

SAFARI

Situational Awareness Framework for Risk Ranking

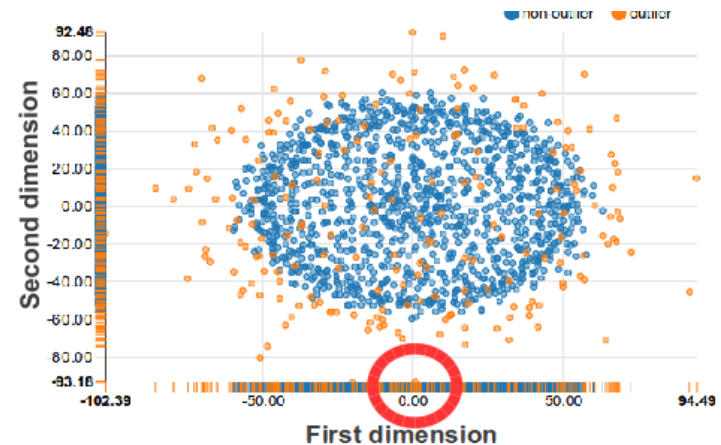
Alberto Garcia-Robledo, Abel Sanchez, Rongsha Li,
Juan-Carlos Murillo-Torres, John Williams and Sascha Boheme

Massachusetts Institute of Technology
MIT Geospatial Data Center



Challenges of Fraud Detection

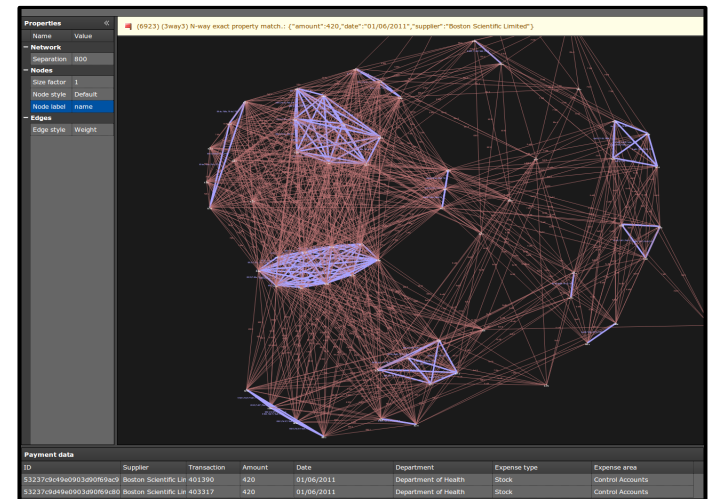
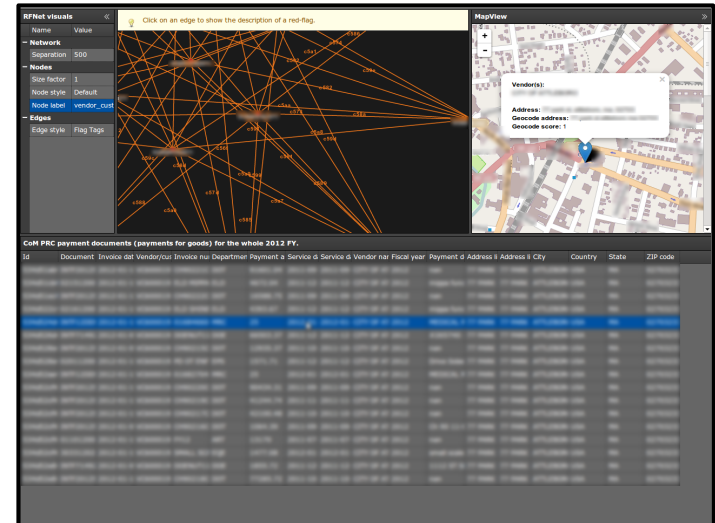
- Few samples of fraud: i.e. unlabeled data (no supervised learning)
- Anomaly detection (unsupervised learning): high false positive rate
- Results may make no sense: what do the outliers actually mean?
- Reducing dimensions causes that data to lose its semantic meaning
- **Finding a needle in a haystack**



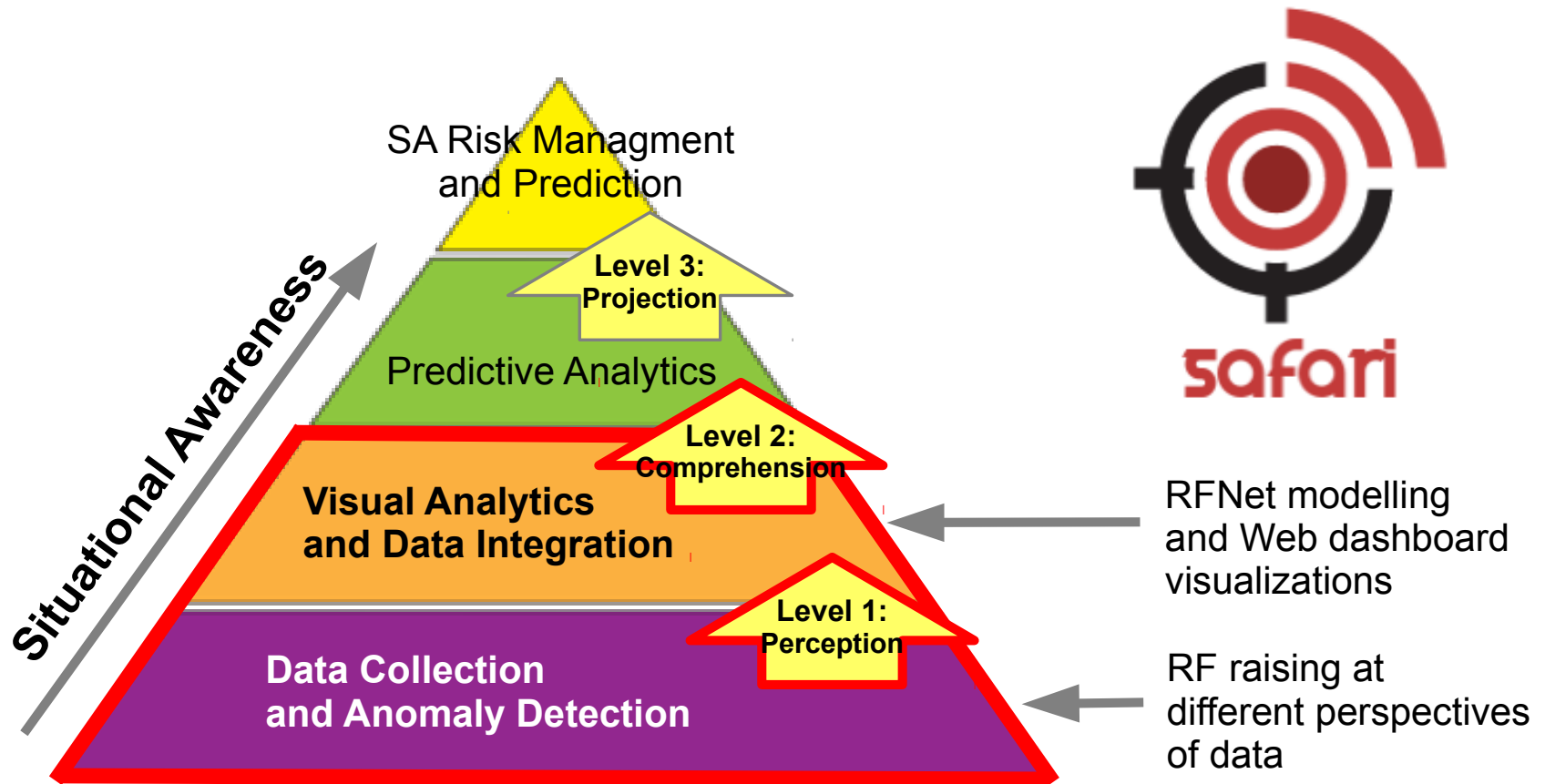
How we can best exploit the unlabeled payment transaction documents considering the different types of information contained in them?

Situational Awareness for Fraud Detection

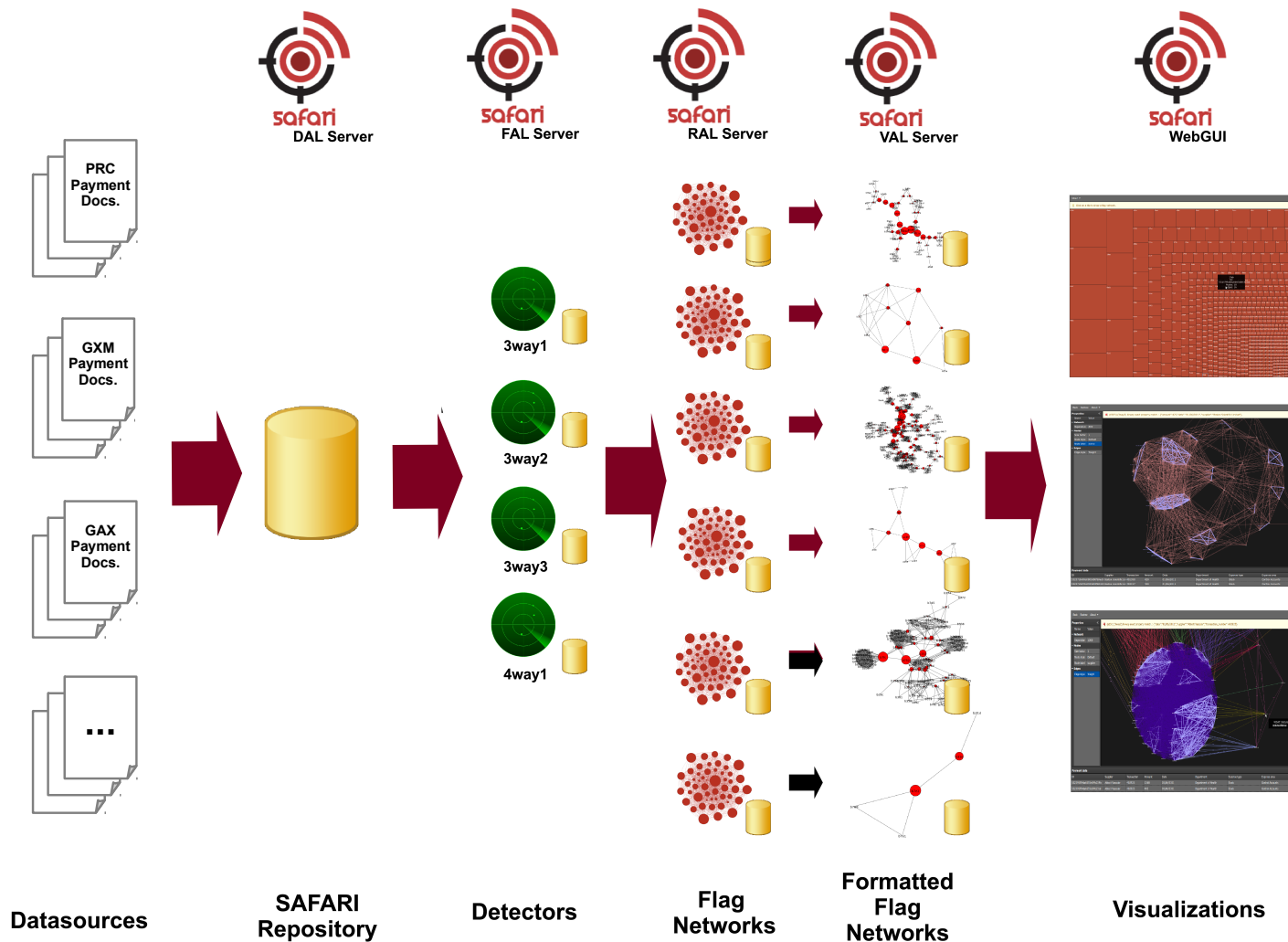
SAFARI introduces the concept of **Situational Awareness** to enable the detection of fraud on large volumes of payments where ground truth is not available, by **integrating different perspectives of financial data**.



SAFARI: 1 and 2-Level SA Approach



SAFARI: Workflow



SAFARI: Data Ingestion and Enrichment

1	department_family	entity	date	expense_type	expense_area
2	Department of Health	Basildon and Thur	01/06/2011	Establishment Expenses	Hotel Services Admin
3	Department of Health	Basildon and Thur	01/06/2011	Establishment Expenses	Hotel Services Admin
4	Department of Health	Basildon and Thur	01/06/2011	Establishment Expenses	Hotel Services Admin
5	Department of Health	Basildon and Thur	01/06/2011	Establishment Expenses	Hotel Services Admin
6	Department of Health	Basildon and Thur	01/06/2011	Establishment Expenses	Theatres
7	Department of Health	Basildon and Thur	01/06/2011	Premises & Fixed Plant	Pain Management
8	Department of Health	Basildon and Thur	01/06/2011	Supplies & Servs-Clinical	Orthopaedics
9	Department of Health	Basildon and Thur	01/06/2011	Miscellaneous Expenditure	Gastroenterology
10	Department of Health	Basildon and Thur	01/06/2011	Miscellaneous Expenditure	Ent
11	Department of Health	Basildon and Thur	01/06/2011	Miscellaneous Expenditure	Ent
12	Department of Health	Basildon and Thur	01/06/2011	Miscellaneous Expenditure	Obstetrics
13	Department of Health	Basildon and Thur	01/06/2011	Miscellaneous Expenditure	Obstetrics
14	Department of Health	Basildon and Thur	01/06/2011	Miscellaneous Expenditure	Obstetrics
15	Department of Health	Basildon and Thur	01/06/2011	Miscellaneous Expenditure	Gynae
16	Department of Health	Basildon and Thur	01/06/2011	Miscellaneous Expenditure	Gynae
17	Department of Health	Basildon and Thur	01/06/2011	Miscellaneous Expenditure	Gynae
18	Department of Health	Basildon and Thur	01/06/2011	Premises & Fixed Plant (Cap)	Equipment Capital Projects
19	Department of Health	Basildon and Thur	01/06/2011	Premises & Fixed Plant (Cap)	Equipment Capital Projects
20	Department of Health	Basildon and Thur	01/06/2011	Premises & Fixed Plant	
21	Department of Health	Basildon and Thur	01/06/2011	Premises & Fixed Plant	
22	Department of Health	Basildon and Thur	01/06/2011	Premises & Fixed Plant	
23	Department of Health	Basildon and Thur	01/06/2011	Premises & Fixed Plant	
24	Department of Health	Basildon and Thur	01/06/2011	Premises & Fixed Plant	
25	Department of Health	Basildon and Thur	01/06/2011	Premises & Fixed Plant	
26	Department of Health	Basildon and Thur	01/06/2011	Premises & Fixed Plant	
27	Department of Health	Basildon and Thur	01/06/2011	Premises & Fixed Plant	
28	Department of Health	Basildon and Thur	01/06/2011	Premises & Fixed Plant	
29	Department of Health	Basildon and Thur	01/06/2011	Premises & Fixed Plant	
30	Department of Health	Basildon and Thur	01/06/2011	Premises & Fixed Plant	

Your Addresses **Address Standardization**

1200 W Lawrence Ave
Springfield, IL 62704

830 S Main St
Springfield, IL 62704

1015 W Governor St
Springfield, IL 62704

→

1200 W Lawrence Ave
Springfield, IL 62704 ✓

830 S Main St
Springfield, IL 62704 ✓

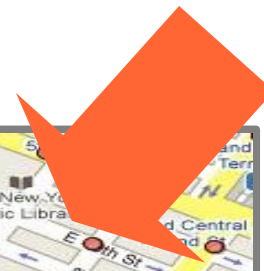
1015 W Governor St
Springfield, IL 62704 ✓

Address Locator

(39.7997, -89.62807)

→

Points on a Map



Your Addresses **Address Standardization**

1200 W Lawrence Ave
Springfield, IL 62704

830 S Main St
Springfield, IL 62704

1015 W Governor St
Springfield, IL 62704

→

1200 W Lawrence Ave
Springfield, IL 62704 ✓

830 S Main St
Springfield, IL 62704 ✓

1015 W Governor St
Springfield, IL 62704 ✓

Address Locator

(39.7997, -89.62807)

→

Points on a Map



SAFARI: Anomaly Detection



N-way Exact Matching



String Fuzzy Matching



String Phonetic Matching



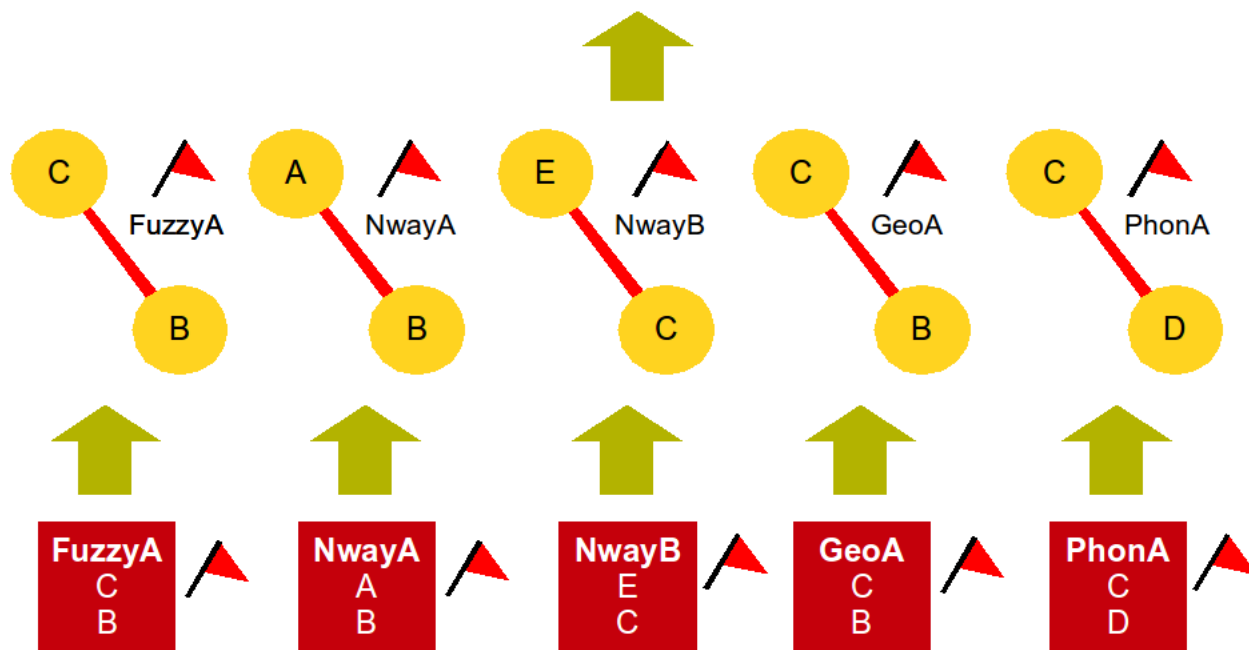
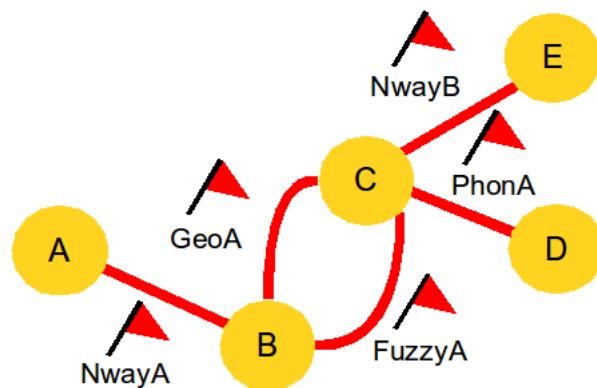
Address Geolocation Matching



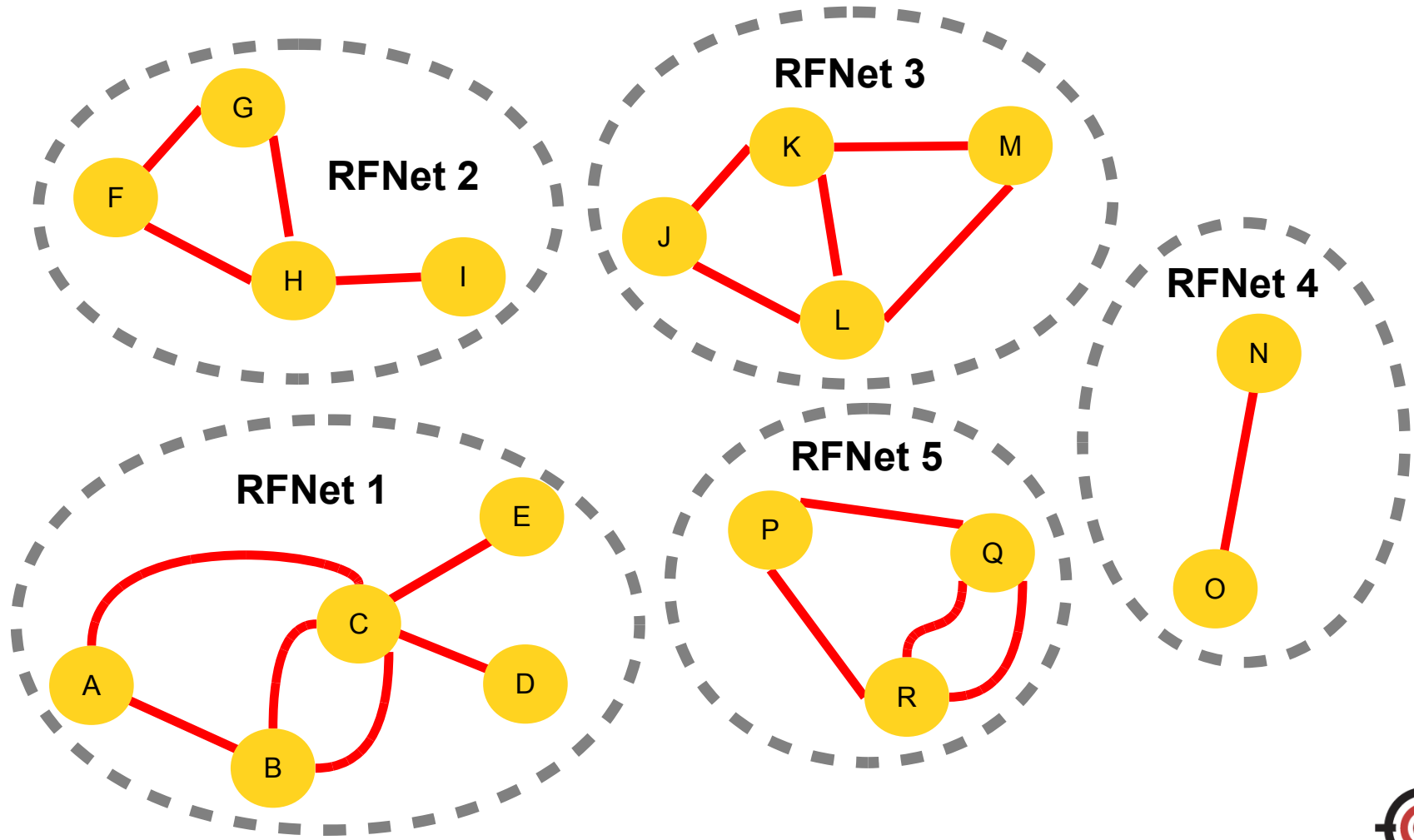
Rule Expression Matching



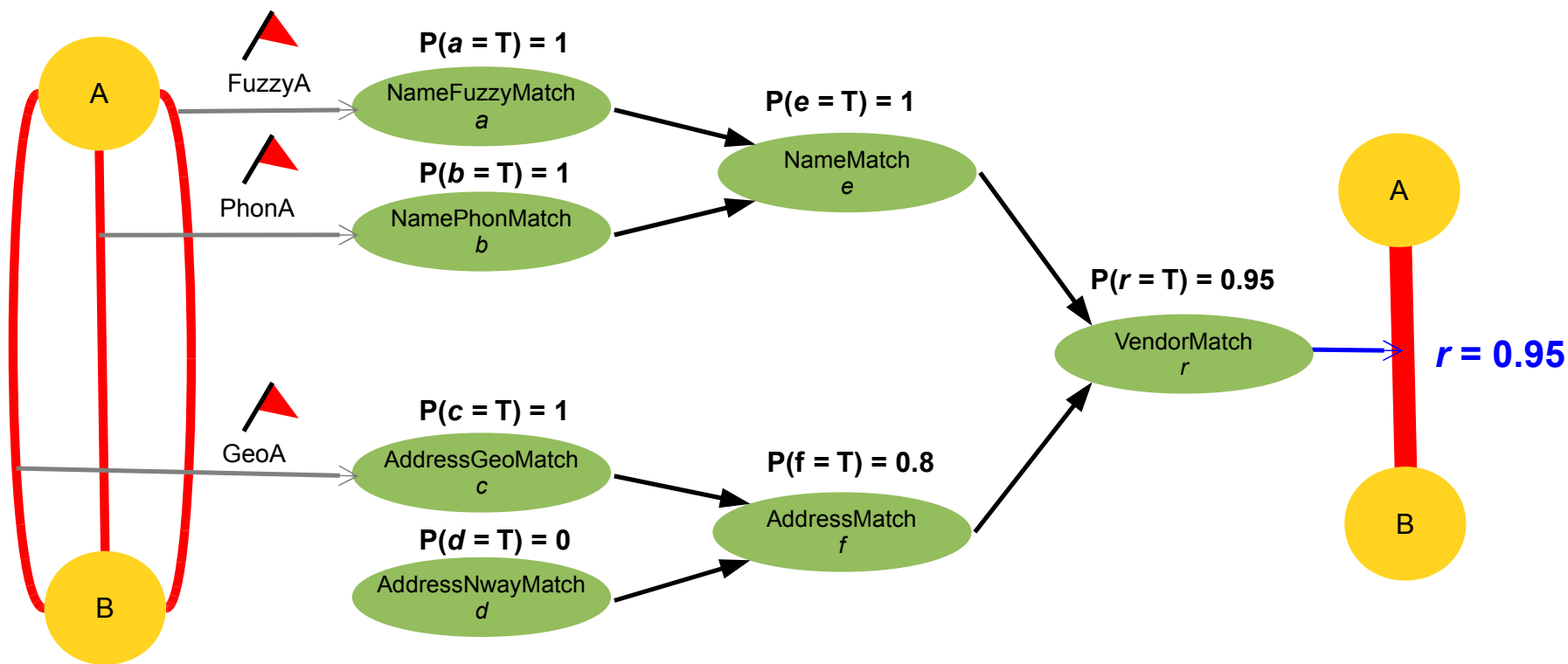
SAFARI: RFs and RFNet Integration



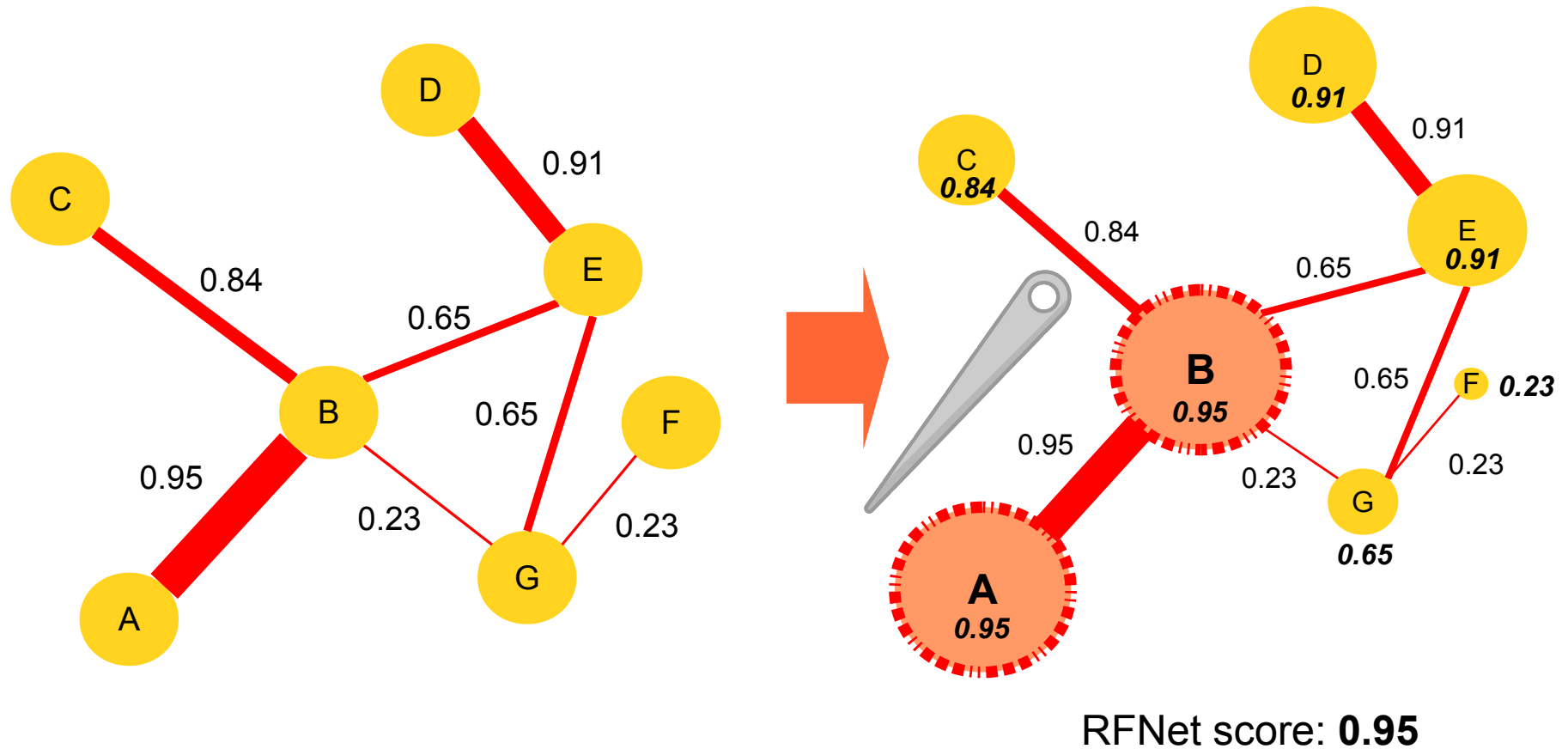
SAFARI: RFNet Scenarios



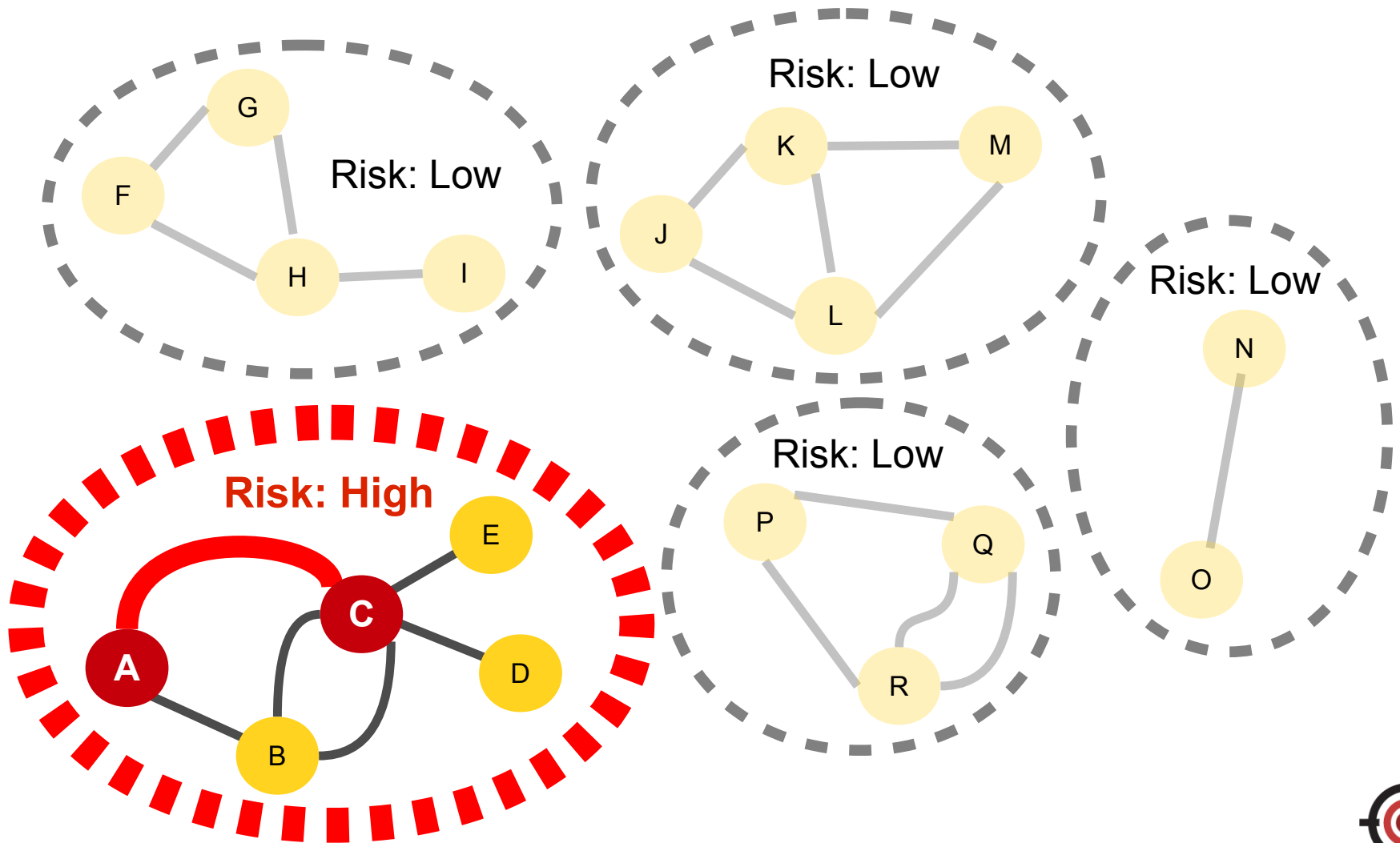
RFNet Pair-Wise Matching and BBN Ranking



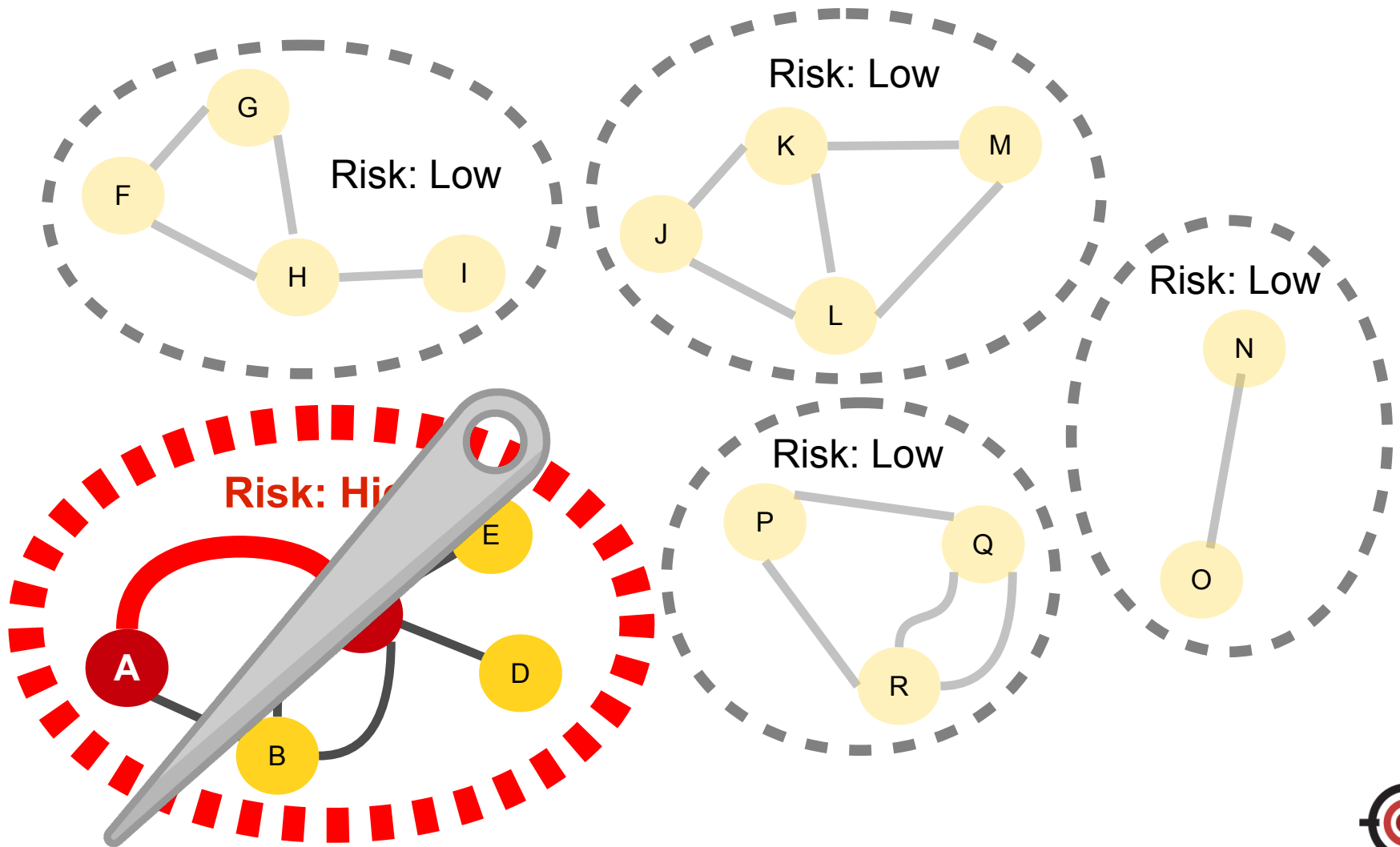
SAFARI: Risk Score Propagation



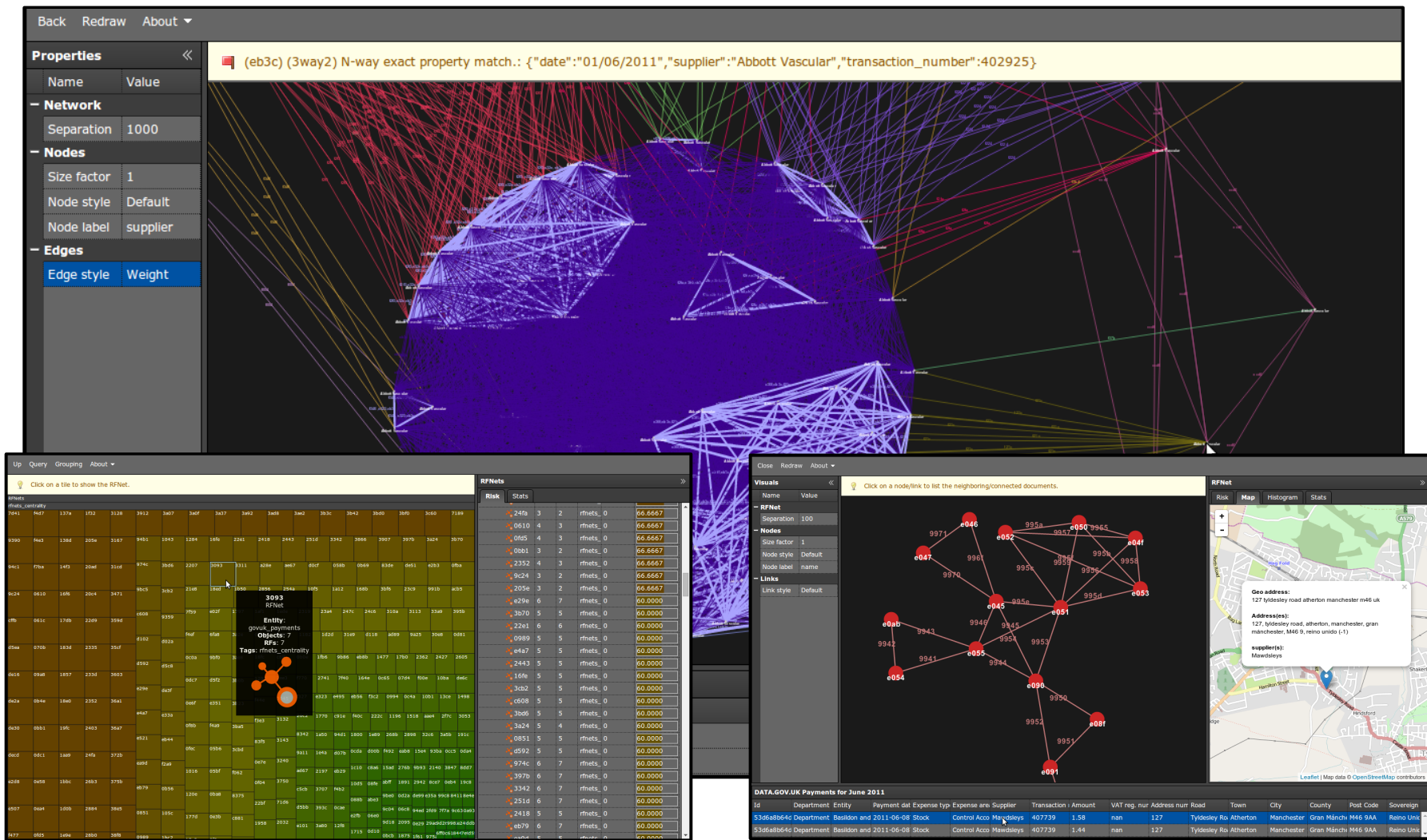
SAFARI: Finding the Needle ...



SAFARI: Finding the Needle ...

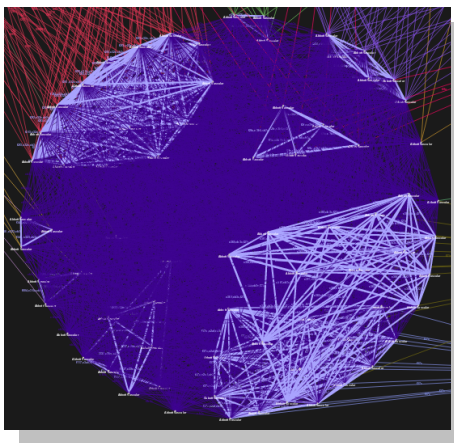


SAFARI: Web-Based Visual Analytics



Conclusions

- **Analysis integration.** Combine different analysis techniques for processing large amounts of payment documents.
- **Big data analysis.** Help SMEs to make sense of a large amount of RFs spread across data.
- **Focus.** Help SMEs to focus on the most suspicious payments by exploiting modern high-performance multi-core computers and visualization techniques.



**Integration
Ranking
Visualization**



**False positive
minimization**

