Requirements
for an Electronic Calendar Tool

Version 1.0
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Contents

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. master 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. Scheduled items can be viewed in a number of display formats, from an individual day to a full year. Calendar operations can be performed by individual users on their personal calendars, as well as by administrative users on multiple calendars. 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:

- an individual user scheduling an appointment
- an individual user viewing calendars in a variety of ways
- an individual user scheduling other types of items
- a group leader scheduling a meeting with several attendees
- a system administrator updating the calendar databases
- details of changing and deleting scheduled items
- details of file-related commands
- details of edit commands
- help commands
- data entry details
- error conditions

Following the usage scenarios is a section that summarizes graphical user interface details relevant to implementations in specific operating environments.

2.1. User Interface Overview

When the 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 preference editing commands.

2.1.1. Command Summary

Figure 2 shows an expansion of the command menus. The `File` menu contains typical commands for manipulating data files and performing other system-level functions. '`File New`' opens a new calendar in a new display window. '`File Open`' opens an existing calendar from a previously saved file, displaying it in the current display window or a new window as selected by the user. '`File Close`' closes the currently active calendar, offering to save if it has been modified since opening. (The currently active calendar is the one on which the user has most recently performed a command.) '`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.

'`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.

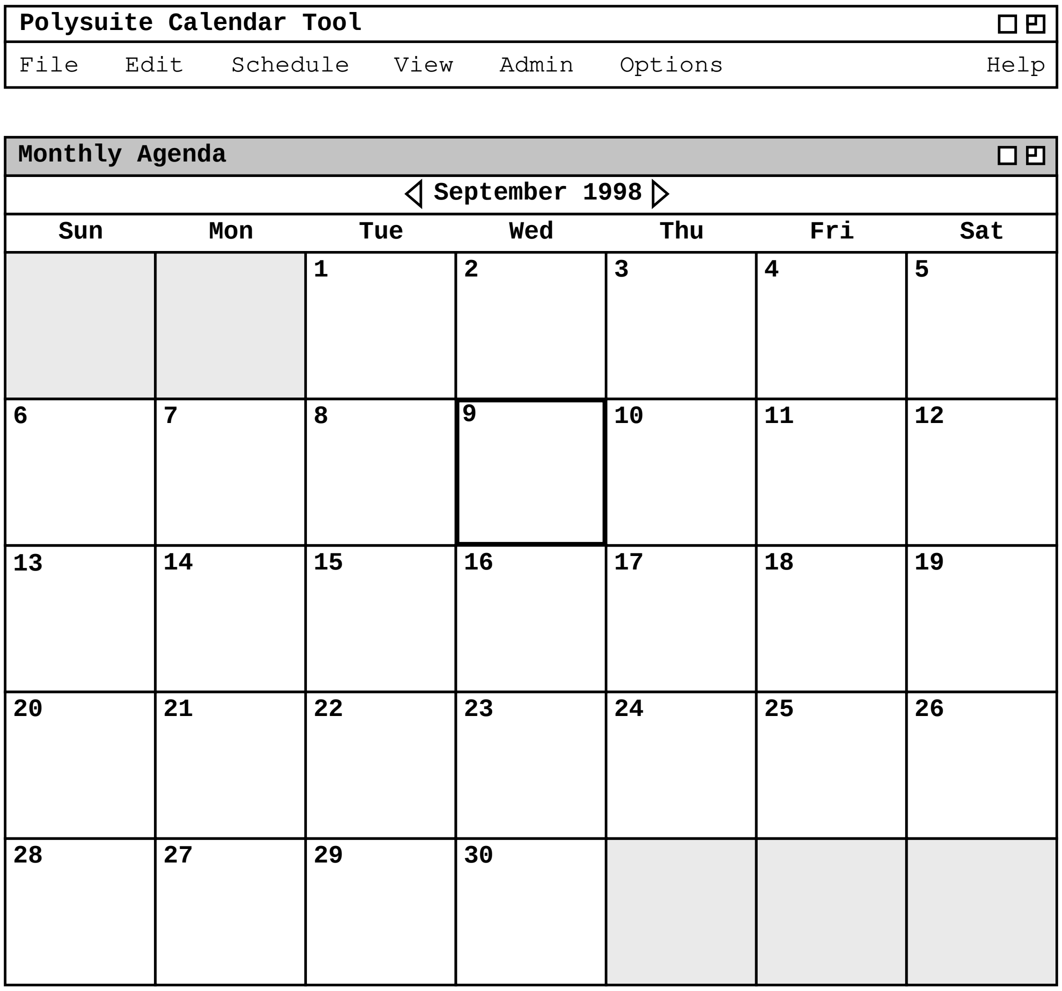


Figure 1: Initial screen.

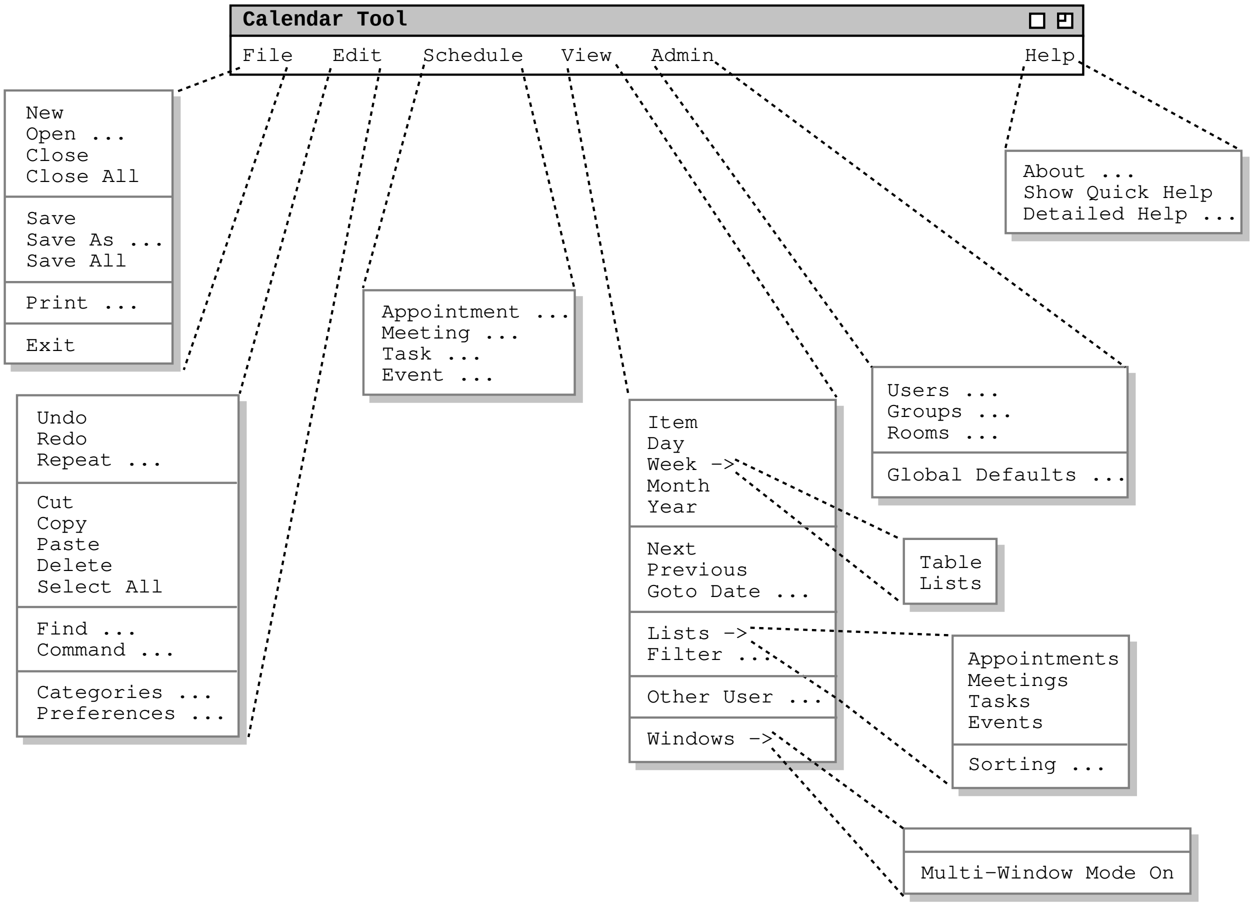


Figure 2: Expanded command menus.

'`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 given 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.

'`Edit Categories`' allows the user to edit the names and display colors for categories of items that appear within calendars. '`Edit Preferences`' displays a dialog for setting various system options. The options are organized in three major areas: times and dates; scheduling categories; viewing formats.

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 system. 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 items, such as holidays.

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 may 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*. The `Sorting` command allows the user to set the order in which list items are sorted. Lists can be shown in separate display windows, allowing side-by-side comparison of listed items. '`View Filter`' allows the user to construct a variety of custom views, based on filtering criteria such as event category and date ranges. Viewing filters apply to both calendar and list views. The user can select to which display windows a filter applies.

'`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 available display windows. The '`Multi-Window Mode On/Off`' command toggles the display mode between using a single window for the results of each `View` command to using a new separate window for each command.

The `Admin` menu contains commands to access the three calendar databases -- users, groups, and rooms. The *User* database contains a record for each officially registered user of the Calendar system. The *Group* database defines user groups, primarily for meeting scheduling purposes. The *Room* database defines rooms in which meetings can be held, including information about the facilities available in the rooms. Some `Admin` functions are available only to certain classes of users. In particular, only users with system adiminstrator priveleges may add, change, or delete registered users.

The '`Admin Global Defaults`' command provides access to the default settings common to all users. Non-privelged users can view the settings; system administrators can alter the settings for all users. System administrators can also control which default settings may be overridden by individual user preferences.

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. Screen Map

Figure 3 shows a hierarchical map of the major user interface screens presented in the Rolodex functional requirements.

-- Excerpt from Milestone 6 Example, Showing Two Completed Scenarios --

2.2. Scheduling an Individual Appointment

This introductory scenario shows an individual user scheduling two simple appointments. Appointment scheduling is one of the most commonly performed operations with the Calendar system. In this scenario, the user is assumed to have just been registered in the Calendar system. 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 2.7.

To schedule an appointment, the user selects the 'Appointment' command in the Schedule menu whereupon the system displays the dialog shown in Figure 3. 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 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 greyed-out to solid type. The recurring information

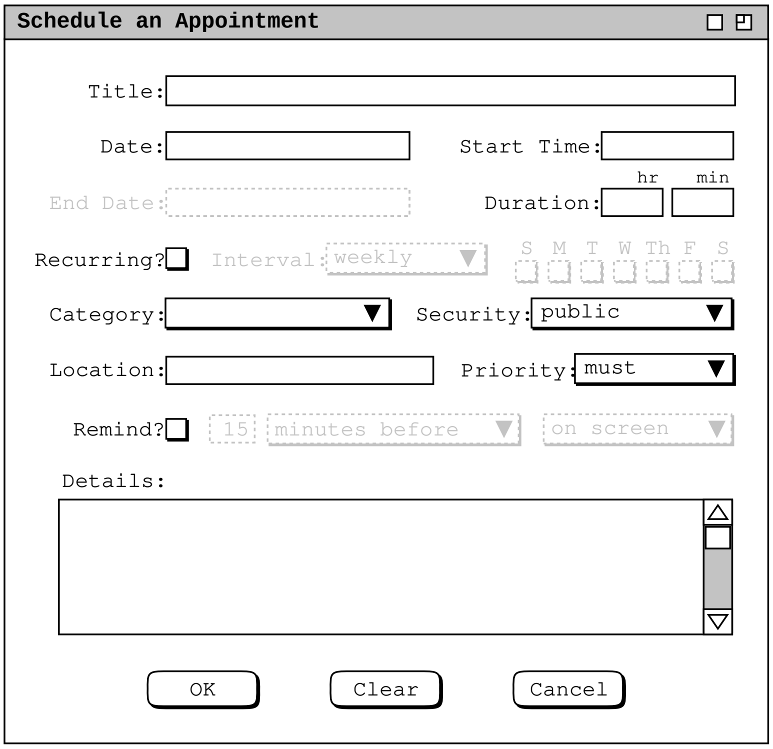


Figure 3: Appointment scheduling dialog.

is the 'End Date', the recurring 'Interval', and the seven daily check boxes to the right of the 'Interval' box.

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. Appointment Security is one of four levels: '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, times, and date(s) of the appointment, but no other information
- confidential -- other users can see the times and date(s) 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

The appointment 'Location' specifies where it will be held. The location value is a plain text string. 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 group meeting scheduling, where optional appointments can be automatically rescheduled if necessary. Meeting scheduling is discussed further in Section 2.5.

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 greyed-out to solid. The two data-entry fields immediately to the right of the check box indicate how soon before the meeting 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 right of the time-before entry is a box for selecting how the reminder should be sent. The three choices are 'on screen', 'beep only', or 'email'. Details of these reminder formats are covered in Section 2.4.5.

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 4 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 system, the only pre-defined appointment category is "Holiday". For the dentist appointment, the user decides to create a new category called 'Outside Appt'.

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 5. 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 6. The user then selects the 'Add' button, which brings up the dialog in Figure 7. To create the new 'Outside Appt' category, the user types into the 'Category Name:' text box, and then selects 'Brown' from the color selection menu, as shown in Figure 8. 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.

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 9. 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 this new appointment to 'optional' instead of 'must'. The operative effect of selecting an 'optional' priority relates to scheduling group meetings, which is discussed further in Section 2.5. Aside from group scheduling, the meaning of 'must' versus 'optional' is purely informational, i.e., it indicates the relative importance of the appointment.

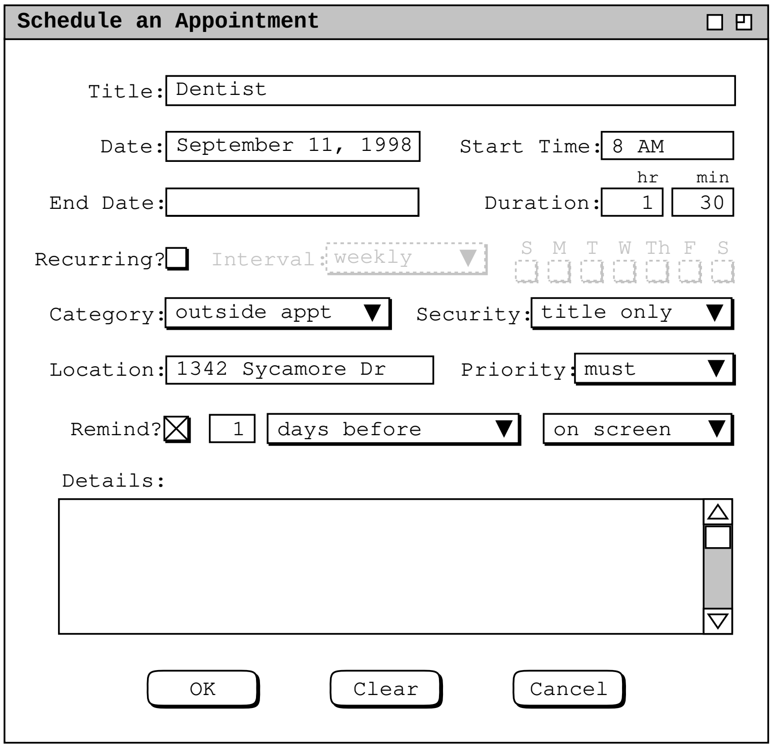


Figure 4: Scheduling a dentist appointment.

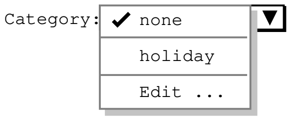


Figure 5: Initial categories menu, before Outside Appt category has been added.

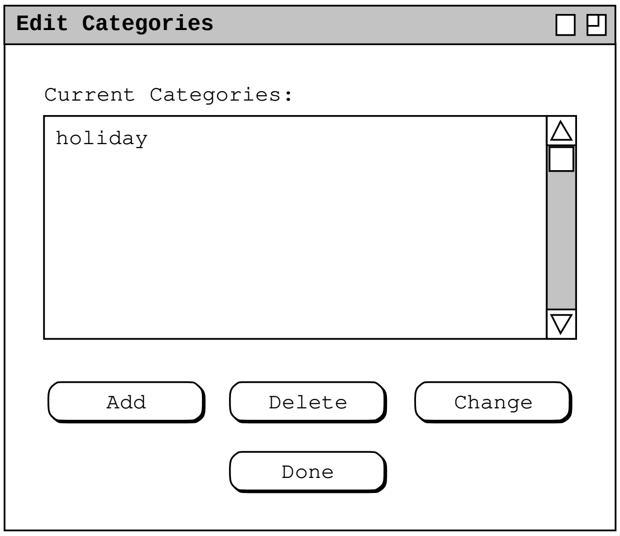


Figure 6: Edit categories dialog.

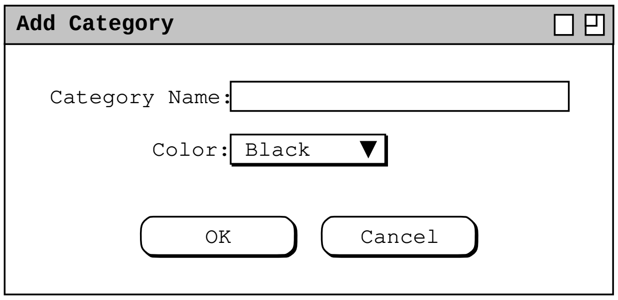


Figure 7: Add category dialog.

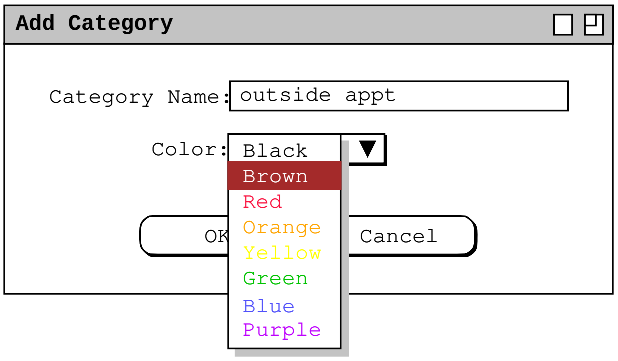


Figure 8: Creating a new category.

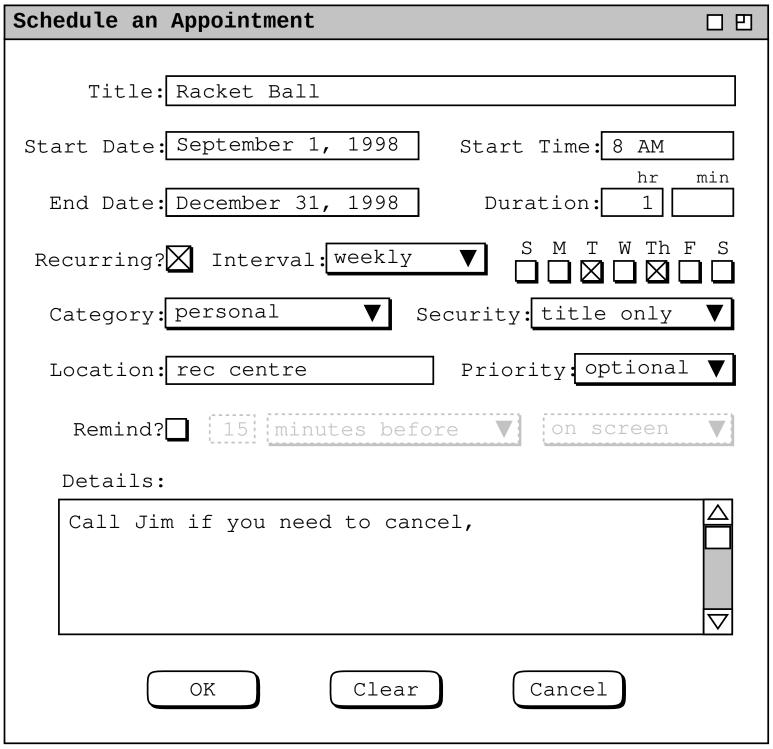


Figure 9: Scheduling a second appointment.

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 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 2.6.

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 Section 2.9.2 on preferences. 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. The default name of the calendar file for new users is chosen by the system administrator, as described in Section 2.7. 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 system 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 scheduling information for a previously scheduled appointment can be reopened 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 display. Details of these displays are covered in the next section of the requirements.

2.3. Viewing an Individual Calendar

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 2). 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.

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 enabling *multi-window* viewing mode. In this mode, the results of *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 as many different periods as desired. Complete details of 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 2.11.4

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 10. 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 10, the user is viewing the details of Wednesday, September 9. The items shown in Figure 10 reflect a number of scheduling commands having been performed by the user, subsequent to the commands illustrated in the

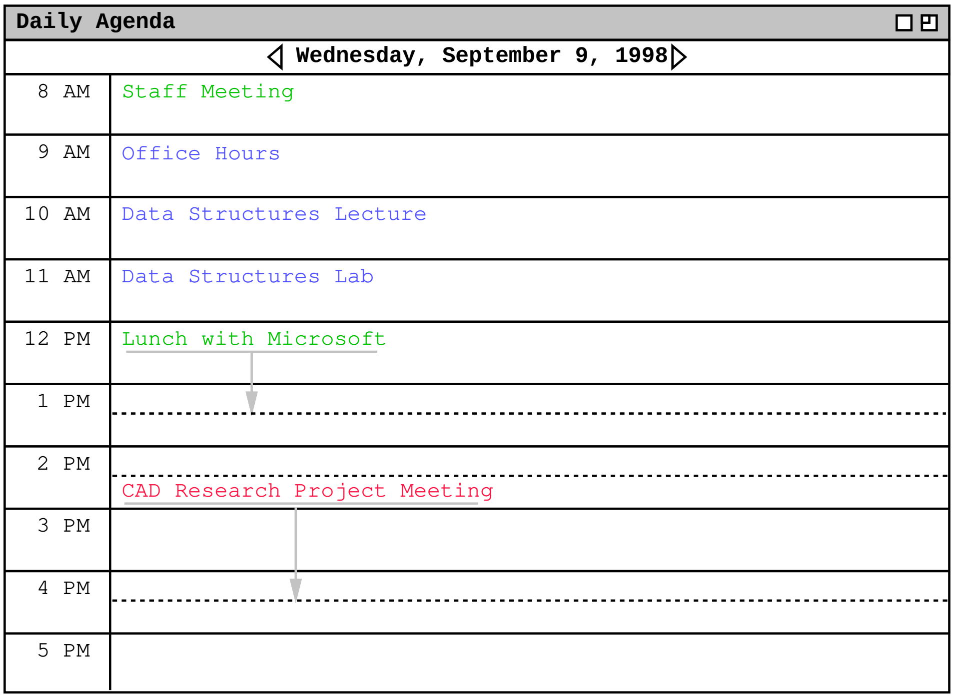


Figure 10: Day view.

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 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 10 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".

At the top of the day view is a full description of the day of the week, month, and year. Immediately to the left and right of the description are arrow buttons used to change the display to the previous or next calendar day. For example, when the user chooses the right-pointing arrow in the display of Figure 10, the display changes to that shown in Figure 11.

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

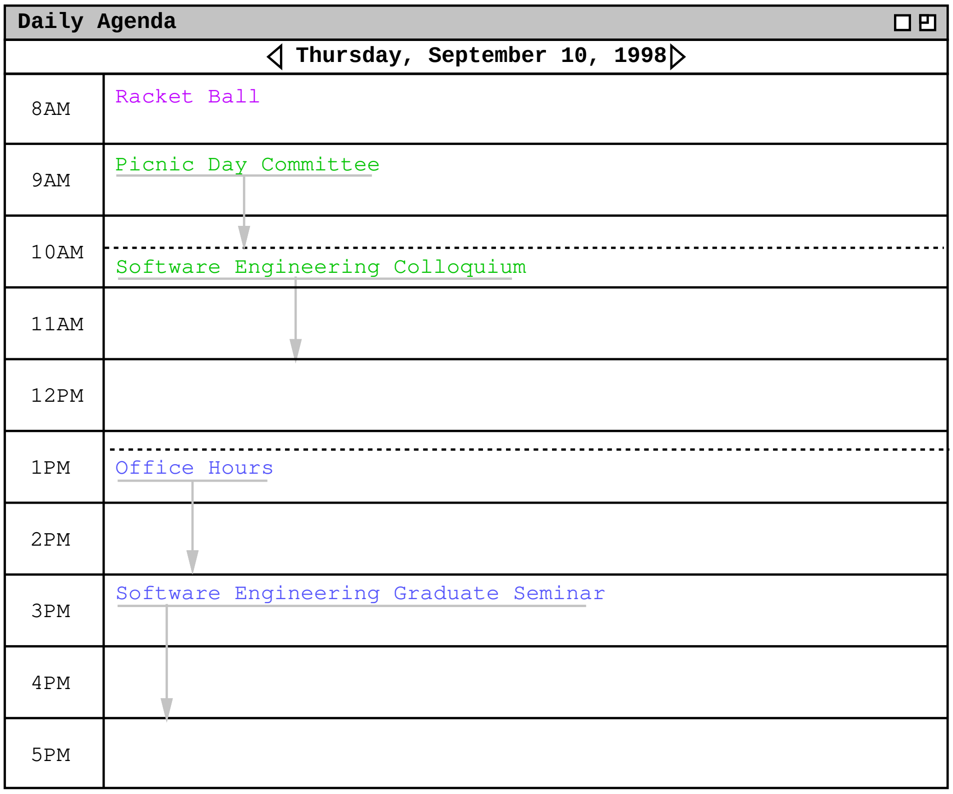


Figure 11: Result of pressing the next day arrow.

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 2.13.1.

The user sets these options in the edit-preferences dialog, as described in Section 2.9.2.

As an example of alternate option settings, Figure 12 shows a day view of the same information shown in Figure 10, 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 12 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 2.13.1.

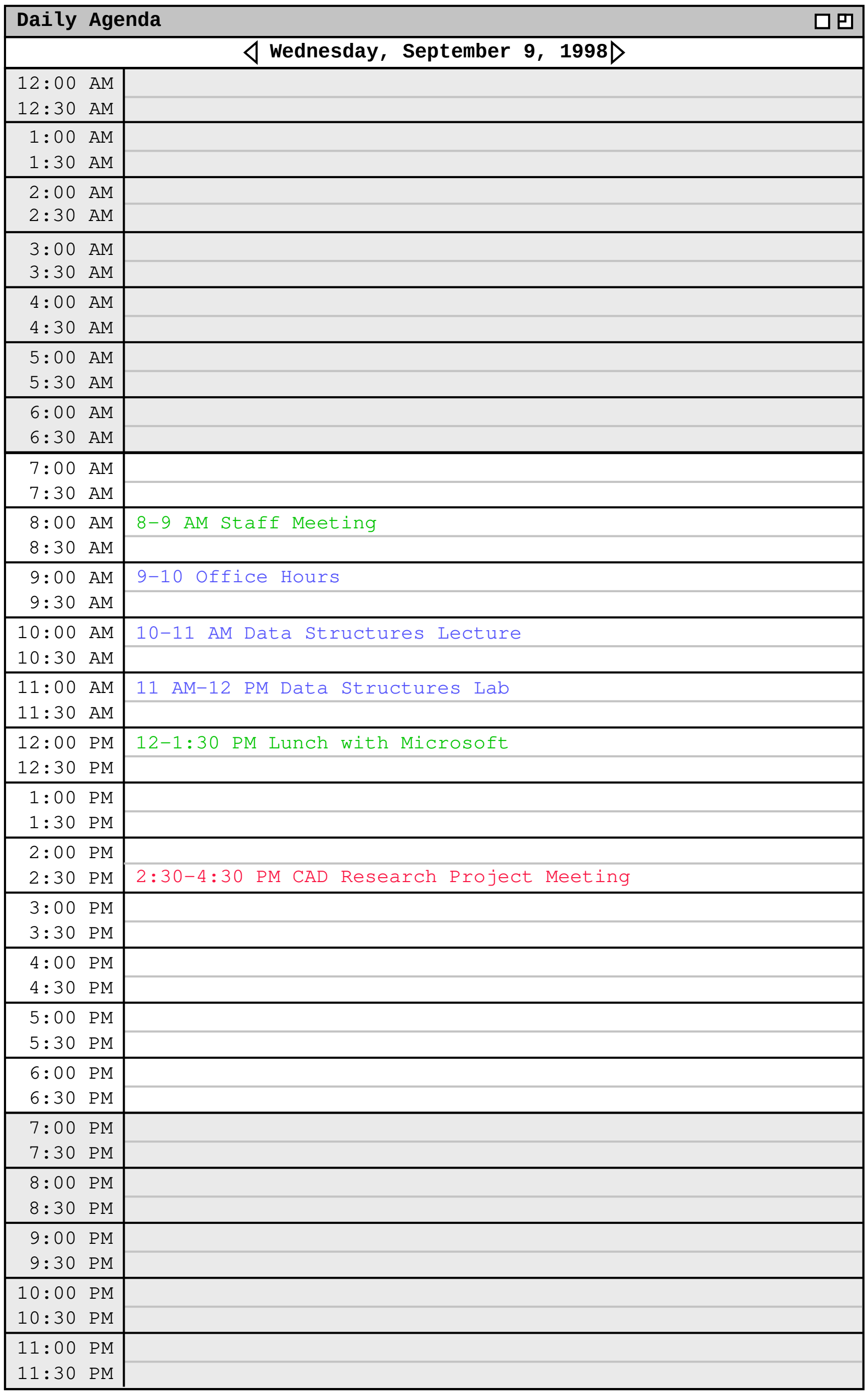


Figure 12: Day display with non-default option settings.

To illustrate the display of overlapping items, Figure 13 shows an updated version of the daily schedule shown in Figures 10 and 12. 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 13. The precise layout rules for such cases are covered in Section 2.13.1.2.

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 2.13.1.1.

Figure 14 shows the same information as Figure 13, 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

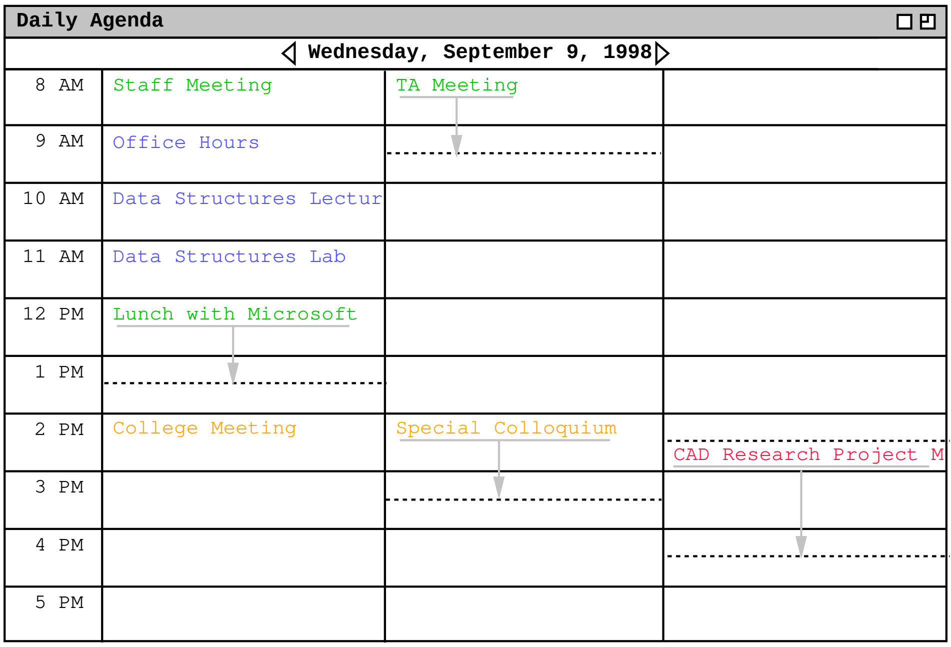


Figure 13: Day view with overlapping times.

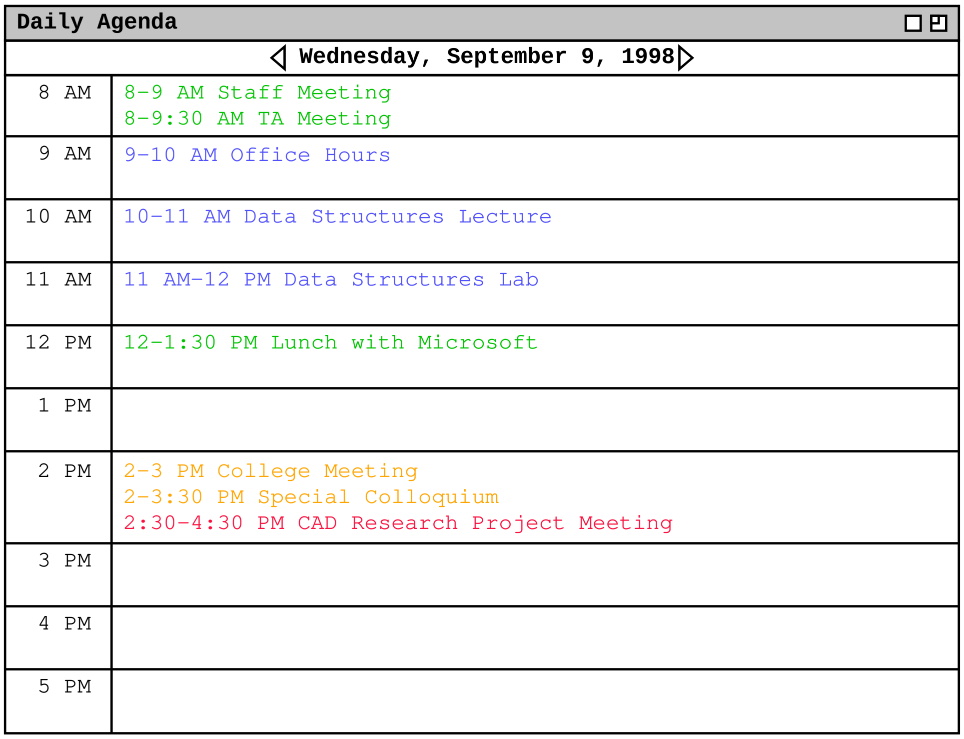


Figure 14: Day view with overlapping times, displayed vertically.

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 14 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 15.

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 9. 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 9.

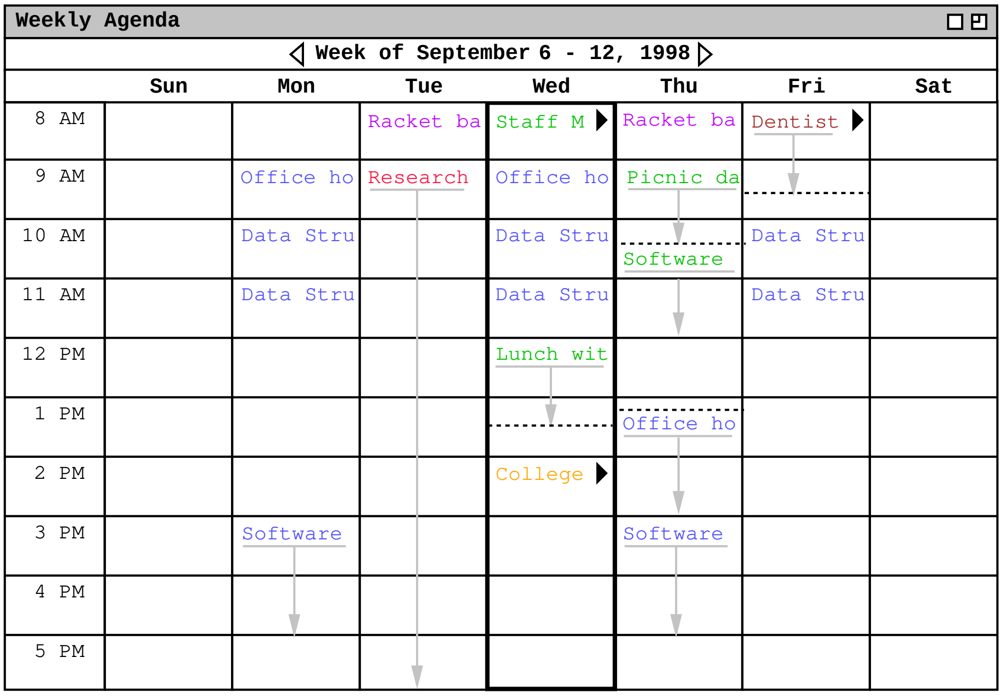


Figure 15: Table-style week view.

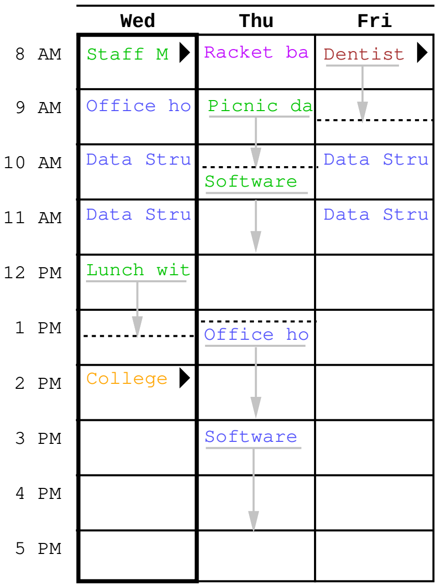
The table-style weekly view shows items in the same format as the day view, except with narrower columns to accommodate all the days of the week. Each item is shown with as much of the title as fits horizontally within its display area. The columns of the weekly table view are all of equal width. If the display window is resized, each column is resized proportionally and equally. At the top of the weekly view is the exact description of the week, with arrow buttons to go to the previous and next weeks.

A notable aspect of the weekly table view is the display format for days that contain overlapping items. In the example shown in Figure 15, 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.

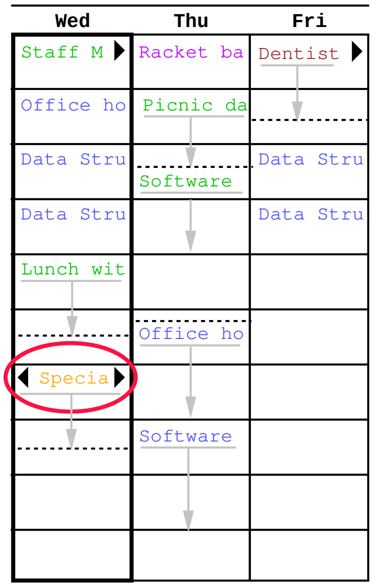
Figure 16 further illustrates the display of overlapping weekly table items. The figure shows four excerpts of the weekly table view for the week of September 6, illustrating four stages of viewing overlapping items. In Figure 16a, three right-pointing arrows appear at Wednesday 8 AM, Wednesday 2 PM, 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 16b, with the changed item circled.

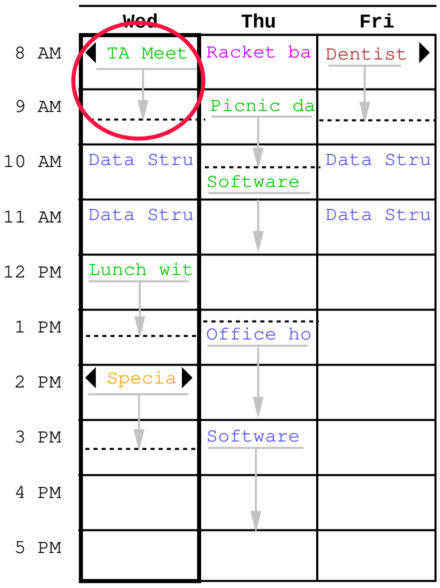
Figure 16c shows the result of the user clicking on the right-pointing arrow at Wednesday 8 AM. The display change is again circled. Of note in Figure 16c is that the Office Hour item at 9 AM has been removed from the display. When overlap scrolling in a weekly view, the system displays only complete overlapping items, no partial items. That is, the system removes all items from the display with which a scrolled-to item fully or partially



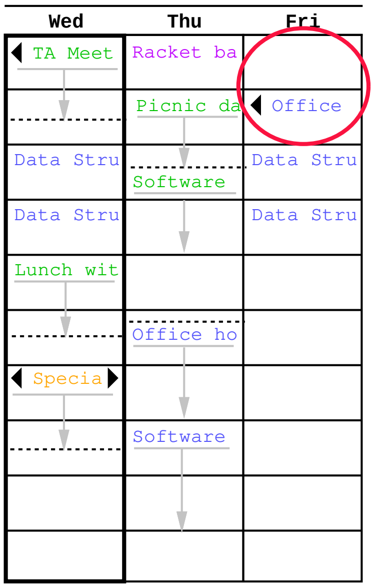
a. Overlapping items to the right.



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 16: Clarification of overlap in a weekly table view.

overlaps.

Figure 16d 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 16d, even though it would fit partially in the display. Figure 16d also illustrates that the left-pointing arrow always appears at the top of the item that is displayed. Hence, the left-pointing arrow in 16d 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 16b, 16c, and 16d. The 2 PM item in Figures 16b-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 16c and the Friday 9 AM item in Figure 16d.

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 only:

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 17. The Figure shows the same week as in the table-style view in Figure 15. In the list-style weekly view, the exact time for each item is always displayed, since there is no

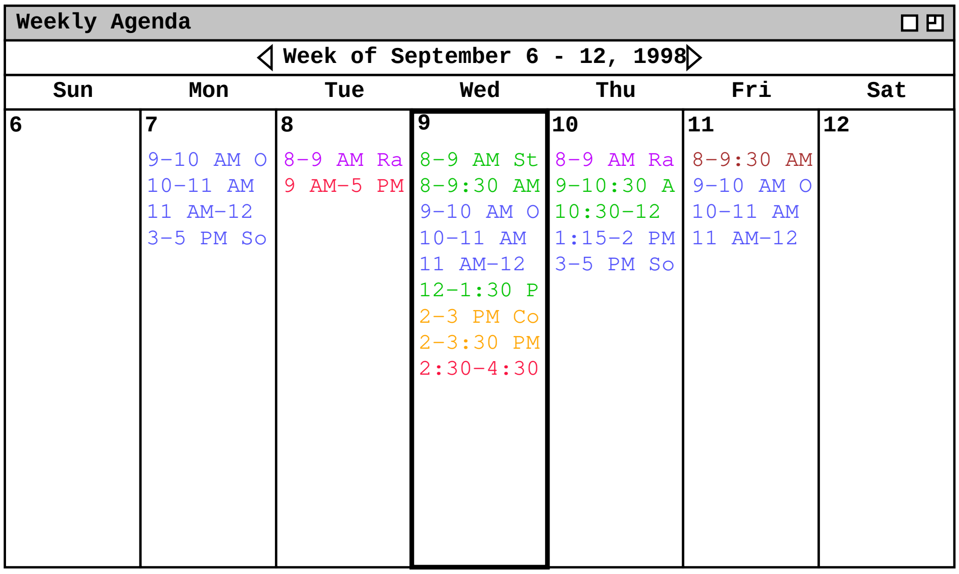


Figure 17: List-style week view.

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 items in each daily list are 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, since the system disallows multiple scheduled items with exactly the same values for start time, duration, and title. This and other scheduling restrictions are discussed further in Section 2.11.

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, since the month view is the standard default. It is chosen explicitly with the '`Month`' command from the '`View`' menu. Figure 18 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. At the top of the view is the name of the month, with arrow buttons to go to the previous and next months.

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 Wednesday September 24 (in Figure 18), the scrollbar appears as shown in Figure 19. The scrollbar appears since there are more items scheduled for September 24 than fit in the current size of the September 24 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 20. The current date is highlighted with a rectangular border. At the top of the view is the year number, with arrow buttons to go to the previous and next years.

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

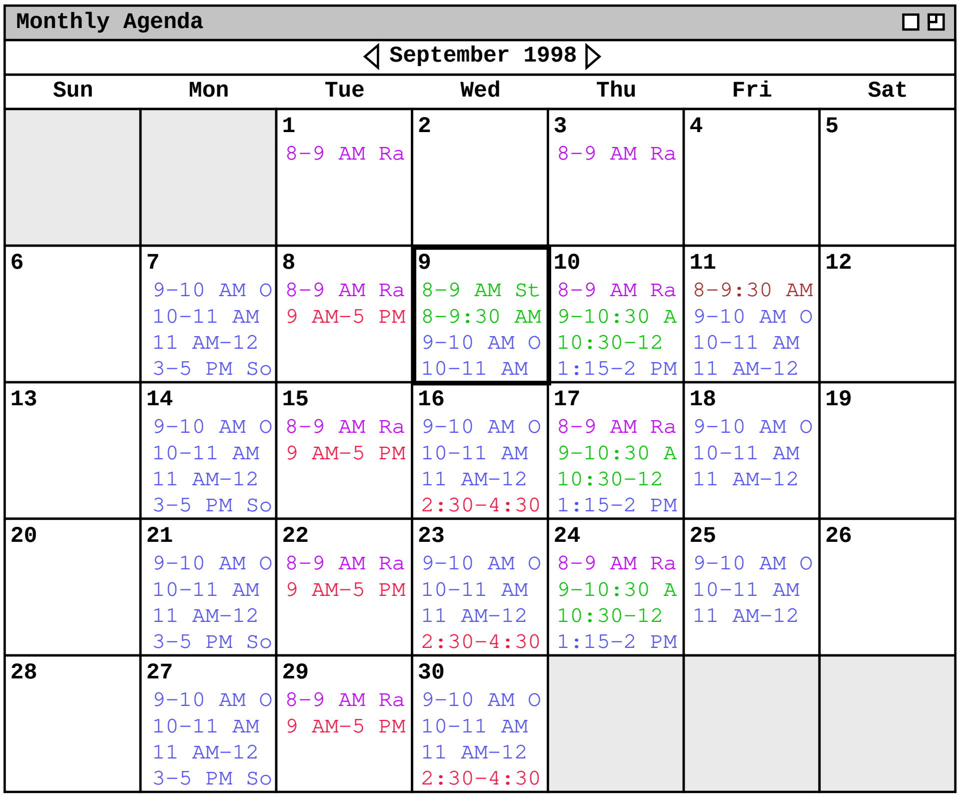


Figure 18: Month view.

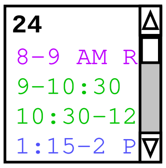


Figure 19: Transient scrolling in a month view.

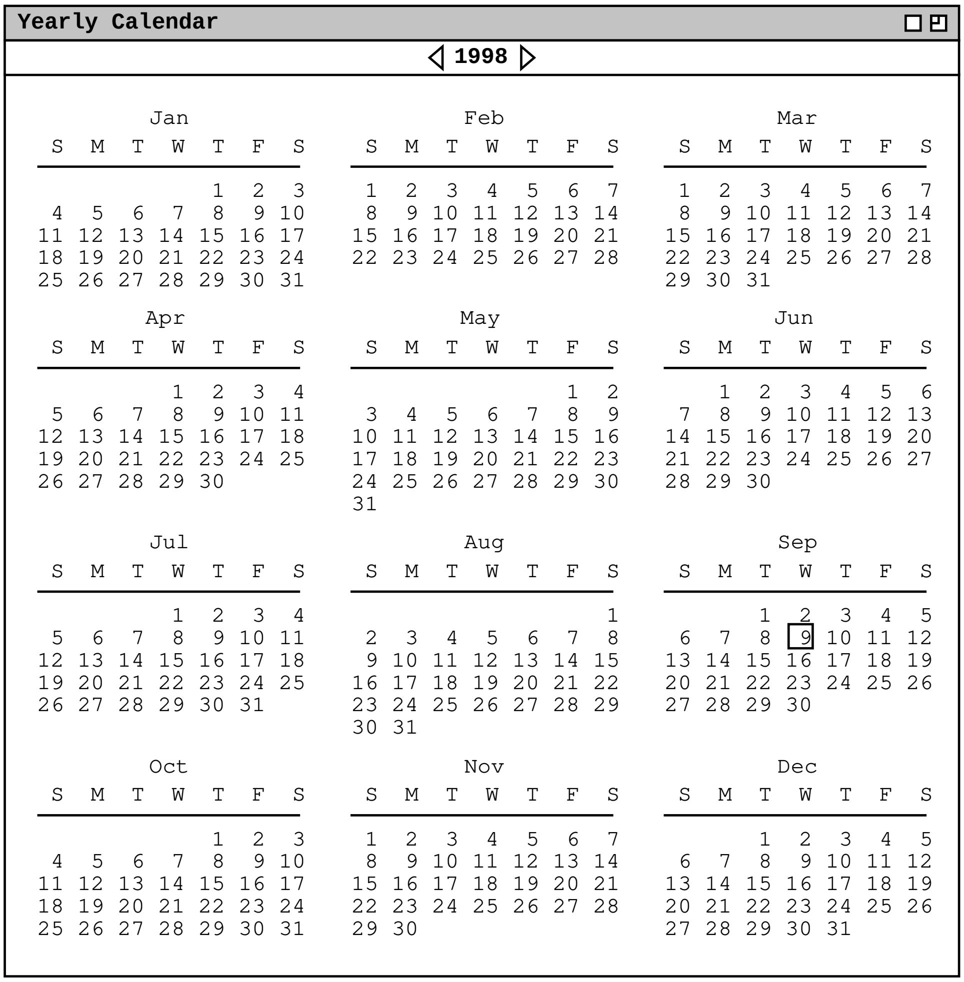


Figure 20: Year view.

details is to double click on the item time or title in any larger-grain view. Figure 21 shows the result of the user having selected to view the item for 8 AM September 11. The information displayed for the 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 item-level display has the same data fields as the scheduling dialog shown in Figure 3. The item display differs from the scheduling dialog in the command buttons along the bottom of the dialog window. Specifically, the scheduling dialog has only '`OK`', '`Clear`', and '`Cancel`' buttons. In the item display there are buttons to '`Change`' the item, '`Delete`' the item, and '`Clear`' the dialog. There are also '`Previous`' and '`Next`' buttons to view the chronologically previous and next scheduled items.

To change the displayed item, the user makes one or more changes in the item data fields and then presses the '`Change`' button. If the user presses '`Change`' without having performed any data-field editing, the system responds with an explanatory error dialog. To delete the displayed item, the user presses the '`Delete`' button. The system responds with a confirmation dialog. If the user confirms affirmatively, the system deletes the scheduled item

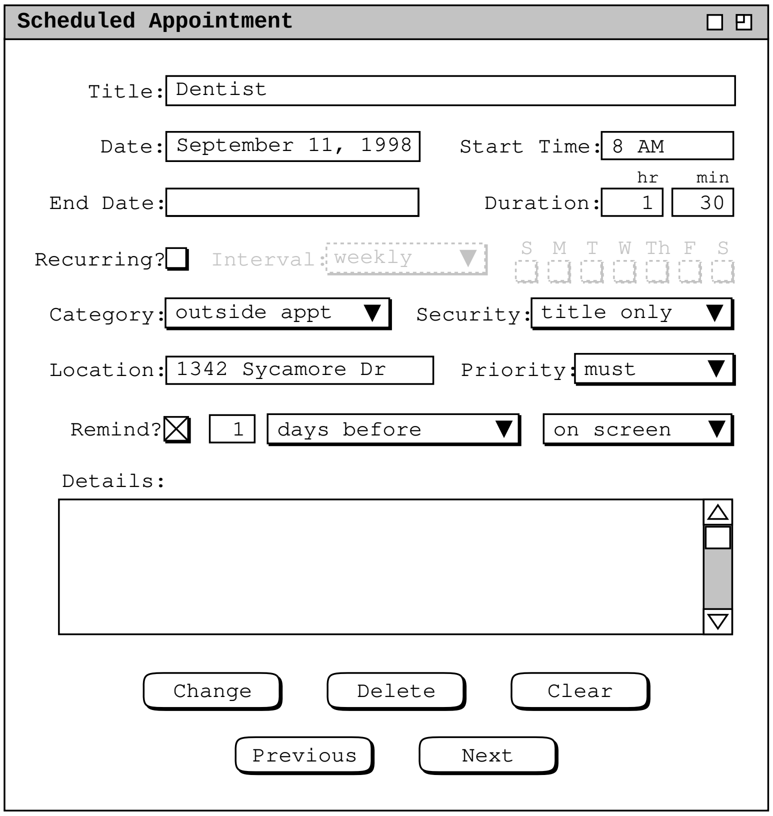


Figure 21: Details of selected scheduled item.

and removes the display from the screen.

The effects of the change and delete commands are potentially wide-ranging, particularly for recurring items or meetings with multiple attendees. Complete details of item change and deletion are covered in Section 2.6.

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.

The effect of 'Next' and 'Previous' is based on the level of the current display. At a given level, 'Next' changes the display so that the next calendar unit at that level is displayed; 'Previous' operates analogously in the backward-time direction. An example of the effect of the 'Next' command is illustrated above in transition from Figure 10 to Figure 11.

The right and left arrows in the banner of each view-level display are shortcuts for the 'Next' and 'Previous' commands, respectively. Pressing one of these arrows has the same effect as the corresponding menu command, with one exception. The exception is that the setting of multi-window mode is ignored when the arrow keys are used. That is, pressing an arrow key always changes the display in the window to which it is attached, and never displays a new window. Further details of the multi-window display option are covered in Section 2.3.6.

Explain that Prev and Next buttons in item-level view are also shortcuts for the Prev and Next menu items. Explain thoroughly that Prev and Next at the item level goto in scheduled-item order, which is different in effect than Prev and Next at higher levels. Viz., (a) at the item level the amount moved is variable, based on when items are scheduled, and (b) at the first and last scheduled items Prev and Next have no effect.

When the user selects the 'Goto Date' command, the system displays the dialog shown in Figure 22. The user enters the desired date and presses the 'OK' button to proceed. In response, the system removes the dialog from the screen and updates the current display based on the entered date. The 'Goto Date' command complies with the setting of the 'multi-window mode' option, either updating the current display window or creating a new window as indicated by the option value.

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 enters the string "INVALID DATE" in the text-entry box of the dialog, whereupon the user may re-enter 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.

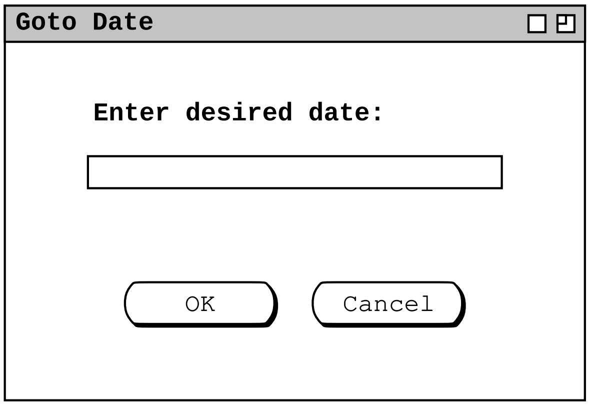


Figure 22: Goto date dialog.

2.3.3. Viewing Lists of Scheduled Items

The calendar views described in the previous section are organized in standard calendar units of days, weeks, etc. 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 23. The first four commands in the '`View Lists`' submenu are the four types of scheduled item. The last command provides functionality to sort the lists in different useful orders.

Figure 24 shows the response to the users selection of the '`View Lists Appointments`' command. The figure shows a chronologically ordered list of the appointments created by the user in the preceding scenarios. The format of the list items is precisely the same as in the daily and weekly lists displays. *[Look at all of the options available for daily and week lists view and figure out which apply here.]*

By default, the list is sorted chronologically by appointment date and time. The list contains all the appointments in the six-week period starting one week prior to today's date. The default ordering and time-range of the list can be changed using the filtering commands described in Section ??? of the requirements.

When the user selects the '`View Lists Sort`' command, the system displays the dialog shown in Figure 25. The sorting dialog allows the user to specify the primary, secondary, and tertiary sorting keys for each of the four types of scheduled item. By default, the sorting keys for all four types of schedule item are as follows:

a. start date/time is the primary key

b. duration is the secondary key

```
Appointments
Meetings
Tasks
Events
------------
Sorting ...
```

Figure 23: View lists dialog.

Figure 24: Basic Appointments List.

Figure 25: List Sorting Dialog.

---

c. title is the tertiary key

The available sorting keys are derived from the information fields in each type of scheduled item. Figure 26 shows expanded sorting menus for each of the four types of scheduled item.

The precise sorting details for each of keys are as follows:

a. Date/time sorting is in ascending chronological order of the starting date and time. Appointments and meetings have both a start date and a start time, the pair of which are used as the combined key. Tasks and events have only start date, which is used as the sorting key.

b. Duration sorting is in ascending order from shortest to longest duration.

c. Title sorting is based on the lexical order of title strings, where lexical ordering is defined as characterwise comparison based on the ASCII character collating sequence, ignoring differences in the case of letter characters (i.e., sorting is case *in*sensitive).

The date/time key consists of both a date and time for appointments and meetings. For these

Lists of the other three types of scheduled items (meetings, tasks, and events) are very similar to appointment lists. Section ??? covers the scheduling as well as the listing formats for the three additional types of items.

2.3.4. Filtered Viewing

2.3.4.1. Important Details

When a filter is active, its name is displayed in the banners of all windows to alert the user that the filter is on.

When "Hide All" is chosen in the filtering, [perhaps] the affected list types should be greyed out in the '`View Lists`' menu.

2.3.5. Viewing Other Users' Calendars

2.3.6. Viewing in Different Windows

Multi-window mode allows the user to create side-by-side comparitive displays.

2.4. More Individual User Scheduling

The scenarios in this section show a user scheduling the three other types of scheduleable items:

- meetings
- tasks
- plain events

Figure 26: List sorting keys.

Sketch:
I dont think the named filter menu is a good style of UI, primarily from a convenience standpoint. The main issue is that it requires the user first to define a filter before using it at all, when naming a storing a filter is likely to be secondary for most users. Rather, the primary thing they want to do is define a quick filter, and then after they've used it, save it if it appears to be particularly useful. So, what we need is a filtering dialog that's very simple at the top-level, and allows more advance form of filtering as a second-level option.

Given the above, here are the components of a general filtering dialog:

a. At the top, there are some radio buttons that specify to what things the filter will apply. Specifically, the four types of scheduled item plus calendar and lists.

b. OK, we have an initial picture:

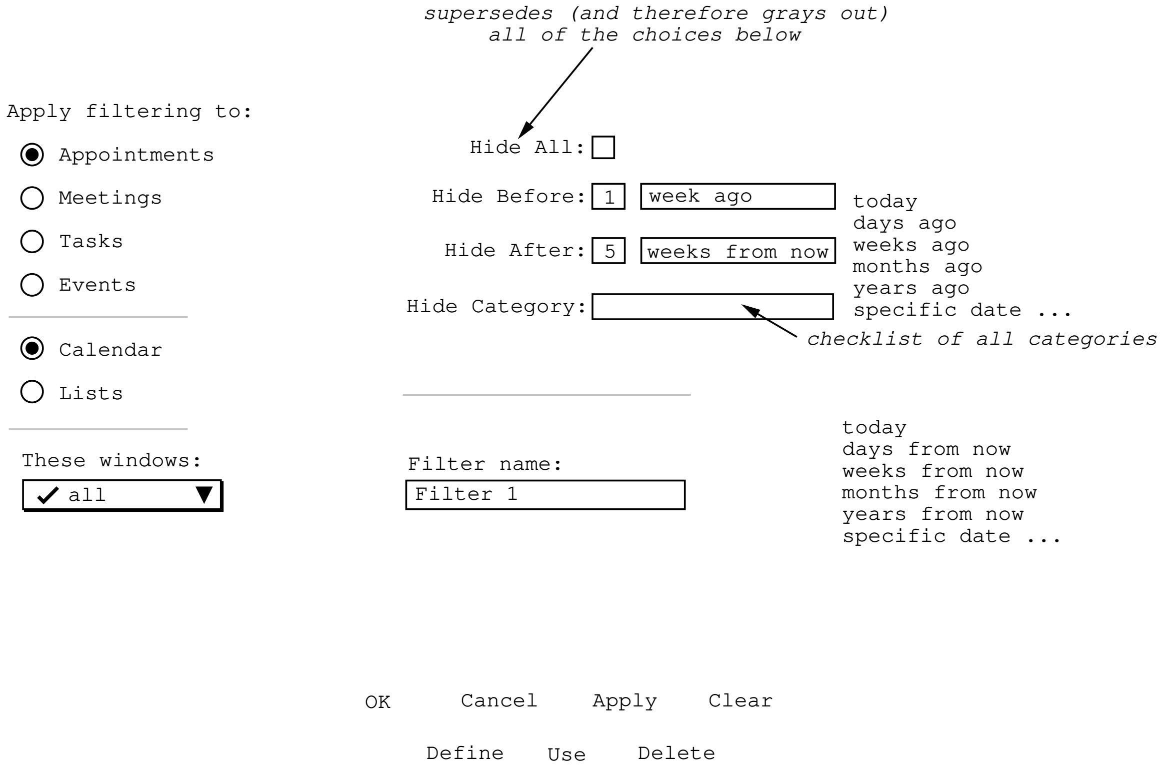


Figure 27: Top-Level Filtering Dialog.

Following these are scenarios covering important scheduling details in the following areas:

- recurring items
- receiving reminders

- changing and deleting scheduled items

2.4.1. Scheduling an Individual Meeting

The scenario in this section illustrates an individual user scheduling a meeting with a few other users. More advanced forms of group scheduling are covered in Section 2.5.

When the user selects `Meeting` in the `Schedule` menu, the system displays the dialog shown in Figure 28.

2.4.2. Scheduling Tasks

When the user selects `Task` in the `Schedule` menu, the system displays the dialog shown in Figure 29.

2.4.3. Scheduling an Event

When the user selects `Event` in the `Schedule` menu, the system displays the dialog shown in Figure 30.

2.4.4. Details of Recurring Items

When the user checks the `Recurring` box in any scheduling dialog, the data-entry boxes to the right become active, as shown in the dialog excerpt in Figure 31. There are four selections available for the recurring interval: weekly, biweekly, monthly, and yearly. When the user selects the down-pointing arrow in the `Interval` box, the system displays the list of selections, as shown in Figure 32.

2.4.4.1. Weekly and Biweekly Intervals

The default recurring interval is weekly. When either this interval or the biweekly interval is selected, the scheduling dialog contains seven check boxes to the right of the interval selection, one box 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 example, ...

2.4.4.2. Monthly Intervals

When the user selects the monthly interval, the system changes the recurring dialog display as shown in Figure 33. *The deal is that the seven day boxes are replaced with a button labeled "Details". When the user presses this button, the monthly details dialog pops up, a sketch of which follows.*

```
Which months:
   Jan  Feb  Mar  Apr  May  Jun  Jul  Aug  Sep  Oct  Nov  Dec

Which days of the week:
   1st week: S  M  T  W  Th  F  S
   2nd week: S  M  T  W  Th  F  S
   3rd week: S  M  T  W  Th  F  S
   4th week: S  M  T  W  Th  F  S
   5th week: S  M  T  W  Th  F  S
  last week: S  M  T  W  Th  F  S

Which dates (enter dates, 1 - last, separated with spaces or commas):

   -- list of zero or more dates --
```

Notes:

1. Days of week versus dates selections are mutually exclusive. In terms of GUI rendering, if anything is selected in the days display, the date display is greyed out. If anything is typed in the date edit box, the days display is greyed out.

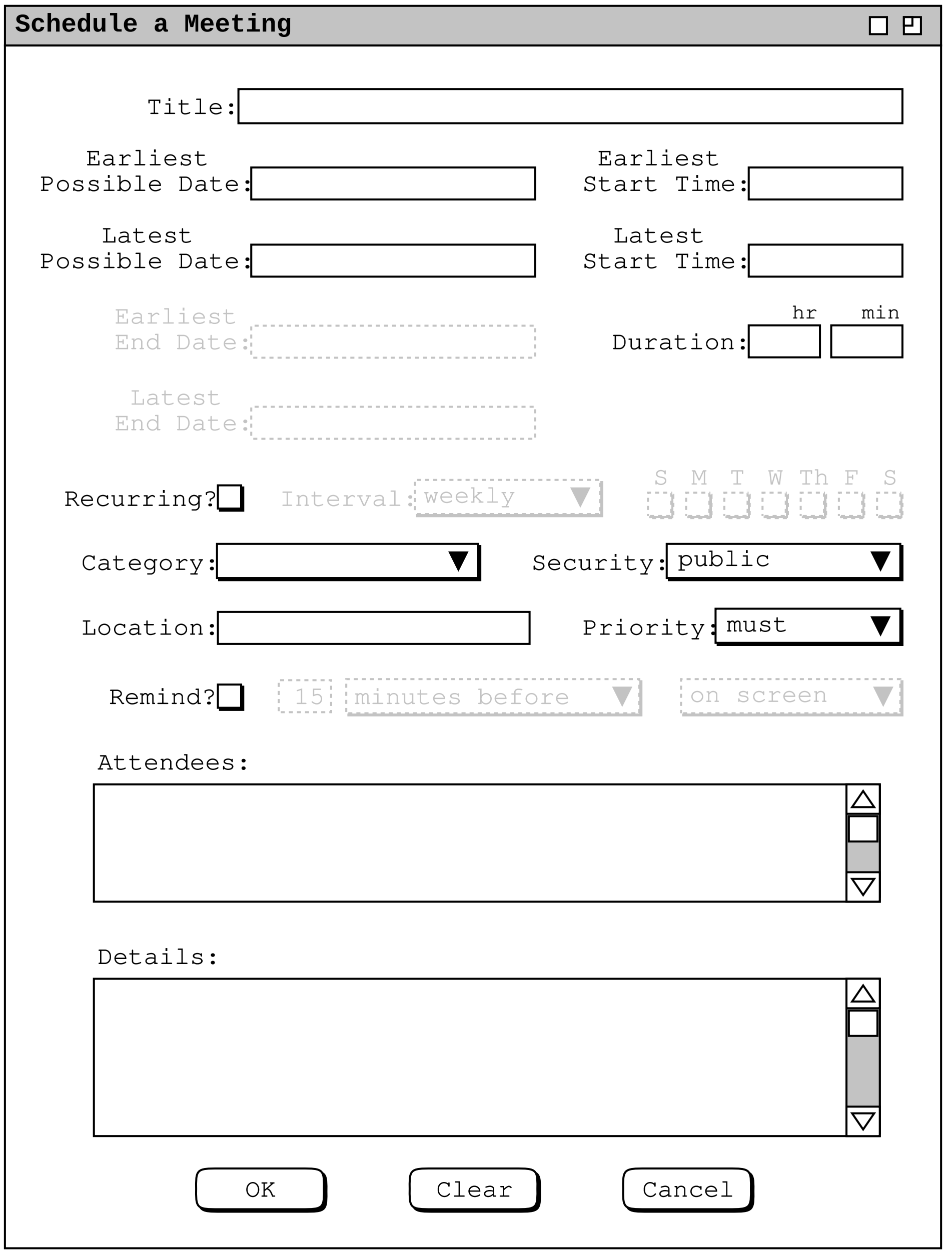


Figure 28: Meeting scheduling dialog.

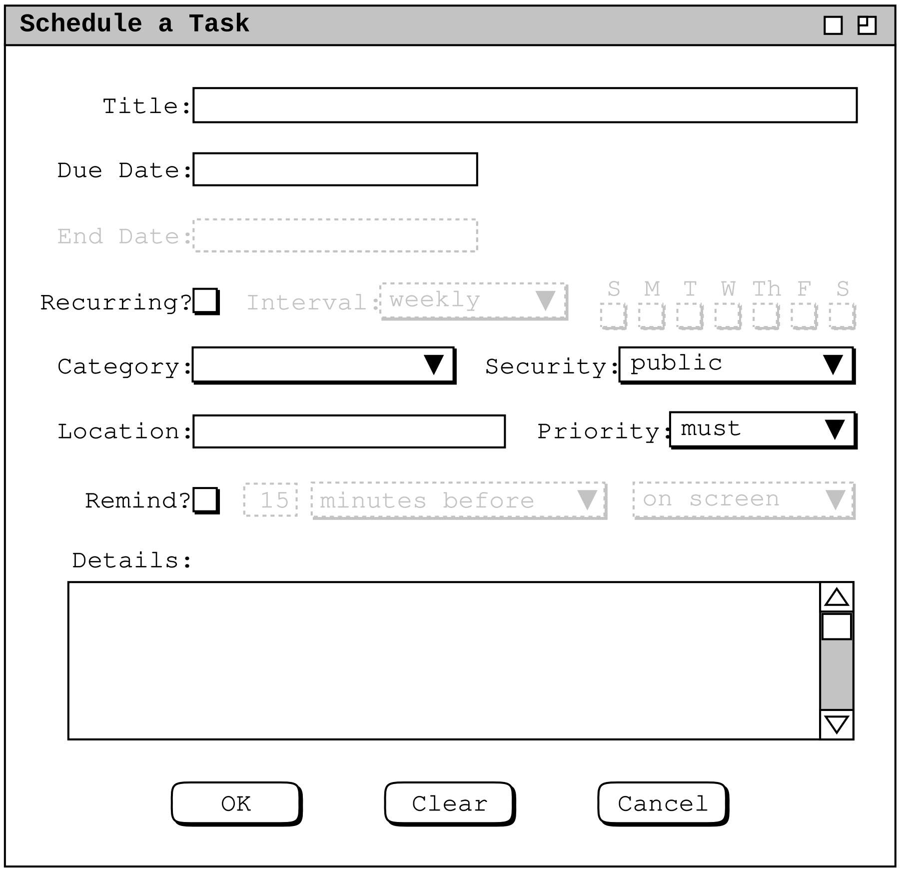


Figure 29: Task scheduling dialog.

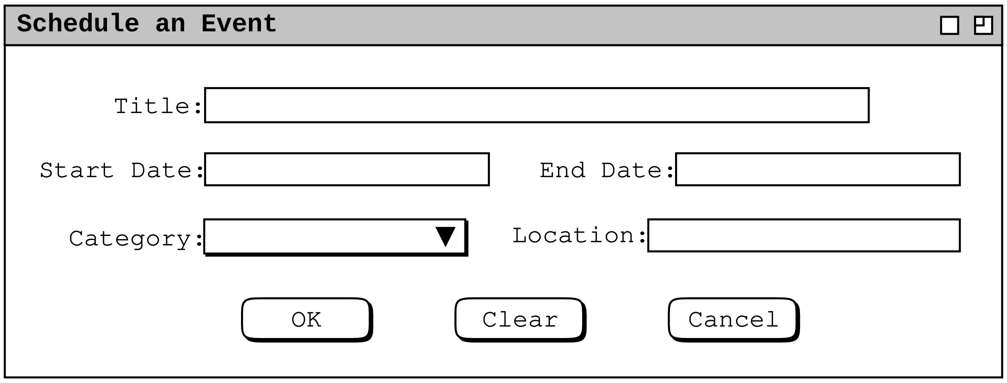


Figure 30: Event scheduling dialog.

Figure 31: Information for a recurring item.

Figure 32: Interval selections.

Figure 33: Monthly interval selected.

2. Details of potential confilcit between specifying some or all of 4th, 5th, and last weeks need to be clearly specified. To whit, for months with 4 weeks only, the specifications for the 5th week do not apply, and the specification for the last week, if present, override any specification for the 4th week, if present. For months with 5 weeks, the specification for the last week, if present, override any specificaiton for the 5th week.

2.4.4.3. Yearly Intervals

Same deal as monthly. I.e., "Details" button which leads to new pop-up dialog. In this case, the pop-up contains a full yearly display, in which the user can select any one or more days on which the item is to recur.

2.4.5. Receiving Reminders

When scheduled items are entered with reminding turned on, the user receives the reminders as specified in the original scheduling dialog. It is important to note that the Calendar system itself need not be running in order for the user to receive reminders, though clearly the computer system on which the Calendar tool is installed must be running.

As described in the earlier scenarios, there are three types of reminders that the user can elect to receive: on-screen message, audible beep, or email message. For example, when it is time for the dentist appointment scheduled in Section 2.2 the user receives the on-screen reminder shown in Figure 34.

In Section 2.4 the user scheduled an event with a 2-day advance email reminder. The reminder message sent by the system for this event is shown in Figure 35.

2.4.6. Changing and Deleting Scheduled Items

2.5. Scheduling Group Meetings

[Make sure the following stuff gets included: the scheduling system automatically figures out if the current user is the leader of one or more of the groups (??or individuals??) listed in the attendees list, and if so prompts with a confirmation that asks if the meeting should be penciled in on those users' calendars.

I'm thinking that we may want to keep it simple here and only allow pencil-in when meetings are scheduled for registered groups. So here's a plausible rule: in the confirmation dialog, the following information/questions are included: (1) You are a leader of the following group(s) whose attendence you've requested; do you want to pencil-in for them? (2) You do not have pencil-in authority over the following user/group calendars: ... ; do you want to send email notices announcing the meeting to these users? (3) the following individually listed attendees are also in one or more of the listed groups:]

The dialog for scheduling a meeting is quite similar to scheduling an appointment. In particular, the following fields are exactly the same in both dialogs: Title, Recurring, Category, Priority, Location,

2.6. Changing and Deleting Scheduled Items

2.7. Administrative Functions

Scenarios in this section illustrate functions available to the system administrator. These functions allow an administrator to update the user, group, room, and global option databases.

Figure 34: Dentist apppointment on-screen reminder.

Figure 35: Event email reminder.

2.7.1. User Database

2.7.1.1. Adding a User

2.7.1.2. Deleting a User

2.7.1.3. Changing a User

2.7.1.4. Finding a User

2.7.2. Group Database *[Include a field that allows the existence of the group and/or its membership to be kept private. Also include confirmation protocol that allows the intended group leader to accept or decline becoming group leader.]*

When the adminstrator assigns one or more users to be a group leader, the assignment does not take effect until the assignee(s) is(are) notified and confirm the assignment. Specifically, when the `uGroup Add` command is confirmed by the administrator, a confirmation requiest is made to each of the assigned group leaders. The form of the confirmation request depends upon the current setting of an assigned leader's reminders options. Specifically, the confirmation requrest is sent immediately as an on-screen pop-up window if the assigned leader has '`on screen`' selected as the default value for receiving reminders. For any other setting default reminders setting, the system sends the leader confirmation request via email.

To avoid the potential difficulties of interfacing the Calendar Tool with a variety of different email systems.

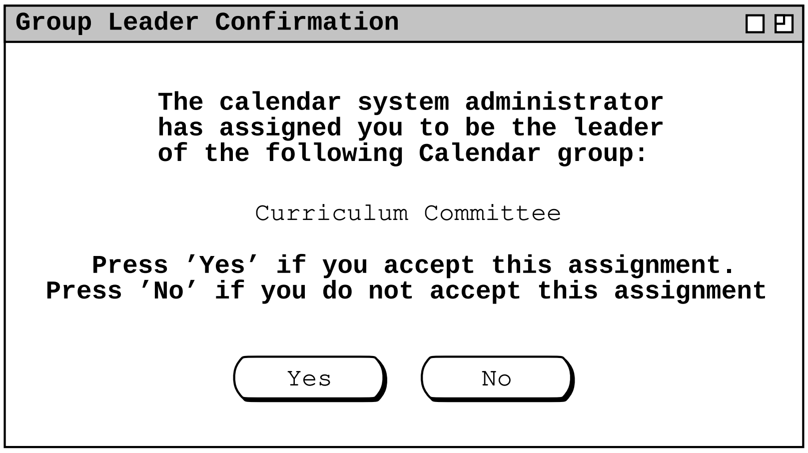


Figure 36: New group leader confirmation.

2.7.3. Room Database

2.7.4. Global Defaults

2.7.5. Group Leader Priveleges

2.8. Details of File Commands

2.9. Details of Edit Commands

Organizationally, this section will need to be broken up into several files. The Preferences section in particular is likely to be large.

2.9.1. 21jun99 Note

Among the more important items to define clerly in this section are the details of how `Edit.Find` works. We should check out how it works in Claris and make sure we have adequate functionality.

2.9.2. Preferences

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

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

2.9.3. Times and Dates

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

2.9.4. Viewing Options

2.9.4.1. List Length

The length of each of the four categories of list is controlled by the dialog shown in figure 37. 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 37 show the user having specified the following format for the display of item lists:

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

2.9.5. Advanced Options

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.

2.10. Help

The Rolodex help was left simple so we could get on with life. A feature that needs to go here that is not in Rolodex help is the +/- explorer-style navigation of the contents window, and problably of the index if the index goes to greater than one level.

Also, there should be a Troubleshooting section at the end of the Users Manual.

2.11. Data Entry Details

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

2.11.1. Date Formats

2.11.2. Scheduling Dialogs

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 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.

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

2.11.2.1. 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.

2.11.3. Required Fields

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 37.

Figure 37: Required fields error dialog.

2.11.4. Selecting Viewing Targets

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 2.12.1 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 38 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.

2.11.5. Deletion of Scheduled Items

2.11.6. 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 calendar system prevents the user from scheduling two or more items with any time overlap. With the second setting, the system allows overlapping items

third option is selected, overlapping items are allowed to be scheduled, and are displayed in horizontally adjacent columns of the daily display.

suppose appointments were scheduled at ... (get info from current sketch file). The daily display form these appointments is shown in Figure 39.

2.12. Error Conditions

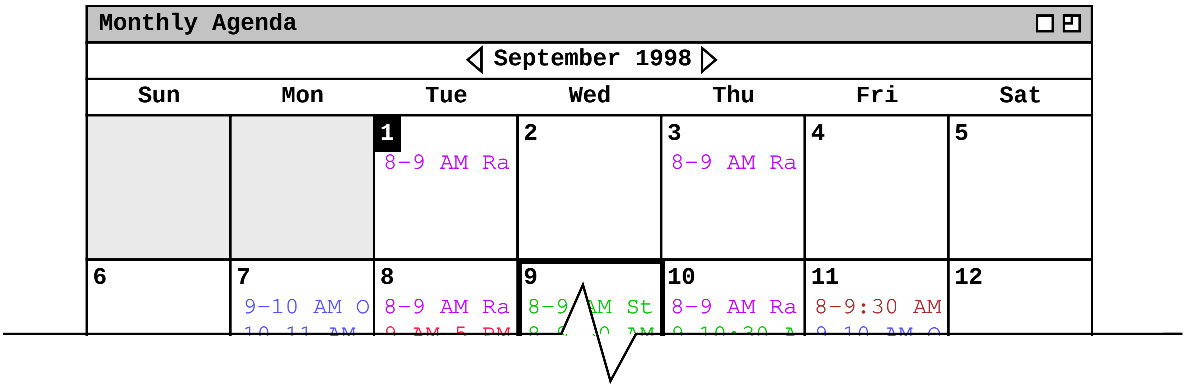


Figure 38: Reverse video selection highlighting.

2.12.1. Commands with No Effect

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

- o *[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.]*
- o *[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.]*

2.13. Graphical User Interface Details

2.13.1. View Command Display Details

2.13.1.1. 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: math_times ×

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 1 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	$72em$ wide; total height is $14V$ + W$1V$ + W$1V$ + W$1V$ + W$1V$, 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 $1p$ and the spelled-out date banner at the top is $1V$ high.

The may change the default font family and size in the preference setting dialog. The font family selected

The default behavior for the `View`

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:

o 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.

o 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 ??.

o 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.

o Dashed lines and down-arrows go off when vertical height is too small -- define "too small" here.

o Resizing behaves as follows:

-- No row in the display will ever shrink smaller than the current setting of the increment size.

-- 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.

-- 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

-- 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.

o 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

2.13.1.2. Details of Horizontal Overlap Display

The example to address here is when in the context of Figure 13 the users 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 somemore 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 (recusively) correct position. "Recursively correct" means in the leftmost column where it will fit such that all criteria are met.

The way Claris Organizer handles overlap in a day view is similar to the above rule, but different given exactly what they're doing. I used the Claris style for help in figuring out how we should do it. We really should look at if and how the is issue is addressed in other tools, particularly outlook.

3. Non-Functional Requirements

See Section 3 of ˜/classes/440/handouts/final-report-overview as well as the Rolodex non-functionals.

4. Developer Overview

5. Rationale

5.1. Misc Ideas from Relatively Early On

The time range; times not in the range will not appear at all until the option value is reset; I'm considering a quick command to toggle between full and reduced display, but maybe it's really just as easy to change the option. This is really a minor ergo matter, but worth considering for its perhaps general applicability. To whit, the reason that a separate toggle-full-partial view command is useful in addition to changing an option setting is that it's typically not that easy to change back to a previous option setting, even with general undo/redo. I.e., the user would go to the options, find the option for how man hours to display in the daily view, change that to 'show full', with presumably a quick way to select 'full', then go back to the daily display. But then if the user wants to change back to the restricted range that was the previous option setting, there seems to be no quick way to do this based on general commands such as undo. We might want to postulate some general way to do this, but it seems rather esoteric and a case where we're trying to get a bit too scientific in the UI design for our own good.

We should consider allowing time range to be changed for a single appt, affecting only a single display, as well as for the full calendar, affecting all daily displays.

What fields of the scheduling details are displayed; depending on how carried away we get here, we could lapse into UI building, which I do *NOT* want to get into in this version of the system. OK, let's not get carried away at all; here's the deal. The only options the user has for display is (i) whether or not the actual time is shown along with the title, (ii) whether or not duration arrows are shown, and (iii) whether or not dashed lines are shown. The precise position of the dashed line is up to the system. A funky thing that can happen is for a really short event, the text height of the event title may be physically taller (in terms of time displacement) than the duration of the event. In order to keep this from happening, the system will automatically adjust the height of the daily display based on the granularity of the time division option set by the user. Specifically: (i) the display always shows one hour granularity of labels; (ii) the height of each hour is equal to one text-line -- NO this sucks -- there should either be no setting of time division at all by the end user (i.e., get rid of the option), or the option setting should only be used to prevent a meeting from being scheduled of a particular duration, but in any case, the time division option should not affect the height of the display. Rather, if a user schedules a bunch of really short meetings within one hour, then some little micro scroll bars should show up in the individual hour that is affected and/or the hour should grow to a different size wrt to the other hours in the day and then if necessary the whole day can be scrolled down to see other hours. YES -- I like the last of these ideas. Viz., that the height of an hour within a day will grow if necessary to show all non-overlapping appts that start (and end, except may for the last), within that hour. The default height for an hour should be two lines, based on the height of the current font. One last thing about the duration arrow -- it won't be drawn if there's not enough vertical room based on the height of an arrow head and some reasonable default for the minimum size of the line tail of the arrow.

5.2. Start/End versus Start/Duration, Revisted

Below it says we've gone start/end time, but I'm leaning towards going back to start time/duration, given that it makes more sense overall. The specific reaons now are: (1) we liked it better in the first place, and I think there was a good reason for this that I've forgotten; (2) the late-night apppointment thing is infrequent, but important enough; (3) the major conceptual problem of distinguishing multi-day recurring from multi-day single I'm pretty sure will be a non-issue when we think it through.

OK, here's the gist of what we've been worried about recently. There's a consistency problem with tasks vis a vis other items when it comes to the due date, particularly with a recurring task. Viz., if there's a fixed due date for a recurring task, what does this mean the due dates are for the tasks that recur. Though I've not looked into it perhaps to the total depth necessary, it appears that both Claris and dtcm have problems here. It's particularly noteworthy in Claris, where in the Task creation dialog, 'Due Date' changes to sense at all.

A related problem is in the creation of the generic ScheduledItem object. Yes, we know of course that inheritance should not drive requirements, but the other way around. That said, there seems to be a good reason for inheritance in the modeling sense, since we would like to use the notion of a generic scheduled item in sorting, and probably other cases. What's useful about generics in these cases is that we can refer to common fields shared by all of the objects. Anyway, if we go for tasks having due dates instead of (start) dates, the structure of the generic scheduled item starts to break down. What happens is we can change the StartDate component to just "Date", but this then lacks modelling power, since the generic "Date" field is in fact interpreted as "Start Date" or "Due Date" in specializations. An alternative is to name the type of the generic field StartOrDueDate, but feels like it's getting pretty hokey.

The serendipitous solution to this mini-mess appears to be the consistent use of duration in all items. In appointments and meetings, it has the obvious meaning, and the UI provides hours and minutes to enter its value. In tasks, the meaning of duration seems pretty clear as well, plus the definition of "due date" is the sum of start date plus duration. This seems to be quite sensible indeed, and the only small drawback is that the words "due date" don't appear explicitly in the task scheduling dialog. However, we may well use the term "due date" in other UI windows, such as some form of task list. (Though such a list may not happen in version 1, for the sake of simplicity.) Also, the UI for duration of tasks and events can include a days entry box (and maybe nix the minutes box), since tasks and events typically span days, whereas appointments and meetings do not. So, the conclusion here is using duration instead of end time seems to work very well overall, and serendipitously allows the ScheduledItem object to be nicely definded.

5.3. Start/End versus Start/Duration (Older Ideas)

We've gone to start/end, since it appears to be the method used in other calendar systems. The reason is probably because of the underlying conceptual problem with start/duration with respect to scheduled items that span a single day. In one sense, it would be nice not to restrict an item to be within one day, particularly for night people who do regularly do things around midnight. Evidently, since there aren't a lot of people like this, calendaring systems don't care that scheduling a meeting to start at 11PM and last to 1AM the next day is a problem.

However, the deep conceptual problem is distinguishing between a multi-day recurring event from a multi-day *single* event. We need to think about this. And I'm not just falling off here -- I really haven't thought it out fully nor do I want to right now.

5.4. Big Issue about Factoring Options

Well, we've never fully come to terms to what exactly an option is and how it should be represented in a UI. This issue comes a bit more into focus when we consider whether UI accesss to options should be distributed accross command menus and individual dialogs and/or centralized in an "centralized" '`options`' menu. There's more to say and think about here.

5.5. Old Remarks from the List Viewing Section

OK, what we need to do is make sense of applying filters to both calendar and list views. I think this can be perfectly sensible, in fact. A potential oddity is filtering a calendar view by date range, since this type of filter seems to make more sense for lists, where it's a way to shorten the lists. However, upon a bit of reflection, a date-filtered calendar view is probably just fine if it means that filtered-out items simply don't show up in whatever calendar views are showing -- which come to think of it is just the normal meaning of filtering (duh). So, for example, if we filter out all but a particular range of dates within a month, in the month view the filtered-out dates are simply displayed as blank. This sounds just fine to me. In the scenario, we'll go through all the other forms of filtering and ensure there sensibleness in both calendar and list views. Cool.

5.6. Filtering Issues

This is potentially a rather complex area. In the style of dialog chosen, one of the key alternatives is whether the "Apply filtering to" choices are one-of radio buttons or multi-select check boxes. At first, the Emacs user in me wanted to make them check boxes, but this is really overly complex and potentially confusing to the user. Hence, for simplicity sake we changed to one-of radio buttons.

The trade-off here is a pretty straightforward of power versus simplicity. The even more specific pro/con is that with check boxes, it's easy to define the same filtering for two or more types of item, whereas with radio buttons the user must repeat the defs for each type. However, the complexity of how consistently to define what selecting one after two have been selected means is high, and any convenience gain is outweighed by the complexity. Plus if we analyze things in terms of how frequently one is likely to do this, the decision was to keep it simple. The future work section discusses the broader issue of much more powerful filtering capabilities.

Appendix A. Users Manual

For organizational clarity, the users manual is presented in a separate stand-alone document. The manual contains no additional information from that presented in the functional requirements of Section 2. Rather, the manual presents Rolodex Tool functionality in a different form than the scenarios. The form is that of a software reference manual, which is terser and less tutorial than the scenario-style form of the requirements.

Appendix B. Help Content

This appendix specifies the complete content delivered for both quick help and detailed help.

B.1. Quick Help Messages

B.2. Detailed Help Content

Appendix C. Feature Comparison Matrix

Features	Microsoft Outlook	Netscape Calendar	Qualcomm Now-Up-to-Date	FileMaker Pro	On Technology Meeting Maker	Proposed
Feature 1						
Feature 1.1						
Feature 1.1.1						
Feature 1.1.2						
Feature 1.1.3						
Feature 1.2						
Feature 1.3						
Feature 1.3.1						
Feature 1.3.2						
Feature 2						
. . .						