

IBM Cloud Pak for Business Automation

Demos and Labs

IBM Process Mining

Lab Guide - Use Process Mining to Get Insights into Client Onboarding Workflow

IBM Process Mining 1.14.0

Lab Version 1.0

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1 Introduction

1.1 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.

More technical information about IBM Process Mining: <https://ibm.box.com/v/IBMProcessMiningTechIntro>

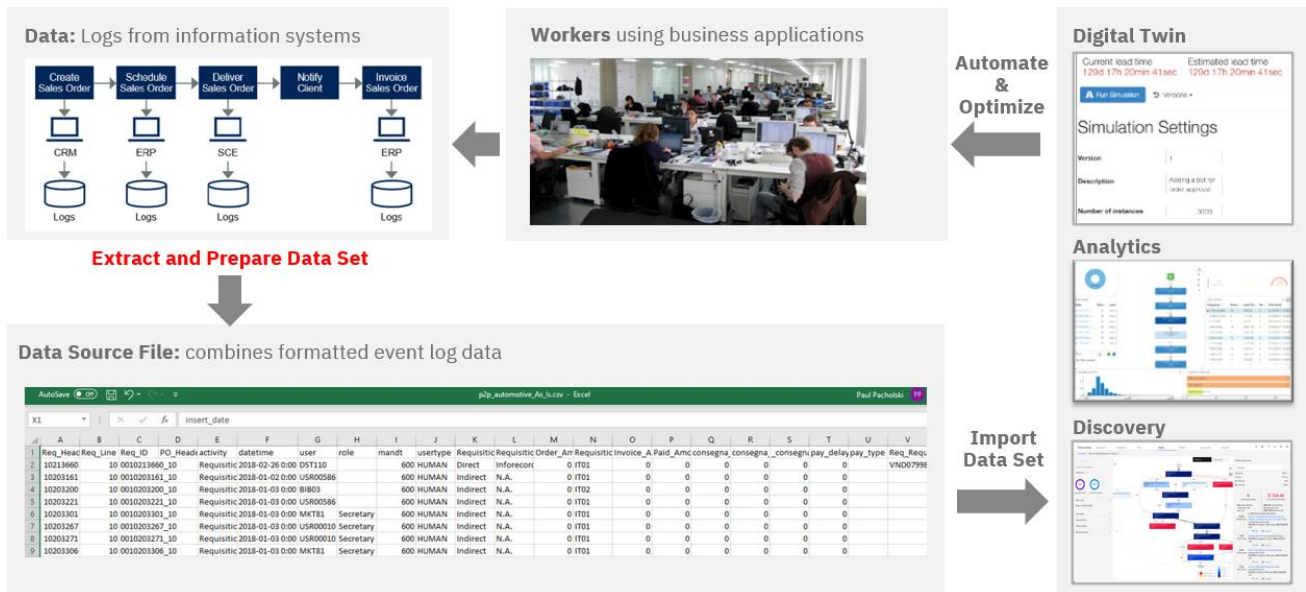


Figure 1. Process Mining

Two initial steps must be completed before we can start using Process Mining tools (see the **Extract and Prepare Data Set** Step in the Figure above, marked in re):

1. Generating and extracting audit log data from applications intended for process mining.
2. Converting the raw audit log data to the format acceptable by IBM Process Mining.

The good news is that if we use IBM Business Automation Workflow with IBM Business Automation Insights, IBM Process Mining can automatically perform data set extraction and data preparation and create a Process Mining Project for you!

1.2 Using IBM Business Automation Insights for Data Extraction

IBM Business Automation Insights enables the capture of events generated by the operational systems implemented with the IBM Business Automation products. Captured events are aggregated into business-relevant KPIs and presented in dashboards for lines of business to have a real-time view of their operations.

More technical information about IBM Business Automation Insights: <https://ibm.box.com/v/IBM-BAI-Tech-Intro>

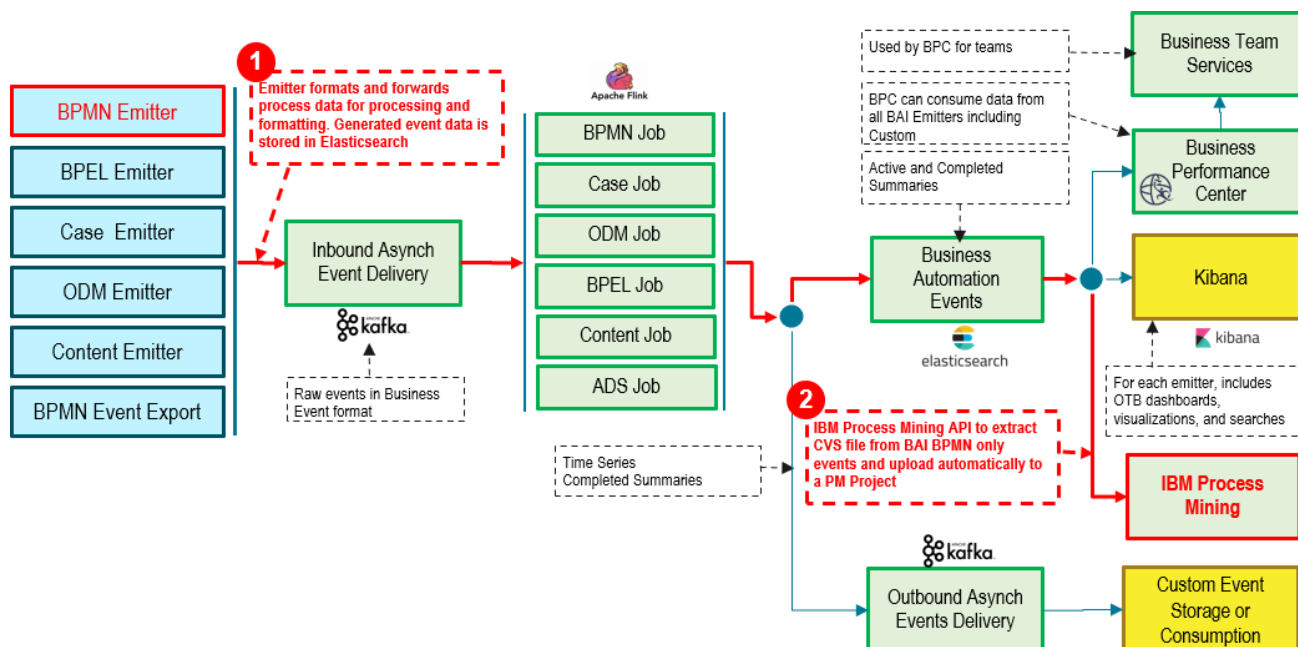


Figure 2. IBM Business Automation Architecture. Path 1: Data Generation. Path 2: Process Mining Project Creation

IBM Business Automation Insights emitters send business and process lifecycle data to the Elasticsearch datastore. The only programming effort required when designing a Workflow is to define what and when to emit the data from Cases and Processes - see **Path 1** in Figure 2 above, marked in red.

1.3 Using IBM Process Mining API for Data Preparation

IBM Process Mining provides several APIs to transfer IBM Business Automation Workflow process data from BAI Elasticsearch directly to an IBM Process Mining project. This capability helps avoid costly manual data preparation and automates process data importing directly into the IBM Process Mining project- see **Path 2** in Figure 2 above, marked in red.

The two key IBM Process Mining APIs are (see Figure 3 below):

1. API to retrieve all Process Apps that have events in Elasticsearch, and
2. API to convert events from all Processes in a selected Process App to CSV files and send them to the IBM Process Mining server.

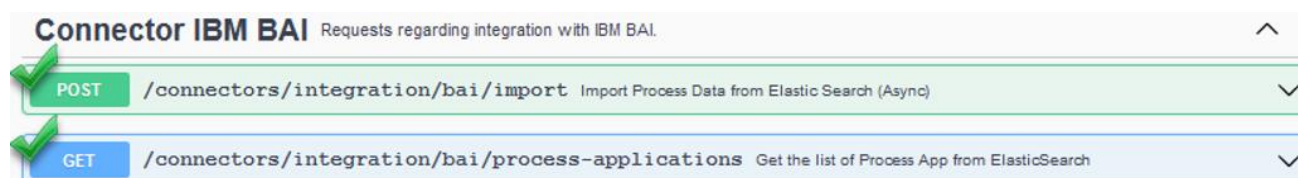


Figure 3. IBM Process Mining API for IBM Business Automation Insights

For more details, see a recorded demo: <https://ibm.box.com/v/BAI-2-PROCESS-MINING-EXPORT> and lab instructions: <https://ibm.box.com/v/BAI-2-PM-EXPORT-LAB>

1.4 Client Onboarding Solution

1.4.1 Client Onboarding Use Case

Focus Corp is a business services provider that offers various services for different industries. Focus Corp uses a fully automated solution called Client Onboarding to onboard clients to the services it provides.

Watch this video to see how client onboarding requests are completed: <https://ibm.box.com/v/CLIENT-ONBOARDING-USE-CASE>

1.4.2 Client Onboarding Workflow Implementation Details

We implemented the Client Onboarding use case using most of the capabilities of IBM Cloud Pak for Business Automation. For orchestration, we selected the Case Solution capability of IBM Business Automation Workflow. There are several reasons for this choice. The use case is ad-hoc event-driven (new situations may arise unexpectedly, e.g., backing documents expire or new regulations require additional documents). A knowledge worker often decides the next steps in the Process. Finally, the use case is document-intensive and requires data persistence beyond the end of a process (we want to go back and reopen a case).

Figure 4 below shows the implementation details. Each Case Activity is implemented using a BPMN Process. Each step in a BPMN Process includes a series of Process steps. Each Process step emits BAI events which are stored in Elasticsearch.

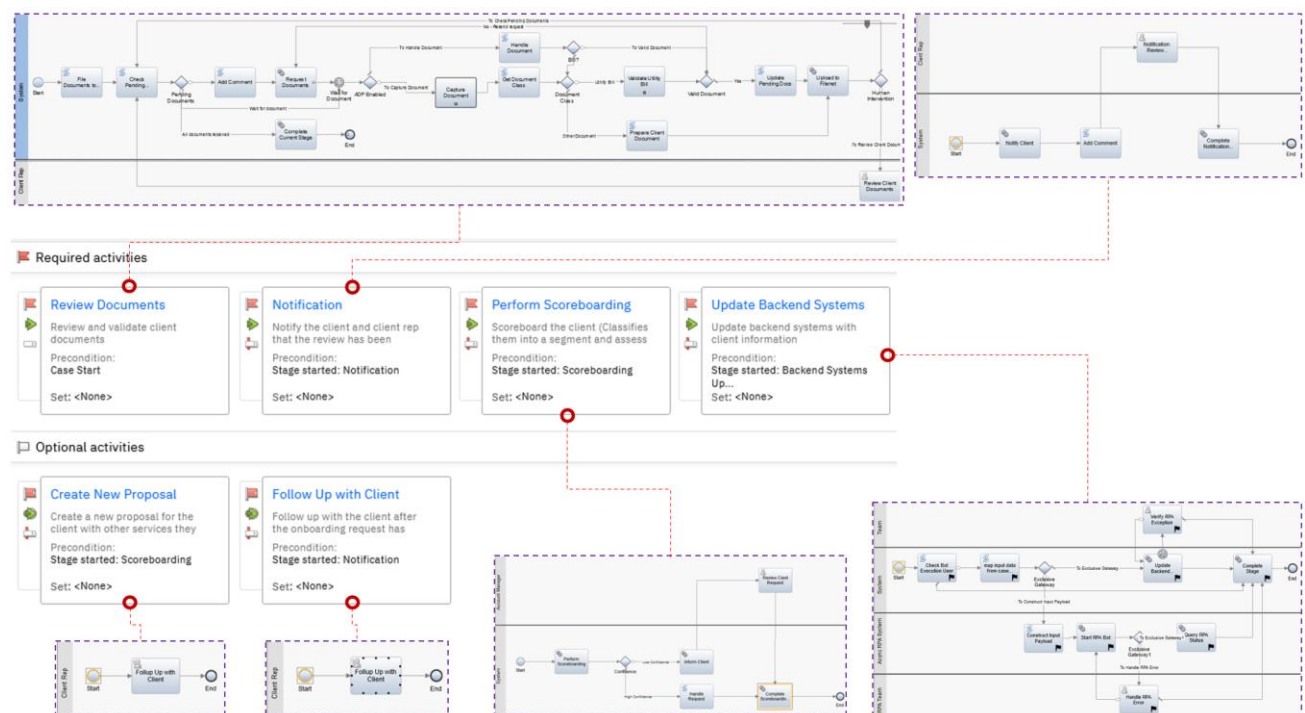


Figure 4 Client Onboarding Solution - Implementation Details

1.5 Lab Objectives

This lab demonstrates how IBM Process Mining leverages the Client Onboarding event data captured in BAI 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/1.13.0.x>

Let's get started!

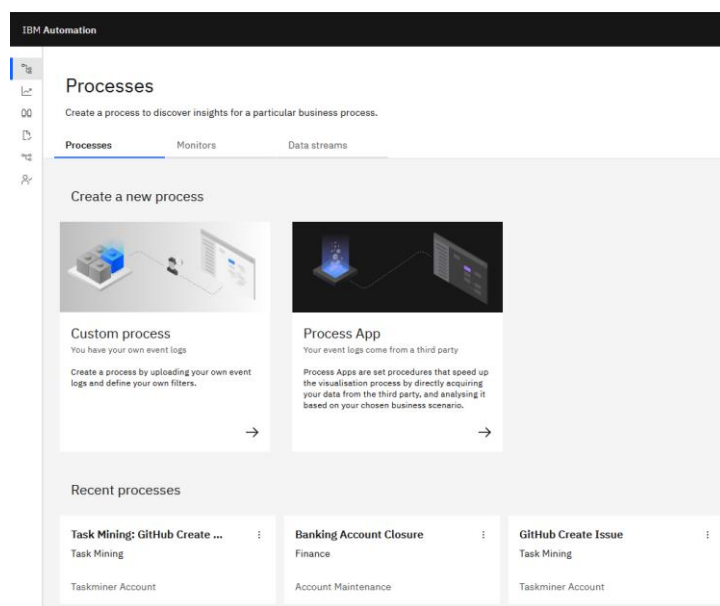
2 Lab Setup

2.1 Provision Process Mining Environment

- _1. Download [this](#) document and follow the instruction for reserving Tech Zone Environment.
- _2. Follow the instructions in "3.4.1 Accessing PM Web Client from the Desktop's Web Browser" to access the PM web console.

2.2 Open IBM Process Mining Application

- _1. Launch the PM Web UI console using one of the methods in "3.4.1 Accessing PM Web Client from the Desktop's Web Browser."
- _2. You should now see the IBM Process Mining web UI.



2.3 Import Lab Files

- _1. Download the following files. You will use them in this lab:

File	Link
Client Onboarding.zip	https://ibm.box.com/v/CO-LAB-DATASET
Client Onboarding.idp	https://ibm.box.com/v/CO-LAB-IDPFILE

3 Exercise: Use Process Mining to Get Insights into Client Onboarding Workflow

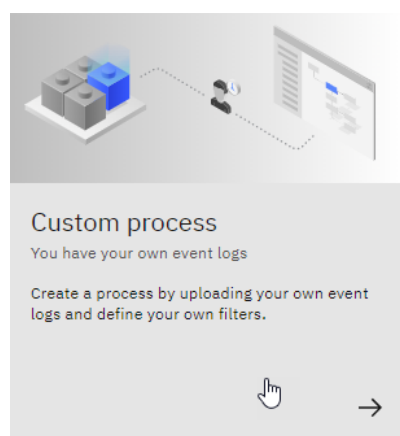
3.1 Create and Configure the Client Onboarding Process

Typically, the Process Mining API that extracts process data from Elasticsearch would create a Process for you, populate it with the process data, and even map the mandatory data columns (process id, time-stamp, and activity name). In this lab, you will not be using the API directly. However, the data set you will be using in this lab to create your Process Mining Project was extracted from the Elasticsearch data store using the IBM Process Mining API.

3.1.1 Create the Client Onboarding Process

Note: IBM Process Mining tools use the term Process for a **Process Mining Project**. From now on, we will refer to Project Mining Project as a **Process**.

_1. Click on the **Custom process** tile



_2. For *Process Title*, enter **Client Onboarding** and click **Next**

3.1.2 Upload Process Data and Configuration Settings

In addition to the CSV file generated by extracting process data from IBM Business Automation Insights (BAI), we will also upload a process configuration. The process configuration file includes predefined process filters, Client Onboarding dashboards (which we will use to analyze Client Onboarding processes), and the process reference model.



The reference model of a process describes its expected standard behavior in terms of activities and Workflow. A process owner usually designs the reference model in the BPMN or XPD language and then imports it to a Process Mining project. A reference model is optional; it is not required to visualize a process.

_1. **Drag and drop** (or click to upload) the **Client Onboarding.zip** file you downloaded earlier.



The supported Data Sources file format is a zipped CSV file.

Data source

Upload data source
Only raw or compressed (.zip, .gz) CSV, XES, up to 200MB. A preview of the uploaded data will be displayed below.

[Drag and drop file here or click to upload](#)

You should now see your file uploaded

Find a data source				Add file
<input type="checkbox"/>	Name	Uploaded date	Events	Included
<input type="checkbox"/>	Client Onboarding.zip	09/09/2022	1,043	<input checked="" type="checkbox"/>

_2. Select **Yes** for *Use a process configuration backup*

Use a process configuration backup? ⓘ

☒ Yes

Upload process configuration backup
Only process backups (.idp) files, up to 200MB

_3. Click **Add file**

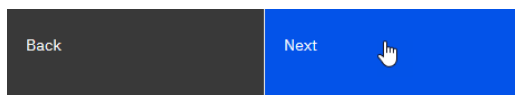
☒ Yes

Upload process configuration backup
Only process backups (.idp) files, up to 200MB

Add file

_4. Select the **Client Onboarding.idp** file you downloaded earlier.

_5. Click **Next**







3.1.3 Perform Additional Data Mapping

The Process Mining API automatically extracted the data from BAI, created a Project for us, and even performed the compulsory data mapping. It mapped the essential fields required to generate Process visualization. The required fields are:

- **Process ID.** Can be multiple columns; in our dataset, we only have one – the Case Reference ID: CO.ReferenceID)
- **Activity.** In Our dataset, it is the name of an Activity in a Process - activityName
- **Time Stamp.** Only one is required (start or stop of an activity). Because BPMN processes emit this lifecycle data to BAI, our dataset has both start and stop time stamps (startTime and endTime). This is important because having both time stamps allows us to compute Activity durations!

Note that some additional fields are already mapped (**green tick**), such as Resource, Role, and a few other business data fields. We mapped these fields for you. The **red x** shows examples of the fields that were not mapped.

shortProcessInstanceId	activityName	startTime	endTime
Select mapping 	Activity 	Start time 	End time 
132	File Documents to Case	2022-07-25T15:26:02.052+00:00	2022-07-25T15:26:07.222+00:00



An Event represents the execution of an Activity in a process. Events are rows in the data source CSV file.

_6. In the search bar enter **CO.An**

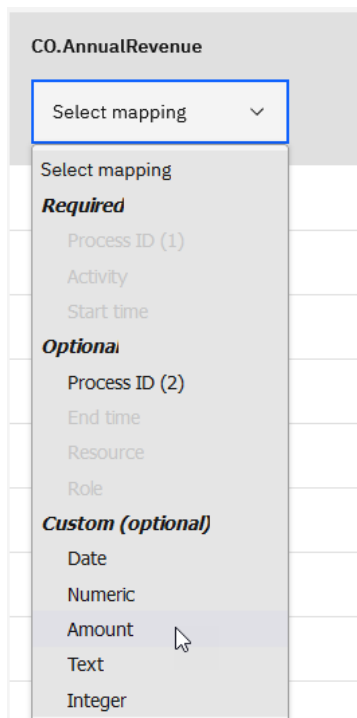
× [Clear mappings](#) ×

CO.AnnualRevenue

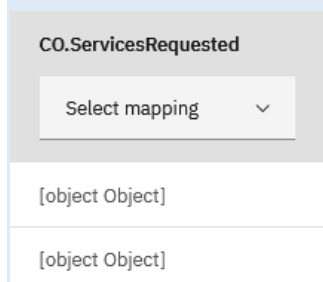
Select mapping ▼

4500000

_7. In the **CO.AnnualRevenue** from the dropdown, select **Amount**



Note: Because the Co.ServicesRequested variable in BPMN Process is a List of Business Objects, and the IBM BAI BPMN Emitter does not serialize complex types, it is marked as [object Object], and the data is not accessible in Process Mining.



_8. After you have mapped all the columns, click **Next**

_9. On the "Time format configuration" page, click **Next**

_10. On the "Custom configuration" page, click **Create Process**

The Client Onboarding process should now open in Model View...

3.2 Gain Business and Technical Insights into Client Onboarding

3.2.1 Explore Model View

The Model View depicts the Client Onboarding Process highlighting the most frequent activities, paths taken, and the "real" Process versus the expected Process. A picture is worth 100 words!



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.

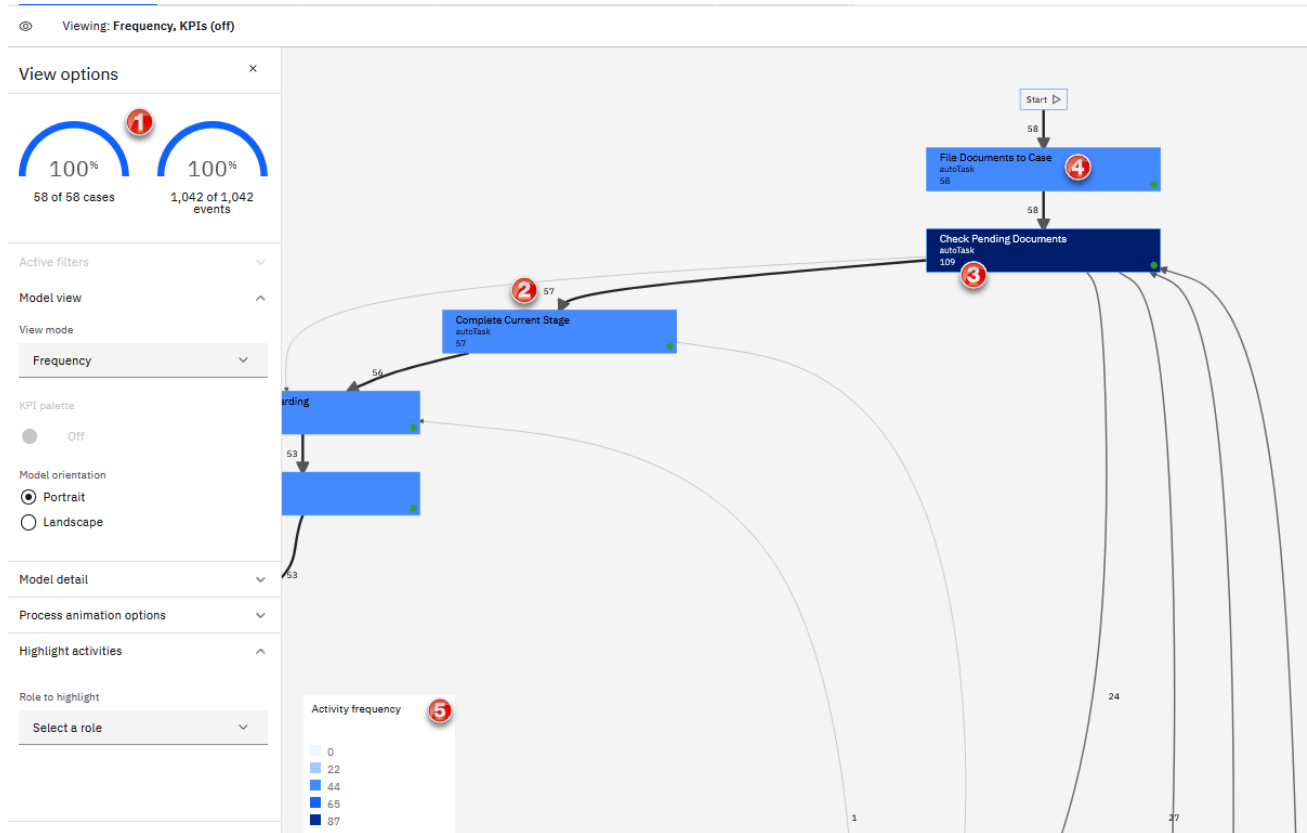
When initially opened, the Model opens in the Frequency View showing all the **Cases** discovered in the imported data.



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 onboard a customer.

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.



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.



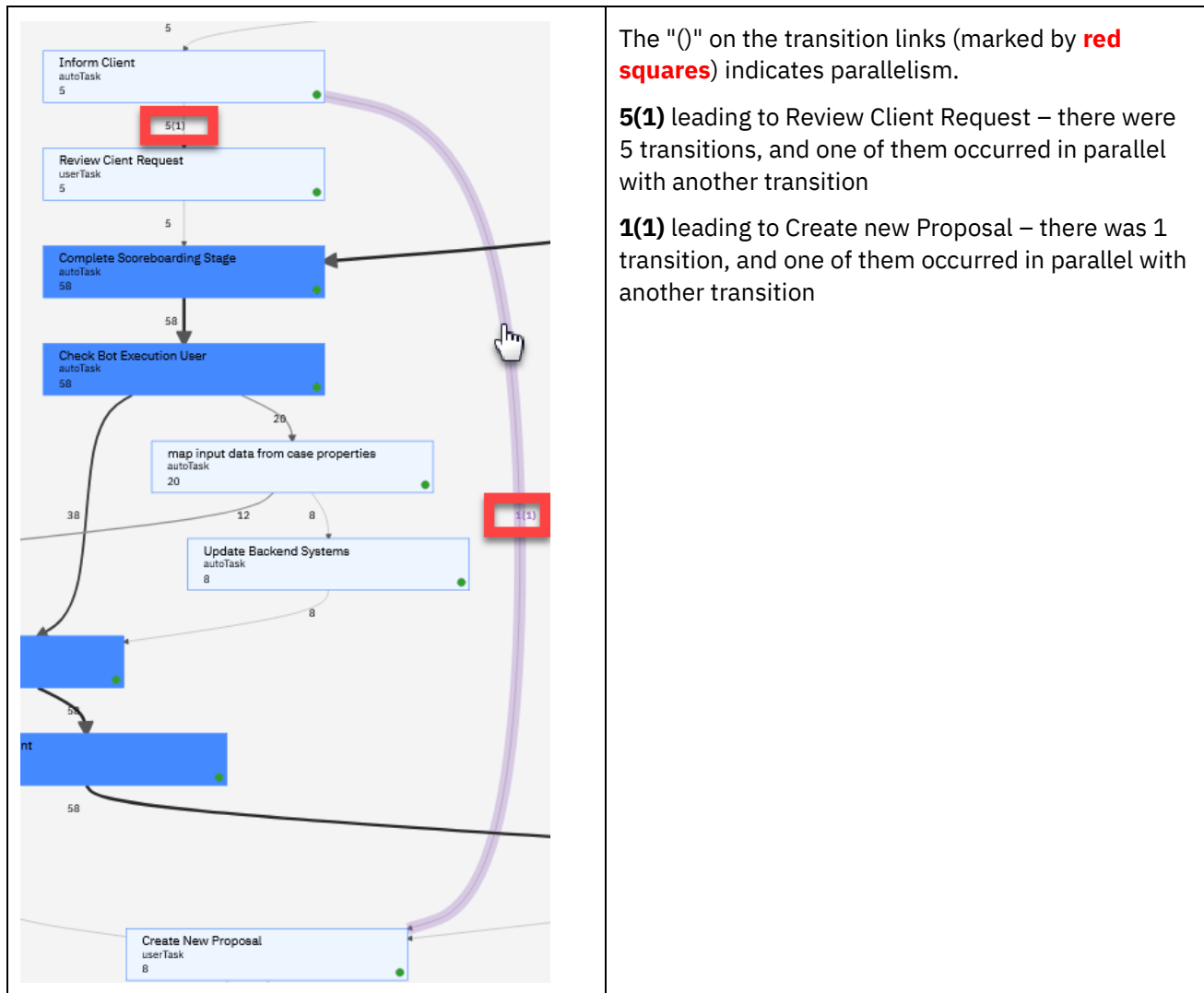
2. The numbers next to the lines show how often a particular path to a given activity has been followed.
3. The numbers within the rectangles show the number of times the Activity is performed. The Activity count is typically a sum of the numbers on the inflowing paths.
4. The description in the rectangles 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.

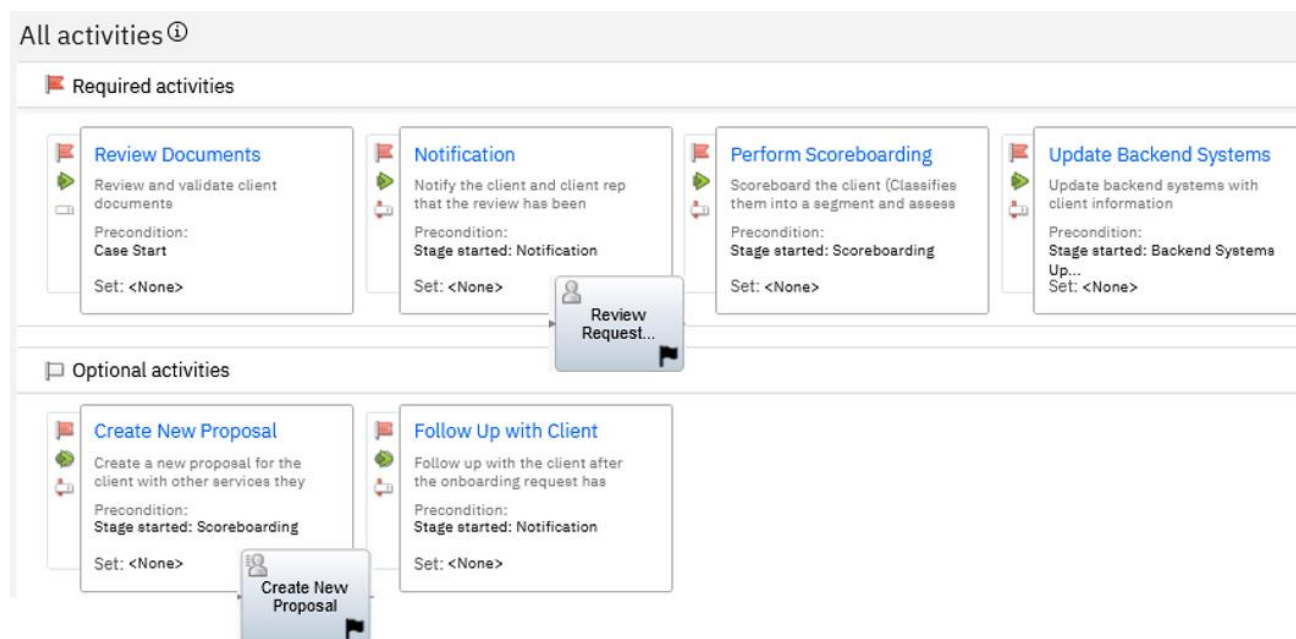
3.2.2 Investigate Parallelism in Client Onboarding

The Client Onboarding solution users can easily create multiple Optional Activities, resulting in parallel process paths. Parallel paths may lead to longer Case lead times if not completed in a timely manner. Let's see how we can identify when this occurs and what users are involved.

_1. Click the **Path** from **Inform Client** to **Create New Proposal** Activity



Looking back at the Case Solution, we can see that Client Rep., while working on the Review Request... human task, also started the Create New Proposal optional activity from the Case UI.



Note: If you want to learn about Process Parallelism in IBM Process Mining, read [this article](#) by Patrick Megard.

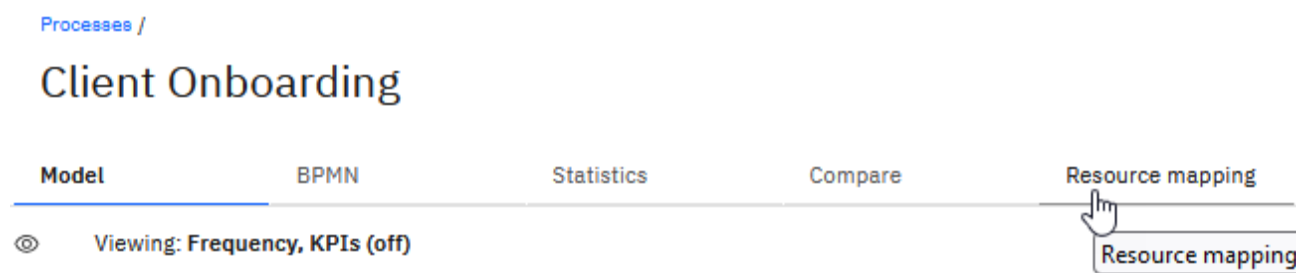
_2. Click **Analyze cases that follow the filter parallelism**



You should now see that only 1 Case included this parallelism, and you can examine in detail all the steps involved.

Let's Find out whom the user was working on this particular Case.

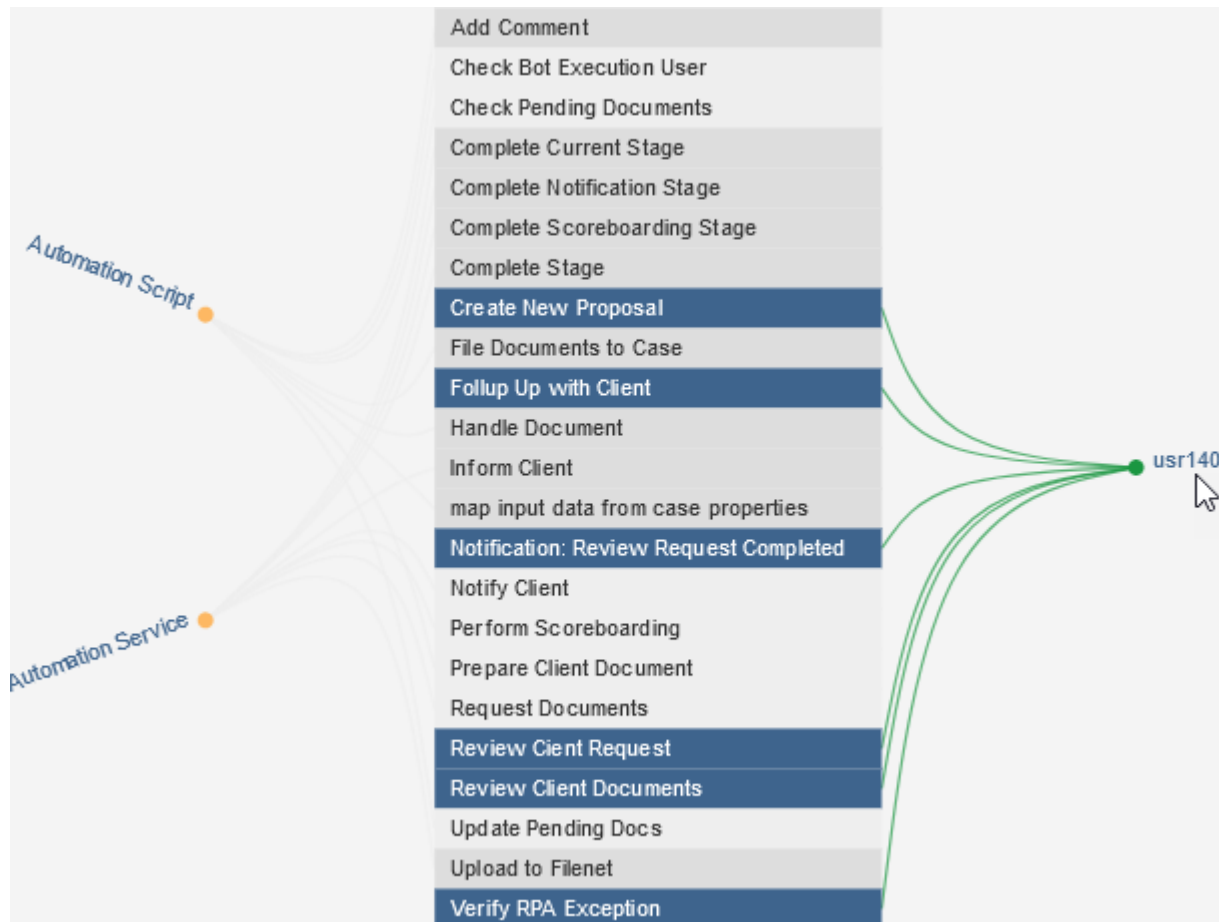
_3. Click **Resource mapping**



_4. Click the **green dot** close to **usr140**



You can see now that all the manual activities, in this Case, were completed by **usr140**, including the parallel activities (Review Client Request and Create New Proposal).



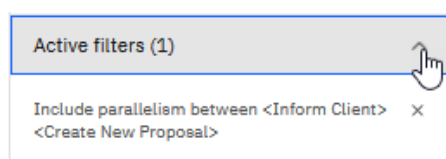
The Resource Mapping capabilities include Activity Map View to discover how resources and roles are involved in each Activity and Social Net View to discover and analyze the relationships that are formed within a process. Use this [documentation link](#) to learn more.

_5. Click **Model** tab

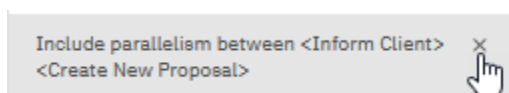
Client Onboarding

Model  BPMN

_6. Click the **Active filters (1)** dropdown on the left



_7. Click **X** to delete "parallelism" filter



Business Insight: We identified where the parallel paths occur, their impact on the Process, and what users are involved.

3.2.3 Identify the Most Costly Activities

The following formula governs activity cost:

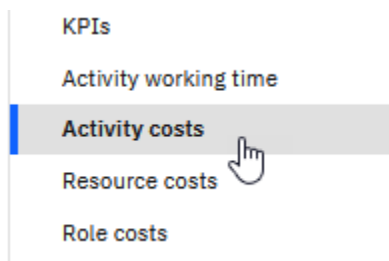
$$\text{Activity Cost} = \text{Activity Standard Cost} + (\text{Average Working Time} * \text{Avg Resource or Role Cost})$$

The variables in the formula are hardcoded in the Manage settings section

_1. Click **Manage** tab



_2. Click **Activity costs**













_3. Note the Activity costs. The Manual activities have their costs set individually. Specifically, note EUR 110 for the Notification: Review Request Completed.









End activities	Activity	Hourly cost	Type	End date	
Simulation	Default	EUR 2.00	Any	N/A	
Alias					
Backup & History	Default	EUR 50.00	Manual	N/A	
Integration & Api					
Translations	Create New Proposal	EUR 350.00	Manual	N/A	
About					
Machine Learning	Follup Up with Client	EUR 390.00	Manual	N/A	
Business metrics					
KPIs	Notification: Review Request Completed	EUR 110.00	Manual	N/A	
Activity working t...					
Activity costs					
Resource costs					

Items per page: 5 1 - 5 of 9 items 1 of 2 pages < >

_4. Click **Activity working time** and note 45 minutes for the Notification: Review Request Completed.

End activities	Activity	Value	Type	End date	
Simulation	Default	10 minutes	Manual	N/A	 
Alias	Default	1 minute	Automatic	N/A	 
Backup & History	Create New Proposal	20 minutes	Manual	N/A	 
Integration & Api	Follup Up with Client	45 minutes	Manual	N/A	 
Translations	Notification: Review Request Completed	45 minutes	Manual	N/A	 
About					
Machine Learning					
Business metrics					
KPIs					
Activity working ...					


_5. Click **Resource costs** and note EUR 150 for all manual (human) tasks.

End activities	Resource	Hourly cost	Type	End date	
Simulation	Default	EUR 100.00	Automatic	N/A	 
Alias	Default	EUR 150.00	Manual	N/A	 
Backup & History	Automation Script	EUR 100.00	Any	N/A	 
Integration & Api	Automation Service	EUR 200.00	Any	N/A	 
Translations					
About					
Machine Learning					
Business metrics					
KPIs					
Activity working t...					
Activity costs					
Resource costs					

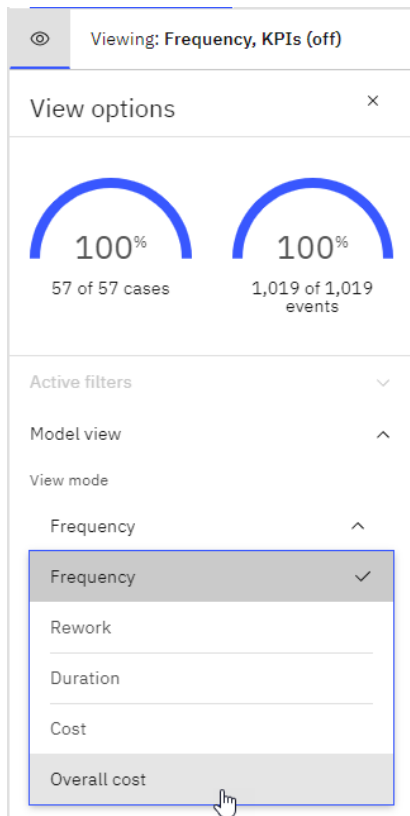
Note: Automated tasks have a lower rate than human tasks because the automated tasks' duration is significantly lower than automated tasks' duration, so the overall costs (duration * cost) are considerably smaller for automated tasks.

_6. Click **Model** tab

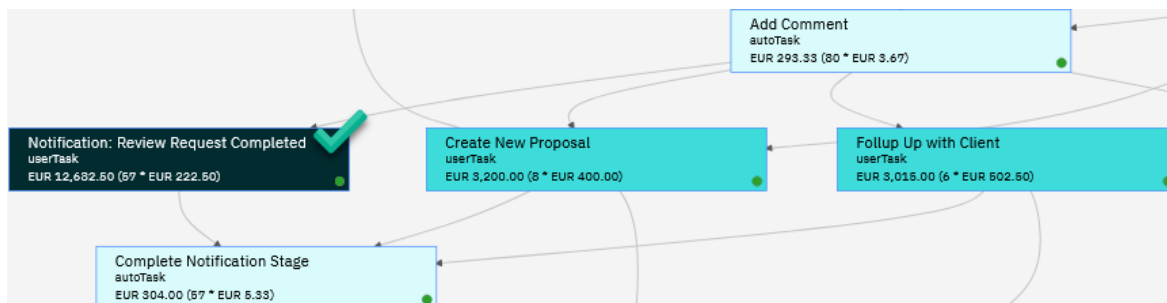
Client Onboarding

Model  BPMN

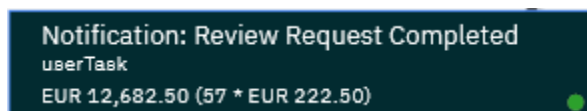
_7. For View mode, select **Overall cost**



_8. Note that the Overall Cost (the sum of all 57 cases) is the highest for the darkest Activity: **Notification: Review Request Completed**



_9. Let's examine how IBM Process Mining calculated this Activity's overall cost.



Activity Cost = Activity Standard Cost + (Average Working Time * Avg Resource or Role Cost)

57 - is the number of Cases in our dataset. This Activity was executed once in each of the 57 cases.

EUR 222.50 = **EUR 110** (Activity Cost) + **0.75** hour (Activity Working Time) * **EUR 150** (Resource cost)

Business Insight: We identified the most costly Activity in the Client Onboarding Process.

3.2.4 Identify Rework

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.

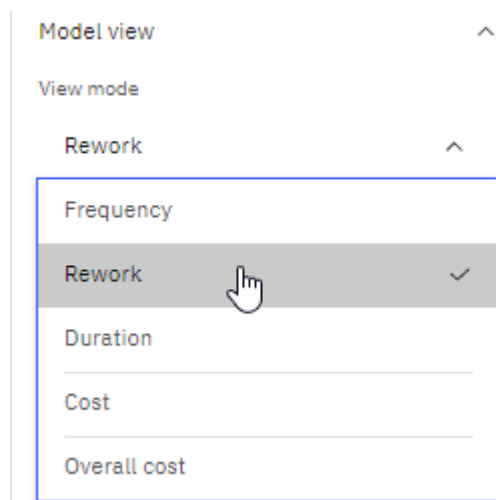
IBM Process Mining automatically discovers two kinds of Rework:

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.

3.2.4.1 Instance Looping Rework

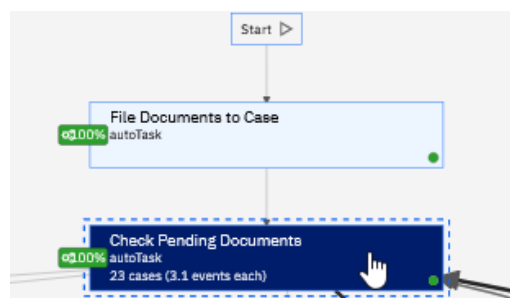
_1. Under *Model view*, open *View mode*, and select **Rework** to change from Frequency to Rework view



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



_3. Click **Check Pending Documents** activity – an example of *instance-looping*

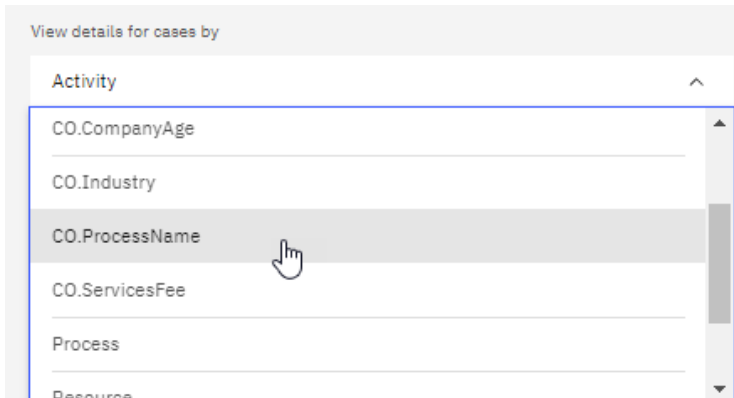


- This Activity is repeated (Rework) in 23 out of 57 cases
- On average, the Activity repeats 3.1 times during the 23 Cases where it occurs.
- This Activity has a 100% automation ratio (meaning it is automated)

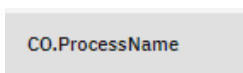
_4. Click **Show activity statistics**



_5. For *View details for cases by* select **CO.ProcessName**

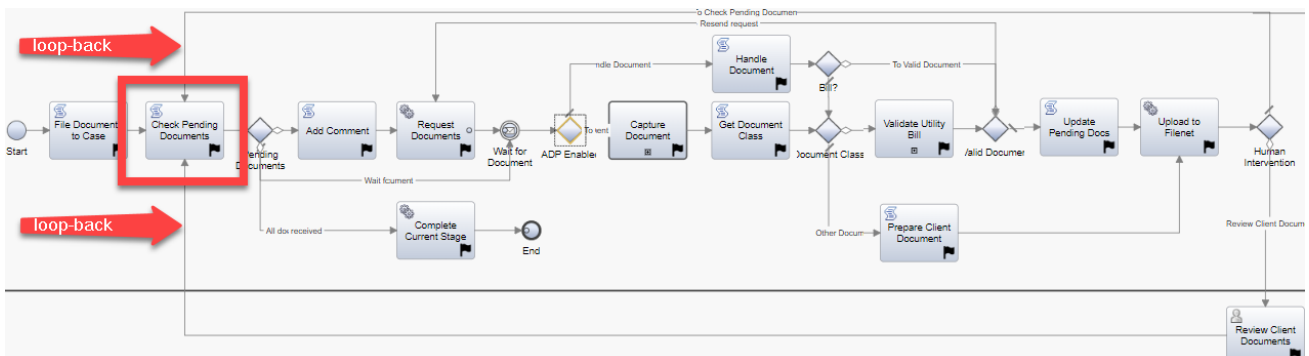


_6. Note that the BPMN Process name is *Review Documents*



_7. Let's examine the *Review Document* process to understand what causes the Rework we identified in the our Process Mining Project.

The Rework occurs when the documents uploaded are incorrect or rejected when inspected by a human.

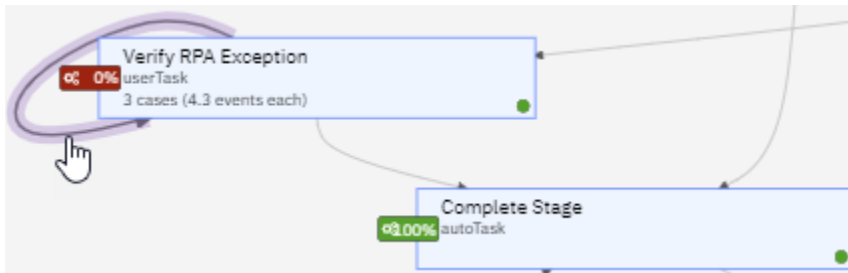


_8. Click **X** to close the Activity statistics window

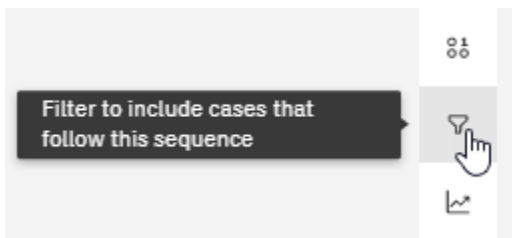
Business Insight: We now know the impact of Rework on the process metrics, such as lead time and costs. Business action is to ensure the customer provides all documents and that the documents are correct when requesting a new service for the first time.

3.2.4.2 Self Looping Rework

_1. Click the **self-link** on the **Verify RPA Exception** activity.

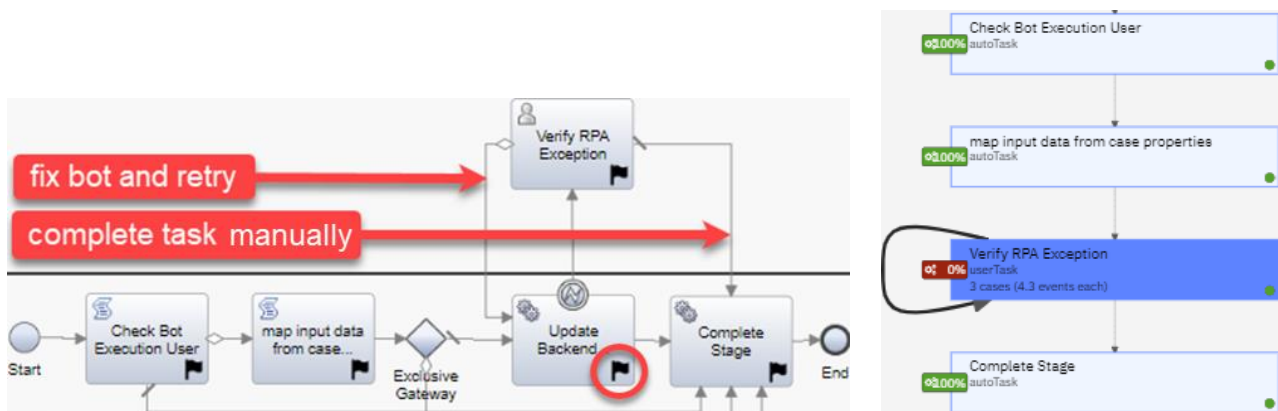


_2. Click **Filter** to include cases that follow this sequence



_3. Let's examine how the Process Mining diagram correlates with the BPMN process...

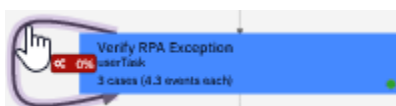
Let's examine the Update Backend system process in the Figure below.



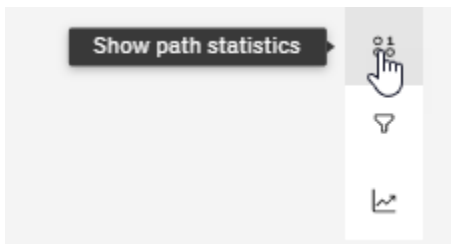
When RPA Bot fails, the Event Emitter (black flag in the **red circle**) on the Update Backend System activity does not fire because the Activity never completes. The Event Emitter fires upon the completion of the Activity (it appears on the right-hand side of the Activity; hence it is a post-event). Therefore we see **Verify RPA Exception Activity** immediately after **map input data from case properties** Activity.

The user that completes the Verify RPA Execution activity is responsible for either fixing the bot execution (restart the Bot in Bot Control Center) or performing manually the task that the Bot performs.

_4. Click the **self-loop** path



_5. Click **Show path statistics**



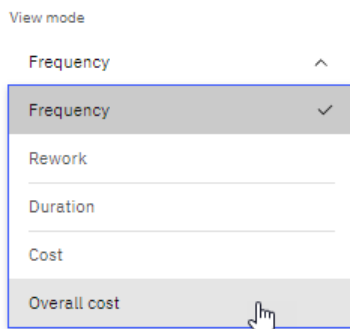
_6. Note the Case IDs and the number of retries between 1 and 6

Verify RPA Exception - Verify RPA Exception

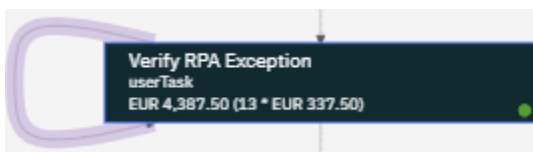
CO.ReferenceID	Count
8NTSYXBT	3
L593QKNV	1
9N5XVWH8	6

_7. Click **X** to close the *Path statistics* window

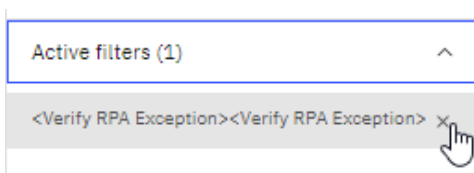
_8. Change *View mode* to **Overall cost**



_9. Note the high overall Cost of having 3 cases, including the Verify RPA Exception activity. EUR 4,387.50! This Cost is avoidable.



_10. Click **X** to remove the Active filter



Business Insight: We discovered self-loop style Rework pattern is associated with failing RPA bots and quantified its impact on the Cost and Lead Time of cases. To address this issue, the IT organization could consider replacing RPA Bots with an API-based Integration.

3.2.5 KPI Analysis

3.2.5.1 KPI Compliance

With IBM Process Mining, we can define KPIs (related to case cost/duration or activity duration) and monitor KPI compliance.

Let's view the current KPI settings for this project.

_1. Click the **Manage** tab



_2. Select **KPIs** view

You should now see the Process and Activity threshold settings for this project.

KPIs

Overall process KPIs [Edit process KPIs](#)

Case duration thresholds
Between 45 minutes and 3 hours

Case cost thresholds
Between 300 EUR and 810 EUR

Default activity KPIs [Edit activity KPIs](#)

Activity throughput thresholds
Between 1 second and 30 seconds

Activity wait queue thresholds
Between 1 second and 30 seconds

Activity duration thresholds
Between 1 second and 30 seconds

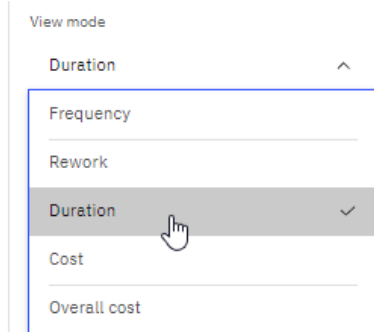
Resource allocation thresholds
Between 33 % and 66 %

Specific activity KPIs [Edit activity KPIs](#)

Create New Proposal	▼
Review Client Request	▼
Notification: Review Request Completed	▼
Verify RPA Exception	▼
Review Client Documents	▼
Follup Up with Client	▼

_3. Click the **Model** tab to get back.

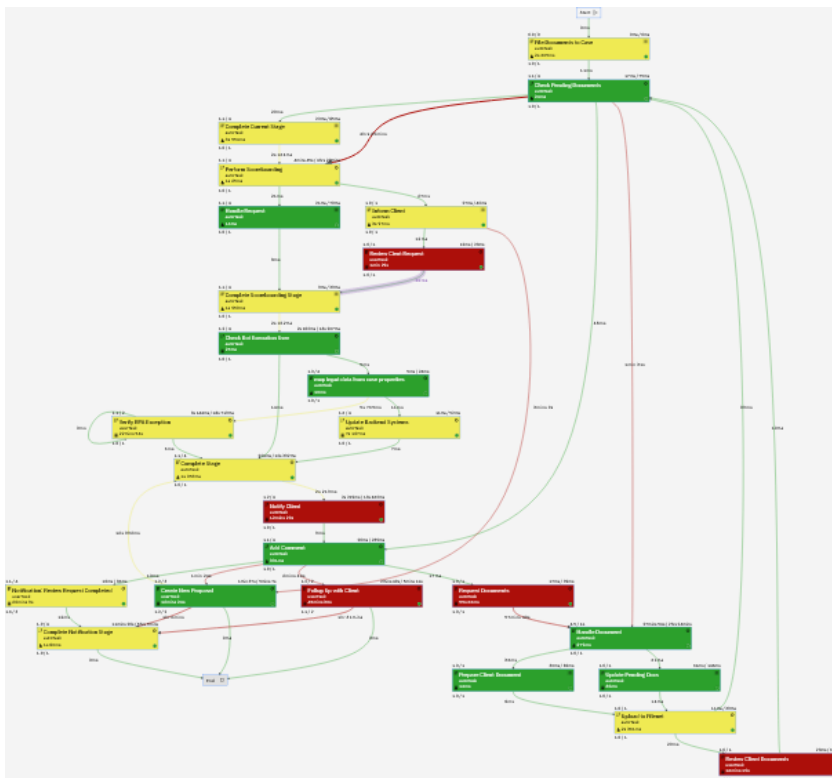
_4. In the section *Model view*, for *View mode*, select **Duration**



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



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



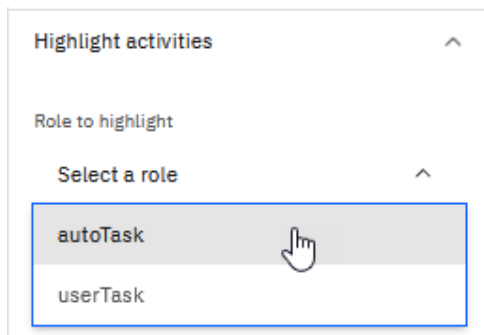
The Activities and Transitions color reflects the KPI settings. See the note below about the KPI Settings.

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

3.2.5.2 Root Cause Analysis of KPI Violations

Let's focus on identifying Automated Activities that exceed their Duration KPI.

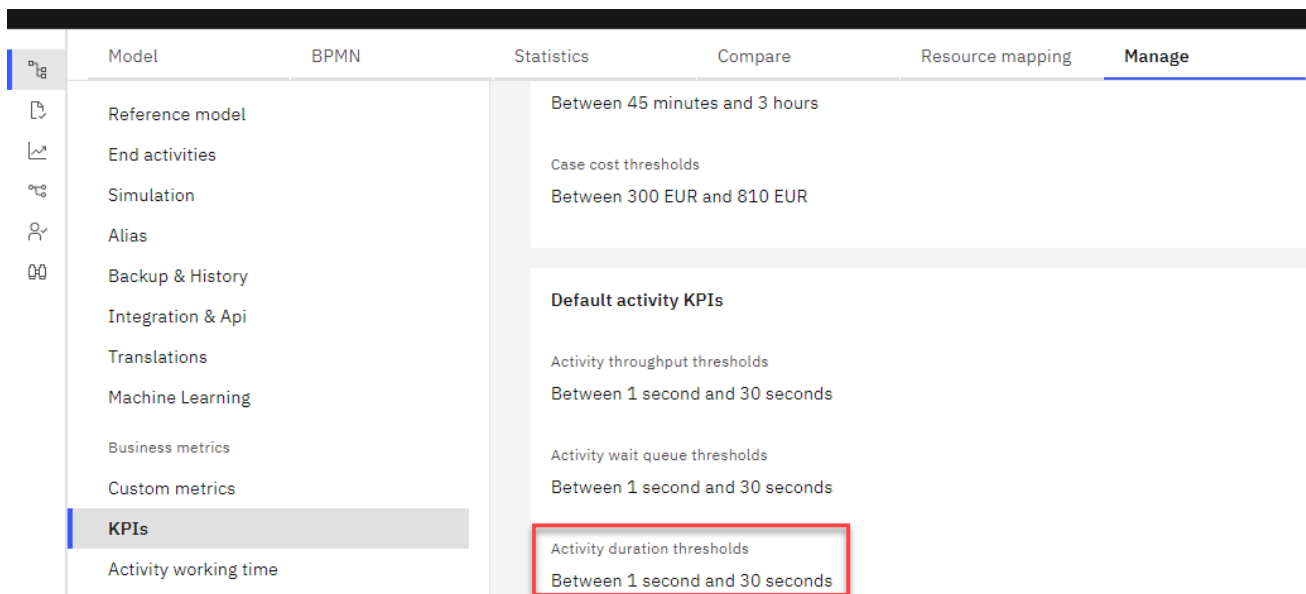
_1. In *View options*, under *Highlight activities*, for *Role to highlight*, select **autoTask**



_2. Notice that **Notify Client** Activity is marked in red

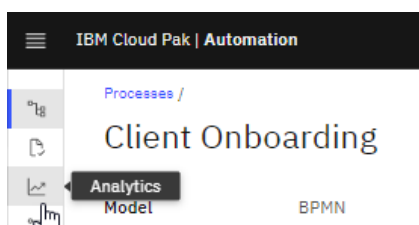


_3. Let's focus on the *Notify Client* Activity! It has an average service time of 12min 29s. This is way above the 30 seconds defined in the KPI Settings you examined earlier (Manage Tab > KPIs > Default activity KPIs)

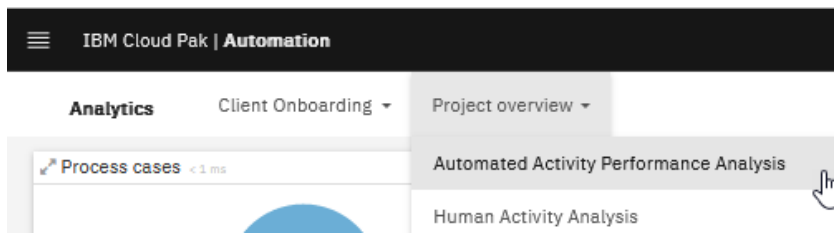


Let's drill down into details to include enough information to create a Ticket for the IT organization to investigate this issue!

_4. Click **Analytics** on the left



_5. Under **Project overview**, click **Automated Activity Performance Analysis**



_6. Note that there are two Cases with Notify Activity exceeding 10 seconds of service time.

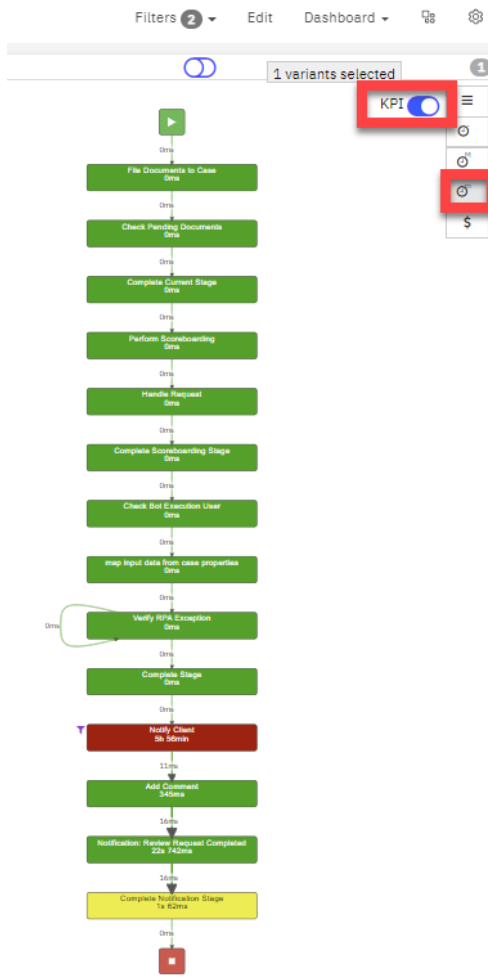
Activities with Service Time > 10 seconds 30 ms			
ACTIVITY	CASEID	Service Time	Case Cost
Notify Client	9N5XVWH8	5h 56min	€ 2,639.00
Notify Client	BDUYHG5A	5h 55min	€ 614.00
Request Documents	9V7VGEK7	19min	€ 298.17
Update Backend Systems	Q5A8RC5F	40s 557ms	€ 361.50
File Documents to Case	STHRK8CA	25s 332ms	€ 614.00
Complete Scoreboarding Stage	6LNN5LSV	18s 613ms	€ 272.83
Update Backend Systems	TB6JBL35	16s 305ms	€ 361.50

_7. Click the **first row** in the table

Activities with Service Time > 10 seconds 30 ms	
ACTIVITY	CASEID
Notify Client	9N5XVWH8
Notify Client	BDUYHG5A

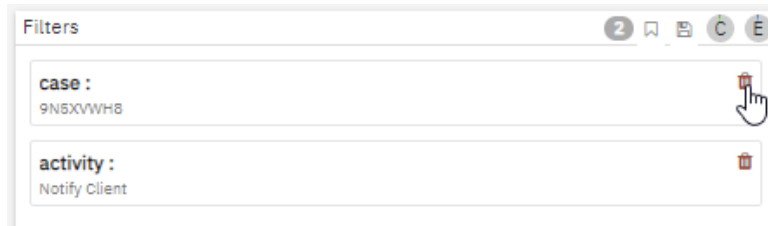
This action adds a filter to restrict the process Model to show the flow only for Case with the Case ID 9N5XVWH8

_8. Select the **Maximum duration** icon first and then select the **KPI** switch

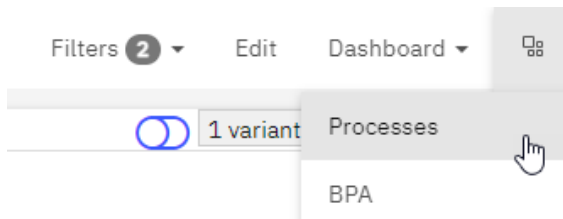


Notice that only the *Notify Customer* Activity took a long time to execute. This indicates the problem lies with the Notify Customer service call, and we can exclude general system outages affecting all automated activities.

_9. Click the **red garbage cans** to remove **both** Dashboard filters.



_10. Select **Processes** to return to the Model View.



Process Improvement Insight: We found that several API calls (Automated Activities) contributed to excessive Case Lead times and were generally way above their KPI settings. We singled out the Notify Client activity and used the Analytics Dashboards to drill down to get more information. We provided the IT organization with the Case IDs and determined that there were no general system outages during the case execution.

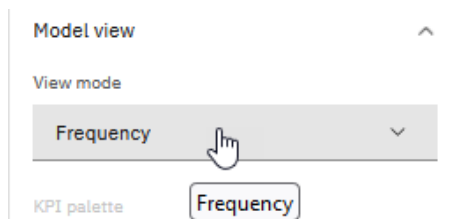
3.2.6 Process Variant Analysis

Client Onboarding Workflow has multiple paths (e.g., happy Path, exception cases, etc.). IBM Process Mining can visualize them individually or together.

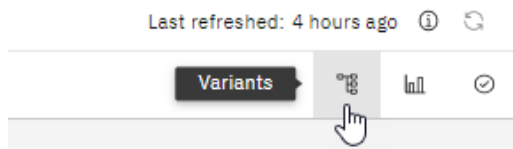


Process Variant represents a unique path that cases take to execute the Process from the start to the end.

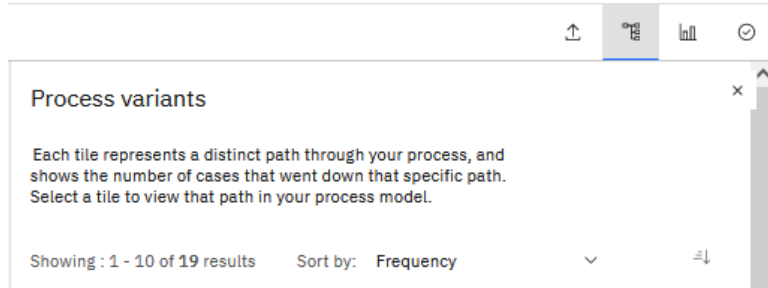
_1. Select **Frequency** view



_2. Click **Variants**



You should now see the Process variants view on the right-hand side.



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

3.2.6.1 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 Cases**.

19.3% (11 cases)	Number of steps 12 steps	Average duration 1 hour 23 minutes	<input checked="" type="checkbox"/>
15.79% (9 cases)	Number of steps 14 steps	Average duration 3 hours 38 minutes	<input checked="" type="checkbox"/>
14.04% (8 cases)	Number of steps 14 steps	Average duration 3 minutes 10 seconds	<input checked="" type="checkbox"/>
12.28% (7 cases)	Number of steps 23 steps	Average duration 4 hours 18 minutes	<input checked="" type="checkbox"/>
8.77% (5 cases)	Number of steps 18 steps	Average duration 1 hour 34 minutes	<input checked="" type="checkbox"/>

_4. Click **Create filter**



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

Create filter

Filter name

Top 5 Variants

Exclude matched cases

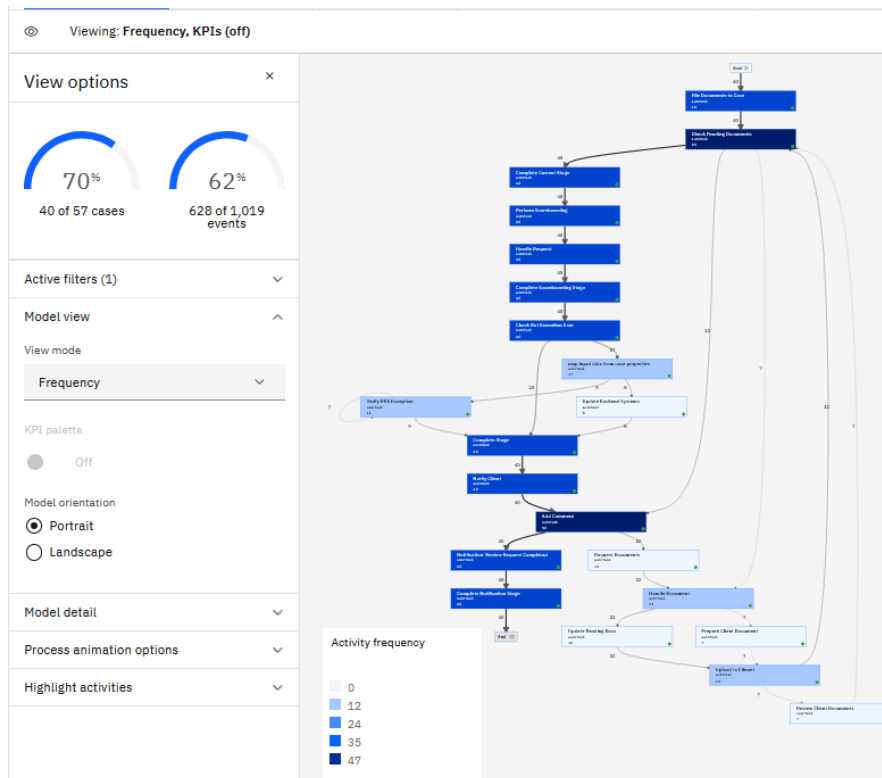
☐ Off

Cancel

Create filter

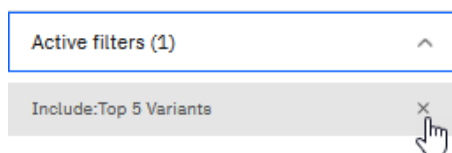
Note that if we selected **Exclude matched cases** in the *Create filter* window above, the resulting Filter would include all the outliers, namely, the cases that belong to the least frequent Variants.

_6. The Model is now updated and shows fewer steps and connections, yet it covers 70% of all process paths.



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

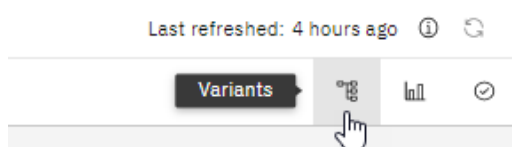
_7. Under *Active filters* click **X** to remove the "Include:Top 5 Variants" filter



3.2.6.2 Use Filter to Discover Happy Path

Let's find the fastest Variant with fewer steps! The Happy Path.

_1. Click **Variants**



_2. Click the **checkbox** to filter out all other cases

Note that it just happened that the most frequent Variant also is the one with the fewest steps (12)!

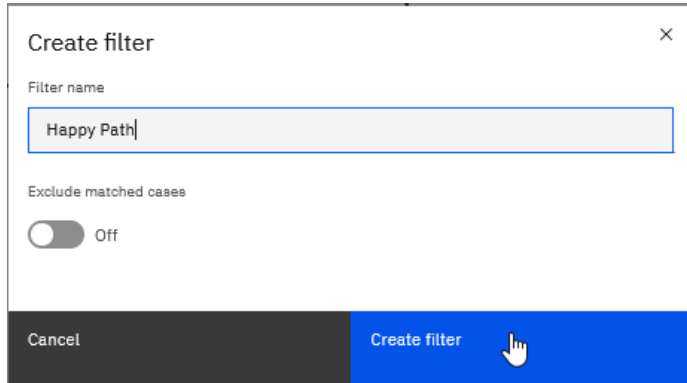
Did we find the Happy Path?

19.3% (11 cases)	Number of steps 12 steps	Average duration 1 hour 23 minutes	<input checked="" type="checkbox"/>
------------------	-----------------------------	---------------------------------------	-------------------------------------

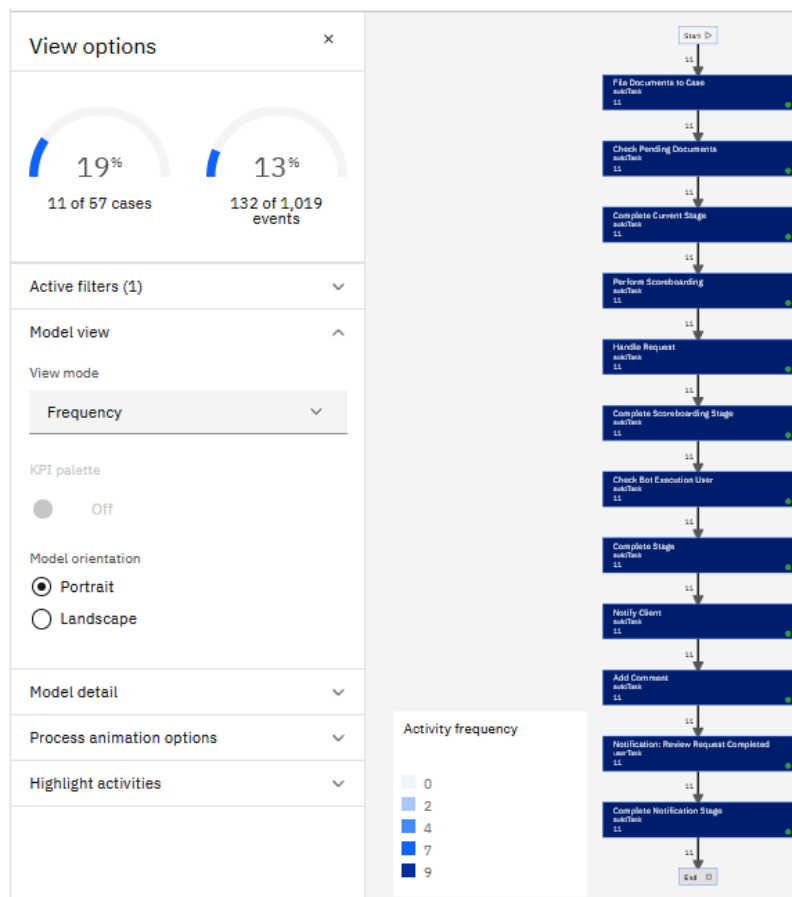
_3. Click **Create filter**



_4. For the *Filter name* enter **Happy Path** and click **Create filter**

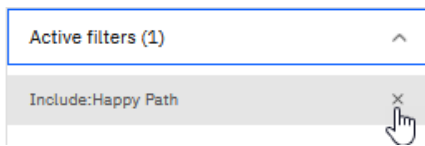


_5. Note that we now see the Happy Path in the Model view. 19% of the cases include 11 steps, no loops, or conditional activities. Happy Path, indeed!



Note that to keep this Filter for future use, you need to save it as a Template Filter (we have already done this for you because we will use it later in this lab). However, you will learn how to create a Template Filter later in this lab.

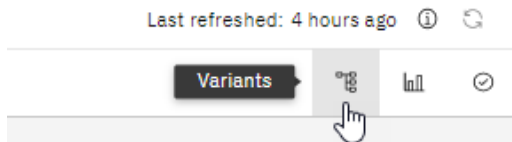
_6. Click **X** to remove the Happy Path filter



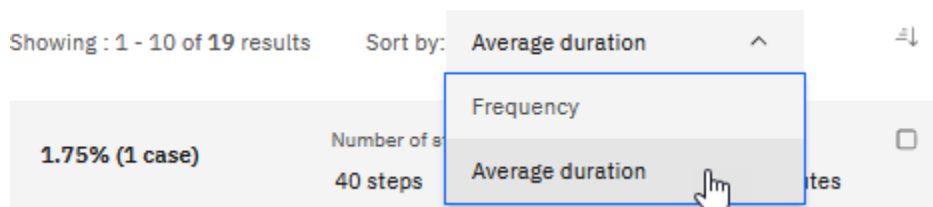
3.2.6.3 Use Filter to Discover Unhappy Path

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

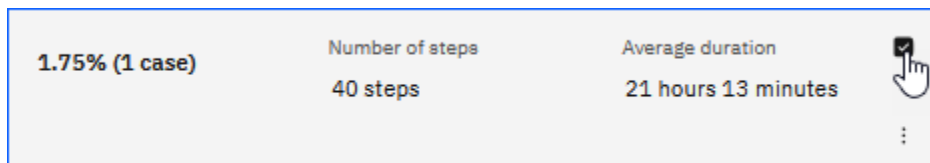
_1. Click **Variants**



_2. Select **Average duration**



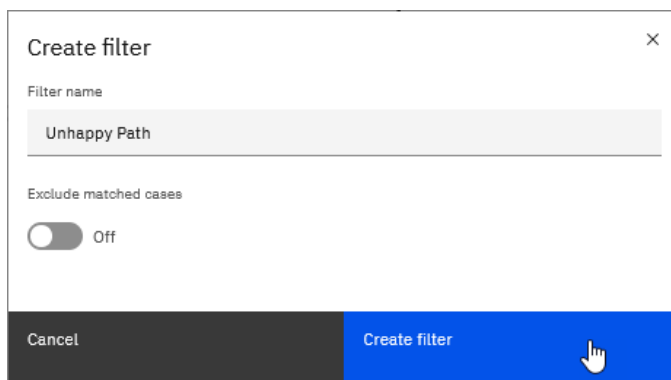
_3. On the Variant that has 40 steps, click the **checkbox** to filter out all other cases
Note that we found the Variant with the highest duration (21 h 13 m).



_4. Click **Create filter**

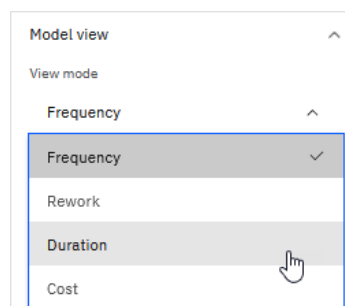


_5. For *Filter name* enter **Unhappy Path** and click **Create filter**



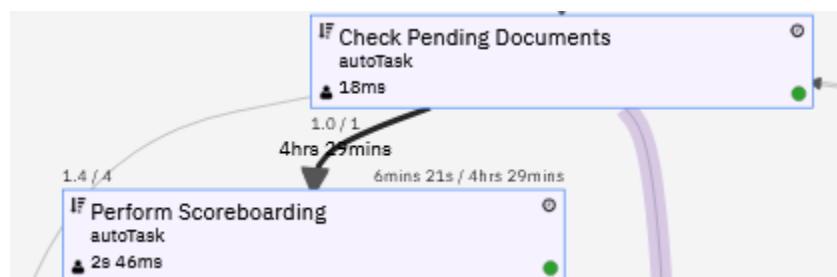
3.2.6.3.1 Investigate Long Case Duration

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

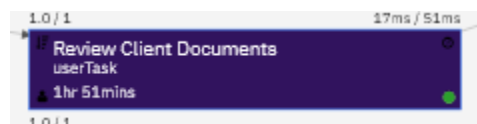


_2. Note the two areas of concern that contribute to the case duration of 21 h 13 m:

- There is a considerable delay of **4hrs 29mins** between the two automated tasks. We will investigate this later when examining Model Conformance. We will discover that this transition is not conformant with the reference model



- Note that the *Review Client Documents* task takes **1hr 51 minutes** to complete. We will now further focus on this automated task.



3.2.6.3.2 Investigate a Large Number of Steps

Rework (repeating the steps in the same Case) is a key contributor to an excessive number of steps in Cases.

_1. Change *View mode* to **Rework**



_2. Note the thick rework arrows (Activity transitions)

See the Figure below to understand the Process logic where missing or inaccurate documents cause the Process to request a document – document upload request loop.

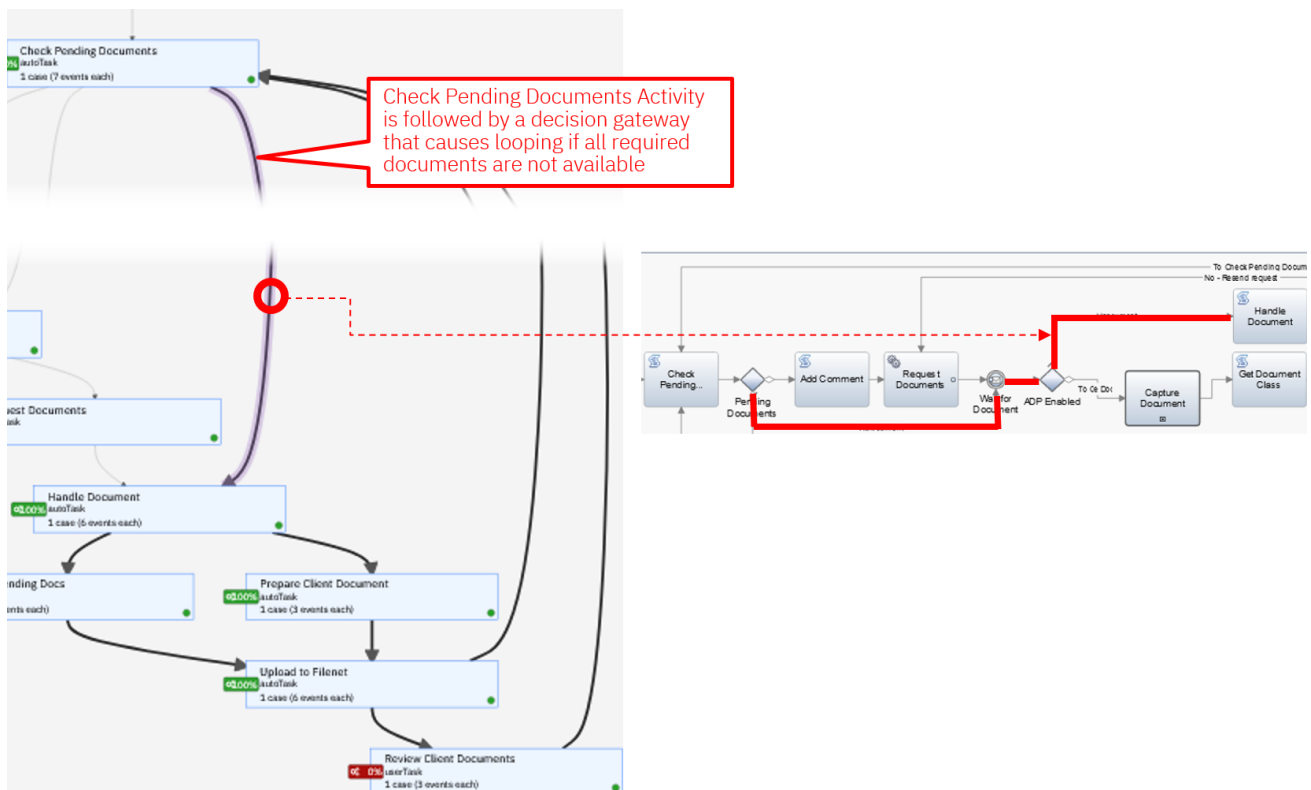
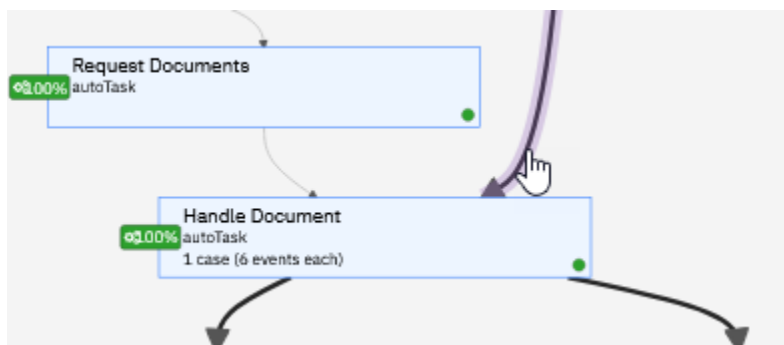
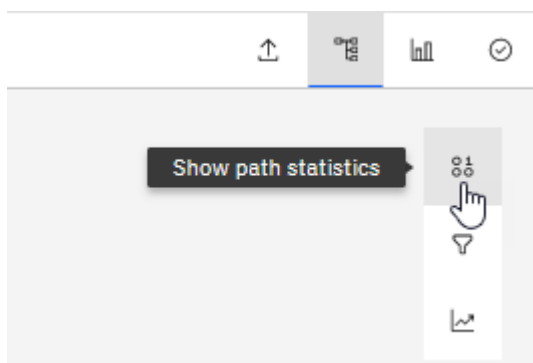


Figure 5. Document Request Upload Loop

_3. Click the thick transition arrow leading to Handle Document Activity



_4. Click **Show path statistics**



_5. Note that the loop occurred 5 times!

Check Pending Documents - Handle Document

CO.ReferenceID	Count	Wait time
TNHWLHQJ	5	3 minutes 2 seconds

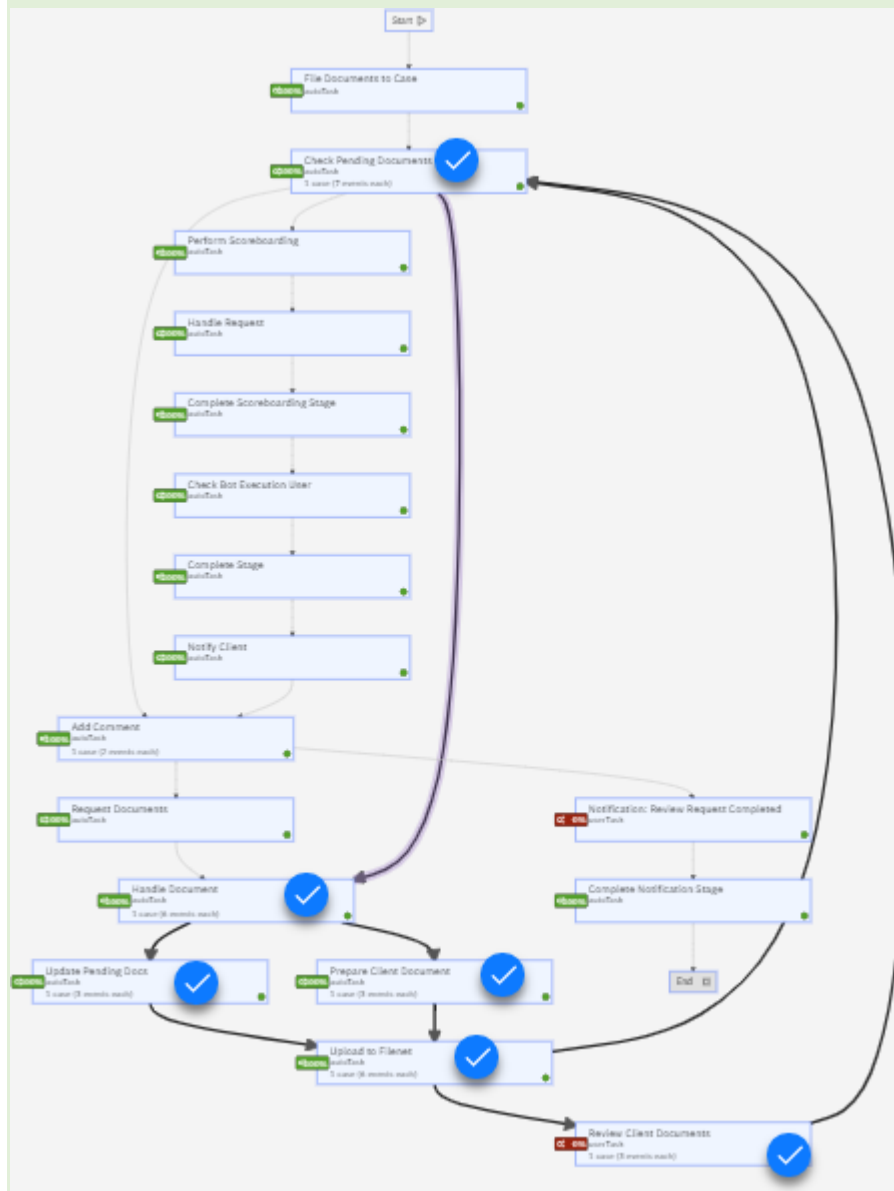
Items per page: 10 ▾ 1 - 1 of 1 item

If you count the number of activities repeated, we can now see that this loop is responsible for

5 ACTIVITIES * 5 LOOPS = 25 ACTIVITIES

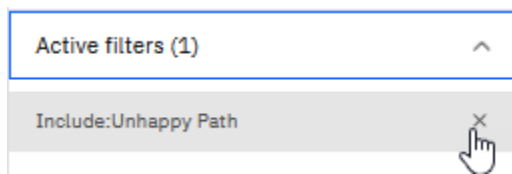
of the 40 Activities executed in this Unhappy Path Process Variant.

The 5 ACTIVITIES count can be deduced by examining the activities involved in the loop (counting Update Pending Docs and Prepare Clint Documnt as one).



_6. Click **X** to close the *Path statistics* window

_7. Remove **Unhappy Path** filter



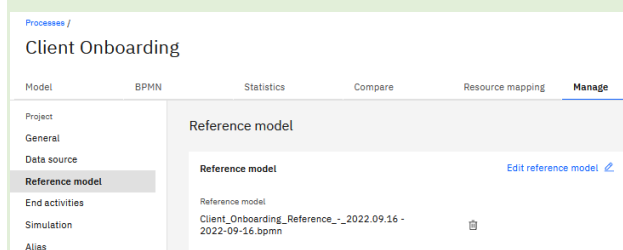
Process Improvement Insight: We identified a Variant with the least number of steps, lowest Cost lowest lead time. We also discovered a variant with the longest lead time. We determined the root causes: (i) a long delay between two automated activities (to be probed further) and (ii) a large number of executed Activities (25) caused by missing or incorrect documents. The former is an IT insight, while the latter is a business decision to ensure a complete set of correct documents is supplied first.

3.2.7 Analyze Model Conformance

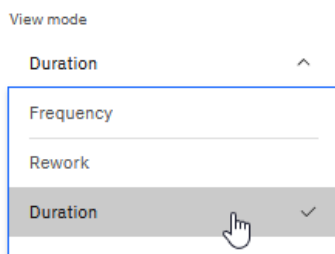
The Model Conformance view provides a visual conformance check between the data-derived and reference models.

Let's address why, with fully orchestrated processes, there could be non-conformance. After all, BPMN processes are predictable by definition! There are two reasons. The Client Onboarding was implemented as a Case that, by definition, is unstructured, allowing for unexpected process variability. The second reason is that even the structured BPMN processes (Activities in the Case) can have unexpected paths: **business fault** handling (throwing exceptions to deal with process faults) and **technical faults** that the admin resolves in the Process Admin Console. The above can cause deviations from the ideal process path defined by our Reference Model!

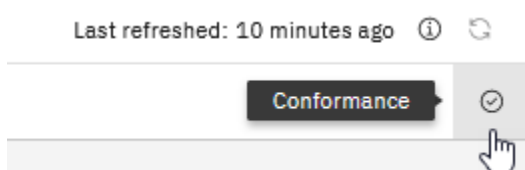
Note: The reference model is supplied with the BPMN diagram and can be uploaded when the new Process Mining project is created. The reference model can also be added or changed after the project is created.



_1. Set View mode to **Duration**



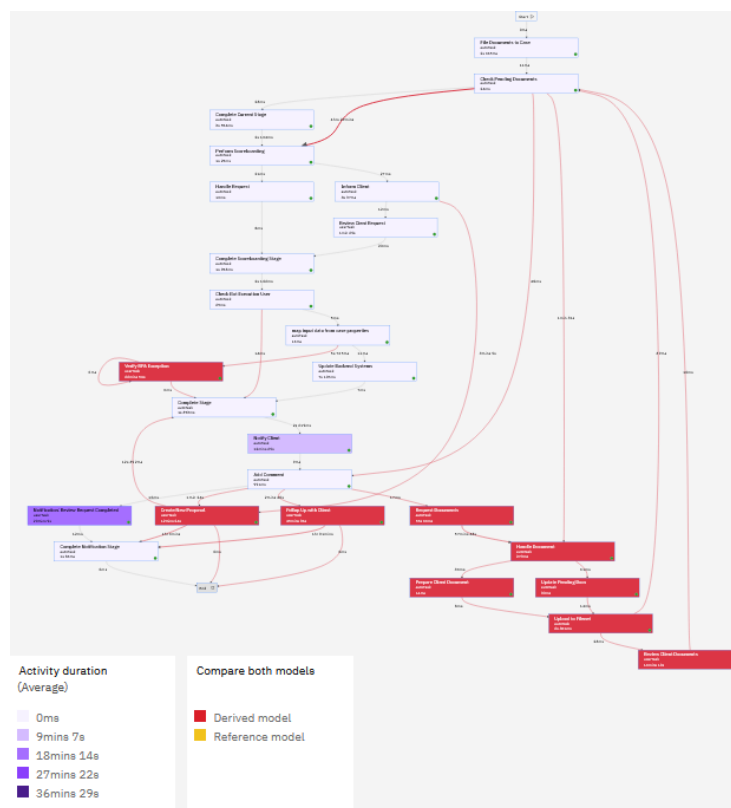
_2. Click **Conformance** (top right)



_3. Note summary of the impact of non-conformance on critical process statistics. It includes three critical Case statistics, as shown below.

Conformant cases			
8 ✓ conformant cases	Steps per case 14	Case cost EUR 362	Average case lead time 3 minutes 10 seconds
49 ✗ non-conformant cases	Steps per case 19	Case cost EUR 672.97	Average case lead time 3 hours 8 minutes

_4. Note that non-conformant Activities and Transitions are marked **red**

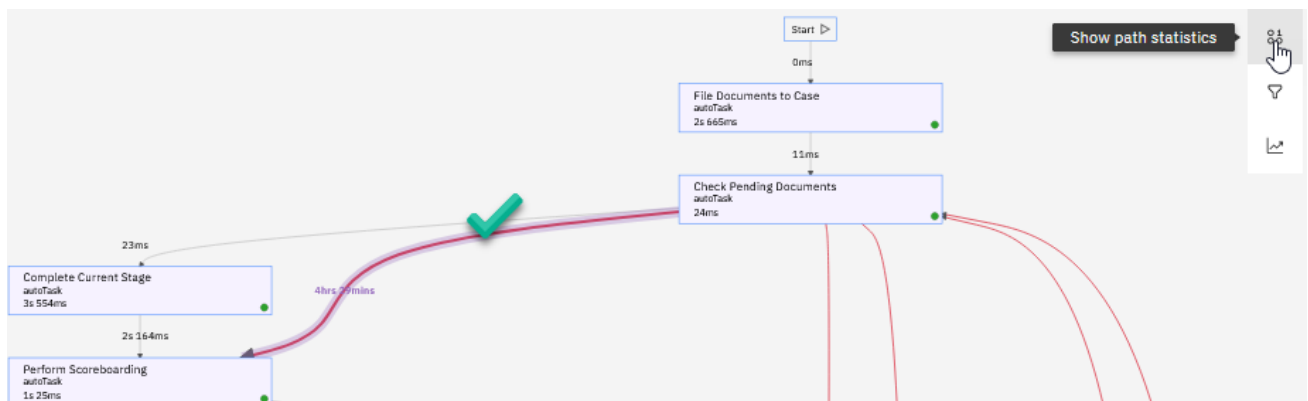


3.2.7.1 Analyze an Unexpected Process Flow

_1. Notice the non-conformant transition that is taking **4hrs 29min**



_2. Select the transition and then select **Show path statistics**



_3. Note that we now see the reference ID.

Path statistics

Check Pending Documents - Perform Scoreboarding		
C0.ReferenceID	Count	Wait time
TNHWLHQJ	1	4 hours 29 minutes
Items per page: 10 1 - 1 of 1 item		

To understand and prevent such significant delays in the future, we could provide the Reference ID to the IT organization for further investigation.

_4. Click **X** to close the *Path statistics* window.

After consulting the IT organization, the incident was explained as follows (See the Figure below):

- The process instance with the reference id **TNHWLHQJ** failed when executing the **Complete Document Stage Activity**.
- This process failure caused it to get stuck at the **Review Documents** Case Stage
- The IT organization manually advanced the Workflow to the **Perform Scoreboarding** Stage using ACCE Admin Console
- After this happened, the Workflow advanced to the next stage (**Perform Scoreboarding**) and started **executing the Perform Scoreboarding Activity**.

This IT intervention took almost 5 hours!

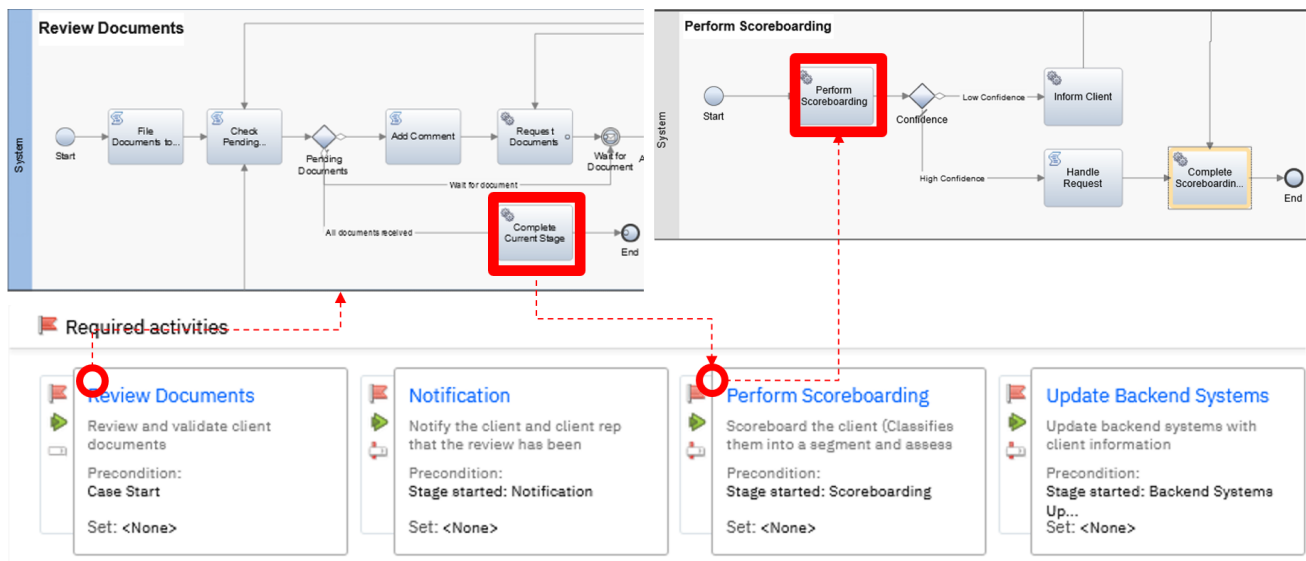


Figure 6. The Explanation of Invalid Transition Causing 4h 29 min Wait

3.2.7.2 Identify the Most Costly Deviant Transition

_1. For *View mode*, select **Frequency** view



_2. Click **Deviations** dropdown

Model conformance

Model view options

- ☐ Data derived model
- ☐ Reference model
- ☒ Compare both models

Similarity

69%

Fitness

100%

Maximum fitness

100%

Minimum fitness

100%

Conformant cases

	Steps per case	Case cost	Average case lead time
8 conformant cases	14	EUR 362	3 minutes 10 seconds
49 non-conformant cases	19	EUR 672.97	3 hours 8 minutes

Reference model deviations

Displaying: 3 Deviations

Open menu

_3. Make sure only **Unexpected activities** is checked

Reference model deviations

Displaying: 1 Deviations

Upload to 41.38%

Average number of steps 24 steps

- ☒ Unexpected activities
- ☐ Unexpected initial activities
- ☐ Unexpected process flow

_4. Scroll down to **Create New Proposal** – the unexpected Activity

_5. Click **vertical ellipses** and then select **Create filter including case**

Create New Proposal

14.04% (8 cases)

Average number of steps	Average case cost	Average case lead time	
19 steps	EUR 1,348.79	0 days 4 hours	

Follup Up with Client

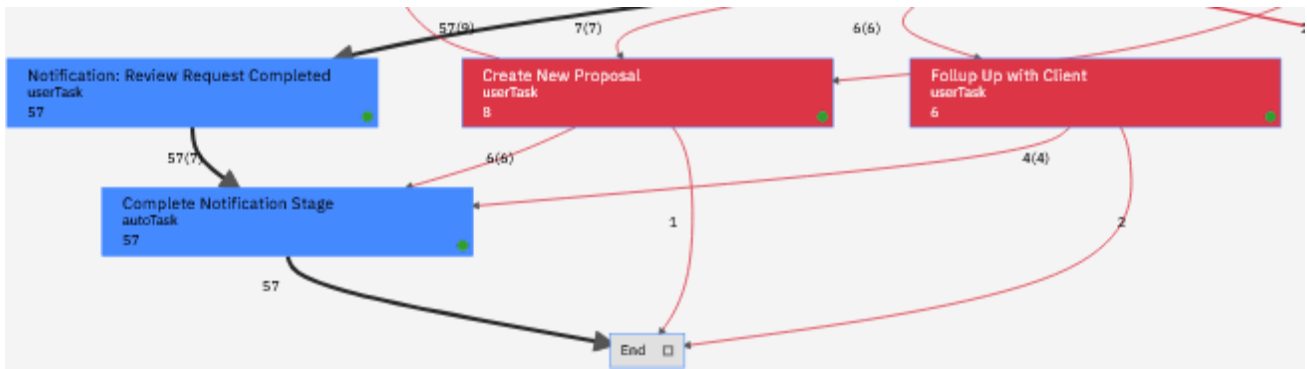
10.53% (6 cases)

Average number of steps	Average case cost

View root cause analysis

Create filter including case

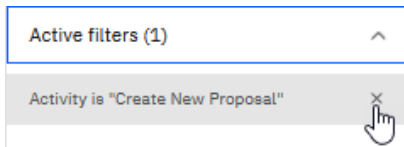
_6. Focus on the part of the Model close to the **End** Activity.



Business Explanation:

The two activities that are non-conformant, shown above in red, are causing the excessive lead time. The reason is that even though the client is already onboarded and the case for all intents and purposes is completed, the clock is still ticking as the actual cases can not be completed until the above activities are completed.

_7. Click **X** to remove the Activity is "Create New Proposal" filter



Technical Explanation - You may skip this part unless you are familiar he IBM Workflow Programming model.

As shown in the Figure below, both Follow Up with Client and Create New Proposal are optional Activities. Note the preconditions; both are available to start when the Notification Stage is reached.

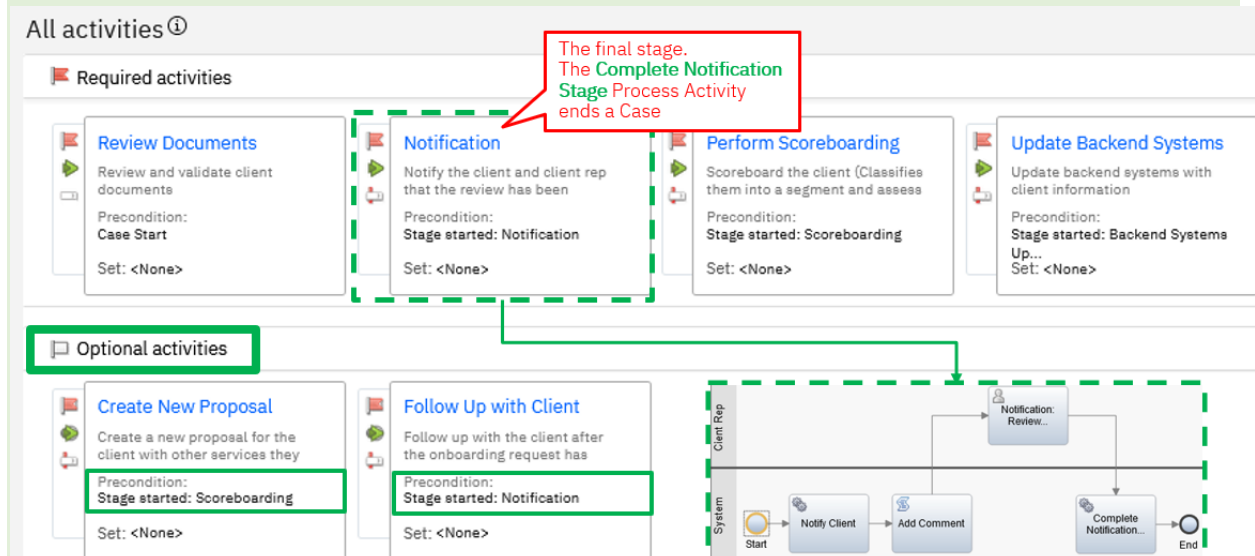
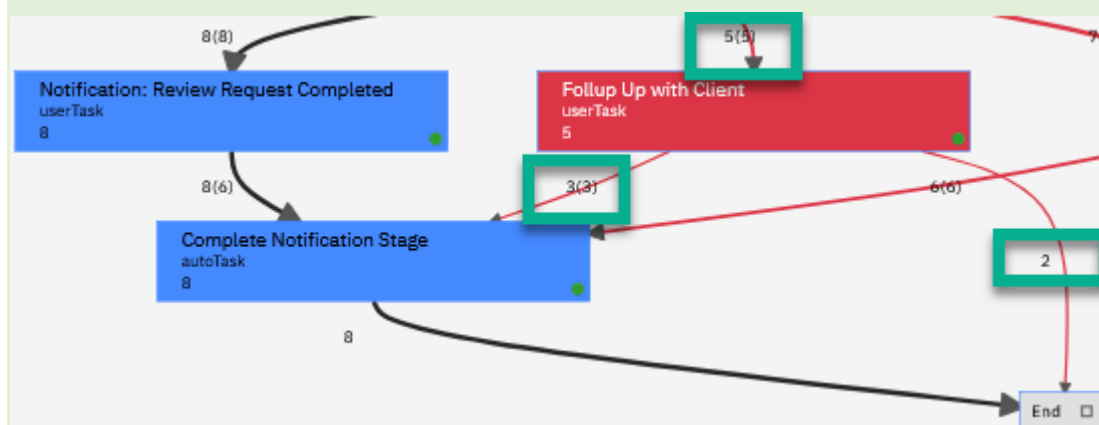


Figure 7. "Follow up with Client" - an Optional Activity Enabled in the Scoreboarding Stage



Here are key insights you can draw from the Frequency view regarding the Follow up with Client Activity:

The Follow up with Client Activity was started before the Notification: Review Request Completed (a human Activity).

2 times the Follow up with Client Activity was completed after Case was completed (Complete Notification Stage activity completed)

6 times the Follow up with Client Activity was completed **before** Case was completed (Complete Notification Stage activity completed). This implies that the Client Rep. delayed the Case completion until the Create New Proposal Activity was completed.

Process Improvement Insight:

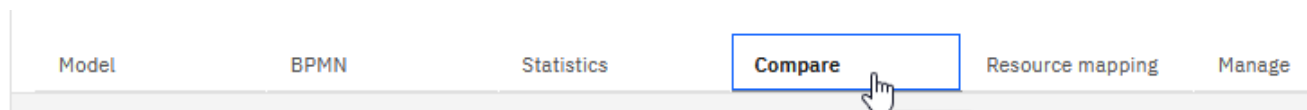
(1) Non-conformant Path Analysis. We found an exception path not covered in the reference model. We discovered that when a process instance fails, it takes too long (the IT intervention took almost 5 hours!) for the process admin to repair a failed instance. This has a significantly negative impact on the Case Lead Time KPI. Business action is to improve monitoring of failed process instances or change the Process to handle technical faults more gracefully.

(2) Non-Conformant Activity Analysis. We discovered a negative impact on Case Lead Time by an Activity not covered by the reference model. Client Reps sometimes delay the Case completion until they complete the Follow Up with Client Activity, negatively impacting the Case Lead Time KPI. Business actions are to instruct Client Reps always to complete the Case first, and a long-term solution is to change the Client Onboarding Workflow to prevent this from happening.

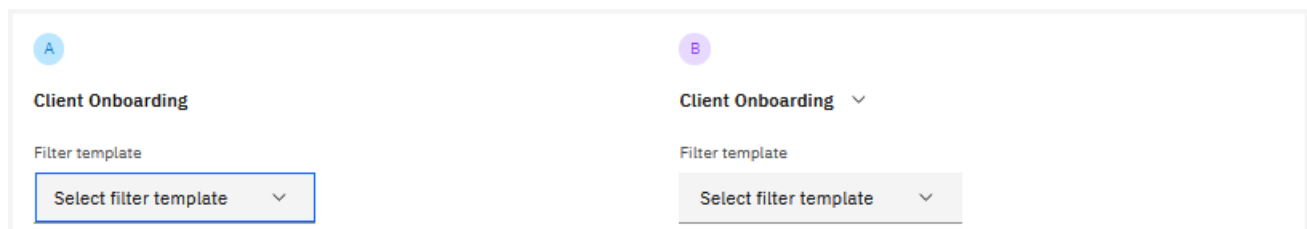
3.2.8 Compare Case Variants

The Compare feature helps you to compare two Case Variants concerning key Process metrics and KPI.

_1. Click **Compare** tab



_2. Examine the *Compare View*



Note that it is organized into two columns:

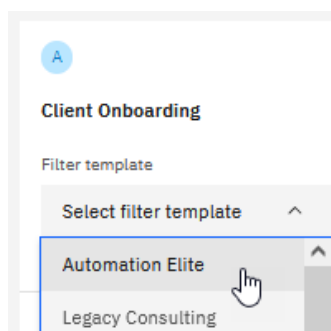
A – (As-is), where you can specify a Filter Template that filters the data in your current project.

B – (To-be), where you can specify a Filter Template that filters either the data in your current project or a different project. Note that you can also use simulation data here (we will do this later in this lab).

3.2.8.1 Compare Clients

Let's compare Client Onboarding Workflow metrics between two different clients. We have already created Filter Templates that filter out cases that represent two different clients: Automation Elite Inc. and Legacy Consulting.

_3. For *As-is*, select **Automation Elite** template filter (you will learn how to create template filters later in this lab)



_4. For *To-be*, select **Legacy Consulting** template filter

_5. Click **Compare processes**

Applied filters (1) [Add new filter](#)

CO.ClientName is "Automation Elite Inc." X

Create new filter template +

Applied filters (1) [Add new filter](#)

CO.ClientName is "Legacy Consulting" X

Create new filter template +

[Compare processes](#)

_6. The **Process details** view shows each customer's key statistics.

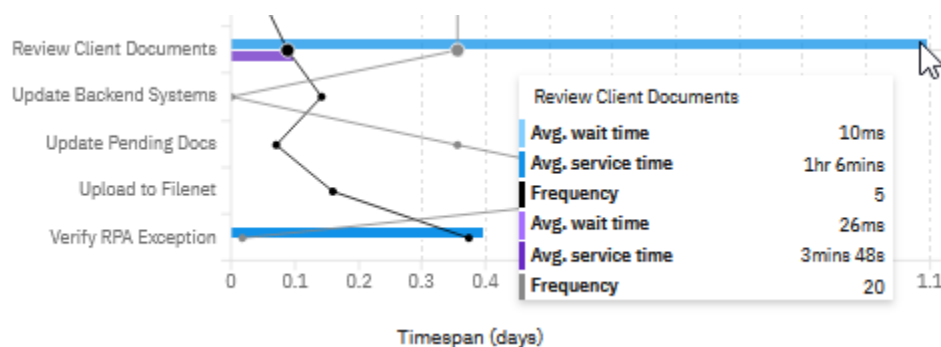
Process details		
Measure: Average ▾	A As-is	B To-be
Case count	35	22
Average case lead time	3hrs 24mins	1hr 35mins
Average case cost	EUR 619.64	EUR 644.55
Total case cost	EUR 21,687.50	EUR 14,180.17

We can use the information here to launch a deeper root-cause analysis. Either in this view or using other features of IBM Process Mining, such as the Dashboards or the Model view.

_7. The **Case duration and count** view shows the Average remaining duration of active cases (line) and the number of active cases (block).

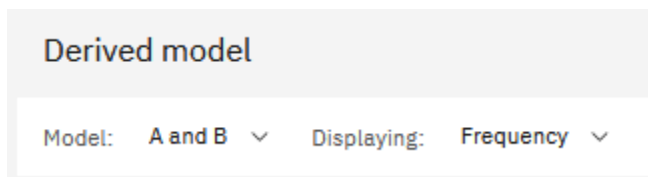


_8. Let's examine the **Activity Duration** view, explicitly focusing on the **Review Client Document** (Human Activity)

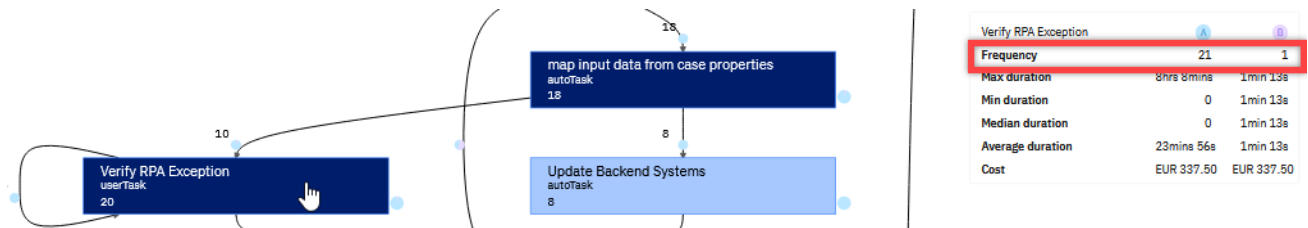


On average, we can see that it takes significantly longer to review documents when onboarding the Automation Elite Inc. client!

_9. In the **Derived model** view, ensure Model **A and B** are selected.

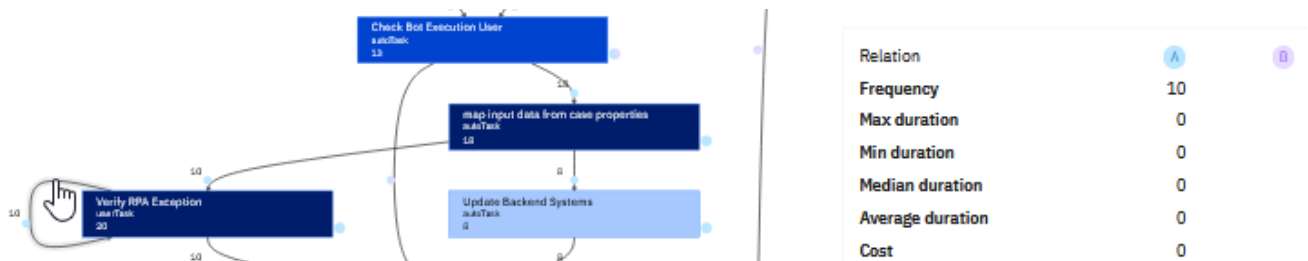


_10. Find and click **Verify RPA Exception** Activity



Notice that Legacy Consulting onboarding shows only one Case where Verify RPA Exception was raised, and manual intervention was required to recover a failed bot.

_11. However over the **self-loop** on the **Verify RPA Exception** Activity



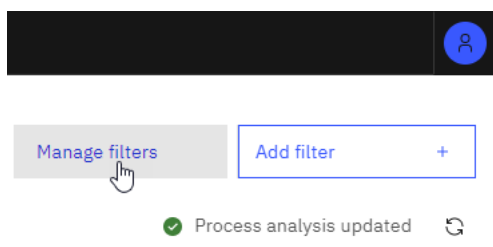
Notice that Automation Elite Inc. shows 10 reworks, where the same Bot had to be fixed/retried multiple times!

3.2.8.2 Compare the Performance of Focus Corp Employees

Let's compare how different Focus Corp employees (usr 141 and user 143) complete Client Onboarding requests!

3.2.8.2.1 Create Filter Templates

_12. Click **Manage filters** (top right of the page)



_13. On the *Manage filters* window, click **Add filter +**



_14. For *including events with attribute*, select **Resource**; for *Resource*, select **usr141**, and then click **Add filter**

Add filter

1. Select filter type

Case attributes ☒ Included

Activity

Process flow

Case

Outlier

Custom metrics

2. Define filter details [Reset filter](#)

Filter to include matched cases and to match anywhere

including events with attribute

Resource ✓

Resource

usr141 ✓

Additional options

☐ Consider only cases with the selected attribute value happening in a specific timespan

Cancel Add filter ✓

_15. Click **Save as template +**

Manage filters

Current filters (1)

Resource is "usr141" [Edit](#) [Delete](#) [Add filter +](#)

Filter template

Find templates [Save as template +](#)

_16. For the *Filter template name*, enter **Usr 141** and then click **Create filter template**

Create filter template

Filter template details

Filter template name

Usr 141

Share with other in organization

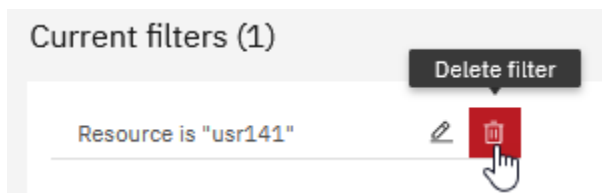
☐ Disabled

Included filters

- Resource is "usr141"

Cancel Create filter template

_17. Click **Delete filter** (We do not want this Filter to be our current Filter!)

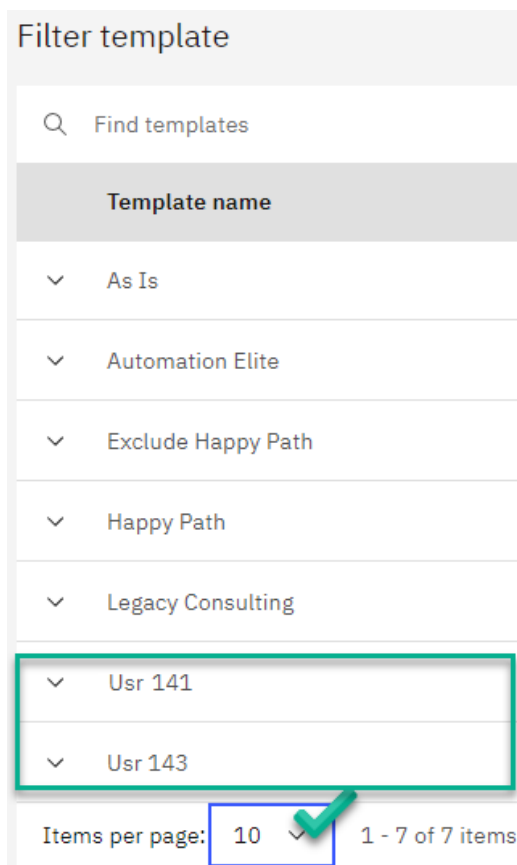


_18. Click the **Close** button to close the *Manage filters* window

_19. Follow the above steps to create **Usr 143** Template Filter.

Change Items per page frpom 5 to 10.

You should now see 2 new Template Filters.



3.2.8.2.2 Create Filter to Exclude KPI Outliers

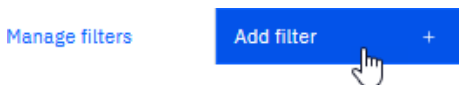
Since the only fair comparison of employee performance is to consider consistent adherence to the KPI, let's exclude the cases considered to be outliers for the KPI.



So far, you have used filters created from the UI. You can also create filters explicitly.

Filters allow you to analyze the Process considering a limited subset of cases that answer specific user requests. For example, to exclude simulated cases or to exclude all cases which are non-conformant to the reference mode

_1. Click **Add filter+**



_2. Select the following and then click **Add filter**

Select filter type – **Outlier**

Filter to – **exclude matched cases**

Case lead time, Activity wait time, Activity service time – **check**

Outlier filtering level (%) - **100**

Add filter

1. Select filter type

Case attributes

Activity

Process flow

Case

Outlier **Included**

KPI

Simulated data

Or

Create advanced filter

2. Define filter details **Reset filter**

Filter to: exclude matched cases

Outlier focus

Case lead time

Include or exclude cases whose lead time exceeds the case duration threshold (previously defined in the KPI settings).

Activity wait time

Include or exclude cases that contain at least one activity whose wait time exceeds the activity wait queue threshold (previously defined in the KPI settings).

Activity service time

Include or exclude cases that contain at least one activity whose service time exceeds the activity duration threshold (previously defined in the KPI settings).

Outlier filtering level (%) ①

0 100 100

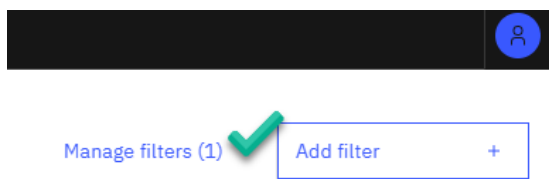
Filter selection

☐ Lower ☒ Both ☐ Upper

Cancel Add filter

_3. Click the **Close** button to close the *Manage filters* window

Note that the new filter is now in effect



3.2.8.2.3 Use Template Filter to Compare Employee Performance

Let's find out which employee turns out to be more productive! As you will find out, the answer is not simple.

_1. For As-is, select **Usr 141** for To-be, select **Usr 143**, and then click **Update comparison**

A

Client Onboarding

Filter template

Usr 141

Applied filters (1) [Add new filter](#)

Resource is "usr141" X

Create new filter template +

B

Client Onboarding

Filter template

Usr 143

Applied filters (1) [Add new filter](#)

Resource is "usr143" X

Create new filter template +

[Reset to previous filters](#) [Update comparison](#)

_2. Let's examine the **Process details** view.

Measure:	Average	As-is	To-be
Case count		8	5
Average case lead time		1hr 11mins	1hr 32mins
Average case cost		EUR 423.94	EUR 393.20
Total case cost		EUR 3,391.50	EUR 1,966.00

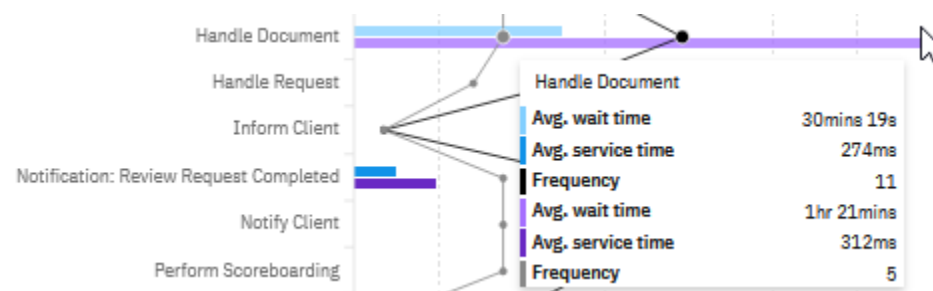
The results look confusing. **Usr 141** completes cases faster than **Usr 143**, but **Usr 143** case cost is lower than **Usr 141**.

_3. Not the Case count numbers 8 and 5. You will use these numbers later on to calculate Average Activity Costs.

3.2.8.2.4 Average Lead Time Comparison and Explanation

Let's examine the Activity Duration view to see why **Usr 141** completes cases faster than **Usr 143**

_1. Hover the mouse over **Handle Document** Activity



Let's examine the Review Document process to see how Handle Document Activity is orchestrated.

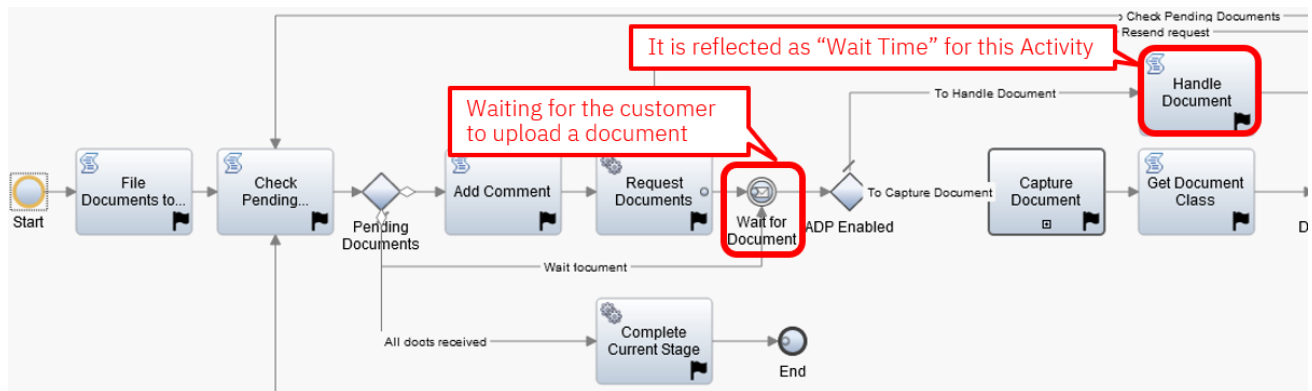


Figure 8. Impact on Waiting for Documents to be Submitted on Lead Time

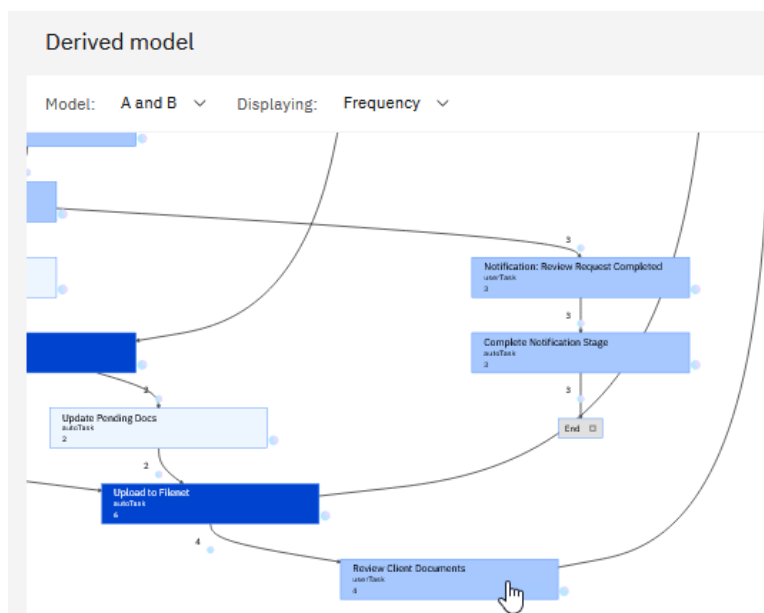
The Figure above shows that the **Wait for Document** message-receive Activity (not recorded in the Process Mining Model) must be complete before the **Handle Document** Activity can start! The **Wait for Document** message-receive Activity blocks the **Handle Document** Activity

We discovered that waiting for customers to supply documents is the root cause of the employee's **Usr 143** poor Case Lead KPI score, but at the same time, we concluded that although it is impacting Case Lead time, we cannot blame **Usr 143**.

3.2.8.2.5 Case Cost Comparison and Explanation

Let's examine the Derived model view to see why **Usr 141** cost is higher than **Usr 143**

_1. In the *Derived model* view (located at the bottom of the page), **find Review Client Documents** Activity



_2. Click **Review Client Documents** Activity

_3. Examine the legend in the top right corner of the view to identify the Frequency numbers 5 and 1. You will use these numbers later on to calculate Average Activity Costs.

Review Client Documents	A	B
Frequency	5	1
Max duration	16mins 45s	1min 8s
Min duration	0	1min 8s
Median duration	49s 396ms	1min 8s
Average duration	3mins 53s	1min 8s
Cost	EUR 125.00	EUR 125.00

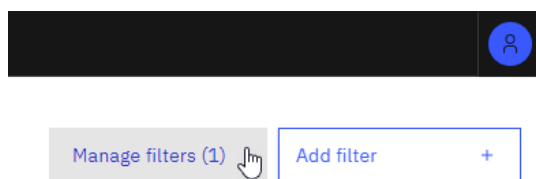
Let's use this formula to calculate the Average Cost of the Average Review Client Documents Activity:

$$\text{Average Activity Cost} = (\text{Activity Frequency} / \text{Number of Cases Completed}) * \text{Activity Cost}$$

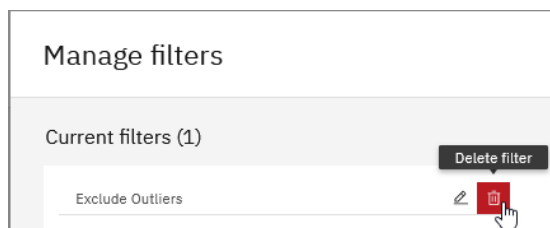
The results are summarized in the table below:

Employee	Average Activity Cost	Conclusion
Usr 141	$(5 / 8) * \text{EUR } 125.0 = \text{EUR } 78.1$	The employee Usr 141 , had to review documents more often. Since this is a costly activity, it had a more significant impact on the average case cost than for the employee Usr 143 .
Usr 143	$(1 / 5) * \text{EUR } 125.0 = \text{EUR } 30.0$	

_4. Click **Manage filters (1)**



_5. In the *Manage filters* window, click **Delete filter**



_6. Click the **Close** button to close the *Manage filters* window

Process Improvement Insight:

(1) Comparing two clients. Two factors affected Automation Elite Inc.'s longer case lead time. Due to inaccurate or missing documents, it took significantly longer to review documents. Time-consuming manual intervention was required to recover a failed RPA bot that updated client information.

(2) Comparing the performance of two employees. Waiting for customers to supply documents is the root cause of the employee's Usr 143 poor Case Lead KPI score. The employee Usr 141, reviews documents more often. Since this is a costly activity, it had a more significant impact on the average case cost than for the employee Usr 143

3.2.9 Happy Path Analysis for New Straight Though Workflow Candidate

In the [Use Filter to Discover Happy Path](#), section, we discovered the "Happy Path" in the Client Onboarding Workflow. We will now evaluate it against instances that did not follow the "Happy Path." If the evaluation

goes well, we will export the BPMN diagram and hand it to the IT Organization to consider using the Happy Path Process Variant as a fully automated Straight-Through-Process implementation!

3.2.9.1 Happy Path Comparison

We have already created two filter templates for you to save some lab steps: Happy Path and Exclude Happy Path. We will use them to compare the Happy Path case variant with one that does not include the Happy Path cases.

_1. For As-is, select **Exclude Happy Path** for To-be, select **Happy Path**, and then click **Update comparison**

A

Client Onboarding

Filter template

Exclude Happy Path

Applied filters (1) Add new filter

Exclude Happy Path X

Create new filter template +

B

Client Onboarding

Filter template

Happy Path

Applied filters (1) Add new filter

Happy Path X

Create new filter template +

Clear comparison

Reset to previous filters

Update comparison

_2. Let's examine the **Process details** view.

Process details		
	A	B
Measure:	As-is	To-be
Case count	46	11
Average case lead time	3hrs 1min	1hr 23mins
Average case cost	EUR 714.49	EUR 272.83
Total case cost	EUR 32,866.50	EUR 3,001.17

The "Happy Path" process variant is the winner! It has almost three times lower lead time and nearly three times the average cost. It looks promising!

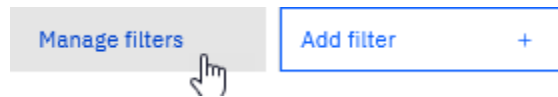
3.2.9.2 Generate Happy Path BPMN Process

We will create a BPMN Process diagram, export it to a file, and hand it to the IT Organization.

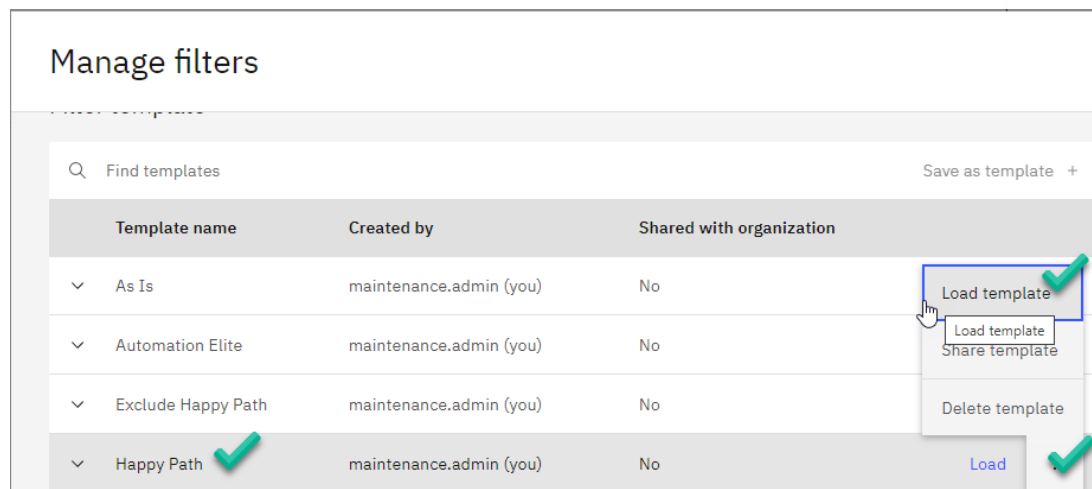
3.2.9.2.1 Create BPMN Diagram

First, let's apply the Happy Path filter to include only the Happ Path Cases.

1. Click **Manage filters**



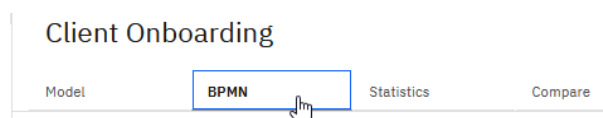
_2. Select the **Happy Path filter, click **vertical ellipses**, and then select **Load template****



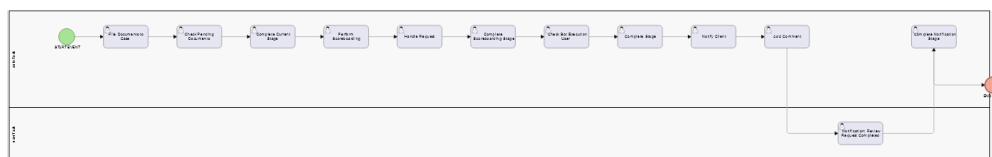
3. On Applying this template replaces all current filters message box, click **Continue**

4. Click the **Close** button to close the *Manage filters* window

5. Click **BPMN** tab



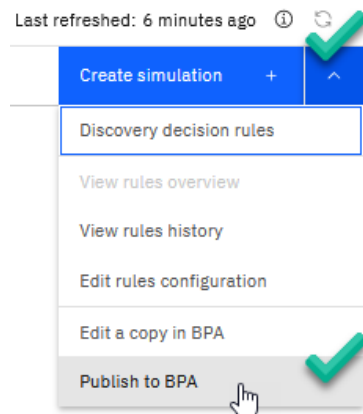
You should now see the BPMN diagram of the Happy Path process



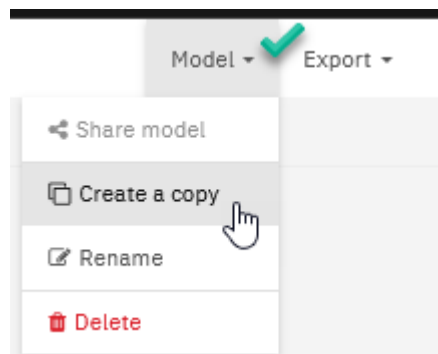
This BPMN diagram does not contain any decisions. However, if it did, the Decision Rules Mining capability would automatically discover the correlations within the mined data and detect decisions governing the Process. The decision could then be exported in DMN format. DMN stands for Decision Model and Notation, see <https://www.omg.org/dmn/>) format.

3.2.9.2.2 Export BPMN Diagram

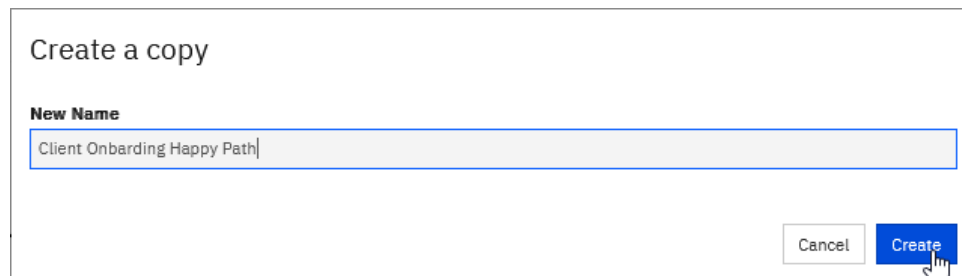
_1. Click the **dropdown** next to *Create simulation +* and then click **Publish to BPA**



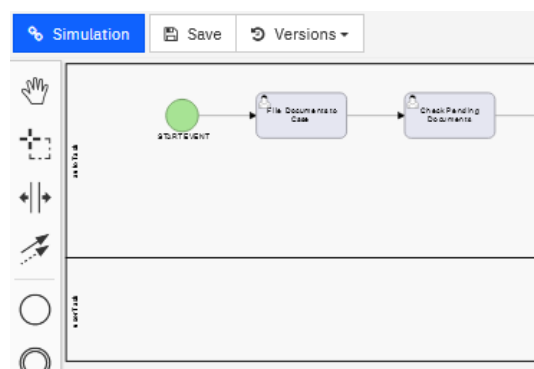
_2. Click the **Model dropdown**, and then click **Create a copy**



_3. For *New Name* enter **Client Onboarding Happy Path** and then click **Create**



You should now see the BPMN diagram in edit mode, with the palette appearing on the left.



The following are optional high-level steps that are not required to complete the lab.

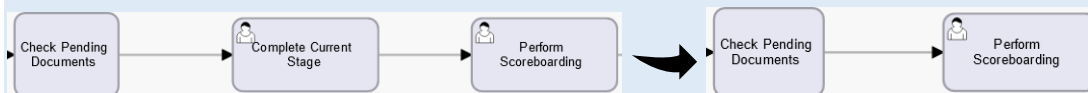
The next step would be to export the BPMN Process. Before exporting the BPMN Process Model, we could now make some changes in the BPMN Editor. Or you could export the Process as is and make the changes in IBM Process Designer in Business Automation Studio.

If you prefer to make the changes in the BPMN Editor, follow these steps.

Change activity types from User Task to a Manual Task

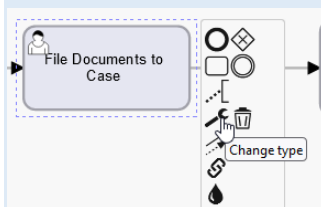


Remove Activities associated with Complete Case Stages (there are no stages in a Straight-Through-Process)

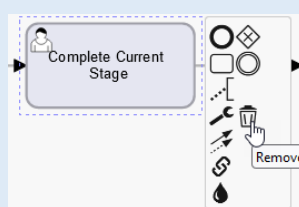


Making these model changes is not required to complete the exercise. But if you like to attempt it, here is how.

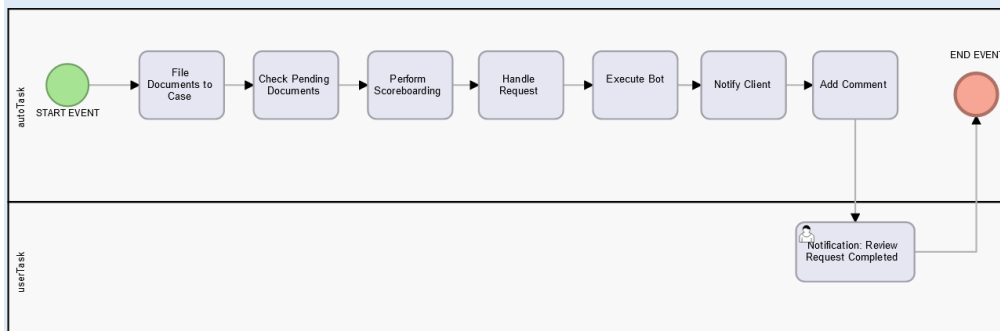
To change activity type



To delete an activity



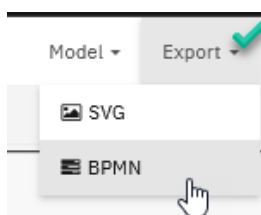
The edited flow should then look similar to this



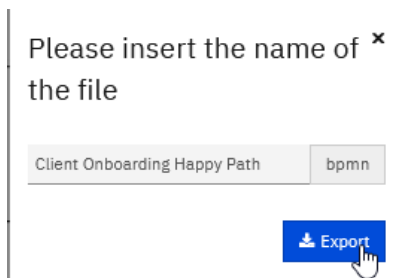
When you are done, click Save



_4. Click the **Export dropdown** and then select **BPMN**



_5. Click **Export**

A screenshot of a web application's export dialog. At the top, it says "Please insert the name of the file" with a close icon (x) to the right. Below this is a text input field containing "Client Onboarding Happy Path" and a file type dropdown menu set to "bpmn". At the bottom right of the dialog is a blue button with a download icon and the word "Export". A mouse cursor is pointing at the "Export" button.

Please insert the name of the file ✕

Client Onboarding Happy Path bpmn

Export

_6. If you plan to use the exported BPMN file later, select the folder and click **Save**

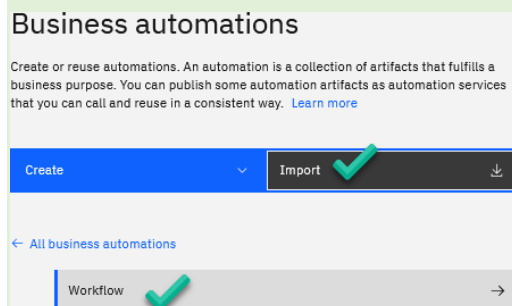


The exported BPMN model could be imported to any BPMN-compliant editor, including IBM Blueworks Live. IBM Blueworks Live processes can also be imported to IBM Process Mining to perform simulations based on the automatically generated event data. The BPMN import transformation maps the Work Time to Working time but does not use Wait time.

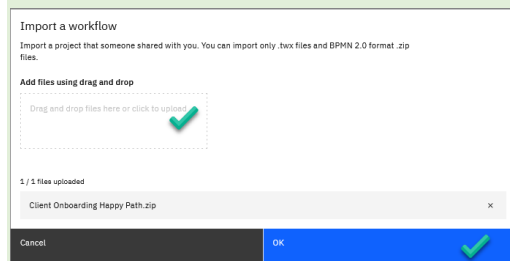
The following are high-level optional steps that are not required to complete the lab.

To import the BPMN file to Web Process Designer, switch to Business Automation Studio and follow these steps:

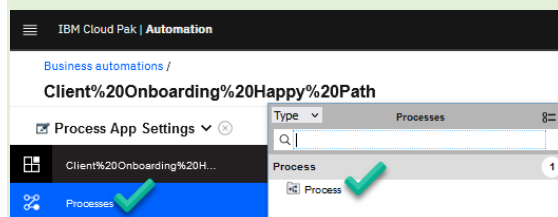
- Create a zip from the "Client Onboarding Happy Path.bpmn" file
- In Business Automations, select Workflow and then Import



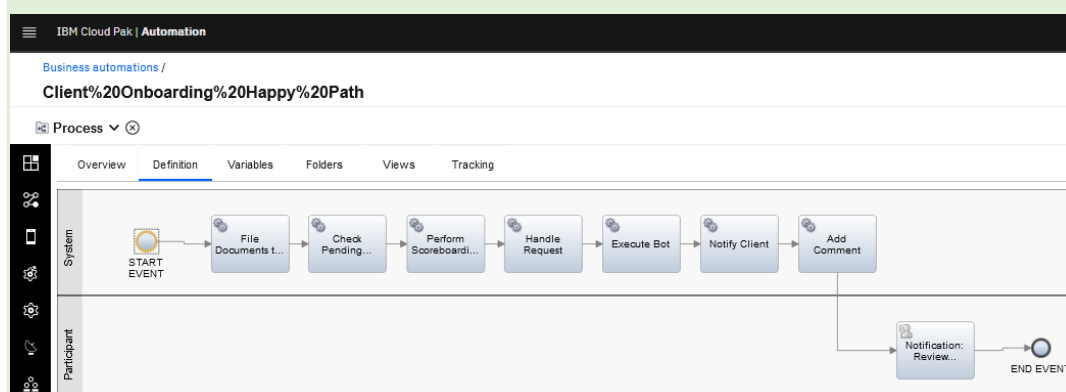
- Drag and drop "Client Onboarding Happy Path.zip" file and click OK



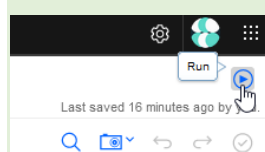
- When Process Designer opens, select Process and then click Process



- The imported Process is executable!

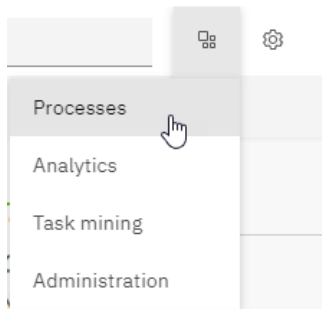


- Try executing it if you like.

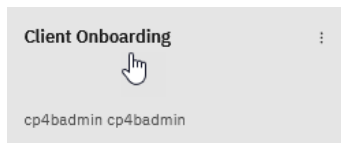


Of course, the Process does not do anything because none of the activities are implemented. This would be the next step to create a BPMN Straight Through Process.

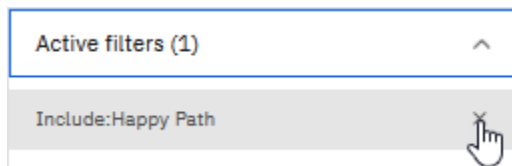
_7. Click **Processes** to switch back to the Process Mining component



_8. Reopen the **Client Onboarding** Process from the *Recent process* list.



_9. Click **X** to remove the Active filter "Include: Happy Path" filter



Process Improvement Insight:

The Compare feature provided the evidence (significantly lower Case Cost and Lead Time for 20% of all cases) to justify investment in creating a Straight Through Process (STP) version of the Client Onboarding Workflow.

When implementing the STP process, the IT organization could also consider automating the only remaining human task in the Process:



Removing this async Activity would make the Client Onboarding Happy Path Process a true STP process,.

3.2.10 Using Dashboards to Optimize Client Onboarding Workflow

Dashboards are a vital feature of the Analytics component of IBM Process Mining. They are authored to provide critical business insights and enable the business user to monitor near real-time critical business metrics and, if needed, dive into a problem-solving mode immediately.

Below are handy definitions of some terms we will use in this part of the lab.

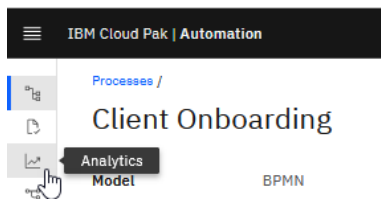
Throughput Time = Service time + Waiting Time

Service Time = End Time – Start Time

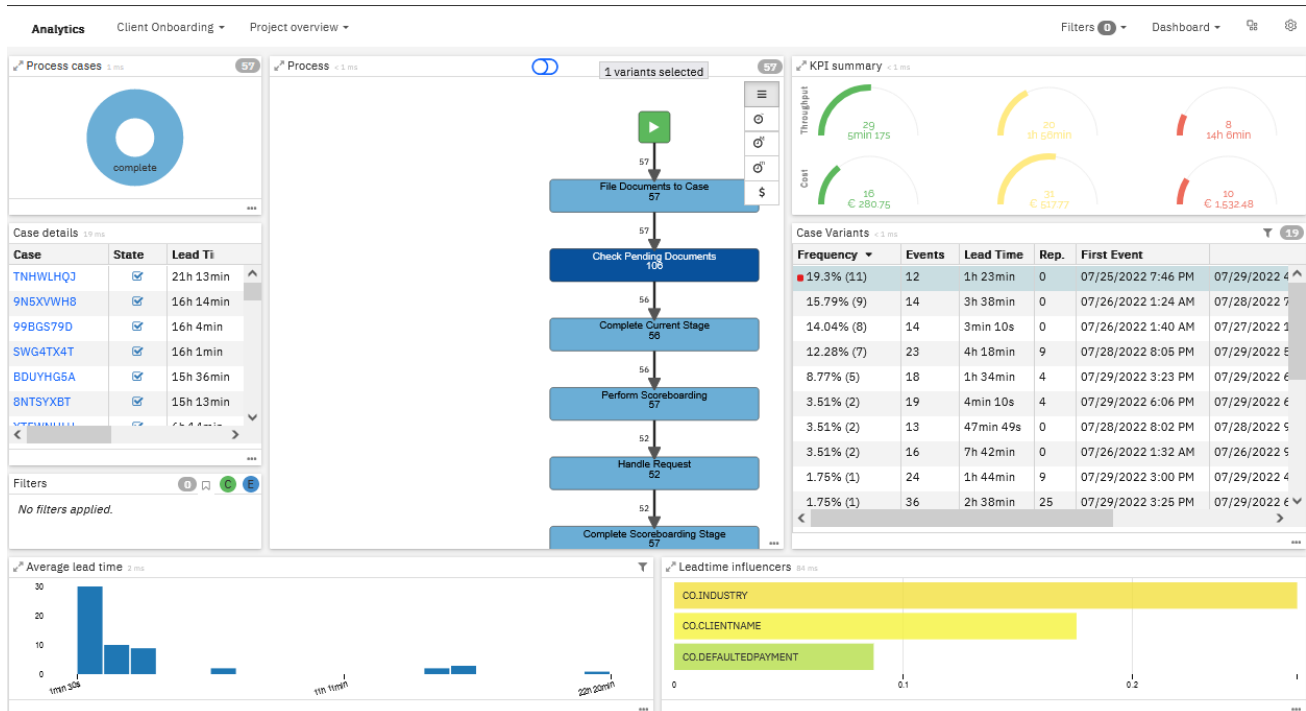
Waiting Time = Previous Activity Stop time – Next Activity Start Time

All the above metrics are available because the data is retrieved from IBM Business Automation Insights. Logs from systems that do not provide Activity End Time use different calculations for the above metrics.

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



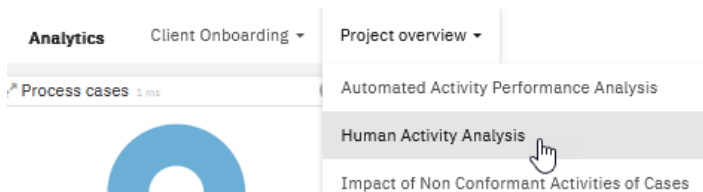
The Analytics view opens, displaying a system-generated *Project overview* Dashboard available to all projects. The default Dashboard cannot be deleted or changed but can be duplicated and then modified.



3.2.10.1 Human Activity Analysis Dashboard

We built this custom dashboard for you to identify and analyze Human Activities' impact on the Process Lead time and Process Cost.

_1. Select **Human Activity Analysis**




3.2.10.1.1 Build Average Human Activity Service Time Chart

Before we proceed with the analysis, let's gain some practical experience building a chart related to Service Time.

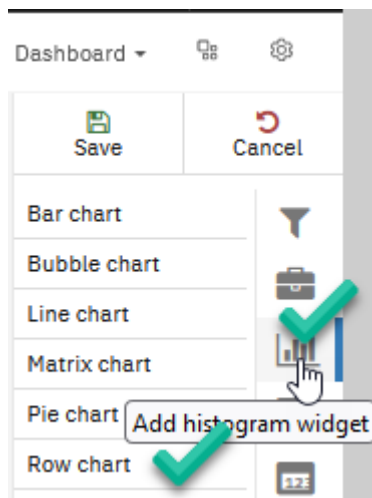
_2. Click **Edit**



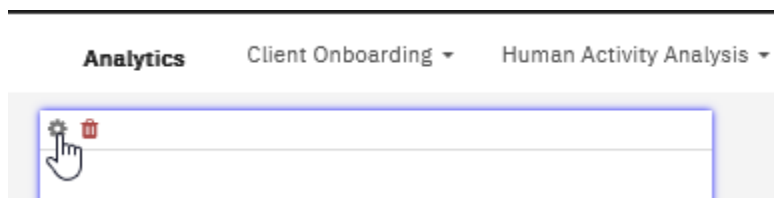


Custom dashboards are built from configurable pre-built widgets (the first six categories) or from user-defined custom widgets that require IT skills (the last category in the palette ).

_3. From the palette, select **Add histogram widget** and then select **Row chart**



_4. Click the **gear icon** to configure the new widget



_5. For *Title*, enter **Average Human Activity Service Time**

Title:

Average Human Activity Service Time

_6. For *Dimensions*, click **+**, and from the dropdown, select **Activity**

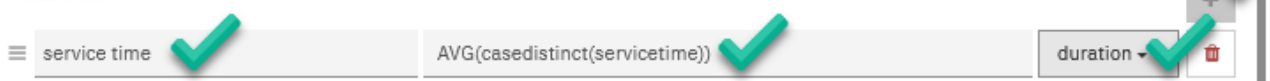
Dimensions:



_7. For *Measures*, click **+**, and then enter the following values

Setting	Value
Name	service time
Expression	AVG(casedistinct(servicetime))
Data type	duration

Measures:



_8. For *Filters*, enter **TYPE = 'userTask'** to ensure we are only looking at the Human Activities

Filters:

TYPE = 'userTask'

_9. The completed Chart should look exactly like this. Click **OK** to create it.

Row chart

Title:
Average Human Activity Service Time

Dimensions:
Activity

Measures:
service time AVG(casedistinct(service time)) duration

Filters:
TYPE = 'userTask'

Activity interval: ☐

Keep last: ☐

Apply dashboard filters: ☒

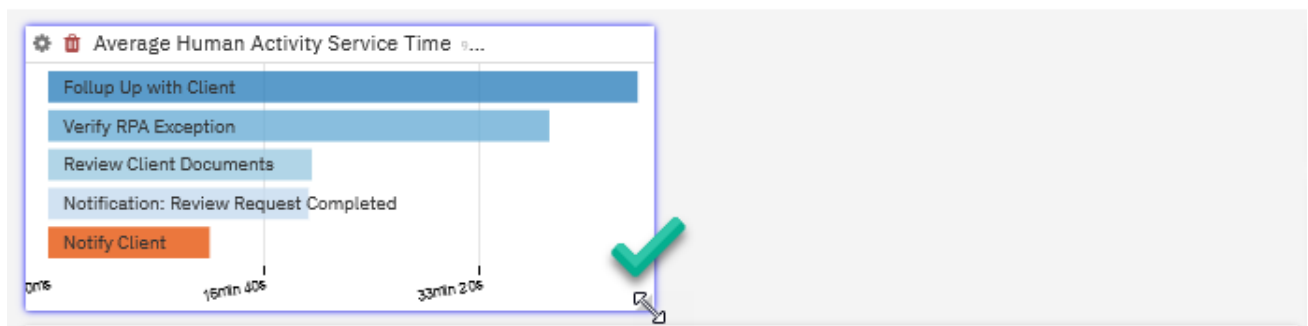
Rowset Threshold: 10

Activities conformance: Show all

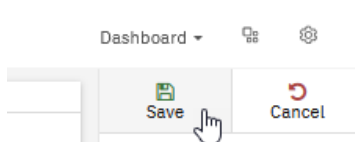
Hide empty dimension: ☐

Show help show SQL-like query Cancel OK

_10. Grab the **bottom right corner** of the Chart to expand it to the right and down,



_11. Click **Save**



Note, to learn more about creating Dashboard Charts, see <https://www.ibm.com/docs/en/process-mining/1.13.0.x?topic=manual-analytics>

3.2.10.1.2 Human Activity Analysis

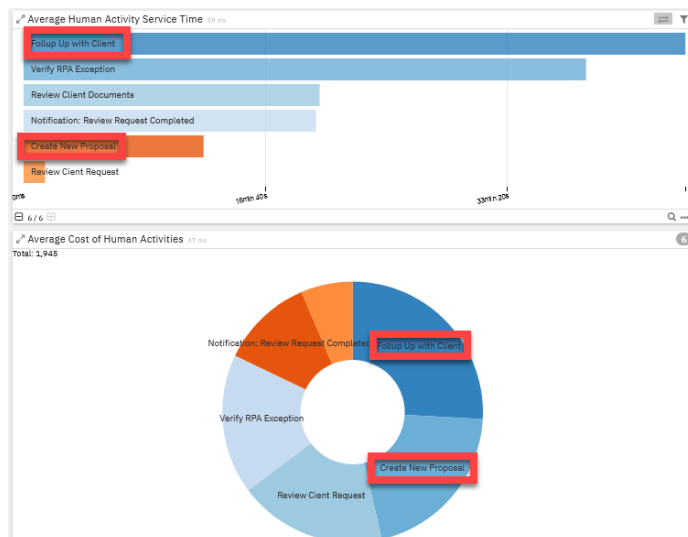
Let's focus on two Human Activities that implement the two optional steps in our Case Solution: **Create New Proposal** and **Follow Up with Client**.

Optional activities

Create New Proposal
Create a new proposal for the client with other services they
Precondition: Stage started: Scoreboarding
Set: <None>

Follow Up with Client
Follow up with the client after the onboarding request has
Precondition: Stage started: Notification
Set: <None>

_1. Notice that these two activities have high Service Time and high Average Cost.



_2. In the pie chart, click **Create New Proposal**. Then **wait a few moments**. Then click **Follow Up with Client**.



_3. Note that this action filtered out the cases that do not include the above Human Activities.

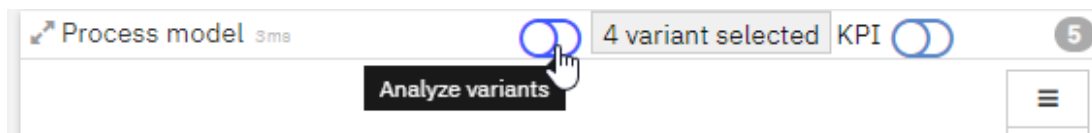
You should now see two filters to this dashboard applied. Note that the filters are internal only to this dashboard

Filters

activity :

- Create New Proposal
- Follow Up with Client

_4. In the *Process model* widget, click **Analyze variants**

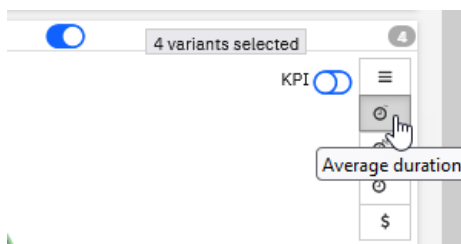


Note that we now have 19 Variants. A different color represents each Variant's Path. Note that the blue Variant has only one Case.

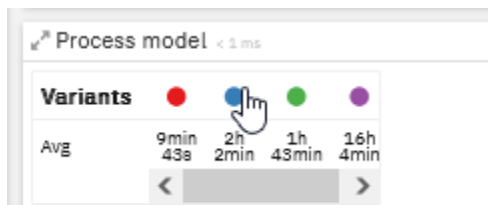
Variables				
cases	2	1	1	1
activities	16	28	25	14

_5. Use the mouse wheel to adjust the *Model view* to fit the viewing area

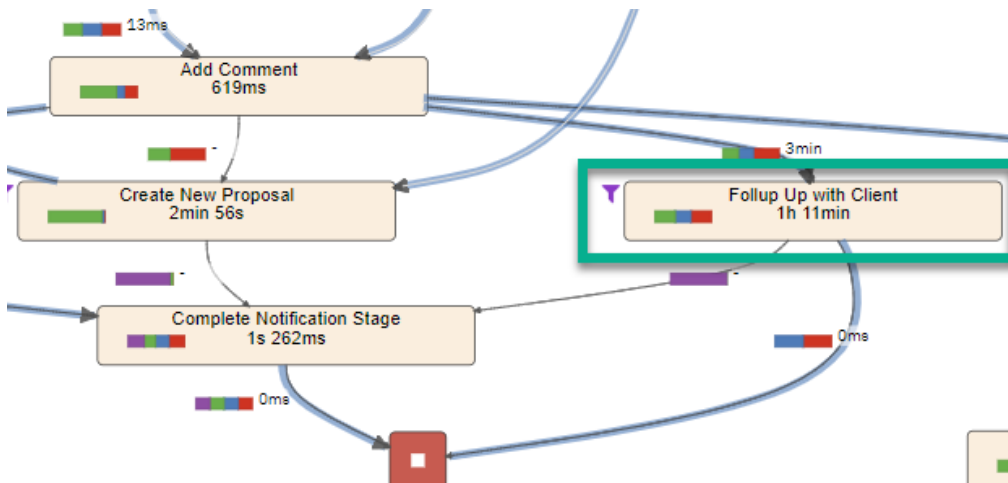
_6. Select **Average Duration** View



_7. Click on the **blue Variant**



Notice that following the blue Variant's process path, you can see what activities were executed in a single Case. Also, notice in this Variant, it took 1 hour 11 min to complete Follow Up with Client Activity



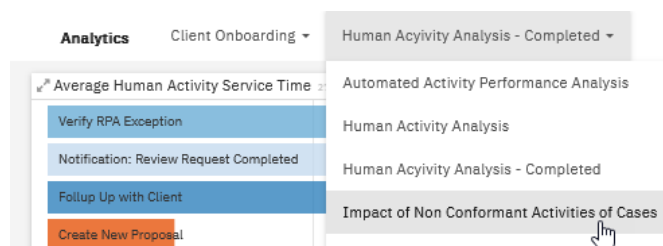
Process Improvement Insight:

We identified human Activities with comparatively large Activity Costs and Service Time. We then linked them to the Variants and Cases where they occurred and assessed their impact. This analysis typically leads to business initiatives such as automation or organizational changes. Later, in this lab, you will learn how any such process improvements we identified in Dashboards can be simulated to understand their impact on process metrics such as Cost and Lead Time.

3.2.10.2 Impact of Non-Conformant Activities on Cases Dashboard

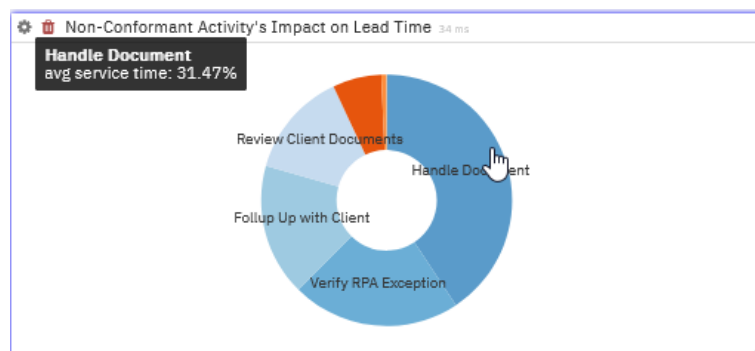
This dashboard helps assess the non-conformant activities' impact on the Case Lead Time and Case Cost.

_1. Select **Impact of Non Conformant Activities on Cases**



3.2.10.2.1 Case Lead Time

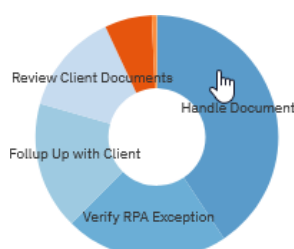
_2. Notice that the **automated** Activity called **Handle Document** contributes to Lead Time with 31.47%.



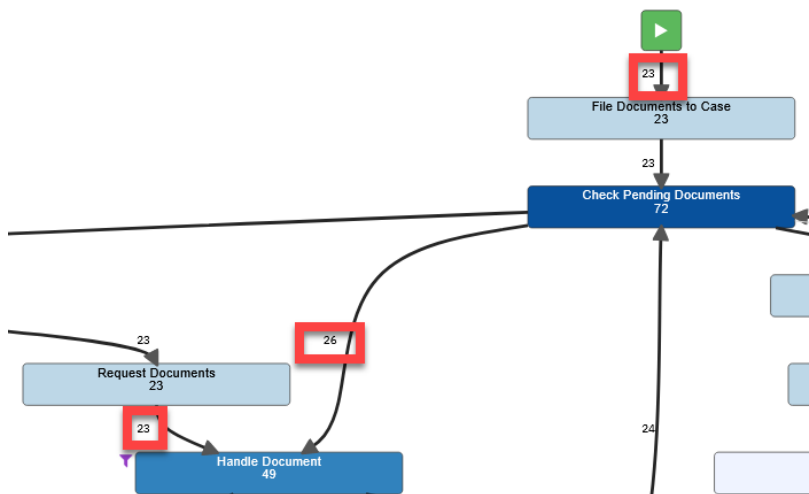
_3. Typically, automated activities are fast (low Service Time), but as shown in the Chart, they may have a considerable Wait Time.

Impact of Non-Conformant Activities 62 ms			
	Avg Service Time	Total Cost of Deviation	Avg Wait Time
Create New Proposal	0ms 12min 24s	€ 0.00 € 3,200.00	0ms 1min 37s
Follup Up with Client	0ms 45min 36s	€ 0.00 € 3,015.00	0ms 2min 40s
Handle Document	280ms 0ms	€ 179.67 € 0.00	27min 54s 0ms

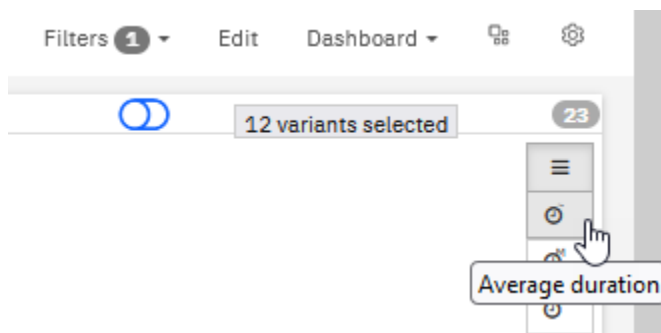
_4. Click the **Handle Document** wedge in the pie Chart



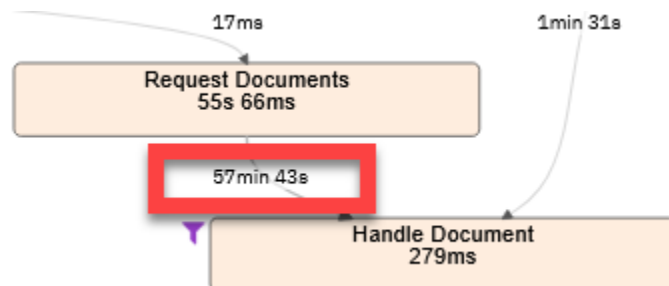
_5. Notice we only have 23 instances, but Handle Document is invoked 49 times. This means Rework which adds to a Case lead time!



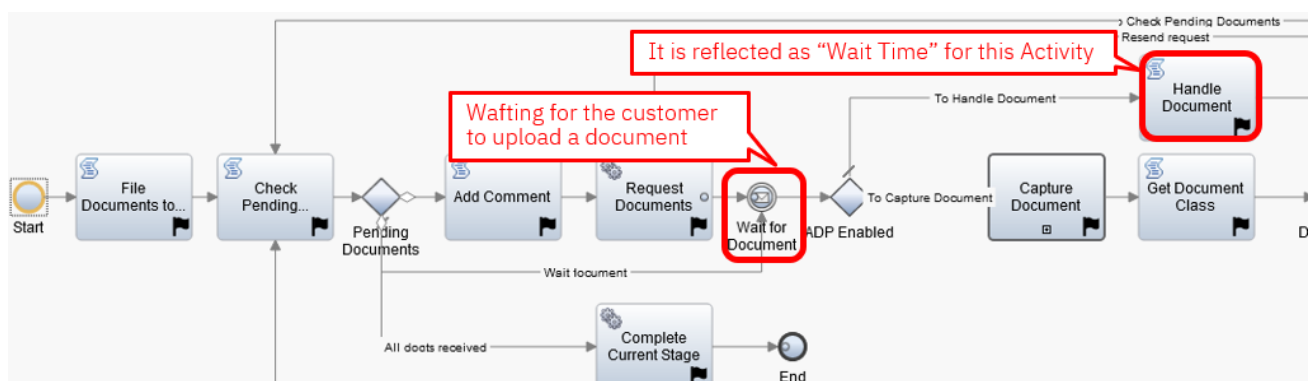
_6. On the *Process model*, select the **Average duration**



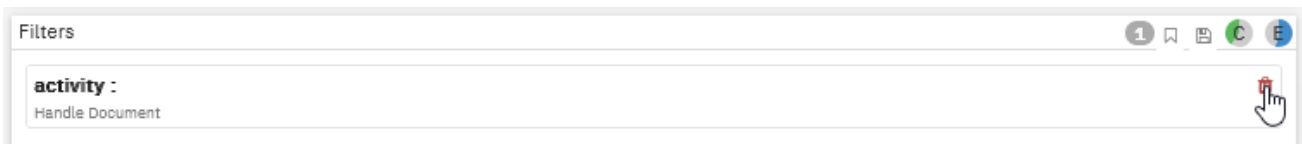
_7. Notice the long wait time!



Recall from the previous analysis that the **Wait for Document** message-receive Activity blocks the **Handle Document** Activity:



_8. Click on the **red garbage can icon** to remove the filter



3.2.10.2.2 Case Cost

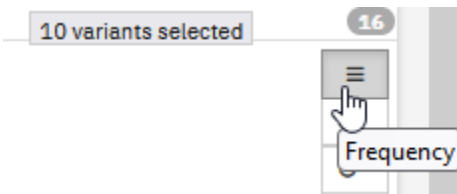
We have already investigated **Create New Proposal** and **Follow up with Client** (optional Activities). Let's focus now on another non-conformant activity that is not optional: **Review Client Documents** Activity – it has a 3rd high Cost of Deviation!

Review Client Documents	0ms	€ 0.00	0ms
	16min 19s	€ 3,125.00	14ms

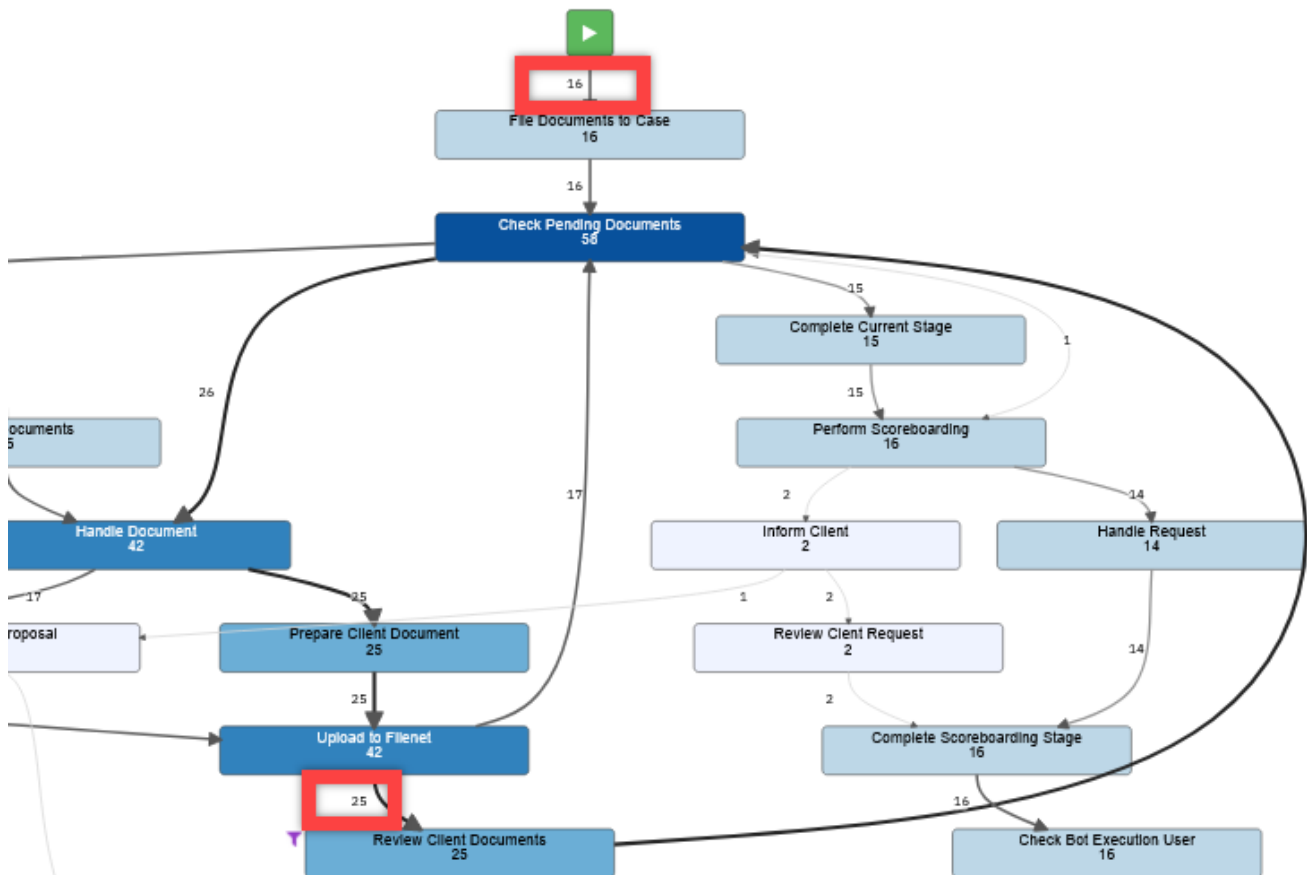
_1. Click the **Review Client Documents** wedge in the pie Chart



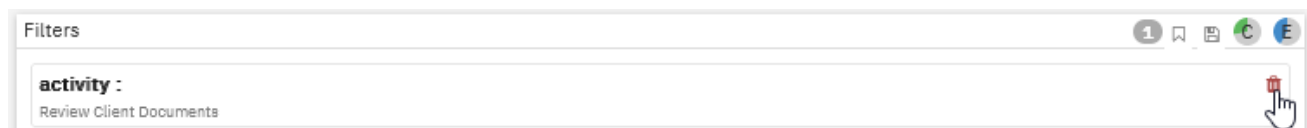
_2. In the *Process model* view, select **Frequency**



_3. Notice we only have 16 instances, but the Review Client Documents Activity is invoked 25 times. This means Rework which adds to a Case Cost.



_4. Click red on the **red garbage can** icon to remove the filter



Process Improvement Insight:

(1) Case Lead Time. We discovered that the Average Wait time of an automated non-conformant Handle Document Activity was a key contributor to Case Lead Time in one of the Variants and, with the help of the IT organization, identified that waiting for clients to upload documents was the root cause.

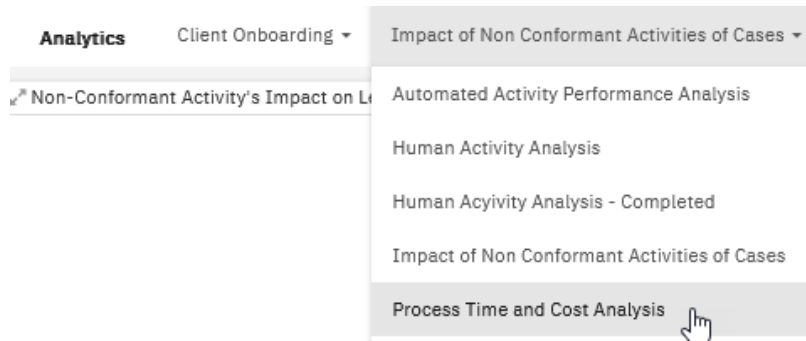
(2) Case Cost. We discovered that the Cost of an automated non-conformant Review Client Documents Activity was a key contributor to Case Cost. Additionally, this Activity was involved in rework loops and contributed to high Case Costs.

Business action is to ensure the customer provides all documents and that the documents are correct when requesting a new service for the first time.

3.2.10.3 Process Time and Cost Analysis Dashboard

This dashboard focuses on individual case performance concerning Cost and Throughput KPI. It identifies KPI violators at the case level and enables drilling down to gain more insights into the root causes.

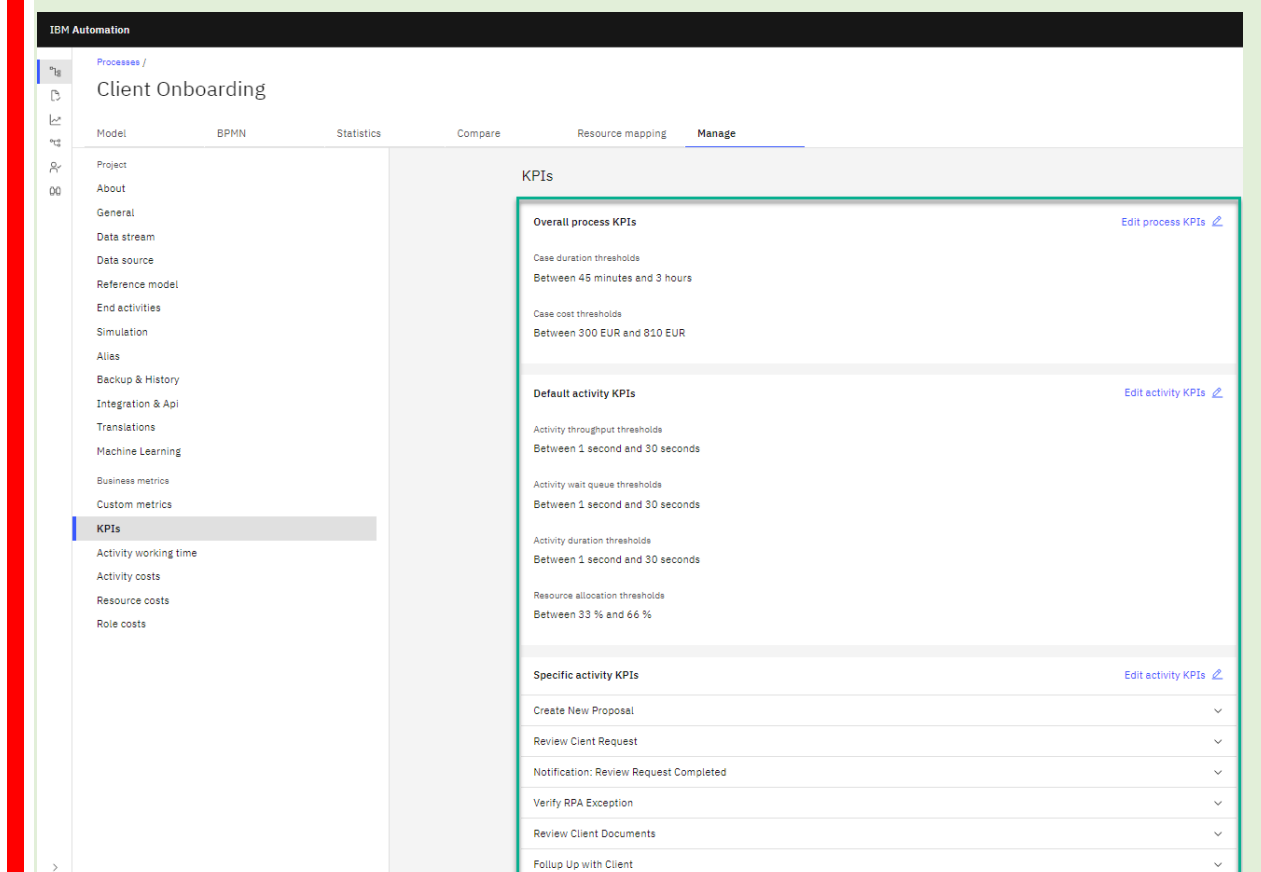
_1. Select **Process Time and Cost Analysis**



_2. Let's examine the widgets.

Before we examine the widgets, it is worth mentioning where the KPI settings used in the widgets come from.

The KPI Settings were defined in the Process definition Manage > KPIs. The KPI



The **KPI Summary** widget shows Case Duration and Case Cost according to the KPI Settings.

See the Figure below to see how these dashboards are related to the KPI Settings.

The **Case details** widget shows the non-conformant activities' impact on the Case Lead Time and Case cost. Some of the less apparent columns are: Status (running or complete), Rep. (number of repetitions/rework loops), Kpi (number of KPI violations)

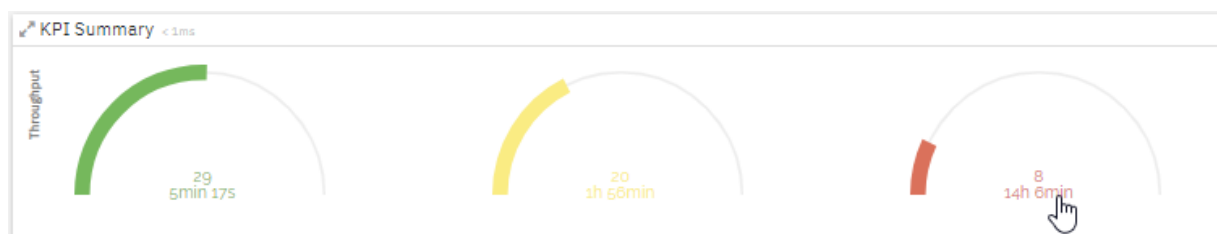


Figure 9. KPI Settings Relation to the Built-in Dashboards: KPI Summary and Case Details.

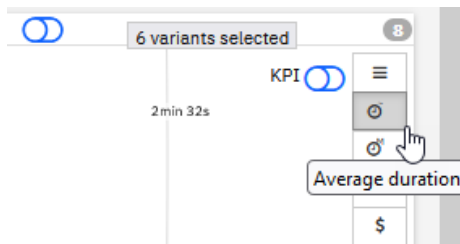
3.2.10.3.1 Drill Down into Throughput KPI Violators

Let's examine the cases that contributed to Throughput KPI violations.

_1. Click on the **text** in the **Red KPI** of the Throughput.



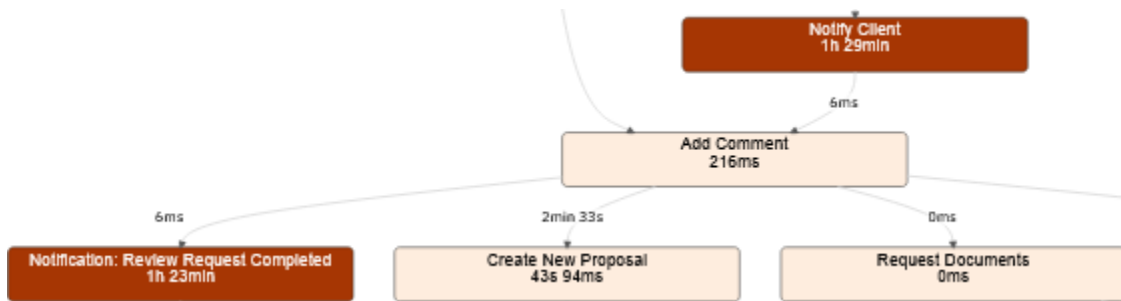
_2. In the *Process model* widget, click **Average duration**



_3. There are two activities with excessive Service time:

- **Notify Client** (automated Activity): 1h 29m average duration
- **Notification: Review Request Completed** (human Activity): 1h 23m average duration

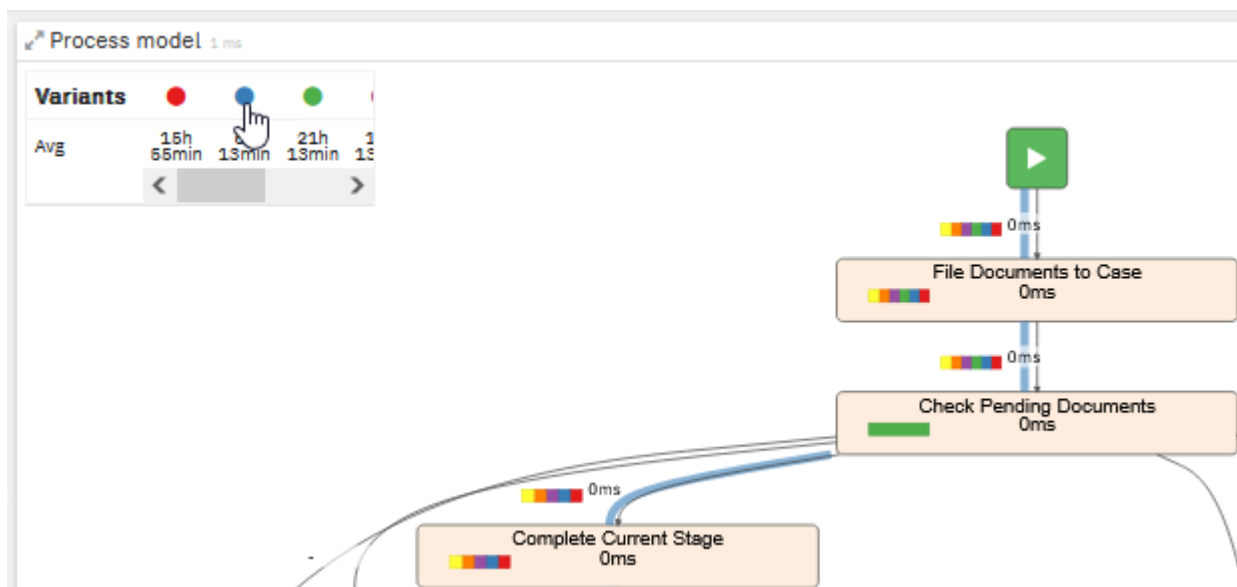
Later in this lab, we will use Simulation capability to determine if providing more computing resources to *Notify Client Activity* and automating the *Notification: Review Request Completed* Activity can help reduce the process cost and increase the throughput.



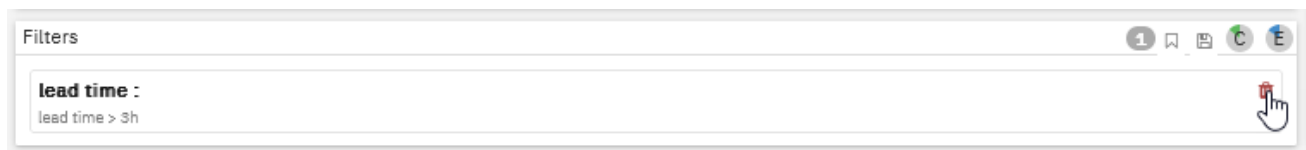
_4. Click **Analyze variants**



Note that all 6 variants and 8 cases contributed to the Case Lead Time KPI violation. You can now analyze them separately by clicking on the colored dots



_5. Click the **red garbage can** to remove the dashboard filter



3.2.10.3.2 Examine a Specific Case with High KPI Violation


Let's pick an individual case of interest and determine the root cause of throughput and cost KPI violations.

_1. In the *Case details* widget, click on the Case ID **8NTSYXBT**

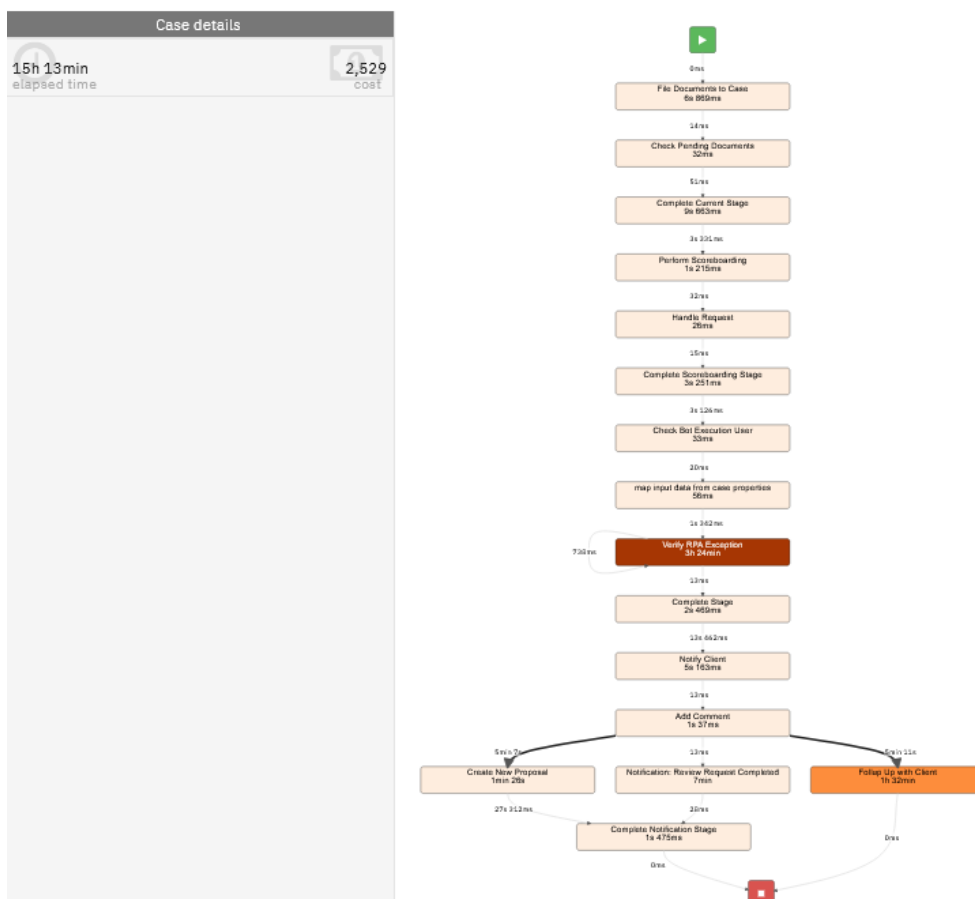
This Case looks interesting as it has a good combination of undesirable metrics!

Case details 15 ms							
Case	State	Lead Time ▾	Cost ▾	⌚	\$	Rep.	Kpi
TNHWLHQJ	✓	21h 13min	€ 749.50	⊗	☹	23	8
9N5XVWH8	✓	16h 14min	€ 2,639.00	⊗	⊗	6	1
99BGS79D	✓	16h 4min	€ 1,175.33	⊗	⊗	0	7
SWG4TX4T	✓	16h 1min	€ 439.50	⊗	☹	5	3
BDUYHG5A	✓	15h 36min	€ 614.00	⊗	☹	0	1
8NTSYXBT	✓	15h 13min	€ 2,529.00	⊗	⊗	3	4

_2. A View showing the Model for the selected Case will appear.

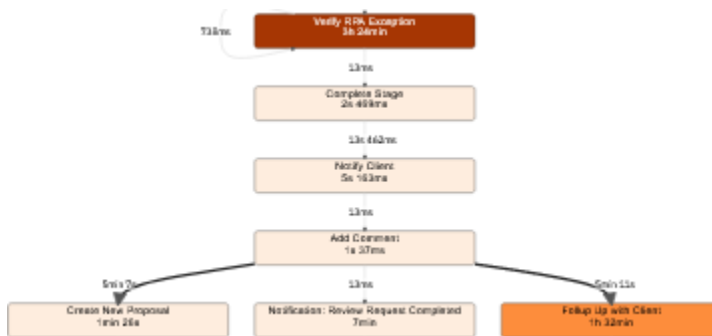
 Hint: Use the mouse wheel to zoom and the mouse right button to move the Process diagram.

Case 8NTSYXBT



_3. Note that two **brightly colored** Activities contributed to the KPI Cost Violations:

- **Verify RPA Exception** (avg) 3h 24min
- **Follow up with Client** (avg) 1h 32 min

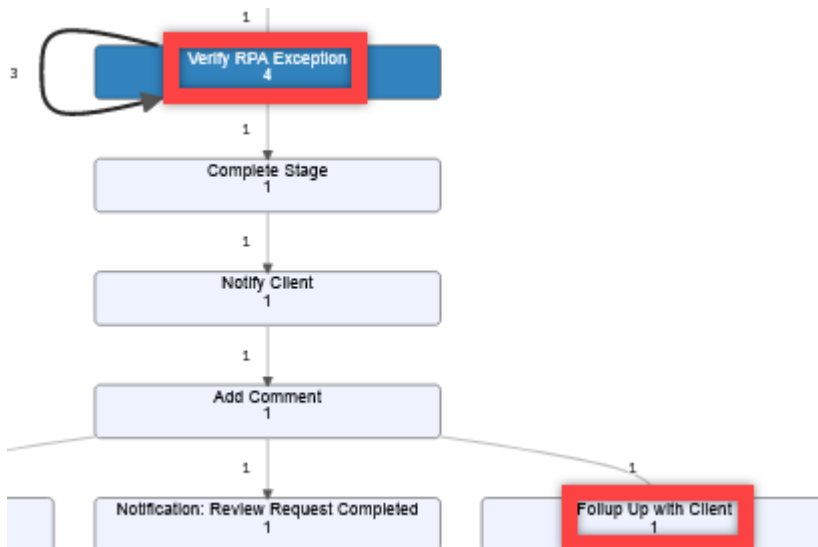


_4. Click the **Frequency View** icon

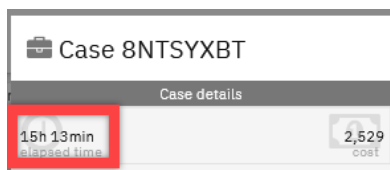
start: 07/26/2022 1:32 AM
end: 07/26/2022 4:45 PM



_5. Due to Rework, Verify RPA Exception was executed four times while Follow Up with Client was only once.



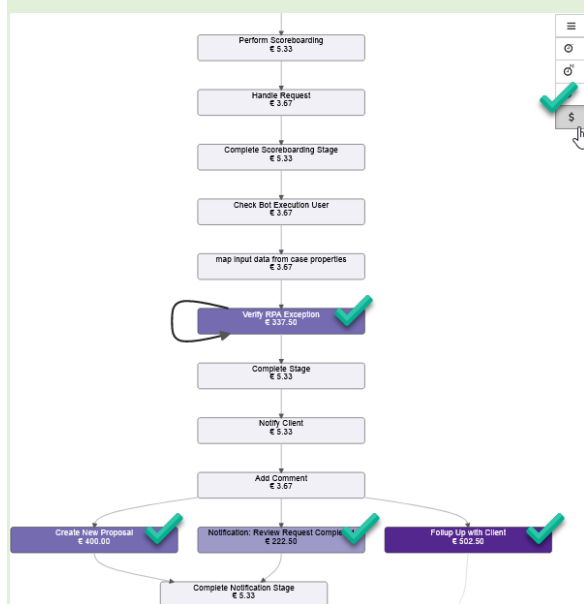
_6. We can now make our Case throughput calculations and compare them with Case details calculation



Verify RPA Exception Duration * 4 + Follow Up with Client * 1 =
3h 24min * 4 + 1h 32min = 13h 3min + 1h 32min = 15h 8min

We now see that the above two Activities combined with Rework account for 15hr 8min of the combined case duration of 15h 13min.

Note: If you like, you can now analyze the Case cost similarly. Hint: use the Cost view to identify the Activities with high Cost.



_7. Click **OK** to close the Case View



Process Improvement Insight:

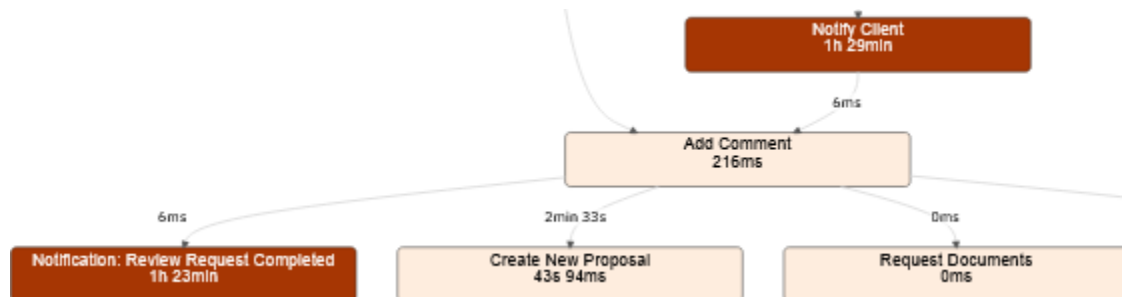
We analyzed the root causes of the Case lead Time KPI violations. We examined Variants (all cases that violated Case Lead Time KPI) and then focused on individual Cases with a high Case Lead Time and Case Cost. We discovered, just as before, that the root cause is a combination of Rework and performing high-cost optional non-conformant Activities.

3.2.11 Using Simulation Validate Business Case for Automation Candidate

The Simulation feature can make future predictions by simulating the ROI before implementing any process improvement initiative.

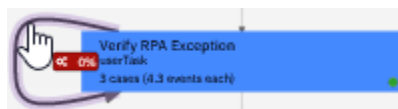
Earlier in this lab, in [Process Time and Cost Analysis Dashboard](#) section, we identified two Activities with an excessive average duration

- **Notify Client** (automated Activity) – 1h 29m average duration
- **Notification: Review Request Completed** (human Activity) – 1h 23m average duration



We will now use the Simulation capability to determine if providing more computing resources to the automated *Notify Client Activity* and automating the human-based *Notification: Review Request Completed Activity* can help reduce the process cost and increase the throughput.

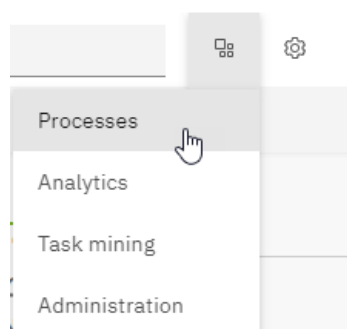
In [Self Looping Rework](#) section, we discovered the impact of self-looping of Verify RPA Exception Activity.



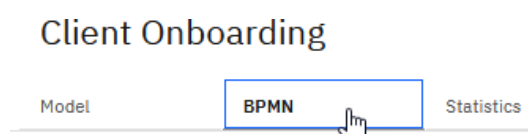
In the long run, we should be fixing the issue at the IT level. Tactically, however, we can immediately improve the performance of this Activity by adding more trained personnel to fix the failing robots.

3.2.11.1 Create New Simulation

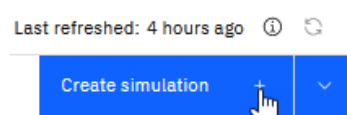
_1. Click **Process**



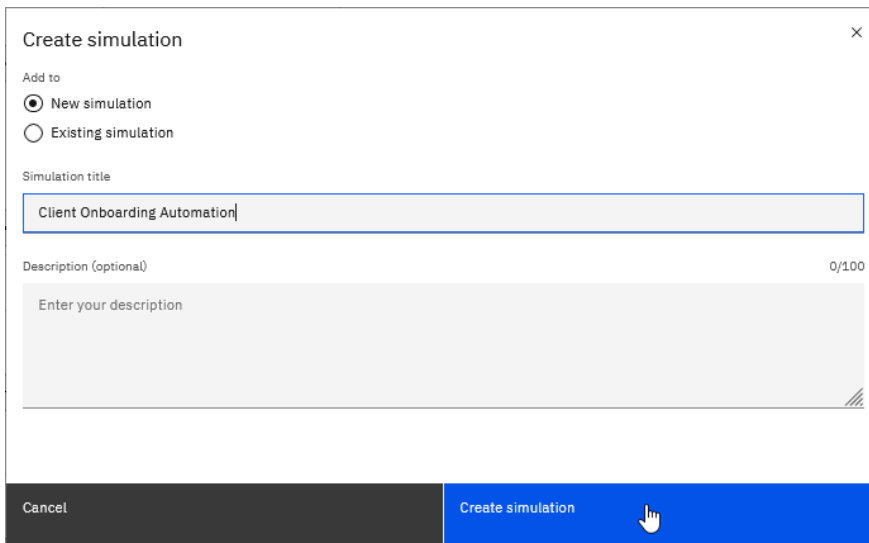
_2. Select **BPMN** tab



_3. Click **Create simulation +**



_4. For the *Simulation title* enter **Client Onboarding Automation** and then click **Create simulation**

A dialog box titled "Create simulation" with a close button (X) in the top right corner. It contains two radio buttons under "Add to": "New simulation" (selected) and "Existing simulation". Below is a text field for "Simulation title" containing "Client Onboarding Automation". Underneath is a larger text area for "Description (optional)" with a character count of "0/100" and the placeholder text "Enter your description". At the bottom are two buttons: "Cancel" and "Create simulation".

Create simulation

Add to

☒ New simulation

☐ Existing simulation

Simulation title

Client Onboarding Automation

Description (optional) 0/100

Enter your description

Cancel Create simulation

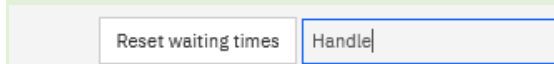
3.2.11.2 Configure Simulation

3.2.11.2.1 Initialize Incorrectly Configured Automated Activities

The Service Time on many Automated Activities is less than 1 second (i.e., 340 ms). IBM Process Mining rounds down the Working Time to seconds. As a result, Service Time and Working Time in the activity simulation settings become 0, which is not permitted. We must set the Working Time value to 1 if it is set to 0.

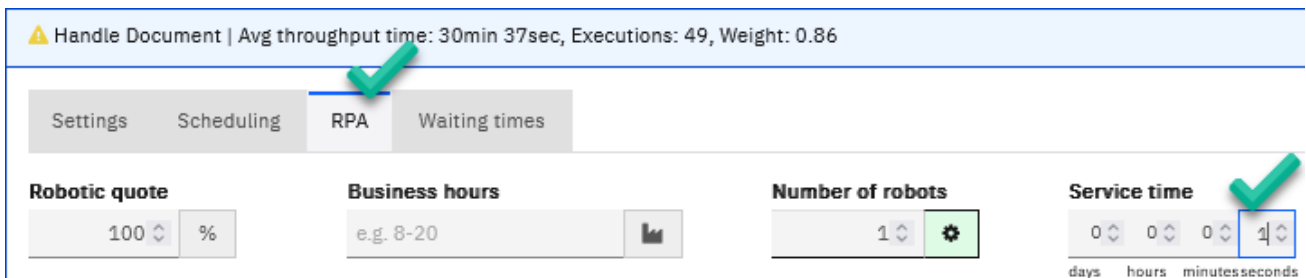
_1. Find **Handle Document** robot Activity

Hint use the search box to locate an Activity.

A search bar with a "Reset waiting times" button on the left and a text input field containing the word "Handle".

Reset waiting times Handle

_2. Click the **RPA** tab and set *Service time* to **1**

A configuration panel for the "Handle Document" activity. The top bar shows "Handle Document | Avg throughput time: 30min 37sec, Executions: 49, Weight: 0.86". Below are four tabs: "Settings", "Scheduling", "RPA" (selected with a green checkmark), and "Waiting times". The "RPA" tab contains four sections: "Robotic quote" (100%), "Business hours" (e.g. 8-20), "Number of robots" (1), and "Service time" (1 second, with a green checkmark). The "Service time" section has a breakdown: 0 days, 0 hours, 0 minutes, and 1 seconds.

Handle Document | Avg throughput time: 30min 37sec, Executions: 49, Weight: 0.86

Settings Scheduling RPA Waiting times

Robotic quote 100 %

Business hours e.g. 8-20

Number of robots 1

Service time 1

days hours minutes seconds

_3. Repeat the above steps for the following Automated Activities:

- **Prepare Client Document**
- **Update Pending Docs**
- **Check Pending Documents**
- **Handle Request**
- **Check Bot Execution User**
- **map input data from case properties**

3.2.11.2.2 Add More Computing Resources for Notify Client Activity

Notify Client Activity is already automated but has a service time of 12 min 29 seconds. Because of this, we determined that it has become a bottleneck responsible for significant Case lead times. Let's significantly increase the computing resources available and work with IT to decrease the Activity's Service Time to 1 second.

_1. Locate **Notify Client** Activity

⚠ Notify Client | Avg throughput time: 12min 31sec, Executions: 57, Weight: 1

_2. Click the **RPA** tab and set

- *Number of robots* to **100**
- *Service time* to **1 second** (change it from 12 min to 29sec)

⚠ Notify Client | Avg throughput time: 3sec, Executions: 57, Weight: 1

Settings | **Scheduling** | **RPA** | Waiting times

Robotic quote 100 %

Business hours e.g. 8-20

Number of robots 100

Service time 0 0 0 1

days hours minutes seconds

3.2.11.2.3 Automate Notification: Review Request Completed Activity

Notify Client Activity is already automated but has a service time of 12 min 29 seconds. Because of this, we determined that it has become a bottleneck responsible for significant Case lead times. Let's significantly increase the computing resources available to it!

_3. Locate **Notification: Review Request Completed** Activity

⚠ Notification: Review Request Completed | Avg throughput time: 45min, Executions: 57, Weight: 1

_4. Click the **RPA** tab and set:

- *Robotic quote* to **100** (this means the Activity is fully automated)
- *Number of robots* to **100**
- *Service time* to **1 second** (change it from 1 min to 1 sec)

⚠ Notification: Review Request Completed | Avg throughput time: 1sec, Executions: 57, Weight: 1

Settings | Scheduling | **RPA** | Waiting times

Robotic quote 100 %

Business hours e.g. 8-20

Number of robots 100

Service time 0 0 0 1

days hours minutes seconds

3.2.11.2.4 Verify RPA Exception Activity

Tactically we create a dedicated team to handle bot exceptions and provide them with better training (this will reduce the Working Time) and increase the number of people in this dedicated team.

_5. Locate **Verify RPA Exception** Activity

_6. Click the **Settings** tab and set:

- *Staff availability* to **5**
- *Working time* to **22 minutes 54 seconds**

Verify RPA Exception | Avg throughput time: 22min 57sec, Executions: 22, Weight: 0.39

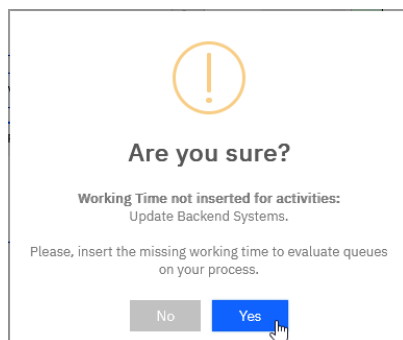
Settings	Scheduling	RPA	Waiting times
FTE 1.66	Staff availability <div> <div>5 </div> </div>	Service time <div> <div>0 </div> <div>0 </div> <div>22 </div> <div>54 </div> </div> <div>days hours minutesseconds</div>	Working time <div> <div> <div>0 </div> <div>0 </div> <div>22 </div> <div>54 </div> </div> </div> <div>days hours minutesseconds</div>

3.2.11.2.5 Run Simulate

_1. Click **Run Simulation**



_2. Click **Yes** on the *Warning message box*



_3. Click **Yes** on the *Warning message box*

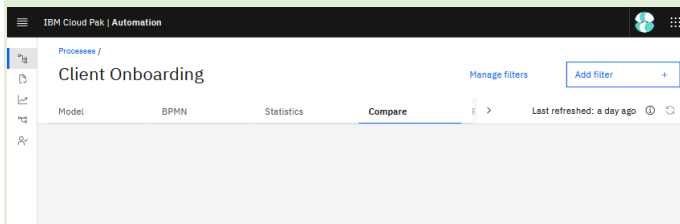
You may encounter the following issues

1. Generic error message.



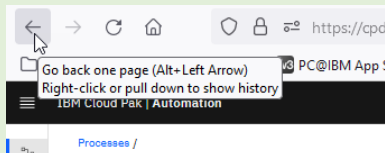
To fix this, return to the section [Initialize Incorrectly Configured Automated Activities](#) and ensure all robot Activities have a non-0 Service time to 1.

2. A blank screen or flashing screen



Solution

To fix this, in your web browser, go back to the previous page by clicking the back button,



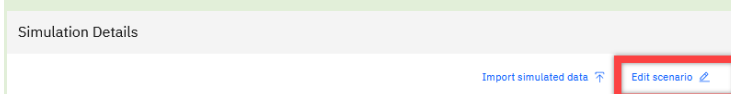
and click Run Simulation again.

3.2.11.2.6 Verify Simulation Results

_1. Examine the **Simulation Details** view.

There is a significant Case Cost decrease and an improvement in Case Lead Time. We can use this data to support a business case for process improvement investment.

Note that because of the random nature of simulations, you may see results not exactly as shown in the screenshot below. If you click the **Edit scenario** button, you can rerun the simulation and see slightly different results.



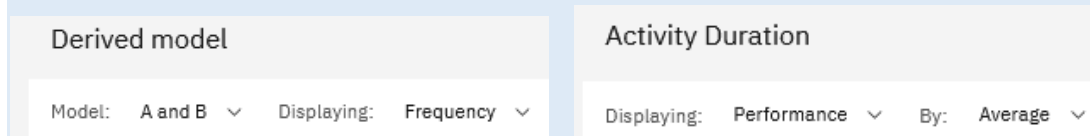
Simulation Details

			Import simulated data ↑	Edit scenario ↗
Measure:	Average ▾	As-is	To-be	
Case count		57	57	
Average case lead time		2hrs 42mins	2hrs 1min	
Average case cost		EUR 629.26	EUR 207.74	
Total case cost		EUR 35,867.67	EUR 11,841.44	

The following are high-level optional steps that are not required to complete the lab.

Optionally, if you want to explore another process improvement change, follow these steps:

Use the **Activity Duration** and **Derived model** views to gain insights into potential process improvement changes. For example, replacing Humans with Automated Activities, decreasing Activity Service Time, or increasing the number of resources (people or robots).



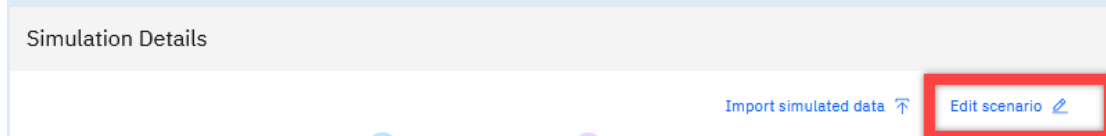
Derived model

Model: A and B ▾ Displaying: Frequency ▾

Activity Duration

Displaying: Performance ▾ By: Average ▾

Once you have decided what changes you want to make, click **Edit scenario** to get back to the Simulation Setting view



Simulation Details

Import simulated data ↗ Edit scenario ↗

Process Improvement Insight:

Through this lab, we discovered numerous process automation opportunities both at the IT and business levels. We then used the simulation feature to assess the impact of the proposed process improvements. We can use these results to calculate the ROI before implementing any process improvement initiative.

We discovered that by automating tasks, adding more people to perform tasks, or improving training, we could achieve significant process cost savings and process lead-time improvements.

3.3 Lab Summary

This lab demonstrated how IBM Process Mining leverages the Client Onboarding event data captured in BAI to identify automation and business improvement opportunities.

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

Thank you for completing this lab!