



Social Networks Analytics Final Project

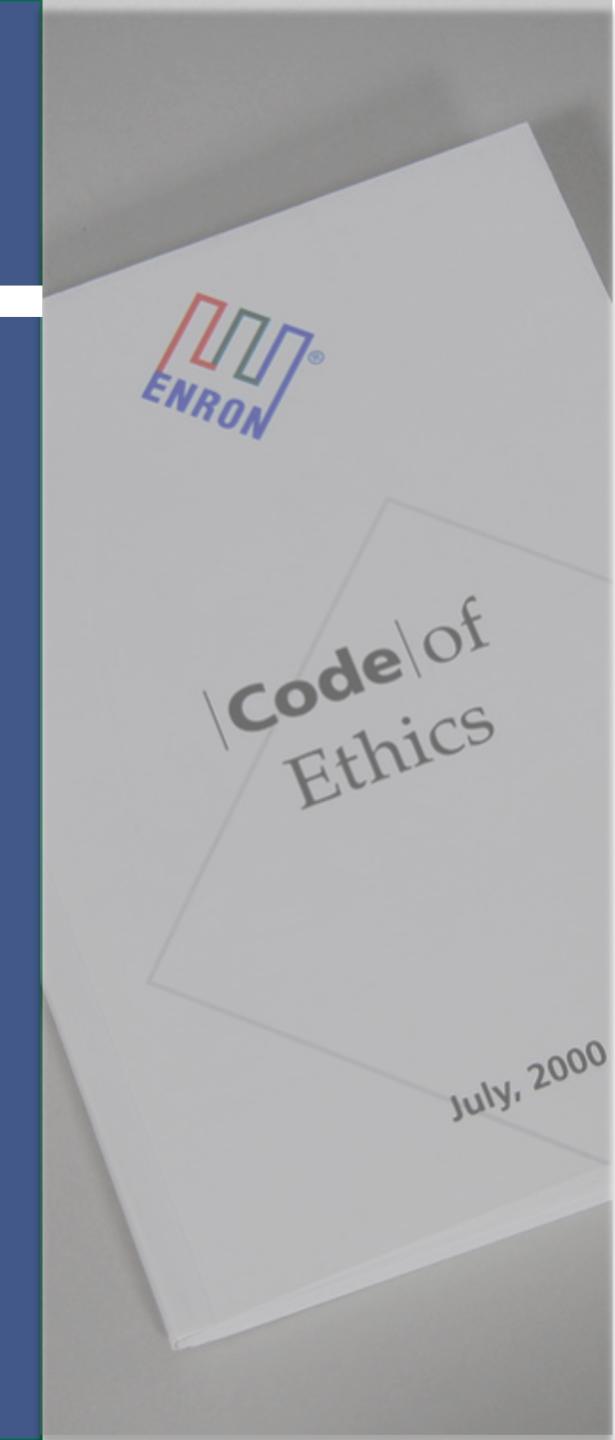
# The Enron Emails

Saturday Working Club + Hashim



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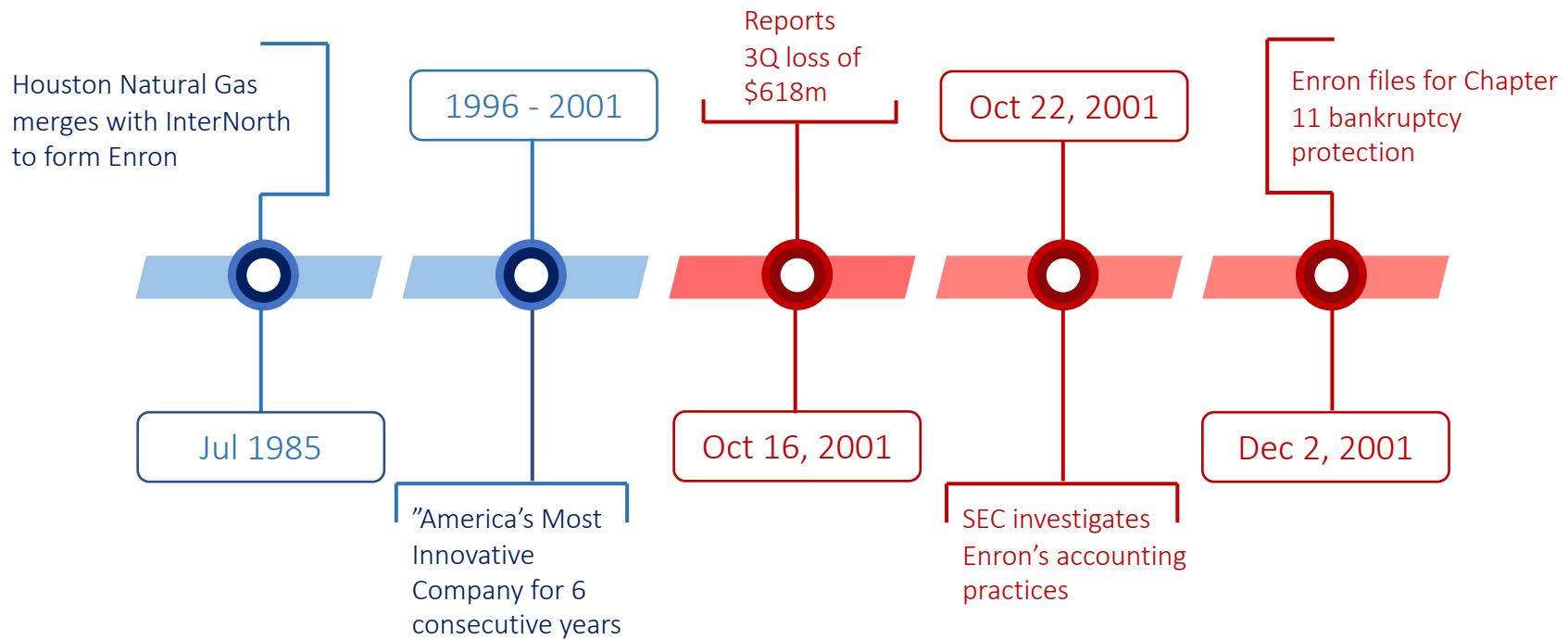


# Backstory of Enron

## Timeline



# One of Largest Bankruptcies in US History

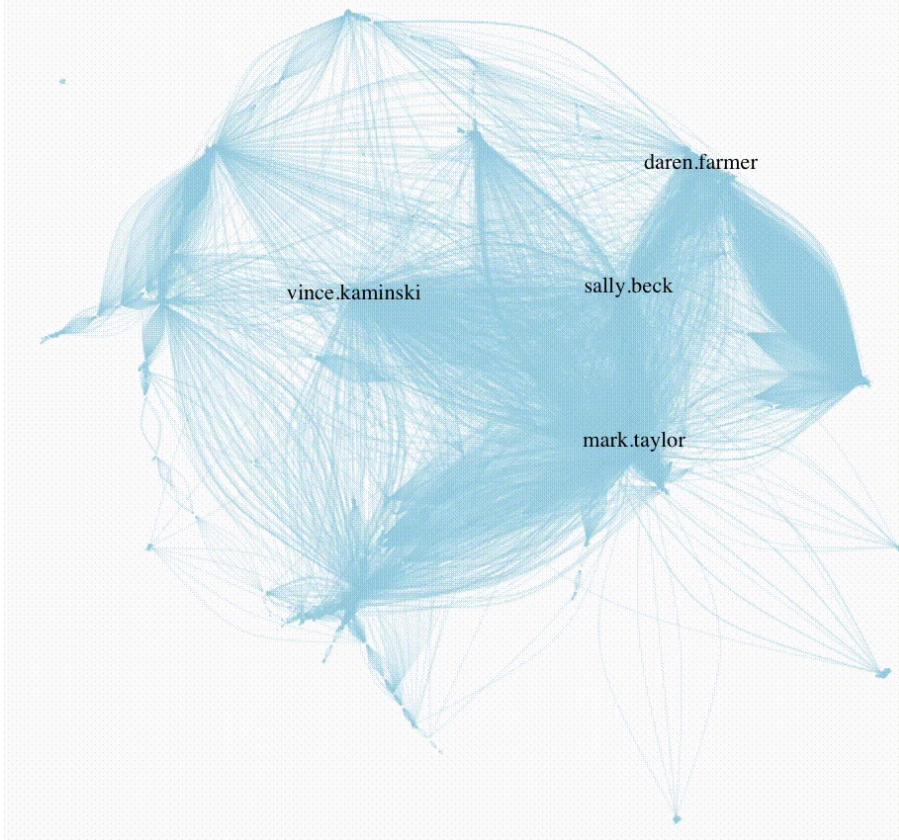


### Project Objective:

To identify the origins of fraudulent activity as well as provide additional evidence and insights to support the three components of the Fraud Triangle: pressuring leadership, risk-taking and competitive culture, and lack of management controls.

# Company Network Analysis: Management Structure

Enron Internal Network Structure in 2000-03



## Internal Network Animation

- Sender and Receiver both using domain '*enron.com*'
- 4 months of active tie window to account for tie decay
- Identify contacts with top 4 PageRank value as key players

## Why PageRank?

- Measure contact influence within network
- A variation of eigenvector centrality for directed network
- Emphasize in-degree more since executives have 12:1 sent and received email ratio

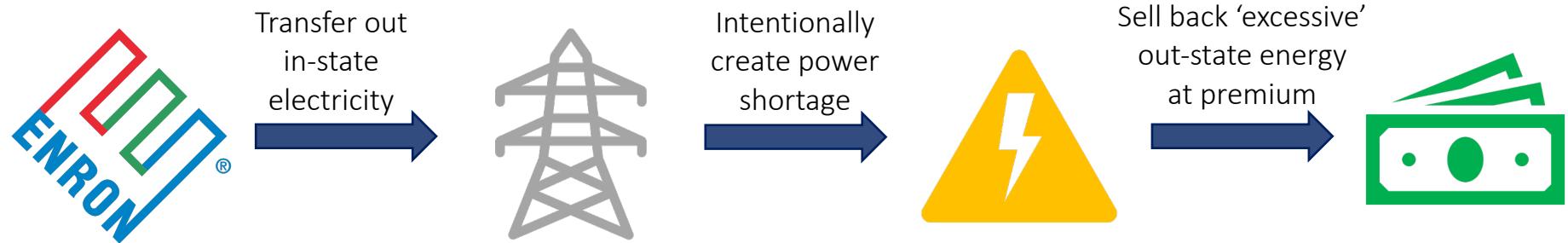
## Insights

- Clear core-peripheral structure
- Reshuffle of core management team in early and late 2001

# Company Network Analysis: Energy Laundering in California



## Enron Energy Laundering Flow Chart



## Secret Trigger Words for Energy Manipulation in emails\* (from movie Star War)

- '*Death Star*': Shuffle energy around state to receive payments for 'relieving congestion'
- '*Fat Boy*': Overschedule power transmission to cause blackout
- '*Ricochet*': Use other state as intermediary to sell back electricity at higher price
- '*Black Widow*': Intentionally create errors to transactions
- '*Bigfoot*': Sign low electricity bid pretending to be competitors
- '*Get Shorty*': Depress market demand by overselling electricity

## Text Scrapping from Email Database

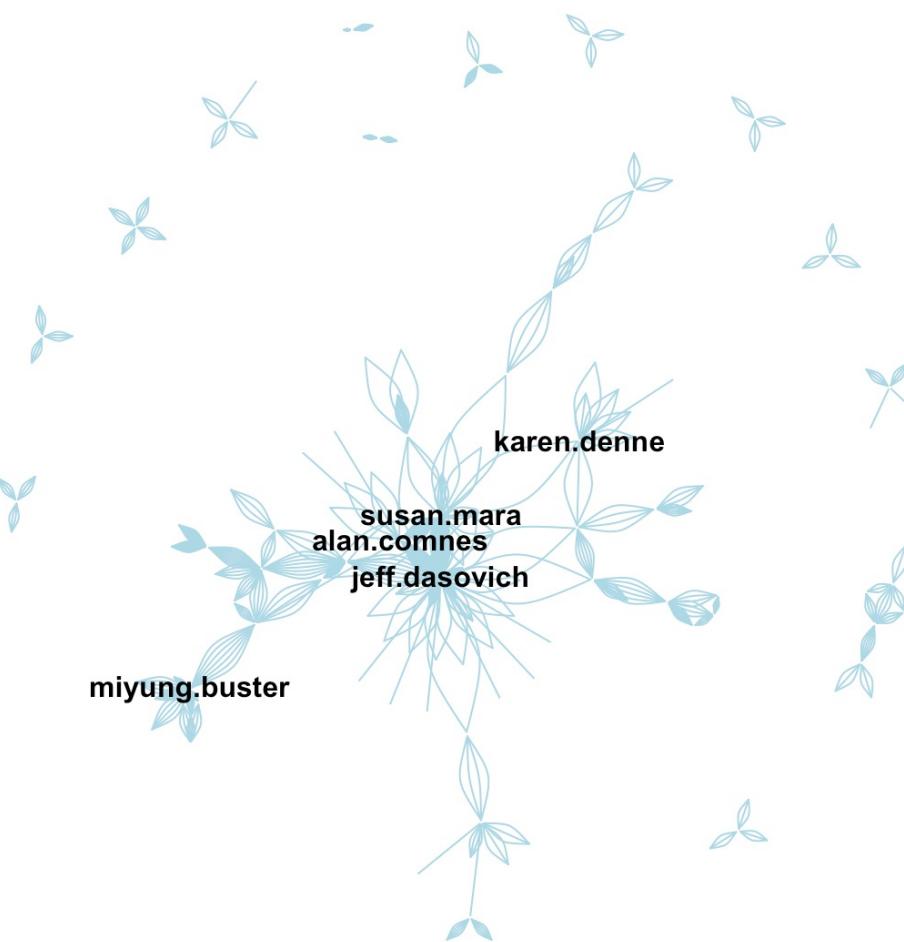
- 1,009 correspondences contain secret trigger words
- Energy laundering order peaked in March 2001 with 80 orders per month

**Source:** New Documents Show Enron Traders Manipulated California Energy Costs, The Wall Street Journal (2002), Kathryn Kranhold, Bryan Lee, Mitchel Benson et al.

# Company Network Analysis: Energy Laundering in California (Cont.)



Players Involved in Illegal Megawatt Laundering



## Energy Laundering Network

- All emails contain coded trigger words from Enron employee

## Who are the people Involved?

- Vice president of public relations  
Karen Denne
- Government relations executive  
Jeff Dasovich
- Government Affair Director  
Alan Comnes
- California Regulatory Affairs Director  
Susan Mara

## Insights

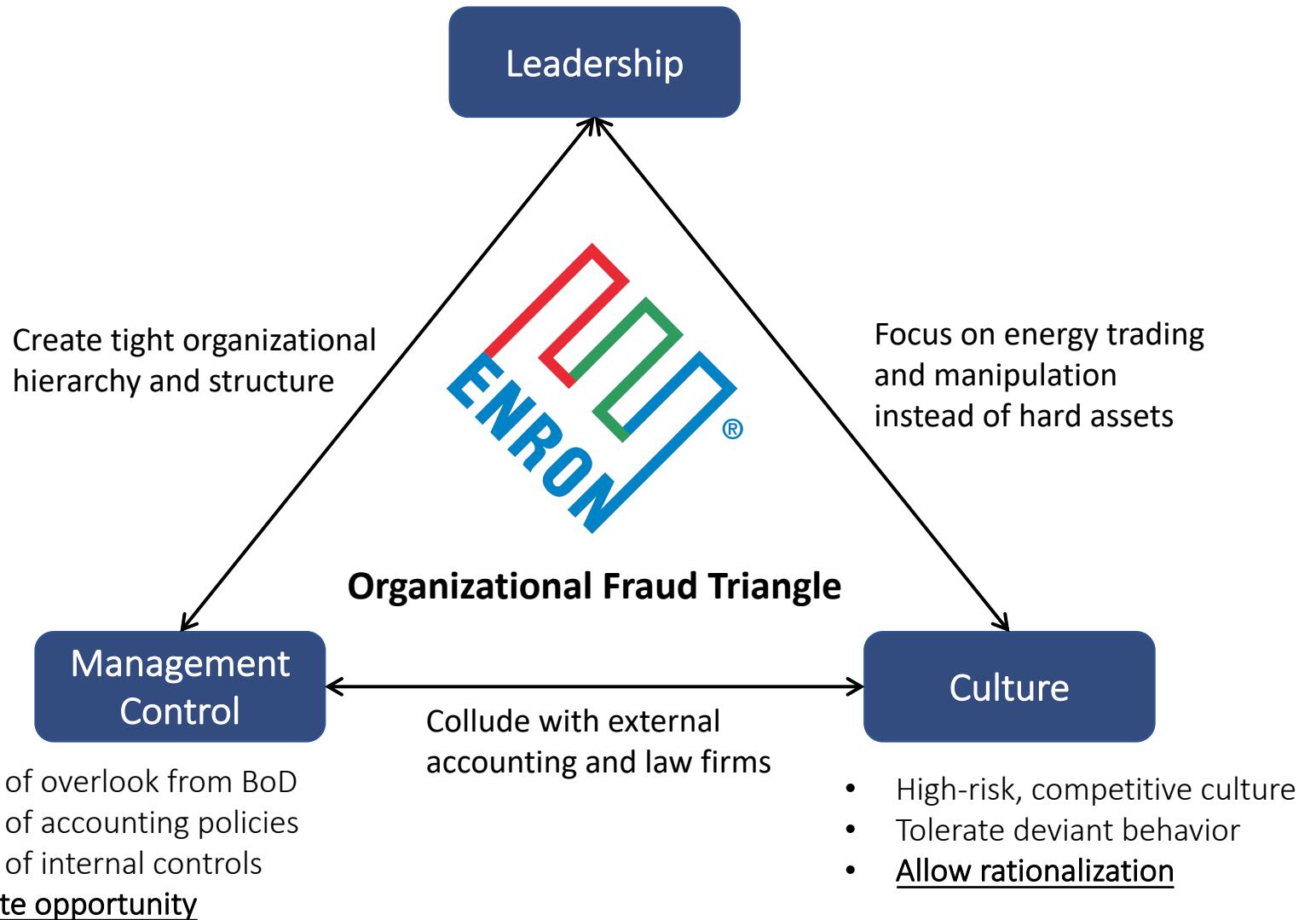
- Order for energy manipulation originate from government regularity affair department
- Information diffuses to multiple departments
- Small clusters represent informed energy traders profiting from situation for Enron

*Conclusion: Enron rots from the top down*

Theoretical  
Framework:

# Fraud Triangle

- Pressure business units to achieve budget targets
- Implement performance-oriented bonuses
- Re-structure to a top-down hierarchy
- Generate incentive

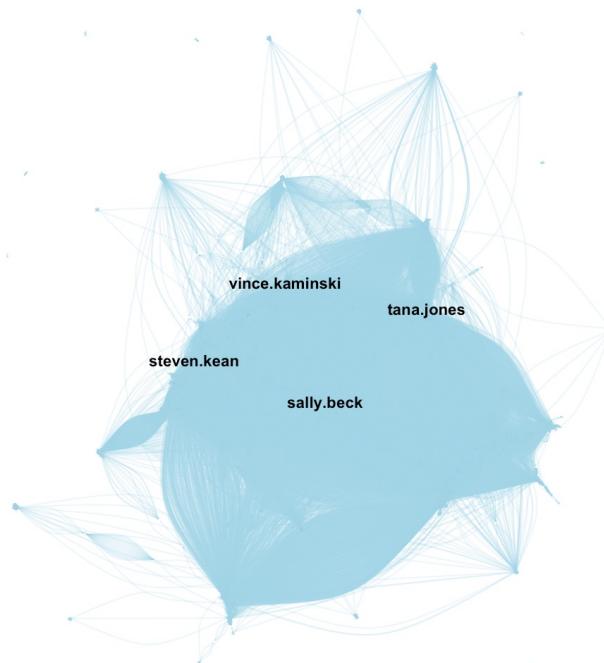


# Fraud Triangle: Change in Leadership

more information @  
[www.studio8.net](http://www.studio8.net)

Enron Internal Network Structure in 2001-02

Jeff Skilling appointed as CEO



Early 2001:

- Engineering-oriented management group
- Pipeline and gas exploration business plan
- Dense network structure
- Flat organizational structure

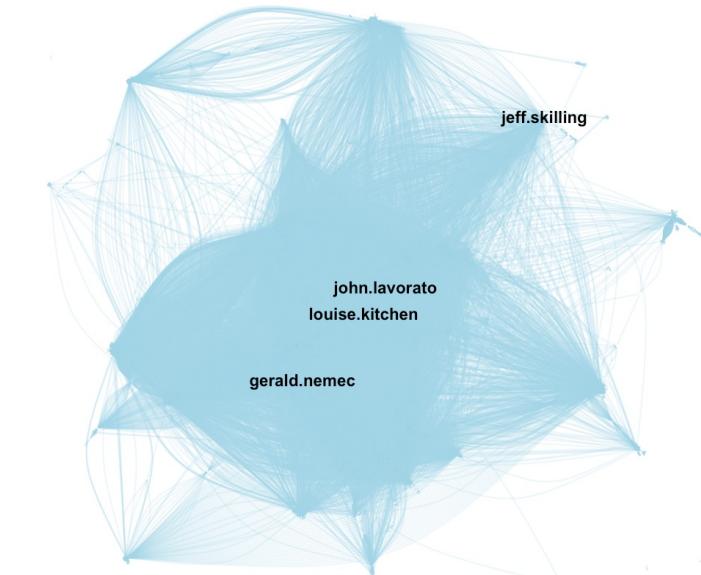


Mid 2001:

- Finance-oriented management group
- Financial engineering specializing in derivative
- Loose network structure
- Tight organizational structure

Enron Internal Network Structure in 2001-08

Jeff Skilling resigned as CEO



### Managing Director for Research

- Vince Kaminski

### Managing Director for Global RM Operations

- Sally Beck

### Legal Specialist

- Tana Jones

### Vice President of Staff

- Steven Kean

### Chief Executive Officer

- Jeffrey Skilling

### Head of North America Energy Trading

- John Lavorato

### Energy Trader for European Market

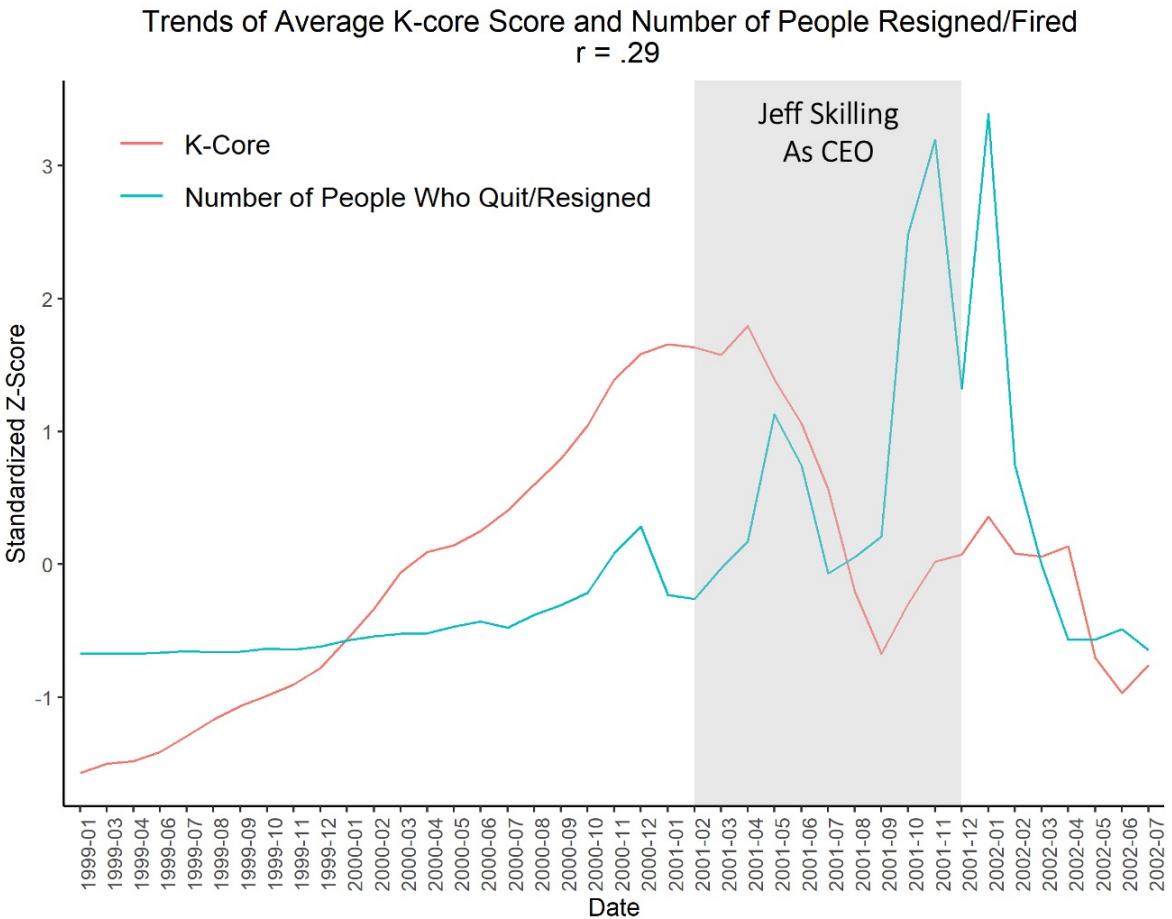
- Louise Kitchen

### Attorney for Enron North America Trading

- Gerald Nemec

# Fraud Triangle: Culture Downfall

**HON**



```
lm(formula = k_core ~ monthly_resign + monthly_incentive + monthly_blackout +
monthly_external_contacts, data = regression_3)
```

Coefficients:

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	1.738e+01	2.714e+00	6.403	0.000684 ***
monthly_resign	-9.010e-03	2.336e-03	-3.858	0.008385 **
monthly_incentive	4.925e-02	1.782e-02	2.764	0.032691 *
monthly_blackout	1.073e-01	9.645e-02	1.113	0.308297
monthly_external_contacts	7.465e-05	1.203e-03	0.062	0.952540

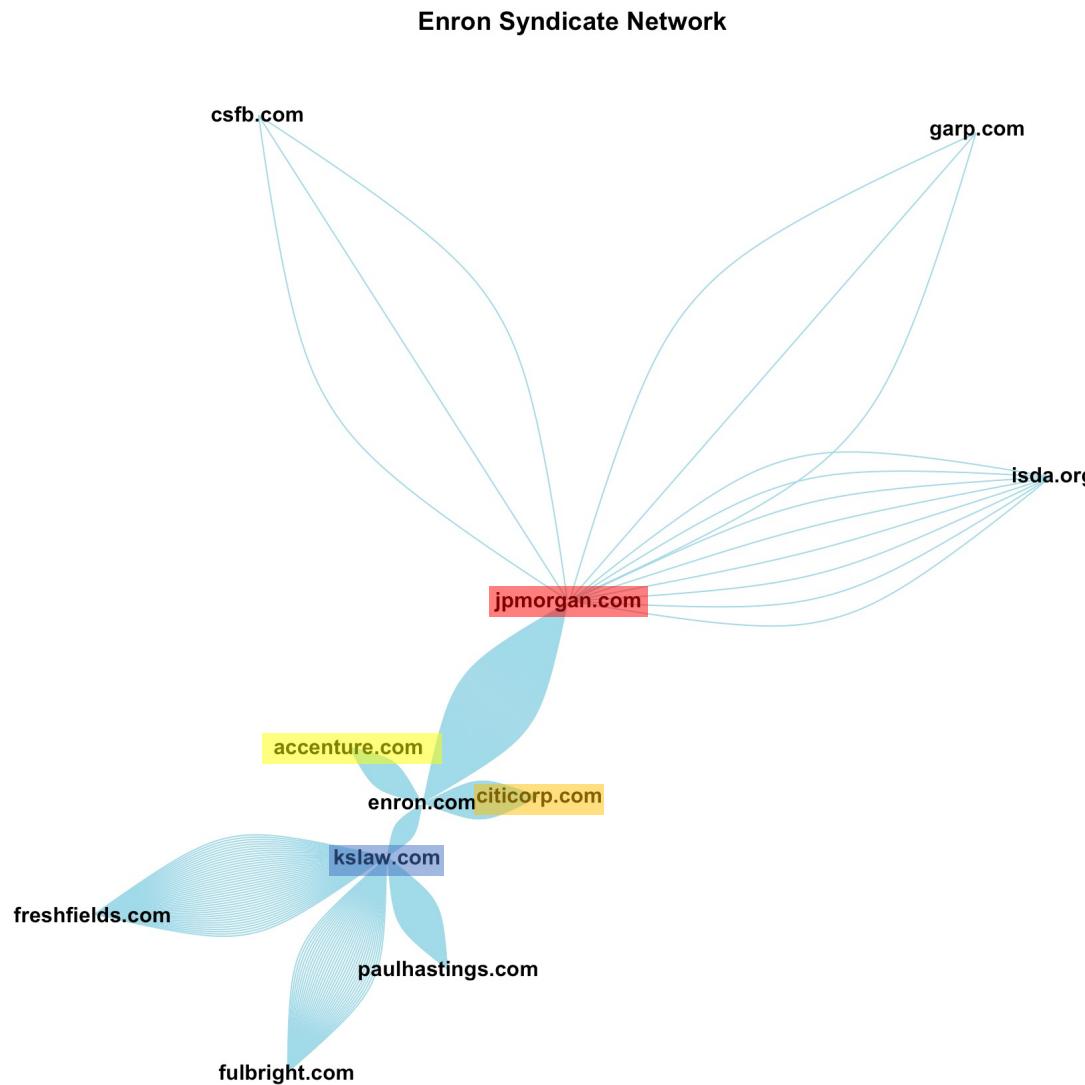
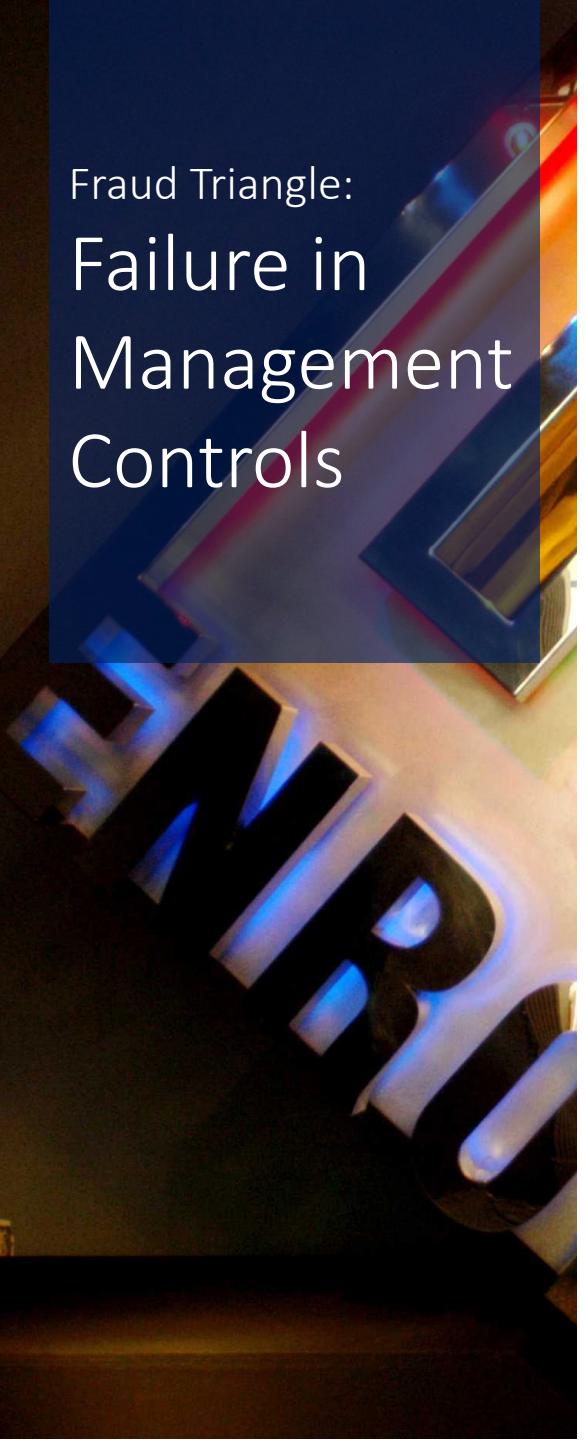
## Culture Downfall

- Average K-core score measures the tightness of the network, with higher being more dense
- The steep decrease in k-core measure can be seen around when Jeff Skilling became the CEO and the subsequent sharp increase in resignations/firings after

## Cause of Downfall

- Predict average K-core score
- Identify resignation based on each contact's last sent email
- Collect incentive info by text scrapping keywords
  - 'Bonus'
  - 'Merits'
  - 'Stock Option'
- Resignations and incentives are significant at the 1% and 5% levels, respectively

# Fraud Triangle: Failure in Management Controls



## Accounting & Auditing Fraud

- Arthur Andersen and Accenture were accused of obstruction of justice and failure to properly audit Enron's financial statements

## Tax Fraud

- JP Morgan Chase, Citi Bank and King & Spalding Law colluded with Enron to manipulate Enron's financial statements to hide debt and enable massive tax savings, misleading investors

## Insights

- The graph on the right indicates that Enron indeed had close ties to JPM, Citi, Accenture & KS Law, which acted as Enron's gateway companies and were also later accused of aiding Enron in fraud



Thank you!

# Data Description



## Email Dataset

- Source: Kaggle
- 517,000 email of Enron
- Range of 1997 to 2002 when Enron shut down
- Sender and Receiver
- Subject field and timestamp
- Message Content
- 5293 unique sender affiliations
- 4294 unique receiver affiliations

## Edge List Dataset

- Source: Canvas
- Clean-up version of email dataset
- Directed Edge List with one sender and multiple receiver

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