Compliance Related Fines are High

USD 342 billion

Source: Quinlan & Associates 2017, covering 50 largest banks
Money laundering occurs in three steps (Jensen 1997, Bolton and Hand 2002)

1. **Placement**: introduction of cash into the banking system or legitimate business. This can be done, e.g., by paying vastly inflated amounts for goods imported across international frontiers.

1. **Layering**: carrying out multiple transactions through multiple accounts with different owners at different financial institutions in the legitimate financial system

1. **Integration**: aggregating the funds with legitimately obtained money or providing a plausible explanation for its ownership
## Famous Cases

<table>
<thead>
<tr>
<th>Scheme</th>
<th>Year</th>
<th>Magnitude</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wachovia and Sinaloa Cartel</td>
<td>2004-2007</td>
<td>$378 billions</td>
</tr>
<tr>
<td>Standard Chartered</td>
<td>2012</td>
<td>£191.8 billions</td>
</tr>
<tr>
<td>Russian Laundromat</td>
<td>2010-2014</td>
<td>$20-80 billions</td>
</tr>
<tr>
<td>Nauru</td>
<td>1998</td>
<td>£53.7 billions</td>
</tr>
<tr>
<td>Bank of Credit and Commerce International (BCCI)</td>
<td>Mid 1980s</td>
<td>£17.6 billions</td>
</tr>
<tr>
<td>Danske Bank</td>
<td>2007 - 2015</td>
<td>$8.3 billions</td>
</tr>
<tr>
<td>Benex Scandal</td>
<td>1996-1999</td>
<td>$6 billions</td>
</tr>
<tr>
<td>MtGox and Always Efficient LLP</td>
<td>2014</td>
<td>£4.5 billions</td>
</tr>
<tr>
<td>Petróleos de Venezuela (PDVSA)</td>
<td>2014-2015</td>
<td>$1.2 billions</td>
</tr>
<tr>
<td>HSBC &amp; Sinaloa Cartel</td>
<td>2006-2009</td>
<td>$881 millions</td>
</tr>
<tr>
<td>Commonwealth Bank of Australia (CBA)</td>
<td>2012-2015</td>
<td>$625 millions</td>
</tr>
</tbody>
</table>
AML Business Operations Overview

**Analysis**

- Analysts

**Triage**

- Analysts

**Investigation**

- Investigators

---

**Individual Transaction View**

- Entities:
  - **Transaction**
    - Sender
    - Receiver
    - Organization
    - Geography
    - Amount
    - etc.

---

**Aggregated Transaction View**

- Entities:
  - **Transactions**
    - Accounts
    - SAR Flag
    - Amount
    - etc.

---

**Client or Case View**

- Entities:
  - **Client / Organization / Related Parties**
  - Sender
  - Receiver
  - Organization
  - Transactions
  - Accounts
  - SAR Flag
  - Amount
  - Geography
  - Amount
  - etc.

---

**Shift of Focus**
Common Challenges

High proportion (>95%) of false positives

Manual time-consuming process of case investigation

Hard to find actual money laundering

Inability to see macro-structures / catching just small fry

New issues with Faster Payment Systems
New Approaches can help

- High proportion (>95%) of false positives
- Manual time-consuming process of case investigation
- Hard to find actual money laundering
- Inability to see macro-structures / catching just small fry
- New issues with Faster Payment Systems

**Improve accuracy of algorithms**

**Automate generation of networks**

**Identify anomalies in financial networks**

**Link cases and other data together to see the full picture**

**Automate "Following the Money" with algorithms**
Automated Generation of Related Parties Networks

www.fna.fi
Investigate a Client or Case Requires New Data - Related Parties

**Data Set:** Customer Related Parties

**Attributes:**
- Company Name
- Directors
- Officers
- Date of Birth
- Start / End Date of Appointment

**Approach:** Ego Distance

An "Ego" is an individual "focal" node. For related parties investigation, it is a person or company of interest. We are interested in relationships to their "neighborhood", which is the collection of ego and all nodes to whom ego has a connection at some path length.
Investigate a Client or Case Requires New Data - Related Parties

**Data Sources:** Public (private) datasets available, e.g.:

- UK Companies House
- SEC Edgar
- Bloomberg
- opencorporates.com
- Panama Papers etc. ([https://www.icij.org/](https://www.icij.org/))
Companies House in UK provides an API.

The API allows searching eg.:

- directors of a given company
- companies that a director is affiliated with

The FNA Platform has an algorithm to build the network around a particular company (or director) automatically through a series of API calls.

The same logic can be used also for any database, csv file or other data source.
Automating the Generation of Related Party Networks
Chart: Emerdata Limited—the new Cambridge Analytica/SCL Group?

Note: chart may be updated periodically, please share page link, not a screenshot.
Automate "Following the Money" with algorithms
The Rise of the Mule

**Faster Payment Systems are being rapidly adopted in the world.**

**Problem:** As Faster Payment systems allow movements of funds rapidly between account, this enables criminals to rapidly hide source of funds by multiple account movements using mule accounts.

In addition, **police requests** are time consuming and cumbersome to comply manually with.

<table>
<thead>
<tr>
<th>Year</th>
<th>Country</th>
<th>System</th>
<th>Year</th>
<th>Country</th>
<th>System</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>Korea</td>
<td>Electronic Banking System</td>
<td>2013</td>
<td>Turkey</td>
<td>BKM Express</td>
</tr>
<tr>
<td>2003</td>
<td>Chinese Taipei</td>
<td>ATM, FXML and FEDI systems</td>
<td>2014</td>
<td>Denmark</td>
<td>Nets Real-time 24x7</td>
</tr>
<tr>
<td></td>
<td>Iceland</td>
<td>CBI Retail Netting System (JK)</td>
<td></td>
<td>Italy</td>
<td>Jiffy – Cash in a flash</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Singapore</td>
<td>Fast And Secure Transfer</td>
</tr>
<tr>
<td>2006</td>
<td>Malaysia</td>
<td>Instant Transfer</td>
<td>2015</td>
<td>Mexico</td>
<td>SPEI</td>
</tr>
<tr>
<td></td>
<td>South Africa</td>
<td>Real-Time Clearing</td>
<td></td>
<td>Switzerland</td>
<td>Twint</td>
</tr>
<tr>
<td>2007</td>
<td>Korea</td>
<td>CD/ATM System</td>
<td>2017p</td>
<td>Australia</td>
<td>New Payments Platform</td>
</tr>
<tr>
<td>2008</td>
<td>Chile</td>
<td>Transferencias en línea</td>
<td>2017/18p</td>
<td>Saudi Arabia</td>
<td>Future Ready ACH</td>
</tr>
<tr>
<td></td>
<td>United Kingdom</td>
<td>Faster Payments Service</td>
<td></td>
<td>Hong Kong SAR</td>
<td>To be determined</td>
</tr>
<tr>
<td></td>
<td>United Kingdom</td>
<td>Faster Payments Service</td>
<td>2018p</td>
<td>Japan</td>
<td>Zengin System</td>
</tr>
<tr>
<td>2010</td>
<td>China</td>
<td>Internet Banking Payment System</td>
<td>2019p</td>
<td>Hungary</td>
<td>Instant Payments</td>
</tr>
<tr>
<td></td>
<td>India</td>
<td>Immediate Payment Service</td>
<td></td>
<td>Netherlands</td>
<td>Instant Payments</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2011</td>
<td>Costa Rica</td>
<td>Transferencias de Fondos a Terceros del Sinpe</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2012</td>
<td>Ecuador</td>
<td>Pago Directo</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Poland</td>
<td>Express ELIXIR</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sweden</td>
<td>BiR/Swish</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Solution
Fedwire Interbank Payment Network (Fall 2001) was one of the first network views into any financial system.

Of a total of around 8000 banks, the 66 banks shown comprise 75% of total value. Of these, 25 banks completely connected.

The research was subsequently used e.g. in congressional hearings to showcase the type of information that should be collected by financial institutions after the financial crisis.

Impact of 9/11 Terrorist Attacks on the Network

Note: 100 = September 10th, 2001.
"The next crisis might not come from a financial shock at all. The more likely culprit: a cyber attack that causes disruptions to financial services capabilities, especially payments systems, around the world."

- "How a Cyber Attack Could Cause the Next Financial Crisis" by Paul Mee & Til Schuermann, HBR 2018
Detect  -->  Prevent  -->  Recover
Detect Anomalies in Cyber Networks in Real-time
Identify Patterns of DDoS attacks
Mapping Interconnectedness
Measuring Technological Interdependence

Network of banks’ system interdependencies

Bank projection

System projection

Banks

IT Systems
How might cyber risks and financial risks interact to cause systemic crises?

Is there anything fundamentally new or different about cyber risks?

How should economists, regulators, policymakers, and central bankers focused on financial stability incorporate cyber risks into their models and thinking?

- "The Future of Financial Stability and Cyber Risk" by Jason Healey, Patricia Mosser, Katheryn Rosen, and Adriana Tache, Brookings Institute 2018
Related Parties - Scripting Example
## Data

### Links

<table>
<thead>
<tr>
<th>company_number</th>
<th>officer_id</th>
<th>officer_role</th>
<th>officer_appointed_on</th>
<th>officer_resigned_on</th>
</tr>
</thead>
<tbody>
<tr>
<td>09375920</td>
<td>YEplkqBMc6Rp3dbPs57pN3aqO4</td>
<td>Director</td>
<td>2015-01-06</td>
<td></td>
</tr>
<tr>
<td>05514098</td>
<td>YEplkqBMc6Rp3dbPs57pN3aqO4</td>
<td>Director</td>
<td>2016-01-28</td>
<td></td>
</tr>
<tr>
<td>05514098</td>
<td>mrwIFdKsooGz_8ijW2M22xzXyHY</td>
<td>Director</td>
<td>2005-10-03</td>
<td></td>
</tr>
<tr>
<td>05514098</td>
<td>hvyCtVBNN2CA8PSIOQFLbwm8BGo</td>
<td>Director</td>
<td>2007-12-20</td>
<td></td>
</tr>
<tr>
<td>05514098</td>
<td>_jEDYwaT6juGo-crc0_MicvZfw5s</td>
<td>Secretary</td>
<td>2005-07-20</td>
<td>2014-03-31</td>
</tr>
<tr>
<td>05514098</td>
<td>Pm5UNghomn3HgjLwQr80umIXr8</td>
<td>Secretary</td>
<td>2014-03-31</td>
<td>2016-01-28</td>
</tr>
<tr>
<td>05514098</td>
<td>tek7o48HCl1FqAOYDbcl5BeWcMFM</td>
<td>Nominee Secretary</td>
<td>2005-07-20</td>
<td></td>
</tr>
</tbody>
</table>

### Nodes

<table>
<thead>
<tr>
<th>vertex_id</th>
<th>name</th>
<th>type</th>
<th>date</th>
<th>active</th>
<th>root</th>
</tr>
</thead>
<tbody>
<tr>
<td>09375920</td>
<td>CAMBRIDGE ANALYTICA(UK) LIMITED</td>
<td>Company</td>
<td>2015-01</td>
<td>True</td>
<td>True</td>
</tr>
<tr>
<td>YEplkqBMc6Rp3dbPs57pN3aqO4</td>
<td>Alexander James Ashburner NIX</td>
<td>Officer</td>
<td>1975-05</td>
<td>True</td>
<td>False</td>
</tr>
<tr>
<td>05514098</td>
<td>SCL GROUP LIMITED</td>
<td>Company</td>
<td>2005-07</td>
<td>True</td>
<td>False</td>
</tr>
<tr>
<td>mrwIFdKsooGz_8ijW2M22xzXyHY</td>
<td>Nigel John OAKES</td>
<td>Officer</td>
<td>1962-07</td>
<td>True</td>
<td>False</td>
</tr>
<tr>
<td>hvyCtVBNN2CA8PSIOQFLbwm8BGo</td>
<td>Julian David WHEATLAND</td>
<td>Officer</td>
<td>1961-07</td>
<td>True</td>
<td>False</td>
</tr>
</tbody>
</table>
# reset database
system.reset_db

# import links
arc.import {
    -table ca_links.csv
    -source_column company_number
    -target_column officer_id
    -columns company_number,officer_id
}
# define node properties and import them

```python
vertex.property.define {
    -property name,type
    -type String
}
```

```python
vertex.property.import {
    -table ca_nodes.csv
    -columns name,type
}
```
Quick visualization

# create dashboard
dashboard.new
dashboard.save -file cambridge_analytics
# calculate distance from ego (Cambridge Analytica) node
vertex.stats.ego_distance {
    -ego_vertex 09375920
    -direction undirected
}

# calculate degree = number of links for each node
vertex.centrality.degree
Set company nodes as squares

# set shape of nodes
vertex.property.set {
    -property shape
    -value 'square'
    -filter type=='Company'
    -type Shape
}
Set companies as green, others as red

```python
# set node colors
vertex.property.set {
    -property color
    -value 'red'
    -type Color
}

vertex.property.set {
    -property color
    -value 'green'
    -filter type=='Company'
    -type Color
}
```
# create dashboard
dashboard.new
dashboard.mappings.vertex.label {
  -text name
  -size degree:8-20
}

dashboard.mappings.vertex {
  -size degree
  -color color
  -shape shape
}

dashboard.save
Dr. Kimmo Soramäki
Founder & CEO
FNA - Financial Network Analysis Ltd.

kimmo@fna.fi

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United Kingdom