



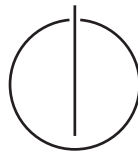
FAKULTÄT FÜR INFORMATIK

DER TECHNISCHEN UNIVERSITÄT MÜNCHEN

Bachelorarbeit in Informatik

**Myriad – a mailmerge tool for massive
parallel, yet individual email conversations**

Ludwig Schubert





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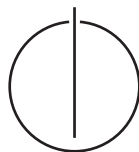
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Bachelorarbeit in Informatik

Myriad – a mailmerge tool for massive parallel, yet
individual email conversations

Myriad – ein Serienbrief Email-Tool für hochgradig
parallele, jedoch individualisierte Emailkonversationen

Author: Ludwig Schubert
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Advisor: Dr. Wolfgang Wörndl
Date: September 30, 2013



Ich versichere, dass ich diese Bachelorarbeit selbständig verfasst und nur die angegebenen Quellen und Hilfsmittel verwendet habe.

München, den 30. September 2013

Ludwig Schubert

Abstract

This thesis introduces the myriad system for email mass communication.

Despite its age, Email has remained the prevalent form of electronic communication, it's usage being wildly different from how it was imagined. The tools to handle it, however, are still stuck in their original UI metaphors.

Myriad aims at producing personalized communication on a comparable level to manually composed messages, while reducing user effort. A cross-over of mailmerge and customer support/helpdesk software, it enables managing big volumes of bidirectional email-based communication. It is based on a self-developed framework for separating information extraction, decision making, and personalization steps in communication.

The myriad system consists of a server component that handles interfacing with email servers, a core logic system and a web frontend for users.

It can be tested at <http://myriad.ludwigschubert.de>.

Keywords

Email, Workflow, Helpdesk, Mailmerge, Crowdsourcing, Personalized Communication, Assisted Templating, Generated Documents, Web-Application



Acknowledgements

This thesis is based on research conducted from October 2012 through April 2013 together with Christian Ikas, Barış Öztop and Nicolas Kokkalis under the guidance of *Prof. Michael S. Bernstein* and *Prof. Scott R. Klemmer* during a stay at Stanford University's Human Computer Interaction Department.

The research stay was partly financed by Elitenetzwerk Bayern through a grant to the study program *Technology Management* at the Center for Digital Technology and Management.



Stanford
University

Elitenetzwerk
Bayern



Contents

Disclaimer	v
Abstract	vii
Acknowledgements	ix
Table of Contents	xi
Main Matter	3
1. Introduction	3
1.1. Motivation	3
1.2. Goals and Background	4
1.3. Outline	5
2. Technical Backgrounds	7
2.1. Web Applications	8
2.1.1. Why build a web application instead of a native one?	8
2.1.2. Main Components of a Web Application	8
2.1.3. Rails and Ruby	8
2.2. Email Systems	8
2.2.1. Working with RFC 2822	8
2.2.2. IMAP and SMTP	8
2.3. Workflow Systems	8
2.3.1. History of Workflow Systems	8
2.3.2. Famous Examples	8
3. Comparison with similar systems	9
3.1. Mailmerge Systems	9
3.1.1. CRM Systems	9
3.1.2. Dedicated Mailmerge Systems	9

3.1.3. Backend Services	9
3.2. Customer Support Systems	9
4. Concept	11
4.1. Functional Analysis	13
4.2. Product Functions	13
4.3. User Interface	13
4.3.1. Prototyping Approaches	13
4.4. Technical Analysis	13
4.4.1. Runtime Environment	13
4.4.2. Server Software Stack	13
4.4.3. Client Side	13
4.4.4. Backend Service Connections	13
4.5. System Design	13
4.5.1. Database Schema	13
4.5.2. Distribution of System Components	13
5. Implementation	15
5.1. Preparation and Tools	15
5.1.1. Development Environment	15
5.1.2. Collaborative Development	16
5.1.3. Deployment	17
5.2. Server Component	17
5.2.1. Workers and their Jobs	18
5.2.2. Maintenance and Rake Tasks	18
5.3. Core Classes and their Interaction	19
5.3.1. Contact	19
5.3.2. Template	19
5.3.3. Email	20
5.3.4. Campaign	22
5.3.5. Conversation	23
5.3.6. Key & Value	23
5.3.7. Search & KeyBinding	24
5.3.8. Notification	24
5.4. Backend Services Connection	24
5.4.1. Email Fetching	25
5.4.2. Google Docs Syncing	26
5.5. "Best Practices"	26
5.5.1. Core Extensions	26

5.5.2. Lean Workers with AbstractWorker	27
5.5.3. Monitoring Services	27
6. Evaluation	29
6.1. Comparison with Initial Goals	29
6.2. Observed Use Cases	29
6.2.1. Recruiting Exchange Students for one of the Most Desired Universi- ties of the World	29
6.2.2. Requesting paper Reviews for a Journal	29
6.2.3. Managing Incoming Class Administration Emails	29
7. Conclusion	31
7.1. Conclusion of this work	31
7.2. Discussion of results	31
7.3. Future Work	31
Bibliography	33
List of Figures	35
Appendix	39
A. Selected Source Code Examples	39
B. UML Diagrams over time	41
B.1. Usage of UML Diagrams for internal communication	41
B.2. Stability of UML Diagrams over time	41
C. Colophon	47

Main Matter

1. Introduction

This chapter gives an overview of the work, arguments for the relevance of new Email tools, as well as the goals pursued by this thesis. Concluding, the structure of the work is explained.

1.1. Motivation

The total number of worldwide email accounts – 3.3 billion as of 2012 [1] – indicates how email still is the primary means of asynchronous online communication, despite continued efforts from corporations for successor technologies.

While specialized tools, e.g. Facebook's Events or Doodle, can provide a better experience, email is still the ubiquitous fall-back medium that everybody can access. It's non-centralized approach, relying only on deeply embedded infrastructure like the DNS system, has allowed email to become bigger than any proprietary tool.

Thus it is unsurprising that email is used a lot as an organizational tool instead of the mere letter-like two person ocmunication medium that it was set out to be. In fact, use of email as an organizational tool is primed to become even more prominent, with most of the growth and traffic in email usage coming from the corporate world. [1, p. 3] A person might use email to figure out a good time for a meeting, soliciting comments on his work, or even just organizing a party.

In all of the abovementioned scenarios, the user has to make a trade-off between effort and personalization – writing individual emails versus sending out a mass mail.

Now, there are lots of benefits of personalized emails. A higher response rate is one of the basic ones. Some scenarios require personalized information as part of the email in order to be effective, e.g. a grade report. Sometimes a personally addressed email is just

a lot more likely to produce the desired result [2, p. 1375, 1380], as it increases perceived social pressure.

In observing one instance of such a usage of email, a recruitment campaign for a scientific study, we observed a lot of duplicated efforts, inconsistent communication and overall potential for tool assistance.¹ We set out to develop a mailmerge system that didn't require complicated desktop software, yet was more powerful and workflow oriented than previously available mailmerge software.²

1.2. Goals and Background

We developed a web-based email client with mailmerging capabilities for massive parallel, yet personalized email conversations, Myriad. The focus of Myriad lies not on traditional, individual email based replies. Instead, it aims to provide tools that allow managing big amounts of similar emails efficiently. To fulfill this goal, Myriad provides a high level organizational abstraction called *Campaigns*, a visualization of individual conversation state and actionability, filtering and actions on groups of results, easy reusability and automation of replies (*Messages*), as well as support for delegation to assistants and generally usable integration into existing email and information management infrastructure. Those simple, combinable features are supposed to enable users' email workflows to be personalized and well-organized, while reducing manual or duplicated effort. To define a simple to understand goal for ourselves we created Figure 1.1, which plots user effort against personalization for an email campaign. The lower, left-hand corner is exemplified by a single mass mail: barely any personalization at minimal effort. The upper, right-hand corner shows writing every email by hand: maximum personalization, but at a high effort. Myriad's goal is to end up below the drawn line; achieving the desired degree of personalization at sublinear effort.

This thesis is based on research I conducted together with Christian Ikas, Barış Öztop and Nicolas Kokkalis. To avoid overlap between the researchers, I will focus on the system design process, architecture and implementation details, for which I was mainly responsible.

For a more in-depth look at the motivation for the project, the comparison with existing

¹See section 4.1.

²See section 3.1 for a more in-depth comparison with pre-existing systems.

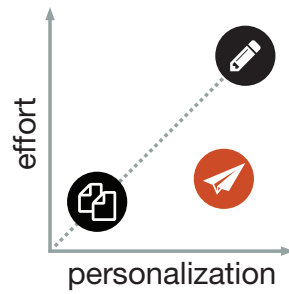


Figure 1.1.: Myriad's goal is to achieve a desired degree of personalization at sublinear effort.

systems and the relevance for survey research, see Barış Oztop's master thesis. For a more business-process focussed look at email workflow tools, see Christian Ikas' Master thesis.

1.3. Outline

This chapter gives an overview of the work, and arguments for the relevance of new Email tools, as well as the goals pursued by this thesis. Concluding, the structure of the work is explained.

In **chapter 2, Technical Backgrounds**, relevant technical background information is provided. The decision to build a web app is motivated. Standard-compliant email systems are explained and relevant standards are introduced. Lastly, an introduction to workflow systems and historic examples is given.

In **chapter 3, Comparison with similar systems**, two major categories of software – dedicated mailmerge systems, and customer support systems – are introduced, which overlap in functionality with Myriad.

In **chapter 4, Concept**, the architecture of the proposed system is motivated and its development process is highlighted.

In **chapter 5, Implementation**, is concerned with technical details of how Myriad was implemented. The collaborative development process is described, as are actual system component and their functionality.

In **chapter 6, Evaluation**, Myriad's initial goals will be reiterated and contrasted with real world observed usage.

In **chapter 7, Conclusion**, the relevance of this system and the proposed framework is discussed; future work is outlined and possible directions proposed.

This is followed by a **Bibliography** of cited works and a **List of Figures**.

The **Appendix** contains selected source code examples, the development of the system design over time in UML Diagrams, and a **Colophon**.

2. Technical Backgrounds

In this chapter, relevant technical background information is provided. The decision to build a web app is motivated. Standard-compliant email systems are explained and relevant standards are introduced. Lastly, an introduction to workflow systems and historic examples is given.

2.1. Web Applications

2.1.1. Why build a web application instead of a native one?

2.1.2. Main Components of a Web Application

2.1.3. Rails and Ruby

2.2. Email Systems

2.2.1. Working with RFC 2822

2.2.2. IMAP and SMTP

2.3. Workflow Systems

2.3.1. History of Workflow Systems

2.3.2. Famous Examples

3. Comparison with similar systems

In this chapter two major categories of software – dedicated mailmerge systems, and customer support systems – are introduced, which overlap in functionality with Myriad.

3.1. Mailmerge Systems

3.1.1. CRM Systems

3.1.2. Dedicated Mailmerge Systems

3.1.3. Backend Services

Amazon SES

SendGrid

3.2. Customer Support Systems

4. Concept

In this chapter the architecture of the proposed system is motivated and its development process is highlighted.

4.1. Functional Analysis

4.2. Product Functions

4.3. User Interface

4.3.1. Prototyping Approaches

4.4. Technical Analysis

4.4.1. Runtime Environment

4.4.2. Server Software Stack

4.4.3. Client Side

4.4.4. Backend Service Connections

Google Mail

Google Docs

4.5. System Design

4.5.1. Database Schema

Unusual Patterns

4.5.2. Distribution of System Components

5. Implementation

This chapter is concerned with technical details of how Myriad was implemented. The collaborative development process is described, as are actual system component and their functionality.

5.1. Preparation and Tools

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5.1.1. Development Environment

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5.1.2. Collaborative Development

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git, gitflow **and Github**

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5.3.3. Email

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FetchEmail

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5. Implementation

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IncomingCreatedEmail

This class is not implemented yet. While, at first sight, it might seem like an *incoming* email could never be *created* by the system, this could be used for a multitude of plausible scenarios, such as sending persistent messages to the user (instead of the more ephemeral on-screen notifications), importing emails from a non IMAP compatible email server, or even integrating a chat system, making incoming chat messages appear as emails to the system.

5.3.4. Campaign

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5.3.5. Conversation

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5.3.6. Key & Value

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5.3.7. Search & KeyBinding

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5.3.8. Notification

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5.4. Backend Services Connection

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5.4.1. Email Fetching

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5.4.2. Google Docs Syncing

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5.5. “Best Practices”

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5.5.1. Core Extensions

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5.5.2. Lean Workers with AbstractWorker

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5.5.3. Monitoring Services

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6. Evaluation

In this chapter Myriad's initial goals will be reiterated and contrasted with real world observed usage.

6.1. Comparison with Initial Goals

6.2. Observed Use Cases

6.2.1. Recruiting Exchange Students for one of the Most Desired Universities of the World

6.2.2. Requesting paper Reviews for a Journal

6.2.3. Managing Incoming Class Administration Emails

7. Conclusion

Herein the relevance of this system and the proposed framework is discussed; future work is outlined and possible directions proposed.

7.1. Conclusion of this work

7.2. Discussion of results

7.3. Future Work

Bibliography

- [1] Sara Radicati and Quoc Hoang. Email statistics report, 2012 - 2016. 2012.
- [2] Adam N. Joinson and Ulf-Dietrich Reips. Personalized salutation, power of sender and response rates to web-based surveys. *Computers in Human Behavior*, 23(3):1372 – 1383, 2007.
- [3] Leslie Lamport. *LaTeX : A Documentation Preparation System User's Guide and Reference Manual*. Addison-Wesley Professional, 1994.

List of Figures

1.1. Myriad's goal is to achieve a desired degree of personalization at sublinear effort.	5
B.1. The first stable UML Diagram from January 24 th still had separate <code>Email</code> and <code>contacts_messages</code> tables, no rule automation and a semantically incomplete model of Emails which didn't discern between user generated emails and system generated emails.	42
B.2. The second UML Diagram from May 28 th fixed most of the aforementioned problems and already introduced optimizations such as extracting the Raw-Mail content to a different table. Those had become necessary when support for attachments was introduced.	43
B.3. This third UML Diagram from May 29 th finally tamed the <code>Email</code> inheritance tree, and also introduced improvements to legibility for the first time.	44
B.4. By the time of this fourth UML Diagram from April 18 th only minor improvements were still made to the system design, such as adding <code>ValueSettingActions</code> and supporting assistants via <code>SharingAssignments</code>	45

Appendix

A. Selected Source Code Examples

```
1  class Notification < ActiveRecord::Base
2    belongs_to :user
3    attr_accessible :user, :message, :resource_id, :resource_type
4
5    def resource
6      @resource ||= resource_class.find resource_id
7    rescue ActiveRecord::RecordNotFound
8      nil
9    end
10
11   def resource_class
12     resource_type.classify.constantize
13   end
14
15   def has_resource?
16     should_have_resource? and resource.present?
17   end
18
19   def should_have_resource?
20     resource_type.present? and resource_id.present?
21   end
22
23 end
```


B. UML Diagrams over time

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B.1. Usage of UML Diagrams for internal communication

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B.2. Stability of UML Diagrams over time

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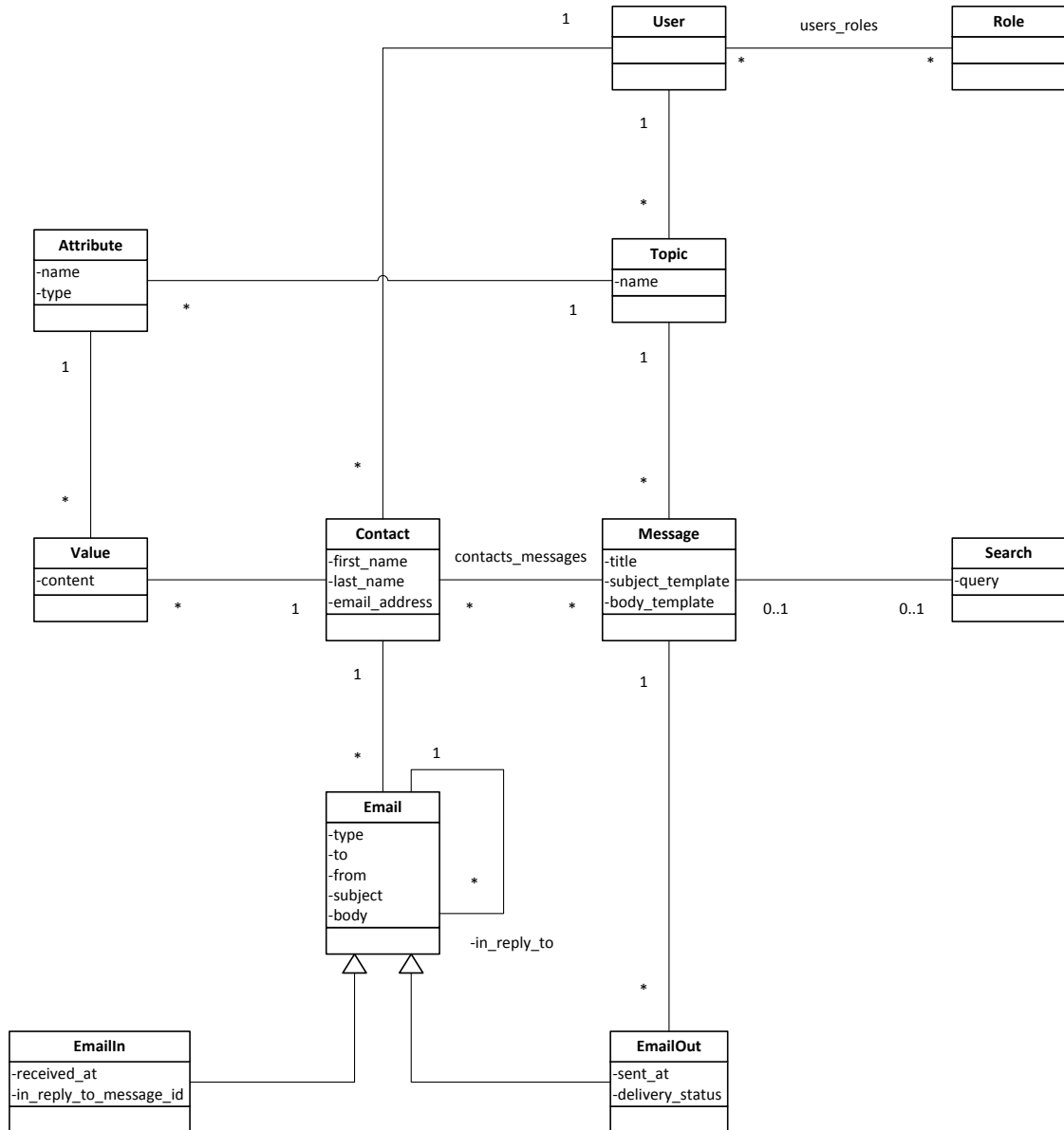


Figure B.1.: The first stable UML Diagram from January 24th still had separate `Email` and `contacts_messages` tables, no rule automation and a semantically incomplete model of Emails which didn't discern between user generated emails and system generated emails.

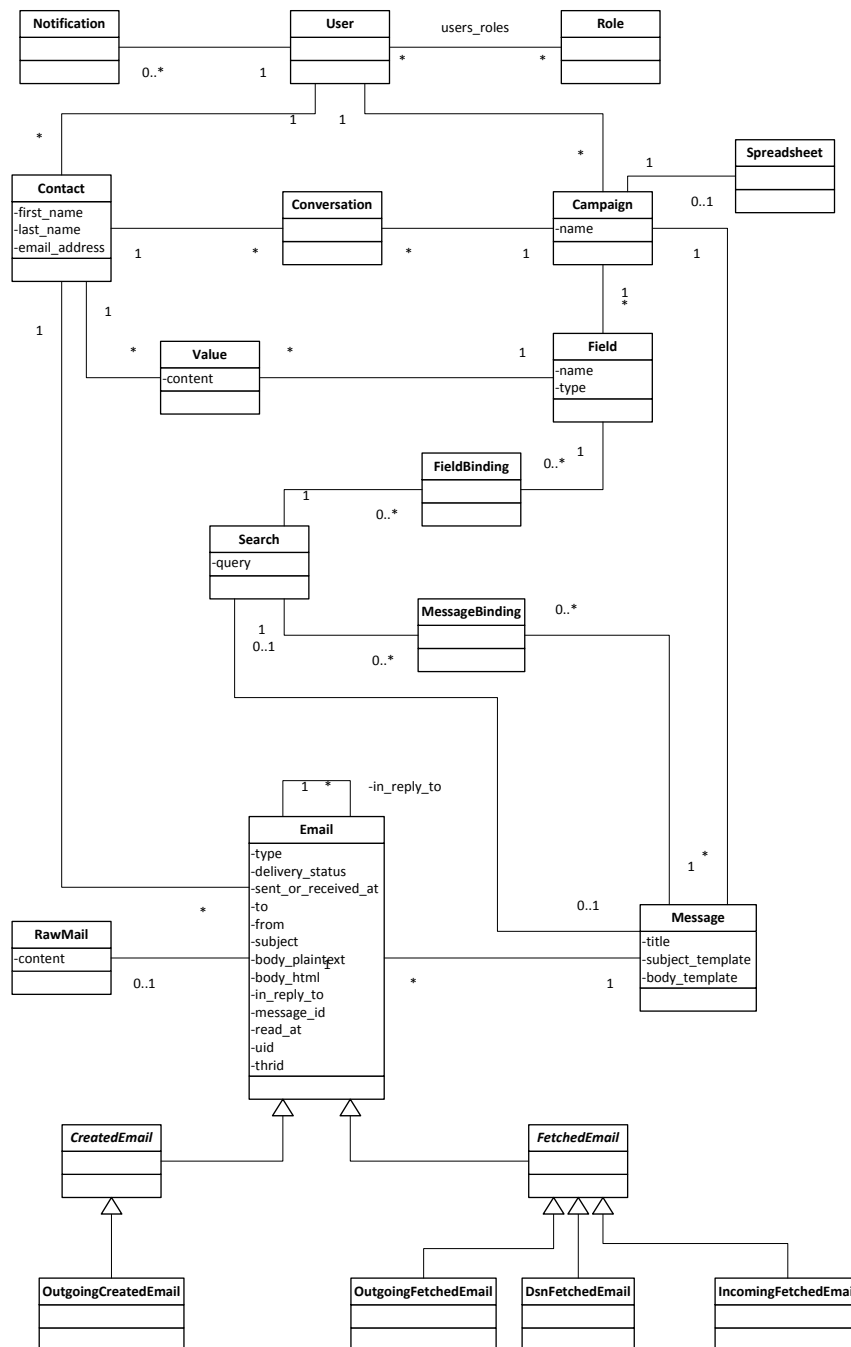


Figure B.2.: The second UML Diagram from May 28th fixed most of the aforementioned problems and already introduced optimizations such as extracting the RawMail content to a different table. Those had become necessary when support for attachments was introduced.

B. UML Diagrams over time

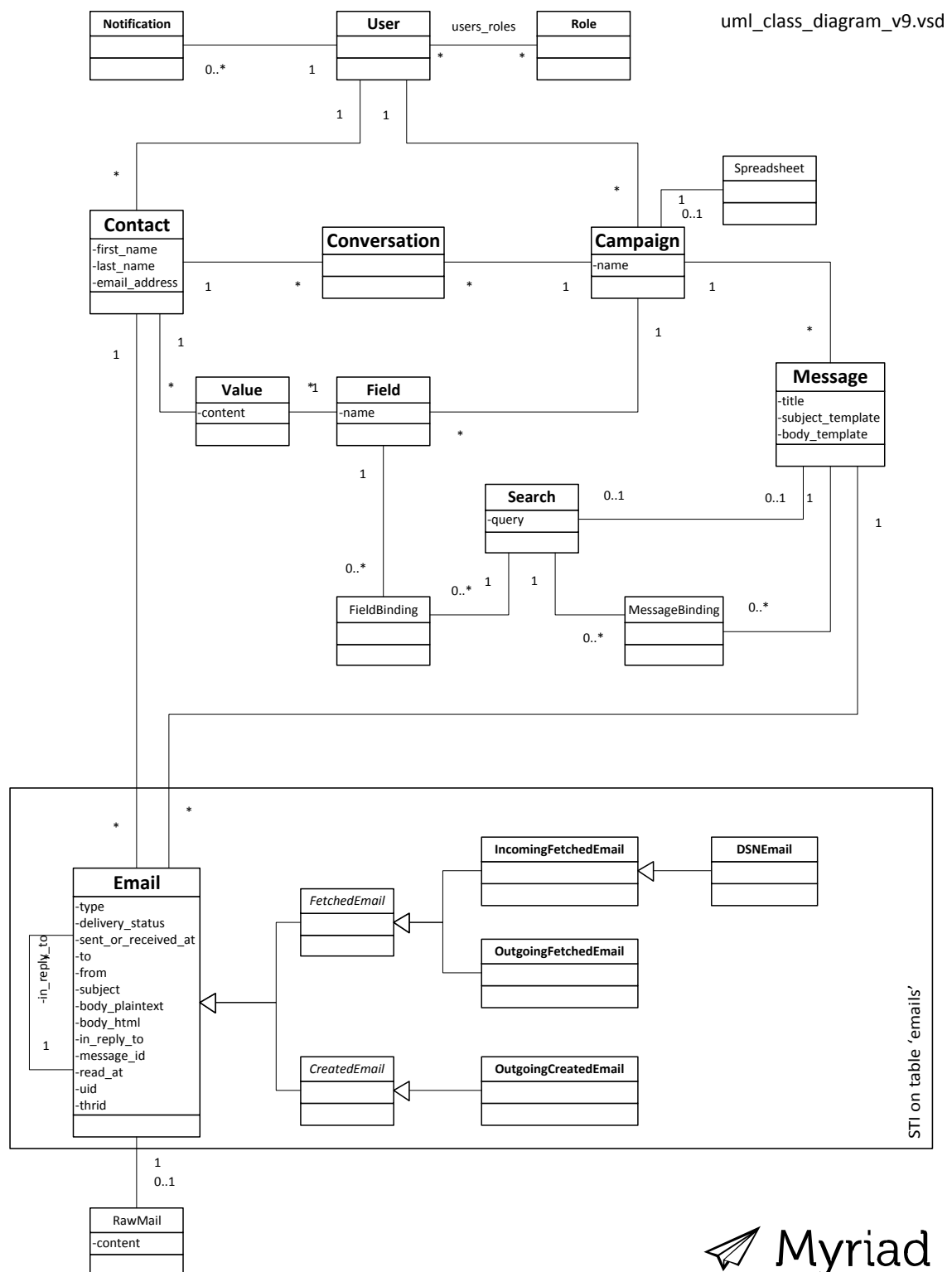


Figure B.3.: This third UML Diagram from May 29th finally tamed the `Email` inheritance tree, and also introduced improvements to legibility for the first time.

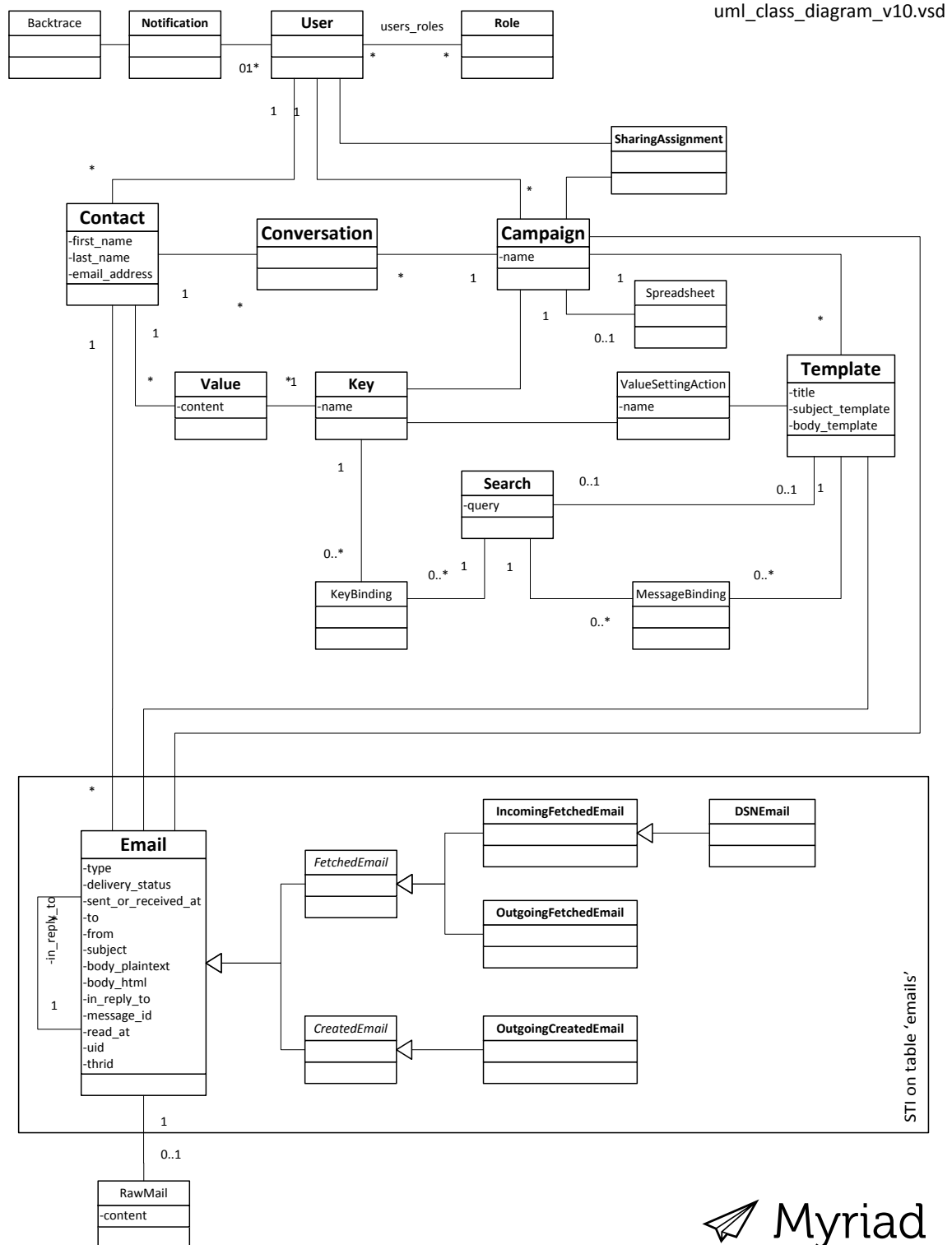


Figure B.4.: By the time of this fourth UML Diagram from April 18th only minor improvements were still made to the system design, such as adding ValueSettingActions and supporting assistants via SharingAssignments.

C. Colophon

This thesis is set in \LaTeX [3]. The template used is based on the official TUM Computer Science template. The sources are hosted publicly on GitHub, while the actual PDF file is built by the continuous integration server Travis.