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Abstract: The purpose of this document is to describe the specifications and the architecture of the ALAMEDA Innovation Hub (AIH), a community hub for AI solutions addressing the improvement of PMSS patient's quality of life. The AIH will be an entry point to accessing the ALAMEDA AI Toolkit.

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** Nature of the Deliverable: *P= Prototype, R= Report, S= Specification, T= Tool, O= Other*

Disclaimer

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Glossary

Abbreviation	Full name
PMSS	Parkinson's, MS and Stroke
SME	Small and medium-sized enterprise
WP	Work Package
AIH	ALAMEDA Innovation Hub
DoA	Description of Action
Dx	Deliverable (where x defines the deliverable identification number e.g. D1.1.1)
GUI	Graphical User Interface
MSP	Multi-Sided Platform
ML/AI	Machine Learning / Artificial Intelligence
OEM	Original equipment manufacturer

Executive Summary

The purpose of this document is to describe the specifications and the architecture of the ALAMEDA Innovation Hub (AIH), a community hub for AI solutions addressing the improvement of PMSS patient's quality of life. The AIH will be an entry point to accessing the integrated ALAMEDA AI Toolkit and to enable external digital healthcare stakeholders to access selected datasets and historic data sources (e.g. anonymized patient datasets) and also to exploit new applications of the ALAMEDA algorithms and ML/AI methods. Through intuitive user interfaces these types of stakeholders will be provided with access to the methods, source code and video service demonstrations that will allow the testing of ALAMEDA results. Additionally, AIH will also provide relevant technical support, documentation and training capabilities. Therefore, ALAMEDA Innovation Hub will serve mostly as an exploitation catalyst for the project and a common place for describing the ALAMEDA AI Toolkit services.

The AIH will be a Community Hub that offers to participants of the ALAMEDA ecosystem relevant functionalities such as browsing and searching services, user registration, Usage Statistics, but also will offer an entry point accessing the enabled ALAMEDA AI Toolkit services. Being a Community Hub means that there should be the ability to allow external service providers to access selected AI Toolkit services and promote them through the ALAMEDA Innovation Hub.

Based on the initial requirements identified in WP2 and the analysis of relevant solutions, the specifications and the functionalities that the AIH shall provide are provided in this document, along with an initial view on the architecture of the AIH.

The deliverable concludes with the implementation planning and the development milestones.

1. Introduction

1.1 Scope and motivation

The ALAMEDA Innovation Hub (AIH) is conceptualized as a community hub for AI solutions addressing the improvement of PMSS patients' quality of life. AIH aspires to be the entry point to accessing the ALAMEDA AI Toolkit services and to enable external digital healthcare stakeholders to access available datasets (e.g. anonymized patient datasets). Via the AIH registered users will have the opportunity to exploit the ALAMEDA algorithms and ML/AI methods in applications of their own via their access to open-source code and the use of ALAMEDA AI Toolkit software components. The intuitive AIH user interfaces will offer access to the methods, data, source code and service demonstrations that will allow users to test and apply ALAMEDA results in other relevant domains. Additionally, AIH will also provide relevant technical support, documentation and training capabilities. Therefore, ALAMEDA Innovation Hub will serve mostly as an exploitation catalyst for the project and a common place for presenting the ALAMEDA AI Toolkit services. The key characteristics of the AIH are depicted below (extracted from the DoA).

Figure 1: AIH Key features (adapted from the DoA)

Based on the initial requirements identified in WP2 and the analysis of relevant solutions, the specifications and the functionalities that the AIH shall provide are presented in this document, along with an initial view on the architecture of the AIH.

1.2 Relation with the other ALAMEDA WPs

Based on the results of WP4 and WP5, WP7 is responsible for the design and implementation of ALAMEDA Innovation Hub, the community hub that will primarily provide a single point of entry for external users to accessing the ALAMEDA AI Toolkit when the project is complete, including relevant technical support services, documentation and training services.

WP7 will receive code from WP5, along with observation and experience from project-wide usage of this code. Software will be appropriately modified, bundled, and documented for external users to be able to make the most of it.

1.3   Report overview

This deliverable summarizes the work performed regarding the specifications and the architecture of the ALAMEDA Innovation Hub (AIH). It is based on the work of D2.1 when the requirements of the ALAMEDA stakeholders were collected and analyzed, and the specifications of the ALAMEDA solution had been defined. In this deliverable we present the scope and main functionalities of AIH, we show the different facets of the architecture of the AIH and we provide the development milestones of the coming period. The remaining deliverable sections are organized as follows:

-        Section 2 describes the specifications of AIH in terms of needed functionalities and services that will be offered;

-        Section 3 provides the architecture of the AIH and technical design decisions regarding the implementation of the AIH.

-        Section 4 provides the planning of the development, the AIH versions and the foreseen milestones

-        Section 5 provides the framework for security and privacy provisions

-        Section 6 concludes the document summarizing the performed work and providing an outlook of the future steps in the project implementation.

2. ALAMEDA Innovation Hub Functional Specifications

2.1   Community Hub scope and definitions

One of the visions of ALAMEDA is to design and develop a service-oriented ecosystem in a Community Hub-like hierarchical structure concisely described in this deliverable as the "ALAMEDA Innovation Hub". The concepts have been inspired by the Multi-Sided Platform type of services, as intermediaries between service or content providers and interested consumer stakeholders. In the case of ALAMEDA these priorities have been adapted to the needs of addressed stakeholders, in order to use the exploitable ALAMEDA assets and additional "building block" components i.e.:

• tools, services, predictive security methodologies,

• methods for PMSS data processing and correlation with therapeutic schemes,

• constructs for services / open data / content that will be offered by the AIH, in order to support predictive medical practices,

• info on relevant AI research,

• an extensive repository of relevant publications, articles and blogs that further justify the ALAMEDA pilots and clinical practice targets

• organised technical support and consulting,

• explanatory presentation of all ALAMEDA pilots and their results (WP6)

2.2   Stakeholders of the ALAMEDA Innovation Hub

This section provides an initial characterisation of the stakeholders expected to be interested in interacting with, joining and contributing to the AIH.

Before enumerating and briefly describing those stakeholder categories, it is important to remark a few critical points which will be important to take into account during the AIH design, development and promotion process:

- The AIH creation process will follow a participatory project-based approach, where the platform development and maintenance are jointly promoted by multiple parties.
- To many extents, the AIH will recall several features of the so-called open innovation multi-sided platforms. In open innovation processes, heterogeneous seekers (organisations or individuals looking for innovations in particular areas) and solvers (organisations and individuals who possess innovation-related knowledge) interact to create solutions to innovation challenges[1]. Although several other types of actors can intervene and play relevant roles such as intermediaries, innovation consultants,

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[1] Daiberl, C.F., Oks, S.J., Roth, A. et al. Design principles for establishing a multi-sided open innovation platform: lessons learned from an action research study in the medical technology industry. Electron Markets 29, 711–728 (2019). https://doi.org/10.1007/s12525-018-0325-2

  legal advisors, etc., in this preliminary phase we limit our analysis to the two main groups of stakeholders which we refer to as demand (seekers) and supply (solvers) side actors.

- In the subsequent iterations of the AIH creation process, it will be important to analyse and take in due account also the cross-side networking effects that the AIH will be potentially able to generate.

2.2.1 Demand side stakeholders (or seekers)

These include: health & medical business actors, healthcare professionals, neurology experts and researchers, caregivers and patients, as well as AI specialists and IT research groups. Affiliated business entities to partners, and all other stakeholders seeking novel tools that are focused on PMSS patients' needs will be invited to participate in the AIH ecosystem to learn about its assets, and to validate the functionalities and operations of the ALAMEDA AI Toolkit. Interfacing of external actors, vendors and start-ups wishing to demonstrate the applicability of ALAMEDA on other medical targets will be also enabled, from both a technical and a business perspective.

2.2.2 Supply side stakeholders (or solvers)

These include Consortium Partners, as well as potential Third-party providers that are exploiting the code and the software components of the ALAMEDA AI Toolkit. Specifically, these include researchers, ecosystems of businesses/research centres, affiliated business entities to ALAMEDA partners, generic parties interested in medical AI applications, etc. These should register and participate in the Hub and provide added value to it through offering reviews and ratings while conceptually enhancing it as contributors of additional content. Moreover, entities that have already achieved their own related implementations can certainly contribute/collaborate with their established work following the provided integration methodology, adding further value to the project.

2.2.3 Roles

For the actual implementation of ALAMEDA Innovation Hub, we identified specific roles that can provide support for the different type of stakeholders and also roles that were needed for the better management and support of the Hub. The roles created in the Community Hub are the following:

- **Visitor**, referring to the view that the Community Hub is offering to unregistered users.

- **Registered Member (Customer)** is the role that reflects the needs of the demand-side stakeholders of the Community Hub. It allows registered users to view and select public AI Toolkit services and at the same time allows the communication with the demand-side stakeholders.

- **Manager** is the role that encapsulates the additional functionalities that allow a user to add, edit and delete additional Hub services in ALAMEDA Innovation Hub.

- **Moderator** is a role that is controlled by ALAMEDA consortium members and allows the creation, editing or deletion of content that can be seen by visitors, customers and managers, as publications, blogs and news. The moderator also facilitates the management of all Hub services created by Managers.

• **Administrator** is also a role managed by the ALAMEDA consortium and is focusing on the control of the users of the Community Hub and its configuration.

2.2.4 Benefits for External Stakeholders

The AIH has the potential to become a meeting place for developers, AI health specialists, PMSS medical experts, health policy experts, relevant service providers, and broader health services developers and integrators, as well as OEMs, SMEs, researchers and other related stakeholders. The participatory ecosystem that is supported by AIH is specifically focused on the promotion of AI methods and tools to benefit PMSS patients and improve their quality of life. AIH is conceptualised as a ground-breaking advantage that would lead to generate a critical mass of stakeholders that will form a multidisciplinary community on a topic that is novel and insufficiently addressed. In addition, this ecosystem will enable stakeholders to benefit from the specific services of ALAMEDA, collect valuable feedback and assessment review results, enable the active engagement of external stakeholders and ultimately augment the initial offerings through further contributions and collaborations at a later stage. For instance, AIH will provide developers with an official place to gather resources and engage with other developers to ask questions and discuss current source code developments, as well as investigate on further context- or organisation-specific developments of the software. At the same time, researchers will take advantage of the increasingly obvious benefit brought in by Open Data: these data can be leveraged, shared and combined with other data sets. This creates novel opportunities for scientific collaboration and partnership.

2.2.5 Benefits for ALAMEDA Partners

AIH will constitute a focal point of gathering results, innovations, services, and an extensive knowledge base of articles, training material, consulting/support material and AI methods on PMSS applications. Additional exploitation of the ALAMEDA services will be made available by external supply-side stakeholders or by related projects and ecosystems, for example those supported by AI Health research communities in the EU, such as those presented in sections 2.3.3 and 2.3.4. These collaboration opportunities could develop into cross-platform and cross-vertical interactions when the AIH will be mature and established. Through stakeholder interaction and even evaluation of offered services by external stakeholders, the process should enable partners to constantly improve Alameda AIH tools and services features. Moreover, the establishment of an ecosystem around the project's results will enable ALAMEDA to pursue a number of exploitation options as part of WP8 activities that would allow the consortium to sustain the project results.

2.3 ALAMEDA Innovation Hub functionalities

2.3.1 Interaction Points between ALAMEDA WPs

The main interactions foreseen with ALAMEDA are the following:

- user requirements and specification delivered in WP2 are considered for the proposed AIH architecture and software design
- parts or all of the code developed in WP5 will be made available, along with feedback from end-users, potentially even as remote services via a dedicated API

- a dataset or various versions of selections of anonymized data from the pilots will be provided via the AIH repository component. The ALAMEDA ontology will be also available via the repository.
- In WP6 know-how, experience, insights and simple comments from all project participants will be collected to be included in the AIH
- WP8 will use AIH to launch stakeholder engagement campaigns and adapt the respective methodology (T7.2) appropriately.

2.3.2 Identification of ALAMEDA Innovation Hub Functionalities (*Table of functionalities and their implementation priority)*

ALAMEDA Innovation Hub will need to be able to offer as much as possible from the entire project achievements, experience, and innovation to the research and innovation community, but also to the business community. To this end, the AIH will be based on community-building tools.

Users from the ALAMEDA community will have access to a library full of tools, code, data, documentation, and references. Everything will be downloadable, along with manuals and examples for training.

A live support of this community is also envisioned, but a lot of factors make it necessary to delay relevant decisions until much later. In order to offer "live" support and even allow access to our infrastructure via APIs, partners will need to be able to commit certain resources, such as personnel and computational power, which normally is difficult to secure for most research projects after they finish. In the case of ALAMEDA a separate agreement is foreseen after the end of the project, in order to enable the AIH to exist as a stand-alone entity and also cluster with the Digital Innovation Hub of ICCS to further support and promote the AIH services and content, adhering to all individual IPR of AIH contributors.

2.3.3 Links with existing EC platforms and with the ICCS Digital Innovation Hub

ALAMEDA is clustering with the ICCS Digital Innovation Hub, in order to find the best ways to present the results of the project and exploit them in all possible ways. ICCS DIH will ensure tools and data will be made available to the new backbone being developed in the EU by initiatives like the European Federation of Data Driven Innovation Hubs (EUH4D) and the Big Data Value Association (BDVA), which is now known as Data, AI and Robotics (DAIRO).

2.3.4 Clustering with related EC Projects on Healthcare

Currently ALAMEDA is exploring the potential synergies and opportunities of collaboration that might arise with some of the projects funded under the same H2020 topic, as well as others focusing on related research challenges and/or the same neurological disorders.

A preliminary list of those projects is provided in the Dissemination Plan (D8.2). Furthermore, a dedicated section of the Stakeholder Engagement Plan (D7.1) is detailing commonalities and potential shared interests. Overall, as illustrated in D7.1, the ALAMEDA team is planning to setup and promote a novel Community of Interest, called AI4Brain, the AIH being one of the core assets for its sustainability over time beyond the funding period.

3. ALAMEDA Innovation Hub Architecture

In this section, we present the architecture of ALAMEDA Innovation Hub. The vision of AIH is to implement a Community Hub for PMSS AI applications and for brain diseases in general, based on the identified WP2 specifications. AIH is exploiting features of Multi-Sided Platforms in order to link research interest with the sustained research activities and will be a single point of entry for ALAMEDA's external stakeholders to grant access to the demonstration and provisioning of public ALAMEDA AI Toolkit services, data and source code.

3.1 Methodology for the formulation of the conceptual architecture

The formulation of the AIH conceptual architecture is initiated with the identification of key capabilities of the AIH. These are the key benefits that are the foundation and backbone of the design process that follows. These key capabilities are not exhaustive, but are essential in guiding the technical decision making towards the appropriate implementation tools and software design decisions.

The AIH design concept is then organized in a structured and hierarchical view of the AIH components, the logical view of the architecture. This approach is following the basic assumptions of ALAMEDA design as they are presented in D2.1 and provide a link with the rest of the ALAMEDA systems. The specific software packages conceived to implement AIH is another facet of the conceptual architecture that we present below. The AIH conceptual viewpoints are summarized with the design of the sequence diagrams for essential AIH processes and most importantly for the incorporation of the AI services that may be made available via an appropriate API gateway.

3.2 Key AIH Capabilities for the validation of the architecture

The AIH needs to support capabilities that offer all user groups the basic anticipated features. These capabilities will be filtered differently and automatically adapt to the different end-user groups, depending on their specific requirements. AIH capabilities constitute the essential features that will be considered across all sections of AIH during the development phase that will follow.

ID	AIH Capability	Description
AC1	AIH Registration	Allow users to register on the AIH with multiple roles
AC2	Usage of AI Services	Demand-side stakeholders can view the available AI Toolkit services and learn how to use them
AC3	Register AI Services	Supply-side stakeholders can register and edit AI Toolkit services that demand-side stakeholders can use
AC4	User Management	Administrator is able to accept, edit or delete a user
AC5	Content Management	Moderator is able to edit content that is presented to visitors. Datasets and accompanying metadata (e.g ontology files) are already accommodated via these capabilities and are stored in the AIH repository.
AC6	Registered users Interact with Service providers	A demand-side stakeholder should be able to communicate with the supply-side stakeholder offering a service, via appropriate messaging mechanisms

AC7	Users communicate and discuss	Users of the Hub use the forum to communicate
AC8	Customers select and rate AI Toolkit services and provide feedback	A demand-side stakeholder should be able to rate an AI Toolkit service and provide feedback.

Table 1 - Key AIH Capabilities

3.3 Logical view

3.3.1 ALAMEDA Overview

Deliverable D2.1 provided the logical view of the ALAMEDA system. In this design the use case requirements have been translated into modules of the ALAMEDA solution and their initial technical specifications. This solution is the basis for the development within WP5 and will include the results of WP3 and WP4 activities, leading to the system's logical and physical architecture definition. In this context the AIH (red dashed outline) is depicted as an individual module of the solution that is integrated with the rest via the appropriate integration interfacing (API/Orchestrator). The AIH, however, is going to be deployed at the end of the project, hence the connection shown will not exist in runtime. There is a logical connection, since data and code will be given to the AIH, but there will be no real-time interaction between AIH and the pilot system. Potentially useful APIs have been considered and some even depicted in this document to be discussed at a later stage, based on partner interest, resources, and commitment.
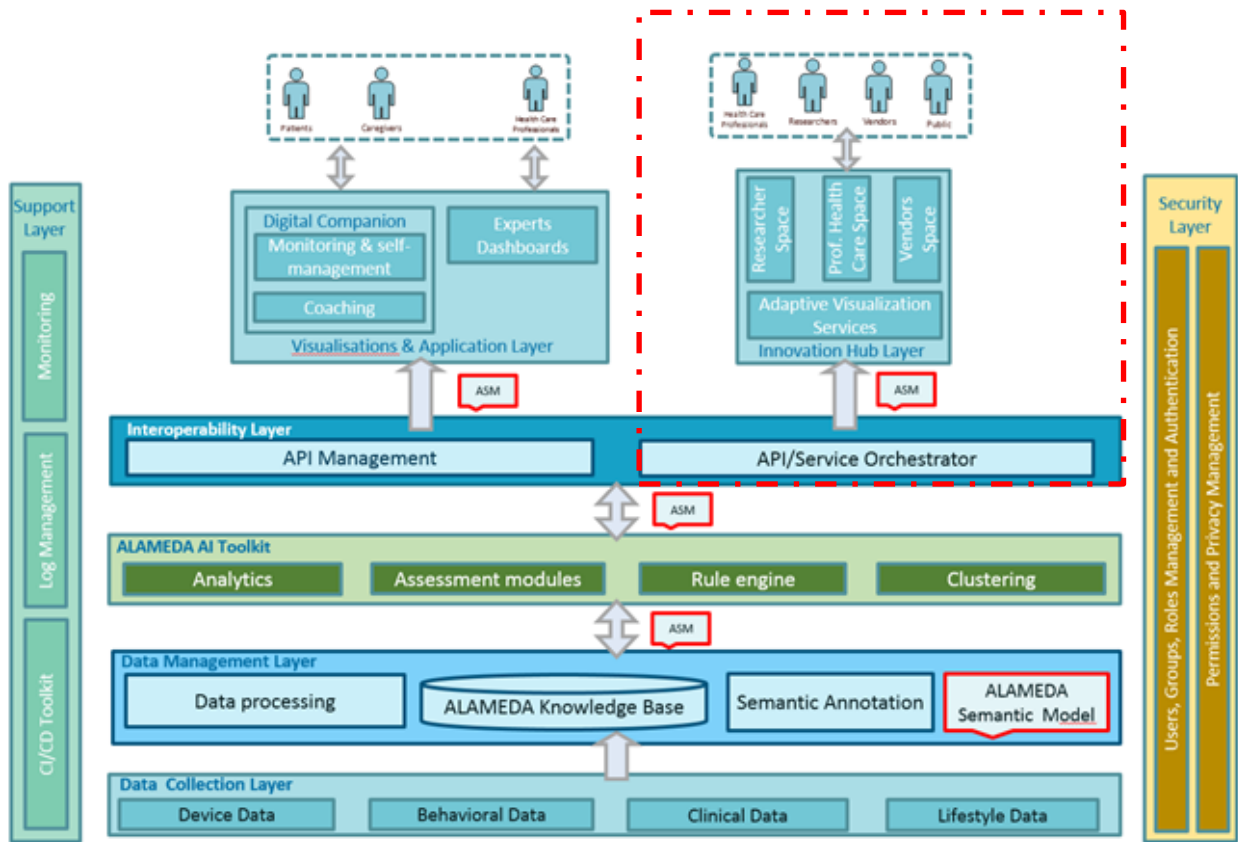
Figure 2: High-Level Logical View of the AIH and the integration with the ALAMEDA Ecosystem (from D2.1)

3.3.2 AIH Conceptual Architecture

Based on the analysis of the user needs and technical specifications of WP2 the conceptual software architecture of the AIH is presented below.
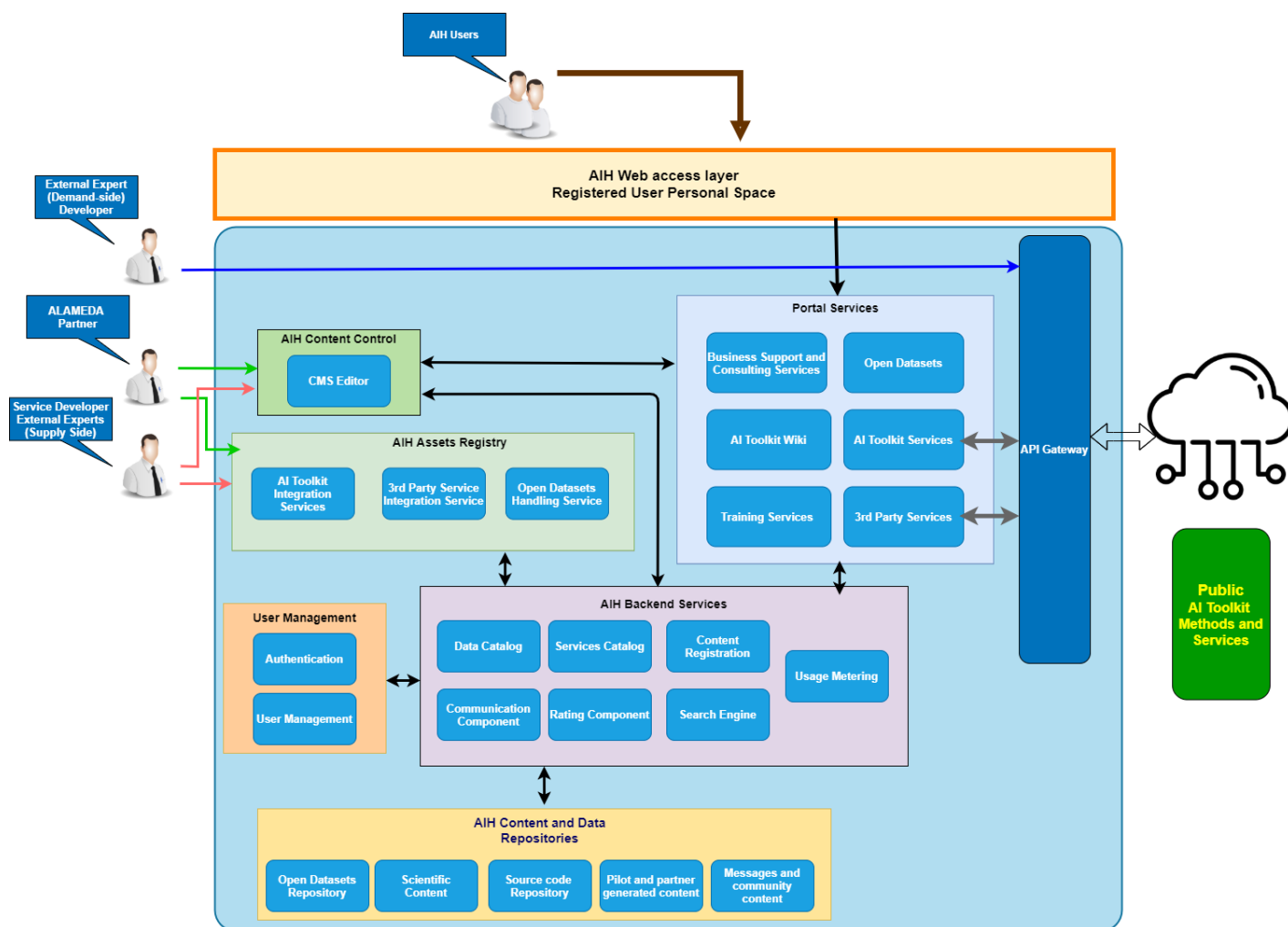
Figure 3: Conceptual Architecture of the ALAMEDA Innovation Hub (AIH)

3.4 Development View

A high-level development view of the AIH architecture is depicted in the following component diagram of Figure 4 and also in Figure 5 that complements the component diagram with the database entities. The component diagram presents the components needed for creating the AIH. For this presentation we have clustered together modules that have similar functionalities, such as the AIH Assets Registry Controllers and the more generic AIH Backend Services that includes Data Catalogue, Search, Rating, Subscription, Usage Statistics and Direct Messaging Services.

The diagram also explains certain dependencies by identifying modules that use other modules. This way we present how the User Interface of the AIH depends on the Web Controllers and User Management modules, and how these modules use the available modules that form the backend of the Community Hub.
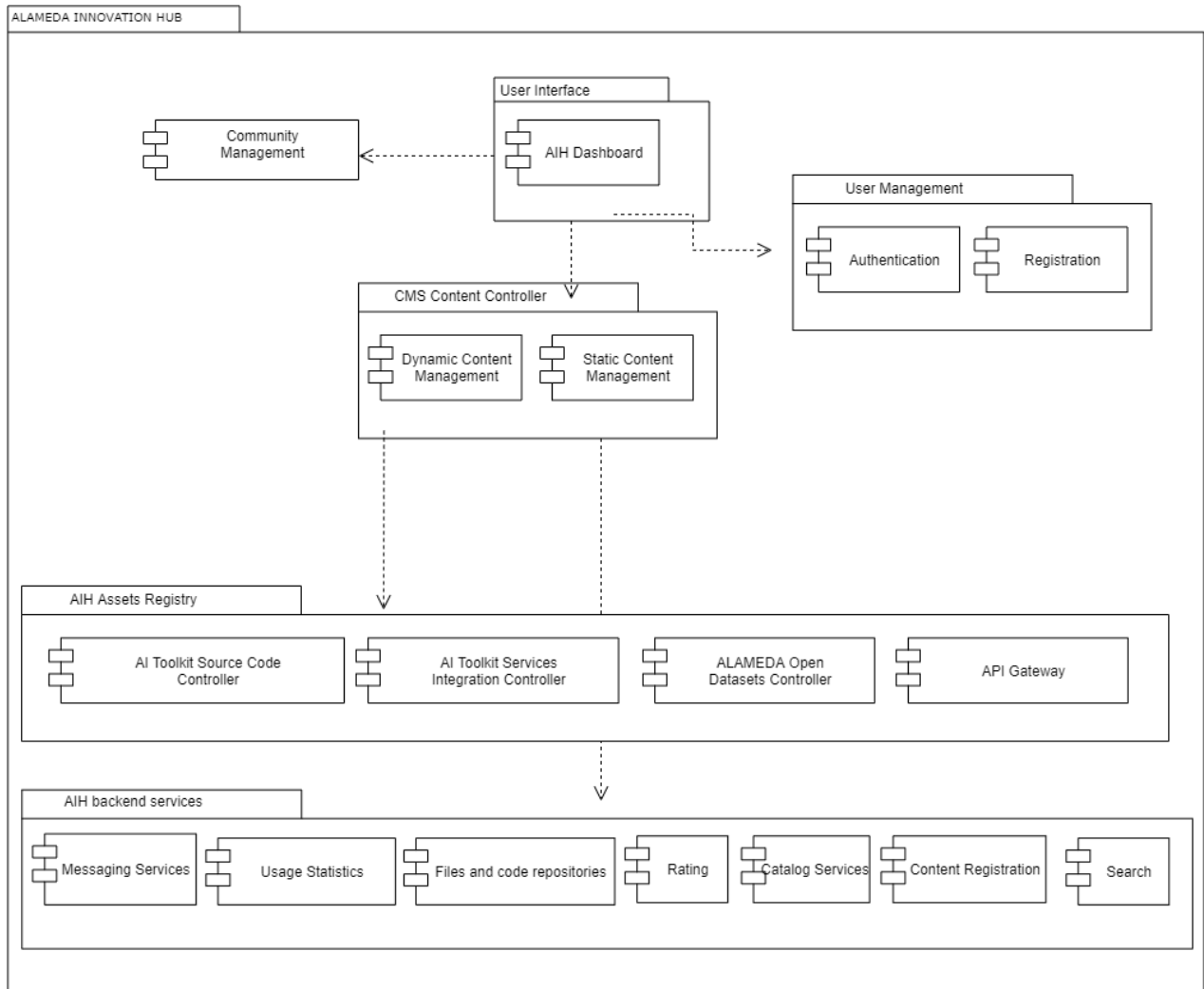
Figure 4: High-Level Development View of ALAMEDA Innovation Hub– Package Diagram

The components that are part of *Assets Registry*, *Community Management, Backend Services* and *User Management* packages rely on a storage space that includes a relational database for the persistent storage of the data of the AIH and also additional databases (including No-SQL document DBs), forming Storage Modalities of interrelated entities. The Storage Modalities of the AIH Repository are depicted in Figure 5 below.
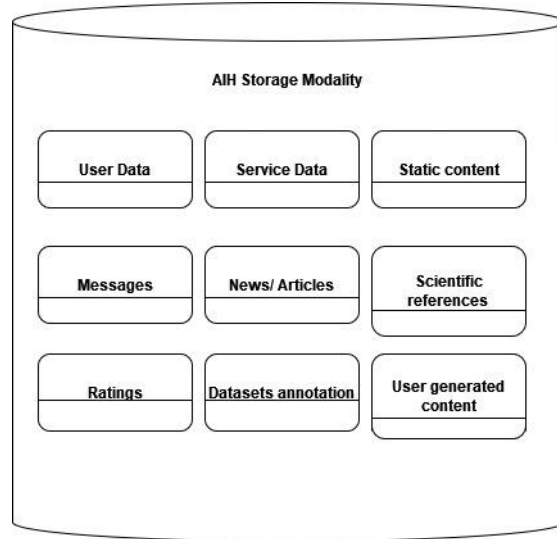
Figure 5: High-Level Development View of ALAMEDA Innovation Hub Storage Modalities

3.5 Process View

The sequence diagrams of Figures 6 and 7 depict two essential facets of the AIH functionality, i.e. the user management and registration, and the ALAMEDA Toolkit service registration, presentation and rating. These processes are implemented through the system components that make the AIH architecture and are presented in the development view of the architecture (section 3.4).

3.5.1 Stakeholder registration

More specifically, Figure 6 presents the registration of a new stakeholder, that can be a registered user whose is either a contributor (service vendor) or a consumer of ALAMEDA (e.g. researcher).
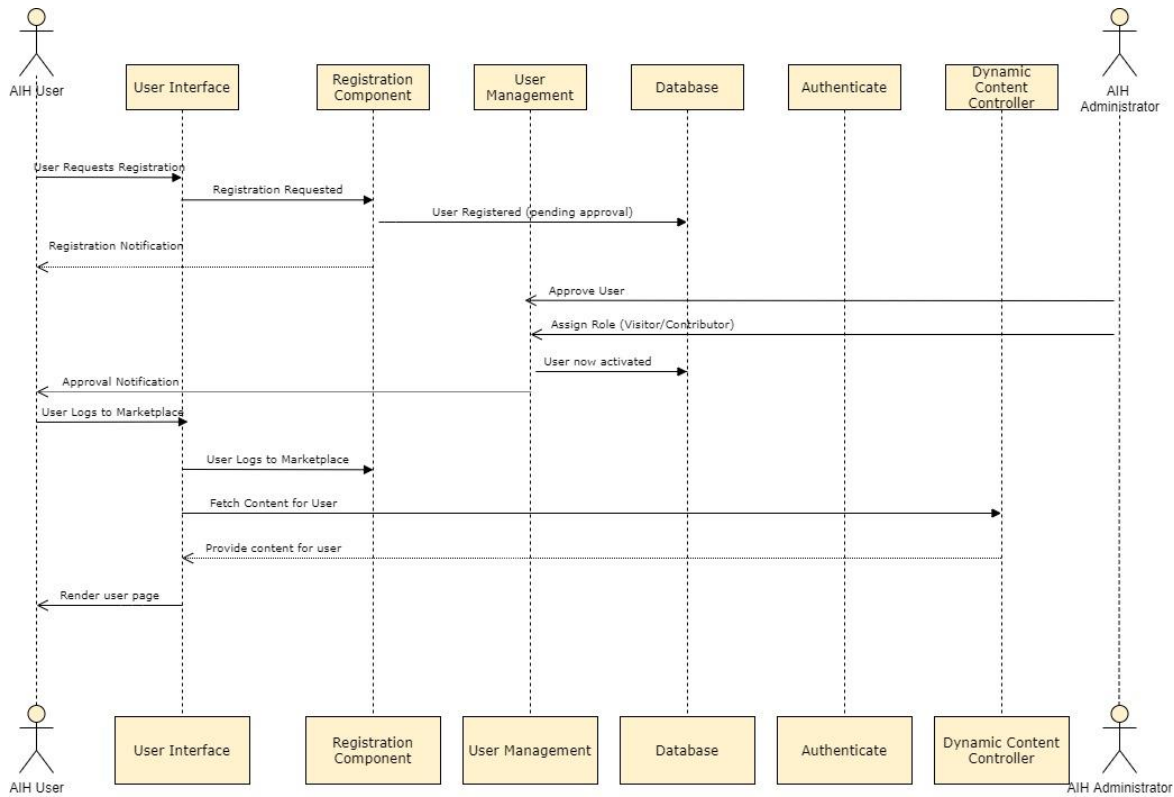
Figure 6: Stakeholder registration process

3.5.2 Static service registration

During the static service registration, as depicted in Figure 7, the Manager or Service Developer initiates the registration of a new service by completing the new service registration form after accessing the AIH Personal Space. The request is handled by the AIH Services Integration Controller and consequently the AIH Backend Services. Once the new service is successfully registered, the AIH Registered User can access the new service, provide feedback and subscribe to this service.
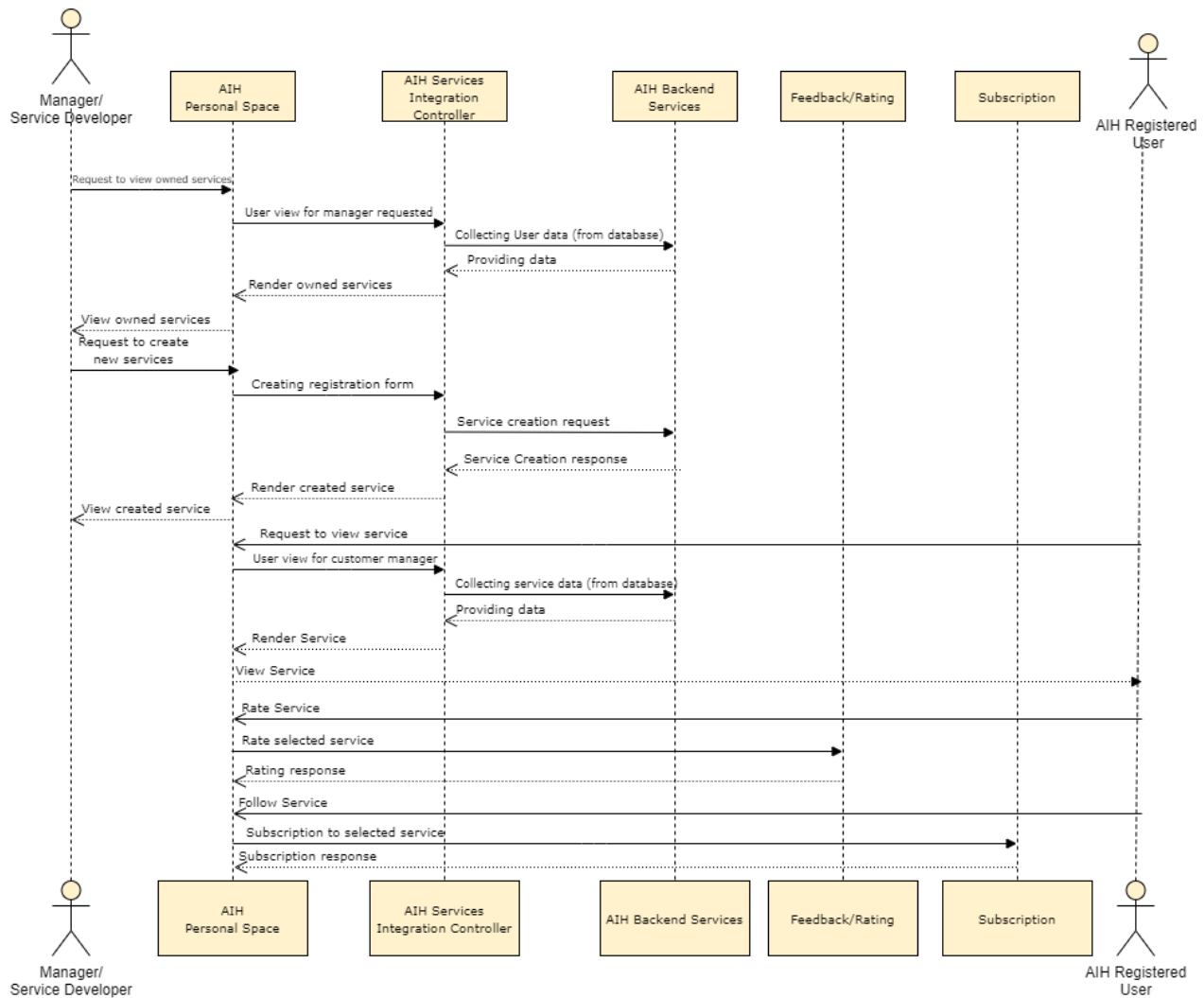
Figure 7: Static service registration process

3.5.3   Automatic service registration

During the automatic service registration the Manager or Service Developer instructs the new service to self-register in the Service Registry, so that it can be directly accessible via the API Gateway, if the project has decided to support one. The API Gateway is being polled in small intervals by the AIH Services Integration Controller, in order for the latter to retrieve the list of newly created and/or updated services and consequently update the AIH Backend Services. Once the new service is successfully registered, the AIH Registered User can access the new service, provide feedback and subscribe to this service.

3.6 Physical view and deployment topology

The last view is the physical view that depicts the topology of AIH and reference with the ALAMEDA Development and Deployment infrastructure. Currently, AIH has considered an application hosted in a single server, as this is sufficient for the project needs. However, the proposed architecture can be

expanded in multiple servers, for example with the usage of a separate server for persistent storage and database hosting, or with the separation of the user interface, the controllers and the backend services.

The following Figure 8 depicts the deployment diagram which clarifies aspects of the physical configuration of AIH and the related AI Toolkit services.
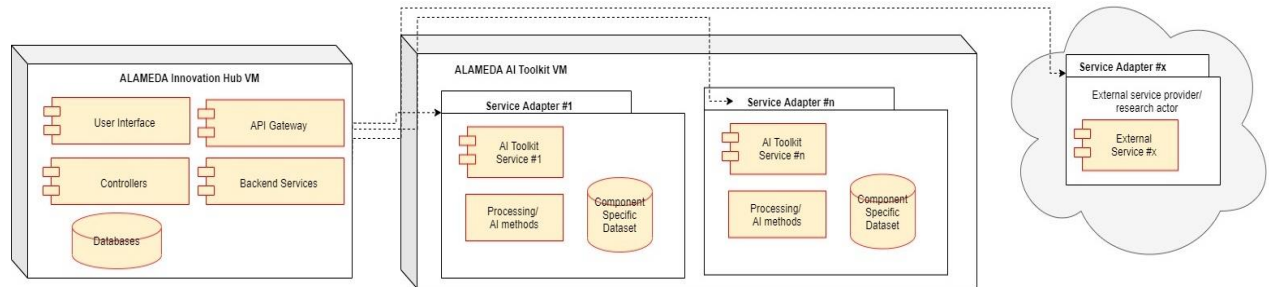

Figure 8: Indicative Topology of the AIH and the public AI Toolkit services

4. Implementation planning

4.1 Milestones and implementation status monitoring

Milestone	Release	Period
MS1 - Core functionalities	**Release 1:** Will include the main components of the AIH (Content Management, User Management, Presentation Layer)	M10 – M15
MS2 – Collaboration features	**Release 2:** Collaboration features, static content, search and indexing	M16 -M19
MS3 – Dynamic content	**Release 3:** Additional collaboration features, wiki entries by participants, Open Datasets and accompanying Datasets	M20 – M24
MS4 – Services Integration	**Release 4:** Additional Datasets, AI Toolkit Integration demonstrations, user feedback and ratings, virtualization of components and handling of multiple dockers to access the service gateway, ability to upload user generated datasets.	M25 – M34

Table 2 - Milestones and implementation status monitoring

4.2   Planning of ALAMEDA Innovation Hub Implementation

In this section we provide the planning of the implementation of the Functionalities presented in Table 1. The following table illustrates the key functionalities and their estimated delivery month, in compliance with the AIH development Milestones presented in section 4.2.

AIH development components and features	Milesto ne	Comments

AIH Presentation Layer	MS1	An initial version of the basic GUIs will be developed following a rapid prototyping development model
AIH Registration	MS1	
User Management	MS1	
Content Management	MS2	Initial content bootstrapping including partner generated videos on the provided AI services
Search and discovery of service offerings	MS2	Standard functionality
Catalogue of services and datasets	MS2	Standard functionality
Catalogues update	MS3	Participating stakeholders will be able to register new services and datasets into the existing catalogues.
Collaboration space layout	MS3	Initial version that will follow a rapid prototyping process
Users communicate and discuss	MS3	Validation of the collaboration features
Register AI Services	MS4	Based on the methods and infrastructure that WP5 will specify
Usage of AI Services	MS4	Depending on the form of the AI toolkit service: integrated demo, interactive demo service, open-source code where available. AIH will host anonymized open sample datasets to be used by researchers and possibly for the demonstration of selected ALAMEDA AI Toolkit results. Service implementations in the form of virtualized containers (e.g. Dockers) will be available and containers will be handled via Docker Compose files in order to invoke AI Toolkit services remotely via the AIH API Gateway.
Registered users Interact with Service providers	MS4	To support the deployment of ALAMEDA results in external servers, in the case that further exploitation opportunities are generated. Registered users will be able to upload their own data to the AIH storage, which can in turn be further used by (some of) the services offered by the AI Toolkit, provided that the users cater for the compliance of the uploaded data with the corresponding data schemas. However, full data sets from the pilot demonstrations will be not be available by the AIH as these are hosted at the pilot sites' repositories.

Additional content and training videos	MS4	Additional training and video resources on the ALAMEDA AI toolkit components
Registered stakeholders select and rate AI Toolkit services and provide feedback	MS4	Community development efforts to after the development of key AIH features

Table 3 - Hub Functionalities Implementation Plan

5. Privacy and Security provisions

Privacy and security implications are specifically the focus of T7.5. This task starts on M18 and will provide external stakeholders and consortium members with the tools and measures that will need to be adopted to ensure that data is collected and processed in ALAMEDA following high standards of security and privacy protection, as prefigured in the Data Management Plan (deliverable D1.2). In particular, a point of reference will be the liaison of ALAMEDA with project H2020-IMI IDEA-FAST via partner PLU who is participating in both projects and will be leading T7.5.

Security policies specifically applicable to AIH will be defined during T7.5 activities.

6. Conclusions

In this deliverable, we presented how the ALAMEDA Innovation Hub will be built in order to offer a single point of entry for ALAMEDA services, documentation, support, etc. The motive for the creation of this collaboration space is to allow easier usage of the ALAMEDA results by stakeholders, to initiate and support the creation of a community of service users and interested collaborators and eventually to develop increased sustainability opportunities for ALAMEDA.

For this purpose, in this document, we presented identification of stakeholders, as well as the key features and functionalities supported by AIH, and proceeded with the software design of the overall architecture and component packages. We conclude with a rigid planning of the AIH releases. The development plan foresees that implementation work is started immediately after the delivery of this report and will continue until the end of the project in manageable increments that follow the overall timeline of the ALAMEDA development.

7. References

[1] ALAMEDA Deliverable D2.1 - Design and Specifications of ALAMEDA Requirements and Use Cases

[2] ALAMEDA Deliverable D8.2 - Dissemination Plan and Material

[3] ALAMEDA Deliverable D7.1 - Design of Stakeholder Engagement Plan

[4] Daiberl, C.F., Oks, S.J., Roth, A. et al. Design principles for establishing a multi-sided open innovation platform: lessons learned from an action research study in the medical technology industry. Electron Markets 29, 711–728 (2019). https://doi.org/10.1007/s12525-018-0325-2