D4.1.3 – The Dicode Collaboration Support Services (final version)

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Summary
This deliverable reports on the final version of the Dicode collaboration support services, which are designed and implemented in the context of WP4. The technical specifications of the services being developed in the context of Tasks 4.1 and 4.4 are presented. The intended audience of this document are designers and developers of the Dicode project. The document informs them on which collaboration services are available in the final version, how the final version differs from previous ones and how these services work and can be used. This deliverable is the final report on the development of the collaboration support services and concludes the deliverables D4.1.1 and D4.1.2, which were reporting on the initial and enhanced version of these services, respectively. Following the conventions adopted in the project, the final version of the collaboration support services is presented using a formalized and project-wide adopted service description template.
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1 Introduction

1.1 Context

This deliverable presents the final version of collaboration support services that have been designed and developed in the context of WP4 (“Data-Intensive Collaboration & Decision Support Services”) of the Dicode project. Specifically, it reports on the progress of work being carried out in Tasks 4.1 and 4.4, by describing the current (final) version of the associated services.

This is the third and last deliverable in a series of three deliverables reporting on the progress of work related to the implementation of collaboration support services. Deliverables D4.1.1 and D4.1.2 reported on the initial and the enhanced version of these services, respectively.

1.2 Objectives

The purpose of this document is to present the final version of the developed collaboration support services, as they originated from the functional specifications outlined in deliverable D2.2 and the updated Dicode approach described in deliverable D2.3.

As in the previous deliverables of this series, these services are presented from a technical perspective, broken down to the level of individual operations, in order to make clear their role and use, and facilitate their assessment with respect to the derived functional specifications. The operations presented are those which are available to clients to be invoked and executed without going into detail about how exactly these can be invoked or executed. In particular, the presented operations can be executed by various technologies such as REST (Fielding, 2000) or Web Services (Web Services Architecture, 2004), but such issues are not the focus of their description. The description of services takes an operation-oriented approach listing the available operations and detailing their aim and purpose.

The final version of the collaboration support services are presented using a service description template, called the Abstract Service Description (see also deliverable D3.1.1: “The Dicode Data Mining Framework”). The Abstract Service Description template provides a technical specification of services by providing an overview of the supported interfaces and the relevant operations. For each operation, a description along with major input and output information is presented.

2 Dicode Collaboration Support Services

The aim of the collaboration support services is to exploit the reasoning abilities of humans to facilitate sense-making of the results of the Dicode data mining services, which are the focus of WP3, thus capitalizing on their outcomes. Towards this, a number of relevant services are being developed that can fully address the user requirements of Dicode use cases, as outlined in deliverables D2.2 and D2.3.

This document reports on the final version of the services that have been developed in the context of the following WP4 tasks:
- Task 4.1: Rich interactive search and analysis mechanism, which is concerned with providing full-text and meta-data search of collaborative spaces and interaction of users with the analytical processes, and
- Task 4.4: Collaboration Support Services, which is concerned with the creation, management and use of innovative workspaces that augment synchronous and asynchronous collaboration.

In the following, we present the service description of the final version of the services being developed in the abovementioned tasks.

### 2.1 Overview of changes in the final version of collaboration support services

The following table provides an overview of the changes made in the final version of the collaboration support services, which will be presented in detail in the rest of this deliverable. The value “Updated” in the “Status” column means that the data type, interface or operation has been updated (compared to the enhanced version reported in D4.1.2), while the value “New” means that the operation has been newly introduced in the final version of the collaboration support services.

<table>
<thead>
<tr>
<th>Dicode Service</th>
<th>Interface</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interactive Analysis</td>
<td>Analysis Interface</td>
<td>New</td>
</tr>
<tr>
<td></td>
<td>createModule</td>
<td>New</td>
</tr>
<tr>
<td></td>
<td>executeModule</td>
<td>New</td>
</tr>
<tr>
<td>Visualization</td>
<td>Crawl visualization Interface</td>
<td>New</td>
</tr>
<tr>
<td></td>
<td>uploadGraph</td>
<td>New</td>
</tr>
<tr>
<td></td>
<td>downloadGraph</td>
<td>New</td>
</tr>
<tr>
<td>Collaboration Service</td>
<td>Workspace Interface</td>
<td>Updated</td>
</tr>
<tr>
<td></td>
<td>openWorkspace</td>
<td>Updated</td>
</tr>
<tr>
<td>MindMap Interface</td>
<td>showContent</td>
<td>Updated</td>
</tr>
<tr>
<td></td>
<td>filterWorkspace</td>
<td>New</td>
</tr>
<tr>
<td></td>
<td>suggestHelp</td>
<td>New</td>
</tr>
<tr>
<td>External Interface</td>
<td>shareWorkspace</td>
<td>Updated</td>
</tr>
</tbody>
</table>

### 2.2 Rich Interactive Search and Analysis Mechanism

Services related to rich interactive search and analysis mechanisms are the focus of Task 4.1. The search interface has been described in deliverables D4.1.1 and D4.1.2. Task 4.1 is also associated with the provision of services related to supporting analysis and enabling the navigation through the various data processing layers. Another aspect is the visualization of analysis results. In the third year of Dicode, the basic processing layer of Dicode was enhanced. Interactive analysis capabilities were added. The related services are provided to
Dicode partners only. In the following section, the new interactive analysis capabilities are described.

### 2.2.1 Interactive Analysis

Starting from the beginning of the project, the Dicode consortium elaborated the issue of latency in Big Data analytics. In Big Data scenarios, data processing strives for data locality: in Hadoop, the processing algorithms are pushed to each processing node and the processing steps are performed on the subset of data available on this node. In Dicode, we decided to develop a collaboration platform which allows for a light-weight integration of REST-based services. Those services are partly asynchronous: the user can train a machine learning model via the workbench and later on use it for analysing a document collection. Depending on the location of the document collection, large amounts of data have to be uploaded before the data can be processed – an approach which is not suitable for Big Data.

In the third year of Dicode, the amount of data to be analysed increased. As described in deliverable D3.2.3, new data sources had to be added in the third year: besides analysing Twitter and Blogs, we started analysing News and a general Web crawl. This required far more hardware resources for storage and processing than Dicode could afford. Therefore, we decided to partner with MIA\(^1\), another publicly funded project at NEO, and join NEO’s cluster infrastructure dedicated to Dicode operation and MIA’s infrastructure.

The collaboration with MIA also provided a set of additional tools which helped us to improve the data analysis workflows and the collaboration between the partners in Dicode. But before we go into details, we will first have a look at the collaboration setup in Dicode concerning document analysis. In the beginning of Dicode, processing of the document corpus on NEO’s development cluster was performed in two different ways: either the partner would download the documents via the REST services and subsequently process them locally, or the software artefacts providing the processing algorithms were uploaded to the cluster. Only the latter option allowed for distributed data processing of the documents. In contrast, the first option was seen as adequate for relatively small amounts of data.\(^2\)

After the first two years of Dicode, NEO’s development cluster of three nodes was joined with MIA’s development cluster as described in deliverable D3.1.2. The project MIA – funded by the German Federal Ministry of Economics and Technology – had been acquired based on the experience from Dicode which had been the first Big Data project at NEO. MIA develops a market place for information and analysis. The market place grants access to document collections ranging from a web crawl (significant parts of the German internet) to a high quality news corpus. MIA’s users can either make use of those collections or offer their own document collections on the data market. Same goes for data analysis algorithms: users can either apply the algorithms provided by MIA or other users to their data of choice. Or they can perform analysis using their own algorithms and sell those algorithms to other users.

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\(^1\) [http://www.dima.tu-berlin.de/menue/research/current_projects/mia/](http://www.dima.tu-berlin.de/menue/research/current_projects/mia/)

\(^2\) Not all of the text mining services rely on NEO’s cluster which holds Dicode’s document collections. Some services require the upload of the document collection before the analysis – which is contrary to any Big Data approach.
MIA not only serves as market place for data and analysis, but also offers a set of tools which support the customers in developing their data analysis components and complex text mining work flows. A high-level SQL-like query language, called MiaQL, can be used to access and analyse the data. The foreseen solution combines batch-processing and low latency data analysis: analysis results will be stored to allow instant access and subsets of the document corpus can be indexed for full-text search. Via the MIA web interface, the user can perform their analysis directly via scripting languages. More complex algorithms can be wrapped into User Defined Functions (UDFs). MIA provides scaffolding for those UDFs: a Maven archetype\(^3\) containing an example project including unit tests can be downloaded from NEO’s Maven repository. Figure 1 shows an example module in MIA for the Interactive Analysis Service.

![Figure 1: Sample Module for the Interactive Analysis Service](image)

During a pilot phase, the platform can be used by so called alpha partners free of charge. FHG will be one of the first alpha partners. The cooperation is seen as a great opportunity for the exploitation of the Dicode results and collaboration between the partners beyond the end of the project. Details about this collaboration will be given in deliverable D7.2.2 (“Dissemination and Exploitation Activities Report (second version)”), which is due in August 2013.

When using the MIA market place, the workflow for data analysis will change: Instead of passing software artefacts to NEO for integration, FHG develops a UDF based on the Maven archetype and uploads the generated JAR-Archive to the MIA market place. After setting up the interfaces of the UDF via the market place and defining the accessibility for other platform users, the UDF can be used in the query language MiaQL on the platform. FHG will then be able to offer the algorithm to other users of the platform.

The first service to be integrated via MIA is FHG’s Phrase Extraction Application service, which is described in deliverables D3.2.2 and D5.4.2. The service extracts phrases from a text collection that convey emotions or other semantic content, using a pre-trained Conditional Random Fields (CRF) model (Lafferty et al., 2001). Those models tend to be highly domain specific. FHG could use MIA to bring models trained on special domains to the market. Potential customers for this kind of algorithms are already involved in the MIA consortium. One of the partners of the MIA consortium, the Social Media Analysis company Vico Research, has acquired large Social Media datasets and analyses the data on MIA’s cluster. Via the market place, companies like Vico Research could give access to training data to FHG who could train a model for the specific use case.

The abstract service description for the Interactive Analysis Service is presented in the table below.

<table>
<thead>
<tr>
<th>Name</th>
<th>Interactive Analysis Service</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standards</td>
<td>Interactive web application</td>
</tr>
<tr>
<td>Description</td>
<td>The Interactive Analysis Service serves an integration environment for Dicode partners developing text mining modules.</td>
</tr>
<tr>
<td>Interface</td>
<td>Analysis interface (New)</td>
</tr>
<tr>
<td>createModule (New)</td>
<td>Creates a new module</td>
</tr>
<tr>
<td>executeModule (New)</td>
<td>Executes the module</td>
</tr>
<tr>
<td>Example usage</td>
<td>The Interactive Analysis Service will be used for the processing of large text collections with Dicode’s text mining components. In the previous integration environment, the Phrase Extraction Application service required the upload of the respective text collection to FHG’s server. The Interactive Analysis Service allows for the definition of module which wraps the text mining component in a Java artefact which adds the text mining functionality as an operator to the analysis scripting language MiaQL. The results of the operation can be stored in the storage layer or downloaded from the cluster. The Interactive Analysis</td>
</tr>
</tbody>
</table>

Service can also be used for the active learning phase during the training of the Phrase Extraction Application service.

The developer has to perform the following steps:

1. Generate a module template for a User Defined Function (UDF) by executing the Maven archetype
2. Implement the UDF based on the Maven archetype
3. Create a module and upload the JAR-File via the web application on the development cluster
4. Execute the UDF via the scripting language
5. Store the results either in Hadoop’s HDFS or in HBase
6. Retrieve the results from the development cluster

Comments
The described setup is experimental. The service was developed to facilitate the execution of algorithms developed by a partner on the development cluster. A long-term option is the cooperation of different partners on the market place for data and analysis (MIA), which is developed by NEO, the Technical University of Berlin and other partners. Details on the cooperation will be given in D7.2.2.

<table>
<thead>
<tr>
<th>Conformance classes</th>
<th>Not available</th>
</tr>
</thead>
<tbody>
<tr>
<td>Implementation rules</td>
<td>Not available</td>
</tr>
<tr>
<td>Implementation status</td>
<td>The platform is implemented. The UDF wrappers for FHG’s text mining algorithms are currently being implemented.</td>
</tr>
<tr>
<td>UML model</td>
<td>Not available</td>
</tr>
</tbody>
</table>

### 2.2.2 Crawl Visualization service

In the third year of Dicode, a service for the visualization of web crawls was also developed. The technologies used for this service have been developed in the second year of Dicode during our experiments concerning influencer analysis. We mainly use Gephi\(^5\), a graph analysis toolkit for the generation of web crawls visualizations. Gephi offers a desktop environment for graph analysis and an API for server-based graph rendering. At first, the

\(^5\) https://gephi.org/toolkit/
usage of the API seemed promising, because it allows for the automatic generation of graphs. We had the idea of automatically generating a graph visualization of a web crawl or a subset of a crawl like all documents classified as weblogs. Due to the big size of the crawl, this did not prove appropriate: the maximum number of nodes for a meaningful visualization is about 10,000 and if labels are used for the single nodes, even this amount is too much. When using the desktop version of Gephi, the analysis of big graphs is much easier, because the generated graph can be adapted manually. In Gephi, graph analysis typically involves filtering and the use of an appropriate layout algorithm, e.g. a force directed layout.

In Task 4.1 we decided not to implement a Graph rendering service, but to use Dicode’s storage service for the upload of manually generated graphs. Figure 2 shows a graph which visualizes a general web crawl.

![Figure 2: Gephi visualization of a web graph](image)

Although such kind of visualization can be used to derive general properties of the link graph, it was not exactly what we wanted, as this image does not allow easy interpretation of the graph structure. Furthermore, it does not give insight into individual domains. Our improved approach is providing visualizations of a meaningful subset of the link graph, which can be interpreted by a social media analyst.
restricted to the top domains with respect to incoming links. The size of the nodes is also determined by the number of incoming links to a domain.

Figure 3: Gephi visualization of a subset of domains

Another option is showing the “ego network” of a single domain which contains all nodes connected to the domain. In this case, the graph only contains the nodes connected to a single node in focus. A typical use case would be the analysis of all incoming links which link to a certain domain.

The abstract service description for the Crawl Visualization Service is presented in the table below.
<table>
<thead>
<tr>
<th>Name</th>
<th><strong>Crawl Visualization Service</strong></th>
</tr>
</thead>
</table>

**Standards**

**Description**
The Crawl Visualization service provides graph-based visualizations of Web crawls.

**Interface**

<table>
<thead>
<tr>
<th>Interface</th>
<th><strong>Crawl Visualization Interface (New)</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>uploadGraph (New)</td>
<td>Upload a graph via Dicode’s storage service</td>
</tr>
<tr>
<td>downloadGraph (New)</td>
<td>Download a graph via Dicode’s storage service</td>
</tr>
</tbody>
</table>

**Example usage**
The Crawl Visualization service can be used for different visualizations of a web crawl like:

- Link structure of general web crawls
- Link structure of a subset of web crawls (e.g. documents classified as weblogs)
- Link structure of the “ego network” of a single domain

Crawl visualizations are created with the help of the graph visualization tool Gephi. As input, Gephi uses a CSV file containing nodes (domains), edges (links) and edge weights (link counts). After loading the data into Gephi, a visualization algorithm is applied. Filtering can be either performed before loading the data into Gephi or afterwards by using Gephi’s filter mechanisms (e.g. filtering for domains classified as weblogs or for the ego network of a single domain). Finally, the graph is exported as an image file which can be uploaded via Dicode’s storage service.

**Comments**
The service depends on Dicode’s storage service.

**Conformance classes**
Not available

**Implementation rules**
Not available

**Implementation status**
Not available

**UML model**
Not available
2.2.3 Collaboration Search Service

The collaboration search service has been integrated into the collaboration service, thus making the service available to users from within individual collaboration workspaces. This service allows for indexing and searching of standard documents and helps users explore the opportunities of full-text and meta-data search. The full specification of the collaboration search service can be found in deliverable D4.1.2.

2.3 Collaboration Support Services

Dicode’s collaboration support services are the focus of Task 4.4; these services aim at developing innovative virtual workspaces which support collaboration towards sense-making in data intensive settings.

From a technical perspective, collaboration related functionalities are available to clients through the collaboration support service. The final version of this service, which is presented in this deliverable, augments the enhanced version of the collaboration workspaces with additional functionalities and improves existing ones. The overall aim of these modifications in the final version is to further facilitate the understanding of the collaboration workspaces, where the actual collaboration takes place, to provide enhanced help facilities and to improve the user interface in order to enhance the user experience. The results from the evaluation of the collaboration services (deliverables D6.2.2, D6.3.2 and D6.4.2), as well as feedback obtained by the Project Officer and Experts during the 2nd Review Meeting of the project, motivated these modifications.

The final version of the collaboration support service, introduces the following new features:

- Filtering of collaboration workspaces, which enables users to keep on the collaboration workspace only the items they are interested in, while discarding all the other. Such filtering is available in the mind-map view of workspaces.
- Proactive help and suggestions, which allow the system to support and help the users during their interactions by automatically suggesting discourse moves.
- Social sharing, which allows sharing of collaboration workspaces via prominent social networking sites.
- Improvement of the User Interface (UI) elements, in order to make the available options more understandable, easier to use and improve usability.

In the appendices of this deliverable, we present in greater detail the new features of the final version of the collaboration support service. The appendices also provide screenshots of the new features in order to clearly explain their use and role.

The new functionalities and improvements were implemented by modifying the relevant methods of collaboration support services’ related interfaces. In the next section, we present how the existing interfaces have been modified to accommodate the abovementioned changes.

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6 By the term “client” we refer to any program (including Web browsers) able to request functionalities by executing specific operations.
2.3.1 Collaboration Service

The Collaboration Service offers the implemented operations via interfaces, each of which focuses on a particular aspect of collaboration-related activities. Following the categorization of service interfaces into Core Collaboration Interfaces, Integration Interfaces and Interoperability Interfaces (as presented in deliverable D4.1.1), the final version of this service introduces modifications to the Core Collaboration and Interoperability interfaces to implement the new functionalities.

In the table below, we present these changes in the final version of the Collaboration Service. We annotate each change with “New” or “Updated” to indicate the type of change that occurred in the final version (compared to the enhanced one). For completeness, we have also included the interfaces and operations reported in the initial and enhanced version of the service, without their description which can be found in deliverables D4.1.1 and D4.1.2.

<table>
<thead>
<tr>
<th>Name</th>
<th>Collaboration Service</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standards</td>
<td>REST (Fielding, 2000)</td>
</tr>
<tr>
<td>Description</td>
<td>The Collaboration Service provides all necessary operations that permit users to create, manage and configure virtual workspaces in which the collaboration takes place and to conduct collaborative activities within workspaces. In addition, this service provides operations to facilitate integration with tools developed in the context of Dicode and interoperability with third party tools (i.e. tools not developed in the context of the project).</td>
</tr>
<tr>
<td></td>
<td>The initial version of the Collaboration Service, presented in deliverable D4.1.1, featured a number of interfaces to provide the necessary functionality. These interfaces included the Workspace Interface, for managing collaboration workspaces, the Forum Interface to allow collaboration in a manner that Web forums allow, the MindMap Interface to allow operating a workspace in the mind-map view, the UserManagement Interface which allows managing users, the Authentication Interface to permit authentication and connection operation to collaboration services and the External Interface for allowing interoperation of workspaces with third party tools.</td>
</tr>
<tr>
<td></td>
<td>The enhanced version of the Collaboration Service updated some of the existing interfaces and introduced new ones to address requirements of the Dicode use cases. The interfaces introduced were the Neighbourhood and KnowledgeType interfaces.</td>
</tr>
<tr>
<td></td>
<td>The final version of the Collaboration Service, presented in this deliverable, updates the MindMap and External interfaces to introduce new functionalities. The changes in the final version are summarized as follows:</td>
</tr>
</tbody>
</table>
- Changes to the user interface when the workspace is operated in the Mind-map view in order to improve its usability
- Ability to filter workspaces to cope with data-intensive collaboration settings
- Proactive help during user interaction in the Mind-map view of workspaces
- Sharing of workspaces via social networking sites

Below, we present all interfaces and their available operations, and describe in detail only those parts that have been introduced in the final version of the Collaboration Service. Due to the fact that user interface issues are not the focus of the abstract service description template, user interface modifications are discussed in the context of the most relevant operation.

<table>
<thead>
<tr>
<th>Interface</th>
<th>Workspace (Updated)</th>
</tr>
</thead>
<tbody>
<tr>
<td>createWorkspace</td>
<td>See deliverable D4.1.1</td>
</tr>
<tr>
<td>openWorkspace</td>
<td>The openWorkspace operation has been introduced in the initial version of the service (deliverable D4.1.1) and opens an existing collaboration workspace in the Mind-map view. The updated version of this operation in the final version of the service introduces user interface changes in the Mind-map view. In particular, these modifications focus on relocating and improving the main menu – where all the required operations are available – of the Mind-map view of collaboration workspaces. Appendix A shows the new user interface for the Mind-map main menu and explains the rationale behind this change in greater detail.</td>
</tr>
<tr>
<td>updateWorkspace</td>
<td>See deliverable D4.1.1</td>
</tr>
<tr>
<td>copyWorkspace</td>
<td>See deliverable D4.1.1</td>
</tr>
<tr>
<td>transformWorkspace</td>
<td>See deliverable D4.1.1</td>
</tr>
<tr>
<td>createKnowledgeType</td>
<td>See deliverable D4.1.2</td>
</tr>
<tr>
<td>showWorkspaceAnalytics</td>
<td>See deliverable D4.1.2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Interface</th>
<th>Forum</th>
</tr>
</thead>
<tbody>
<tr>
<td>postItem</td>
<td>See deliverable D4.1.1</td>
</tr>
</tbody>
</table>
### Interface | `Neighbourhood`
--- | ---
`getNeighbourhood` | See deliverable D4.1.2
`getAllNeighbourhoods` | See deliverable D4.1.2
`hideNeighbourhood)` | See deliverable D4.1.2
`showNeighbourhood` | See deliverable D4.1.2
`likeItem` | See deliverable D4.1.2
`dislikeItem` | See deliverable D4.1.2
`showLikes` | See deliverable D4.1.2
`showDislikes` | See deliverable D4.1.2
`updateItem` | See deliverable D4.1.2
`createItem` | See deliverable D4.1.2

### Interface | `KnowledgeTypes`
--- | ---
`createGroup` | See deliverable D4.1.2
`createKnowledgeType` | See deliverable D4.1.2
`addKnowledgeTypeToGroup` | See deliverable D4.1.2
`setForumTransformationRule` | See deliverable D4.1.2
`setFormalTransformationRule` | See deliverable D4.1.2
`assignGroupToWorkspace` | See deliverable D4.1.2
`assignGroupToWorkbench` | See deliverable D4.1.2

### Interface | `MindMap (Updated)`
--- | ---
`createItem` | See deliverable D4.1.1
`uploadItem` | See deliverable D4.1.1
`createRelationship` | See deliverable D4.1.1
`updateItem` | See deliverable D4.1.1
`updateRelationship` | See deliverable D4.1.1

**showContent (Updated)**

The showContent operation was introduced in the initial version of the service (deliverable D4.1.1) and allows displaying the content of an item that has been uploaded into the collaboration workspace. In the final version, user interface issues related to this call have been changed. In the previous (enhanced) version of the service, the showContent operation is called when the user double clicks on a collaboration item in the workspace, revealing the item’s content. In the final version, a call to showContent is issued when the user hovers over an item. More details on this modification is given in Appendix A.

`deleteItem` | See deliverable D4.1.1

`deleteRelationship` | See deliverable D4.1.1
<table>
<thead>
<tr>
<th>Function</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>moveItem</td>
<td>See deliverable D4.1.1</td>
</tr>
<tr>
<td>createGroup</td>
<td>See deliverable D4.1.1</td>
</tr>
<tr>
<td>updateGroup</td>
<td>See deliverable D4.1.1</td>
</tr>
<tr>
<td>deleteGroup</td>
<td>See deliverable D4.1.1</td>
</tr>
<tr>
<td>filterWorkspace (New)</td>
<td>Allows filtering of workspaces that are operated in the Mind-map view, by specifying criteria that the available items must match. Upon successful completion, only the items that match the specified criteria remain on the workspace. Appendix B presents this functionality in greater detail.</td>
</tr>
<tr>
<td>suggestHelp (New)</td>
<td>Gives users suggestions when they interact with the workspace in the Mind-map view in order to fully exploit its capabilities. The suggestions pop-up whenever users interact with the workspace, proposing additional operations. Appendix C presents this functionality in greater detail.</td>
</tr>
</tbody>
</table>

**Interface UserManagement**

<table>
<thead>
<tr>
<th>Function</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>registerUser</td>
<td>See deliverable D4.1.1</td>
</tr>
<tr>
<td>updateProfile</td>
<td>See deliverable D4.1.1</td>
</tr>
</tbody>
</table>

**Interface Authentication**

<table>
<thead>
<tr>
<th>Function</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>loginUser</td>
<td>See deliverable D4.1.1</td>
</tr>
<tr>
<td>logoutUser</td>
<td>See deliverable D4.1.1</td>
</tr>
</tbody>
</table>

**Interface External**

<table>
<thead>
<tr>
<th>Function</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>exportWorkspace</td>
<td>See deliverable D4.1.1</td>
</tr>
<tr>
<td>importWorkspace</td>
<td>See deliverable D4.1.1</td>
</tr>
<tr>
<td>exportToCompendium</td>
<td>See deliverable D4.1.1</td>
</tr>
<tr>
<td>importFromCompendium</td>
<td>See deliverable D4.1.1</td>
</tr>
<tr>
<td>importFromForum</td>
<td>See deliverable D4.1.1</td>
</tr>
<tr>
<td>shareWorkspace (New)</td>
<td>Allows sharing of a collaboration workspace via popular social networking sites. The operation posts the URL of the collaboration workspace to social networking sites that the user specifies. The operation supports a great number of popular social networking sites which include Facebook, Twitter, LinkedIn, Delicious etc.</td>
</tr>
</tbody>
</table>
Appendix D presents this functionality in greater detail.

Example usage (Updated) A web application will provide the necessary user interface through which the previously mentioned operations can be executed by end users. In general, all Dicode use cases that require support for collaboration will be able to use the above operations. In particular, users of the Dicode use cases can use the operations provided by the workspace interface to create and configure new workspaces where the collaboration will take place. When they use collaboration workspaces in the Mind-map view and the workspace reaches a critical level in terms of the number of uploaded items, they may filter the workspace by keeping only the items they are interested in.

Comments The final version of the service provides a proof-of-concept implementation of all the new operations. In addition, bugs and malfunctions which were identified in the enhanced version have been addressed.

Conformance classes Not available
Implementation rules Not available
Implementation status Prototypical version implemented. The source code of the final version of the collaboration service, implementing the changes mentioned in this deliverable, can be found in the Subversion repository at the following locations:

- Modifications related to the user interface: https://devel-dek.cti.gr/svn/ftel/dicode/trunk/src/www
- Modifications related to operations: https://devel-dek.cti.gr/svn/ftel/dicode/trunk/src/dll

UML model Not available

3 Conclusions

This deliverable presents the final version of collaboration support services that have been designed and developed in the context of Tasks 4.1 and 4.4. The final version of the previously described services have been developed using the guidelines outlined in deliverables D5.1.1: “Standards and guidelines for development” and D5.1.2: “Standards and guidelines for development (enhanced version)”. The changes introduced were motivated by findings that came out during the evaluation of the Dicode services, as well as by issues raised during the project’s 2nd Review Meeting.
Future work will concentrate on thoroughly testing the functionalities of the final version. Moreover, the final version of the collaboration support services will be used in diverse collaboration settings in order to further assess their usefulness and ease-of-use.
4 References


Dicode Deliverable D2.3 (2012). The Dicode Approach Revisited

Dicode Deliverable D3.1.1 (2011). The Dicode Data Mining framework (initial version)

Dicode Deliverable D3.1.2 (2013). The Dicode Data Mining Framework (enhanced version)

Dicode Deliverable D3.2.2 (2012). The Dicode Data Mining Framework (enhanced version)


Dicode Deliverable D4.1.2 (2012). The Dicode Collaboration Support Services (enhanced version)

Dicode Deliverable D5.1.1 (2011). Standards and guidelines for development (initial version)

Dicode Deliverable D5.4.2 (2012) Integrated Dicode Services (enhanced version)

Dicode Deliverable D6.2.1 (2012). Report from the evaluation of use case #1 (first version)

Dicode Deliverable D6.3.1 (2012). Report from the evaluation of use case #2 (first version)

Dicode Deliverable D6.4.1 (2012). Report from the evaluation of use case #3 (first version)


APPENDIX A: User Interface improvements of the Mind-map view of Collaboration Workspaces

The user-interface of the Mind-map view of collaboration workspaces has been improved in order to respond to related findings that emerged during the evaluation of the service (deliverables D6.2.1, D6.3.1 and D6.4.1). These findings indicated that users had difficulties in uploading and exploring workspaces mainly because it was difficult to locate the main user interface which allows invoking all relevant operations. Furthermore, users had difficulties in viewing the content of individual collaboration items on the workspace, as it was not obvious how they could invoke the relevant operations. The overall aim of the carried out modifications was to increase the usability of collaboration workspaces when they are operated in the Mind-map view.

To address the main user interface issue, the main user interface was redesigned and relocated. Figure 4 shows the design and location of the new main menu in the final version of the collaboration service, when the workspace is operated in the Mind-map view. The menu appears on the left side of the collaboration workspace, and the individual options pop-out whenever the user hovers over them. That way, the user interface indicates its presence without obstructing the working area.

![Figure 4: Location and style of the new main menu in the final version of the collaboration service. The main menu is located on the far left side of the Mind-map view and individual options pop-out when users place the mouse over them.](image)

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With respect to the issue of displaying an item’s content, in the final version users can display the content of items on the Mind-map view by simply placing the mouse over an item. This is in contrast to the enhanced version, where users had to double click on an item to reveal its content. Figure 5 shows how the content of an item is displayed in the final version of the service.

**Figure 5:** Example of displaying an item’s content when the user places the mouse over the item.
APPENDIX B: Filtering items on collaboration workspaces

The final version of the collaboration service also introduces a new feature that allows users to filter out items that appear on the collaboration workspaces. Such filtering allows users to keep only a subset of the available items, while hiding all the others. The purpose of this functionality is to allow users to focus on particular items on the workspace when the workspace becomes large, with many interrelated items. Its overall aim is to make the discourse more understandable to participants when the number of items grows large.

A criteria-based approach has been adopted to filter out items on a workspace: users may specify what criteria the items that they want to keep on the workspace should match. Figure 6 shows the dialog that enables users to specify these criteria.

Figure 6: User interface dialog which allows users to select criteria to filter items in a collaboration workspace operated in the Mind-map view.
The available criteria include:

- the *creator of items*, which allows to specify items that were uploaded by a specific user.
- the *last user modifying the item*, which allows to specify items that were last modified by a particular user. In the Mind-map view, all participants can modify the available items.
- the *item’s Mime-type*, which allows users to specify which Mime-type the items must match. This allows for example to specify Mime-types such as PDF, DOC or PS files.
- the *item’s knowledge type*, which allows users to keep on the workspace items which are of a particular knowledge type.
- the *item’s creation date*, which allows users to keep items that have been modified within a specific period.
- the *item’s argumentation level*, which allows to specify items that are connected to an item of knowledge types “Idea” via a path whose length is less or equal to a specified value. In the Mind-map view, items can be explicitly associated via arrows in order to express a particular semantic relationship. Considering such arrows as vertices and items as nodes, the mind map can be conceptualized as a graph. The terms “path” and “length” is perceived in the graph theoretic sense (Path (graph theory), 2013). This option allows users to keep on the collaboration workspace only those items that lie on a path that contains an item of type “Idea” and its length is no greater than the specified value.

All the above criteria are used conjunctively; items matching all specified criteria are kept on the collaboration workspace, while items not matching even one of these criteria are temporarily removed.\(^7\)

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\(^7\)This removal is not permanent. During filtering, these items and their relationships are just not shown on the collaboration workspace. Hidden items will show up again, when the user exits the filtered view.
APPENDIX C: Proactive help and suggestions during interactions

In order to further help users understand and exploit the capabilities of the Mind-map view of collaboration workspaces, the final version of the service introduces new ways of providing help and suggestions when users interact with the workspace. In particular, the final version implements a proactive form of suggestions, which display relevant next actions depending on the action performed by the user. The overall aim of such proactive suggestions is to:

- guide and help the user in constructing meaningful argumentation structures in the Mind-map view by proposing suitable next steps,
- make users aware of the available functionalities in the Mind-map view, so as to get them quickly accustomed with the way of working in it.

Such suggestions automatically pop-up on the workspace (whenever the user performs an operation). They may suggest next steps related to the performed operations, such as how to create a relationship when a new collaboration item is uploaded, how to edit and change the properties of a relationship if one is created, and how to change colours and the title of grouping mechanisms available in the Mind-map view. Figure 7 shows an automatic suggestion that pops-up and advises the user to relate an item with others, after a new item has been uploaded.

![Figure 7: Suggestion popping up after the user has uploaded an item into the workspace, indicating how to further process the new item.](image-url)
Automatic, proactive suggestions can be turned off by users, by choosing the appropriate option from the Mind-map main menu. In addition, all suggestion messages can be accessed and browsed by users via the main menu.
APPENDIX D: Sharing of collaboration workspaces via social networking sites

The final version includes a new functionality that allows the sharing of collaboration workspaces via popular social networking sites. In particular, this functionality allows users to post the URL of collaboration workspaces onto social networking sites, through which access to the shared workspace is possible. It supports such a sharing via many social networking sites (including Facebook, Twitter, LinkedIn, etc.) by exploiting the relevant APIs that these sites provide. A main menu option gives users access to this functionality.

Figures 8 and 9 show how the ability to share collaboration workspaces has been implemented and integrated into the final version of the service.

![Diagram showing collaboration workspace sharing via Facebook, Twitter, LinkedIn, etc.]

Figure 8: Quick social networking sharing option of collaboration workspaces via the main menu.
Figure 9: Full social networking sharing options of collaboration workspaces. The “full” option, which can be displayed by clicking on the menu’s “Share” icon, offers sharing to a great range of social networking sites.