Modelling Cyber and Liability Insurance Risk

Dr Milan Simic, EVP and Managing Director
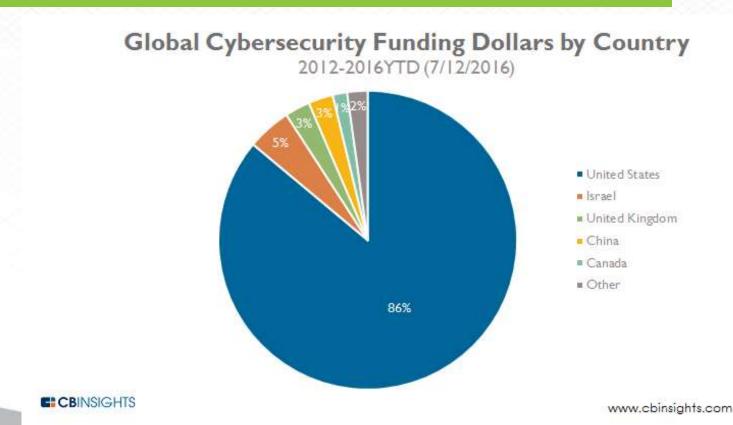
AIR WORLDWIDE®

Overview

- **Modelling Cyber Insurance Risk**
  - Cyber insurance – risks, market and challenges
  - Review of recent events
  - Role of Verisk/AIR in managing cyber risk
  - Recently launched ARC (Analytics of Risk from Cyber) tool

- **Modelling Liability Insurance Risk**
  - Liability insurance and casualty LOBs
  - Modelling approach
  - Arium platform demo
  - Stochastic modelling developments

Cybersecurity Investment Is Increasingly Global with Israel Leading Non-US Countries

Global Cybersecurity Funding Dollars by Country
2012-2016YTD (7/12/2016)

- United States — 86%
- Israel — 5%
- United Kingdom — 3%
- China — 3%
- Canada — 1%
- Other — 2%

CBINSIGHTS

www.cbinsights.com

Cyber Insurance

What is Cyber Risk?

Cyber Risk Loss Types

- Data breach
- Business Interruption
- Physical Damage
- Extortion / Ransom

Cyber Insurance Categories

- 1st party loss
- 3rd party liability

Company Records Targeted

- PCI
- PHI
- PII
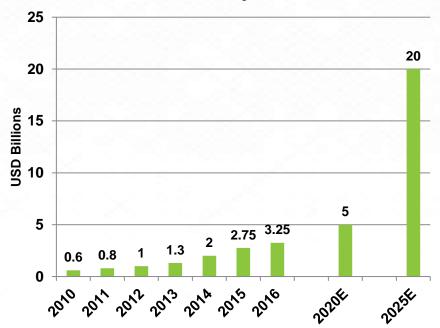
The Global Cyber Insurance Market Is Growing Rapidly

U.S. Insureds Cyber Premiums

Bar chart showing USD Billions:
- 2010: 0.6
- 2011: 0.8
- 2012: 1
- 2013: 1.3
- 2014: 2
- 2015: 2.75
- 2016: 3.25
- 2020E: 5
- 2025E: 20

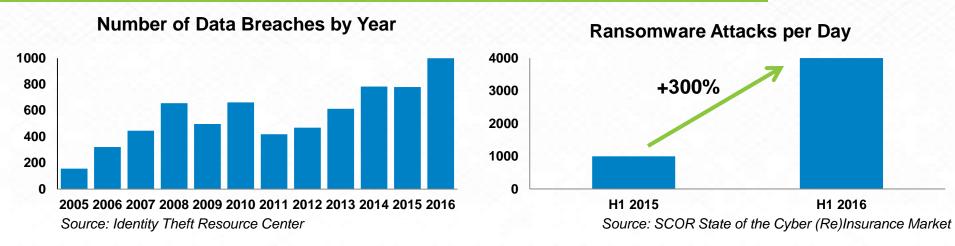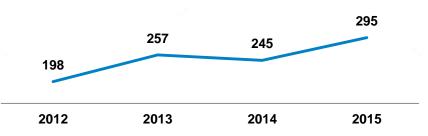*Source: Advisen, Allianz, Betterley Risk Consultants*

- *"The cyber insurance industry is showing real innovation and demonstrates the ability of insurers to develop policies to cover modern, complex risks. Due to the growing importance of this risk class, quality standardised exposure data is critical for increased levels of insurance coverage and better risk modelling."*
  - **Tom Bolt, Lloyd's (formerly)**

- *"Premiums have grown as insureds choose higher limits and select additional types of cyber coverages."*
  - **Betterley Report**

- *"Before, we were selling 1.2 policies for every 10 inquiries; since recent hackings it is 4.2 for every 10 inquiries."*
  - **Senior Executive, Aon Risk**
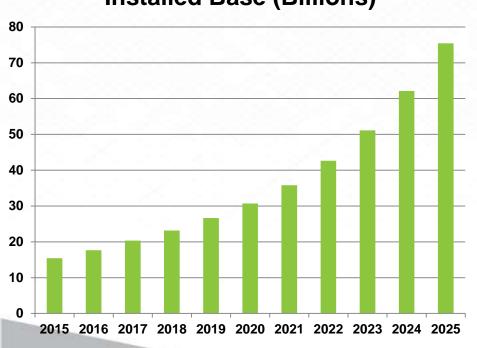
Cyber Risk – Opportunity and Threat

Number of Data Breaches by Year

Source: Identity Theft Resource Center

Ransomware Attacks per Day

+300%

Source: SCOR State of the Cyber (Re)Insurance Market

Reported cyber incidents against US Critical Infrastructure

198   257   245   295

2012   2013   2014   2015
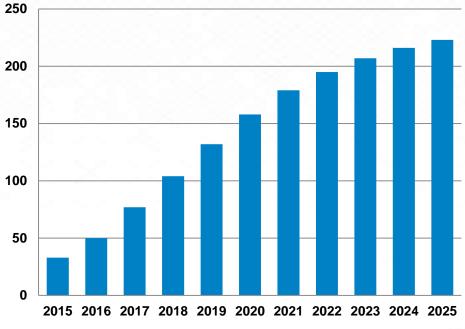
Source: US Department of Homeland Security CONFIDENTIAL

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Future Cyber Exposure is Going to Increase Dramatically

Global Internet of Things Installed Base (Billions)

Source: Ericsson

IaaS Hardware and Software Spending (USD Billions)

Source: Statista

Challenges of the Cyber Insurance Market

Demand Side

- Poor awareness of the risk

- Inconsistent policy wording among carriers

- Limited coverage

Supply Side

- Rapidly evolving risk landscape

- Lack of understanding of exposures

- Accumulation risk uncertainty

Notable Data Breaches 2013-2016

Dyn DDoS Attack (Oct 2016)
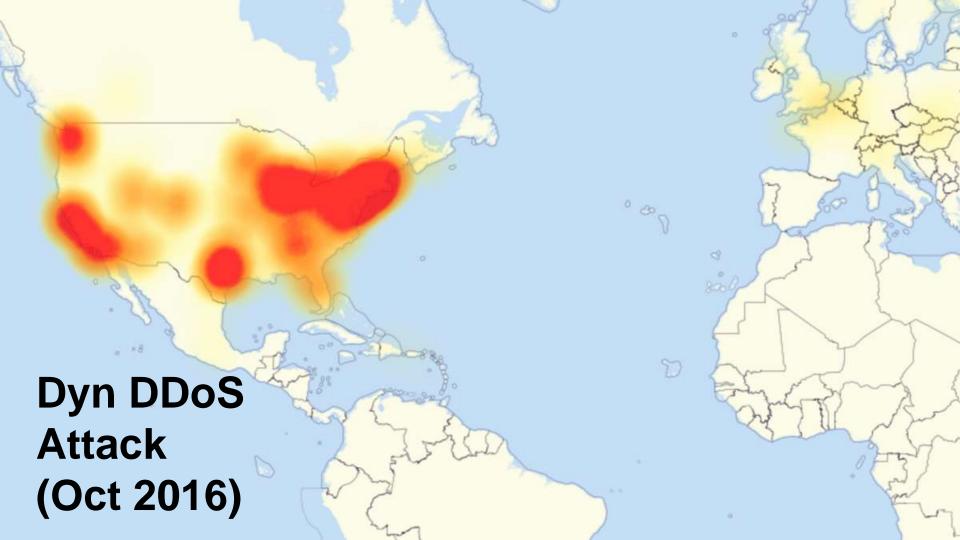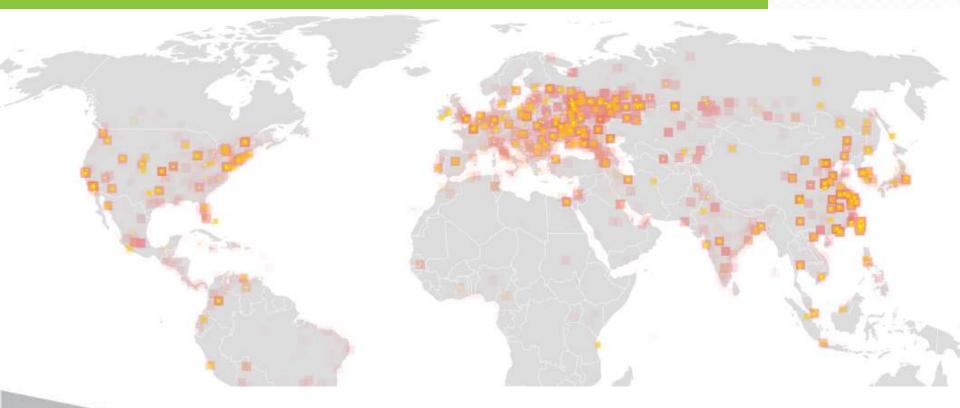
Amazon Web Services Outage (Feb 2017)

WannaCry Ransomeware Pandemic (May 2017)

A hypothetical satellite image of a major Northeast blackout

How Can Verisk and AIR Help?

Verisk Analytics is Committed to Supporting Cyber Insurance Market

Global Risk Research

Underwriting	Portfolio Management	Risk Transfer

Government Relations

Partnerships Help Provide AIR Key Risk Data and Calibrate Models

RiskBased SECURITY

BITSIGHT

(Re)Insurers

- Database of historical worldwide cyber incidents
- Analyses public Internet traffic to unobtrusively give company ratings
- Market feedback and cyber exposure and claims

How Can Cyber Risk Be Managed?

1
- Determine policies with cyber risk

2
- Collect detailed cyber exposure data

3
- Analysis of plausible cyber scenarios

4
- Estimate frequency of cyber incidents

5
- Decision making using modelling insights

1) Which Policies are Exposed to Cyber Risk ?

Standalone Cyber

Cyber Endorsements

Silent Cyber

Silent Cyber Exists with Policy Wording Untested

D&O

E&O

Property

GL

Silent Cyber

2) Cyber Exposure Data Can Be Coded Using the Verisk Cyber Exposure Data Standard

- A cross-market, open source cyber exposure data format

- Includes Cyber Exposure Data Preparer's Guide and a database framework for collecting cyber exposures

- Available on AIR website

Data Requirements for Modeling Cyber Risk Are Minimal

Industry

Revenue

Insurance Terms

	A	B	C	D	E	F
1	Company	Industry	Revenue	Limit	Deductible	
2	XYZ Corp.	Retail	1000000000	1000000	10000	
3						

Company Information - Detailed

Industry	Recovery Plans	Demographics	Revenue	Security
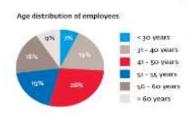
Data Are the Basis of Potential Cyber Losses

Type

Country of Origin

Number and Value

Asset / Storage Record

Transfer Record

AIR

Storage Can Lead to Aggregation Risks

Type

Security

OS Type

Cloud

Transferring Data Introduces Additional Vulnerabilities

Type

Security

Service / Vendor Type

Cloud

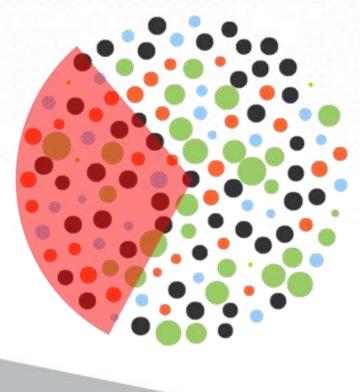# Causes of Loss Can Be Mapped to Unique Coverage Frameworks

Causes of Loss

- Security breach expense
- Security breach liability
- (Contingent) Business interruption

Initial Release
April 2017

- Fines
- Replacement of electronic data
- Website publishing liability
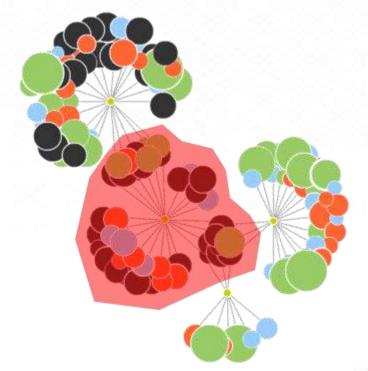- Programming errors and omissions
- Extortion
- Public relations
- Physical

Future Releases

3) Cyber Scenario Modelling Is More Accurate Using the Detailed Accumulation Approach
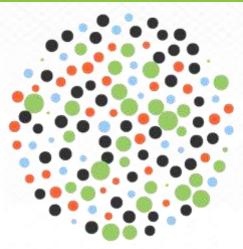
Market Share Approach

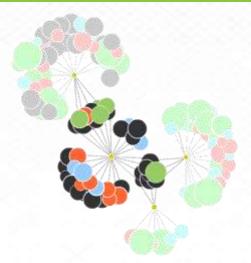**Detailed Accumulation Approach**

Detailed Accumulation Modeling Process

Start:

Uncorrelated view of exposures in portfolio

Step 1:

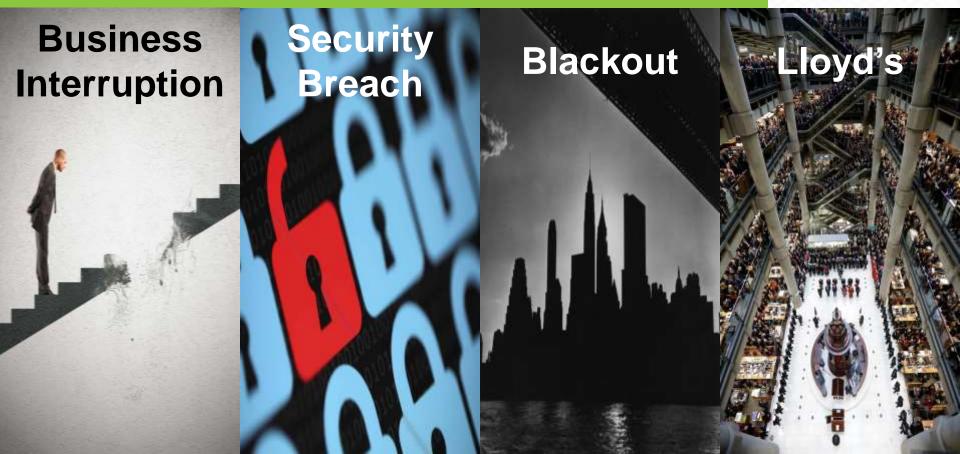**Organize exposures around aggregation points**

Step 2:

Identify exposures that will be impacted by aggregation scenario

Step 3:

Calculate ground-up and insured losses for scenario

AIR Can Model Many Cyber Scenarios

Business Interruption

Security Breach

Blackout

Lloyd's

Make Informed Business Decisions with Deterministic Scenario Modeling Output

Reinsurance decisions

Evaluating limits

Accumulation analysis for underwriting and ERM

Regulatory compliance

Cost-benefit Analysis

Mitigate the risk
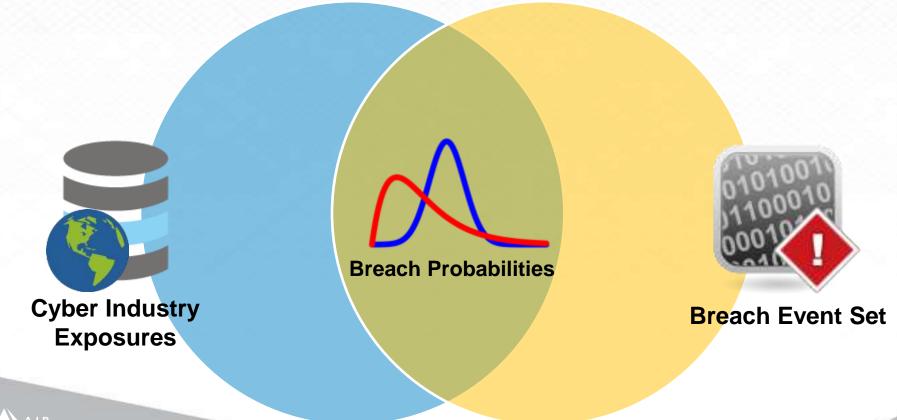
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AIR Is Building a Probabilistic Cyber Model

Yearly probability of breach, by revenue/industry

Given a breach, probability of X records stolen, by revenue/industry

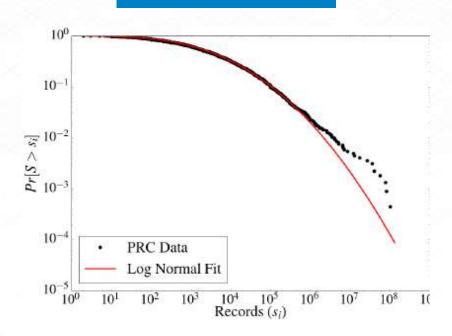Cost of breach, given Y records stolen

AIR

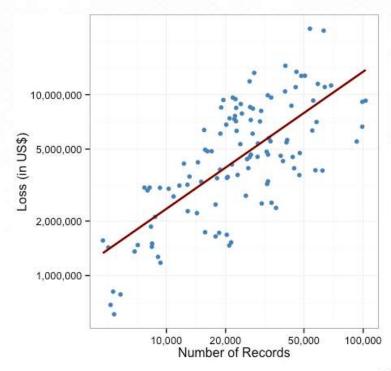# Historical Event Data Leveraged to Determine Breach Probability

Cyber Industry Exposures

Breach Probabilities

Breach Event Set

Breach Severity Data Are Available to Determine Ground-Up Losses

Size of Breach

Cost of Breach

Cyber Security Features Incorporated as Secondary Modifiers in Probabilistic Model

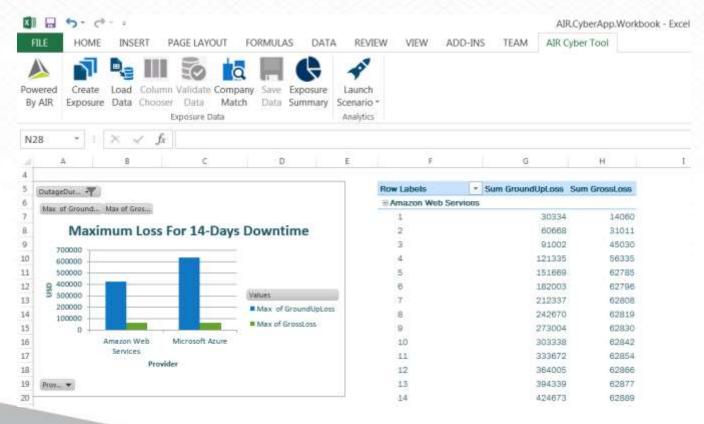**Antivirus Effectiveness**

Intrusion Detection

Email Filters

File Sharing

Firewall Health

Security Ratings

BITSIGHT

ARC (Analytics of Risk from Cyber) Available Now

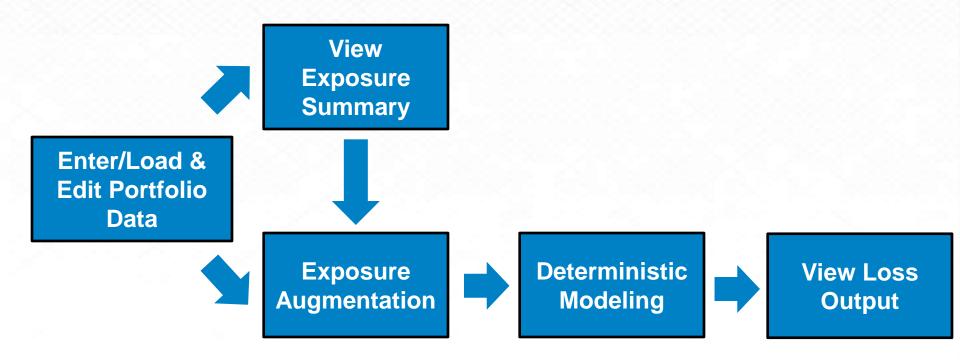# ARC Initial Release Scope

Exposure Management
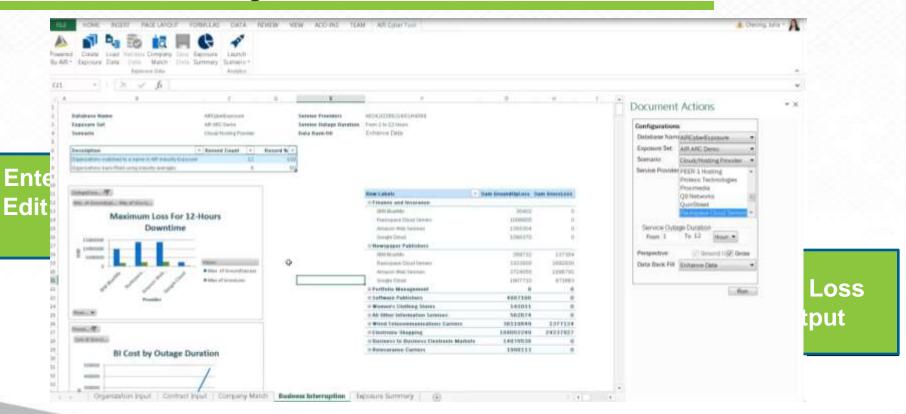
Data Augmentation

Deterministic Modeling

ARC Portfolio Management Workflow

ARC Portfolio Management Workflow

AIR's Cyber Vision

Better Data	Access to industry exposures
Better Models	Probabilistic model More scenario models More causes of loss and granularity Aggregate modeling capabilities
Better Workflows	User experience enhancements Integration capabilities Batch processing

AIR

Overview

- Background
  - Liability insurance and casualty LOBs
  - Potential scale of the problem
  - Why is modelling casualty catastrophes so difficult?
- Modelling approach
- Arium platform demo
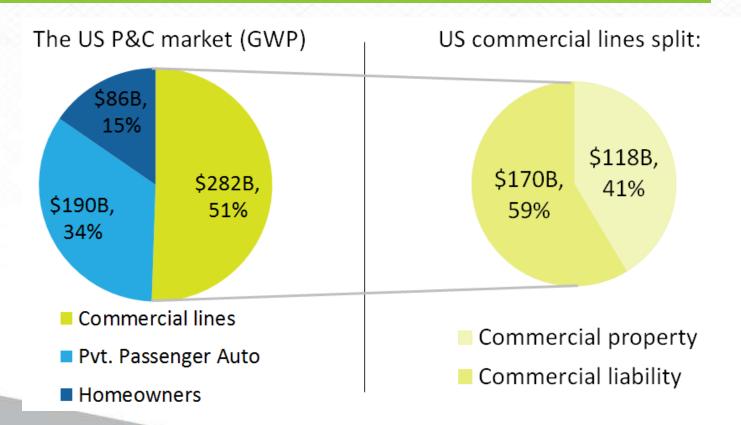- Stochastic modelling developments

Types of P&C Insurance

- Personal Lines
    - Motor
    - Home
- Commercial Lines (including common Casualty LOBs)
    - Workers Compensation (WC)
    - Employers Liability (EL)
    - General Liability (GL/CGL) *UK: Public Liability*
    - Professional Liability
        - Errors and Omissions liability (E&O)
        - Directors and Officers liability (D&O)
    - Product Liability
    - Cyber Liability
    - Commercial Auto (AL)
    - Commercial Property
    - Business Owners Policy – GL and Property (BOP)

US Market as an Example of the Scale of the Problem

The US P&C market (GWP)

- Commercial lines: $282B, 51%
- Pvt. Passenger Auto: $190B, 34%
- Homeowners: $86B, 15%

US commercial lines split:

- Commercial property: $118B, 41%
- Commercial liability: $170B, 59%

Top 10 Causes of Liability Loss (2011-16)

1.	Defective product/work	23%
2.	Collision/crash	22%
3.	Human error	19%
4.	Accidental nature/damage	6%
5.	Slips/falls/falling objects	6%
6.	Water/fire/smoke damage	3%
7.	Environmental damage	3%
8.	Natural hazards	2%
9.	Vandalism/terrorism	1%
10.	Property Damage	1%

Source: Allianz Global Claims Review 2017

Legal Climate Is an Important Factor That Influences Liability Loss Potential

Most litigious countries by capita:
1. Germany: 123.2/1,000
2. Sweden: 111.2/1,000
3. Israel: 96.8/1,000
4. Austria: 95.9/1,000
5. US: 74.5/1,000
6. UK: 64.4/1,000
7. Denmark: 62.5/1,000
8. Hungary: 52.4/1,000
9. Portugal: 40.7/1,000
10. France: 40.3/1,000

Source: "Exploring Global Landscapes of Litigation," Christian Wollschlager

Casualty Catastrophe Modelling Is in Its Infancy

- Casualty cat modelling is where nat-cat modelling was about 30 years ago:
  - No standard accepted framework yet for casualty accumulation tools
  - Portfolio data are not yet standardised but there is continuous improvement and viable solutions
- But, according to AM Best, most insurance insolvencies are down to under-reserving for casualty losses
- Regulators and insurers increasingly concerned about inability to quantify casualty accumulations

Casualty Catastrophes Are Different…

Casualty cats are driven by human factors and sensitive to a (fast) changing legal, technological and social environment

Casualty events and claims can take years to unfold ("long tail") and pose profound challenges for reserving

Casualty losses can vary widely for same event

Casualty events are diverse and (usually) nonrepeating

Modelling Approach
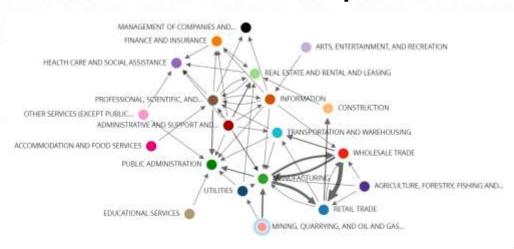
Risk Landscape

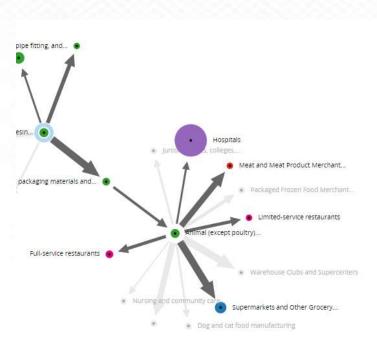- A geographical landscape is for property cats what an economic landscape is for casualty cats

U.S. Geographical Map

U.S. Economic Map

Economic Relationships

Example: Food Scenario Footprint

- Scenarios are liability "storm tracks", the footprint is based on the spread of a product or service up and down a supply chain

- Evidence
  - Back-validated against historical losses
  - Credible results against market expertise
  - Direction of market for assessing and projecting liability accumulations

Arium Tool Data

>1M industry-to-industry trade data serves as a *visual* guide to identify liability footprints and clusters.
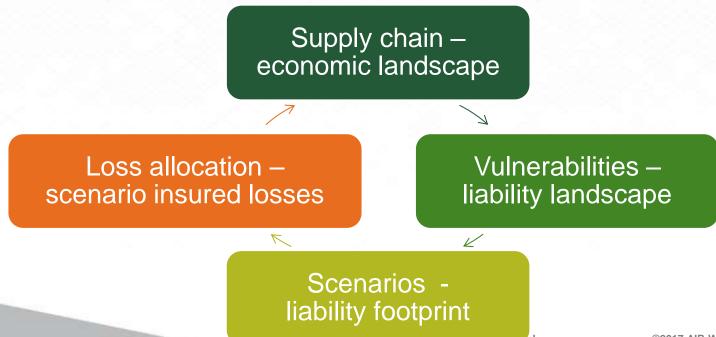
Total industry revenue (turnover), employee count or payroll data help derive market shares of particular insureds, as well as insureds combined across a portfolio. This helps allocate shares of losses of insureds *relative* to others in that industry.

North American Industry Classification NAICs codes are used to merged insured to the trade network and connect all tool data. 20,000 products can be searched for rapid identification of industries.

Arium Modelling Approach

Aim: To align liability exposure management with property exposure management, but with greater transparency, control and on-the-fly stress testing
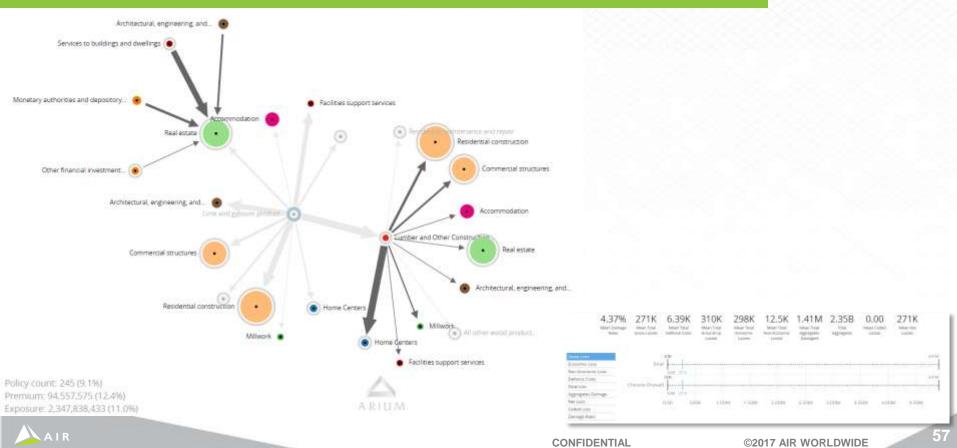

Supply chain – economic landscape

Vulnerabilities – liability landscape

Scenarios - liability footprint

Loss allocation – scenario insured losses

Arium Platform Demo

AIR

Cantaloupe Listeria (Colorado 2011)
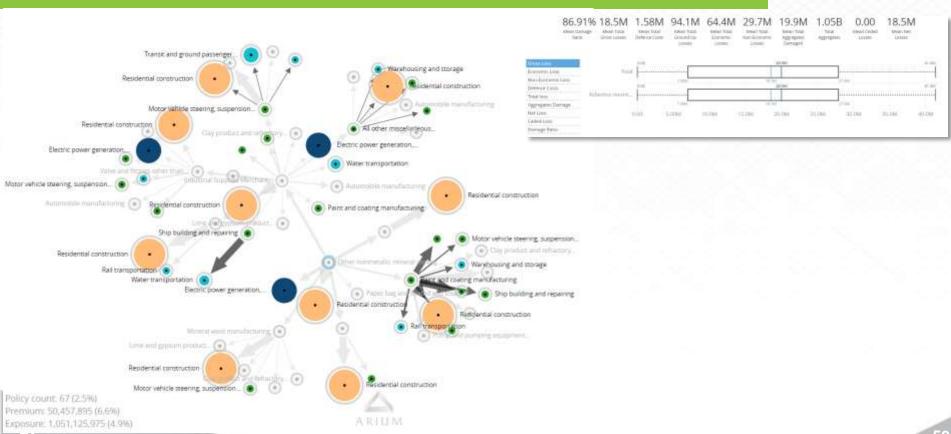
Chinese Drywall (Florida 2004/5+)

Policy count: 245 (9.1%)
Premium: 94,557,575 (12.4%)
Exposure: 2,347,838,433 (11.0%)

Lac Megantic (Quebec 2013)
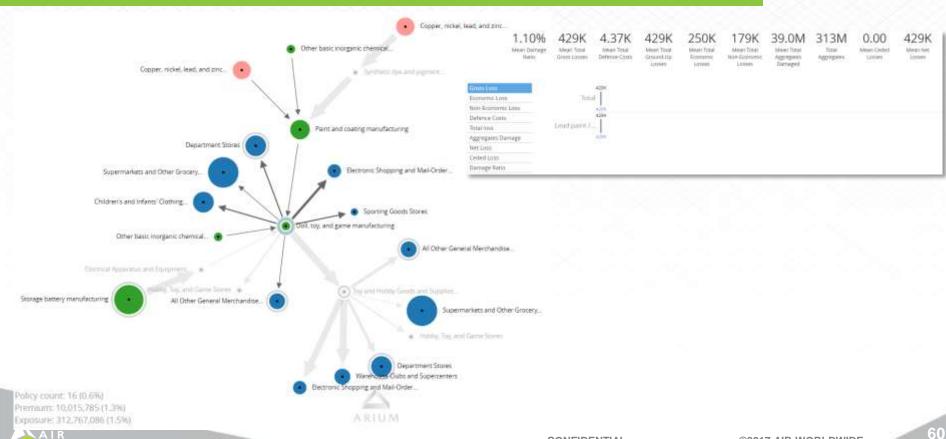
Recent Asbestos Losses (Worldwide 2007+)
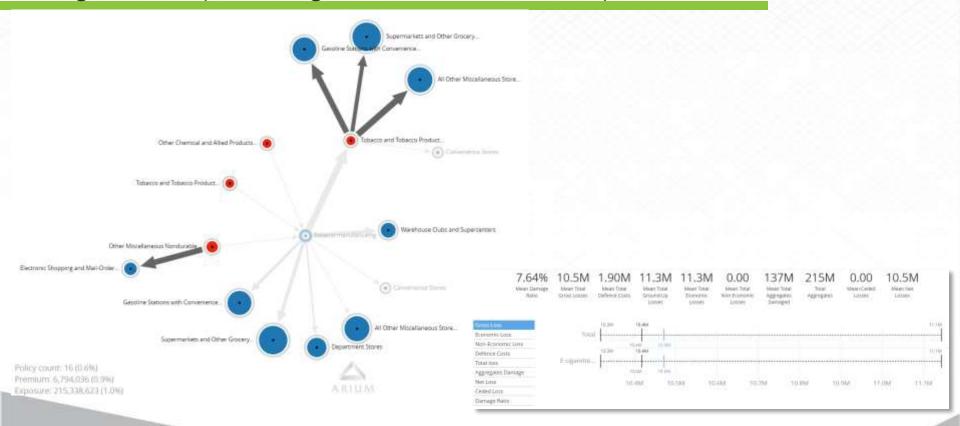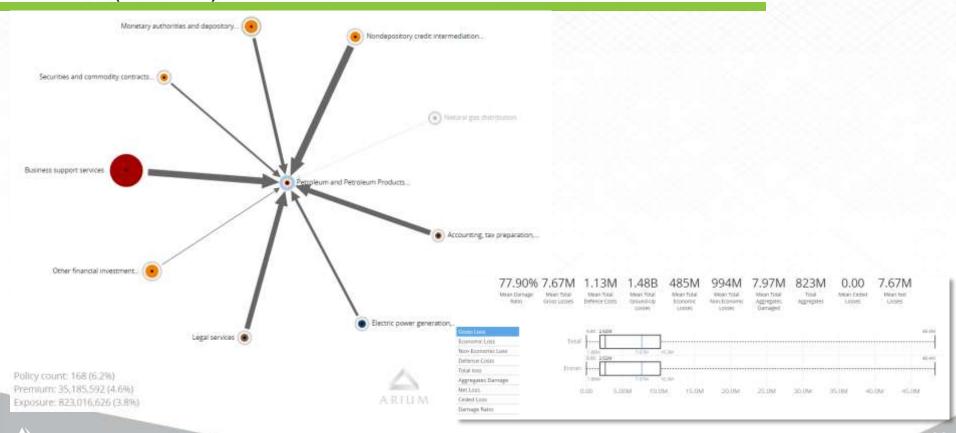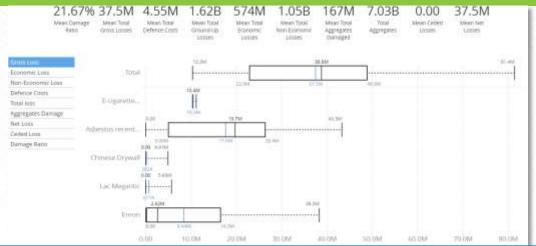
Lead Paint / Batteries in Toys (Worldwide 2006+)

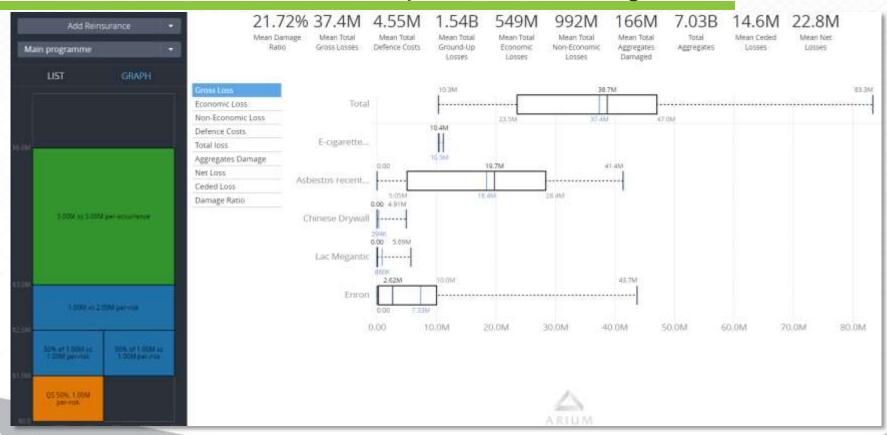# E-cigarettes (Causing Asthma in Children)

Enron (2002+)

Policy count: 168 (6.2%)
Premium: 35,185,592 (4.6%)
Exposure: 823,016,626 (3.8%)

Scenario Losses Can Be Examined Together…

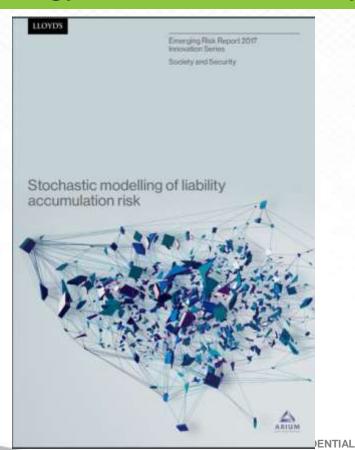| Capabilities	Insights
Provides estimated insured loss / PML	Consistent, transferable and scalable view of loss allocations across portfolios
Adjust parameters and stress test interactively in real time	Understand risk profile through rapid stress testing
Arium is not a black box	
Run multiple scenarios as a single event	

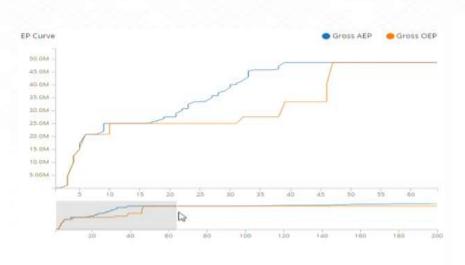# … and Various Financial Perspectives Investigated

Stochastic Methodology Has Been Recently Published
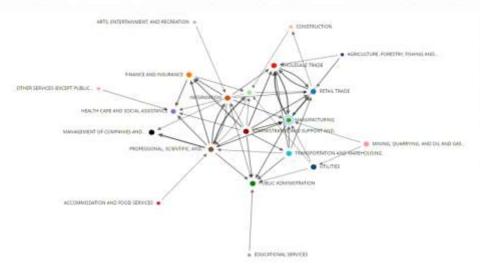
Outputs from the Pilot Stochastic Model

EP curves

Footprint

Summary

- Although casualty modelling is inherently difficult, a novel modelling approach allows better understanding of portfolio exposures and how they are connected

- Various deterministic scenarios can be created and run against the portfolio

- Estimates of affected aggregates and insured losses can be produced