

A Survey on Tree Algorithms and their Analysis

Philippe Robert, INRIA-Rocquencourt, Domaine de Voluceau, 78153 Le Chesnay, France,
Philippe.Robert@inria.fr

A tree algorithm is a procedure that recursively divides (splits) an initial set of n items into subsets until each of the subsets obtained has a cardinality strictly less than some fixed number D . These algorithms have a wide range of applications:

- access protocols in communication networks
- divide and conquer algorithms for data structures
- algorithms in distributed systems (leader election)
- statistical tests.

On the mathematical side, the analysis of tree algorithms is connected to classical problems of several research domains such as:

- fragmentation processes
- random recursive decomposition
- dynamical systems (Zeta functions)
- physics (complex dimensions of strings)

In this talk, we present a general survey of this area and present the mathematical methods used to analyze the asymptotic behavior of additive functionals associated to these algorithms. Several approaches for this analysis will be discussed: Complex Analysis, Functional Operators and Probabilistic Methods (with an emphasis on the latter one).

The key result at the heart of the probabilistic analysis is the renewal theorem and its extensions when independence assumptions are relaxed. The purpose of this talk is also to stress the power and the complexity of this set of results in applied probability theory.