

# Research Interests

Matteo Dell'Amico

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## 1 Algebraic Specification of Distributed Applications

Libraries, in programming languages, are widely used to support the programmer productivity by providing solutions to common tasks and abstractions of low-level operations.

Advocating the same approach for specification languages, and using P2P applications as a case study, we developed [1] a set of specifications written in the CASL [2] language. It is meant to be used as the core of a library, abstracting away complexity during the application specification in the same way software libraries hide complexity in the implementation.

Using our library, applications may be designed without requiring an early choice of a particular middleware. Also, requirements for new features can be added effortlessly, thanks to a modular architecture in which independent requirements can be combined.

We also developed an extension to CASL, to be used in conjunction with our library, that simplifies the definition of loose dynamic specifications. A formal definition and the implementation of a translator from our extension to standard CASL is yet to be done.

## 2 Reputation in P2P

P2P systems are most often built on the cooperation between different entities. In general, peers have no incentives to a cooperative behaviour, since giving service to other nodes would yield a cost and no gain. "Free-riding" [4] is thus a significant problem.

In game-theoretic terms, these kinds of interactions have been modelled as instances of the "Prisoner's Dilemma". Cooperation can emerge between selfish entities as a consequence of known "image scores" [3] (i.e., reputation values) relative to the past interactions an actor had with others.

To compute reputation values in P2P systems, three main approaches based on reports of past interactions between nodes have been followed.

1. Calculation based exclusively on local observations. In large-scale networks, it is unfeasible to have a global image of the whole network, thus making this approach less effective;
2. Global calculation based on all reports in the network. It is obviously problematic to trust reports filed by every node; in [5] a set of “pre-trusted” nodes is required.
3. Trust calculation done locally “on-demand”, using trusted neighbours’ reports. [6] uses this approach, demonstrating that there is an incentive to cooperation, since well-behaving actors obtain a better service. Nevertheless, an algorithm that requires peers to know all reports in the network is proposed.

I am now working on an approach that uses knowledge about a small part of the network to calculate good metrics for reputation; an immediate goal is to evaluate this kind of metrics using an approach similar to the one taken in [6]. A subsequent goal would be to implement this kind of reputation management framework in an existing peer-to-peer network overlay.

## References

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