



# **Frankfurt University of Applied Sciences**

Faculty of Computer Science and Engineering

## **Implementation and Evaluation of an Enterprise Architect Chatbot Using a RAG-Based Approach**

Thesis to Obtain the Academic Degree

Master of Science (M.Sc.)

Submitted by

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## DECLARATION (ERKLÄRUNG)

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The drawings or images in this work were created by myself or provided with a corresponding source reference.

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*Frankfurt a.M., 16. April, 2026*

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Hendrik Gruber

## ABSTRACT

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Lorem ipsum ...

## CONTENTS

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<b>I THESIS</b>	
<b>1 INTRODUCTION</b>	<b>2</b>
1.1 Motivation and Thesis Question . . . . .	2
1.2 Research Method . . . . .	2
<b>2 TERMINOLOGY AND TECHNOLOGY</b>	<b>3</b>
2.1 Terminology . . . . .	3
2.1.1 Enterprise Architecture Management . . . . .	3
2.1.2 Enterprise Architect . . . . .	3
2.1.3 Business Capabilities . . . . .	4
2.1.4 Architecture Diagrams . . . . .	4
2.2 Technology . . . . .	4
2.2.1 Large Language Models . . . . .	4
2.2.2 Graph Database . . . . .	4
2.2.3 Retrieval Augmented Generation . . . . .	4
2.2.4 neo4j and the Cypher Query Language . . . . .	4
2.2.5 Model Context Protocol . . . . .	4
2.2.6 XML and Transpilers . . . . .	4
2.2.7 APOC and XPATH . . . . .	5
<b>3 CURRENT STATE OF THE ART</b>	<b>6</b>
3.1 Enterprise Architecture Management . . . . .	6
3.2 Large Language Models, Conversational Agents, and Retrieval-Augmented Generation . . . . .	6
3.3 Comparable Projects and Prototypes . . . . .	7
3.4 Evaluations and Limitations . . . . .	7
<b>4 METHODOLOGY</b>	<b>8</b>
4.1 Action Research Design . . . . .	8
4.2 Action Research Setup . . . . .	9
4.3 Action Research Cycles . . . . .	9
4.3.1 Cycle 1 . . . . .	10
4.3.2 Cycle 2 . . . . .	10
4.3.3 Cycle 3 . . . . .	10
4.3.4 Cycle 4 . . . . .	10
4.4 Final Meeting . . . . .	10
<b>5 IMPLEMENTATION</b>	<b>12</b>
5.1 Data Used . . . . .	12
5.2 Finished Prototype . . . . .	12
5.2.1 Finished Architecture . . . . .	12
5.2.2 Generating Text-to-Cypher Independent of the Database Schema . . . . .	12
<b>6 EXPERIMENTS</b>	<b>14</b>
<b>7 IMPLEMENTATION</b>	<b>18</b>

<b>8 DISCUSSION</b>	<b>19</b>
<b>9 CONCLUSION AND FUTURE WORK</b>	<b>20</b>
9.1 Conclusion . . . . .	20
9.2 Future Work . . . . .	20
<b>BIBLIOGRAPHY</b>	<b>21</b>
<b>II APPENDIX</b>	
<b>A ACTION RESEARCH PROTOCOL</b>	<b>24</b>
A.1 Preconditions . . . . .	24
A.2 Cycle 1 . . . . .	24
A.3 Cycle 2 . . . . .	24
A.4 Cycle 3 . . . . .	24
A.5 Cycle 4 . . . . .	24
A.6 Final Meeting . . . . .	24
<b>B INSTRUCTION MANUAL FOR MASUTĀ</b>	<b>25</b>
B.1 Downloading Masutā . . . . .	25
B.2 First Time Setup . . . . .	25
B.2.1 Hard-Resetting Everything . . . . .	25
B.3 Running the Application . . . . .	26
B.4 Feature Overview . . . . .	26
B.4.1 Input Field and Chat History . . . . .	26
B.4.2 Toggling the Database . . . . .	26
B.4.3 Resetting the Playground Database . . . . .	27
B.4.4 Importing Custom Data . . . . .	27
B.4.5 Inspect Database . . . . .	27
B.4.6 Chat Context and Building on Previous Answers . . . . .	27
B.5 Example Questions . . . . .	27
<b>C MASUTĀ CODE SNIPPETS</b>	<b>29</b>
C.1 System Prompt and Results Explainer . . . . .	29
<b>D MASUTĀ EXAMPLE QUESTIONS AND ANSWERS</b>	<b>30</b>
D.1 Question xyz . . . . .	30

## LIST OF FIGURES

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Figure 6.1	Raw response returned from the Cypher in listing 6.1. Notice that the response contains both information about the applications themselves as well as textbook information on enterprise architecture management (right-most column). . . . .	16
Figure 6.2	Raw response returned from the Cypher in listing 6.1. Notice that the response contains both information about the applications themselves as well as textbook information on enterprise architecture management (right-most column). . . . .	17

## LIST OF TABLES

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Table 4.1	Overview of Action Research Cycles . . . . .	10
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## ACRONYMS

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AI	Artificial Intelligence
APOC	Awesome Procedures on Cypher
AR	Action Research
EA	Enterprise Architect / Architecture
EAM	Enterprise Architecture Management
GenAI	Generative Artificial Intelligence
IT	Information Technology
MCP	Model Context Protocol
PAR	Participatory Action Research
RAG	Retrieval-Augmented Generation
UI	User Interface

## USAGE OF GENERATIVE AI

---

OpenAI GPT-5 and GPT-5.2 (OpenAI, 2025) were used in order to find sources and summarize them. OpenAI GPT-5 and GPT-5.2 (OpenAI, 2025) were used in order to build both transpilers and the node.js backend server.

Part I  
THESIS

## INTRODUCTION

---

### 1.1 MOTIVATION AND THESIS QUESTION

In the field of define that we are building a RAG system which will be referred to as a chatbot. it is not an agent, as it is not executing anything.

### 1.2 RESEARCH METHOD

Action Research (AR) was applied in order to gain scientific value out of the developed prototype. The advantage of this research method is that it is very supportive of the development process for information systems. According to Baskerville (1999), all types of action research have the following four characteristics in common: An orientation towards developing, a focus on a specific problem, an iterative process, and a collaboration amongst participants. This is applicable to the work at hand because a prototype is being developed for a specific problem. The development cycle is conducted iteratively and collaboratively with different stakeholders. More details on this are described in chapter ?? [2]

## TERMINOLOGY AND TECHNOLOGY

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This chapter goes in detail on the terminology and technology that will be relevant for the reader to have a foundational understanding of the rest of this thesis. Later chapters will build upon these concepts and pieces of technology.

### 2.1 TERMINOLOGY

#### 2.1.1 *Enterprise Architecture Management*

Enterprise Architecture Management (EAM) can be summarized as being the bridge between the business and IT departments of an enterprise. The goal is to implement information technology that is aligned with the business needs of the company. This is in contrast to the IT department implementing information technology for the sake of implementing information technology, which people in IT are often fond of doing [1]. An unwanted situation would then be when the IT department falls into a siloed way of thinking where they are decoupled from the rest of the company. EAM helps to ensure that the implemented information technology is achieving the right things, namely supporting the business capabilities and processes. [11, pg. 2-3]

Enterprise Architecture can benefit a company in various ways.

Diese Quelle hierfür vielleicht verwenden: [10] Die Quelle hat vor allem eine Menge Fragen aus der echten Welt, was EA's sich im Alltag fragen. Diese Liste kann als Referenz dienen für meinen Copilot. Diese Quelle hilft da vielleicht auch nochmal um in die Tiefe zu gehen. [3]

#### 2.1.2 *Enterprise Architect*

A common challenge for an EA is dealing with the heterogeneous nature of an application landscape [11, pg. 6]

Erwähnen, dass eine Herausforderung des EA's es ist, dass die zunehmenden Änderungen zwar von einem high-level POV einfach aussehen, aber in den Details viele Herausforderungen stecken. zB Stakeholder Management (jede Applikation hat einen eigenen verantwortlichen, viele Schnittstellen der Applikationen, etc.)

### **2.1.3 Business Capabilities**

#### **2.1.4 Architecture Diagrams**

##### **2.1.4.1 Application Landscape**

##### **2.1.4.2 EAM Modeling Tool - Archi**

## **2.2 TECHNOLOGY**

### **2.2.1 Large Language Models**

LLMs are capable of supporting in language-related tasks where text needs to be generated, translated, summarized, analysed, or questions answered [9].

[17] describes what llms are and why they are not good with domain specific information and how that causes them to hallucinate.

### **2.2.2 Graph Database**

### **2.2.3 Retrieval Augmented Generation**

### **2.2.4 neo4j and the Cypher Query Language**

### **2.2.5 Model Context Protocol**

Also explain (maybe in the SOTA) how it is able to understand the schema of the graphdatabase (by calling get-schema when initializing the MCP it knows how my graph database is setup).

### **2.2.6 XML and Transpilers**

As will be shown later in section xyz, the working prototype uses a domain-specific, source-to-source transpiler to turn the archimate-exported XML data into Cypher queries to insert the EA data into the graph database.

This source has a bit of good information on why XML is good as a structure language[16] "Simply speaking, eXtensible Markup Language (XML) is a data architecture connecting meta-data and data. The architecture's defining feature is the hierarchical network of nodes. Every node in the XML structure is connected somehow to any other node; also, being a hierarchy, every node is either subordinate or superordinate to another node, as shown in the tree structure in Figure 1. Further, XML "provides a standard syntax for the mark-up of data and documents" (Watt 2002:1). The syntax along with the hierarchical network structure make XML documents exhaustively searchable and therefore useful for linguistic research."

More detailed information on the transpiler is described in section xyz.

### 2.2.7 APOC and XPATH

Describe how apoc + xpath work and what this has to do with the neo4j cyphers. this might be better in the methodology section as a quick paragraph, but it has to be described somewhere.

# 3

## CURRENT STATE OF THE ART

---

Briefly explain why a literature analysis is important. Define the scope (what fields you looked at, which databases, what keywords). Define the research method and how you narrowed it down from x sources to y sources.i

### 3.1 ENTERPRISE ARCHITECTURE MANAGEMENT

theories, digital twin efforts, EA tool landscapeStandards or frameworks (e.g., TOGAF, ArchiMate, IATA ONE Record, LeanIX). Theoretical foundations (auch auf prozessmanagement eingehen, wie der aktuelle Prozess aussieht, wenn die Landschaft geändert werden soll) Current tools and methods Research prototypes in EA

Authors Jung and Fraunholz 2021 [11] lay foundational work from which many EAM concepts can be derived.

### 3.2 LARGE LANGUAGE MODELS, CONVERSATIONAL AGENTS, AND RETRIEVAL-AUGMENTED GENERATION

strengths, hallucination issues, graph-RAG enhancements Theoretical foundations Current tools and methods

This paper covers how ai tools are more scalable than manual expertise analysis of things. The source is highly relevant. Look at the summary in notebookLM. 05.10.25 [8]

This 2025 paper has ideas on how changing knowledge-graphs (e.g. through updates) can be handled [12]. It looks at temporal data and how to handle it. This might be relevant since addressing how a changing application landscape can be handled will probably be a challenge.

This paper gives an overview on how to control the dialog sequence and also notes 4 types of dialog options for chatbots in the related works section: [13].

This paper [20] covers how a chatbot can support in task-planning and output generation. Might be helpful in understanding how my chatbot can tell the EA how to conduct changes in the application landscape.

This paper [5] states how proactive dialogue systems work and can be improved. It goes into detail on 3 types of dialogue systems: clarification, target-guided, and non-collaborative dialogues. All 3 of these have a certain relevance for the EAM Chatbot.

RAG: Geh darauf ein, was es für unterschiedliche Chunking methoden gibt, wie man ein Buch runterbringt, und was das alles für vor und nachteile hat. auch welche tools es gibt (neo4j) ist wichtig.

### 3.3 COMPARABLE PROJECTS AND PROTOTYPES

Proof-of-concepts, research prototypes, industry whitepapers, GitHub projects.

Tools like ChatEA, LeanIX AI features, or Microsoft Copilot integrations in architecture/governance.

A prototypical graph-based RAG approach for text-summarization has been created by Microsoft: y[6]. The accompanying paper is here: [7]  
Dragon1 needs to be detailed here!

### 3.4 EVALUATIONS AND LIMITATIONS

Studies analyzing strengths/weaknesses of RAG, embedding quality, hallucination mitigation.

Papers about user interaction with EA tools, chatbot evaluation frameworks, usability challenges

This paper [19] gives a standardized method and framework for evaluating conversational AI agents.

This paper [14] proposes a benchmark for open-ended multi-turn conversational agents. I think this paper focuses more on evaluating agents and comparing their results, but maybe i can copy their evaluation methods and benchmarks?

## METHODOLOGY

---

This chapter describes how the chatbot "Masutā" (pronounced "mah-soo-taa" - a phonetic adaptation of the English term "master" into Japanese katakana) was developed. It provides further insight into the applied research method and the process through which the prototype was created. This gives the reader the understanding of how the research and implementation was conducted before discussing the implementation details in chapter 7.

### 4.1 ACTION RESEARCH DESIGN

Action Research (AR) is a research method which is highly applicable when developing an information system such as the one presented in this paper. The advantage of AR is that a large focus can be laid on the development of a system while still achieving an academic benefit.

Cyclical phases are central to the concept of Action Research. Baskerville [2] describes Action Research as an iterative process consisting of five steps within a single cycle. Other sources, such as Cornish et al. [4], propose variations with fewer (usually three) phases within a cycle; however these models also boil down to the same concepts. Across the literature, Action Research cycles follow the same structure: planning what should be done in the new cycle, taking action, and evaluating the outcome of the completed cycle before moving on to the next one [2, 4].

The paper at hand applied a cycle using the following five steps according to Baskerville [2]: diagnosing, action planning, action taking, evaluating, and specifying learning. The reason for choosing five cycles instead of three is the benefit of describing the development process in more detail. This five-step-cycle including the preliminary and subsequent steps are summarized in figure **to do create a drawing of the cycles**.

Each cycle lasted between three and four weeks. The sources used do not mention how long a single cycle should last. However, a cycle of two to three weeks were deemed as reasonable for the development of Masutā because status updates were held at the end of each cycle and with the given amount of time for the cycle, there was enough progress to discuss in these meetings. Participatory Action Research (PAR) goes a step further in creating a more collaborative environment between the researcher and client participants. Instead of leaving the theorizing up to the researcher, new information and ideas are thought up together with the client participants, giving both parties an active role. This is beneficial because the client participants often have both theoretical and practical knowledge of the subject matter being worked on. [2]

The following subsections explain the research design of the applied action research. For the exhaustive action research protocol, refer to chapter A of the appendix.

#### 4.2 ACTION RESEARCH SETUP

The domain of EAM was focused on within this research. In particular, the study addressed application landscapes, business capability maps, as well as the relationships between these two architectural artifacts. These artifacts are commonly used to support documenting an enterprise's landscapes are used to align an enterprise's IT with its strategic business objectives.

Due to their structural complexity with heterogenous data sources and multiple stakeholders involved, these artifacts are often large and difficult to interpret. Maintaining an overview can be especially challenging for junior level enterprise architects. This challenge motivates the exploration of AI-supported solutions that enable conversational interaction with the architecture, rather than manually navigating the complex diagrams.

The research was conducted in close collaboration with the academic supervisor and a co-advisor. The academic supervisor gave academic guidance and supported the structuring of the research process to ensure academic relevance. The co-advisor acted as the domain expert and the critical partner, contributing practical insights to ground the research in real-world relevance. The author of this thesis assumed the role of the researcher, implementing the action research cycles, validating findings, and planning subsequent steps in coordination with the other stakeholders.

At the outset of the research, the general problem space was clear, but the potential solution was only vaguely defined. The co-advisor initialized the research with a vague vision of a centralized system containing all enterprise architecture information, which can be interacted with via natural language. The motivation for this was to reduce the effort required to interpret the enterprise architecture artifacts.

However, in the early stages of the project, not only were the technical details of the potential solution unclear, but also the feasibility of such a system. Early on it was mutually agreed upon that LLMs and AI would play a key role in realizing this, even though the data structures, mechanisms, storage options, and interaction patterns were still open. Consequently, the initial problem statement was intentionally formulated at a high level to provide a suitable starting point for iterative exploration. Through the iterative development cycles, this high level problem statement was refined into a concrete problem definition and technical solution.

#### 4.3 ACTION RESEARCH CYCLES

The above mentioned vague details of the implementation became clear during the development cycles, leading to a final architecture with a clear structure.

Objective of the cycle Planned activities Expected outcomes Do not describe: daily work exact prompts logs meeting transcripts

#### 4.3.1 *Cycle 1*

#### 4.3.2 *Cycle 2*

#### 4.3.3 *Cycle 3*

#### 4.3.4 *Cycle 4*

The main challenge of this cycle was refactoring the cyphers that get called against the database. the reason being that the previous method for generating text-to-cypher was easy because it was only calling the speedparcel database and the schema of this was entirely known. however, during this sprint we got new data exported from architecture diagrams in archi. this data is well structured but the schema is unknown. this means that the text-to-cypher has to be able to query the graph database agnostic of any schema in it. meaning, the text-to-cypher has to be completely refactored in order to be able to reliable query the dataset with unknown contents.

The source from Wan i 5.2.2 [18] explains how he created a 3-step-preprocessing in order to query the database agnostically. what i did is not 1-to-1 the same thing, but i borrowed the ideas. the main change being changing the CALL db.schema.visualization() from before to the APOC call apoc.meta.schema() which apparently returns more sensible information. that combined with the SHOW INDEXES call give a better result (i assume - i'm writing this before testing just to get my ideas out of my head lol have fun rewriting this. i wrote this in Bremen on 28.12 xoxo)

Table 4.1: Overview of Action Research Cycles

Cycle	Diagnosis	Action Planning	Action Taken	Evaluation	Learning / Outcome
Cycle 1					
Cycle 2					
Cycle 3					
Cycle 4					

#### 4.4 FINAL MEETING

Todo: den Termin vor Ort beschreiben Purpose of the meeting, who participated, what was validated, what kind of feedback was collected.

As described in this chapter, it becomes clear why action research was an invaluable methodology. From unclear beginnings containing only a vague vision for a final prototype, each development cycle contributed to the final architecture being clear and goal oriented. Each phase helped to examine

what was possible from a technical standpoint as well as how to move forward.

# 5

## IMPLEMENTATION

---

The methodology chapter describes how and why we did things. This chapter describes what we built, including architecture, data processing, sequence diagrams, retrieval, UI and interaction flow.

Do not evaluate here. Only describe what is done.

### 5.1 DATA USED

### 5.2 FINISHED PROTOTYPE

Explain here, what the finished prototype is (including architecture diagram, sequence diagram, etc.). or should this be an entirely separate chapter? describing this somewhere here makes sense though before moving on to the experiments done with the prototype.

Mention that this is a "ephemeral conversation memory" and why that is. We will probably need some kind of source on this.

Also mention that we agreed to test my system using exported XML files from Archimate. So other tools like

#### 5.2.1 *Finished Architecture*

Explain in detail here what each component of the finished architecture is and how it all fits together.

##### 5.2.1.1 *XML Transpiler*

Explain in detail here how the XML transpiler takes an XML file as the input and transpiles it into Cypher. It is model-to-model and thus touches on the subjects compiler construction, model-driven engineering, graph databases, and enterprise architecture tooling.

Show how fine-tuning the system prompt can have an effect on the results. E.g. if in the context it says to answer within 1-2 sentences or to answer in 4-6 sentences. Show examples of how small things in the prompt can have a large impact.

#### 5.2.2 *Generating Text-to-Cypher Independent of the Database Schema*

Highlight this as the main challenge of the thesis!

This source describes how and why agnostic cyphers can and should be generated. [18] also, check their sources and use those as well. It also mentions that a challenge when giving the LLM the necessary context is that it

gets overloaded with information and that the context length may get exceeded (page 5).

This source [15] talks about how natural language text can be used to **create** the knowledge graph. Def use this when explaining how i created my speedparcel imports.

The whole system prompting this is called "in-context learning (ICL)". search for sources that support this.

# 6

## EXPERIMENTS

What we did with the finished prototype and how we tested it. Prompts we used, cases we built, edge cases, etc.

show some test cases here. break down an answer like "i want to remove the application StatManPlus. What do i have to look out for as an enterprise architect?". the returned answer goes into a lot of depth as this is a level 3 question. break down the result of the query and how the result pulls information about the application but also pulls information from the Lehrbuch database.

```
1 MATCH (a:Application {name: 'StatManPlus'})  
  OPTIONAL MATCH (a)-[:SUPPORTS]->(cap:Capability)  
  WITH a, collect(DISTINCT cap) AS caps  
  UNWIND (CASE WHEN size(caps) > 0 THEN caps ELSE [NULL] END) AS cap  
  OPTIONAL MATCH (cap)-[:HAS_CHILD*0..]->(desc:Capability)  
6 WITH a, caps, collect(DISTINCT desc) AS cap_impacted  
  OPTIONAL MATCH (a)-[:DATA_FLOW]->(outApp:Application)  
  WITH a, caps, cap_impacted, collect(DISTINCT outApp.name) AS outgoing_apps  
  OPTIONAL MATCH (inApp:Application)-[:DATA_FLOW]->(a)  
  WITH a, caps, cap_impacted, outgoing_apps, collect(DISTINCT inApp.name) AS  
    incoming_apps  
11 OPTIONAL MATCH (ch:Chunk)  
  WHERE toLower(coalesce(ch.text,'')) CONTAINS toLower(a.name)  
    OR toLower(coalesce(ch.table_summary,'')) CONTAINS toLower(a.name)  
    OR toLower(coalesce(ch.title,'')) CONTAINS toLower(a.name)  
    OR toLower(coalesce(ch.definition,'')) CONTAINS toLower(a.name)  
16 WITH a, caps, cap_impacted, outgoing_apps, incoming_apps,  
    collect(DISTINCT {key: ch.key, title: ch.title, snippet: ch.  
      table_summary, text: ch.text}) AS app_chunks  
  OPTIONAL MATCH (guid:Chunk)  
    WHERE toLower(coalesce(guid.text,'')) CONTAINS 'decommission'  
      OR toLower(coalesce(guid.text,'')) CONTAINS 'retire'  
21 OR toLower(coalesce(guid.text,'')) CONTAINS 'sunset'  
    OR toLower(coalesce(guid.title,'')) CONTAINS 'decommission'  
    OR toLower(coalesce(guid.title,'')) CONTAINS 'retire'  
    OR toLower(coalesce(guid.title,'')) CONTAINS 'sunset'  
    OR toLower(coalesce(guid.definition,'')) CONTAINS 'decommission'  
26 OR toLower(coalesce(guid.definition,'')) CONTAINS 'retire'  
    OR toLower(coalesce(guid.definition,'')) CONTAINS 'sunset'  
    OR toLower(coalesce(guid.table_summary,'')) CONTAINS 'decommission'  
    OR toLower(coalesce(guid.table_summary,'')) CONTAINS 'retire'  
    OR toLower(coalesce(guid.table_summary,'')) CONTAINS 'sunset'  
31 WITH a, caps, cap_impacted, outgoing_apps, incoming_apps, app_chunks,  
    collect(DISTINCT {key: guid.key, title: guid.title, snippet: guid.  
      table_summary, text: guid.text}) AS guidance_chunks  
  RETURN a.name AS application,  
    [c IN caps WHERE c IS NOT NULL | c.id] AS supported_capability_ids,  
    [g IN cap_impacted WHERE g IS NOT NULL | g.id] AS  
    impacted_capability_ids,  
36      outgoing_apps AS outgoing_data_flows_to_apps,
```

```
incoming_apps AS incoming_data_flows_from_apps,  
app_chunks AS chunks_referencing_application,  
guidance_chunks AS chunks_with_decommission_guidance
```

Listing 6.1: Cypher query to retrieve application impact and decommission guidance

The screenshot shows a web-based application interface for 'Masutā - Your Enterprise Architecture Assistant'. At the top, there's a purple header bar with the application name and a toggle switch labeled 'Using SpeedParcel Data'. Below the header, a pink rounded rectangle contains the text: 'I want to remove the application StatManPlus. What do I have to look out for as an enterprise architect?'. The main content area is titled 'Agent' and contains several sections:

- Summary**: A detailed paragraph about the impact of removing StatManPlus on business and IT landscapes.
- Key Considerations**:
  - Business Capabilities Impacted**: Removal will affect core business capabilities; ensure alternative solutions are in place.
  - Redundancy or Orphan Status**: Check if StatManPlus is redundant or truly an orphan; removing it could introduce capability gaps.
  - Business Ownership**: Establish clear ownership for capabilities currently supported by StatManPlus; risks increase if no responsible stakeholder is identified.
  - Decommissioning Process**:
    - Decommissioning should be run as a formal project involving multiple stakeholders.
    - Validate for hidden integrations, manual workarounds, or critical users.
    - Review and update documentation like capability maps and roadmaps.
    - Plan for user migration, communications, and staff retraining.
- Practical Guidance**:
  - Successor Applications**: Designate successor systems and update mapping artifacts.
  - Project Approach**: Decommissioning should be planned and executed as a managed project, including communication and change management.
  - Documentation & Roadmaps**: Update architectural documentation to reflect changes and the transition timeline.
  - Risks & Mitigation**: Analyze for potential orphan capabilities and document rationale if intentionally left unsupported.
- References**: A section with best practices and recurring themes extracted from guidance.
- Copy Cypher**: A button for copying the Cypher code used to generate the response.

At the bottom, a pink footer bar contains the placeholder text: 'Ask Masutā something about your enterprise architecture...'.

Figure 6.1: Raw response returned from the Cypher in listing 6.1. Notice that the

application	supported_capability_ids ≡	impacted_capability_ids	outgr	incon	chunks_referencing_application	chunks_with_decommission_guidance
"StatManPlus"	[ "cap_l2_51_spot_management", "cap_l2_52_planning_and_coordination", "cap_l2_53_freight_management", "cap_l2_54_delivery_mangement", "cap_l2_58_parcel_so rting", "cap_l2_59_inspection_o f_incoming_returns", "cap_l2_60 _restocking" ]	[ "cap_l2_51_spot_management", "cap_l2_52_planning_and_coordination", "cap_l2_53_freight_management", "cap_l2_54_delivery_mangement", "cap_l2_58_parcel_so rting", "cap_l2_59_inspection_o f_incoming_returns", "cap_l2_60 _restocking" ]	[]	[]	[ { snippet:null, text:"Capability \"Spot Management\" (Level 2 in band \"Core Capabilities\", under L1 capability \"Transport Management\") is supported by: StatManPlus (flag \"x\"), TrackDB (flag \"x\").", title:null, key:"c7e0b12a9b94ca889c7e13d9e4cea9e504e5e0d2_se_c_transport_management_chunk_spot_management" }, { snippet:null, text:"Capability \"Planning and Coordination\" (Level 2 in band \"Core Capabilities\", under L1 capability \"Transport Management\") is supported by: StatManPlus (flag \"x\"), TrackDB (flag \"x\").", title:null, key:"c7e0b12a9b94ca889c7e13d9e4cea9e504e5e0d2_se_c_transport_management_chunk_planning_and_coordination" }, { snippet:null, text:"Capability \"Freight Management\" (Level 2 in band \"Core Capabilities\", under L1 capability \"Transport Management\") is supported by: StatManPlus (flag \"x\"), TrackDB (flag \"x\").", title:null, key:"c7e0b12a9b94ca889c7e13d9e4cea9e504e5e0d2_se_c_transport_management_chunk_freight_management" } ]	[ { snippet:null, text:"This last difference is visible in a lot of companies today. There are software systems available and used by business people, but nobody on the business side feels responsible for them. Responsibility would include maintenance (i.e. conducting projects to perform changes), support and funding (e.g. for licenses). It, furthermore, refers to making decisions on the future of individual software applications, like its decommissioning if it does no longer provide relevant value. Making decisions based on business relevance implies an assessment from the business perspective. In fact, many systems are just handed over to IT so that they keep them running but there is no business ownership. IT people then need to drive changes driven by business requirements. Ideally, these should be driven by business stakeholders. We still have to convince people in business and IT to understand the relevance of each IT system and then make sure the IT system has business relevance. We further need clear ownership within the business to take the responsibility for decisions on this IT system.", title:null, key:"27be2852-75f0-44bc-a0d8-343ee3ed7ce9_10" }

Figure 6.2: Raw response returned from the Cypher in listing 6.1. Notice that the response contains both information about the applications themselves as well as textbook information on enterprise architecture management (right-most column).

# 7

## IMPLEMENTATION

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The methodology chapter describes how and why we did things. This chapter describes what we built, including architecture, data processing, sequence diagrams, retrieval, UI and interaction flow.

Do not evaluate here. Only describe what is done.

# 8

## DISCUSSION

---

This chapter discusses what the answers mean. interpretation of the results, comparison with the literature, limitations, implications for EAs in practice.

## CONCLUSION AND FUTURE WORK

---

Todo

### 9.1 CONCLUSION

### 9.2 FUTURE WORK

Some ideas for future work: how to improve the challenges mentioned. what other areas this could find utility in. how could access management be handled? e.g. if the database contains customer-information that not every user should be able to see, how can that be differentiated? real-world scenarios that could use my prototype and try out a pilot phase?

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Part II  
APPENDIX

# A

## ACTION RESEARCH PROTOCOL

---

This chapter contains the full action research protocol.

### A.1 PRECONDITIONS

Test: This reference should have a lowercase, small caps A if the option

### A.2 CYCLE 1

Start: October 17th, 2025. End: October 31st, 2025

### A.3 CYCLE 2

Start: October 31st, 2025. End: November 28th, 2025

### A.4 CYCLE 3

Start: November 28th, 2025. End: December 17th, 2025

### A.5 CYCLE 4

Start: December 17th, 2025. End: January 23rd, 2026

### A.6 FINAL MEETING

Meeting date: January 23rd, 2026. Location: Campus of the Frankfurt University of Applied Sciences.



## INSTRUCTION MANUAL FOR MASUTĀ

---

Masutā is the name of the prototype enterprise architecture chatbot. Follow these instructions to download Masutā, set it up, and learn how to use it.

When executing the commands from the terminal, always execute them from the root folder of the project. The best results are achieved by executing each command individually (i.e. copy-paste the commands individually line-for-line instead of the entire block).

### B.1 DOWNLOADING MASUTĀ

In order to get Masutā up and running, a few prerequisites will have to be fulfilled.

The first is to download the application code for Masutā from GitHub:  
<https://github.com/HendrikDA/masuta-ea-chatbot-prototype>

The second prerequisite is to download Docker and Docker Compose. You can find instructions on how to set this up on your machine under this link:  
<https://docs.docker.com/compose/install/>.

An optional prerequisite is to download neo4j Desktop. This allows the user to inspect the graph database within an interactive desktop application. Neo4j Desktop can be found here: <https://neo4j.com/download/>. However, this is not mandatory and the databases may also be inspected via neo4j's web-application.

### B.2 FIRST TIME SETUP

If Masutā is being run for the first time, then two containers need to be setup so that they are populated with the default data. From within the root folder of the project, execute the following commands

```
1 docker compose --profile speedparcel-restore run --rm speedparcel-restore  
docker compose --profile textbook-restore run --rm textbook-restore
```

Once these commands have run through successfully, both databases are populated with the default data and are ready to be used.

#### B.2.1 Hard-Resetting Everything

If at any time you would like to hard-reset the entire application, you may run the following commands:

```
1 docker compose down  
2 rm -rf $HOME/neo4j/data  
3 rm -rf $HOME/neo4j_empty/data
```

After resetting the application, you will have to restart with the first time setup.

### B.3 RUNNING THE APPLICATION

Running Masutā is as simple as running the following command:

```
docker compose up
```

With this command, four containers are started.

- The SpeedParcel neo4j database filled with example data and the textbook
- The playground neo4j database filled with only the textbook
- The MCP-Backend which is the backend node.js which by default runs under <http://localhost:4000>
- The frontend which by default runs under <http://localhost:3000/>

If Docker does not automatically open the frontend in your browser, navigate to it under <http://localhost:3000/>. You are now ready to start using Masutā.

### B.4 FEATURE OVERVIEW

This section details the features within Masutā.

#### B.4.1 *Input Field and Chat History*

At the bottom of the application is an input field where the user may prompt Masutā. Pressing enter sends the prompt. The user's input prompt then appears as a chat bubble bound to the right of the chat-area. The system then starts working on answering the prompt and displays a chat bubble bound to the left of the chat-area displaying "Thinking...". As soon as the application is done thinking, the response is displayed in the same chat bubble.

Masutā's response has a button appended to it which allows the user to copy the cypher which was used to generate the answer. The user may take this copied cypher and paste it into neo4j desktop to inspect the raw response that was used to generate the answer.

#### B.4.2 *Toggling the Database*

At the top right of the application is a toggle switch. This allows the user to toggle between the SpeedParcel database and the playground database.

#### B.4.3 Resetting the Playground Database

Under the menu at the top left, the user is presented with the option to reset the database. This option is only available if the playground database is selected via the toggle switch. After confirming the reset in the dialog that pops up, the playground is reset to its default state with only the textbook information. The SpeedParcel database cannot be reset via the UI.

#### B.4.4 Importing Custom Data

Under the menu at the top left, the user is presented with the option to import their own data. This option is only available if the playground database is selected via the toggle switch. Within the dialog that pops up, the user can add up to 10 files either by selecting them via the file system or by dragging-and-dropping them into the dialog. Only .xml files are accepted.

After clicking the import button, the files are uploaded. If the upload was successful, an alert is shown notifying the user of this. The uploaded data remains within the realms of the Docker containers and is not uploaded to any third-party sources. The data can then be queried via the playground database.

#### B.4.5 Inspect Database

Under the menu at the top left, the user is presented with the option to view the graph data in neo4j browser their own data. This option is available for both the SpeedParcel and playground database. Clicking this opens another tab under <https://console-preview.neo4j.io/tools/query>. Here, the user can connect to the selected database. The connection string is displayed in a dialog within Masutā. Here, the user can inspect the graph structure and paste the cyphers used for the generated responses.

#### B.4.6 Chat Context and Building on Previous Answers

Masutā saves the chat history so that the user is able to build upon previous prompts. The chat history is set so that the single previous user prompt and corresponding response is saved. This means that a further question can be asked about the previous prompt or its response. The chat history's context only goes back one prompt and response.

### B.5 EXAMPLE QUESTIONS

Questions can be broken down into three categories:

1. Category 1: Textbook questions about enterprise architecture management
2. Category 2: Basic information about the enterprise architecture data

3. Category 3: Questions that span both category 1 and 2 and are more complex than questions in category 2. These require more in-depth information about the data as well as how to deal with it as an enterprise architect.

The following list of questions serve as examples that Masutā can handle. These simply serve as ideas to test the system - the user may input their own thought up questions.

1. Questions in Category 1

- What are the schools of enterprise architecture management?
- How does enterprise architecture relate to town planning?

2. Questions in Category 2

- How many capabilities are supported?
- How many applications are in use?
- Which application supports the most capabilities?
- If I remove application x, which capabilities will be affected?

3. Questions in Category 3

- We plan on removing application x. What do we have to look out for when doing so?
- We wish to implement a new application x which covers the capabilities x, y, and z. Which existing applications may become redundant?
- Which capabilities currently rely on single-point-of-failure applications? How should we deal with this?
- Which capabilities are over-supported by multiple applications?

This concludes the instruction manual for Masutā. Beyond the example questions, users are encouraged to prompt Masutā to explore the example data provided in SpeedParcel or to analyze their own proprietary data after importing it, in order to gain insights into their enterprise architecture.

# C

## MASUTĀ CODE SNIPPETS

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This chapter showcases code snippets which are of special interest as they show how key functionalities of Masutā work. The code snippets do not showcase the full application and may not complete.

### C.1 SYSTEM PROMPT AND RESULTS EXPLAINER

The following code snippets showcase what meta-prompts are passed to the LLM in order to generate the cyphers via the natural language text input and how the cypher results are transformed back into natural language.

Todo: Add the system prompts here.

# D

## MASUTĀ EXAMPLE QUESTIONS AND ANSWERS

---

This chapter contains screenshots of user prompts and the system's responses. It serves as a showcase of what the application looks like and how it responds to questions.

### D.1 QUESTION XYZ

todo