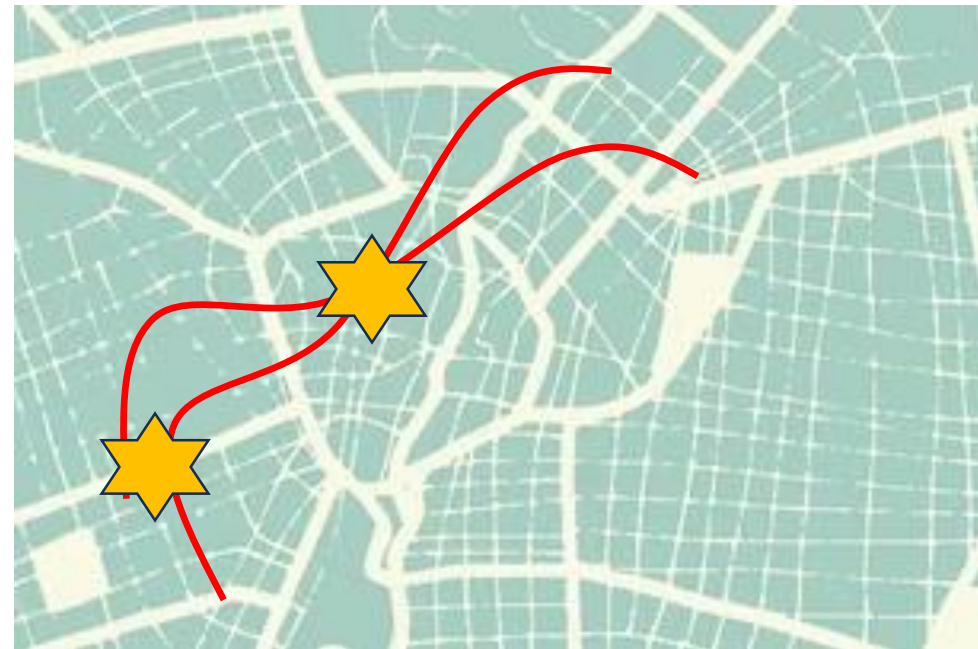# A [Big-Data] Analytics methodology
e-Evidence System

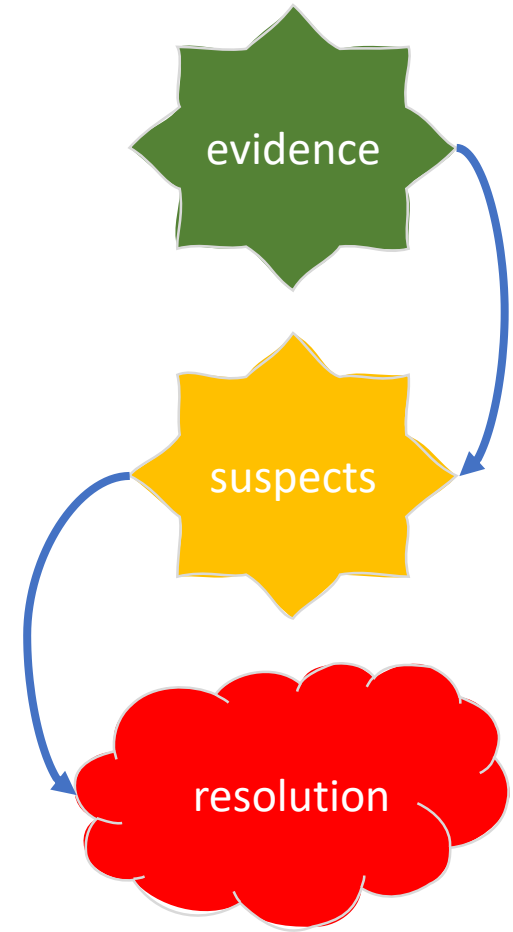Dr. Manolis M. Tsangaris

Head of Analytics

Performance Technologies
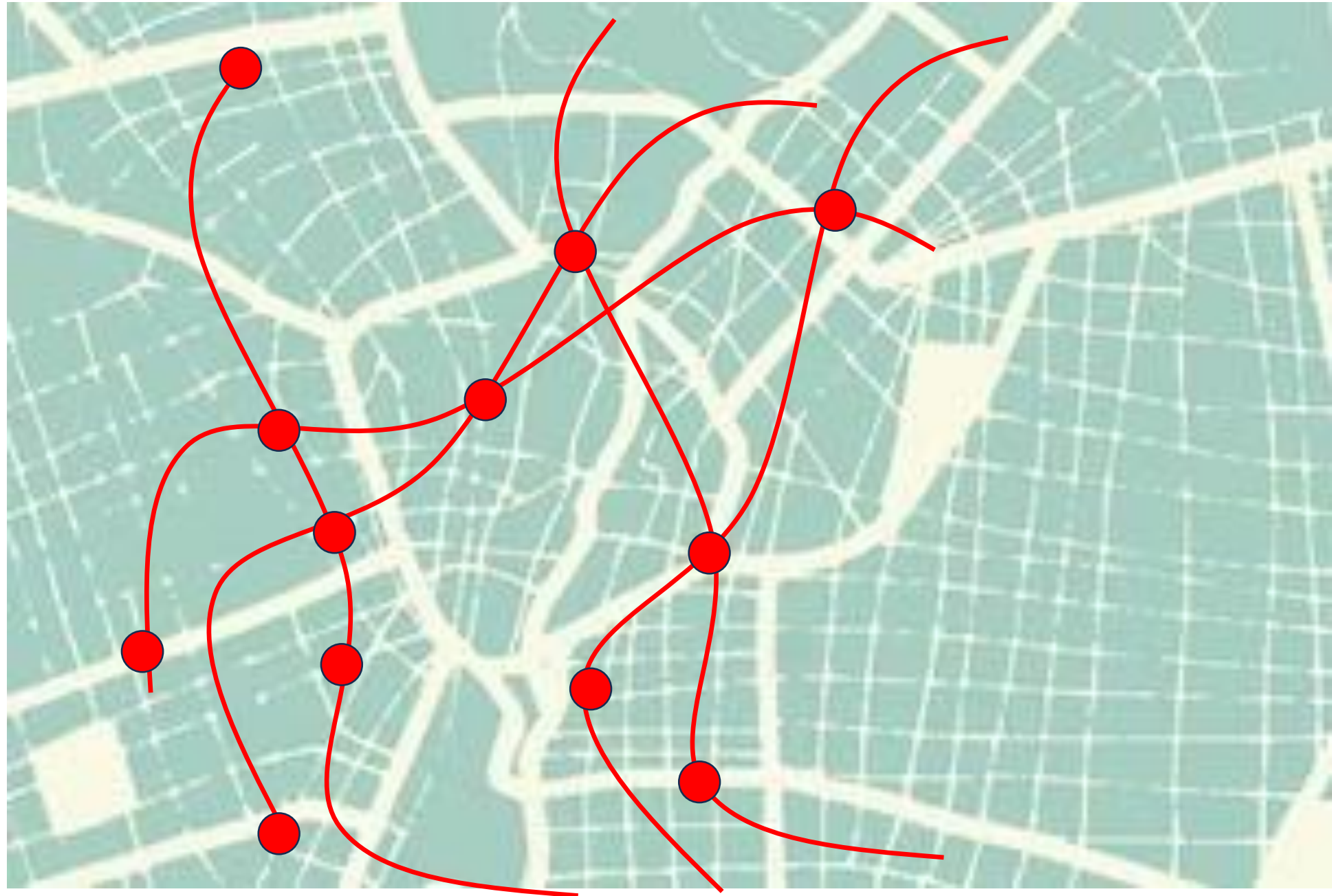
version 1.12

"They all lead back to this ball of yarn."

Detective Work,
according to a cartonist of NYT

evidence
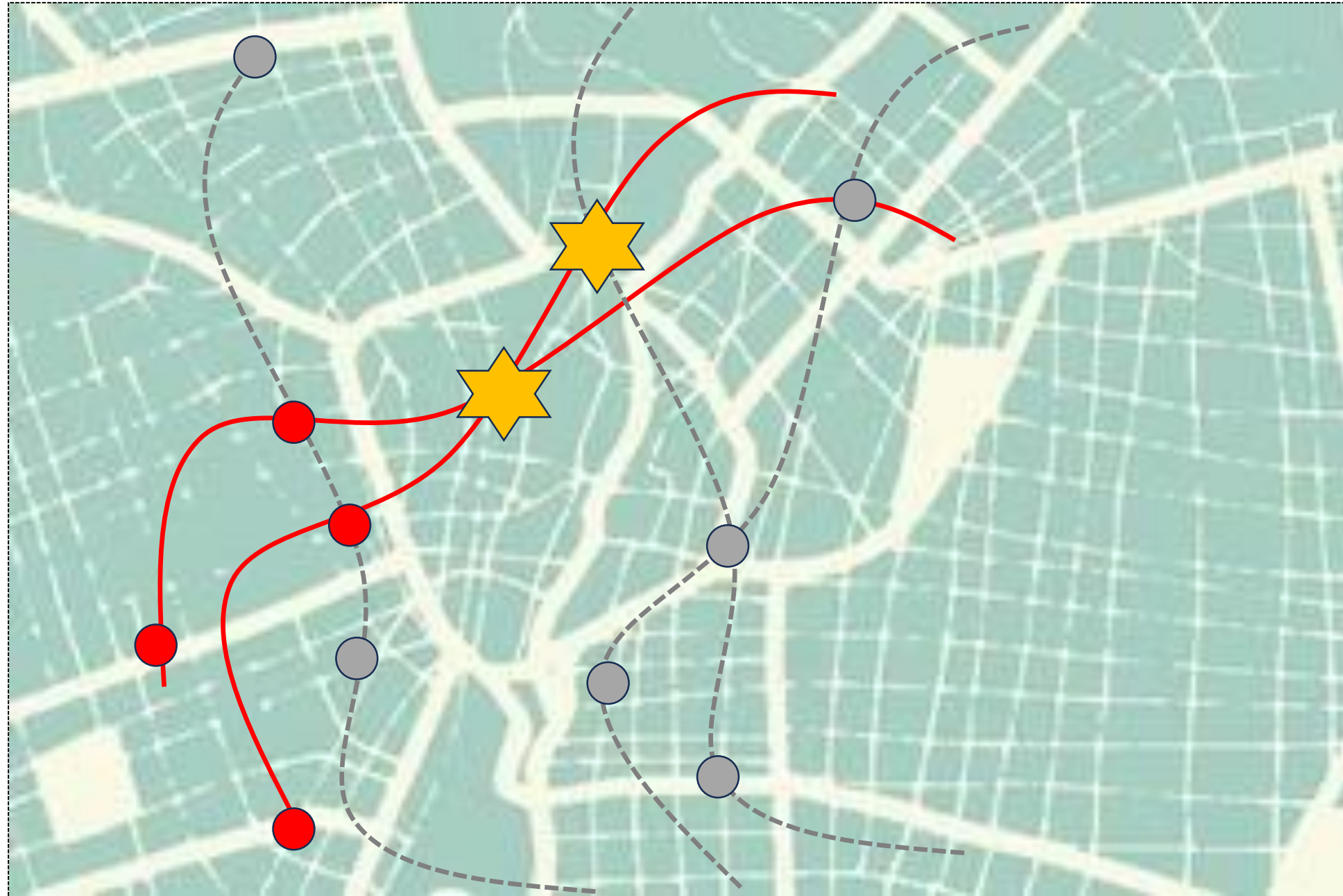
suspects

resolution

Before TRACY

- Law Enforcement Agents process evidence data from multiple channels
  - Eyewitness
  - Cameras
  - License Plates
  - **Mobile Non Content Data**
  - ...
- The amount of information is overwhelming
- How can we piece the evidence together?

Using TRACY

- Modeling a case using TRACY
  - Eyewitness
  - Cameras
  - License Plates
  - Mobile Non Content Data
  - …
- TRACY provides answers:
  - Suspects
  - Scores
  - Relationships
- Through a process:
  - Interactive
 - Iterative
  - Analytics Based

How TRACY models Evidence (ontology)?

- Evidence Data
  - E.g. Images, Mobile Network non-content data
- Evidence Information
  - E.g. faces, license plate numbers, trajectories of terminals
- Suspects Model
  - Presence of Suspects at different locationns
  - Suspect to Suspect relationships
- Event Model
  - A time and location where multiple suspects were present

How TRACY processes evidence?

- Applies constraints to evidence
- Generates a graph of suspects that "best matches" the evidence
- Provides observability
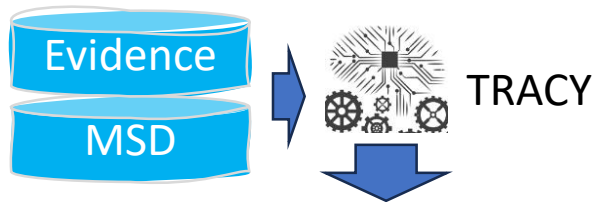- Enables interactive application of the evidence and costraints
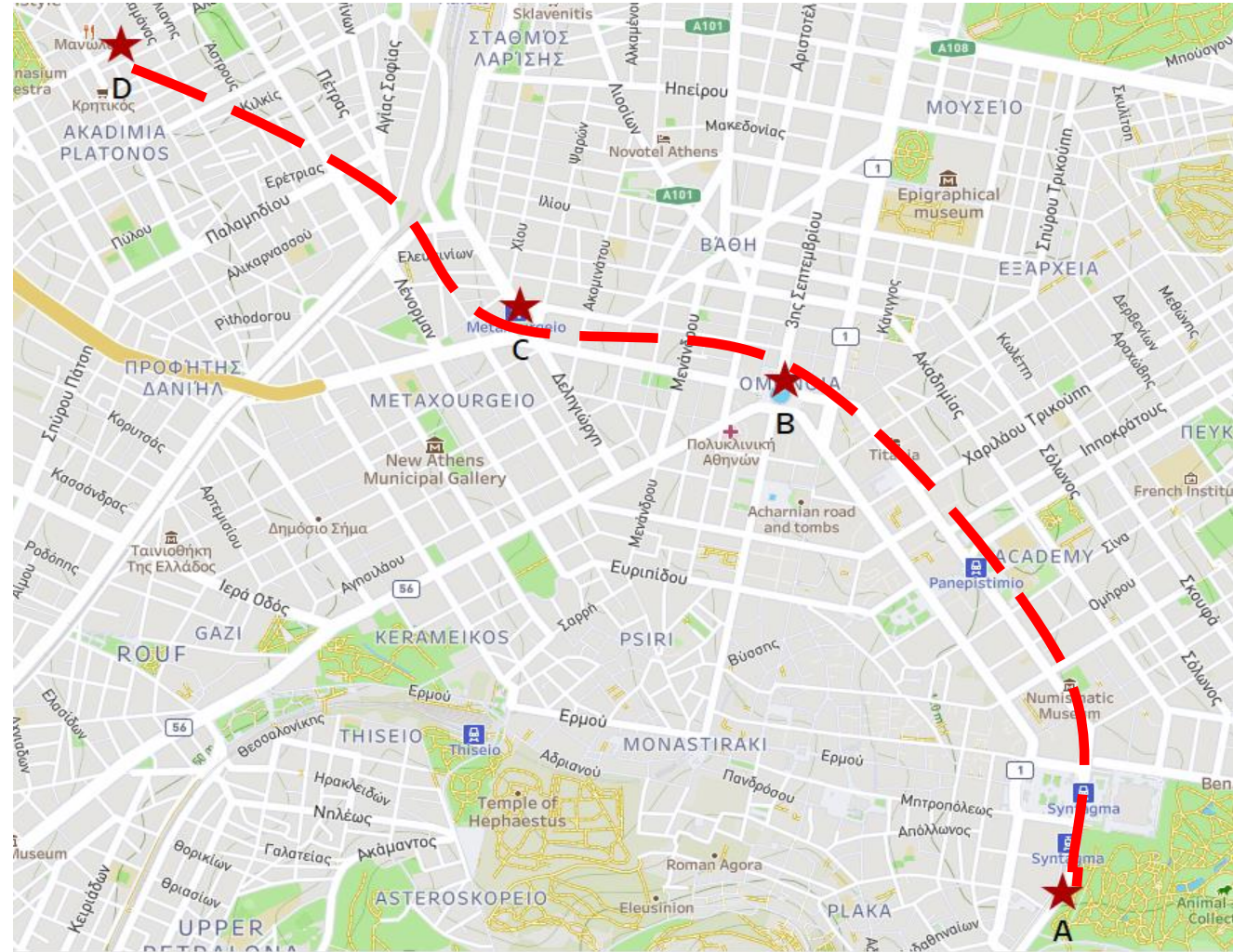
Locating suspect mobile terminals
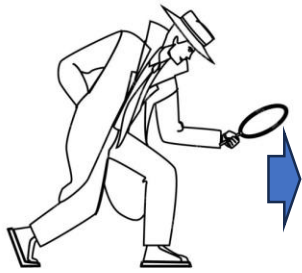
detective

- Evidence:
  - Seen **near** A **around** 1pm
  - Seen **near** B **around** 1:10pm
  - Has **passed** from C **after** 1:10
  - **Stayed** in D **after** C

Evidence

MSD

TRACY

- Best matches:
  - Terminal1, 90
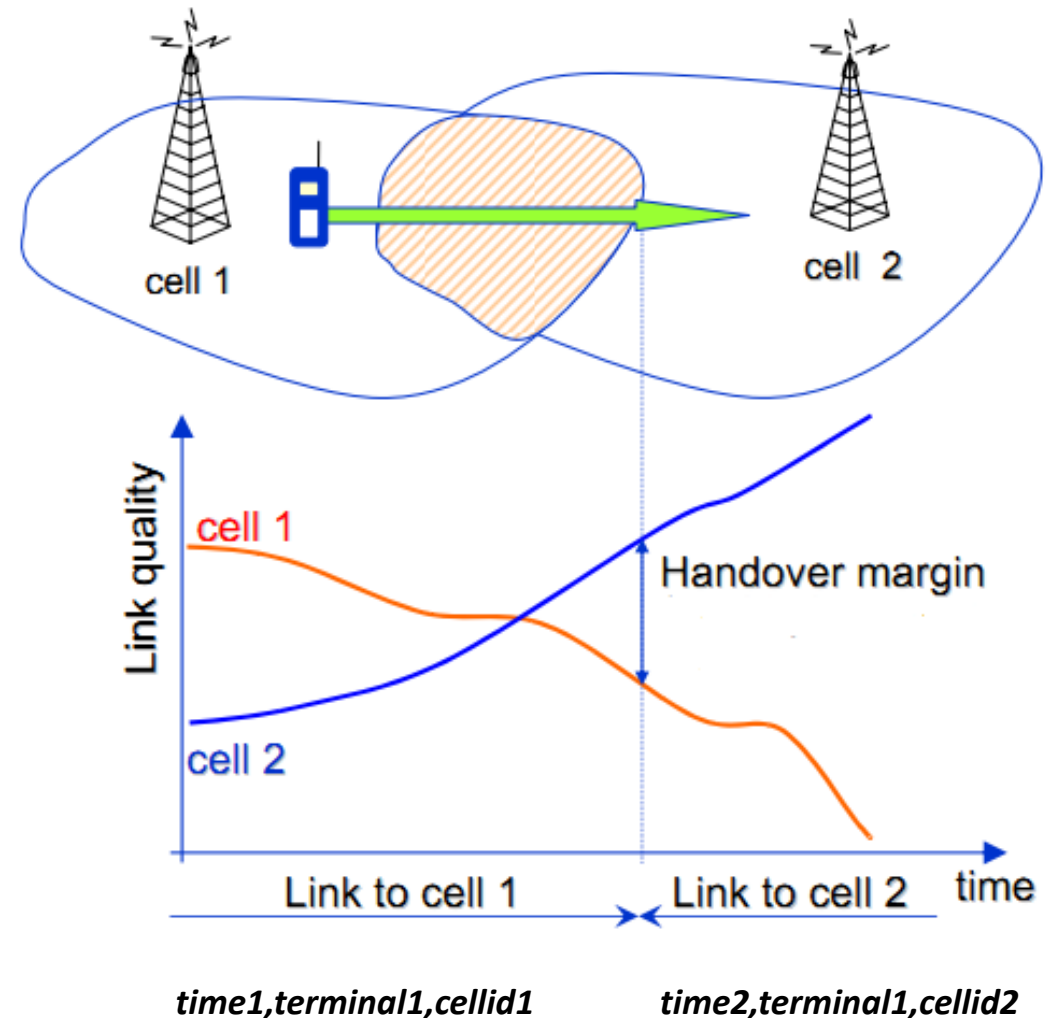 - Terminal2, 80
  - Terminal3, 60
  - …

What is MSD (Mobile Signaling Data)?

- The association of a mobile terminal to a base station cell

- Valid for a period of time

- While the terminal is active (not in "idle" mode)
  - During a phone call
  - During a (significant) data transfer

Looks like this:

Time	Terminalid*	CELLID
20230101T11:44:00	4552e43bf	d74edb9

cell 1

cell 2

Link quality

cell 1

cell 2

Handover margin

Link to cell 1

Link to cell 2

time

time1,terminal1,cellid1

time2,terminal1,cellid2

# It is hard to get evidence data (today)

- MSD:
  - Today: LEAs collect NCD (call detail triggered data)
  - Come from different MNO in different formats
  - They are spotty, because of multiple data collection requests

  - Sensitivity – personal & criminal information
  - Collection obstactles – Technical & Regulatory
- …

Simulated "realistic" Datasets

- We have generated **suitable synthetic** data sets
  - Based on actual LEA cases
  - Encoded as "user stories"
  - Injecting actors that satisfy the user stories
  - Validated with specific real traces (collected)
- The datasets represent **relevant problem dimensions**:
  - The type of the criminal activity
  - The location of the crime and the surrounding areas
  - The techniques criminals used to conduct the crime
  - The types of devices used to commit the crime

TSIM – Tracy simulator generation

- Goal:
  - Simulate the mobile network traffic of a town segment

- Generated Synthetic data
  - Given an area of the town
  - Simulate **people motion**:
    - Residents, cars and other vehicles
    - Including visitors from outside
  - Simulate **mobile network events** and other **evidence data**

- Ingest ground truth (control)
  - Make specific terminals follow a specific trajectory across town

TOWN SEGMENT

Residents, Vehicles Visitors …

TRACY (synthetic) Data Set
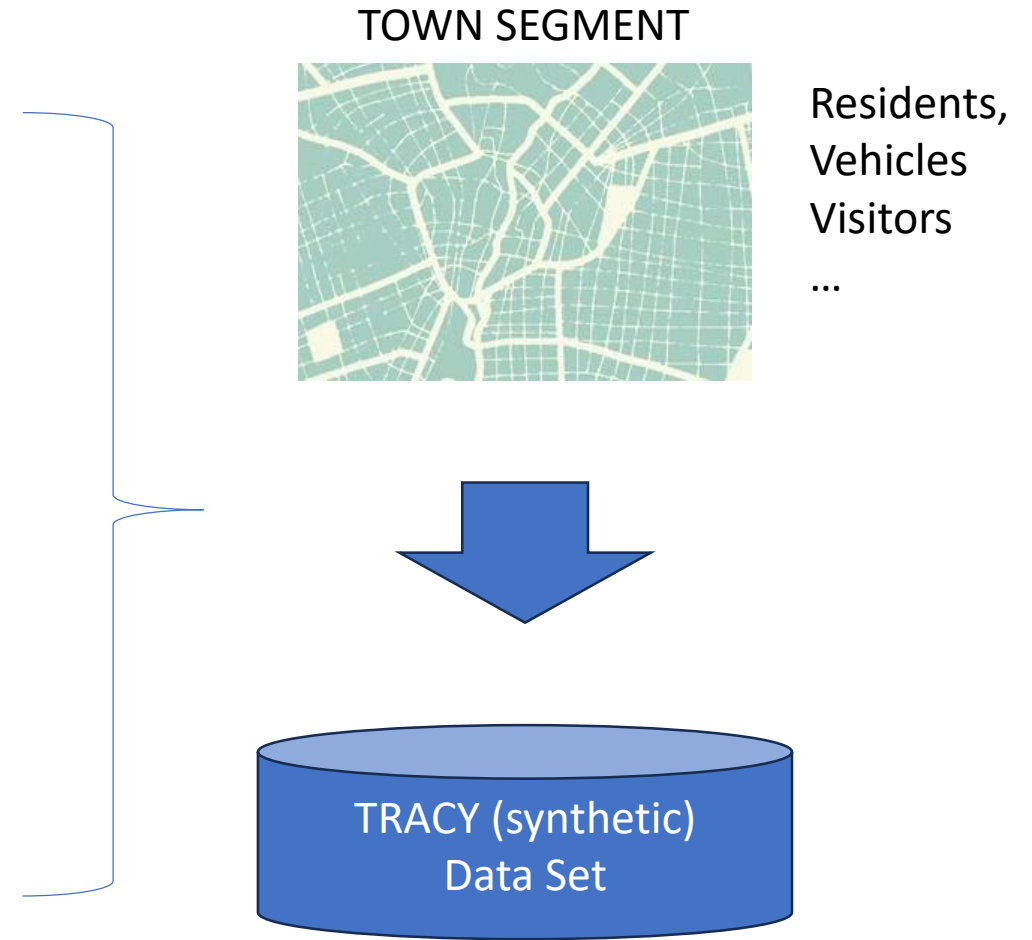
Benefits & Challenges

- Benefits
  - Bring Analytics Methodology to LEA's investigation
  - Faster Convergence to crime investigation
  - Full Observability to the analysis algorithms and evidence data
- Challenges
  - Map LEA cases to Tracy methodology
  - Evaluate and refine the methods & tools
  - Collect and curate MSD from Mobile Network Providers
- Status:
  - In our first year of the project – developing capabilities
  - Getting ready to resolve real cases
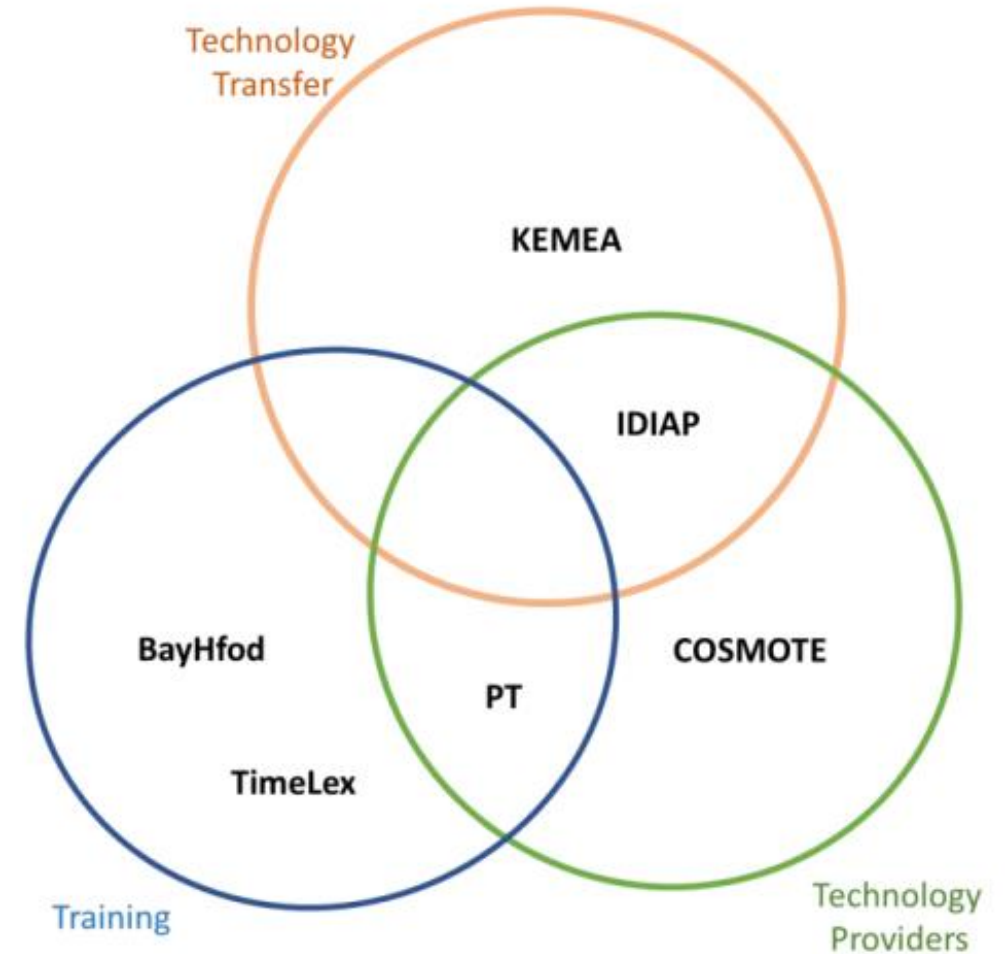
- https://www.tracy-project.eu
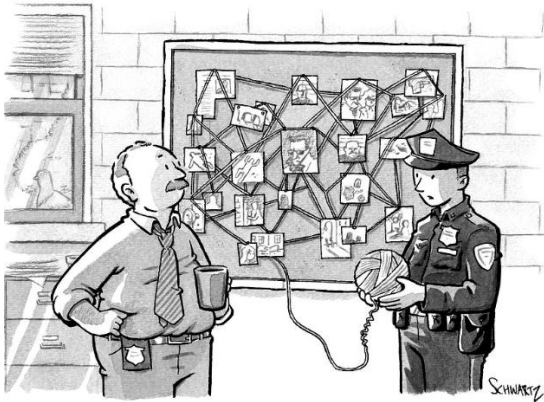
The TRACY consortium

3 LEAs also participate as end
users:
- Hellenic Police
- Romania Police
- Moldova Police

Vital statistics:
- 2-year EU funded project (DIGITAL)
- June 2023-June 2025