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Palette

Pedagogically sustained Adaptive LEarning Through the exploitation of Tacit and Explicit knowledge

Integrated Project

Technology-enhanced learning

D.KNO.01 – CoP-independent meta-ontologies and support ontologies

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Summary

This deliverable offers a theoretical background on which the KM services will be based.

It deals with the meta-models necessary for the Knowledge Management services and concerns the development and the choices of CoP-independent ontologies.

The existing models for each main concept determined as important in a CoP are presented, the discussions on these models summarized and finally the proposal of the model adopted for Palette is presented.

This deliverable is a basis for the task 3.2 (“Development of reference ontologies for information annotation and user profiling”), and will serve also for the task 3.3 (“Development of CoP-oriented KM services”).

TABLE OF CONTENT

Introduction

The work package 3 aims at offering knowledge management services, for efficient and effective management of the Communities of Practices (CoP) knowledge resources.
The first step to do in order to reach this objective is to provide the theoretical grounding upon which the foreseen services will be based. This theoretical grounding is composed of meta-models necessary for the service tools to exploit the knowledge properly. These meta-models will be organized in order to constitute a CoP-independent meta-ontology, from which a CoP-dependent ontology will be built later, so as to annotate the CoP knowledge resources. The CoP-dependent ontology could then be instantiated for the different CoPs.

When an organization considers knowledge as a key asset, the presence of communities of practice plays an important role. CoPs can be considered as a means by which knowledge is "owned" in practice. Indeed CoPs allows the functions of creation, accumulation and diffusion of knowledge in organizations.

The meta-models we identified as the most significant concern five main concepts: **competency, collaboration, learner profile, process/activity and lessons learnt**.

Different actors can participate in a CoP; they can be experts in a domain, students, or professionals. Actors can be characterized by their role in the CoP, and by their competency, linked to the domain of the CoP. According to their competency (knowledge, experience, etc), actors can learn more or less about a practice or can participate more or less actively in an activity. Therefore competency is one of the major concepts useful to define KM services appropriate to CoPs.

Collaboration is considered as an important concept because the objective of a CoP is to deepen members' knowledge and expertise in the CoP's area by interacting on an ongoing basis (Wenger et al, 2002). Sharing and exchanging knowledge about a subject is thus a key activity within a CoP, it requires putting in common various resources concerning the CoP's area or domain. Participation is one of the two fundamental principles of negotiation of meaning in a CoP (E. Wenger, Communities of Practice, Learning, Meaning and Identity, Cambridge University press, 1998), the other one being reification. Participation implies action, even if, according to Wenger, it is "broader than mere engagement in practice". Activities are central to the life of a CoP. They are the place and moment where and when interaction is made visible and fruitful. Specifically, activities are organized in order to exchange experience about a practice but also to enlarge knowledge of different members. Activities enable to define the different possible roles in the CoP; moreover activities allow seeing the evolution of the CoP, and the evolution of the members.

Learning is one of the key reasons why communities of practice are being created and cultivated (see E. Wenger, R. McDermott, W.M Snyder, Cultivating Communities of Practice, Harvard Business School Press, 2002). Every member of a CoP is at one moment or another implied in a learning process. Being able to define and characterize learner's profiles is an important aspect of KM within CoPs, and thus a key concern when it comes to implementing KM services for CoP. Indeed it is important to know how learners react, exposed to a piece of knowledge in order to provide services personalized to their cognitive profile for example.

One of the key activities of a CoP is to share and exchange about the CoP' practice. This sharing of knowledge can lead to the definition of best practices, or agreement on a subject for example; this is considered as lessons learnt. Lessons learnt allow us to determine the behavior that is appropriate to a given situation. In fact lessons learnt lead to identification and qualification of best practices.

To define the meta-models concerning the five major concepts defined previously, we follow three stages. After a study on the existing models for each concept, we compare these models so as to make decisions, and eventually propose a final model to be adopted in the meta-ontology.

The study and presentation of the existing models have been made according to five steps:
1. general presentation and description of the model,
2. presentation of the roots of the model,
3. presentation of associated models
4. discussion on the strengths and weaknesses of the model
5. description of some applications of the model

The second part concerns the comparisons and discussions around the studied models. Each studied model was presented to the partners involved in the task 3.1, and everyone could expose his/her ideas and opinions on the models. A summary of the discussions and the final decisions are presented in the second step.

The final part deals with the proposal of a unified model. This part is divided into three sections. The first one deals with the overview of the model, then a detailed description of the concepts and axioms of the model is made, and finally, use-case scenarios are described. A technical description in a specific format is done in appendix.

1 Competency model

1.1 Study and presentation of existing models

1.1.1 The Paquette's Competency model

- General presentation and description of the model

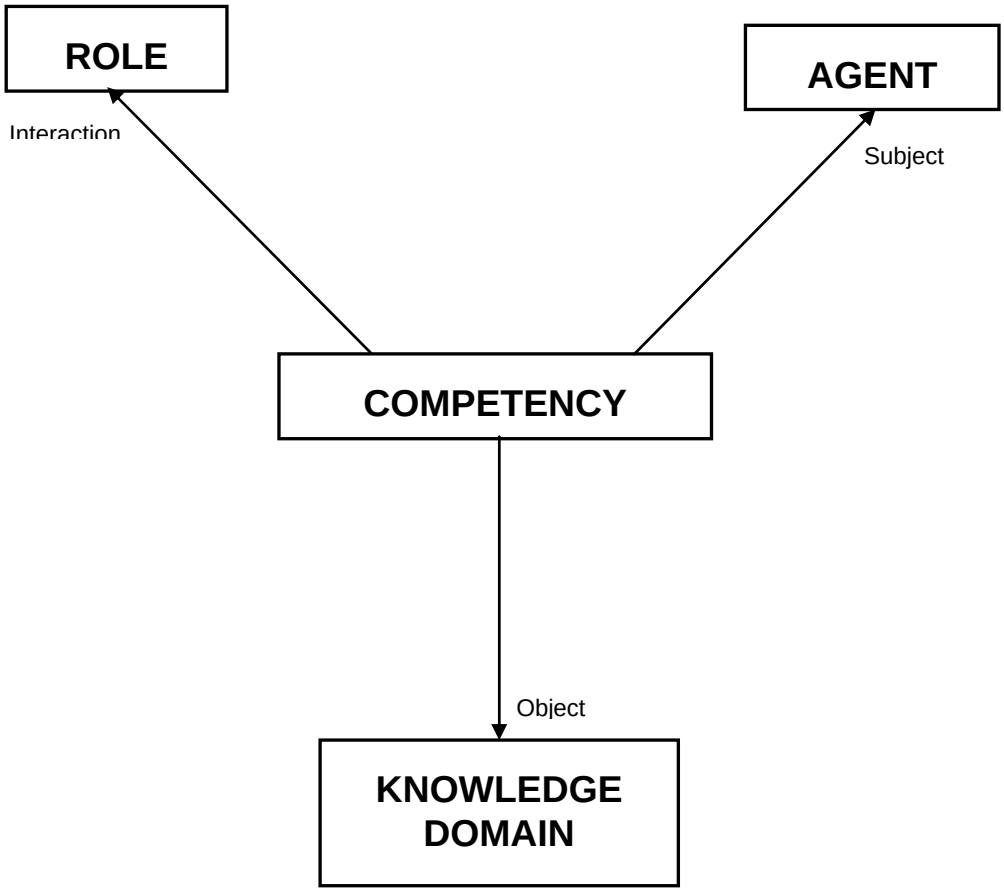

Figure 1: The Paquette's Competency model

This competency model (Paquette, 2002) is based on a ternary relation. It describes competency as a relation between an *agent*, the *role* played, and the *knowledge domain* concerned.
The **agent** is the "holder" of the competency; competency is determined partly by the person who holds it. According to a number of bibliographical references, the definition of competency in a domain varies significantly. In this model, the agent is the subject of competency.
The **role** determines in what way the actor will interact with the competency. A role is a function ensured by the actor (product manager for example).
Competency is relative to a specific knowledge domain. The **knowledge domain** is considered as the object of the competency. It allows the qualification and a precise identification of the domain concerned by the competency.

- Roots of the model

This model was built in order to propose a general technique of modeling knowledge, adapted to learners' needs, but also to developers of training systems. This model allows us to have a same view of competency and having the same base of work.

- Associated models

As this model presents it, the competencies are appropriate to an actor. We know that by some activities, we increase or develop some competencies. That is the reason why the evaluation of the competency could be associated to the competency model.
A model of competency evaluation is associated to the competency meta-model. It can be composed of *skills* and *capabilities* needed to determine a level in a competency.
Several models of competency evaluation could be exploited.

- Strengths and weaknesses of the model

The aim of the competency meta-model is to define competency, and not to classify it. The presented model allows to define competency and not to categorize it, unlike models used in Human Resources (that distinguish know, know-how, behavior). This model was built in order to represent competency irrespective of its context of use, so it does not take into account the environment in which competency is used or applied. It can be argued that the context in which competency is used influences the definition of the competency. That is the reason why another model is proposed.

- Applications

An application of this model could be the exchange of knowledge in a CoP. An exchange could happen during a discussion, a debate or through an activity. The competency of two persons exchanging their points of view in a same project could be represented with the Paquette's competency model. Indeed the competency of each actor is defined by the person itself, the role he/she has in the project and the domain knowledge concerned.

1.1.2 The aristotelician Competency model

- General presentation and description of the model

This competency model is based on a quaternary relation: *action* implemented, *resources* "mobilized", the *context* and the *objective* of application.
Competency is defined differently according to the **context** in which it is applied. The context allows the description of the environment in which competency is used, e.g. a group face-to-face discussion.
Moreover, **resources** involved define partly competency: nature, quantity…
Competency depends on the nature of the domain concerned; a competency needed to compose a document is different from a competency used to drive a car for example.
In addition the purpose for which competency is used, or its **objective**, makes the definition of the competency more precise. The definition of the objective indicates the way in which the competency will be used, and how to consequently adapt the competency.
The **action(s)** involved in the application of the competency further refines the definition of the competency. Indeed the fact of knowing the activities at stake facilitates the comparison and the mapping of a competency with other competencies.

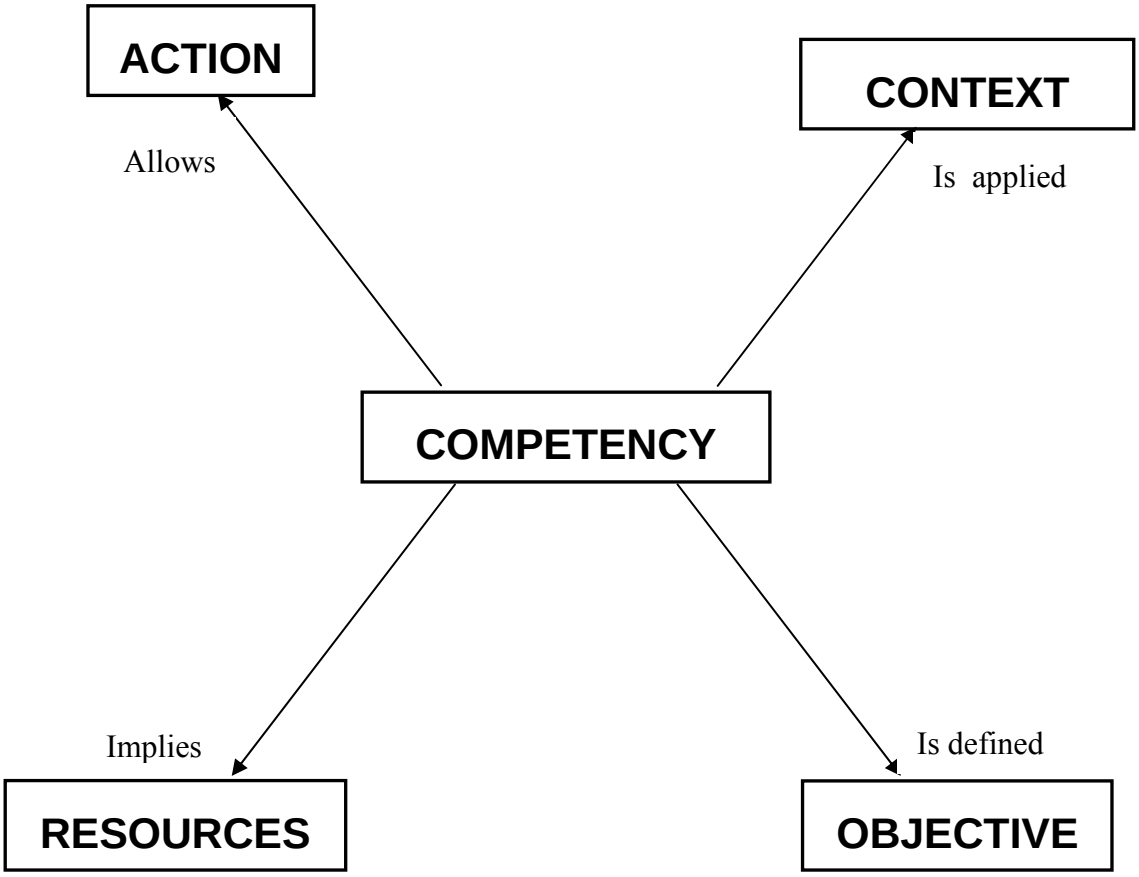

Figure 2: The aristotelician Competency model

- Roots of the model

This model was inspired by the TRIVIUM competency model, which is based on the four aristotelician causalities: efficient, final, formal and material.
The efficient causality allows us to categorize the action by determining the origin of the move.
The final causality identifies the recipient of the action.
The formal causality allows us to identify a concrete result.
The material causality deals with the environment, the conditions under which the action takes place.
The principles associated with these causalities are respectively the principles of action, finality (the recipient and environment), legibility (the result) and systemic (the mobilized resources). These four principles determine the most important concepts defining competency: *action*, *resources*, *objective* and *context*.

- Associated models

The aristotelician model is obviously linked to the activity model, by actions involved during collaboration.

- Strengths and weaknesses of the model

In this model, competency is defined by the context in which it is involved; in fact we do not use our competencies in the same way for teaching or for writing an article.

The context allows the description of the competency application: in a group or in face-to-face interaction, in a formal or informal discussion …
The objective allows to define to what purpose the competency will be used, and not to classify the different types of competencies. The aim of the presented model is to define competency, which is the main reason of our interest in this model.
However the actor is not directly present in the aristotelician model, which is considered as a weakness.

- Applications

This model could be applied in a situation of making a "cartography" of competencies in a CoP. In fact, a cartography of the competencies allows a better attribution of roles to the members and distribution of the activities.

1.1.3 CRAI Model

- General presentation and description of the model

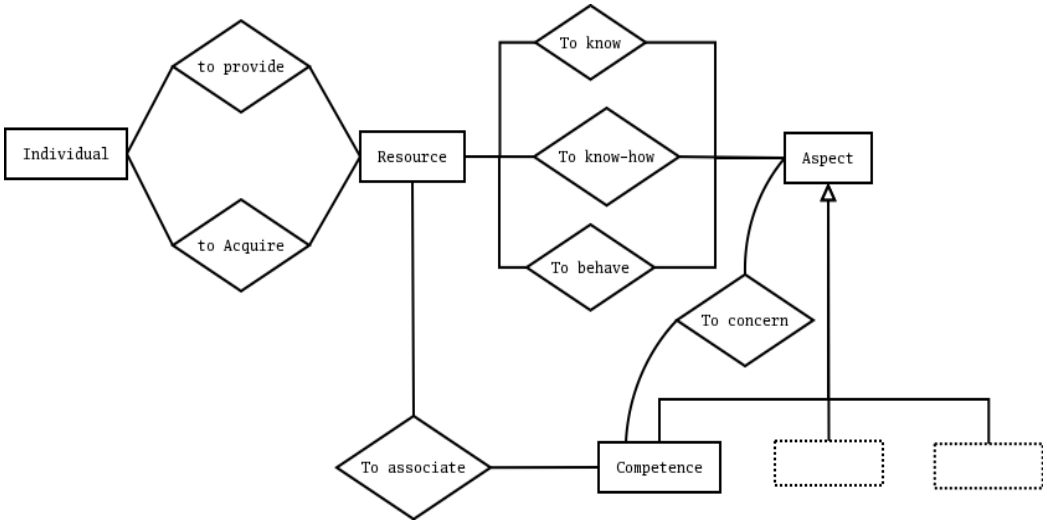

Figure 3: CRAI Model

CRAI Model was defined and discussed in (Blanchard and Harzallah, 2004) and (Harzallah et al. 2004). Its main purpose is to represent required Competency from the point of view of competency management.
In this model, ***Competency*** is a set of *resources* (knowledge, know-how and behavior) related to the accomplishment of one or more tasks, and associated with a given context. It is acquired by users.
The main concepts used to define competency in this model are:
Resources *are related to an aspect of the domain, and are falling into one of three categories:*
• Knowledge: comprises theoretical knowledge on existing things and procedural knowledge;
• Know-How: related to personal experience of the individual, acquired by doing;
• Behavior: refers to individual characters, talents and human traits
Individual is an actor that has one or more resources, and who provides or acquires a competency.

Aspect is the set of elements describing the domain. It defines the purpose of competencies and specifies the context.

- Roots of the model

This model is based on a state of art review of competency definitions.

- Associated models

This model is associated to the Actor model.

- Strengths and weaknesses of the model

This model was built to represent required competency in an industrial context. It can be used to describe individual competency acquisition, but it does not deal with its assessment or use.

1.1.4 MIT/IT Competency Model

- General presentation and description of the model

Figure 4: The Iceberg metaphor of competency

In this model, the different types of competencies can be depicted as different levels of an iceberg, as illustrated in Figure 4. The upper levels are visible, but they do not typically predict or determine outstanding performance. The deeper level of competencies (traits and motives) guides a person's behavior, and thus her/his performance. Figure 5 gives a more detailed view of the model.

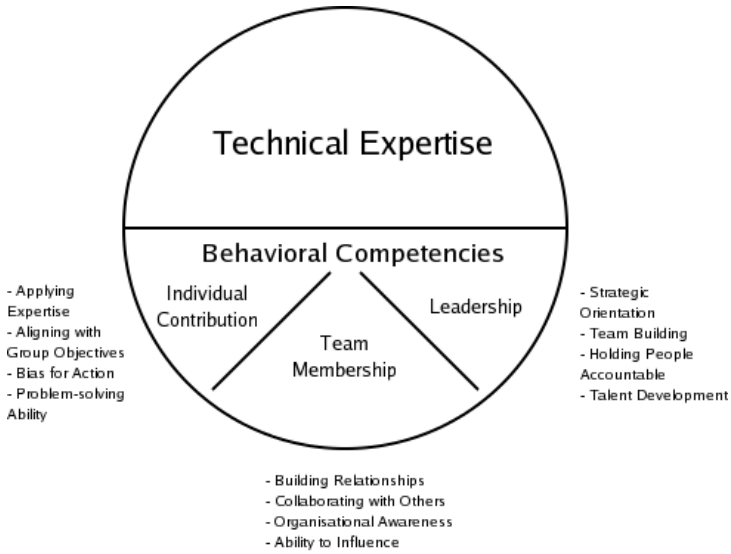

Figure 5: MIT/IT Competency model

The *competency* is associated to an individual or a group and has two components:

- *Technical Expertise* is the acquisition and mastery of specialized knowledge (usable information in a particular area e.g. In-depth understanding of a technical area) and skills (ability to do something well, e.g. Business Planning) in specific areas necessary for customers and organization to perform and achieve objectives.
- *Behavioral Competencies* which describe a *trait* (a typical way of behaving, e.g. Being a good listener), a *motive* (natural and constant thoughts in a particular area that determine outward behavior, e.g. wanting to continuously achieve and make things better) and a *social role* (the image an individual projects to others, e.g. viewing oneself as a teacher and coach) of an actor in competency and can be of three types:
  - **Individual Contribution**: applying expertise, aligning objectives, bias for action, problem-solving ability
  - **Team Contribution**: building relationships, serving customers, collaborating with others, organizational awareness, ability to influence
  - **Leadership Contribution**: strategic orientation, team-building, holding people accountable, talent development.

This model is fully described in (I/T Competency Group 1996).

- Roots of the model

This model is based on the iceberg metaphor of competency.

- Associated models

This model can be associated with the Collaboration model since many of behavioral competencies are achieved in a group and comprise a collaboration dimension.

- Strengths and weaknesses of the model

This model gives an internal point of view of competency since it gives a characterization of the competency.

- Applications

The Competency model allows us to define the needed competencies identified as critical to the successful performance of a particular role. It was used to identify, in the MIT Information Services and Technology department, the IT professionals that can provide the necessary expertise to achieve tasks for the MIT community. It is also useful to manage the collaboration with other IT groups and professionals across campus.

1.1.5 KmP competency model

- General presentation and description of the model

The *KmP* model was designed in the context of a RNRT (Réseau National de Recherche en Télécommunication) project involving INRIA, the Rodige and Latapses research laboratories, ENST Bretagne, Telecom Paris, and the Telecom Valley Association in Sophia Antipolis.

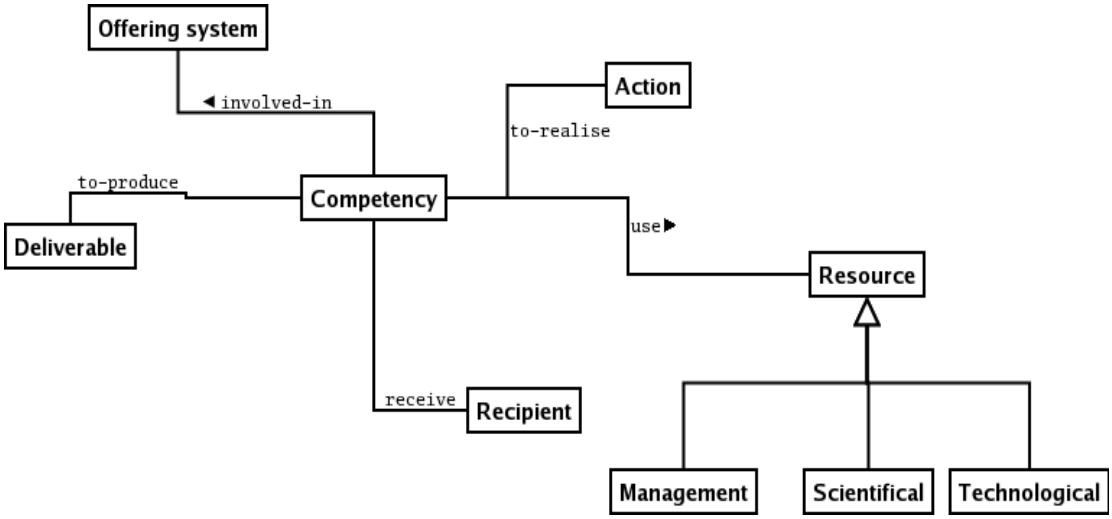

Figure 6: KmP Competency model

The model is based on a five dimensions relation: *action* achieved, *resources* used, *deliverable* to produce, the *recipient* of competency and the *offering system* (or market) in which the competency is involved.

The **Competency** is defined as the capacity to achieve an action using a set of resources in order to produce a deliverable appropriate for the *offering system*. Where:

- ***Action*** is an activity that produces a deliverable.
- ***Deliverable*** is the product expected by a given recipient in a given offering system.
- ***Offering system*** is the environment or the context.
- ***Recipient*** is the *Actor* that receives the product competency (i.e. the deliverable). This actor can be an *individual* or an *organization.*
- ***Resources*** are the set of material or immaterial elements used to achieve the action by an actor and can be of three types:
  - **Technological** related to an application,
  - **Scientific** theoretical or generic knowledge or know-how,
  - **Managerial** relational and organizational knowledge.

In addition the competency belongs to an actor that can be an individual or an organization; this makes it possible to deal with either individual or collective competencies. The actor is represented in the KmP actor model.

For a detailed description of the model see (Lazaric and Thomas 2006, Rouby and Thomas 2004, Gandon et al. 2005, Giboin et al. 2005).

- Roots of the model

As the aristotelician competency model presented above, the KmP competency model was inspired by the TRIVIUM competency model, which is based on the four Aristotelian causalities: efficient, final, formal and material.

- Associated models

The KmP model is associated with:

- *Activity and Process Model* that describes the types of actions

- *Actor model* where actors can be individuals or organizations

- Alliance model

- Strengths and weaknesses of the model

This model has been built to represent required competency in an industrial context. It does not characterize the competency but it makes it possible to identify the needed competency and the possible provider in a given context.

It can deal either with individual and collective competencies.

In the KmP model, the actor that provides knowledge is not depicted, which represents a weakness of this model.

- Applications

The KmP competency model is in use in the KmP platform that manages the competencies of companies in the context of intra-firm skills management within the Telecom Valley. The platform enables users to search for competencies and for potential partners having given competencies.

1.2 Comparison of models and decisions

The models of competency presented above give mainly two different points of view of competency.
On the one hand, an internal point of view that characterizes or defines the competency - this is the case of the Paquette's model and the MIT/IT model that make an interesting distinction between objective kinds of knowledge involved in a competency and subjective ones that provide important information on how people use their competencies.
On the other hand, an external point of view that considers the competency in its context of use and acquisition is provided in the other models. The KmP model makes it possible to deal with both individual and collective competency and allows us to search the space of existing competencies.
These two points of view are complementary and we need both of them to represent competency in the context of CoPs, although we will assign them different levels of importance.
Since one of the key aspects of a CoP is to allow its members to exchange their knowledge and experience, the competency acquisition/exchange has to be a major aspect in the competency model for CoPs.
The main use (we consider separately the exchange/acquisition of competency) of competency is done outside the scope of the CoP in the practice of members. In a certain manner it can be considered as a minor aspect in the competency model for CoPs, but we will try to represent it through the relation between the actor and the competency.
The other perspective of competency is its definition/characterization, this aspect is also important for CoPs since it allows us to link the competency with the resources present in the CoP space and to find the relevant competency in a given situation. Our model will take this aspect into account.

1.3 Unified model proposal

This model is proposed by INRIA, and was validated by all WP3 partners.

1.3.1 General overview of the model

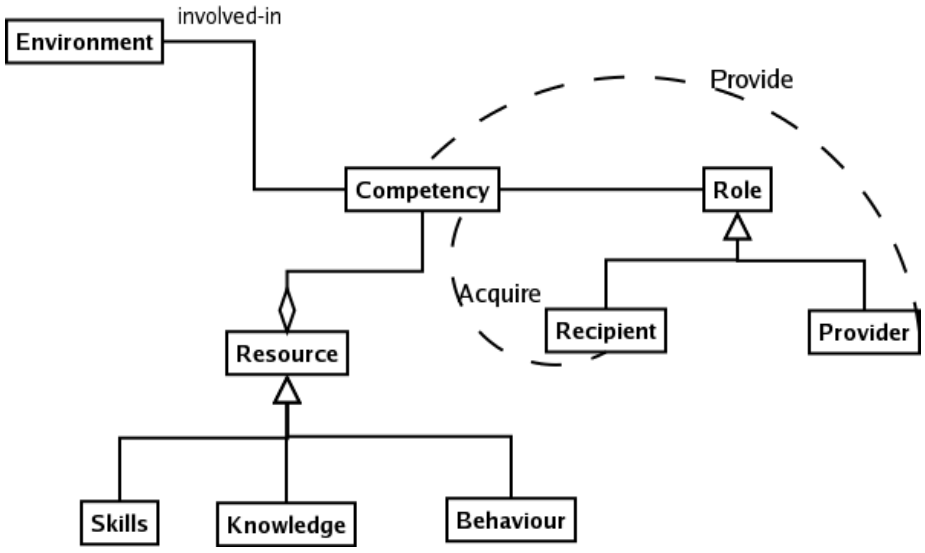

Figure 7: The proposed "Unified Competency" model

The goal of the Palette's competency model is to represent the competency in the context of CoPs. As indicated in the previous section, the main aspect of competency to deal with in this context is the acquisition/exchange of competencies. We take it into account in the proposed model through the distinction of different roles that actors can play in their relation with competency. We also need to define the competency, and we chose to make the distinction between three types of resources that characterize the competency. The last aspect that this model allows us to represent is the link between a competency and its context of use that is represented by the environment in which it is involved.
This model is linked to the Actor model via the role played by an actor in a competency. Notice that through this link between Role and Actor, and by distinguishing two kinds of actors (individual and group), it would be possible to take into account the differences between individual competencies and collective competencies.
The model may also be associated to Activity model (section 3) to represent the involvement of competency in different activities. And a particular case will be the learning process where we can deal with assessment of competency, and this will be represented in the learner model (section 4).

1.3.2 Detailed presentation of the concepts and axioms

Environment describes the situation in which the Competency is involved: solving a problem, achieving an objective or a task.

Competency is a set of Resources provided or to be acquired by an Actor that plays a particular Role in the environment.

Role can be Provider or Recipient of a Competency.

Resources is the set of items that compose a competency. It can be of three types:

- *Knowledge:* theoretical knowledge (declarative or procedural),
- *Skills:* capabilities of an actor to do some thing,
- *Behaviour:* the way of behaving of the actor in a group or in a particular situation.

1.3.3 Use-case scenarios

Scenario 1: Competency acquisition

A competency can be acquired by an actor in a CoP, in this situation the actor plays the role of *Recipient*, and some other members of the CoP can play the role of *Providers*.

Let us take an example from the Telecom-INT UX11 CoP of Palette, where a student uses the resources present in the e-learning platform and communicates with other students and tutors to acquire a specific competency related to a course.

In this case, the student is the *recipient* of the competency, the other students and the tutors that help him/her to acquire the competency are the *providers*, the *resources* that compose this competency are:

- The courses (*knowledge*)

- The capabilities acquired by the student when doing the activities associated to the course (*skills*)

- The behavior of the student in the community of students and in his contacts with tutors (*behavior*).

The situation of acquiring the competency and the e-learning platform in which the exchanges take place constitute the *environment*.

The acquisition of competency is the process in which the student learns the knowledge, develops his/her skills and behavior.

Scenario 2: Competency use

In the context of a CoP, a competency can be used either inside the scope of the CoP or outside (in members' practices). Inside the CoP, the main use of competency is related to its acquisition by other actors (see Scenario 1). Outside the CoP, an actor uses the competency she/he acquired in a CoP in the context of her/his practice.

Let us take an example, also from the Telecom-INT UX11 CoP of Palette. A student who acquires a given competency in the CoP (e.g. programming in C language) will use it in a training (e.g. games programming in C language) in which this competency is necessary, she/he may also come back to the CoP to improve her/his competency or to complete it if some pieces of knowledge (e.g. knowledge about a graphic library needed to program games) needed for the training were not acquired previously, the context of the training may raise this issue, and the student will try to acquire it in the CoP.

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2 Collaboration model

In a Community of Practice, people are joined together in order to share their knowledge, experience about a subject. This sharing of knowledge is seen as collaboration.
The word collaboration comes from the Latin words “co” and “labor”. “Co” is a prefix that means **with**, and “labor” is a noun, which means **work**. Consequently collaboration is the fact of working together, in order to achieve a common objective.
In a CoP, collaboration is considered as a means of increasing its knowledge and having a larger range of resources. Moreover collaboration allows CoP members to share experience and exchange knowledge. Collaboration can be a source of creation of new knowledge, through activities.
To better understand how collaboration takes place requires to list the different activities that occur in a CoP, the different roles existing in the CoP to understand the CoP’s structure, and to know how the CoP operates by means of these activities.
In this section, we will be interested in the fact of modeling the process of collaboration, that is to say the way things happen when people collaborate.

2.1 Study and presentation of existing models

2.1.1 The Engeström’s Collaboration model

- General presentation and description of the model

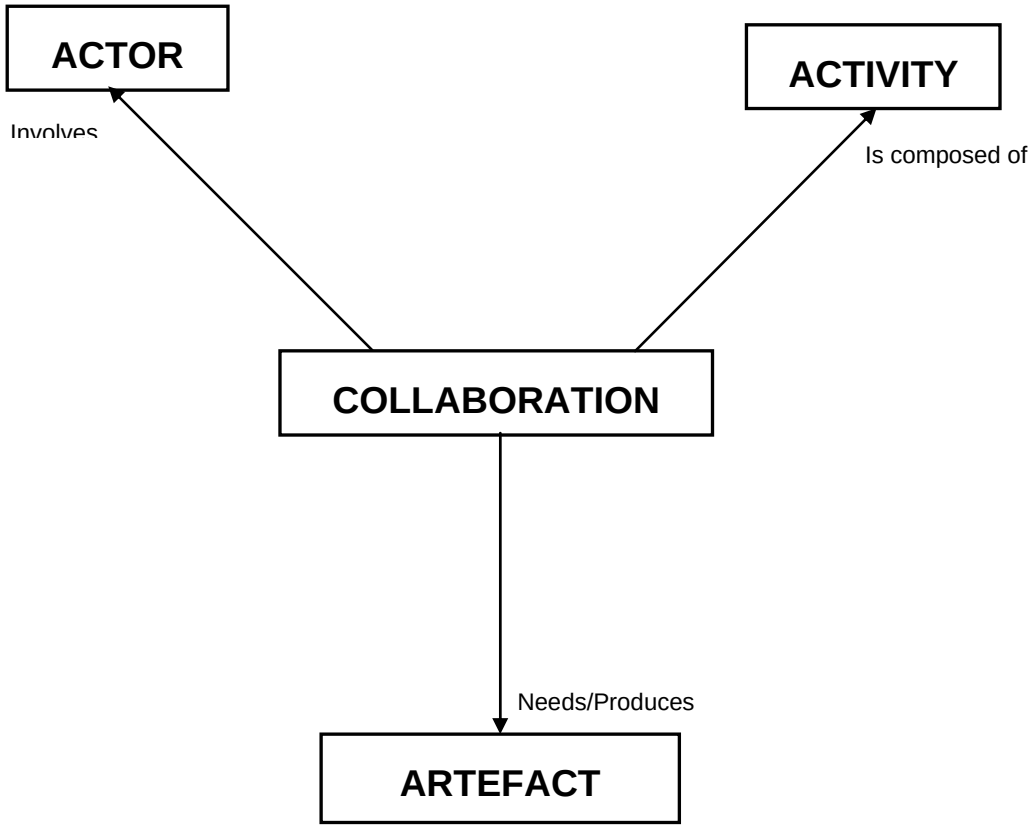

Figure 8: The Engeström Collaboration model

This first model represents the collaboration as a ternary relation: actors involved, activities implemented and artefacts used and produced.
In this model, collaboration is seen as a composition of several actors, one or several activities that lead to the achievement of the objective and of artefacts used or produced during the collaboration.
Collaboration is defined by the persons involved (*actor*), the various steps to be crossed (*activity*) and resources needed or produced (*artefact*).
Actors are the persons who take part in collaboration and exchange their knowledge. They can be defined by their role, their competency, and their cognitive style for example. They also can be represented by their role within a group.
In a CoP, the actors are the members; they can have several roles within the CoP. During collaboration, an actor can change role according to the activity undertaken.
Collaboration takes place during activities. These activities lead to artefacts or use artefacts, and are implemented by actors. Activities materialize the sequence of tasks that sustain the collaboration.
An activity, in the framework of collaboration, can be an exchange of mail or a discussion; it could be a definition of a practice or an agreement on a point of view.
An artefact is a product resulting from a human activity. It can be a theory, a document, a model, etc. According to this, the different tools used or produced during collaboration are considered as artefacts. This can be a tool supporting an activity or a document produced by the collaboration.

This model represents collaboration as a set of activities, implemented by actors, who could need or produce some artefacts.

- Roots of the model

This model was built according to the theory of Engeström, exposed in 1990 in “Learning by expanding”.
This model represents collaboration as the objective of the collaboration itself, it seems in this model that the collaboration is the work to achieve with the different activities, by the actors and with some artefacts.
The objective of the collaboration is thus not presented in the model.

- Associated models

As noticed before, this model of collaboration involves actors, activities and artefacts.
Moreover Engeström’s model is based on Activity theory.
Indeed the characteristics of the actors have an influence on the collaboration. Someone who is really motivated and committed in the CoP will participate a lot and bring some constructive remarks in the collaboration process. On the contrary, someone who is shy and does not have a lot of knowledge will not dare to deliver its opinion and will not commit himself/herself a lot in the collaboration.
There are a lot of characteristics to take into account in order to evaluate the influence of a member in collaboration.
The activity model allows us to structure the different activities occurring during collaboration, and consequently to define the advance of the collaboration.
Moreover it indicates the main steps to go through to achieve the final goal.

Accordingly we could evaluate the quality and the advance of collaboration; it could be a metrics for the CoP and its evolution. Moreover this could also lead to the evaluation of the members’ participation.

- Strengths and weaknesses of the model

It seems this model presents a flaw: the objective of the collaboration is missing.
The objective is considered as a major component of collaboration, thus this model could constitute a source for the final model, to be completed.

- Applications

This collaboration model could be use in a learning domain. For example, a teacher who wants learners to do an exercise in common will organize his/her work like this. He/She will think to the activity he/she wants to do, and then identify the learners concerned and the instruments needed.
Moreover the teacher could draw up a list of the different theories to know in order to solve the problem.

2.1.2 The Laferrière's Collaboration model

The second model represents collaboration as a ternary relation; it is inspired from collaborative learning.

- General presentation and description of the model

This model is derived from the collaborative learning domain. A large number of research findings shows that learning by interacting with other people enables to enlarge the amount of knowledge and to increase the involvement of the students in learning.

The collaborative learning model is composed of an objective, of actors that realize activities, in order to achieve the aim of collaboration.

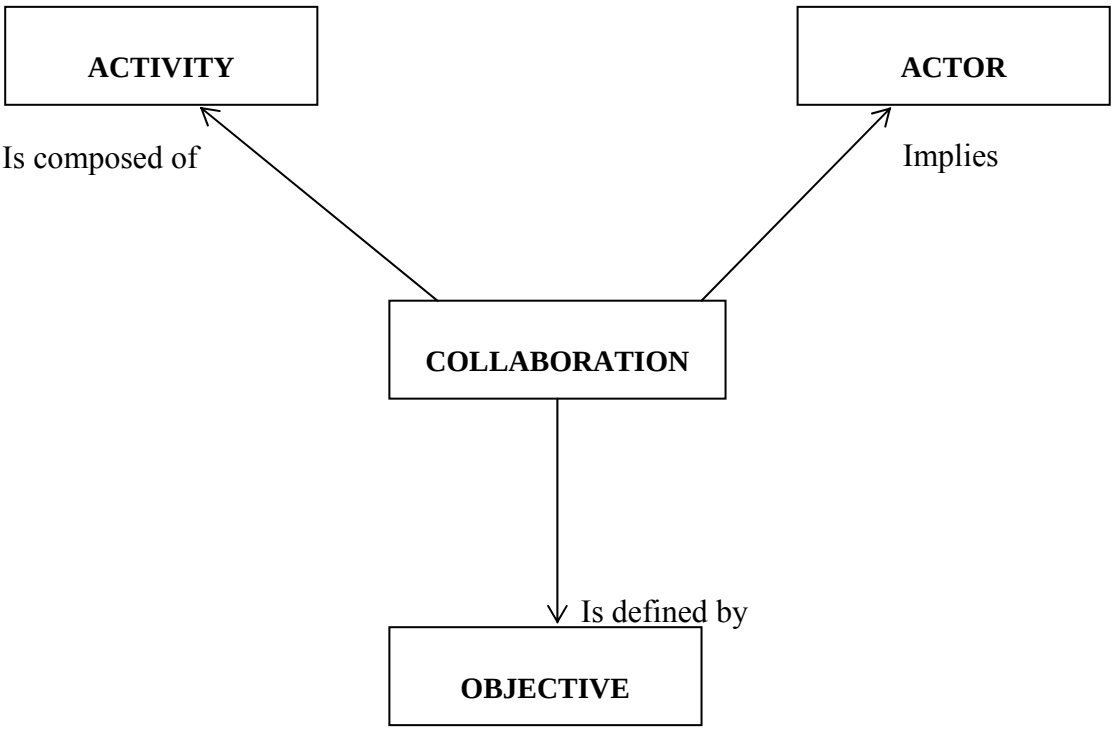

Figure 9: The Laferrière's Collaboration model

In this vision of learning, the actors are the learning facilitators and learners. Learners are considered as an information source, agent of motivation and constitute a mean of help and support. They can be defined by their role in the collaborative learning, their engagement and their motivation.
Learning facilitators are the animators; they have to manage the interaction and collaboration.

The objective defines the aim common to all students; it enables everyone to know the common objective and to define personal aims. The objective can be a question to resolve, a project to realize…
The activities are realized in order to achieve the final objective, by intermediary steps. It can be making researches, presenting a talk …
Activities can be distributed at the beginning of the collaboration, according to the repartition, role, and responsibility of each actor.
In this way, everybody can evaluate its implication in the collaboration and determine personal objectives.
Moreover it allows the awakening and the responsibility awareness of the actors in the CoP.

- Roots of the model

This model is inspired by the definition of collaborative learning, written by Thérèse Laferrière, in the foreword of the book "*Collaborer pour apprendre et faire apprendre, La place des outils technologiques*".
This model was built with the vision of collaboration to learn, in communities of learners. However it can be adapted to communities of practice: definitions of concepts must be redefined according to the context (communities of practice).

- Associated models

As the description of this second model explains, collaboration induces activity and is linked to actors. Consequently Actor and Activity models are associated to Collaboration model. Indeed collaboration implies both actors and activities, but the link between actor and collaboration is more complex than the link between collaboration and activity. In fact actor and collaboration are interdependent, so it could be interesting to study the characteristics of the actor that influence the collaboration and to know how collaboration influences the actors.

- Strengths and weaknesses of the model

This second model presents collaboration as a ternary relation. It takes into account the actors that participate in collaboration, the activities induced by collaboration and the objective of the collaboration.
Nevertheless tools supporting or produced, instruments and resources needed to achieve the collaboration are not presented in this model.
Resources produced and needed are considered as important for the collaboration model. This second model could be used to inspire the final model.

- Applications

This model of Collaboration could be used for the description of a project.
The objective is presented, the different actors with their respective roles in the project, and finally the different steps to do to achieve the project.
This could correspond to the description of work in a project, with the repartition of the different activities between the partners.

2.1.3 The Montiel's Collaboration model

This third model was partly inspired by the two previous models.

- General presentation and description of the model

Collaboration is a joint work between people, in order to achieve a common goal.

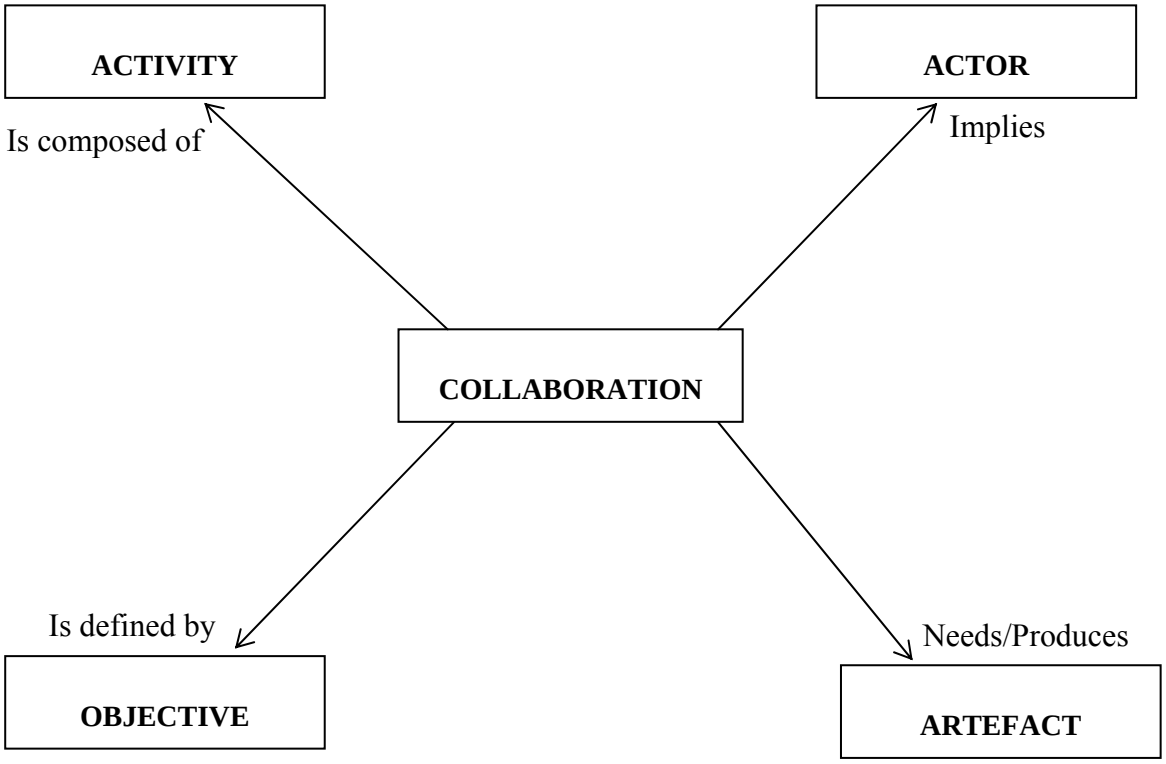

Figure 10: The Montiel's Collaboration model

This model presents collaboration as a four dimensions relation: actors involved, activities implemented, artefacts used and produced and objective.
The actors involved are important in the definition of collaboration. According to their level of knowledge, their role, they contribute differently to collaboration. Thus the final quality and the result of the collaboration depend on the actors involved.
The artefacts used allow us to know what is needed to perform collaboration. Moreover artefacts describe what is produced by collaboration, so artefacts are important in the definition of collaboration. Indeed their implication is essential in collaboration.
Activities allow us to define the various stages to accomplish during the collaboration.
Therefore it enables to know the progress and the evolution of collaboration.
The objective is important in the definition of the collaboration in order to always have in mind what is the goal to reach. The objective enables to see if the work is in the right way and if there is no drift of the work.

- Roots of the model

The construction of this model is inspired from collaboration between teachers and librarians.
This model was built by crossing different definitions of collaboration, and by taking the main keywords in each definition.

- Associated models

As this model is built, we see that the Actor model and the Activity model are associated to it.
Moreover the quality of collaboration depends on the involvement of the actors, their commitment and their motivation to work in this collaboration. This influence shows the link between the Collaboration model and the Actor model.
The Activity model is linked to collaboration, as the collaboration is composed of a single or a set of activities.
Another associated model could be a model describing the characteristics that contribute to the collaboration success.

- Strengths and weaknesses of the model

This model of Collaboration includes the major components of collaboration. Thereby this model could be used in order to build the final model.
It does not present weaknesses as the two previously presented models, and as we have seen before, this model includes the strengths of the previous models.
The non-visibility of the dynamic side could be considered as a weakness of the model. However this can be filled by showing the interdependence of activities and artefacts, when instantiating the model.

- Applications

This model could be used in order to manage a project within a company.
The definition of the request of proposal is assimilated to the objective in the model.
The project will be structured according to the different activities that will be necessary to reach the final aim of the project.
According to the definition of the artefacts and the activities to do, a specific employee could have a specific role in the project.
By using this model, the collaborative work could be structured, and every actor could know exactly the role he has and the work to do.

2.2 Comparison of models and decisions

The first two presented models are considered as complementary.

Indeed the first model was incomplete according to the lack of the objective. Concerning the second model, it does not take into account the resources needed in order to support collaboration.

This is the reason why we propose a third model, which is a combination of the previous.

The third model presented inspires the model that is finally proposed. According to the discussions with the partners, the proposal of the final model defines collaboration as a relation between Actor, Activity, Objective and Resources.

2.3 Unified model proposal

The final model proposed by CRP HT is inspired by the models previously presented.
After discussions and decisions with the other partners, we have decided to build a model on a quaternary relation.

2.3.1 General overview of the model

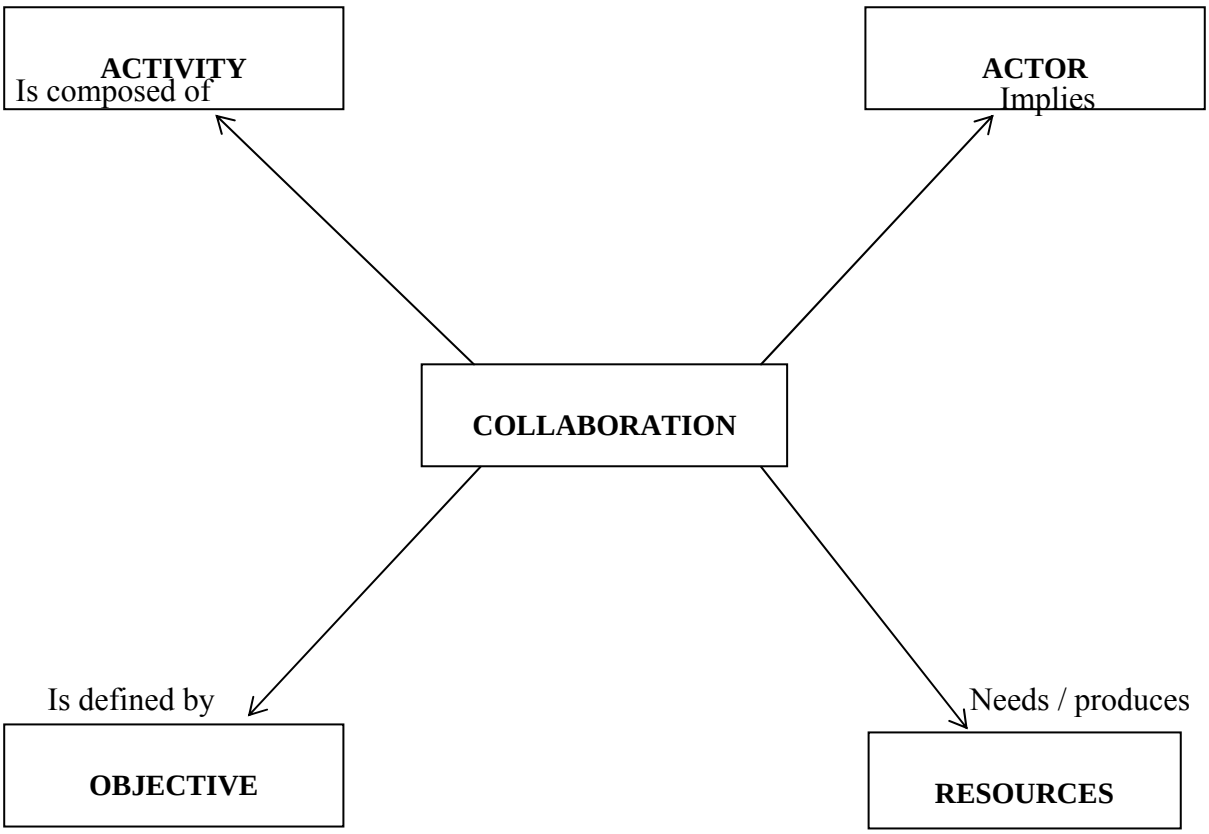

Figure 11: The proposed "Unified Collaboration model"

The final model presents the collaboration as a relation between four main concepts: the actors involved, the activities induced, the objective and finally the resources needed and produced during collaboration.
The actors are the members that participate to collaboration, whatever their level of commitment or their knowledge. The actors may have several roles during collaboration; they can be responsible for an activity or animator of the collaboration.
Collaboration is composed of activities, such as discussions, exchange of knowledge, of experience. Moreover actors can do a lot of things in common, and without being aware of it, they work in collaboration.
Collaboration is organized due to a specific reason; this reason is assimilated to the objective of collaboration. The objective describes the main goal and the aim of collaboration.
Resources represent all needs and products of collaboration. There can be documents, theories, software, and instruments … Resources support collaboration and some are created during collaboration.
Some resources can be allotted to an actor or to a specific activity. But competencies specifically needed for collaboration are not considered as resources, there are linked directly

to the actor. An actor possesses some competencies, which allow him/her to do some activities. Obviously competencies of an actor evolve during collaboration, even if this is not the main goal of collaboration.

2.3.2 Detailed presentation of the concepts and axioms

In this model, collaboration is seen as a common work between two or more people, producing and supported by resources; this common work, lead to reach a common objective, is composed of various activities.
Activities represent the different stages to do in order to achieve the final aim of collaboration. There can be activities planned or impromptu activities such as discussions or mail exchanges… Activity concerns sharing, exchange around the objective of collaboration. It can lead to a definition of best practices, a decision, a document creation … A product of an activity can be used by another activity. However this interdependence between activities are not dealt with in this section because this is managed in the Activity model. We can see here the direct link with the Activity model.
The objective presents the main aim of collaboration, the goal common to every actor. Each actor can have personal aims to reach during collaboration; there can also be incidental acquired knowledge. In fact in this model, the objective is assimilated to the first reason, the main goal of collaboration.
The actors represent the members participating in collaboration. Their roles, their competency levels and other concepts can define them; they can be learners, knowledge providers, and animator… In this way, Collaboration model is linked to the learner profile, another meta-concept presented in a following section.
The actors can be responsible for an activity; an actor possesses some competencies, which rely the actor model to the competency model, previously presented.
Resources are included in the model because of their importance in collaboration.
Indeed resources are considered as a support or a product of collaboration. In fact all that can support collaboration such as documents, software, theories… is regarded as a resource. Furthermore what is produced during collaboration is considered as a resource.

2.3.3 Use-case scenarios

There are many use-case scenarios linked to this model.
A debate around a specific subject is seen as collaboration. Indeed several actors expose their ideas and their visions about this subject and exchange with the others actors. The objective of this collaboration is to share ideas and to agree on some aspects of the subject. The fact of sharing, exchanging and discussing is the activity of collaboration; the actors are the animator of the debate and the persons that share their opinions. The various reports such as statistics or surveys, on which the different parts are based to argue their opinions, are the resources of collaboration.

A fusion of two companies can be another situation of collaboration. In the field of industry, it is not rare to see two companies combined in order to answer a specific request or to counter a competitor. In this situation of collaboration, the companies are the actors; the objective is the reason of collaboration and generally is known of everybody. The resources are the contributions of each company in the collaboration, such as know-how, material, or funds.
The activities are the diverse stages to cross before reaching the final aim. The activities could be distributed according to the knowledge of each company, but also financial resources brought.

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3 Process/activity model

3.1 Study and presentation of existing models

Developing the Process meta-model within the Palette context aims at describing sequences, roles, objectives, inputs and outputs of transformations, be they knowledge transformations within the CoP or transformations being part of the CoP's objective or core processes.
The proposed meta-models are mainly based on the Coordination Theory Approach and on the Activity Theory as well as socio-cultural and socio-historical theories. Here again, research was conducted towards finding existing ontology models that formally describe process and activity. The unified model was chosen on basis of WP3.1 partners' consensus.

3.1.1 The Crowston and Osborn Process/activity model

- General presentation and description of the model

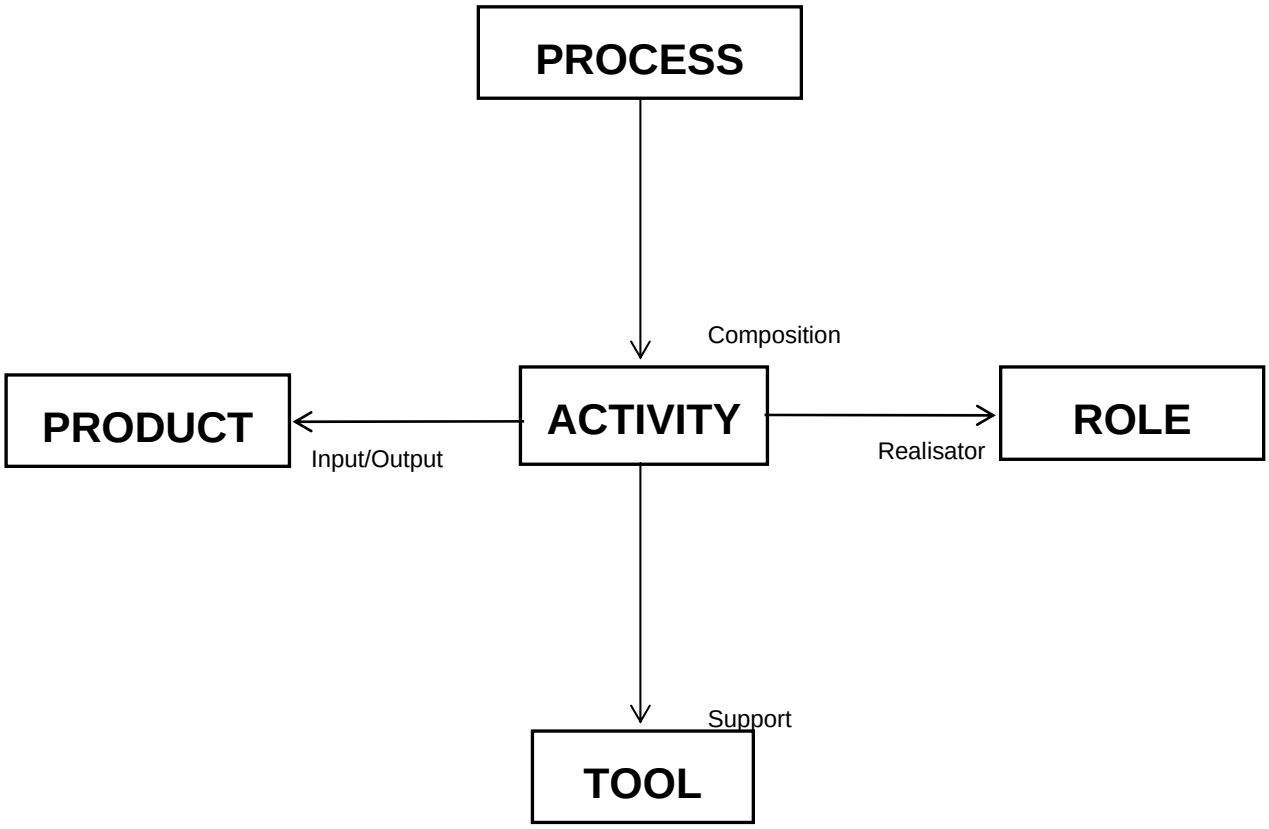

Figure 12: The Crowston and Osborn Process/Activity model

This model presents a process as a composition of activities.
A **process** is a set of activities that use resources in order to transform input objects into output objects.
An **activity** is considered as a transformation of a product during a process.
An activity is seen as a ternary relation: a role, product and tool.
An activity is exercised by a certain **role**, with a specific level of competency. Some activities require specialized skills, thus they constrain which actors can work on them. Thus an activity represents and includes the behavior that the role can, or has to, adopt during the realization of a process.

The role represents also the responsibilities ensured by a function (e.g. product manager). It is defined by all the activities assigned to fulfill a function. This is not a physical person. The role can be responsible for one or several activities.

The **product** can be the input or output of the activity; it can change state during activity throughput, passing from a state "created" to a state "destroyed", for example. A product could be software, a document, competency, etc…

A **tool** supports or facilitates the realization of an activity.

- Roots of the model

This model was constructed for a project realized at the Centre de Recherche Public Henri Tudor (CRP HT). This project aimed to facilitate the initiation, exploitation and animation of innovated and learning networks, and to have some economic tools and software supporting activity of these networks.
It is based on Crowston and Osborn's "Coordination Theory Approach" (1998) as they describe: "processes as sequences of activities performed by organizational actors that produce and consume resources".

- Associated models

As presented previously, the role involved in the realization of the activity is important to the process definition. The role of an agent can be defined by its cognitive profile, its responsibilities… Thus the Learner/Actor meta-model could be interestingly related to this Process meta-model.

- Strengths and weaknesses of the model

Strength: This model was constructed for a project realized at the CRP HT. This project aimed to facilitate the initiation, exploitation and animation of innovated and learning networks, and to have some economic tools and software supporting activity of these networks.
Weakness: Difficulties to understand in the figure how a product can be an input and an output for an activity.

- Application

See the use case scenario described in section 3.3.3.

3.1.2 The Engeström's Activity System Model modified

- General presentation and description of the model

This model presents an adaptation of Engeström's Activity System Model (ASM) (1987) and refers to the Activity Theory. The original names of the ASM elements were changed in order to respect the terms used by the Palette partners working on the WP3.1.
In this model, mutual relations between actor/object, actor/community and community/object are mediated and each of the mediating terms is historically formed and open to further development. The transformation process of an object refers to different steps, which refer to different resources, rules, etc.

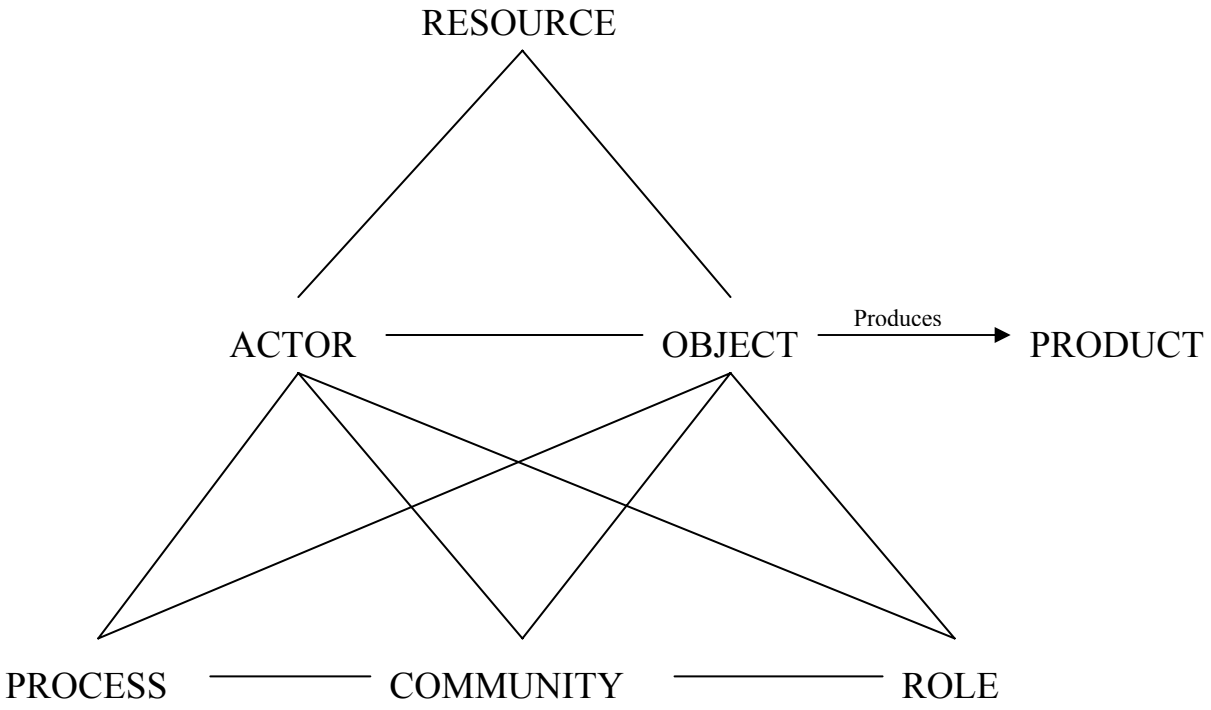

Figure 14: The Engeström's Activity System Model modified

An **activity is a form of doing directed to an object**. It is the minimal meaningful context for understanding individual actions. In the ASM, an activity is a systemic whole. Each element has a relationship to others. Each relation is also mediated.
An **actor** is someone performing an activity.
An **object** can be a material thing or an intangible thing such as an idea, a representation, etc. The participants/actors of the activity share it for manipulation or transformation. It can change during the process of an activity.
The relation between an actor and an object is mediated by a **resource**. The object is seen and manipulated not as such but within the limitations set by the resource. In the ASM, the resource carries with it the historical development of the relationship. The resource, called instrument, tool or artefact in the ASM, can be a material tool or a cognitive tool. It enables and limits the relation between an actor and an object. It can be anything used in the manipulation or transformation process. It empowers the actor in the transformation process with the historically collected experience and skills "crystallized" to it, but it also restricts the interaction.
A **community** is a group of actors sharing the same object. The relation between a community and an object is mediated by the role (the division of labor in the original ASM).
Role, division of labor in the ASM, refers to the organization of a community as related to the transformation process of an object into the product (or outcome in the ASM).
Process, rules in the ASM, mediates the relation between an actor and a community. It can be either explicit or implicit norms, conventions, habits, terminology or social relations built in the community. Processes are conventions for interactions. They can be constructed for a particular activity.

A large part of this description is taken from Kuutti (1996).

- Roots of the model

This model refers to Engeström's Activity System Model. The ASM refers to Activity Theory and to socio-cultural and socio-historical theories. The cultural-historical theory of activity was initiated by a group of Russian psychologist in the 1920s and 1930s. The basic concept of the approach was formulated by Lev Vygotsky. Vygotsky (1978) and his colleagues, A. R. Luria (1976) and A. N. Leont'ev (1978), formulated a new theoretical concept: the concept of artefact-mediated and object-oriented action.

- Associated model

The process model is a model that can be associated with:

- The Learner Profile model, because of the presence of the actor in the model
- The Collaboration model, because of the link between actor and community
- The Competency model, because of the role of an actor
- The Lessons Learnt model, because of the product of the activity, which can be part of lessons learnt.

- Strengths and weaknesses

The strength of this model is that it can be utilized for every CoP as it describes the different interacting elements that appear in its activities. Another strength is that it allows making clear links with other proposed meta-models: an actor having competencies and skills and working or learning collaboratively, having a given role within a community. The dynamic aspect of this model allows us to make a link with the Lessons Learnt model as an activity can have different steps and as the result of each step, it influences all the elements of the model and consequently it also influences the following steps.

A weakness of this model is that it can be difficult to understand without a description, because the relations between the various concepts are not explicit and do not have predicate.

- Applications

Let us refer to the transcription of interview Form@hetice_04_Izida_21avril2006.PDF (BSCW server: PALETTE / Workpackages / WP1 / Community of CoPs Observers / About CoPs data / Transcription of interview)

The interviewee is an actor explaining her different roles in the community (facilitator and animator). She is working in a community that has a common objective and common objects. She uses different resources (one of these is a Wiki) and different rules (formalization of the exchanged practices, usage of a research-action methodology…). She exchanges with people who enter and leave the community and she feels the necessity of having all the shared experiences of these people located in a same place in order to avoid to lose the history of the group and in order to give a guide (rule) to the members that will help them to work on their project.

3.2 Comparison of models and decisions

The discussions about the comparisons between the two proposed models led us to adapt the Crowston and Osborn's model and choose this adapted model as the unified model. It was not clear for the WP3's partners to understand how, in the first version of this unified model, a product could be an input and an output for an activity as the arrow direction was only from the activity to the product. The term "Tool" was also too restrictive as it was possible to understand it only as a technical tool. The discussions led to the adaptation of this first proposed model and to the proposition of its second version.

Some WP3 partners prefer the model 2, based on Engeström's Activity System Model, because it allows us to see the interactions between the different elements of the model and it also shows the links with the other proposed meta-models. But as this model was too complicated to understand without its description, the partners adopted the Crowston and Osborn's model adapted.

3.3 Unified model proposal

3.3.1 General overview of the model

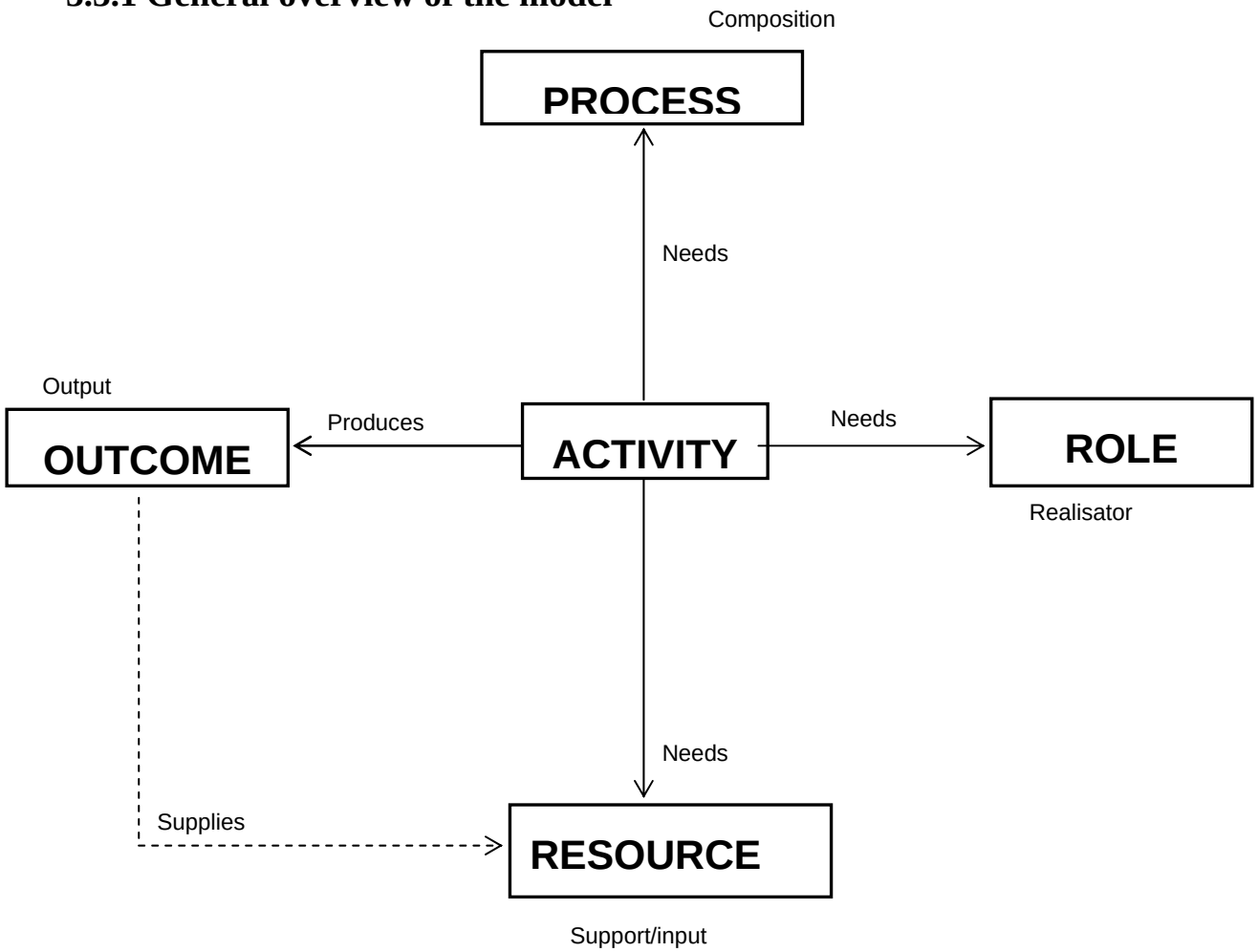

Figure 15: The proposed "Unified Process/Activity" model

3.3.2 Detailed presentation of the concepts and axioms

A **process** is a set of activities that need roles and resources in order to transform input objects into output objects, called outcome.
An **activity** is considered as a transformation of an input resource by a role during a process.
An activity is seen as a ternary relation: a role, resource and a process. It needs the three following elements in order to be performed
A **role** represents the responsibilities ensured by a function. It refers to a specific level of competency and to specialized skills.
A **resource** enables or helps the realization of an activity. A resource can be a tool or a product: software, a document, a competency, a practice, a method …
The **outcome** is the output of the activity.

3.3.3 Use-case scenarios

Let's take as example the work we have done in the WP3 with the two other partners.
To be able to choose the unified meta-model concerning the Process model and to all agree on this model, which is the final outcome of the main activity, we had different activities: identify models in bibliography, represent and describe these models, exchange these models and explain them to the other partners and finally write this part of the deliverable. Each activity has an outcome, which is a sub-class of a resource for the following activity, except the last outcome.
Each of these activities is associated to a certain process. For example the process of the activity "exchange these models and explain them to the other partners" required us to meet every week, via a conference call. These conference calls have had the same structure: presentation of each model by the designer partner and exchange regarding remarks or comments on the proposed model, followed by a conclusion of the remarks.
Each activity, referring to a specific process required different roles: coordinator, animator and participants. The roles need specific competencies and skills and linked us to the Competency model and to the Learner Profile model.
The resources used were the phone, the BSCW server, the outcome of the previous activity, etc. Regarding the use of the outcome of previous activity, we can refer to the Lessons Learnt model.

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4 Learner profile

4.1 Study and presentation of existing models

Learners are actors whose main objective is learning. Given the fact that learning is a major part of a CoP's activities, one of the most significant roles undertaken by almost all CoPs' members is the role of a learner. Acknowledging the importance of enhancing learning within the Palette project, in this section we focus on actors as learners. More specifically, we present a generic Learner Profile meta-model that aims at exposing the learners' cognitive characteristics when exposed to a piece of knowledge. To achieve this goal, information about existing learners' profile models was gathered from various sources in addition to a thorough literature review as regards learning activities and learners *per se* (Dolog and Schäfer, 2005; Jameson, 1996). Furthermore, research was conducted in order to derive existing ontology models that formally describe Learners' Profiles. Then, a creative synthesis of the existing approaches was made, so as to produce the proposed Learner Profile ontology meta-model.

4.1.1 The Chen and Mizoguchi's Learner model

- General presentation and description of the model

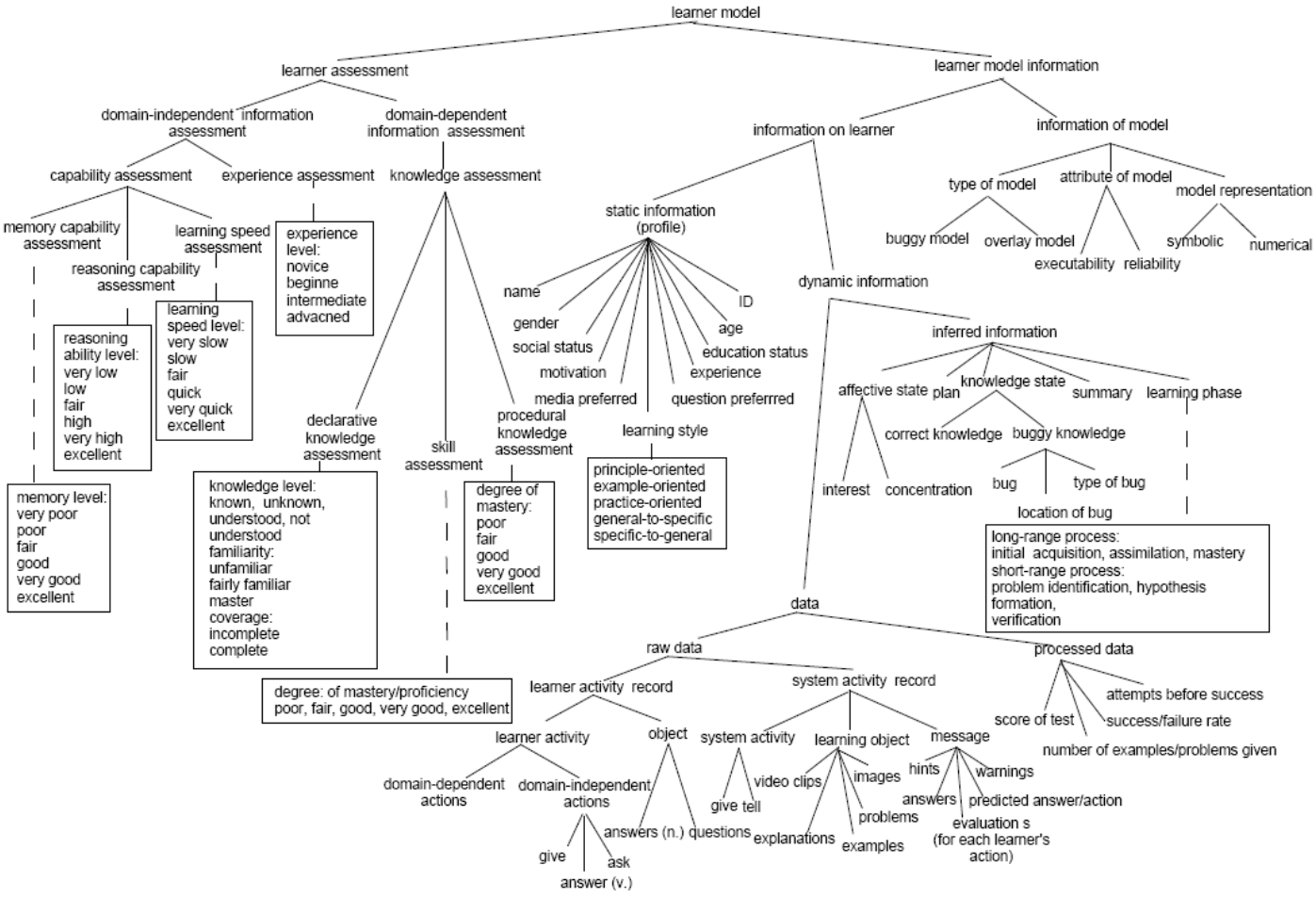

Figure 16: The Chen and Mizoguchi Learner model (Chen and Mizoguchi, 1999)

Figure 16 presents "Learner profile" ontology, which is the concept hierarchy for the communication between learner model agent and other agents in Intelligent Educational Systems (IES) (Chen and Mizoguchi, 1999). The main concepts and relation appearing in the above ontology are presented in Figure 17, forming a meta-ontology model.

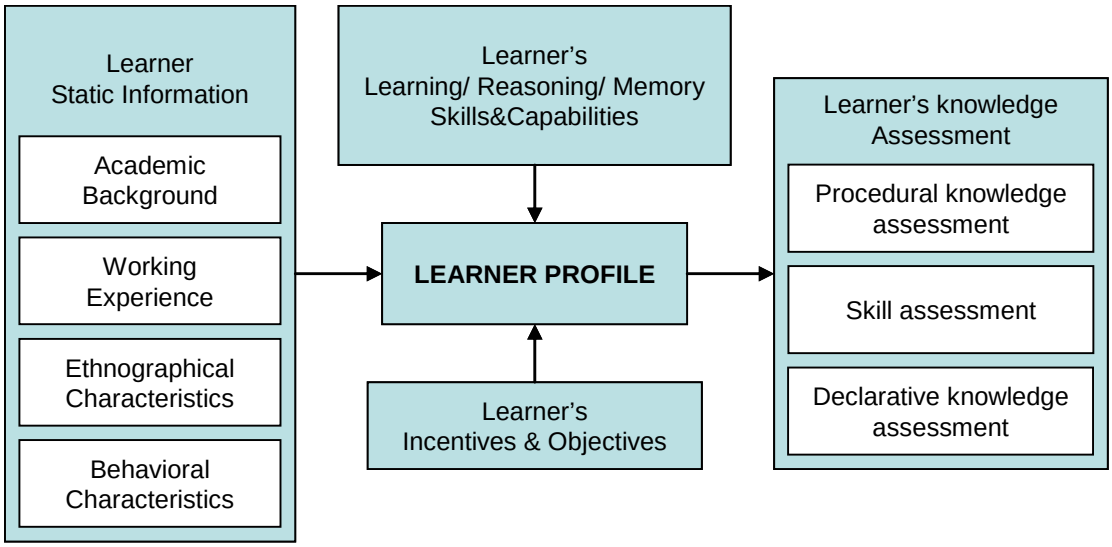

Figure 17: The "Learner Profile" meta-ontology model inspired by Chen and Mizoguchi (1999)

This meta-model presents the "Learner Profile" as a four dimensional relation between: the learner's "Static Information", "Objectives & Incentives", "Skills & Capabilities" and "Knowledge Assessment". The learner's static information comprises information such as the learner's academic background and working experience, as well as information related to the ethnographic characteristics and social behavior. All these are strongly related to the learner's cognitive characteristics. The learner's incentives and objectives are decisive factors as regards the learner's behavior in learning activities. The learner's learning, reasoning and memory skills, as well as capabilities reflect on the learner's cognitive style as regards his/her cognitive characteristics when exposed to a piece of knowledge. Finally, the assessment of the learner's knowledge regards the qualitative measures as far as his/her procedural and declarative knowledge as well as learning skills are concerned.

- Roots of the model

The roots of this model lie in work related to agent communication in the field of IES by Chen and Mizoguchi (1999). The main purpose of this model is to define the entities, relations and functions needed to describe the procedure of modeling a learner, making instructional decisions, interacting with a learner and communicating between agents, so as to form an educational ontology. Further information on the concepts of this model can be found in Mizoguchi *et al*. (1996).

- Associated models

This model could be associated with Actor and Competency models.

- Strengths and weaknesses of the model

As shown in Figure 16, this model comprises a detailed definition of the "learner assessment" notion. This aspect relates to learners' cognitive characteristics when exposed to a piece of knowledge, such as the learners' memory, learning speed and reasoning capabilities that are thoroughly described. Thus, this model fulfils at some level the aims of developing a Learner Profile within the Palette context. Another strong point of this model is that it has already been validated and used. Moreover, an additional advantage of this model is that it is technically oriented towards its integration with agents and software tools. On the other hand, this particular model does not refer to issues such as the learning object, or the learners' interactions with their environment and other people.

- Applications

This model can also be used as a "think piece" for the development of the "Learner Profile" ontology model to be developed in the Palette, and the CoP-dependent ontologies in the following. More specifically, the definition of various notions such as the declarative and procedural knowledge assessment could be of use in our future work steps.

4.1.2 The PAPI Learner profile model

- General presentation and description of the model

The "PAPI Learner" conceptual model, also known generically as a "learner profile", is a subset of general learning technology information (PAPI, 2000). This model is considered as a standard that describes a particular subset of learner information. The term "learner profile" is the generic name, whereas the "PAPI learner information" is one specific description of this "learner profile".

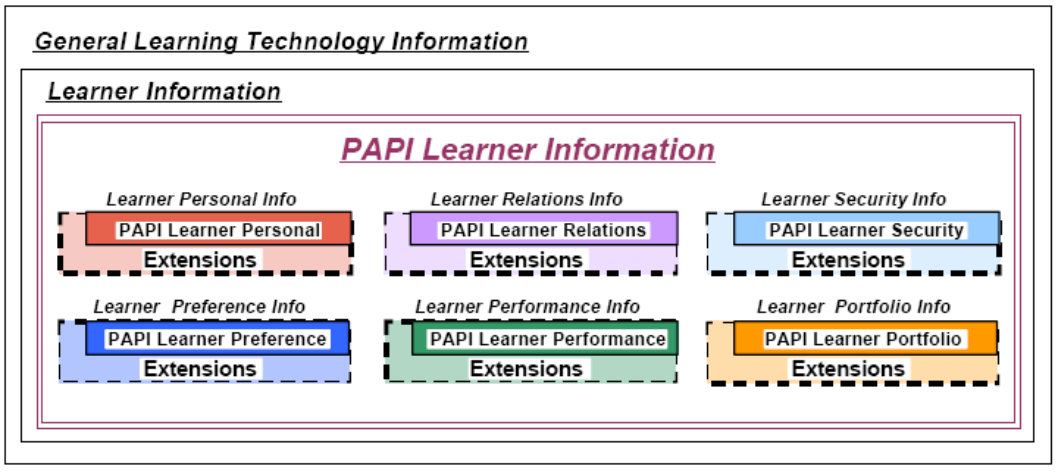

Figure 18: The "PAPI Learner" information/profile model (PAPI, 2000)

The following is a brief description of the six information types of the "PAPI Learner" model:

- **Learner personal information** is not directly related to the measurement and recording of learner performance and is primarily related to administration. It is noted that this type of information is private and secure.
- **Learner relations information** is about the learner's relationship to other users of learning technology systems, such as teachers, proctors, and other learners.
- **Learner security information** is about the learner's security credentials, such as: passwords, challenge/responses, private keys, public keys, and biometrics.

- **Learner preference information** describes preferences that may improve human-computer interactions.
- **Learner performance information** relates to the learner's history, current work, or future objectives and is created and used by learning technology components to provide improved or optimized learning experiences.
- **Learner portfolio information** is a representative collection of a learner's works or references to them that is intended for illustration and justification of his/her abilities and achievements.

- Roots of the model

The roots of this model lie in the need to define a standard for modeling a learner's profile in the field of Learning Technology Information (PAPI, 2000). More specifically, the information described in the "PAPI Learner" model includes personal, preferences, performance, portfolio, and, possibly, other types of information. The selection of each of the six information types defined in this model describes a subset of information types based on their usefulness and their likelihood to be widely implemented.

- Associated models

This method could be associated with Actor, Process and Competency models.

- Strengths and weaknesses of the model

This model does not describe all possible learner information, but includes only the minimum information necessary to satisfy the functional requirements and to be maximally portable, and the ability to extend this information.

- Applications

This model can also be used as a "think piece" for the development of the "Learner Profile" ontology model to be developed in the Palette, and the CoP dependent ontologies in the following.

4.2 Comparison of models and decisions

The first "Learner model" presented in section 4.1.1 is an ontology expressed as concept hierarchy for the communication between learner model agent and other agents in IES. This model provides interesting information about a learner's cognitive characteristics and is furnished with the representation of knowledge assessment issues. Thus, it can be helpful in the structuring of a "Learner Profile" ontology meta-model, but it can not be adapted without alterations due to the fact that it is very detailed in some aspects, whereas issues such as interactions are neglected.
The "PAPI Learner" conceptual model presented in section 4.1.2 comprises personal, preference, performance, portfolio and is open to other types of information. Even though each of the six information types defined in this model describes a subset of information types based on their usefulness and their likeness to be widely implemented, this is an issue under investigation. Furthermore, this model does not provide any information about a learner's profile dynamic aspects, thus it is not well suited for the depiction of a learner when exposed to a piece of knowledge and how this is affected by the learner's profile.
Besides the above two models, the Instruction Management Systems (IMS) Learner Information Package specification was also considered for the development of the "Learner Profile meta-ontology model" (IMS LIP, 2001). The IMS Learner Information Package is a

collection of information about a Learner (individual or group learners) or a Producer of learning content (creators, providers or vendors). This specification addresses the interoperability of internet-based Learner Information systems with other systems that support the Internet learning environment. The core structures of the IMS LIP are based upon: accessibilities; activities; affiliations; competencies; goals; identifications; interests; qualifications, certifications and licenses; relationship; security keys; and transcripts. Being very close to the PAPI learner model, this model is not presented in detail.

Considering all the above, the development of a new "Learner Profile meta-ontology model" was decided, so as to combine and augment the existing approaches. Furthermore, the development of a new model was considered as the best option given the fact that the "Learner Profile meta-ontology model" should be integrated with the "Competency", "Collaboration", "Process" and "Lessons Learnt" models.

4.3 Unified model proposal

4.3.1 General overview of the model

As stated in the introductory section, developing the Learner Profile meta-model within the Palette context aims at exposing the learners' cognitive characteristics when exposed to a piece of knowledge. The proposed model can be employed for developing ontologies for both individual and group learners. This model can also be used for representing dynamic aspects of the Learner Profile. Furthermore, it should be noted that the interactions among notions are not exhaustively defined. It is one of our intentions to determine all relations and their types.

4.3.2 Detailed presentation of the concepts and axioms

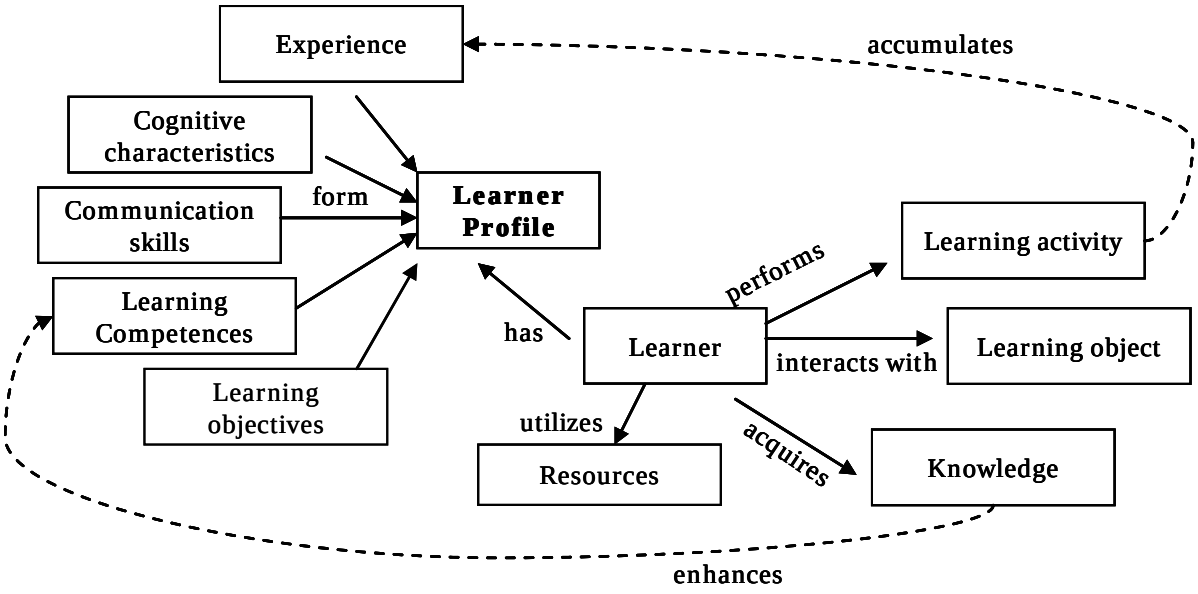

Figure 19: The proposed "Unified Learner Profile" model

Figure 19 presents the proposed "Unified Learner Profile" model that is inspired by all above-mentioned models, as well as the "Learner Information" collection of information defined in the "IMS Learner Information Package" specification (IMS, 2001). The following is a brief description of the notions and relations appearing in the "Unified Learner Profile" model:

- *Experience* comprises knowledge of or skill in or observation of something or some event gained through involvement in or exposure to that thing or event.
- *Cognitive characteristics* comprise intelligence, perception, memory capabilities, creativity, organizing skills.
- *Communication skills* refer to the individuals' abilities in interacting with their environment.
- *Learning competencies* refer to academic background, education, training, working experience etc
- *A learning objective* is a statement establishing a measurable behavioral outcome. The statement must include how the measurement is accomplished.
- *Learner* is the person who learns or takes up knowledge or beliefs. A learner is an actor's role that can be undertaken by an individual or a group of actors
- *Learning activity* is every activity performed that intentionally or non-intentionally resides to knowledge acquisition
- *Learning object* is every piece of knowledge
- *Knowledge* refers to a fluid fix of verbal and/or manual skills brought about through training, instruction or practice that denote familiarity with facts, truths, concepts or principles
- *Resources* i.e. every means a Learner utilizes to perform a learning activity.

All arrow connections appearing between the "Unified Learner Profile" concepts express the relations occurring between them. For instance, Learner and knowledge are linked by the relation "acquires".
Finally, it should be noted that as regards the relations among notions depicted in Figure 19, these are indicative and further relations or amendments to the proposed ones may occur according to findings of our future work.

4.3.3 Use-case scenarios

This section presents two use-case scenarios of the "Unified Learner Profile" model as well as its relations with the other meta-models.

Scenario 1
The individual learner Lr participates as a student in a University course about Knowledge Management. There:

Actor	Activity	Topic	Description
Lr	Performs	Learning activity	Lr being a course student participates in a learning activity where (s)he utilizes competences such as reasoning and memory skills in order to perceive the tutors instructions
Lr	Interacts with	Learning object	Lr interacts with learning object «Knowledge Management lectures notes»

			in order to assemble information regarding assignment given to the class
Lr	Acquires	Knowledge	Lr acquires knowledge when performing the previous two activities
Lr	Utilizes	Resources	Lr utilizes resources such as University libraries or the Internet to retrieve knowledge resources related to Knowledge Management

All the above activities performed by Lr are strongly related to the learner's experience, cognitive characteristics, communication skills, learning objectives, competences and motives.

Scenario 2

A University course about Knowledge Management is taught to a group of students. So, in this case, the Unified Learner Profile model applies to the group of learners GLr.

Actor	Activity	Topic	Description
GLr	Performs	Learning activity	GLr performs a group learning activity where the combined group members' use individual competences such as reasoning and memory skills in order to perceive the tutors instructions
GLr	Interacts with	Learning object	GLr members interact with learning object «Knowledge Management lectures notes» in order to exchange their individual interpretation on the learning object
GLr	Acquires	Knowledge	GLr members acquire knowledge when performing the previous two activities
GLr	Utilizes	Resources	GLr members utilize resources such as Internet forums to exchange their knowledge resources related to Knowledge Management course

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5. Lessons learnt model

The analysis of any activity by the actors taking part in this activity or by external observers can lead to "Lessons learnt" enabling these actors to draw recommendations useful for them or for other actors in their further similar activities / decisions. A typology of lessons-learnt can rely on the nature of these lessons-learnt: for example, we can distinguish positive lessons and negative lessons. In the case of problem-solving activities or decision-making activities, research on Lessons learnt can rely on models of problem-solving and of decision-making. We will not detail such models, but we can notice that when models offered for design rationale (e.g. IBIS model (Conklin et al, 1988) or QOC model (MacLean et al, 1991)) are used for building a project memory a posteriori, they may constitute a basis for extracting lessons learnt from this project. In the next sections, we will focus on some existing methods/models enabling to describe lessons learnt from experience.

5.1 Study and presentation of existing models

5.1.1 REX method

- General presentation and description of the model

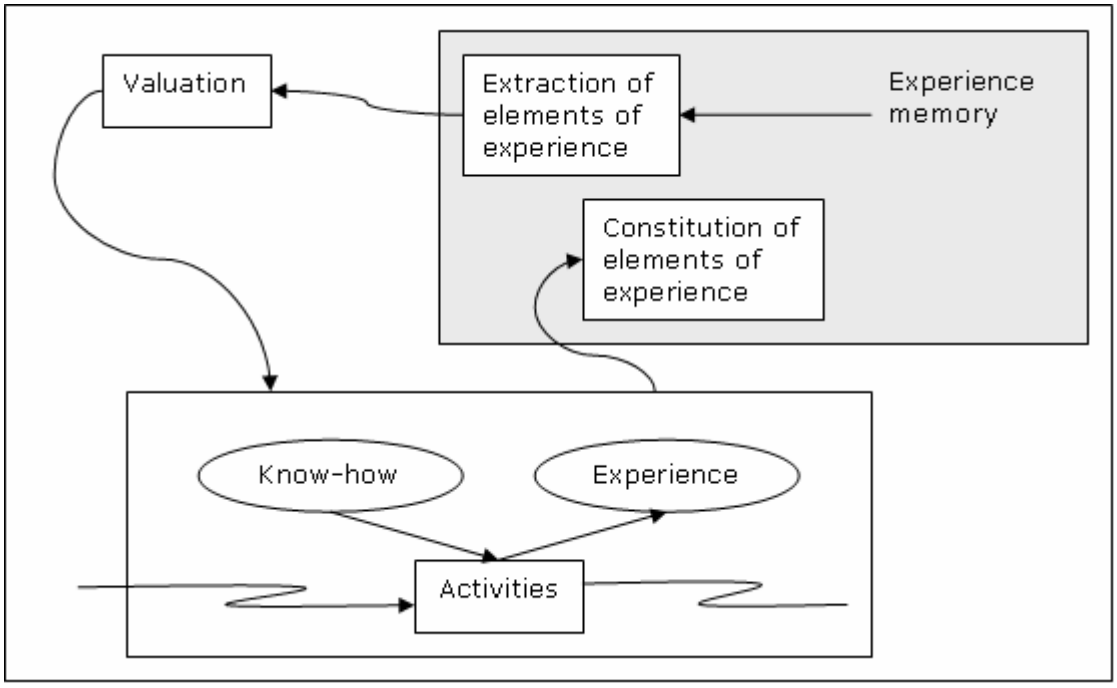

Figure 20: REX method

REX (Retour d'EXpérience) method (Malvache et al., 1993; Eichenbaum et al, 1994, Eichembaum-Voline et al, 1997) consists of constituting "knowledge elements" such as "experiment elements", stemming from any activity, and to store these knowledge elements in a corporate memory in order to be retrieved and reused by members of the company.
In REX method, several kinds of knowledge cards can be handled, in particular experience cards defined by:

- A **context**;
- A **description** or body, itself decomposed into:
    - A **description** of facts (e.g. incidents, failures, problems, etc),
    - An **opinion** (or comments),
    - **Recommendations**, or decisions taken.
- A list of **references**.

In the context of a company or of a community, a lesson-learnt can be described through such a REX experience card.

- Roots of the model

Designed in order to capitalize experience on Superphenix reactor and experience of CEA R&D Department on nuclear reactors, REX method is well appropriate for building project memories.

- Associated models

REX method is associated with an activity model. In fact, the knowledge cards and in particular,r the experience cards are built based on knowledge acquisition from experts and from documents related to an activity.

- Strengths and weaknesses of the model

A lesson-learnt can be characterized by:

- The context of the lesson-learnt
- The facts (experiences, observations on the CoP, on its actors, on its activities/processes, on its collaboration, etc.) from the analysis of which the lesson is learnt,
- The interpretation / opinion / comment of the actor – in fact, it constitutes the lesson-learnt,
- The consequences of the lesson learnt: final recommendations, decisions, etc.

REX method is well adapted to represent such information. But, more generally, a lesson-learnt is the result of the process of analysis of one or several experiences, this analysis being performed by an actor (an individual or a group). Therefore, we consider that REX method lacks:

- The actor (individual or group) playing the role of creator of the lesson-learnt,
- The actors (individuals or group) playing the role of (potential) addressees of the lesson-learnt or that could be interested in it.

The actor model does not explicitly appear in the REX model.

- Applications

REX method was applied in various domains (Dieng-Kuntz et al, 2005): nuclear energy, aeronautics design, SNCF signalization specifications, and experience return on submarine fight detection systems. It was used for building cards on events on nuclear reactors, but also know-how forms, business forms, failure forms, in various industrial domains As previously noticed, REX seems quite appropriate for project memory and in particular, positive lessons-learnt (on successful experiments) or negative lessons-learnt (on failures, problems and incidents) during a project.

5.1.2 MEREX method

- General presentation and description of the model

MEREX (Mise en Règle de l'Expérience) is a method of capitalization of solutions resulting from the best practices of Renault, a company in the automotive sector (Corbel, 1997; Golebiowska, 2002). But this method could be adapted to any engineering domain. It consists of filling structured forms. The initial model for structuring these forms is rather specific to automotive sector and to Renault organization for vehicle design projects. But this structure can be generalized, as proposed in Table 1, and MEREX model thus generalized could then be adapted to capitalize experience return from projects in any engineering domain or even in any domain.

Identifier of the form	
Creation date or modification date	
Effects on the Clients	how the clients related to the problem can be affected
Title	summarizes the problem described in the concerned form
Organizational Group	group in the organization, concerned by the problem described
Statement/sketch	Explains the problem and the solution (product, process, product/process) or the rule to respect. This statement must be precise and describe a single problem per form, and it must correspond to a solution proven as effective.
Consequences of non-respect of the rule	negative effect on the client, on delay, on quality, on cost, on security, or on environment
Support to check the respect of the rule	plans, mock-up, prototypes, trial results, etc.
Milestones	project milestones when a rule validation action must be performed
Context	technical aspects, providers or other corporate departments involved
Readjustment Solution	alternative solution to use according to the entry point, if the rule is not respected
Elements of validation	means to check the respect of the rule, as well as means to prove the rule validity, based on positive or negative experiments of previous projects
Reference documents	documents that complete or confirm the form
Replaces	the past form replaced by the present one (for keeping history of the evolution of the forms on this problem)
Written-by	writer of the form
Validated-by	expert validating the form
Managed-by	person responsible of the organizational group involved in the problem
Used-by	person responsible for the form later use

Table 1: Generalized structure of MEREX forms

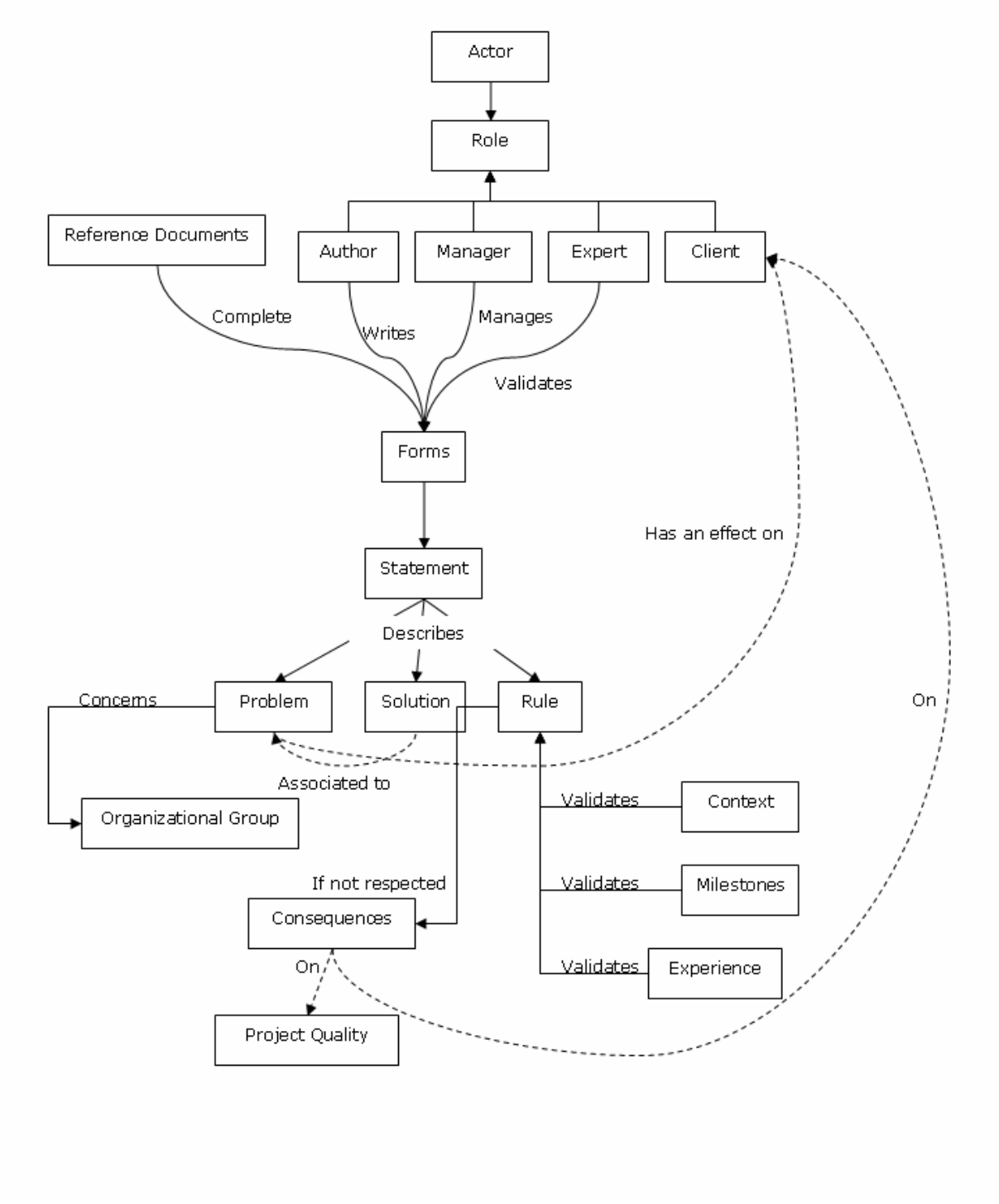

Figure 21: Model underlying MEREX method

- Roots of the model

MEREX aims at supporting analysis of problems before decision making during a vehicle project at Renault. It relies on forms and check-lists (gathering the set of titles of the forms), and it is used for process supervision. The method consists of examining the list of questions of the check-list in order to check if all the process steps (or all the expected results) were obtained. MEREX can thus be used as a tool both for technical memory and for project memory. MEREX forms must contain complete proposals, with different kinds of information about the context. It takes into account innovations (cf. positive experiments leading to design rules) and problems (cf. negative experiments leading to solve or avoid such problems).

- Associated models

This method is associated with an actor model, an organization model, a product model and a process model.

- Strengths and weaknesses of the model

The strength of MEREX model is that it is very well adapted to project memory. It must be noticed that that, initially, MEREX was dedicated to automotive sector and was thus very specific to this domain – which could be considered as a weakness. Moreover, MEREX model was not explicit in the MEREX method. Therefore, we had to abstract it from the method description in order to obtain the generalized structure summarized in Table 1, and the generalized model proposed in Fig. 21. With this effort of abstraction, MEREX can be generalized to project memory in any domain, in particular in engineering.
If we try to generalize the MEREX method to a CoP aimed at collective creation of an artefact, MEREX enables to make explicit information such as:

- The **context** where a given problem can raise,
- The **rules** to be respected in order to avoid this problem,
- The **consequences** of non-respect of these rules,
- The **milestones** for control,
- Alternative **solutions** to solve the problem,
- The CoP **actors** concerned by the problem (resp. its resolution).

- Applications

Examples of applications are described in (Dieng-Kuntz et al, 2005): for example, the solution of a problem of noise under the vehicle was capitalized through MEREX method and thus enabled to save the huge cost of loading silencers at the client site.

5.1.3 Weber's Lessons learnt model

- General presentation and description of the model

R. Weber, D.W. Aha and I. Becerra-Fernandez (2000) present the lessons learnt process as follows:

Figure 22: A generic Lesson learnt process

Here, lessons learnt are to be collected, verified by a team of experts, and then stored for use and dissemination. The purpose of the Lessons learnt is to be consistent enough to ensure their reusability. As shown in Figure 23, the Lessons learnt[1] are represented using the concepts summarized in Table 2:

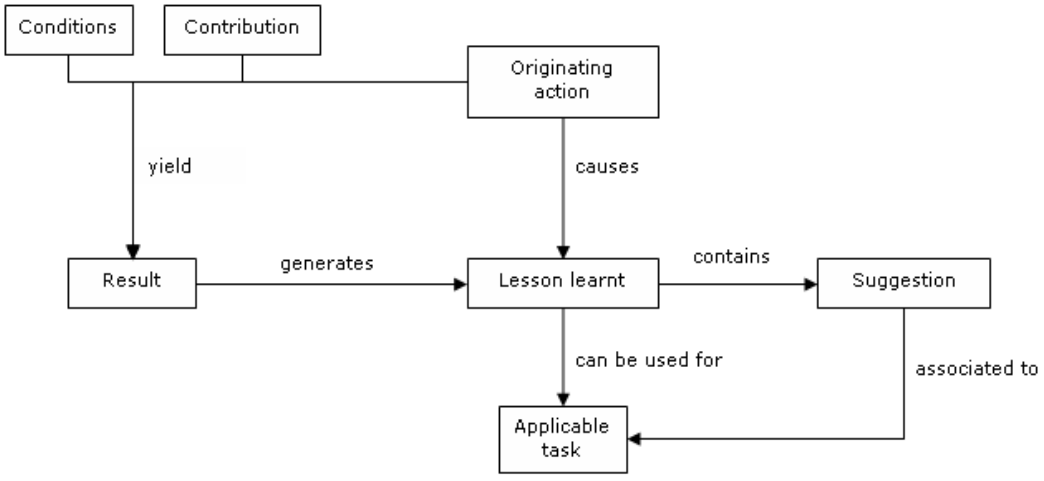

Figure 23: Weber's Lessons-learnt model

Originating action an action that occurred and caused a lesson to

[1] Here the Lessons learnt are "Planning Lessons learnt", which relate to the way to execute a plan and lead to the changing of the way a task is performed.

	be learnt
Contribution	can be a method, a resource, etc
Conditions	define the context in which performing an Originating action and providing Contributions yield a specific Result
Result	can be positive or negative, but in both cases, leads to learning Lessons
Applicable task	a task on which the lesson can be reused and applied. This task is identified by a domain expert
Suggestion or recommendation	an interpretation of the Lesson learnt and how to reuse it for the Applicable task

Table 2: Concepts underlying Weber' lessons-learnt model

- Roots of the model

This model was proposed to deal with planning lessons, which are related to the way a plan is executed, it is not assumed to support the lessons which involve problem solving (problems, their causes and solutions).

- Associated models

As seen in the description of the model, it appears clearly that Weber's model is associated to the Activity/Process model, through the notions of "Originating action" and "Applicable task"). Concerning the Actor model, there is no explicit link associating it to Weber's model.

- Strengths and weaknesses of the model

This model provides some interesting notions such as the Originating action, the Conditions and the Result, which draw a general view of the context of learning the lessons. However, it is at the same time too specific (in that it deals with a particular type of activity) and too generic in that it considers the knowledge resources as part of the Contribution and does not consider the user factor as we have to do, since we work with CoPs.

- Applications

As said above, Weber's Lessons learnt model aims at representing planning lessons. In (Weber R., Aha D. W. and Becerra-Fernandez I. (2000)), the following example illustrates the use of the proposed model to represent a lesson from the JCLL[2]'s database concerning non-combatant evacuation operations.
The selected lesson summary is:
"The triple registration process was very time consuming and contributed significantly to delays in throughput and to evacuee discomfort under tropical conditions."

Weber et al. (2000) represents this lesson as shown in Table 3:

Originating action	Implement the triple registration process (i.e., register evacuees using the triple registration process);

[2] The Joint Center for Lessons Learned (JCLL) of the Joint Warfighting Center.

Action result	**negative:** The process was time consuming, and contributed to evacuee discomfort
Contribution	Triple registration process is problematic
Applicable task	Evacuee registration
Conditions	Tropical climate
Suggestion	Avoid the triple registration process when registering evacuees. Locate an Immigration and Naturalization Service (INS) screening station at the initial evacuation processing site. Evacuees are required to clear INS procedures prior to reporting to the evacuation processing center

Table 3: Example of a lessons-learnt (Weber et al, 2000)

The expression 'tropical climate' is a condition for reuse.
In this lesson, the ***applicable task*** is the same as the ***originating action***, although this is not necessarily true for all lessons.

5.2 Comparison of models and decisions

The REX and the MEREX methods were proposed to deal with experience capitalization in industrial context. The schemes describe a process to make explicit good practices to be stored in a corporate memory or in a project memory. In these methods we associate to each experience a Knowledge form containing information about the context, comments and recommendations. This information allows us to organize this knowledge and search in the repository of forms.

The Weber's model describes a procedure to construct lessons learnt within an organization, the process includes five main actions: collect, verify, store, disseminate and reuse.

The elements proposed in these models will be useful to capitalize lessons from previous experiences in the CoP or within the CoP members' organization:

- The description of the context in which we learn lessons,
- The different operations to achieve (through the role of actors in these operation)

In our model we will try to include these elements, in addition we also need to link the lessons learnt to the practice of CoP members and we will need different roles for the actors to be able to represent the different levels of Lessons-learnt construction.

5.3 Unified model proposal

5.3.1 General overview of the model

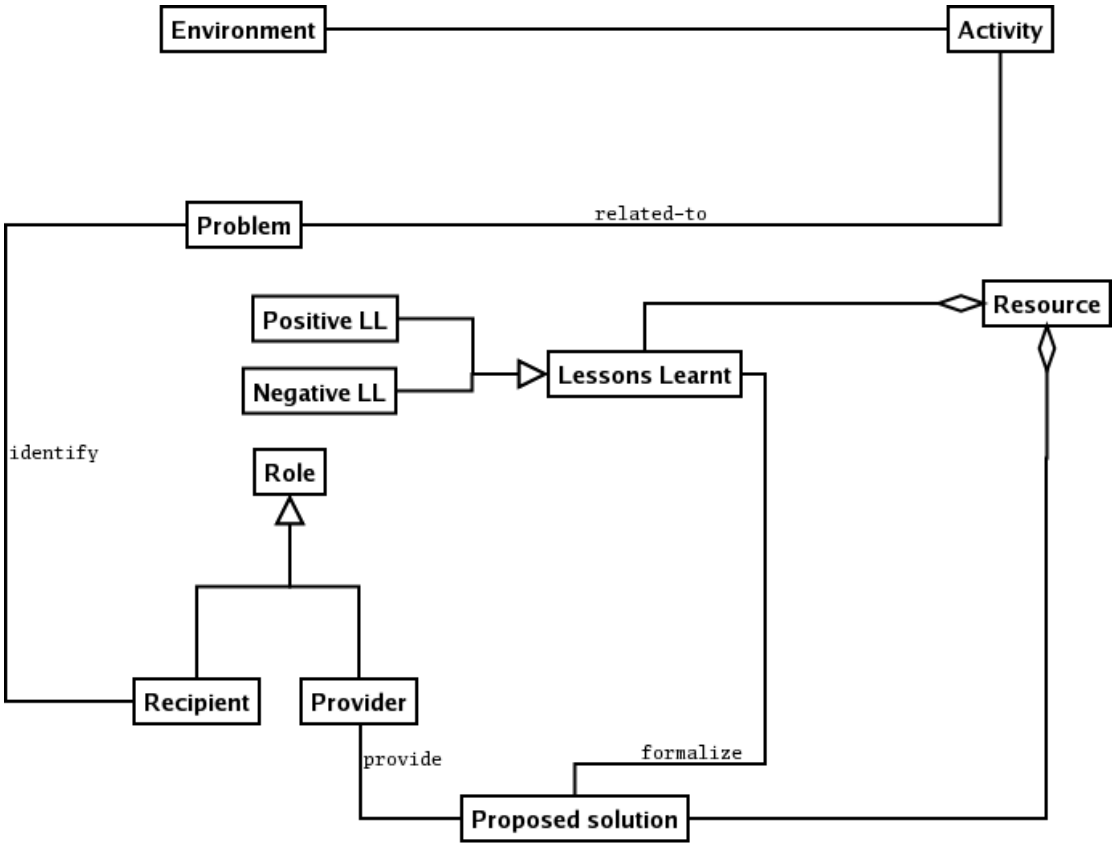

Figure 24: The proposed "Unified Lessons Learnt Model"

5.3.2 Detailed presentation of the concepts and axioms

We consider the following components intervening in the Lessons Learnt meta-model:

- **Environment:** it represents the context or situation in which Lessons learnt are involved. It relates to the notions of competency and collaboration, and therefore, links the Lessons Learnt model and the Collaboration model as well as the Competency model;
- **Problem:** it is the "raison d'être" (the core concept) of the Lessons learnt. It describes, in the context of an activity or practice, a problematic or critical point whose related solutions are analyzed so as to determine the best way to find an issue on it;
- **Activity:** relates to the individual objectives of the actors involved in the Lessons learnt process. The activity requires the use of lessons learnt in order to be performed. This part of the model allows us to link the Lessons learnt model to the Action/Process model.
- **Proposed solution:** it represents the proposal of a solution to the Problem or a clue to solve it;
- **Role:** it is the role played by the actors involved in the processes related to the Lessons learnt (i.e. Problem formulation, solution proposition and assessment of the proposed solutions). We distinguish the four dynamic main roles:
  - ✓ **Recipient:** who submits a Problem to be solved;
  - ✓ **Provider:** who provides a solution or a clue to the Problem;
  - ✓ **Tester:** who proceeds to the experimentation of the proposed solutions and gives his/her feedback;

- ✓ **Expert:** who is able to assess the proposed solutions, using his expertise on the domain and, at the same time, taking into account the feedback of the Testers;

The interactions between these roles are described in Figure 25.

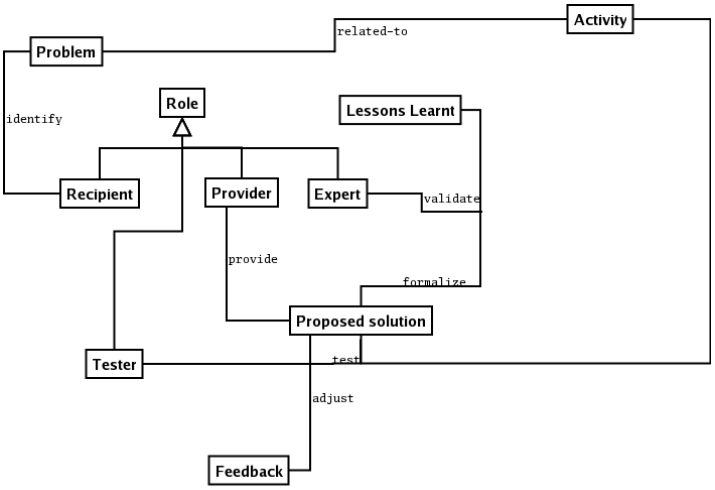

Figure 25: Lessons-Learnt on-line construction model

The Tester can be the Recipient or a person who encounters a similar Problem as the one submitted by the Recipient.
This part of the model allows us to link the Lessons Learnt model to the Actor's model.

- **Resource:** includes the different types of knowledge resources used to produce Lessons learnt (knowledge, know-how, etc.);
- **Lesson learnt:** the knowledge gained and produced as a result to the activity of the actors of the CoP. It is the synthesis and formalization of the Proposed solutions to the Problem. We propose two categories of Lessons learnt:
  - ✓ **The positive Lessons learnt:** which consist of the activities recommended in the problem solving. They relate to the Good Practices of the CoP;
  - ✓ **The negative Lessons learnt:** which describe the activities that are unadvised or to avoid. They relate to the Bad Practices of the CoP.

5.3.3 Use-case scenarios

Scenario 1:

Let's take the example of the situation of a new member (A1) of the Palette project, which tries to find orientations about the most efficient and rapid way to get the necessary knowledge related to the project.
Problem of A1: How to deal with the large volume of documentation used and produced from the very beginning of the project?

Actor	Role	Activity	Resource	Feedback

A1	Recipient	What to read first?	All the documents used and produced in the project's context	
A2	Provider		Documents presenting the project	
A3	Provider		Mails between the project's members	
A4	Tester (another new member)	Follows the recommendation of A2	Documents presenting the project	Positive
A1	Tester	Follows the recommendation of A3	Mails between the project's members	Positive
A5	Expert	Compares the recommendations proposed as well as the testers' feedbacks	Knowledge, experience	

As the feedback is positive for both the recommendations, the expert will rely on his/her competency, which in this case comes from his experience, to give more credit to one of the recommendations.
If the feedback were different, then the expert would make a synthesis using one of the recommendations (the one positively assessed by a Tester) to produce a Positive Lesson learnt and the other one (the one negatively assessed by a Tester) to produce a Negative Lesson learnt.

Scenario 2:

Contrary to the previous example where a Lesson learnt is produced in response to a need expressed (the process being initiated by the member A1), here, we give another example, where Lessons are learnt in a "preventive" way, based on the analysis of the past events and interactions into the CoP.
Here, we consider the only two roles of Provider and Recipient:

- The Providers are the members who are going to supply knowledge they have deduced from their experience, analysis.
- The Recipients are those who are interested in getting such a knowledge.

Let's assume that, in the same context as in the Example 1, as the Palette project evolves, some of the members (such as team leaders) get the feedback of the newcomers (typically engineers or Ph.D. students) concerning the difficulties they were/are confronted with.
Through the analysis of this feedback, their own observations and their experience (of tutoring, for example), the team leaders can provide lessons as a set of recommendations on what to read during the first days, what to avoid to read, what to focus on, etc.

This knowledge is then available and dedicated to the future newcomers.

Actor	Role	Lessons Learnt	Category
A	Provider	Reading the documents which present the project	Positive
B	Provider	Reading the mails exchanged between the project's members	Negative

In this case, when a newcomer integrates the project, these Lessons learnt will be disseminated to him/her together with a recommendation to read the project's presentation documents and to avoid the reading mails without having acquired the necessary knowledge.

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Conclusions

As we have seen with the proposals of the final models, they are all related to one another. In fact we can notice that the actor is in the center of all the meta-models.

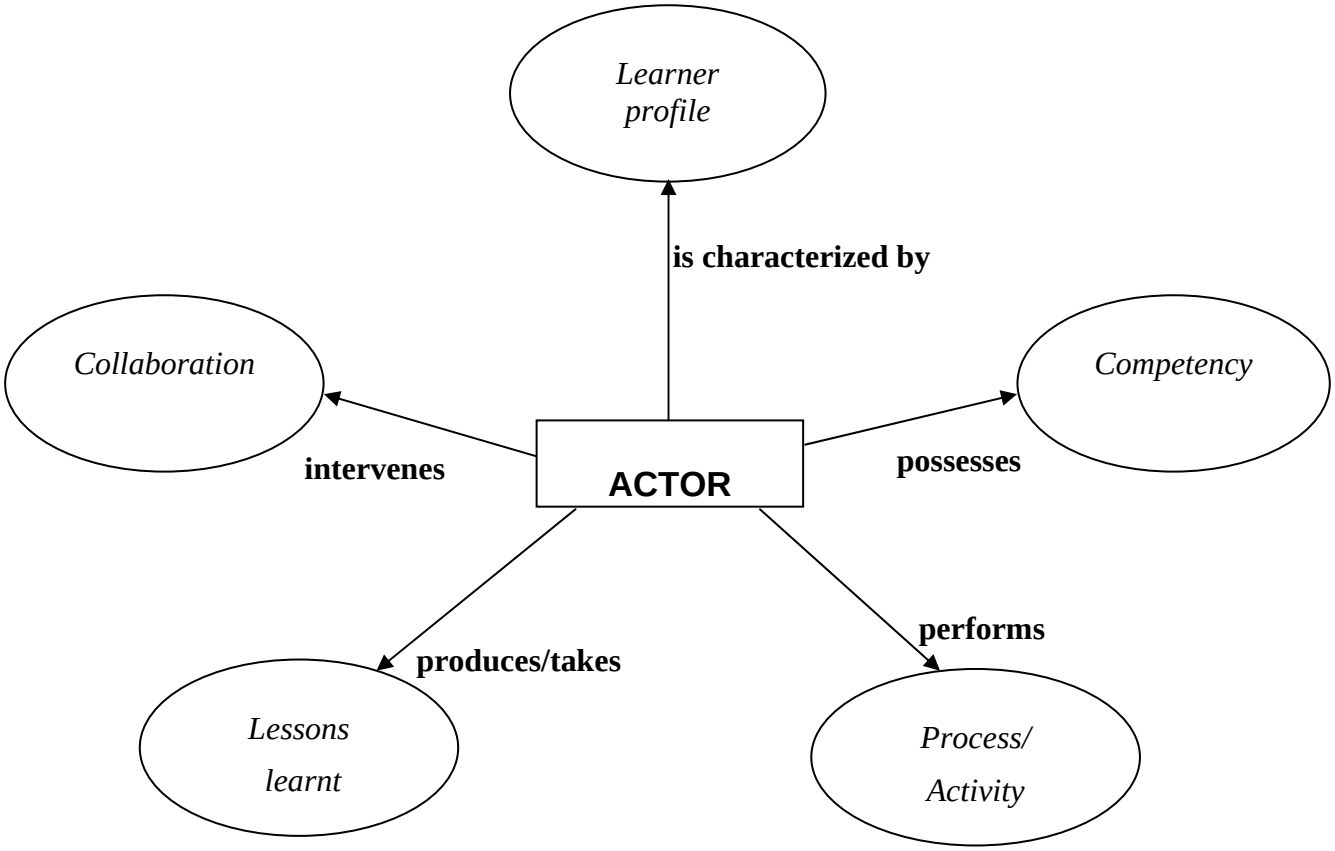

Figure 26: Integrated model

As we can see in this schema, all the meta-models are linked to the actors, and by the way are related to each other.
For example, in order to perform an activity, an actor needs specific skills or knowledge. These needs are considered as the competencies of the actor, this enables to link activity with competency, via the actor.
In the same way, we can link all the meta-models with other ones.

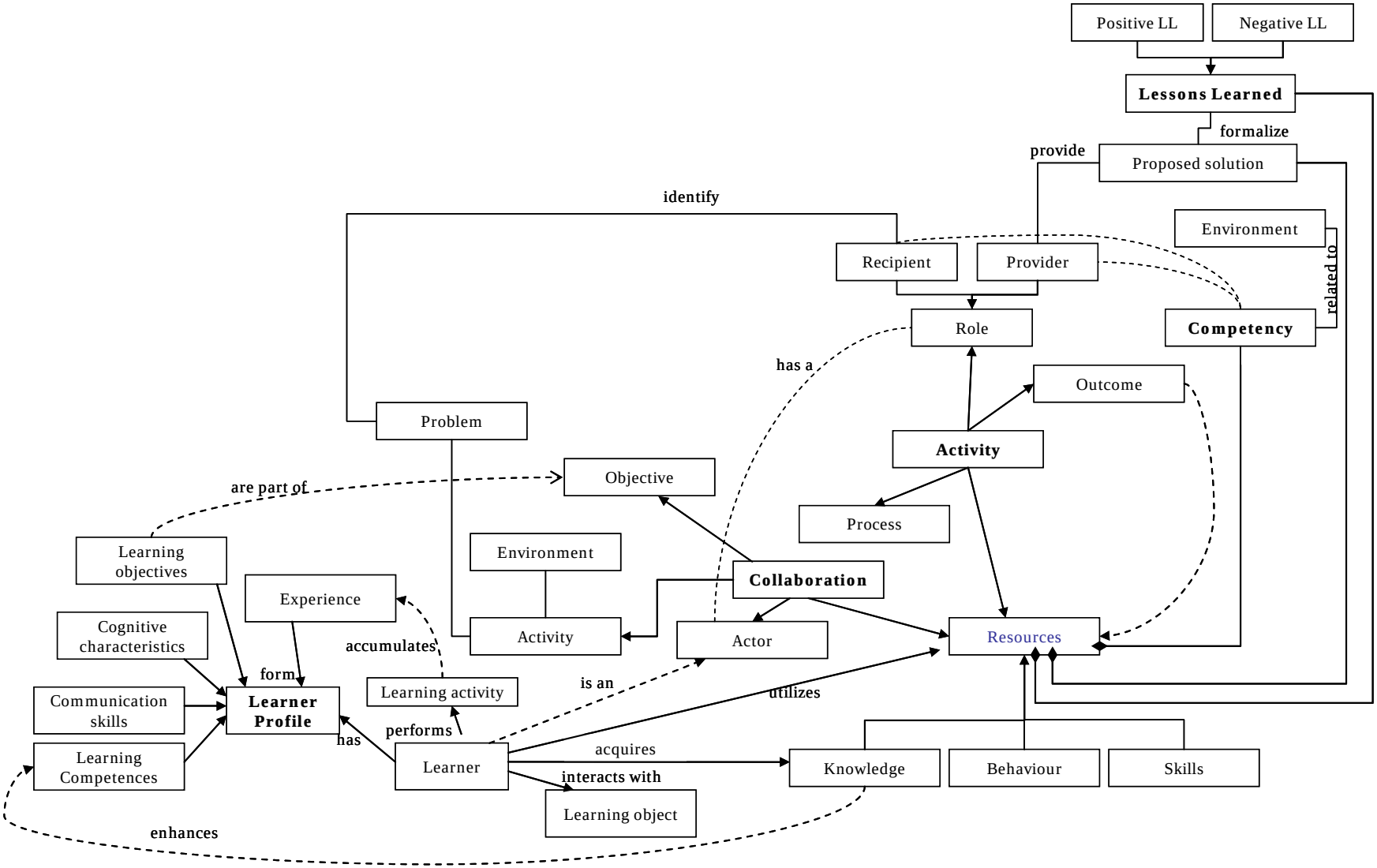

Figure 27: Detailed Integrated model

The presented models show a static view. Neither do they represent the dynamic aspect nor can they include the dynamic aspect of the learning process they can be linked to.
These models have been built in order to first support the development of KM services. As they are generic models, a dynamic view is not necessary.

As the second task of the WP3 is to provide CoP-oriented models, based on the models presented in this document, the dynamic aspects could be added by matching the meta-models with situations of learning process.

However we can have a first vision of this dynamic aspect with the learning process model, proposed by Bernadette Charlier and Amaury Daele, in the outline implementation plan of the initial proposal of Palette.

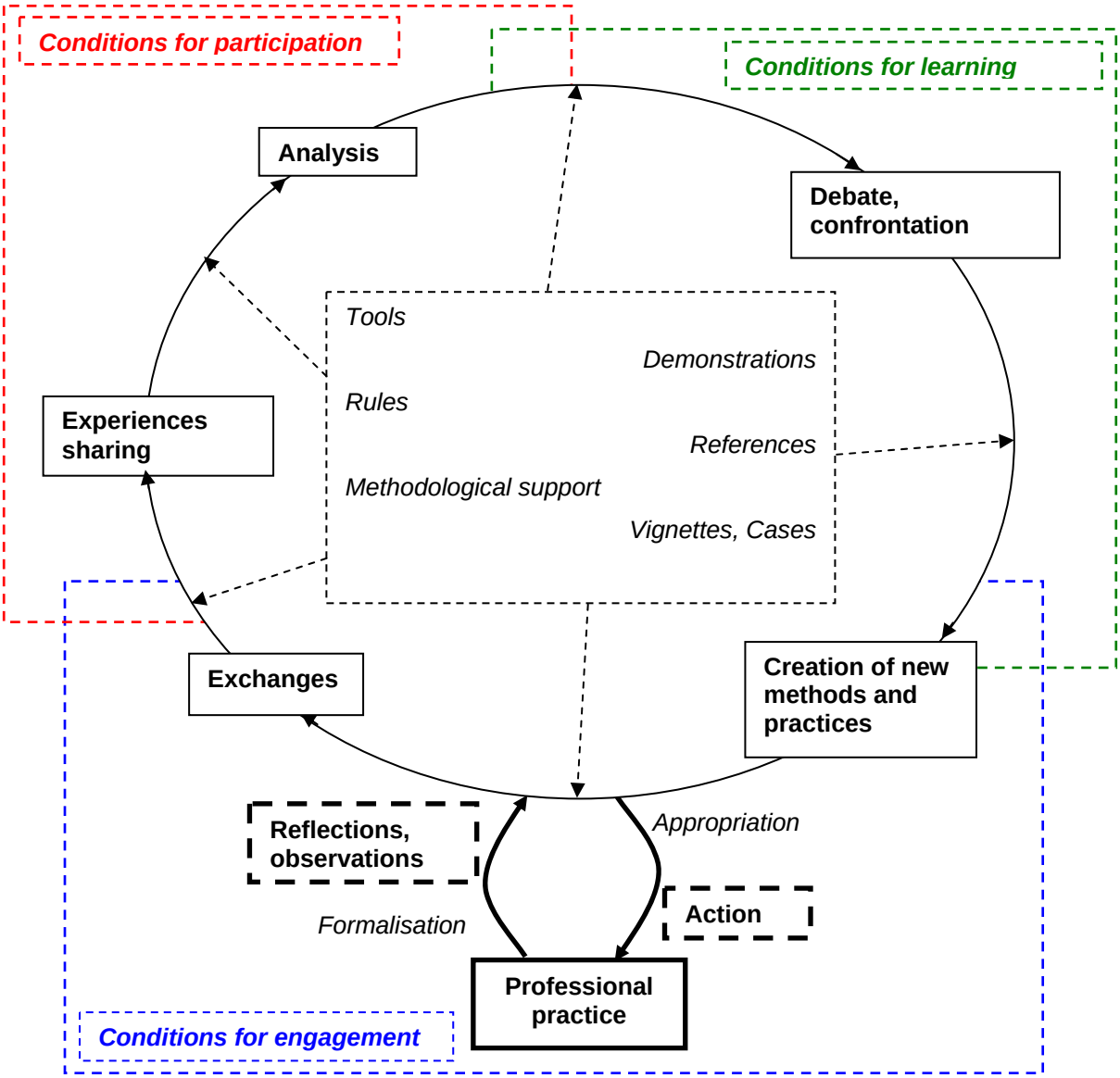

Figure 28: The learning process model adopted in Palette

The learning process model represents the different steps occurring in a CoP. This model is knowledge management oriented; it could inspire the development of KM services and moreover present some use-case scenarios.

In this model, we can see that a learning process is composed of various situations, such as exchanges, analysis, and debate, in which the proposed meta-models could be applied. Indeed in a situation of experience sharing, we can make the link with the proposed meta-models and adapt these models to this situation.

The adaptation of the meta-models to the situation and for development of KM services will be made by the task 3.2 “Development of reference ontologies for information annotation and user profiling”. The CoP-dependent ontologies will rely on the terminology specific to CoP.

Table of Figures

Appendix : Technical descriptions of the proposed unified models

The proposed “Unified Competency” model technical description

```
<?xml version="1.0" encoding="UTF-8"?>

<!DOCTYPE rdf:RDF [
      <!ENTITY cos     "http://www.inria.fr/acacia/corese#">
      <!ENTITY rdf     "http://www.w3.org/1999/02/22-rdf-syntax-ns#">
      <!ENTITY rdfs    "http://www.w3.org/2000/01/rdf-schema#">
      <!ENTITY owl     "http://www.w3.org/2002/07/owl#">
      <!ENTITY palette "http://www.inria.fr/acacia/2006/palette#">
      <!ENTITY xsd     "http://www.w3.org/2001/XMLSchema#">
      <!ENTITY dc      "http://purl.org/dc/elements/1.1#">
      ]>

<rdf:RDF
      xmlns:rdfs="&rdfs;"
      xmlns:rdf="&rdf;"
      xmlns:cos="&cos;"
      xmlns:palette='&palette;'
      xmlns:owl='&owl;'
      xmlns:dc='&dc;'
      xml:base='&palette;'>
 <!--nameFile=palette_metamodel_lessonslearnt.rdfs-->

  <rdf:Description rdf:about="#Activity">
    <rdf:type rdf:resource="http://www.w3.org/2000/01/rdf-schema#Class"/>
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">relates to the
individual objectives of the actor involved in a process. DEF: The Activity requires the use of
Lessons learnt in order to be performed. This concept links the Lessons learnt model to the
Process/Activity model.</rdfs:comment>
     <rdfs:label xml:lang="en-US"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">Activity</rdfs:label>
     <rdfs:label xml:lang="fr-FR"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">Activite</rdfs:label>
  </rdf:Description>
  <rdf:Description rdf:about="#Environment">
    <rdf:type rdf:resource="http://www.w3.org/2000/01/rdf-schema#Class"/>
    <rdfs:label xml:lang="en-US"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">Environment</rdfs:label>
    <rdfs:label xml:lang="fr-FR"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">Environnement</rdfs:label>
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">refers to the
context or situation.</rdfs:comment>
  </rdf:Description>

  <rdf:Description rdf:about="#Lesson_learnt">
```

```
    <rdf:type rdf:resource="http://www.w3.org/2000/01/rdf-schema#Class"/>
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">the
knowledge gained or produced as a result to the Activity of CoP members.</rdfs:comment>
    <rdfs:label xml:lang="en-US"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">Lessons learnt</rdfs:label>
    <rdfs:label xml:lang="fr-FR"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">Lessons apprises</rdfs:label>
  </rdf:Description>

  <rdf:Description rdf:about="#Negative_lesson_learnt">
    <rdf:type rdf:resource="http://www.w3.org/2000/01/rdf-schema#Class"/>
    <rdfs:subClassOf rdf:resource="#Lesson_learnt"/>
     <rdfs:label xml:lang="en-US"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">Negative lessons
learnt</rdfs:label>
     <rdfs:label xml:lang="fr-FR"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">Lessons apprises
negatives</rdfs:label>
<rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">subclass of the
Lesson learnt class, they relate to the bad practices of the CoP, the actions or decisions to
avoid.</rdfs:comment>
  </rdf:Description>


  <rdf:Description rdf:about="#Positive_lesson_learnt">
    <rdf:type rdf:resource="http://www.w3.org/2000/01/rdf-schema#Class"/>
    <rdfs:subClassOf rdf:resource="#Lesson_learnt"/>
    <rdfs:label xml:lang="en-US"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">Positive lessons
learnt</rdfs:label>
    <rdfs:label xml:lang="fr-FR"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">Lessons apprises
positives</rdfs:label>
<rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">subclass of the
Lesson learnt class, they relate to the good practices of the CoP, they determine the decisions
or actions that are recommended.</rdfs:comment>
  </rdf:Description>

  <rdf:Description rdf:about="#Problem">
    <rdf:type rdf:resource="http://www.w3.org/2000/01/rdf-schema#Class"/>
     <rdfs:label xml:lang="en-US"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">Problem</rdfs:label>
     <rdfs:label xml:lang="fr-FR"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">Probleme</rdfs:label>
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">represents a
critical point or issue to be analyzed. DEF:it's the reason for being of the Lessons learnt. It
describes, in the context of an activity or practice, a problematic or critical point whose
related solutions are analyzed so as to determine the best way to find an issue on
it.</rdfs:comment>
  </rdf:Description>
```

```
  <rdf:Description rdf:about="#Proposed_solution">
    <rdf:type rdf:resource="http://www.w3.org/2000/01/rdf-schema#Class"/>
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">a solution to
a Problem or a clue to solve it.</rdfs:comment>
     <rdfs:label xml:lang="en-US"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">Proposed solution</rdfs:label>
     <rdfs:label xml:lang="fr-FR"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">Solution proposee</rdfs:label>
  </rdf:Description>

  <rdf:Description rdf:about="#Resource">
    <rdf:type rdf:resource="http://www.w3.org/2000/01/rdf-schema#Class"/>
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">the different
types of knowledge resources used or produced in the CoP.</rdfs:comment>
    <rdfs:label xml:lang="en-US"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">Resource</rdfs:label>
    <rdfs:label xml:lang="fr-FR"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">Ressource</rdfs:label>
  </rdf:Description>

<rdf:Description rdf:about="#Feedback">
    <rdf:type rdf:resource="http://www.w3.org/2000/01/rdf-schema#Class"/>
     <rdfs:subClassOf rdf:resource="#Resource"/>
                                        <rdfs:label xml:lang="en-US"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">Feedback</rdfs:label>
                                         <rdfs:label xml:lang="fr-FR"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">Reaction</rdfs:label>
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">return on
experience, opinion or assessment based on some criteria.</rdfs:comment>
  </rdf:Description>

<rdf:Description rdf:about="#Behaviour">
    <rdf:type rdf:resource="http://www.w3.org/2000/01/rdf-schema#Class"/>
    <rdfs:subClassOf rdf:resource="#Resource"/>
    <rdfs:label xml:lang="en-US"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">Behaviour</rdfs:label>
    <rdfs:label xml:lang="fr-FR"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">Comportement</rdfs:label>
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">is a kind of
Resource (subclass), it particularly represents the behavioral characteristics of a member in a
group, his social interactions among the others, etc.</rdfs:comment>
  </rdf:Description>

  <rdf:Description rdf:about="#Knowledge">
    <rdf:type rdf:resource="http://www.w3.org/2000/01/rdf-schema#Class"/>
    <rdfs:subClassOf rdf:resource="#Resource"/>
     <rdfs:label xml:lang="en-US"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">Knowledge</rdfs:label>
```

```
    <rdfs:label xml:lang="fr-FR"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">Connaissance
theorique</rdfs:label>
   <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">is a kind of
Resource (subclass), it particularly represents the theoretical knowledge (procedural or
declarative).</rdfs:comment>
  </rdf:Description>

  <rdf:Description rdf:about="#Skills">
   <rdf:type rdf:resource="http://www.w3.org/2000/01/rdf-schema#Class"/>
   <rdfs:subClassOf rdf:resource="#Resource"/>
    <rdfs:label xml:lang="en-US"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">Skills</rdfs:label>
    <rdfs:label xml:lang="fr-FR"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">Capacites</rdfs:label>
   <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">a kind of
Resource (subclass), they particularly relate to the individual capabilities to do
something.</rdfs:comment>
  </rdf:Description>

  <rdf:Description rdf:about="#Role">
   <rdf:type rdf:resource="http://www.w3.org/2000/01/rdf-schema#Class"/>
   <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">the role
played by an actor involved in a process.</rdfs:comment>
    <rdfs:label xml:lang="en-US"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">Role</rdfs:label>
    <rdfs:label xml:lang="fr-FR"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">Role</rdfs:label>
  </rdf:Description>

  <rdf:Description rdf:about="#Expert">
   <rdf:type rdf:resource="http://www.w3.org/2000/01/rdf-schema#Class"/>
   <rdfs:subClassOf rdf:resource="#Role"/>
   <rdfs:label xml:lang="en-US"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">Expert</rdfs:label>
   <rdfs:label xml:lang="fr-FR"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">Expert</rdfs:label>
   <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">a kind of
Role (subclass), it represents the situation where a member is considered as Expert, assigning
him particular tasks in some processes of the CoP. DEF: in the context of Lessons learnt, the
Expert assesses the proposed solutions, using his expertise and taking into account the
feedbacks of the Testers.</rdfs:comment>
  </rdf:Description>

  <rdf:Description rdf:about="#Provider">
   <rdf:type rdf:resource="http://www.w3.org/2000/01/rdf-schema#Class"/>
   <rdfs:subClassOf rdf:resource="#Role"/>
   <rdfs:label xml:lang="en-US"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">Provider</rdfs:label>
```

```
   <rdfs:label xml:lang="fr-FR"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">Fournisseur</rdfs:label>
   <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">a kind of
Role (subclass), where a member furnishes something during a particular
process.</rdfs:comment>
  </rdf:Description>

  <rdf:Description rdf:about="#Recipient">
   <rdf:type rdf:resource="http://www.w3.org/2000/01/rdf-schema#Class"/>
   <rdfs:subClassOf rdf:resource="#Role"/>
   <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">a kind of
Role (subclass), where a member receives something during a process of the
CoP.</rdfs:comment>
   <rdfs:label xml:lang="en-US"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">Recipient</rdfs:label>
   <rdfs:label xml:lang="fr-FR"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">Receveur/Destinataire</rdfs:la
bel>
  </rdf:Description>

  <rdf:Description rdf:about="#Tester">
   <rdf:type rdf:resource="http://www.w3.org/2000/01/rdf-schema#Class"/>
   <rdfs:subClassOf rdf:resource="#Role"/>
   <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">a kind of
Role (subclass), where a member tests something during a CoP process and gives his results.
DEF: in the context of Lessons learnt, the Tester experiments the proposed solutions to a
problem and gives his feedback.</rdfs:comment>
   <rdfs:label xml:lang="en-US"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">Tester</rdfs:label>
   <rdfs:label xml:lang="fr-FR"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">Testeur</rdfs:label>
  </rdf:Description>

  <rdf:Description rdf:about="#adjusts">
   <rdf:type rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#Property"/>
   <rdfs:range rdf:resource="#Proposed_solution"/>
   <rdfs:domain rdf:resource="#Feedback"/>
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">le Feedback
concernant une solution propos\'e9e permet de la corriger, de l'affiner.</rdfs:comment>
   <rdfs:label xml:lang="en-US"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">adjusts</rdfs:label>
   <rdfs:label xml:lang="fr-FR"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">ajuste</rdfs:label>
  </rdf:Description>

  <rdf:Description rdf:about="#can_be_composed_of1">
   <rdf:type rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#Property"/>
   <rdfs:domain rdf:resource="#Lesson_learnt"/>
   <rdfs:range rdf:resource="#Resource"/>
```

```
    <rdfs:label xml:lang="en-US"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">can be composed
of</rdfs:label>
    <rdfs:label xml:lang="fr-FR"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">peut se composer
de</rdfs:label>
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">describes the
relation between two concepts, among which one can, in the context of the CoP, be a part of
the other.</rdfs:comment>
  </rdf:Description>

<rdf:Description rdf:about="#can_be_composed_of2">
    <rdf:type rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#Property"/>
    <rdfs:domain rdf:resource="#Proposed_solution"/>
    <rdfs:range rdf:resource="#Resource"/>
    <rdfs:label xml:lang="en-US"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">can be composed
of</rdfs:label>
    <rdfs:label xml:lang="fr-FR"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">peut se composer
de</rdfs:label>
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">describes the
relation between two concepts, among which one can, in the context of the CoP, be a part of
the other.</rdfs:comment>
  </rdf:Description>

  <rdf:Description rdf:about="#formalizes">
    <rdf:type rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#Property"/>
    <rdfs:range rdf:resource="#Proposed_solution"/>
    <rdfs:domain rdf:resource="#Lesson_learnt"/>
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">the Lessons
learnt are a synthesis or a formalization of the Proposed solutions to the
Problem.</rdfs:comment>
    <rdfs:label xml:lang="en-US"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">formalizes</rdfs:label>
    <rdfs:label xml:lang="fr-FR"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">formalise</rdfs:label>
  </rdf:Description>

  <rdf:Description rdf:about="#identifies">
    <rdf:type rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#Property"/>
    <rdfs:domain rdf:resource="#Recipient"/>
    <rdfs:range rdf:resource="#Problem"/>
     <rdfs:label xml:lang="en-US"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">identifies</rdfs:label>
     <rdfs:label xml:lang="fr-FR"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">identifie/definit</rdfs:label>
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">when
someone identifies something.</rdfs:comment>
  </rdf:Description>
```

```
  <rdf:Description rdf:about="#is_involved_in">
    <rdf:type rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#Property"/>
    <rdfs:range rdf:resource="#Environment"/>
    <rdfs:domain rdf:resource="#Activity"/>
    <rdfs:label xml:lang="en-US"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">is involved in</rdfs:label>
    <rdfs:label xml:lang="fr-FR"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">est impliquee dans</rdfs:label>
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">where the
realisation of something implies the realisation of something else.</rdfs:comment>
  </rdf:Description>

  <rdf:Description rdf:about="#is_related_to">
    <rdf:type rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#Property"/>
    <rdfs:domain rdf:resource="#Problem"/>
    <rdfs:range rdf:resource="#Activity"/>
     <rdfs:label xml:lang="en-US"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">is related to</rdfs:label>
     <rdfs:label xml:lang="fr-FR"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">est lie a/concerne</rdfs:label>
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">describes a
link between two concepts.</rdfs:comment>
  </rdf:Description>

  <rdf:Description rdf:about="#provides">
    <rdf:type rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#Property"/>
    <rdfs:range rdf:resource="#Lesson_learnt"/>
    <rdfs:domain rdf:resource="#Provider"/>
    <rdfs:label xml:lang="en-US"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">provides</rdfs:label>
    <rdfs:label xml:lang="fr-FR"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">fournit</rdfs:label>
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">describes the
situation where someone furnishes something.</rdfs:comment>
  </rdf:Description>

  <rdf:Description rdf:about="#tests">
    <rdf:type rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#Property"/>
    <rdfs:range rdf:resource="#Proposed_solution"/>
    <rdfs:domain rdf:resource="#Tester"/>
     <rdfs:label xml:lang="en-US"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">tests/experiments</rdfs:label>
     <rdfs:label xml:lang="fr-FR"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">teste/expérimente</rdfs:label>
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">describes the
situation where someone experiments something.</rdfs:comment>
  </rdf:Description>
```

```
<rdf:Description rdf:about="#validates">
   <rdf:type rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#Property"/>
   <rdfs:range rdf:resource="#Proposed_solution"/>
   <rdfs:domain rdf:resource="#Expert"/>
   <rdfs:label xml:lang="en-US"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">validates</rdfs:label>
   <rdfs:label xml:lang="fr-FR"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">valide</rdfs:label>
   <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">describes the
situation where someone validates something.</rdfs:comment>
  </rdf:Description>

 </rdf:RDF>
```

The proposed “Unified Collaboration” model technical description

```
<?xml version="1.0" encoding="UTF-8"?>

<!DOCTYPE rdf [
    <!ENTITY cos     "http://www.inria.fr/acacia/corese#">
    <!ENTITY rdf     "http://www.w3.org/1999/02/22-rdf-syntax-ns#">
    <!ENTITY rdfs    "http://www.w3.org/2000/01/rdf-schema#">
    <!ENTITY owl     "http://www.w3.org/2002/07/owl#">
    <!ENTITY palette "http://www.inria.fr/acacia/2006/palette#">
    <!ENTITY xsd     "http://www.w3.org/2001/XMLSchema#">
    <!ENTITY dc      "http://purl.org/dc/elements/1.1#">
    ]>

<rdf:RDF
    xmlns:rdfs="&rdfs;"
    xmlns:rdf="&rdf;"
    xmlns:cos="&cos;"
    xmlns:palette="&palette;"
    xmlns:owl="&owl;"
    xmlns:dc="&dc;"
    xml:base="&palette;">

  <!--nameFile=palette_metamodel_collaboration.rdfs-->

<Class rdf:ID="Activity">
                <label xml:lang="en">Activity</label>
                <comment>relates to the activites induced during collaboration </comment>
</Class>

<Class rdf:ID="Actor">
                <label xml:lang="en">Actor</label>
                <comment>relates to the actors implied in collaboration </comment>
</Class>

<Class rdf:ID="Collaboration">
                <label xml:lang="en">Collaboration</label>
                <comment> relates to the fact of working together in ordetr to achieve a
common goal</comment>
</Class>


<Class rdf:ID="Objective">
                <label xml:lang="en">Objective</label>
                <comment>collaboration is defined by the objective to achieve </comment>
</Class>
<Class rdf:ID="Resources">
                <label xml:lang="en">Resources</label>
                <comment>relates to the resources neede or produced during collaboration
</comment>
```

```
</Class>
<Class rdf:ID="">
                    <label xml:lang="en"></label>
                    <comment> </comment>
</Class>


<rdf:Property rdf:ID="implies">
                     <comment xml:lang="en">collaboration implies actor(s)</comment>
                     <label xml:lang="en">implies</label>
                    <rdfs:domain rdf:resource="Collaboration"/>
                    <rdfs:range rdf:resource="Actor"/>
</rdf:Property>
<rdf:Property rdf:ID="is-composed-of">
                     <comment xml:lang="en">collaboration is composed of one or several
acitivty(ies)</comment>
                     <label xml:lang="en">is-composed-of</label>
                    <rdfs:domain rdf:resource="Collaboration"/>
                    <rdfs:range rdf:resource="Activity"/>
</rdf:Property>

<rdf:Property rdf:ID="is-defined-by">
                     <comment xml:lang="en">collaboration is defined by the objective to
achieve</comment>
                     <label xml:lang="en">is-defined-by</label>
                    <rdfs:domain rdf:resource="Collaboration"/>
                    <rdfs:range rdf:resource="Objective"/>
</rdf:Property>
<rdf:Property rdf:ID="needs">
                     <comment xml:lang="en">collaboration needs specific resources to be
performed</comment>
                     <label xml:lang="en">needs</label>
                    <rdfs:domain rdf:resource="Collaboration"/>
                    <rdfs:range rdf:resource="Resources"/>
</rdf:Property>

<rdf:Property rdf:ID="produces">
                     <comment xml:lang="en">collaboration produces certain
resources</comment>
                     <label xml:lang="en">produces</label>
                    <rdfs:domain rdf:resource="Collaboration"/>
                    <rdfs:range rdf:resource="Resources"/>
</rdf:Property>

</rdf:RDF>
```

The proposed “Unified Process-Activity” model technical description

```
<?xml version="1.0" encoding="UTF-8"?>

<!DOCTYPE rdf:RDF [
     <!ENTITY cos     "http://www.inria.fr/acacia/corese#">
     <!ENTITY rdf     "http://www.w3.org/1999/02/22-rdf-syntax-ns#">
     <!ENTITY rdfs    "http://www.w3.org/2000/01/rdf-schema#">
     <!ENTITY owl     "http://www.w3.org/2002/07/owl#">
     <!ENTITY palette "http://www.inria.fr/acacia/2006/palette#">
     <!ENTITY xsd     "http://www.w3.org/2001/XMLSchema#">
     <!ENTITY dc      "http://purl.org/dc/elements/1.1#">

     ]>

<rdf:RDF
     xmlns:rdfs="&rdfs;"
     xmlns:rdf="&rdf;"
     xmlns:cos="&cos;"
     xmlns:palette='&palette;'
     xmlns:owl='&owl;'
     xmlns:dc='&dc;'
     xml:base='&palette;'>

   <!--nameFile=palette_metamodel_process_activity.rdfs-->

<Class rdf:ID="Activity">
                <label xml:lang="en">Activity</label>
                <comment>relates to the transformation of an object during a
                process</comment>
</Class>

<Class rdf:ID="Outcome">
                <label xml:lang="en">Outcome</label>
                <comment xml:lang="en">relates to the output of the activity during a
                process</comment>
</Class>

<Class rdf:ID="Process">
                 <label xml:lang="en">Process</label>
                <comment xml:lang="en">A process is a set of activity that uses and
                produces resources in order to transform input objects into output
                objects</comment>
</Class>

<Class rdf:ID="Resources">
                 <label xml:lang="en">Resources</label>
                <comment xml:lang="en">relates to what it is needed to perform an
activity</comment>
```

```
</Class>

<Class rdf:ID="Role">
                <label xml:lang="en">Role</label>
                <comment xml:lang="en">relates to the role that is needed to realize an
                activity</comment>
</Class>

<rdf:Property rdf:ID="belongs-to">
                 <comment xml:lang="en">An activity takes part of a process</comment>
                 <label xml:lang="en">belongs-to</label>
                <rdfs:domain rdf:resource="Activity"/>
                <rdfs:range rdf:resource="Process"/>
</rdf:Property>

<rdf:Property rdf:ID="is-performed-by">
                 <label xml:lang="en">is-performed-by</label>
                <comment xml:lang="en">An activity is performed by one or several
actors</comment>
                <rdfs:domain rdf:resource="Activity"/>
                <rdfs:range rdf:resource="Role"/>
</rdf:Property>

<rdf:Property rdf:ID="needs">
                 <comment xml:lang="en">activity needs specific resources to be
performed"</comment>
                 <label xml:lang="en">needs</label>
                <rdfs:domain rdf:resource="Activity"/>
                <rdfs:range rdf:resource="Resources"/>
</rdf:Property>

<rdf:Property rdf:ID="produces">
                 <comment xml:lang="en">an activity produces an outcome</comment>
                 <label xml:lang="en">produces</label>
                <rdfs:domain rdf:resource="Activity"/>
                <rdfs:range rdf:resource="Outcome"/>
</rdf:Property>

<rdf:Property rdf:ID="supplies">
                 <comment xml:lang="en">an outcome can supply resources</comment>
                 <label xml:lang="en">supplies</label>
                <rdfs:domain rdf:resource="Outcome"/>
                <rdfs:range rdf:resource="Resources"/>
</rdf:Property>

</rdf:RDF>
```

The proposed “Unified Learner profile” model technical description

```
<?xml version="1.0" encoding="UTF-8"?>

<!DOCTYPE rdf [
    <!ENTITY cos     "http://www.inria.fr/acacia/corese#">
    <!ENTITY rdf     "http://www.w3.org/1999/02/22-rdf-syntax-ns#">
    <!ENTITY rdfs    "http://www.w3.org/2000/01/rdf-schema#">
    <!ENTITY owl     "http://www.w3.org/2002/07/owl#">
    <!ENTITY palette "http://www.inria.fr/acacia/2006/palette#">
    <!ENTITY xsd     "http://www.w3.org/2001/XMLSchema#">
    <!ENTITY dc      "http://purl.org/dc/elements/1.1#">
    ]>

<rdf:RDF
    xmlns:rdfs="&rdfs;"
    xmlns:rdf="&rdf;"
    xmlns:cos="&cos;"
    xmlns:palette="&palette;"
    xmlns:owl="&owl;"
    xmlns:dc="&dc;"
    xml:base="&palette;">

  <!--nameFile=palette_metamodel_learner.rdfs-->

<Class rdf:ID="CognitiveCharacteristics">
                <label xml:lang="en">CognitiveCharacteristics</label>
                <comment>cognitive characteristics comprise intelligence, perception,
                memory capabilities, creativity, organizing skills </comment>
                 <subClassOf rdf:resource="#LearnerProfile"/>
</Class>

<Class rdf:ID="Actor">
                <label xml:lang="en">Actor</label>
                <comment>relates to the actors   </comment>
</Class>

<Class rdf:ID="CommunicationSkills">
                <label xml:lang="en">CommunicationSkills </label>
                <comment>communication skills refer to the individual's capability in
interacting with his enviroment </comment>
                <subClassOf rdf:resource="#LearnerProfile"/>
</Class>


<Class rdf:ID="Experience">
                <label xml:lang="en">Experience </label>
                <comment>experience comprises knowledge of or skill in or observation of
```

```
                some thing or some event gained through involvement in or exposure to that
thing
                or event </comment>
                <subClassOf rdf:resource="#LearnerProfile"/>
</Class>

<Class rdf:ID="Knowledge">
                <label xml:lang="en">Knowledge</label>
                <comment>knowledge refers to a fluid fix of verbal and/or manual skills
                brought about through training, instruction or practice that denote familiarity
                with facts, truths, concepts or principles </comment>
</Class>

<Class rdf:ID="Learner">
                <label xml:lang="en">Learner</label>
                <comment>Learner is the person who learns or takes up knowledge or
beliefs </comment>
                <subClassOf rdf:resource="#Actor"/>
</Class>

<Class rdf:ID="LearnerProfile">
                <label xml:lang="en">LearnerProfile</label>
                <comment> </comment>
                <subClassOf rdf:resource="#Learner"/>
</Class>


<Class rdf:ID="LearningActivity">
                <label xml:lang="en">LearningActivity</label>
                <comment>Learning activity is every activity performed that
                intentionally or non-intentionally resides to knowledge acquisition
</comment>
</Class>

<Class rdf:ID="LearningCompetences">
                <label xml:lang="en">LearningCompetences</label>
                <comment>learning competences refer to academic background, education,
training, working experience etc </comment>
                <subClassOf rdf:resource="#LearnerProfile"/>
</Class>

<Class rdf:ID="LearningObject">
                <label xml:lang="en">LearningObject</label>
                <comment>Learning object is every piece of knowledge </comment>
</Class>
<Class rdf:ID="LearningObjectives">
                <label xml:lang="en">LearningObjectives</label>
                <comment>learning objectives refer to the reasons that initiate learning such
as self evolvement and accomplishment, acquiring of qualifications etc.  </comment>
                <subClassOf rdf:resource="#LearnerProfile"/>
```

```
</Class>
<Class rdf:ID="Resources">
                    <label xml:lang="en">Resources</label>
                    <comment>resources refer to every means a Learner utilizes to perform a
learning activity </comment>
</Class>




<rdf:Property rdf:ID="accumulates">
                     <comment xml:lang="en"></comment>
                     <label xml:lang="en">accumulates</label>
                    <rdfs:domain rdf:resource="LearningActivity"/>
                    <rdfs:range rdf:resource="Experience"/>
</rdf:Property>
<rdf:Property rdf:ID="acquires">
                     <comment xml:lang="en"></comment>
                     <label xml:lang="en">acquires</label>
                    <rdfs:domain rdf:resource="Learner"/>
                    <rdfs:range rdf:resource="Knowledge"/>
</rdf:Property>
<rdf:Property rdf:ID="enhances">
                     <comment xml:lang="en"></comment>
                     <label xml:lang="en">enhances</label>
                    <rdfs:domain rdf:resource="Knowledge"/>
                    <rdfs:range rdf:resource="LearningCompetences"/>
</rdf:Property>
<rdf:Property rdf:ID="form">
                     <comment xml:lang="en"></comment>
                     <label xml:lang="en">form</label>
                    <rdfs:domain rdf:resource=""/>
                    <rdfs:range rdf:resource=""/>
</rdf:Property>
<rdf:Property rdf:ID="has">
                     <comment xml:lang="en"></comment>
                     <label xml:lang="en">has</label>
                    <rdfs:domain rdf:resource="Learner"/>
                    <rdfs:range rdf:resource="LearningObject"/>
</rdf:Property>
<rdf:Property rdf:ID="interactsWith">
                     <comment xml:lang="en"></comment>
                     <label xml:lang="en">interactsWith</label>
                    <rdfs:domain rdf:resource="Learner"/>
                    <rdfs:range rdf:resource="LearningObject"/>
</rdf:Property>
```

```
<rdf:Property rdf:ID="performs">
                    <comment xml:lang="en"></comment>
                    <label xml:lang="en">performs</label>
                   <rdfs:domain rdf:resource="Learner"/>
                   <rdfs:range rdf:resource="LearningActivity"/>
</rdf:Property>
<rdf:Property rdf:ID="utilizes">
                    <comment xml:lang="en"></comment>
                    <label xml:lang="en">utilizes</label>
                   <rdfs:domain rdf:resource="Learner"/>
                   <rdfs:range rdf:resource="Resources"/>
</rdf:Property>

</rdf:RDF>
```

The proposed “Unified Lessons learnt” model technical description

```
<?xml version="1.0" encoding="UTF-8"?>

<!DOCTYPE rdf:RDF [
      <!ENTITY cos     "http://www.inria.fr/acacia/corese#">
      <!ENTITY rdf     "http://www.w3.org/1999/02/22-rdf-syntax-ns#">
      <!ENTITY rdfs    "http://www.w3.org/2000/01/rdf-schema#">
      <!ENTITY owl     "http://www.w3.org/2002/07/owl#">
      <!ENTITY palette "http://www.inria.fr/acacia/2006/palette#">
      <!ENTITY xsd     "http://www.w3.org/2001/XMLSchema#">
      <!ENTITY dc      "http://purl.org/dc/elements/1.1#">
      ]>
<rdf:RDF
      xmlns:rdfs="&rdfs;"
      xmlns:rdf="&rdf;"
      xmlns:cos="&cos;"
      xmlns:palette='&palette;'
      xmlns:owl='&owl;'
      xmlns:dc='&dc;'
      xml:base='&palette;'>
 <!--nameFile=palette_metamodel_lessonslearnt.rdfs-->

  <rdf:Description rdf:about="#Activity">
    <rdf:type rdf:resource="http://www.w3.org/2000/01/rdf-schema#Class"/>
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">relates to the
individual objectives of the actor involved in a process. DEF: The Activity requires the use of
Lessons learnt in order to be performed. This concept links the Lessons learnt model to the
Process/Activity model.</rdfs:comment>
     <rdfs:label xml:lang="en-US"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">Activity</rdfs:label>
     <rdfs:label xml:lang="fr-FR"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">Activite</rdfs:label>
  </rdf:Description>

  <rdf:Description rdf:about="#Environment">
    <rdf:type rdf:resource="http://www.w3.org/2000/01/rdf-schema#Class"/>
    <rdfs:label xml:lang="en-US"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">Environment</rdfs:label>
    <rdfs:label xml:lang="fr-FR"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">Environnement</rdfs:label>
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">refers to the
context or situation.</rdfs:comment>
  </rdf:Description>

  <rdf:Description rdf:about="#Lesson_learnt">
    <rdf:type rdf:resource="http://www.w3.org/2000/01/rdf-schema#Class"/>
```

```
   <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">the
knowledge gained or produced as a result to the Activity of CoP members.</rdfs:comment>
   <rdfs:label xml:lang="en-US"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">Lessons learnt</rdfs:label>
   <rdfs:label xml:lang="fr-FR"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">Lessons apprises</rdfs:label>
  </rdf:Description>

  <rdf:Description rdf:about="#Negative_lesson_learnt">
   <rdf:type rdf:resource="http://www.w3.org/2000/01/rdf-schema#Class"/>
   <rdfs:subClassOf rdf:resource="#Lesson_learnt"/>
    <rdfs:label xml:lang="en-US"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">Negative lessons
learnt</rdfs:label>
    <rdfs:label xml:lang="fr-FR"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">Lessons apprises
negatives</rdfs:label>
<rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">subclass of the
Lesson learnt class, they relate to the bad practices of the CoP, the actions or decisions to
avoid.</rdfs:comment>
  </rdf:Description>

  <rdf:Description rdf:about="#Positive_lesson_learnt">
   <rdf:type rdf:resource="http://www.w3.org/2000/01/rdf-schema#Class"/>
   <rdfs:subClassOf rdf:resource="#Lesson_learnt"/>
   <rdfs:label xml:lang="en-US"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">Positive lessons
learnt</rdfs:label>
   <rdfs:label xml:lang="fr-FR"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">Lessons apprises
positives</rdfs:label>
<rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">subclass of the
Lesson learnt class, they relate to the good practices of the CoP, they determine the decisions
or actions that are recommended.</rdfs:comment>
  </rdf:Description>

  <rdf:Description rdf:about="#Problem">
   <rdf:type rdf:resource="http://www.w3.org/2000/01/rdf-schema#Class"/>
    <rdfs:label xml:lang="en-US"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">Problem</rdfs:label>
    <rdfs:label xml:lang="fr-FR"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">Probleme</rdfs:label>
   <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">represents a
critical point or issue to be analyzed. DEF:it's the reason for being of the Lessons learnt. It
describes, in the context of an activity or practice, a problematic or critical point whose
related solutions are analyzed so as to determine the best way to find an issue on
it.</rdfs:comment>
  </rdf:Description>

  <rdf:Description rdf:about="#Proposed_solution">
```

```
    <rdf:type rdf:resource="http://www.w3.org/2000/01/rdf-schema#Class"/>
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">a solution to
a Problem or a clue to solve it.</rdfs:comment>
     <rdfs:label xml:lang="en-US"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">Proposed solution</rdfs:label>
     <rdfs:label xml:lang="fr-FR"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">Solution proposee</rdfs:label>
  </rdf:Description>

  <rdf:Description rdf:about="#Resource">
    <rdf:type rdf:resource="http://www.w3.org/2000/01/rdf-schema#Class"/>
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">the different
types of knowledge resources used or produced in the CoP.</rdfs:comment>
    <rdfs:label xml:lang="en-US"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">Resource</rdfs:label>
    <rdfs:label xml:lang="fr-FR"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">Ressource</rdfs:label>
  </rdf:Description>

<rdf:Description rdf:about="#Feedback">
    <rdf:type rdf:resource="http://www.w3.org/2000/01/rdf-schema#Class"/>
     <rdfs:subClassOf rdf:resource="#Resource"/>
                                        <rdfs:label xml:lang="en-US"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">Feedback</rdfs:label>
                                         <rdfs:label xml:lang="fr-FR"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">Reaction</rdfs:label>
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">return on
experience, opinion or assessment based on some criteria.</rdfs:comment>
  </rdf:Description>

<rdf:Description rdf:about="#Behaviour">
    <rdf:type rdf:resource="http://www.w3.org/2000/01/rdf-schema#Class"/>
    <rdfs:subClassOf rdf:resource="#Resource"/>
    <rdfs:label xml:lang="en-US"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">Behaviour</rdfs:label>
    <rdfs:label xml:lang="fr-FR"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">Comportement</rdfs:label>
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">is a kind of
Resource (subclass), it particularly represents the behavioural characteristics of a member in a
group, his social interactions among the others, etc.</rdfs:comment>
  </rdf:Description>

  <rdf:Description rdf:about="#Knowledge">
    <rdf:type rdf:resource="http://www.w3.org/2000/01/rdf-schema#Class"/>
    <rdfs:subClassOf rdf:resource="#Resource"/>
     <rdfs:label xml:lang="en-US"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">Knowledge</rdfs:label>
     <rdfs:label xml:lang="fr-FR"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">Connaissance
theorique</rdfs:label>
```

```
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">is a kind of
Resource (subclass), it particularly represents the theoretical knowledge (procedural or
declarative).</rdfs:comment>
  </rdf:Description>

  <rdf:Description rdf:about="#Skills">
    <rdf:type rdf:resource="http://www.w3.org/2000/01/rdf-schema#Class"/>
    <rdfs:subClassOf rdf:resource="#Resource"/>
     <rdfs:label xml:lang="en-US"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">Skills</rdfs:label>
     <rdfs:label xml:lang="fr-FR"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">Capacites</rdfs:label>
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">a kind of
Resource (subclass), they particularly relate to the individual capabilities to do
something.</rdfs:comment>
  </rdf:Description>

  <rdf:Description rdf:about="#Role">
    <rdf:type rdf:resource="http://www.w3.org/2000/01/rdf-schema#Class"/>
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">the role
played by an actor involved in a process.</rdfs:comment>
     <rdfs:label xml:lang="en-US"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">Role</rdfs:label>
     <rdfs:label xml:lang="fr-FR"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">Role</rdfs:label>
  </rdf:Description>

  <rdf:Description rdf:about="#Expert">
    <rdf:type rdf:resource="http://www.w3.org/2000/01/rdf-schema#Class"/>
    <rdfs:subClassOf rdf:resource="#Role"/>
    <rdfs:label xml:lang="en-US"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">Expert</rdfs:label>
    <rdfs:label xml:lang="fr-FR"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">Expert</rdfs:label>
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">a kind of
Role (subclass), it represents the situation where a member is considered as Expert, assigning
him particular tasks in some processes of the CoP. DEF: in the context of Lessons learnt, the
Expert assesses the proposed solutions, using his expertise and taking into account the
feedbacks of the Testers.</rdfs:comment>
  </rdf:Description>

  <rdf:Description rdf:about="#Provider">
    <rdf:type rdf:resource="http://www.w3.org/2000/01/rdf-schema#Class"/>
    <rdfs:subClassOf rdf:resource="#Role"/>
    <rdfs:label xml:lang="en-US"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">Provider</rdfs:label>
    <rdfs:label xml:lang="fr-FR"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">Fournisseur</rdfs:label>
```

```
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">a kind of
Role (subclass), where a member furnishes something during a particular
process.</rdfs:comment>
  </rdf:Description>

  <rdf:Description rdf:about="#Recipient">
    <rdf:type rdf:resource="http://www.w3.org/2000/01/rdf-schema#Class"/>
    <rdfs:subClassOf rdf:resource="#Role"/>
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">a kind of
Role (subclass), where a member receives something during a process of the
CoP.</rdfs:comment>
    <rdfs:label xml:lang="en-US"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">Recipient</rdfs:label>
    <rdfs:label xml:lang="fr-FR"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">Receveur/Destinataire</rdfs:la
bel>
  </rdf:Description>

  <rdf:Description rdf:about="#Tester">
    <rdf:type rdf:resource="http://www.w3.org/2000/01/rdf-schema#Class"/>
    <rdfs:subClassOf rdf:resource="#Role"/>
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">a kind of
Role (subclass), where a member tests something during a CoP process and gives his results.
DEF: in the context of Lessons learnt, the Tester experiments the proposed solutions to a
problem and gives his feedback.</rdfs:comment>
    <rdfs:label xml:lang="en-US"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">Tester</rdfs:label>
    <rdfs:label xml:lang="fr-FR"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">Testeur</rdfs:label>
  </rdf:Description>

  <rdf:Description rdf:about="#adjusts">
    <rdf:type rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#Property"/>
    <rdfs:range rdf:resource="#Proposed_solution"/>
    <rdfs:domain rdf:resource="#Feedback"/>
     <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">le Feedback
concernant une solution propos\'e9e permet de la corriger, de l'affiner.</rdfs:comment>
    <rdfs:label xml:lang="en-US"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">adjusts</rdfs:label>
    <rdfs:label xml:lang="fr-FR"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">ajuste</rdfs:label>
  </rdf:Description>

  <rdf:Description rdf:about="#can_be_composed_of1">
    <rdf:type rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#Property"/>
    <rdfs:domain rdf:resource="#Lesson_learnt"/>
    <rdfs:range rdf:resource="#Resource"/>
    <rdfs:label xml:lang="en-US"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">can be composed
of</rdfs:label>
```

```
    <rdfs:label xml:lang="fr-FR"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">peut se composer
de</rdfs:label>
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">describes the
relation between two concepts, among which one can, in the context of the CoP, be a part of
the other.</rdfs:comment>
  </rdf:Description>

<rdf:Description rdf:about="#can_be_composed_of2">
    <rdf:type rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#Property"/>
    <rdfs:domain rdf:resource="#Proposed_solution"/>
    <rdfs:range rdf:resource="#Resource"/>
    <rdfs:label xml:lang="en-US"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">can be composed
of</rdfs:label>
    <rdfs:label xml:lang="fr-FR"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">peut se composer
de</rdfs:label>
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">describes the
relation between two concepts, among which one can, in the context of the CoP, be a part of
the other.</rdfs:comment>
  </rdf:Description>

  <rdf:Description rdf:about="#formalizes">
    <rdf:type rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#Property"/>
    <rdfs:range rdf:resource="#Proposed_solution"/>
    <rdfs:domain rdf:resource="#Lesson_learnt"/>
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">the Lessons
learnt are a synthetisis or a formalization of the Proposed solutions to the
Problem.</rdfs:comment>
    <rdfs:label xml:lang="en-US"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">formalizes</rdfs:label>
    <rdfs:label xml:lang="fr-FR"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">formalise</rdfs:label>
  </rdf:Description>

  <rdf:Description rdf:about="#identifies">
    <rdf:type rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#Property"/>
    <rdfs:domain rdf:resource="#Recipient"/>
    <rdfs:range rdf:resource="#Problem"/>
     <rdfs:label xml:lang="en-US"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">identifies</rdfs:label>
      <rdfs:label xml:lang="fr-FR"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">identifie/definit</rdfs:label>
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">when
someone identifies something.</rdfs:comment>
  </rdf:Description>

  <rdf:Description rdf:about="#is_involved_in">
    <rdf:type rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#Property"/>
```

```
    <rdfs:range rdf:resource="#Environment"/>
    <rdfs:domain rdf:resource="#Activity"/>
    <rdfs:label xml:lang="en-US"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">is involved in</rdfs:label>
    <rdfs:label xml:lang="fr-FR"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">est impliquee dans</rdfs:label>
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">where the
realisation of something implies the realisation of something else.</rdfs:comment>
  </rdf:Description>

  <rdf:Description rdf:about="#is_related_to">
    <rdf:type rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#Property"/>
    <rdfs:domain rdf:resource="#Problem"/>
    <rdfs:range rdf:resource="#Activity"/>
     <rdfs:label xml:lang="en-US"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">is related to</rdfs:label>
     <rdfs:label xml:lang="fr-FR"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">est lie a/concerne</rdfs:label>
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">describes a
link between two concepts.</rdfs:comment>
  </rdf:Description>

  <rdf:Description rdf:about="#provides">
    <rdf:type rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#Property"/>
    <rdfs:range rdf:resource="#Lesson_learnt"/>
    <rdfs:domain rdf:resource="#Provider"/>
    <rdfs:label xml:lang="en-US"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">provides</rdfs:label>
    <rdfs:label xml:lang="fr-FR"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">fournit</rdfs:label>
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">describes the
situation where someone furnishes something.</rdfs:comment>
  </rdf:Description>

  <rdf:Description rdf:about="#tests">
    <rdf:type rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#Property"/>
    <rdfs:range rdf:resource="#Proposed_solution"/>
    <rdfs:domain rdf:resource="#Tester"/>
     <rdfs:label xml:lang="en-US"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">tests/experiments</rdfs:label>
     <rdfs:label xml:lang="fr-FR"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">teste/expérimente</rdfs:label>
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">describes the
situation where someone experiments something.</rdfs:comment>
  </rdf:Description>

  <rdf:Description rdf:about="#validates">
    <rdf:type rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#Property"/>
    <rdfs:range rdf:resource="#Proposed_solution"/>
    <rdfs:domain rdf:resource="#Expert"/>
```

```
   <rdfs:label xml:lang="en-US"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">validates</rdfs:label>
   <rdfs:label xml:lang="fr-FR"
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">valide</rdfs:label>
   <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">describes the
situation where someone validates something.</rdfs:comment>
  </rdf:Description>

 </rdf:RDF>
```