

TOWARD PRACTICAL P SYSTEMS FOR DISTRIBUTED COMPUTING

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We present a digest of our current research in the field of biologically inspired computing models. We enumerate our recent research contributions, discuss their merits and limits, and conclude with a list of open problems.

Keywords: P systems, hyperdag P systems, P modules, distributed computing, distributed algorithms, network discovery, synchronization, fault-tolerant computing.

1. Introduction

Professor Solomon Marcus' students will undoubtedly recall one of his favourite anecdotes, the story of the wise Nasruddin, earnestly looking for his lost key under a bright lamp, blissfully ignorant that his key had been lost a little further away, in the shadows of the night [25, 33]. We found ourselves in a similar situation when we were looking for good formal models, practical enough to be used in distributed computing. One outstanding model has attracted our attention: P systems, a biologically inspired computational model, with great potential for parallelism and distribution [18]. This model has been thoroughly investigated from the theoretical side and successfully applied in a variety of pilot studies, but, seemingly, not enough in practical *distributed computing*, as this term is generally understood [28]. We felt challenged to bridge this gap and this was the beginning of a longer than expected, but very interesting, journey. We hope that the extensions introduced in this exploration retain a natural flavour and can be retrofitted in the original models, to benefit the whole P systems community.

2. P systems and Hyperdag P systems

P systems provide a *distributed computational model*, based on the structure and interaction of living cells, introduced by Pãun in 1998 [30]. The model was

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