

# Job Scheduler

International Christian Academy

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The Job Scheduler is designed to schedule automated report and maintenance jobs at ICA. This program was written in Delphi and incorporates features for standard Unix cron and the "yesterday" program written by Alan Shea.

The program was designed to be simple to configure and install and to manage from across the network (a schedule may be modified on one system and the actual computer running the schedule will reload it automatically). It is possible to run multiple schedulers under different systems and users, though it is unlikely that this will be needed or even desired.

Job Scheduler has been installed in o:\pbx (or \\genesis\offices\pbx). Only one file is needed, with a second containing the defined schedule – the program does not use the Windows registry. The files used:

scheduler.exe – the main program for both setting up the schedules and running them. The program only takes one parameter which can be anything, if specified it will automatically start the enable the scheduling thread; otherwise it starts with the thread disabled. Typically one might see this used as: "scheduler enable".

scheduler.ini – this contains the current schedules and must be in the same folder as the scheduler.exe program.

scheduler.log – a record of scheduling events.

Note: If you rename "scheduler.exe" then you can have additional schedules in the same directory as the program name will be used to determine the actual INI and log file name. For example, if the name is changed to "cron.exe", the INI file would then be "cron.ini" and the log file would be "cron.log".

The remainder of this document shows how to use Job Scheduler. There is a separate document defining the current schedules and what they do, see "*Automated Jobs.pdf*".

## How Schedules Work

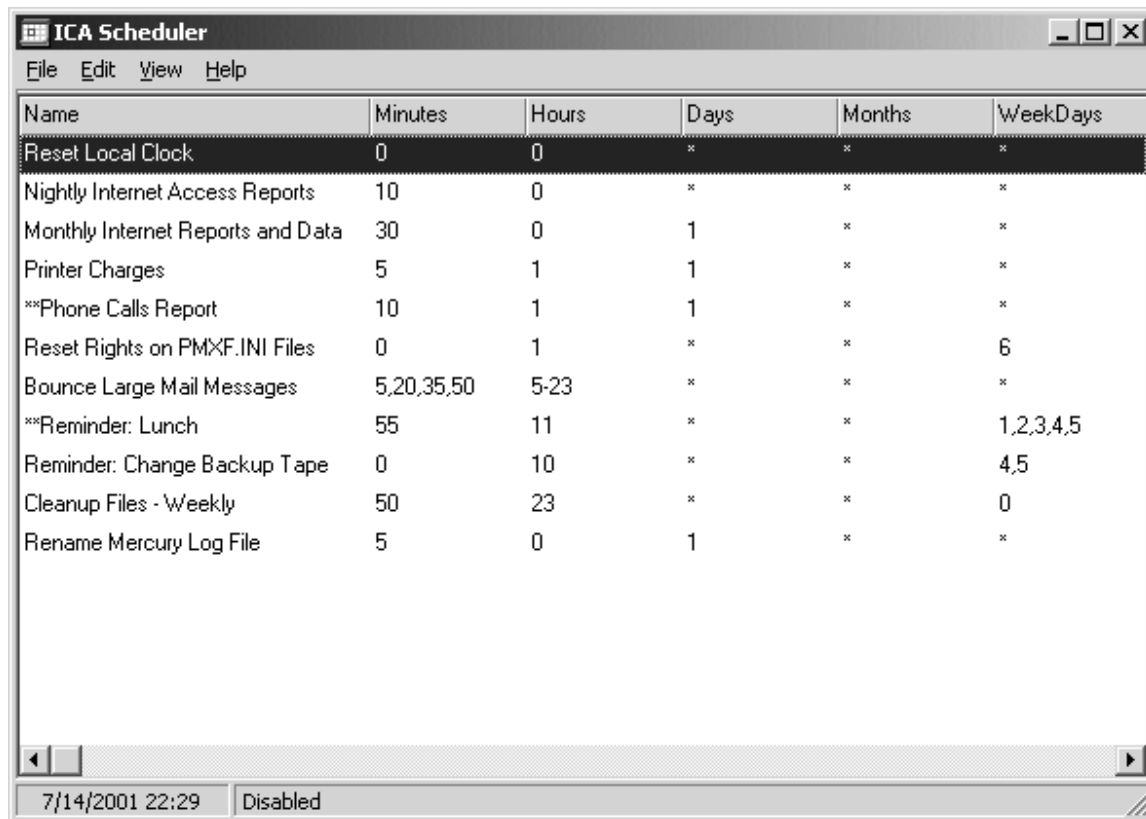
Scheduler must be "enabled" before it will execute any scheduled items. This can be done by running the program and manually enabling it by choosing File/Run. It can also be automatically enabled from the command line but using any parameter (e.g. "scheduler enable").

When enabled, Scheduler starts a timer event that will occur once each minute (every 60 seconds). At each occurrence of this timer, Scheduler:

1. Checks to see if the INI file has changed. If so, it loads the new schedule and writes a record to the log file.
2. Scans the schedule list to see if there are any entries that qualify for the current Month, Day, Week Day, Hour, and Minute.
3. For each matching schedule, the command line is parsed, replacing any special date and environment variable references and then the command is executed. Scheduler also writes a log entry indicating success or failure for this command.

## Job Scheduler Main Window

When the ICA scheduler starts, it shows the main scheduling window, listing the various current scheduled items, including inactive entries.



The screenshot shows the 'ICA Scheduler' application window. It has a menu bar with 'File', 'Edit', 'View', and 'Help'. The main area contains a table of scheduled tasks. The table has six columns: 'Name', 'Minutes', 'Hours', 'Days', 'Months', and 'WeekDays'. The tasks listed are: 'Reset Local Clock', 'Nightly Internet Access Reports', 'Monthly Internet Reports and Data', 'Printer Charges', '\*\*Phone Calls Report', 'Reset Rights on PMXF.INI Files', 'Bounce Large Mail Messages', '\*\*Reminder: Lunch', 'Reminder: Change Backup Tape', 'Cleanup Files - Weekly', and 'Rename Mercury Log File'. The status bar at the bottom shows the date and time '7/14/2001 22:29' and the state 'Disabled'.

Name	Minutes	Hours	Days	Months	WeekDays
Reset Local Clock	0	0	*	*	*
Nightly Internet Access Reports	10	0	*	*	*
Monthly Internet Reports and Data	30	0	1	*	*
Printer Charges	5	1	1	*	*
**Phone Calls Report	10	1	1	*	*
Reset Rights on PMXF.INI Files	0	1	*	*	6
Bounce Large Mail Messages	5,20,35,50	5-23	*	*	*
**Reminder: Lunch	55	11	*	*	1,2,3,4,5
Reminder: Change Backup Tape	0	10	*	*	4,5
Cleanup Files - Weekly	50	23	*	*	0
Rename Mercury Log File	5	0	1	*	*

As with most windows programs there is one main window, with menu, application display area, and a status bar. The top section is a typical menu with File, Edit, View, and Help (though Help has not been implemented). The central section, the application display area, shows the currently scheduled items. Finally, the bottom section of the window is the status bar.

## Schedule Display Area

Name	Minutes	Hours	Days	Months	WeekDays
Reminder: Change Backup Tape	0	10	*	*	4,5
Reset Local Clock	0	0	*	*	*
Reset Rights on PMXF.INI Files	0	1	*	*	6
**Phone Calls Report	10	1	1	*	*
Nightly Internet Access Reports	10	0	*	*	*
Monthly Internet Reports and Data	30	0	1	*	*
Printer Charges	5	1	1	*	*
Rename Mercury Log File	5	0	1	*	*
Bounce Large Mail Messages	5,20,35,50	5-23	*	*	*
Cleanup Files - Weekly	50	23	*	*	0
**Reminder: Lunch	55	11	*	*	1,2,3,4,5

A double asterisk (\*\*) next to an item (see the "Phone Calls Report" entry, above) indicates an entry that is inactive.

Double clicking on an entry starts the edit dialog box for that item (see the discussion under menu item Edit/Modify, below). This is also accessed by selecting the item (up or down arrow or mouse click) and then choosing Edit/Modify from the menu or pressing the CTRL-M hot key. For viewing purposes, the scheduled items may be sorted by any column, simply click on the column heading. This sort is not saved so items will be shown in the order entered the next time the program is executes.

Note: The display order does **not** effect the execution schedule in any way.

The scheduled item columns are as follows.

Name	Name given to the scheduled item. Names may be duplicated but this may be confusing. The name is written to the log file each time the scheduled item is executed.
Minutes	The minute value(s) when the item will be executed (see below).
Hours	The hour value(s) when the item will be executed (see below).
Days	The day value(s) when the item will be executed (see below).
Months	The month value(s) when the item will be executed (see below).
WeekDays	The day(s) of the week when the item will be executed. This may be "*" for any day of the week or a list of day numbers, where 0=Sunday, 1=Monday, etc.

Each of the scheduled value columns (Minutes, Hours, Day, Months, and WeekDays), contain values that are matched against the current date/time to see if the item should be run. These values may be an "\*" (asterisk) meaning any value, or one of the following numbers:

Minutes	0-59
Hours	0-23
Days	1-31
Months	1-12
WeekDays	0-6

The values may be included multiple times using a comma (",") or as a range using a dash ("-"); commas and dashes may be combined multiple times. For example, to schedule an item each minute for the first 5 minutes and then on each 15 minute interval each hour you would use:

0-4,15,30,45

Multiple ranges are possible, so you could schedule something for 5 minutes every 15 minutes:

0-4,15-19,30-34,45-49

### **Status Bar**

The status bar shows some useful information about the ICA Scheduler. It appears on the bottom of the main window and looks like this:



The first pane shows the current date and time.

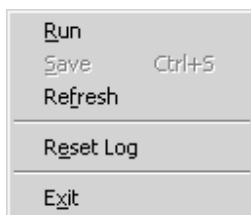
The second pane displays whether or not Scheduler is enabled. You will see either "Disabled" or "Enabled" here.

## Using Job Scheduler

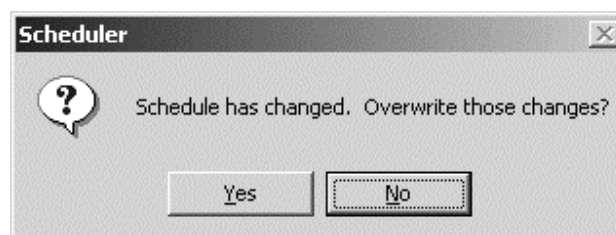
The menu structure in ICA Scheduler is fairly easy to learn as there are not a lot of options. There are four main menu items, as you would find in many Windows programs: File, Edit, View, and Help.

### **File**

The file menu controls the execution of scheduler and update options for the configuration file and log file. The file menu looks like this:



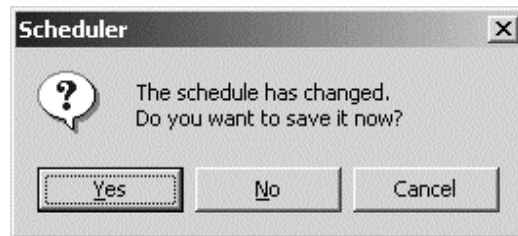
- |         |  |
|---------|--|
| Run     | Choose this option to enable or disable Scheduler. Without any command lines parameters (as would be the case if you double click on the program file), Scheduler would start disabled. A check mark next to this indicates that Scheduler is "enabled", you will also see the word "enabled" in the 2 <sup>nd</sup> pane of the status bar at the bottom of the window. |
| Save    | This is only available if changes have been made to the current schedule. Choose save or the short-cut key (CTRL-S) to save the schedule. Any other enabled Scheduler using the same INI file will reload the schedule within the next 60 seconds.   |
| Refresh | Use this option to reset the currently shown schedule back to the last saved schedule. You will be warned if you have already changed the schedule and have a chance to not refresh it from the save copy:   |



- |           |   |
|-----------|---|
| Reset Log | This option will empty the log file, there is no warning message. |
|-----------|---|

Exit

Quits the program, like the "X" icon in the top right of the window. If you have made any unsaved changes to the current schedule you will be warned, with the following message:

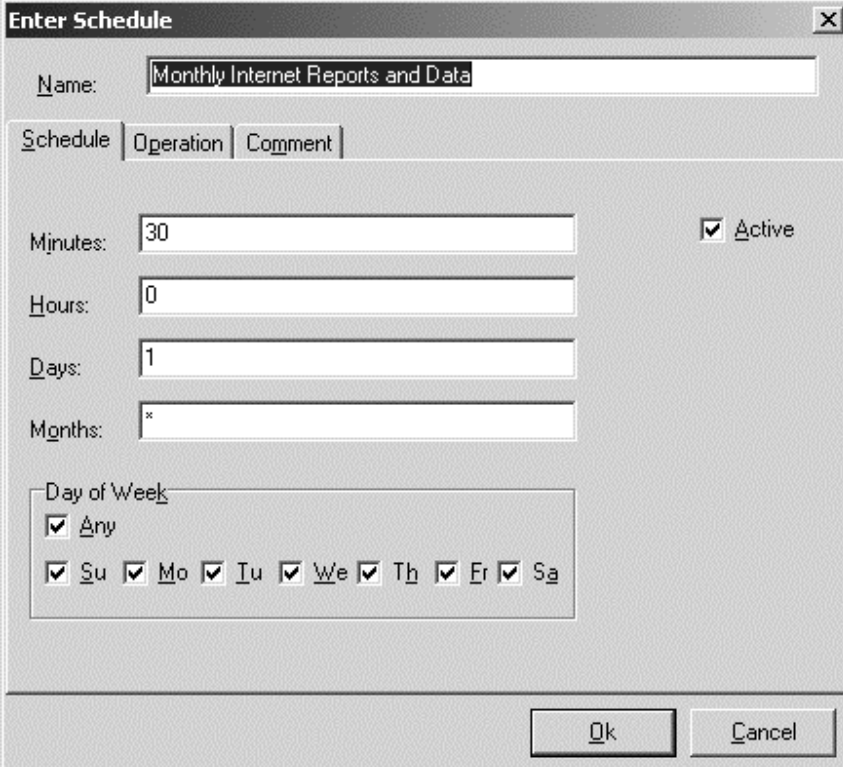


## Edit

<u>A</u> dd...	I <u>n</u> s
<u>M</u> odify...	C <u>tr</u> l+ <u>M</u>
<u>D</u> elete	<u>D</u> el
<hr/>	
<u>E</u> xecute Now	C <u>tr</u> l+ <u>E</u>
<hr/>	
D <u>u</u> plicate	C <u>tr</u> l+ <u>D</u>
<u>C</u> ut	C <u>tr</u> l+ <u>X</u>
<u>C</u> opy	C <u>tr</u> l+ <u>C</u>
<u>P</u> aste	C <u>tr</u> l+ <u>V</u>

**Add** Add a new schedule item following the currently selected item. The modify dialog will start with all fields set to their default values.

**Modify** Change the currently selected schedule. You will see the following dialog:



The 'Enter Schedule' dialog box is shown with the following fields and options:

- Name:** Monthly Internet Reports and Data
- Schedule** tab selected, with sub-tabs for **Operation** and **Comment**.
- Minutes:** 30
- Hours:** 0
- Days:** 1
- Months:** \*
- Active:** ☒ Active
- Day of Week:**
  - ☒ Any
  - ☒ Su ☒ Mo ☒ Tu ☒ We ☒ Th ☒ Fr ☒ Sa
- Buttons:** Ok, Cancel

**Name** – This field is always available, it is mostly for descriptive purposes. The name shows on the main schedule display and is written to the schedule log so it is important that you use something meaningful.



The "Schedule" tab contains entries that effect when the item will execute.

**Minutes** – This contains the values to match against the current minute number.

**Hours** – This contains the values to match against the current hour number.

**Days** – This contains the values to match against the current day number.

**Months** – This contains the values to match against the current month number.

**Day of Week** – You can select "Any" day (this is the same as the wildcard, "\*" character). To be clear, all the day check boxes will be set. If you want to start with the day boxes off, just uncheck the "Any" box. To run the schedule on just one or two days of the week, just check those specific boxes ("Su" is Sunday, etc).

**Active** – This box must be checked for the schedule to work. If unchecked the scheduled item will be marked with double asterisks in the main window ("\*\*") and the item cannot be run even with the Edit/Execute Now menu option. This is handy for temporarily disable a schedule item that may be used in the future.

The operation tab contains the fields that describe what should be executed at the schedule time(s):

The screenshot shows the 'Enter Schedule' dialog box with the 'Operation' tab selected. The 'Name' field contains 'Monthly Internet Reports and Data'. The 'Operation Type' dropdown is set to 'Direct Execute' and the 'Run' dropdown is set to 'Normal'. The 'Program File' field contains 'c:\pbx\jobs\nbmlog.bat'. The 'Parameters' field contains '"-report=allmail" %d-1M[firstday] %d-1M[lastday]'. The 'Working Directory' field contains 'c:\pbx\jobs'. The 'Ok' and 'Cancel' buttons are at the bottom right.

**Operation Type** – there are two types, though this drop down list shows three.

*Builtin: Reset Time From Server* – this disables all the other operation fields. This will execute some internal code to reset the local workstation time to the time on the server. Use this item sparingly as the clock can "jump" if the workstation has gotten too far off the network time. If the clock jumps too far forward another scheduled item may be skipped, if it jumps too far backward, another item may be run a second time. It is probably best to keep other scheduled items at least 5 minutes away from one of these events.

*DOS Command* and *Direct Execute* – both do the same thing at this time. That is they enable all the other fields and execute the file directly using the Windows API `ExecuteFile`.

**Run** – Allows you to control how the application window appears when it is run: Minimized, Maximized, Normal, or Hidden. I have found that, under Windows 95, the Hidden option can be confusing as sometimes programs remain (DOS commands that were not set to automatically

close) and then use up valuable resources. I have found that using "normal" on an unattended work stations seems to work best.

**Program File** – The path to the program file that is to be run. This can be document files as Windows will find the associated program and start it; .bat files work as well. Use network common paths or UNC names when specifying program file names, this will allow you to use the Scheduler from any workstation on the network.

**Parameters** – The parameters to pass to the program on the command line. There are some special codes you can use in the parameter list, all start with "\$":

Note: The curly braces "{}" delineate optional strings. The square braces "[]" are required where shown.

\$t – Today's date (old, use %d now).

\$y – Yesterday's date (old, use %d now).

\$d{+-#{MDY}}{[modifier]} – Relative date based on today's date.

The "+" or "-" character adds or subtracts a number (#) of days, or optionally a different unit of time (M=Months, D=Days, and Y=Years; no unit is the same as using "D"; this is case sensitive to you must use capital "D", "M", or "Y"). Multiple "+" or "-" entries may be used (you could subtract one day and one month with "-1D-1M").

The modifier string may contain the word "firstday" or "lastday" followed by an optional colon (":") and then a date format string.

The modifier keyword "firstday" instructs Scheduler to choose the first day of the month after adding and subtracting all the relative values to the current date. The "lastday" is similar, but selects the last day of the resulting month.

The default format string is "yyyymmdd", but any can be specified using a combination of these letters and any other characters. You could use "mm/yy" to output the date with just month and short year and a slash between the values.

Example 1: \$d-1M[firstday] - outputs the first day of the **previous** month using the default format.

Example 2: \$d-1[mmdd] \$d+1D[mmdd] – outputs the month and day of yesterday ("D" does not need to be specified as that is the default unit) followed by the month and day for tomorrow.

Example 3: \$d-1M-1Y[firstday:mm/dd/yyyy] – outputs the day, month, and year of the first day of the previous month, one year ago; the date values are separated with a "/" character.

\$n{+-#{MDYhms} {[modifier]}} - Relative time based on the current time (stands for "now").

See the discussion under \$d for how the calculations, units, and modifier strings work. In addition to \$d, however, \$n allows using relative time specifiers, where "h"=Hour, "m"=Minute, and "s"=Seconds; these must be lower case.

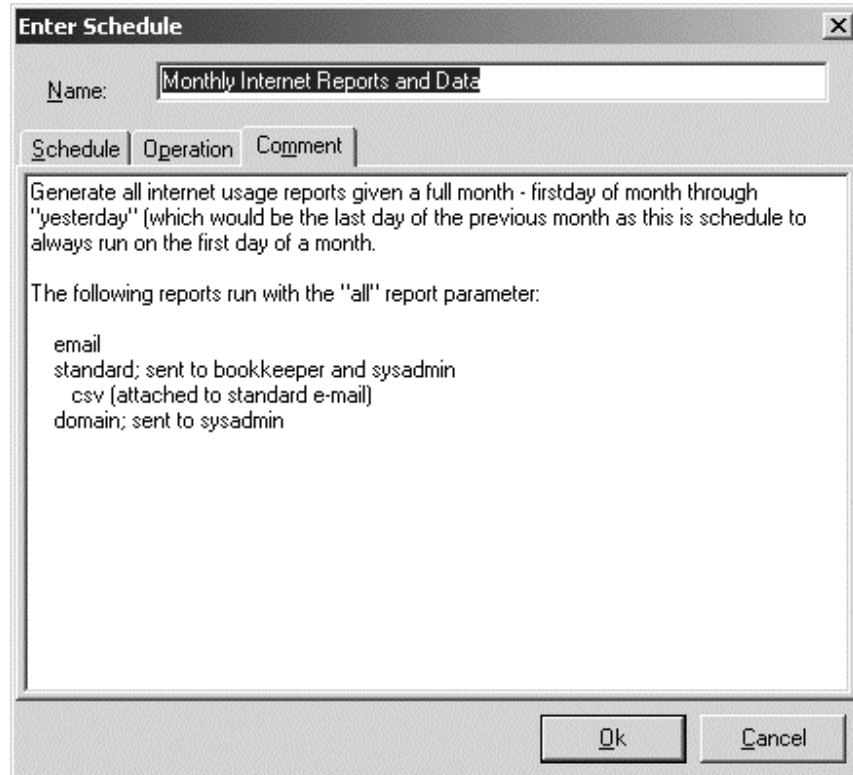
For more information on how to write the date and time format strings, see the Delphi manual on the TDateTime type. Scheduler simply builds and TDateTime value and then formats that value using a standard Delphi function.

\$v[<environment variable>] - The value of an environment variable. (e.g. \$v[COMSPEC], gets the value of the COMSPEC variable and places that on the command line where the \$v occurs).

\$\$ - Replaced with a single "\$" symbol.

**Working Directory** – The directory to set as the current one when executing the program.

The final tab is the "Comment" tab.



The screenshot shows a dialog box titled "Enter Schedule" with a close button (X) in the top right corner. Below the title bar, there is a "Name:" label followed by a text field containing "Monthly Internet Reports and Data". Below this, there are three tabs: "Schedule", "Operation", and "Comment". The "Comment" tab is currently selected. The main area of the dialog is a large text field containing the following text:

Generate all internet usage reports given a full month - firstday of month through "yesterday" (which would be the last day of the previous month as this is schedule to always run on the first day of a month.

The following reports run with the "all" report parameter:

- email
- standard; sent to bookkeeper and sysadmin
  - csv (attached to standard e-mail)
- domain; sent to sysadmin

At the bottom right of the dialog, there are two buttons: "Ok" and "Cancel".

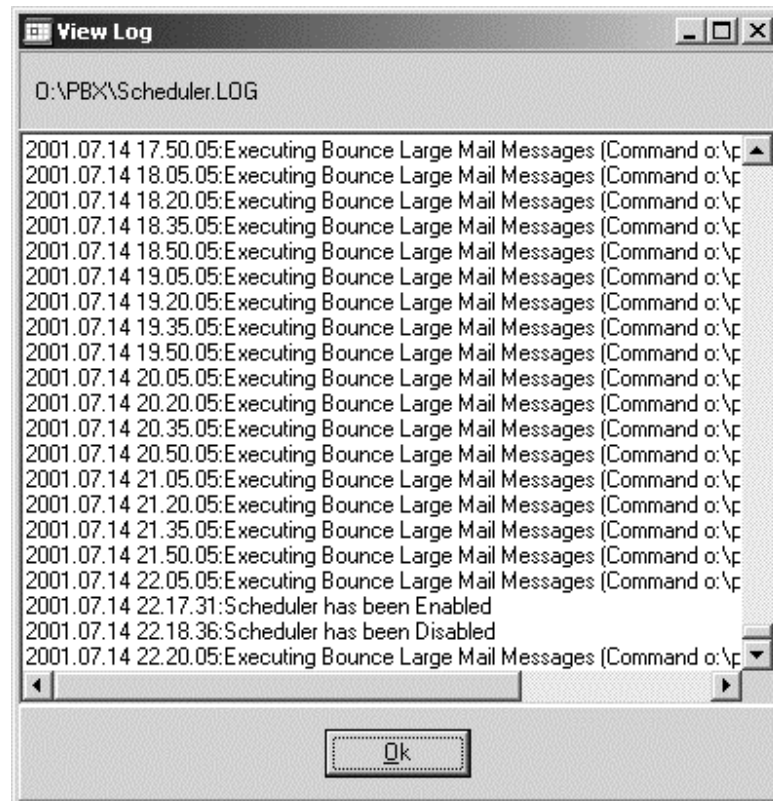
This is just a text/memo field where you can type useful information about the schedule. This is good for notes to other administrators and such.

## View

Log File

Log File

This shows the current contents of the Scheduler log file.



## ***Help***

About...

### About

As with most Windows programs there is a way to find out the current version and copyright information. Help/About shows a simple dialog box:

