

WACS: an Alternative to PC² for Programming Contests

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Abstract— This paper describes Wide Area Contests System (WACS) that allow people from different cities or countries to participate in different contests. WACS is designed to be an alternative to the PC² system, which is used worldwide by the ACM programming competitions. Moreover, WACS is not limited to programming contests and it could be used for other written contests like math, physics, or any other subject. The contestants should be able to interact with the judges through this system by submitting their code in C, C++, Java, PHP, python and other programming languages. WACS is developed using different web languages and technologies such as PHP, CSS, JavaScript and Ajax. It uses MySQL relational database system to store its information rather than plain files as in PC².

Index Terms—Contest, programming languages, web, Apache, PHP, AJAX, CSS, MySQL, Open-Source.

I. INTRODUCTION

The authors were involved during several years in local and regional ACM International Collegiate Programming (ICPC). They were participating in all levels: contestant, coach and chief judge. [1-2]

We were using the *Programming Contest Control System*, PC², developed at California State University, Sacramento (CSUS) that is worldwide used by the ACM International Collegiate Programming Contest (ICPC). [3-4]

We found that PC² system has many limitations and weaknesses. PC² is limited to English language. It is mainly used for programming language contests and it is used in local area competitions in one center for example. Although it can be used in different centers, it cannot be used behind firewalls: “in a multi-site contest, every machine running a PC² server must be able to communicate via TCP/IP with the machines running PC² servers at every other site. In particular, there must not be any firewalls which prohibit these communication paths; the system will not operate if this communication is blocked.” [5]. PC² system is restricted only to programming contest types and it is limited to Pascal C/C++ and Java. Recently “Pascal has been dropped as a World Finals Language.” [6]

For these reasons and others, we decided to design WACS system (Fig.1) to allow people from different cities or

countries to participate in different contests not only programming language contests. WACS is developed using different web languages and technologies such as PHP, CSS, JavaScript and Ajax. It uses MySQL relational database system to store its information rather than plain files as in PC². It is then more flexible and easy to add modules to WACS than to PC², which is written in Java. Connecting to a contest on WACS is just as easy as to browse web pages. All what teams need is the contest’s web address, a login name and a password.

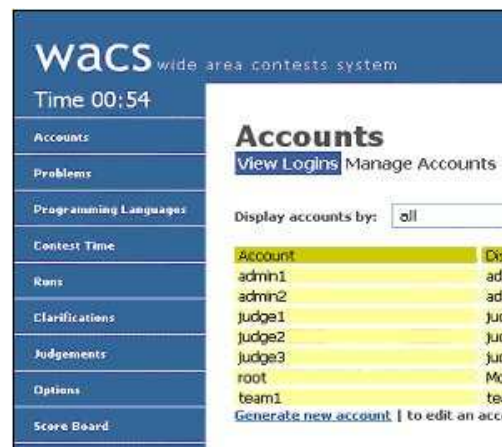


Fig 1. WACS system Web Interface

II. SYSTEM OVERVIEW

A. System Description

The WACS system is developed to allow teams from different places to participate in contests. WACS is implemented in focusing on programming language contests. However, other contest types, such as math, physics, history and so forth can be easily plugged to the system as long as they are written using web languages and technologies. The system has three categories of users, which are administrator, judges and contestants or teams. The administrator has a full control for the system. He/She is responsible for adding and deleting accounts, adding problems, adding languages to the system, set the contest time, etc. The system allows the contestants (teams) to interact with the judges during the contest through messages to request clarification and submit their problem answers. The Judges can communicate with each team through messages to answer their requests. The judges can read the programs codes sent by teams and they can run them to evaluate them. The WACS the system is able to run each team

program code. Finally, the system provides a scoreboard that shows the results during the contest period with automatic update using Ajax without any manual page reload, as is the case in PC², “Though originally considered an acronym for Asynchronous JavaScript + XML, the term is now used simply to encompass all the technologies that allow a browser to communicate.” [7]

with the server without refreshing the current page.

B. System Architecture

The system is divided into two major parts: the base of the system and the contest type. The base of the system, where the WACS system allows people in:

- the same room or different rooms,
- in the same building or in different buildings,
- in the same city or in different cities,
- and in the same country or in different countries

to participate in a contest. It consists of a Apache web server running a MySQL database server with PHP engine. On the client side, each educational institution can participate with one or more teams – according to the programming contest type – of three students supervised by one or more coaches. The contest itself is designed and supervised by the contest steering committee. During the contest, the responsibility is shifted to the judges with the support of the WACS administrators.

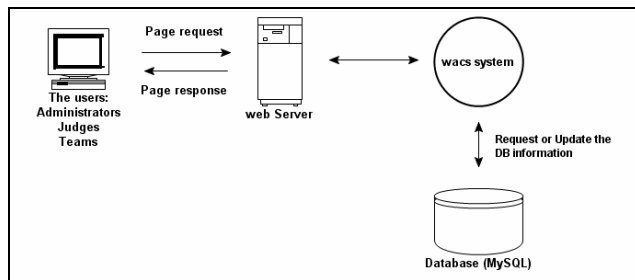


Fig. 2 WACS components.

Figure 2 shows the main parts of the system's components. Users communicate and interact with each other through the web server. Every category of users has a different web page to access the WACS. Any action performed in WACS is recorded within the MySQL Database system, such as logins, submitting problems' solutions. During the contest, each team can interact with judges through the WACS system only by submitting their answers and they may ask for clarification or if they have any doubt regarding any contest question. The judges also can send contestants feedbacks or special messages through WACS only. There is no physical contact between teams and judges during the contest.

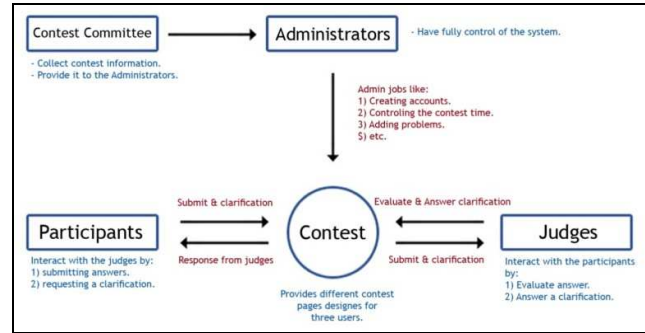


Fig. 3 Interactions between WACS users.

The block diagram in Fig. 3 shows the interactions between the three categories of users and the system.

III. PROGRAMMING LANGUAGE CONTEST TYPE

The WACS system is designed to allow only coaches to register teams. Unregistered coaches, who have teams to participate to the contest, can register and then create accounts for their teams. Coaches have to fill standard information such as name, password and email address. The WACS stores the information in the database after checking whether it is there or not and send an email to the coaches to activate their accounts.

Regarding the teams, once they finished solving any problem, they can submit their source code via Submit window as shown in figure 4. It provides the team with two options Test the program before uploading it and submit it to the judges.

The screenshot shows a web form titled 'Submit'. It includes fields for 'Problem:' (set to 'smarty'), 'Language:' (set to 'java'), and 'Main File:' (with a file path 'C:\xampp\htdocs\wacs\test5\smal' and a 'Browse...' button). There are 'Submit' and 'Test' buttons. Below the buttons, a message reads: 'Results: Your Answer Submitted Successfully.'

Fig. 4 Submit and test page

The WACS administrator can add or remove problems. For each problem, he/she has to set the mark for it and to insert the input and output files into the database. WACS has a script that allows judges to compare the teams' results (outputs) with the results stored in the database for each problem. Depending on the results of these comparisons, the judges send appropriate messages to any team that submitted any source code for evaluation. The administrator manages the time of the contest. He can start, stop or reset the contest time. Finally, WACS has a scoreboard that allows users to view the teams' ranks, the number of tries and the number of problem solved by each team and the time taken to solve these problems. It fetches the information from the database and it is refreshed automatically using Ajax technique.

IV. CONCLUSION

This paper describes the WACS system. The implementation of this system is mainly focused on programming languages contests. However, to add any contest type is an easy task because of the flexibility of web programming languages and technologies. All what you need to add any subject is to design the test using web programming languages such as PHP and then you plug the test into the WACS system. We used extensively, during the development of the WACS, open-source web languages and technologies such as XHTML, CSS, PHP, Apache, MySQL, and Ajax. Since WACS should be installed on a server (running Linux or Windows) and without any component on client machines, will reduce the burden for educational institutions or any participant without IT experts. All the configurations files, applications and servers (web, database) reside on the main server, which should be in the institution who hosts the competition. The only requirement a client needs in order to connect to this system is a web-browser.

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