
SETI@home Project and it's Website

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Introduction

SETI@home (**SETI** is an acronym of Search for Extra-Terrestrial Intelligence)[[1](#)] attempts to harness the massive computing power distributed over the Internet to accomplish the Herculean task of analyzing radio telescope data for signals from extra-terrestrial intelligence. SETI@home follows a "Divide and Conquer" paradigm wherein huge sets of data are processed and divided into small chunks which are then distributed to other machines for processing. Following processing, results are passed to a central repository. The divide and conquer paradigm is not new. It has been used within local intranets with great success. However, SETI@home casts its net wider, making use of computing resources around the Internet. Computers around the Internet function together as a parallel computing system. Unlike traditional distributed systems, the computers linked via the Internet have a variety of operating systems, processor architectures, and physical locations. The sheer number of processors available allows SETI@home access to more processing power than any existing supercomputer. In fact it has been said:

"SETI@home is the largest distributed computation project in existence. It could also be considered to be the largest supercomputer in existence and the largest computation ever performed [[2](#)]."

SETI@home

SETI@home, managed by a group of researchers at the Space Sciences Laboratory (SSL) of the University of California, was designed to search for radio signals from extraterrestrial civilizations and thus detect intelligent life-forms within the radio telescope data obtained from the National Astronomy and Ionospheric Center's 305-meter wide radio telescope stationed at Arecibo, Puerto Rico. The idea was conceived in 1996 and the website was launched on May 13, 1999. Although the site was only planed to be active for two years, the incredible response it engendered prompted its extension. There are also plans for a SETI@home II. The SETI@home program runs as a screen-saver or as a background process (depending on the operating system) on the volunteer's machine and connects to the Internet only when it has to download data or upload processed data. SETI@home reached the Zeta-FLOP (10^{21} Floating-Point Operations) mark on September 26, 2001, as stated in the News section of the SETI@home website.

The radio telescope generates data at the rate of approximately 55 Gigabytes per day, while recording a

2.5 MHz-wide band centered at the 1,420 MHz hydrogen line. This data is then split into smaller chunks - about 107 seconds in duration, equivalent to 10 kHz of bandwidth[2]. The small chunks of data, called "work units," are approximately 300 kilobytes. Adjacent work units overlap by about ten seconds. The work units are sent across the Internet and processed comparatively quickly in a duration of 10-12 hours. Each work unit is analyzed by two or three clients or sometimes more, but only one result of each work unit is stored in the database if there is a match in the result from the different clients.

The software searches through the work unit for narrow-band signals that begin weakly, grow stronger, and then diminish within a twelve second interval. The twelve second interval corresponds to the time an object would take to pass over the angular of view of the telescope. It is possible to catch signals that are not from extraterrestrial sources, due to both the telescope sensing and the data analysis. To eliminate Radio Frequency Interference (RFI), the data is processed with a variety of techniques (e.g. baseline smoothing, data chirping, Fast Fourier Transform (FFT), Gaussians and triplets searching). All the steps are carried out for different Doppler drift rates (to correct the Doppler drift at the receiving end) from - 50Hz to +50Hz in steps of 0.029Hz/sec and making the entire procedure computationally intensive. Doppler drift is the change in the frequency of a signal and it is caused by the relative motion of the sender and receiver. The processing is briefly explained in [2].

SETI@home Website

SETI@home website (Figure 1) is available at <http://setiathome.ssl.berkeley.edu>. The website is available in 33, languages emphasizing by the global nature of the project. The homepage of the website is neatly organized into the following sections:

- Use SETI@home
- Science
- Help &Information
- Statistics
- How you can help
- Operations
- Translations and The Project
- News and Sponsors and Acknowledgments

The front page has been organized in the form of a site map.

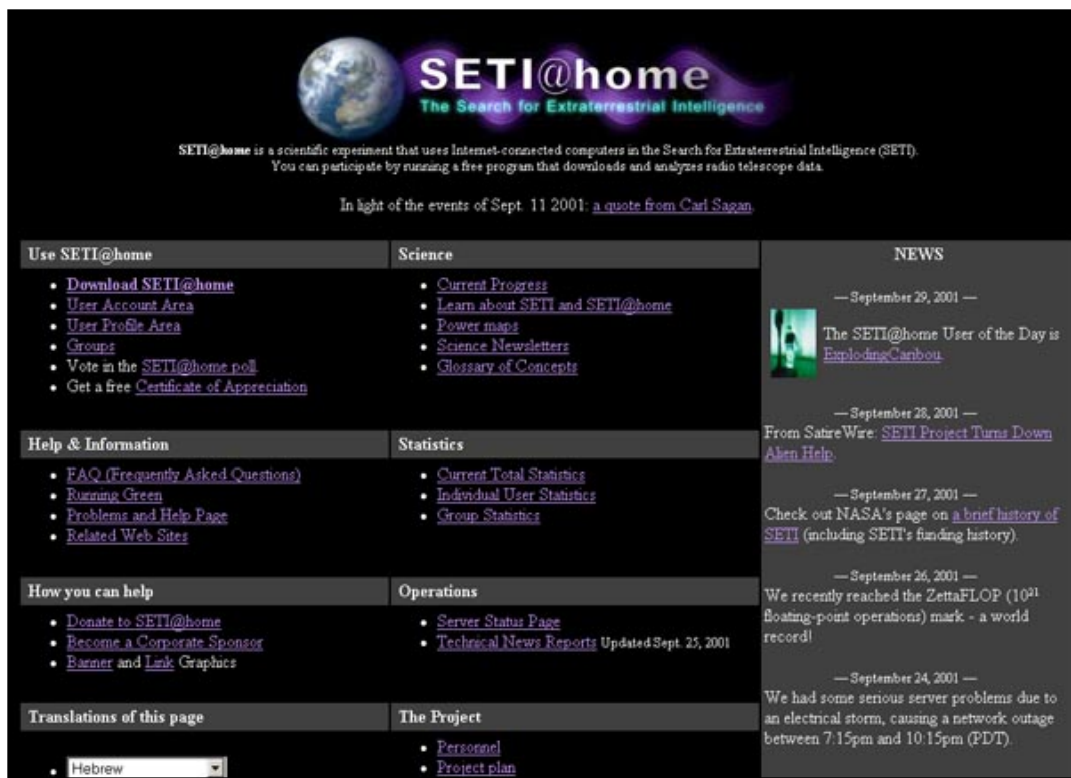


Figure 1: The SETI@home homepage

The "Use SETI@home" section lets you download the SETI@home installation software, which is available for Windows 95/98/2002/NT (Fig. 2), Mac OS and the various flavors of Unix like FreeBSD, OpenBSD, Linux, Solaris and many more.

The "Science" and "Help & Information" sections help visitors understand the inner-workings of SETI@home. The former helps to understand the technical details and methods of data analysis while the latter helps with solving problems encountered during execution of the screen saver.

An enormous amount of data is collected by the SETI@home project, not just about the SETI problem, but also about the systems and volunteers joining the process. SETI@home has taken care not to ignore these important bits of data. For example the amount of time taken by the different operating systems and the different processor architectures is neatly presented.

Anyone interested in making a monetary donation to SETI@home will find the necessary information in the "How you can help" section. The "Operations" section can be used to check out if the server is working fine and that there have been no hitches lately in the operation of the radio telescope.

The news section is updated each day with the latest developments of the project with a daily "User of the Day" to acknowledge volunteer participation. The essential information in the homepage is rendered much earlier than the complete download of the page, thus giving a feel of fast availability of the page. The majority of the load time can be attributed to sponsors' logos. As of the printing of this article, the site lacks a search facility, which might be a helpful addition.

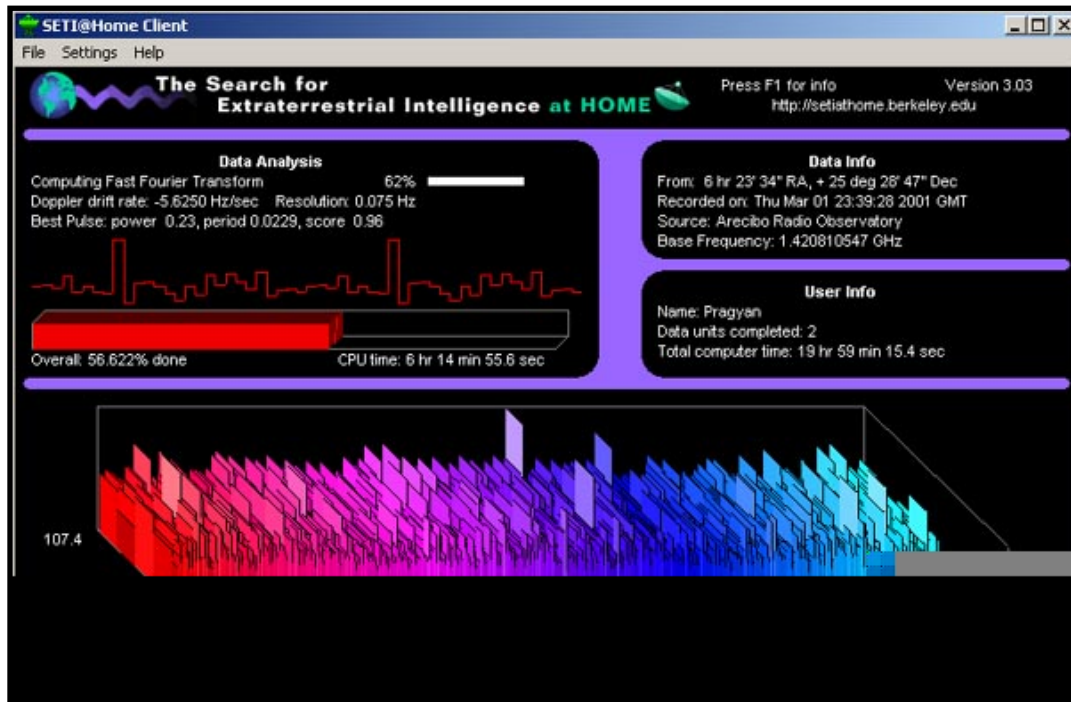


Figure 2: SETI@home screen saver on a Windows 2000 machine

The SETI@home site is served by an Apache web server with CGI (Common Gateway Interface) functionality, running on a dual processor Sun Ultra machine. The SETI@home servers consist of three computers - a science database, a data server, and a user database [2]. The user database stores the information about the volunteers involved and related data as shown in "Current Total Statistics" and "Individual User Statistics" sections. The distribution of work units and collection of results is done by the data server while the maintenance of the information related to the work units is done by the science database. All of the databases are implemented using Informix Dynamic Server software. A Network Appliance F840 3 Terabyte capacity storage appliance is in place for the online databases, work unit storage, and splitting of data for distribution. For added reliability, Veritas disk mirroring is used for the SCSI disks on the three servers. The server architecture involved is as shown in Fig 3.

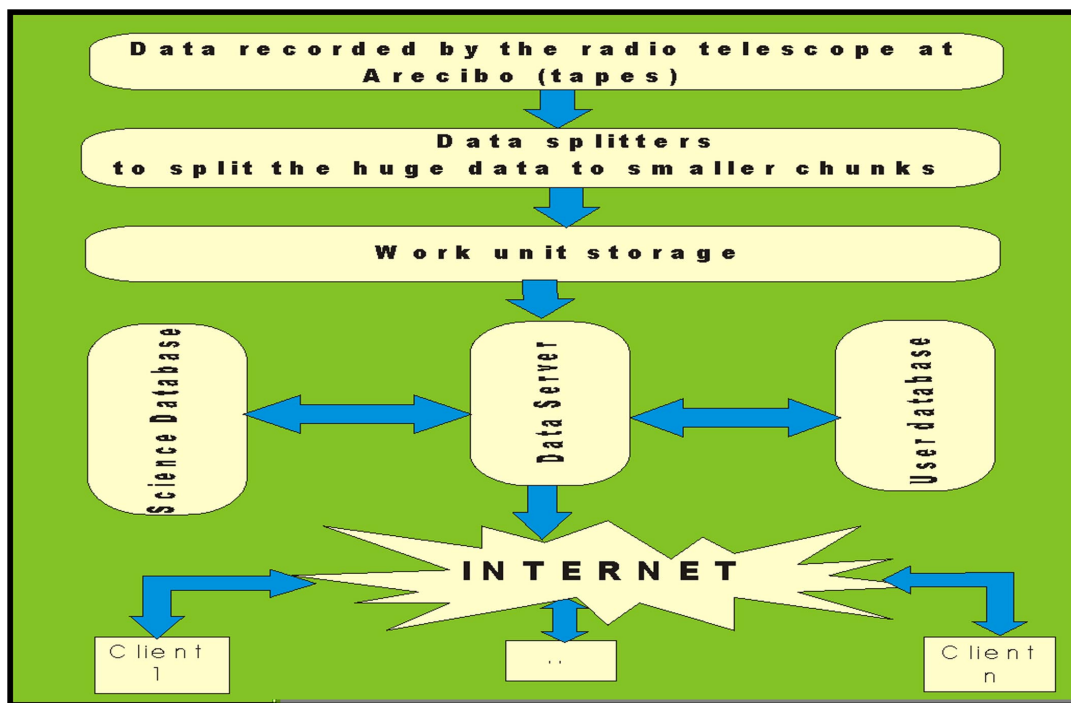


Figure 3: The Server Architecture of SETI@home

Conclusion

All in all, the SETI@home website is very well organized with the information carefully categorized and easily accessible. Images have been used only where it is important for better understanding of concepts, thus improving the accessibility of the page from a bandwidth perspective. Due attention has been given to the design of the web pages and readability, which is important for an application like this. It is an application which makes us understand the true value of the Internet connectivity. It shows us a way in which the Internet can be used for the betterment of humanity and solving problems which are distributed in nature but have not been solved so far due to lack of resources. According to the FAQ section of the website, the idea of using the Internet to get processing power can be used for genome analysis and financial analysis, indicative of the importance of the technology developed in the SETI@home project.

References

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SETI@home, "SETI@home: Search for Extraterrestrial Intelligence at Home", <<http://setiathome.ssl.berkeley.edu>> (30 September 2001).

2

Korpela E., Werthimer D., Anderson D., Conn J. and Lebofsky M., "SETI@home : Massively Distributed Computing for SETI." In *IEEE Computing in Science and Engineering* <<http://www.computer.org/cise/articles/seti.htm>>, January/February 2001, Vol. 3, No. 1 (30 September 2001)

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