Distributed REal-time Architecture for Mixed criticality Systems

Community Repository

D 9.1.1

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1 Introduction

This document is the deliverable D9.1.1 of the DREAMS project. It is the first deliverable of task *T9.1 –Community Building* of work package *WP9 - Community building and standardization*. This deliverable *D9.1.1 – Community Repository* presents the report of the first activities that have taken place with respect to community building, i.e. the design, implementation and launch of a common community building platform (called *Mixed-Criticality Forum*) to facilitate interaction, as well as the establishment of a repository for facilitating the sharing of building blocks for Mixed-Criticality Systems (MCS).

1.1 Position of the Deliverable in the Project

The goal of work package WP9 is to steer and increase European research and technology awareness in the area of distributed mixed-criticality and embedded computing systems. Work package WP9 comprises of three tasks: T9.1, T9.2 and T9.3. Task *T9.1 – Community building* aims at building a sustainable community focusing on the results of the DREAMS project and other projects on mixed-criticality systems. Task *T9.2 – Standardization support* aims to provide support towards all standardization efforts emerging from all activities and results of the DREAMS project. Task *T9.3 - Innovation roadmap* aims to help align the academic and industrial research by developing a research and innovation roadmap on the topic of mixed criticality to achieve critical mass and facilitate breakthrough innovations in the medium and long- term.

This deliverable relates to task T9.1. Over the course of the project, the task will provide three deliverables:

- *Deliverable D9.1.1 Community Repository*: This deliverable provides an overview of the activities related to the start of the community building activities, i.e. the set up of the respective infrastructure for providing services to the community.
- *Deliverable D9.1.2 Intermediate Community Building Report*: This deliverable focuses on the intermediate report on building up a sustainable community for mixed-criticality systems and particularly the “Mixed-Criticality Cluster” (representing the DREAMS, PROXIMA and CONTREX projects).
- *Deliverable D9.1.3 Final Community Building Report*: This deliverable is the final report on the results of the DREAMS project with respect to community building both within the Community Repository and within already existing communities (e.g. HIPEAC).

The confidentiality level of this deliverable is public (PU) and it will be published on the DREAMS website, once approved by European Commission.

1.2 Contents of the Deliverable

In chapter 2, we provide the overall goals of the Community Repository. Further in chapter 3, we provide the conceptual design and the design choices that were made as part of the Community Repository. Chapter 4 deals with the implementation and launch of the community platform and chapter 5 gives more details about the Code Repository that can be used for sharing source code (e.g. open source) within and beyond the mixed-criticality community. Conclusions and next steps are finally presented in chapter 6.

2 Goals of Community Building

2.1 Background and Goals

Technological and market leadership in the safety-critical market is currently based in Europe, with strong R&D investment in both small and large enterprises. However, R&D expenditures in for example the US are up to five times higher than in Europe in critical areas[1], placing enormous pressure on European industry. With this context in the background, a strong collaborative effort is required to extend this leadership position in the next decade.

As the EU FP7 work programme notes, "*Driven by use cases addressing the grand societal challenges in Europe, the objective is to combine and expand Europe's industrial strengths in embedded and mobile computing and in control of networked embedded systems*". It is of importance to deal efficiently with these challenges and not to re-invent the wheel every time, but rather base innovation on the wealth that has already been made available and as such 'stand on the shoulders of giants' and build on the following three pillars:

- Connect, share and learn from previous experiences
- Make technology accessible
- Strong and focused European Community

The major impact achieved by mixed-criticality systems is to provide support for systems combining multiple and different criticality levels on multi-core and networked platforms whilst maintaining required reliability, safety and security guarantees "by design". DREAMS will significantly increase the efficiency of the overall system architectures used across a diverse range of industrial sectors that employ critical systems.

The mixed-criticality community activities in DREAMS are aimed to achieve additional value with marginal additional costs. The overall goals for the Community Building activities in DREAMS are:

- Cross-fertilization of European industry and strong cooperation between European universities, R&D centers, large enterprises and SMEs. Eased access to leading edge technology, contacts to complementary SMEs, support on the take-up and use of technology and tools as well as support and participation in standardization activities. This is facilitated by *harmonization of mixed-criticality efforts* allowing for long-term reduction of development efforts and increased innovation uptake, by building on the expertise in the European mixed-criticality community and promoting knowledge exchange.
- Streamlining of research efforts is achieved by *identifying industrial needs and research challenges in the innovation and research roadmap* that is shared among European stakeholders through the mixed-criticality community building activities.
- Standardization and coordinated future development is made possible by a thriving mixed-criticality community that can promote standard practices, i.e. de facto industry standards. Standardization reduces fragmentation and supports further collaboration in European industry, reducing costs and entry-barriers of proprietary solutions.
- Reinforced competitiveness of European technology suppliers across the computing spectrum by supporting R&D efforts and support the rapid take-up of project results beyond the project consortium, providing a single 'hub' for European R&D on mixed-criticality systems. This comes directly at the advantages particularly of small and medium enterprises that profit from

[1] 2010 EU Industrial R&D Investment Scoreboard

the network and community ranging from component developers to application developers and system integrators.

The first set of activities under the Community Building flag deal with the setup, design and implementation of the necessary infrastructure, which aims to "***Support the mixed-criticality community by facilitating active exchange of ideas as well as technological building blocks***".

Support is provided to the setup and provision of the Community Building Platform in order to achieve the above goals and to connect relevant stakeholders in the European ecosystem. In particular, the community shall target "mixed criticality" per se, focusing on system integrators and component developers that deal with mixed-criticality as well as application developers, and link them to R&D providers in the same space. Specific targeted stakeholders in the community are:

- Community of ***component developers*** that have a real interest in and incentives for developing components initially based on the results developed in DREAMS (e.g., tools, platform components) and other mixed-criticality projects, e.g. within the Mixed-Criticality Cluster.
- Community of ***application developers*** that use the resulting architecture for mixed-criticality applications.
- Community of ***R&D performers*** that address open challenges within mixed-criticality systems, deepening the knowledge, methods, components and approaches that have been developed in European research activities and need further research to drive them to market-ready innovation.

2.2 Objective 1: Support the Innovation Roadmap

The area of applications of mixed-criticality in networked complex embedded systems has been receiving increasing interest in the international research community, industry, funding agencies and policy makers. As a new field, understanding of applications and coverage of research topics have not been fully understood or identified, leaving significant gaps and establishing islands of research.

In this regard, we aim to develop a roadmap for research and innovation on mixed critically to establish the state-of-the-art in the area and identify research challenges by harnessing the collaborative efforts of the partners in the DREAMS consortium and the international experts from both the industry and the research community.

This activity shall be supported with a specific section of the MCS community website, directly accessible from the website landing page.

2.3 Objective 2: Provide News on Mixed-Criticality Activities

In order to act as an innovation hub for mixed-criticality stakeholders, the Mixed-Criticality Forum shall provide up-to-date information related to the activities of its members, particularly of the Mixed-Criticality Cluster and the other stakeholders that constitute the European Mixed-Criticality community.

It must be noted that the goal of the Mixed-Criticality Forum is not to replicate existing scientific information or websites providing news in general on cyber-physical systems, as these would require a specific editorial focus of the Forum, which is currently not foreseen (in terms of resources). Rather, the news section shall highlight those activities that deserve attention with respect to the activities of its members or that are hosted on the mixed-criticality forum itself.

2.4 Objective 3: Mixed-Criticality Projects Visibility

As a further way to increase interaction and alignment between the MCS projects, it is important that these projects are made visible in a context. The increased visibility among projects dealing with mixed-criticality leads to increased interaction and reuse of results, as such streamlining research and R&D activities between the respective actors.

The MCS community infrastructure shall provide information about the projects dealing with Mixed-Criticality Systems. Next to standard information such as start date, duration and partners, it shall provide the opportunity to projects to provide more detailed information about their research and results achieved. It shall not be the goal to duplicate information, but rather to provide links and facilitate access to the projects' own web presence.

2.5 Objective 4: Catalogue of Project results

One specific objective of the Mixed-Criticality Forum is to make available project results and also facilitate sharing, discussion and further development on the community platform, focusing on:

- Meta-models for application and platform modelling
- Virtualization components (e.g., extended network interfaces, resource managers)
- Simulation environment
- Tool support
- Documentation and training material

The mixed-criticality forum aims to support liaisons with other projects targeting mixed-criticality systems and the exploration of synergies with related European, national and international initiatives to influence the research and innovation in the mixed-criticality application domains and portray the results on the community website. Particularly, the ongoing and closed mixed-criticality projects in FP7 and ARTEMIS will be contacted through designated persons that are participating in these projects.

The Community Building Platform shall support partners in DREAMS and other MCS projects to present the results of their activities in order to facilitate visibility and re-use. Project results are not limited to technological results (e.g. models, software, hardware, simulations, tools), but can also apply to supporting materials such as documentation and training, courses, video materials, etc. The Community Building Platform shall support the availability of such project results.

The catalogue of project results will also facilitate impact and exploitation by

- enabling end users to identify suitable technology providers (e.g., tools, IP, hardware components, software components)
- enabling technology providers and suppliers to communicate technology/product portfolios and identify potential customers
- supporting the identification of joint exploitation opportunities combining different technological building blocks

2.6 Objective 5: Code Repository

In order to create a comprehensive MCS Community Building Platform and support the community building goals, it is important to facilitate the sharing of information beyond linking to results only. In addition to the catalogue of project results, a code repository shall be made available for the sharing of software, both within the DREAMS project consortium and within the wider MCS community (i.e.

open source). The code repository will also include open source DREAMS results including the extension of Linux KVM and the open source virtual platform.

2.7 Mixed-Criticality Cluster

Next to DREAMS, two further European projects have received funding under FP7-ICT-2013-10 with regards to Mixed-criticality systems. These projects together constitute the "Mixed-Criticality Cluster":

- **DREAMS** – Distributed REal-time Arcchitecture for Mixed Criticality Systems
  - **Coordinator**: Roman Obermaisser, University of Siegen
  - **Start**: 1 October 2013
  - **End**: 30 September 2017 (4 years)

- **CONTREX** – Design of embedded mixed-criticality CONTRol systems under consideration of EXtra-functional properties
  - **Coordinator**: Kim Grüttner, OFFIS
  - **Start**: 1 October 2013
  - **End**: 30 September 2016 (3 years)

- **PROXIMA** – Probablistic real-time control of mixed-criticality multicore and manycore systems.
  - Coordinator: Francisco J. Cazorla, Barcelona Supercomputing Center
  - **Start**: 1 October 2013
  - **End**: 30 September 2016 (3 years)

Whereas the focus of these projects is on different aspects of mixed-criticality systems, they share common goals with regards to the overall challenges on mixed-criticality. The uptake of scientific results from the three projects benefits from a common community platform which can act as a single point of entry for results from the mixed-criticality cluster.

Although the projects address different mixed-criticality aspects, their results are related in terms of technology, e.g. modelling approaches, tools, embedded SW, FPGA implementation. Therefore, the Community Repository increases the efficiency of the cluster both with regards to streamlining the infrastructural activities and by providing a common community platform for these results.

The Mixed-Criticality Cluster uses their own logo to identify their joint dissemination and exploitation activities (see Figure 1)

Figure 1: Logo of the Mixed-Criticality Cluster (CONTREX, DREAMS and PROXIMA projects)

3 Conceptual Design

As the goal of the Community Repository is the support of the overall community building activities, the conceptual design of the repository aims to reflect the overall goals as addressed in chapter 2 and addresses the five objectives from the Community Building Platform, i.e.:

1. Support the Innovation Roadmap
2. Provide News on Mixed-Criticality Activities
3. Mixed-criticality Projects Visibility
4. Catalogue of Projects' results and
5. Code Repository

In addition to the functional, also the name and graphical design of the Community Repository was developed in this stage of the activities.

3.1 Name and Graphical Design

In order to make clear that the Community Building Platform shall not limit itself to the DREAMS project but provide a central starting point to the Mixed-Criticality community, a separate name and corporate identity for the repository was chosen. The name shall reflect the open nature of the repository, i.e. not DREAMS-specific. Furthermore, the repository shall indicate that it is not intended to be a one-way source of information but that the repository requires and facilitates the participation of the various stakeholders.

In order to address these aspects of (1) openness to multiple stakeholders and (2) openness to participation, the name "Mixed-Criticality Forum" was chosen to reflect the 'open public spaces for interaction' in accordance with the ancient civic center in Roman times as a gathering place and often the scene of diverse activities, including political discussions and debates.

With this name, the URL http://www.mixedcriticalityforum.org was registered for this purpose and a corporate identity in the form of a branding (logo, color set, and typeface) were designed, see Figure 2.

Figure 2: Logo for the Mixed-Criticality Forum

3.2 Content Strategy

In order to support the interaction between the project members, a strong commitment and participation from all members of the community is requested. As a 'gathering place' of stakeholders in the area of MCS, the Community Building Platform shall be largely interactive and content will be made available by the community members.

Nonetheless, in a first stage, there will be an active role for the partners in DREAMS active in *WP9 – Community Building*, to provide a "go-live" content and have useful content available at the launch of the forum.

3.3 Information Architecture

In order to support the five mentioned objectives, the information architecture is developed alongside these elements, which shall be accessible directly from the homepage. In addition, core information about the background of the Community Building Platform is provided on the project home page. Therefore, the following information architecture will be utilized for the website:

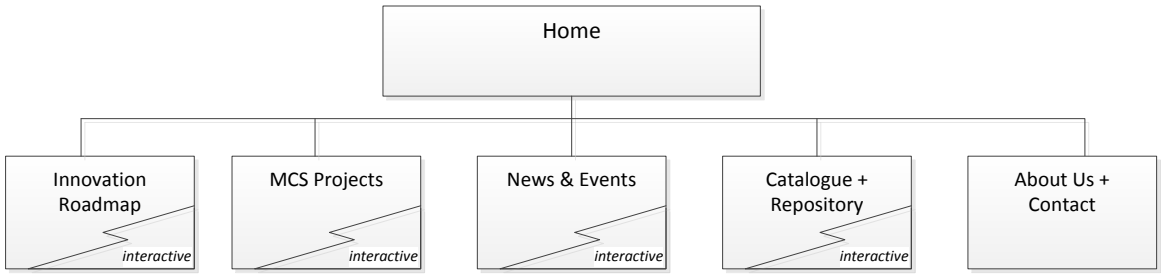

Figure 3: High-level Information Architecture Mixed-Criticality Forum

The areas that provide interactive services are highlighted in the above services. This is in line with the content strategy described above (chapter 3.2).

For each of these areas, a further information architecture has been conceived. They are explained in the coming sub-chapters.

3.3.1 Innovation Roadmap Area

The innovation roadmap section is populated by the DREAMS partners focusing specifically on the topic of the innovation roadmap activity in Work Package 9. This area of the website facilitates the online and offline activities (e.g. workshops) that are organized and provides event information, summaries, and discussion items in the form of 'entries' that can be entered by those partners active in the area. When these are made available online, all community members can engage in the discussion and have the possibility to provide their input to each entry that is made available.

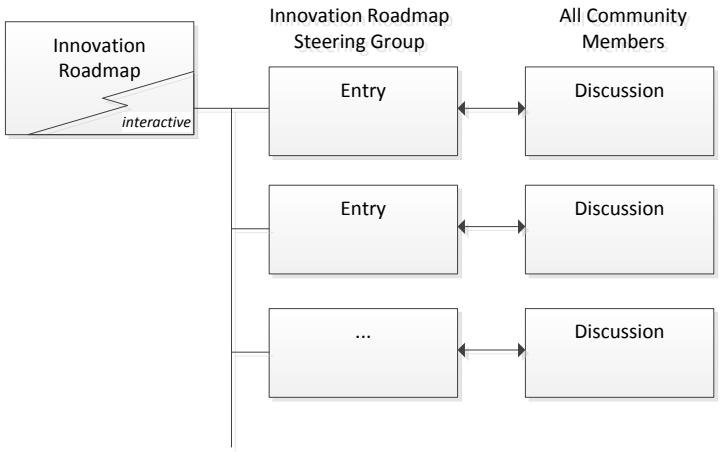

Figure 4: Information Architecture - Innovation Roadmap Area

3.3.2 Projects Area

The area related to mixed-criticality projects is straightforward: each project can set up its own web presence within the Community Building Platform. Figure 5 gives an overview of the respective information architecture. Each project is linked to its project partners and to the project results that are available in the catalogue.

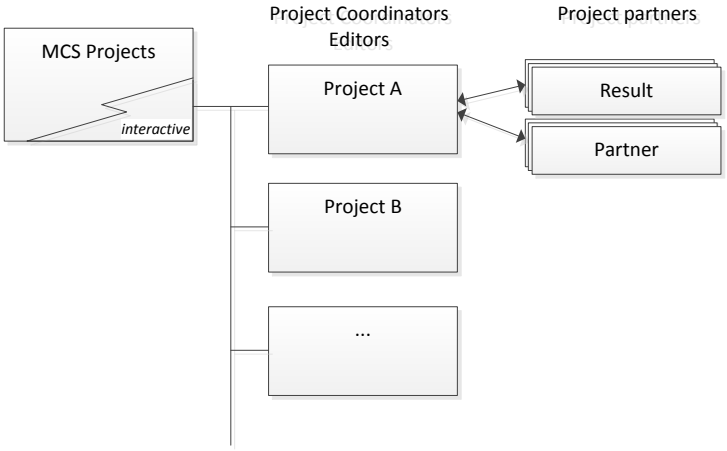

Figure 5: Information Architecture –Projects Area

3.3.3 News & Events Area

The area related to News and Events is set up as a straightforward news element where new entries can be entered when they occur and events can be announced. Optionally, discussion by community members can be facilitated directly with the news item. However, if the news item links to another content area of the Community Building Platform, the discussion ideally should take place directly at the content element rather than at the news item. Figure 6 gives an overview of the information architecture.

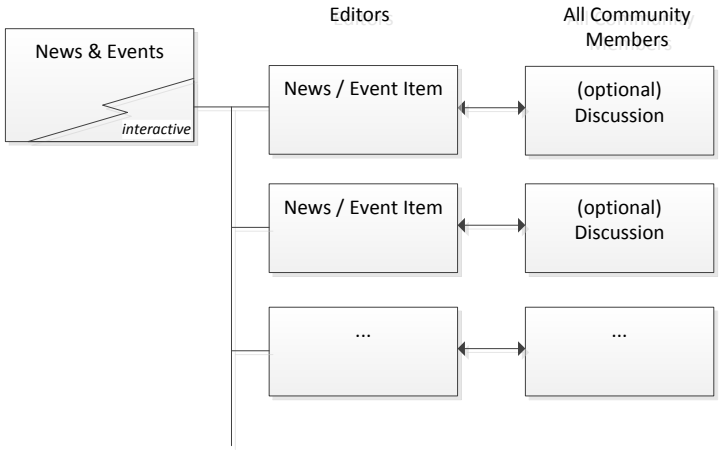

Figure 6: Information Architecture –News & Events Area

3.3.4 Catalogue & Repository Area

The area related to the catalogue and repository is subdivided into a number of categories that can be flexibly extended. Initially, the categories relate to those as described in the objectives:

- Models and Meta-models
- HW and SW components
- Simulations
- Tooling
- Documentation and training material

Additionally, a grouping by domain can be undertaken. The category system shall be implemented by means of a “tagging” approach. This implies that each item can be attached to multiple tags and thus can be shown in multiple categories. The results are clustered in these categories.

Each member of the community can add results to the catalogue of his or her organization/project and choose whether these can be discussed (“Discussion yes/no”) or if code is added to the repository (“Repository yes/no”).

Figure 7 gives an overview of the respective information architecture.

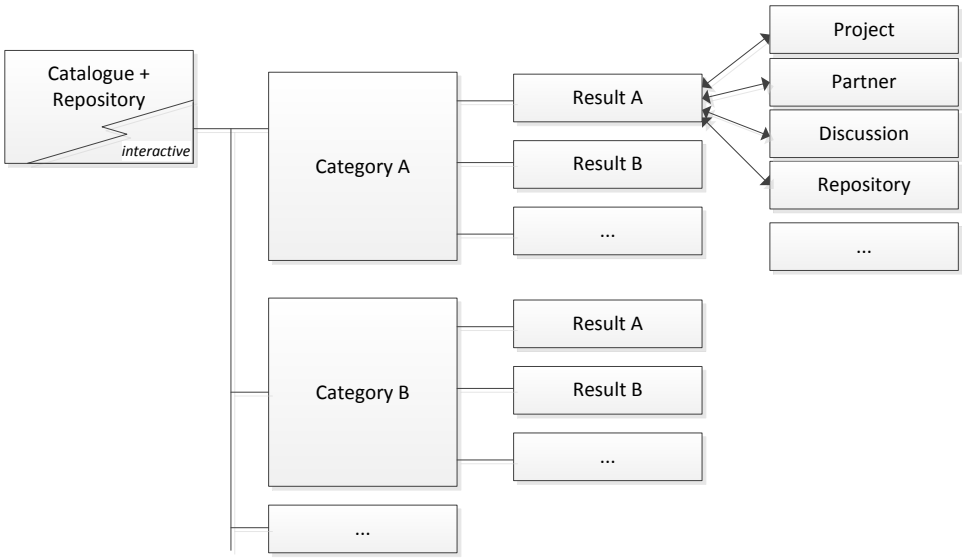

Figure 7: Information Architecture –Projects Area

3.3.5 About Us & Contact Area

Finally, a separate area of the website is dedicated to provide some information about the Community Building Platform and about Mixed-Criticality Systems in general. It also provides some information about the Mixed-Criticality Cluster that is at the core of the community platform.

3.3.6 Interrelation between Projects, Organisations and Results

There is a tight relation between the three concepts of projects, project partners (organisations), and project results (catalogue), which is indicated in Figure 8. These interrelations have an implication on the rights management for the individual items, which are described later in this document.

- Individual members of the community are attached to organizations. Each member can be attached to only one affiliation.
- Organizations are connected to projects. Each organization can be connected to more than one project. Each project can be connected to more than one organization.
- Result items are connected to both projects and organizations. In order to keep the amount of rights and permissions manageable, each result can be connected to one organization and to one project.

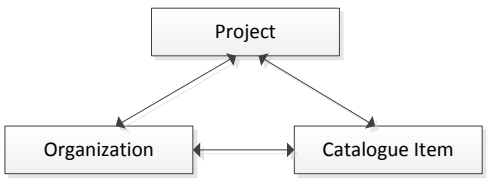

Figure 8: Projects, Organizations and Results

In order to give credit to the organizations contributing to the Mixed-Criticality Forum, a top level menu item was created where Organizations can be directly accessed. From the organization sub-page, links are provided to the projects it is involved in and to catalogue items it has made available.

3.4 Users, User Rights, Registration and Login

3.4.1 User Roles and Rights

The Community Building Platform shall be largely interactive. To this end, different user roles are necessary in order to control who can access and edit which information. The following roles are defined:

- **0 - Visitor**: a visitor is shown all contents of the website that have been released by the administrators for release-to-public
- **1 - Registered user**: a visitor can register him-/herself and gain rights to engage in the discussions in the website frontend.
- **2 - Organization editor:** a registered user can request permission to act on behalf of an organization. He or she can then create and/or edit the organization profile, create and/or edit projects the organization is active in, and create and/or edit catalogue items in the website frontend.
- **3 – Roadmap editor:** a roadmap editor can add new information to the Innovation Roadmap area and moderate ongoing discussions. The Roadmap editor has (limited) access to the backend server for this purpose. An editor can decide whether discussions should be allowed or not and can activate or deactivate the function for each content element.
- **4 – News editor**: similar to a roadmap editor, a news editor can add new information to the News & Events area and moderate ongoing discussions. The News editor has (limited) access to the backend server for this purpose.
- **5 - Administrator**: an administrator has access to the frontend and backend, can moderate the discussions and ensure correct operation of the website.

3.4.2 Registration

At registration, users automatically obtain rights in the first category (registered user – engage in discussions). At registration time, users can request rights to the second category (organization editor). This must be manually administered in the server backend by one of the system administrators to ensure correct system access. A double-opt in (including a verification e-mail sent to the person's e-mail address) is used to ensure correct authentication.

The aim of registration is to provide easy access to the registration and keep the hurdles for engagement in the community activities low. Therefore, a registration/login possibility will be visible throughout the website and users are prompted. After registration, the user is automatically logged in and has access to all features that are permitted by the user rights management. Furthermore, only a minimal number of required form fields are requested and further optional information can be added at a later stage.

For user rights beyond the second category, a manual request to the administrators is necessary. The number of people with access to categories 3, 4 and 5 will be kept relatively low.

3.4.3 Login

The login procedure takes place using the chosen username and password. An optional “remember login” checkbox can be checked to login the user automatically at each site visit. A procedure for the case of a lost password is also accessible from the Login module on the website.

3.5 Facilitate Discussion

The interactive elements of the Community Repository facilitate the availability of discussions. All users that have registered themselves and are logged in can participate in the discussion by means of writing their contribution in direct response. It is currently not planned that the MCS Community Repository will host a full-fledged ‘discussion forum’ functionality. Discussion forums about general topics are only successful if the community addressed is very large or if the discussions are very focused around specific and concrete topics or problems that can be “solved”. The MCS community does not fit to this description, which is why a more targeted ‘reactive’ discussion approach is chosen.

For example, within the Innovation Roadmap area, discussions can focus around e.g. a white paper on the innovation roadmap, where registered users can add position papers or direct responses to requests for contributions by the Roadmap Editors.

For each content element, the author / editor of the element can decide whether discussions should be allowed or not and can activate or deactivate the function. This functionality is available to users with user roles in the categories 2, 3, 4 and 5, who can also moderate the discussion.

3.6 Code Repository

Another important part of the community building effort is the creation of a specific area for sharing source code, project ideas, as well as to manage and promote cross-project development between the partners of the Mixed-Criticality community. For this reason there is a direct need to incorporate a Version Control System with complementing features integrated together with the website. This infrastructure will enable the community to collaborate together and manage in a meaningful way shared ideas and projects, through a multi-purpose Community Repository with many extensions that will be showcased in Chapter 5 with more details.

In overview, the Community Repository is based on the Git distributed revision control system as the main facilitation for source code management. On top of Git, a feature-rich repository management solution is used called GitLab, which includes advanced user and group creation policies, source code reviews, issue tracking, wikis and many other enhancements useful for collaborating content creation.

3.6.1 Version Control System

Version control, also known as revision and/or source control system, is a way to manage versions (changes) of files, documents, source code or any kind of information. This kind of software is mainly used in software development, where a large team may have to apply changes in common files. The need of a version control system is crucial to efficient and successful software development, ranging from a usage of one-man projects to big multi-team collaboration ventures.

The common problems that version control systems alleviate are:

- **Software versioning and development history:** Tracking development is crucial for conceptualizing how much progress has happened in the past, and assisting the planning of next phases. With flat history logs, it is difficult to discern development activity, impact of

changes, or the logical expansion of the code base. With version control systems each change to the code base is logged with a commit message and a detailed view of the changes that took place, preserving the history of development, and providing easy references at a later time.

- **Multiple instances of software:** In its simplest form different instances of software (with varying features/bugs, etc.) can be manually stored separately. While this in theory can work for a limited amount of use cases, in practice it is very difficult to enforce good habits among a large group of developers. For this reason in a version control system, different instances of software are logically stored under a common repository but with the concept of different branches. Each branch has its own development history which eventually converges or diverges to different branches respectively, according to the development of the code base.
- **Resolving conflicts:** Most of the times in collaboration projects, a group of people is working on the same set of files during the development process. The members of this team can be geographically dispersed and even have different views on the progression of a co-developed feature. Without a version control system a lot of time is spent for resolving conflicts of diverging files that must eventually be merged. This is one of the most serious problems that hinders progress of big projects, which require a system to automatically detect hard and resolve soft conflicts, as well as provide a way to merge different versions. Version Control Systems must offer a way to handle this issue in an efficient manner, i.e. to resolve emerging conflicts in a (semi-) automatic way.

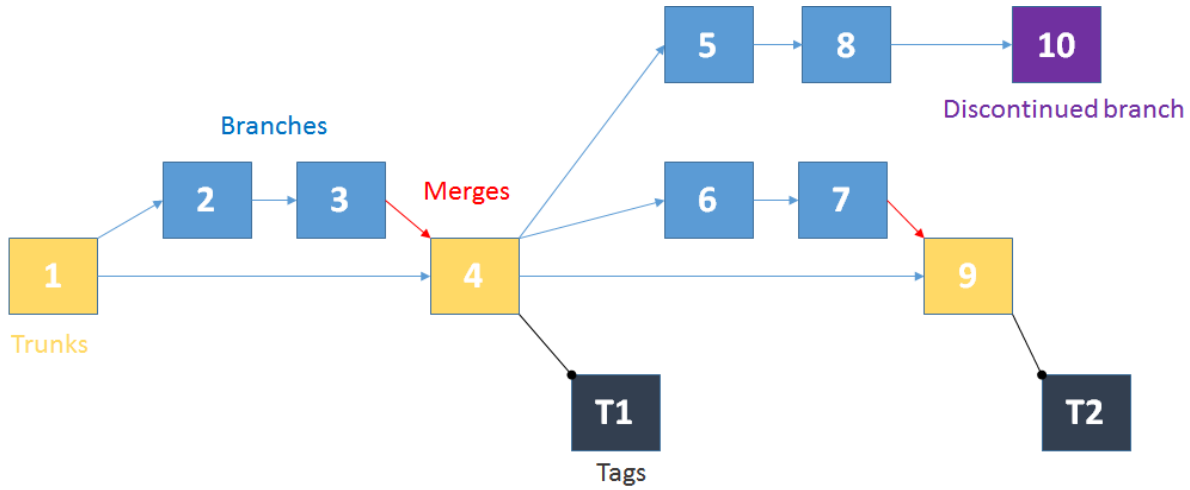

Figure 9: History graph of a version controlled project

3.6.2 Git

For all afore-mentioned problems, nowadays the use of version control systems is considered mandatory in software engineering. For the purpose of the Mixed-Criticality forum and the Community Repository Git was selected as the solution of a version control system.

Git is an open source distributed revision control system which focuses on efficiency, data integrity, decentralization and speed. Development on Git started around 2005 by Linus Torvalds and was meant to change the previous way of how the Linux kernel source code was managed. By now it is considered the most widely adopted version control system, due to its many features and distributed nature. The difference with client-server systems is that every Git working instance is a full clone of the actual repository with complete history and version tracking capabilities.

Git has many characteristics, trying to share advantages with other version control systems but at the same time avoids conventional approaches, which leads to its unique design. The following list of characteristics is a subset of what makes Git to be used so extensively:

- **Cheap local branches:** One of the most important features in Git, related also to its distributed nature. With Git you can have entirely independent branches, which makes creation and merging a very quick and easy task.
- **Optimization and efficiency:** Compared to other version control systems (SVN, CVS, etc.), Git is accepted as the faster solution for common tasks, such as repository initialization, document addition, source diffing as well as, branching and committing.
- **Offers multiple workflows:** Although distributed, it can still be mapped to client-server use cases of a centralized repository. For example, users cannot push changes to a remote repository if they didn't update their local repository first, which turns out to be a very similar workflow as SVN (central remote repository). Git is flexible enough to apply many workflow scenarios according to the project's needs.
- **Staging area:** A unique feature of Git is the staging area. Between the task of adding files and finally committing, the staging area acts as an intermediate stage where you can select which changes you want to incorporate as your next commit. That way you control with greater granularity your committed changes.
- **Distributed:** Being a distributed version control system means that instead of a "checkout", which captures the tip of the repository, you "clone" the entire repository. This results in that even if you are using a centralized workflow, every user of the repository has a full backup of the main server. Basically this means that there is no single point of failure with Git.

3.6.3 Repository management: GitLab

For the community building effort, a basic Git server implementation wouldn't be enough for the needs of the Mixed-Criticality Forum. Beyond the essential repository infrastructure for pure development purposes, there are requirements for more features built on top, to further enhance the process of sharing ideas, planning, managing projects and communicating, always in the context of software development and open collaboration between partners.

GitLab CE (Community Edition) offers Git repository management through an extensive web interface with additional integrated features, furthermore, GitLab is an open source project with a large userbase ranging from small to large organizations. In the case of the Mixed-Criticality Forum it will be a gateway for all shared development activity, from project source code, to tracking tutorials and wiki information, as well as bug and history tracking.

The following is a summary of some of the most useful features that are included with GitLab:

- **User and groups management:** Without GitLab user access to repositories would have to be placed on the server that Git is hosted. In the case of GitLab users and groups is an internal abstraction which can be easily managed from the Web Interface.
- **Git repository management:** Beyond the basic Git server infrastructure, GitLab offers an extensive view of created repositories. From creation to deletion, user assignment and source code overview, it enables quick access to relevant data without any need of command line usage.
- **Activity feed:** An overview of the recent activity for user groups and projects.
- **Wiki creation:** Each project can have a Wiki where developers can include tutorials and information useful for new members.
- **Visualization tools:** Network graphs of branches, commit and developer activity statistics to give a quick look on the project activity.
- **Code snippets:** A user personal area to create code snippets for quick code sharing and a place for easy reference.
- **Repository forking:** Quick and automatic cloning of diverging projects.
- **Issue tracking:** Gitlab includes its own implementation of a per project bug tracker.

3.6.4 Administrative and repository structure

The administrative and structure details of the community repository have not been finalized by the Executive Board at the time of writing of this deliverable. At this stage, functionally the repositories are administrated by Virtual Open Systems and will be done so in collaboration with DREAMS partners if needed, when the final details are set. Gitlab offers an easy way to set multiple administration accounts in the system, allowing selected users to manage all the configuration details of the existing source code projects.
For the Repository structure, granularity is available on a user or group level. Repositories can be created by users separately or be part of defined groups, and additionally each project can be set as private, internal or public. Administrators can select easily which users can access which repositories and with what permissions.

The URL naming scheme of a created source code repository, is tightly related to the user, group and project name*:*

- git@git.mixedcriticalityforum.org/[**user**-name]/[project-name].git
- git@git.mixedcriticalityforum.org/[***group***-name]/[project-name].git

According to these options it will be meaningful that the structure of the repositories is created based on the group level. An example for a DREAMS project repository could be in the following format: *[MCS-Project].[work-package]/[project-name].git E.g. dreams.wp2/linux.git.*

4 Implementation Community Building Platform

The implementation of the Community Building Platform is undertaken on the basis of an open-source Content Management System (CMS). The CMS makes it easier to support the many interactive features of the platform and allows for fine-grained user management. In order to provide the necessary functionality, a specific extension module is written that enables the management and interaction between Organizations, Projects, and Catalogue Items and the management of the News and Events.

4.1 Home Page

The Mixed-Criticality Forum landing page or homepage is designed to provide a quick overview of the latest news and facilitate access to the underlying areas (Innovation Roadmap, Projects, News& Events, Catalogue, Organizations) as well as provide information about the MCS Community Building Platform itself. A screenshot of the website is provided below.

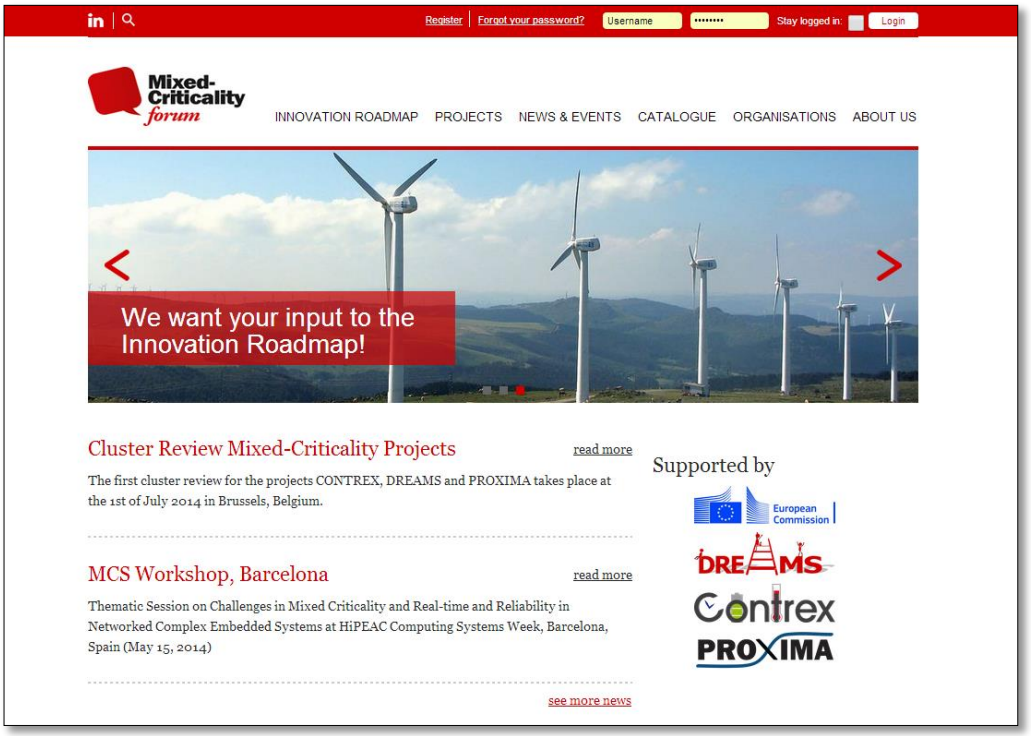

Figure 10: Mixed-Criticality Forum – Home Page

4.1.1 Header

The header of the MCS community Building Platform is visible from all areas of the website and provides the following functionality:

- Direct access to the login functionality of the website
- A link to the social network group LinkedIn
- Search functionality

The header is depicted in Figure 11.

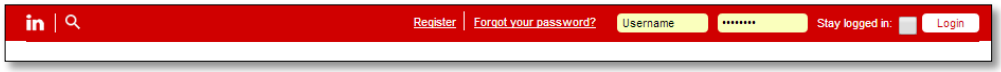

Figure 11: Mixed-Criticality Forum – Page Header

4.1.2 Footer

The footer of the MCS community Building Platform is visible from all areas of the website and provides the following functionality:

- Access to all main areas of the website
- Access to the login and management functionality of the website
- A link to the social networking activities (currently: LinkedIn)
- FAQs and Imprint information

The footer is depicted in Figure 12.

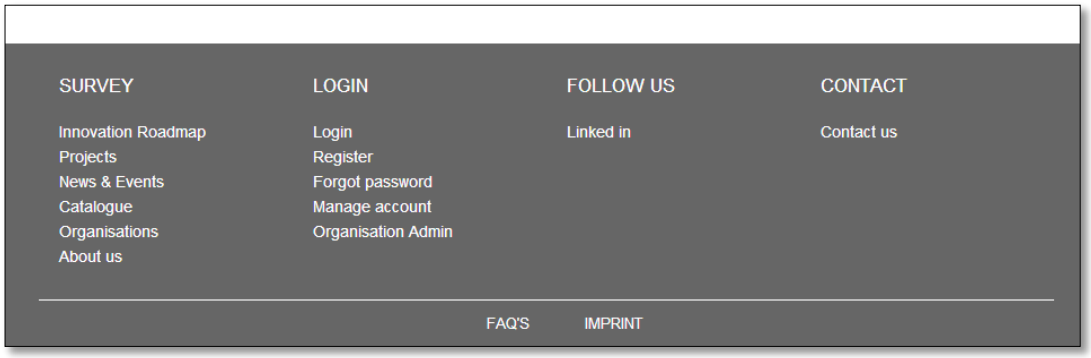

Figure 12: Mixed-Criticality Forum – Page Footer

4.1.3 Main Menu

The main menu of the MCS Community Building Platform is visible from all areas of the website. It provides direct access to the main areas of the website:

- Innovation Roadmap
- Projects
- News & Events
- Catalogue
- Organisations
- About Us

The main menu is depicted in Figure 13.

Figure 13: Mixed-Criticality Forum – Main Menu

4.1.4 Slider Area

Within the slider area, teaser information for content on the website can be placed. For each area of the website, different sliders can be chosen (picture, text and link) that provides a teaser to specific content, or the whole slider can be disabled.

The main menu is depicted in Figure 14.

Figure 14: Mixed-Criticality Forum – Slider area

4.1.5 Content Area

The content area on the home page consists of a main area on the left and a second small column on the right (sidebar). The main area provides information about the latest news and events that are available. In the sidebar, additional information can be shown.

The main menu is depicted in Figure 15.

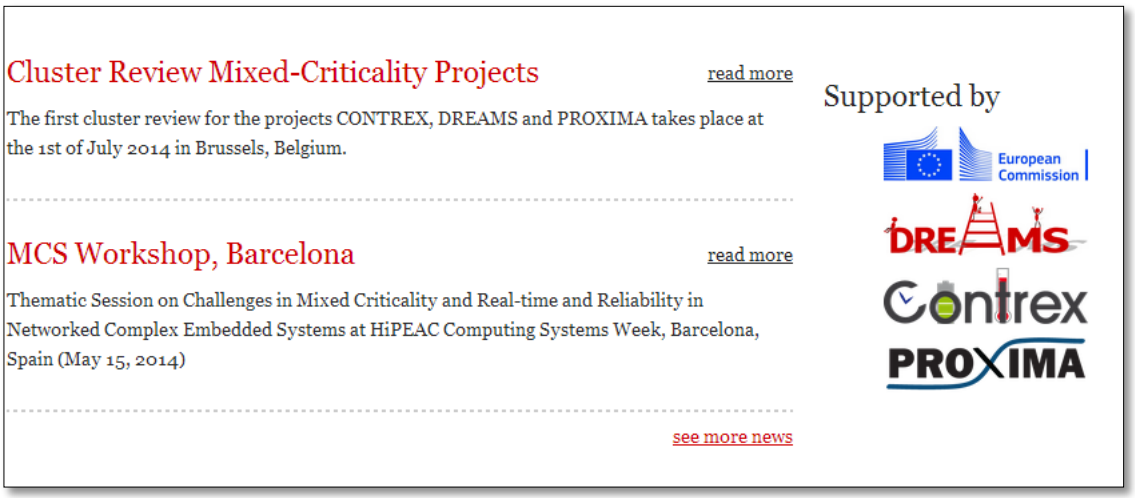

Figure 15: Mixed-Criticality Forum – Content area and sidebar

4.2 Innovation Roadmap Area

The Innovation Roadmap area contains overview information about the goals of the innovation roadmap. The Innovation Roadmap Editors have the possibility to add and change all pages within the area in order to fully support the online and offline activities deployed.

The Innovation Roadmap Area landing page is depicted in Figure 16.

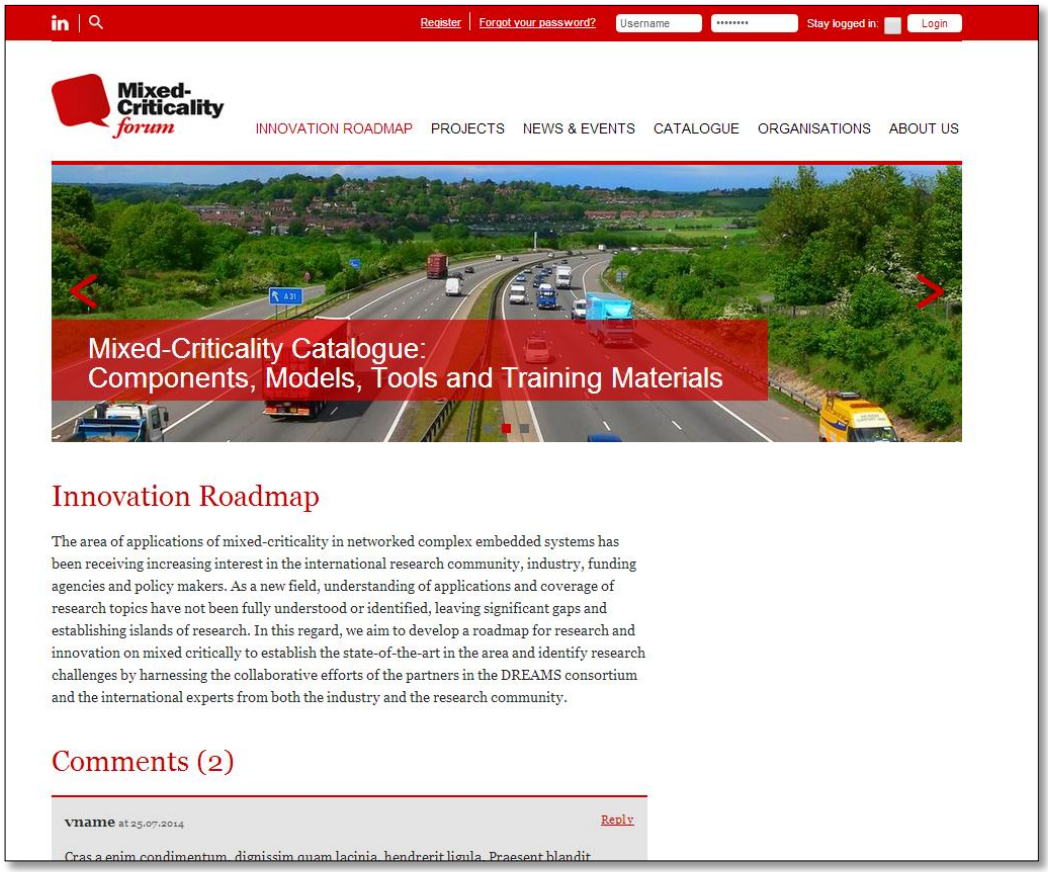

Figure 16: Mixed-Criticality Forum – Innovation Roadmap Area

4.3 Projects Area

The Projects area contains overview information about the projects that are represented on the MCS Community Building Platform. Each MCS project is invited to add information about their activities in this overview. Initially, the three projects of the Mixed-Criticality Cluster (Contrex, DREAMS and Proxima) have been added to the Projects Area.

The Projects Area landing page is depicted in Figure 17.

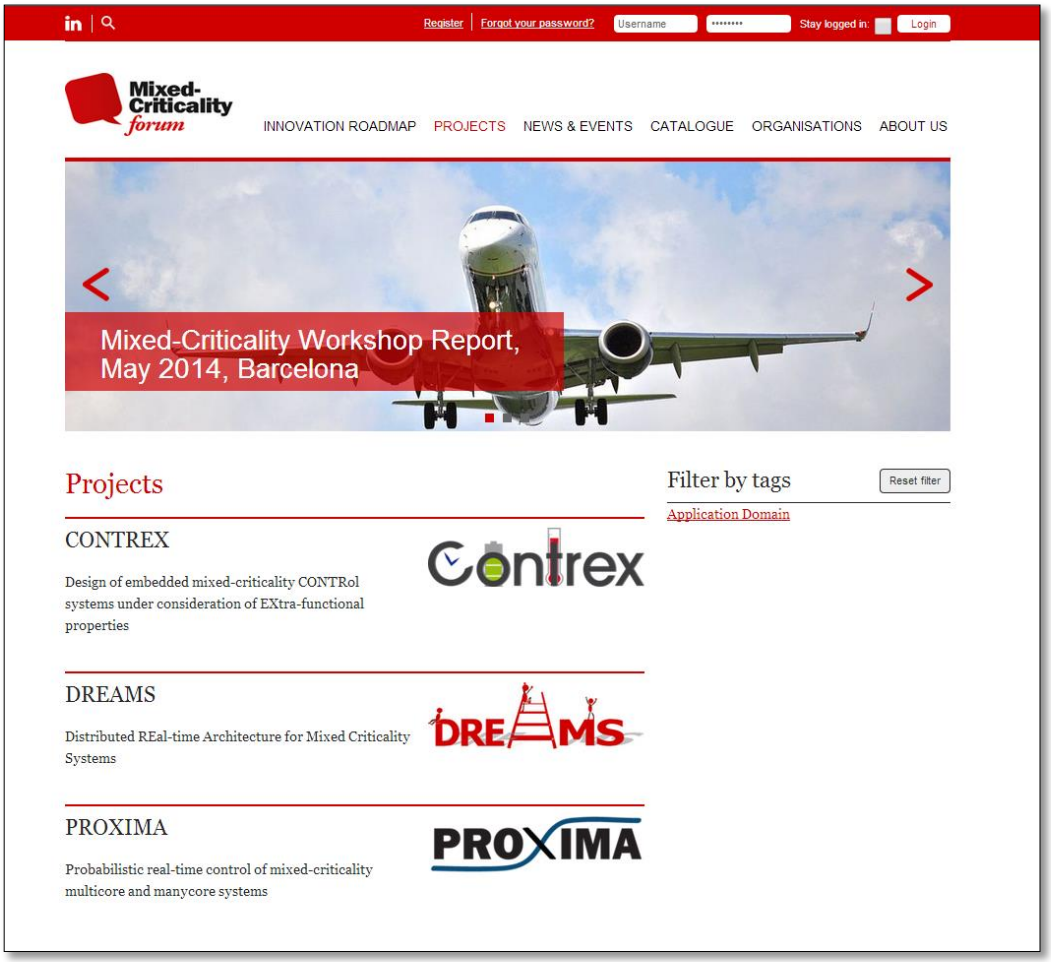

Figure 17: Mixed-Criticality Forum – Projects Area

4.4 News & Events Area

The News & Events area contains news and events about the MCS Community that have been submitted by partners or that come from other areas of the Community Building Platform (e.g. new roadmap activities).

The News & Events Area landing page is depicted in Figure 18.

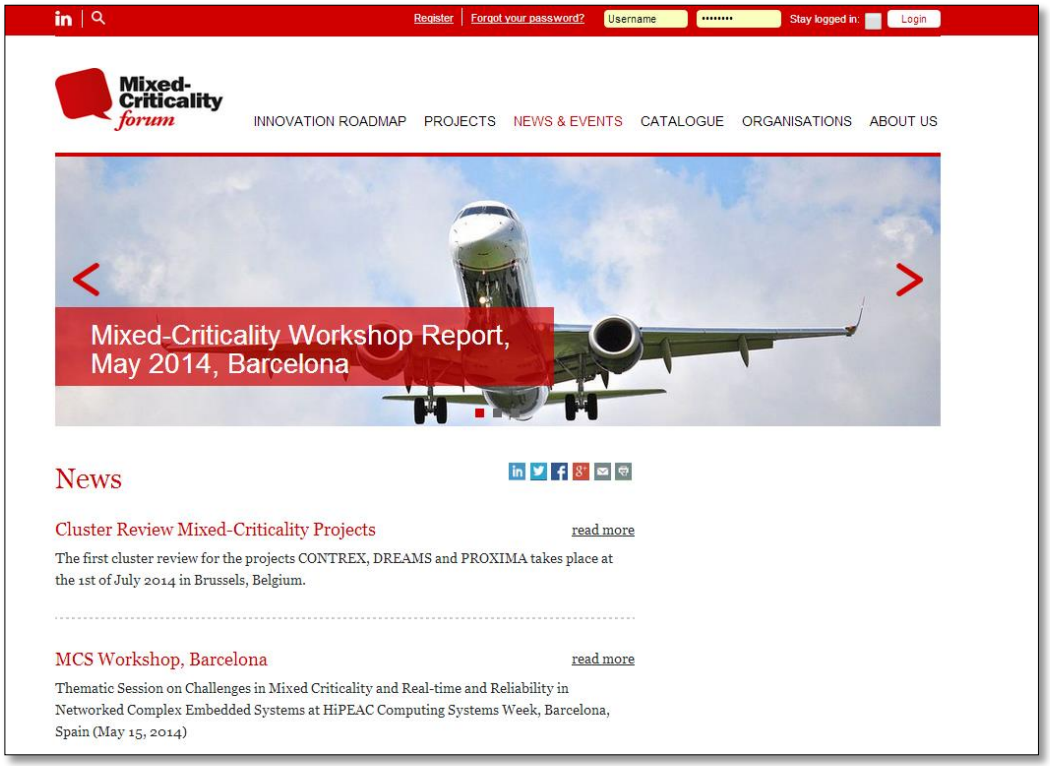

Figure 18: Mixed-Criticality Forum – News & Events Area

4.5 Catalogue Area

The Catalogue area contains a collection of project results from the MCS Community that have been submitted by partners of those projects that are represented on the Platform.

The Catalogue Area landing page is depicted in Figure 19.

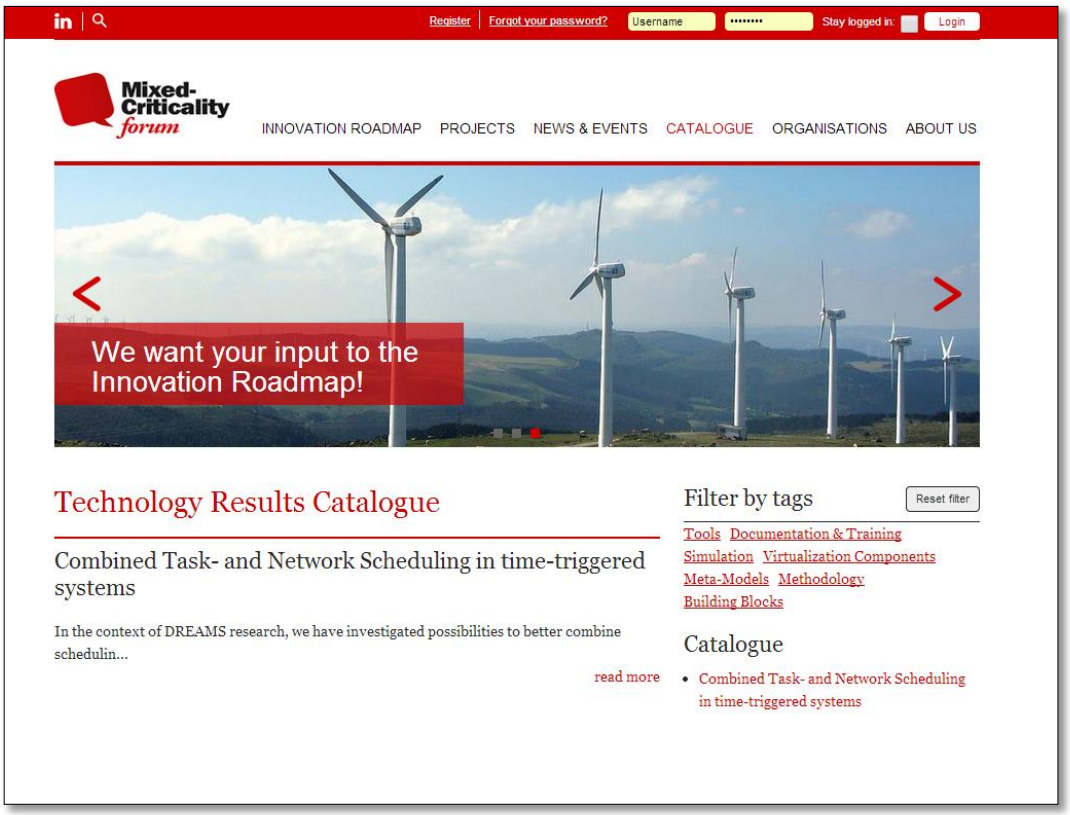

Figure 19: Mixed-Criticality Forum – Catalogue Area

4.6 Organizations Area

The Organizations area contains a list of all organizations that are registered in the MCS Community. The Organizations Area landing page is depicted in Figure 20.

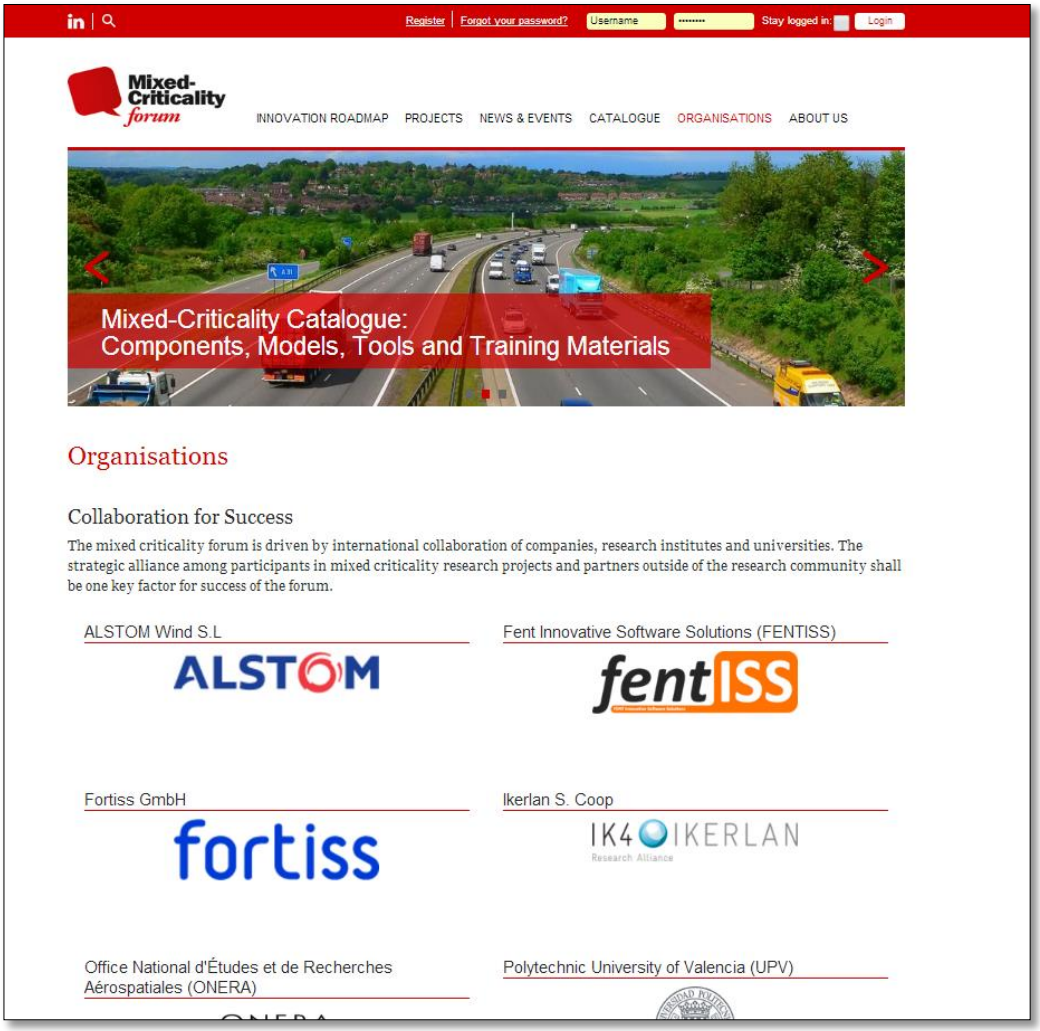

Figure 20: Mixed-Criticality Forum – Organizations Area

5 Implementation Code Repository

The implementation of the Code Repository consists of the deployment of GitLab. This includes the Git repository infrastructure, coupled with the web interface features and enhancements for the users. In the following paragraphs the major parts of the repository are showcased.

5.1 Login screen

The login screen of the Community Repository can be seen in Figure 21. This is the welcoming interface with the user, where other than logging in, the user can explore the public repositories (no need for an account), as well as see the available documentation for GitLab.

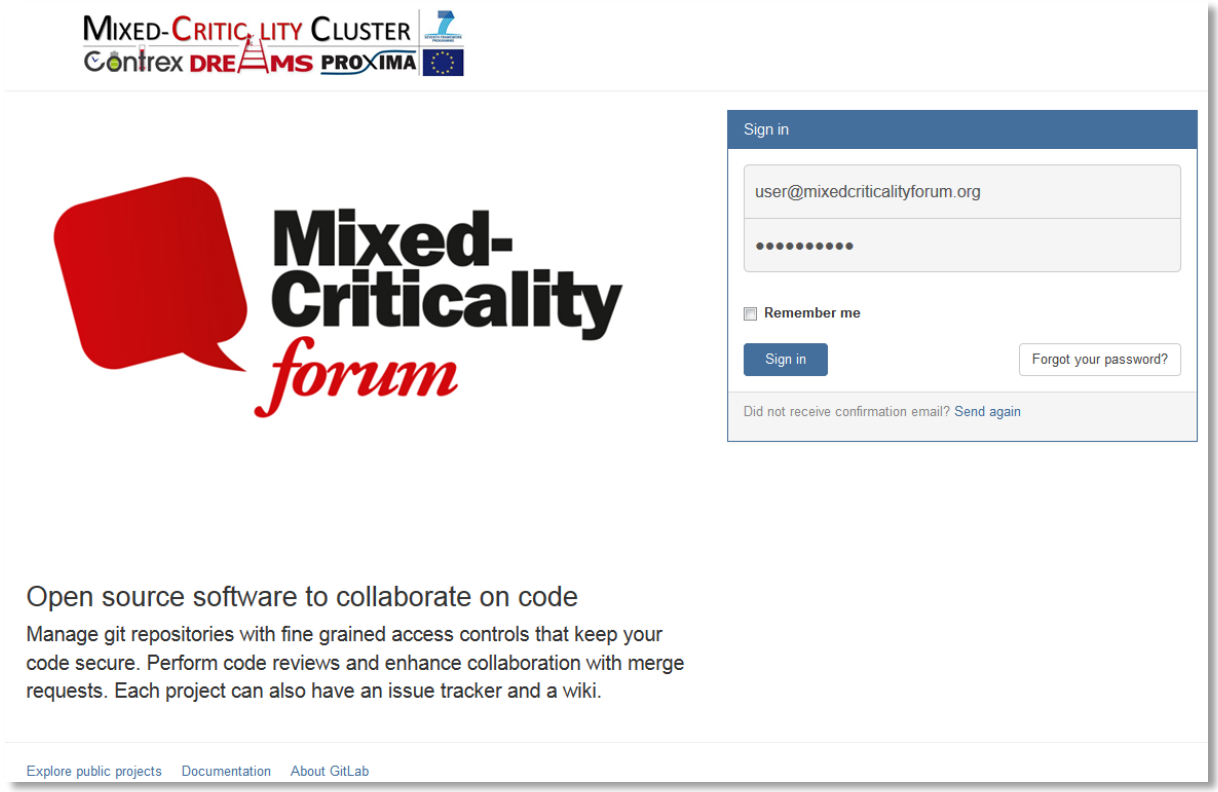

Figure 21: Community Repository login screen

5.2 Dashboard

Upon logging in the user has access to his account through the Dashboard. The Dashboard is the main area for the user, where a lot of information can be reached.

The Dashboard consists of four main areas two of which are common for all areas of the web interface:

1. **Activity feed:** Where the user can see the latest updates for the projects that are accessible (left side).
2. **Side bar:** The side bar holds information about the available groups and projects (right side)
3. **Main toolbar:** The main toolbar is common throughout the web interface and links to the following areas:
    - Search
    - Help

- Public area
- Snippets
- Profile Settings
- Logout
- Profile Overview

4. **Context toolbar:** Also common part of the web interface, the context toolbar dynamically changes and links to information that is related to the current viewing element of the repository.

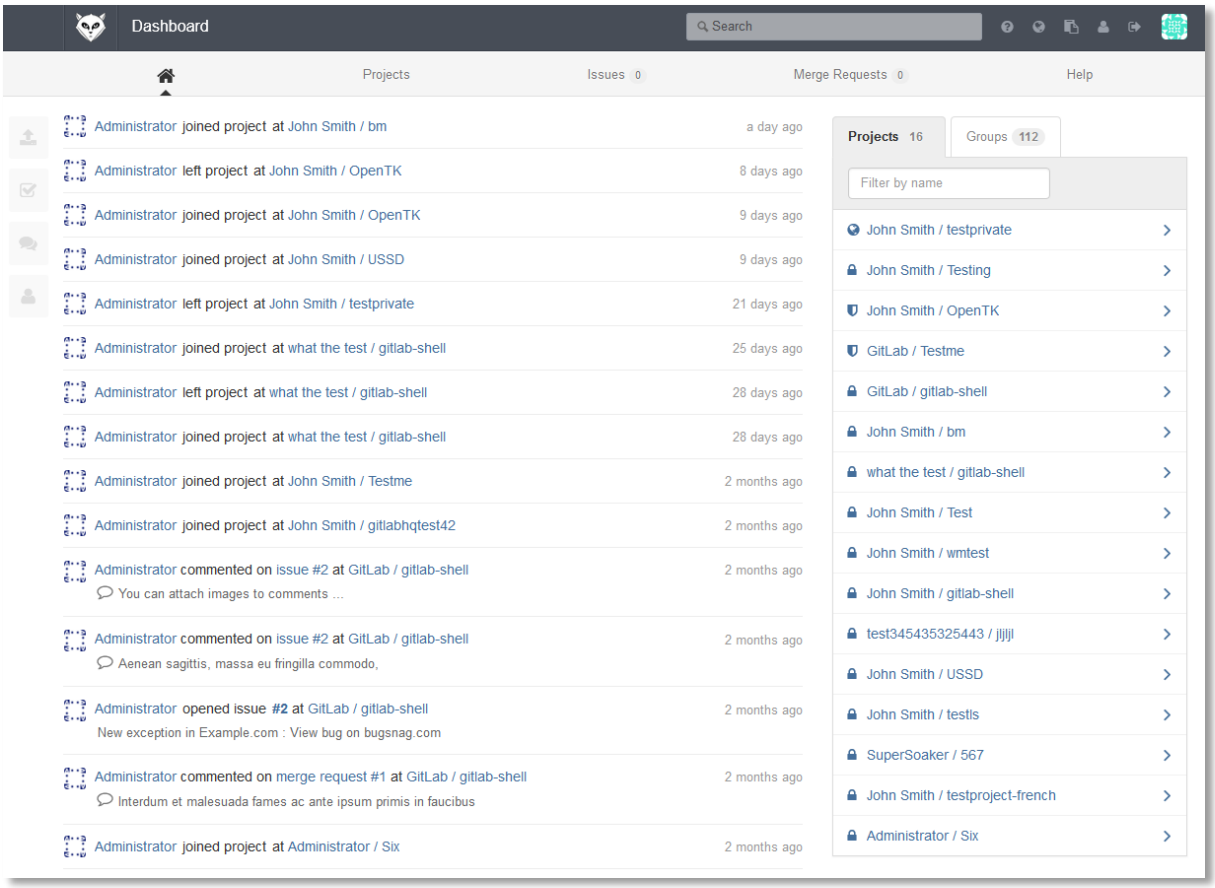

Figure 22: The main Dashboard area

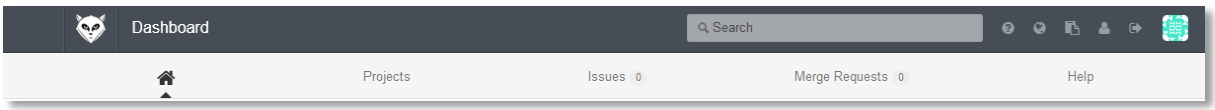

Figure 23: The main and context toolbar

From the Dashboard area the user can also quickly access from the context toolbar and quickly glance Projects, any Open Issues and pending Merge Requests.

5.3 Project Area

Upon selecting a project the user can find various information at a glance as seen in Figure 24. The Project Area displays various details about the selected project. In the left side, the activity feed informs the user about latest commits, push/merge events, comments as well as the team members of the project. On the right side, quick buttons offer the functionality to fork the project, download the whole source code, or compare the source code parts of different branches in the project.

In the context toolbar, the user can directly access the files of the current repository, see the commit log, as well as access the Wiki, issue tracker and merge request history. Additionally there are some vizualization tools available as seen in Figure 25 and 26 for the network and activity graphs.

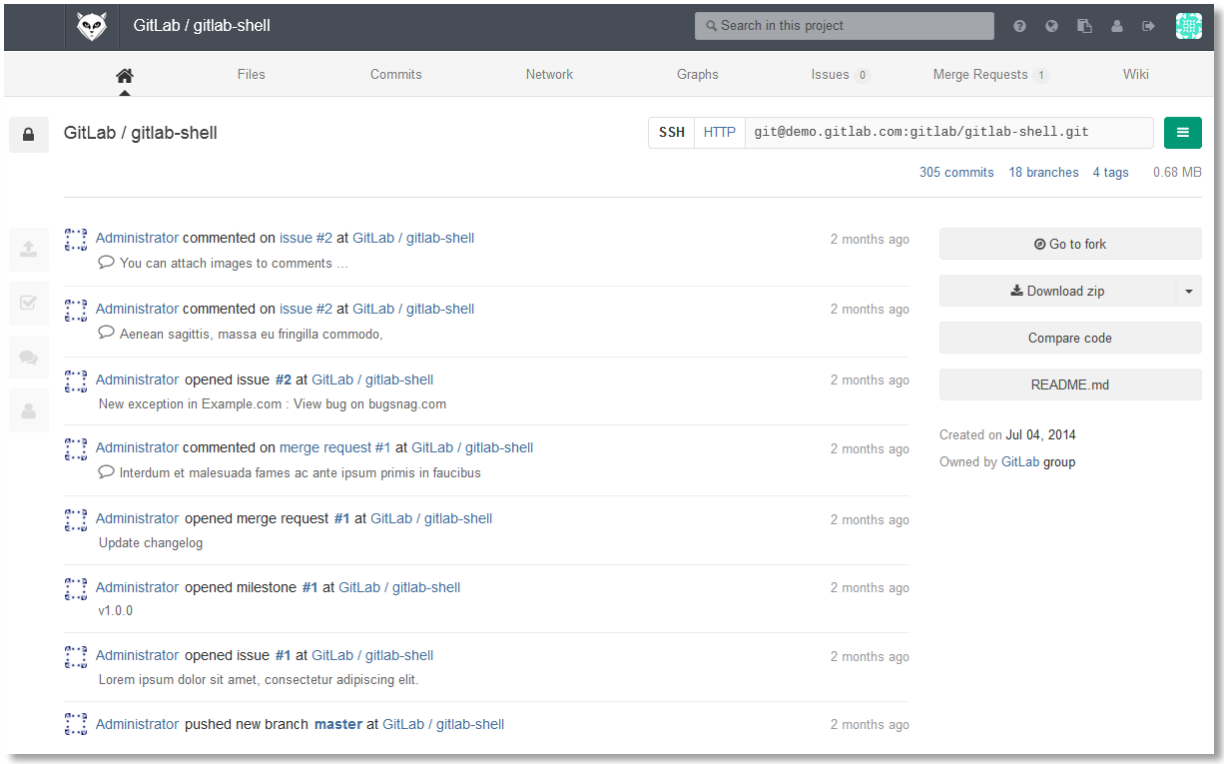

Figure 24: Project Area

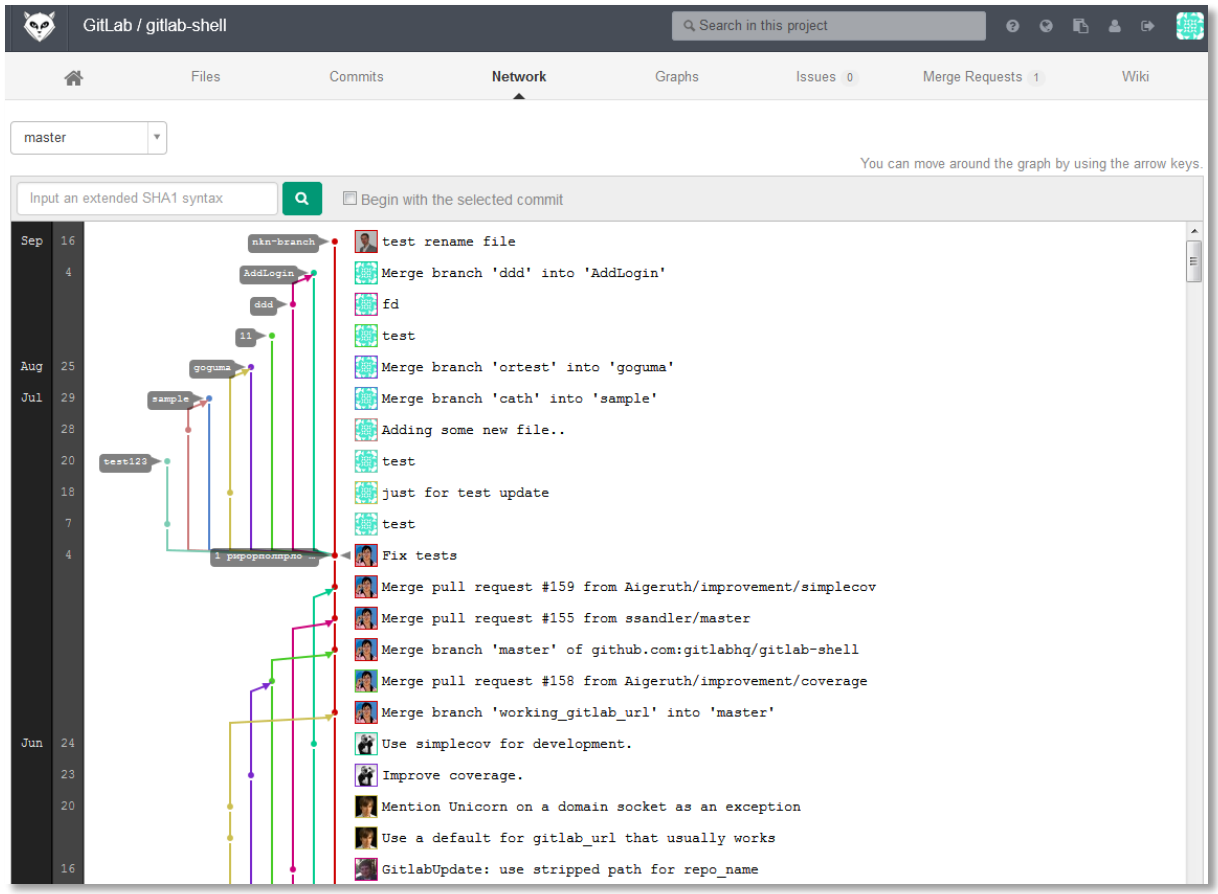

Figure 25: Network graph showing branching relations

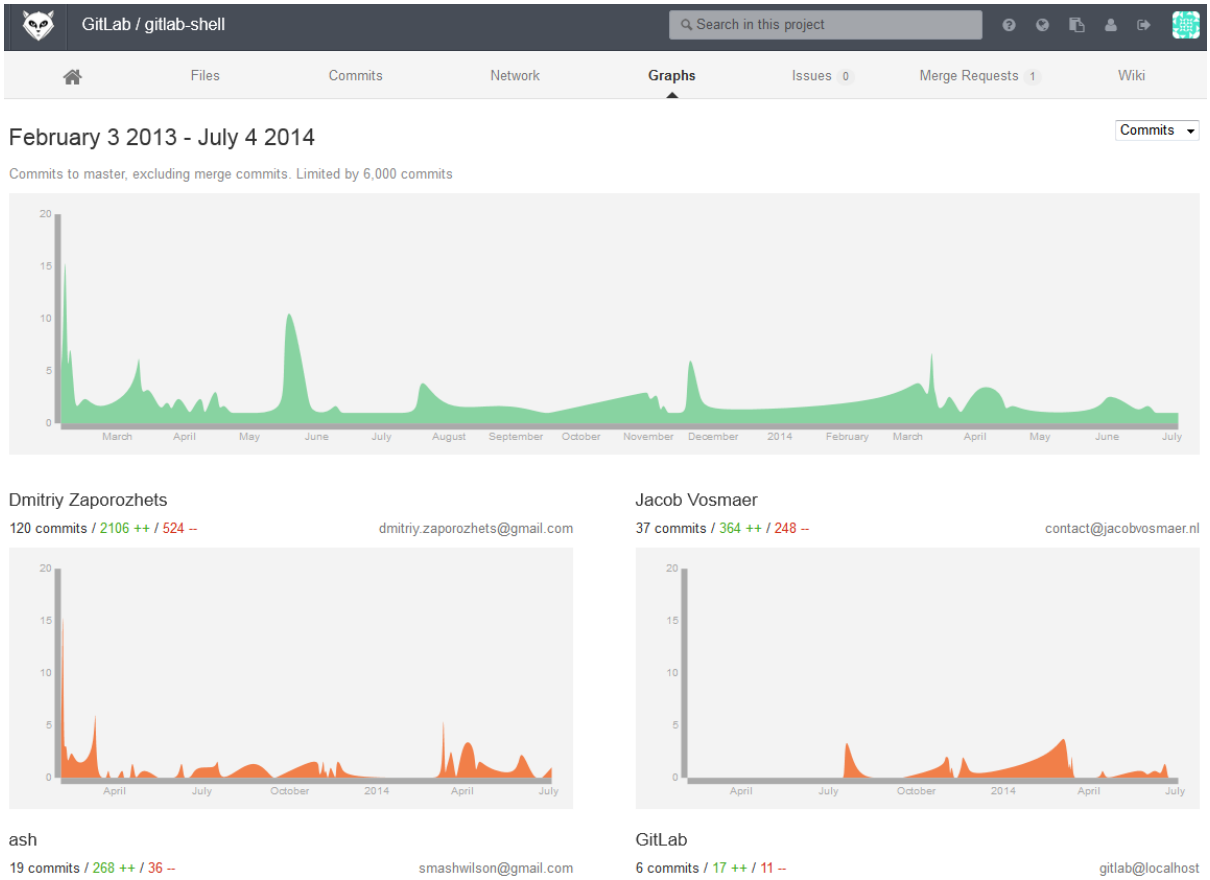

Figure 26: Activity graph show timeline of commits/additions/deletions

5.4 User Profile

Finally, the profile area is where the user can edit his/her contact and account details. Among other things the user can set a number of accessible email addresses, change password, edit notification settings, provide SSH keys for automatic access, set a web interface them, as well as accessing his/her account history.

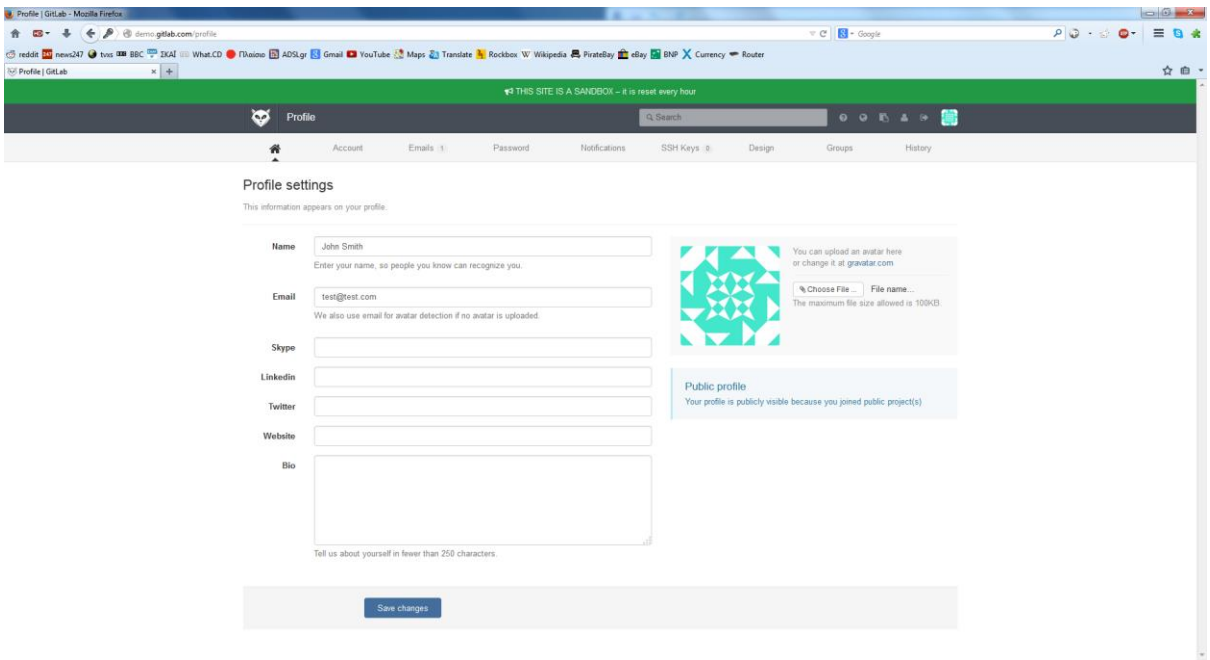

Figure 27: Profile settings view

6 Conclusions and Next Steps

6.1 Conclusion

This document describes the goals, conceptual design and implementation of the community building infrastructure. It is a major milestone for the community building activities in the DREAMS project, as it provides the basic infrastructure for achieving the community building goals, i.e. to steer and increase European R&D awareness in the area of distributed mixed-criticality and embedded computing systems. With respect to the infrastructure itself, the goal was to “Support the mixed-criticality community by facilitating active exchange of ideas as well as technological building blocks”. In this way, the Community Building activities in DREAMS shall act as a main communication point for mixed-criticality research activities and support is provided.

6.2 Next steps

Although the first milestone has been reached successfully, the community building activities are far from finished, as the infrastructure is only a first step in this respect.

In order to achieve the overall community building goals, it is necessary to make sure that content is provided to the platform. When more content becomes available, the platform also will successively gain momentum and increase its role as a communication hub for mixed-criticality research activities. In order to reach this point, the next step is to support the rollout phase of the MCS community infrastructure, contacting relevant stakeholders in the MCS community, identify the relevant past and ongoing projects and promote the use of the Mixed-Criticality Forum for future activities. In this line of activities the identification of the relevant stakeholders (end-users, public authorities, suppliers) and the identification of channels where these stakeholders are involved (e.g. workshops) is included. This is a joint activity with the exploitation activities as described in D10.2.1.