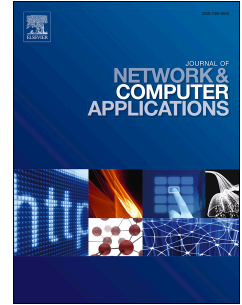# Accepted Manuscript

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Please cite this article as: Cicirelli, F., Forestiero, A., Giordano, A., Mastroianni, C., Parallelization of space-aware applications: Modeling and performance analysis, *Journal of Network and Computer Applications* (2018), doi: 10.1016/j.jnca.2018.08.015.

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Parallelization of space-aware applications: modeling and performance analysis

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Abstract

Many applications in fields like sociology, biology and urban computing, need to cope with an explicit use of a spatial environment, or territory. Such applications, referred to as space-aware applications (SAAs), are based on a set of entities that live and operate in a territory. Parallel execution of space-aware applications is needed to improve the performance when the demand of computational resources increases. Despite the great interest towards SAAs, there is a lack of models and theoretical results for assessing and predicting their execution performance. This paper presents a novel framework, based on Stochastic Time Petri nets, which is able to capture the execution dynamics of parallel SAAs, and model the aspects related to computation, synchronization and communication. The framework has been validated by comparing the predicted performance results for a testbed application, i.e., the ant clustering and sorting algorithm, to those experienced on a real execution platform. An extensive set of experiments have been performed to analyze the impact on the performance of some important parameters, among which the number of parallel nodes and the ratio between computation and communication load.

Keywords: space-aware applications, Petri nets, parallel applications, performance evaluation, multi-agent systems

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