Requirements
for an Electronic Calendar Tool

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1. Introduction

This document defines requirements for an electronic Calendar Tool. The tool provides functions to manage calendars for individual users as well as for groups of users. Individuals use the Calendar Tool to schedule appointments and to view their calendar information in a variety of useful ways. Administrative users can schedule meetings for groups of users and perform other system administration functions.

In addition to providing useful functionality, the Calendar Tool serves as a pedagogical example of software engineering concepts and principles. The software development artifacts for the Calendar tool are considered part of the overall Calendar Tool package.

1.1. Problem Statement

The general problems to be solved by the Calendar Tool are the following:

a. to provide a reliable and easy to use tool that manages an individual's calendar, in a manner comparable to non−electronic media such as day planners and date books

b. to provide a secure group environment that manages a collection of individual calendars for the purposes of group scheduling and information sharing

While these problems have been solved by a number of commercially available and public domain products, the Calendar Tool provides a solution with certain functional improvements over existing tools. In addition, the development of the Calendar Tool focuses on two other specific problems not addressed in commercial tools:

a. to provide a pedagogical example for use in the instruction of software engineering, including an example of the practical application of formal methods

b. to provide fully documented public domain source code for use by others

1.2. System Personnel

The personnel involved in the Calendar Tool project are organized into the following groups and subgroups:

a. end users
   i. registered users
   ii. user group leaders
   iii. system administrators
   iv. unregistered individual users

b. system developers

c. software engineering students

d. outside parties

End users are those who use the Calendar Tool for its intended purpose. Registered end users have calendars that are stored in a Calendar Tool multi−user database, which is used for group scheduling purposes. Group leaders are designated registered users who may perform group scheduling operations which affect other users' calendars. Master system administrators perform overall system administration functions, including user and group leader registration. Finally, anyone can use the Calendar Tool as an unregistered user for the management of a strictly individual calendar.

The primary system developer is Gene Fisher. His efforts are based on the work of a number of software engineering students who have used the Calendar Tool as a class project in software engineering courses. Students whose work has been particularly helpful are Larry Bolef, Brent Smolinski, Rick Myers, Brandon Wallace, and Oliver Wallace.

As noted above, the Calendar Tool is intended to serve as an example for use in software engineering courses. The students who use the Calendar Tool for this purpose focus on the artifacts of its development rather than its use as a functioning tool.

The Calendar Tool is available as public domain software for use by outside parties. The project directory is located at

`http://www.csc.calpoly.edu/~gfisher/projects/calendar`

1.3. Operational Setting

There are two operational settings for the Calendar Tool: (1) normal use as a functioning software system; (2) use as an example in software engineering courses.

Since the Calendar Tool is designed as general public domain software, there is no specific operational setting in which it is intended to be installed. The setting for which it is appropriately suited is an office or organizational environment of some form, where users maintain their own calendars and need to schedule meetings with other users on a regular basis.

For use as a pedagogical example, the Calendar Tool has been designed to fit the curriculum used by Gene Fisher in undergraduate and graduate software engineering courses at Cal Poly University. These courses are two−quarter sequences that cover standard aspects of software engineering, with emphasis on the practical application of formal methods. For the most part, the concepts covered in these courses, and hence the concepts embodied in the Calendar Tool, are mainstream software engineering. Other instructors may therefore find the Calendar Tool and its development artifacts useful as course examples.

1.4. Impacts

The positive potential impacts of the Calendar Tool as a functioning system are increased convenience and efficiency in managing individual and group calendars. The positive impacts of the Calendar Tool as a course example are

a. the presentation of a non−trivial software system that students can use as a guide for their own software development work;
b. an illustration of how formal methods of can be put to practical use.

Potential negative impacts include those common to any user−oriented software system. Viz., if the system is poorly designed and implemented, it can be inconvenient to use and decrease rather than increase user productivity. More specific negative impacts relate to issues of privacy, reliability, and data integrity. If the system implementation is flawed, it may reveal private information that users do not wish to be revealed. If an organization of users relies on a flawed implementation of the system to schedule critical events, and such events are improperly or incompletely scheduled, the organization may suffer significant disruption of its operations. Significant disruption may also occur if the system looses or corrupts important calendar data.

As a course example, the use of the Calendar Tool has no significant negative impacts, unless its development methodology is considered weak or unrelated to the concepts being taught in a particular course. Such negative impacts can be easily avoided if instructors carefully examine the example before using it in a particular software engineering curriculum.

1.5. Related Systems

Widely used commercial systems that provide functionality comparable to the Calendar Tool include

- Microsoft Outlook,
- Netscape Calendar
- Qualcomm Now-Up-to-Date,
- FileMaker (formerly Claris) Organizer, and
- On Technology Meeting Maker.

Each of these systems provides a wide variety of calendar and scheduling functionality. In terms of such functionality, the goal for the Calendar Tool is to provide the important core features found in these tools, not the full range of features found in all of them. The Calendar Tool does provide modest functional improvements in three areas, when

compared to most commercially available tools. These improvements are:

a. more flexibility in viewing and selecting from lists of possible meeting times that are generated by the automatic scheduler;
b. more flexibility in specifying recurring events;
c. more extensive forms of view filtering.

The goals for the Calendar Tool relating to public domain source code and sound pedagogical development are not met by any of the above commercial systems.

2. Functional Requirements

The Calendar Tool provides functionality to schedule appointments, meetings, events, and tasks. Calendars can be viewed in a variety of display formats, from single day to a full year. Calendar operations can be performed by individual users on their personal calendars, as well as by administrative users on a system-wide calendar. Administrative users can schedule meetings for user groups and perform general administrative operations for managing databases and setting global defaults.

Following an overview of the Calendar user interface, details of system use are presented in the following scenarios:

- basic appointment scheduling
- viewing calendars in a variety of ways
- scheduling the other types of calendar item
- finer points of viewing and scheduling
- performing administrative functions
- using options commands
- details of file-related commands
- details of edit commands
- help commands
- data entry details
- error conditions

Following the usage scenarios are two sections that summarize operational details in the areas of graphical user interface and multi-user data access. These details are relevant to implementations in specific operating environments. The functional requirements conclude with a discussion of possbile future enhancements to the Calendar Tool. These are enhancments that may be incorporated into some future version of the system, beyond its initial release.

2.1. User Interface Overview

There are three user interfaces to the Calendar Tool. The primary interface is for regular users to browse and edit their calendars. A "regular user" is defined as a registered user without special administrative privileges. A separate interface is provided for administrative users to maintain Calendar Tool databases and set default user options. A third interface, for unregistered users, is a subset of the regular user interface.

When a regular user initially invokes the Calendar Tool, the screen appears as shown in Figure 1. The initial display consists of two windows: a pulldown command menu and a display of the current monthly calendar. The calendar entry for the current date is highlighted with a widened border. The monthly display is the standard default view. The user can change this and other default settings using the option commands.

For a system administrator, the initial interface is shown in Figure 2. The initial display consists of a command menu and a window for the Calendar Tool user database. The user database has one pre-defined entry for a system administrator. Other users are added with the adminstrative commands.

2.1.1. Command Summary for Regular Users

Figure 3 shows an expansion of the command menus for the primary user interface for regular users. The `File` menu contains typical commands for manipulating data files and performing other system-level functions. '`File New`' creates a new empty calendar. '`File Open`' opens an existing calendar from a previously saved file. '`File Close`' closes the currently active calendar, offering to save if it has been modified since opening. '`File Close All`' closes all open calendars, offering to save any that have been modified.

'`File Save`' saves the currently active calendar on the file from which it was opened, or on a new file if it was created from a new display. '`File Save As`' allows the current calendar to be saved on a different file from which it was opened or most recently saved upon. '`File Save All`' saves all currently open calendars.

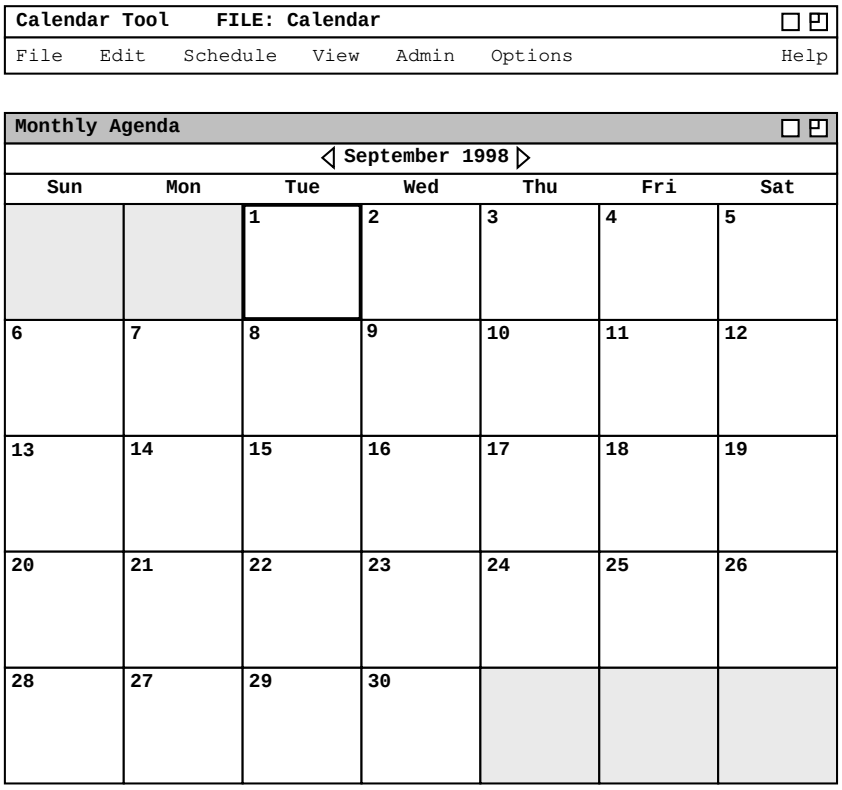


Figure 1: Initial screen for a regular user.

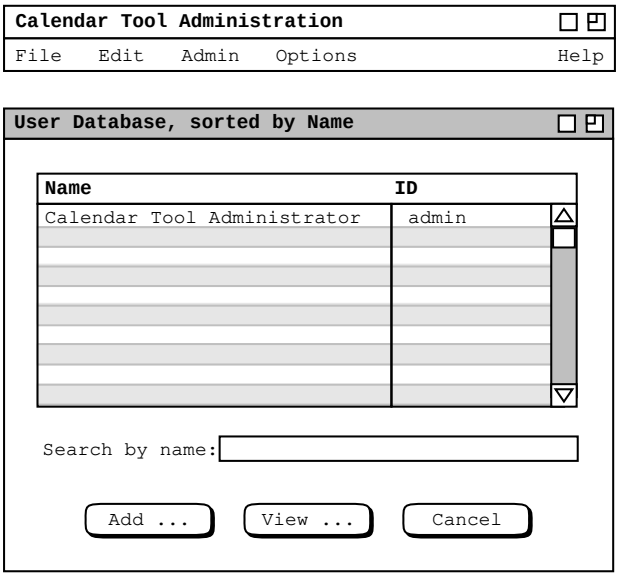


Figure 2: Initial screen for system administrator.

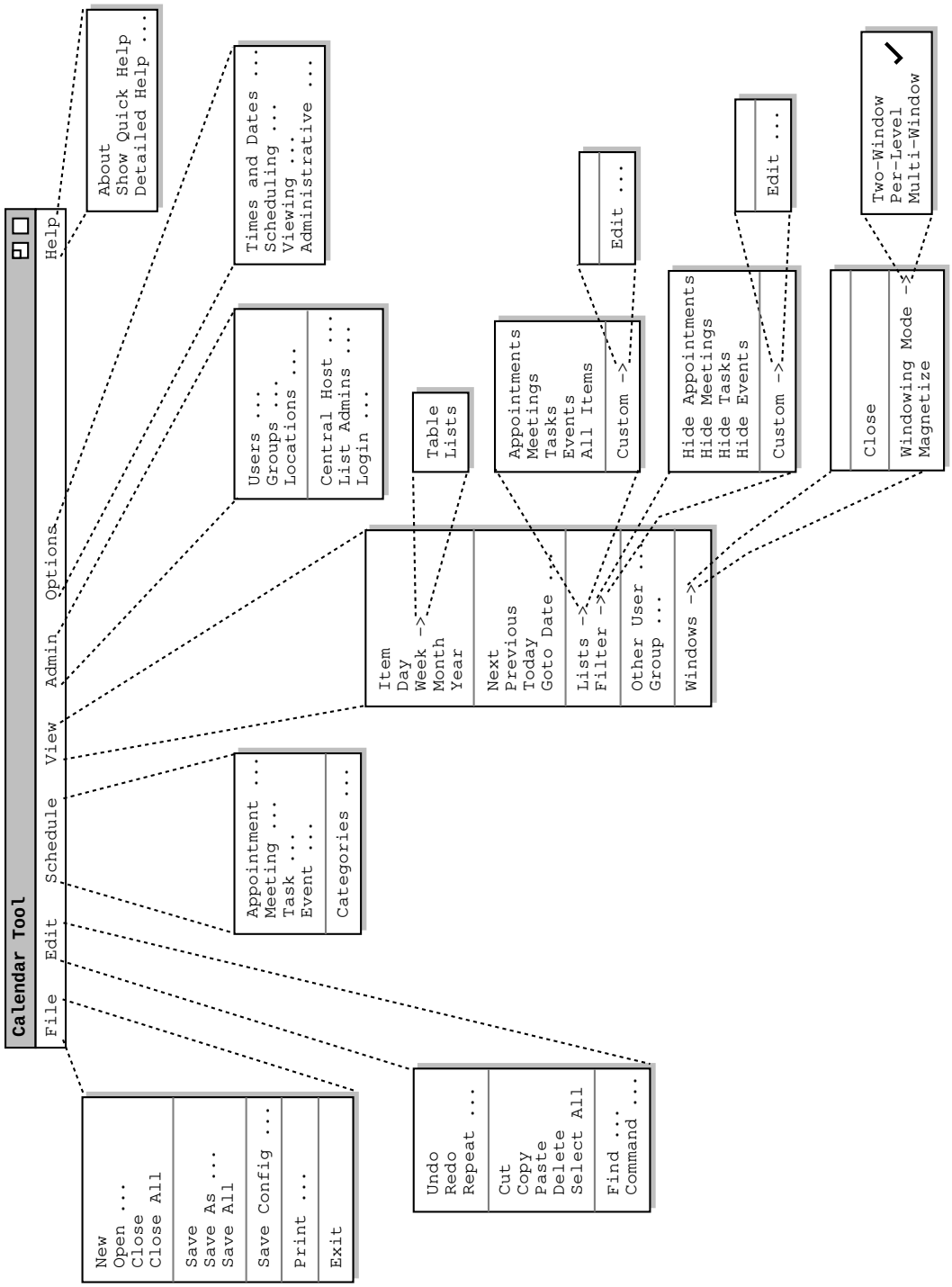


Figure 3: Expanded command menus for the regular user interface.

'`File Save Config`' saves the current screen configuration of all Calendar Tool windows. The saved configuration file can be used for a subsequent invocation that starts the Calendar tool in exactly the same configuration as was saved.

'File Print' prints the contents of the currently active display window in a form suitable for output to a printing device capable of displaying text and graphics. 'File Exit' exits the Calendar Tool, offering to save any modified calendars if necessary.

The Edit menu contains commands for manipulating calendar data during editing. 'Edit Undo' undoes the most recently completed editing commands. Repeated successive invocations of 'Undo' undo successively earlier commands. 'Edit Redo' redoes the most recently undone command. Repeated successive invocations of 'Redo' redo the series of undone commands in reverse order. 'Edit Repeat' displays a dialog that allows the most recently invoked command to be repeated one or more times.

'Edit Cut' removes and copies the currently selected datum in the current display. 'Edit Copy' copies the currently selected datum without removing it. 'Edit Paste' inserts the most recently cut or copied datum at the currently selected edit point in the current display. 'Edit Delete' removes the currently selected datum without copying it. 'Edit Select All' selects all editable data in the current display.

'Edit Find' performs a search for a text string. The search is performed in all open calendars. Successive invocations of search with an unchanged search string search for further occurrences of the string until all occurrences are found. 'Edit Command' allows the user to enter any Calendar tool command in textual form, including sequences of commands to form scripts.

The Schedule menu contains commands to schedule four types of item on a calendar. An *Appointment* is an item scheduled for an individual user, containing a title, time, date, and other information. A *Meeting* is similar to an appointment, but may be scheduled for multiple users of the Calendar Tool. A *Task* is a form of "to do" item, with information similar to an appointment plus other task-related information. An *Event* is the simplest form of scheduled item, containing a subset of the information in an appointment. Events are useful for scheduling simple, one-time items.

'Schedule Categories' allows the user to view and edit the categories of scheduled items. A category is a descriptive, color-coded label used to help organize calendar items.

The View menu allows the user to browse through a calendar in a variety of ways. 'View Item' displays the scheduling details for a selected scheduled item. 'View Day' displays details of the currently selected calendar day. 'View Week' displays the seven-day week in which the currently selected day appears, with less detail than the daily display. Weeks can be displayed in tabular or list format. 'View Month' displays a large-grain view of the current month. 'View Year' displays a very large-grain view of the current year. Each of these view commands can display its results in a separate window. With this feature, the user can create side-by-side displays to view any number of consecutive days, weeks, months, or years.

'View Next' and 'View Previous' move forward and backward in the current display, based on the display granularity (i.e., item, day, week, month, or year). 'View Goto Date' displays a dialog for choosing a specific date to become the current date in the active display.

'View Lists' displays lists of currently scheduled items of the four schedule types -- *Appointments*, *Meetings*, *Tasks*, and *Events*, or of all item types together. Custom lists can also be created, showing selected items only. 'View Filter' allows the user to hide selected information from calendar displays. Any or all of the four types of scheduled items can be selectively hidden. The user can also construct custom viewing filters, based on a wide range of filtering criteria. Custom filters apply to both calendar and list views uniformly.

'View Other User' allows the current user to view the public portions of other users' or groups' calendars. Each individual user controls the visibility of scheduled items that other users may see.

'View Windows' allows the user to select for viewing from all active display windows. The 'Close' command in the 'View Windows' menu closes the current display window by removing it from the screen.

The 'Windowing Mode ->' submenu provides three settings for the Calendar Tool windowing mode. In 'Two-Window' mode, all views are shown in just two windows, one for calendars and the other for lists. In the default 'Per-Level' mode, each level of the calendar, from individual item through full year, is shown in a separate level-

specific window; each type of list is also shown in a separate window. In 'Multi-Window' mode, the result of each and every view command is shown in a separate window, even for commands at the same level or the same type of list. Multi-window mode allows the user to create side-by-side displays of adjacent calendar periods.

The View Windows Magnetize command controls the "magnetic" property of display windows. When a window is magnetized, it "sticks to" an adjacent window when dragged next to it.

The Admin menu contains commands to access the three system databases -- users, groups, and locations. The *User* database contains a record for each officially registered user of the Calendar Tool. The *Group* database defines user groups, primarily for meeting scheduling purposes. The *Location* database defines rooms and other venues in which meetings can be held, including information about the facilities available in the locations. Regular users only have read access to the databases, that is they cannot add, change, or delete any database information.

The 'Admin Central Host' command displays the identity of the computer that is used to coordinate calendar tool users. 'List Admins ...' shows the Calendar Tool IDs of all system administrators. The 'Login' command allows a user with administrative privileges to launch the administrative interface from the regular user interface.

The 'Options menu has commands for setting various system options. The options are organized in four major areas: 'Times and Dates', 'Scheduling', 'Viewing', and 'Administrative'.

The Help menu contains commands for viewing documentation of the Calendar Tool. 'Help About' displays a brief description of the tool, including information about the tool developers and how they can be contacted. 'Show Quick Help' activates brief help messages that appear when the user moves the mouse over various areas of the display screen. 'Detailed Help' displays an online version of the complete Calendar Tool users manual.

2.1.2. Command Summary for Administrative Users

Figure 4 shows an expansion of the command menus for administrative access to the Calendar Tool databases. The 'File' menu has a reduced set of commands, since databases and system-wide options are stored in fixed files. The 'File Save' command saves all database changes performed by the administrative user. 'File Save Copy' saves a backup copy of the databases in a selected file directory. 'File Print' prints the contents of one or more databases in a form suitable for output to a printing device capable of displaying text and graphics. 'File Exit' exits Calendar Tool Administration, offering to save if necessary.

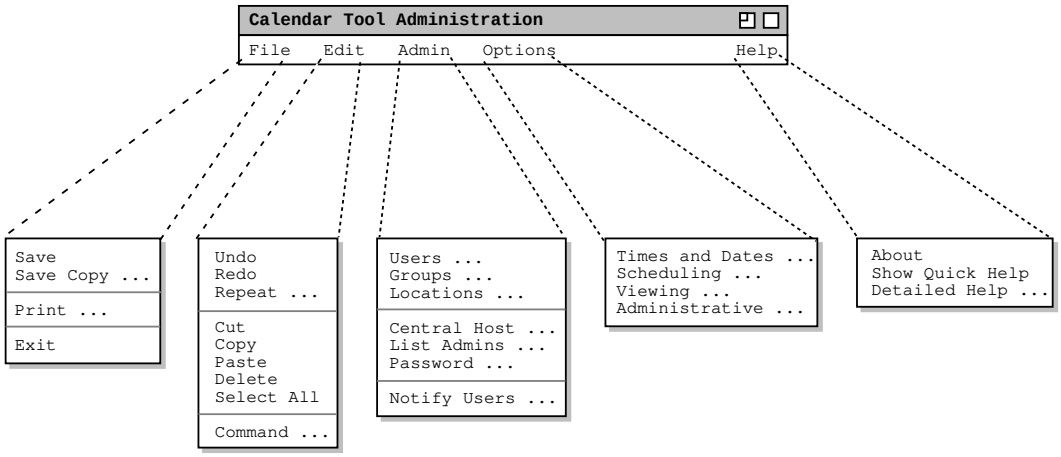


Figure 4: Expanded command menus for the administrative interface.

The 'Edit Menu' in the administrative interface is a proper subset that in the regular user interface. The edit commands that are present have the same functionality as in the regular interface.

The 'Admin' menu provides access to the three databases. Users with administrative privileges can add, change, and delete database information. The 'Central Host' command allows the administrator to view and change the identity of the Calendar Tool central host computer. 'List Admins ...' shows the Calendar Tool IDs of all system administrators. The 'Password' command allows the adminstrative user to set her own administrative access password. 'Notify Users ...' provides the means to send a message to some or all users.

The 'Options' menu has the same commands as for the regular user. When an administrator sets option values, the values serve as the defaults for all regular users.

The 'Help' functionality is same as for regular users. Help content is modified accordingly to describe the commands that are particular to administrative users.

2.1.3. Command Summary for Unregistered Users

The interface for unregistered users is a proper subset of the regular user interface. The following are absent in the unregistered user interface:

- the 'Schedule Meeting' command
- the 'View Other User' and 'View Group' commands
- the 'Admin' command menu
- the 'Options Administrative' command

Description of these commands is absent in the help content.

2.1.4. Screen Map

Figure 5 shows a hierarchical map of the user interface screens for regular users. Figure 6 shows a screen map for administrative users.

2.2. Basic Appointment Scheduling

This introductory scenario shows an individual user scheduling two simple appointments. Appointment scheduling is one of the most commonly performed operations with the Calendar Tool. In this scenario, the user is assumed to have just been registered in the Calendar Tool. Hence the user has a brand new calendar with no entries and the standard default settings for all options. Details of user registration and default calendar creation are covered in Section 2.6.

To schedule an appointment, the user selects the 'Appointment' command in the Schedule menu. In response, the system displays the dialog shown in Figure 6. The figure shows the appointment scheduling dialog that contains a number of data-entry fields for the various components of the appointment. The 'Title' field is a one-line string that describes the appointment briefly. The 'Date' field contains the date on which the appointment is to occur. The 'End Date' field applies only to recurring appointments; it is initially disabled (physically greyed out) since the default for an appointment is non-recurring. The 'Start Time' and 'Duration' fields specify the time the appointment starts and how long it lasts.

The information in the fourth row of the appointment dialog is used to specify whether, and if so how often an appointment recurs. Immediately to the right of the 'Recurring?' label is a check box. If it is checked on, then information pertinent to a recurring appointment changes from disabled (greyed-out) to enabled (solid type). The recurring information is the 'End Date', the recurring 'Interval', and the seven daily check boxes to the right of the 'Interval' box. The 'Interval' selection is one of 'Weekly', 'Biweekly', 'Monthly', or 'Yearly'. Complete details on scheduling recurring items are covered in Section 2.5.3.

Below the recurring information are additional data entry boxes. The 'Category' entry is a color-coded text string that categorizes the appointment for listing and filtering purposes. The appointment 'Security' indicates what

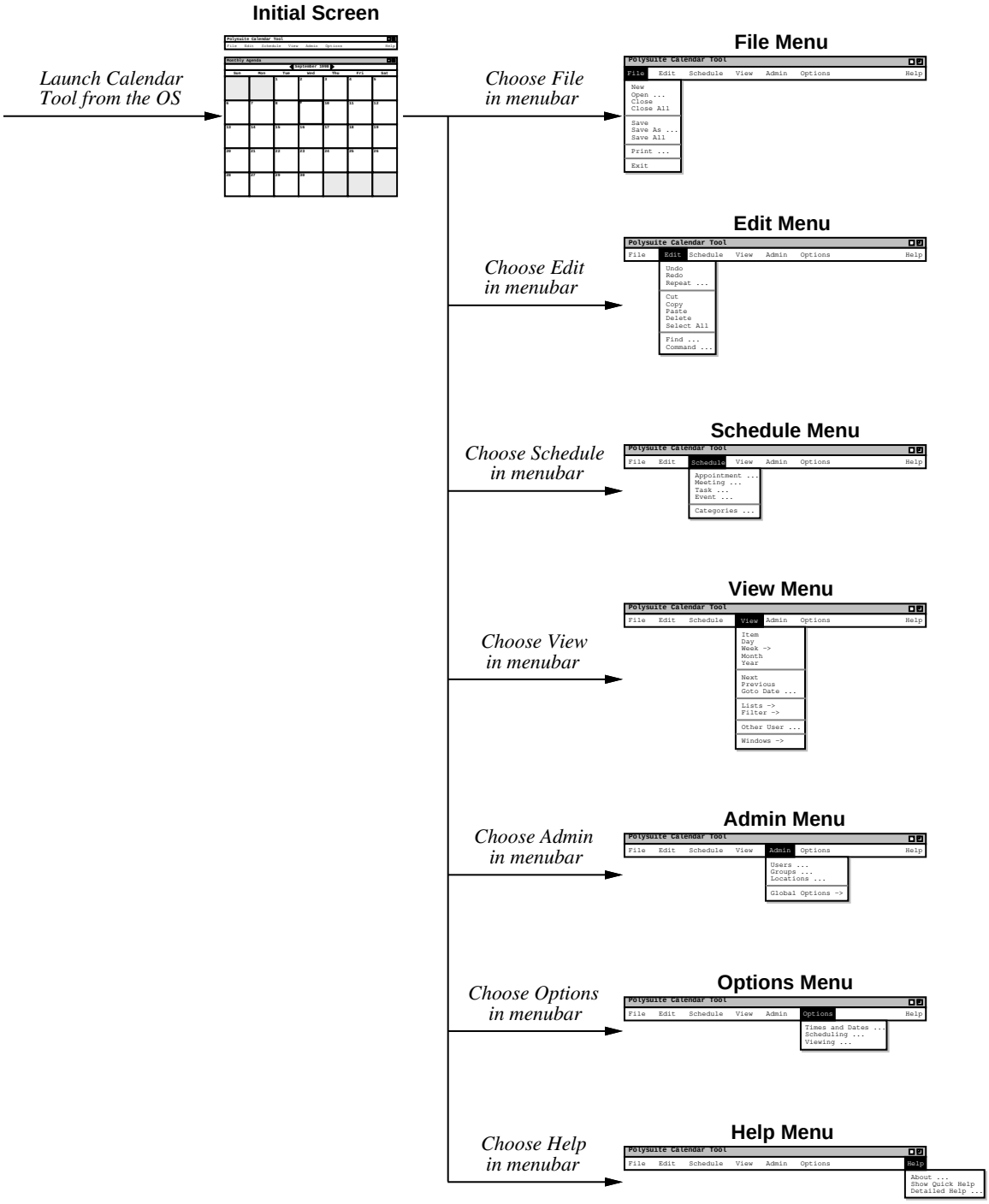


Figure 5: Top-level screen map.

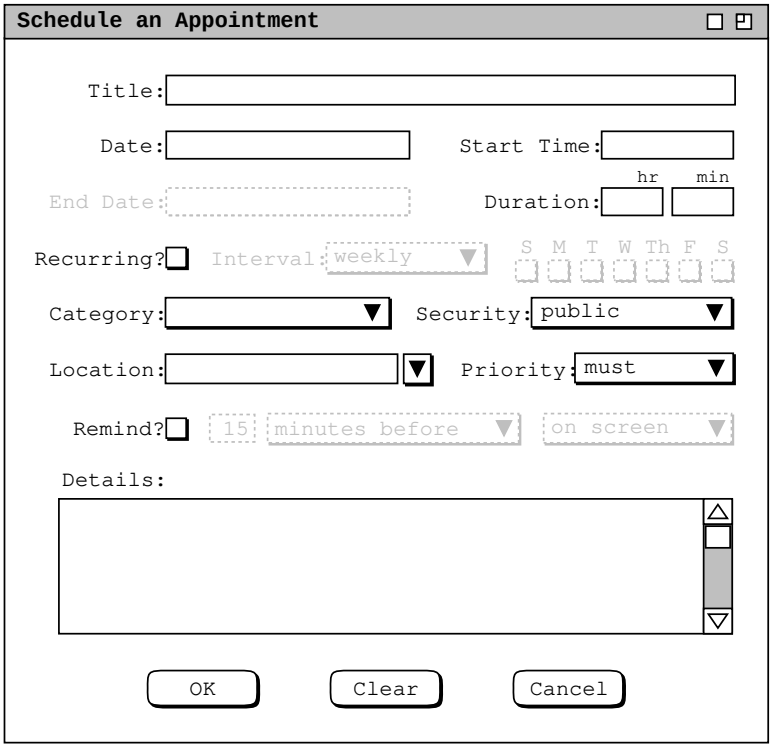


Figure 6: Appointment scheduling dialog.

portions of a user's calendar other users may see. The four security levels are: '`public`', '`title only`', '`confidential`', and '`private`'. The meaning of the four security levels is as follows:

- `public` -- other users can see all details of the appointment
- `title only` -- other users can see the title, time, date, and duration of the appointment, but no other information
- `confidential` -- other users can see the time, date, and duration of the appointment, but no other information; the appointment title shows as "Unavailable" to other users
- `private` -- other users can see no information at all about the appointment

Details of viewing other users' calendars are discussed in Section 2.3.5.

The appointment '`Location`' specifies where it will be held. The location value can be typed manually by the user or selected from a list of available locations, which are stored in the locations database. Further details of location definition and selection are covered in Sections 2.6.4 and Section 2.11.3 respectively.

The appointment '`Priority`' indicates whether an appointment is a '`must`' or '`optional`'. The priority is used to indicate the general importance of an appointment to the user. The priority is also used in meeting scheduling, where optional appointments can be automatically scheduled over if necessary. Meeting scheduling is discussed further in Section 2.4.1.

The data-entry row starting with '`Remind?`' is used to enable the sending of a reminder prior to the start of the appointment. When the '`Remind?`' check box is on, the other reminder information changes from disabled to enabled. The two data-entry fields immediately to the right of the check box indicate how soon before the appointment the reminder is sent. The small box is a numeric value and the other box is one of the three alternatives '`minutes before`', '`hours before`', or '`days before`'. To the right of the time-before entry is a menu for selecting how the reminder should be sent. The choices are '`on screen`' or '`email`'. Details of these reminder formats are covered in Section 2.5.4.

The bottommost data-entry area in the appointment dialog is for writing a detailed description of the appointment. The user may enter any amount of free-form textual information in the ‘Details’ field.

After the dialog appears on the screen, the user enters information by a combination of typing and selecting from pre-defined choices. Figure 7 shows the result of the user having filled in information for a new appointment titled "Dentist". The dentist appointment has a date, start time, and duration, but no end date since it is non-recurring. Since this is the user’s first time on the Calendar Tool, the only pre-defined appointment category is "Holiday". For the dentist appointment, the user decides to create a new category called ‘personal’.

To create a new appointment category, the user initially selects the down arrow next to the ‘Category’ display box. In response, the system displays the menu shown in Figure 8. Since the user wants to create a new category, she selects the ‘Edit ...’ command at the bottom of the menu, whereupon the system displays the dialog shown in Figure 9. The user then selects the ‘Add’ button, which brings up the dialog in Figure 10. To create the new ‘personal’ category, the user types into the ‘Category Name:’ text box, and then selects ‘Purple’ from the

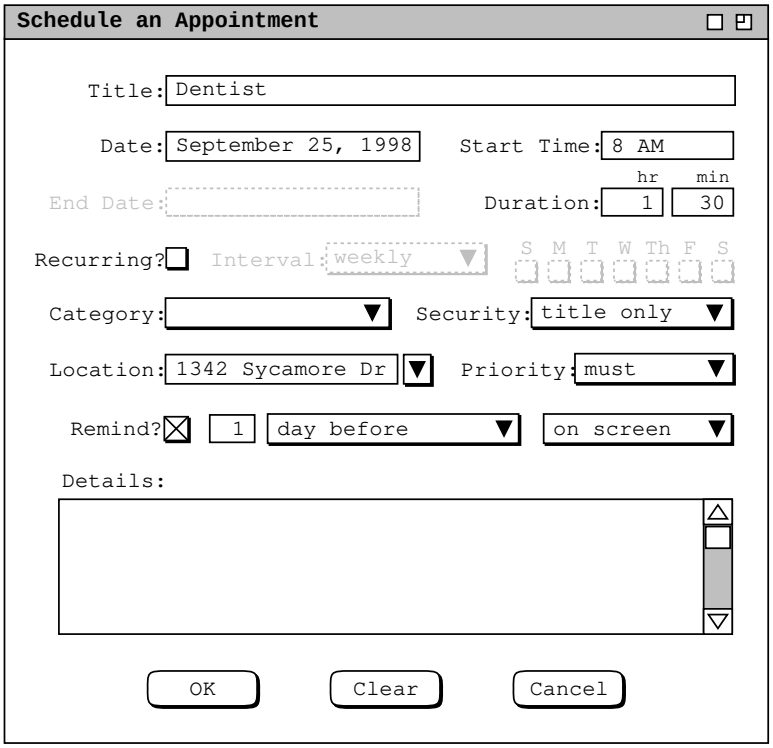


Figure 7: Scheduling a dentist appointment.

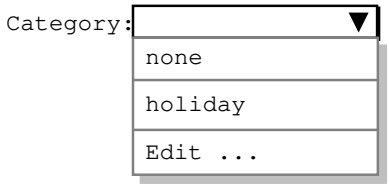


Figure 8: Initial categories menu.

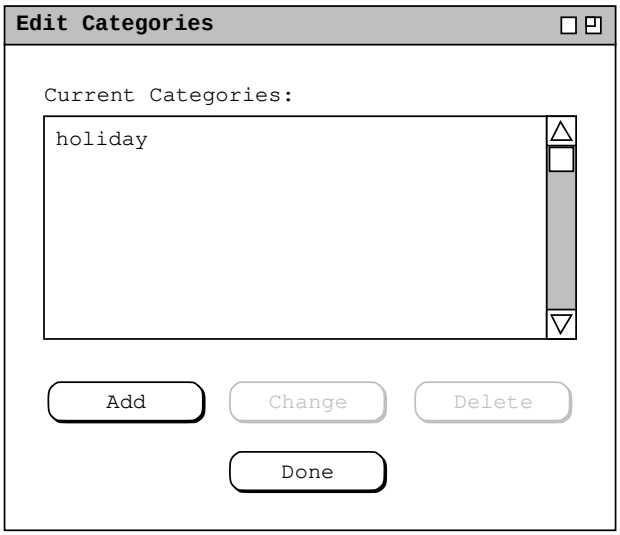


Figure 9: Edit categories dialog.

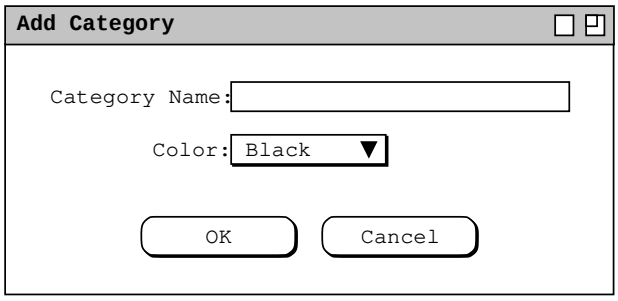


Figure 10: Add category dialog.

color selection menu, as shown in Figure 11. The user then presses the '`OK`' button to confirm the creation of the new category. To complete the edit, the user presses the '`Done`' button in the still pending edit–categories dialog. At this point, the system adds the purple-colored text for the newly created category, as shown in Figure 12.

To confirm the scheduling of the dentist appointment, the user presses the '`OK`' button in the main schedule-appointment dialog. At this point, the dentist appointment is added to the user's personal calendar.

The user now proceeds to create another appointment, following the same procedure as above for the dentist appointment. The resulting filled-in appointment dialog is shown in Figure 13. In this case, the appointment is recurring, scheduled for each Tuesday and Thursday between the specified start and end dates. Note that when the recurring check box is selected, the '`Date`' field label is changed to '`Start Date`' to clarify the display.

The user has set the priority for the new appointment to '`optional`' instead of '`must`'. The operative effect of selecting an '`optional`' priority relates to scheduling meetings, which is discussed further in Section 2.4.1. Aside from meeting scheduling, the meaning of '`must`' versus '`optional`' is purely informational, i.e., it indicates the relative importance of the appointment.

The information entered for a recurring appointment initially applies to all occurrences of the appointment. When the user confirms a recurring appointment with the '`OK`' button, the appointment is entered into the user calendar on

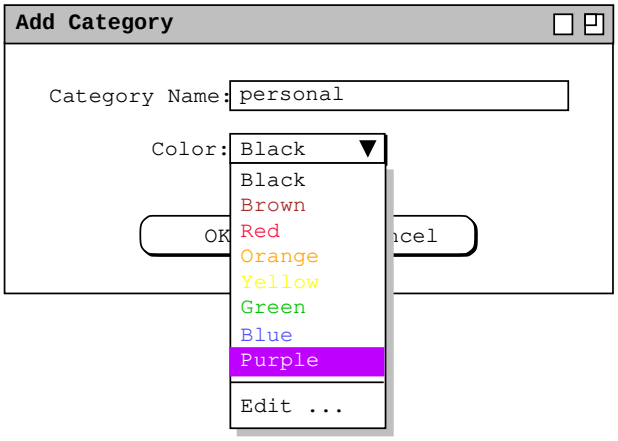


Figure 11: Creating a new category.

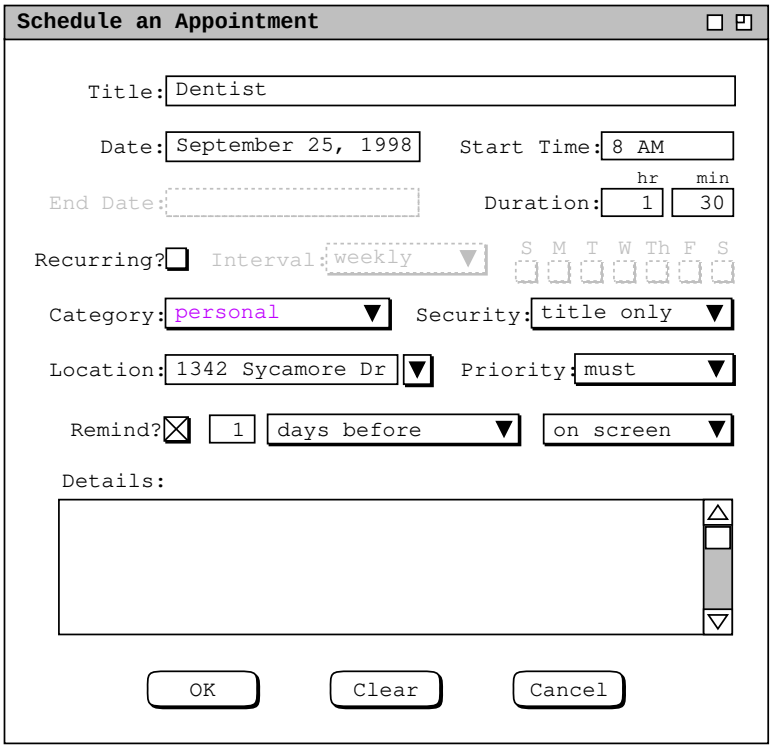


Figure 12: Dentist appointment with category filled in.

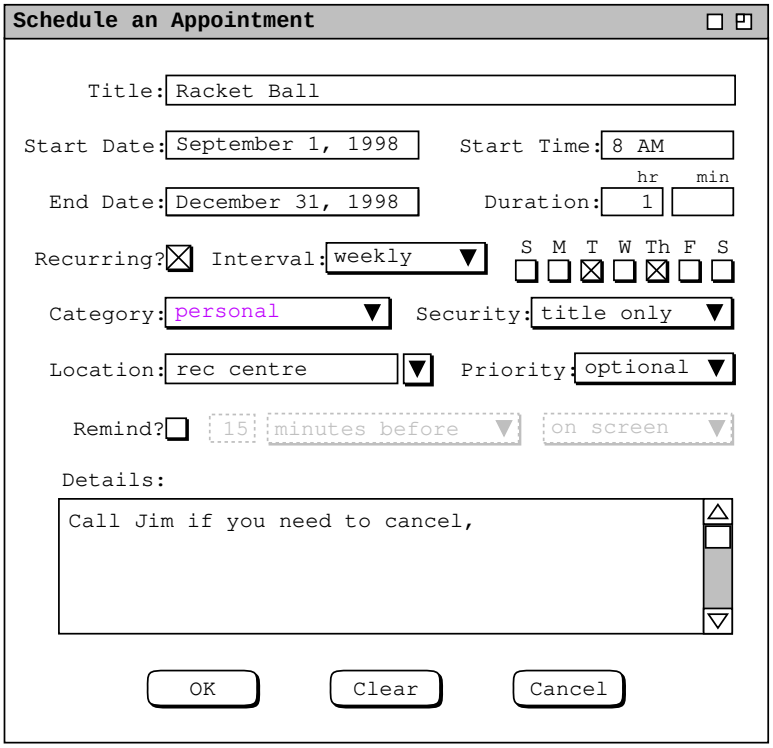


Figure 13: Scheduling a second appointment.

all of the specified dates. Subsequently, the user can change some or all of the information on a recurring appointment for some or all of the recurring dates. Details of how a recurring appointment is changed are covered in Section 2.5.2.1

To clear all information entered in an appointment dialog, the user presses the '`Clear`' button. In response, the system clears all typing areas and restores all other data-entry fields to their default states. Details of default settings are covered in Sections

and 2.7. To cancel a scheduling command entirely, the user presses the '`Cancel`' button. In response, the system removes the dialog from the screen without performing any scheduling action.

After scheduling and confirming an appointment, the appointment data are entered in an online working copy of the user's calendar. In order for the appointments to be permanently saved in the calendar file, the user must invoke the '`File Save`' command, as discussed in Section 2.8.3. The default name of the calendar file for new users is chosen by the system administrator, as described in Section . The user may save calendars on as many different files as desired. However, the filename chosen by the system administrator is the only name known to the Calendar Tool for group scheduling purposes. Further details of file commands are discussed in Section 2.8.

After the user presses the '`OK`' button in the scheduling dialog, the dialog itself is removed from the screen. The complete information for a scheduled appointment can be viewed by selecting the '`Item`' command in the '`View`' menu, or by double clicking on the title of an appointment in a daily, weekly, or monthly calendar display. Details of these displays are covered in the next section of the requirements.

2.3. Viewing Calendars

The scenarios in this section show a user viewing her personal calendar in a variety of ways, in particular:

- viewing the calendar at different levels of detail

- moving backward, forward, and to specific dates
- viewing lists of scheduled items
- filtered viewing

There is also a scenario showing how a user views the public portions of another user's calendar, including a group's "virtual" calendar. The viewing section of the requirements concludes with a scenario showing how to control multiple viewing windows, including the creation of new windows for side-by-side displays.

2.3.1. Viewing the Calendar at Different Levels

A calendar can be displayed at five levels of detail. The levels, from the greatest detail to the least are: an individual scheduled item, a day, a week, a month, and a year. The commands to show these levels are the first five items in the '`View`' menu (see Figure 3). In the discussion that follows, these are referred to as the *view-level* commands.

During normal use of the Calendar Tool, the user has one or more viewing windows displayed on the screen. The most recently selected window is called *current*. When the user wants to view the calendar at a different level than is displayed in the current window, she chooses one of the five view-level commands.

Normally, each of the five viewing levels is displayed in a separate level–specific window, sized appropriately to fit its contents. For example, if the user executes a '`View Day`' command followed by a '`View Year`' command, both a daily and yearly window are displayed on the screen.

By default, one separate window is used at each of the five view levels. Hence, there are up to five windows for the view-level commands, each holding the result of the most recently executed command at a particular level. When the user changes the display at a particular level, that level's display is changed and brought to the front, without a new window being created. For example, if the user moves from one day to the next at the daily level, the day-level display window is changed, with no new window created.

The user may change the default display style by selecting *two-window* or *multi-window* viewing mode in the `Windows` menu. In two-window mode, the results of all viewing commands are shown in just two windows, one for calendars and the other for lists. In multi-window mode, the results of each and every view command are shown in a separate new window, even for commands at the same level. For example, if the user executes two successive '`View Month`' commands in multi-window mode, the results are shown in two separate month-view windows. This allows the user to create side-by-side displays of different calendar periods. Complete details of two-window and multi-window viewing are described in Section 2.3.6.

By default, the target date for all view-level commands is today's date. The user can select another target by clicking on a desired date in the current window. For example, the user can click on a specific date in a month view and choose the 'View Day' menu item. In response, the system displays the day-level view for the selected date. Complete details of target date selection are covered in Section 2.11.5

2.3.1.1. Day View

To view the daily details for today's date, the user chooses the '`View Day`' menu command. In response, the system displays a window of the form shown in Figure 14. To view the details of a day other than today, the user selects the name or date of the desired day in the current display, and then chooses the '`View Day`' menu command. An interface shortcut to view a particular day is to double click on the name or date of the desired day in the current display.

In Figure 14, the user is viewing the details of Wednesday, September 23, which is today's date in this scenario. The items shown in Figure 14 reflect a number of scheduling commands having been performed by the user, subsequent to the commands illustrated in the scenario of Section 2.2. In particular, the user has scheduled some typical items such as meetings, lunch dates, and class lectures.

The day view shows the scheduled items for a day in abbreviated form. The column on the left lists the starting times for scheduled items. The wider column on the right shows the item titles. The displayed title for one item is

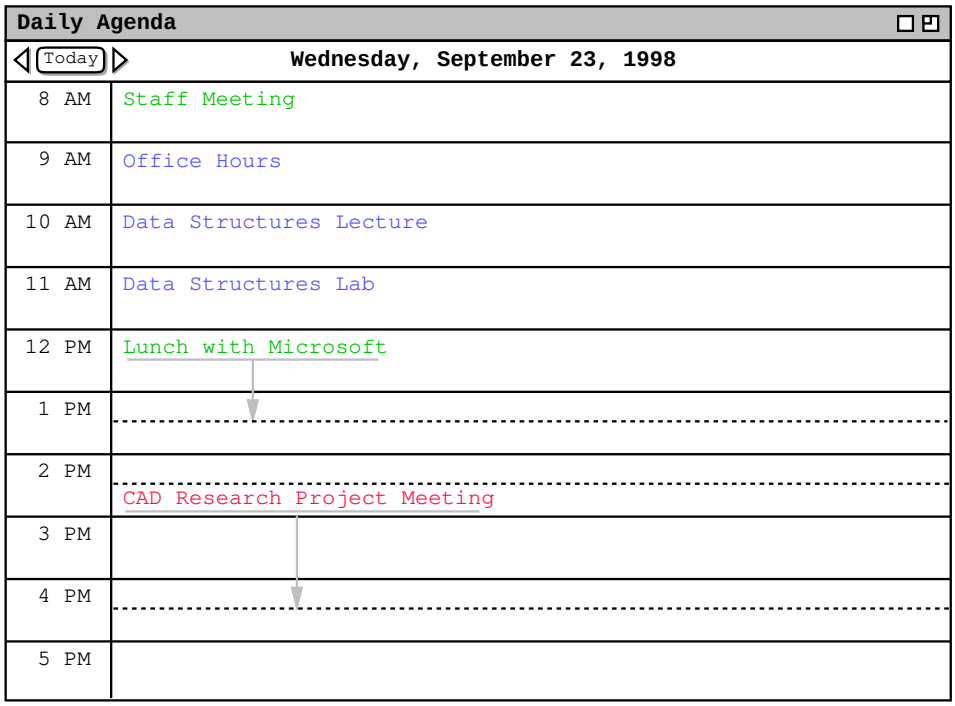


Figure 14: Day view.

always a single line high; long titles are viewed by horizontal scrolling or enlarging the display window as necessary. The following are details of how information is presented in a day view:

a. When an item starts and ends exactly on the hour, it is listed at the top of the row for the starting hour. For example, the "Staff Meeting" item shown in Figure 14 starts on the hour, and is thus displayed at the top of the 8AM to 9AM time slot.

b. When an item starts at a time other than on the hour, the text for the item is placed proportionally down from the top of the hour, with a dashed line immediately above the text. For example, the "CAD Research Project Meeting" starts at half-past the hour, and is thus displayed half way down in the 2PM to 3PM time slot.

c. When an item ends at a time other than on the hour, a dashed line is placed proportionally at the ending time. For example, the "CAD Research Project Meeting" ends at 4:30PM, and its ending time is thus displayed as a dashed line in the middle of the 4PM to 5PM time slot.

d. When an item ends in an hour after the hour in which it begins, a down-pointing arrow is drawn to the ending time. This case is also illustrated by the "CAD Research Project Meeting".

Immediately below the window banner in the day view is a full description of the day of the week, month, and year. To the far left of the day description are three buttons -- a left-pointing arrow, right pointing arrow, and one labeled '`Today`'. The arrow buttons used to change the display to the previous or next calendar day. The '`Today`' button is used to return to today's date. For example, when the user chooses the right-pointing arrow in the display of Figure 14, the display changes to that shown in Figure 15. Figure 15 shows a display when events and tasks are scheduled, in addition to appointments and meetings. When all four types of item are scheduled, the items are organized into three display areas:

a. events are listed immediately below the full date label;

b. tasks are listed below the events;

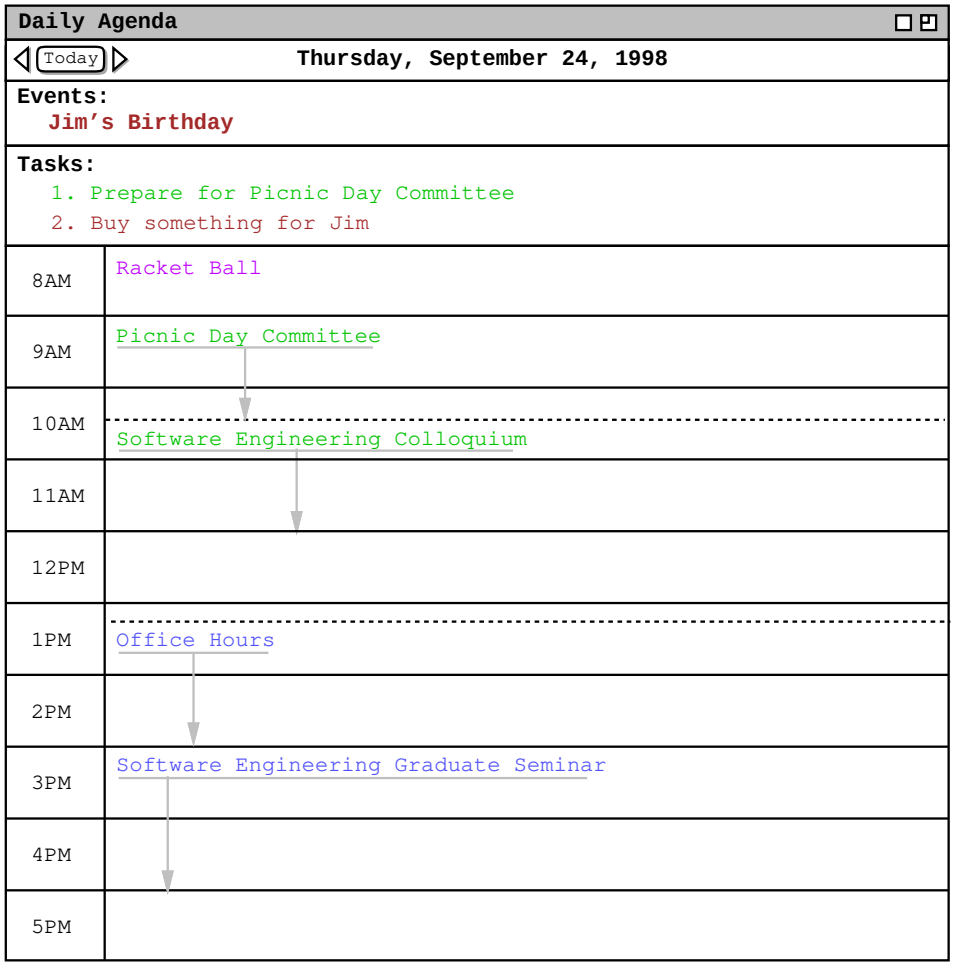


Figure 15: Result of pressing the next day arrow.

c. following the tasks are the co-mingled appointments and meetings, listed in time slots.

If more than one event is scheduled, the events are displayed in a multi-line list, one event title per line, sorted alphabetically by title. Event titles are shown in boldface font. Tasks are displayed in a numbered list, one task title per line, sorted first by due time, second by priority, and third by title. Tasks without due times appear at the end, sorted first by priority and second by title.

When no events or tasks are scheduled for a particular day, those display areas are absent. For example, Figure 14 shows the case where no events or tasks are scheduled for a day, whereas Figure 15 shows the case where both events and tasks are scheduled. If only events but not tasks are scheduled, or vice versa, the scheduled events or tasks are displayed, and the other display area is absent.

The following options are available to control the format of the day display:

a. *Normal time range.* This option defines the starting and ending times that normally appear in the left column of the display. The default range of times is 8AM to 5PM.

b. *Time increment.* This option defines the time increment of the left column labels. The smallest allowable time increment is five minutes, the largest is twelve hours. When the time increment is less than one hour, the time labels are shown in hour and minute format; when the increment is one hour or greater, the labels

are shown as hours with no minutes. The default increment is one hour.

c. *Increment height.* This option defines the default minimum number of text lines shown in each time increment. If there are more items starting in an increment than fit in the minimum number of lines, the system automatically increases the height for that increment to a size sufficient to display all items fully. The default value is two lines per increment.

d. *Show/hide 24 hours.* This option toggles between showing a full 24 hours of display versus the normal time range only. If the 24-hour time range is shown, non-normal times are shown with a light grey background, to distinguish them from normal times. The default value for this option is to hide non-normal times.

e. *Show/hide exact time.* This option toggles between showing or not showing the starting and ending times for each scheduled item immediately to the left of the title. This option is useful when items do not typically start or end exactly on the hour. The default value for this option is to hide the exact time.

f. *Show/hide dashed lines.* This option toggles between showing and not showing the dashed lines that appear above and below items that do not start or end on the hour. The default is to show dashed lines.

g. *Show/hide extension arrows.* This option toggles between showing and not showing the down-pointing arrows for items with end times that extend beyond the hour of the start time. The default is to show extension arrows.

h. *Proportional spacing on/off.* This option toggles between placing items proportionally down from the top of the hour based on starting time. When the option is off, the first (only) item in an hour is placed at the top of that hour and any other items starting in the hour are placed immediately below it. The default is proportional spacing on.

i. *Display overlaps horizontally or vertically.* This option controls how items with overlapping times are displayed. When displayed horizontally, overlapping items appear side-by-side in separate columns of the day view. When displayed vertically, overlapping items appear on separate lines in a single column, sorted by start time, duration, and title. The default is horizontal display.

j. *Default display width* and *default display height.* These options control the default width and height of the full daily display. If one or both of the default dimensions is too small to accommodate all information in the display, the information is truncated appropriately and scrollbars are added to the display window. Details of how this truncation is performed are covered in Section 2.13.2.

The user sets these options using the dialogs described in Section 2.7.2.

As an example of alternate option settings, Figure 16 shows a day view of the same information shown in Figure 14, with the following non-default option settings: normal time range 7AM to 6PM; time increment of 1/2 hour; increment height equal to one line; show 24-hour display; show exact time; hide dashed lines; and hide extension arrows. Figure 16 shows a fully expanded window, with all 24 hours of the day visible. If the user shrinks the window display vertically, a vertical scrollbar appears to allow viewing the non-visible hours. Further details on the effects of display resizing are covered in Section 2.13.2. Specific details on the effect of all the display options are presented in Section 2.7.3.

To illustrate the display of overlapping items, Figure 17 shows an updated version of the daily schedule shown in Figures 14 and 16. Here the user has added three new items, with times that overlap with previously scheduled items. The new items are a "TA Meeting" from 8 - 9:30 AM, a "College Meeting" from 2 - 3 PM, and a "Special Colloquium" from 2 - 3:30 PM. The overlapping items are shown in two new columns next to the items with which they overlap. The left-to-right order of items is based first on start time (earliest first), second on duration (shortest first), and third on alphabetic order of the title. Note that this ordering has placed the "CAD Research Project Meeting" in the rightmost column, even though this item was scheduled by the user before the items with which it overlaps. That is, the order of overlapping items does not depend at all on the chronological order in which the user executes scheduling commands.

The layout of overlapping items may be further complicated when three or more items do not overlap fully, for example if the user were to add an appointment from 3-4PM to the schedule shown in Figure 17. The precise layout rules for such cases are covered in Section 2.13.2.2.

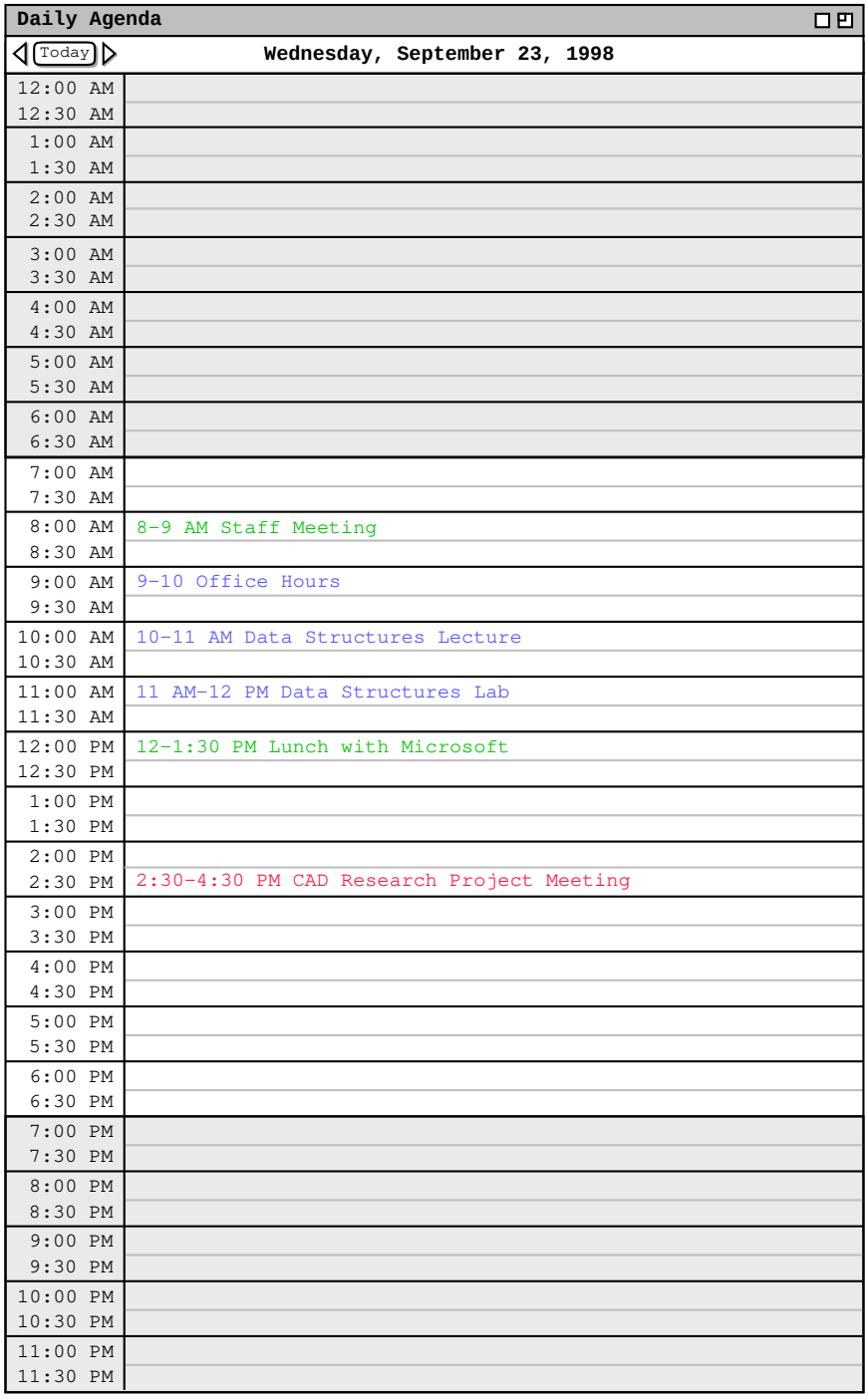


Figure 16: Day display with non-default option settings.

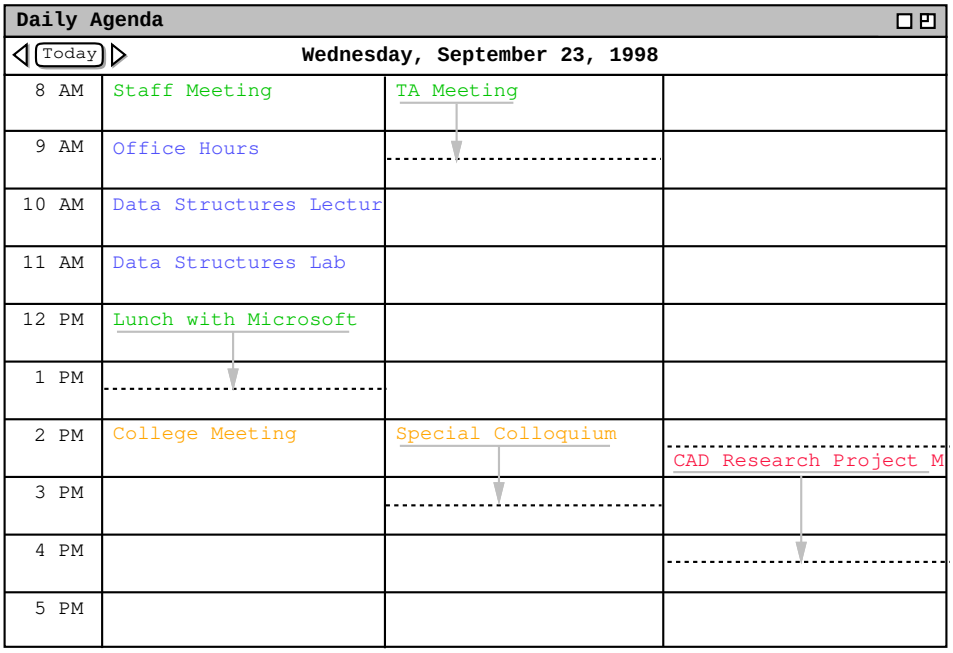


Figure 17: Day view with overlapping times.

In displaying overlapping items horizontally, the system attempts to display the full width of all items in one screen. If there is insufficient physical screen width to display all items in full width, the system truncates the display, leaving overlap columns of equal width. If the display window is resized, each column is resized proportionally and equally. Further exact details of truncation and display resizing are covered in Section 2.13.2.1.

Figure 18 shows the same information as Figure 17, after the user has changed the overlapping display option from *horizontal* (the default) to *vertical*. When the user selects the vertical display option for overlapping items, the system automatically turns on the *show exact times* option and turns off the *dashed lines*, *extension arrows*, and *proportional spacing* options. Turning off these three options is necessary since they are generally incompatible with the vertical display of overlaps. (The reader is invited to think this through clearly.) If the user subsequently sets the overlapping-item display option to horizontal, the system restores the settings of all automatically-set options to their values prior to their automatic setting.

Of note in Figure 18 is the automatic resizing of the 2PM time slot from two to three rows, even though the current setting of the *increment height* option is 2. Whenever the number of items in a time increment is greater than the current increment height, the system automatically increases the height of the affected increment to show all items that start in that increment. This automatic height increase is performed as necessary for any time increment in a day view, not just for increments with overlapping items.

2.3.1.2. Week Views

After the day view, the next larger-grain level of viewing is a week. There are two choices for the format of the week view: table and lists. These choices are available on a submenu when the user chooses the '`Week`' command from the '`View`' menu. When the user chooses the table–style week view, the screen appears as shown in Figure 19.

When the user chooses either style of week view, the displayed week is the one that contains the most recently selected day. Here for example, the user is viewing the week that contains the most recently viewed day of Wednesday, September 23. The current date, that is today's date, is highlighted with a darkened border in the week display. In this scenario, for example, the current date is Wednesday, September 23.

Daily Agenda

Today **Wednesday, September 23, 1998**

8 AM	8–9 AM Staff Meeting 8–9:30 AM TA Meeting
9 AM	9–10 AM Office Hours
10 AM	10–11 AM Data Structures Lecture
11 AM	11 AM–12 PM Data Structures Lab
12 PM	12–1:30 PM Lunch with Microsoft
1 PM	
2 PM	2–3 PM College Meeting 2–3:30 PM Special Colloquium 2:30–4:30 PM CAD Research Project Meeting
3 PM	
4 PM	
5 PM	

Figure 18: Day view with overlapping times, displayed vertically.

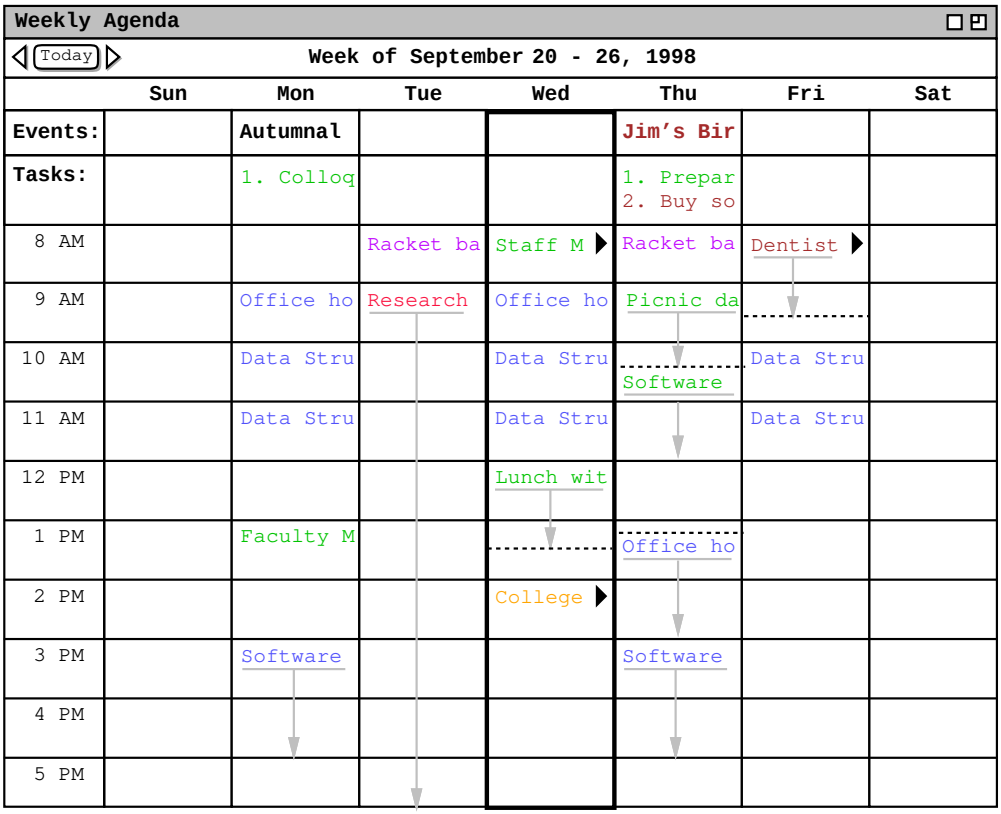


Figure 19: Table-style week view.

The table-style weekly view shows items in the same format as the day view, except with narrower columns to accommodate all the days of the week. Each item is shown with as much of the title as fits horizontally within its display area. The columns of the weekly table view are all of equal width. If the display window is resized, each column is resized proportionally and equally. Immediately below the window banner in the weekly view is the exact description of the week. To the left of the week description are arrow buttons to go to the previous and next weeks, and a '`Today`' button to return to the week containing today's date. As with the day view, if there are no events or tasks scheduled for the entire week, then the event and/or task display areas are absent.

A notable aspect of the weekly table view is the display format for days that contain overlapping items. In the example shown in Figure 19, there are three overlapping appointment times. These overlaps are indicated by solid right-pointing arrows wherever overlap occurs. When the user presses a right-pointing arrow, the display for the column scrolls to the left to allow overlapping items to be viewed.

Figure 20 further illustrates the display of overlapping weekly table items. The figure shows four excerpts of the weekly table view for the week of September 20, illustrating four stages of viewing overlapping items. In Figure 20a, three right-pointing arrows appear at Wednesday 8 AM, Wednesday 2 PM, and Friday 8 AM. Each arrow is positioned vertically at the start time of an overlapping item.

When the user clicks on the right-pointing arrow at Wednesday 2 PM, the list of 2 PM overlapping items scrolls to the left. The result is shown in Figure 20b, with the changed item circled. Figure 20c shows the result of the user clicking on the right-pointing arrow at Wednesday 8 AM. The display change is again circled. Of note in Figure 20c is that the Office Hour item at 9 AM has been removed from the display. When overlap scrolling in a weekly view, the system displays only complete overlapping items, no partial items. That is, the system removes all items from the display with which a scrolled-to item fully or partially overlaps.

a. Overlapping items to the right.

b. Pressed right arrow at Wed 2 PM.

c. Pressed right arrow at Wed 8 AM.

d. Pressed right arrow at Fri 8 AM.

Figure 20: Clarification of overlap in a weekly table view.

Figure 20d shows the result of the user clicking on the right arrow at Friday 8 AM. This change again illustrates how only one overlapping item is displayed at a time. That is, the Dentist appointment at 8 AM is not displayed at all in 20d, even though it would fit partially in the display. Figure 20d also illustrates that the left-pointing arrow always appears at the top of the item that is displayed. Hence, the left-pointing arrow in 20d appears next to the 9 AM office hour appointment, not in the empty 8AM slot where the Dentist appointment previously appeared.

When necessary, a left-pointing arrow appears to allow scrolling back. Examples of left-pointing arrows are shown in Figures 20b, 20c, and 20d. The 2 PM item in Figures 20b-d has both left- and right-pointing arrows, since there are overlapping items on both sides. When there are no further overlapping items, the left- or right-pointing arrow disappears, as appropriate. Disappearance of the right-pointing arrow is illustrated in the Wednesday 8 AM item in Figure 20c and the Friday 9 AM item in Figure 20d.

All of the display options available for the day view are also available for the table-style week view. In addition, the following display options are available for the week view:

a. *Show/hide title*. This option toggles between showing or not showing the title for each scheduled item. When the user selects to hide item titles, the system automatically turns on the *show exact times* option, if it is not on already. This prevents both the exact time and title from being hidden simultaneously. The default value for the show/hide title option is to show the title.

b. *Normal day range*. This option defines the starting and ending days that appear along the top of the display. The default range is Sunday through Saturday, inclusive.

The display of a list-style weekly view is shown in Figure 21. The Figure shows the same week as in the table-style view in Figure 19. In the list-style weekly view, the exact time for each item is always displayed, since there is no times column as in the table-style view. The display sizing constraints for the list-style view are the same as for the table-style view. Specifically, each item is shown with as much of the time and title as fit horizontally within its display area. The columns of the list-style view are all of equal width. If the display window is resized, each column is resized proportionally and equally.

For each day of the week, the items for that day are listed consecutively in the column for that day. The list starts with bold-faced event titles, if any, sorted alphabetically by title. Following the events are the scheduled tasks, if any. Tasks are numbered starting from 1, sorted first by due time, second by priority, and third by title. Tasks without due times appear at the end, sorted first by priority and second by title. After the tasks are the appointments and meetings, sorted first by start time (earliest first), second by duration (shortest first), and third by alphabetic order of the title. No further sorting criteria are necessary for appointments and meetings, since the system disallows multiple scheduled items with exactly the same values for date, start time, duration, and title.

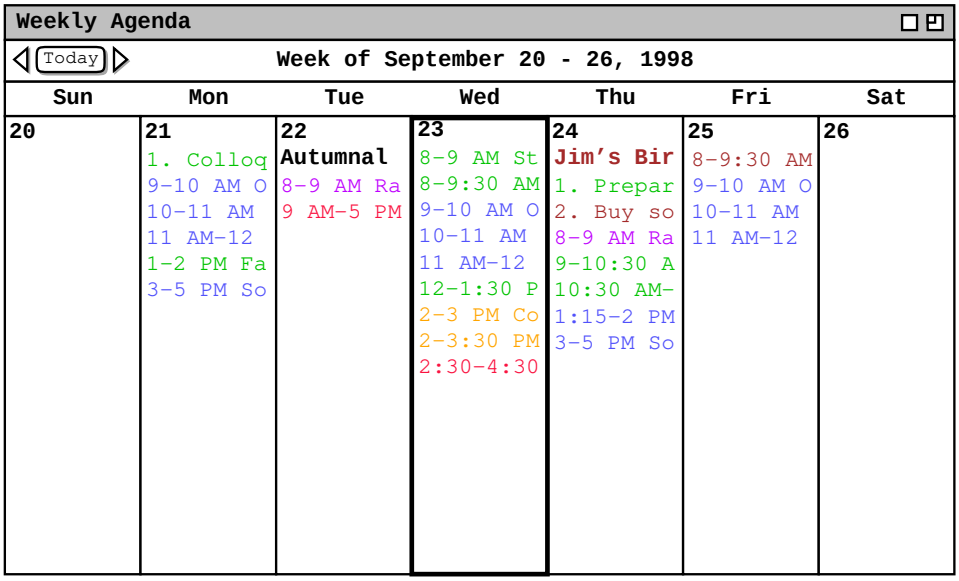


Figure 21: List-style week view.

A subset of the table-style display options are applicable for the list-style weekly view. These options are:

a. *Normal day range*.

b. *Show/hide title*.

c. *Default display width* and *default display height*.

Each of these options has the same meaning and defaults as for the table-style weekly view.

2.3.1.3. Month View

An example of the month view was shown originally in the initial screen configuration (Figure). since the month view is the standard default. It is chosen explicitly with the '`Month`' command from the '`View`' menu. Figure 22 shows the result of the user making this selection for the month of September 1998. The Figure shows the scheduled items that have been added during the course of the scenarios up to this point. The current date is highlighted with a darkened border. Immediately below the window banner is the name of the month, with arrow buttons to go to the previous and next months, and a '`Today`' button.

In the month view, the display format for an individual day is the same as the list-style weekly view. That is, the time and title for each item are displayed in a vertically-formatted list, sorted by start time, duration, and title. Since the height of each day in the month view is considerably shorter than in the week view, a transient vertical scrollbar is provided when the number of items in a day is greater than fits vertically in the display box for a day. "Transient" for the scrollbar means that it only appears when the user clicks within a day for which scrolling is necessary. For example, if the user clicks within the display box for Monday September 21 (in Figure 22), the scrollbar appears as

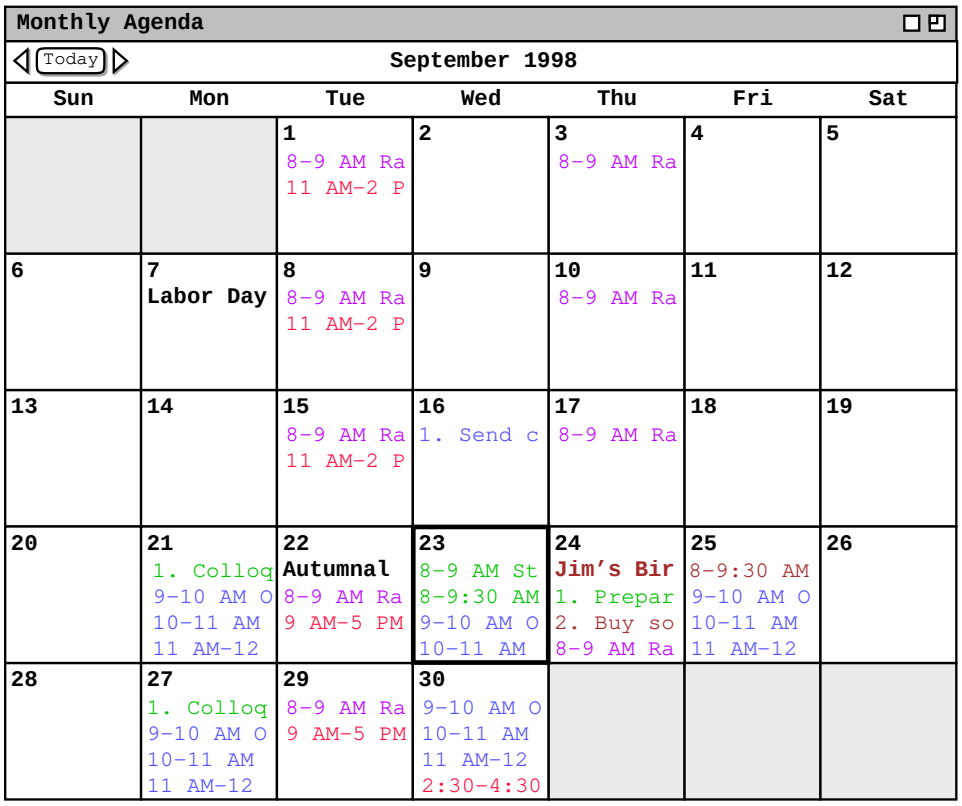


Figure 22: Month view.

shown in Figure 23. The scrollbar appears since there are more items scheduled for September 21 than fit in the current size of the September 21 box. If the user clicks within a day where scrolling is not necessary, such as September 22, no scrollbar appears. A displayed transient scrollbar for any day disappears when the user clicks anywhere outside of the day in which the scrollbar appears.

A subset of weekly list-style display options are applicable to the month view. These options are:

a. *Show/hide title*.

b. *Default display width* and *default display height*.

These options have the same meaning and defaults as for the list-style weekly view.

2.3.1.4. Year View

The largest-grain calendar view is a year, as shown in Figure 24. The current date is highlighted with a rectangular border. Immediately below the window banner the year number, with arrow buttons to go to the previous and next years, and a '`Today`' button.

Unlike the smaller-grain views, the yearly view shows no information about scheduled items. The user may select any date as the target of another view command to show item details.

2.3.1.5. Scheduled Item View

The user may view the full scheduling details for an item shown in any day, week, or month display. To do so, the user selects the item time or title and then chooses the '`View Item`' menu command. A short cut to view item details is to double click on the item time or title in any larger-grain view.

Figure 25 shows the user having selected the item for 8 AM September 25 in a monthly view. When the user clicks anywhere in the item time or title, the system highlights the entire item. When the user then selects the '`Item`' command in the '`View`' menu, the system displays the item level view in Figure 26. This is the item-level view for an appointment. Details of item-level viewing for meetings, tasks, and events are presented later in Section 2.5.1.

The information displayed for an item is editable by the user. This editability distinguishes the item-level view from the larger-grain daily, weekly, and monthly views. That is, none of the larger-grain displays allows the user to edit any of the displayed item information.

The appointment item display in Figure 26 has the same data fields as the appointment scheduling dialog shown in Figure 6. The item display differs from the scheduling dialog as follows:

a. there is a time and date summary in the item display, just below the window banner;

b. the command buttons at the bottom of the item display are different than in the scheduling dialog.

The left and right arrow buttons at the top of the display are used to view the previous and next scheduled item, as described further in Section 2.3.2. The most important difference between the item-level display and the corresponding scheduling dialog are the command buttons along the bottom of the display window. Specifically, the scheduling dialog has '`OK`', '`Clear`', and '`Cancel`' buttons. In the item display, the buttons are '`Change`',

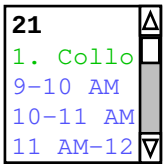


Figure 23: Transient scrolling in a month view.

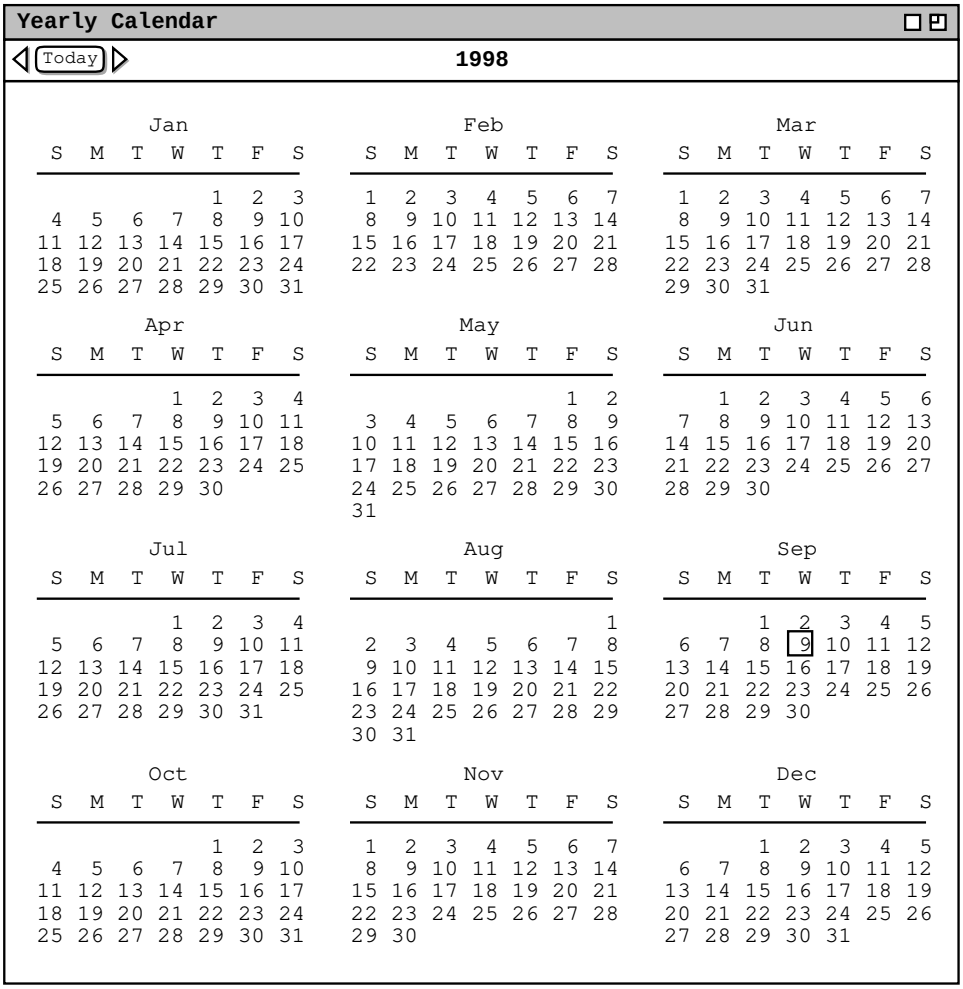


Figure 24: Year view.

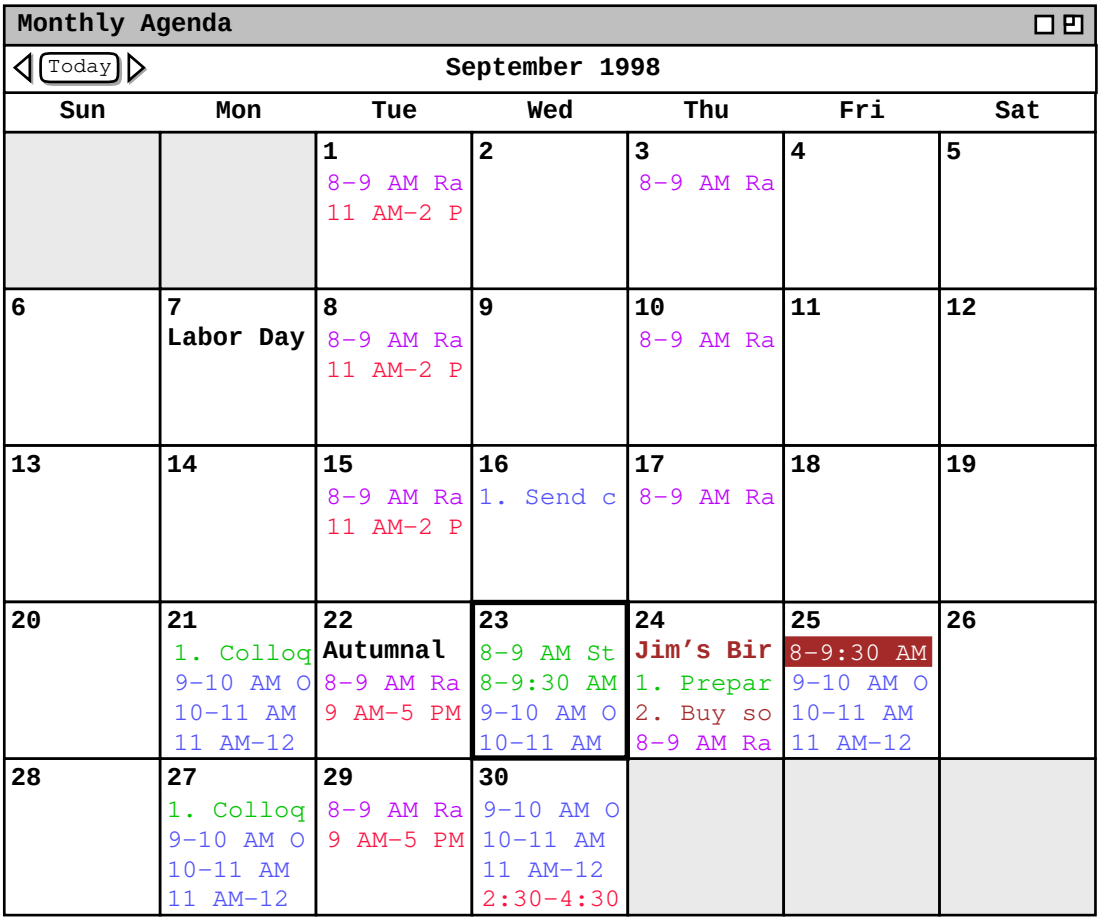


Figure 25: Item selected in monthly view.

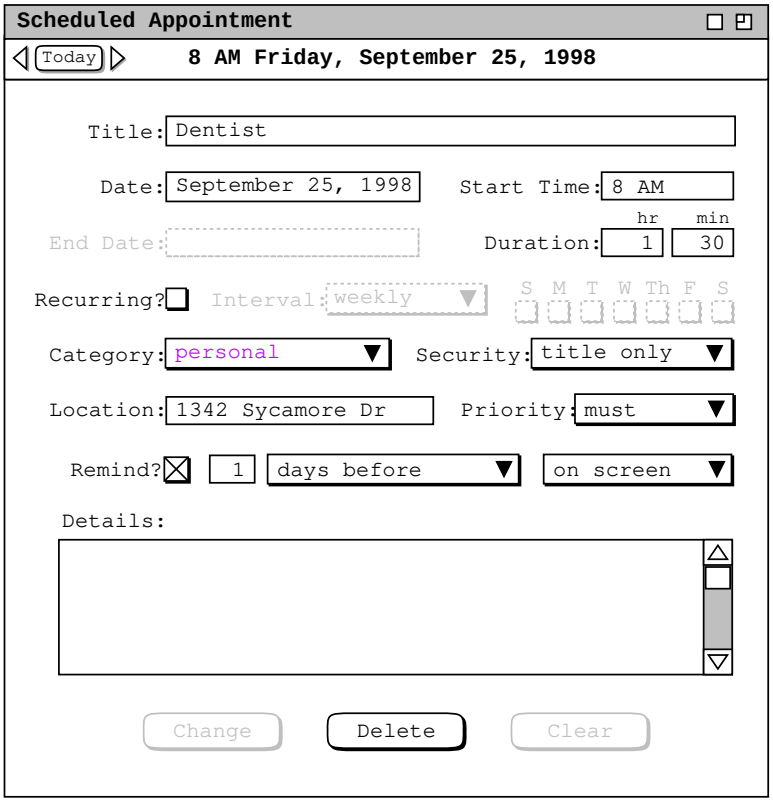


Figure 26: Details of selected scheduled item.

'Delete', and 'Clear'.

To change the displayed item, the user makes one or more changes in the item data fields and then presses the 'Change' button. As soon as the user changes one or more data fields, the 'Change' and 'Clear' buttons become enabled, and the 'Delete' button becomes disabled. To delete the displayed item (prior to editing any data fields), the user presses 'Delete'. The system responds with a confirmation dialog. If the user confirms affirmatively, the system deletes the scheduled item and removes the display from the screen. To clear any edits made since the dialog was intitally displayed, the user presses 'Clear'. This disables the 'Change' and 'Clear' buttons, and re-enables 'Delete'.

The effects of the change and delete commands are potentially wide-ranging, particularly for recurring items or meetings with many attendees. Complete details of item change and deletion are covered in Section 2.5.2

2.3.2. Viewing Previous, Next, and Specific Calendar Dates

Immediately below the 'Year' on the 'View' menu are the three commands 'Next', 'Previous', and 'Goto Date'. These commands provide a quick means to go to another calendar date than is in the current display.

2.3.2.1. Next and Previous

The effect of 'View Next' and 'View Previous' is based on the level of the current display. At the day, week, month, and year levels, the 'View Next' command changes the display to the next calendar unit at that level. At the item level, 'View Next' changes the display to the chronologically next scheduled item, if any. The 'View Previous' command operates analogously in the backward-time direction. An example of the effect of 'View Next' at the day level is illustrated in Section 2.3.1.1 in the transition from Figure 14 to Figure 15.

The right and left arrow buttons at the top of the view-level displays are shortcuts for the 'View Next' and 'View Previous' commands, respectively. These arrows appear to the far left of the date headers, as shown in Figures 14 , 19 , 22 , 24 , and 26 . Pressing one of these arrows has precisely the same effect as the corresponding menu command. Using the shortcut arrow keys is most effective when multi-window mode is *off*. With multi-window mode off, the user can leave the mouse in a fixed position on the screen while repeatedly pressing a next or previous arrow. This permits the user to move more rapidly in the next and previous directions. Further details of the multi-window display option are covered in Section 2.3.6.

At the item-level of display (Figure 26), moving in the next and previous directions is fundamentally different than at the day through year levels. Specifically, movement at the item level is non-uniform through time. At the day through year level, Next and Previous move exactly one unit of time at the given level. At the item level, Next and Previous move a variable amount of time, based on when the next or previous scheduled item appears in the calendar.

By default, 'Next' and 'Previous' at the item level move through the complete list of all scheduled items of all four item types, i.e., appointments, meetings, tasks, and events. The day−to−day order of the item list is conveniently visualized in a list-style week view, as shown in Figure 21. Within a given day, the order of scheduled items is as follows:

a. all events come first, sorted alphabetically by title;

b. tasks follow the events, sorted first due time, second by priority, and third by title;

c. the combined list of appointments and meetings come next, sorted first by start time, second by duration, and third by title.

Within a particular day, 'Next' and 'Previous' move through the items in this order. When a 'Next' command is executed at the last item of a day, the display is changed to the first item of the next day that has an item, if any. Similarly, when a 'Previous' command is executed at the first item of a particular day, the display is changed to the last item of the previous day that has an item, if any.

The default item-level behavior of 'Next' and 'Previous' can be altered with the 'View Filter' command, described in Section 2.3.4. By setting various filtering options, the user can change which items appear in the next/previous traversal, as well as the beginning and ending time ranges of the traversal.

If the current display window is not a calendar view or if there is no current window, the 'Next' and 'Previous' commands are disabled in the 'View' menu. A calendar view is a display created by one of the five view-level commands, i.e., 'Item', 'Day', 'Week', 'Month', or 'Year'.

2.3.2.2. Today

There are two ways to execute the command that displays information for today's date. The 'Today' menu command is immediately below the 'Prevous' command in the 'View' menu. There is also the small 'Today' command button between the left and right arrow buttons at the top left of all view-level displays. Both of these commands have exactly the same effect.

When the user selects a 'Today' command, the system changes the current or most recent calendar display to show the information for today's date. If there is no calendar display, the system displays a new window at the default start-up level. The exact behavior of the 'Today' command is the same as when the user enters today's date for the 'Goto Date' command, as described in the immediately following section of the requirements.

2.3.2.3. Goto Date

When the user selects the 'Goto Date' command from the 'View' menu, the system displays the dialog shown in Figure 27. The user enters the desired date and presses the 'OK' button to proceed. For example, Figure 28 shows the user having entered the date 31 October 1998. In response to 'OK', the system removes the dialog from the screen and updates the current display based on the entered date. The exact manner of display update is based on the level of the current display and the setting of the windowing mode option.

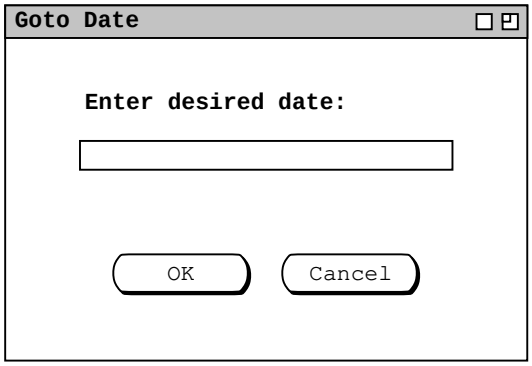


Figure 27: Goto date dialog.

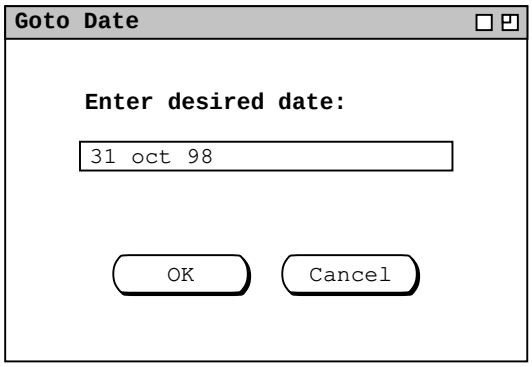


Figure 28: Goto date 31 Oct 98.

When per-level mode is on, the system responds to '`Goto Date`' by changing the current display, or by creating a new display window if there is no applicable current display. Specifically:

a. If the current display is at the month or year level, the system changes the display to the month or year that contains the selected date, and highlights the date number. For example, if the current display is at the month level when the user presses '`OK`' in Figure 28, the system updates the display as shown in Figure 29.

b. If the current display is at the week level, the system changes the display to the week containing the selected date and highlights the day name of that date. For example, if the current display is a list-style week view when the user presses '`OK`' in Figure 28, the system updates the display as shown in Figure 30.

c. If the current display is at the day level, the system simply updates the display to the selected date, with no component of the display highlighted.

d. If the current display is at the item level or not a calendar view, the system brings to the front the most recently active display window at the day, week, month, or year level, if any. This newly fronted window is then updated per the immediately preceding rule a, b, or c, whichever is applicable.

e. If there is no calendar view window on the screen, the system creates a new window at the standard start-up level and updates that window per the immediately preceding rule a, b, or c, whichever is applicable. The default start-up level is the month view; this default setting can be changed via the option settings commands described in Section 2.7.3.

If multi-window mode is on, the system follows these same rules, but instead of updating the current or most recently active window at a given level, it creates a new window at that level. The new window having been created,

Monthly Agenda

Today October 1998

Sun	Mon	Tue	Wed	Thu	Fri	Sat
				1 8-9 AM Ra 10:30-12 1:15-2 PM 3-5 PM So	2 9-10 AM O 10-11 AM 11 AM-12	3
4	5 1. Colloq 9-10 AM O 10-11 AM 11 AM-12	6 8-9 AM Ra 9 AM-5 PM	7 9-10 AM O 10-11 AM 11 AM-12 2:30-4:30	8 8-9 AM Ra 10:30-12 1:15-2 PM 3-5 PM So	9 9-10 AM O 10-11 AM 11 AM-12	10
11	12 1. Colloq 9-10 AM O 10-11 AM 11 AM-12	13 8-9 AM Ra 9 AM-5 PM	14 9-10 AM O 10-11 AM 11 AM-12 2:30-4:30	15 8-9 AM Ra 10:30-12 1:15-2 PM 3-5 PM So	16 9-10 AM O 10-11 AM 11 AM-12	17
18	19 1. Colloq 9-10 AM O 10-11 AM 11 AM-12	20 8-9 AM Ra 9 AM-5 PM	21 9-10 AM O 10-11 AM 11 AM-12 2:30-4:30	22 8-9 AM Ra 10:30-12 1:15-2 PM 3-5 PM So	23 9-10 AM O 10-11 AM 11 AM-12	24
25 Daylight	26 1. Colloq 9-10 AM O 10-11 AM 11 AM-12	28 8-9 AM Ra 9 AM-5 PM	27 9-10 AM O 10-11 AM 11 AM-12 2:30-4:30	29 8-9 AM Ra 10:30-12 1:15-2 PM 3-5 PM So	30 9-10 AM O 10-11 AM 11 AM-12	31 Halloween

Figure 29: Goto date 31 Oct 98 at the Month Level.

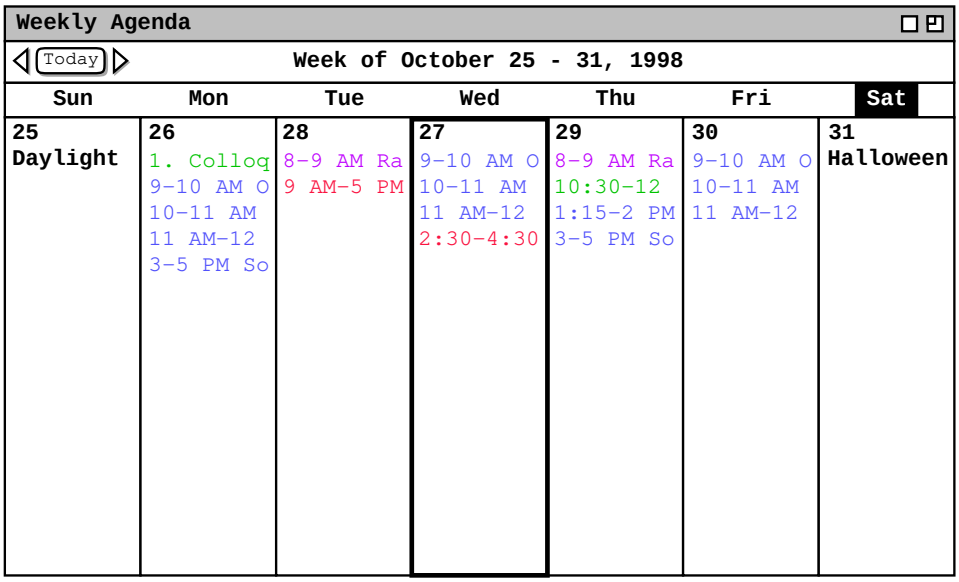


Figure 30: Goto date 31 Oct 98 at the Week Level.

the system updates the window per rule a, b, or c, whichever is applicable.

The user may enter dates in a variety of common formats. Details of these formats are covered in Section 2.11.1. If the user enters an improperly formated date string, the system highlights the entry and issues an audible alert, whereupon the user may retype the date or press the '`Cancel`' button to cancel the operation entirely. Further details of this and other error conditions are covered in Section 2.12.

2.3.2.4. Upper and Lower Date Bounds

The earliest and latest possible dates in a calendar are 1 January 0000 and 31 December 9999, respectively. These are the operative boundaries of the '`View Next`', '`View Previous`', and '`Goto Date`' commands at the day through year levels. At the item level, the operative boundaries of '`View Next`' and '`View Previous`' are the latest and earliest scheduled items, respectively.

When user issues '`View Next`' (or one of its shortcuts) at the upper end of the operative boundary, the command has no effect. Similarly, when the user issues '`View Previous`' (or one of its shortcuts) at the lower end of the operative boundary, the command has no effect. Specific details of how the system indicates a no-effect command are covered in Section 2.12.2.

2.3.3. Viewing Lists of Scheduled Items

The calendar views described in Section 2.3.1 are organized in standard calendar units of days through years. The user may also view scheduled items in the alternate form of ordered lists. To view a list of scheduled items, the user chooses the '`View Lists`' menu command. In response, the system displays the submenu shown in Figure 31.

The first four commands are used to list the four different types of scheduled item. The fifth '`All Items`' command displays a list of all four types of scheduled item. The last command displays a menu of custom views created by the user.

By default, one separate window is used for each of the six subcommands. For example, if the user executes '`View Lists Appointments`' followed by '`View Lists Meetings`', both an appointments list and meetings list window are displayed on the screen. Hence, there are up to six list windows, each holding the result of the most recently executed listing command. When the user re-executes a particular '`View Lists`' command, that

Figure 31: View lists submenu.

command's display is changed (if necessary) and brought to the front, without a new window being created. For example, if the user executes '`View Lists Appointments`', then adds two new appointments, and re–executes '`View Lists Appointments`', the appointments-list display window is changed, with no new window created.

As for the view-level commands of Section 2.3.1, the user may change the default display style by enabling *two-window* or *multi–window* viewing mode. In two-window mode, the results of view commands are shown in just two windows, one for calendars and the other for lists. In multi-window mode, the results of each and every viewing command are shown in a separate new window, even for lists of the same type. For example, if the user executes two successive '`View Lists Meetings`' commands in multi-window mode, the results are shown in two separate meeting list windows. Complete details of multi-window viewing are described in Section 2.3.6.

Multi-window lists are particularly useful when applied in conjunction with filtered viewing. For example, the user can display a list of two different categories of appointments in two separate side-by-side windows. Complete details of filtered viewing are presented in Section 2.3.4.

2.3.3.1. Appointment Lists

Figure 32 shows the response to the user's selection of the '`View Lists Appointments`' command.

Appointments, sorted by Date

Title	Date	Time	Duration	Recurs?	Category	Location	Security	Priority
Racket Ball	17 sep 98	8:00 AM	1 hr	yes	personal	Rec Cente	title	optional
Office Hours	21 sep 98	9:00 AM	1 hr	yes	classes	14-210	public	must
Data Structure	21 sep 98	10:00 AM	1 hr	yes	classes	14-256	public	must
Data Structure	21 sep 98	11:00 AM	1 hr	yes	classes	14-232	public	must
Software Engin	21 sep 98	3:00 PM	2 hrs	yes	classes	14-301	public	must
Racket Ball	22 sep 98	8:00 AM	1 hr	yes	personal	Rec cente	title	optional
Research	22 sep 98	9:00 AM	8 hrs	yes	research	14-210	public	must
Office Hours	23 sep 98	9:00 AM	1 hr	yes	classes	14-210	public	must
Data Structure	23 sep 98	10:00 AM	1 hr	yes	classes	14-256	public	must
Data Structure	23 sep 98	11:00 AM	1 hr	yes	classes	14-232	public	must
Lunch with Mic	23 sep 98	12:00 PM	1 hr 30	no	departmen	Staff din	public	optional
Racket Ball	24 sep 98	8:00 AM	1 hr	yes	personal	Rec cente	title	optional
Office Hours	24 sep 98	1:15 PM	1 hr 45	yes	classes	14-210	public	must
Software Engin	24 sep 98	3:00 PM	2 hrs	yes	classes	14-301	public	must
Dentist	25 sep 98	8:00 AM	1 hr 30	no	personal	1342 Syca	title	must
Office Hours	25 sep 98	9:00 AM	1 hr	yes	classes	14-210	public	must
Data Structure	25 sep 98	10:00 AM	1 hr	yes	classes	14-256	public	must
Data Structure	25 sep 98	11:00 AM	1 hr	yes	classes	14-232	public	must
Office Hours	28 sep 98	9:00 AM	1 hr	yes	classes	14-210	public	must
Data Structure	28 sep 98	10:00 AM	1 hr	yes	classes	14-256	public	must

Figure 32: Basic Appointments List.

The figure shows a list of appointments created by the user in the scenarios presented thus far. By default, the list is sorted primarily by date, secondarily by time, thirdly by duration, and fourthly by title. The default date range of the list is the three-week period starting one week prior to today's date. The default physical height of the list display window is twenty items. Any of these default settings can be changed using the options commands described in Section 2.7.3.

For the ongoing scenario, the current date is September 23. This means that the three-week period covers the dates September 16 through October 6, inclusive. Since there are more than twenty appointments scheduled in this period, the list window can be scrolled or resized to view the additional items.

The items in an appointments list are a somewhat abbreviated version of the information for a scheduled appointment. The precise extent of the abbreviations is as follows:

a. A list item has only a start date, with no end date. This is because there is a separate list item for every instance of a recurring appointment.

b. A list item has only a yes/no indication of whether the appointment recurs, not the full recurring information.

c. A list item contains no remind information or details.

The user can change the default order of the list by clicking on any of the column labels that appear in the display. For example, if the user clicks on the **`Title`** column label in Figure 32 the system updates the display to that shown in Figure 33, where the list items are sorted alphabetically by title. The precise sorting rules for each of columns are as follows:

a. The `Title` column is sorted in ascending lexical order of title string, ignoring differences in the case of letter characters. Lexical ordering is defined precisely as the case-insensitive characterwise comparison of strings based on the ASCII collating sequence, or comparable collating sequence in standard use in a particular operating environment.

b. `Date` is sorted in ascending chronological order.

c. `Time` is sorted in ascending time-of-day order.

d. `Duration` is sorted is in ascending order from shortest to longest duration.

Appointments, sorted by Title

Title	Date	Time	Duration	Recurs?	Category	Location	Security	Priority
Data Structure	21 sep 98	11:00 AM	1 hr	yes	classes	14-232	public	must
Data Structure	23 sep 98	11:00 AM	1 hr	yes	classes	14-232	public	must
Data Structure	25 sep 98	11:00 AM	1 hr	yes	classes	14-232	public	must
Data Structure	28 sep 98	11:00 AM	1 hr	yes	classes	14-232	public	must
Data Structure	30 sep 98	11:00 AM	1 hr	yes	classes	14-232	public	must
Data Structure	2 oct 98	11:00 AM	1 hr	yes	classes	14-232	public	must
Data Structure	5 oct 98	11:00 AM	1 hr	yes	classes	14-232	public	must
Data Structure	21 sep 98	10:00 AM	1 hr	yes	classes	14-256	public	must
Data Structure	23 sep 98	10:00 AM	1 hr	yes	classes	14-256	public	must
Data Structure	25 sep 98	10:00 AM	1 hr	yes	classes	14-256	public	must
Data Structure	28 sep 98	10:00 AM	1 hr	yes	classes	14-256	public	must
Data Structure	30 sep 98	10:00 AM	1 hr	yes	classes	14-256	public	must
Data Structure	2 oct 98	10:00 AM	1 hr	yes	classes	14-256	public	must
Data Structure	5 oct 98	10:00 AM	1 hr	yes	classes	14-256	public	must
Dentist	25 sep 98	8:00 AM	1 hr 30	no	personal	1342 Syca	title	must
Lunch with Mic	23 sep 98	12:00 PM	1 hr 30	no	departmen	Staff din	public	optional
Office Hours	21 sep 98	9:00 AM	1 hr	yes	classes	14-210	public	must
Office Hours	23 sep 98	9:00 AM	1 hr	yes	classes	14-210	public	must
Office Hours	24 sep 98	1:15 PM	1 hr 45	yes	classes	14-210	public	must
Office Hours	25 sep 98	9:00 AM	1 hr	yes	classes	14-210	public	must

Figure 33: Appointments list sorted by title.

e. `Recurs` is sorted with all '`yes`' values before all '`no`' values.

f. `Category` is sorted lexically in the same manner as `Title`. Items with an empty category value appear after all items with non-empty category value.

g. `Location` is sorted in the same manner as `Category`.

h. `Security` is sorted in the order '`public`', '`title`', '`protected`', '`private`'.

i. '`Priority`' is sorted with '`must`' values before '`optional`' values.

Since no single field value in an appointment is necessarily unique, the primary sorting order must be augmented with secondary, tertiary, quaternary and in some cases quintinary orders. Table 1 specifies the precise subordering for each of the column labels used as the primary sorting key.

Figure 33 shows how the banner of a list window is altered to indicate that a sorting order other than the default is in use. The format of the banner for all list displays is the following:

type-of-list`, sorted by` *field-name*

where *type-of-list* is one of **`Appointments`**, **`Meetings`**, **`Tasks`**, **`Events`**, or **`All Items`**; *field-name* is the name of item field used as the primary sorting key.

The default date range of the list can be changed using the custom list features described in Section 2.3.3.6, as well as with the filtering commands described in Section 2.3.4.1 The default display height and width can be changed using the general option commands described in Section 2.7.3.

2.3.3.2. Meeting Lists

To view a list of scheduled meetings, the user selects the '`View Lists Meetings`' menu command. Figure 34 shows the result of the user so doing. The list contains eleven entries, which reflects that fact that eleven meetings are scheduled for the default listing period of September 16 through October 6. The format of meetings lists is the same as appointments, with the addition of a '`Sched By`' column. This new column contains the id of the Calendar Tool user who scheduled the meeting.

The default sorting order for meeting lists is the same as for appointments. The '`Sched By`' column is sorted lexically in the same manner as '`Title`'. When '`Sched By`' is used as the primary sorting key, the secondary through quintinary sorting keys are, respectively: Date, Time, Duration, and Title.

Primary	**Secondary**	**Tertiary**	**Quaternary**	**Quintinary**
Title	Date	Time	Duration	
Date	Time	Duration	Title	
Time	Date	Duration	Title	
Duration	Date	Time	Title	
Recurs	Date	Time	Duration	Title
Category	Date	Time	Duration	Title
Location	Date	Time	Duration	Title
Security	Date	Time	Duration	Title
Priority	Date	Time	Duration	Title

Table 1: Sorting suborders for appointment and meeting lists.

Meetings, sorted by Date

Title	Date	Time	Duration	Recurs?	Category	Location	Security	Priority	Sched By
Faculty Meetin	21sep98	1-2 PM	1 hr	yes	departmen	14-256	public	must	hlandis
Staff Meeting	23sep98	8-9 AM	1 hr	no	departmen	14-238	public	must	estier
TA Meeting	23sep98	8-9:30 A	1 hr 30	no	departmen	14-238b	public	optional	estier
College Meetin	23sep98	2-3 PM	1 hr	no	campus	3-206	public	must	wsmith
Special Colloq	23sep98	2-3:30 P	1 hr 30	no	campus	20-118	public	optional	hpaulsen
CAD Research P	23sep98	2:30-4:3	2 hrs	yes	research	14-301	public	must	vralgazi
Picnic Day Com	24sep98	9-10:30	1 hr 30	no	departmen	14-238	public	must	estier
Software Engin	24sep98	10:30 AM-	1 hr 30	yes	departmen	21-139	public	must	gfisher
CAD Research P	30sep98	2:30-4 P	2 hrs	yes	research	14-301	public	must	vralgazi
Software Engin	1oct98	10:30 AM-	1 hr 30	yes	departmen	21-139	public	must	gfisher
Faculty Meetin	5oct98	1-2 PM	1 hr	yes	departmen	14-256	public	must	hlandis

Figure 34: Meetings List.

2.3.3.3. Task Lists

When the user selects the '`Tasks`' command from the '`View Lists`' menu, the system displays a window of the form shown in Figure 35. The list reflects the fact that there are only six tasks scheduled in the default three-week list period.

By default, the task list is sorted primarily by due date, secondarily by due time, thirdly by title. Tasks without a user-specified due time are considered to have a time after those with user-specified due times.

As for the appointments list, the task list is an abbreviation of the full information for scheduled tasks. Specifically,

Tasks, sorted by Due Date

Title	Due Date	Due Time	Recurs?	Category	Security	Priority	Completed
Send class mat	16 sep 98	8:00 AM	no	classes	public	10	17 sep 98
Colloquium ann	21 sep 98	9:00 AM	yes	departmen	public	8	21 sep 98
Prepare for Pi	24 sep 98	9:00 AM	no	departmen	public	10	23 sep 98
Buy something	24 sep 98		no	special e	private	5	
Colloquium ann	28 sep 98	9:00 AM	yes	departmen	public	10	
Colloquium ann	5 oct 98	9:00 AM	yes	departmen	public	10	

Figure 35: Tasks list.

a. There is a separate list item for each instance of a recurring task.
b. A list item has only a yes/no indication of whether the task recurs, not the full recurring information.
c. A task list has a completion date column, but no separate checkbox to indicate task completion; a blank completion date in the list indicates the task is not yet completed.
d. A list item contains no remind information or details.

Also as with appointments lists, the user can change the default order of the list by clicking on any of the column labels that appear in the display. For list columns that are common to both appointments and tasks, the precise sorting rules for tasks lists are the same as those given above for appointment lists. Sorting rules for the other task list columns are as follows:

a. '`Due Date`' is sorted in ascending chronological order.
b. '`Due Time`' is sorted in ascending time-of-day order for those tasks with a user-specified due time; tasks without user-specified due time appear after those with user-specified due times.
c. '`Priority`' is sorted in descending numeric order, i.e., higher priority tasks appear earlier in the list.
d. '`Completed`' is sorted in ascending chronological order, with all uncompleted items appearing after all completed items.

The subordering for each of the primary sorting keys in a task list is given in Table 2. These are the same subordering rules as for appointments, without the `Duration` field.

2.3.3.4. Event Lists

Figure 36 shows the result of the user selecting the '`View Lists Events`' command. Only two events are scheduled for the three-week listing period. The September 24 event was scheduled by the user. The September 22 event is built-in to the Calendar tool and hence automatically scheduled. The complete list of system-defined events is given in Section 2.11.12. By default, the events list is sorted primarily by date, secondarily by title.

Events do not recur, but multi-day events can be defined with a start and end date. There is a separate list item for each day of a multi-day event. For example, there are three separate list items for an event with start date September 21 and end date September 23.

The events-list columns are a subset of the appointments list. For those columns that are present in the events list, the precise sorting rules are the same as given above for appointment lists.

The subordering for each of the primary sorting keys is given in Table 3.

Primary	**Secondary**	**Tertiary**	**Quaternary**
Title	Date	Time	
Due Date	Time	Title	
Due Time	Date	Title	
Recurs	Date	Time	Title
Category	Date	Time	Title
Security	Date	Time	Title
Priority	Date	Time	Title
Completed	Date	Time	Title

Table 2: Sorting suborders for task lists.

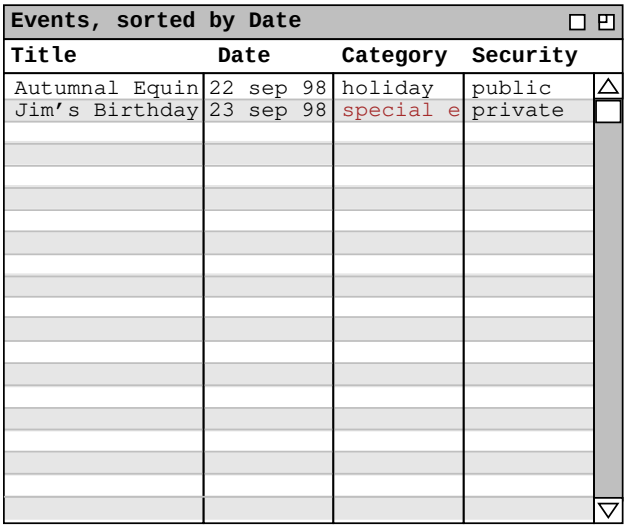


Figure 36: Events list.

Primary	Secondary	Tertiary
Title	Date	
Date	Title	
Category	Date	Title
Security	Date	Title

Table 3: Sorting suborders for event lists.

2.3.3.5. All Items Lists

The final listing form contains all four types of scheduled item together in one list. To select this form, the user executes the '`View Lists All Items`' command, in response to which the system displays a window of the form shown in Figure 37.

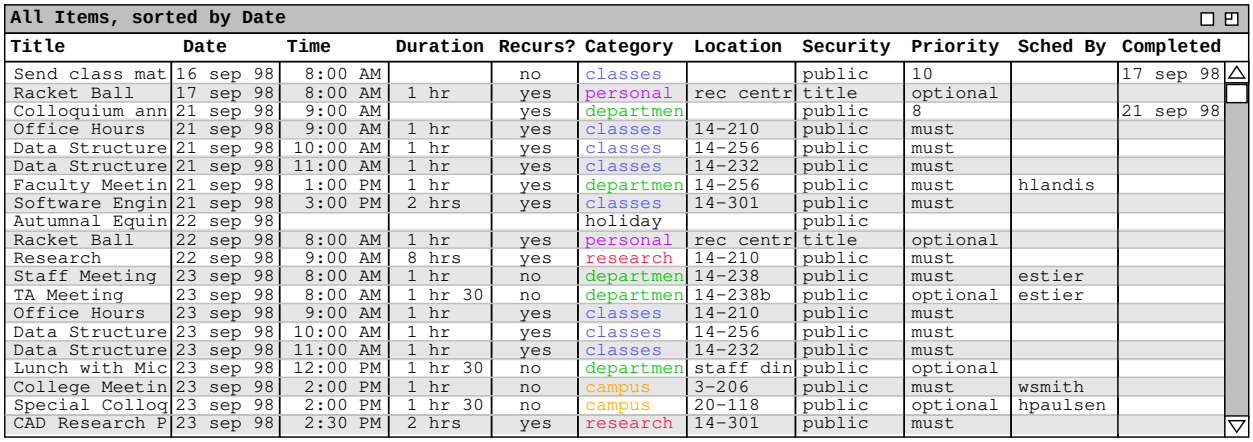
By default, the list is sorted primarily by date. Among items of the same type, the precise sorting rules for each list column are as stated above in Sections 2.3.3.1, 2.3.3.2, 2.3.3.3, and 2.3.3.4 above.

Table 4 gives the subordering for all possible primary keys, of which there are twelve in the all-items list. The '`Time`' field applies to appointments and meetings, representing the start time of the item. '`Due Time`' applies only to tasks, representing the time the task is due. The '`Time`' and '`Due Time`' columns are distinct in the all-items list so that the relative order among appointments, meetings, and tasks can be made consistent with the order among these items in calendar views.

The following assumptions are made for sorting lists with different types of items, in which one or more of the sub-order keys are missing:

a. The '`Time`' value for any event is considered to be earlier than that of any appointment, meeting, or task; this means that events precede tasks, appointments, and meetings when '`Time`' is used as the sort key.

b. The '`Time`' value (*not* the '`Due Time`') for any task is considered to be later than that of any event and earlier than that of any appointment or meeting; this means that tasks follow events and precede



All Items, sorted by Date

Title	Date	Time	Duration	Recurs?	Category	Location	Security	Priority	Sched By	Completed
Send class mat	16 sep 98	8:00 AM		no	classes		public	10		17 sep 98
Racket Ball	17 sep 98	8:00 AM	1 hr	yes	personal	rec centr	title	optional		
Colloquium ann	21 sep 98	9:00 AM		yes	departmen		public	8		21 sep 98
Office Hours	21 sep 98	9:00 AM	1 hr	yes	classes	14-210	public	must		
Data Structure	21 sep 98	10:00 AM	1 hr	yes	classes	14-256	public	must		
Data Structure	21 sep 98	11:00 AM	1 hr	yes	classes	14-232	public	must		
Faculty Meetin	21 sep 98	1:00 PM	1 hr	yes	departmen	14-256	public	must	hlandis	
Software Engin	21 sep 98	3:00 PM	2 hrs	yes	classes	14-301	public	must		
Autumnal Equin	22 sep 98				holiday		public			
Racket Ball	22 sep 98	8:00 AM	1 hr	yes	personal	rec centr	title	optional		
Research	22 sep 98	9:00 AM	8 hrs	yes	research	14-210	public	must		
Staff Meeting	23 sep 98	8:00 AM	1 hr	no	departmen	14-238	public	must	estier	
TA Meeting	23 sep 98	8:00 AM	1 hr 30	no	departmen	14-238b	public	optional	estier	
Office Hours	23 sep 98	9:00 AM	1 hr	yes	classes	14-210	public	must		
Data Structure	23 sep 98	10:00 AM	1 hr	yes	classes	14-256	public	must		
Data Structure	23 sep 98	11:00 AM	1 hr	yes	classes	14-232	public	must		
Lunch with Mic	23 sep 98	12:00 PM	1 hr 30	no	departmen	staff din	public	optional		
College Meetin	23 sep 98	2:00 PM	1 hr	no	campus	3-206	public	must	wsmith	
Special Colloq	23 sep 98	2:00 PM	1 hr 30	no	campus	20-118	public	optional	hpaulsen	
CAD Research P	23 sep 98	2:30 PM	2 hrs	yes	research	14-301	public	must		

Figure 37: All items list.

Primary	Secondary	Tertiary	Quaternary	Quintinary
Title	Date	Time	Duration	
Date	Time	Duration	Title	
Time	Date	Duration	Title	
Due Time	Date	Time	Duration	Title
Duration	Date	Time	Title	
Recurs	Date	Time	Duration	Title
Category	Date	Time	Duration	Title
Location	Date	Time	Duration	Title
Security	Date	Time	Duration	Title
Priority	Date	Time	Duration	Title
Sched By	Date	Time	Duration	Title
Completed	Date	Time	Duration	Title

Table 4: Sorting suborders for all-item lists.

appointments and meetings when ‘`Time`’ is used as the sort key. (The ‘`Time`’ key for a task is effectively its start time, as distinguished from its due time; task due time is a separate list column with its own relative sorting order.)

c. The ‘`Due Time`’ value for appointments, meetings, and events is considered to be greater than any task; this means that tasks precede all other types of item when ‘`Due Time`’ is the sort key.

d. The ‘`Duration`’ of any event is considered to be shorter than that of any appointment meeting, or task; this means that events precede all other types of item with ‘`Duration`’ is the sort key.

e. The ‘`Duration`’ of any task is considered to be longer than that of any event, shorter than any appointment or meeting; this means that tasks follow events and precede appointments and meetings when ‘`Duration`’ is used as the sort key.

f. The ‘`Recurs`’ value for events is considered to be ‘`no`’; this means that events follow all other types of item when ‘`Recurs`’ is used as the sort key.

g. The ‘`Location`’ value for events is considered to be emtpy; this means that events follow all other types of item when ‘`Location`’ is used as the sort key.

h. The ‘Priority’ value for events is considered to be higher than any appointment, meeting, or task; this means that events precede all other types of item when ‘Priority’ is used as the sort key.

i. The ‘Sched By’ value for appointments, tasks, and events is considered to be greater than that for any meeting; this means that meetings precede all other types of item when ‘Sched By’ is used as the sort key.

j. The ‘Completed’ value for appointments, meetings, and events is considered to be greater than any task; this means that tasks (whether completed or not) precede all other types of item when ‘Completed’ is used as the sort key.

2.3.3.6. Custom Lists

The custom lists feature of the Calendar Tool allows the user to define specialized forms of lists. In particular, the user can specify which types of items appear in a list, which item fields appear as list columns, and what range of dates the list covers. For example, the user can define a list that shows only the title and date of appointments and meetings for the next six months.

By default, there are no pre-defined custom lists. Hence, when the user initially selects the ‘View Lists Custom’ menu command, the system displays the submenu as shown in Figure 38. The blank space above the ‘Edit ...’ command is where the names of custom lists appear once they are defined by the user.

To create a new custom list, the user selects the ‘Edit ...’ command, whereupon the system displays the custom list dialog shown in Figure 39. The ‘List Name’ text box contains the name of the list being defined. The initial default name is "New List". The user enters a new list name by typing in the text box. The name for each custom list must be unique among all other defined lists.

The check boxes under the heading ‘Show these items’ specify which types of item appear in a custom list. At least one of the boxes must be checked. The check boxes under the heading ‘Show these fields’ specify which item fields appear as column headings in the list. At least one of the boxes must be checked. The ‘Primary sort key’ is a menu containing each of the fields listed under ‘Show these fields’. The default primary sort key for custom lists is the ‘Date’ field.

The ‘Start Date’ and ‘End Date’ data entry fields specify the starting and ending dates of the custom list. As shown in the figure, the default start date is 1 week ago, the default end date 2 weeks from now. The small data-entry box immediately to the right of the label is a typeable numeric field in which the user can enter a value between 1 and 99. Immediately to the right of the numeric field is a menu-augmented text box containing the date range information. Immediately below the range information is a two-element menu containing the selections ‘ago’ and ‘from now’. Figure 40 shows an expansion of both the pulldown menus. If either the ‘today’ or ‘specific date’ entries is selected, the numeric text field is disabled, since it does not apply in theses cases. Also in these cases, the date direction menu is disabled (physically greyed out). When ‘specific date’ is selected, the user types a specific date value into the text field. When any of the other menu entries is selected, typing is disabled in the text field.

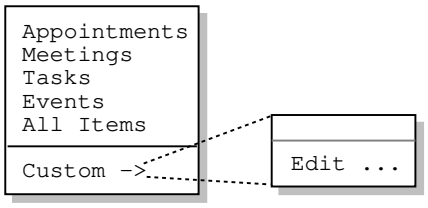


Figure 38: Initial custom lists menu.

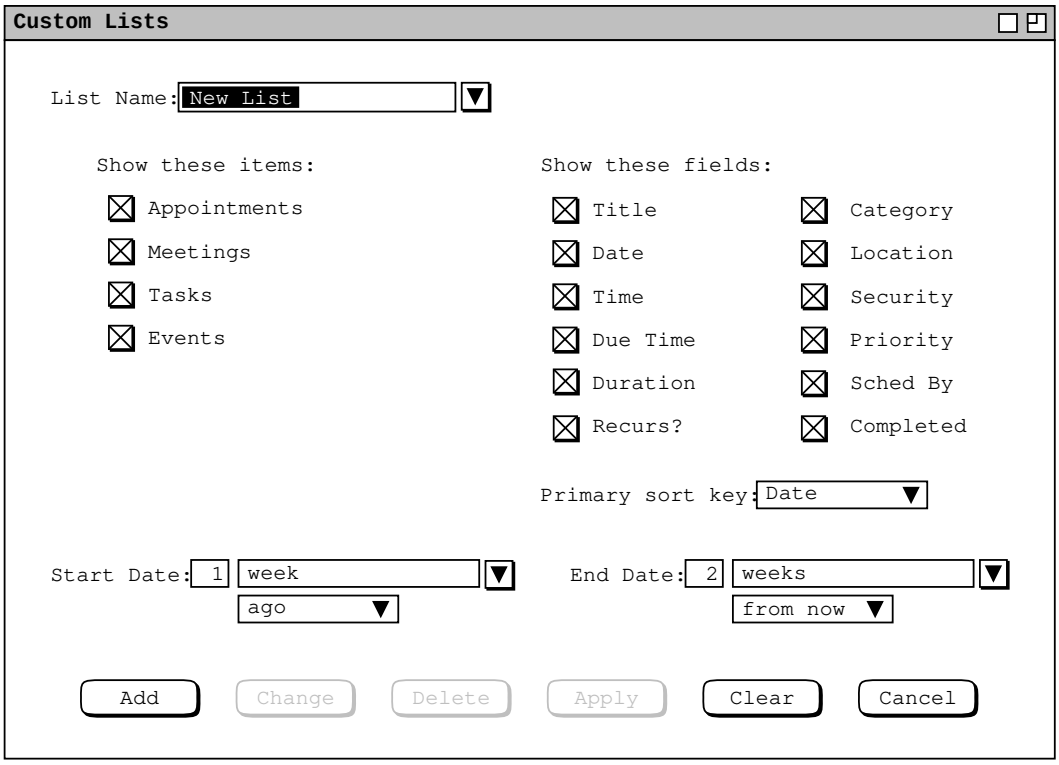


Figure 39: Custom list dialog.

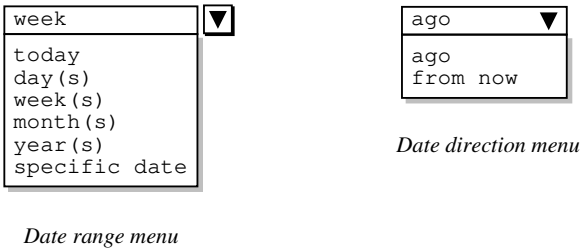


Figure 40: Custom list date menus.

Figure 41 shows the result of the user having defined a new list named "Year's events". The list applies only to events, leaves out the security column, and extends over the date range of six months before and after today. The figure illustrates how the check boxes for some fields are selectively disabled when a subset of item check boxes are on. The field check boxes that are disabled correspond to those fields that do not apply to any of the selected types of item. Table 5 defines specifically which fields apply to which types of item. A check box under the '`Show these fields`' heading is enabled (physically solid type) when one or more of the types to which it applies is checked under the '`Show these items`' heading. The state of the check boxes is reflected in the '`Primary sort key`' pulldown menu. Specifically, the active menu items correspond to the check-box selected fields. For example, Figure 42 shows the state of the '`Primary sort key`' menu in the context of Figure 41 The enabled menu items are correspond to the three selected check boxes. The disabled items in the menu cannot be selected as the primary sort key. When '`Date`' is not selected in the check boxes, the default primary sort key is chosen as the

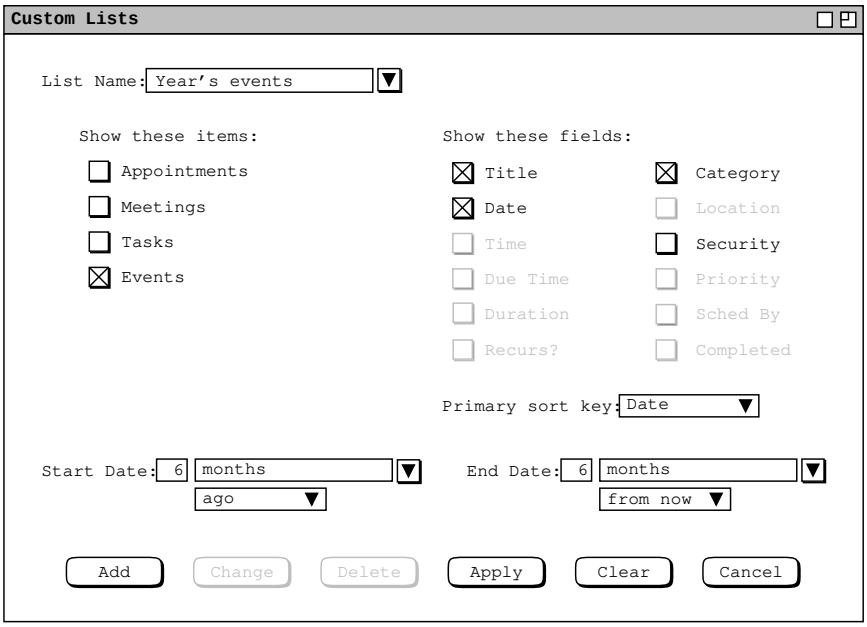


Figure 41: Year's events custom list.

Data field	Applicable to these types of item
Title	all
Date	all
Time	appointments, meetings
Due Time	tasks
Duration	appointments, meetings
Recurs?	appointments, meetings, tasks
Category	all
Location	appointments, meetings, events
Security	all
Priority	appointments, meetings, tasks ('must' or 'optional' for appointments and meetings; number between 0 and 10 for tasks)
Sched By	meetings
Completed	tasks

Table 5: Fields applicable to each type of scheduled item.

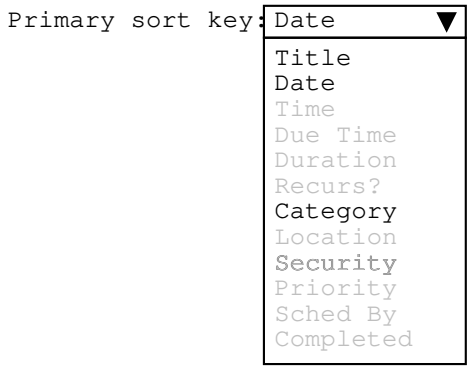


Figure 42: Primary sort key menu Year's events custom list.

first checked key in top-to-bottom order of check boxes in the dialog (which is the order shown in Table 4).

Sorting suborder for custom lists is based on Table 3, with the following additional provisions. When a field that would otherwise be used as a suborder key is missing from the custom list, the next field in the subordering takes the place of the missing key. When one or more of the subording keys in Table is missing, additional subordering is defined by the following order among the remaining keys: '`Due Time`', '`Recurs`', '`Category`', '`Location`', '`Security`', '`Priority`', '`Sched By`', and '`Completed`'. For example, if the user defines a custom list that contains only '`Location`', '`Priority`', and '`Sched By`', those keys are used as the primary, secondary, and tertiary sorting keys, respectively.

To complete the definition of a new list, the user presses the '`Add`' button at the bottom of the custom lists dialog. In response, the system adds the list to those that are available for use. To define additional new lists, the user types the new names into the '`List Name`' text box, selects the desired settings, and presses the '`Add`' button for each new list to be defined.

The names of available lists appear in two contexts:

a. the '`View Lists Custom`' submenu, accessible from the main command menubar;

b. the '`List Name`' menu, in the custom lists dialog.

These contexts are illustrated in Figure 43. The figure reflects the user having defined two additional custom lists named "`Appt titles only`" and "`Mtgs next 2 months`". The list names are sorted alphabetically in the menus. In the custom list dialog, the name in the '`List Name`' text box is that most recently selected or typed by the user.

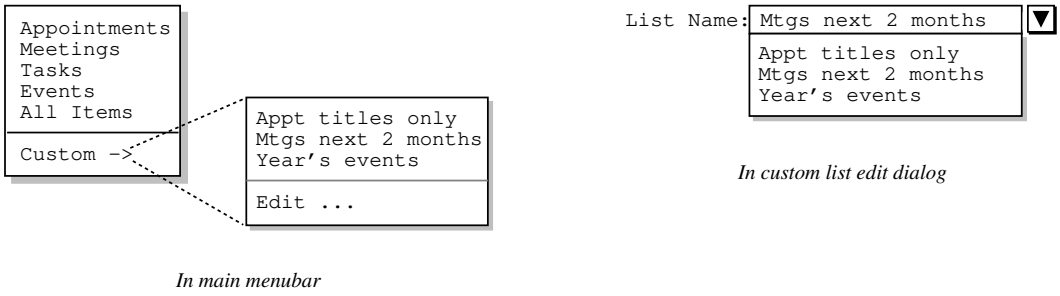


Figure 43: Menu contexts in which list names appear.

Figure 44 shows the result of the user selecting the ‘Year’s events’ list in the ‘View Lists Custom’ submenu. The banner of a custom list display contains the name of the custom list.

In the context of the scenarios thus far, "Jim’s Birthday" is the only user-scheduled event. The other events in the ‘Year’s Events’ list are all pre-defined holidays, as discussed further in Section 2.11.12.

The user can change or delete defined lists in the custom list dialog. To change an existing list, the user selects the desired list in the ‘List Name’ menu, or types its name in the text box and presses the Enter key. The user then performs the desired changes and presses the Change button. For example, Figure 45 shows the user having edited the previously defined ‘Year’s events’ list. The edits involve changing the date range to specific dates instead of the six month range before and after today’s date. To perform these edits, the user selects ‘specific date’ in both the ‘Start Date’ and ‘End Date’ menus, and then types the desired date range of January 1, 1999 to December 31, 1999. To confirm these changes, the user presses the ‘Change’ button at the bottom of the dialog.

To delete an existing list, the user selects its name from the ‘List Name’ menu and presses the ‘Delete’ button. In response, the system removes the list from those that are defined, removes it from the ‘List Name’ menu, and clears the ‘List Name’ text box. The ‘Apply’ button is used to apply the currently selected list, as if its name had been chosen from ‘View Lists Custom’ submenu.

To clear all entered information in the custom list dialog, the user presses the ‘Clear’ button. In response, the system restores the dialog to the state it was in when it was most recently displayed on the screen. The ‘Cancel’ button removes the custom lists dialog from the screen. Only the explicit selection of ‘Cancel’ (or an environment-specific window closing button) removes the dialog from the screen. Execution of any of the other commands (‘Add’ through ‘Clear’) leaves the dialog on the screen.

2.3.4. Filtered Viewing

When the user selects the ‘Filter ->’ item in the View menu, the system displays the submenu shown in Figure 46. The first four commands in the menu allow the user to filter in or out the four types of scheduled item. The menu commands act as show/hide toggles. When the ‘Hide ...’ form is visible in the menu, selecting it hides the selected type of scheduled item and toggles the menu label to ‘Show ...’. When the ‘Show ...’ form of the

Year’s events, sorted by Date

Title	Date	Category
April Fool’s D	1 apr 98	holiday
Daylight Savin	5 apr 98	holiday
Easter Sunday	12 apr 98	holiday
Mother’s Day	10 may 98	holiday
Memorial Day	25 may 98	holiday
Flag Day	14 jun 98	holiday
Summer Solstic	21 jun 98	holiday
Father’s Day	21 jun 98	holiday
Independence D	4 jul 98	holiday
Labor Day	7 sep 98	holiday
Autumnal Equin	22 sep 98	holiday
Jim’s Birthday	23 sep 98	special e
Daylight Savin	25 oct 98	holiday
Halloween	31 oct 98	holiday
Veteran’s Day	11 nov 98	holiday
Thanksgiving	26 nov 98	holiday
Hanukkah	14 dec 98	holiday
Ramadan Begins	20 dec 98	holiday
Winter Solstic	21 dec 98	holiday
Christmas	25 dec 98	holiday

Figure 44: Year‘s events list display.

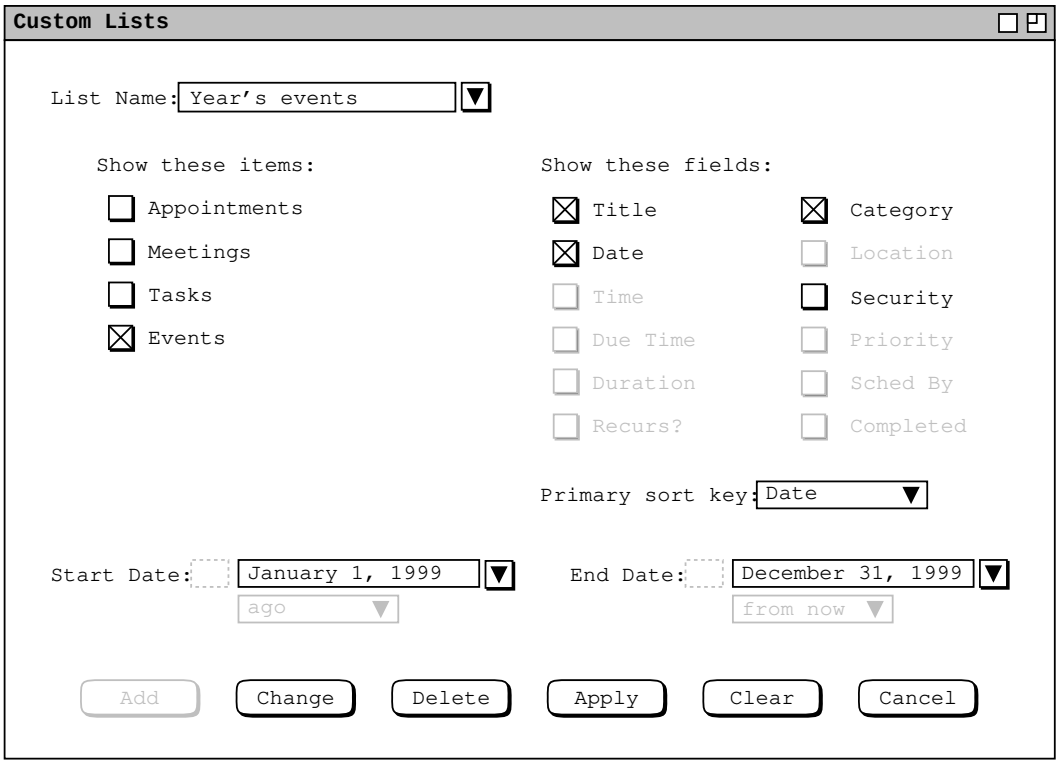


Figure 45: Changed years-events list.

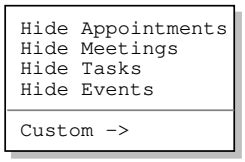


Figure 46: Filter submenu.

command is selected, items that were hidden are made visible again, and the menu is toggled back to the '`Hide ...`' form.

Consider for example the month view shown earlier in Figure 22. If the user selects '`Filter Hide Appointments`' in the context of that view, the system updates the display as shown in Figure 47. If the user then selects '`Hide Meetings`', the system updates the display to that shown in Figure 48. Since most of the items scheduled for the month of September were appointments and meetings, only a few items remain in the display.

Having hidden appointments and meetings, a subsequent invocation of the '`Filter`' menu appears as shown in Figure 49. If the user selects '`Show Appointments`' and '`Show Meetings`', the month display is restored to the original state shown in Figure 22.

Showing and hiding tasks and events is analogous to meetings and appointments. At the day level and weekly table level, the separate areas of the display are removed when tasks and/or events are hidden. For example, Figures 50 and 51 show the results of hiding both events and tasks in the context of the daily and weekly views shown originally in Figures 15 and 19.

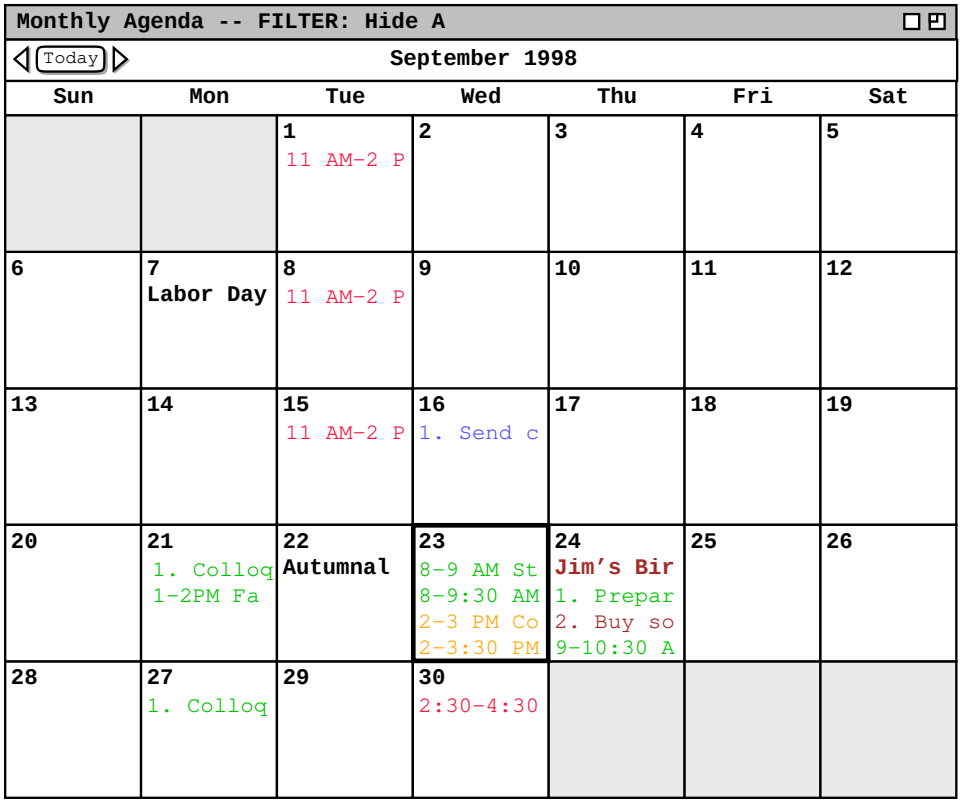


Figure 47: Month view with appointments filtered out.

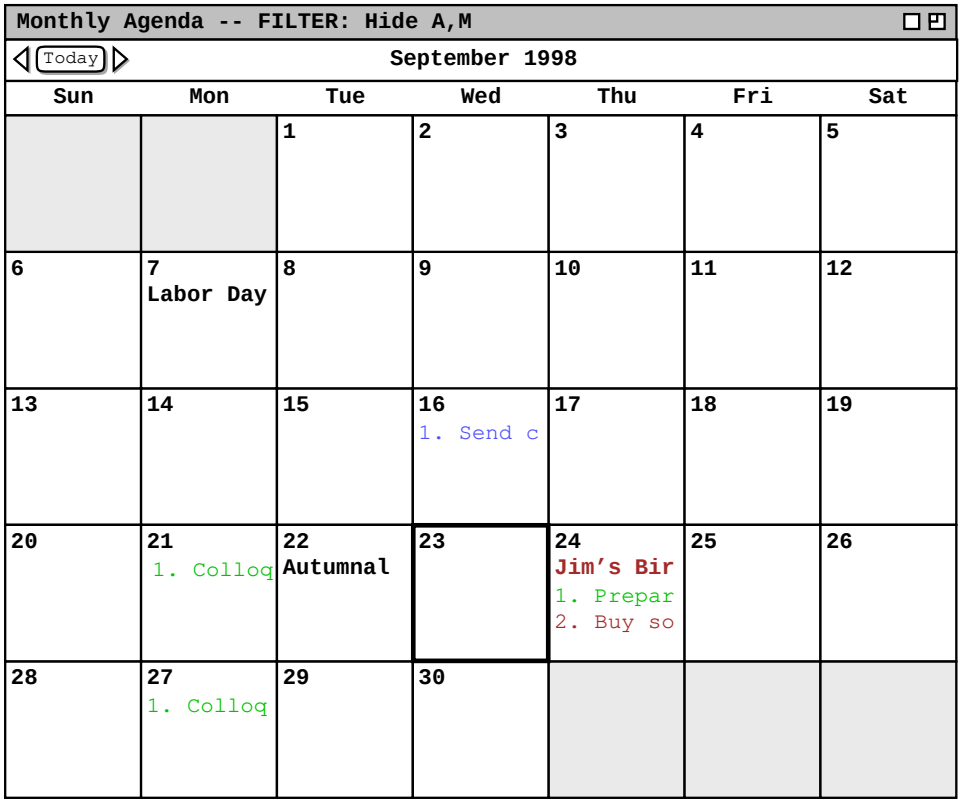


Figure 48: Month view with meetings filtered out.

Figure 49: Filter menu in 'Show Appointments', 'Show Meetings' state.

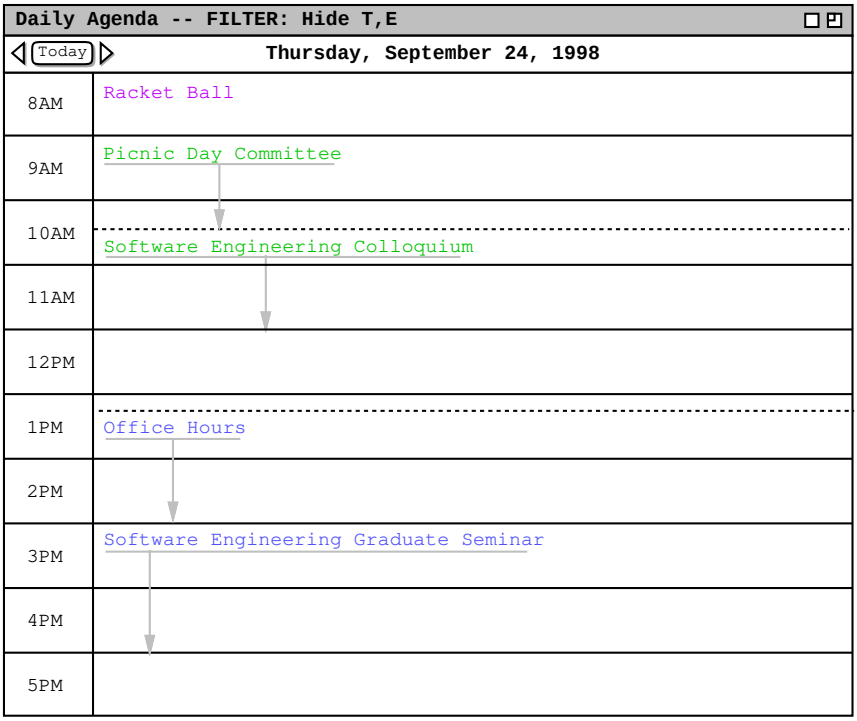


Figure 50: Events and tasks filtered out of a day view.

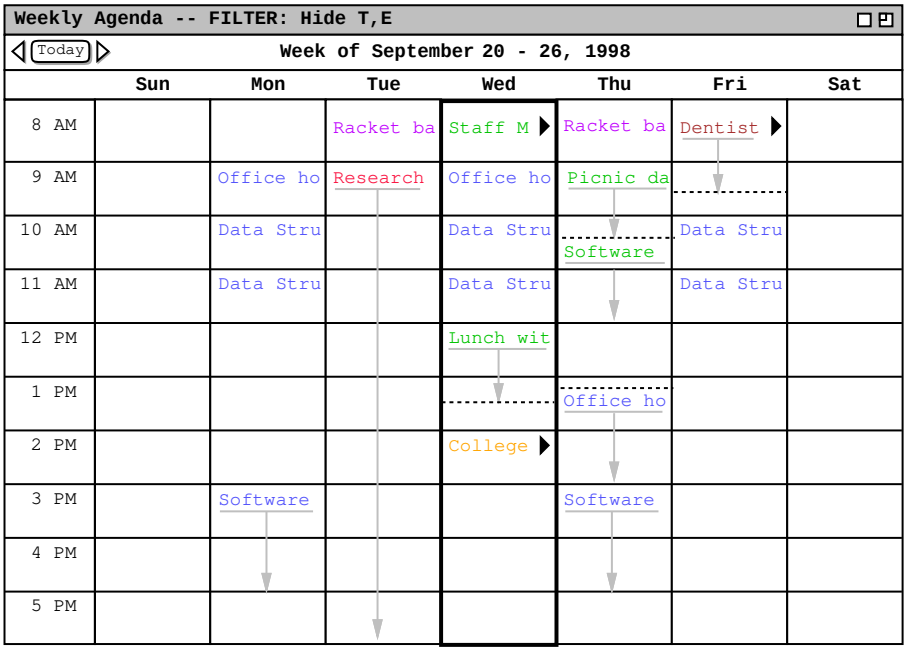


Figure 51: Events and tasks filtered out of a table-style week view.

Any or all of the commands can be in either the show or hide state. When all four commands are in the show state, all scheduled items are visible. When all four commands are in the hide state, no scheduled items are visible.

The four show/hide filtering commands apply only to calendar views at the item, day, week, and month levels. Show/hide does not apply to year-level views since there are no items visible at that level. Show/hide filtering also does not apply to list views, since lists are already specialized to each kind of item. The custom filters described in the next section apply to calendar views as well as to lists. Operational details of show/hide and custom filtering used in conjunction are covered in Section .

2.3.4.1. Custom Filter Definition

The custom filtering feature of the Calendar Tool allows the user to define finer-grain filters than simply all items of a particular type. For example, the user can choose to filter out all but a particular category of item that is scheduled between some particular dates.

By default, there are no custom filters defined. Hence, when the user initially selects the '`View Filters Custom`' menu item, the system displays the submenu as shown in Figure 52. The blank space above the '`Edit ...`' command is where the names of custom filters appear once they are defined by the user.

To create a new custom filter, the user selects the '`Edit ...`' command, whereupon the system displays the filter definition dialog shown in Figure 53.

The '`Filter Name`' text box contains the name of the filter being defined. The initial default name is "`New Filter`". The user enters a chosen filter name by typing in the text box. The name for each defined filter must be unique among all other filters.

The editing fields below the filter name allow the user to define detailed filtering criteria for the display of items in calendars and lists. The criteria apply to all types of items that are currently visible, i.e., items for which the show state is on in the show/hide filter commands. The criteria apply uniformly to all calendar and list displays.

The fields in the filter definition constitute the union of components from all four types of scheduled item. Given this, each field is not necessarily applicable to all types of scheduled item. Table 6 defines specifically which fields apply to which item types. (This table is a superset of Table 5 defined for custom lists.)

There are a number of pulldown menus associated with the fields of the filter definition. Figure 54 shows an the expansion of these menus. Descriptions of each filtering field follow. Section 2.11.9 defines the precise pattern matching rules that apply to filtering

2.3.4.1.1. Title

The '`Title`' field in the filter definition defines which items are visible based on the value of their titles. Immediately to the right of the '`Title`' label is a text box containing a pattern string for item titles. The pattern is used in conjunction with the selection in the pulldown menu below the '`Title`' label. Specifically:

a. When '`any`' is selected in the menu, items with any title are visible. Typing in the '`Title`' text box is

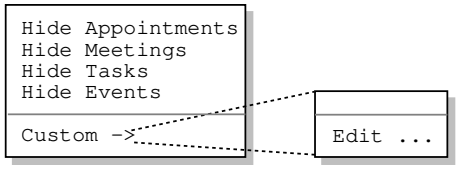


Figure 52: Initial custom filters menu.

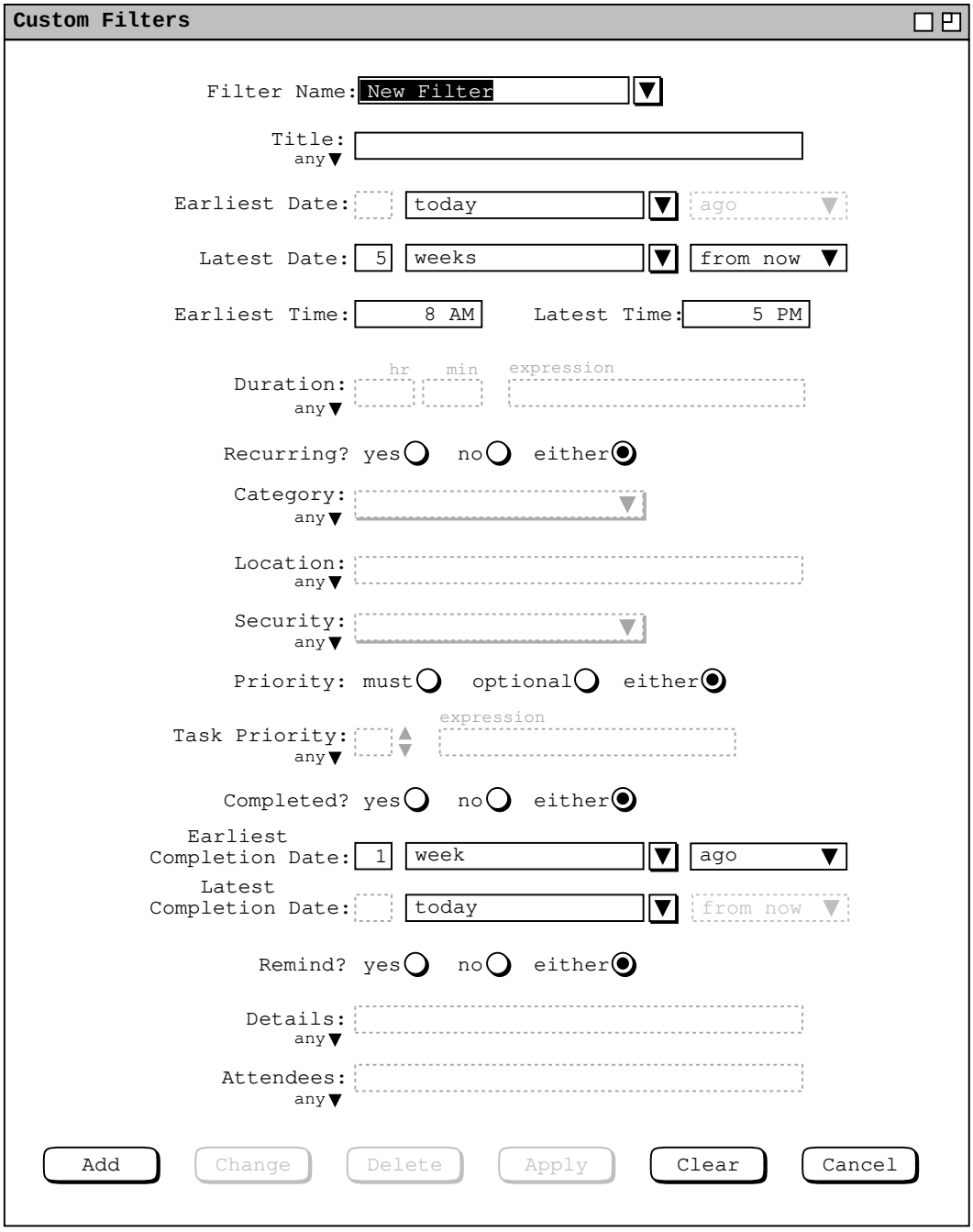


Figure 53: Filter definition dialog.

Data field	Applicable to these types of item
Title	all
Earliest Date	all
Latest Date	all
Earliest Time	appointments, meetings, tasks
Latest Time	appointments, meetings, tasks
Duration	appointments, meetings
Recurring?	appointments, meetings, tasks
Category	all
Location	appointments, meetings, events
Security	all
Priority	appointments, meetings
Task Priority	tasks
Completed	tasks
Earliest Completion Date	tasks
Latest Completion Date	tasks
Remind	appointments, meetings, tasks
Details	appointments, meetings, tasks
Attendees	meetings

Table 6: Filter fields applicable to each type of scheduled item.

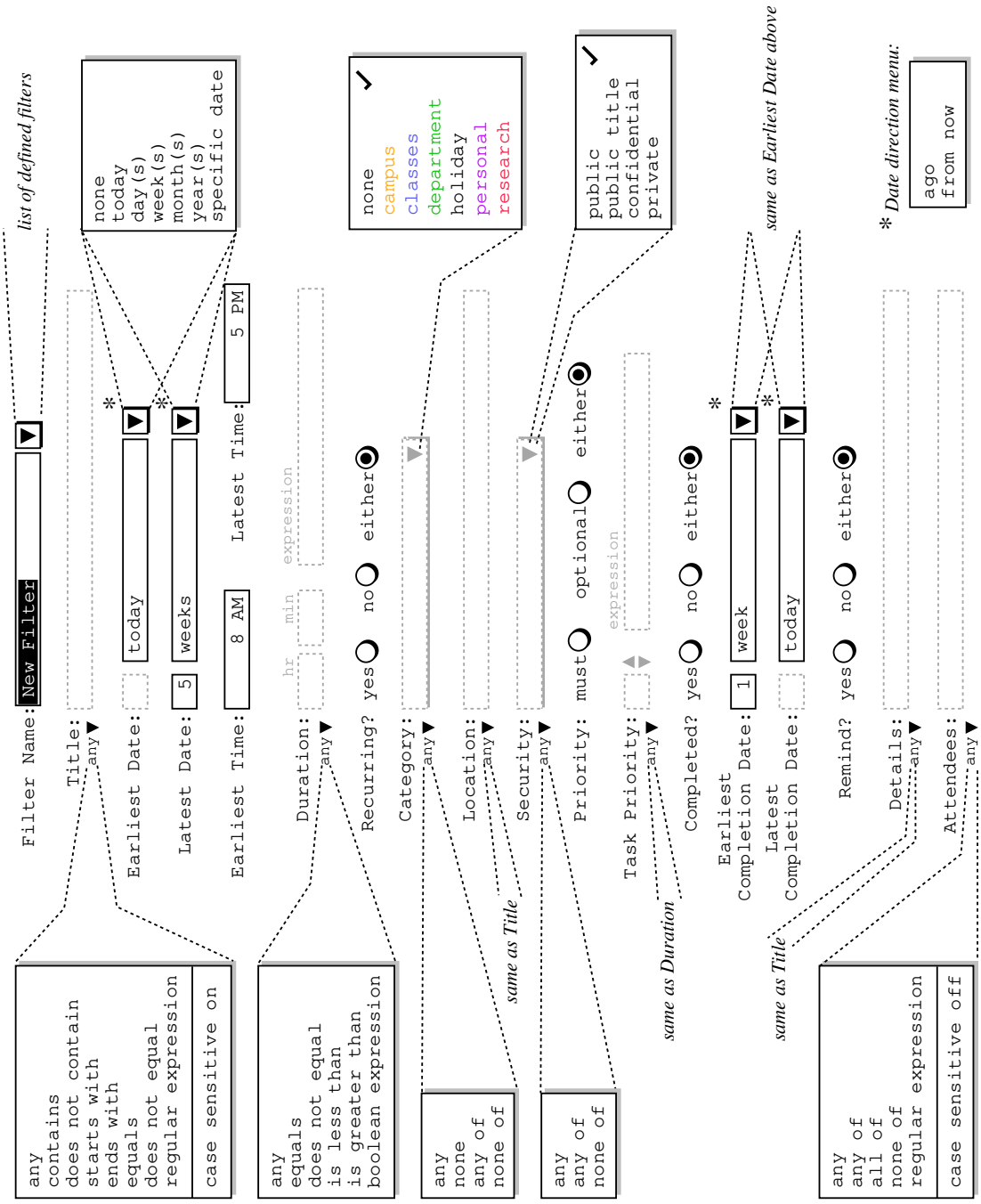


Figure 54: Expansion of Filter Definition Menus.

disabled when ‘`any`’ is selected.

b. When ‘`contains`’ is selected, items are visible when they have a title that contains the pattern string.

c. When ‘`does not contain`’ is selected, items are visible when they have a title that does not contain the pattern string.

d. When ‘`starts with`’ is selected, items are visible when they have a title that starts with the pattern string.

e. When ‘ends with’ is selected, items are visible when they have a title that ends with the pattern string.

f. When ‘equals’ is selected, items are visible when they have a title that exactly equals the pattern string.

g. When ‘does not equal’ is selected, items are visible when they have a title that does not equal the pattern string.

h. When ‘regular expression’ is selected, items are visible when they match a regular expression pattern. The pattern is typed into the text box. Details of regular expression syntax are covered in Section 2.11.10.

The last item in the ‘Title’ field menu specifies the case sensitivity of the pattern string matching. The menu item is an on/off toggle. By default, case sensitive matching is on for ‘Title’ matching.

2.3.4.1.2. Earliest and Latest Date

The ‘Earliest Date’ and ‘Latest Date’ fields define the earliest and latest scheduled dates for which items are visible. The small text box immediately to the right of the field label is used for a numeric value in the range 1 through 99. To the right of the numeric box is a combination text box and pulldown menu that is used to define the date range. Specifically:

a. When ‘none’ is selected, items are visible all the way to the system-enforced earlist and latest dates, which are, respectively, 1 January 0000 and 31 December 9999. Typing in the numeric box is disabled when ‘none’ is selected.

b. When ‘today’ is selected, the earliest (latest) date for visible items is today’s date. Typing in the numeric box is disabled when ‘today’ is selected.

c. The next four menu selections define how far before or after today’s date items are visible, in terms of days, weeks, months, or years. These items are defined in conjunction with a specific numeric value, the default being 1.

d. When ‘specific date’ is selected, items are visible up to and including a specific date before or after today’s date. The date is entered by typing in the text box. Typing in the numeric box is disabled when ‘specific date’ is selected.

At the far right of the date entry fields is a two-element menu containing the selections ‘ago’ and ‘from now’. These selections specify whether the selected date pattern comes before or after today’s date.

2.3.4.1.3. Earliest and Latest Time

The ‘Earliest Time’ and ‘Latest Time’ fields define the earliest and latest scheduled times for which items are visible. For appointments ane meetings, the scheduled time is the start time; for tasks, the scheduled time is the due time. Both fields contain time values. The default values are 8 AM for earliest and 5 PM for latest. If the ‘Earliest Time’ field is empty, it is assumed to be 12:00 AM; if ‘Latest Time’ is empty, it is assumed to be 11:59 PM. If both fields are non-empty, the earliest time must be less than or equal to the latest time.

2.3.4.1.4. Duration

The ‘Duration’ field defines item visibility based on duration. A duration value is entered in hours and minutes in the two text edit boxes. If the user enters no duration value, the default is 1 hour and no minutes. The duration value is used in conjunction with a selection in the pulldown menu below the ‘Duration’ label. Specifically:

a. When ‘any’ is selected, items with any duration are visible. Typing in the hour and minute text boxes is disabled when ‘any’ is selected.

b. When ‘equals’ is selected, items are visible when they have a duration that exactly equals the specified hour/minute value.

c. When ‘not equals’ is selected, items are visible when they have a duration that does not equal the specified hour/minute value.

d. When ‘is less than’ is selected, items are visible when they have a duration that is less than the specified hour/minute value.

e. When '`is greater than`' is selected, items are visible when they have a duration that is greater than the specified hour/minute value.

f. When '`boolean expression`' is selected, items are visible when they equal a boolean expression. The expression is typed in the text box labeled '`expression`' immediately to the right of the minute-value text box. Details of boolean expression syntax are covered in Section 2.11.11.

2.3.4.1.5. Recurring?

The '`Recurring?`' field defines visibility based on whether a scheduled item is recurring. Specifically:

a. If `yes` is selected, items are visible if they are recurring.

b. If `no` is selected, items are visible if they are not recurring.

c. If `either` is selected, items are visible whether or not they are recurring.

2.3.4.1.6. Category

The '`Category`' field defines visibility based on the category of scheduled items. The pulldown menu to the right of the `Category` label allows the user to select one or more category values. A selected category is indicated with a check mark to the right of its name. The category-value selection is used in conjunction with the selection in the pulldown menu below the `Category` label. Specifically:

a. When '`any`' is selected, items with any category, including none, are visible. All items in the categories menu are unchecked when '`any`' is selected.

b. When '`none`' is selected, only items with no category are visible. All items in the categories menu are unchecked when '`none`' is selected.

c. When '`any of`' is selected, scheduled items are visible if they have a category value that is any of the values selected in the menu.

d. When '`none of`' is selected, scheduled items are visible if they have a category value that is not any of the values selected in the menu.

If exactly one category is checked in the right-side menu, then its color-coded name appears in the text area. If two or more categories are checked, then the name of the first category appears in the text area, suffixed with the string "`+ ...`".

2.3.4.1.7. Location

The '`Location`' field is the same form of text box and menu combination as the '`Title`' field. The entered pattern defines which items are visible based on the value of their locations.

2.3.4.1.8. Security

The '`Security`' field defines visibility based on the security of scheduled items. The pulldown menu to the right of the field label allows the user to select one or more of the four security values. The security-value selection is used in conjunction with the selection in the pulldown menu below the label. Specifically:

a. When '`any`' is selected, items with any security are visible. All items in the security menu are unchecked when '`any`' is selected.

b. When '`any of`' is selected, scheduled items are visible if they have a security value that is any of the values selected in the menu.

c. When '`none of`' is selected, scheduled items are visible if they have a security value that is not any of the values selected in the menu.

2.3.4.1.9. Priority

The '`Priority`' field defines visibility based on the priority of scheduled items. Specifically:

a. If '`must`' is selected, items are visible if their priority is '`must`'.
b. If '`optional`' is selected, items are visible if their priority is '`optional`'.
c. If '`either`' is selected, items are visible with either priority.

2.3.4.1.10. Task Priority

The '`Task Priority`' field defines the visibility of tasks only, based on their numeric priority. The small text box immediately to the right of the field label is used for a numeric value in the range 0 through 10. To the right of the text box are up- and down-pointing arrows that are used to increment and decrement the numeric value. A value can also be typed directly into the text box. The priority value is used in conjunction with the pulldown menu below the '`Task Priority`' label. The items in the menu have the same meanings as described above for the '`Duration`' field.

2.3.4.1.11. Completed? and Completion Dates

The '`Completed?`', '`Earliest Completion Date`', and '`Latest Completion Date`' fields define the visibility of tasks based on if and when tasks are completed. The '`Completed?`' field has the same three alternatives as the '`Recurring`' field described above. The completion date fields have the same text box and menu combinations as the '`Earliest Date`' and '`Latest Date`' fields described above.

2.3.4.1.12. Remind?

The '`Remind?`' field defines visibility based on whether a scheduled item has a reminder. The field has the same three alternatives as the '`Recurring?`' field.

2.3.4.1.13. Details

The '`Details`' field is the same form of text box and menu combination as the '`Title`' and '`Location`' fields. The entered pattern defines which items are visible based on the value of their `Details` field.

2.3.4.1.14. Attendees

The '`Attendees`' field defines the visibility of meetings, based on their attendees lists. Immediately to the right of the '`Attendees`' label is a text box containing a pattern string. The pattern is in the form of a comma-separated list of calendar user IDs or a regular expression. The pattern is used in conjunction with the the selection in the pulldown menu below the '`Attendees`' label. Specifically:

a. When '`any`' is selected in the menu, items with any attendees are visible. Typing in the text box is disabled when '`any`' is selected.
b. When '`any of`' is selected, meetings are visible if they have an attendees list that contains any of the listed user IDs.
c. When '`all of`' is selected, meetings are visible if they have an attendees list that contains all of the listed user IDs.
d. When '`none of`' is selected, meetings are visible if they have an attendees list that contains none of the listed user IDs.
e. When '`regular expression`' is selected, meetings are visible when the IDs of all attendees match the regular expression pattern. The regular expression is typed into the text box; details of regular expression syntax are covered in Section 2.11.10.

The last item in the '`Attendees`' menu specifies case sensitivity in the same manner as in the '`Title`' menu. The default for attendees filtering is case sensitive off.

2.3.4.2. Using Custom Filters

Figure 55 shows the result of the user having defined a filter named "Fall classes" with the following criteria:

- earliest date is September 21
- latest date is December 4
- category is '`classes`'

To complete the definition of this new filter, the user presses the '`Add`' button at the bottom of the custom filter dialog. In response, the system adds the filter to those that are available for use. To define additional new filters, the user types new names into the '`Filter Name`' text box, selects the desired settings, and presses the '`Add`' button for each new filter to be defined.

The names of available filters appear in two contexts:

a. the '`View Filters Custom`' submenu, accessible from the main command menubar;

b. the '`Filter Name`' menu, in the custom filters dialog.

These contexts are illustrated in Figure 56. The figure reflects the user having defined two additional custom filters named "`Parties`" and "`Past SE classes`". The filter names are sorted alphabetically in the menus. In the custom filter dialog, the name in the '`Filter Name`' text box is that most recently selected or typed by the user.

NOTE: Finish this section by showing the effects of applying a custom filter to some calendar and list views.

2.3.5. Viewing Other Users and Group Calendars

The Calendar Tool provides cross-user access to the calendars it manages. It also provides access to the group calendars that contain the meetings scheduled for user groups.

2.3.5.1. Viewing Other User's Calendars

To gain access to the calendar of another registered user, the current user selects '`Other User ...`' from the '`View`' menu. In response, the system displays the dialog shown in Figure 57. The users listed in the dialog reflect additions to the user database made by one or more system administrators. Details of user database operations are covered in Section 2.6.2.

The scrolling area at the top of the dialog lists all existing users by name and Calendar Tool ID. The default sorting order of the user list is case-insensitive by name. Since names are listed with last name first, the sorting order is primarily by last name. Secondary, tertiary, and quaternary orders are first name, middle name, and ID, respectively. The sorting order can be changed to ID by pressing the '`ID`' column heading. The order for the '`ID`' column is alphabetic, case-insensitive. Since IDs are unique, no secondary order is necessary when ID is the primary sort key.

To select a user for viewing, the current user clicks on the name or ID in any row of the display. The '`Search by`' field allows the current user to type a name or ID to be searched for. As characters are typed, the list scrolls to the earliest listed name or ID with a leading prefix that matches the typed characters. Whether the search is by name or ID is based on the selected sorting order. When the list is sorted by the '`Name`' field, the search field is labeled "`Search by name`". The search field is labeled "`Search by ID`" when the list is sorted by '`ID`'. The current user can enter a regular expression in the search field. Details of regular expression search and syntax are covered in Section 2.11.9.

Figure 58 shows the user having selected user `James L. Brandon` for viewing. When the user presses the '`View ...`' button, the system responds with a new display window as shown in Figure 59. Other users' calendars may be viewed with all of the commands available in the `View` menu. For example, Figure 60 shows the effect a `View Day` command on the September 22 entry in Figure 59. Figure 61 shows the daily view of September 23.

Exeuction of the '`View Other User`' command is independent of the windowing mode in that the system always opens a new window for each different user being viewed. Once the initial window for another user is open, the windowing mode affects subsequent viewing commands in the normal way, as described in Section 2.3.6.1

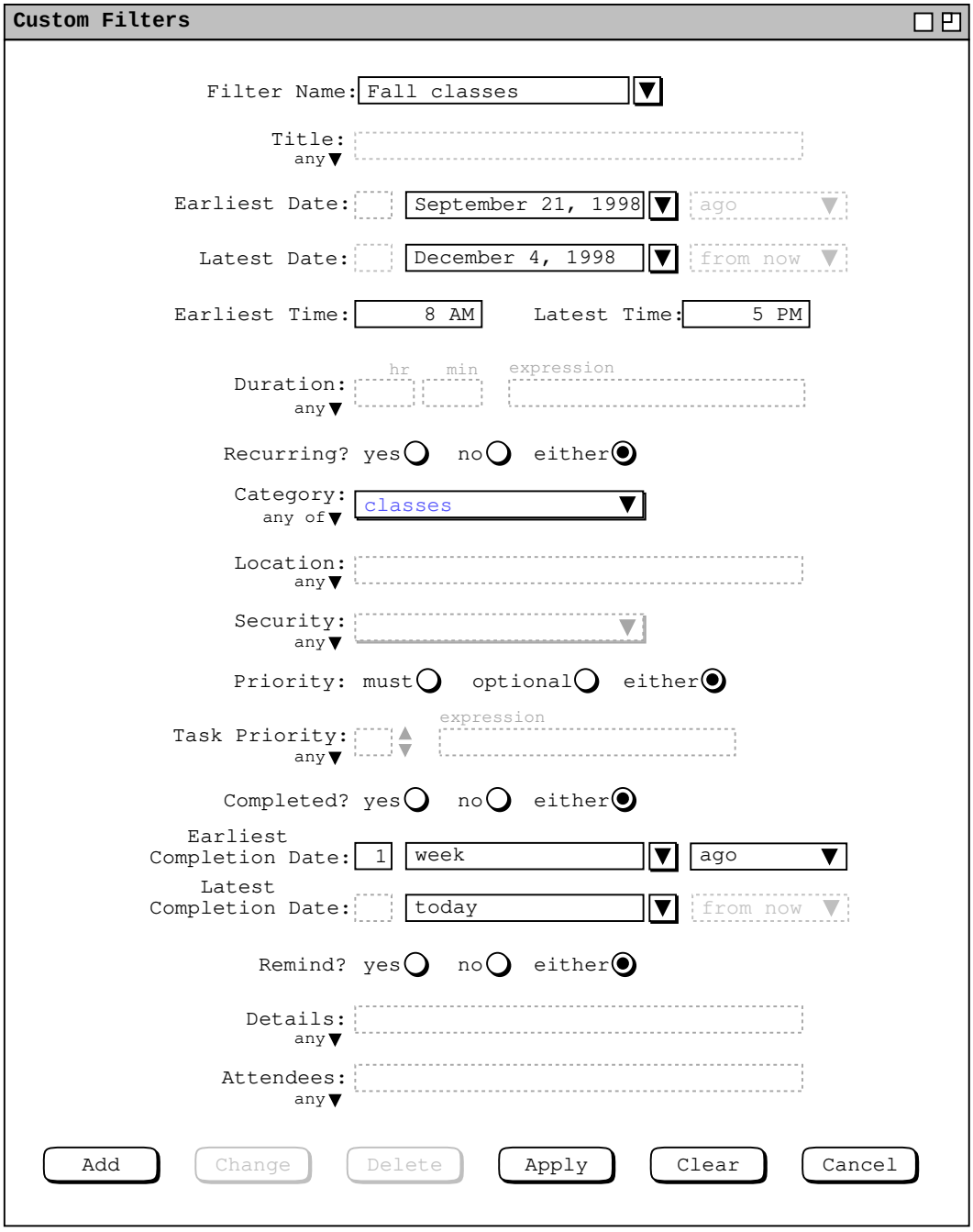


Figure 55: Fall classes custom filter.

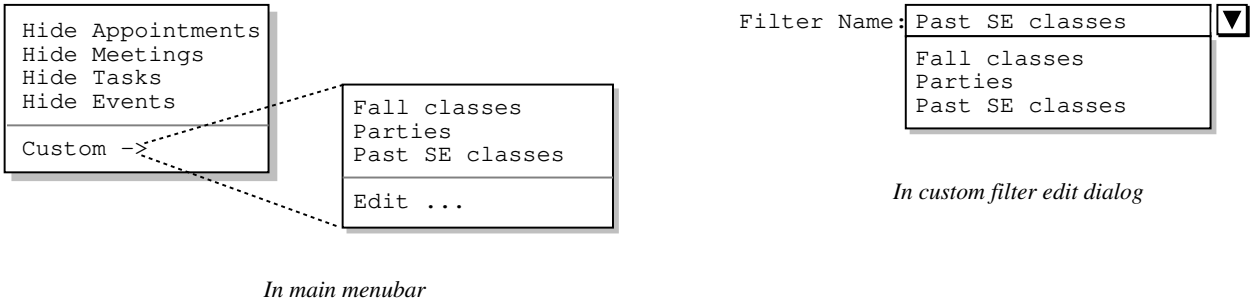


Figure 56: Menu contexts in which filter names appear.

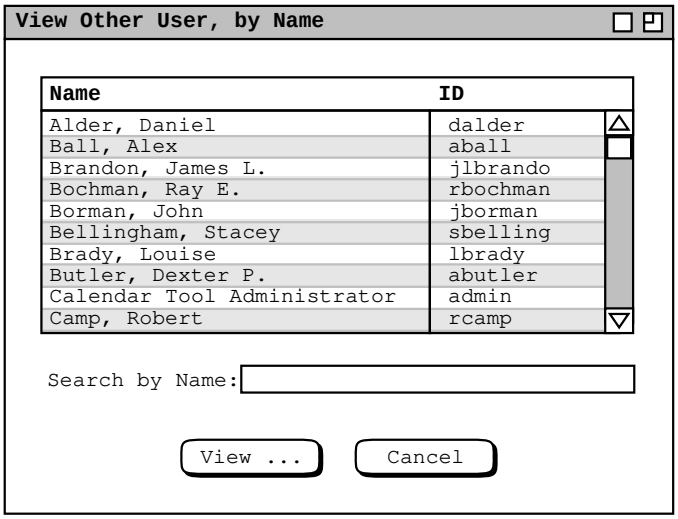


Figure 57: View other user dialog.

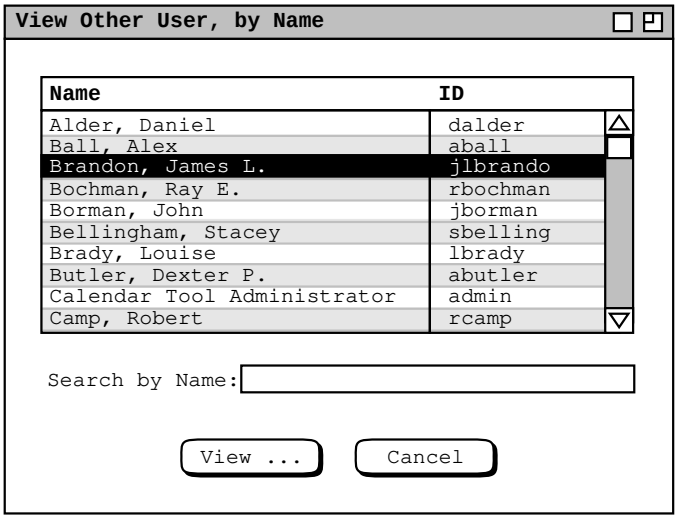


Figure 58: Selecting user for viewing.

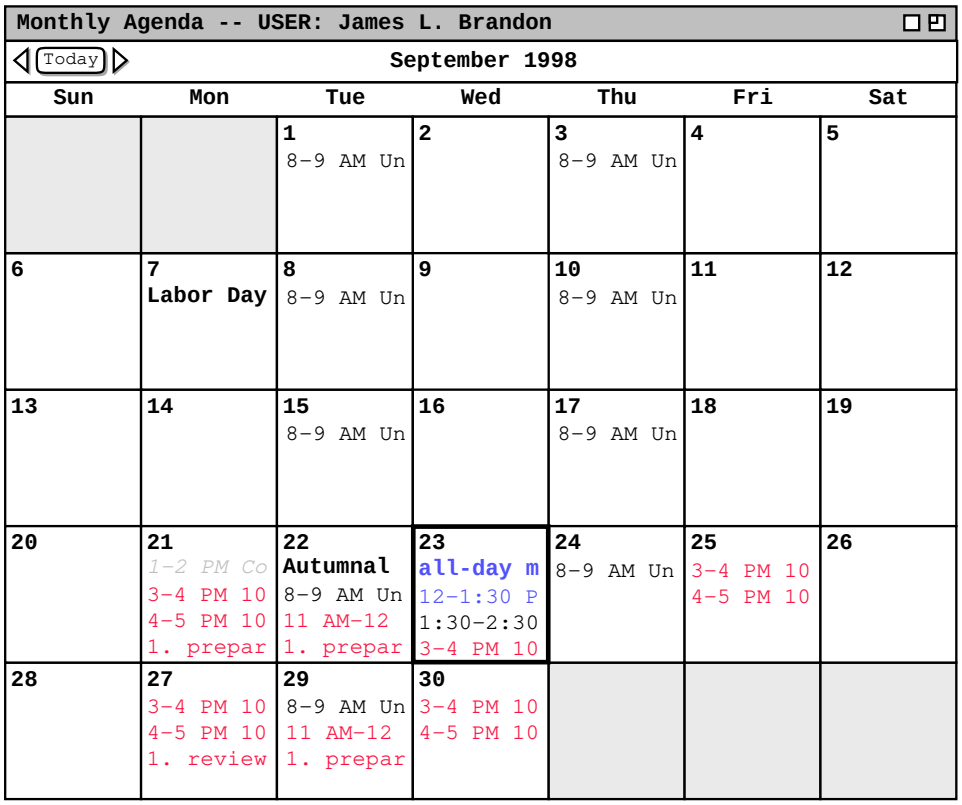


Figure 59: Monthly view for user James L. Brandon.

Daily Agenda -- USER: James L. Brandon

Today **Tuesday, September 22, 1998**

Events:
Autumnal equinox

Tasks:
1. prepare for grad seminar
2. prepare for Microsoft visit

8AM	Unavailable
9AM	
10AM	
11AM	grad seminar
12PM	
1PM	
2PM	
3PM	
4PM	
5PM	

Figure 60: Day view in the James L. Brandon calendar.

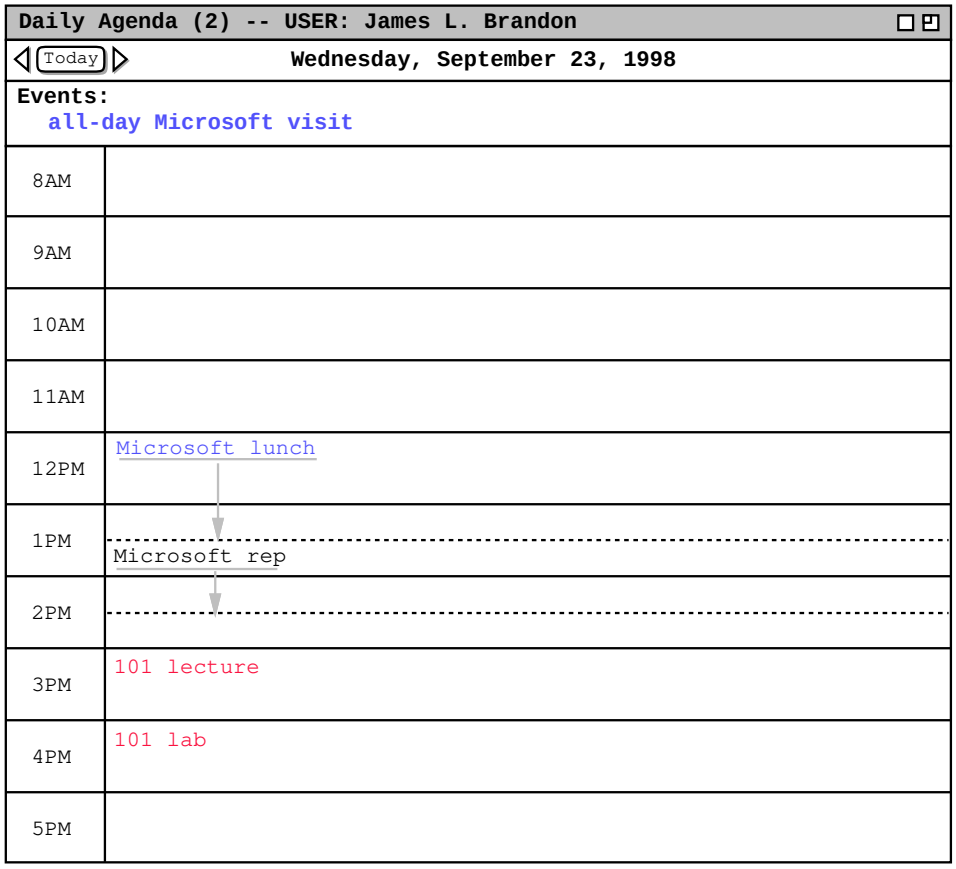


Figure 61: Another day view in the James L. Brandon calendar.

The visibility of items in other users' calendars is controlled by the security settings established by each user. As introduced originally in Section 2.2, the four security levels are the following:

- `public` -- other users can see all details of a scheduled item
- `title only` -- other users can see the title, time, date, and duration of the item, but no other information
- `confidential` -- other users can see the time, date, and duration of the item, but no other information; the item title shows as "Unavailable" to other users
- `private` -- other users can see no information at all about the item

The operational effect of these security settings is detailed in the following paragraphs. In these paragraphs, the term "current user" refers to the user who is viewing another user's calendar; the term "other user" refers to the user whose calendar is being viewed.

To the current user, `public` items appear in displays as they appear to the other user, except:

a. The other user's items are not editable in item-level views. This means that the change, delete, and clear buttons that normally appear in an item-level view are absent when viewing another user at the item level.

b. All display option settings are those of the current user; the other user's option settings have no effect from the current user's perspective. This means that the initial view of the other user's calendar is based on the setting of the current user's initial view option (see Section 2.7.3.1).

c. Filtering is based on the current user's filter settings, if any; the filter definitions of the other user have no effect from the current user's perspective.

The category definitions of `public` items, including their coloring, are those of the other user. The current user's category definitions have no effect when viewing another user's calendar.

'`Title only`' and '`confidential`' security apply only to appointments and meetings, not to tasks or events. Other users' appointments and meetings with either of these securities are viewable at the month, week, and day levels, not at the item level. For '`title only`' security, the title of the item appears at its scheduled date, time, and duration. For `confidential` security, the title "Unavailable" appears. Since the category is not visible for '`title only`' and '`confidential`' items, the text of their titles appear in black type only. At the item level of calendar viewing, '`title only`' and '`confidential`' items are skipped in the next/previous traversal (see Section 2.3.2.1).

To the current user, the precise effect of '`private`' security in another user's item is to filter the item out of view, in exactly the same manner as if it had been filtered out with a custom filter definition. At the day, week, and month level, this means that private items are not visible at all. At the item viewing level, `private` items are not visible and are skipped in the next/previous traversal.

Per the operational details just described, the contents of Figures 59 , 60, and 61 reflect the following settings in the calendar of James L. Brandon:

a. There is a category named "school" colored red.
b. There is a category named "industry" colored blue.
c. There are public recurring appointments titled "101 lecture" and "101 lab", scheduled MWF 3-4 and 4-5, starting September 21, of the "school" category.
d. There is a public recurring appointment titled "grad seminar", scheduled weekly Tu 11-12, starting September 22, of the "school" category.
e. There is a non-recurring public appointment titled "Microsoft lunch", scheduled 12-1:30 September 23, category "industry".
f. There is a public recurring meeting titled "Computer Science Faculty Meeting", scheduled biweekly M 1-2, starting September 21 (appearing penciled-in because it is not yet accepted by the other user)
g. There is a title-only meeting "Microsoft rep", scheduled 1:30-2:30 September 23, category "industry" (but appears in black type because it is title-only).
h. There is a recurring confidential appointment titled "racket ball", scheduled TuTh 8-9 AM, starting September 1 (but appears as "Unavailable" because it is confidential).
i. There is a public recurring task titled "prepare for faculty meeting as necessary", scheduled biweekly Mon 9 AM, category "school".
j. There is a public recurring task titled "review lecture notes", scheduled Mon 11 AM, category "school".
k. There is a public recurring task titled "prepare for grad seminar", scheduled weekly Tu 10 AM, category "school".
l. There is a public non-recurring task titled "prepare for Microsoft visit", Tu, no due time, September 22, category "industry".
m. There is a private event titled "my birthday", scheduled September 24 (but does not appear because it is private).

The figures show how the banner of the display window is altered to indicate that the calendar of another user is displayed. The format of the banner is the following:

-- USER: *full-user-name*

where *full-user-name* is the full name of the other user as registered in the Calendar Tool user database (see Section 2.6.2).

2.3.5.2. Viewing Group Calendars

When the user selects the '`Group ...`' item in the '`View menu`', the system displays the dialog shown in Figure 62. This dialog has the same format as the one for viewing users, shown Figure 57 The groups listed in Figure 128

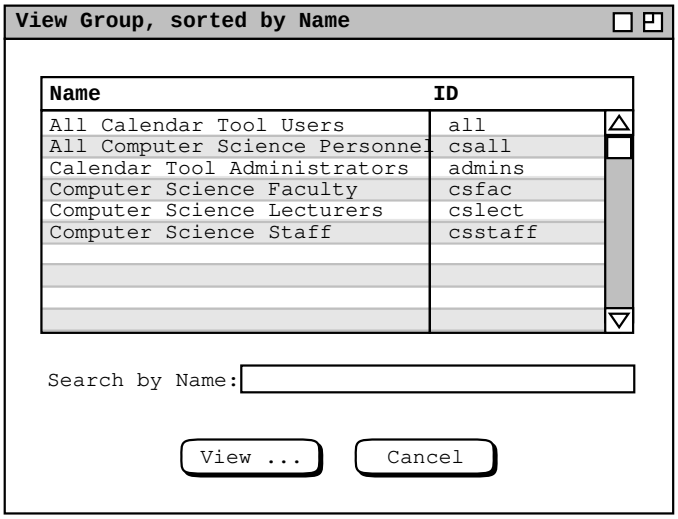


Figure 62: View group dialog.

reflect additions having been made by system administrators. Details of group database operations are covered in Section 2.6.3. The default sorting order for the user list is by name, which can be changed to ID by clicking on the '`ID`' column heading. Since names need not be unique, the secondary sorting order is by ID when `Name` is the primary sort key. The '`Search by`' field operates in the same manner as in the user database dialog.

To choose a group for viewing, the user selects its name or ID in the group list and presses '`View ...`'. In response, the system displays the monthy calendar for the selected group, for the month containing today's date. For example, Figure 63 shows the response to the user selecting the `csfac` group for viewing. The figure shows two meetings: a recurring "Faculty Meeting", scheduled 1-2PM on alternate Mondays; a recurring "Software Engineering Colloquium", scheduled 10:30-12PM on Thursdays.

All of the rules described in the preceding section for viewing other users' calendars apply to viewing group calendars. In addition, the following rules apply specifically to viewing group calendars:

a. only meetings appear in a group calendar;

b. the only meetings that appear are those scheduled by a leader of the group

Section 2.4.1.6.1 discusses further the contents of group calendars.

Figure 63 shows how the banner of the display window is altered to indicate that the calendar of a group is displayed. The format of the banner is the following:

`-- GROUP:` *full-group-name*

where *full-group-name* is the full name of the group as registered in the Calendar Tool group database (see Section 2.6.3).

2.3.6. Viewing in Different Windows

When the user selects the '`Windows ->`' command in the '`View`' menu, the system displays a submenu of the form shown in Figure 64. The top segment of the menu is a list of all active windows currently displayed on the screen. The contents of the menu in Figure 64 represent the windows as they have been displayed in the requirements scenarios up to this point. The order of the windows is chronological, from the most current to least the current. "Most current" is the window most recently made current by the user selecting it or by the system displaying it. "Least current" is the window least recently made current or displayed.

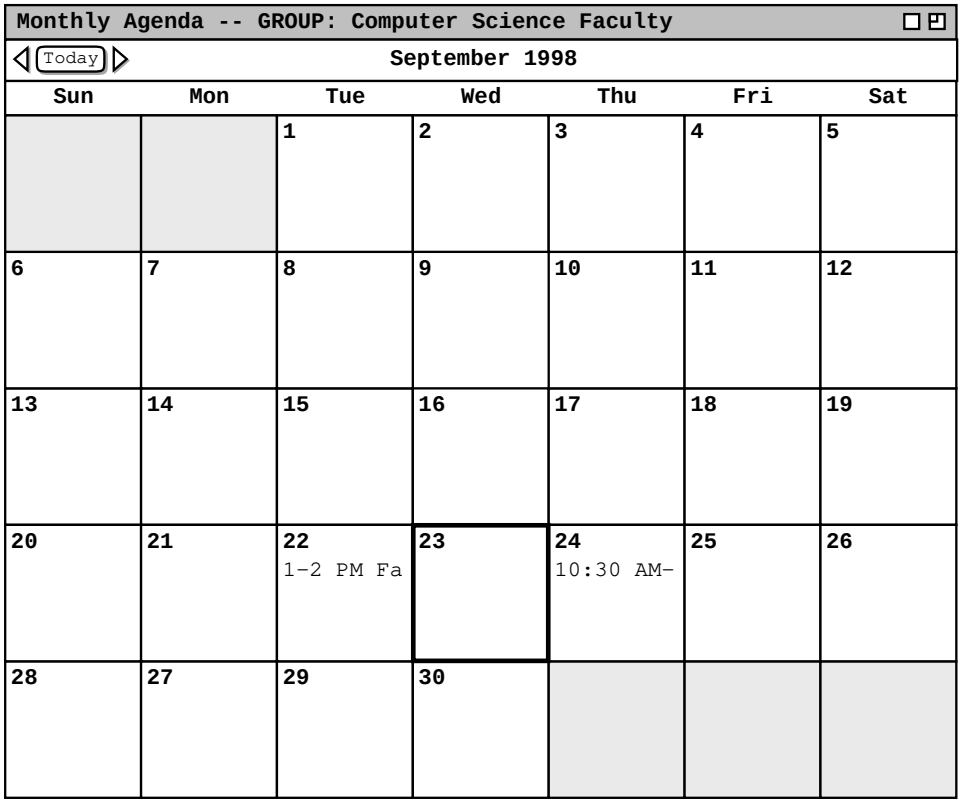


Figure 63: Monthly view for group Computer Science Faculty.

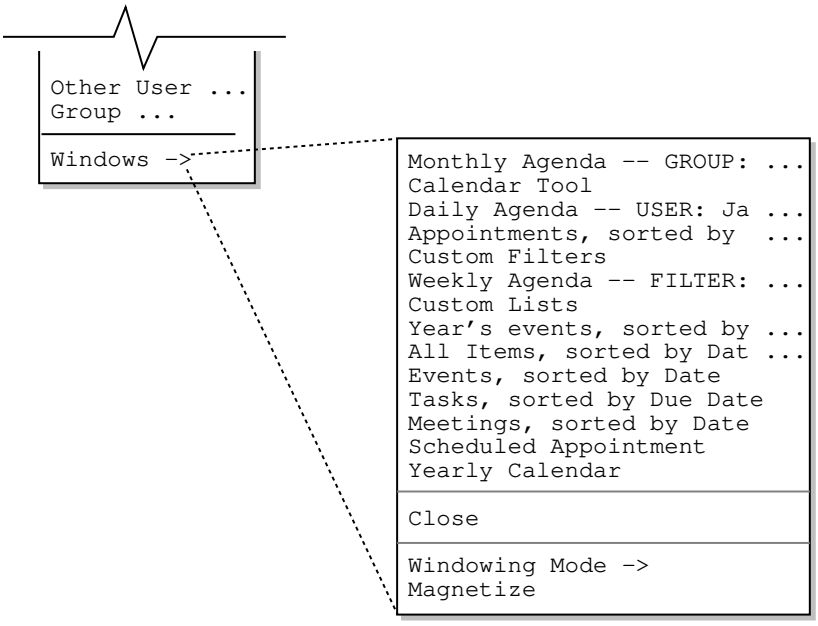


Figure 64: Windows submenu with chronological list of active windows.

The windows are listed by the title strings that appear in the window banners. When the title is longer than the default menu width, the " `...`" suffix is added. The window titled "`Calendar Tool`" is the command menubar. It is listed explicitly since it is indeed a physically separate window.

To make any window active, the user selects its name in the '`Windows`' menu. In response, the system performs the following actions:

a. moves the selected window to the front on the screen, so it is in front all other windows;

b. defines the window as current;

c. moves the window's title to the top of the windows menu list.

The same actions are performed when the user physically selects a window through the normal means of the underlying operating environment, such as clicking on its banner, border, or body.

Immediately below the window list is the '`Close`' window command. When the user selects this command, the system removes the current window from the screen and removes its name from the windows list. After the current window is closed, the next window in the list becomes current. Any window except the command menubar can be closed.

The action performed by the '`Close`' command is different from the action typically referred to as "iconify" or "minimize" in window-based operating environments. The iconify action does not completely remove a window, but rather reduces it to an iconic form that can be re-opened. In contrast, the close operation fully removes a window from the screen, leaving no icon of any form. An underlying operating environment may provide both iconify and close operations. If it provides close, the Calendar Tool detects closure of one of its windows, removes the name of the closed window from the windows list and makes the next window on the list current.

2.3.6.1. Windowing Mode

As introduced in earlier scenarios, the user may choose from three different windowing modes. To do so, the user selects the '`Windowing Mode`' command, in response to which the system displays the submenu shown in Figure 65. The windowing mode determines how the system displays the results of certain commands in the '`View`' menu. Specifically, Figure 66 shows precisely which commands are affected by the windowing mode setting. The

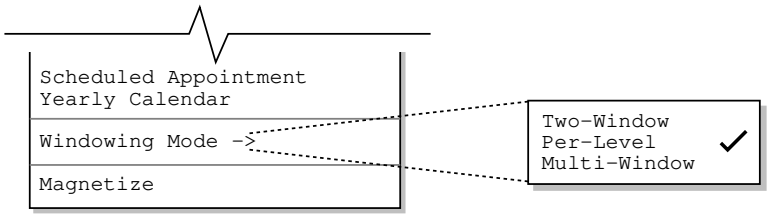


Figure 65: Windowing mode submenu.

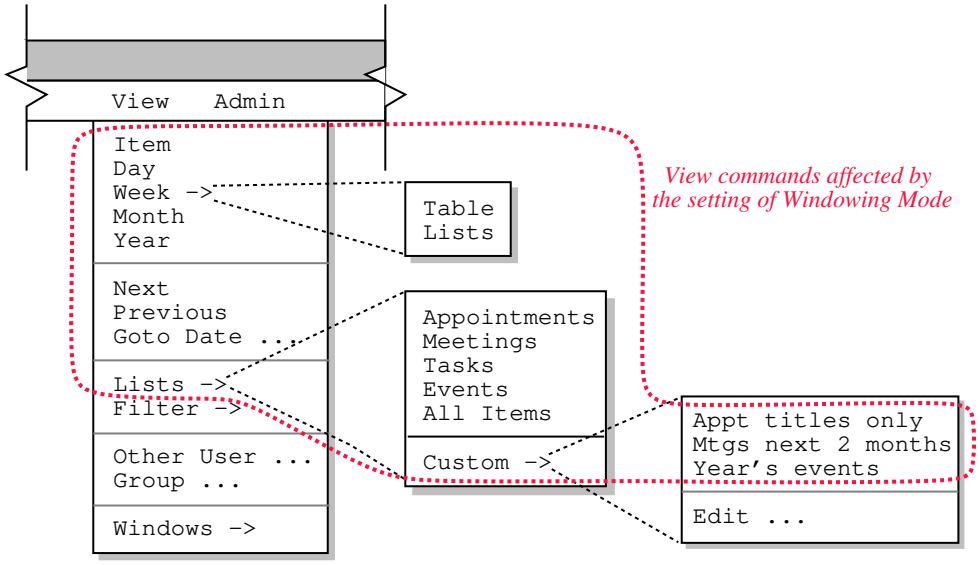


Figure 66: Commands affected by the setting of Windowing Mode.

commands are those that display items in calendar and list format.

2.3.6.1.1. Per-Level Windowing Mode

The default windowing mode is 'Per-Level'. The windows list in Figure 64 reflects the state of windows based on per-level mode having been active during the scenarios presented to this point.

In per-level mode, there are up to eleven separate viewing windows active on the screen. Table 7 describes each of these windows. At the item level, the *item-type* in the title is one of "Appointment", "Meeting", "Task", or "Event". At the week level, the results of the two styles of '`View Week`', i.e., '`Table`' or '`Lists`', go in the same window. For custom lists, the *custom list name* is the name of one of the custom lists defined by the user.

When one of the eleven mode-affected view commands is executed in per-level mode, the system performs the following display actions:

a. If there is no window currently displayed for that command, one is created and displayed on the screen.

b. If there is an existing window for that command, the contents of the window are updated to reflect the results of the latest command execution and the window is moved to the front of all other windows on the screen.

Window Title	**Command Results Displayed**
"Scheduled *item-type*"	`View Item`
"Daily Agenda"	`View Day`
"Weekly Agenda"	`View Week`
"Monthly Agenda"	`View Month`
"Yearly Calendar"	`View Year`
"Appointments, sorted by ..."	`View Lists Appointments`
"Meetings, sorted by ..."	`View Lists Meetings`
"Tasks, sorted by ..."	`View Lists Tasks`
"Events, sorted by ..."	`View Lists Events`
"All Items, sorted by ..."	`View Lists All Items`
custom list name	`View Lists Custom` *custom list name*

Table 7: Windows used in per-level windowing mode.

The '`View Next`' and '`View Previous`' commands never create a new window in per-level mode. This is because these two commands must be executed in the context of an existing display. Therefore, '`View Next`' and '`View Previous`' always change the current display when executed in per-level mode.

The '`View Goto Date`' command updates an existing applicable window if one exists. Otherwise it creates a new window at the default viewing level. Further operational details of '`View Goto Date`' are given in Section 2.3.2.3.

In some cases, the size of an existing window may change when a command is executed in per-level mode. For example, at the item-level of viewing, the size of an appointment display is larger than an event display. In such cases, the window is positioned so that its upper left corner stays in the same screen location.

2.3.6.1.2. Two-Window Mode

In two-window mode, a single window is used to display all calendar viewing commands; another single window is used to display all list commands. Hence there up to two active display windows in two-window mode. The calendar viewing commands are the first five in the '`View`' menu, and the first five listed in Table 7. The list viewing commands are those in the '`View Lists`' submenu, and the last six listed in Table 7

When the user selects two-window mode, the mode transition does not itself change the state of the screen. Rather, the transition establishes how windows will be displayed subsequently. Hence, the transition to two-window mode from per-level or multi-window modes does not remove any windows from the screen.

When one of the five calendar view commands is executed in two-window mode, the system performs the following actions:

a. If there is no calendar view window currently displayed, one is created and displayed on the screen.
b. If there is an existing calendar view window, the contents of the window are updated to reflect the results of the latest command execution and the window is moved to the front of all other windows on the screen.

The same two actions apply to the six list viewing commands and the single list-viewing window.

Three or more windows can be displayed while in two-window mode, but only two of them are actively used for command display. If the user changes the active calendar window while in two-window mode, the newly current window becomes that in which all subsequent single-window calendar display occurs. The same applies to a change in the current list view window.

The size of an existing window may frequently change when a command is executed in two-window mode. In such cases, the window is positioned so that its upper left corner stays in the same screen location.

2.3.6.1.3. Multi-Window Mode

In multi-window mode, a separate window is used for each and every execution of a mode-affected view command, even for commands at the same calendar level and for list commands of the same type. The purpose of multi-window mode is to allow the user to create side-by-side displays of consecutive calendar periods, or other useful combinations of multi-window information. For example, Figure 67 shows a side-by-side three-month display, which the user creates by performing the following actions:

a. execute the '`View Windowing Mode Multi-Window`' command

b. execute '`View Month`' for the month of September 1998

c. execute '`View Previous`' and '`View Next`' from the September display

d. resize the monthly agenda windows to a smaller sizes and move them next to each other on the screen

2.3.6.2. Magnetizing Windows

Here's where we put in the cool idea for having the windows stick to each other when they're moved in close proximity to each other.

2.4. More Scheduling

The scenario in Section 2.2 focused on appointment scheduling. The scenarios in this section describe the scheduling of the three other types of scheduleable item:

- meetings
- tasks
- plain events

2.4.1. Scheduling Meetings

The scenarios in this section show how meetings are scheduled for Calendar Tool users. A scheduled meeting has all the information that an appointment has, plus the following additional information:

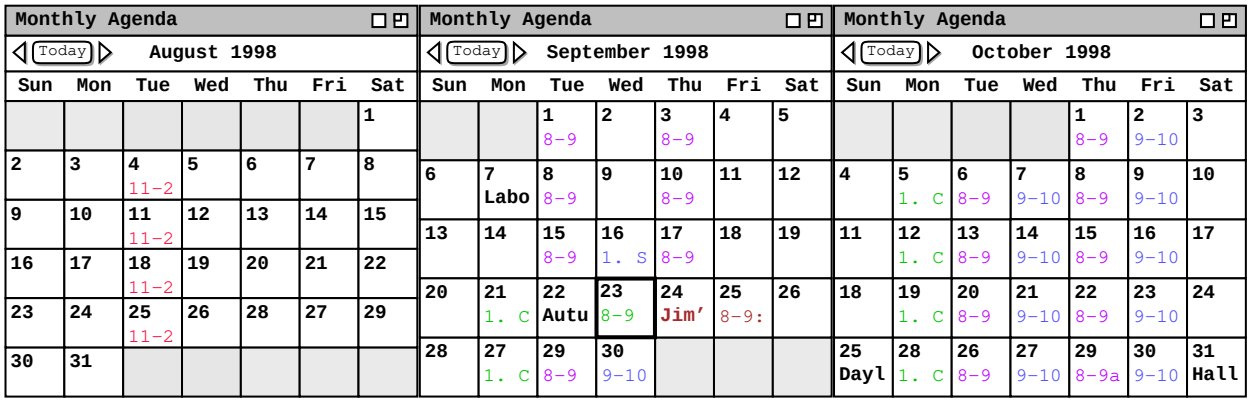


Figure 67: Side-by-side three-month display.

- a list of the meeting attendees
- the ID of the user of who schedules the meeting
- the date and time scheduling takes place
- a reference to the minutes of the meeting, once it has taken place

Meetings are scheduled among registered users of the Calendar Tool system. For convenience, the Calendar Tool provides administrative functions to define groups of users among whom meetings may be regularly scheduled. Complete details of defining user groups are covered in Section 2.6.3. For the purposes of meeting scheduling, a group is viewed simply as a collection of Calendar Tool users with a common group name. When the group name is listed in the attendees list for a meeting, all members of the group are considered attendees.

User groups have leaders, who are themselves Calendar Tool users. When a group leader schedules a meeting for a group, the system automatically notifies group members about the meeting and adds the meeting to the group calendar. Meetings can also be scheduled by users who are not group leaders, with individual users as attendees. Administratively, scheduling a meeting for a group as a whole is restricted to leaders of the group.

2.4.1.1. A Group Leader Scheduling Two Straightforward Meetings

The scenario in this section presents a group leader scheduling both a non-recurring and recurring meeting, with some variations in scheduling details. In this scenario and the meeting scenarios to follow, "the scheduler" refers to the user performing the scheduling.

To begin the meeting scheduling process, the scheduler selects the '`Meeting`' command in the '`Schedule`' menu. In response, the system displays the dialog shown in Figure 68. Scheduling a meeting is much like scheduling an appointment, as described in Section 2.2. The principle difference between meeting versus appointment scheduling is that a meeting dialog defines a range of possible dates and times, rather than a single date and time as for an appointment. Hence, a meeting dialog holds a form of scheduling *request*. Key elements of the request are a date/time range, a list of attending users, and an optional meeting location. When the dialog is filled in, the system computes all the dates and times that satisfy the request. The scheduler then chooses a specific desired meeting time from those computed.

The following fields in the scheduling request dialog hold the same form of information as the appointment scheduling dialog in Figure 6:

- `Title`
- `Duration`
- `Category`
- `Security`
- `Location`
- `Priority`
- `Remind`, and its accompanying fields
- `Details`

The scheduler enters information for these fields in the same manner as for an appointment, as described in Section 2.2.

The date and time fields for a scheduling a meeting are notably different than for an appointment. In the case of a meeting, there are earliest and latest possible dates, and earliest and latest possible start times. These date and time ranges are used by the scheduler to indicate the range of acceptable dates and times in which the meeting can be scheduled. For a recurring meeting, the earliest and latest end dates are enabled. These fields indicate the acceptable range of dates for the last occurrence of a recurring meeting.

The `Recurring` checkbox and `Interval` menu are the same for meetings as they are for appointments. The recurring details are different for a meeting request, as discussed further below.

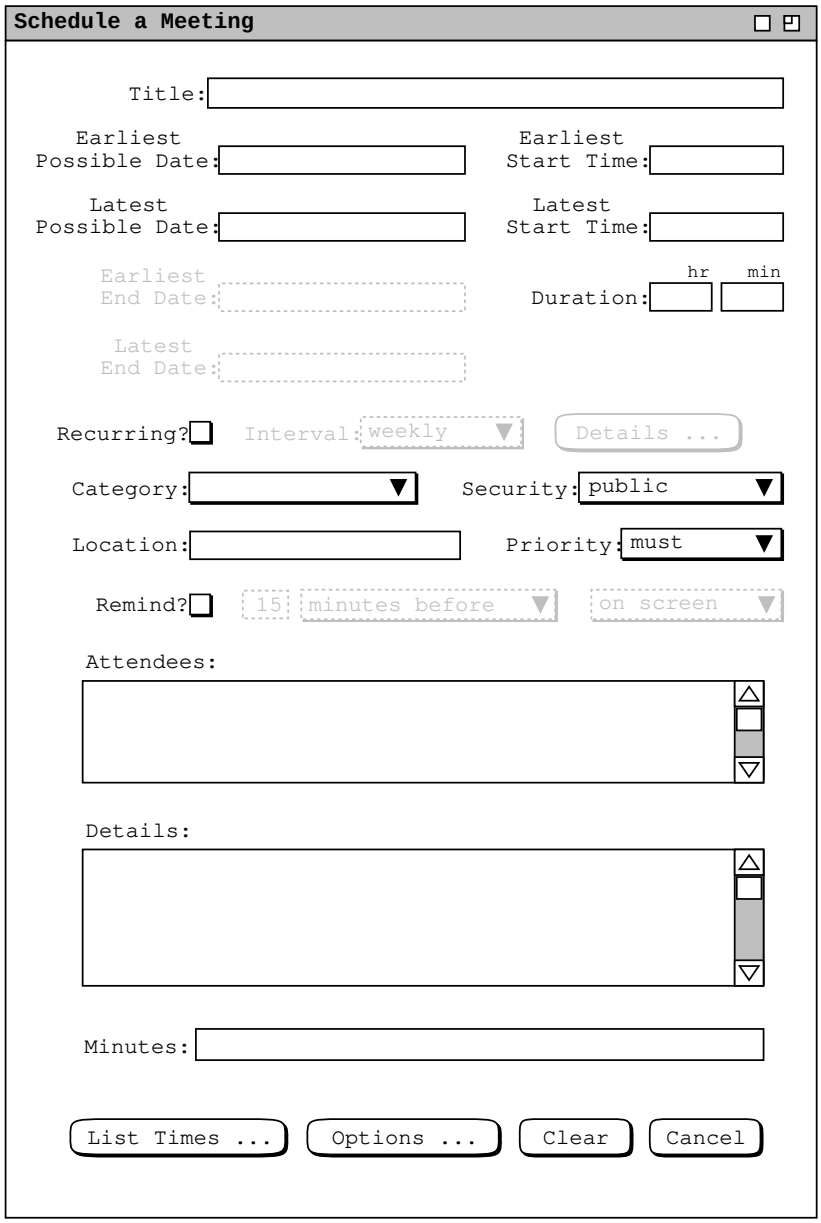


Figure 68: Meeting scheduling request dialog.

The `Attendees` field contains a comma-separated list of attendee names. Attendee names are those of individual calendar tool users or user groups. User and group names can be entered in one of two forms: ID or nickname. The ID of a user or group is the unique identifier by which the user or group is known in the Calendar Tool system. A nickname is an optional user-defined identifier by which a user or group is known. IDs and nicknames are defined and searched for as described in Section 2.6. The names in the `Attendees` list need not be unique. The system ignores duplicates in the attendees list in that only a single meeting notification is sent to each attending user, even if a user is listed more than once in the attendees list. Duplication of users in the attendees list can arise when a single user is a member of two or more groups appearing in the attendees list.

The ‘Minutes’ text field specifies the location of the meeting minutes as a WWW URL. In the case of a recurring meeting, the scheuler may specify the URL as a directory rather than as an individual file. When a directory URL is entered, the scheduler must subsequently enter the name for each individual minutes file by editing individual meeting occurrances, as described in Section 2.5.2.2. Details of how users view meeting minutes are covered in Section 2.5.1.2.

Figure 69 shows the scheduler having entered information for a non-recurring meeting of the computer science staff. The earliest and latest possible dates are the Monday and Friday of the week of September 20. The earliest and latest start times are 8 AM to 6 PM. The category is blank and there is no reminder. To proceed with the scheduling

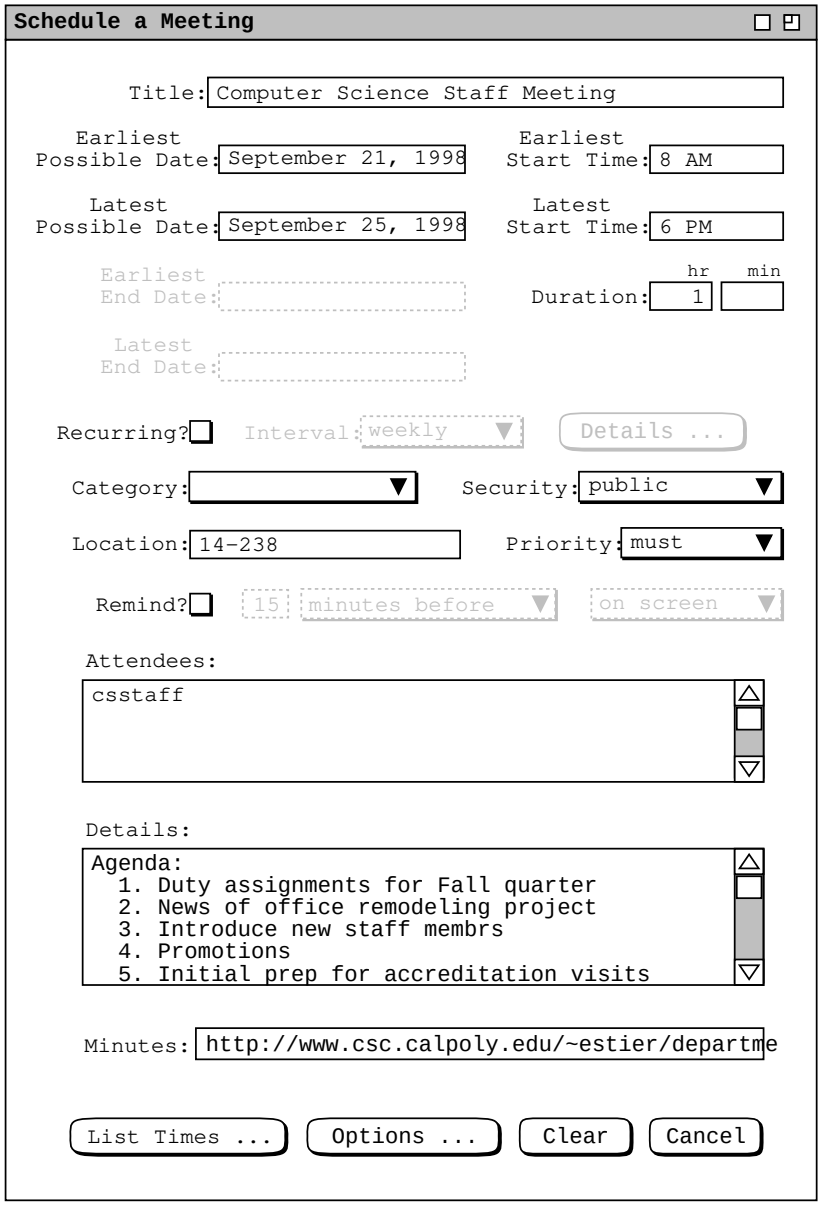


Figure 69: Scheduling a staff meeting.

operation, the user presses the '`List Times ...`' button. In response, the system displays a list of possible meeting times, as shown in Figure 70. The scheduling request dialog remains on the screen, but all of its data-entry fields and command buttons are disabled until the meeting confirmation process concludes.

The list in Figure 70 contains all the meeting times that conform to the values entered in the scheduling request dialog. Each item in the list consists of a time range, day of the week, and date. The precise meaning of "conform to" is as follows:

a. All meeting dates in the possibles list are between the earliest and latest possible dates entered in the scheduling request dialog.

b. All meeting start times are between the earliest and latest start time range entered in the scheduling request dialog.

c. All meeting durations are the value entered in the scheduling request dialog.

d. For all attendees, there is no non-private scheduled item for the attendee that overlaps with any listed meeting time.

e. If the location in the request dialog is in the location database (Section 2.6.4), then the location is available at the scheduled time and date. A location not in the database is assumed to be available at any time.

The list of possible times is sorted first by date and second by time, from earliest to latest. The default maximum number of listed items is twenty, which value can be changed as an option setting. The minimum number of items in the list is one. When there are no conforming possible times, the system displays an alert message instead of the list, as discussed in the next meeting scheduling scenario.

To select one of the possible meeting times, the user clicks on the desired item in the list and presses the '`Confirm ...`' button, which becomes enabled when the user makes a list selection. For example, Figure 71 shows the scheduler having selected the 8-9 AM time slot on September 23.

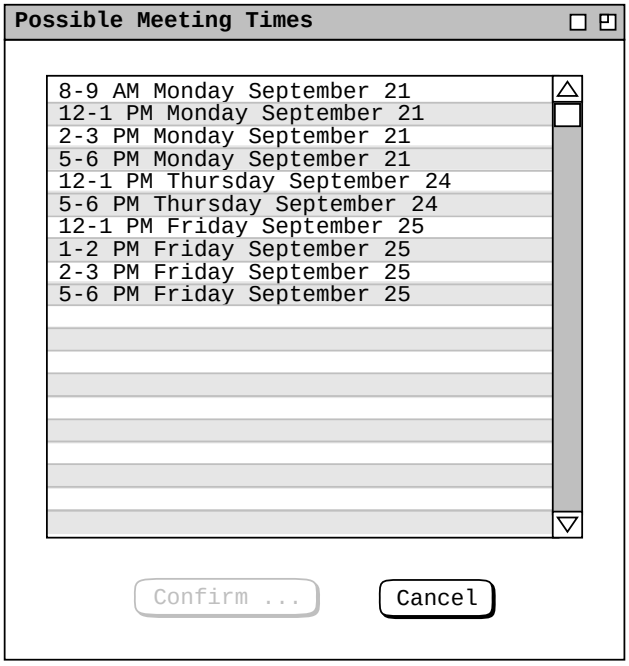


Figure 70: List of possible meeting times for the csstaff meeting.

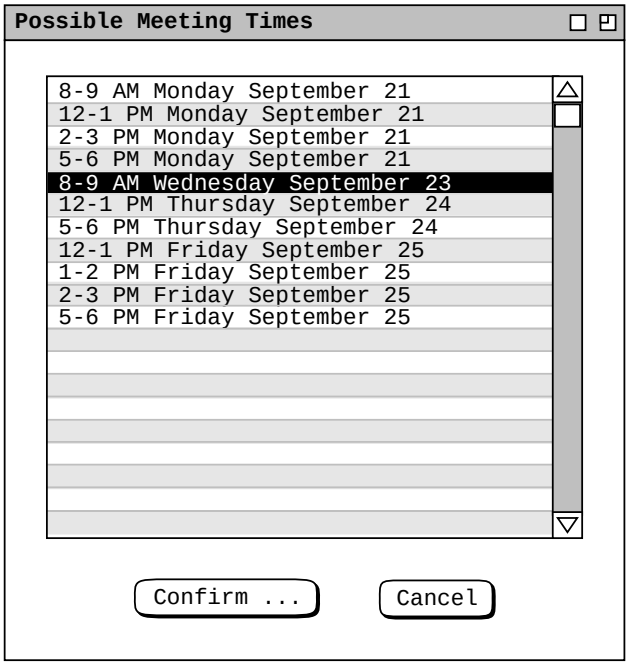


Figure 71: Selection in the possible meeting times list.

When the scheduler presses '`Confirm ...`' in Figure 71, the system responds with the meeting confirmation dialog in Figure 72. The confirmation dialog contains the information entered in the initial scheduling request dialog, with the date and time ranges replaced with the single date and time selected from the list of possible times. There are three additional data fields below '`Minutes`'. The '`Scheduled By`' and '`On`' fields are read-only text. The values of these two fields are set by the system to the ID of the user performing the scheduling and the date/time on which the scheduling occurs. Below the scheduler ID is a check box indicating whether or not to send email notification to all attendees. All attendees are automatically notified of a confirmed meeting with a pop-up dialog, as explained in Section 2.4.1.5. An email message can be sent in addition to the Calendar Tool dialog notification.

The scheduler can edit some of the data-entry fields in the meeting confirmation. The uneditable fields are those that affect how the list of possible times is computed. These fields have greyed and dashed borders to indicate their disabled state. The complete information for a meeting is that entered initially in the scheduling request dialog (Figure 68) and subsequently in the meeting confirmation dialog (Figure 72). Information that is not necessary for the possible-times computation can be left blank in the initial request dialog. For example, if the meeting title is left blank in the scheduling request dialog, it can be entered subsequently in the confirmation dialog. The exact data entry rules for the request and confirmation dialogs are given in Section 2.11.3.1.

While the meeting confirmation dialog is displayed, the original request dialog and possible times list remain on the screen for reference purposes. However, all of the data-entry fields of these earlier two dialogs remain inactive while the confirmation dialog is displayed. Changes made in the confirmation dialog do not affect any of the values in the original scheduling dialog. For example, if the scheduler edits the title in the confirmation dialog, the title remains as initially entered in the scheduling request dialog.

Figure 73 shows the scheduler having edited the meeting confirmation dialog by adding a reminder and correcting a spelling error in the original '`Details`' data field.

After completing the edits in the meeting confirmation dialog, the scheduler confirms the meeting by pressing the '`OK`' button. In response, the system schedules the meeting. On the screen, the system removes the three pending dialogs windows -- the possible meeting times, the confirmation dialog, and the original scheduling request dialog.

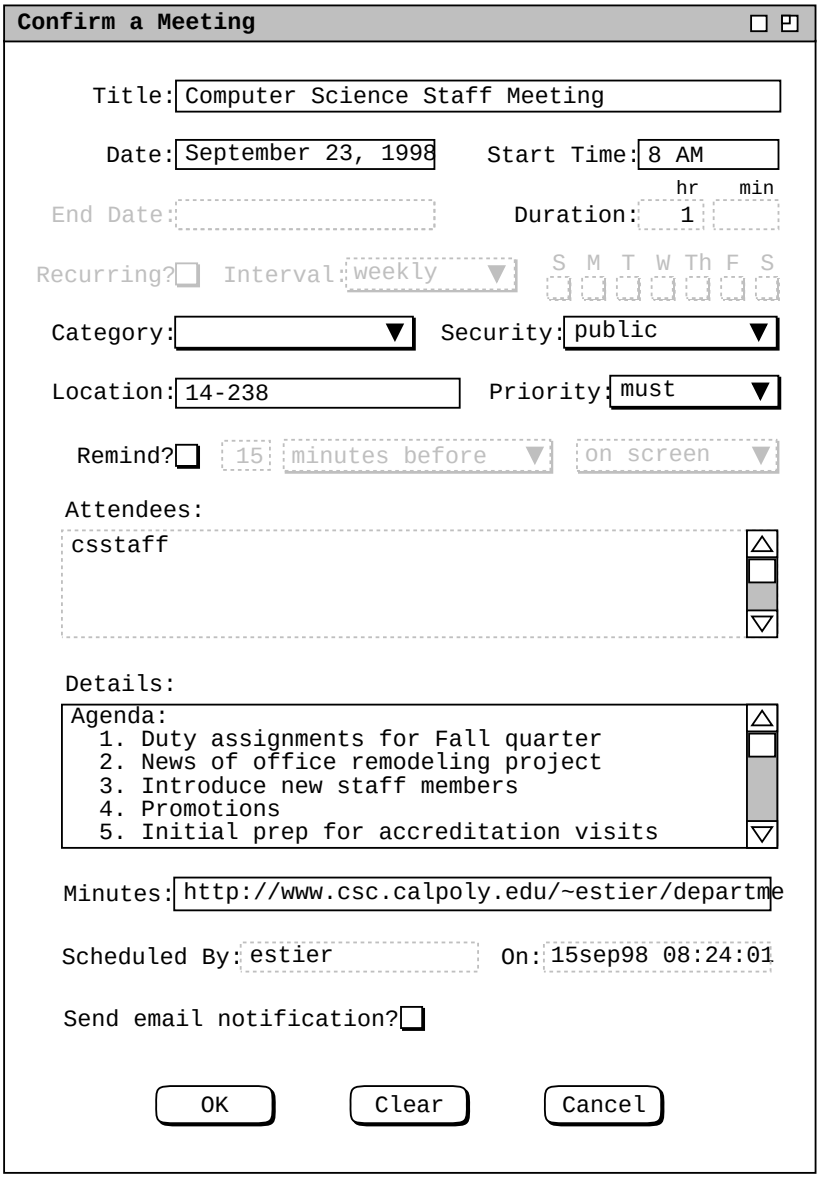


Figure 72: Staff meeting confirmation dialog.

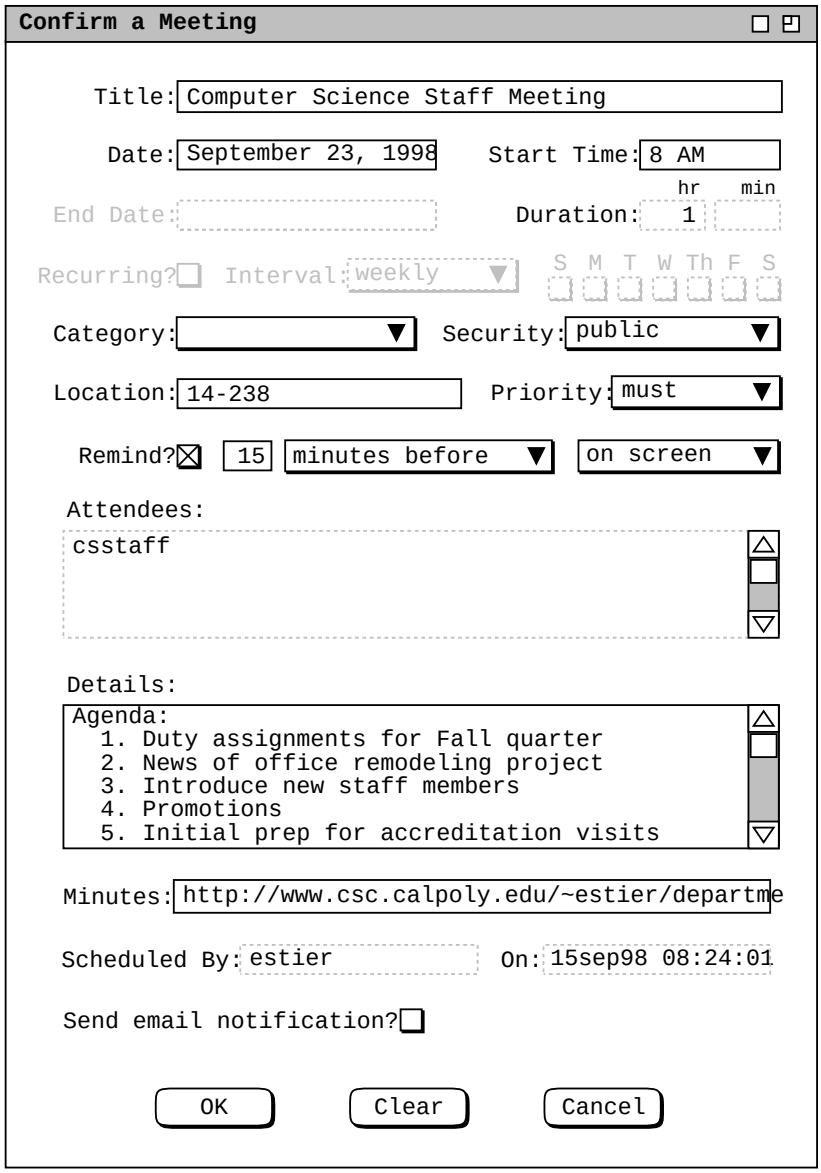


Figure 73: Meeting confirmation dialog with some edits.

The precise effects of scheduling a meeting are the following:

a. Each attendee except the scheduler is notified of the meeting, as discussed in Section 2.4.1.5.

b. The meeting is added to the scheduler's calendar, whether or not the scheduler is an attendee.

c. The meeting is added to the calendar of all groups that appear in the attendees list. Details on the contents of group calendars are covered in Section 2.4.1.6.1.

d. If the specified location is in the location database, the location is marked as booked for the duration of the meeting. If the location is not in the database, then no location-related action is taken.

Only a group leader can schedule a meeting for a group. If a non-leader attempts to do so, the system responds with an error message, as described further in Section 2.12.4.

In the case of the staff meeting in Figure 73, only the single csstaff group appears in the attendees list. In this scenario, the scheduler is assumed to be a leader of that group, as well as a member. Therefore, when the scheduler confirms the staff meeting, the system:

a. notifies all members of csstaff except the scheduler;
b. adds the meeting to the scheduler's calendar;
c. adds the meeting to the csstaff group calendar;
d. marks the 14-238 location as booked for the duration of the meeting.

The scheduler now proceeds to create another meeting, following the same procedure as for the preceding staff meeting. The resulting filled-in request dialog is shown in Figure 74. This is a recurring meeting for computer science lecturers. The earliest and latest start dates are the same as for the staff meeting. Since the meeting is recurring, the latest and earliest end date fields are enabled. Also, the word "Possible" in the two start date labels is changed to "Start" to clarify the display as that of a recurring meeting.

The recurring interval of the meeting is 'weekly', which is the default. In this case, the scheduler does not specify any further recurring details. This means that the system will consider all days of the week in the normal day range for which times are available. The default normal day range is Monday through Friday, which can be changed as an option. The 'Details ...' aspect of recurring meetings is covered in the next meeting-scheduling scenario as well as in Section .

When the scheduler presses the 'List Times ...' button for the lecturer meeting, the system responds with the list of possible meeting times shown in Figure 75. For a weekly recurring meeting, each item in the list consists of a time range, day(s) of the week, start date, and end date. The scheduler selects the third item in Figure 75 and presses 'Confirm ...', whereupon the system displays the confirmation dialog in Figure 76. The scheduler accepts the meeting without further edits by pressing 'OK' in the confirmation dialog. In this scenario, the scheduler is assumed to be a leader but not a member of the cslect group. Therefore, when the scheduler confirms the lecturer meeting, the system:

a. notifies all members of cslect, which does not include the scheduler;
b. adds the meeting to the scheduler's calendar, even though the scheduler is not an attendee;
c. adds the meeting to the cslect group calendar;
d. marks the 14-238 location as booked for the duration of the meeting.

Before a meeting is confirmed, the 'Clear' button in the confirmation dialog clears all changes made since the system initially displayed the dialog. For example, if the user presses 'Clear' in the dialog of Figure 73 the system restores the dialog state to that shown Figure 72. The 'Cancel' button in the meeting confirmation dialog removes the dialog from the screen and re-activates the possible-times dialog. Pressing 'Cancel in the possible-times dialog removes it from the screen and re-activates the original scheduling request dialog. 'Cancel' there removes the dialog, thereby canceling the scheduling operation entirely. Hence at the level of the meeting confirmation dialog, cancelling the scheduling operation is a three-step process: first the confirmation is cancelled, then the possibles list, and finally the original scheduling request dialog.

Once a meeting is confirmed, the item that appears in the scheduler's calendar is that through which attendee-wide changes or cancellation are performed. This is the reason that a scheduled meeting is added to the scheduler's calendar even if the scheduler is not an attendee. Changing and cancelling scheduled meetings are discussed in Section 2.5.2.2.

2.4.1.2. A Group Leader Encountering Difficulties While Scheduling

This section presents a scenario where the scheduler must adjust scheduling options in order to arrive at an acceptable meeting time. The scheduler in this scenario is a different Calendar Tool user than in the preceding scenario.

To begin, the scheduler selects 'Schedule Meeting' in the command menu and fills in the dialog as shown in Figure 77. In this case, the scheduler wants to schedule a recurring meeting on a specific day and time. The single specific time is chosen by entering the same 1 PM value for both the earliest and latest start times. To select a

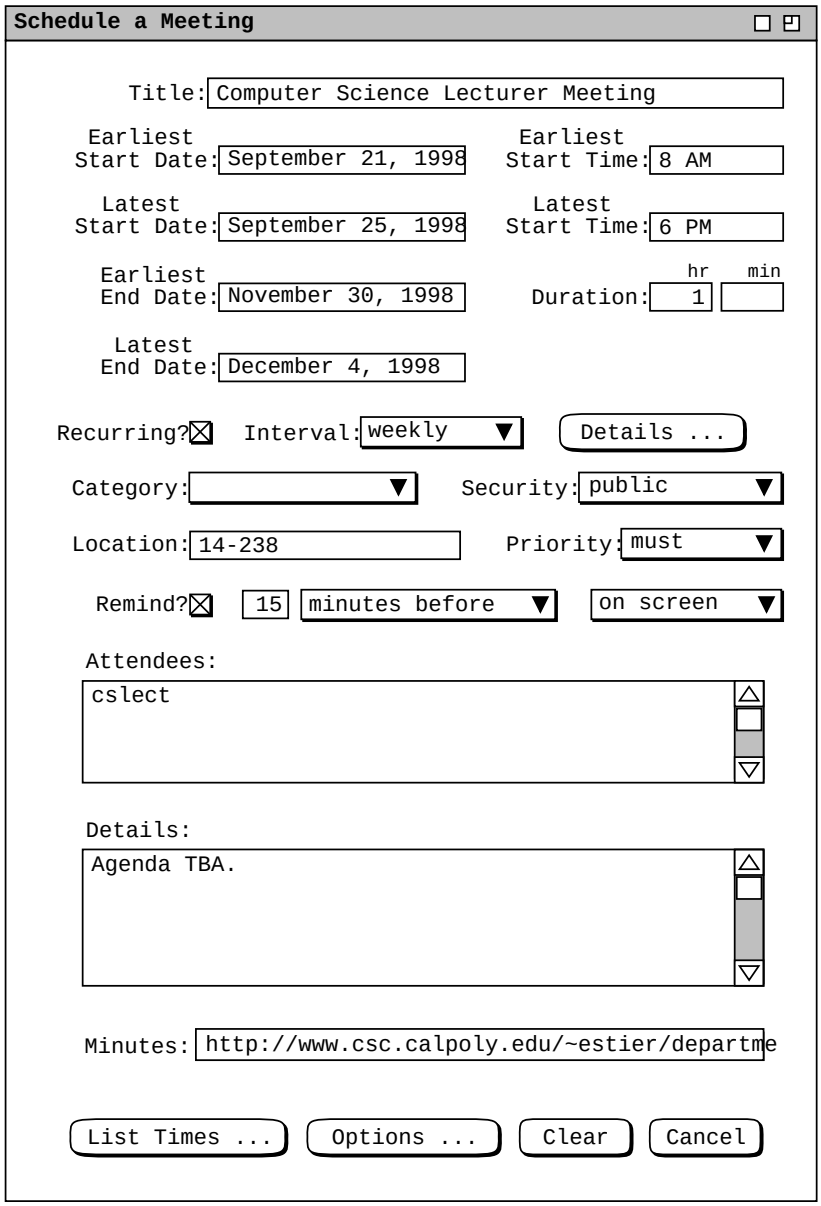


Figure 74: Scheduling another meeting.

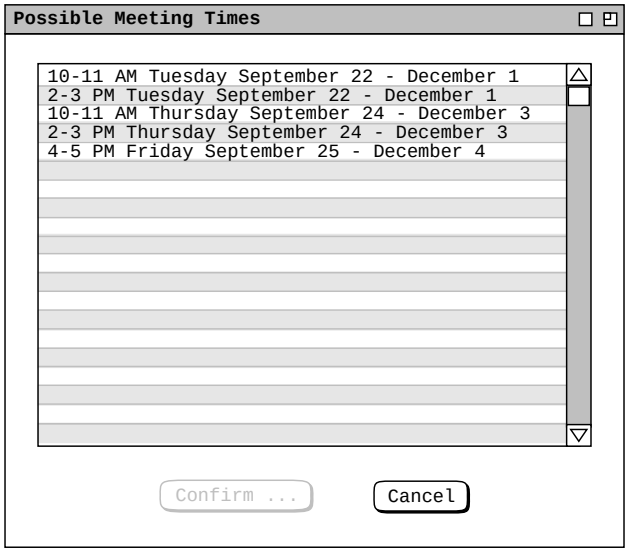


Figure 75: List of possible meeting times for the cslect meeting.

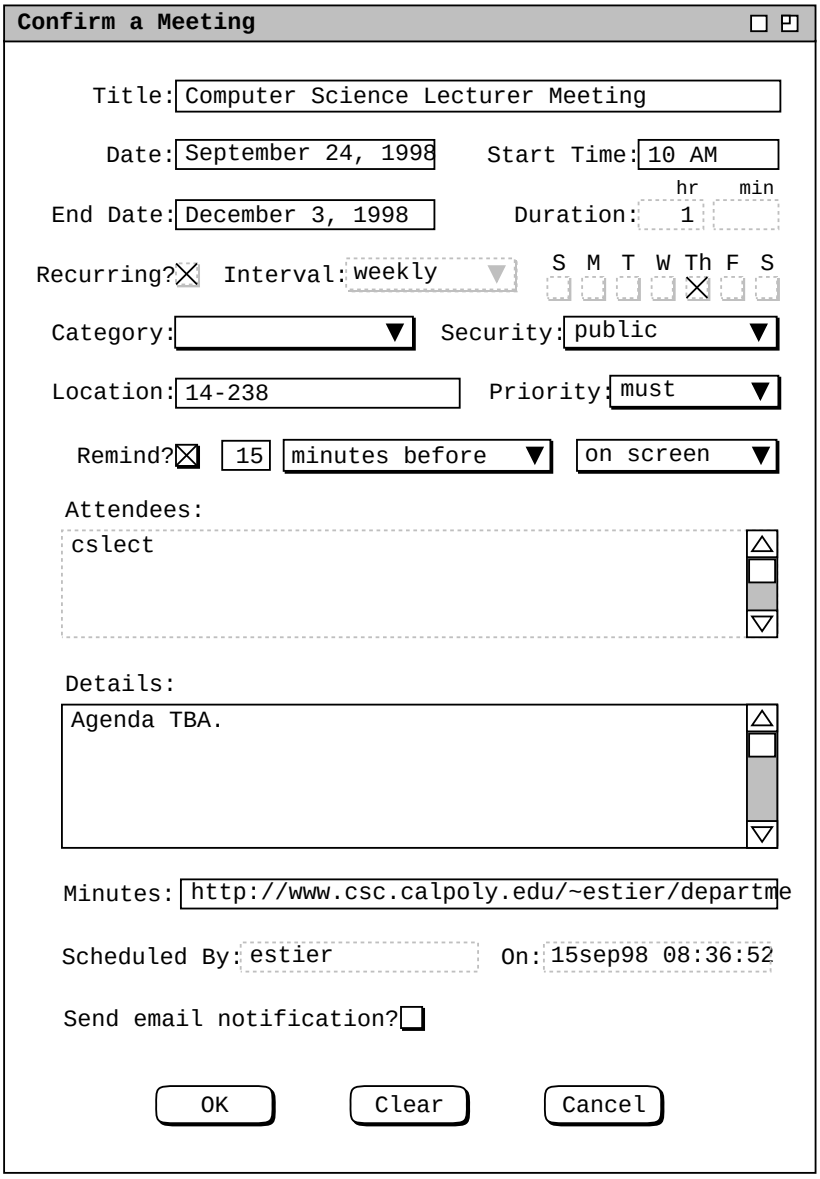


Figure 76: Lecturer meeting confirmation dialog.

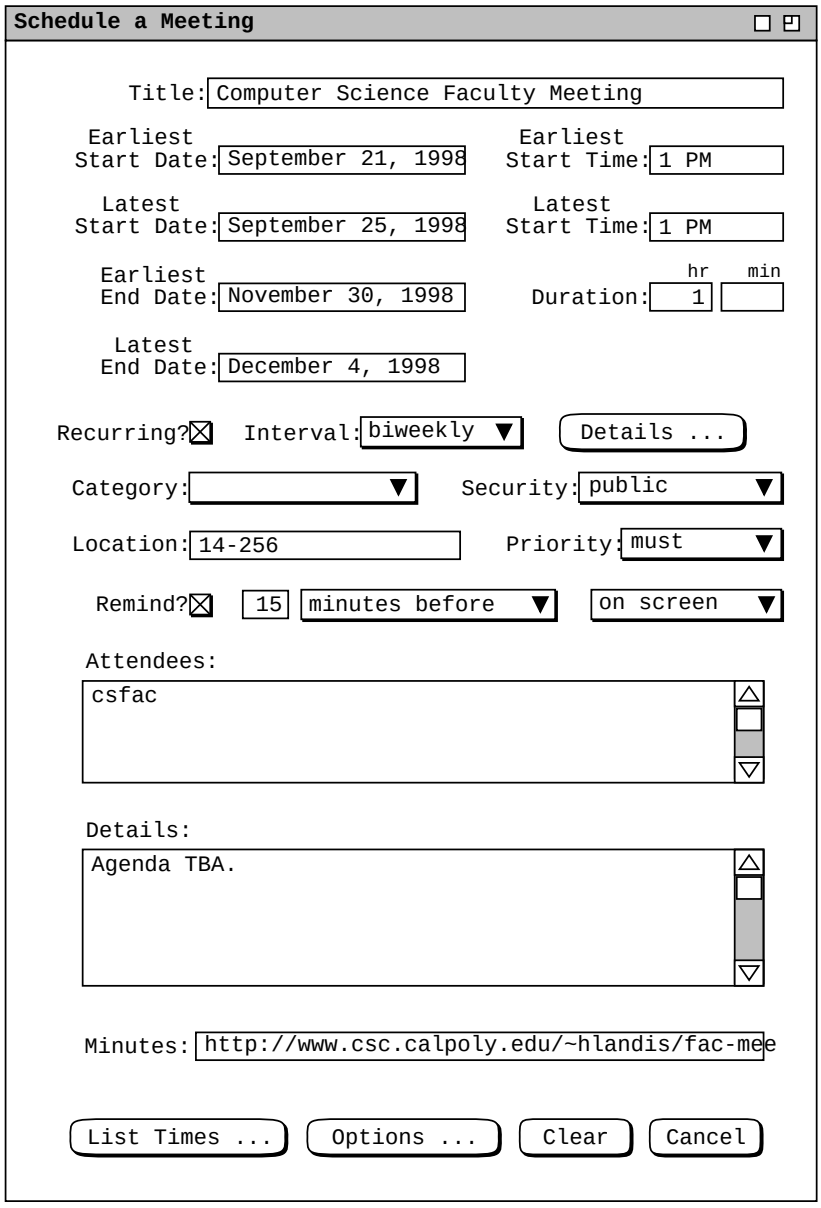


Figure 77: Scheduling a Faculty Meeting.

specific day of the week, the scheduler presses the '`Details ...`' button to the right of the recurring interval. In response the system displays the dialog shown in Figure 78. The first field in the dialog specifies the number of days per week on which to schedule a recurring meeting. The default value is one; the maximum possible value is 7. The second field specifies the allowable days for the meeting. The default days are Monday through Friday. The number of allowable days must be greater than or equal to the days per week, and least one allowable day must be checked.

The third and fourth fields specify, respectively, the minimum and maximum number of days between each meeting occurrence. These last two fields are enabled if the '`Days per week`' value is greater than the number of allowable days. As an example, consider the days per week set to 2, allowable days set to the default, and the last two fields set to 1 and 2 respectively. These settings specify a meeting scheduled two days per week, with each meeting one or two days apart. This allows Monday/Wednesday, Tuesday/Thursday, Monday/Thursday, or Tuesday/Friday meeting times.

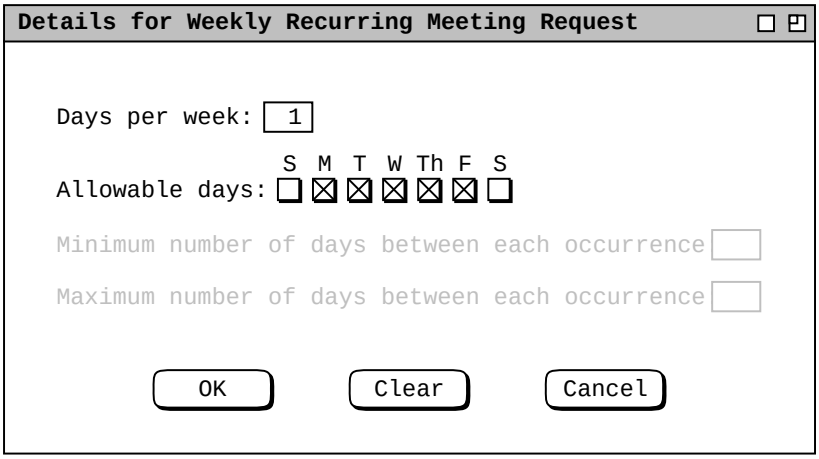


Figure 78: Details of a weekly recurring schedule.

In the current scenario, the scheduler wants to schedule the faculty meeting for Mondays at 1PM, and so fills in the details dialog as shown in Figure 79. where only the Monday checkbox is selected. In this scenario, the scheduler is acting on an assumed agreement made among the meeting attendees. Specifically, the computer science faculty attendees have been asked in advance to leave the 1-2 PM MWF time slot free on their calendars. This request is assumed to have been made through some means outside of the Calendar tool, such as in-person contact or other communication. Unfortunately, not all faculty have honored the request. Hence, when the scheduler presses the '`List Times ...`' button, the system responds with the message shown in Figure 80. This message indicates that the system is unable to find any meeting times that conform to the values entered in the scheduling request dialog.

To address the outcome of no possible meeting times being found, the scheduler can change one or more of the values entered in the scheduling request dialog and re-execute the '`List Times ...`' command. For example, the scheduler can change the range of possible times, dates, or days on which the meeting can be scheduled. In this

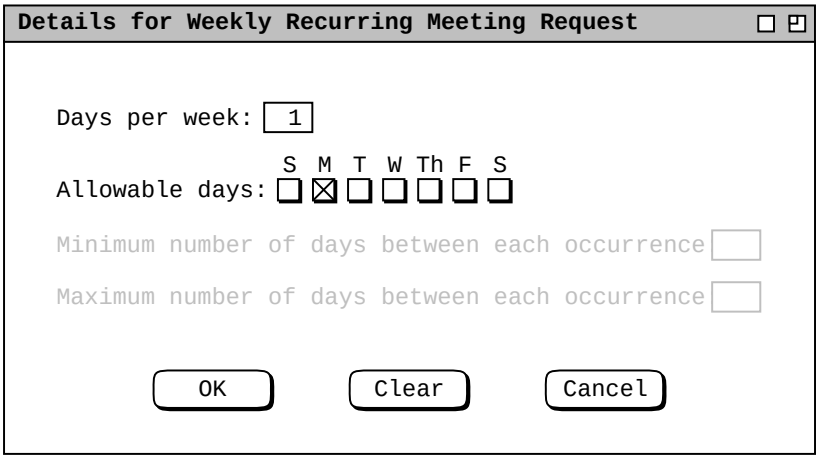


Figure 79: Weekly recurring details filled in.

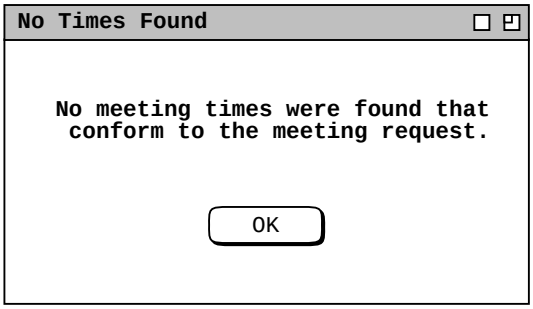


Figure 80: No times found dialog.

scenario, the scheduler decides to leave the date and time range the same, but expand the possible days from Monday only to Monday, Wednesday, or Friday. To do so, the scheduler reselects the recurring '`Details ...`' command and changes the values as shown in Figure 81. Here the scheduler has checked the Wednesday and Friday check boxes in addition to the Monday check box. Having made the desired changes, the scheduler presses '`OK`' in the details dialog and '`List Times ...`' in the scheduling request dialog. In response, the system again displays the no-times-found dialog of Figure 80, meaning that the system is still unable to find any conforming meeting times. It must be the case that one or more faculty have scheduled appointments or meetings in the 1-2 PM MWF time slots.

The other way to deal with the no-times outcome is to adjust one or more scheduling option values. To do so, the scheduler presses the '`Options ...`' button at the bottom of the scheduling request dialog. In response, the system displays the dialog in Figure 82. The first option setting is the length of the possible times list, the default value for which is 20. The second and third options specify whether a meeting can be scheduled at the same time as items with '`optional`' or '`must`' priority on attendee calendars. If the default value of '`no`' is selected for both options, the system will not attempt to schedule a meeting at the same time as any non-private scheduled items. If '`yes`' is selected for either or both options, then the system will allow a meeting to be scheduled at times that overlap with optional and/or must items. Such items will appear in the possible times list, flagged with the IDs of the affected

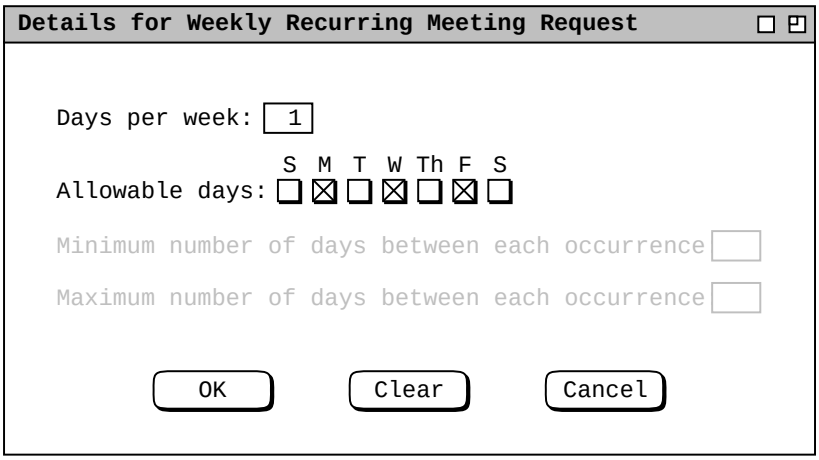


Figure 81: Weekly recurring details modified.

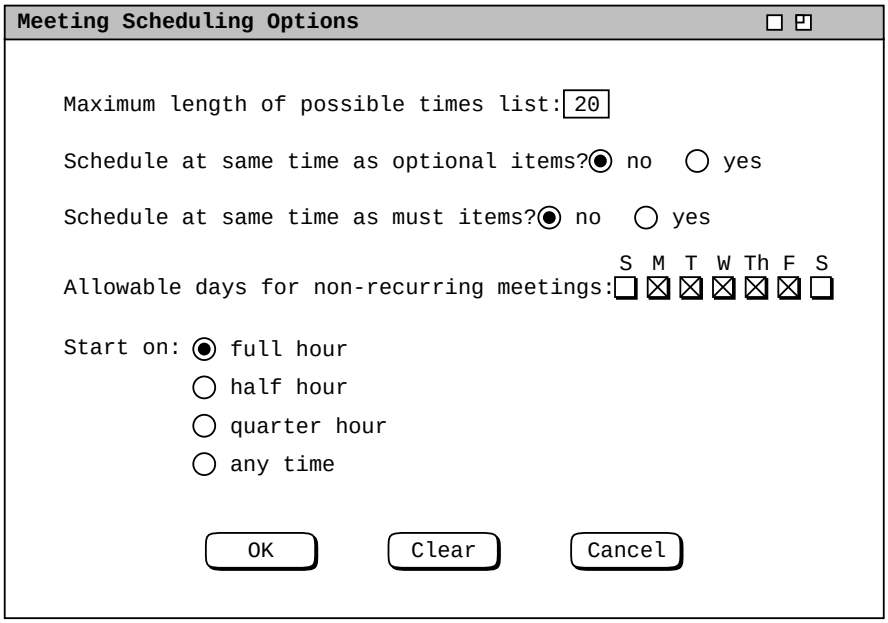


Figure 82: Meeting scheduling options.

attendees.

The fourth scheduling option specifies the specific allowable days on which non-recurring meetings can be scheduled. The default days are Monday through Friday, inclusive. This option applies only to non-recurring meetings, since the '`Details`' dialogs contain more specific settings for the allowable days of recurring meetings. Recurring details for weekly meetings are shown in Figure 78. Recurring details for other intervals are described in Section .

The final scheduling option indicates the time increment on which meetings can start. The default is for meetings to start on the full hour. The other selections are on the half hour, quarter hour, or at any time. For the '`any time`' selection, the smallest possible increment is five minutes.

The scheduler proceeds to adjust the scheduling options as shown in Figure 83, where the second and third options are both changed to '`yes`'. Having made the desired option changes, the scheduler presses '`OK`' in the options dialog and '`List Times ...`' in the scheduling request dialog. This time the system responds with the dialog shown in Figure 84. The new list of possible times has two additional columns containing the user IDs of attendees with items scheduled at conflicting times. The columns appear in the list when the scheduler selects the '`yes`' setting for the second and/or third scheduling option, as is done in Figure 83. A user is listed under '`Optional Conflicts`' for each possible time where the user has an optional, non-private scheduled item that overlaps with the possible time. A user is listed under '`Must Conflicts`' for each possible time where the user has a must, non-private scheduled item that overlaps with the possible time.

The default sorting order for a list with overlap columns is the same as without the columns -- first by start date and second by time, from earliest to latest. The user can click on either of the overlap column headings to change the default sorting order. For both columns, the primary order is from the smallest to largest number of users with overlapping times; the secondary, tertiary, and quaternary orders are date, time, and alphabetic by user ID. Clicking on the '`Possible Times`' column label restores the default sorting order. The sorting order for the names in any conflicts row is alphabetic.

The '`View User`' button at the bottom of the list allows the scheduler to view the daily calendar of any user listed in one of the overlap columns. To do so, the user selects one of the user IDs and then presses the '`View User`'

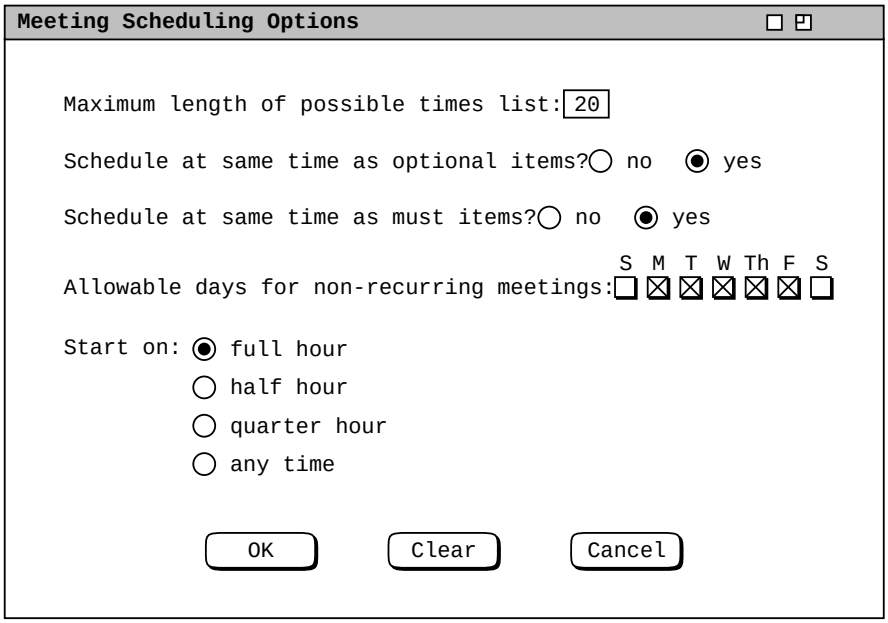


Figure 83: Modified meeting scheduling options.

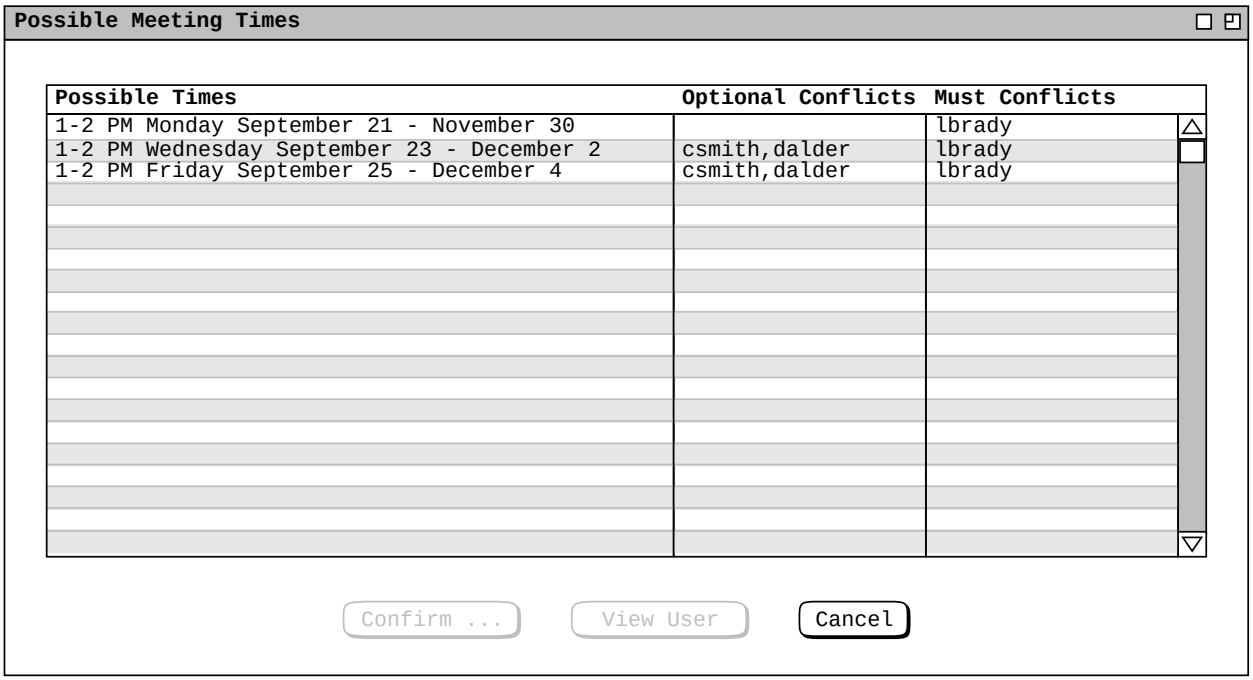


Figure 84: Possible meeting times with one or two faculty unable to attend.

button, which becomes enabled upon selection of an ID. This command is discussed further in Section 2.4.1.3

For this scenario, the scheduler elects to choose the 1-2 PM Monday meeting time as originally planned, as shown in Figure 85. The scheduler presses '`Confirm ...`' in the possible times list and '`OK`' in subsequent confirmation dialog. The system then notifies all attendees, including those with overlapping items. The notification message for the attendees with overlapping items makes note of the condition. Details of attendee notification are covered in Section 2.4.1.5.

2.4.1.3. A Super-Group Leader Scheduling a Meeting

This section presents further details of meeting scheduling. Here the scheduler is the leader of a Calendar Tool *supergroup*, which is a group comprised of other groups.

Figure 86 shows a filled-in meeting request dialog for a computer science special colloquium; Figure 87 shows the options settings for this request. It is a non-recurring meeting, to be held on October 29 or 30, between 1:30 and 4 PM; the category is set to '`CS Special`'. The attendees are the '`csall`' user group, and three additional individual users. The options allow the meeting to be scheduled at the same time as both optional and must items. The increment is changed from '`full hour`' to '`half hour`'.

As defined in Section 2.6.3, `csall` is a Calendar Tool supergroup, comprised of the subgroups `csfaculty`, `cslect`, and `csstaff`. These groups are in turn comprised of individual Calendar Tool users. When a supergroup is listed among the attendees of a meeting, individual attendees are all members of all subgroups. The complete set of attendees is comprised of all group members plus all individual users appearing in the attendees list.

When the scheduler presses '`List Times ...`' in Figure 86, the system responds with the possible times list shown in Figure 88. Given the large number of requested attendees, there are a large number of time conflicts listed in the conflicts columns. To determine the most acceptable time, the scheduler can use the '`View User`' command to examine the calendars of one or more users listed in the conflicts columns. For example, Figure 89 shows the scheduler having selected user `mhutchen` for viewing. When the scheduler clicks anywhere in a user name, the

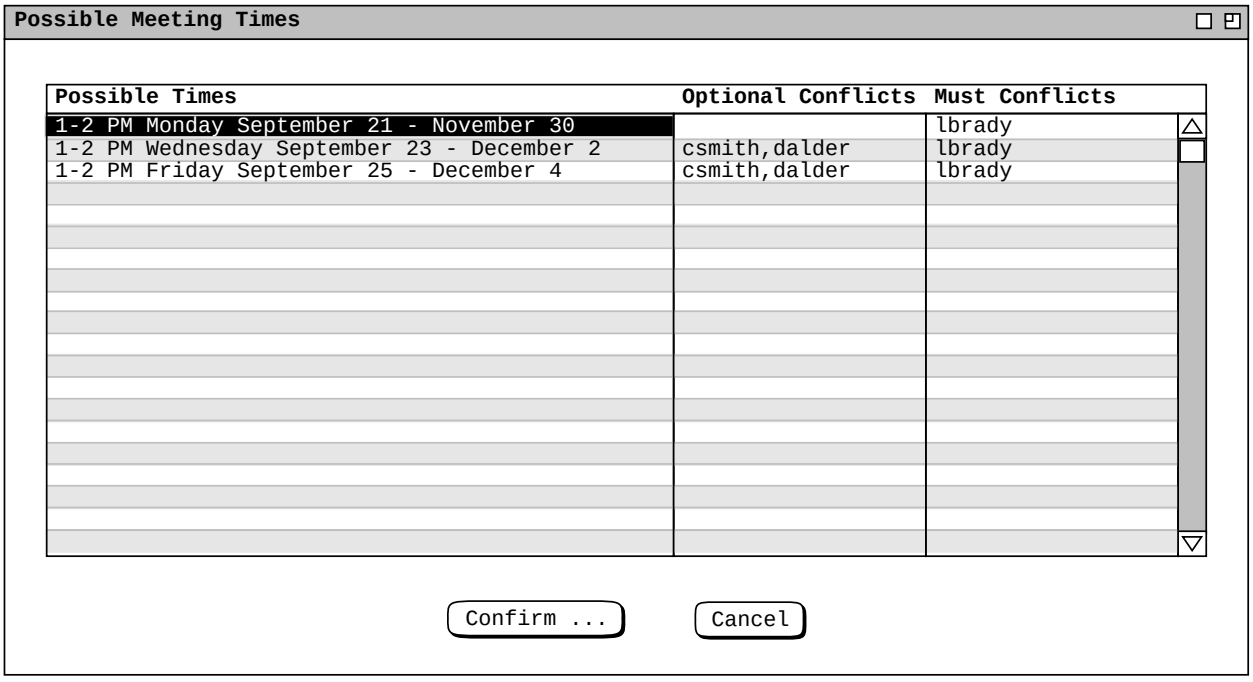


Figure 85: Selected faculty meeting time.

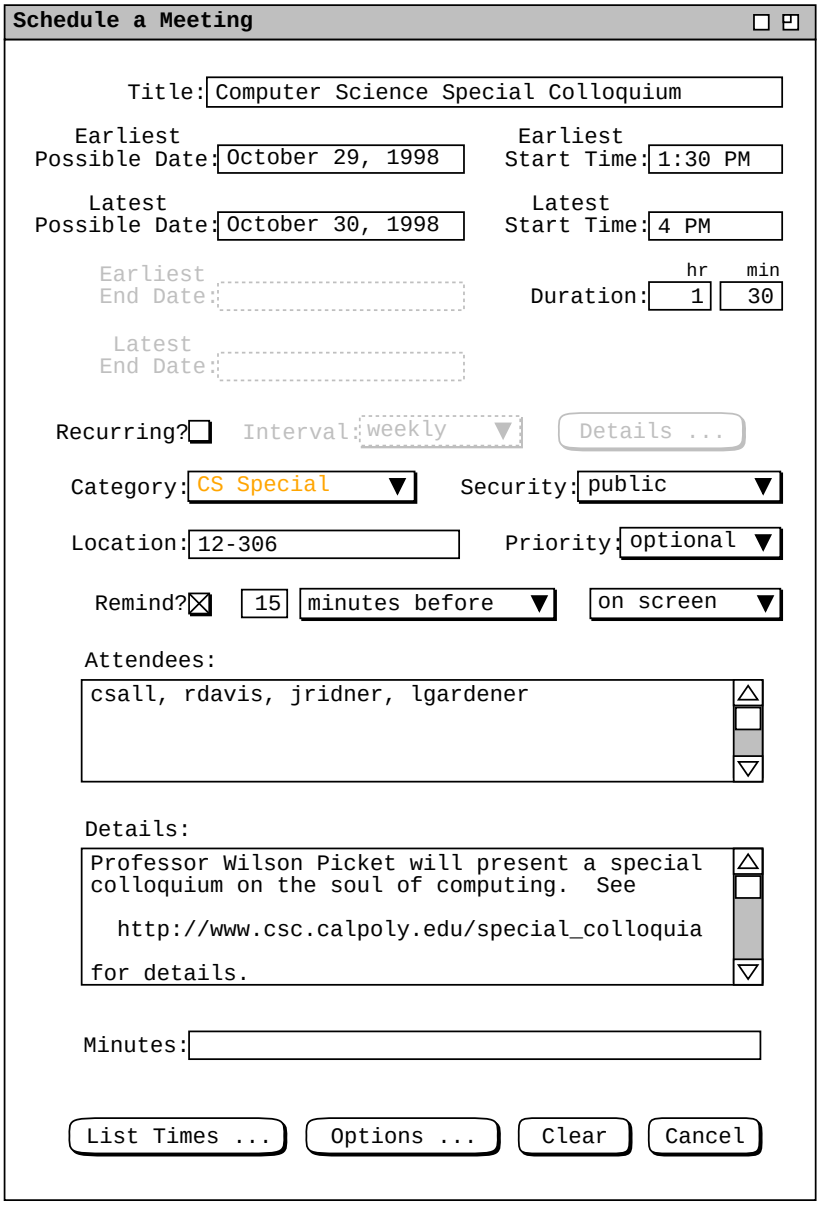


Figure 86: Scheduling a special colloquium.

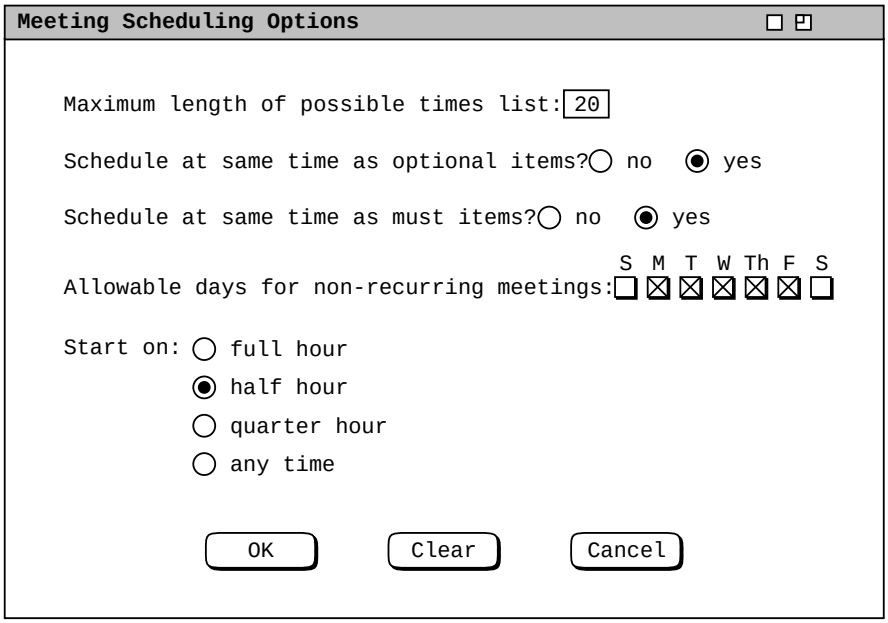


Figure 87: Special colloquium options settings.

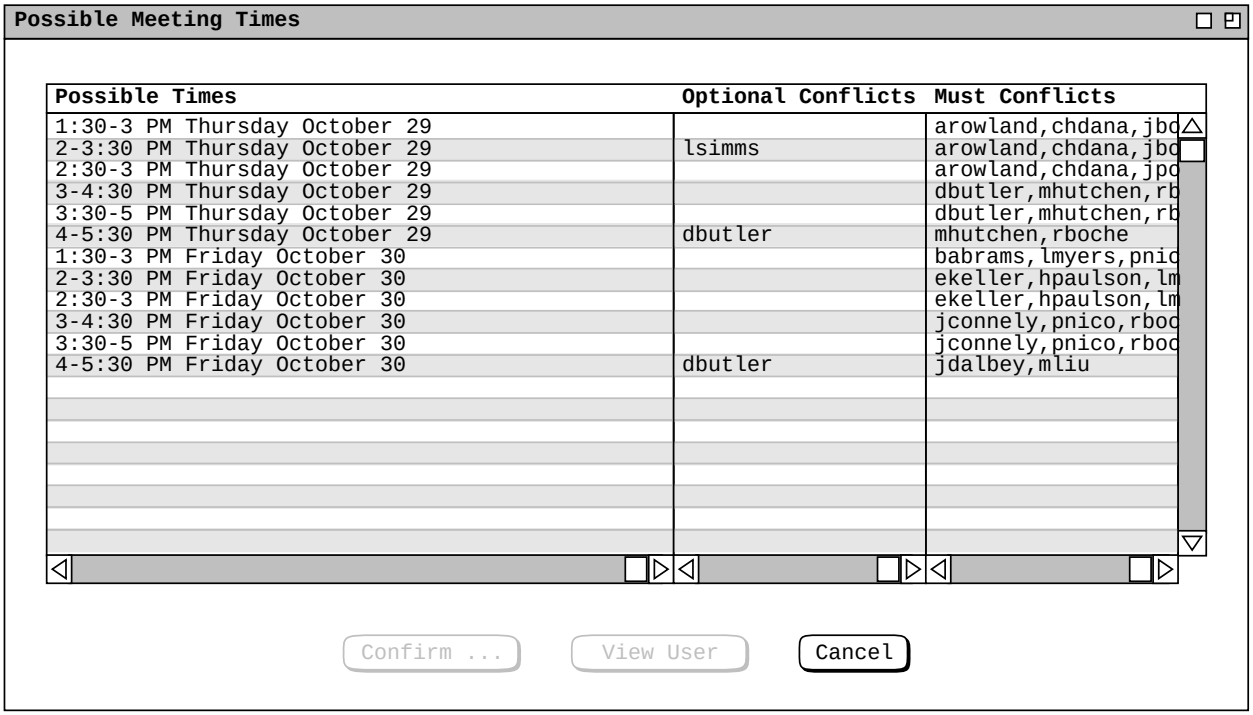


Figure 88: Possible times for the special colloquium.

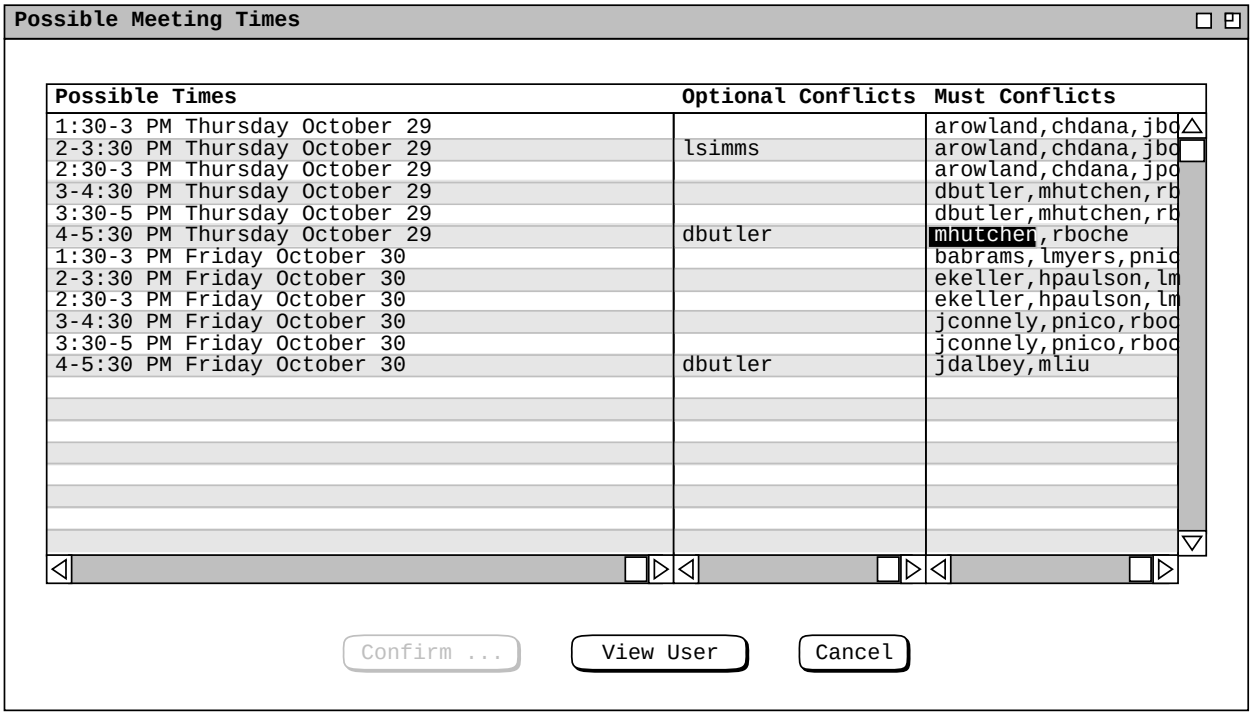


Figure 89: Selecting a conflicting user for the purpose of view his calendar.

system highlights the entire name and enables the '`View User`' button. When the scheduler selects '`View User`' in Figure 89, the system displays the daily agenda for `mhutchen` for Thursday October 29. Viewing such conflicting user calendars may assist the scheduler in choosing a meeting time that overlaps with relatively less important scheduled items.

After viewing some user calendar information, the scheduler decides to choose the 4-5:30 time slot on Thursday October 29, and confirm the meeting. In response, the system notifies all members of `csall` plus the three individually-listed attendees; the system adds the meeting to the `csall` group calendar.

2.4.1.4. A Non-Leader Scheduling a Meeting for Selected Individuals

The final meeting scheduling scenario presents an individual user scheduling for a selected number of individual users. The attending users are not members of a group that could be used for the meeting at hand. The scheduler begins by entering the request information shown in Figure 90. The meeting is non-recurring, confidential security, for six individual attendees. In this scenario, the entered value for the meeting location is assumed not to be in the location database. This means that location has no effect on the possible times computation. The same would be true if the location field were empty.

When the scheduler selects '`List Times ...`', the system responds with the no-times dialog of Figure 80. In this case, the scheduler deals with the situation by expanding the date and time range for the meeting, as shown in Figure 91. The scheduler also changes the last two scheduling options, as shown in Figure 92. Saturday is added to the allowable days and the '`Start on`' interval is set to '`any time`'. When the scheduler again presses '`List Times ...`', the system responds with the result in Figure 93. In this case, the scheduler has been a tad over-zealous in date/time and options settings, since the possibles list contains a large number of times. As might be typical among Calendar Tool users, many time slots on Saturday are available among the selected attendees. Hence combining a '`Start on`' setting of '`any time`' with Saturday as an allowable day results in a large number of possible times. Rather than adjust the date/time ranges or options further, the scheduler scrolls through the list of possible times to find one that is acceptable and selects it, as shown in Figure 94. The scheduler then proceeds to confirm the

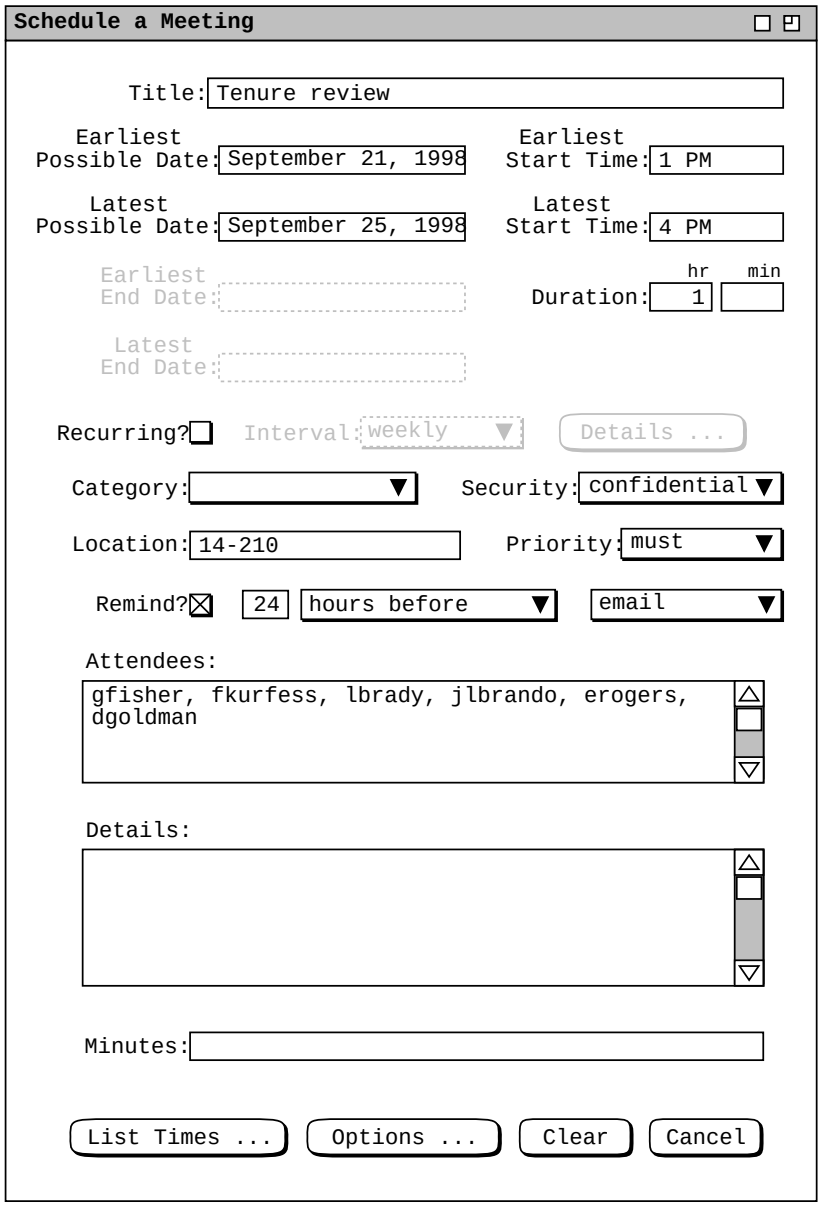


Figure 90: Scheduling a tenure review meeting.

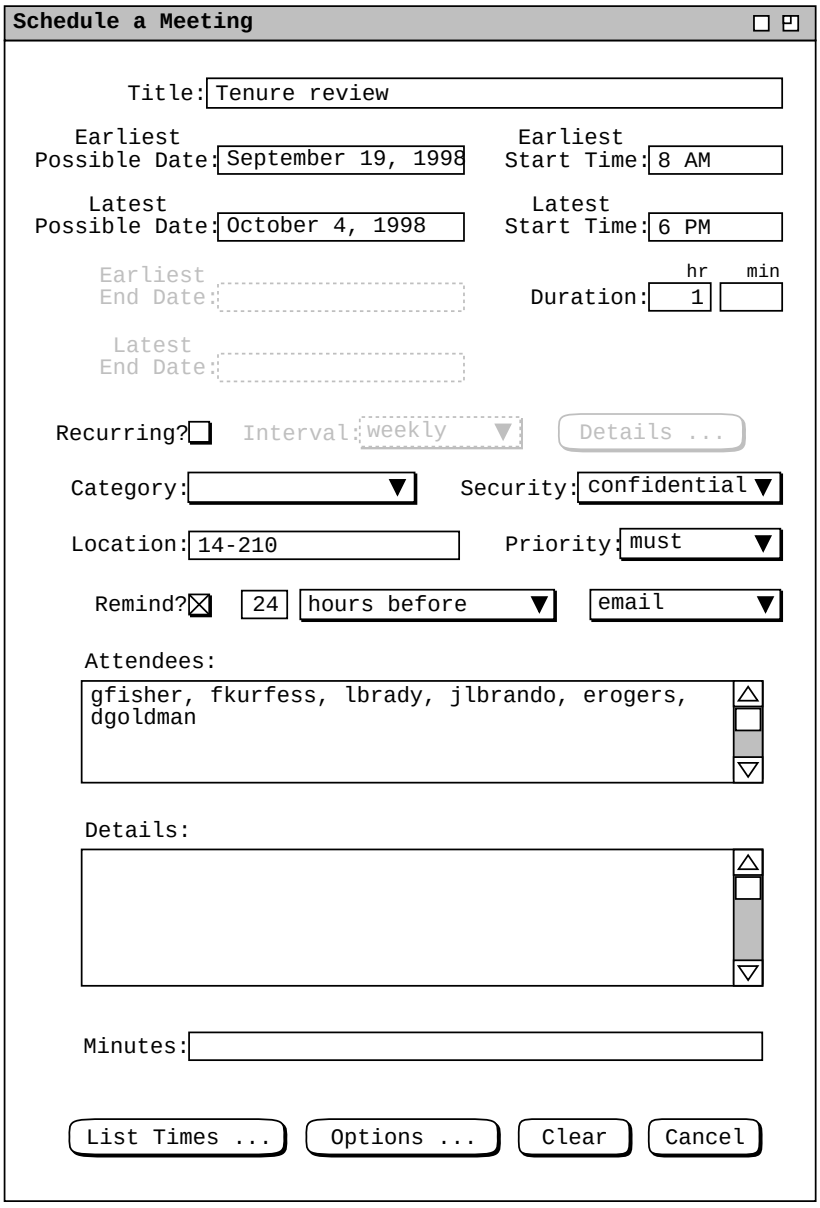


Figure 91: Modified tenure review meeting request.

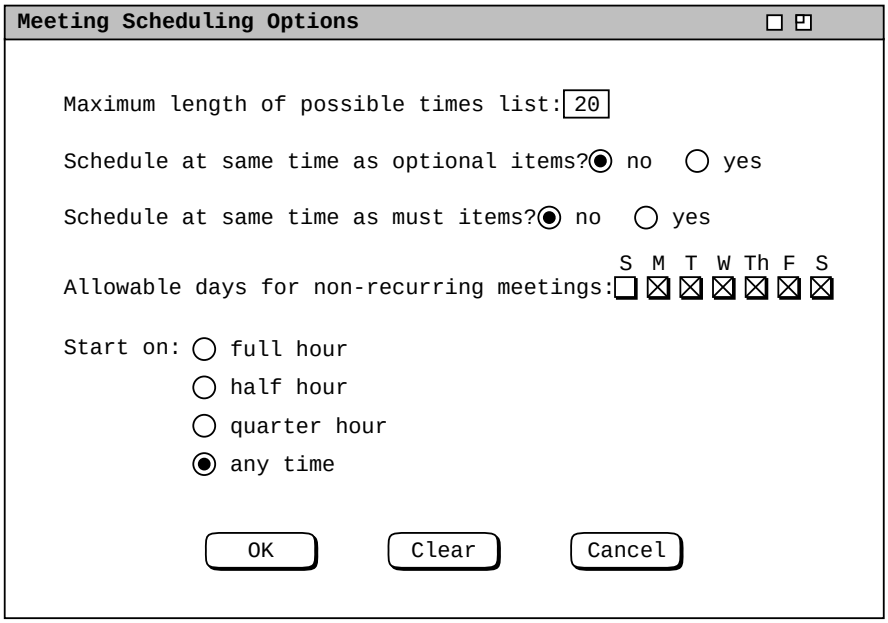


Figure 92: Tenure review meeting options.

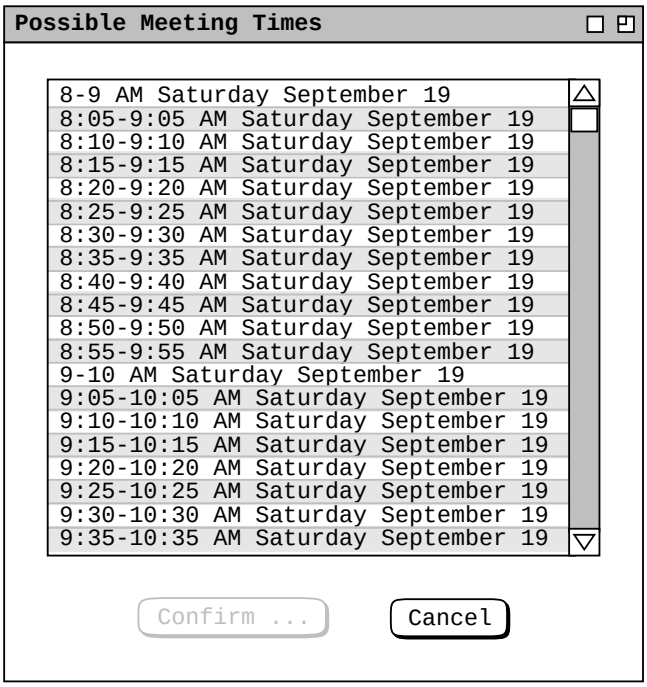


Figure 93: Very long possible times list.

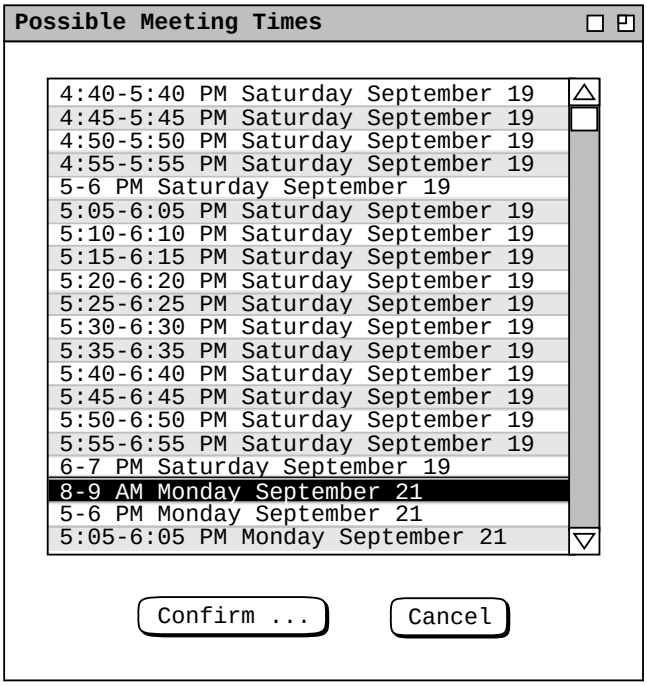


Figure 94: Long possible times list scrolled to an acceptable time.

meeting.

Of note in Figures 93 and 94 is how the possible times list contains all allowable times, including ones that overlap such as 8-9 AM and 8:05-9:05 AM. The list contains all distinct meeting times that individually conform to the scheduling request values and option settings. Two possible times are *distinct* if they differ in at least one value of start time, end time, or date.

2.4.1.5. Receiving and Accepting Meeting Notifications

Describe all of the details of meeting notifications.

2.4.1.6. Further Operational Details of Meeting Scheduling

Describe important operational deteils of meeting scheduling, as indicated by the titles of the subsections that follow.

2.4.1.6.1. The Contents of Group Calendars

2.4.1.6.2. Scheduling Over Private Items

Explain that private items are not visible to a scheduler, and so will get scheduled over.

2.4.1.6.3. The Status of Not-Yet-Accepted Meetings

Explain that non-yet-accepted meetings are considered as scheduled for the purposes of possible times computation.

2.4.1.6.4. Creation of New Categories

Explain the unusual and subtle case of when a leader-scheduled meeting has a category that is not defined in an attendee's calendar.

2.4.1.6.5. The Role of the Location Database

Describe the limited role of the location database in meeting scheduling.

2.4.1.6.6. Non-Unique Scheduled Meetings

Explain the resolution of the unusual and subtle case of a leader-scheduled meeting not being unique in an attendee's calendar, in terms of having the same date, start time, duration, and title.

2.4.1.6.7. Concurrent Scheduling

Describe the rules for two or more users trying to schedule a meeting at the same time and the way that one user cannot indefinitely block other waiting users.

2.4.2. Scheduling Tasks

A task is a "to-do" item in a calendar. To schedule a task, the user selects the '`Task`' command in the '`Schedule`' menu, in response to which the system displays the dialog shown in Figure 95.

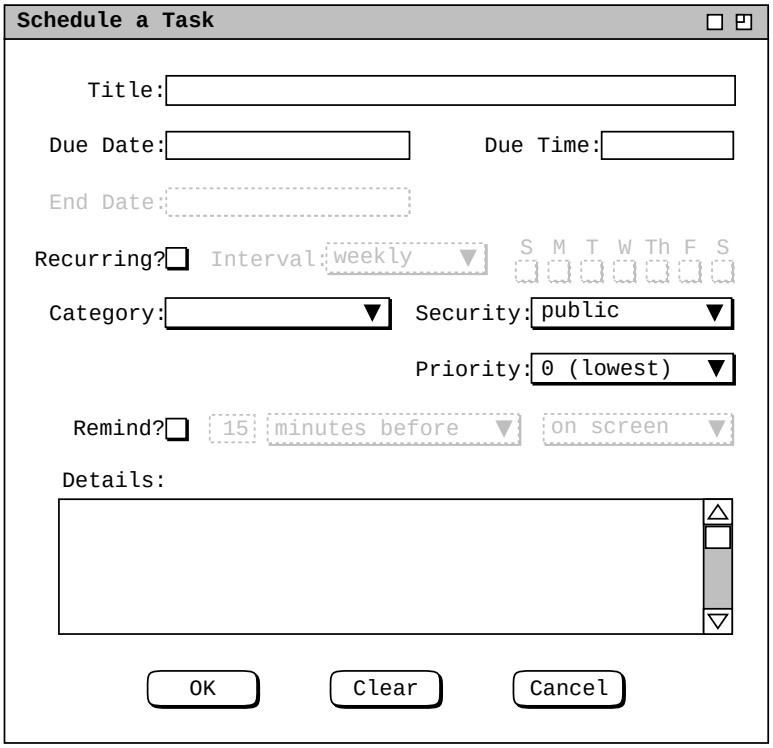


Figure 95: Task scheduling dialog.

The following fields in the task scheduling dialog hold the same form of information as the appointment scheduling dialog in Figure 6:

- `Title`
- `Recurring`, and its accompanying fields
- `Category`
- `Remind`, and its accompanying fields
- `Details`

The user enters information for these fields in the same manner as for an appointment, as described in Section 2.2.

The date and time fields of a task specify when the task is due. A task has no specific start time or duration. The '`End Date`' field applies to recurring tasks; it is initially disabled since the default for tasks is non-recurring. The '`Security`' for a task is one of two levels: '`Public`' or '`Private`'. The '`TitleOnly`' and '`Confidential`' security levels do not apply to tasks, since these levels are only meaningful for scheduled items that have a start time and duration, i.e., appointments and meetings.

The '`Priority`' for a task is fundamentally different than for the other types of scheduled item. For a task, priority is a numeric value that defines the relative importance among tasks. The value is between 0 and 10, with a higher value indicating a higher priority. Figure 96 shows the task priority pulldown menu. For documentation purposes, the menu lists parenthetically that 0 is the lowest and 10 the highest priority. These documentary words do not appear in the data field itself for the 0 and 10 values.

Figures 97 and 98 show two filled-in task scheduling dialogs for tasks that have appeared in the figures of earlier scenarios. In the recurring task, the '`Due Date`' label is changed to '`Start Date`' to clarify the display. As with the appointment scheduling dialog, the user presses the '`OK`' button to add the task to her calendar, '`Clear`' to clear all data-entry values to the defaults, and '`Cancel`' to cancel the scheduling operation. The system removes the dialog window from the screen when the user presses '`OK`' or '`Cancel`'.

2.4.3. Scheduling Events

An event is the simplest form of scheduled item in a calendar. When the user selects `Event` in the `Schedule` menu, the system displays the dialog shown in Figure 99. The Title and Category fields contain the same information as in an appointment, meeting, and task. Events have a start date and an optional end date, but no time. Since events cannot be recurring, the end date is used to define a multi-day event. A multi-day event is a single item in the calendar, but it appears on multiple days in calendar and list views. If specified, the end date must be one or more days after the start date. If the end date is empty, the event is for a single day. As for a task, security is one of '`public`' or '`private`'.

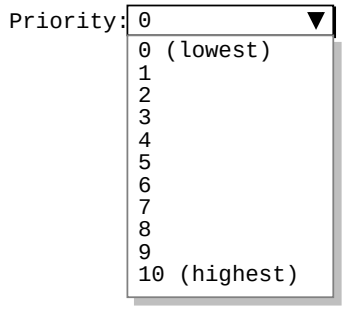


Figure 96: Task priority menu.

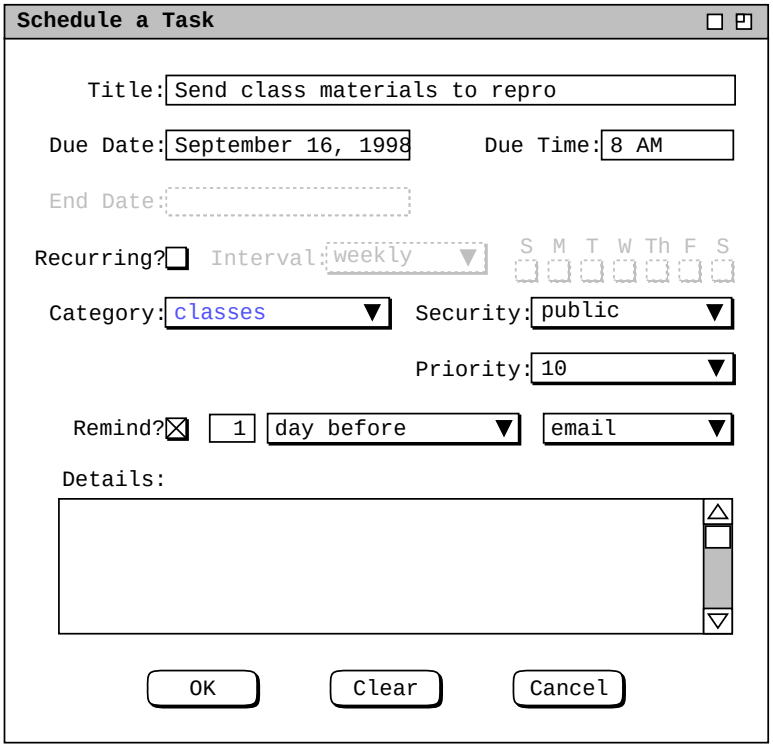


Figure 97: Scheduling a non-recurring task.

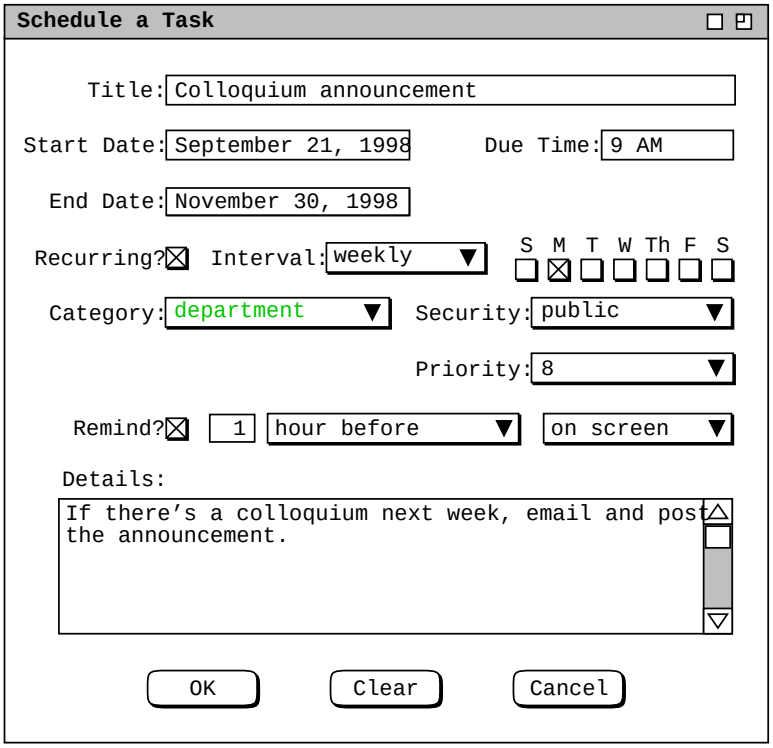


Figure 98: Scheduling a recurring task.

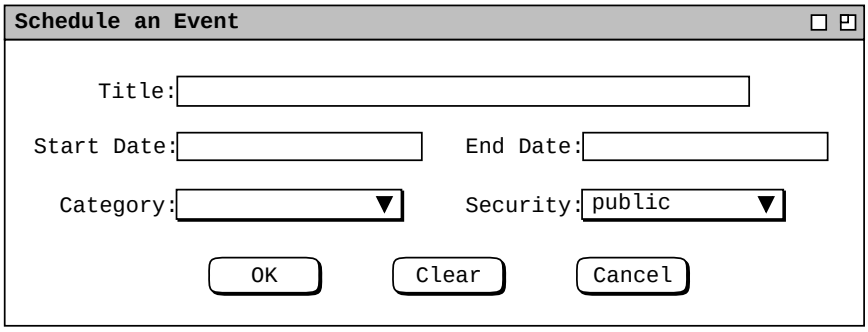


Figure 99: Event scheduling dialog.

Figures 100 and 101 show two filled-in event scheduling dialogs, for a single-day and multi-day event, respectively. When the user presses '`OK`', the system adds the event to the user's calendar. '`Clear`' clears any entered data values; '`Cancel`' cancels the event scheduling operation. The system removes the dialog window from the screen when the user presses '`OK`' or '`Cancel`'.

Figures 102 and 103 show how a multi-day event appears in calendar and list views. The figures show how each day of a multi-day event is displayed as a separate item in both calendar and list views. The list view contains the "`Year's events`" custom list, shown originally in Figure 44. Here the "`Ski vacation`" event has been added and the list is scrolled down to show all its occurrences.

The Calendar Tool defines a number of built-in events for standard holidays and other event-worthy dates. The complete list of system-defined events is given in Section 2.11.12.

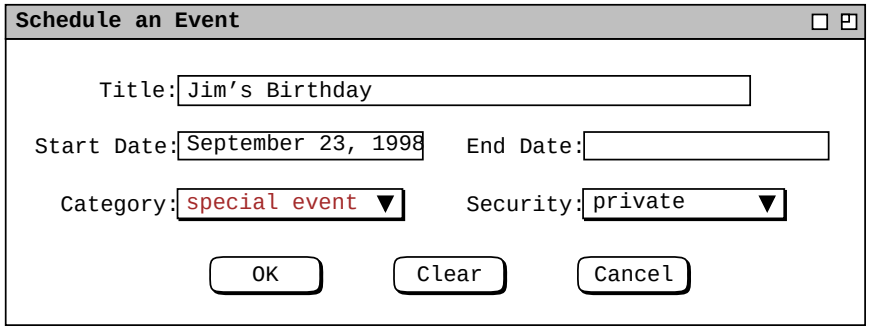


Figure 100: Jim's birthday event.

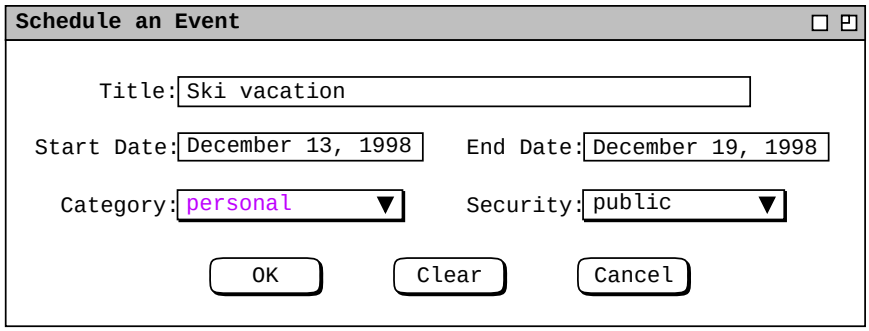


Figure 101: Multi-day vacation event.

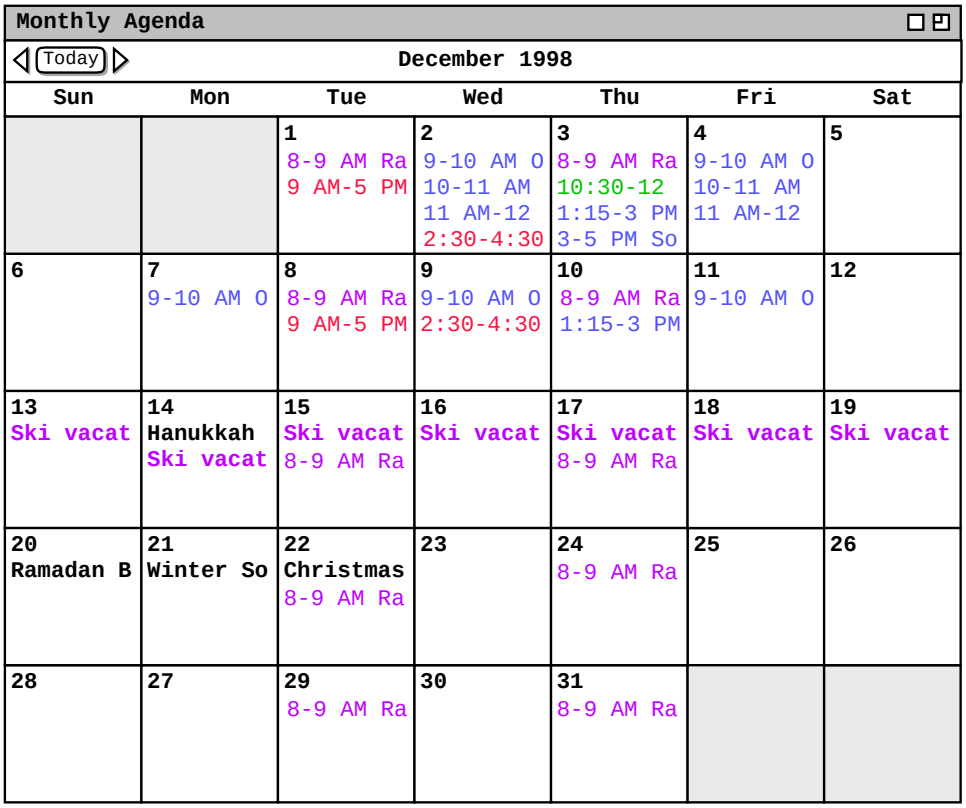


Figure 102: Month view showing a multi-day event.

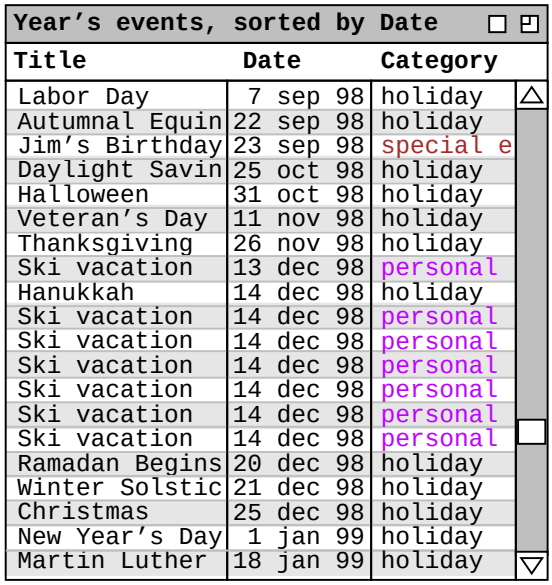


Figure 103: Event list showing a multi-day event.

2.5. Finer Points of Viewing and Scheduling

This section of functional requirements covers the remaining details of viewing and scheduling calendar items. The topics covered are:

- viewing at the individual item level
- changing and deleting scheduled items
- details of recurring items
- scheduling and receiving reminders
- editing categories
- dynamic view updating

2.5.1. Item-Level Viewing

Item-level viewing for appointments was introduced in Section 2.3.1.5. This section covers further details of appointment viewing, as well as item views for meetings, tasks, and events. Independent of item type, the user views an item by selecting its time or title in any larger-grain view, and then executing the '`View Item`' menu command. This series of interactions is illustrated in Figures 25 and 26 A short cut to view an item is to double click on the item time or title. Complete details of target item selection are covered in Section 2.11.5.

Common to all item views are change, delete, and clear buttons at the bottom of the display. In the initial viewing state, the change and clear buttons are disabled, and the delete button is enabled. If the user edits one or more data fields, the button states are reversed, with change and clear enabled, delete disabled. The scenarios of this section focus on viewing scheduled items prior to any editing by the user. Hence all item-level displays are shown in the initial change-disabled state. Complete details of changing and deleting items are covered in Section 2.5.2

NOTE: Details need to be filled in, as outlined in the following subsections.

2.5.1.1. Viewing Appointment Items

2.5.1.2. Viewing Meeting Items

Important point to cover is how not-yet-accepted meetings appear at the item level.

2.5.1.3. Viewing Task Items

Important point to cover is what the display completion status information.

2.5.1.4. Viewing Event Items

Not expecting anything special here.

2.5.1.5. Item-Level Viewing in Other Users' Calendars

Be sure to say that other-user views are completely read only.

2.5.2. Changing and Deleting Scheduled Items

Changing and deleting scheduled items is performed in item-level displays. As illustrated in the preceding section of the requirements, all item-level displays have '`Change`' and '`Delete`' command buttons to perform these operations. The enabled/disabled state of these buttons is consistent in all four types of item. Specifically, when the system initially displays an item-level view, the '`Change`' and '`Clear`' buttons are disabled and the '`Delete`' button is enabled. This is illustrated in the display excerpt shown in Figure 104. What this means is that '`Change`' and '`Clear`' are not applicable until the user edits one or more data fields. Furthermore, the '`Delete`' command is only applicable prior to any data field editing, or after the user presses '`Clear`' to remove the edits.

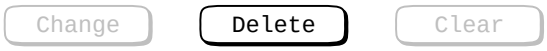


Figure 104: Initial state of command buttons in all item-level displays.

As soon as the user performs an edit to some data field, the initial state of the command buttons is reversed. Namely, the 'Change' and 'Clear' buttons are enabled and the 'Delete' button is disabled. This is illustrated in Figure 105. The command buttons remain in the Figure 105 state until the user executes 'Change' or 'Clear', or re-edits all edited data fields back to their original values. Executing the 'Change' command changes the item in the affected calendar(s) and all affected displays. Executing the 'Clear' command clears all edits, restoring the data fields to their original values when the item-level view was initially displayed. No calendar changes are made when 'Clear' is executed. When either 'Change' or 'Clear' is executed, the command button state returns to that of Figure 104. The command buttons also return to this state when the user re-edits all edited data fields back to their original values.

When the user executes and confirms 'Delete', the system removes the item from the affected calendar(s), removes the item-level display from the screen, and updates any affected display windows.

Since the different types of scheduled item share many data fields in common, many aspects of changing items are common to all types. Aspects of item deletion are also common among the different types of item, such as the general form of the confirmation dialogs. The most wide-ranging effects of change and delete are made to meetings by meeting schedulers. Such changes and deletions potentially affect all attending users.

NOTE: Details need to be filled in, as outlined in the following subsections.

2.5.2.1. Changing and Deleting Appointments

2.5.2.2. Scheduler Changing and Deleting Meetings

The change and delete commands for meetings behave much the same as they do for appointments. The significant difference is when a scheduler changes a critical meeting data field or deletes a meeting, all attendees are notified. Scheduler deletion of a meeting is the means by which the meeting is effectively cancelled.

2.5.2.3. Changing and Deleting Tasks

2.5.2.4. Changing and Deleting Events

2.5.3. Details of Scheduling Recurring Items

The scheduling of weekly and biweekly recurring items has been presented in preceding scenarios. This section presents the remaining details of monthly and yearly recurring intervals.

When the user checks the Recurring box in a scheduling dialog or item-level view, the data-entry boxes to the right become active. Figure 106 shows the general format. The 'Interval' menu in Figure 107 shows the four available selections: weekly, biweekly, monthly, and yearly. The details area to the right of the interval menu varies

Figure 105: State of command buttons after user edits one or more data fields.

Figure 106: Information for a recurring item.

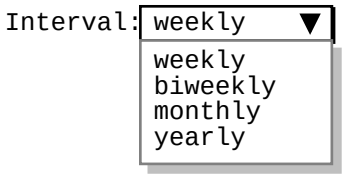


Figure 107: Interval selections.

based on the menu selection and the scheduling context. In all contexts except a meeting request, the details area has three possible configurations:

a. for weekly and biweekly intervals there are check boxes for the days of the week;

b. for the monthly interval there is a single '`Details ...`' button;

c. for the yearly interval the details area is empty.

In the scheduling request dialog for a meeting, the details area always contains the '`Details ...`' button, whatever the interval selection. Descriptions of the different details configurations and dialogs follow.

2.5.3.1. Weekly/Biweekly Intervals

The default recurring interval is weekly. When either the weekly or biweekly interval is selected, the interval details area contains seven check boxes, one for each day of the week. When the user checks one or more of the day boxes, the system schedules the item to recur on the selected day(s). For a weekly interval, the item recurs each week on the selected days. For biweekly, the item recurs every other week on the selected days. At least one of the day boxes must be checked. Examples of weekly and biweekly scheduling appear in Sections 2.2, 2.4, and 2.5.

2.5.3.2. Monthly Intervals

When the user selects the monthly interval, the system changes the recurring information display as shown in Figure 108. When the user presses '`Details ...`', the system displays the dialog in Figure 109. The dialog allows the user to schedule a recurring item on one or more months of the year, selected via the check boxes. Below the month selections are two alternatives for choosing the days on which the item recurs. The '`Days of the week`' alternative allows the user to select one or more days within the different weeks of the month. The '`Date`' alternative allows the user to select one or more numeric dates. Only one of the two alternatives is active at one time. For convenience, check box selections made in either alternative remain checked when the other alternative is activated.

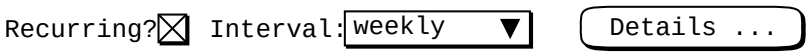


Figure 108: Monthly interval selected.

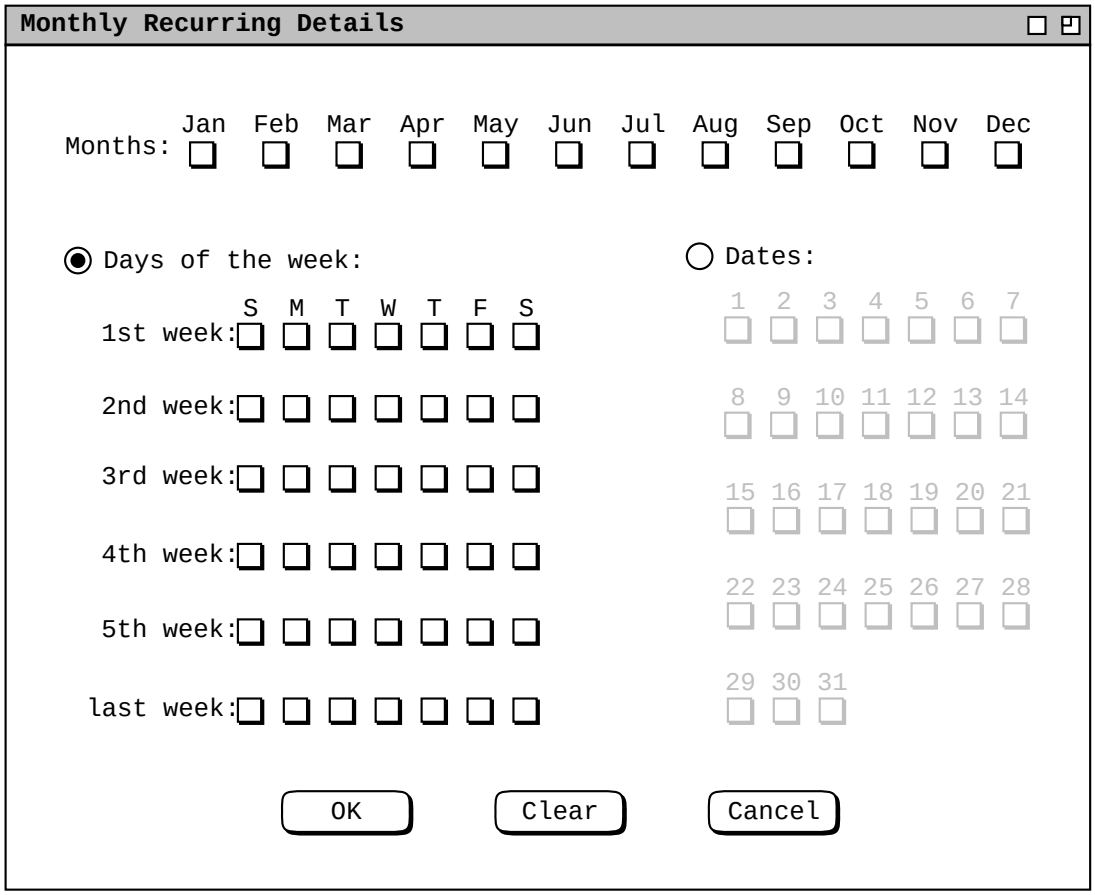


Figure 109: Monthly interval scheduling dialog.

Figure 110 shows settings for an item that recurs on the first Monday of every other month, starting in January. Figure 111 shows an item that recurs on the first and third Friday of every month. An item scheduled in this way recurs at most two times per month. In particular, it does not occur on any fifth Fridays, when they happen. Figure 112 uses the '`Dates`' selection to schedule a meeting on the 15th of every third month, starting in January.

The monthly details dialog contains generic information, not applicable in all cases. The following restrictions apply to the '`Days of the week`' settings:

a. For months with four weeks only, the specification for the 5th week does not apply, and the specification for the last week, if present, overrides any specification for the 4th week, if present.

b. For months with five weeks, the specification for the last week, if present, overrides any specification for the 5th week.

Since the number of weeks per month varies dynamically from year to year, it is not possible to consistently disable any particular row of check boxes under '`Days of the week`'. Hence, all day boxes are enabled whenever '`Days of the week`' is selected. The two override rules are applied dynamically when an item is scheduled.

Under '`Dates`', the check boxes for 30 and 31 are selectively disabled based on which months are selected. Specifically, both 30 and 31 are disabled if only '`Feb`' is selected. 31 is disabled if one or more of '`Apr`', '`Jun`', '`Sep`', or '`Nov`' are selected. The 29 selection applies only to '`Feb`' on leap years.

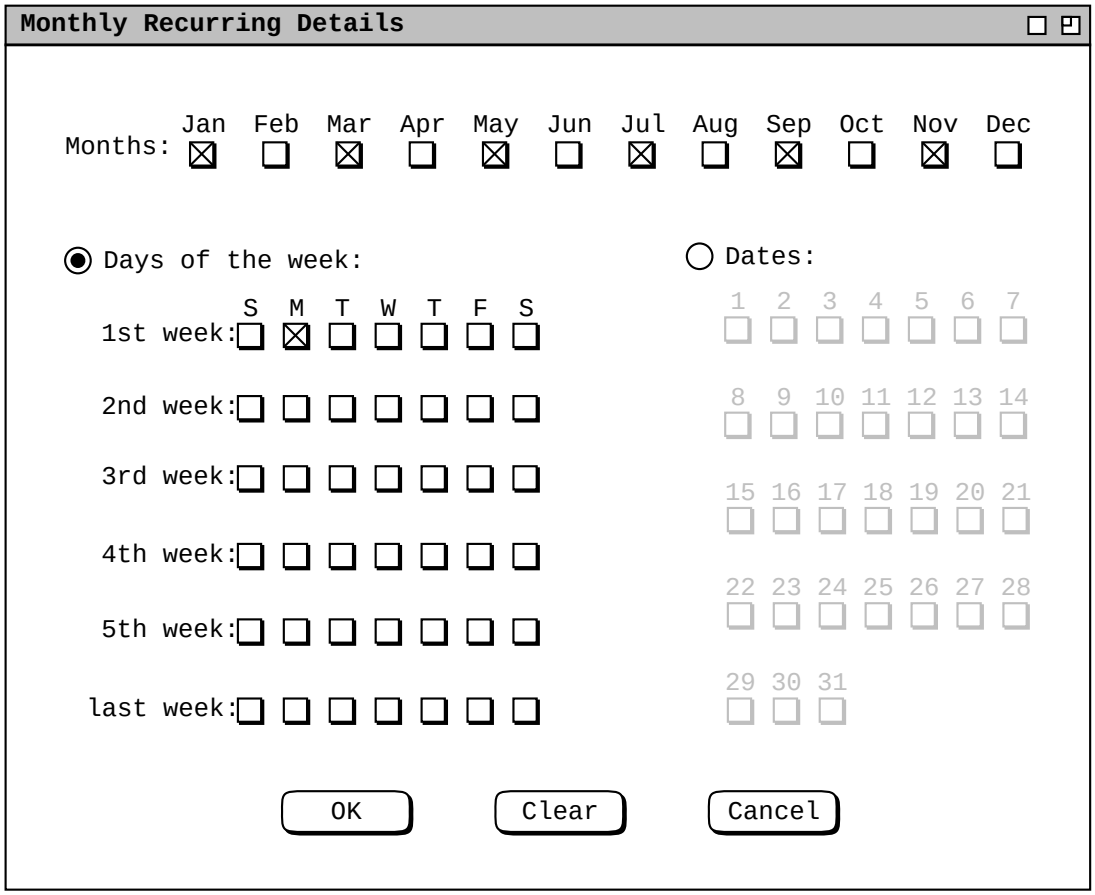


Figure 110: Item recurs on the first Monday of every other month.

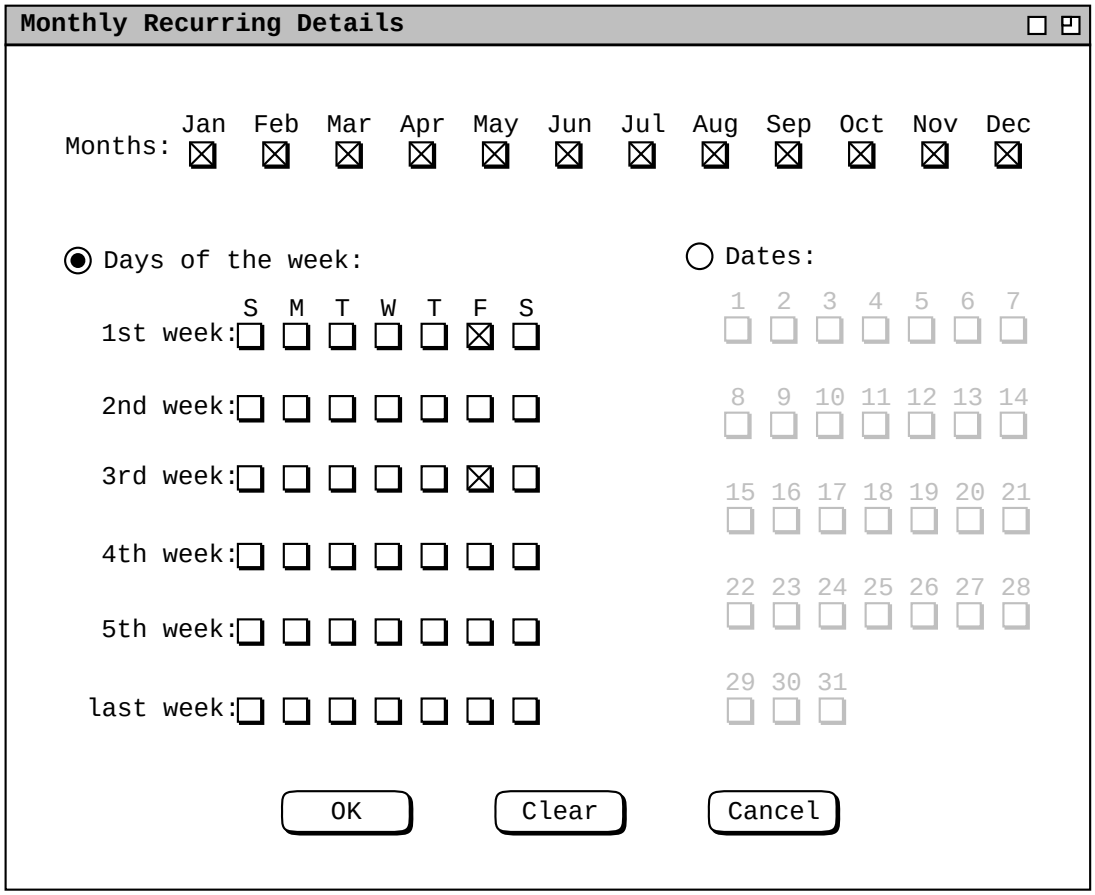


Figure 111: Item recurs on the first and third Fridays of every month.

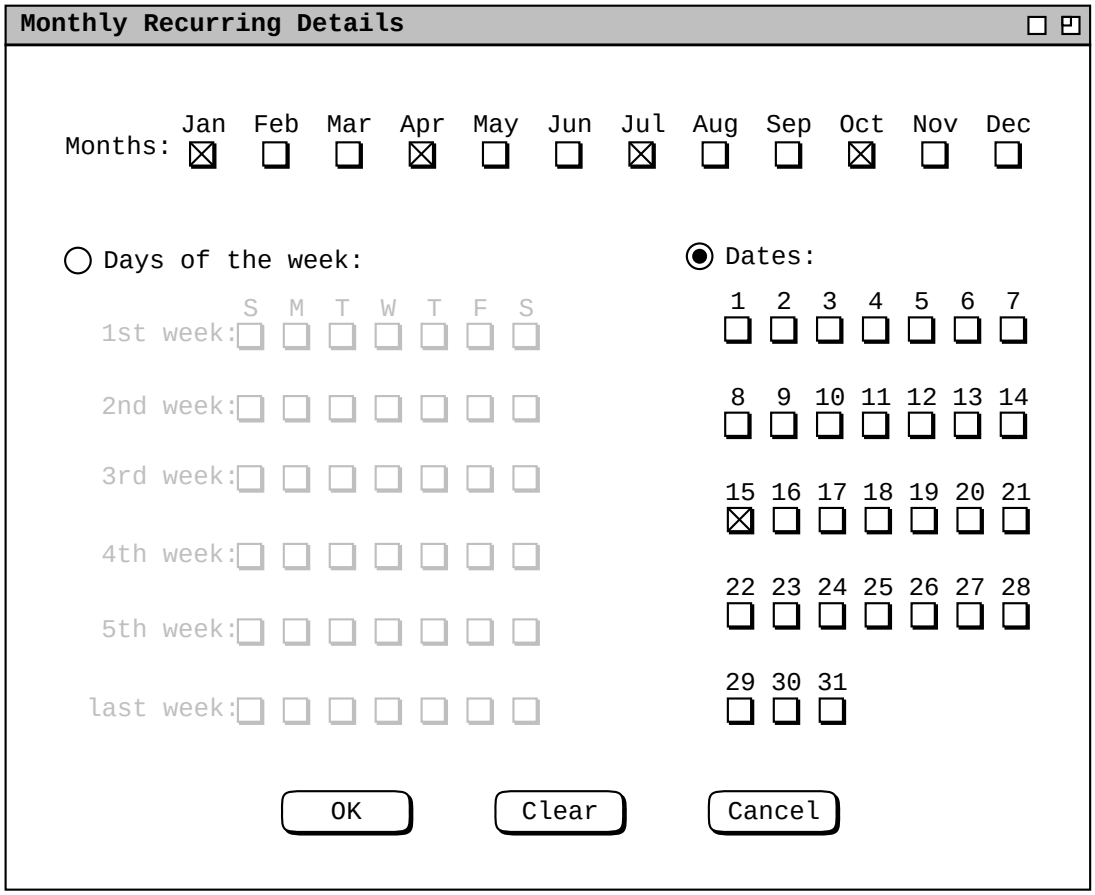


Figure 112: Item recurs quarterly on the 15th.

2.5.3.3. Yearly Intervals

The yearly interval setting means that an item recurs once every year on the same date. For example, Figure 113 shows an appointment that recurs yearly on August 27, from 1998 through 2048. The '`Start Date`' and '`End Date`' must be the same month and date. The recurring details area is empty. Although yearly recurrence can be specified using monthly details, the yearly form is provided as a simple convenience.

2.5.3.4. Recurring Meeting Requests

As discussed in Section 2.4.1, a meeting request specifies a range of possible times and dates on which a meeting can be held. In this context, the recurring details specify *allowable* days on which the meeting can occur, rather than specific days on which the meeting does occur.

For weekly and biweekly intervals, recurring meeting requests are covered in Section 2.4.1.2. For the monthly interval, the recurring details dialog is shown in Figure 114. In the top row of the dialog, the user selects one of three alternatives for granularity of recurrence. At the far right of the first row is the value for the selected granularity. The default granularity is 1 day per month.

The '`Allowable months`' check boxes are used to specify the months on which a meeting is allowed to occur. The default is all months.

'`Allowable days`' and '`Allowable dates`' are two alternatives for setting the specific days or dates on which the meeting is allowed to occur. The use of these alternatives is similar to the regular monthly recurring

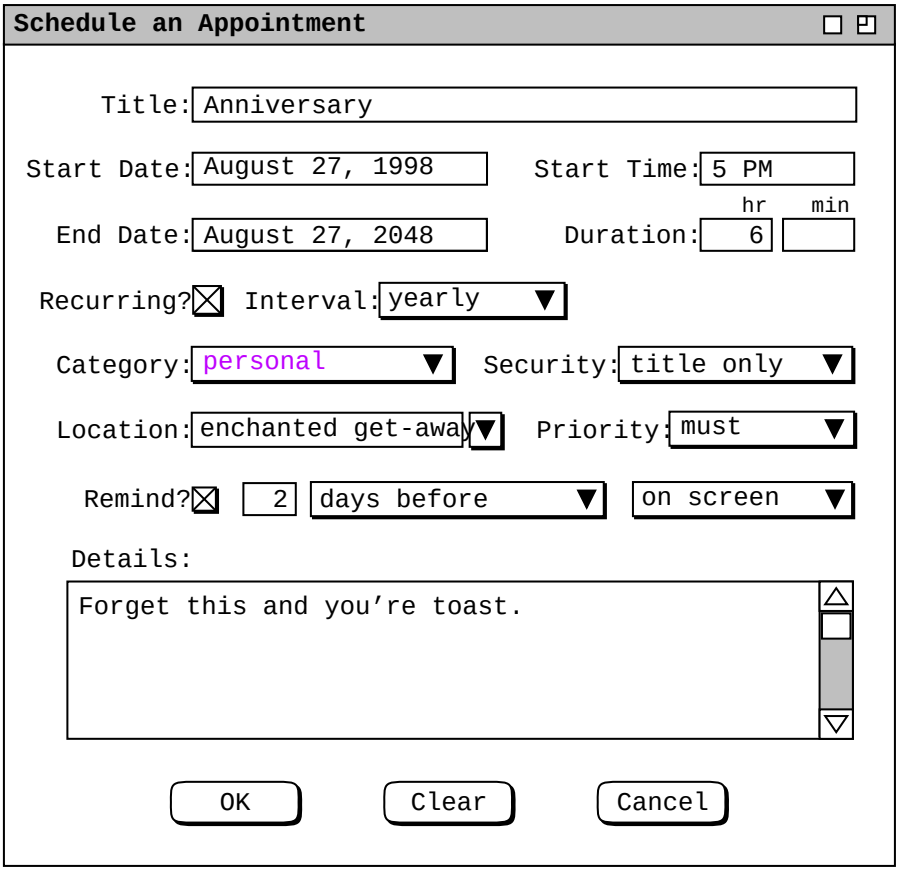


Figure 113: Anniversary appointment.

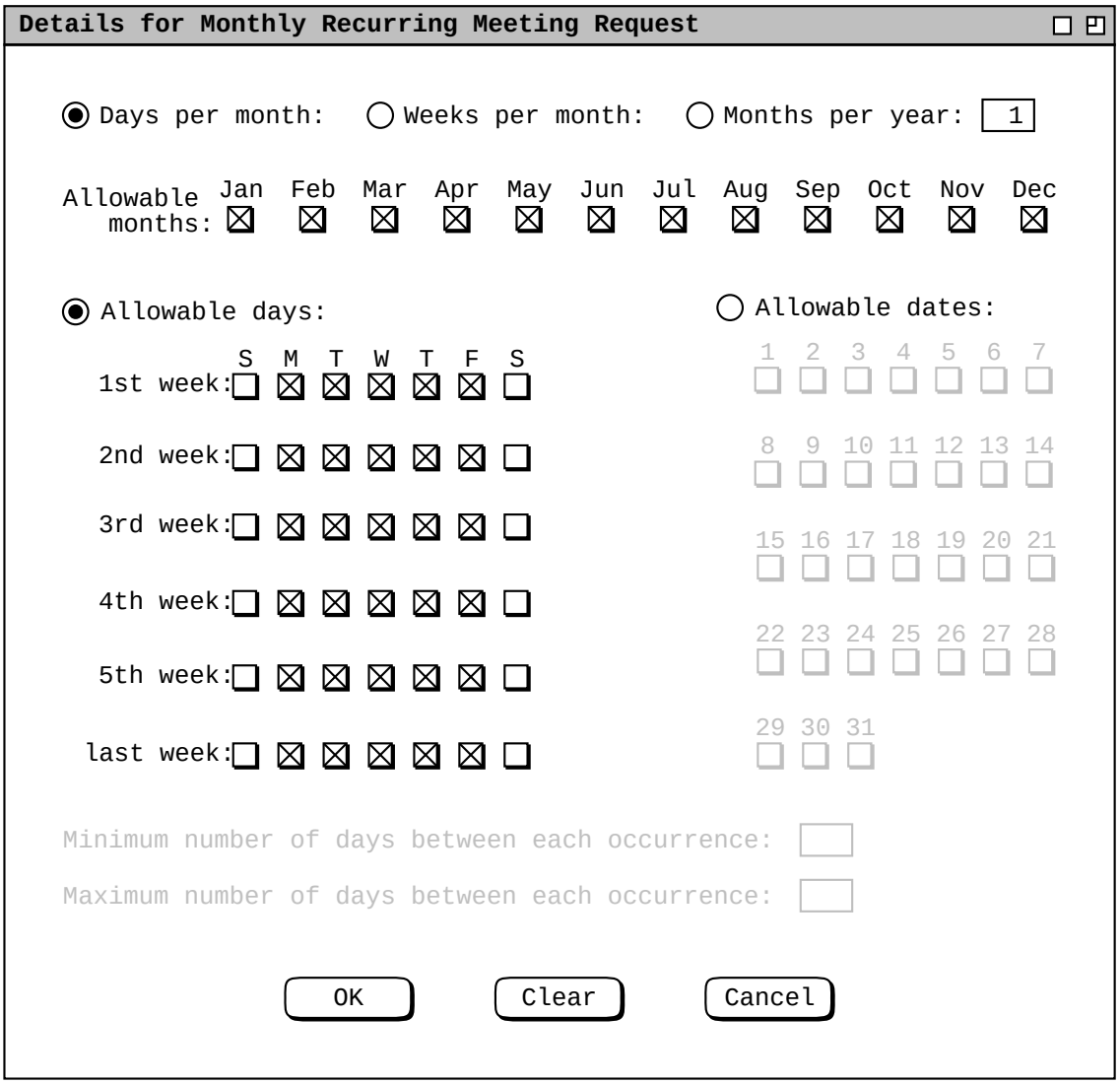


Figure 114: Monthly recurring details for a meeting request.

dialog in Figure 110. In the case of the meeting request, the settings select *possible* days or dates rather than actual days or dates.

The last two lines in Figure 114 define the minimum and maximum span between meeting occurrences. The use of these settings is analogous to the last two settings in the weekly recurring request shown in Figure 78. The occurrence granularity changes based on the setting in the first-row radio buttons. The figure shows the default case of "`days`". If the '`Weeks per month`' selection is on, the the string "`days`" is replaced with '`weeks`' in both the minimum and maximum labels. If '`Months per year`' is on, the the string "`days`" is replaced with '`months`' in both labels. The minimum and maximum fields are enabled if the numeric value in the first row is greater than the number or allowable days, weeks, or months, as appropriate. The number of allowable days is defined as the number of day or date check boxes that are selected. The number of allowable weeks is defined as the number of rows under '`Allowable days`' or '`Allowable dates`' that have one or more days or dates selected. The number of allowable months is the number of month check boxes selected.

2.5.3.5. Recurring Items and Instances

When a recurring item is scheduled, it generates a collection of *instances* in the user's calendar. The instances occur on the dates specified by the recurring information. The system keeps track of the instance collections as a whole, for the purposes of change and delete. Each instance that is generated from a particular recurring item is marked as part of that item's collection. In this way, when the user changes or deletes all instances of a recurring item, the system knows precisely which calendar items are affected.

Since a recurring item cannot be changed to non-recurring, an instance always remains part of its recurring collection, unless the instance is deleted. Hence, when an individual recurring instance is changed, it still remains part of its recurring collection. This means that a changed instance can continue to be used for changing or deleting all other or all future instances. The cummulative effect of individual instance changes is reflected whenenver an instance is used to change all other or future instances. For example, suppose the user confirms two separate change operations to an individual item, then selects '`all instances`' and confirms a third change. In this case, the results of all three changes are made to all instances, not just the result of the third change after '`all instances`' is selected.

To maintain a reasonable degree of consistency for recurring items, all instances in the same collection must have the same start date, end date, and recurring information. For this reason, the start date, end date, and recurring information can only be changed when the '`all instances`' radio button is selected in an item-level view.

When the user changes the start date, end date, or recurring details for all instances, the effect can be to delete one or more instances. Specifically, the following forms of change result in instance deletion:

a. changing the start date forward, to after the existing start date

b. changing the end date backward, to before the existing end date

c. removing one or more days from the recurring details

The effects of such change are reflected in all affected display windows, including the removal of the item-level display for the changed instance if the change results in its deletion.

2.5.4. Receiving Reminders

The user receives a reminder for each item with '`Remind`' turned on. Reminders appear in one of two forms: on-screen or email. On-screen reminders appear anytime the Calendar Tool host computer is running, whether or not the Calendar Tool itself is running. For example, when it is time for the dentist appointment reminder (Figure), the system displays the on-screen dialog shown in Figure 115. The reminder text indicates the start time, end time, and title of the scheduled appointment. An audible alert accompanies the on-screen display. When the user responds by pressing '`OK`', the system removes the dialog from the screen and the reminder will not appear again. For recurring

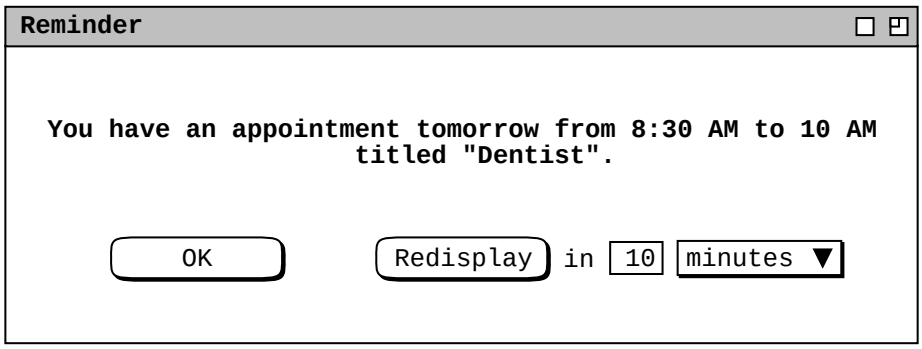


Figure 115: Dentist appointment on-screen reminder.

items, a reminder appears for each instance in which ‘Remind’ is turned on.

The reminder text varies depending on how soon before the appointment the reminder is to appear. Specifically,

a. If the reminder appears on the same date as the appointment is scheduled, the word "today" appears before the time.
b. If the reminder appears on the day before the appointment is scheduled, the word "tomorrow" appears before the time. This is the case in Figure 115, because the reminder has been set to appear 24 hours before the appointment.
c. If the reminder appears two or more days before the appointment is scheduled, the month name and numeric date appear before the time.

If the user responds with ‘Redisplay’, the system removes the reminder dialog from the screen and redisplays it in the indicated amount of time. The default time is 10 minutes, which the user can change to a value between 1 minute and 99 hours. The menu to the right of the numeric data field contains the selections ‘minutes’ and ‘hours’. The default value of 10 minutes can be set as an option, as described in Section 2.7.2

The same general form of reminder is sent for all types of scheduled item. The difference is in leading several words of the reminder text. The four text forms are:

"**You have an appointment ...**"

"**You have a meeting ...**"

"**You have a task due ...**"

"**There is an event ...**"

The ellipses are the same in all cases, consisting of the today/tomorrow/date indicator, start time, end time, and title.

When the ‘email’ setting is selected for a reminder, the system sends an electronic mail message to the user at the time the reminder is scheduled to appear. The subject of the message is "Calendar Tool Reminder". The body of the message is the same text that appears in an on-screen reminder, left justified in 72 character columns.

The Calendar Tool sends email reminders using the electronic mail facilities of the underlying operating environment. Once an email reminder has been sent, its further handling and delivery are beyond the control of the Calendar Tool.

2.5.5. Editing Categories

Finish all the details of category editing not done in the earlier sections.

2.5.6. Dynamic View Updating

Whenever a user confirms command execution, the effects of the command are immediately reflected in all affected display windows for that user, unless filter or option settings limit the visibility of the effects. The definition of "affected display window" is any visible window the contents of which are altered by the command execution. The scenarios in the preceding sections describe the specific effects of commands in specific contexts.

When a meeting scheduler confirms an operation to schedule, change, or delete, the notification dialog and penciled-in changes appear immediately on the displays of all active attending users whose filter and option settings permit. If user option settings limit when the notification dialog can appear, it appears as soon as the option setting allows or is changed to allow. When a user hides penciled-in items, such items appear immediately after the user changes the pencil-in option to ‘show’.

Display updates to other user and group calendars do not appear dynamically. If user A is viewing user B, changes made by user B do not appear on user A’s screen until user A re-executes the command the generates the view of user B’s calendar. Similarly, if user A is viewing group calendar G, changes made by a leader of G do not appear on

A's screen until A re-executes the command that generates the changed group calendar view.

Display updates that reflect user or group database changes do not appear dynamically. If user A is viewing a display that contains information about user B, changes made by an admistrator to that information to not appear on user A's screen until user A re-executes the command that generates the affected display. Details of adminstrator database changes are presented in Section 2.6.

2.6. Administrative Functions

The scenarios in this section cover administrative commands. The commands provide access to the three Calendar Tool databases: users, groups, and locations. Regular users can access the databases with viewing commands. Administrative users can modify the databases with add, change, and delete commands. In addition to database access, there are other administrative commands for performing small managerial functions.

As described in Section 2.1, there are separate interfaces for two types of registered user -- regular and administrative. An administrative user is one with designated administrative privileges. Both regular and administrative users can run the Calendar Tool through the regular user interface shown in Figure 1. Only users with administrative privileges can run through the administrator interface of Figure 2. The administrative interface provides commands that modify the databases.

Privileged administrator access is covered in Sections 2.6.1 through 2.6.5 Access to administrative commands by regular users is covered in Section 2.6.6. In the scenarios, the term "administrator" refers to a user with administrative privileges; the term "user" refers to a regular user without administrative privileges. Also, the term "privileged `Admin` menu" refers to the command menu in the privileged administrator's interface; the term "`Admin` menu" refers to the menu accessible from the regular, non-privileged interface.

2.6.1. Gaining Administrative Access

When a user invokes Calendar Tool Administration, the system presents the password dialog shown in Figure 116. The user must enter a legal password in order to be confirmed as an administrator. If the user does so, the system displays the administrative interface of Figure 2. If the user fails to enter the correct password, the system denies access by presenting the dialog of Figure 117. The system displays this dialog for up to three additional attempts, after which the dialog is removed and the user is not permitted administrative access. As the password is typed, it is echoed as asterisk characters, not as the actual characters typed.

Each administrative user has a separate password, which is set with the password command described in Section 2.6.5. The Calendar Tool is installed with one pre-defined administrative user. The user name is "`Calendar Tool Administrator`", with ID "`admin`". This pre-defined administrator cannot be deleted.

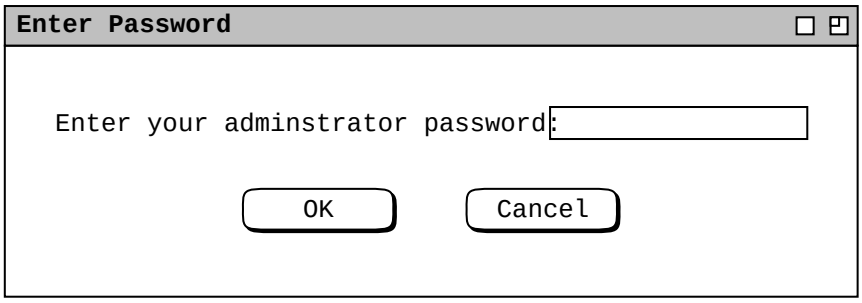


Figure 116: Password entry dialog.

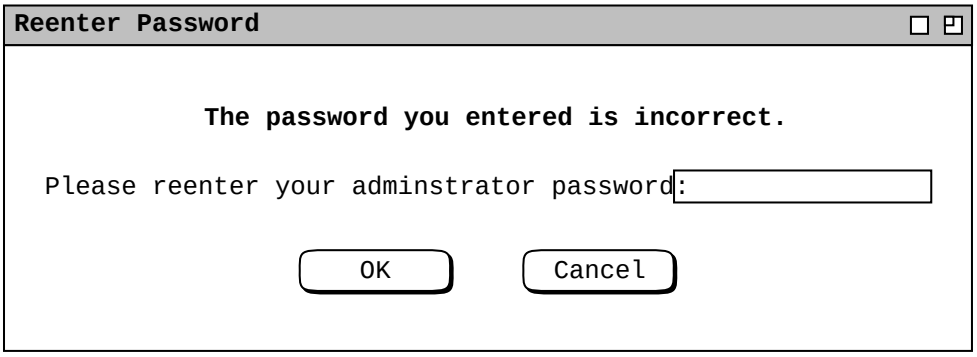


Figure 117: Password re-entry dialog.

2.6.2. User Database

The user database contains a record for each registered user. To access the user database, the administrator selects the '`Users ...`' item in the privileged '`Admin`' menu. In response, the system displays a dialog of the form shown in Figure 118. The scrolling area and search field operate in the same manner as described Section 2.3.5.1 for viewing other users.

To add a new user to the database, the administrator presses the '`Add ...`' button. In response, the system displays the dialog shown in Figure 119. The dialog contains all the information in a user record. The '`Name`' is entered separately as '`last`', '`first`', and '`middle`'. Only '`last`' is required. If '`middle`' is non-empty, '`first`' must be non-empty. The names appearing in the database list of Figure 118 are formatted as follows:

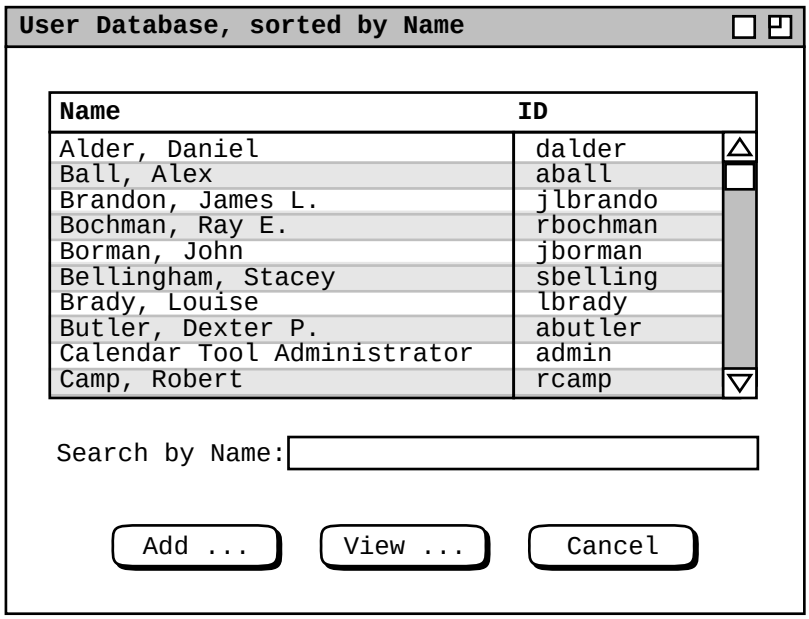


Figure 118: User database dialog.

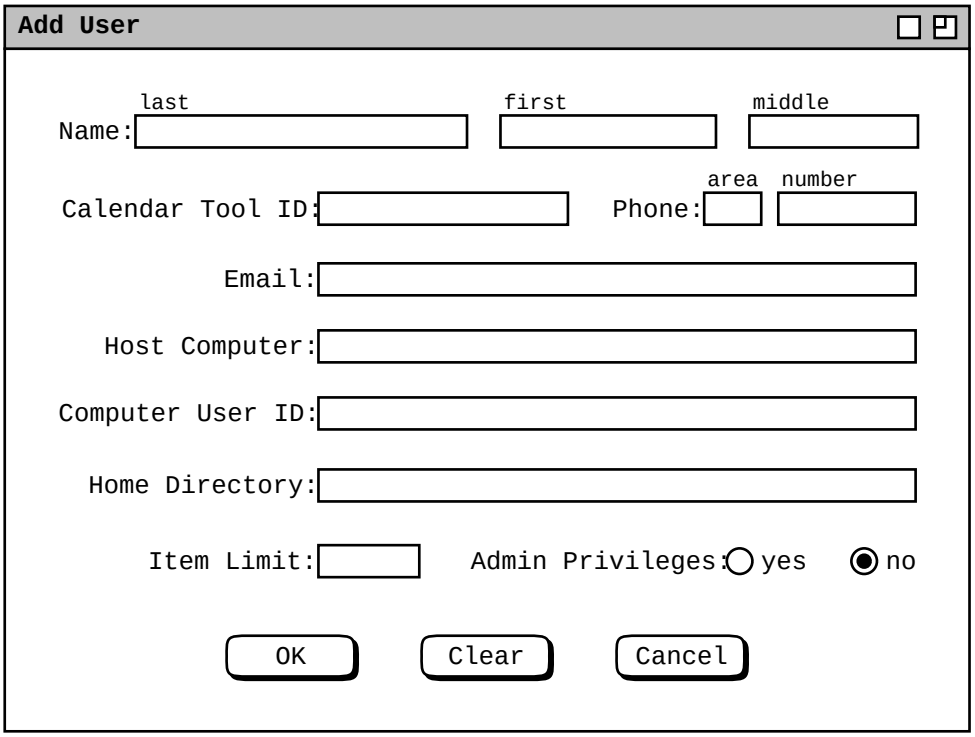


Figure 119: Add user dialog.

last, *first middle*

The comma and spaces are absent if there are no first and last names. The last name can itself contain space characters. For example, the last name "`Calendar Tool Administrator`" is that of the initial pre-defined user in the user database.

The '`Calendar Tool ID`' is the identifier by which a user is known in the Calendar Tool system. The ID must be unique among all Calendar Tool users and groups. The area code and phone number fields are optional information that may be useful for communicating with users outside the context of the Calendar Tool.

'`Email`' is required information for all users. It is the electronic mail address of the user for mailing meeting notifications and reminders. The '`Host Computer`' is the unique identifier of the computer on which the user runs the Calendar Tool. The format of the identifier is platform-dependent, based on the type of network to which host computers are attached. IP address is a typical format. '`Computer User ID`' is the user's identification on the host computer. '`Home Directory`' is the file directory (i.e., folder) assigned as the user's home directory on the host computer.

'`Host Computer`', '`Computer User ID`', and '`Home Directory`' are optional data fields. All three must be provided in order for the user to receive notification of meetings scheduled by other users. If the value is empty for one or more of these fields, the user does not receive such notifications.

The '`Item Limit`' field specifies the maximum number of scheduled items that can be stored for the user in the Calendar Tool central repository. The limit value is optional. If it is absent, there is no limit. The item limit can be zero, in which case the user has an empty calendar in the central repository. Complete details on the central calendar repository are covered in Section 2.14.

The ‘Admin Privileges’ radio buttons indicate if the user has administrative privileges. The default is ‘no’. When the administrator selects ‘yes’, the system performs the following actions when the Add operation is confirmed:

a. grants the affected user administrative access privileges
b. adds the user to the ‘admins’ group
c. sets the value of the user’s administrative password to the user’s ID

The default password can (and should) be changed using the ‘Admin Password’ command described in Section 2.6.5. When the administrator changes the ‘Admin Privileges’ setting from ‘yes’ to ‘no’, the system ungrants administrative access and removes the user from the ‘admins’ group.

Figure 120 shows the administrator having entered values for a new user. As may be typical, values for several of the fields are similar. Here, for example, the ‘Calendar Tool ID’, ‘Email’ prefix, and ‘Computer User ID’ are the same. This is not required, but is likely to be a common practice of administrators. When the administrator presses ‘OK’, the system performs the following actions:

a. adds the new user record to the user database
b. updates the list of names in the user database dialog
c. adds the new user’s ID to the All Users group, as described further in Section 2.6.3.

Pressing Clear in the add-user dialog erases any edits made since the dialog was displayed. ‘Cancel’ cancels the add operation without adding to the database.

To view the database record of an existing user, the administrator selects the user name or ID in the list and presses the ‘View ...’ button. Clicking on either the name or ID highlights both. For example, Figure 121 shows the

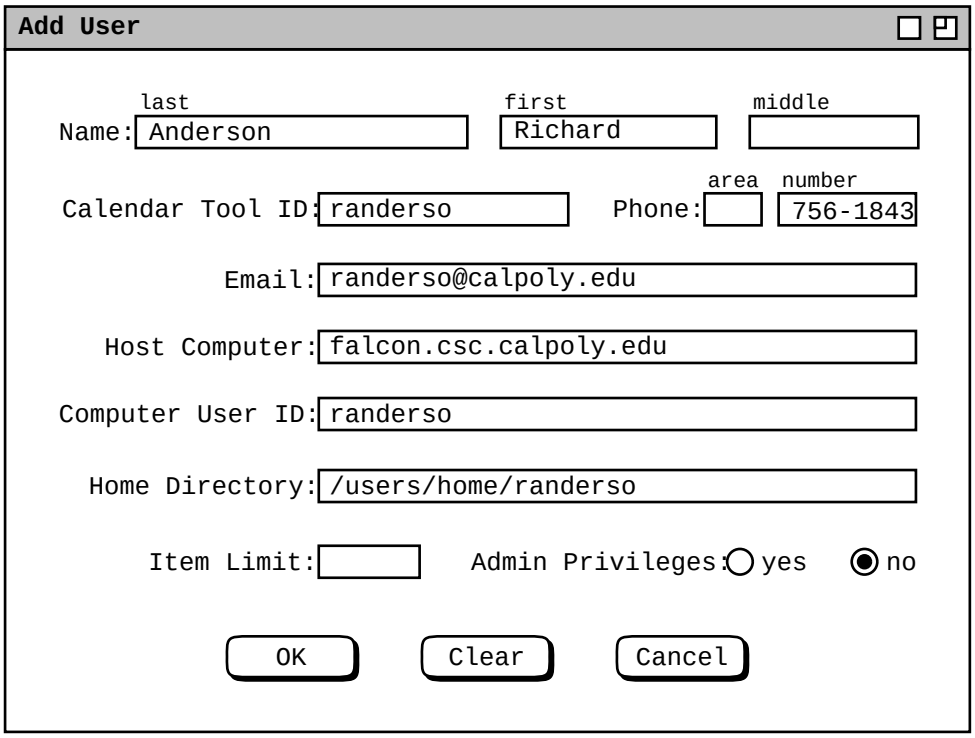


Figure 120: Adding a new user.

user having selected James L. Brandon for view. The figure shows the newly added user Richard Anderson. When the administrator presses '`View ...`' in Figure 121, the system displays the dialog of Figure 122. A shortcut to view a user's record is to double click on the user name or ID in the scrolling list.

The user record dialog has all of the same data fields as the dialog for adding a new user. In addition, there are two scrollable lists that show the Calendar Tool groups of which the user is a member and a leader. The administrator can change all data fields except '`Calendar Tool ID`', '`Member of`', and '`Leader of`'. Once an ID is assigned for a particular user, it cannot be changed. Group membership and leadership are changed with the group database commands described in Section 2.6.3.

Figure 123 shows edits to the user record for James L. Brandon. The edits are to the phone, email, and host computer fields. When the user presses '`Change`', the system displays the confirmation dialog in Figure 124. The administrator confirms the change with '`OK`' or cancels it with '`Cancel`'. Upon confirmation, the system performs the following actions:

a. updates the user record in the database

b. notifies the affected user of the change

c. deletes items from the user's calendar in the central repository, if necessary to satisfy a changed item limit value; Section Section 2.14.2 has further details on central repository item limits

d. terminates the Calendar Tool Administration program if '`Admin Privileges`' was set to '`no`' and the the changed user is executing it at the time the change is confirmed, including if it is the administrator who has performed the change

In this example, neither action c or d applies.

The change notification appears on the affected user's screen, in the form shown in Figure 125. The notification message lists the specific details of the change. The email address at the end of the message is that of the administrator who performed the change. This email address is defined in the user record for the administrator.

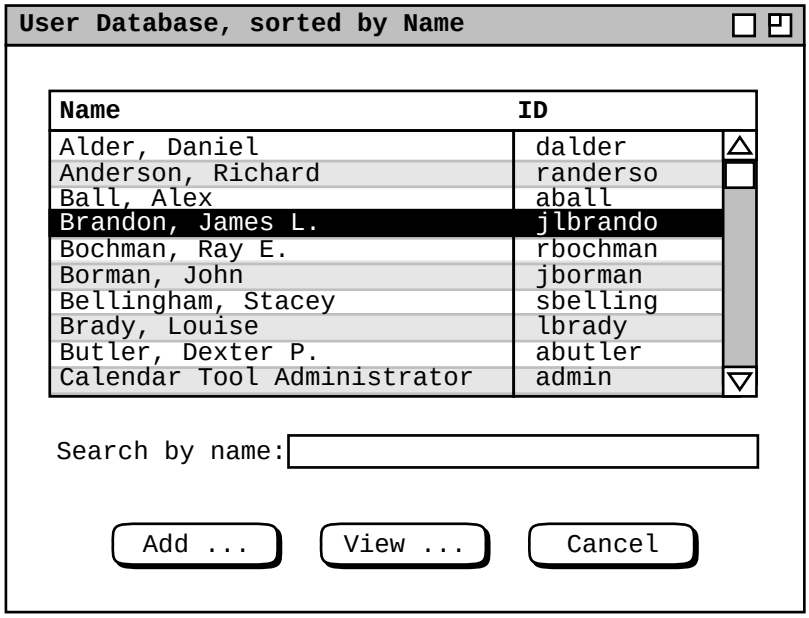


Figure 121: Brandon selected in users list.

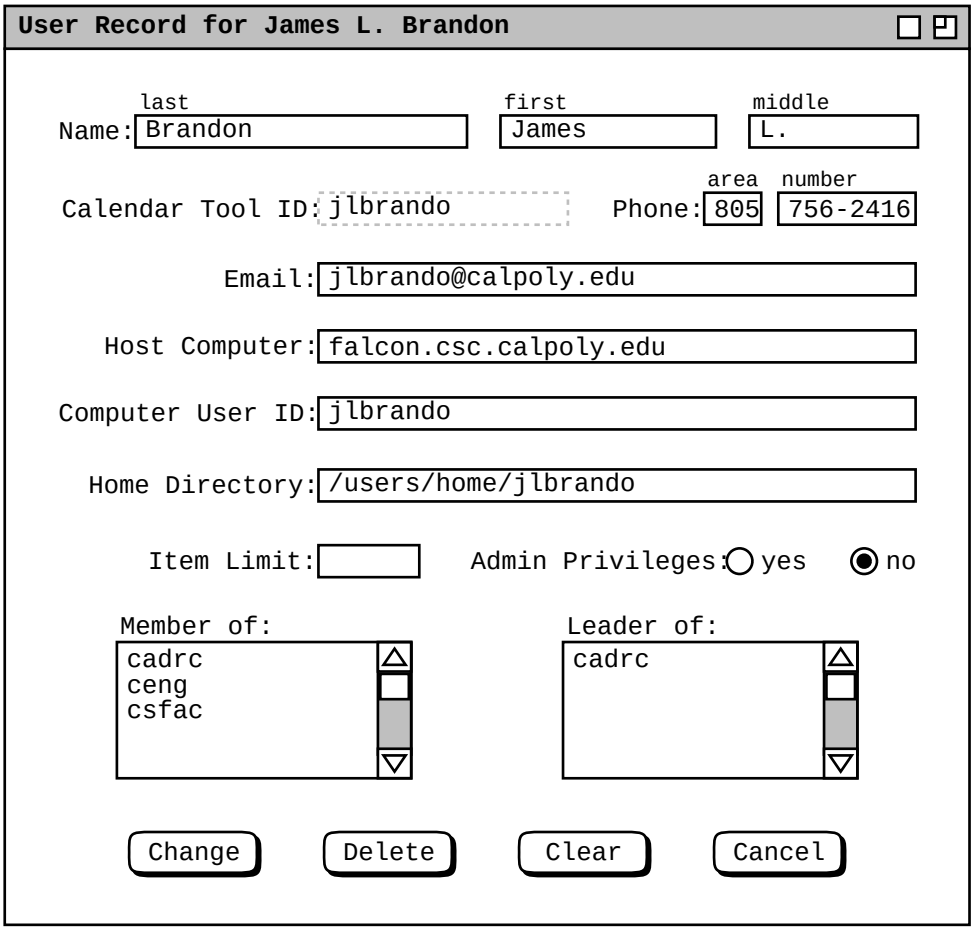


Figure 122: User database record for James L. Brandon.

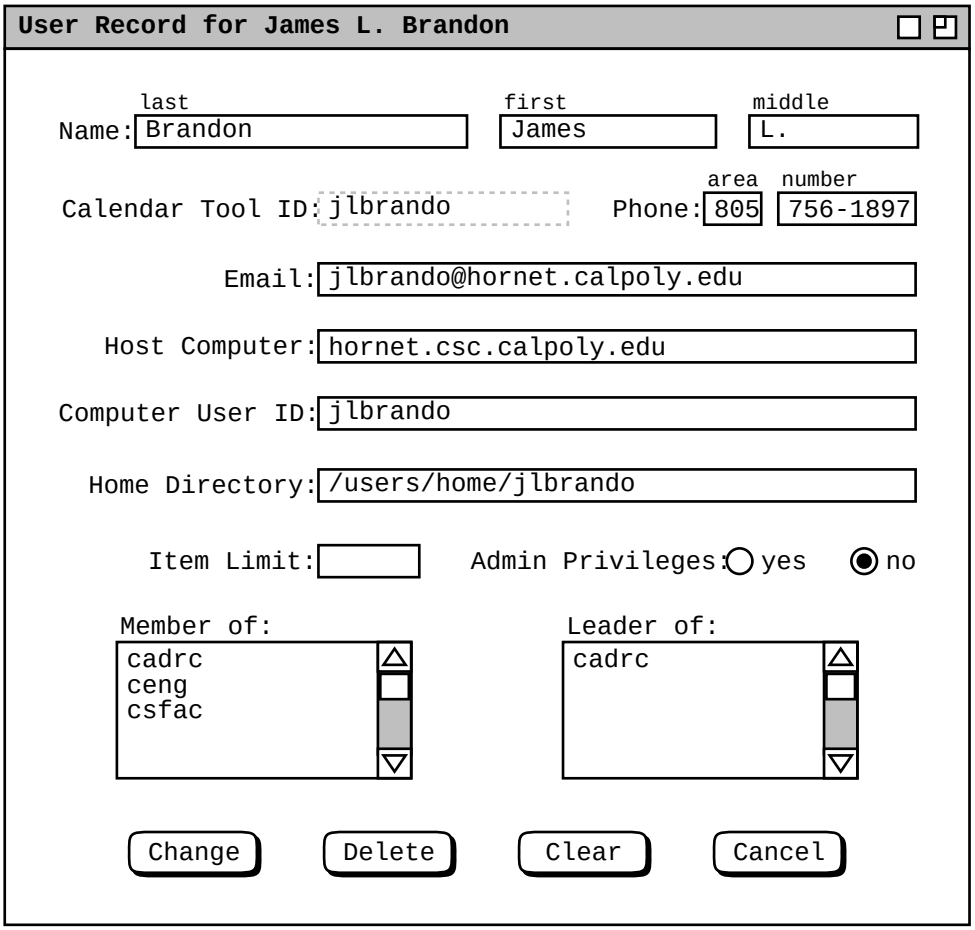


Figure 123: User record for James L. Brandon edited.

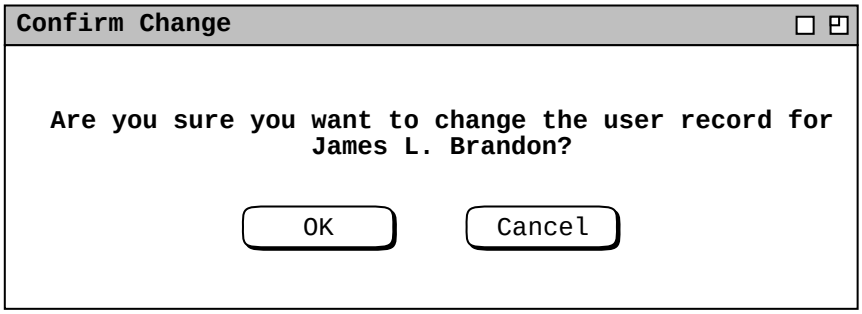


Figure 124: Confirmation dialog for changing a user record.

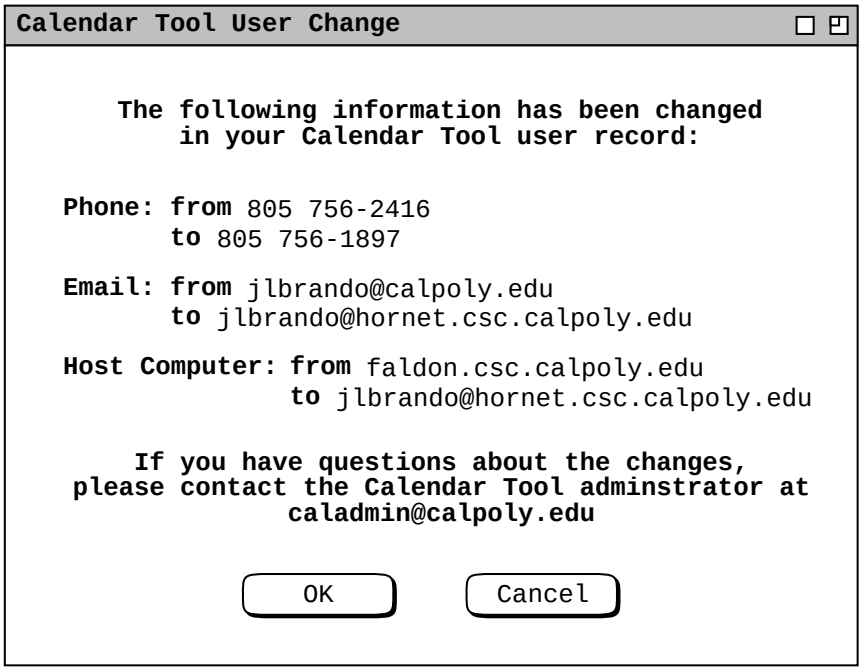


Figure 125: Notification of change to James L. Brandon user record.

To delete a user, the administrator presses '`Delete`' in the user record display. In response, the system displays a confirmation dialog of the form shown in Figure 126. When the administrator confirms the deletion with '`OK`', the system notifies the deleted user with an on-screen notification of the form shown in Figure 127. This is the notification sent to user Frank D. Smith. The notification text explains the delete action.

Deleting a user has the following effects on system data:

a. removes the user's record from the user database

b. removes the user from all groups of which the user is a member and/or leader, including the `All Users` group, and if appropriate the `Adminstrators` group

c. removes the user's calendar from the central repository

d. cancels any meeting scheduling operation that the deleted user is executing at the time the deletion is confirmed

e. terminates the Calendar Tool Administration program if the deleted user is executing it at the time the

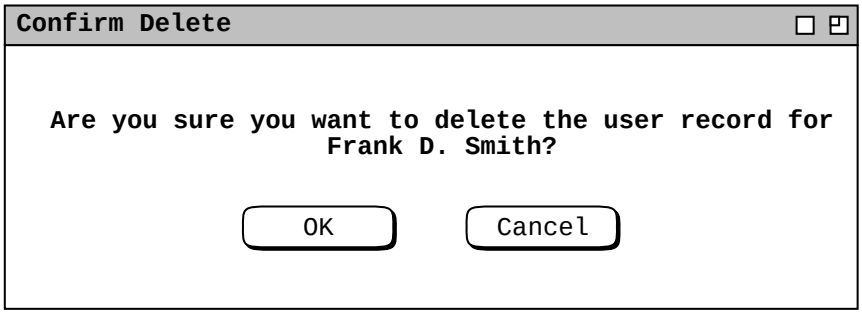


Figure 126: Confirmation dialog for deleting a user record.

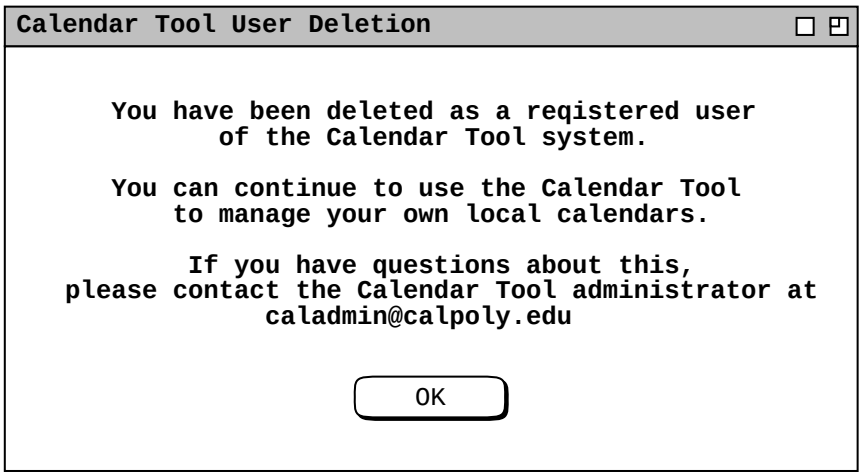


Figure 127: Notification sent to deleted user.

deletion is confirmed, including if it is the administrator who has performed the deletion

Deleting a user does not delete the user's ID from any meeting attendees lists on which it appears. Once a meeting is scheduled, its attendees list remains unchanged, except for local edits performed by individual (non-scheduler) users.

There is a rare but possible condition where an administrator deletes a user while another user is scheduling a meeting. Under this condition, the user deletion could affect the possible times or time conflict lists that are already displayed at the time of user deletion. In such cases, the system does *not* dynamically update the affected lists. Therefore, the in-progress scheduling operation proceeds without reflecting the user deletion. All meeting scheduling that begins subsequent to the user deletion is performed as it should be in the context of the deleted user.

Unlike meeting notifications, there is no option to disable the notifications for change or delete of a user record. The on-screen notification appears immediately if the affected user is running the Calendar Tool, or the next time the user invokes the Calendar Tool if it is not running at the time of notification.

2.6.3. Group Database

User groups are a convenient means to define a named list of related users. In comparison to an individual user, a group can be considered a virtual entity. No single user owns the group; a group has no email address and no host computer information. As explained in Section 2.4.1, meetings scheduled by group leaders are recorded in group

calendars, as are meeting changes made by leaders. However, none of the group leaders owns the group calendar explicitly. In particular, if all group leaders are deleted, the group calendar persists.

To access the group database, the administrator selects the '`Groups ...`' command in the privileged '`Admin`' menu. In response, the system displays the dialog in Figure 128. This dialog has the same format as that for the user database in Figure 118. Two groups are built-in to the Calendar Tool: `all` and `admins`. These groups consist of all registered users and all adminstrative users, respectively.

To add a new group, the administrator presses '`Add ...`', whereupon the system displays the dialog of Figure 129. The group '`Name`' is free-form text for the full name of the group. The '`ID`' is the unique group identifier. The '`ID`' must be unique among all Calendar Tool users and groups. The '`Item Limit`' specifies the maximum number of scheduled items that can be stored for the group in the central repository.

The '`Members`' and '`Leaders`' lists contain the user IDs of the group members and leaders. Both of these lists can have zero or more entries. A group with no members or leaders is considered dormant. A group with members but no leaders cannot have meetings scheduled for it. The utility of dormant and leaderless groups is limited, but the system allows them to exist at the discretion of system administrators. A group leader need not be a member. This allows a leader to schedule a meeting at which the leader is not an attendee.

Figure 130 shows the administrator having entered values for a new group. Immediately below the member and leader lists are small '`Add ...`' and '`Delete`' buttons. These are used to add and delete users from the lists. For example, when the administrator presses the '`Add ...`' button below the '`Members`' list, the system displays the dialog of Figure 131. The dialog allows the administrator to enter one or more IDs for group members. The entered IDs must be of current registered users and/or defined groups. To facilitate entry, ID completion is operative in the dialog. Specifically, the administrator can type the leading prefix for an ID and press the `TAB` key to have the ID completed. Details of name and ID completion are covered in Section 2.11.16 The administrator can view the list of all available user and group IDs in the database dialogs of Figures 118 and 128. Allowing multiple IDs to be entered facilitates the definition of groups with a large number of users. If desired, the administrator can use the '`Edit Paste`' command to enter names from an outside text file, assuming inter-program copy/paste operations are

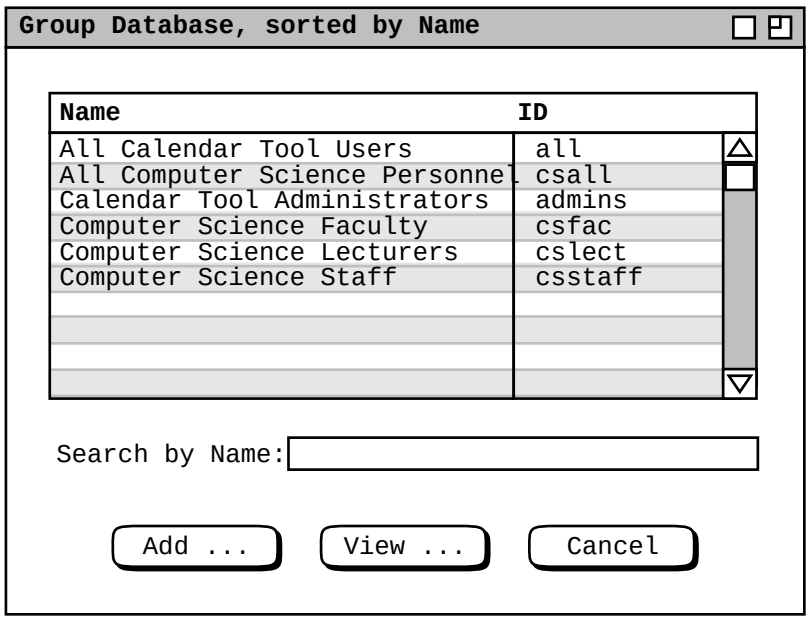


Figure 128: Group database dialog.

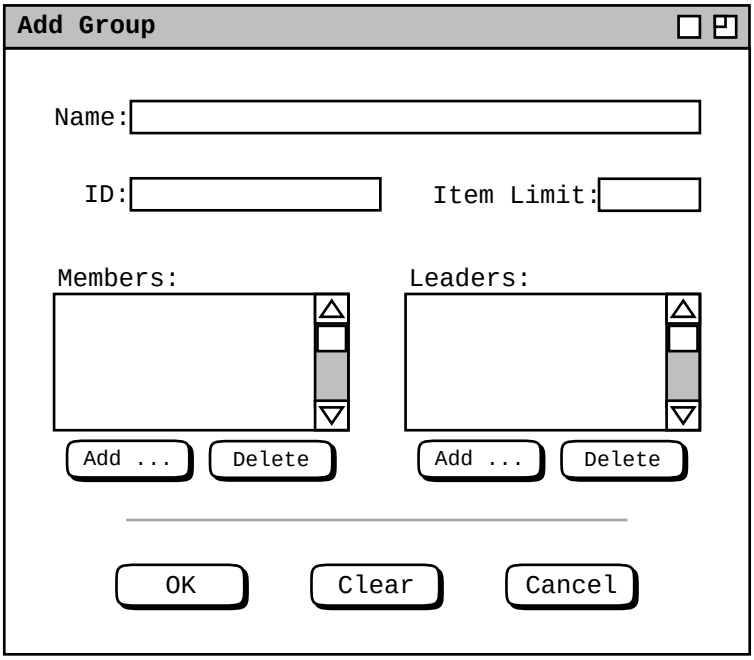


Figure 129: Add group dialog.

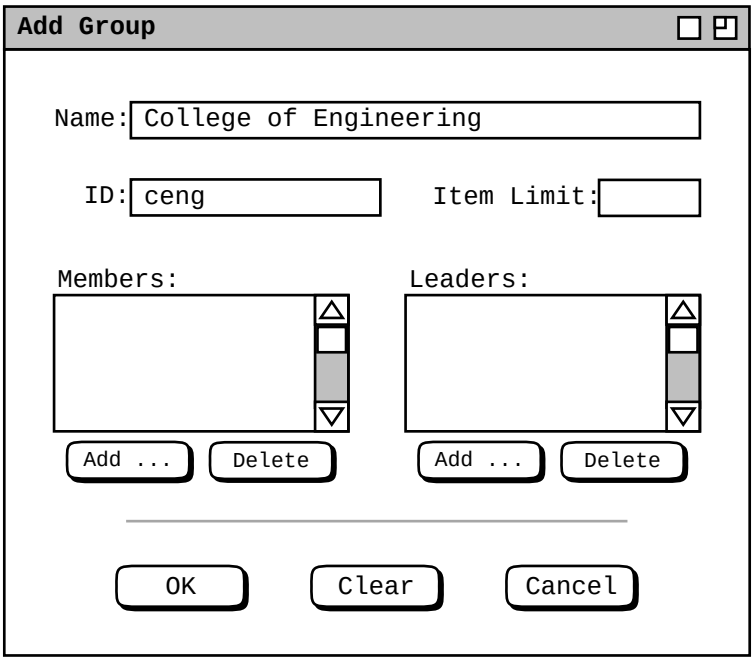


Figure 130: Adding a new group.

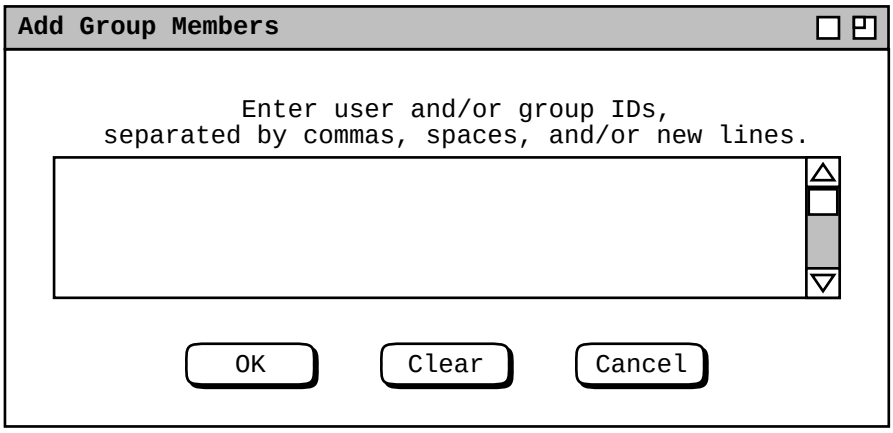


Figure 131: Add group member dialog.

supported by the underlying operating environment.

Figure 132 shows the administrator having entered IDs for the `ceng` group. The first row of IDs are for individual users. The IDs that follow are for other groups. As introduced in Section 2.4.1.3, a group that contains other groups as members is a *supergroup*. There is no limit on the depth of the supergroup hierarchy. That is, a supergroup can have one or more supergroups as members. In terms of individual users, supergroup membership is defined as the set of all users appearing throughout the supergroup hierarchy. As explained in Section 2.4.1.1, user duplication in a group membership hierarchy is ignored in the context of scheduling meetings.

When the user presses '`OK`' in Figure 132, the system validates all entered IDs. If one or more IDs are invalid, the system issues an appropriate error message, as described in Section 2.12.6. If all IDs are valid, the system enters them in alphabetic order into the members list for the group. If the same ID is entered more than once in the add-member dialog, the name appears only once in the completed members list. Figure 133 shows the results of adding the '`ceng`' group members. The added members are listed alphabetically, one per line in the '`Members`' viewing list.

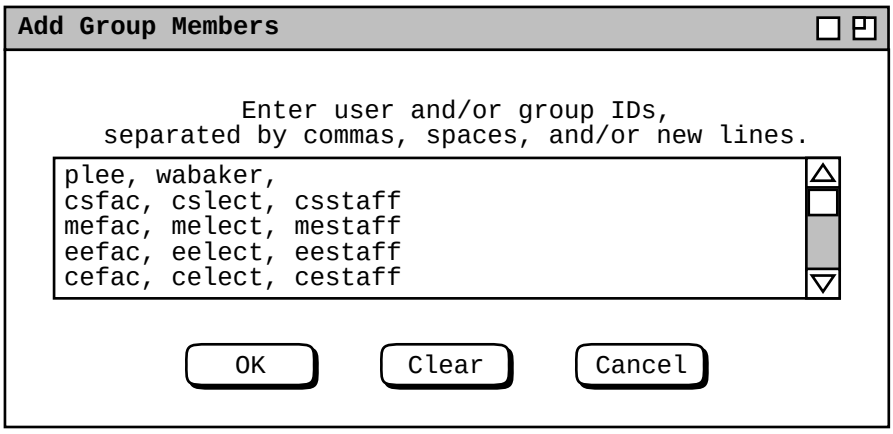


Figure 132: Add group member dialog.

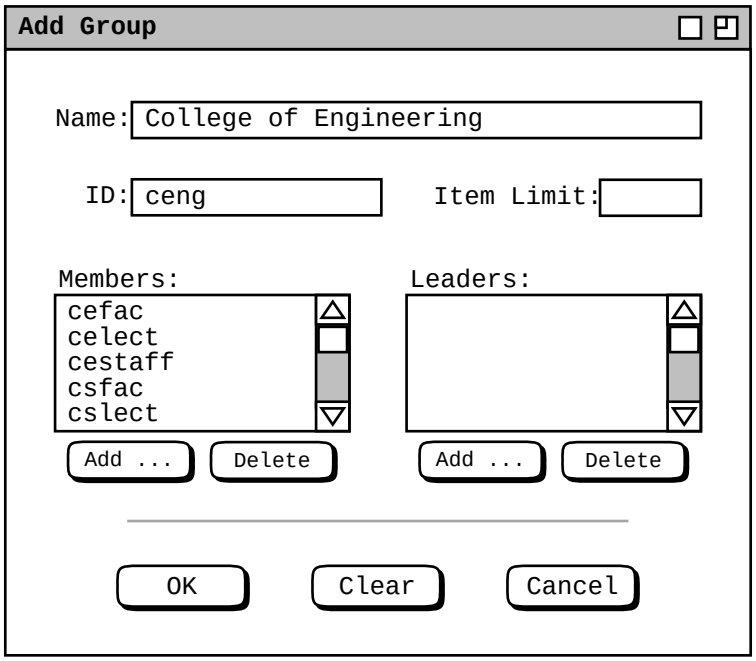


Figure 133: Add group dialog with members added.

To add one or more group leaders, the administrator follows mostly the same procedure as for adding members. The only difference is that the IDs of group leaders must be individual users, not groups.

At the bottom of the add-group dialog are '`OK`', '`Clear`', and '`Cancel`' buttons. These apply to the group as a whole. When the user presses '`OK`', the system adds the group to the database. '`Clear`' and '`Cancel`' have the normal functionality.

To view an existing group, the administrator selects the group name or ID in the group database dialog of Figure 128. and then presses the '`View ...`' button. For example, Figure 134 shows the result of the user viewing the `csfac` group. The administrator can change all fields except '`ID`'. As for a user, once an '`ID`' is assigned to a group in cannot be changed. The '`Add`' buttons immediately below the members and leaders lists operate in exactly the same manner as in the add-group dialog of Figure 129.

To delete one or more group members, the administrator selects the name(s) in the '`Members`' list and presses the '`Delete`' button immediately below the list. To select multiple names for deletion, the user holds down the `SHIFT` key as each name is selected in the list. In response to executing '`Members: Delete`', the system displays a confirmation dialog of the form shown in Figure 135. Here the confirmation is in response to the administrator selecting two users for deletion from the `csfac` group. '`OK`' confirms the deletion, '`Cancel`' cancels it. In response to confirming the delete, the system removes the names from the members list, as shown in Figure 136. Since the members list is longer than fits in the scrolling area, only the deletion of '`cdaniels`' is immediately visible.

To delete one or more group leaders, The administrator follows the same procedure as for member deletion. In the leader-deletion confirmation dialog, the word "**`member`**" is replaced by "**`leader`**".

The four command buttons at the very bottom of group dialog correspond to the group record as a whole. When the user presses '`Change`', the system displays a confirmation dialog of the form shown in Figure 137. When the administrator confirms the change with '`OK`', the system performs the following actions:

a. updates the group record in the group database

b. updates the members and leaders lists in the group records of all affected users

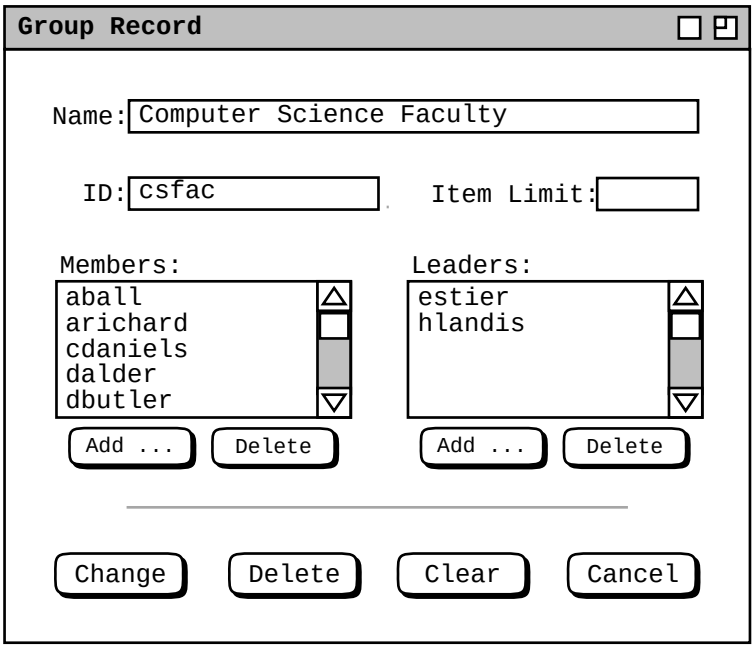


Figure 134: Group database record for the Computer Science Faculty.

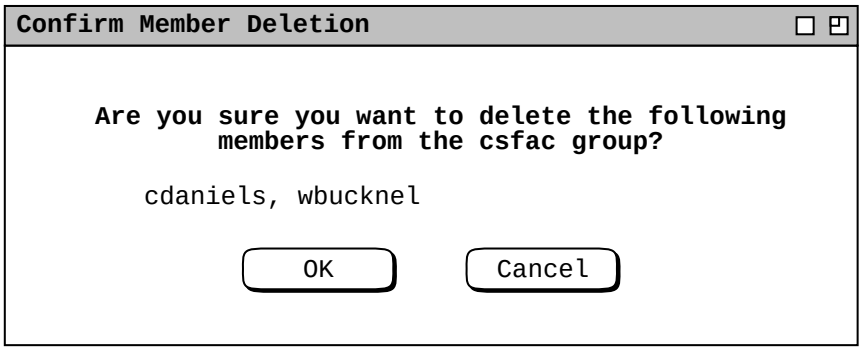


Figure 135: Group member delete confirmation.

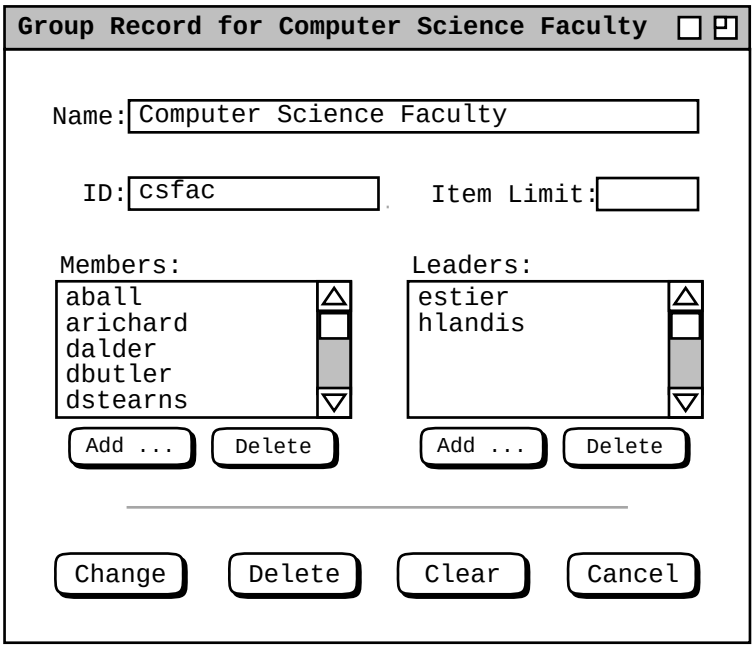


Figure 136: Members deleted in group record dialog.

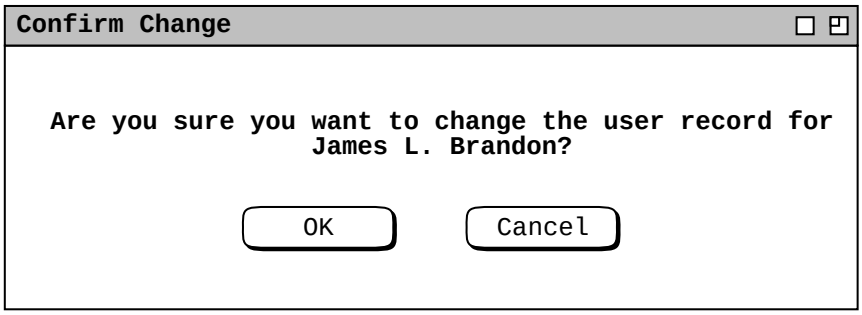


Figure 137: Confirmation dialog for changing a group record.

c. notifies all added or deleted users of the change

d. notifies all added or deleted leaders of the change

If the same user is added as both a member and leader, only one notification is sent. The notification takes the following form:

You have been *actioned*
the *group* **Calendar Tool group.**

If you have questions about this
please contact the Calendar Tool administrator at
admin

The *actioned* string is one of the following, as appropriate to the change(s) made:

"**added as a member of**"

"**added as a leader of**"

"**added as a member and leader of**"

"**deleted as a member of**"

"**deleted as a leader of**"

"**deleted as a member and leader of**"

The *group* string is the group ID. The *admin* string is the email address of the administrator performing the operation.

When the user executes '`Delete`' for a group record, the system displays the same form of confirmation dialog as shown in Figure 137, with the word "**change**" replaced with "**delete**" in both the dialog banner and message text. When the delete is confirmed, the system

a. removes the record from the group database

b. removes the group calendar from the central repository

c. removes the group from the members and leaders lists of all affected users

d. notifies all affected users

The notification takes the following form:

The Calendar Tool *group* **group,**
of which you were a *affiliation*,
has been deleted.

The *group* string is the group ID. The *affiliation* is one of the following, as appropriate: "**member**", "**leader**", or "**member and leader**"

Change or deletion of a group record has no effect on any user calendars. In particular, no meetings scheduled with the group as an attendee are changed or deleted. Since deleted group IDs remain in scheduled items, system administrators must exercise good judgment in reusing the ID of a deleted group. If a deleted group ID is reused for a group with different membership, the extant appearances of the ID in user calendars will be misleading in terms of the users for whom the meeting was originally scheduled.

The Calendar Tool provides no commands for a user to request addition to or removal from a group. Such requests must be made to an administrative user by some means outside of the Calendar Tool, such as electronic mail. The user can view a list of all administrators using the '`List Admins`' command. The email address for an administrator is available in the administrator's user database record.

2.6.4. Location Database

The location database contains information records for rooms and other locations in which meetings can be scheduled. To access the location database, the administrator selects the '`Locations ...`' command in the privileged '`Admin`' menu. In response, the system displays the dialog in Figure 138. This dialog has a very similar format to the user and group database dialogs. Here, locations are listed by name and number. The default sorting order is by name, which can be changed to number by clicking on the '`Number`' column heading. Since names need not be unique, secondary order is by number when name is the primary sort key. The '`Search by`' field operates in the same manner as in the user and group database dialogs.

To add a new location, the administrator presses '`Add ...`', whereupon the system displays the dialog of Figure 139. The '`Name`' field is a free-form text string. '`Number`' is the unique location identifier, typically in the form of a room number, but not restricted to any specific format. The scrollable '`Bookings`' field contains a list of time slots during which the room is booked for meetings or other activities. The entries in the '`Bookings`' list are of two forms:

a. the title of a scheduled meeting

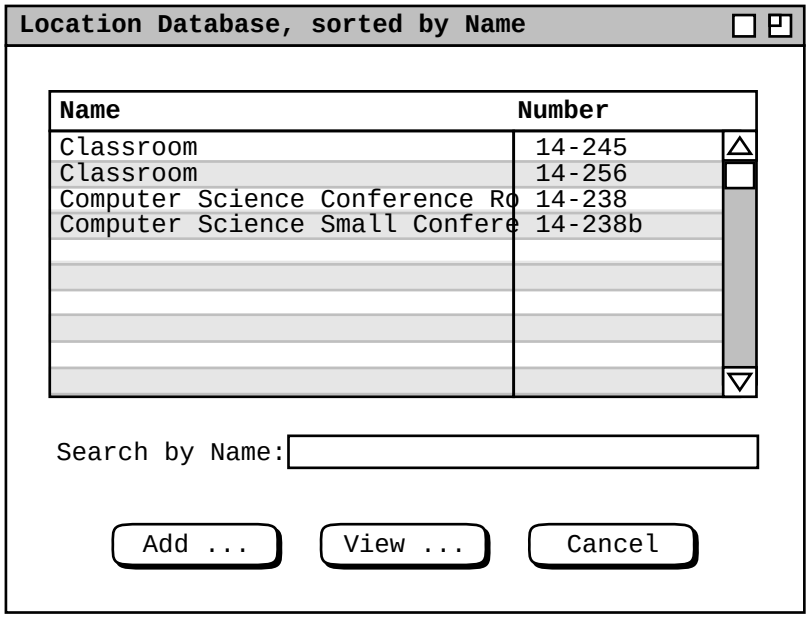


Figure 138: Location database dialog.

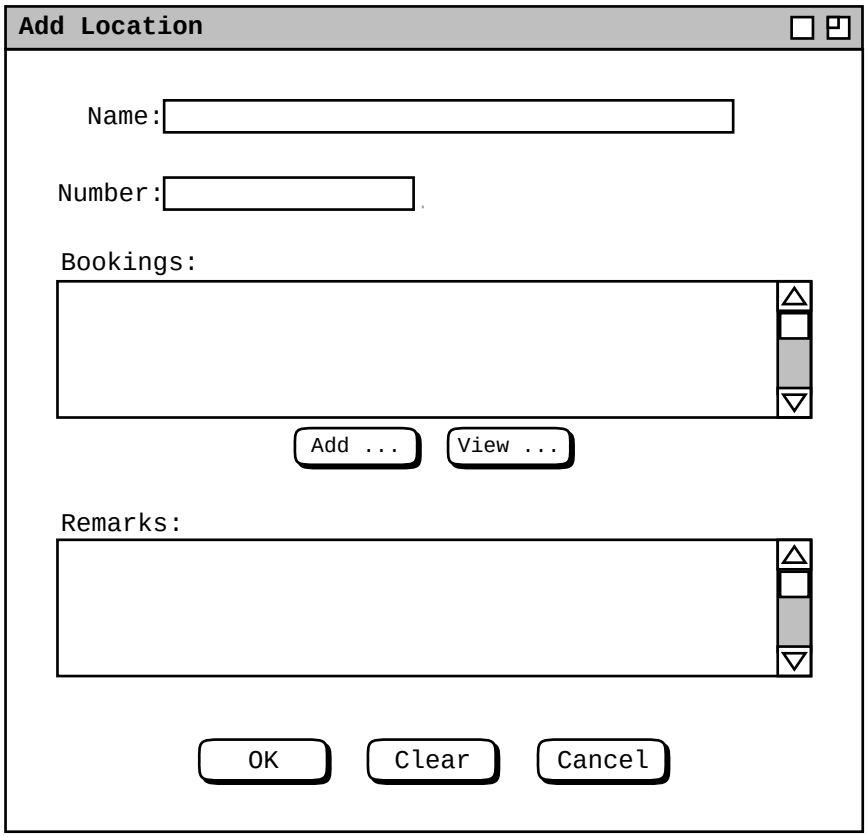


Figure 139: Add location dialog.

b. the description of some other usage

The meeting titles are for meetings scheduled using the Calendar Tool, as described in Section 2.4.1. The other usage descriptions are added by the administrator for times during which the location is known to be in use, meaning that meetings cannot be scheduled at those times. Immediately below the bookings list are command buttons to add and view bookings. The '`Remarks`' field contains optional explanatory information about the location, such as equipment or facilities it contains.

Figure 140 shows the administrator having entered values for a new location record. The '`Name`', '`Number`', and '`Remarks`' values are entered by normal typing. To add a booking, the administrator presses the '`Add ...`' button below the bookings list, in response to which the system displays the dialog of Figure 141. The '`Use`' field describes the use for which the location is booked. The '`Use`' string must be unique among all bookings for the same location. The '`Start Time`' and '`Duration`' specify the time slot of the booking. The '`Start Date`' and '`End Date`' specify the date range. The dates may be empty, which means that the location is booked indefinitely for the specified use. If the '`Start Date`' is specified but the '`End Date`' is empty, the start date is taken as a single date. The time and date values must follow the normal data entry rules described in Section 2.11. Pressing '`OK`' adds the booking to the '`Bookings`' list, if it does not conflict with any existing booking. The '`Clear`' and '`Cancel`' commands have the standard functionality.

Figure 142 is an example of a location booking. In this example, the booking is the first to be added, so no conflict exists. If the administrator attempts to add a booking that conflicts with an existing booking, either meeting or other usage, the system issues an appropriate error message as described in Section 2.12.6. A booking conflict arises when the time and date range of any existing booking overlaps with any part of the time and date range for a new booking to be added.

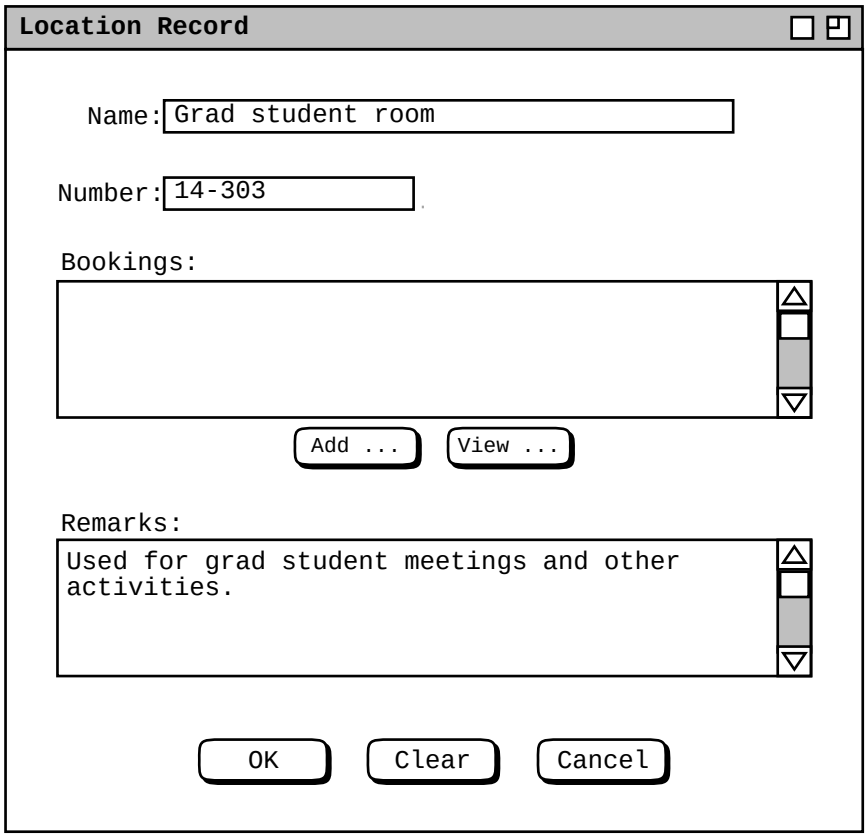


Figure 140: Location database record.

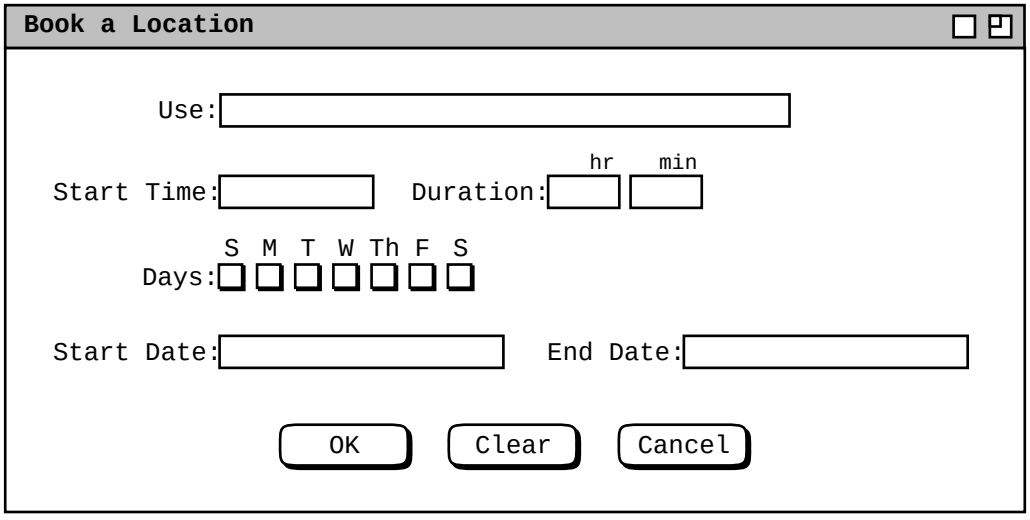


Figure 141: Book location dialog.

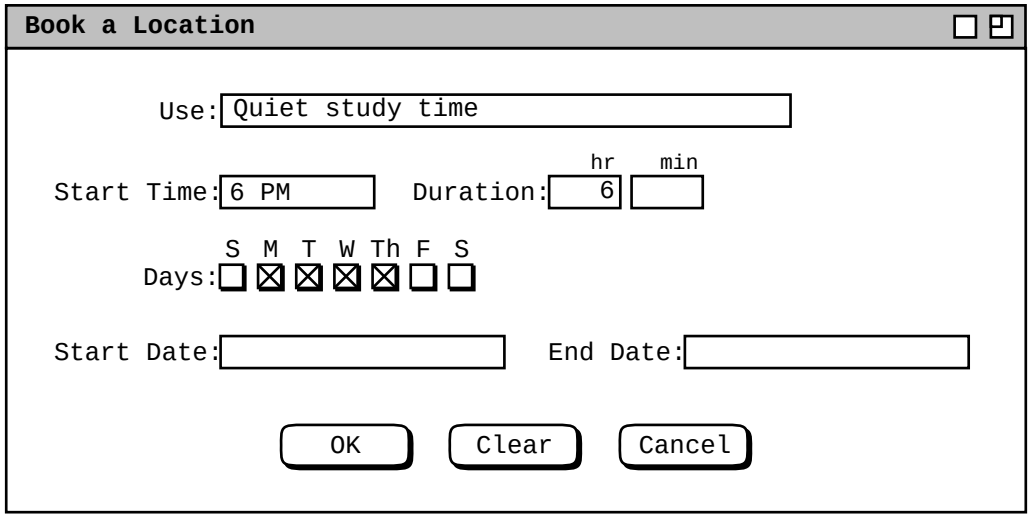


Figure 142: A location booking for the Grad Student Room.

To view an existing location record in the database, the administrator selects a location name or number in Figure 138 and presses '`View ...`'. For example, Figure 143 shows the result of the administrator viewing the second listed location in Figure 138. The location record dialog has exactly the same data fields as the add-location dialog shown in Figures 139 and 140. In place of the '`OK`' button there are '`Change`' and '`Delete`' buttons. The sorting order for the '`Bookings`' list is alphabetic, case-insensitive. If a meeting title and other-usage booking are the same string, the meeting title appears first in the list.

The '`Add ...`' booking command is described above. To view an existing booking, the administrator selects the booking description in the list and presses the '`View ...`' button immediately below the list. When the selected booking is for a meeting, the system displays an item-level view for the version of the meeting on the scheduler's calendar. If it is a recurring meeting, the displayed instance is for the start date. When the viewed booking is for a non-meeting usage, the system displays a booking dialog. For example, Figure 144 shows the result of '`View ...`' for the second booking listed in Figure 143; Figure 144 shows the result of '`View ...`' for the third listed booking. Since an outside-usage booking is for a contiguous time period, it takes multiple bookings to define discontinuous usages. For example, the '`Morning Classes`' booking in Figure 143 covers the 8 AM to 1 PM time slot. The '`Afternoon Classes`' booking covers 2 PM to 6 PM. These two definitions allow meetings to be scheduled between 1 and 2 PM.

The adminstrator can change or delete a booking using the command buttons at the bottom of the booking dialog. To change, the administrator edits one or more data fields and presses '`Change`'. To delete, the administrator presses '`Delete`'. '`Clear`' removes any edits made after initial dialog display. '`Cancel`' removes the dialog with no change or deletion made.

An other-usage booking is not a scheduled item, so it does not appear on any calendar. The effect that a booking has on scheduling is to prohibit a meeting from being scheduled in the location during any of the booked times and dates. An other-usage booking expires after its end date or single start date, if present. The system does not automatically delete expired bookings, but an expired booking no longer affects meeting scheduling. Deletion of expired bookings is the responsibility of system administrators.

2.6.5. Other Admin Commands

Describe that the Central Host command allows the admin user to set unique identification for the Calendar Tool central host computer. Describe functions of central host, viz,

a. facilitates communication among computers of Calendar Tool users

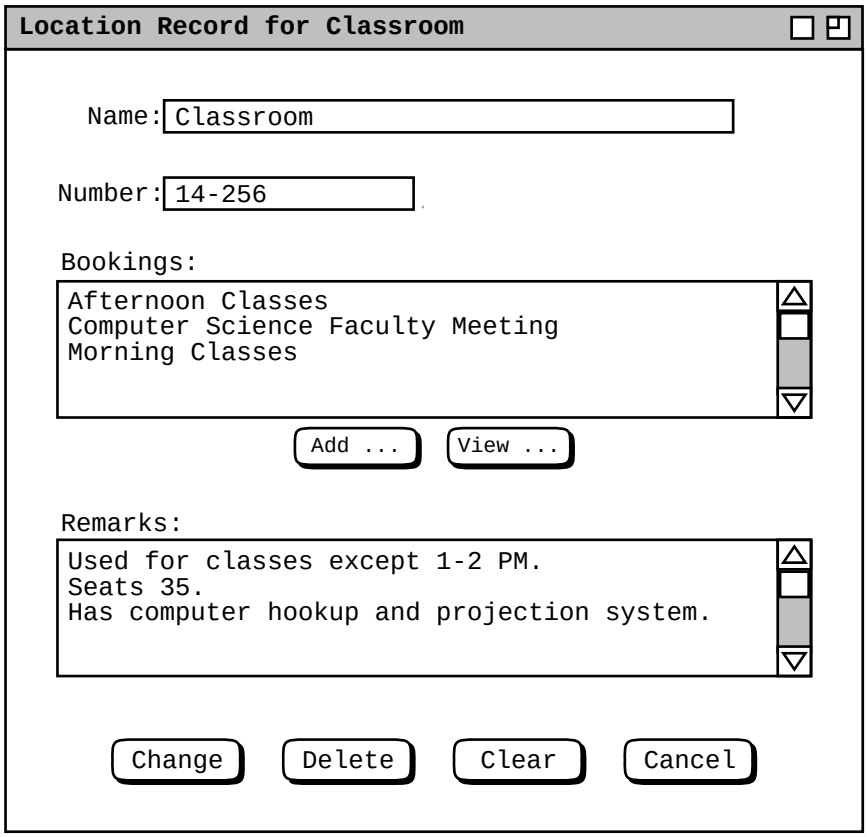


Figure 143: Viewing a location record.

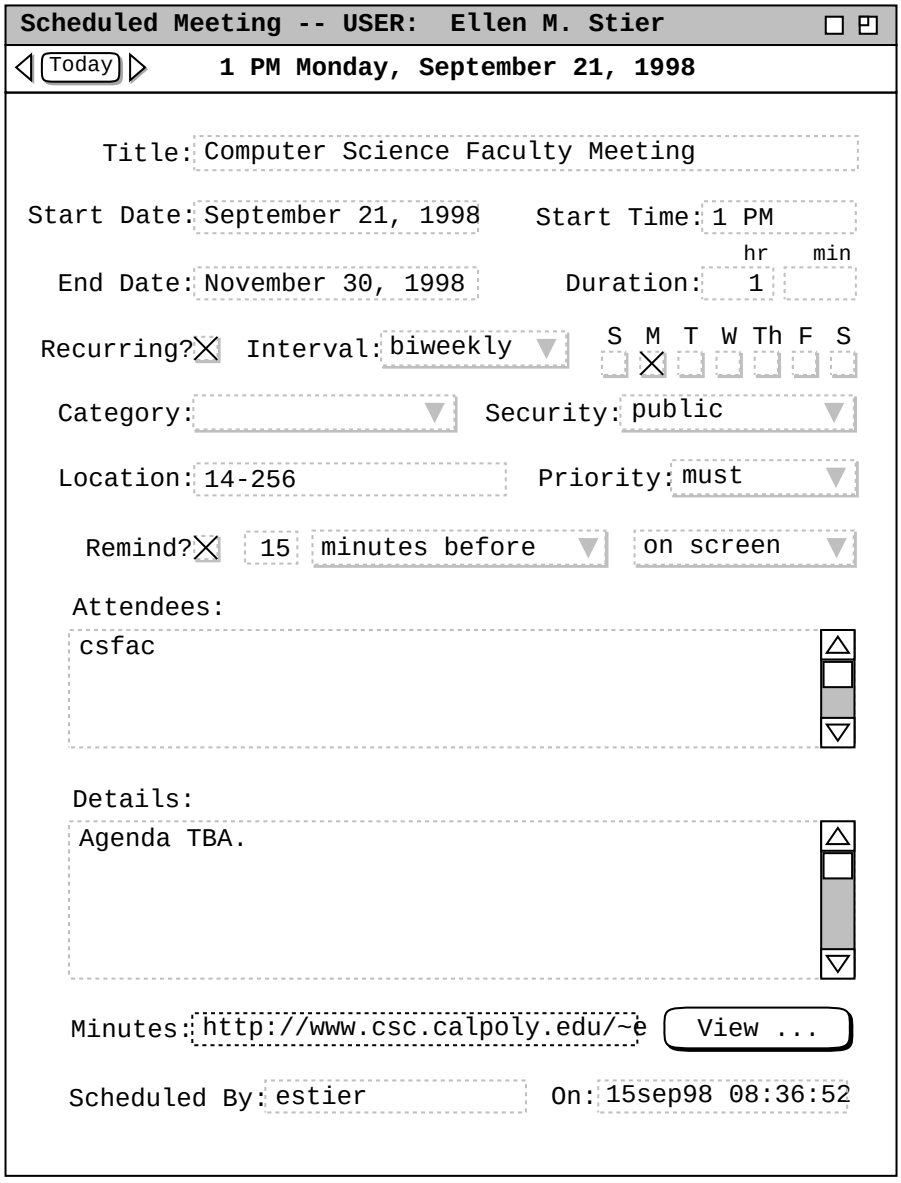


Figure 144: Viewing a meeting from the location record dialog.

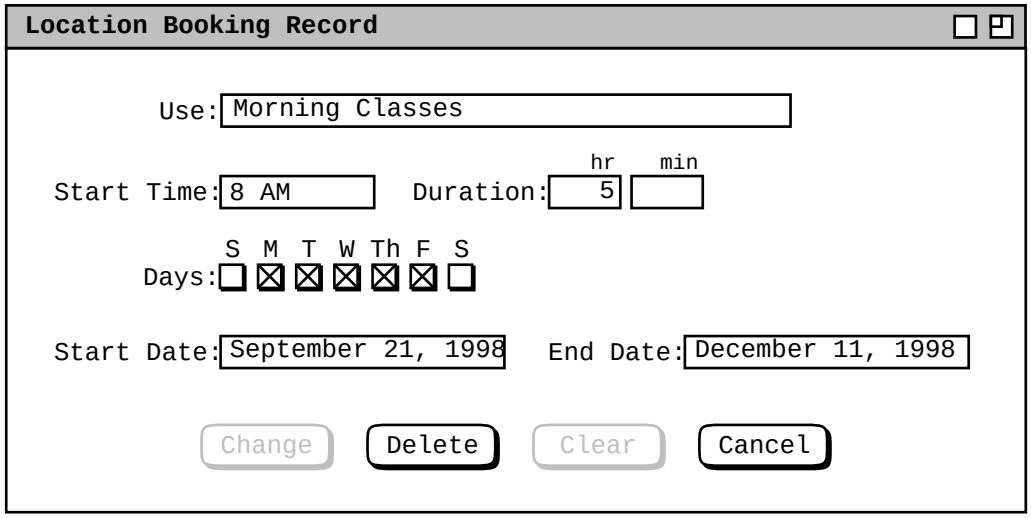


Figure 145: Viewing an other-usage booking from the location record dialog.

b. stores calendar information and notifications when necessary (i.e., when user computers are not operating or accessible in the network)

Describe that '`List Admins`' shows who all the admins are, Figure 146.

Describe that '`Password`' lets the admin change her password or the password of any other system administrator. Clearly, administrators should use good judgment when changing passwords, particularly for other administrators.

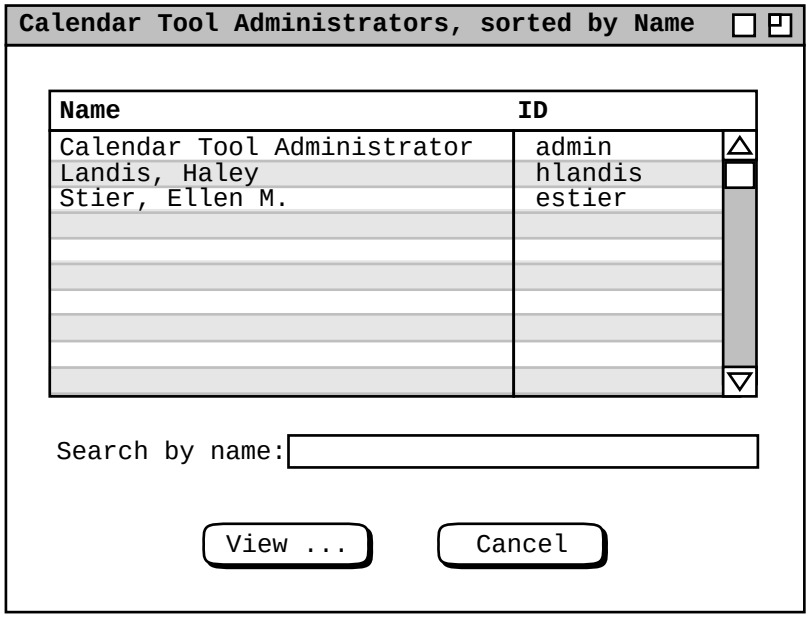


Figure 146: List of Calendar Tool administrators.

2.6.6. Regular User Access to Admin Commands

2.6.6.1. Summary of Super User Privileges

a. *Maybe on this one.* Can cancel any leader-scheduled meeting. We need to clarify that the super user can see only the meeting in the group calendar, not in any individual user's calendar.
b. Can delete items from group calendars.
c. Can delete any user. The user's calendar wont be affected, but the user will no longer participate the way a registered user does.
d. Can*not* see any more of any user calendar than any other user can; cannot change or delete anything from any user's calendar.
e. Can cap the number of items that appear in the central Cal Tool repository for any particular user or group.

2.7. Individual User Options

4jan01 thot about 14dec00 thot: Hmm, with movement of prefs to options menu, I'm not sure about the tabbing dialog any more. We may want to put a prefs menu back, with 'Edit Prefs' being tool prefs versus the top-level 'Options' menu being data prefs. I'm not sure the distinction is worth making, so I guess we have to think about this some more.

14dec00 thot (and I think it's quite a good one): organize preferences into a tabbing dialog with exactly one tab for each menu.

Among the other options, there should be some for little things. Here's the beginnings of a list:

- (yes/no) remind on File Save As -- turn on/off the reminder about only the default calendar name being used for group scheduling purpose.

2.7.1. Times and Dates

- day time granularity
- displayed times of the day
- displayed days of the week

Be sure to say that none of the settings of these options will ever leave anything out. I.e., the breadth of a display, hour and daywise is maximum of the normal range setting and the range determined by actually scheduled items.

2.7.2. Scheduling Options

Potpourri:

- default amount of reminder redisplay time.

2.7.2.1. Accepting Meeting Notifications

Provide a dialog that looks like this:

```
OUT:

    Accept Calendar Tool Meeting Notifications from the leaders of these groups:
        * all
        * specific group list, with a radio button beside each, scrollable in
          case there are a large number of groups defined
        * none
:TUO (see "NO" paragraph below)

    Accept Email Meeting Notifications from the leaders of these groups:
        * all
```

```
    * specific group list, with a radio button beside each, scrollable in
      case there are a large number of groups defined
    * none

Accept Email Meeting Meeting Notificaions from new groups you're added to:
    * yes
    * no

Accept Meeting Notifications from these individuals:
    * all
    * specific user list
    * none
```

The idea is that each user can control who she accepts being bugged by for meeting scheduling. But hmm, am having a bit of second thoughts about being able to reject requests from group leaders, since it doesn't make necessarilyt good sense; it may well be better just to have a user request to be removed from the group. I do still however very much the ability to be able to accept meeting requirest from indifiduals, as the next paragraph attests.

But OK, here's a case where rejecting requests from some group leaders makes perfectly good sense -- I'm going on vacation and I dont want my calendar and possibly email cluttered up with meeting requests.

So, here's a nice happy medium -- the leader of a group for whom meeting requiests are turned off is notifed when the turn off happens. This may be getting overly complicated, but hey, so are a number of things.

NO, screw the happy medium -- users CANNOT decline meeting notification from the leaders of groups they're members of, only email notifications. If they're gonna participate in the Cal Tool community, they're on the hook for receiving meeting notifications.

NO, NO, users can turn off notifications, as imprudent as it may be. See latest version of meeting scheduling section.

The ability to accept meeting request from individuals effectively allow Cal Sys users the ability to establish unoffical groups, by establishing mutual acceptance of meeting requests.

Some question/details pursuant to the above dialog idea:

a. *Should a user be able to acccept meeting requests from the leader of a group she's not a member of? Well, this doesn't really make much sense, because if she's not a member, then she won't normally be sent a meeting requesnt for that group, so it looks like the answer is "no". This means that a user is only asked to accept*
b. *The radio-buttoned of groups list should probably be in tree form, since it will allow the user to select subgroups by clicking on a parent group.*
c. *... probably more to say here.*

2.7.3. Viewing Options

2.7.3.1. Initial View Level

To be consistent with the way things are explained in specific-date-viewing, the default level cannot be at the item level. Nor do I think it makes particuarly good sense to have it be some list. Therefore, the default initial view level is one of four day through year levels, and perhaps a "no window" option. Remember also the bit about the initialization file and how it deals with the default view level always happening, including how a "no window" option value affects things initialization-filewise.

2.7.3.2. List Length

The length of each of the four categories of list is controlled by the dialog shown in figure 147. The dialog controls allow the user to specify the number of items before and after a specified date. For example, the dialog settings shown in Figure 147 show the user having specified the following format for the display of item lists:

- the appointments list is 100 elements long, starting with today's date
- the meetings list is 75 elements long, starting at seven days before today
- the length of the task list is unlimited, i.e., all tasks currently scheduled in the calendar are displayed in the task list
- the length of the events list is 25 elements long, starting with today's date

Hmm ... now that I'm doing this, I'm thinking that maybe we should just make this part of the regular filtering section, so that we maintain orthogonality. We need to think about this. An immediate question in this regard is do we really need to provide both a list-length feature as well as start/end date means to specify the number of items in a list. Curiously, this is pretty much the same concept as specifying start/end versus start/duration item lengths.

2.7.3.3. Other Lists Options

2.7.3.3.1. Expand Recurring

2.7.3.4. External WWW Browser

2.7.4. Administrative Options

[NOTE: This category of options is not in the current menu. Deal with this discrepancy accordingly.]

Possibles:

- notifiy/don't notify when added to a group
- how/if to be notified of various things (options are zero or more of: (1) email (2) on-screen at start up (3) on-screen any time (4) on-screen at exit):
  - *o* meeting being scheduled
  - *o* becoming a member of a group
  - *o* if group leader, attendee deleting a meeting

I dont think we should include a default for item reminders here, since this default will go with the other item field defaults.

2.7.4.1. The Text Body of Meeting Announcements

2.7.5. Advanced Options

[NOTE: This category of options is not in the current menu. Deal with this discrepancy accordingly.]

A useful but low priority option would be to find all events that have reminders turned on. This would be useful to me because I may have accidently turned on a reminder when I didn't want to, or forgot to turn on a reminder for something I should have. Anyway, this is a low priority requirement.

2.8. Details of File Commands

2.8.1. Invoking the Calendar Tool from the Underlying Operating Environment

Points to include:

- Init file only invoked one time at start-up, not at each file open
- Prev rule means no init file happens when other user's calendars are open.

2.8.2. New, Open, and Close

Zero or more calendar files may be open at any time. The name of the currently active file is listed in the banner of the command menubar. When no calendar file is open, the file name in the banner is listed as "`none`."

When exactly one calendar file is open, its name is listed only in the banner of the command menubar, not in any other display window. When two or more calendar files are open, the banner of every display window is augmented with the name of the file on which the displayed data are or will be stored.

The effect of multiple files on the windowing modes is as follows. Every window says what file it's associated with. The current file is defined as the file associated with the current window. Whenever a different window becomes active, the current file is changed to the file of that window. The banner of the menubar is changed as necessary dynamically. The default per-level windowing mode applies separately to each

22aug01 Note: The problem with every window having the file ID in the banner is that with the newish listing and filtering banner paraphenalia, the banners may get too crowded. So, oet's leave the filename out of the individual window banners and have it just be in the menubar banner, updating as noted in the preceding paragraph.

Note that File Close and Window Close are different commands. The former closes a fill and all windows containing views of that file's data. The latter closes only the current window and does not close any file.

2.8.3. Save, Save As, Save All

Note that '`Save`' and '`Save As`' are disabled when the current window display data from another user's or group calendar.

2.8.4. Save Config

It's more than just the window config since it includes what files are open. I think the easiest way to define exactly what save config does is as a script file. This way we can deal with the tricky issue of having the dispaly look the same, but having the displayed content all be relative to today's date. If for some reason the user would like to have a config that is absolute datewise, of relative some other date than today, then she can tweak the generated script from '`Save Config`', or of course write her own start-up script from scratch.

An issue we need to deal with is the relationship between the option setting of what we call "the standard default view" in the ui-overview. Here's what I think could work well: There is an option called `default-initi-view-level` that specifies the default viewing level from item to year. The value of this option cannot be empty. If there is no init file in the user's home dir (per OS-specific definition of "home dir"), then the Cal Tool comes up a la described in the initial screen config in the ui-overview. Viz., there's a menubar and one view window at the level specified by the setting of `default-init-view-level`, open on today's date. If there is an init file or the tool is invoked with an start-up file in the command line or from a start-up file icon, then we could do one of two things:

a. The system displays *no* windows automatically, thus ignoring entirely the setting of `default-init-view-level`; this means that the mere existence of an init file means there's no default display, and I don't think I like this; so let's try thing b ...

b. The system proceeds to put up the initial window per `default-init-view-level`, and then goes about executing the init file. If the user really wants to get rid of the default initial window, she puts this code at the beginning of the init file, which code closes the initial window:

```
ViewWindows(1);
FileClose();
```

This works because of the rule that says the default window is put up before the init file is run, which means therefore that it's window 1 in the windows list, hence the arg of 1 to `ViewWindows` (assuming lists start from 1 like humans think, not from 0 like geeks think). But given this, here's an even simpler bit of code to do the same thing:

```
FileCloseAll();
```

which works for hopefully obvious reasons.

This all seems pretty darn clean. To be consistent, it seems with this scheme that the first like of the init file saved with '`Save Config`' will in fact be the preceding chunk of code to close the default window, so that the config file starts with a blank slate.

2.8.5. Printing

Sketch of some ideas: The print dialog should include at least the following options:

- *start date*
- *end date*
- *apply active filter?*

I really want to keep things simple here. I just had a look at all of the features in Claris, particularly for the "book" option, including editing its format. I think this will be an excellent place to draw the line and say that fancy printing will be part of future work.

So, here's the deal with printing. We'll keep it brutally simple by printing out in the plain text form of the current example-items file. In fact, we can use this file pretty much as is, except for the parenthetical remarks about edits made. We'll also need to add some kind of indication of individual instance changes to recurring items, which will be done in the same brutally simple form.

2.9. Details of Edit Commands

Organizationally, this section will probably need to be broken up into several files.

2.9.1. Undo, Redo, Repeat

2.9.2. Cut, Copy, Paste

2.9.3. Find

[Sketch: Among the more important items to define clerly in this section are the details of how Edit.Find works. We should check out the details of how it works in other systems.]

2.9.4. Text Command Interface

2.10. Help

2.11. Data Entry Details

This section covers all data-entry and command usage details that may not have been fully elucidated in the preceding scenarios.

2.11.1. Date Formats

Include min/max values for year, which within reason are 0 and 3000.

2.11.2. Item Uniqueness Requirements

For appts and meetings, go get it from whereever. I think we need to do a refinement of what we have so far, in that we have to unbundle recurring instances in order to make the check, or at least "conceptually" unbundle them. There's a modelling issue lurking here, viz., whether to model recurring items as physically as single or multiple items. If we go with the single-item model, the logic like the last clause of the ScheduleAppt precond, q.v., needs to

to be updated to deal properly with recurring items by somehow conceptually "generating" instances of recurring appts.

For events, I think it's gotta be name only, or name plus non-overlapping date. The deal is we need to be able to distinguish between a 3-day event versus 3 separate 1-day events, at least to some extent. It seems if we allow non-unique event names, then there's no way to distinguish multi-day from multiple consecutive 1-day events. I guess the same exact thing goes for an appointment.

A subtlety here is that changing the instance date of a single recurrig item to the same date as another instance violates the uniqeness rule. It's nice that the uniqueness rule covers this case in a general way, but I think it is worth mentioning. Way better redundant than sorry.

2.11.3. Scheduling Dialogs and Item-Level Displays

Ed. Note: I think it would be quite good to summarize these requirements in tabular form, with one table for each class of dialog, with one table row for each data-entry field in the dialog.

The following data entry formats apply to any scheduling dialog or item-level display where the indicated field appears:

a. The `Title` and `Location` fields are free-form, one-line strings. If the text is longer than will fit in the provided data-entry area, then it will automatically scroll as the user types and can be repositioned using the normal text movement arrow keys or such other forms of horizontal scrolling as may be available on a particular implementation platform.

b. The value of the `Location` field can be selected from the pulldown list of available locations, as shown in Figure 147.

c. The `(Start) Date` and `End Date` are type-in fields, with checking for legal date syntax. The following are legal forms of date entry: ...

2.11.3.1. Meeting Scheduling Dialogs

Ref to two appropriate figures for meeting request and confirmation dialogs.

The precise data-entry rules for the fields that appear in both the scheduling request and confirmation dialogs are as follows:

- `Title` can be entered in either the request or confirmation dialog; it must be entered before confirmation.
- `Duration` must be entered in the request dialog, where the system-supplied default is 1 hour; it cannot be edited in the confirmation dialog.
- `Recurring` is optional in the request dialog, where the system-supplied default is non-recurring; it cannot be edited in the confirmation dialog.
- `Category` can be entered in either the request or confirmation dialog; the default is no category.
- `Security` can be entered in either the request or confirmation dialog; the default is public.
- `Location` can be entered in the request dialog; the default is empty, which is an allowable value. Location may be edited in the confirmation dialog; if edited there, the system validates that the newly entered location is available at the meeting date. If it is not available, the system signals the condition with an error dialog as discussed in Section 2.12. If the location of the confirmed meeting is empty, it is the presumed responsibility of the scheduler to inform attendees of the meeting location via some means external to the Calendar Tool system.

Figure 147: List of available locations.

- `Remind` is optional in the request dialog, where the system-supplied setting is not to remind. It can be edited in the confirmation dialog and is optional there as well.
- `Attendees` must be entered in the request dialog and cannot be edited in the confirmation dialog.
- `Details` can be entered in either the request or confirmation dialog; it is optional in both. There is no system-supplied default.
- `Minutes` can be entered in either the request or confirmation dialog; it is optional in both. There is no system-supplied default.

The precise data-entry rules for fields that appear only in the scheduling request dialog are as follows:

- `Earliest Possible Date` must be entered; the system-supplied default is today's date.
- `Latest Possible Date` must be entered; the system-supplied default is two weeks from today's date
- `Earliest Start Time` must be entered; the system-supplied default is the value of the normal beginning-of-day time, the default for which is 8 AM.
- `Latest Start Time` must be entered; the system-supplied default is the value of the normal end-of-day time, the default for which is 5 PM, minus the default value for the duration, which is 1 hour; this means the default latest start time is 4 PM.
- `Earliest End Date` must be entered for a recurring meeting; there is no system-supplied default.
- `Latest End Date` must be entered for a recurring meeting; there is no system-supplied default.

The precise data-entry rules for fields that appear only in the confirmation dialog are as follows:

- `Start Date` and `Start Time` can edited only to one of the value pairs that appears in the possibles list.
- `End Date` can edited only to an earlier date that is not before the start date.
- `Scheduled By` cannot be edited.

2.11.3.2. Defaults

If the user specifies a recurring event without checking any box in the additional recurring information, the event will be set by default to recur weekly, on the day of the week that is specified for the start date of the event. *[Sketch: some other defaults are made clear by default display of selection box.]*

Also explain what the standard defaults are for the settings of all dialog fields and note that these default settings can be changed in the by editing preferences.

2.11.4. Required Fields

The discussion in the next paragraph needs to be more precise in specifying for which types of item which fields are required. In working on the custom lists section, I've been thinking about adding a table that there with an added third column indicating if the field value is required or optional. If this table is added here, it should probably be ref'd from the custom lists section instead of appearing directly there. The only question is that this complete table (with all three columns) is more that is need either in the custom lists section or here, but seems like a good thing that should appear somewhere. Perhaps it belongs in another place. Anyway, we'll figure it out eventually, if we live that long.

When scheduling or changing an item, the following fields are required to be non-empty and properly formated: Title, (Start) Date, Start Time, and Duration. If one or more of these fields is missing when the user presses the '`OK`' or '`Change`' button, the system responds with the error dialog shown in Figure 148.

-- To appear. --

Figure 148: Required fields error dialog.

2.11.5. Selecting Viewing Targets

20aug01 note: need to update this section to include target selection in list displays as well as calendar displays.

The first five commands in the '`View`' menu apply to a user-selected target in the calendar display, or to a default target. To select a viewing target, the user clicks on a desired location somewhere in the current display window. The "current display window" is defined precisely as the display window most recently generated by the system or the window most recently made current by the user having clicked on it or selecting it in the '`View Windows`' menu. The following are the specific details for how a viewing target is selected in the current display window:

For the '`View Item`' command, an item is selected as follows:

a. In a day, week, or month view, the user selects a scheduled item by clicking anywhere on the time range or title of the item.
b. An item cannot be selected in a year view, since no times or titles are displayed there.
c. If no item is explicitly selected by the user, the default is the first item, if any, scheduled on today's date. If there is no such item, then the '`View Item`' command has no effect. (The exact system response to commands with no effect is described in Section 2.12.2 on error conditions.)

For the '`View Day`' command, a day is selected as follows:

a. In a table- or list-style week view, the user selects a day by clicking on any of the day names that label the table columns, or on any item in a desired day.
b. In a list-style week view, a month view, or a year view, the user selects a day by clicking on the numeric date of any day, or on any item in a desired day.
c. If the current display window is a day view, the '`View Day`' command has no effect.
d. If no day is explicitly selected by the user, the default is today's date.

For the '`View Week`' command, a week is selected as follows:

a. In a day view, the selected week is the one that contains the currently displayed day.
b. In a month or year view, the user selects a week by clicking on the numeric date of any day within the desired week, or on any item in a day within the desired week.
c. If the current display window is a table-style week view, the '`View Week Table`' command has no effect; if the current display window is a list-style week view, the '`View Week Lists`' command has no effect.
d. If no week is explicitly selected by the user, the default is the week containing today's date.

For the '`View Month`' command, a month is selected as follows:

a. In a day or week view, the selected month is the one that contains the currently displayed day or week.
b. In a year view, the user selects a month by clicking on the name of any month or on the date of any day within the month.
c. If the current display window is a month view, the '`View Month`' command has no effect.
d. If no month is explicitly selected by the user, the default is the month containing today's date.

For the '`View Year`' command, a year is selected as follows:

a. In a day, week, or month view, the selected year is the one that contains the currently displayed day, week, or month.
b. If the current display window is a year view, the '`View Year`' command has no effect.
c. If no year is explicitly selected by the user, the default is the year containing today's date.

In all of the cases where a name or numeric date is selected, the system confirms the selection by highlighting the name or date in reverse video. For example, Figure 149 shows how the system highlights the date of September 1 when the user clicks on that date number in the monthly display. When a view command is completed by the display of the appropriate window, the highlighted selection is changed back to normal type font.

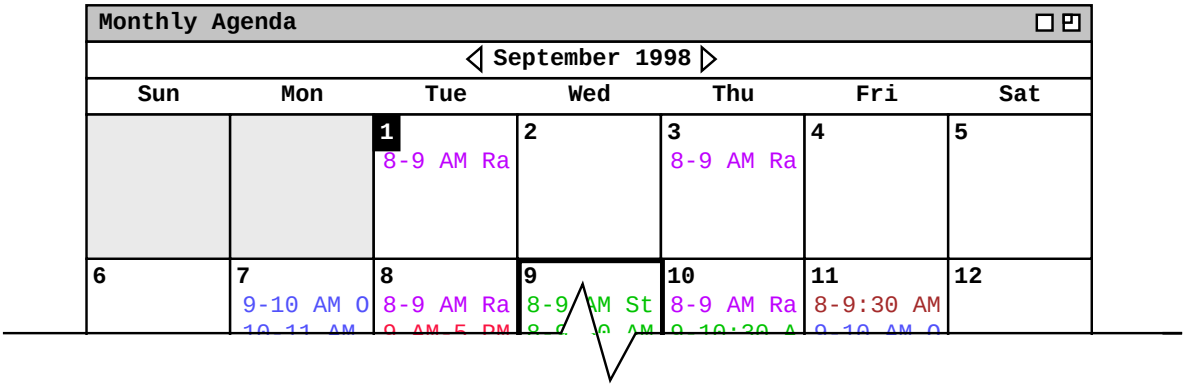


Figure 149: Reverse video selection highlighting.

2.11.6. Deletion of Scheduled Items

2.11.7. Overlapping Items

The system provides a three-way option to control the scheduling of items with overlapping times. The option settings are the following:

a. disallow overlapping times entirely
b. allow overlapping times, with warning
c. allow overlapping times, no warning

When the first of these settings is selected, the system prevents the user from scheduling two or more items with any time overlap. With the second setting, the system allows overlapping items but warns when overlapping items are scheduled. When the third option is selected, overlapping items are allowed to be scheduled without warning.

2.11.8. Category Editing Details Explain/illustrate the Delete and Change category commands in the edit-categories dialog of Figure 9.

Explain what happens when a user selects the '`Edit ...`' *item in the* '`Add Category`' *dialog. Here's a sketch:*

a. A typical dialog naming/add/delete dialog comes up.
b. There's also some form of generic color chooser, e.g., RGB.
c. Deletion is prohibited if there exists any scheduled item with a category that is colored with the color to be deleted.

2.11.9. String and Pattern Matching Rules

Dont forget to explain emacs-style reg expr search for the name lists that appear in the admin dialogs.

2.11.10. Regular Expression Filtering Patterns

2.11.11. Boolean Expression Filtering Patterns

2.11.12. System-Defined Events

While the soltice and time-change events may not strictly be considered "holidays", they are none-the-less included in the ‘`holiday`’ category.

2.11.13. Dialog State Details

This is the section where we define all of the horendously boring details of what intial and historical states the various dialogs assume. Hopefully we can batch bunches of them together under a single heading. Anyway, I think it's pretty clear that such details are necessary, and I think this is the best place to put them. The motivation for this section having come into existence was slogging through the details of the custom list dialog states, and thinking how boring it was to have all of those details piled up there.

2.11.13.1. Custom List Dialog

Dialog state rules:

a. List Name text box: Initially, contains highlighted text "New List". There after, dialog remembers whatever name that was in the text box when the dialog window was most recently closed; in the case when the last defined list is deleted, the dialog reverts to the intial "New List" state.

b. Field check boxes: per Table 5

c. Start and end dates: initially the default, thereafter most-recently entered

d. Command buttons:

`Add` enabled when any currently undefined list name appears in the list-name text box, including the system-supplied "New List" and an empty value.

i. `Change`, `Delete`, and `Apply` enabled when any currently defined list name appears in list-name text box; `Apply` is also enabled when the user has done some editing to a not-yet-defined list that is yet to be confirmed with `Add`.

The following is a way-too-complex version of things, which might be useful at some point as a class/book example, but maybe is best just nuked.

Dialog state is simply that the

- Intially, ‘`List Name`’ field contains "New List", highlighted.
- When `Add` is the most recently invoked dialog command, the most recently added list name appears in the `List Name` box, unhighlighted.
- When `Change` is the most recently invoked dialog command, the most recently changed list name appears in the `List Name` box, unhighlighted.
- When `Apply` is the most recently invoked dialog command, the most recently applied list name appears in the `List Name` box, unhighlighted.
- When `Delete` is the most recently invoked dialog command, the most recently added, changed or list name appears in the `List Name` box, unhighlighted.
- When `Cancel` is the most recently invoked dialog command of the first four, the most recently added list name appears in the `List Name` box, unhighlighted.
- *Aborted here when noticed that things were getting way too complex.*

2.11.14. Combo-box menu text truncation and other behaviours

A long text string is scrollable in the text box and truncated in the menu, based on how wide the menu otherwise is in the dialog.

This is originally from Section 2.3.3.6. and needs to be generalized here for all combo boxes:

> *When ‘`specific date`’ is initially selected, the system clears the text box and the user types a specific date value into the text field. When ‘`specific date`’ is subsequently selected, the system restores and*

highlights the most recently typed value. If any of the other menu entries is selected, typing is disabled in the text field.

2.11.15. Default Names

Sketch: Form of default names is "New XXX", where XXX is the subject, e.g., "List", "Filter". Initially, we were going to say that "New XXX" form cannot be used to save a filter, but is only displayed as the high-lighted name when the user selects the 'New' item in some name menu. Howerver, instead of this, I think we should say the following. "New XXX" is the initial default name. If the user uses it, so be it, becauuse "New XXX" will not appear again if and until all extant filters are deleted. Sweet.

2.11.16. Name Completion

2.11.17. Meeting Minutes

2.11.18. Merging Scheduler Changes

Need to define precisely what "change" and "most recent" mean in terms of data field editing. It seems like we'll need to model this using time stamps for each meeting field. Here's an interesting scenario that we need to make sure is well understood and covered by our rules:

a. scheduler schedules
b. user changes non-critical field F
c. scheduler changes F, elects not to notify
d. scheduler changes some critical field, therefore notifies

Question: does scheduler change to F show up in notification? I believe the answer has to be yes, and I think this answer is readily discernable from the rule, though the formal spec will help out, since it will specifiy things in terms of differences with scheduler and user copies, not in terms of how many executions of Change may have taken place, thereby ignoring the fact that the scheduler changed something once with out notification and then subsequently notified. Anyway, what I'm envisioning for the formal model is that it does things in terms of diffs at the time the confirmation takes place, independent of the ups and downs of intermediate changes that may have happened. I.e., we're acting like CVS acts when it computes the 'M' flag. Viz., it does it on diffs at the time, not file date stamps.

2.11.19. Change and Delete of Recurring Items

Explain fully that the changes that go into all other instances are the current (visble) values in the instance being used to effect the change, even if those values were the result of a previous individual change. For example, a user may confirm several changes to a single recurrint instance, then selected 'all instances' and

THE FOLLOWING IS NOW DONE IN THE RECURRING-DETAILS SECTION:

Explain how chaning start date, end date, or recurring information is an effective delete, *including how if such a change is made through an instance that is effectively deleted, that instance dislay is removed from the screen.*

2.11.20. Picky Details about Change/Delete Button Enabling

Things work like Emacs, not as hairy-assed as they could by coninuous diffing. Viz., as sonn as an edit is made, '`Change`' gets enabled and '`Delete`' disabled. If the edit is reversed by further editing, the system does not notice that there are effectively no changes, and hence leaves the buttons in the changes-made state. If the user proceeds with a confirmed change at this point, the system goes throught the motions, but the change has no effect on the data. This just like adding a char, deleteing it, then saving in Emacs -- the same data get saved back on the file.

I believe what this means from the formal perspective is that we dont want the precond on channge that says the two args must be different. If we do have this, then we either need to enforce it with diff-style change button enable/disable, or issue an error/warning when the change is confirmed. The latter seems pretty useless, given this seems to be

a "no harm done" case if we let the nugatory change just happen.

2.12. Error Conditions

Just recently, I've thought about the following distinction between an error condition versus non-error, particularly in the context of scheduling (and which is also applicable to searching probably):

> *"It's an error if it's a precond violation."*

Ah, but now that I've written it down, it's exactly right and what we've always been saying. This means that it's not an error for the scheduling op not to find any available times, nor similarly for a search to find applicable search targets. This in turn is (further) justification for searching and scheduling not to be formally spec'd with non-success as preconds (which I think we already pretty much know). From the requirements perspective, specifically with regard to the guideline that we leave error conditions to later, it's consistent with this guideline to include the "No times found" message" in the scheduling section, but leave other scheduling errors, such as "You're unauthorized to send to these users: ..." to the error section of the requirements.

2.12.1. Non-Admin Attempting to Login as Admin

The system should be able to detect this through the login ID.

2.12.2. Commands with No Effect

OK, here's a no-effect issue that must be dealt with. Viz.,. when the user conforms a change that is really no change at all, the system should not send notifications. Changes that this applies are scheduler meeting changes and administrator database changes. OK -- I just fixed this by adding the "re-edit" conditions to the introduction of the change-delete section.

28jun01 Note: I'm thinking we should not go the Rolodex route with the "no effect" business, but rather do things thusly:

a. *say that nothing was greyed out in the initial menu expansions for clarity, and since it's a generic display independent of any particular system state.*
b. *have an explicit discussion here, or in data-entry-details, or even in gui-details, that describes precisely the conditions under which main menu items are enabled and disabled*
c. *have a similar explicit (summary) discussion of the dialog state conditions in terms of when GUI elements are enabled and disabled.*

The paragraphs that follow are pre the preceding remark and therefore mostly obsolete if we go this way.

The following notes were removed from the structure-viewing section. Deal with them:

- *[Ed. Note: determine if we should discuss here that the system beeps and/or discuss in general elsewhere how the system signals an uneffectual command, including allowing an option for such signaling. See just below for further discussion of this.]*
- *[Ed. Note: Think about adding a dialog, probably an option-controlled dialog, to each of the above "no effect" cases that says something to the effect of: "No X selected, please select one.", where "X" is one of item, day, week, month, or year. The emacs name of the controlling option would be something like display-dialog-on-no-effect-command.]*

2.12.3. Searching for Unknown User

2.12.4. Scheduling Errors

Potpourri:

- the start date and time must be after the time at which the scheduler operation is confirmed
- the time to send a reminder must be after the time at which the schedule operation is confirmed

2.12.4.1. Unknown Meeting Attendees

If the list of attendees contains unregistered attendees not so marked, the system will output the error dialog shown in Figure 150.

2.12.4.2. Meeting Scheduler Validation

As noted in the preceding scenarios, only a group leader may schedule a meeting for a group. When one or more group names appear in the attendees list, the scheduler must be a leader of all groups in order for the scheduling operation to proceed. The determination of group leader status is based on the definitions in the group database (Section 2.6.3).

Scheduler validation is performed when the '`List Times ...`' command is executed. If the scheduler is not a leader of all groups in the attendees list, the system displays an error message, the precise format of which is described in Section 2.12.4.

2.12.4.3. Non-Unique Items

The system disallows multiple scheduled items with exactly the same values for date, start time, duration, and title. Error happens if user tries to violate this. Conditions where is can arise are:

a. schedule appt op; in this case, penciled-in meetings are considered "in"
b. schedule meeting op for the scheduler (handled during notification for attendees), including the case where the scheduler has a private item that causes violation to occur
c. changing an appt or meeting

Possibly useful verbiage axed from meeting-scheduling section:
When a single user schedules an item on the user's own calendar, the system displays an error message if the uniqueness condition is violated. When a scheduler schedules a meeting for other user's, the system does not check the condition for all attendees. Rather, the condition is checked at the time the meeting is accepted by the attending users.

2.12.4.4. Changing a Meeting to an Unavailable Location

2.12.5. Errors from an External WWW Browser

2.12.6. Administrative Errors

To cover:
• invalid user IDs in group member dialog of Figure 132,
• conflicting location booking in book location dialog of Figures 141 and

```
The following attendees are not registered users:

    ...

Check 'OK' to mark each of these names as 'Not Registered'.

              OK    Check All  Cancel
```

Figure 150: Unregistered attendees error dialog.

2.13. Graphical User Interface Details

2.13.1. 28jun01 Note

May be OK to relax dialog history requirements if a particular GUI environment does things consistently differently. Give some examples, of e.g. Java versus how things are defined here.

2.13.2. View Command Display Details

2.13.2.1. Resizing Windows

The default size of the view displays is based on the size of the currently selected display font. In specifying display size, the following standard units of typographic measure are used:

Unit	Meaning
p	one printer's point = 1/72 inch
S	user-selected font size in points; default font is 12-point courier
V	vertical height of text line, including vertical spacing = 1.2 x S
em	width of a representative "m" character = 6 x S

Based on these units, Table 8 defines the default size for each of the view-level display windows.

View Level	Dimensions
item	60*em* wide by 34*V* high
day	time column is W+4*em* wide, where W is the width in characters of widest displayed time; title column is 64*em* wide; total height is TI*em* x R*em*, where TI is the current setting of the *time increment* option and R is the total number of displayed rows based on the current settings of the *normal time range* and *show/hide 24 hours* options
week	each day column is 10*em* wide; total width is N columns, where N is the number of days based on the current setting of the *normal day range* option; total height is 24*V*
month	each day cell is 10*em* square; total width is 7 cells; total height in cells is based on the number of days in a month
year	72*em* wide; total height is 14*V* + W1*V* + W1*V* + W1*V* + W1*V*, where each W_i is number of weeks in the month with the most weeks for each of the four quarters of the year.

In all displays, border lines are 1*p* and the spelled-out date banner at the top is 1*V* high.

The user may change the default font family and size in the preference setting dialog.

In general, all views scale evenly when the display window is resized, but font size does not change. There is no maximum window size, other than that dictated by the physical limits of a particular display screen. The minimum window size is generally based on the size of the currently selected text font. Specific details of resizing windows follow.

Display features for the day view:

- The time increment setting does not affect the allowable start and end times for scheduling any item, it only affects the appearance of the display.
- Horizontal lines on the hour are shown in black across the full width of the day display; lines at increments smaller than an hour are shown in light grey across the width of the title column, but not the time label column. See Figure ??.
- When dashed lines are hidden and the increment is smaller than one hour, item titles are positioned vertically

so that their tops start at the same height as the increment label nearest to but not after the start time of the item.

- Dashed lines and down-arrows go off when vertical height is too small -- define "too small" here.
- Resizing behaves as follows:
  - *o* No row in the display will ever shrink smaller than the current setting of the increment size.
  - *o* Hence, if a day display window is shrunk such that there is not enough room to show all rows of a all days, the display will start clipping rows from the bottom of the display, adding a scrollbar on the right of the full display.
  - *o* If a day display window is grown such that there is more than enough room to show all rows of all days, then each row is increased equally in size, and the scrollbar is removed
  - *o* When a particular hour has more scheduled items than the current setting of the increment height, and there is not enough vertical height in that hour row per the preceding resizing rules, then a mini vertical scrollbar is added to that hour of the display. Mini scrollbars are only shown when the user clicks within an affected hour. Also, mini scrollbars are only shown for an hour display or greater, not for increments smaller than an hour. The mini scrollbars work, independently from the larger vertical scrollbar for the full day display.
- The font size is not automatically shrunk when window is shrunk.

The precise default format of an item listing is as follows:

a. The item begins with the starting and ending times, separated by a dash.
b. If the starting and ending times are both in the AM or PM, then the numeric time values are separated by a dash with no surrounding spaces, and the pair is followed by one space and then "AM" or "PM" designation.
c. If the starting time is in the

2.13.2.2. Details of Horizontal Overlap Display

The example to address here is when in the context of Figure 18 the user adds appointments at the following times: 3-4PM, 2:45-3:15PM, 3:15-3:45PM.

Here's the rule that I think works, which may be easier to explain if we think some more about it. For any day, create sets of items with any overlap whatsoever. Sort those items by the normal criteria, vis a vis earliest start time, shortest duration, alphabetically earliest title. Within this list, move all items over as far as possible to the left, as long as the no two items in the same column overlap and the sorting criteria continue to be met. It appears what we're doing is maximally filling each column, i.e., not leaving any space blank in a column if a none overlapping item will fit there. If tow or more items will fit in a give space, then the one chosen is the one earliest in the sorting order, with the unchosen one relegated somewhere to the right, in the (recursively) correct position. "Recursively correct" means in the leftmost column where it will fit such that all criteria are met.

2.13.3. Banner Augmentation

Other user, if any, comes first, preceded with "-- USER: ". Filtering, if any comes next, per details described elsewhere. If banner isn't wide enough, text is truncated, with trailing "..." added, and expands if window expands.

Don't forget about the "SCHEDULER CHANGED" annotation and where it fits in the banner pecking order. It's probably first, therefore pushing other possible augmentations to the right, with "..." addded as necessary.

2.13.4. Window Positioning for Next/Previous Commands

At the day through year levels, the window position stays fixed at the top. At the item level, the window position stays fixed at the bottom. OK, the spelling out in the last sentence made me realize that its pretty bogus and non-orthogonal. So, we'll change the item-level display to have the time and data at the top.

2.13.5. Non-Modal Dialogs

Make sure the effect of window closing is 100% defined. Hopefully close === Cancel works most or all of the time.

Unless otherwise noted in the scenarios, all dialogs are non-modal. *It would be prudent here to list exactly the (hopefully few) cases where modal behavior is enforced.* We should also discuss what happens when would-be modal dialogs are closed, viz., and not necessisarily limited to, reminders and meeting notifications. Another interesting case is when the same user executes two or more '`Schedule Meeting`' operations while an original such operations is in the synchro stage. It seems clear that this should mean that the user is put in the queue behind himself (!).

I'm thinking that --maybe-- modal dialogs should never appear in the windows list, hence we don't need to mention window modality when we discuss the '`View Windows Close`' command, as we don't currently do. We do need to address the issue that any "pending" activities are canceled with a window is closed.

Somewhere we need to address what it means for the system to interrrupt a modal dialog, particularly with the proceed-to-schedule notification. In this case, I'm pretty sure that it should mean the modal dialog is canceled, which means we have to be careful to put a cancel button in all modal dialogs.

2.14. Multi-User Operating Environment

The functional requirements presented in the preceding sections ... . *Here's where the art of not over specifying comes in.*

Draw a nice little picture that shows where the data are actually stored. Viz., in the central repository has a copy of all user calendars, with non-private items and not-yet-accepted meetings. Each user has her own copy of the calendar containing all items, including the private ones, but no not-yet-accepted meetings. Hence, when the view commands operate, they are showing information from potentially both the local copy and the central repository. Viz., all local items plus penciled items for each user looking at her own stuff. When viewing another user, everything comes from the central repository.

Mention the requirement for distributed clock synchronization for comparing the times of scheduler and attendee meeting field changes.

2.14.1. Invoking the Calendar Tool from the Operating Environment

There are to separate executable programs named `CalendarTool` and `CalendarToolAdmin`. When a user invokes `CalendarTool`, the system determines if the invoking user is a registered user of the Calendar Tool system. This check is performed by searching for a user record in the Calendar Tool database containing the invoking user's computer ID on the user's host computer. If the system confirms that the user is registed, then the system displays the regular user interface, otherwise it displays the unregistered user interface.

Explain that the system establishes the user's calendar tool ID by matching it against computer user ID. This means, in effect, that in order for a cal tool user to participate in the network functionality of the system, the user must have an account in an operating environment with a user name.

As explained in ..., admin users must login with a password when invoking `CalendarToolAdmin`.

2.14.2. The Central Calendar Repository

If the item limit value is set such that it is smaller than the current number of items on the user's calendar in the central repository, the system deletes enough items to reach the limit value. Item deletion is performed in the following order, until the limit is reached:

a. items before today's date are deleted, in order from the earliest to latest scheduled time and date

b. if further deletion is required, items are deleted in order from that latest scheduled time and

2.14.3. Messaging

Points:

- Central system stores all notifications (including host-change messages) until user computers are ready to receive them.
- As soon as user machines are ready to receive them, central machine sends them.
- Implementors can figure how to do this in any combination of distributed implementations.

2.14.4. Coordination

The central system coordiates the synchronization of meeting schedulers.

2.14.5. Implementation Considerations

An important characteristic of the central caltool host is that it is assumed to stay running all of the time, whereas individual users may turn their computers off or disconnect them from the network. If users aren't allowed to do this, then a distributed implementation is allowed. Here's the deal with this -- whenever a caltool user's computer is running and connected to the network, other users can see the latest public items and receive notifications immeidately from that user. Whether they

OK, maybe we do need to be a bit more restrictive in the model than the "weak view" paragraphs below indicate. Try this. From each user's perspecitive, there's her own computer with her own personal stuff and the Caltool host computer, which is the "gateway" to everyone else's stuff. Now, the implementation freedom comes in in how the gateway computer chooses to store stuff. It can either store central copies or ship out distributed copies. If it does the latter, things might get tricky cause it's not allowed to ever let anyone's copy of the "central" database get out of date or inconsistent. As far as the central calendar is concerned, it could in fact be highly distributed. There does need to be a place wher

The following paragraphs discuss a weak view of the implementation:

The idea of the "central" calendar need not be implemented on a single central server, it need only appear that way to users. Viz., from a single user's perspective, the user owns a local file that is her personal calendar. Everyone else's calendar is "out there", accessible when asked for, assuming the computer holding the desired information is running.

The central host computer is where the database information is stored. It may or may not be where a central calendar is stored.

Need to allow the case where central calendar contains references to local calendars, as long as proper semantics are maintained.

3. Non-Functional Requirements

4. Developer Overview

5. Formal Specification

The files of the formal specification are organized following the functional decomposition presented in the command menubar and outlined in the developer overview. At this abstract stage of development, there is one file for each major fucntional category. As the specification evolves into the design, the specification will be packaged, and each class will go into its own .java file, as is the standard convention in Java.

- scheduling
- viewing
- administration
- options
- calendar database

These files are located in the `specification` project directory. There `javadoc` subdirectory with the generated model documentation. the clases in the model.