

BSc Thesis in Software Technology Engineering

Process Report

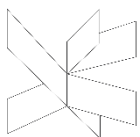
Building a website to promote the CERN Academic Training lectures

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Supervisors:

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VIA University College



**VIA University
College**

Maria Dimou

CERN IT, Academic Training



15,093 characters

Software Technology Engineering

7th Semester

2023

Version: August, 2018

Template responsible: dans@via.dk

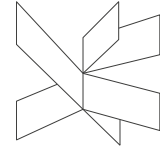
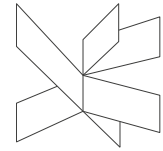


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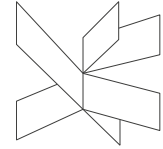
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1 Introduction

During my Technical Studentship between 1 August 2021 – 31 July 2022 at CERN, the project for the Academic Training website has been completed through several meetings, brainstorming sessions, tasks' recording and follow-up via a formal tracking system, discussions on the development. This document will reflect on the process following the Methodology defined in the Project Description (See **Appendix A**).



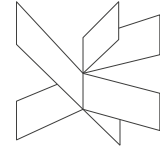
2 Group Description

The IT developer (me) and RCS maintainer (Harris) actively exchanged information and coding improvements during the development, while the project initiator (Maria) occasionally joined the technical sessions and gave valuable inputs for further enhancements. The usability tester (Salome) gave comments mainly regarding CDS, as the lectures were harvested from it. Salome has a wider view of the available Academic Training lectures that are accessible from CDS and must exist on the website.

This restricted development team regularly interacted for feedback with CERN pilot users. Their comments steered the development to more functional directions. This was very positive as an enriching experience and as assurance that the end product satisfied users' expectations.

Details of group communication are mentioned in the **Project Execution** section of this report.

As the laboratory was closed during COVID-19, people had to work from home, so we held our meetings only on Zoom, since physical meetings were not allowed. When the restrictions got more relaxed, we returned to physical meetings.



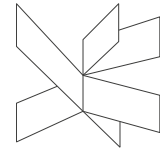
3 Project Initiation

In May 2021, when the opportunity for a one-year Technical Studentship has been confirmed, I have also gotten the offer from CERN to write the BSc thesis on the proposed subject. This had to be agreed on by the Head of Programme and Study Counsellor at VIA, as the first 6 months had to be accepted as an internship, the rest the preparation for the thesis.

The Project Description has been already written by the Project Initiator (Maria Dimou) who also proposed the project.

As soon as I arrived at CERN, ideas for the **mockups** came quickly and they were introduced to the ATC members. This presentation received several positive comments that carried professional value.

Note: See **Appendix C** for mockups.



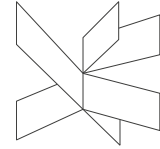
4 Project Description

Maria, the project initiator, had already written the Project Description on the CERN IT student projects' website. This was the proposal that was sent to me by e-mail in April 2021 for potential BSc subject.

This Project Description later has been adapted to some additional requirements, like the rejection of the Comments, while the rest and newer requirements were accomplished.

The Project Description **for the thesis** I have prepared half year later during the course BPR (Bachelor Project Preparation).

Note: See **Appendix A** for the Project Description.



5 Project Execution

The approach to execute this project was determined by:

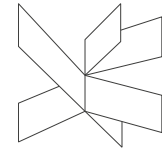
- creating issues in the software **JIRA** under the project named **ATWEB**.
- writing notes in **CodiMD** ^[3],
- communicating in the team via **Mattermost** and/or **CERNmail**,
- setting meetings on **Indico** and **Zoom** (along with physical ones).

The **Agile-Waterfall hybrid method** has been used throughout the project, which is a combined version of Agile and Waterfall methodology (See **Appendix A** for Methodology). However, we periodically returned to the Requirements and several points have been altered due to frequent changes from the stakeholders.

During my Technical Studentship, I have built the necessary expertise for this project via courses and study that took place mostly during the internship period (the first 6 months). Along with my personal learning path, the project execution happened continuously.

Concerning the Methodology, several discussions and workflow changes led to the decision in favor of an individual method rather than the regular SCRUM ^[4] or Waterfall ^[5] ones. Since people working at CERN are busy working on their projects too, setting up meetings and regular checkpoints with them were rather challenging, and required setting appointments sometimes a month or months ahead. Using SCRUM Sprints would not have worked here, but maybe between students that are not that busy with other projects at the same time might have ended up well.

Note: See **Appendix H** for more detailed logbook.



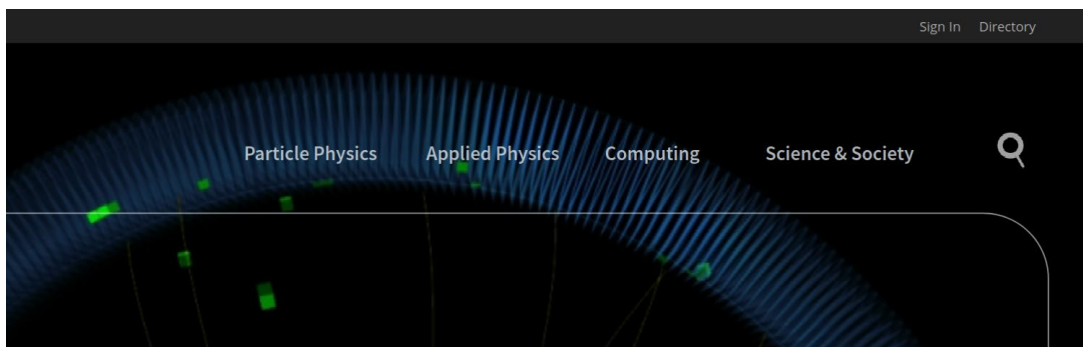
5.1 The choice of technology use

It took several meetings to decide which technology was best to use and how to establish the design for the site. As the majority of CERN sites currently use Drupal, it was initially recommended more. Next, Invenio was suggested as a possible alternative. In the end, React and Django technologies won the debate.

Note: For reasons and arguments see **Technology Alternatives** in the **Project Report**.

5.2 The exclusion of categories

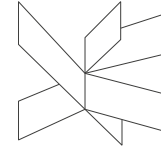
In the early mockups, next to the search engine I have placed several categories that Maria suggested to put in the top banner. While we have been examining the metadata from CDS, we have realized that one piece of data was just missing – the category.



The goal was to fill these categories with lectures, create subcategories, and have the metadata to return relevant results during search. As a Machine Learning algorithm was the only way to improve categorization and searches, which was not a requirement, this has been **omitted**.

5.3 The issue with keywords

The *keywords* data field **did exist** in the Indico API that contained the event information about the lectures, which was eventually built into the software's system. However, due to the fact that this field mainly held empty values, it did not have a major impact on the outcome of the search.

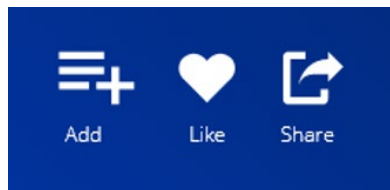


5.4 Different file formats

As we handled old records of the Academic Training Lecture series, some limitations came up. Since the CERN Academic Training institution has been around for such a long time, the old records don't have video material, but they do have the knowledge written in files in different file formats. We discovered two types of file extensions: TIF and PDF. Since most browsers' built-in PDF reader makes it easy to display PDF files, only PDFs were handled in this project.

5.5 The postponed CERN SSO login

Earlier, during the design of the mockups, three different buttons were added next to the lecture: **Add**, **Like** and **Share**, as can be seen below.

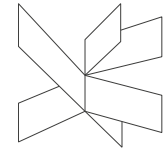


These buttons were planned to be used for the following goals:

- **Add** – add lecture to a personal playlist or an album (such as Favourites)
- **Like** – like the lecture
- **Share** – share the link of the lecture on several other platforms

Having personal playlists, having the possibility to give likes to lectures would have required to implement CERN SSO login, but it was not a priority. These buttons were additional, optional elements – and hence they have been left out, including the Share button.

While the CERN Design Guidelines required to have the mandatory CERN banner on the top of the site, including the Sign In, which has been indeed displayed. However, knowing that the site viewers do not necessarily need to Sign In in order to have access to the lectures, this has been said to be done by Harris's team after my leave from CERN.



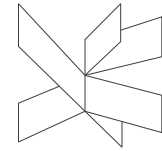
6 Personal Reflection



Figure 1: Portrait of Franciska next to CERN ATLAS Experiment

Franciska

As a Technical Student, the fact that I have been working on a project with a supervisor at CERN for a whole year really helped me a lot to open doors to unique opportunities. I must admit that I felt extremely lucky being selected as one of the Technical Students back at the time. I had the chance to gain valuable skills from experts at CERN, both in programming and design, as well as experience in a professional work environment. Maria, my CERN supervisor introduced me to Mónica Bello, the Curator and Head of Arts at CERN. I was invited to different events through her where I had the chance to meet the guest artists of Arts at CERN and take part in interviews and more. I am grateful for my

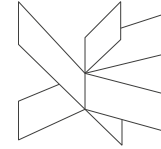


supervisor's continuous attention for my work. She also approved an Adobe packages' license for the CERN project and for other photos' editing for publication to the CDS. These photos that I have taken throughout the visits were necessary for the project that I worked on, and I have really enjoyed taking them.

It was an exciting challenge for me to work on the CERN website since web design is something that I enjoy doing. My background in graphic design made preparing the views for the website much faster than constructing the logic. The project was built with React JS + Django from scratch, and although it was a custom solution, I gained valuable experience in coding thanks to it.

While the project itself went smoothly thanks to JIRA and the continuous notes in CodiMD, unexpected errors sometimes came up during the development process, making it difficult to resolve them quickly. There have been a lot of hours, sometimes even days spent searching on Stack Overflow for potential solutions to these problems, but they have eventually been solved. As a result, I gained a broader view of software engineering as I gained experience with a variety of problems.

I caught diseases during the last 2 months of my contract and underwent one surgery after another while writing my thesis and documentation. I had a difficult time getting my health together and setting everything in their final stages. Nevertheless, I ended up with a rewarding experience, was filled with useful knowledge, and I managed to be on time with all deadlines.



7 Supervision

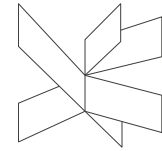
In the beginning, I have been being told that I am not going to get a supervisor from VIA before spring 2022 because I write my thesis from VIA without a group. However, my CERN supervisor, Maria Dimou, heavily suggested to contact one of my professors from VIA for supervision during the preparation of the BSc thesis.

Following the first Zoom meeting with Kasper Knop Rasmussen, Maria and I – Kasper agreed upon supervising the project from VIA. Shortly after, the VIA Engineering Study Counsellor contacted the Head of Programme to reconsider their previous decision about having an individual supervisor from VIA, which later has been confirmed.

Maria closely supervised me at CERN throughout the whole year, and Kasper provided valuable feedback informally during a couple of Zoom meetings between the three of us. We usually set Zoom meetings a month ahead. The backlog of the supervision meetings between Kasper, Maria and I – can be seen below:

Meeting subject	Date
Supervision agreement and technology approval for BSc thesis	11 October 2021
CERN Terra Incognita Presentation ^[6] and BSc thesis plan	2 March 2022
BSc Thesis Draft – Project Description	8 April 2022
BSc Thesis Draft – Final Project Description	19 April 2022
BSc Thesis Draft – Requirements and User Stories	06 May 2022
BSc Thesis Draft – Project Report	17 July 2022
BSc Thesis Draft – Process Report	16 August 2022

Figure 2: Supervision meetings



Me and Maria were able to share our inputs and comments about the project and documentation daily due to the direct supervision I have received at CERN. Being in contact with Kasper was only possible through online sessions since Kasper was in Denmark, while Maria and I were at CERN (Switzerland).

Note: Kasper supervised the project over the year of 2022. A clear separation has been set between the work done in the internship and the work that had to be done for the thesis itself to make sure *the same work is not credited twice*.

7.1 Separation between the internship work and BSc thesis work

7.1.1 Internship work

August 2021 - January 2022 (6 months)

The learning process of Linux system administration, React, Django, Kubernetes, OpenShift, and the CERN Web Frameworks. I had a CERN Udemy license for any technical and/or managerial course, potentially useful for my future career.

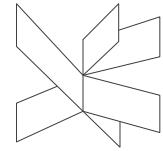
I have also followed the CERN French language courses. Maria approved an Adobe ® packages' license for my web development project and for other photos' editing for publication to CDS.

7.1.2 BSc thesis work

February 2022 - July 2022 (6 months)

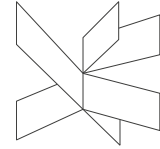
Application of the acquired knowledge with the above-mentioned tools to implement the web site ^[7] according to the Project Description (See **Appendix A**).

Scripting for video fetching from CDS, development of the Search function, performance testing, entry in operation, documentation ^[8], enhancements based on users' feedback.



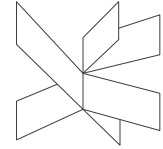
8 Conclusions

The process we followed at CERN for this project was slightly different from the academic way taught at VIA. The reason was the collaborators' busy schedules and the multiple iterations and input changes of our users. This showed that different work environments and cultures may have different methods to approach a goal. Adaptation is key and this versatile approach allowed us to gain experience and learn from the experts on the job. One of the lessons learned was how to match priorities to the colleagues' availabilities. Planning and keeping track of work done made this project a success.



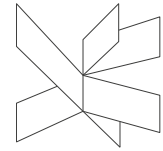
Sources of information

1. Mattermost. [online] Available at: <<https://mattermost.com/customers/cern/>> [Accessed on 25 July 2022].
2. JIRA. [online] Available at: <<https://its.cern.ch/jira/projects/ATWEB/>> [Accessed on 25 July 2022].
3. CodiMD – Notes for Franciska’s BSc Thesis. [online] Available at: <<https://codimd.web.cern.ch/I75TITVDRKyeFEI-yS79uA>> [Accessed on 25 July 2022].
4. What is SCRUM? [online] Available at: <<https://www.scrum.org/resources/what-is-scrum/>> [Accessed on 25 July 2022].
5. Waterfall Methodology. [online] Available at: <<https://www.workfront.com/project-management/methodologies/waterfall/>> [Accessed on 25 July 2022].
6. CERN Terra Incognita Presentation – The public web site for Academic Training. [online] Available at: <<https://indico.cern.ch/event/1080998/>> [Accessed on 24 July 2022].
7. Academic Training website. [online] Available at: <<https://academictraining.cern.ch/>> [Accessed on 25 July 2022].
8. Academic Training website – Documentation site. [online] Available at: <<https://academictraining-admin.docs.cern.ch/>> [Accessed on 25 July 2022].



Appendices

1. Appendix A – Project Description
2. Appendix B – Group Contract
3. Appendix C – Mockups
4. Appendix H – Backlog



BSc Thesis in Software Technology Engineering
Project Description

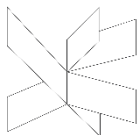
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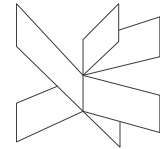
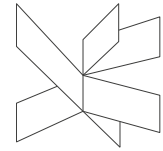


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Appendices (including Group Contract)



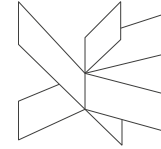
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Figure 1: Agile-Waterfall Hybrid method (E. Bergmann & A. Hamilton, lucidchart.com)

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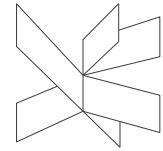
1 Background description

Lectures can be used by instructors to help students to easily acquire knowledge of terms, basic facts, and simple concepts. There is no difference in the effectiveness of lectures and other methods for conveying simple information [Bligh, 2000] [1].

CERN Academic Training lectures include both cutting-edge science and valuable historical information [2]. These lectures cover physics and technology research results, as well as news from other disciplines. Past lectures often present a great historical value. Lectures are open to all members of the CERN staff (including fellows, students, workers, users, and apprentices) free of charge. Some of these lectures are also available in a dedicated YouTube playlist [3]. All lectures are recorded and published on the Web, along with visual support materials. The complete catalogue of the Academic Training Programme lectures is archived since 1968, however, not all of them have videos. Similar lectures can also be found in other CERN programmes, such as Colloquia, Seminars, and various student programmes. Our project is only concerned with Academic Training lectures; however, it is a pioneering example for adoption by the others.

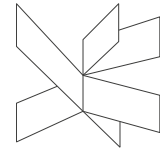
CERN Academic Training consists of a series of a few hourly lectures, all on consecutive days. Everyone at CERN receives an email inviting them to participate. It is generally decided by the lecturer and his/her sponsor what degree of complexity the lectures will have. On top of that, all lectures in any domain with their full content and their slides and video in the CERN Document Server (CDS) [4] are available for viewing from the lectures' description page [5]. Sponsors of these lectures are mostly members of the CERN Academic Training Committee (ATC).

While CDS ensures that these lectures are archived in a dedicated collection, there is no easy way to find lectures in that collection as they are simply indexed with the most recent first.



CDS has other purposes other than archiving Academic Training lectures, so their layout does not focus on aesthetics - it is only designed to store information.

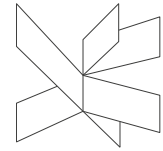
On the other hand, the reward for the prestigious speakers of Academic Training - who are willing to give their lectures almost free or with some symbolic financial contribution - is far from adequate. Lectures related to Academic Training are not widely advertised, and the speakers deserve more than just recording and storing their presentations.



2 Problem Statement

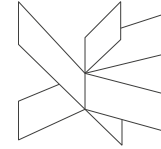
Even though CDS archives Academic Training lectures, there is no attractive presentation and advertising of the lectures to encourage the programme exploration by various target groups.

1. How to make the process of promoting lectures more attractive?
2. How to encourage the target audience to consume lectures more often?
3. How to help the target audience reach Academic Training lectures more easily?
4. How to gain proposals from target audience to get ideas for future lectures?
5. How to support speakers to promote their lectures?



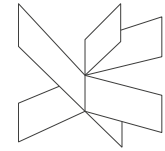
3 Definition of purpose

In this project, the aim is to promote CERN's Academic Training lectures in a coherent way, and one that can be easily maintained in the future.



4 Delimitations

1. The product will prioritize videos over records with other filename extensions like PDFs from the lecture collection. Only videos will be displayed.
2. Due to the absence of subtitles/captions in CERN Academic Training lectures, searching between the lectures is only possible by using the archived metadata. If one could use the transcript of the whole lectures' content, the search results would be more sophisticated and more accurate. However, the transcription is not yet available, therefore, this is not going to be covered in this project.
3. Records have no category information encoded in their metadata. The categorization of lectures is not feasible due to the impossibility of providing a curator of the data that can serve for fetching relevant lectures. Amongst the over 900 records stored on CDS, no one would watch all the videos of the past to identify categories and subcategories such as Particle Physics, Technology, Computing, Science & Society. As a result of all these unavoidable reasons, the categories cannot be implemented in this project.
4. Allowing comments under lectures was a requirement from the project initiator up until the ATC members on the first call for feedback on the site decided against it due to the exposure to resentful and malicious messages. Such comments usually come from a skeptical point of view towards scientific evolution and technology. They occur even today under CERN social media accounts, like Facebook or Instagram.
5. Keywords is the best field we have for good quality search results. Unfortunately, hardly any lecture record contains keywords. This enhancement is time-consuming, can only be done by the specialists in the ATC and the development part of this project cannot help in any way.



5 Methodology

For this process will be used a quite unique methodology that incorporates the best of both Waterfall and Agile methods.

Agile-Waterfall hybrid method allows teams developing software to work within the Agile methodology, while the project manager sticks to the Waterfall approach.

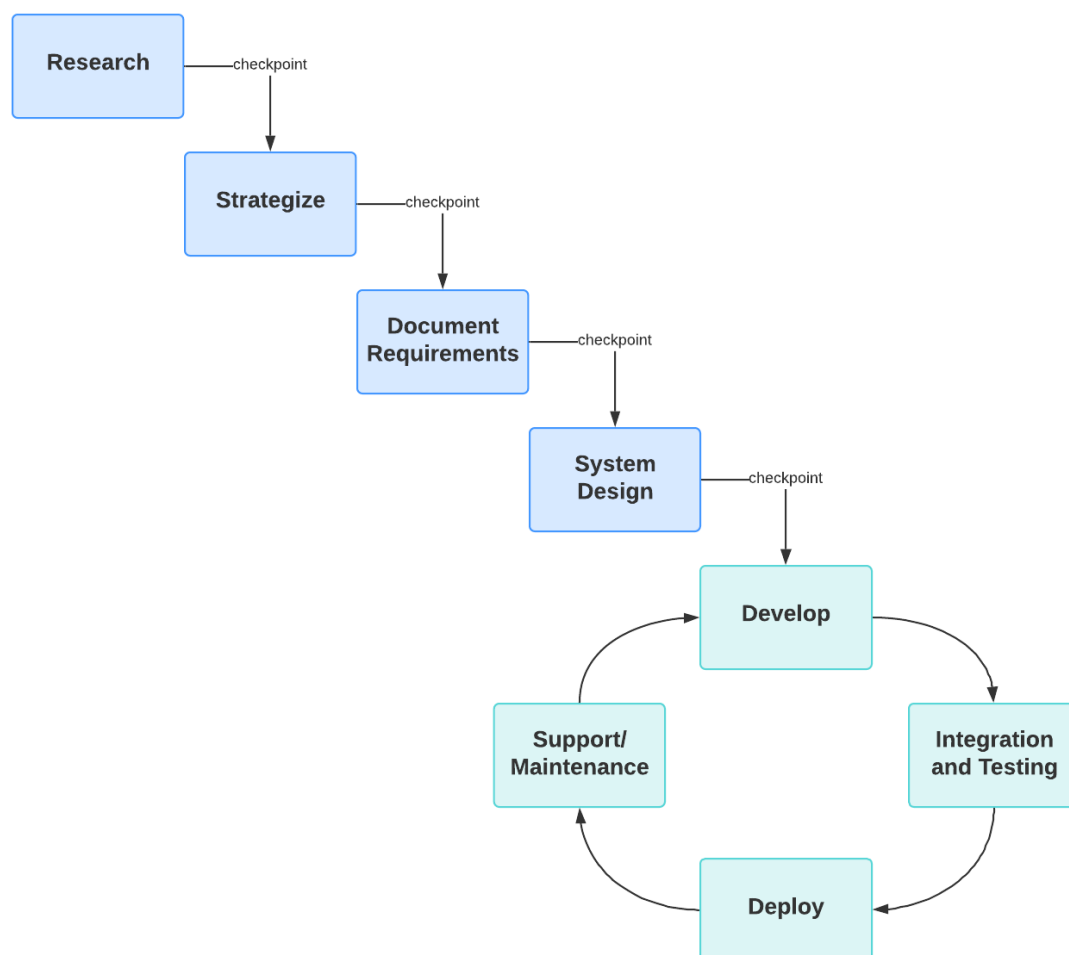
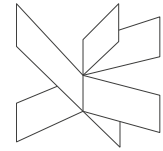
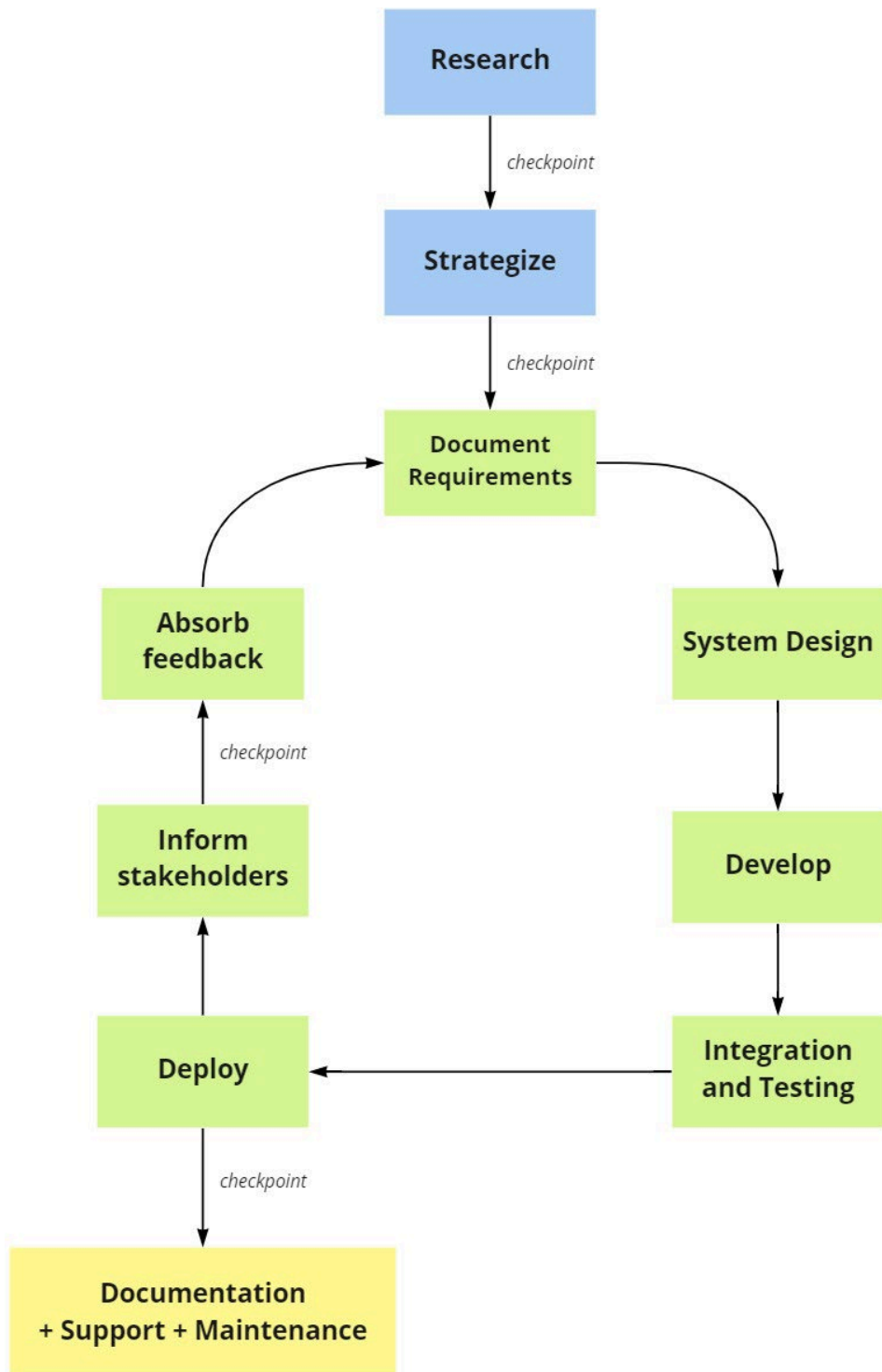
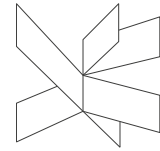


Figure 1: Agile-Waterfall Hybrid method (E. Bergmann & A. Hamilton, lucidchart.com)



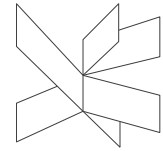
This methodology has been chosen because the project has a delivery date, hence it would benefit from Agile's fast design, analysis, and planning. Using Waterfall at the organization level (starting from Research, Strategy, Requirements, Design), and using the Agile approach at a project level (circulating between Development, Testing, Deployment, Support/Maintenance) was found the best fit for this project.

However, since the stakeholders' wishes and requirements were changing more often, going back to **Requirements** through the stakeholders' **Feedback** was necessary. Hence, in our case, the used methodology loops through the following:



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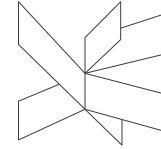
Figure 2: Agile-Waterfall Hybrid method – individual approach



As can be seen on the previous figure, two extra phases have been added to our individual approach between **Deployment** and **Requirements**:

1. **Informing the stakeholders**
2. **Absorbing the stakeholders' Feedback**

By doing so, the requirements can be updated accordingly.

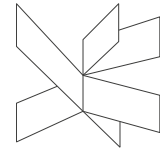


6 Time schedule

The Time schedule is based on CERN JIRA tickets, stakeholders' meetings and the need to have the site in production by the end of June 2022.

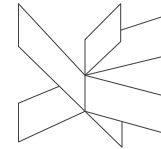
VIA deadlines are stated accordingly.

CERN Research	Early August 2021
CERN Mockups [Start]	05 August 2021
CERN Stakeholders' Meeting – Presentation of mockups	17 August 2021
CERN Mockups [End]	Early October 2021
CERN Strategy - Proposal for technology use	13 October 2021
CERN System Design - Architecture	Mid-October 2021
CERN Development - Implementation [Start]	14 October 2021
CERN Stakeholders' Meeting	14 October 2021
CERN Testing [Start]	1 November 2021
CERN Development - Implementation [End]	02 February 2022
CERN 1 st Deployment	04 February 2022
CERN Documentation [Start]	11 February 2022
CERN Terra Incognita Presentation	28 February 2022
CERN Stakeholders' Meeting – Project Presentation	15 March 2022
VIA BPR1 Project description Draft [Start]	18 March 2022
VIA BPR1 Project description Draft [End]	31 March 2022
VIA BPR1 Project description Final [Start]	08 April 2022
VIA BPR1 Project description Final [End]	28 April 2022
VIA BPR1 Requirements/User Stories [Start]	29 April 2022
VIA BPR1 Requirements/User Stories [End]	09 May 2022



CERN Testing [End]	Mid-June 2022
CERN Documentation [End]	28 June 2022
CERN Project Delivery	30 June 2022
VIA BPR2 Final Report	March 2023

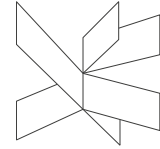
Figure 3: Time schedule



7 Risk assessment

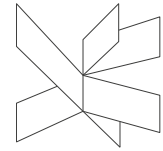
Risks	Likelihood Scale: 1-5 5=high risk	Severity Scale: 1-5 5=high risk	Product of likelihood and severity	Risk mitigation e.g Preventive-& Responsive actions	Identifiers	Responsible
Bad quality data, e.g.: a) corrupt video b) missing metadata c) typos in metadata that confuse the searches	2	4	8	Raise awareness with the sponsors	Bad searches	ATC chairperson
Non endorsement by the user community	3	3	9	Dissemination campaigns	Questions answered in the site	Site maintainer and the whole of the ATC
Software out of date or vulnerable for security	3	5	15	Maintenance processes well documented	Warnings in the repo	Site maintainer

Figure 4: Risk Assessment



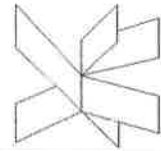
8 Sources of Information

1. Bligh, D.A., 2000. Bligh, D. A. (2000). What's the use of lectures? San Francisco: Jossey-Bass. Jossey-Bass.
2. It-student-projects.web.cern.ch. 2022. CERN Academic Training web site | IT student projects. [online] Available at: <<https://it-student-projects.web.cern.ch/projects/cern-academic-training-web-site>> [Accessed 6 April 2022].
3. Youtube.com. 2022. CERN Lectures | YouTube. [online] Available at: <https://www.youtube.com/channel/UCwXkOx0EuKBR5m_00iaZRUA/playlists> [Accessed 6 April 2022].
4. Cds.cern.ch. 2022. Academic Training Lectures - CERN Document Server. [online] Available at: <<https://cds.cern.ch/collection/Academic%20Training%20Lectures?ln=en>> [Accessed 6 April 2022].
5. Schools, S., Development, T. and Programme, A., 2022. Academic Training Lecture Regular Programme · Indico. [online] Indico. Available at: <<https://indico.cern.ch/category/72/>> [Accessed 6 April 2022].
6. Lucidchart.com. 2022. Agile-Waterfall Hybrid: Is It Right for Your Team? | Lucidchart Blog. [online] Available at: <<https://www.lucidchart.com/blog/is-agile-waterfall-hybrid-right-for-your-team>> [Accessed 6 April 2022].



Appendices

1. Appendix B – Group Contract



Group Contract

Group Name (optional):
ATWEB

Group 31

Date: **03/03/2022**

These are the terms of group conduct and cooperation that we agree on as a team.

Participation: We agree to....

- Be completely involved into the Academic Training web site project
- Be active during all the stages of the project
- Do our best to achieve the results defined in the project description

Communication: We agree to...

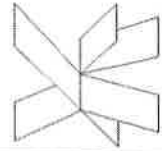
- Maintain a friendly and tolerant atmosphere in the group
- Listen to every group member's input / opinion
- Not ignore any of the members' messages

Meetings: We agree to....

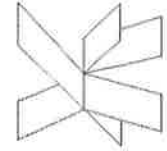
- Have daily checkpoints between Franciska and Harris (can be postponed when necessary or omitted when there is nothing to discuss), other meetings scheduled together with other members when necessary
- The communication take place using Mattermost
- The meetings take place using Zoom (online) or using the office or social room (onsite) at CERN – depending on COVID restrictions
- Face-to-face and/or Mattermost discussions on the overall progress between Maria and Franciska on deadline, deliverables, interactions with the Academic Training Committee (ATC) and service managers of recording, transcoding and video publishing on the official CERN repository

Conduct: We agree to....

- Focus on discussed topic / tasks
- Track tasks with JIRA regularly



- Open SNOW Tickets at CERN Service Portal in case of other issues that cannot be solved on our own
 - Keep backlog and other notes in CodiMD
 - Regularly inform the BSc thesis supervisor on project progress (Maria, Kasper, Franciska)
-



Conflict: We agree to....

- In case a personal conflict occurs, we agree to respectfully express our thoughts and talk through them firstly in person.

Deadlines: We agree to....

- Do our best to meet the deadlines
- Warn the group members at least 3 days before deadline
- Franciska shares the drafts with Maria before handing in at VIA

Other Issues:

Technical Student	Student number (VIA)	Signature
Franciska-Leonóra Török (VIA)	293171	

Usability Tester	Signature
Salome Rohr (CERN)	

Project Maintainer	Signature
Harris Tzovanakis (CERN)	

Project Coordinator and Supervisor	Signature
Maria Dimou (CERN)	

Backlog

The backlog is available on the following CodiMD notebook:

<https://codimd.web.cern.ch/s/RCE7a9XIz>