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Remote Eavesdropping at the JCMT via the World Wide Web

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Abstract. The James Clerk Maxwell telescope (JCMT), a submillimetre facility on Mauna Kea, has recently adopted flexible scheduling. This is expected to result in fewer astronomers travelling out to Hawaii, and more data being taken by local observatory staff. In order to allow astronomers to monitor their data from their home institutions, JCMT has adopted the WWW Observing Remotely Facility (WORF) already offered by the United Kingdom Infrared Telescope (UKIRT).

WORF allows astronomers to eavesdrop on their data using the Netscape™ browser with minimal impact on observatory staff and computer systems. The UKIRT implementation has been extended to meet the differing expectations of the JCMT community, and has many additions including a telescope status screen, the ability to access the observation log and the use of a conferencing tool between the observer and the eavesdropper(s).

1. Introduction

The James Clerk Maxwell Telescope (JCMT) is a UK-Canada-Netherlands 15-m submillimetre telescope situated on the summit of Mauna Kea, Hawaii. In order to use good observing conditions more efficiently, the JCMT is moving to full flexible-scheduling. This will result in fewer astronomers travelling out to Hawaii, and more observations taken by observatory staff. It also implies that astronomers may only be given a few hours notice before observations in their program are taken. Although JCMT users understand the advantages of flexible scheduling, they are reluctant to relinquish the ability to modify observing strategy on-the-fly as new data come in.

We are anticipating the community's requirement for a way to monitor remotely their observations by developing the World Wide Web Observing Remotely Facility (WORF). WORF had been developed previously for the United Kingdom Infra-Red Telescope (UKIRT), where the HTTP based implementation was shown to have clear advantages (Economou et al. 1995); the JCMT specific development has become known as WORF2.

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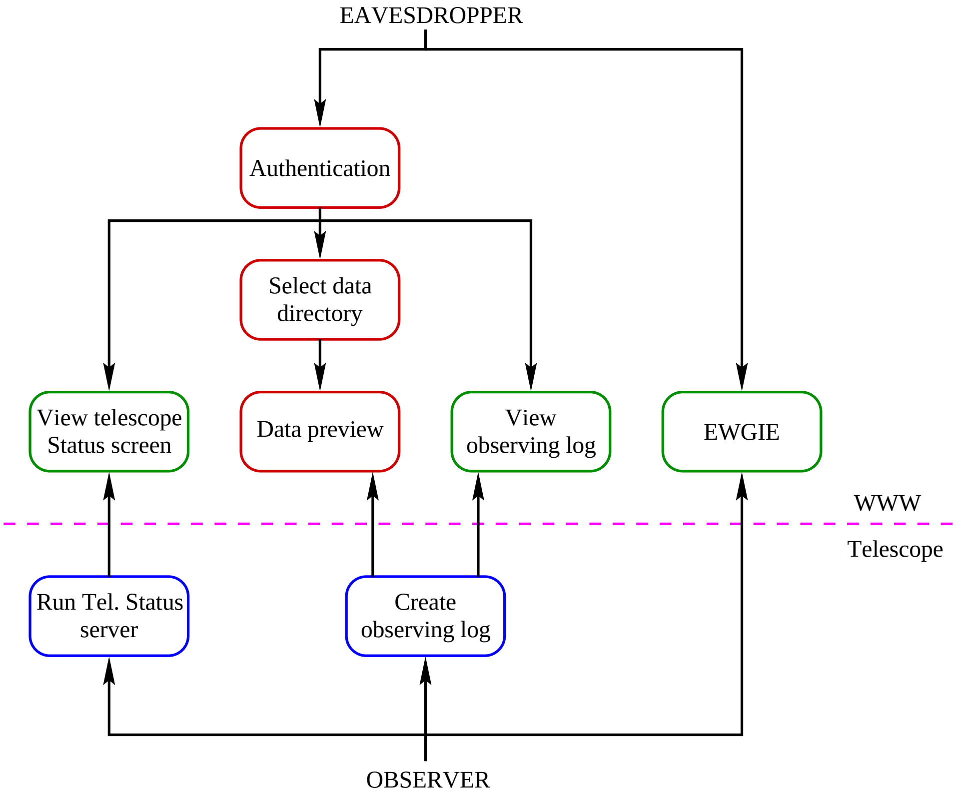

Figure 1. The structure of the WORF2 system.

2. User Interface

Each successful proposal for JCMT time is assigned a user name and password at the beginning of the semester. The first thing the potential eavesdroppers have to do is authenticate themselves, as access to data directories is restricted. They can then enter the WORF2 system, whose user interface consists of four Web pages (the locations of which are shown in Figure 1):

- **Data Preview**. This is the main display window of the WORF2 system. Here the eavesdropper is presented with a list of completed observations from which to choose a particular one and display spectral line data, adjusting the plotting scale as desired.
- **Telescope status**. This is a continuously updating (every 60 s) display of basic telescope parameters. The most important of those are the Right Ascension and Declination, which reassures the eavesdropper that the telescope is indeed pointing at her source. It is also important that the observer can check the current instrumentation configuration.
- **Observation log**. The person actually observing at the telescope can use in-house software to generate a log consisting of basic information about the observations and additional comments on the quality of the data. This window enables the eavesdropper to peek at this log file.

- **Conferencing tool**. A WWW based conferencing tool[2] is also used so that the observer and astronomer(s) can discuss details of the run using both text and diagrams.

3. Implementation

3.1. Data Preview

The data previewing CGI backend is written entirely in Perl5 (Wall, Christiansen, & Schwartz 1996). JCMT observations are stored in a telescope specific GSD format originally developed for single-dish radio telescopes. Using the flexible Perl extension mechanism, we first had to develop a module allowing access to the C GSD library. Data from the JCMT digital autocorrelation spectrometer (DAS) needs to be processed before being displayed in a manner meaningful to an astronomer. The processed data is plotted into a GIF image via pgperl, the Perl PGPLOT module,[3] and is then served via HTTP.

File naming conventions do not provide sufficient information for the eavesdropper to determine the type of observation contained in a file. Rather than reading in every file in the data directory to extract this information, an observing log generated by the scientist at the telescope is used instead. In the absence of such an observing log, only observation numbers are displayed.

3.2. Security

Data privacy is a subject dear to the heart of many an astronomer. The eavesdropper is authenticated by the HTTP server and the login name thus provided is compared against the ownership of each individual file requested thereafter (data ownership is determined by an entry in the file header). This takes advantage of the way observations from different projects are taken and stored at the JCMT.

3.3. EWGIE

We use the public domain **E**asy **W**eb **G**roup **I**nteraction **E**nabler (EWGIE) conferencing tool. This Java based tool provides a "chat area" as well as a "whiteboard" allowing diagrams to be exchanged between multiple participants over HTTP.

3.4. Browsers

The data preview component of WORF2 will run on most graphical WWW browsers. EWGIE requires Java support. The observation log and telescope status screens make use of client pull in order to automatically update, a feature which is not currently supported by many browsers other than Netscape™. These pages can, of course, be updated manually by reloading the page.

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[2] EWGIE, developed by Kevin Hughes at kevinh@commerce.net. (http://www.eit.com/ewgie/)

[3] http://www.ast.cam.ac.uk/AAO/local/www/kgb/pgperl/

4. Future

JCMT has recently taken delivery of SCUBA, a much anticipated submillimetre bolometer array, which will provide our users with imaging data for the first time. Data from SCUBA is stored in the Starlink N-dimensional Data Format (NDF), which is widely used in the UK community. We have already developed a Perl module allowing access to the FORTRAN Starlink libraries, and intend to take full advantage of the on-line data reduction pipeline written for SCUBA.

WORF2 is already in use, mainly by Dutch astronomers who were the first JCMT partner to move to flexible scheduling. We expect it will be used more widely as the British and Canadian allocated telescope time switches to flexible scheduling later this year.

We are in the process of adding more features to WORF2 but, as with WORF, other aspects of the software group's work are of higher operational priority.

A demo of the data preview component of WORF2[4] is also available.

References

Economou, F., Bridger, A., Daly, P. N., & Wright, G. S. 1996, in ASP Conf. Ser., Vol. 101, Astronomical Data Analysis Software and Systems V, ed. G. H. Jacoby & J. Barnes (San Francisco: ASP), 384

Wall, L., Christiansen, T., & Schwartz, R. L. 1996, Programming Perl, 2nd edn. (Sebastopol, CA: O'Reilly)

[4]http://jach.hawaii.edu/worf2/worf2.csh