SINGAPORE ACTUARIAL SOCIETY

8th SAS General Insurance Conference

Data, Data, Everywhere…

SAS GI Committee

Singapore's Got Talent

26th / 27th May 2016
Resorts World Sentosa, Singapore

Introduction

- 3rd ***Singapore's Got Talent*** contest
- **Give a chance to Singapore's students!**
  - Open the floor to students for 1 hour
  - SAS believes that **Singapore's Got Actuarial Talents**!
  - **21 March:** students from all Singapore Universities invited to participate
  - **Topic**: Identify protection gaps in society which may be solved with Data
  - **28 April:** 4 finalists selected and coached by SAS GI Committee
  - **GI Conference:** Final Four → Winner selected by **All Conference Delegates**
  - **Prize Ceremony: Winner** unveiled at the **Conference closing**
  - **$300 prize**
- **Education and Career Committee initiatives**
  - Raise university students visibility
  - Improve public speaking: ***Speakers & Influencers***

The 4 Finalists

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Ma Xinning

Reputation risk through Cyber Insurance

XMA006@e.ntu.edu.sg

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Grand Finale Schedule

- **Presentations**
  1. **Ong Wei Chang:** Drone Insurance *(10 min.)*
  2. **Paul Wang/Huang Guoyu:** Travel Insurance for Urban Commuters *(10 min.)*
  3. **Richard Li:** The Motor Revolution *(10 min.)*
  4. **Ma Xinning:** Reputation risk through Cyber Insurance *(10 min.)*
- **Q&A** *(10 min.)*
  - Questions from SAS GI Committee judges
- **Voting Process** *(1 min.)*
- **Lunch!**

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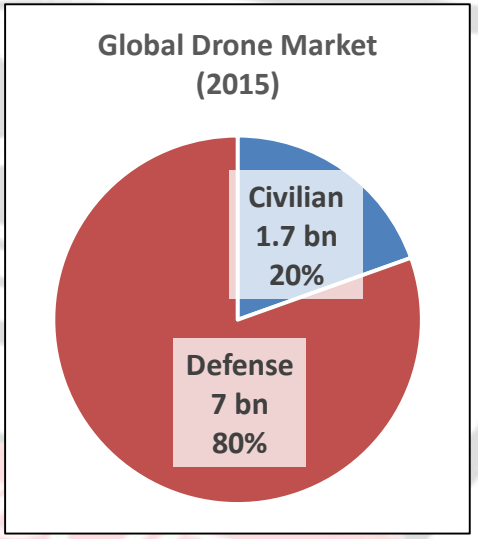
Drones Overview

- Main segments – Defense, Civilian
- 2015 global estimates for Civilian Market
  - US$ 1.7 billion
  - 4.3 million units shipped
- Forecasts for civilian market
  - Research and Markets: 28% CAGR from 2014 to 2019
  - Business Insider: 19% CAGR from 2015 to 2020



Sources: Business Insider, Fortune

Impact: civilian drones has immense growth potential

Driving Factors

- Current regulatory landscape – permit based framework in major jurisdictions

Country	Date	Recreational	Commercial
Singapore	Jun 2015	Not needed unless >7kg	Operator/activity permits from CAAS
China	Nov 2014	Not needed unless >7kg	License from CAAC
USA	Dec 2015	Drone registration with FAA for drones that weighs 0.25kg - 25kg	
UK	Nov 2009	Not needed unless >20kg	Permission from CAA

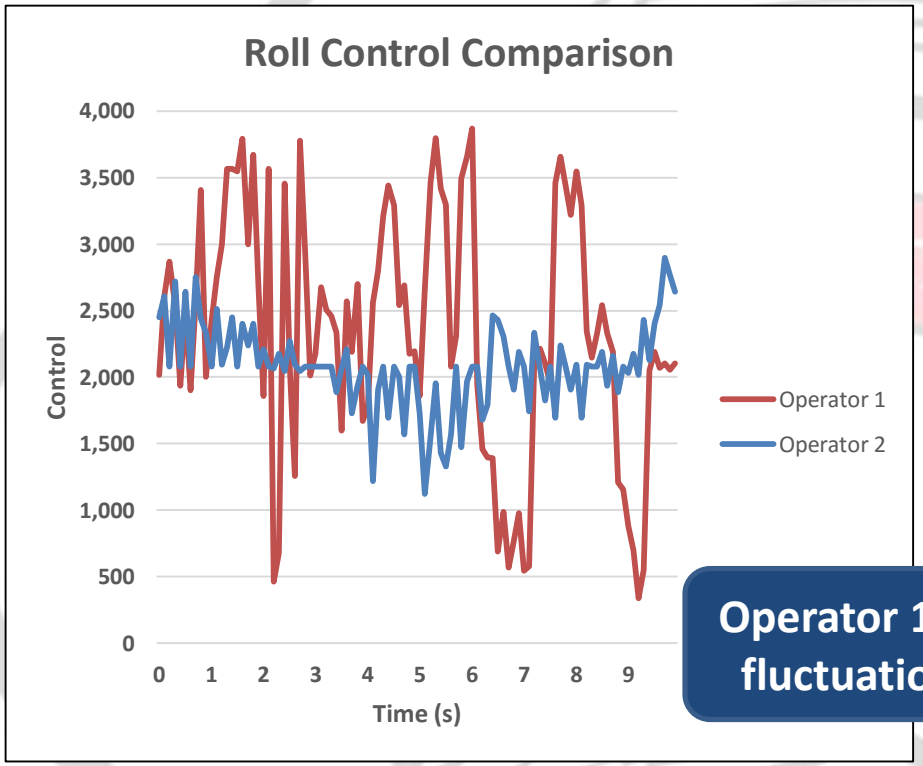
Sources: aviation agencies of Singapore, China, USA and UK

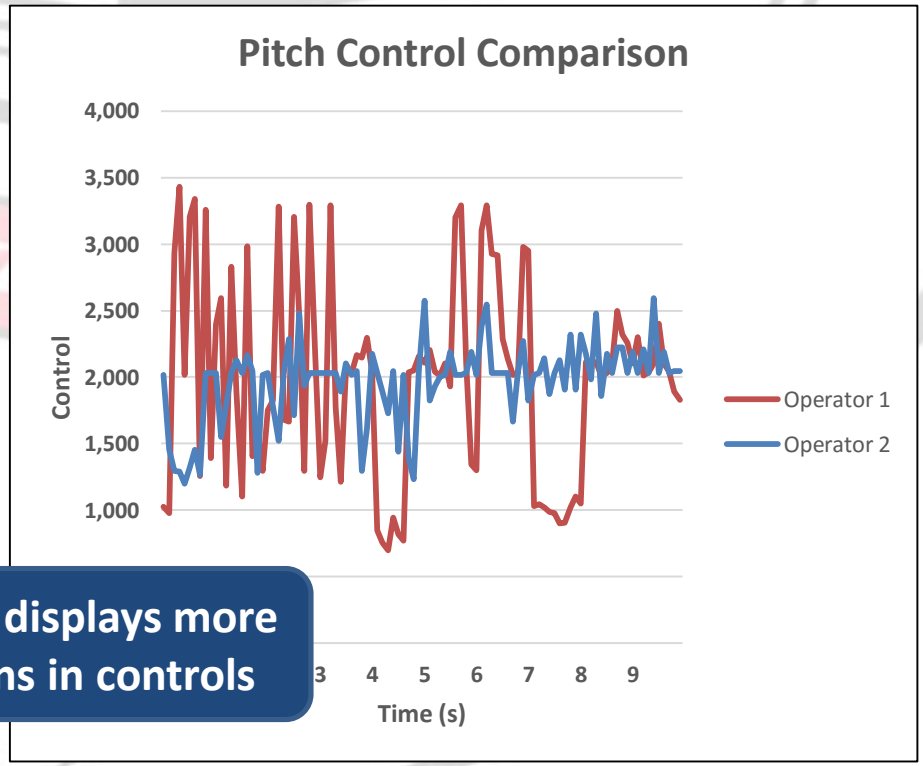
- Upcoming – Florida to pass bill on 1st July 2016 to make drone operators/owners liable for damages

Impact: likely for drone insurance to be compulsory

Leveraging Data – Flight Control

- Overview – controls of two operators





Operator 1 displays more fluctuations in controls

Leveraging Data – Flight Control

1 Collection

- Data from 100 flights from two operators
- Software: Robotics Operating System

ROS

2 Analysis

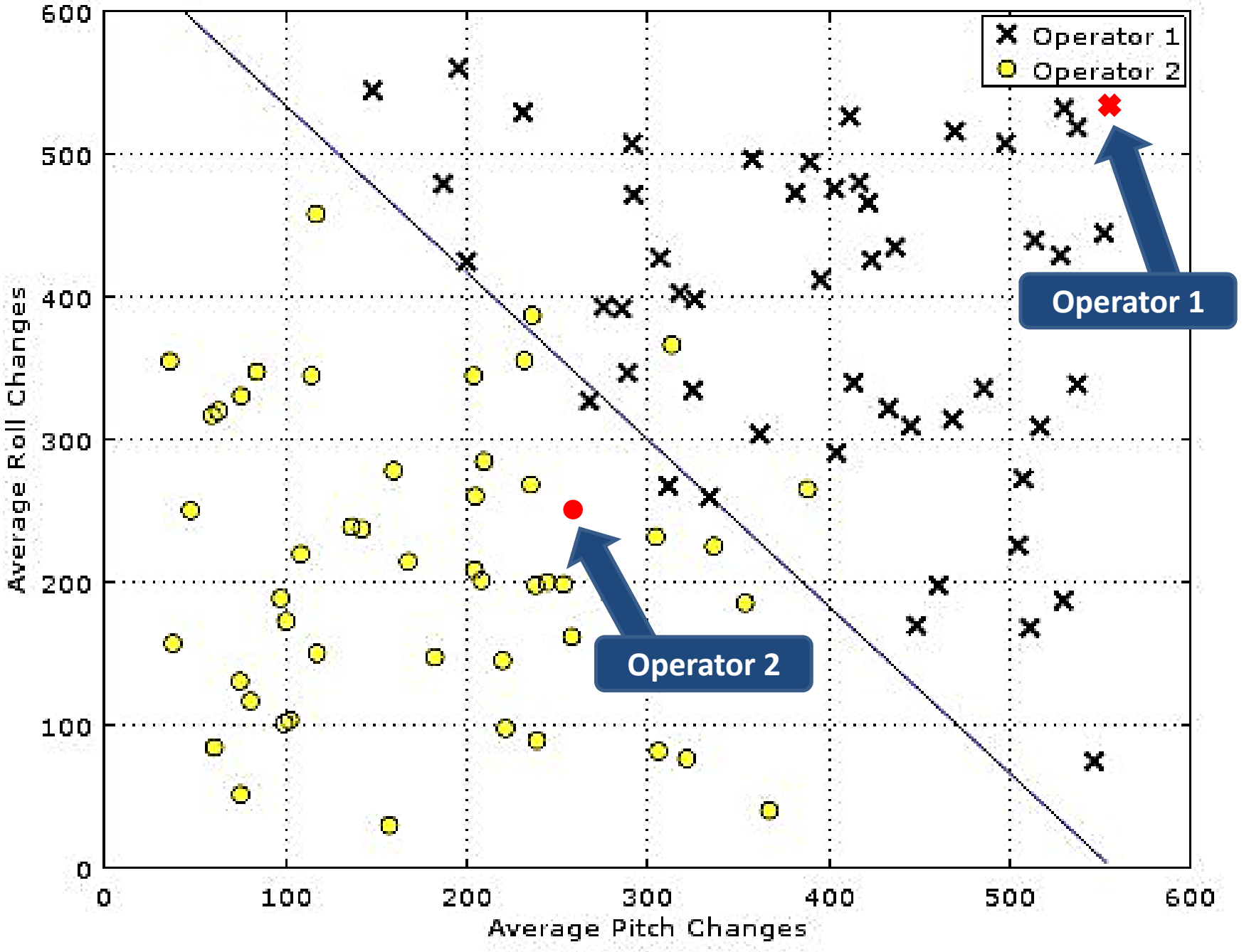
- Software: GNU Octave

- Analysis
  - ➢ Concept: classification using logistic regression
  - ➢ Implementation: gradient descent

3 Prediction

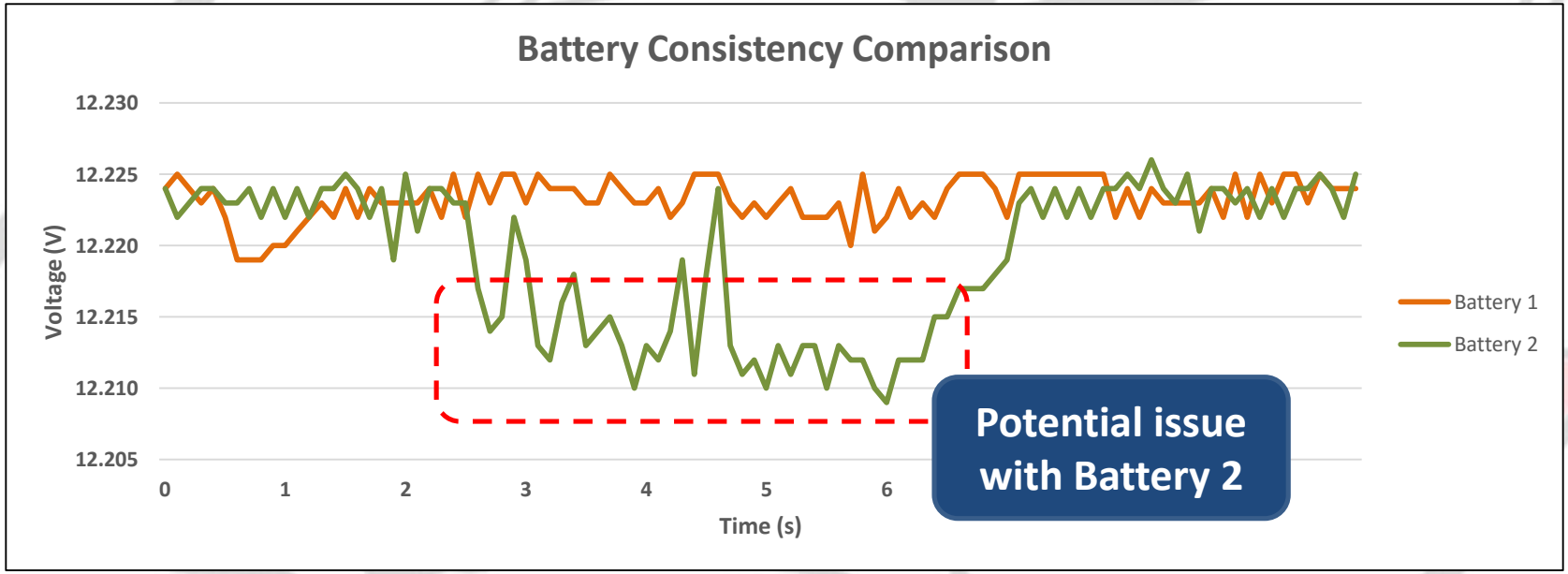
- Decision boundary to obtain insights on new flight data

Impact: customised pricing based on operator


Operator 1
Operator 2
Average Roll Changes
Average Pitch Changes
0
100
200
300
400
500
600
Operator 1
Operator 2

Leveraging Data – Battery Health

- Relevance – batteries a key reason for drone incidents

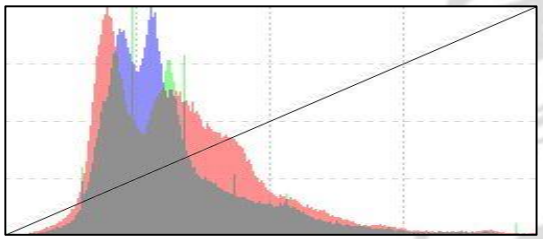


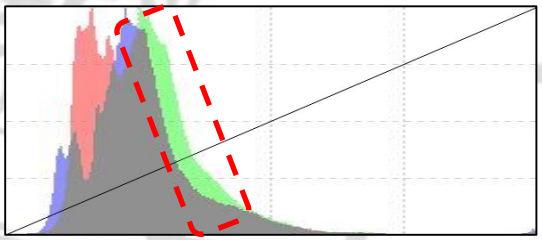
Impact: customised pricing based on equipment

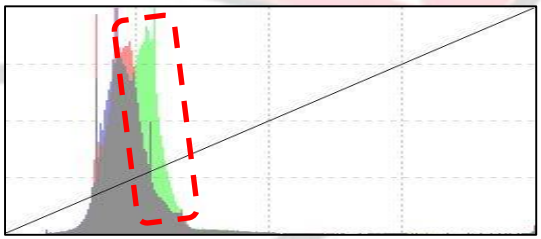
Leveraging Data – GPS Position

- Relevance – risk is related to terrain of location

Possibility of terrain identification to quantify location risk

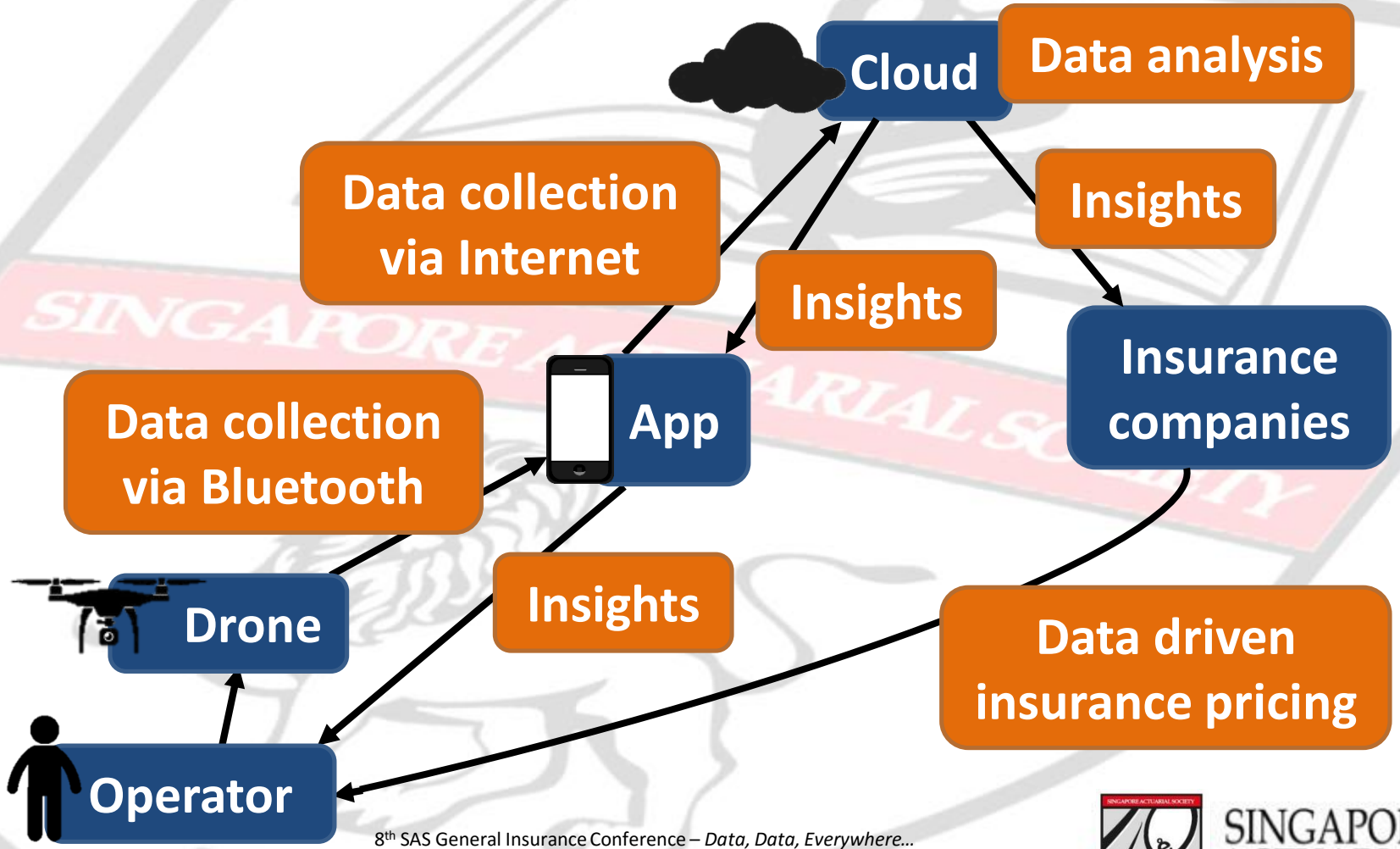




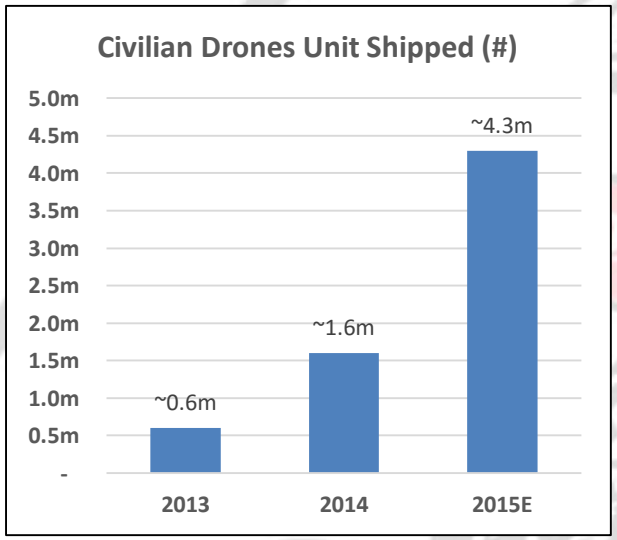


Impact: customised pricing based on location

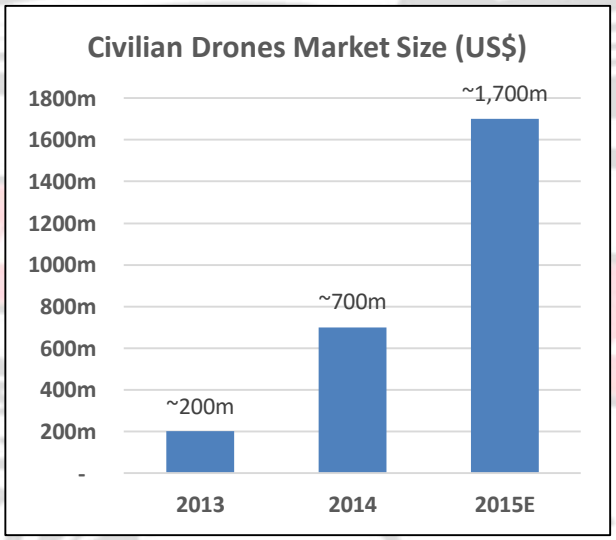
Bigger Picture – Building an Ecosystem



Global Market Figures



Source: Emberify



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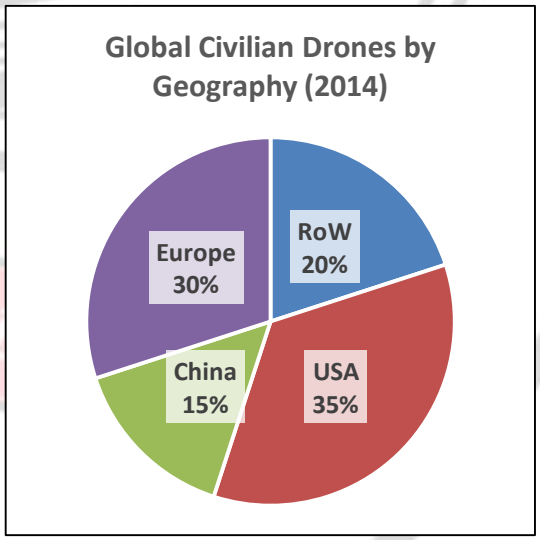


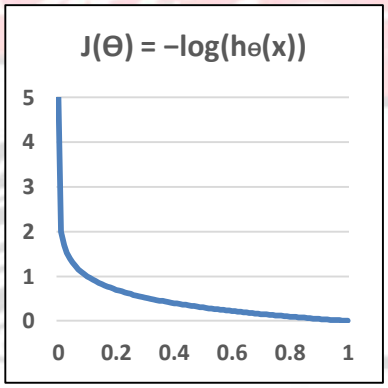
Source: Emberify

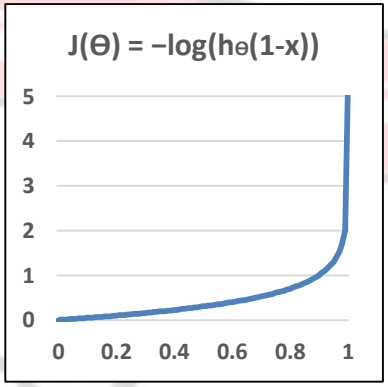
Data Analysis

- **Hypothesis** $h_\theta(x) = \frac{1}{1+e^{-(\theta_0+\theta_1 x_1+\theta_2 x_2+\cdots)}}$

- **Cost function** $J(\theta) = \begin{cases} -\log\left(h_\theta(x)\right) & \text{if } y = 1 \\ -\log\left(1-h_\theta(x)\right) & \text{if } y = 0 \end{cases}$

- **Intuition**





- **Gradient descent** repeat until convergence $\left\{\theta_j := \theta_j - \alpha\frac{\partial}{\partial\theta_j}J(\theta)\right\}$

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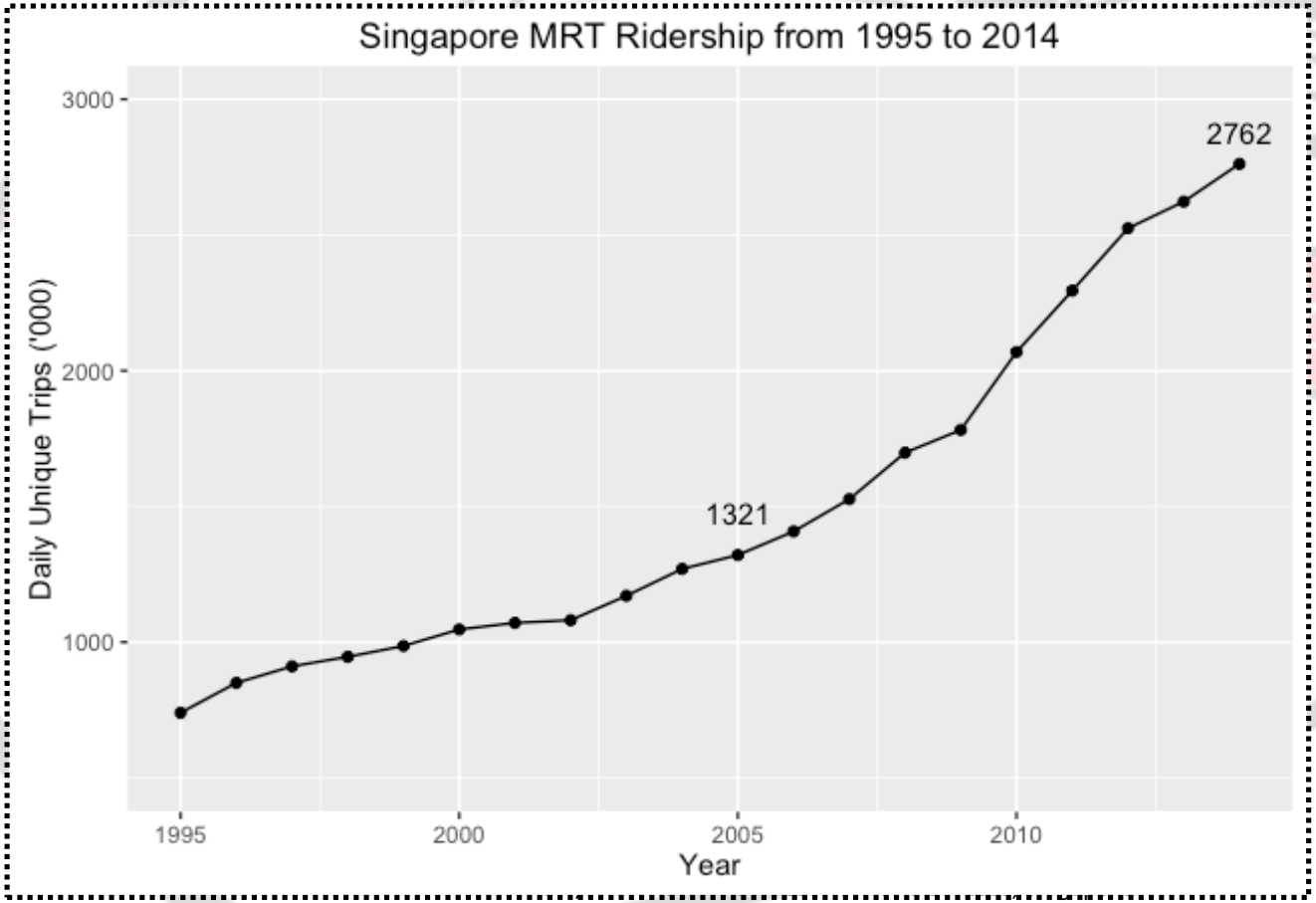
Singapore's MRT

- Singapore's Massive Rapid Transit (MRT) has grown significantly in the past ten years:
  - Rail length increased by 50%
  - Train capacity increased by 100%
  - **Circle Line** and **Downtown Line** introduced 48 new stations
  - **East-West Line** and **North-South Line** mark their 30th birthdays next year

Growing Passenger Population

- Growing even more rapidly is the number of passengers taking the MRT system each day



SINGAPORE ACTUARIAL SOCIETY

Problem: More Passenger + Aging Infrastructure

- Analysing news articles and incident reports, we found that:
  - 436 unique disruptions reported from 2011 to present
  - Average duration > 30 minutes
  - 76% of incidents from **East-West Line** and **North-South Line**

Data Source: http://failrailsg.appspot.com/

Insufficient Protection

- The current protection against disruption is insufficient
  - Non-personalised excuse slip
  - No monetary compensation for wasted time

SMRT

S/No. 20220

To Whom It May Concern

MRT TRAIN SERVICE DELAY

There was a train service delay on 13/4/12 which occurred at about 08:00hrs. Passengers travelling on the North-South Line/East-West Line/Circle Line were affected.

Should you require further clarification, please call our SMRT Customer Relations Centre Hotline (toll-free) at 1800 - 3368900.

Yours sincerely

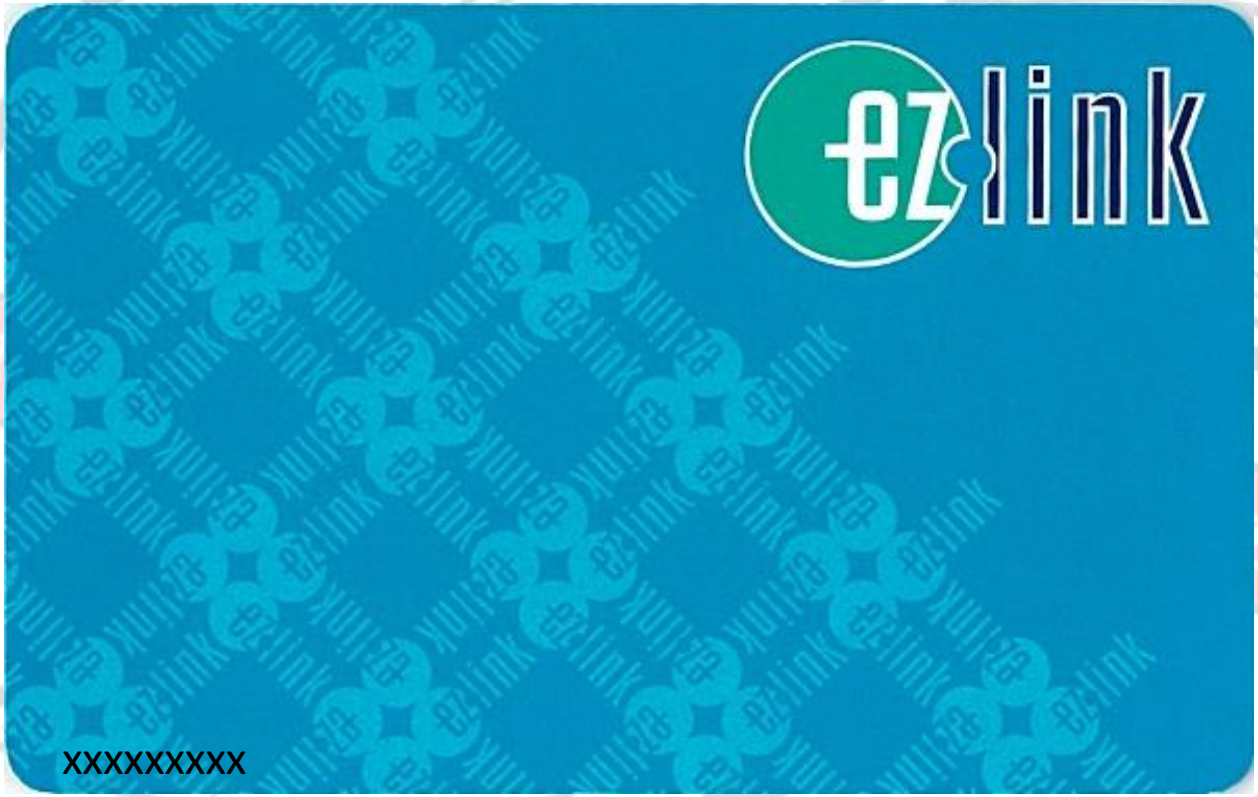
BUONA VISTA SMRT

Goal and challenges

- Goal: Provide "delay insurance" to urban commuter for protection against MRT disruptions

- Present Challenges:
  - Access to detailed data of MRT usage in terms of passenger
  - Access to means for identifying loss events
  - Effective transaction of premium and claims

A Solution to All



Rich Data for Experience Analysis

- Challenge: Access to detailed data of MRT usage in terms of passenger
- Currently, smart cards (EZ-Link, NETS, …) are able to:
  - record time, origin, transitions, destination for each trip
  - generate millions of data points each day

Big Data for Loss Event Identification

- Challenge: Access to means for identifying loss events
- Solution: Data Mining on smart card records
  - expected travel time between two points can be estimated because of law of large number
  - abnormally long trips are identified
  - cross-validate with SMRT and SBS for confirmation

An Integrated Transaction System

- Challenge: Effective transaction of premium and claims
- Solution: Smart card for "paperless" transaction
  - Automatic deduction/top-up upon tapping
  - Check balance easily using a variety of devices

Proposed Product Structure

- Parties
  - Insurer: SMRT and SBS
  - Beneficiary: Passengers
- Coverage
  - MRT disruptions from all causes

Proposed Product Structure

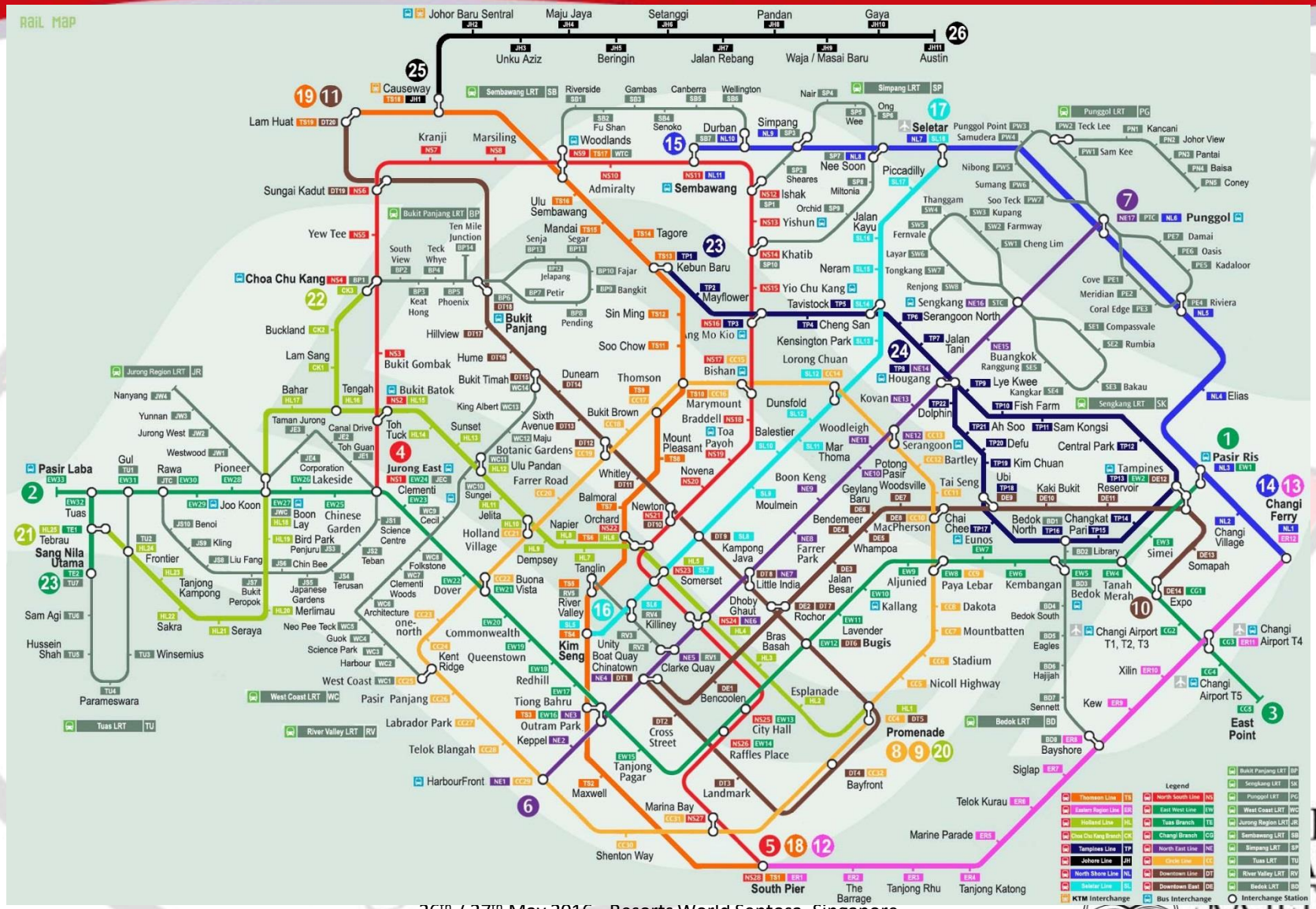
- Premium
  - Payable upon leaving the platform
  - A percentage of fare proportional to distance traveled

- Underwriting
  - combining data mining and official incident report to identify additional travel time caused by disruptions

Proposed Product Structure

- Claim
  - Collectable as an automatic top-up at the card reader before next ride
  - Claim amount proportional to additional travel time
  - Log in with ID on the smart card to check claim payment and forward excuse slip to supervisor

Future Trends



Connected = Opportunity + Challenge

- Opportunity
  - Reduce chance of large loss events
  - Extend coverage to other modes of public transportation
- Challenge
  - Heterogeneous user behaviour
  - Imperative to understand transition pattern and distribution of passenger

Conclusion

- Smart card data present invaluable opportunity for the identification of loss events in urban commute
- Payment with smart card allows smooth, cashless transaction of premium and claims
- "Delay insurance" for urban commuter is one of the potential applications of the smart card infrastructure

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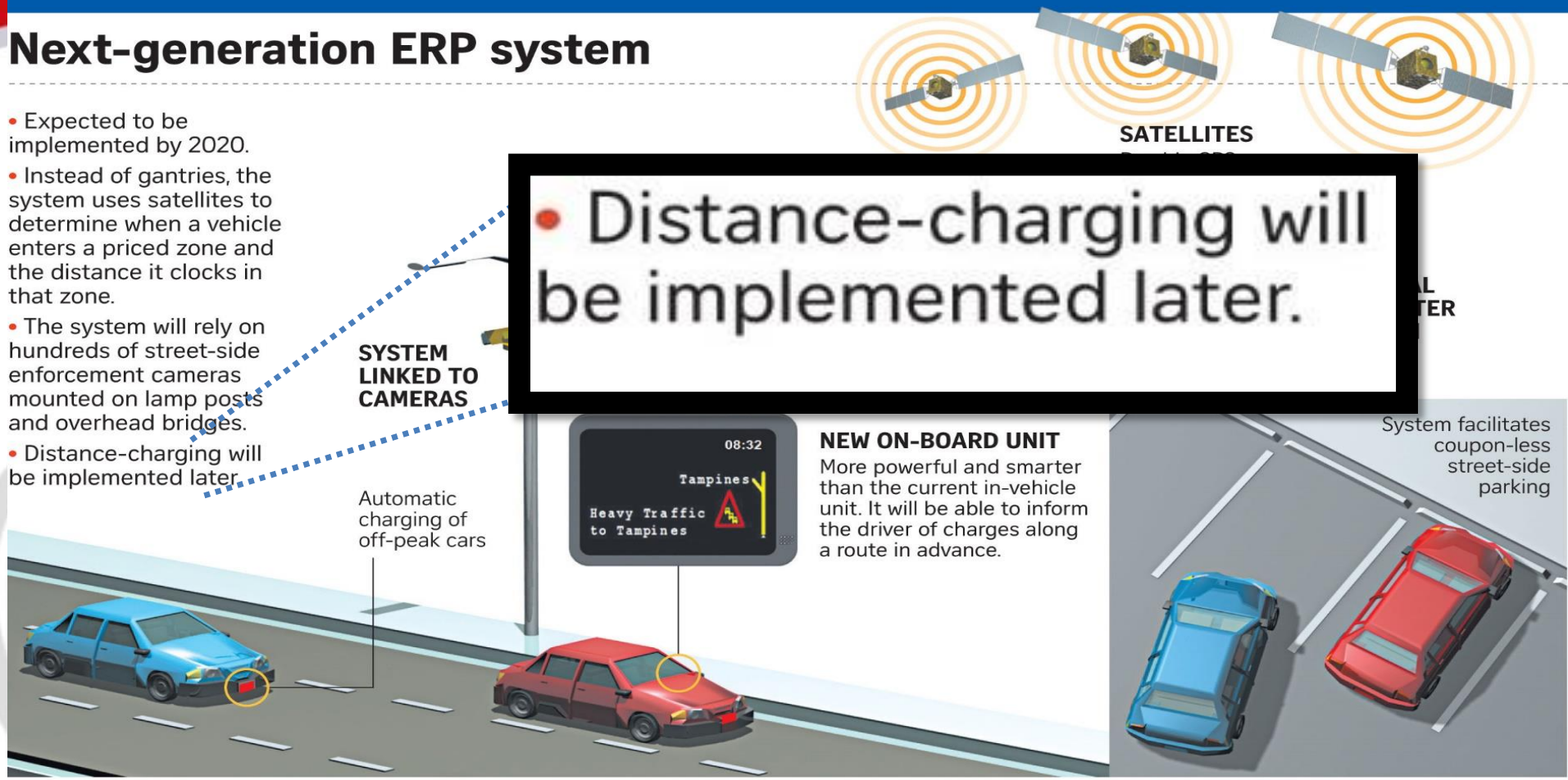
ELECTRONIC ROAD PRICING (ERP)

Next Generation ERP

Next Generation ERP

Next-generation ERP system

- Expected to be implemented by 2020.
- Instead of gantries, the system uses satellites to determine when a vehicle enters a priced zone and the distance it clocks in that zone.
- The system will rely on hundreds of street-side enforcement cameras mounted on lamp posts and overhead bridges.
- Distance-charging will be implemented later.



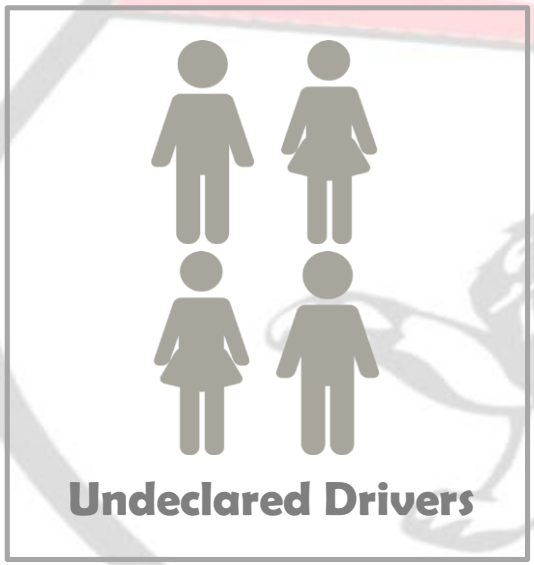
- Distance-charging will be implemented later.

STRAITS TIMES GRAPHICS Source: LTA

Current Insurance Model

Insurer

LTA/ERP



Owner / Declared co-driver

Changes Taking Place

1. **Many people will not have their own cars. Instead, they will rent or carpool.**
2. **Insurers increasingly want to retrieve journey times, distances and speeds.**
3. **More carpooling means insurers are unable to know who is driving the car.**

Revolutionised Motor Insurance

Insurer A

Insurer B

Insurer C

Insurer D

Insurer E

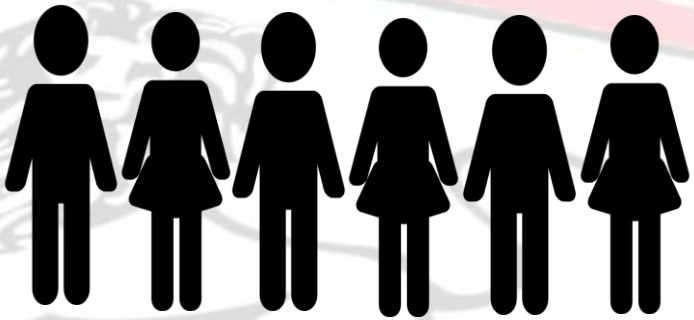
Insurer F

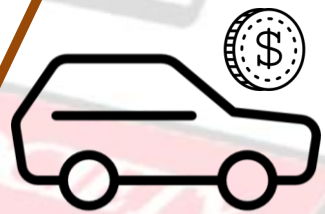
Usage Behaviour

NCD, Claims and driving behaviour

ERP 2.0

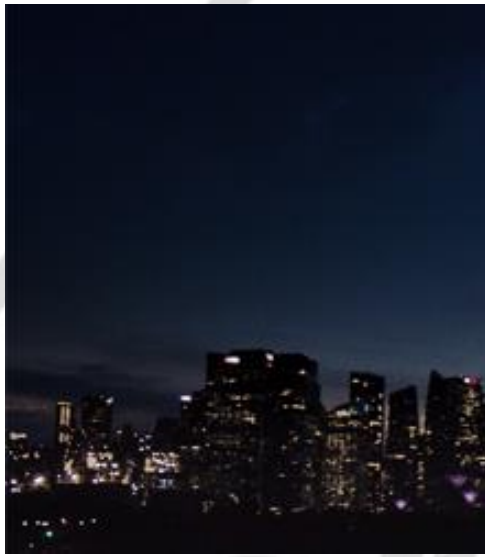
Declare distance.





ALL DRIVERS IN SINGAPORE

What Singapore will be in the future



KEEP
CALM
AND
SHARE
A CAR!

Revolutionised Motor Insurance

- Vehicle repairs
- Losses and damages
- Third-party damages
- Towing service

Eligibility

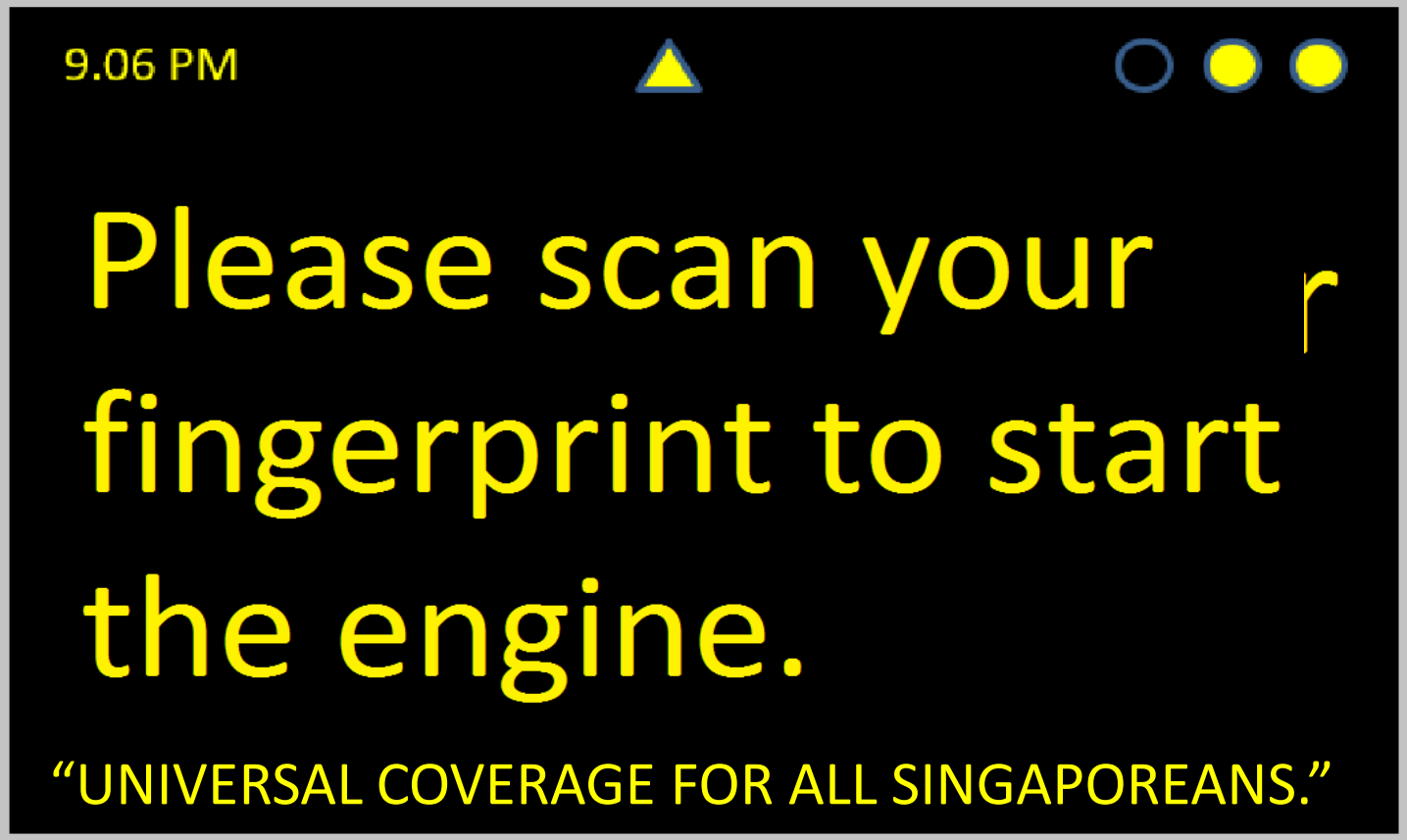
- **Valid Driving License with no suspensions in force.**
- **Premiums are set based on:**
  - **Driving experience**
  - **Accident history**
  - **Driving habits**

Driving Habits

- **Based on real time information by the onboard computer and central server.**
- **Insurers will retrieve information necessary for analysis from LTA.**
  - **Speed**
  - **Distance**
  - **Time**
- **Analysis will determine premium of next month.**

On-Board Unit

Fingerprint scanner



On-Board Unit

Sample Price Plan and Method of Payment

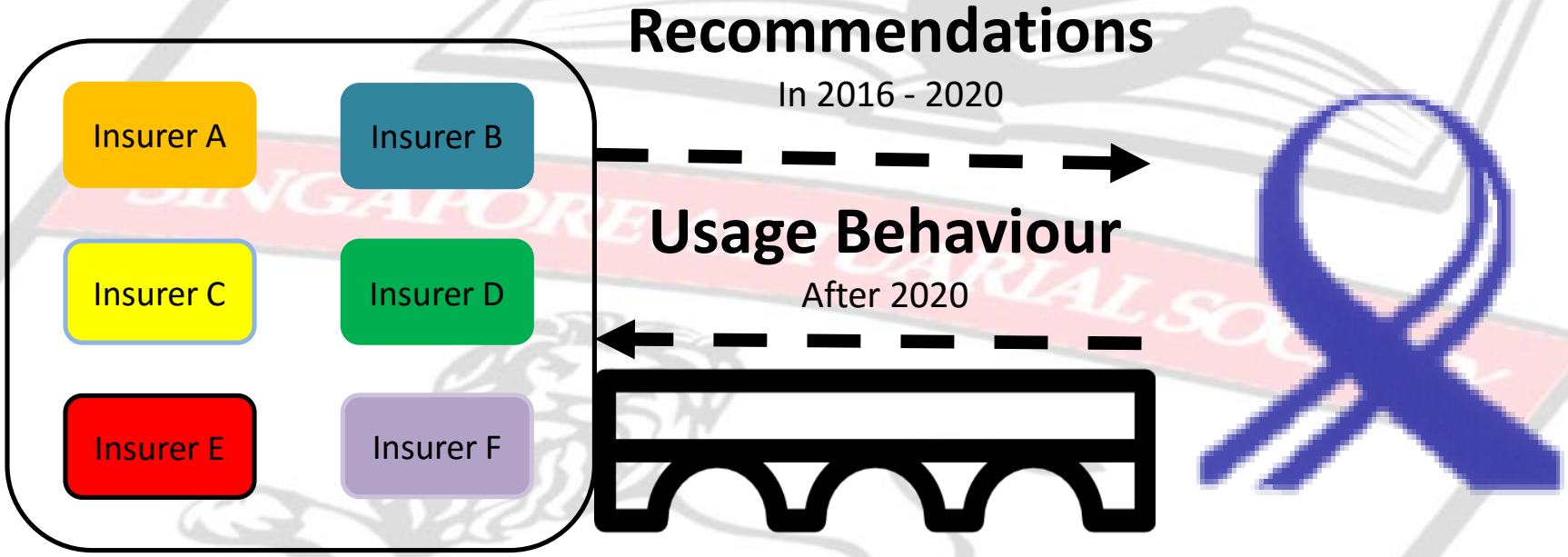
Distance	Price (S$)
1st 20km	1.50
Subsequently	0.06 / km

- **Payment can be per-month or per-day, through ATM/internet transfer/AXS machines.**
- **Insurers will update drivers' quota, once drivers pay their premiums.**

Other Applications

Which is the SAFEST driverless vehicle out there?

Conclusion & Action Plan



Take Action now!

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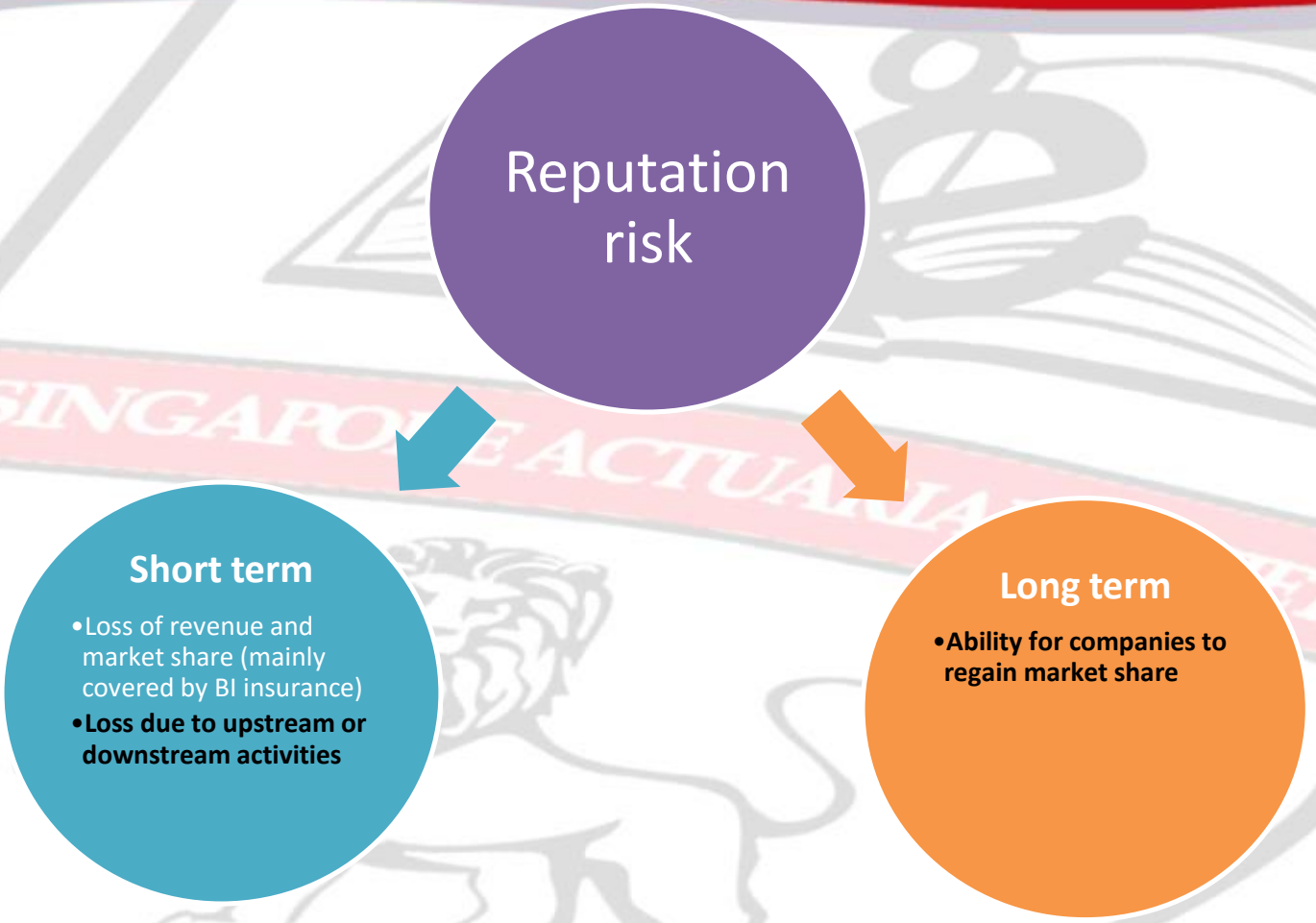
Contents

1. Rationale
2. Insurability
3. Data collection
4. Ethical issues
5. Summary

Rationale

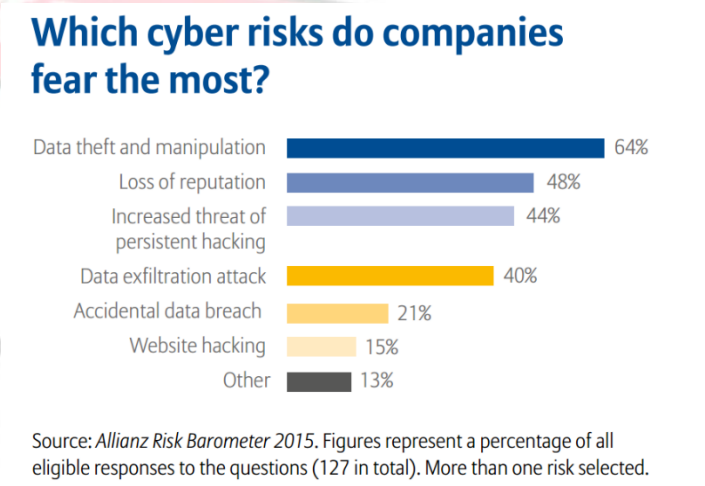
- Protection Gap
  - Breaches used to be under-reported as they cause loss to reputation
  - Stricter regulations governing data breaches
  - Issues that arise:
    - Not sure how to protect themselves against it
    - Not aware that they can protect themselves
      - Products covering the risk specifically not available/designed yet
      - Cyber insurance market is also rather new

Rationale - Definitions



Rationale

- Impacts to business
  - Kaspersky survey 2014[1]: Accidental data leaks by staff, which were reported by businesses… are now the biggest source of lost data
  - Loss of reputation, loss of competitive advantage, loss of market share, potential regulatory issues etc.[2]
  - 71% of customers say they will leave the company after a data breach[3]
  - 48% of companies fear loss of reputation



Rationale

- Measurement of reputation loss
  - Cost associated with having to regain market share
    - Cutting lines of businesses to appease public
    - Overhaul of company governance/other policies
  - Revenue lost due to data breach along supply chain

Insurability

- Marketability
  - Most likely B2B over personal insurance
  - Depends on risk level of company in question
    - E.g. High data risk clients more marketable
  - Depends on type of industry/businesses
    - Supply chains: reputation of companies maybe interconnected
- Adverse selection
  - Purchasers of insurance maybe less careful

Insurability

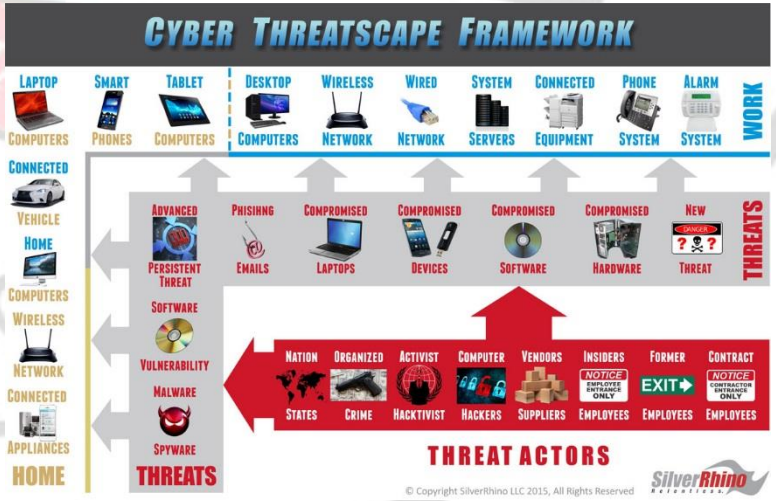
- Profitability of insurance
  - There could be difficulty in linking long-term reputation loss directly with data leaks as there could be a butterfly effect
    - i.e. not sure if other business events also affect reputation loss or if it is solely due to data breach (underwriting issue)
- Potential loss events
  - Inability to regain 20% of original customer base for a specific product (due to data breach) within 2 years
  - Inability to recover 50% of short-term income lost
    - higher probability of going concern issues
  - Additional losses while fixing data breach problem

Data Collection

- Data mining
  - Tracking keywords used in customer comments/social media to determine extent of damage to company reputation
    - Using hastag tracking or twits per day to track negative comments
- Monitoring costs of reversing damage due to data breach over the next 1 year
  - Within company
  - In relation to supply chain
- Sales data & analytics
  - To analyse market share changes

Data Collection

- Present issues
  - Increasing vulnerability due to widespread use & device interconnectivity
  - Issue is exacerbated due "hactivists"
  - Difficulty collecting data to link cyber risk and reputation specifically



Ethical Issues

- Invasion of Privacy
  - Tracking keywords used social media could be an infringement of privacy to the general public
  - Social Media companies may not be willing
    - They may even work against businesses trying to data mine for information

Approaches

- Rider to existing cyber/reputation insurance products (short term loss)
  - Operation issues: proof that upstream/downstream data breach impacts reputation of company
- Liability product (Long term loss)
  - Verification that going concern is due to inability to recover from previous reputation loss events
- Potential for catastrophic data insurance due to high device connectivity
  - For companies highly reliant on connected devices

Summary

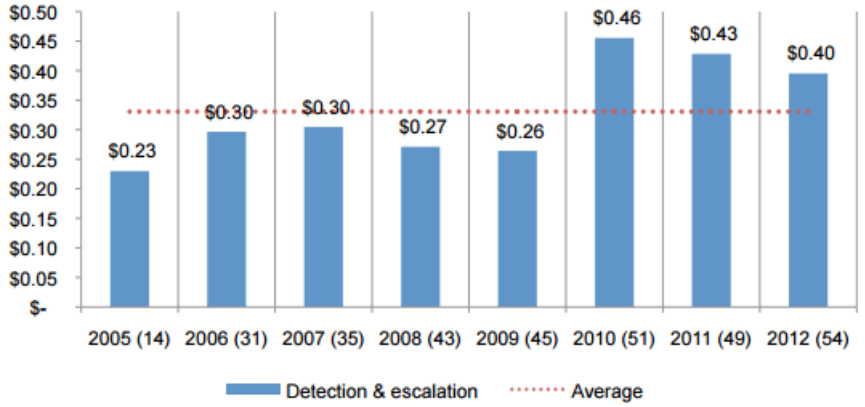
- Greater instance of reputation loss due to cyber breach
- Short term losses
  - Loss in revenue due to data breach affecting supply chains
  - Beneficial to companies whose reputation relies heavily on supply chain
- Long Term losses
  - Resolves going concern issues
    - Inability to recover customer base
    - Inability to recover 50% of short-term losses
- Several approaches
  - Rider to existing cyber/reputation insurance products (short term loss)
  - Liability product (Long term loss)
  - Potential for catastrophic data insurance due to high device connectivity

References

1. http://www.kaspersky.com/about/news/virus/2014/Kaspersky-Lab-Survey-Identifies-Internal-IT-Threats-in-Businesses-and-Infrastructure-that-Lead-to-the-Most-Data-Loss
2. http://www.ey.com/Publication/vwLUAssets/EY_Data_Loss_Prevention/$FILE/EY_Data_Loss_Prevention.pdf
3. http://www.agcs.allianz.com/assets/PDFs/risk%20bulletins/CyberRiskGuide.pdf

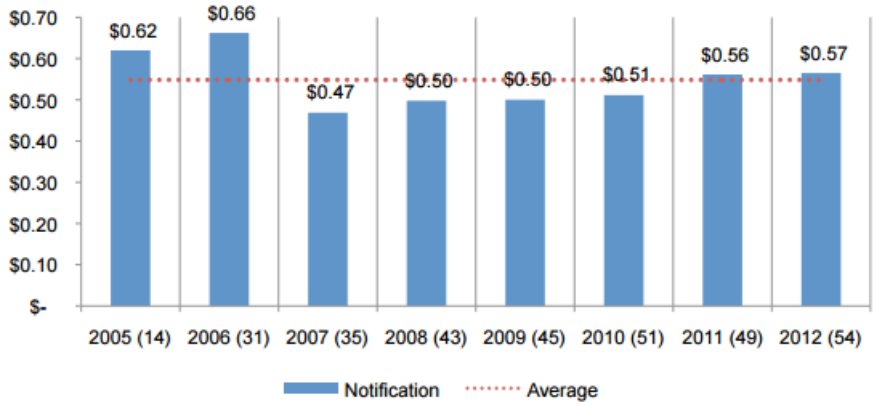
Detection and escalation costs decrease. Figure 11 shows the eight-year trend for costs associated with detection and escalation of data breach incidents. Such costs typically include forensic and investigative activities, assessment and audit services, crisis team management, and communications to executive management and board of directors. As noted, average detection and escalation costs declined slightly from a high of $.46 million in 2010 to $.40 million in the present study.

Figure 11. Average detection and escalation costs over eight years
$000,000 omitted



Notification costs increase. Figure 12 reports the distribution of costs associated with notification activities. Such costs typically include IT activities associated with the creation of contact databases, determination of all regulatory requirements, engagement of outside experts, postal expenditures, secondary contacts to mail or email bounce-backs and inbound communication set-up. This year's average notification increased slightly from $.56 million in 2011 to $.57 million in the present year. The highest notification cost over eight years was $.66 million that occurred in 2006.

Figure 12. Average notification costs over eight years
$000,000 omitted



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1

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SINGAPORE ACTUARIAL SOCIETY

Thank you for watching

Singapore's Got Talent 2016

NANYANG TECHNOLOGICAL UNIVERSITY

Starring

Ong Wei Chang
Paul Wang, Huang Guoyu
Richard Li
Ma Xinning

NUS National University of Singapore

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