Wildfire Wally: A Volunteer Computing Game

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ABSTRACT
Online casual games can be used to significantly enhance the productivity of volunteer computing. We call games which perform volunteer computing *volunteer computing games*. We introduce *Wildfire Wally*, a volunteer computing game capable of solving the maximum clique problem.

Categories and Subject Descriptors
G.2.1 [**Discrete Mathematics**]: Combinatorics–*Combinatorial algorithms;* G.4 [**Mathematical Software**]: Parallel and vector implementations; H.5.3 [**HCI**]: Group and Organization Interfaces–*Web-based interaction*

General Terms
Algorithms, Performance, Human Factors

Keywords
Casual games, online games, distributed algorithms, volunteer computing, distributed computing, human computing

1. INTRODUCTION
As scientists have become more frequently confronted by increasingly complex problems, research teams have turned to computers to aid in the exploration of these challenges. Unfortunately, technology has simply not kept pace. A single processor is no longer adequate for the problems researchers now encounter on a daily basis. Consequently, a research team may not receive tangible results from a problem for weeks, months, or even years.

An increasingly popular solution to this problem is *volunteer computing*. Volunteer computing is a process that allows people from across the globe to donate their computer resources in a joint effort, effectively creating a powerful supercomputer. To illustrate the potential for volunteer computing, consider that as of 2004, approximately 150 million personal computer were connected to the internet—a number that is estimated to exceed one billion by 2015 [1]. Of these machines, consider further that many are idle for nearly ninety percent of each day. Even active computer users typically use less than ten percent of their machine's CPU [2]. Volunteer computing is a wonderful opportunity to take advantage of this enormous source of unused computation and refocus it back towards the research community.

FuturePlay 2007, November 15-17, 2007, Toronto, Canada.

Unfortunately, volunteer computing falls short of its potential. While the world's largest contributor to volunteer computing, the Berkeley Open Infrastructure for Network Computing (BOINC), contains approximately 400,000 users, this number pales in comparison to the total number of available online computers [3].

We believe that by combining online casual gaming with volunteer computing—creating volunteer computing games—some of the problems plaguing volunteer computing can be solved. Therefore, we present *Wildfire Wally*, a prototype volunteer computing game that explores combining the accessibility and entertainment of online casual games with the effectiveness of volunteer computing.

2. MOTIVATION
Since the success of volunteer computing is entirely dependent on participation, it is a problem that deserves special attention. Currently, there are at least four distinct barriers to participation in volunteer computing: *lack of awareness, lack of broad appeal, a limited demographic,* and *lack of technical savvy* [4].

We believe that casual online gaming is capable of breaking all of these barriers. As a medium, gaming immediately overcomes barriers of awareness and broad appeal. Casual gaming websites such as *AddictingGames*, *MiniClip*, and *Yahoo! Games* have experienced remarkable success as of late. Moreover, casual games appeal to a more balanced demographic, and can be catered even further to different people groups. Finally, since, online casual games are by definition simple, the final barrier of technical savvy is broken.

3. WILDFIRE WALLY
3.1 The Game
In *Wildfire Wally*, players play as Wally, a red-bearded wilderness personality who is desperately trying to protect his forest from a raging fire. Wally extinguishes the flames by either dousing blazing trees with water, or by creating fire lines that isolate a burning area of the forest. As players progress from level to level, wind gusts and dropping humidity make containing the fire increasingly difficult. If a certain number of trees are not conserved, the player loses.

But *Wildfire Wally* is more than a casual game—it actually helps solve instances of the maximum clique problem. *Wildfire Wally* uses a distributed search tree algorithm, with each move in the game corresponding to a decision in the search tree. This allows individual players to exhaust a portion of the enormous search tree. In addition to gameplay contributing to the solution, players may contribute their spare computing cycles as well. Hence, by playing a game, people from across the globe simultaneously work on the same problem.

3.2 Game Features

Although general design principals apply to any computer or video game, particular decisions become even more critical when designing volunteer casual games. A few of these design goals include *simplicity, rapid decision-making, showing progress,* and *replayability*. *Wildfire Wally* helps illustrate design decisions that can dictate the success of a volunteer computing game.

To promote simplicity, *Wildfire Wally* was designed with easy-to-learn instructions and controls. The entire game can be played using nothing but the mouse. Also, as a web-based java applet, *Wildfire Wally* is made accessible to anyone who is familiar with basic internet browsing.

To promote rapid decision-making, the game is based on trying to extinguish a fire as quickly as possible, forcing the player into quick actions to protect their forest. Furthermore, the game is broken into short levels to minimize stress.

Progress is demonstrated in two different ways in *Wildfire Wally.* One score represents the player's score within the context of the game, while a second score represents the player's total contribution towards solving the maximum clique problem.

Wildfire Wally's replayability hinges on its variation from game to game. We introduced a random element into gameplay by creating randomly generated forests and random lightning strikes that sparks the initial fire. Also, variables such as wind and humidity effect gamplay, and are adjusted from level to level. Finally, extending the game is relatively simple. We can introduce new objectives or twists in gameplay with minimal programming effort.

3.3 Adaptation

Since our foremost goal is to attract as many participants as possible, it was important for us to make our application as flexible as possible.

In *Wildfire Wally*, the only communication between the game and the problem solving portion of the application is a list of choices and decisions. This allows our implementation to utilize different game ideas with minimal programming effort (in this case, substituting only one java class). As long as a player makes decisions in a game, his or her gameplay will work seamlessly with our search tree solving algorithm. Hosting a variety of games gives us the opportunity to appeal to players of a wide array gaming genres. As a result, we could theoretically construct an entire gaming website of casual online games that caters to numerous demographics, with their cumulative game actions being used to solve the same problem

On the other hand, our implementation of *Wildfire Wally* can also solve any problem mapped to a search tree. Once again, only one java class needs to be substituted—one that is tailored to the specific problem. However many games and problems we implement, each game will be able to solve each problem. We could even allow the player to decide which problem they are contributing to as they play the game.

3.4 Future Possibilities

Whereas *Wildfire Wally* takes steps in harnessing the average internet user's time and effort playing games, we similarly believe we can use the public's ingenuity to solve problems in more intelligent ways. Future progress can be made in constructing games that generate visual representations of problems – allowing players to have a more direct interaction with them.

4. CONCLUSION

Merging online casual games with volunteer computing merely takes advantage of an engaging and rapidly growing leisure activity. Casual gaming very nearly has universal appeal. By refocusing the actions of casual gamers towards volunteer computing, we are increasing the processing power available to researches and improving their research efficiency. The pursuit of this vision can have profound effects on volunteer computing efforts.

5. ACKNOWLEDGMENTS

We would like to thank Chris Martens and Priyanshu Mutreja for previous work done on the topic, and Hope College for housing our research. This work was partially supported by the National Science Foundation (NSF) grant CNS-0353566.

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