IBM Cloud Pak for Business Automation Demos and Labs

IBM Process Mining

Lab Guide - Use Process Mining to Get Insights into Claims Adjudication

IBM Process Mining 1.14.0
Lab Version 1.2

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1 Introduction

1.1 IBM Process Mining

Process mining is a family of techniques in process management that support the analysis of actual business processes based on event logs. During process mining, specialized data mining algorithms are applied to identify trends, patterns, and details in event logs recorded by an information system. Process mining aims to improve process efficiency and understanding of processes.

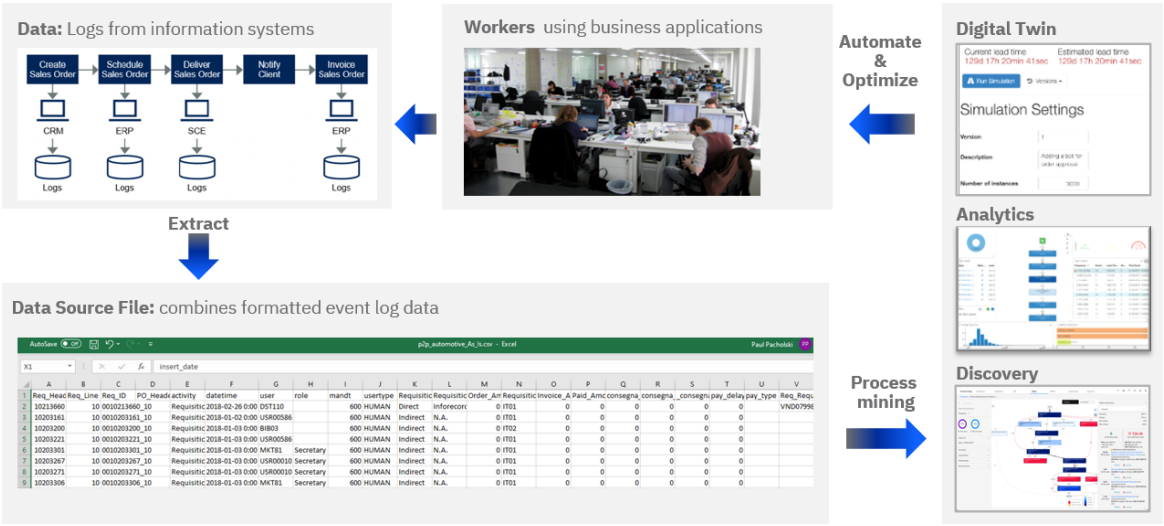


Figure 1. Process Mining

1.2 Claims Adjudication

1.2.1 Claims Adjudication Use Case

Focus Insurance has many processes that they are looking to get visibility into as them continue to transform their business. They are also using IBM Process Mining in their finance team to look at Procure to Pay, Accounts Receivable and Accounts Payable. Their Human Resouce team is focused on Hire to Retire processes and their IT teams are examining Ticketing and Product Development Lifecycles for improvement. But now the claims team is trying to understand very long and costly process of paying claims where they can improve operational efficiency, move faster to automating manual steps and in some cases process engineer old processes from legacy platforms to newer more efficient process flow.

1.3 Lab Objectives

This lab demonstrates how IBM Process Mining leverages the Claims Adjudication event data captured in Focus Insurance systems to identify automation and business improvement opportunities.

The primary objective is to introduce you to the rich feature and functions of IBM Process Mining through the experiential learning of identifying process improvement opportunities.

If you feel you need to dive deeper into any particular topic while working through the instruction or after completing the lab, please take a look at the documentation: https://www.ibm.com/docs/en/process-mining/1.14.1.

Let's get started!

2 Lab Setup

2.1 Provision Process Mining Environment

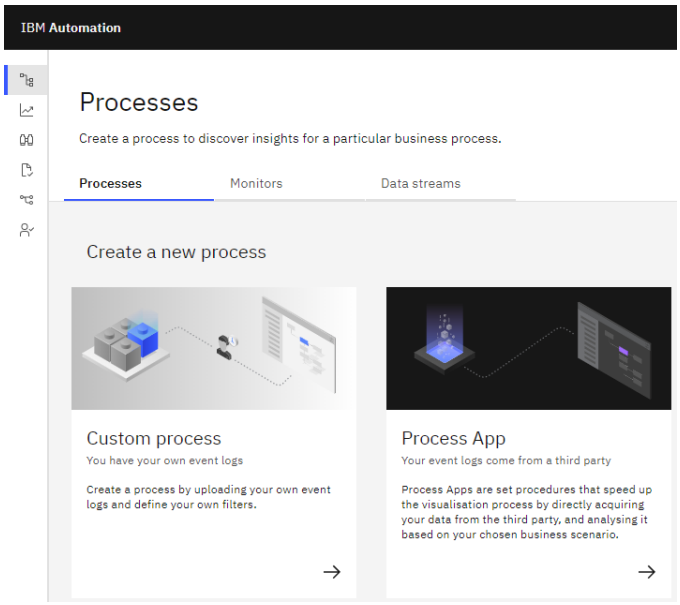
_1. Download this document and follow the instructions for reserving Tech Zone Environment.

_2. Follow the instructions in "**3 Start IBM Process Mining Web Application"** to start the Process Mining Web application.

2.2 Open IBM Process Mining Application

_1. Start your browser using one of the access methods described in this document: Tech Zone Console; Web Browser URL; **Remote Desktop (recommended).**

You should now see the IBM Process Mining web UI.



3 Exercise: Use Process Mining to Get Insights into Claims Adjudication Workflow

3.1 Gain Business and Technical Insights into Claims Adjudication

3.1.1 Explore Model View

The Model view is the starting point for all analysis and for Claims Adjudication it is no different. In the model view you will highlight the most frequent activities, paths taken, and the "real" process discovered from log data versus the expected process. A key point is that we are now looking at a digital twin of our process and with that we capture all variation in the model

> Our data set only has one Process ID field (Reference ID). IBM PM supports the visualization of multiple processes, each having a different Reference ID. This capability is called multi-level and is critical as you scale the complexity of the processes you discover.

When initially opened, the Model opens in the Frequency view showing all the **cases** discovered in the imported data.

> A case is an instance of a process. In flat processes, a different Process ID defines a new case. In our data set, a Case represents all activities executed to a claim.
>
> In multi-level processes, the combination of process ids defines a new case. Each process-id represents a different sub-process that contributes to executing a single case. See this link for more details about multi-level process mining.

The dark blue color highlights the most frequent activities, while the bold arrows highlight the most frequent transitions. In this way, the most frequent paths between activities of the process can be identified.

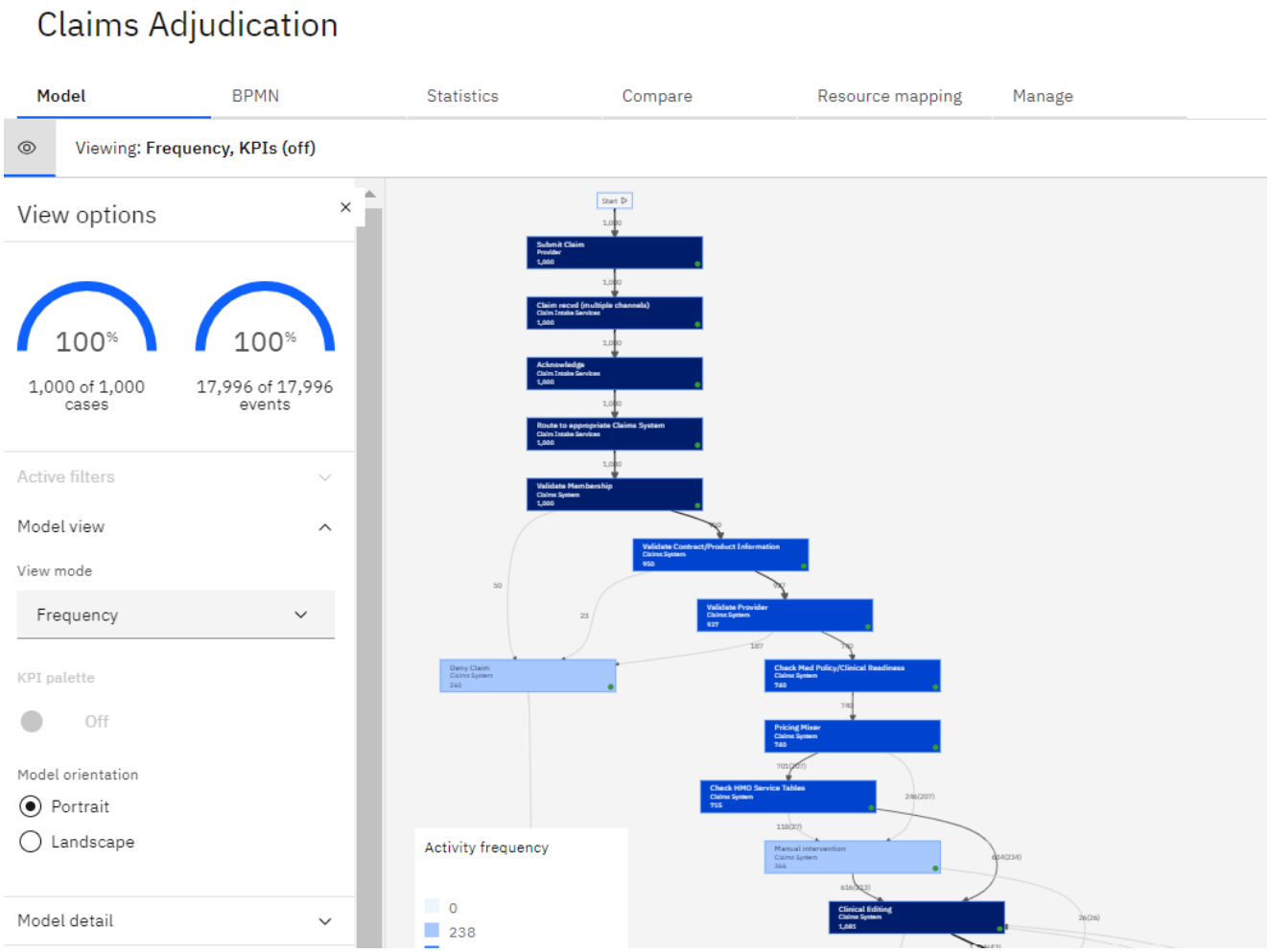
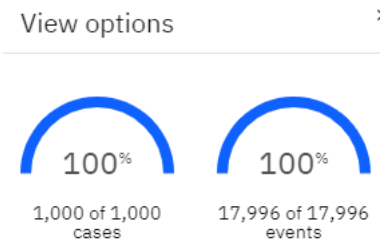


Figure 2

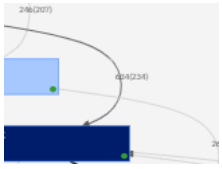
Hint: Use the mouse wheel to zoom and the mouse right button to move the process diagram.

Let's examine the default Frequency view:

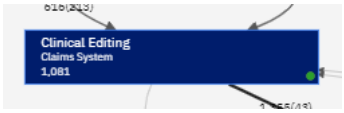
1. The top left view shows the number of Cases and all the associated events (rows in the CSV file). 100% indicates that we have no filters and are seeing all the data. The number of events represents the number of rows in the data set, Each row representing an invocation of an activity.



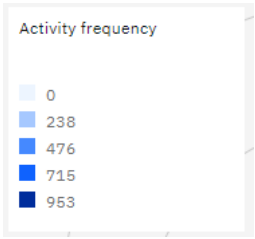
2. The numbers next to the lines show how often a particular path to a given activity was followed.



3. The numbers within the rectangles show the number of times the activity was performed. The activity count is typically a sum of the numbers on the inflowing paths.



4. The description in the rectangles includes the name of the activity and the roles that performed the activity.
5. The color saturation of activity reflects how often an activity was invoked (the frequency). See the activity frequency legend.



Business Insight: We are able to understand using data the path of our process activites and their variations from end to end. This establishes the “as is” process of how it works in production.

3.1.2 Identify Rework

The second area that we want to explore are activities that are repeated more than once in the same process instance are defined as rework. Activities with rework typically reveal process inefficiencies that can be targeted for process re-engineering.

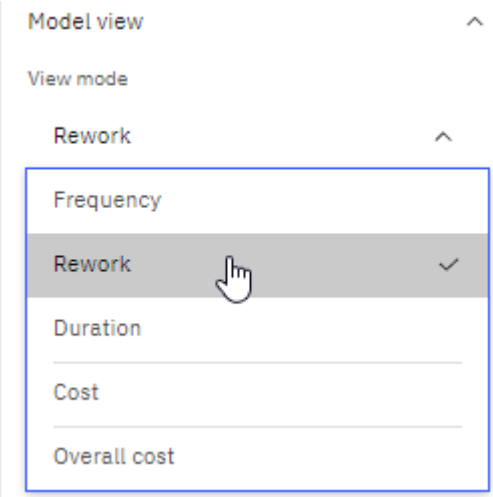
IBM Process Mining automatically discovers two kinds of rework:

1. If you can see an arrow that goes out and falls into the same activity, it is called a **self-loop**.
2. When the activity is repeated several times in the same process instance, it is called **instance-looping**.

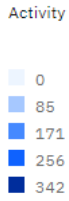
Let's identify the activity with a large rework value and then identify the process to which this activity belongs. This will help us to identify the root causes of the rework.

3.1.2.1 Instance Looping Rework

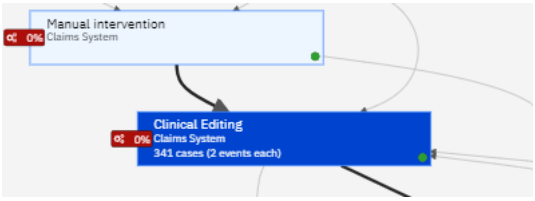
_1. On the **Model** tab, open the **View mode** dropdown, and select **Rework**



_2. Note that activities with rework are marked according to the legend. The darker the activity color, the more times rework occurred in the same process instance.



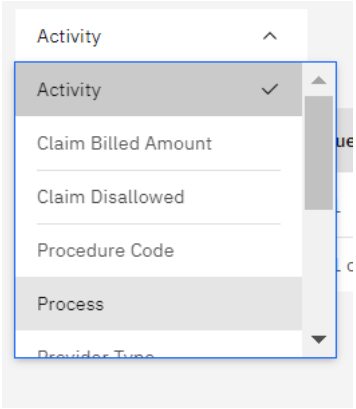
_3. Click **Clinical Editing** activity – an example of *instance-looping*



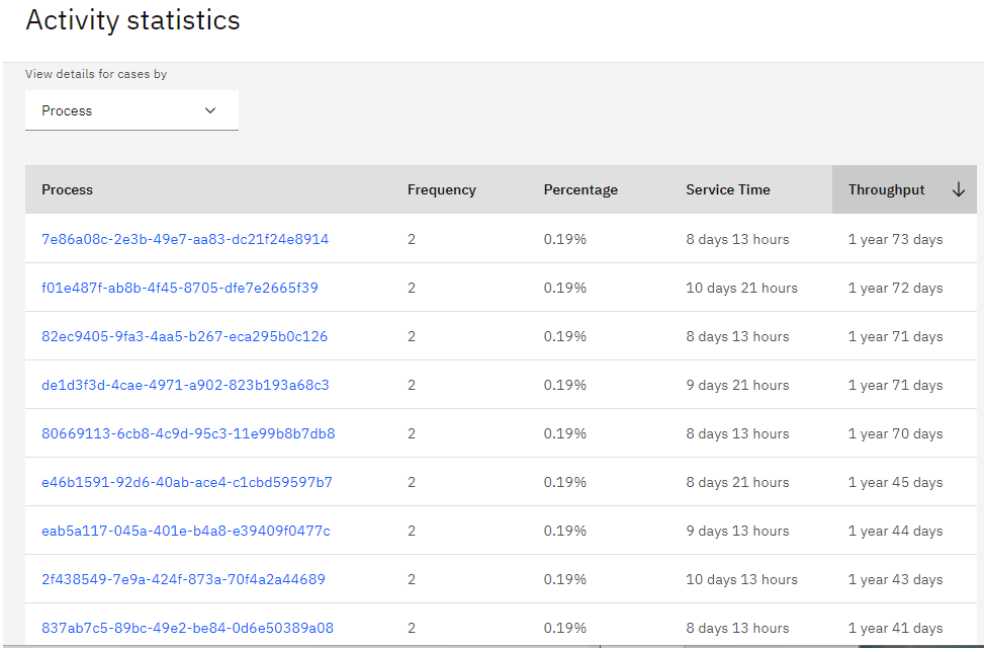
- This activity is repeated (rework) in 341 out of 1000 cases
- On average, the Activity repeats 2 times during the 341 cases where it occurs.
- This activity has 0% automation ratio the red box (meaning it is completely manual)

_4. Click **Show activity statistics** so that we can exam in more detail what cases are impacting this rework

_5. For **View details for cases by**, select **Process**

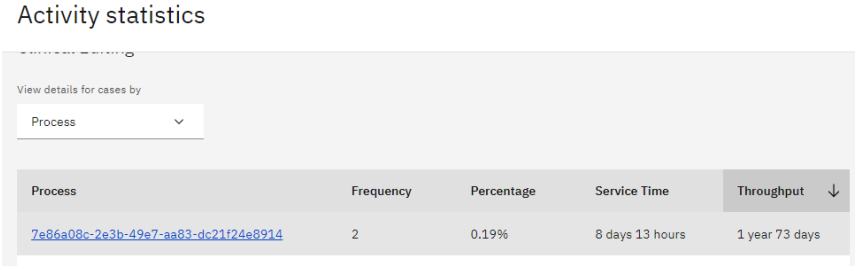


_6. This provides a complete list of all the processes that incurred rework that we identify as inefficientcy. *Click on the Throughput arow to sort for the longest process time. It should be 1 year 73 days.*



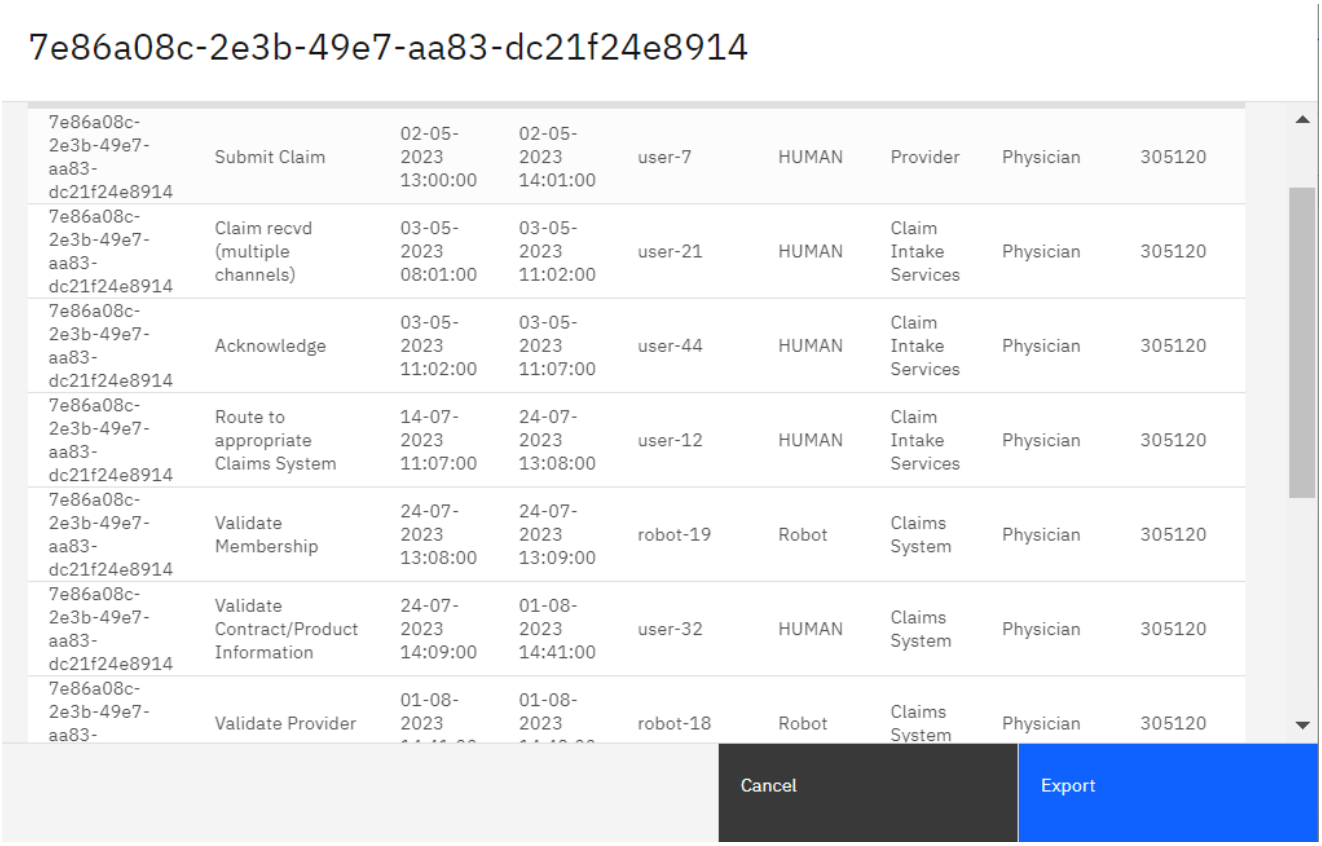
Process	Frequency	Percentage	Service Time	Throughput
7e86a08c-2e3b-49e7-aa83-dc21f24e8914	2	0.19%	8 days 13 hours	1 year 73 days
f01e487f-ab8b-4f45-8705-dfe7e2665f39	2	0.19%	10 days 21 hours	1 year 72 days
82ec9405-9fa3-4aa5-b267-eca295b0c126	2	0.19%	8 days 13 hours	1 year 71 days
de1d3f3d-4cae-4971-a902-823b193a68c3	2	0.19%	9 days 21 hours	1 year 71 days
80669113-6cb8-4c9d-95c3-11e99b8b7db8	2	0.19%	8 days 13 hours	1 year 70 days
e46b1591-92d6-40ab-ace4-c1cbd59597b7	2	0.19%	8 days 21 hours	1 year 45 days
eab5a117-045a-401e-b4a8-e39409f0477c	2	0.19%	9 days 13 hours	1 year 44 days
2f438549-7e9a-424f-873a-70f4a2a44689	2	0.19%	10 days 13 hours	1 year 43 days
837ab7c5-89bc-49e2-be84-0d6e50389a08	2	0.19%	8 days 13 hours	1 year 41 days

_7. Now that we have identified the longest process let's click on the highlighted process name to examine this claims history.



Process	Frequency	Percentage	Service Time	Throughput
7e86a08c-2e3b-49e7-aa83-dc21f24e8914	2	0.19%	8 days 13 hours	1 year 73 days

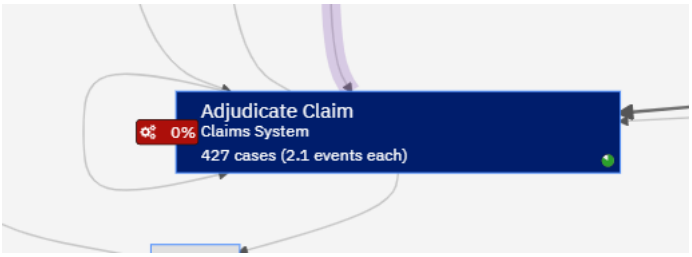
_8. We can now review the history of this claim and each user as well as RPA bots perform parts of this reworked process. When you are done reviewing you can click Cancel and close the Activity window to return to the model



Business Insight: We now know the impact of rework on the process metrics, such as lead time and costs. Rework loops are important areas of discovery for automation tools to solve issues as they are costly to the business.

3.1.2.2 Self Looping Rework

_1. As mentioned there are two types of rework. In the self looping type we click on the procee line outside to the left of the **Adjudicate Claim** activity box.



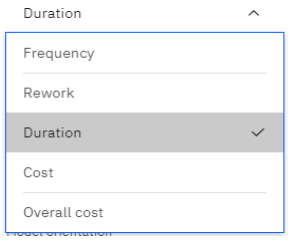
_2. You can repeat the activity you just complete for an **Instance Rework Loop** reviewing case statsitics then closing and returning to the model view

3.1.3 Duration and KPI Analysis

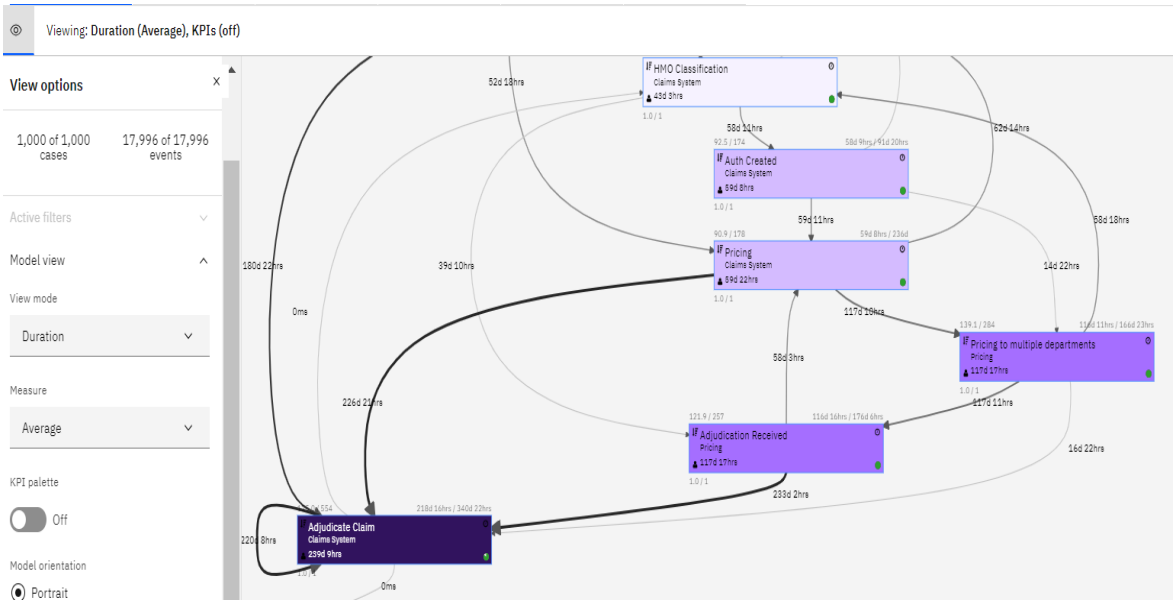
3.1.3.1 Duration

In this view we will focus on understanding where in the process we have the longest processing times by activities or process flows. Time efficiency impacts not only costs but also delivery times that impact customers. We will start with duration and then overlay KPI visulation to the model for more insight.

_1. Click the **Duration** tab

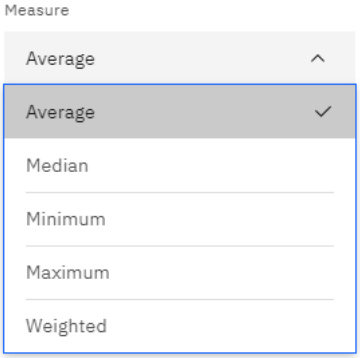


_2. In our Duration view we can see by color what activities take the longest and what flows between activities are also causing delay in the process.



- Our three longest activities are **Adjudicate Claim** and **Adjudication Received**.
    - **Adjudicate Claim** – 239d 9hrs
    - **Adjudication Received** – 117d 17hrs
- We can also see that moving from **Pricing** to **Adjudicate Claims** takes on average 226d 21hrs

_3. Duration can be viewed in various ways as seen below.

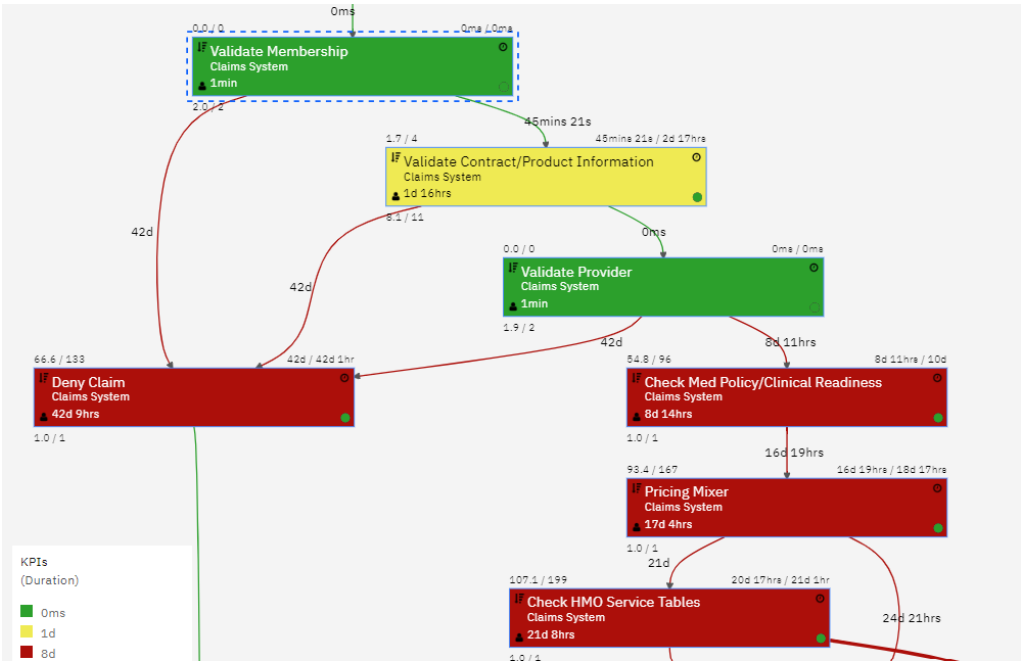


_4. **KPI's** - Are defined by the customer by using internally established KPI's, Industry Benchmarks or using IBM Process Mining. Using KPI's can be used in a number of ways.

- **Historical Analysis**
- **Continuous Monitoring of a process for near real time Operational Management**
- **Insights to Action – using monitors to predict KPI friction and alerting and workflows to resolve**

_5. Toggle the **KPI palette** to on

You should now see the model with activities and teransitions. You can use this view to identify what Activities and Transitions deviate from the KPI.



The activities and transitions color reflects the KPI settings. See the note below about the KPI Settings.

ACTIVITY	Activity with service time in line with the defined KPIs
CONNECTION	Transition with waiting time in line with the defined KPIs
ACTIVITY	Activity with risky service time
CONNECTION	Transition with risky waiting time
ACTIVITY	Activity with critical service time
CONNECTION	Transition with critical waiting time

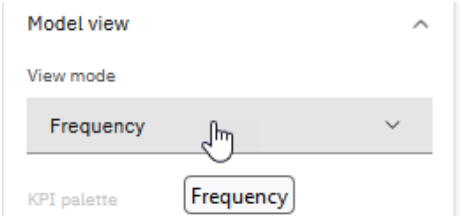
Process Improvement Insight: We found a direct correlation between activities that are highly automated and those that are still manual. The three activities where validation is the activity, when you switch back to a rework model you will also see they are automated between 80-100%

3.1.4 Process Variant Analysis

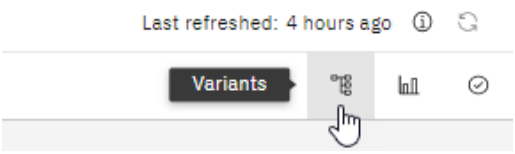
Claims Adjudication has multiple paths (e.g., happy path, exception cases, etc.). IBM Process Mining can visualize them individually or together.

A process variant represents a unique path that cases take to execute the process from the start to the end.

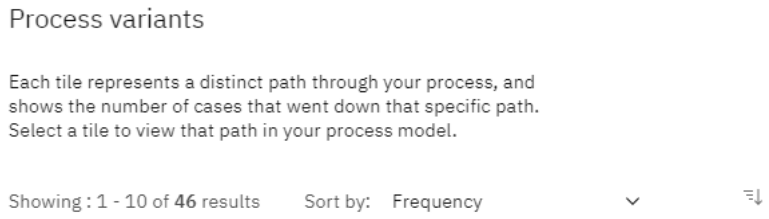
_1. Select **Frequency** view



_2. Click **Variants**



You should now see the process variants view on the right side.

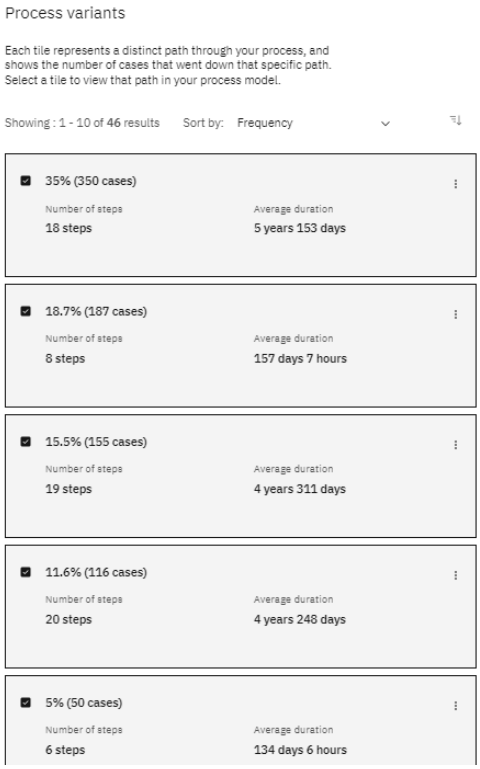


The process variants view enables the user to find the most frequent variant(s) and compare with other variants in terms of performance (average lead time) and the number of events (flat processes) or relations (multi-level processes).

3.1.4.1 Filter the top N variants

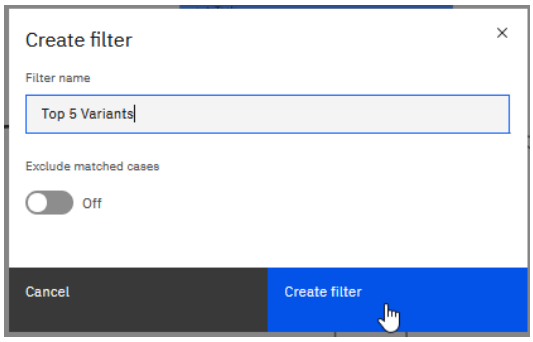
When analyzing process data, excluding outliers and focusing on the most frequently executed process paths is often essential. Focusing on the top process variants simplifies the analysis and allows us to focus on the most impactful process paths.

_3. Select the **check boxes of the first 5 variants**.



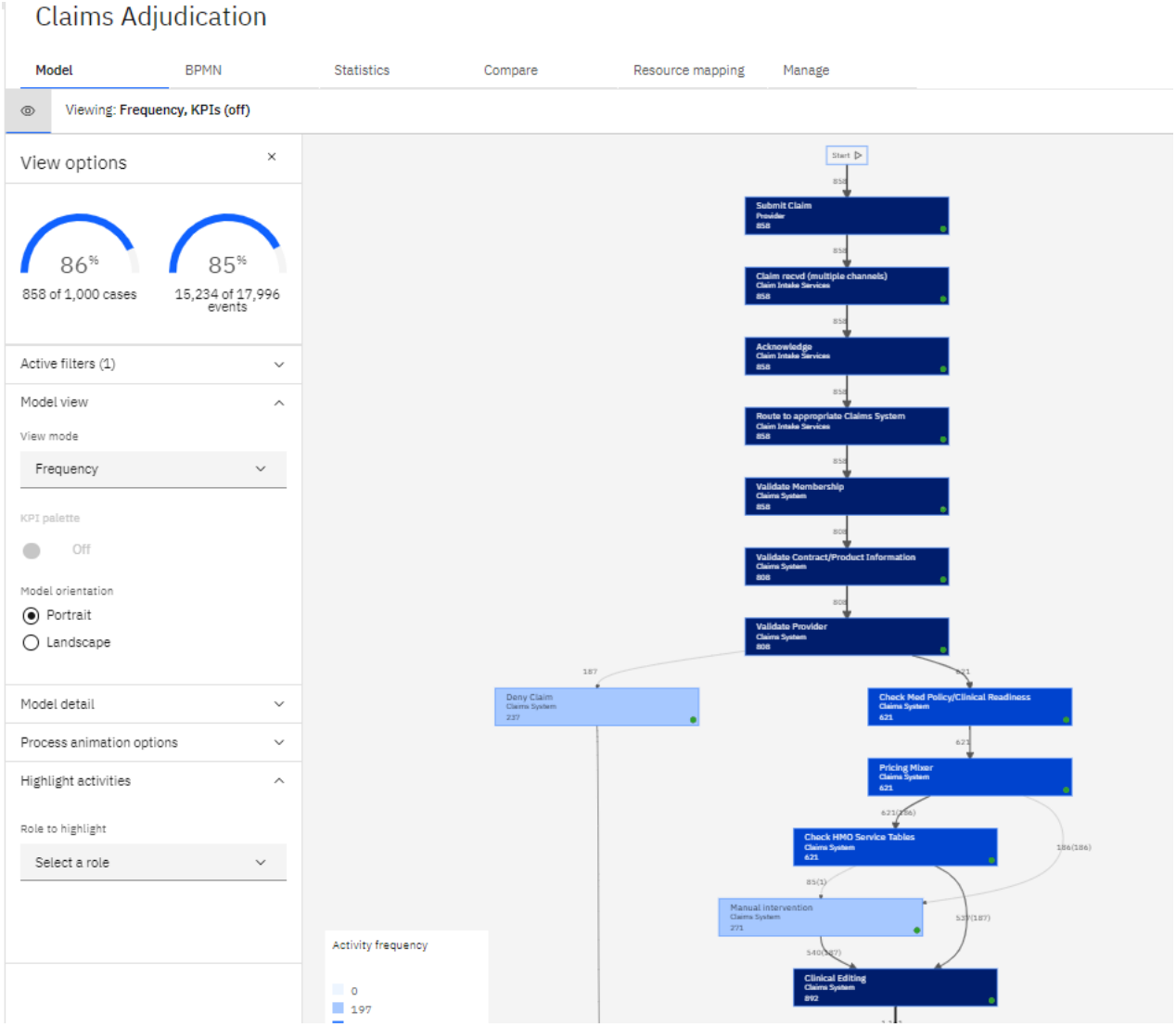
_4. Click **Create filter**

_5. Foe **Filter name** enter **Top 5 Variants** and click **Create filter**



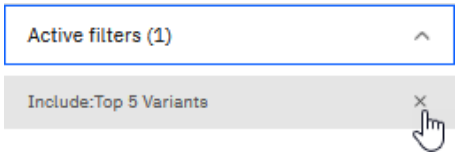
Note that if we selected **Exclude matched cases** in the Create filter window above, the resulting filter would include all the outliers, namely, the cases that belong to the least frequent Variants.

_6. The Model is now updated and shows fewer steps and connections, yet it covers 86% of all process paths.



Note that it is possible to permanently save this filter and use it later in all process analysis tasks!

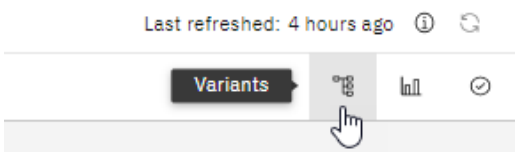
_7. Under **Active filters** click **X** to remove the " Include:Top 5 Variants" filter



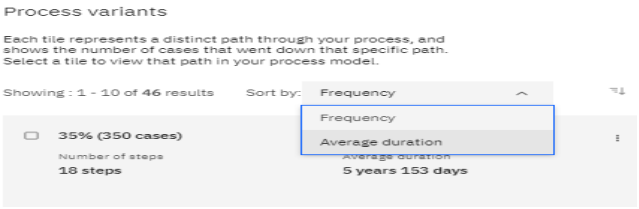
3.1.4.2 Use Filter to Discover Unhappy Path

Let's find the slowest variant and discover what the root causes are.

_1. Click **Variants**



_2. Select **Average duration**

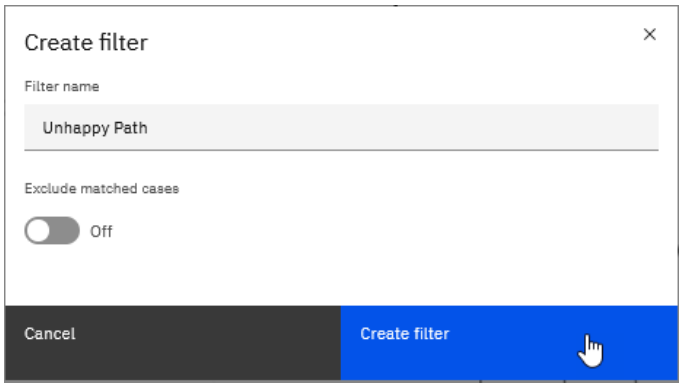


_3. On the Variant that has *18 steps*, click the **checkbox** to filter out all other cases.

Note that we also found the variant with the highest duration (5years 153 days).

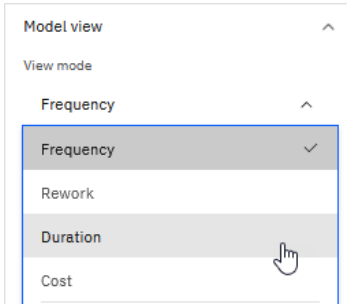
_4. Click **Create filter**

_5. For **Filter name** enter **Unhappy Path** and click **Create filter**



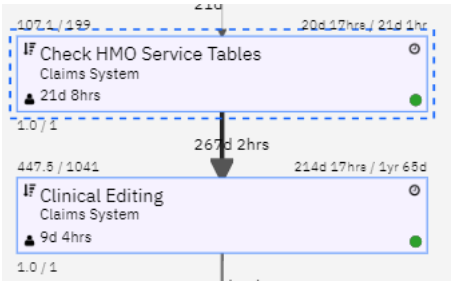
3.1.4.2.1 Investigate Long Case Duration

_1. For **View mode**, select **Duration**



_2. Note the concern that contribute to the case duration:

- There is a considerable delay of **267d 2hrs** between the two activites. We will investigate this later when examining Model Conformance. We will discover that this transition is not conformant with the reference model



_3. Under Active filters click X to remove the " Unhappy Path" filter

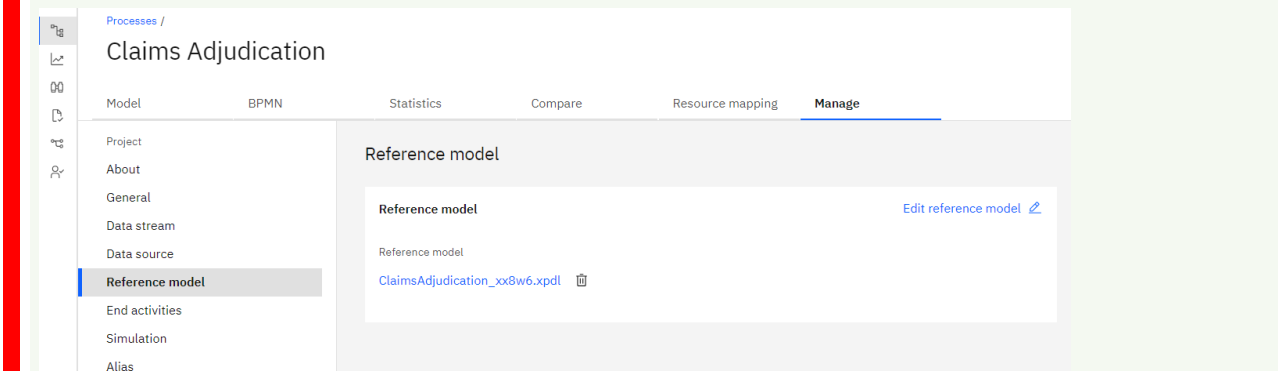
Process Improvement Insight: Variants can also be exported to BPMN tools like Blue Works Live to accelerate process documentation leveraging actual as is processes for more accuracy. Also variants can be used to drive reference models when unknow to use in the next section of Model Conformance.

3.1.5 Analyze Model Conformance

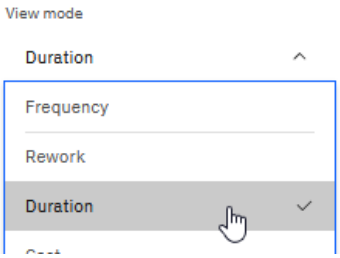
The Model Conformance view provides a visual conformance check between the data-derived and reference models. The value we get from Model Conformance view is that we get to compare our discovery from BPMN models that we have built on our as is process to what a data driven process model provides.

Typically a manual reference model can vary in accuracy to how a process is actually performing. With IBM Process Mining you can load BPMN 2.0 models you have already created as a reference model. If you do not have a BPMN model you can also use the Variance functionality to build your happy path as a reference model.

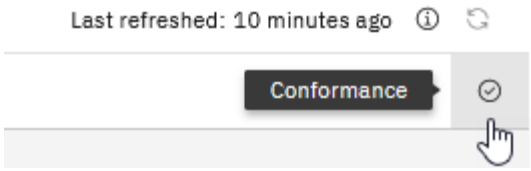
Note: The reference model is supplied with the BPMN diagram and can be uploaded when a new Process Mining project is created. The reference model can also be added or changed after the project is created.



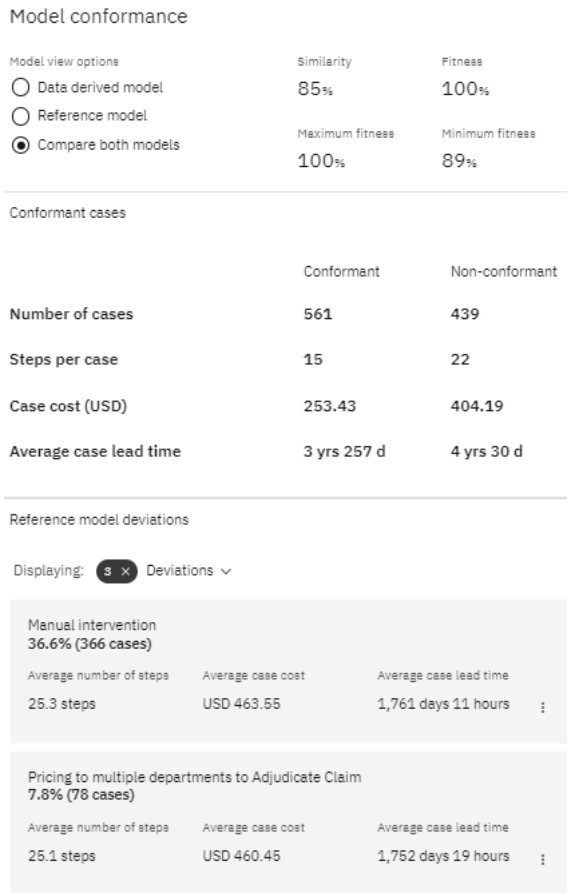
_1. Set **View mode** to **Duration**



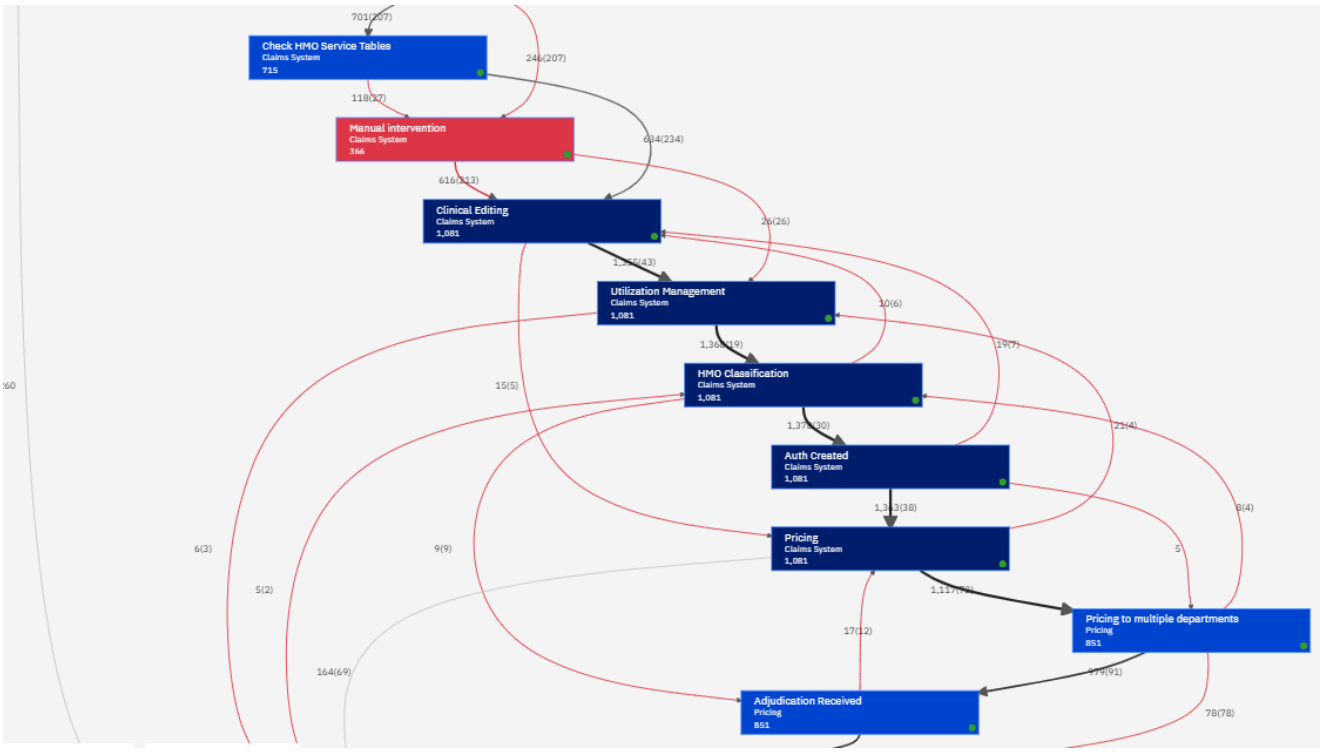
_1. Click **Conformance** (top right)



_2. Note the summary of the impact of non-conformance on critical process statistics. It includes essential case statistics, as shown below. As well as each deviation and the impact of steps, cost and lead time.

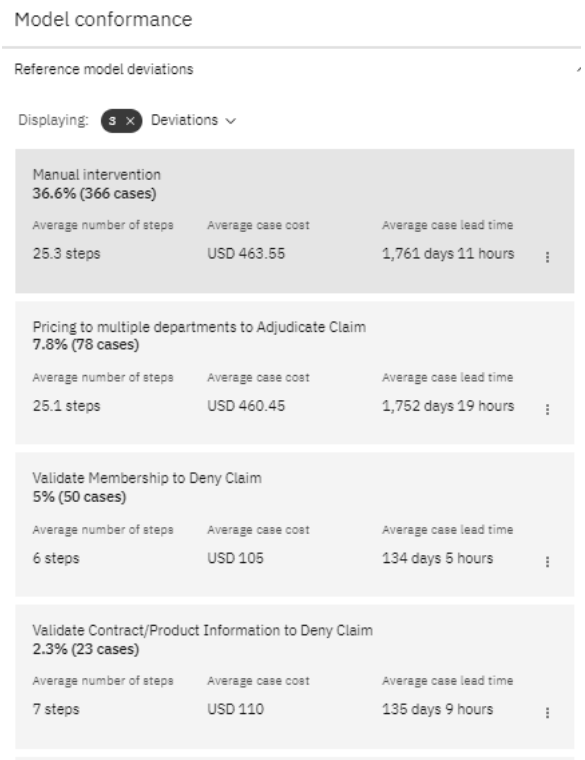


_3. Note that non-conformant Activities and Transitions are marked **red**



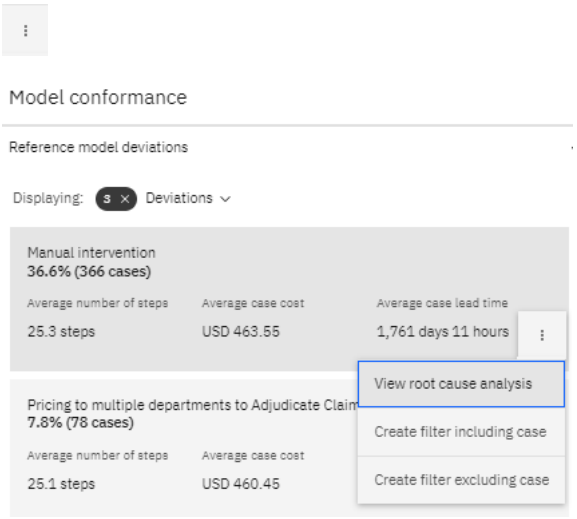
3.1.5.1 Analyze an Unexpected Process Flow

_1. You can analyze unexpected process flows by either drilling into activities or transitions for deeper insight like we have done before, or you can review the deviations from the model conformance summery view.

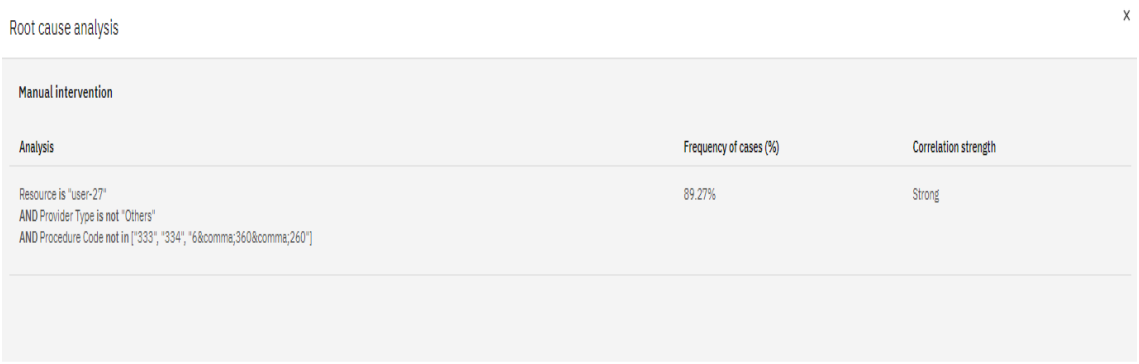


_2. Let's look at our number one conformance deviation **Manual Intervention**. It is occurring in 36.6% of our total use cases and as we can see has a significant cost and time impact to our process. For the lab we want to first explore a unique IBM Process Mining feature called Business Rules Mining. Business Rules Mining allows us to determine the root cause of a deviation. These rules can be applied to help us understand how to make a

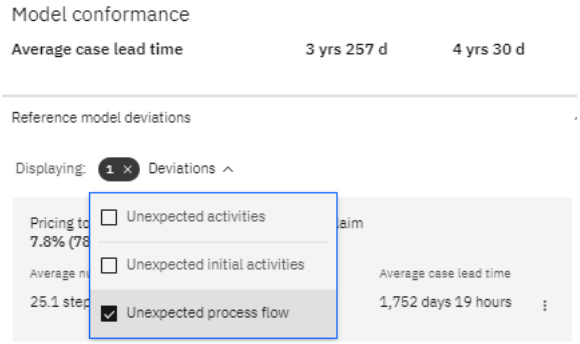
process more efficient as well as they can be exported and used to support Decision Management tools like ODM. First on the deviation **Manual Intervention** click on the icon and then select **View root cause analysis.**



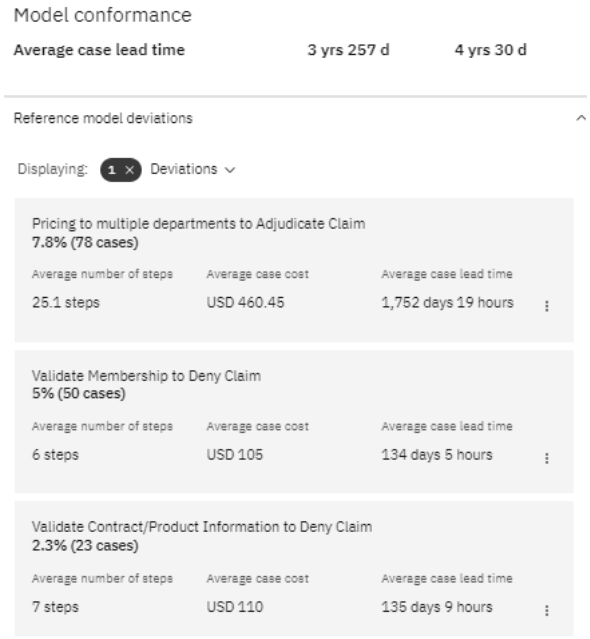
_3. Business Rules Mining provides us with insight on this particular deviation for Manual Intervention, We can determine that in 89.27% of these cases the person involved is user-27. We can also see the conditions of the Provider Type and Procedure Code that impact this deviation. After viewing close the root cause analysis window.



_4. We can also search deviation by looking at activities, initial activites or process flow. In this example instead of looking at **Manual Intervention** which is an activity, lets filter by **Unexpected process flow**



With this view we can see our top unexpected process flow deviations.

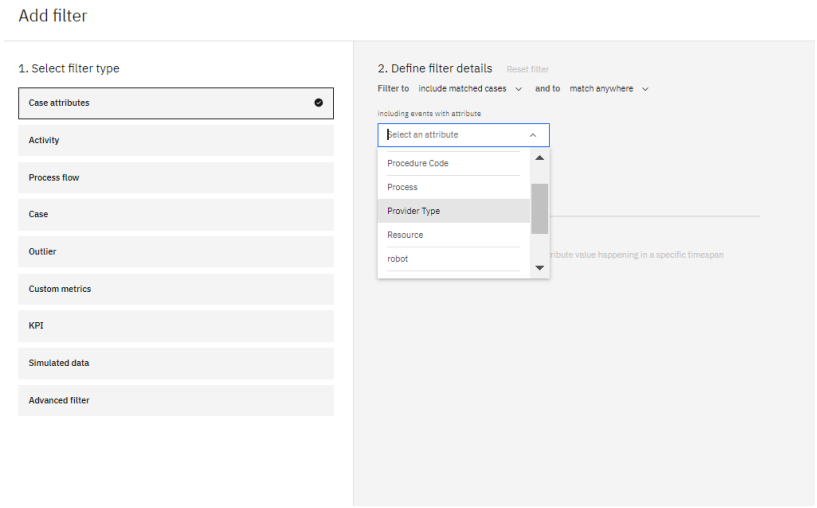


3.1.6 Compare Case Variants

The Compare tab allows us to compare different variant views and see the delta between them. This can be valuable if you are looking to compare one product line versus another, or employees, groups, locations or bots vs humans. Because the the unique simulations capabilities that we will also explore in this lab we can compare the as is to a future state simulated process as well.

3.1.6.1 Compare the Performance

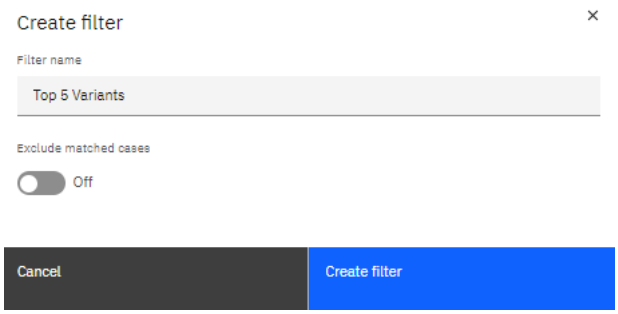
For this lab example we are going to compare our process in all cases that we have rework activities to our happy path activities. In order to use the compare capabilities we will need to create filter views and a new technique called templetes Filters can be created in many places, we can create filters from the model visualization, from variants, conformance and also from the filters function icon. With the filter function icon we can filter one or multiple filters.



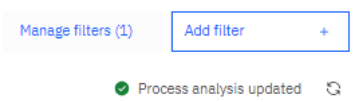
3.1.6.1.1 Create Filter Templates

For this compare part of the lab we are going to repeat creating a filter that we did before for capturing the top five variants. Click on Variants and then click on the first five variants.

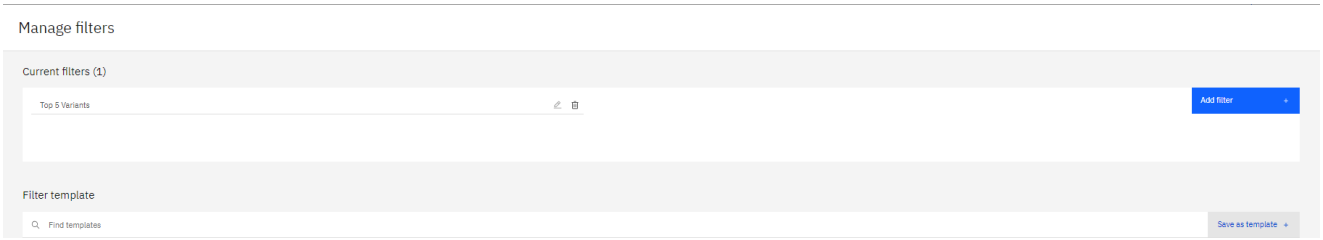
_1. Click on Create filter and name the filter Top 5 Variants



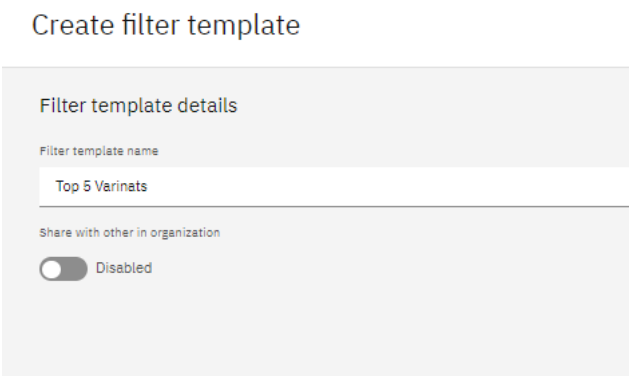
_2. Click on Create Filter, then click on Manage Filters



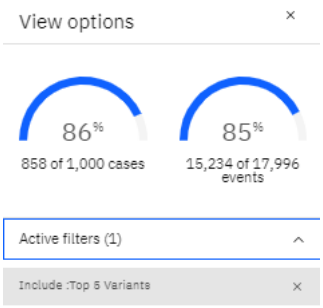
_3. Click on Save as Templete in the bottom right corner



_4. Name as Top 5 Variants and save templete

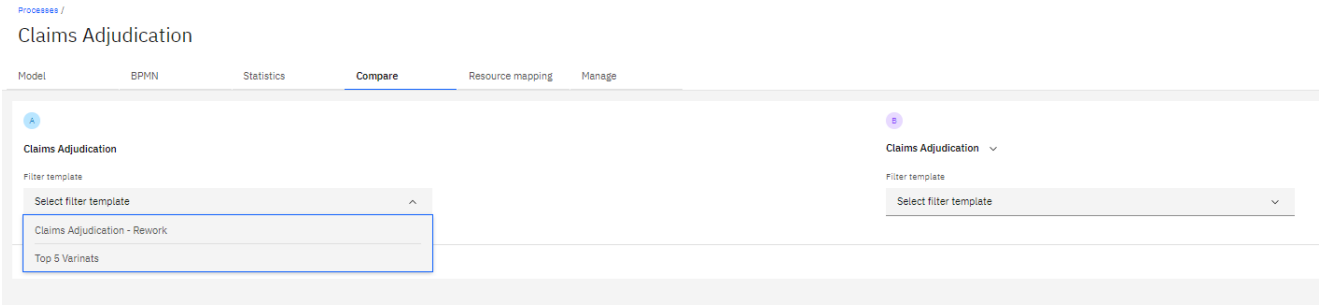


_5. Return to model view and clear the Top 5 Variant from the filter as we now have it saved as a templete.

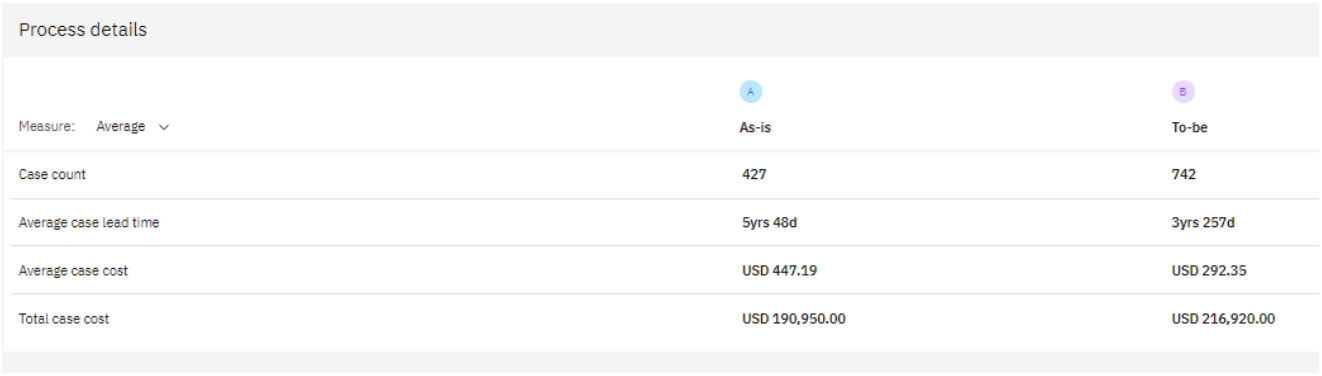


3.1.6.1.2 Use Template Filter to Compare the Processes

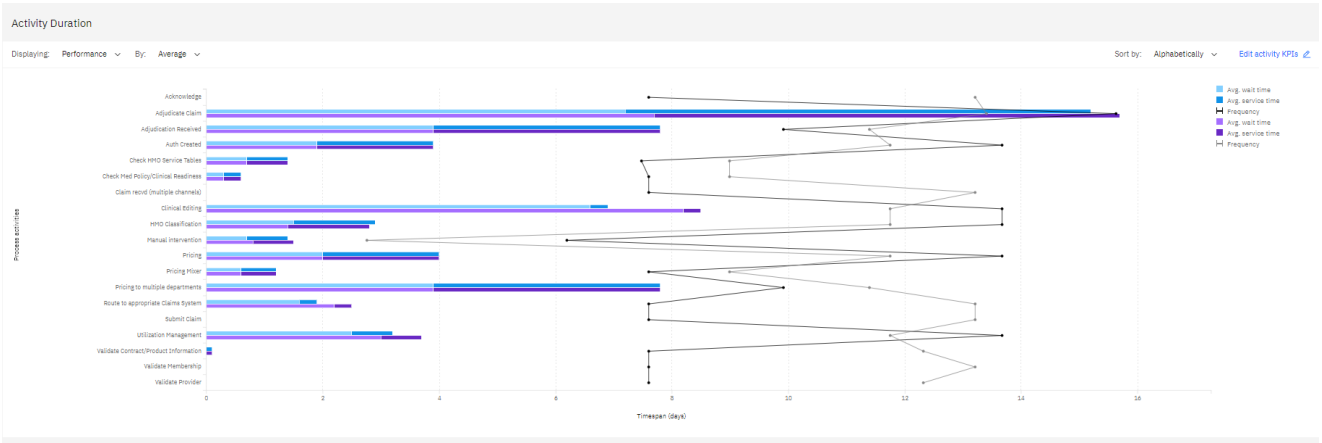
Select the Compare tab select on the A side **Claims Adjudication – Rework**, and then on the B side select **Top 5 Variants.** Then click **Update Comparison**



Our first comparison table show the top leve statistics between the rework process and the top five variants. We can see that the time to complete a case with rework is impacting the time to complete on average almost a year and one half. Our average cost is almost $165 more when we have rework in our process.



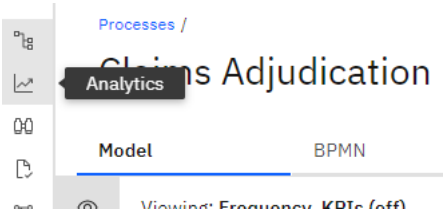
We can also drill into the comparison by activities with interaction to view by performance or KPI's. KPI's can also be edited from the view if needed.



3.1.7 Using Dashboards for Claims Adjudication

Dashboards are a vital feature of the Analytics component of IBM Process Mining. Dashboards can be used in a number of ways depending on the maturity of your practice. The first way they can be used, and how we will use the in the lab, is to review historical performance. Another way is for running analytics for operational excellence. And the third way is for what we call Insights to Action, where you are prdictively monitoring performance and KPI's and triggering actions to prevent missed KPI's.

_1. Click **Analytics** to switch to the Analytics component.



The Analytics view opens, displaying a system-generated Project overview Dashboard available to all projects. The default dashboard cannot be deleted or changed but can be duplicated and then modified. Dashboards are no-code/low-code views that you can build for whatever business perspective. In the Project overview Dashboard let's review some of the common widgets that are displayed.

Process cases – In this view we only have completed cases, but in an on-going feed of events we would also be able to see cases that are still running and have not completed. We could then also look at including or excluding with the interactive filters what we want to review.

Case details – We can drill to case specific details or sort data by case parameters like time, cost and KPI achievement.

Filters – quick accessible view of what if any filters have been applied

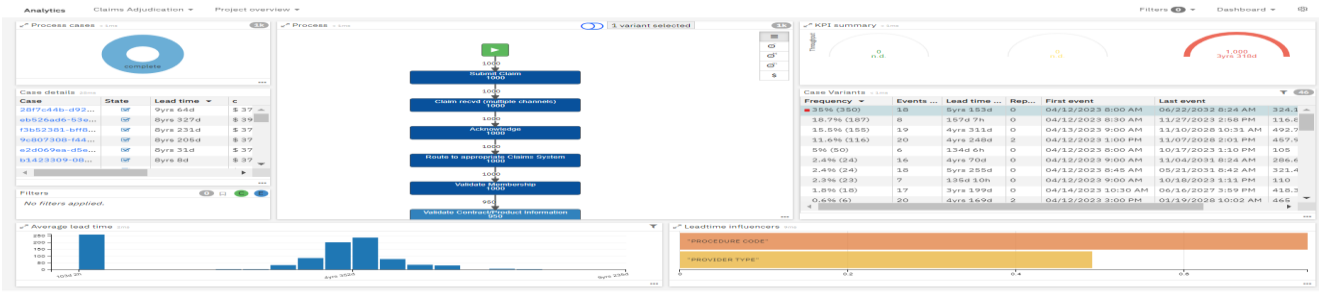
Process – similar to our model view that we have previously explored

KPI summary – The KPI's for this Claims Adjudication are aggressive so we show all cases not meeting the expected KPI. But you can filter and drill into all your cases depentant on what KPI range they are in.

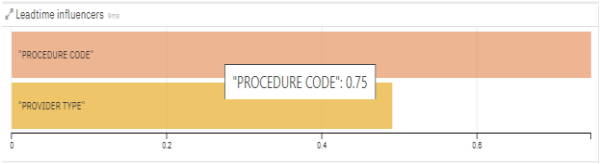
Case Variants – agains similar to variants we have covered but within dashboards we can use these as filters to gain insights by deviation.

Average Lead Time – Summary count of distribution of cases by lead time.

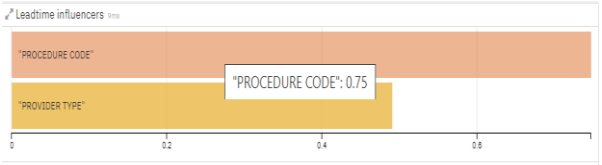
Influencers – Insight into what is impacting the processes the most and we'll see that these can be filtered for deeper insight.



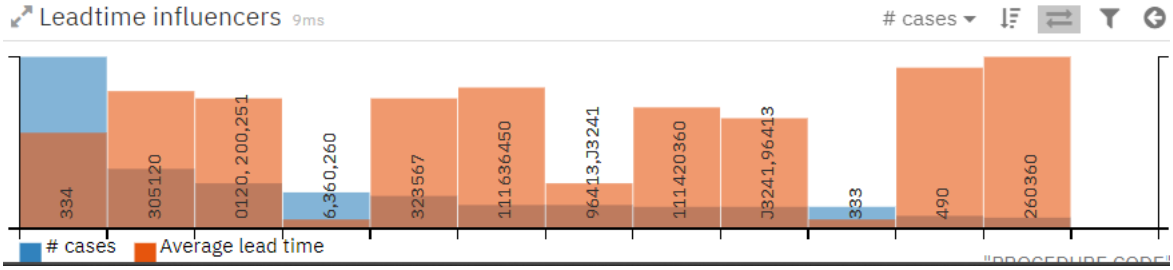
_2. So in this scenario we see that our two main influencers are "Procedure Code" and "Provider Type". Let's click on "Procedure Code"



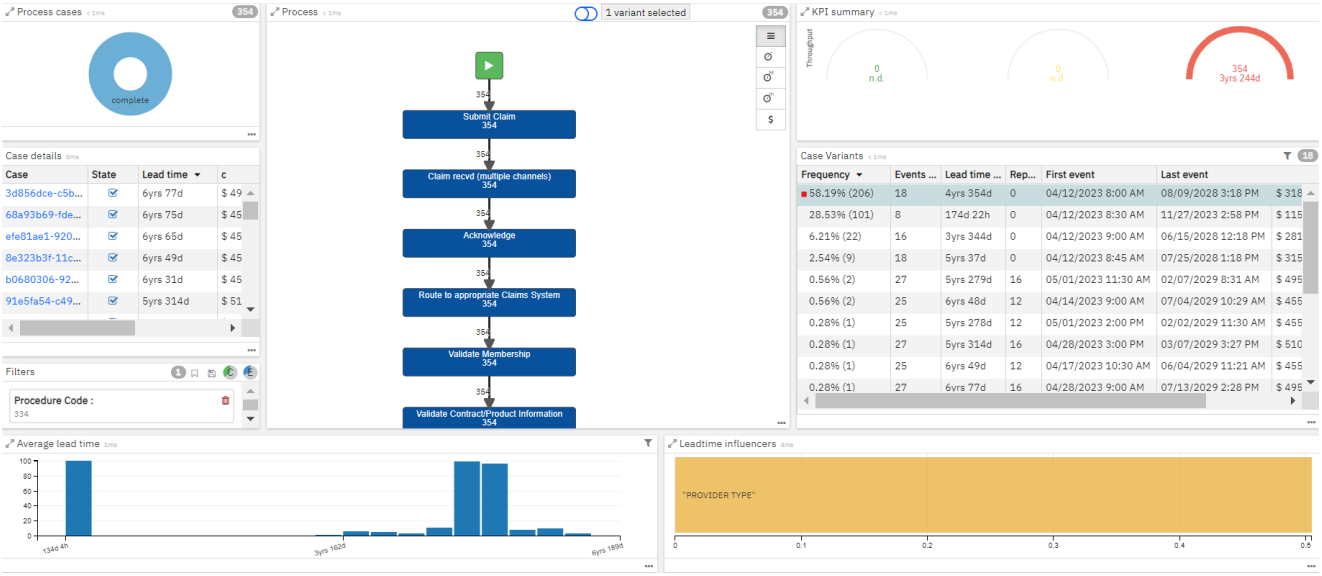
_3. So in this scenario we see that our two main influencers are "Procedure Code" and "Provider Type". Let's click on "Procedure Code"



We can now see that procedure code **334** is associated with the greatest number of cases.

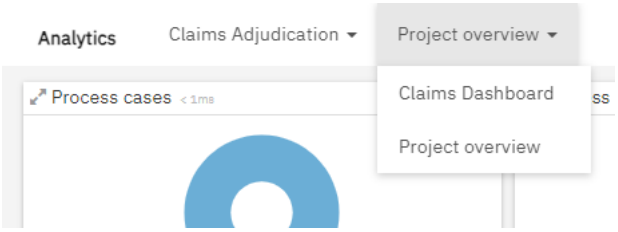


_4. If we click on **334** to highlight we can then applying the filter button so that our Project Overview widgets only reflects cases where procedure code **334** is involved.



_5. Let's delete that filter and review another dashboard related to Claims Adjudication.

_6. Select Claims Dashboard

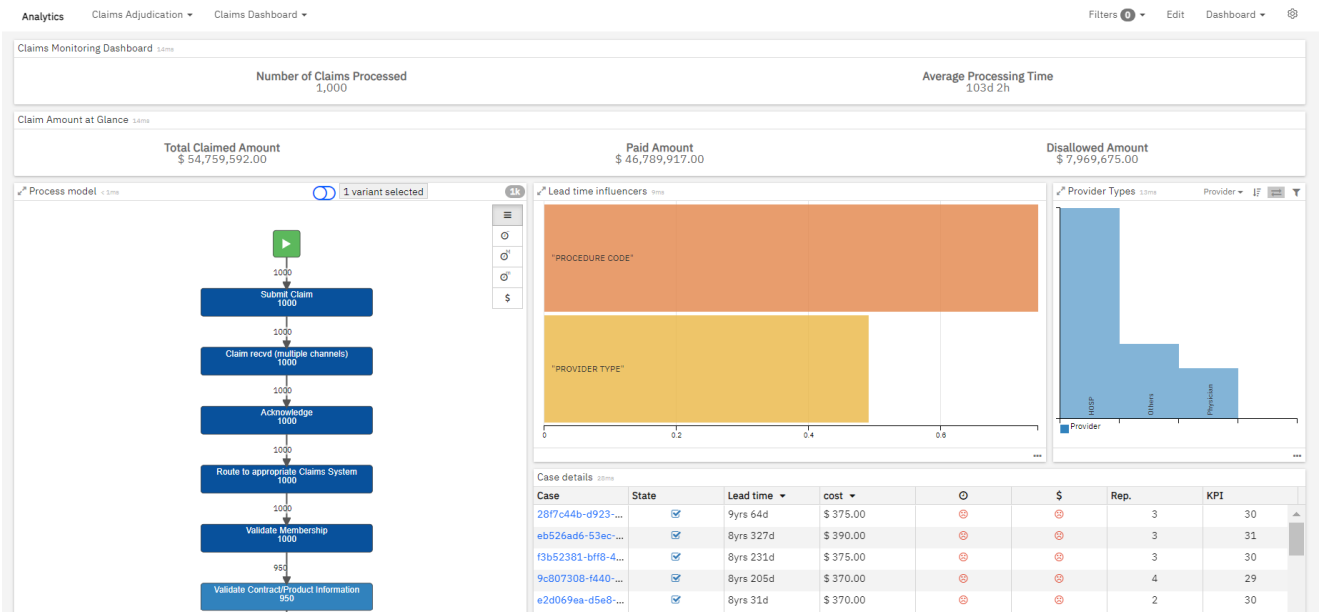


In the **Claims Dashboard** we are have not added the capacity to review the monetary impact of our processes as we have brought in cost factors to our Claims Adjudication process.

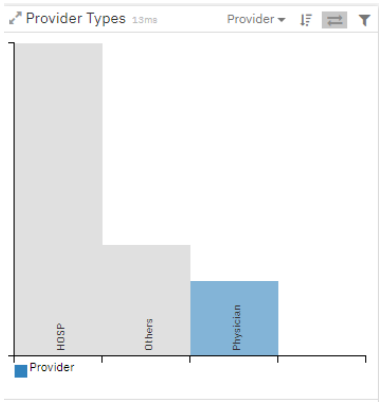
You will notice that for the 1000 claims that we are reviewing we can now look at our total lead time average in the dashboard. But more importantly we have added **Claims Amount at a Glance**.

This is an example of the custom dasboards that business users can develop for specific insights they are looking for.

In this case we are adding **Total Claimed Amount, Paid Amount and Disallowed Amount.** Everytime we filter we will be able to see the cases related to that filter as well as the changes within **Claims Monitoring and Claims Amount at Glance**.

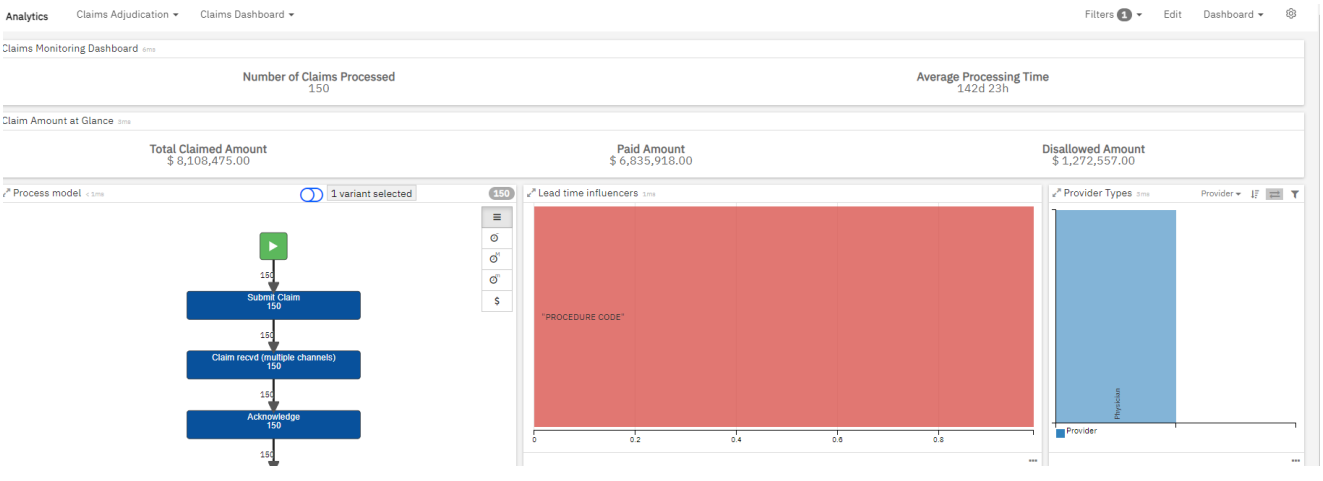


_7. To see how this works. In the **Provider Types** widget we can see that there are three types of providers, Hospitals, Other and Physicians. We want to examine what are the influencers and claims impact for the physians. So we want to click on the physcians. (With ctrl and the mouse we could select as many provider types as we would want, but for this we will only select physicians).

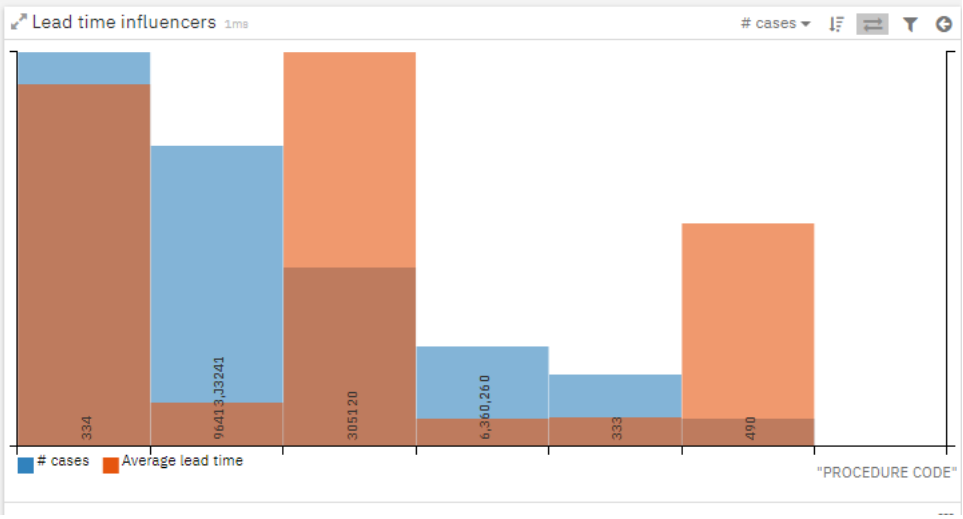


_8. Then click the filter icon.

Our view now represents only Claims Adjudication processes where the provider type is Physicians. As we can see this represents 150 claims with an average processing time of 142d 23h. We also see that our primary leadtime influencer is Procedure Code.



So we want to identify what procedure codes are impacting claims when the provider type is physicians as a sub set. So we click on procedure codes to determine which of these that are impacting this the most and we can determine that procedure codes **334, 305120** and **490** are impacting our lead time the greatest.

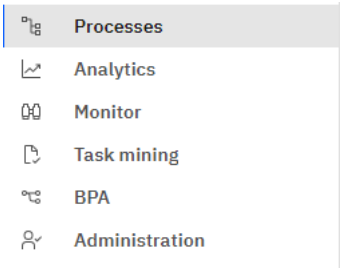


What we have done so far in this lab is show that with the data driven approach to discovering your processes we are finding fact based inefficiencies that we probably were not aware of. This is the benefit of process mining – visibility of your end to end processes. Now that you have found them should I start solving these problems? No there is a better approach in the next section before you act.

3.1.8 Simulation

Simulation is a key capability within process mining. If we think of a typical process that we want to improve we normally estimate the time of the activity, what we think we can improve and what the cost benefit of improving that activity process. The chalenge with this approach is we don't have factual data that process mining solves for, but we also are not looking at the larger picture. We aren't considering the bottlenecks that are created by improving an activity without understanding how that connects and impacts the end to end process. Simulation allows us to create what if scenarios across our end to end process to not only reflect more accurate ROI of change but to also help prioritize the improvements that have the largest impact to our objectives.

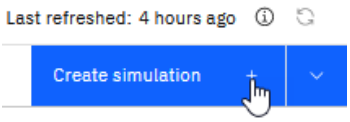
So let's see how simulation works by first moving out of analytics and back to the Processes view.



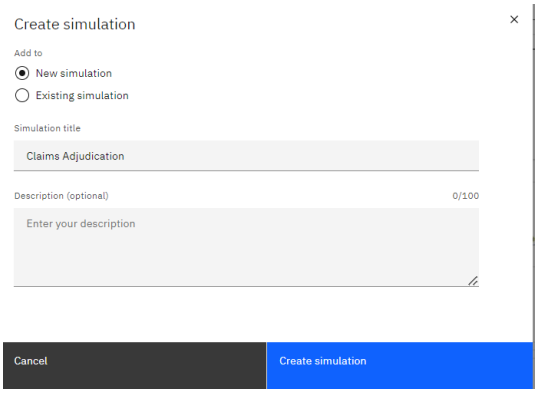
_1. Click on the BPMN tab

Just a quick introduction of the BPMN capabilities of IBM Process Mining before we move to simulation. All Model processes are also capture as BPMN. These processes can be exported to any BPMN 2.0 tools like Blueworks Live as well as Workflow tools like BAW. A unique feature of IBM Process Mining is our Business Rules Mining. With this capability we can understand the logic or rules behind the gateways in our BPMN model.

_2. Okay off to Simulation, first click on Create Simulation



_3. Then you will be creating a new simulation, you can also see that you can retrieve previously created simulations and create additional versions. This is helpful when you want to create multiple outcomes or ROI's based on your scenario. But with this one we are going to create a new simulation and we are going to call it Claims Adjudication. Once you name it proceed with **Create Simulation +**

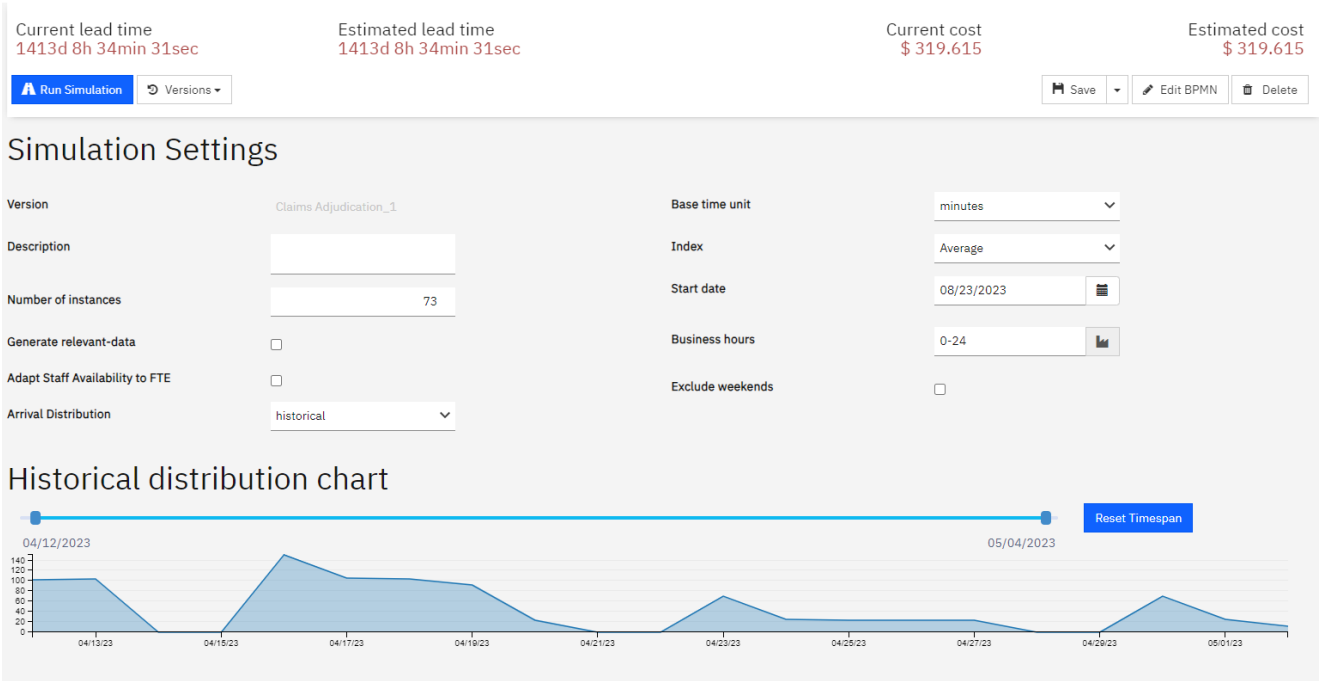


Let's review what we are looking at within the first steps of simulation. You have data that is brought in based on the BPMN or Model that you determined. Meaning you can bring in filtered views for simulation.

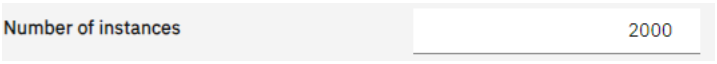
So since we are starting with an "as is" model our Current lead time and cost will match out Estimated lead time and cost.

You can change many variables in your settings but there are a couple that we'll focus on for this lab scenario.

- **Number of instances** – do we want to simulate like for like in this case 1000 cases or do we want to simulate a smaller or larger amount of instances. As an integrated feature you can also import BPMN models into process mining and leverage simulation.
- **Arrival Distribution** - you can use historical, uniform, exponential or logarithmic patterns

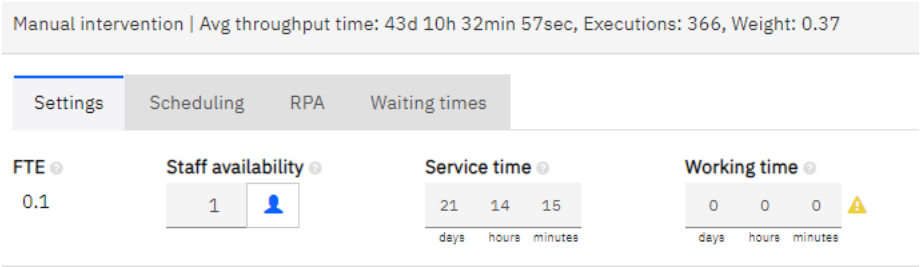


_4. For the lab example we will chane the **Number of instances** to **2000** but we will leave the historical distribution in place.

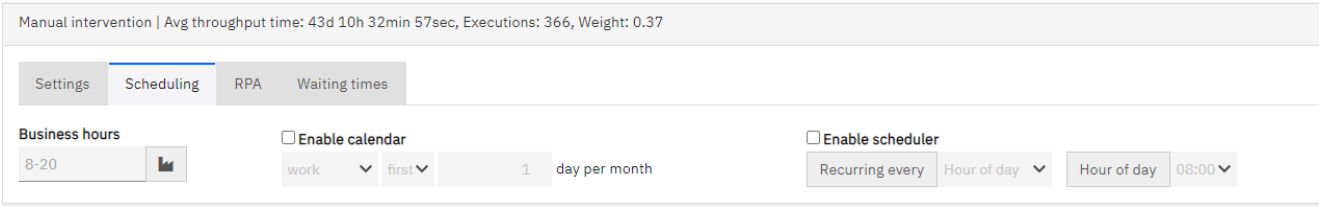


We now have the capability to change any activity or multiple activities in the process to reflect a simulated change. As the example let's scroll down to the activity **Manual Intervention.** We can see in this activity for this time period that we are pulling in historical data. We have FTE averages, staff availability and we also have service time and working time. Service time reflects the time it takes to get from one activity to another and working time is the actual time spent on the activity. Working time can be brought in with your events logs if available or it can be defined in the settings. In this case we are focusing in on the service time.

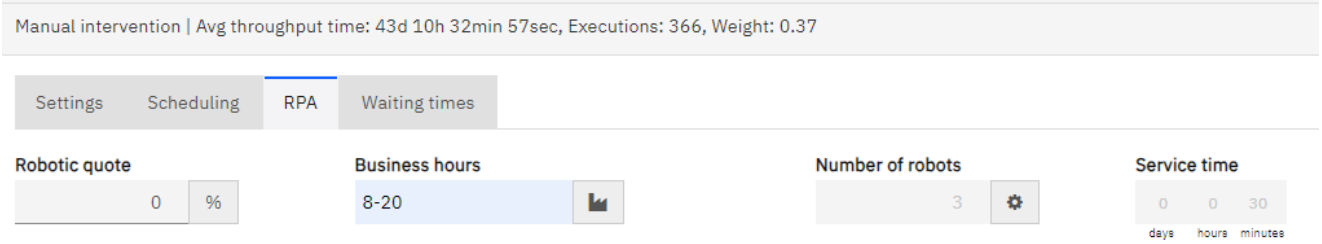
_5. With simulation we can elect to change different components based on if we are working toward operational change, re-engineering a process or automating a process. In the first tab we see below **Settings** we may elect to impact the service time by changing the process, eliminating steps that are redundant or retraining staff to reduce service time. We also can look at adding staff to see if that could potentially reduce a bottleneck and lower service time.



_6. In the second tab of **Manual Intervention** simulation we can simulate changes to our **Scheduling**. This is often used if a activity is only scheduled during a specific time of week and we want to measure the impact of opening up scheduling to reduce end to end process friction. But it can also be used if you are looking reduce availability and see what the impact to your cost and customer lead time would be before taking action.

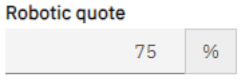


_7. In the third simulation option we focus on RPA or any Automation action to the activity. Currently when we click on the RPA tab we will see that there is no current automation for this activity step **Manual Intervention.**

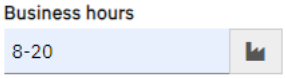


_8. We believe based on our discovery with Process Mining or addition follow-up with Task Mining that we can improve this activity step. We can change the following fields to complete this simulation.

- From 0% automation to 75%

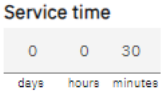


- The RPA bot in this instance will be running from 8-20 military time

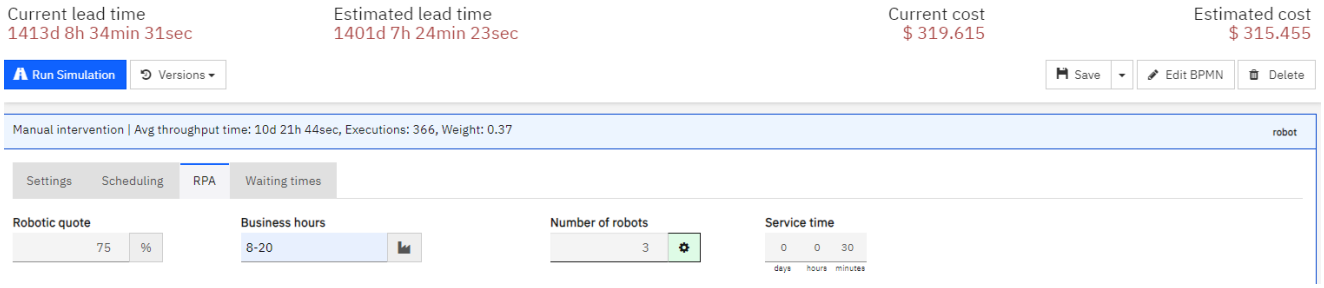


- We will be running 3 RPA bots

- And we believe that the RPA can complete the service time in 30 minutes



_9. As these and any other changes are made we can review the impacts of those changes to our Current Lead Time and Cost. In this simulation automation one activity of many we have impacted the lead time by over 11 days and the cost per process by more than $4 dollars per case.



3.2 Lab Summary

This lab demonstrated how IBM Process Mining leverages event data on a Claims Adjudication use case.

The primary objective was to introduce the rich capabilities of IBM Process Mining.

Thank you for completing this lab!