Composition Games for Distributed Systems: the EU Grant games (Abstract)

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A traditional distributed system is often designed by some central manufacturer and owned by some central owner. However, increasingly, more modern distributed systems are composed of components, each owned by a different owner. Moreover, such systems are formed rather distributively, by people teaming up to pool their resources together. For example, many Peer to Peer (P2P) networks are composed of nodes belonging to different persons, who would like to gain by cooperation.

In this paper, we consider ways by which people make distributed decisions regarding this composition of such systems, attempting to realize high values. We initiate the evaluation of those ways, by the quality of the resulting systems. We concentrate on settings in which a node can increase its utility by connecting to other nodes. However, the node must also pay a cost that increases with the size of the system. The right balance is achieved by the right size group of nodes.

We address this issue using game theory, and refer to games in such settings as European Union grant games (based on the competition for the commission's grants) . For such a game, we study its price of anarchy (and also the strong price of anarchy) – the ratio between the average (over the system's components) value of the optimal possible system, and the average value for the system formed in the worst equilibrium. We formulate and analyze three intuitive games and show how simple changes in the protocol can improve the price of anarchy drastically. In particular, we identify two important properties for a low price of anarchy: agreement in joining the system, and the possibility of appealing a rejection from a system. We show that the latter property is especially important if there are some pre-existing constraints regarding who may collaborate (or communicate) with whom.

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