

THE EUROPEAN SPACE AGENCY

COLLABORATIVE WORKING ENVIRONMENT

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EXECUTIVE SUMMARY

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EUROPEAN SPACE AGENCY CONTRACT REPORT

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Collaborative Working Environment

- Executive Summary -

Summary

Collaborative Working Environments (CWEs) are nowadays very important for managing complex projects involving large teams. This study explored the possibility to implement such a tool throughout the European Space Agency. First of all, the User and System requirements were collected and correlated with an analysis of the present ESA IT infrastructures. Based on those requirements, the architecture of a suitable CWE was designed and its most interesting points implemented in a Pilot Project. This was completed by the analysis of possible Roadmaps and Business Models for future implementation within ESA. Finally, conclusions and recommendations were collected.

I. Study Background and Objectives

The study presented here was conducted under the General Studies Programme and investigated on how a Collaborative Working Environment (CWE) could be developed, implemented and deployed at ESA. It was carried out in the period between September 2010 and June 2012 by a team led by 4CON Space, including Capgemini Italia and the Vienna University of Technology (TUV).

The European Space Agency is exploring the possibility to adopt a tool, or a combination of tools, with the objective of coordinating its management and engineering activities, not only internally but also with industrial and academic entities, and potentially with any other entity collaborating with the Agency. In its intentions, an ideal CWE would take advantage of all the recent advances in hardware and software technologies, such as for example wikis, document management systems, application sharing solution and social media, allowing different users to share and co-edit documents, use instant messaging, voice and video chat, virtual teams and communities, blog and collaborative tagging, cloud-computing, and so on in a consistent and coordinated way.

It was specifically highlighted at the beginning of the study that areas of particular interest to ESA were: communication, project management, resource management, online work and engineering applications.

Therefore this study aimed to:

- Establish relevant use-cases;
- Perform a critical review of the available technologies;
- Perform an assessment of the existing ESA IT Infrastructure and collaboration tools;
- Develop a suitable architecture in the institutional context, including an assessment of the business model;
- Propose and implement a pilot setup, including a prototype common user interface, unifying the system for end users; and
- Assess the pilot and develop recommendations for deployment and operations.

2. User Requirements Definition.

A campaign of interviews was carried out throughout the several ESA establishments in Europe in order to define use-cases based on the different user profiles which characterise the staff members in different areas of the European Space Agency.

After this process, six different teams were identified that obviously did not represent a cross-section of all the ESA's activities, which are much more diversified, but only a model for the people interviewed. Those are a Science Team, a System Software Team, a Corporate Team, a Management and Coordination Team, an Engineering Team and an Operational Team. To each team an utilisation scenario was associated, from where three simple use-cases were derived.

From the analysis of the use-cases and the their correlation with the users' expectations, 14 top-level requirements were derived. They involved different aspects of a CWE such as its functionality, compatibility and interface, the potentiality to share documents and data, to use it remotely, and the aspects related to security and respect of privacy. A record sheet for each one of those requirement was created in order to be easily retrievable and modified.

Even if the people interviewed belonged to different ESA departments and therefore they had varied requirements and expectations, there seemed to be an almost universal opinion that these kinds of issues are essentially ignored by upper management, although there was a vast support by the interviewees for the study and its objectives. Obviously the particular needs were very diversified from one user to the other, but despite that, many common threads could be identified. Those in particular involved simple and common tasks of the everyday working activities, such as emailing, documents managing and editing, voice and video conferencing, calendaring and project management.

Mobility was also a very common requirement, especially for those ESA staff members who are often on mission and need to work offline in locations different than the office.

Large-scale document and data sharing, as well as the need of mobility, brings along all kinds of issues related to security and privacy protection, which are of primary importance especially for some programmes where high-confidentiality is required.

Some staff members are heavy users of IT infrastructures, because their activities involve, for example, processing of large amount of data or the management of a very large team spread all around the world. These people would have much more demanding requirements, especially regarding flexibility, scalability and possibility to work offline and outside the ESA's firewall.

3. Present IT Architecture at ESA

An analysis of the present IT infrastructure at ESA was carried out as part of the study, in order to design an environment which is as compatible as possible and easily implementable within the Agency.

In particular, it was observed that:

- most collaboration services are used for communication purposes;
- apart from communication, existing ESA infrastructure also support several document management systems;

- most collaboration services do not support collaborative online work on the move (e.g. through mobile devices). Many of them can be accessed from the Internet but they are not widely deployed and not in the ESA corporate infrastructure;
- some services that are used by ESA staff are not officially provided and support by ESA, such as Skype for example, even if some are planned to be in the future;
- many services are not well-integrated into existing ESA infrastructure (e.g. use of different user management).

As part of this task, an overview of the most interesting collaboration technologies that can support user requirements and the ESA rules and regulations were evaluated. Since those tools evolves very quickly with time, emerging trends for in-collaboration technologies were also analysed, such as highly mobility and dynamic teams, flexible and integrated service solutions, and social-aware collaboration.

Several methods and tools for corporate collaboration services has been identified during the study. Both on-premise and cloud based solutions can be used in principle. If allowed further investigation, these solutions could cover several missing parts in the ESA infrastructure. However, it was also noted that a few single collaboration services will not be enough due to the diverse needs of collaboration in ESA. This requires different solutions for different types of collaborations.

4. System Requirements

An important task to be performed in order to support the design of a future conceptual architecture for current and future online collaboration in ESA, is to identify the major system requirements.

In this study, this was done based on a set of criteria that has been devised to characterise collaboration requirements, relevant corporate policies and collaboration services by considering contemporary and future trends of collaborative engineering and management in ESA. The system requirements are built to overcome drawbacks of the existing ESA infrastructure and take into account emerging trends in collaboration and collaborative technologies.

The system requirements cover different aspects, including flexible and customizable on-premise collaborative services, mobility support, and service integration. In particular they were divided into fundamental system requirements, supporting adaptation and integration of collaboration services, recommendation tools, and system requirements for the development of policies. The activities of this part of the study were carried out considering that the future conceptual architecture for ESA's online collaboration will not just focus on software adaptation/customization/integration but also on the recommendation of different solutions packaging collaboration services and the development of policies suitable for different collaborative team profiles.

Given that several collaboration services have been well-developed and already offered by different providers, it was recommended that the future conceptual architecture design should focus more on enhancing collaboration features, software customization and composition, etc., rather than developing new software. It was also recommended that such a design should go towards open integration standards and integration of external services to a stable framework.

5. Architecture Design

The collection of the User and System Requirements, as well as the definition of the ESA IT infrastructure and the existing methods and tools for corporate collaboration services, served as background for the Architectural Design of a CWE tailored around the needs of the European Space Agency.

Instead of focusing on a centralised or brokering platform for all collaboration services, the approach was oriented towards a user-centric collaboration: different collaboration services interact with each other in a peer-to-peer manner based on open, distributed identity management mechanisms widely adopted on the Internet. Service interactions are established based on the collaboration features required. This user-centric collaboration architecture maximised the flexibility of user activities in their collaborative works.

As a result, the Architecture Design was based on several core services and common collaboration services, covering aspects such as Identity Management, Emailing, Instant Messaging, Conference Calls, etc. The conceptual architecture designs of several complex collaboration services covering Team Management, Notification, Event Management, Facility Booking, Document Management, Software and Document Development, and Engineering Data Management, were also explored.

Despite the fact that certain collaboration services shown in the present Design are well developed, and therefore taken into account, one of the purposes of the Design was to support re-usability of existing collaboration technologies. Thus, some of their collaboration features can be fulfilled by some existing products in the market, however it is possible that these products may arise some additional issues.

The study showed that by considering fundamental elements and service-oriented architecture, and relying on common collaboration services, one can extend these services to meet ESA needs and can build more complex collaboration services and application suites.

Although during this phase of the study several services and application suites were presented, the list of the services is not exhaustive, and it is possible to have more complex services and application suites.

6. Pilot Project

A Pilot Collaborative Working Environment was implemented and deployed with the objective to validate some of the key features highlighted in the analysis of the User and System Requirements, as well as in the Architecture Design. Due to the limited amount of time and resources available for this kind of study, only basic and fundamental services were implemented, such as:

- the Identity Management service;
- the Event Management and Calendar service;
- the Notification service;
- the Contact Management service;
- the Social Network service; and
- the Document Management service.

Nevertheless, those services were proven to be the core of ESA staff members' daily activities and in many cases the most immediate to implement.

In this Pilot, the SharePoint platform was chosen because it allows to test many of the features identified in the User and System requirements. This does not mean that such a tool would be best recommended for eventual implementation at a corporate level throughout all the Agency of a Collaborative Working Environment, but for the purposes of this study it was indeed a very good compromise given the time and the resources available, and the fact that the development of a new system starting from zero was not an objective of this study.

In order to support all the features of the Pilot, a cloud computing platform was also chosen, because it was the best cost effective “ready to go” solution for a Pilot of 3 months. Furthermore it was one of the aspect to assess in the study according to the SOW. Thus the Cloudshare service was selected and used, demonstrating a good level of support and flexibility.

The Pilot Project was deployed to a User Panel composed of 30 ESA staff member that for 3 months had the possibility to evaluate the functionality of the services proposed. A good level of participation was recorded, although less than what was hoped for. Users were particularly interested on the Event Management and Calendar Service, and in the Notification Service Management, while they showed less interest in the creation of personal/project pages in the collaborative environment (called subsites) and in the Document Management Service, mainly because of the lack of working relationships between Pilot users at the default ESAPilot website.

7. Roadmap and Business Model

At the end of the Pilot implementation phase, a Roadmap was produced with the intent to outline the steps needed for the transition from the Pilot to an operational collaborative application deployed as an ESA corporate application, so that all ESA users may use it, and possibly collaborate with the ESA ecosystem, such as for example Universities, National Space Agencies, the European Union, Industry.

Most of the tools and services being tested during the Pilot were found to be suitable for a CWE within ESA and therefore recommended to be further investigated in an eventual solution at corporate level such as Plaxo, LinkedIn and Twitter for the social networking aspects, Doodle (or alternative solutions) and Google Calendar for the calendaring and scheduling, GoogleTalk/SMS for notification.

Other interesting solution to be further investigated is OpenId implementation which allows external users to collaborate with ESA users in a ESA controlled collaboration system. It was recommended to keep the OpenId implementation for an ESA future collaboration system and to offer this way of accessing the collaboration system to external users, by making use of existing OpenId identity providers such as Google, Yahoo, Myopenid, etc. Also an integration with the ESA Active Directory authentication system was recommended. Security was the main concern related to this protocol, especially against current ESA security policies. The Pilot did not experience any issue about this matter, although security concerns have been expressed by few users. This may require a study by itself.

The out-of-the-box Sharepoint features proved to be able to deal fairly with calendaring, contact management, workflow management, wikis, blogs, forums and documents libraries, and therefore were certainly recommended in case of an ESA future collaboration system based on Sharepoint.

An integration with the ESA document management systems is recommended to be further explored, as well as an integration with WebeX and other DMS such as for example DropBox.

Related to the Roadmap, four different business models were elaborated, together with a implementation strategy. The different options includes the possibility to procure, own and maintain both Hardware and Software, or to procure and own the Software but not purchasing and maintaining the Hardware, or alternatively to rent some infrastructure from external Cloud providers, or ultimately outsourcing completely both infrastructure and software maintenance and transferring the Intellectual Property rights to a third party interested in developing the ESA collaboration system for other organisation. The first of these possibilities was recommended in this study.

8. Conclusions and Recommendations

This study on Collaborative Working Environments got a very high interest and appreciation by users and the people interviewed. Present corporate collaboration services already in use at ESA are considered rather inflexible and heavy, manly because based on outdated infrastructures both in terms of hardware and software. This often forced many ESA staff members to use their own collaborative tools. Features such as single-sign-on and cloud-based collaborative services are essential for a modern and up-to-date collaborative working environment, but many of them were found still not to be well supported by ESA IT infrastructure. Supporting mobility was also a strong requirement, especially for those staff members who are often on mission.

It was preferred to design a tool which was as flexible and customisable as possible, cloud-based, that could integrate services offered by different providers. The design of such a tool, or collection of tools, was focused on enhancing present collaboration features, software customization and composition, etc., rather than developing new software.

The above was one of the reasons why an existing tool, such as Sharepoint, with many collaborative features already available out-of-the-box was chosen as a basis for the Pilot. For this objective Sharepoint proved to be a good tool, and it was recommended to be at least considered for an eventual implementation at corporate level.

One of the services that was recommended to be investigated as a fundamental system provided by the IT infrastructure is the identity management system. OpenId was used for the Pilot of this study, with the support of the existing OpenId identity providers such as Google, Yahoo, MSN, etc.

Many aspects of a possible deployment at a corporate level of a Collaborative Working Environment with ESA were investigated in this study.

Among the four business models considered as plausible for deployment, the traditional way of procuring was the recommended model, that means owning and maintaining both hardware and software. This approach gives the best results with a phased implementation strategy. In reason of this it was also suggested that the team profiling identified in the User Requirements Document should be used as a starting point to organise tailored training for different team profiles, targeting different collaboration features.