A Classroom Scheduling Service for Smart Classes

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Abstract—During past decades, the classroom scheduling problem has posed significant challenges to educational programmers and teaching secretaries. In order to alleviate the burden of the programmers, this paper presents SmartClass, which allows the programmers to solve this problem using web services. By introducing service-oriented architecture (SOA), SmartClass is able to provide classroom scheduling services with back-stage design space exploration and greedy algorithms. Furthermore, the SmartClass architecture can be dynamically coupled to different scheduling algorithms (e.g. Greedy, DSE, etc.) to fit in specific demands. A typical case study demonstrates that SmartClass provides a new efficient paradigm to the traditional classroom scheduling problem, which could achieve high flexibility by software services reuse and ease the burden of educational programmers. Evaluation results on efficiency, overheads and scheduling performance demonstrate the SmartClass has lower scheduling overheads with higher efficiency.

Index Terms—Services-oriented, Classroom Scheduling, Resources Modeling

1 Introduction

The classroom scheduling problem has been regarded as one of the most important challenges for educational programmers and teaching secretaries. In most cases, this is still a manual process, especially in the developing countries with a large amount of students and lectures. During the past decades, the problem has been concentrated and widely conducted using computer-aid design (CAD) methodology. However, due to that the classroom scheduling has been long proved to be NP-Complete problem [1], thereby the focus of current researches are shifting towards more practical instead of optimal technical sound solutions.

Unfortunately, the growing complexity of the input factors is posing significant challenges to solve the classroom scheduling problem. Several significant constrained factors must be considered in the modeling: such as timing, teacher, lecture, classroom, and students. Meanwhile, there are also additional constraints such as the multimedia requirements and seats constraints. It takes quite a lot of time and effort to make a practical and high efficient classroom scheduling plan.

Learning from the current state-of-the-art disciplines, the classroom scheduling problem is encountering following serious challenges:

1) First, at a specific time, the classroom is solely mapped to a certain class. That is, each class could be mapped to only one room, while it is also preferable to allocate all the lectures from a same class to the exactly same classroom. This potential requirement has increased the complexity of the classroom scheduling scheme;

2) Second, if a conflict appears, e.g. no more available classrooms, or no more available time slots, the scheduling method needs to roll back to previous solutions, which has a strong effect on the partial finished scheduling plan, thereby may bring new conflicts;

3) Last but not least, the additional constraints, such as the seat number and multimedia requirements also need special consideration in the scheduling method.

To address the above problems, numerous researches have been devoted to the scheduling problem. Most state-of-the-art approaches normally utilize one or multiple following methodologies: integer linear programming (ILP), greedy algorithm, simulator approach, graph theory, or Lagrange etc. Due to the complex maze of the constraints, most computing-aided-design methodologies encounter the design-space-exploration problem; therefore how to design a practical and scalable scheme is still one of the serious challenges of the problem.

Considering the high-level overview, the classroom scheduling problem can be modeled as a traditional resource scheduling problem. Regarding all the classroom resources as function units, a group of lectures are treated as a series of tasks. Furthermore, in order to reduce the maze, the problem can be divided into two sub issues: classroom scheduling and time slot scheduling, respectively. The time slot scheduling is similar to the conventional timetabling issue, the main contribution is to calculate the timetable for the lectures. Compared to the time slot scheduling, the classroom scheduling is