Technical Note TN2009

The Browser Control (aka That ListView Thing)

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This Technote presents the Application Programmer's Interface for the DataBrowser control. This new control is available through the Carbon API and was introduced in CarbonLib 1.1. Carbon applications running in Mac OS 8.6 or later with CarbonLib 1.1 can use the DataBrowser control.

The browser control is object oriented in design, and conceptually it serves as a base class that you can use to build your own specialized lists. In its current implementation, the DataBrowser is a small object-oriented hierarchy with two different specializations that are available for use in applications: the column view and the list view. The column view provides the multi-column hierarchical navigation scheme appearing in the file selection lists in Mac OS X. The list view specialization provides a display scheme similar to the one provided by the list manager together with hierarchical display capabilities as found in the Finder's list view. This document discusses the list view specialization of the browser control.

Using DataBrowser will ensure that your lists adhere to the Macintosh Human Interface Guidelines. It also ensures that users will find your lists familiar and easy to understand since they appear and behave in a way that is consistent with the way lists appear and behave in other applications. As well, the DataBrowser does all of its drawing in accordance with the appearance manager. As a result, if your application uses the DataBrowser to display lists, your lists will always be drawn in a way that is consistent with the current appearance settings, whether on Mac OS 9 or Mac OS X. Most importantly, this means that your application running in Mac OS X and using the DataBrowser will have the full benefits of Aqua appearance in the lists it displays. DataBrowser does the difficult user interface work for you, letting you focus on the functionality of your application.

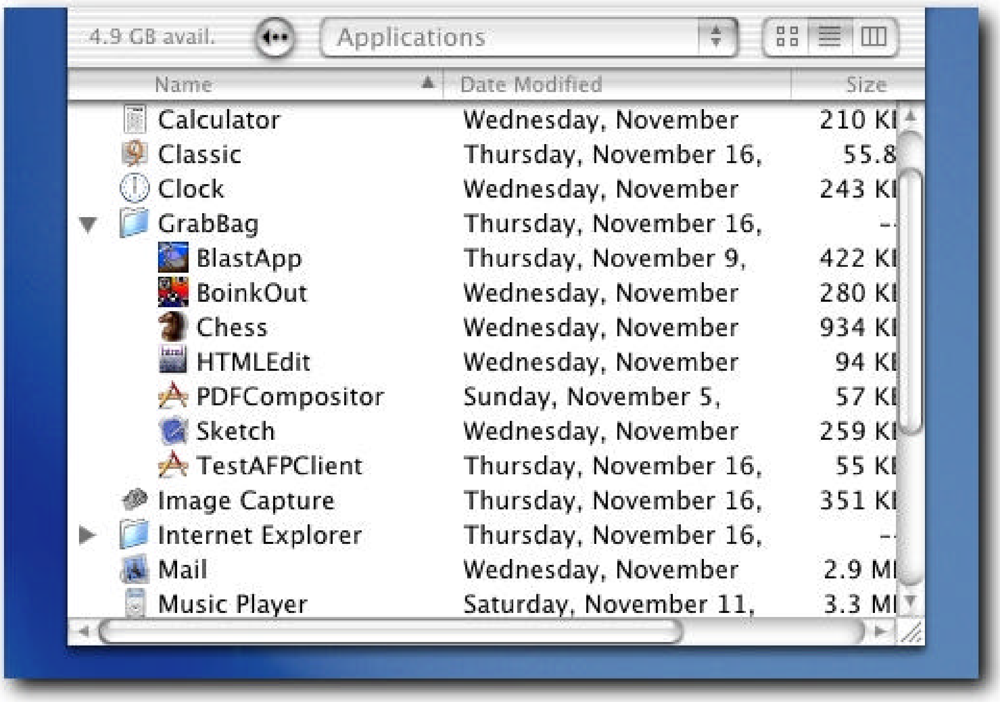
This note is directed at application developers who are interested in using the DataBrowser control in their applications.

Updated: [Dec 05 2000]

Overview

This section provides a description of what the browser control is and definitions for key concepts used in the rest of this document. The main points described in this section include how the DataBrowser interacts with your application, and how both your application and the DataBrowser use ID numbers to reference items displayed in the browser control.

The DataBrowser is a list management utility that allows your application to provide complex lists that have built-in user interaction functionality. Figure 1 provides an illustration of the DataBrowser control in action.



Name	Date Modified	Size
Calculator	Wednesday, November	210 K
Classic	Thursday, November 16,	55.8
Clock	Wednesday, November	243 K
GrabBag	Thursday, November 16,	-
BlastApp	Thursday, November 9,	422 K
BoinkOut	Wednesday, November	280 K
Chess	Wednesday, November	934 K
HTMLEdit	Wednesday, November	94 K
PDFCompositor	Sunday, November 5,	57 K
Sketch	Wednesday, November	259 K
TestAFPClient	Thursday, November 16,	55 K
Image Capture	Thursday, November 16,	351 K
Internet Explorer	Thursday, November 16,	-
Mail	Wednesday, November	2.9 M
Music Player	Saturday, November 11,	3.3 M

Figure 1. An illustration of the DataBrowser being used to display a list of files.

About the DataBrowser....

The DataBrowser is a user interface gadget used to display lists of items inside of windows in your application. The DataBrowser replaces the older List Manager API and surpasses the List Manager API in many ways. Major features found in the DataBrowser that were not supported in the List Manager include:

- No limitation on the number of cells displayed in a list,
- Built-in drag-and-drop handling,
- Built-in display types for text, icons, checkboxes, pop-up menus, progress bars, relevance ranks, and sliders,
- Support for contextual menus and context-sensitive help,
- Built-in text editing for cells displaying text, and
- Built-in hierarchical list support.

The DataBrowser's implementation is object oriented in nature. The List View discussed in this document is only one of the many possible specializations of the DataBrowser's Table View. Figure 2 illustrates the object-oriented hierarchy internal to the DataBrowser. For the purposes of this document, it is useful to be aware of this structure since some of the routines defined for the Table View class can also be used in List View class.

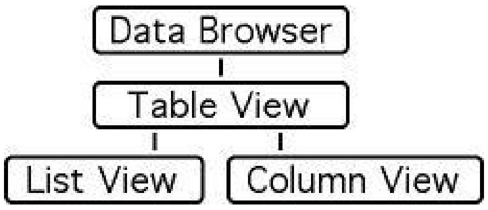


Figure 2. An illustration of the object-oriented hierarchy used inside of the browser control.

In the interfaces you will find routines that appear to reference different parts of this hierarchy. The routines discussed in this document include both routines for the Table View class and routines for the List View class. Table View is really an abstract class, and when you create a browser control of type List View, the List View object will have its own specialized methods for all of the methods defined for the Table View class.

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You call the DataBrowser, the DataBrowser calls you....

The DataBrowser provides your application with sophisticated list display and interaction functionality that is both easy to use and extensible in many ways. To allow this level of fidelity and control, the DataBrowser control uses callbacks to your application at several points during processing where key choices in the interaction process are made. At the very least, your application must provide a routine that allows the data browser to gain access to the information it displays.

Further discussion of how to provide your own callback routines for the DataBrowser control are discussed later in this document starting in the DataBrowser Call-back Routines section.

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Data & the DataBrowser

The DataBrowser control can be used to display a single linear list of data items. When you provide a list of items for display in a DataBrowser control, you do not provide the actual data that will be displayed. Instead, you provide a unique 32-bit ID number that your application can use to refer to the actual data. Whether you store the actual data in memory, on disk, or across a network is entirely up to your application. The DataBrowser control uses these ID numbers when it is drawing the list of items to ask your application for information about particular properties of the data items that are being drawn in the display as that information is required.

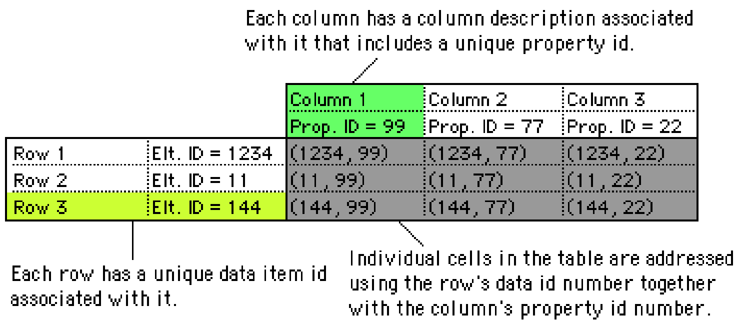
Each column has a column description associated with it that includes a unique property id.
Column 1
Prop. ID = 99
Column 2
Prop. ID = 77
Column 3
Prop. ID = 22
Row 1
Elt. ID = 1234
(1234, 99)
(1234, 77)
(1234, 22)
Row 2
Elt. ID = 11
(11, 99)
(11, 77)
(11, 22)
Row 3
Elt. ID = 144
(144, 99)
(144, 77)
(144, 22)
Each row has a unique data item id associated with it.
Individual cells in the table are addressed using the row's data id number together with the column's property id number.

Figure 3. How Data ID numbers are used together with Property ID numbers to address particular rows in a table.

The values your application uses as data item ID numbers are entirely up to you. The only requirement is that the values are non-zero. (The value `zero` is used internally by the Data Browser in a way similar to the `NULL` pointer to indicate that a row has no data item associated with it.) For example, some possibilities for data item ID numbers you may use are pointer values, data file offsets, or 32-bit TCP/IP host addresses. Whenever the DataBrowser needs to display the data for a particular data item, it will ask your application for the data associated with the data item ID number you provided.

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Rows

Each row in a table displayed by the DataBrowser control has a unique data item ID number associated with it, together with some flags describing state information related to the row. Figure 4 provides a view of the values associated with each row in a list displayed by the DataBrowser control.

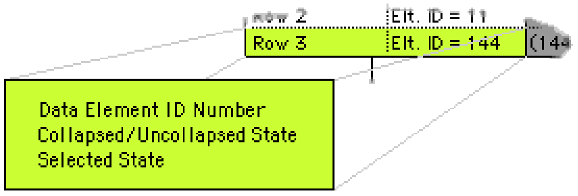

Figure 4. Information maintained by the DataBrowser for each row displayed in a DataBrowser control.

The selection state reflects the selection state of the item. The collapsed/uncollapsed state is used in hierarchical lists that feature turn-down arrows that open sub-lists. These flags are read-only states associated with rows displayed in the list: an application can query these values using DataBrowser routines.

Definition 1. Data Element ID or **Data ID.**
Any non-zero, 32-bit value uniquely identifying a data element being displayed in a list. Data ID values map to rows in the tables displayed by the DataBrowser. Data ID values need not be in any particular order, and the values used are entirely up to the application.

The constant `kDataBrowserNoItem` is a special Data ID value used by the DataBrowser to mean "none of the Data ID numbers currently stored in the browser control." Its usage is analogous to the `NULL` pointer in C.

Concepts relating to specifying the Data ID numbers that will be used to display a list are discussed in the Adding Rows section.

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Columns

For every column that is to be displayed in a table, the application must provide a number of parameters governing how the column will be displayed. One of these parameters is a non-zero, 32-bit value called the column's Property ID number. Together with the data item ID number, property numbers are used to refer to individual cells in the table during callbacks to the application. Figure 3 illustrates how the DataBrowser uses Property ID numbers together with Data ID numbers to reference particular cells in the tables it displays. As with Data ID numbers, the values an application chooses to use as Property ID numbers are completely arbitrary.

Definition 2. Property ID.

Any non-zero, 32-bit unsigned integer value that uniquely identifies a column in a table being displayed by the DataBrowser. Property ID numbers do not need to be ordered or sequential, and the values used are entirely up to the application. Property ID values 0 through 1023 are reserved by Apple for use in the DataBrowser control.

The constant `kDataBrowserItemNoProperty` is a special Property ID value used by the DataBrowser to mean "none of the Property ID numbers (columns) currently stored in the browser control." Its usage is analogous to the `NULL` pointer in C.

Other information an application provides when a column is being added to a table includes the column's title, formatting information for the title, and some other parameters governing the format of the information displayed. Figure 5 provides and expanded view of some of the information associated with a column.

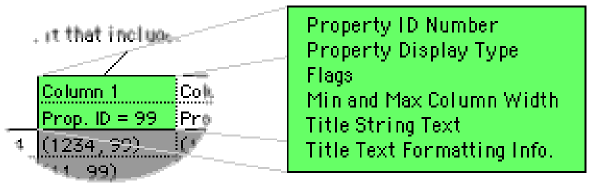

Figure 5. Information associated with each column.

Later sections will discuss this information in greater detail; however, at this point, it is worthwhile to take note of the property display type that is associated with a column. For convenience, the DataBrowser pre-defines several display types including strings, pop-up menus, icons, pictures, and buttons. It is also possible for applications to implement their own custom display types through callback routines. We revisit this subject later in the Defining Columns and Defining Custom Columns sections.

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Cells

As shown in Figure 3, particular cells displayed in the tables drawn by the DataBrowser control are addressed using a combination of the Data ID assigned to the row and the Property ID assigned to the column.

Definition 3. Cell.

A Data ID together with a Property ID uniquely identifies a cell in a table displayed by the DataBrowser. A cell corresponds to a location inside of a Data Browser list that is at the intersection of a row and a column.

Individual cells are used to display facets of the data items being displayed in a list. The method used to display the cell's contents is governed by its Property ID.

The concepts presented in this section describe how the DataBrowser control represents data. It does not necessarily entail that your application must use this same data model for the information it is displaying in a Data Browser control; however, if an application has its own data model, then the application must provide the mapping between the structures expected by the DataBrowser and its own internal representation. As will be shown in later sections, the DataBrowser control has been designed to accommodate developers providing a mapping between their own data model and the data model used by the DataBrowser.

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Creating DataBrowser Controls

This section discusses about how you can create and initialize a new DataBrowser control inside of your application. Basic structures and operations for adding columns and rows to a browser control are discussed. The structures used to define columns allow your application to provide columns that utilize any of the pre-defined display types such as checkboxes, menus, icons, or text, while at the same time allowing you to design your own presentation mechanisms used when drawing columns. Listing 1 illustrates how an application would add a column to a browser control.

DataBrowser controls can be created using the `CreateDataBrowserControl` routine. Once a control has been created, applications can proceed to install their own custom callback routines, columns, and rows.

The CreateDataBrowserControl routine.

```
    OSStatus CreateDataBrowserControl(
        WindowRef window,
        const Rect *boundsRect,
        DataBrowserViewStyle style,
        ControlRef *outControl);
```

- **window** - the window where the control should be placed.
- **boundsRect** - location where the control should appear in the window.
- **style** - the view style that should be used when the control is drawn. Currently, the only view styles defined are `kDataBrowserListView` and `kDataBrowserColumnView`. This document's primary focus is the `kDataBrowserListView` type.
- **outControl** - if the control has been successfully created, then it will be returned in the location referenced by this parameter.

When an application is finished with a DataBrowser control, it can call `DisposeControl` to release the memory occupied by the control. If an application has allocated any special UPPs for use in the DataBrowser control, then it should de-allocate these after disposing of all of the DataBrowser controls where they were installed.

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Defining Columns

Columns have both a unique `Property ID` number associated with them along with information governing the appearance of the information displayed in the column. This information is specified by an application in a `DataBrowserListViewColumnDesc` structure. It is the application's responsibility to fill in all of the fields in this structure before providing it to a DataBrowser control.

The DataBrowserListViewColumnDesc Structure

```
enum {
    kDataBrowserListViewLatestHeaderDesc = 0
};

typedef struct DataBrowserListViewHeaderDesc
        DataBrowserListViewHeaderDesc;

typedef struct DataBrowserListViewColumnDesc
        DataBrowserListViewColumnDesc;

typedef struct DataBrowserPropertyDesc
        DataBrowserTableViewColumnDesc;


struct DataBrowserListViewColumnDesc {
    DataBrowserTableViewColumnDesc propertyDesc;
    DataBrowserListViewHeaderDesc headerBtnDesc;
};

struct DataBrowserPropertyDesc {
    DataBrowserPropertyID propertyID;
    DataBrowserPropertyType propertyType;
    DataBrowserPropertyFlags propertyFlags;
};

struct DataBrowserListViewHeaderDesc {
    UInt32 version; /* Use kDataBrowserListViewLatestHeaderDesc */
    UInt16 minimumWidth;
    UInt16 maximumWidth;

    SInt16 titleOffset;
    CFStringRef titleString;
    DataBrowserSortOrder initialOrder;
    ControlFontStyleRec btnFontStyle;
    ControlButtonContentInfo btnContentInfo;
};
```

- **propertyDesc**. This field contains information about the property attached to the column. See the description of the DataBrowserPropertyDesc type for more information.
- **headerBtnDesc**. This field contains information about the appearance of the column heading. See the description of the DataBrowserListViewHeaderDesc type for more information.

The DataBrowserPropertyDesc sub-record

The `DataBrowserPropertyDesc` contains information about the `Property ID` associated with the column described in the `DataBrowserListViewColumnDesc`. Specific values that can be stored in this structure are described in the following.

The DataBrowserPropertyDesc Structure

```
typedef struct DataBrowserPropertyDesc
    DataBrowserTableViewColumnDesc;

struct DataBrowserPropertyDesc {
    DataBrowserPropertyID propertyID;
    DataBrowserPropertyType propertyType;
    DataBrowserPropertyFlags propertyFlags;
};
```

- **propertyID**. This field contains a 32-bit integer value that uniquely identifies this column. It is the `Property ID` that your application uses to identify the column. This `Property ID` number will also be used by the DataBrowser to identify the column in callbacks to your application. The DataBrowser interfaces use the type `DataBrowserPropertyID` for Property ID values.
- **propertyType**. This field contains a 32-bit `OSType` value that indicates the type of data that is to be displayed in the column. At the time of this writing, permissible values for use in this field are as follows:
    - `kDataBrowserCustomType` - No associated data type; custom callbacks used.
    - `kDataBrowserIconType` - `IconRef`, `IconTransformType`, and `RGBColor`.
    - `kDataBrowserTextType` - `CFStringRef` for displaying text.
    - `kDataBrowserDateTimeType` - `DateTime` or `LongDateTime`.
    - `kDataBrowserCheckboxType` - `ThemeButtonValue`.
    - `kDataBrowserProgressBarType` - Min, Max, and Value.
    - `kDataBrowserRelevanceRankType` - Min, Max, and Value.
    - `kDataBrowserSliderType` - Min, Max, and Value.
    - `kDataBrowserpop-upMenuType` - MenuRef displays pop-up menus.
    - `kDataBrowserIconAndTextType` - `IconRef` and `CFStringRef` together as icons with text.
- **propertyFlags**. This field contains a 32-bit integer value of type `DataBrowserPropertyFlags` containing flags controlling the display or interaction provided by this column. The following constants define mask values that can be used to set particular flags in this field. All unused bits in this field are currently reserved for future use.
    - `kDataBrowserDefaultPropertyFlags` - this constant contains the default property flags that should be used to initialize the `propertyFlags` field if no other flags are required.

- `kDataBrowserRelativeDateTime` - this flag is only used if the `propertyType` field is set to the constant `kDataBrowserDateTimeType`. When this flag is specified, date values close to the current date will be displayed as relative dates.
- `kDataBrowserPropertyIsEditable` - this flag may be set if the values being displayed in the column can be changed. If an application specifies this flag, then the application must also provide a callbacks that allow the DataBrowser to both retrieve and store data values displayed in this column.

Note:
The DataBrowser requires the `kDataBrowserPropertyIsEditable` flag to be set in order to enable editing of any changeable display type (namely checkboxes, pop-up menus, etc). Be sure your application is setting the `kDataBrowserPropertyIsEditable` flag when defining columns containing checkboxes, menus, and so forth.

The DataBrowserListViewHeaderDesc sub-record

`DataBrowserListViewHeaderDesc` contains a number of fields describing the appearance of the column's title. Specific contents of the fields in the structure are as follows:

The DataBrowserListViewHeaderDesc Structure

```
struct DataBrowserListViewHeaderDesc {
    UInt32 version; /* Use kDataBrowserListViewLatestHeaderDesc */

    UInt16 minimumWidth;
    UInt16 maximumWidth;

    SInt16 titleOffset;
    CFStringRef titleString;
    DataBrowserSortOrder initialOrder;
    ControlFontStyleRec  btnFontStyle;
    ControlButtonContentInfo  btnContentInfo;
};
```

- **version**. The version field identifies the format of the structure. You should always set this field to the value `kDataBrowserListViewLatestHeaderDesc`.
- **minimumWidth**. For resizable columns, this field contains the smallest width that the column can be resized to. If the column is not resizable, then `minimumWidth` should be set to the same value as `maximumWidth`.
- **maximumWidth**. For resizable columns, this field contains the largest width that the column can be resized to. If the column is not resizable, then `maximumWidth` should be set to the same value as `minimumWidth`.
- **titleOffset**. This field contains an offset in pixels from the left side of the title column where the title text will be drawn. Both the `titleAlignment` and the `titleOffset` fields dictate the alignment and offset (inset by default) of the content of the column when displaying one of the pre-defined content types.
- **titleString**. This field contains the text that is to be drawn as the column's titled. `titleString` may be `NULL` to indicate that no string is to be displayed.
- **initialOrder**. This field contains a value of type `DataBrowserSortOrder`. `initialOrder` is the initial sort ordering presentation for the column when that column is the current sort column. Once the DataBrowser is visible, the user may change this via direct manipulation. Setting this value to anything other than `kDataBrowserOrderDecreasing` will map to `kDataBrowserOrderIncreasing`. `initialOrder` may be assigned one of the following values:
  - `kDataBrowserOrderUndefined` - this value is currently not supported.
  - `kDataBrowserOrderIncreasing` - means this column is to be sorted in ascending order.
  - `kDataBrowserOrderDecreasing` - means this column is to be sorted in descending order.
- **btnContentInfo**. Contains a structure of type `ControlButtonContentInfo`. This structure describes the contents of the column heading and how it should be drawn. Only text-only and `IconRef` (& text) are supported.

- **btnFontStyle**. This field contains a structure of type `ControlFontStyleRec` that defines the text style used for the column heading.

Installing Columns

Once an application has initialized the `DataBrowserListViewHeaderDesc` structure with all of the values it requires, then the application can install the column in a DataBrowser control by calling the `AddDataBrowserListViewColumn` routine.

The AddDataBrowserListViewColumn routine

```
    OSStatus AddDataBrowserListViewColumn(
        ControlRef browser,
        DataBrowserListViewColumnDesc *columnDesc,
        UInt32 position);
```

- **browser** - a DataBrowser control created by the `CreateDataBrowserControl` routine.
- **columnDesc** - a record of type `DataBrowserListViewColumnDesc` with all of its fields initialized to their appropriate values.
- **position** - refers to the position among the columns that are already installed in the DataBrowser where this column should be inserted. To insert this column to the right of all other columns, provide a very large value such as `ULONG_MAX`.

Returns an operating system result code describing the success of the operation. The code `noErr` will be returned if the operation was successful. `paramErr` will be returned if the `columnDesc` record is not formatted correctly.

The routine `AddDataBrowserListViewColumn` assumes that the `DataBrowserListViewColumnDesc` has been set up by your application to describe the column being added to the list. The application must set all of the fields in this record, including the reserved fields (that must be set to `-1`) before calling `AddDataBrowserListViewColumn`. Listing 1 provides an example showing how you would go about adding a new column to a DataBrowser control.

Listing 1. Adding a new column to a DataBrowser control.

```
DataBrowserListViewColumnDesc columnDesc;

columnDesc.propertyDesc.propertyID = kCheckboxColumn;
columnDesc.propertyDesc.propertyType = kDataBrowserCheckboxType;
columnDesc.propertyDesc.propertyFlags = kDataBrowserDefaultPropertyFlags;

columnDesc.headerBtnDesc.minimumWidth = 30;
columnDesc.headerBtnDesc.maximumWidth = 30;

columnDesc.headerBtnDesc.titleAlignment = teCenter;

columnDesc.headerBtnDesc.titleFontTypeID = kControlFontViewSystemFont;
columnDesc.headerBtnDesc.titleFontStyle = normal;
columnDesc.headerBtnDesc.titleOffset = 0;

columnDesc.titleString = CFStringCreateWithPascalString(
    CFAllocatorGetDefault(), "\p", kCFStringEncodingMacRoman);

AddDataBrowserListViewColumn(a_browser, &columnDesc, ULONG_MAX),
```

In this example, the column being added to the browser control will be a fixed-width column containing checkboxes. All of the user interactions related to those checkboxes will be handled automatically be the browser control.

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Installing Rows

Adding rows to a DataBrowser control is simply a matter of providing a list of Data ID numbers that you would like to display in the control. Routines for adding rows are described in the Providing Data section below.

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Providing and Ordering Your Data

As discussed earlier, the DataBrowser control itself does not store any of the data displayed in the list. The data itself is provided by your application's clientDataCallback routine that you provide in the DataBrowserCallbacks structure. Internally, though, the DataBrowser stores 32-bit key values that it passes to your clientDataCallback routine that your application can use to retrieve the data being requested. Listing 6 illustrates how your clientDataCallback should translate these ID numbers to look up and data values as requested by the DataBrowser. This section describes routines your application can use to provide and modify the Data ID values being used by the DataBrowser control for displaying data.

Providing Data

The `AddDataBrowserItems` and `RemoveDataBrowserItems` routines can be used to modify the list of Data ID values that are being displayed in the list. In addition, by using `AddDataBrowserItems`' `container` parameter, an application can construct a hierarchical list of items that can be displayed with turn-down arrows. For more information about routines available for managing hierarchical lists, see the section Managing Hierarchical Lists section.

The AddDataBrowserItems routine.

```
    OSStatus AddDataBrowserItems(
        ControlRef browser,
        DataBrowserItemID container,
        UInt32 numItems,
        const DataBrowserItemID *items,
        DataBrowserPropertyID preSortProperty);
```

- **browser** - a DataBrowser control created by a call to `CreateDataBrowserControl`.
- **container** - if the items being installed are sub-items of another data element already installed in the browser control, then this parameter should contain the Data ID of that data element. Otherwise, if the items have no parent data element, then you can provide the constant `kDataBrowserNoItem` as this argument. The `container` parameter can be used to construct hierarchical lists for display. **NOTE:** adding an item to a container item will have the side effect of opening that container item.
- **numItems** - the number of items in the array pointed to by the items parameter.
- **items** - points to an array of unsigned long integers containing the Data ID numbers of items that are to be added. **Note:** If `items` is set to `NULL`, then the data browser will automatically generate and add the Data ID numbers 1, 2, ..., `numItems` to the browser control.
- **preSortProperty** - If the array of items have been sorted according to the sorting order currently in use in one of the columns in the list being displayed, then you can use this parameter to reference this column. This will allow the DataBrowser to skip the sorting step if the values are already in the correct order.

Returns an operating system result code describing the success of the operation. The code `noErr` will be returned if the operation was successful.

If the new items being added to the browser control will appear in the visible part of the list, then they will be drawn to the screen. Applications constructing hierarchical lists must proceed in a top-down fashion when installing the Data IDs in the browser control. Once a Data ID has been installed in a browser control, it is possible to associate a list of Data ID numbers with it as sub-items.

IMPORTANT:
Adding items to an existing item (as the parent) means that the specified parent item must be classified as a container. This means that when the DataBrowser asks for the `kDataBrowserItemIsContainerProperty` of the specified parent item, the answer must be `true`. If your application does not provide this condition, then the `AddDataBrowserItems` call will fail.

Listing 2 illustrates some possible ways you can go about adding a sequence of Data ID numbers to a browser control. Of course, the numbers you decide to use in your application will depend on what is most appropriate for the particular data set you are trying to display.

Listing 2. Adding a sequence of Data IDs (rows) to a browser control.

```
#define kMyItemCount 22

    DataBrowserItemID newitems[kMyItemCount];
    long i;

        /* add a bunch of generated ID
        numbers to the control */
    for (i = 0; i < kMyItemCount; i++) {
            /* Make some arbitrary ID value.  The only
            requirement is that it be unique. */
        newitems[i] = ( i<<12 ) + (4095 ^ i);
    }
    AddDataBrowserItems(mybrowser, kDataBrowserNoItem,
            kMyItemCount, items, kDataBrowserItemNoProperty);


        /* instead of indexes or codes, let's use
        picture references.  Of course, we're assuming we
        have a resource file set up with picture resources
        128, 129, ... */
    for (i = 0; i < kMyItemCount; i++) {
        newitems[i] = (DataBrowserItemID) GetResource('PICT', i+128);
        if (newitems[i] == NULL) { err = resNotFound; goto bail; }
    }
    AddDataBrowserItems(some_other_browser, kDataBrowserNoItem,
            kMyItemCount, items, kDataBrowserItemNoProperty);


        /* let's just use the numbers 1, 2, ..., kMyItemCount.  We
        only have kMyItemCount items to display, so why not just
        number them from 1 to kMyItemCount.  In this case, we don't
        need to provide an array of ID numbers - the browser will
        generate them the ID numbers for us.  */
    AddDataBrowserItems(yet_another_browser, kDataBrowserNoItem,
            kMyItemCount, NULL, kDataBrowserItemNoProperty);
```

The RemoveDataBrowserItems can be used to remove Data IDs from the list of Data ID numbers internally maintained by the DataBrowser. If one of the Data IDs you provide refers to a container item that has a number of sub items, then those sub-items will be removed from the list as well.

The RemoveDataBrowserItems routine.

```
    OSStatus RemoveDataBrowserItems(
        ControlRef browser,
        DataBrowserItemID container,
        UInt32 numItems,
        const DataBrowserItemID *items,
        DataBrowserPropertyID preSortProperty);
```

- **browser** - a DataBrowser control created by a call to `CreateDataBrowserControl`.
- **container** - if the items being removed are sub-items of another data element already installed in the browser control, then this parameter should contain the Data ID of that data element. Otherwise, if the items have no parent data element, then you can provide the constant `kDataBrowserNoItem` as this argument.
- **numItems** - the number of items in the array pointed to by the items parameter.
- **items** - points to an array of unsigned long integers containing the Data ID numbers of items that are to be removed. If this parameter is set to `NULL`, then all of the items will be removed. If this parameter is `NULL`, then all of the items in the container item referenced by the `container` parameter will be removed. If `items` is `NULL`, then the numItems parameter is ignored.

- **preSortProperty** - if the array of items has already been sorted, then set this parameter to the Property ID of the column that has the same sorting order.

Returns an operating system result code describing the success of the operation. The code `noErr` will be returned if the operation was successful.

The `GetDataBrowserItems`, the `GetDataBrowserItemCount`, and the `ForEachDataBrowserItem` routines can be used to walk through the Data IDs your application has installed for the DataBrowser control.

The GetDataBrowserItems routine.

```
OSStatus GetDataBrowserItems(
    ControlRef browser,
    DataBrowserItemID container,
    Boolean recurse,
    DataBrowserItemState state,
    Handle items);
```

- **browser** - a DataBrowser control created by a call to `CreateDataBrowserControl`.
- **container** - to obtain a list of items displayed at the top level of the control's display, provide the constant `kDataBrowserNoItem`. Otherwise, to obtain a list of items that are organized as sub-items of a container item, provide the container item's Data ID.
- **recurse** - When this parameter is true, `GetDataBrowserItems` will return a flattened list of all of the data IDs stored in the DataBrowser as sub-items of container parameter. The list will be created using a in-order traversal of the Data ID hierarchy maintained internally by the DataBrowser.
- **state** - When this field is non-zero, only items with this state will be incorporated into the result.
- **items** - should contain a new zero-length handle. Upon return, the contents of this handle will be set to contain an array of Data ID numbers for the items that match the criteria provided by other parameters.

Returns an operating system result code describing the success of the operation. The code `noErr` will be returned if the operation was successful.

`GetDataBrowserItems` is a powerful routine for gathering information about the items being displayed in a DataBrowser during user interaction sequences. For example, to obtain a list of all of the selected items in a list, your application would call the `GetDataBrowserItems` as shown in Listing 3. The example to `GetDataBrowserItems` in Listing 3 calculates both the number of items in the selection and it creates a list of the Data ID numbers in the selection. If your application is only interested in determining the number of items in the selection (and not the Data IDs of those items), then you should use the `GetDataBrowserItemCount` routine as shown in Listing 4.

Listing 3. Obtaining a list of all of the selected items in a browser control.

```
Handle selectedItems;
OSStatus err;
UInt32 selectionCount;
selectedItems = NewHandle(0);
if (selectedItems == NULL) { err = memFullErr; goto bail; }
err = GetDataBrowserItems(browser,
    kDataBrowserNoItem,  /* start searching at the root item */
    true, /* recursively search all subitems */
    kDataBrowserItemIsSelected, /* only return selected items */
    selectedItems);
if (err != noErr) goto bail;
selectionCount = (GetHandleSize(selectedItems) /
                         sizeof(DataBrowserItemID));
```

This is a one-step call that provides a complete list of all of the items the user has highlighted in the browser control.

Note:

When the `recurse` parameter to the `GetDataBrowserItems` is set to `true`, the routine will flatten an entire hierarchy into a single vector of Data ID numbers, but, when it does so, it does not encode any information about that hierarchy into the list of returned Data ID numbers. If your application requires the sort of functionality where it would like to save and restore a hierarchy of Data IDs as they are displayed in a DataBrowser control, then you should build that functionality yourself using combinations of the routines described in this section.

The GetDataBrowserItemCount routine.

```
    OSStatus GetDataBrowserItemCount(
        ControlRef browser,
        DataBrowserItemID container,
        Boolean recurse,
        DataBrowserItemState state,
        UInt32 *numItems);
```

- **browser** - a DataBrowser control created by a call to `CreateDataBrowserControl`.
- **container** - to obtain a list of items displayed at the top level of the control's display, provide the constant `kDataBrowserNoItem`. Otherwise, to obtain a list of items that are organized as sub-items of a container item, provide the container item's Data ID.
- **recurse** - When this parameter is true, `GetDataBrowserItemCount` will return the number of all of the data IDs stored in the DataBrowser as sub-items of container parameter.
- **state** - When this field is non-zero, only items with this state will be counted.
- **numItems** - The total number of items found is returned in the unsigned 32-bit integer referenced by this parameter.

Returns an operating system result code describing the success of the operation. The code `noErr` will be returned if the operation was successful.

The routine `GetDataBrowserItemCount` is useful for performing quick inquiries about the state of the items being displayed in a browser control. For example, Listing 4 illustrates how you could go about finding out how many items are selected in the browser control. This routine provides a fast efficient mechanism for an application to perform such inquiries.

Listing 4. Counting the number of selected rows in a browser control.

```
    UInt32 selectionCount;
    OSStatus err;
    err = GetDataBrowserItemCount(myBrowserControl,
        kDataBrowserNoItem,  /* start searching at the root item */
        true, /* recursively search all subitems */
        kDataBrowserItemIsSelected, /* only return selected items */
        &selectionCount);
    if (err != noErr) goto bail;
    if (selectionCount > 0) { ...
```

For enumerating the Data ID numbers stored in a DataBrowser control or performing some operation for each of those items, your application can use the `ForEachDataBrowserItem` routine. One of the parameters to this routine is a callback procedure that will be called for each of the Data ID numbers referenced by the other parameters to this routine.

The ForEachDataBrowserItem routine.

```
typedef void (*DataBrowserItemProcPtr)(
        DataBrowserItemID item,
        DataBrowserItemState state,
        SInt32 clientData);

    typedef DataBrowserItemProcPtr DataBrowserItemUPP;


    OSStatus ForEachDataBrowserItem(
        ControlRef browser,
        DataBrowserItemID container,
        Boolean recurse,
        DataBrowserItemState state,
        DataBrowserItemUPP callback,
        SInt32 clientData);
```

- **browser** - a DataBrowser control created by a call to `CreateDataBrowserControl`.
- **container** - to have your callback called for all of the items displayed at the top level of the control's display, provide the constant `kDataBrowserNoItem`. Otherwise, to have your callback called for all of the items that are organized as sub-items of a container item, provide the container item's Data ID.
- **recurse** - When this parameter is true, `ForEachDataBrowserItem` will call the callback routine for all of the data IDs stored in the DataBrowser as sub-items of container parameter.
- **state** - When this field is non-zero, only items with this state will be counted.
- **callback** - a UPP referencing your callback routine. The `DataBrowserItemProcPtr` declaration above shows how this routine should be defined in your application. This routine will be called for every Data ID currently stored in the browser control matching the criteria you provide in the other `ForEachDataBrowserItem` parameters.
- **clientData** - this is a reference value passed through to your callback routine. Its contents are defined by the application.

Returns an operating system result code describing the success of the operation. The code `noErr` will be returned if the operation was successful.

The `ForEachDataBrowserItem` routine is especially useful for situations where you would like to enumerate and perform some operation on some set of Data ID numbers. Listing 5 illustrates how your application could use the `ForEachDataBrowserItem` to perform some additional filtering when selecting Data ID numbers. `ForEachDataBrowserItem` is a powerful routine that allows your application to perform complex inquiries about the Data IDs stored in a data browser control; however, before calling this routine for all of the inquiry operations required by your application you should consider whether it would be more appropriate to call either `GetDataBrowserItems` or `GetDataBrowserItemCount`.

Listing 5. Enumerating and acting on certain items in the selection.

```
static Handle gCollector = NULL;
OSStatus gCoStatus = noErr;

/* in our item callback routine, we add any of the items
that satisfy some interesting criteria to the list of
data ID numbers we are accumulating in the handle
referenced by the global variable gCollector. */
static void MyDataBrowserItemProc( DataBrowserItemID item,
     DataBrowserItemState state, SInt32 clientData) {
    if (gCoStatus == noErr && clientData == 'Yeah') {
    if ( SatisfiesSomeInterestingCriteria(item) ) {
        gCoStatus = PtrAndHand(&item, gCollector, sizeof(item));
    }
}
}

....
    OSStatus err;
    DataBrowserItemUPP myItemProc;
    UInt32 selectionCount;

    gCoStatus = noErr;
    gCollector = NewHandle(0);
    if (gCollector == NULL) { err = memFullErr; goto bail; }

    /* set up our callback's routine descriptor */
    myItemProc = NewDataBrowserItemUPP(MyDataBrowserItemProc);
    if (myItemProc == NULL) { err = memFullErr; goto bail; }

    /* call our callback routine for every item that
    is currently a member of the selection. */
    err = ForEachDataBrowserItem(any_old_browser,
        kDataBrowserNoItem,  /* start searching at the root item */
        true, /* recursively search all subitems */
        kDataBrowserItemIsSelected, /* call it for selected items */
        myItemProc, /* a reference to our callback */
        'Yeah'); /* our arbitrary and private parameter */
    if (err != noErr) goto bail;
    if ((err = gCoStatus) != noErr) goto bail;
    selectionCount = (GetHandleSize(selectedItems) /
                         sizeof(DataBrowserItemID));
```

To discover the state of a particular item, your application can call the `GetDataBrowserItemState` routine. Using this routine your application can find out if a cell is selected or if a container cell has been opened (i.e., the turn-down arrow is in the down position).

The GetDataBrowserItemState routine.

```
    OSStatus GetDataBrowserItemState(
        ControlRef browser,
        DataBrowserItemID item,
        DataBrowserItemState *state);
```

- **browser** - a DataBrowser control created by a call to `CreateDataBrowserControl`.
- **item** - the Data ID of the row you are interested in. **NOTE:** As discussed later in the Selection Handling section, the DataBrowser provides facilities for selecting and highlighting entire rows of data, but it does not provide any facilities for selecting individual cells within rows.
- **state** - various combinations of the following flags:
  - `kDataBrowserItemNoState` - has no state associated with it at this time.
  - `kDataBrowserItemIsSelected` - is a member of the current selection.
  - `kDataBrowserContainerIsOpen` - disclosure open.
  - `kDataBrowserItemIsDragTarget` - Only true during a drag operation.

Returns an operating system result code describing the success of the operation. The code `noErr` will be returned if the operation was successful.

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Ordering Data

There are two sides to ordering the data displayed by the DataBrowser control. First, your application must provide a way for the DataBrowser to compare items referenced by Data ID numbers based with a common Property ID number. That is to say, your application must provide a method for comparing rows based on values displayed in particular columns. Your application can do this by providing a comparison callback routine in the `compareCallback` field of the `DataBrowserCallbacks` structure. For more information providing a comparison routine, please refer to that section.

The other side of ordering the data displayed by the DataBrowser is telling the browser control which column should be used for sorting and in what order items should be presented (ascending or descending). For the most part, your application should leave these settings up to the user. However, in situations where you would like to sort the values displayed in the DataBrowser control explicitly, the following routines have been provided.

Note:
The sorting routine used by the DataBrowser is non destructive and it preserves the ordering of elements that are equal across sorts. This means that if the list displayed is sorted based on column 1, and then you sort using column 2 and all of the Data IDs in column 2 map to the same value, then the order of the list will not change.

`SetDataBrowserSortOrder` can be used to explicitly set the sorting order for the list. If the list has not been sorted or the sorting order requested is not in effect, then the list with be sorted and re-drawn using the new sorting order. To find out what sorting order is currently in effect, your application can call the `GetDataBrowserSortOrder` routine.

The SetDataBrowserSortOrder routine.

```
    OSStatus SetDataBrowserSortOrder(
        ControlRef browser,
        DataBrowserSortOrder order);
```

- **browser** - a DataBrowser control created by a call to `CreateDataBrowserControl`.
- **order** - this parameter should be set to one of the three following constant values:
    - `kDataBrowserOrderUndefined` - not supported.
    - `kDataBrowserOrderIncreasing` - ascending order.
    - `kDataBrowserOrderDecreasing` - descending order.

Returns an operating system result code describing the success of the operation. The code `noErr` will be returned if the operation was successful.

The GetDataBrowserSortOrder routine.

```
    OSStatus GetDataBrowserSortOrder(
        ControlRef browser,
        DataBrowserSortOrder *order);
```

- **browser** - a DataBrowser control created by a call to `CreateDataBrowserControl`.
- **order** - see the description of `SetDataBrowserSortOrder` for the different values that can be returned in the variable pointed to by this parameter.

Returns an operating system result code describing the success of the operation. The code `noErr` will be returned if the operation was successful.

To designate a column that is used for the sorting operation, your application call `SetDataBrowserSortProperty` with the column's associated Property ID number. If the list is not currently sorted or if the list is currently sorted with a different column, then the list will be resorted and re-drawn. The `GetDataBrowserSortProperty` can be used to discover the Property ID number of the column currently being used for sorting the list.

The SetDataBrowserSortProperty routine.

```
    OSStatus SetDataBrowserSortProperty(
        ControlRef browser,
        DataBrowserPropertyID property);
```

- **browser** - a DataBrowser control created by a call to `CreateDataBrowserControl`.
- **property** - the Property ID of the column used to sort the list.

Returns an operating system result code describing the success of the operation. The code `noErr` will be returned if the operation was successful.

The GetDataBrowserSortProperty routine.

```
    OSStatus GetDataBrowserSortProperty(
        ControlRef browser,
        DataBrowserPropertyID *property);
```

- **browser** - a DataBrowser control created by a call to `CreateDataBrowserControl`.

- **property** - the Property ID of the column being used to sort the list will be stored in the variable pointed to by this parameter.

Returns an operating system result code describing the success of the operation. The code `noErr` will be returned if the operation was successful.

The routine `SortDataBrowserContainer` can be used to sort hierarchical lists of items. For information about setting up a hierarchical list, refer to the Managing Hierarchical Lists section.

The SortDataBrowserContainer routine.

```
    OSStatus SortDataBrowserContainer(
        ControlRef browser,
        DataBrowserItemID container,
        Boolean sortChildren);
```

- **browser** - a DataBrowser control created by a call to `CreateDataBrowserControl`.
- **container** - to sort all of the items displayed at the top level of the control's display, provide the constant `kDataBrowserNoItem`. Otherwise, sort all of the items that are organized as sub-items of a container item, provide the container item's Data ID.
- **sortChildren** - if this parameter is true, then all of the sub-items and sub-containers organized within the container will be sorted.

Returns an operating system result code describing the success of the operation. The code `noErr` will be returned if the operation was successful.

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DataBrowser Callback Routines

As discussed in the preliminary section discussing callbacks, "You call the DataBrowser, the DataBrowser calls you....", the DataBrowser control calls back to your application at key points during its execution either to request information from your application or to notify your application of changing conditions. As the DataBrowser control was designed to support many varied and complex scenarios of deployment, there are a large number of callback routines that your application can provide. Keep in mind, though, it is not necessary for an application to provide its own definition for each callback - only the ones actually required by an application need to be defined.

The DataBrowserCallbacks Structure

The `DataBrowserCallbacks` structure is the structure your application must use to provide references to the routines it would like the DataBrowser control to use when asking your application for information or notifying your application about changing conditions. At the very least, your application must define its own `clientDataCallback` routine, but keep in mind, the functionality of the list will improve as you add more routines.

```
struct DataBrowserCallbacks {
    UInt32 version; /* use kDataBrowserLatestCallbacks */
    union {
        struct {
            DataBrowserGetSetItemDataUPP clientDataCallback;
            DataBrowserCompareUPP compareCallback;

            DataBrowserItemNotificationUPP itemNotificationCallback;

            DataBrowserAddDragItemUPP addDragItemCallback;
            DataBrowserAcceptDragUPP acceptDragCallback;
            DataBrowserReceiveDragUPP receiveDragCallback;
            DataBrowserPostProcessDragUPP postProcessDragCallback;

            DataBrowserGetHelpContentUPP getHelpContentCallback;
            DataBrowserGetContextualMenuUPP contextualMenuCallback;
            DataBrowserSelectContextualMenuUPP selectContextMenuCallback;
        } v1;
    } u;
};
```

clientDataCallback. The client data callback is used for communicating data between the DataBrowser and your application. When the DataBrowser needs to display a value for a particular cell, it will call your `clientDataCallback` to request the data. If the user changes the value for a particular cell, the DataBrowser will call your `clientDataCallback` with a new copy of the data that you should use to replace your application's internal copy.

DataBrowserGetSetItemDataUPP - the Client Data Callback.

```
    typedef OSStatus (*DataBrowserGetSetItemDataProcPtr)(
        ControlRef browser,
        DataBrowserItemID item,
        DataBrowserPropertyID property,
        DataBrowserItemDataRef itemData,
        Boolean setValue);

    typedef DataBrowserGetSetItemDataProcPtr
        DataBrowserGetSetItemDataUPP;
```

- **browser** - a DataBrowser control created by a call to `CreateDataBrowserControl`.
- **item** - the Data ID of the data row whose data is being requested in this call.
- **property** - the Property ID to be used in conjunction with the Data ID to locate the cell whose data is being requested in this call. This value uniquely identifies the column.
- **itemData** - a pointer to the data or to a data buffer prepared to receive the data.
- **setValue** - if `setValue` is true, then your callback should replace its current copy of the value associated with (`item`, `property`) with the value pointed to by `itemData`. If `setValue` to `false`, then your application should store a copy of the value associated with (`item`, `property`) to the buffer pointed to by `itemData`.

Returns an operating system result code describing the success of the operation. Your callback should return the result code `noErr` if the operation was successful.

The data callback routine is the place where your application provides a mapping between Data ID numbers used to identify rows in the list, Property ID numbers used to identify columns, and the actual data that should be displayed in any particular cell. The DataBrowser will call your data callback routine with a Data ID and a Property ID. Your data callback routine should respond by either saving or returning the appropriate value depending on the state of the `setValue` parameter. Listing 6 a simple example of how your application could implement a data callback routine.

Listing 6. Example data callback routine.

```
    /* MySimpleDataCallback is a simple data callback routine
    that would be used in a browser control displaying a list
    of generic document icons together with a list of checkboxes.
    The checkbox column is a mutable column. */
OSStatus MySimpleDataCallback(
    ControlRef browser,
    DataBrowserItemID itemID,
    DataBrowserPropertyID property,
    DataBrowserItemDataRef itemData,
    Boolean changeValue) {

    IconRef myIcon;
    OSStatus err;

        /* start with a known state */
    myIcon = NULL;

        /* look at the property ID and decide what to do
        depending on what column we're dealing with... */
    if (property == kMyCheckboxColumn) {
        ThemeButtonValue buttonValue;
```

```
            /* are we being asked to change the value
            we have in our own store or are we being
            asked to retried the value?  You'll only
            have ask this question for mutable columns. */
        if (changeValue) {

            err = GetDataBrowserItemDataButtonValue(itemData,
                                     &buttonValue);
            if (err != noErr) goto bail;

                /* NOTE: our internal storage lookup mechanism must
                map itemID numbers to the values stored for each
                button in the list. */
            err = StoreTheValueSomewhere(itemID, buttonValue);
            if (err != noErr) goto bail;

        } else {

            err = GetTheButtonValueFromSomewhere(itemID, &buttonValue);
            if (err != noErr) goto bail;

            err = SetDataBrowserItemDataButtonValue(itemData,
                    buttonValue);
            if (err != noErr) goto bail;
        }

    } else if (property == kMyIconOnlyColumn) {

            /* if the column is not mutable, then we
            can safely assume we are only being asked
            to retrieve the value. */
        err = GetIconRef(kOnSystemDisk, kSystemIconsCreator,
            kGenericDocumentIcon, &myIcon);
        if (err != noErr) goto bail;

        err = SetDataBrowserItemDataIcon(itemData, myIcon);
        if (err != noErr) goto bail;

        ReleaseIconRef(myIcon);
        myIcon = NULL;

    } else {
        err = errDataBrowserPropertyNotSupported
        goto bail;
    }

    return noErr;

bail:
    if (myIcon != NULL) ReleaseIconRef(myIcon);
    return err;
}
```

compareCallback. This routine will be called by the DataBrowser when it is ordering the values displayed in a column. Your application should provide a comparison for all of the every property type your application presents that is capable of being sorted.

```
    typedef Boolean (*DataBrowserCompareProcPtr)(
        ControlRef browser,
        DataBrowserItemID itemOne,
        DataBrowserItemID itemTwo,
        DataBrowserPropertyID sortProperty);

    typedef DataBrowserCompareProcPtr DataBrowserCompareUPP;
```

- **browser** - a DataBrowser control created by a call to `CreateDataBrowserControl`.
- **itemOne** - the Data ID of the first row to be used in the comparison.

- **itemTwo** - the Data ID of the second row to be used in the comparison.
- **sortProperty** - the Property ID number for the column being sorted.

Your application's callback should return `true` if the value of the data referenced by `itemOne` is less than the value of the data referenced by `itemTwo`, and it should return should return `false` if the value of the data referenced by `itemOne` is greater than or equal to the value of the data referenced by `itemTwo`. The comparison should only consider the values being displayed in the column referenced by the Property ID in `sortProperty`. Sorting is stable, so you can use secondary and tertiary sorting. Each time a user clicks a column, the column will be sorted, but the sort order of matching items will be preserved.

itemNotificationCallback. The item notification callback routine will be called by the DataBrowser to notify your application of interesting conditions that it may wish to respond to. The kinds of conditions that your application will be notified of are enumerated and defined in Table 1.

```
typedef void (*DataBrowserItemNotificationProcPtr)(
    ControlRef browser,
    DataBrowserItemID item,
    DataBrowserItemNotification message);

typedef DataBrowserItemNotificationProcPtr
    DataBrowserItemNotificationUPP;
```

- **browser** - a DataBrowser control created by a call to `CreateDataBrowserControl`.
- **item** - the Data ID of the row being identified by this call.
- **message** Possible values for this parameter are described in Table 1.

Table 1. Notifications provided by the browser control.

Constant Name	Description
`kDataBrowserItemAdded`	The specified item has been added to the browser.
`kDataBrowserItemRemoved`	The specified item has been removed from the browser.
`kDataBrowserEditStarted`	Starting an EditText session for specified item.
`kDataBrowserEditStopped`	Stopping an EditText session for specified item.
`kDataBrowserItemSelected`	Item has just been added to the selection set.
`kDataBrowserItemDeselected`	Item has just been removed from the selection set.
`kDataBrowserItemDoubleClicked`	The user double clicked on an item.
`kDataBrowserContainerOpened`	Container has been opened.
`kDataBrowserContainerClosing`	Container is about to close.
`kDataBrowserContainerClosed`	Container has been closed.
`kDataBrowserContainerSorting`	Container is about to be sorted (lock any volatile properties).
`kDataBrowserContainerSorted`	Container has been sorted (you may release any property locks).
`kDataBrowserTargetChanged`	The target has changed to the specified item.
`kDataBrowserUserStateChanged`	The user has reformatted the view for the target.
`kDataBrowserSelectionSetChanged`	The selection set has been modified (net result may be the same).

addDragItemCallback. Once the DataBrowser has determined it is beginning an outgoing drag, it iterates through all of the selected items calling the `DataBrowserAddDragItemProcPtr`. At this point, your application can add the items drag inside of the `addDragItemCallback` routine. Your application's `addDragItemCallback` routine will be called after the DragReference has been created, but before TrackDrag is called. DataBrowser takes care of the imaging and adds transparency for you, so there is no need to create or add your own transparency information to the drag reference.

In this routine your application should add the item to the drag. Return true from this routine to tell the DataBrowser to add a transparent representation of the row to the drag image.

```
typedef Boolean (*DataBrowserAddDragItemProcPtr)(
    ControlRef browser,
    DragReference theDrag,
    DataBrowserItemID item,
    ItemReference *itemRef);

typedef DataBrowserAddDragItemProcPtr DataBrowserAddDragItemUPP;
```

- **browser** - a DataBrowser control created by a call to CreateDataBrowserControl.
- **theDrag** - the drag reference being constructed by the DataBrowser.
- **item** - this is the item ID of the item your application should add to the drag.
- **itemRef** - this parameter is currently unused. You should set this parameter to point to an ItemReference variable before calling this routine.

If your callback returns true, then the item will be added to the transparent drag image. If it returns false, it will not.

acceptDragCallback. As an incoming drag is moved over an item, this routine is called. If your routine returns true, then the DataBrowser will draw the right highlighting and be prepared to receive a DataBrowserReceiveDragProcPtr call.

```
typedef Boolean (*DataBrowserAcceptDragProcPtr)(
    ControlRef browser,
    DragReference theDrag,
    DataBrowserItemID item);

typedef DataBrowserAcceptDragProcPtr DataBrowserAcceptDragUPP;
```

- **browser** - a DataBrowser control created by a call to CreateDataBrowserControl.
- **theDrag** - a Drag Manager reference.
- **item** - This is the item ID of the item the drag is being held over. If the drag is being held over the list but not over any item, then item will contain the default target item ID for the list. The default target item ID for the list is discussed in the section Setting the Root Container.

Your callback should return true if it is capable of accepting the drag in the location designated by the item parameter.

receiveDragCallback. Your receiveDragCallback routine will be called to receive drags. In this routine, your application should extract the items it needs from the drag and add them to the list in the location defined by the item parameter.

```
Boolean (*DataBrowserReceiveDragProcPtr) (
    ControlRef browser,
    DragReference theDrag,
    DataBrowserItemID item);

typedef DataBrowserReceiveDragProcPtr
    DataBrowserReceiveDragUPP;
```

- **browser** - a DataBrowser control created by a call to CreateDataBrowserControl.
- **theDrag** - a Drag Manager reference.
- **item** - This is the item ID of the item the drag is being held over. If the drag is being held over the list but not over any item, then item will contain the default target item ID for the list. The default target item ID for the list is discussed in the section Setting the Root Container.

Your callback should return true if is successfully completes processing all of the information in the drag. Otherwise, it should return `false`. If your callback returns `false`, the zoom-back animation will occur for the drag.

postProcessDragCallback. Your application's `postProcessDragCallback` routine will be called after a drag command has been completed if any one of the drag processing callback routines you installed (`receiveDragCallback`, `acceptDragCallback`, or `addDragItemCallback`) were called during the drag. Specifically, this routine will be called if any one call to `addDragItemCallback` returns `true`, and after all calls `acceptDragCallback` and `receiveDragCallback`. Inside of your `postProcessDragCallback` routine, your application should deallocate any resources that were allocated when the other drag handlers were called. The `postProcessDragCallback` will be called immediately before the drag reference is deallocated by the DataBrowser so your application should not assume that this structure will remain intact after this callback is made.

```
    typedef void (*DataBrowserPostProcessDragProcPtr)(
        ControlRef browser,
        DragReference theDrag,
        OSStatus trackDragResult);

    typedef DataBrowserPostProcessDragProcPtr
        DataBrowserPostProcessDragUPP;
```

- **browser** - a DataBrowser control created by a call to `CreateDataBrowserControl`.
- **theDrag** - a Drag Manager drag reference.
- **trackDragResult** - the result returned by `TrackDrag`

Returns an operating system result code describing the success of the operation. Your callback should return the result code `noErr` if the operation was successful.

getHelpContentCallback - for Displaying Help Content.

```
    typedef void (*DataBrowserGetHelpContentProcPtr)(
        ControlRef browser,
        DataBrowserItemID item,
        DataBrowserPropertyID property,
        HMContentRequest inRequest,
        HMContentProvidedType *outContentProvided,
        HMHelpContentPtr ioHelpContent);

    typedef DataBrowserGetHelpContentProcPtr
        DataBrowserGetHelpContentUPP;
```

- **browser** - a Data Browser control created by a call to `CreateDataBrowserControl`.
- **item** - the Data ID indentifying the row.
- **property** - the Property ID identifying the column.
- **inRequest** - either `kHMSupplyContent` or `kHMDisposeContent`.
- **outContentProvided** - should be set to the content type provided in the record pointed to by `ioHelpContent`.
- **ioHelpContent** - a help content record containing the help information to be displayed.

Returns an operating system result code describing the success of the operation. Your callback should return the result code `noErr` if the operation was successful.

contextualMenuCallback.

```
    typedef void (*DataBrowserGetContextualMenuProcPtr)(
        ControlRef browser,
        MenuRef *menu,
        UInt32 *helpType,
        CFStringRef *helpItemString,
        AEDesc *selection);

    typedef DataBrowserGetContextualMenuProcPtr
        DataBrowserGetContextualMenuUPP;
```

- **browser** - a DataBrowser control created by a call to `CreateDataBrowserControl`.
- **menu** - Your callback should provide a MenuRef in this parameter.
- **helpType** - set this variable to one of the values `kCMHelpItemNoHelp`, `kCMHelpItemAppleGuide`, or `kCMHelpItemOtherHelp`. This value will be passed to `ContextualMenuSelect`.
- **helpItemString** - The very first item that appears in the contextual menu. If you set this value to `Null`, then the default "Help" string will be displayed.
- **selection** - this will point to an empty `AEDesc` and your callback should set this to your own internal representation of the selection. This will be passed to `ContextualMenuSelect`.

Returns an operating system result code describing the success of the operation. Your callback should return the result code `noErr` if the operation was successful.

selectContextMenuCallback.

```
    typedef void (*DataBrowserSelectContextualMenuProcPtr)(
        ControlRef browser,
        MenuRef menu,
        UInt32 selectionType,
        SInt16 menuID,
        MenuItemIndex menuItem);

    typedef DataBrowserSelectContextualMenuProcPtr
        DataBrowserSelectContextualMenuUPP;
```

- **browser** - a DataBrowser control created by a call to `CreateDataBrowserControl`.
- **menu** - the menu reference your application provided in its `contextualMenuCallback`.
- **selectionType** - returned from `ContextualMenuSelect`.
- **menuID** - the menu ID of the menu selected. This field will be `zero` if no selection was made.
- **menuItem** - the menu item number of the item selected.

Routines for managing the DataBrowserCallbacks structure

This section discusses operations on the `DataBrowserCallbacks` structure as a whole; discussion of the meaning of its constituent elements is provided later in this document. For your convenience, the field names listed above are linked to those descriptions. In the simplest of cases, the `clientDataCallback` is the only callback your application will need to re-define.

Pointers to the callback routines used by a particular DataBrowser control can be accessed through the `DataBrowserCallbacks` structure. The mechanism used for installing the callback routines for a Data Browser control is analogous to the mechanism used for QuickDraw's `SetStdProcs` routine: an application calls `InitDataBrowserCallbacks` to set up a `DataBrowserCallbacks` structure so it contains all of the standard DataBrowser callback routines, then your application replaces the callbacks it wishes to customize with pointers to its own routines.

The InitDataBrowserCallbacks routine.

```
    OSStatus InitDataBrowserCallbacks(
        DataBrowserCallbacks* callbacks);
```

- **callbacks** - a pointer to a `DataBrowserCallbacks` structure. The version field of the

DataBrowserCallbacks structure must be set to the value kDataBrowserLatestCallbacks before this routine is called.

Returns an operating system result code describing the success of the operation. The code noErr will be returned if the operation was successful.

The routine InitDataBrowserCallbacks initializes a DataBrowserCallbacks structure so it contains references to all of the default callback routines used by the DataBrowser control. After calling InitDataBrowserCallbacks, your application should replace the callback routines it wishes to customize with references to its own routines.

Once your application has installed references to its own callback routines in the DataBrowserCallbacks structure, it can install the new callbacks in a Data Browser control by calling the SetDataBrowserCallbacks routine. This routine replaces the DataBrowserCallbacks structure currently being used by the control with the structure the application provides as a parameter.

The SetDataBrowserCallbacks routine.

```
    OSStatus SetDataBrowserCallbacks(
        ControlRef control,
        const DataBrowserCallbacks *callbacks);
```

- **control** - a DataBrowser control created by a call to CreateDataBrowserControl.
- **callbacks** - a pointer to a DataBrowserCallbacks structure.

Returns an operating system result code describing the success of the operation. The code noErr will be returned if the operation was successful.

It is also possible to retrieve a copy of the DataBrowserCallbacks structure that is currently being used by a DataBrowser control. This can be done using the GetDataBrowserCallbacks routine.

The GetDataBrowserCallbacks routine.

```
    OSStatus GetDataBrowserCallbacks(
        ControlRef control,
        DataBrowserCallbacks *callbacks);
```

- **control** - a DataBrowser control created by a call to CreateDataBrowserControl.
- **callbacks** - a pointer to a DataBrowserCallbacks structure.

Returns an operating system result code describing the success of the operation. The code noErr will be returned if the operation was successful.

When used in combination with the SetDataBrowserCallbacks routine, GetDataBrowserCallbacks provides a mechanism in which an application can either temporarily override or replace one or more callbacks being used by a DataBrowser control at particular points during processing.

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Pre-defined Column Display Types

For convenience, the DataBrowser control provides a number of pre-defined display types that your application can use to display different types of data. These are provided to reduce the coding overhead involved for displaying a number common data types. Furthermore, facilities have been provided for developers who wish to provide their own display code for drawing their data types in special ways.

Listing 1 illustrates how you would go about creating a column of checkboxes for display in the DataBrowser. This was done by providing the kDataBrowserCheckboxType as the property type in the DataBrowserListViewColumnDesc record passed to the AddDataBrowserListViewColumn routine. Columns that use any of the other pre-defined display types can be created in the same way.

> **Note:**
> The DataBrowser requires the kDataBrowserPropertyIsEditable flag to be set in order to enable editing of any changeable display type (namely checkboxes, pop-up menus, etc). Be sure your application is setting the kDataBrowserPropertyIsEditable flag when defining columns containing checkboxes, menus, and so forth.

The remaining parts of this section detail the various pre-defined display types provided by the DataBrowser. For information about how to provide routines for doing your own drawing, refer to the Custom Column Display Types section that follows.

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Icons

To display a list of icons in a DataBrowser column, your application must define a property with the type kDataBrowserIconType. Columns with the property type kDataBrowserIconType are used to display lists of icons. For columns of this type, the DataBrowser control expects that your Data Callback Routine will provide an IconRef referring to the icon that is to be drawn in a cell. It is also possible for your data callback routine to provide other information used in drawing the icon such as a tint color and an icon transform type. Routines you can use for providing this information are described in detail below.

The SetDataBrowserItemDataIcon routine

```
    OSStatus SetDataBrowserItemDataIcon (
        DataBrowserItemDataRef itemData,
        IconRef theData );
```

- **itemData** - the itemData reference number that was passed to your Data Callback Routine.
- **theData** - the icon reference for the icon that is to be displayed.

Returns an operating system result code describing the success of the operation. The code noErr will be returned if the operation was successful.

SetDataBrowserItemDataIcon should be called from inside of your Data Callback Routine to specify what icon is to be drawn in a particular cell. This routine should only be called for columns that have been defined with either the kDataBrowserIconType property type or the kDataBrowserIconAndTextType property type. For more information about IconRefs refer to the Icon Services documentation.

The SetDataBrowserItemDataIconTransform routine

```
    OSStatus SetDataBrowserItemDataIconTransform (
        DataBrowserItemDataRef itemData,
        IconTransformType theData );
```

- **itemData** - the itemData reference number that was passed to your Data Callback Routine.
- **theData** - the icon reference for the icon that is to be displayed.

Returns an operating system result code describing the success of the operation. The code noErr will be returned if the operation was successful.

SetDataBrowserItemDataIconTransform allows your application to specify that a special visual transformation is to be applied to the icon when it is drawn. These transformations correspond to the various display states the Finder uses when drawing icons.

The SetDataBrowserItemDataRGBColor routine

```
    OSStatus SetDataBrowserItemDataRGBColor (
        DataBrowserItemDataRef itemData,
        RGBColor *theData );
```

- **itemData** - the `itemData` reference number that was passed to your Data Callback Routine.
- **theData** - an RGB color record.

Returns an operating system result code describing the success of the operation. The code `noErr` will be returned if the operation was successful.

`SetDataBrowserItemDataRGBColor` allows your application to provide a color that will be used to tint the icon when it is drawn. The effect provided by this facility is similar to the effect provided by the icon label transformation constants, except this method allows your application to specify a specific color.

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Text

For displaying a list of textual strings, the DataBrowser defines the display type `kDataBrowserTextType`. When used, this type tells the DataBrowser that the column is to be drawn as a list of Unicode-encoded strings. Core Foundation `CFStringRef`s are used to represent the text data drawn in the column. Inside of your application's data callback routine, call the `SetDataBrowserItemDataText` routine to provide the text data that the DataBrowser is to display in the list.

The SetDataBrowserItemDataText routine

```
    OSStatus SetDataBrowserItemDataText (
        DataBrowserItemDataRef itemData,
        CFStringRef theData );
```

- **itemData** - the `itemData` reference number that was passed to your Data Callback Routine.
- **theData** - a Core Foundation string reference.

Returns an operating system result code describing the success of the operation. The code `noErr` will be returned if the operation was successful.

`SetDataBrowserItemDataText` must be called from inside of an application's data callback routine when the cell being drawing is inside of a column with either the `kDataBrowserTextType` property type or the `kDataBrowserIconAndTextType` property type. If the `kDataBrowserPropertyIsEditable` flag is set among the `DataBrowserPropertyFlags` for the column's property, then the text displayed in the column will be editable and can be changed by the user. In these cases, your application can retrieve the modified text using the `GetDataBrowserItemDataText` routine. The data browser will make its own internal copy of the `CFStringRef` when this routine is called.

The GetDataBrowserItemDataText routine

```
    OSStatus GetDataBrowserItemDataText (
        DataBrowserItemDataRef itemData,
        CFStringRef *theData );
```

- **itemData** - the `itemData` reference number that was passed to your Data Callback Routine.
- **theData** - a pointer to a location where a Core Foundation string reference will be returned. On completion, this parameter will contain a newly created `CFStringRef`. Your application must release this string reference once it is no longer needed.

Returns an operating system result code describing the success of the operation. The code `noErr` will be returned if the operation was successful.

If your data callback routine is called with the `setValue` parameter set to `true`, then that means that the text being displayed in the cell referred to in the call has been modified. At that point, your application should call `GetDataBrowserItemDataText` to retrieve the new text. Your application must release the `CFStringRef` once it is no longer needed.

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Icons with Text

To display a list of icons associated with text, your application must create a column with the property type `kDataBrowserIconAndTextType`. After that, your application can use both the routines defined for icon columns and the routines defined for text columns to define the contents for each cell.

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Time

To display a list of date values, use the property type `kDataBrowserDateTimeType`. Columns defined with this property type are capable of date values returned by the date and time utilities routines. If the `kDataBrowserRelativeDateTime` flag is specified among the `DataBrowserPropertyFlags` for the column's property, then the time will be displayed as a relative time value for times proximate to the current clock setting rather than an absolute time value.

The SetDataBrowserItemDataDateTime routine

```
    OSStatus SetDataBrowserItemDataDateTime (
        DataBrowserItemDataRef itemData,
        long theData );
```

- **itemData** - the `itemData` reference number that was passed to your Data Callback Routine.
- **theData** - a 32-bit value representing the number of elapsed seconds elapsed since midnight January 1, 1904.

Returns an operating system result code describing the success of the operation. The code `noErr` will be returned if the operation was successful.

`SetDataBrowserItemDataDateTime` can be used to provide a 32-bit time value for display. The value displayed should be encoded as the number of seconds elapsed since midnight January 1, 1904. For more information about date and time encodings used in the Mac OS, refer to the Date and Time Measurement Utilities documentation.

The SetDataBrowserItemDataLongDateTime routine

```
    OSStatus SetDataBrowserItemDataLongDateTime (
        DataBrowserItemDataRef itemData,
        const LongDateTime *theData );
```

- **itemData** - the `itemData` reference number that was passed to your Data Callback Routine.
- **theData** - a pointer to a 64-bit integer representing the number of seconds that have elapsed since midnight January 1, 1904.

Returns an operating system result code describing the success of the operation. The code `noErr` will be returned if the operation was successful.

`SetDataBrowserItemDataLongDateTime` can be used to provide a 64-bit time value for display. The value displayed should be encoded as the number of seconds elapsed since midnight January 1, 1904. For more information about date and time encodings used in the Mac OS, refer to the Date and Time Measurement Utilities documentation.

If the `kDataBrowserRelativeDateTime` flag has been set among the column's property flags, then the time will be displayed as a relative time value for times proximate to the current clock setting.

checkboxes

Columns created with the property type `kDataBrowserCheckboxType` will contain a list of checkboxes. Normally, to allow editing, your application should set the `kDataBrowserPropertyIsEditable` flag among the `DataBrowserPropertyFlags`. Checkboxes displayed by the DataBrowser are capable of displaying three values defined for the `ThemeButtonValue` data type: `kThemeButtonOff`, `kThemeButtonOn`, `or kThemeButtonMixed`. The value displayed for the control is determined by the `SetDataBrowserItemDataButtonValue` routine.

The SetDataBrowserItemDataButtonValue routine

```
    OSStatus SetDataBrowserItemDataButtonValue (
        DataBrowserItemDataRef itemData,
        ThemeButtonValue theData );
```

- **itemData** - the `itemData` reference number that was passed to your Data Callback Routine.
- **theData** - a value representing the setting to display for the control.

Returns an operating system result code describing the success of the operation. The code `noErr` will be returned if the operation was successful.

If the user has changed the value displayed by the control, then your callback routine will be called with the `setValue` parameter set to `true`. At that point, your application can call the `GetDataBrowserItemDataButtonValue` routine to find out the new checkbox setting.

The GetDataBrowserItemDataButtonValue routine

```
    OSStatus GetDataBrowserItemDataButtonValue (
        DataBrowserItemDataRef itemData,
        ThemeButtonValue *theData );
```

- **itemData** - the `itemData` reference number that was passed to your Data Callback Routine.
- **theData** - a value representing the setting to display for the control.

Returns an operating system result code describing the success of the operation. The code `noErr` will be returned if the operation was successful.

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Progress Indicators

To display a progress indicators in a column, your application must create a column with the property type `kDataBrowserProgressBarType`. Progress indicators are displayed using the standard appearance mercury/groove visual analogy. Three values are used by the DataBrowser to determine the appearance of the progress indicators: the minimum, maximum, and current value. Routines described in this section allow you to modify these values.

The SetDataBrowserItemDataValue routine

```
    OSStatus SetDataBrowserItemDataValue (
        DataBrowserItemDataRef itemData,
        SInt32 theData );
```

- **itemData** - the `itemData` reference number that was passed to your Data Callback Routine.
- **theData** - a value representing the setting to display.

Returns an operating system result code describing the success of the operation. The code `noErr` will be returned if the operation was successful.

`SetDataBrowserItemDataValue` sets the current value being displayed by the control. This value should be between the minimum and maximum values specified by calling `SetDataBrowserItemDataMinimum` and `SetDataBrowserItemDataMaximum`. Values displayed by a progress bar may vary inclusively between the minimum and maximum values.

The SetDataBrowserItemDataMinimum routine

```
    OSStatus SetDataBrowserItemDataMinimum (
        DataBrowserItemDataRef itemData,
        SInt32 theData );
```

- **itemData** - the `itemData` reference number that was passed to your Data Callback Routine.
- **theData** - a value representing the minimum setting.

Returns an operating system result code describing the success of the operation. The code `noErr` will be returned if the operation was successful.

`SetDataBrowserItemDataMinimum` determines the minimum bound for the values being displayed in the control. Values displayed by a progress bar may vary inclusively between the minimum and maximum values.

The SetDataBrowserItemDataMaximum routine

```
    OSStatus SetDataBrowserItemDataMaximum (
        DataBrowserItemDataRef itemData,
        SInt32 theData );
```

- **itemData** - the `itemData` reference number that was passed to your Data Callback Routine.
- **theData** - a value representing the maximum setting.

Returns an operating system result code describing the success of the operation. The code `noErr` will be returned if the operation was successful.

`SetDataBrowserItemDataMaximum` determines the maximum bound for the values being displayed in the control. Values displayed by a progress bar may vary inclusively between the minimum and maximum values.

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Relevance Rank

Relevance Ranks are drawn in a way similar to progress indicators using the familiar mercury/groove visual analogy. Specifically, relevance ranks are drawn without the groove. Columns used to display relevance rankings are created with the property type `kDataBrowserRelevanceRankType`. Once your application has created a column for displaying relevance rankings, the same routines used for setting values for progress indicators may be used to control its appearance.

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Pop-up Menus

Columns of pop-up menus can be created by adding new columns with the `kDataBrowserpop-upMenuType` property type. The `SetDataBrowserItemDataMenuRef` routine can then be used to specify the menu that will be displayed as a cell's pop-up menu.

The SetDataBrowserItemDataMenuRef routine

```
    OSStatus SetDataBrowserItemDataMenuRef (
        DataBrowserItemDataRef itemData,
        MenuRef theData );
```

- **itemData** - the `itemData` reference number that was passed to your Data Callback Routine.
- **theData** - a menu reference designating the menu to display in the cell.

Returns an operating system result code describing the success of the operation. The code `noErr` will be returned if the operation was successful.

The `SetDataBrowserItemDataValue` routine can then be used to set the pop-up menu's value. When the user chooses a command from one of your pop-up menus, your data callback routine will be called with the `setValue` parameter set to `true`. At that time, your application can call the `GetDataBrowserItemDataValue` to determine the new value for the pop-up menu.

The GetDataBrowserItemDataValue routine

```
    OSStatus GetDataBrowserItemDataValue (
        DataBrowserItemDataRef itemData,
        SInt32 *theData );
```

- **itemData** - the `itemData` reference number that was passed to your Data Callback Routine.
- **theData** - a pointer to a 32-bit integer where the value should be stored.

Returns an operating system result code describing the success of the operation. The code `noErr` will be returned if the operation was successful.

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Defining Your Own Column Display Types

Columns created with the property type `kDataBrowserCustomType` have no pre-defined display mechanism. It is assumed that when such a column is created, the application will be providing the drawing routines used to display the column. This section discusses the structures and routines an application uses to provide drawing routines for a custom column.

IMPORTANT
Information presented in this section refers to the current state of these APIs. These APIs are currently under review and are subject to change without notice. If you are using these APIs and you have special requirements that they currently do not provide, then please feel free to contact us and let us know about your needs so we may give them consideration when we are looking at these APIs.

The DataBrowserCustomCallbacks Structure

For even greater control over the presentation of user interface elements displayed inside of DataBrowser views, applications can use the `DataBrowserCustomCallbacks` structure. This structure provides callbacks for implementing custom drawing and user interaction for special kinds of data an application displays.

The DataBrowserCustomCallbacks Structure

```
struct DataBrowserCustomCallbacks {

    UInt32 version; /* use kDataBrowserLatestCustomCallbacks */

    union {
        struct {
            DataBrowserDrawItemUPP CustomDrawItemCallback;
            DataBrowserEditItemUPP CustomEditTextCallback;
            DataBrowserHitTestUPP CustomHitTestCallback;
            DataBrowserTrackingUPP CustomTrackingCallback;

            DataBrowserItemDragRgnUPP CustomDragRegionCallback;
            DataBrowserItemAcceptDragUPP CustomAcceptDragCallback;
            DataBrowserItemReceiveDragUPP CustomReceiveDragCallback;
        } v1;
    } u;
};


/* Macro for initializing custom callback structure */
#define InitializeDataBrowserCustomCallbacks(callbacks, version) \
{ callbacks->version = version; \
  InitDataBrowserCustomCallbacks(callbacks); }
and macro for setting version in the callbacks structure.
```

CustomDrawItemCallback. If your application would like to provide custom drawing for a column, it can do so by providing its own `CustomDrawItemCallback`. Whenever the DataBrowser needs to draw or redraw a cell in a custom column, it will call this routine to draw the cell. When your `CustomDrawItemCallback` is called the DataBrowser will already have called `EraseRect` and set the clipping region, the pen, and the font to appropriate settings for your routine to begin drawing. Your drawing routine should not attempt to modify the clipping region, pen, port, or origin.

```
    typedef void (*CustomDrawItemCallbackPtr)(
        ControlRef browser,
        DataBrowserItemID item,
        DataBrowserPropertyID property,
        DataBrowserItemState itemState,
        const Rect *theRect,
        SInt16 gdDepth,
        Boolean colorDevice);

        typedef CustomDrawItemCallbackPtr DataBrowserDrawItemUPP;
```

- **browser** - a DataBrowser control created by a call to `CreateDataBrowserControl`.
- **item** - the Data ID number for the item to be drawn.
- **property** - the Property ID number for the item to be drawn.
- **itemState** - the current state of the item being drawn. Possible values for this parameter are listed in the description of the `GetDataBrowserItemState` routine. Your application should draw the cell in whatever way is appropriate for the state reflected by the value of this parameter.
- **theRect** - the bounding rectangle in local window coordinates where the cell should be drawn.
- **gdDepth** - the bit depth of the current QuickDraw GrafPort.
- **colorDevice** - `true` if the current QuickDraw port is a color device.

CustomEditTextCallback. When the DataBrowser has determined that the user would like to edit a text field, it will call your `CustomEditTextCallback` callback to ask your application for both permission to perform the editing operation and parameters used in the editing operation.

```
    typedef Boolean (*CustomEditTextCallbackPtr)(
        ControlRef browser,
        DataBrowserItemID item,
        DataBrowserPropertyID property,
        CFStringRef theString,
        Rect *maxEditTextRect,
        Boolean *shrinkToFit);

        typedef CustomEditTextCallbackPtr DataBrowserEditItemUPP;
```

- **browser** - a DataBrowser control created by a call to CreateDataBrowserControl.
- **item** - the Data ID number for the item to be drawn.
- **property** - the Property ID number for the item to be drawn.
- **theString** - a reference to the string that is to be edited.
- **maxEditTextRect** - if shrinkToFit is turned on, this is the largest size the edit field can grow in size. If the text grows beyond the size of the edit field, it will scroll inside of the field as the user types (according to the Aqua user interface guidelines). If shrinkToFit is false, this is the size of the edit field that will be used.
- **shrinkToFit** - if you set this parameter to true, then the DataBrowser will expand and shrink the text editing box to match the width of the text appearing in the edit field. With this version of the DataBrowser, this parameter is ignored and shrinkToFit it always true by default.

If your application returns the value true, then the DataBrowser will go ahead and perform the editing operation. If your application returns the value false, then no editing operation will occur.

CustomHitTestCallback. When the DataBrowser is tracking the cursor and mouse clicks, it will call your application's CustomHitTestCallback to determine if the mouse is over any content that is selectable or draggable. If the mouse position is over selectable or draggable content, then your CustomHitTestCallback routine should return true.

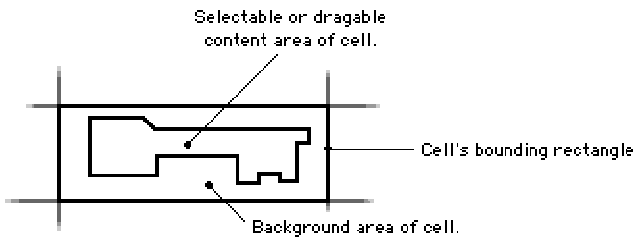
Selectable or dragable content area of cell.
Cell's bounding rectangle
Background area of cell.

Figure 6. Differentiation between a custom cell's content area and its background.

Your CustomHitTestCallback callback will be called by the DataBrowser to determine if the mouse is in the selectable or draggable content area of your custom cell (the cell's content area - see Figure 6). If the DataBrowser is processing a mouse-down event, and the click is inside of the cell's content area then the DataBrowser will call your CustomTrackingCallback; otherwise, it will begin processing the mouse-down event as the beginning of a marque selection operation.

```
    typedef Boolean (*CustomHitTestCallbackPtr)(
        ControlRef browser,
        DataBrowserItemID itemID,
        DataBrowserPropertyID property,
        const Rect *theRect,
        const Rect *mouseRect);

    typedef CustomHitTestCallbackPtr DataBrowserHitTestUPP;
```

- **browser** - a DataBrowser control created by a call to CreateDataBrowserControl.
- **itemID** - the Data ID number for the row where the mouse is located.
- **property** - the Property ID number for the column where the mouse is located.
- **theRect** - the location of the cell's boundary rectangle on the screen in local window coordinates.
- **mouseRect** - contains the coordinates of the mouse. If the top left and bottom right

coordinates of this rectangle are identical, then a single point is being tested. If they differ, then the DataBrowser is testing to see if your custom item is inside of a marque selection (use `SectRect` or `SectRgn` to determine if the selectable content of the custom cell is part of the selection).

Your application should return a `true` when either the mouse is located over the selectable or draggable content part of the cell or the marque selection rectangle, provided in `*mouseRect`, intersects with the selectable or draggable content area of the cell.

CustomTrackingCallback. If you would like to provide custom drag-and-drop behavior inside of your application, then you should provide a `CustomTrackingCallback`. Once the DataBrowser has determined that the mouse is being held down over the selectable or draggable part of the cell (see Figure 6), it will call your `CustomTrackingCallback`. Your application can use the `CustomTrackingCallback` perform its own tracking such as highlighting a button, or tracking the mouse over a pop-up palette.

```
typedef SInt16 (*CustomTrackingCallbackPtr)(
    ControlRef browser,
    DataBrowserItemID itemID,
    DataBrowserPropertyID property,
    const Rect *theRect,
    Point startPt,
    EventModifiers modifiers);

typedef CustomTrackingCallbackPtr DataBrowserTrackingUPP;
```

- **browser** - a DataBrowser control created by a call to `CreateDataBrowserControl`.
- **itemID** - the Data ID number for the row where the mouse is located.
- **property** - the Property ID number for the column where the mouse is located.
- **theRect** - the cell's location in local window coordinates.
- **startPt** - the location of the mouse when the drag began.
- **modifiers** - the state of the modifier keys as passed in the modifiers parameter to the `HandleControlClick` routine.

Your `CustomTrackingCallback` will only be called for mouse-down events and only after your `CustomHitTestCallback` has returned true. Your tracking procedure should do one of three things:

1. Provide its own custom tracking behavior and animation and return the result `-1`. A result of `-1` tells the DataBrowser that your application performed its own drag processing and no further processing is required.
2. Return the value `zero` to indicate that nothing has been hit and no further processing should take place.
3. Return the value `1` to tell the DataBrowser to continue processing the click in its own way.

CustomDragRegionCallback. Once the DataBrowser has determined that it is going to begin a drag using the Drag Manager, it will create a transparent drag image that will appear during the drag operation. When creating the transparent drag image, it will call your application's `CustomDragRegionCallback` routine to determine what part of the cell's rectangle should be used when creating the transparent image. Normally, your callback should return the boundary region for the cell's content area (see Figure 6). The DataBrowser will use this region as a clipping region when it calls back to your `CustomDrawItemCallback` while it is generating the transparent drag image.

```
typedef void (*CustomDragRegionCallbackPtr)(
    ControlRef browser,
    DataBrowserItemID itemID,
    DataBrowserPropertyID property,
    const Rect *theRect,
    RgnHandle dragRgn);

typedef CustomDragRegionCallbackPtr DataBrowserItemDragRgnUPP;
```

- **browser** - a DataBrowser control created by a call to `CreateDataBrowserControl`.
- **itemID** - the Data ID number for the row to be represented in the drag region.
- **property** - the Property ID number for the column to be represented in the drag region.
- **theRect** - the cell's location in local window coordinates.
- **dragRgn** - a reference to the region.

Your application's `CustomDragRegionCallback` should set the region passed in the `dragRgn` parameter to the region inside of `theRect` that should be incorporated into the images used to create the transparent drag. This region is used to crop the image data produced by the `CustomDrawItemCallback` routine when creating the drag image. Your `CustomDragRegionCallback` should set this region to the boundary of the content area inside of your custom cell.

Set the region to the region used to pick up the transparent drag image. This region is used as a mask when passed to the custom draw routine to generate the drag image. All of these routines draw and calculate inside the coordinates provided in `theRect`. Do not call `SetOrigin` in any of your drag callbacks.

CustomAcceptDragCallback. While processing a drag and the drag is held over one of your custom items, the DataBrowser will call your application's `CustomAcceptDragCallback` routine to determine if your item can accept the drag.

```
typedef UInt16 (*CustomAcceptDragCallbackPtr )(
    ControlRef browser,
    DataBrowserItemID itemID,
    DataBrowserPropertyID property,
    const Rect *theRect,
    DragReference theDrag);

typedef CustomAcceptDragCallbackPtr
    DataBrowserItemAcceptDragUPP;
```

- **browser** - a DataBrowser control created by a call to `CreateDataBrowserControl`.
- **itemID** - the Data ID number for the target row.
- **property** - the Property ID number for the target column.
- **theRect** - the cell's location in local window coordinates.
- **theDrag** - a Drag Manager drag reference.

The value returned by this routine is passed through to your application's `CustomReceiveDragCallback` in the `dragFlags` parameter. Your application's `CustomAcceptDragCallback` will be called by the DataBrowser when a drag is moved over your custom cell. If the cell cannot accept the drag, return `zero`. Otherwise, if the cell is an acceptable drop location for the drag, return a non-zero value.

CustomReceiveDragCallback. If your custom item has indicated that it can accept a drag from the `CustomAcceptDragCallback`.

```
typedef Boolean (*CustomReceiveDragCallbackPtr )(
    ControlRef browser,
    DataBrowserItemID itemID,
    DataBrowserPropertyID property,
    UInt16 dragFlags,
    DragReference theDrag);

typedef CustomReceiveDragCallbackPtr
    DataBrowserItemReceiveDragUPP;
```

- **browser** - a DataBrowser control created by a call to `CreateDataBrowserControl`.
- **itemID** - the Data ID number for the row where the drop occurred.
- **property** - the Property ID number for the column where the drop occurred.

- **dragFlags** - the drag flags provided by the Drag Manager.
- **theDrag** - the Drag Manager drag reference.

Your `CustomReceiveDragCallback` should return `true` if it successfully received the drag. If it returns `false`, then the zoom-back animation will occur.

Routines for managing the DataBrowserCustomCallbacks structure

As with the `DataBrowserCallbacks` structure, a routine, `InitDataBrowserCustomCallbacks`, is provided that allows applications to initialize a `DataBrowserCustomCallbacks` structure so that it contains references to all of the default callback routines used by the DataBrowser.

The InitDataBrowserCustomCallbacks routine.

```
    OSStatus InitDataBrowserCustomCallbacks(
        DataBrowserCustomCallbacks *callbacks);
```

- **callbacks** - a pointer to a `DataBrowserCustomCallbacks` structure. The version field of the `DataBrowserCustomCallbacks` structure must be set to the value `kDataBrowserLatestCustomCallbacks` before this routine is called.

Returns an operating system result code describing the success of the operation. The code `noErr` will be returned if the operation was successful.

`InitDataBrowserCustomCallbacks` fills in a `DataBrowserCustomCallbacks` structure with references to the default callback routines used by the DataBrowser control. Once you have replaced the callbacks you wish to redefine with references to your own routine, you can install your custom callbacks by calling `SetDataBrowserCustomCallbacks`.

The SetDataBrowserCustomCallbacks routine.

```
    OSStatus SetDataBrowserCustomCallbacks(
        ControlRef browser,
        DataBrowserCustomCallbacks *callbacks);
```

- **control** - a Data Browser control created by a call to `CreateDataBrowserControl`.
- **callbacks** - a pointer to a `DataBrowserCustomCallbacks` structure.

Returns an operating system result code describing the success of the operation. The code `noErr` will be returned if the operation was successful.

`SetDataBrowserCustomCallbacks` replaces the `DataBrowserCustomCallbacks` structure that is currently in use by a DataBrowser control with the new structure referenced in the `callbacks` parameter.

The GetDataBrowserCustomCallbacks routine.

```
    OSStatus GetDataBrowserCustomCallbacks(
        ControlRef browser,
        DataBrowserCustomCallbacks* callbacks);
```

- **control** - a Data Browser control created by a call to `CreateDataBrowserControl`.
- **callbacks** - a pointer to a `DataBrowserCustomCallbacks` structure.

Returns an operating system result code describing the success of the operation. The code `noErr` will be returned if the operation was successful.

Applications wishing to either replace or temporarily override the callbacks that are currently being used by a DataBrowser control can use the `GetDataBrowserCustomCallbacks` routine to retrieve a copy of the

`DataBrowserCustomCallbacks` that is currently being used by a DataBrowser control.

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Browser Appearance and Behavior

This section provides an overview of programming issues related to the appearance of the browser control and its behavior while processing user input. The bulk of the work needed to maintain these aspects of the browser control are managed for you by the browser control itself; however, the browser control provides APIs and callbacks to notify your application of key events and conditions during user interaction.

Event Handling

The DataBrowser is a control. As such, it does not require any special event handling beyond the Control Manager routines (`HandleControlClick`, `HandleControlKey`, `DrawControls`, and `IdleControls`) that your application will normally call to manage controls. However, if your application has installed the default Carbon event handler for your window, then even these calls are not necessary since the Carbon event manager will take care of these operations for you.

Figure 7 illustrates the general flow of control for mouse clicks received by the DataBrowser control. The DataBrowser provides its own support for keyboard navigation and keyboard events. If the keyboard handling provided by the DataBrowser is not appropriate for your application, then you may wish to filter keyboard input before calling `HandleControlKey`.

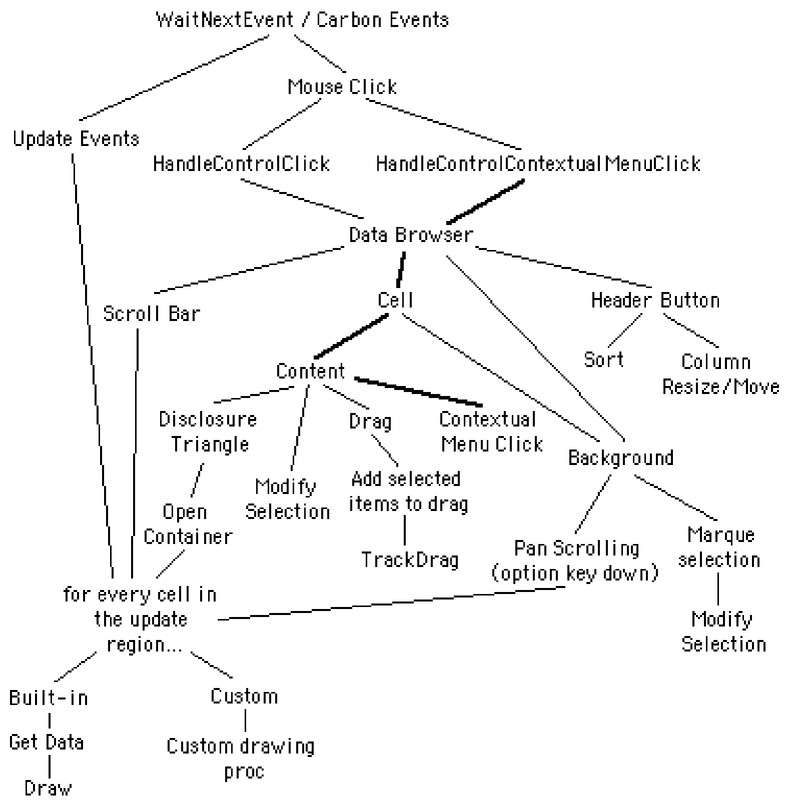

Figure 7. The general flow of control for mouse-down and update events.

The DataBrowser provides an API your application can use to turn on and off mouse event handling for items displayed in the list. When a browser control is set to inactive it will be drawn appropriately, and it will not accept mouse-down events. The `SetDataBrowserActiveItems` routine allows your application to control the active/inactive state of the control.

The SetDataBrowserActiveItems routine.

```
    OSStatus SetDataBrowserActiveItems(
        ControlRef browser,
        Boolean active);
```

- **browser** - a DataBrowser control created by a call to `CreateDataBrowserControl`.
- **active** - a boolean value containing the new active state for the items displayed in the list.

Returns an operating system result code describing the success of the operation. The code `noErr` will be returned if the operation was successful.

The GetDataBrowserActiveItems routine.

```
    OSStatus GetDataBrowserActiveItems(
        ControlRef browser,
        Boolean *active);
```

- **browser** - a DataBrowser control created by a call to `CreateDataBrowserControl`.
- **active** - the current active state of the items displayed in the list will be returned in the boolean variable pointed to by this parameter.

Returns an operating system result code describing the success of the operation. The code `noErr` will be returned if the operation was successful.

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Interesting Conditions

The browser control can handle nearly all of the interface display and user interaction operations involved in displaying a list in a window. However, the true power of the browser control comes from the fact that it calls back to your application at key points during execution to provide notification of changing conditions that your application can act upon to perform further processing. At the time of this writing, the DataBrowser provides the notifications shown in Table 1 by calling back to your application's Notification Callback routine (Table 1 is located in the section describing the Notification Callback callback). Your application can provide a reference to its notification callback routine in the `itemNotificationCallback` field of the DataBrowserCallbacks structure.

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Scroll Bars

The DataBrowser control provides a number of routines for controlling and managing the appearance of the scroll bars displayed for the list. The routine `SetDataBrowserScrollPosition` can be used to scroll the list to any arbitrary scrolling position. Normally, `SetDataBrowserScrollPosition` will be used in conjunction with the routine `GetDataBrowserScrollPosition` to restore the scrolling position of a list to the user's last scrolling position when a window containing a scrollable DataBrowser control is being created.

Your application should use `GetDataBrowserScrollPosition` and `SetDataBrowserScrollPosition` to save and restore the scrolling position. These routines should not be used to scroll particular cells into the view. To do that, your application should use the `RevealDataBrowserItem` routine.

The SetDataBrowserScrollPosition routine.

```
    OSStatus SetDataBrowserScrollPosition(
        ControlRef browser,
        UInt32 top,
        UInt32 left);
```

- **browser** - a DataBrowser control created by a call to `CreateDataBrowserControl`.

- **top** - the current vertical scrolling position will be set to the value provided in this parameter.
- **left** - the current horizontal scrolling position will be set to the value provided in this parameter.

Returns an operating system result code describing the success of the operation. The code `noErr` will be returned if the operation was successful.

The GetDataBrowserScrollPosition routine.

```
    OSStatus GetDataBrowserScrollPosition(
        ControlRef browser,
        UInt32 *top,
        UInt32 *left);
```

- **browser** - a DataBrowser control created by a call to `CreateDataBrowserControl`.
- **top** - the variable pointed to by this parameter will be set to the current vertical scrolling position.
- **left** - the variable pointed to by this parameter will be set to the current horizontal scrolling position.

Returns an operating system result code describing the success of the operation. The code `noErr` will be returned if the operation was successful.

If the list your application would like to display is small and its coordinates do not extend beyond the bounds of the area used to display the list, then it is possible for your application to turn of the display of scroll bars. The routine `SetDataBrowserHasScrollBars` can be used to turn off either the horizontal or the vertical scroll bar. The routine `GetDataBrowserHasScrollBars` is useful for determining if the browser control currently has scroll bars. For example, you would only want to call the `AutoSizeDataBrowserListViewColumns` routine if the browser control does not have a horizontal scroll bar.

The SetDataBrowserHasScrollBars routine.

```
    OSStatus SetDataBrowserHasScrollBars(
        ControlRef browser,
        Boolean horiz,
        Boolean vert);
```

- **browser** - a DataBrowser control created by a call to `CreateDataBrowserControl`.
- **horiz** - set this parameter to `true` if the list should be displayed with a horizontal scroll bar.
- **vert** - set this parameter to `true` if the list should be displayed with a vertical scroll bar.

Returns an operating system result code describing the success of the operation. The code `noErr` will be returned if the operation was successful.

The GetDataBrowserHasScrollBars routine.

```
    OSStatus GetDataBrowserHasScrollBars(
        ControlRef browser,
        Boolean *horiz,
        Boolean *vert);
```

- **browser** - a DataBrowser control created by a call to `CreateDataBrowserControl`.
- **horiz** - the variable pointed to by this parameter will be set to `true` if the browser control is being displayed with a horizontal scroll bar.

- **vert** - the variable pointed to by this parameter will be set to `true` if the browser control is being displayed with a vertical scroll bar.

Returns an operating system result code describing the success of the operation. The code `noErr` will be returned if the operation was successful.

Sometimes, it is desirable to place special placards or controls beside the horizontal scroll bars or above the vertical ones. Figure 8 provides an illustration of a placard displayed in the bottom left corner of a list to the left of the scroll bar. To allow placement of such objects, the browser control provides the routines `GetDataBrowserScrollBarInset` and `SetDataBrowserScrollBarInset`. Applications that would like to modify the scroll bar inset values used by the browser control should always call `GetDataBrowserScrollBarInset` to obtain the current settings. After modifying the current inset settings, your application can then pass the new values back to `SetDataBrowserScrollBarInset`.

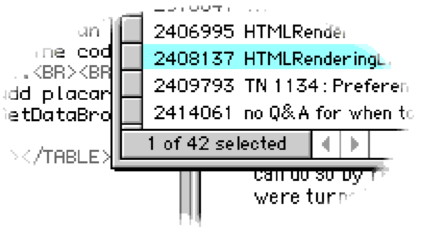

Figure 8. An example of a placard displayed at the bottom left of the list. As shown here, the scroll bar is inset on its right-hand side to provide enough space for the placard.

The SetDataBrowserScrollBarInset routine.

```
    OSStatus SetDataBrowserScrollBarInset(
        ControlRef browser,
        Rect *insetRect);
```

- **browser** - a DataBrowser control created by a call to `CreateDataBrowserControl`.
- **insetRect** - the current inset settings your application would like the DataBrowser to use. Your application should modify the inset settings returned by `GetDataBrowserScrollBarInset` instead of assuming that the DataBrowser will set them to any particular value.

Returns an operating system result code describing the success of the operation. The code `noErr` will be returned if the operation was successful.

Use this to add placards or status panels beside above or below the scroll bars. Call `GetDataBrowserScrollBarInset` before calling this routine.

The GetDataBrowserScrollBarInset routine.

```
    OSStatus GetDataBrowserScrollBarInset(
        ControlRef browser,
        Rect *insetRect);
```

- **browser** - a DataBrowser control created by a call to `CreateDataBrowserControl`.
- **insetRect** - the current inset settings for the browser control's scroll bars will be returned in the rectangle pointed to by this parameter. The left and right fields will contain the horizontal inset values for the horizontal scroll bar, and the top and bottom fields will contain the vertical inset values for the vertical scroll bar.

Returns an operating system result code describing the success of the operation. The code `noErr` will be returned if the operation was successful.

`RevealDataBrowserItem` can be called to scroll any cell in the browser control into view.

The RevealDataBrowserItem routine.

```
OSStatus RevealDataBrowserItem(
    ControlRef browser,
    DataBrowserItemID item,
    DataBrowserPropertyID propertyID,
    Boolean centerInView);
```

- **browser** - a DataBrowser control created by a call to `CreateDataBrowserControl`.
- **item** - the Data ID of the item to display.
- **propertyID** - the Property ID of the column to display.
- **centerInView** - if `true`, then the DataBrowser will try to center the item in the display area.

Returns an operating system result code describing the success of the operation. The code `noErr` will be returned if the operation was successful.

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Selection Handling

The DataBrowser control provides a complete set of routines for managing the cells currently contained in the selection. The DataBrowser uses Data ID numbers to track which rows are in the selection. The current selection is represented as a group of 32-bit Data ID numbers. Each Data ID refers to a row in the current selection (columns within rows are not differentiated inside of selections).

The SetDataBrowserSelectionFlags routine.

```
OSStatus SetDataBrowserSelectionFlags(
    ControlRef browser,
    DataBrowserSelectionFlags selectionFlags);
```

- **browser** - a DataBrowser control created by a call to `CreateDataBrowserControl`.
- **selectionFlags** - can be any combination of the following flag values:
  - `kDataBrowserDragSelect` - This turns on or off the availability of the selection marque. The marque will show up if the click was not on content, or the Option key is not down and `kDataBrowserDragSelect` is on `kDataBrowserSelectOnlyOne` is off and `kDataBrowserNoDisjointSelection` is off.
  - `kDataBrowserSelectOnlyOne` - allow only one item to be selected at once.
  - `kDataBrowserResetSelection` - reset list before processing next selection operation.
  - `kDataBrowserCmdTogglesSelection` - allow use of command to toggle items in and out of the selection.
  - `kDataBrowserNoDisjointSelection` - prevent discontinuous selections.
  - `kDataBrowserAlwaysExtendSelection` - enable multiple item selection without holding down any modifier keys.

Returns an operating system result code describing the success of the operation. The code `noErr` will be returned if the operation was successful.

The GetDataBrowserSelectionFlags routine.

```
    OSStatus GetDataBrowserSelectionFlags(
        ControlRef browser,
        DataBrowserSelectionFlags *selectionFlags);
```

- **browser** - a DataBrowser control created by a call to `CreateDataBrowserControl`.
- **selectionFlags** - See the description of `SetDataBrowserSelectionFlags` for more information about the value that can be returned in this parameter.

Returns an operating system result code describing the success of the operation. The code `noErr` will be returned if the operation was successful.

The IsDataBrowserItemSelected routine.

```
    Boolean IsDataBrowserItemSelected(
        ControlRef browser,
        DataBrowserItemID item);
```

- **browser** - a DataBrowser control created by a call to `CreateDataBrowserControl`.
- **item** - the Data ID of the item to be tested.

Returns `true` if the item specified by the Data ID provided in the item parameter is a member of the current selection.

The SetDataBrowserSelectedItems routine.

```
    OSStatus SetDataBrowserSelectedItems(
        ControlRef browser,
        UInt32 numItems,
        DataBrowserItemID *items,
        DataBrowserSetOption operation);
```

- **browser** - a DataBrowser control created by a call to `CreateDataBrowserControl`.
- **numItems** - the number of Data ID numbers stored in the array pointed to by the `items` parameter.
- **items** - an array of Data ID numbers.
- **operation** - the operation to be performed on the current selection:
  - `kDataBrowserItemsAssign` - set the selection to the items specified in the array pointed to by the `items` parameter. Any previous selection is replaced and the list will be re-drawn appropriately.
  - `kDataBrowserItemsToggle` - if any of the items specified in the array pointed to by the `items` parameter are in the current selection, then remove them from the selection. For those items that are not in the selection, add them to the selection.
  - `kDataBrowserItemsRemove` - if any of the items specified in the array pointed to by the items parameter are in the current selection, then remove them from the selection and redraw their cells so they are not highlighted.

Returns an operating system result code describing the success of the operation. The code `noErr` will be returned if the operation was successful.

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Drag-and-Drop Processing

Normally, if you have installed the appropriate drag handling callback routines for a browser control, your application will not have to make any special calls when the user performs drag-and-drop operations to and from the browser control. However, the browser control has been designed with flexibility in mind and it can be customized to your application's requirements. This section provides an overview of how you can easily add drag-and-drop capability to your application using a browser control.

If the window containing the browser control contains other items capable of receiving drag-and-drop commands, then you must turn off the Control Manager's automatic drag handling by calling `SetAutomaticControlDragTrackingEnabledForWindow` before installing your own drag receive and accept handlers using the Drag Manager APIs. Once you have done so, you can then handle your own drag operations and direct the ones that belong to the browser control to the browser control using the `HandleControlDragTracking` and `HandleControlDragReceive` routines.

To provide outgoing drags your application must install an `addDragItemCallback` callback routine in the `DataBrowserCallbacks` structure. The browser control calls your `addDragItemCallback` routine when it has determined that it is appropriate to start a drag command. Inside of your `addDragItemCallback` routine your application should add whatever information is appropriate for the drag command to the drag.

To receive drags, you application must install both an `acceptDragCallback` routine and a `receiveDragCallback` routine in the `DataBrowserCallbacks` structure. The function of these routines are analogous to the corresponding Drag Manager accept-and-receive routines.

To receive drags and drop commands destined for the list, but not dropped over any particular item in the list being displayed, your application can set the default target ID for the list. Information about how to set the default target ID for a browser control can be found in the Setting the Root Container section.

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Forcing Redraw

Once your application has made changes to some of the data referenced by the Data ID numbers and properties you have installed in a data browser control, you will want tell the DataBrowser to update the display. To do this, you should call the `UpdateDataBrowserItems` routine referencing the Data ID numbers of those items that have changed.

The UpdateDataBrowserItems routine.

```
OSStatus UpdateDataBrowserItems(
    ControlRef browser,
    DataBrowserItemID container,
    UInt32 numItems,
    const DataBrowserItemID *items,
    DataBrowserPropertyID preSortProperty,
    DataBrowserPropertyID propertyID);
```

- **browser** - a DataBrowser control created by a call to `CreateDataBrowserControl`.
- **container** - The ID number of the container for the Data ID numbers referenced by the items parameter.
- **numItems** - the number of Data ID numbers referenced by the items parameter.
- **items** - a pointer to an array of Data ID numbers. If the value `kDataBrowserNoItem` appears anywhere in this array, then all of the rows will be updated.
- **preSortProperty** - the sort order of the Data ID numbers referenced by the items parameter. If the Data ID numbers referenced by the `items` parameter are not sorted according to any property, then your application should provide the value `kDataBrowserNoProperty` in this parameter.
- **propertyID** - the Property ID of the column that must be `kDataBrowserPropertyIsEditabled`. To update all columns for the items referenced by the Data ID numbers referenced by the items parameter, set this parameter to `kDataBrowserNoItem`.

Returns an operating system result code describing the success of the operation. The code `noErr` will be returned if the operation was successful.

IMPORTANT
Instead of forcing an update event to redraw the DataBrowser control contents, your application should call the `UpdateDataBrowserItems` routine as this routine since it will also update any internal caches that may have been allocated by the DataBrowser.

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Column and Cell Dimensions

In this implementation of the DataBrowser, it is possible to use the routines `SetDataBrowserListViewHeaderBtnHeight` to turn column headings on or off. To turn off the display of column header buttons, call `SetDataBrowserListViewHeaderBtnHeight` with a height parameter of `zero`. If you would like to be able to turn the display of column headers on again after you have turned them off, then you can do so by restoring their height to the value returned by `GetDataBrowserListViewHeaderBtnHeight` before column header buttons were turned off.

The SetDataBrowserListViewHeaderBtnHeight routine.

```
    OSStatus SetDataBrowserListViewHeaderBtnHeight(
        ControlRef browser,
        UInt16 height);
```

- **browser** - a DataBrowser control created by a call to `CreateDataBrowserControl`.
- **height** - 0 turns off header buttons, use a saved value returned by `GetDataBrowserListViewHeaderBtnHeight` to turn on buttons. No other values are defined at this time.

Returns an operating system result code describing the success of the operation. The code `noErr` will be returned if the operation was successful.

The GetDataBrowserListViewHeaderBtnHeight routine.

```
    OSStatus GetDataBrowserListViewHeaderBtnHeight(
        ControlRef browser,
        UInt16 *height);
```

- **browser** - a DataBrowser control created by a call to `CreateDataBrowserControl`.
- **height** - the current height of the header buttons area is returned in the variable pointed to by this parameter.

Returns an operating system result code describing the success of the operation. The code `noErr` will be returned if the operation was successful.

The routine `AutoSizeDataBrowserListViewColumns` allows your application to set all of the column widths to a standard display width on the screen. When you call this routine, the DataBrowser will resize all of the columns in such a way that they will fill the available space on the screen. `AutoSizeDataBrowserListViewColumns` is only available if the horizontal scroll bar has been turned off. To turn scroll bars off, your application can call the `SetDataBrowserHasScrollBars` routine.

The AutoSizeDataBrowserListViewColumns routine.

```
    OSStatus AutoSizeDataBrowserListViewColumns(
        ControlRef browser);
```

- **browser** - a DataBrowser control created by a call to `CreateDataBrowserControl`.

Returns an operating system result code describing the success of the operation. The code `noErr` will be returned if the operation was successful.

To discover the window based coordinates of any part of a cell that is visible on the screen, your application can call the `GetDataBrowserItemPartBounds` routine. Your application can then use these coordinates to perform special drawing or calculations. The coordinates returned in the `*bounds` parameter will be the location of the requested part relative to the window's top left corner.

The GetDataBrowserItemPartBounds routine.

```
    OSStatus GetDataBrowserItemPartBounds(
        ControlRef browser,
        DataBrowserItemID item,
        DataBrowserPropertyID property,
        DataBrowserPropertyPart part,
        Rect *bounds);
```

- **browser** - a DataBrowser control created by a call to `CreateDataBrowserControl`.
- **item** - the Data ID identifying the cell's row.
- **property** - the Property ID identifying the cell's column.
- **part** - a constant value describing the part of the cell you would like to obtain information about. The type of information requested will depend on the type of information being displayed in the column. It is up to your application to ensure it is requesting the appropriate information. The following constants may be provided in this parameter:
  - `kDataBrowserPropertyEnclosingPart` - the outer boundary of the cell.
  - `kDataBrowserPropertyContentPart` - the content of the cell.
  - `kDataBrowserPropertyDisclosurePart` - the location of the disclosure rectangle.
  - `kDataBrowserPropertyTextPart` - the location where the text is drawn.
  - `kDataBrowserPropertyIconPart` - the location where the icon is displayed.
  - `kDataBrowserPropertyCheckboxPart` - the location of the checkbox.
  - `kDataBrowserPropertyProgressBarPart` - the location of the progress bar.
  - `kDataBrowserPropertyRelevanceRankPart` - the location of the relevance rank.
- **bounds** - a pointer to a rectangle where the coordinates will be returned.

Returns an operating system result code describing the success of the operation. The code `noErr` will be returned if the operation was successful. If the cell is not visible (scrolled off the screen), it will return an `ItemNotFound` error.

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List Background Color

The background pattern used when drawing the list is determined by the Appearance Manager. When running under in the Classic environment with platinum appearance, the list background will be shades of gray with the sort column drawn in a darker shade. If you would prefer the background be drawn all white, then you can call `SetDataBrowserListViewUsePlainBackground` with the `usePlainBackground` parameter set to `true`. Currently, Aqua draws all lists with a plain white background.

The SetDataBrowserListViewUsePlainBackground routine.

```
    OSStatus SetDataBrowserListViewUsePlainBackground(
        ControlRef browser,
        Boolean usePlainBackground);
```

- **browser** - a DataBrowser control created by a call to `CreateDataBrowserControl`.
- **usePlainBackground** - platinum only. Plain background uses all white background. False uses shaded platinum background. Currently Aqua only supports plain white background. Call this only if you do not want to have a shaded sort column.

Returns an operating system result code describing the success of the operation. The code `noErr` will be returned if the operation was successful.

The GetDataBrowserListViewUsePlainBackground routine.

```
    OSStatus GetDataBrowserListViewUsePlainBackground(
        ControlRef browser,
        Boolean *usePlainBackground);
```

- **browser** - a DataBrowser control created by a call to `CreateDataBrowserControl`.
- **usePlainBackground** - the variable pointed to by this parameter will be set to `true` if the control is set to use a plain white background.

Returns an operating system result code describing the success of the operation. The code `noErr` will be returned if the operation was successful.

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In-place Text Editing

The DataBrowser control provides built-in text editing capability for columns with the display type `kDataBrowserTextType`. Inside of these columns, it is possible to allow the user to click on a cell and begin editing the text displayed in that cell. While a cell is open and the text is being edited, the browser control is said to have an editing session open.

Normally, if you create an editable text column, the DataBrowser will automatically manage edit sessions. However, if your application requires special operations then the routines described in this section can be used. The routine `SetDataBrowserEditItem` can be used to open or close an editing session. And the routines `SetDataBrowserEditText` and `GetDataBrowserEditText` can be used manipulate the text in the edit field while an edit session is open. To allow text editing to occur, your application follow these steps:

1. When creating the column you would like the edit text to appear in, set the `kDataBrowserPropertyIsEditable` for the column. This will allow modification of the values displayed in the column.
2. In your Data Callback Routine return the value `true` when your callback receives an `kDataBrowserItemIsEditableProperty` inquiry (i.e., call `SetDataBrowserItemDataBooleanValue(itemData, true)` when you receive this inquiry). If your application has more than one column containing editable text and you would like to know which property is about to be edited, you can call the `GetDataBrowserItemDataProperty` routine.
3. When the edit session is finished, your Data Callback Routine will be called again for the edited property with the `setValue` argument set to `true`. Your callback should extract the edited text string for the item/property by calling `GetDataBrowserItemDataText`. Your callback should then verify and decide either to accept or reject the new string value before saving the new data into your application's private data store. (If your application decides to reject the new text then you should provide an alert explaining why.)

Note:
The DataBrowser requires the `kDataBrowserPropertyIsEditable` flag to be set in order to enable editing of any changeable display type (namely checkboxes, pop-up menus, etc). Be sure your application is setting the `kDataBrowserPropertyIsEditable` flag when defining columns containing checkboxes, menus, and so forth.

Once your application has responded true to the "May I edit this item?" query from the DataBrowser (which is only asked of properties that have been flagged as editable), the DataBrowser will issue the following two notifications (to your `ItemNotification` callback):

- `kDataBrowserEditStarted` (you should lock down any data that might need to be locked, or manipulate your UI as needed).
- `kDataBrowserEditStopped` (the edit session and all transactions has finished, you may unlock any locked data, or update your UI as needed).

The remainder of this section describes the routines your application can use for selecting the current edit item and for modifying the text in the current edit item.

The SetDataBrowserEditItem routine.

```
    OSStatus SetDataBrowserEditItem(
        ControlRef browser,
        DataBrowserItemID item,
        DataBrowserPropertyID property);
```

- **browser** - a DataBrowser control created by a call to `CreateDataBrowserControl`.
- **item** - the Data ID of the item to be edited.
- **property** - the Property ID of the column containing the item.

Returns an operating system result code describing the success of the operation. The code `noErr` will be returned if the operation was successful.

The `SetDataBrowserEditItem` routine can be used for beginning or ending an edit session for a text item. To begin an editing session for a particular text cell, specify its data and Property ID number. To end an editing session, provide either the Data ID or the Property ID number of another cell, or provide the constant `kDataBrowserNoItem` as the Data ID number.

The GetDataBrowserEditItem routine.

```
    OSStatus GetDataBrowserEditItem(
        ControlRef browser,
        DataBrowserItemID *item,
        DataBrowserPropertyID *property);
```

- **browser** - a DataBrowser control created by a call to `CreateDataBrowserControl`.
- **item** - the Data ID of the item that is being edited will be returned in the variable pointed to by this parameter. If there is no cell being edited, this parameter will be set to `kDataBrowserNoItem`.
- **property** - the Property ID of the column containing the item that is being edited will be returned in the variable pointed to by this parameter. If there is no cell being edited, this parameter will be set to `zero`.

Returns an operating system result code describing the success of the operation. The code `noErr` will be returned if the operation was successful.

The routines `GetDataBrowserEditText` and `SetDataBrowserEditText` allow your application to modify the displayed contents of the text cell while it is being edited. These routines can only be called during an edit session and they may be used to query, modify or replace the text as it is being typed by the user.

The SetDataBrowserEditText routine.

```
    OSStatus SetDataBrowserEditText(
        ControlRef browser,
        CFStringRef text);
```

- **browser** - a DataBrowser control created by a call to CreateDataBrowserControl.
- **text** - a CFStringRef. The DataBrowser will make its own internal copy of this reference so it is safe to release your own internal reference after you call this routine.

Returns an operating system result code describing the success of the operation. The code noErr will be returned if the operation was successful.

The GetDataBrowserEditText routine.

```
    OSStatus GetDataBrowserEditText(
        ControlRef browser,
        CFMutableStringRef text);
```

- **browser** - a DataBrowser control created by a call to CreateDataBrowserControl.
- **text** - a CFMutableStringRef. Your application must allocate this string and pass it to the DataBrowser. The DataBrowser will set its contents to the current contents of the edit session's text field.

Returns an operating system result code describing the success of the operation. The code noErr will be returned if the operation was successful.

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Edit Menu Commands

The browser control manages the state of selection editing for you. Your application can discover if it is appropriate to enable specific edit menu commands at any time by calling the EnableDataBrowserEditCommand routine. To execute a specific editing command, call the ExecuteDataBrowserEditCommand routine.

The EnableDataBrowserEditCommand routine.

```
    Boolean EnableDataBrowserEditCommand(
        ControlRef browser,
        DataBrowserEditCommand command);
```

- **browser** - a DataBrowser control created by a call to CreateDataBrowserControl.
- **command** - this parameter must be set to one of the following constant values:
    - kDataBrowserEditMsgUndo - undo the last operation.
    - kDataBrowserEditMsgCut - cut the contents of the selection inside of the current edit session to the clipboard.
    - kDataBrowserEditMsgCopy - copy the contents of the selection inside of the current edit session to the clipboard.
    - kDataBrowserEditMsgPaste - replace the contents of the selection inside of the current edit session with the contents of the clipboard.
    - kDataBrowserEditMsgClear - remove the contents of the selection inside of the current edit session.
    - kDataBrowserEditMsgSelectAll - select all of the text inside of the current edit session.

Returns true if the requested editing command can be performed by the DataBrowser control at this time.

Currently, these editing commands will be available when an editable text field is open and being edited. If your application has defined any custom display types that allow editing, editing commands will also be available when your callbacks indicate editing is available.

The ExecuteDataBrowserEditCommand routine.

```
    OSStatus ExecuteDataBrowserEditCommand(
        ControlRef browser,
        DataBrowserEditCommand command);
```

- **browser** - a DataBrowser control created by a call to `CreateDataBrowserControl`.
- **command** - a constant indicating what command should be performed. See the description of `EnableDataBrowserEditCommand` for a list of possible values for this parameter.

Returns an operating system result code describing the success of the operation. The code `noErr` will be returned if the operation was successful.

Context-Sensitive Help

Use the `getHelpContentCallback` field of the `DataBrowserCallbacks` structure.

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Contextual Menus

Use the `contextualMenuCallback` and the `selectContextMenuCallback` fields of the `DataBrowserCallbacks` structure.

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Managing Hierarchical Lists

As described in the section Providing and Ordering your Data, it is possible to create complex hierarchical lists of Data IDs for display in the DataBrowser control. Most of the DataBrowser routines have been designed with this mind. Essentially, any of the DataBrowser routines with a "container" parameter, has special functionality available for hierarchical lists. Some of those routines are described in other sections, but routines specifically designed for managing hierarchical lists are described in this section.

Setting the Root Container

The root container designates the Data ID of the highest level of a hierarchy being displayed in a browser control. In some routines, such as the drag-and-drop commands, this ID number is used to refer to the entire browser control rather than any particular item. For example, if a user drags a selection across a DataBrowser control's content area and the mouse is not positioned over any particular item, the DataBrowser will call the browser control's accept routine using the Root Container's Data ID number.

The SetDataBrowserTarget routine.

```
    OSStatus SetDataBrowserTarget(
        ControlRef browser,
        DataBrowserItemID target);
```

- **browser** - a DataBrowser control created by a call to `CreateDataBrowserControl`.

- **target** - the ID that should be assigned as the default target ID for the browser control.

Returns an operating system result code describing the success of the operation. The code `noErr` will be returned if the operation was successful.

In these circumstances, it is appropriate to respond as if the user is dragging a new item into the list or column. The Root Container ID is also called the default container ID number. By default, the browser control's target ID number will be set to Item ID will be `zero`. Your application can change this to a different value, if necessary.

The GetDataBrowserTarget routine.

```
    OSStatus GetDataBrowserTarget(
        ControlRef browser,
        DataBrowserItemID *target);
```

- **browser** - a DataBrowser control created by a call to `CreateDataBrowserControl`.
- **target** - a pointer to a location where the currently assigned target ID will be returned.

Returns an operating system result code describing the success of the operation. The code `noErr` will be returned if the operation was successful.

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Setting the Disclosure Column

The disclosure column contains the turn-down arrows that the user can use to navigate down into your data hierarchy. Use the `SetDataBrowserListViewDisclosureColumn` to designate the column where these turn-down arrows will appear.

The SetDataBrowserListViewDisclosureColumn routine.

```
    OSStatus SetDataBrowserListViewDisclosureColumn(
        ControlRef browser,
        DataBrowserTableViewColumnID column,
        Boolean expandableRows);
```

- **browser** - a DataBrowser control created by a call to `CreateDataBrowserControl`.
- **column** - if this is no column or the column doesn't exist, then there will be no disclosure column.
- **expandableRows** - if the row itself expands rather than opening up several sub-rows set this parameter to `true`. Currently this parameter is ignored.

Returns an operating system result code describing the success of the operation. The code `noErr` will be returned if the operation was successful.

The GetDataBrowserListViewDisclosureColumn routine.

```
    OSStatus GetDataBrowserListViewDisclosureColumn(
        ControlRef browser,
        DataBrowserTableViewColumnID *column,
        Boolean *expandableRows);
```

- **browser** - a DataBrowser control created by a call to `CreateDataBrowserControl`.
- **column** - the `Property ID` of the column where the disclosure triangles are being displayed will be returned in the variable pointed to by this parameter.
- **expandableRows** - if the row itself expands rather than opening up several sub-rows, then the variable pointed to by this parameter will be set to `true`.

Returns an operating system result code describing the success of the operation. The code `noErr` will be returned if the operation was successful.

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Opening and Closing Containers

Normally, the user will navigate down into your hierarchy by activating the turn-down arrows themselves. But, under some circumstances, such as when you are restoring the display to its last known state when opening a window, you will want to explicitly set the turn-down display state for the container items displayed in the list. The routines described in this section allow your application open and close container items in the display.

The OpenDataBrowserContainer routine.

```
    OSStatus OpenDataBrowserContainer(
        ControlRef browser,
        DataBrowserItemID container);
```

- **browser** - a DataBrowser control created by a call to `CreateDataBrowserControl`.
- **container** - The Data ID of the container you would like to open.

Returns an operating system result code describing the success of the operation. The code `noErr` will be returned if the operation was successful.

The CloseDataBrowserContainer routine.

```
    OSStatus CloseDataBrowserContainer(
        ControlRef browser,
        DataBrowserItemID container);
```

- **browser** - a DataBrowser control created by a call to `CreateDataBrowserControl`.
- **container** - The Data ID of the container you would like to close.

Returns an operating system result code describing the success of the operation. The code `noErr` will be returned if the operation was successful.

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