Service Oriented Architecture for Competency-based Lifelong Learning and Personal Development

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This version contains only the introduction, terminology, and a preliminary inventory of services. Processes and use cases are to be added soon.)

Abstract

This document describes a compact framework for a service-oriented architecture for the competency data aspects of lifelong learning management systems. Lifelong learning management requires extraordinary data longevity as well as auditing and confidence management. The ability to deal with data that may come from many non-standard sources and may be based on opinion rather than objective facts has to be built into the framework. The described framework supports competency models such as would be found in a job competency profile or educational plan. It also supports the capture and storage of personal or group competency data of various levels of quality and trustworthiness. It facilitates but does not specify security and privacy protections for data as well as processes. The framework enables a number of application scenarios, such as collection of personal competency profiles, remapping of information from a curriculum vitae against a standardized competency model, matching of information from a curriculum vitae against competency requirements for a job, or skill gap analysis to determine training needs.

Introduction

Lifelong learning management requires the ability to set long term personal development goals, which can often be expressed in terms of competency goals, and to set near term objectives in the form of learning objectives to acquire the missing competencies. It also requires the ability to record and keep track of acquired competencies, based on various forms of assessment.

Unusually long life cycles

Unlike many business processes, lifelong learning requires usually long data and process management life cycles. This, in turn, requires standards that can survive not only for years but for decades, because the data and some of the associated processes must be able to survive for decades and even outlast any particular system or implementation. Proprietary systems come and go, but the data that are worth keeping must persist.

Subjective data and evolution of beliefs

Another unusual characteristic of lifelong learning management is that most of the data modeling and many of the processes have highly subjective aspects, often based on opinion rather than objective fact, and subject to evolution over time. For example, whereas in automobile parts order processing there is nothing controversial about whether a particular part number designates a particular component, or whether an order can be considered complete as soon as all the parts are accounted for and delivered, there is some controversy about what makes up, say, the competencies required of an automobile service parts counter clerk. Does the competency model for this job include cultural sensitivity? How and when does knowledge about the parts for the next year's models become a critical requirement? How do the competencies acquired while

working in an automobile dealership apply for someone looking for a job in a general automobile parts store, or when an employee is considered a promising candidate for succession planning?

Need to support imperfect data and to account for credibility

Since when it comes to competencies there are often no hard answers, and yet it is necessary to support automation, it is necessary to allow the capture of imperfect or dubious data. At the same time, of course, it must be possible to distinguish between dubious and credible data, and to keep track of how such data came into the system and of the policies used to determine credibility. For example, data that comes from a person's job application should not be given the same credibility as data from a reliable, validated assessment. At the same time, it is important to capture both data points, because policies regarding the assessment may change over time, or it may turn out that what was thought to be a valid assessment is not so valid after all and it is necessary to fall back on the next best data.

Disparate data sources

The ability to deal with data that may come from many non-standard sources and may be based on opinion or self-report rather than objective facts has to be built into the framework. For example, competency assessments can take many forms and their results may be captured in many different formats, ranging from a claim of competency in a curriculum vitae to the result set from a formal 360 degree evaluation of an employee or team. Sometimes the assessment itself is not auditable but there is a certificate or diploma that must be taken at face value as evidence of competency.

Security and privacy

The framework must also facilitate the implementation of security and privacy policies. The framework described in this document does not specify security and privacy of the data and processes, but it facilitates implementation of security and privacy protections by defining a limited number of "choke points" where protection measures can be applied to data transfers and processes. For example, to preserve privacy it may be necessary to filter out or obfuscate some information depending on the querying entity. The framework does not specify specific protection measures, because those are defined by other, more generic standards and regulations such as those that apply to repositories and transfer of personally identifiable information. The regulatory and policy constraints that govern security and privacy are also likely to evolve over time and to vary from jurisdiction to jurisdiction.

Competency models

The framework supports competency models such as those found in a job competency profile or educational plan. It must support many competency models. It must also facilitate the discovery of relationships, commonalities and differences between competency models. It must allow for imperfect, incomplete and evolving competency models, as well as for aggregate models. Finally, it must make it possible to work with "quick and dirty" ad-hoc models as well as with thoroughly researched and validated models accredited by governments, enterprises, or trade organizations. For example, the general competencies for a job don't usually change much over time, but the competencies required for specific tasks may change rapidly with the introduction of new tools or business initiatives. The framework is intended to support the requirements of both situations, as well as any combination of those requirements.

Personal and group competencies

The framework also supports the capture and storage of personal or group competency data of various levels of quality and trustworthiness. The same framework supports group competency data because in most situation group performance is as much a requirement as individual

performance. In some situations where privacy is paramount, aggregate group performance may be the only available metric to guide the learning and training plans.

Pragmatic application scenarios

The framework enables a number of application scenarios, such as collection of personal competency profiles, remapping of information from a curriculum vitae against a standardized competency model, matching of information from a curriculum vitae against competency requirements for a job, skill gap analysis to determine training needs, and so on.

Datarrhea control

The framework must support economical and pragmatic implementations. This means that the data modeling to support useful operations in practical applications must be carefully tuned avoid overwhelming transactions and service interfaces with unnecessary contextual data. It also means that the growth of data in repositories must be manageable. Experience has shown that, even though data storage costs keep falling, it is often not enough to keep up with the growth in the sheer volume of data; as a result, much important data gets lost along with the unimportant because it is too difficult to figure out the difference. Datarrhea also creates unnecessary security risks. The framework described in this document should make it possible for implementers to define retention policies or hierarchical storage rules depending on the importance of the data in supporting the core automation and query processes. For example, the raw assessment results referenced by a competency evidence record may be archived offline and eventually discarded while keeping online just a standard competency evidence record that captures the assessment summary.

Framework components

The framework defines some common terminology, services and processes. . It is impossible to write a document such as this one without settling on a specific terminology, but it is also impossible to achieve unanimity on the terminology. The field of competency in particular is fraught with quasi-religious conflicting terms and interpretations for those terms. The terms used in this document can often be interchanged with the terms used by different communities of practice. The terms that appear in this document and that may lead to confusion because they are controversial or subject to various interpretations are defined below.

Terminology

Competence – Often synonym for competency (in French there is no difference between the two terms). Competency is more frequently used in educational and training contexts in association with performance ability for specific tasks and roles, whereas Competence is frequently used in a more general sense, e.g. *Competence* means both “a sufficient amount to live on, to meet one’s needs” and “having legal or practical ability to perform.” (*The Columbia Guide to Standard American English,* by Kenneth G. Wilson. New York: Columbia University Press, 1993. www.bartleby.com/68/. [2006].)

Competency – The skills, knowledge and attitude that enable a person to perform a particular task or fulfill a particular role in an organization or in society at large. A broader definition of competency as the complete set of abilities of a person in its social context also exists, but this is usually referred to as "Competence". This document assumes the narrower, more task, job or role-specific definition which is often found in training or educational literature. This document uses "competency" in preference to "competence" because "competency" seems to be used more frequently in the training community, and usually implies something that is granular and can be assessed, whereas "competence" seems to denote a holistic ideal that is more difficult to define in operational terms.

Competency definition – A statement or set of statements that define a competency—whatever that means to the people who create the definition. Competency definitions may exist at different levels of specificity, from "Gets along with people" to "Can maintain eye contact during a conversation as appropriate for the culture of the interlocutor and without causing discomfort or anxiety". See also Reusable Competency Definition.

Education – Learning targeted toward the acquisition of general competence and the development of the whole person, with an open ended time frame—education never stops.

Experience – In this document, the life and work experience of a person or group, as one of the ways to acquire competency.

Framework –A generic term to cover a documented grouping of concepts, terms, constructs and specifications for a particular purpose.

Grade – This document avoids using the term "Grade". This is a confusing term because it is used in many different ways, e.g. to indicate a proficiency score, an reference level, the classification of a group of people according to ability, or some other administrative label or symbol assigned to a person or group independently of specific competency or abilities to represent a proficiency level, an reference level.

Learning – The process by which a person or a group acquires knew skills, knowledge and/or attitude.

Level – See Reference level, proficiency.

Model – No good definition. A generic term to cover any grouping of concepts, terms, constructs and specifications for a particular purpose. E.g. "mental model", "data model".

Proficiency – An assessed or targeted level of accomplishment or ability in regard to a particular competency definition. E.g. Sue is 75% proficient in the math competencies defined for Grade 3 in the state of Texas. Sometimes called "score", "measure", "grade" with more or less particular contextual connotations. In this document, proficiency is usually mapped to a score value.

Proficiency Level – In this document, the value that represents a measure of proficiency.

Rating – A number that expresses the level at which a particular requirement or standard is met. In this document, a rating is assumed to be a number relative to a scale in which the lowest value represents a total failure to meet the requirement and the top value represents a complete fulfillment of the requirement or standard. Ratings can be used to express levels of credibility and quality, for example. For competency related measures, see Score.

Reference level – In this document, a set or targeted level of competency, usually implying different combinations and weights of component skills, knowledge and attitude. Sometimes referred to as "level", or "grade". For example, a competency may be defined differently for novice, intermediate and expert reference levels. Depending on the competency and/or the modeling philosophy, this can take the form of three separate competency definitions, or of a single competency definition that is used in three different contexts. In each of those three contexts the required reference level is different. In this framework, proficiency is a separate metric that represents how well a person or group meets the requirements of the reference level. For example, an advanced level triathlete may be more or less proficient in target shooting, relative to the expectations of the advanced level.

Reusable competency definition – A competency definition that has a globally unique identifier and that can be reused for different people or groups, and/or in different contexts, and/or with different metrics of proficiency. Typically abbreviated as "RCD".

Reusable competency map – A graph representing the relationships between competency definitions at different levels of granularity. It may be used to show how different sub-competencies "roll up" into a larger competency, for example, or to capture the weights one assigns to the different sub-skills that make up a particular competency. A reusable competency

map can be reused for different people or groups, and/or in different contexts, and/or with different metrics of proficiency; it can also be used to represent the competency requirements for a job or role. Typically abbreviated as "RCM".

Score – A number that expresses the level at which a particular competency requirement is met. In this document, a score is assumed to be a number relative to a scale. A score is assumed to be a number relative to a scale in which the lowest value represents a total failure to meet the competency requirement and the top value represents complete satisfaction of the requirement. For measures not related to competency, see also Rating.

Training – Learning targeted toward specific competencies, usually constrained in time and focused on a specific task, job or role.

Services

Services overview

The architecture assumes a number of core services that can be supplemented by value added and specialized services. Specialized services are typically required to support advanced applications and the specialized requirements of various communities of practice or regulatory environment. While they are assumed to exist, defining them is outside the scope of this document. The existence of some other services such as HR databases, student rosters, security and authentication, etc. is also assumed although those services are not represented here.

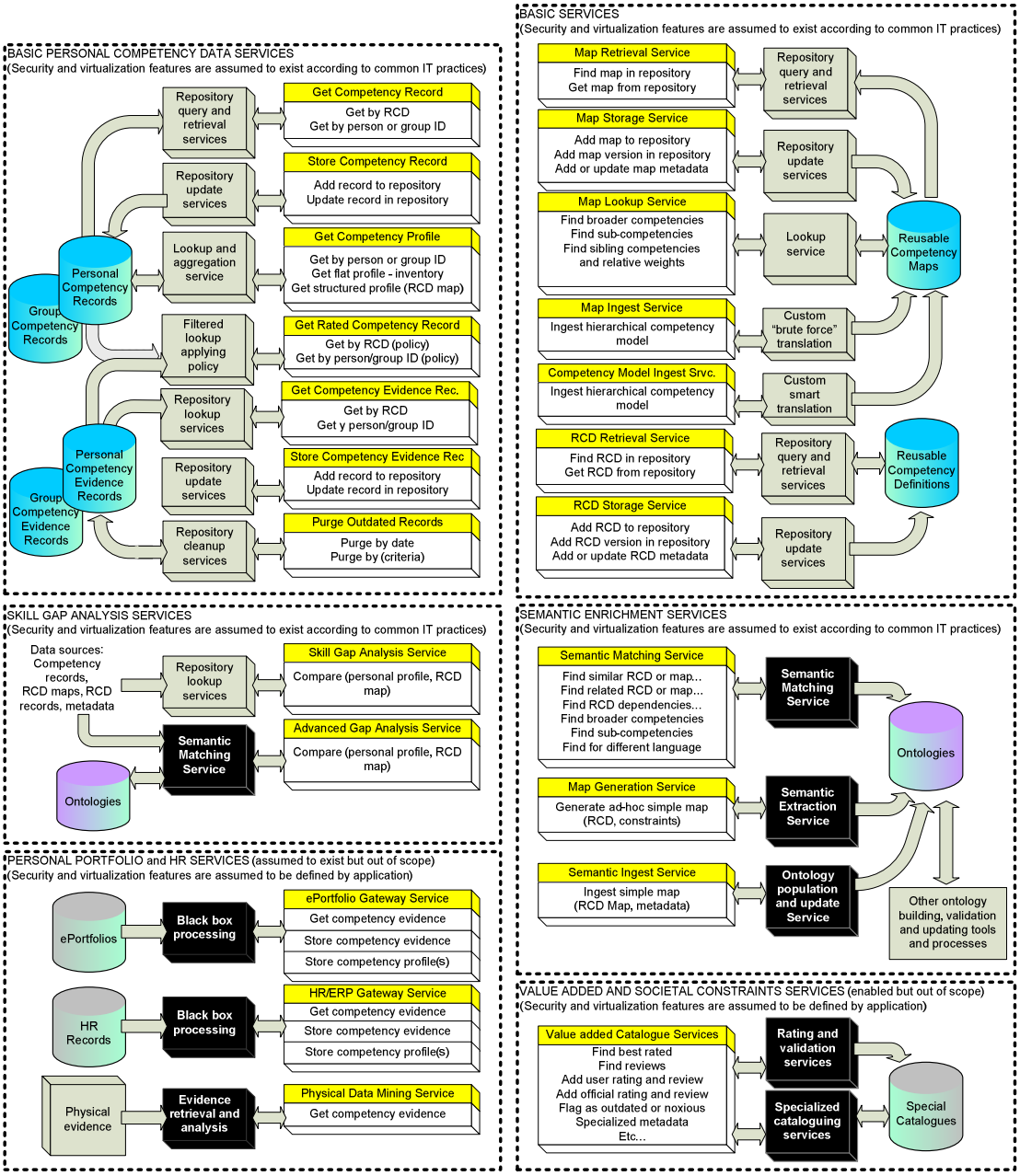

Figure 1 - Services Overview – See specific sections of this document for more readable views.

Processes and applications

The architecture is designed to support a number of basic processes that in turn support some common applications. This may be best understood by looking at a small set of applications, with the understanding of course that many other applications are possible. Other processes can also be added that build upon the services, data models and processes defined in the framework.

Use cases

The use cases describe various application requirements, which in turn assume certain processes and data defined in the framework. Note that the framework does not define all the processes and data required for the use cases. The purpose of these examples is to tease out and illustrate the advantages of using the standard functionality defined in the framework.

Recruitment and hiring

(tbd)

Project management

(tbd)

Skill gap analysis

(tbd)

Self-service learning and development

(tbd)

Learning management in an enterprise context

(tbd)

Learning management in an academic context

(tbd)

Personal development

(tbd)

Basic competency definition management services

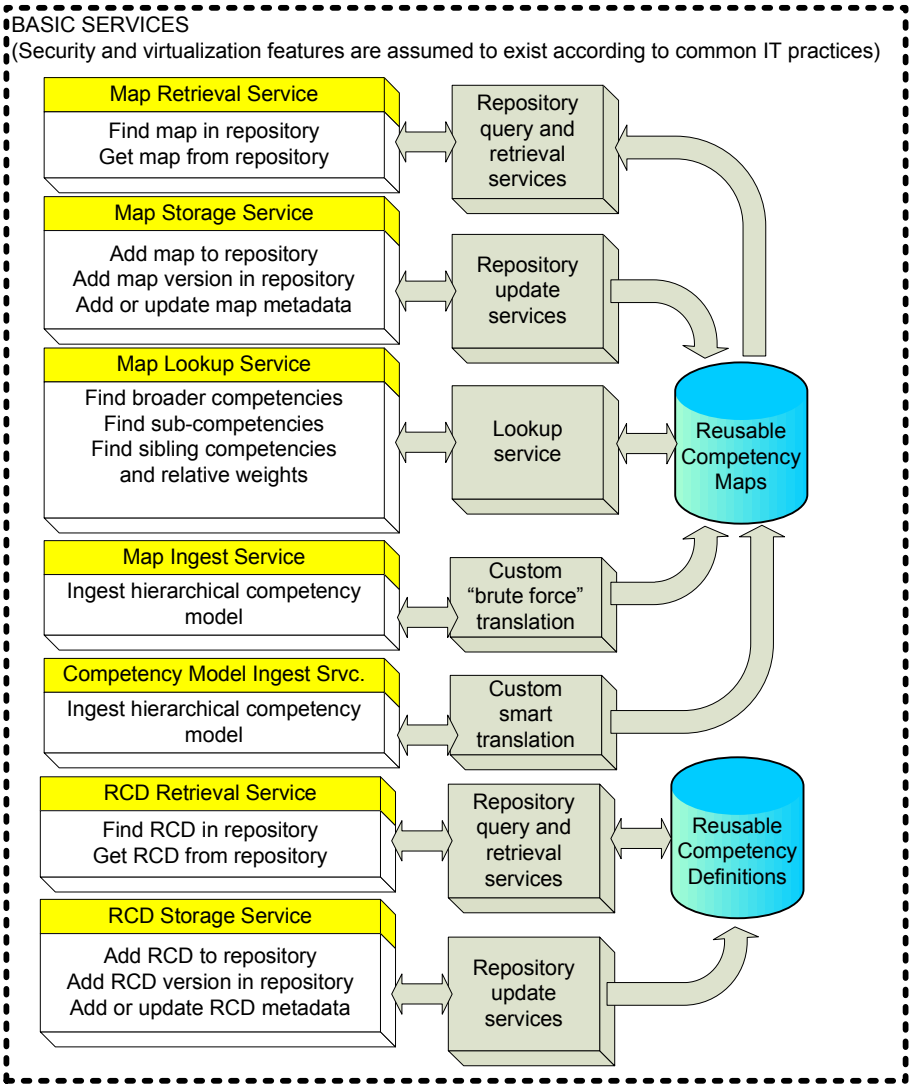

Figure 2 - Basic Competency Definition management services

Semantically rich competency definition management services

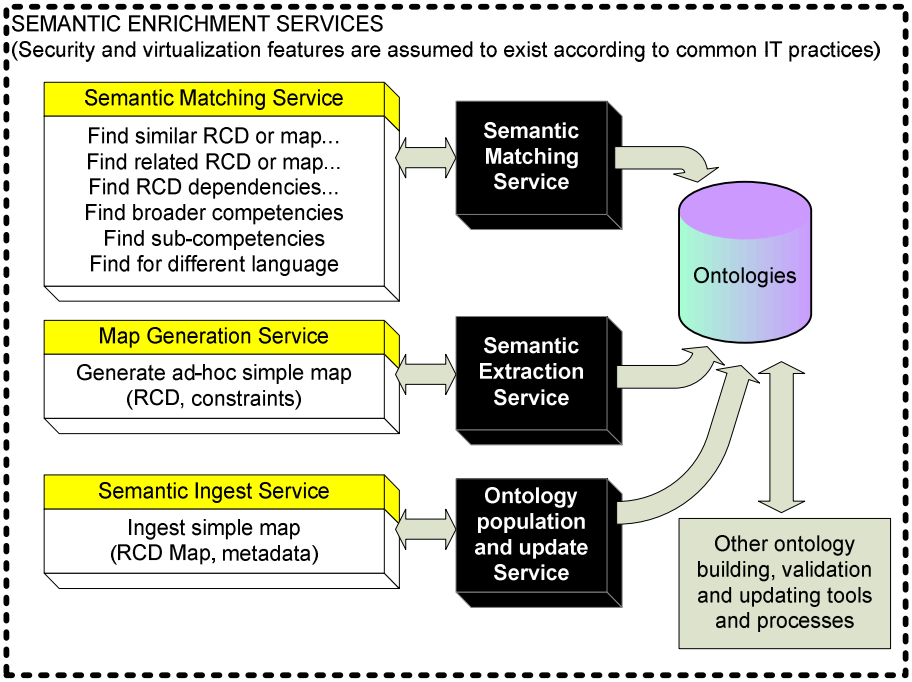

Figure 3 - Semantic enhancement services

Specialized competency definition management services

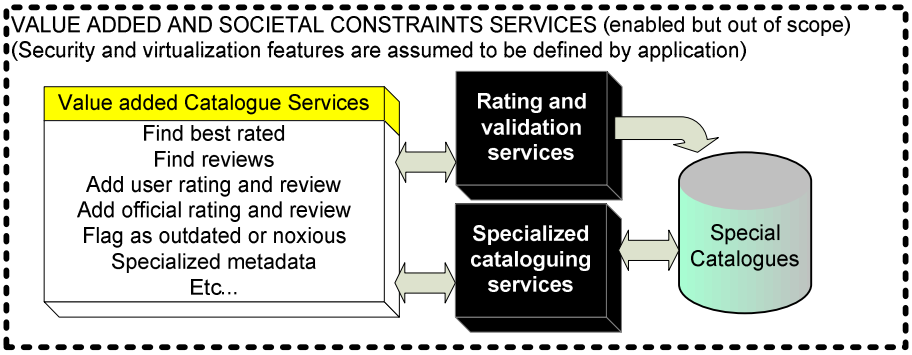

Figure 4 - Specialized and value added services

Personal or group competency data services

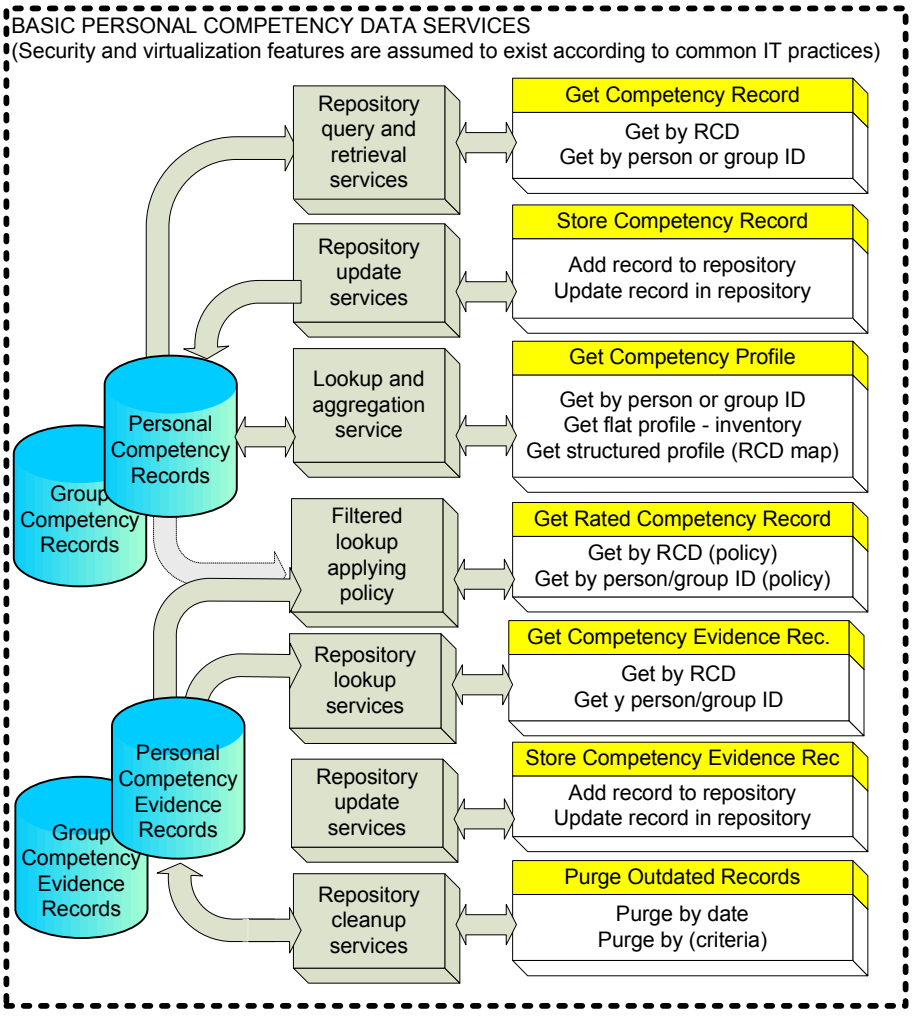

Figure 5 - Basic personal or group competency data management services

Skill Gap analysis services

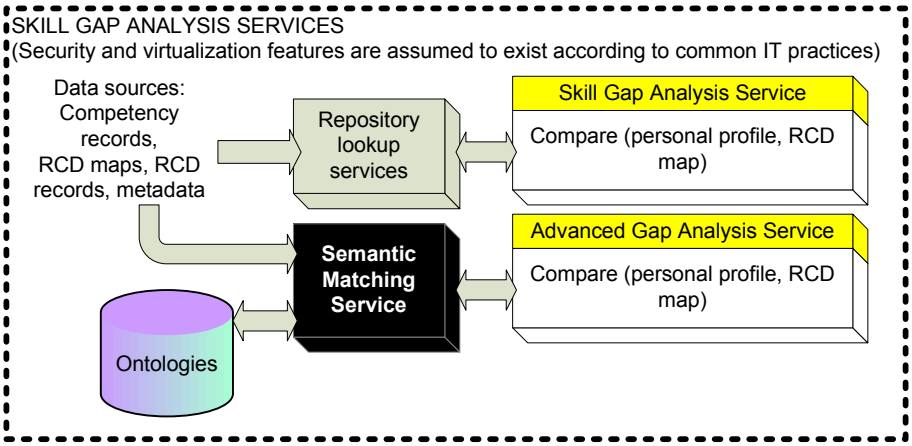

Figure 6 - Skill gap analysis services

Other personal competency related services, just out of scope

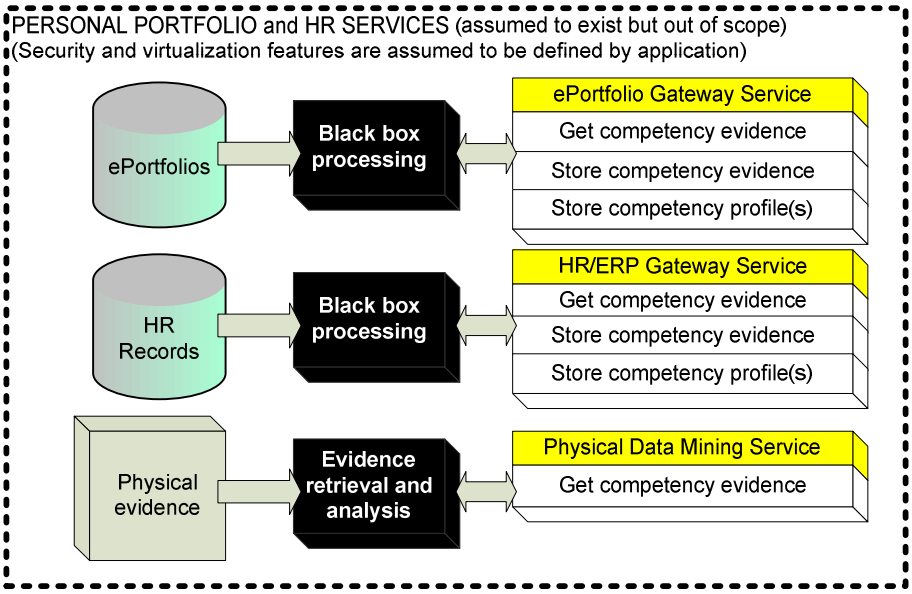

Figure 7 - Examples of related services outside the scope of the framework