A NATURAL LANGUAGE INTERFACEAL FOR QUERYING PROCESS EXECUTION DATA

QUERYING GRAPH DATABASES FROM NATURAL LANGUAGE USING HYBRID APPROACH

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BUSINESS PROCESS

A **business process** is a set **of inter-related activities** involving a number of **actors** and **data** triggered by a need and leading to an outcome

Hiring process

- Examples
  - Order-to-Cash
  - Purchase-to-Pay
  - Application-to-Approval
  - Fault-to-Resolution
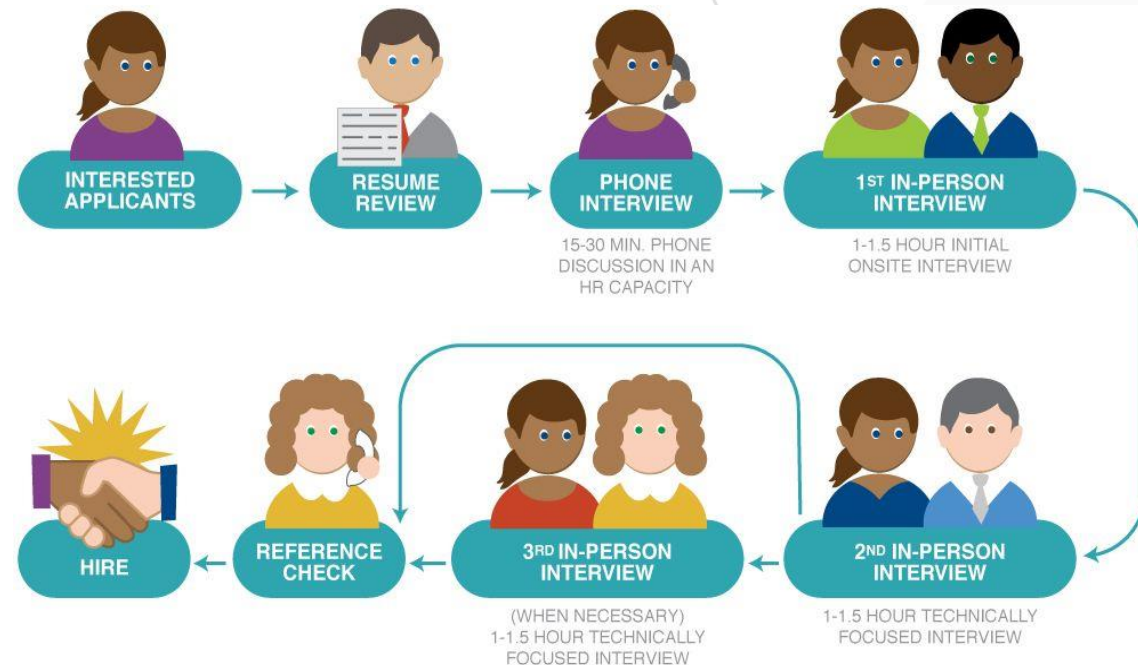
EVENT LOGS

The data about the execution of business processes (aka event logs) are usually logged by the enterprises' information systems

order number	activity	timestamp	user	product	quantity
9901	register order	22-1-2014@09.15	Sara Jones	iPhone5S	1
9902	register order	22-1-2014@09.18	Sara Jones	iPhone5S	2
9903	register order	22-1-2014@09.27	Sara Jones	iPhone4S	1
9901	check stock	22-1-2014@09.49	Pete Scott	iPhone5S	1
9901	ship order	22-1-2014@10.11	Sue Fox	iPhone5S	1
9903	check stock	22-1-2014@10.34	Pete Scott	iPhone4S	1
9901	handle payment	22-1-2014@10.41	Carol Hope	iPhone5S	1
9902	check stock	22-1-2014@10.57	Pete Scott	iPhone5S	2
9902	cancel order	22-1-2014@11.08	Carol Hope	iPhone5S	2

case id | activity name | timestamp | resource | other data

Analyzing process execution data allows organizations to extract information about the execution of business process.

PROCESS QUERYING

- **Process querying** is the fundamental technique of process analytics
- It allows analysts to easily **explore the data** with the intent of getting insights about the execution of business processes.

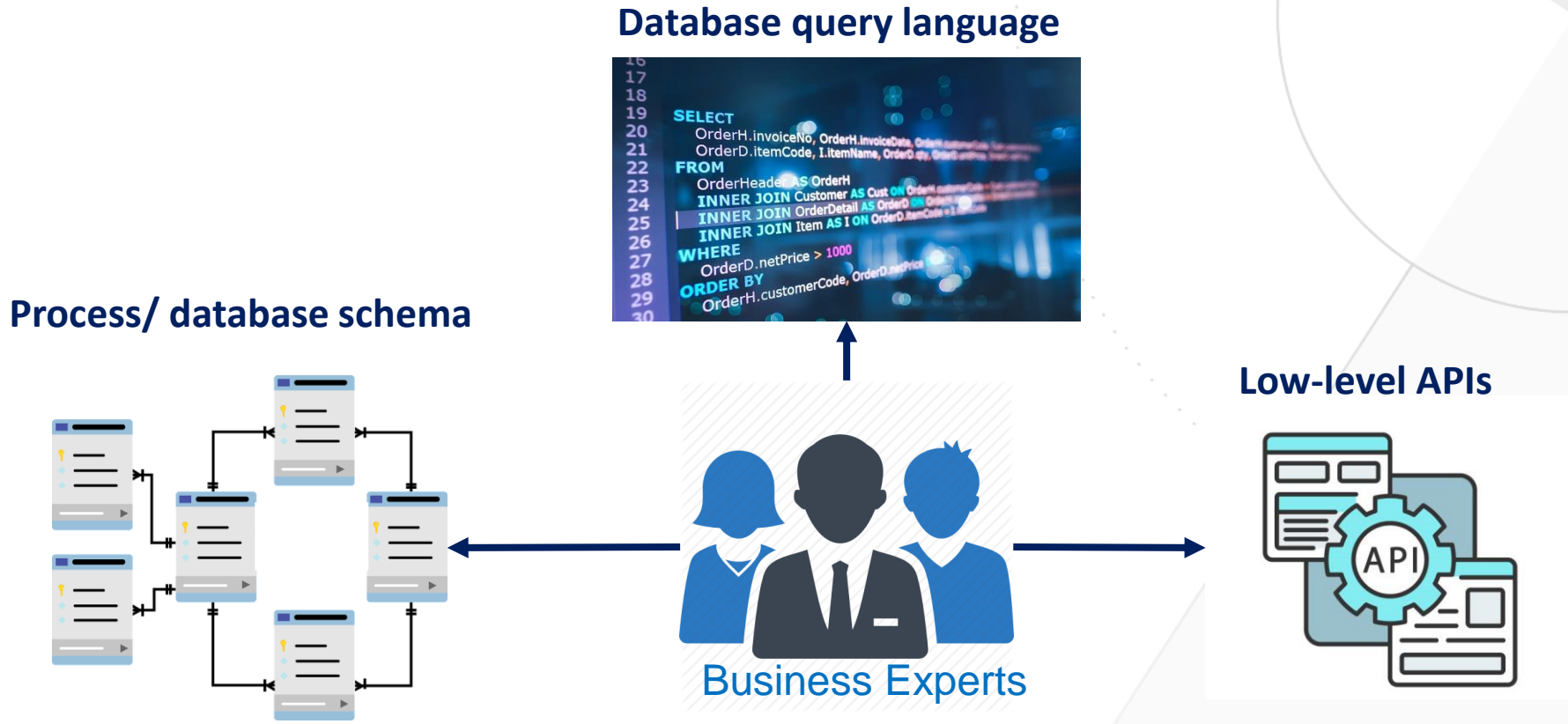Which actors are involved, Who executed what?

Which activities are executed? At what time? In which order?

Which data is produced?

MOTIVATION

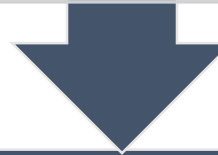The current generation of **process query** languages targets **data scientists.**

Database query language

Process/ database schema

Low-level APIs

Business Experts

RESEARCH PROBLEM

How to Make Process Data Accessible to Human Users in Natural Manner?

1. How to effectively store the process data?

•- Relations between events should be modeled as first-class citizen

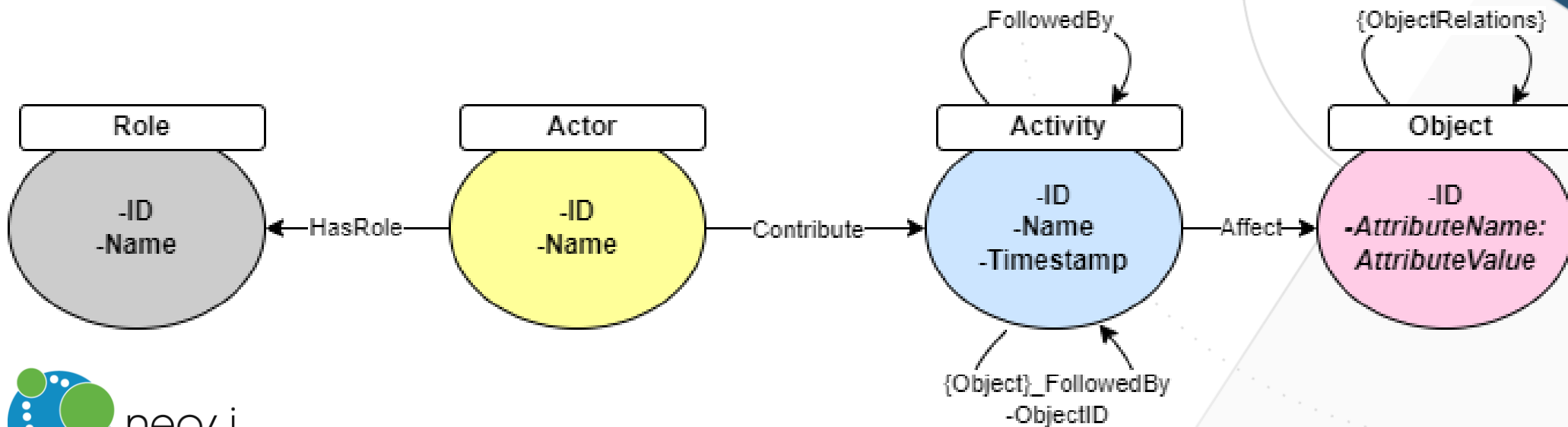•- Querying of paths between events should be straightforward

2. How to easily query the stored data?

Querying event data should be accessible to business user

Labeled Property Graph (LPG): Multi-dimensional event data storage

GRAPH-BASED STORED OF PROCESS DATA USING LPG

21/03/2023

8

HYBRID NATURAL LANGUAGE INTERFACE

Applications with an amount greater than 10000 and validated by John

```
MATCH (actor: Actor)-[:Contribute]-(activity: Activity),
       (activity)-[:Affect]-(application: Application)

WHERE actor.Name= 'JOHN' AND application.amount> 10000
       AND activity.Name= 'A_validation'

RETURN (application)
```
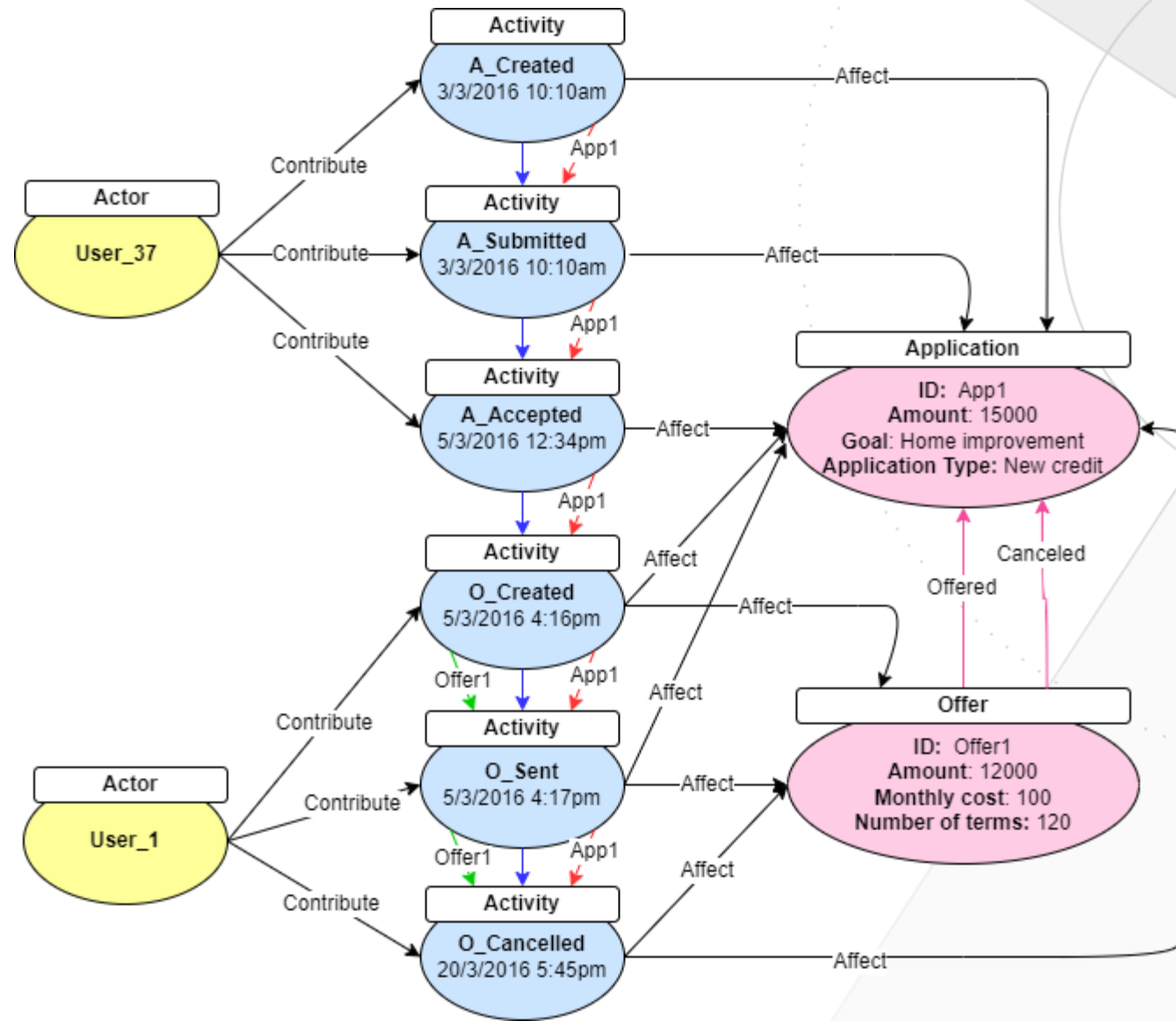
HOW TO EASILY QUERY THE STORED DATA?
HYBRID NATURAL LANGUAGE INTERFACE

Machine-learning **Rule-based**
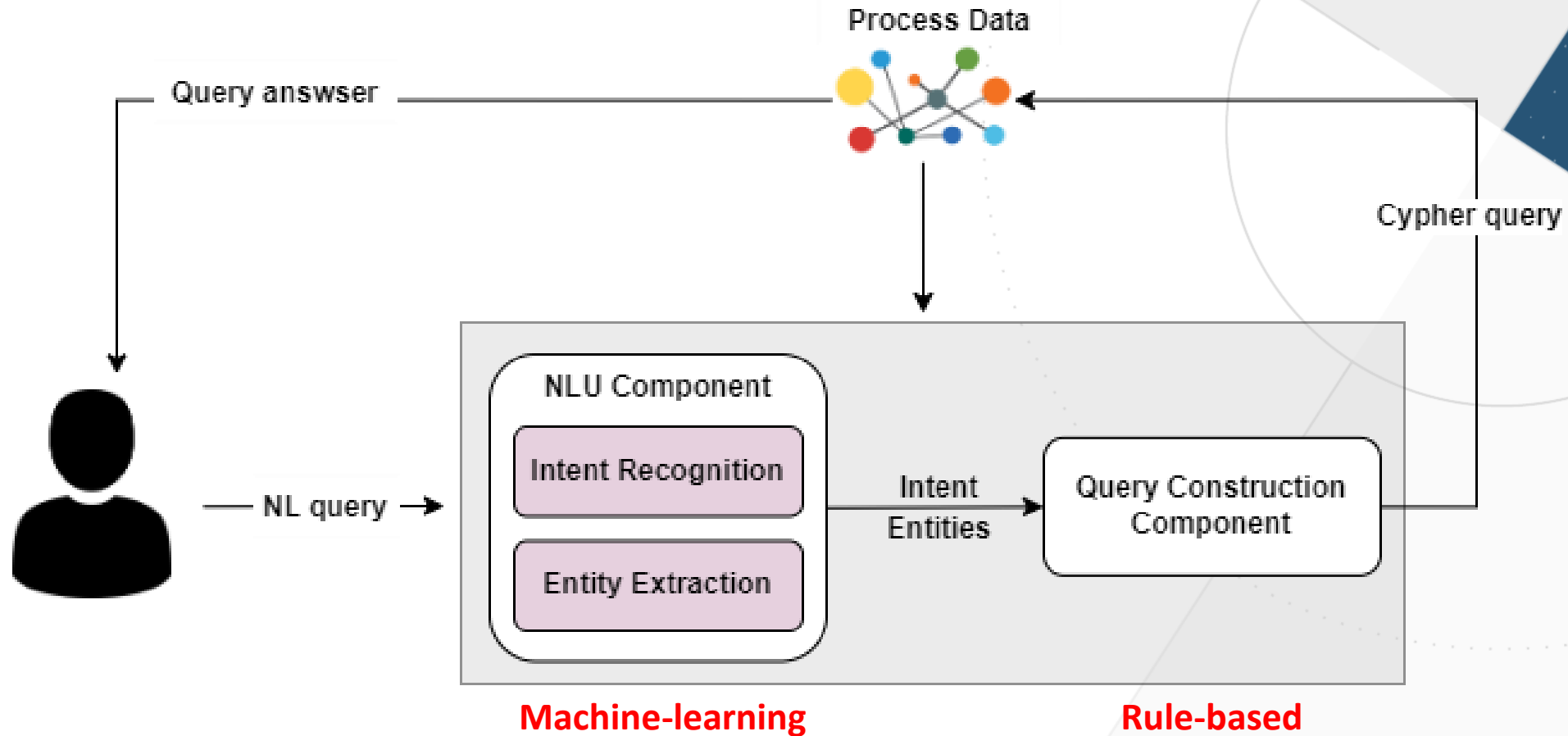
EVALUATION

Data set:

- BPIC'17 event log related to the loan application process
- OCEL order management log related to the order management process

Experimental setup:

- We collected more than 380 NL queries related to the loan application process from external users
- We generated 150 NL queries related to the order management process using a paraphrasing tool

Results:

- Our proposed approach is able to answer a wide variety of process related natural language queries.

PUBLICATIONS

- *"An Intent-based Natural Language Interface for Querying Process Execution Data"*
  M.Kobeissi, N.Assy, W.Gaaloul, B.Defude, B.Haidar
  Accepted at ICPM (2021).

- *"Natural Language Querying of Process Execution Data"*
  M.Kobeissi, N.Assy, W.Gaaloul, B.Benatallah, B.Defude, B.Haidar
  Accepted at Information System Journal – Special issue ICPM best papers (2022), **Class: A*.**