Invited Papers

Assets and intellectual capital management into the ETC project

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One of the important aspects in the software development process is the knowledge transfer between team members.
This process exhibits some critical points: the knowledge transfer during the project and, after its conclusion, towards other projects and towards other teams and communities.
How this knowledge should be represented, transmitted and reused is still a matter of scientific debate. Something interesting we can draw from observation of how the man has been accustomed to manage it in his recent past to think on how it should happen now, and under the pressure of time and economic constraints.
This article shows an innovative way to represent, manage and transfer knowledge through assets. The aim is to give persistence to the memory of the projects and for this purpose, as a case study, we chose a community project called the Eclipse Italian OTRE (On the Road Eclipse) to show how

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knowledge can flow more easily through the network of those who work there. The work is the result of cooperation between the University of Naples Federico II and IBM Italy and especially with the Rational brand and the Academic Initiative (Academic, 2012) that is responsible for cooperation with the Italian universities.

1 Introduction

The lack or absence of software documentation in the production environment has always been one of the biggest problems for companies and one of the activities difficult to teach. Writing documentation is always perceived as a waste of time, unnecessary cost, pushed and pressured by deadlines and the low budget allocated for the task.

The real problem is that the documentation is not perceived as "knowledge hibernated" in the project and therefore it is considered unnecessary, without opportunities of future reuse. If we look, for example, what is the dominant behavior when writing code is that "first the code is written and then you add the comments (if you have time)".

This is a bad practice, because in this way the comments are useless because they do not provide any additional knowledge of the code neither the decisions taken during the analysis time. Instead, the complete and coherent documentation is very useful for those who must read and maintain the systems across the application lifecycle and in production environment.

It's clear that to change this habit we must perceive the importance of the analysis and of the code documentation not just as an illustration of what has been done but in terms of content reuse and design.

In short, the code, the analysis, and all artifacts produced, must be perceived as "Assets". An asset is a collection of artifacts that provides a reusable solution to a specific problem.

With this approach, the perception of the software is different: it turns out that there are assets for everything: to document the software for the design, to document best practices and to manage a plan for measuring etc. If we reason with reusability in mind, then the focus of many of the activities in the software process development acted by different actors, changes.

Assets can be used to document competencies and knowledge too, very useful think for the communities of practices in which the learning is driven by cooperation.

One of the biggest mistakes done managing the knowledge in the software projects is the usage of the **verbal** communication only (poor analysis, obsolete documentation, lack of alignment between design models and code, a lot of roles, outsourcers and so on), like happened thousands of years ago, before the invention of writing.

Analyzing the features of this way to information transfer we can discover these critical points:

Synchrony: the people involved in the verbal exchange of information and culture must be both available simultaneously in the same place.

Ambiguity: the information transmitted verbally is not encoded and is prone to personal interpretation.

Inconsistency: the communication of such information is unlikely to be repeated in the same way, so every 'session' of communication is unique. Any further session will contain differences.

Evanescence vs. Persistence: The information have a low level of persistence over time: things are forgotten, are remembered in a different way day after day, belonging only to a person that can disappear, die or simply forget.

Fan-out: there is a limit to the number of people to whom you can communicate verbally knowledge, just speaking.

Accumulation: because the amount of things you can communicate verbally is a function of the time and the average life of a person has a standard length, once used all the available time is not possible to pass on further knowledge. This means that the generation n+1 is not able to receive information verbally more than the generation n. The maximum amount of transmitted culture remains constant over time.

These aspects depict a scenario of little or no codified and rationalized information, where teacher's memory and mood greatly influence the communication.

With the invention of **writing**, and then of the books in their various forms, things have changed radically.

Knowledge has become 'visible', has been codified, it suddenly became persistent, repeatable and independent from the people.

We could say that has become eternal (or at least, its life is linked to that of inanimate objects such as books, usually more longevous than people).

Pass on the culture and information through writing has resolved the negative characteristics that we listed above, in particular: the ***Synchrony*** is no more: I write a book and anyone can read it at any time. ***Ambiguity***: It is what the author has decided to keep in the book but it can be demolished or altered by other authors and reviewers in very different times, adding chapters, commentaries and analysis. ***Inconsistency***: solved by reusing and re-read the same book several times. ***Persistence***: the information remains unchanged over time if the book is not burned or eaten by a mouse. The life and destiny of the written information is independent in most cases from the life and destiny of its author. ***Fan-out***: a book can be read by an arbitrary number of people, as long as it was printed in sufficient copies. ***Incremental Accumulation***: it is one of the most beautiful aspects: each generation bequeaths to the future people new books and new knowledge, often built on the study of existing books. Each generation can grow by taking advantage of knowledge accumulated over millennia in the millions of books produced. The availability of written information is the key. The ‘by asset’ approach finds its roots in the story of human culture. The generations so now can study pieces of culture coming from the past, from the present and from various parts of the world. This is the context in which we were educated and we continue to live.

In following pages we will show how, shifting the focus towards the assets, the students change their way to see the things and adapt their approach towards the reuse, sharing knowledge easier and improving the way to learn the good practices. Software tools for the asset management, their reuse and sharing, become knowledge accelerators and location for the knowledge persistence.

In this work we show how the assets are perceived as way to share knowledge; with well written assets the knowledge is shared easier in the network. The outline of this work is this: in the section 2 we will speak about assets and intellectual capital in the context of real projects: using assets in OTRE and DKMS & VSA projects to gather the intellectual capital produced by teams; in the section 3 we will show final results and conclusions.

2 Assets, Intellectual Capital and the ETC project

An Asset, in the meaning described in this paper, is a resource of value to a project, system or organization. This resource could be a set of artifacts (documents, text, diagrams etc.) that are related with a problem, with a domain and describing a solution or part of it. Main aspect of Assets is that they are reusable intellectual capital. In particular, (we are speaking about IT world), the intellectual capital is done by: source code, analysis documents, use cases specifications and diagrams, acceptance test reports, build logs, deployment logs, list of solved defects in the release, outsource agreement with suppliers, architectural diagrams, design patterns, business model diagrams, test cases list, test plans, strategic choices, requirements list, project plans, priorities list, weakness list, list of services used in the system, components, list of interfaces, hardware needs, constraints, and so on. Obviously we desire that these documents are in digital format, so we can manage them properly. Every file or set of files, containing meaningful information can be an asset for the organization. From technical point of view, to every Asset are related metadata for its categorization, typing and description, allowing its reuse and showing the relationship with other assets. An Open Community of Practices (Ocop) shares several asset types and contributes to define a lot of them during the activity. The principle upon which a community is based, is reusing both the objects (as object reuse) and processes (reuse as process). In both cases the re-use is facilitated if to describe objects or processes we use a standard formalism: the asset.

In this way we reduce the costs and time of 'resonance' of the community. Project's Asset are formal plans and informal ones, directives, procedures, guidelines, lessons learned, historical data, risk data and everything is connected with the project and the organization. Assets have a central role in the context of an integrated environment that, in a network of OcoP, has to manage knowledge and cooperation between different entities (people and groups) to achieve shared goals. If we use the asset paradigm meanwhile we are working to achieve our goals, composing correctly our assets (using metadata, attributes and descriptions), we will able to obtain better measure and governance. Rules of behavior, security norms, evaluation rules, communication patterns and methodology, are other kinds of Assets that a Community of Practices needs to create and manage. To maximize the benefits obtained by asset production and to minimize development costs, we need to have a common standard about the way we organize, structure, describe the artifacts. These standards are useful to measure the network of OcoPs, in particular about consonance and resonance. A standard to organize and describe assets is provided by OMG: the *Reusable Asset Specification* (*RAS*) (SOA, 2012; OMG, 2012); this standard is included in IBM *Rational Asset Manager* (RAM, 2012), the tool we are using to manage our assets.

We have chosen this tool because it allows to define, create and modify the assets, it is compliant with RAS, allows the assets searching in a very effective way, promotes assets reusing, monitors the asset usage. (Reamsnyder, 2010; Pendergrass & Lane, 2009).

In the Fig.1 we show the ETC project architecture (Coccoli *et al.*, 2011; Maresca *et al.*, 2011; Coccoli *et al.*, 2010), based on RAM and Jazz. ETC, acronym of Enforcing Team Cooperation using Rational tools, is a project born from the cooperation between IBM Italia (IBM, 2012), the Italian Eclipse community (EclipseIT, 2012) and the Federico II university of Naples. The goal is to improve the students learning using the cooperation. To achieve this goal we have chosen to adopt an architectural platform, market leader in the professional world of software development: the IBM Jazz platform (Jazz, 2012). In this way, another goal achieved, is to allow the student to use modern tools for software development and using collaboration to enforce the concepts presented in the courses (Maresca *et al.*, 2008; Coccoli *et al.*, *op.cit.*).

This paradigm implements a new way to form the students, in which the professor assumes the role of 'coach' and the students can cooperate in the developing own tasks, even if belonging to different courses, different universities, different regions etc. in the same way of real industrial team in a great corporate.

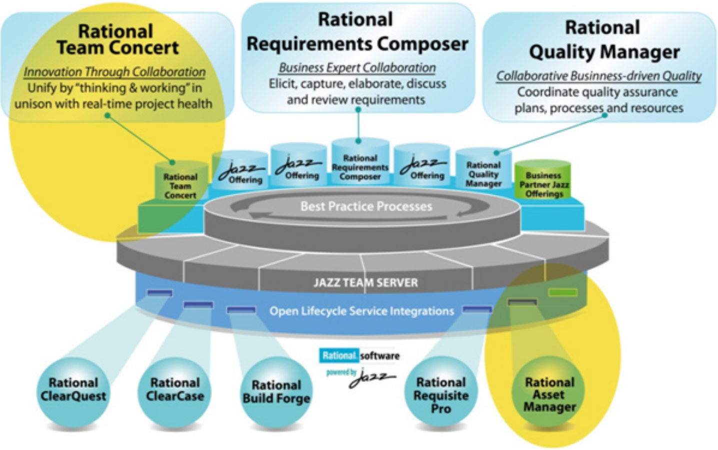
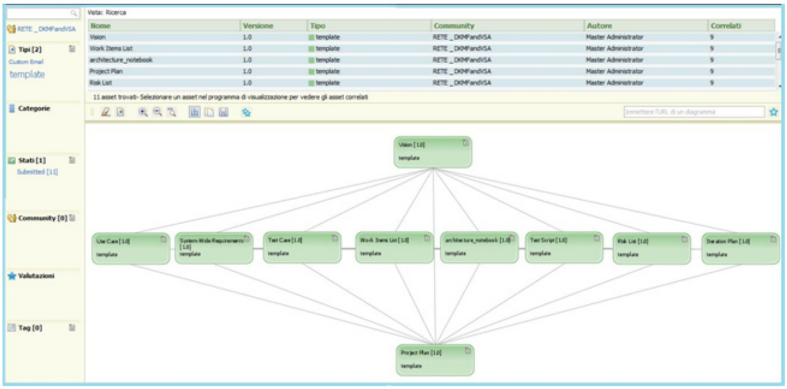

Rational
Team Concert
Innovation Through Collaboration
Unify by "thinking & working" in unison with real-time project health
Rational
Requirements Composer
Business Expert Collaboration
Elicit, capture, elaborate, discuss and review requirements
Rational
Quality Manager
Collaborative Businness-driven Quality
Coordinate quality assurance plans, processes and resources
Rational Team Concert
Jazz Offering
Jazz Offering
Rational Requirements Composer
Jazz Offering
Rational Quality Manager
Business Partner Jazz Offerings
Best Practice Processes
JAZZ TEAM SERVER
Open Lifecycle Service Integrations
Rational software
powered by Jazz
Rational ClearQuest
Rational ClearCase
Rational Build Forge
Rational Requisite Pro
Rational Asset Manager

Fig. 1 - Jazz as knowledge sharing platform for ETC

In Fig.2 we show some shared assets of an open community named RETE_ DKMF &VSA working in the OTRE project. The assets are related as shown. Asset relations help to create well written assets and are useful to asset search.



Vista: Ricerca

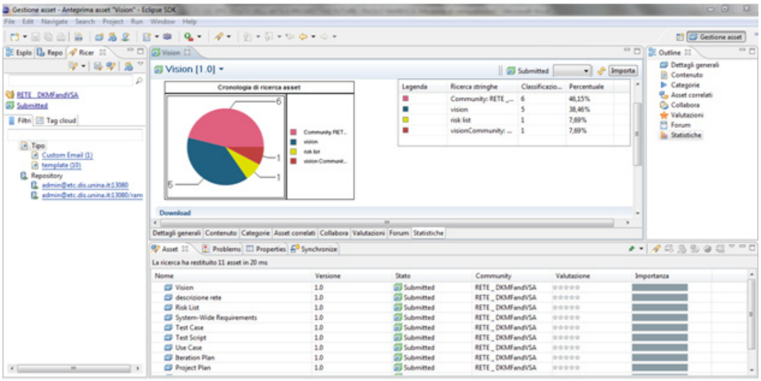
Nome	Versione	Tipo	Community	Autore	Correlati
Vision	1.0	template	RETE _DKMFandVSA	Master Administrator	9
Work Items List	1.0	template	RETE _DKMFandVSA	Master Administrator	9
architecture_notebook	1.0	template	RETE _DKMFandVSA	Master Administrator	9
Project Plan	1.0	template	RETE _DKMFandVSA	Master Administrator	9
Risk List	1.0	template	RETE _DKMFandVSA	Master Administrator	9

11 asset trovati- Selezionare un asset nel programma di visualizzazione per vedere gli asset correlati

Fig. 2 - View of Assets community DKMF&VSA

In Fig.3 we report the Eclipse platform that we use to access to the architecture shown in Fig.1.

The student, selecting the Eclipse perspective changes the aspect of the system and assumes the correct role in the team (asset manager, analyst, developer, tester, and so on).


Gestione asset - Anteprima asset "Vision" - Eclipse SDK
File Edit Navigate Search Project Run Window Help
Gestione asset
Esplo Repo Ricer
RETE_DKMFandVSA
Submitted
Filtri Tag cloud
Tipo
Custom Email (1)
template (10)
Repository
admin@etc.dis.unina.it:13080
admin@etc.dis.unina.it:13080/ram
Vision
Vision [1.0]
Submitted
Importa
Cronologia di ricerca asset
6
1
1
5
Community RET...
vision
risk list
vision Communit...
Download
Dettagli generali Contenuto Categorie Asset correlati Collabora Valutazioni Forum Statistiche
Outline
Dettagli generali
Contenuto
Categorie
Asset correlati
Collabora
Valutazioni
Forum
Statistiche
Asset Problems Properties Synchronize

Legenda	Ricerca stringhe	Classificazio...	Percentuale
🟥	Community: RETE_...	6	46,15%
🟦	vision	5	38,46%
🟨	risk list	1	7,69%
🟥	visionCommunity: ...	1	7,69%

La ricerca ha restituito 11 asset in 20 ms

Nome	Versione	Stato	Community	Valutazione	Importanza
Vision	1.0	Submitted	RETE_DKMFandVSA	☆☆☆☆☆	
descrizione rete	1.0	Submitted	RETE_DKMFandVSA	☆☆☆☆☆	
Risk List	1.0	Submitted	RETE_DKMFandVSA	☆☆☆☆☆	
System-Wide Requirements	1.0	Submitted	RETE_DKMFandVSA	☆☆☆☆☆	
Test Case	1.0	Submitted	RETE_DKMFandVSA	☆☆☆☆☆	
Test Script	1.0	Submitted	RETE_DKMFandVSA	☆☆☆☆☆	
Use Case	1.0	Submitted	RETE_DKMFandVSA	☆☆☆☆☆	
Iteration Plan	1.0	Submitted	RETE_DKMFandVSA	☆☆☆☆☆	
Project Plan	1.0	Submitted	RETE_DKMFandVSA	☆☆☆☆☆	

Fig. 3 - Eclipse platform with RAM perspective

At present, ETC owns 49 started projects (Coccoli *et al.*, *op.cit.*), with 739 students belonging to the universities of: Napoli Federico II, Bologna Alma Mater, Bergamo, Milano Bicocca, Genova, Military Academy of Pozzuoli. ETC has helped to build dozens of courses in several Italian universities. The students, as well as conducting their formal educational activities, have produced many teaching aids and assets. This does reflect much of what must be the type of teaching aid for a learning community (Maresca *et al.*, 2010 c).

In order to access to an asset in RAM, starting from an assigned work item (WI) in Rational Team Concert (RTC), is:

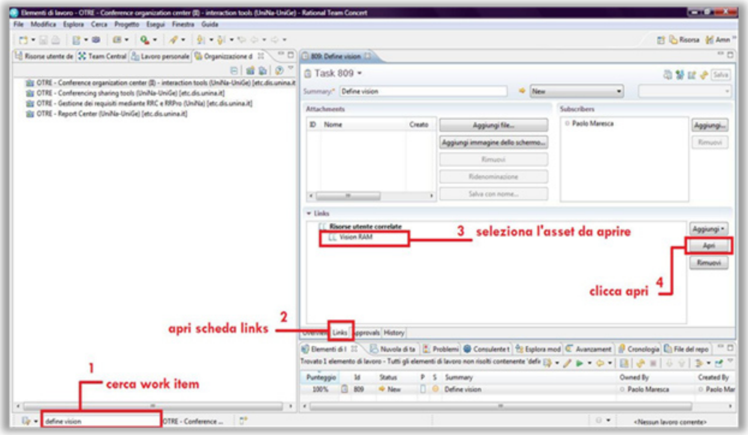
- The student reads the WI in the own to do list in the RTC dashboard or looks for it in his Eclipse perspective.
- Opens the 'link' tab and can find the link to the RAM asset. Clicking on it, the student will access to RAM, visualizing the asset and its data.
- If the student is not a member of the community that owns the asset, he can ask for authorization to the community administrator.

In the figg.4 and 5 the procedure is shown in seven steps.

A file, or set of files, to be used as formal asset has to be described properly, adding metadata for its classification. Asset's nature is to collect knowledge valuable for the organization, reusable and available.

To make an asset reusable, at least these conditions must be met:

1. We have to own the asset (or have the access to it),
2. We have to know where it is,
3. We have to know who is responsible for it,
4. We have to know the usage details and what is its purpose.



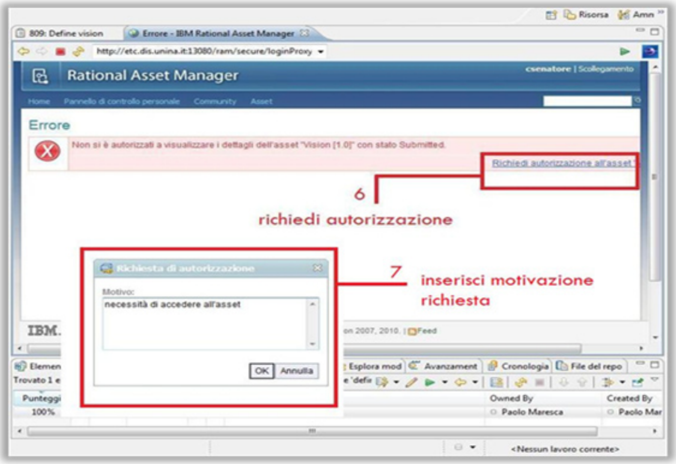
1 cerca work item

2 apri scheda links

3 seleziona l'asset da aprire

4 clicca apri

Fig. 4 - Opening an asset starting from a work item



Rational Asset Manager

Errore

Non si è autorizzati a visualizzare i dettagli dell'asset "Vision [1.0]" con stato Submitted.

Richiedi autorizzazione all'asset

6 richiedi autorizzazione

Richiesta di autorizzazione

Motivo: necessità di accedere all'asset

OK Annulla

7 inserisci motivazione richiesta

809: Define vision
Errore - IBM Rational Asset Manager
http://etc.dis.unina.it:13080/ram/secure/loginProxy
csenatore | Scollegamento
Home
Pannello di controllo personale
Community
Asset
IBM.

Fig. 5 - Access to the asset from WI: asking for authorization

Conclusions and future developments

To share knowledge using assets is a good practice to build and disseminate the knowledge between communities. In particular, the usage of this practice is been positive, applied to university students along the learning time but it is already positive being adopted in great industries to document projects executed in a distributed environment. An Asset can describe objects, skills, knowledge. In this way Assets can be used to close the gap between communities. There are a lot of aspects not yet well understood about the dynamics that allows to the communities of practices to be born, to die, move away, to merge together, move forward. We think that the main factors are the complexity and dynamics that affect the communities' lifecycle. This dynamism requires that a set of individuals is: accessible, observable and controllable. It is important that the communities can be measured objectively. A viable method to perform these measures is using the assets that individuals produce, collecting data expressed through numbers or attributes. As an asset is associated with meta-data, in them can be inserted probes that allow to record asset usage.

In the ETC project the students use very frequently the assets, adopting a pervasive approach to the cooperation, reusing assets and sharing knowledge. In this way they are able to improve their skills and cutting learning time. Eclipse, RTC and RAM are very useful tools to work and share assets, using them as "knowledge accelerators".

Assets are perceived by students as a way to share knowledge and well written assets improve the effectiveness of this sharing. This happens mostly for all the assets produced in the ETC project, being reused in more contexts, not only in the project where they are produced (e.g. Military Air Force Academy, different universities, etc). The students seem to prefer this way to work, because they reuse directly pieces of knowledge to build new concepts. With the assets will be possible to measure how the communities of practice become closer and what are the best communities' components for specific topics along the time.

Awards

The ETC project has had numerous national and international awards over the past 2 years. Among these a prestigious IBM Faculty Award 2011 (IBM Award, 2011) awarded to Paolo Maresca, and an IBM Rational Champion 2012 awarded to Paolo Maresca (IBM Champion, 2012). ETC has also been mentioned as the IBM Best Practice 2011 in IBM Innovate 2011 in Orlando (FL) USA. The University Federico II of Naples and his team of ETC-HUB have been cited among the three academic institutions worldwide participating in the JazzHub initiative (SDTimes). ETC has been mentioned as IBM Internal Rational Success Story (Batten, 2011).

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