

# **Business Process Technologies (BPT, ST)** **Automatisierung von Geschäftsprozessen (AGP, DPT)**

Winter Term 2024 / 2025 (Master ST and Master DPT)

Hochschule  
für Technik  
**Stuttgart**

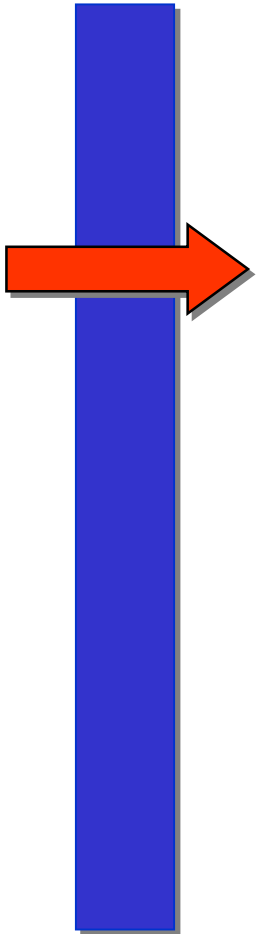
## **Chapter 8 / Process Mining**

**Prof. Dr. Oliver Höß**  
oliver.hoess@hft-stuttgart.de

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# Agenda

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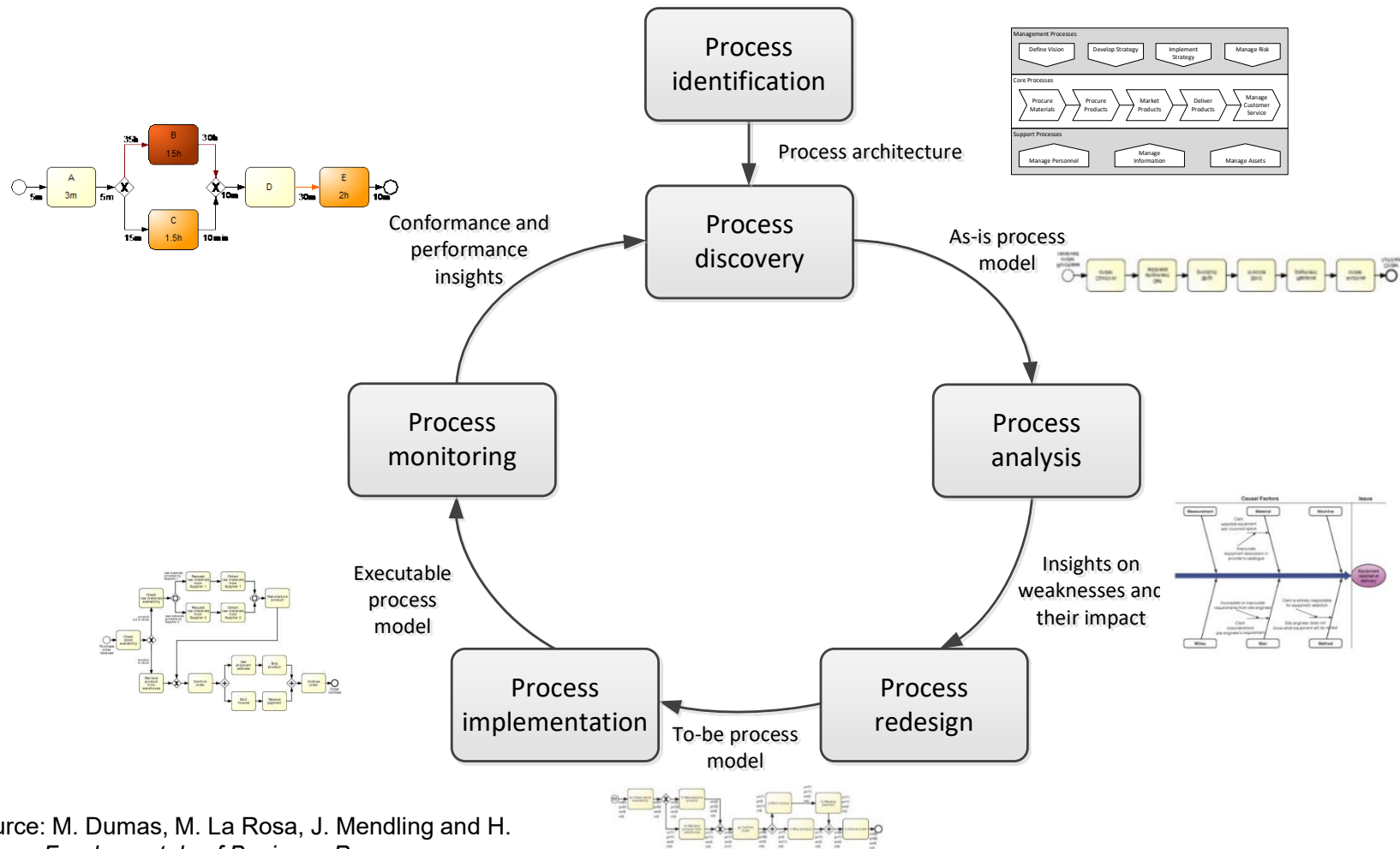


**Initial Situation / Motivation**

**Process Mining Fundamentals**

**Process Mining with Celonis**

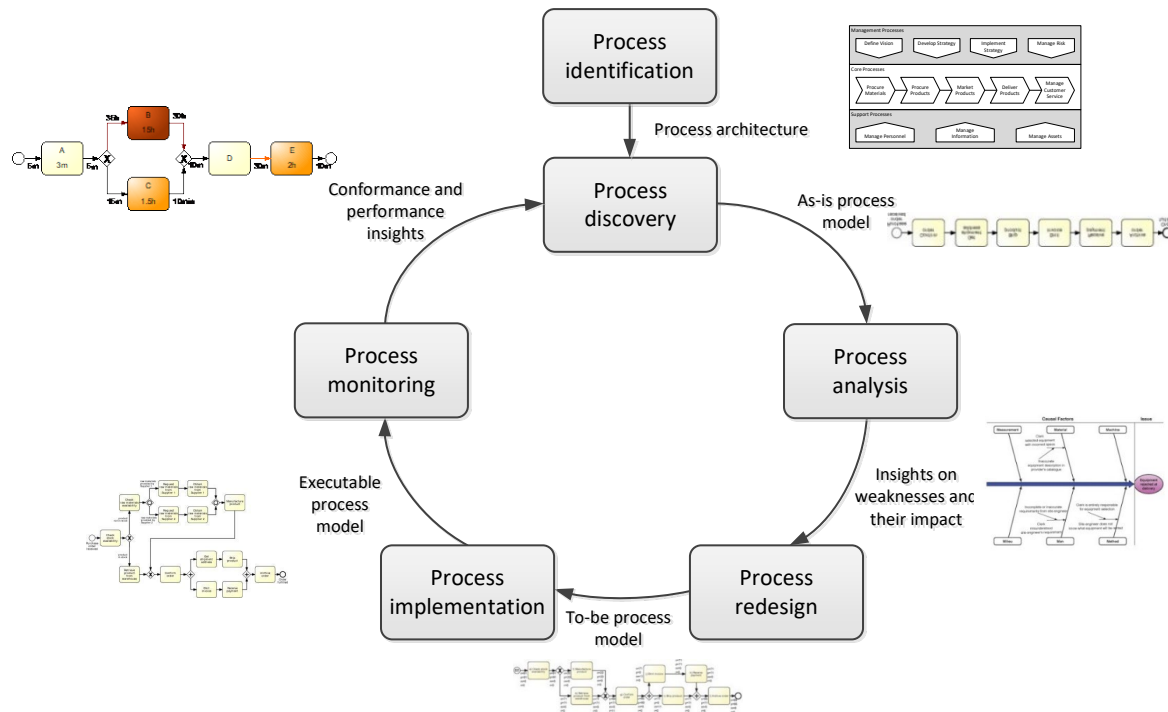
# Motivation



“Source: M. Dumas, M. La Rosa, J. Mendling and H. Reijers, *Fundamentals of Business Process Management*, 2nd edition, Springer, 2018”.

# Questions

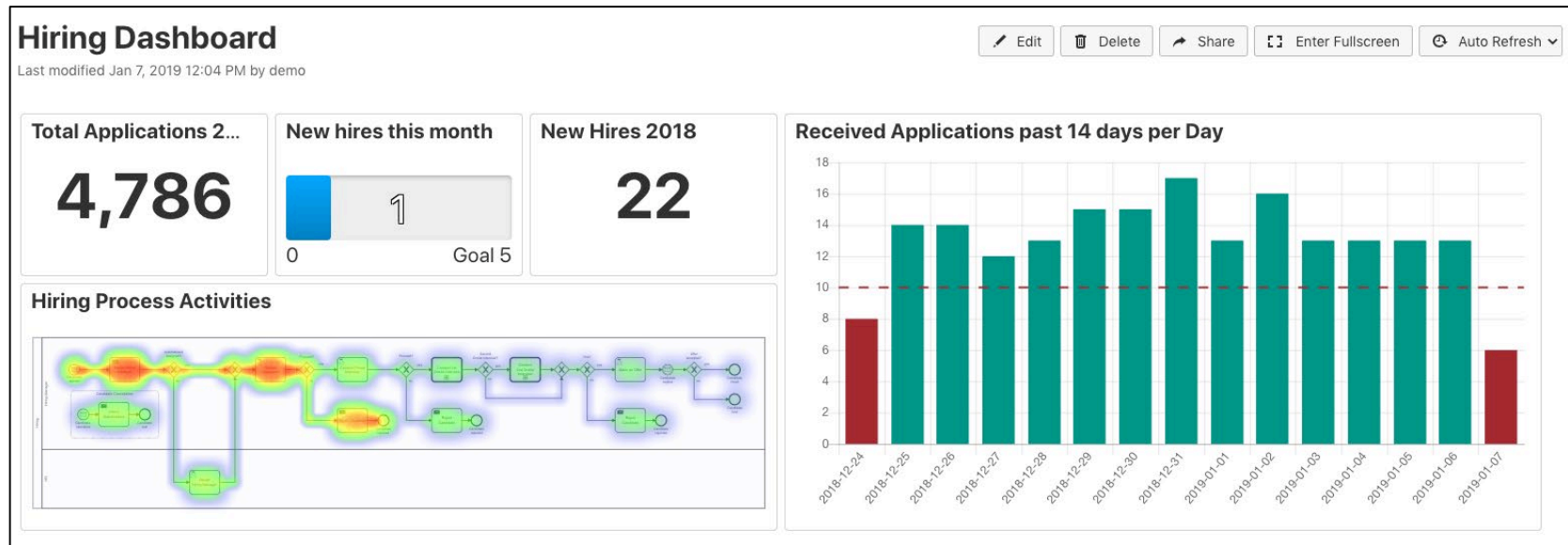
- How is the As-Is process really working ?
- Is the To-Be-Process working as planned ?
- How can we get insights how to improve the processes ?



“Source: M. Dumas, M. La Rosa, J. Mendling and H. Reijers, *Fundamentals of Business Process Management*, 2nd edition, Springer, 2018”.

# Use of a central Workflow System with integrated monitoring

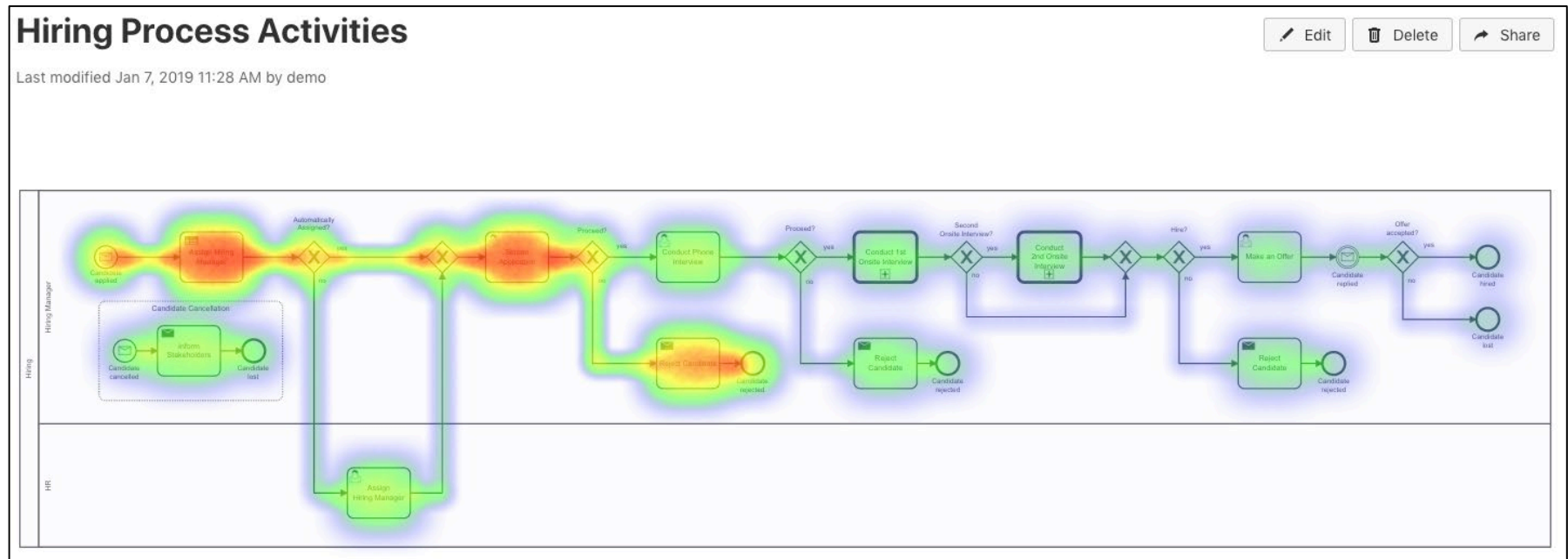
e.g. Camunda / Camunda Optimize



Analysis of Key Performance Indicators (KPIs) and comparison with goals

# Use of a central Workflow System with integrated monitoring

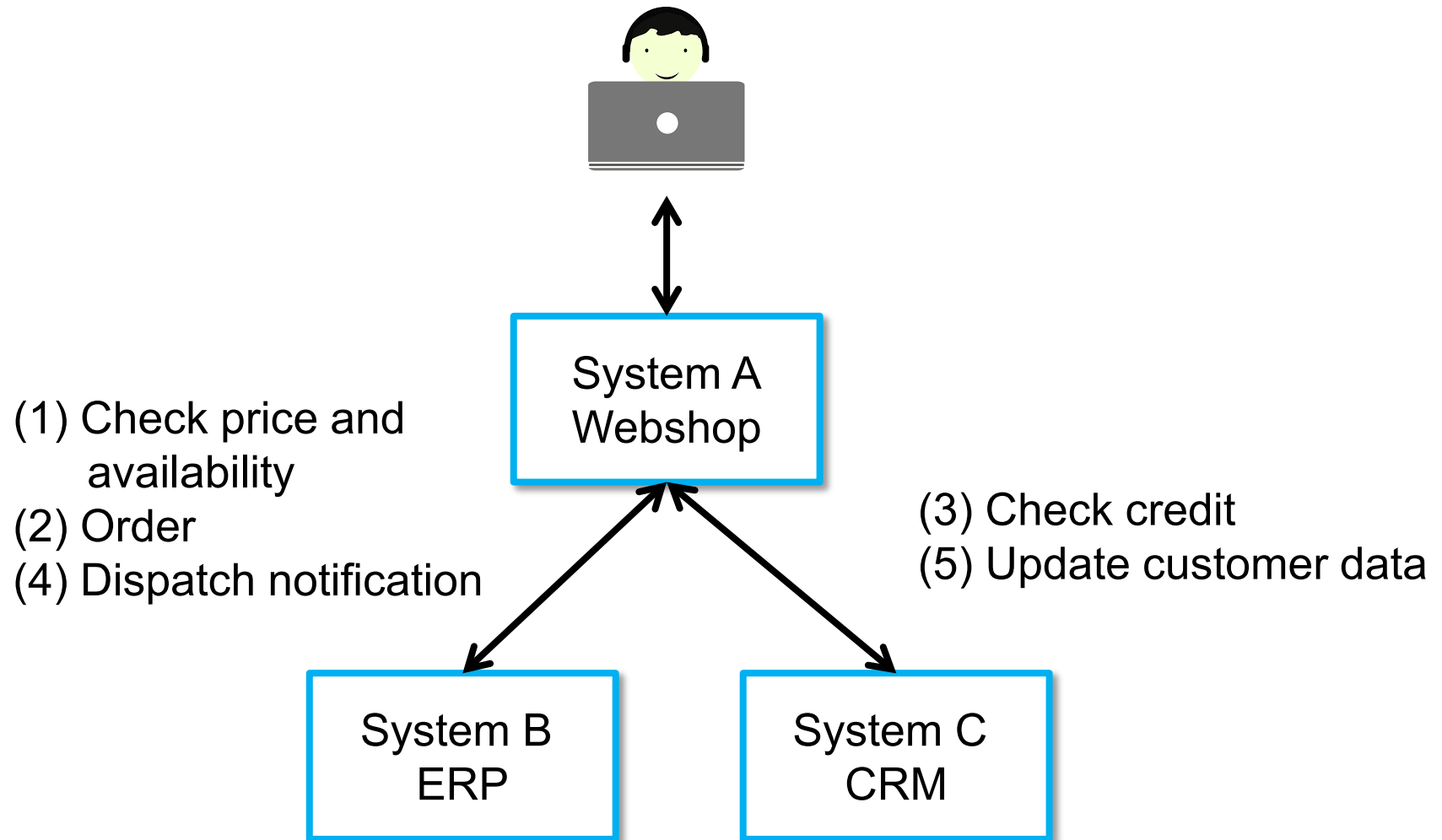
e.g. Camunda / Camunda Optimize



Analysis of process paths (Heat Map)

# Reality: No central Workflow, processes run over multiple systems which communicate directly

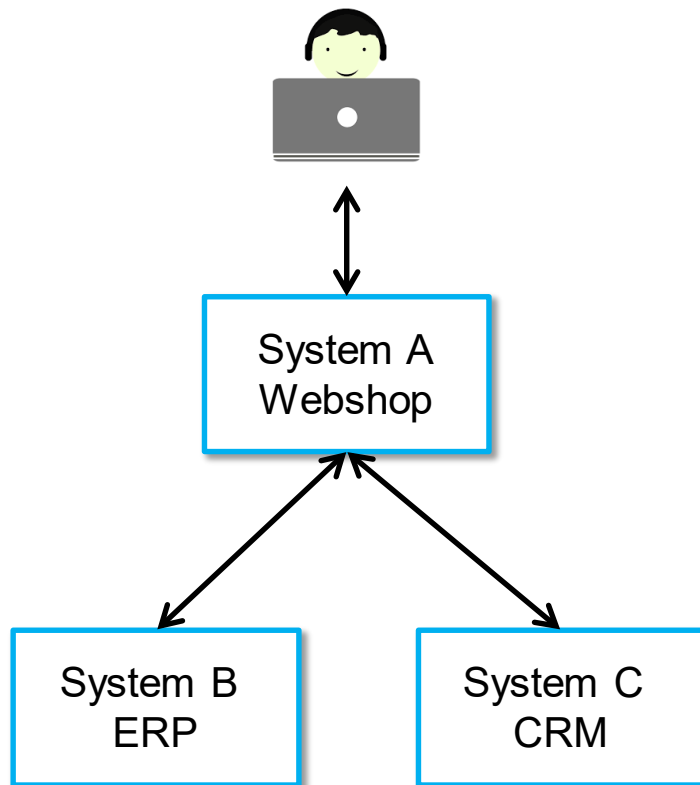
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# Reality: No central Workflow, processes run over multiple systems which communicate directly

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Questions (Examples):

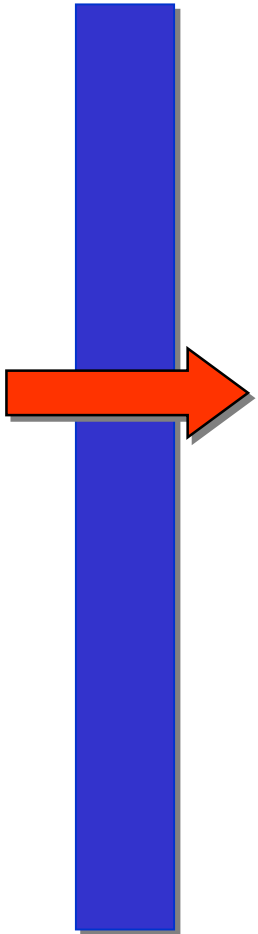


- How is the process running through the systems ?
- Does the process comply with the planned process ?
- Which process variants exist and how often do they occur ?
- Where are process exits or delays ?
- How long does it take from step A to B ?
- ...



# Agenda

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**Initial Situation / Motivation**

**Process Mining Fundamentals**

**Process Mining with Celonis**

# The Godfather of Process Mining

**INNOVATIVE TRENDS**  
*News, Events und Knowledge rund um IT, Digitalisierung, Cloud, Unternehmenssoftware, Innovation, Startups uvm. von Prof. O. Höß*

StartseiteSearchTop PostsAll PostsEventsNewsKnowledgeOpinionBooksSpecial TopicsAbout

**Startseite** Process-Mining-Ikone Professor Wil van der Aalst wird Chief Scientist bei Celonis

## Process-Mining-Ikone Professor Wil van der Aalst wird Chief Scientist bei Celonis

25/08/2021 ohoess News BPM, Business Process Management, Celonis, Digitale Transformation, Digitalisierung, Forschung, Personalia, Process Mining, Unternehmenssoftware, Wissenschaft

Gerne den [Artikel](#) bzw. die [Posts auf XING](#), [LinkedIn](#), [Facebook](#) und [Twitter](#) teilen !



Wil van der Aalst  
The Godfather of Process Mining joins Celonis as Chief Scientist

Prof. van der Aalst verstärkt Celonis als Chief Scientist (Quelle: Celonis, leicht modifiziert)

Eine interessante Personalie: **Prof. Dr. Wil van der Aalst** verstärkt Celonis ab **1. September 2021** als **Chief Scientist** (siehe [Pressemeldung Celonis](#)).

Dem **Shooting-Star** im Bereich **Process Mining** und **Execution Management** Celonis aus München (u.a. [Gewinner des Deutschen Zukunftspreises](#)) ist mit dem **Process-Mining-Vordenker** van der Aalst ein toller „Fang“ gelungen.

 **Power Search**

**SOCIAL MEDIA**  


**NEWSLETTER**  
 **Anmelden**

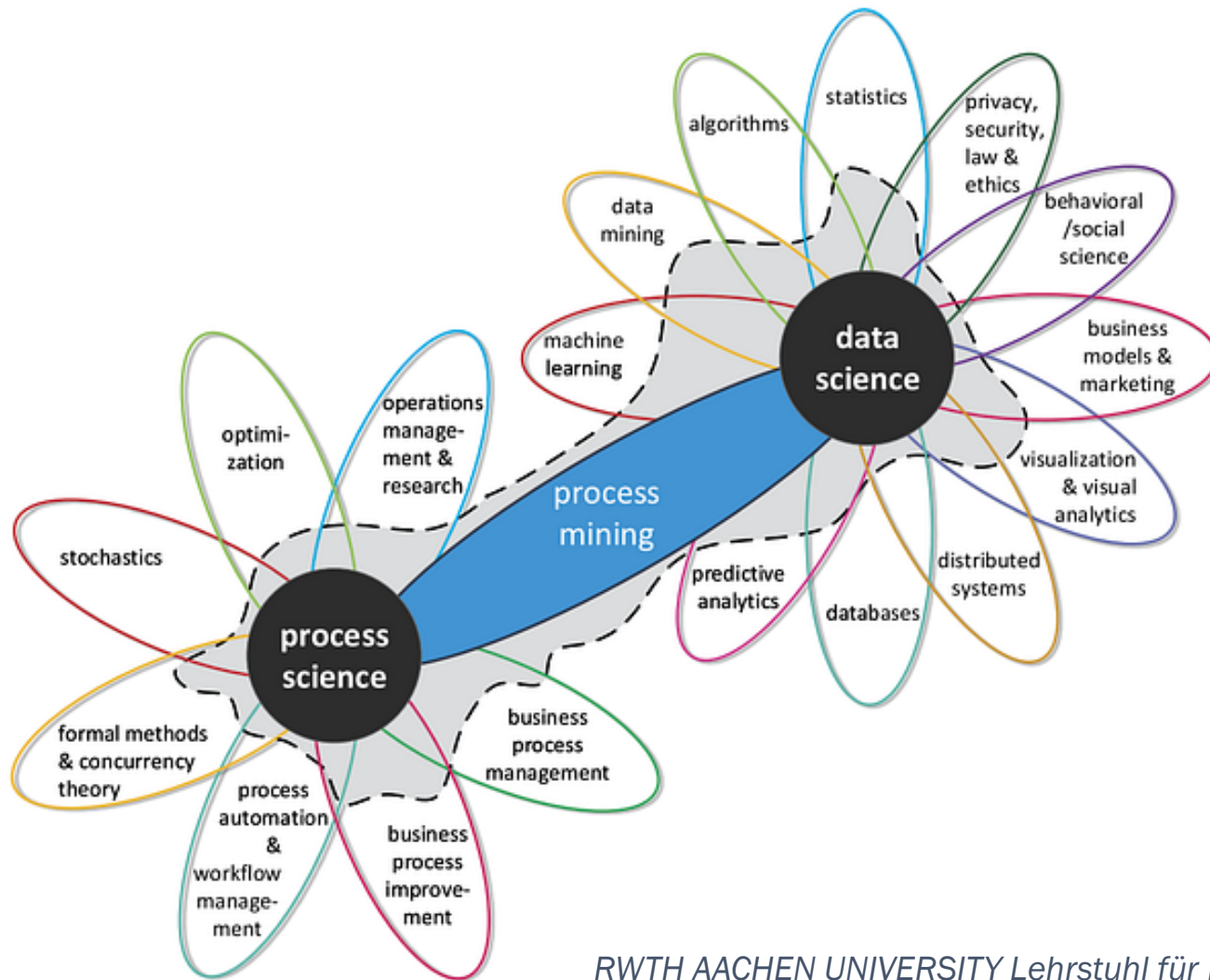
**FEATURED**  


# Process Mining

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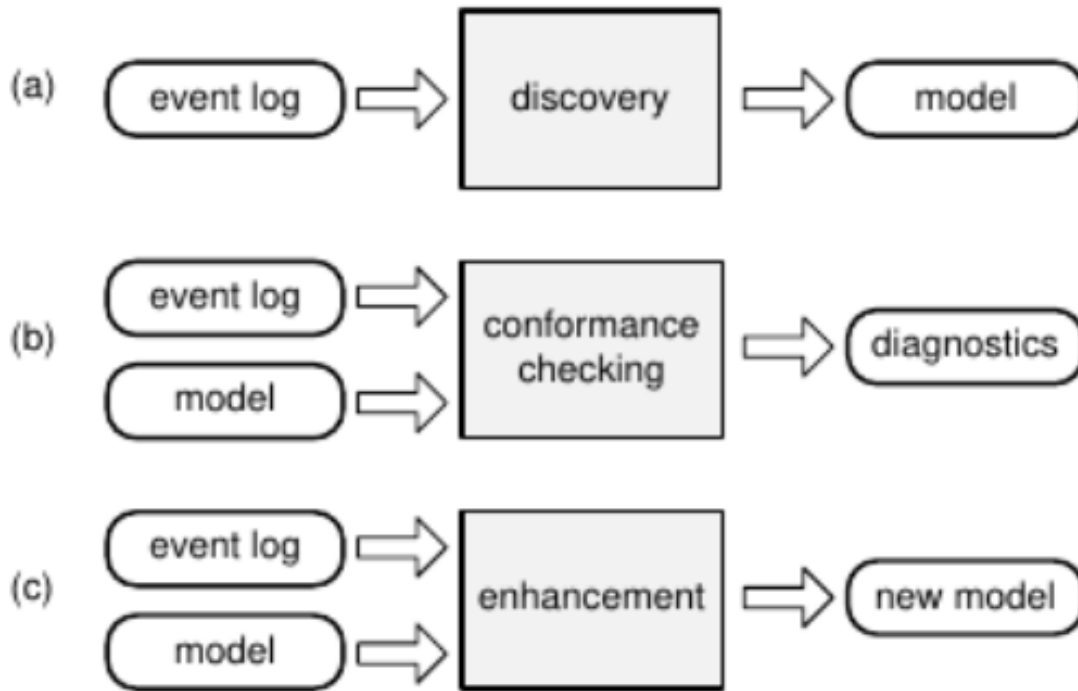
- Data Mining Technique in BPM where Business Processes are analysed by analysing Data / Logfiles from productive information systems.
- **Process Mining = Data Mining / Data Science applied to Process Data**

# Process Mining and Data Science



RWTH AACHEN UNIVERSITY Lehrstuhl für Process and Data Science 2023 (Prof. v.d.Aalst)

# Types of Process Mining



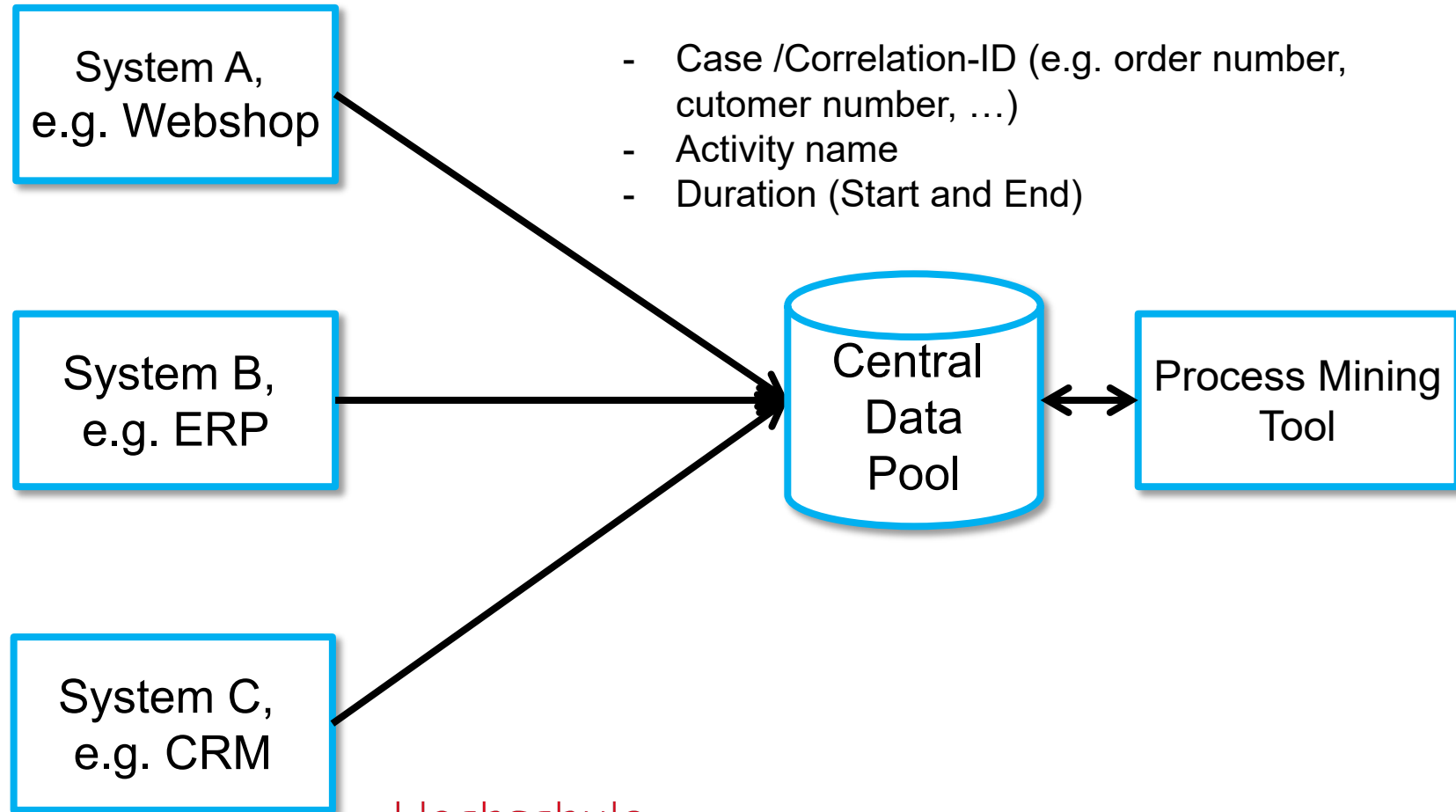
- Van der Aalst et al.
- [https://www.researchgate.net/publication/221585990\\_Process\\_Mining\\_Manifesto](https://www.researchgate.net/publication/221585990_Process_Mining_Manifesto)

# Process Mining Overall Architecture

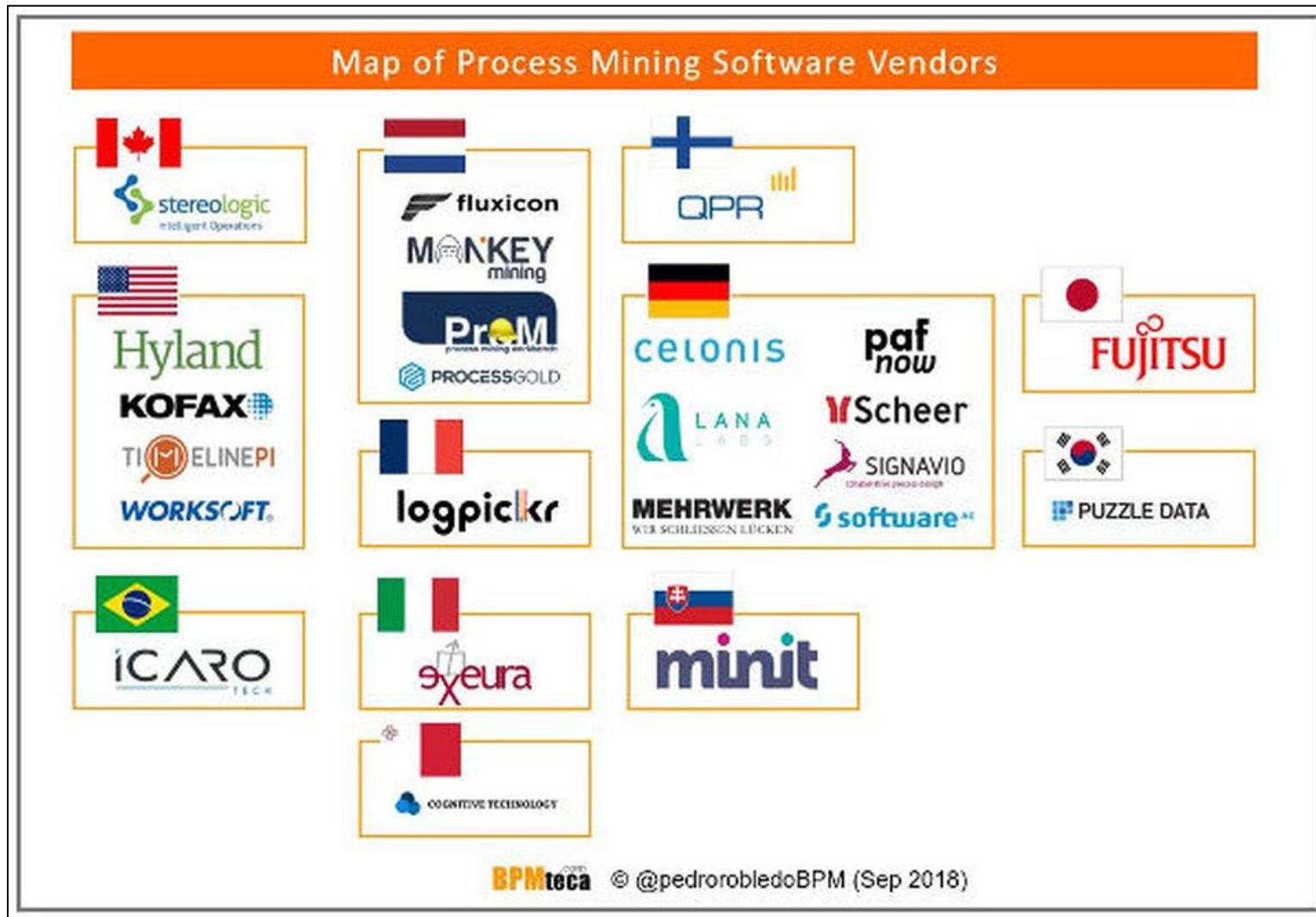
Analysis of collected process data

Important data fields

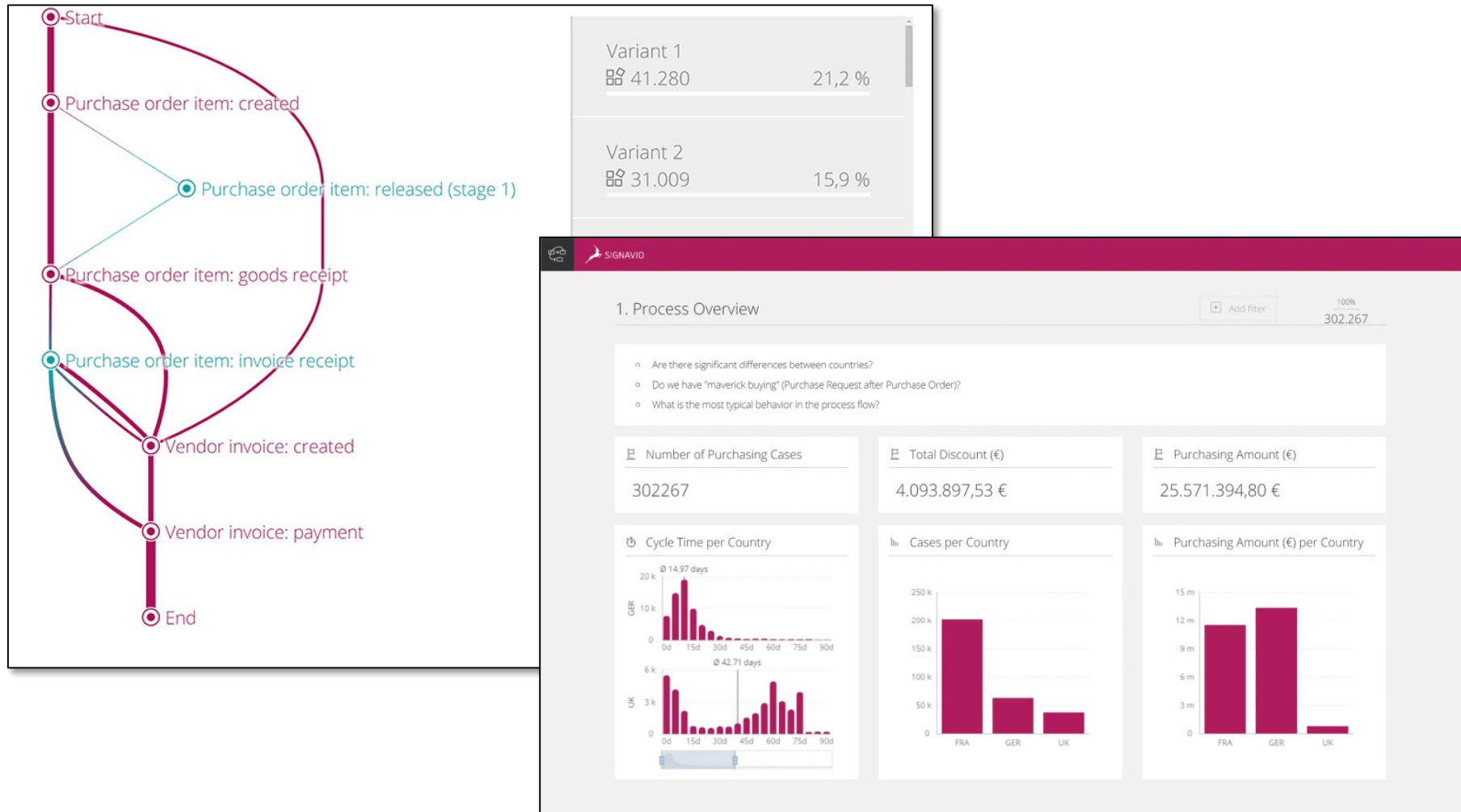
- Case /Correlation-ID (e.g. order number, customer number, ...)
- Activity name
- Duration (Start and End)



# Vendor Landscape

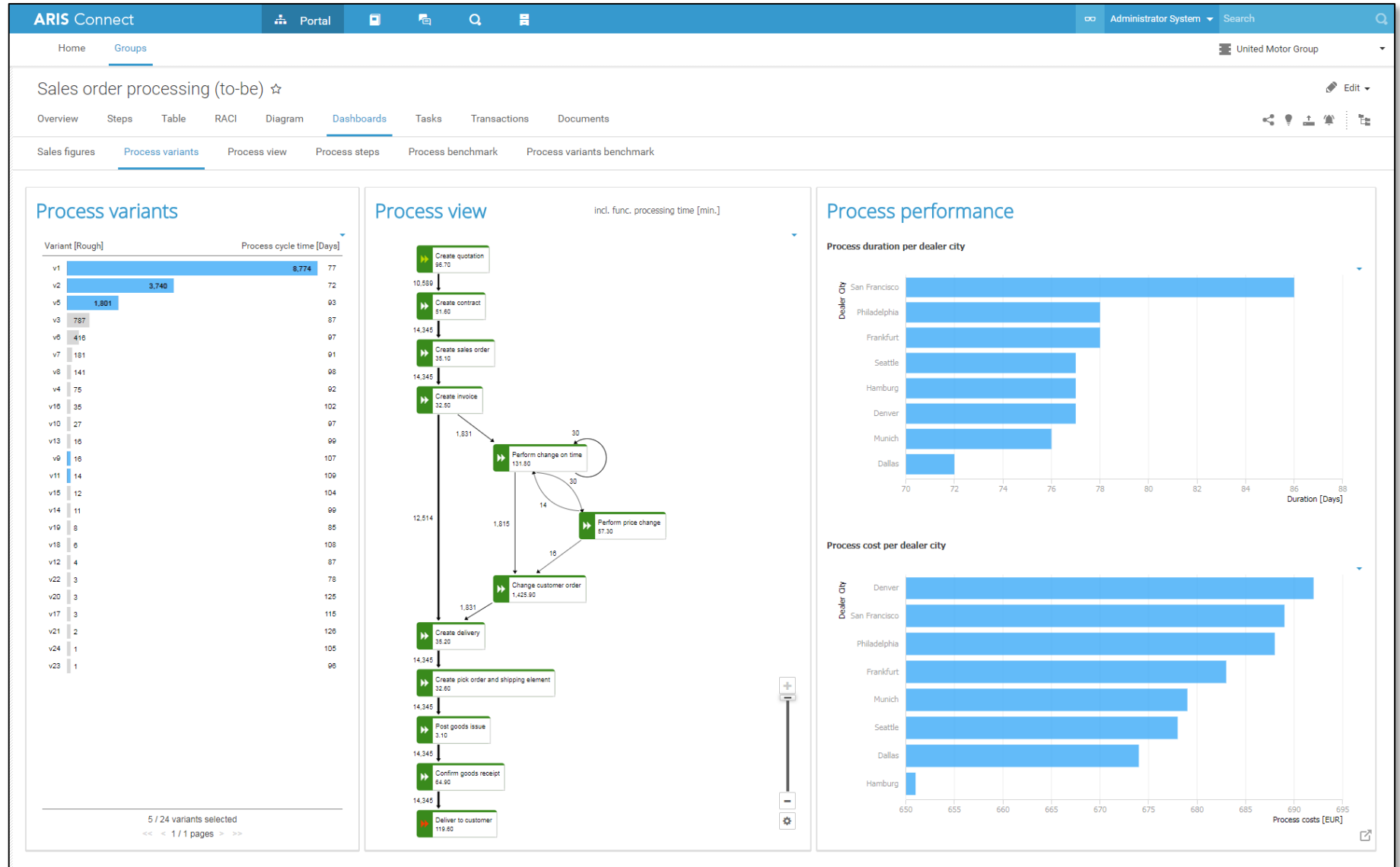


# Example: Signavio Process Intelligence



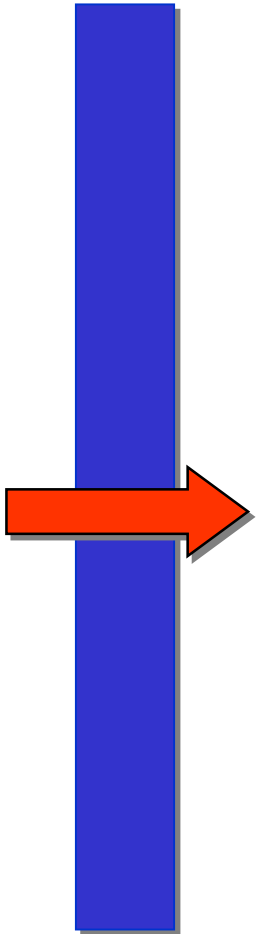


# Example: ARIS Connect



# Agenda

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**Initial Situation / Motivation**

**Process Mining Fundamentals**

**Process Mining with Celonis**

# Example: Celonis from Munich wins German Future Award 2019

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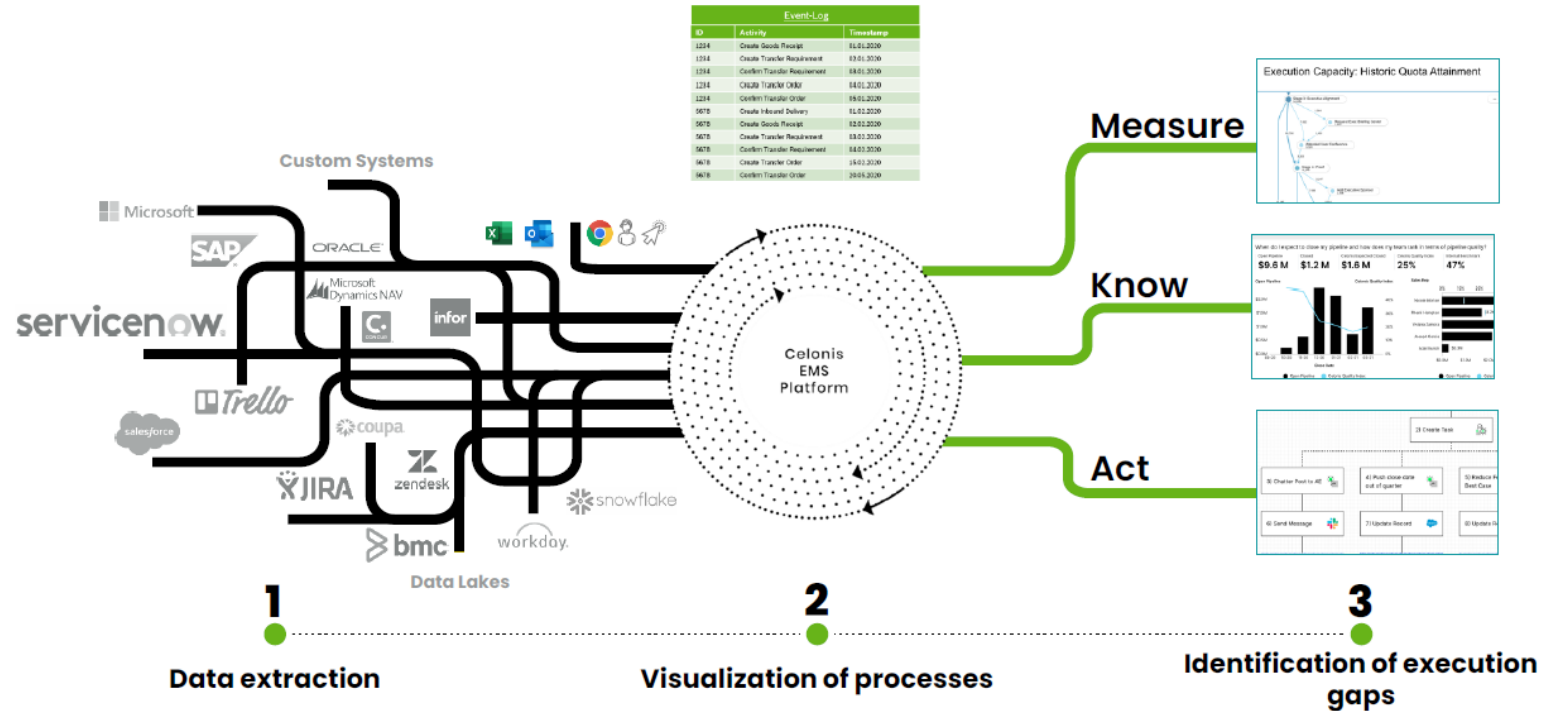
**Founded 2011 (Spin Off from TU Munich)**

**Over 800 Employees**

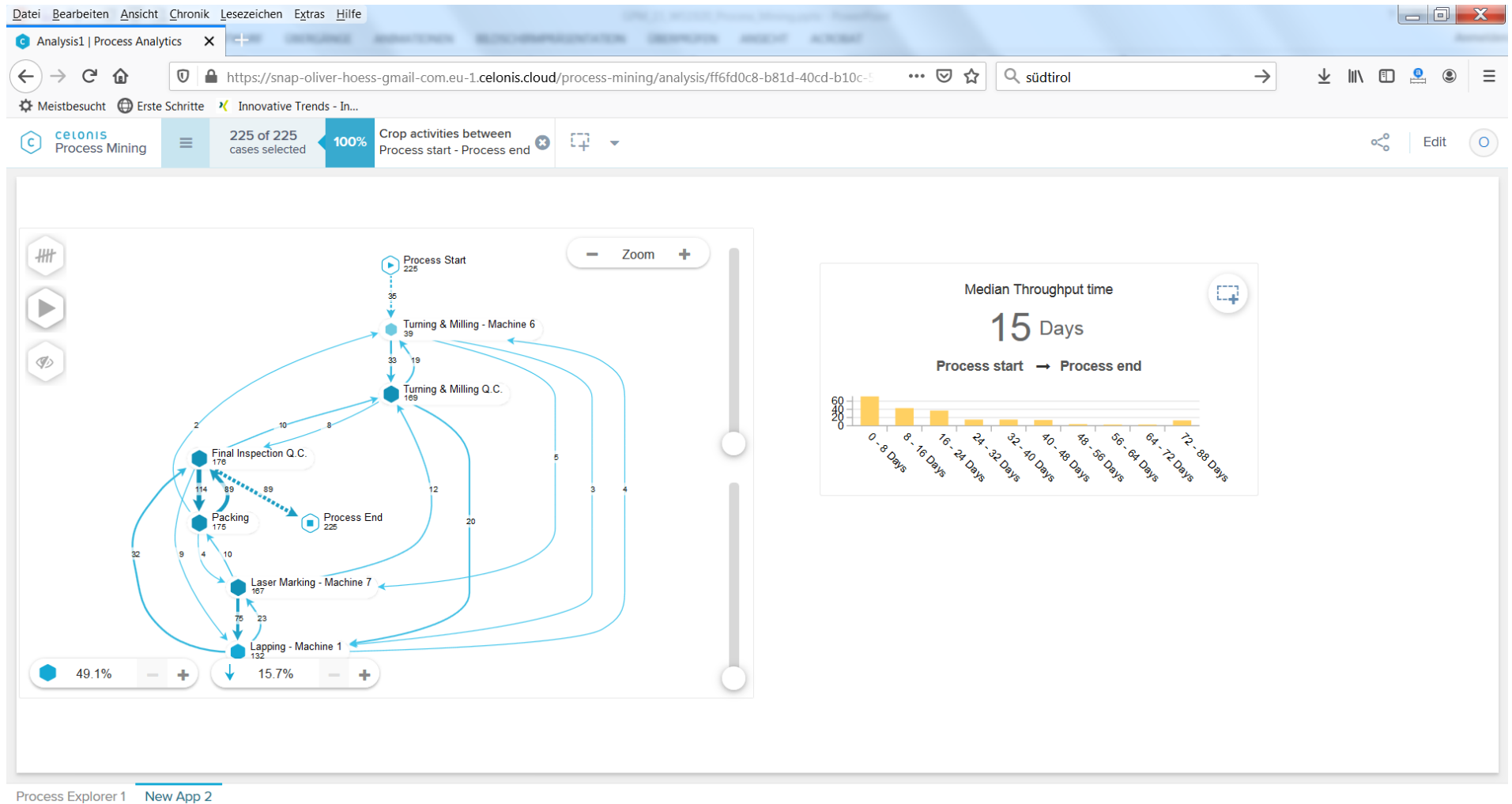
**Valuation: over 10.000.000.000 Euro (Decacorn)**

# Generic Architecture

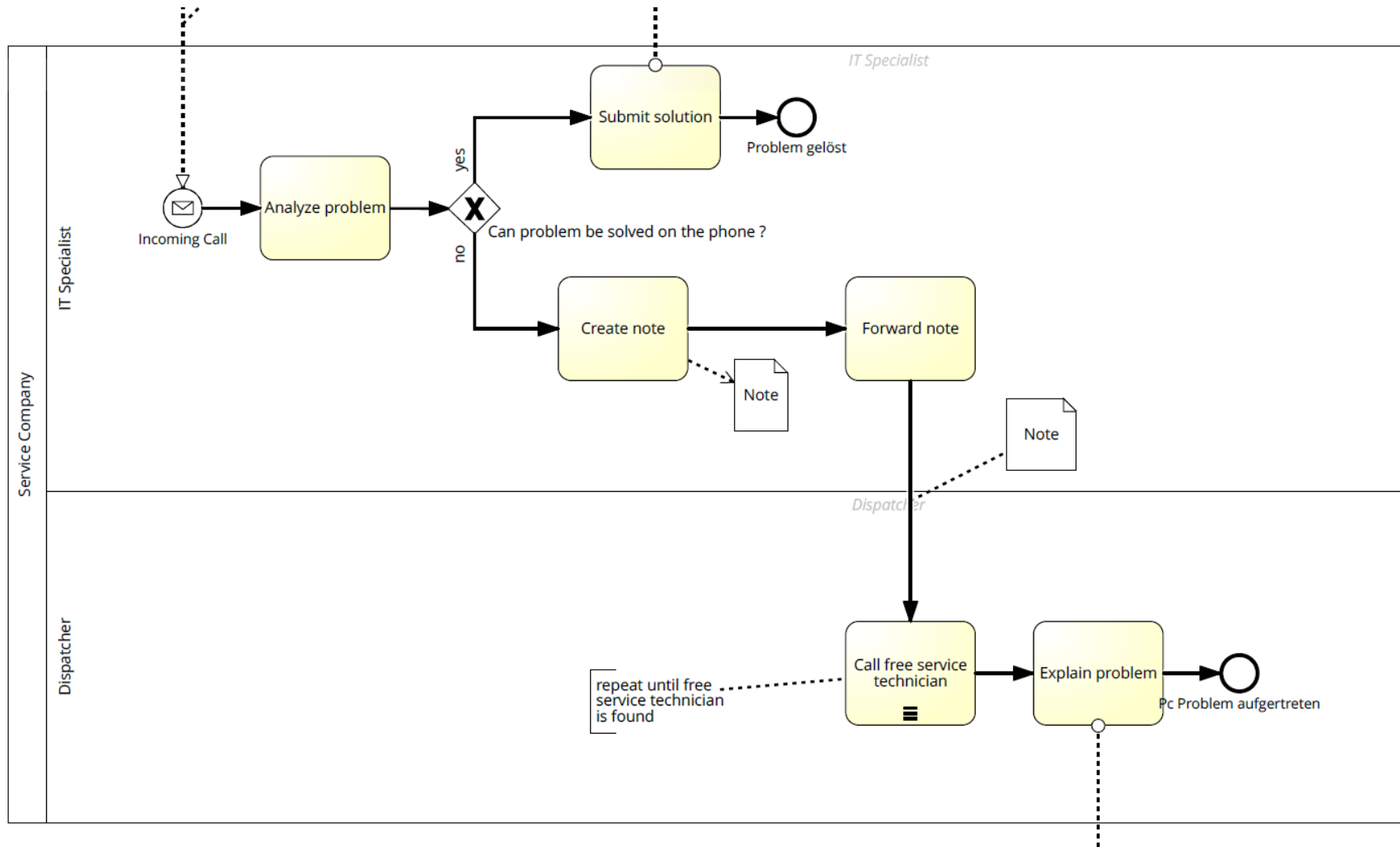
## Theoretical Basics: Process Mining



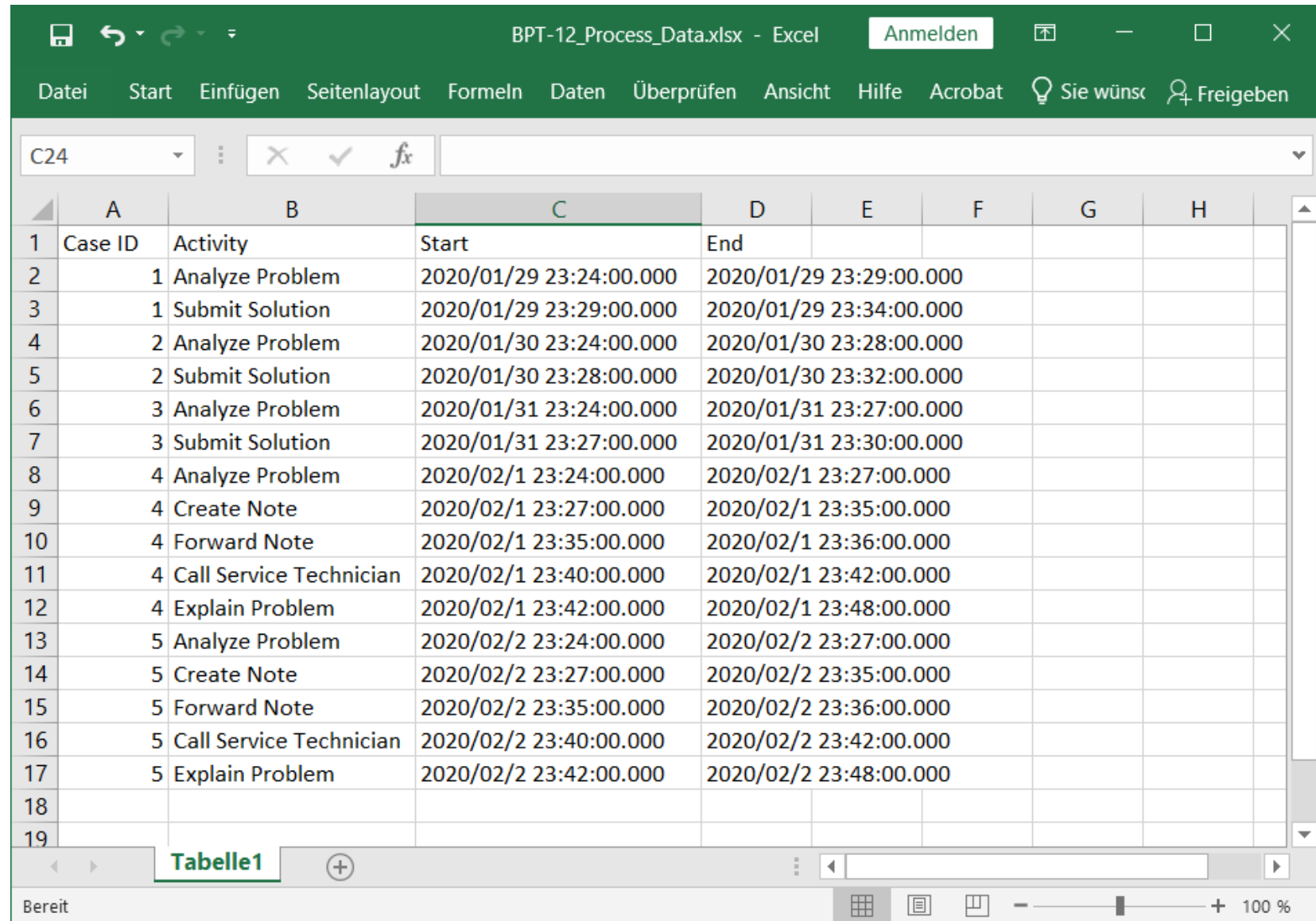
# Example: Celonis EMS (Execution Management System)



# Simple Example Process

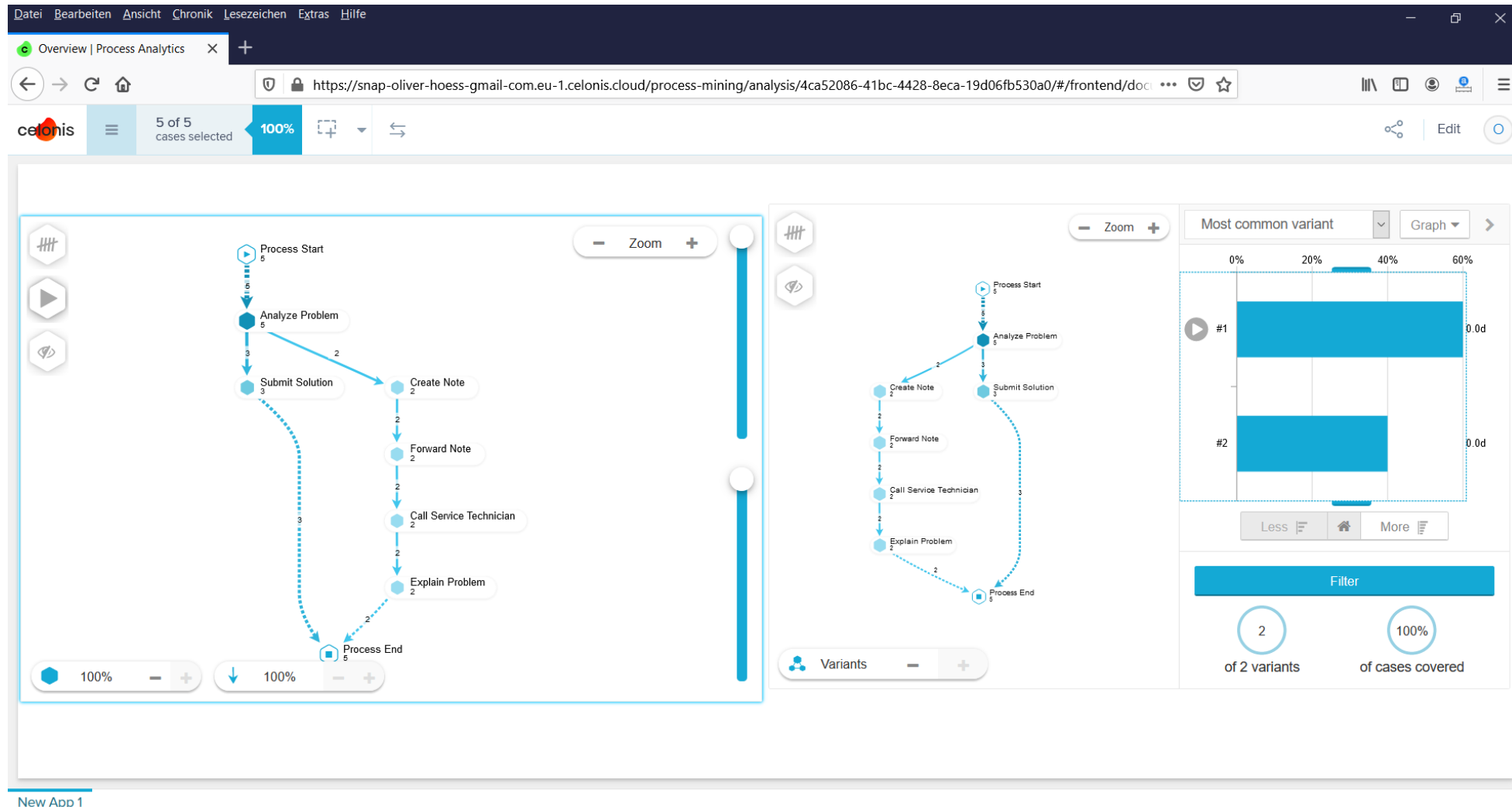


# Simple Process Log



Case ID	Activity	Start	End
1	Analyze Problem	2020/01/29 23:24:00.000	2020/01/29 23:29:00.000
1	Submit Solution	2020/01/29 23:29:00.000	2020/01/29 23:34:00.000
2	Analyze Problem	2020/01/30 23:24:00.000	2020/01/30 23:28:00.000
2	Submit Solution	2020/01/30 23:28:00.000	2020/01/30 23:32:00.000
3	Analyze Problem	2020/01/31 23:24:00.000	2020/01/31 23:27:00.000
3	Submit Solution	2020/01/31 23:27:00.000	2020/01/31 23:30:00.000
4	Analyze Problem	2020/02/1 23:24:00.000	2020/02/1 23:27:00.000
4	Create Note	2020/02/1 23:27:00.000	2020/02/1 23:35:00.000
4	Forward Note	2020/02/1 23:35:00.000	2020/02/1 23:36:00.000
4	Call Service Technician	2020/02/1 23:40:00.000	2020/02/1 23:42:00.000
4	Explain Problem	2020/02/1 23:42:00.000	2020/02/1 23:48:00.000
5	Analyze Problem	2020/02/2 23:24:00.000	2020/02/2 23:27:00.000
5	Create Note	2020/02/2 23:27:00.000	2020/02/2 23:35:00.000
5	Forward Note	2020/02/2 23:35:00.000	2020/02/2 23:36:00.000
5	Call Service Technician	2020/02/2 23:40:00.000	2020/02/2 23:42:00.000
5	Explain Problem	2020/02/2 23:42:00.000	2020/02/2 23:48:00.000

# Analysis of the process / log data with Celonis





# Step 1 - Quickstarts

File Bearbeiten Ansicht Chronik Lesezeichen Extras Hilfe

EMS

https://academic-oliver-hoess-hft-stuttgart-de.eu-2.celonis.cloud/quickstart/ui/studio/processes

## Quickstarts

### Analyze a business process

Evaluate pre-defined business processes for common source systems.

Accounts Payable  
ORACLE

Order to Cash  
ORACLE

Procurement  
ORACLE

Accounts Payable  
SAP

Accounts Receivable  
SAP

Order To Cash  
SAP

Purchase to Pay  
SAP

Case Management  
salesforce

Opportunity Management  
salesforce

Incident Management  
servicenow

### Analyze an event log

Evaluate any process that is formatted as an event log.

CSV/XLSX file

Google Sheets

XES File

# Step 2 – Define Key Fields

File Bearbeiten Ansicht Chronik Lesezeichen Extras Hilfe

EMS

https://academic-oliver-hoess-hft-stuttgart-de.eu-2.celonis.cloud/quickstart/ui/csv/configure-activity-columns

## CSV/XLSX Upload

Upload Select sheet Configure **Map your data** Finalize

### Map your data

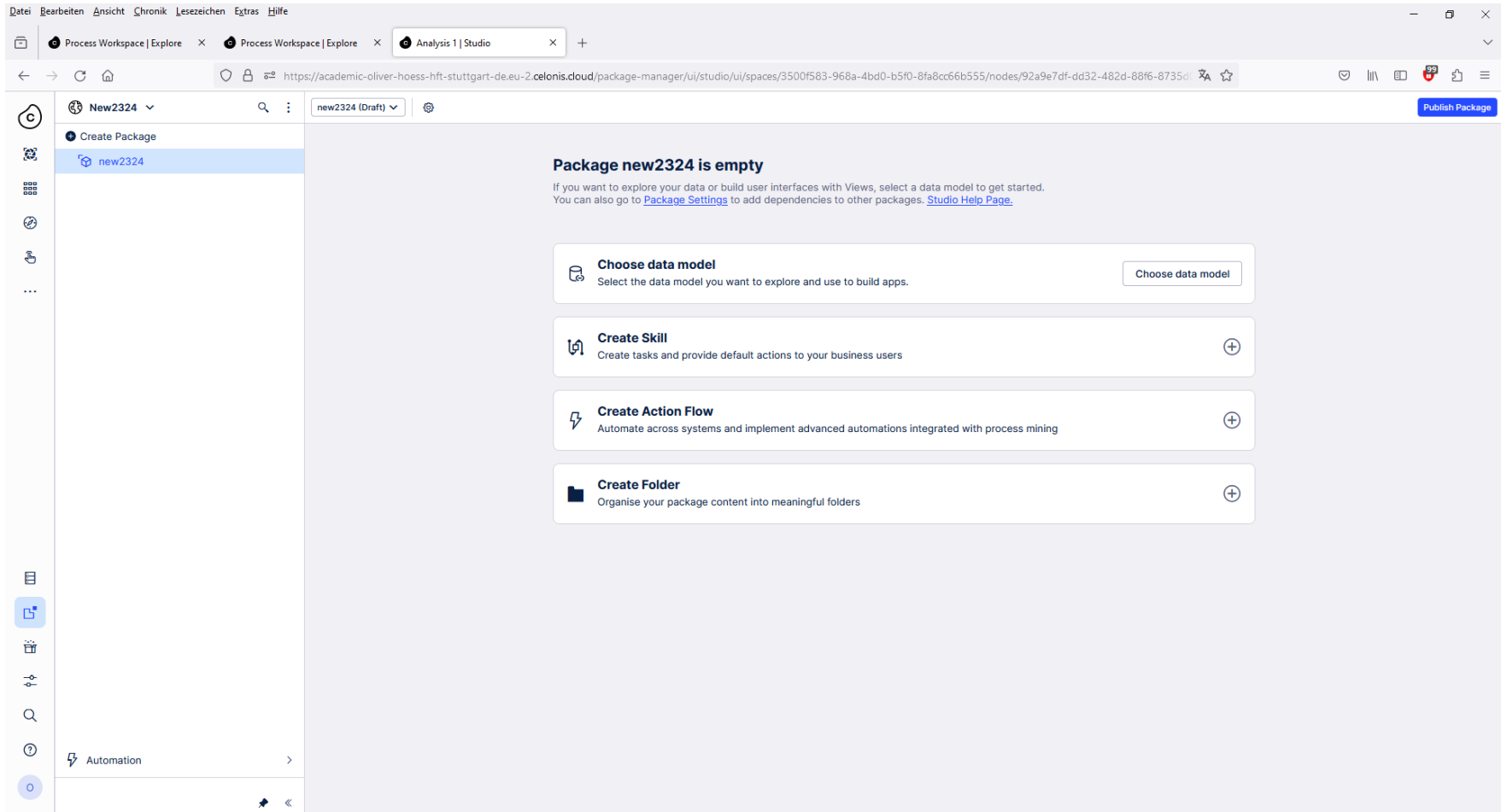
Click on the column that contains the Case ID, then Activity name, then the Timestamp

**Case ID Column:** Click on the column that contains your Case IDs.

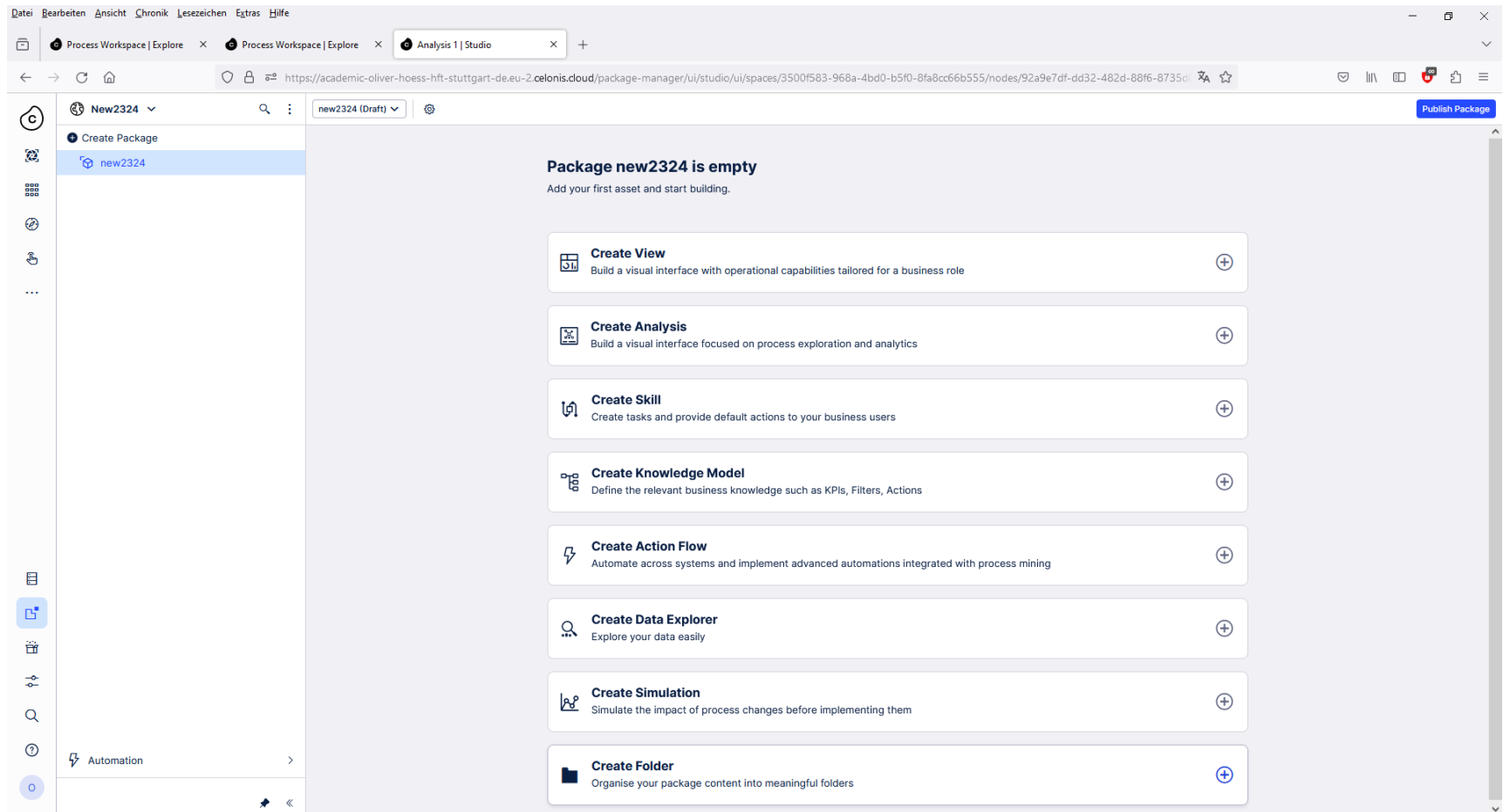
ABC	CASE ID	ABC	ACTIVITY	DATE	START	DATE	END
1			Analyze Problem	2020/01/29 23:24:00....		2020/01/29 23:29:00....	
1			Submit Solution	2020/01/29 23:29:00....		2020/01/29 23:34:00....	
2			Analyze Problem	2020/01/30 23:24:00....		2020/01/30 23:28:00....	
2			Submit Solution	2020/01/30 23:28:00....		2020/01/30 23:32:00....	
3			Analyze Problem	2020/01/31 23:24:00....		2020/01/31 23:27:00.0...	
3	Case ID	Case ID	Submit Solution	2020/01/31 23:27:00.0...		2020/01/31 23:30:00....	
4			Analyze Problem	2020/02/1 23:24:00.000		2020/02/1 23:27:00.000	
4			Create Note	2020/02/1 23:27:00.000		2020/02/1 23:35:00.000	
4			Forward Note	2020/02/1 23:35:00.000		2020/02/1 23:36:00.0...	

Back Next →

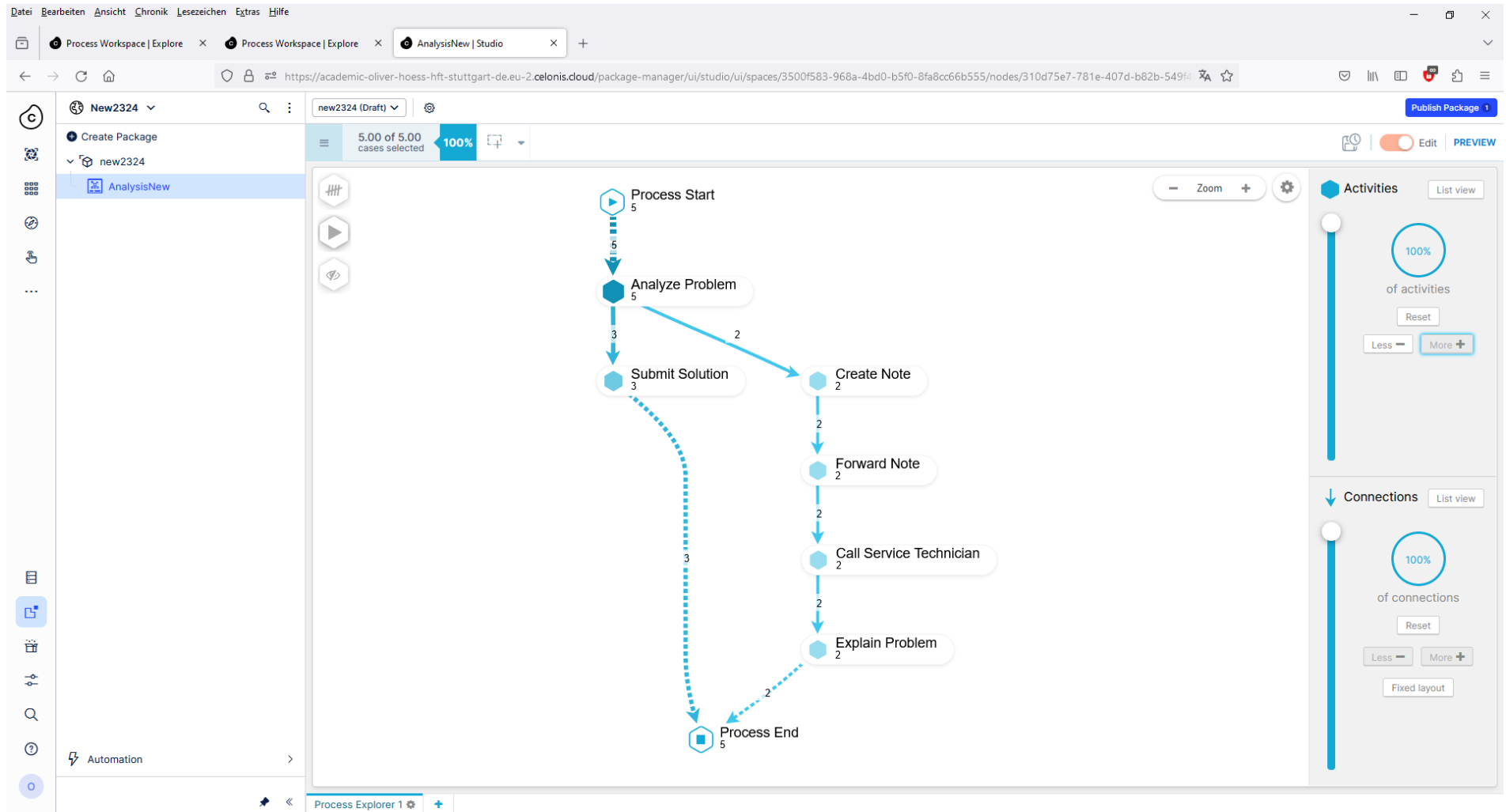
# Step 3 – Studio explore- Choose Data Model



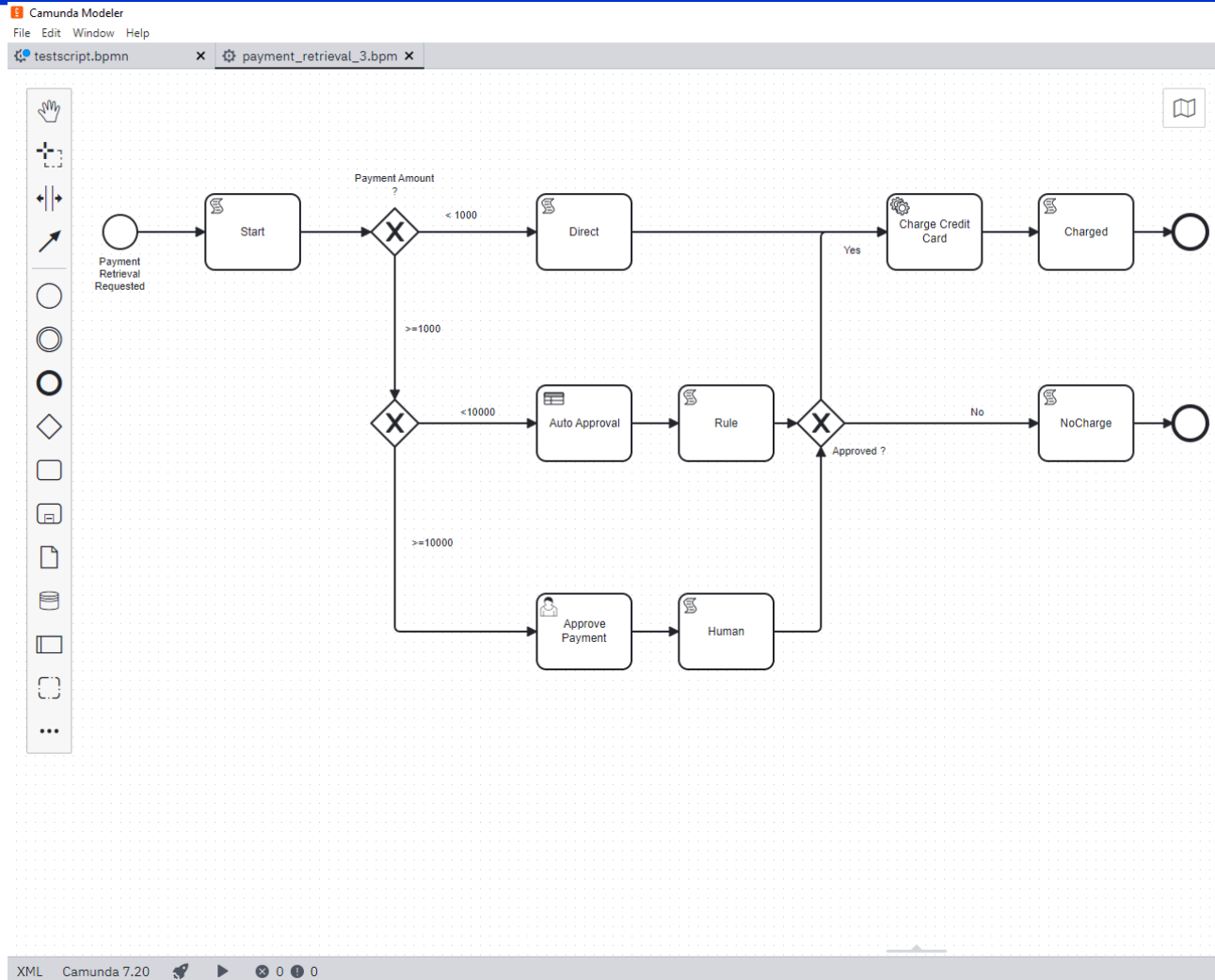
# Step 4 – Create Analysis



# Step 6 – Result



# 2nd Example: Camunda Instrumentation with script tasks



# 2nd Example: Camunda Instrumentation with script tasks

Camunda Modeler

File Edit Window Help

testscript.bpmn x payment\_retrieval\_3.bpmn x

```
graph LR; Start((Start)) --> G1{XOR}; G1 -- "< 1000" --> Direct[Direct]; G1 -- ">= 1000" --> G2{XOR}; G1 -- ">= 10000" --> Approve[Approve Payment]; Direct --> G3{XOR}; G3 -- "Yes" --> Charge[Charge Credit Card]; G3 -- "No" --> NoCharge[NoCharge]; Approve --> Human[Human]; Charge --> Charged((Charged)); NoCharge --> End1(( )); Human --> G4{XOR}; G4 -- "Approved?" --> Charge; G4 -- "Not Approved" --> NoCharge; G4 --> End2(( ));
```

Payment Retrieval Requested

Start

Payment Amount ?

< 1000

>= 1000

>= 10000

Direct

Charge Credit Card

Charged

Auto Approval

Rule

Approved ?

No

NoCharge

Approve Payment

Human

SCRIPT TASK

Start

General

Name

Start

ID

Activity\_1ta4hjp

Documentation

Script

Format

groovy

Type

Inline script

Script

```
String step="Start"

String timenew="" + time

File file = new File("c:\\tmp\\out.csv")
file.append(""+PID+", "+timenew.replace("T", " ")+"", "+step+"\n")
println file.text
```

Result variable

Asynchronous continuations

Inputs

> PID

> time

Outputs


Execution listeners

Extension properties

XML Camunda 7.20 5.16.0

More elegant solution on the assignment sheet No. 5 (Credits go to Jan-Henrik Preuss)

# 2nd Example: Camunda Instrumentation with script tasks

 **SCRIPT TASK**  
Start

Documentation >

Script • ▾

Format  
groovy

Type  
Inline script ▾

Script

```
String step="Start"

String timenew="" + time

File file = new File("c:\\tmp\\out.csv")
file.append(""+PID+", "+timenew.replace("T", " ")+" "+step+"\n")
println file.text
```

Result variable

Asynchronous continuations >

Inputs + 2 ▾

▾ PID

Local variable name  
PID

Assignment type  
String or expression ▾

Value

Inputs + 2 ▾

▾ PID

Local variable name  
PID

Assignment type  
String or expression ▾

Value  
\${execution.getId()}  
Start typing "\${}" to create an expression.

▾ time

Local variable name  
time


Assignment type  
String or expression ▾

Value  
\${dateTime()}  
Start typing "\${}" to create an expression.

Outputs +

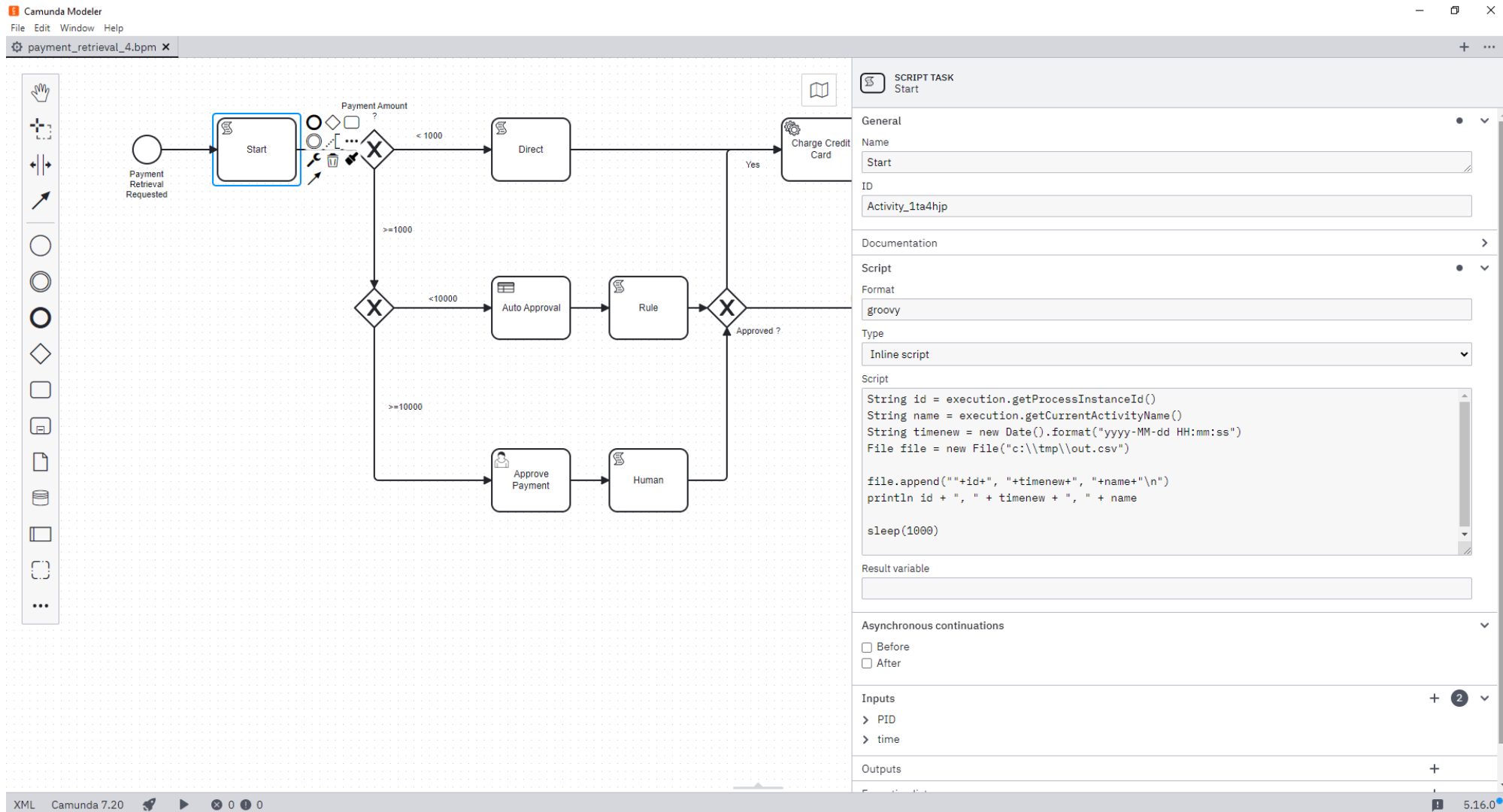
Execution listeners +

Extension properties +

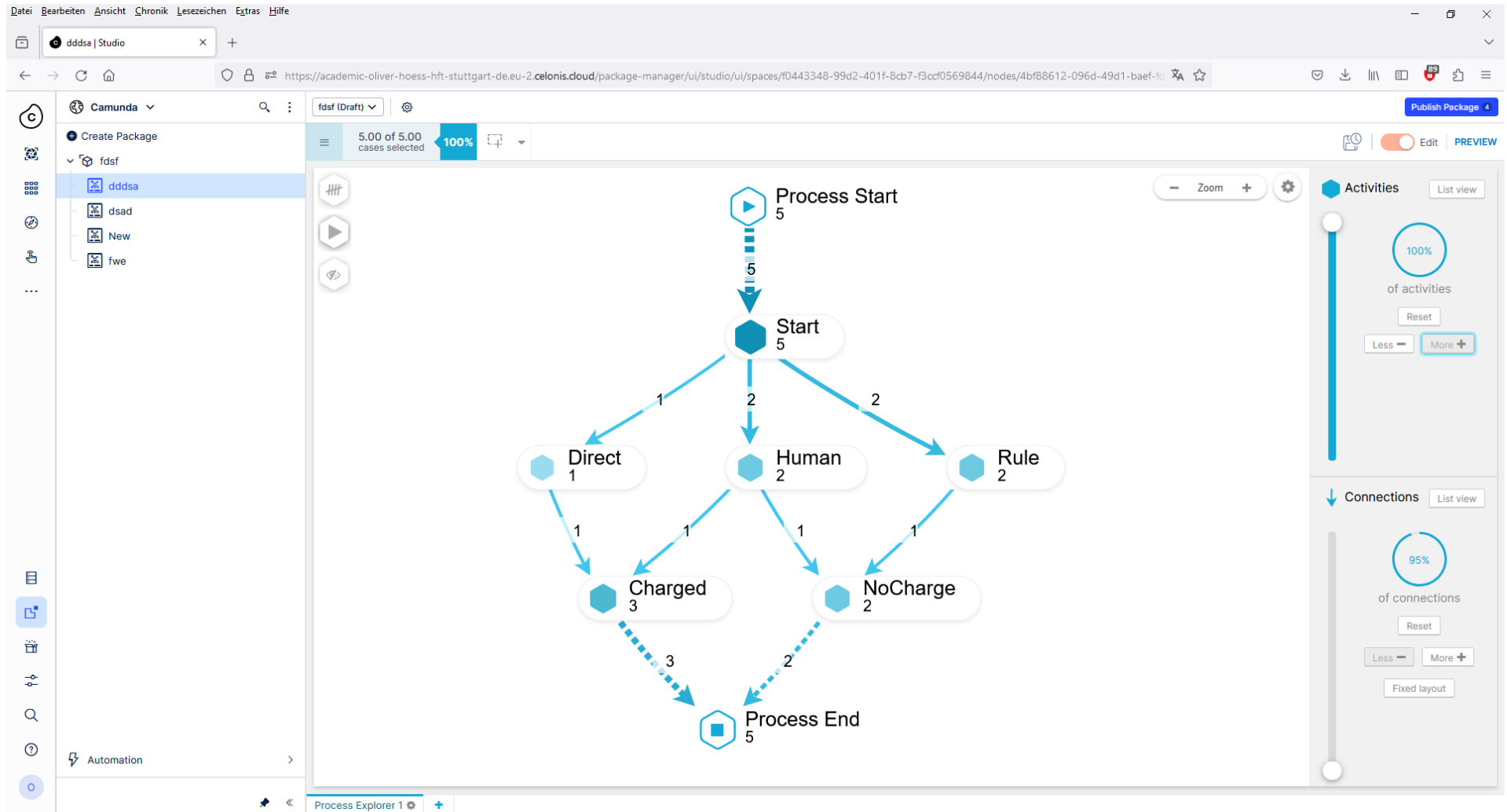
 5.16.0



# Elegant Solution: No Variables & automatic extraction of activity name (Credits: J-H Preuß)



# Result for all paths in Celonis



The image shows a close-up of several white rectangular cards stacked on top of each other. Each card features a large, bold, black question mark. The cards are slightly offset, creating a sense of depth. The lighting is soft, casting gentle shadows between the cards.

[Weitere] Fragen?!