Panel #2: Measurement and Impact of Cyber Risk

- **Gilles Hilary**, *Chaired Professor, Georgetown University*
- **Patrick Naim**, *CEO, Elseware*
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Cyber-Incidents & Measurement

Presented by: Gilles HILARY

gilles.hilary@georgetown.edu

Georgetown University
McDonough School of Business


40
30
20
10
0
PRICE($ PER SHARE), VOLUME (MM SHARES)
20140501
20140701
20140901
20141101
20150101
20150301
20150501
20150701
DATE
PRICE
Vol_MM


80
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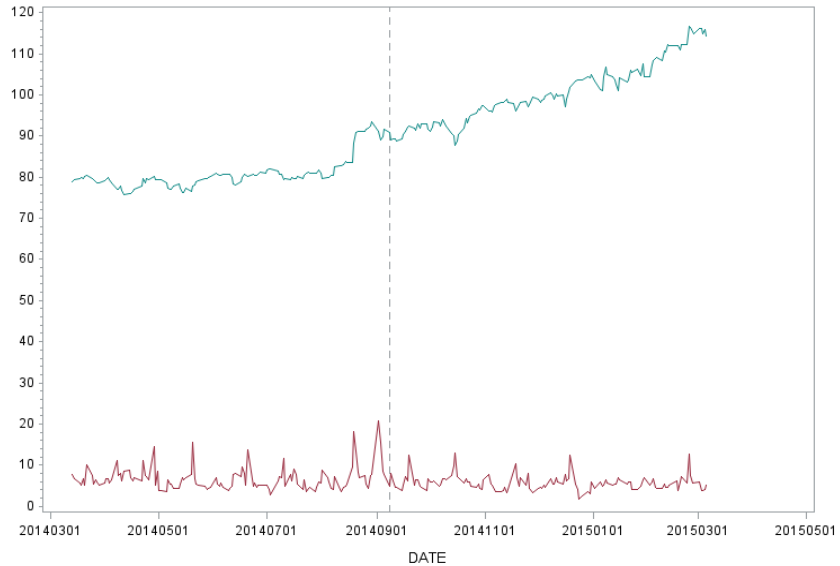
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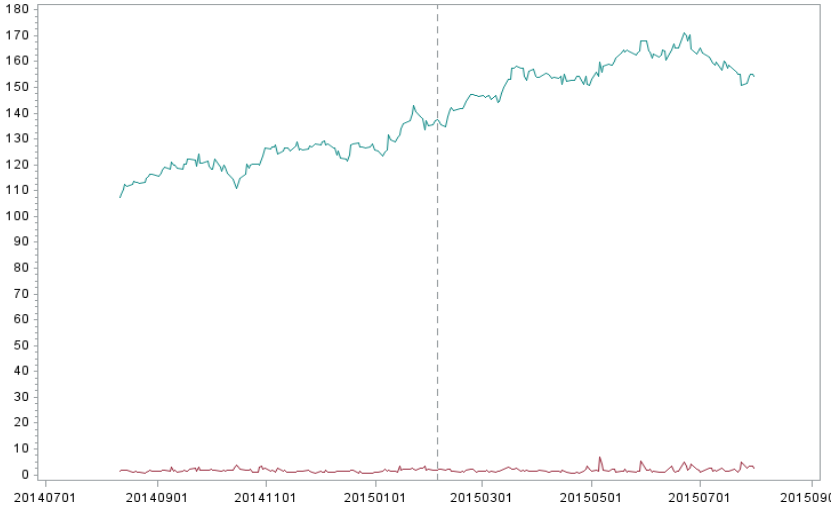
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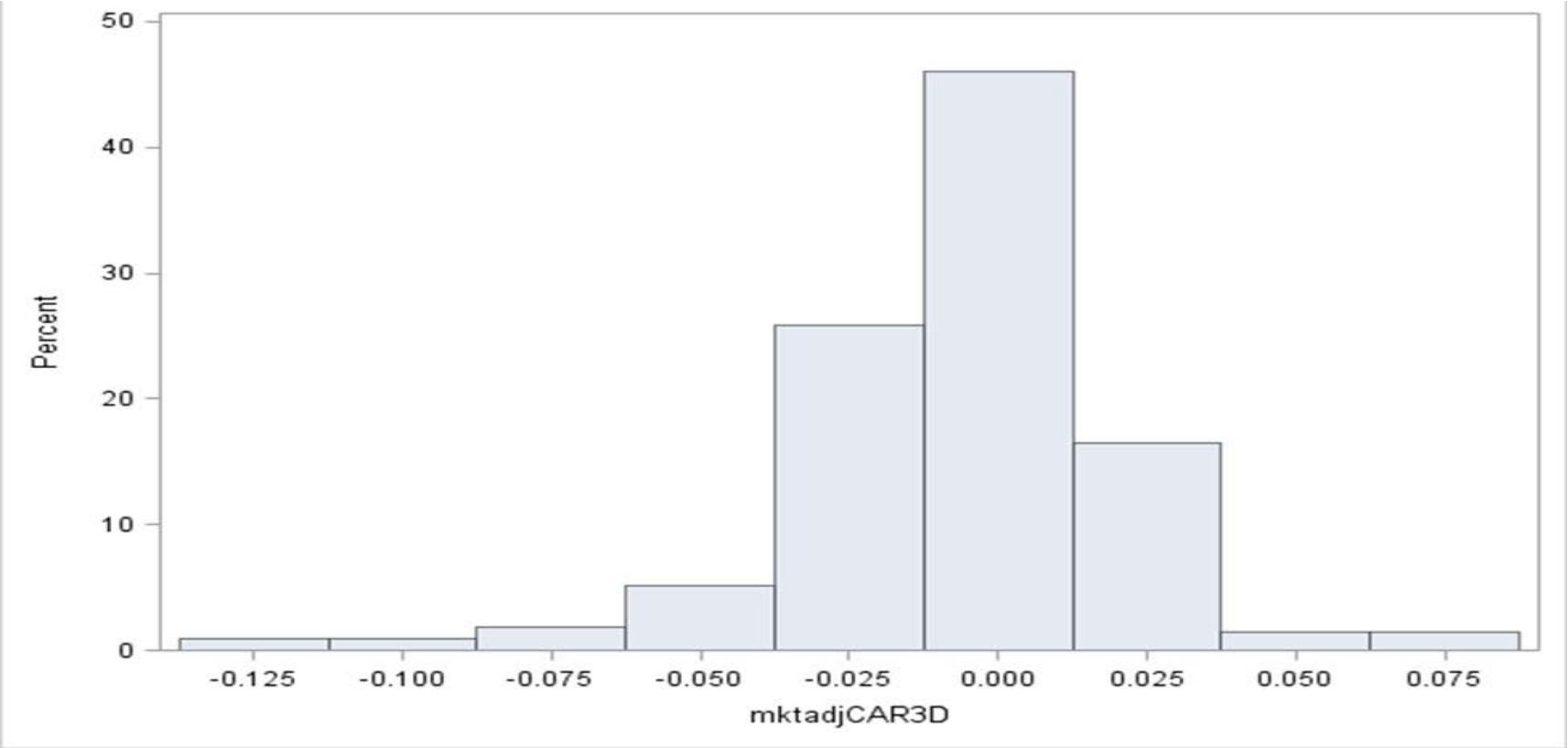
ST Return Distribution

Median: -0.5%

Mean: - 0.7%




Vol (20)
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8.653K
45.500
45.000
44.500
44.000
43.500
43.000
42.500
42.000
41.460
41.000
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40.000
39.500
39.000
38.500
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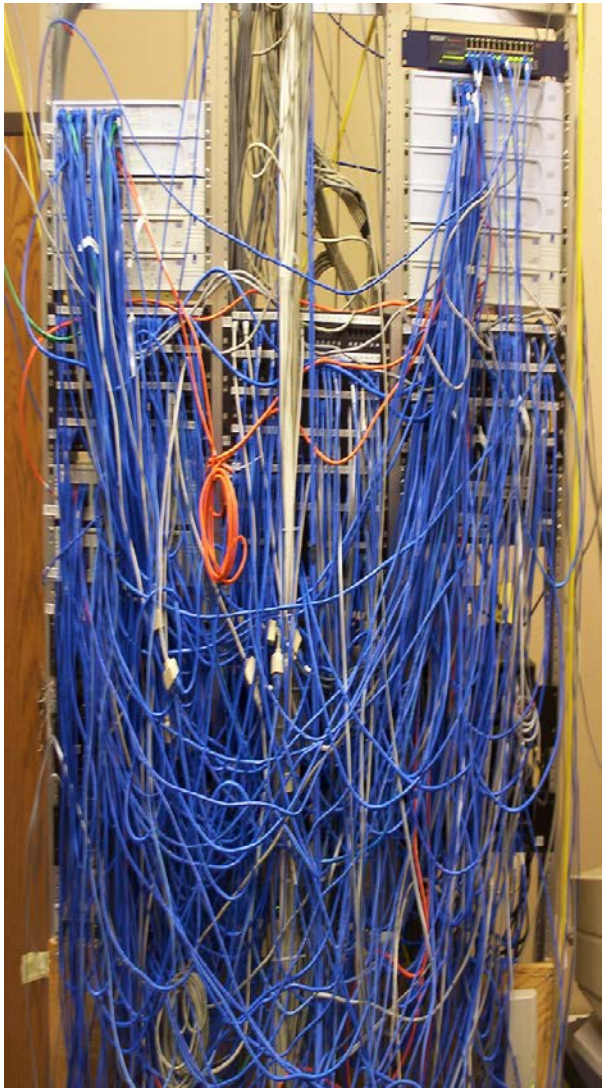
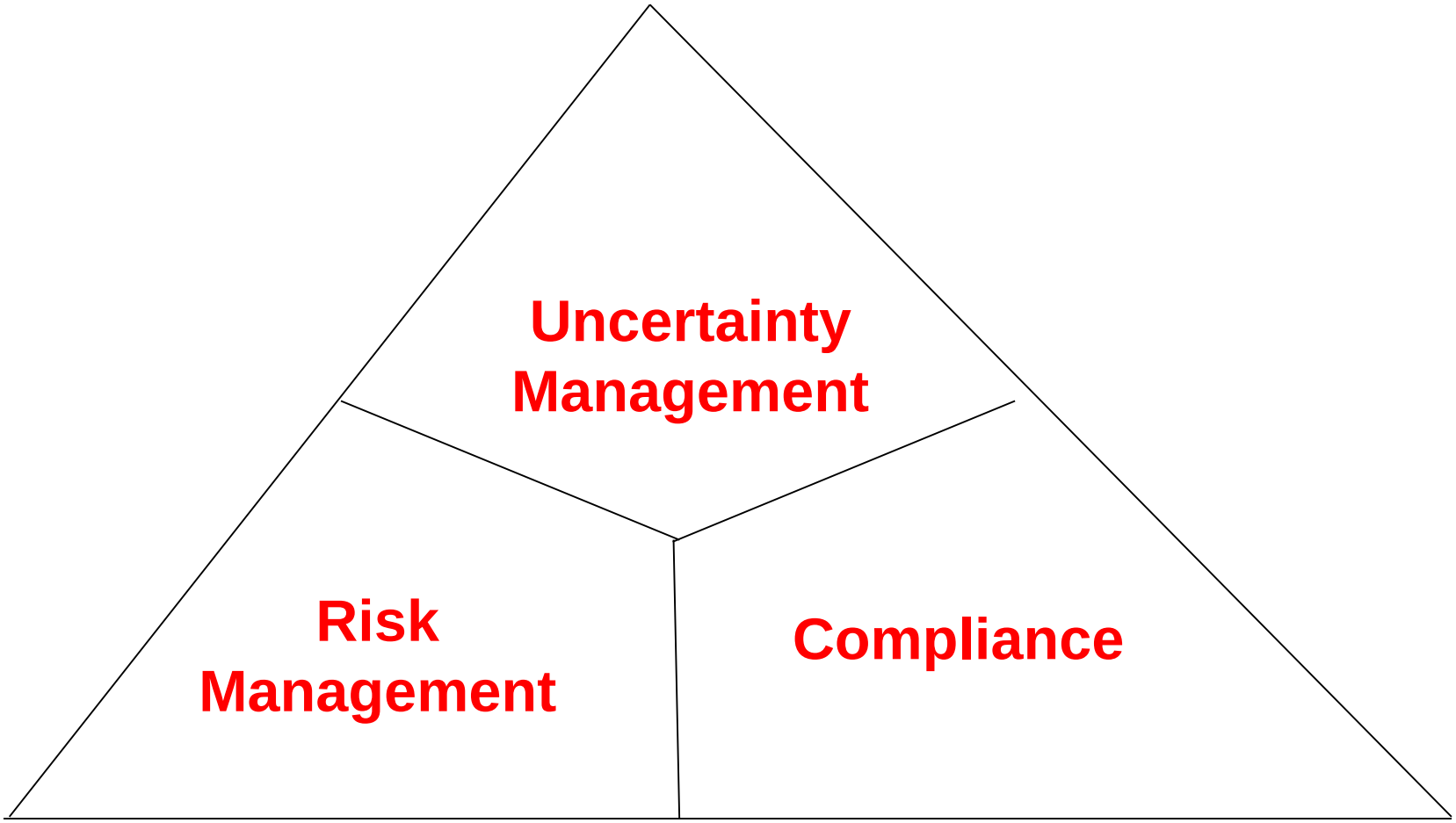
Déc
2019
16
Févr
15
Mars
18
Avr


AMERICAN ROSE SOCIETY
MINIATURE
ROSE TEST GARDEN



FUD vs CURe



Thank You !

Gilles.Hilary@georgetown.edu

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Assets, Access and Attackers

A consistent framework for identification, assessment, peer benchmarking and mitigation of cyber risk

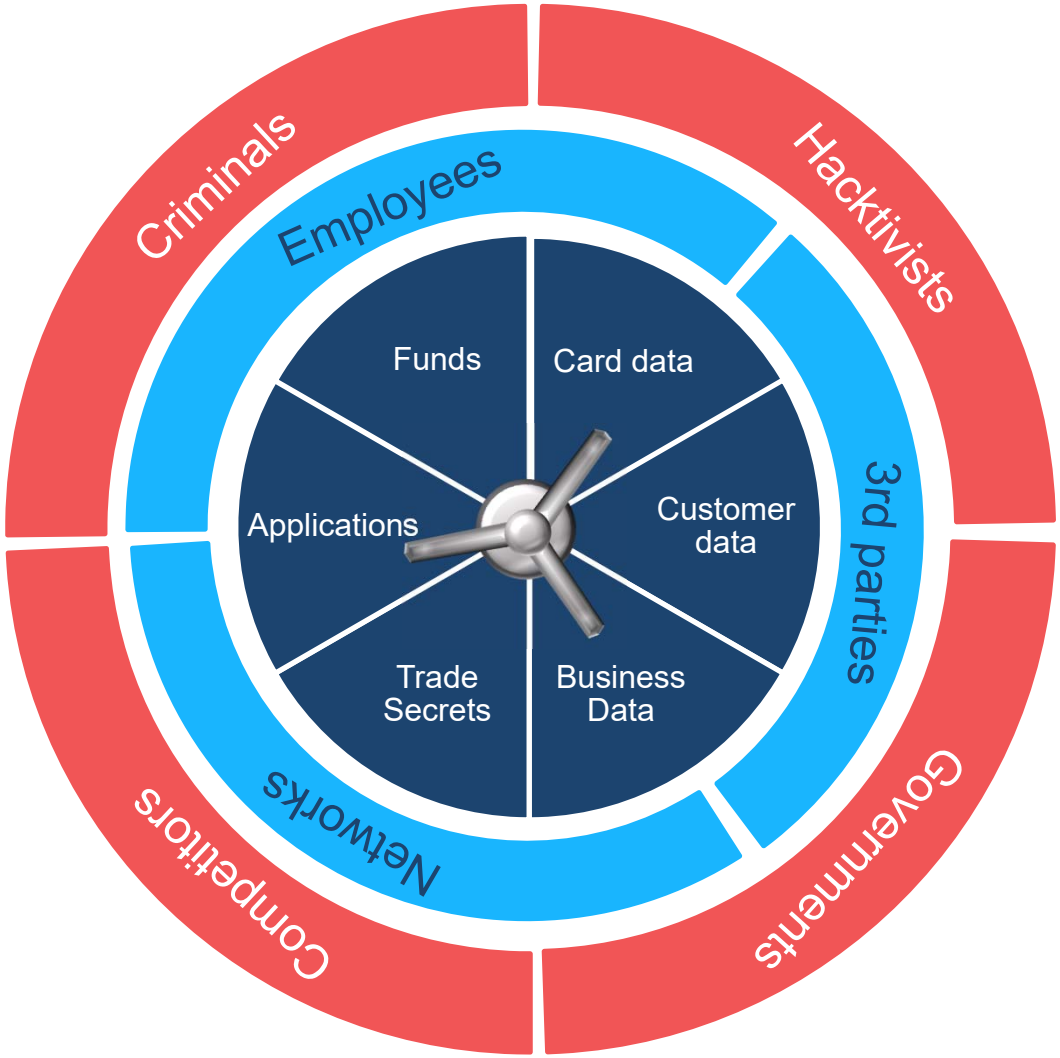
Naim, Patrick, Mstar, patrick.naim@elseware.fr
Condamin, Laurent, Mstar, laurent.condamin@elseware.fr

Version 25/03/2019

Executive SUMMARY

- We propose a consistent method for the structured identification and assessment of cyber risks:
- **The identification of risks** is based on a breakdown of critical Assets, possible Accesses to these assets, and possible Attackers.
- This decomposition by **Asset, Access, Attacker** can be directly mapped to the Exposure, Occurrence, Impact approach to **Structured Scenario modelling**.
- Structured modelling defines a **loss generation mechanism** which allows an explicit quantification of scenarios and peer benchmarking.
- Structured modelling allows the impact of **mitigation** actions to be assessed.

The cyber risk wheel

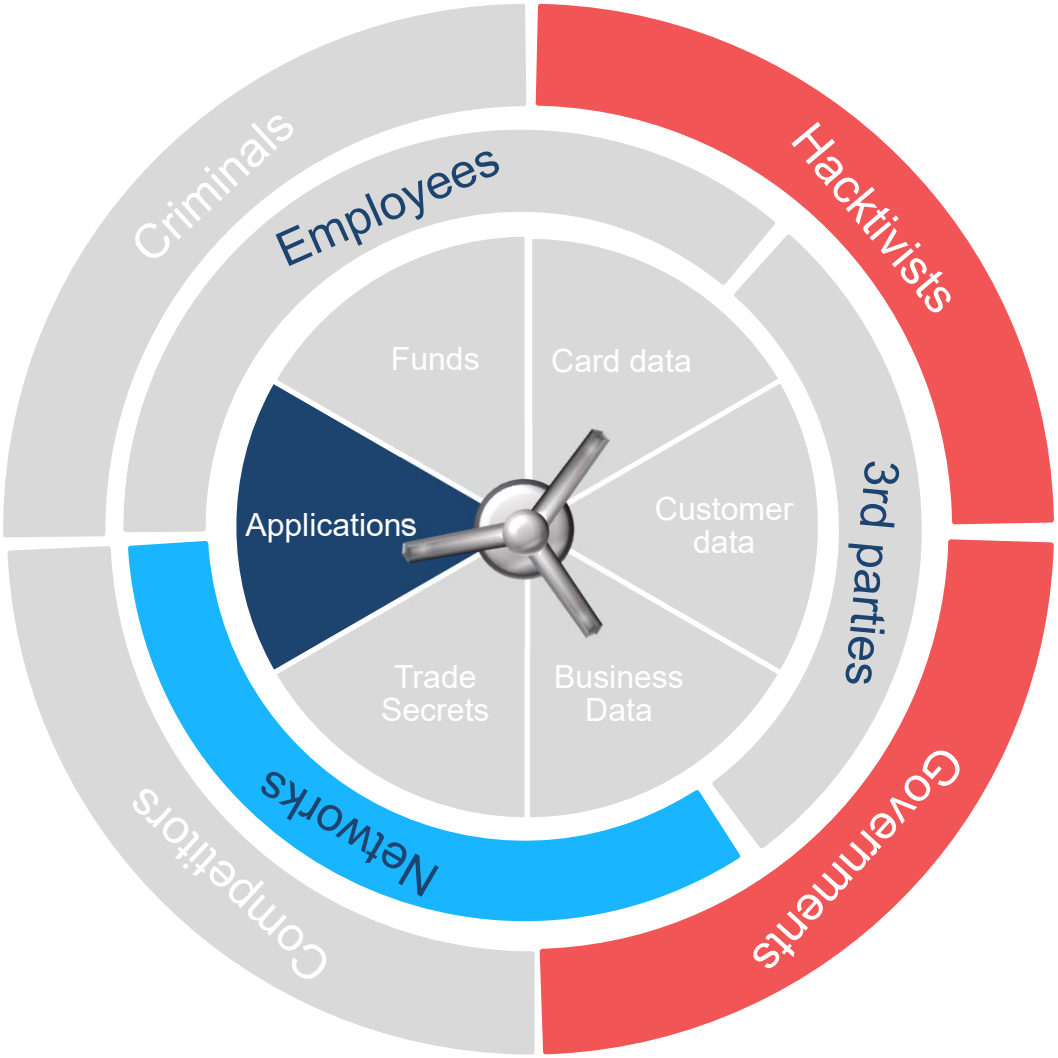


ATTACKERS

ACCESS

ASSETS

Example – CYBER Attack on critical service

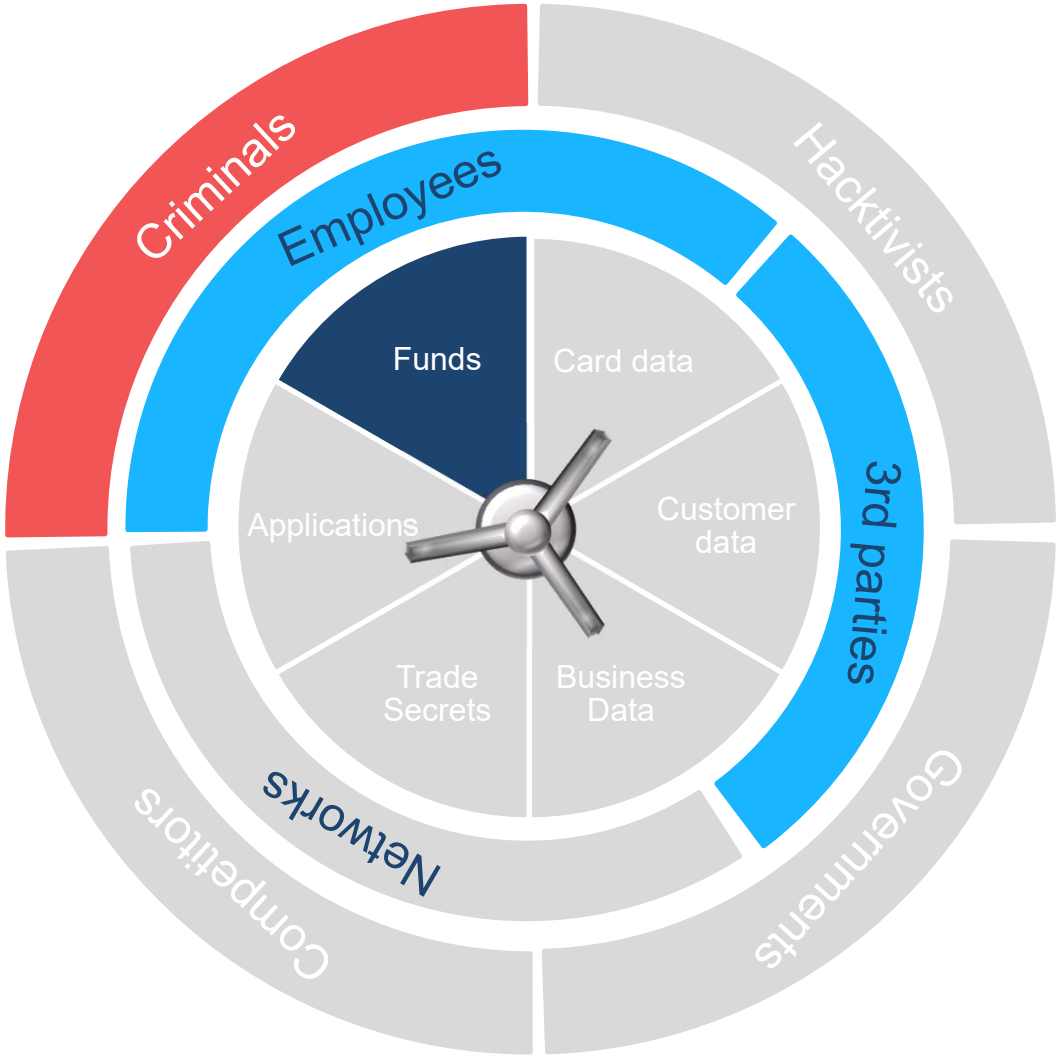


ATTACKERS

ACCESS

ASSETS

Example – CYBER FUND MISAPPROPRIATION

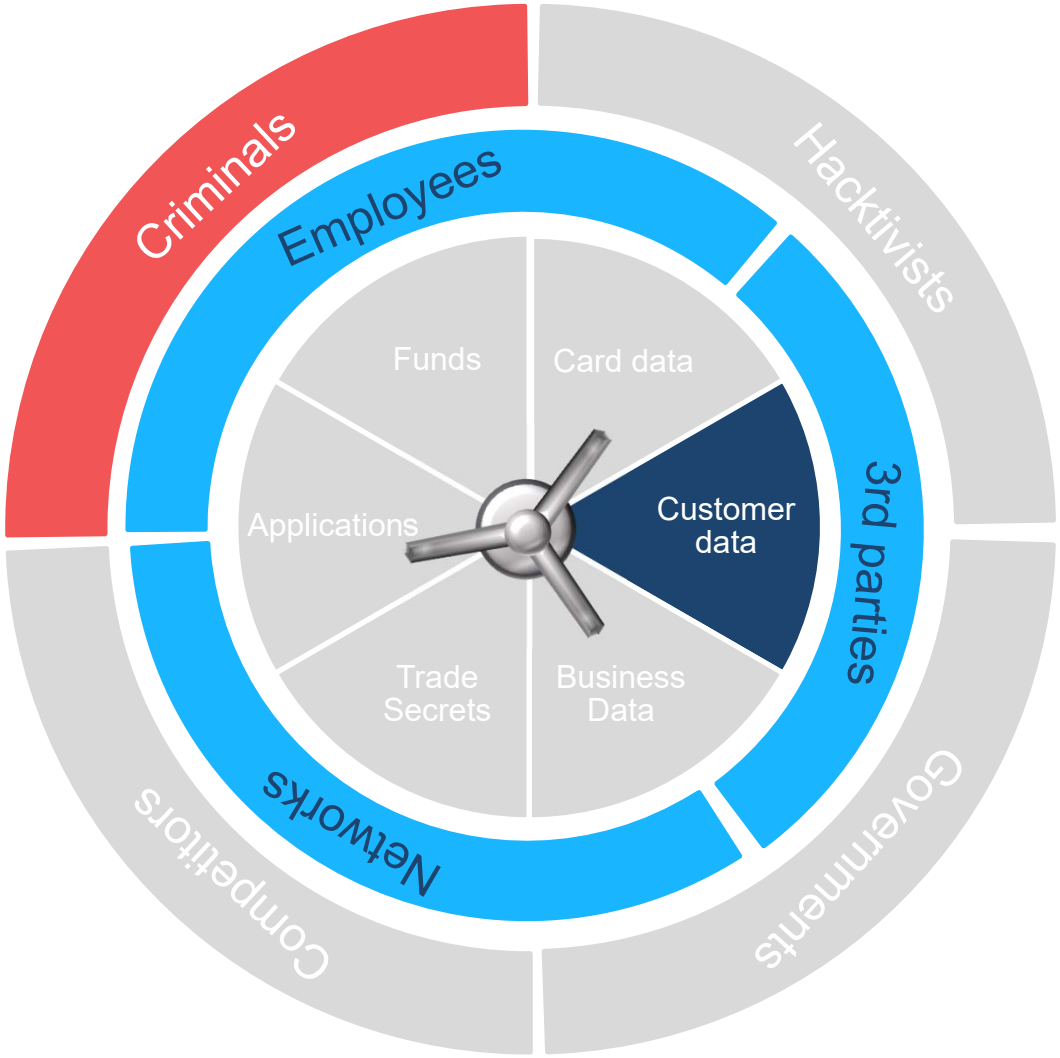


ATTACKERS

ACCESS

ASSETS

Example – customer data compromise



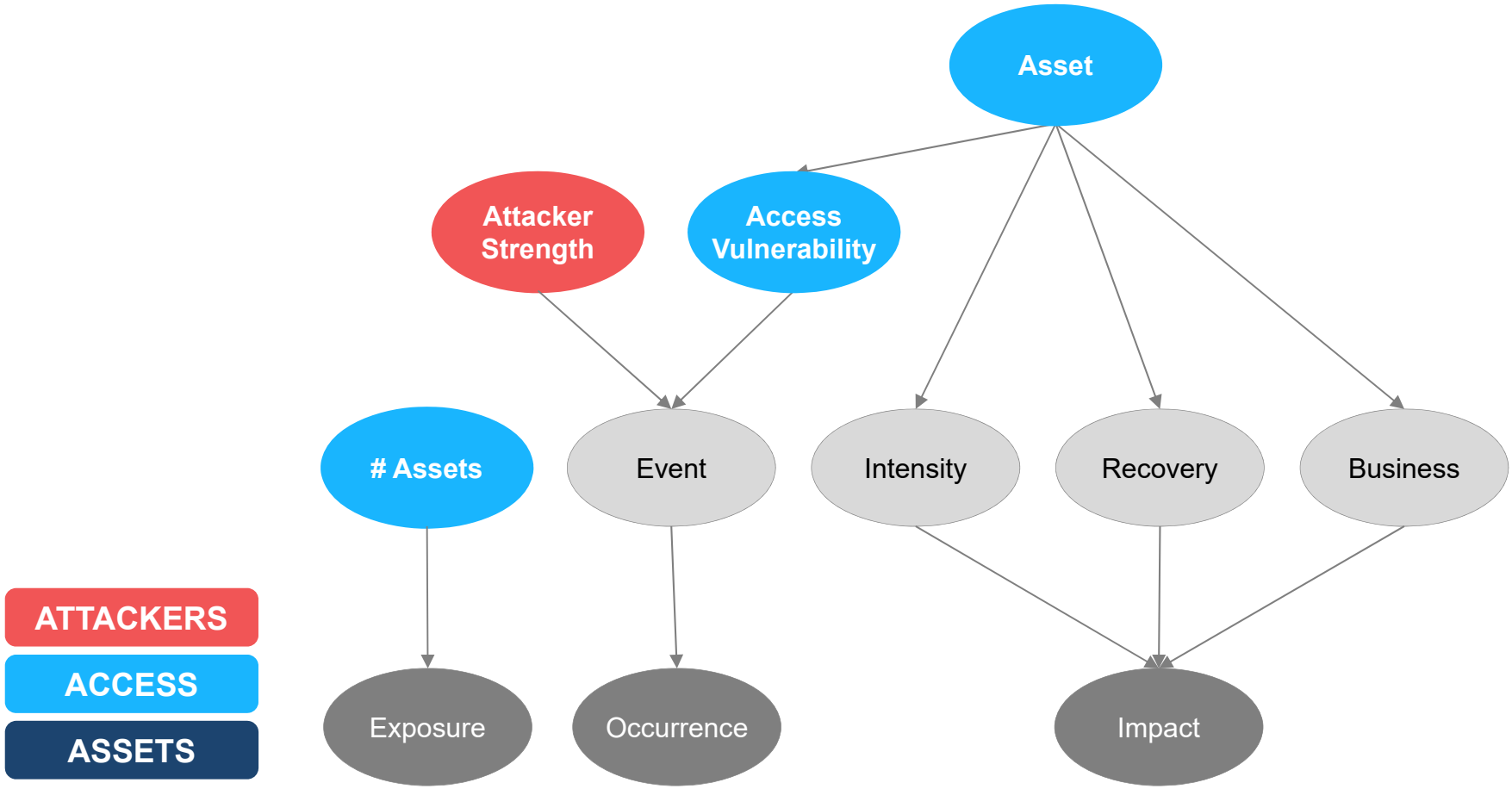
ATTACKERS

ACCESS

ASSETS

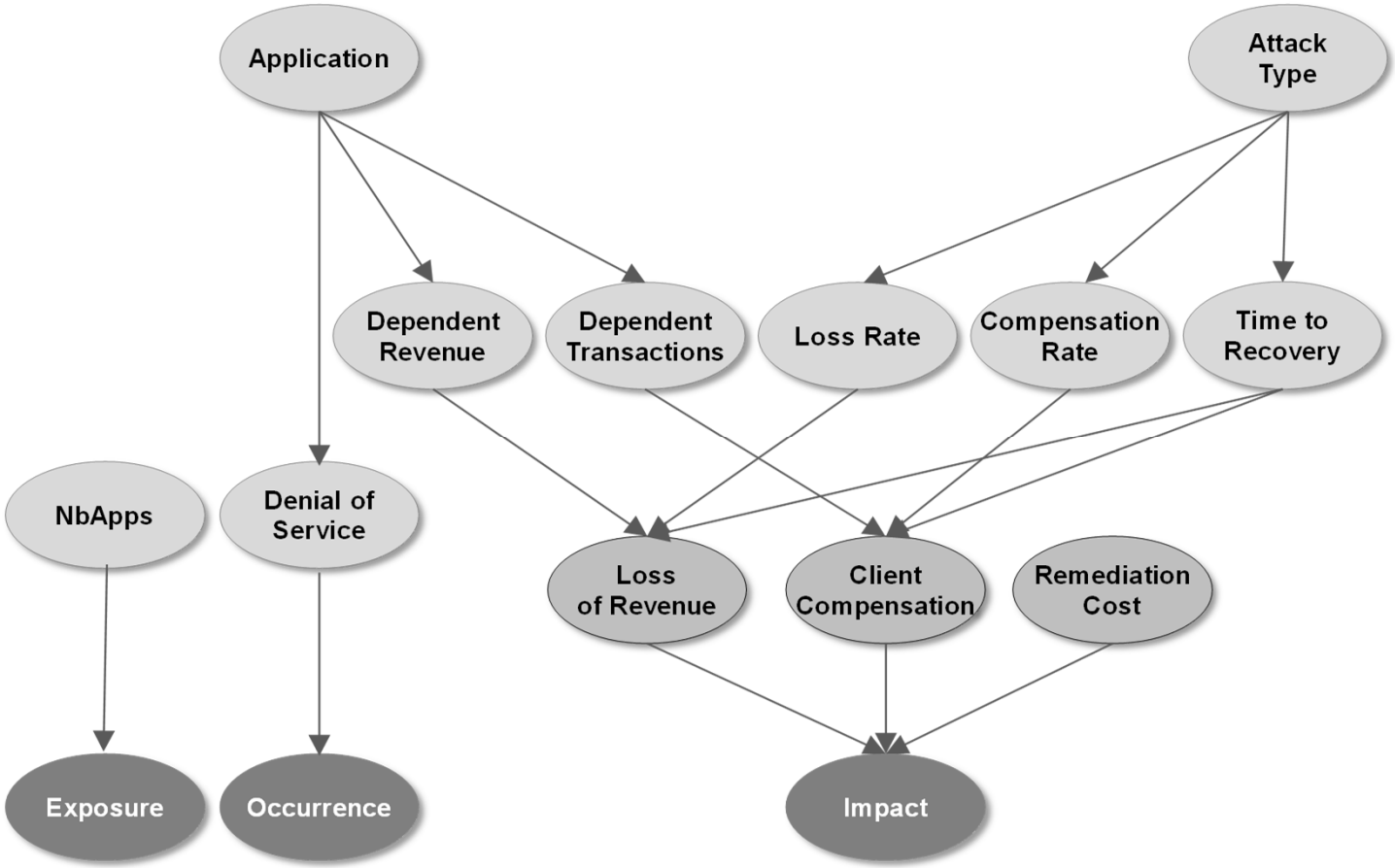
Mapping to scenario assessment

- The decomposition of a cyber risk scenario into Asset, Access and Attacker can be used to build a structured assessment of the scenario:



Example – CYBER Attack on critical service

- The decomposition of a cyber risk scenario into Asset, Access and Attacker can be used to build a structured assessment of the scenario:



Cyber Attack Critical service - Quantification

DRIVER	TYPE	ASSESSMENT	SOURCE
Number of critical services	Objective	5 services: Cards, Transfers, Trade, Loans, Internet Banking	Business Data, Resiliency Team
Type of Attack	Subjective	Duration: 80% Magnitude: 20%	SMEs, External Research, ILD & ELD
Probability of Cyber Attack	Subjective	[5%-20%] per application	SMEs, External Research, ILD & ELD
Dependent Revenue	Objective	Internet Banking: $5m-$10m Cards, Loans: $10m-$20m	Business Data, Annual Reports
Dependent Transactions	Objective	Transfers: $70bn-$80bn Trades: $4bn-$6bn	Business Data
Compensation Rate	Subjective	Transfers: 0-10$ per $1mm trans. Trades: 0-300$ per $1mm trans. for a duration attack, 0-600$ per $1mm trans. for a magnitude attack	Local model used based on Daily Penalty, Slowdown, Average TTR
Loss of Revenue Rate	Subjective	Duration Attack: 20% Magnitude Attack: 100%	SMEs
Time To Recovery	SMEs	Duration Attack: 2-12 days Magnitude Attack: 0-2 days	Resiliency Team, Business Impact Analysis, External Research

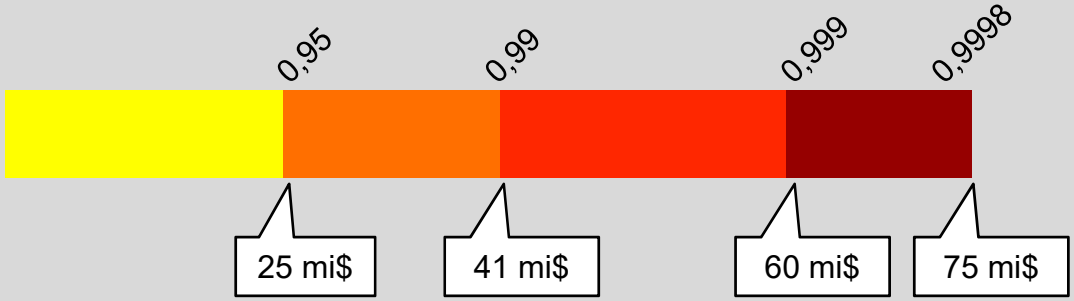
Cyber Attack – Critical Application - Simulation

The scenario structure and the driver assessments are compiled into a Bayesian Network that is sampled through Monte Carlo simulation to estimate the distribution of the potential losses.

REPEAT 1,000,000 times:

- SET the cumulated loss to 0
- SAMPLE the **exposure** from its conditional distribution
- FOR each exposed unit, sample the **occurrence** of the event from its conditional distribution
  - IF the occurrence is TRUE:
    - SAMPLE the **impact** of the event from its conditional distribution
    - ADD the impact to the cumulated loss

Number of iterations	**1 mi**
Single Loss	
Average	9.5 mi$
Max Possible	48.5 mi$
Frequency	
Average	0.5
Cumulated Loss	
Min	0$
Max	119 mi$
Mean	5.0 mi$



Benefits of the approach

- **Explicit definition of Cyber Scenarios and their boundaries**
- **Consistent reporting of events – and use of external events**
- **Direct mapping to structured asssement**
- **Identification of KRI**
- **Quantification of risk scenarios**
- **Possibility to benchmark assessment with peers**
- **Evaluation of mitigation actions**

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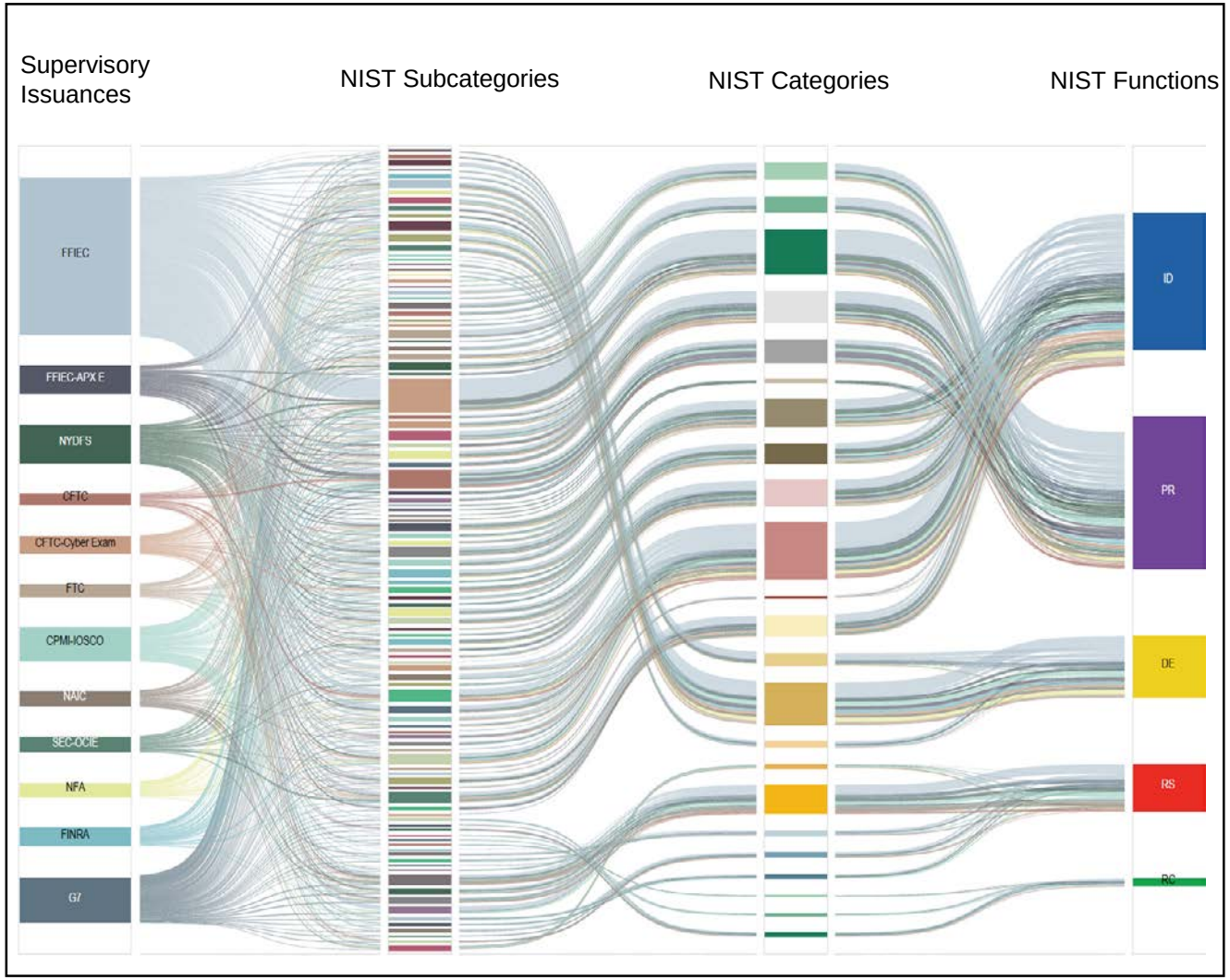
FSSCC Cybersecurity Profile

- An Overview -

Financial Services Sector Coordinating Council
for Critical Infrastructure Protection and Homeland Security

Topical Overlaps, Semantic Differences = Resources Focused on Reconciliation, Compliance

- 2016 Survey: **40%** of Information Security teams' time on avg spent on reconciliation of cyber expectations
- (ISC)2: Gap of cyber pros growing, with a **gap of 3 million projected for 2019**
- FSB (2018): **72% of jurisdictions** reported plans to issue new cyber requirements



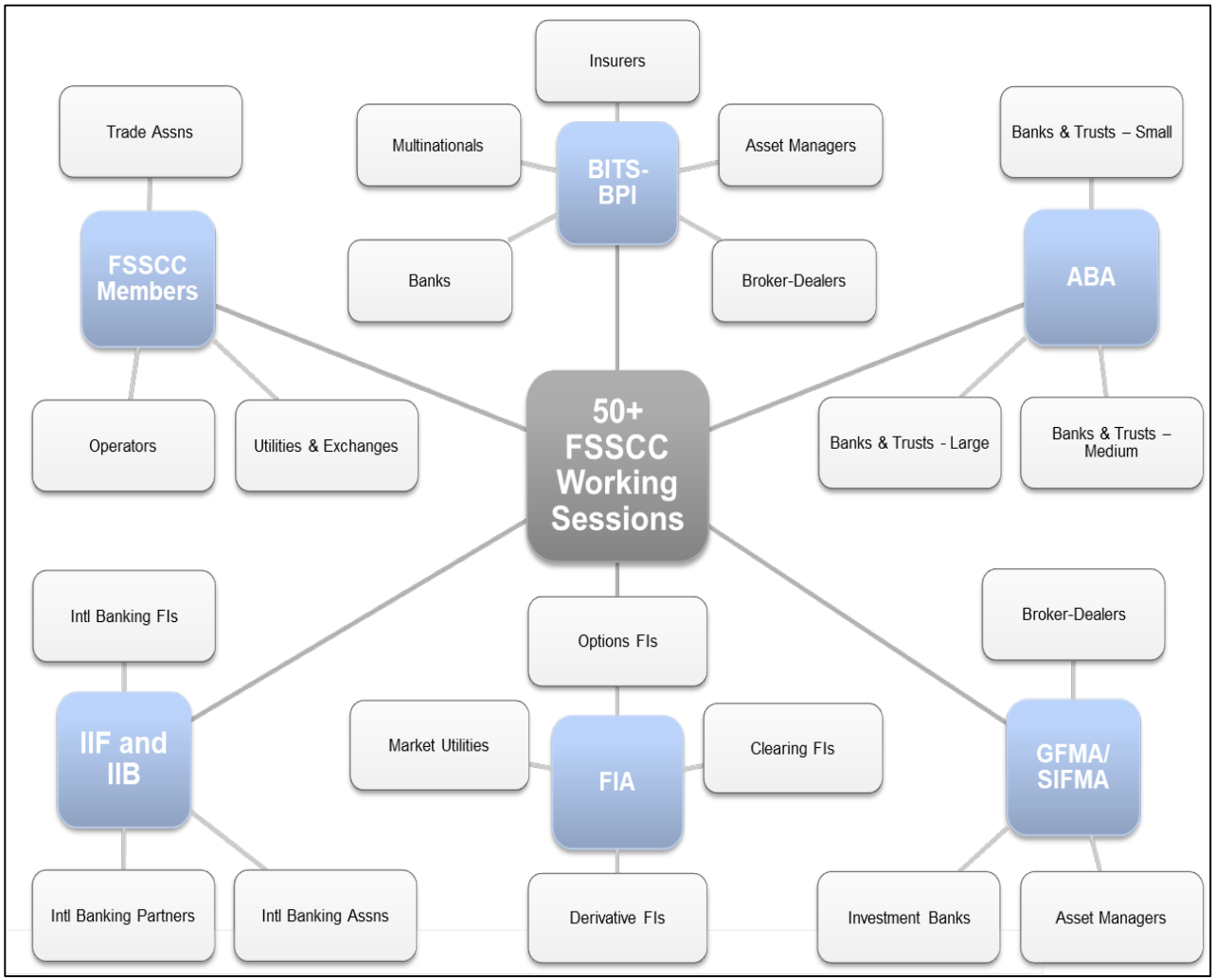
Developing the Profile: Process and Participants

Over the past 2 years –

- FSSCC Coalition;
- BITS and ABA co-lead;
- ***50+ working sessions;***
- ***300+ participants;***
- ***150+ financial institutions represented***.

Financial Services and Other Agencies –

- *Provided material for incorporation*, notably:
  - FRB;
  - OCC;
  - FDIC;
  - SEC;
  - CFTC;
  - FINRA;
- NIST workshop on risk/impact scaling.

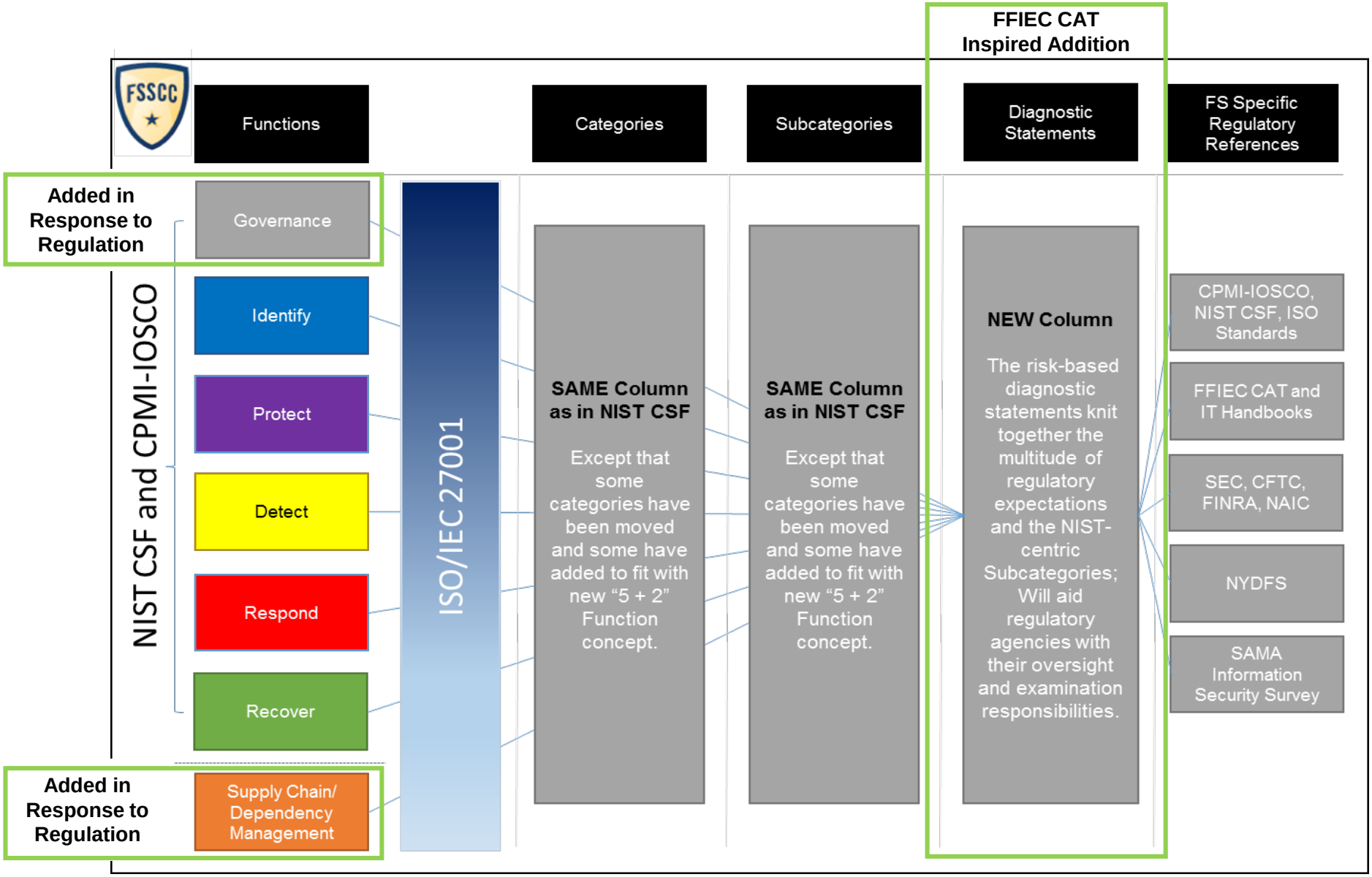


Benefits Explored - Efficiencies Gained

- ***73% Reduction for Community Institution Assessment Questions.*** For the least complex and interconnected institutions, it is expected that they would answer a total of 145 questions (9 tiering questions + 136 Diagnostic Statement questions). As compared to another widely-used assessment tool's 533 questions, this represents a ***73% reduction.***

- ***49% Reduction in Assessment Questions for the Largest Institutions.*** For the most complex and interconnected institutions, the reduction also is significant. With the Profile, it is expected that such institutions would answer 279 questions (2 tiering questions + 277 Diagnostic Statement questions) as compared to the other widely-used assessment's 533, ***a 49% reduction.***

PART I: The Profile's Underlying NIST Architecture



Part II: Sector-Wide Impact Assessment

National or Global Impact – Tier 1

- Systemically important and/or multinational firms.
- GSIBs, GSIFIs, systemically important market utilities.

Subnational (Regional) Impact – Tier 2

- Firms offering mission critical services or have over 5 million customer accounts.
- Super-regional banks, large insurance firms.

Industry-wide scaling achieved through collaboration with NIST, Federal Reserve, OCC, FDIC, SEC, FINRA.

40+ firms implementing the Profile or actively exploring implementation for 2019/2020.

- Firms with a high degree of interconnectedness, and between 1-5 million customer accounts.
- Regional banks, large credit unions.

Sector Only Impact – Tier 3

- Applies to the firms with a relatively small number of customers.
- Community banks, small broker dealers/investment advisors.

Customer/3rd Party Impact Only – Tier 4

Benefits of the Profile Approach

Financial Institutions

- ✓ ***Optimization of cyber professionals' time*** "at the keyboard," defending against next gen attacks – ***complete once per cycle, report out to many***.
- ✓ ***Improved Boardroom and Executive engagement***, understanding and prioritization.
- ✓ Enhanced, ***efficient third-party vendor management***.

Supervisory Community

- ✓ ***Examinations more tailored to institutional complexity, enabling "deeper dives"*** in those areas of greater interest to that particular agency.
- ✓ ***Enables supervisory agencies to better discern the sector's systemic risk***, with more agency time for specialization, testing and validation.
- ✓ Enhanced ***visibility of non-sector and third-party cyber risks***.

The Ecosystem

- ✓ ***Based on NIST and ISO, it allows for greater intra-sector, cross-sector and international cybersecurity collaboration and understanding***.
- ✓ Enables ***collective action to better address collective risks***.
- ✓ ***Greater innovation as technology companies, including FinTech's, are able to evidence security*** against the standardized set of compliance requirements.

FSSCC

The Profile: A NIST Cybersecurity Framework Extension to Align with Financial Services Requirements and Supervisory Expectations

NIST Cybersecurity Framework provides a globally accepted organizational structure and taxonomy for cybersecurity and cyber risk management

The following countries are either exploring its use or promoting it through translation –

- Bermuda
- Brazil
- Canada
- Israel
- Italy
- Japan
- Malaysia
- Mexico
- Philippines
- Saudi Arabia
- Switzerland
- United Kingdom
- Uruguay

The Profile extends the NIST Cybersecurity Framework to be more inclusive of financial services requirements and supervisory expectations

Extended NIST to highlight 2 special categories of particular (& appropriate) regulatory focus:

Governance

Supply Chain/ Dependency Management

The following international governments and organizations have expressed positive interest in the Profile –

- Argentina
- Brazil
- China (Mainland and Hong Kong)
- Chile
- Colombia
- European Union
- International Standards Organisation
- Japan
- Organization of American States
- Singapore
- United Kingdom

Websites

- https://www.fsscc.org/Financial-Sector-Cybersecurity-Profile
- https://www.fsscc.org/The-Profile-FAQs
- https://www.fsscc.org/files/galleries/NIST_Letter_of_Support_re_FSSCC_Financial_Services_Sector_Cybersecurity_Profile.pdf

Executive Summary

The Issue: Domestic and international regulatory agencies asking the same question in many different ways, stretching already scarce cybersecurity talent.

The Profile as a Solution: The Profile, which is a common, standardized approach that can act as a baseline for examination and future cyber regulation - *fill out once per exam cycle, report out many*.

Voluntary with Many Benefits, Including:

- Provides more consistent and efficient processing of examination material by both firms and regulators.
- Allows Regulators and Firms to focus on systemic risk and risk residual to firms.
- Establishes an Industry best practice beyond regulatory use.

Supporting Associations:

Financial Services Sector Coordinating Council
for Critical Infrastructure Protection and Homeland Security

Institute of International Bankers
Advancing the interests of the International Banking Community in the United States

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AMERICAN EXPRESS

Cyber Risk Quantification

March 2019 | Phil Collett

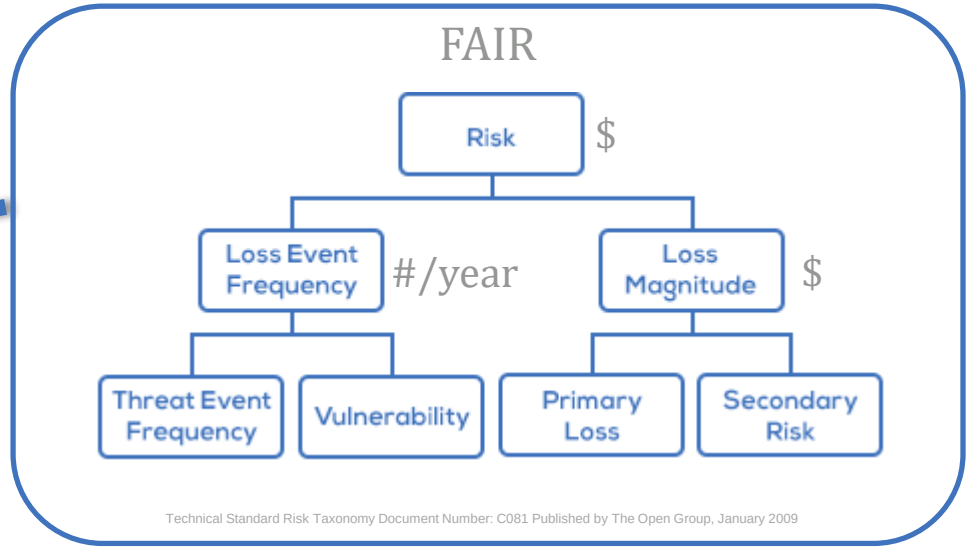
Risk Quantification

Problem Statement:

*An increasing number of control frameworks and regulations trend toward using less prescriptive language in favor of an emphasis on taking a **'risk-based approach'.** However, many firms struggle to design and implement operationally feasible, repeatable, and accurate risk quantification methodology and tooling.*

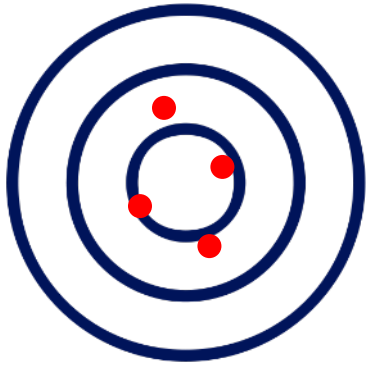
Analysis of Risk Quantification Methods:

Cyber Risk Methodology	Precision	Quantification	Agility	Ease of Use	Overall (0 – 100)
Factor Analysis Information Risk (FAIR)	^	^^	I	I	70
CORA	I	^	^	^	70
ISRAM	I	^	I	I	65
Facilitated Risk Analysis Process	^	v	I	I	60
COBRA	I	v	I	^	55
OACTIVE ALLEGRO	^	v	I	I	55
NIST 800-30	^	v	I	I	50
ISO 30101:2009	I	v	I	I	45
COBIT	vv	v	I	I	40

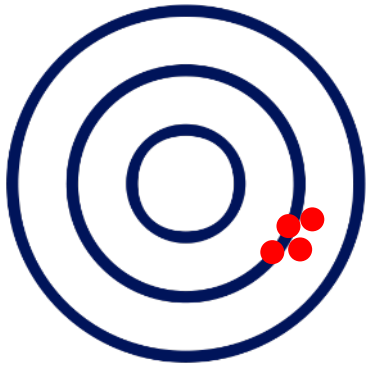


Quantification Accuracy

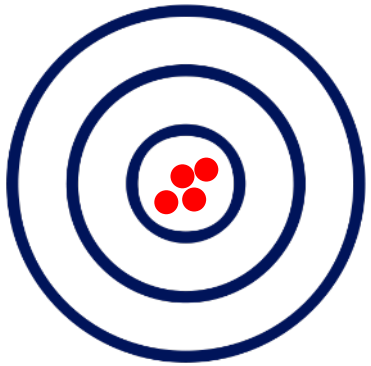
*It is better to be consistent (precise) by using a **single source of truth for** inputs such as **asset value**, **control strength**, and **threat frequency**. Once precision is achieved, focus on calibrating the inputs to achieve accuracy.*



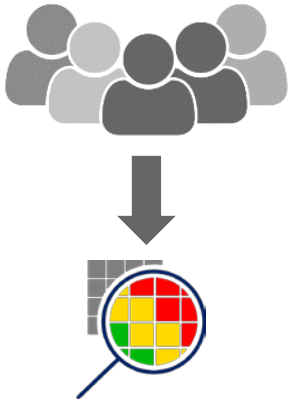
TRUE, BUT LACKING PRECISION



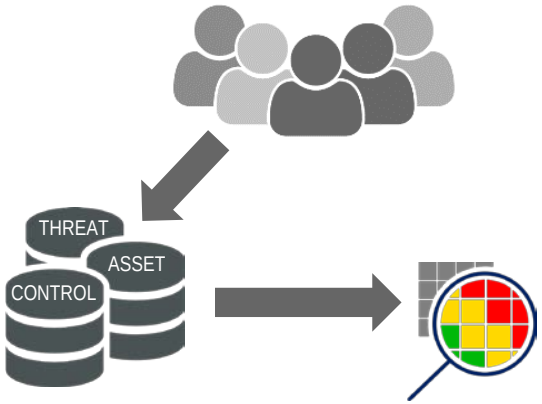
PRECISE, BUT LACKING TRUENESS



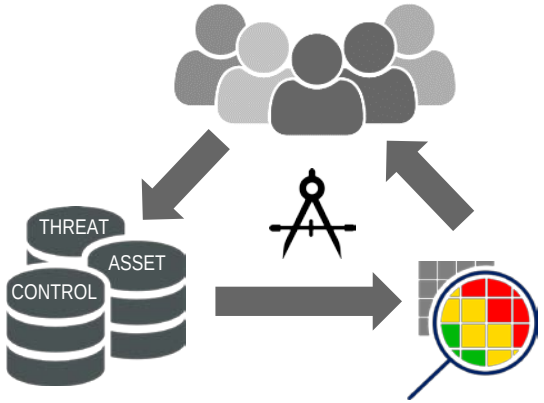
ACCURATE



Assessor relies upon their own experience and training while interacting with the model



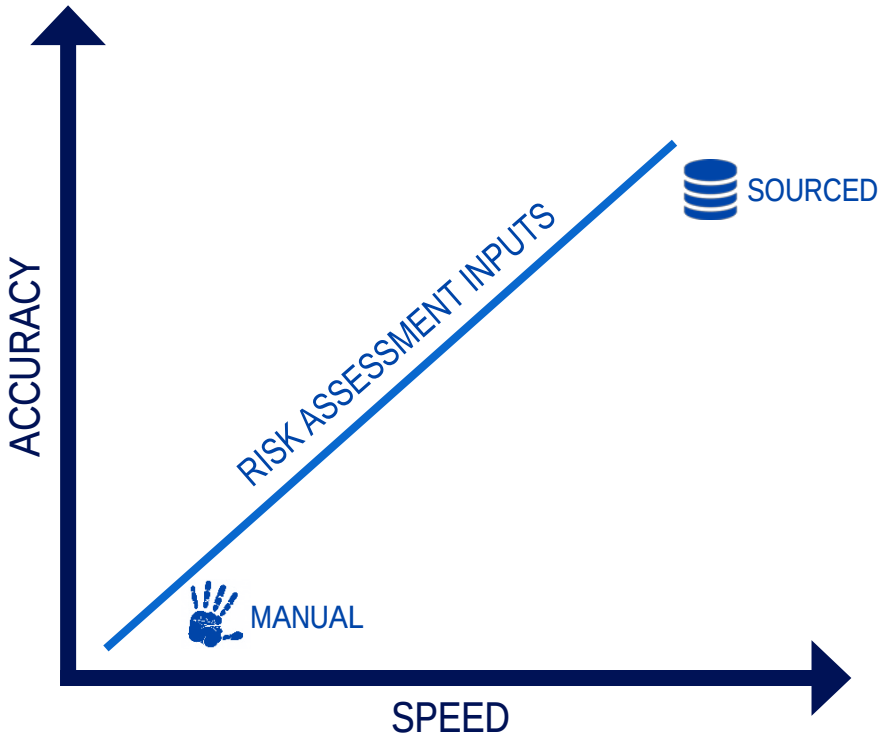
Assessor uses pre-defined values for asset value, control effectiveness, and threat inputs



Over time, the systems of record for asset, control, and threat data are calibrated for accuracy

Quantification Adoption

Improve risk assessment speed and accuracy by sourcing as many risk assessment inputs as possible from either metrics or pre-aligned values.

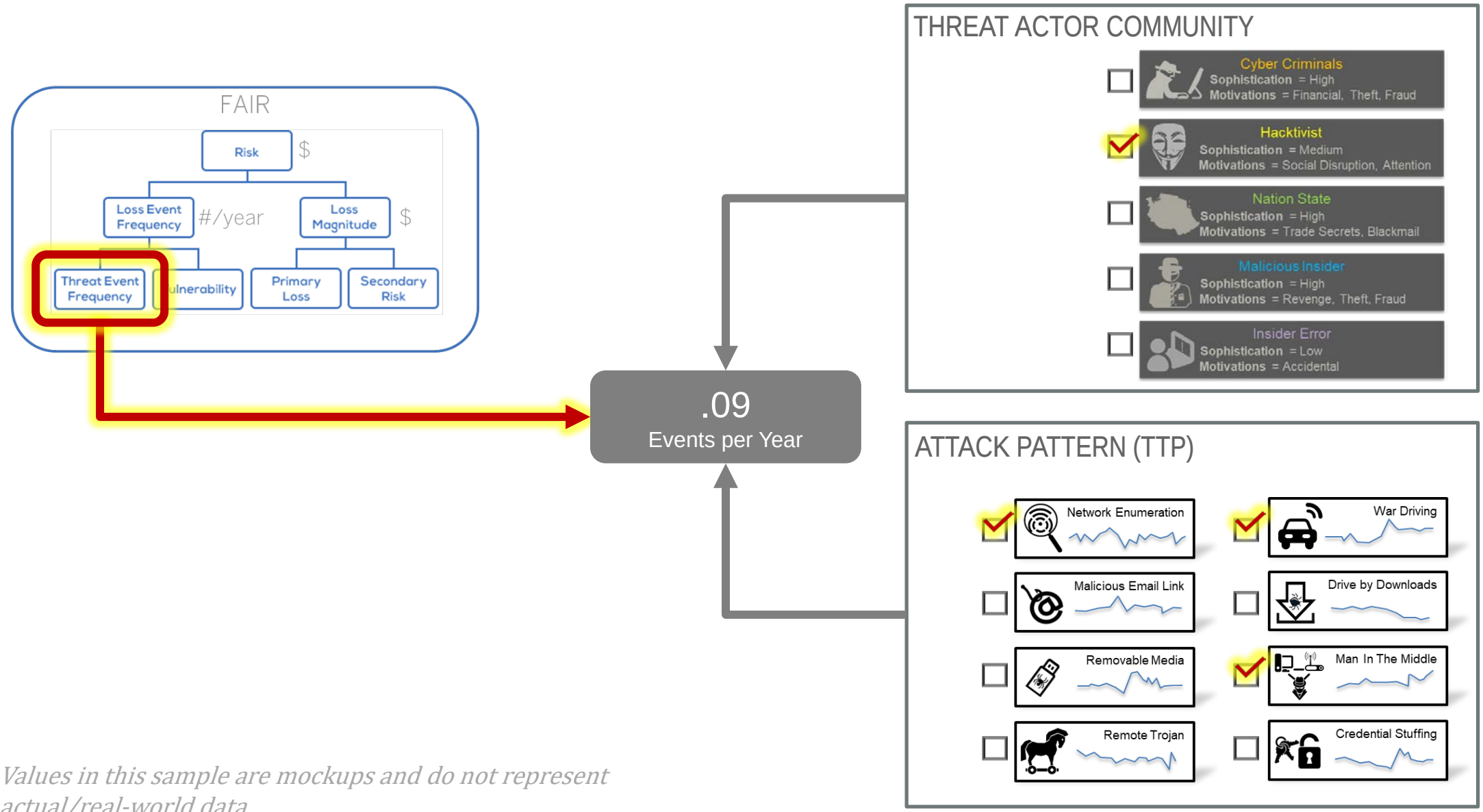


Sample Risk Assessment Inputs:

Assessment scope
Identify relevant threats
Identify relevant assets
Identify applicable controls
Threat actor capability
Threat frequency
Effectiveness of applicable controls
Controls ability to reduce likelihood
Controls ability to reduce impact
Primary losses based on asset
Reputation costs based on asset
Response costs based on asset
Potential fines and legal fees

Example: Threat Input Quantification

*This sample shows how a single source of truth for **attack types** and **threat actor communities** can save an assessor from having to speculate on the threat event frequency in a risk assessment using FAIR.*



Values in this sample are mockups and do not represent actual/real-world data

Thank You

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Morgan Stanley

2019 Cyber Risk Workshop

John DeLong

Operational Risk

Discussion & Questions