INJECT

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# Design specification for creative support for news journalists and consumers

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## Executive Summary

The purpose of this deliverable is to document the INJECT user requirements and to describe the INJECT architecture and design specifications. The goal of the architecture and design specifications is to provide a holistic view on the INJECT software architecture, its building blocks, components, interdependencies among components and associated functionalities. This report provides a specification of the required software behaviour, qualities and characteristics that is consistent with the architecture described in this deliverable.

The architecture identifies the following key components divided into three main layers: (a) User Interaction Layer which comprises a Google Doc interface, a CMS interface and stand-alone version of the INJECT software. (b) Application Layer which implements the core logic capable of providing the INJECT functionalities, algorithms and methods needed to deliver the envisaged functionalities as well as user authentication and authorisation. (c) Data Layer which provides access to internal and external resources and content repositories.

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# 1 Introduction

The present deliverable of the INJECT project is prepared under WP1 and is the main result of the Task 1.1 *Understand and describe journalism work and tools*. In this task, all stakeholders in the INJECT ecosystem participated in agile co-design activities and produced a coherent design specification of new forms of creative support for journalists. The work practices of journalists in the news and media SMEs were observed to determine requirements and potential barriers to software uptake. Key software tools used by journalists have been identified and analysed. Leading stakeholders in the SMEs have been interviewed to understand their strategic needs.

In a development project, the collection of requirements, i.e. requirements engineering, is a collaborative and creative process, based primarily on the needs and domain knowledge of the users, but also on the potential that lies in various technologies and the capabilities of users and developers to see how the technologies can be creatively applied in the domain. Core activities in a process of requirements engineering are *eliciting* requirements, *modelling and analysing* requirements, *communicating* requirements, *agreeing* requirements, and *evolving* requirements (Nuseibeh and Easterbrook, 2000). However this analysis reveals limitations of their scoping of requirements research and practice. For example, the reporting of cognitive psychology addresses problems of tacit knowledge and matching to user models – problems that suggest a process of eliciting and modelling rather than creating requirements. One reason is that Nuseibeh & Easterbrook (2000) frame the requirements problem using already-established processes – eliciting, modelling, analysing, communicating, agreeing and evolving requirements. They appear to have viewed requirements engineering as processes of problem scoping and understanding rather than problem solving. Whilst problem scoping and understanding are important in research-led projects such as INJECT, research-led problem solving is also critical requirements work to ensure scientific advance that still satisfies the requirements of different stakeholder groups.

Therefore, in INJECT, we set up and ran three creativity workshops involving INJECT stakeholders to explore how the requirements of the news and media SMEs can be achieved with the baseline four digital services and tools. During the workshops, the capabilities of these services and tools have been explored to invent unforeseen opportunities for the SMEs, and to adapt the software capabilities in response to the SME needs. To do this we drew on consortium experiences of extending requirements processes with creativity frameworks and techniques (e.g. Maiden et al. 2004, Maiden et al. 2010). In the workshop, various creativity techniques were applied to help the participants generate and select ideas combining needs and solutions. The creativity techniques deployed during the workshops included brainstorming, constraint removal and creativity triggers. Selected ideas were connected in stories and represented as visual desktop walkthroughs and storyboards that depicted how INJECT advances could meet new and discovered requirements from the application partners. The deliverable documents the outputs from the workshops including a set of design scenarios and storyboards that describe how journalists in the participating news and media SMEs will use the new software.

Further, this deliverable gives a bird's eye view on the general architecture of the INJECT software and lays a foundation for the integration of all components which are described through the application scenario requirements. The goal is to provide a high-level overview of the INJECT architecture, describing the key components and outlining the new

functionalities that will be developed in INJECT.

The process to develop the architecture was undertaken in three key stages:

1. The scenarios and storyboard diagrams generated from the creativity workshops, and which define the actor scope for INJECT were used to determine the boundaries for the architecture – which requirements are to be delivered by the INJECT architecture, and which user requirements are to be satisfied through the use of the INJECT solution.
2. The requirements identified during the elicitation process were analysed and, where similarities were identified, aggregated to determine capabilities already provided or required, and the required qualities associated with these capabilities. The requirement aggregations were used to determine the key components of the conceptual architecture in the next stage.
3. The requirements aggregated and linked to architecture components were reviewed to determine their satisfaction of support for prospective users – the requirements that satisfied these core INJECT outcomes were analysed further to determine how the requirements can be satisfied by INJECT software.

This deliverable is organised as follows: A summary of the creative scenarios and associated storyboards are described in section 2. Section 3 outlines the key requirements while section 4 describes the key components of the INJECT architecture and elaborates on the role, responsibility, functionalities of each architecture component. Section 5 describes the software engineering approach and tools that we will use for the delivery of the INJECT software. Finally, section 6 concludes the document with a summary and outlook.

# 2 Creative Journalism Scenarios and Storyboards

Section 2 presents a summary of the journalism scenarios and associated storyboards derived during the creative workshops with the INJECT end users and aim to illustrate the working context which INJECT will leverage.

To ensure the grounding of the discovered requirements in stakeholder needs, we followed the acknowledged approach of acquiring the requirements *with the stakeholders.* This implies a focus on requirements based on linguistic expressions rather than formal specification and validation (Sutcliffe and Maiden, 1993), and use of different media to depict scenarios and actions (Zachos, Maiden and Tosar, 2005). Hence, we relied on scenarios as a powerful antidote to the complexity of systems and analysis, and were deemed to be an effective mechanism to use to discover requirements in INJECT. We sought to understand, scope and describe each of the work contexts of the different journalism SMEs in creativity workshops with the aim of starting the process of thinking more concretely of needs and solutions. In the workshop, various creativity techniques were applied to help the participants generate and select ideas combining needs and solutions. Selected ideas were connected in scenarios and represented as storyboards.

Telling stories about systems helps to ensure that people share a sufficiently wide view to avoid missing vital aspects of problems. Scenarios vary from brief stories to richly structured analyses, but are always based on the idea of a sequence of actions carried out by intelligent agents. People are very good at reasoning from even quite terse stories, for example detecting inconsistencies, omissions, and threats with little effort. These innate human capabilities give scenarios their power, so scenarios were deemed to be useful with the diverse types of stakeholders from the different application domain partners. Indeed, the use of the narrative scenario in complex projects is emerging as a kind of reaction against too much technology, too fast.

In INJECT, we used scenarios to both discover and analyse requirements emerging from the application partners. Using scenarios for analysis can be paradoxical, because analysis is about refinement, precision, and completeness with respect to the parts of a problem. In contrast, scenarios are basically holistic. Whether in terse and summary form, or written out at length in a carefully-studied sequence – or even in a complex analytical framework with multiple paths ingeniously fitted together – the scenario is in essence a single thing that conveys a human meaning enhanced by each reader's own experience. Therefore, each scenario is used to define discrete, contextualised actions that both permitted not only the analysis of requirements associated with these actions, but also the human interpretation of the scenarios to discover and validate requirements.

**Scenario 1: Freelancing Journalism in the Netherlands**

*Description*

First step into writing a new story by a freelancer journalist is the generation of the idea for the news story (Figure 1). The idea needs to be written as a pitch, in no more than two lines. It is of great importance that the idea is secured from the moment it is written down till the publishing of the story. Journalists should not worry about privacy and security issues, i.e. that someone steals their idea.

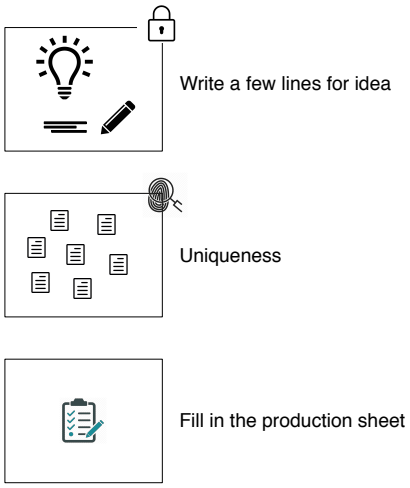



*Figure 1. Into a New Story*

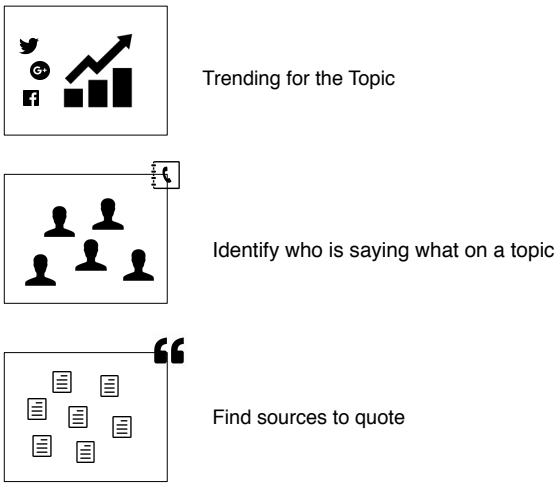



*Figure 2. Trending the Story*

Journalists check their sources to validate if the idea is new. Has the story been published yet? Has the topic been sufficiently covered? Sources to validate the novelty of the idea include Lexis Nexis and Google News.

If the idea is novel and not covered extensively in the press, the production sheet is filled-in. The production sheet is an operational document containing several elements starting from the story title. The title is very important for the success of an article. Journalists often check successful stories to get inspired and create a good title for their story. The title should reflect trending topics, even if these are not linked directly to the new story (Figure 2).

Journalists enter into the production sheet details about known experts in fields relevant to the story at hand. Some of these experts will be interviewed later on. Others will be checked on-line for quotes and viewpoints that can be used in the story (Figure 3). Further, checks need to be made about whether the story fits with the company identity / mission. Other checks include the news pack, which refers to whether the story topic is in the news, if the topic is trending.

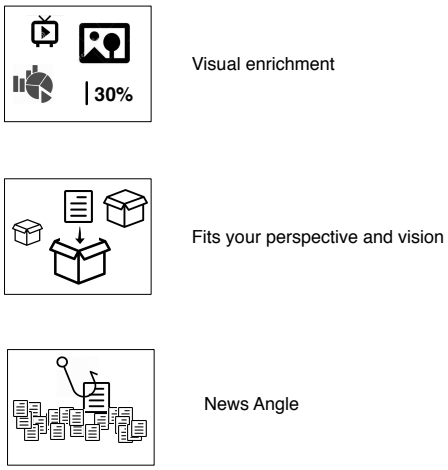



*Figure 3. Looking for Story Angles*

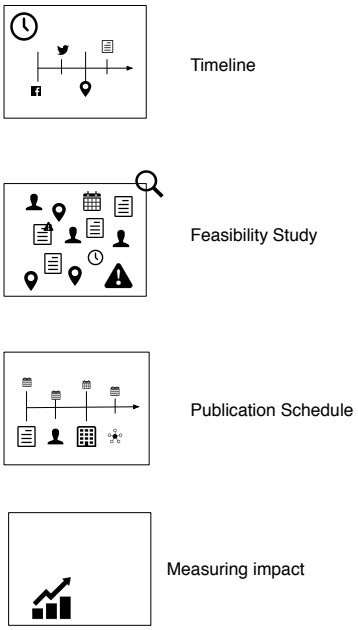



*Figure 4. Finishing up*

The story timeline is then checked in order for the journalist to avoid omissions or mistakes. Feasibility checks are also made: how many days are needed and what are the costs to produce the story? What are the associated risks? E.g., flying to a less safe location. During this phase, the journalist looks for more physical sources and facts, people to interview/quote, perspectives, what is already published, what stats and relevant visuals are available, etc. Finally, the publication schedule is created and search for organisations that can we approached to publish the story is initiated (Figure 4). Key people and editors who would like to publish the story are contacted and hopefully an agreement is reached with a publishing editor.

*Limitations that INJECT can address*

There are currently no tools that can help journalists search simultaneously in well-established and known news sources. Moreover, the widespread use of general-purpose search engines, often used without logging-in, limits the capability of bookmarking and annotating searches so that these can be re-used by fellow journalists. Further, there are currently no tools for helping journalists explore creatively the background events that underpin a story in order to discover new angles to a story, discover statistics and other essential information for a new story, generate information timelines as well as retrieve material such as comical sketches that can be used to illustrate a new story. Another area in which INJECT could contribute is in assessing the impact of news stories. Here, support would be welcome to assess the impact of past stories by measure how much these have been shared in social media, by whom as well as whether they have reached important social media users, so-called “tipping points”.

**Scenario 2: Hordaland Story Development Process**

*Description*

Sara Finne, a journalist in Hordaland, works a lot with articles that's especially written for children. She describes the process she follows to develop a news story:

Every Thursday we have two pages in our newspaper that takes on themes that children care about, and where the children get to speak out. This column is called "Badnateigen", and I would like to show an example of how I made an article for this column for a couple of weeks ago, from idea to print.

In order to get ideas for this column, I follow a lot of the schools in the area on social media. The progress with this article started when I saw this picture (Figure 5), posted on Instagram by a school in a small village called Stanghelle.

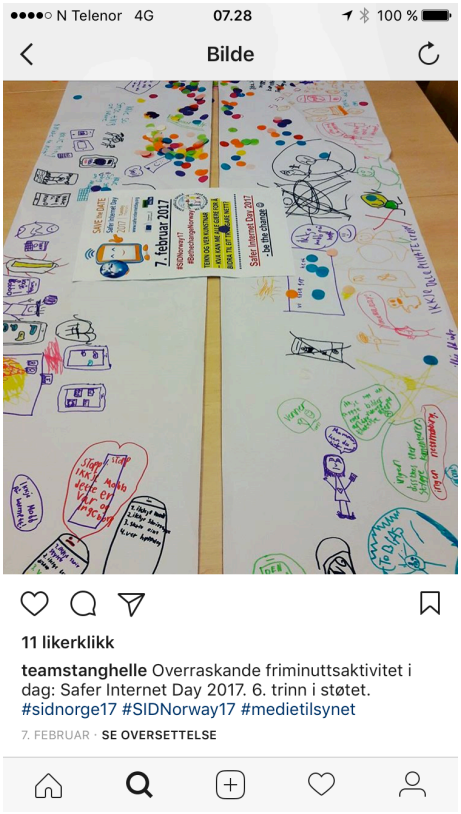



*Figure 5. Instagram photo by a school in a small village called Stanghelle*

In Figure 6, the school informs that they are having a "Safer Internet Day", where they are learning about **safety for kids on the internet, and internet bullying.** When I see this, I get inspired to write an article about this exact theme, and I call the school to get an appointment.

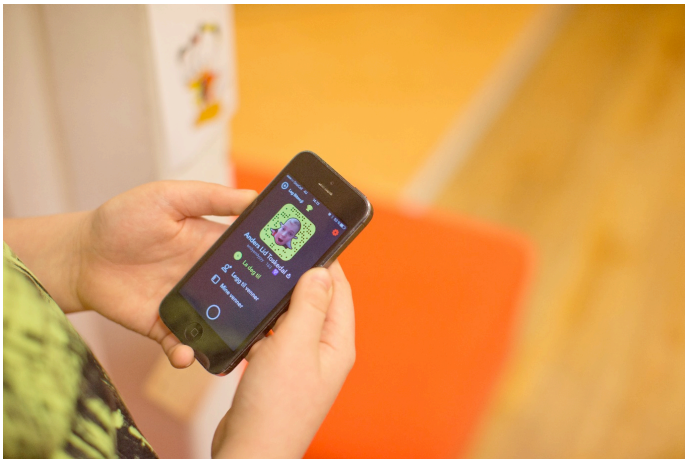
*Figure 6. Safer Internet Day*

The principle says that we can come over the next day to talk to some sixth-graders, and I go there with photographer Ingerid Jordal.


*Figure 7. Anders and Hedda*

When we get to the school, we meet Anders and Hedda, both 11 years old (Figure 7). We make an interview with Anders and Hedda, who tells us a lot about what they have learned on the “Safer Internet Day”. They advice other children to think before they post anything on social media or online, especially pictures. They also talk about how important it is to know who you’re actually talking to online. Anders and Hedda are very conscious about internet safety, and they both have closed profiles on both Instagram and Snapchat.

We also talk to Anders and Hedda about internet bullying, which seems like a bigger and bigger issue for kids nowadays. Anders and Hedda tells us that they have heard of some internet bullying at their school. They even had some bad things written about themselves online that they told us about.



When we got back from the interview, I knew that I had to get some statistics to back up my story about internet bullying and internet safety. After talking to Anders and Hedda, I wanted to find the answer to several questions. How common is internet bullying among kids in Norway?

I google “Internet bullying kids” (in Norwegian) and get a hit on a site called Redd Barna. This is an organization that is working for children’s rights, and I find out that they have gathered some statistics on the subject (Figure 8).

**Fakta om mobbing på nett og mobil**

Medietilsynet siste undersøkelse om norske barns medievaner viste at, blant norske 9-16-åringer:

- Hadde **1 av 4 lagt merke til at noen har blitt mobbet** på nett, spill eller mobil en elle flere ganger i måneden.
- I tillegg hadde **1 av 10** barn **lagt merke til at noen ble utestengt** eller ikke fått delta der andre barn og unge er på nett, spill eller mobil minst hver måned. Jo eldre barn blir, jo mer legger de merke at andre blir mobbet, utestengt eller truet på nett.
- **Hvert fjerde barn** har opplevd at noen har vært slemme med dem eller **mobbet** dem på internett, spill eller mobil en eller annen gang
- **1 av 10 norske 9-16-åringer opplevd dette oftere enn en gang i måneden.**
- **Hvert femte barn** har opplevd at noen har **lagt ut bilder** av dem som gjorde dem triste eller sinte - 4 % av barna opplevde dette mer enn en gang i måneden. Flere jenter opplever dette enn gutter, og flere av de eldre barna har opplevd dette.
- **7 % opplever å bli utestengt på nett og mobil mer enn en gang i måneden**, og mens flere av de unge jentene opplever dette, er det flere av de eldre guttene som opplever å bli utestengt.

> UNICEF Den ene tilbyr nettforedrag om håndtering og forebygging av mobbing

**FOTO:** Redd Barna/Lisbeth Michelsen

Det kan være en stor belastning når mobbing kringkastes på nettet, og det som sies om deg kan ses av jevnaldrende. Samtidig kan det være skjult for voksne, så be om hjelp hvis du har behov for det.

*Figure 8. Discovering supporting statistics*

Here it says that one out of four children between 9-16 years in Norway (that participated in the questionnaire) have experienced internet bullying. It also says that one out of five children had others posted pictures of them that made them angry or sad. 7 % of the children that were asked felt that they were “left out” online more than once a month.

I find these facts and statistics very interesting, and start to incorporate them into my article. I focus on the story about Anders and Hedda, but I use the facts to get a more interesting article. The facts and statistics are also helping to emphasize what they are saying.

On the same website, I also find that the organization of Redd Barna have made a “How to”-list for children on how to behave safely online (Figure 9). I also use some of this in my article.

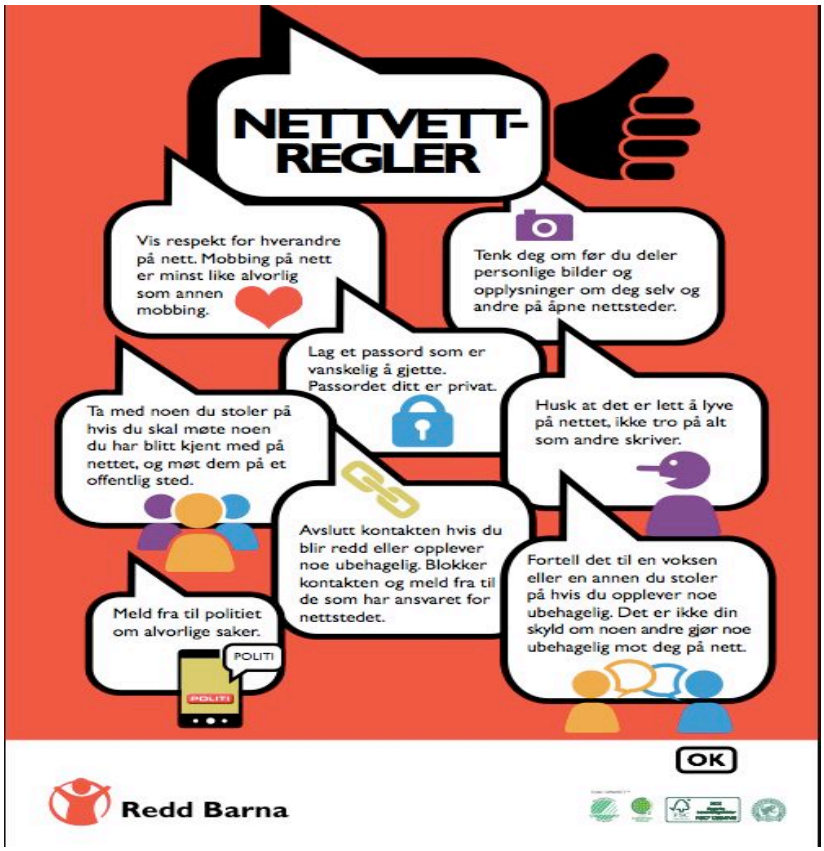



*Figure 9. "How-to" children on-line*

After some hours of writing, I put the whole story together with photographer Ingerid. The pictures are often the first priority, and can influence how the title and article gets angled. We also want it to look appealing for kids, and use a lot of time on the layout. We work tightly with the graphic designers to get the article to look the way we want to, and this is based on cooperation from both sides. When the article is ready for print, it looks like this! Figure 10).


*Figure 10. Finished Story*

If I should put INJECT into this, I would use it in the process when I was looking for facts and statistics on the subject. In this case I already knew that I wanted to write about internet bullying, and the INJECT search engine would therefore enter the process at a later stage. I could use this search engine when I would normally use Google, and if not instead of, at least in addition to. I could combine these to search engines, and hopefully get more hits on interesting statistics, for example. Who knows, maybe the article would get an completely different angle?

*Limitations that INJECT can address*

INJECT is expected to complement and not replace general-purpose, ubiquitous search engines that journalists will continue to use. Important for Hordaland journalists is to have a tool that could help them identify new angles to a story. Although journalists often already know the angle that will be used during the story development process, INJECT can enhance this activity by helping Hordaland journalists find facts and statistics on a particular topic of their story. Finally, INJECT could also fill a gap by helping journalists creatively explore the background events that underpin a story in order to discover a new angle to the story from its background.

**Scenario 3: Reduced postal service in Hallingdølen**

*Description*

Hallingdølen is a Norwegian language local newspaper published in Ål, Norway and serves Hallingdal. Hallingdølen was established in 1936 and founded by community members. The paper is published three times per week and has its headquarters in Ål. It was published in broadsheet format until 1995 when it switched to tabloid format. The following video gives an overview of a typical story development process:

https://www.dropbox.com/s/spx8geerp1d594r/Hallingdolen_news%20story%20development.mp4?dl=0

To illustrate the story development process, let us focus on a storyboard about writing a story about the reduced local post service affecting the local community (Figure 11).


*Figure 11. The Postal Service is reducing delivery in Hallingdølen*

Hence, easy access and search of the newspaper archives is essential before event starting the investigation (Figure 12).

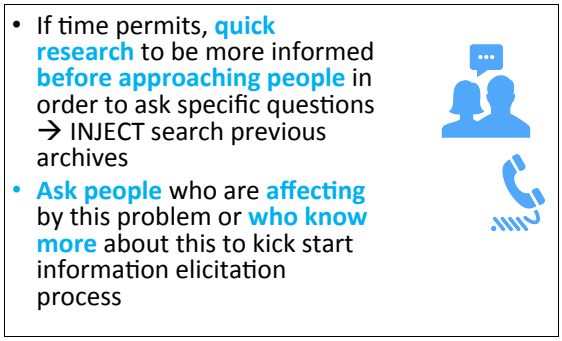



*Figure 12. Establishing Communication*

Once key story components have been identified, the journalist can then start looking for people to contact and interview (Figure 13).

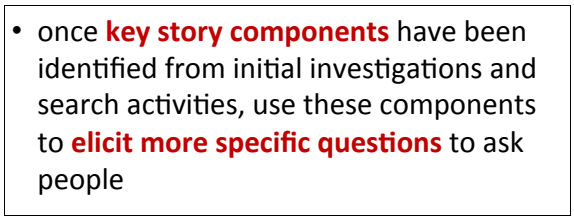



*Figure 13. Detailed Information Elicitation*

In investigating the impact of the reduced post service, the journalists need to find facts such as the number of households affected (Figure 14).

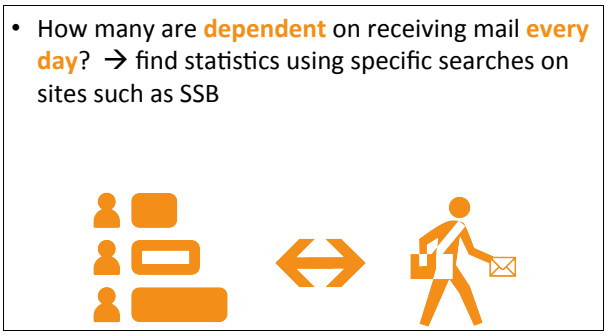



*Figure 14. Supporting with Statistics*

The journalists also needs to find background information that will help her understand the global picture. E.g., How many are dependent on receiving mail every day? Have similar things happened in other countries? What kind of ideology/politics lie behind these reductions in service? etc. (Figure 15)

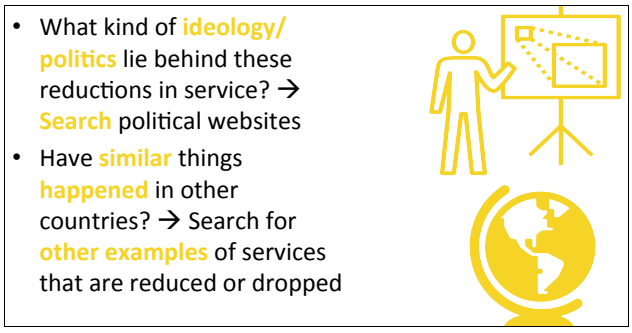



*Figure 15. Providing Background Information*

In the end, the journalists needs to put all information together, report the facts and discuss them in her article (Figure 16).

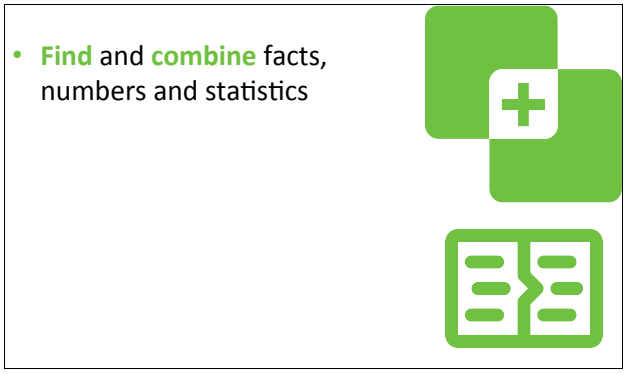



*Figure 16. Combining Information*

*Limitations that INJECT can address*

A main limitation that INJECT is expected to address is the amount of time needed to write a story, from the ideation phase to the published article. In particular, INJECT can accelerate the time needed to investigate the background of a story, without having to spend too much time finding and talking to relevant people. Consequently, it is important for Hallingdølen journalists to be able to search their archives that will provide a key source for information and backing data for new stories. Moreover, Hallingdølen journalists do not have specific tools:

- to search news from major Norwegian and international press as well as specific political web-sites;
- to find statistics, facts and to creatively explore numerical and quantified information about a news story in order to back it up with evidence in new and useful ways;
- to discover and explore information different concept categories such as places, things, people and organisations relevant to the story at hand.

**Scenario 4: Mediehuset Sunnhordland**

*Description*

The editorial team in Sunnhordland receives a tip. The tip is that many minor refugees, which lives in a reception centre in Stord, run away when they turn 18 years. They don`t want to wait until their case appeal (Figure 17).

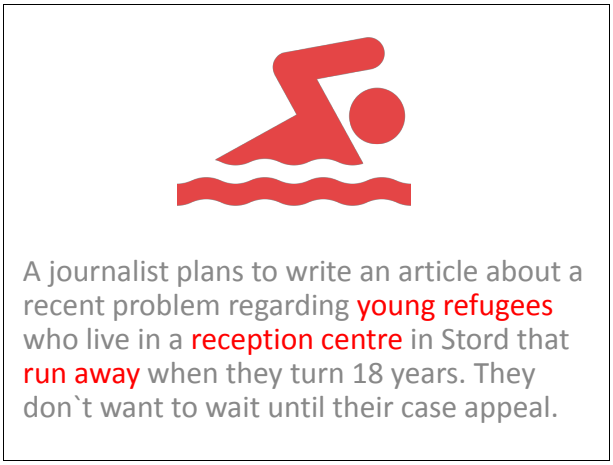



*Figure 17. Writing a story about young refugees*

In a morning meeting, which the newspaper has every day, a journalist is appointed to make a story (Figure 18).


*Figure 18. Reflection*

The journalist calls the manager of the reception centre (Figure 19). She asks him whether he could confirm or tell us something about the tip. How many of the refugees living in the centre, has ran away when they turned 18? He tells the journalist that the number is four. The journalist asks a little bit about which challenges this faces for the centre. The journalist asks if she could visit the centre, and maybe take some pictures of the manager. She drives out to the centre. She makes some interviews, and then she takes a picture of the manager. Then she heads back to the newspaper to write the story.

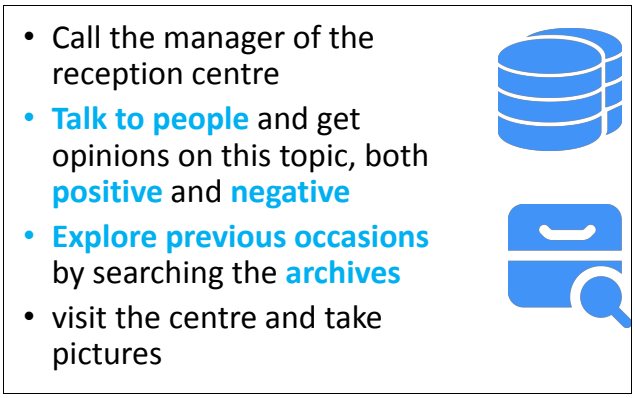



*Figure 19. Communication*

During the writing process, the journalist uses information gathered from the manager. He is also providing the journalist with pictures from some of the refugees who has fled. In this process, she uses mainly information gathered from the manager and his staff (Figure 20). The sharp angle on the story is that many refugees sleep outside, without shelter, in some European capitals.

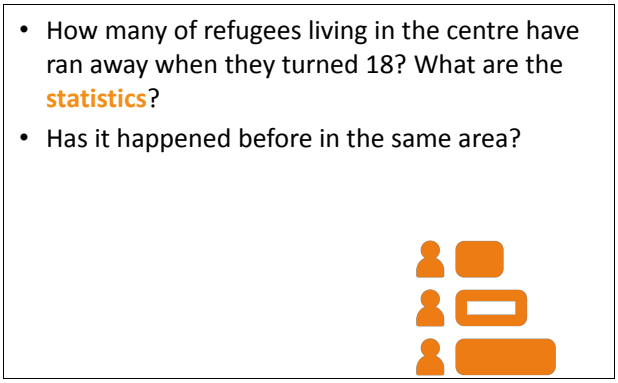



*Figure 20. Statistics*

In making a good story, an experienced journalist will manage to find some points that makes the audience interested. Points that could unveil a problem, which again could make the authorities aware of the problem. Hopefully the story will help raise awareness and eventually do something about the problem.

After the story is written, which is mostly based on information gathered from the manager, the journalist start to discover more about the problem (Figure 21). She googles the internet. Search words, in Norwegian, include “asylsøkjar”, “mindreårig”, “litlabø”. The search engines used are mainly google. There she finds a site called www.globalis.no, a site which gives the reader information about issues. The sites are based on United Nations, World Bank, and other relevant sites. There she finds some interesting facts. In the end, the story ends with two main sources: the manager and the site Globalis.


*Figure 21. Background information*

To make it useful for us in Norway, INJECT needs to be linked to Norwegian sources (Figure 22). It could have an option, where the user could switch between English and Norwegian sources. This would enable us to put a local story in a global context. Moreover, we could manage to put the story into a local and historical context.

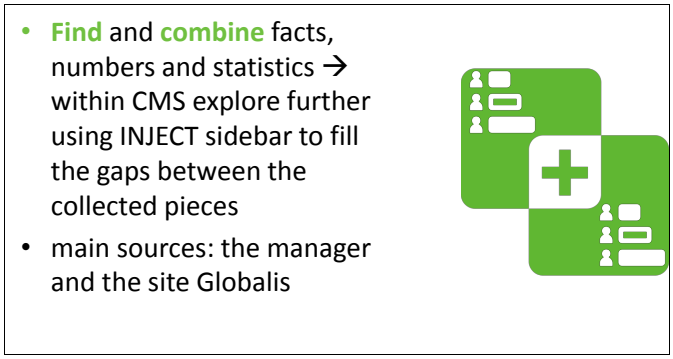



*Figure 22. Finding and combining facts*

Often small newspapers, like HSH, have very limited time to write a story. They have to numerous issues, such as culture, sports, and news of any kind, within a short timeframe. Moreover, often stories are handed out from the editor in chief every day. These activities limit the time for creativity search and new angles on stories. That is why a tool for easy access to information is important to us.

*Limitations that INJECT can address*

Similar to Hallingdølen, INJECT is expected to help Sunnhordland journalists to reduce the amount of time needed to complete a story. To this end, capabilities to search own archives as well as specific political sites are essential. Support for the Norwegian language is expected as well as functionalities that could leverage the identification of new angles for new stories. In addition, there are currently no tools available that specifically help journalists

- to find statistics, facts and numbers that can be used to augment new stories;
- to creatively explore different data sets and visualisations in order to generate new and useful ways about how to display information in a news story to encourage human insight.

# 3 Creative Journalism Requirements

Table 1 lists the requirements elicited from the participating journalism SMEs through the scenarios described above. Each requirement is mapped to the user scenario it relates to. Moreover, requirements have been evaluated based on their importance for the end users. Finally, requirements are commented and explained.

*Table 1. Creative Journalism Requirements*

| Functional Requirement | User Scenario | Ranking by journalists | Notes |
|---|---|---|---|
| 1. Individuals: creatively explore different human angles in a news story based on the different people and roles associated with the story. | 1, 2, 3, 4 | 1st place | This requirement focuses on presenting creative human angles to journalists, i.e. the names of identified individuals with distinct angles on the story, in a random order, to encourage the journalist to explore creatively the information about these angles. |
| 2. For each article extract and present different concept categories such as places, things, people and organisations. | 1, 3, 4 | 1st place (tied) | Presenting relevant information pertinent to the story in a structured manner. |
| 3. Search private news archives. | 1, 2, 3, 4 | 2nd place | Provided there exist means to access archives programmatically. |
| 4. Quantifiable elements: creatively explore numerical and quantified information about a news story in order to back it up with evidence in new and useful ways. | 1, 2, 3, 4 | 2nd place (tied) | Finding and presenting quantifiable information and data. |
| 5. Data visualizations: creatively explore different data sets and visualisations in order to generate new and useful ways about how to display information in a news story to encourage human insight. | 1, 3, 4 | 2nd place (tied) | Visualising relevant quantifiable information. |
| 6. Search additional web news sources, upon request. | 1, 2, 3, 4 | 3rd place | The system should be easily extensible to accommodate additional news sources. |
| 7. Bookmark search results and categorise bookmarks using tags. | 1 | 3rd place (tied) | This requirement includes the capability to log in the system with personal or institutional accounts and to allow bookmarking and annotating searches for future reference. |
| 8. Causal: creatively explore the background events that underpin a story in order to discover a new angle to the story from its background. | 1, 2, 3, 4 | 3rd place (tied) | This requirement focuses on presenting background, causal events and information underpinning a story. |
| 9. Search for topic timeline. | 1 | 3rd place | Presenting a timeline view of the events |

| | | | |
|---|---|---|---|
| | | (tied) | that lead to the current affairs. |
| 10. Generate search queries for news information to stimulate journalists to create new story angles. | 1, 2, 3, 4 | 4th place | This requirement includes the need to integrate INJECT search capabilities with a commonly used CMS editor as well as the need for a stand-alone INJECT version. |
| 11. Rank articles in provided sources by social media impact. | 1 | 5th place (tied) | This requirement refers to the capability to rank articles in provided sources by social media impact, where social media impact is related to the number of Likes / Shares. |
| 12. Find in Facebook and Twitter accounts content that relates to topics and have links to articles published in specific sources. | 1 | 5th place (tied) | Search Facebook and Twitter for recent, relevant to the a topic posts and tweets. |
| 13. Search well-established and known news sources. | 1, 2, 3, 4 | 6th place | Including non-English sources. |
| 14. Quirky: creatively explore unusual or comical information about a story as a means of using wit to report serious news. | 1 | 6th place (tied) | Suggesting a funny angle to a story. |
| 15. Rank "tipping points" based on the number of re-tweets and favourites. | 1 | 7th place | Tipping points are twitter users that generate significant impact by re-tweeting articles. |

Table 2 lists the non-functional requirements deemed important by journalists.

*Table 2. Non-functional requirements*

| Non-Functional Requirement |
|---|
| 1. Accessible from desktops, tablets and smartphones. |
| 2. Interoperability with popular editors. |
| 3. Support for different languages. |
| 4. Enhanced usability and gentle learning curve. |
| 5. Performance on par with UX standards. |
| 6. User authentication with support for team accounts. |

# 4 Design Specification of the INJECT Solution

In this section, we report a first version of the technical architecture for INJECT that specifies the architectural structures, the underlying key components, their design specifications as well as the relationships between them.

**The INJECT Architecture Approach**

The approach of the INJECT architecture is to direct attention at an appropriate decomposition of the INJECT system without delving into the details of interface specification. Key constructs are identified, including significant architectural elements such as components and relationships among them, as well as architectural mechanisms that address cross-cutting concerns. Different architectural approaches exist (e.g. (Ogush et al., 2000, Malan and Bredemeyer, 2006, Grace et al., 2008) that yield differing degrees of fit to various system requirements, where modeling and evaluating alternatives, and analysing trade-offs among them, are an important part of the structuring phase.

In INJECT, during the construction of the architecture, we focused on architecturally significant requirements and adopted the method of describing architectural components as outlined in Malan and Bredemeyer (2006). We also put emphasis on providing rationales for all parts of the architecture and address cross-cutting concerns that will become important for subsequent development of all INJECT services and tools. In particular, the architecture activities included:

1. *Architectural Requirements*: The architecture started with identifying architecturally significant requirements. Section 2 provided a description of the process of user requirements analysis and specification.
2. *Architecture Specification*: Describing the requirements gave us the basis for creating the components of INJECT's architecture. Each component is described in terms of its responsibilities and rationale. A component's responsibilities are those pieces of work that the component executes as part of the solution. The rationale records the reasons and decisions that have led to the component.
3. *Architecture Validation*: Architecture assessment involved "thought experiments", modeling and walking-through application scenarios that exemplify requirements, as well as assessment by both application and technical partners who looked for gaps and weaknesses in the architecture.

The resulting first version of the architecture is presented in the following sections and covers the key components, their relationships and externally visible properties, the key mechanisms, and how they interact.

**Components**

An overview of the conceptual architecture is shown in Figure 24. The architecture is divided into three main layers:

- *User Interaction Layer*. Users will interact with the INJECT system through User Interfaces belonging in the User Interaction Layer.
- *Application Layer*. The application layer describes the key architecture components, their high-level functionality and interdependencies that will support journalists to undertake creative story-writing activities.

- *Data Layer*. The data layer provides access to internal and external resources and content repositories.

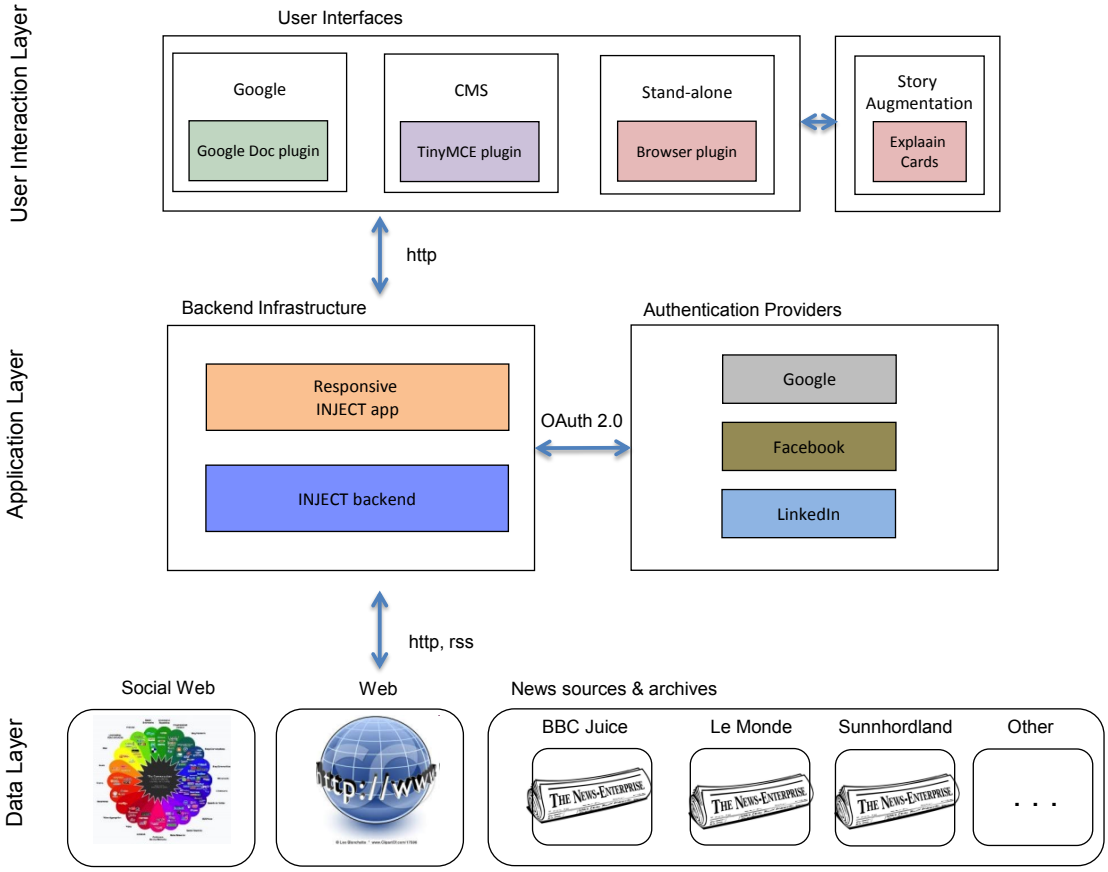



*Figure 24. INJECT Architecture*

To cater for the diverse needs of a large number of journalists participating in the INJECT ecosystem and operating in different environments (newsroom, freelancing, etc.), the user interaction layer of the architecture specifies three different user interfaces through which the INJECT functionality will be provided:

1. Google Doc interface, which provides the INJECT functionalities through a plug-in / sidebar and exploits Google Doc as the editor for creating, editing, storing and deleting news stories. A Google Doc interface is expected to serve freelancing journalists (e.g., see scenario 1) who are accustomed to the free on-line editing tools provided by Google and wish to have easy access to INJECT functionalities.

2. CMS interface, which provides the INJECT functionalities through a TinyMCE plug-in / sidebar and exploits TinyMCE as the editor and associated popular CMSs such as Wordpress for creating, editing, storing and deleting news stories. This interface is expected to serve journalists working in newsrooms and are accustomed to write their articles in CMSs. TinyMCE has been selected because it is among the most popular CMS editors and in use by most INJECT use case partners.

3. Stand-alone interface, which provides the INJECT functionalities via a browser-

displayed sidebar and allows journalists to use the INJECT functionalities and interact with desktop editing tools such as Microsoft Word using standard operating system capabilities. This interface is expected to serve casual or first time INJECT users such as new members of the INJECT ecosystem.

The application layer of the conceptual architecture identifies two key components:

1. Backend infrastructure, which implements a responsive user interface logic capable of providing the INJECT functionalities, through the user interaction layer components, to mobile, tablet and desktop devices. Moreover, the backend component implements the algorithms and methods needed to deliver the envisaged functionalities.
2. Authentication Providers, which are external web sites (Google, Facebook, LinkedIn) used to authenticate INJECT users programmatically using the OAuth 2.0 protocol.

The data layer of the conceptual architecture consists of local content repositories, which are physically part of the INJECT system as well as web and social media sources:

1. Web and Social Media sources include relevant, on-line resources that can be accessed programmatically for content search and retrieval by INJECT. Examples include the web sites of Le Monde, BBC as well as popular social media such as Twitter and Facebook.
2. News sources and archives, which are proprietary repositories of media and articles used by the INJECT participating journalism SMEs and other third party repositories.

**Design Specifications**

### 4.1.1 User Interaction Layer

Inject will be available as a GoogleDoc plug-in and as a TinyMCE plug-in. The latter allows for incorporation of INJECT capabilities in many popular CMSs used in newsrooms which are interoperable with TinyMCE. There will also be a stand-alone INJECT version, accessible through a standard web browser. Figure 25 and Figure 26 show mock-ups of the GoogleDoc and TinyMCE plug-ins, respectively, using screenshots of the currently available tools.

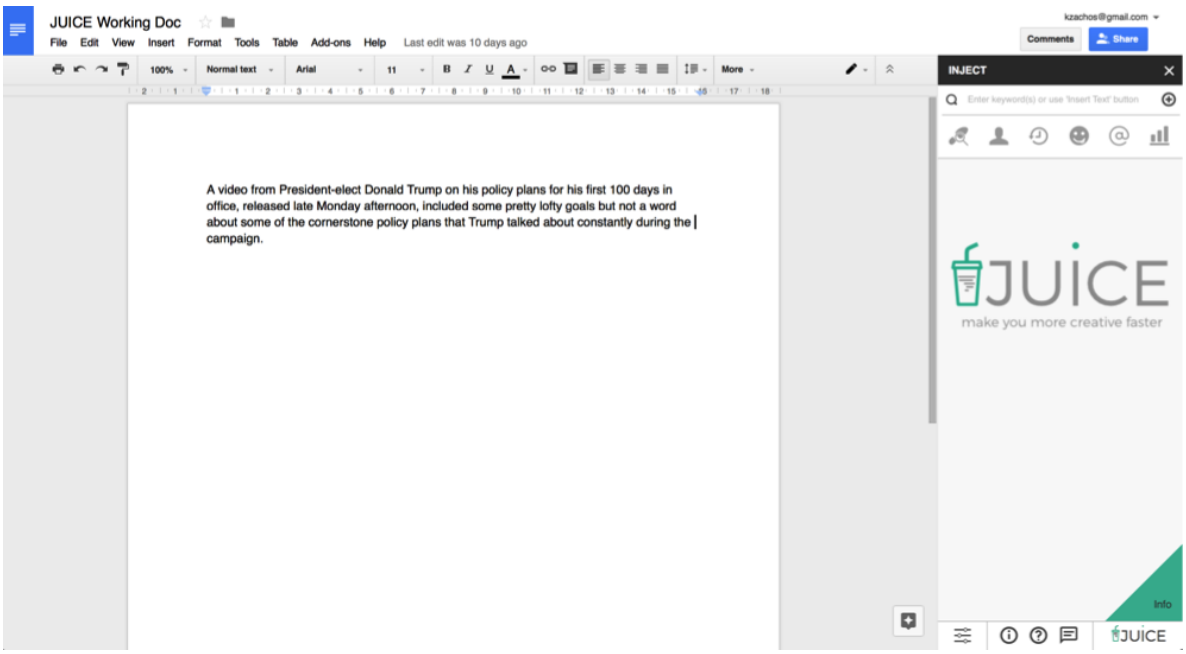



*Figure 25. Google Doc Plugin Mock-up*

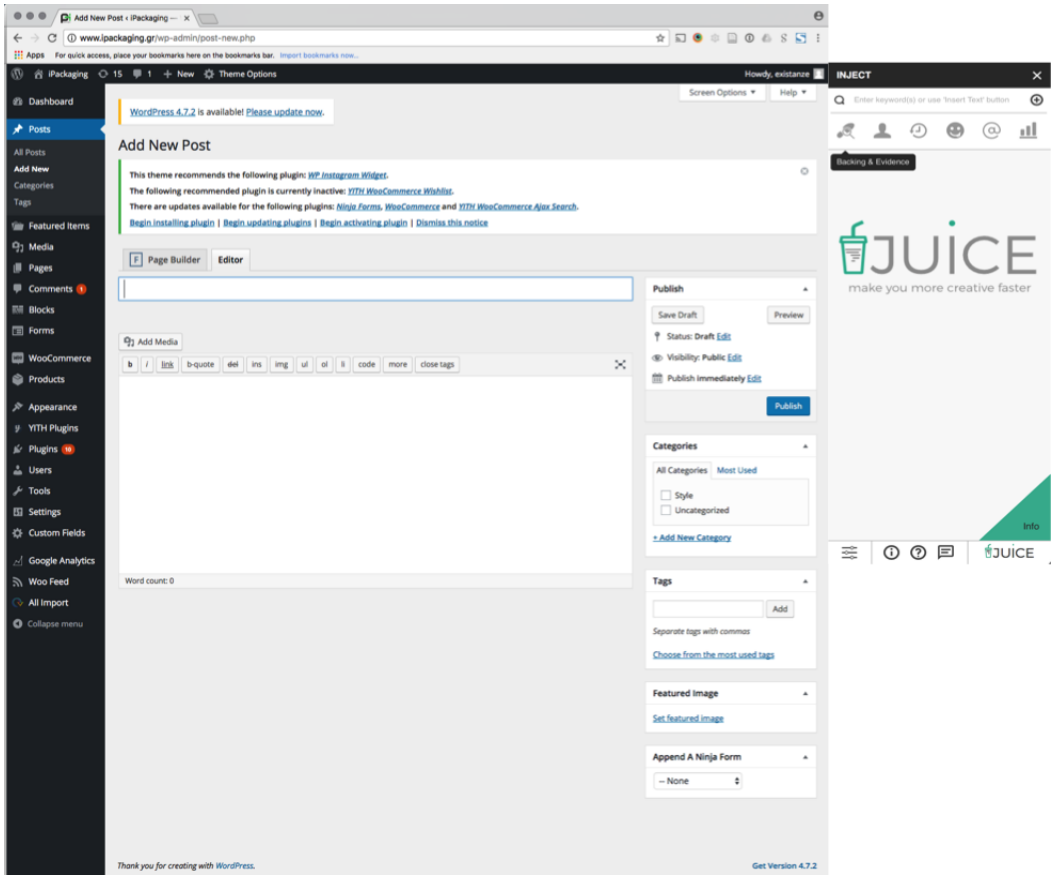



*Figure 26. CMS/TineMCE Plugin Mockup*

The INJECT sidebar will be able to open and close at any time without affecting document editing.

### 4.1.2 Application Layer

| Component | Functions | Notes / Mapping to requirements | Leading Partner | Delivery Date |
|---|---|---|---|---|
| Responsive INJECT app | Capability to display INJECT app in various display sizes | Support for desktop, tablets and smartphones (non-functional requirement 1) | CITY | M6 |
| | Capability to initiate search by highlighting text in editor | GoogleDoc and TinyMCE versions, only (non-functional requirement 2) | CITY for GoogleDoc<br>ICCS for TinyMCE | M6 |
| | Capability to initiate search by entering search terms directly into the search box. | In support of functional requirement 1, 3, 4, 6 and 13 there will be six creative search dimensions to open up possible new angles on a story:<br>Individuals – Who are the key players? The viewpoint of an individual.<br>Backing & Evidence – Quantitative evidence (e.g. numbers and measures).<br>Causal - The background, the history, what caused something.<br>Quirky – Satire, not the obvious (cartoons).<br>Ramifications – What for the future?<br>Data visualisations – Charts and infographics. | CITY | M6<br>(M12: ramifications and visualisations) |
| | Capability to find and display article-related information as cards | In support of functional requirement 2, for each article the component will extract and present different concept categories such as places, things, people and organisations. | Explaain | M6 |
| | Setting advanced search options | This supports functional requirements 1, 8, 9, 10 by providing the following capabilities:<br>Search strategy: a. Strict to find news that contains ALL of the specified terms OR b. Relaxed to find news that contains SOME of the specified terms to expand your search space.<br>Publish date – Find news that was written in the past 48 hours, past week, past month, past 6 months or past year.<br>News sources – Select publications e.g., from Europe, USA & Canada, Australia & New Zealand. | CITY | M6 |
| | Bookmark search | Addressing functional requirement 7 | CITY and ICCS | M6 |

| | | | | |
|---|---|---|---|---|
| | results and categorise bookmarks using tags. | and aiming at enhanced usability (non-functional requirement 4). | | |
| INJECT backend | Index and structure news sources and archives | Care will be taken to ensure good performance and scalability of index and search (non-functional requirement 5). | CITY | M6 |
| | Capability to group news sources and archives by team | Addressing non-functional requirement 6: User authentication with support for team accounts. | CITY | M6 |
| | Parse text in editor, highlight specific keywords and display keyword description as cards | GoogleDoc and TinyMCE versions, only (non-functional requirement 2) | Explaain | M12 |
| | Retrieve quantifiable and visual elements | Functional requirement 5. | CITY | M12 |
| | Retrieve quirky elements | Functional requirement 14. | CITY | M6 |
| | Process non-English content | Non-functional requirement 3. | CITY | M6 |
| | Rank articles in provided sources by social media impact. | Functional requirement 11. | ICCS | M12 |
| | Rank “tipping points” based on the number of retweets and favourites. | Functional requirement 15. | ICCS | M12 |
| | Find in Facebook and Twitter accounts content that relates to topics and have links to articles published in specific sources. | Functional requirement 12. | ICCS | M12 |
| Authentication | Capability to authenticate (login) users using their Google, Facebook or LinkedIn accounts | Non-functional requirement 6. | ICCS | M6 |

### 4.1.3 Data Layer

The INJECT data layer will tap into the resources and archives listed in Table 3. The INJECT data layer will be extensible and will facilitate access to additional resources and archives upon request.

*Table 3. INJECT Web repositories and archives*

| **Source** | **Country** |
|---|---|
| BBC | UK |
| Quartz | UK |
| The Guardian | UK |
| Telegraph | UK |
| FT | UK |
| The Times | UK |
| Sky News | UK |
| The Independent | UK |
| The Huffington Post | UK |
| The Huffington Post | US |
| Reuters News | UK |
| The Economist | UK |
| The New York times | US |
| Daily Mail | UK |
| The Wall Street Journal | US |
| The Washington Post | US |
| The Metro | UK |
| Herald Scotland | UK |
| Bloomberg | US |
| The Scotsman | UK |
| The Irish Times | Ireland |
| Irish Independent | Ireland |
| New Statesman | UK |
| Newsweek | US |
| The Daily Beast | US |
| Times Education Supplement | UK |
| BBC Mundo | UK |
| El Mundo | Spain |
| El Pais | Spain |
| Cinco Dias | Spain |
| CNN | US |
| CNN Money | US |
| London Evening Standard | UK |

| | |
|---|---|
| Birmingham Post | UK |
| Birmingham Mail | UK |
| Farming Life | UK |
| Belfast Telegraph | UK |
| Yorkshire Post | UK |
| Yorkshire Evening Post | UK |
| Manchester Evening News | UK |
| South Wales Evening Post | UK |
| Irish Examiner | Ireland |
| Herald Scotland | Scotland |
| The Mirror | UK |
| The Irish Sun | Ireland |
| Irish Daily Star | Ireland |
| The Sun | UK |
| Daily Star | UK |
| Daily Record | UK |
| Daily Express | UK |
| Los Angeles Times | US |
| Chicago Tribune | US |
| The Onion | US |
| Forbes | US |
| Fox News | US |
| Herald Tribune [International NY Times] | US |
| ABC News | US |
| Buzzfeed | US |
| Newsmax Media | US |
| U.S. News and World Report | US |
| The Globe and Mail | Canada |
| Toronto Star | Canada |
| New Zealand Herald | NZ |
| Dominion Post | NZ |
| The Sydney Morning Herald | Australia |
| The Brisbane Times | Australia |
| Herald Sun | Australia |
| The Daily Telegraph (Australia) | Australia |
| The Courier-Mail | Australia |
| Bangkok Post | Thailand |
| Jakarta Globe | Indonesia |
| South China Morning Post | Hong Kong |

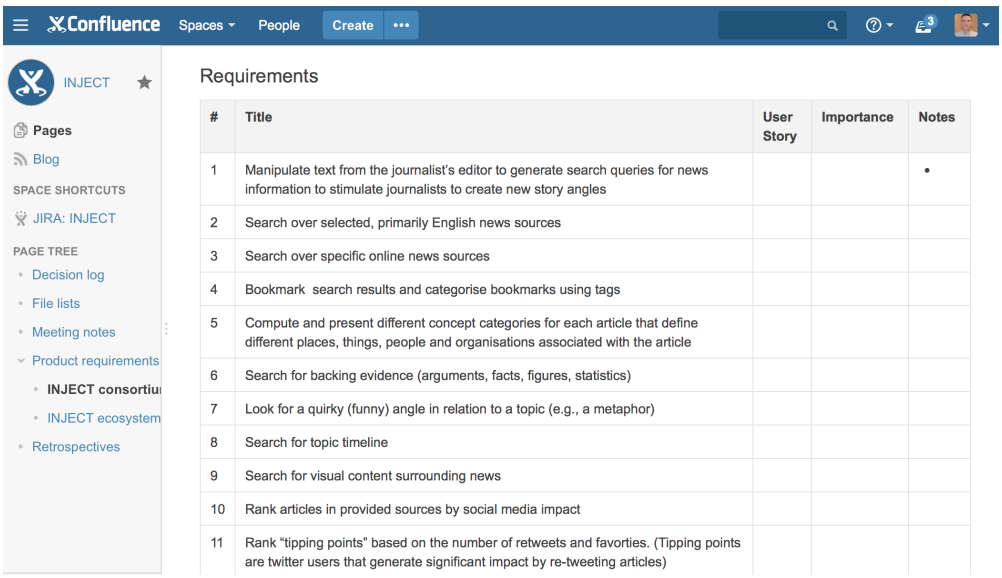
| | |
|---|---|
| Der Spiegel International | Germany |
| Ekathimerini | Greece |
| Dutch News | Netherlands |
| Krakow Post | Poland |
| Portugal Resident | Portugal |
| The Local Newspaper | Sweden |
| Connexion Newspaper | France |
| Le Monde | France |
| Le Monde Diplomatique | France |
| EuroFora | EU |
| Friedl News | Austria |
| New Europe | Belgium |
| Copenhagen Post | Denmark |
| News of Iceland | Iceland |
| Finnbay Newspaper | Finland |
| North Cyprus News | Cyprus |
| Prague Daily Monitor | Czech Republic |
| Daily News Egypt | Egypt |
| The Punch | Nigeria |
| Business Day Live | South Africa |
| Independent Newspaper | South Africa |
| Mail and Guardian | South Africa |
| Bhutan Observer | Bhutan |
| Financial Express | India |
| Business Standard | India |
| Economic Times | India |
| The Indian Express | India |
| Live Mint [INDIA] | India |
| Stavanger Aftenblad | Norway |
| Bergens Tidende | Norway |
| Dagbladet | Norway |
| Verdens Gang (VG) | Norway |
| Dagens Næringsliv | Norway |
| NRK | Norway |
| Aftenposten | Norway |
| Le Figaro | France |
| BFMTV | France |
| Le Parisien | France |
| Le Express | France |

| | |
|---|---|
| L'OBS | France |
| Le Point | France |
| Les Echos | France |

# 5 Software Engineering and Collaboration

## Overview

This section describes the tools that the INJECT technical partners will use to facilitate software engineering and collaboration during the project lifecycle. It covers source control management, continuous integration build environment as well as issue tracking and team collaboration.




| # | Title | User Story | Importance | Notes |
|---|---|---|---|---|
| 1 | Manipulate text from the journalist's editor to generate search queries for news information to stimulate journalists to create new story angles | | | • |
| 2 | Search over selected, primarily English news sources | | | |
| 3 | Search over specific online news sources | | | |
| 4 | Bookmark search results and categorise bookmarks using tags | | | |
| 5 | Compute and present different concept categories for each article that define different places, things, people and organisations associated with the article | | | |
| 6 | Search for backing evidence (arguments, facts, figures, statistics) | | | |
| 7 | Look for a quirky (funny) angle in relation to a topic (e.g., a metaphor) | | | |
| 8 | Search for topic timeline | | | |
| 9 | Search for visual content surrounding news | | | |
| 10 | Rank articles in provided sources by social media impact | | | |
| 11 | Rank "tipping points" based on the number of retweets and favorties. (Tipping points are twitter users that generate significant impact by re-tweeting articles) | | | |

*Figure 27. Confluence Team Collaboration*

Team collaboration is supported with Confluence (Figure 27), a team collaboration software written in Java. Confluence provides project and task management support, file sharing capabilities, support for organising, tracking and reviewing decisions as well as collaborative spaces for shared documentation.

The INJECT development is a continuous process which contains all required discrete steps that re-assure quality during the entire lifetime of the project. This process is supported by the following functional components a) Source-Code-Versioning/Management, b) Continuous Integration and c) Issue/Bug Tracking. Each part of the circle is supported by the following tools: a) Bitbucket for Source Versioning, b) Bamboo for Continuous Integration, c) Jira for Issue Tracking. In the following sections we will elaborate on these tools.

## Version Control

There are several factors to be considered when selecting a version control system like speed, functionality, and the learning curve associated with the system. In the context of INJECT, greater priority is assigned to speed and flexibility. Due to the nature of the project, branches should be created, managed and merged constantly. This happens whenever a new feature is introduced, a bug is fixed or an enhancement is applied. As such, branch management should be inexpensive in terms of time and space consumption. Developers are not centrally placed, but dispersed throughout many countries. As such, code decoupling

to a central repository is vital and therefore no client-server solution can be followed. Therefore the consortium has selected Bitbucket is a web-based hosting service for revision control (Figure 28).

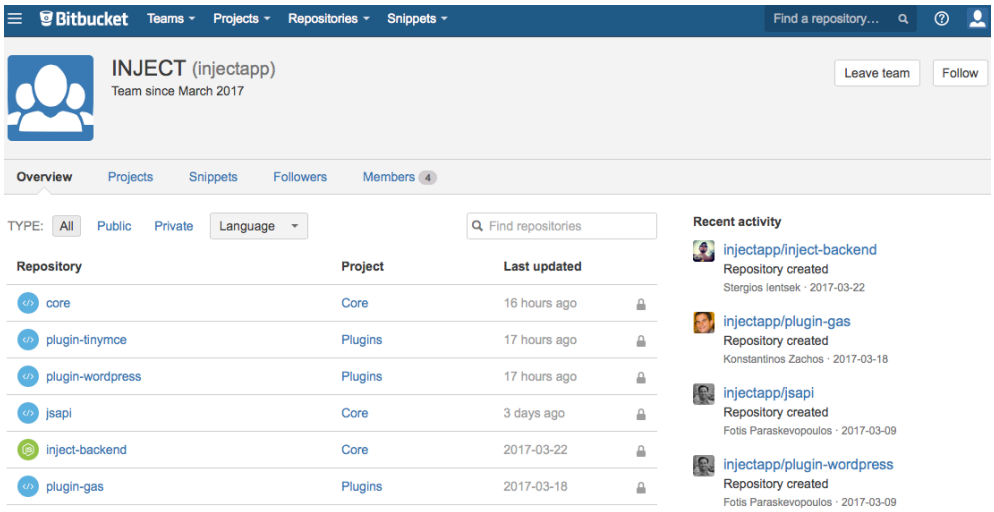



*Figure 28. Bitbucket repository*

## Continuous Integration

Beyond the version control system, in the frame of the project automatic builds will be supported. This process is addressed as continuous integration (CI) and will be supported by CircleCI. Builds can be started by various means, including scheduling via a cron-like mechanism, building when other builds have completed, and by requesting a specific build URL (Figure 29).

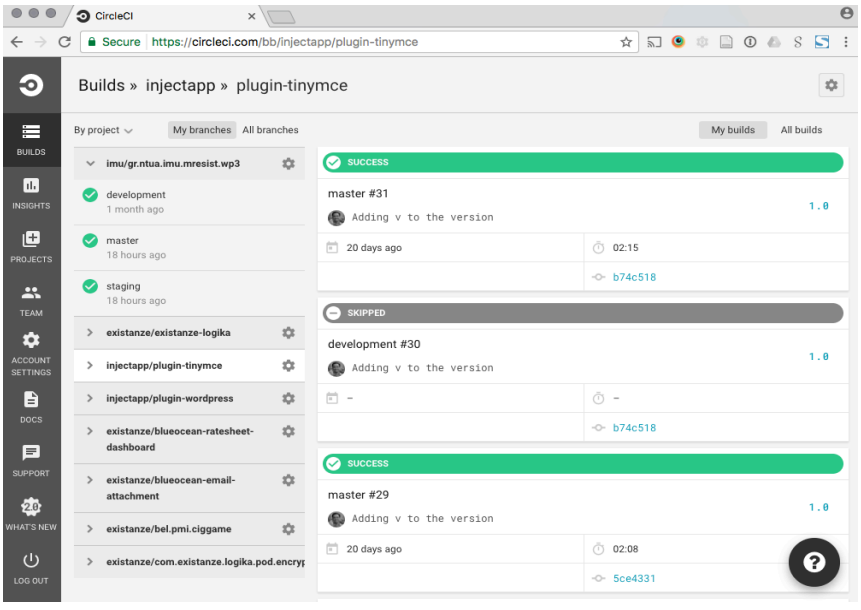



*Figure 29. CircleCI Continuous Integration*

### Issue Tracking

An issue tracker that is reachable for every developing partner needs to be included to collect development time issues like problem reports, feature requests, and work assignments. Users of the INJECT will be provided with bug reporting facility. For issues concerning coding, features and distribution the Jira issue tracker is chosen (Figure 30).

When an end-user or a INJECT developer recognizes a problem or missing feature in the INJECT s/he will report the bug or issue. The reporting is typically done by creating a new issue via the front end of the issue/bug tracker. The newly created issue is picked by a responsible and is typically assigned to a developer. A notification mechanism, usually implemented using e-mail, notifies the assignee about created issues and updates. The developer starts working on the ticket and documents the progress.

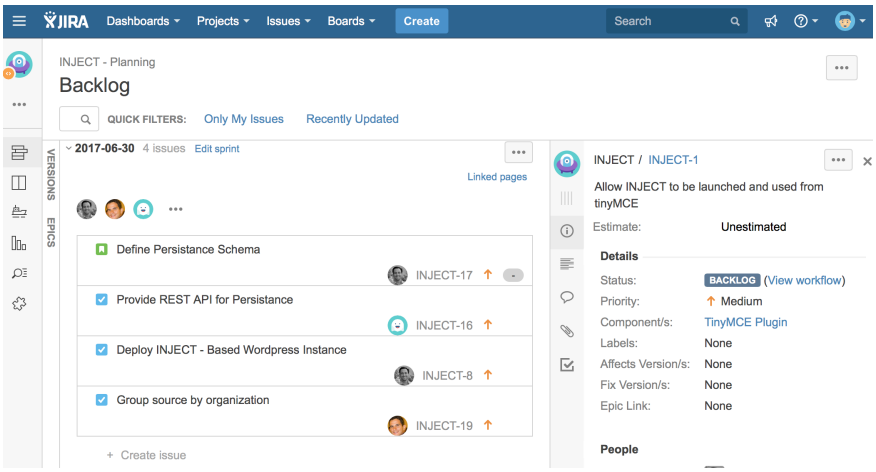



*Figure 30. Issue Tracking in Jira*

In order to derive a suitable process time there should be some time restrictions. Every developing partner should check the issue tracking system once per week. The ticket processing should not take more than one week except the reparation of the reported bug cause high charge in developing. The committed tickets are marked such that there is the possibility to identify the ticket uniquely.

# 6 Summary and Outlook

The project has undertaken substantial work to both explore new requirements and research ideas, and to integrate these requirements and ideas into a single coherent architecture incorporating existing software available by City University, ICCS and Explaain and providing the platform for more conceptual and technical development. Central to developing the architecture was an effective, first-cut integration of the scenarios and requirements discovered from the application partners, the research innovations generated from the technical partners and technical constraints on the required INJECT solutions. The resulting INJECT architecture describes the system's main building blocks and gives a comprehensive overview of all components, their high-level functionality and their interdependencies.

The architecture identifies the following key components divided into three main layers: (a) User Interaction Layer which comprises a Google Doc interface, a CMS interface and stand-alone version of INJECT. (b) Application Layer which implements a responsive user interface logic capable of providing the INJECT functionalities, the algorithms and methods needed to deliver the envisaged functionalities as well as user authentication and authorisation. (c) Data Layer which provides access to internal and external resources and content repositories.

The subsequent INJECT deliverable D1.2 will implement the architecture presented herein by developing the components of the user interaction, application and data layers. The tools supporting software engineering will be used throughout the INJECT project to facilitate collaboration between technical partners, to manage user requirements and issues as well as to support capturing additional requirements and ideas coming from new users and participants in the emerging INJECT ecosystem.

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