PhD proposal:

Distributed self-management methods : optimization and planning for resource allocation in telecommunication networks

KEYWORDS: network management, self-management, self-organizing network, optimization, distributed algorithm

LOCATION:
This topic is proposed in the framework of the **joint research lab between Alcatel-Lucent Bell Labs and INRIA**, dedicated to self-organizing networks. The candidate will be physically located at INRIA Rennes, but tight interactions with ALU-BL will require stays in Paris.

SUBJECT:
Telecommunication networks are becoming increasingly complex, by the multiplicity of technologies involved, by their geographical span, by the growing trafic demand and by the variety of applications. All this makes network management extremely complex and heavy, prone to errors, and thus very expensive for telecom operators.

The various solutions that aim at making network management more autonomous is generally covered by the term "self-management." The idea is to facilitate the deployment of functions that are more complex, more efficient, and less demanding in terms of human operations, compared to their traditional deployment. The operator can then concentrate on its essential task, i.e. taylored services for customers, and "program" the network by high level objectives.

The objective of this thesis is to contribute to the self-management, by focusing on some management functions, proposing algorithmic solutions, and then studying their consequences on the management architecture.

As a starting point, the study of autonomic functions will focus on two specific use cases. The first one concerns maintenance strategies: When a component needs upgrading or replacement, it can not be simply turned off. One has to move all the functions this component was assuming, one has to reroute traffic, etc. All these operations should be performed automatically, in a specific order, and in an optimal manner, that is without risk for the network and with a minimal number of human operations. The second problem is somehow related, and consists in assigning some SLS (service level specifications) requests on the network, in a way that maximizes customer satisfaction and minimizes network stress. This is related to risk analysis and reconfiguration procedures.

To address these problems, the candidate will have to model the relevant network resources, and their relations/dependences. Several formalisms will be explored: for example network of static entities, or networks of automata. A specific attention will be paid to using information that is effectively accessible in network management architectures (present of future). This formal model will then be used to design algorithms that solve the problems mentioned above. Distributed algorithms will be explored in priority, in order to ensure deployment simplicity and scalability. Their sensitivity to modeling errors will be analyzed, as well as the effect of dynamic changes in the network architecture. Finally, the candidate will study the integration of these algorithms into existing paradigms for management architectures (knowledge plane, control plane,...).

PROFILE:
Master in networking, with a focus on network management. Skills in optimization and distributed algorithms. Taste for formalization and modeling.

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