



# Process Mining in Insurance: Measuring and Managing Activity Costs

**Midwestern Actuarial Forum**  
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Presenters: Tony Beirne, Director, Risk Analytics  
Andy Cheng, Manager, Risk Analytics



# Agenda

- **Introductions**
- **What is Process Mining?**
- **Value Proposition**
- **Demo**
- **Use Cases**
- **Process Simulation**
- **Q&A**

# With you today



## **Tony Beirne, FCAS Director**

Tony is an actuary, former underwriter, and operations consultant, with experience in the American and Australian insurance and banking industries.

He advises clients on actuarial, business process, analytics, data quality, regulatory, credit risk, technology, financial reporting, controls, and due diligence issues.



## **Andrew Cheng, FCAS Manager**

Andrew is a Manager in KPMG's Actuarial practice with over 14 years of P&C experience.

He focuses on advisory services for business processes, actuarial, modeling, data quality, risk management, controls, and due diligence. Andy leads loss reserve analysis for some of KPMG's largest and most complex US insurance clients.



# What is Process Mining?

# Overview

## What is Process Mining?

- **An analysis and visualization tool that emerged out of industrial engineering**
- Journey maps show how transactions flow within a process
- System-log event data objectively measures business process activity
- Discovery and analysis tool which informs process optimization

## Why use it?

- **Adds the time dimension to analyses**
- Pivots from traditional, qualitative to quantitative process analysis
- Intermediate activities lead to significant costs and bottlenecks—but are often unmonitored
- More granular segmentation of tasks, timing, and dependencies
- Projects are typically faster, cheaper, and less disruptive than interview-based analysis
- Provides greater transparency

Process Mining

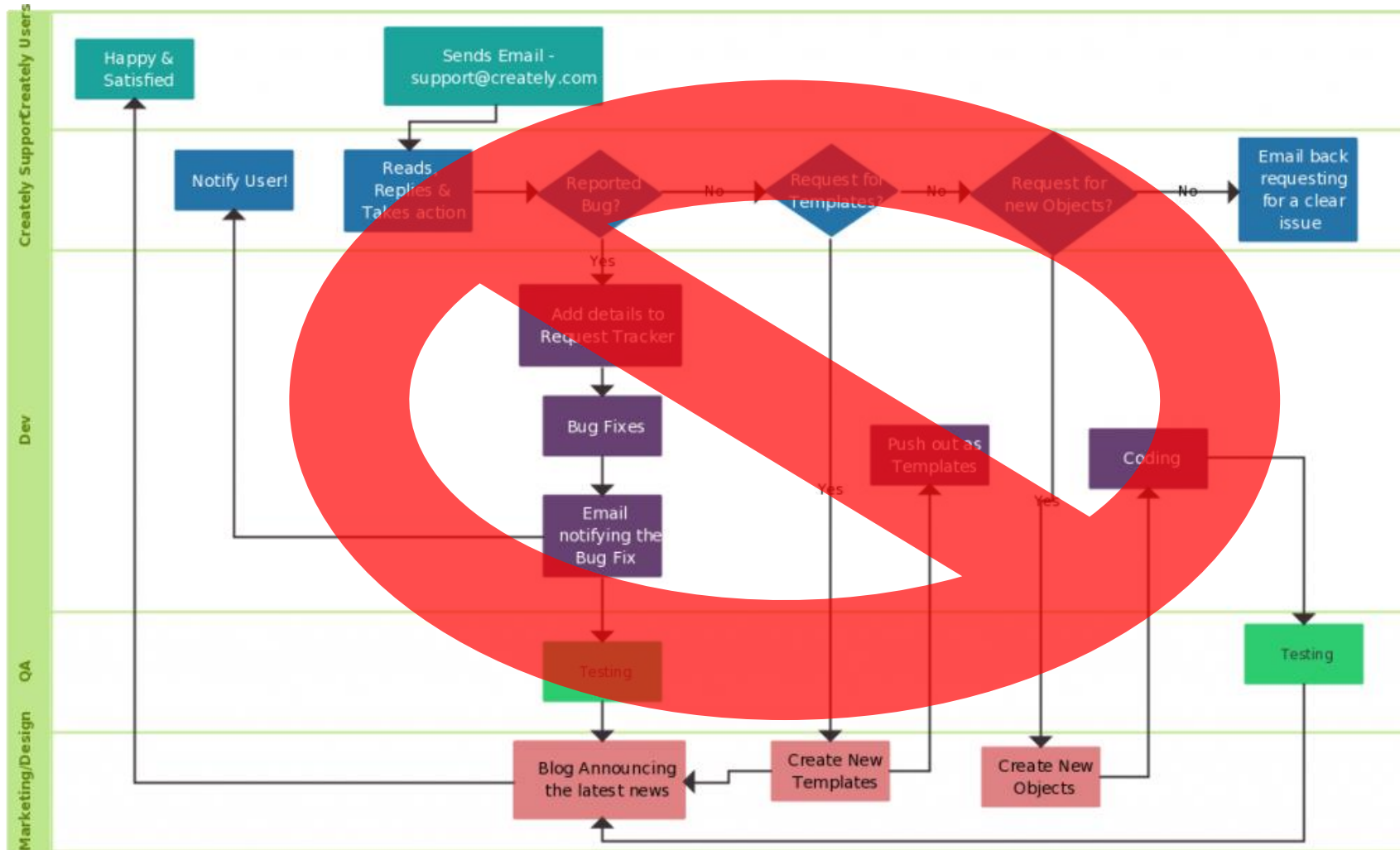
Process  
Simulation

Business Rules  
/ KPIs

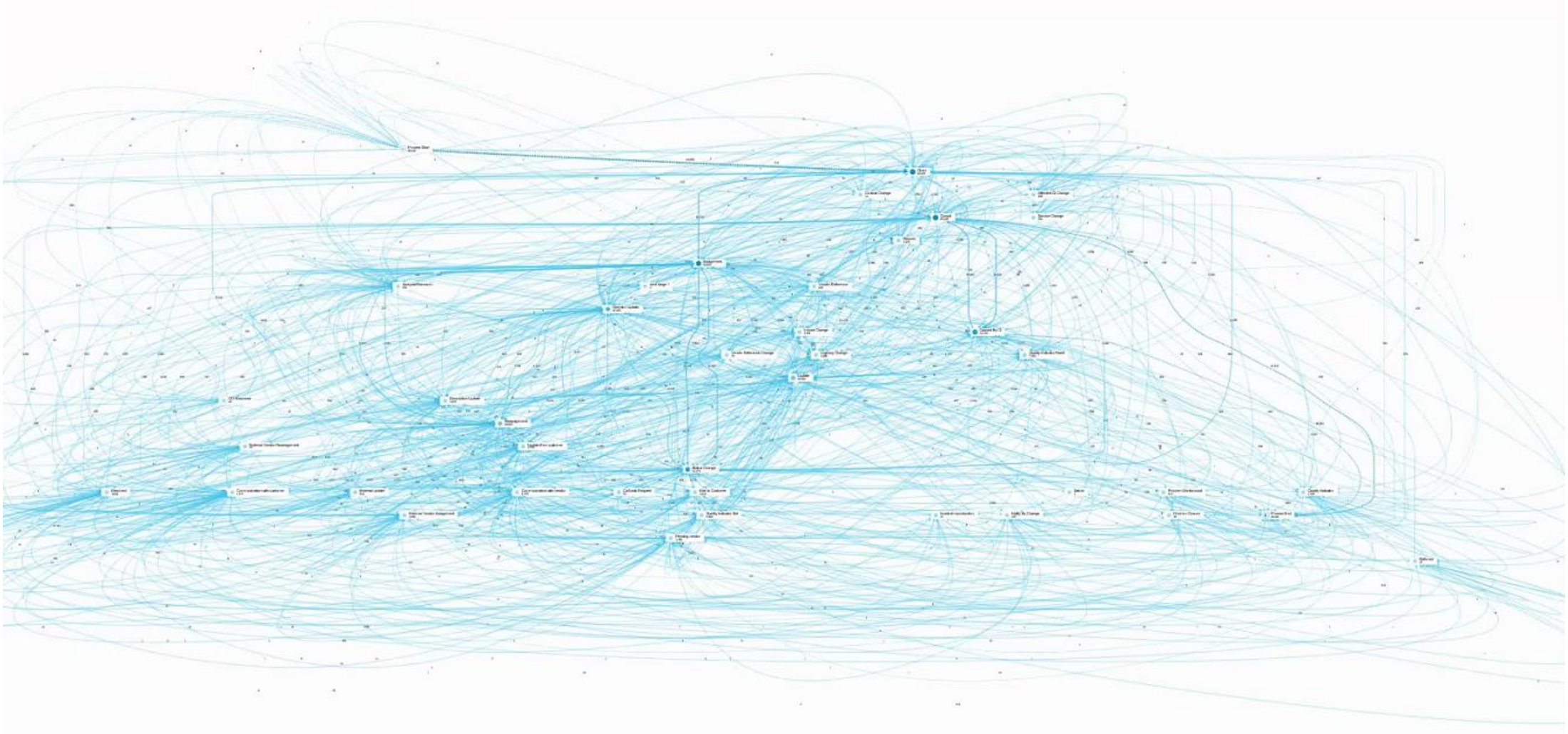
Automation

Process  
Redesign

# Use data; not stories

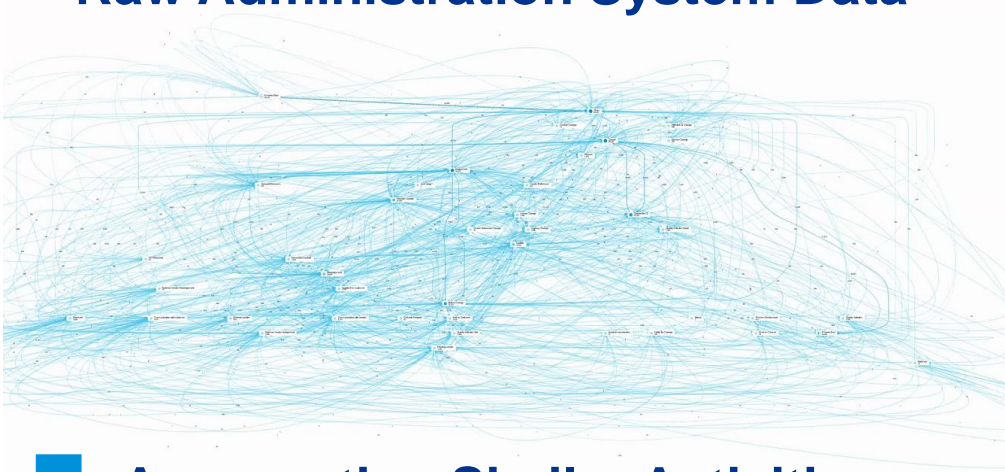


# Process Mining in action: Raw Admin System Data

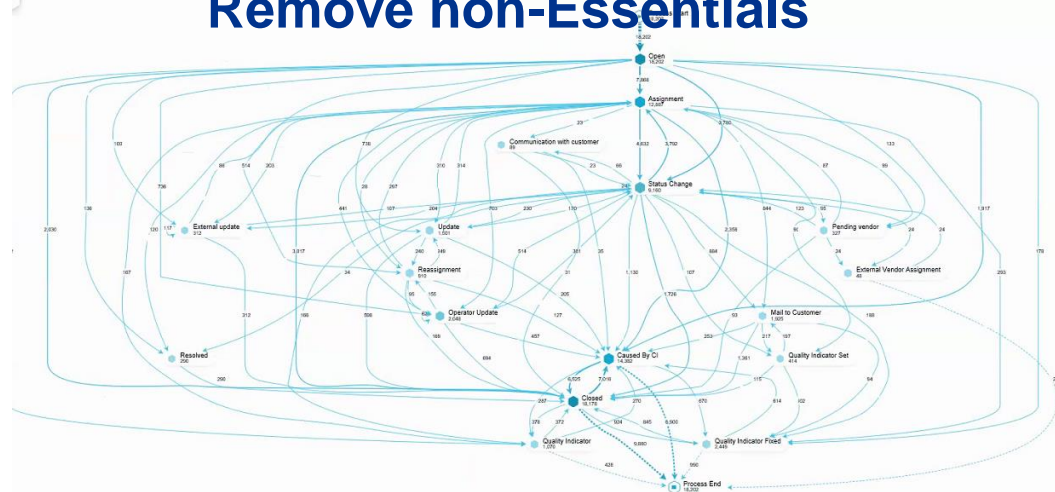


# Process Mining in action

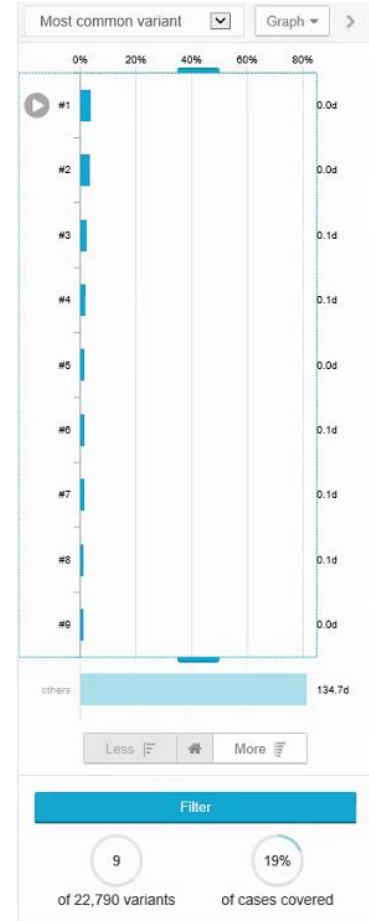
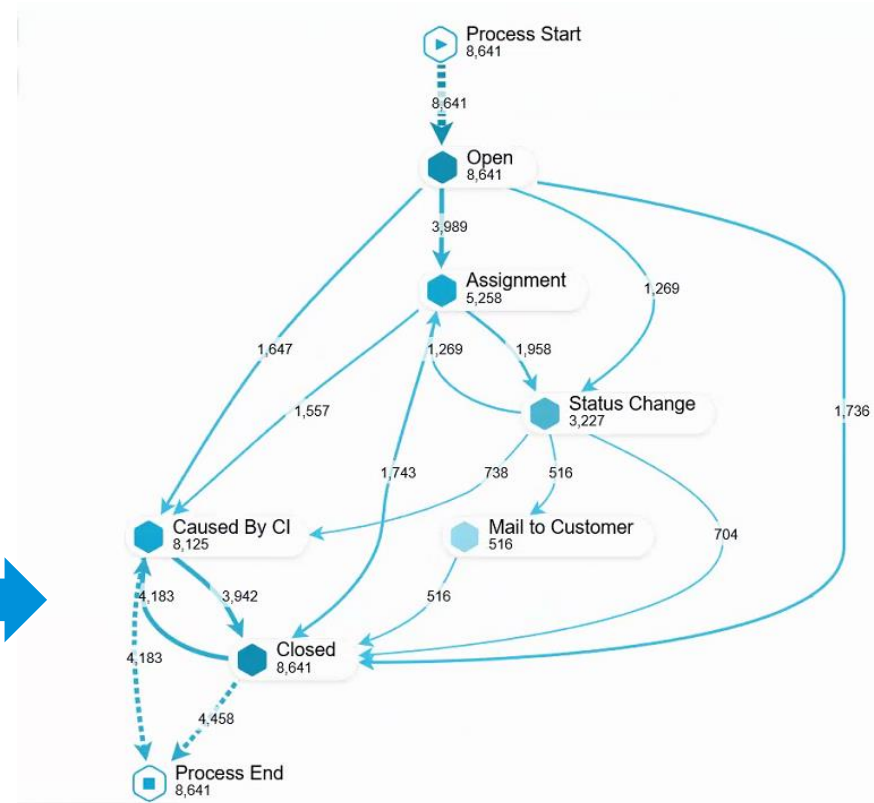
## Raw Administration System Data



**Aggregating Similar Activities;  
Remove non-Essentials**



## Top 10 Variants







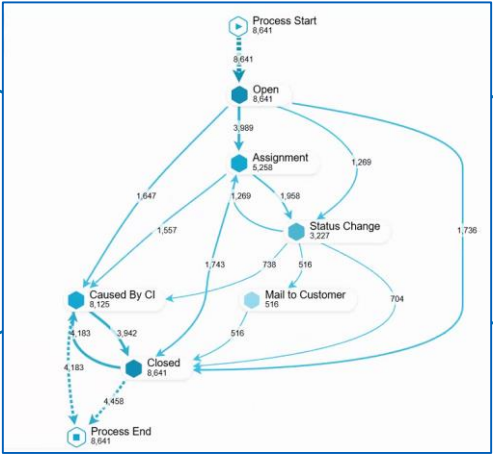
# Value Proposition

# When to use Process Mining?

Discovery / Compliance

Process Improvement

## Process Mining Analysis

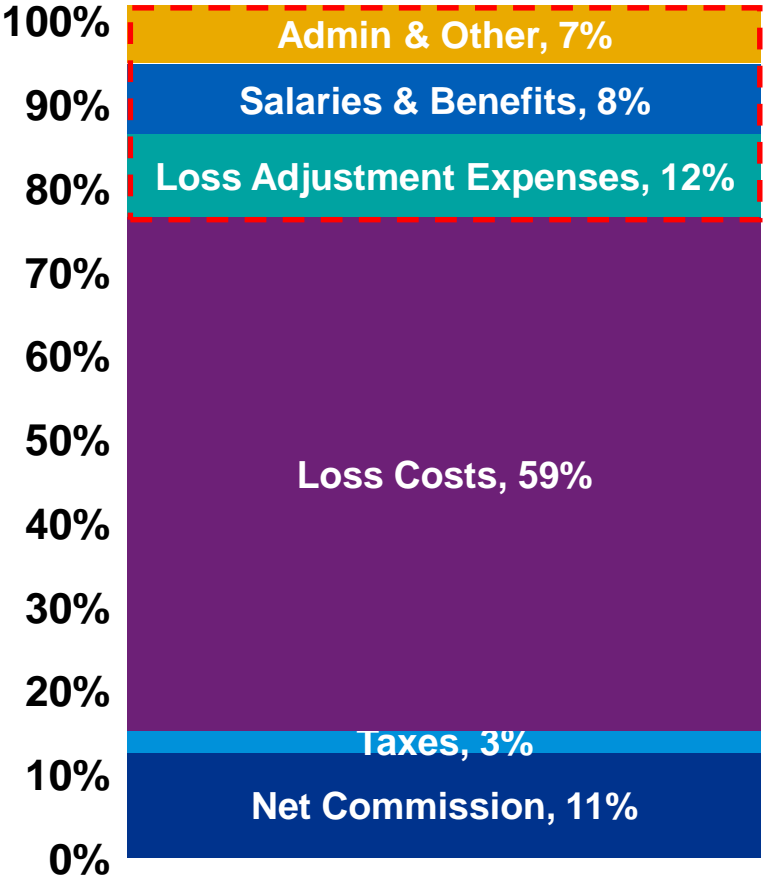


Process Intervention

Transformation

# Processes are manual—and therefore difficult to measure

P&C Industry Total Costs

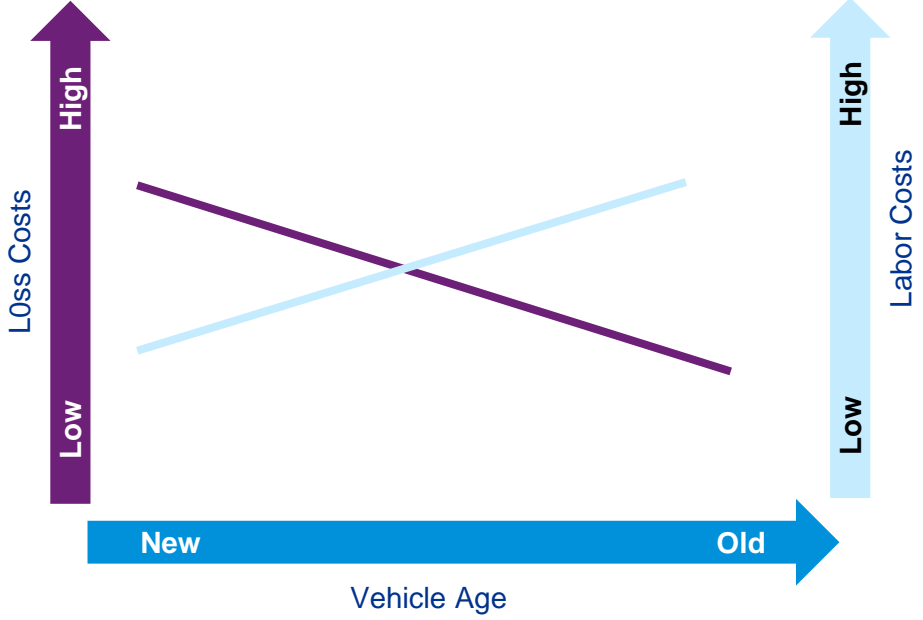


**Improved process management would help the P&C industry better manage over 1/4<sup>th</sup> of its cost base.**

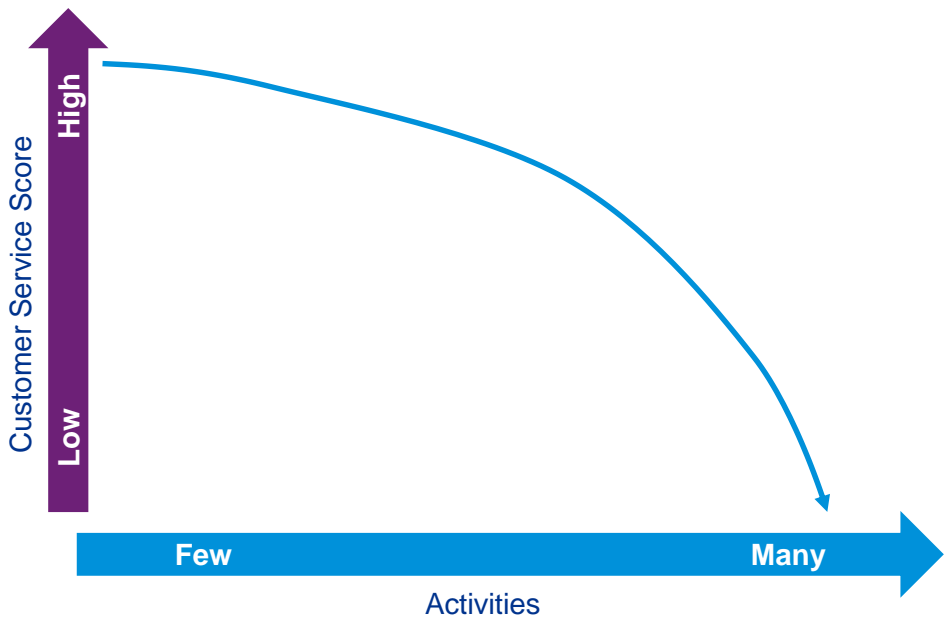
**These costs are often not rigorously studied today.**

# Sample Findings from P&C Claims analysis...

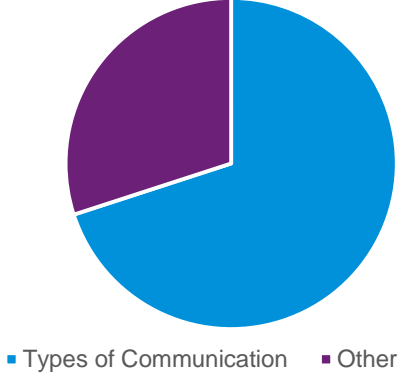
**Labor vs Loss Costs**



**Customer Service Score by Activity Count**



**Settlement Effort Drivers**





# Demo: How to Process Mine

# Variant + Cost Models

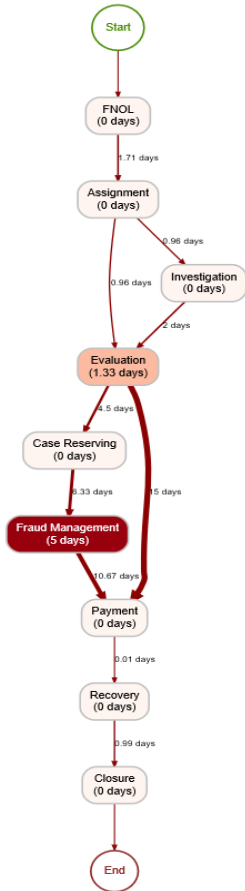
## Variant Model

Orders activities by:

- Transaction # (e.g. claim, policy number)
- Activity type
- Timestamp

Used to analyze:

- Where processes “break”
- The impact on cycle time, throughput counts, or other metrics
- Differences between good/bad paths



## Cost Model

	<b>Time per activity</b>	<b>Simple matrix multiplication</b>
*	<b>Resource Cost (per Hour)</b>	
*	<b>Activity Count</b>	
\$	<b>Total Costs</b>	

Used to analyze:

- Operational costs of process differences

Execution:

- Calculate in any tool (e.g. Excel, R, SAS, SQL)
- Then merge back onto the Variant model by Transaction # for deeper analysis

# How the models work: Sample Claim Path

## Raw Data

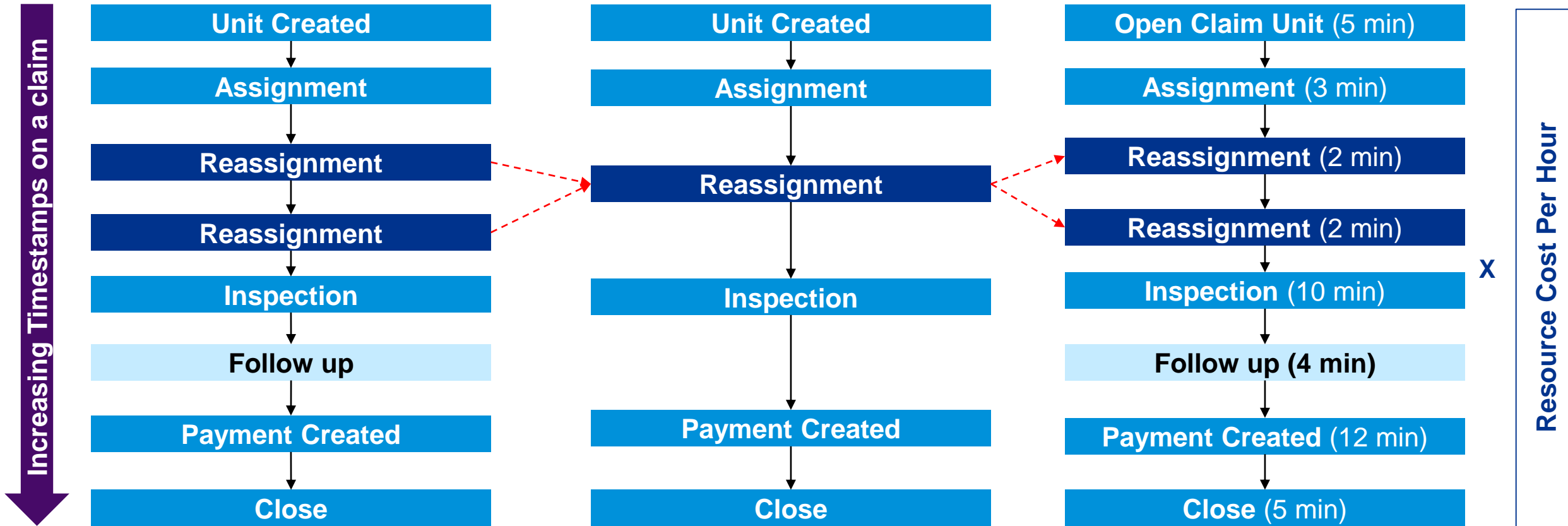
Many repetitive action codes in the same stage.

## Variant Model

Collapses down repetitive steps in the same stage, and removes non-core actions (e.g. communication) for more intuitive analysis.

## Cost Model

Includes all activities. Adds time per activity and multiplies by resource cost rates.



# Data Considerations

## Typical Data Elements:

- Unique Identifiers, Action Names, Start Times, Action Costs, Action Executor

Unit Number	Action Code	Action Created	Policy State	Estimated Amount	Executor
01-A	File Start	9/10/2017 9:37AM	MA	1012.31	Matt
01-A	Assignment	9/10/2017 10:39AM	MA	31.50	Brian
01-A	Outbound Correspondence	9/11/2017 8:30AM	NJ	200.10	Julia
02-A	Unit Open	9/11/2017 10:24AM	NJ	12.15	Brian
02-A	Initial Contact with Rep	9/10/2017 9:45AM	NJ	36.22	Andrew
02-A	Document Arrival	9/17/2017 2:12PM	MA	22.78	Steve
03-A	Document Arrival	9/17/2017 3:09PM	MA	23.40	Steve
03-A	Call	9/29/2017 10:13AM	MA	51.26	Joe
03-A	Reassignment	10/01/2017 11:03AM	MA	64.25	Brian
04-A	Call	10/30/2017 9:45AM	NJ	48.98	Maria
04-A	Document Arrival	11/4/2017 10:42AM	MA	33.64	Steve
04-A	Inspection Complete	11/25/2017 3:07PM	MA	189.34	Mike
05-A	Unit Closed	11/25/2017 4:10PM	MA	44.65	Brian
05-A	Payment Created	11/26/2017 12:09PM	MA	1770.58	Rachel
05-A	Document Arrival	11/26/2017 2:12PM	NJ	1770.58	Rachel

The data needed for process mining is:

- Simple to prepare, with few required fields
- Readily available from most policy and claims administrating systems
- Easy to join to wider analysis data using the policy/exposure or claimant number

Additional internal and external data can be used to supplement the core process mining analysis to derive claim-type or customer-segment insights.

### — Internal Data

- Policy type, state, coverage options
- 1st versus 3rd party coverage
- Loss type, severity
- Policyholder and claimant demographics
- Customer Satisfaction Scores
- Geographic
- Vendors involved

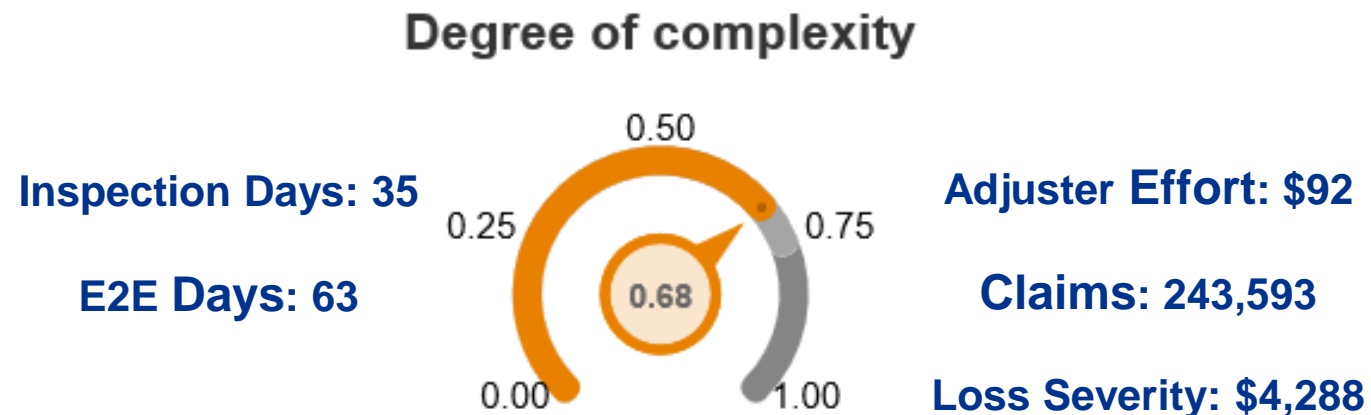
### — External Data

- Psycho/Firmo-graphics
- 3rd party exposure, loss assessment, and vehicle history data
- Geo-Environmental



# Celonis Demo

- Many process mining tools are available, including vendor solutions through freeware (R packages)
- The KPMG demo will be shown in Celonis, which is easy for non-technical teams to use
  - This expands the analyst pool from the Data Science team to anyone who can use Business Intelligence (BI) tools





# KPMG Use Cases: Effective Nudges

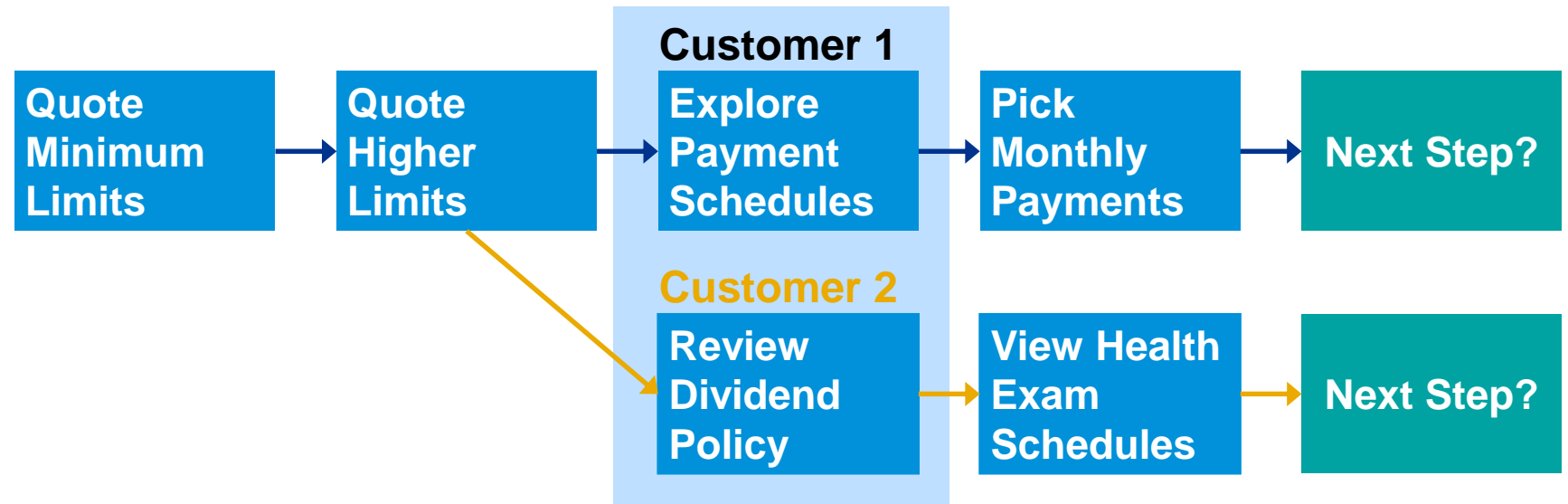
# Use Case 1: Sales

Many carriers segment their book, but then let the chips fall where they may.

Each customer touchpoint reveals new information.

Carriers should use that intel to improve outcomes.

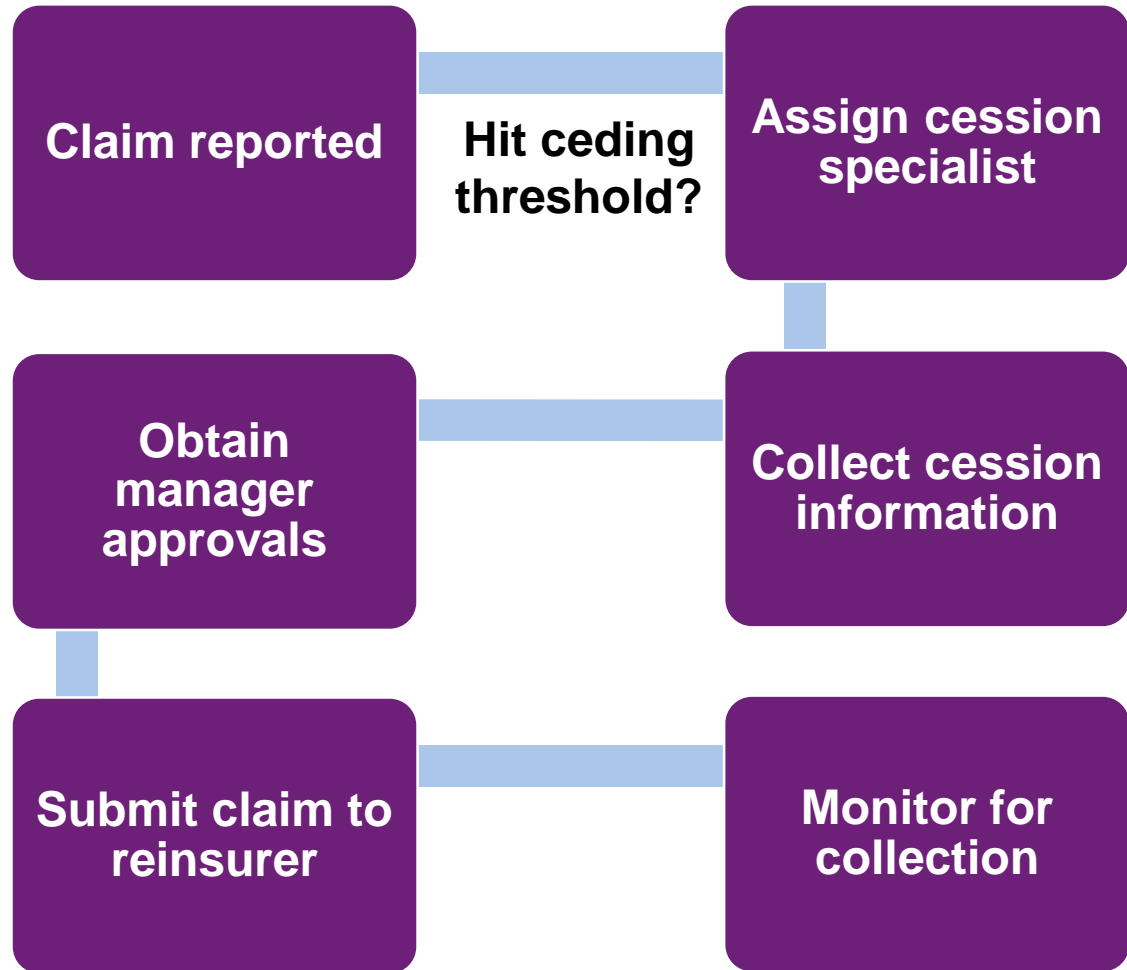
These customers are different—and have different buying behavior. Carriers should tailor interactions to these separate individuals.



**New opportunities created to customize service in terms of the next:**

- Person to interact with the customer
- Mode of engagement

# Use Case 2: Reinsurance collections

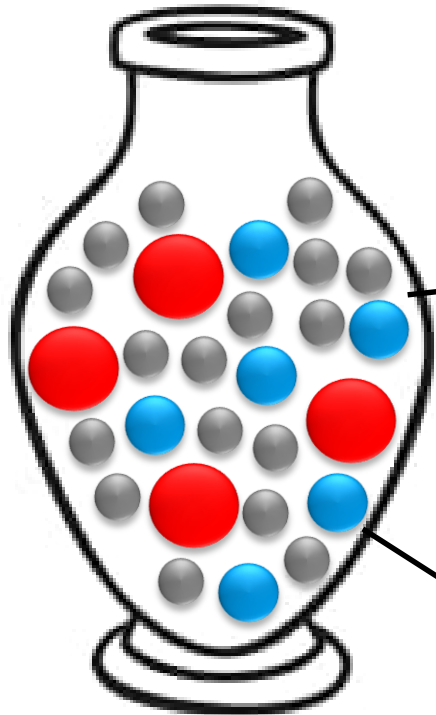


## Real-time Discovery and Conformance

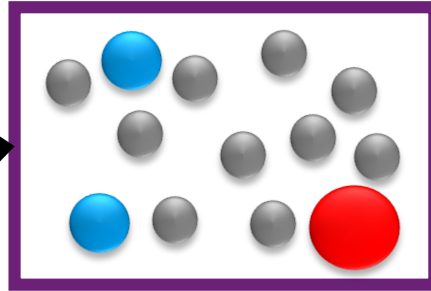
**Lack of timely cession activity is problematic at many carriers.**

- How soon does your carrier check for reinsurance eligibility?
- Which claims had the required data on file? Which required additional manual fieldwork?
- Are controls functioning appropriately? i.e. complete, effective and at the right time?
- Are the recoveries being received?
- Can effort-intensive activities be mitigated?
- Where did unnecessary time lags exist?

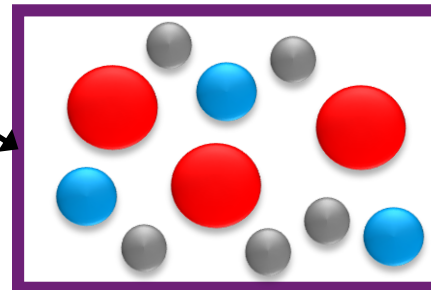
# Use Case 3: Higher Risk Audit Samples






## Random Sampling



## Transaction Complexity in Stratified Sampling



Transaction Type	
	Small, simple
	Medium
	Large, complex

**Transaction journeys affect risk**






**Transaction flags**

- Unusual actors
- Lag time between transactions steps
- Many or unusual steps on journey
- Multiple unsuccessful steps or loops
- Complexity paths

**Control flags**

- Appropriate, timely sign offs
- Timing of reserve changes or payments versus claim status changes

# Domain Agnostic Use Cases and Benefits

Use Case	Description
 <b>Process Discovery</b>	<ul style="list-style-type: none"><li>— Uncover what really happened, spot long runners and unusual process paths</li><li>— e.g. adjuster assignment for certain claim types takes longer than expected</li></ul>
 <b>Conformance Checking</b>	<ul style="list-style-type: none"><li>— Compare the desired “to be” process against the actual “as is” process</li><li>— e.g. find anomalies in process flows for internal controls/audit</li></ul>
 <b>Benchmarking</b>	<ul style="list-style-type: none"><li>— Compare processes between geographies/companies to improve performance</li><li>— e.g. more SIU time spent in claim fraud management in the West region compared to other regions</li></ul>
 <b>People Behavior</b>	<ul style="list-style-type: none"><li>— Insights into system usage behaviors and variances amongst teams</li><li>— e.g. excessive policy system access by personnel during weekends</li></ul>
 <b>Dashboard &amp; Monitoring</b>	<ul style="list-style-type: none"><li>— Customized and interactive KPI dashboards enables real-time analysis</li><li>— e.g. call center dashboard showing past interactions with customers</li></ul>



# Using the results: Process Simulation

# Understand process → Simulate for constrained optimization

## Analysis of as-is processes

- Dynamic correlation of processes
- Semantic correctness of process modeling
- Throughput times of processes with given resources
- Wait (= wasted) times
- Detection of resource bottlenecks and low resource utilization
- Execution of (end-to-end) processes within determined period of time
- Determination of critical paths (time, cost)

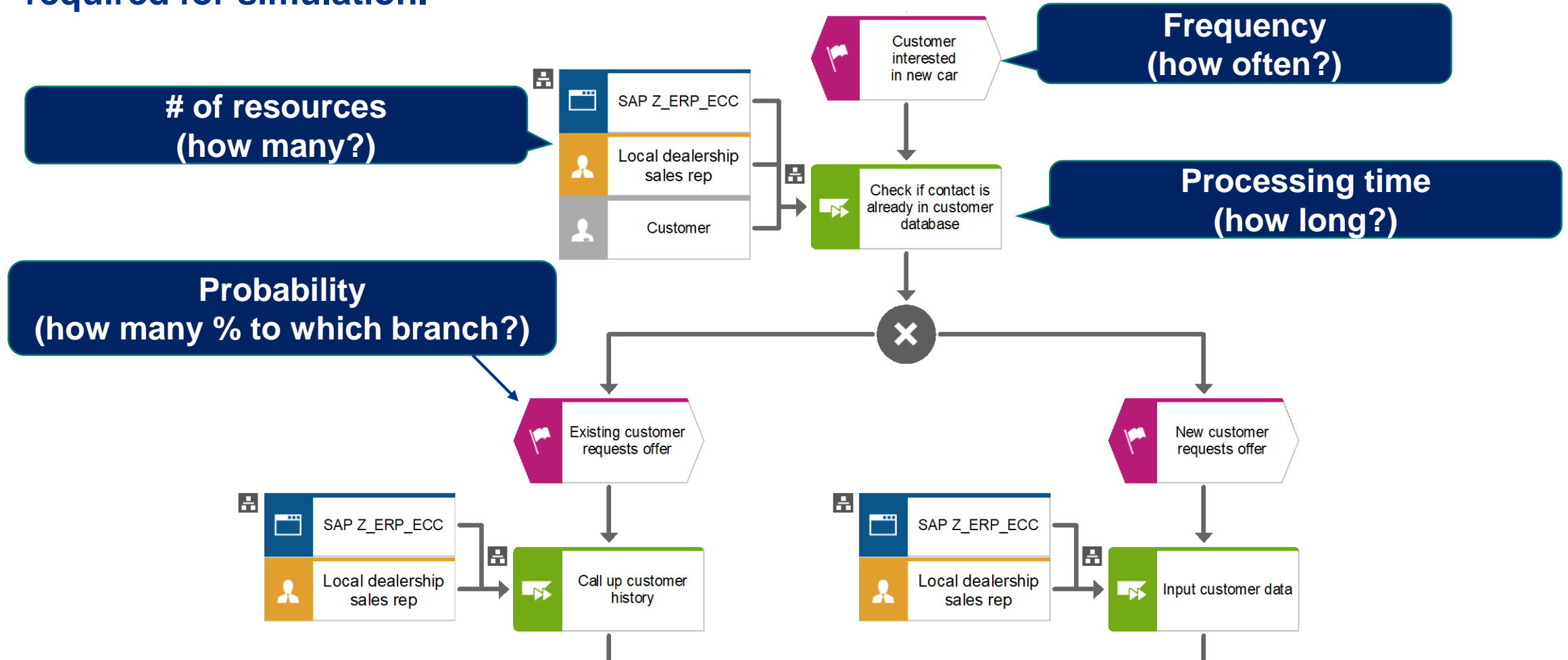
## Optimization of to-be processes

- Removal of bottlenecks
- Evaluation of process variants for Benchmarking
- Reduction of throughput times and costs
- Increasing number of process deliverables within given time
- Capacity planning
- Optimization of resource utilization

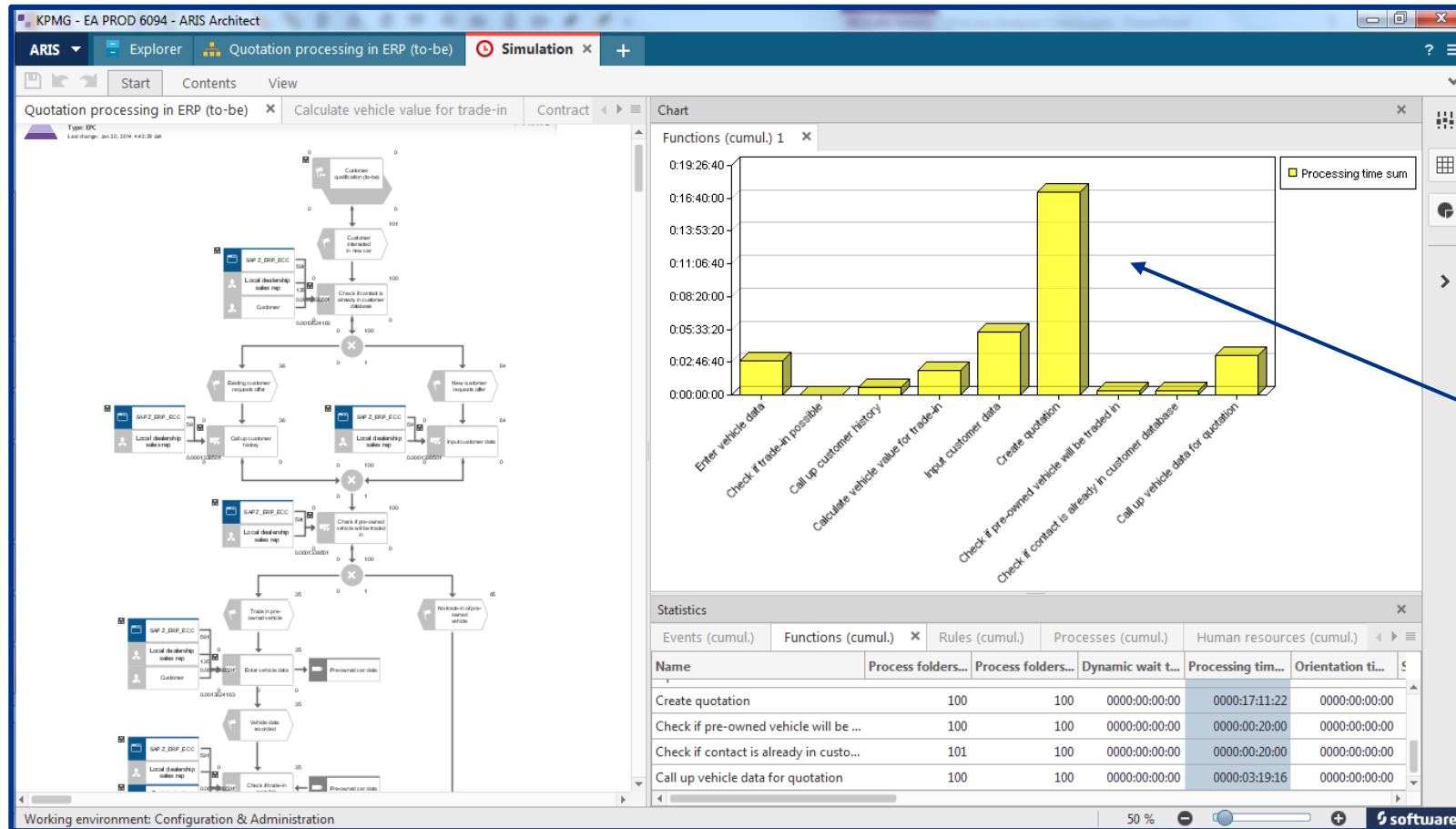


# ARIS Process Simulation Example

This is a sample process model in ARIS and indicates the type of process information required for simulation.



# Process simulation results: Processing time of a particular statistical outlier

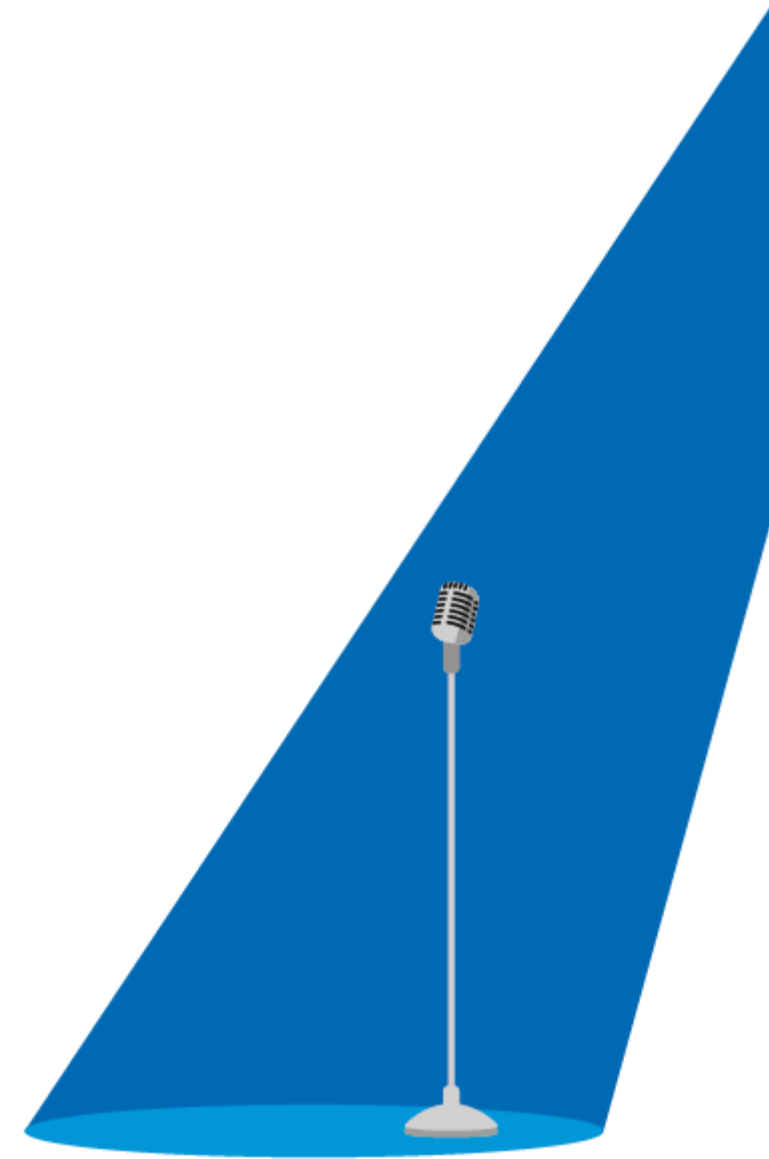


Create quotation is a bottleneck.

- Not enough resources?
- Complicated process?
- Technology availability?

Iterative, alternative simulations with refined parameters lead to a better operating model.

# Questions?





Thank you



**Scott Shapiro, Principal**

+1 860 297 5088

[sashapiro@kpmg.com](mailto:sashapiro@kpmg.com)

**Tony Beirne, Director**

+1 (609) 500-2468

[anthonybeirne@kpmg.com](mailto:anthonybeirne@kpmg.com)

**Andrew Cheng, Manager**

+1 (202) 533-3467

[andrewcheng@kpmg.com](mailto:andrewcheng@kpmg.com)

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