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<tr>
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## Definitions and abbreviations

<table>
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<th>Platform</th>
<th>The Online S3 platform that contains applications and online services, which will assist national and regional authorities in the EU in elaborating or revising their smart specialisation agenda, in terms of policies and strategy.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application/Tool</td>
<td>Tools and applications are programs and services that can be used in assisting</td>
</tr>
<tr>
<td>CMS</td>
<td>Content Management System</td>
</tr>
<tr>
<td>DB</td>
<td>Database</td>
</tr>
<tr>
<td>UI</td>
<td>User Interface</td>
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</table>
1. Introduction

The main goal of the Online S3 platform is to describe the process of developing smart specialisation strategies and provide tools to support each phase of the process. In particular, a key objective for the platform is to lower the barrier to developing smart specialisation strategies by making the whole process smoother and more understandable.

The purpose of this document is to provide a clear overview of the Online S3 platform from the technological point of view, covering the most important architectural design decisions and the platform’s technological architecture. This design document is intended to serve as a centralised design reference towards a diverse set of stakeholders, and as such the architecture of the platform is discussed at various abstraction levels.

The architecture of the platform is first described using a context view, with a purpose of communicating how the platform interacts with external systems, users and stakeholders on a higher abstraction level. Next, the platform is described to a higher level of detail from the functional viewpoint, using a functional view and an element catalogue. Furthermore, the integration plan is explained and the different types of tools will be explicated and discussed. Finally, the document is summarised with conclusions on the covered topics.

2. Architectural Design Decisions

In this section, we will present and discuss the key architectural design decisions. First, we will discuss higher level design decisions, gradually shifting focus towards more specific and detailed, lower level design decisions. Furthermore, we will present potential challenges and drawbacks associated with the design decisions made.

When designing the platform, we had several goals to accomplish from the technical point of view. Firstly, the technical implementation should be as simple as possible. The platform should be based on common technologies that are easy to apply and maintain. At the same time, the simple implementation should assist with another important goal, transferability. The project is planned and budgeted to last only two years, after which some organisation would preferably take over in operating the platform. The attempt to reach these two major goals, simplicity in platform implementation and transferability of tools and the platform, can be seen in the decisions made in this document.

2.1 Technological decisions
Essentially, the platform is built on top of the WordPress content management system (CMS). WordPress is a well-known and broadly used content management system that has a wide, active development community. Furthermore, WordPress provides the important core features needed for construction of the platform and content management and additionally, it allows extending the CMS functionality through customisation and plugins created by third-party developers. Another benefit of the WordPress’s CMS is its simplicity; even by people with low technical skills are able to use it effectively. The platform’s site structure and layout are managed using an external plugin, Divi\(^1\), that provides a graphical user interface for creating the layout and styling, allowing the content creators to focus more on content creation.

While WordPress is built on top of PHP and uses a MySQL database to store the content of the platform, the platform tools can be built independently from the platform, allowing the developers to choose technologies for tools on a case-specific basis. Furthermore, the tools should be designed for transferability, and as such they should be decoupled from the platform, making no assumptions about the platform.

In section 4.2, we will discuss the platform tools in more detail.

### 2.2 Open-source and licensing

To maximise the long-term use and development of the platform and the tools, we intend to release them openly on GitHub\(^2\), a version control repository, under open-source licenses that limit third-party entities and contributors as little as possible. The goal is to allow anyone to freely access, use and make modifications to our software. In addition, by opting for open-source licenses, we also abide by the EU Commission’s principle of openness and avoid possible legal problems when transferring the platform. At the same time, effort towards reinventing existing functionality, services

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1. [https://www.elegantthemes.com/gallery/divi/](https://www.elegantthemes.com/gallery/divi/)
2. [https://github.com/](https://github.com/)
or tools should be minimised and instead, the goal is to reuse suitable - preferably open-source - software wherever possible. However, the possible use of any external software should be carefully assessed beforehand to avoid any problems with openness.

In terms of the licenses, we have ended up selecting two preferred licenses:

1. GPLv3 for the platform
2. MIT license for the tools

These licenses will be published on GitHub alongside the source code and the licenses and copyright notices of possible dependencies. The owner mentioned in our licenses will be the ONLINE-S3 Consortium by default.

GPLv3\(^3\) is a free copyleft license that ensures the freedom to share and change any version of a program. It allows anyone to copy, distribute and modify the software as long as they track changes in the source files. In addition, any modifications to the software or any software including GPL-licensed code must also be made available under the GPL along with build and install instructions. This is also the reason we ended up selecting GPLv3 as the platform’s license; WordPress, the basis of the platform, is licensed under GPLv2. The license of the WordPress requires us to license the platform under GPL and to publish any modifications that we make. GPLv3 is the newest version of GPL and compatible with GPLv2 and many other licenses (see Figure 1). Due to this compatibility and

\[\textit{Figure 1 - The compatibility of GPLv3 with other licenses.}\]

\[^3\] https://www.gnu.org/licenses/gpl-3.0.en.html
newness, we ended up selecting it over GPLv2 and other possible licenses.

As the tools will be quite separate from the platform and not based on WordPress, they can be published on another license and we have chosen to use the MIT license for them. It is a short, permissive license that allows anyone to do whatever they want with the software as long as they include the original copyright and license notice in any copy of the software. We selected this license to be used for the tools as it maximises the amount of freedom in their use and distribution. Also, it does not include the hassle of republishing changes, making transferring of the tools as easy as possible.

Despite having preferred licenses, there may be some cases in which the use of some other license is necessary. For example, if a developer decides to use a technology in a tool that has some other licence than MIT, that license (e.g. GPL) may also be required to be used in the tool itself. In such cases, the implications of the license should be carefully considered and possible obstacles to openness should be avoided.

2.3 Personal data collection and analytics

As the platform will ultimately have plenty of users, there will eventually be a need to collect user related information. However, we will seek to allay possible privacy concerns by only collecting the minimal amount of data required for our purposes. At the same time, we will abide by the national and EU laws related to privacy and personal data collection. Overall, personal information will be collected in two forms:

1. Submission of personal information for registration
2. Tracking of user behaviour for analytics

The purpose of registration is to provide the user with possible extra services, for example, save the progress done in tools. To minimise the amount of personal data, only the user’s email address and password will be collected by the platform. This should minimise possible privacy concerns while still allowing users to register on the platform.

The purpose of analytics is, in turn, to help us improve the site over time by giving us valuable information on how the platform is used. In addition, the collected data could also be used for academic purposes. The main tool applied for tracking will most likely be Google Analytics as it is free for basic use and allows great tracking options. As a user navigates between web pages, Google Analytics JavaScript tags record information on the user’s behaviour. This provides us with analytics information on many interesting topics, such as which tools interest and attract the users the most.

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4 https://opensource.org/licenses/MIT
5 https://analytics.google.com/
Furthermore, it will tell how users find and end up on the platform, how they navigate on the platform and which pages they spend the most time on. Even though Google Analytics does track individual users, it does not provide us data on any individual user, allaying any possible privacy concerns. Yet, the Google Analytics JavaScript libraries use HTTP Cookies to record user activity, which are in turn subject to EU legislation; we have to place a cookie consent banner on the website to allow users to accept and reject cookies.

3. Context View

The Online S3 platform is the system that is created by the project team in WP3 and described in detail in this design document. The platform is an e-policy website that links to tools and services and provides guidance on RIS3 with the intention of assisting European regions in the formulation and revision of their smart specialisation agenda, in terms of policies and strategy. Figure 2 represents the context view of the Online S3 platform. It visualises the scope and location of the platform in relation to other systems. Additionally, it identifies the users of the platform and their relationship with it.

The Online S3 platform will eventually have many different types of users. Yet, these can be divided into two main types, to which the platform is targeted:

1. User - Policymakers, consultants, academics or anyone who is interested in RIS3 and seek to apply the tools and guidance on the platform to elaborate and revise their smart specialisation agenda.
2. Administration user - System administrators who are responsible for maintaining the site, managing its content and users, and assisting users with their problems.

Even though the platform offers tools for the users, it does not in most cases contain them itself. Instead, the tools are usually provided on subdomains and other external sites to which there are links on the platform. In general, there are two types of tools:

1. Online S3 tool - A RIS3-specific tool developed by the project team.
   a. An interactive tool that is hosted on a subdomain of the platform.
   b. Documents and other assisting material that is directly available on the platform.
2. External tool - A generic tool that is developed by an external organisation (not part of the project team) and hosted on their own site.

Overall, there is a clear boundary that separates the platform from the tools and other external sites and sets the scope for the development of the platform. This separation of the platform and tools, in turn, enables their independent development and increases the transferability of the tools, two major goals of the design.
Figure 2 - The context view of the Online S3 platform.
4. Platform architecture

4.1 Functional View

In this section, we will discuss the main responsibilities of these components, the component interfaces and interaction between components. The functional view, presented in Figure 3, describes the platform’s architecture on a more detailed level and considers the different components that compose the platform. The components and their respective key responsibilities are presented in the element catalogue, table 2.

As already discussed briefly, the open-source based WordPress CMS, backed up by a wide developer community, is the core of the platform. The WordPress backend component contains the main business logic of the platform, providing models for generic components used in building a website, such as pages or blog posts. The administration panel component represents the user interface available for content creators and platform administrators, whereas the Platform UI represents the user interface for the end users of the platform. Essentially, the Administration panel provides tools for the content creators to construct and populate the platform UI with content.

Finally, while the tools are highly relevant to what the platform has to offer, they are external to the platform and should have little impact on the actual architectural design: the platform should not make assumptions about tools, and instead avoid dependencies. Tools are linked to the platform using superficial methods, such as URL links or iframes, and essentially, the platform administrators should be able to manage them via the Administration Panel.
Figure 3 - The functional view diagram that describes the platform architecture on a component level.

Table 2 - The element catalogue, presenting the components and their respective responsibilities.

<table>
<thead>
<tr>
<th>Layer</th>
<th>Component</th>
<th>Responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frontend</td>
<td>Administration Panel</td>
<td>• User interface for platform administrators and content producers.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Provided by WordPress</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Allows altering the page content structure, creating, modifying or removing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>content and adjusting site styles or themes.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Allows administrators to manage plugins, backup the site content and perform</td>
</tr>
<tr>
<td></td>
<td></td>
<td>other general platform management activities.</td>
</tr>
<tr>
<td></td>
<td>Platform UI</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Platform Tool Frontend</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Platform Tool Backend</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tool Database</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-------------------------</td>
<td>-------------------------------------------------------------------------------------</td>
<td></td>
</tr>
</tbody>
</table>
| **Platform UI**         | ● Platform user interface for end users  
                          ● Provided by WordPress  
                          ● Allows accessing site content and tools available on the platform |
| **Platform Tool UI**    | ● Tool user interface for end users  
                          ● Independent from the platform                                                  |
| **Backend**             |                                                                                     |
| WordPress Backend       | ● The underlying WordPress site engine that provides the core platform functionality  
                          ● Provides data models for content, such as pages, blogs and users           |
| Platform Tool Backend   | ● The backend service for a particular tool  
                          ● Responsibility depends on specific tool                                      |
| **Data Storage**        |                                                                                     |
| CMS Database            | ● Stores platform related data, such as site content  
                          ● Stores users  
                          ● Stores case-specific data related to a particular tool                     |

### 4.2 Platform tools

The smart specialisation strategy formulation, implementation and revisioning process involves six different phases, and for each phase, there are multiple tools that support the process. However, many of the required tools are essentially widely used and known tools or frameworks, for example, used in strategic management. As such, many dedicated tools fit for our purposes exist, and thus these tools should be reused where possible to minimise effort towards redundant development of new tools. Consequently, it should be possible to embed and serve tools from external sources on the platform. Furthermore, from the tools’ point of view, the platform essentially functions as a portal that directs users to the tools.

Since all tools are independent of the platform, the tools are primarily connected to the platform using URL-links. In some cases, it may be reasonable to embed a tool using an Iframe element, which can also be done through the WordPress CMS. The platform itself may include general guidance to the end users, and justification on why the tool is part of the Online S3 platform, aligning the purpose.
of the tool with the Smart Specialisation Strategy process. Further information and documentation for usage is a responsibility of a particular tool, and as such should be included with the tool. This promotes the ideology that neither the platform nor the embedded tool makes assumptions about the other.

The main benefits and drawbacks of having decoupled and independent tools are described in Table 3. The most significant benefit can be identified in the implications to distributed development of the platform and tools. Essentially, the development of the platform can be isolated from the tools, and further, individual tools can be developed in perfect isolation from each other. Furthermore, development teams may choose technologies for each tool based on their personal preference and judgment. This allows individual developers to leverage their competence in technologies that they are particularly experienced in.

Table 3 - Benefits and drawbacks of decoupled, independent and autonomous tools.

<table>
<thead>
<tr>
<th>Benefits</th>
<th>Drawbacks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technological heterogeneity between tools</td>
<td>Limits data collection and analytics opportunities</td>
</tr>
<tr>
<td>Allows reuse of existing tools</td>
<td></td>
</tr>
<tr>
<td>Simplifies distribution of work and responsibilities in a distributed development team</td>
<td>No centralised user account management across tools</td>
</tr>
<tr>
<td>Simplifies platform maintenance</td>
<td></td>
</tr>
<tr>
<td>Clear responsibilities</td>
<td></td>
</tr>
<tr>
<td>Transferability of tools</td>
<td></td>
</tr>
</tbody>
</table>

5. Conclusion

In this document, we presented the main design decisions, the context of the platform and the architectural design. Furthermore, we discussed topics with implications for these design decisions and discussed the implications of the design decisions regarding the platform tools.

Essentially, the design decisions have been aligned with the high-level strategic goals of the Online S3 project. The platform has been designed with a primary emphasis on distributed development work, breadth of the toolset and transferability. The ability to develop and contribute to parts of the
platform in isolation is a significant benefit, since the development work is not only distributed to different teams, but also geographically distributed. As such, integrating different modules of the platform together is easier, and the independent development teams are less concerned with the development work carried out by other teams, improving overall productivity. Finally, the technologies selected for the platform ensure that content creation and administration can be carried out by non-technical users.