Milliman

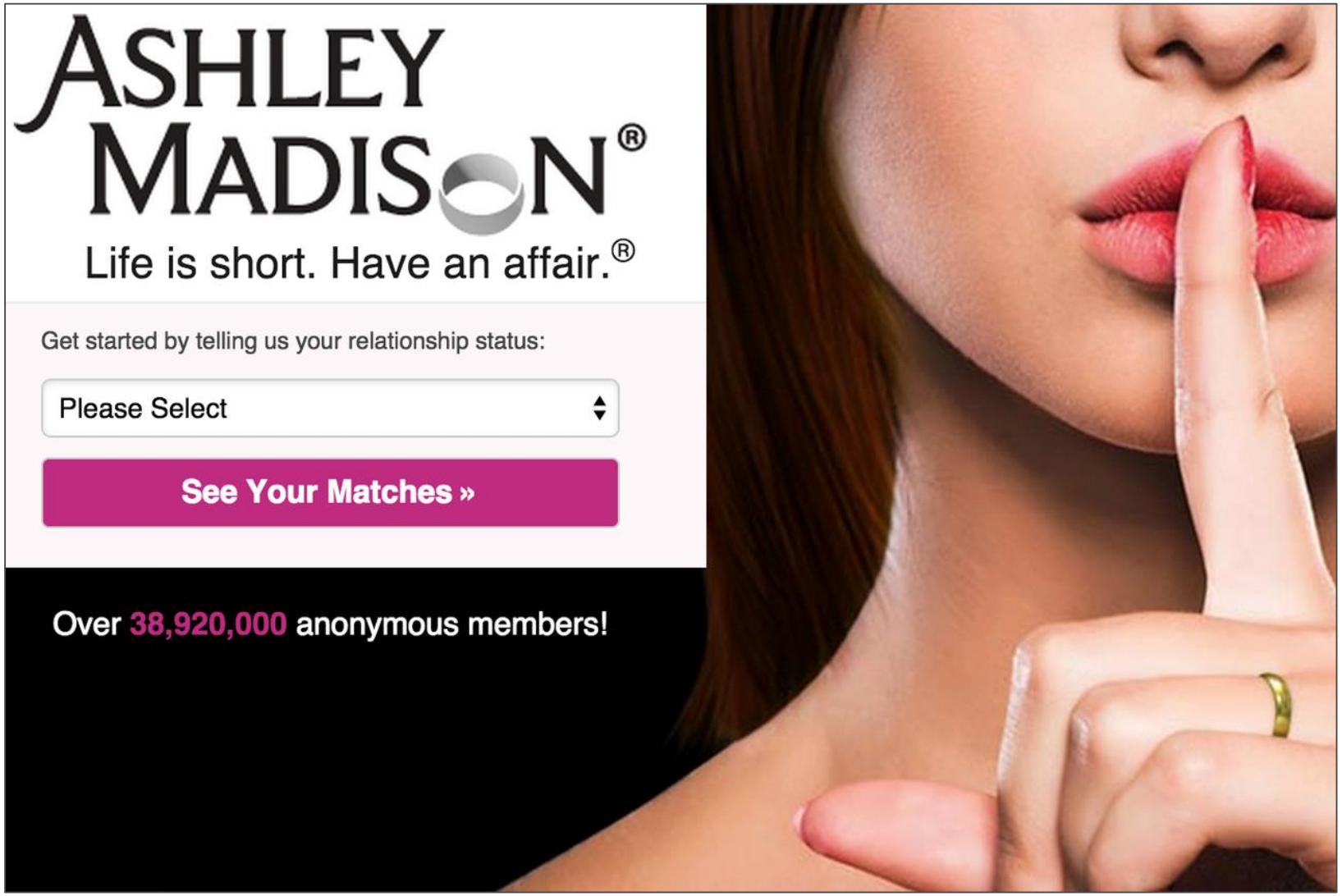
Cyber Risk Modelling

Patrick Meghen

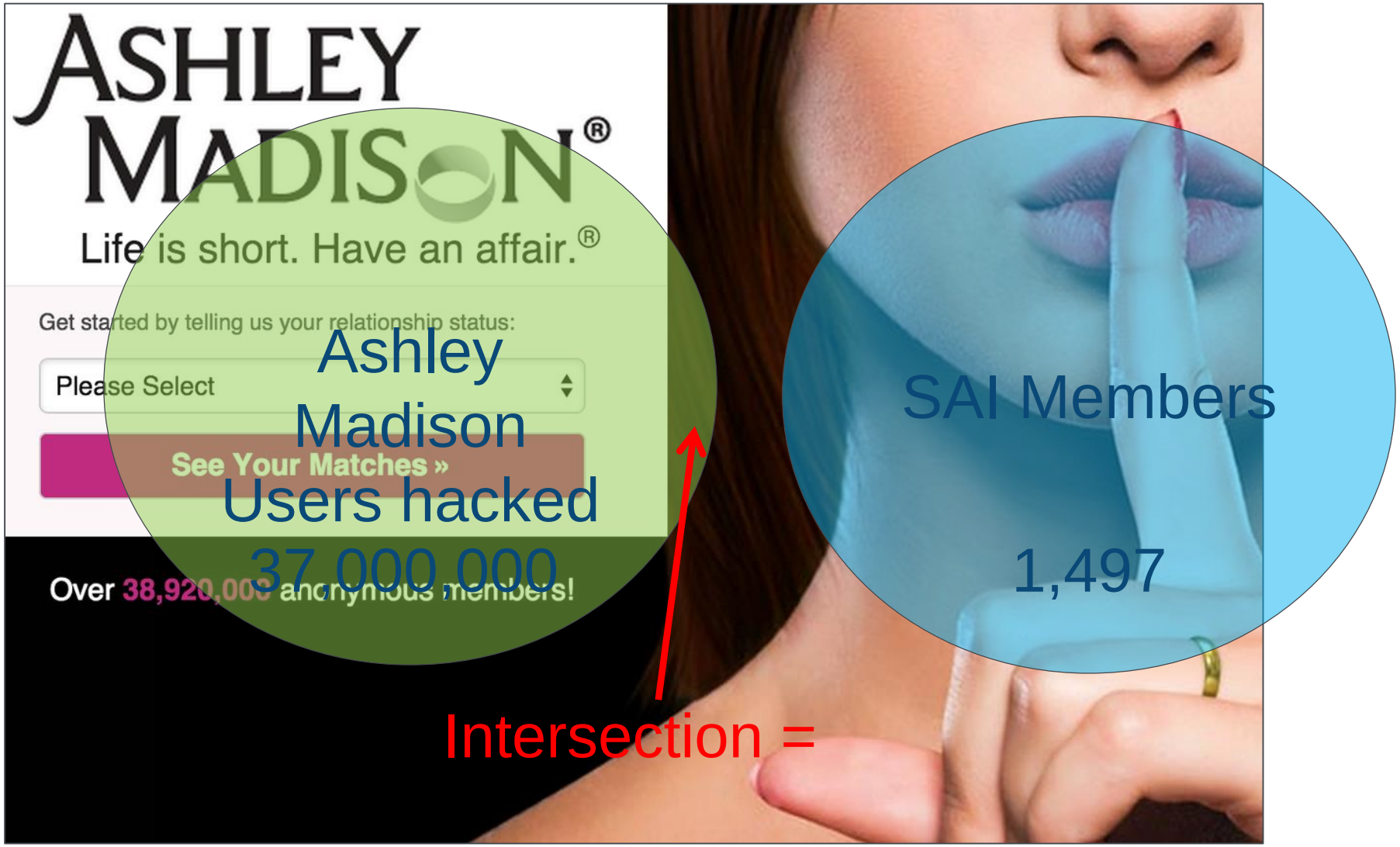
Why worry about Cyber Risk?

Cyber Risk – it's expensive!

Cyber Risk – it's personal!



Cyber Risk – it's personal!



Cyber Risk – Supervisory Focus

- Central Bank of Ireland
  - Thematic reviews
  - Best Practice Guide & Self Assessment Questionnaire
  - Consider cyber risk in ORSA
  - Cross Industry Guidance in respect of Information Technology and Cybersecurity Risks

- PRA
  - Cyber security & resilience capabilities

- EIOPA
  - Consider Cyber Risk in ORSA
  - Risk Management & Governance of Operational Risk
  - Sub-group on cyber risk

Cyber Risk – It's a hot topic

- Board Concern
  - Increased focus on cyber risk
  - Prominent item on risk registers

- Ratings Agencies

STANDARD &POOR'S
FitchRatings
KNOW YOUR RISK
Moody's Corporation

- Data Protection Laws

- "Top Ten Risks" –
  - e.g. 3rd highest risk in the Allianz Risk Barometer

Operational Risk Modelling

For Cyber Risk

Cyber Risk – definition

- No agreed definition!

- CRO Forum
  - *"..cyber risk covers the risks of doing business, including managing and controlling data, in a digital or "cyber" environment."*

- Institute of Risk Management
  - *"Cyber risk' means any risk of financial loss, disruption or damage to the reputation of an organisation from some sort of failure of its information technology systems."*

Modelling

- Cyber risk as a subset of Operational Risk

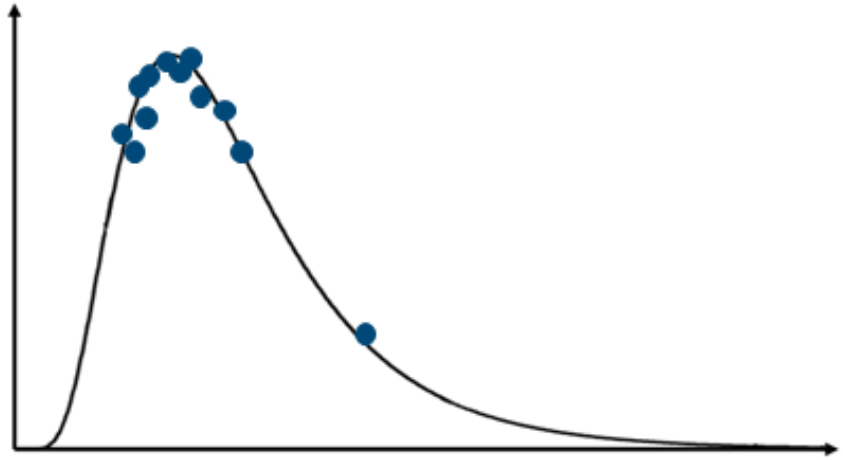
- Possible approaches
  - K.R.I. Methodology (e.g. Standard Formula)
  - Loss-Frequency
  - Scenario Analysis
  - Bayesian Networks

K.R.I Methodology

- Approach
  - Key Risk Indicators as a measure of risk
  - Standard Formula approach for Operational Risk uses premiums/reserves/expenses
- Pros 
  - Quick, simple, comparable
- Cons 
  - Difficult to calibrate correctly
  - Doesn’t describe cyber risk adequately
  - False sense of security

Loss Frequency Model

- Approach
  - Fit a distribution to observed historical data
    - Loss Frequency – distribution of losses over time
    - Loss Severity – size of losses
    - Aggregate distributions - Monte Carlo Simulation



  - Extreme Value Theory
    - losses above a predefined threshold are modelled separately from the main body of the losses

Loss Frequency Model

- Pros 
  - Use existing operational risk structure/model
  - Familiar approach
- Cons 
  - Data availability
  - Distributions – no perfect fit
  - Difficult to combine distributions
  - Historical focus
  - Hard to communicate to other stakeholders

Scenario Analysis

- Approach
  - Use expert judgement to determine the impact of a cyber risk scenario
  - Use existing modelling structures

- Example – cyber risk event:
  - Immediate loss
  - Increased expenses
  - Reputational damage

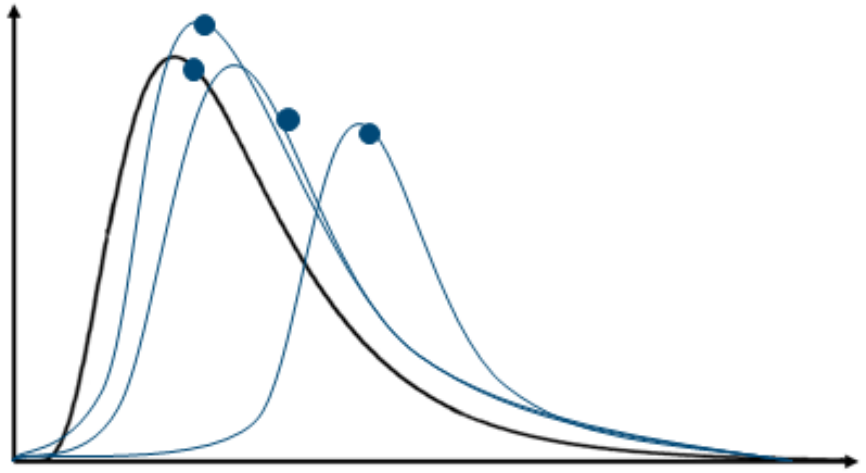
Scenario Analysis

- Pros 
  - Simple to implement
  - Simple to explain
  - Similar to other ORSA shocks

- Cons 
  - Too simple?
  - Limited view of risks – no range of outcomes
  - Not capturing/describing the risk adequately

Bayesian Networks Model

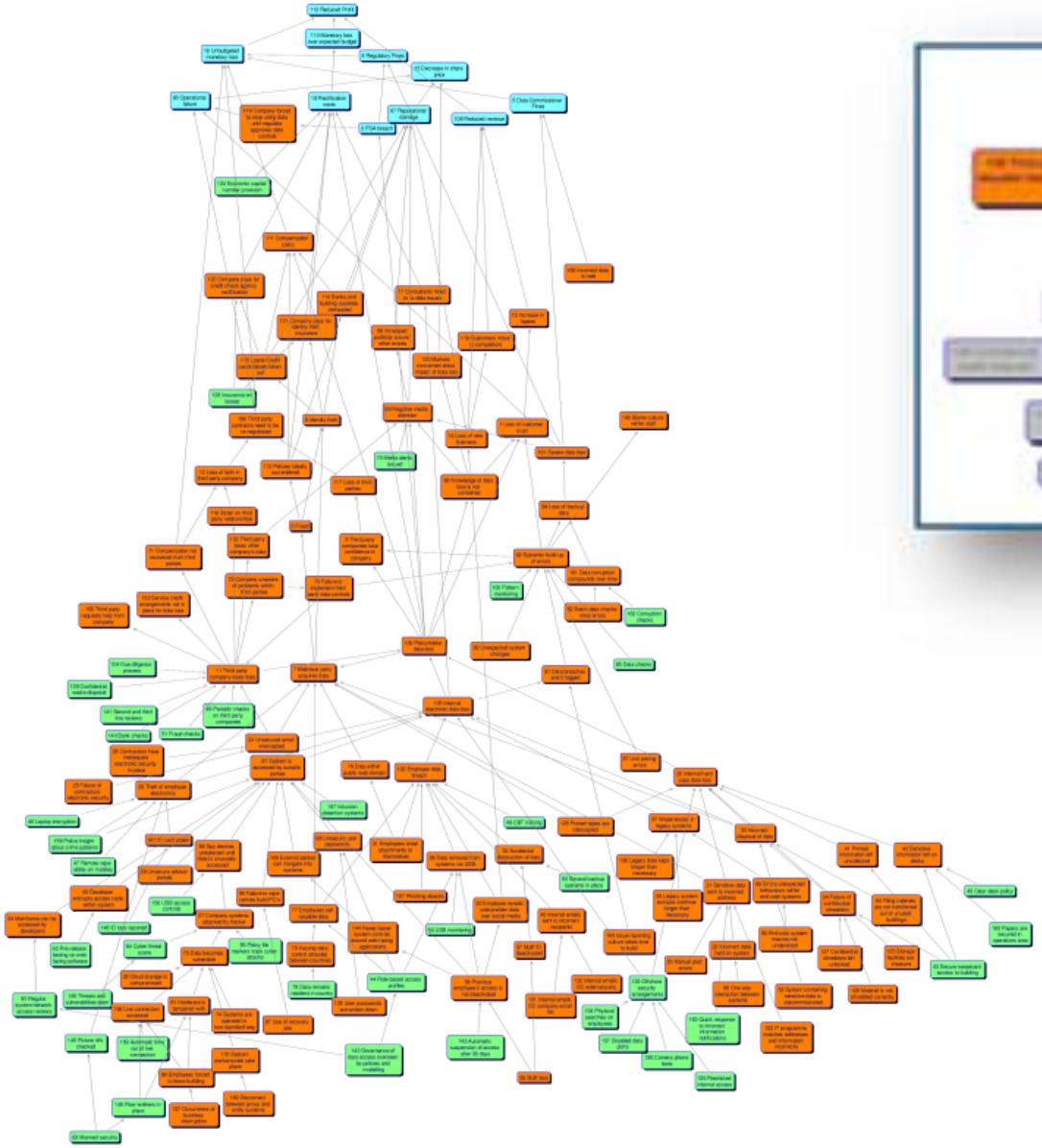
- Approach
  - Cognitive analysis
  - Reduce to a minimally complex structure
  - Model the relationships -> Bayesian Networks
  - Parameterise the model
  - Aggregation



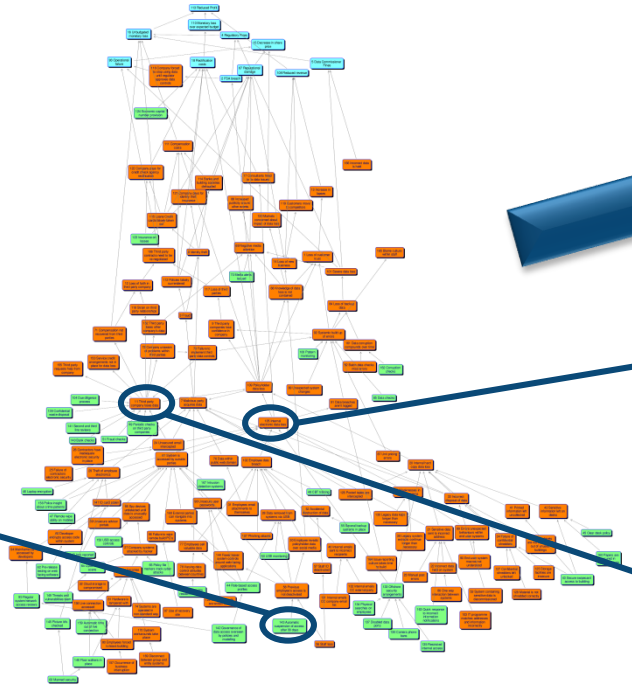
- Choice of approach
  - Within overall Operational Risk Model
  - Separate Cyber Risk Model

Cognitive Analysis

Describing the system



Minimally Complex Structure



Produce a "minimally complex" summary

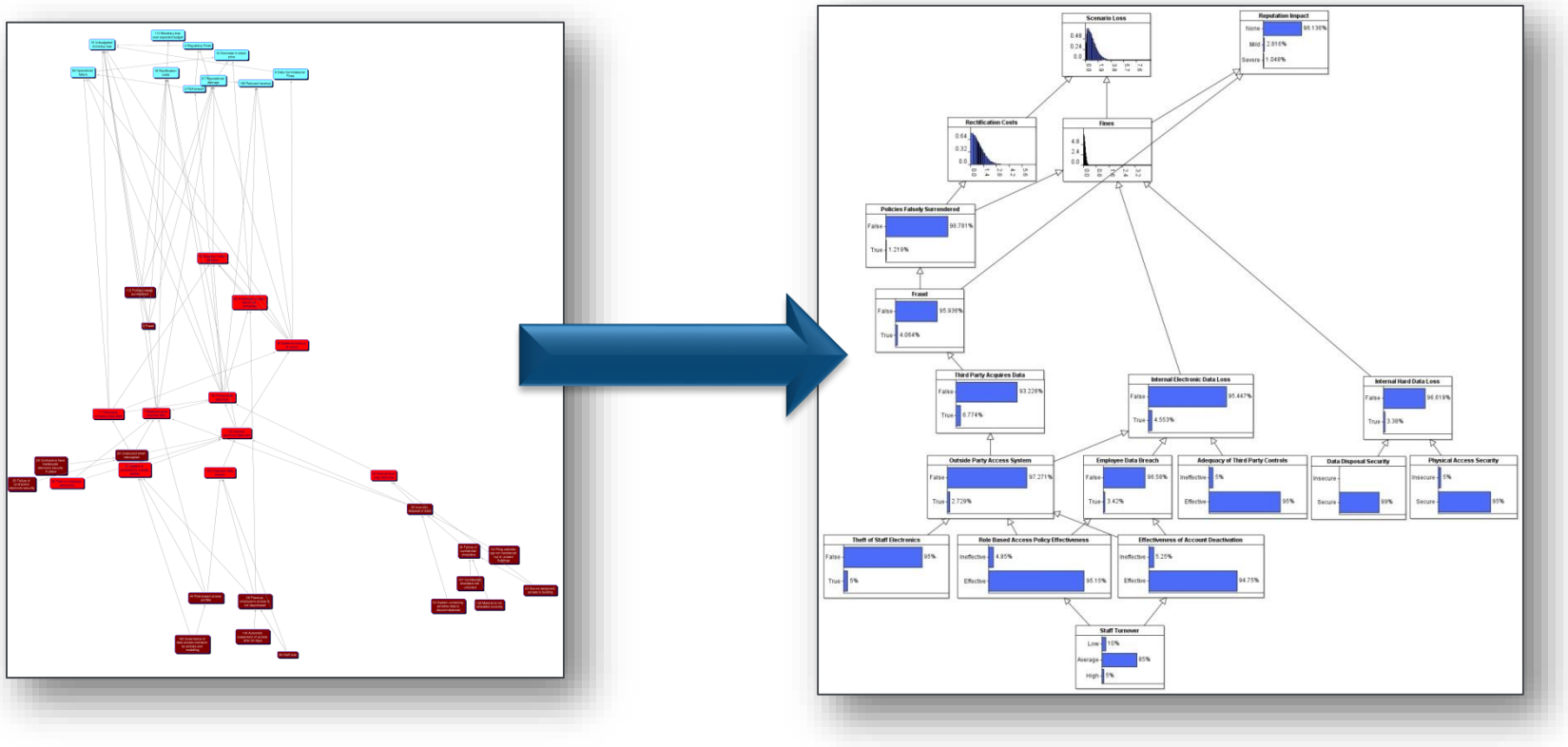
Nodes which lead to multiple highly connected nodes

Ultimately connected to many nodes

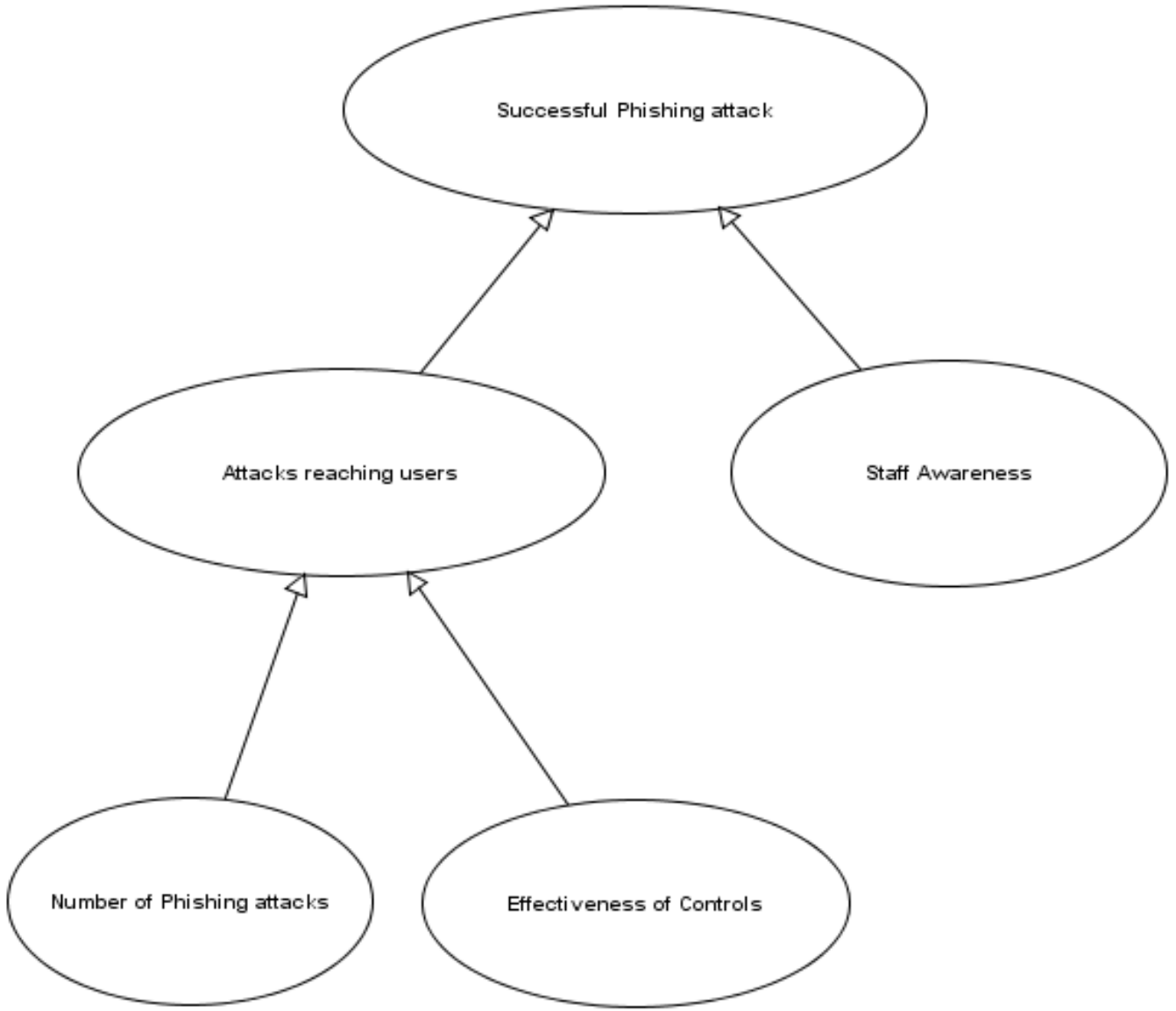
Immediately connected to many nodes

Find the most important elements of the "system"

Model the Relationships

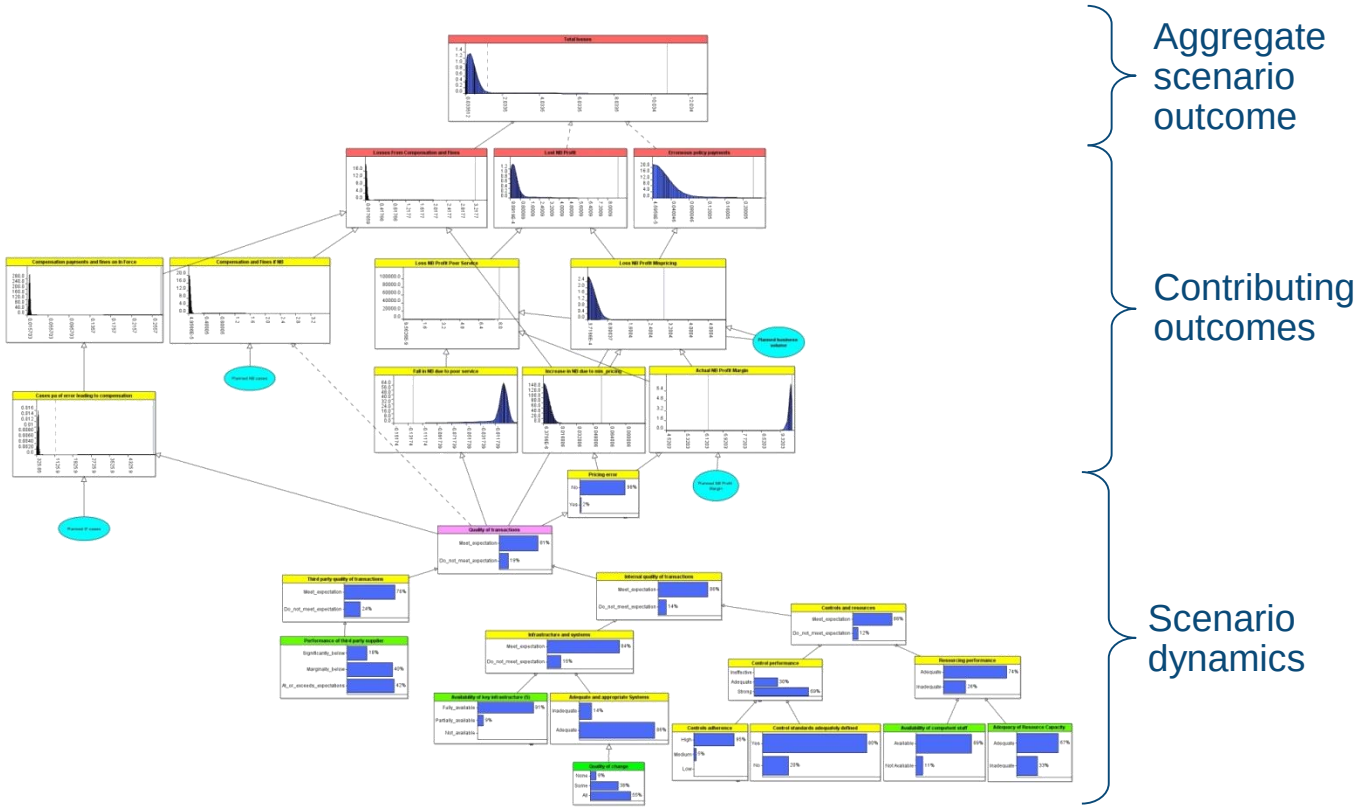


Bayesian Networks - Example



Parameterise & Aggregate

- Describing outcomes (e.g. capital) in terms of drivers means you can “explain” different outcomes in a real way
- No need for correlation (it is an output)



Aggregate scenario outcome

Contributing outcomes

Scenario dynamics

Source: Milliman, using AgenaRisk™

Bayesian Networks Model

- Pros 
  - Combines scenarios & data
  - Grounded in reality – built by asking simple questions
  - Provides meaningful explanation of how outcomes are directly related to business drivers
  - Sensitivity analysis, what-if
- Cons 
  - Still reliant on expert judgement
  - Risk of over-simplification
  - Time & effort

Useful Links

(but we don't take any responsibility for the safety & security of these links!)

Milliman Operational Risk Modelling Framework

Milliman ORSA: Beyond the Regulation

These slides are for general information/educational purposes only. Action should not be taken solely on the basis of the information set out herein without obtaining specific advice from a qualified adviser.

Thank you

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