



Process-oriented Learning and Information eXchange

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A Executive summary

This document explains the progress made in the development of the Competency Analyser.

In PROLIX the business processes and learning material are annotated with competencies. The people are assessed to determine their competency profile. Matching on competencies is used to determine which courses people could follow to perform the process better.

This matching is a two step process. The validity of the assessments is evaluated to determine the person's competency profile, and this is matched with the competency profiles of the tasks to perform and the learning material to suggest the courses to follow.

We will indicate the advances made in the Competency Analyser in the previous year, and also recapitulate how this fits into the full system. We also include lessons learned and suggestions for further improvements to the system.

B Introduction

The advanced version of the competency analyser laid a strong basis for the competency modelling and matching in the project. However, some required functionality was still lacking, the usability needed additional work and the pilots have uncovered aspects which were unclear, impractical or not sufficiently developed.

Time constraints have limited what has been accomplished and we have some ideas about further work which would be useful for competency modelling and matching.

The competency analyser provides services for retrieving, updating, inserting, and formalizing (by semantic annotation) competencies. These services can either be called directly by the other components (using web services) or can be accessed via a web interface. Competencies can be assembled into competency profiles which are associated with artefacts which represent objects in the outside world (in other components). These artefacts can be objects of any kind:

- functions in a business process
- roles attached to functions
- learning objects
- learning templates
- individuals

The artefacts are however split into three different types, which also determine the kind of competency profile.

- *task artefacts*, representing a set of competencies which are required at a certain proficiency level to indicate the execution of the task could be done satisfactorily.
- *learning artefacts* which contain a competency profile with *prerequisite* and *objective* levels. The idea is that consumption of the artefact *should* raise your competencies to the objective level if you already had them at prerequisite level beforehand. Artefacts are normally created at the initiative of the other PROLIX components.
- *Person artefacts*.

The Competency Analyser is *assessment based*, this means that you cannot directly say "person X has competency Y". You can only indicate the results of an *assessment* for competencies or a task. The assessments are evaluated when the competencies for a person need to be determined. This is called "evidence distillation". At that point, you can choose (by using a "matching profile" which assessments should be considered and how they impact the profile.

For the management of components the following is available

- Simple creation of the competencies and all related information in the user interface
- Easy creation of a competency in a context.
- Extending competencies by applying in a new context.
- Provide visual assistance to formalize the competency and the proficiency levels by means of semantic annotation (definition of the commitment on a context ontology).

The competency matching allows selecting the best persons for a specific task, and for each of these, matching the *optimal* learning objects to increase the competencies for a person to satisfactorily perform a task. You can also do matching based on a competency plan. This is useful for matching on groups of people or teams. You can determine the tasks or roles which are needed for the plan, and who should fulfil these tasks or roles. Matching then takes the whole group into account.

Matching and evidence distillation work using a matching profile. This defines how exactly the matcher should behave. The matcher starts by applying evidence resolution on the persons assessments to define the competencies at the current time considering the rules defined in

the matching profile. This can define things like the amount of influence of evidence degradation (e.g., do not consider assessments older than x months which have not been at least partly re-assessed), minimum confidence rating of assessments and how confidence should be treated etc.

The person and task competency profile are then matched. This uses several decision layers, like direct matching, structure matching (based on competency composition), semantic matching. Each of the matching methods gives a vector as match result. This vector contains match score, match confidence (a measure determined by the match method used), assessment reliability for the match etc. The matching profile determines how these vectors are combined and how they are sorted.

The PROLIX consortium has undergone some changes in the last period which have forced some changes. These have been summarized as the “contingency plan”. In trying to combine the goals of the project and the individual partners in the project, the result has been a tighter integration of the Competency Analyser in the Learning Process Execution Platform, thus assuring the learners have less components to interact with. The results of this have received a separate chapter (Integration of the CA in LPEP).

B.1 What is new in this version

Compared with the previous deliverable “D3.3 Competency Analyser, advanced” the following major changes have been implemented :

- Filtering on artefacts. An artefact can be either a person, a learning object or a task/role. In some cases only one type of artefacts, for example when selecting the assigned tasks/roles for a person. This is now filtered to assure you cannot select the other types.
- Artefact reference now only unique per organization. Previously this was world unique, which (though theoretically correct) is impractical, especially for testing.
- Matching profiles implemented
- Changed the layout/design of the application to look more professional.
- Matching indexes are now organization specific
- Auto indexing (avoiding manual indexation)
- Logout working
- Speed improvements
- Usability improvements for adding multiple contextualised competencies at once (instead of adding them one by one).
- Extra learning artefact info, extra person info
- Allow explicit modelling of assigned tasks/roles for a person
- Improved automatic (integration) testing
- Import and re-index pages
- Authorization and configuration features. Based on the roles of the logged in user, there is a granularly configurable access control, allowing access to certain tables or fields, selectors, actions, delete to be prohibited. For fields and tables, there is a choice between read-write, read or no access. For the fields which are allowed to be viewed the user can still choose to hide some.
- Improved person-task matching result display
- Improved competency plan matching result page
- Self assessment page (assessing the assigned tasks/roles)
- Manager assessment page
- SSO with the other prolix modules (especially with the portal)
- Allow creation of users from the portal
- PROLIX compliant web services (using the PROLIX SOAP header and SSO)

- Allow inclusion of the semantic matching based on DOGtagger, Dmatch, DOGMA-mess technology
- Many usability improvements and bug fixes

B.2 How to use this document

This document tries to be suitable for both technical people and users of the software, for people who already know the software and PROLIX and for people new to the subject. Therefore not all content is suitable for everyone.

The chapters are given in the following order :

- Positioning in PROLIX
- Methodology
- Technical details, how is the software built
- User manual
- Lessons learned
- Appendixes with some more technical details

Each of the chapters starts with an indication of the intended audience to make it easier to determine whether you should read or skip that chapter.

C Position of the Competency Analyser in PROLIX

Who should read this chapter : persons who don't know the PROLIX system, the parts of it and how it all works together.

This section presents an overview of the PROLIX system. We first shortly present the system components and then put them all in place, presenting the core interaction between the Competency Analyser and the other components and services.

C.1 Functional Components

This section will provide a short summary of the various components which are be integrated into the Prolix system:

1. *Business Process Cockpit (WP1)*: The uniqueness behind PROLIX is that it binds the Business Process Descriptions with the competencies for each process, so that learning objects and plans for covering the gaps between the employees and the processes can be proposed. For the task of modelling-formalizing the business processes, and attaching the competencies in each of the processes, a cockpit-interface is required. The Business Process Cockpit will be used for creating and editing the business process according to these requirements. The cockpit also serves as a repository for the Business Process models.
2. *Competency Analyser (WP3)*: The competency analyser is used as a repository for storing competency definitions and competency profiles (a binding between competencies and real world artefacts) and as user interface for managing them. It contains an advanced matching engine for competency based matching. There are separate components which allow defining the semantic definition of the competencies. These definitions can also be considered during the matching. These competency analyser is centrally placed in prolix, as it is used (though the web service interface) from most other components.
3. *Didactical Learning Modeller (WP4)*: The Didactical Learning Modeller component offers an interface for creating and modifying didactical learning templates. Note that the Didactical Learning Modeller, though it might have one, does not serve as a learning modeller repository for the PROLIX system. Instead, the main repository for the Didactical Learning Models is provided by the Learning Process Configurator (WP5).
4. *Learning Process Configurator (WP5)*: The Learning Process Configurator is used by the Learning Process administrator for configuring a Learning Process that will cover a specific competency gap. The component not only offers the user interface for configuring the Learning Process, but also serves as the central repository for Learning Processes and Learning Templates in PROLIX.
5. *Competency Oriented Process Simulator (WP6)*: The Competency Oriented Process Simulator is used for simulating the processes (both learning and business processes) and reporting on specific cost and benefit metrics. Furthermore, the simulator provides the suitable interface for creating the cost and benefit metrics.
6. *Performance Monitor (WP7)*: The functionality of the Performance Monitor is twofold: (a) it offers the user interface for configuring the performance metrics for both types of processes, business or learning processes, and (b) it attaches seamlessly with the learning process execution platform and other existing systems to collect Performance

Metrics and report them to the process managers (Learning Process and Business Process Manager) and save them to the relevant repositories.

7. *Learning Process Execution Platform (WP8)*: The Learning Process Execution Platform is responsible for the actual execution of the selected Learning Process to the students-employees. Furthermore, the Execution Platform updates any newly acquired competencies for the employees to the central competency repository.

Error! Reference source not found. gives an overview of the components and the data flow between them.

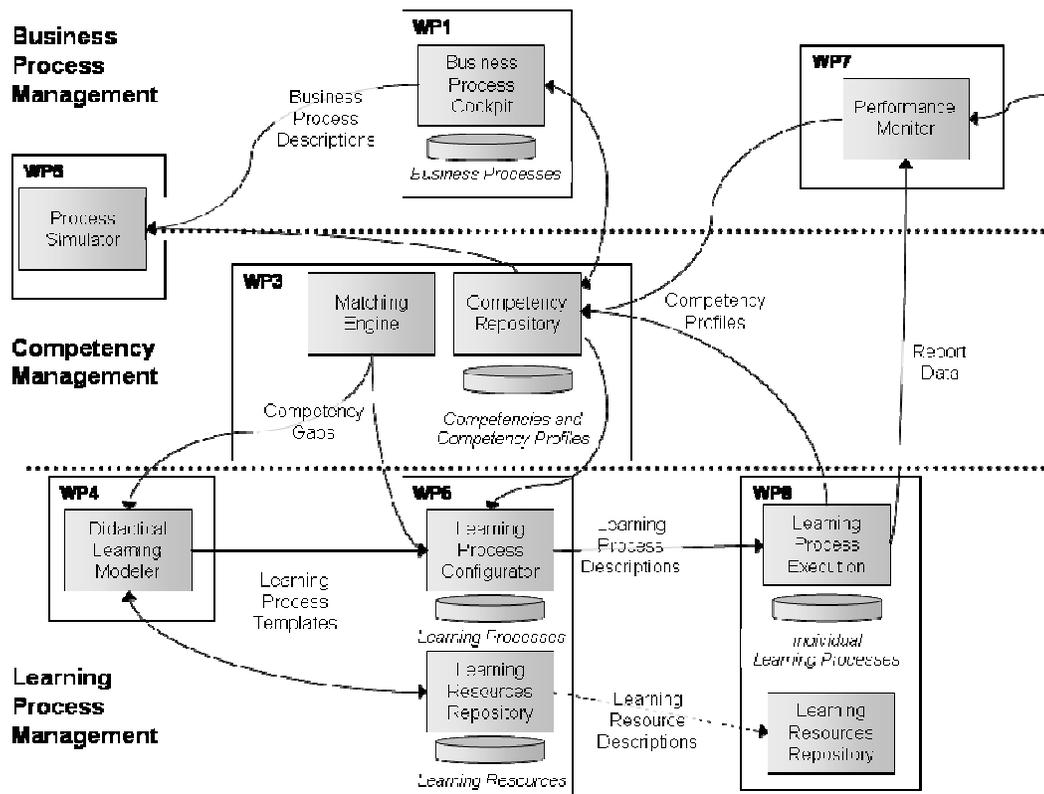


Figure C.1.1: Component diagram and data flow

C.2 Infrastructural Components

Besides the functional components, Prolix provides infrastructural components to smoothen the interaction between the interconnected applications:

8. *Enterprise Service Bus Event Handler (WP2)*: All events within Prolix are sent via interfaces offered by the ESB. The ESB dispatches them to subscribed components.
9. *Workflow Engine and Task Management (WP2)*: Several Prolix processes cut through different components. The workflow engine allows creating instances of these processes as workflows and to tracks their progress. Automatic tasks of the workflows are executed by the engine; manual tasks are added to the responsible user's task lists.

10. *Prolix Portal (WP2)*: The portal offers a single entry point to the Prolix system. After login, a user can select the application they need to use. Additionally, the portal provides support information, and integrates a user’s task list.

11. *Prolix Identity Services and Server (WP2)*: The Prolix identity services allow for centralized user and permission policy management. This will all allow the system to manage any security and user related information in one central place. Also, the individual components are not bothered to implement own authorization and authentication mechanisms.

C.3 Interactions between CA and other components

The basic services offered by the competency analyser towards the other components are:

- Handling of artefacts and the related competencies, including retrieval and update of competency profiles.
- Matching service.
- Direct user access for the creation and/or modification of competency profiles.
- Direct invocation of the matcher user interface, with the specific purpose of investigating the remaining competency gap.

Business Process Cockpit	BPC has links to the CA to allow the following : <ul style="list-style-type: none"> - Define, investigate competencies for a “competency” node. - View the combined competencies for a role. - Unlink function from role, link function to role.
Learning Process Configurator	<ul style="list-style-type: none"> - Define, investigate competencies for a learning object (or part of a learning object) or test. - Linking and unlinking related learning objects and tests.
Simulator	<ul style="list-style-type: none"> - Get competency profile as basis for simulation - Update proficiency levels for a task from simulation results
Learning Process Execution Platform	<ul style="list-style-type: none"> - Invoke competency plan matcher - Check which people could benefit from a course - Add assessments when learning completed, tests completed.
Enterprise Service Bus	All web service communication between components should happen through the service bus.
Workflow Engine	The workflow engine links to the CA when needed in the process.
Portal	The portal allows clicking through to the CA. It is then included in the window in an iframe. No login in necessary thanks to Single Sign On.
Identity Services	<ul style="list-style-type: none"> - Used by the CA to verify SSO credentials. - CA handles notification when users are created to create the user and person artefact in the CA.

D Competency modelling

Who should read this chapter : everybody, methodology or recommendations for competency modelling. Some of the terms may not be clear until either domain model or user manual are read.

The Competency Analyser allows many ways to define relations between competencies. We try to clarify the use of the concepts, when and how to use which.

Context

We consider that competencies are generally defined in a certain context or environment where the competency is used. For example, the competency “business English” will have a slightly different meaning when applied in a law firm or in a chemical company.

One sensible approach is to consider where the exact (semantic) definition of the competencies come from. Is it a particular standard, an industry sector or the company itself who defined the competencies? When in doubt, it is generally best to use your own organization (or even a department) as context.

Category

Using categories, you can define one or more taxonomies and place your competencies in the taxonomies.

This allows you to create relations between competencies which may be useful for identifying the correct competency but which do not affect the matching.

Organization

This level is implicit for normal users. They will not be able to view data outside of their organization. However, for administrators, it is useful to know that certain data, like competencies, contextualised competencies, contexts, scales can be shared between organizations.

Application Domain

The application domain (not fully supported in the implementation yet), is intended to allow filtering on the data. An organization may have several divisions, like hr, administration, work floor, stock. Most competencies, tasks will only apply to some of the divisions. By defining application domains and setting which application domains a competency or task belong to, you can reduce the data which is normally visible, thus making the list more manageable.

Competency structure

The competency analyser allows defining competency structure, decomposing competencies into more granular competencies.

For example, the competency “driving a car”, can be decomposed into “operating a car”, “knowing the traffic rules”, “defensive driving”.

The advantage is that it is generally easier to think of jobs/roles in the sense of more general competencies, but evaluations and learning can more easily be managed on more granular competencies.

When doing competency elicitation, it may be useful to start creating competencies using more general descriptions, and then drilling down to the actual meaning by looking for more granular competencies.

Note that when matching the more granular competencies can be recombined (by applying the rollup rules) into more general competencies. The reverse is never true. For example, (in the example above) having the competency “driving a car” at a certain proficiency level says nothing about your proficiency level for “defensive driving”.

Semantic definition

Apart from (human readable) description and competency structure (to allow constructing proficiency levels from more granular competencies), defining a semantic definition as an annotation on an ontology is possible. This holds the promise of improved matching by allowing similarities between competencies to be considered.

Competency vs task artefact

In the Competency Analyser, there is some overlap between the concepts of “task artefact” and more skill oriented (contextualised) competencies.

A competency is defined as being a combination of skill, knowledge and behaviour (or attitude). For example to hang a painting on the wall, you need to be able to operate hammer and/or drill (skill), know which type of screw or hook to use (knowledge) and be meticulous or accurate enough to hang is straight (behaviour).

A task artefact is something we want to use in matching, to assign a person to that task or role. “Hang painting on wall” could also be a task artefact.

It may be problematic to know whether this should be defined as a task artefact or as a (contextualised) competency or both.

Simply put, for more “skill” oriented competencies, defining it as both is never wrong (though it may clutter the database).

The rule of thumb is that when it has to be “done” by someone, it needs to be defined as a task. When it an “ability”, then it is a competency.

In the example above, you define the task “hang painting on wall”. You can still model this in two ways.

- Task “hang painting on wall”
 - o Competency “hang painting on wall”
 - More granular competency “operate hammer”
 - More granular competency “know screw/hook types”
 - More granular competency “be meticulous”

Or

- Task “hang painting on wall”
 - o Competency “operate hammer”
 - o Competency “know screw/hook types”
 - o Competency “be meticulous”

The first option has the advantage that the more granular competency “hang painting on wall” can be reused and included in competency profiles, so that is the preferred option.

The next complication occurs when defining a task "decorate house" which consists of sub-tasks "paint wall" and "hang painting on wall".

You have some modelling freedom again:

- Task "decorate house"
 - o Subtask "paint wall"
 - Competency "paint wall"
 - o Subtask "hang painting on wall"
 - Competency "hang painting on wall"

Or

- Task "decorate house"
 - o Competency "paint wall"
 - o Competency "hang painting on wall"

Or

- Task "decorate house"
 - o Subtask "paint wall"
 - Competency "paint wall"
 - o Subtask "hang painting on wall"
 - Competency "hang painting on wall"
 - o Competency "paint wall"
 - o Competency "hang painting on wall"

After competency aggregation, all three modelling methods will result in the same set of competencies, so they are all equivalent.

The third option is not recommended as this is overly complex and does not have any added value.

The second option is clearly the easiest (least complex), but it does not allow assigning the task "paint wall" or "hang painting on wall" to a person or allow matching on these tasks.

For that reason, the first model is the preferred one.

E Domain Model, data format

Who should read this chapter : technical people, researchers, details are given of how competencies and all related objects are modelled in the Competency Analyser.

The domain model needs to address the needs of having competencies, contexts, assessments, competency profiles, competency gaps,...

The domain model used was built to assure that competencies have an explicit context. When people talk about competencies, these are typically contextualised. People speak about their interpretation of what a competency entails in a certain context.

One of the goals of the Competency Analyser is to make this more explicit. This is partly done by explicitly modelling the context in which a competency is applied, and partly done by allowing an ontology to be defined for the context and allowing semantic definitions (a commitment on the ontology) to be defined.

We to make competencies more manageable by splitting competencies between their generic aspects and the context in which the competency is applied. This context may entail extra context specific skill, knowledge or behaviour. Only the combination of the competency with the context in which it is applied is considered useful.

The domain model contains some provisions for features which have not been fully implemented in the Competency Analyser. These will be indicated as such (and there is also a note about the in the [Lessons Learned / Future work](#) section).

Note that this section will sometimes use different terms (especially in the diagrams). This is because the system uses class names which don't necessarily match the wording used in the project, user interface, user documentation. We will make clear what these terms refer to.

E.1 General

The competencies which are stored in the Competency Analyser are used for matching and to allow selection of learning objects which are relevant to close a "competency gap" between acquired competencies for a person and required competencies to perform a task, function or role. Competencies are attached to artefacts (which represent objects outside of the Competency Analyser). The competencies attached to an artefact are often referred to as "*competency profile*", the difference between the required competencies for a task or roles and the competencies a person has is called the "*competency gap*".

The Competency Analyser is responsible for maintaining a repository for all the competencies modelled in the Prolix system. All the other components which work with competencies use the central competency repository for storing, retrieving and matching competencies.

Several methods are used to make competencies more meaningful for matching and for the people using them.

- Context is separated from the competencies. By making a distinction between a competency and the contexts in which the competency can be applied the number of competencies becomes more manageable and it becomes easier to detect and model both similarities and differences. For example a competency "English" would be interpreted differently in the context of "programming" and "secretarial work". In the former faultless writing are less important, while in the latter case, it is.
- Each (contextualised) competency has a description.

- Each (contextualised) competency can be split up into more granular competencies. Rollup rules can be used for recombination.
- Each (contextualised) competency can be assigned a specific semantic meaning by defining the commitment on the context ontology.
- Each (contextualised) competency can be attached to one or more “*categories*”. You can define one or more trees of categories (or taxonomies) and place the competency in indicate which categories apply for the competency.

Competencies are assigned using “*proficiency levels*”. The possible proficiency levels for each competency are defined in a “*scale*”. This can be a discrete scale (good, average, bad) or continuous (between 0 and 10). When no scale has been defined, the system assumes a continuous scale from zero to one.

There are three types of artefacts in use in the competency analyser and each has their own set of competency profiles.

People: People *acquire* competencies, either by work experience, or by training. Assessments are used to certify that certain competencies have indeed been acquired. For matching competency or *evidence resolution* needs to be applied. This takes several factors into consideration. Each assessment has a relevance score (which is based on the age of the assessment), a reliability score (a self-assessment is less reliable than the assessment of a boss or colleague which is less reliable than a diploma from an official school). Evidence resolution is based on a matching profile. This allows the user to control how the evidence resolution should behave. As an example, let’s consider the competency “French”. The person has the following assessments.

What	Proficiency level	When	Reliability
French course	Above average	10 years ago	High
Task involving French knowledge	Good	6 months ago	Low

Depending on the matching profile, there are several ways to consider what the status of the competency “French” is at this moment.

- Above average with high reliability but low relevance as the assessment was ten years old (reliability was more important than relevance)
- Good with low reliability and high relevance (relevance was considered very important and thus the old assessment was ignored)
- Above average with high reliability and high relevance (the recent assessment counters the decrease in relevance as it required a higher proficiency level and is thus proof of experience)
- Good with medium reliability and high relevance (the reliability of the old assessment influences the recent assessment, even if it was for a lower proficiency level).

Task: Each task artefact (this can represent a BPC function, a role, a job description, a task) has a set of *required* competencies. Each competency should be mastered at a specific proficiency level to be able to perform the task satisfactorily.

Note that a test also has a set of required competencies which you need to have to succeed for the test (or succeeding the test proves you have acquired the competencies). As such, because the competency profile is the same, tests are also modelled as task artefacts in the Competency Analyser.

Learning: A learning artefact (which can be a learning design, a learning template or even a learning resource which is used to build learning designs) has a so-called delta profile. This is a set of competencies with both a *prerequisite* and an *objective* proficiency level. The prerequisite level should be acquired by the person before starting the course. Otherwise the course will probably be too high-level and which makes it difficult to understand. The objective level is the level which the course targets. If the student absorbed what is taught, then this is the

level the students acquires (though obviously without a test which “proves” that the competencies have been acquired, the completion of a course should be considered as an assessment with low reliability).

Below is the domain model looked upon from a specific perspective. This is done as the scheme would be too large to visualize.

Two aspects are not displayed in these models.

- *Organization* : The Competency Analyser is built to allow one deployment to contain the data for different organizations. All users can only see data linked to the organization they are part of. Some data is expected to be preconfigured and can be shared between organizations. Examples are assessment methods, competencies.
- *ApplicationDomain* : The user has a choice to split the data into *application domains*. This can for example be useful to represent the different departments of an organization. The use of application domains is entirely optional. If no application domain is used, then all the data is in one global space.

E.2 Competencies

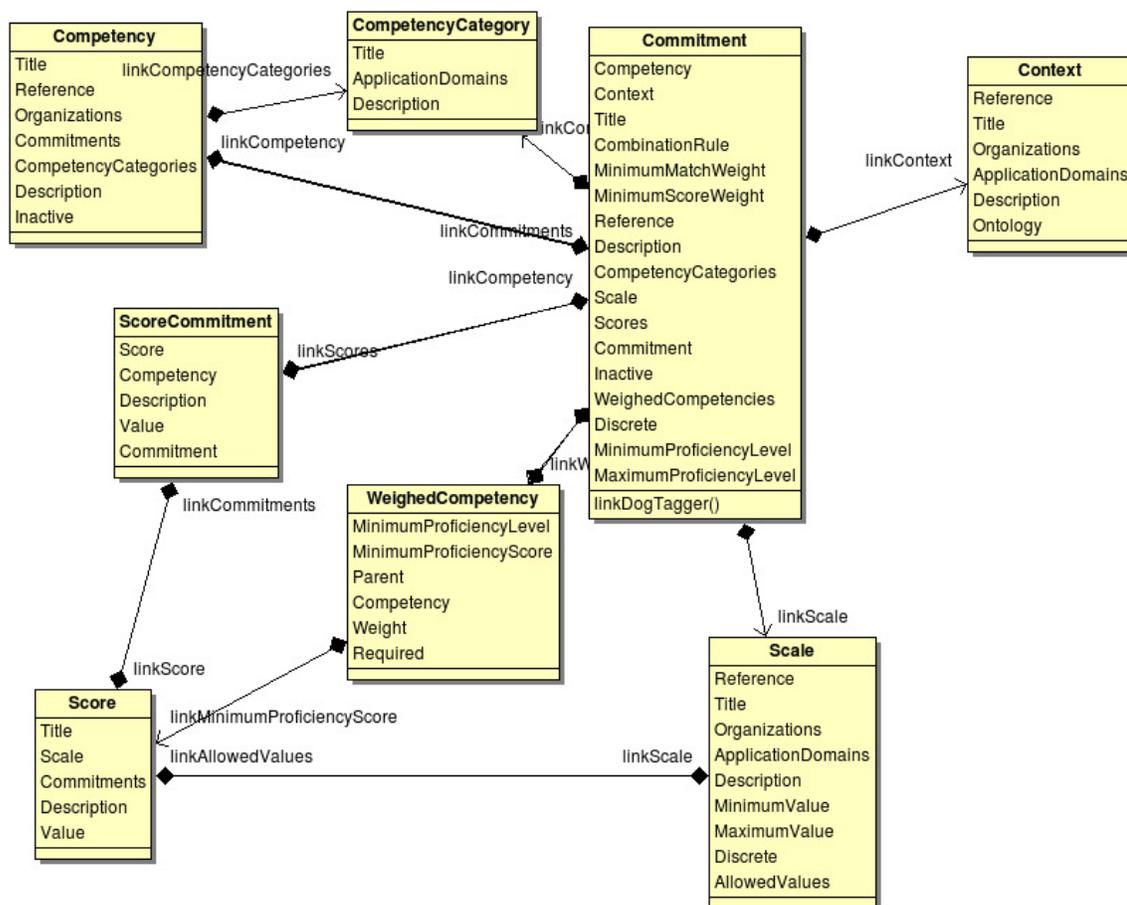


Figure E.2.1: UML model : competency

The main object is the *contextualised competency* which is represented by the “*Commitment*” class.

A contextualised competency is always linked to a (generic) Competency and a Context. The contextualised competency is thus the application of the (generic) competency in a specific context. The context has a title and description and may optionally contain a URI for the ontology which can be used to define the semantic commitment for the contextualised competency (which is represented by the “*Commitment*” field in the table, which is also a URI).

To make the handling and selection of competencies easier, you can create a hierarchy or taxonomy for classifying competencies. Each competency can be assigned its place into one or more of these *competency categories*. This is possible for both (generic) competencies and contextualised competencies.

Competencies can have structure. You can define the more granular competencies and the rollup rules which should be used to recombine the more granular competencies into the more general competency.

This is done using the *CombinationRule*, *MinimumMatchWeight* and *MinimumScoreWeight* fields and the link to *WeighedCompetency*.

- *CombinationRule* : indicates whether you need a proficiency level for all more granular competencies, or only some, to be able to apply the rollup rules.
- *MinimumMatchWeight* : allows indicating the minimum sum of the weights of the more granular competencies to be able to apply the rollup rules. When this is set to the sum of the weights of all more granular competencies, this is the same as setting “*CombinationRule*” to “all”.
- *MinimumScoreWeight* : The score which is needed to reach “full level”. For example it may be sufficient to have five out of six more granular competencies to reach the maximum on the more general competency.

WeighedCompetency links to the more granular contextualised competencies. For each one, you can indicate the proficiency level (anything higher is topped off), whether this one is required to have a chance of applying the rollup rules and the possible weight (which allows you to set the relative importance of the different more granular competencies).

A competency or contextualised competency can be set to “inactive” state. In principle competencies should not be allowed to change once in use and should also not be deleted when in use. However, to allow competencies to no longer be selectable for exclusion in task or learning profiles, the “inactive” status can be set. This feature is not yet functional in the user interface.

A contextualised competency can determine the possible proficiency levels using a *Scale*. When no scale is used, it defaults to allowing all values between zero and one. A scale has a title and description and indicates the range of values. A scale can be continuous (all values between the minimum and maximum (inclusive, decimals can be used) are allowed), or discrete, in which cases you enter the possible *Score* values which indicate title, description and the actual value. When using semantics, you can define the semantic meaning (commitment on the context ontology) for each of the scores individually.

E.3 Artefacts

To allow linking of competencies to objects outside of the competency analyser, an *artefact* should be created. The linked competencies (plural) are usually referred to as a “competency profile”. We consider three types of artefacts, each with their specific variants of competency profile. When matching competencies, these artefacts are used to refer to the competencies.

All artefacts have a title and description. They may have a reference, which is the key or id used (outside the CA) in the system where the artefact really exists.

Each artefact may have some non-competency related *criteria* which can be used when matching. Examples of these are "distance from home", "salary", "available for night work", "preferred learning method". When matching these sometimes are treated as hints (like the "preferred learning method"), but more often they can veto matches (for example, person is not available for night work, lives too far from the job, ...).

To make the handling and selection of artefacts easier, you can create a hierarchy or taxonomy for classifying artefacts. Each artefact can be assigned its place into one or more of these *artefact categories*.

Note that the UML diagrams always list all fields (for all three types of artefacts).

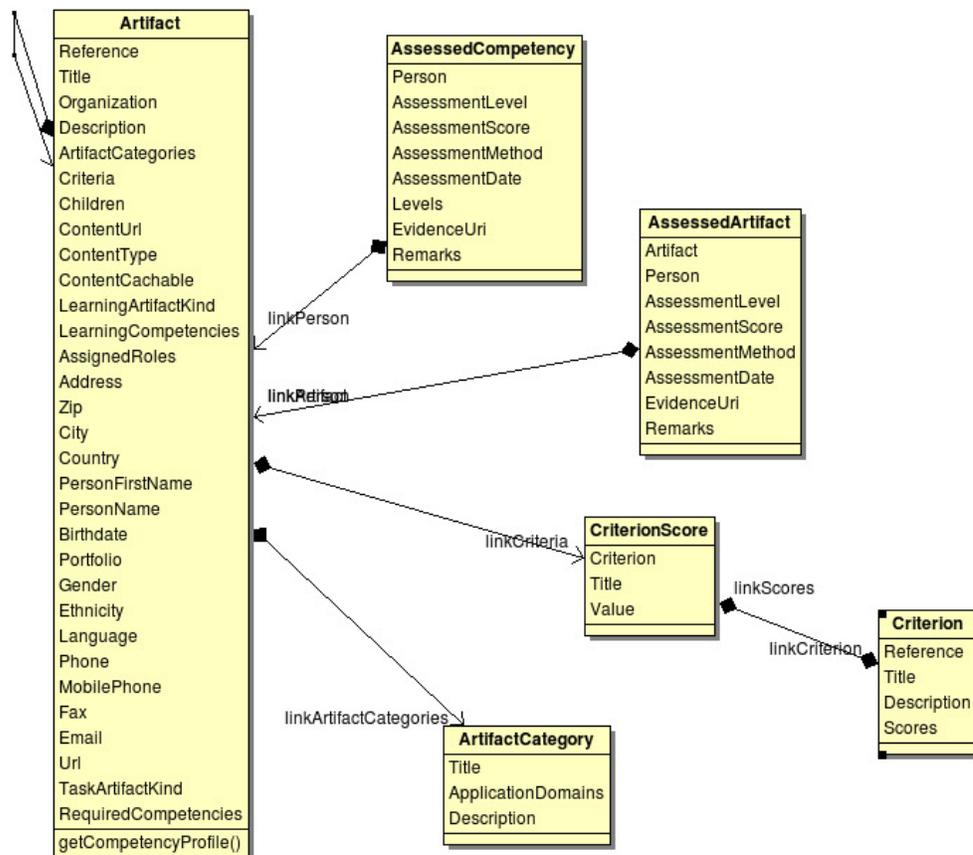


Figure E.3.1: UML model : person artefact

A person artefact is a representation of a real world person.

A person artefact is referred by the assessments which have been created for this person.

Person artefacts contain some person information like

- Assigned tasks or roles
- Person name and first name
- Birthdate

- Portfolio link (URL)
- Gender
- Ethnicity
- Language
- Contact details (address, phone, e-mail,...)

A person has a set of acquired competencies, but these are actually attached to the person based on assessments. Because a person’s competencies are changing all the time (either because of experience or competency degradation), the set of competencies is specific for a moment and has to be determined based on competency or evidence resolution (using “get-CompetencyProfile()”).

A person can have a set of assigned roles or tasks. These are the tasks (or roles) the person is expected to be capable of. It does not imply anything about presence of competencies.

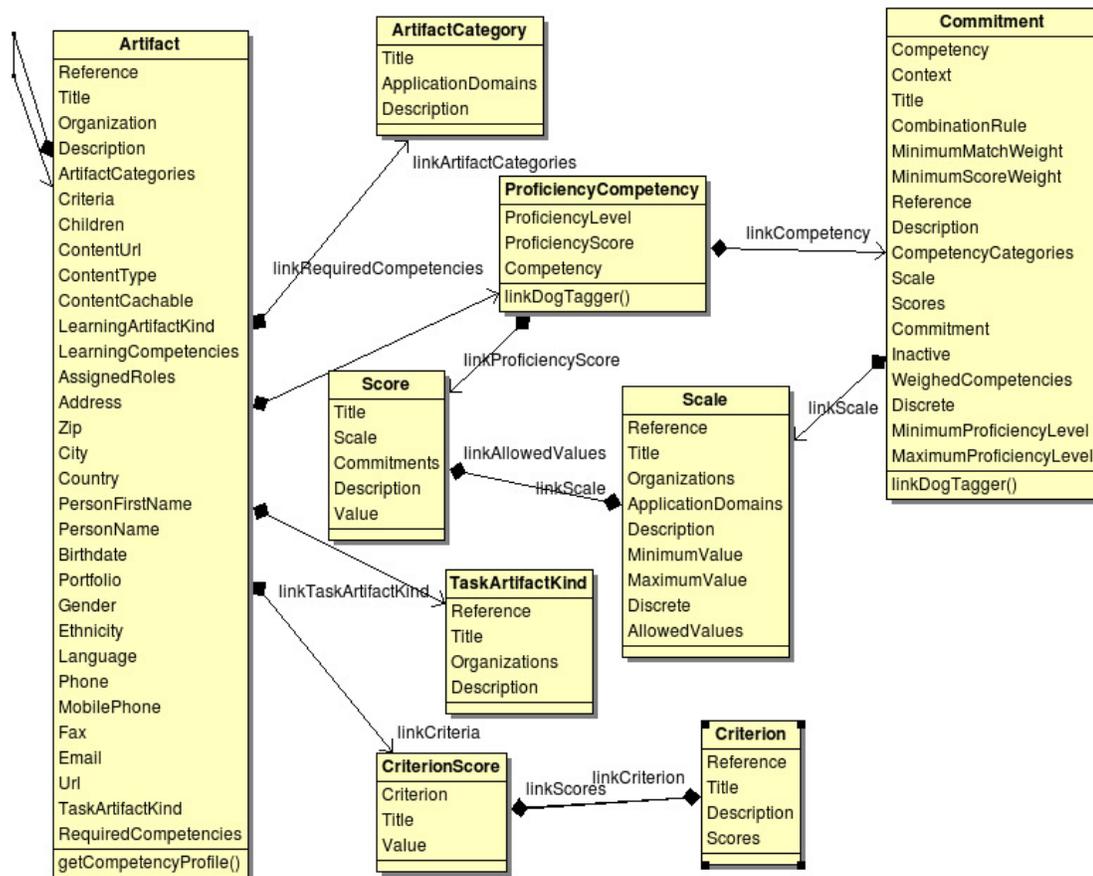


Figure E.3.2: UML model : task artefact

A task artefact contains a *required competency profile*. This means that the set of competencies are required to be present at the given level to be able to successfully complete the artefact. In practice, a task artefact can refer to a task, role, job, function,... or a test.

Though the system does not make a distinction between task, role, function or any other object which has a required competency profile, it is possible to indicate this by linking to a *TaskArtifactKind* object.

A task artefact can have children. This allows modelling by splitting tasks in subtasks. The competency profile for a task artefact, is an aggregation of the set of competencies for the task (linked by *ProficiencyCompetency*) and the competency profiles of the children. The default aggregation method only considers child task artefacts.

The set of competencies attached to this task artefact is defined by the linked "*ProficiencyCompetency*" records. This links the artefact with the contextualised competency indicating the proficiency level. The proficiency level is given as a number (*ProficiencyLevel*) when the contextualised competency has a continuous (or no) *Scale*. Otherwise the proficiency level is indicated by the *Score* (though *ProficiencyScore*).

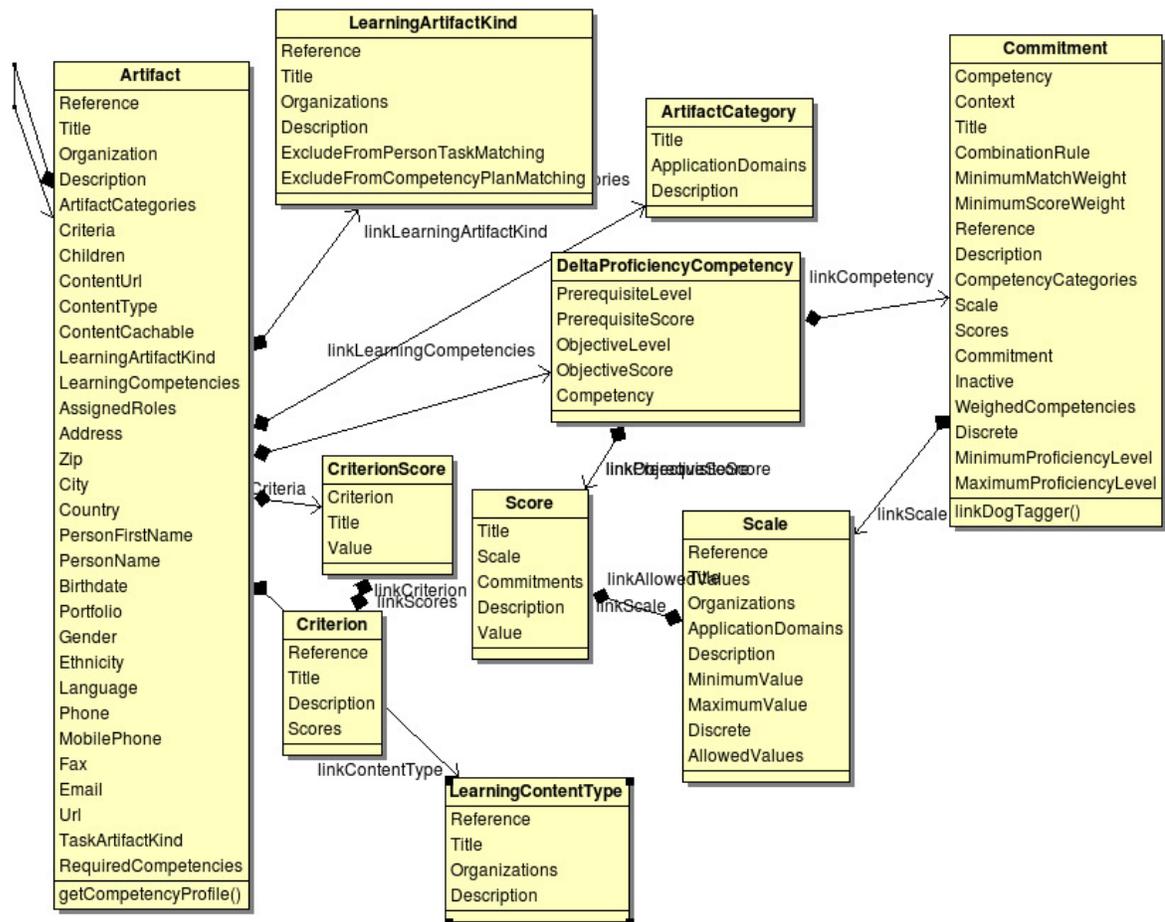


Figure E.3.3: UML model : learning artefact

A learning artefact contains a *delta competency profile*. This combines a *prerequisite* and *objective* proficiency level. The competency should be available at the prerequisite level to be able to understand the learning content. Once the learning material is fully absorbed, your level *should* have risen to the objective level for each of the competencies.

The system does not make a distinction between different kinds of learning object (IMS-LD package, learning design, a page on the web, ...), but the user can define and indicate the kind by linking to a *LearningArtifactKind* object.

A learning artefact can have children. This allows modelling by splitting tasks in subartefacts. Typical examples are (smaller) learning objects and test which are part of the course. The competency profile for a learning artefact, is an aggregation of the set of competencies for the learning object (linked by *LearningCompetency*) and the competency profiles of the children. The default aggregation method considers all artefacts. For child task artefacts (typically tests), the required level will be interpreted as objective (and no prerequisite set).

The set of competencies attached to this learning artefact is defined by the linked "*DeltaProficiencyCompetency*" records. This links the artefact with the contextualised competency indicating the prerequisite and objective proficiency levels. The proficiency levels are given as numbers (*PrerequisiteLevel* and *ObjectiveLevel*) when the contextualised competency has a continuous (or no) *Scale*. Otherwise the proficiency level is indicated by the *Score* (though *PrerequisiteScore* and *ObjectiveScore*).

E.4 Assessments

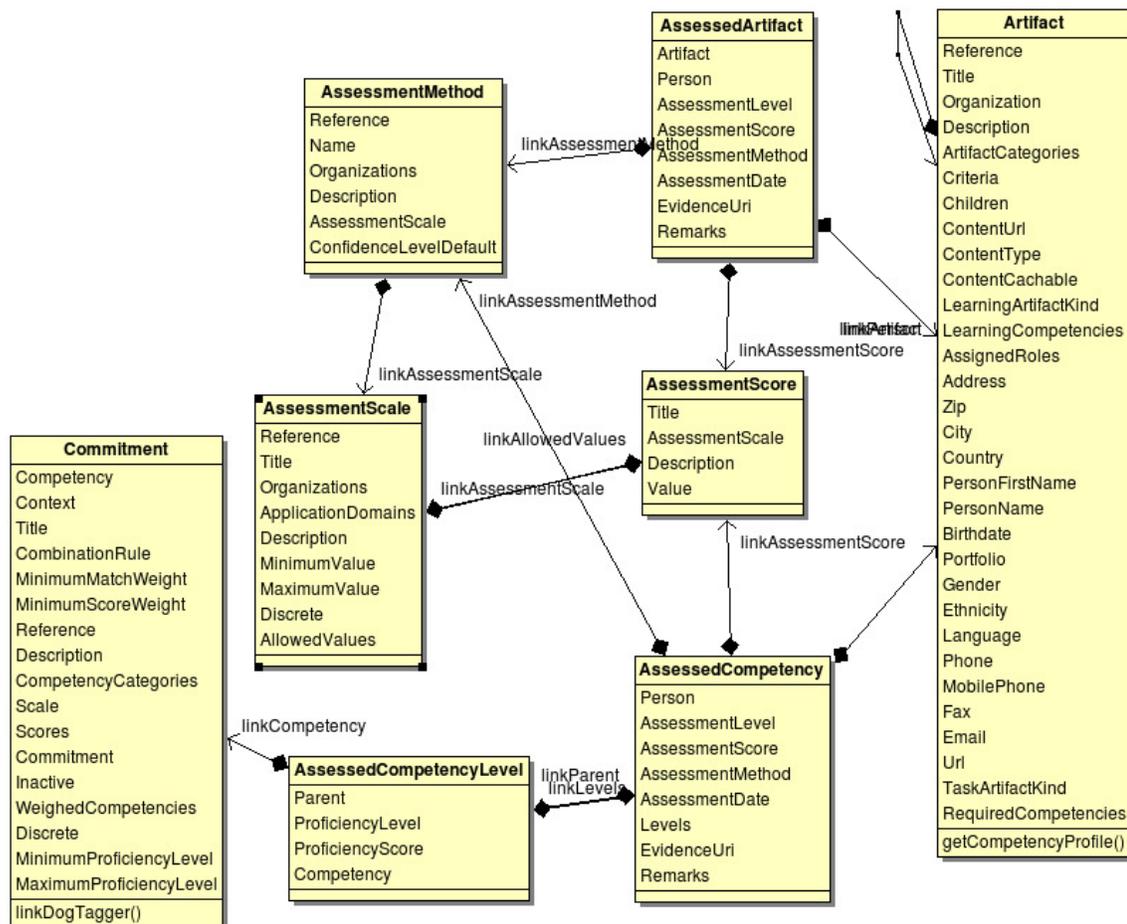


Figure E.4.1: UML model : assessment

There are two types of assessments, *AssessedArtifact* and *AssessedCompetency*. The difference between the two is that the competencies (and proficiency levels) are either indicated by a reference to a (task) artefact and thus defined by the competency profile it defines, or by a list of (contextualised) competencies with proficiency level.

An assessment conveys information about the person who is being assessed. The *AssessmentMethod* indicated the type of assessment and the possible results in the form of an *AssessmentScale* (like a Scale for contextualised competencies). When no assessment scale is defined, a continuous scale with values between 0 and 1 is used. Otherwise the scale defines the minimum and maximum values and possibly the discrete options (*AssessmentScore*).

The assessment method has a *confidence level* which is considered during evidence resolution. It can be used to for example indicate that the confidence you have in a self assessment is lower than in a manager assessment which again has a lower confidence that a final exam (and diploma) from a known university.

The *AssessmentLevel/AssessmentScore* combination indicates the result of the assessment. This works similar to proficiency levels. The "level" field is used if the assessment method has a continuous scale. Otherwise the "score" is set.

An assessment has an assessment date and may contain links (url's) to the evidence of the assessment (like a scan of the exam pages or the digital diploma).

Each assessment can be accompanied with a comment.

E.5 Competency Gap

A "competency gap" is a very important notion, but there is no actual representation of a competency gap in the competency analyser. This is for good reason.

To explain, let's make abstraction of the evidence distillation as this complicates things even more.

When you want to know if a certain person is suitable for a task, you invoke the matcher with the artefacts to match (and thus the competency profile they indicate). The matcher will then indicate whether the profiles match or not. If they don't, the matcher will try to find a *optimum* set of learning designs to bridge the gap. If there is a remaining gap after that, then an *optimum* set of learning templates for the remaining gap need to be determined, followed by an indication that there is a remaining gap after that.

However, there is no easy way to represent the remaining gap. The competencies may be decomposed into more granular competencies, so the gap is actually a tree with options.

To demonstrate this, let's use the following example. The boxes represent competencies and proficiency levels.

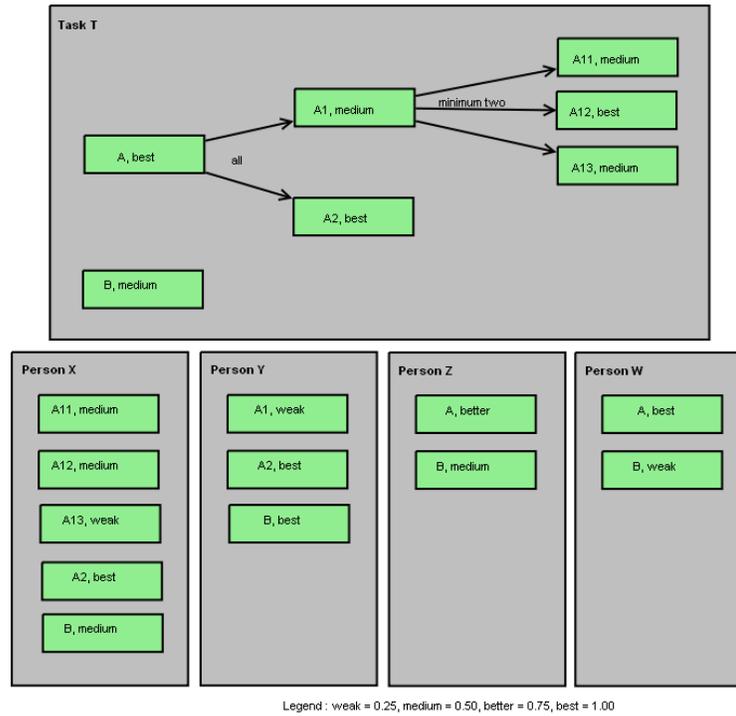


Figure E.5.1: Competency gap example, profiles

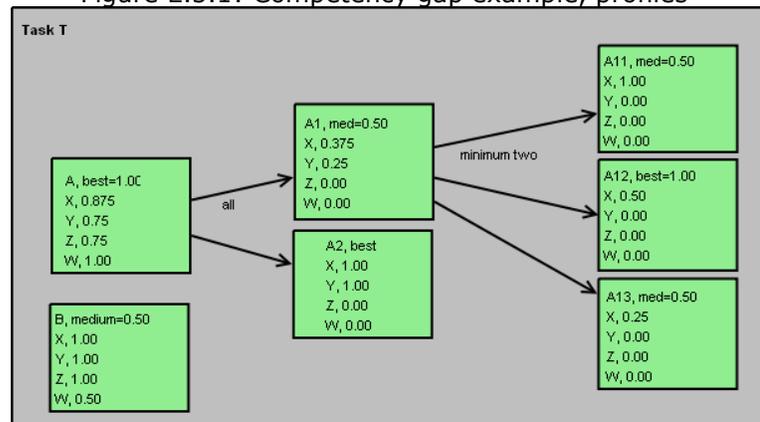


Figure E.5.2: Competency gap example, details

For the calculations, the proficiency levels are interpreted as values in the [0, 1] range. The levels are re-scaled to match the required level and forced back in range (truncated). For combining, the average of the best matching items is used. The score is then scaled again to assure an exact fit if the children match the required level.

This would mean that the persons would match in the order (from best to worst match score) X, Y/Z, W.

However, this is not necessarily true. For example, it could well be that the competency B is easier to teach than competency A1 (both up to medium level). In that case it would be easier to teach W to fit the task than teaching either X or Y. Worse still, it could depend on the person.

What would be the competency gap for person X? There are a few options

- A should increase from 0.875 to 1.00
- A1 should increase from 0.375 to 0.5

- A12 should increase from 0.50 to 1.00
- A13 should increase from 0.25 to 0.50

Which competency gap is the right one to propose depends on the learning objects which are available and how these learning objects can be compared to one another.

The only way this competency gap can be properly considered is by assuming the gap is an "OR" combination of these four differences. When the competency has a structure which is more complex, this can turn into a tree of "OR" conditions.

When we try to match which is the optimum learning path, we probably also have to consider the cost of each course. This cost can be split in two parts, the cost for following the course (price of the course including transportation, hotel etc), and the cost for the time spent learning (wages of the person). Note that these are currently not considered by the software.

The competency gap is mostly interesting as a way to visualize to users of the system what the gap is. This could probably better be done by displaying the task competencies (with their structure) and annotating this with the competencies as they are acquired by the person. This itself is then complicated by the evidence resolution. This is useful to do inside a program, but it seems a lot less useful to communicate this gap with other systems where they would then need to duplicate the effort to display the gap. A web link to the visualization page in the competency analyser seems more practical.

E.6 Comparison with ISO/IEC 24763 conceptual reference model for competencies and related objects

(This comparison if based on the 2008-11-28 version, it is **not** yet a standard).

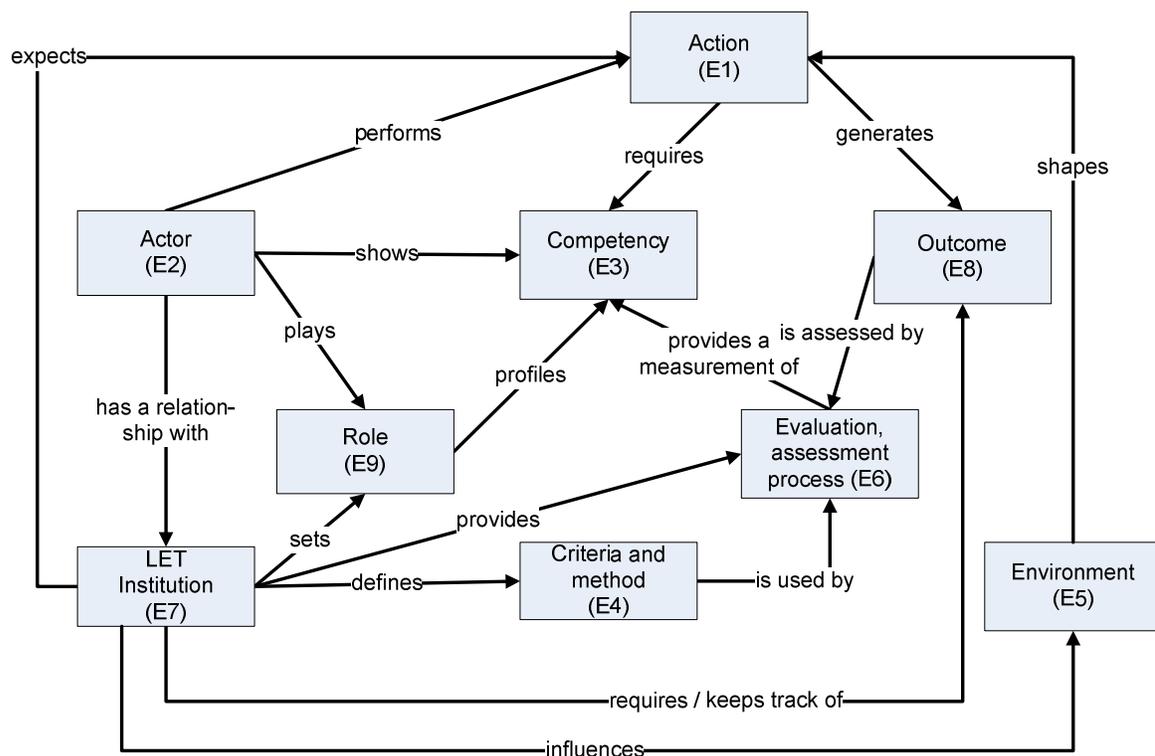


Figure E.6.1: ISO/IEC 24763 Conceptual Reference Model for Competencies and Related Objects

The differences are mainly the used terms. Some translations :

- Action (E1) = task artefact
- Actor (E2) = person artefact
- Competency (E3) = contextualised competency
- Criteria and method (E4) = assessment method
- Environment (E5) = context
- Evaluation, assessment, process (E6) = assessment
- Institution (E7) = organization
- Outcome (E8) = assessment (more comments below)
- Role (E9) = task artefact

Missing in this model (and supported by PROLIX) :

- Competency structure and rollup rules
- Learning artefact
- Proficiency levels
- Matching related data like matching profile, confidence score, non-competency-related criteria
- User interface and/or grouping related data like artefact categories, extra info about artefact kind, application domain
- Artefact structure, a role consists of tasks

Some important differences include :

In PROLIX we apply the context at the competency level. We assume tasks are always organization specific and thus contextualised (linked with the "environment" in ISO terms). The reason for making this explicit at the competency level is to give us more options for the competency matching. In our model, a task or role can require competencies from different

contexts. This gives more modelling freedom for the context and allows more reuse. It is also designed to facilitate cross organization and cross context matching of competencies.

In PROLIX we don't explicitly have the concept "outcome". We do promote registering the completion of a task as "assessment" as this may indicate that you have (some of) the required competencies, especially when you performed the task often. (Note that you probably want to assign an assessment method with relatively low confidence).

When studying, outcomes are often diplomas or certificates. These are not registered as such within PROLIX as these are not competencies.

This becomes clear when matching. For jobs there is often a requirement that you have a certain diploma. When a person has the diploma, it does not guarantee presence of the competencies as they may have been (partially) lost or forgotten. Similarly, certain certificates may be required which can expire. For example, a lifeguard may need a certificate which is less than two years old. This again does not mean that the competencies required to get the certificate are suddenly "lost" when the term expires.

In PROLIX this kind of requirements should be handled by setting non-competency-related criteria for matching.

The "actor shows competency" mentioned in the ISO model is implicit in PROLIX. As evidence distillation based on a matching profile is used, the presence is computed based on the assessments. There is no way in PROLIX to directly assign a competency, it is always done through an assessment and the matching profile which is used for the evidence distillation then determines what the impact is of the assessment on the computed competency profile.

This has major advantages when doing job matching for example. You can start by selecting persons using a very strict profile which only allows the most reliable assessments to be considered. When this does not result in suitable matches, you can relax your matching profile and include more assessments.

F Architecture

Who should read this chapter : technical persons interested in the internal workings of the competency analyser.

F.1 General

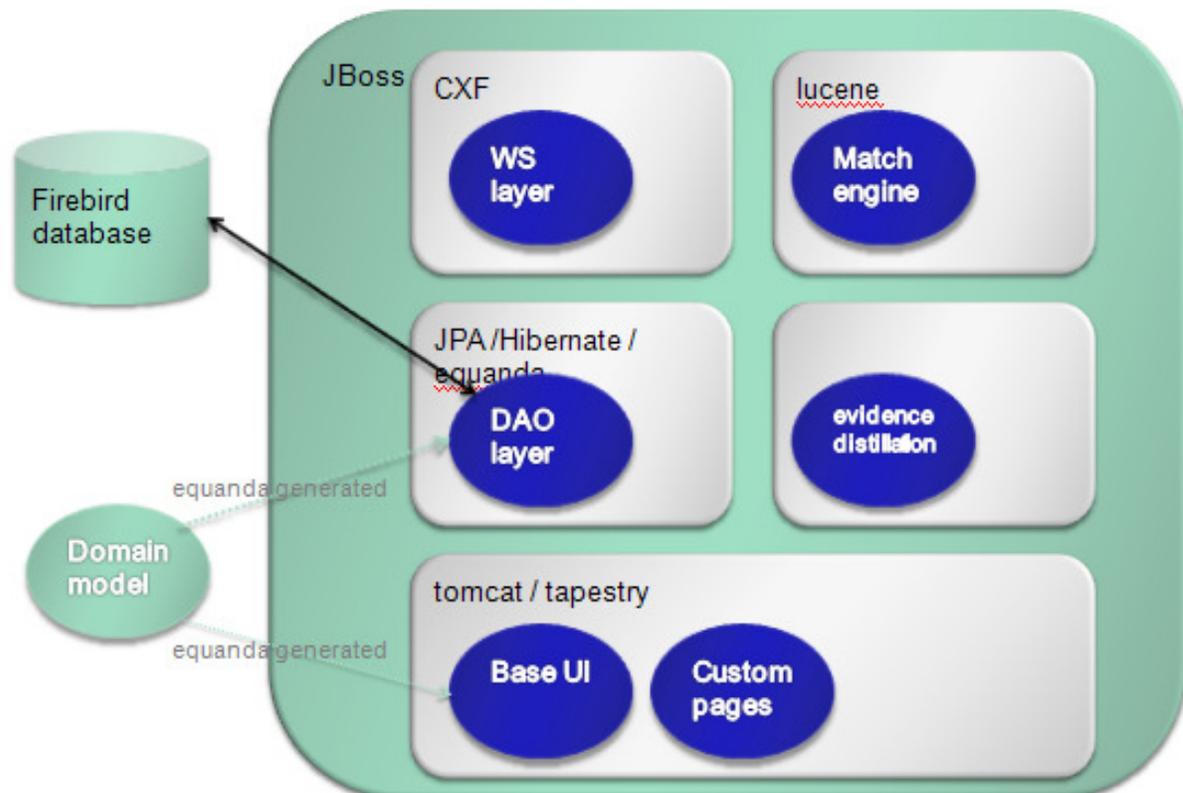


Figure F.1.1: Competency Analyser architecture

The application is built using a domain model driver approach. The domain model (described in the next section, details see [Appendix, domain model](#)) contains hints which are used to generate both the persistence layer and the CRUD (with granular authorization) user interface. This is possible thanks to the "equanda" (<http://equanda.org/>) open source project.

The generated web interface is customized (thanks to the flexibility provided by the tapestry web framework and the customization hooks which are provided in equanda). This way the default representation of some (groups of) fields have been modified to be more user friendly and/or better match the competency domain.

Several additional pages have been added for the main functionality which is presented to the user, most importantly for matching and some methods of adding assessments.

The matching (more details in [Matching](#)) is designed to be able to handle evidence distillation, multi-criteria matching and matching profiles.

The *evidence distillation* is needed as a person's competencies change all the time. People learn and forget, they acquire new competencies and existing competencies may degrade. Moreover, the notion of "having" a competency depends on the (person who wants to) use the competency profile. In some cases showing experience is sufficient. At other times a di-

ploma is needed. In this case though, maybe not all diplomas should be treated equally (is a diploma from a university in Ethiopia valued equally to a European diploma?)

Multiple criteria are used for the matching. Currently these include direct matching, structure matching (with rollup rules) and semantic matching.

The *matching profiles* are used both to determine the behaviour of the evidence distillation and of the matching process. It can for example be used to determine whether semantic matching should be included or used exclusively. It is also used to determine the influence of the different matching factors.

For interaction with the other PROLIX modules, there is (apart for some parts of the user interface which can be directly accessed by other components) a set of web services which are made available. These use the CXF framework to assure the services are standards (specifically WS-I) compliant. There are two sets of services available, one set which is PROLIX specific, using the PROLIX header and SSO for authentication and one generic set which uses BASIC authentication.

For security, the system is built to allow outside access only through the web services and user interface. To protect privacy of the information which is transferred or visualized all access is encrypted using SSL/https. All services and the user interface are only accessible when authenticated either using login/password or using the PROLIX SSO token.

The system can contain information for several organizations, but only information which is linked to the same organization as the user is visible.

In the user interface, the authorizations can be granularly controlled by an administrator. Based on the role, entire tables or individual fields can be prohibited or made read-only. Access to selectors, actions and the delete function can be granted or prohibited.

For deployment, the system runs inside JBoss (<http://jboss.org/>) application server. JBoss contains a JPA provider based on Hibernate and uses the tomcat servlet engine. As a bonus JBoss offers some additional management features (a console to monitor the state of the application server and applications in it, hot-deploy of application, possible changes of logging levels on a running application etc).

The generated persistence layer is database agnostic (thanks to JPA/hibernate). In PROLIX the deployments use the firebird (<http://firebirdsql.org/>) open source database.

F.2 User interface

The user interface is built using Tapestry (<http://tapestry.apache.org/tapestry5/>) as web framework.

Users need to login using login and password or PROLIX compliant SSO token to be allowed access. As protection against eavesdroppers https/SSL is always used.

Data is split into different organization (users can only see the data which is linked to the organization they are part of).

Users can be assigned roles and for each role, it can be defined which tables and which fields in the tables can be viewed and/or edited.

F.3 Web services

The web services are provided as WS-I compliant web services according to the SOAP standard. CXF is chosen as framework which handled the low level stuff.

There are two sets of web services which are made available by the CA. Functionally both are almost identical, they differ only to aid integration.

The first set are the Competency Analyser native web services.

These provide all the interfaces (see [appendix](#)) and are secured using BASIC authentication on top of SSL/https.

The second set is PROLIX native and uses the PROLIX compliant header with SSO token for authentication. It also uses SSL/https to protect against eavesdroppers.

F.4 Matching

For the matching (more about behaviour and configuration in [Matching](#)) consists of three components and a pre-processing part.

- Evidence distillation (pre-processing)
- Generic matching (integrates the others)
- Structure matching
- Semantic matching

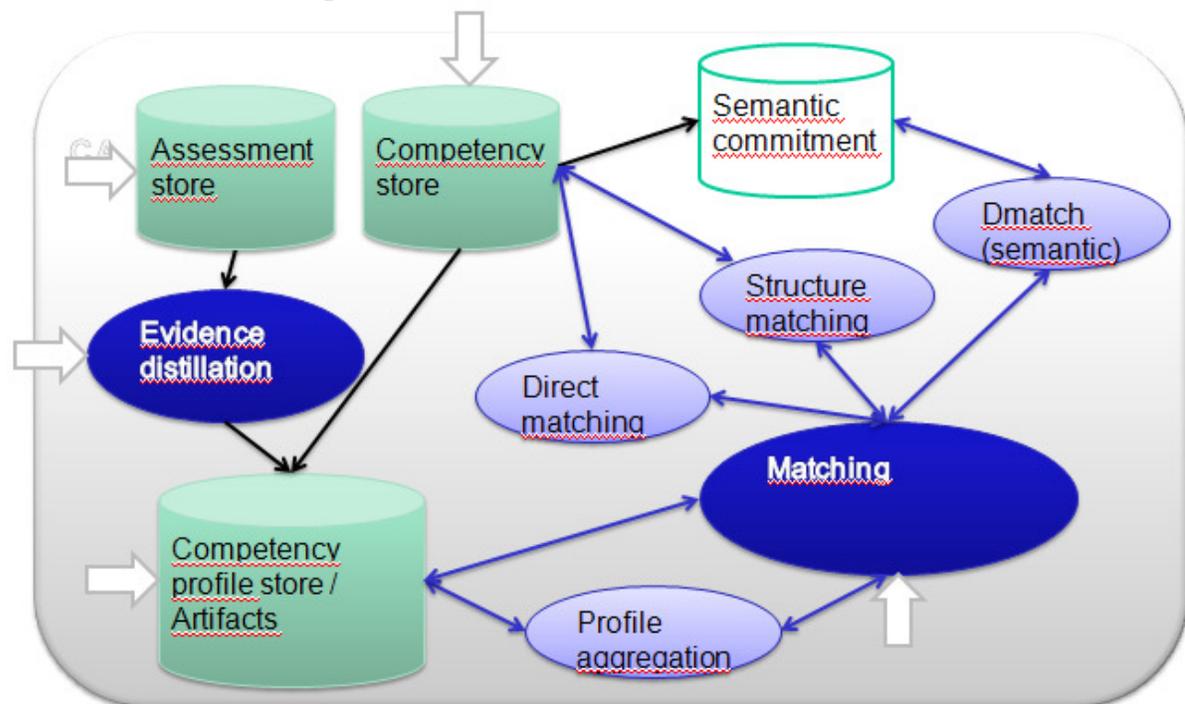


Figure F.4.1: Matching architecture

The picture above gives an images of how the matching works (conceptually). When matching the competency profiles for the artefacts to be compared are fetched. When one of the two artefacts is a person artefact, this involves the evidence distillation, otherwise the competencies for the artefact and the children need to be combined (profile aggregation).

The evidence distillation will investigate all assessment for the person in question, and based on the matching profile, determine the current level of the competencies which have been assessed.

There a generic (domain agnostic) matcher which allows structure matching with rollup rules. This is based on lucene (an open source project mostly known as full-text search engine,

<http://lucene.apache.org/java/docs/>) which is customized to be able to handle object-level queries with several ways to select “matches” and to handle the rollup rules needed for the matching.

There is also the semantic matcher which uses Starlab’s Dmatch engine (see D3.4, D3.6 and D3.7).

Both these matchers are combined to produce the results.

You can define the confidence which needs to be assigned to each of the matchers.

The system will try to find the match score by combining match scores for direct matches (match score depends on the proficiency), the structure matching (where the proficiency is calculated using the matches on more granular competencies and the rollup rules) and the semantic matching (match score determined by Dmatch). The confidence level is considered by the matcher according to the rules set forth in the matching profile.

To increase the performance of the system, an index is used. When assessments are added, matching profiles or artefacts are created or modified, then the index is updated. Depending on the amount of data which needs to be re-indexed, this either occurs instantaneous or asynchronously (every couple of minutes the system checks whether indexes need updating).

G Matching

Who should read this chapter : everybody, details how the matching works, useful for both power users and technical persons.

Registering competencies and defining the meaning of competencies is by itself not useful. It only becomes interesting once we start using this to match different objects and their competency profile (which is basically a set of competencies).

There are two generic queries

- Find best person for a task, minimizing the competency gap
- Find learning suggested learning path for a person-task combination (to assure the learning closes the competency gap).

There are two more specific cases

- Person has already been set, so only the learning path is calculated.
- Combining several match results in the competency plan.

G.1 Base matching methods

The basis of the matching is that a competency profile which is *requested* is matched to possible competency profiles which are *available*.

This can be done in four ways :

- *Simple direct checking* : competencies can only be compared when they are equal. So requested competency A at level X can only match the available competency B at level Y. There is a match if $A=B$ and $X \leq Y$.
- *Structure direct checking* : the structure of the requested competency is used. For each node the structure of the requested competency, the best matching competency (using simple direct checking) from the available competencies is chosen. These competencies are then used to calculate the scores for parent competencies using the rollup rules which are defined on the parent node.
- *Simple fuzzy checking* : same as simple direct checking, but using fuzzy (for example semantic) tests instead of equals comparison.
- *Structure fuzzy checking* : the same as structure direct checking, but the nodes of the competency are checked using simple fuzzy checks.

These are be mixed and at each point the best matching method chosen. This becomes

- match one desired competency with the potential profile using direct matching
- match one desired competency with the potential profile using semantic matching
- match one desired competency with the potential profile using structure matching
- determine the *best* match when several match methods have been used
- combine the matches for the different competencies in the desired profile

G.2 Evidence distillation

All matching which involves the competency profile of a person, is preceded by evidence distillation. Based on the assessments which have been registered for the person, the base set of competencies for matching is calculated. This will result in a map with the following information tuple for each (contextualized) competency.

(proficiency level, confidence, relevance, fluency)

- Proficiency level : normalized proficiency level. This is a value in the]0,1] range.
- Confidence : assessment method confidence. This is a value in the [0,1] range. For example, the confidence rating for a subjective assessment will probably be lower than having an assessment based on a diploma. At a more detailed level, a certificate from a commercial firm may have a different confidence rating than the certificate of a university.
- Relevancy : indication of competency degradation. Competencies with older assessments are considered less relevant. This is a value in the [0,1] range. It is based on the date at which the assessment took place. As it is not a priori known whether a person has used a certain competency or tried to maintain or improve a competency, the relevancy should decrease over time. For example, the competency of reading a language probably decreases slowly over time when not reading in that language. However, the proficiency level of speaking a language probably has a faster decay. On the other hand, it is far easier to regain a competency at a certain level than to reach a level which has not been reached before.
- Fluency : indication of the number of assessments for this competency at this level.

Basically, the system will check all assessments. If the assessment level is higher than the threshold and the confidence for the assessment method is higher than the threshold, then the competencies are included in the map.

At the end, the match profile worker is used to determine the end result from all the assessments for a specific (contextualized) competency. This may either select one of the tuple, or construct a new one. For example, the fluency is only set by the worker.

G.3 Competency aggregation

For matching artefact, it is always the aggregated (combined) competency profile which needs to be considered.

Artefacts can have children, indicating links between the artefacts. For a task artefact, this indicates other tasks which are "part of" the parent task. For example a task "test car" may consist of the tasks "test car brakes" and "test car lights" which each have their required competencies. The combined competency profile then contains the maximum proficiency levels for each of the competencies of the task and all child tasks (recursively).

G.4 Competency structure

When a competency is defined, it can be indicated as some kind of combination of other competencies, with a certain rollup rule. For example the competency "programming" may consist of one of the competencies of "java", "c++" or "visual basic".

A competency can be evaluated, and this results in a proficiency level. This is expressed using a scale. A scale can either have distinct scores (e.g. "limited", "medium", "good"), or be expressed as a range (e.g. between 0 and 100). Internally proficiency levels are in the [0,1] interval. Though sometimes negative scores are used to indicate competencies which are bad or undesirable, we do not follow this convention. We consider it better to use a negative weight in this case.

For combined competencies, the rollup rules can be different for each score. For example, ("web programming", "medium") in the context of the development of a java application could be at least two of (("visual basic","medium"), ("java","medium"),

("javascript","medium")), but a "good" rating might also require at least ("java","medium") and ("javascript","limited").

If rollup rules are only provided for the highest scores, then the rules for the lower scores can be interpolated.

In combination with the rollup rules, you can define the weight for each competency. A low match score on a competency with a high weight will degrade overall rating more than the same score on a competency with a lower weight.

G.5 Non-competency related factors

When matching, there are some non-competency related aspects which also need to be considered. For example, a person may only be willing to work in normal office hours, or may not want to work more than 25km away from home.

To determine the best match, cost is also an important factor. This is comprised of a combination of wages and cost of the learning path. The cost of the learning path itself depends on both the cost of buying the learning object and wages which need to be paid to the person who is absorbing the learning object.

When choosing the learning objects, the system could consider the learning methodologies which are most easily absorbed by the person. Some people can learn easily by reading, while others benefit a lot from having a tutor or hands-on experience.

G.6 How to determine a match score for one competency profile compared with another

When matching there are several factors which need to be considered to calculate the match score.

- match confidence rating, how sure are you that the competency is achieved at the desired level
- assessment confidence rating, how sure are you that the assessment is reliable
- relevancy factor for the proficiency assessment (based on age of the assessment)
- fluency (or experience), when a competency has been used regularly, the assessment confidence rating should rather increase and relevancy should stay high. However, this is extremely difficult to evaluate, so in principle it would be better to have regular re-evaluation of competencies.

As mentioned above, there are four ways to match depending on whether you match directly or fuzzy, and whether you match based directly on the competency (simple) or use the structure of the competency.

In principle you have to test all four methods and use the match with the highest score.

When using direct matching, the match confidence rating is always 1 (or 100%). It is assumed that the fuzzy engine is capable of giving a match confidence rating.

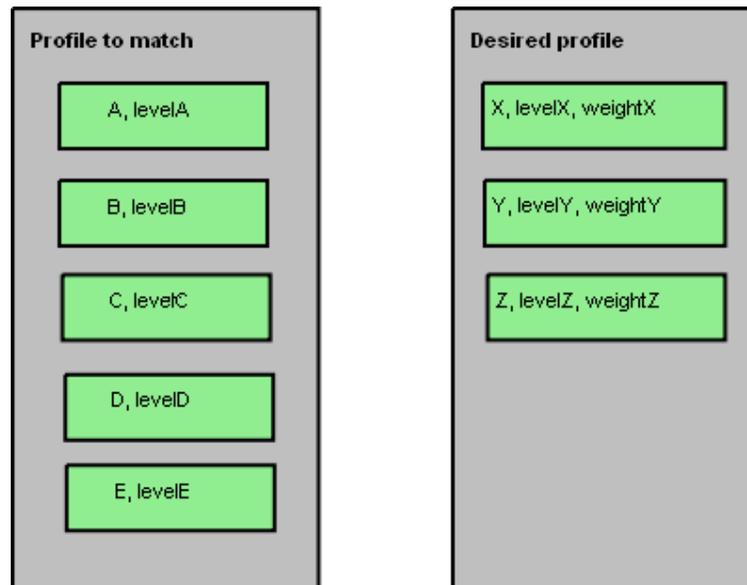


Figure G.6.1: simple direct matching

Basically, you have to assign a match score to each of the desired competencies. These are then combined.

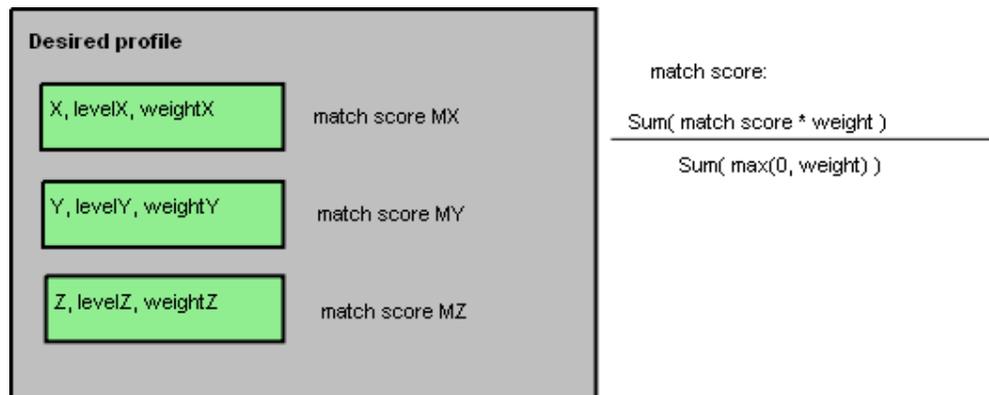
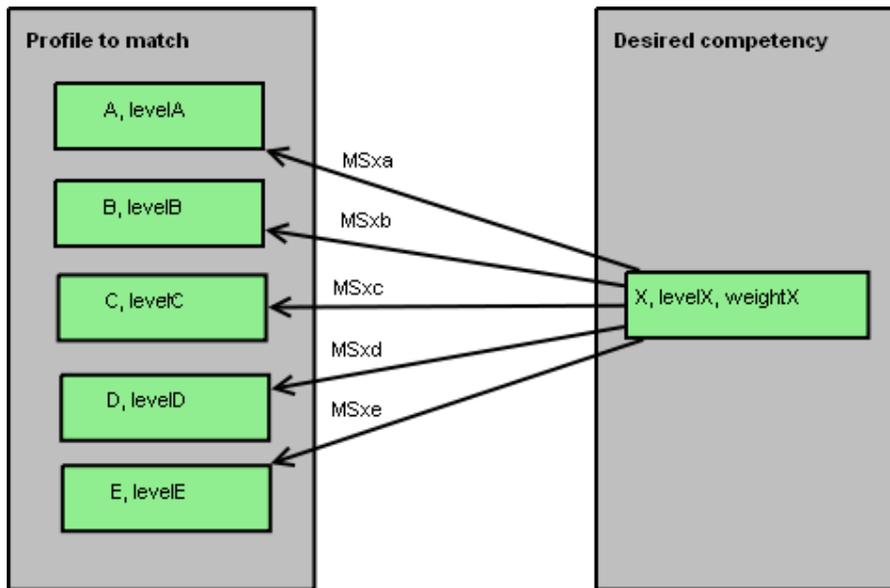


Figure G.6.2: combine matches from different competencies

Combining match scores is simple, you multiply the match score for each competency with the weight, then divide the result by the sum of the positive weights. The negative weights are skipped from the divisor as these scores should explicitly negatively impact the match score.



$MSx_a(\text{score}, \text{match confidence}, \text{assessment confidence}, \text{relevancy}) =$
 $(\max(1, \text{levelA}/\text{weightX}), X=A ? 1.00 : 0.00, \text{A's assessment confidence}, \text{A's relevance})$
 $X \text{ match score} = \text{MatchScoreFunction}(MSx_a, MSx_b, MSx_c, MSx_d, MSx_e)$

Figure G.6.3: matching, compare all options

For calculating the match score for an individual, the desired competency should be compared with each of the competencies to match. For starters, it should be determined if there competencies match. For direct matching, this is done by comparing the competencies. If they are the same, the match confidence is 1.00. If they are different, there is no match (match confidence=0.00 and the competency is no longer considered).

If there is a match, then the match score is a rescaled proficiency level, compared with the desired proficiency level. First the proficiency levels are mapped to the [0,1] interval, all values higher than the desired are reduced to the desired and then the result is rescaled to [0,1] to assure the score is 1.00 if the desired level was reached. Any overshoot of the proficiency level is irrelevant for the match scores. This is necessary as otherwise competency shortcomings could be masked.

Once all the individual competencies from the profile to match are compared with the competency from the desired profile, you need a function to determine the actual match result. This could be by choosing the *best* result or using some kind of weighed average. The current implementation always used the match with highest score. (A function should be built to combine these matches. It is up to the user to choose how this should be determined as it is not clear how the match score, match confidence, assessment confidence and relevancy factors interrelate. For example the assessment confidence could be increased if there are many matches, or it could increase the relevancy factor for an older assessment if there are similar resent assessments, etc).

To use fuzzy matching, the same approach is used, except that confidence and match score for the match come from the fuzzy engine instead of being a test on whether the competencies are the same. The fuzzy engine needs to do fuzzy comparisons on the combination of competency and proficiency level. This needed because for example a competency "French" with a proficiency level of .2 might well be similar to a competency "Reading French" with a competency level of .8. This needs to be considered when matching.

G.7 Structure matching

For structure matching, the desired competency is matched using its structure and the rollup rules.

For each of the child nodes, the best match is calculated, using any of the available matching methods.

Two rollup rules are available. One where all child competencies are needed and one with a "minimum weight". In principle, some child competencies can be marked as required.

Because complex competencies can have different rollup rules and weights for the children depending on the proficiency level, the match should be done for each proficiency level on-wards.

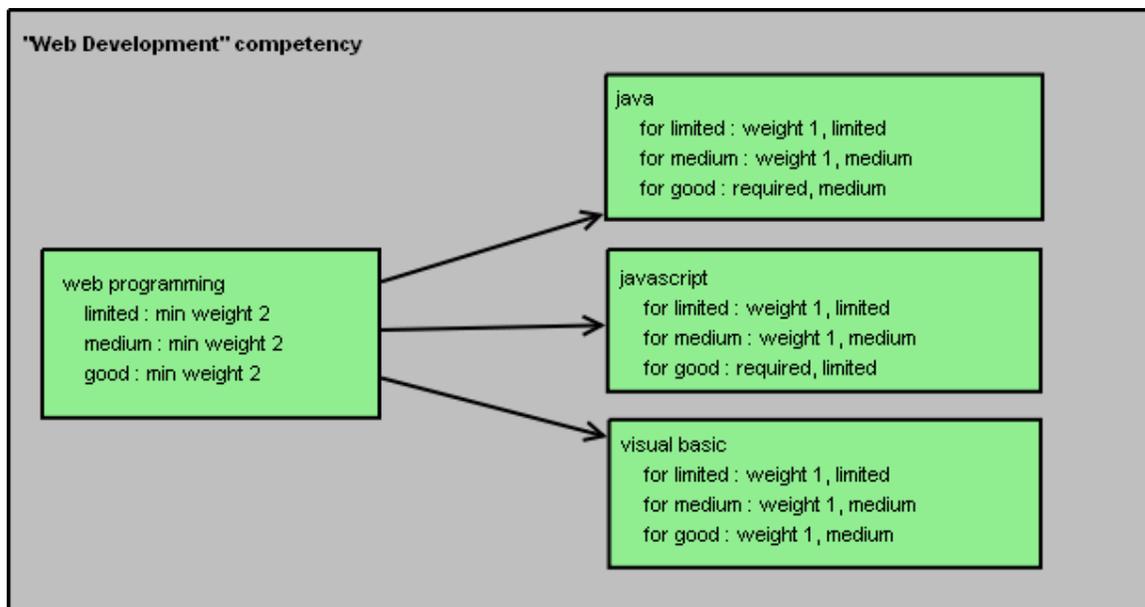


Figure G.7.1: structure matching

There are two options. The scale for the competency can be discrete or continuous.

If the scale is continuous, then the match score just has to consider the rollup rules.

If one of the children is required and there is no match, then the matching fails.

If the "all" rollup rule is active and one of the children has no match, then the matching fails. The score is calculated as in "combine matches from different competencies".

If the "minimum weight" rollup rule is active, then the weight for each child which has a match is added. If this total weight is smaller than the minimum weight then matching fails. The score is calculated as in the "all" case from the best combination which matches the minimum weight constraint.

If the scale is discrete, then for each level below the desired level the constraints should be checked. If the constraints are met (see above for the continuous scale) then that level is met and the next level can be attempted.

H Integration of the CA in LPEP

Who should read this chapter : users.

As learners will mostly interact with the Learning Process Execution Platform, an extra effort was made for close cooperation and strong integration between these two platforms.

Apart from the web service integration between the two components, there is also some Competency Analyser functionality which is also made available in the Learning Process Execution Platform user interface.

This is done at two levels, either by replicating user interface in native style, or by embedding the Competency Analyser.

For the learners this simplifies things. They no longer need to access the Competency Analyser as a separate system. They only interact with the LPEP and will see the competency information which is relevant for them appear in the LPEP screens.

This is also useful from a security point of view. In the portal the access to the Competency Analyser can be complete prohibited. In the embedded CA, provisions are made that they cannot view information which does not relate to them.

H.1 Examples

Direct access to “my competencies”, using the Competency Analyser’s evidence distillation in LPEP native style.



My competencies		
Name	Self assessment	Info
<input type="checkbox"/> Basic English for Book sales	██████████	
<input type="checkbox"/> English oral comprehension	██████□□□□	
<input type="checkbox"/> Knowledge of the Happy Books catalogue	██████████	
<input type="checkbox"/> Friendliness in Customer Service	██████████	
<input type="checkbox"/> Happy Books Cash Register Handling	██████████	

Figure H.1.1: “My competencies” in LPEP

You can also access this same information using the embedded Competency Analyser (which does show some additional information and click-through options).

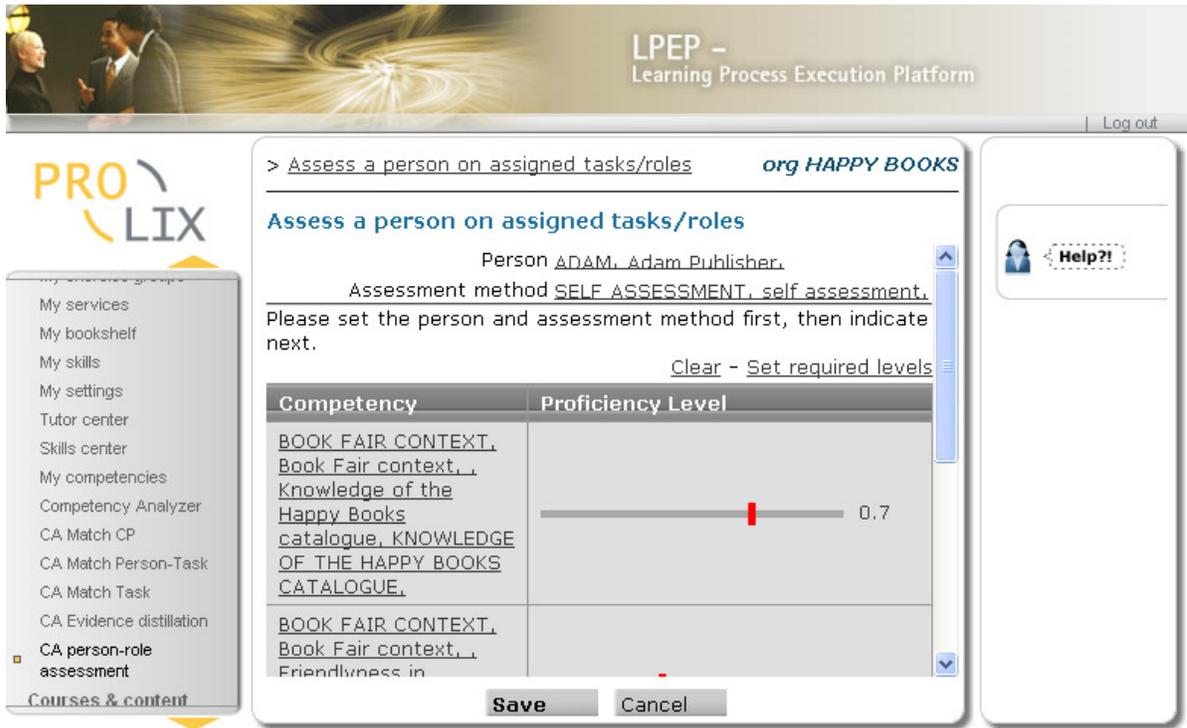
The screenshot shows the LPEP (Learning Process Execution Platform) interface. At the top, it says "LPEP - Learning Process Execution Platform" and "org HAPPY BOOKS". Below this is a navigation menu on the left with options like "My courses", "My communities", etc. The main content area is titled "Evidence Distillation" and contains a table with the following data:

Competency	Title	Context	Proficiency
BASIC ENGLISH FOR BOOK SALES	Basic English for Book sales	Book Fair context	1.00
C11	English oral comprehension	PROCAR-Demo	0.40
KNOWLEDGE OF THE HAPPY BOOKS CATALOGUE	Knowledge of the Happy Books catalogue	Book Fair context	0.80
FRIENDLYNESS IN CUSTOMER SERVICE	Friendliness in Customer Service	Book Fair context	0.80

At the bottom of the table, there are "Find" and "Cancel" buttons. A "Help?!" button is also visible on the right side of the interface.

Figure H.1.2: Evidence distillation

You can directly add an assessment.



LPEP – Learning Process Execution Platform | Log out

> [Assess a person on assigned tasks/roles](#) org HAPPY BOOKS

Assess a person on assigned tasks/roles

Person ADAM, Adam Publisher

Assessment method SELF ASSESSMENT, self assessment

Please set the person and assessment method first, then indicate next.

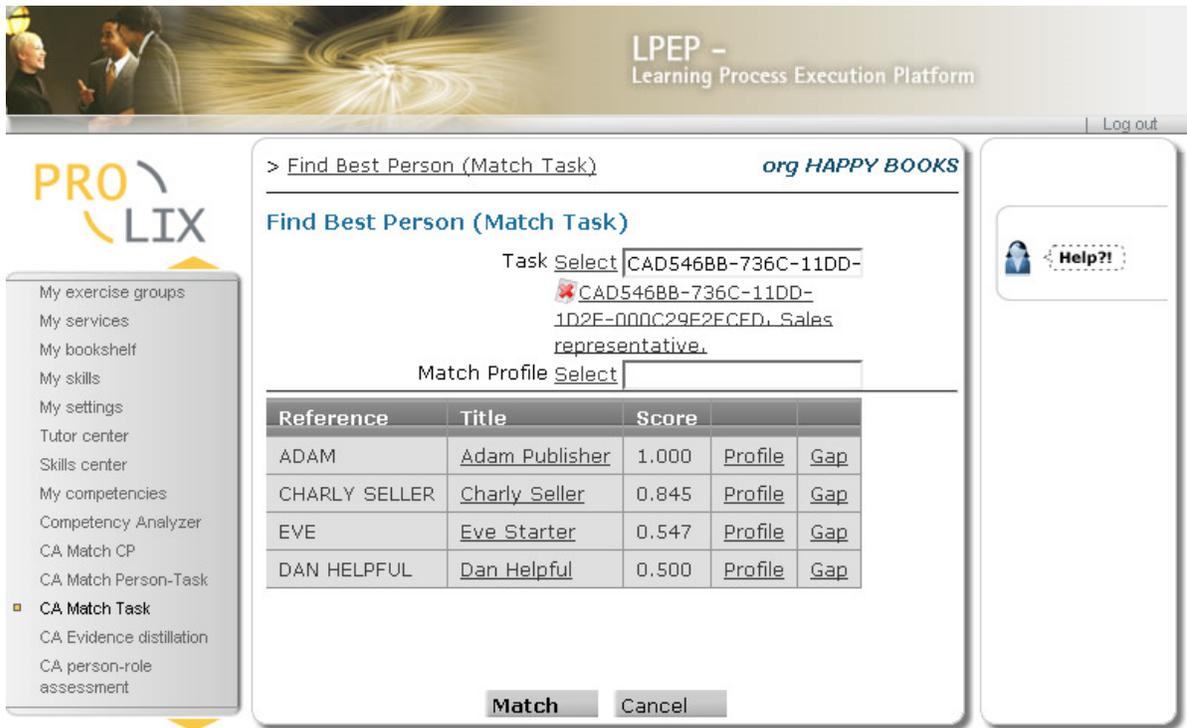
[Clear](#) - [Set required levels](#)

Competency	Proficiency Level
<u>BOOK FAIR CONTEXT, Book Fair context, Knowledge of the Happy Books catalogue, KNOWLEDGE OF THE HAPPY BOOKS CATALOGUE,</u>	<input type="range" value="0.7"/> 0.7
<u>BOOK FAIR CONTEXT, Book Fair context, Friendliness in</u>	<input type="range" value="0.0"/>

Save **Cancel**

Figure H.1.3: Add a person/role assessment

All the matching pages are accessible.



LPEP – Learning Process Execution Platform | Log out

> [Find Best Person \(Match Task\)](#) org HAPPY BOOKS

Find Best Person (Match Task)

Task Select

Match Profile Select

Reference	Title	Score		
ADAM	Adam Publisher	1.000	Profile	Gap
CHARLY SELLER	Charly Seller	0.845	Profile	Gap
EVE	Eve Starter	0.547	Profile	Gap
DAN HELPFUL	Dan Helpful	0.500	Profile	Gap

Match **Cancel**

Figure H.1.4: "find best person" matching

The screenshot shows the LPEP interface with the following components:

- Header:** LPEP – Learning Process Execution Platform
- Navigation:** > Find Best Person (Match Task) > Find Best Person (Match Task) org HAPPY BOOKS
- Task Selection:** Find Learning Path (Match Person and Task) Cash Register Training LDP-CR
- Match Results Table:**

Title	Start proficiency	Requested proficiency	Match score
Sales representative			
Friendlyness in Customer Service	0.80	0.40	0.00
Knowledge of Book Catalogue			
Knowledge of the Happy Books catalogue	0.70	0.70	0.00
Cash register handling			
Happy Books Cash Register Handling	0.10	0.60	1.00
- Buttons:** Match, Cancel
- Right Panel:**
 - Task or role Competency already present
 - There is a remaining gap for this competency
 - Competency will be acquired by following the courses
 - Help?!
- Left Menu:**
 - My exercise groups
 - My services
 - My bookshelf
 - My skills
 - My settings
 - Tutor center
 - Skills center
 - My competencies
 - Competency Analyzer
 - CA Match CP
 - CA Match Person-Task
 - CA Match Task
 - CA Evidence distillation
 - CA person-role assessment

Figure H.1.5: "person-task" matching

I New features

Who should read this chapter : users who already know the Competency Analyser and are interested in the improvements.

I.1 Layout

Competency Analyzer

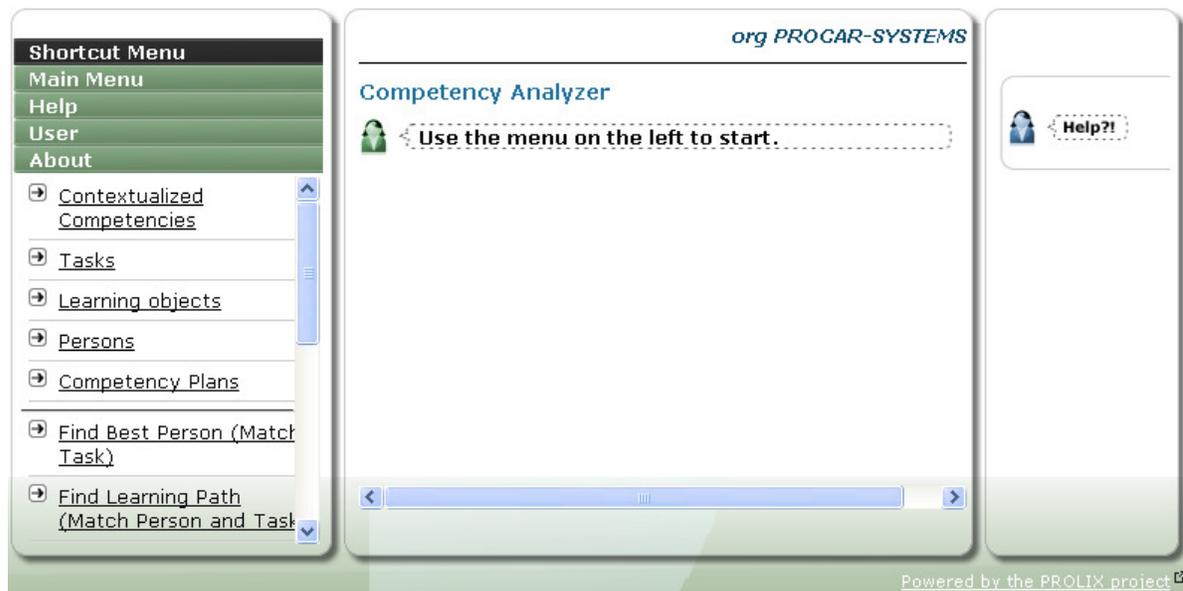


Figure I.1.1: CA initial page

The layout and design of the application has been modified to become more appealing and more user friendly.

The design has three columns. The left column is the menu. The middle is the main working area and on the right there is another column which gives you some context specific links and help.

The middle section has a breadcrumbs bar at the top and some context information including a permanent indication of the organization the user is part of.

At the bottom of the middle part the buttons (if any) are displayed. They always remain displayed to allow quick navigation.

I.2 Matching profiles

Matching profiles are used to configure the behaviour of the evidence distillation and matching.

Competency Analyzer

Shortcut Menu
Main Menu
Help
User
About

- Application Domain
- Artefact
- Artefact category
- Assessed Artefact
- Assessed Competency
- Assessment Method
- Assessment Scale
- Assessment Score
- Contextualized Competency
- Competency
- Competency Category
- Competency Plan
- Confidence Scale
- Confidence Score
- Context
- Criterion
- Criterion Score
- Match Profile
- Scale

Threshold 0.5 Minimum level for the assessments to be considered as "passed"

Threshold 0.65 Minimum confidence level for the assessments to be taken into consideration.

Direct multiplier 1 Multiplier to apply to direct matching confidence score, 0 for no direct matching, 1 for normal

Semantic multiplier 0 Multiplier to apply to semantic matching confidence score, 0 for no direct matching, 1 for normal

Worker Highest proficiency level

Parameters

Max results 10

Confidence Weight 0

Relevancy Weight 0

Fluency Weight 0

Relevancy

Relevancy grace 0 Grace period in days during which a competency remains fully relevant (no degradation yet)

Relevancy degrade 0 Number of days during which the relevancy degrades linearly

Fluency

Fluency grace 1 Number of occurrences before fluency is increased

Fluency add 0 Amount of fluency to add for each occurrence above the grace number of occurrences

Fluency include Should higher proficiency levels be included when counting the number of

Save Reset Cancel Delete

display

Actions

- Get Matching Profile

Powered by the PROLIX project

Figure I.2.1: Edit match profile

Apart from title and reference, the following fields are defined :

- Assessment level threshold : minimum level for the assessments to be considered as "passed". Any assessment with an assessment level lower than this is not considered during evidence distillation.
- Assessment confidence threshold : minimum confidence level for the assessments to be taken into consideration. Any assessment which was done using an assessment method which has a confidence lower than this value is not considered during evidence distillation.
- Direct multiplier : multiplier to be applied to the direct matching confidence score. When this is zero, the direct matching is not used.
- Semantic multiplier : multiplier to be applied to the semantic matching confidence score. When this is zero, the direct matching is not used.
- Worker : determines how the proficiency level is determined if there were several assessments for the same competence. You have the following choices :
 - o Average proficiency level : the average proficiency level of all (considered) assessments is used.
 - o Highest proficiency level : the highest proficiency level of all (considered) assessments is used.
 - o Highest confidence : the proficiency level which was determined using an assessment method with the highest confidence is chosen.
 - o Highest relevancy : the proficiency level which was most recently assessed is chosen.
 - o Weighted confidence : the weighted average proficiency level is calculated. The assessment method confidence is used as weight.

- Weighted relevancy : the weighted (by relevancy) average proficiency level is calculated.
 - Average proficiency level with fluency : same as “average proficiency level” but with calculation of fluency.
 - Weighted relevancy with fluency : same as “weighted relevancy” but with calculation of fluency.
 - Highest relevancy with fluency : same as “highest relevancy” but with calculation of fluency.
- Parameters : allow passing extra parameter to the worker. Not used at this moment.
 - Max results : Maximum number of results which are displayed in the “find person for task” page.
 - Confidence weight : weight of the confidence score which is used when sorting the results to determine the “best” match.
 - Relevancy weight : weight of the relevancy score which is used when sorting the results to determine the “best” match.
 - Fluency weight : weight of the fluency score which is used when sorting the results to determine the “best” match.
 - Relevancy grace : the relevancy score is a value between 0 and 1. For assessments which are recent enough (fully relevant), this is 1. All assessments which are less than the grace period (in days) old, are considered to be fully relevant.
 - Relevancy degrade : After the grace period, the relevancy linearly decrease during the number of days mentioned in the degrade period, which is specified in days).
 - Fluency grace : people are considered to be more fluent in a competency when there are more assessments for that competency. The “grace” allows you to configure the number of occurrences a person needs to have before the fluency starts to increase.
 - Fluency add : once the grace number of occurrences has been reached, this amount is added to the fluency factor for each extra occurrence.
 - Fluency include : when calculating fluency, should the number of occurrences be counted using equal proficiency level or should occurrences with higher proficiency also be considered.

I.3 Matching indexes

The Competency Analyser uses indexes to increase the matching performance. There are specific indexes for each organization and matching profile combinations.

The indexes are automatically kept up-to-date. When assessments are added, matching profiles or artefacts are created or modified, then the index is updated. Depending on the amount of data which needs to be re-indexed, this either occurs instantaneous or asynchronously (every couple of minutes the system checks whether indexes need updating, so there can be a little delay).

Some changes are not automatically updated. Specifically changes in competencies or competency structure are not propagated to the indexes. This is because of the not-yet-

implemented competency lifecycle (in principle you should not be able to modify competency definitions once they are in use).

The indexes for an organization can be rebuilt on request. This can be needed when they become corrupt (probably due to file system problems or server crashes), or because of aforementioned changes in competency definitions.

Just indicate the “matching index statuses” page in the “main menu”.

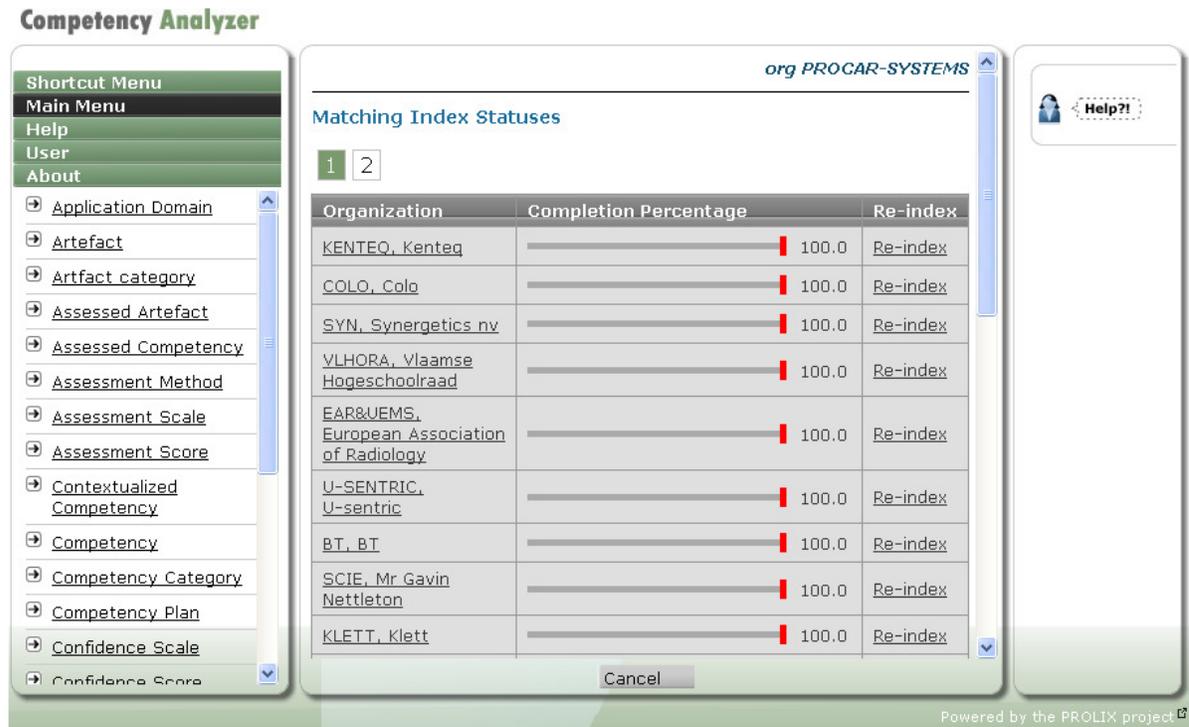


Figure I.3.1: Matching index statuses

For each organization, the current status of indexes is indicated as a completion percentage. When you want to re-index you have to indicate the “re-index” link for the specific organization.

Note that the completion percentage is calculated when the page is loaded. If you want to check whether the statuses change, you have to refresh the screen. In most browsers this can be done by pressing <F5>.

I.4 Import page

To allow bulk import of information, there is a page which allows you to insert or update data in the Competency Analyser by using a specific file format. This can be accessed using the “import” item in the “main menu”.

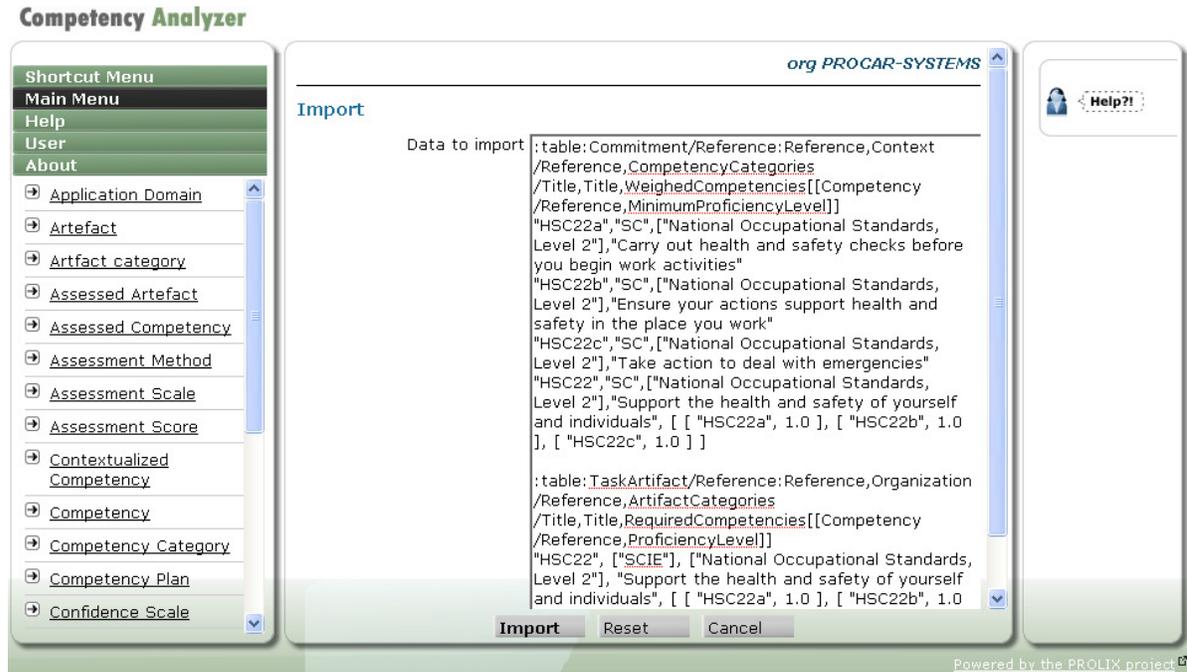


Figure I.4.1: Matching index statuses

The import file format is documented at <http://equanda.org/equanda-tool/ImportFileFormat>. You need knowledge of the domain model to know the correct table and field names. See [Appendix, domain model].

I.5 Authorization and configuration

I.5.1 Users

A user can choose to remove fields from their display. This can be configured by using the "user preferences" link in the "user" menu.

Competency Analyser

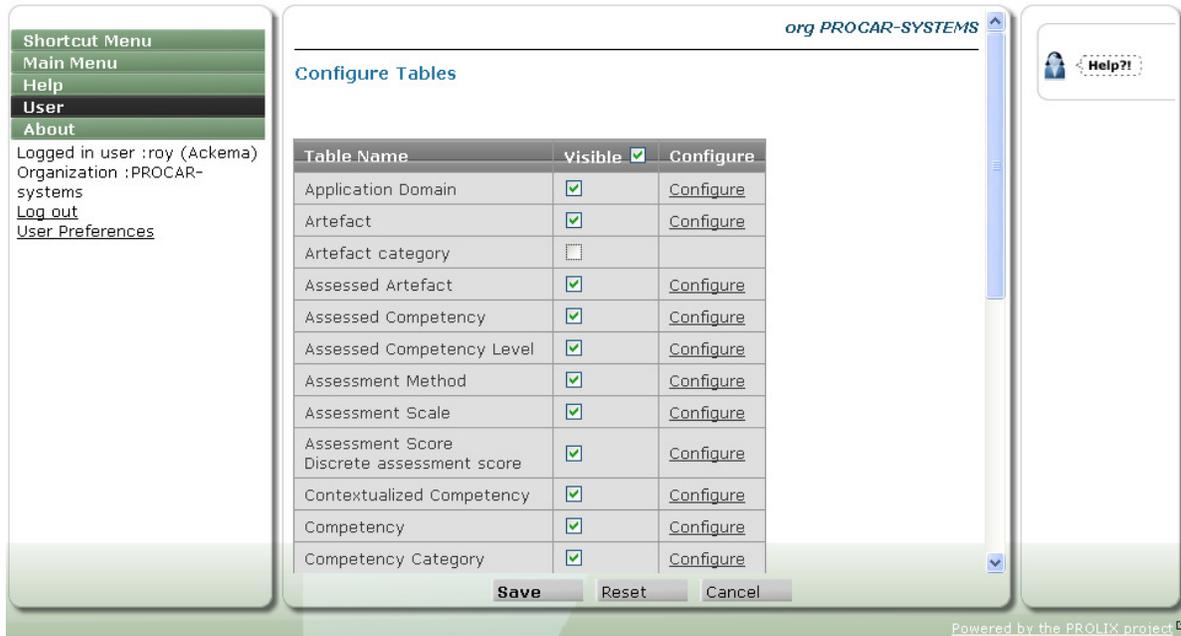


Figure I.5.1: Configure a users table settings

You can select which tables should be visible or not. The checkbox at the top allows you to indicate all checkboxes.

You have to indicate the "save" button at the bottom to save your changes.

Once the settings have been defined at table level, you can alter the settings for each table.

Competency Analyser

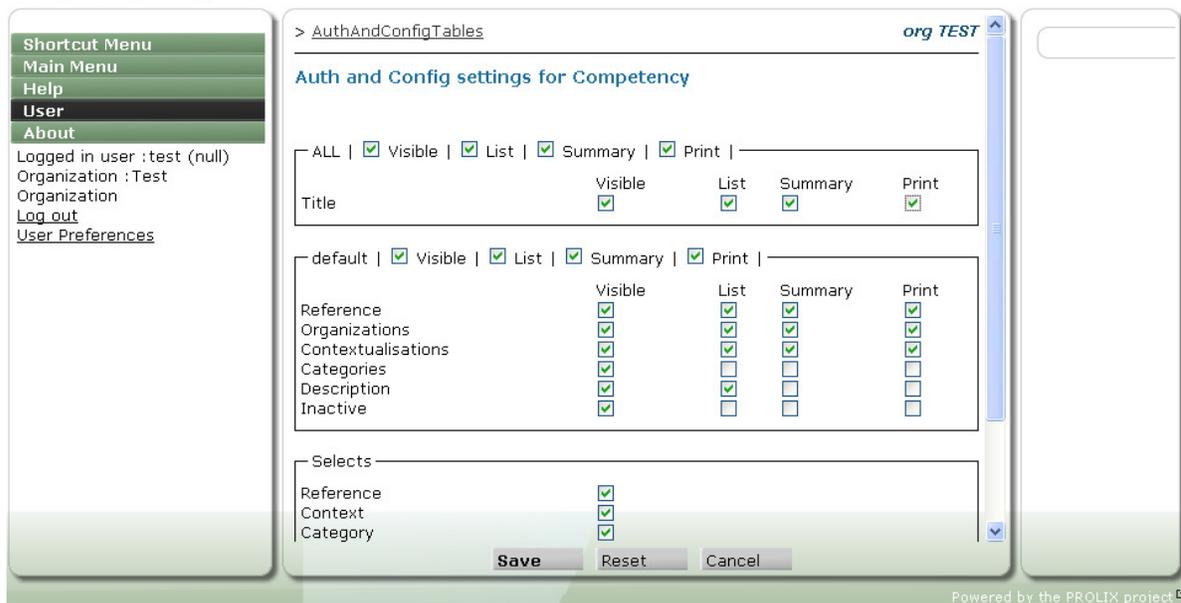


Figure I.5.2: Configure a users settings for a table

You can now select whether certain fields should be visible for you and which of the visible fields should be include in lists, in summary displays and (for future) in printouts. You can also indicate for each of the possible selectors whether you want to be able to use them.

I.5.2 Administrator

For administrators, there are similar screens where you can configure the base settings for a role. To be able to access this option, you need to be logged in using a user which is indicated as "gui administrator".

You can access these screens from the "user" menu using the "role configurations" link.

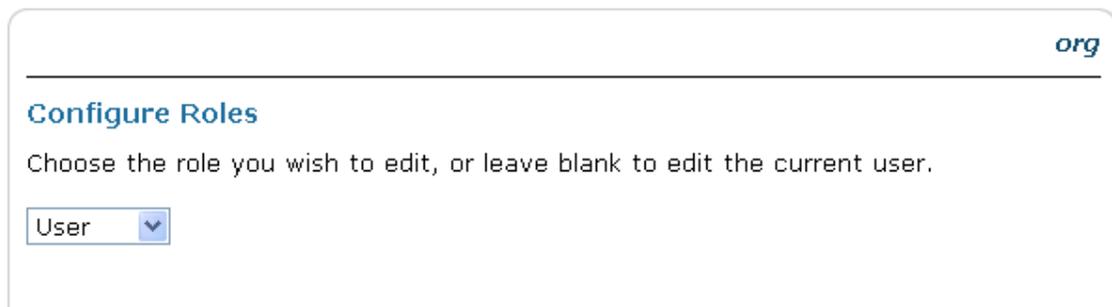


Figure I.5.3: Choose role to configure authorizations for

You can then choose the role for which you want to edit the settings.

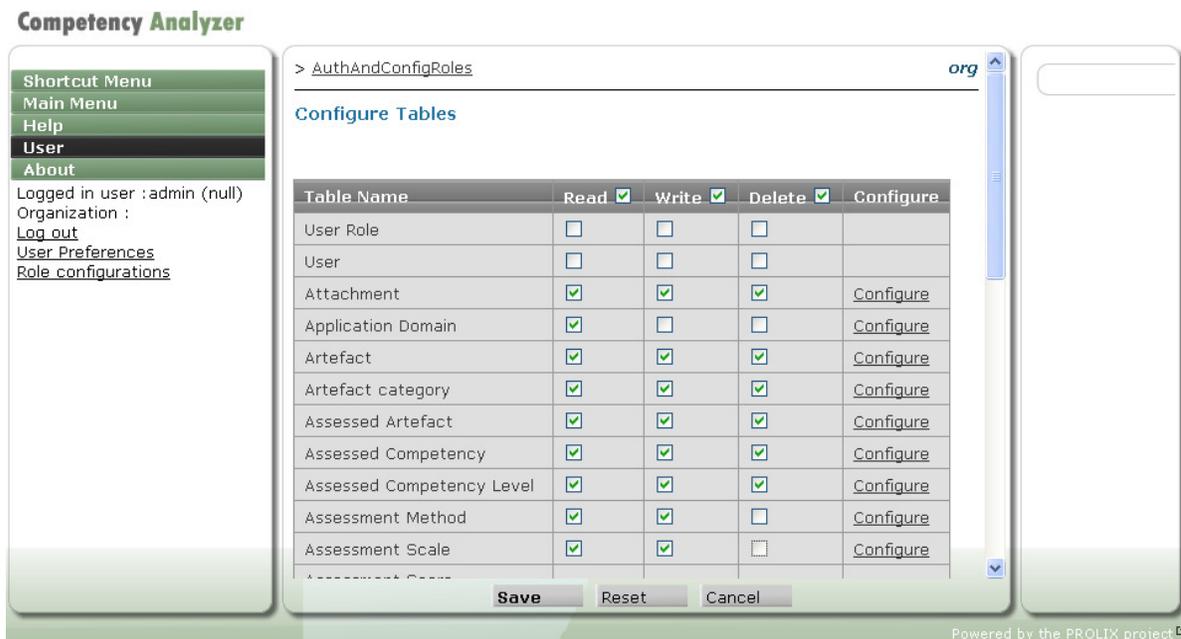


Figure I.5.4: Configure table level authorizations for a role

You can now select which table should be readable, read and writable or read, write and deletable by users of the chosen role.

Using the "configure" link, you can also click through to configure the detailed access rights for the table.

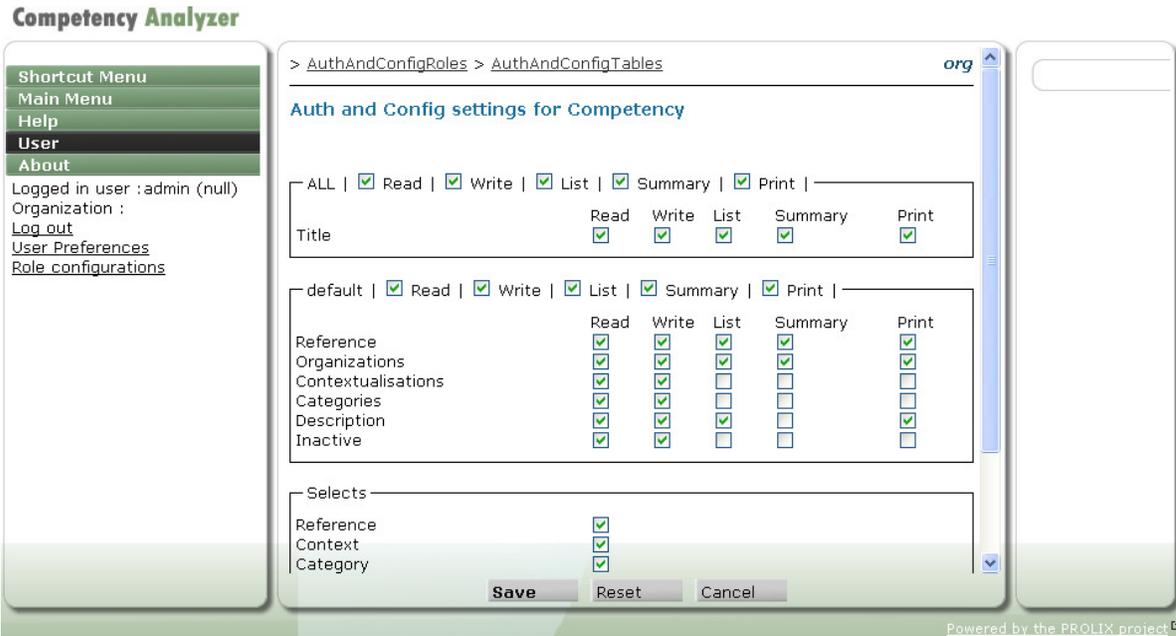


Figure I.5.5: Configure authorizations for a table

You can now determine the detailed access rights for each field, for the actions and selectors on the table. For the fields you can now set whether it should be read only or read/write and which of the readable fields should be include in lists, in summary displays and (for future) in printouts.

Note that when a user has multiple roles, the rights will be combined, allowing everything which is allowed by one of the roles.

I.6 Better match result display

I.6.1 Person-task matching

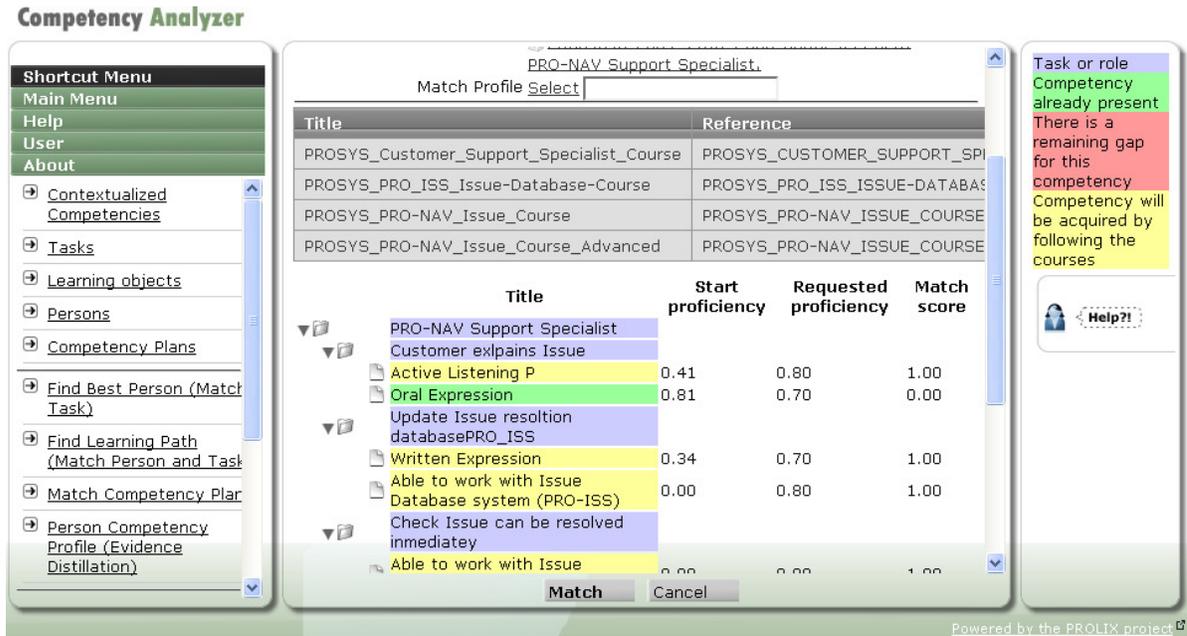


Figure I.6.1: Match person-task

The person-task matching has been improved to not only display the suggested courses, but also give some kind of gap display.

This is represented by a tree which has the matched task as root, and below that all subtasks (blue labels). Under each task is the set of required competencies for that task. The colour indicated the status of the competency.

- Green : the competency is already mastered at the required level.
- Yellow : the competency will be mastered when the learning has successfully completed.
- Red : the competency cannot be improved to the required level by any learning material known in the Competency Analyser.

On each line some additional information is displayed, specifically the proficiency the person has at the time of matching, the required level for the task and the match score.

I.6.2 Competency plan matching

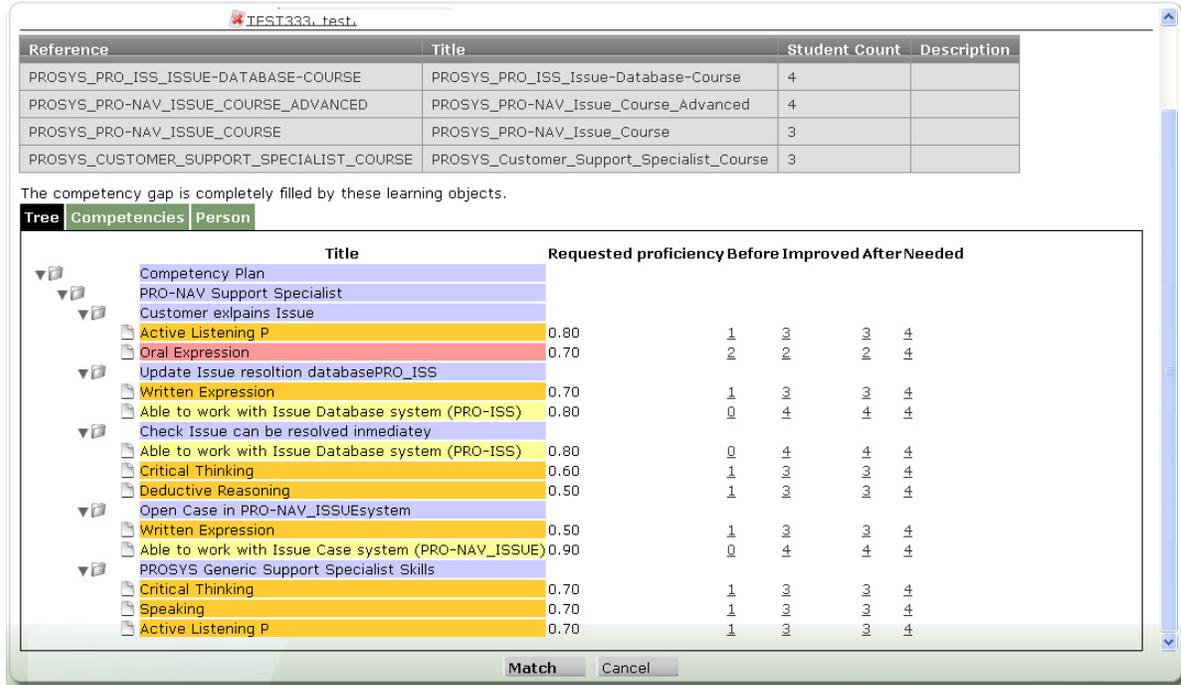


Figure I.6.2: Match competency plan, tree view

Student Count	Description
4	
4	Sam White, Volker Zimmermann, Jo White, Agela Black
3	
3	

When you invoke the matching on a competency plan, the result is the proposed set of learning objects which are needed to raise the competencies of the people in the plan (in order, though not all learning objects should be followed by everyone). When you hover the mouse over the student count, you see a list of students for the course.

Below, there are three tabs with possible displays of information.

- Tree : gives a tree view of the tasks and competencies
- Competencies : gives a list of competencies across all tasks
- Person : overview of people in the competency plan

The tree view displays the labels in colours :

- Blue : the tasks which are matched.
- Green : the competencies were already present for all persons in the plan.
- Yellow : competency will be acquired for all persons in the plan when the course have been successfully absorbed.
- Orange : competency will be acquired for some people only. This probably means that some people don't have sufficient competencies to be able to enrol in a course to reach the required level.
- Red : There is a remaining gap for this competency. This is probably caused by no course offering to teach the required level or nobody being able to reach the prerequisites.

For each competency the following is displayed :

- Request proficiency level
- Number of people who had that proficiency at the time of matching
- Number of people who will have some level after (successful) learning
- Number of people who will have the proficiency after (successful) learning

- Number of people who need this competency according to the plan

Clicking on the number of people will give some information about the persons requiring this competency.

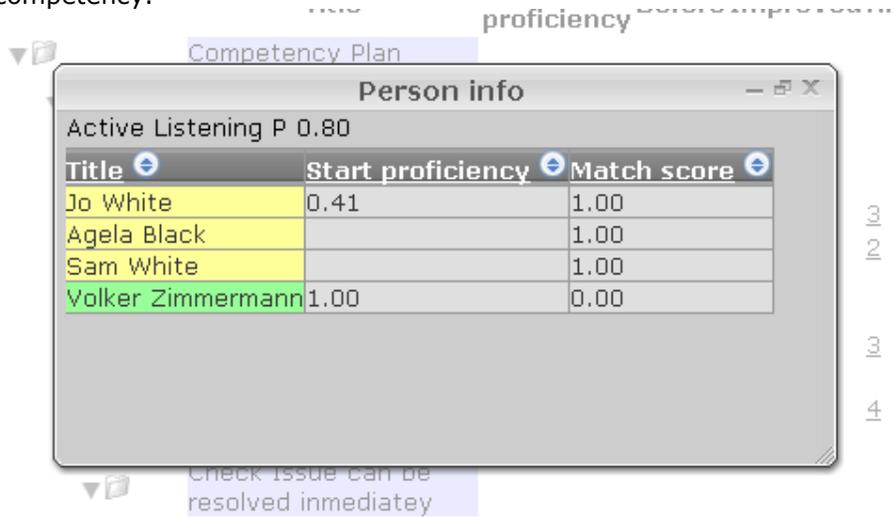


Figure I.6.3: Match competency plan, person detail on competency in tree

For each person, the usual colours are indicated to indicate the status for this competency and the start proficiency and match score are displayed.

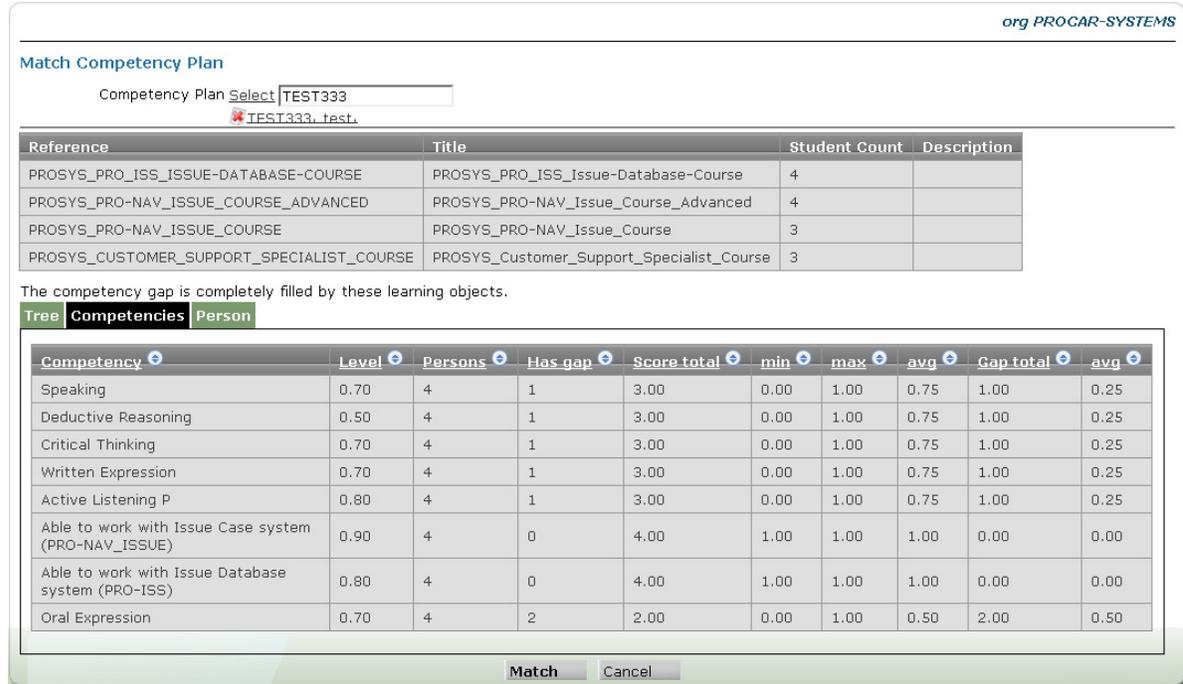


Figure I.6.4: Match competency plan, competencies view

The competencies tab displays the details for the individual competencies. This table allows sorting by clicking the label at the top. Clicking the label again will revert the sort order.

Details displayed are :

- Competency title
- Required level (highest across the tasks)

- Number of persons who need this competency
- Number of people with a competency gap at the time of matching
- Total matching score (sum over the individuals needing the competency, score is 1.00 when the competency is reached after learning or lower if there is a remaining gap).
- Minimum match score for a person needing the competency
- Maximum match score for a person needing the competency
- Average score for the people needing the competency.
- Total remaining competency gap (sum over the individuals needing the competency, gap is 1.00 when the competency is lacking, or 0.00 when the required level is reached).
- Average gap for the people needing the competency.

Competency Analyser

Match Competency Plan

Competency Plan Select [TEST333
TEST333.test]

Reference	Title
PROSYS_PRO_ISS_ISSUE-DATABASE-COURSE	PROSYS_PRO_ISS_Issue-Da
PROSYS_PRO-NAV_ISSUE_COURSE_ADVANCED	PROSYS_PRO-NAV_Issue_Cc
PROSYS_PRO-NAV_ISSUE_COURSE	PROSYS_PRO-NAV_Issue_Cc
PROSYS_CUSTOMER_SUPPORT_SPECIALIST_COURSE	PROSYS_Customer_Support

The competency gap is completely filled by these learning objects.

Tree Competencies Person

Name	Score after
Sam White	1.00
Volker Zimmermann	0.25
Jo White	0.88
Agela Black	1.00

Match Cancel

Task or role
Competency already present
There is a remaining gap for this competency
Competency will be acquired for some people only
Competency will be acquired by following the courses

Help??

Powered by the PROLIX project

Figure I.6.5: Match competency plan, person view

The persons tab displays the people in the competency plan with an indication of the match score after learning (0.00 when all competencies are lacking, 1.00 when all competencies are available at the required level).

The names are coloured to indicate the status :

- Green : all competencies are acquired at the required level without learning
- Yellow : all competencies will be learning when successfully absorbing the courses
- Red : there is a remaining gap even after learning. This indicates no suitable learning objects are available to fully bridge the competency gap.

I.7 Self assessment and manager assessment pages

I.7.1 Self assessment

People can easily do a self assessment for the tasks which have been assigned to them. For this, they need to indicate the "self assessment for assigned tasks" link in the menu.

For this screen to function properly, the "self assessment" type needs to be set in the organization (need to be done by an administrator), and the person needs to have a set of assigned tasks or roles. In that case a screen like the following will appear.

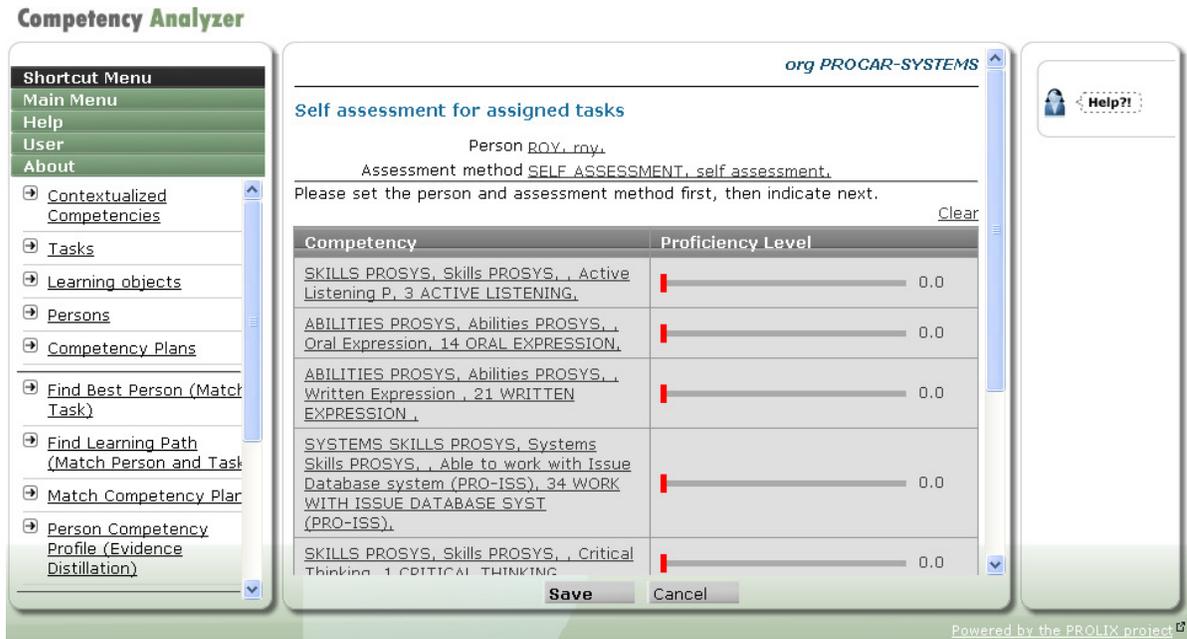


Figure I.7.1: Self assessment

Each of the competencies which is required for one of the assigned tasks is displayed and either a slider (competency with continuous scale) or a select box with the possible proficiency levels.

The user can set the proficiency levels he or she thinks apply. When needed, you can always clear all levels again by clicking the “clear” link at the top. This will reset all levels back to zero.

I.7.2 Manager assessment

For managers there is a similar screen as for the self assessment.

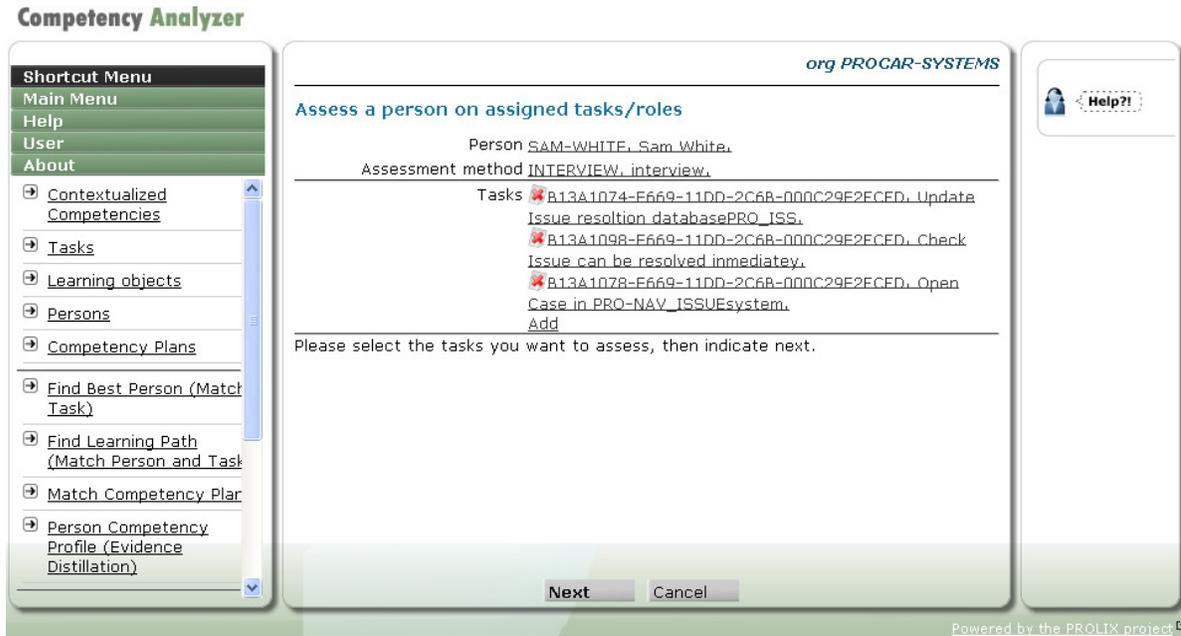


Figure I.7.2: Assess person for assigned task, start

You have to start by selecting the person and assessment method, then you indicate next and select the tasks to assess.

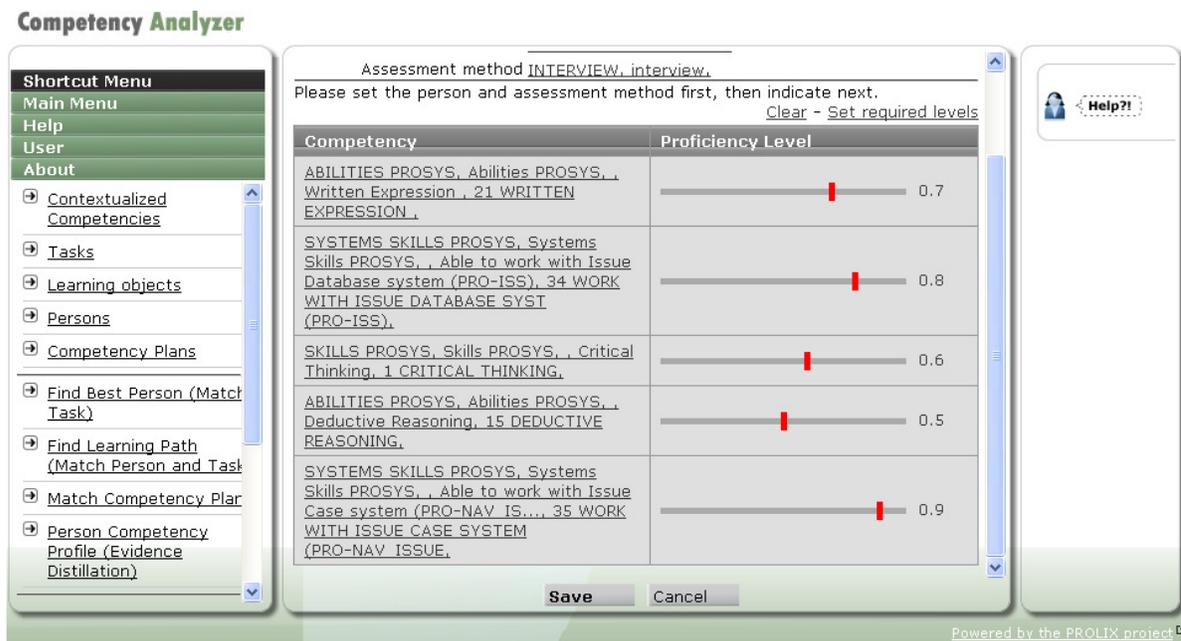


Figure I.7.3: Assess person for assigned task, actual assessment

After pressing "next" again, the competencies for the tasks are displayed. The proficiency levels are by default set to the (highest) required level for the tasks. At the top there are two links to "clear" the competency levels or to reset them to the required levels ("set required levels").

I.8 Other new features

- Filtering on artefacts. An artefact can be either a person, a learning object or a task/role. In some cases only one type of artefacts, for example when selecting the assigned tasks/roles for a person. This is now filtered to assure you cannot select the other types.
- Artefact reference now only unique per organization. Previously this was world unique, which (though theoretically correct) is impractical, especially for testing.
- Logout working
- Speed improvements
- Usability improvements for adding multiple contextualised competencies at once (instead of adding them one by one).
- Extra learning artefact info, extra person info
- Allow explicit modelling of assigned tasks/roles for a person
- Improved automatic (integration) testing
- SSO with the other prolix modules (especially with the portal)
- Allow creation of users from the portal
- PROLIX compliant web services (using the PROLIX SOAP header and SSO)
- Allow inclusion of the semantic matching based on DOGtagger, Dmatch, DOGMA-mess technology
- Many usability improvements and bug fixes

J User's manual

Who should read this chapter : users, can be used both as reference and for introduction.

Note that the previous two sections ([Competency modelling](#) and [Matching](#)) should also be considered part of the "user's manual" but are mentioned separately because of their importance in the Competency Analyser.

J.1 Screen layout and general operation

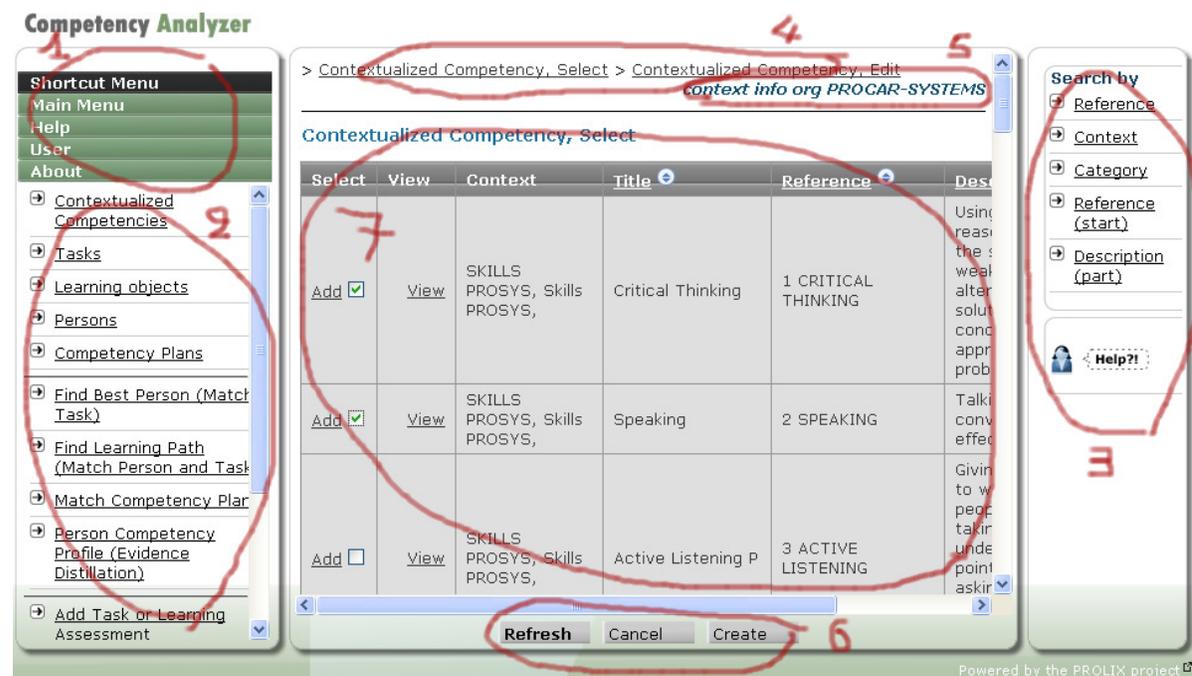


Figure J.1.1: Screen layout

The screen is divided in three columns.

The left column is the menu. The main items are in area (1). When you click on one of these items, the actual options are displayed below that (2).

The right column (3) has some context specific selections and help.

The middle column is the main work area. At the very top left there is the breadcrumbs bar (4). This indicates the previous pages and maintains a trail of your navigation through the program. At the top right there is some context information (5) which always contains the organization the user is part of and sometimes some other info as well.

The buttons with possible actions always remain at the bottom of the screen (6). The middle (7) is the actual work area.

In all the pages, you can use either <tab> or <enter> for navigation between fields. You can go back to the previous field using <shift-tab>. The only exception are buttons. When the focus is on a button and you press <enter>, then the button behaves as if it is clicked on (so when pressing the <enter> key several times this will usually save the screen at some point.

When you reach the last field in a tab page, pressing <tab> or <enter> will automatically take you to the next tab (if any). Similarly, when pressing <shift-tab> on the first field in a tab page, you will go back to the last field in the previous tab.

Screens often have a default action which is indicated by a bold font (see the “refresh” button in the screenshot above). You can automatically submit using the default button by pressing <ctrl-enter>.

When a field allows multiple lines to be inserted, you can go to the next line by pressing <shift-enter>.

When editing data with links, you often get an input field like this :

Select

You can then choose to indicate the “select” link which allows you to select the linked data from a screen with the options (the right column will probably also allow specific selectors to be used), or you can start typing the reference in the input field. You should get a list of choices using auto-completion and can indicate the preferred one yourself.

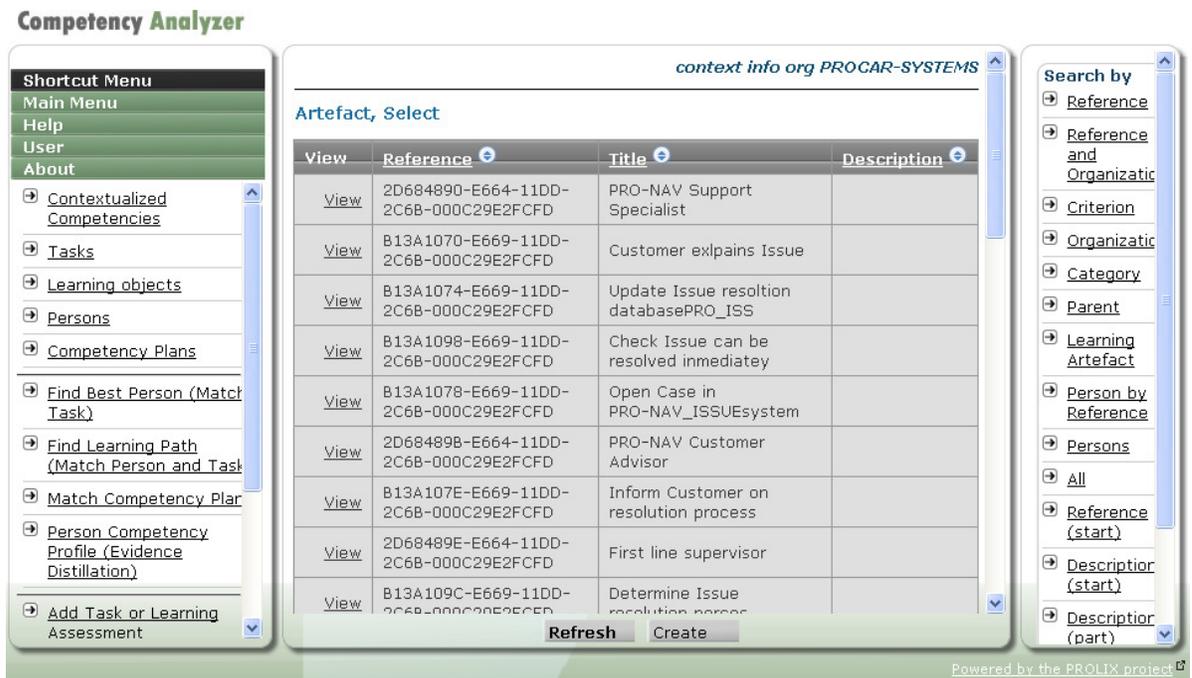


Figure J.1.2: Select example

In select screens, you get a list with some of the fields. You can use the headers to sort the list. On the right you see some options to select based on certain criteria and parameters you have to give.

You can have a look at the record by indicating the “view” link.

New records can be created using the “create” button.

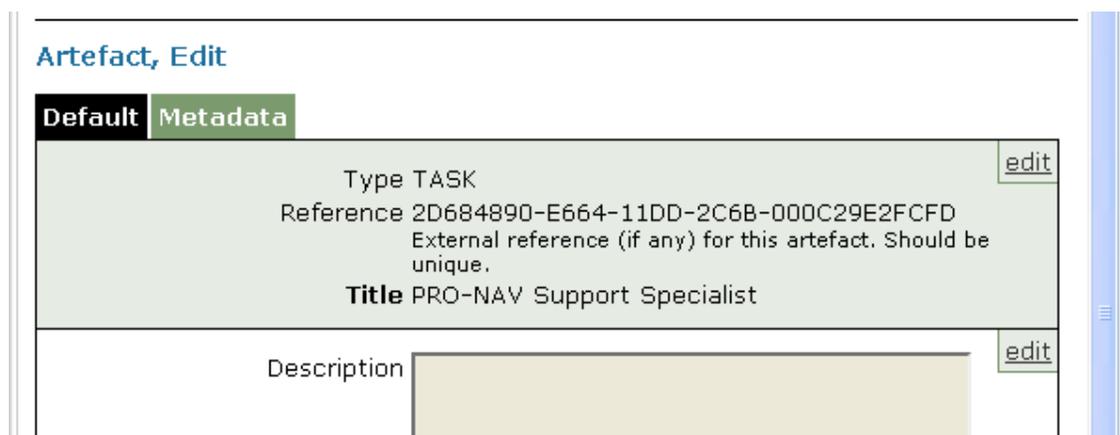


Figure J.1.3: Viewing a record

This brings you to a view screen. Clicking on the “edit” links allows you to edit that portion of the screen.

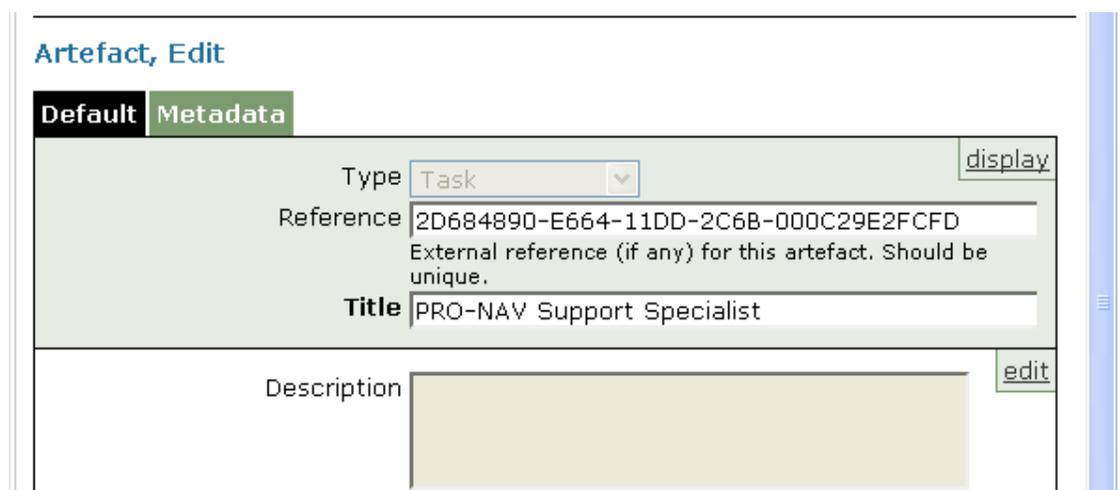


Figure J.1.4: Edit a section

Note that changes you make in the edit portion are not propagated when you move back to the “display” view. If you need to revert the changes you made in the screen, you should use the “reset” button.

Labels which are displayed in bold are required to be set to be able to save the data.

When you are given the option to select links, you get something like

Select	View	Referen
Add <input type="checkbox"/>	View	2D68489
Add <input type="checkbox"/>	View	B13A107
Add <input type="checkbox"/>	View	B13A107
Add <input type="checkbox"/>	View	B13A109

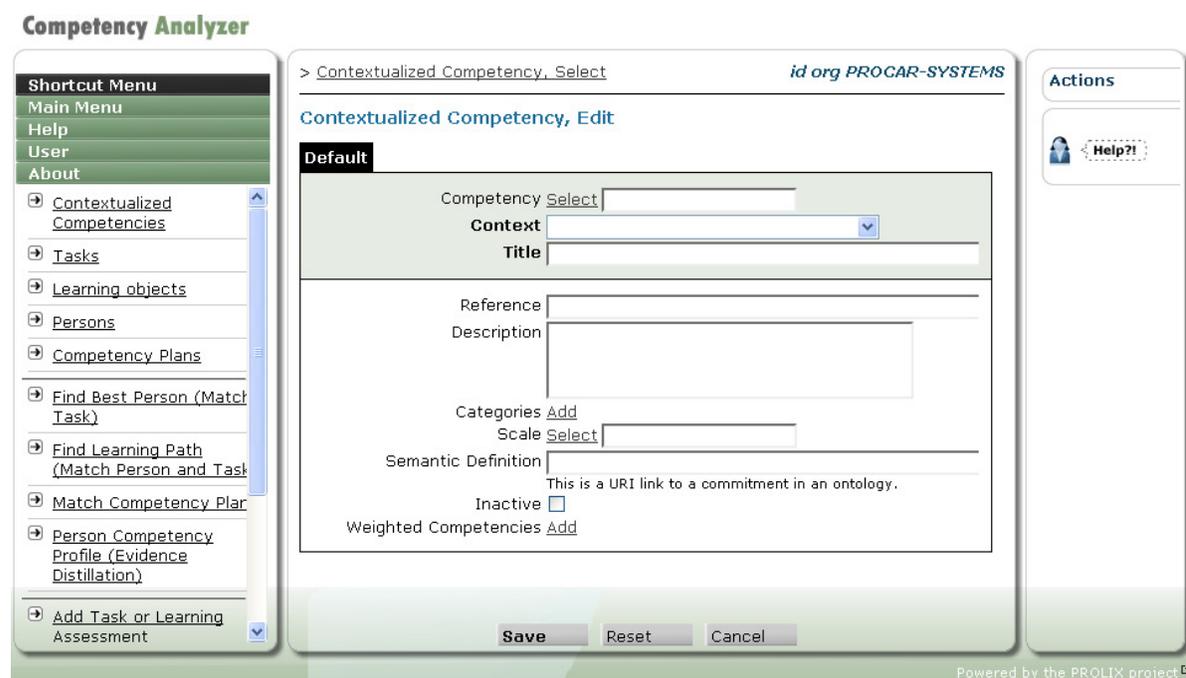
Figure J.1.5: Single and multiple select

The “add” allows you to add the selected record. Indicating the select boxes next to the add links allow choosing several records at once. The can be added using the “add selected objects” link at the bottom of the screen (you may need to scroll down to see this).

J.2 Data entry and manipulation

J.2.1 Contextualised competency

The contextualized competency is the bread and butter of the Competency Analyser. This details the competencies which can be combined in task and learning profiles, which can be assessed and which are compared during matching.



Competency Analyser

Shortcut Menu
Main Menu
Help
User
About

- Contextualized Competencies
- Tasks
- Learning objects
- Persons
- Competency Plans
- Find Best Person (Match Task)
- Find Learning Path (Match Person and Task)
- Match Competency Plan
- Person Competency Profile (Evidence Distillation)
- Add Task or Learning Assessment

> Contextualized Competency, Select id org PROCAR-SYSTEMS

Contextualized Competency, Edit

Default

Competency

Context

Title

Reference

Description

Categories

Scale

Semantic Definition

This is a URI link to a commitment in an ontology.

Inactive

Weighted Competencies

Save **Reset** **Cancel**

Powered by the PROLIX project

Figure J.2.1: Contextualized competency

The following fields can be given

- Competency : the (generic) competency which is contextualized by this. When not filled, a new (generic) competency is created with the same title and description as this one.
- Context : allows you to define the context which need to be used.
- Title : title for the competency.
- Reference : this is a key (which needs to be unique and is always capitalized) you can use to quickly retrieve the competency. This can be used to type the reference instead of going through a separate selection screen).
- Description : long description of the competency. It is recommended to give as many details as possible about all aspects of the competency.
- Categories : allows indicating which categories this competency belongs to.
- Scale : the scale which is used for the proficiency levels of the competency.
- Semantic definition : when the competency is semantically annotated this will display the URI for the annotation. In principle, you should not fill this yourself, a value will be set when you use the “DOGTagger” action to define the semantic annotation.

- Inactive : when this is set, the competency is not intended to be used any more. It may still be in use for existing competencies or competency profiles, but will not be presented when building new definitions (provisional, not yet used).

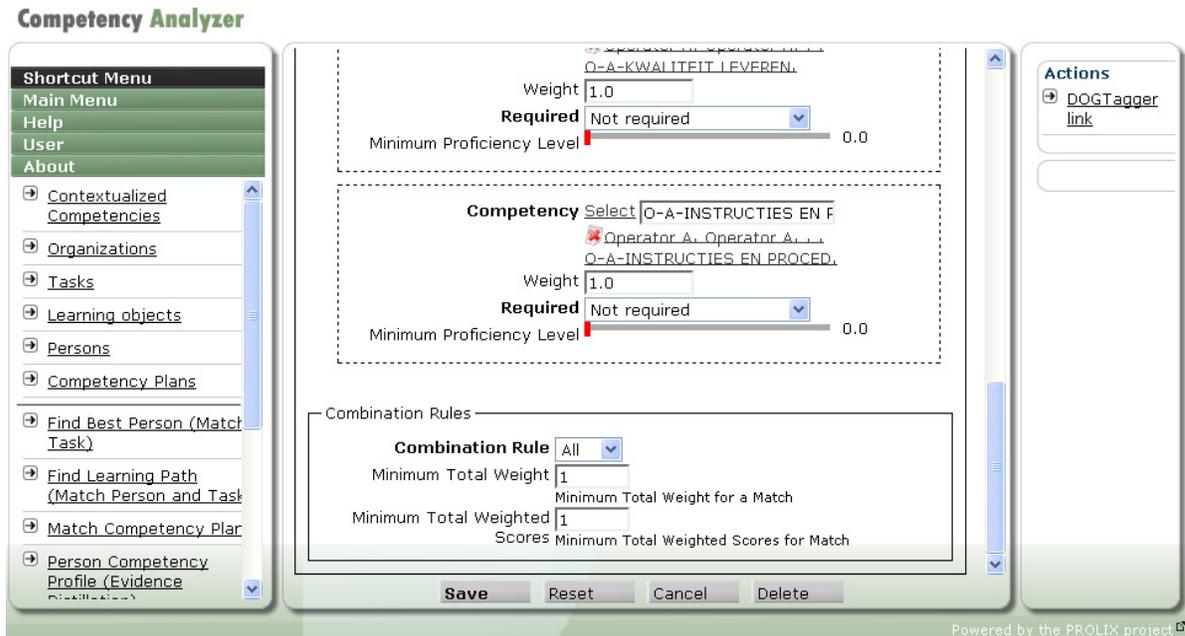


Figure J.2.2: Contextualized competency, weighted more granular competencies

- Weighted competencies : allows adding the more granular competencies which define this one. The "add" link allows selecting one or more competencies to add. You can then define the weight, requiredness and proficiency level. The weight is used when using the rollup rules. The proficiency score is calculated as weighted average, using the weights applied to the competencies. The "required" field indicates whether this competency is required. Applying the rollup rules is not possible when a required more granular competency is missing. The minimum proficiency level is the level required to have a full match on that competency. This is either presented as a slider (for competencies with a continuous scale) or as a select box (for competencies with a discrete scale).

At the bottom, the combination rules are displayed (note that ordinary prolix users don't have rights to modify these rules, they are included here for completeness).

- Combination rule : when this is set to "all" the behaviour is the same as when all competencies are marked as "required".
- Minimum total weight : to be able to apply the rollup rules, the more granular competencies which have a (non-minimum) proficiency level need to account for at least the minimum total weight.
- Minimum total weighted scores : to be able to have the maximum proficiency level as result of the rollup rules, you need to combine proficiencies for at least the total weight of "minimum total weighted scores".

There is also an action "DOGTagger link" which allows defining the semantic annotation for this contextualized competency. This action only works for competencies which have already been saved and which have a context which has a ontology link. More details about the use of the dogtagger can be found in de semantic deliverables D3.4 and D3.6.

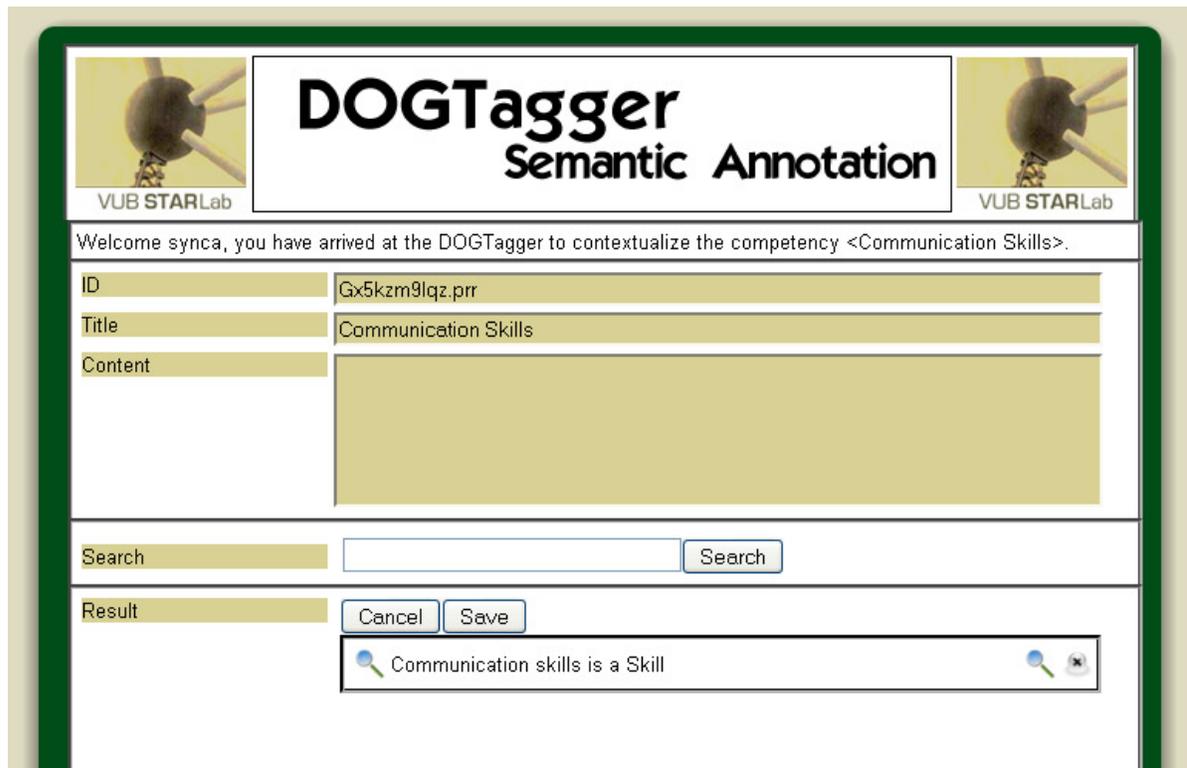


Figure J.2.3: DOGTagger in action

J.2.2 Tasks

A task can be a representation of a task, function, skill, role, job, vacancy, test,... It points to any artefact which can be annotated with a required competency profile.

Competency Analyser

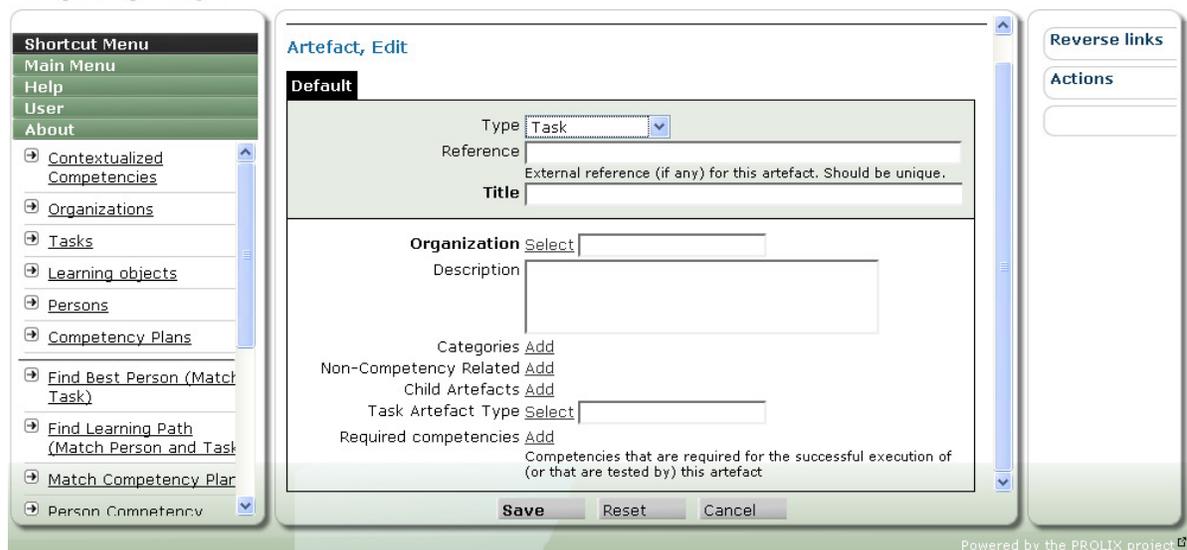


Figure J.2.4: Creating a task artefact

- Type : indicates the type of artefact you are creating. This needs to be set to “task” to create a task artefact. You can use the same screen to add learning objects or persons.
- Reference : the outside world reference used for this task. This is always capitalized and needs to be unique. Typically this is the reference is used as link for this artefact to an object in another software system (like the business process modeller).
- Title : title for the task.
- Organization : organization this task is part of (hidden for prolix users).
- Description : description for this task. It is recommended to make this reasonably detailed.
- Categories : allows indicating which categories this task belongs to.
- Non-competency related criteria : extra data which can be used while matching (not yet used)
- Child artefacts : child artefacts, the required competencies of the children are combined with the competencies of this artefact to build the competency profile.
- Task artefact type : an extra indication you can assign. This may for example be used to indicate whether it is a test, task, role,... The types can be defined at will.
- Required competencies : allows you to indicate the competencies for this task. You don't have to repeat competencies from the subtasks. The “add” link allows you to select one or more contextualized competencies. You can then select the required proficiency level, either as a slider (for competencies with a continuous scale) or as a select box (for competencies with a discrete scale).

J.2.3 Learning Object

A learning object or learning artefact represents the competency profile for a learning object. It has a delta competency profile. Successful absorbing a learning object should raise a person's competencies from the prerequisite level (the level you need to have to be able to grasp the course) to the object levels.

Competency Analyser

The screenshot shows the 'Competency Analyser' application window. On the left is a 'Shortcut Menu' with options like 'Main Menu', 'Help', 'User', 'About', 'Contextualized Competencies', 'Organizations', 'Tasks', 'Learning objects', 'Persons', 'Competency Plans', 'Find Best Person (Match Task)', 'Find Learning Path (Match Person and Task)', 'Match Competency Plan', and 'Person Competency Profile (Evidence Distillation)'. The main area contains a 'Description' text box, 'Categories Add', 'Non-Competency Related Add', 'Child Artefacts Add', 'Learning Artefact Type Select', and 'Competencies Add'. A dashed box highlights a 'Competency Select' dropdown with a red 'X' icon, showing 'Operator A. Operator A. ... O-A-WP-ONDERHOUDEN APPARATUUR.' Below it are two sliders: 'Prerequisite Level' at 0.2 and 'Objective Level' at 0.8. The 'Content' section has 'Content URL', 'Content type Select', and 'Content cachable' (checkbox). At the bottom are 'Save', 'Reset', and 'Cancel' buttons. The right panel has 'Reverse links' and 'Actions' buttons. A footer note says 'Powered by the PROLIX project'.

Figure J.2.5: Creating a learning artefact

- Type : indicates the type of artefact you are creating. This needs to be set to "learning object" to create a learning artefact. You can use the same screen to add tasks or persons.
- Reference : the outside world reference used for this task. This is always capitalized and needs to be unique. Typically this is the reference is used as link for this artefact to an object in another software system (like the learning process cockpit).
- Title : title for the learning object.
- Organization : organization this learning artefact is part of (hidden for prolix users).
- Description : description for this learning object. It is recommended to make this reasonably detailed.
- Categories : allows indicating which categories this task belongs to.
- Non-competency related criteria : extra data which can be used while matching (not yet used)
- Child artefacts : child artefacts, the competencies of the children are combined with the competencies of this artefact to build the delta competency profile.
- Learning artefact type : an extra indication you can assign. This may for example be used to indicate whether it is a e-course, group learning,... The types can be defined at will.
- Competencies : allows you to indicate the competencies for this learning object. You don't have to repeat competencies from the children. The "add" link allows you to select one or more contextualized competencies. You can then select the prerequisite and objective proficiency levels, either as a slider (for competencies with a continuous scale) or as a select box (for competencies with a discrete scale).
- Content URL : you can provide a link to the actual content here.
- Content type : when you have provided a link to the content, you may add an extra indication here. Examples could be "SCORM" or "WEB-CONTENT".
- Content cacheable : indication of whether the content may be cached by user agents. Should be set to false for dynamic content. For static content is probably depends on copyright limitations.

J.2.4 Person

A person artefact is a reference to a real person in the outside world. It exists in the CA to be able to create assessments for that person and calculate the competency profile based on evidence distillation and a matching profile.

Competency Analyser

Shortcut Menu

- Main Menu
- Help
- User
- About

- Contextualized Competencies
- Organizations
- Tasks
- Learning objects
- Persons
- Competency Plans
- Find Best Person (Match Task)
- Find Learning Path (Match Person and Task)
- Match Competency Plan
- Person Competency Profile (Evidence Distillation)

Child Artefacts [Add](#)

Assignments

Assigned roles [Add](#)
Roles and tasks the person is assigned to, independent of whether all the competencies are acquired

Person info

First Name

Name

Date of Birth

e-Portfolio URL

Gender

Ethnicity

Language

Phone

Mobile Phone

Fax

E-mail

URL

Address

Address

Reverse links

Actions

Powered by the PROLIX project

Figure J.2.6: Creating a person artefact

- Type : indicates the type of artefact you are creating. This needs to be set to "person" to create a person artefact. You can use the same screen to add tasks or learning objects.
- Reference : the outside world reference used for this person. This is always capitalized and needs to be unique. Typically this reference is used as link for this artefact to an object in another software system. It can also be used for quick entry of the person in screens by typing the reference instead of switching to a select page.
- Title : indication for the person, typically the full name.
- Organization : organization this person is part of (hidden for prolix users).
- Description : description for this person.
- Categories : allows indicating which categories this person belongs to. This could be used to indicate teams or other groupings this person is part of.
- Non-competency related criteria : extra data which can be used while matching (not yet used)
- Child artefacts : child artefacts, obsolete, was typically used as indication of assigned tasks, but there is a separate field for this now.
- Assigned roles : tasks and/or roles which have been assigned to this person (this does not indicate that the person has the competencies, separate assessments are needed to indicate this).
- First name ; first name.
- Name : name.
- Date of birth : person's birth date.
- e-portfolio URL : link to the ePortfolio for the person.
- Gender : gender.
- Ethnicity : indication of ethnicity.
- Language : mother language for the person.
- Phone : voice contact method.
- Mobile phone : voice contact method when on the road.
- Fax : fax address.
- E-mail : e-mail address.
- URL : URL for homepage, blog or other.
- Address : place of living.

- Zip : Zip or postal code for the place of living.
- City : place of living.
- Country : country of living.

On the right (for an existing person artefact) there is a link for the “get current competency profile” actual. This should display the competency profile. However, it is advised to use the evidence distillation page for this (which gives a better display).

J.2.5 Competency plan

A competency plan is a grouping of task or roles and the persons who should be trained to acquire the competencies for properly executing these tasks or roles. This concept allows you to define team or group goals, test presence or absence of competencies when planning changes in your organization etc.

The screenshot displays the 'Competency Analyzer' application. On the left is a 'Shortcut Menu' with options: Main Menu, Help, User, About, Contextualized Competencies, Organizations, Tasks, Learning objects, Persons, Competency Plans, Find Best Person (Match Task), Find Learning Path (Match Person and Task), Match Competency Plan, and Person Competency Profile (Evidence Distillation). The main window is titled '> Competency Plan, Select' and 'id.org'. Below the title bar is 'Competency Plan, Edit'. A 'Default' tab is active. The form contains: 'Reference' and 'Title' text boxes; 'Organization' and 'Match Profile' dropdown menus; a 'Description' text area; an 'Assignments' section with a dashed border containing 'Task / Role' and 'Persons' dropdowns and an 'Add' button; and an 'Inactive' checkbox. At the bottom are 'Save', 'Reset', and 'Cancel' buttons. A footer note reads 'Powered by the PROLIX project'.

Figure J.2.7: Creating a competency plan

- Reference : this is a key (which needs to be unique and is always capitalized) you can use to quickly retrieve the competency plan. This can be used to type the reference instead of going through a separate selection screen).
- Title : short description for the competency plan
- Organization : organization this plan is part of (hidden for prolix users).
- Match profile : the match profile which should be used when doing matching for this competency plan.
- Description : description for the competency plan.
- Assignments : allows you to define the task/person goals for the competency plan. The “add” button adds another box, which can be removed by clicking the delete icon. You can choose the task or role and the persons which should have the required competencies for this task/role.
- Inactive : this allows you to indicate that the competency plan is no longer being developed and should only be kept for statistics of archiving.

J.2.6 Application Domain

An application domain is a grouping which can be used to indicate the department, division or other subdivision of an organization.

- Reference : this is a key (which needs to be unique and is always capitalized) you can use to quickly retrieve the application domain. This can be used to type the reference instead of going through a separate selection screen).
- Title : title for the application domain.
- Organization : organization this application domain is part of (hidden for prolix users).
- Description : description of the application domain.

J.2.7 Artefact

General artefact which groups the person, task and learning artefacts. The exact fields depend on the type of artefact, see [Person], [Tasks] and [Learning Object].

J.2.8 Artefact Category

Categories allow building a taxonomy which can be used to annotate the artefacts. This way, artefacts can be grouped and you can easily navigate to other artefacts in the same category. Each category can be given a title and descriptions and you can specify which application domains the category applies for.

J.2.9 Assessed Artefact

This table allows you to create and edit assessments based on tasks or tests.

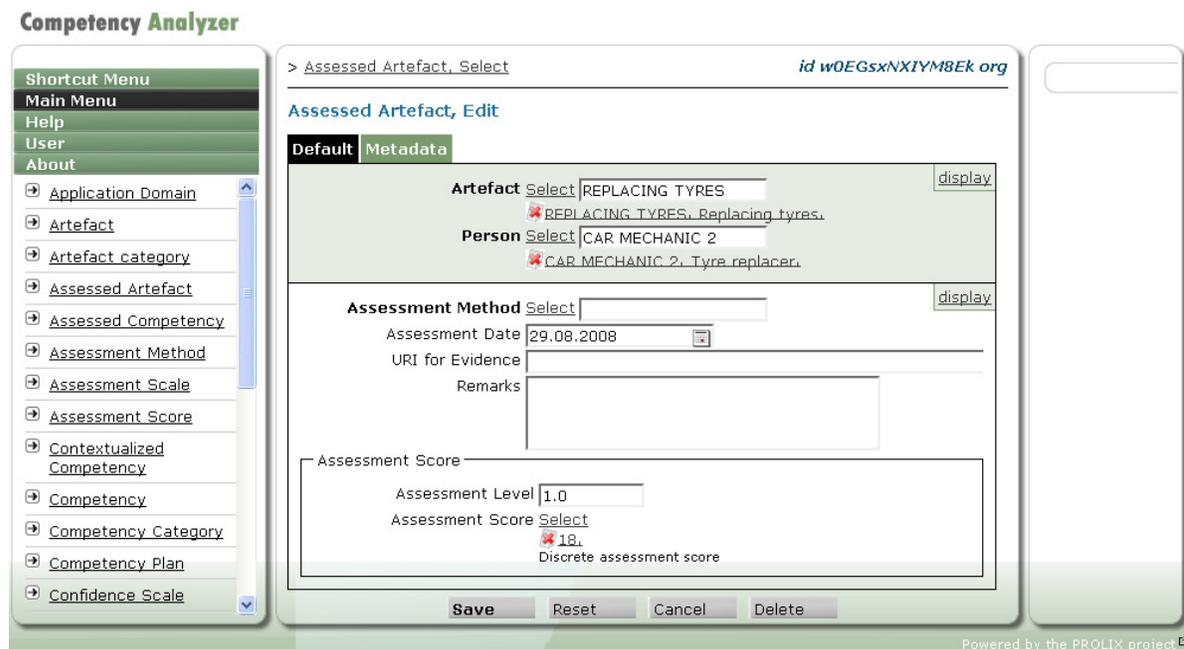


Figure J.2.8: Assessed artefact

- Artefact : this is the task artefact which is being tested. The assessment gives an indication of the presence of all the (required) competencies at the level at which they are present in the competency profile.
- Person : the person being assessed.
- Assessment method : indication of the method used for the assessment. Very important is the confidence which is related to the assessment method. This can be used to indicate that there is less confidence in a self assessment than in a official test at a learning institute.
- Assessment date : the date when the assessment took place. This is also the base date which is used for calculating competency degradation.
- URI for evidence : link to the (online) evidence, which is typically an electronic diploma or certificate.
- Remarks : any remarks for the assessments.
- Assessment level or score : indicates the result. The result of the assessment as expressed according to the assessment scale which applies (as defined in the assessment method). Note that it is assumed (default behaviour in the matching profiles) to only consider assessments which the person has passed. For the default scale (zero to one) this would mean an assessment level larger than .5.

J.2.10 Assessed Competency

This table allows you to create and edit assessments for a set of chosen competencies at a specific proficiency level.

Competency Analyser

The screenshot displays the 'Assessed Competency' form in the Competency Analyser application. The interface is divided into a sidebar menu on the left and a main form area on the right. The sidebar menu includes sections for 'Shortcut Menu', 'Main Menu', 'Help', 'User', and 'About', with a list of application domains and competency categories. The main form area is titled 'Person ALFRED, Alfred Judokus Kwak' and contains the following fields and data:

- Person:** ALFRED, Alfred Judokus Kwak (with an 'edit' button)
- Assessment Method:** Select SELF (with a 'display' button)
- Assessment Date:** 25.12.2004
- Competencies:** Add
- Competency 002:** 270482, ProCar, , supplier knowledge, 002. Proficiency Level: 0.8
- Competency 003:** 270482, ProCar, , communication skills, 003. Proficiency Level: 0.4
- Competency 007:** 270482, ProCar, , quality knowledge, 007. Proficiency Level: 0.7

At the bottom of the form, there are buttons for 'Save', 'Reset', 'Cancel', and 'Delete'. The footer of the application indicates 'Powered by the PROLIX project'.

Figure J.2.9: Assessed competency

- Person : the person being assessed.
- Assessment method : indication of the method used for the assessment. Very important is the confidence which is related to the assessment method. This can be used to indicate that there is less confidence in a self assessment than in a official test at a learning institute.
- Assessment date : the date when the assessment took place. This is also the base date which is used for calculating competency degradation.

- Competencies : the competencies which are evaluated by this assessment. The assessment gives an indication of the presence of all the listed competencies at the selected level. The “add” link allows adding one or more competencies. The proficiency level can either be selected using a slider (for continuous competencies) or a select box (for discrete competencies).
- URI for evidence : link to the (online) evidence, which is typically an electronic diploma or certificate.
- Remarks : any remarks for the assessments.
- Assessment level or score : indicates the result. The result of the assessment as expressed according to the assessment scale which applies (as defined in the assessment method). Note that it is assumed (default behaviour in the matching profiles) to only consider assessments which the person has passed. For the default scale (zero to one) this would mean an assessment level larger than .5.

J.2.11 Assessment Method

The screenshot shows the 'Competency Analyzer' application. On the left is a sidebar menu with options: Shortcut Menu, Main Menu, Help, User, About, Application Domain, Artefact, Artefact category, Assessed Artefact, Assessed Competency, Assessment Method (highlighted), Assessment Scale, Assessment Score, and Contextualized Competency. The main window is titled '> Assessment Method, Select' and 'id.org'. Below the title is 'Assessment Method, Edit'. A 'Default' tab is active. The form contains: 'Reference' (text input), 'Name' (text input), 'Organizations' (text input with an 'Add' link), 'Description' (text area), 'Assessment Scale' (select dropdown), and 'Confidence level' (text input with '0,0' and 'Default confidence level' below it). At the bottom are 'Save', 'Reset', and 'Cancel' buttons. A footer note says 'Powered by the PROLIX project'.

Figure J.2.10: Assessment method

Indicates how an assessment was performed and most importantly defines the confidence level for the assessment.

- Reference : reference for the assessment method. The reference is always capitalized and should be unique. It can be used to quickly set the assessment method by typing the reference instead of using the select page.
- Name : title for the assessment method.
- Organizations : list of organizations for which this assessment method applies (not visible to normal PROLIX users).
- Description : full description of the assessment method.
- Assessment scale : the scale which defines the possible results for assessments. When no scale is specified all values between zero and one are allowed.
- Confidence level : indication (using a value between zero and one) of the confidence which can be placed in this type of assessments. Zero is unreliable, one if very reliable.

J.2.12 Assessment Scale

An assessment scale defines the possible values for an assessment.

- Reference : reference for the assessment scale. The reference is always capitalized and should be unique. It can be used to quickly set the assessment method by typing the reference instead of using the select page.
- Title : title for the assessment method.
- Organizations : list of organizations for which this assessment method applies (not visible to normal PROLIX users).
- Application domains : possible application domains for this assessment scale.
- Description : full description for the assessment scale.
- Minimum value : lower limit for the range of values, defaults to zero.
- Maximum value : upper limit for the range of values, defaults to one.
- Discrete : indication of whether there is a limited set of values which may be assigned for this assessment scale. It is automatically set when there are “allowed values” (which are assessment scores).
- Allowed values : possible values (which makes the scale discrete). For each allowed values (assessment score), you can specify the title, description and (numeric) value which should be in the [minimum,maximum] range.

J.2.13 Assessment Score

In principle you should never need to directly access this table. You are likely to access it only through the assessment scale.

- Title : title for the scale.
- Assessment scale : scale this score is part of.
- Description : description for the score.
- Value : actual value in the [minimum,maximum] range for the scale.

J.2.14 Competency

These are the generic, non-contextualised competencies. The idea is that these may be applied in different contexts which then further define the exact meaning of the competency.

Competency Analyzer

The screenshot displays the 'Competency, Edit' form in the Competency Analyzer application. The form is titled '> Competency, Select' and 'id.org'. The main content area is labeled 'Competency, Edit' and 'Default'. It contains several input fields: 'Title', 'Reference', 'Organizations' (with an 'Add' link), 'Contextualisations' (with an 'Add' link), 'Categories' (with an 'Add' link and 'Competency Categories' text), and 'Description'. There is also an 'Inactive' checkbox. At the bottom of the form are 'Save', 'Reset', and 'Cancel' buttons. A left sidebar menu includes 'Shortcut Menu', 'Main Menu', 'Help', 'User', 'About', and a list of application domains and artifacts. The bottom right corner of the application area says 'Powered by the PROLIX project'.

Figure J.2.11: Create competency

- Title : the title for the competency

- Reference : reference for the competency. The reference is always capitalized and should be unique. It can be used to quickly set the assessment method by typing the reference instead of using the select page.
- Organizations : list of organizations for which this assessment method applies (not visible to normal PROLIX users).
- Contextualisations : contextualized competencies which build on this. Should not be set directly by users, will be maintained when creating contextualized competencies.
- Categories : list of categories this competency belongs to.
- Description : full description of this competency.
- Inactive : when this is set, the competency is not intended to be used any more. It may still be in use for existing competencies or competency profiles, but will not be presented when building new definitions (provisional, not yet used).

J.2.15 Competency Category

Categories allow building a taxonomy which can be used to annotate the competencies. This way, competencies can be grouped and you can easily navigate to other competencies in the same category.

Each category can be given a title and descriptions and you can specify which application domains the category applies for.

J.2.16 Context

The context is the base reference for contextualising competencies.

- Reference : reference for the context. The reference is always capitalized and should be unique. It can be used to quickly set the context by typing the reference instead of using the select page.
- Title : the title for the context.
- Organizations : list of organizations for which this context applies (not visible to normal PROLIX users).
- Application domains : list of application domains for which this context applies (not yet used).
- Description : full description of this competency.
- Ontology : this allows you to specify the URI for the ontology which can be used to define the semantic annotations for the contextualised competencies which are applied in this context.

J.2.17 Criterion

This is the representation if a non-competency related criteria which may be used in matching. Examples for job matching are distance to work, full-time vs part-time work, indication of night shifts etc.

- Reference : reference for the criterion. The reference is always capitalized and should be unique. It can be used to quickly set the criterion by typing the reference instead of using the select page.
- Title : the title for the criterion.
- Organizations : list of organizations for which this criterion applies (not visible to normal PROLIX users).
- Description : full description of this criterion.

- Scores : the possible values for the criterion.

J.2.18 Criterion Score

Possible values for a criterion.

- Criterion : indicate the criterion this score applies to.
- Title : the title for the criterion score.
- Value : numeric value.

J.2.19 Match Profile

Matching profiles are used to configure the behaviour of the evidence distillation and matching.

The screenshot shows the 'Competency Analyser' application window. On the left is a sidebar menu with a tree view containing items like 'Application Domain', 'Artefact', 'Assessed Artefact', 'Assessed Competency', 'Assessment Method', 'Assessment Scale', 'Assessment Score', 'Contextualized Competency', 'Competency', 'Competency Category', 'Competency Plan', 'Confidence Scale', 'Confidence Score', 'Context', 'Criterion', 'Criterion Score', 'Match Profile', and 'Scale'. The 'Match Profile' item is selected. The main window displays the 'Edit match profile' dialog. It has several input fields: 'Threshold' (0.5), 'Threshold' (0.65), 'Direct multiplier' (1), 'Semantic multiplier' (0), 'Worker' (Highest proficiency level), 'Max results' (10), 'Confidence Weight' (0), 'Relevancy Weight' (0), 'Fluency Weight' (0), 'Relevancy grace' (0), 'Relevancy degrade' (0), 'Fluency grace' (1), 'Fluency add' (0), and 'Fluency include' (checked). There are 'Save', 'Reset', 'Cancel', and 'Delete' buttons at the bottom. An 'Actions' panel on the right contains a 'Get Matching Profile' button. The footer of the dialog says 'Powered by the PROLIX project'.

Figure J.2.12: Edit match profile

Apart from title and reference, the following fields are defined :

- Assessment level threshold : minimum level for the assessments to be considered as "passed". Any assessment with an assessment level lower than this is not considered during evidence distillation.
- Assessment confidence threshold : minimum confidence level for the assessments to be taken into consideration. Any assessment which was done using an assessment method which has a confidence lower than this value is not considered during evidence distillation.

- Direct multiplier : multiplier to be applied to the direct matching confidence score. When this is zero, the direct matching is not used.
- Semantic multiplier : multiplier to be applied to the semantic matching confidence score. When this is zero, the direct matching is not used.
- Worker : determines how the proficiency level is determined if there were several assessments for the same competence. You have the following choices :
 - o Average proficiency level : the average proficiency level of all (considered) assessments is used.
 - o Highest proficiency level : the highest proficiency level of all (considered) assessments is used.
 - o Highest confidence : the proficiency level which was determined using an assessment method with the highest confidence is chosen.
 - o Highest relevancy : the proficiency level which was most recently assessed is chosen.
 - o Weighted confidence : the weighted average proficiency level is calculated. The assessment method confidence is used as weight.
 - o Weighted relevancy : the weighted (by relevancy) average proficiency level is calculated.
 - o Average proficiency level with fluency : same as "average proficiency level" but with calculation of fluency.
 - o Weighted relevancy with fluency : same as "weighted relevancy" but with calculation of fluency.
 - o Highest relevancy with fluency : same as "highest relevancy" but with calculation of fluency.
- Parameters : allow passing extra parameter to the worker. Not used at this moment.
- Max results : Maximum number of results which are displayed in the "find person for task" page.
- Confidence weight : weight of the confidence score which is used when sorting the results to determine the "best" match.
- Relevancy weight : weight of the relevancy score which is used when sorting the results to determine the "best" match.
- Fluency weight : weight of the fluency score which is used when sorting the results to determine the "best" match.
- Relevancy grace : the relevancy score is a value between 0 and 1. For assessments which are recent enough (fully relevant), this is 1. All assessments which are less than the grace period (in days) old, are considered to be fully relevant.
- Relevancy degrade : After the grace period, the relevancy linearly decrease during the number of days mentioned in the degrade period, which is specified in days).
- Fluency grace : people are considered to be more fluent in a competency when there are more assessments for that competency. The "grace" allows you to configure the number of occurrences a person needs to have before the fluency starts to increase.
- Fluency add : once the grace number of occurrences has been reached, this amount is added to the fluency factor for each extra occurrence.

- Fluency include : when calculating fluency, should the number of occurrences be counted using equal proficiency level or should occurrences with higher proficiency also be considered.

J.2.20 Scale

An scale defines the possible values for the proficiency levels for a contextualized competency.

- Reference : reference for the scale. The reference is always capitalized and should be unique. It can be used to quickly set the assessment method by typing the reference instead of using the select page.
- Title : title for the scale.
- Organizations : list of organizations for which this scale applies (not visible to normal PROLIX users).
- Application domains : possible application domains for this scale.
- Description : full description for the scale.
- Minimum value : lower limit for the range of values, defaults to zero.
- Maximum value : upper limit for the range of values, defaults to one.
- Discrete : indication of whether there is a limited set of values which may be assigned for this assessment scale. It is automatically set when there are "allowed values" (which are assessment scores).
- Allowed values : possible values (which makes the scale discrete). For each allowed values (ascore), you can specify the title, description and (numeric) value which should be in the [minimum,maximum] range.

J.2.21 Score

In principle you should never need to directly access this table. You are likely to access it only through the scale.

- Title : title for the scale.
- Scale : scale this score is part of.
- Description : description for the score.
- Value : actual value in the [minimum,maximum] range for the scale.

J.2.22 Score Commitment

A score commitment is the relation between a contextualized competency and a score. For competencies with a discrete scale, if you want to define a semantic annotation, then this needs to be done for each individual proficiency level.

- Score : score this score commitment applies to.
- Competency : contextualised competency this record applies to.
- Description : human readable description of the meaning of this competency at this proficiency level.
- Value : proficiency level numeric value.
- Semantic definition : URL for the semantic annotation.

Once the record has been saved, you can create the semantic annotation by indicating the DOGTagger action in the right column.

J.2.23 Task Artefact Type

For task artefacts, you can define an indication of the type. This could be used to indicate the difference between a task, function, test, role, job,...

- Reference : reference for the task artefact type. This is always capitalized and should be unique. It can be used to directly select the type without going through a select screen.
- Title : title for the record.
- Organizations : organizations in which this task artefact type can be applied (not visible to normal PROLIX users).
- Description : description for the record.

J.2.24 Learning Artefact Type

For learning artefacts, you can define an indication of the type. This could be used to indicate the difference between a learning design, learning nugget,...

- Reference : reference for the learning artefact type. This is always capitalized and should be unique. It can be used to directly select the type without going through a select screen.
- Title : title for the record.
- Organizations : organizations in which this learning artefact type can be applied (not visible to normal PROLIX users).
- Description : description for the record.

J.2.25 Organization

This allows creating new organizations. It should only be available to administrators and not for normal PROLIX users.

Competency Analyzer

The screenshot displays the 'Default' form for creating an organization. On the left is a 'Shortcut Menu' with options: Main Menu, Help, User, About, Application Domain, Artefact, Artefact category, Assessed Artefact, Assessed Competency, Assessment Method, Assessment Scale, and Assessment Score. The main form area contains the following fields: Reference (text input), Name (text input), Self Assessment (dropdown menu with 'Select' selected), Phone (text input), Mobile Phone (text input), Fax (text input), and E-mail (text input). Below the form are 'Save', 'Reset', and 'Cancel' buttons. A footer note reads 'Powered by the PROLIX project'.

Figure J.2.13: Create organization

- Reference : reference for the organization. Amongst other things this is used to display the organization for the current user in the top right corner. The reference is always capitalized and should be unique.
- Name : name of the organization.
- Self assessment : assessment method which is used for self assessments in the current organization. This is automatically filled in when the self assessment link in the "shortcut menu" is used.
- Phone : phone for contacting the organization.
- Mobile phone : mobile access for the organization.
- Fax : fax number for the organization.
- E-mail : general e-mail address for the organization.
- URL : web address for the organization.
- Address : street address.
- Zip : zip or postal code.
- City : location.
- Country : country.

J.2.26 User

This is only accessible by administrators and not by normal PROLIX users. This is used to create users who can login to the application (note that the user may be automatically created when logging into the Competency Analyser from the portal using the SSO token).

Competency Analyser

The screenshot shows the 'Create user' interface in the Competency Analyser. On the left is a 'Shortcut Menu' with 'User' selected. The main form area contains the following fields and sections:

- Type:** User (dropdown)
- User Name:** First Name, Name (text inputs)
- Password:** (text input)
- Roles:** Add (button)
- Language:** (dropdown)
- Authorization and Configuration:** (text area)
- Organization:** Select (dropdown)

At the bottom of the form are 'Save', 'Reset', and 'Cancel' buttons. On the right side, there are 'Reverse links' and 'Actions' sections. The footer text reads 'Powered by the PROLIX project'.

Figure J.2.14: Create user

- User name : user name or login.
- First name : Christian name.
- Name : last name.
- Password : password for logging in.
- Roles : roles for this users which define the authorizations at table and field level.
- Language : preferred language for the user interface. When not specified the language is read from the browser.
- Authorization and configuration : user specific authorization and configuration settings. Should normally not be edited here but through the "user preferences" link in the "user" menu.
- Organization : organization this user is part of. When not set the user can access all data but is unable to match.

J.2.27 User Role

Roles which can be assigned to users to define the authorizations in the user interface.

- Role name : name for the role.
- Description : description.
- Can administer user interface : when this is selected, all users who have this role will be able to edit the authorizations for the role in the system.
- Gui access prohibited : when this is selected, the user will only be able to access the Competency Analyser through the web service interface, and not through the web interface.
- Appserver role : role to be assigned for this role in the application server. Should not be set in PROLIX.
- Authorization and configuration : role authorization and configuration settings. Should normally not be edited here but rather through the “role configurations” link in the “user” menu.

J.3 Matching

The principal function for the Competency Analyser is doing competency based matching.

J.3.1 Find best person

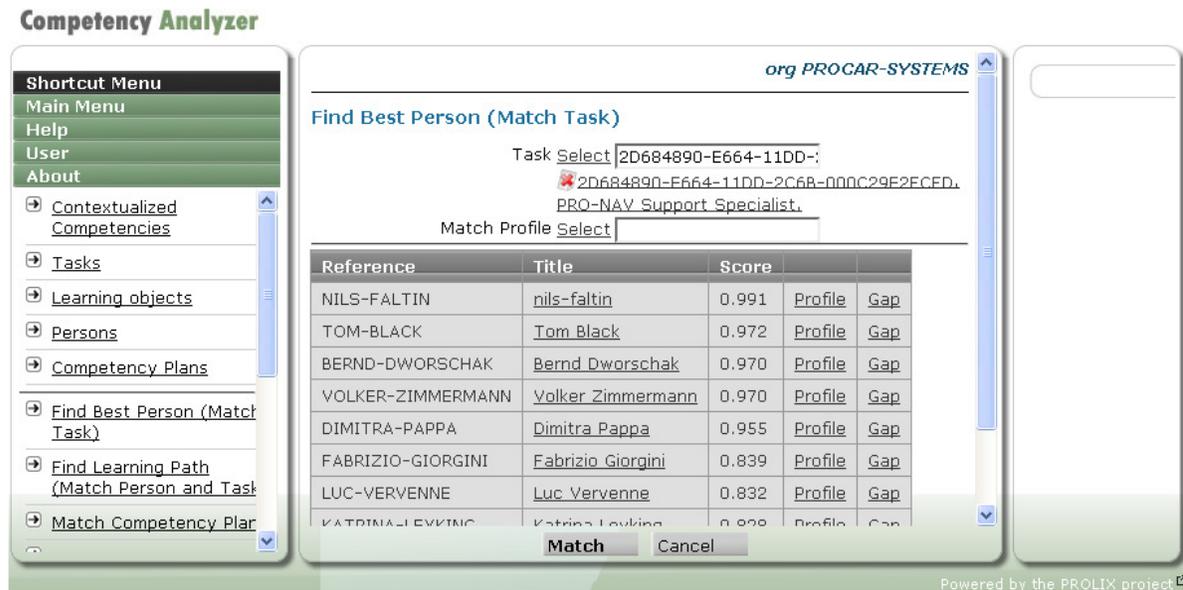


Figure J.3.1: Find best person

This function allows you to find the best person for a task, function, role or job.

You have to select the task artefact to search persons for, possibly also select the matching profile and then indicate “match”.

The result shows you (from best match decreasing), the best persons who match at least some of the required competencies.

Only a limited set of results are displayed. By default (no matching profile) these are the top-10 results. You can change the maximum number of results which need to be displayed in the matching profile.

The result displays the following :

- Reference : person artefact reference.
- Title : title for the person artefact. You can display the person’s details by clicking on the title.
- Score : match score. This is 1.0 for a full match and decreases to zero for persons who have a bigger competency gap.
- “profile” : allows direct access to the person’s current competency profile according to the selected matching profile (the evidence distillation screen).
- “gap” : allows you to display the specific person-task matching page which display the suggested learning path and remaining gap for this person and the selected task.

J.3.2 Find learning path

You are asked to select the person and task which need to be matched. Optionally you can also define the learning profile to be used.

After indicating the “match” button at the bottom of the screen, you get a result like the following.

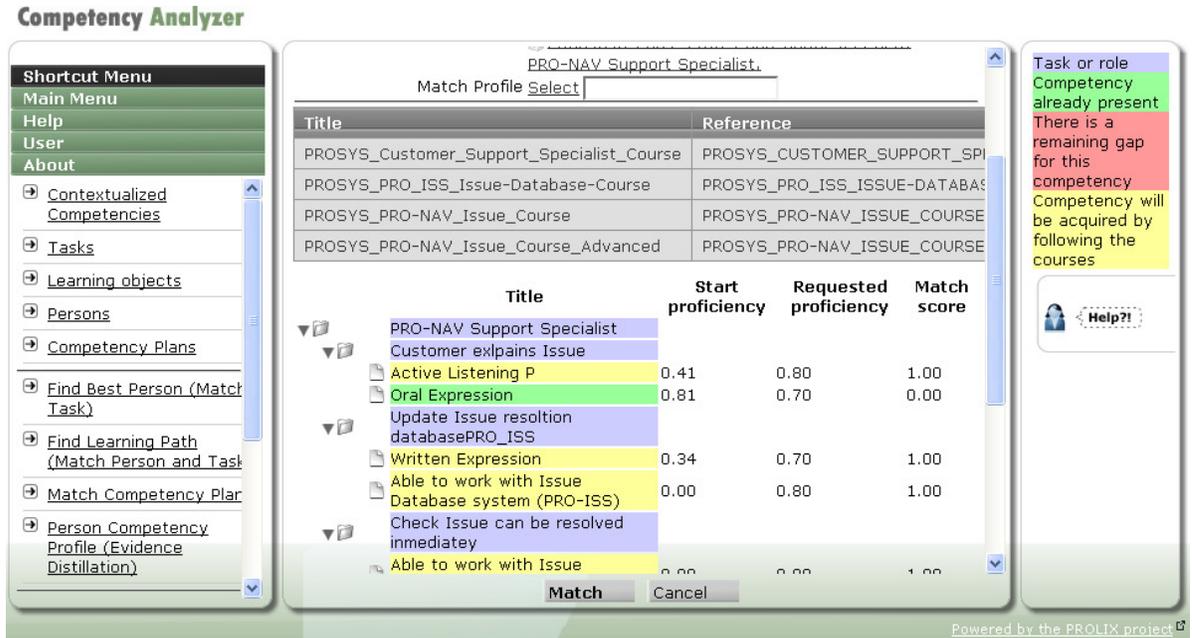


Figure J.3.2: Match person-task

This indicated the suggested courses (to be learned in order, as there may be some prerequisites which are taught by course which are earlier in the list), and also gives some kind of gap display.

This is represented by a tree which has the matched task as root, and below that all subtasks (blue labels). Under each task is the set of required competencies for that task. The colour indicated the status of the competency.

- Green : the competency is already mastered at the required level.

- Yellow : the competency will be mastered when the learning has successfully completed.
- Red : the competency cannot be improved to the required level by any learning material known in the Competency Analyser.

On each line some additional information is displayed, specifically the proficiency the person has at the time of matching, the required level for the task and the match score.

J.3.3 Match competency plan

Select the competency plan and indicate “match” at the bottom of the screen. Depending on the complexity of the competency plan (the number of task-person pairs), this matching may take some time.

Note that you cannot select the match profile as this is specified as part of the competency plan.

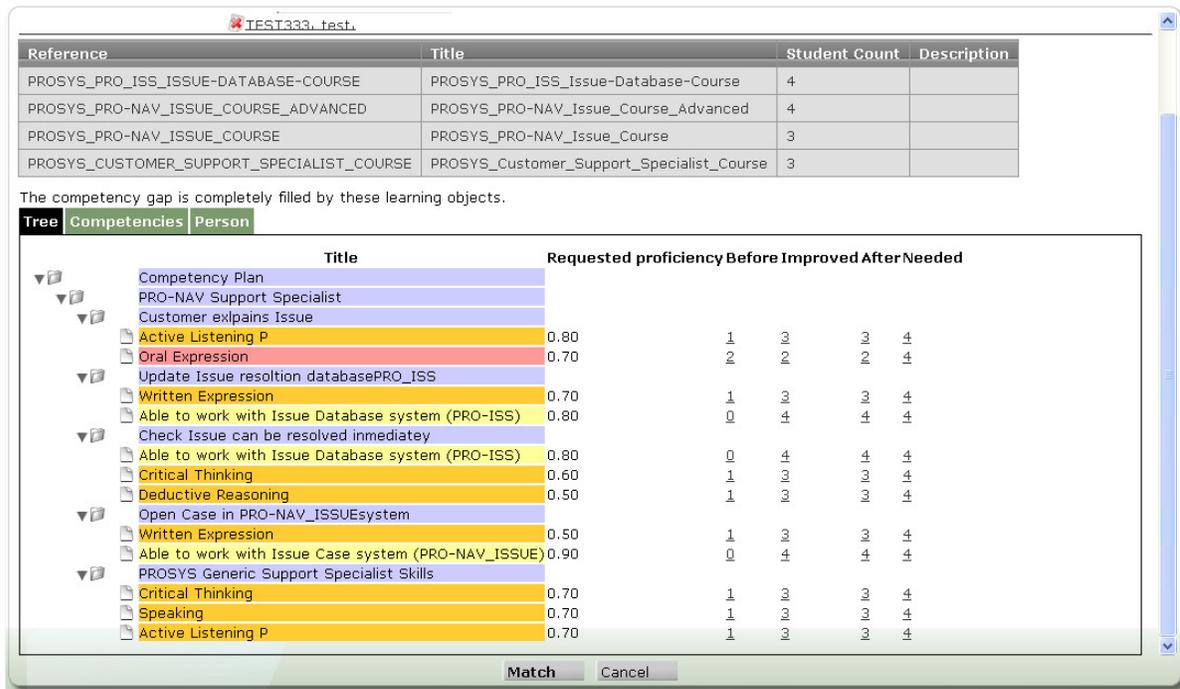


Figure J.3.3: Match competency plan, tree view

	Student Count	Description
	4	
d	4	Sam White, Volker Zimmermann, Jo White, Agela Black
	3	
urse	3	

The displayed result is the proposed set of learning objects which are needed to raise the competencies of the people in the plan (in order, though not all learning objects should be followed by everyone).

When you hover the mouse over the student count, you see a list of students for the course.

Below, there are three tabs with possible displays of information.

- Tree : gives a tree view of the tasks and competencies
- Competencies : gives a list of competencies across all tasks
- Person : overview of people in the competency plan

The tree view displays the labels in colours :

- Blue : the tasks which are matched.

- Green : the competencies were already present for all persons in the plan.
- Yellow : competency will be acquired for all persons in the plan when the course have been successfully absorbed.
- Orange : competency will be acquired for some people only. This probably means that some people don't have sufficient competencies to be able to enrol in a course to reach the required level.
- Red : There is a remaining gap for this competency. This is probably caused by no course offering to teach the required level or nobody being able to reach the prerequisites.

For each competency the following is displayed :

- Request proficiency level
- Number of people who had that proficiency at the time of matching
- Number of people who will have some level after (successful) learning
- Number of people who will have the proficiency after (successful) learning
- Number of people who need this competency according to the plan

Clicking on the number of people will give some information about the persons requiring this competency.

Title	Start proficiency	Match score
Jo White	0.41	1.00
Agela Black	1.00	1.00
Sam White	1.00	1.00
Volker Zimmermann	1.00	0.00

Figure J.3.4: Match competency plan, person detail on competency in tree

For each person, the usual colours are indicated to indicate the status for this competency and the start proficiency and match score are displayed.

org PROCAR-SYSTEMS

Match Competency Plan

Competency Plan
✖ TEST333_test

Reference	Title	Student Count	Description
PROSYS_PRO_ISS_ISSUE-DATABASE-COURSE	PROSYS_PRO_ISS_Issue-Database-Course	4	
PROSYS_PRO-NAV_ISSUE_COURSE_ADVANCED	PROSYS_PRO-NAV_Issue_Course_Advanced	4	
PROSYS_PRO-NAV_ISSUE_COURSE	PROSYS_PRO-NAV_Issue_Course	3	
PROSYS_CUSTOMER_SUPPORT_SPECIALIST_COURSE	PROSYS_Customer_Support_Specialist_Course	3	

The competency gap is completely filled by these learning objects.

Tree
Competencies
Person

Competency	Level	Persons	Has gap	Score total	min	max	avg	Gap total	avg
Speaking	0.70	4	1	3.00	0.00	1.00	0.75	1.00	0.25
Deductive Reasoning	0.50	4	1	3.00	0.00	1.00	0.75	1.00	0.25
Critical Thinking	0.70	4	1	3.00	0.00	1.00	0.75	1.00	0.25
Written Expression	0.70	4	1	3.00	0.00	1.00	0.75	1.00	0.25
Active Listening P	0.80	4	1	3.00	0.00	1.00	0.75	1.00	0.25
Able to work with Issue Case system (PRO-NAV_ISSUE)	0.90	4	0	4.00	1.00	1.00	1.00	0.00	0.00
Able to work with Issue Database system (PRO-ISS)	0.80	4	0	4.00	1.00	1.00	1.00	0.00	0.00
Oral Expression	0.70	4	2	2.00	0.00	1.00	0.50	2.00	0.50

Figure J.3.5: Match competency plan, competencies view

The competencies tab displays the details for the individual competencies. This table allows sorting by clicking the label at the top. Clicking the label again will revert the sort order.

Details displayed are :

- Competency title
- Required level (highest across the tasks)
- Number of persons who need this competency
- Number of people with a competency gap at the time of matching
- Total matching score (sum over the individuals needing the competency, score is 1.00 when the competency is reached after learning or lower if there is a remaining gap).
- Minimum match score for a person needing the competency
- Maximum match score for a person needing the competency
- Average score for the people needing the competency.
- Total remaining competency gap (sum over the individuals needing the competency, gap is 1.00 when the competency is lacking, or 0.00 when the required level is reached).
- Average gap for the people needing the competency.

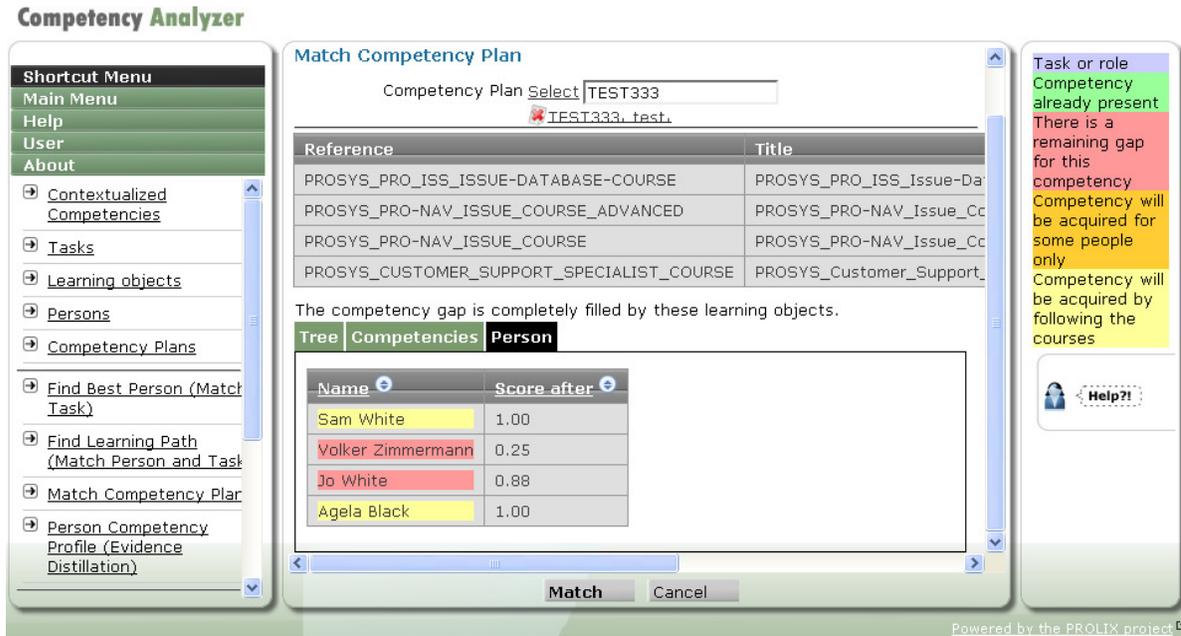


Figure J.3.6: Match competency plan, person view

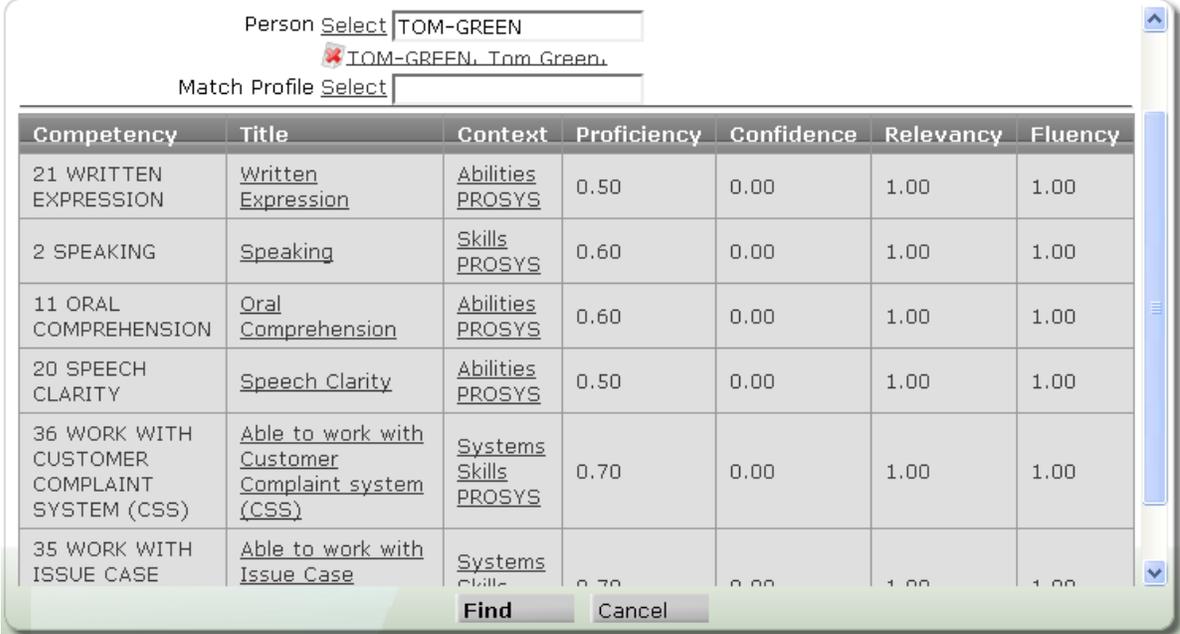
The persons tab displays the people in the competency plan with an indication of the match score after learning (0.00 when all competencies are lacking, 1.00 when all competencies are available at the required level).

The names are coloured to indicate the status :

- Green : all competencies are acquired at the required level without learning
- Yellow : all competencies will be learning when successfully absorbing the courses
- Red : there is a remaining gap even after learning. This indicates no suitable learning objects are available to fully bridge the competency gap.

J.3.4 Person competency profile

This page allows you to display the result of evidence distillation.



Competency	Title	Context	Proficiency	Confidence	Relevancy	Fluency
21 WRITTEN EXPRESSION	Written Expression	Abilities PROSYS	0.50	0.00	1.00	1.00
2 SPEAKING	Speaking	Skills PROSYS	0.60	0.00	1.00	1.00
11 ORAL COMPREHENSION	Oral Comprehension	Abilities PROSYS	0.60	0.00	1.00	1.00
20 SPEECH CLARITY	Speech Clarity	Abilities PROSYS	0.50	0.00	1.00	1.00
36 WORK WITH CUSTOMER COMPLAINT SYSTEM (CSS)	Able to work with Customer Complaint system (CSS)	Systems Skills PROSYS	0.70	0.00	1.00	1.00
35 WORK WITH ISSUE CASE	Able to work with Issue Case	Systems Skills PROSYS	0.70	0.00	1.00	1.00

Figure J.3.7: Person competency profile

You have to select the person and optionally a match profile. It will check all the assessments for the selected person and depending on the matching profile, determine the current competency profile.

- Competency : (contextualized) competency reference.
- Title : (contextualized) competency title. You can click on this to display the details.
- Context : the context in which the competency is defined. Clicking on this allows you to display the details of the context.
- Proficiency : the proficiency level according to the matching profile.
- Confidence : confidence of the match, based on the matching method used.
- Relevancy : relevancy, and indication of competency degradation. The competency is considered fully relevant when 1.0 and will drop to zero when the assessment is older.
- Fluency : fluency factor as calculated according to the matching profile (or 1.0 when not calculated).

J.4 Creating assessments

Assessments are essential to build the competency profile for the persons in the Competency Analyser. The assessments are then processed during the evidence distillation to allow considering the confidence in the assessment methods, competency degradation, multiplicity of assessments etc.

J.4.1 Create task or learning assessment

This is a direct link to allow you to create an assessment on a task or learning artefact.

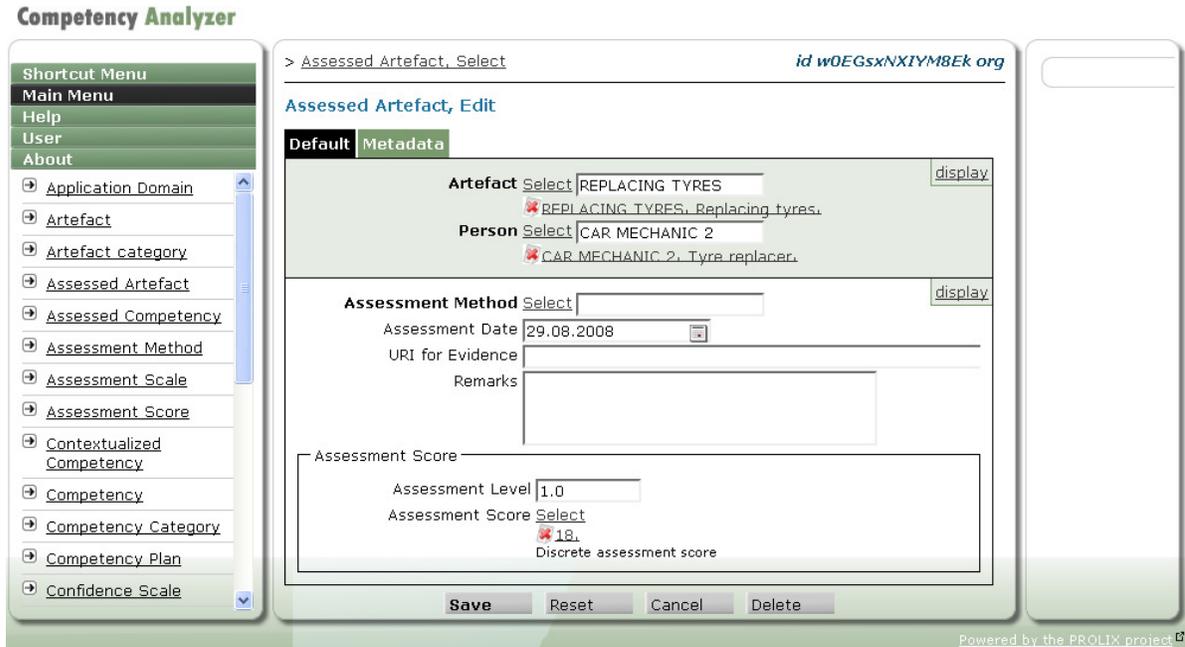


Figure J.4.1: Assessed artefact

- Artefact : this is the task or learning artefact which is being tested. The assessment gives an indication of the presence of all the (required) competencies at the level at which they are present in the competency profile.
- Person : the person being assessed.
- Assessment method : indication of the method used for the assessment. Very important is the confidence which is related to the assessment method. This can be used to indicate that there is less confidence in a self assessment than in a official test at a learning institute.
- Assessment date : the date when the assessment took place. This is also the base date which is used for calculating competency degradation.
- URI for evidence : link to the (online) evidence, which is typically an electronic diploma or certificate.
- Remarks : any remarks for the assessments.
- Assessment level or score : indicates the result. The result of the assessment as expressed according to the assessment scale which applies (as defined in the assessment method). Note that it is assumed (default behaviour in the matching profiles) to only consider assessments which the person has passed. For the default scale (zero to one) this would mean an assessment level larger than .5.

J.4.2 Add competency assessment

This option allows you to create and edit assessments for a set of chosen competencies at a specific proficiency level.

Competency Analyser

Shortcut Menu
Main Menu
Help
User
About

- Application Domain
- Artefact
- Artefact category
- Assessed Artefact
- Assessed Competency
- Assessment Method
- Assessment Scale
- Assessment Score
- Contextualized Competency
- Competency
- Competency Category
- Competency Plan
- Confidence Scale

Default Metadata

Person ALFRED, Alfred Judokus Kwak, [edit](#)

Assessment Method [Select](#) SELF [display](#)
SELF, Self-Assessment,
Assessment Date 25.12.2004
Competencies [Add](#)

Competency [Select](#) 002
270482, ProCar, , supplier knowledge, 002,
Proficiency Level 0.8

Competency [Select](#) 003
270482, ProCar, , communication skills, 003,
Proficiency Level 0.4

Competency [Select](#) 007
270482, ProCar, , quality knowledge, 007,
Proficiency Level 0.7

[Save](#) [Reset](#) [Cancel](#) [Delete](#)

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Figure J.4.2: Assessed competency

- Person : the person being assessed.
- Assessment method : indication of the method used for the assessment. Very important is the confidence which is related to the assessment method. This can be used to indicate that there is less confidence in a self assessment than in a official test at a learning institute.
- Assessment date : the date when the assessment took place. This is also the base date which is used for calculating competency degradation.
- Competencies : the competencies which are evaluated by this assessment. The assessment gives an indication of the presence of all the listed competencies at the selected level. The "add" link allows adding one or more competencies. The proficiency level can either be selected using a slider (for continuous competencies) or a select box (for discrete competencies).
- URI for evidence : link to the (online) evidence, which is typically an electronic diploma or certificate.
- Remarks : any remarks for the assessments.
- Assessment level or score : indicates the result. The result of the assessment as expressed according to the assessment scale which applies (as defined in the assessment method). Note that it is assumed (default behaviour in the matching profiles) to only consider assessments which the person has passed. For the default scale (zero to one) this would mean an assessment level larger than .5.

J.4.3 Evaluation of competencies for assigned tasks

This is intended for managers to create an assessment for their staff. There is a similar screen as for the self assessment.

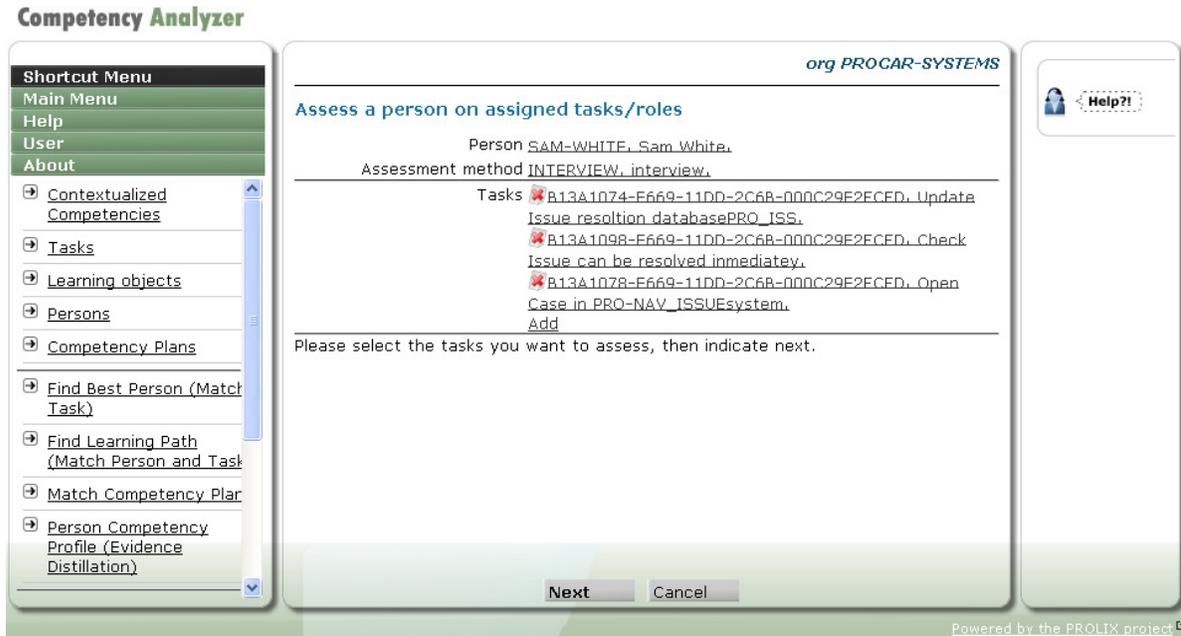


Figure J.4.3: Assess person for assigned task, start

You have to start by selecting the person and assessment method, then you indicate next and select the tasks to assess.

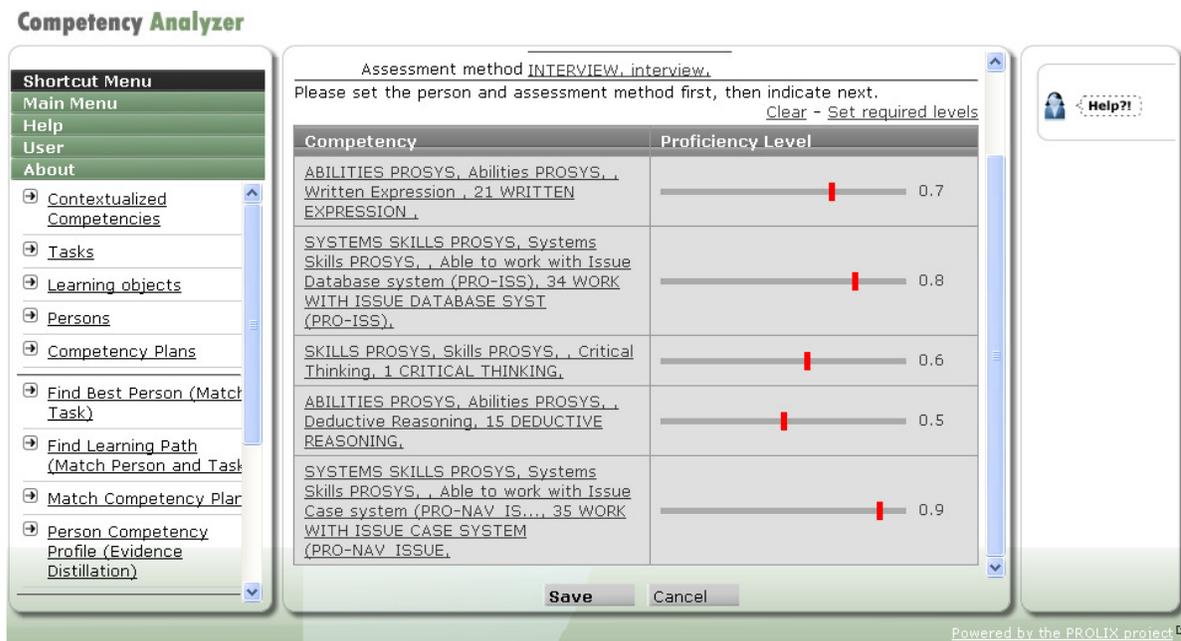


Figure J.4.4: Assess person for assigned task, enter proficiency levels

After pressing "next" again, the competencies for the tasks are displayed. The proficiency levels are by default set to the (highest) required level for the tasks. At the top there are two links to "clear" the competency levels or to reset them to the required levels ("set required levels").

J.4.4 Self assessment for assigned tasks

People can easily do a self assessment for the tasks which have been assigned to them. For this, they need to indicate the “self assessment for assigned tasks” link in the menu.

For this screen to function properly, the “self assessment” type needs to be set in the organization (need to be done by an administrator), and the person needs to have a set of assigned tasks or roles. In that case a screen like the following will appear.

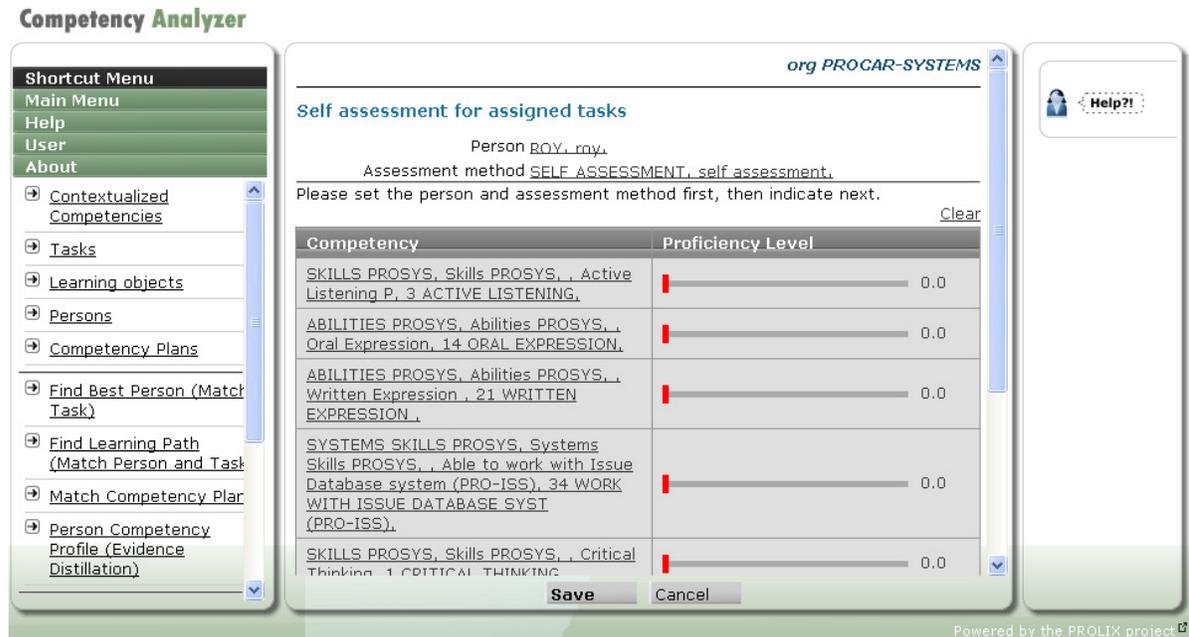


Figure J.4.5: Self assessment

Each of the competencies which is required for one of the assigned tasks is displayed and either a slider (competency with continuous scale) or a select box with the possible proficiency levels.

The user can set the proficiency levels he or she thinks apply. When needed, you can always clear all levels again by clicking the “clear” link at the top. This will reset all levels back to zero.

J.5 Administration

The Competency Analyser should require very little administration. However, there are a couple of things which may need to be done. Especially for managing the access rights to the application, the administrator may have some work.

J.5.1 Matching index statuses

The Competency Analyser uses indexes to increase the matching performance. There are specific indexes for each organization and matching profile combinations.

The indexes are automatically kept up-to-date. When assessments are added, matching profiles or artefacts are created or modified, then the index is updated. Depending on the amount of data which needs to be re-indexed, this either occurs instantaneous or asynchronously (every couple of minutes the system checks whether indexes need updating, so there can be a little delay).

Some changes are not automatically updated. Specifically changes in competencies or competency structure are not propagated to the indexes. This is because of the not-yet-implemented competency lifecycle (in principle you should not be able to modify competency definitions once they are in use).

The indexes for an organization can be rebuilt on request. This can be needed when they become corrupt (probably due to file system problems or server crashes), or because of aforementioned changes in competency definitions.

Just indicate the “matching index statuses” page in the “main menu”.

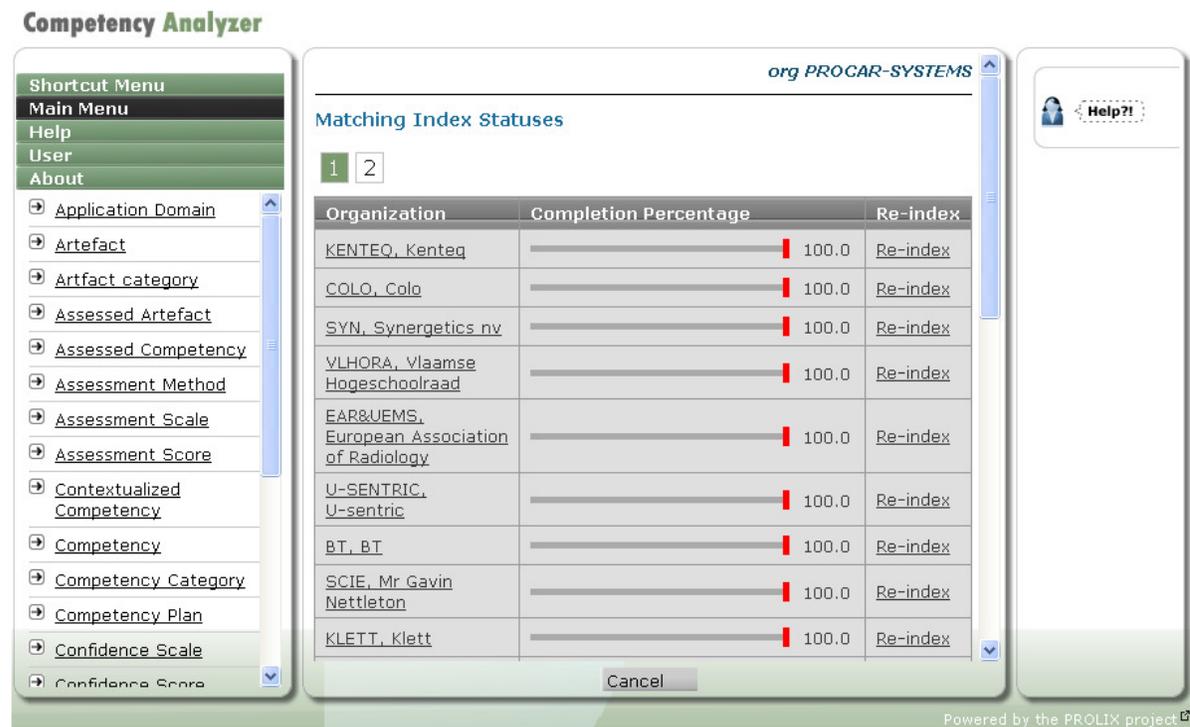


Figure J.5.1: Matching index statuses

For each organization, the current status of indexes is indicated as a completion percentage. When you want to re-index you have to indicate the “re-index” link for the specific organization.

Note that the completion percentage is calculated when the page is loaded. If you want to check whether the statuses change, you have to refresh the screen. In most browsers this can be done by pressing <F5>.

J.5.2 Authorization and authentication

J.5.2.1 Users

A user can choose to remove fields from their display. This can be configured by using the “user preferences” link in the “user” menu.

Competency Analyser

org PROCAR-SYSTEMS

Configure Tables

Table Name	Visible <input checked="" type="checkbox"/>	Configure
Application Domain	<input checked="" type="checkbox"/>	Configure
Artefact	<input checked="" type="checkbox"/>	Configure
Artefact category	<input type="checkbox"/>	
Assessed Artefact	<input checked="" type="checkbox"/>	Configure
Assessed Competency	<input checked="" type="checkbox"/>	Configure
Assessed Competency Level	<input checked="" type="checkbox"/>	Configure
Assessment Method	<input checked="" type="checkbox"/>	Configure
Assessment Scale	<input checked="" type="checkbox"/>	Configure
Assessment Score Discrete assessment score	<input checked="" type="checkbox"/>	Configure
Contextualized Competency	<input checked="" type="checkbox"/>	Configure
Competency	<input checked="" type="checkbox"/>	Configure
Competency Category	<input checked="" type="checkbox"/>	Configure

Save Reset Cancel

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Shortcut Menu
Main Menu
Help
User
About
Logged in user :roy (Ackema)
Organization :PROCAR-systems
Log out
User Preferences

Help?!

Figure J.5.2: Configure a users table settings

You can select which tables should be visible or not. The checkbox at the top allows you to indicate all checkboxes.

You have to indicate the “save” button at the bottom to save your changes.

Once the settings have been defined at table level, you can alter the settings for each table.

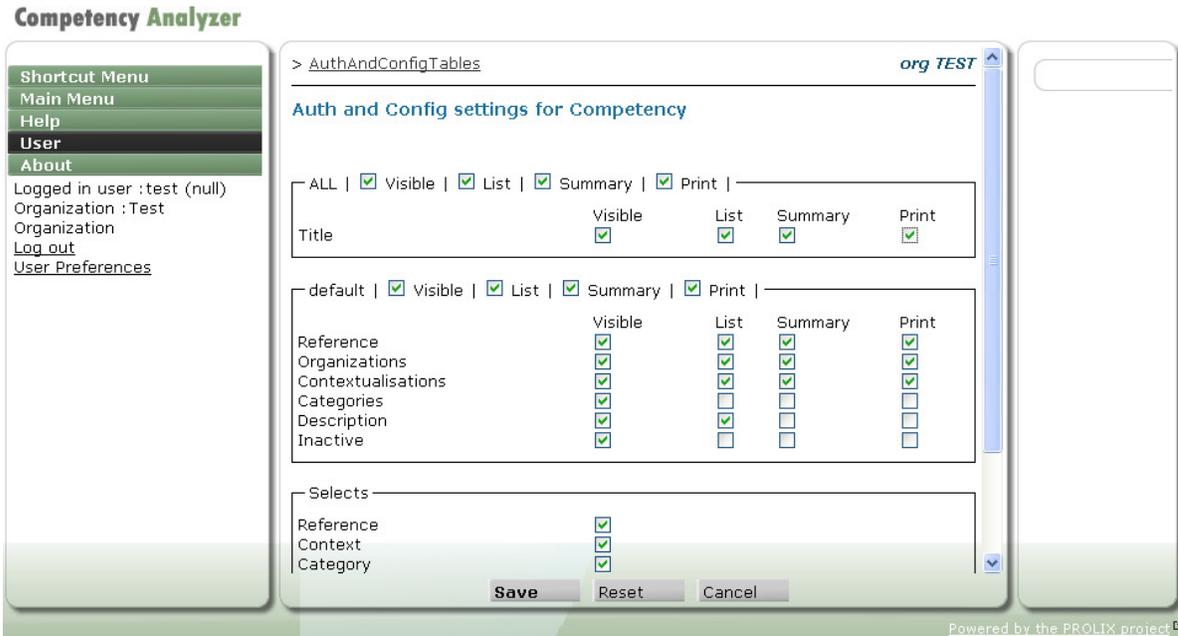


Figure J.5.3: Configure a users settings for a table

You can now select whether certain fields should be visible for you and which of the visible fields should be include in lists, in summary displays and (for future) in printouts. You can also indicate for each of the possible selectors whether you want to be able to use them.

J.5.2.2 Administrator

For administrators, there are similar screens where you can configure the base settings for a role. To be able to access this option, you need to be logged in using a user which is indicated as "gui administrator". You can access these screens from the "user" menu using the "role configurations" link.

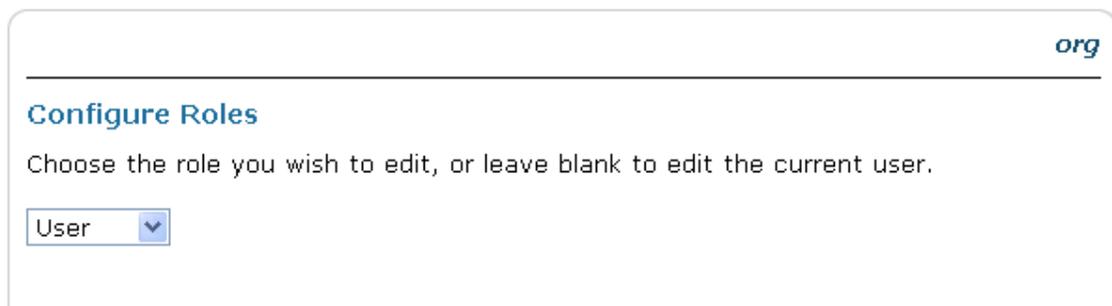


Figure J.5.4: Choose role to configure authorizations for

You can then choose the role for which you want to edit the settings.

Competency Analyser

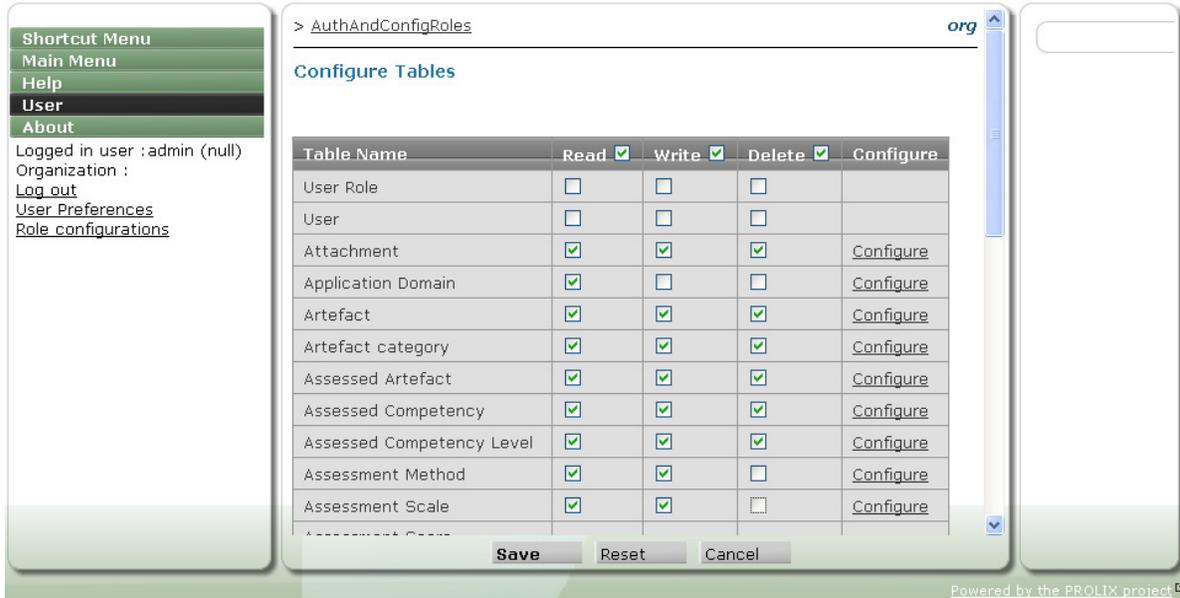


Figure J.5.5: Configure table level authorizations for a role

You can now select which table should be readable, read and writable or read, write and deletable by users of the chosen role. Using the "configure" link, you can also click through to configure the detailed access rights for the table.

Competency Analyser

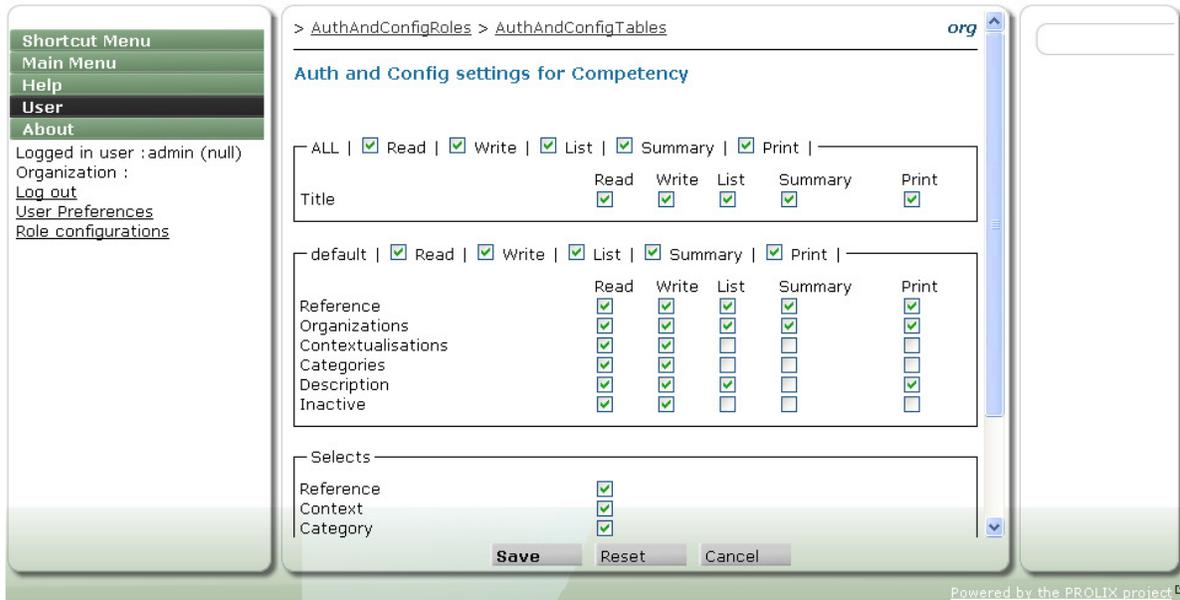


Figure J.5.6: Configure authorizations for a table

You can now determine the detailed access rights for each field, for the actions and selectors on the table. For the fields you can now set whether it should be read only or read/write and

which of the readable fields should be include in lists, in summary displays and (for future) in printouts.

Note that when a user has multiple roles, the rights will be combined, allowing everything which is allowed by one of the roles.

J.5.3 Import

To allow bulk import of information, there is a page which allows you to insert or update data in the Competency Analyser by using a specific file format. This can be accessed using the “import” item in the “main menu”.

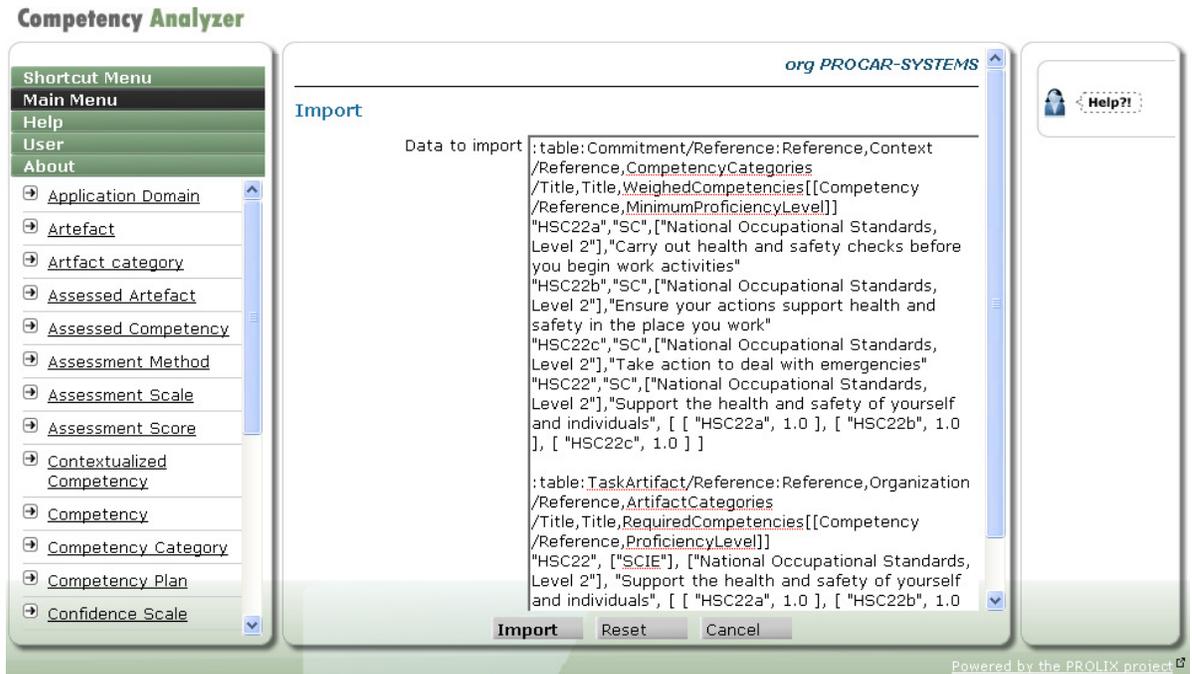


Figure J.5.7: Matching index statuses

The import file format is documented at <http://equanda.org/equanda-tool/ImportFileFormat>. You need knowledge of the domain model to know the correct table and field names. See [Appendix, domain model].

K Lessons Learned / Future work

Who should read this chapter : researchers, users who want to know possible future directions, technical people to have some idea of possible challenges.

Competencies and contextualised competencies

In hindsight the wording we use is wrong. We started the project assuming that we have “competencies” and “contextualised competencies”. This has led to some confusion. In practice when people think about a competency, they do this within a certain context. This is mostly tacit, but the context is implicitly there.

It would have been better to talk about “generic” and “contextualised” competencies and then agree that when no indication is given, you always talk about contextualised competencies. This would have helped in many discussions/explanations.

Some definitions exemplify this, like HR-XML.

The specific, identifiable and measurable knowledge, skill, ability and/or other deployment-related characteristic (eg. attitude, behaviour, physical ability) which a human resource may possess and which is necessary for, or material to, the performance of an activity within a specific business context. (definition from the HR-XML consortium, http://ns.hr-xml.org/2_4/HR-XML-2_4/CPO/competencies.html).

Related with this is the “limitation” that a contextualised competency always contextualizes a generic competency (which is automatically generated if not present). The system should not require the link to the generic competency. It would be better to only define this when necessary, assuring that the generic competencies are truly defined as being generic.

The use of generic competencies (as in competencies without context)

Though the plan was to explore the use of have competencies both with and without context, we did not have enough time to explore the benefits of the competencies without context. This is largely because PROLIX is focussed on business processes within one organization. No organization boundaries needed crossing and therefore the need for considering the competencies without context was not there.

In principle, I can image that for cross organization competency matching, it would be useful to have a set of generic competencies which are applied in the organization’s contexts. The matching could then give a high match score if the competency is based on the same generic competency but applied in a similar context.

The problem is then shifted towards determining similarity of contexts, which should already make it an order of magnitude easier (and can more easily be done by human evaluation as the number of contexts will be much more limited then the number of competencies). Of course the next problem would be the relative importance of matches between contextualised competencies and matched on the generic competency and context.

Wording : Artefact vs ??

Another source of confusion was the term artefact.

Some say this should be called “competency profile”, but this has no reason of existing with being linked to a real world object. An artefact also has more information than the competency profile. It also contains links to the categories, the non-competency related criteria etc. Another proposal was “matching object” which quite accurately describes the use of the term. For now the term “artefact” is being used mainly to use something different from “object”.

Non-competency related matching criteria

Though the Competency Analyser has some provisions for non-competency-related matching criteria, these have not been used during the projects.

Matching will often be important when doing matching for jobs or roles. Some examples

- Requires a (valid) certificate like a driving license
- Limits of maximum distance to work
- Limits on personnel cost
- Limits on working time or amount
- Learning method preference

In general there are two types of non-competency related matching criteria. You have make-or-break criteria and preferences. In the latter case, it is used for sorting, while the former they can veto a match.

Test archetype

The task artefact is used for all objects with a competency profile of required competencies, Typical examples are tasks, functions, roles, jobs etc.

Tests are also "task artefacts". However, they serve a different purpose and are often used in different cases (when doing person-task matching, you are unlikely to want to do this with a test).

For this reason, it may make sense to change from three to four types of artefacts. In that case the distinction would not be based on the type of competency profile but rather on the type of object which has a profile. Whether this would be better or not is not entirely clear.

Three types of archetype

The system currently uses the notion of "artefact" which has three possible incarnations (using inheritance), being a person, learning object or task.

The main reason for having the inheritance is the shared "children", "criteria" and "categories" fields which consists of any of these artefacts.

For persons, the children are assigned roles (which are already defined separately as this was very unclear to users).

For tasks, the children can be subtasks. However, people or learning objects can also be children. This could indicate that the competencies the person has (or which are assigned to that person?) should also be included. And what for learning objects which are children? It is clear the semantics are not accurately defined which can lead to confusion.

For learning objects, the children can be other learning objects (for example to aggregate lessons into a course), tests (to assess the acquired competencies), tasks or persons. For tasks you could assume that you learn the required competencies by doing the task. But is this the case? Will you learn all competencies? The meaning of child persons is very unclear.

For both the criteria and categories you can wonder whether the same objects are applicable to all types of artefacts? Maybe this should also be split.

It may be better to change this to have three different types of object, which would make the semantics of the (now shared) fields more specific.

Task artefact vs competency

In the [Competency modelling] section, there is a discussion on modelling certain cases as task or as competency. The short of it is that skill oriented competencies, things you can “do” and you want to match on should probably be modelled as both task and competency.

The similarities between the two are so striking that the difference is mostly artificial and implementation detail. Clearly, an indication that a competency can be used for “task” matching could remove this duplication between task and competency.

There are some differences in the linked competencies.

For tasks, you have a “required competency profile”, which is a set of competencies at a specific level which need to be present. Matching treats all of these competencies as equals.

For competencies, you have “more granular competencies” which have weights and can be combined using rollup rules.

In general, the more powerful rollup rule concept could be applied to tasks and increase expressiveness, which would be good.

There are some contra-indications as well though. While this reasoning is very valid for task artefact which indicate a task, does it apply equally well for roles or job descriptions?

Competency model, skill-knowledge-behaviour

It may be interesting to be able to define a competency model, probably based on the skill-knowledge-behaviour split, and allow assigning values on these three aspects individually. For the matching it could then be defined which of the aspects need to be considered.

It could then be chosen to consider only the behavioural aspects when matching, and this could be compared based on the SHL 8 basic behaviour types, expressed as a spider graph.

The disadvantage is that this requires all competencies to be defined using the same model or limiting/forcing the models which can/should be used.

Categories (aka taxonomies)

The support for the taxonomies needs to be improved, as a minimum by displaying the tree structure and allowing the selection of the category from the tree.

On/off competencies

When looking around at competency usage and standards, it is obvious that the possibility to use proficiency levels is more the exception than the rule. In the Competency Analyzer, it is mandatory to use proficiency levels.

The user interface should allow having on/off competencies. These should have an implicit proficiency level of “1.0” which should not be changeable or visible. The presence of the competency indicates competence.

Competency degradation configuration

The system currently treats the competency degradation the same for all competencies, it can be configured in the competency profile.

In practice, the rate at which competencies degrade depend on a lot of factors. According to the popular saying, “you never forget how to ride a bike”. Other competencies like speaking a foreign language decrease quite a lot faster when you don’t speak that language often. On

the other hand, if you do, it will degrade slowly. This distinction could be handled with repeated assessments (possible assessment with a lower confidence rating). It should also be possible to indicate the difference in degradation rate between riding a bike and speaking a foreign language in some way.

Competencies and assessments versus certificates

This is more explanation than "to do". There is some discussion on the use or need for an expiration date on assessments. In theory, this should be handled by competency degradation (with more configuration probably).

The need for an expiration date sounds more like a certificate problem. The presence of the competencies changes little between the day before and the day after the expiration. However, the requirement that a valid certificate is present can be valid for matching but this is a non-competency related criterion. The non-competency related criteria on persons would need the expiry date.

Competency lifecycle, locking

In principle competencies should not be allowed to change once in use and should also not be deleted when in use. For this the "inactive" state is available. In normal use, you should only be allowed to select "active" competencies.

There should be a user interface feature to "replace" a (contextualised) competency. When clicking this, the user should be able to edit details about the competency. On save, the old variant should be marked as "inactive" and store a link to the replacing competency.

The user interface should assure that competencies can no longer be changed

Once used (or marked as "usable") competencies should be locked to prevent the users to make changes.

Authorization for custom pages

The custom pages are currently always visible and usable by all users. The configuration and authorization should be extended to also allow configuring the access to the custom pages.

Full text search

The current user interface is somewhat limited when searching for competencies and other data. One feature that would be especially useful is to introduce full text search.

More matching profiles, rule based

More work is needed evaluating the current set of options in the matching profile (especially the workers which can be chosen). Some more advanced, rule based workers should also be added. These could then use rules to combine say a recent assessment with low confidence and an old assessment with high confidence in a match with high relevancy (recent) and confidence.

Audit ability (click through to explanation on matching and evidence distillation)

The matching is currently more or less a black box which needs to be trusted.

It would be useful to be able to investigate where certain results come from. For the evidence distillation this could mean giving an indication of all the assessments for the competency and some explanation why the given result was chosen or constructed (maybe just a worker indication is enough).

Application domain

Though the application domain exists as concept inside the Competency Analyser, the details are not entirely worked out.

It should be possible to link data to a set of application domains and filter based on the application domains the user is part of. In some cases it should be possible to change the filter to either see all data or limit to only one of the application domains.

RCD support

One of the most important standards in the competency are is the RCD standard (from IEEE WG20). In the Competency Analyser, both the contextualised and generic competencies are valid RCD. To be able to use them as such, a URI should be assigned to each and that URI should be usable to get information about the RCD without logging into the system.

Tagging / folksonomy support

Apart from the categories (which are organized as a taxonomy or tree, with “fixed” keyword), it would also be useful to have folksonomy or tagging support. Users could then just type the words they believe are applicable for a competency or artefact and use these for defining relations. You can then also have the cloud display where tags are display using a colour or size which indicated their popularity.

Choose course while matching

When matching for a learning path, the Competency Analyser always automatically chooses the best match and then (if there still is a remaining gap) re-invokes the matcher to find the next course assuming the previous were absorbed successfully.

Some users would prefer this behaviour to be changed to allow the user to choose their preferred course at each step of the way and storing that results.

This seems useful as it allows considering more aspects than the matcher knows, but would be quite a derivation of the current state as the results are now re-evaluated each time. This is done because the person competency profiles are expected to change all the time. Once the learning path can be humanly defined and stored, it is needs to be considered what the influence of changes on the person profiles is on the stored learning path.

Printing lists

The system currently only allows display of information on screen. There is some limited support in the configuration and authorization support to indicate fields which should be included in print, but this needs to be finished by providing a print button on all list display to allow the details to be converted to PDF for printing.

Authorization on record level

Once a user is logged into the CA, he or she currently has access to all the information which is linked to organization he or she is part of. The access can only be limited by blocking fields, but not by blocking (or allowing) specific data.

This should be changed.

It should be possible to limit access on assessment to only see the assessment which involve themselves (either as assessor or assessee).

It should be possible to limit access to person artefacts within their team or department (or even to only themselves).

Competency navigation

The domain model allows several ways to indicate relations between competencies. Examples are other contextualisations of the (generic) competency or competencies which have been linked with the same category. It would be useful to have some support in the user interface to easily navigate to these related competencies. This would probably help in searching for competencies by starting with a match on a keyword and then improving the result by checking related competencies.

Competency reorganization

One of the uses of contextualization of competencies is the grouping of competencies which are linked to the same generic competency.

When the user has uncovered that two contextualised competencies should have the same generic competency, the system should help to assure this change can be made, including the removal of generic competencies which are not contextualised.

Ideally, a method should also be included to help discovering these competencies.

Similarly, it should also be possible to split a generic competency in two different definitions, dividing the contextualisations between the two or joining two generic competencies.

The system should help in trying to uncover the contextualised competencies which should have the same generic competency and make it easy to assure two contextualised competencies share the

More matching methods

The matching now only uses direct matching (same competency) and optionally semantic matching. More matching methods could be added, like text bases similarity of the title and/or description, relations in the categories, different contextualisations of the same (generic) competency.

When matching the title and/or descriptions several methods could be applied, like using occurrences of matching words using string matches like levenstein distance, soundex or jaccard similarly or using linguistic matching using wordnet with synsets or the jaro algorithm.

Competency limit and competency potential

The current matcher only uses what I would call "positive matching". It will try to compute a matching score under the assumption that any remaining gap can be closed by learning.

Sometimes, the system could be aware of indications of competency limitation. If a person has failed several assessment for a certain competency, than that may be an indication that it would be very difficult to raise the competency further (here a distinction needs to be made

between failing the assessments and having a matching profile which requires a higher standard for evaluating assessments).

Similarly, there may be mechanisms or tests which can indicate a certain potential for improvement. These could indicate that a person has the capacities to increase certain competencies but still needs more training to reach that level.

Somewhat related to this is the difference between having assessment which indicate you don't have a certain competency (level 0) or that a certain competency has never been evaluated. The current system does not make a distinction between these case though maybe it should.

Matching should probably try to consider such limitations. There is no point in suggesting top people for a job if you "know" that it will be difficult for them to become fully competent? Sometimes another person with a larger competency gap may prove to be the better choice as he/she can more easily be trained to fully master the job.

Cost optimizations

It makes sense to enhance the matcher to consider cost. When searching learning material for a person-task pair, there are likely different costs involved when following a course. This cost consists of a combination of the earnings of the student during the learning and the actual cost of enrolling for the course. Considering this cost can improve the matching to ensure the most cost-effective learning instead of just trying to have the largest possible competency improvement for each additional course.

When doing best person for a job matches, this could be enhanced by calculating a minimum period a person should be enrolled and minimizing the cost of hiring (wages) plus training over that period.

Competency plan matching and scheduling

When matching on a team, the reality is a lot more challenging than the simple combination which is now part of the Competency Analyser. The system now more or less assumes that all courses are individual and can be completed at will. In practice, some of the courses will probably be taught by someone and thus scheduled. When several people need that course they all need to be available and may have to follow other courses before they can start to assure they have the required prerequisite competencies. It can become complex.

Indirect matching

When matching on courses, only courses are selected for which the prerequisites are met. The system never tries to figure out if an intermediate course would be useful to reach competencies which are required only to reach prerequisites of another course.

Competency repositories

It would be useful for standards organizations (and possibly some commercial ones as well) to build and maintain a set of competencies which are used by other organizations. The competencies would need to be shared between organizations. These may be using different systems, so there would be a need for doing either replication or reuse competencies in some other way.

Learning object repositories

It would be suitable for organizations who publicize libraries of learning objects to create their own competency annotations. It should then be made possible to share this information between multiple organizations, possibly stored on different systems. This itself could either be solved doing some automatic replication between Competency Analysers, or by doing some distributed matching (or indexing based on distributed info). This does required the uses of shared competencies though, otherwise the matching will not give any results anyway.

L Conclusion

An overview was given of the Competency Analyser, a piece of software which allows the management and use of competencies. All aspects of the software have been explained, how it fits in the PROLIX lifecycle, interactions with other software, technical aspects like domain model and architecture, and a the user manual. There is also a section about methodology which can be used for competency modelling.

The experience of building and using the Competency Analyser have given us many ideas which would be interesting to further explore, but which we have been unable to achieve in the project.

The system has proven inside PROLIX to be usable and useful.

M Appendix, domain model

The domain model was expressed in an XML format which combines the actual database format, documentation (you could call it "subjectory", see <http://www.hoppie.nl/pub/node/81>), and hints for the user interface.

Details for the format used can be found on <http://equanda.org/dm.html>.

Global file, definition of custom types, dm.xml.

```
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE equanda SYSTEM "equanda.dtd">

<equanda>
  <type name="referenceString" length="50">
    <constraints>
      <unique/>
    </constraints>
    <display/>
    <case value="upper"/>
  </type>
  <type name="referenceNonUniqueString" length="50">
    <display/>
    <case value="upper"/>
  </type>
  <type name="titleString" length="100">
    <display/>
    <indexed/>
  </type>
  <type name="descriptionClob" type="clob" renderer="wiki,lines=10,cols=50"/>
  <type name="uri" length="250" renderer="url"/>
  <type name="email" length="150" renderer="email"/>
  <type name="organization" type="Organization">
    <constraints>
      <required/>
    </constraints>
    <default
type="class">be.synergetics.ca.util.DefaultOrganization</default>
  </type>
  <type name="organizations" type="Organization">
    <multiple/>
    <constraints>
      <required/>
    </constraints>
    <default
type="class">be.synergetics.ca.util.DefaultOrganizations</default>
  </type>

  <table dir="."/>
</equanda>
```

Include file : address.xml

```
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE include-data SYSTEM "equanda.dtd">

<include-data>
```

```
<group name="Address">
  <field name="Address" type="string" length="120" renderer="text,lines=3,cols=50"/>
  <field name="Zip" type="string" length="20"/>
  <field name="City" type="string" length="40"/>
  <field name="Country" type="string" length="2" priority="4">
    <choice class-name="org.equanda.validation.ISOCountry2Letter"/>
    <default>"BE"</default>
    <constraints>
      <required/>
    </constraints>
  </field>
</group>

<field name="Phone" length="32">
  <description>Phone number</description>
</field>

<field name="MobilePhone" length="32">
  <description>Phone number</description>
</field>

<field name="Fax" length="32">
  <description>Fax number</description>
</field>

<field name="Email" type="email">
  <description>E-mail address</description>
</field>

<field name="Url" type="uri">
  <description>Web site for this address</description>
</field>

</include-data>
```

Include file : userLanguage.xml

```
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE include-data SYSTEM "equanda.dtd">

<include-data>
  <choice name="LANGUAGE_ENGLISH" value="en"/>
  <choice name="LANGUAGE_DUTCH" value="nl"/>
</include-data>
```

Table definition : ApplicationDomain.table

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<!DOCTYPE table SYSTEM "equanda.dtd">

<table name="ApplicationDomain" expected-amount="medium" category="tables.Main">

  <description>
    An application domain indicates an area or division within an organization for which the competency details are specific.
  </description>

  <data-filter name="Organization"><filter-query where="o.organization.reference=${}"/></data-filter>
```

```

<page name="ALL">
  <field name="Reference" type="referenceString">
    <constraints>
      <required/>
    </constraints>
  </field>

  <field name="Title" type="titleString">
    <description>
      Title for the application domain
    </description>
  </field>

</page>

<page>

  <field name="Organization" type="organization">
    <description>
      Organization for which this application domain is applicable.
    </description>
  </field>

  <field name="Description" type="descriptionClob">
    <description>
      Description for the base competency.
    </description>
    <display/>
  </field>

</page>

<select name="Reference" type="single">
  <selection field="Reference"/>
</select>

</table>

```

Table definition : Artefact.table

```

<?xml version="1.0" encoding="ISO-8859-1"?>
<!DOCTYPE table SYSTEM "equanda.dtd">

<table name="Artefact" expected-amount="medium" category="tables.Main" internal="true">

  <description>
    An artefact indicates a link to an object outside of the competency world,
    but which can have a competency profile attached to it.
  </description>

  <data-filter name="Organization"><filter-query where="o.organization.reference=${}"/></data-filter>

  <page name="ALL">

    <field name="Reference" type="referenceNonUniqueString">
      <description>
        This is the (external) reference ffor this artefact. It should

```

```
be world unique!
    </description>
    <constraints>
        <unique-for>Organization</unique-for>
    </constraints>
</field>

<field name="Title" type="titleString">
    <description>
        Title for the artefact.
    </description>
    <constraints>
        <required/>
    </constraints>
</field>

</page>

<page>

    <field name="Organization" type="organization">
        <description>
            Organization for which this artefact is applicable.
        </description>
    </field>

    <field name="Description" type="descriptionClob">
        <description>
            Description for the base competency.
        </description>
        <display/>
    </field>

    <field name="ArtefactCategories" singular="ArtefactCategory"
type="ArtefactCategory">
        <description>
            Categories for this artefact.
        </description>
        <multiple/>
        <cascade-keep/>
    </field>

    <field name="Criteria" singular="Criterion" type="CriterionScore">
        <description>
            Non-competency related criteria for the selection of the arte-
fact.
        </description>
        <multiple/>
        <cascade-keep/>
    </field>

    <field name="Children" singular="Child" type="Artefact">
        <description>
            Child artefacts for this one. Basically the profiles of chil-
dren should be aggregated in some cases
            (for example a person combines the CP for the roles etc).
        </description>
        <multiple/>
        <other-side-multiple/>
    </field>
```

```
</page>

<select name="Reference" type="single">
  <selection field="Reference"/>
</select>

<select name="ReferenceOrganization" type="single">
  <selection field="Reference"/>
  <selection field="Organization" />
</select>

<select name="Criterion">
  <selection field="Reference" path="criteria" table="Criterion"/>
</select>

<select name="Organization">
  <selection field="Organization" />
</select>

<select name="Category">
  <selection field="ArtefactCategories" />
</select>

<select name="ParentOf">
  <selection field="Reference" path="children" table="Artefact"/>
</select>

</table>
```

Table definition : ArtefactCategory.table

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<!DOCTYPE table SYSTEM "equanda.dtd">

<table name="ArtefactCategory" expected-amount="small" cate-
gory="tables.Settings">

  <description>
    An competency category allows grouping competencies in categories, for
    easier browsing.
  </description>

  <data-filter name="ApplicationDomain"><filter-query
where="o.applicationDomain.reference=${}"/></data-filter>

  <page name="ALL">

    <field name="Title" type="titleString">
      <description>
        Title for the category.
      </description>
    </field>

  </page>

  <page>

    <field name="ApplicationDomains" type="ApplicationDomain">
      <description>
        Application domain for which this category is applicable.
      </description>
    </field>
  </page>
</table>
```

```
        </description>
        <multiple/>
    </field>

    <field name="Description" type="descriptionClob">
        <description>
            Description for the category.
        </description>
        <display/>
    </field>

</page>

<select name="Title">
    <selection field="Title"/>
</select>

</table>
```

Table definition : AssessedArtefact.table

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<!DOCTYPE table SYSTEM "equanda.dtd">

<table name="AssessedArtefact" expected-amount="large" cate-
gory="tables.Maintenance">

    <description>
        A proficiency competency is a competency which also contains a profi-
ciency level indication or score.
    </description>

    <data-filter name="Organization"><filter-query
where="o.person.organization.reference=${}"/></data-filter>

    <page name="ALL">

        <field name="Artefact" type="Artefact">
            <description>
                Artefact for which the competencies are assessed. This should
be either a task or learning artefact.
            </description>
            <constraints>
                <required/>
                <!--@todo <compare test="type"
value="PersonArtefact, LearningArtefact"/>-->
            </constraints>
            <display/>
        </field>

        <field name="Person" type="Artefact">
            <description>
                Artefact for which this assessment was applied. Should be a
person artefact.
            </description>
            <constraints>
                <required/>
                <compare test="type" value="PersonArtefact"/>
            </constraints>
            <display/>
        </field>
```

```
</page>

<page>

  <field name="AssessmentMethod" type="AssessmentMethod">
    <description>
      The way the proficiency level was determined.
    </description>
    <constraints>
      <required/>
    </constraints>
  </field>

  <field name="AssessmentDate" type="date">
    <description>
      Date when the assessment was done.
    </description>
    <default>TODAY</default>
  </field>

  <group name="AssessmentScore">
    <field name="AssessmentLevel" type="double">
      <description>
        Actual value, only relevant when there is no Score.
      </description>
      <display/>
    </field>

    <field name="AssessmentScore" type="AssessmentScore">
      <description>
        If the competency has a discrete values, then the score
should be used to assign a value.
        {note}Only scores which are attached to the selected as-
sessment method should be allowed.{note}
      </description>
      <display/>
      <!-- @todo these should be restricted to the scores that match
the assessment method -->
    </field>
  </group>

  <field name="EvidenceUri" type="uri">
    <description>
      Location where the evidence can be retrieved. This is likely
to be inside a e-portfolio.
    </description>
  </field>

  <field name="Remarks" type="clob" renderer="wiki,lines=10,cols=50">
    <description>Any additional remarks about the assess-
ment.</description>
  </field>
</page>

<hide/>

<select name="Person">
  <selection field="Reference" path="person" table="Artefact"/>
</select>
```

```
<select name="PersonId">
  <selection field="Person"/>
</select>

<select name="Artefact">
  <selection field="Reference" path="artefact" table="Artefact"/>
</select>

</table>
```

Table definition : AssessedCompetency.table

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<!DOCTYPE table SYSTEM "equanda.dtd">

<table name="AssessedCompetency" expected-amount="large" cate-
gory="tables.Maintenance">

  <description>
    A proficiency competency is a competency which also contains a profi-
    ciency level indication or score.
  </description>

  <data-filter name="Organization"><filter-query
where="o.person.organization.reference=${}" /></data-filter>

  <page name="ALL">

    <field name="Person" type="Artefact">
      <description>
        Artefact for which this assessment was applies. Should be a
        person artefact.
      </description>
      <constraints>
        <required/>
        <compare test="type" value="PersonArtefact"/>
      </constraints>
      <display/>
    </field>

  </page>

  <page>

    <field name="AssessmentMethod" type="AssessmentMethod">
      <description>
        The way the proficiency level was determined.
      </description>
      <constraints>
        <required/>
      </constraints>
    </field>

    <field name="AssessmentDate" type="date">
      <description>
        Date when the assessment was done.
      </description>
      <default>TODAY</default>
    </field>
```

```

    <field name="Levels" type="AssessedCompetencyLevel">
      <description>
        List of the competencies with proficiency level for this as-
        sessment.
      </description>
      <link-name>AssessedCompetency_Level</link-name>
      <multiple/>
      <embedded/>
    </field>

    <group name="AssessmentScore">
      <field name="AssessmentLevel" type="double">
        <description>
          Actual value, only relevant when there is no Score.
        </description>
        <display/>
      </field>

      <field name="AssessmentScore" type="AssessmentScore">
        <description>
          If the competency has a discrete values, then the score
          should be used to assign a value.
          {note}Only scores which are attached to the selected as-
          sessment method should be allowed.{note}
        </description>
        <display/>
        <!-- @todo these should be restricted to the scores that match
        the assessment method -->
      </field>
    </group>

    <field name="EvidenceUri" type="uri">
      <description>
        Location where the evidence can be retrieved. This is likely
        to be inside a e-portfolio.
      </description>
    </field>

    <field name="Remarks" type="clob" renderer="wiki,lines=10,cols=50">
      <description>Any additional remarks about the assess-
      ment.</description>
    </field>
  </page>

  <hide/>

  <select name="Person">
    <selection field="Reference" path="person" table="Artefact"/>
  </select>

  <select name="PersonId">
    <selection field="Person"/>
  </select>
</table>

```

Table definition : AssessedCompetencyLevel.table

```

<?xml version="1.0" encoding="ISO-8859-1"?>
<!DOCTYPE table SYSTEM "equanda.dtd">

```

```
<table name="AssessedCompetencyLevel" expected-amount="large" category="tables.Main">
  <description>
    Combinations of competency and proficiency level for competency assessments.
  </description>
  <page name="ALL">
    <field name="Parent" type="AssessedCompetency">
      <description>
        AssessedCompetency this is part of.
      </description>
      <link-name>AssessedCompetency_Level</link-name>
      <constraints>
        <required/>
      </constraints>
    </field>
  </page>
  <page>
    <field name="Competency" type="Commitment">
      <description>
        Competency (in context) which is Weighed, to be assigned in an artefact as embedded details for competencies.
      </description>
      <constraints>
        <required/>
      </constraints>
      <display/>
    </field>
    <group name="ProficiencyScore">
      <field name="ProficiencyLevel" type="double">
        <description>
          Actual value, only relevant when there is no Score.
        </description>
      </field>
      <field name="ProficiencyScore" type="Score">
        <description>
          If the competency has a discrete values, then the score should be used to assign a value.
          {note}Only scores which are attached to the selected competency should be allowed.{note}
        </description>
        <!-- @todo these should be restricted to the scores that match the assigned competency -->
      </field>
    </group>
  </page>
  <hide/>
</table>
```

Table definition : AssessmentMethod.table

```
<?xml version="1.0" encoding="ISO-8859-1"?>
```

```
<!DOCTYPE table SYSTEM "equanda.dtd">

<table name="AssessmentMethod" expected-amount="medium" cate-
gory="tables.Settings">

  <description>
    How a certain competency and its proficiency level have been deter-
    mined.
  </description>

  <data-filter name="Organization"><filter-query from="IN (o.organizations)
org" where="org.reference=${}" /></data-filter>

  <page name="ALL">

    <field name="Reference" type="referenceString">
      <constraints>
        <required/>
      </constraints>
    </field>

    <field name="Name" type="titleString">
      <description>
        Title for the assessment method.
      </description>
    </field>

  </page>

  <page>

    <field name="Organizations" type="organizations">
      <description>
        Organizations for which this assessment method is applicable.
      </description>
    </field>

    <field name="Description" type="descriptionClob">
      <description>
        Description for the scale.
      </description>
      <display/>
    </field>

    <field name="AssessmentScale" type="AssessmentScale">
      <description>
        Scale to be used for the assessment type.
        When the scale is chosen, and the scale is discrete, then the
        user should be given a list of scores.
      </description>
    </field>

    <field name="ConfidenceLevelDefault" type="double">
      <description>
        Value indicating the confidence that the assessment method is
        accurate.
      </description>
      <constraints>
        <required/>
        <compare test=">" value="0"/>
      </constraints>
    </field>
  </page>
</table>
```

```
        <compare test="&lt;=" value="1.0"/>
      </constraints>
    </field>

  </page>

  <select name="Reference" type="single">
    <selection field="Reference"/>
  </select>

</table>
```

Table definition : AssessmentScale.table

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<!DOCTYPE table SYSTEM "equanda.dtd">

<table name="AssessmentScale" expected-amount="medium" cate-
gory="tables.Settings">

  <description>
    A assessment scale gives possible assessment ratings for assessments
    (of artefacts).
  </description>

  <data-filter name="Organization"><filter-query from="IN (o.organizations)
org" where="org.reference=${}"/></data-filter>
  <data-filter name="ApplicationDomain"><filter-query
where="o.applicationDomain.reference=${}"/></data-filter>

  <page name="ALL">

    <field name="Reference" type="referenceString">
      <constraints>
        <required/>
      </constraints>
    </field>

    <field name="Title" type="titleString">
      <description>
        Title for the scale.
      </description>
    </field>

  </page>

  <page>

    <field name="Organizations" type="organizations">
      <description>
        Organizations for which this scale is applicable.
      </description>
    </field>

    <field name="ApplicationDomains" type="ApplicationDomain">
      <description>
        Application domain for which this scale is applicable.
      </description>
      <multiple/>
    </field>
```

```

    <field name="Description" type="descriptionClob">
      <description>
        Description for the scale.
      </description>
    </field>

    <field name="MinimumValue" type="double">
      <description>
        Lowest (inclusive) allowed value for the scale.
      </description>
      <default>0.0</default>
    </field>

    <field name="MaximumValue" type="double">
      <description>
        Highest (inclusive) allowed value for the scale.
      </description>
      <default>1.0</default>
    </field>

    <field name="Discrete" type="boolean">
      <description>
        If the scale is discrete, then only the use of "score" records
        is allowed as value. In that case the values can be given names.
        This is automatically determined by the existence of actual
        score values.
      </description>
      <calculated/>
    </field>

    <field name="AllowedValues" type="AssessmentScore">
      <description>
        Allowed values for the scale. When any exist, than not other
        values are allowed for the scale as exist here.
      </description>
      <link-name>AssessmentScore</link-name>
      <multiple/>
      <embedded/>
    </field>

  </page>

  <select name="Reference" type="single">
    <selection field="Reference"/>
  </select>

</table>

```

Table definition : AssessmentScore.table

```

<?xml version="1.0" encoding="ISO-8859-1"?>
<!DOCTYPE table SYSTEM "equanda.dtd">

<table name="AssessmentScore" expected-amount="medium" cate-
gory="tables.Settings">

  <description>
    A assessment score is a distinct value which can be assigned as a as-
    sessment rating.
  </description>

```

```

<page name="ALL">
  <field name="Title" type="titleString">
    <description>
      Name for the score.
    </description>
    <!-- @todo should be unique for the scale -->
  </field>
</page>

<page>
  <field name="AssessmentScale" type="AssessmentScale">
    <description>
      Scale for which this score is applicable.
    </description>
    <link-name>AssessmentScore</link-name>
    <constraints>
      <required/>
    </constraints>
  </field>

  <field name="Description" type="descriptionClob">
    <description>
      Description for the score.
    </description>
    <display/>
  </field>

  <field name="Value" type="double">
    <description>
      Value for the scale, should be between minimum and maximum al-
      lowed values for the scale.
    </description>
  </field>
</page>
</table>

```

Table definition : Commitment.table

```

<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE table SYSTEM "equanda.dtd">

<table name="Commitment" expected-amount="small" category="tables.Main">

  <description>
    Link between a competency and the context. The link with the compe-
    tency content ontology is also considered a context.
  </description>

  <data-filter name="Organization"><filter-query from="IN
(o.competency.organizations) org" where="org.reference=${}"/></data-filter>
  <data-filter name="ApplicationDomain"><filter-query
where="o.applicationDomain.reference=${}"/></data-filter>
  <data-filter name="InactiveFilter"><filter-query
where="o.inactive=0"/></data-filter>

```

```
<page name="ALL">

  <field name="Competency" type="Competency">
    <description>
      Competency for this commitment.
    </description>
    <link-name>Competency_Commitment</link-name>
  </field>

  <field name="Context" type="Context">
    <description>
      Context for this commitment.
    </description>
    <display/>
    <constraints>
      <required/>
    </constraints>
    <default
type="class">be.synergetics.ca.util.DefaultCommitmentContext</default>
    </field>

  <field name="Title" type="titleString">
    <description>
      Competency title.
    </description>
    <constraints>
      <required/>
    </constraints>
  </field>

</page>

<page>

  <field name="Reference" type="referenceString">
    <description>
      Reference for competency, also referred to (in documents) as
      Id.
      This will typically be the RCD URI.
    </description>
  </field>

  <field name="Description" type="descriptionClob">
    <description>
      Description for the competency in this context.
    </description>
    <constraints>
      <value-when-null field="Description" path="Competency"/>
    </constraints>
    <display/>
  </field>

  <field name="CompetencyCategories" singular="CompetencyCategory"
type="CompetencyCategory">
    <description>
      Categories for this competency.
    </description>
    <multiple/>
    <cascade-keep/>
  </field>
```

```
<field name="Scale" type="Scale">
  <description>
    Scale to be used for the competency in this context.
    When the scale is chosen, and the scale is discrete, then the
    user should be given a list of scores as it needs to be allowed to specify
    context specific text/commitment.
  </description>
</field>

<field name="Scores" type="ScoreCommitment">
  <description>
    Commitments for the scale.
  </description>
  <link-name>Competency_ScoreCommitment</link-name>
  <cascade-delete/>
  <hide/>
</field>

<field name="Commitment" type="uri">
  <description>
    Location where the semantical commitment can be found. This
    uri is also used to determine how the commitment can be defined.
    It is normally based on the ontology for the context.
    In principle this is only filled if the scale is continuous,
    otherwise the commitment should be specific for each possible score.
  </description>
</field>

<field name="Inactive" type="boolean">
  <description>
    Indicates that the object should not be selectable in the gui.
  </description>
</field>

<group name="RollupRules">

  <field name="CombinationRule" length="4">
    <description>
      How should the child competencies be matched?
    </description>
    <choice name="COMBINATIONRULE_ALL" value="ALL"/>
    <choice name="COMBINATIONRULE_SOME" value="SOME"/>
    <default>COMBINATIONRULE_ALL</default>
    <constraints>
      <required/>
    </constraints>
  </field>

  <field name="MinimumMatchWeight" type="int" priority="6">
    <description>
      Details the minimum combined weight of matching child com-
      petencies to allow this one to match.
      Can not be higher than the total weights linked WeightCom-
      petencies with positive weight.
      Only relevant when combinationrule is set so "some".
    </description>
    <default>0</default>
  </field>
```

```
<field name="MinimumScoreWeight" type="int" priority="6">
  <description>
    Details the minimum combined weight of matching child com-
    petencies as used to calculate the match score.
    Has to be positive.
    For example a competency with three children, all weighed
    as "1", and one child weighed as "2" may have a MinimumMatchWeight of "2" and
    a MinimumScoreWeight of "3". The match competency matches when at least a
    weight of two is reached, but you need a weight of 3 to have a shot at 1.0 as
    match score.
    Only relevant when combinationrule is set so "some".
  </description>
  <default>1</default>
</field>

</group>

<field name="WeighedCompetencies" singular="WeighedCompetency"
type="WeighedCompetency">
  <description>
    Child competencies for this one.
  </description>
  <link-name>Competency_WeighedCompetency</link-name>
  <multiple/>
  <embedded/>
</field>

<!-- some calculated fields to easu display of levels etc -->
<field name="Discrete" type="boolean">
  <description>
    Indicates whether the scale (if any) is discrete.
  </description>
  <calculated/>
  <hide/>
</field>
<field name="MinimumProficiencyLevel" type="double">
  <description>
    Lowest (inclusive) allowed value for the scale.
  </description>
  <calculated/>
  <hide/>
</field>
<field name="MaximumProficiencyLevel" type="double">
  <description>
    Highest (inclusive) allowed value for the scale.
  </description>
  <calculated/>
  <hide/>
</field>

</page>

<select name="Reference" type="single">
  <selection field="Reference"/>
</select>

<select name="Context">
  <description>Select the commitments in a specific con-
  text.</description>
  <selection field="Context"/>
</select>
```

```

</select>

<select name="Category">
  <selection field="CompetencyCategories" />
</select>

<select name="HasSemantics">
  <selection field="Commitment" test="is not null"/>
  <hide/>
</select>

<action name="linkDogTagger" return="java.net.URL">
  <description>
    Allows the definition of the link with the semantic definition using Starlab's dogtagger.
  </description>
</action>
</table>

```

Table definition : Competency.table

```

<?xml version="1.0" encoding="ISO-8859-1"?>
<!DOCTYPE table SYSTEM "equanda.dtd">

<table name="Competency" expected-amount="medium" category="tables.Main">

  <description>
    A general competency, as interpreted inside a context.
  </description>

  <data-filter name="Organization"><filter-query from="IN (o.organizations)
org" where="org.reference=${}" /></data-filter>
  <data-filter name="ApplicationDomain"><filter-query
where="o.applicationDomain.reference=${}" /></data-filter>
  <!--<data-filter>Context</data-filter>-->
  <data-filter name="InactiveFilter"><filter-query
where="o.inactive=0" /></data-filter>

  <page name="ALL">

    <field name="Title" type="titleString">
      <description>
        Competency title.
      </description>
      <constraints>
        <required/>
      </constraints>
    </field>

  </page>

  <page>

    <field name="Reference" type="referenceString">
      <description>
        Reference for competency, also referred to (in documents) as
        Id.
        This will typically be the RCD URI.
      </description>
    </field>

```

```
<field name="Organizations" type="organizations">
  <description>
    Organizations for which this assessment method is applicable.
  </description>
</field>

<field name="Commitments" type="Commitment">
  <description>
    Semantic commitments including possible context links.
  </description>
  <link-name>Competency_Commitment</link-name>
  <multiple/>
  <embedded/>
</field>

<field name="CompetencyCategories" singular="CompetencyCategory"
type="CompetencyCategory">
  <description>
    Categories for this competency.
  </description>
  <multiple/>
  <cascade-keep/>
</field>

<field name="Description" type="descriptionClob">
  <description>
    Description for the Competency.
  </description>
  <display/>
</field>

<field name="Inactive" type="boolean">
  <description>
    Indicates that the object should not be selectable in the gui.
  </description>
</field>

</page>

<select name="Reference" type="single">
  <selection field="Reference"/>
</select>

<select name="Context">
  <selection field="Reference" table="Context"
path="commitments.context"/>
</select>

<select name="Category">
  <selection field="CompetencyCategories" />
</select>

<select name="Organization">
  <selection field="Reference" table="Organization"
path="organizations"/>
</select>

</table>
```

Table definition : CompetencyCategory.table

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<!DOCTYPE table SYSTEM "equanda.dtd">

<table name="CompetencyCategory" expected-amount="small" category="tables.Settings">

  <description>
    An competency category allows grouping competencies in categories, for
    easier browsing.
  </description>

  <data-filter name="ApplicationDomain"><filter-query
where="o.applicationDomain.reference=${}"/></data-filter>

  <page name="ALL">

    <field name="Title" type="titleString">
      <description>
        Title for the category.
      </description>
    </field>

  </page>

  <page>

    <field name="ApplicationDomains" type="ApplicationDomain">
      <description>
        Application domain for which this category is applicable.
      </description>
      <multiple/>
    </field>

    <field name="Description" type="descriptionClob">
      <description>
        Description for the category.
      </description>
      <display/>
    </field>

  </page>

  <select name="Title">
    <selection field="Title"/>
  </select>

</table>
```

Table definition : CompetencyPlan.table

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<!DOCTYPE table SYSTEM "equanda.dtd">

<table name="CompetencyPlan" expected-amount="medium" category="tables.Main">

  <description>
    A plan which lists the desired competencies (expressed as tasks) for a
    set of people. Each person can have different target competencies.
  </description>
```

```
<data-filter name="Organization"><filter-query
where="o.organization.reference=${}" /></data-filter>
<data-filter name="InactiveFilter"><filter-query
where="o.inactive=0" /></data-filter>

<page name="ALL">

  <field name="Reference" type="referenceString">
    <description>Reference for the competency plan.</description>
  </field>

  <field name="Title" type="titleString">
    <description>
      Competency plan title.
    </description>
  </field>

</page>

<page>

  <field name="Organization" type="organization">
    <description>
      Organization for which this plan is applicable.
    </description>
  </field>

  <field name="MatchProfile" type="MatchProfile">
    <description>Match profile to use for the competency
plan.</description>
  </field>

  <field name="Description" type="descriptionClob">
    <description>
      Description for the Competency.
    </description>
    <display/>
  </field>

  <field name="Assignments" type="CompetencyPlanAssignment">
    <description>
      List of users and the tasks they should have all the required
competencies for.
    </description>
    <link-name>Plan_Assignment</link-name>
    <multiple/>
    <embedded/>
  </field>

  <field name="Inactive" type="boolean">
    <description>
      Indicates that the object should not be selectable in the gui.
    </description>
  </field>

</page>

<!-- @todo need finder on person + reverse finders -->

<select name="Reference" type="single">
```

```
<selection field="Reference"/>
</select>

<select name="Active">
  <selection field="Inactive" test="=0"/>
</select>

</table>
```

Table definition : CompetencyPlanAssignment.table

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<!DOCTYPE table SYSTEM "equanda.dtd">

<table name="CompetencyPlanAssignment" expected-amount="large" cate-
gory="tables.Main">

  <description>
    Assignments for a person as part of a competency plan.
  </description>

  <page name="ALL">
    <field name="Plan" type="CompetencyPlan">
      <description>
        CompetencyPlan this assignment is part of.
      </description>
      <link-name>Plan_Assignment</link-name>
      <constraints>
        <required/>
      </constraints>
    </field>
  </page>

  <page>

    <field name="Task" type="Artefact">
      <description>
        List of users and the tasks they should have all the required
        competencies for.
      </description>
      <constraints>
        <required/>
        <compare test="type" value="TaskArtefact"/>
      </constraints>
      <display/>
    </field>

    <field name="Persons" type="Artefact">
      <description>
        Person for whom the desired tasks are registered.
      </description>
      <link-name>Assignment_Person</link-name>
      <multiple/>
      <constraints>
        <required/>
        <compare test="type" value="PersonArtefact"/>
      </constraints>
      <display/>
    </field>

  </page>
```

```
<hide/>
```

```
</table>
```

Table definition : Context.table

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<!DOCTYPE table SYSTEM "equanda.dtd">

<table name="Context" expected-amount="medium" category="tables.Main">

  <description>
    In an application domain, the actual competencies are modelled inside
    a specific context.
  </description>

  <data-filter name="Organization"><filter-query from="IN (o.organizations)
org" where="org.reference=${}"/></data-filter>
  <data-filter name="ApplicationDomain"><filter-query
where="o.applicationDomain.reference=${}"/></data-filter>

  <page name="ALL">

    <field name="Reference" type="referenceString">
      <constraints>
        <required/>
      </constraints>
    </field>

    <field name="Title" type="titleString">
      <description>
        Title for the context.
      </description>
    </field>

  </page>

  <page>

    <field name="Organizations" type="organizations">
      <description>
        Organizations for which this context is applicable.
      </description>
    </field>

    <field name="ApplicationDomains" type="ApplicationDomain">
      <description>
        Application domain for which this context is applicable.
      </description>
      <multiple/>
    </field>

    <field name="Description" type="descriptionClob">
      <description>
        Description for the context.
      </description>
      <display/>
    </field>

    <field name="Ontology" type="uri">
```

```
        <description>
            Location where the ontology can be found. This uri is also
            used to determine how the commitment can be defined.
        </description>
    </field>

</page>

<select name="Reference" type="single">
    <selection field="Reference"/>
</select>

</table>
```

Table definition : Criterion.table

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<!DOCTYPE table SYSTEM "equanda.dtd">

<table name="Criterion" expected-amount="small" category="tables.Main">

    <description>
        Possible non-competency related criteria which may be important for
        the matcher.
    </description>

    <page name="ALL">

        <field name="Reference" type="referenceString">
            <constraints>
                <required/>
            </constraints>
        </field>

        <field name="Title" type="titleString">
            <description>
                Title for the organization.
            </description>
        </field>

    </page>

    <page>

        <field name="Description" type="descriptionClob">
            <description>
                Description for the Competency.
            </description>
            <display/>
        </field>

        <field name="Scores" type="CriterionScore">
            <description>
                Possible choices for this Criterion.
            </description>
            <link-name>CriterionScore</link-name>
            <multiple/>
        </field>

    </page>
```

```
<select name="Reference" type="single">
  <selection field="Reference"/>
</select>

</table>
```

Table definition : CriterionScore.table

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<!DOCTYPE table SYSTEM "equanda.dtd">

<table name="CriterionScore" expected-amount="medium" cate-
gory="tables.Settings">

  <description>
    A possible value for a Criterion, which can be used to compare.
  </description>

  <page name="ALL">

    <field name="Criterion" type="Criterion">
      <description>
        Criterion for which this score is applicable.
      </description>
      <link-name>CriterionScore</link-name>
      <constraints>
        <required/>
      </constraints>
    </field>

    <field name="Title" type="titleString">
      <description>
        Name for the score.
      </description>
      <!-- @todo should be unique for the Criterion -->
    </field>

  </page>

  <page>

    <field name="Value" type="double">
      <description>
        Value for the scale, should be between 0 and 1 and is used to
        compare scores, 1 is the best allows most.
      </description>
    </field>

  </page>

</table>
```

Table definition : DeltaProficiencyCompetency.table

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<!DOCTYPE table SYSTEM "equanda.dtd">

<table name="DeltaProficiencyCompetency" expected-amount="large" cate-
gory="tables.Maintenance">

  <description>
    A delta proficiency competency is a competency which also contains a
```

```
before and after proficiency level indication or score.
</description>

<page>

    <field name="Competency" type="Commitment">
        <description>
            Weighed competency, to be assigned in an artefact as embedded
details for competencies.
        </description>
        <constraints>
            <required/>
        </constraints>
        <display/>
    </field>

    <group name="DeltaProficiencyScore">
        <field name="PrerequisiteLevel" type="double">
            <description>
                Value which need to be acquired beforehand.
                Only relevant when there is no Score.
            </description>
            <display/>
        </field>
        <field name="PrerequisiteScore" type="Score">
            <description>
                The level which should be acquired beforehand.
                If the competency has a with discrete values, then the
score should be used to assign a value.
                {note}Only scores which are attached to the selected com-
petency should be allowed.{note}
            </description>
            <display/>
            <!-- @todo these should be restricted to the scores that match
the assigned competency -->
        </field>

        <field name="ObjectiveLevel" type="double">
            <description>
                Value which should to be acquired at the end (not veri-
fied).
                Actual value, only relevant when there is no Score.
            </description>
            <display/>
        </field>
        <field name="ObjectiveScore" type="Score">
            <description>
                After score, the level which should be acquired afterwards
(not verified).
                If the competency has a with discrete values, then the
score should be used to assign a value.
                {note}Only scores which are attached to the selected com-
petency should be allowed.{note}
            </description>
            <display/>
            <!-- @todo these should be restricted to the scores that match
the assigned competency -->
        </field>
    </group>
```

```
</page>
<hide/>
</table>
```

Table definition : LearningArtefact.table

```
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE table SYSTEM "equanda.dtd">

<table name="LearningArtefact" type="LEAR" expected-amount="medium" cate-
gory="tables.Main">

  <description>
    An learning artefact indicates a link to a learning object outside of
    the competency world, but which can have a competency profile attached to it.
  </description>

  <template parent="Artefact"/>
  <default-instance/>

  <page>

    <field name="LearningArtefactKind" type="LearningArtefactKind">
      <description>Indicates the kind of object the (learning) artefact
      represents.</description>
    </field>

    <field name="LearningCompetencies" type="DeltaProficiencyCompetency">
      <description>
        The competencies which apply for this learning object, with
        both the before (should be acquired (at minimum the specified level) before
        starting the learning object) and after (what the end result for the compe-
        tency is).
      </description>
      <multiple/>
      <embedded/>
    </field>

    <group name="Content">
      <field name="ContentUrl" type="uri">
        <description>Points to the learning content.</description>
      </field>
      <field name="ContentType" type="LearningContentType"/>
      <field name="ContentCachable" type="boolean">
        <description>
          When true client applications are allowed to cache the
          content for display/execution.
        </description>
      </field>
    </group>

  </page>

  <select name="Learning">
    <description>Select all learning artefacts.</description>
  </select>

</table>
```

Table definition : LearningArtefactKind.table

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<!DOCTYPE table SYSTEM "equanda.dtd">

<table name="LearningArtefactKind" expected-amount="small" cate-
gory="tables.Main">

  <description>
    Indicates the type of object the (learning) artefact represents.
  </description>

  <data-filter name="Organization"><filter-query from="IN (o.organizations)
org" where="org.reference=${}" /></data-filter>

  <page name="ALL">

    <field name="Reference" type="referenceString">
      <constraints>
        <required/>
      </constraints>
    </field>

    <field name="Title" type="titleString">
      <description>
        Title for the learning artefact kind.
      </description>
    </field>

  </page>

  <page>

    <field name="Organizations" type="organizations">
      <description>
        Organizations for which this learning artefact kind is appli-
cable.
      </description>
    </field>

    <field name="Description" type="descriptionClob">
      <description>
        Description for the learning artefact kind.
      </description>
      <display/>
    </field>

    <field name="ExcludeFromPersonTaskMatching" type="boolean">
      <description>
        When this is indicated, then the artefacts of this kind should
not be included in the result when
        doing person-task matching.
      </description>
    </field>

    <field name="ExcludeFromCompetencyPlanMatching" type="boolean">
      <description>
        When this is indicated, then the artefacts of this kind should
not be included in the result when
        doing competency plan matching.
      </description>
```

```
        </field>

    </page>

    <select name="Reference" type="single">
        <selection field="Reference"/>
    </select>

</table>
```

Table definition : LearningContentType.table

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<!DOCTYPE table SYSTEM "equanda.dtd">

<table name="LearningContentType" expected-amount="small" cate-
gory="tables.Main">

    <description>
        Indicates the type of learning content as pointed to by the content url
        in a learning artefact.
    </description>

    <data-filter name="Organization"><filter-query from="IN (o.organizations)
org" where="org.reference=${}"/></data-filter>

    <page name="ALL">

        <field name="Reference" type="referenceString">
            <constraints>
                <required/>
            </constraints>
        </field>

        <field name="Title" type="titleString">
            <description>
                Title for the learning content type.
            </description>
        </field>

    </page>

    <page>

        <field name="Organizations" type="organizations">
            <description>
                Organizations for which this learning artefact kind is appli-
                cable.
            </description>
        </field>

        <field name="Description" type="descriptionClob">
            <description>
                Description for the learning artefact kind.
            </description>
            <display/>
        </field>

    </page>

    <select name="Reference" type="single">
```

```
<selection field="Reference"/>
</select>

</table>
```

Table definition : MatchProfile.table

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<!DOCTYPE table SYSTEM "equanda.dtd">

<table name="MatchProfile" expected-amount="small" category="tables.Main">

  <description>
    Match profile which is used for both evidence resolution and matching.
  </description>

  <data-filter name="Organization"><filter-query from="IN (o.organizations)
org" where="org.reference=${}" /></data-filter>

  <page name="ALL">

    <field name="Reference" type="referenceString">
      <constraints>
        <required/>
      </constraints>
    </field>

    <field name="Title" type="titleString">
      <description>
        Title for the profile.
      </description>
    </field>

  </page>

  <page>

    <field name="Organizations" type="organizations">
      <description>
        Organizations for which this assessment method is applicable.
      </description>
    </field>

    <field name="AssessmentThreshold" type="double">
      <description>
        The minimum assessment level for a competency to be included
during evidence destillation.
      </description>
      <default>0.5</default>
    </field>

    <field name="ConfidenceThreshold" type="double">
      <description>
        The minimum assessment method confidence value for an assess-
ment to be included during evidence destillation.
      </description>
      <default>0.5</default>
    </field>

    <field name="DirectMatchMultiplier" type="double">
      <description>
```

```
Multiplier which should be applied to the confidence rating
for direct matching.
The value should be in the [0..1].
Direct matching is not considered when the value is 0.
</description>
<constraints>
  <compare test="&lt;=" value="1.0"/>
  <compare test="&gt;" value="0"/>
</constraints>
<default>1.0</default>
</field>

<field name="SemanticMatchMultiplier" type="double">
  <description>
    Multiplier which should be applied to the confidence rating
for semantic matching.
The value should be in the [0..1].
Semantic matching is not considered when the value is 0.
  </description>
  <constraints>
    <compare test="&lt;=" value="1.0"/>
    <compare test="&gt;=" value="0.0"/>
  </constraints>
  <default>0.0</default>
</field>

<group name="Relevancy">
  <field name="RelevancyGraceDaysDefault" type="int">
    <description>
      Period (in days) before competency degradation starts.
      This may be overwritten by settings in the competency.
      When both grace and degrade are zero, there is no compe-
tency degradation.
    </description>
    <constraints>
      <compare test="&gt;=" value="0"/>
    </constraints>
  </field>
  <field name="RelevancyDegradeDaysDefault" type="int">
    <description>
      Period (in days, after the grace period) that the rele-
vance degrades linearly.
      This may be overwritten by settings in the competency.
      When both grace and degrade are zero, there is no compe-
tency degradation.
    </description>
    <constraints>
      <compare test="&gt;=" value="0"/>
    </constraints>
  </field>
</group>

<group name="Fluency">
  <field name="FluenceGraceCountDefault" type="int">
    <description>
      Number of occurrences which do not influence the fluency
factor.
    </description>
    <constraints>
      <compare test="&gt;" value="0"/>
    </constraints>
  </field>
</group>
```

```
        </constraints>
        <default>1</default>
    </field>
    <field name="FluencyAddDefault" type="double">
        <description>
            Amount to add to the fluency for each occurrence after the
            grace count.
        </description>
        <constraints>
            <compare test=">=" value="0.0"/>
        </constraints>
    </field>
    <field name="FluencyIncHigherProficiency" type="boolean">
        <description>
            Should higher proficiency levels also be considered when
            counting the occurrences?
        </description>
        <default>>true</default>
    </field>
</group>

    <field name="MatchProfileWorker" length="120">
        <description>Classname for the matching profile implementation. A
            prefix of "be.synergetics.ca.matcher.profile." is added when needed to instan-
            tiate the class.</description>
        <choice name="MPW_AVERAGE_PROFICIENCY"
            value="AverageProficiencyProfileWorker"><description>Uses the average of the
            proficiency levels, not considering other factors</description></choice>
        <choice name="MPW_HIGHEST_PROFICIENCY"
            value="HighestProficiencyProfileWorker"><description>Uses the highest profi-
            ciency level, not considering other factors</description></choice>
        <choice name="MPW_HIGHEST_CONFIDENCE"
            value="HighestConfidenceProfileWorker"><description>Uses the match competency
            with the highest confidence rating</description></choice>
        <choice name="MPW_HIGHEST_RELEVANCY"
            value="HighestRelevancyProfileWorker"><description>Uses the match competency
            with the highest relevancy factor</description></choice>
        <choice name="MPW_CONFIDENCE_WEIGHTED"
            value="ConfidenceWeightedProfileWorker"><description>Uses the weighted average
            of the proficiency levels, with weights based on the confidence rat-
            ing</description></choice>
        <choice name="MPW_RELEVANCY_WEIGHTED"
            value="RelevancyWeightedProfileWorker"><description>Uses the weighted average
            of the proficiency levels, with weights based on the relevancy fac-
            tor</description></choice>
        <choice name="MPW_AVERAGE_WITH_FLUENCY"
            value="AverageWithFluencyProfileWorker"><description>Uses the average of the
            proficiency levels, and assigns a fluency factor</description></choice>
        <choice name="MPW_WEIGHTED_AVERAGE_WITH_FLUENCY"
            value="WeightedAverageWithFluencyProfileWorker"><description>Uses the weighted
            average of the proficiency levels, with weights based on the relevancy factor,
            and assigns a fluency factor</description></choice>
        <choice name="MPW_HIGHEST_WITH_FLUENCY"
            value="HighestWithFluencyProfileWorker"><description>Uses the highest profi-
            ciency level, and assigns a fluency factor</description></choice>
        <default>MPW_HIGHEST_PROFICIENCY</default>
        <constraints>
            <required/>
        </constraints>
    </field>
```

```
<field name="Parameters" type="clob">
  <description>Parameters for the mathing profile implementa-
tion.</description>
</field>
</page>

<page>
  <field name="MaxResults" type="int">
    <description>
      The maximum number of match results to return
    </description>
    <default>10</default>
  </field>
  <field name="ConfidenceWeight" type="double">
    <description>
      The impact of the confidence ratings (if defined) on the over-
all match score.
      This should be a double in the interval [0-1].
      0 (default) means no impact, 1 means full impact.
    </description>
    <default>0.0</default>
  </field>
  <field name="RelevancyWeight" type="double">
    <description>
      The impact of the relevancy factors (if defined) on the over-
all match score.
      This should be a double in the interval [0-1].
      0 (default) means no impact, 1 means full impact.
    </description>
    <default>0.0</default>
  </field>
  <field name="FluencyWeight" type="double">
    <description>
      The impact of the fluency factors (if defined) on the overall
match score.
      This should be a double in the interval [0-1].
      0 (default) means no impact, 1 means full impact.
    </description>
    <default>0.0</default>
  </field>

</page>

<action name="getMatchingProfile" re-
turn="be.synergetics.ca.matcher.MatchProfileWorker">
  <description>Get the initialised matching profile instance defined by
this record.</description>
</action>

<select name="Reference" type="single">
  <selection field="Reference"/>
</select>

<select name="Organization">
  <selection field="Reference" path="organizations" ta-
ble="Organization"/>
</select>

</table>
```

Table definition : Organization.table

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<!DOCTYPE table SYSTEM "equanda.dtd">

<table name="Organization" expected-amount="small" category="tables.Main">

  <page name="ALL">

    <field name="Reference" type="referenceString">
      <constraints>
        <required/>
      </constraints>
    </field>

    <field name="Name" type="titleString">
      <description>
        Name for the organization.
      </description>
    </field>

  </page>

  <page>

    <include file="include/address.xml"/>

    <field name="SelfAssessmentMethod" type="AssessmentMethod">
      <description>
        Which assessment method should be considered as self-
assessment for the PersonRoleAssessment page.
      </description>
    </field>

    <field name="Reindex" type="boolean">
      <description>
        True if the match index for this organization needs to be re-
built
      </description>
      <hide/>
      <default>>false</default>
    </field>

    <field name="ReindexProgress" type="double">
      <description>
        Keeps track of re-indexing progress if Reindex is set to true
      </description>
      <hide/>
      <default>1</default>
    </field>

  </page>

  <cascade-keep/>

  <select name="Reference" type="single">
    <selection field="Reference"/>
  </select>

  <select name="NamePart">
```

```
<selection field="Name" test="like %?%"/>
</select>

<select name="Reindex">
  <selection field="Reindex"/>
</select>
</table>
```

Table definition : PersonArtefact.table

```
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE table SYSTEM "equanda.dtd">

<table name="PersonArtefact" type="PERS" expected-amount="medium" cate-
gory="tables.Main">

  <description>
    An person artefact indicates a link to a physical person,
    but which can have a competency profile attached to it.
  </description>

  <template parent="Artefact"/>

  <page>

    <group name="Assignments">
      <field name="AssignedRoles" type="Artefact">
        <description>List of assigned tasks and/or roles for this per-
son</description>
        <multiple/>
        <constraints>
          <compare test="type" value="TaskArtefact"/>
        </constraints>
      </field>
    </group>

    <group name="PersonInfo">
      <field name="PersonFirstName" length="32">
        <description>Phone number</description>
      </field>
      <field name="PersonName" length="32">
        <description>Phone number</description>
      </field>
      <include file="include/address.xml"/>
      <field name="Birthdate" type="date">
        <description>Birthdate for the person.</description>
      </field>
      <field name="Portfolio" type="uri">
        <description>
          Location of the e-portfolio for this person.
        </description>
      </field>
      <field name="Gender" length="1">
        <description>The gender is the official current gender of a
natural person. This can be affected by a gender changing operation. This
field is not affected by the Y-chromosome count (use field sex for that). When
in doubt, gender is the preferred field to indicate gender/sex.</description>
        <choice name="GENDER_MALE" value="M">
          <description>Male gender.</description>
        </choice>
        <choice name="GENDER_FEMALE" value="F">
```

```

        <description>Female gender.</description>
    </choice>
    <choice name="GENDER_UNKNOWN" value="?">
        <description>Unknown gender.</description>
    </choice>
    <constraints>
        <required/>
    </constraints>
    <default>GENDER_UNKNOWN</default>
</field>
<field name="Ethnicity">
    <description>Ethnic information for the person.</description>
</field>
<field name="Language">
    <description>Language information for the per-
son.</description>
</field>
</group>

</page>

<select name="PersonReference" type="single">
    <selection field="Reference"/>
</select>

<select name="Persons">
    <description>Select all person artefacts.</description>
</select>

<action name="getCompetencyProfile" re-
turn="java.util.List<be.synergetics.ca.matcher.MatchCompetency>";>
    <description>Get person's competency profile based on evidence resolu-
tion.</description>
    <parameter type="String" name="matchProfileReference">
        <description>Reference for the MatchProfile to use.</description>
    </parameter>
</action>

</table>

```

Table definition : ProficiencyCompetency.table

```

<?xml version="1.0" encoding="ISO-8859-1"?>
<!DOCTYPE table SYSTEM "equanda.dtd">

<table name="ProficiencyCompetency" expected-amount="large" cate-
gory="tables.Maintenance">

    <description>
        A proficiency competency is a competency which also contains a profi-
ciency level indication or score.
    </description>

    <page>

        <field name="Competency" type="Commitment">
            <description>
                Competency (in context) which is Weighed, to be assigned in an
artefact as embedded details for competencies.
            </description>
            <constraints>

```

```

        <required/>
    </constraints>
    <display/>
</field>

<group name="ProficiencyScore">
<field name="ProficiencyLevel" type="double">
    <description>
        Actual value, only relevant when there is no Score.
    </description>
    <display/>
</field>

    <field name="ProficiencyScore" type="Score">
    <description>
        If the competency has a discrete values, then the score should
be used to assign a value.
        {note}Only scores which are attached to the selected compe-
tency should be allowed.{note}
    </description>
    <display/>
    <!-- @todo these should be restricted to the scores that match the
assigned competency -->
    </field>
</group>

</page>

<hide/>

<action name="linkDogTagger" return="java.net.URL">
    <description>
        Allows the definition of the link with the semantic definition us-
ing Starlab's dogtagger.
    </description>
</action>

</table>

```

Table definition : Scale.table

```

<?xml version="1.0" encoding="ISO-8859-1"?>
<!DOCTYPE table SYSTEM "equanda.dtd">

<table name="Scale" expected-amount="medium" category="tables.Settings">

    <description>
        A scale gives a ApplicationData specific way of assigning proficiency
levels.
    </description>

    <data-filter name="Organization"><filter-query from="IN (o.organizations)
org" where="org.reference=${}"/></data-filter>
    <data-filter name="ApplicationDomain"><filter-query
where="o.applicationDomain.reference=${}"/></data-filter>

    <page name="ALL">

        <field name="Reference" type="referenceString">
            <constraints>
                <required/>

```

```
        </constraints>
    </field>

    <field name="Title" type="titleString">
        <description>
            Title for the scale.
        </description>
    </field>

</page>

<page>

    <field name="Organizations" type="organizations">
        <description>
            Organizations for which this scale is applicable.
        </description>
    </field>

    <field name="ApplicationDomains" type="ApplicationDomain">
        <description>
            Application domain for which this scale is applicable.
        </description>
        <multiple/>
    </field>

    <field name="Description" type="descriptionClob">
        <description>
            Description for the scale.
        </description>
        <display/>
    </field>

    <field name="MinimumValue" type="double">
        <description>
            Lowest (inclusive) allowed value for the scale.
        </description>
        <default>0.0</default>
    </field>

    <field name="MaximumValue" type="double">
        <description>
            Highest (inclusive) allowed value for the scale.
        </description>
        <default>1.0</default>
    </field>

    <field name="Discrete" type="boolean">
        <description>
            If the scale is discrete, then only the use of "score" records
            is allowed as value. In that case the values can be given names.
            This is automatically determined by the existence of actual
            score values.
        </description>
        <calculated/>
    </field>

    <field name="AllowedValues" type="Score">
        <description>
            Allowed values for the scale. When any exist, than not other
```

```
values are allowed for the scale as exist here.
    </description>
    <link-name>Score</link-name>
    <multiple/>
    <embedded/>
  </field>

</page>

<select name="Reference" type="single">
  <selection field="Reference"/>
</select>

</table>
```

Table definition : Score.table

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<!DOCTYPE table SYSTEM "equanda.dtd">

<table name="Score" expected-amount="medium" category="tables.Settings">
  <description>
    A score is a distinct value which can be assigned to a scale.
  </description>

  <page name="ALL">

    <field name="Title" type="titleString">
      <description>
        Title for the score.
      </description>
      <!-- @todo should be unique for the scale -->
    </field>

  </page>

  <page>

    <field name="Scale" type="Scale">
      <description>
        Scale for which this score is applicable.
      </description>
      <link-name>Score</link-name>
      <constraints>
        <required/>
      </constraints>
    </field>

    <field name="Commitments" type="ScoreCommitment">
      <description>
        Commitments for this score.
      </description>
      <link-name>Score_ScoreCommitment</link-name>
      <cascade-delete/>
      <hide/>
    </field>

    <field name="Description" type="descriptionClob">
      <description>
        Description for the score.
      </description>
```

```
        <display/>
    </field>

    <field name="Value" type="double">
        <description>
            Value for the scale, should be between minimum and maximum al-
            lowed values for the scale.
        </description>
    </field>

</page>

</table>
```

Table definition : ScoreCommitment.table

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<!DOCTYPE table SYSTEM "equanda.dtd">

<table name="ScoreCommitment" expected-amount="small" cate-
category="tables.Settings">

    <description>
        A commitment for a specific score (or the scores for a possible compe-
        tency commitment).
    </description>

    <page name="ALL">

        <field name="Score" type="Score">
            <description>
                Score for which this is a specific commitment.
            </description>
            <link-name>Score_ScoreCommitment</link-name>
            <constraints>
                <required/>
            </constraints>
        </field>

        <field name="Competency" type="Commitment">
            <description>
                Competency (and context) for which this score is applicable.
            </description>
            <link-name>Competency_ScoreCommitment</link-name>
            <constraints>
                <required/>
            </constraints>
        </field>

    </page>

    <page>

        <field name="Description" type="descriptionClob">
            <description>
                Description for the score.
            </description>
            <display/>
        </field>

        <field name="Value" type="double">
```

```

        <description>
            Value for the scale, should be between minimum and maximum al-
            lowed values for the scale.
        </description>
    </field>

    <field name="Commitment" type="uri">
        <description>
            Location where the semantical commitment can be found. This
            uri is also used to determine how the commitment can be defined.
            It is normally based on the ontology for the context.
            IN principle this is only filled if the scale is continuous,
            otherwise the commitment should be specific for each possible score.
        </description>
    </field>

</page>
</table>

```

Table definition : TaskArtefact.table

```

<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE table SYSTEM "equanda.dtd">

<table name="TaskArtefact" type="TASK" expected-amount="medium" cate-
gory="tables.Main">

    <description>
        A task artefact indicates an artefact for which some competencies are
        required.
    </description>

    <template parent="Artefact"/>

    <page>

        <field name="TaskArtefactKind" type="TaskArtefactKind">
            <description>Indicates the kind of object the (task) artefact
            represents.</description>
        </field>

        <field name="RequiredCompetencies" type="ProficiencyCompetency">
            <description>
                The competencies which are required (at minimum the specified
                level) for handling this task.
            </description>
            <multiple/>
            <embedded/>
        </field>

    </page>

    <select name="Tasks">
        <description>Select all task artefacts</description>
    </select>

</table>

```

Table definition : TaskArtefactKind.table

```

<?xml version="1.0" encoding="ISO-8859-1"?>

```

```
<!DOCTYPE table SYSTEM "equanda.dtd">
<table name="TaskArtefactKind" expected-amount="small" category="tables.Main">
  <description>
    Indicates the kind of object the (task) artefact represents.
  </description>
  <data-filter name="Organization"><filter-query from="IN (o.organizations)
org" where="org.reference=${}" /></data-filter>
  <page name="ALL">
    <field name="Reference" type="referenceString">
      <constraints>
        <required/>
      </constraints>
    </field>
    <field name="Title" type="titleString">
      <description>
        Title for the task artefact kind.
      </description>
    </field>
  </page>
  <page>
    <field name="Organizations" type="organizations">
      <description>
        Organizations for which this task artefact kind is applicable.
      </description>
    </field>
    <field name="Description" type="descriptionClob">
      <description>
        Description for the task artefact kind.
      </description>
      <display/>
    </field>
  </page>
  <select name="Reference" type="single">
    <selection field="Reference"/>
  </select>
</table>
```

Table definition : User.table

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<!DOCTYPE table SYSTEM "equanda.dtd">
<table name="User" type="USER" category="tables.Settings">
  <template parent="EquandaUser"/>
  <default-instance force="true"/>
  <description>
```

A user can include the organization, to make sure this is always known.

```
</description>
```

```
<page>
```

```
  <field name="Organization" type="Organization">
```

```
    <description>
```

```
      Organization this user is part of.
```

```
    </description>
```

```
  </field>
```

```
</page>
```

```
<select name="Organization">
```

```
  <description>
```

```
    Get the users for a specific organization
```

```
  </description>
```

```
  <selection field="Reference" table="Organization"/>
```

```
</select>
```

```
</table>
```

Table definition : WeighedCompetency.table

```
<?xml version="1.0" encoding="ISO-8859-1"?>
```

```
<!DOCTYPE table SYSTEM "equanda.dtd">
```

```
<table name="WeighedCompetency" expected-amount="large" category="tables.Maintenance">
```

```
  <description>
```

```
    A weighed competency is a competency which also contains a weight to indicate importance when combining.
```

```
  </description>
```

```
  <page>
```

```
    <field name="Parent" type="Commitment">
```

```
      <description>
```

```
        Competency which combines this one.
```

```
      </description>
```

```
      <link-name>Competency_WeighedCompetency</link-name>
```

```
    </field>
```

```
    <field name="Competency" type="Commitment">
```

```
      <description>
```

```
        Weighed competency, to be assigned in an artefact as embedded details for competencies.
```

```
      </description>
```

```
      <constraints>
```

```
        <required/>
```

```
      </constraints>
```

```
      <display/>
```

```
    </field>
```

```
    <group name="MinimumProficiencyScore">
```

```
      <field name="MinimumProficiencyLevel" type="double">
```

```
        <description>
```

```
          Actual value, only relevant when there is no Score.
```

```
        </description>
```

```
        <display/>
    </field>

    <field name="MinimumProficiencyScore" type="Score">
        <description>
            If the competency has a scale with discrete values, then
the score should be used to assign a value.
            This is the minimum allowed score for the competency.
            {note}Only scores which are attached to the selected com-
mitment should be allowed.{note}
        </description>
        <display/>
    </field>
</group>

<field name="Weight" type="double">
    <description>
        Actual value, only relevant when there is no Score.
    </description>
    <default>1.0</default>
    <display/>
</field>

<field name="Required" type="string" length="1">
    <description>
        Indication whether this competency is required within the par-
ent.
    </description>
    <choice name="REQUIRED_NO" value="N"><description>Just use weight
to combine.</description></choice>
    <choice name="REQUIRED_COMPETENCY"
value="C"><description>Competency is required, but proficiency level may be
lower (affects match score).</description></choice>
    <choice name="REQUIRED_LEVEL" value="L"><description>Competency
has to be available at the minimum proficiency level or there is no
match.</description></choice>
    <default>REQUIRED_NO</default>
    <constraints>
        <required/>
    </constraints>
</field>

</page>

<hide/>

</table>
```

N Appendix, graphical user interface direct access

To access these (as the rest of the application, including the web services), https and (basic) authentication are required.

If you try to access using the http protocol, you are automatically redirected.

The data in the CA is partitioned. What is visible depends on the organization to which the logged in user belongs. For testing purposes, it is possible to login using "test"/"test" as credentials.

Normal user interface access is at the address

<https://prolixdev3.prolix-dev.de/ca/gui/>

Create/edit competency profile

Allow creation of an artefact, possibly including a parent artefact and allows the user to edit or define the competency profile for that artefact.

This can be done using the following URL :

[https://prolixdev3.prolix-dev.de/ca/gui/updateProfile/TYPE/REF?title=TITLE&kind=KIND
&parent=PARREF&parentTitle=PARTITLE&parentType=PARTYPE&parentKind=PARKIND](https://prolixdev3.prolix-dev.de/ca/gui/updateProfile/TYPE/REF?title=TITLE&kind=KIND&parent=PARREF&parentTitle=PARTITLE&parentType=PARTYPE&parentKind=PARKIND)

The words in all capitals need to be replaced by their proper value.

The query parameters may be omitted when not needed (like all the parent stuff).

The URL is displayed on two lines for readability only, it should all be on one line.

Parameters :

- TYPE : artefact type : should be "TASK" for task artefacts like BPC functions or roles, or "LEAR" for learning objects.
- REF : artefact reference : when no artefact with this reference exists, a new one is created of the given type. if it already exists, the type is not considered.
- TITLE : artefact title : if this parameter is specified and the artefact already existed, then the title is overwritten.
- KIND : artefact kind : a sub-type for the artefact. This is the reference of either a TaskArtefactKind or a LearningArtefactKind record which details the kind of task/learning artefact which is used. If this parameter is specified and the artefact kind was already set, then the kind is overwritten.
- PARREF : parent artefact : when this parameter is given then the (REF) artefact is linked as child to the parent artefact. The reference is searched. If not found it is created.
- PARTYPE : parent type : type for the parent artefact when it needs to be created. This can be "TASK" (typically for a role, but it may be any other task artefact), or "LEAR" when the parent is a learning object, or "PERS" if the parent artefact is a person.
- PARTITLE : parent title : title for the parent object. When this parameter is specified, the title for the parent artefact is updated to be what was specified.
- PARKIND : parent artefact kind : a sub-type for the artefact. This is the reference of either a TaskArtefactKind or a LearningArtefactKind record which details the kind of task/learning artefact which is used as parent. If this parameter is specified and the artefact kind was already set on the parent, then it is overwritten.

View combined artefact profile

Allow display of the combined profile for an artefact. Specifically this displays the combined competency profile for the artefact and all the children.

This can be done using the following URL :

<https://prolixdev3.prolix-dev.de/ca/gui/combinedProfile/REF>

The words in all capitals need to be replaced by their proper value.
The query parameters may be omitted when not needed (like all the parent stuff).

Parameters :

- REF : artefact reference : the artefact reference for which the combined profile needs to be visualized.

Create/edit competency plan

Allow creation of a competency plan, possibly setting the title.

This can be done using the following URL :

<https://prolixdev3.prolix-dev.de/ca/gui/updatePlan/REF?title=TITLE>

The words in all capitals need to be replaced by their proper value.
The query parameters may be omitted when not needed.

Parameters :

- REF : competency plan reference : when a competency plan with this reference exists, it is displayed for further editing. Otherwise a new plan is created with given reference. If you know you want a new plan but don't know the reference yet, use "NEW".
- TITLE : competency plan title : if this parameter is specified and the competency plan already existed, then the title is overwritten.

View/match competency plan

Allows a user to view the (matching of) a competency plan.

This can be done using the following URL :

<https://prolixdev3.prolix-dev.de/ca/gui/matchCompetencyPlan/REF>

The words in all capitals need to be replaced by their proper value.

Parameters :

- REF : competency plan reference : when a competency plan with this reference exists, it is displayed. Otherwise a the user will have to select an existing (or create a new) competency plan.

Match person-task

Allows a user to view the matching of a person and a task, giving the proposed learning material.

This can be done using the following URL :

<https://prolixdev3.prolix-dev.de/ca/gui/matchPersonTask/SELF?person=REF>

The words in all capitals need to be replaced by their proper value.

Parameters :

- SELF : when this has the value "self", then the first assigned task is used to match with (you still need to pass the person using (person=REF)). The part can be removed from the URL (including slash before it).
- REF : person reference : when an artefact with this reference exists, it is displayed. In that case, the person also become immutable. Otherwise a the user will have to select an existing (or create a new) person. This parameter can be removed from the URL.

Person-Role assessment

Allows a user to do either a self assessment or a general assessment on the competencies need for certain tasks for anyone.

This can be done using the following URL :

<https://prolixdev3.prolix-dev.de/ca/gui/personRoleAssessment/SELF>

The words in all capitals need to be replaced by their proper value.

Parameters :

- SELF : when this has the value "self", then the page will treat this as a self assessment, filling in the person and the assigned tasks (if any). The part can be removed from the URL (including slash before it).

O Appendix, web services

All web services have their wsdl files available in the CA application itself, see

<https://prolixdev3.prolix-dev.de/ca/ws/1.0>

The services are all accessible through https only (attempts to connect through http are redirected) and require basic authentication.

The data in the CA is partitioned. What is visible depends on the organization to which the logged in user belongs. For testing purposes, it is possible to login using "test"/"test" as credentials.

O.1.1.1 PingService

This is a simple service which can be used for testing whether accessing the services is possible.

```
String getPing();
```

Testing can be done using following java code (which uses the CXF web services libraries).

```
public void testPingService()
    throws Exception
{
    ClientProxyFactoryBean factory = new ClientProxyFactoryBean();
    factory.setServiceClass( PingService.class );
    factory.setAddress( "https://localhost:8443/ca/pxws/1.0/ping" );
    factory.getServiceFactory().setDataBinding( new AegisDataBinding() );
    PingService client = (PingService) factory.create();
    Client proxy = ClientProxy.getClient( client );

    HTTPConduit conduit = (HTTPConduit) proxy.getConduit();
    TLSClientParameters tcp = new TLSClientParameters();
    tcp.setTrustManagers( SslUtil.TRUST_MANAGERS );
    conduit.setTlsClientParameters( tcp );
    AuthorizationPolicy auth = conduit.getAuthorization();
    if ( null == auth ) auth = new AuthorizationPolicy();
    auth.setUsername( "test" );
    auth.setPassword( "test" );

    String res = client.getPing();
    assertTrue( res.startsWith( "Ping back @" ) );
}
}
```

O.1.1.2 MatchingService

This service computes the gap between a source competency profile and a target competency profile. The following methods are offered from the service:

```
LoMatchResult matchPersonTask( String personReference, String taskReference,
String matchProfileReference ) throws CaWsException;
```

Returns a list of matched learning objects and a status whether the matching filled the entire gap.

The given matching profile is used when specified, or the default if it is null.

STATUS : dummy implementation, reply is always empty

```
LoTestResult matchPersonLearningObject( String personReference, String loRefer-  
ence, String matchProfileReference ) throws CaWsException;
```

Test whether the person can gain extra competencies by absorbing a learning object and whether that user already has the necessary prerequisite competencies.

The given matching profile is used when specified, or the default if it is null.

STATUS : implemented and deployed

O.1.1.3 ArtefactService

This service enables access features which apply for all artefacts, like access to the non-competency related criteria and linking or artefacts. The following methods are offered from this service:

```
Criterion[] getCriteria( String artefactReference ) throws CaWsException;
```

Get non-competency related criteria for artefact.

STATUS : implemented and deployed

```
void addArtefactCriteria( String artefactReference, Criterion[] criteria )  
throws CaWsException;
```

Add extra non-competency related criteria to an artefact. When a criterion already existed, the score is overwritten.

STATUS : implemented and deployed

```
void deleteArtefactCriteria( String artefactReference, Criterion[] criteria )  
throws CaWsException;
```

Delete given criteria (the score is not considered) from the list of non-competency related criteria for the artefact (still succeeds when some of the criteria did not yet exist on the artefact).

STATUS : implemented and deployed

```
void addChildren( String artefactRefernce, String[] childArtefactReferences )  
throws CaWsException;
```

This allows adding linked children to a parent artefact. This can be used for example to add all the functions which are applicable for a role in the business process modeller.

STATUS : implemented and deployed

```
void unlinkChildren( String artefactRefernce, String[] childArtefactReferences
) throws CaWsException;
```

Unlink the given artefacts from the children list (if the were (direct) child).

STATUS : implemented and deployed

```
void removeArtefacts( String[] artefactReferences ) throws CaWsException;
```

Allows removal of given artefacts from the database. This will delete the artefact including all the links to the competencies. This should be used with great care!

STATUS : implemented and deployed

```
ArtefactInfo getInfo( String artefactReference ) throws CaWsException;
```

Get base information (reference, title and description) about the artefact with given reference.

STATUS : implemented and deployed

```
ArtefactInfo[] getInfoAll() throws CaWsException;
```

Get base information (reference, title and description) about all available artefacts.

STATUS : implemented and deployed

0.1.1.4 TaskArtefactService

This service enables modifying and retrieving competency profiles for task artefacts. The following methods are offered from this service:

```
TaskCompetencyProfile[] getCompetencyProfiles( String[] taskArtefactReferences
) throws CaWsException;
```

Get the competency profiles for a list of task artefacts.

STATUS : implemented and deployed

```
TaskCompetencyProfileWithScale[] getCompetencyProfilesWithScale( String[]
taskArtefactReferences ) throws CaWsException;
```

Get the competency profiles for a list of task artefacts. Results include details about the scale (possible proficiency levels).

STATUS : implemented and deployed

```
void updateProficiencyLevels( TaskCompetencyProfile[] profiles ) throws CaWsEx-
ception;
```

This service method allows updating the proficiency levels for the task artefact's competencies. It only modified the proficiency levels for the competencies which are passed. When the scale for a competency is discrete, then the update only succeeds if a score can be found with the given title.

STATUS : implemented and deployed

```
ArtefactInfo[] getInfoAll() throws CaWsException;
```

Get base information (reference, title and description) about all available task artefacts.

STATUS : implemented and deployed

O.1.1.5 LearningArtefactService

This service enables retrieving competency profiles for learning artefacts. The following methods are offered from this service:

```
LearningCompetencyProfile[] getCompetencyProfiles( String[] learningArtefactReferences ) throws CaWsException;
```

Get the list of learning object competency profiles.

STATUS : implemented and deployed

```
LearningArtefactInfo getInfo( String artefactReference ) throws CaWsException;
```

Get base information (reference, title, description and content info) about the learning artefact with given reference.

STATUS : implemented and deployed

```
LearningArtefactInfo[] getInfoAll() throws CaWsException;
```

Get base information (reference, title, description and content info) about all available learning artefacts.

STATUS : implemented and deployed

O.1.1.6 PersonArtefactService

This service enables retrieving the current competency profile for a person artefact, based on a match profile.

```
ProficiencyCompetency[] getPersonProfile( String personArtefactReference, String matchProfileReference) throws CaWsException;
```

Get the current competency profile (acquired competencies based on assessments). When no match profile is specified, the default profile is used.

STATUS : implemented and deployed

```
void addAssessment( String personArtefactReference, Assessment assessment )  
throws CaWsException;
```

Add a competency assessment for a person.

STATUS : implemented and deployed

0.1.1.7 CompetencyPlanService

This service gives access to the competency plan and related information.

```
CompetencyPlanInfo getInfo( String competencyPlanReference ) throws CaWsExcep-  
tion;
```

Get information about a competency plan

STATUS : implemented and deployed

```
public CompetencyPlanInfo[] getActive()throws CaWsException;
```

Get information about all the active competency plans.

STATUS : implemented and deployed

```
CpMatchResult getMatchingCourses( String competencyPlanReference ) throws  
CaWsException;
```

Get the courses which are needed to bridge the competency plan gap.

STATUS : implemented and deployed

```
CpPersonTestResult[] getPersonsForLearning( String competencyPlanReference,  
String learningReference ) throws CaWsException;
```

Get the persons who should follow the given course for this competency plan, and their compliance with the prerequisites.

STATUS : implemented and deployed

Document Control

Amendment History

Version	Baseline	Date	Author	Description/Comments
1.0		April 30, 2009	IMC	Initial version
1.1		June 30, 2009	IMC	Reordered the chapters a bit, small changes to make the document easier to read