



The Insurance  
Institute of London  
Chartered Insurance Institute

# The Insurance Institute of London

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# Cyber Catastrophe Modelling

Capturing the Complexity of Cyber

*Bethany Vohlers, Senior Manager and Cyber Lead across  
Europe and Asia at Verisk Analytics*



# Agenda

- What is cyber risk?
- How can cyber catastrophe models address the challenges unique to cyber?
- Explore three risk modelling frameworks for capturing exposure to cyber

# Verisk: The Original InsurTech

- Leading responsible data analytics company in pursuit of our customers' most strategic opportunities
- Provider of predictive analytics and decision support solutions to customers in specific markets
- Global company with offices and customers in 80+ countries around the world
- Member of the S&P 500 and NASDAQ-100 indices with market cap of c. USD 30 billion
- Socially responsible company serving the long-term interests of our stakeholders



# Cyber Across the (Re)Insurance Value Chain



## Cyber Policy Workflows

Integrated workflows across policy pricing, underwriting, and distribution



## Insurance Program

Product Development



## Single-Risk Underwriting

Underwriting Pre-fill and Scoring



## Risk Modelling

Portfolio Risk Modelling



## Industry Loss Estimates

Loss Indices

## Industry Aggregates

Accessing aggregate cyber data across the industry



## Cyber Industry Data

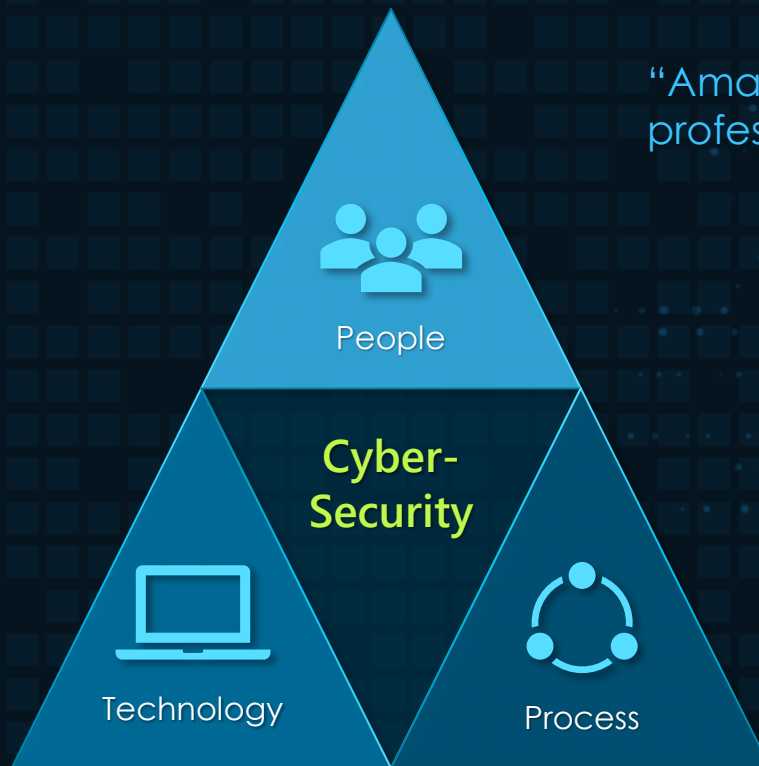
Incident data, cyber and business data for exposures

# The Cyber Challenge

# The Cyber Peril

		Confidentiality	Integrity	Availability	Liability
<b>Digital Assets</b>	Data				
	Networks				
	Applications				
	Devices				
	Business Disruption				
<b>Physical Assets</b>	Structure				
	Vehicles				
	People				
	Speciality				

# What is Cyber Risk? A Cybersecurity Perspective

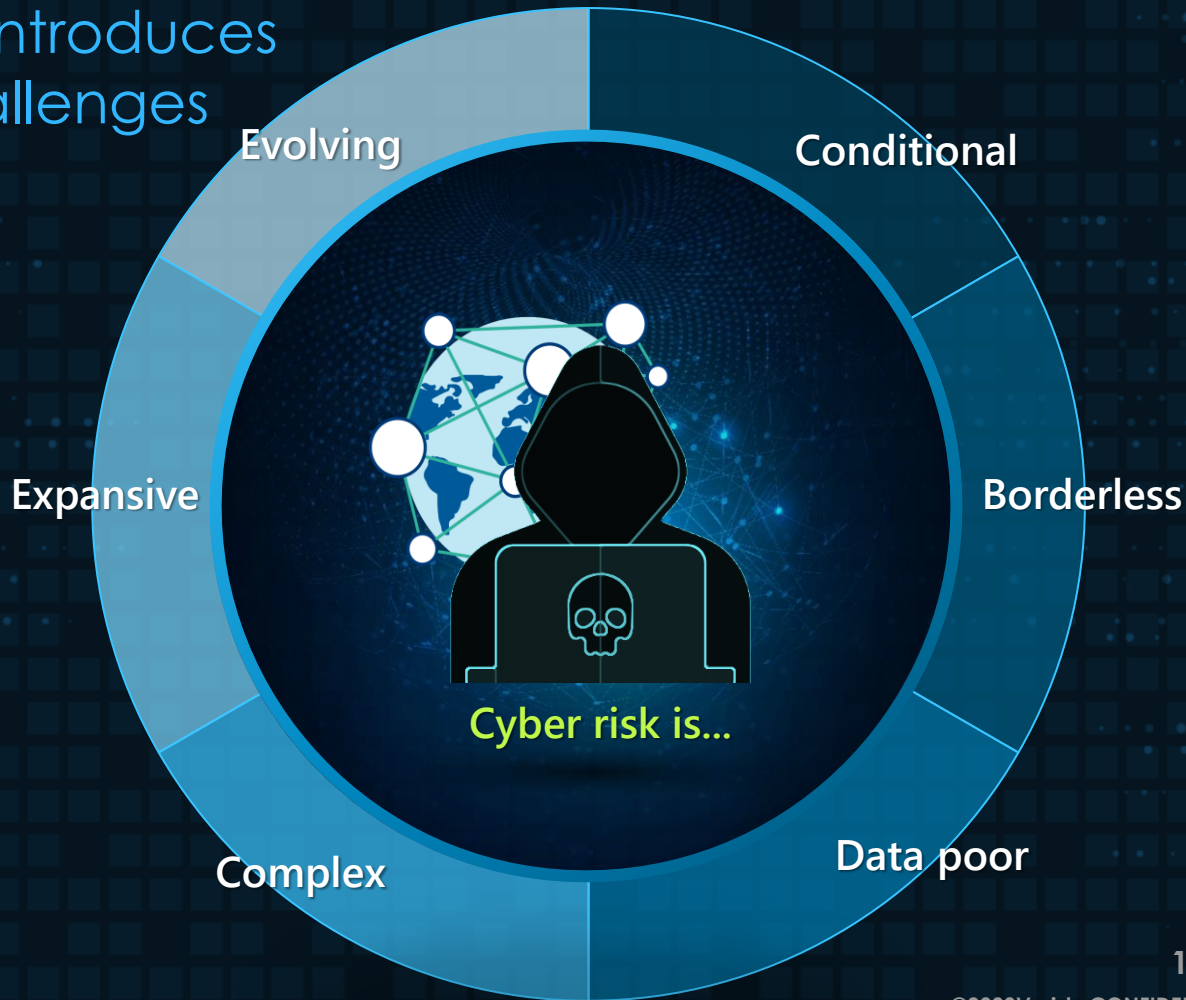


“Amateurs hacks systems,  
professionals hack people.”

— Bruce Schneier,  
SECURITY TECHNOLOGIST



# Cyber Risk Introduces Unique Challenges



# Cyber Challenges Affect the Insurance Industry

## Industry Challenges



Lack of relevant  
in-house data



Disconnected  
tools, discrete  
data sources



Lack of  
aggregated  
industry data



Complex &  
dynamic exposures



Poor understanding  
of cyber risk &  
exposure

# Our Approach Is Founded on 3 Key Pillars



Cyber Risk Data  
Augmentation



Innovative  
Risk Modelling

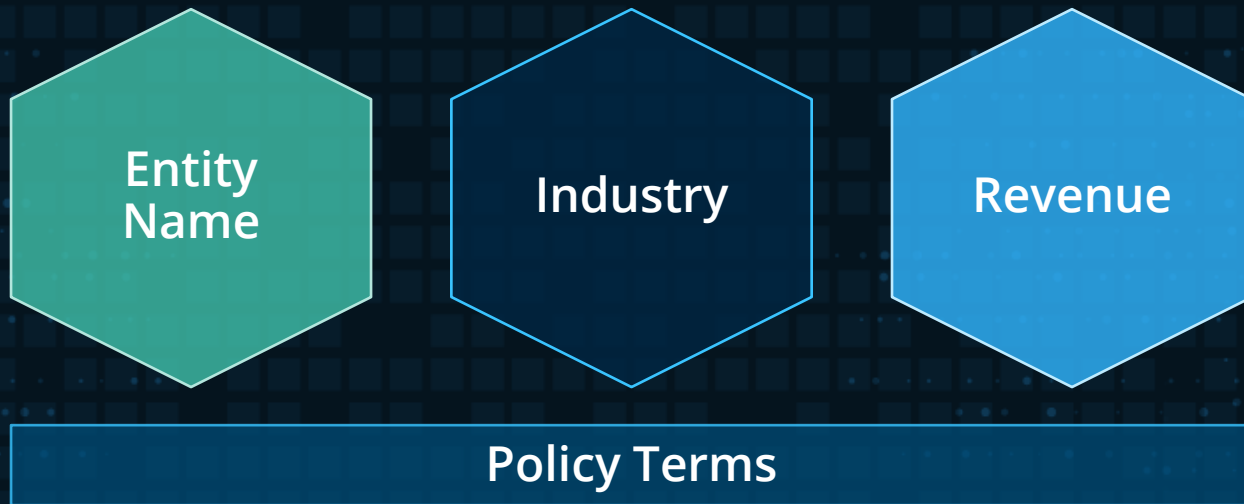


Flexibility and  
Transparency

# Conquering the Data Challenge

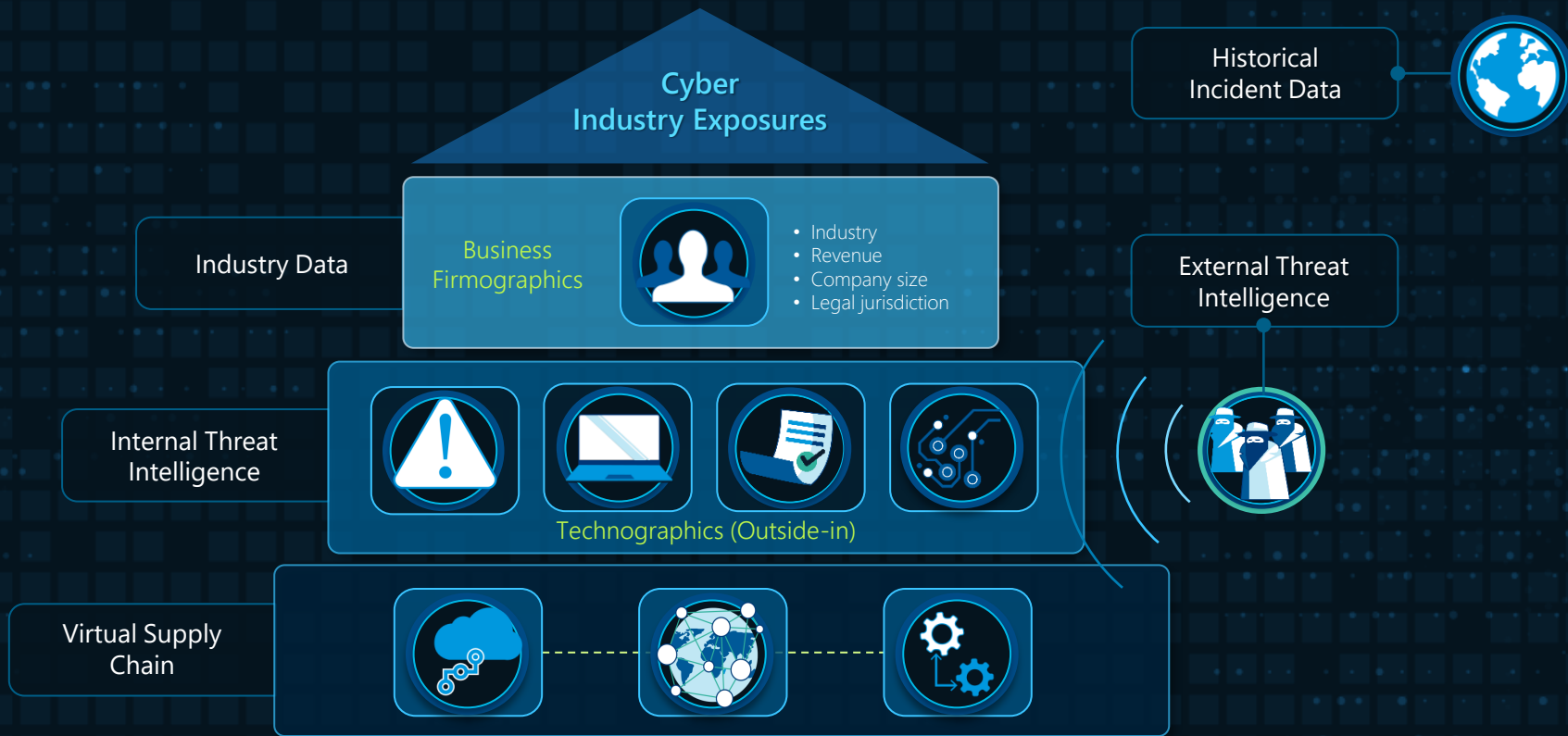
Reading Between the Lines

# Limitations in Insurance Data



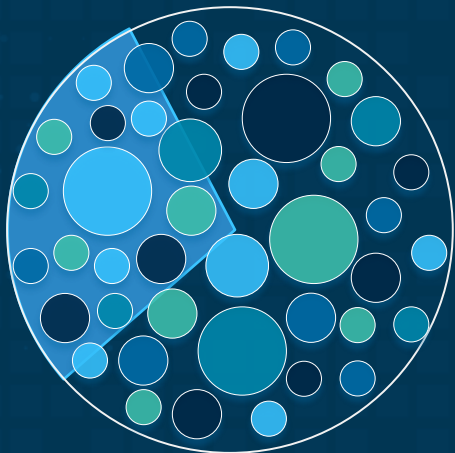
Company ABC | Finance | USD 2b revenue | USD 10m limit | USD 20m AP

# Cyber Requires a Data-Driven Approach



# Using Industry Exposures to Augment Portfolio Data

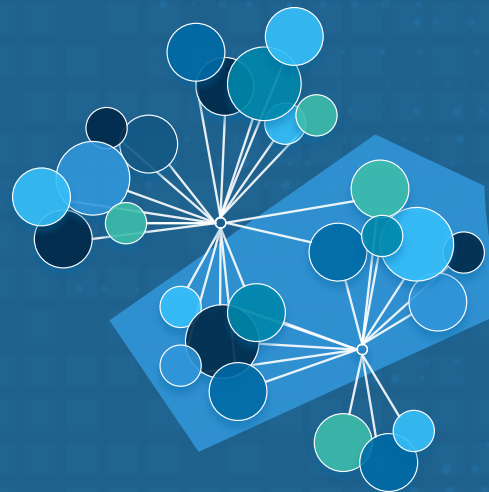
## Market Share Approach



Market shares constructed from **detailed data** of more than 100,000 companies worldwide:

Bin = ( **Industry**, **RevenueClass**, **Region** )

## Detailed Accumulation Approach



Augments known **firmographic** and **technographic** data points

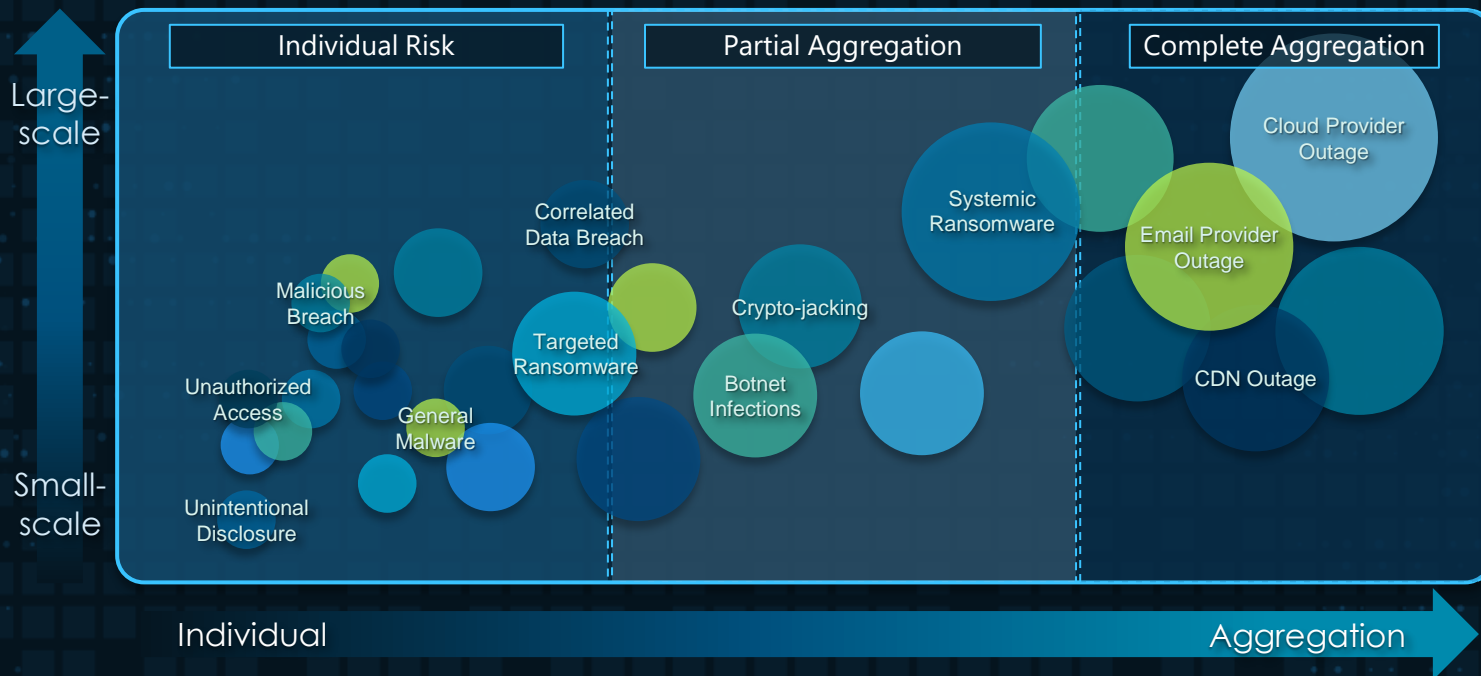
# Cyber Catastrophe Modelling

Capturing a complex risk



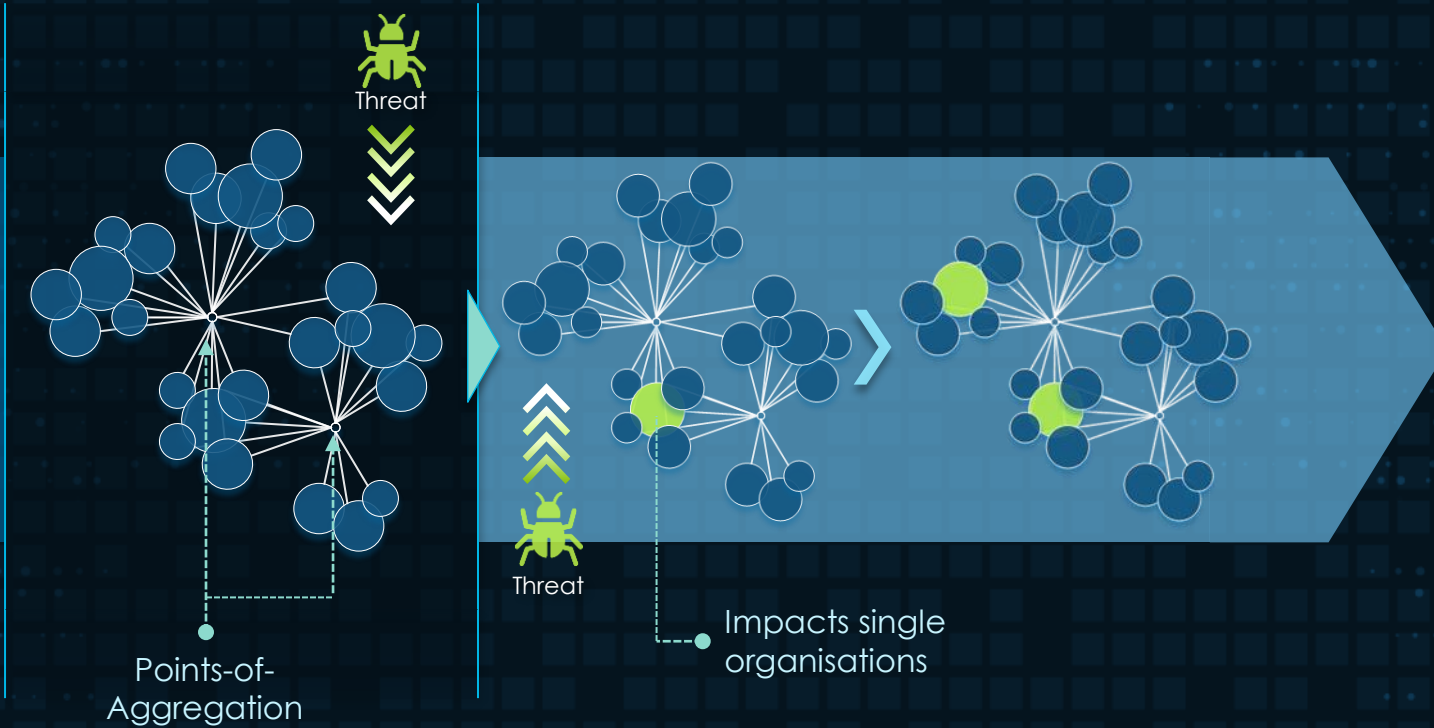
# The Spectrum of Cyber Risk

Size = No. of impacted entities



# Individual Risk Events

# Individual Risk Events: Targeted, Small & Extreme

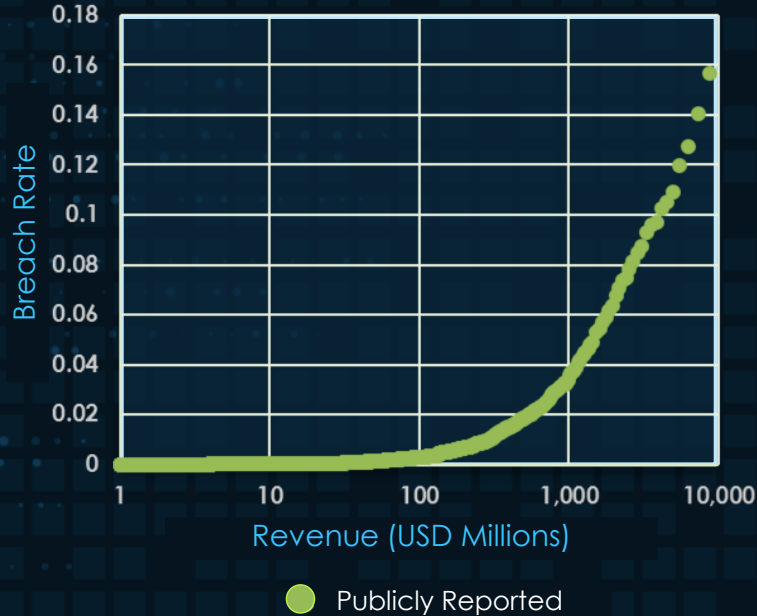


# Machine Learning Identifies Drivers of Risk and Evaluates Vulnerability

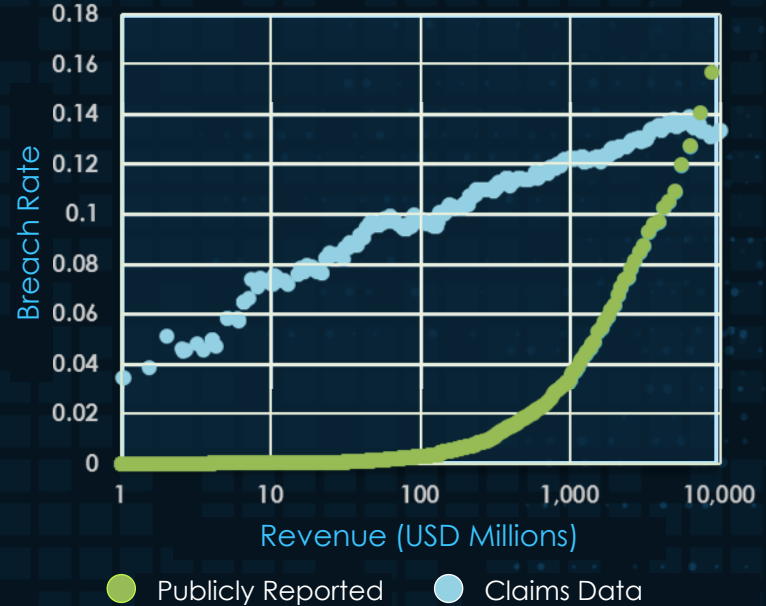


# Bias in Reported Event Frequencies Requires Adjustments Using Real Claims Data

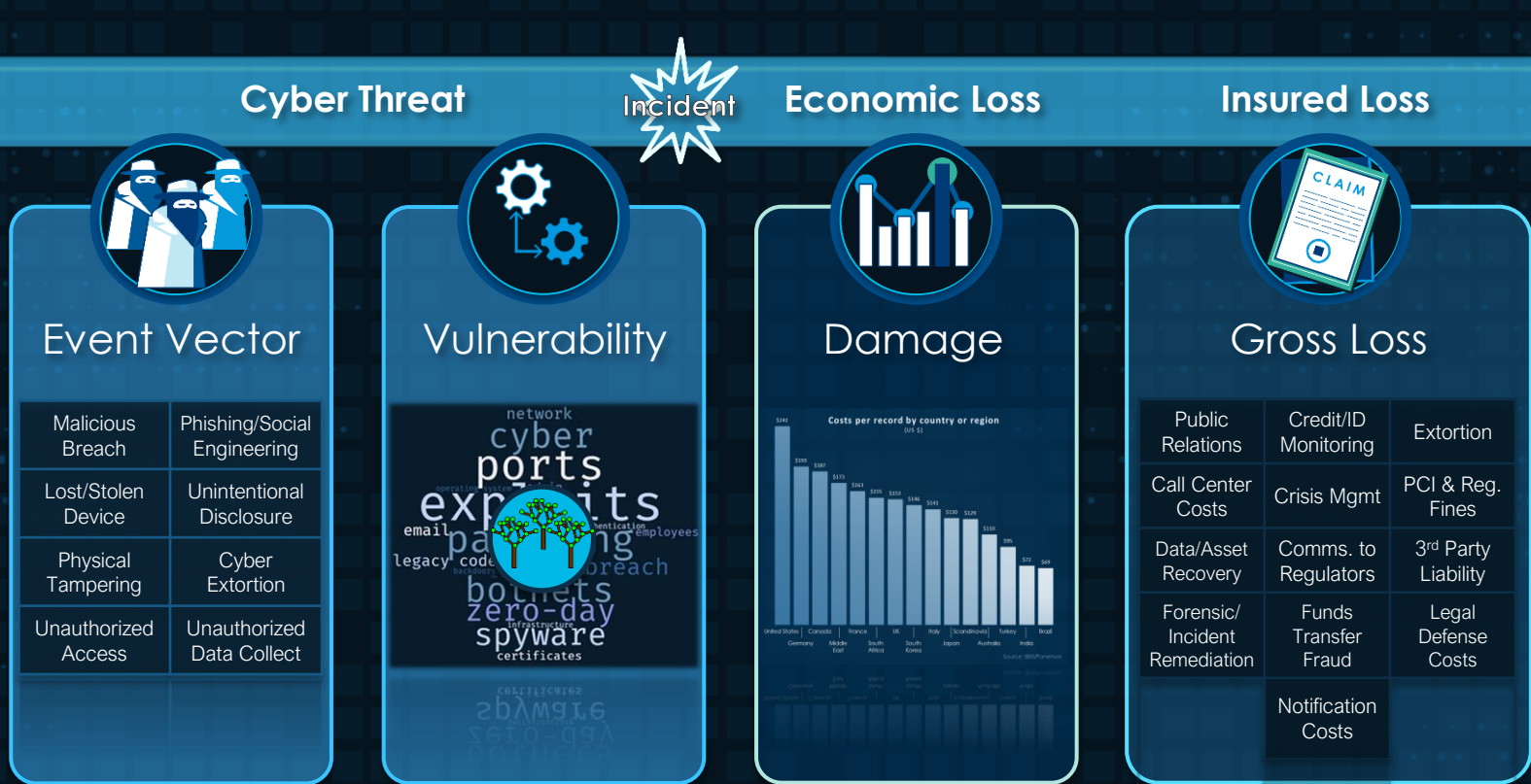
Security Breach Frequency Varies by Company Size



Security Breach Frequency Varies by Company Size



# Individual Risk Events: From Attack to Loss



### Event Vector

Malicious Breach	Phishing/Social Engineering
Lost/Stolen Device	Unintentional Disclosure
Physical Tampering	Cyber Extortion
Unauthorized Access	Unauthorized Data Collect

### Vulnerability

### Damage

Country/Region	Cost (US \$)
United States	5141
Germany	5055
Canada	5187
France	5175
UK	5153
Italy	5141
Japan	5130
Australia	5130
India	5072
Brazil	5051

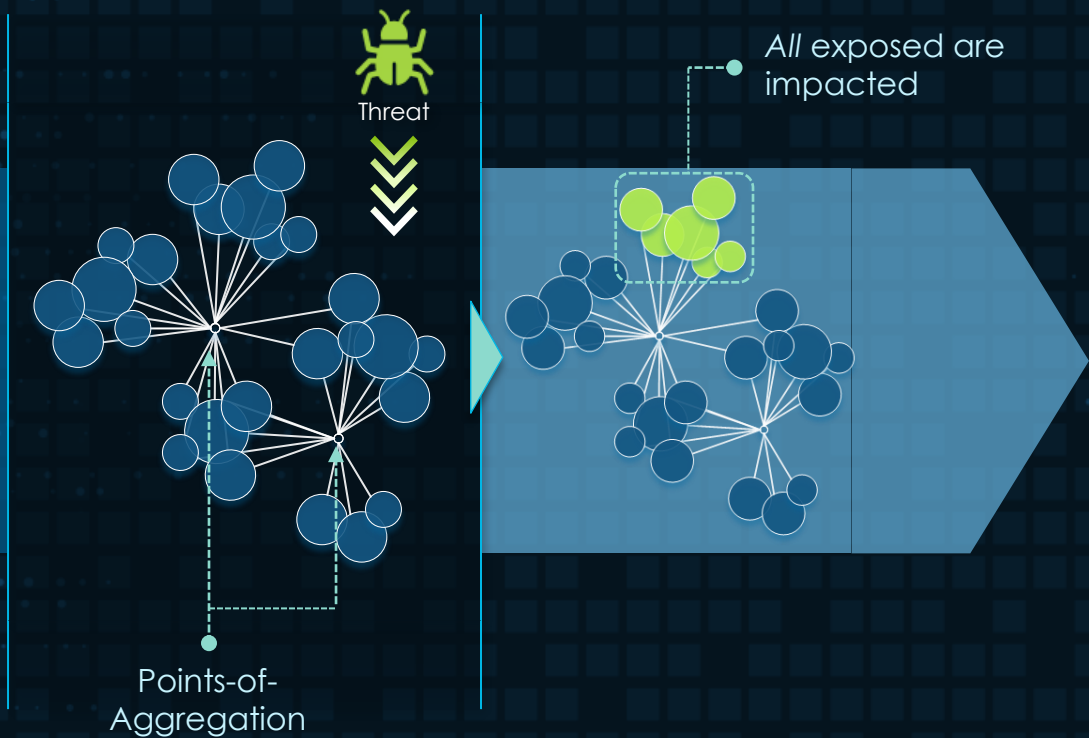
### Gross Loss

Public Relations	Credit/ID Monitoring	Extortion
Call Center Costs	Crisis Mgmt	PCI & Reg. Fines
Data/Asset Recovery	Comms. to Regulators	3rd Party Liability
Forensic/Incident Remediation	Funds Transfer Fraud	Legal Defense Costs
	Notification Costs	

# Aggregation Events

Complete and  
Partial Aggregation

# Capturing Complete Aggregation



## Cloud Down

Joint report with Lloyd's of London (2018)

<https://www.lloyds.com/news-and-risk-insight/risk-reports/library/technology/cloud-down>



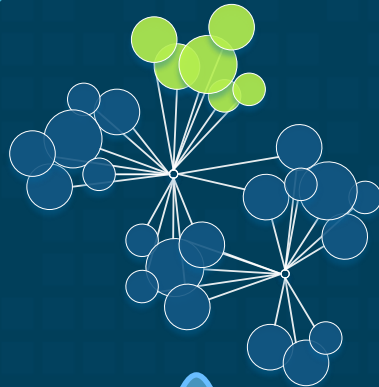
# Complete Aggregation: Across the Virtual Supply Chain

## Points of Aggregation



- **Cloud Providers**
- Email Providers
- Ad Provider
- SSL Certificate
- CDN Provider
- DNS Provider
- Payment Processor

## Event Generation

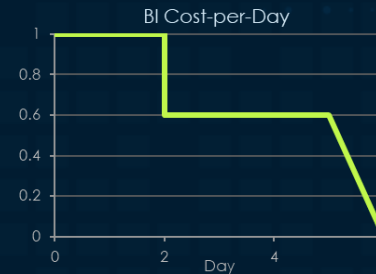


Traditional stochastic modelling techniques

## Event Severity



- ✓ Impacted Regions
- ✓ Back-up Plans
- ✓ Recovery Schedules

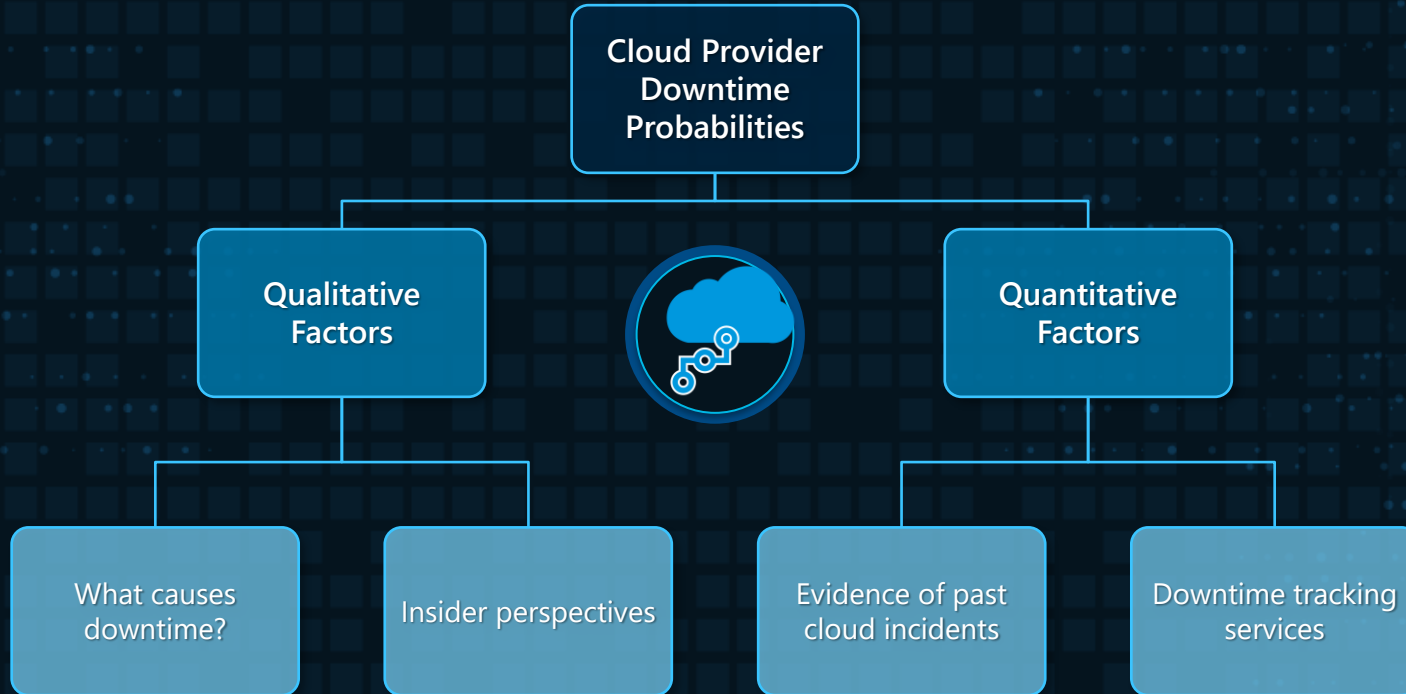


## Insured Loss

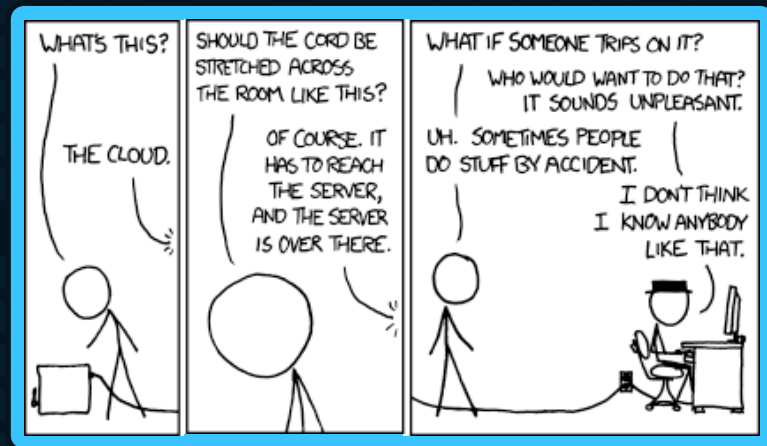
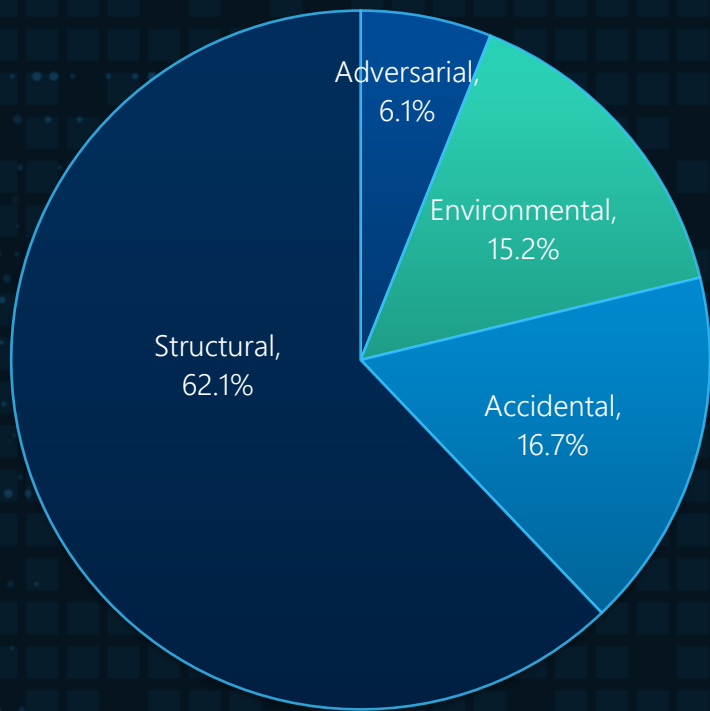
Business Interruption



# Assigning Downtime Frequencies – Not All Clouds Are Created Equal

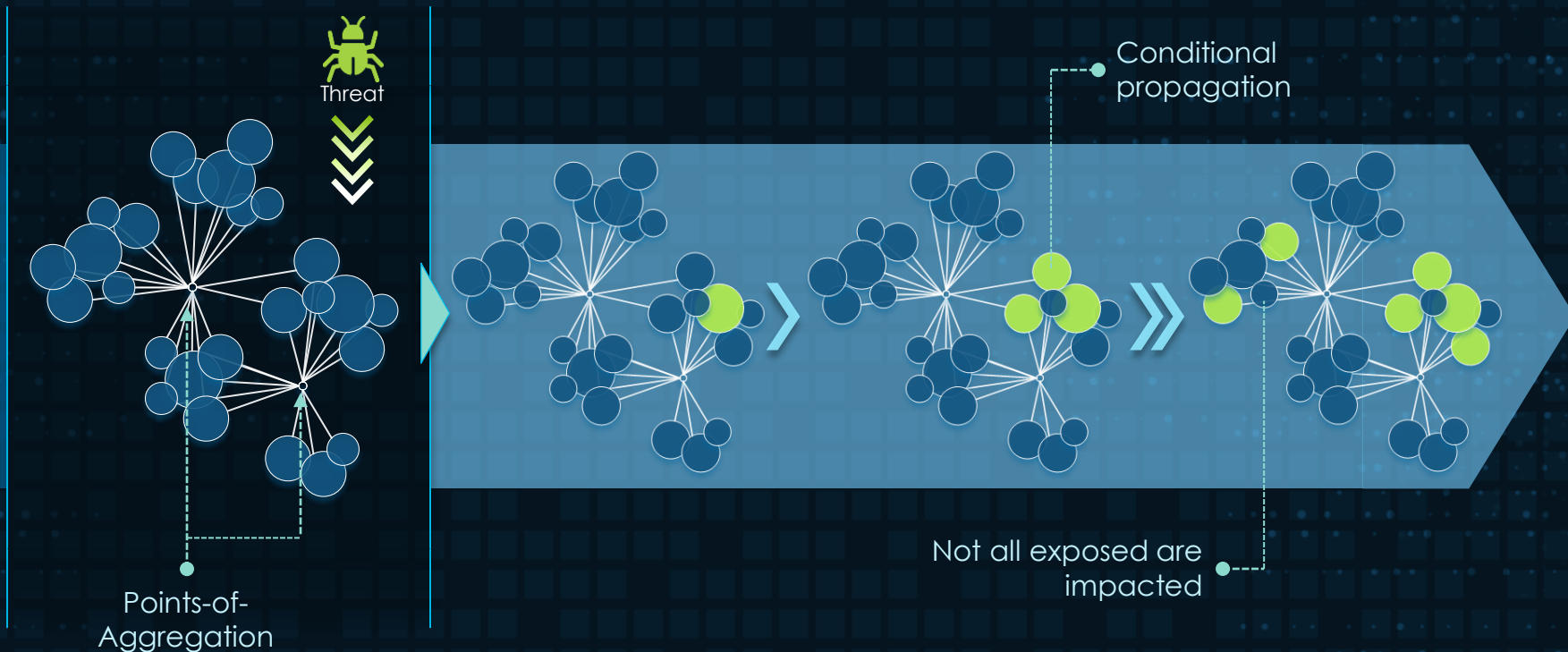


# Clouds Can Fail for a Variety of Reasons



Source: XKCD webcomic

# Partial Aggregation as a Model for Systemic Risk

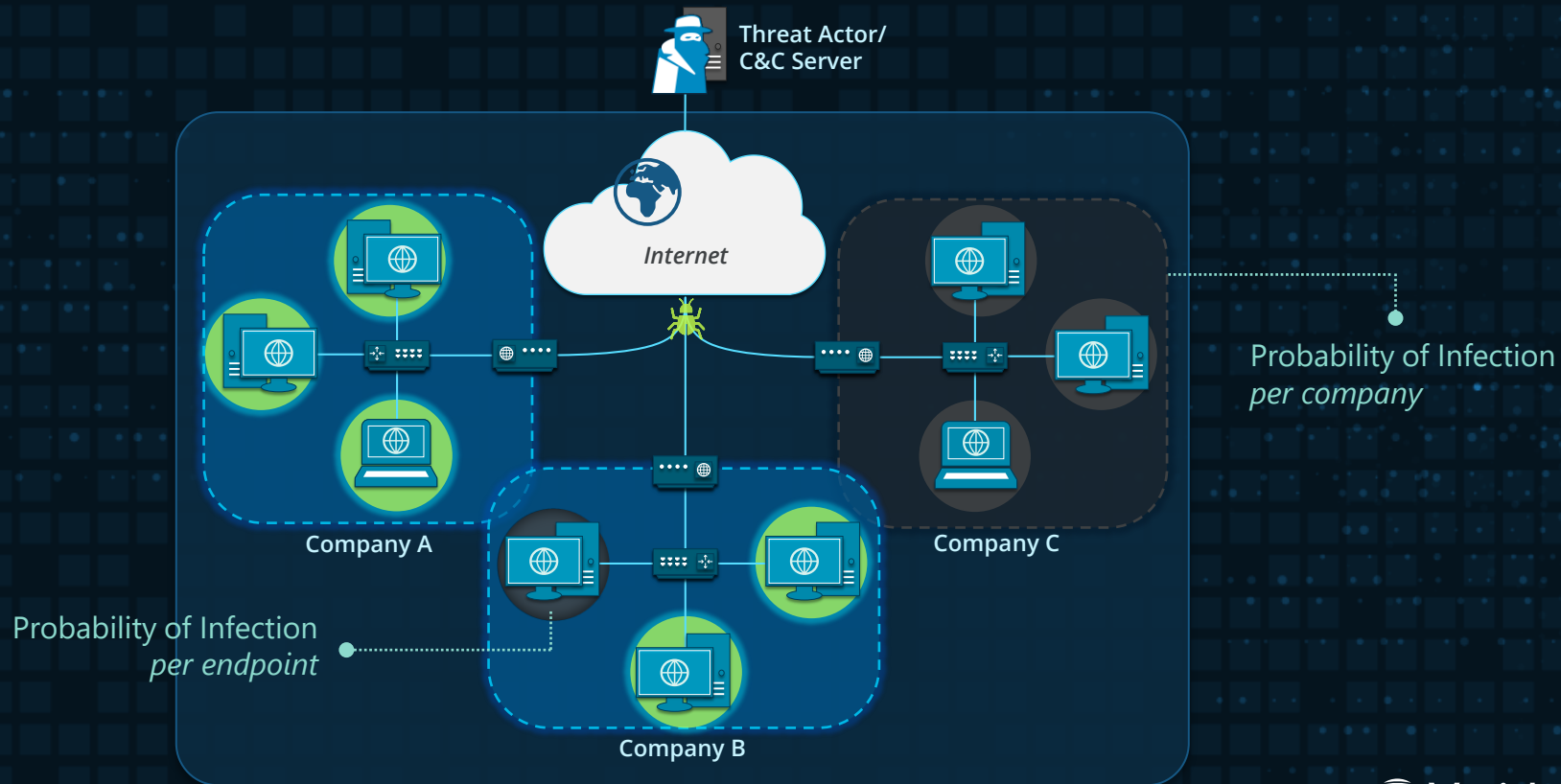


# Parameterising Points-of-Aggregation

Bad Rabbit  
 Cerber  
 CryptoLocker  
 CryptoWall  
 Crysis  
 CTB-Locker  
 DoubleLocker  
 Filecoder  
 GoldenEye  
 Jigsaw  
 KeRanger  
 LeChiffre  
 LockerGoga  
 Locky  
 Maze  
 NotPetya  
 Petya  
 Spider  
 TeslaCrypt  
 TorrentLocker  
 WannaCry  
 ZCryptor

<b>Operating System</b>	Windows (x4)		Mac OS		Linux/UNIX	
<b>Geo-Targeted?</b>	Yes					No
	Ukraine	Israel	United States	China	... (x21)	
<b>Industry</b>	Yes					No
	Education	Finance & Insurance	Professional Services	Retail Trade	...	
<b>Cyber Hygiene Scores</b>	Patching Cadence	P2P File Sharing	Spam Propagation	Potentially Exploited	Botnet Infections	
	GOOD		AVERAGE		POOR	

# Infection Rates as a Proxy for Conditional Spread



# Partial-Aggregation for Systemic Ransomware



# Concluding Remarks



## Concluding Remarks

- Risk models must innovate and adapt to the challenges introduced by cyber
- Appropriate data and flexible frameworks are required to capture cyber's complexity
- There are no right answers, but there are certainly wrong ones



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