



**Applications of Networks Analytics &
Simulations in Finance, Banking and Regulation**
18 October 2021



The University of Edinburgh



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Introduction



Kimmo Soramäki, Founder and CEO, FNA



Dr. **Kimmo Soramäki** is the Founder and CEO of Financial Network Analytics (FNA) and the founding Editor-in-Chief of the Journal of Network Theory in Finance.

Kimmo started his career as an economist at the Bank of Finland where in 1997, he developed the first simulation model for interbank payment systems. In 2004, while at the Federal Reserve Bank of New York, he was among the first to apply methods from network theory to improve our understanding of financial systems. During the financial crisis of 2007–2008, Kimmo advised several central banks in modeling interconnections and systemic risk. His research on these topics have been cited in over 1500 publications.

Kimmo founded FNA in 2013 to develop software for solving important issues around financial risk and for exploring the complex financial networks that play a continually larger role in the world around us.



About FNA

Our mission

To make the financial system **safer** and more **efficient**

FNA is a deep technology company and award-winning leader in **Regulatory Technology** (Regtech) and **Supervisory Technology** (Suptech). FNA combines industry leading data science capabilities with deep business domain expertise.

Supervisors, banks and FMIs have recognized the **interconnected nature of financial systems** and now have access to large amounts of **granular data**.

FNA's software solutions allow central banks and financial institutions and authorities to **map and monitor complex financial networks** and to **simulate operational and financial risks**.



Representative Clients

Our clients

FNA's clients include the world's largest central banks, supervisors and financial market infrastructures.



Bank of England



Central Bank of
Colombia



Hong Kong Monetary
Authority



US Department
of the Treasury



US Department of
Defense



CME Group



Payments
Canada



CLS Group



SWIFT



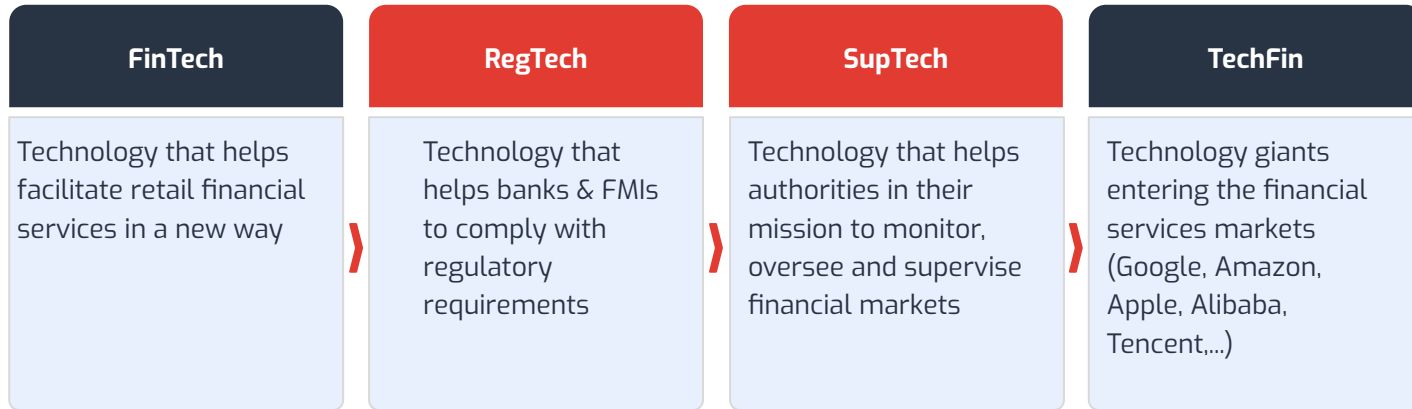
Fnality



Network Theory in Suptech and Regtech



Evolution of Terminology





Network Theory is about

New Way of Looking at Data

- How is data connected with other data?
- How do these connections matter?
- How do complex systems move in time?

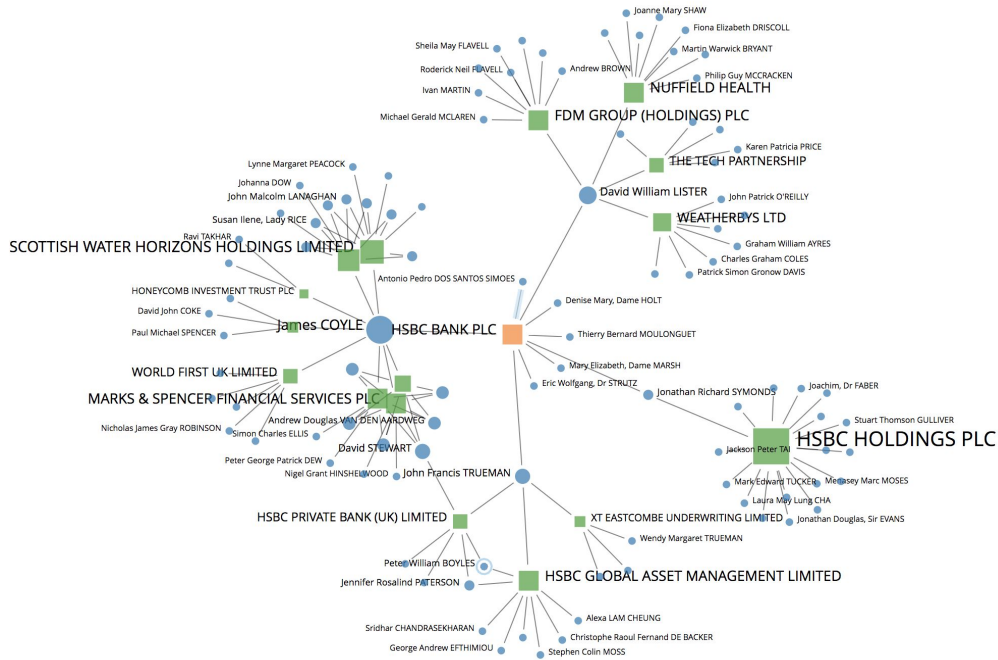
For the first time we are able to measure and model this!



Three Main Modes of Analysis

- Bottom up analysis
- Top down analysis
- Features of Data

Bottom Up



Typical use cases:

- Criminal investigation
- Terrorist networks
- Money laundering
- KYC & KYCC
- Fundamental investment analysis
- Supply chain analysis



Top Down

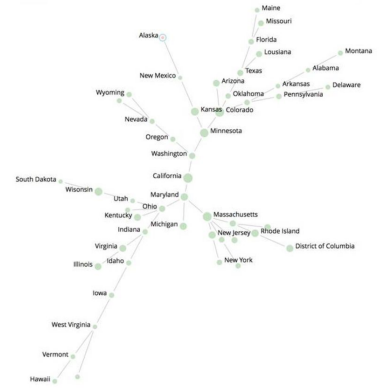
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New Tools Give Better Picture, Literally, of Financial-System Risk

Researchers are using network analytics and advanced data modeling to identify weak spots in the system that otherwise might go unnoticed



This sprawling tree shows housing prices in U.S. markets moving with little correlation in 2000. The tree has gotten shorter and shorter since, indicating higher correlation between markets.

PHOTO: FINANCIAL NETWORK ANALYTICS

Typical use cases:

- Systemic risk analysis
- System monitoring
- System design
- System stress testing
- Clustering/Classification
- Early warning
- Anomaly detection



Network Features of Data



Typical use cases:

- AI/ML
- Fraud algorithms
- Recommendation engines
- Algorithmic investment

FNA Research: [Comparison of Graph Computing Platform Performance](#)





FNA's Technology



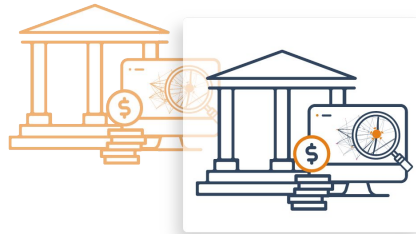
Our Technology

FNA's technology enables decision makers and business analysts to easily uncover hidden connections, access and understand complex datasets and create network dashboards & simulations.



Discover

Uncover hidden connections in large, complex datasets and visualize them via interactive dashboards



Simulate

Build AI simulations to predict the impact of anomalies and stress events within systems and networks



Optimize

Enhance and configure for optimal performance using proven machine learning algorithms



Our Solutions



Client sectors

Solutions

Central Banks

Suptech

CBDC
Simulation

Network analytics
for large datasets
and training

Simulating the
impact of introducing
a digital currency

FMs & Exchanges

System Simulation

Simulating the impact of changes or
stresses to large payment and settlement
systems

Banks & Treasuries

Intraday Liquidity Optimization

Optimizing payment flows and intraday to
reduce liquidity costs

National Security

Augmented Targeting

Advanced targeting and anomaly detection
within complex networks

Flow from Data to Insights



FNA Retrieve

Connect and Combine data from online APIs and data collectors



FNA Resolve

Clean, Transform and Resolve entities in data



FNA Analyze & Visualize

Apply latest data science techniques, network analysis and AI/ML methods. Create flexible interactive dashboards.



FNA Simulate

Carry out simulations on granular transaction data

The FNA Platform



Use Cases and Demos





Case Study: Insights from global payments data



SWIFT maps its global payment network



Background

SWIFT messaging services are used by over 11,000 financial institutions in more than 200 countries. SWIFT was interested in what insights could be drawn from the "Big Data" that it collects when transmitting messages between financial institutions.



Objective

To analyse the payment networks created by flows of SWIFT MT103 messages to draw insights about macroeconomic, geo-political and compliance topics.



Outcome

Analysis of the SWIFT payment networks revealed a number of insights, including the phenomena of de-risking, payment country blocks relevant for sanctions analysis and how geopolitics shape them, and estimated the cost of the financial crisis at \$5tr. The outcome/research was presented at Sibos 2014 by SWIFT CEO Gottfried Leibbrandt.

SWIFT Institute Research Paper: [The global network of payment flows](#)

Research Paper: [The Impact of Anti-Money Laundering Regulation on Payment Flows](#)



Case Study: Understanding systemic risk



Bank of England maps Interbank Exposures in the United Kingdom



UK Interbank Exposure Network



Background

During the 2008 financial crisis, many banks ran into difficulties at the same time as shocks spread rapidly across the financial system. One of the main reasons for this was that the global financial system had become highly interconnected.



Objective

To measure bank interconnectedness and associated systemic risk in the UK.



Outcome

Direct interconnectedness such as interbank credit exposures, have decreased materially since the financial crisis. On the other hand indirect interconnectedness such as correlations in banks' CDS premia remain elevated. The analysis helps to define the case for policy interventions to reduce the associated risks.

Bank of England: [Banking sector interconnectedness: what is it, how can we measure it and why does it matter?](#)

Research paper: [Interbank Exposure Networks](#)



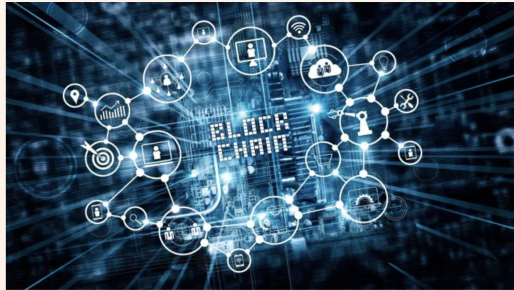
Case Study: Simulating and Modelling New Settlement Systems



Finality designs, simulates and models optimal system design

Top banks push ahead with digital coins for 2020

Move draws on four years of research into uses of crypto technology



The 'utility settlement coin' is expected to soon be used for clearing and settling trades

Laura Noonan in New York JUNE 3 2019



Thirteen of the world's biggest banks are preparing to launch digital versions of major global currencies in 2020 after years of research convinced them that the technology underpinning cryptocurrencies could be used to make trading less risky and cheaper.



Background

Finality is a consortium of global banks that is developing a novel asset-backed digital cash instrument for use within global institutional financial markets using Distributed Ledger Technology.



Objective

Finality is using FNA's technology to model and simulate the proposed FnPS ecosystem using realistic individual transaction data from member banks. This allows FFINALITY, member banks and regulators to evaluate the impact that system design will have on liquidity requirements and consequently balance sheets supporting the settlement of interbank payments.



Outcome

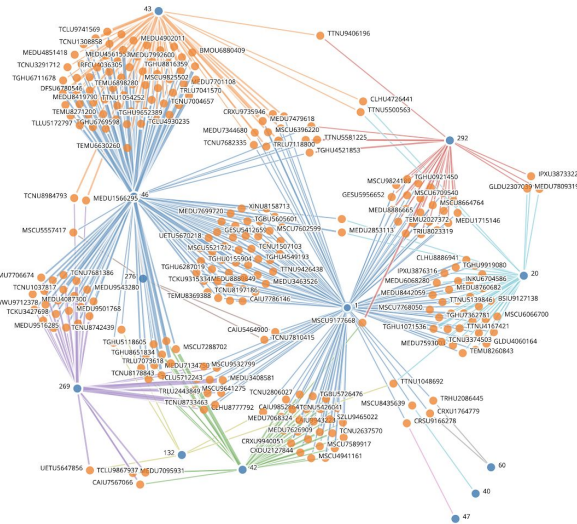
Finality has used the economic models created with FNA to provide valuable insights to member banks on the overall economic, balance sheet, liquidity and operational benefits of its proposed new service.



Case Study: Anomaly Detection in Maritime Shipping



US Department of Defence



FNA Augmented Targeting Cycle applied to International Maritime Shipping: 12 identified communities of IP addresses anomalously pinging 294 containers; based on real data used by the US DOD



Background

Through a US Department of Defense entity, several agencies from the five eyes countries, including the UK border force, required clearer intelligence in order to focus resources for multinational drug trafficking and sanctioned entity shipment interdiction



Objective

Provide an end to end solution from data query through anomaly detection and visualization that can support decision making based on 1 month's data set containing millions of containers, tens of thousands of ships and 2,730 global shipments between 369 international ports.



Outcome

In one month of data, 91,207 ip address inquiries on the status of nearly 100,000 containers in a 2 week period is reduced to a maximum of 12 ip address communities of interest that inquired on ~294 containers. This process has been implemented as a repeatable function for the US DOD and this program's stakeholders.

Publicly Available Demos: G20 Monitor

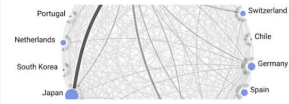
10 monitors with
30+ interactive
dashboards

100M+ data points
from public
sources, data
vendors

Sign up and explore
for yourselves

www.g20monitor.com

Cross Border Banking Exposures




Monitor the evolution of foreign claims by the primary country of reporting banks to understand banks' foreign exposures and global financial stability ramifications.

Banking Credit Risk Contagion

View Monitor

Global Markets




Monitor global markets and correlation networks across asset classes and regions for gaining a systemic view on recent developments, and for building stress tests.

Markets Correlation Outliers

View Monitor

Remittance Flows




Identify the main corridors of global remittances and monitor changes in them.

Remittance Banking

View Monitor

World Input/Output Networks




Monitor the global interconnectedness of economic sectors across OECD countries.

WIOT Input/Output Supply Chains

View Monitor

CCP Interconnectedness & Simulation

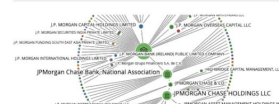


Monitor the topology of the global clearing system and related interconnectedness by using publicly available data on clearinghouse memberships.

CCP Clearing Disruptions

View Monitor

LEI Level 2

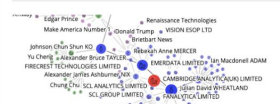


The LEI level 2 monitor provides for easy understanding of "who owns whom" for legal entities that are part of the LEI dataset.

LEI Ownership

View Monitor

Related Parties Analysis




Investigate related parties and company-director networks.

Related Parties AML CFT

View Demo

Global Markets



Monitor global markets and correlation networks across asset classes and regions to gain a systemic view of recent developments, and to build stress tests.

Markets Correlation Outliers

View Monitor

Internship Opportunities



FNA's Internship Program

Since 2015, the internship program has been attended by 20+ students from all around the world - over a half of these continue to work with FNA.

Examples of current projects:

- G20 Monitor
- FMI & CBDC Simulator
- Related Parties Analysis for National Security
- Anomaly Detection for FinCrime and Cyber threats

We are also happy to support dissertation projects with a relevant thematic focus

If interested, please reach out to Will Towning on will@fna.fi





Discussion





Thank you



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FNA news, events, jobs and research



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