Deliverable

D4.1 Frontend mockups

Project Acronym:	DUET	
Project title:	Digital Urban European Twins	
Grant Agreement No.	870697	
Website:	www.digitalurbantwins.eu	
Version:	1.0	
Date:	24 September 2020	
Responsible Partner:	VCS	
Contributing Partners:	AIV, IMEC, ATC	
Reviewers:	Gert Vervaet (AIV) Dimitra Tsakanika (DAEM) Zdeněk Malík (PLZ)	
Dissemination Level:	Public	X
	Confidential – only consortium members and European Commission	

This project has received financial support from the European Union's Horizon 2020 Programme under grant agreement no. 870697

Revision History

Revision	Date	Author	Organization	Description
0.1	17.07.2020	Thomas Adolphi	VCS	Initial structure
0.2	18.08.2020	Thomas Adolphi	VCS	reworked structure
0.3	21.08.2020	Thomas Adolphi	VCS	added content
0.4	24.08.2020	Thomas Adolphi	VCS	added more content, clarification of statements
0.5	25.08.2020	Thomas Adolphi	VCS	added block for dealing with the mockup and comments for this
0.6	26.08.2020	Dimitra Tsakanika	DAEM	Review
0.7	28.08.2020	Michiel Van Peteghem	VMM	Review
0.8	31.08.2020	Thomas Adolphi	VCS	Applied changes from reviews
0.9	18.09.2020	Thomas Adolphi	VCS	adjusted Text, images, wireframes acc. to new and updated wireframes / user feedback
1.0	24.09.2020	Thomas Adolphi, Jurgen Silence	VCS AIV	Final version

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1. Executive summary

We have two angles of approach for this deliverable: a **descriptive part** of the relevant DUET UI components (frontend and designed backend architecture) and a **demo mockup/wireframe model**.

The descriptive part

This report describes the relevant components for the DUET UI based on 9 months project work and the designed backend architecture. In general, the UI concept must be divided into several parts:

- UI design for DUET project pages
  - relevant for project, use and showcase overview
  - data catalog
  - relevant for administrators, users, and data management
- UI design for DUET frontend, respectively visualization components either as:
  - dashboard
  - 2D or 3D web map application.

Besides the DUET backend UI and the visualization frontend there will be a Data catalog frontend following the specification of DCAT maybe as CKAN implementation or as described in document "DUET data catalog". A proposal of how it could look, integrated into the DUET environment is explained in this document and depicted inside the mockup.

Furthermore, to this point in time **user feedback** regarding the design/mockup is not available and not all architectural components are fully developed. These things will be gathered and expected after handing in this document. Thus, the hereby presented wireframe design principles and rules are just ideas based on expert knowledge of developers and companies in that field but without any kind of validation from end-users. Using the mockups and some initial implementations will solve that issue and the design principles and rules will be adjusted after user feedback is available, see the Design Steps chapter. In some sections, links to already existing hosted pages for the pilots are done. If a password and username is requested, please use the following to access the pages:

URL: https://duet.virtualcitymap.de/beta/#/
Username: duet
Password: flanders2020

The wireframe mockup demo

In parallel to this document a (demo mockup / wireframe model) is created to show the UI to users and give them some module insights regarding look & feel as well as handling.
The Wireframe Demo is created by using Adobe XD and thus hosted by an Adobe server. The URL to this site is as follows:
https://xd.adobe.com/view/c3ac9931-9bbe-4bd5-8bfc-6a3bd0396f3f-96ff/

The wireframe mockup is a so-called **low-fidelity mockup** [see here]. This means that the design is deliberately kept at a low level to enforce a common understanding of the intentions of the pages and their interactions. This is exactly the focus of this first design step - the clarification of pages, their intention and the interaction between pages and the role-play between Frontend and backend components.

To be able to figure out the mockup, please open the URL and you will see the webpage in a sketch design. You can identify the interaction points by clicking on a blank part of the page. By doing so, page interaction points will be highlighted in light blue. By clicking on those points the respective linked page will open, as it is planned for the prototype and final version. Of course, due to mockup reasons not every page is accessible from everywhere, but the main interactions between the components are reflected in this mockup.

Comments and Feedback to structure, components, elements is highly appreciated by using the *comment* field on the right-hand side of each page. If you want to pinpoint your comment to a specific element instead of for the whole page, please drag & drop the pin to the position/element you want to comment for and type your comment afterwards.

Design proposal

Thus, this document together with the wireframe mockup demo can be rather seen as a general **design proposal** for DUET components, to be followed by end-user adjustments. Following the rules in the *terminology section* the demo and the hereby presented pages are specifically created in a sketch design, since at this point in time it is more relevant to discuss and fix the interaction, structure and intention of components located in the several pages rather than having a colorful designed frontend. The demo however represents both a wireframe model and a mockup since it is clickable to showcase the page's interaction.

Important note

Covered by this report are only the applications provided and developed by the DUET consortium. The follow-up implementations will be based on the hereby defined design principles, wireframes and mockups. External visualization API can have different designs and thus a different look & feel and handling. However, this completely aligns with the general idea of DUET to be an open platform for all kinds of relevant and used software in the respective domains.

2. Used terminology

Wireframes

A wireframe is an early conceptual design of the website. It is primarily concerned with the arrangement and positioning of the individual elements of a website and not yet with the concrete visual design and functionality. Wireframes are often already used in the conception phase. They can be used to visualize the content structure of an individual page.

Since graphic elements such as colors, shapes, images or typography do not yet play any role there, the focus is on the content, its arrangement, and the interaction by the visitor. A common argument for wireframes is that if a user does not know where to go on a simple hand-drawn diagram of the website, it is irrelevant which colors or text is ultimately used. A button, link, or other means of interaction must be clearly visible to the user, even if they are not brightly colored and blinking.

Since wireframes are purely concerned with the content or its arrangement, the decisive aspects of content can be discussed before individual design decisions are made ("The red does not fit").

Especially for pages with a high degree of interaction such as the DUET landing page, catalog page or start pages wireframes are a helpful technique. They allow customers and web designers to concentrate on the content and functions:

- Which contents are put on the page?
- Where are they placed?
- Which functions (buttons etc.) should be available?

Free of visual influences, the structure of the individual pages and the interaction between pages can be developed. For this purpose, different layout variants can be created and tried out more quickly before detailed designs are created that (cannot) work at all.

First the contents are structured, and the design direction is determined and then the concrete technical and visual implementation is started.

Wireframes should therefore be derived directly from the content strategy of the website by showing the hierarchy of content on each page and showing how each page fits into the overall strategy.

Once wireframes have been created, the designer has a template from which to create the design. Likewise, the technical implementation can begin after acceptance of the wireframes. Together with a sitemap, the content structure of the website is clear. The page structure, individual templates and elements can thus be technically created. The optical adjustments via CSS are then "almost" only fine tuning.

Low fidelity wireframes

“There are a few ways to include low fidelity wireframes in the UX design process. Some designers will start by sketching out their web or mobile interface’s screens on paper – these sketches are often referred

to as paper wireframes. They are typically concept sketches, a set of drawings or storyboard, representing the skeleton of the interface.

The next level up is a low fidelity wireframe. Low fidelity wireframes include the most basic content and visuals and are usually static (not interactive). They are often used to help map out the shell of the interface, its screens and basic information architecture.

These wireframes are created using publishing software, such as the Microsoft Office suite, or a wireframing tool, such as Justinmind. Low-fidelity wireframes usually serve as a checkpoint for the product team and stakeholders at the beginning of the design process. They help teams visualize and test early concepts, requirements, and design assumptions at the beginning of a web design project.

Whilst some designers will move on to a digital wireframe after sketching, others prefer to kick off with one directly. And as sketching UI kits become more readily available, we may see more designers scrapping the paper wireframe phase."
[cited from https://www.justinmind.com/blog/low-fidelity-vs-high-fidelity-wireframing-is-paper-dead/]

High fidelity wireframes

"Medium to high fidelity wireframes or prototypes are more complete representations of the end product than low fidelity wireframes. Many are clickable and respond to the user's actions, mimicking authentic interface interaction.

Their aesthetics and content are more precise than lower down the fidelity spectrum, as designers concentrate on refining the graphics, spacing and layout.

High fidelity wireframes are often built in the advanced stages of the design process to communicate design decisions to the development team prior to coding the final product.

Additionally, they help validate complex interactions during user testing. These wireframes provide test participants with realistic representations of what the product will look and feel like, as well as how it will respond to them."
[cited from https://www.justinmind.com/blog/low-fidelity-vs-high-fidelity-wireframing-is-paper-dead/]

Mockups

Mockups are created based on a wireframe and are much more detailed. A mockup can be seen as a screenshot of the future website. It already shows the used typography and color scheme. The goal is to reflect as accurately as possible the later appearance of the website to be created.

This type of visualization is used to present an exact draft of the later page. Thanks to its detailed presentation, the user can get a good picture of the final product and decide whether the design is going in the right direction. Mockups are therefore indispensable when it comes to providing meaningful feedback from users.

3. Introduction

3.1. The DUET portal structure

DUET portal components

Figure 1 visualises the overall DUET portal structure and the synergy between the webpages and platform components. An early version of this scheme was presented in Deliverable 2.3., it grew in time based on new insights.

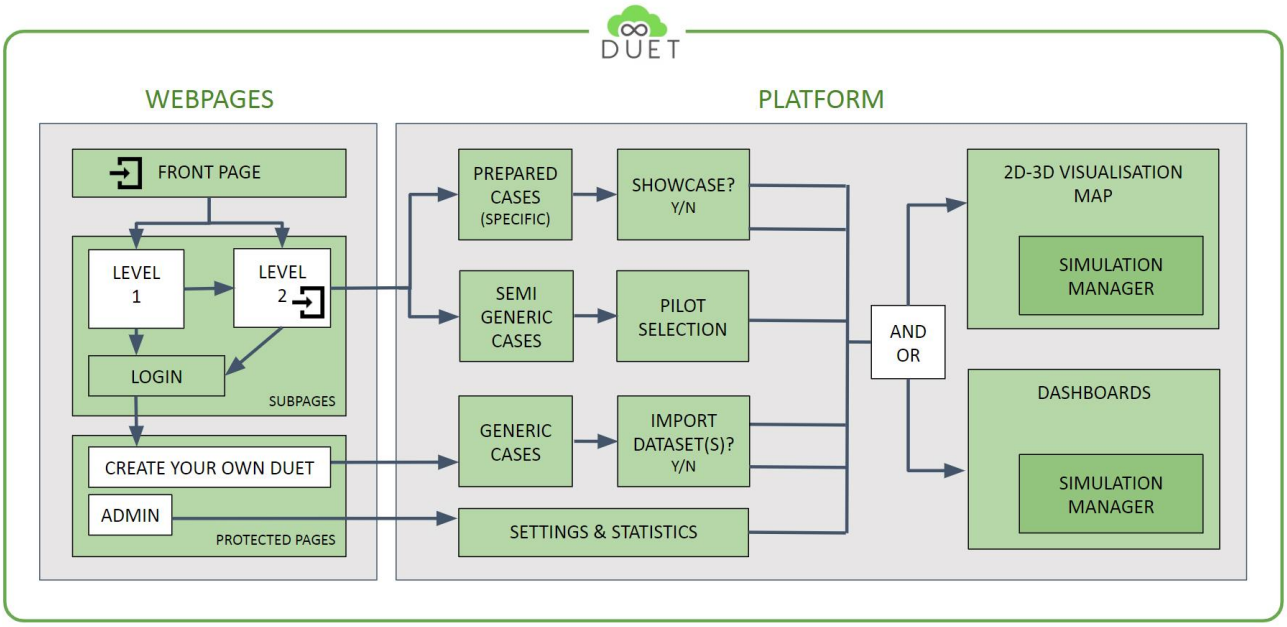


Figure 1: The DUET overall portal structure

Visitors/users generally enter the DUET portal via a front page (landing page), but they can also directly enter via deeper lying pages and the platform itself using direct hyperlinks and bookmarks.
Once inside the DUET portal, visitors are guided towards the platform by using the level 1 and 2 web page information. Skilled visitors/users can get access to password protected pages with extra functionalities and datasets.

The level 1 (data catalog) and level 2 (catalog details) DUET **data catalog web pages** are generally accessible although a limited amount of DUET datasets can be reserved to the skilled visitors/users via the protected pages.

Case-driven entry

Cases can be described as entries into the system, with a view specific for a certain analysis, discussion, policy action/decision, … Depending on the selected case, datasets are selected, settings are filled in, relevant models will be presented and dashboards will be created in the platform component of the DUET portal.

As for the DUET portal, we defined 3 case variants:

- **Prepared cases** where the initial settings are predefined/preset to get an optimal visualisation of a specific case and its accompanying analysis as a starting point. This category includes the showcases, which are exceptional cases fully worked out, being key examples for similar (future) studies.
- **Semi generic cases** offer more exploration freedom to the visitor/user. For these pilot-related and epic-based (see Deliverable 2.3) cases, the initial settings and selected datasets can be easily adapted according to the personal interest or angle of approach of the visitor/user.
- **Generic cases** are defined by the user himself/herself. It is the user who decides which of the available data layers, models or dashboard will be utilized. Supported by the information available on the password protected pages (the user needs to apply for a password first), datasets, models and dashboards can be freely used and additional datasets can be **uploaded** to create an own - tailor made - DUET with access to all available datasets and tools.

Trusted logged in partners get extra rights to directly update predefined settings of the prepared and semi-generic cases, based on new insights. They can also update the essential **storytelling aspect** supporting these specific cases.

Back-office

Limited **admin rights** will be granted to access the back-office where the overall settings of all components of the DUET platform can be managed and user statistics can be consulted.

Front end mockup basis

Given this background information, mockups were designed for each front end component/aspect as further described in chapter 4.

3.2. The DUET T-cell architecture

The technical group proposes the design of a central entity (referred to as the T-cell) that acts as a central data broker.

APIs are guarding the proper use of the broker in terms of data contracts, security, etc. Internally the broker has the following components:

1. An event broker for handling IoT, interaction, simulation, and other events
2. A data catalog for registering different kind of data sources
    a. IoT event sources
    b. City Geo data sources (federated)
    c. Time series data sources (federated)
3. A knowledge hub/data catalog, containing a detailed description of data sources in the form of schemas and metadata
4. Master data and security data for tenant configuration, user authentication and access management
5. A context broker component keeping track of context information, allowing real-time visualization, and supporting interactions.

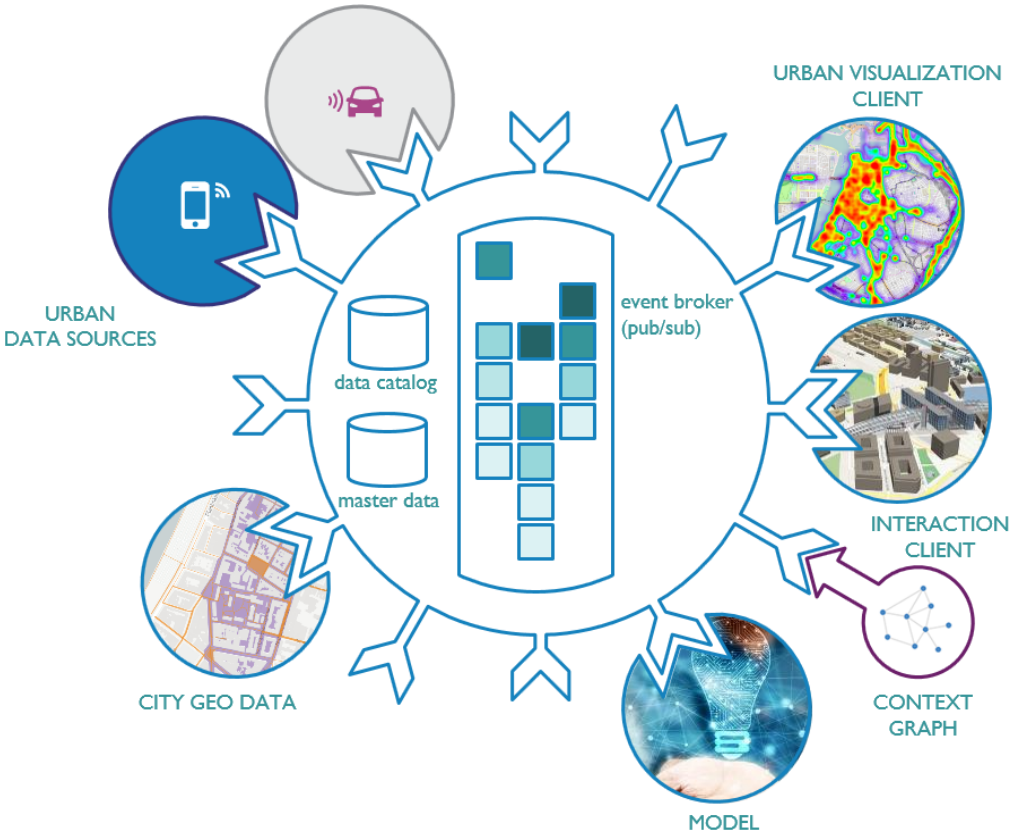


Figure 2: The T-cell architecture acts as a central broker onto which data sources, models, visualizations, interaction clients and other components connect.

Translated to a high-level technical view, the T-Cell architecture looks as depicted below.

The different components and services (logically grouped into modules) are connected to the central data broker component.

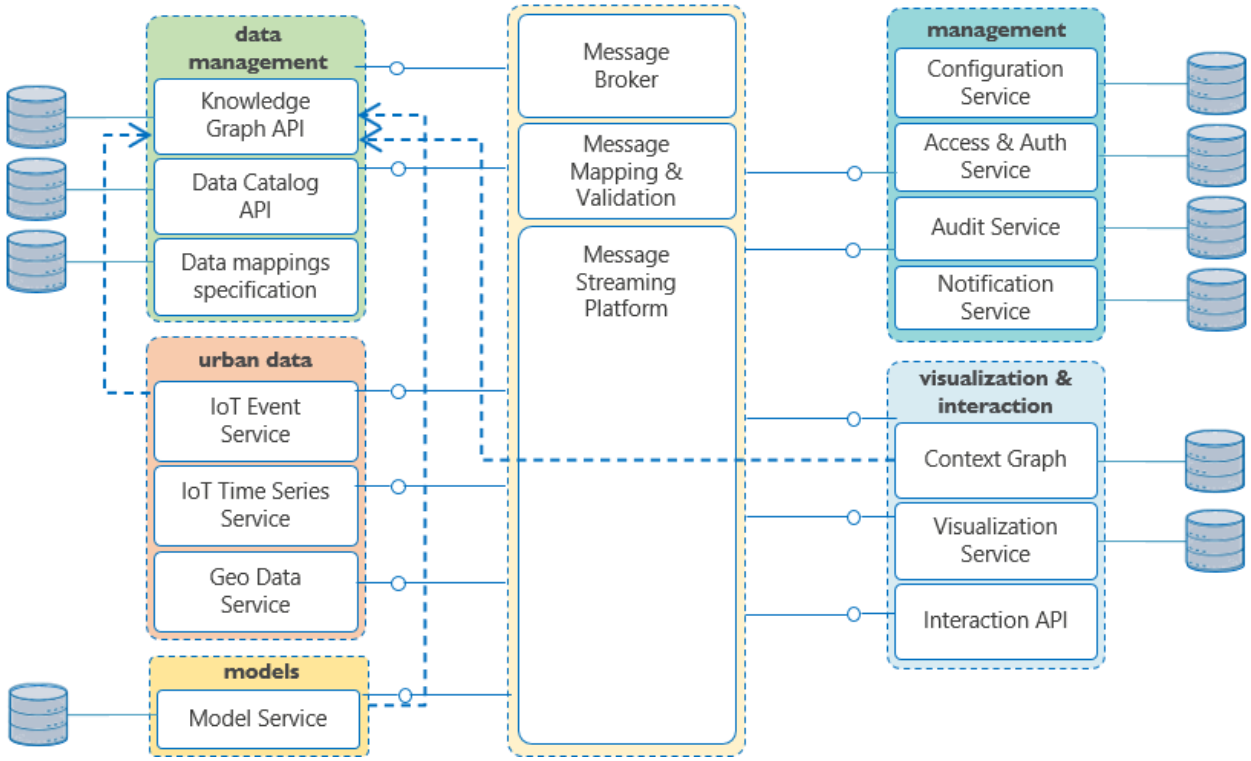


Figure 3: The T-cell architecture translates into modules containing decoupled services that interact with each other through the central data broker

3.3. Frontend design steps

3.3.1. Architecture – concept - components

Since an understanding of the technical architecture is relevant for the design process, a brief overview about the background architecture was given in the previous chapter. In general, the proposed architecture contains several major components relevant for the frontend to be built. These are:

- project and pilot overview and information
- data catalog
- data and user management
- data and pilot visualization

Thus, the DUET frontend and its underlying hierarchy should be designed according to those major components.

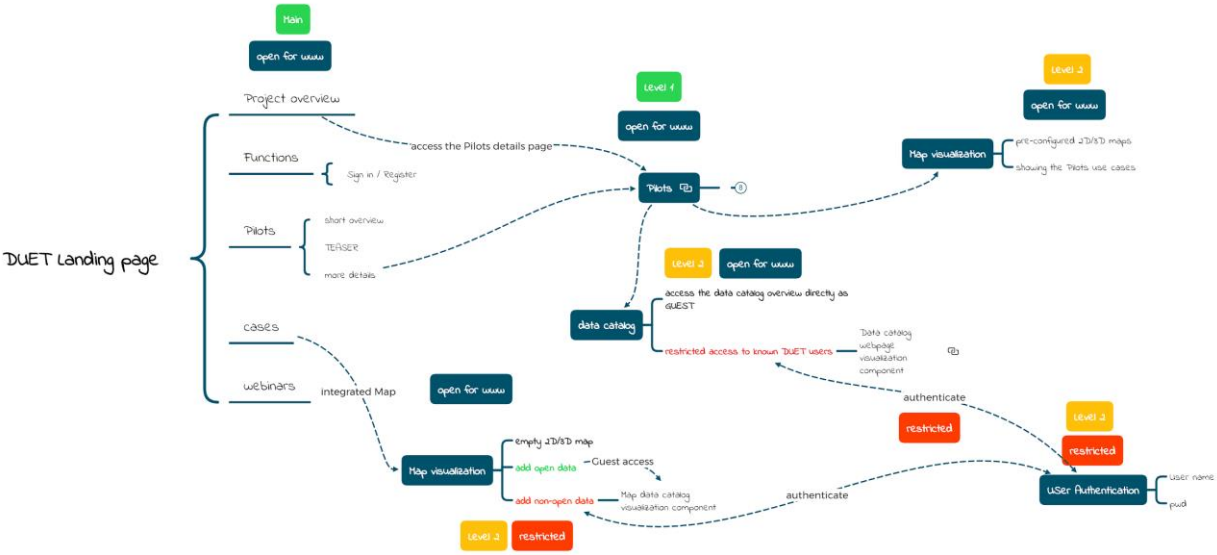


Figure 4: DUET Landing page concept and relations to nested pages, see also Annex 6 for a higher-resolution version

Generally, the **frontends** are intended to provide information to users about the DUET project (overview, pilots showcases, use cases) and available data sources and they shall give users the possibility to create their own DUET visualization from scratch (starting with an empty map).

Thus, several components will be integrated into the frontends supporting these general tasks. Those are:

Component	Function
Teaser (Image + Text)	Catching the user's attention.
Pilot summary	To provide helpful information about the pilot's point of view, aim and ideas.
Use case carousels	Providing summary in conjunction with an image pointing to a specific location showing a specific use of data, specific data, use or showcase, typically limited number of items in *auto play* mode.
Image carousels	Underlining content of a page or section by using appropriate images in a carousel, typically limited number of items in *auto play* mode.
Data / user carousels	Infinite lists of datasets, providing short and necessary information with respect to the displayed item, typically linking to a more detailed information page.
Storytelling map	Nicely prepared show- and use cases in conjunction with some textual descriptions explaining the ideas and aim of the respective case (e.g. Smarter Together). Here the user gets a detailed description beside a map visualization. The user can freely move inside the virtual environment and some relevant information is provided to the specific location aside to that.
Data catalog (open)	Available data for own use, inside and outside DUET.
Data catalog restricted access	Available data for own use, inside and outside DUET.
Visualization frontend	Creating an own DUET map using the available data from DUET data catalog. Creating an own DUET dashboard using the available IOT data, either in live stream or by using historical data.
Management page restricted access	For managing user, datasets, groups etc., registration of user and datasets.

Table 1: overview of the components integrated in the frontends and their function

The figure below shows the draft concept of an interaction diagram starting from the DUET landing page. Obviously, a lot of interactions between subpages are required as soon as the user enters the data catalog.

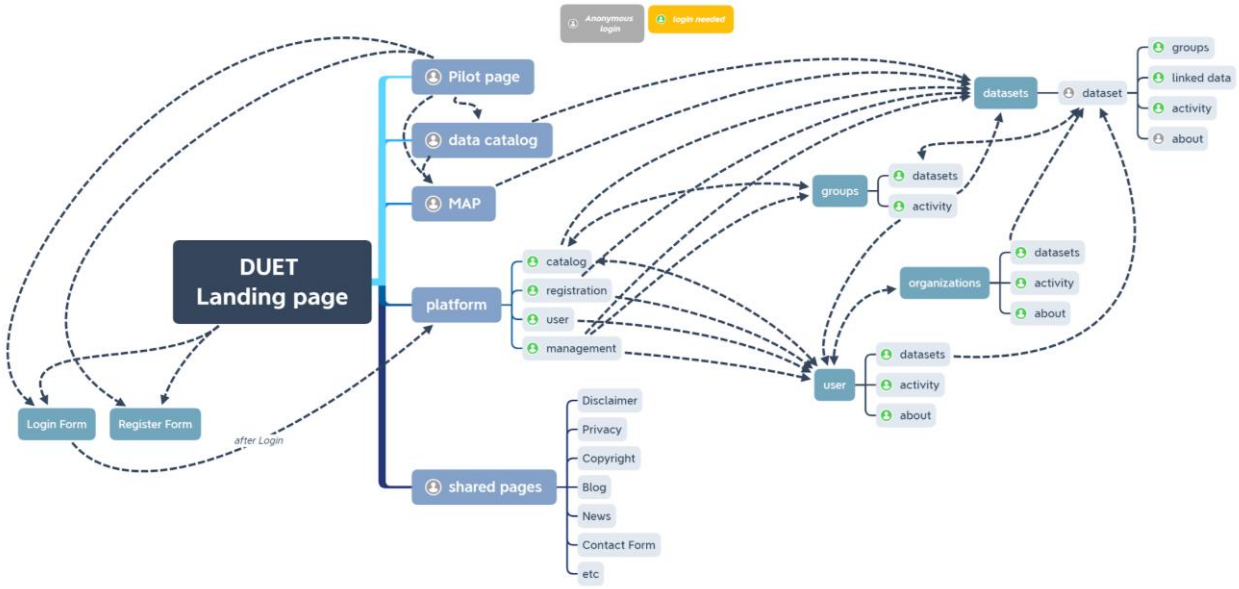


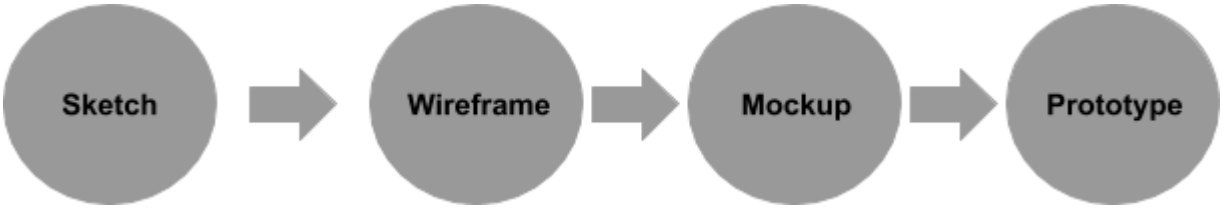
Figure 5: DUET Interaction concept and relations to nested pages, see also Annex 7 for a higher-resolution version

Besides the overall description of a dataset, it is necessary to provide information about the organization, group, user, to whom the dataset belongs, in order to be able to assist the user to find other datasets from the respective entities.

The same concept will be applied inside the map/visualization frontend. The *visualization frontend* will provide a data overview of DUET data catalog after login to the DUET platform. Afterwards the user can find respective data and add them to its own map.

3.3.2. From sketch to prototype

Usually the planning of a new website starts with a hand-drawn outline. This hand-drawn outline is also called a **sketch**, and it is followed by the pixel-perfect **wireframe**. Although this is still a very simplified version of the next design, it allows very precise conclusions to be drawn about the positioning of the content elements. In addition, you can already use the wireframe to test the user interface and optimize it if necessary.



The wireframe is followed by the **mockup**. Here, the content elements are provided with the correct color and font specifications. A mockup is static and its purpose is the exact visualisation of the later design.

The mockup is transferred into a **prototype**. This is often created in HTML and CSS. In a prototype you can already perform interactions. This means that you can test the navigation and get a very accurate idea of the interaction between design and content in the browser.

3.3.3. Inclusion of the user perspective

The demo is created in *Adobe XD* which offers a web publishing where users can comment on each page, component, etc. All project partners will be informed via the central DUET mailing service to participate in design review and comment on the pages. This completely aligns with deliverable D2.3 (*Final list of user requirements for the DUET solution*) and deliverable D2.2.

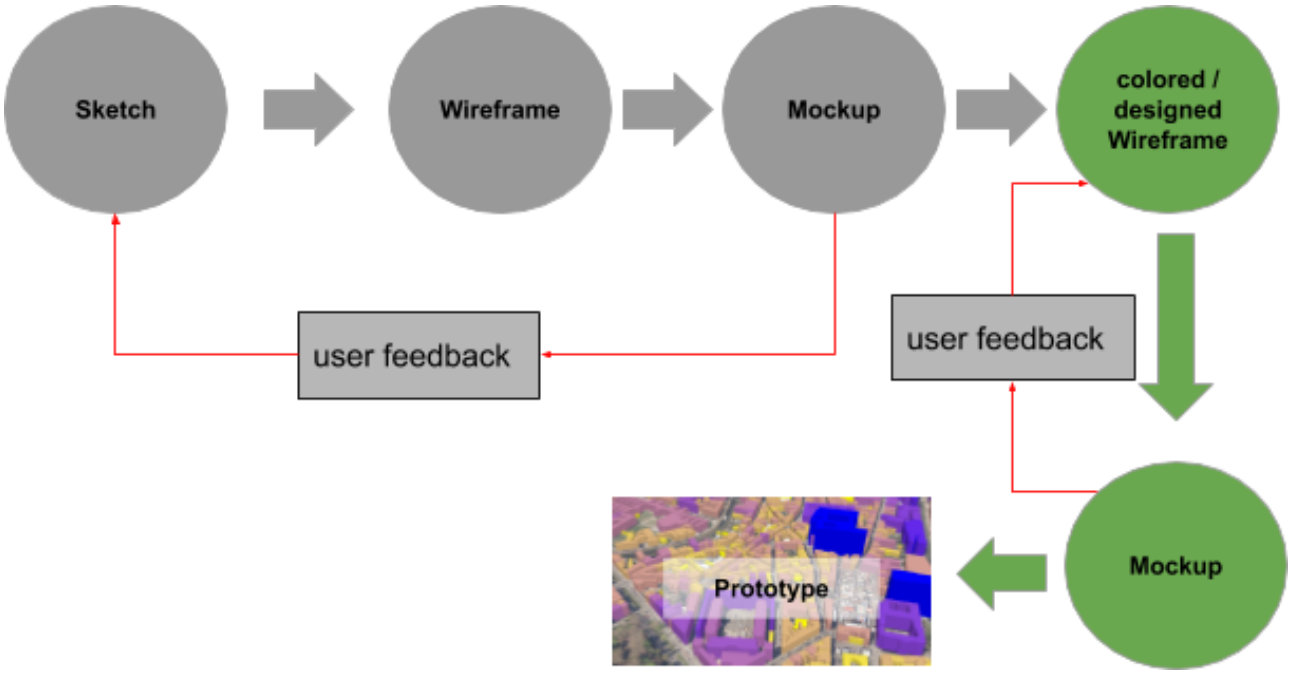


Figure 6: User feedback integration and design loops

During this phase of the project, the users review process will focus on **structure** and **interaction design** of the pages and components. The next step then will be to process the user's comments, clarify issues and redevelop the sketch wireframe, as shown by the figure above.

After the initial **feedback round**, maybe a second and third design loop is needed to appropriately integrate the user's feedback.
The following step will be to create based on the sketchy design a colored and well-designed second wireframe mockup, using the structure and interaction design of the first design phase.

Once more, user feedback will be collected and will influence the design process. The focus of the second step lies then in color scheme, placement, and size of button / dropdowns etc.

Based on the user feedback loops the prototypes of the pages will be developed and hosted on a webserver to again collect user feedback. The developed backend components will be used and integrated to showcase the final pages.

It is promised that undisputable components will immediately go into the second and third phase to make this process as agile and fast as possible. Thus, parts of the visualization prototype components will be developed faster, by the way due to time and showcase reasons of the DUET *Alpha Version*.

4. Frontend mockup designs

4.1. DUET landing page

4.1.1. Characteristics

Purpose	The DUET landing page gives an overview about the project, pilots, and available open data.
Level	This page is the main entry point into DUET. Thus, the page is on level **MAIN** and sits on top of the hierarchy. 
Security	The content of this page is OPEN for WWW. Everyone can see, use, and access the content and provided data.
Target user group	The landing page is for **everyone from WWW**. It will give the users general and specific information about the DUET project, respective use and showcases. Moreover, open data sources and datasets will be presented from the DUET data catalog to be used in any kind of GIS-software or other related tools.

4.1.2. Wireframe

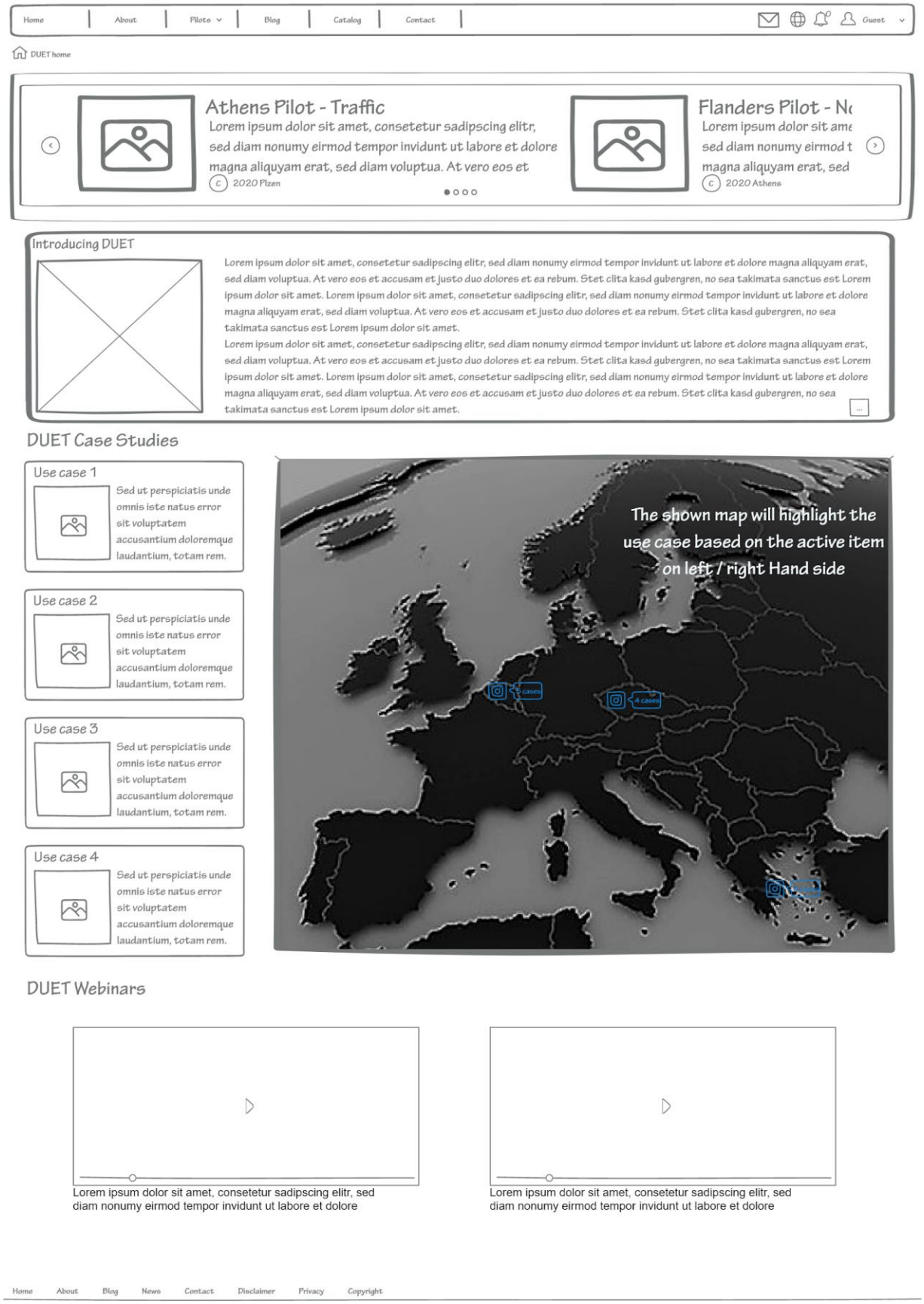


Figure 7: DUET landing page wireframe, see also [Annex 1](#) for a higher-resolution version

4.1.3 Description

The landing page provides a general overview about the DUET project and the pilots in conjunction with the achievements of the consortium.

The page will be divided into three main sections:

1. General Information about DUET
2. Overview about cases and its location
3. Selected webinars of DUET

Thus, the landing page starts with the presentation of selected showcases of the pilots on top of the page.

Followed by some Teaser Sections providing information about **DUET** and **DUET cases. Links** will guide users to more specific pages on Level 1 of the hierarchy providing more detailed information about pilots, showcases, etc.

The next section will give users an overview about DUET cases. The users have the possibility to see cases according to subject/theme/region and category. Each case will lead the user to a more specific case page where detailed information about the case, the used data, models, and visualization is presented. The last section provides information about webinars related to specific cases, models etc. of DUET.

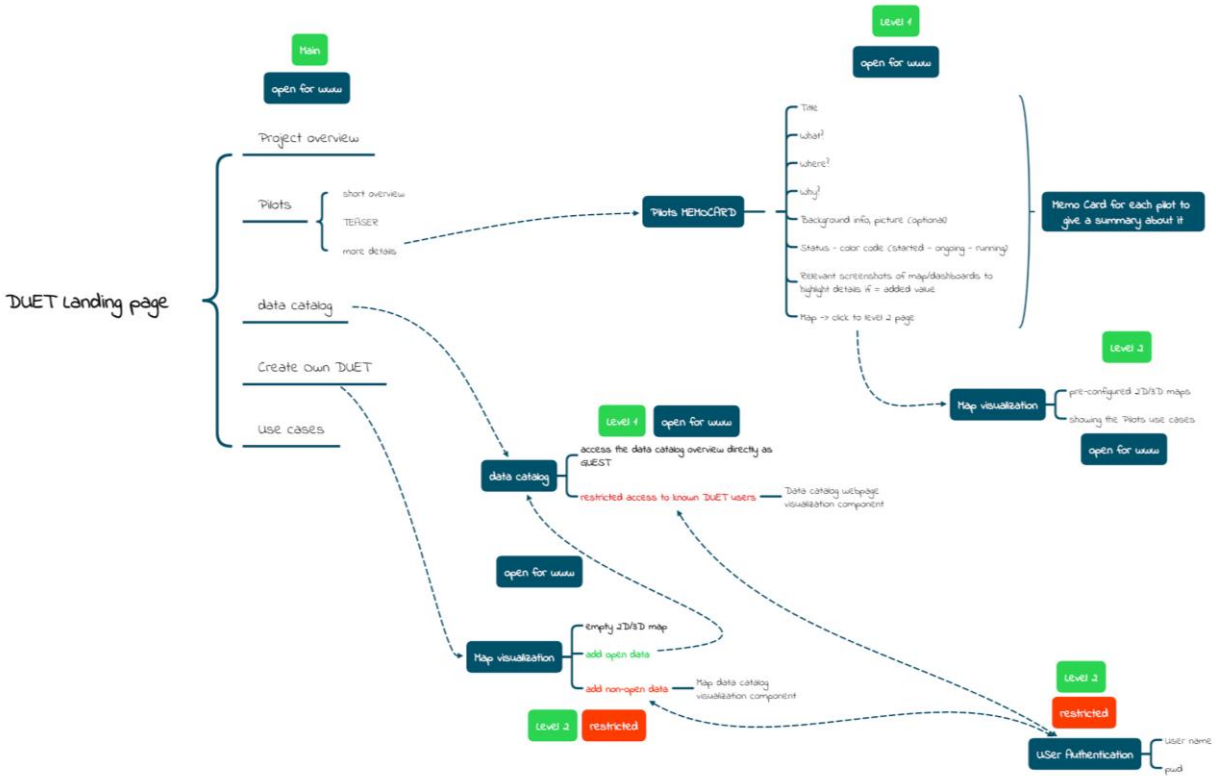


Figure 8: DUET landing page concept and interactions to nested pages, see also Annex 7 for a higher resolution version

A picture of the sketch design of the landing page can be found on the DUET landing page wireframe.

To check out the above mentioned interactions between the pages please visit this page.

4.2. Use cases, showcases and pilot overviews

4.2.1. Characteristics

Purpose	The DUET pilots page gives detailed insights into the specific pilot and its use and showcases.
Level	These pages are on LEVEL 1 of DUET. Thus, these pages sit below the MAIN page of the hierarchy. 
Security	The content of this page is OPEN for WWW. Everyone can see, use, and access the content.
Target user group	The pilot page is open for everyone from WWW. It will give the users specific information about the Pilot Project, respective use and showcases. Moreover, open data sources and datasets for that pilot region will be presented from the DUET data catalog to be used in any kind of GIS-software or other related tools.

4.2.2. Wireframe

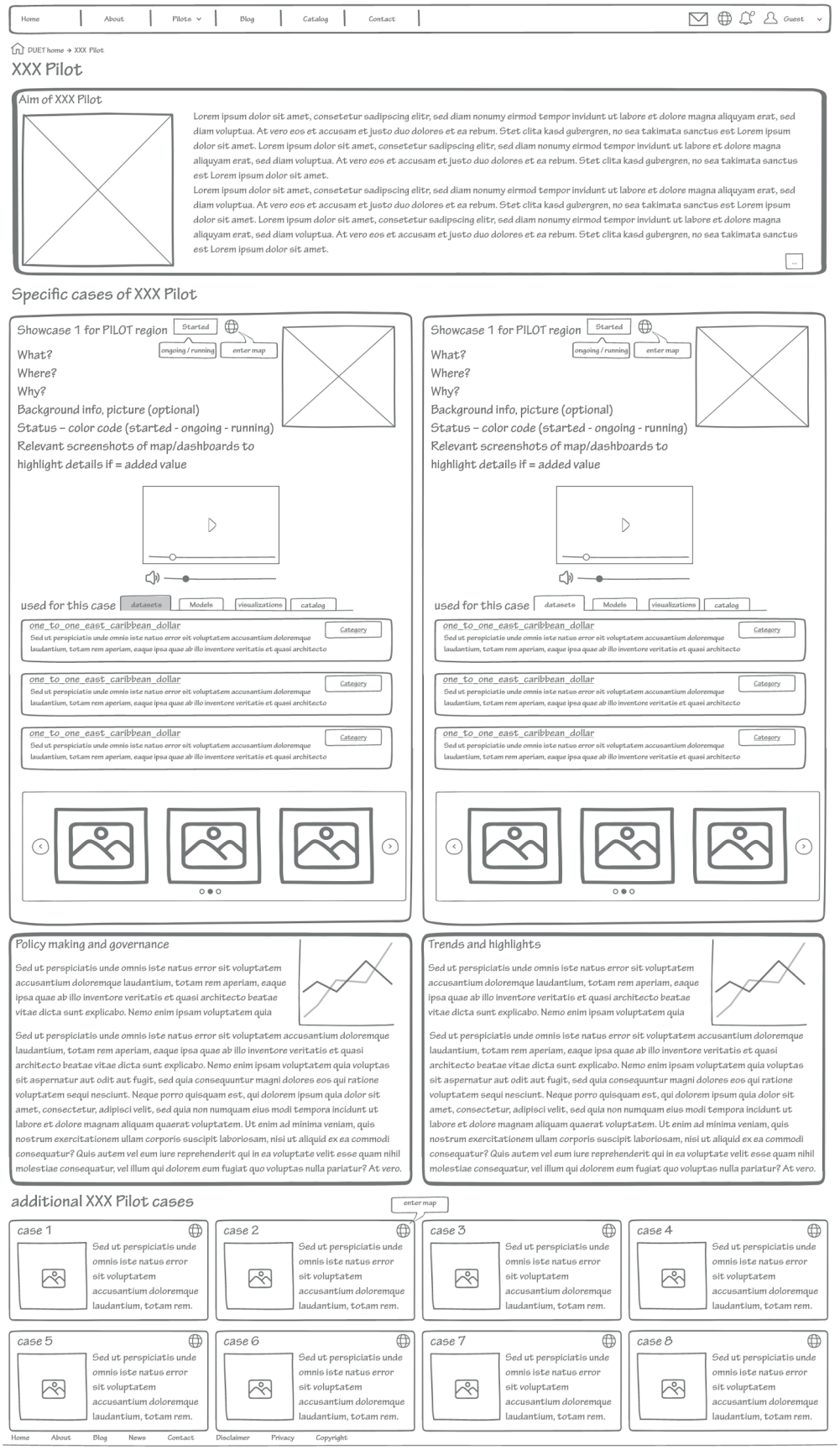


Figure 9: DUET pilot page wireframe, see also Annex 2 for a higher-resolution version

4.2.3. Description

Each pilot page is structurally located below the main DUET landing page starting on top of the page with recent information about the specific pilot site and its aim. Figure 11 shows the planned draft interaction diagram of the Pilots details page.

This section is followed by the region-specific cases. Each of the presented cases provides information about its purpose, status and used data, models, visualizations, and the possibility to enter the open part of the DUET data catalog. This catalog initially represents a subset of the whole DUET catalog valid for the specific represented region of the page. Besides that, the restrictions of this catalog are for **GUEST** users. The catalog view is open for every user. Hence, users do not have to be logged in to view datasets for the selected pilot. Thus, only free accessible items and subitems will be shown. For getting more and detailed information users have to login and access the **DUET catalog component** directly. The *spatial extent map* will show the overall extent of the represented region.

The two representative showcases of the pilot will be introduced in detail including questions such as:

- What?
- Where?
- Why?
- Background info, picture (optional)
- Status – color code (started - ongoing - running)
- Relevant screenshots of map/dashboards to highlight details
- Very specific, details

That should be answered to provide to the interested users deep insights of the idea and aim of the showcase. To be able to support this, videos and an image carousel can be used.

To support the case-driven entry, users can enter the visualization/map component by clicking a button on each specific case and a semi-generic case visualization will be opened in a new browser page. Here, users can add/change the visualization datasets. Depending on their granted rights, they can store, visualize, extend the case. See the image at the right-side for an example. Depending on the user's role and rights he/she can choose from different options to save his/her created case. See also here and Annex 6 for a higher-resolution version.

The showcase section is followed by a text section providing helpful information from the pilot region for policy makers and governance from other European regions. Also interviews, statements, etc from relevant persons from the pilot region can be integrated.

Figure 10: Save your case pop-up

The *trends and highlights* part can be used to state personal assessments, opinions, knowledge etc. of relevant persons from the pilot region regarding the pilot itself, the use of spatial data, spatial data analysis etc. In general, everything covered by the pilot, its show- and use cases.

The last section of each pilot page is used for describing use cases in the pilot. A representative image in conjunction with a brief description of the use case should be provided. Each use case can be linked to a 2D/3D map visualization, **but the latter is optional**. The major difference with the use cases of the main page is that these use cases are not specially prepared for storytelling etc. The **storytelling** use cases are extended and well prepared for the sake of storytelling. This requires some extra work for this specific case. Whereas the use cases of the Pilots pages should reflect the existing data inventory used for that use case as a good example for other regions owning similar data.

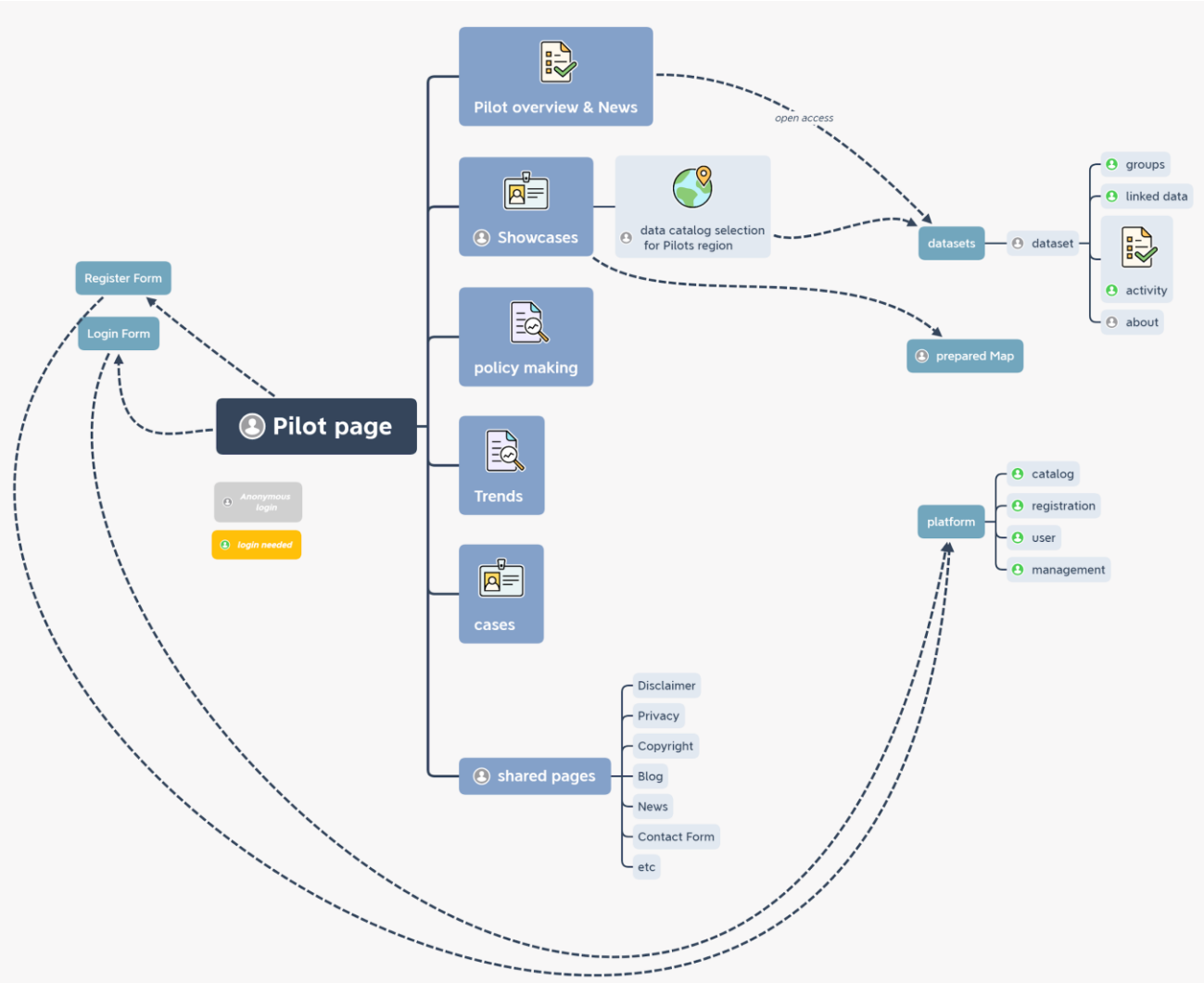


Figure 11: Pilot page interaction diagram, see also Annex 8 for a higher-resolution version

A picture of the sketch design of the pilots page can be found in Annex 2. To check out the above mentioned interactions between the pages please visit this page.

Example for use case / Showcase preparation inside a pilots detail page

A showcase or use case example could be the visualization of a traffic simulation for Ghent integrated into the 3D virtual environment.

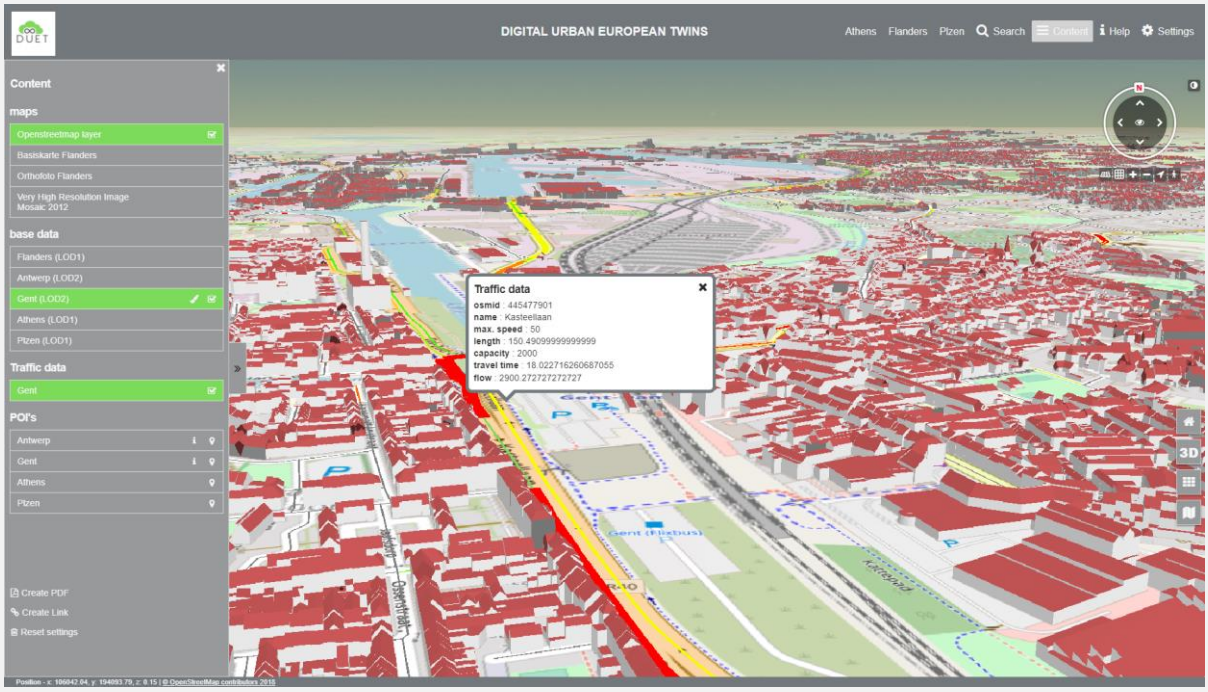


Figure 12: Prepared map visualization for use- or showcase (Flanders pilot), [view it here]

4.3. DUET open catalog component

4.3.1. Characteristics

Purpose The DUET open catalog component gives detailed insights into the DUET pilots datasets, used models, visualizations, and its use.

Level These pages are on LEVEL 3 of DUET. Thus, these pages sit below the pilot page of the hierarchy and data catalog.

DUET home → XXX Pilot → data catalog

Security The content of this page is OPEN for WWW. Everyone is able to use and access the content and provided data.

Target user group This specific catalog component and all its underlying subpages are open to guest users. The pages will give the users specific information about the available datasets, the used models, and visualizations. This will help users to create their own DUET case based on the provided information.

4.4.2. Wireframe

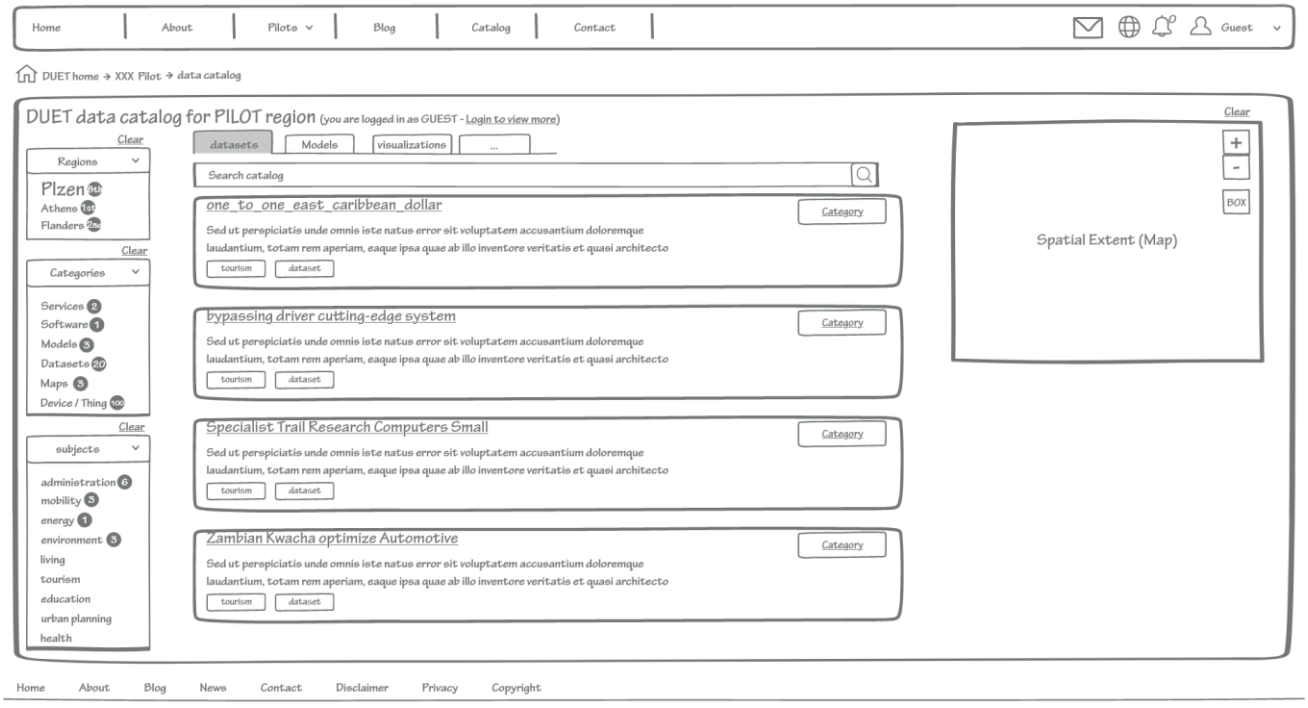


Figure 13: DUET open catalog component wireframe, see also Annex 3 for a higher-resolution version

At first, only the open data is represented in the view and options like activity tree, last updates tree etc will not be shown to **GUEST** users. This catalog view is restricted to the pilot-regions and to open datasets and gives users the possibility to gather more information about the used datasets of the pilot-regions.

For getting more information about all available datasets, users have to register/login.

See Annex 3 wireframe, or as mockup version here.

After registration/login users will have access to the DUET restricted catalog component.

4.4. DUET restricted catalog component

4.4.1. Characteristics

Purpose	The DUET catalog component gives detailed insights into the DUET datasets and its use.
Level	These pages are on LEVEL 2 of DUET. Thus, these pages sit below the MAIN page of the hierarchy and data catalog. 
Security	The content of this page is CLOSED for WWW. Everyone needs to be registered and logged in to be able to use and access the content and provided data.
Target user group	The catalog component and all its underlying subpages are closed to registered users. The pages will give the users specific information about the available datasets, the possibility to register new datasets, getting information about users, linked datasets, activities and much more.

4.4.2. Wireframe

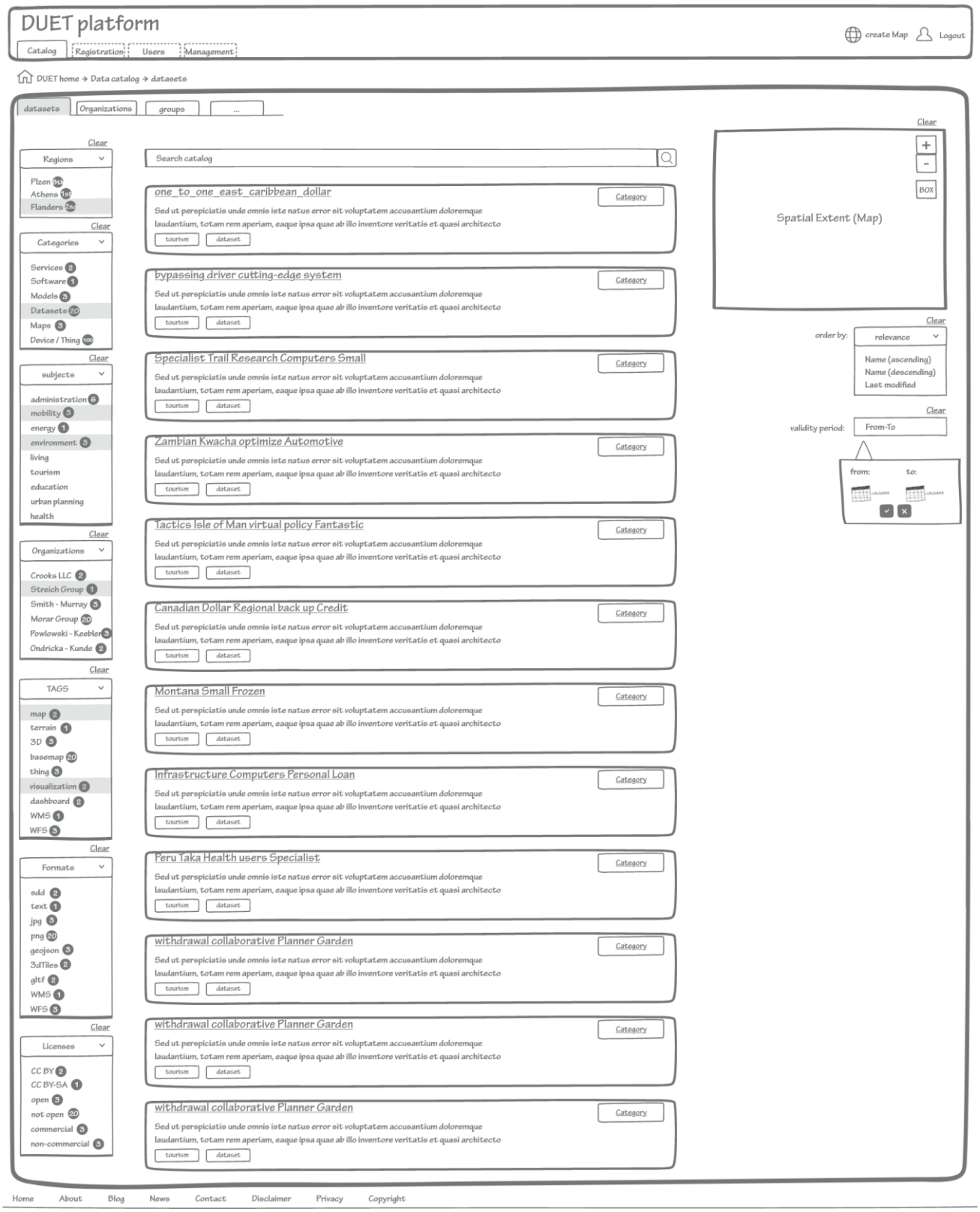


Figure 14: DUET restricted catalog component wireframe, see also Annex 4 for a higher-resolution version

4.4.3. Description

In addition to the open data catalog component, a limited access catalog component is also available. This allows the user to see all records in the catalog, to get activity indicators for records, users and more. The design and the interactions between the individual components are complex and are achieved by numerous links.

The catalog view represents an excerpt of the full catalog functionality. For getting complete access to the data catalog and full access to all available data users must be logged into the system. Thus, a registration/login form will be provided within the page.

The catalogue component mainly uses tabs, dropdowns, and vertically scrollable lists to present the content to the user.

The individual components are based on the capabilities of CKAN and on the search and interest behavior of future users. Thus, it makes sense to make the data records searchable and filterable on the one hand, but also to assign data records and users to categories and organizations on the other. This is mainly done in the backend and must be configured, but the frontend must represent these links and categorizations accordingly. For this reason, the subordinate pages are strongly linked and the interactions between the individual pages are very high.
Each signup Interaction within the frontend ends up by displaying the catalog component startview - that is the presentation of the datasets, as shown in Annex 4 (wireframes) or as here (mockup).

Next overview gives a good idea of the complexity of the interaction between the pages.

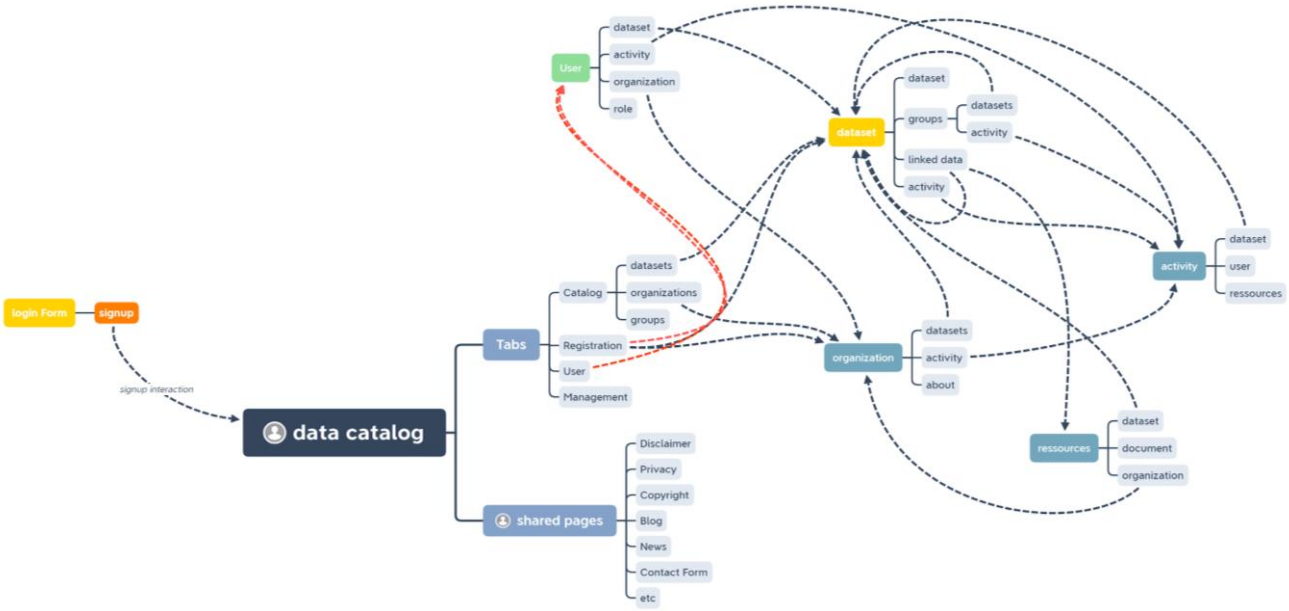


Figure 15: Data catalog interaction diagram, see also Annex 9 for a higher-resolution version

The use of Tabs in the catalog frontend and all of its subpages gives the user the full flexibility to gather the information he/she prefers and also allows him/her to discover familiar or other datasets by starting from a dataset to either linked data, data from same organization or user, etc.

4.5. General UI components & overall design

This chapter describes general UI components relevant for visualization purposes and management UI within DUET. The overall design principles are shown in the wireframes, see section above. The bottom of each page is used for the footer section, holding elements such as disclaimer, privacy, etc. The presented items are just a rough base for the further development of a high-fidelity mockup of the DUET frontends. Since the design process of those elements is time consuming, on first stage user feedback regarding the sketch design will be collected before further elements will be designed according to the color schema and look and feel. In general, the frontends will be designed with Google materials Design. So further elements such as TABS, cards etc will be designed with that design principle and the proposed color scheme applied.

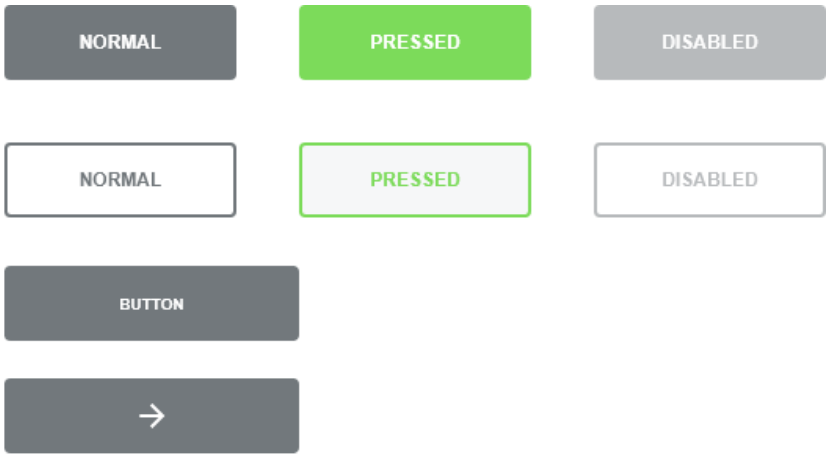
4.5.1. Color scheme

The color scheme is based on the current used colors of the DUET web page (see here). Of course, depending on the pilots use cases more colors will be integrated. However, it is expected that those colors will appear inside the map visualization component and dashboards and not within the web pages. Thus, the presented color scheme is valid for all web pages except for the map visualization and dashboard views. A good example is the *traffic integration* use case of Flanders Pilot. Here some more colors are needed to visualize the capacity and flow of the streets (Example for use case / Showcase preparation inside Pilots details page).

System Colors			Selection & Hover Colors	True / False Colors		Additional Colors	
White	light Grey	Dark Grey	Green	Red	Green	Golden	Black
R 246 G 247 B 248	R 127 G 196 B 253	R 114 G 120 B 124	R 124 G 219 B 90	R 252 G 7 B 24	R 124 G 219 B 90	R 255 G 177 B 0	R 0 G 0 B 0
Hex #F6F7F8	Hex #97999B	Hex #72787C	Hex #7CDB5A	Hex #FC0718	Hex #7CDB5A	Hex #FFB100	Hex #000000

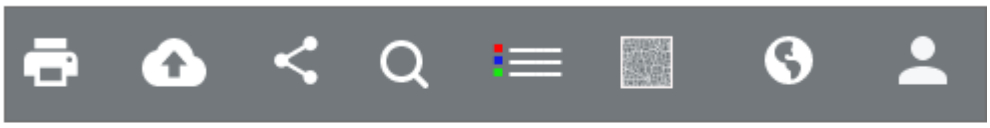
4.5.2. UI elements

Buttons



Dropdowns

Navbar Buttons + Hover



Navbar Buttons + Seletced

Icons

Icons - highlighted

4.5.3. Typography

Typography - main Font Arial

Character Styles

Headline

Bold 40pt

Title

Bold 30pt

Subheader

Regular 20pt

Quote

Italic 20pt

Large Body

Bold 14pt

Body

Regular 14pt

Secondary Body

Regular 12pt

Placeholder

Italic 12pt

BUTTON / Navbar / Links

Bold 10pt

Paragraph Styles

Large Body

Excepteur sint occaecat cupidatat non proident, sunt in culpa qui officia deserunt mollit anim id est eopksio laborum. Sed ut perspiciatis unde

Body

Excepteur sint occaecat cupidatat non proident, sunt in culpa qui officia deserunt mollit anim id est eopksio laborum. Sed ut perspiciatis unde omnis istpoe natus error sit voluptatem accusantium doloremque eopsloi

Small Body

Excepteur sint occaecat cupidatat non proident, sunt in culpa qui officia deserunt mollit anim id est eopksio laborum. Sed ut perspiciatis unde omnis istpoe natus error sit voluptatem accusantium doloremque eopsloi laudantium, totam rem

4.5.4. Balloon

Information balloon - Position over Center of clicked Object

4.6. Visualization components

The visualization components can be divided into categories for which specific Frontend and capabilities will be available. The distinction can be made into:

- 2D / 3D Map visualization component
    - preconfigured / prepared
    - user created ones
    - preconfigured / prepared +
    - storytelling
    - geospatial dashboard view for IOT

4.6.1. 2D / 3D map visualization components - preconfigured / prepared

Figure 16 shows the overall design concept for DUET 2D / 3D map visualization. The left-hand side will be used for Information about layers, data, etc. All relevant information about the map data will be displayed here. At the right-hand side of the page, the navigation controls as well as helpful tools can be found. The footer section again will be used to provide information about data origin, privacy, and a disclaimer.

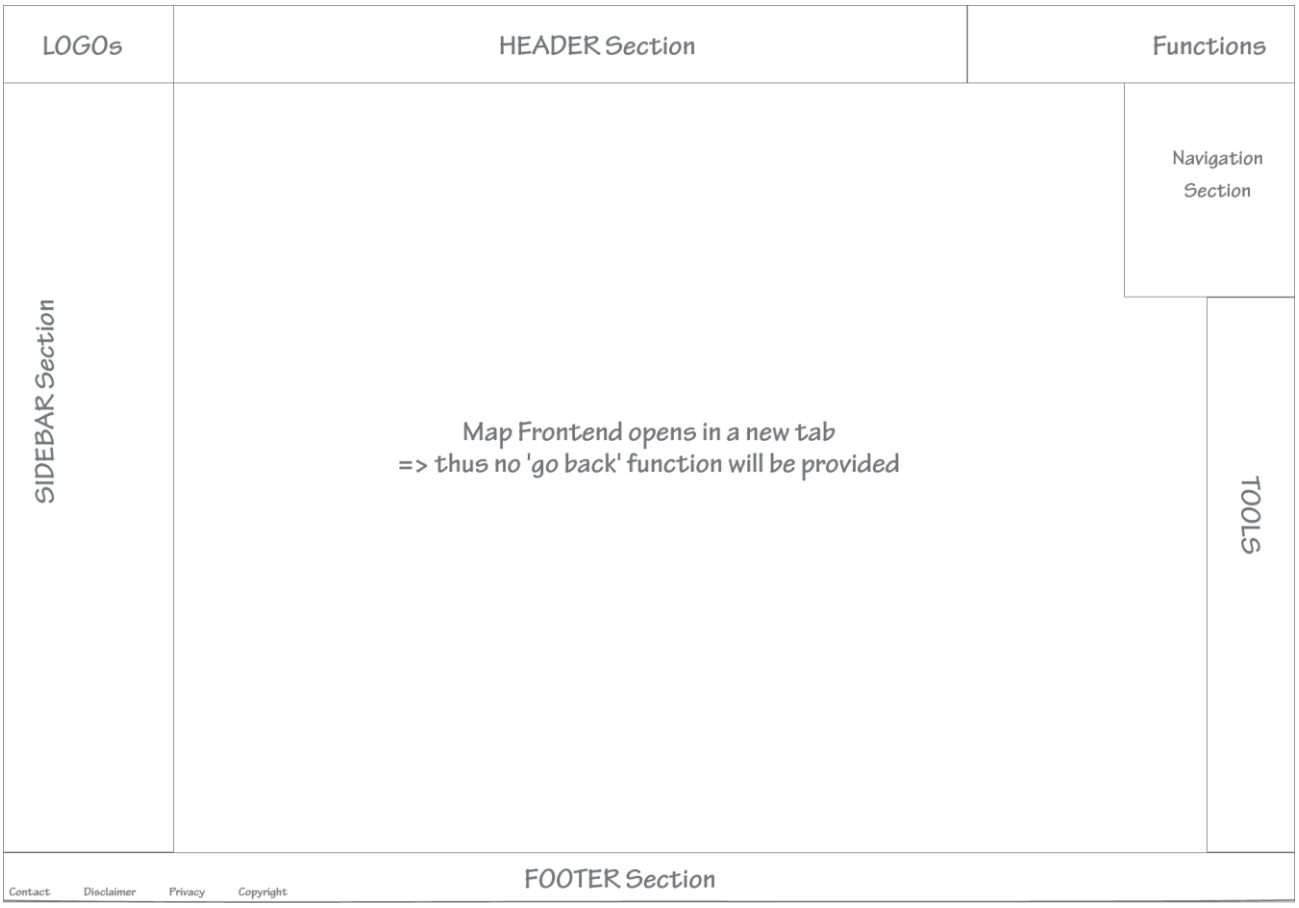


Figure 16: Overall Design principle for DUET 2D / 3D Map UI, see also Annex 5 for a higher-resolution version

As mentioned in the Introduction section - approach to include the user perspective some parts of the visualization frontend will be developed earlier than other frontend parts due to time reasons for the *Alpha Version* of DUET. Therefore, some already existing technologies will be reused to present some results in the DUET design schema.

The color scheme mentioned before is applied to the first web pages showing content of DUET pilots. The overall design of the map visualization frontend can be tested in conjunction with the color design. An example for this is depicted in figure 17, showing one page holding the data for all three Pilots. By clicking one of the top three pilot names, the map visualization redirects to the start view for each region and loads some initial data, such as terrain, 3D-building and some map overlays. The user has no permission to add data from the DUET data catalog. The overall content of the map is fixed. The user can switch on/off the presented data in the content tab, no additional data is available, since the catalog is not accessible.

The overall page view can be accessed here.

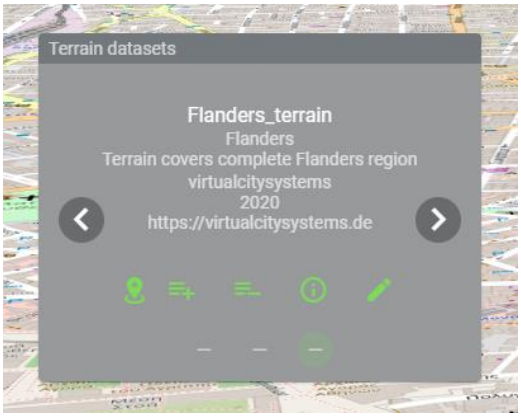
However, each of the regions can be also directly accessed by a link:

1. Athens
2. Plzen
3. Flanders - Gent
4. Flanders - Antwerp

Thus, the technology is available to link pilots showcases or use cases directly (via button or clickable icon) to the respective visualization part. Since this visualization is external and not integrated into the overall architecture, the visualization view opens in a new tab of the browser.

Figure 17: Map component using the proposed color scheme of Duet and the proposed design principles

4.6.2. User created map visualization



Besides the already existing visualization technology - which is mainly a preconfigured one - first attempts to integrate a catalog solution were made. However, since the design is not discussed and the backend does not exist yet, it is just a first glimpse to an approach to start with an empty map and adding data sources to the map frontend via selection from the catalog. See figure 18 and the figure aside. Accessing the catalog will give the user the option to select and filter the datasets according to themes, such as terrain data, 3D objects data, map overlays, etc.

By providing helpful metadata the user can easily identify the region and extent of the data and can then select and add the data source to his/her own created map. Thus, from a technological point of view the mentioned capability of creating an own map by adding data from catalog is proven and realizable, but the overall design approach is not yet defined.

Figure 18: Map component using the proposed data catalog (design test)

Another appropriate approach is to reuse the catalog view design of the DUET webpage frontend and all its inherited capabilities, adapted to the capabilities of the viewer. This means that only visualizable datasets will be presented to the user and can be thus added to the map visualization component, see figure 19.

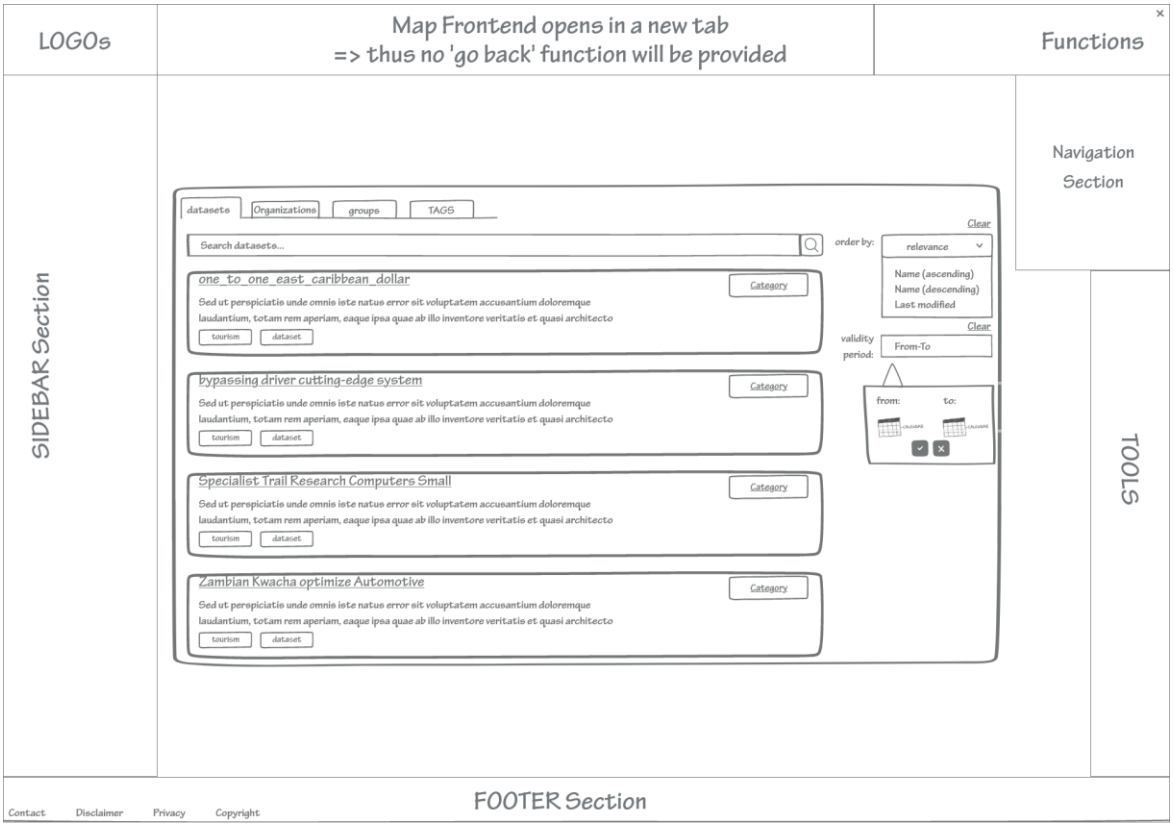


Figure 19: Wireframe sketch for data catalog view in map visualization component

In all kinds of cases (prepared, semi-generic and generic) the visualization component must be enhanced according to styling and setting purposes of each dataset. Assuming a workflow where users add data from the catalog, the datasets will be added to the visualization in raw format. Users should be able to add, style and edit the settings of the dataset to integrate the respective dataset into their own map. Figure 20 gives a good indication of how this could look like.

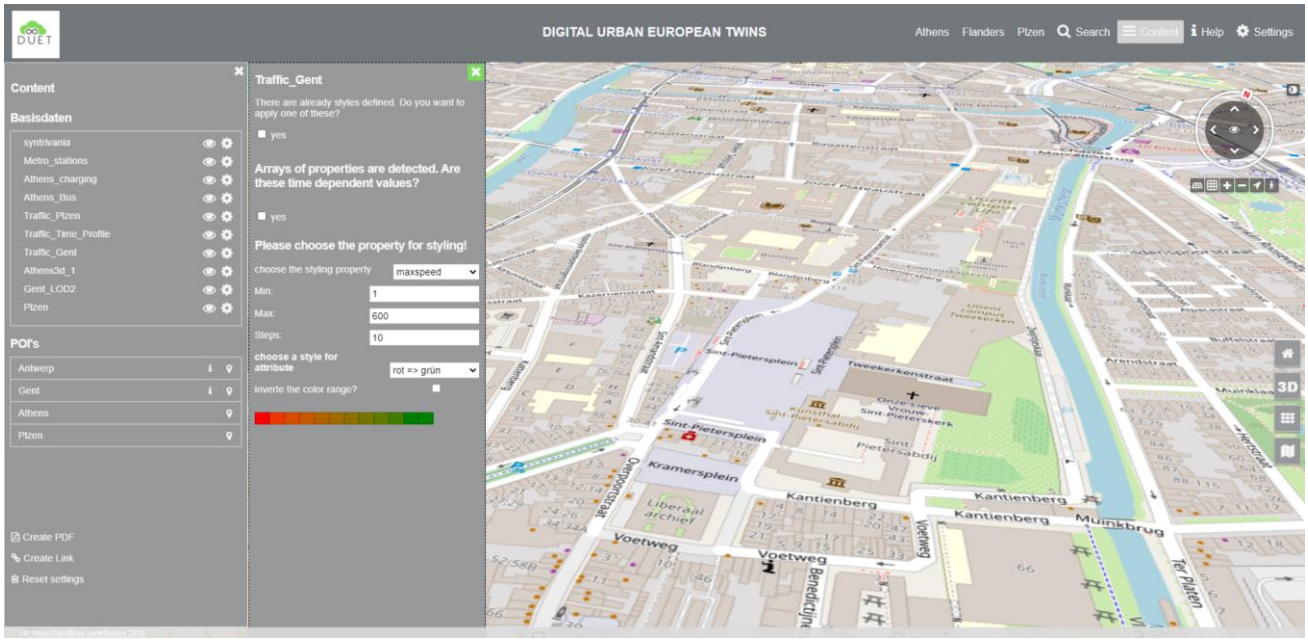


Figure 20: Map component including the needed styling and settings components to be able to define user or model driven styling and settings for the visualization

At the left-hand side of the content window, the user can select one of his/her chosen layers from the catalog and is able to change the visibility and apply some user centric settings by clicking on the cogwheel. This action will open a new window presenting some user definable settings relevant for the visualization of the dataset itself.

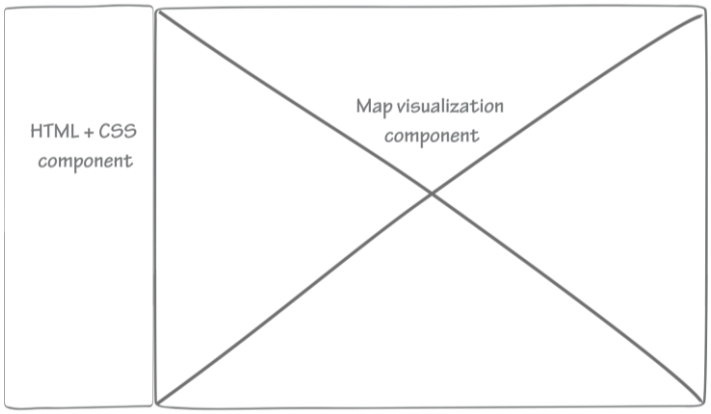
The catalog view is created by using the Query API as proposed in D3.1 IoT stack and API specifications v1, chapter 2.6.1 Data Registration API using the list data sources query. Once the data sources are listed in the view a user can simply add the dataset (source) to his/her map and is able to adjust the visualization of the dataset on its own.

After doing this with all his/her datasets, each user is able to save his/her own map according to his/her role and rights using the dialog displayed on the right or depicted by Annex 6 and figure 10.

4.6.3. Preconfigured / prepared + map visualization component

Preconfigured/prepared + refers to an already existing map visualization where the user is allowed to add additional content by selecting data from the DUET data catalog. The map appears in an initial view including several data and the user is allowed to access the DUET data catalog and add data to the visualization from it. It is a mix of section 2D / 3D map visualization components - preconfigured / prepared and the user created map visualization. It is foreseen to add the catalog access to the visualization component header inside the functions section aside of the content button.

4.6.4. Storytelling visualization component



The storytelling component is a specific prepared map visualization component whereas the prepared map is integrated into an overall HTML-element. Inside this HTML-element, HTML-content such as videos, images, carousels, text is used to add valuable information to the map visualization. Besides that, the map visualization changes when the user scrolls, clicks or otherwise interacts with the HTML-content. A good example for the storytelling component can be found here.

Storytelling will be used to combine the information of the use cases with a 2D/3D map visualization embedded in the page. The storytelling can be used to link the content of the use case with the map visualization. Thus, a user can go through the information of the use case and can see the specific region, data, etc. in a map visualization. Nicely prepared stories can be used to inform about activities and goals of the DUET pilot regions.

The visualization component is reduced to a minimum of necessary components. Usually only the map and the data are present. The map component can be placed on the left- or right-hand side of the HTML-content. Usually the HTML-content is vertically scrollable, so that the descriptive content is present to the user and only the relevant content linked to the current visualization is displayed.

4.6.5. Geospatial dashboard component

Currently, there is no design approach available for geospatial dashboards. It needs further discussion about the content and the representation of the relevant data.

The main questions regarding the data and the design approach are:

- What?
- Where?
- How?

The article “Geospatial Dashboards for Monitoring Smart City Performance” [Jing et al. 2019] proposes some design examples, however it is currently unclear and how this could be integrated and supported by the overall architecture. That is why this topic is shifted to a later point in time this year.

5. Next steps to be taken

The next step after handing in this document is to start the review process for the developed Sketch design by pilot users and project developers focusing on page interaction and content presentation. The review process and the use of the sketch mockup should give users the first impression how the different backend components are integrated by the proposed DUET Frontends. Ideally a common understanding of the interactions between components will be achieved. This completely aligns with deliverable D2.3 (*Final list of user requirements for the DUET solution*). As it is mentioned there in chapter 4.1.3 the basic wireframes will be used during the users interview to gather feedback. There users can create wireframes on their own but based on the presented presentation file. As starting point of the creation maybe the here presented wireframes help users to understand the DUET idea and leads to further improvements and feedback regarding the here presented Mockups.

As already mentioned in the “Executive summary” section, the described and presented Wireframe is a low fidelity one covering the complexity of the background architecture and tackling the aim of the project. However after the first user feedback loop the low fidelity wireframes will be refined and the development of medium / high fidelity wireframes [see here] will start.

After collecting user feedback for the sketch design and page interaction, the development process for the web mockup (including colors, button, texts, etc.) starts and will end in a further review process by pilot users for design and usage of the Frontend components.

Based on backend development and the availability of backend components, the development of initial web page prototypes will be enforced, especially for:

- catalog views
- map frontends
- dashboard frontends

In D4.4 the achieved concepts will be developed, and prototypes will be presented.

6. Conclusion

In this report design achievements for frontend components were presented. The report is a supporting document to the Mockup hosted on

https://xd.adobe.com/view/c3ac9931-9bbe-4bd5-8bfc-6a3bd0396f3f-96ff/

During the last 3-4 months of the project, it became clear that for the development of the frontend components a common understanding of the underlying architecture and the general project goals in combination with the intended transferability must exist. This is the only way to create a meaningful and still usable frontend that satisfies the use cases as well as being transferable and reusable. VCS started the work package with the initial development of a medium/high fidelity wireframe model and quickly realized that more information about the use cases and the later use of DUET was necessary to create a targeted front-end mockup.

Such as:

https://xd.adobe.com/view/d8e253e2-596d-478a-571e-4acf590c1923-aed3/?hints=on
https://xd.adobe.com/view/def64f6f-1994-456a-6e80-685324190f40-a8c7/

Both mockups are focused on visualization purposes of the map and the data catalog integration into it. It became obvious that these high fidelity mockups were too detailed, too focused and not fitting into the general idea of DUET at first. To be clear about that, the work done can be reused to a later point in the design process.

For now, thanks to the work of AIV and their target-oriented presentation, a new approach was undertaken starting from a new point of view to the topic and the result is promising regarding the aim to create a common understanding of DUET goal, the frontend components in conjunction with backend architecture, the overall catalog integration and interaction between the pages.

The main focus of this document was to explain the underlying idea of several components/features to this stage of the project. Namely the purpose of the landing page, pilots page and data catalog page.

Currently, not all of the components needed can be designed properly due to the lack of meaning and usage within the user stories / use cases. Especially the use and meaning of (geospatial) dashboards must be clarified in further meetings and design phases. Besides the geospatial dashboards the management of the DUET platform (backend) has to be designed or at least a decision has to be done if available, existing frontends for backend components (such as CKAN) can and will be used for administration and management purposes of the backend components. If not, frontend designs must be created for those components as well.

However even if not all components are designed detailly the general interaction, aim and intention of components is pointed out and will assist users to understand the backend architecture.

This document is the initial document for the design process and will be refined and extended during the next months including and reporting the overall design for DUET's frontend.

7. References

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- Storytelling example, url: https://3dweb.lgl-bw.de/3D/BUGA/#/mystory, Ministerium für Ländlichen Raum und Verbraucherschutz Baden-Württemberg, Kernerplatz 10 D-70182 Stuttgart, www.mlr.baden-wuerttemberg.de, last accessed 24.08.2020
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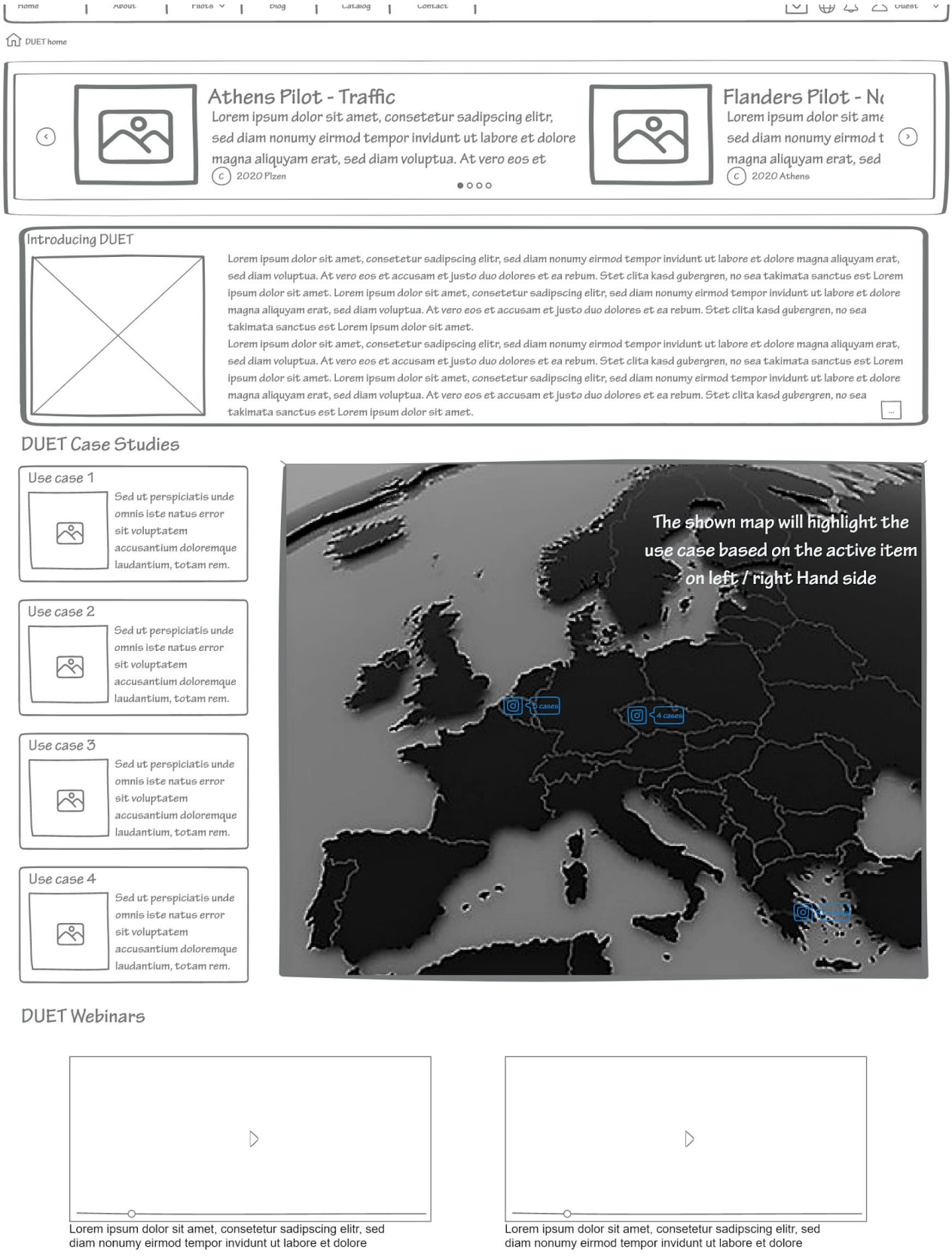
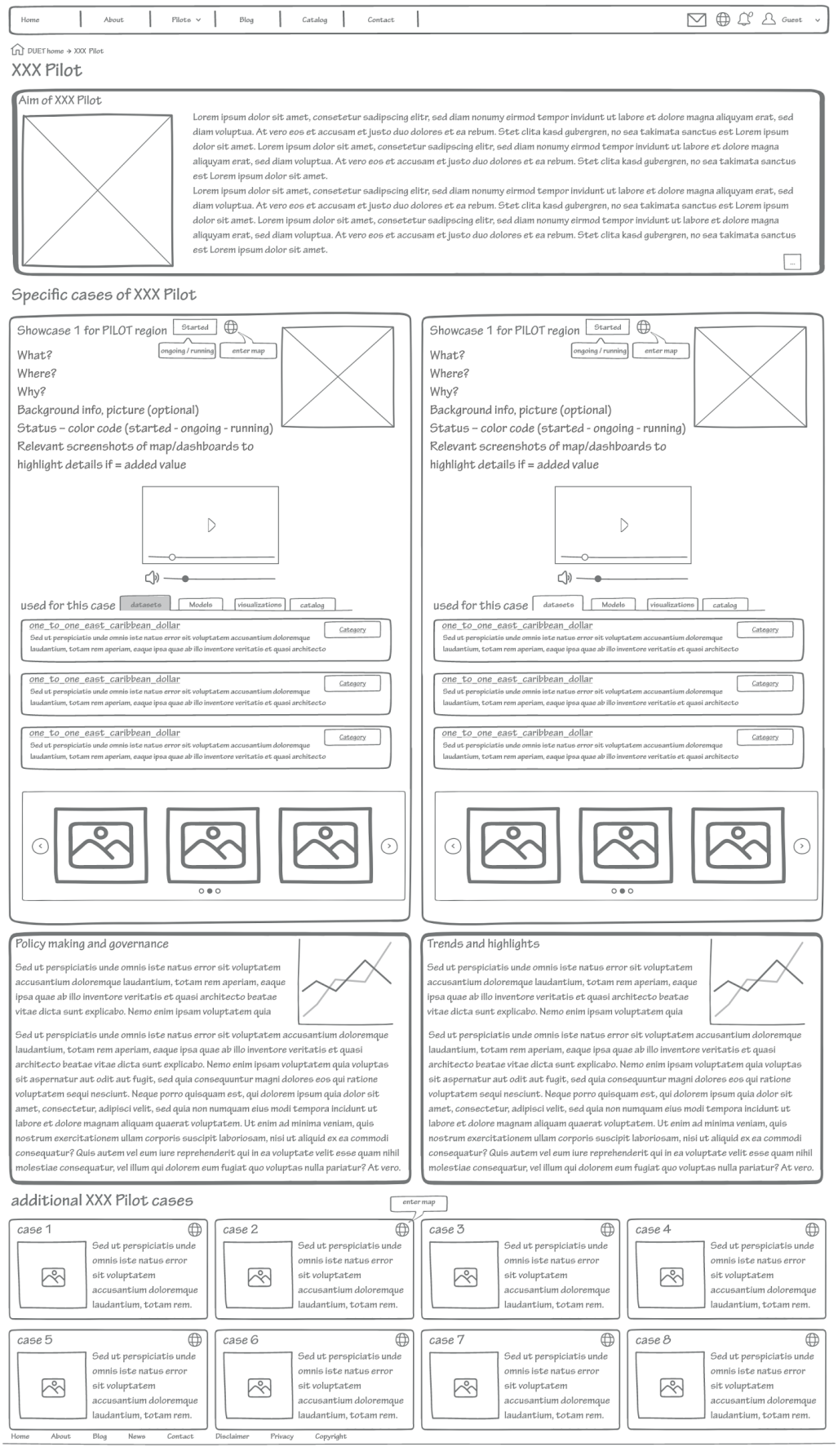
8. Annex

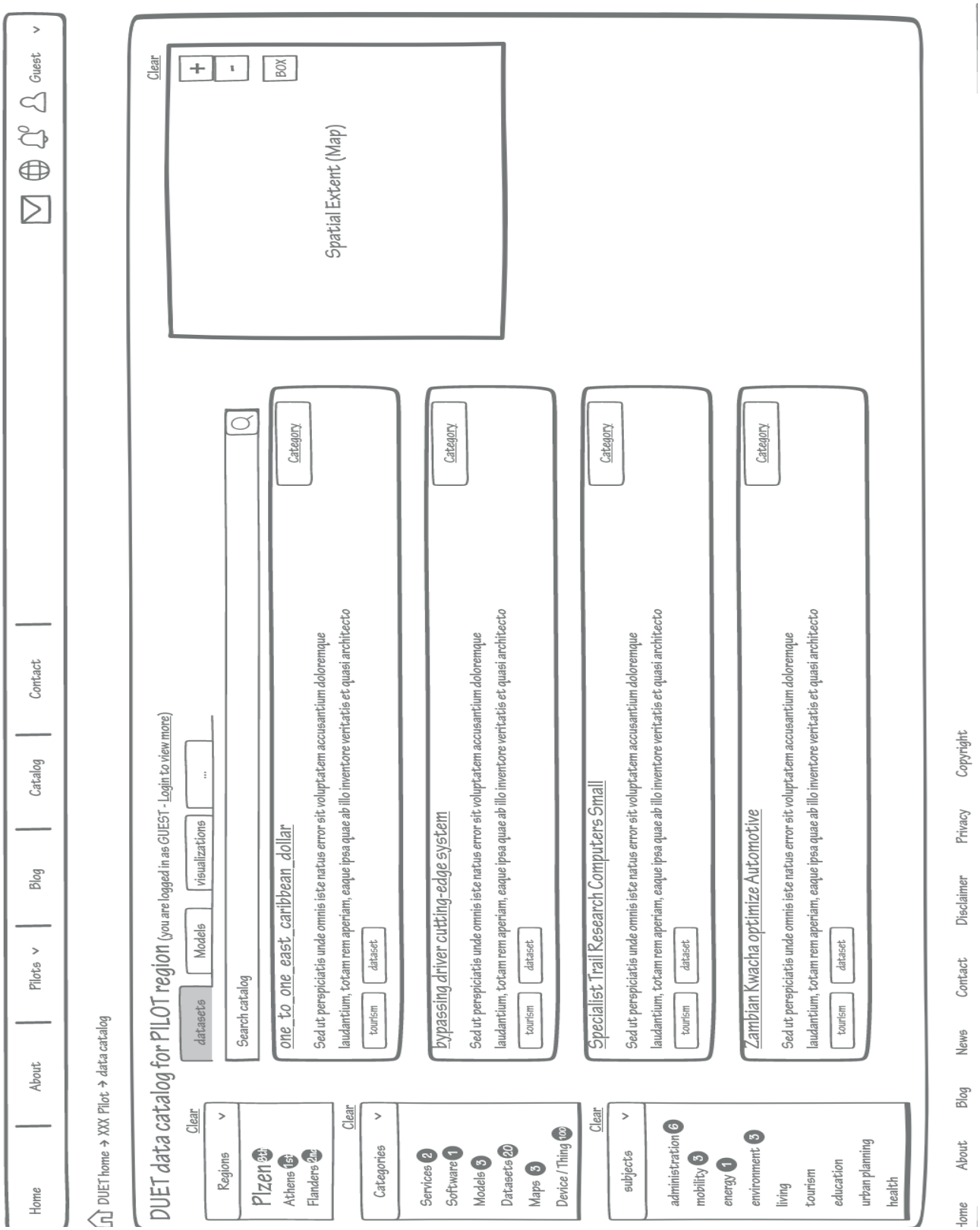
8.1. DUET landing page wireframe



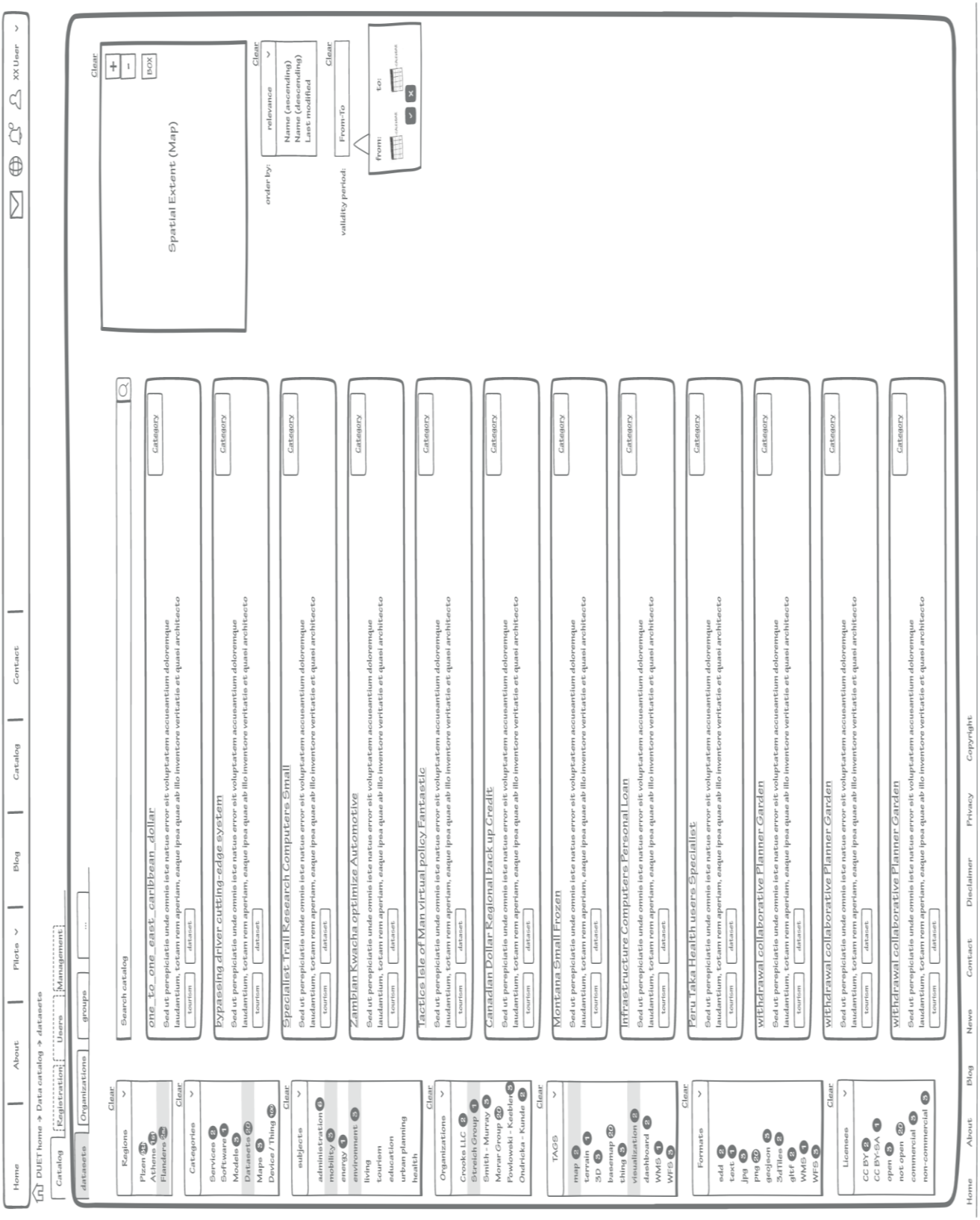
8.2. DUET pilot page wireframe



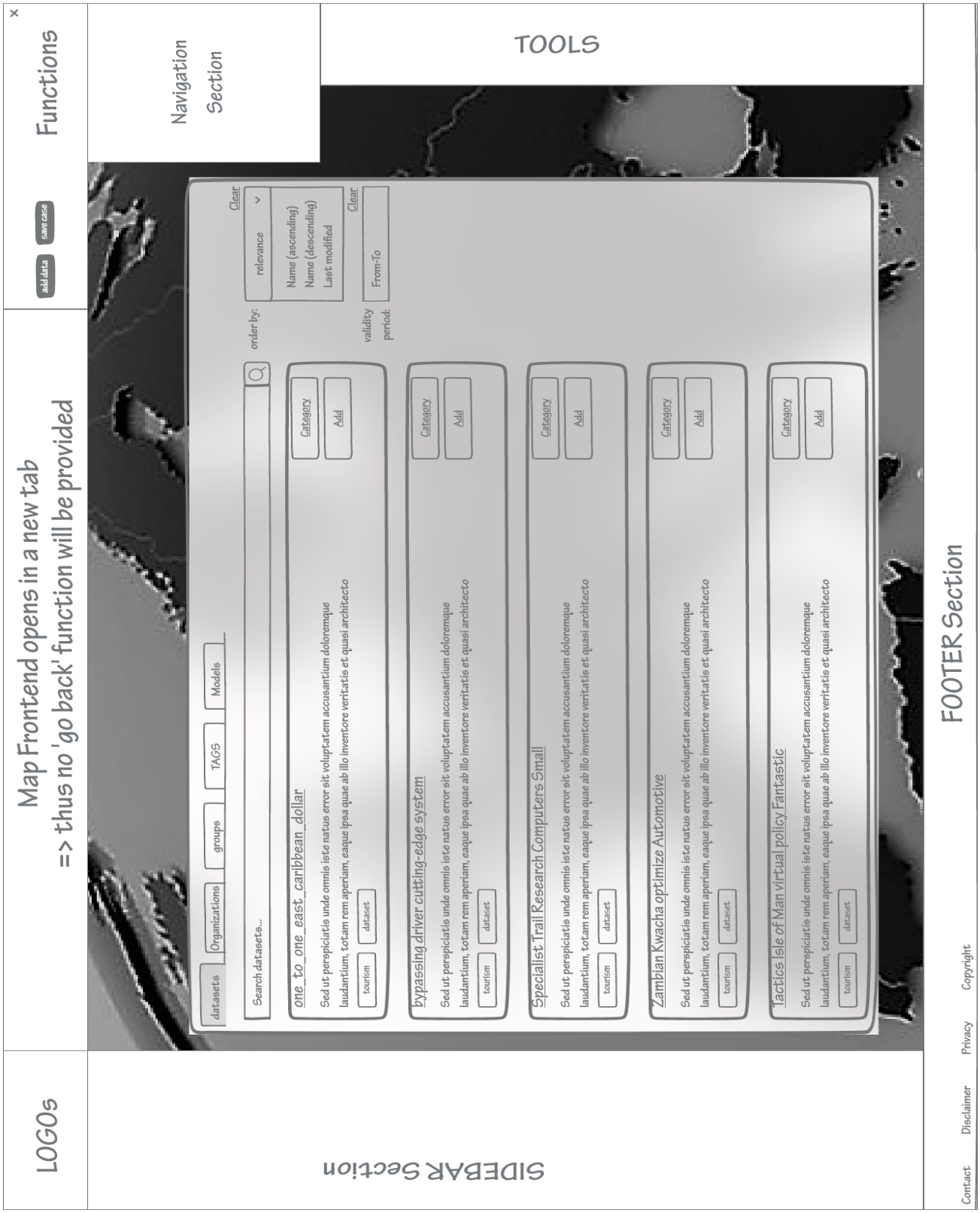
8.3. DUET open catalog component page Wireframe



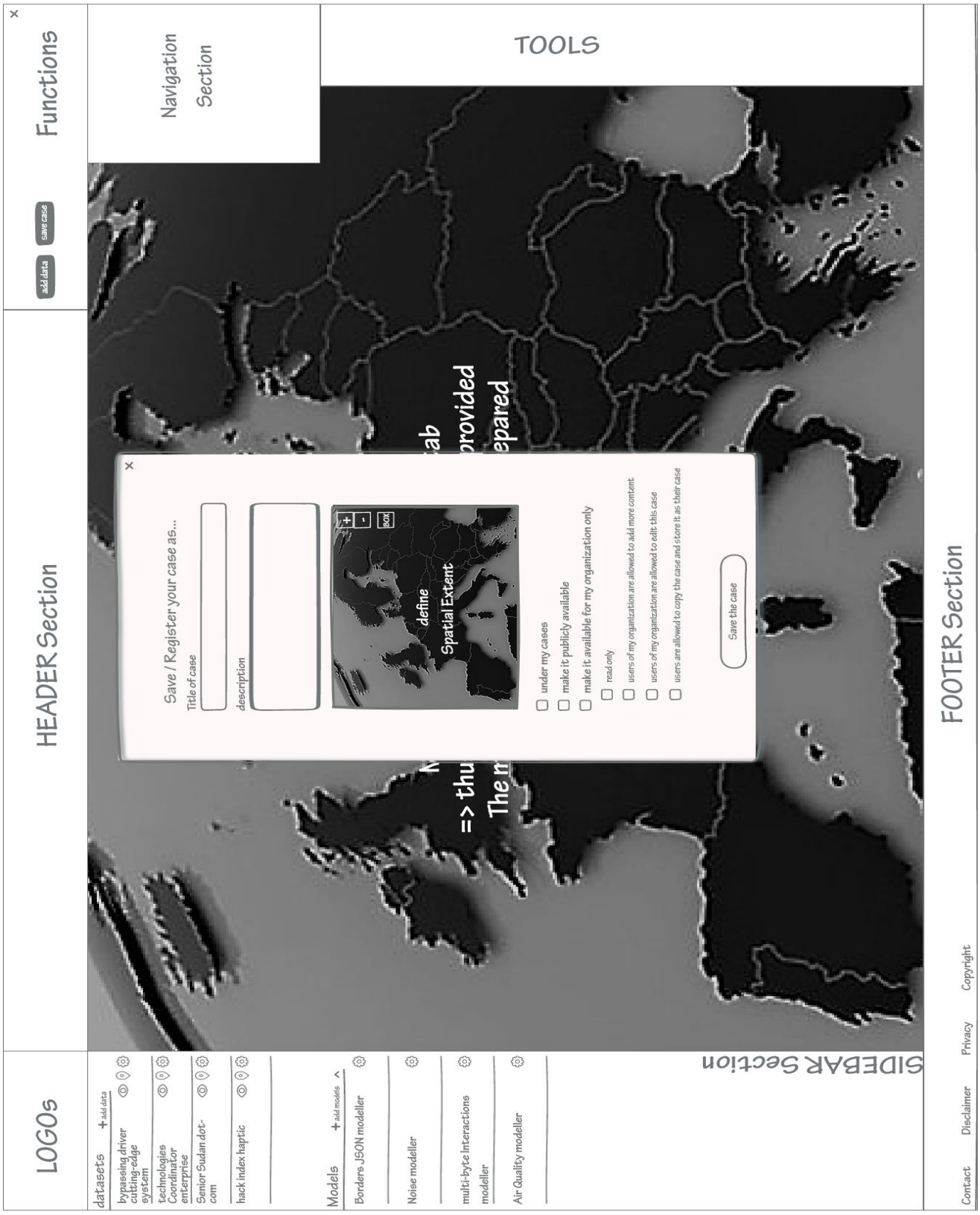
8.4. DUET restricted catalog component page wireframe



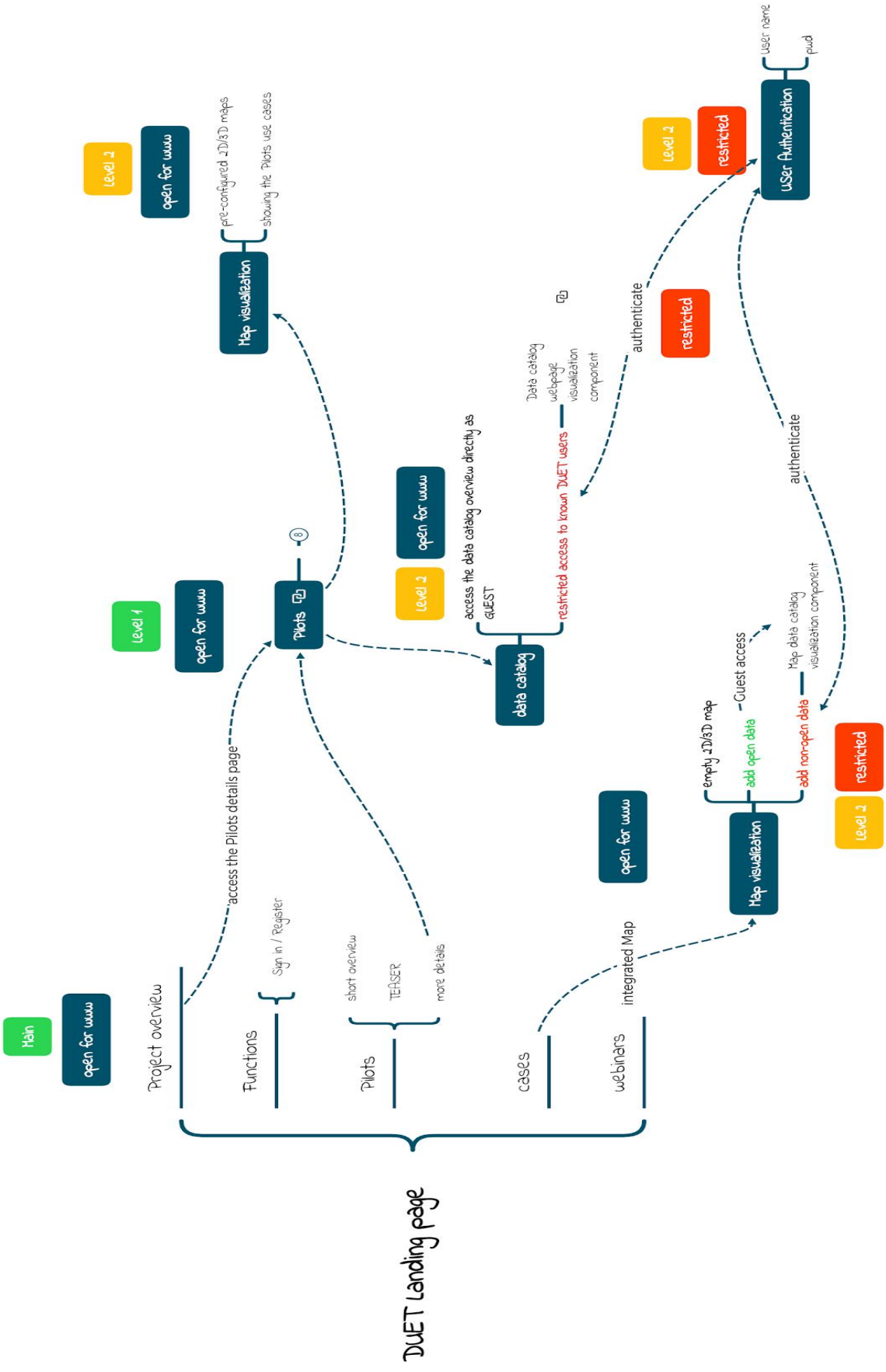
8.5. DUET catalog representation in map visualization component



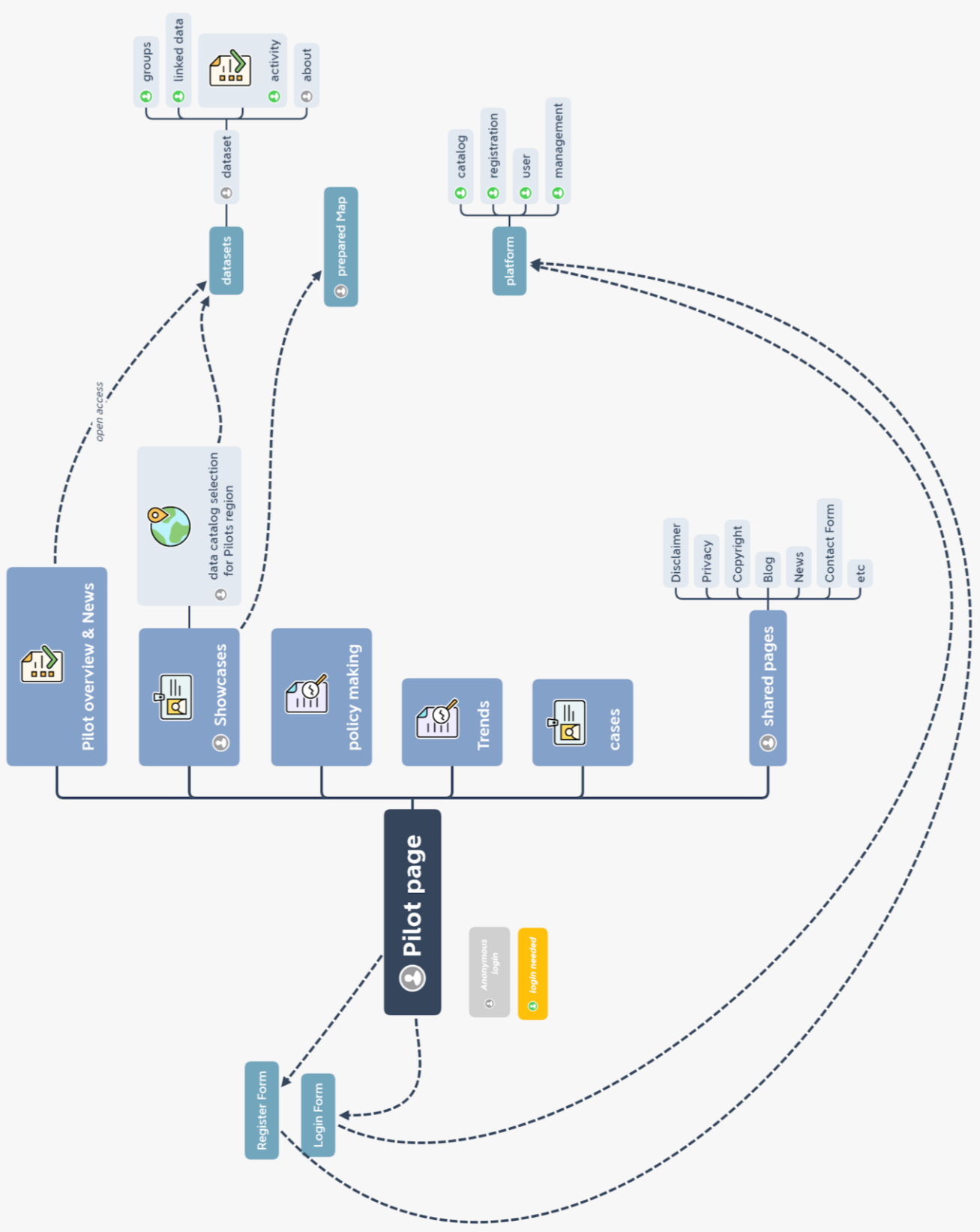
8.6. DUET save case



8.7. DUET landing page hierarchy



8.8. DUET pilot page interaction diagram



8.9. DUET data catalog interaction diagram