A multi-agent approach to the design of Coordination Mechanisms

Carla Simone*, Monica Divitini*, Kjeld Schmidt°, Peter Carstersen°

*Dept. of Computer Sciences
University of Milano
Via Comelico, 39/41
I-20135 Milano, Italy
{simone, divitini}@hermes.dsi.unimi.it

°System Analysis Department
Risø National Laboratory
P. O. Box 49
DK-4000 Roskilde, Denmark
{kschmidt,phc}@risoe.dk

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 category 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 enviroment 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 concen. 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 enviroment 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 posesses 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

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