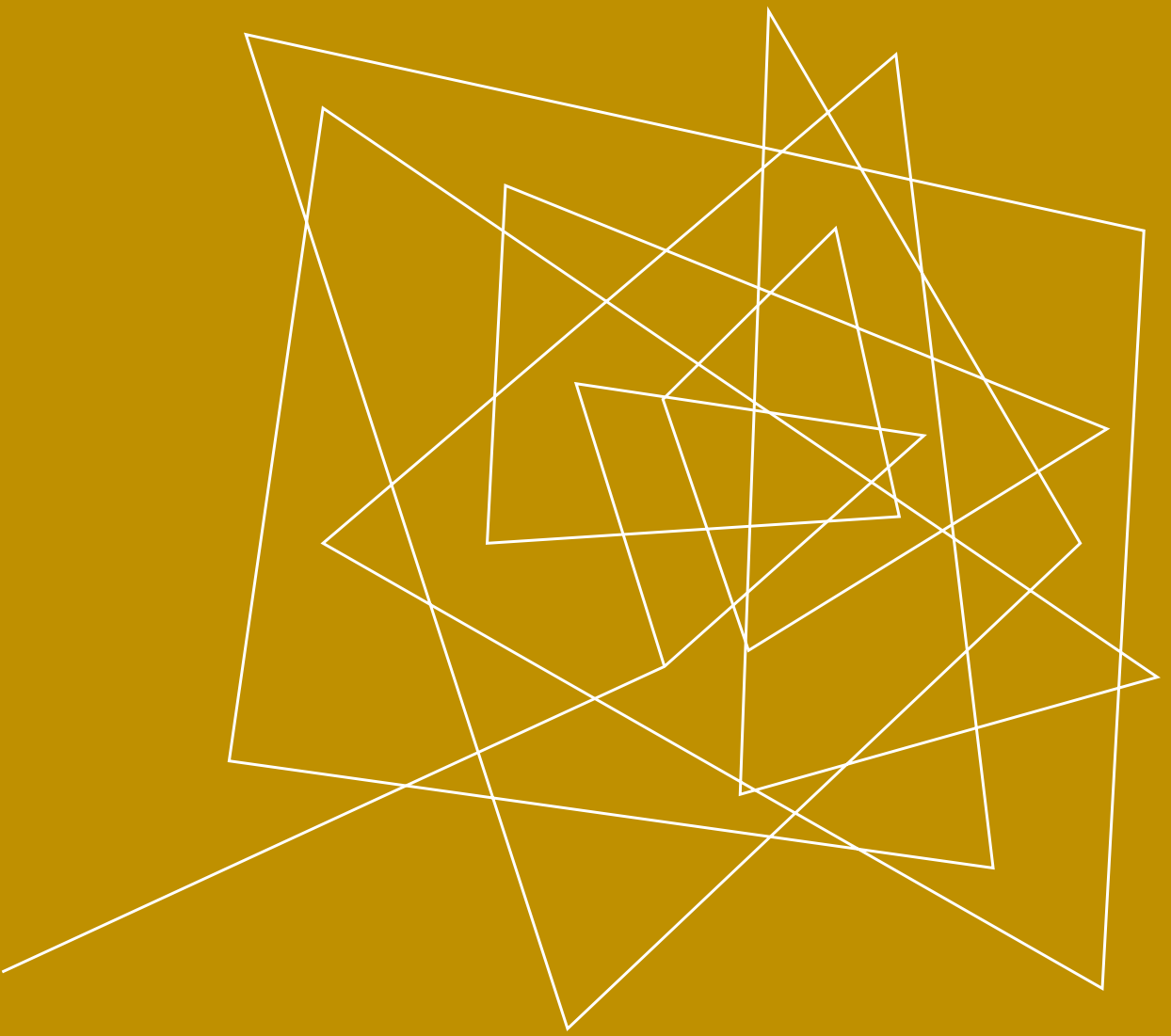
Goal: analyse the Esselunga logistic network

STEPS

NETWORK CONSTRUCTION — Presentation of the data, Route Assignment, igraph network creation

ANALYSIS — The classical network analysis are presented: Macro, Micro, Meso

WHAT-IF — Further possible analysis



NETWORK CONSTRUCTION

DATA

FROM ESSELUNGA

Location distribution center of Pioltello

List of the point of sales

Approximative flows of goods transported

FROM OPEN DATA REGIONE LOMBARDIA

Data of the point of sales:

- Coordinates
- Size

MERGE OF THE TWO SOURCES

ROUTE ASSIGNMENT

QGIS

1. From OSM the shapefile
2. Algorithm shortest path

PROBLEM:

- Unclassified route
- Unable to estimate level of aproximation

R with stplanr

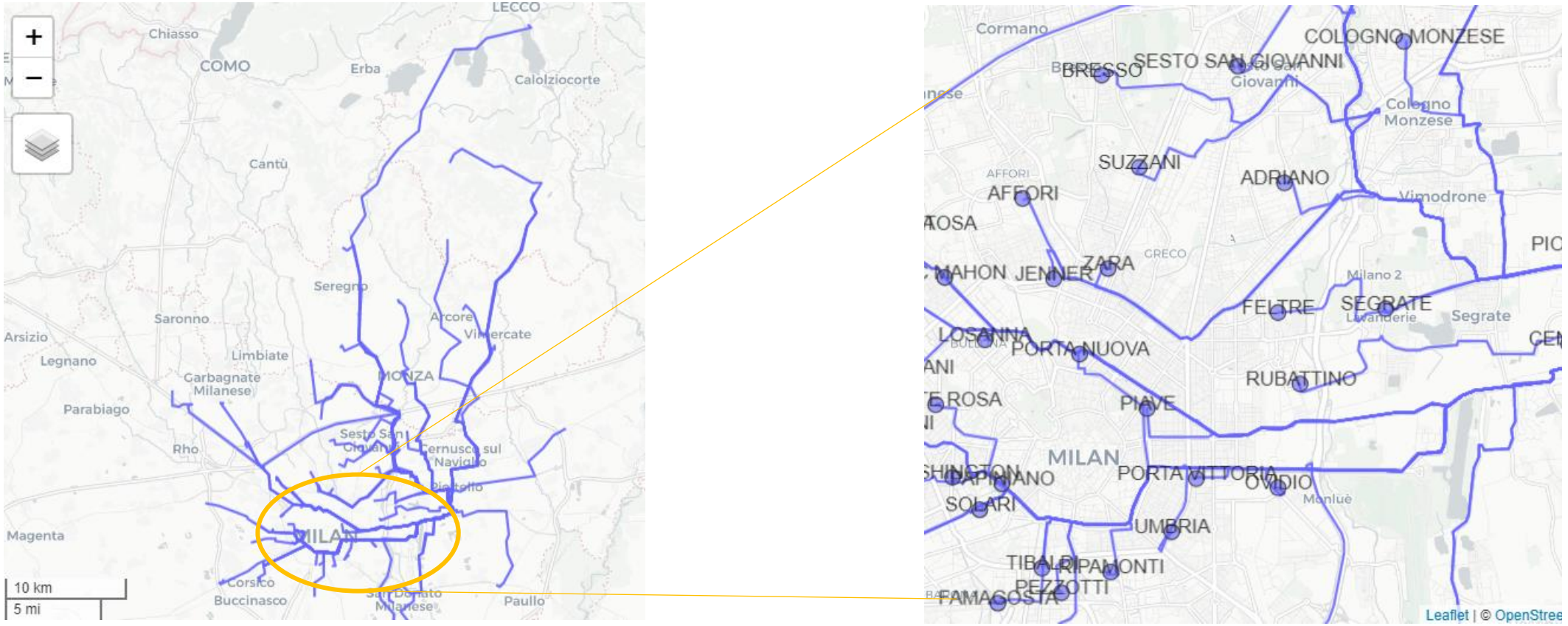
Use function route(). Input:

- Coordinates
- Routing function -> osrmRoute()

PROBLEM:

- Only three profiles (car/bike/foot)

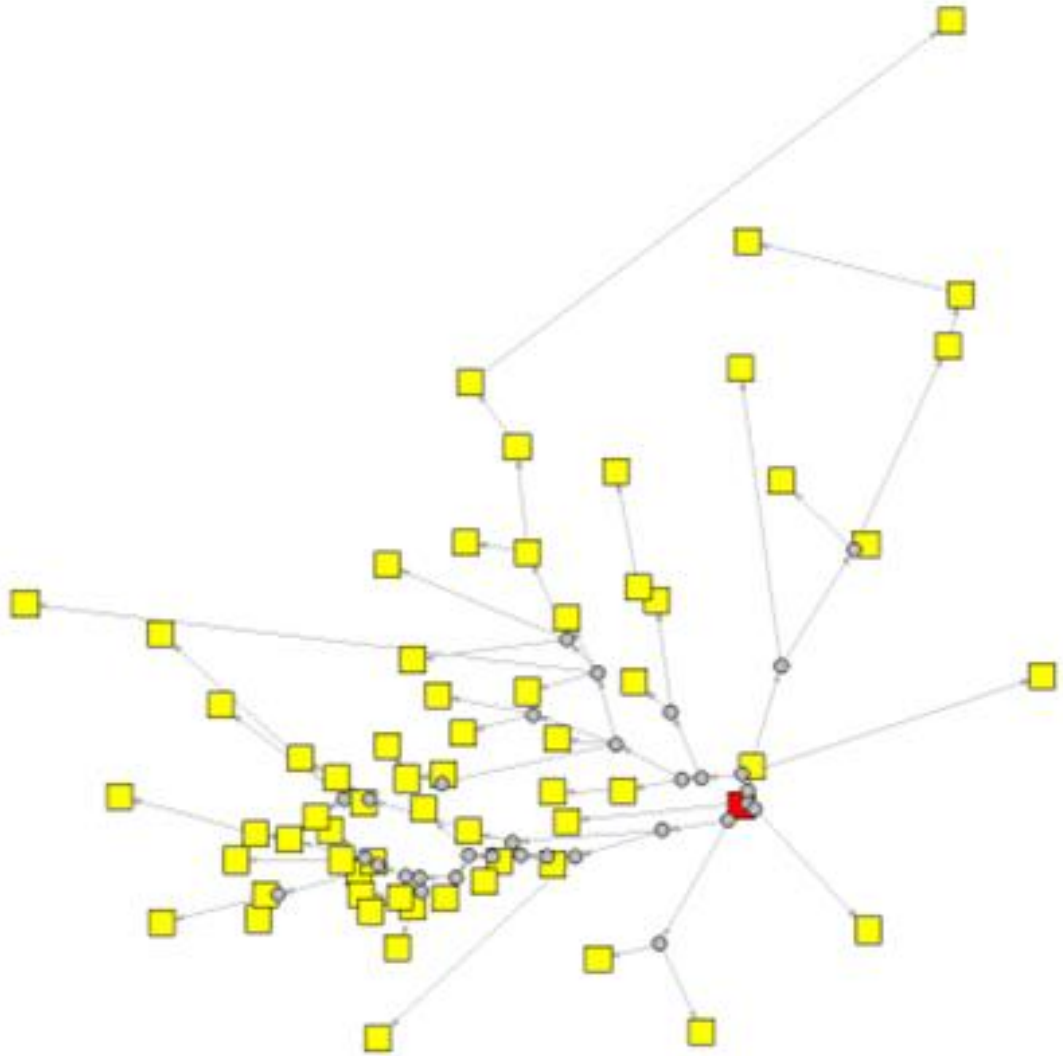
THE NETWORK FROM ROUTE()

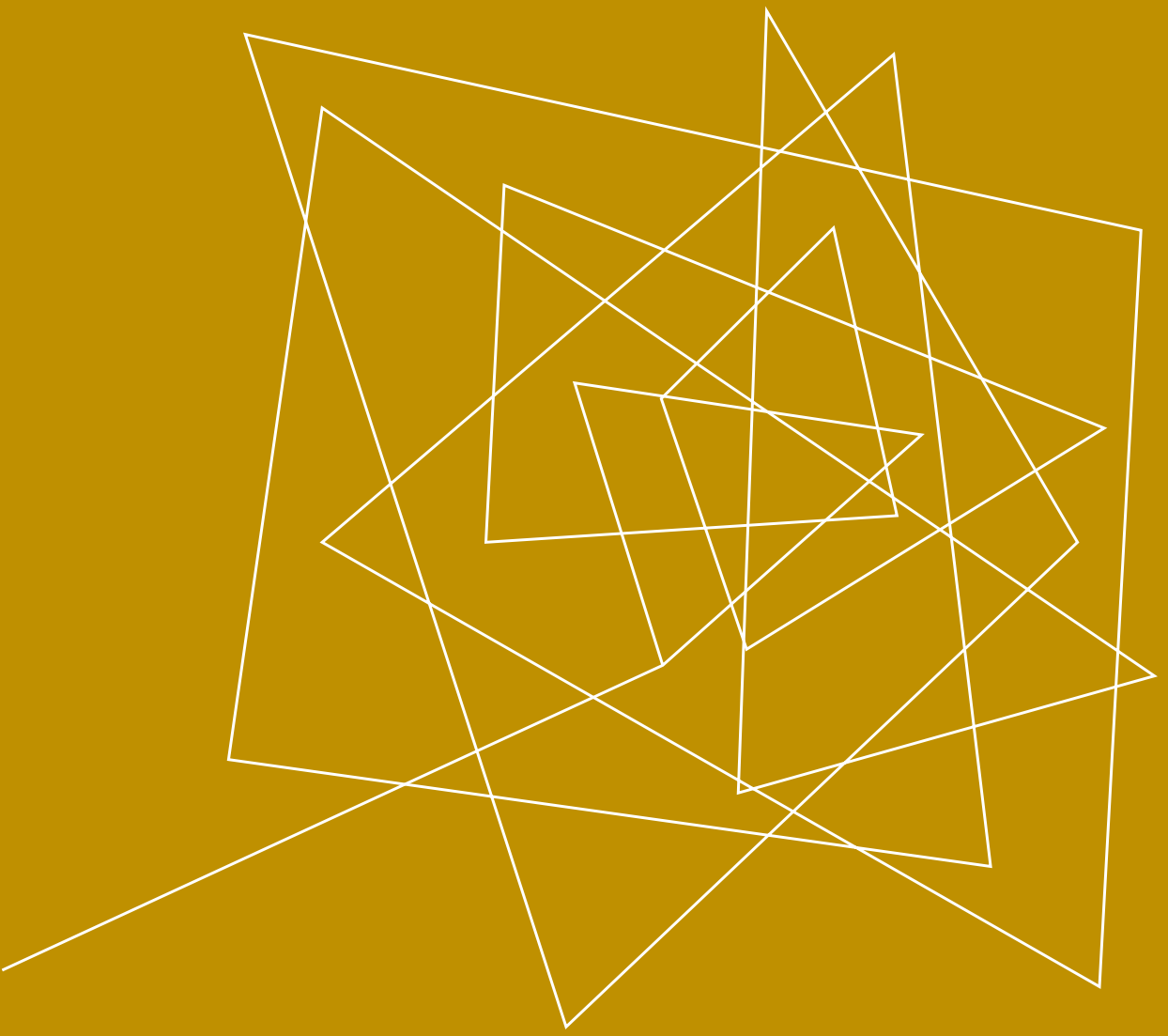


FROM IGRAPH

Given the route, we can create the logical network with igraph

- Yellow & square: Point of sales
- Red & square: Distribution centre
- Gray & circle: deviation points





NETWORK ANALYSIS

MACRO-SCALE ANALYSIS

- SIZE: 96

  63 point of sales, 32 fictitious nodes, 1 distribution center

- NUMBER OF COMPONENTS: 1

  Just one connected subnetwork

- DIAMETER: 50.5 KM OR 64.98 MIN

- DENSITY: 0.011

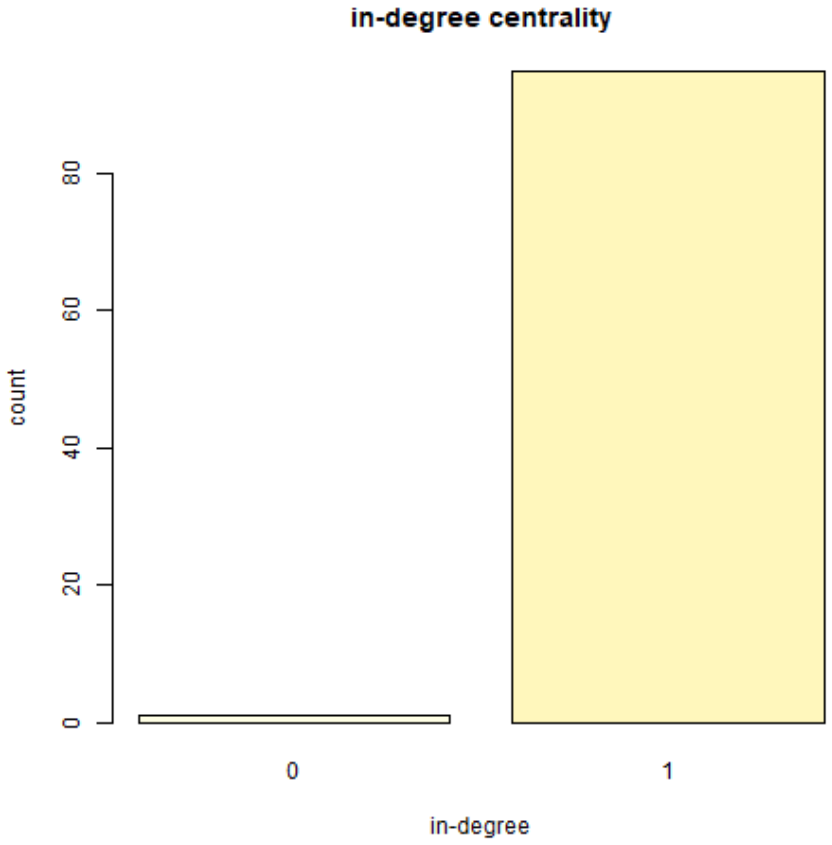
  Sparse network

- CLUSTERING COEFFICIENT: 0.019

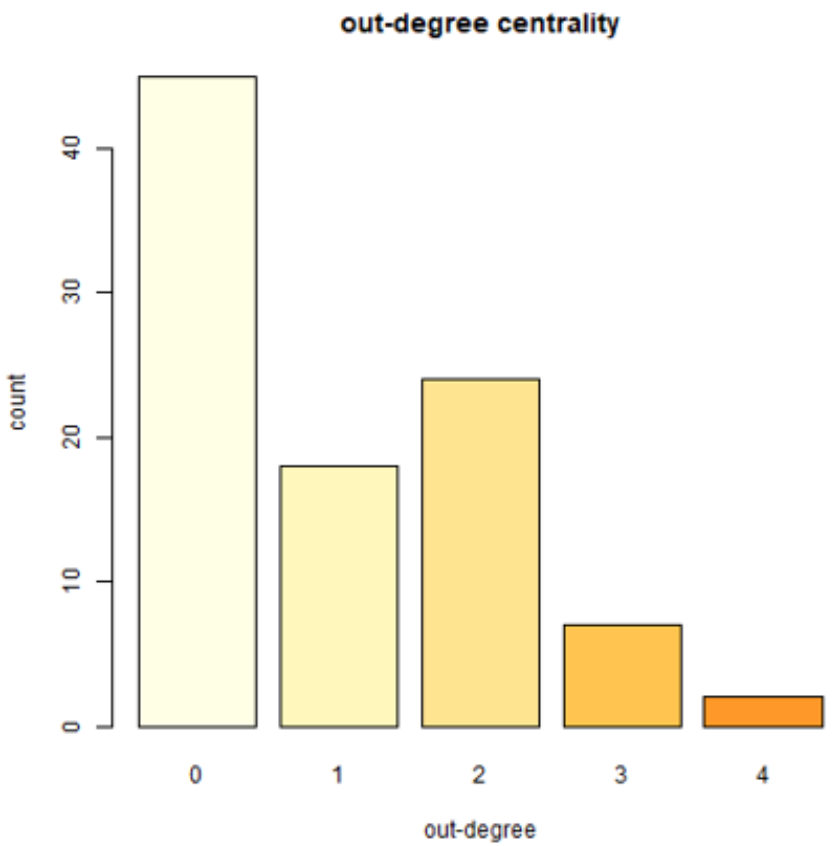
  The network is not redundant

MICRO-SCALE ANALYSIS: DEGREE CENTRALITY

IN-DEGREE

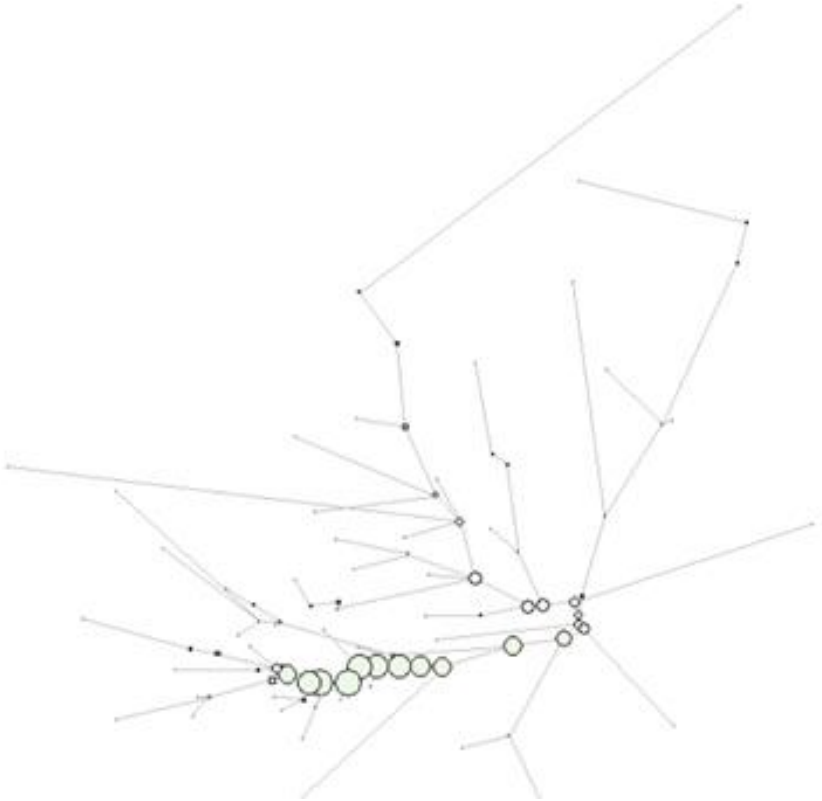


OUT-DEGREE

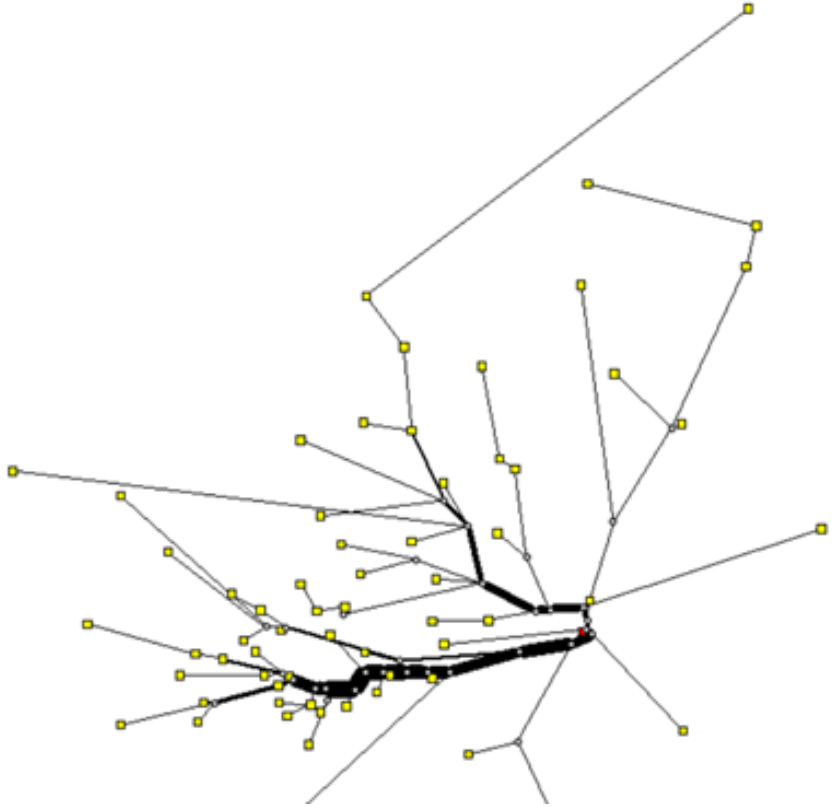


MICRO-SCALE ANALYSIS: BETWEENNESS CENTRALITY

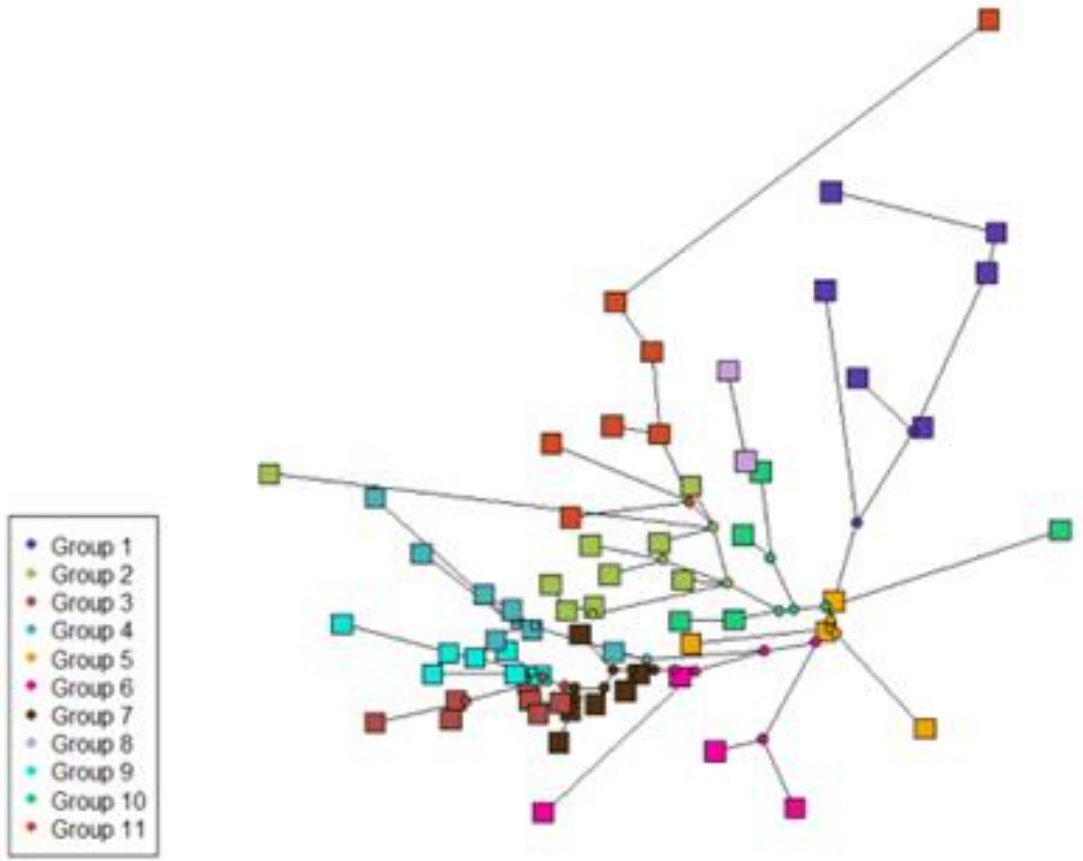
NODES



EDGES

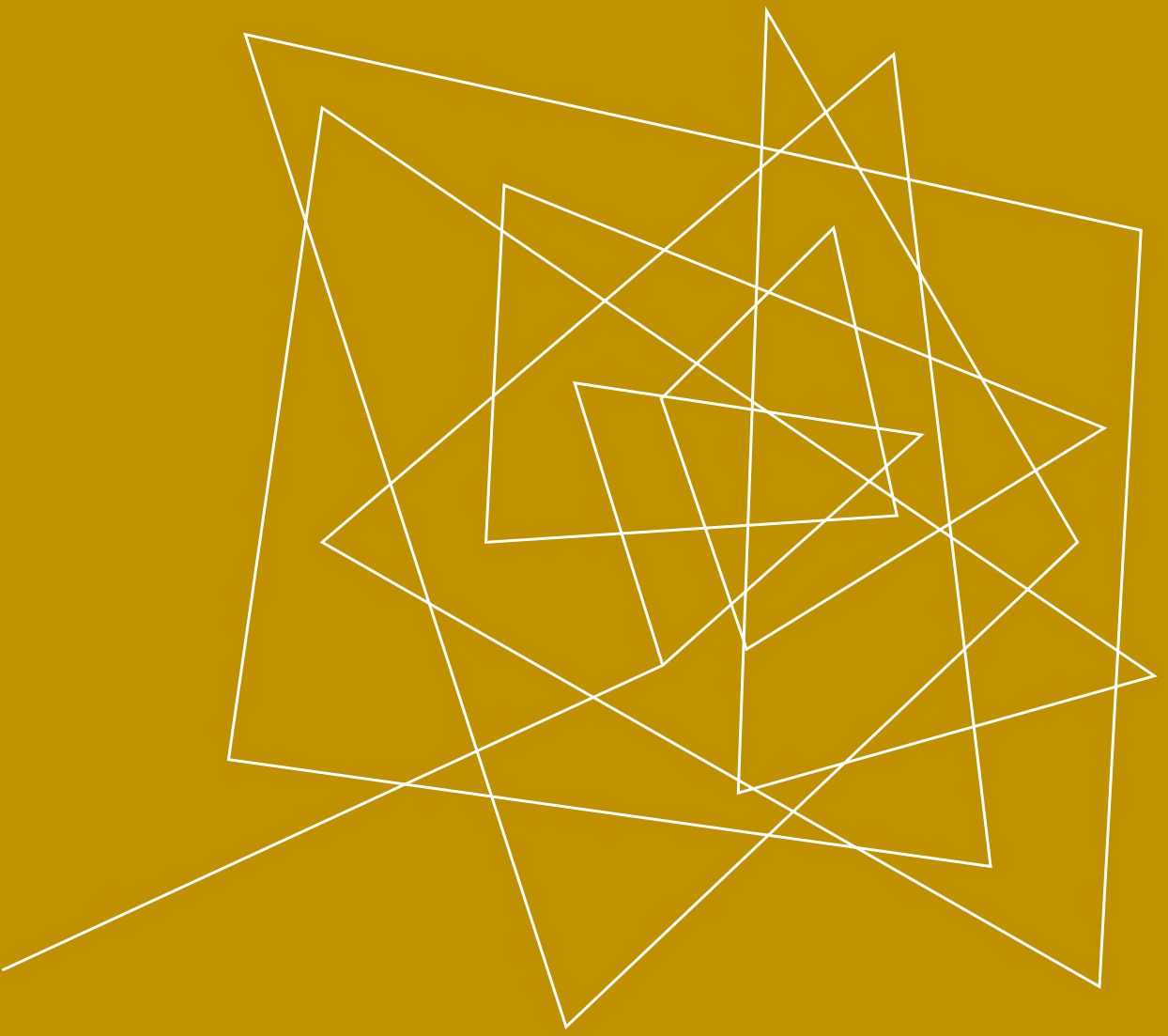


MESO-SCALE ANALYSIS



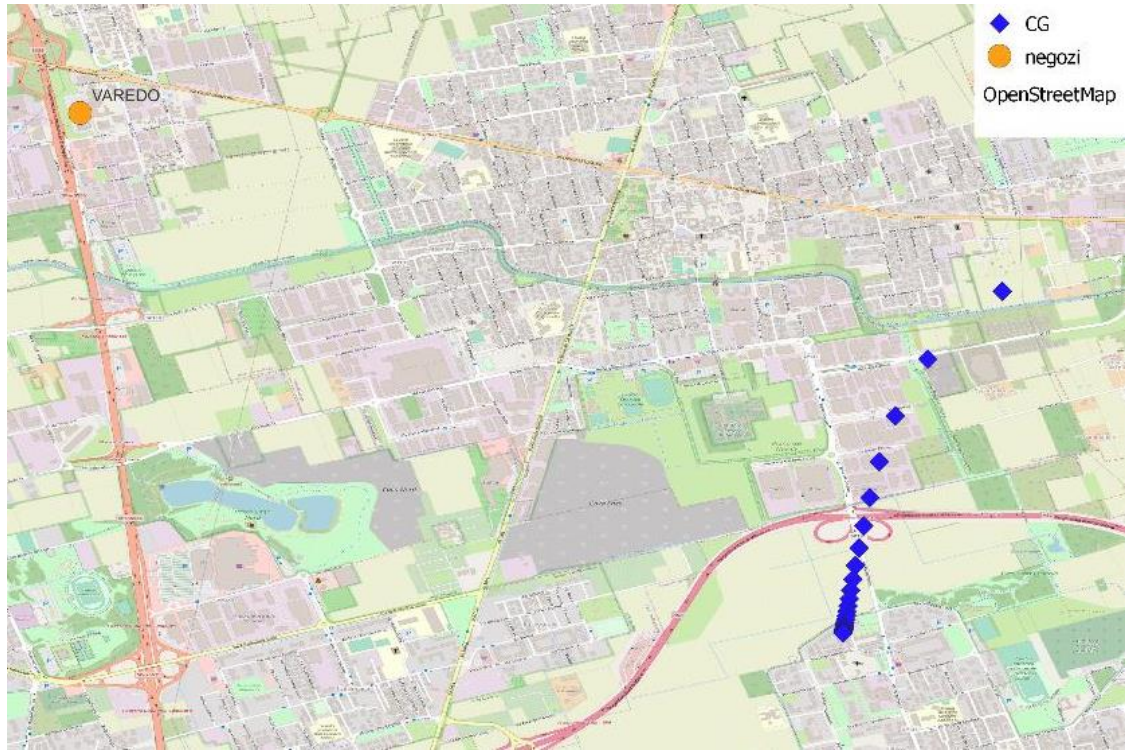
COMMUNITY DETECTION

- Newman method
- Mutual help communities in case of disruption of deliveries



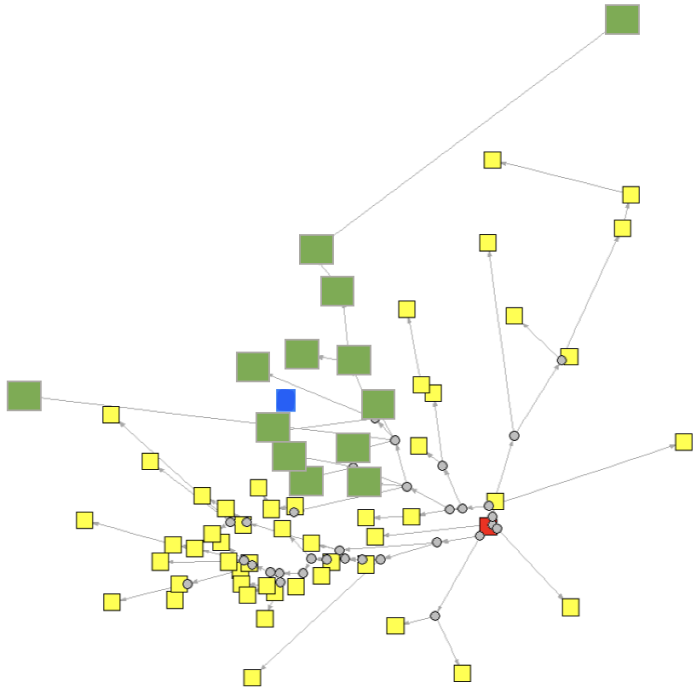
WHAT-IF ANALYSIS

WHAT IF – TWO DISTRIBUTION CENTRES

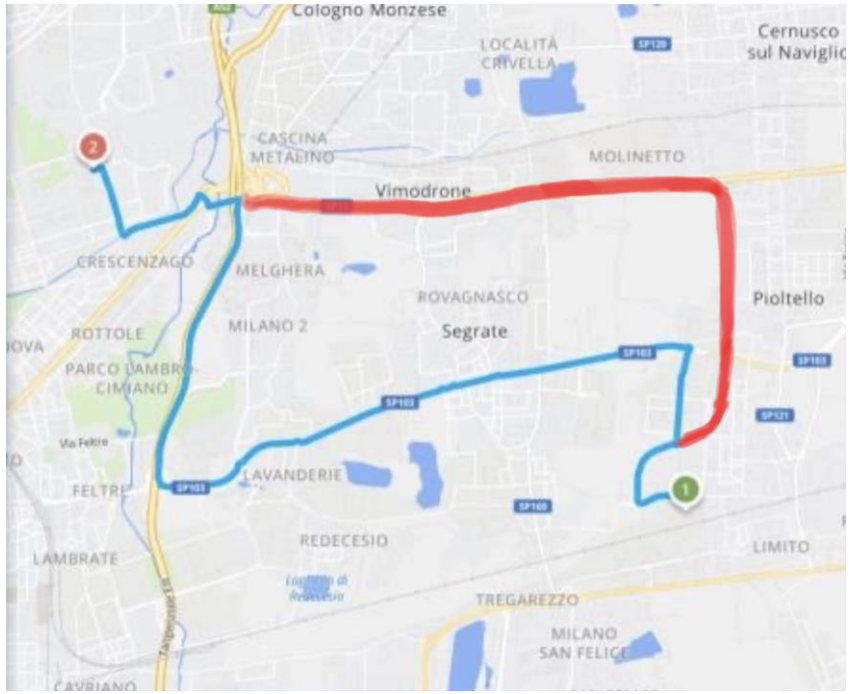


CENTRE OF GRAVITY METHOD

$\min(Total\ Cost) = \min \sum[F \cdot R \cdot d\ (x, y)]$



WHAT IF – DATA ROAD TRUCK



SOME SOLUTIONS:

- route() with a routing function designed for truck
- Using osrm.profile for truck. Some data are needed (height, width, length and weight)
- The actual truck route planner used by Esselunga

WHAT IF - DETAILED DATA ABOUT SALES

DETAILED DATA OF SUPPLIES

SHELF PRICE OF PRODUCTS

SALES BY PRODUCT

ESTIMATION OF SALES-LOSS RISK

and

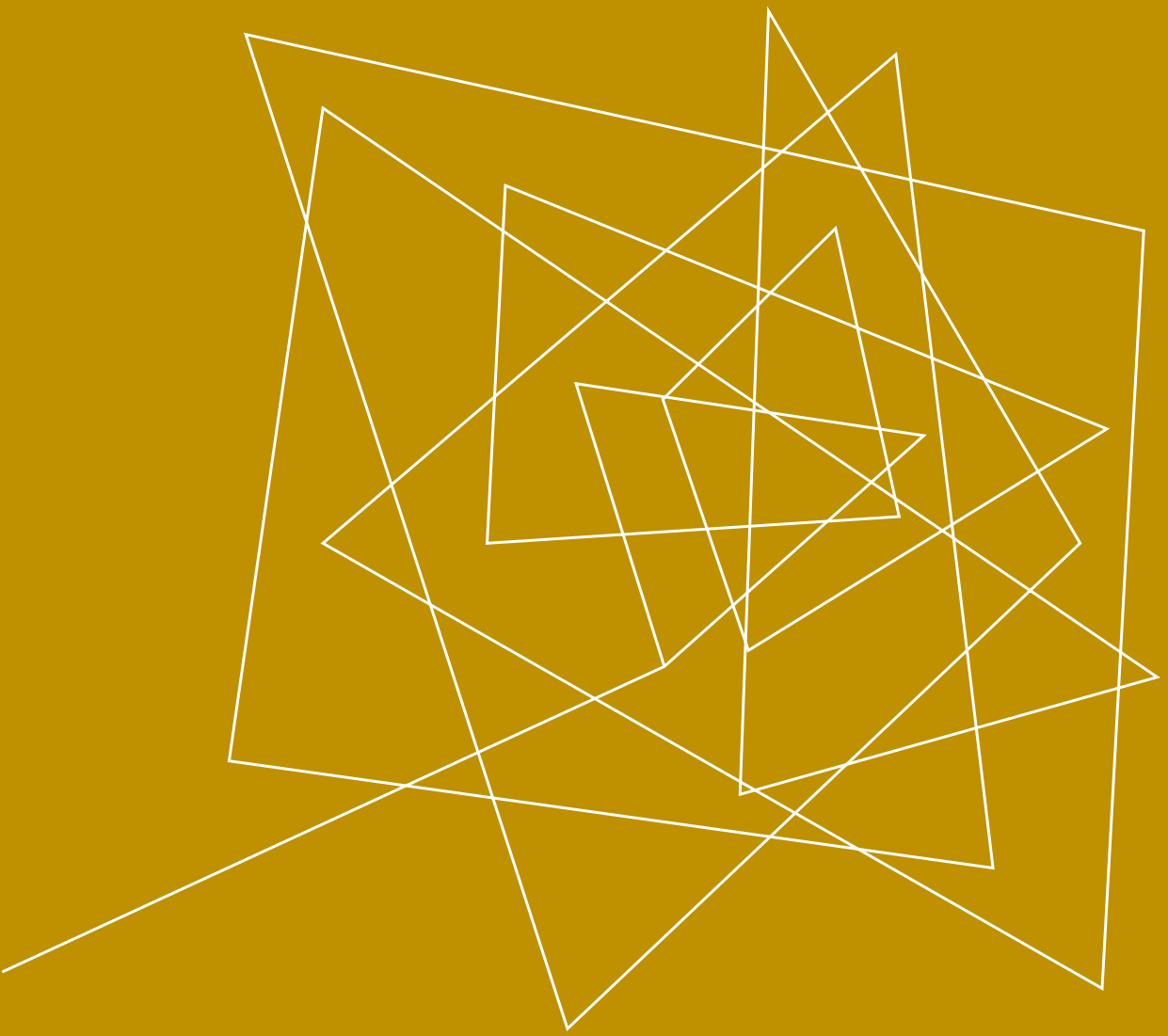
PRIORITIZATION STRATEGY

WHAT IF – SUPPLIES' SCHEDULE DATA

		HOUR OF DEPARTURE FROM PIOLTELLO							
POINT OF SALES		1	4	7	10	13	16	19	22
	Lecco	x			x	x	x		
	Zara	x	x			x	x		x
	Monza		x	x		x	x	x	
	Seregno	x	x				x	x	

MINIMIZATION OF COSTS OF TRANSPORTATION

- Min N° trucks necessary
- Min N° trips during the night
- Min N° trips in peak hour
- Supply shops reachable from heavily trafficked roads during off-peak hours.



Q&A