



Towards a Decision Support Architecture for Digital Preservation of Business Processes

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**Alex Neumann¹, Hossein Miri¹, John Thomson²,
Goncalo Antunes³, Rudolf Mayer⁴, Michael Beigl¹**

¹Karlsruhe Institute of Technology, Karlsruhe, Germany

²Caixa Magica Software, Lisbon, Portugal

³INESC ID, Lisbon, Portugal

⁴Secure Business Austria, Vienna, Austria

Agenda

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Introduction

- Motivation and Goal

Decision Support

- Architecture

Model

- Business Processes and their Environments

Use Case

- What to preserve?

Conclusion

- Summary and Outlook



Introduction

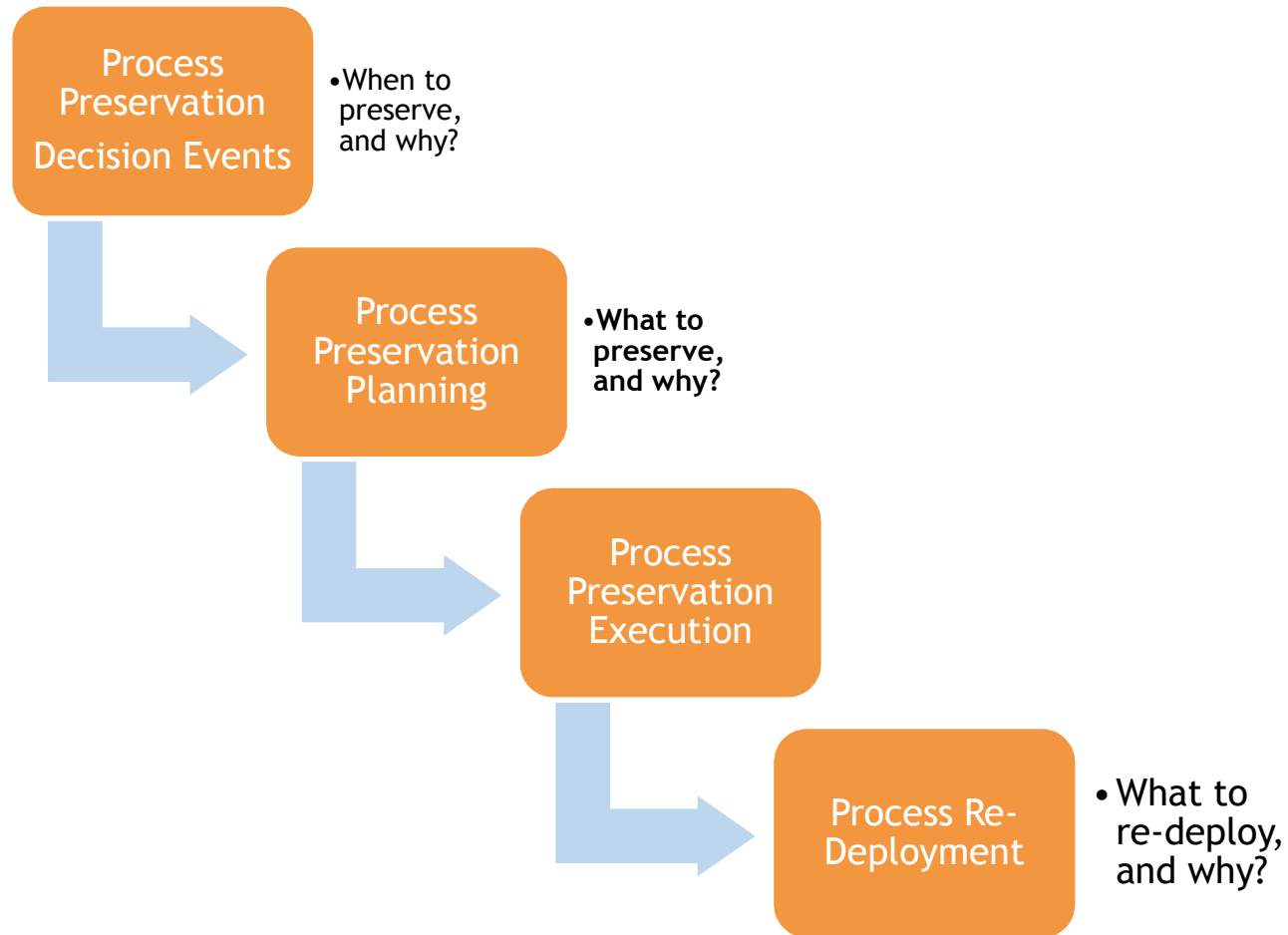
Motivation and Goal



- **Business Continuity (means long-term)**
 - Business depends on many processes
 - Administration, Management, Engineering, Science, ...
 - Processes describe the behavior of entities in domains
 - Define the context in which digital objects are generated, manipulated, or executed.
 - Processes are at risk of going down
- **Time-Resilient Business Processes**
 - Enabled by digital preservation of processes
 - Preserve all relevant processes and their relevant context
 - Technical infrastructure and standards
 - People (roles, concerns, responsibilities , ...)
 - ...

Preservation Process

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Requirements on Challenges

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- Involved arguments need to be preserved besides decisions
 - Effective tool in business
- Answering problems is (in worst case) process-specific
 - What to preserve?
 - Different process dependencies are relevant
- Answer problems as automated as possible for cost-efficiency
 - Problems are frequently evaluated

One Generic Tool

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- Interpret challenges as (generic logic-based) reasoning problems
 - Process-specific formulation of problems
 - Logically explainable solutions using a generic, sound and complete logic calculus
- One tool, which is easy to preserve
 - Operates on a well-documented knowledge representation and according to a well-documented calculus
 - Future will benefit from our system being able to explain its (process-specific) reasoning on a step-by-step base
 - e.g. based on inference rules, as a forward chainer would

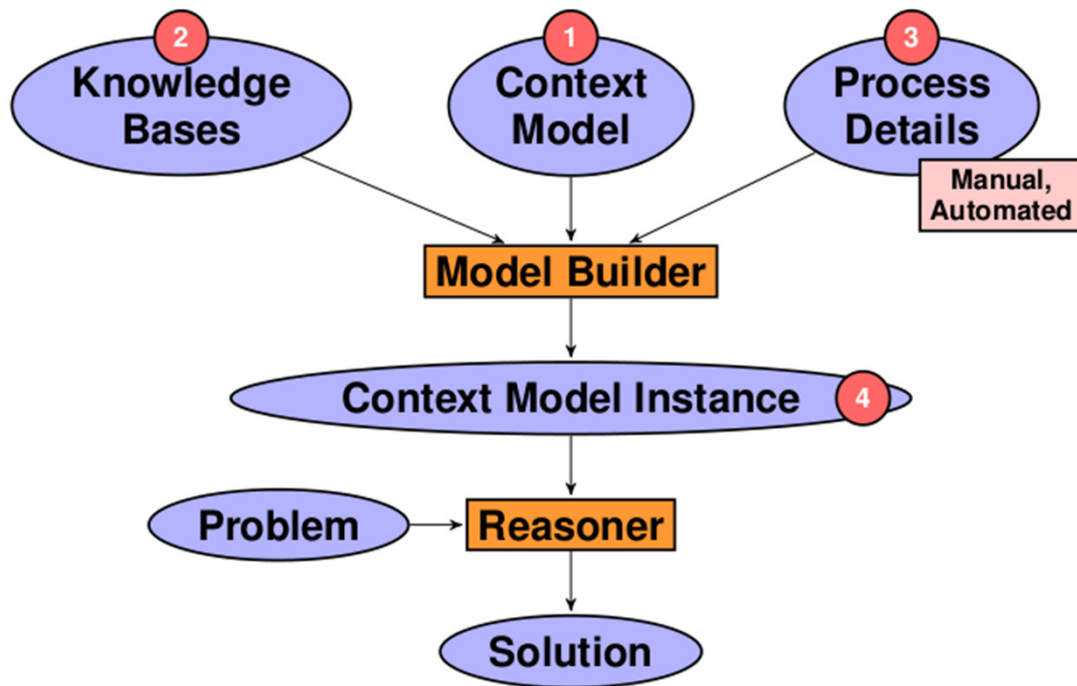


Decision Support

Architecture

Decision Support Architecture

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- Context Model (Instance)
 - Describes business processes and their context
 - OWL 2 DL proposed for potentially required expressiveness
- Formulate problems on these models
 - OWL 2 DL
 - SPARQL
- Apply off-the-shelf reasoners (and solvers) to solve problems
 - Pellet
 - APT-BPO



Model

Business Processes and their Environment

Context Model

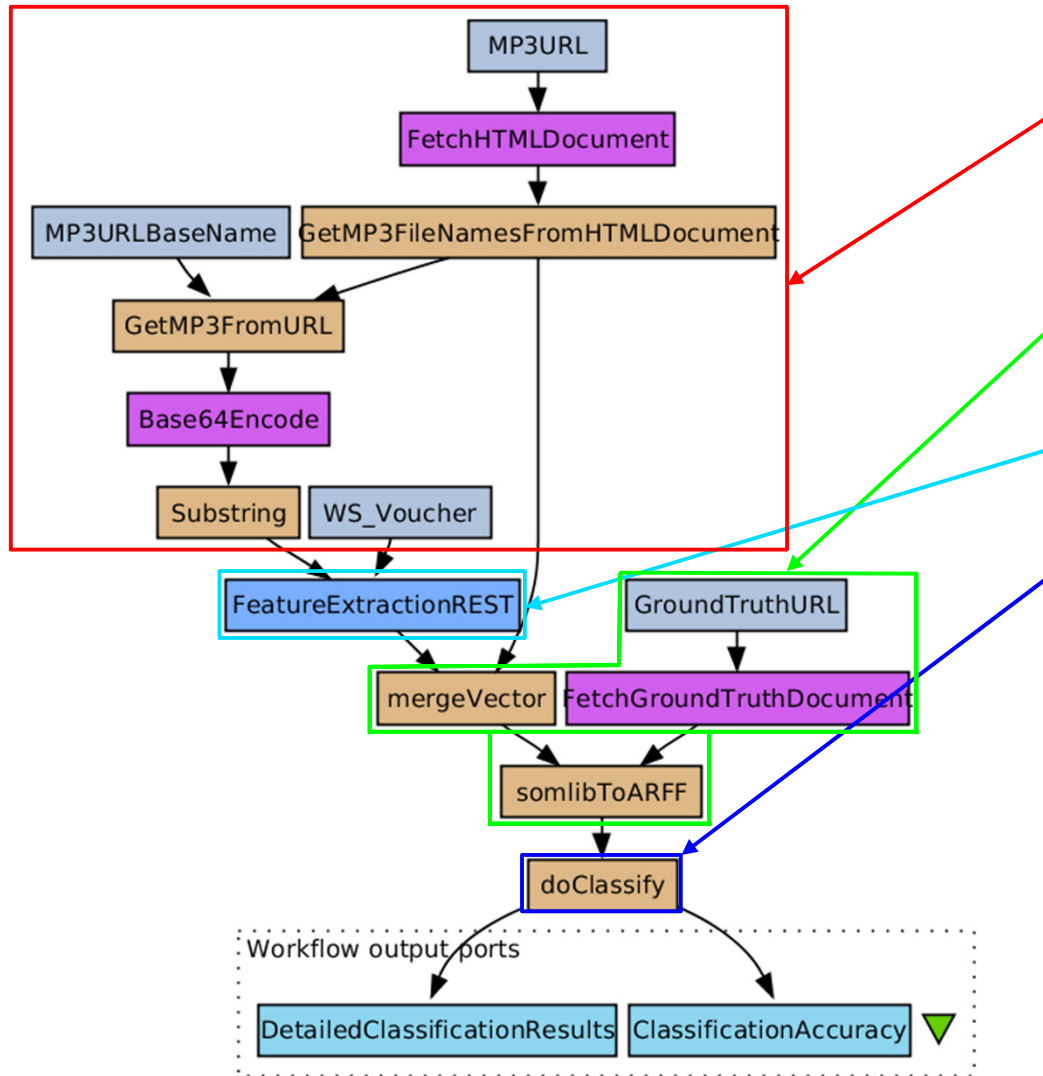
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- Describes business processes and their context
- Processes
 - Time Condition/Event Structures (Time Petri Nets)
 - Models causal flow and temporal constraints
 - Aligned with other models, such as WF4Ever (wrt causal flow)
 - Aligned to process models in provenance models, such as SHAMAN Context Model and PREMIS (wrt causal flow)
- Context
 - Ontology (proposed OWL 2 DL)
 - Model classes, individuals, relations and rules as generic process context framework
 - Aligned with other models, such as SHAMAN CM

Music Classification Process

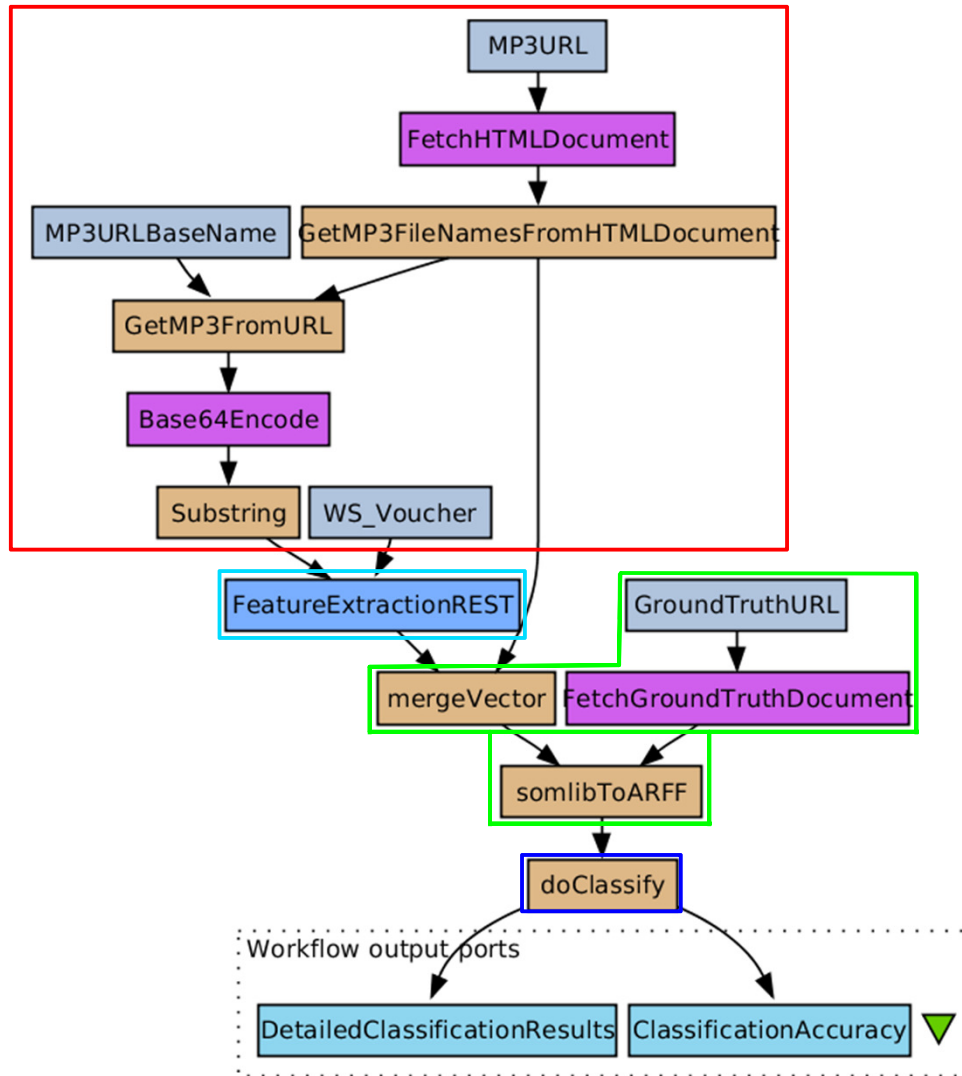
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- Get training and test data
- Get ground truth
- Extract features
- Build classifier and perform classification

Process Context (1)

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■ Process Specification

- Inputs and Outputs
- URLs, Files, Documents, Streams, Constants, Classifier, Classifications

■ Services (purple/blue)

■ Software

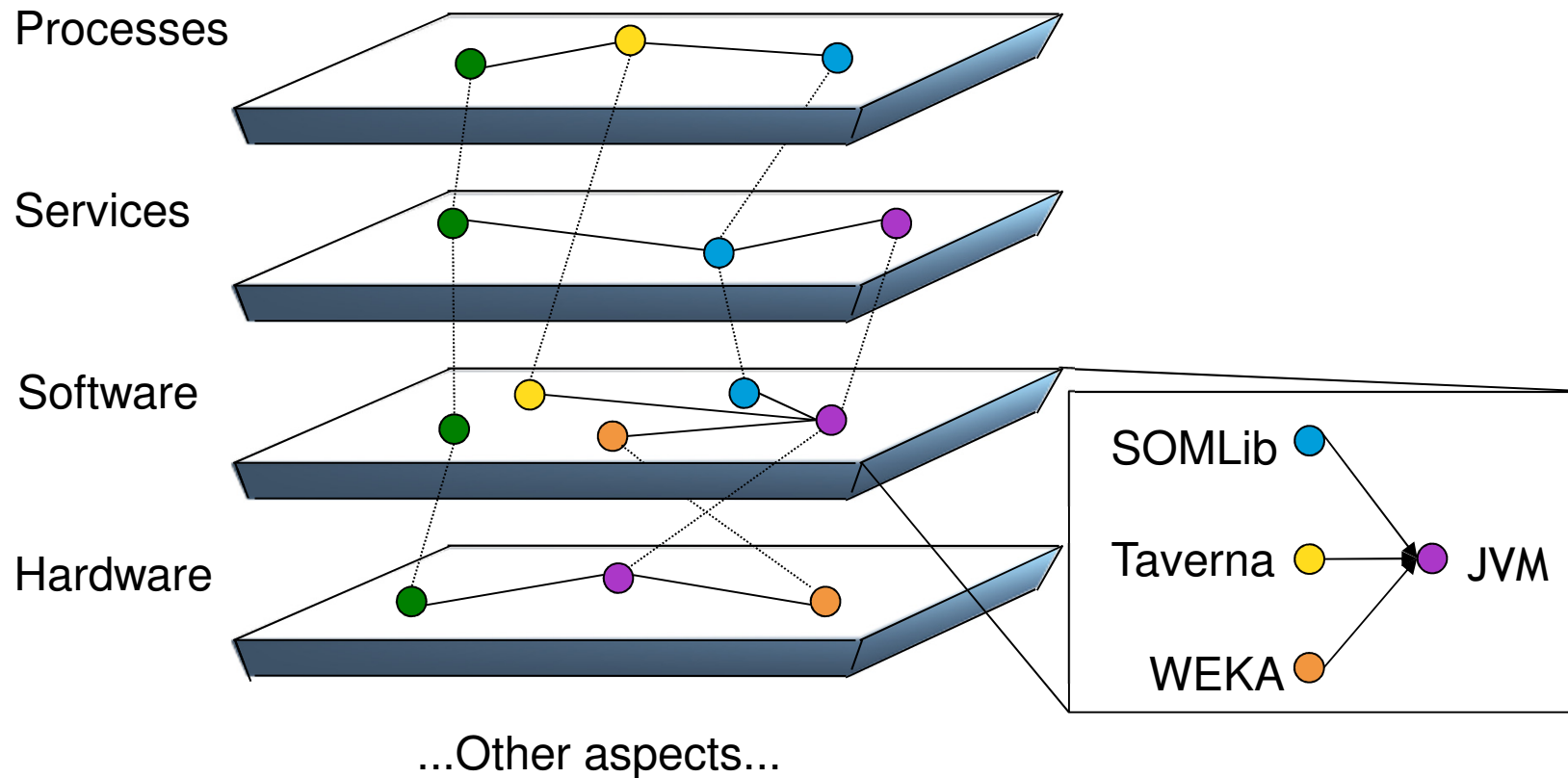
- Platform (Taverna)
- Libraries (WEKA, SOMLib)

■ Specifications

- ARFF, REST, HTTP, HTML, MP3, Algorithms

Process Context (2)

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Use Case

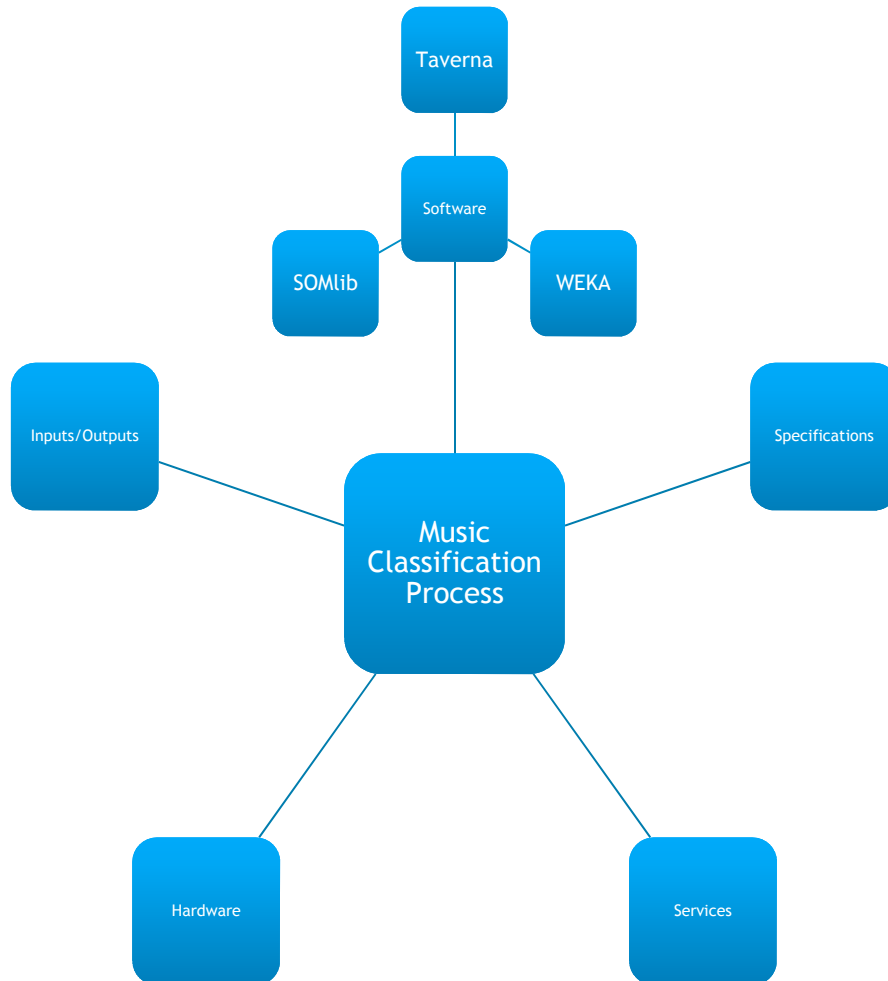
What to preserve?



- Process-specific notion of what is required by a process to be preserved and successfully re-deployed
- Requirements scopes
 - Entire domain of process preservation
 - Based on a repository
 - Sub-domains of process preservation
 - Based on a repository, or a digital preservation engineer
- Requirements types
 - **Required conditions**
 - What dependencies are at least **required** for re-deployment?
 - **Completeness conditions**
 - What dependencies need better to be **complete** for re-deployment?

Music Classification Process

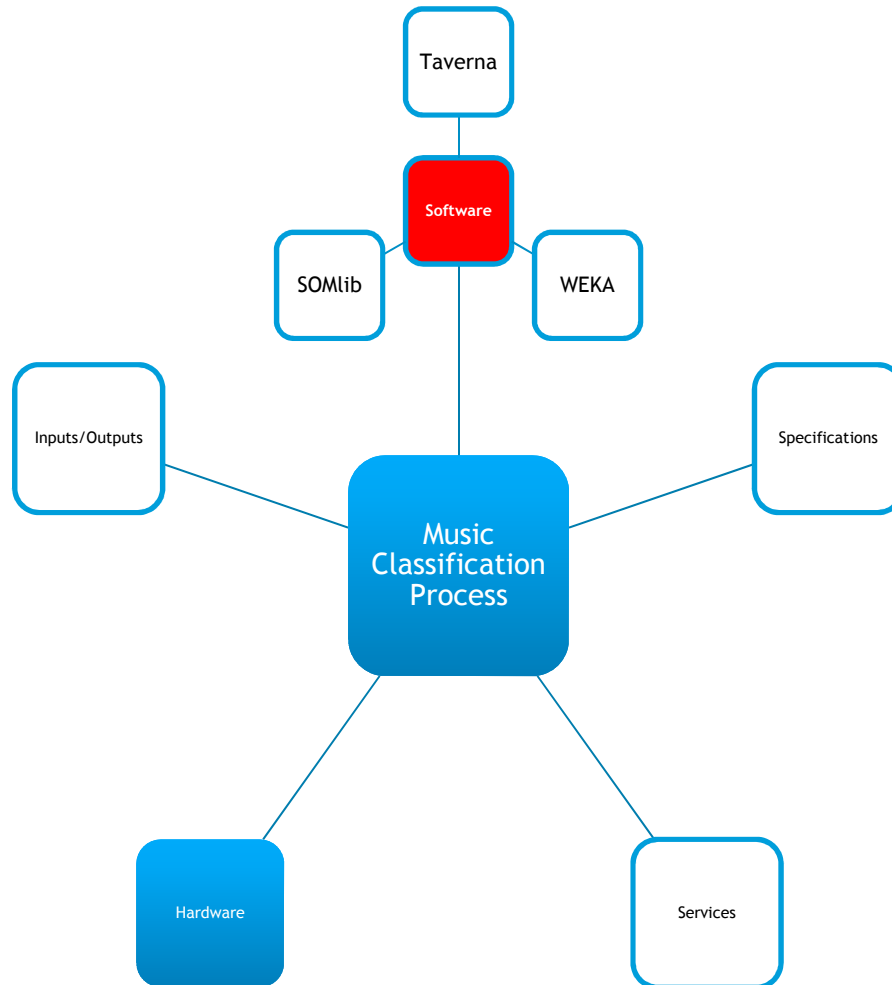
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- Model instance built using
 - Data extractors/crawlers
 - Expert knowledge
- Process preservation requirements
 - Need causal behavior equivalence only
 - **Required conditions**
 - Preserve anything but HW
 - **Completeness conditions**
 - All related software is preserved

Reasoning Assistance

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- What is required to be preserved?
 - Preserve anything but hardware
 - Software, Specifications, Services, Inputs/Outputs
- Is the model complete?
 - All related software is preserved
 - SW completeness condition not yet satisfied

Workflow

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- Populate the context model
 - Extraction tools
 - Expert knowledge

Instantiate
Context Model

- Specify requirements of preservation setting
 - Required conditions
 - Completeness conditions

Specify
Requirements

Evaluate
Results

- Inspect and adapt the model to requirements
 - Address required conditions
 - Address completeness conditions, and sign off model parts

Specialize
Context Model

- Use reasoning engine
 - Requirements satisfied?
 - What parts of the model are required to be preserved?
 - Are these parts complete?





Conclusion

Summary and Outlook

Summary

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- Generic architecture to assist in digital preservation of business processes
 - Based on off-the-shelf reasoners (and solvers) that operate according to generic logic calculi
 - Logically explainable answers to problems
 - Tools and arguments are easily preservable
- Addressed three decision support problems (using this architecture)
 - Talk
 - What to preserve? (Pellet reasoner, N2EXPTIME-complete)
 - Paper
 - When to preserve? (Pellet reasoner, N2EXPTIME-complete)
 - What to re-deploy? (APT-BPO solver, NP-complete)



- Problem: Expressiveness of our ontology language (OWL 2 DL) poses high computational complexity in ontology reasoning
 - Satisfiability and querying is N2EXPTIME-complete
- Future: Evaluation of the architecture in use cases of the TIMBUS project will determine
 - Practical feasibility of OWL 2 DL in the domain of business process preservation
 - Whether we can restrict expressiveness of used language



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