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Sujet: *Resource Provision and Allocation in Shared Network Testbed Infrastructures*

Durée : 5 mois (environ de avril a septembre 2008)

Équipe d'accueil : Université Pierre et Marie Curie, Laboratoire LIP6-CNRS, équipe NPA (réseaux)

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Descriptif :
In this project we will use research tools from game theory and economics in order to design and evaluate incentive mechanisms (system rules) for the efficient allocation and provision of resources in shared network testbed infrastructures. We will focus on PlanetLab, the largest and most popular shared network testbed today.

Shared network testbeds interconnect powerful machines, contributed by different research institutions and universities around the world, in order to provide an infrastructure of sufficient size to allow them to run large scale experiments on overlay networks created over the Internet. So, in addition to the use of the aggregated computing and network resources made available, similarly to a Grid system, their goal is to provide the means to researchers to evaluate novel network applications and services, and conduct networking experiments over a realistic world-wide testbed.

A key characteristic of shared network testbeds is that participants are both producers and consumers of the available resources. That is, they are peer-to-peer (p2p) systems. This means that the suitable incentives should be in place in order for the participants to share their resources. Otherwise, their rational strategy would be to rely on the contributions of others. Additionally, when demand exceeds capacity, allocating resources efficiently upon contention would increase the value of the system. The design of practical mechanisms to achieve these two objectives is the subject of this project. This is particularly important in the case of the OneLab project and PlanetLab Europe, in the context of which this project will be carried out. The reason is that OneLab aims to introduce specialized network resources to be shared among participants, such as wireless testbeds (e.g., WiMAX, UMTS, etc.), for which there will be likely high demand. This means that an efficient mechanism must be devised for their allocation and for exploiting their increased value towards encouraging contribution.

Our goal is to define simple rule-based incentive mechanisms that relate contribution to a small number of predefines levels of service. If designed appropriately such rules can increase the system's efficiency without introducing significant complexity, as the existing market-based approaches. Their design will be based on the economic characteristics of the system, but also on PlanetLab usage data already gathered by the CoMon monitoring system. Then a suitable way, both theoretical and practical, for evaluating and comparing the different alternatives should be devised and implemented.

Références :
[1] P. Antoniadis, T. Friedman, and X. Cuvellier. Resource Allocation and Provision in Shared Network Testbed Infrastructures. In Real Overlays and Distributed Systems (ROADS) Workshop, Warsaw, 2007.
[2] OneLab. http://www.one-lab.org/.
[3] K. Park and V. Pai. CoMon: A Mostly-Scalable Monitoring System for PlanetLab. ACM SIGOPS Operating Systems Review, 40(1), 2006.