Access management for knowledge communities - a policy orchestration formula

Ioan Rosca, Val Rosca
LICEF, Teleuniversity of Montreal, Canada
ioan.rosca@licef.teluq.uqam.ca; rosca@amazon.com

Abstract

Access management for learning communities requires a unified theory, nourishing the description, definition and control of instructional policies for "social networks". We have refined this issue in a series of projects, which we succinctly relate- to explain the management method we have reached. It is based on the integration of content-rich resources in "operations" that model/control the access of those seeking to learn something by using them, with or without assistance. These "orchestration scores" for both human and machine interprets/executors - support the procedural aggregation of resources. The activities may be sequenced emergently (using "operation" repositories) or planned, using scenarios ("functions" - a biological metaphor). The proposed formula aims at multiple facilitations: description, coordination, instruction, connection, control. The gradual concretisation of operational elements may rely on semantic and administrative indexing and on the "metafunctions" mechanism. Our current prototyping work refines and applies these ideas in areas like software engineering, CSCW/L.

1. Introducing the issue of "meaningful access"

In his online blog [1], Stephen Downes, a pioneer of online resource sharing, goes from frustration to scepticism: "*The Semantic Web will never work because it depends on businesses working together, on them cooperating*". In today's world, it is often more important to block access to information than to facilitate it. Walls pierced by the doors of technical inter-operability are … administratively bricked up, if no secure locks can be found. The gates open for external access must at least be under some form of control [2].

There are cases however where information accessibility (and even promotion) is encouraged, as a social-intellectual necessity, relying on easily reproducible goods: spreading material-spiritual well-being, social equity, personal emancipation, civic watch. Special motivations and situations can be invoked to restrain access to information, for personal (private) or governmental (classified) interests: defending intimacy and honour, copyright, property rights, personal and social risks.

The definition of the principles forming the vision of the LORNET project [3] relied on the presumption of an aspiration for sharing and cooperation. The attitude of the community members interconnected by TELOS will also depend on the strategy (policy) of stimulating cooperation (incentives), though studies (like [4]) show natural limits to stimulating fraternity. The coexistence of situations when accessibility is favoured over protection and vice-versa, within the same informational network, calls for a means to adapt the access level and thus- for a coherent management system of rights negotiation.

Our position regarding Downes's alarm call covers two complementary aspects. On the one hand, along the line of currents such as social/distributed/situated cognition (see an example in [5]) or community computing, we are interested in the consolidation of the "collective brain", with the help of computer-networked synapses. We envision a future in which participants ask the global system to be placed into contact with optimal support resources (objects, services or persons) for solving a given problem. We imagine new forms of knowledge propagation in this milieu (through "semantic waves"), along with new approaches to collective projects (through ad-hoc formed distributed teams).

On the other hand, we are aware of the risks engendered by major modifications of the collective intellectual physiology. Social systems, equipped with revolutionary technical instruments, form socio-technical meta-systems- that could evolve in harmful directions for society or individuals (also see [6]).

Therefore, in order to defend individual or group interests (privacy, autonomy, etc), members of large communities need appropriate "synapses", with adjustable and observable accessibility. It is, we believe, a necessity, for initiatives such as the Augmented Social Network (ASN) [7] *"that would build identity and trust into the architecture of the Internet, in the public interest, in order to facilitate introductions between people who share affinities or complimentary capabilities across social networks"*. Hence the interest for a "*policy aware infrastructure*" as in [8] that proposes "*a rule-based policy management system that can be deployed in the open and distributed milieu of the World Wide Web"*. A gateway layer - with explicit, adaptable and negotiable penetrability, should therefore be available at several levels (entering a system, accessing a resource, calling a service, etc).

A variety of efforts from different fields have been made in this direction (see examples in [9], [10], [11], [12], [13]) leading to multiple attempted standards for expressing policy in information systems. Here's a short list (see a synthesis in [14]): *ITU-T X.812 Recommendation (1995): Access control framework; ISO MPEG 21 Rights Expression Language, Rights Data Dictionary (2004); ANSI/INCITS 359: Information Technology -- Role Based Access Control (RBAC) 2004 (see [15])*; *IETF RFC2748: The COPS (Common Open Policy Service) Protocol; ETF RFC3460: Policy Core Information Model (PCIM) and IETF RFC4011: Policy Based Management (MIB*)*; W3C Web Services Architecture; W3C Web Services Policy 1.5 – Framework; OASIS Extensible Access Control Markup Language (XACML); OASIS WSPL* [16]; *W3C Open Digital Rights Language (ODRL);*etc. Beyond differences between norms, the problem of managing a "resource repository" is usually solved by attaching a set of administrative rules onto a resource - or an entire group of resources.

Domains interested in facilitating human activities, complex or cooperative (workflow management, CSCW, DSS, HCI etc) have also confronted the problem of managing concurrent (shared) access to resources, required for task fulfilment, by establishing their own models, norms, methods and instruments for the coordination (synchronization) of processes driven by multiple human wills (see examples in [17], [18], [19] [20]).

On the other hand, the apparition of mechanical entities that observe, control and execute (computers, machine agents) has triggered research on their access to resources (objects, services). Orchestrating machine access (flowchart sequencing, parallel thread synchronization, remote service connection, composed service choreography, transaction management, etc) is also intensively studied in computer science.

The practical solutions arising from many directions are very diverse, each system having to harmonize its access policy (rules) editors with its interpreters/executors. Furthermore, inter-system administrative interoperability requires efforts for coupling or adopting shared norms. This leads to the organization of an intervention mediation layer (space), that can be found in the context of the shared target (resource, service, repository), of the beneficiary (caller), or on a separate tier, dedicated to the orchestration of concurrent access. An interface-gateway (adaptable, programmable) can intervene in: identification, verification or evaluation, personalization, adaptation, protection, control, supervision, tracing (for repudiability), retrieval, matching, assistance, facilitation, automation, translation, chaining within a task, transaction (rollback), integration, sharing and co-piloting, concurrency solving (semaphore, floor control), group (team, community) communication and coordination, negotiation, payment, etc.

In distributed instructional systems - we encounter aspects related to: accessing (pedagogical) resource repositories, instruction process choreography (learnflow), administration of various activities collateral to learning, adoption of interoperation norms. These problems can thus be studied within the framework of theoretical domains mentioned above and the instruments they elaborate can be valorized, with appropriate adaptations. However, our exploratory focus was the issue of access specific to systems dedicated to knowledge propagation (instruction).

We have sought to coagulate the administrative aspects - like rights and obligations - and the coordinative aspects - like intervention roles**,** around the instructional goal: ***the use of a resource by someone who wishes to act understanding something*** **-** with the possible support of objects and persons. Therefore, we've scrutinized the pedagogical use of resource repositories along with the use of repositories of pedagogical resources, the pedagogical management of workflows along with the management of pedagogical workflows.

2. Quest for refining a management formula

Managing intervention rights in complex systems lacks a unitary theory (although it is approached by a multitude of disciplines), due to the fact that it involves a great number of aspects, methods, instruments, problems, objectives, criteria and concepts. One sometimes refers to rights and obligations (administrative nuance/flavour/aspect/dimension), privacy and transparency (informational nuance), chaining and synchronization (coordinative nuance), supervision and security (control nuance), facilitation and assistance (instructive nuance), decision and negotiation (managerial nuance), etc. Considerations from different communication levels (society, software, hardware) are intricate (the apparition of "computer agents" further blurring the boundaries).

It is difficult to presume that convergence towards a universal "ontology of access" will easily succeed, considering the multitude of directions from which come the concepts it should collect. Even modelling the geography of these potential sources is challenging. Therefore, in order to introduce the synthesis formula we propose for access management, we will appeal to a succinct narration of the modality through which we have established it - in a series of projects of applied-illustrative-exploratory nature. This explanation completes the presentation of our past research [21] and further orientates it towards a progressive formula calibration (see chapter 4).

The complexity of managing socio-technical interactions showed up during the study of pedagogically aimed cooperation ("learning by co-doing") in expert-computer-novice triangles (the Metamorph, SAFARI and NUAC projects, research exposed in a PhD thesis - [22]). In each node of the collaborative-instructive operation chain, we can encounter (after connecting the participants - eventually sustained by semantic matching) a fructuous intersection between the interventions of the assisting expert, the beneficiary novice and the supporting computer. The ***issue of pedagogically exploiting concurrency*** (co-action, sharing) is therefore formulated in different terms than when tasks are distributed or shared for operational reasons. The actual interventions during an instructional session creatively exploit the space of the rights established for each operation, through negotiation. The local interaction protocol can be integrated into a collaboration "mode", valid along the entire chain- that determines the posture of the protagonists: student executing freely or under human supervision, expert demonstrating an execution, work in pair, machine demonstrator etc. However, in order to pertinently intervene in the process of instructive cooperation, the computer must be equipped with an appropriate model of the phenomena, requiring a ***microscopy of management*** (negotiation atomics). The necessity for bi-controlling applications has led to the model of the "bi-computer" (conceived for two correlated users) and to the principle of the "glass window"; a transparent layer through which all the user's orders are sent to the application (resource), so that it is possible to intercept and communicate them to the remote partner; his reactions are then mixed with the executor's actions. It was the start of the idea to "wrap" resources with a layer that can intermediate actions on them.

Enriching primary resources (applications, documents) with layers (declarations and executors) facilitating their use (retrieval, usage, aggregation, automation, etc), we have obtained (in the ION project) "secondary resources"- capable of being manipulated through an intermediary logic, with the help of a "resource controller". A "command batch" formulated in the intermediary language of a secondary resource forms a "tertiary resource" – as an operational cascade. Observing the graphical editor and executor of those cascades, we realised that they behaved as a procedural aggregation of the chained automated operations. Facilitating the composition of a new resource from existing ones, used as components, is of special interest for the support of pedagogical design, pursued in LICEF projects (ADISA, Explora, SavoirNet). We have tried to overcome the technical difficulties of the composition (interoperability, dependencies, etc) by using the facilities of secondary resources. The calibration of the ION aggregator through the exercise of decomposing-recomposing the ADISA system has revealed the problems and limits of structural ("fusion type") aggregation [21, 23]. The access policy for the system resulted from a composition must be redefined, as it does not automatically result from the policies attached to the components (governed by the will of their constructor/owner).

All these have driven our attention towards procedural aggregation, inspired by the LICEF work on workflow modelling (MOT and MOT+ projects). Attempting to pass from passive (descriptive) procedure model edition to active orchestration managers, we have realized that by interfacing resources with procedural management filters, one prepares their integration for various use contexts. From here came (in the VAL project –see [24]) the idea of "function" type aggregation – able to orchestrate a group of resources and persons by sequencing a series of "operations".

To systemically integrate the objects, actors and rules involved in an instructional process, the "operation" models topology and physiology and may become an active tool, an "orchestration score" for both human and machine interprets/executors. This procedural orientation allows us to approach "organically" the issue of aggregating composed resources (also see [23]). Instead of structural concatenation, we follow the chaining of operations (processes/contexts).

The method focuses (pragmatically) on the facilities created by the functional model that reflects and accompanies a procedural reality, allowing its reproduction, more or less accurate, in execution instances:

(1) Description (for understanding and inspiration). The operation (function) is used for explaining a phenomenon or as a guide for the orientation of the actors involved in actions. The model's interpret observes the operation (chain), follows the instructions and the criteria that determine the decisions, reads the support documents connected to some nodes, etc.

(2) Interception and declaration (for memory, control, evaluation, local help, general feedback). The user produces traces, annotates the execution (announcing and commenting the progress in realising operations) and may answer to certain verification questions. The data about his progress (traces, annotations, answers) may be watched by some partner or supervisor, steer automatic assistance, or be recorded for later evaluation and ameliorating feedback.

(3) Facilitation The function eases the resources' retrieval, launch and manipulation, aggregating them dynamically. It can launch batches of automatic operations.

(4) Coordination. Acting as a synchronization whiteboard (orchestration score), the function facilitates the coordination of the team of human participants and machine agents (via communication, co-action and sharing).

(5) Connection and matching. The function can provide filtering, selection, advising, matching and alerting services, sustaining the selection of the connected resources.

As we can see in figure 1, in order to be used in the ways described above, a "function" must have been prepared during the edition phase. After the definition of a generic model and the particularization of "derivate models" through the concretization of appropriate elements- found in the person directories or resource repositories- these models can be indexed and published in a function/operation repository, becoming retrievable, as any resource. The users of such "procedural aggregates" take advantage of the facilities prepared during edition. The transformation cascades (function or operation life-cycle) involving a model and the procedural reality that it mirrors (as the one presented in grey-up right- in the figure 1) can be managed with *meta-functions* [25].

Functions, and the operations they can be broken up

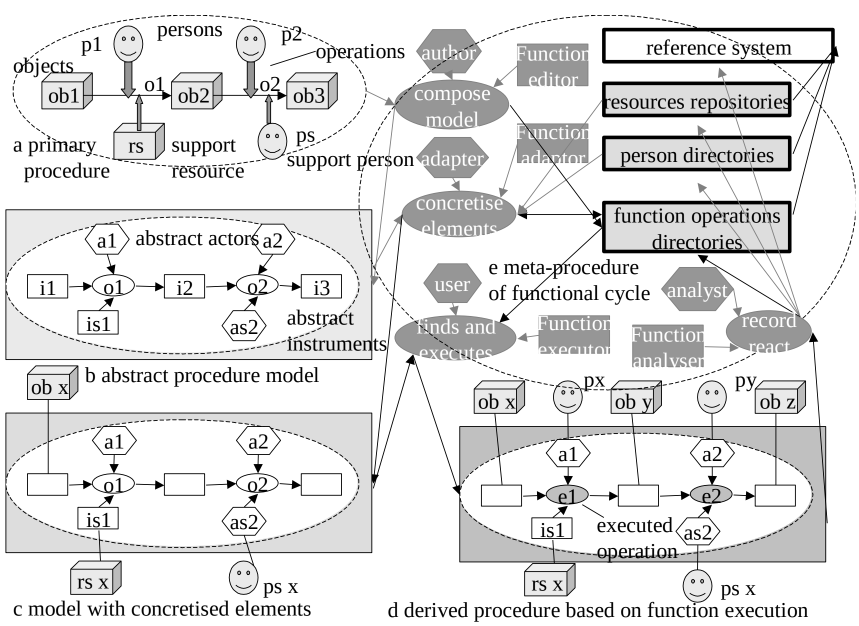

Figure 1: Adapting functional orchestrations

into, form a new category of resources and can be seen as a wrapper for intermediating access to procedurally-aggregated/encapsulated resources. In the general schema of the Explora2 tele-instruction system [26], the Resource Manager/Controller, equipped with an access condition editor and executor, is empowered with a module for the management of wrapped operations. We also have considered the possibility of declaring conditions for person participation, as a definition layer for "secondary human resources"- handled with the Participants Manager. What was left to decide was the way in which concurrent rules were to be handled (repartition of access rights, negotiated) establishing the equilibrium between the intervention mandates of: operations, participants and resources. Inspired by the collaboration between the Explora2 [26] and iHelp [27] projects and by other works on using agents to coordinate communities - we have proposed, in the Explora2 specifications, that secondary resources (objects, operations, persons) be backed by "mediation agents".

The implementation of this solution in Explora2 was, however, delayed, due to the passage to the SavoirNet context, where the Explora management system became also an intermediary, facilitating the inter-operation of connected tele-instruction systems. Services found in various technical and administrative contexts now had to be aggregated, using resource description, inter-operation and orchestration norms- insufficiently stabilized.

The sequencing of activities can be established emergently, using "operation" repositories. In such cases, a posteriori chain modelling is possible, intercepting resource use information at the operation interface layer. Operation preparation (population with support resources and participants) relies on repositories: primary resources, participants, secondary resources (wrapped or at least accompanied by metadata records). The eduSource project revealed the complications of the access rights issue, created by the wish to federalise pedagogical resource repositories. The solutions proposed by our colleagues [28] were axed on equipping repositories of resources described in LOM, with DRM mandates, implemented by mediation agents (brokers).We followed the trends on managing the metadata descriptors for resources and services (from LOM and WSDL towards ontologies and semantic web), participating to the reengineering of the MOT+ graphical knowledge editor (in order to support graphical ontology edition). On this occasion, we resumed the study of content management, observing that knowledge evolution explicitation is essential for instructional systems. In order to retrieve, with a unique query, the documents, persons and operations pertinent as support, a common semantic (knowledge) reference system for resource, participants and operations may be envisioned [29].

On the other hand, we have refined the study of planned procedures, observing the adaptation of MOT+ so that it can edit IMS-LD scenarios [30]. Perfecting the mechanisms of process orchestration (functional model enactment) has led us to an advanced prototype of operation/function management (GEFO- [24]).With the help of a "metafunction", we can manage the chain of states that leads from the abstract definition of a function to the concretisation of the involved elements, and finally to execution instances. Throughout this process, the operation can work as a synapse, employing semantic matching strategies (resolving competence equations) or administrative conformance strategies (solving mandate equations). This connective facility (see [31]]) supposes that the elements be indexed semantically (administratively) on the basis of appropriate reference systems (knowledge, rights). The presence of a K layer (knowledge: detained, necessary or acquired) reveals the evolution of competences, enforcing the operation's **instructive aspect**. In the same direction goes the introduction of "interaction modes" (that characterize a protagonist's position in a functional chain: who learns by observing or doing, who teaches by doing or showing etc). This longitudinal view allows us to reveal the global management policy of local access policies- giving a knowledge community the control over its informational physiology.

All these efforts have been collected in the LORNET project [3], which aims to support technical and semantic inter-operation between educational service sources and resource repositories, accessible through the Internet. The conceptual architecture of the TELOS middleware ([3], [21], [25]) combines the emergent aggregation of the objects and processes extracted from the primary and secondary resource repositories with the orchestration of (cooperative) operations through "functions". When the execution of a sequence of operations is accomplished by enacting a functional model, the management of the intervention rights may be tuned, in each operation, according to the edited mandate (for processes, actors, instruments), using the data from the current session (resulting from previous operations) and considering the chosen working mode. It remains to establish the way to declare mandates and to use them in the dialogue between the broker-agents – coordinated by the global operational logics. The difficulty of coordinating man-machine orchestras comes from the combination of human team management (workflow, CSCW, DSS) and technical synchronization (service choreography, flowchart, concurrent and parallel processing, etc). A first attempt (presented at last year's LORNET congress [21]) was the combination of GEFO's capabilities (editing operational topologies, concretising them with elements extracted from repositories, controlling the enactment of operation chains) with the possibilities of managing service contracts- explored in the TERMS prototype.

The *Sn* template of a collaborative operation, edited with GEFO, is placed in a "service database". Using instruments of service particularisation for a local administrative context (institution, community, project), the TERMS editor drives the process of negotiating the *Om* concretisation of resource and support participants– fuelling an "offer database" (*OmSn*). Starting from it, the final concretisation of the beneficiary *p* can be done, leading to a *CpOmSn* contract. Other advancement tracks in the state machine that leads from a *Sn* service to a *Cp* contract are also possible; for instance – first, the concretisation of the beneficiary *m*, placed in a "request database" *RmSn*, and then the selection of the assistants - *CpRmSn*. Managing contract execution in the GEFO-TERMS prototype (solving concurrency, rollback, chaining, verification, tracing and other problems) combines the GEFO capabilities of machine control and human expressiveness with the TERMS orientation towards human responsibility in tracking contract fulfilment.

In the actual stage of our research, we reorganize the elements from GEFO and TERMS in a unique but modularized system that would allow the unitary treatment of rights, competences and technical conditions management.

3. The "operation": topology, aggregation, aspects, concretisation, management

Figure 2 models the behavioural physiology of access management in mixed (man-machine) distributed systems- attained while pursuing the objectives mentioned in paragraph 1, following the experiences related in paragraph 2 and upon which the specifications of the systems we are implementing rely on (paragraph 4).

A distributed system contains primary resource repositories and secondary resource repositories ("prepared" by adding certain metadata descriptors *M* - depicted with lozenges, manipulation layers, and possibly certain representation agents *A* – brokers, depicted with octagons). Among the elements of the indexation (description) of object-resources (applications, documents), apart the "semantic" area *K* (describing the resource's content) and the technical area *T* (the technical conditions for its operation), a *Mn* access mandate contains, in the *P* area, the administrative rules of access (policies). The *P* mandate definition is based on a dictionary/ontology specific to the access problem space (access orchestrated through various means, for instance with functions)- and can be used by the human participants or by some orchestration agents.

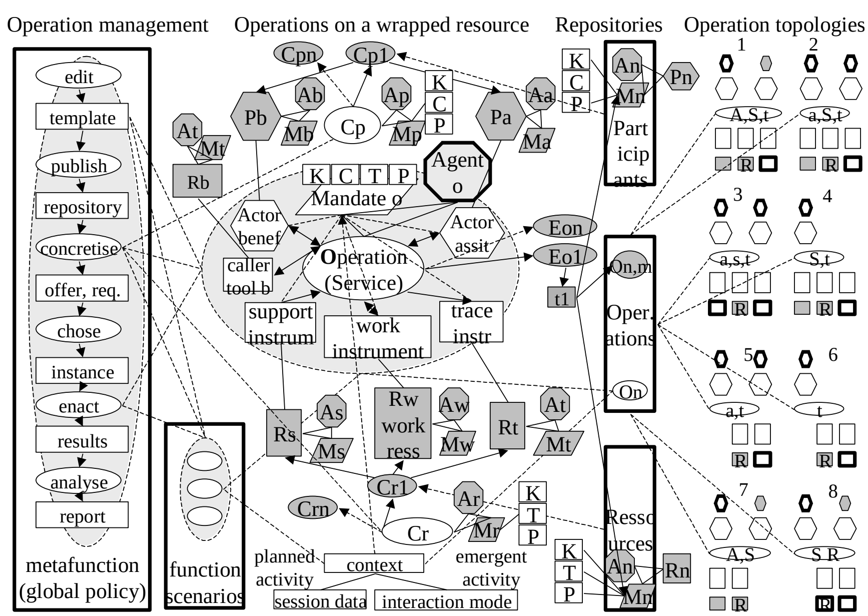

Figure 2: A formula for the management of access policies

The persons *Pn* that participate to the community life may also be indexed semantically (K area-competences linked to various knowledge), communicatively (C area - communication modes, preferences, language, etc) and administratively (identity, credentials, authority, including categories and groups, personal portfolios, rights and obligations, tasks and roles etc). In the case of "secondary human resources", the policy area *P* of a *Mn* mandate (correlated with the intervention of potential orchestrators) may rely on a specific ontology, built progressively by the community, and may be sustained by a specialized broker *An* (octagon in figure) that accompanies (supports, controls, etc) the person in his actions (online case) or represents him in his absence (offline case).

The key instrument for the coordination of system activities is the operation O, which regulates (orchestrates) the service of using a certain resource in the community. We won't go into the technical or content issues of coordination (seeking the optimal equilibrium for the K, T and C areas - exposed in other contexts– [31]), focusing instead on managing the administrative (access policy) aspects (*P* area of Mn mandates).

An operation's template contains, as key abstract elements:

- The working "instrument" (empty rectangle) – *Iw* (that will be materialized with concrete resources *Rw* – filled rectangle, during the resource concretisation phase *Crn*); it can be indexed semantically technically or administratively - if the definition of restrictions (conditions) imposed to the concretisation process is desired. These policy restrictions can be declared extensively (list of admitted/required resources), through access rules belonging to a specific dictionary or as a "selective filter" (SQL-like) based on the resources' metadata administrative characterization fields (*P* area).

- The operation *O* (empty oval) (that will be concretized/"enacted" in various execution instances – filled oval *Eon*); declarations of abstract elements composing the operation (*Iw*, *Ab*, etc) may be considered integrated in the operational mandate *Mo* or treated separately**.**

- The beneficiary actor (user) *Ab* (empty hexagon– a role that will be concretized by a human participant *Pb);* The semantic indexing K defines the conditions imposed to the potential executor/learner (competences required or gained playing the role). The administrative indexing P - may impose extra-semantic restrictions (conditions) to the participants who will concretize the actor. These restrictions can be declared extensively (list of admitted/required persons or categories), through rules belonging to a specific dictionary or as a "selective filter" (SQL-like) defined based on the persons' metadata characterization (rights and responsibilities).

Apart these components, the operation may also involve:

-One (or several) support instrument *Is* (materialized by the support resource *Rs*). It may be a document or a content-less support tool, used in parallel to the main resource

-One (or several) human assistant *Aa* (materialized, during *Cp* concretization-piloted by *K*, *C*, *P* criteria, by the person *Pa*); The cooperation report (interaction mode) between the beneficiary executor *b* and his assistant *a*, determines their pedagogical posture.

-Instruments *It* (materialized, in each instance, by an object *Rt*) for recording and managing the execution's results (*t1* - lozenge): traces, annotation, products etc. These allow us to observe and evaluate (**control aspect**) the execution process (planned or emergent) and steers potential modifications (**reactive aspect**). The execution data *t1*, fuelling the dataset of the instance execution *Eo1*, may enrich (global feedback) the participant model or the metadata characterization of the used resource. The trace facility may be included in the function manager or external if we wish to use an "epiphyte" assistance tool [32]

- One (or several) beneficiary tool *Tb*- (materialized by a calling system/process *Rb*). This case arises when, instead of a human participant, the operation is used by a machine element (application, system, agent)- working for a beneficiary.

An operation can have various topologies, tailored to the necessities. We can have: 1) Situations when the human support *a* and the material support *s* are already established (as *A* and *S*), the only things left to be concretized during the execution being the user and the resulted trace; 2) The human assistant a is established during the execution phase (with possibilities of optimization through matching); 3) The concretisation of both support forms a and s is done during the execution phase; 4) Only a support document S is connected 5) Only human assistant a, not yet concretized; 6) Working without support; 7) Without trace; 8) the work resource *R* is only abstractly specified, being chosen at execution time, depending on availabilities.

In order to solve the concurrency between the intervention mandates (with Knowledge, Communication, Technical and Policy areas) of the various entities (*Ma, Mb, Mt, Mw, Ms*, etc) which concretize the actors and instruments- the operation is provided with a mandate *Mo* for the coordination of (parallel) processes, expressed in an appropriate language, comprehended by all involved interpreters. The experimental versions attempted in our prototypes have confirmed the difficulty of synthesizing this hybrid language. Editing such a global mandate (like an orchestra score) must take into account the distribution (topology) of participation, the semiotic and ergonomic requirements linked to the interpretation of human participants, the characteristics of machine interpreters, the methods for realising a convergent negotiation.

"Semaphorisation execution" is the responsibility of the conducting agent of the operation *Ao*. It will attempt ***to optimally accommodate the mandates of the passive components, the will of the human participants and the intervention of the eventual representation agents (brokers)***. The specification of this orchestration mechanism (language, processes, tools) proves to be extremely challenging and is our main research track.

The operation *On* can be executed in the *context* of an *emergent* activity functioning, with participants freely choosing their procedural-type resource, placed in the operation repository. Compared to a direct approach on the resources, the users will have, at their disposal, all the orchestrating facilities prepared in the operation's wrapper. They may chain a sequence of operations, seeking a given objective. The system could offer post-factum reflection (modelling) possibilities for observing expressive sequencings (demonstrations, expertise eliciting, behavioural studies, etc), taking advantage of the possibility to intercept actions at the operational interface level. In this case, the orchestration logic conducted by *Ao* will be relatively autonomous (although it can consider the working "*mode*" fixed at the operation catalogue level, or use some resources or data coming from preceding operations - if the resource controller offers the possibility of propagating "system variables").

When the *planned* operations' sequencing is required, the inclusion of operations in "functions" is recommended. In this context, the activity of any individual operational conductor *Aon* may strongly depend on the function chaining logic (manifested through the elements shared between two operations or trough the propagation of *session data*). The "*interaction mode*", specified for an entire function, can homogenize the way concurrency is resolved, along an operational cascade.

Therefore, the blended community of people and tools forming "augmented social networks" may be provided with orchestrators (synapses, semaphores) of operation type- procedural resources, preparing the machine and human interpretation and action, adapting the system to various capacities and needs.

The operation sequencing for some community project, will be realized freely (emergently) or with the help of functions. The concretisation of the elements (persons, resources) of an orchestrator (operation, function) can become the object of a negotiation, piloted by a meta-semaphore. Editing an operation (function) is a socio-collaborative process; in order to facilitate it (allowing authoring – more accessible – instead of programming – too specialized), the administrative attributes of an operation may belong to a dictionary (ontology) of specific concepts – negotiated by the community. Citizens will be able to participate to activities, according to the posture they have in a project, based on clear and controllable intervention protocols. In order to ensure the public control at the level of the global management policy of the community's collaborative activities, one can process, through the function mechanism, the organisation chain of an orchestrated activity: editing operation (function) templates; publishing them in a repository; concretising beneficiaries (obtaining "request-functions") or assistants ("offer-functions") or all elements ("contract-functions"); choosing and approaching an execution instance (by one or more persons, in one or more work sessions); operation enactment (while respecting the prepared rules, solving conflicts by the conductor and recording the results); analysing the data resulted from one or more instances and proposing reports (as feed-back upon which the process can be resumed). These "meta-functions" will reflect (sustain) the community's administrative policy, being modified through the same collaboration mechanisms as those they regulate.

4. In guise of conclusion: new exploratory applications

We are aware that too many un-tackled problems of principle or ambiguous aspects- remain to be studied. Being adepts of behavioural exploration applied in concrete projects, we intend to integrate function-based policy management in a few pilot-applications. We will expose, in future papers, the findings of these prototypal implementations and the consequences for the refinement of the above specifications.

4.1 Use cases evolving to support functions (refining global management of local access)

A major orientation in software engineering (generalized in system engineering) is the employment of use-cases for eliciting behavioural specifications.

The architecture can be defined onto them, and then the system can be built. The growing attention for the use of "scenarios" in "requirements engineering" [33] enhances the interest for the procedural modeling (descriptive aspect) of a software-equipped system's physiology (treatable as a function model). The necessity to develop instruments for systems in continuous evolution raises the challenge of the evolutionary engineering of instruments, architecture and specifications [34]. New use cases (taking the access conditions into account) can be created to deal with changes in requirements. Another way is to progressively modify existing ones. Such an evolutionary procedural model will less and less express the "scenario" (showing what instruments ought to be built) and more and more how the developed instruments can be used. A use-case enriched as an active policy-aware "function" can converge towards a support tool for the final system. Meta-functions are valorized to govern the edition of these orchestrating use-cases- as an instrument for the global management of software projects.

4.2 Instructive cooperation in software production (refining the orchestration for explanative co-action)

Managing the global evolution of software projects involves managing the inevitable modifications that occur in the design team (the departure and arrival of members, knowledge modification for those remaining, etc). The use of content-aware and policy-aware "functions" for managing cooperative programming activities (active aspect), including task sharing in novice-expert pairs (instruction aspect), would allow, apart the coordination of production flows according to given protocols and methodologies, to form interns through "learning by doing inside the team". Such a flexible training solution would correspond to the needs of the industry and to the interest of pioneer learning institutions (like CMU, see http://west.cmu.edu/prospective_students/unique_features) that practice software engineering instruction through involvement in pedagogically- prepared projects. Control over each actor's intervention could also sustain the ad-hoc constitution of distributed programming teams - for projects emerging in large programmer communities.

4.3 Managing extension cascades for TELOS-like systems (refining the administration of planned operation chains)

The extension of the TELOS space (see [3], [21], [25]) through recursive aggregation, facilitated by the means to support composition and inter-operability, is confronted to administrative aspects. The core-LKMS-LKMA-LKMP cascades, defined in the conceptual architecture, may encounter "political" boundaries: to whom do the components and the aggregation instruments used to compose a new resource belong? Will a statically (embedded) or dynamically (linked) resource depend on the services of the core? On those of the LKMS? On the LKMA that built it? Or will it be autonomous? If TELOS should sustain a "social augmented network", the solution to these macro-organisation problems can no longer be hard-coded: it must be handled explicitly. Global policy management facilities are required, like those of "system metafunctions".

4.4 Public management of civic research (refining emergent operation chains)

In order to exploit distributed resources in a given informational space (p2p, institution repositories, etc), keeping an optimal compromise between privacy and transparency, access filtering with policy-aware operations- can be decisive. The SOMCRAC project is dedicated to organizing the collective memory about the communist regime's crimes in Romania (see explanations in [35]). The design of public controllable mechanisms for managing the access policy to bookmarks, documents, testimonies, proofs and pleadings should help us to surpass the obstacles (raised by the culprits and their accomplices) and the inertia of a malevolent bureaucracy (paralysed by the giant mass of disorganized, critical, information).

5. References

[1] Stephen, D. Why the Semantic Web Will Fail http://halfanhour.blogspot.com/2007/03/why-semantic-web-will-fail.html

[2] Sessions R. Software Fortresses: Modeling Enterprise Architectures Addison-Wesley Professional; (2003)

[3] Paquette, G., Rosca, I., Mihaila, S., Masmoudi, A.: "TELOS, a service-oriented framework to support learning and knowledge Management" E-Learning Networked Environments and Architectures: a Knowledge Processing Perspective, S. Pierre (Ed), Springer (2006)

[4] Greer J., McCalla G., Vassileva J., Deters R., Bull S., Kettel L. (2001) Lessons Learned in Deploying a Multi-Agent Learning Support System: The I-Help Experience, Proceedings of AIED'2001, San Antonio, p 410-421.http://julita.usask.ca/Texte/Aied01-camera.pdf

[5] Payne J. S., Howes A, Reader W.: Adaptively distributing cognition: a decision-making perspective on human-computer interaction *Behaviour & Information Technology* V 20, No5, 339-346, 2001, Taylor & Francis ed 2000

[6] Rosca, I. The risks of virtual learning *ICVL'2006 Proceedings*, Bucharest Univ Press, Marin Vlada &others ed. pp155-163,2006, http://fmi.unibuc.ro/cniv/2006/disc/icvl/documente/pdf/met/12_rosca.pdf

[7] Jordan,K., Hauser, J, Foster S. The augmented social network: building identity and trust into the next-generation internet A Link Tank Report. http://asn.planetwork.net/AugmentedSocialNetwork.pdf

[8] Weitzner,D.J., Hendler, J, Berners-Lee, T., Connolly, D. Creating a Policy-Aware Web: Discretionary, Rule-based Access for the World Wide Web. Web and Information Security, E. Ferrari and B. Thuraisingham (eds), http://www.w3.org/2004/09/Policy-Aware-Web-acl.pdf.

[9] Bauer, L. Access Control for the Web via Proof-Carrying Authorization http://www.cs.princeton.edu/research/techreps/TR-677-03

[10] Kaviani,N Gašević,D, Hatala, M. Wagner G. Web Rule Languages to Carry Policies. http://www.sfu.ca/~mhatala/pubs/2007-Kaviani-et-al-Policy07.pdf

[11] Weiss S. Online Social Networks and the Need for New Privacy Research in Information and Communication Technology. http://www.cs.kau.se/IFIP-summerschool/papers/S04_P1_Stefan_Weiss.pdf

[12] Anwar, M, Greer J. Reputation Management in Privacy-Enhanced E-learning, LOR'06 congress

[13] Desmarais,C Shen,X Shirmohammadi,S Cameron,A Georganas, N. D., Kerr,I Privacy Management in e-Commerce Communities, *Proc. IEEE Canadian Conference on Electrical and Computer Engineering*, Vancouver, BC, Canada, April 2007

[14] Anderson, A - Policies in the Alphabet Soup, *Sun Microsystems, IEEE Policy 2006 Workshop, 5 June2006. http://www.csd.uwo.ca/Policy2006/anne.anderson.pdf*

[15] Sandhu, R. Ferraiolo,D, Kuhn *R*- The NIST Model for Role-Based Access Control: Towards a Unified Standard *(2000) - http://csrc.nist.gov/staff/kuhn/towards-std.pdf*

[16] Anderson, A An introduction to the Web Services Policy Language (*2004), Sun Microsystems,* http://research.sun.com/projects/xacml/Policy2004.pdf

[17] Isenhour P.L., Rosson M.M., Caroll J.M, Supporting interactive collaboration on the Web with CORK *Interacting with computers* 13 655-676, 2001, Elsevier Science

[18] Dommel, H. P.; Garcia-Luna-Aceves, J. J., Floor control for multimedia conferencing and collaboration, MultiMedia, 5 (1), 23-38, 1997.

[19] Liu,P Shen,X Georganas,N D Roth,G "Multi-resolution Modeling and Locally Refined Collision Detection for Haptic Interaction", Proc. 3DIM 2005: The Fifth International Conference on 3-D Digital Imaging and Modeling, Ottawa, ON, Canada, June 2005

[20] Raghunathan S A structured modelling based methodology to design decision support systems. In Decision Support Systems 17, 299-312, 1996, Elsevier Science B.V

[21] Rosca, I Five years for five perspectives on TELOS LORNET'06 conference,2006 http://www.lornet.org/Portals/7/I2LOR06/30_Five%20years%20for%20five%20Perspectives%20on%20TELOS.pdf

[22] Rosca, I Towards a systemic vision of the explanation process; story of a research on integrating pedagogy, engineering and modeling PhD thesis, Montreal, http://www.ioanrosca.com/education/these, 1999

[23] Rosca, I., Paquette, G.: Organic Aggregation of Knowledge Objects in Educational Systems, *Canadian Journal of Learning Technologies*, Volume 28-3, pp. 11-26 (2002)

[24] Rosca, I, Rosca V. Pedagogical workflow management with functions, LOR'04 congress, Montreal, http://www.lornet.org/i2lor/pps/Rosca.pps, 2004

[25] Rosca, I Knowledge and object phylogenetic production cascades - the TELOS case CE'2006 conference, Antibes Knowledge in CE track, ,Proccedings in Leading the web in concurrent engineering, Parisa Godus &others ed., 2006, pp 296-304, IOS pres, 2006

[26] Paquette,G, Rosca, I: EXPLORA2, An open educational operating system for managing learning objects repositories CANARIE Workshop, Deuxième Atelier national canadien sur le cyberapprentissage, Montréal, 25-26 février (2002)

[27] Vassileva, G.I. McCalla, and J.E. Greer, "Multi-Agent Multi-User Modelling in I-Help". User Modeling and User-Adapted Interaction J., Special Issue on User Modelling and Intelligent Agents (E. André and A. Paiva, eds.), 13 (1), 2003, 1-31.

[28] McGreal,R, Anderson, T,Hatala,M, Richards,G & others EduSource: Canada's Learning Object Repository Network

[29] Rosca,I, Paquette G. An Ontology-based Referencing of Actors, Operations and Resources in eLearning Systems SW-EL, 2004

[30] Marino,O, Paquette,G, Rosca,I, De la Teja,I Leonard,M, Contamine,J Rogozan, D. Pedagogical modeling languages: a bridge between educational engineering and online information systems. 72e congress AGFAS, 2004

[31] Rosca.I Instrumentation de la gestion des connaissances au sein d'une communeaute de pratique sur le web semantique Symposium REF-2005, Montpellier (2005)

[32] Dufresne, A., Basque, J., Rosca, I., Rosca V. , Paquette, G., El Khettab, H., Leonard, M., Lundgren-Cayrol, K., & Villot-Leclerc, E. Modélisation et intégration de fonctions de soutien aux concepteurs de systemes de téléapprentissage dans l'environnement ADISA. ACFAS '2004, Montreal

[33] Caroll, J.M. Five reasons for scenario based design, IN Interacting with computers 13 43-60, 2000, Elsevier Science

[34] M.M Lehmann, G. Kahen, J.F. Ramil, 2002. Behavioural modelling of long-lived evolution process-sonme issues and an example. Journal of software maintenance and evolution: research and practice, 335-351,2002,John Wiley & Sons ed

[35] Rosca I Organising a public information space about the crimes of a totalitarian regime InSciT2006 Merida, Digital libraries track. Proceedings in Current research in information science and technologies, Vicente P.Guerrero-Bote ed. pp 191-197, 2006