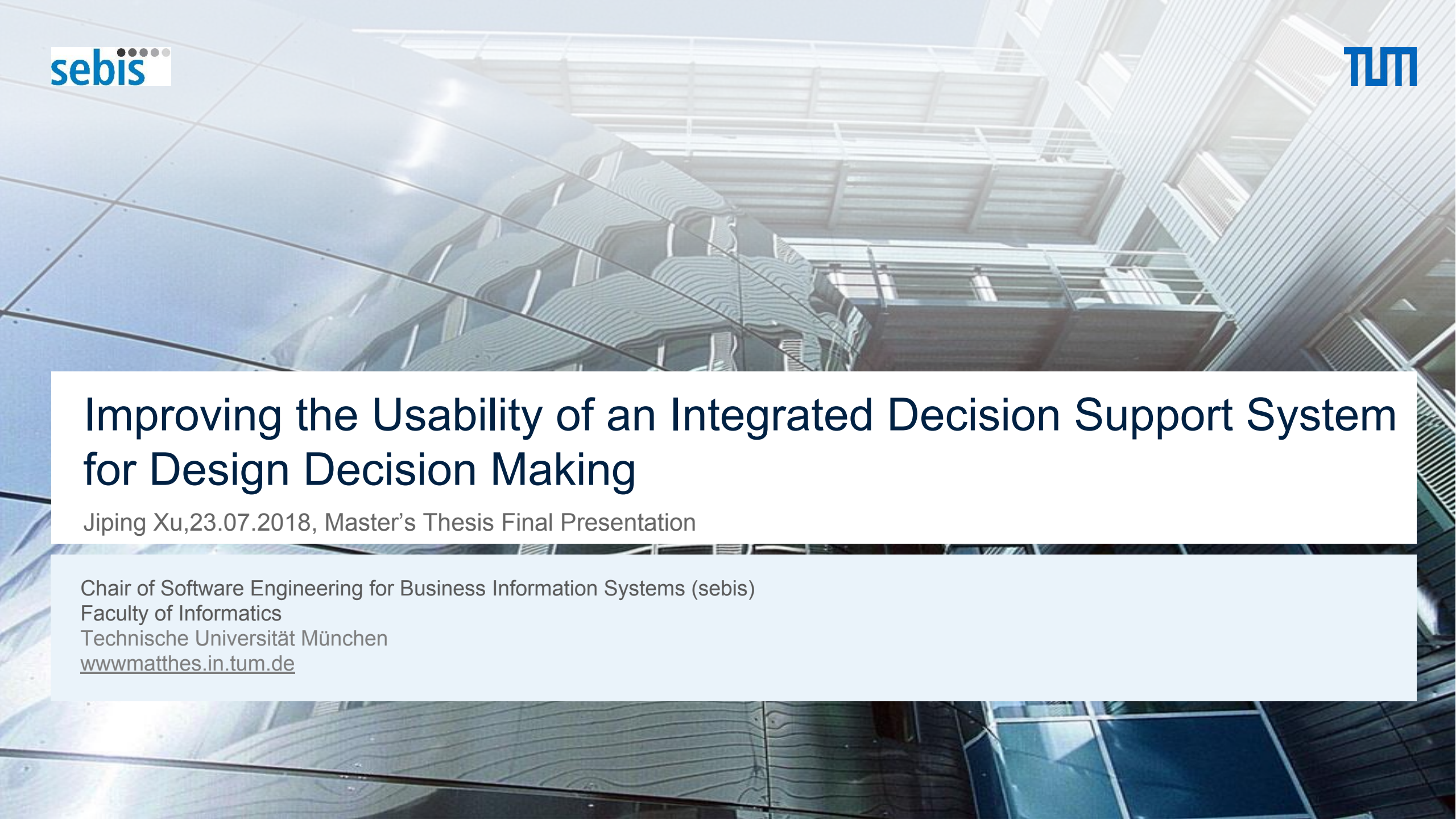

Improving the Usability of an Integrated Decision Support System for Design Decision Making

Jiping Xu,23.07.2018, Master's Thesis Final Presentation

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Outline

Motivation
- Architectural Design Decision
- Architecture Management Enabler for Leading Industrial software (AMELIE)

Research Questions

Contribution
- Requirements Analysis
- Enhancing User Interfaces
- Containerization
- End-user and Developer Documentation

Conclusion

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Motivation

- Software architecture is a set of architectural design decisions [1].
- These design decisions involve important choices on core components to satisfy and balance stakeholders' concerns [2].
- Benefits of explicitly capturing design decisions: lower costs of change, reusability [3], …
- But architects and developers do not document their design decisions: manual effort, extra cost [4].

Design decisions are important to the success of the software, but it is difficult to make good decisions. So there is a need for a system to support architects and developers in the process of design decision making - Architecture Management Enabler for Leading Industrial software (AMELIE).

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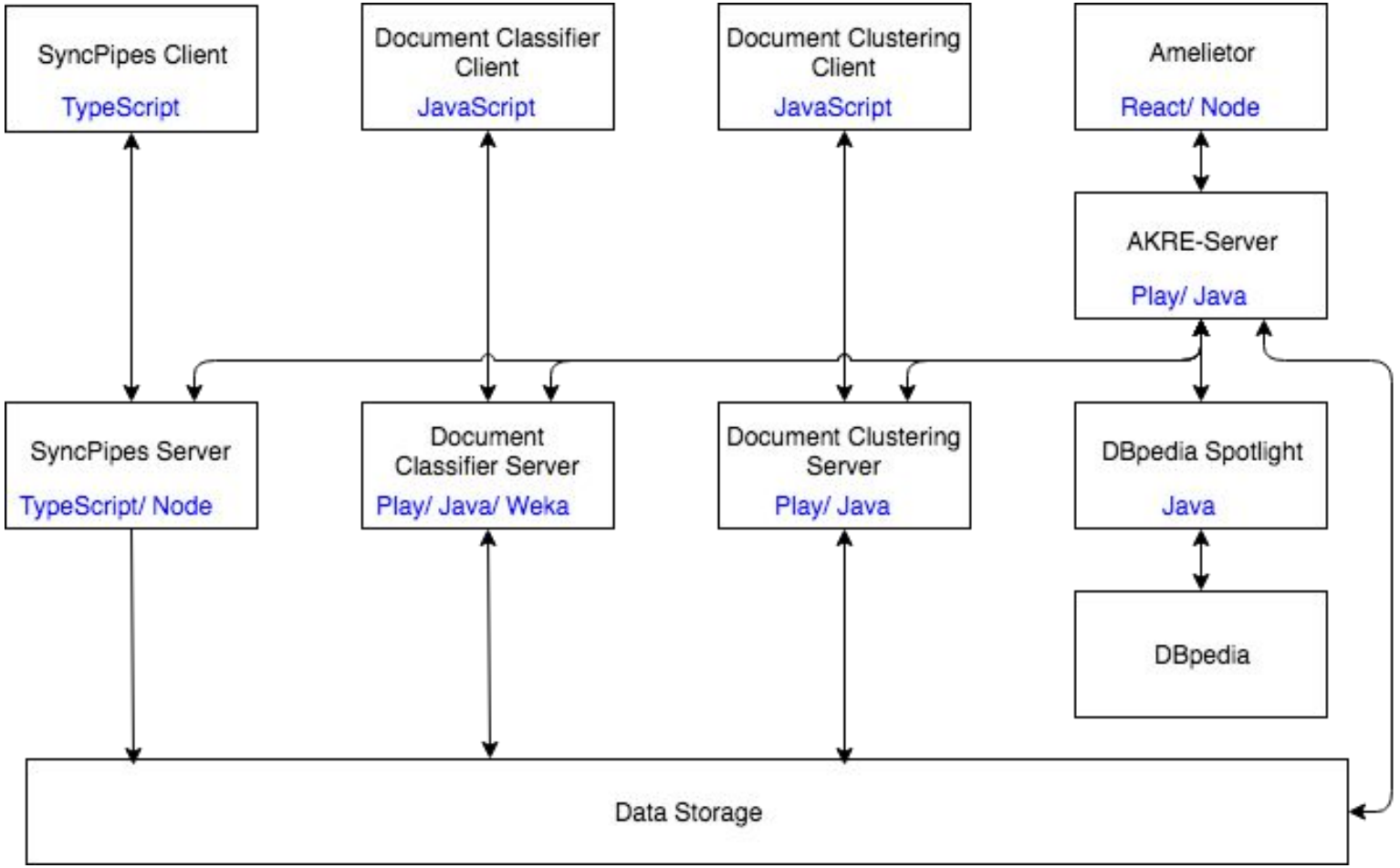
Motivation - AMELIE

- Microservice architecture
- Developed by different people at different time



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Research Questions

RQ1: What are the requirements of a decision support system (DSS) for making design decisions?

- A rather new field with emerging models and tools
- Industry partner - Siemens AG: real-world use cases

RQ2: How to improve the *usability* of an existing DSS that supports design decision making?

- Identified stakeholders of the system: end-users and developers
- End-users:
  - Usability of user interfaces
  - Understandability
  - Learnability
- Developers:
  - Understandability
  - Maintainability

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Requirements Analysis

- Requirements elicitation based on a literature review
- Practitioners' feedback
- Artifact: a list of requirements
  - 31 requirements related to architectural knowledge management
  - 15 requirements focused on architectural design decisions

Example:

No.	Description	Siemens*	AMELIE**
1	Integration with other tools [5, 6, 9]: automatic or semi-automatic integration with others tools during different phases of software lifecycle.	Y	Y
2	Reasoning capability [6]: basic inference mechanism that can automatically detect inconsistencies, state new questions or perform some fuzzy reasoning.	Y	-
3	Architectural decision consequence analysis [7, 8, 10]: the main consequences of a decision are the changes in the model when a decision is executed. In addition, new decision topics can be introduced.	Y	P

* Is this a real-world use case from our industrial partner?

** Is this already supported by AMELIE?

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Enhancing User Interfaces (UIs)

- Performed an expert review on the UIs
- Identified 14 major issues
- Redesigned and reimplemented UI elements based on those issues
- Results:
  - Projects Overview
  - Import a Project
  - Quality Attributes
  - Architectural Elements
  - Expertise Matrix
  - Expert Recommender
  - Design Decisions
  - Decision Details

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Enhancing User Interfaces - Projects Overview

Search...

Projects

	Project Name	Description	Category	# Issues
☐	Spark	Apache Spark is a fast and general cluster computing system.	Apache Software	22279
☐	NCK	Numerical Control Kernel		16885
☐	Hadoop Common	Hadoop Common is the common library for Apache Hadoop.	Hadoop	12906
☐	Connected Mobility Lab		CML	1232
☐	XmlSchema		Web Services	Import

Identified problems:

- Search field away from table
- Misleading checkboxes
- Multiple types of elements mixed in '# Issues' column
- No pagination: entire table on one page
- Delay during scrolling the table

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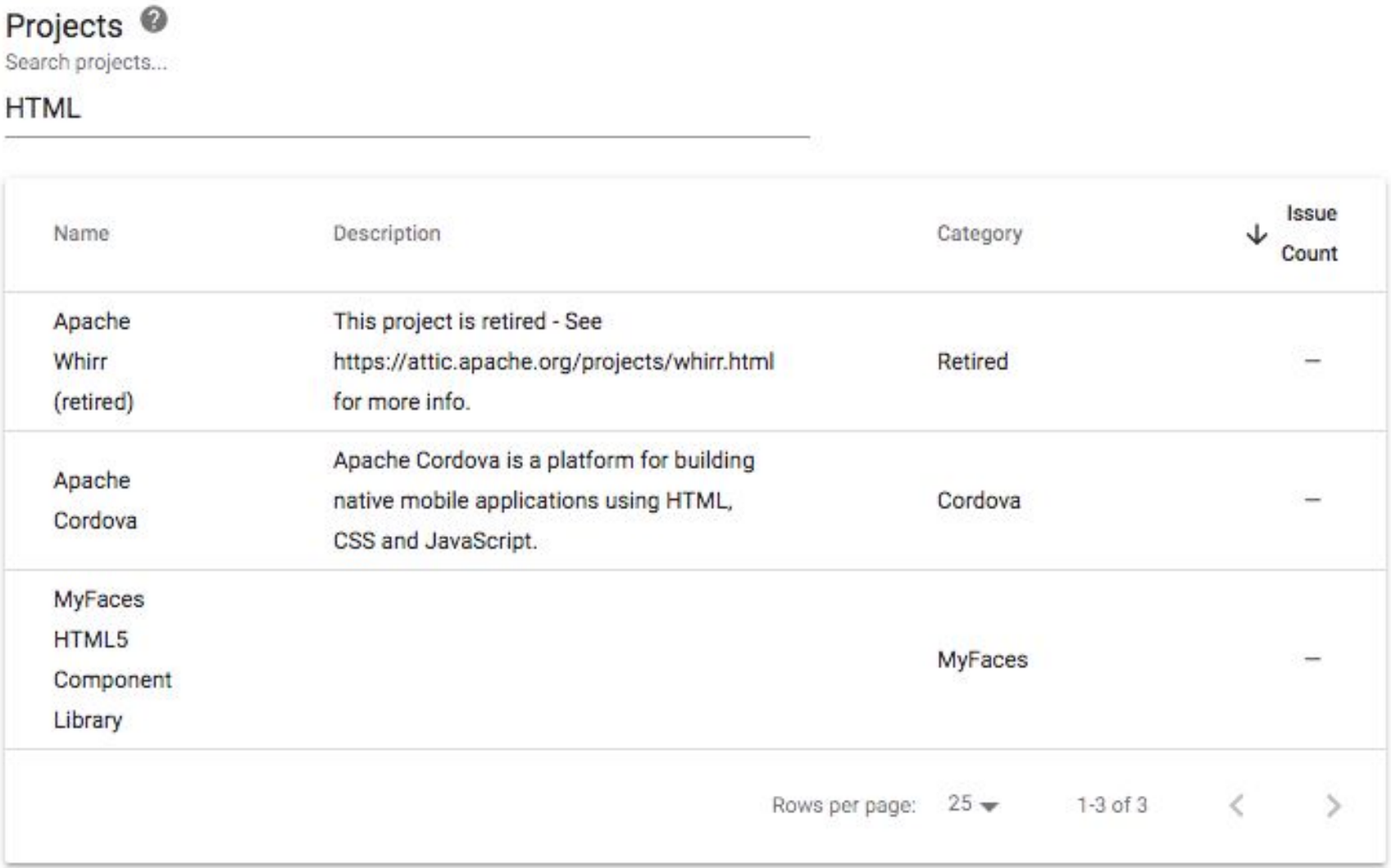
Enhancing User Interfaces - Projects Overview Cont'd



Improvements:

- Repositioned search field ✓
- Removed checkboxes ✓
- Removed import action from the '# Issues' column ✓
- Added customizable pagination ✓
- Replaced the deprecated data table component ✓

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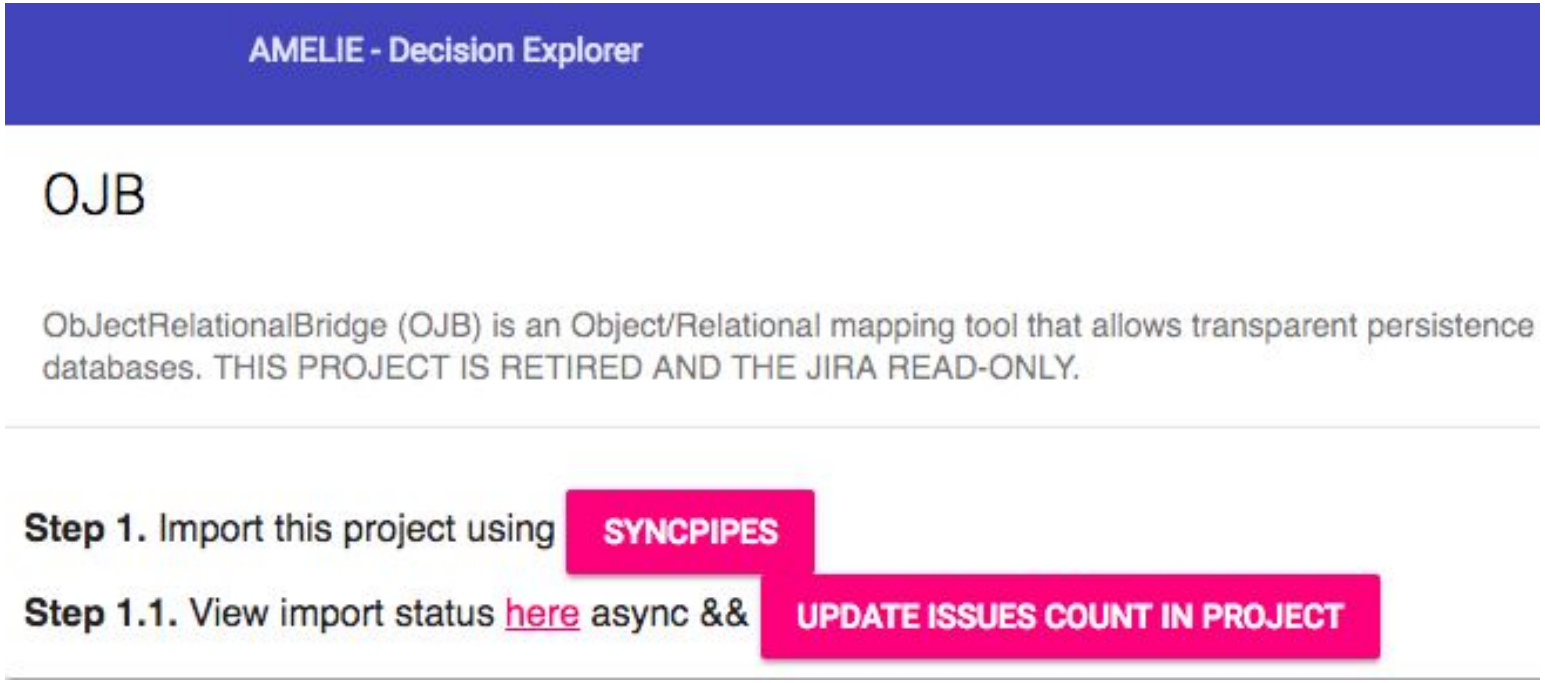
Enhancing User Interfaces - Import a Project



Identified problems:

- Unclear meaning of step 1.1
- Manual state checking in another web application
- Confusing button labels

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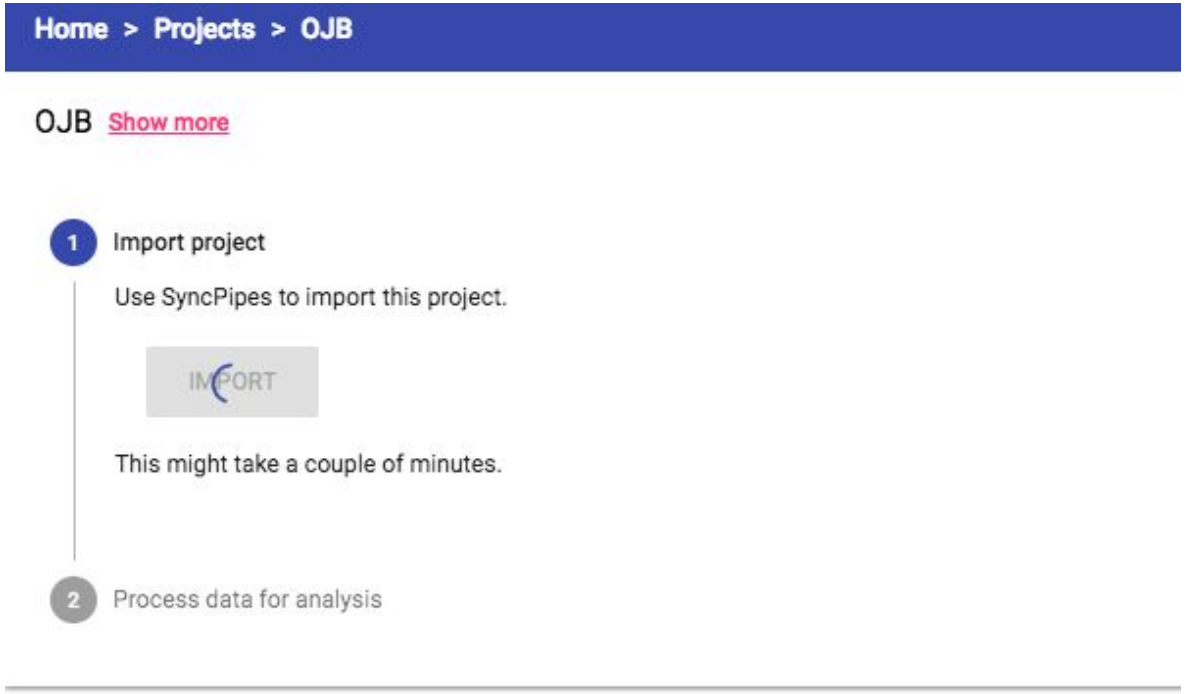
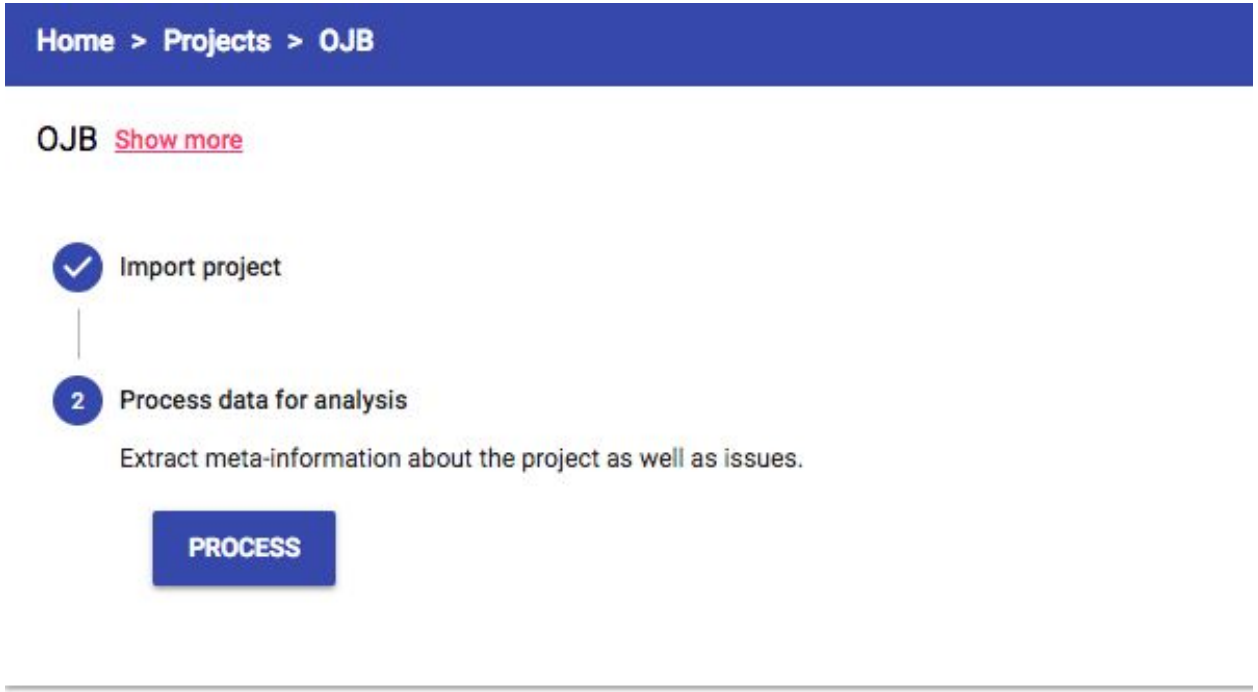
Enhancing User Interfaces - Import a Project Cont'd



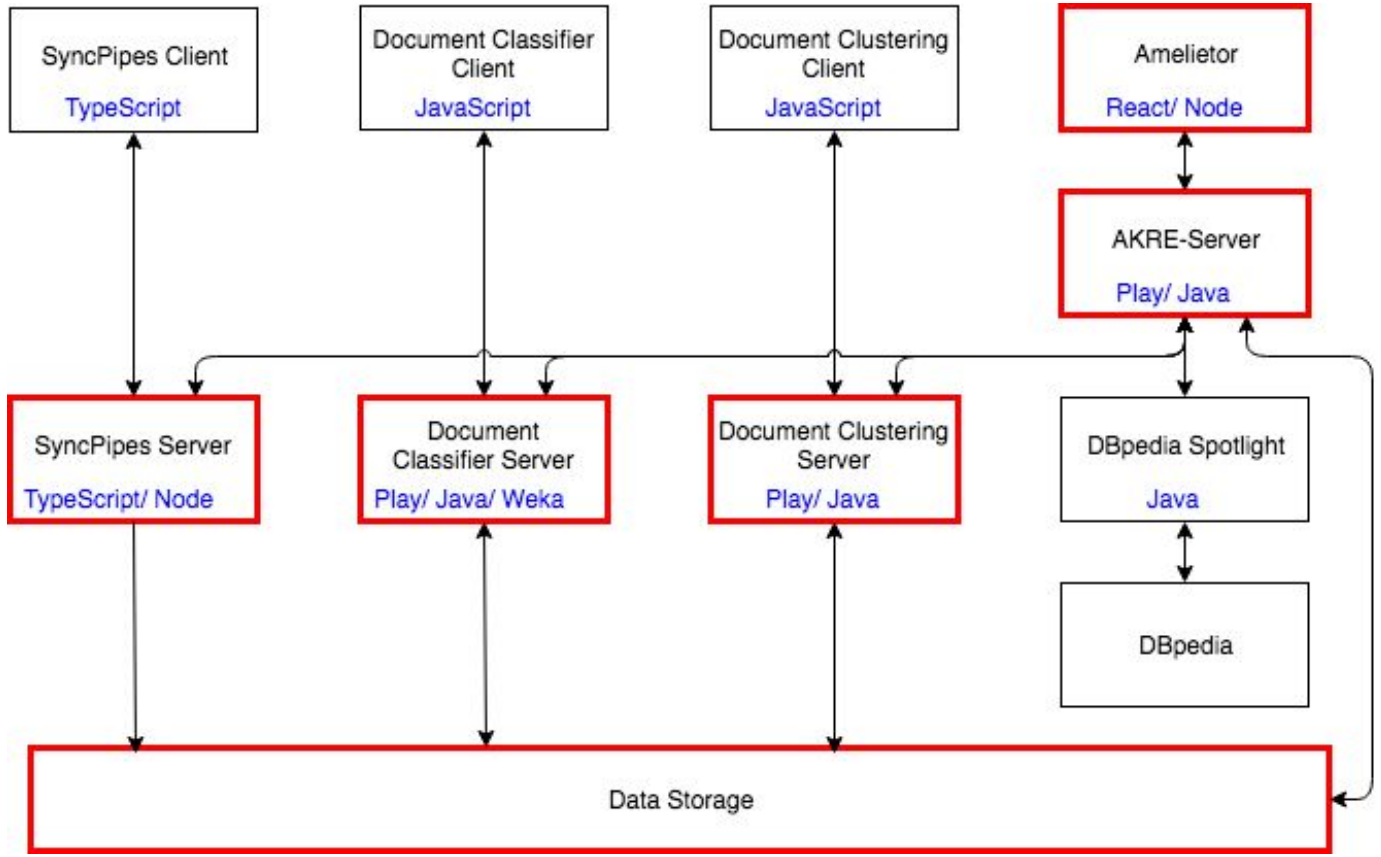


Improvements:

- Restructured the workflow for an intuitive user experience ✓
- Implemented automatic status update and step advancement ✓
- Renamed button labels ✓

Containerization

- Individual docker for each microservice
- Shared data storage:
  - One dedicated container for the database
  - Restore from database dumps
- One-click deployment



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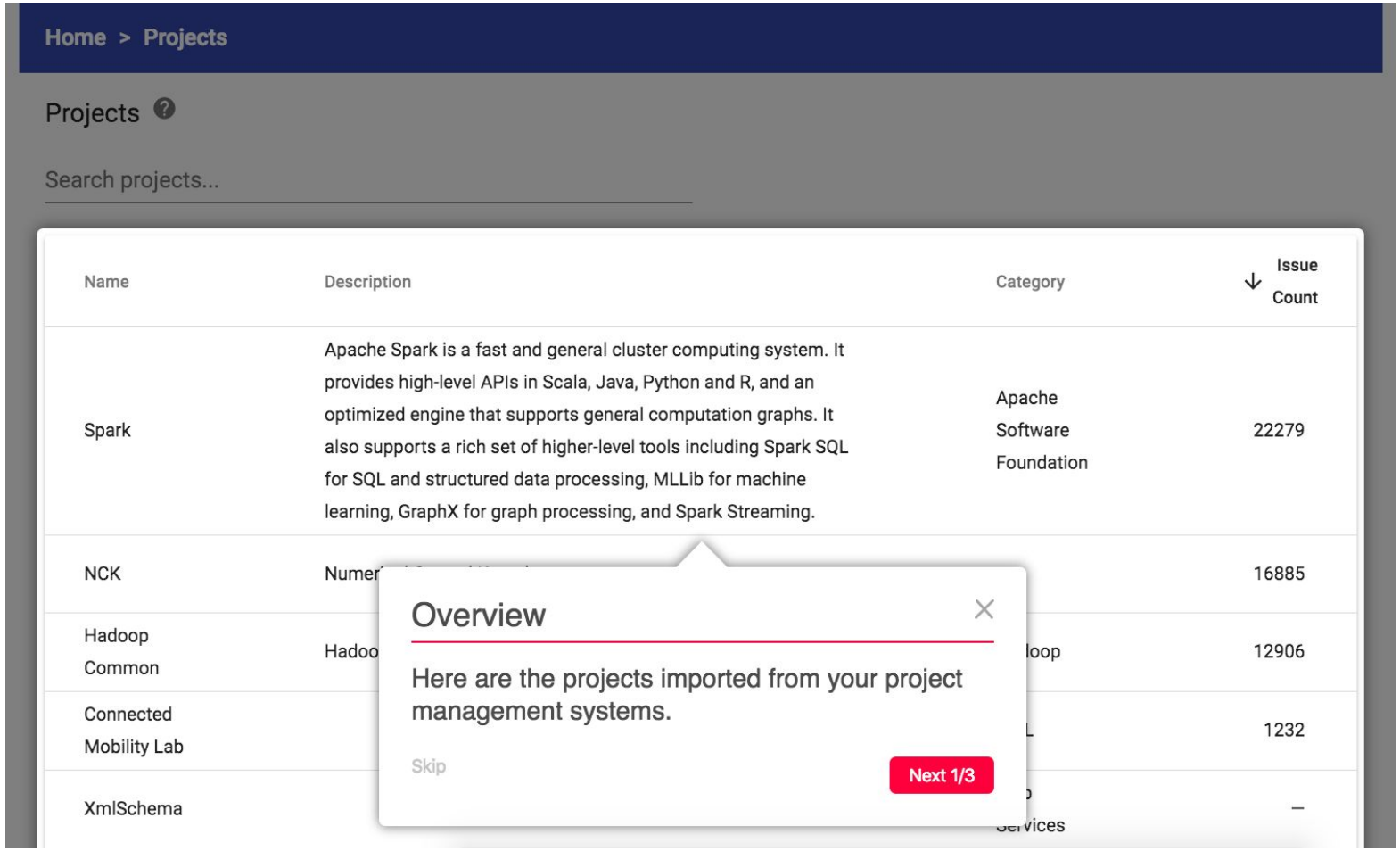
End-user Documentation

- In-app guided tour: learnability, understandability
  - Implementation: React Joyride library



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End-user Documentation - Cont'd

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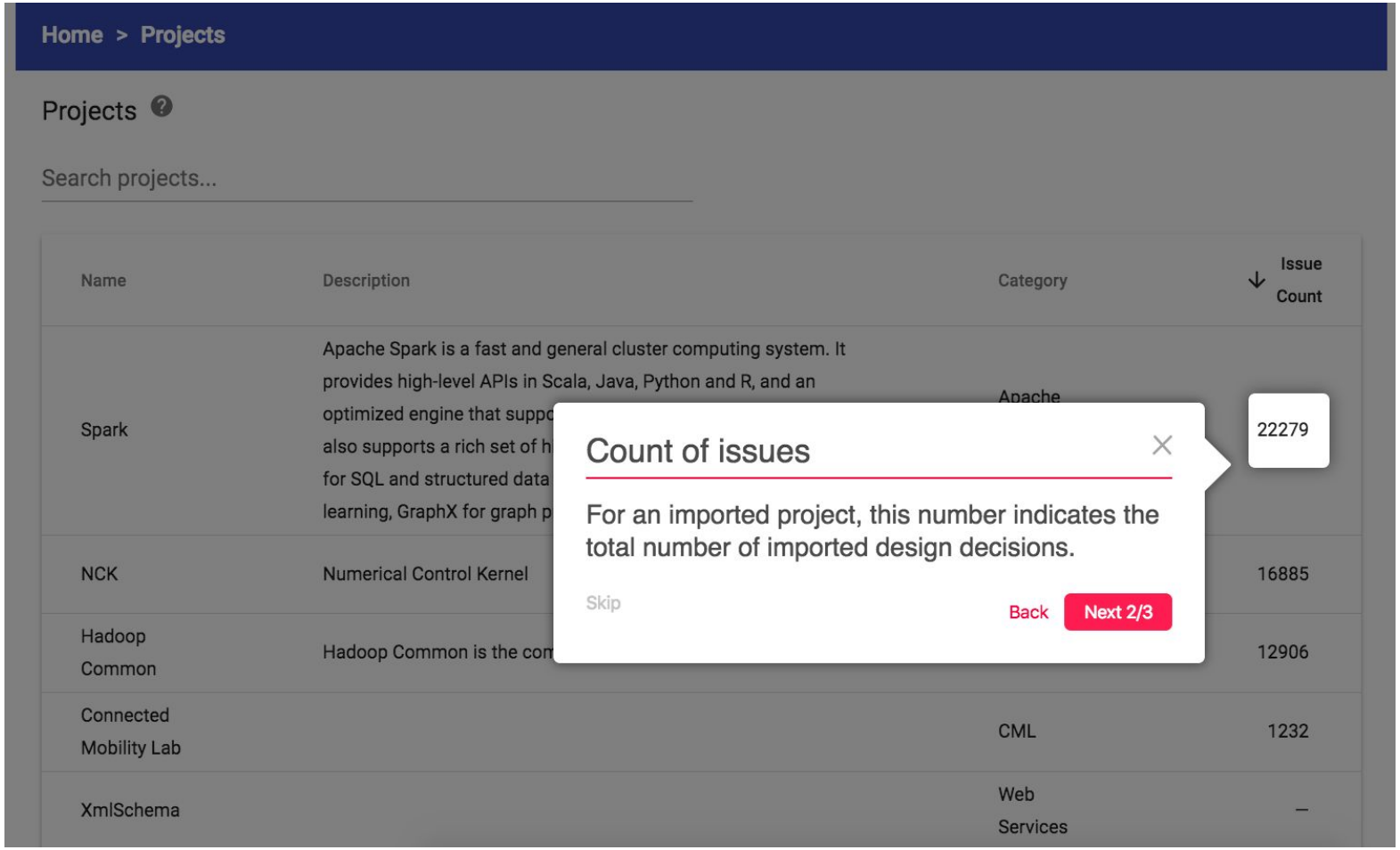

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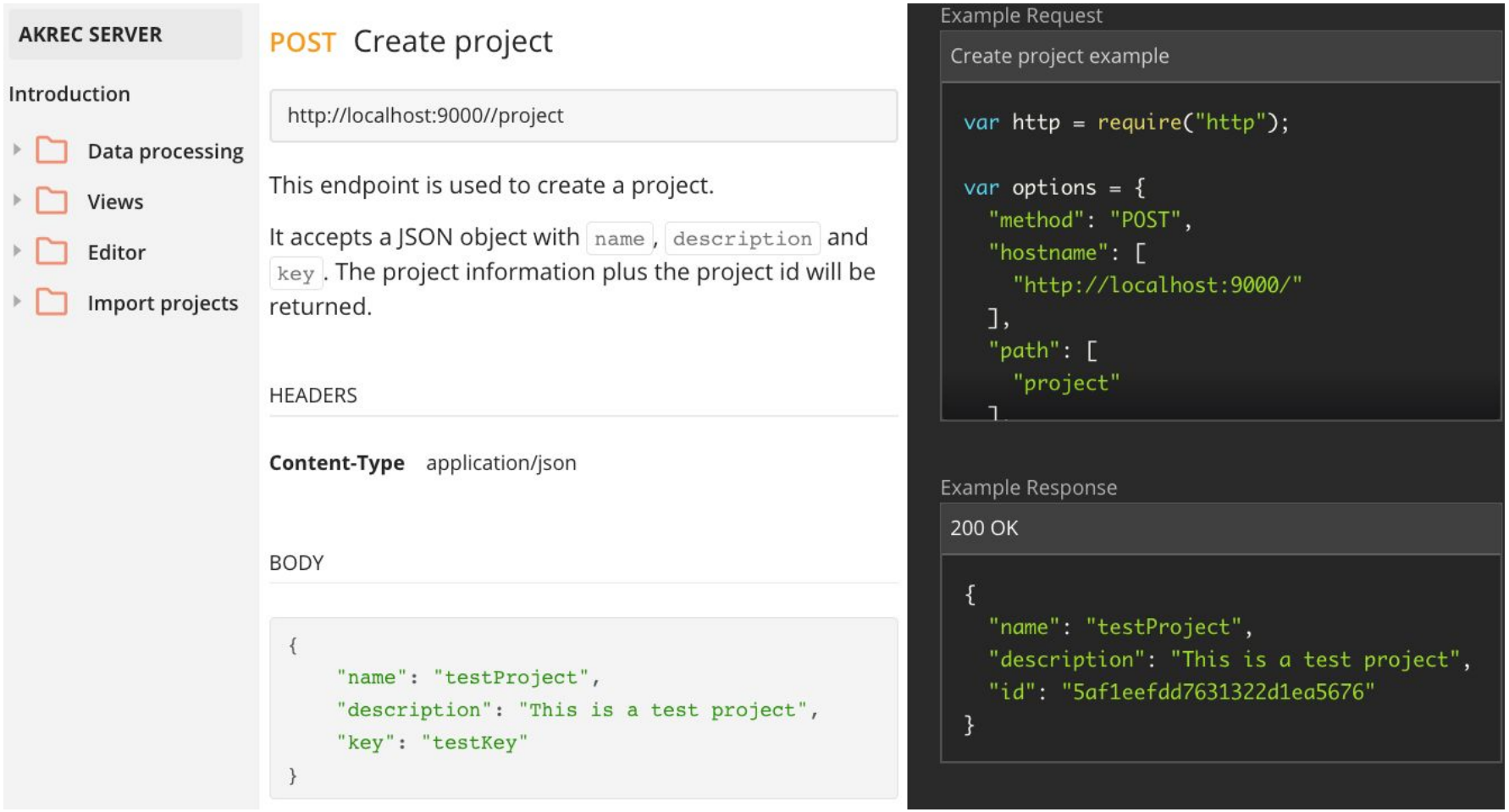
Developer Documentation

- Addresses understandability, maintainability
- API documentation based on Postman Tool
- Instructions for configuring machine learning models



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- Requirements elicitation based on a literature review
- Practitioners' feedback
- Researcher's feedback
- Artifact: a list of requirements
  - 31 requirements related to architectural knowledge management
  - 15 requirements focused on architectural design decisions

RQ2: How to improve the *usability* of an existing DSS that supports design decision making?

- End-users:
  - Enhancing user interfaces
  - In-app guided tour
- Developers:
  - Containerization [1] : development, deployment
  - API documentation [2] : development, maintenance
  - Machine learning configuration [3] : development

1. https://hub.docker.com/r/sebischair/amelie/
2. https://github.com/sebischair/akre-server
3. https://github.com/sebischair/DocClusteringWorkbench/wik

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References

[1] Jansen, A., & Bosch, J. (2005). Software architecture as a set of architectural design decisions. In Software Architecture, 2005. WICSA 2005. 5th Working IEEE/IFIP Conference on (pp. 109-120). IEEE.

[2] Zimmermann, O. (2011). Architectural decisions as reusable design assets. IEEE software, 28(1), 64-69.

[3] Tofan, D., Galster, M., Avgeriou, P., & Schuitema, W. (2014). Past and future of software architectural decisions–A systematic mapping study. Information and Software Technology, 56(8), 850-872.

[4] Capilla, R., Nava, F., & Carrillo, C. (2008, September). Effort estimation in capturing architectural knowledge. In Proceedings of the 2008 23rd IEEE/ACM International Conference on Automated Software Engineering (pp. 208-217). IEEE Computer Society.

[5] Tang, A., Avgeriou, P., Jansen, A., Capilla, R., & Babar, M. A. (2010). A comparative study of architecture knowledge management tools. Journal of Systems and Software, 83(3), 352-370.

[6] Capilla, R., Jansen, A., Tang, A., Avgeriou, P., & Babar, M. A. (2016). 10 years of software architecture knowledge management: Practice and future. Journal of Systems and Software, 116, 191-205.

[7] Van Der Ven, J. S., Jansen, A., Avgeriou, P., & Hammer, D. K. (2006, July). Using architectural decisions. In Second International Conference on the Quality of Software Architecture (Qosa 2006).

[8] Jansen, A., Van Der Ven, J., Avgeriou, P., & Hammer, D. K. (2007, January). Tool support for architectural decisions. In Software Architecture, 2007. WICSA'07. The Working IEEE/IFIP Conference on (pp. 4-4). Ieee.

[9] Regli, W. C., Hu, X., Atwood, M., & Sun, W. (2000). A survey of design rationale systems: approaches, representation, capture and retrieval. Engineering with computers, 16(3-4), 209-235.

[10] Tang, A., Jin, Y., & Han, J. (2007). A rationale-based architecture model for design traceability and reasoning. Journal of Systems and Software, 80(6), 918-934.