

DATA, MLOPS, AND IoT

For the Next-Generation Insurance Industry

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Max Ang

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EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

- MLOps is a multi-phase process that leverages the power of large volumes and variety of data, abundant compute on GPU, and open-source machine learning tools to build intelligent applications
- MLOps brings two disciplines of different skillsets and priorities, software engineering and data science, together with the clear definition of business objectives. This report will cover the following

01

The integrated ecosystem and customer experience design

To begin, we will introduce the integrated ecosystem concept for insurance and how data plays a role in designing good customer experience

02

Life and P&C trends in APAC today

In this section, we illustrate business and IT priorities of CIOs and how this leads to investments for data, analytics, and AI

03

Putting AIOps, DevSecOps, and MLOps together

From MLOps, we establish an understanding of MLOps and the ops' moniker, piecing together the varying terminology to form a coherent understanding of technological operations

04

Data management and MLOps

We will explain the challenges of deploying AI/ML projects and the key considerations to consider when managing data. This will lead to a reference architecture for MLOps

05

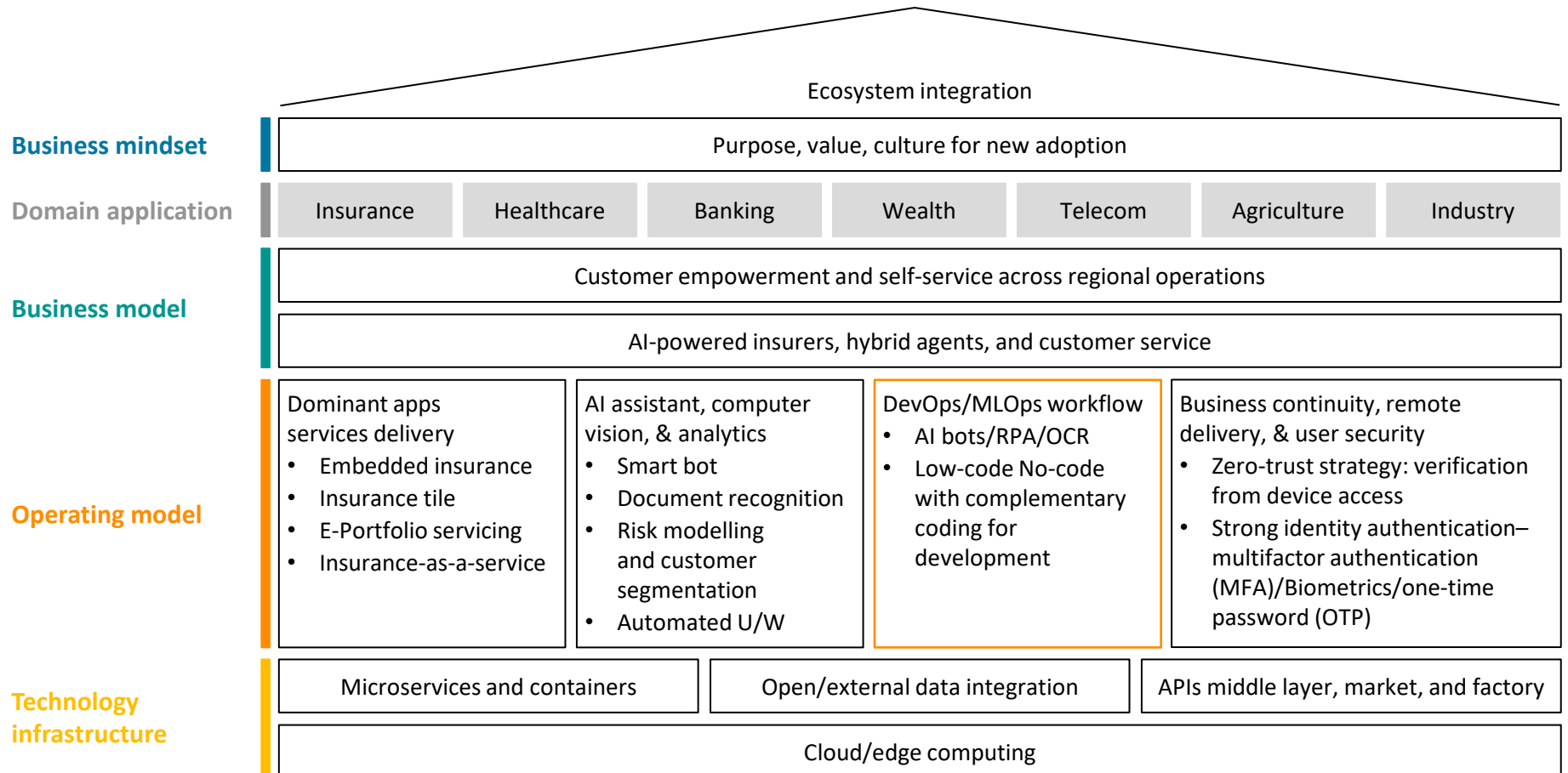
Use Case – Internet of Things

As conclusion, we will explain IoT as an alternate data source for AI/ML solutions in insurance and process with MLOps

THE INTEGRATED ECOSYSTEM AND CUSTOMER EXPERIENCE DESIGN

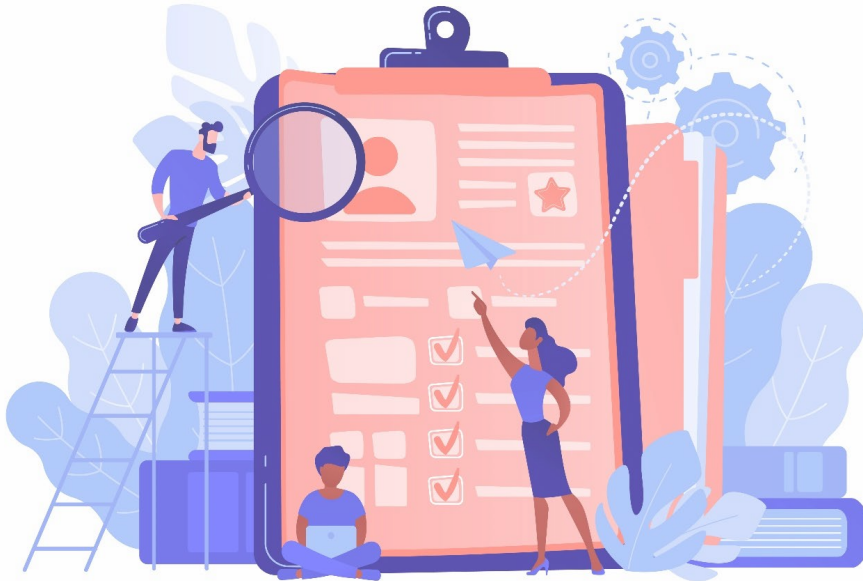
INSURERS WILL FURTHER BUILD AN INTEGRATED ECOSYSTEM COMPATIBLE WITH THEIR VALUE CHAIN TO FORM THE NEXT GENERATION OF INSURERS

And as part of the overall business strategy, this will include the operating model of MLOps to bring to production AI/ML innovations. We will look deeper into the application architecture of MLOps below in this report



Source: Celent report, [Integrated Insurance Ecosystem: The Next Generation Insurer](#)

BUILDING THE ECOSYSTEM

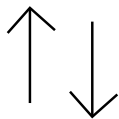


- The key focus is to build with modularity and via API for delivery and to power applications with data and MLOps processes
- Insurance as a domain is not the centrepiece, but the technology infrastructure and operating model is, along with other complementing industries such as banking, telecommunication, or industry. Collaboration will occur on a much bigger scale and the ecosystem will organise it
- Through an ecosystem and modular application design, product development and deployment will happen at a much faster rate. Insurers will need to choose the right use case, measure the right metrics, and go beyond current indicators. An iterative approach will help to test and learn what will work and what will not
- The focus of this report is on AI/ML adoption and the use case of IoT device, which will benefit the Industry 4.0 change—for example, using drones and sensors to measure building safety for commercial insurance underwriting assessment, with MLOps providing the pipeline for mining such data

CUSTOMER EXPERIENCE DESIGN

- The design of an ecosystem and accompanying technology such as data, analytics, and AI is to offer a customer experience strategy. Through such a customer experience strategy, insurers can develop customer engagement processes and products, uncovering touchpoints to meet customers' needs.
- Technically, we are looking to a microservices architecture on the cloud, served through an open API middle-layer platform. Ideally on the business front, customer empowerment and a self-service marketplace will be the future of insurance. Processes will be automated through AI/ML engines. Embedded insurance will be a growing area as well, delivering an insurance-as-a-service model to the customer.
- A data approach might be an obvious choice in today's digital world, but the planning and execution of implementing a data-focused strategy must be carefully thought through. Customer or user experience is the service or front-end layer presented to customers (policyholders and insurers alike), and the fuel to drive an omnichannel, integrated ecosystem, and personalised and contextual experience is data.
- Culture and education would play an important role in developing a new approach in the industry as well, and an enlightened mindset is the catalyst to re-imagine how insurance can be. Data literacy will breed an appreciation for data and the ability to choose the right method or product for the right problem. With the right partnership and data science experience, insurance can further benefit from data, leading to a richer user experience that serves customers and the insurance organisation within.
- Lastly, data will be important, and a good MLOps process will enable the innovation. But customers' data security and personal information protection must be considered as well, to build trust in digital services. Data must adhere to cybersecurity guidelines of confidentiality, integrity, and availability, with a single source of truth for nonrepudiation.

Data, Analytics, and AI



**Wearables, IoT, Mobile
Knowledge Repository**



**Life and Health
P&C Commercial**



Data Literacy, Education, and Culture

Insurance Re-Imagined

LIFE AND P&C TRENDS IN APAC

TO SUPPORT THE ECOSYSTEM CONCEPT AND TO DESIGN A GOOD CUSTOMER EXPERIENCE DESIGN...

The trends of IT spending will reflect the current industry's direction and what it could shape into. IT spending by APAC life insurers is heavily allocated towards internal resources, including maintenance in data and software. APAC life insurers split their IT spending between internal and external resources. The challenge is to find the optimal balance between these resources to support their business operations efficiently

Internal Resources

55%

The amount of the IT budget that remains dedicated to internal resources for the **APAC region**

- Internal staff
- Internal assets, including the following
 - Software maintenance and support
 - Data centres and infrastructure

External Resources

38%

The amount APAC insurers dedicate to external services is comparable to internal amount

Insurers typically use a variety of services, including the following

- Professional services
- Software
- Infrastructure

These are typically in the form of an outsourcing or partnership agreement

- Most of the IT budget remains dedicated to internal resources, with 19% for internal staff development and the rest (29%) split among software maintenance, support, data centre, and infrastructure
- This is in line with staff development, whereby insurers strive to provide agents with quality training and to develop hybrid agents comfortable in both digital and in-person advisory services

7% is for everything else and is not included in the estimation above

More on our IT budget allocation projections can be found in the following Celent report: [IT Spending In Insurance](#)

- We estimate that APAC life insurers dedicate 19% of their IT budget to external professional services and an additional 11% to outsourced software services
- The remaining 8% is spent on outsourced infrastructure

Source: Celent report, [IT Spending in Insurance](#) (September 2020).

AND TO NONLIFE INSURERS IT SPENDING

IT spending by APAC nonlife insurers have a more balanced split between internal and external resources.

APAC nonlife insurers split their IT spending between internal and external resources. The challenge is to find the optimal balance between these resources to support their business operations efficiently

Internal Resources

55%

The amount of the IT budget that remains dedicated to internal resources for the **APAC region**.

- Internal staff
- Internal assets, including the following:
 - Software maintenance and support
 - Data centres and infrastructure

External Resources

41%

The amount APAC insurers dedicate to external services is comparable to internal amount.

Insurers typically use a variety of services, including the following:

- Professional services
- Software
- Infrastructure

These are typically in the form of an outsourcing or partnership agreement

- Most of the IT budget remains dedicated to internal resources, with 19% for internal data centres and infrastructure and the rest (32%) split between staff development and software maintenance/support. This is likely due to the goal of providing mobile, on-demand, and self-service applications for nonlife insurance

- We estimate that APAC nonlife insurers dedicate 19% of their IT budget to external professional services and an additional 13% to outsourced software services, on average
- The remaining 9% is spent on outsourced infrastructure. Compared to life LOB, there was more focus on software and infrastructure support, which is in line with nonlife digitisation efforts

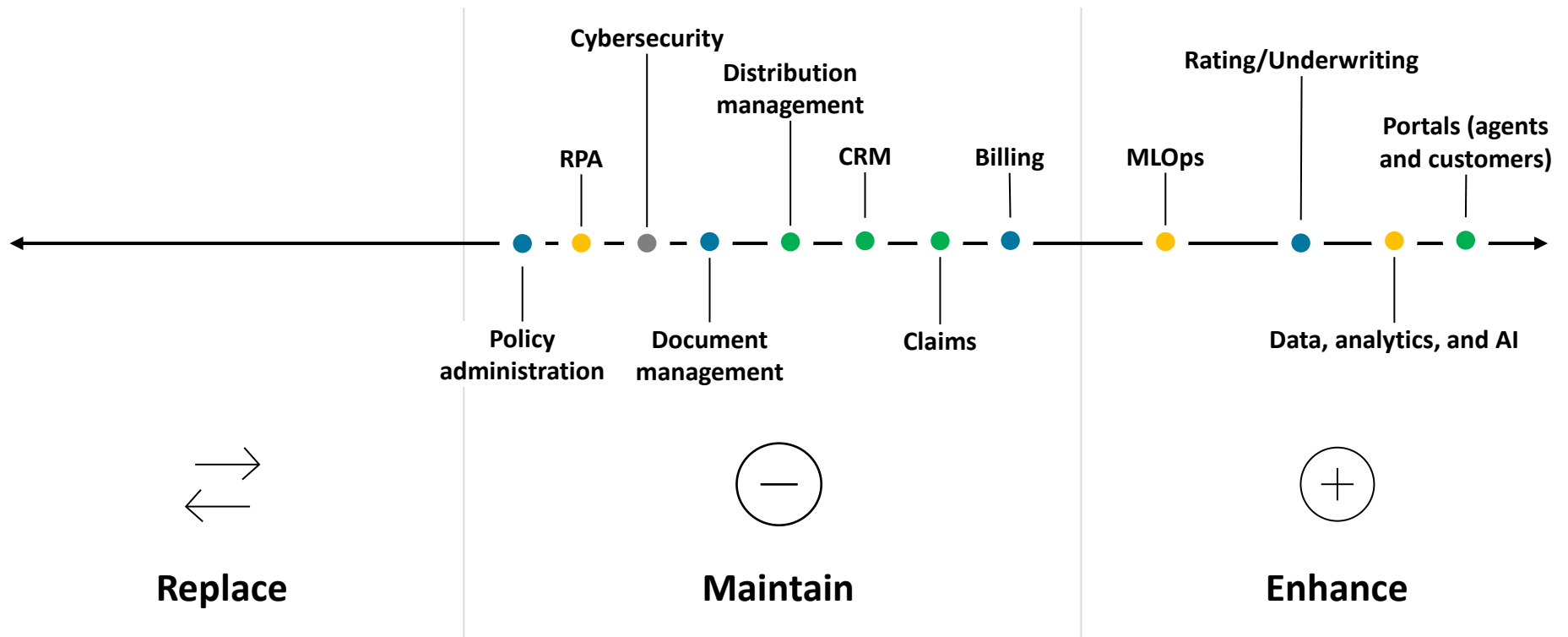
4% is for everything else and is not included in the estimation above

More on our IT budget allocation projections can be found in the following Celent report: [IT Spending In Insurance](#).

Source: Celent report, [IT Spending in Insurance](#) (September 2020).

AND TO LOOK DEEPER INTO THE FOCUS OF THEIR INVESTMENTS, INSURERS PLAN TO ENHANCE PORTALS AND CYBERSECURITY AND LEVERAGE DATA AND AI

When CIOs are asked about the technology priorities for future investment, APAC insurers' digital efforts focus on front-end components such as claims and portals. Data management with MLOps are to complement back-end components. There is an increased recognition for MLOps to enhance data/analytics capabilities



● Front-end ● Back-end ● Data/analytics ● Cybersecurity

Source: 2021 Celent CIO survey. Location of dots reflects the highest proportion of where CIOs placed the systems in their future plans, prioritized according to each segment (Replace, Maintain, or Enhance).

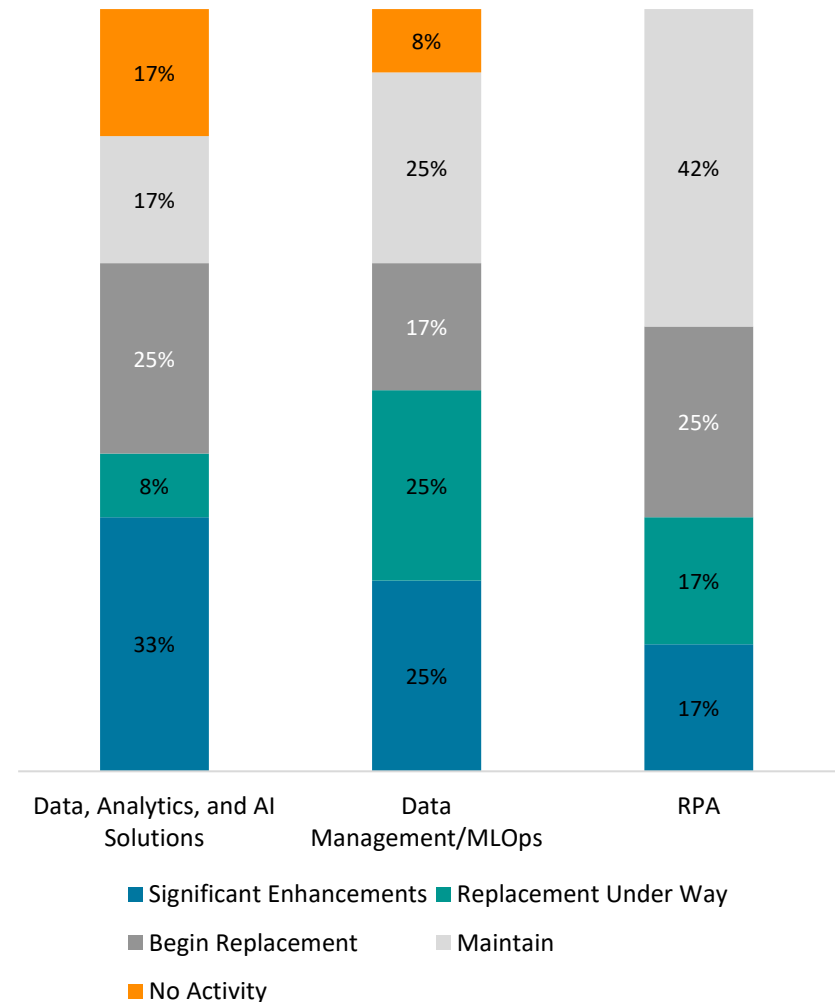
WHAT DOES IT SPENDING MEAN FOR DATA, ANALYTICS, AND AI INVESTMENTS?

- As we witnessed earlier, there is an increased and sustained priority of IT spending towards internal resources for both lines of business (life and nonlife). Although life is focused more on internal staff development and nonlife is towards the internal data centre and infrastructure, the requirement for data management, analytics, and AI/ML solutions will be the foundation for both LOBs
- Therefore, IT spending will shift more towards data and its accompanying infrastructure and technology because the realisation of the integrated ecosystem depends on using data and microservices for the broader business strategy of delivering customer empowerment and the AI-powered insurer
- In life insurance, the vision for a hybrid agent will require the use of data analytics to augment their existing distribution process, such as providing lead generation recommendations, and to contribute to an omnichannel strategy with the inclusion of social media and online interaction data. In nonlife, mobile, on-demand, and self-service applications will require a strong technical infrastructure to meet the demand and deliver such services
- In comparison with external resource spending, the majority is towards external professional services. We can define external professional services to include solution providers such as AI/ML vendors and their corresponding consultancy services. The lower focus for outsourced spending signals the desire to nurture talent internally. This could be purchasing external AI/ML vendors' products, having the vendor train internal staff, and encouraging internal development as part of data literacy efforts
- For instance, the goal is to bring in external knowledge and expertise for AI/ML best practices and to allow the internal data science team to realise increased productivity from the usage of such tools. Naturally, in-house development will benefit from internal domain knowledge, and internal development is a better allocation of resources for legacy modernisation efforts. External tools and consulting bring in the ideas and concept architecture, but it will be the internal team that can intimately understand and produce the intended results. And to enforce this throughout the organisation, a data literacy educational campaign must be conducted to ensure knowledge transfer and continuous innovation
- The following pages will highlight the selected use cases and priorities for data, analytics, and AI application in the insurance value chain

DATA, ANALYTICS, AND ARTIFICIAL INTELLIGENCE ARE DRIVING HIGH INTEREST AND INVESTMENTS CURRENTLY

Data-Related Technologies Investment Status (% of insurers)

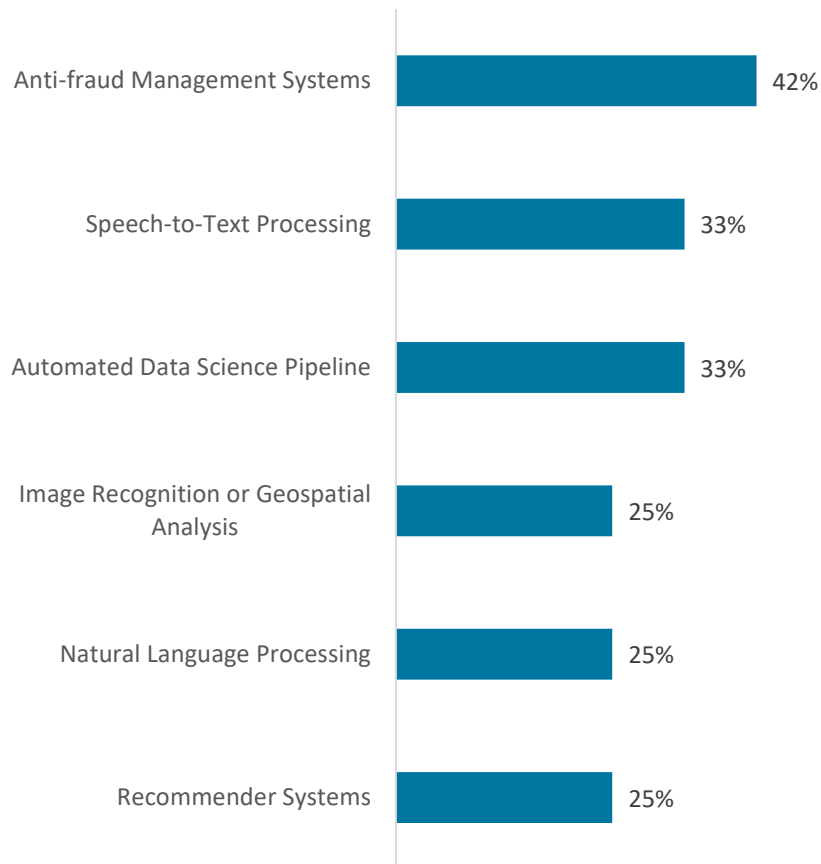
- Most of this year’s Celent CIO survey respondents have or plan activities around analytics and artificial intelligence (Begin Replacement, Replacement Under Way, and Significant Enhancements)
- Data, analytics, and artificial intelligence are increasingly perceived as key enablers by APAC insurers to improve many aspects of their business, including, among others, the following
 - New business, distribution, claims, and underwriting
 - Pricing
 - Fraud mitigation
 - Customer services
- As we noted in last year’s survey, we think insurers will invest more in technologies, allowing them to use internal and external data for solutions involving analytics or ML/AI. We think predictive analytics, machine learning, and artificial intelligence will serve as the foundation for delivering products with a customer-centric user experience
- On the other hand, we see less activity around robotic process automation (RPA). We think insurers have been leveraging RPA in their digital transformation efforts around process automation. They are now progressing to personalised product development with data and ML/AI algorithms and establishing new development infrastructure such as legacy systems with API connectivity



Source: 2021 Celent CIO survey

FIGHTING FRAUD, IMAGE RECOGNITION, AND NATURAL LANGUAGE PROCESSING ARE ARTIFICIAL INTELLIGENCE TECHNOLOGIES IN WHICH INSURERS INVEST THE MOST

Artificial Intelligence or Data Analytics Use Cases Adopted (% of insurers)

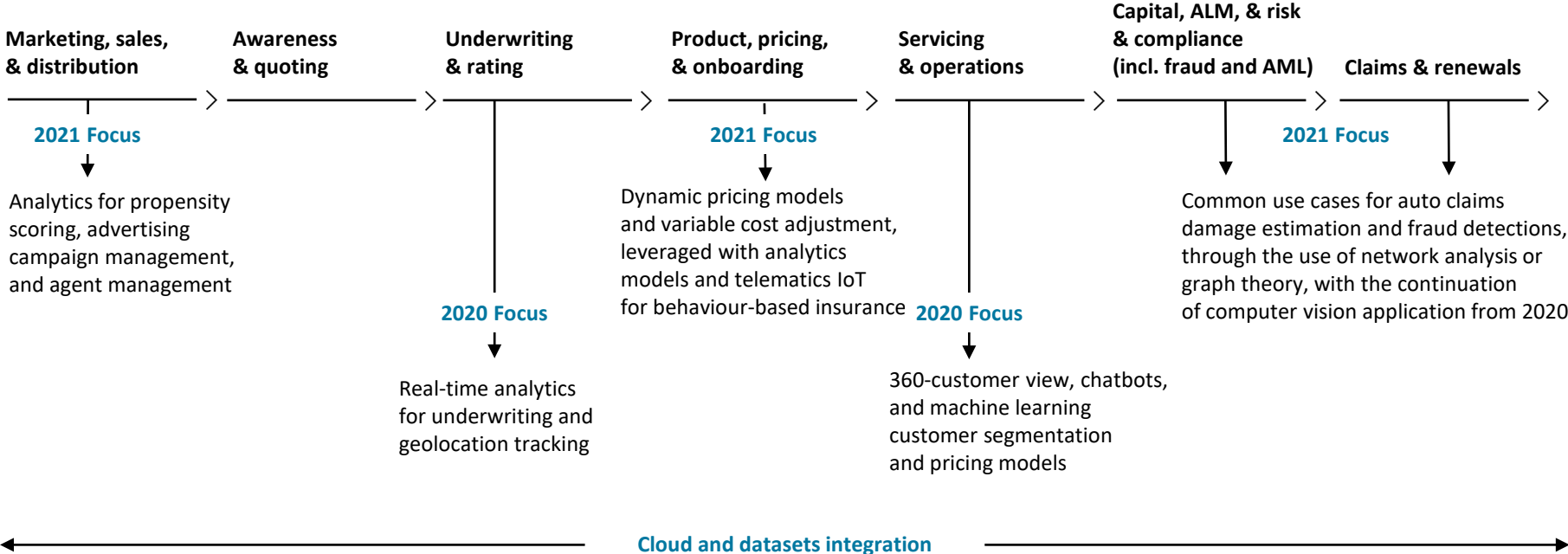


- Insurers are investing in artificial intelligence and data analytics use cases either in partnership with insurtechs or technology providers or via an internal development
- APAC insurers use these technologies in various domains
 - Image recognition or geospatial analysis, for instance, in underwriting and claims image analysis
 - Natural language processing in customer services, for instance, via conversational chatbots
 - Speech-to-text processing in call centre operations
 - Recommender systems for doctors' recommendations or social network analysis
- It is worth noting that APAC insurers are looking at executing their data science pipeline (MLOps) reliably to enable a more robust development process
- We expect insurers to make wide use of these technologies, with a focus on improving their technical ratios

Source: 2021 Celent CIO survey

PROMINENT VALUE CHAIN TECHNOLOGY INVESTMENT

And to supplement the investment priorities in data, analytics, and AI, we identified these trends along the insurance value chain over the past two years from Celent Model Insurer Data Management and Applied Analytics/Machine Learning categories. We will also look at two winners using computer vision and image recognition for motor claims and antifraud solutions.



Source: Celent Model Insurer for Data, Analytics, and AI 2021

DIGITAL 360-DEGREE SINGLE VIEW OF CUSTOMER AND PROCESS AUTOMATION HAVE ENABLED INSURERS TO ENGAGE CUSTOMERS BETTER...



-
- Prudential Singapore conversational AI chatbot engages visitors on digital platforms and “askPRU” for its agents, providing real time information tailored to customers’ life insurance plans
 - Prudential Pulse uses AI/ML and a mobile approach to promote holistic health management and provide self-help tools with real time information to consumers. The goal is to offer a new level of consumer engagement and accessible healthcare digitally. Features such as exercise posture checks can promote healthier life and reduce claims in the long term
-
- China Taiping’s speech-to-text prototype in 2019 is an elephant mascot termed Elephant of Peace. It is a physical robot in the shape of the mascot and used for translating speech-to-text as an AI insurance advisor
 - AIA International Super Connect combines a data-driven 360-degree customer view, with predictive analytics and an AI/ML engine to enable the insurer’s financial planners to present customers with a report based on the customer’s current product portfolio and on portfolio analysis of similar customers
-
- Customer contact centre is enabled with a **cloud-based robo-advisory** and **data analytics recommender**, **natural language processing**, and **speech-to-text** transcription capability. **Customer-centric machine learning propensity** and a **value-based model** provide insights into customer needs, behaviour, and preferences
 - Machine learning models increase policy repurchase and renewal rate, discovery of new channels of distribution, and lead generation techniques and improve claims processes. Agents can better serve clients or provide modular-based insurance (such as term life), automating underwriting with machine learning
 - Multidimensional data mining (internal/alternative data source) provides **protection-gap analysis** and a **recommender system** based on similar customer demographics, voice of customer, digital/social media footprint, and policy history
 - Life insurance is moving towards **agentless or multichannel solutions**, away from traditional agent-driven models. Agents will need to leverage financial planning technology to value-add customer advisory

Sources: Celent reports, [AIA International: Super Connect](#) and [Natural Language Processing: Chatbots, Speech Recognition and More](#)

...AND WE ARE SEEING INITIATIVES ACROSS THE APAC REGION USING PARTNERSHIPS AND DATA



- Partnered with Chubb to offer in-app travel insurance—Travel Cover
- On-demand travel insurance is for app users and distributed by GrabInsure Insurance Agency, Grab Financial Group's insurance platform



- Taikang Life Insurance implemented an AI platform with partnership expertise from leading technology players and university research. The AI platform results in an amalgamation of various technologies, from customer verification, natural language processing (NLP), and speech analysis to optical character recognition (OCR)
- Taikang's natural language processing platform (NLPP) is an offline customer service robot that uses NLP and depends on a semantic knowledge base



- Cathay Life, the [2020 Celent Model Insurer for Customer Experience Transformation](#), increasingly engages customers online and provides a digital channel to educate customers before they reach a purchase decision
- Cathay Life initiated the ACE project with the goal of using data analysis to create a better customer experience and expanded digital capabilities throughout the three stages of the customer journey acquisition, communication, and engagement



- AI algorithms and image recognition capture and assess damaged vehicles and accident area for automated underwriting, claims assessment, and pricing

-
- **AI algorithms and image recognition** will play a key role in data analytics for automated underwriting, claims assessment, and pricing
 - The **mobile-first model** will enable constant operation and flexibility in end-to-end mobile service and payments to give autonomy and empowerment to customers and instant access and feedback to claims processing

Sources: Celent reports, [Image Recognition in Insurance: Applied Machine Learning](#) and [Natural Language Processing: The Next Frontier in Data Aggregation and Understanding](#)

PZU: MORFEUS IMAGE RECOGNITION TOOL FOR MOTOR CLAIMS

- PZU, the largest insurer in Poland and CEE, handles 500,000 motor claims yearly and uses a huge number of photos and technical documentation analysis
- With 10% of documentation requiring detailed analysis by experts, AI technology can be used to improve the work of the experts
- AI models were first calibrated and followed by business rules calibration with PZU's workflow process
- Detailed user testing was then conducted after it went live. Procedural method ensures testing viability
- Through planned phases, three workflows are tested on similar metrics, which increase claims efficacy by 10 times
- AI and computer vision methods used by PZU aid damage analysis, claims severity checks, and replacement/repair recommendations of motor parts
- The technology is developed in cooperation with a UK-based insurtech startup
- This project concluded in a viable use case to grow the AI stack, with constant iterations leading to success



Claims Documents

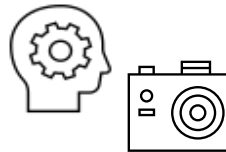
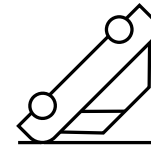


Image Recognition



Motor Claims Analysis

DYNAMIC PRICING OPTIMISATION FOR AUTO INSURANCE LEVERAGED BY DATA AND ANALYTICS MODELS

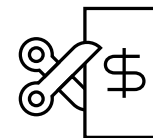
- iúnigo, the first digital full-stack insurer of Argentina, started in September 2018 as the spinoff project of Grupo San Cristóbal, one of the largest insurance groups in Argentina. As a new carrier with no claims or client data, there was an opportunity to invoke a strong culture of transfer learning and predictive modelling from the early stages of the company
- iúnigo showcased an application of dynamic pricing optimisation for auto insurance, using demand pricing or time-based pricing to set flexible pricing based on customers' data (with initial data from Grupo San Cristóbal)
- Customer Lifetime Value (CLTV) estimation became a new tool to evaluate the performance of the portfolio and create a new strategic guideline for the business. The goal is to design a pricing scheme with the potential to maximise the CLTV at price quote
- iúnigo focus on customers and product design was to meet the highest user experience standards, including pricing analytics. **A good data and analytics pipeline was needed to provide the foundation for future initiatives**
- Putting customer lifetime value at the centre provided a strategy for actuarial and data science methods to work in tandem with business goals and objectives



Dataset Integration



Dynamic Pricing



Price Personalisation

Source: Celent Model Insurer for Data, Analytics, and AI, [iúnigo: Dynamic Pricing Optimization for Auto insurance](#)

PUTTING AIOps, DEVSECOps, AND MLOps TOGETHER

DEFINING MLOps

- From the business coverage of the integrated ecosystem model and the investment priorities of data, analytics, and AI, we understand the viability of such solutions. To build a robust AI/ML system with a good production pipeline and behaviour mechanism, we can implement MLOps. Therefore, we will begin with a definition of MLOps

MLOps is not a component of application architecture but rather the set of processes/practices used to deploy and maintain a machine learning model in production. MLOps comprises the engineering techniques to bring ML to production scale. Therefore, MLOps is the ML practice that builds upon the principles and philosophy of DevOps and DataOps approaches to increase production robustness, process visibility, automation, availability, and maintenance in production ML systems

- The key principles for MLOps are the visibility of procedures taken, version control (e.g., Git and collaboration), and automation (allowing the system to set requirements). The automation of various tasks in an MLOps pipeline allows the data scientists and engineers to focus on the creative aspects of solving business objectives/challenges, hypothesis development, and data feature usage
- But customers' data security and personal information protection must be considered as well, to build trust in digital services. Data must adhere to cybersecurity guidelines for confidentiality, integrity, and availability, with a single source of truth for nonrepudiation

WHAT ARE DEVSECOPS, AIOps, AND MLOps

In this section, we consolidate the common Ops moniker and acknowledge that it can be confusing, but this also points to the recent trends in the technological space. The key goal of any data-related project is to define the business objectives well and lay out data requirements for either a data analytics or ML application. Through defining the relationships of the Ops moniker, we hope to help insurers understand the interconnecting processes that are available to design a suitable data, development, and AI/ML pipeline to realise AI/ML models in application/system production

DevSecOps

- DevSecOps is an extension of DevOps and addresses security as early in the lifecycle as possible. It manages the core activity of software engineering
- DevSecOps considers the concept of *shift left* in its methodology. Shift left means that information security is built into the application process at the start of the development cycle and not as an afterthought. It forces development to implement security guard rails through the entire development lifecycle

AIOps

- AIOps provides visibility into system and data performance across all environments. AIOps analyses and extracts significant events, automatically alerting IT staff to problems, their root cause, and recommended solutions
- AIOps is the automation of IT and data operational processes by analytics and ML capabilities, including those of data processing, data sharing, system logs and metrics, incident-related data, and ticketing

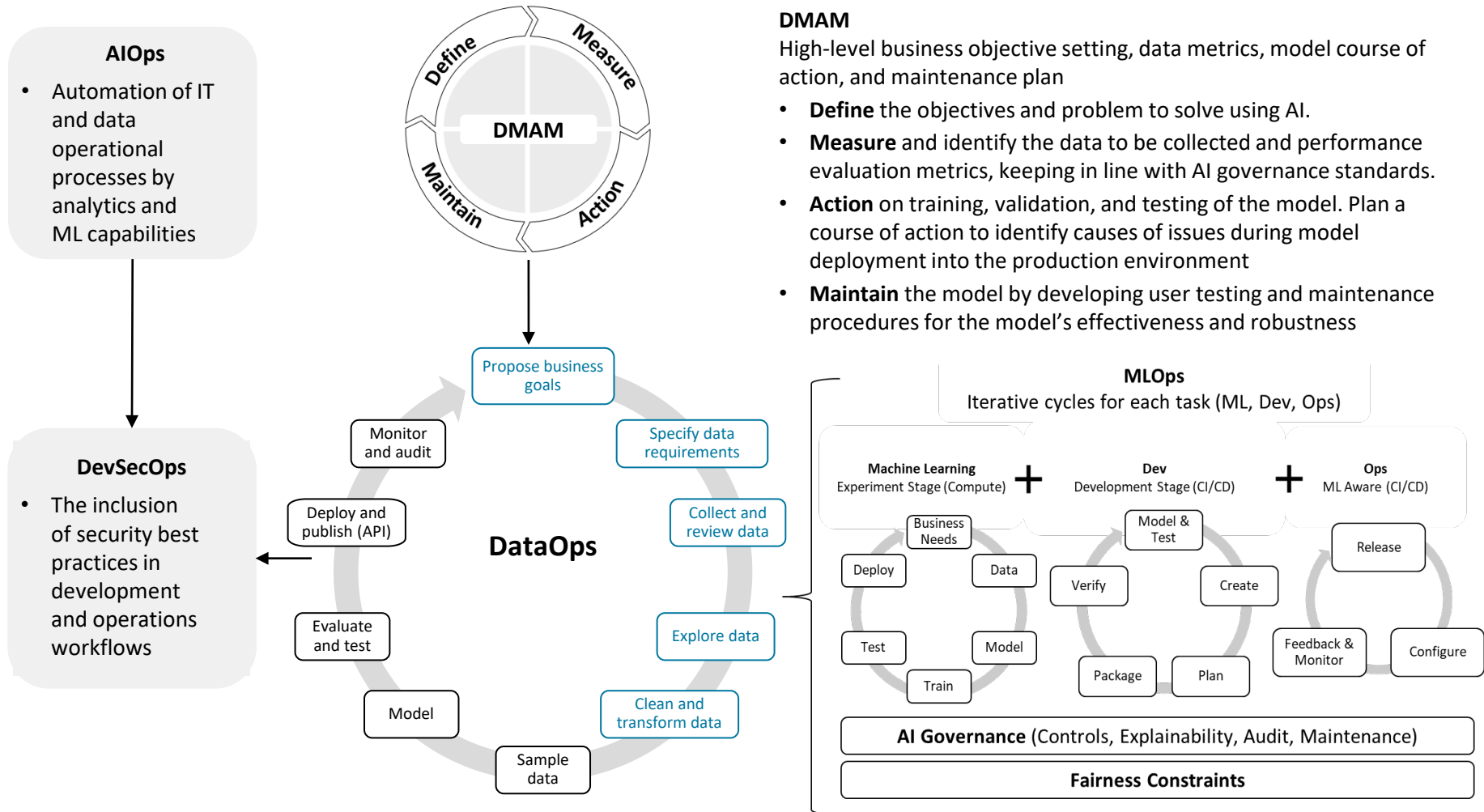
DataOps

- DataOps is the methodology for data operations, which improve the quality and reduce the cycle time of data analytics tasks. It begins with automated data retrieval, sample selection through model development, and deployment and monitoring, with concern for data privacy and data sensitivity

MLOps

- From the 2018 Celent report on DataOps for data analytics, MLOps is the progression and development of workflow for the entire ML pipeline. The key differentiation is that MLOps focuses more on ML applications, which are primarily more complex neural network computations, and shows the methodologies in managing ML-specific applications

PUTTING THE OPS TOGETHER: THE DATA PROJECT LIFECYCLE

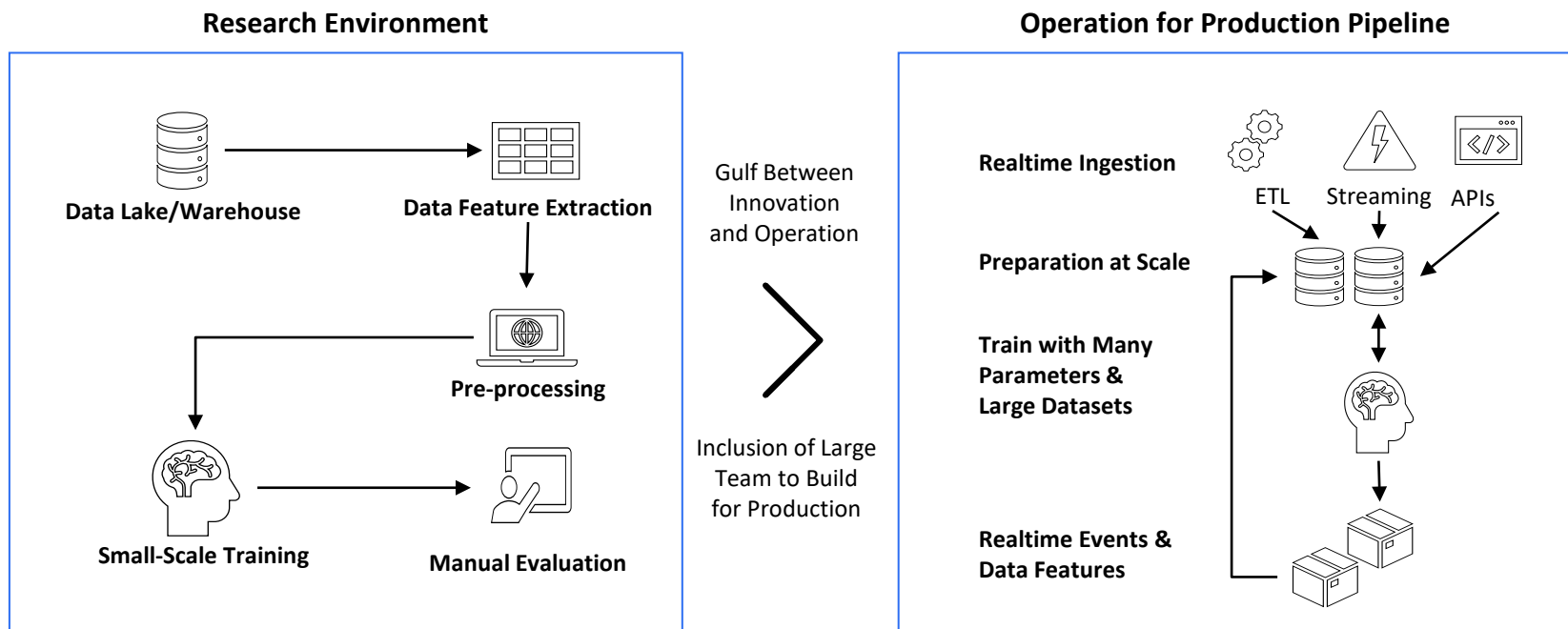


Source: Celent Report—[MLOps Part 1: From ML Innovation to Production](#)

DATA MANAGEMENT AND MLOPS

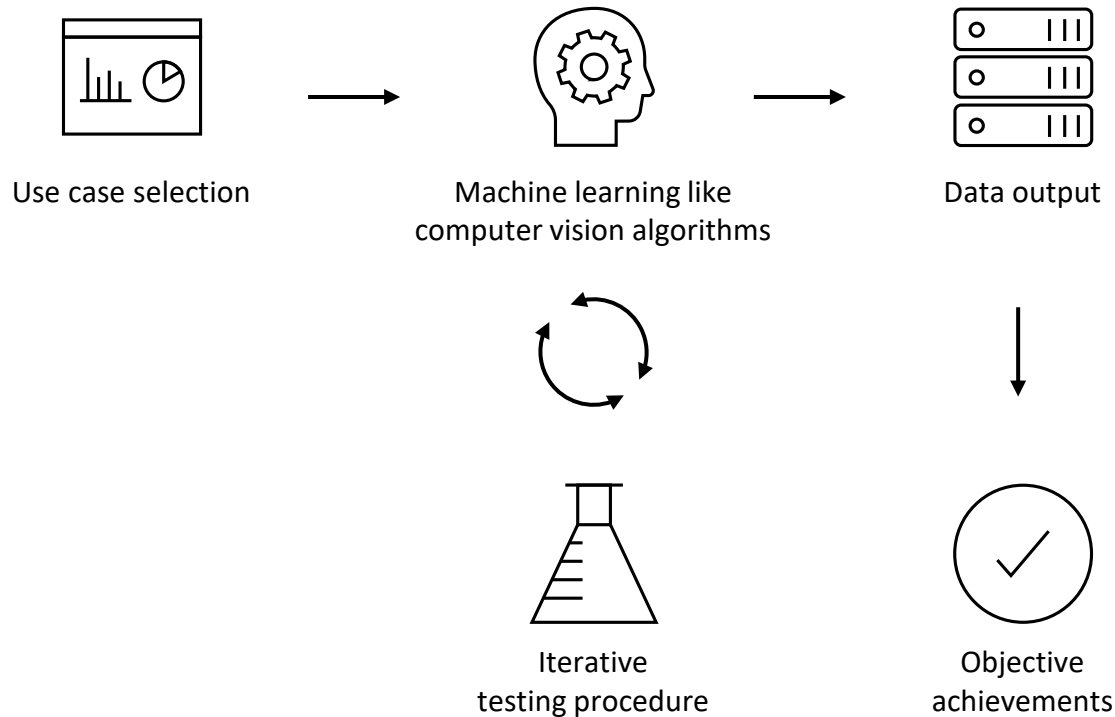
FROM EXPERIMENT TO PRODUCTION

- In actual operations, the data science teams developing ML innovations are usually situated in a research or business unit and can be separated from the DevOps or production unit. The steps involved in the development of the innovation lab prototype are not built for scale and, when passed to production, further preparations are required to scale the prototype in an automated manner
- There can be a gap between the research environment/innovation labs and the operation unit responsible for the production pipeline. This gap between local innovation and scalability can be bridged on a centralised platform and workflow pipeline. The platform will handle the engineering aspect of model deployment, while allowing the data science team to focus on innovation that uses ML techniques. The diagram aims to recommend the usage of production practices to scale the experiment from the innovation lab



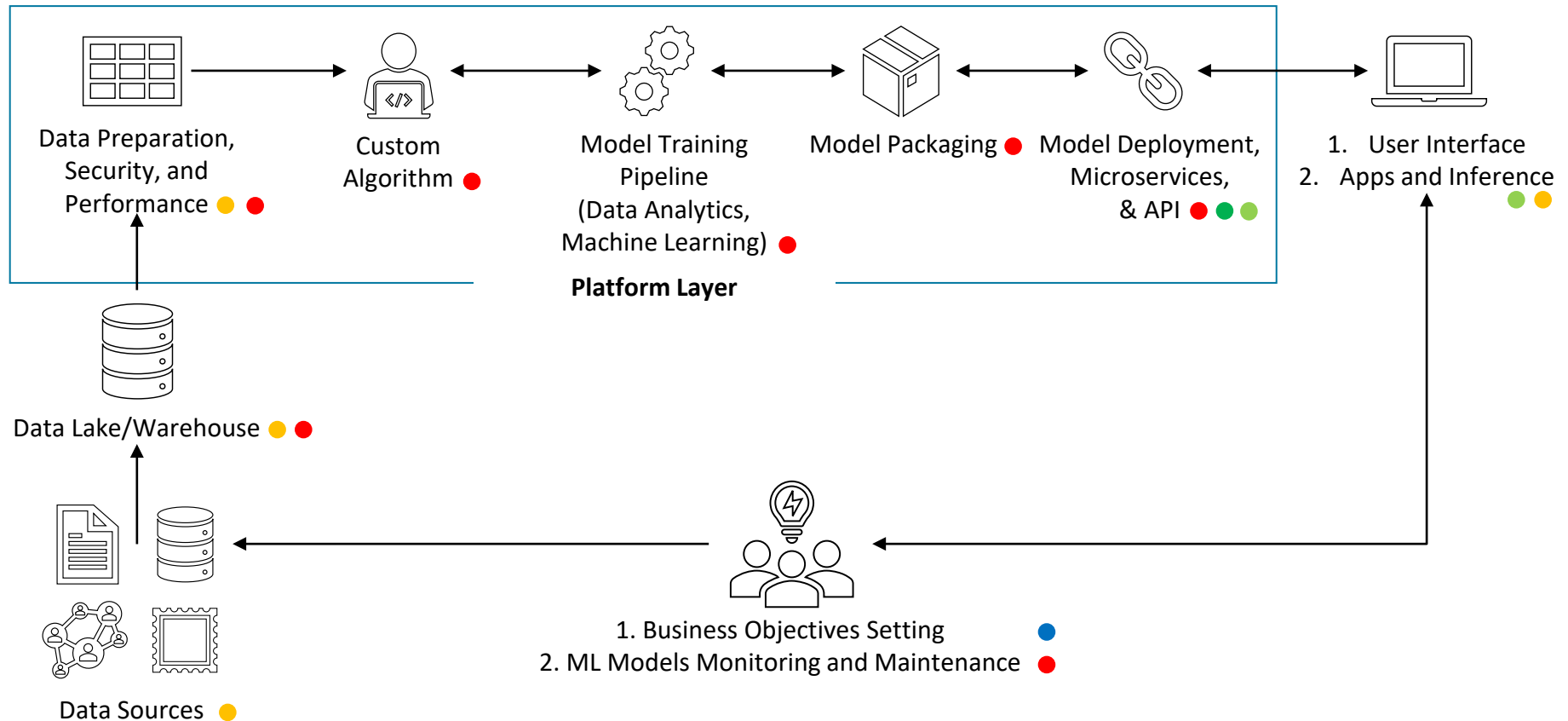
Source: Celent report, [MLOps Part 1: From ML Innovation to Production](#)

FROM EXPERIMENT TO PRODUCTION



1. To bring innovation from experimental stage to production, the selection of a good use case will show analytics or AI/ML effectiveness and feasibility
2. After use case selection, machine learning and deep neural networks model development are developed. User acceptance testing will then be conducted for production-ready solutions
3. In some instances, output is transformed into tabular data format and stored in database storage for visualisation analysis
4. The goal is to realise and promote the objective of the use case, such as good driving behaviour

PLATFORM TO BRIDGE THE GULF BETWEEN ML INNOVATION AND PRODUCTION: AN ITERATIVE PROCESS



● Data Engineer ● App Developer ● Data Scientist ● IT Operations ● Business User

Source: Celent report, [MLOps Part 1: From ML Innovation to Production](#)

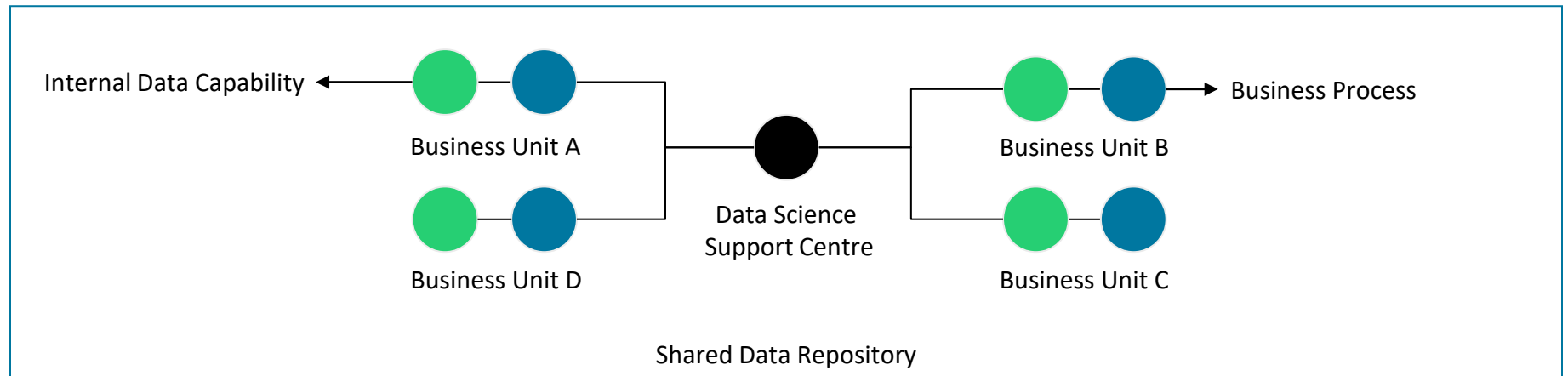
AI/ML KEY EXECUTION CHALLENGES AND BENEFITS OF AI/ML PLATFORM

- As we recommended an iterative and collaborative approach between the business and IT users, niche projects of AI/ML faced additional challenges too
- AI/ML projects faced a typical set of challenges, such as
 - **Talent shortage and lack of key skills to maintain operations.** We will need to improve on the data literacy of the entire organisation to promote the greater usage of data solutions
 - Lack of collaboration across teams
 - **Readily usable data was lacking, and there was a lack of integration between disparate data sources**
 - **Lack of a centralised repository to exchange and consume third party data**
 - Unavailability of rapid infrastructure and software
 - Slow CPU processing, but datasets continue to increase in size
- Data scientists were quoted as wanting an infrastructure platform that could integrate ML tooling and provide them with agility, flexibility, portability, and scalability
- A data scientist wish list included
 - Self-service portal to access ML tools and sources
 - Perform ML modelling with hardware acceleration
 - ML model deployment in the app development process
 - Inferencing with hardware acceleration
- As we explore in the following insurance use cases, we also find a similar challenge of integrating datasets and workflows to build meaningful AI/ML models for anti-fraud management and dynamic pricing. Furthermore, **data management should include considerations for security during production**, because the experimental approach of ML fits badly with data compliance policies in the industry
- Therefore, a further discussion on data management and MLOps aims to provide additional clarity about a controlled platform for AI/ML solutions

Source: Celent report, [The Data Force: Cultivating a Data-Ready Organization](#) and Red Hat

DEMOCRATISING DATA THROUGH TALENT SKILLSET DEVELOPMENT AND INNOVATION

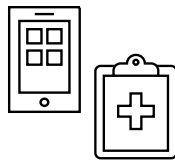
- The data science team in an organisation can be organised into two directions: as a centralised hub with spokes to support specific needs or as internal data science teams in each business domain. The decision of which direction to take will depend on the requirements of an organisation, both at an initial stage and at a mature stage
- Initially, the data science team can be a single hub servicing various units, which can be a good way to develop data models for specific use cases. This approach maintains a centralised strategy and control over the vision and purpose of the models developed
- However, a decentralised approach of having a dedicated data science team in each business unit has an advantage in promoting data professionals who are well versed in their business unit tasks. This ensures that data specialists have deep business process knowledge, creating strong internal capabilities. However, being decentralised can lead to data ownership silos and hamper the collaboration needed for organisation-wide strategies and programs
- Therefore, the sweet spot is to have the data science team operate between a centralised hub and decentralised business units. Data sources should sit at a shared location with various access controls. This helps to break down data silos and allows expansive insight into the database. Gradually, the data science team will become a support system for citizen data professionals across the organisation and will promote the common data language in the organisation



Source: Celent report, [The Data Force: Cultivating a Data-Ready Organization](#)

TAIWAN LIFE: ALTERNATIVE DATA USING GOVERNMENT OPEN HEALTH DATA INITIATIVE

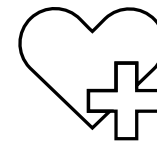
- Taiwan Life is Taiwan's oldest insurer, established by the government in 1947 and privatised in 1988. Taiwan Life joined CTBC Financial Holding Group in 2016 and is one of Taiwan's top insurers
- Knowtions Research, an applied AI company, tapped the Taiwan's government open health data initiative and Taiwan's Mobile Health Bank app to derive better outcomes for health insurance. The application allows users to access their historical health data and grant this access to third parties that the customer trusts.
- Open health initiatives increased consumer adoption of open health data and new data sources that insurance companies can use to assess risks and improve customer experience. This enables a new generation of insurance called Pay How You Live insurance.
- Taiwan Life combines these new open data sources with Knowtions' health AI models to assess risk and improve customer experience, to enable the Pay How You Live insurance and optimise cost of care. More data lead to more accurate predictions for customers and encourage people to stay healthy rather than file claims.
- Taiwan Life also works with Knowtions to protect customers' data with validation by external cybersecurity organisations.



**Open Health Data
and App**



Data Analytics



**Pay How You
Live Insurance**

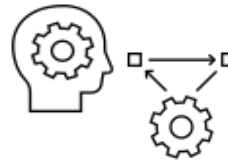
Source: Celent Analyst's Panel Discussion at InsureTech Connect Asia 2021

GRUPO SAN CRISTÓBAL: FRAUD DETECTION USING COMPUTER VISION AND DEEP LEARNING

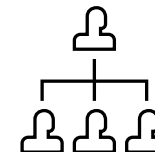
- San Cristóbal's markets, Argentina and the Latino region, suffer from a high insurance fraud rate, partly due to legacy processes contributing to its increase and to full manual work
- This resulted in high claims costs and a low fraud detection rate, with poor-quality and wrong data being recorded. Such actions resulted in a slow resolution of claims
- San Cristóbal adopted the agile methodology with a two-week sprint for in-house data scientists to develop algorithms with cloud-based data upload
- Supervised and unsupervised models, together with convolutional neural networks are used for computer vision application in fraud analytics
- This project was first supported by consultants, with an in-house team to maintain the technology
- To improve the model's accuracy, San Cristóbal uses data augmentation for data creation and third-party data
- San Cristóbal uses machine learning technology in its transformation, with a focus on computer vision for claims analysis
- This enhances current processes, which rely heavily on manual image inspection
- Using computer vision methods, car claims inspection can be selective and automated, improving efficiency
- An in-house system provided customisation unique to the Argentine insurance market



Datasets Integration



In-house Model Development



Fraud Detection

Source: Celent Model Insurer for Data, Analytics, and AI, [Grupo San Cristobal: Innovating Fraud Detection Using Computer Vision and Deep Learning](#)

UNIQA INSURANCE GROUP AG: STRATEGIC P&C GROUP ANTI-FRAUD INITIATIVE

- UNIQA's use case for developing a fraud analysis model was rooted in disparate solutions across business units and lack of automation
- For UNIQA, **a common workflow and data source will aid in centralised fraud investigations**
- UNIQU developed unified workflow processes, with localisation across business units sharing their own best practices to the entire firm
Once initial technology is rolled out, constant reviews will be conducted for technical improvements
- To supplement its existing data, external data sources will be adopted for comprehensive modelling
- UNIQA manages the data structure by having a common workflow and utilising FRISS, an anti-fraud solution provider for insurers, for its technology in claims fraud analysis
- Notwithstanding process commonality, UNIQA's individual business units shared best practices from their own anti-fraud experiences



Source: Celent Model Insurer for Data, Analytics, and AI, [UNIQA Insurance Group AG: Partnering Against Fraud – Network Analytics, Text Mining, and AI in Action](#)

DATA MANAGEMENT THROUGH MLOPs AND SECURITY

- Data management includes considerations for incoming data streams and datasets. The process for data discovery, obtaining raw data, and processing requires access approval and tools. Therefore, we must build a strong data management standard before diving into the applications of AI/ML.
- Features must be built from the raw data obtained, and this includes both structured and unstructured data. Consideration must be given for data processed in batches or as data streams. Querying data from different technology sources and stacks (files systems, RDBMS, cached data, etc.) also pose additional challenges which must be addressed in the overall data retrieval process.
- To protect the data collected, data integrity, confidentiality, and availability must be enforced during the data usage lifecycle, extending to the archival stage as well.
- Data must be maintained for use across the preparation, training, and testing cycle. Data maintenance comes in the form of data/concept drift, which is the change in predictive variables as the model results change over time.
- This is where the business, technological, and data units of an organisation must come together to define the data dictionary and set a single source of truth for the data to be used.
- Ownership of data AI/ML initiatives must coincide with project sponsorship by the business unit. A finding by DataRobot revealed that projects with business units' support are more likely to be implemented successfully.
- Data management also includes the development of data literacy in the organisation, which imbues in the organisation an appreciation of data which will translate into data innovations in production. A strong data team that can communicate, educate, and work with various stakeholders in the organisation will provide a good foundation for the implementation of data initiatives.

KUBERNETES AND CONTAINER IMAGES FOR MACHINE LEARNING

- Modularity will be the key to packaged AI/ML innovation in plug-and-play APIs that can be shipped for appropriate applications. The architecture will be using microservices
- To build the microservice architectures, containers and Kubernetes can accelerate the ML lifecycle as these technologies provide the agility, flexibility, modularity, and scalability to train, test, and deploy models. Any Open Container Images (OCI) -compliant container can be used on Kubernetes
- To put the terms into perspective, on the cloud, Kubernetes (as a cluster) manages container images (distributed over multiple nodes with multiple GPUs) to provide microservice capabilities. This will achieve horizontal scalability, which means adding more machines for data partitioning and scalability
- **Red Hat® OpenShift®** is one such example, providing hybrid cloud capabilities with Kubernetes and allowing for an integrated DevOps process. This platform gave a collaboration avenue for data scientists and software developers, accelerating the roll-out of intelligent applications across the hybrid cloud (data centre, edge, and public clouds)
- Red Hat OpenShift Data Science is a managed cloud service for data scientists and developers to train and test containerised machine learning models in the public cloud before deploying them in production
- In addition, there are considerations for AI governance. Solution provider **BasisAI**, a Singapore-based artificial intelligence company recently acquired by Aicadium, enables enterprises to develop machine learning models with built-in AI governance features. The additional governance engine tracks model performance and explainable AI (XAI) metrics. Bedrock provides out-of-the-box features to explain ML models and reveal the underlying drivers of automated decisions

EXPLAINABLE METRICS AND FAIRNESS CONSTRAINTS

- Model explainability and governance will provide fair and unbiased model results. They also provide an avenue for the business and audit teams to understand what is under the hood, providing traceability and an audit trail
- Explainable metrics can be visualised according to the feature contribution towards the model performance. Business users will understand the metrics (features) used in a model and collect appropriate data
- Prohibited variables such as gender and race are predefined to ensure that models are not biased, with fairness constraints in place. **BasisAI**'s Bedrock platform can prevent unfair models from being deployed with control of a button on the platform
- Embedded governance provides a good framework for ML/AI risk management. Governance policies for ML ensure that workflows, models, and data have strong governance practices in MLOps. The goal of MLOps should be to maintain control over production models, with the goal to minimise risk and comply with regulations
- **Red Hat OpenShift Data Science** provides data scientists and intelligent application developers the ability to build, train, and deploy machine learning (ML) models for rapid experimentation use cases, bearing in mind that not all experiments will end up in production

MULTIMODAL DATA TYPES AND METADATA FOR DATA QUALITY

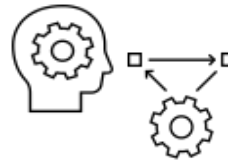
- And the priority of an AI/ML initiative is not primarily on the algorithms, but also on the data input. The right kind of data must be considered and should not be limited to a single data type or source
- Multimodal data types and models provide a richer representation and closely resemble human decision making. Data processing steps will precede model deployment, and the right data sources can help provide a good illustration of the use case
- To adopt a common understanding on the dataset used, the inclusion of metadata for model development will enable the model to understand the data as common knowledge and have a single data source.
- Metadata will provide a shared knowledge base and allow MLOps to be inserted into the wider organisation functions. A shared knowledge base also ensures data quality and integrity, involving both technical and business users.
- Metadata can fulfil different requirements of the data science research and engineering/development teams. For instance, metadata can provide researchers with graphs for dataset creation and document metadata for engineers to track development pipeline performance. This also helps in audits and explainability with the wider audience of a solution.
- MLOps focus on constant iterative data feedback, model training, validation, and testing and the inclusion of metadata will provide a common library for both the machine and human stakeholders to use machine learning to meet business objectives

ORGANISED FRAUD DETECTION VIA SOCIAL NETWORK ANALYSIS (SNA)

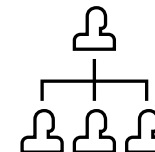
- In continuation of graphs as metadata, the usage of graph structure can describe data relationship on a unified data store, which will prevent duplication and provide data linkages and tracking
- Graphs also supplement the model's learning ability and provide domain knowledge beyond the limited training data provided—also known as the few-shot learning challenge. In a way, the model learns from prior experiences and related knowledge before attempting its own learning. This concept of using graphs to share information is referenced from research papers on graph neural networks (GNN)
- Anadolu Sigorta is a Turkey-based insurance provider and offers health, liability, marine, engineering, motor, and fire and home insurance packages, among others
- To overcome manual workload and traditional methods for fraud detection, Anadolu Sigorta showcased an **application of graph theory through SNA**. Currently, manual workload dominates the fraud detection process, which makes visualising and analysing issues difficult. Large amounts of data need to be integrated and detection techniques need to go beyond traditional methods
- Anadolu Sigorta investigate social structure by using network graph models to map real-world entities through nodes (people or things) and the links (relationships or edges) that connect them. Networks can be represented visually; these visualisations are intuitive and may make apparent patterns of connections and reveal nodes that are highly connected or that play a critical role in connecting groups
- This automated fraud detection is a step a way from the traditional fraud detection techniques of rule-based systems and machine learning or data analytics fraud-prediction techniques and show an interesting combination of datasets for model development



Dataset Integration



SNA Algorithm



Fraud Detection

GRAPH APPLICATIONS IN FINANCIAL SERVICES

- Graphs can help to organise an overflowing amount of information in financial institutions, bridging siloed data together. Graphs semantically integrate diverse data and connect at scale, regardless of data formats and models
- Possible applications can be for document classification, know-your-customers (KYC) information, compliance and regulatory reporting, investment research, fraud analysis, insurance underwriting and claims processing, and chatbot recommendations. Knowledge graphs allow an expansive organisation of data
- To elaborate on some possibilities: Customer analysis, risk dimensions, and relevant regulations can be mapped in a single graph and used for identification of at-risk customers of a financial institution. Relationships between related members and regulations can be visualised as interconnecting parts and provide opportunities for analysis and pattern identification
- Data lineage and metadata management are especially important in financial institutions, for use cases in regulatory reporting and management of systems or new data sources. Complex financial data must be described with relevant metadata and relationship to be contextually useful. Graphs provide a semantic data layer with data lineage tracking, allowing both business and technical users to understand the relation and dependency between data sources
- Fraud detection to prevent anti-money laundering (AML) and counterfeiting are traditionally detected through relational databases held together by complex joins that make them hard to maintain and scale. Graphs can provide better pattern recognition in real time, through graph traversing. Insurance fraud detection can be enhanced with graphs, with visualisation of an entity, and potential clusters of fake claims, augmenting existing ML pipelines with graph feature engineering

Applications in Financial Services



**Document
management**



**Customer
relationships**



**Regulatory
reporting**



**Data lineage and
management**



**Fraud
detection**



**Context-driven and personalised
recommender system**

Source: Celent report, [Introduction to Graph Data Design: Alternative Database and Tools](#)

OPEN SOURCE PLATFORM WITH MLOPS



- An example is Kubeflow, which is a free and open source ML platform designed to enable a ML pipeline and orchestrate complex workflows running on Kubernetes. Kubeflow was based on Google's internal method to deploy TensorFlow models called TensorFlow Extended
- Kubeflow is the ML toolkit for Kubernetes, with configurations to choose the platforms and services needed for each stage of the ML workflow (from data preparation to model training, prediction serving, and service management). Kubeflow has two components, Kubeflow and Kubeflow pipelines, with the latter focused on model deployment and CI/CD
- Compared to MLflow, an end-to-end open source Python library with predefined patterns that train and deploy scikit-learn models to Amazon SageMaker or Microsoft Azure ML, Kubeflow can be adapted to existing workflow on Kubernetes
- Kubeflow is a customisable solution that relies on Kubernetes and MLflow to aid deployment to managed platforms. However, Kubeflow and MLflow are both smaller and specialised ML tools
- From an open source infrastructure provider, Red Hat OpenShift facilitates automated deployment with Kubernetes operators and enables project and resource isolation, protected resource sharing, quotas, and priority and pre-emption for AI/ML projects
- There is no magic solution to MLOps deployment. It is more important to ensure good business objectives, use case selection, team culture, and data literacy levels to ensure successful AI/ML solutions to current insurance needs

Source: Celent report, [MLOps Part 2: Examples of Enterprise ML Deployment Providers](#) and Red Hat

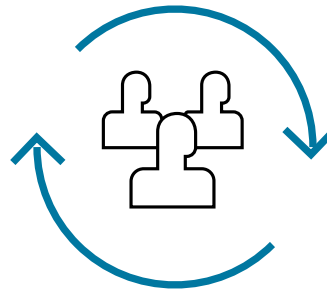
OPEN-SOURCE PLATFORM WITH MLOps

- MLOps is an approach towards AI/ML adoption and helps empower lines of business with the ability to manage their ML solutions with pipeline tools for task management. From a solution provider standpoint, they can provide additional consultation and coaching
The following diagram shows an iterative approach to foster innovation in ML
- This approach highlights the additional development of data literacy within the organisation as part an overall data management and MLOps strategy and will enable better workflow processes on top of an AI/ML platform
- On the subsequent page, we show a reference application architecture for specific AI/ML solutions, from business objective identification and data requirement to computing resources required



MLOps Process and Practices

Adopt open practices to quickly develop, validate, and launch new machine learning models in response to changing demands



Coach and Mentoring

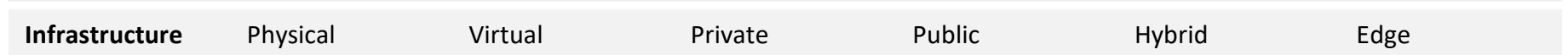
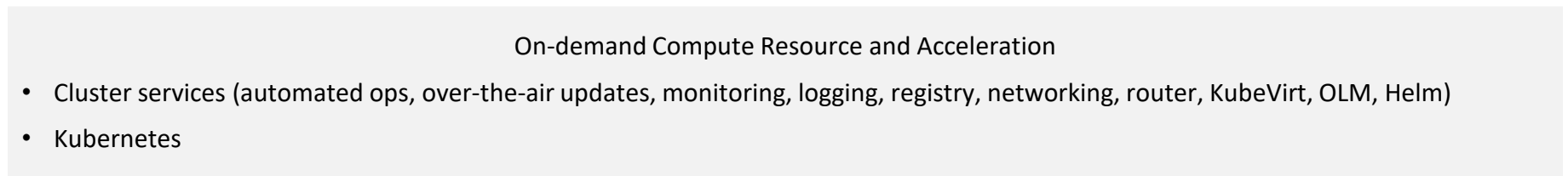
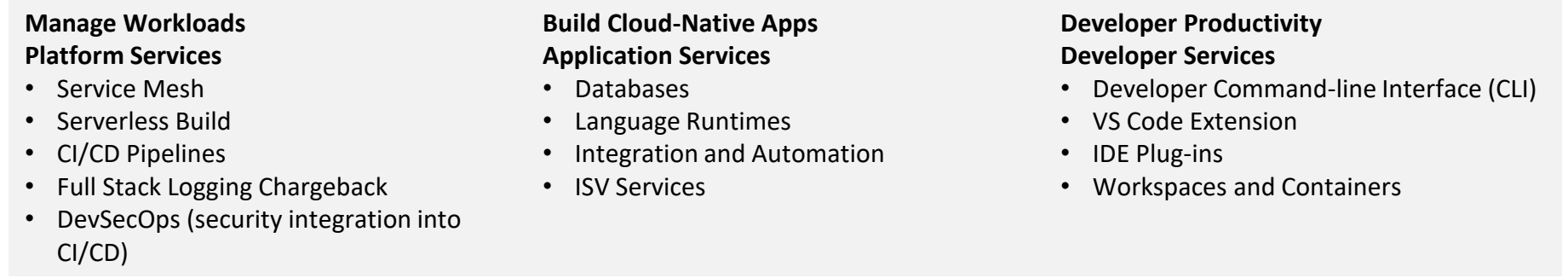
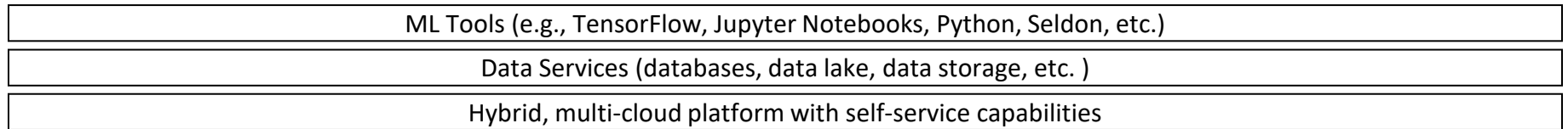
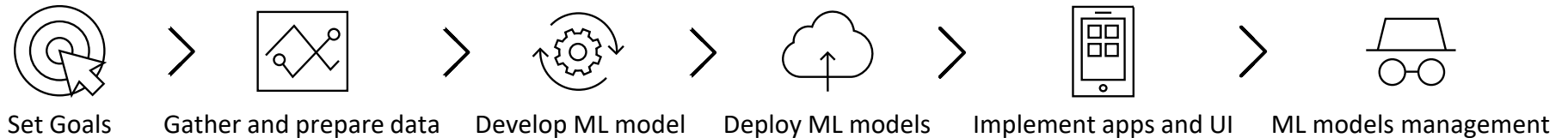
Spark innovation and agility with collaborative approaches between solution provider and customer. Foster communities to empower and inspire the organisation



Tools and Technology

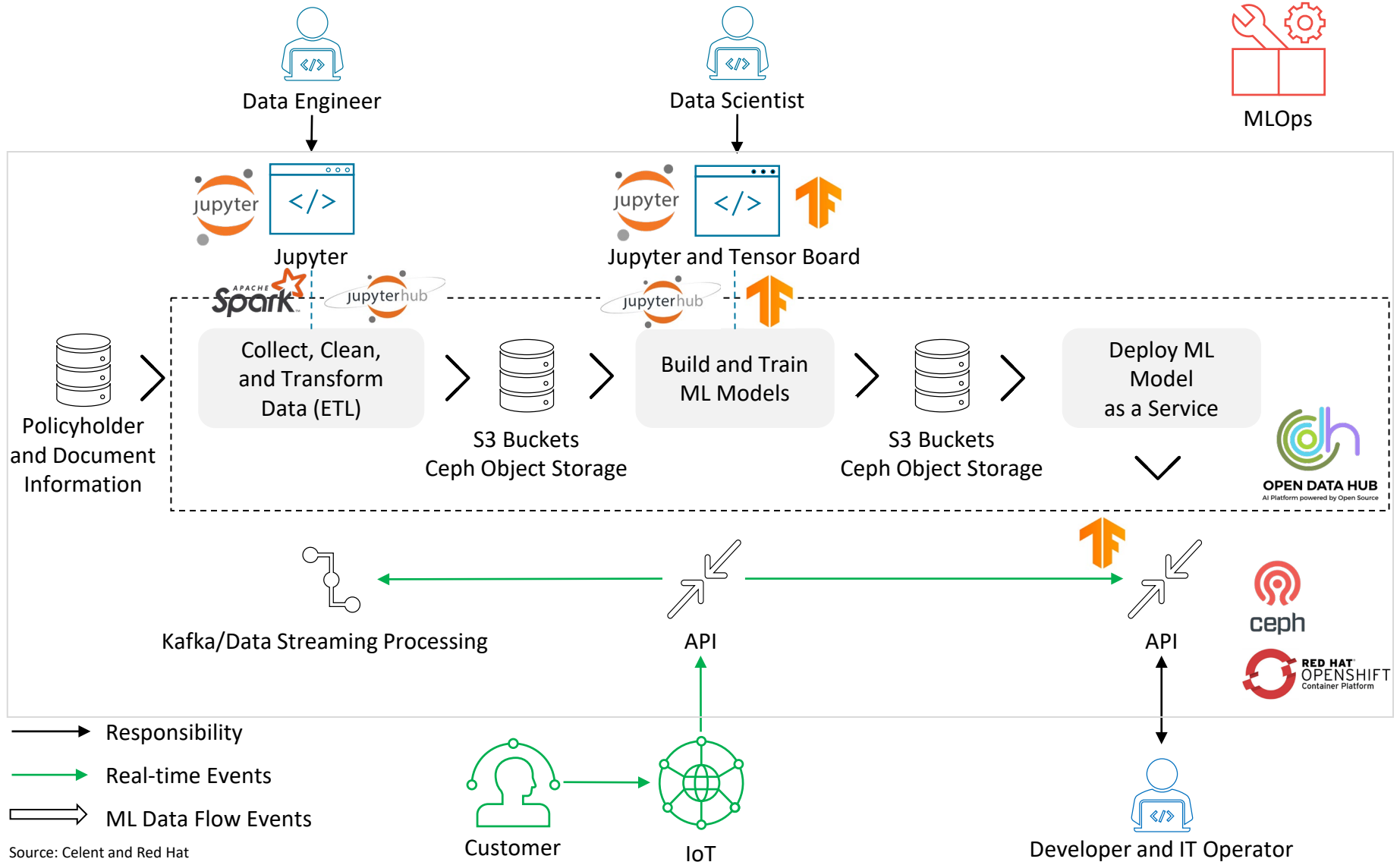
Establish an open-source architecture for AI/ML platforms and techniques to accelerate innovation

REFERENCE ARCHITECTURE FOR AI/ML PLATFORM



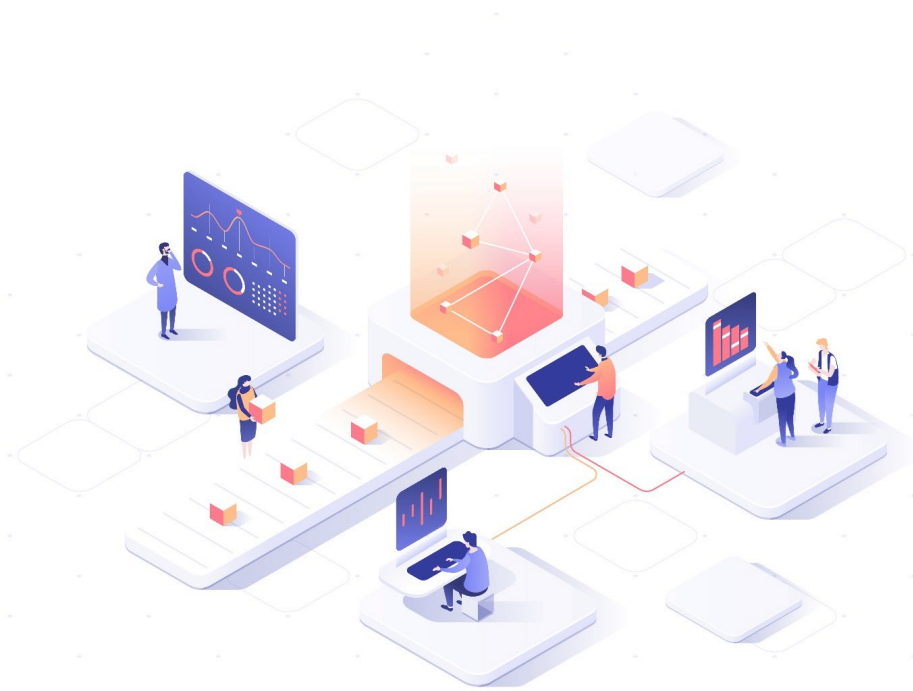
Source: Red Hat

EXAMPLE OF AN END-TO-END MLOps FLOW



Source: Celent and Red Hat

INSURANCE MLOPS USE CASE

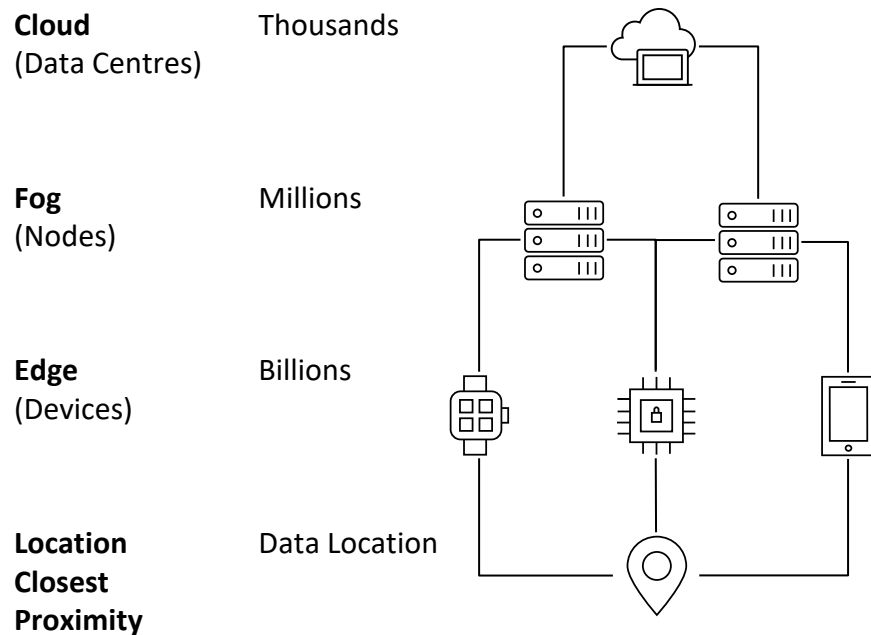


- DataRobot is a US-based provider in enterprise AI technology, which enables enterprises with end-to-end AI automation to build, deploy, and manage machine learning models at scale
- DataRobot machine learning operations (MLOps) is part of the DataRobot Enterprise AI platform and provides a central hub to deploy, manage, and govern machine learning models in production. This integrated platform includes flexible model deployment, centralised management, and capability to run models anywhere (including on IoT devices, cloud platforms, or on-premises operations)
- DataRobot’s technology has been used globally to help insurance companies detect fraudulent claims, set competitive pricing, predict financial loan defaults, and reduce customer churn. DataRobot views advanced analytics as a cornerstone to insurance, and automated ML processes will lower technical barriers for business domain specialists to adopt AI/ML solutions
- Insurance use cases include **NTUC Income, a Singapore insurer** that uses **DataRobot** to manage rising claim costs by identifying key drivers for pricing analysis. The usage of an automated ML platform helps to estimate feature impact and identify exposure factors with the most significant change in the portfolio. Results are presented as data visualisation for easy communication with business owners for change action

Source: Celent report, [MLOps Part 2: Examples of Enterprise ML Deployment Providers](#)

USE CASE DISCUSSION: INTERNET OF THINGS

IOT SENSORS AND DATA EXCHANGE

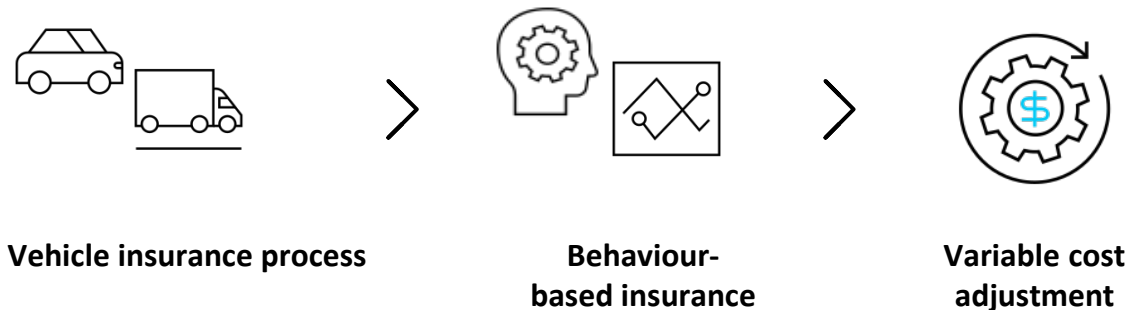


- IoT refers to the network of physical objects with embedded sensors and software that exchange data over the internet to provide real time analytics and machine learning solutions, such as for vehicle fleet management. Remote vehicle fleet management enables real time vehicle status monitoring, acting as additional data points for underwriting and claims analysis
- For the end user, this includes wearables and smart devices for better wellness management. Data might traditionally belong in the cloud or data centre, but it can happen on the edge as well
- An example is **Red Hat edge computing capabilities**, which extend the open hybrid cloud all the way to the data sources and end user. Edge computing can overcome the challenges of huge volumes of data from connected devices, intermittent connectivity issues due to remote physical computing locations, and privacy and security attacks. Edge compute is conducted at the location closest to a system’s data or its end user—where information is coming from or going to. Therefore, it is done at the location where the data reside and the compute needs are required
- Edge computing is the granular state and is preceded by fog and cloud computing, with each added exposure to attacks
- The growth of IoT is also due to the 5G network infrastructure, which will enable edge computing devices with high bandwidth and speed, bringing faster transmission for IoT. By incorporating 5G standards in telecommunication, IoT will have fast processing and low latency

Sources: Celent report, [IoT, Augmented and Virtual Reality: Remote Sensing Tools for Insurance Value Chain](#) and Red Hat

AON-CARRIERHQ SMALL FLEET TRUCKING PROGRAM

- In the following pages, we will look deeper into an IoT use case of using Electronic Logging Devices (ELD) data for behaviour-based insurance products. ELD, as the name suggests, tracks hours that truckers drive and promotes safe driving from logged data analysis. ELD data usage is a step towards a digital trucking industry and using IoT technology to automate data collection
- Aon Affinity (Aon), a leading global professional services firm, and CarrierHQ, a leading software and solutions developer for the motor carrier industry, teamed up to develop Small Fleet Advantage RRG
- This solution is focused on the motor carrier segment in the United States and is the first behaviour-driven, adjustable-rate auto liability product in the industry. Data from ELD are used to score fleets on a monthly basis and rates are then adjusted based on driving performance
- Behaviour-based insurance products simplify and speed up the entire motor vehicle insurance process, from application, risk assessment, and underwriting through quoting, acceptance, and billing
- Insurance costs are better controlled, and fixed-cost premiums are now a variable cost model



Sources: Celent Model Insurer for Data, Analytics, and AI, [AON-CarrierHQ: Small Fleet Advantage Risk Retention Group – The First Telematics Driven Insurance Product](#)

CHALLENGE



97.3% of the fleets in the \$700 billion US trucking industry operate with fewer than 20 trucks and have largely been overlooked by insurance, financial, and transportation tech companies.



Auto liability insurance premiums have doubled in recent years as the second-highest fixed expense for a small fleet and the largest up-front expense for a new fleet.



Coverage may frequently take weeks to secure and require small fleet owners to pay expensive down payments and quarterly premium instalments, often via premium finance.



There is a need to directly influence insurance premium expense during the policy term.

METRICS AND RESOLUTION

Initiative/Metrics

- 1** Aon Small Fleet Advantage Risk Retention Group was developed by Aon and CarrierHQ to provide technology that harnessed data from ELDs to assess driving behaviour in real time during the policy period

- 2** Aon and CarrierHQ teamed together to address motor vehicle insurance needs of small fleet trucking owners, combining Aon's risk management and proprietary rating algorithms with CarrierHQ's mobile-friendly online portal

- 3** The program applies a fully integrated, cloud-hosted web application and underwriting process that provides a bind-able quote in minutes, automated through a series of APIs and using integrated data

- 4** Insurance rates are adjusted monthly based on the Driver Score, an algorithmic calculation based on third-party underwriting details and telemetry data from approved ELDs

Resolution/Outlook

- 1** Small Fleet Advantage was selected as an award winner for their innovative use of technology, data, and analytics into a commercial lines auto liability insurance solution

- 2** A data-driven risk measurement and pricing decisioning process created new value for Aon and their customers

- 3** Analytics on the driving environment support the situational observational data as drivers and vehicles operate over time.

- 4** By using data from electronic logging devices (ELDs) and Aon's proprietary rating algorithm, fleet owners can pay a variable monthly rate based on driver scores derived from their actual actions behind the wheel.

IMPLEMENTING IoT WITH MLOps AND CLOUD

IoT devices provide alternate data sources and an almost real time data stream for analysis. Following are some considerations when implementing IoT strategy to offer contextualised or personalised insurance products.

01

Financial services, including insurance, that require regulatory oversight and the implementation of alternate data for risk modelling or product development will need to adhere to such regulatory guidelines. A suggestion is to have collaboration with regulators. Frameworks can be created for data transition, to include IoT data streams and comply with regulators' requirements. For example, drones can interfere with regulated airspace, and there can be partnerships with regulatory bodies for approval of flights and the usage of a regulatory sandbox for cross-border data usage



02

Tracking sensors of IoT must be secured to protect user data. The concern for data privacy, security, and consent must also be considered as IoT will typically run on the edge, fog, and cloud, which can be vulnerable to breach. Users' location and preferences need to be protected securely with respect to privacy. This also relates to processing data in a timely manner and organising data as a single customer view to prevent data duplication and potential fraud. Despite these potential challenges, IoT devices typically conduct edge compute at the local level, keeping sensitive information at the device level, avoiding data transfer to the cloud. Hence, sensitive data would not need to pass through a network to the cloud during processing



03

The motivation to adopt IoT technologies is the exchange of domain data between entities and the use of better AI/ML models. However, internet outage and connectivity issues can disrupt the constant data stream of IoT devices, causing missing data in a time series. Consideration for connectivity risks will anticipate possible outages. An example is an insurtech, **Riskwolf**, which uses parametric data sources to protect and insure against internet connectivity risk



04

Edge-to-cloud integration includes the gateway providing the functionalities for IoT convergence, data synchronization of feeds from field to enterprise, cloud integration, and data security during transfer. This reliance on the gateway can help offset other edge infrastructure devices' point-to-point integration, such as switches and routers, and migrate between the microprocessors and OS necessary to achieve cloud integration, support for integration protocols, and hosting of IoT applications. The focus is on delivering IoT device data to gateways and across the IoT architecture, including the cloud. Processing is mainly done at the edge, based on real time and service demands, with central management on the cloud for edge nodes

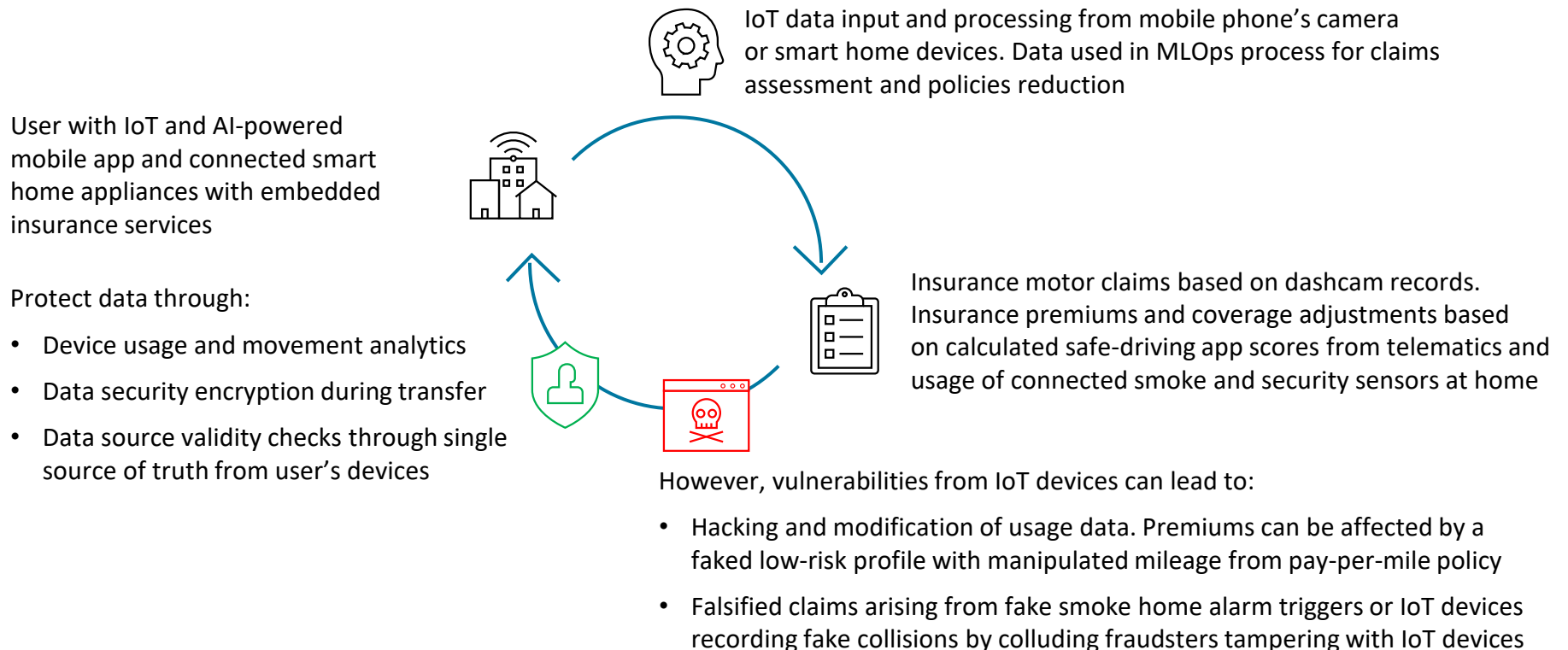


IoT AS ALTERNATE DATA SOURCE

- The application of IoT in drones and wearables is enabling a more digital experience, from industrial monitoring for property and casualty risk protection to the quantified self for health and life insurance. Current possibilities and use cases are encouraging safer workplaces and remote monitoring of properties, infrastructure, and policyholders
- IoT is providing alternative data, which can improve analytical insight for decision-making. IoT insurtechs will help integrate the physical and insurance sector through sensor tracking from wearables and devices such as crop or flood detectors, powered by edge computing capabilities
- IoT powered by AI/ML technology can also provide for more financial inclusion and protect gig workers in Asia, where developing countries may not have a robust financial infrastructure. New solutions can be developed through IoT which includes wearables and mobile solutions that have high penetration in Asia. And this can be achieved through partnerships and investments. An example is **ZA Tech** investment in the **Asia Fintech Centre**, which offers sponsorship of \$1 million for free tech development annually
- However, we should emphasise that security and protection of data will be important; hence, the data collected from such edge devices can be secured through blockchain technology and be transmitted securely for analytics. Although IoT devices conduct edge compute on the device itself, data encryption during transfer to the cloud must be considered
- For IoT to achieve mass adoption, greater integration will ensure wider acceptance and use of such functions. For sustained interest in IoT devices, initial adoption must show greater efficiency and cost savings in the value chain and improve current workflows

CONCEPTUAL REPRESENTATION OF IoT, MLOps, FRAUD, AND INSURANCE

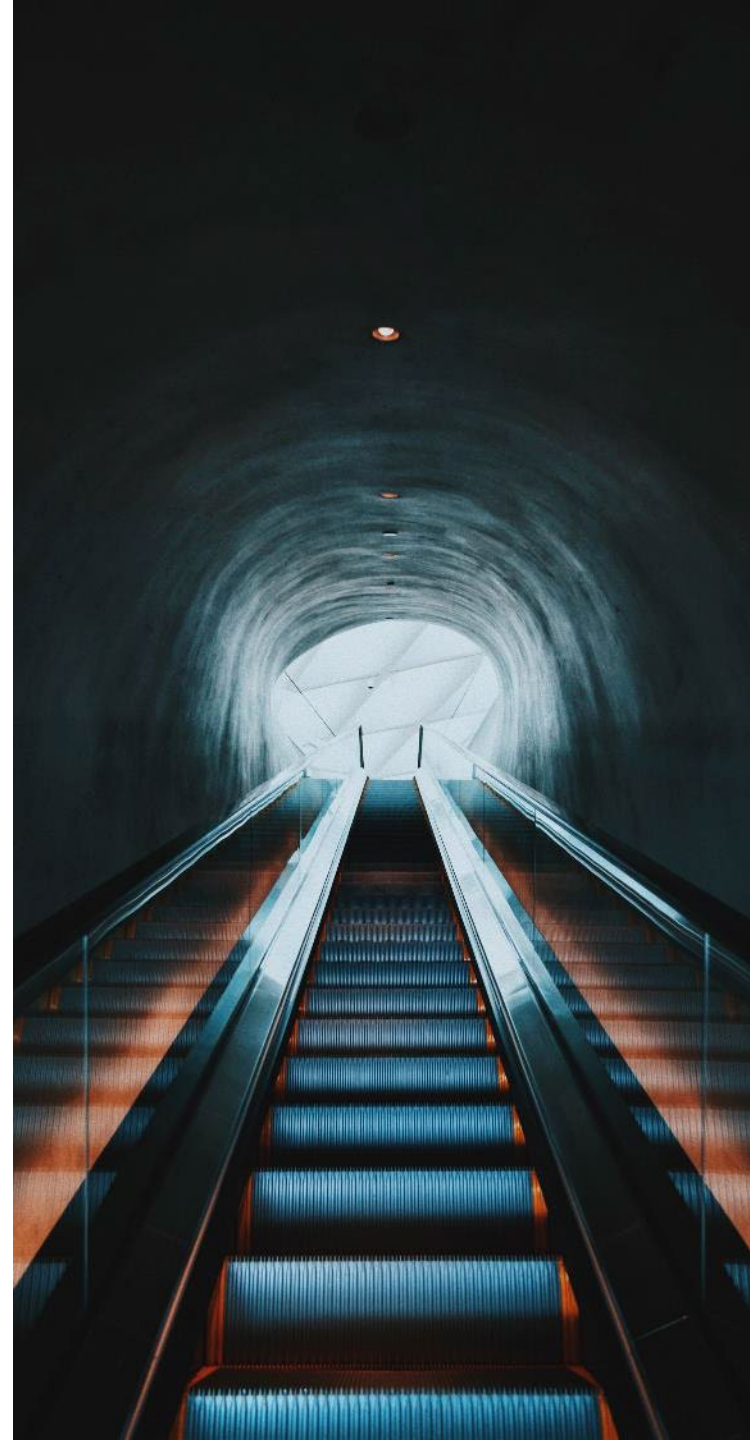
- Below is a simplistic concept of how IoT, together with MLOps, can produce additional recommendations and analytics in the IoT and insurance space but can be an avenue for fraud as well. Data generated from connected devices can provide valuable insights during claims and loss adjustment processes but there can be claims fraud due to IoT exploitation
- We will conclude by showing how IoT can benefit insurance yet create loopholes for data corruption by crime syndicates



ANALYSIS AND PATH FORWARD

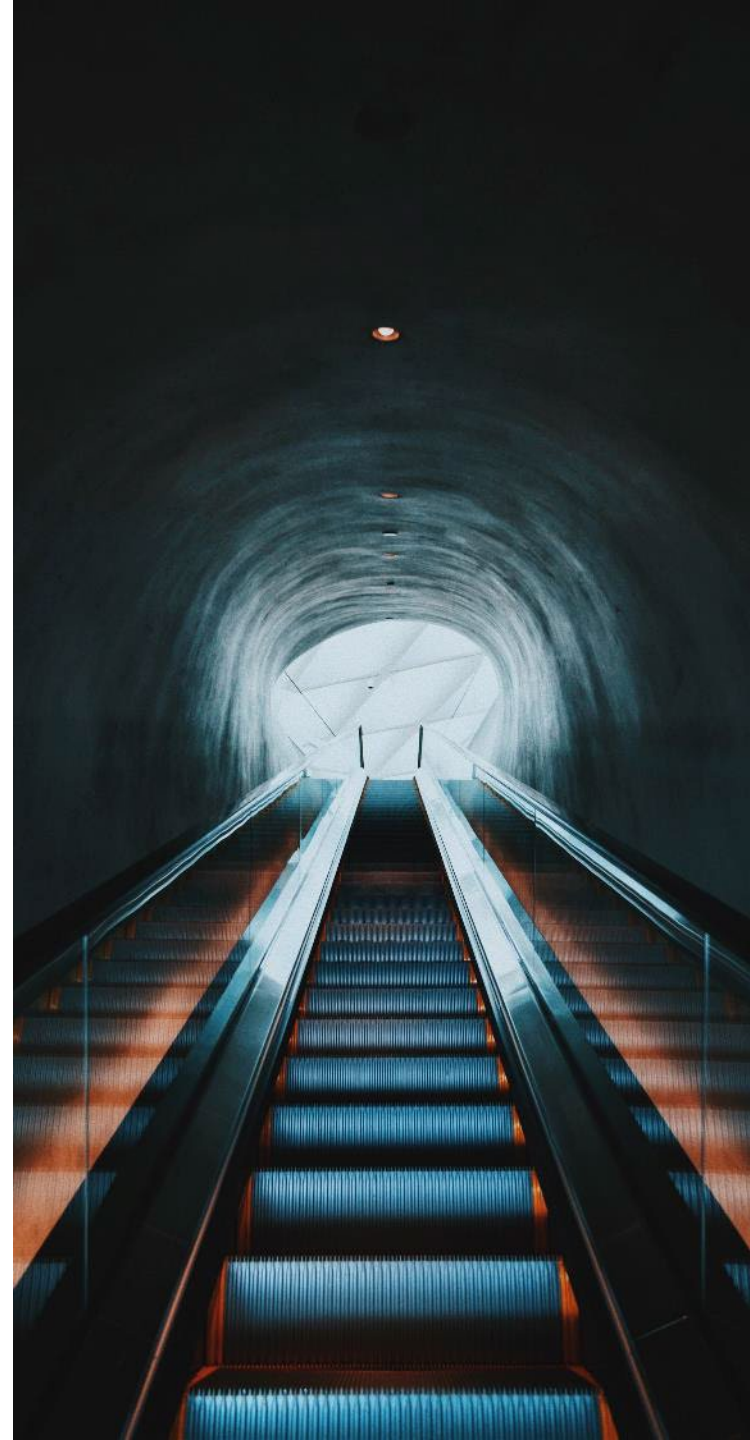
ANALYSIS AND THE PATH FORWARD

- MLOps offer a straight-through deployment process and workflow, with a coordinated development effort for developers, data scientists, and the business users. However, project ownership should reside at the business users for successful implementation, because this is where business objectives are set with ML models as the solution
- Typically, an integrated ML/AI workflow tracks experiments, packages projects, manages and deploys models, and has a centralised registry of models, API, and UI on the cloud. The ML/AI platform will enable flexible model deployment and run models anywhere, including on IoT devices or on-premises.
- Monitoring and management of production models help to prevent issues such as data drift while maintaining model-specific metrics, and alerts ML/AI platforms should have integrated functions to help data scientists' model development and complement developers' productivity such as VS code extension
- Automation in the MLOps process will overcome the challenges traditional insurers face in implementing data science by classic underwriting methods. It also provides insurers with a predictive capability--the opposite of selling an insurance policy based on a prospect's historical risk and loss data for coverage terms and pricing

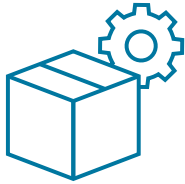


ANALYSIS AND THE PATH FORWARD

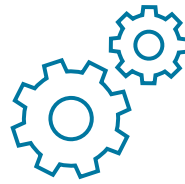
- Despite how MLOps provides an automated and guided process for delivering ML-enabled solutions, the human-in-the-loop factor must be included as well
- As we consider IoT as alternative data points to strengthen MLOps model development, the human factor must not be neglected. From being alerted by sensors of parametric threshold breaches or data from wearables, the human is always involved in the process. Hence, from an insurer's view, MLOps should provide checkpoints which enable humans to intervene when the machine triggers an alert
- But we need first to cultivate the right culture and educate the organisation in data literacy. This will enable the right use cases and data selection
- For modern methodologies like MLOps and technologies like IoT to work in a regulated industry like insurance, regulators must be involved to provide support, and the technology must reach adoption maturity to be considered useful. This means selecting good use cases for successful adoption, integration, and security compliance for data protection
- There are various innovations to include AI/ML and IoT in insurance, but we only offer a single reference implementation design in this report
- For example, IoT and MLOps can produce an operating model of an embedded insurance experience through data analytics and recommendations. This can be in the use case of parametric insurance for healthcare, whereby pay-out only occurs at the time of diagnosis and trigger. This can close the protection gap for less common health conditions and encourage sign-up.



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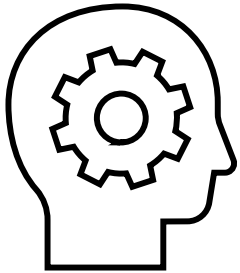
Insurance Analyst

✉ mang@celent.com

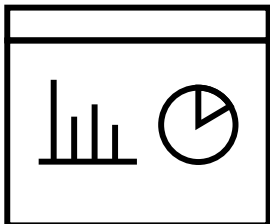
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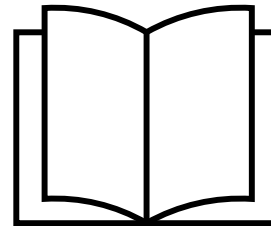


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