A multi-agent approach to the design of Coordination Mechanisms

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In the area of Computer-Supported Cooperative Work (CSCW), a crucial issue is to devise computational Coordination Mechanisms (CMs) that provide support for cooperating actors in managing the complexity of articulating their distributed and yet interdependent activities. The concept of CM has been developed as a generalization of phenomena described in different ways in different empirical investigations. These show that the articulation of distributed activities requires support by means of categories of symbolic artefacts which, in the context of a set of procedures and conventions, stipulate and mediate articulation work. From the evidence of empirical studies, we have derived a set of general requirements for CMs and, by implication, for a general environment for constructing such CMs [2; 3].

First, we defined a model capturing the dimensions of articulation work that are formalized in a collection of Objects of Articulation Work (OAW), for example role, actors, tasks, activities and the like, together with their relationships, for example, responsible of, committed to, assigned to etc. Secondly, we derived the basic constituents of a CM: (a) the OAW characterizing the CM; (b) the distributed protocol encompassing the set of conventions and procedures governing the articulation through the CM; and (c) a symbolic artifact with a standardized format to represent the type of information necessary to mediate the articulation of distributed activities in the cooperative arrangement and in relation to the specific field of work under concern. Third, since no single mechanism will apply to all aspects of articulation work in all domains of work, a CM must be able to interoperate with other CMs in the wider organizational field. Finally, the environment must provide means for the dynamic reconfiguration of the CMs and must give actors means of controlling in a cooperative manner the propagation of changes to the behavior of the mechanisms.

From the architectural standpoint, the collection of CMs in a given setting can therefore be conceived of as a multi-agent system [1], in which each agent corresponds to one of the constituents of a CM and possesses the capabilities to interoperate with other agents in order to fulfill the above requirements. This capability is mainly realized through an Interoperability Language whose primitives reflect the various modes in which CMs and their constituents can interoperate. The reference mode allows a CM to contribute to the definition of another CM typically, through the OAWs that this latter is constituted of or through the subscription of policies encompassed by another CM. The awareness mode expresses the propagation of changes among CMs. The coordination mode expresses the synchronization among CM's behavior. The recursiveness mode expresses the change of the protocols by other CMs. The linking mode allows for the construction of compound mechanisms from more elemental ones through the definition of a suitable interface. The resulting architecture is multi-layered since agents can be organized according their functionalities: OAWs are the agents that are referenced to by all CMs, artefacts and protocols are grouped into single CMs, and different CMs can be linked together to form compound CMs.

The language and its environment are currently tested against some of the cases used in the empirical studies and implemented in a first prototype. This activity will check the expressive power of the language and define the ultimate requirements both for the functionalities needed to support the design, the modification and the composition of CMs, and for a platform suitable to support the second version of the implementation.

References

