NEW FRONTIERS FOR NETWORK ANALYSIS IN ANTI-MONEY LAUNDERING

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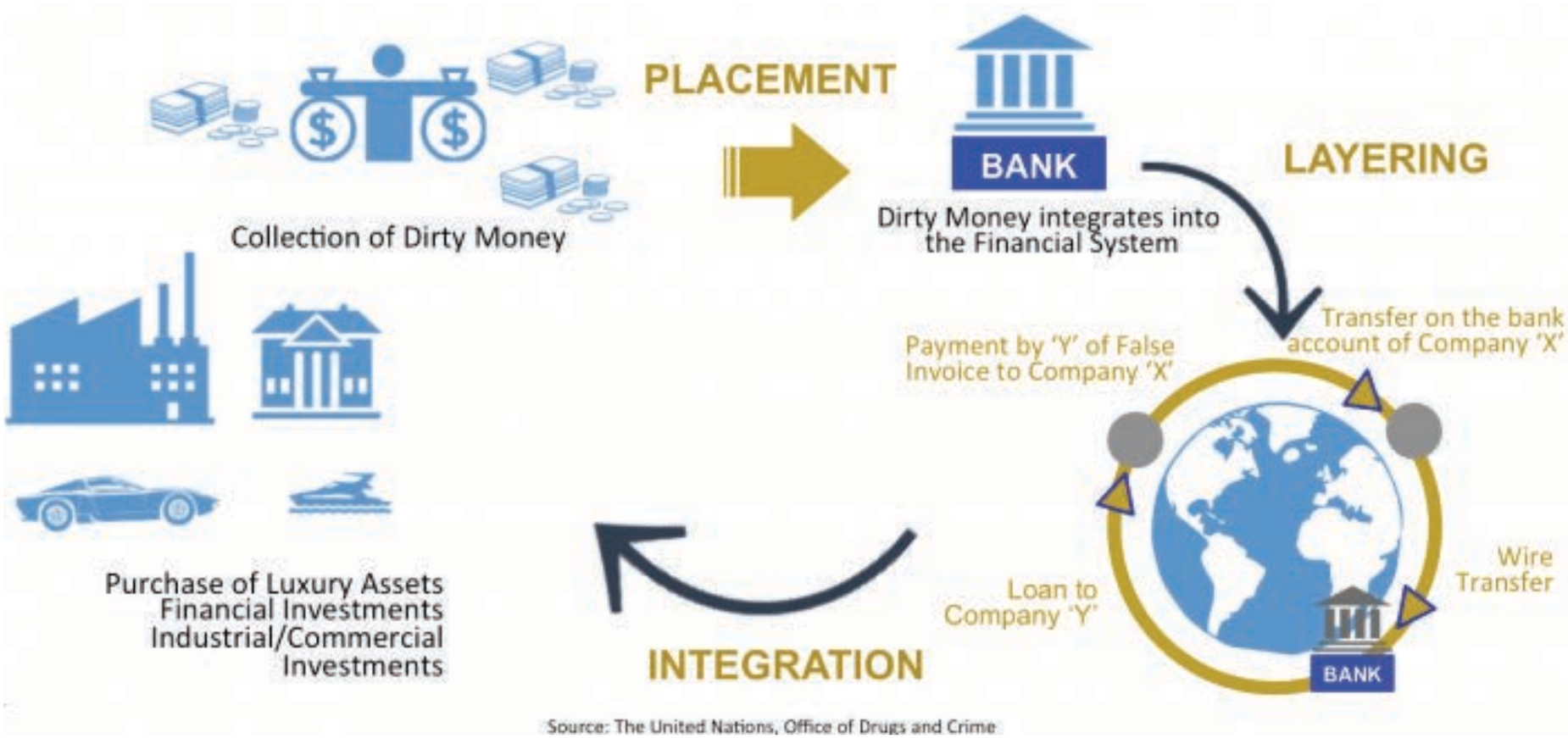
FINANCIAL INTELLIGENCE

- Money laundering cycle: PLACEMENT, LAYERING, INTEGRATION



Source: The United Nations, Office of Drugs and Crime

ARTIFICIAL INTELLIGENCE: NETWORK ANALYSIS

- **Statistical** approaches:

  Social Network Analysis

- **Algorithmic** & **machine learning** approaches:

  Neural networks,

  Classification and sub-tasks such as clustering,

  Classical graph algorithms

  Embeddings

- **Reasoning** approaches:

  Knowledge Graphs

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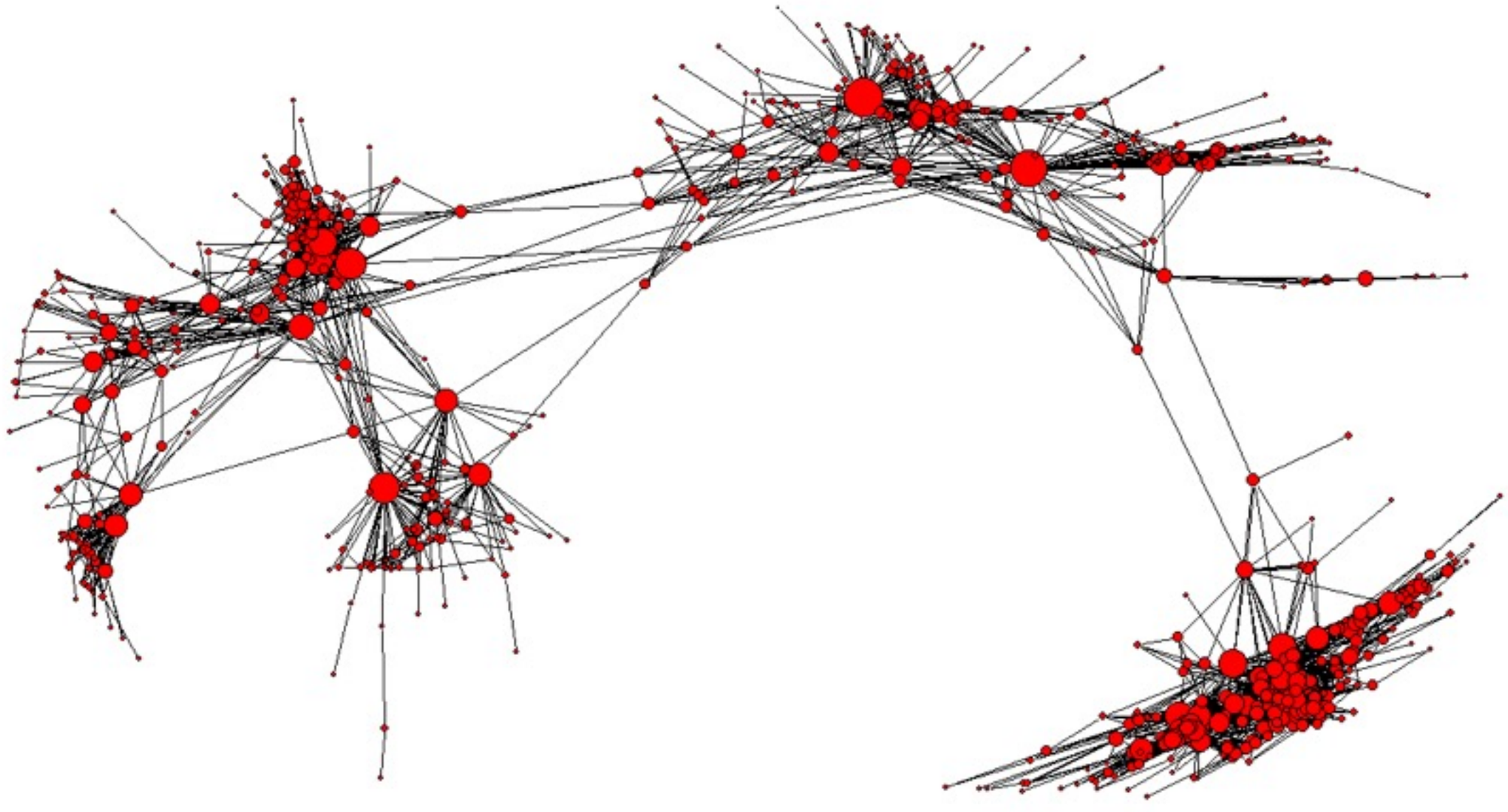
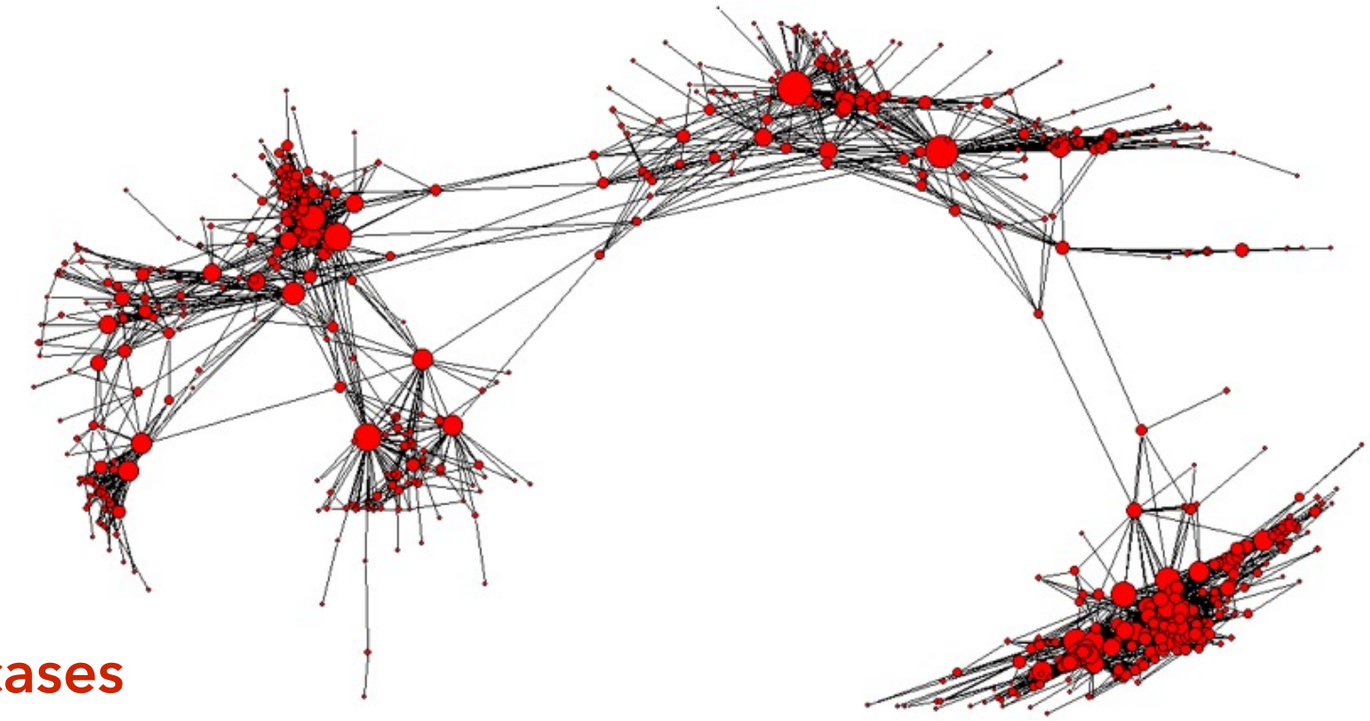
STATISTICAL APPROACHES: Social Network Analysis



STATISTICAL APPROACHES: Social Network Analysis

* **descriptive statistics**
* **core-periphery analysis**
* **exploratory analysis**



* **inapplicable to specific cases**
* **neglects analyst's knowledge**
* **cannot extract evidence for judicial or law enforcement authorities from SNA**

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  Graph Embeddings

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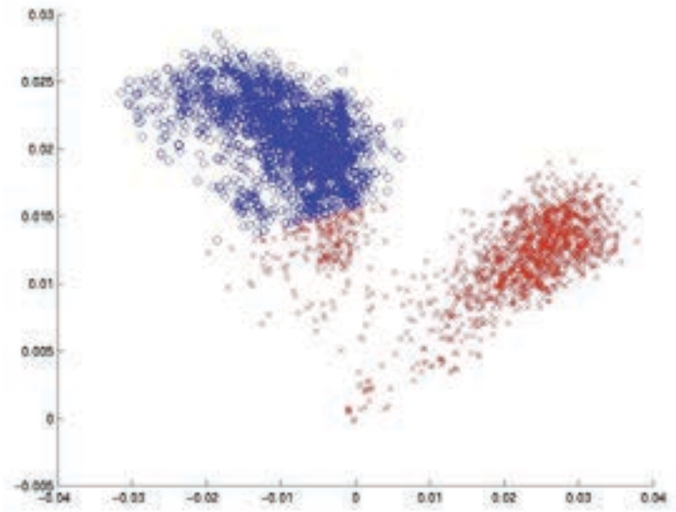
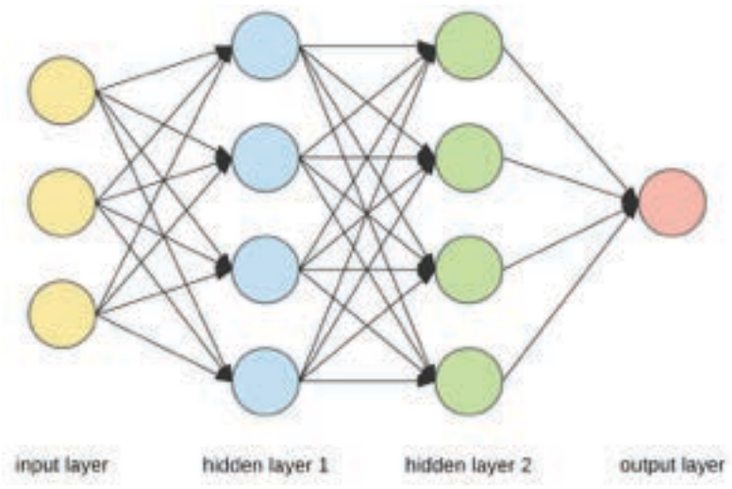
MACHINE LEARNING APPROACHES



* access to a large toolbox of techniques and algorithms

* support for low experience personnel



* neglects analyst's knowledge

* mostly supervised methods

* highly unbalanced training sets

* few true positives to train models

* scarce or absent explainability

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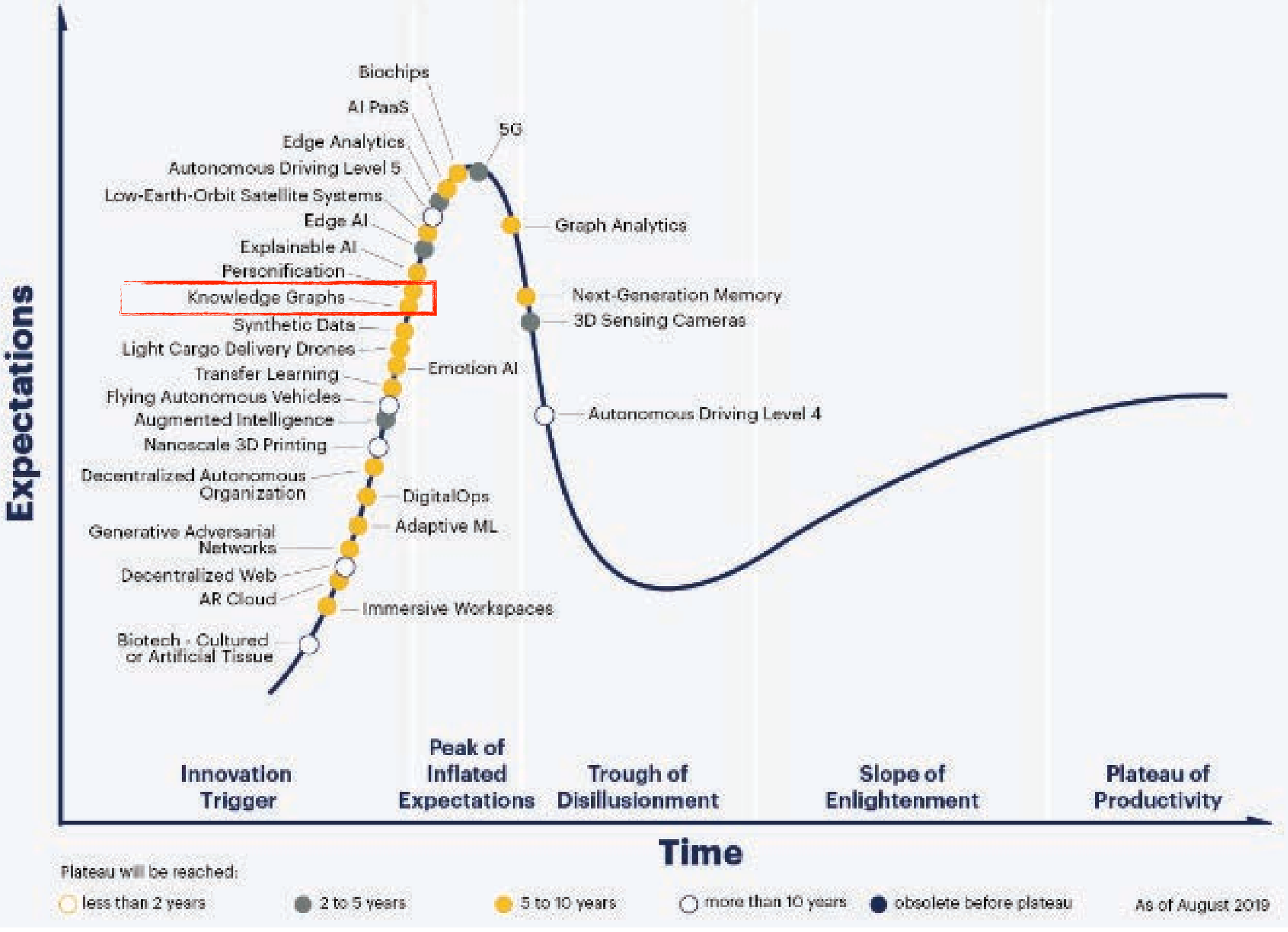
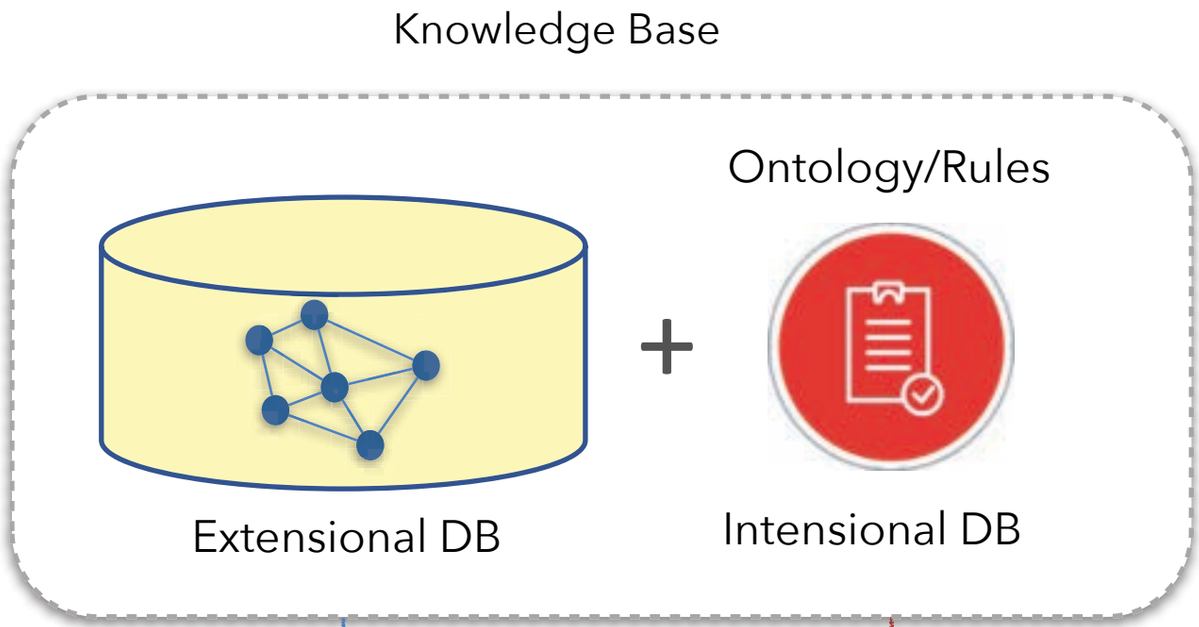
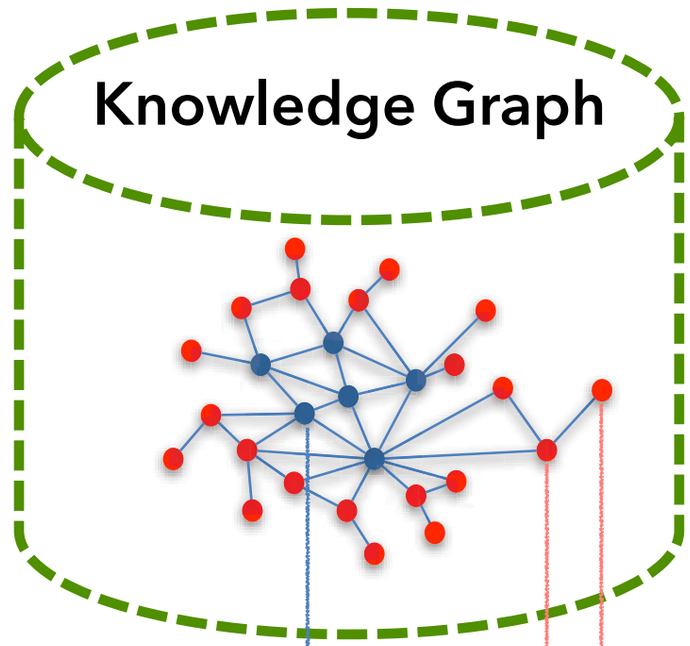
Gartner Hype Cycle for Emerging Technologies, 2019



REASONING IN KNOWLEDGE GRAPHS





P	
Person	Parent
Andrew	Hector
Micheal	Hector
Mario	Humberto
Sandra	Jane
Humberto	Karl
Jane	Karl
Thomas	Mario
Laura	Sandra

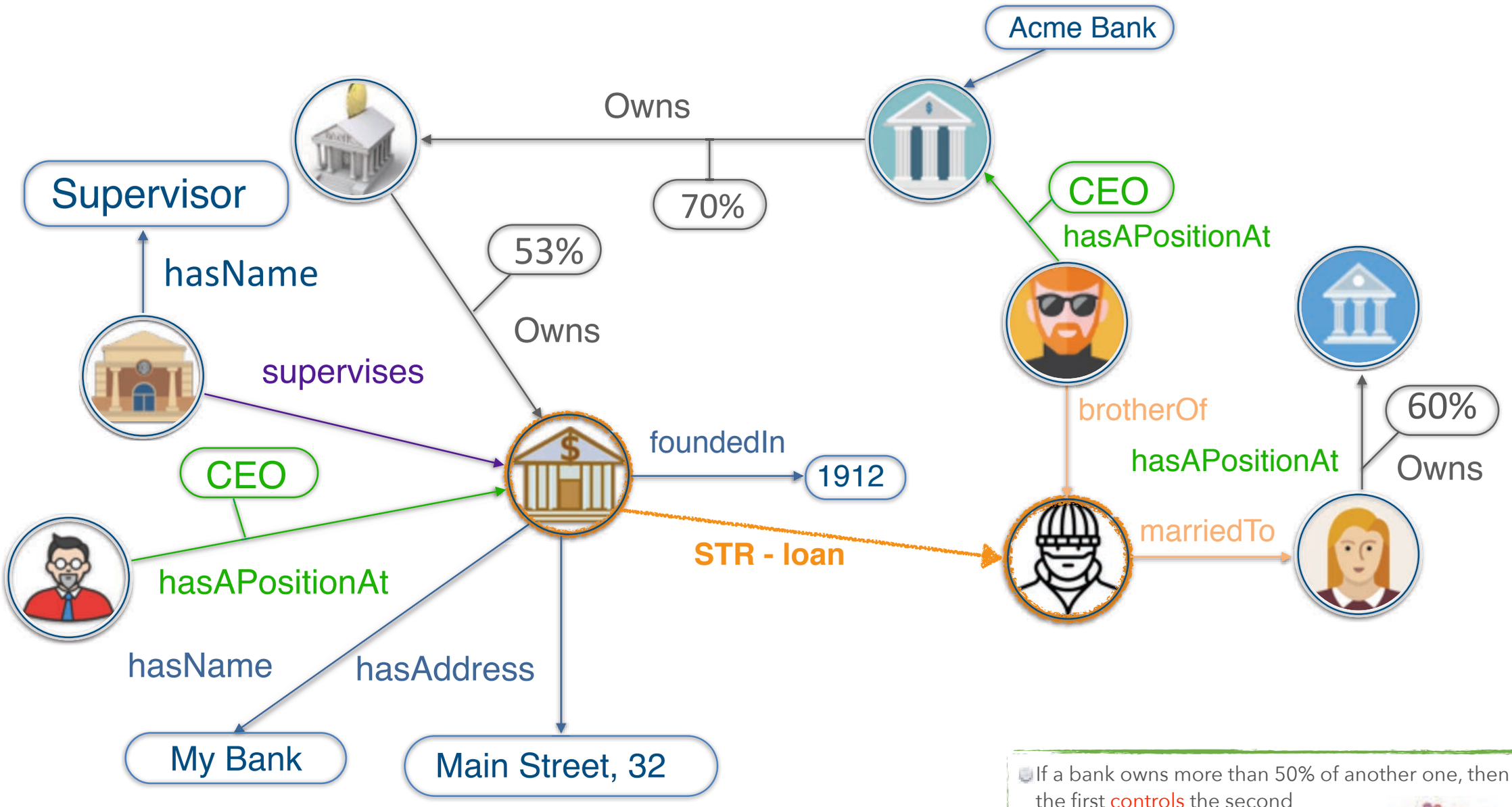
$$\text{Person}(x) \rightarrow \exists q\ G(x,q)$$

$$P(x,v),P(y,w),G(v,z),G(w,z) \rightarrow \exists q\ G(x,q),G(y,q)$$

Person	Person
Andrew	Micheal
Humberto	Jane
Mario	Sandra
Thomas	Laura

Q: Who are the **pairs of persons** of the **same generation**?

Detecting Collusion with KG and Reasoning



- If a bank owns more than 50% of another one, then the first controls the second
- Brothers are in the same family
- Two partners are in the same family
- Relations are transitive
- Two banks whose CEOs and/or major shareholders are in the same family are in a person-based link

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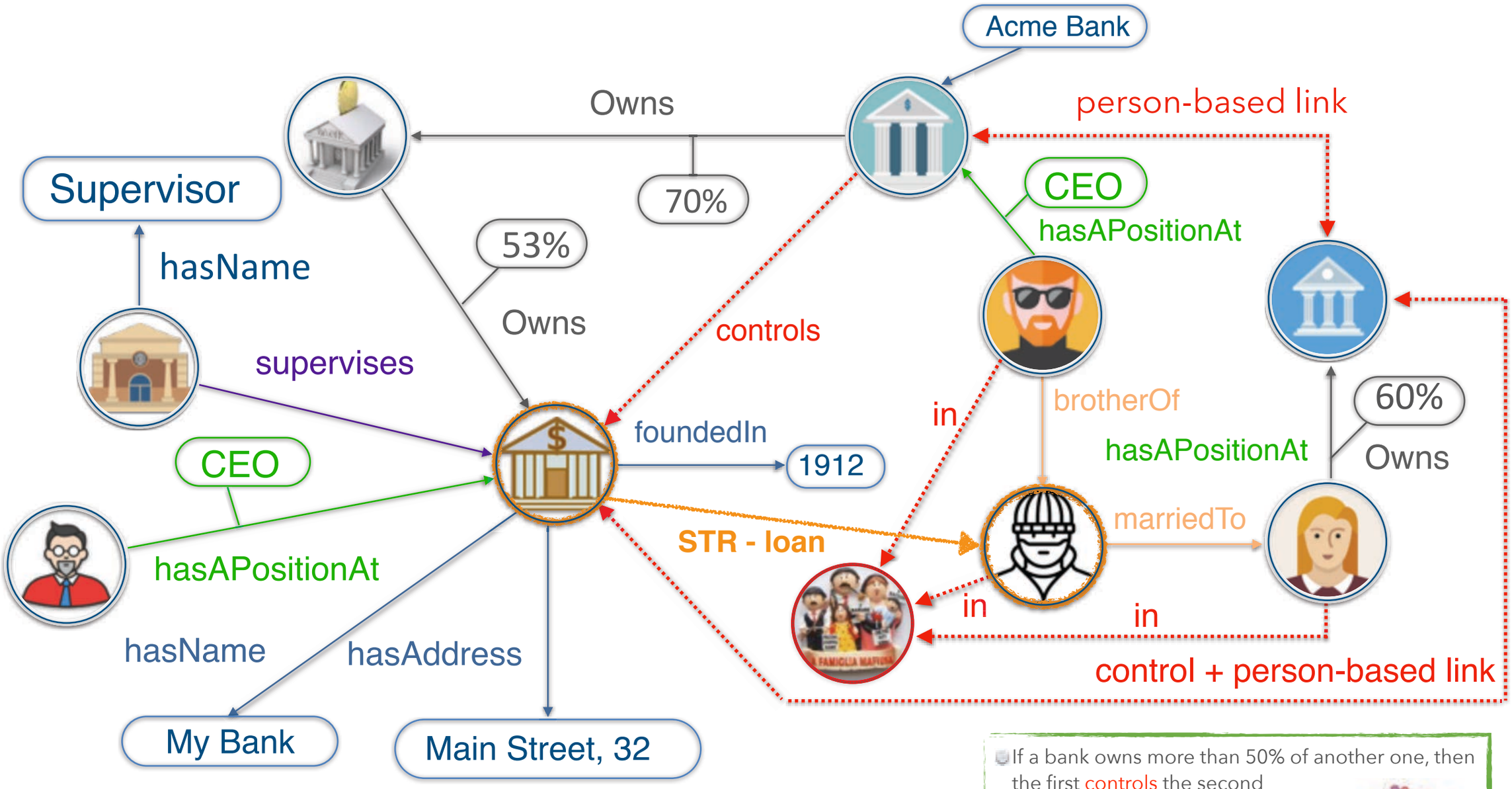

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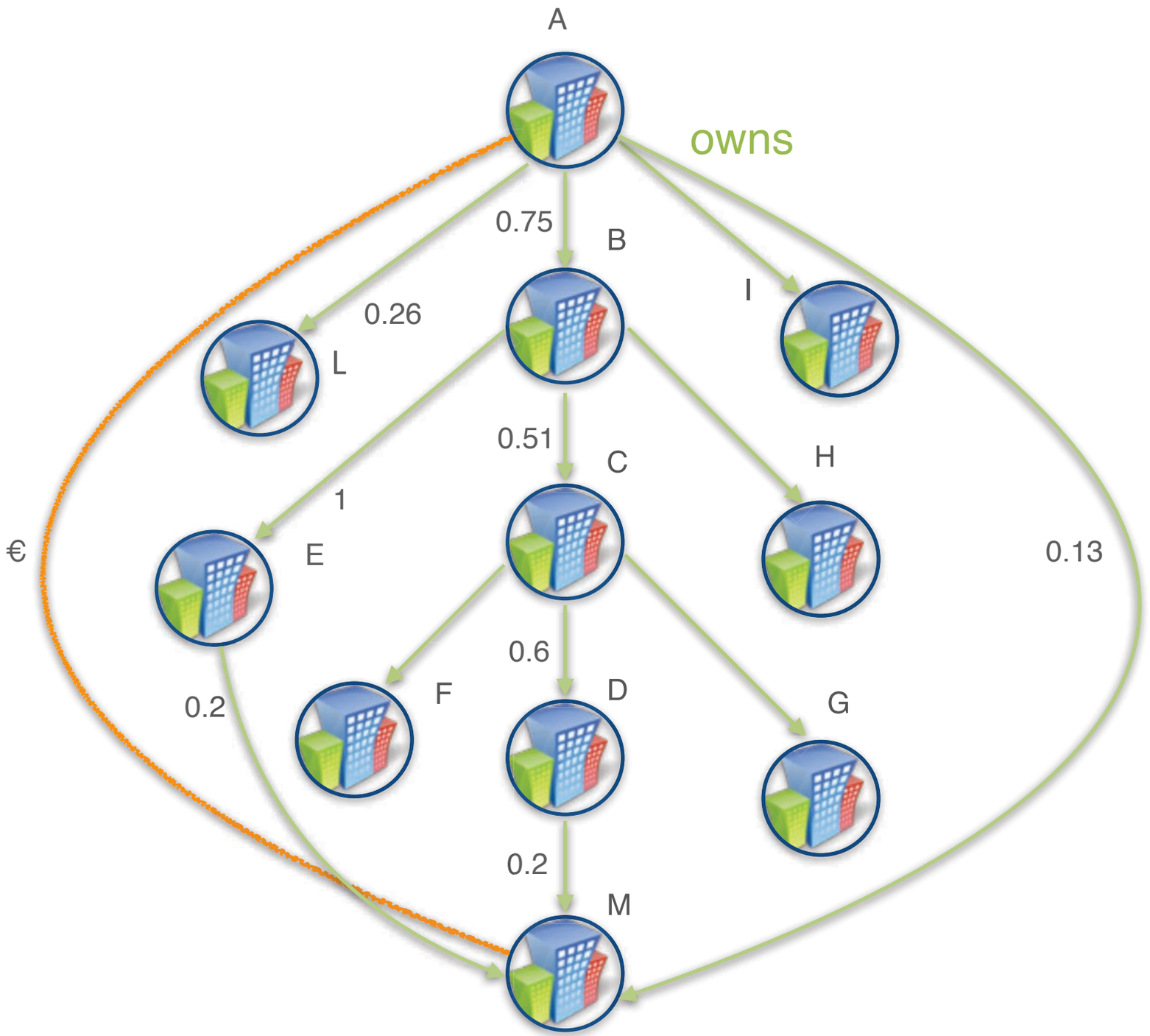
Money Laundering Geometries

Finding Beneficial Owner



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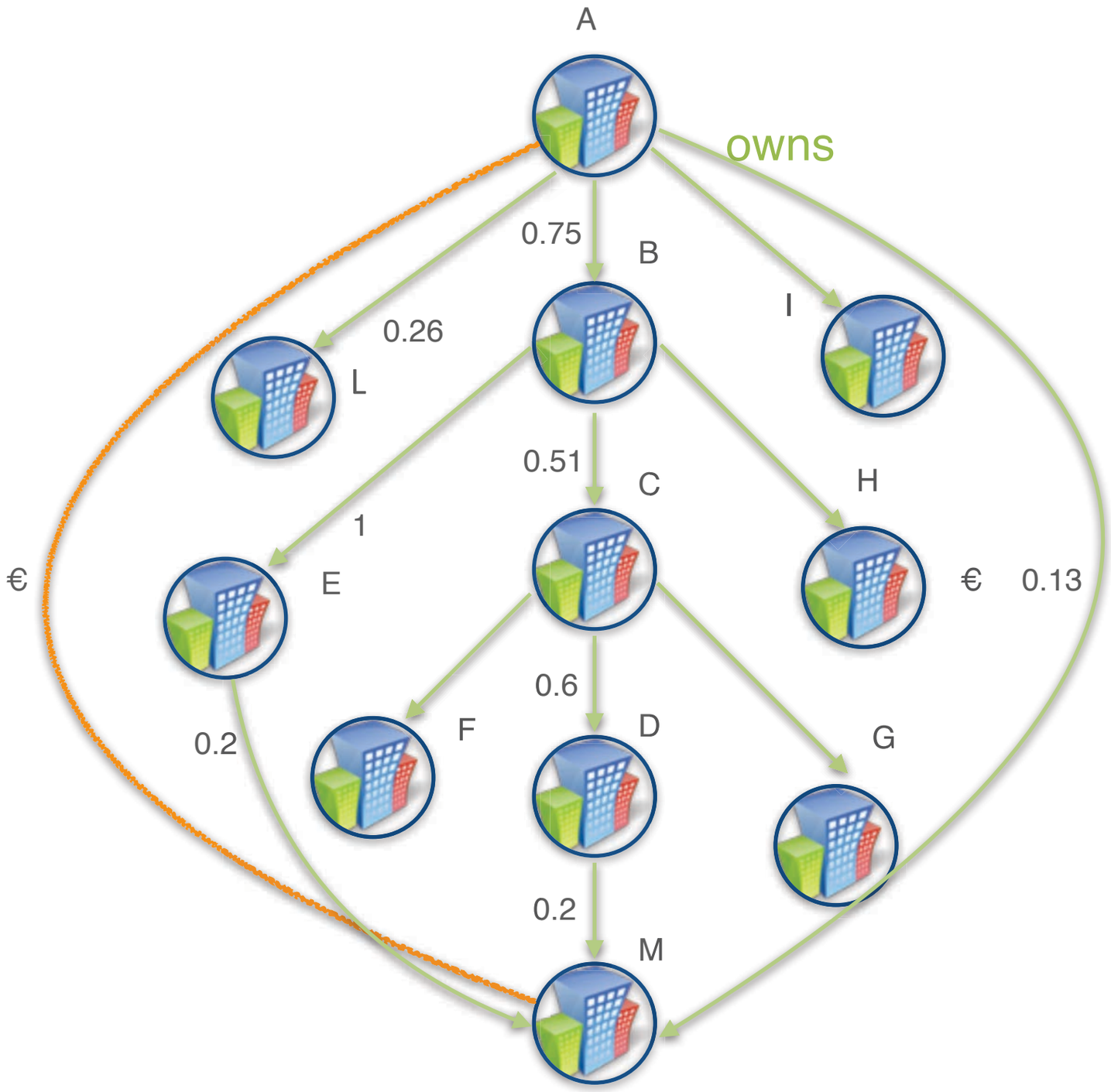

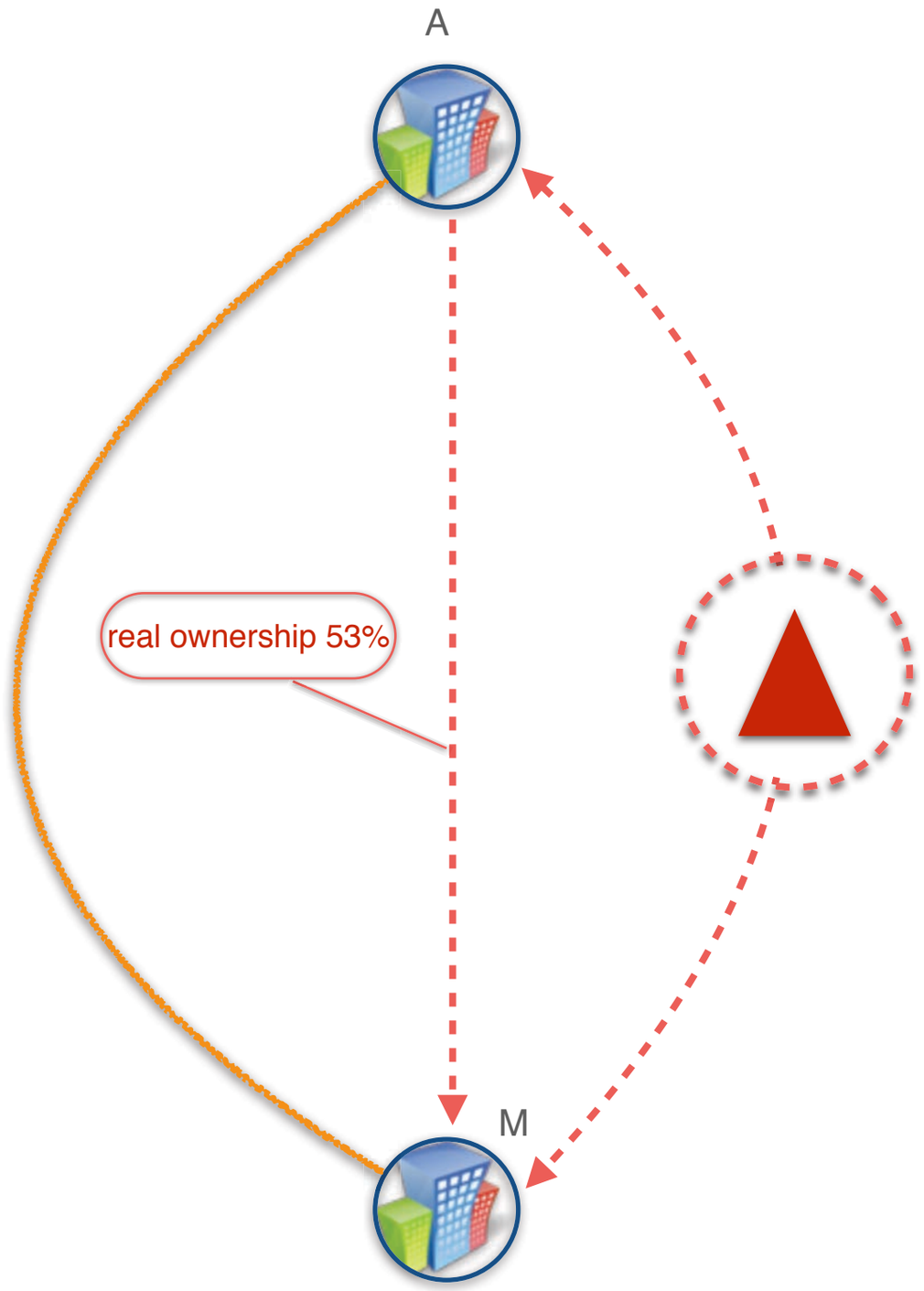

FINAL REMARKS

- A vision: reasoning approaches will **disrupt** the way AML is performed in the next years.
- A challenge: knowledge graphs approaches entail a **holistic** approach to the contrast of financial crimes phenomena, which is almost absent now.