

Decentralized Chat

NOTE

This version of the template contains some help and explanations. It is used for familiarization with arc42 and the understanding of the concepts. For documentation of your own system you use better the *plain* version.

1. Introduction and Goals

The development will consist of a WebApp whose objective is to be a decentralized chat, using SOLID technologies. This chat will allow users to exchange messages in different formats (audio, text, video), as well as other functions such as: share screen or video call; It will also allow you to save friends lists, show notifications, among other functions. It will be a web application developed at Angular, and an RDF library will be used to communicate and obtain information on the different PODs

1.1. Requirements Overview

The application will mainly comply with the following:

- The system will be based on a decentralized architecture where data storage is separated from the app
- Users can store their chat data in their own pods
- The app will allow a user to share pictures, videos or other kinds of files with other friends through the chat
- A user can get notifications when some friend wants to chat with him
- Users can have groups of friends with whom they may want to chat
- It will be possible to have group chats where all members receive the messages
- Users can have live calls and videos
- Users can share their screens in the chat

1.2. Quality Goals

The main Stakeholders of this application are Inrupt and users, I will list the most important quality goals for them:

- Usability : Ease of use by non-technical people.
- Responsiveness : The application must send messages in real time.
- Privacy: The application must keep the data private (this is what solid is based on, each one owns their data).
- Security: The application must be secure, users must know who they are talking to and who has access to the chat.

1.3. Stakeholders

Stakeholders of the system:

- Developers
- Professor
- Users
- Inrupt

Role/Name	Contact	Expectations
Developer	Laura Sanchez	Have to work with the architecture or with code, documentation of the architecture, have to come up with decisions about the system or its development
Developer	Enrique Fernandez	Have to work with the architecture or with code, documentation of the architecture, have to come up with decisions about the system or its development
Developer	Jose Luis Bugallo	Have to work with the architecture or with code, documentation of the architecture, have to come up with decisions about the system or its development
Developer	Victor Manuel Chaves	Have to work with the architecture or with code, documentation of the architecture, have to come up with decisions about the system or its development
Developer	Carlos Gomez	Have to work with the architecture or with code, documentation of the architecture, have to come up with decisions about the system or its development
Developer	Daniel Fernandez	Have to work with the architecture or with code, documentation of the architecture, have to come up with decisions about the system or its development https://forum.solidproject.org/u/danielferromeral/activity
Professor	Jose Emilio Labra	Evaluate and guide the project
Users		Users can chat, they can have live calls and videos and they can share their screens in the chat
Inrupt	Inrupt	They has been proposed as a challenge

2. Architecture Constraints

2.1. Technical Constraints

Code	Restricction	Motive
TC001	Online independence: no central control of data	Linked-data are completely decentralized and fully under users' control rather than controlled by other entities.
TC002	Frameworks: Angular	We haven ´t worked with this framework before, so we will have to learn how to use it.
TC003	SOLID technology	app based on the solid specifications.
TC004	Data Storage	Users can store their chat data in their own pods.
TC005	Share files	The app will allow a user to share pictures, videos or other kinds of files with other friends through the chat.
TC006	Notifications	A user can get notifications when some friend wants to chat with him.
TC007	Groups	Users can have groups of friends with whom they may want to chat.
TC008	Program language: JavaScrip or TypeScript	We have chosen this language, but we don't have enough knowledge about this languages.

2.2. Organizational Constraints

Code	Restricction	Motive
OC001	About Version Control: Git, Tool: Github	Keep a version of the project after making changes
OC002	6 person group	We didn't know each other
OC003	Time schedule	We don't have a lot of time for developing the app. Furthermore, we are developing other projects at the same time.
OC004	Documentation	Arc42 model .
CC005	Open source	The project, including source code and documentation.
CC005	Beta version	Limited time to develop the project maximum in May 2019.

2.3. Conventions Constraints

Code	Restricction	Motive
CC001	Language	English. The project and the corresponding blog targets an international audience, so English should be used throughout the whole project.
CC002	6 person group	We didn't know each other
CC003	Time schedule	We don't have a lot of time for developing the app. Furthermore, we are developing other projects at the same time.
CC004	Non-technical	Every user should manage the app.
CC005	Security	Data must not be in touch by external devices
CC006	Privacy	Only own users can manage their own data.
CC007	Intuitive	Aesthetics and friendliness of the application.
CC008	Usability	Usability of technical documentation.
CC009	Originality	Originality of the solution
CC010	Documentation	We use AsciiDoc

3. System Scope and Context

The project that we are going to develop aims to communicate two people through different mechanisms:

- **Text messages.**
- **Images.**
- **Videos.**
- **Video calls.**

However, the approach that the application will take it's around permits. A user can not send a file of any kind or speak with a person if they do not have explicit permission from the recipient.

But the most important point of the chat is not the permissions, but the decentralization. We want only users to have access to the content of those conversations, so that they are the owners of their personal information.

To achieve this goal we will use SOLID. SOLID is a project that consists of a decentralized website. It deals with establishing a connection between several users, separating data application. To establish this connection, we will use what is known as POD. A POD is a unique profile of each user, which allows to store information on the web about it.

We will use these PODs to connect both users, but the data they exchange will be stored in the interlocutors' devices. In this way, we will create a private chat that will have the advantage of being isolated, reliable and safe.

3.1. Business Context

- Communication elements:
 - **Users:** Users are the main recipient of the application.
 - **Web:** Users will connect to the web through their PODs to establish secure communication.
- Communication process:
 - The partners create a POD.
 - The user adds as friend through the PODs to the second interlocutor.
 - The interlocutors log in with their POD in the chat.
 - Ready!

What data are exchanged with the environment? Through the website, users will enter some small data on the SOLID website to obtain their POD. Once established the connection between both interlocutors, they will be the only owners and holders of the information they exchange.

Communication Partner	Input	Output
User	Chat, video, images, POD information	Chat, video, images, POD information
Web		POD, Server Connection

3.2. Technical Context

As we have said before, we will use the so-called PODs provided by SOLID to connect to the server of the same, and through it, communicate with other people.

For the design of the connection we will use different mechanisms:

- **RDF:** This library allows us to establish the connection. Act as a communicator and thanks to it we can obtain the POD information necessary to establish communication.
- **Authenticator:** This tool receives the POD of a user and allows us to know if it is a valid POD.
- **Angular:** It is a JavaScript framework that will allow us to handle the language in a more comfortable way.

[03 System Scope and Context] | *images/03_System_Scope_and_Context.JPG*

4. Solution Strategy

4.1. Technology and IDE

The team had to choose between new technologies for us and technologies already known but that did not have as much support to SOLID. Based on what we knew, our first option was to choose Java as programming language, but after reading the SOLID documentation, we decided to choose TypeScript, which is a JavaScript-based language, and, more specifically, the Angular Framework.

About the IDE, we choose WebStorm due to its power and the fact that, as students, we have a free payment license. In addition, some of the members of the group have used it in previous subjects. Although, another powerful tool like Visual Studio Code have been really helpful when developing our project.

4.2. Architectural pattern

The development of our architecture is based on a service system. The main class relies on these services to perform the different operations that it needs throughout the execution of the application.

[04 solution strategy] | *images/04_solution_strategy.JPG*

4.3. Methodology of work

We will use Scrum to develop this project. Scrum can provide us an early software development, and more independence when programming. Our project will start implementing the basic functions of a chat and it will grow in complexity ([https://en.wikipedia.org/wiki/Scrum_\(software_development\)](https://en.wikipedia.org/wiki/Scrum_(software_development))).

5. Building Block View

Content

The building block view shows the static decomposition of the system into building blocks (modules, components, subsystems, classes, interfaces, packages, libraries, frameworks, layers, partitions, tiers, functions, macros, operations, data structures, ...) as well as their dependencies (relationships, associations, ...)

This view is mandatory for every architecture documentation. In analogy to a house this is the *floor plan*.

Motivation

Maintain an overview of your source code by making its structure understandable through abstraction.

This allows you to communicate with your stakeholder on an abstract level without disclosing implementation details.

Form

The building block view is a hierarchical collection of black boxes and white boxes (see figure below) and their descriptions.



Level 1 is the white box description of the overall system together with black box descriptions of all contained building blocks.

Level 2 zooms into some building blocks of level 1. Thus it contains the white box description of selected building blocks of level 1, together with black box descriptions of their internal building blocks.

Level 3 zooms into selected building blocks of level 2, and so on.

5.1. Whitebox Overall System

Here you describe the decomposition of the overall system using the following white box template. It contains

- an overview diagram
- a motivation for the decomposition
- black box descriptions of the contained building blocks. For these we offer you alternatives:
 - use *one* table for a short and pragmatic overview of all contained building blocks and their interfaces
 - use a list of black box descriptions of the building blocks according to the black box template (see below). Depending on your choice of tool this list could be sub-chapters (in text files), sub-pages (in a Wiki) or nested elements (in a modeling tool).
- (optional:) important interfaces, that are not explained in the black box templates of a building block, but are very important for understanding the white box. Since there are so many ways to specify interfaces why do not provide a specific template for them. In the worst case you have to specify and describe syntax, semantics, protocols, error handling, restrictions, versions, qualities, necessary compatibilities and many things more. In the best case you will get away with examples or simple signatures.

<Overview Diagram>

Motivation

<text explanation>

Contained Building Blocks

<Description of contained building block (black boxes)>

Important Interfaces

<Description of important interfaces>

Insert your explanations of black boxes from level 1:

If you use tabular form you will only describe your black boxes with name and responsibility according to the following schema:

Name	Responsibility
<i><black box 1></i>	<i><Text></i>
<i><black box 2></i>	<i><Text></i>

If you use a list of black box descriptions then you fill in a separate black box template for every important building block . Its headline is the name of the black box.

5.1.1. <Name black box 1>

Here you describe <black box 1> according the the following black box template:

- Purpose/Responsibility
- Interface(s), when they are not extracted as separate paragraphs. This interfaces may include qualities and performance characteristics.
- (Optional) Quality-/Performance characteristics of the black box, e.g.availability, run time behavior,
- (Optional) directory/file location
- (Optional) Fulfilled requirements (if you need traceability to requirements).
- (Optional) Open issues/problems/risks

<Purpose/Responsibility>

<Interface(s)>

<(Optional) Quality/Performance Characteristics>

<(Optional) Directory/File Location>

<(Optional) Fulfilled Requirements>

<(optional) Open Issues/Problems/Risks>

5.1.2. <Name black box 2>

<black box template>

5.1.3. <Name black box n>

<black box template>

5.1.4. <Name interface 1>

...

5.1.5. <Name interface m>

5.2. Level 2

Here you can specify the inner structure of (some) building blocks from level 1 as white boxes.

You have to decide which building blocks of your system are important enough to justify such a detailed description. Please prefer relevance over completeness. Specify important, surprising, risky, complex or volatile building blocks. Leave out normal, simple, boring or standardized parts of your system

5.2.1. White Box <building block 1>

...describes the internal structure of *building block 1*.

<white box template>

5.2.2. White Box <building block 2>

<white box template>

...

5.2.3. White Box <building block m>

<white box template>

5.3. Level 3

Here you can specify the inner structure of (some) building blocks from level 2 as white boxes.

When you need more detailed levels of your architecture please copy this part of arc42 for additional levels.

5.3.1. White Box <_building block x.1_>

Specifies the internal structure of *building block x.1*.

<white box template>

5.3.2. White Box <_building block x.2_>

<white box template>

5.3.3. White Box <_building block y.1_>

<*white box template*>

6. Runtime View

The architecture of the application is very simple:

Once you launch the application, you'll see a login view. That login view will redirect you to the official solid login page.

[06 runtime view login] | *images/06_runtime_view_login.JPG*

In the solid login page, you'll introduce your solid credentials. If your data is correct, you'll login into your profile and see your solid profile page.

In the navigation bar of the application, you will see 4 labels:

- Profile: The same page. In there you can edit your profile information
- Chat: The chat page. We'll introduce about it later.
- Documentation: A documentation page.
- A logout icon: It will redirect to the application login.

The chat page

[06 runtime view chat] | *images/06_runtime_view_chat.JPG*

As you can see, the chat page is divided in three layers:

- Friends layer: In this layer you can search between your friends (for those you should add in solid), and start a conversation.
- Conversation layer: Here it will show the different conversations. Your own messages will appear in white colour, and your friends' will be black.
- Message layer: There you can send a message to your friend. Once you write you can press the button or simply the Enter key to send it. This message will appear as yours in the conversation layer and will be sent to your partner.

Lets see a couple runtimes scenarios

Scenario 1 Actor 1 wants to send a message to one of his friends, after login in successfully, his runtime would be like this:

[06 runtime view scenario1] | *images/06_runtime_view_scenario1.JPG*

Scenario 2 Actor 1 wants to send a message to Actor 2, Actor 2 sends a message to Actor 3 and Actor 3 sends a message to Actor 1:

[06 runtime view scenario2] | *images/06_runtime_view_scenario2.JPG*

¿What hardware do you need to use the application?

Fortunately, to use the application you just need one computer connected to Internet. You can also use a mobile phone to chat with your friends, but we haven't developed the app specifically to be used on it, so there will be some problems. We are working hard to try to make it more comfortable for mobile users.

At this point of the development, there is no need for geographical permissions or others like that, so the only thing you need is a computer and an Internet connection.

Although, this is an early version of the project, and it hasn't been optimized yet, so you'll need some available RAM in your computer, but not too much for worrying about it.

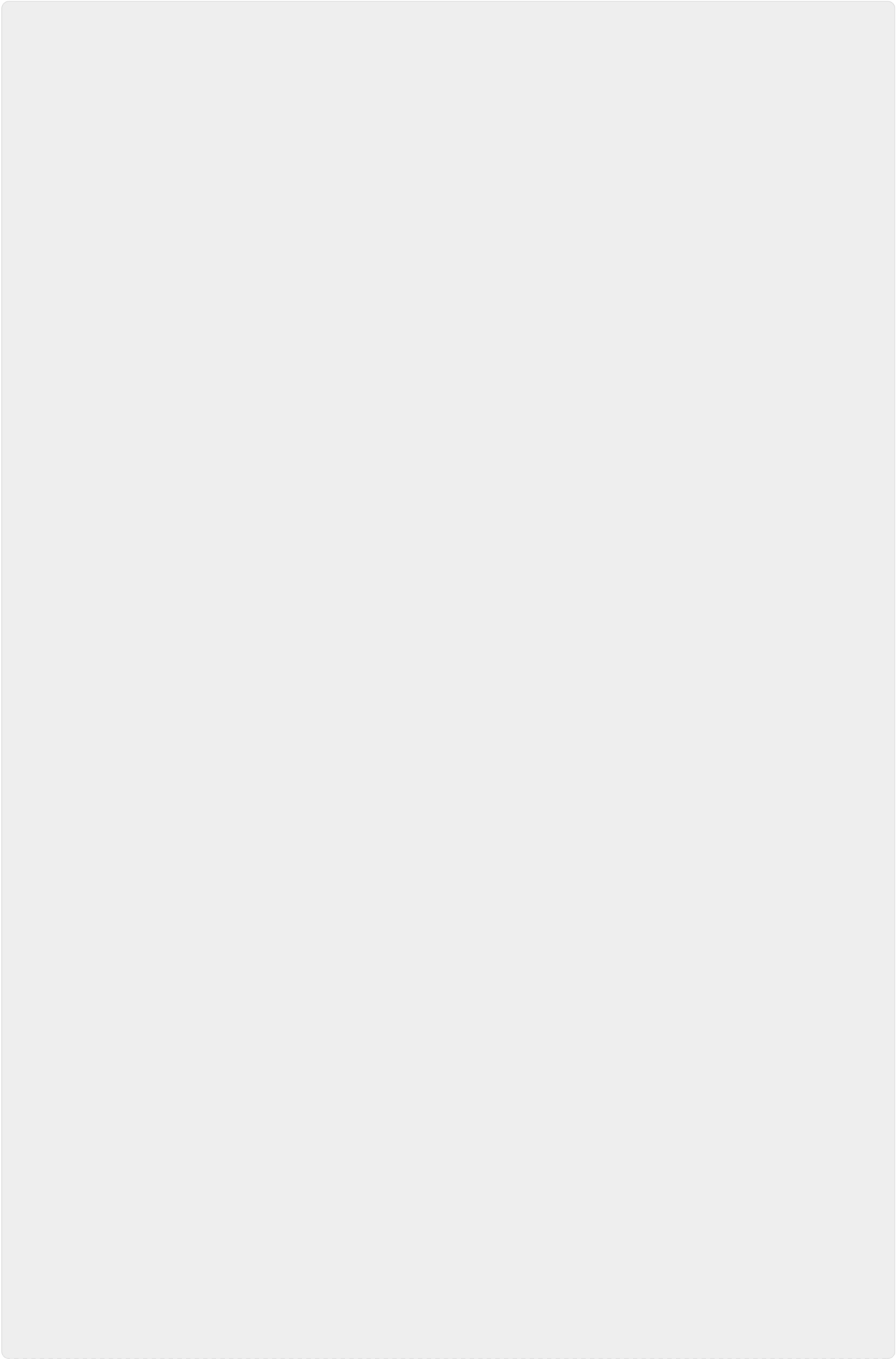
We developed this app mostly in Google Chrome and Firefox, so we recommend this browser.

Mapping of relationship between hardware and software

The relationship between software and hardware is very simple, there are three main components that need special attention:

- Computer.
- Browser: As we said before, we recommend Google Chrome and Firefox. Browser connects to the application.
- Application: It connects to server.
- Server: Automatically synchronizes with solid server.

It is important to notice that talking about resources **the application consumes the same resources as another app**, because it is launched in a browser.



== Cross-cutting Concepts

=== Important modules As we saw before, the architecture of the application is based on services, like printers, creators and another useful ones.

[04 solution strategy] | *images/04_solution_strategy.JPG*

It is important to remember that for the application we are using npm, working (obviously) in Node.js, which is a package administrator that allows you to easily manage your resources.

- Testing * To test our application, we are using karma testing, with the Jasmine framework.

Jasmine is an easy OpenSource framework that allows you to test JavaScript functionality developed in Angular. More information here:

[https://en.wikipedia.org/wiki/Jasmine_\(JavaScript_testing_framework\)](https://en.wikipedia.org/wiki/Jasmine_(JavaScript_testing_framework))

=== Directory Structure and Required Files This is the directory structure of the source folder:

```
|-----app
|   |-----card
|   |-----chat
|   |-----dashboard
|   |-----fragments
|   |   |-----footer
|   |   |-----header
|   |   |-----navbar
|   |-----friends
|   |-----login
|   |-----login-popup
|   |-----models
|   |-----register
|   |-----services
|   |   |-----creators
|   |   |-----printers
|   |   |-----query
|   |   |-----sorters
|   |   |-----utils
|-----assets
|   |-----images
|   |-----js
|   |   |-----libs
|   |-----types
|   |   |-----rdflib
|-----coverage
|   |-----Chrome 73.0.3683 (Windows 10 0.0.0)
|-----environments
```

== Design Decisions

- First decision is that we are using Git as version control system instead of using mercurial, vsn, etc. and GitHub as source code management instead of using Bitbucket, this decision was imposed by the teachers of the subject.
- We are using javascript family language(javascript, typescript, node.js, angular, etc) to build the application as the main programming language. As we understand, javascript is the easiest way to make a SOLID application.
- We are also using basic languages for the web such as html, css, etc.
- Social linked data(SOLID) based application. A must decision we have to follow if we want to make a decentralized application. This means following several important constraints to build the application. One of them is storing data in PODS, so the user is the owner of their data.
- Using a Service architecture that helps us to easily separate responsibilities. This services are used from the main app to obtain extra-functionality.
- Following Angular components structure, so we can build a high cohesion and low coupling app.
- Use Karma testing, with Jasmine framework, a tool that allow us to easily test code on Angular.
- Turtle language (.ttl) to create the messages.
- Sparql queries, to access to Turtle files and get resources faster than using plain text.
- Notificaitons service, that allows us to send a notification to a user when he receives a message.

== Quality Requirements

Content

This section contains all quality requirements as quality tree with scenarios. The most important ones have already been described in section 1.2. (quality goals)

Here you can also capture quality requirements with lesser priority, which will not create high risks when they are not fully achieved.

Motivation

Since quality requirements will have a lot of influence on architectural decisions you should know for every stakeholder what is really important to them, concrete and measurable.

=== Quality Tree

Content

The quality tree (as defined in ATAM – Architecture Tradeoff Analysis Method) with quality/evaluation scenarios as leafs.

Motivation

The tree structure with priorities provides an overview for a sometimes large number of quality requirements.

Form

The quality tree is a high-level overview of the quality goals and requirements:

- tree-like refinement of the term "quality". Use "quality" or "usefulness" as a root
- a mind map with quality categories as main branches

In any case the tree should include links to the scenarios of the following section.

=== Quality Scenarios

Contents

Concretization of (sometimes vague or implicit) quality requirements using (quality) scenarios.

These scenarios describe what should happen when a stimulus arrives at the system.

For architects, two kinds of scenarios are important:

- Usage scenarios (also called application scenarios or use case scenarios) describe the system's runtime reaction to a certain stimulus. This also includes scenarios that describe the system's efficiency or performance. Example: The system reacts to a user's request within one second.
- Change scenarios describe a modification of the system or of its immediate environment. Example: Additional functionality is implemented or requirements for a quality attribute

change.

Motivation

Scenarios make quality requirements concrete and allow to more easily measure or decide whether they are fulfilled.

Especially when you want to assess your architecture using methods like ATAM you need to describe your quality goals (from section 1.2) more precisely down to a level of scenarios that can be discussed and evaluated.

Form

Tabular or free form text.

Contents

A list of identified technical risks or technical debts, ordered by priority

Motivation

“Risk management is project management for grown-ups” (Tim Lister, Atlantic Systems Guild.)

This should be your motto for systematic detection and evaluation of risks and technical debts in the architecture, which will be needed by management stakeholders (e.g. project managers, product owners) as part of the overall risk analysis and measurement planning.

Form

List of risks and/or technical debts, probably including suggested measures to minimize, mitigate or avoid risks or reduce technical debts.

Risks	Solutions
Lack of knowledge and use of angularjs	<ul style="list-style-type: none"> • Consult forums • Look at the documentation • take courses
Lack of knowledge of solid	<ul style="list-style-type: none"> • Look at the solid forums • Ask other classmates
Abandonment / lack of work of a member	<ul style="list-style-type: none"> • Know the status of the entire project • Hold periodic meetings
Lack of time to complete the project	<ul style="list-style-type: none"> • Do it stepwise and continue
Misunderstood the requirements of the application	<ul style="list-style-type: none"> • Consult with the professor about the requirements
Problems with git	<ul style="list-style-type: none"> • Use a specific methodology to do merges and commits

== Glossary

Definition of most important terms every stakeholder should know to understand the documentation.

Order by rarity.

Only in english at the moment.

Term	Definition
Decentralized	User is the owner of their data and not the application
Git	Version control system
Inrupt	SOLID enterprise
MVC	Model-View-Controller, software architecture
PODS	Personal Online Data Stores, used to save data
RDF	Resource Description Framework, standard model for data interchange in the web
Scrum	Agile methodology for working in group
SOLID	Social Linked Data
Stakeholders	People interested in a project
Angular	A framework for working in typescript
Turtle	Is a syntax for expressing data in RDF

About arc42

arc42, the Template for documentation of software and system architecture.

By Dr. Gernot Starke, Dr. Peter Hruschka and contributors.

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