TITLE OF RESEARCH WORK: Adaptive Steady-state Scheduling for Grid Platforms

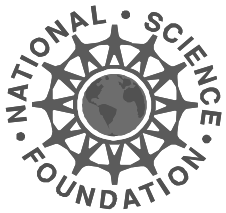
Research Description:

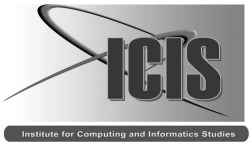
Harnessing the power of wide-area distributed computing platforms is a major challenge nowadays, and *scheduling*, this is the optimal assignment of a set of jobs to the compute elements in the system, is crucial for achieving this goal. Traditional batch scheduling seeks to minimize the *makespan* of the execution of a given set of jobs on a single processor. In most practical situations, the exact computation of a minimal makespan is NP-Hard. An interesting alternative introduced by D. Bertsimas, D. Gamarnik in 1999, is a schedule that optimizes the steady-state operation of the system. This approach is proven to be particularly well-suited for master-slave tasking, and in general, for divisible load applications. There are three main advantages of steady-state optimization: First is the *simplicity and tractability* provided by the relaxation of the makespan minimization problem. Second is the *efficiency* associated to a periodic schedule describable in a compact form, which facilitates its implementation. Third but equally important is *adaptability*. Because the schedule is periodic and computable in polynomial time, it is possible to observe its actual performance of the system in a period, inject that information into the polynomial methods, and re-compute the optimal steady-state schedule for upcoming periods. Adaptability is indeed, the core of this research. This is particularly useful is wide-area distributed systems where hard-to-predict communications jams may occur. The adaptability property of a steady-state optimizing scheduler is indeed, the central theme of this research. The effects of incorporating self-adaptive mechanisms between periods of a steady-state optimazing scheduler will be modeled, and simulated in a first phase, and a prototype system produced in a second phase.

WALSAIP GROUP ASSOCIATION: Parallel and Distributed Computing	
THESIS TITLE: Steady-state Workflow Scheduling	
THESIS ADVISOR: Prof. Jaime Seguel	
INSTITUTION: Doctoral program in CISE	
PERSONAL WEBSITE:	**NAME OF RESEACH ASSISTANT:** Jaime Andrés Ballesteros Mejía

RESEARCH PROJECT OUTCOMES:

Publications:





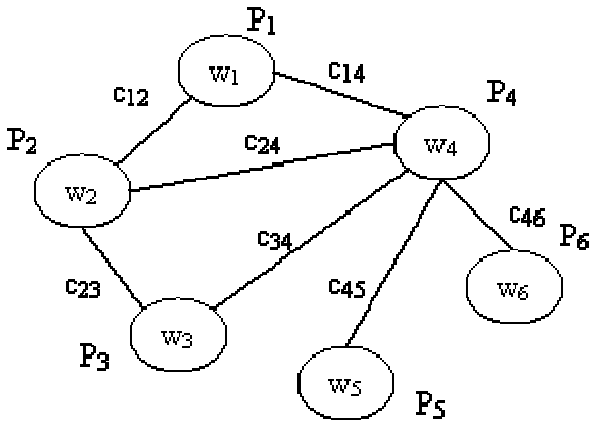
Tools and Applications:

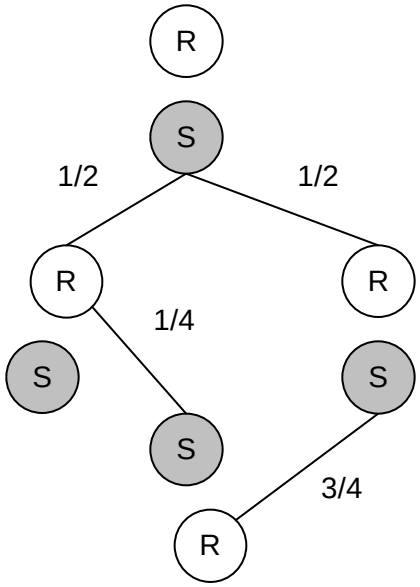
There are a lot of tools in the development of this project. Python is the programming language selected to work in the demo. We have to use some programs that resolve linear programming models. One of this is Lindo, but there are some open source alternatives like libraries working on Python. Another programming language will be C++. It provides some performance when the execution of algorithms turns slow.

RELATION OF RESEARCH WORK TO WALSAIP PROJECT:

The Master-slave tasking paradigm is frequent in scientific applications. The distributed solution of hydrological simulations with numerical methods yields this kind of paradigms, quite frequently.

IMAGE REPRESENTATIVE OF RESEARCH WORK:

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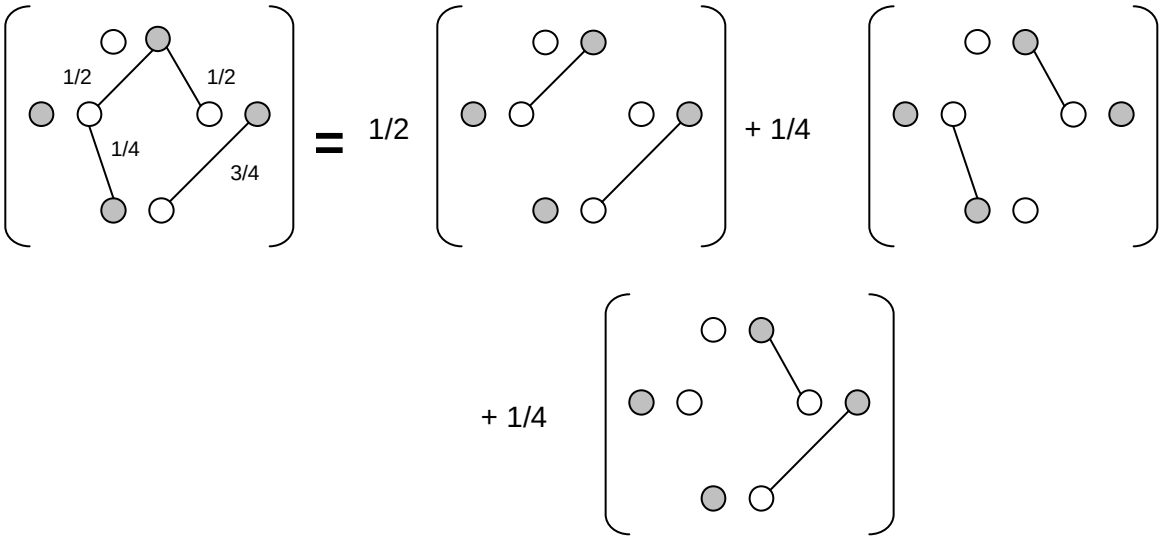
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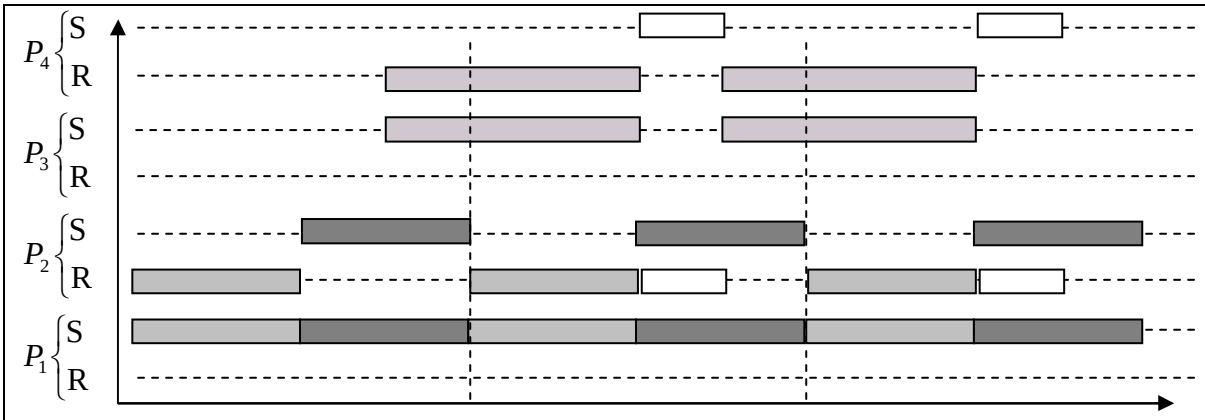

RESEARCH DEMONSTRATION:

A research demonstration showing the graph representation and Gannt charts of steady-state schedulers under several system characteristics and condition will be built. The purpose of this research demonstration is not only to demonstrate the main elements behind the steady-state scheduling methodology but also the effects on the throughput of unexpected communication jams and the advantages of re-scheduling on the fly.