



SOLVING
CYBER RISK
PROTECTING YOUR
COMPANY AND SOCIETY

ANDREW COBURN
ÉIREANN LEVERETT
GORDON WOO

WILEY



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A Risk Management Framework for Cyber Security

***“If you can’t measure it,
you can’t improve it.”***

Peter Drucker

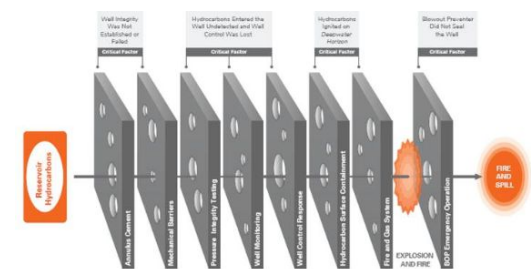
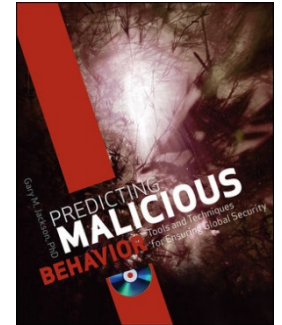
1909 - 2005

The cyber security market is massive;
but what cyber security expenditure
is most cost-effective?



Principles for Modeling Man-Made Catastrophe Risk

- The malicious behavior of terrorists, hackers and saboteurs, requires an adversarial **game theory** perspective.
- The universal prevalence of human error requires **probabilistic fault-tree analysis**.
- The common occurrence of near-misses requires **counterfactual disaster risk analysis**.



Adapted from James Reason (Hampshire: Ashgate Publishing Limited, 1997).
Figure 1. Barriers Breached and the Relationship of Barriers to the Critical Factors.

ON WAR

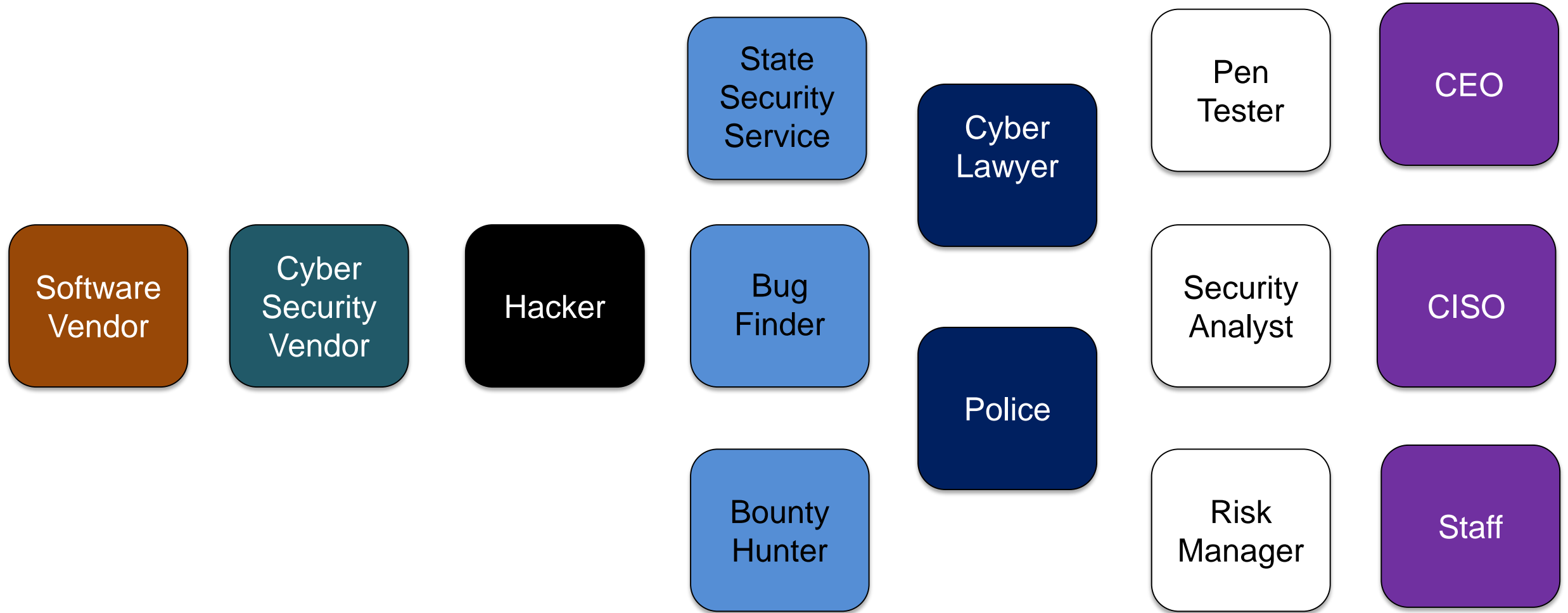


Carl von Clausewitz

“Perfecting the art of warfare entails knowing not only what has occurred in previous wars,

....but also everything that could have occurred.”

Cyber Attackers, Defenders, and Targets

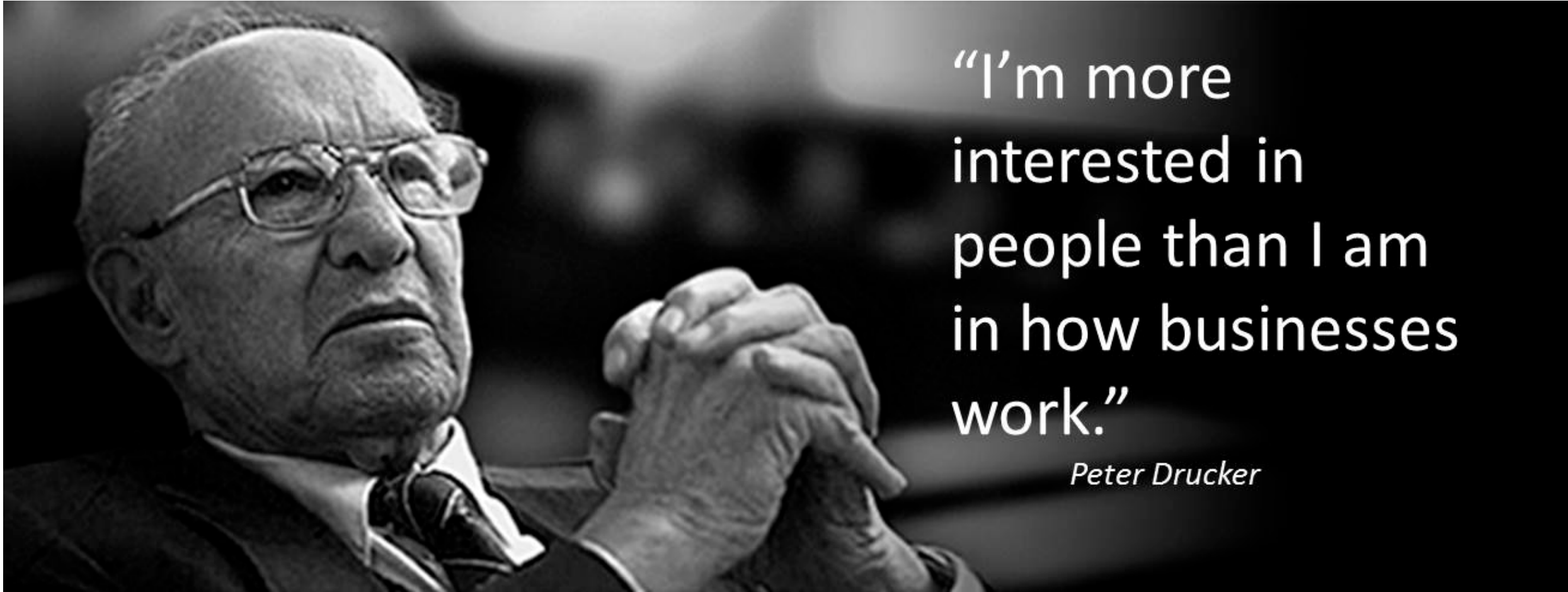


Six Positive Attributes for Cyber Resilience

- Top-level commitment to recognizing and valuing human performance
- A just culture supporting the reporting of issues up through the organization
- A learning culture benefiting from both good and bad experiences
- Awareness of the true state of defences, and their state of degradation
- Preparedness for problems, especially in human performance
- Organizational flexibility to adapt that maximizes ability to solve problems

Anticipate, Withstand, Recover, and Evolve

A Risk Management Framework for Cyber Security



“I’m more interested in people than I am in how businesses work.”

Peter Drucker



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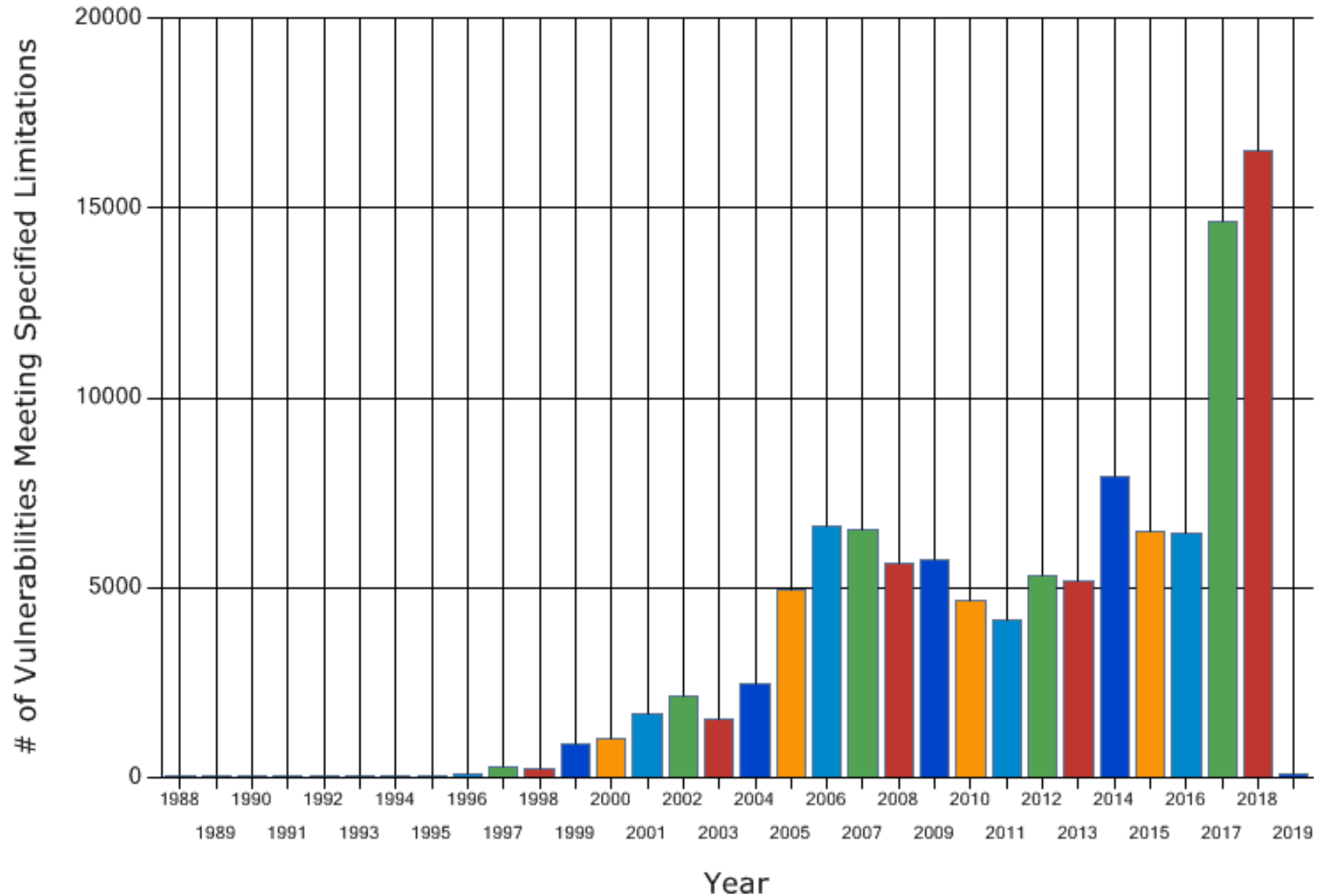
How many Vulnerabilities Are There? Easy to Ask, Much Harder to Answer...

- We do have national vulnerability databases
 - **111,228 Current Vulnerabilities**
- We have product dictionaries
 - **169,827 Software products**
- ***Stats from one national vulnerability database***
 - Different countries, sometimes different software
 - Different countries, different vulns, standardised naming coming soon*

*Fingers crossed

Beware of Linear Extrapolation.

Total Matches By Year

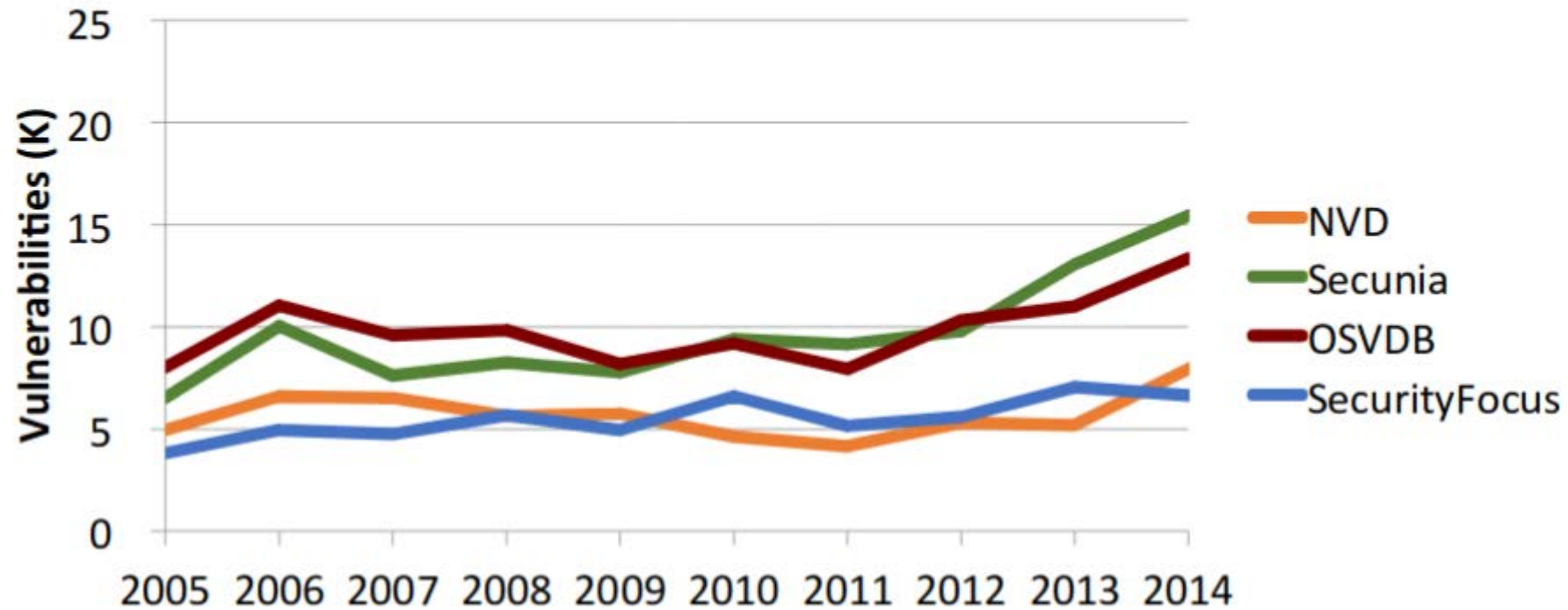


Some years more vulnerabilities are found than the existing database.

This can happen for many reasons.

Before...

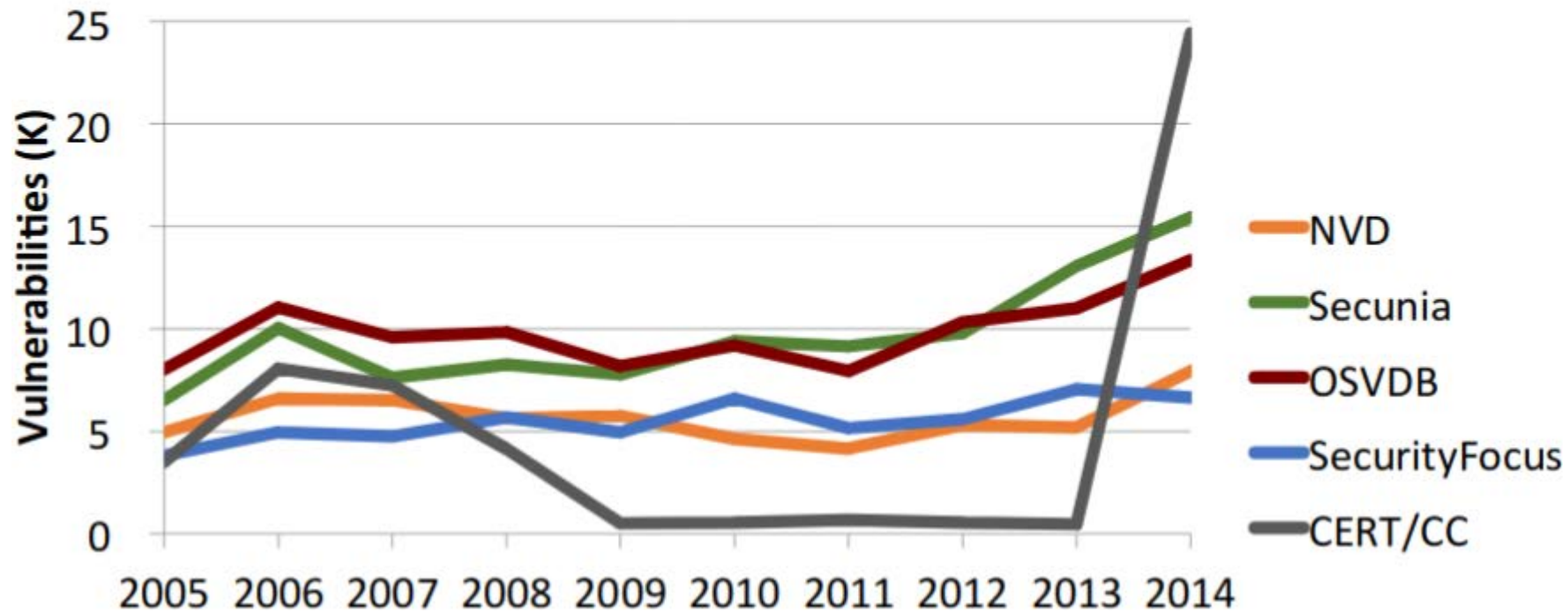
- How many vulnerabilities are there?
 - Public disclosures in a year?



With Thanks to A. Manion, M. Tereda, and T. Uchiyama

...After One New Tool Becomes Available

- CERT/CC automated Android SSL testing
 - Tested ~1M apps, found ~23K vulnerabilities



With Thanks to A. Manion, M. Tereda, and T. Uchiyama

What Dangers are There for Linear Extrapolation?

- Growth of vulnerability finders and tools
- Growth of software and version numbers
- Growth of deployments
- Growth of address spaces
- Growth in number of users
- All of the above

How Do We Normalise Stats in N Dimensions?

- If we have growth in:
 - Populations
 - Addressable computers
 - Bandwidth
 - Installations
 - Users
 - Computers
 - Attacks
 - Attackers
 - We need to be careful with these numbers!
 - See Eric Jardine's paper:
 - Mind the denominator: towards a more effective measurement system for cybersecurity

For Example, our Book Reached #5 on Amazon in Risk Management

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Best Sellers in Risk Management

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#6 	#7 	#8 	#9 Wealth, Actually Frazer Rice	#10

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...on the Same Day as Oscar Wilde Reached #8 in Financial Insurance

← → ↻ 🏠 https://www.amazon.co.uk/gp/bestsellers/books/268183/ref=pd_zg_hrsr_books_1_4_last ⋮

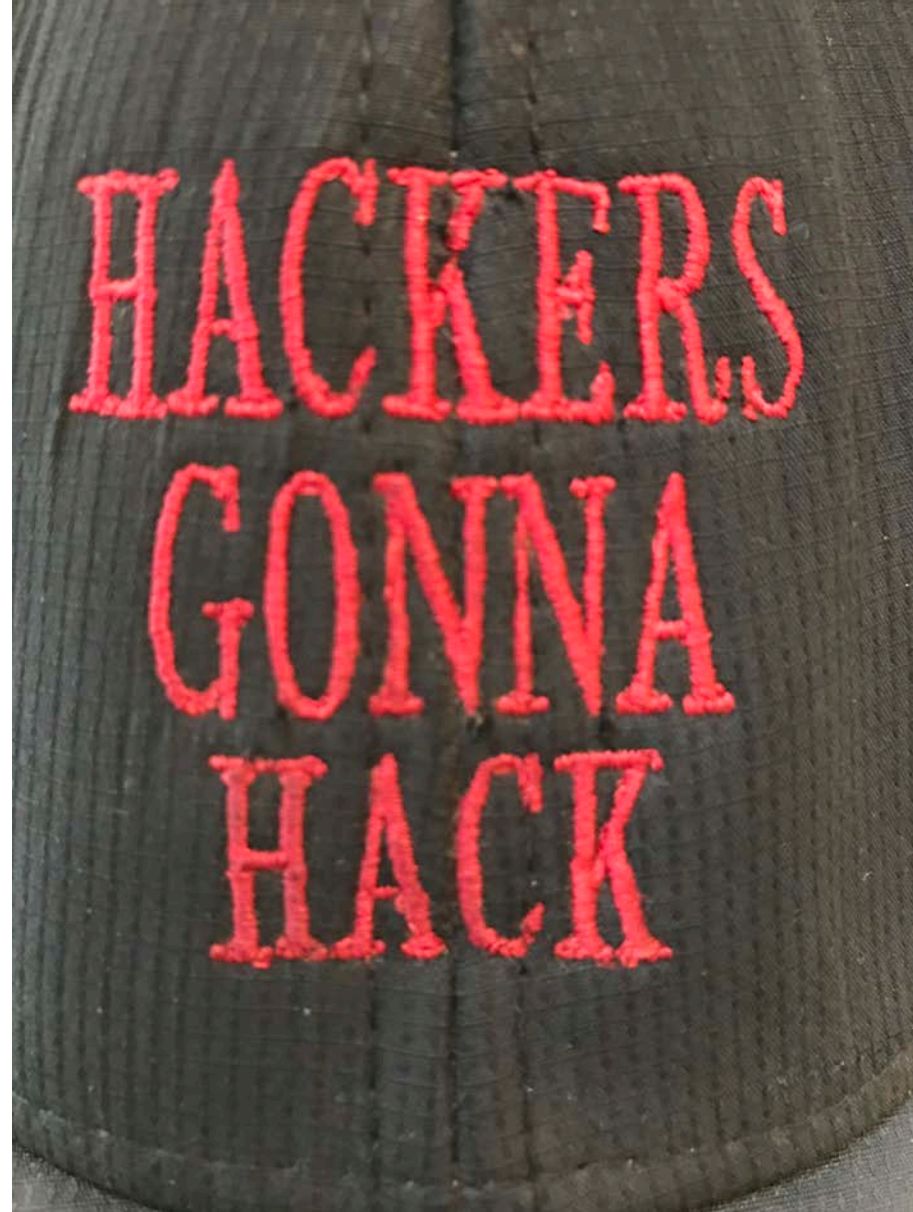
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Personal Finance
Budgeting
Financial Planning
Insurance
Investing
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Mortgages
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PRIME ORIGINAL
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PRIME ORIGINAL
FROM CLAYTON'S JACK RYAN

Primarily Because I like Gaming Stats and Oscar Wilde...





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A Two Year Journey



1. LOSS - how
- History - Cybercrime total loss
- Counterfactual - How much would it have been? (if not)
- Geography - Non-physical

2. Types of Loss/Attacks + ELKS
- Data Breach/Leak
- Denial of Service (DoS) - used for a backdoor

3. Lifes + Exploits (EL)
- Time to live in software - Improved
- Zero-Day
- Vulnerability Database - LISTS scores - for marketing & price
- Remediation of CVEs
- Business Model - Hackonomics
- Data Markets
- Forging or Objectives
- Opportunity
- Get Next - how long for year
- Resources or Capabilities - how much of them

4. Security + Law Enforcement (AL)
- Prosecution of cybercriminals
- CERTs

5. Risk + Governance (GR)
- Security
- EL
- AL
- GR

6. Cyber Law
- State of Cyber Law
- Legislation, Regulation, Litigation
- Algorithmic Law

7. Cyber Insurance
- Economics
- Cyber risk for corporate world
- Actuarial
- Cyber Claims

8. Cyber Resilience for Organizations
- Resilience
- Cyber Resilience

9. Cyber Insurance (IE)
- Cyber Risk - Evaluation
- Resilience
- Pricing
- Actuarial
- Cyber Claims

10. Cyber Insurance (IE)
- Cyber Risk - Evaluation
- Resilience
- Pricing
- Actuarial
- Cyber Claims

11. Cyber Insurance (IE)
- Cyber Risk - Evaluation
- Resilience
- Pricing
- Actuarial
- Cyber Claims

12. Cyber Insurance (IE)
- Cyber Risk - Evaluation
- Resilience
- Pricing
- Actuarial
- Cyber Claims



Cambridge Centre for Risk Studies Research Team

Centre for
Risk Studies






UNIVERSITY OF
CAMBRIDGE
Judge Business School

Centre for Risk Studies Executive Team

 Prof Danny Ralph <i>Academic Director</i>	 Dr Michelle Tuveson <i>Executive Director</i>	 Dr Andrew Coburn <i>Chief Scientist</i>	 Simon Ruffle <i>Director of Research & Innovation</i>
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Centre for Risk Studies Research Team

 James Bourdeau <i>Geopolitics and Cyber Terrorism</i>	 Dr Jennifer Daffron <i>Behavioural Science of Catastrophe Risk</i>	 Tamara Evan <i>Geopolitics and Cyber Terrorism</i>	 Andrew Smith <i>Cyber Risk and Economics</i>	 Kelly Quantrill <i>Data Scientist</i>
 Oliver Carpenter <i>Resilience Analysis and Risk Recovery</i>	 Ken Deng <i>Corporate Finance and Risk Modelling</i>	 Philip Cameron <i>Mathematical Models and Cyber Risks</i>	 Kayla Strong <i>Insurance and Clash Modelling</i>	 Jayne Tooke <i>Centre Administration</i>
 Jennifer Copic <i>Insurance Loss Modelling</i>	 Tim Douglas <i>Cyber Risk Modelling</i>	 Olivia Majumdar <i>Corporate Risk</i>		

Risk Researchers and Consultants

 Dr Jay Jung <i>Financial Risk</i>	 Dr Scott Kelly <i>Economics and Environmental Risk</i>	 Dr Duncan Needham <i>Financial History</i>	 Dr Stephen Platt <i>Social Science and Disaster Recovery</i>	 Dr Andrew Skelton <i>Senior Risk Researcher</i>
 Lee Coppack <i>Insurance Media Advisor</i>	 Eireann Leverett <i>Cyber Risk and Security</i>	 Dr Edward Oughton <i>Infrastructure Risk</i>		

RMS Cyber Risk Team



Business Development



Adam Sandler
Cyber Business
Lead



Tom Harvey
Cyber
Sr. Product Manager



Kathleen Maloney
US Cyber Solutions
Lead



Danielle Smith
Sr. Product
Management Analyst



Peter Ulrich
Cyber Business
Development

Cyber Risk Research



Dr Andrew Coburn
Cyber Research
Lead



Dr Gordon Woo
Catastrophist,
Man-made Peril Expert



Dr Robert Muir-Wood
Chief Research
Officer

Cyber Model Development



Dr Christos Mitas
Head of Cyber
Model Development



Dr Hichem Boudali
Cyber Model
Development



Chris Vos
Cyber Model
Development



Ieuan George
Cyber Model
Development



Simon Arnold
Software
Development Lead



John Agordiantis
Cyber Model
Development



EunJin Kim
Software
Development



Edida Rajesh
Sr. Director Cyber
Model Development



Parveen Singh
Cyber
Data Scientist



Vicky Suman
Cyber
Data Scientist

Consulting and Client Support



Eddie Lister
Lead
Consultant



Rowena McGill
Model
Analyst



Theodore Smith
Manager,
Model Specialist



Cailey Palmer-Rohorst
Senior Model
Specialist



Sarah Payne
Model Analyst

RMS Analytical Services

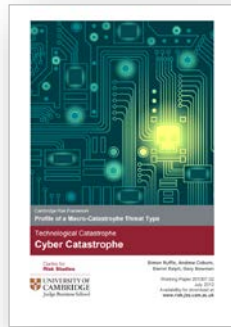


Satya Guda
Manager
Analytical Services

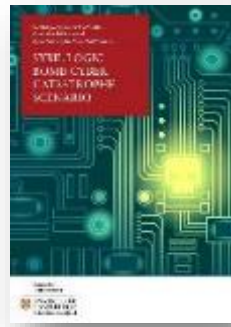


Ruchika Khanna
Cyber
Risk Analyst

Six Years of Cyber Risk Research



2013
Cyber Catastrophe
Threat Monograph



2014
Sybil Logic Bomb
Stress Test
Scenario



2015
Business Blackout
CNI Scenario



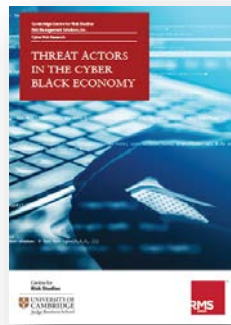
2016
Exposure Data Schema
and Accumulation Risk



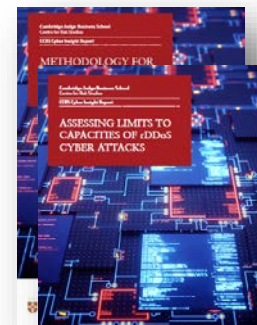
2017
Cyber Risk
Landscape Monitoring



2018
Cyber Risk
Outlook



2018
Threat Actors in the
Cyber Black
Economy



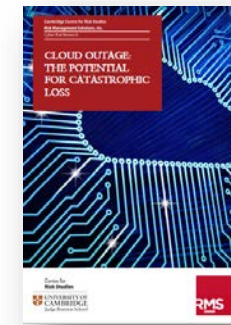
2018
Assessing Limits to
Capabilities of rDDoS
Cyber Attacks



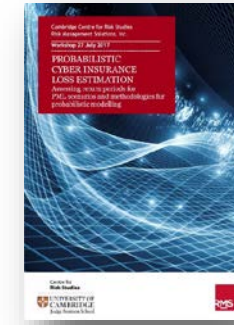
2018
Insights from the
MISP Database



2018
Assessing the Impact
of Global ISP Outages

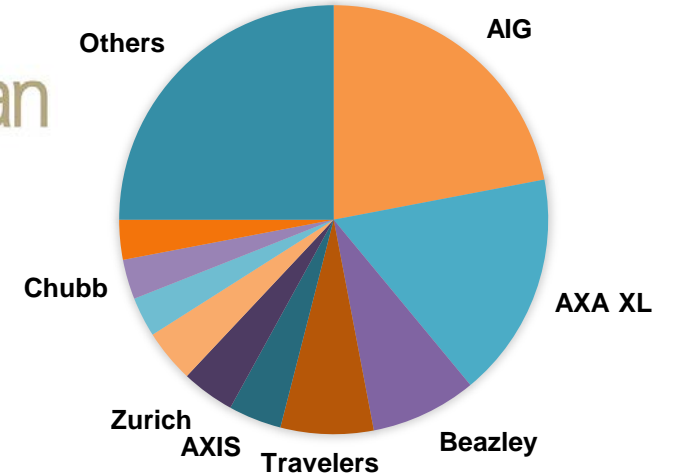


2018
Cloud Outage: The
Potential for
Catastrophic Loss



2018
Probabilistic
Cyber Assessment

Working With Many of the World's Leading Cyber Insurance Players

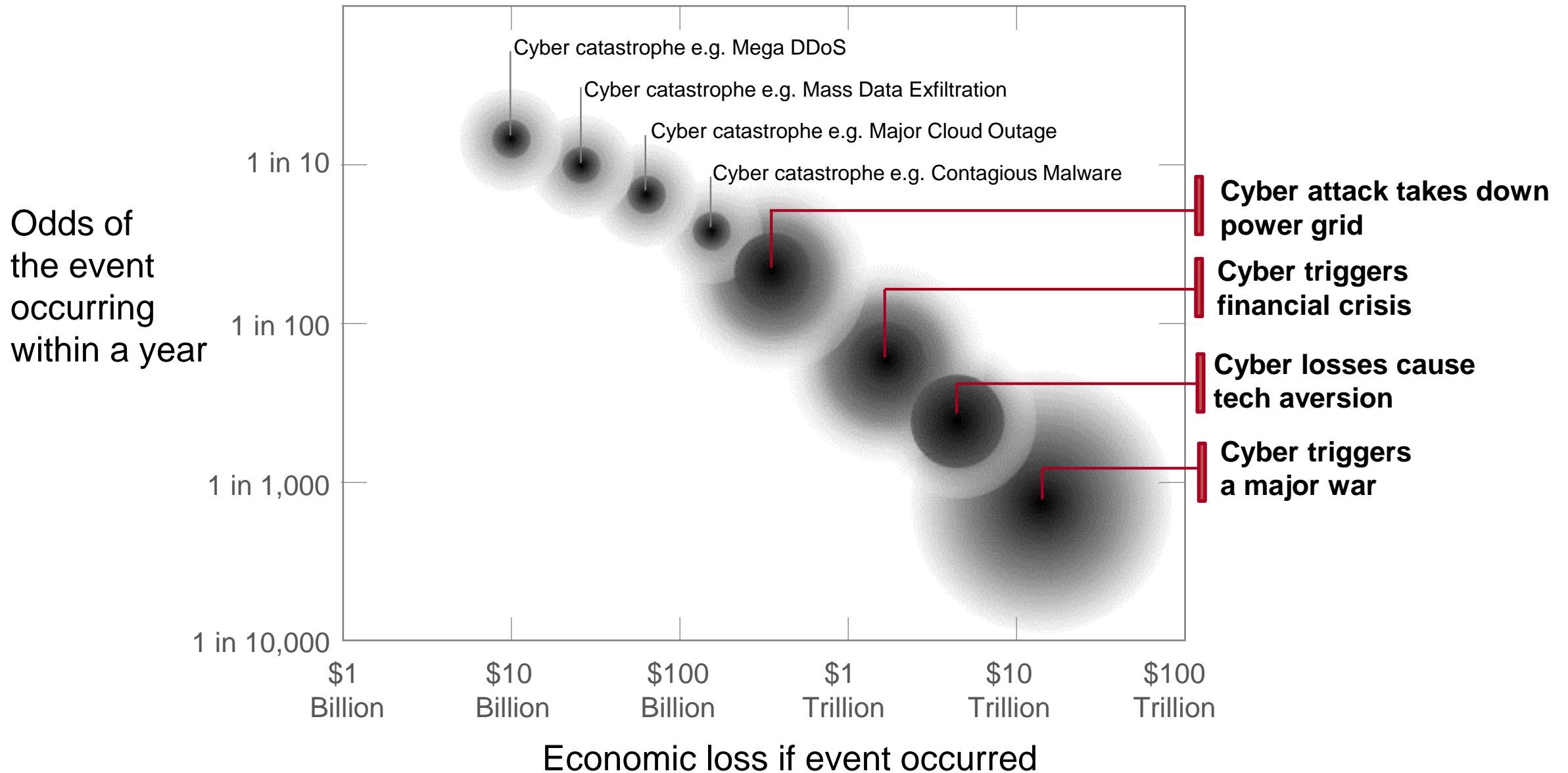


Cyber Loss: A Modern Plague

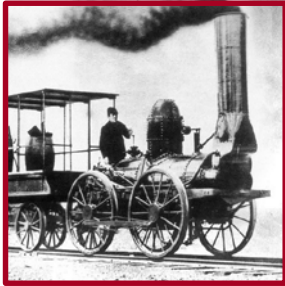
- 1,000 companies a year report a theft of protected data
- A data theft of 10 million records can cost a company a billion dollars
- Over 3 billion personal data records have been stolen in US
 - Enough for each citizen to have lost their personal details 10 times
- Companies suffer attempted denial of service attacks every 8 minutes
- One in every 100 e-mails is suspected to carry malware
- Online financial theft is estimated at tens of billions of dollars a year
- Less than a hundred people were sent to jail for cyber crime in 2017

- **We estimate that cyber loss accounts for over \$500,000,000,000 a year**
 - **Around 2% of Global GDP**

The Potential for a Cyber Catastrophe



Cyber Jeopardizes the 4th Industrial Revolution



1st Industrial Revolution

The Steam Age

1760 to 1830

GDP per capita (2019 value)

\$1,800 to \$3,600



2nd Industrial Revolution

The Technology Age

1870 to 1914

GDP per capita (2019 value)

\$4,800 to \$8,000



3rd Industrial Revolution

Globalization

1970 to 2008

GDP per capita (2019)

\$17,400

to

\$40,000



4th Industrial Revolution

The Digital Age

2019 to ???

GDP per capita

\$38,200

to

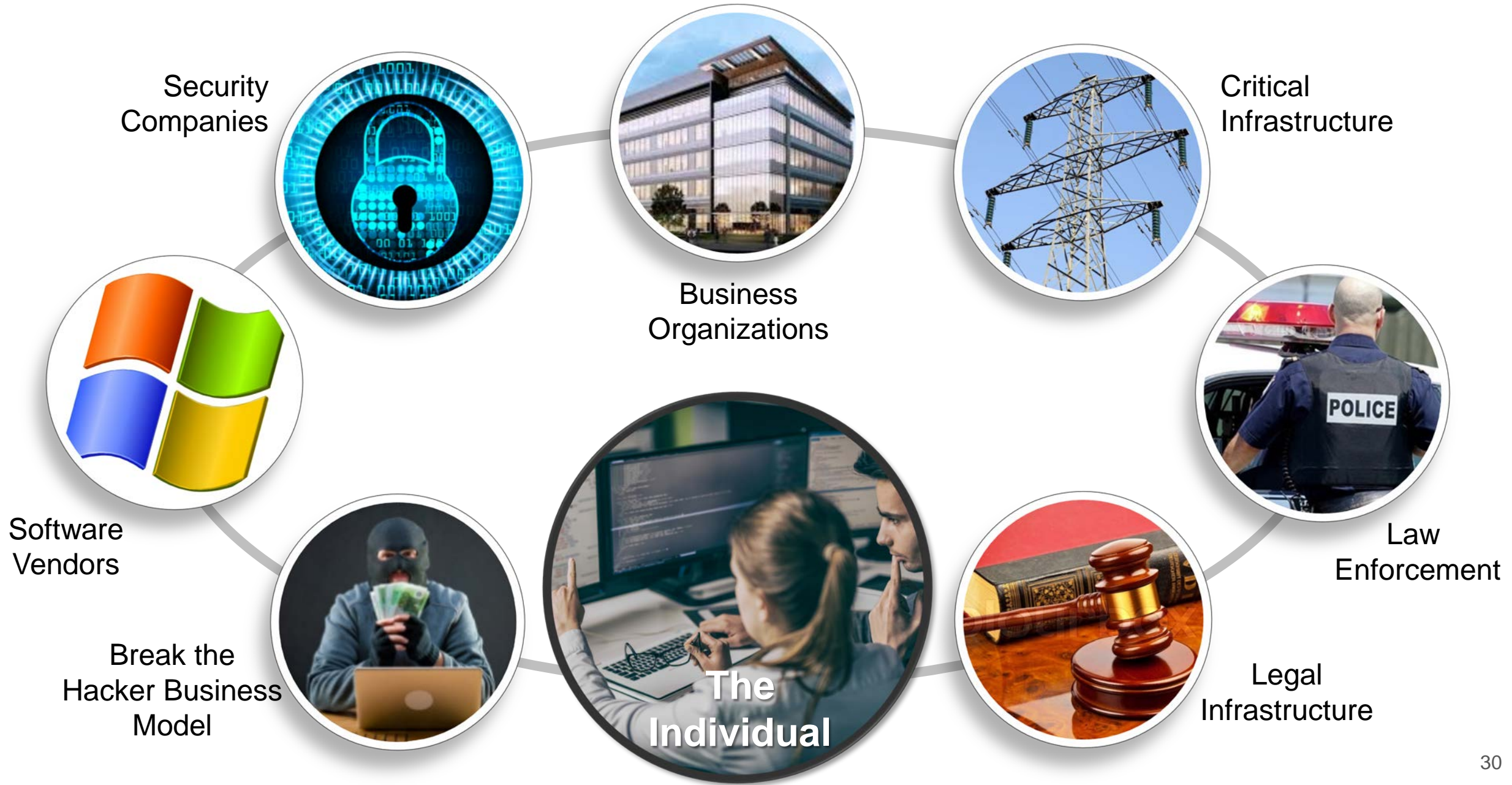
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What's in a Title?

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Solving Cyber Risk





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