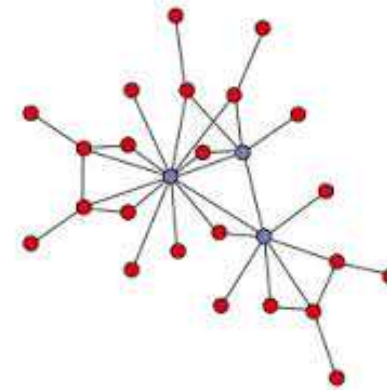# Financial network analysis using SWIFT and

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(joint work of Krešimir Kalafatić and Marijana Buždon)

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General overview

- What is SWIFT?
  - SWIFT is software platform for exchanging standardized financial messages between banks, financial institutions and corporations
  - more than ten of thousands of banks, financial institutions and corporations, in more than 200 countries use SWIFT platform for exchanging millions of financial messages daily – www.swift.com

- Project idea:
  - build the infrastructure for international statistical analysis how joining the country to EU affects its financial system and economy from a perspective of one large bank
  (Croatia joined the EU on 1 July 2013, neighboring countries are in the process of negotiation and experience from Croatia can be used for their integration in EU)

- Why use SWIFT data:
  - SWIFT is used in cross-border transactions, HSVP (RTGS in Croatia), TARGET2 (European Monetary Union RTGS), TARGET2-Securities, uses international standardized message format, ...

- Why financial network analysis:
  - financial networks are probably the next step in evolution of risk management and accounting standards
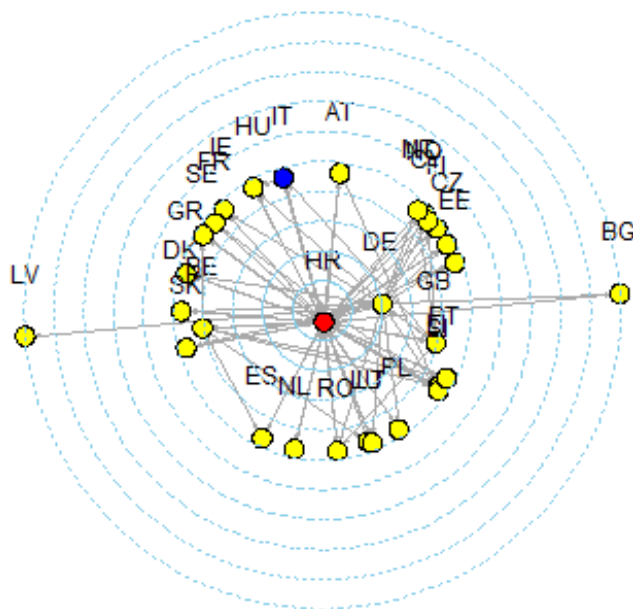
System design

- SWIFT production system
    - SWIFT Alliance Access server – central point of SWIFT application

- our system for statistical analysis:
    - 1 RHEL server for production
        - NoSQL database
        - parser for SWIFT MT format
        - R version 3.1
            - data import
            - data analysis
            - HTML report generation using **knitr**
            - for visualization we are using **rCharts**
            - financial network analysis
                - used R libraries: **igraph**, **sna**, **network, ...**
            - web browser graphical representation – our own javascript using d3.js and data generated in R with custom options of filtering, zoom-in, zoom-out, selection by country, drill-down options to HTML reports generated by knitr,....
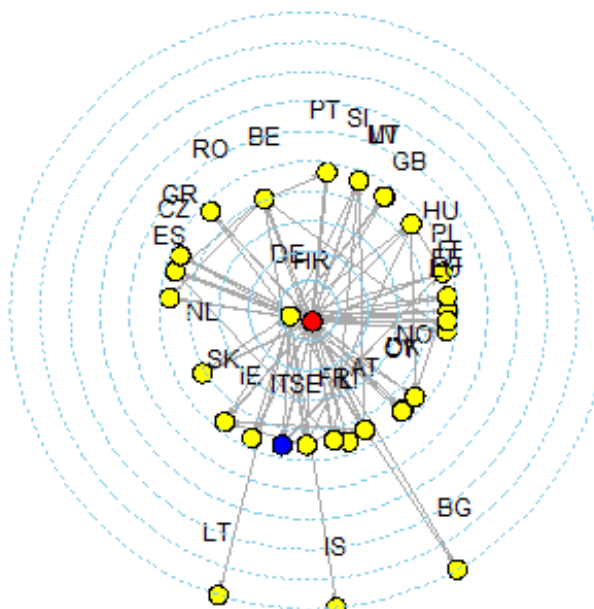
Credit transfer network

- credit (wire) transfer network is for economy as coronary angiogram
  for heart blood vessels
- several factors have to be taken into account:
  - network structure and behavioural change between ordering and beneficiary customer
  - network structure and behavioural change between the banks
    (change in regulation and monetary policy, bank consolidation and contracts,...)
- interbank wire transfer network analysis:
  - network metrics used for statistical analysis and conclusions
  - e.g. closeness centrality of interbank wire transfers with EEA countries in periods before
    joining EU, after joining EU and after joining SEPA
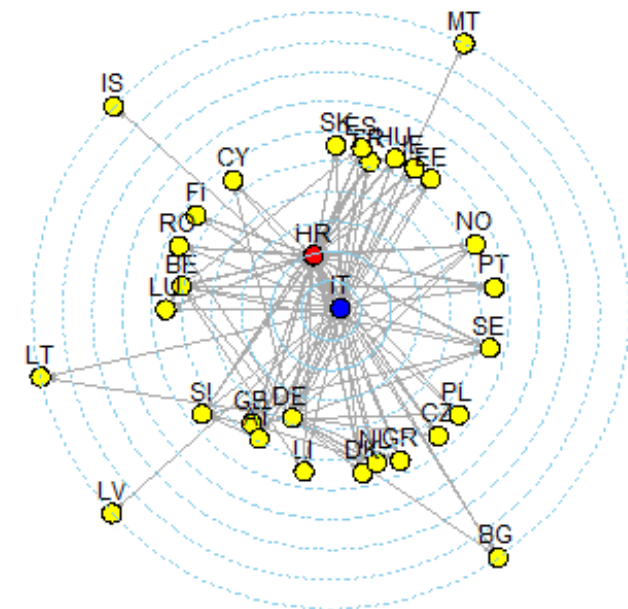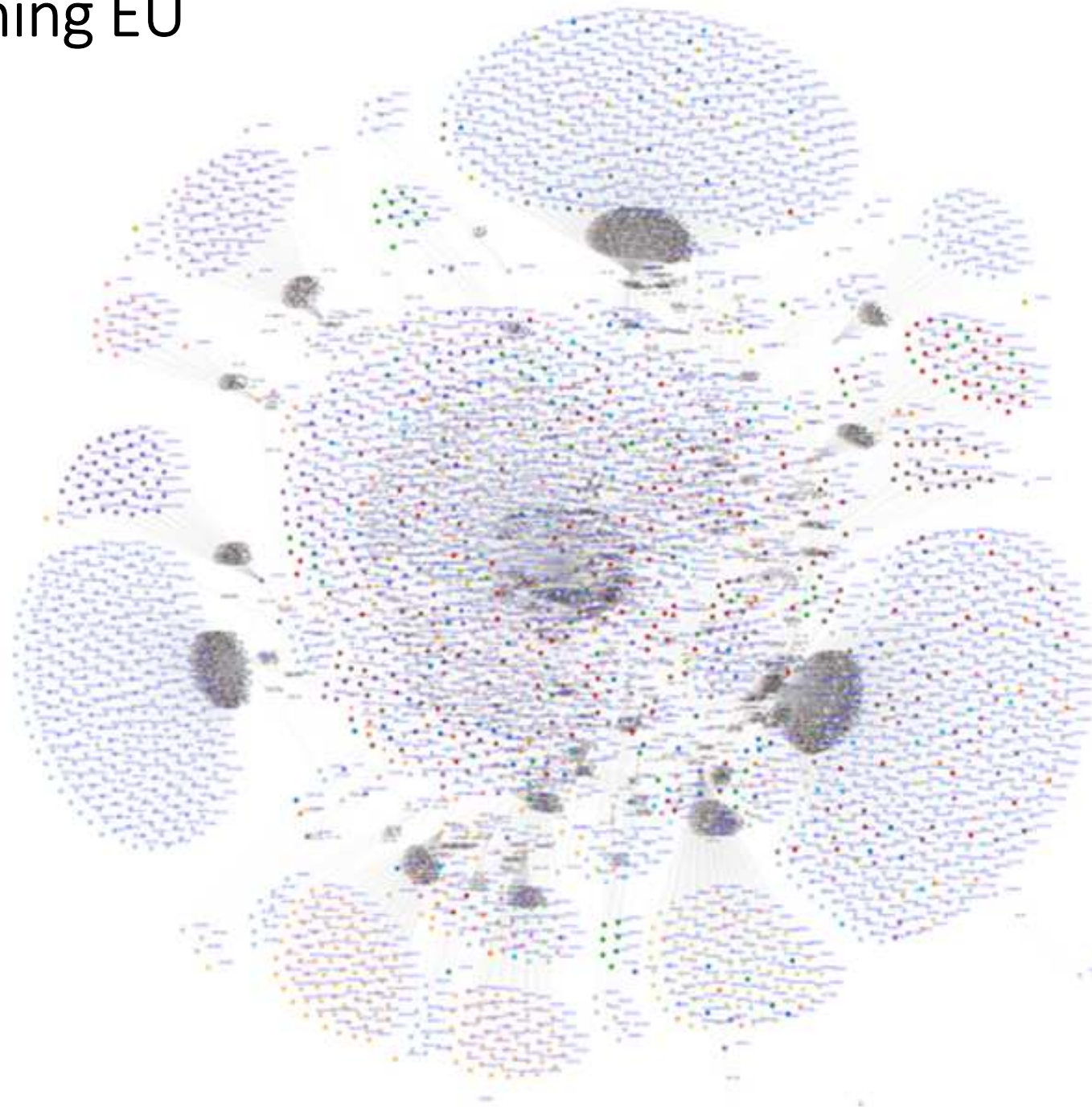 - graphical analysis of financial network
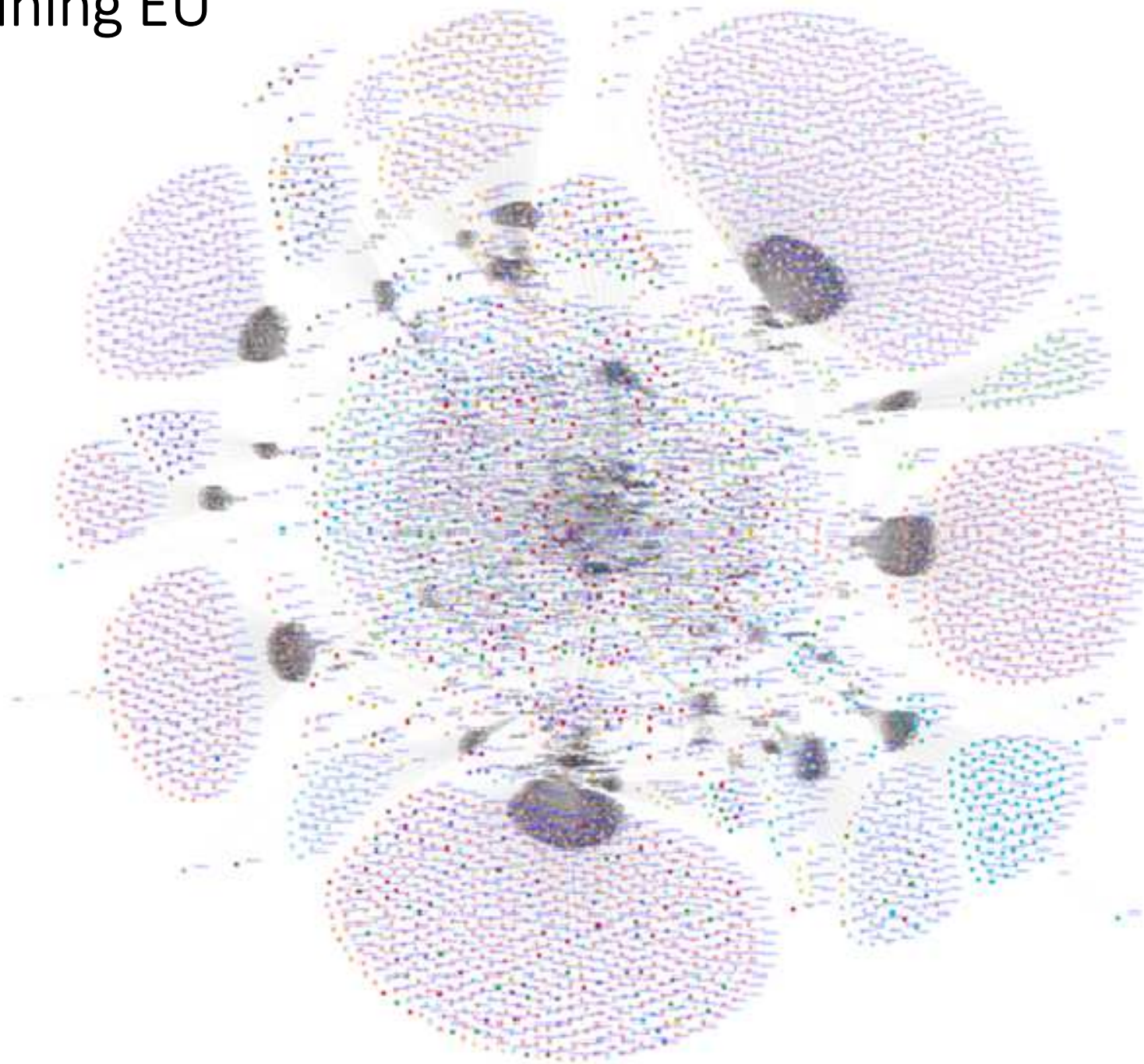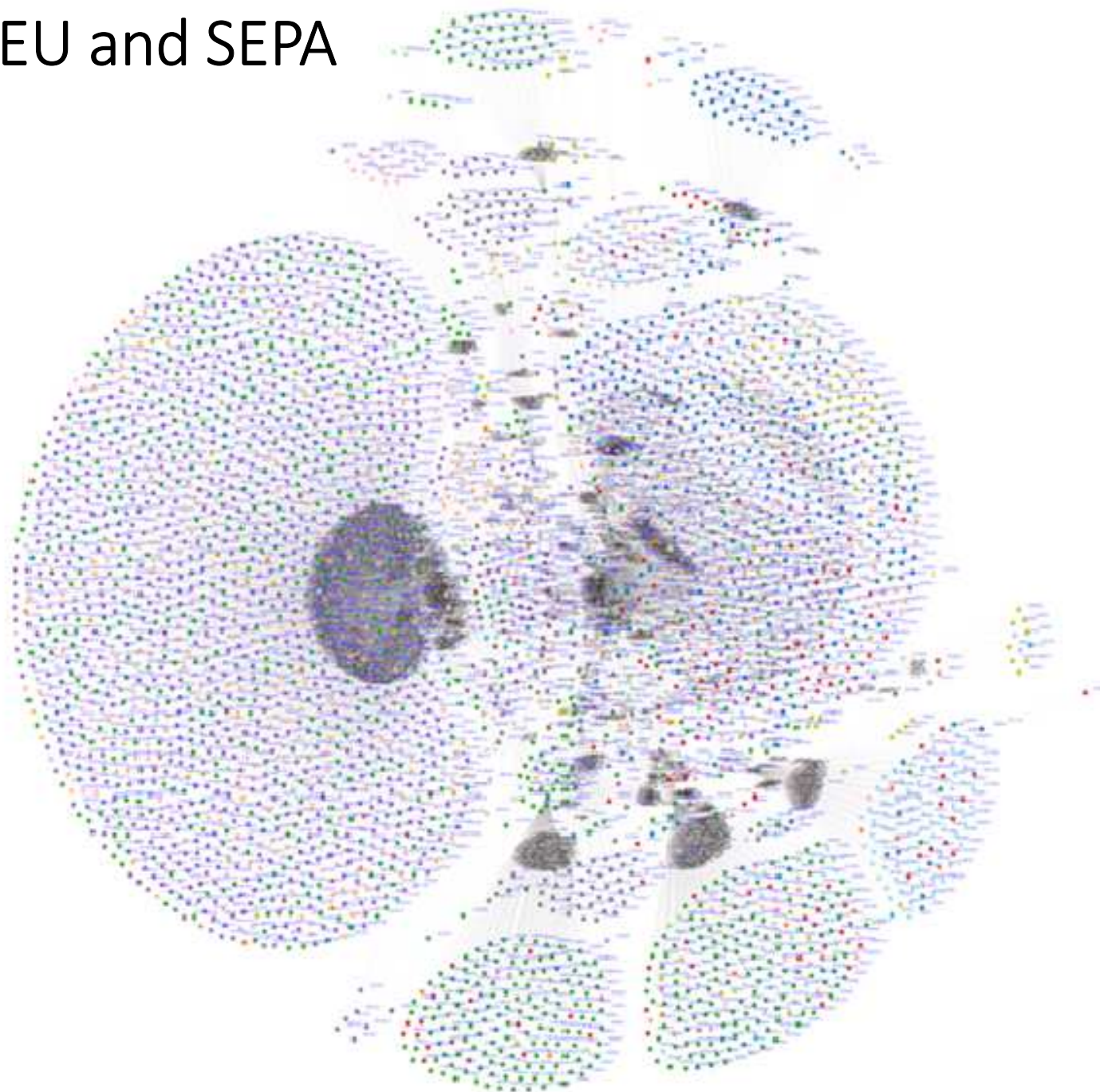

Closeness before EU

Closeness EU

Closeness EU-SEPA

Cross-border interbank credit transfer network before joining EU

Cross-border interbank credit transfer network after joining EU

Cross-border interbank credit transfer network after joining EU and SEPA

Project results

- System was till now used for:
    - reporting to internal business users
    - performing analysis for regulatory requirements
    - financial network analysis
      (wire transfers, operational risk management, interbank communities,...)

- The infrastructure is simple to implement, requires low maintenance and can be used in countries and banks with small and limited IT budgets

- The infrastructure can also be used in following fields:
    - double checking of the internal computer systems
    - auditing of SWIFT traffic
    - various statistical research

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