Process Mining in Insurance: Measuring and Managing Activity Costs

Casualty Loss Reserve Seminar
September 17, 2019 | Austin, TX

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Nate Loughin, Manager, Risk Analytics

Agenda

- **Introductions**

- **What is Process Mining?**

- **Value Proposition**

- **How to Process Mine**

- **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.

Nate Loughin, ACAS Manager

Nate is a Manager in KPMG's Actuarial practice with over 13 years of P&C experience.

His experience is focused in E&S reserving, large account pricing, IFRS 17, and machine learning analytics. He also volunteers with the CAS Machine Learning Working Group and has spoken at various actuarial seminars, including the CAS Crash Course on Autonomous Vehicles.

What is Process Mining?

Overview

| **What is Process Mining?**	**Why use it?**
— **An analysis and visualization tool that emerged out of industrial engineering**	— **Adds the time dimension to analyses**
— Journey maps show how transactions flow within a process	— Pivots from traditional, qualitative to quantitative process analysis
— System-log event data objectively measures business process activity	— Intermediate activities lead to significant costs and bottlenecks—but are often unmonitored
— Discovery and analysis tool which informs process optimization	— More granular segmentation of tasks, timing, and dependencies
	— Projects are typically faster, cheaper, and less disruptive than interview-based analysis
	— Provides greater transparency

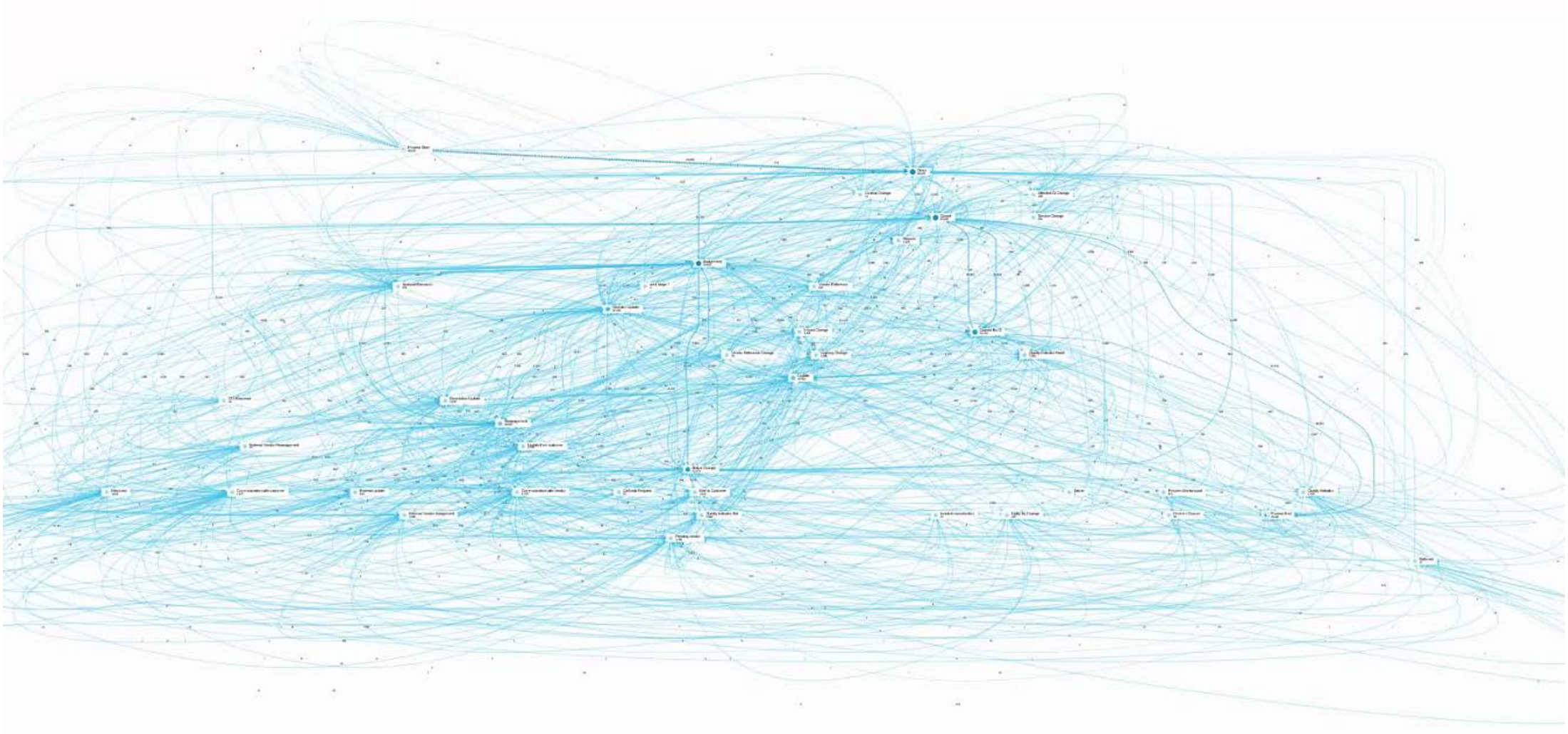Process Mining ▶ Process Simulation ▶ Business Rules / KPIs ▶ Automation ▶ Process Redesign

Use data; not stories
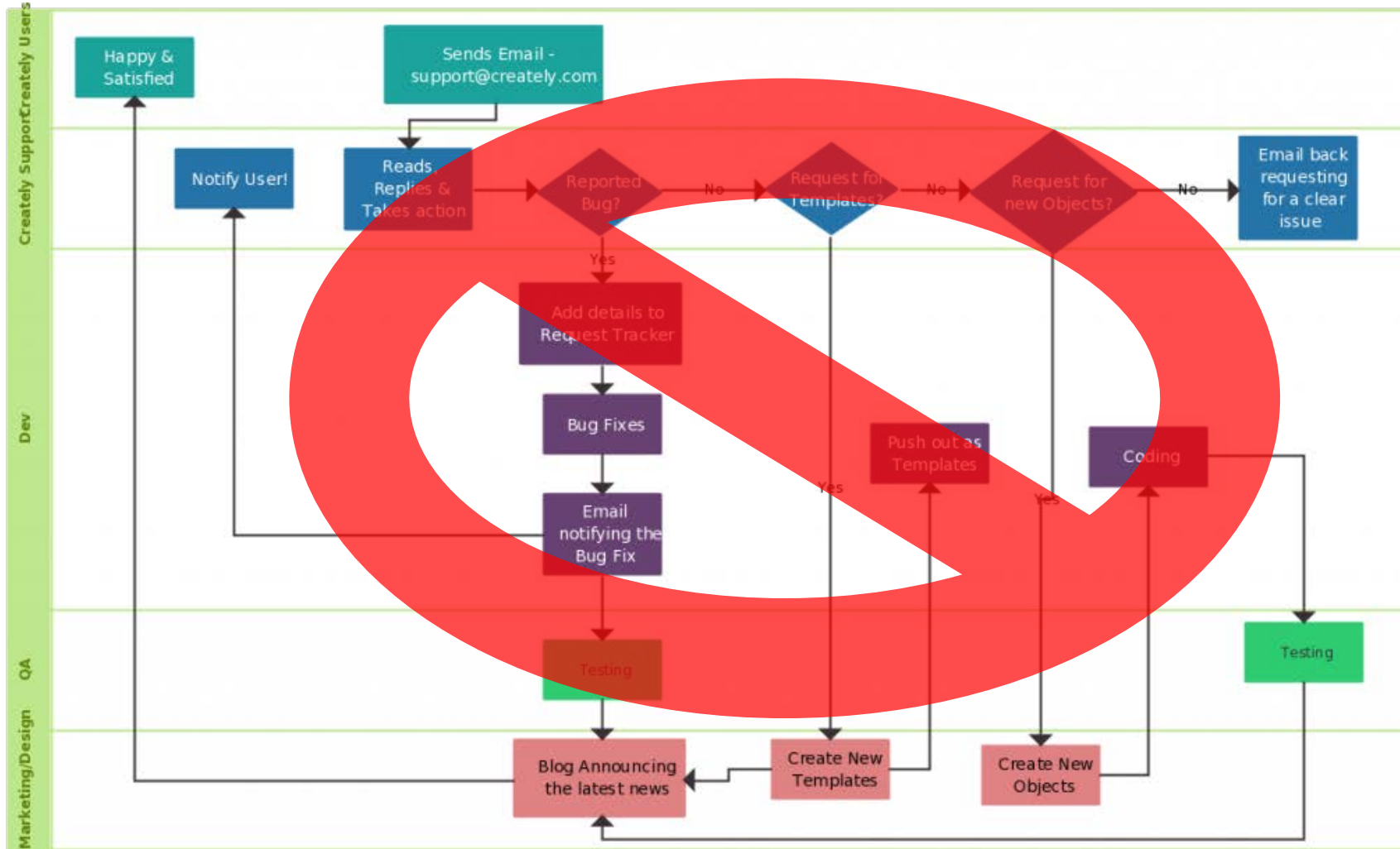
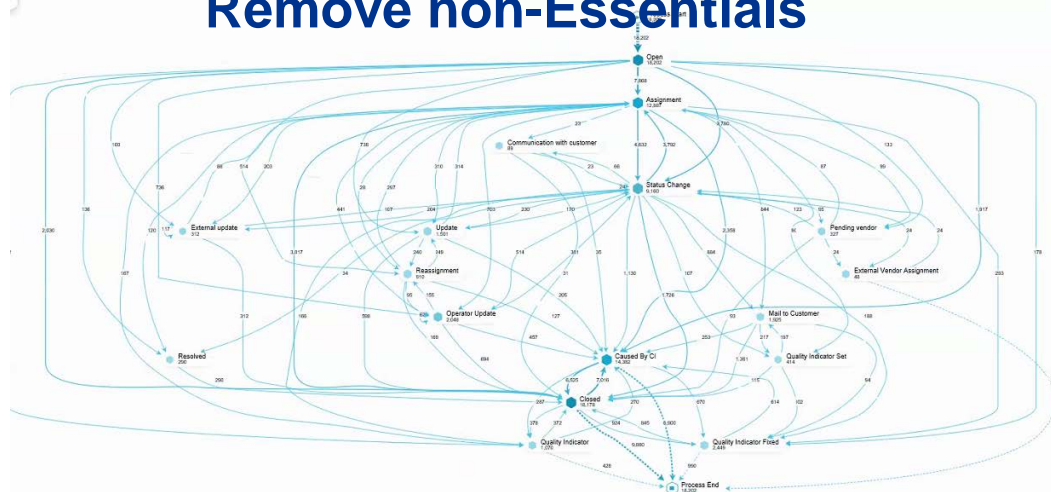# Process Mining in action: Raw Admin System Data
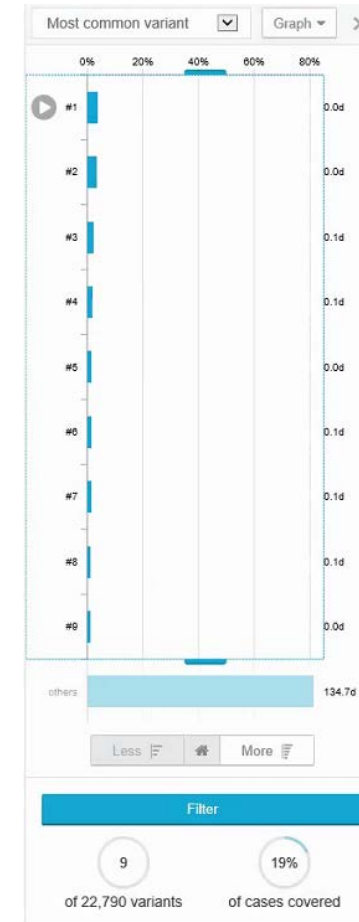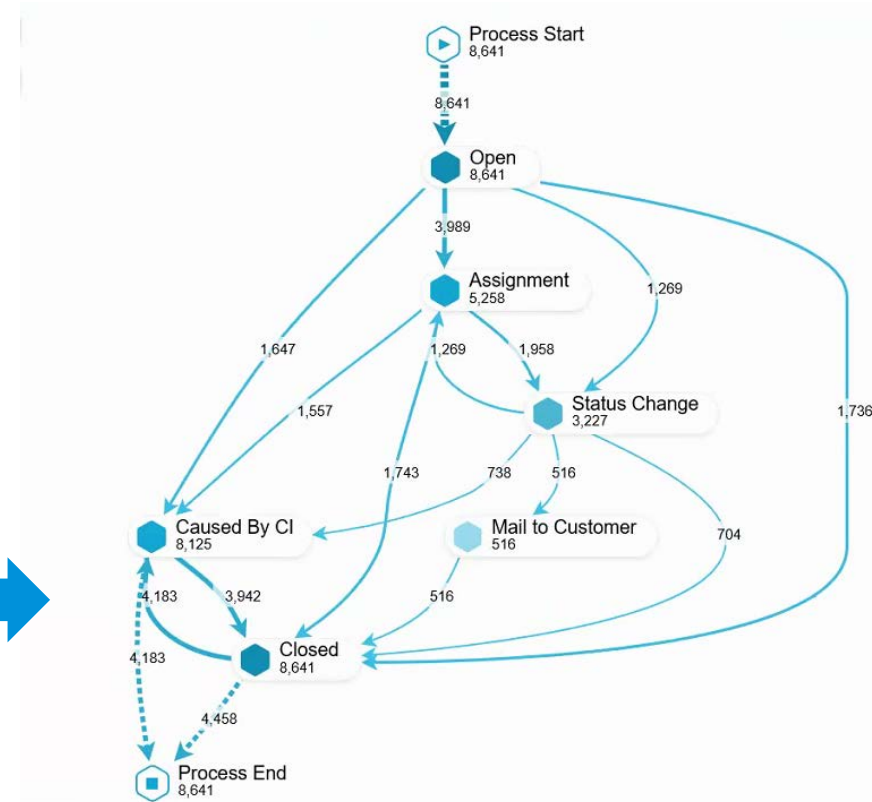
Process Mining in action

Raw Administration System Data

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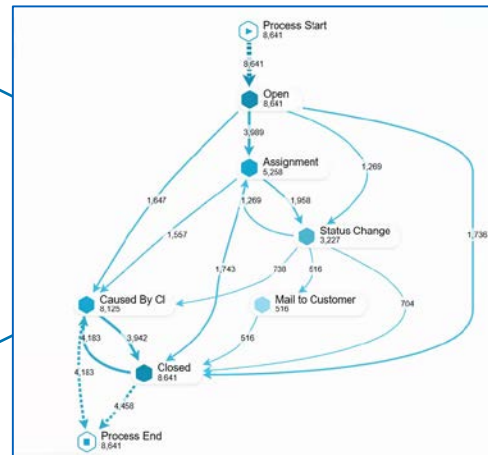Remove non-Essentials**

Top 10 Variants

Value Proposition

When to use Process Mining?

Discovery / Compliance

Process Improvement

Process Intervention

Transformation

Process Mining Analysis

Processes are manual—and therefore difficult to measure

P&C Industry Total Costs

Stacked bar chart (bottom to top):
- Net Commission, 11%
- Taxes, 3%
- Loss Costs, 59%
- Loss Adjustment Expenses, 12%
- Salaries & Benefits, 8%
- Admin & Other, 7%
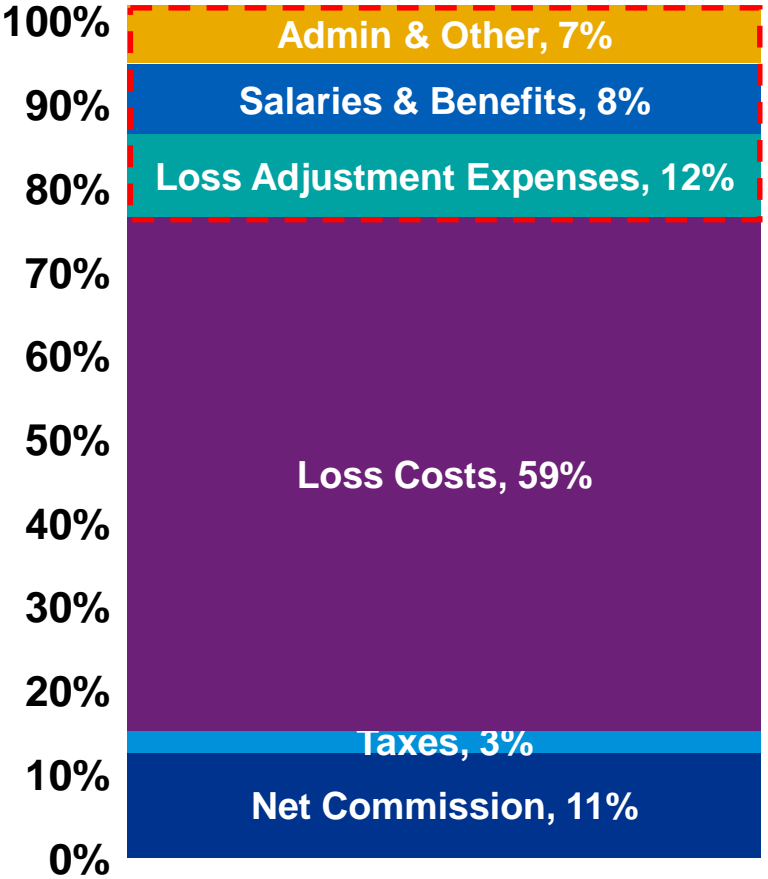
Improved process management would help the P&C industry better manage over 1/4th of its cost base.

These costs are often not rigorously studied today.

Sample Findings from P&C Claims analysis…

Labor vs Loss Costs

Loss Costs — Low / High

Labor Costs — Low / High

Vehicle Age — New / Old
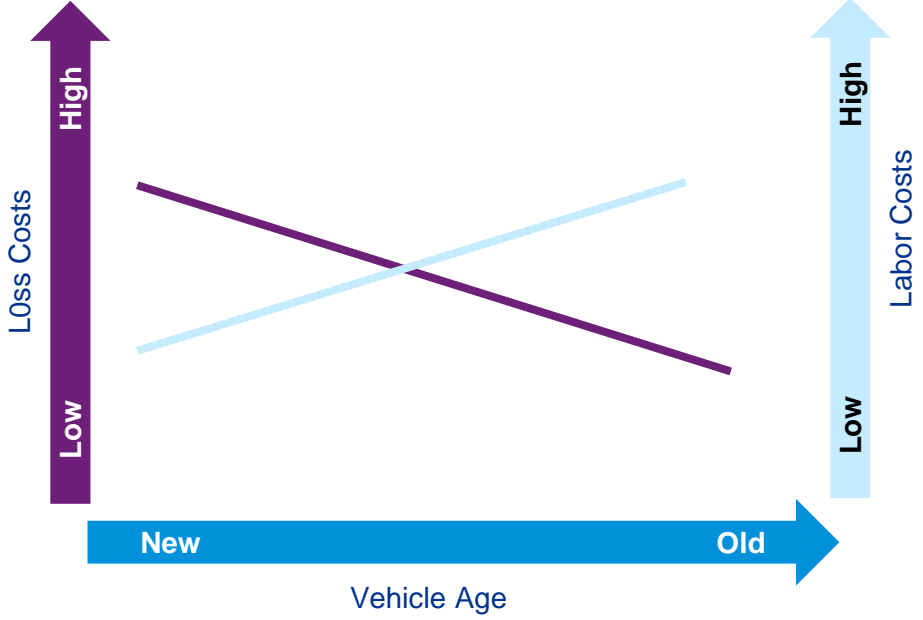
Customer Service Score by Activity Count

Customer Service Score — Low / High

Claim Adjuster Activities — Few / Many
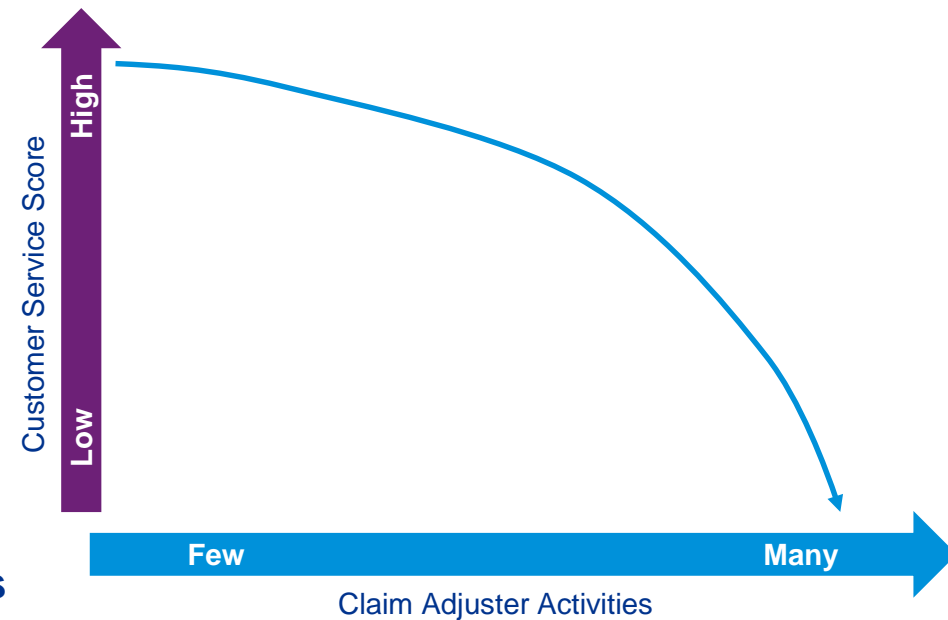
Settlement Effort Drivers

- Types of Communication
- Other
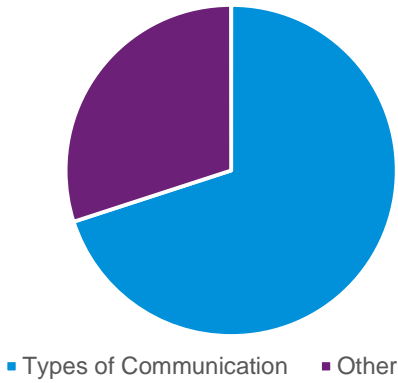
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How to Process Mine

KPMG's General Approach to Process Mining

1 Processing

Clients workflow system data enriched with better practices and benchmark data

Policy/Claims Admin. System Logs → Extracted data → Data transformation → End-to-end process view

2 Analysis

I. Process Flow	II. Process Patterns / Model validation	III. Process Analytics, Conformance

3 Results

Final results report provided detailed insights and provides measures to improve ICS & process performance

Summary / Benchmarks · Performance & Compliance reports · Detailed findings and documents · Recommendations & measures

Variant + Cost Models

Variant Model

Orders activities by:
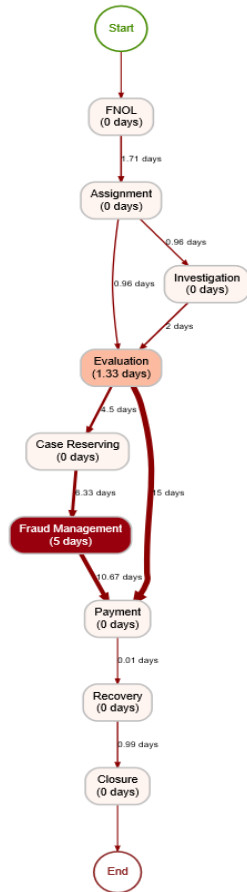
- Transaction # (e.g. claim, policy number)
- Activity type
- Timestamp

Used to analyze:

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

Can be done in R, but process mining tools like Celonis provide much easier user interface

Cost Model

	Time per activity	
*	**Resource Cost (per Hour)**	**Simple matrix multiplication**
*	**Activity Count**	
$	**Total Costs**	

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
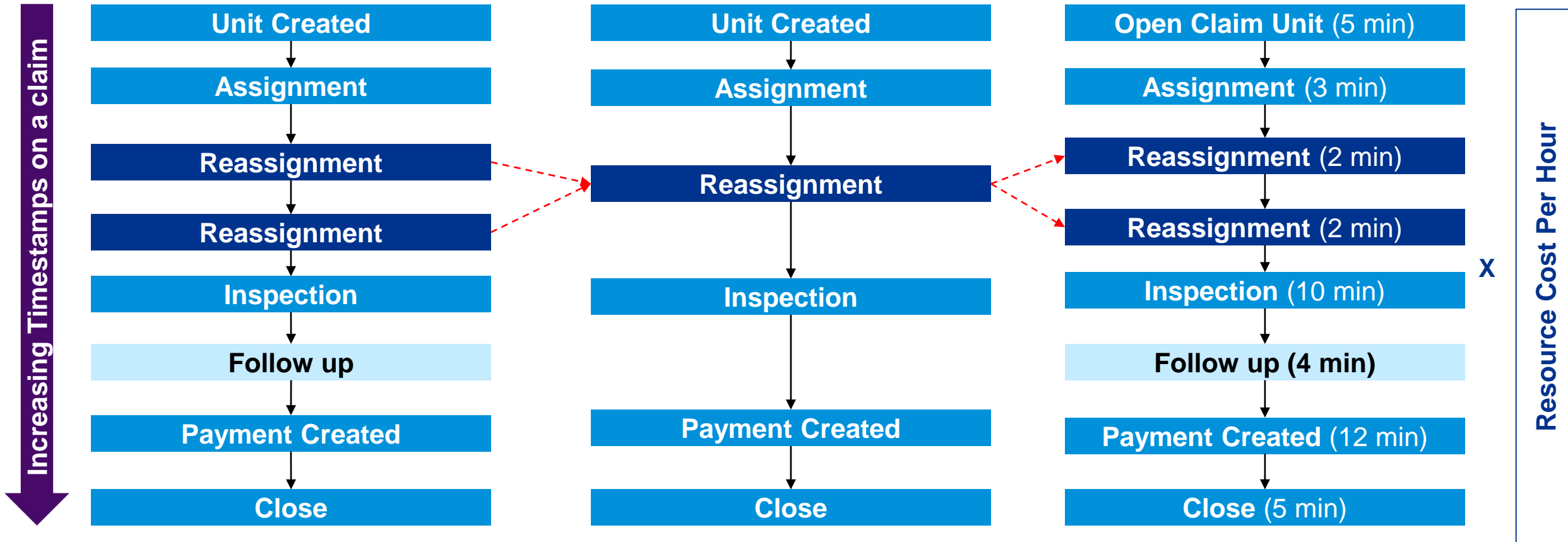

Raw Data

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.

Increasing Timestamps on a claim

Raw Data	Variant Model	Cost Model
Unit Created	Unit Created	Open Claim Unit (5 min)
Assignment	Assignment	Assignment (3 min)
Reassignment	Reassignment	Reassignment (2 min)
Reassignment		Reassignment (2 min)
Inspection	Inspection	Inspection (10 min)
Follow up		Follow up (4 min)
Payment Created	Payment Created	Payment Created (12 min)
Close	Close	Close (5 min)

X

Resource Cost Per Hour

Data Requirements and Considerations

Data Requirements:

— 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 analysis 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. Process Mining is an analysis and visualization step that informs later stage process optimization activities, along the journey below.

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

Successful process mining projects

"Happy Paths" can be based on either the most frequent policy/claim journeys, or business views of "should be" process flows. Comparing "as is" versus "happy paths" identifies anomalies, potential conformance risk, and other issues impacting the customer.

In this example, not all claims are completing required Investigation steps prior to Evaluation. Later in the journey, some payments occur without case reserves, which may be a compliance issue.

Typical Phase 1 process mining projects help management visualize:
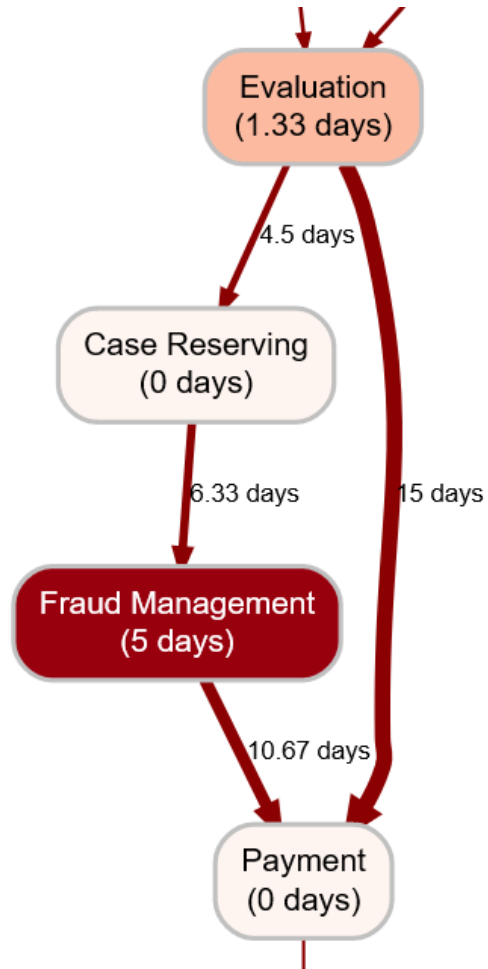
- How often processes follow the happy path

- If variants are more common with particular claim, policy, or resource cohorts

- Triggers—and effects—of processes falling off the happy path

Process changes to address these issues can then be proposed to improve future operations.
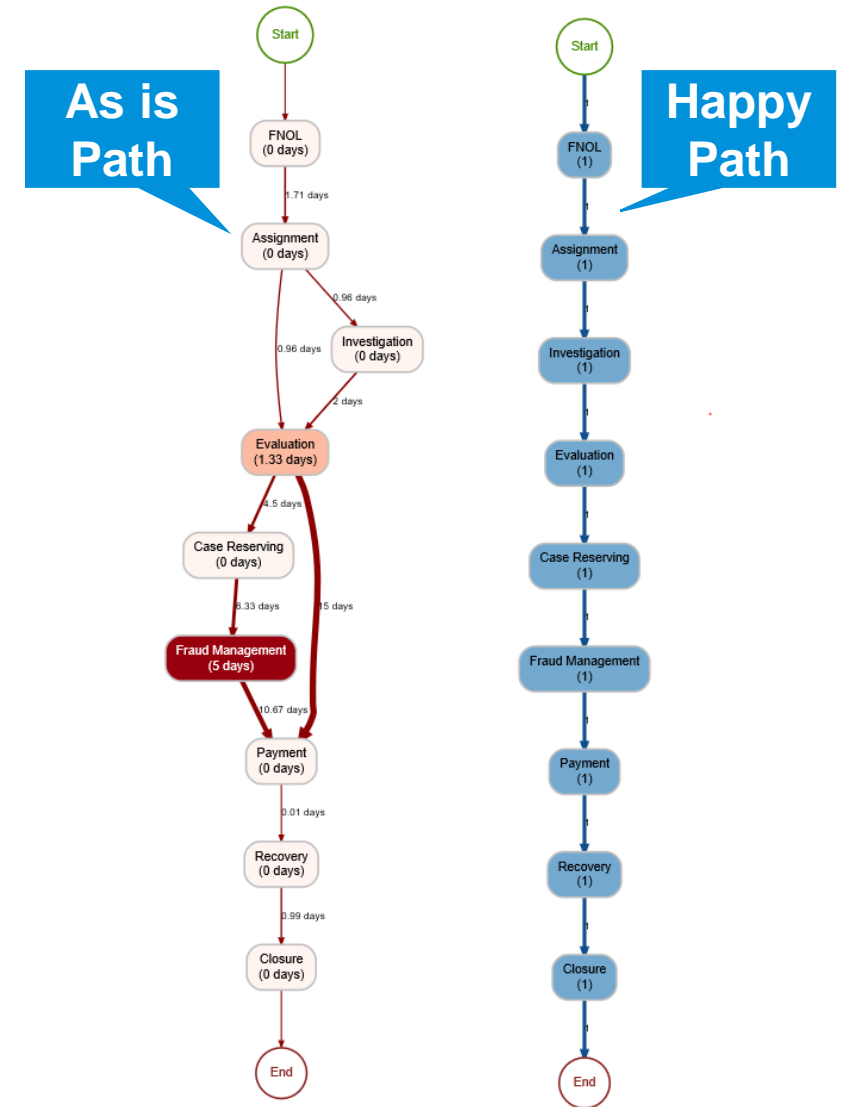
Bottlenecks and Benchmarking

SIU (expectedly) adds 2 weeks to the process

- Benchmarking can be based on internal management dimensions or industry standards

- The main cycle time difference between East and West is time spent in fraud management
  — More fraud in the West
  — Inefficient fraud management
  — Included investigation step in Fraud Management

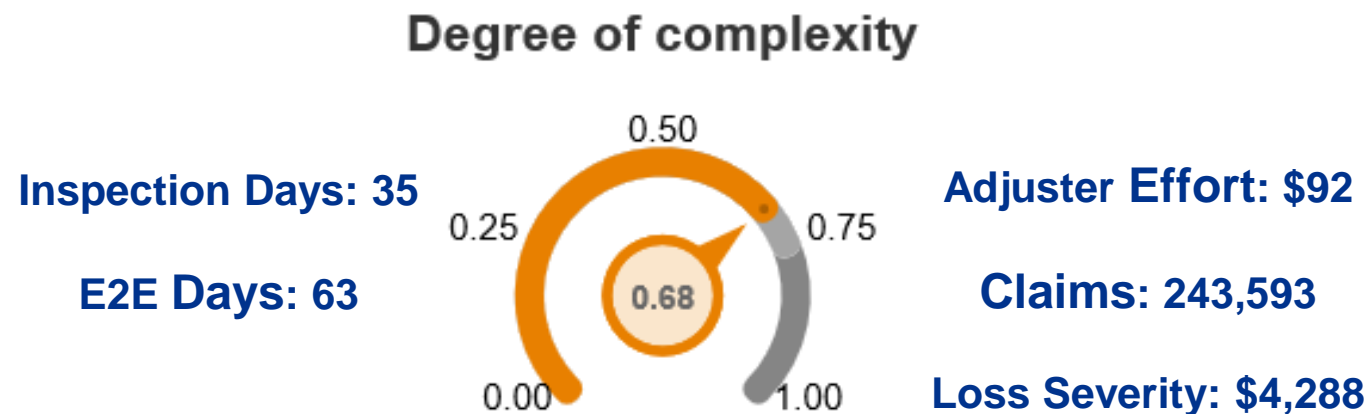- 2 days difference from Fraud Management to Payment

West

East
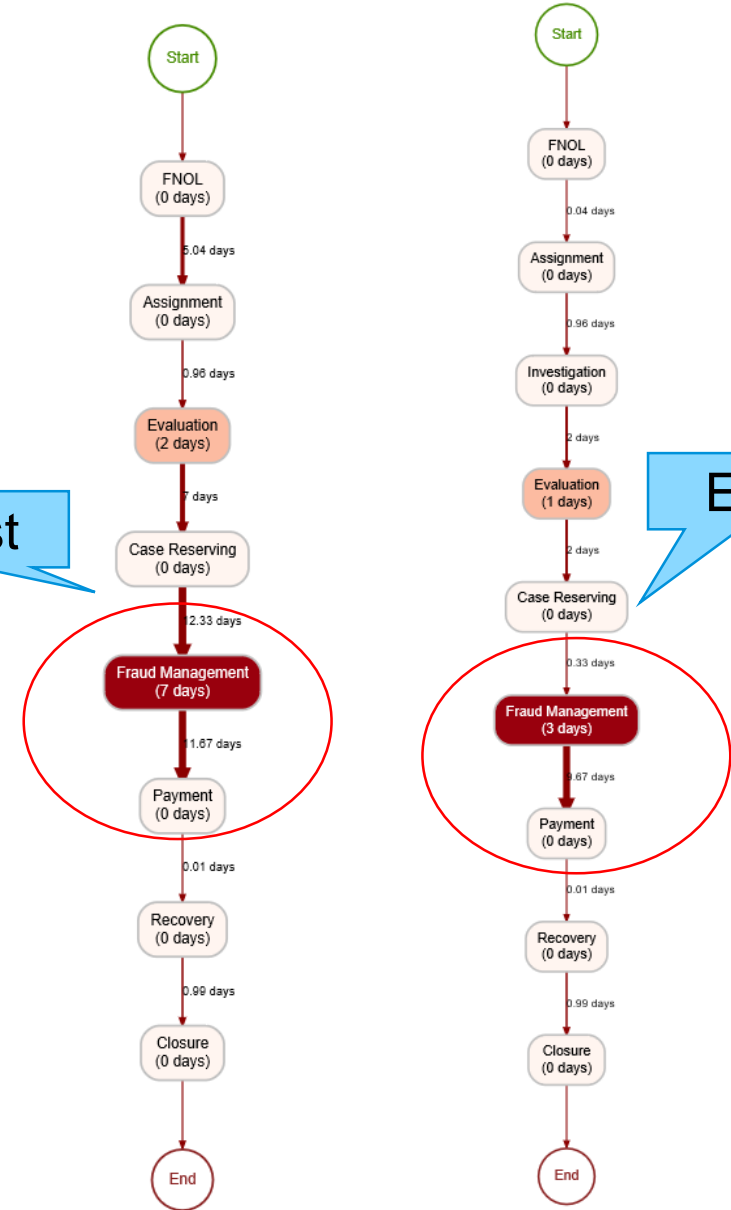
Celonis Demo

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

Degree of complexity

Inspection Days: 35

E2E Days: 63

0.50

0.25   0.75

0.68

0.00   1.00

Adjuster Effort: $92

Claims: 243,593

Loss Severity: $4,288
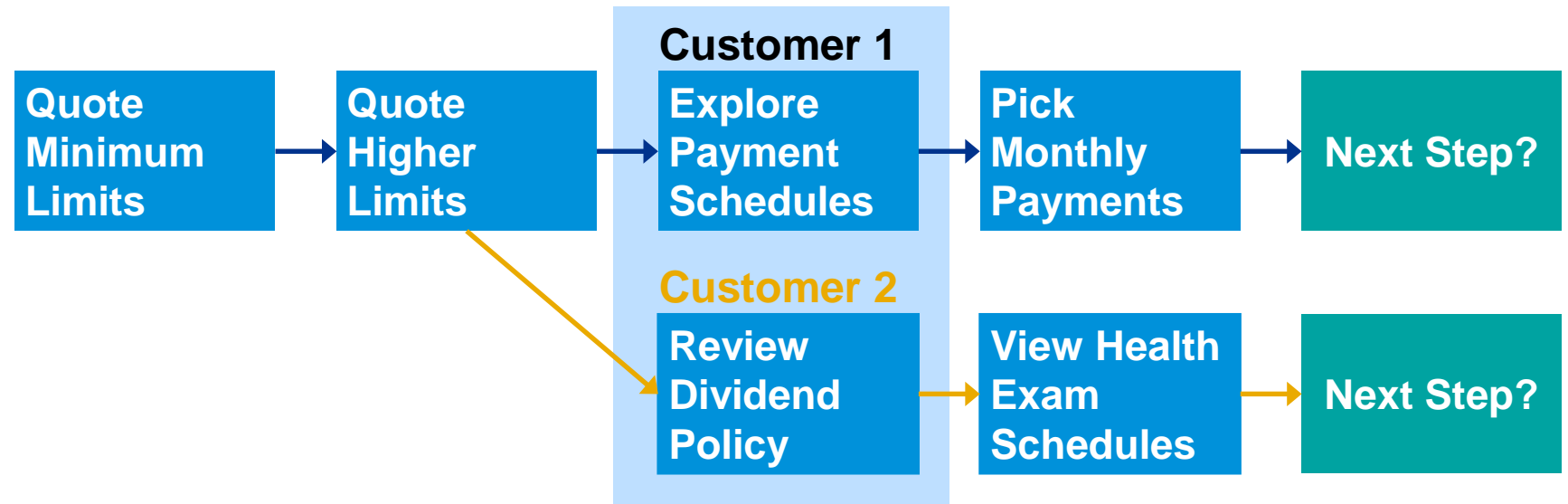
KPMG Use Cases: Effective Nudges

Use Case 1: Sales

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

Each customer touchpoint reveals new information.

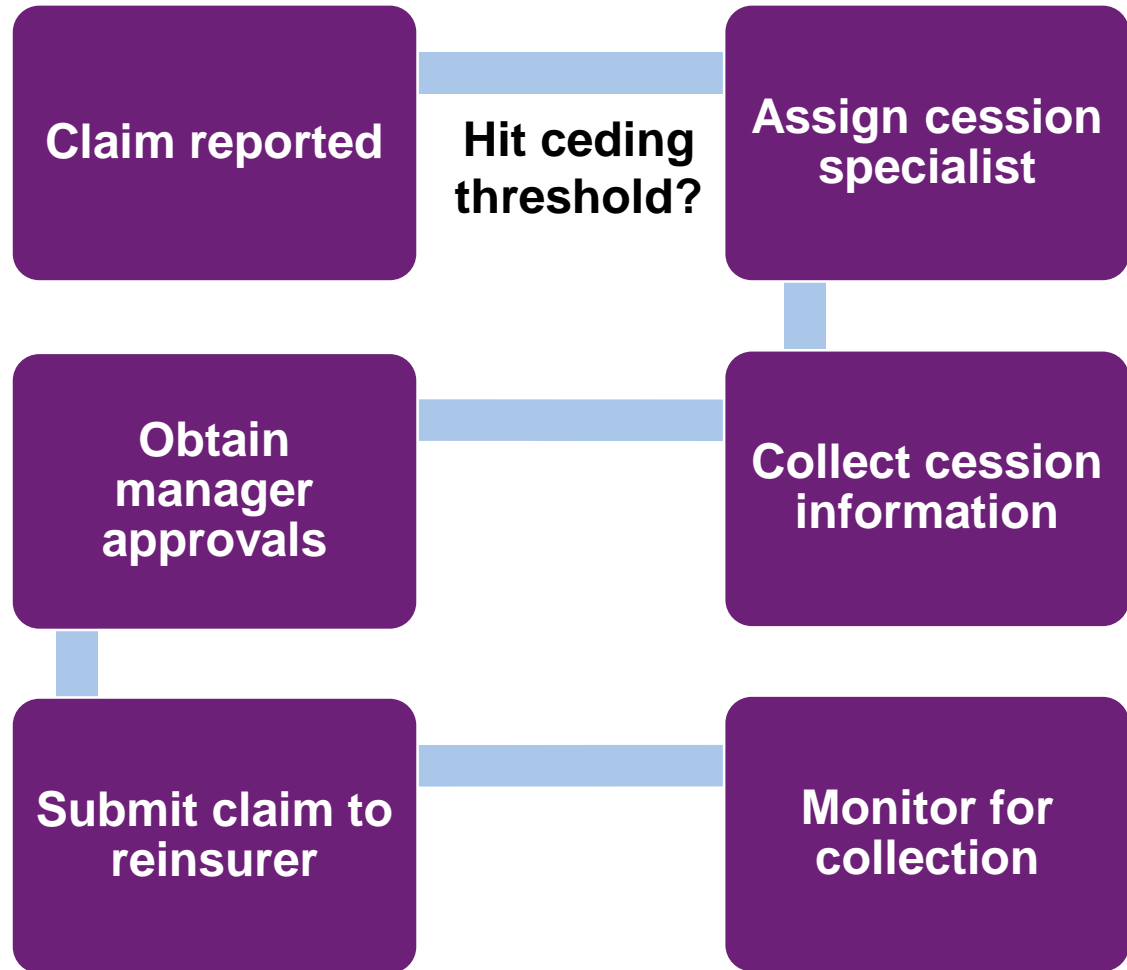**Carriers should use that intel to improve outcomes.**

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

Customer 1

Quote Minimum Limits → Quote Higher Limits → Explore Payment Schedules → Pick Monthly Payments → Next Step?

Customer 2

Review Dividend Policy → View Health Exam Schedules → Next Step?

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

```
Claim reported    Hit ceding       Assign cession
                  threshold?       specialist

Obtain                             Collect cession
manager                            information
approvals

Submit claim to                    Monitor for
reinsurer                          collection
```

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: Claim Settlement

Context / Client Challenge

The client sought to improve performance on vehicles repaired through their preferred body shop network.

Claims administration system log data was mined to understand claim settlement:

— Bottleneck and cycle time issues

— Common settlement pathways

— Variations from the "should be" process flows that the client derived through interviews with claims handlers and managers

— Cost to settle various types of claims, based on the:

  - Number and types of settlement actions needed

  - Time to complete each action

Benefits

— Identify that 4 action types contributed >2/3rds of settlement effort costs

— Quantify LAE costs at the action-level, rather than allocating-down balance sheet values

— Link claim settlement actions and sequences to customer service scores

— Identify new relationships between settlement actions and claim outcomes, while confirming several previously unverified suspicions

— Develop new analytics skills, ahead of the broader insurance sector

Domain Agnostic Use Cases and Benefits

Use Case	Description
Process Discovery	— Uncover what really happened, spot long runners and unusual process paths. — e.g. adjuster assignment for certain claim types takes longer than expected.
Conformance Checking	— Compare the desired "to be" process against the actual "as is" process — e.g. find anomalies in process flows for internal controls/audit
Benchmarking	— Compare processes between geographies/companies to improve performance — e.g. more SIU time spent in claim fraud management in the West region compared to other regions
People Behavior	— Insights into system usage behaviors and variances amongst teams — e.g. excessive policy system access by personnel during weekends
Dashboard & Monitoring	— Customized and interactive KPI dashboards enables real-time analysis.

Using the results: Process Simulation

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Understand process ➔ Simulate for constrained optimization

Analysis of as-is processes	Optimization of to-be processes

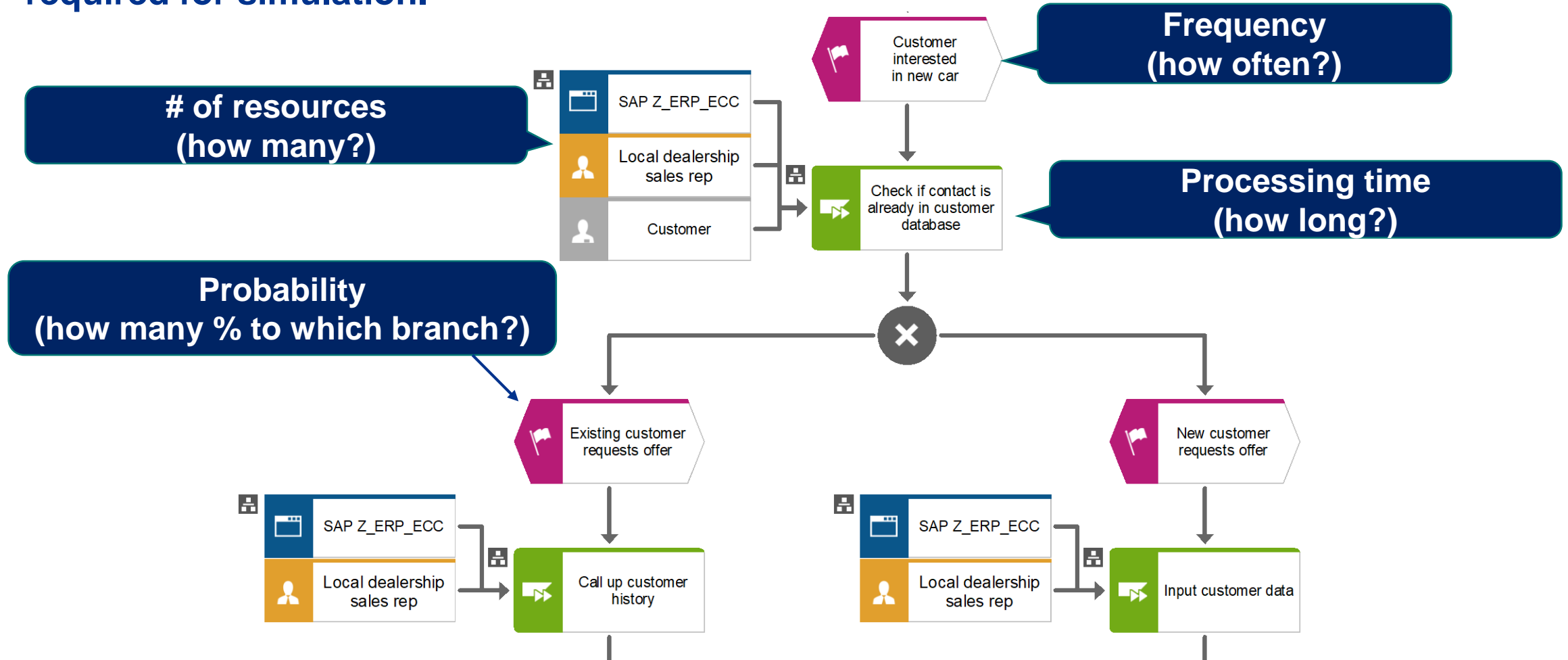**Analysis of as-is processes**

- 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)
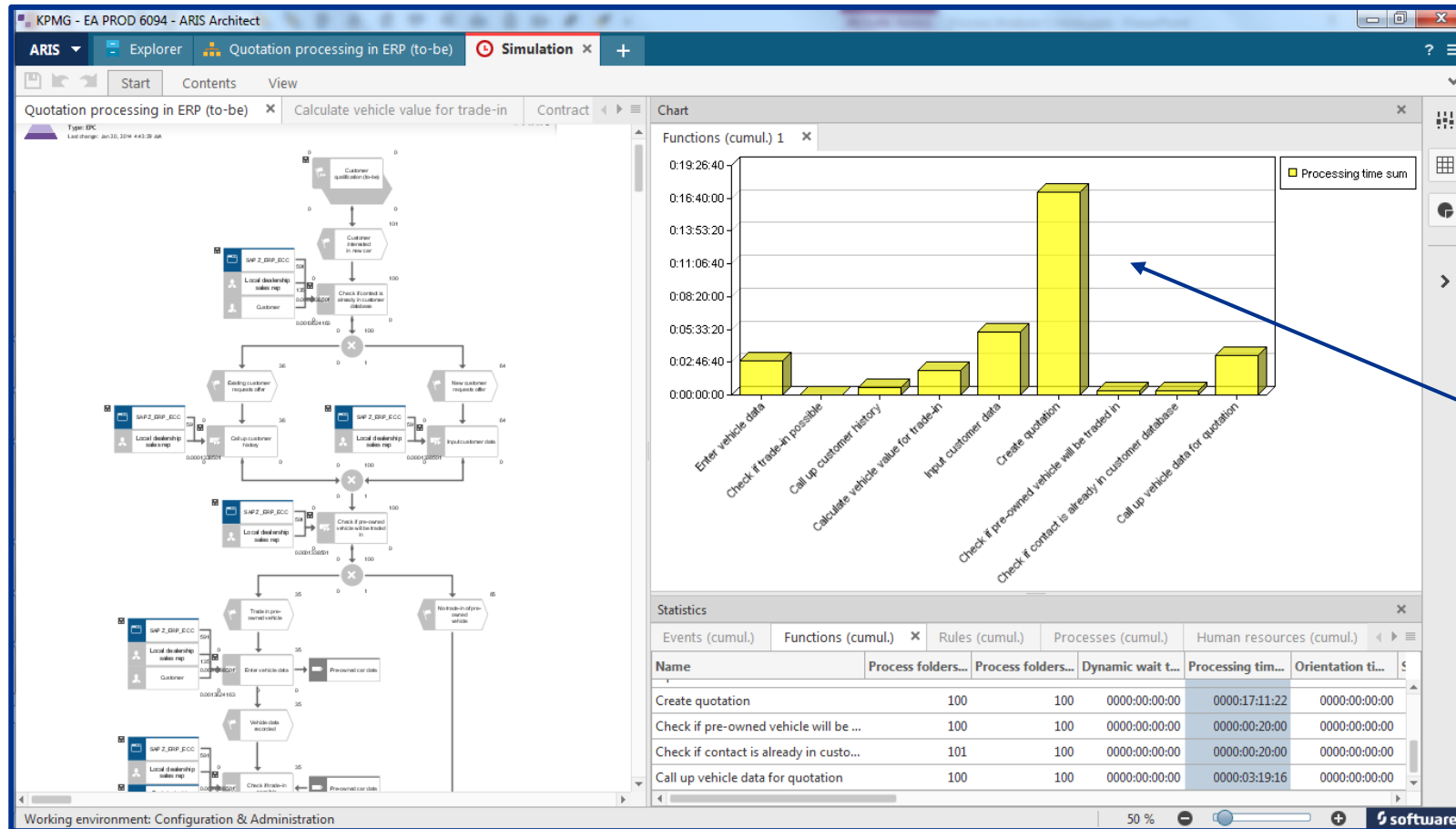
Optimization of to-be processes

- 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.

# of resources
(how many?)

Frequency
(how often?)

Processing time
(how long?)

Probability
(how many % to which branch?)

Customer interested in new car

SAP Z_ERP_ECC

Local dealership sales rep

Customer

Check if contact is already in customer database

Existing customer requests offer

New customer requests offer

SAP Z_ERP_ECC

Local dealership sales rep

Call up customer history

SAP Z_ERP_ECC

Local dealership sales rep

Input customer data

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?

Appendix:
Case studies

Claim Settlement Actions

Context / Client Challenge

The client sought to improve performance on vehicles repaired through their preferred body shop network.

Claims administration system log data was mined to understand claim settlement:

— Bottleneck and cycle time issues

— Common settlement pathways

— Variations from the "should be" process flows that the client derived through interviews with claims handlers and managers

— Cost to settle various types of claims, based on the:

- Number and types of settlement actions needed

- Time to complete each action

Approach

KPMG assisted the client to execute their first process mining project, including:

— Aligning system log data with real-world settlement actions

— Developing a cost model to quantify the resource-labor cost associated with each settlement action

— Examining cost and throughput differences in a variant model, which facilitated analysis of where—and how often—claim paths diverged

Sample Variant Model
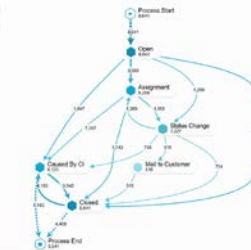
Benefits

Insights helped the client to:

— Identify that 4 action types contributed >2/3rds of settlement effort costs

— Quantify LAE costs at the action-level, rather than allocating-down balance sheet values

— Analyze settlement costs by claim and policy holder dimension

- Many low-cost claim types were labor intensive to settle (or vice versa), implying cross-subsidization

— Link claim settlement actions and sequences to customer service scores

— Identify new relationships between settlement actions and claim outcomes,

— Develop new analytics skills, ahead of the broader insurance sector

Document Intake and Management

Document Intake Process
## Generating Process Efficiencies in Shared Services

Context / Client Challenge

— Document intake production line issues resulted in process bottlenecks, increased cycle times, and higher resource costs (e.g. multiple entry points, stations, queues)

— KPMG sought to identify process improvement levers by simulating multiple production line scenarios (e.g. effort/load distribution, shift patterns, number of queues and prioritization)

— Prioritized recommendations needed to be synthesized into an implementation roadmap for document intake modernization

Approach

KPMG assisted the client to:

— Document current state processes including on-site interviews, documentation and data review

— Establish benchmark process assumptions for use in simulation modeling (e.g. cycle time and process path probability)

— Simulate processes and test scenarios to identify process improvement opportunities
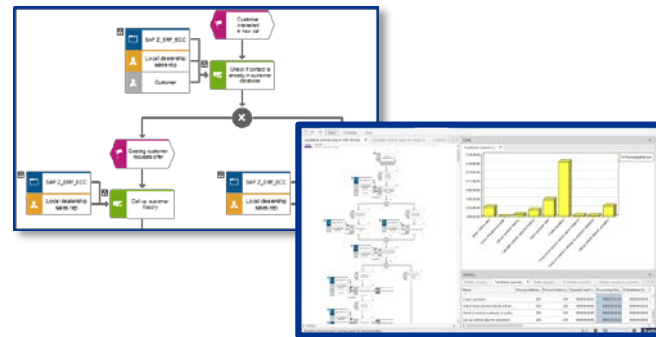
Benefits

Through process simulation the client is able to:

— Generate insights into process inefficacies such as bottlenecks and wait times

— Simulate scenarios to better plan and manage resources

— Reduce throughput time and costs

— Establish new KPI benchmarks, based on the targeted customer experience

Thank you

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