# Newton 2.0 OS Q&A's

## Introduction

This document addresses Newton 2.0 OS development issues that are not available in the currently printed documentation. Please note that this information is subject to change as the Newton technolog and development environment evolve.

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# Application Design

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## Optimizing Root View Functions (9/15/93)

Q: I've got this really tight loop that executes a "global" function. The function isn't really global, i defined in my root view and the lookup time to find it is slowing me down. Is there anything I can to optimize it?

A: If the function does not use inheritance or "`self`", you can speed things up by doing the lookup explicitly once before executing the loop, and using the call statement to execute the function wit the body of the loop.

Here's some code you can try inside the Inspector window:

```
f1 := {myFn: func() 42};
f2 := {_parent: f1};
f3 := {_parent: f2};
f4 := {_parent: f3};
f5 := {_parent: f4};
f5.test1 := func ()
   for i:=1 to 2000 do call myFn with ();
f5.test2 := func() begin
   local fn := myFn;
   for i:=1 to 2000 do call fn with ();
   end
```

```
/* executes with a noticeable delay */
f5:test1();

/* executes noticeably faster */
f5:test2();
```

Note: Use this technique only for functions that don't use inheritance or the self keyword.

This trick is analogous to the MacOS programming technique of using `GetTrapAddress` to get a t
real address and calling it directly to avoid the overhead of trap dispatch.

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## Code Optimization (9/15/93)

Q: Does the compiler in the Newton Toolkit reorder expressions or fold floating point constants? Can
order of evaluation be forced (as with ANSI C)?

A: The current version of the compiler doesn't do any serious optimization, such as eliminating subexpressions, or reordering functions; however, this may change in future products. (Note: NTK added constant folding, so for example `2+3` will be replaced with `5` by the compiler.) In the meantime, you need to write your code as clearly as possible without relying too heavily on the ordering of functions inside expressions.

The current version of the NTK compiler dead-strips conditional statements from your applicatio
code if the boolean expression is a simple constant. This feature allows you to compile your code conditionally.

For example, if you define a `kDebugMode` constant in your project and have in your application a
statement conditioned by the value of `kDebugMode`, the NTK compiler removes the entire if/the
statement from your application code when the value of `kDebugMode` is NIL.

```
constant kDebugMode := true;        // define in Project Data
if kDebugMode then Print(...);      // in application code
```

When you change the value of the `kDebugMode` constant to NIL, then the compiler strips out the
entire if/then statement.

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## Global Name Scope (6/7/94)

Note that in NewtonScript, global functions and variables are true globals. This means that you might get name clashes with other possible globals, and as this system is dynamic you can't do an
pre-testing of existing global names.

Here are two recommended solutions in order to avoid name space problems:

Use your signature in any slot you create that is outside of the domain of your own application.

Unless you really want a true global function or variable, place the variable or function inside you
base view template. You are actually able to call this function or access this variable from other applications, because the base view is declared to the root level.

If you really need to access the function or variable from a view that is not a descendent of your ba
view (like a floater that is a child of the root view), you might do something like:

```
    if getroot().|MyBaseView:MySIG| then
```

```
            local s := getroot().|MyBaseView:MySIG|.BlahSize;
        end;
```

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## Preventing an Application From Opening (6/9/94)

Q: I do not want my application to open sometimes, for example because the screen size is too small, o because the Newton OS version is wrong. What's the best way to prevent it?

A: Check for whatever constraints or requirements you need early, if not in the `installScript`, the the `viewSetupFormScript` for the application's base view. In your case, you can do some math the frame returned from `GetAppParams` to see if the screen is large enough to support your application.

If you do not want the application to open, do the following:

- Call `Notify` to tell the user why your application cannot run.
- Set the base view's `viewBounds` so it does not appear, use `RelBounds(-10, -10, 0, 0)` so the view will be off-screen.
- Possibly set (and check) a flag so expensive startup things do not happen.
- Possibly set the base view's `viewChildren` and `stepChildren` slots to NIL.
- call `AddDeferredSend(self, 'Close, nil)` to close the view.

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## Creating a Polite Backdrop Application (1/19/96)

Q: How do I get backdrop behavior in my application?

A: Backdrop behavior is given to you for free. If your applicationÕs close box is based on `protoCloseBox` or `protoLargeCloseBox` then your close box will automatically hide itself your application is the backdrop application. If you also use `newtStatusBar` as your status bar proto, the appropriate buttons will shift to fill the gap left by the missing close box. Note that yo not have to use the NewtApp framework to use the `newtStatusBar` proto.

The system will automatically override the `Close` and `Hide` methods so your application cann closed.

If you need to know which application is the backdrop application, you can find the appSymbol the current backdrop app with `GetUserConfig('blessedApp)`.

Here are some tips on being a polite backdrop application:

• Your application should be full-screen. (Set "Styles" as the backdrop to see why.)

• A polite backdrop application will also add the registered auxiliary buttons to its status bar. S the "Using Auxiliary Buttons" in the Newton Programmers Guide (Chapter 18.)

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## Responding to Changes From a Keyboard (2/6/96)

Q: I open a custom keyboard to edit my view. How can I tell that the keyboard has been closed so th can process the potentially modified contents of the view?

A: The `viewChangedScript` for the view will be called each time the user does something to mod the view. For keyboards, this means the script is called each time the user taps a key. This is the only notification that is provided to indicate the view contents have changed.

There are no hooks you can use to tell you when standard keyboards have closed. If you implemer your own keyboard, you could provide a `viewQuitScript` or other custom code to explicitly not the target that the keyboard is going away, but we do not recommend this. (There may be a hard keyboard attached, a system keyboard may be open, or the user may be writing into your view. It mistake to assume that the only way to modify your view is through your own keyboard.)

If the processing you need to do is lengthy and would interfere with normal typing on the keyboar you can arrange it so the processing won't start for a few seconds. This usually gives the user time type another key, which can then further delay the processing.

To make this "watchdog timer" happen, use the idle mechanism as your timer. Put the code to prc the changes in the `viewIdleScript` (or call it from the `viewIdleScript`.) In the `viewChangedScript`, if the `'text` slot has changed, use `:SetupIdle(<delay>)` to arrange fo the `viewIdleScript` to be called in a little while.

If `:SetupIdle(<delay>)` happens again before the first delay goes by (perhaps because the use typed another key,) the idle script will be called after the new delay. The older one is ignored. `SetupIdle` resets the timer each time it's called.

Don't forget to have the `viewIdleScript` return `NIL` so it won't be called repeatedly.

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## Testing Your Application (2/7/96)

Q: Before I ship my application, what should I test?

A: Although there is no complete answer, the following is a quick outline of things that should be te to ensure compatibility with the Newton OS. Items that are OS or Locale specific are noted. Also that this list only covers current Apple MessagePad devices.

This is something to help you think of other areas to test. Covering the areas in this list should improve the stability of your application, but is not guaranteed to make it stable and fool-proof.

This list does not cover the functionality of the application itself. That is, it is not a test plan for application.

1. Versions (Latest supported system updates)
See current versions of MessagePad devices in the Misc. Q&A section

2. Basic Functional Testing
2.1. Launch and use app from internal RAM, memory card, locked memory card, in rotated mode

3. Data Manipulation
3.1. Create and store data in internal RAM
3.2. Create and store data to memory card
3.3. Delete data from internal RAM
3.4. Delete data from memory card
3.5. Move data from internal RAM to memory card and vice versa
3.6. Duplicate data
3.7. Find data from with app frontmost
3.8. Find data in app using Find All from paperroll
3.9. Find data in all user enterable fields
3.10. Check the app name in the Find slip when "Selected" is checked, and check that the app nan correct for the radio button in the Find slip
3.11. If the app implements custom find, make sure other types of find (selected and everywhere) s work.
3.12. Select and Copy data to and from clipboard

3.14. Backup via NBU and restore to different Newton device. Verify that data is intact.
3.15. File data into folders (if supported.)

4. Communications
4.1. Print data to serial printer and network printer
4.2. Fax data
4.3. Beam data to another 2.x Newton device
4.4. Beam data to a 1.x Newton
4.5. Backup and restore data and app to memory card
4.6. Backup and restore data and app with NBU

5. Exception Testing (all of the following should cause exceptions)
5.1. Create new data to locked memory card
5.2. Delete data from locked memory card
5.3. Move data from internal memory to locked card
5.4. Beam data to a Newton device that does not have the expected application
5.5. With application running from memory card, unlock card with application open.
5.6. With application installed on memory card, unlock card with application closed.
5.7. Install application on memory card, run application, create data, close application, remove memory card.
5.8. Turn power off while application is running (PowerOff handler?)
5.9. Attempt to create new data with store memory full.
5.10. Run application with low frames heap (us HeapShow to reserve memory)
5.11. If appropriate, run application with low system heap.

6. Misc.
6.1. Does application work if soup is entirely deleted from Storage folder in Extras?
6.2. Delete application. Does any part stay behind? (icons? menus? etc.)
6.2. Check store memory and frames heap, install application, check store memory and frames he Do this several times and check for consistency
6.3. Do 6.2. and also check store and frames memory after removing application. Is all/most of the memory restored?
6.4. Check frames heap. Launch & use application. Check heap. Close application. Check heap.
6.5. Does the application add anything to the Preferences App?
6.6. Does the application add Prefs and Help to the "i" icon?
6.7. Does the application add anything to Assist, How Do I?
6.8. Launch with pager card installed
6.9. Check layout issues on MP100 vs. MP110 screen sizes (if application runs in 1.x.)
6.10. If multiple applications are bundled together, open all at the same time, check to see that th applications together aren't using too much frames heap.
6.11. Open, use, and close the application many times. Check frames heap afterward to check for leaks.
6.12. If application has multiple components and components can be removed separately, verify th application does the right thing when components are missing.

7. Compatibility
7.1. After application is installed and run, do the built-in applications work:
Names, Dates, To Do List, Connection, InBox, OutBox, Calls, Calculator, Formulas, Time Zone Clock, Styles, Help, Prefs, Owner Info, Setup, Writing Practice.
7.2. If the application can be the backdrop (this is the default case)
    7.2.1 Do the built-in applications continue to work? The list is as in 7.1. and Extras.
    7.2.2 Do printing and faxing work?
    7.2.3 Run through the other tests in this document with your application as backdrop.
7.3. If the application can operate in the rotated mode
    7.3.1. Perform all tests with the application in rotated mode as well.
    7.3.2. Check that screen layouts look correct.
    7.3.3. Make sure that bringing up dialogs or other BuildContext views works correctly.

# Views

## Saving clEditView Contents to a Soup (10/4/93)

Q: How can I save the contents of a `clEditView` (the children paragraph, polygon, and picture viev containing text, shapes, and ink) to a soup and restore it later?

A: Simply save the `viewChildren` array for the `clEditView`, probably in the `viewQuitScript`. restore, assign the array from the soup to the `viewChildren` slot, either at `viewSetupFormScr` or `viewSetupChildrenScript` time; or later followed by `RedoChildren`.

You shouldn't try to know "all" the slots in a template in the `viewChildren` array. (For exampl text has optional slots for fonts and tabs, shapes have optional slots for pen width, and new optic slots may be added in future versions.) Saving the whole array also allows you to gracefully han templates in the `viewChildren` array that don't have an ink, points, or text slot. In the future, may be children that represent other data types.

## Declaring Multiple Levels (6/9/94)

Q: Call the main application view viewA. ViewB is a child of viewA and is declared to viewA. ViewC is a child of viewB and is declared to viewB. ViewB and ViewC are both initially invisi This causes the ViewC slot in viewB to be nil when the application is first run. Is there any way access viewC without first opening and then then hiding it?

A: The built-in declare mechanism will not work without opening the view. The declared view fran are not created until the view they are declared to is opened. You may consider trying to declare viewC to viewA, but this will actually illustrate a problem with the declare mechanism--it can confused in this case because viewC's parent (viewB) may not have been created when the view fi for viewC needs to be allocated.

Depending on what sort of access you need to viewC, you could choose alternative such as

- promoting the shared data from viewC to viewB, where it can be accessed.
- writing your own equivalent of the declare mechanism, with a slot called myViewC in viewE Have viewC's viewSetupFormScript copy data from myViewC into the view frame being cre

## Constraints on KeyboardsSizing to the View (6/9/94)

Q: I am having a problem with dynamically adjusting the size of keyboards. According to the documentation, adjusting the size of my keyboard view should cause the keys to size correctly to t bounds of the view. This does not happen. If I set the viewbounds of the keyboard (a full alphanumeric keyboard) to anything less than 224x80, the keys scrunch up only taking up about h the view (horizontally). They seem to size fine vertically. Note: this happens even if I set the viewbounds to 222 (only 2 pixels shorter.)

A: It turns out the the documentation does not give the full story. The final size of the keys in a keyb is constrained by the smallest fractional key unit width you specify in the keyboard. To understar this explanation, you really need to understand the explanation of key dimensions give in pages 4 26,8 of the 1.0 Newton Programmer's Guide.

In addition to calculating the size (in key units) of the longest key row, the clKeyboardView also finds the smallest key unit specified in the keyboard and uses this to constrain the final horizont

keyboard can be 10 pixels or 20 pixels, but not 15 pixels. If the view is 15 pixels, the keyboard will
10 pixels.

The calculation for this minimal size is:

m = w * (1/s)

m - minimal size
w - width of the longest keyboard row in key units
s - numeric equivelent for smallest keyboard unit specified in the keyboard:
(keyHUnit = 1, keyHHalf = 0.5, keyHQuarter = 0.25, keyHEighth = 0.125)

So for the ASCII keyboard, the longest row is 14 key units, the smallest key unit used is keyHQua
so the minimal width for the ASCII keyboard is:

m = 14 * (1 / 0.25) = 14 * 4 = 56 pixels.

The keyboard will always be an integral multiple of 56 pixels in width. Notice that 224 pixe
exactly 4 * 56. By changing the width to 223, the keyboard now becomes 168 pixels wide.

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## Adding Editable Text to clEditViews. (6/9/94)

Q: How can I add editable text to a `clEditView`? If I drag out a `clParagraphView` child in NTK,
text is not selectable even if I turn on `vGesturesAllowed`.

A: `clEditViews` have special requirements. To create a text child of a `clEditView` that can be
selected and modified by the user (as if it had been created by the user) you need to do the followi

```
textTemplate := {
   viewStationery: 'para,
   viewBounds: RelBounds(20, 20, 100, 20),
   text: "Demo Text",
};
AddView(self, textTemplate);
```

The view must be added dynamically (with `AddView`), because the editView expects to be able to
modify the contents as the user edits this item. The template (`textTemplate` above) should also
created at run time, because the editView adds some slots to this template when creating the vie
(Specifically it fills in the `_proto` slot based on the `viewStationery` value. The `_proto` slot
be set to `protoParagraph`) If you try to create too much at compile time, you will get -48214 (obj
read only) errors when opening the edit view.

The minimum requirements for the template are a `viewStationery` of `'para`, a `text` slot, and a
`viewBounds` slot. You can also set `viewFont`, `styles`, `tabs`, and other slots to make the text loo
you would like. (See the Notarize sample code for additional relavant information.)

The way `viewStationery` is handled will change in future Newton versions, and we cannot
guarantee that the above code will continue to work.

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## TieViews and Untying Them (6/9/94)

Q: What triggers the pass of a message to a tied view? If I want to "untie" two views that have been
tied with `TieViews`, do I simply remove the appropriate slots from the `viewTie` array?

the user writes into a view that has recognition enabled, the `viewChangedScript` will get calle

As of Newton 2.0 OS there is no API for untying tied views. It may be wise to first check for the existance of an `UntieViews` function, and call it if it exists, but if it does not, removing the pair o elements from the tied view's `viewTie` array is fine.

## Immediate Children of the Root View are Special (11/17/94)

Q: In trying to make a better "modal" dialog, I am attempting to create a child of the root view that full-screen and transparent. When I do this, the other views always disappear, and reappear wh the window is closed. Why?

A: Immediate children of the root view are handled differently by the view system. They cannot be transparent, and will be filled white unless otherwise specified. Also, unlike other views in New OS 2.0, their borders are considered part of the view and so taps in the borders will be sent to ther

This was done deliberately to discourage tap-stealing and other unusual view interaction. Each t level view (usually one application) is intended to stand on its own and operate independently of other applications.

So-called "application modal" dialogs can and should be implemented using the technique you describe with the transparent window as a child of the application's base view.

You can make system modal dialogs with the view methods `FilterDialog` and `ModalDialog`. following Q&As for important information on those methods.)

## Arguments to AsyncConfirm and ModalConfirm (12/12/95)

Q: The Newton Programmer's Guide says that I can pass a symbol as the 2nd argument to `ModalConf` and `AsyncConfirm`, but doesn't say what symbols to use. What symbols can I use?

A: `ModalConfirm` and `AsyncConfirm` are actually very flexible. You can pass three different thin the 2nd argument (the list of buttons.) These things are:

a symbol - Supported symbols are `'okCancel` or `'yesNo`.
an array of strings - for example `["Three", "Two", "One"]`
an array of frames - each frame has two slots, `'value` and `'text`.
`text` - holds the label for the button, a string
`value` - holds the result that tapping the button generates.

In `ModalConfirm`, the function returns the result of the user's choice. In `AsyncConfirm`, the call back function provided as the 3rd argument is called with the result. The result varies depending what was passed as the 2nd argument.

If a symbol was used, the result is non-`NIL` for the "OK" and "Yes" buttons, and `NIL` for the "Canc and "No" buttons. If an array of strings was passed, the result is the index into the array of the it that was chosen. If an array of frames was passed, the result is the contents of the `value` slot for item that was chosen.

## FilterDialog and ModalDialog Limitations (2/5/96)

Q: After closing a view that was opened with `theView:FilterDialog()`, the part of the screen t was not covered by the `theView` no longer accepts any pen input. `theView` is a `protoFloatNGo`

A: There is a problem with `FilterDialog` and `ModalDialog` when used to open views that are n immediate children of the root view. At this point we're not sure if we'll be able to fix the proble

You must not use `FilterDialog` or `ModalDialog` to open more than one non-child-of-root view time. Opening more than one at a time with either of these messages causes the state informatior from the first to be overwritten with the state information from the second. The result will be a failure to exit the modality when the views are closed.

Here are some things you can do to avoid or fix the problem with `FilterDialog`.

• Redesign your application so that your modal slips are all children of the root view, created with `BuildContext`. This is the best solution because it avoids awkward situations when the c of an application is system-modal. (Application subviews should normally be only application-modal.)

• Use the `ModalDialog` message instead of `FilterDialog`. `ModalDialog` does not have th child-of-root bug. (`FilterDialog` is preferred, since it uses fewer system resources and is faste

• Here is some code you can use to work around the problem much like a potential patch would. (This code should be safe if a patch is madeÑthe body of the if statement should not execute on a corrected system.)

```
view:FilterDialog();
if view.modalState then
   begin
      local childOfRoot := view;
      while childOfRoot:Parent() <> GetRoot() do
         childOfRoot := childOfRoot:Parent();
      childOfRoot.modalState := view.modalState;
   end;
```

This only needs to be done if the view that you send the `FilterDialog` message to is not an immediate child of the root. You can probably improve the efficiency in your applications, since root child is ususally your application's base view, which is a "well known" view. That is, you r be able to re-write the code as follows:

```
view:FilterDialog();
if view.modalState then
   base.modalState := view.modalState;
```

# NewtApp

## Creating Preferences in a NewtApp-based Application (01/31/96)

Q: How do I create and use my own preferences slip in a NewtApp-based application?

A: In your application's base view create a slot called `prefsView` and place a template for your preferences slip there using the NTK `GetLayout` function. When the user selects "Prefs" from the Info button in your application, the NewtApp framework will create and open a view based on th template in the `prefsView` slot.

When your preferences view opens, a reference to your application's base view is stored in a slot called `theApp` in the preferences view. Use this reference to call the application's preferences. `GetAppPreferences` is a method provided by NewtApp and should not be overidd

When adding slots to the preferences frame, you must either append your developer signature to t name of the preference (for example, `'|Pref1:SIG|`) or create a slot in the preferences frame usir your developer signature and save all preferences in that frame. This will guarantee that you do overwrite slots used by the NewtApp framework.

Here is an example of how to get the preferences frame and add your data:

```
preferencesSlip.viewSetupFormScript := func()
begin
   prefs := theApp:GetAppPreferences();
   if NOT HasSlot(prefs, kAppSymbol) then
      prefs.(kAppSymbol) := {myPref1: nil, myPref2: nil};
end;
```

To save the preferences, call the application's `SaveAppState` method.

```
preferencesSlip.viewQuitScript := func()
   theApp:SaveAppState(); // save prefs
```

In the preferences frame you will find a slot called `internalStore`. Setting this slot to `true` v force the NewtApp framework to save all new items on the internal store.

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## Creating an About Slip in a NewtApp-based Application (01/31/96)

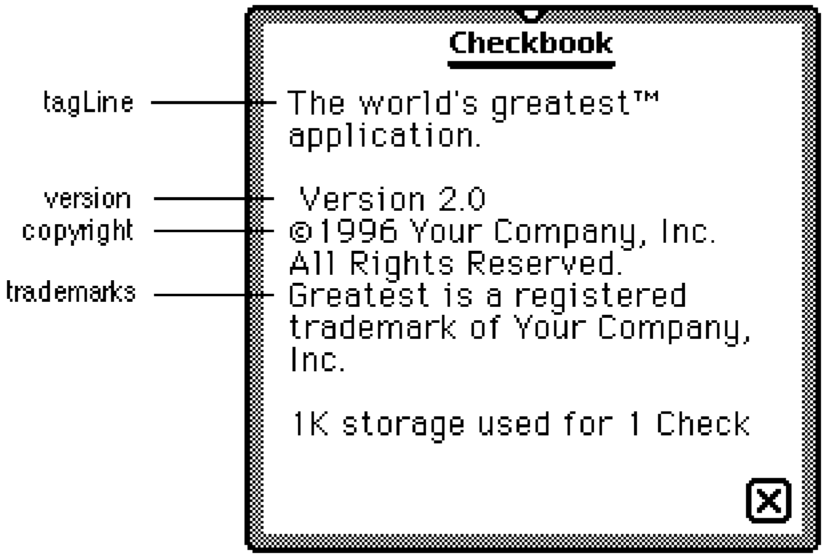
Q: How do I create my own About slip in a NewtApp-based application?

A: Depending on how much control you want, there are two ways to do this. For the least amount of control, create a slot in your application's base view called `aboutInfo`. Place a frame in that slc with the following slots:

```
{tagLine:  "",       // A tagline for your application
 version: "",        // The version number for the application
 copyright: "",      // Copyright information
 trademarks: "",     // Trademark information
}
```

The information found in this frame will be displayed by the NewtApp framework when the use selects "About" from the Info button's popup.

Here is an example of what the user will see:



Checkbook

The world's greatest™ application.

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1K storage used for 1 Check

Alternatively, you can create your own About view. If you do this, create a slot in your applicatic base view called `aboutView`. Then use the NTK `GetLayout` function to place a template of your view in that slot. A view will be created from that template and opened when the user selects "About" from the Info button's popup.

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## Customizing Filters with Labelled Input Lines (2/5/96)

Q: I need to open a slot view on a slot that isn't a standard data type (int, string, etc). How do I trans the data from the soup format to and from a string?

A: Here is some interim documentation on the filter objects that `newtLabelInputLines` (and thei variants) use to accomplish their work.

A filter is an object, specified in the `'flavor` slot of the `newtLabelInputLine` set of protos, w acts as a translator between the target data frame (or more typically a slot in that frame) and th text field which is visible to the user. For example, it's the filter for `newtDateInputLines` w translates the time-in-minutes value to a string for display, and translates the string into a time- minutes for the target data.

You can create your own custom filters by protoing to `newtFilter` or one of the other specialized filters described in Chapter 4 of the Newton Programmer's Guide.

When a `newtLabelInputLine` is opened, a new filter object is instantiated from the template fo in the `'flavor` slot for that input line. The instantiated filter can then be found in the `'filter` of the view itself. The `_parent` slot of the instantiated filter will be set to the input line itself, which allows methods in the filter to get data from the current environment.

Here are the slots which are of interest. The first four are simply values that you specify which you control over the recognition settings of the inputLine part of the field, and the rest are methoc which you can override or call as appropriate.

**Settings:**

`recFlags`

Works like `entryFlags` in `protoLableInputLine`. This provides the `'viewFlags` setti for the inputLine part of the proto -- the field the user interacts with.

`recTextFlags`

Provides the `'textFlags` settings for the inputLine part of the proto.

`recConfig`
Provides the `'recConfig` settings for the inputLine part of the proto.

`dictionaries`
Like the `'dictionaries` slot used in recognition, Provides custom dictionaries if `vCustomDictionaries` is on in the `recFlags` slot.

**Methods:**
`PathToText()`
Called when the inputLine needs to be updated. The function should read data out of the appropriate slot in the `'target` data frame (usually specified in the `'path` slot) and retur user-visible string form of that data. For example, for numbers the function might look like `func() NumberStr(target.(path))`

`TextToPath(str)`
Called when the inputLine value changes. The result will be written into the appropriate slo the `'target` data frame. The string argument is the one the user has modified from the inputLine part of the proto. For example, for numbers the function might look like `func(str if StrFilled(str) then StringToNumber(str)`

`Picker()`
An optional function. If present, this method is called when the user taps on the label part of item. It should create and display an appropriate picker for the data type. For the pre-defir filters, you may also wish to call this method to open the picker.

`InitFilter()`
Optional. This method is called when an inputLine that uses this filter is first opened. This method can be used to get data from the current environment (for example, the `'path` slot of inputLine) and adjust other settings as appropriate.

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## Creating a Simple NewtApp (2/7/96)

Q: What are the basic steps to create a simple NewtApp-based application?

A: The following steps will create a basic NewtApp-based application:

**Basic setup**
1) Create a project.
2) In NTK's Project Settings dialog, set Platform to "Newton 2.0".

**Create the NewtApp base view**:
1) Create a layout file.
2) Draw a `newtApplication`.
3) Remove the following slots:
`afterScript, allDataDefs, allViewDefs, superSymbol`.
4) Set the following slots to the following values:

```
allLayouts:     {
   default: GetLayout("default.t"), // see step 9 in the next section.
   overview: GetLayout("overview.t")} // see step 4 , overview section.
allSoups:       {
   mySoup: {
      _proto: newtSoup,
      soupName: "SoupName:Signature",
      soupIndices: [],
      soupQuery: {}   }  }
appAll:         "All items"
```

```
title:          kAppName
```
5) Draw a `newtClockFolderTab` or `newtFolderTab` as a child of the `newtApplication`.
6) Draw a `newtStatusBar` as a child of the `newtApplication`.
7) For the `newtStatusBar` set the following slots:
```
   menuLeftButtons:  [newtInfoButton]
   menuRightButtons: [newtActionButton, newtFilingButton]
```
8) Save the layout file as `"main"` and add it to the project.

**Create the default view**:
1) Create another layout file.
2) Draw a `newtLayout` in the new layout file.
3) Add a `viewJustify` slot to the `newtLayout` and set it to `parentRelativeFull` horizon and vertical (necessary only until platform file is updated).
4) Set the `viewBounds` of the `newtLayout` to:
```
{top: 20, // leave room for the folder tab
bottom: -25,  // leave room for the status bar
left: 0,
right: 0}
```
5) Draw a `newtEntryView` as a child of the `newtLayout`.
6) Add a `viewJustify` slot and set it to `parentRelativeFull` horizontal and vertical (necessary only until platform file is updated).
7) Set the `viewBounds` of the newtEntryView to:
```
{top: 0, bottom: 0, right: 0, left: 0};
```
8) Draw slot views as children of the entry view to display slots from the soup entry. For example:
   a) Draw a `newtLabelInputLine` as a child of the `newtEntryView`.
   b) Set the following slots:
```
   label:  "My Label"
   path:   'myTextSlot
```
   c) Draw a `newtLabelNumInputLine` as a child of the `newtEntryView`.
   d) Set the following slots:
```
   label:  "Number"
   path:   'myNumberSlot
```

9) Save the layout file as `"default.t"` and add it to the project. Move it so that it is compiled before the main layout (use the Process Earlier menu item).

**Add Overview support**
1) Create another layout file.
2) Draw a `newtOverLayout` in the new layout file.
3) Add the `Abstract` slot to the `newtOverLayout`, for example:
```
    Abstract := func(item, bbox )
    begin
       local t := item.myTextSlot & ",";
       if item.myNumberSlot then
          t := t && NumberStr(item.myNumberSlot);
       MakeText(t, bbox.left+18, bbox.top,
          bbox.right, bbox.bottom - 18);
    end;
```
4) Save the layout file as "overview.t" and add it to the project. Move it so that it is compiled before the main layout (use the Process Earlier menu item).

**Add InstallScript and RemoveScript**
1) Create a text file and add the following to it:
```
InstallScript := func(partFrame) begin
  partFrame.removeFrame :=
  (partFrame.theForm):NewtInstallScript(partFrame.theForm);
end;

RemoveScript := func(partFrame) begin
```

```
            NewtRemoveScript(partFrame.removeFrame);
        end;
```
2) Save the text file and add it to the project.

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## Setting the User Visible Name With NewtSoup (2/6/96)

Q: How can I make the user visible name for my NewtApp's soup be something besides the internal sc name, as I can do with `RegUnionSoup`?

A: There is a method of `newtSoup` called `MakeSoup` which you can override. The `MakeSoup` metho responsible for calling `RegUnionSoup` (or otherwise making a soup) and then calling the `FillNewSoup` method if the soup is new/empty.

`MakeSoup` is called normally as part of initializing the `newtSoup` object. Here is a sample `MakeSoup` method that will use a newly defined slot (from the `newtSoup` based template) for th user name.

The current documentation doesn't tell you everything you need to do to properly override the `MakeSoup` method. In particular, `MakeSoup` is used by the `newtSoup` implementation to initiali the object, so it needs to set up other internal slots. It's vital that the `'appSymbol` slot in the mes context be set to the passed argument, and that the `'theSoup` slot be set to the soup or unionSoup `MakeSoup` creates or gets. (Recall that `RegUnionSoup` returns the union soup, whether it previo existed or not.)

The `GetSoupList` method of union soups used in this code snippet returns an array with the mem soups. It should be considered documented and supported. A newly created union will have no members, so `FillNewSoup` should be called. This is an improvement over the default `MakeSoup` method, which calls `FillNewSoup` if the soup on the internal store is empty.

The `'userName` slot is looked up in the current context. As with `soupName`, `soupDescr`, etc, you should set a new `userName` slot in the frame in the `allSoups` frame in the `newtApplication` template.

```
MakeSoup: func(appSymbol)
   begin
      self.appSymbol := appSymbol;    // just do it...
      self.theSoup := RegUnionSoup(appSymbol, {
            name: soupName,
            userName: userName,
            ownerApp: appSymbol,
            userDescr: soupDescr,
            indexes: soupIndices});
      if Length(theSoup:GetSoupList()) = 0 then
         :FillNewSoup();
   end;
```

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## **NEW:** NewtSoup FillNewSoup Uses Only Internal Store (2/5/96)

Q: My `NewtSoup` continues to get the `FillNewSoup` message, even when the soup already exists. An doing something wrong?

A: The `FillNewSoup` message is only checking the internal store. Check the "Setting the UserVisi Name With NewtSoup" Q&A for more details, and a description of how to work around the prob

## **NEW**: How to Control Sort Order in NewtApp (5/10/96)

Q: While a NewtApp application is running, can I change the order in which soup items appear?

A: Yes, the key to changing the sort order is to modify the query spec in the `allSoups` frame, and th cause the application to refresh. The cursor that controls the sort order for the layout is built fror `masterSoupSlot` slot. Both the default and the overview layouts have a `masterSoupSlot` which points back to the relevant `allSoups` slot in the app base view.

Here are the basic steps:

1) Ensure `newtAppBase.allSoups` & `newtAppBase.allSoups.mySoup` are writeable. (Since th frames reside in the package, they are in protected memory.)
2) Modify the query spec to the new sort order.
3) Now send `newtAppBase.allSoups.mySoup:SetupCursor()` to create a new cursor using the ne query spec.
4) Then do a `newtAppBase:RedoChildren()` to display the items in the new sort order.

The code would look something like:

```
if IsReadOnly (newtAppBase.allSoups) then
     newtAppBase.allSoups := {_proto: newtAppBase.allSoups};
if IsReadOnly (newtAppBase.allSoups.mySoup) then
     newtAppBase.allSoups.mySoup :={
          _proto: newtAppBase.allSoups.mySoup};
newtAppBase.allSoups.mySoup.soupQuery :=
   {indexpath: newKey};       // new sort order!
newtAppBase.allSoups.mySoup:SetupCursor();
newtAppBase:RedoChildren();
```

## **NEW**: How to Avoid NewtApp "Please insert the card" errors (5/10/96)

Q: If a NewtApp-based application is on a PCMCIA card and the card is removed, the user gets the following error message:

"The package <package name> still needs the card you removed. Please insert it now, or informa on the card may be damaged."

How can I avoid this problem?

A: While a PCMCIA card is unmounting, if an object on the card is still referenced, then the user will the above error message asking them to reinsert the PCMCIA card. For more information about iss for applications running from a PCMCIA card see the article "The Newton Still Needs the Card Y Removed"

The `newtApplication` method `NewtInstallScript` is normally called in the part's `InstallScript` function. One thing the `NewtInstallScript` does is register the viewDefs in NewtApp base view allViewDefs slot using the global function `RegisterViewDef`.

Currently, `RegisterViewDef` requires that the data definition symbol be internal. If the symb on the card, then when the `NewtRemoveScript` tries to unregister the viewDef a reference to da on the card is encountered and the above error message will be shown. This bug will be fixed in a future ROM.

To work around this bug, add the following code to the part's `InstallScript` before calling

```
local mainLayout := partFrame.theForm;
if mainLayout.allViewDefs then
   foreach dataDefSym,viewDefsFrame in
         mainLayout.allViewDefs do
      foreach viewDef in viewDefsFrame do
         RegisterViewDef (
                        viewDef, EnsureInternal (dataDefSym) );
partFrame.removeFrame :=
   mainLayout:NewtInstallScript(mainLayout);
```

Note that it is OK to call `RegisterViewDef` more than once with the same view definition. `RegisterViewDef` will return NIL if the template is already registered.

# Stationery

## **NEW:** Limits on Stationery Popups (4/30/96)

Q: If I add stationery to Notes, Names, or my application and it is off the bottom of the popup in the button, I am unable to scroll to it in the stationery popup. Why?

A: There is a problem in the MessagePad 120 and 130 with Newton 2.0 OS constructing popups that contain icons. See the "Picker List is Too Short " Q&A in the Pickers, Popups and Overviews sect

# Pickers, Popups and Overviews

## ProtoDigit Requires a DigitBase View (2/6/96)

Q: I get an exception concerning an undocumented `digitbase` slot in `protoDigit`. The slot is not documented in the current release of the documentation. How can I make `protoDigit` work?

A: `protoDigit` is not really designed to be used independently. You should use `protoNumberPick` for input like this.

If you really need to use `protoDigit` then it expects to be contained in a view that has a `declareSelf` slot whose value is the symbol `digitBase`. To solve the problem, draw out a `clV` give it a `declareSelf` slot with a value of `'digitBase` and draw your `protoDigits` inside view. You are responsible for propagating carries and other information to all `protoDigits`. Yo also responsible for animation and the flip digit look. Unfortunately, the dotted line picture is n available.

As of 2/6/96, the Newton 2.0 Platform file also gives a `protoDigit` a default `digitBase` slot the number type. This slot must be removed.

## Single Selection in ProtoListPicker-based Views (12/5/95)

Q: How do I allow only one item to be selected in a `protoListPicker`, `protoPeoplePicker`, `protoPeoplePopup`, or `protoAddressPicker`?

option of `protoListPicker`. That means that the particular class of nameRef you use must inclu
single selection. In general, this requires creating your own subclass of the particular name referen
class.

The basic solution is to create a data definition that is a subclass of the particular class your
`protoListPicker` variant will view. That data definition will include the `singleSelect` s
As an example, suppose you want to use a `protoPeoplePopup` that just picks individual people.
could use the following code to bring up a `protoPeoplePopup` that only allowed selecting one
individual at one time:

```
// register the modified data definition
RegDataDef('|nameref.people.single:SIG|,
  {_proto: GetDataDefs('|nameRef.people|), singleSelect: true});

// then pop the thing
protoPeoplePopup:New('|nameref.people.single:SIG|,[],self,[]);

// sometime later
UnRegDataDef('|nameref.people.single:SIG|);
```

For other types of `protoListPickers` and classes, create the appropriate subclass. For example
transport that uses `protoAddressPicker` for emails might create a subclass of
`'|nameRef.email|` and put that subclass symbol in the `class` slot of the `protoAddressPick`

Since many people are likely to do this, you may cut down on code in your`installScript` and
`removeScript` by registering your dataDef only for the duration of the picker. That would mea
registering the class just before you pop the picker and unregistering after the picker has closed. Y
can use the `pickActionScript` and `pickCanceledScript` methods to be notified when to
unregister the dataDef.

## Using Icons withProtoLabelPicker (1/3/96)

Q: How do I successfully specify an initial icon for my `protoLabelPicker` and change the value of
icon programatically?

A: There are two relevant methods of `protoLabelPicker` that did not appear in early documenta

`IconSetup()`
Returns an icon to use initially (like `TextSetup`). The default script will use the icon associated
the first item in the labelCommands array.

`UpdateIcon(newIcon)`
Set the icon to the `newIcon.`

## Determining Which ProtoSoupOverview Item Is Hit (2/5/96)

Q: Ho w do I determine which item is hit in a `protoSoupOverview`?

A: There is a method called `HitItem` that gets called whenever an item is tapped. The method is
defined by the overview and you should call the inherited one. Also note that `HitItem` gets cal
regardless of where in the line a tap occurs. If the tap occurs in the checkbox, you should do nothir
otherwise you should do something.

protoSoupOverview. So, you can find the actual soup entry by cloning the cursor and moving it.

Here is an example of a HitItem method. If the item is selected (the checkbox is not tapped) th
the code will set an inherited cursor (called myCursor) to the entry that was tapped on:

```
func(itemIndex, x, y)
begin
   // MUST call the inherited method for bookeeping
   inherited:HitItem(itemIndex, x, y);

   if x > selectIndent then
   begin
  // get a temporary cursor based on the cursor used
  // by soup overview
      local tCursor := cursor:Clone();

  // move it to the selected item
      tCursor:Move(itemIndex) ;

  // move the inherited cursor to the selected entry
      myCursor:Goto(tCursor:Entry());

  // usually you will close the overview and switch to
  // some other view
      self:Close();
   end;
   // otherwise, just let them check/uncheck
 // which is the default behavior
end
```

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## Displaying the ProtoSoupOverview Vertical Divider (2/5/96)

Q: How can I display the vertical divider in a protoSoupOverview?

A: The mechanism for bringing up the vertical divider line was not correctly implemented in protoSoupOverview. You can draw one in a viewDrawScript as follows:

```
// setup a cached shape for efficiency
mySoupOverview.cachedLine := nil;

mySoupOverview.viewSetupDoneScript := func()
begin
   inherited:?viewSetupDoneScript();

   local bounds := :LocalBox();
   cachedLine := MakeRect(selectIndent - 2, 0,
        selectIndent - 1, bounds.bottom);
end;

mySoupOverview.viewDrawScript := func()
begin
   // MUST call inherited script
   inherited:?viewDrawScript();

   :DrawShape(cachedLine,
      {penPattern: vfNone, fillPattern: vfGray});
end;
```

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Q: I can't figure out how to use `protoOverview`, even after reading the NPG 2.0 First Edition (beta) docs. How does it work?

A: The most recent documentation does not contain the current information on `protoOverview`. Belo some interim documentation on how to use it. This information is also in a DTS sample called "protoOverview".

`protoOverview` was really set up as the basis for `protoSoupOverview`. Because of that, you r to do some extra work to use just the `protoOverview`.

The easiest way to use the overview is to encapsulate your data in a "cursor"-like object that supp the methods: `Entry`, `Next`, `Clone`. Since your data is probably in an array, you can use a "cursor" object like this:

```
{  items: nil,

   index: 0,

   Entry: func()
   begin
      if index < Length(items) then
      items[index];
   end,

   Next: func()
      if index < Length(items)-1 then
      begin
         index := index + 1;
         items[index];
      end,

   Move: func(delta)
   begin
      index := Min(Max(index + delta, 0), kNumItems-1) ;
      items[index];
   end,

   Clone: func()
      Clone(self),

   GetIndexEntry: func(theIndex)
      items[theIndex]
}
```

You need to define the following methods in your `protoOverview`:

`Abstract(item, bbox)`
   `item` - data item returned by your
   `bbox` - bounding box of the shape you should draw
Return a shape that represents the item. Must fit in the bounding box specified by bbox.

`HitItem(hitIndex, xcoord, ycoord)`
   `hitIndex` - index of item relative to top of displayed items
   `xcoord` - x coordinate of the tap relative to item that was tapped
   `ycoord` - y coordinate of the tap relative to item that was tapped
Called when an item is tapped. If checkboxes are enabled, you should check if the x is less that tl `selectIndent`. If so, call the inherited `HitItem`, otherwise your item has been tapped on.

Note: `hitIndex` is relative to the displayed items, not the total items. You will need to track w

An example is:

```
func(hitIndex, xcoord, ycoord)
begin
   if xcoord < selectIndent then
      inherited:HitItem(hitIndex, xcoord, ycoord) ;
   else begin
      hitIndex := hitIndex + saveIndex;
      print("hit item: " & hitIndex) ;
      :Dirty(); // refresh the view
   end ;
end
```

`IsSelected(entry)`
`entry` - the "entry" that is tapped on
Return true if the entry is selected (the checkbox is checked in the overview). Note that selec
is different from highlighted or hit.

`Scroller(dir)`
`dir` - direction to scroll
Implements the code necessary to scroll the contents that will be displayed.

Typically, this will update some sort of saved index and any highlight tracking an then redc
children of the view.

`SelectItem(hitIndex)`
`hitIndex` - index of item relative to top of displayed items
Perform whatever record keeping is required to toggle the selected state of the item at `hitIn`
`SelectItem` is called each time the checkbox for an item is tapped.

Note: `hitIndex` is relative to the displayed items not the total items. You will need to trac
what the real "top" index is.

`viewSetupChildrenScript()`
You must provide this method. You must send the `SetupAbstracts` message from this scrip
Note that `SetupAbstracts` is expecting a cursor object. If you use the cursor object given abo
this method will work correctly.

You also need to define the following slot in your `protoOverview`:

`cursor`
The cursor object based on the above object. This should contain the encapsulated array you ar
displaying.

In addition to the above methods and slot, you must provide a mechanism to find an actual data i
given an index of a displayed item. In general, you need some sort of saved index that corresponds
the first displayed item.

You also should provide a mechanism to track the currently highlighted item. This is distinct fro
selected item.

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## **NEW:** Validation and Editing in ProtoListPicker (4/1/96)

Q: I am trying to use the `ValidationFrame` to validate and edit entries in a `protoListPicker`.
When I edit certains slots I get an error that a path failed. All the failures occur on items that ar
nested frames in my soup entry. What is going on?

A: The built-in validation mechanism is not designed to deal with nested soup information. In gener
you gain better flexibility by not using a `validationFrame` in your pickerDef, even if you have
nested entries. Instead, you can provide your own validation mechanism and editors:

- Define a `Validate` method in your picker definition
- Define an `OpenEditor` method in your picker definition
- Draw a layout for each editor you require

`pickerDef.Validate(nameRef, pathArray)`
`nameRef` - nameRef to validate
`pathArray` - array of paths to validate in the nameRef
returns an array of paths that failed, or an empty array

Validate each path in `pathArray` in the given nameRef. Accumulate a list of paths that are no
valid and return them.

The following example assumes that `pickerDef.ValidateName` and
`pickerDef.ValidatePager` have been implemented:

```
pickerDef.Validate := func(nameRef, pathArray)
begin
   // keep track of any paths that fail
   local failedPaths := [];

   foreach index, path in pathArray do
   begin
      if path = 'name then
      begin
         // check if name validation fails
         if NOT :ValidateName(nameRef) then
            // if so, add it to array of failures
            AddArraySlot(failedPaths, path);
      end;
      else begin
         if NOT :ValidatePager(nameRef) then
            AddArraySlot(failedPaths, path);
      end;
   end;
   // return failed paths or empty array
   failedPaths;
end;
```

`pickerDef.OpenEditor(tapInfo, context, why)`
The arguments and return value are as per `OpenDefaultEditor`. However, you need to use this
instead of `DefaultOpenEditor`.

```
pickerDef.OpenEditor := func(tapInfo, context, why)
begin
   local valid = :Validate(tapInfo.nameRef, tapInfo.editPaths) ;
   if (Length(valid) > 0) then
      // if not valid, open the editor
      // NOTE: returns the edit slip that is opened
      GetLayout("editor.t"):new(tapInfo.nameRef,
         tapInfo.editPaths, why, self, 'EditDone, context);
   else
   begin
      // the item is valid, so just toggle the selection
      context:Tapped('toggle);
      nil;                                    // Return <nil>.
   end;
```

The example above assumes that the layout "editor.t" has a `New` method that will open the edi
and return the associated View.

The editor can be designed to fit your data. However, we suggest that you use a `protoFloatNGo` that is a child of the root view created with the `BuildContext` function. You are also likely to a callback to the pickderDef so it can appropriately update the edited or new item. Finally, your editor will need to update your data soup uing an "Xmit" soup method so that the listPicker will update.

In the `OpenEditor` example above, the last three arguments are used by the editor to send a callback to the pickerDef from the `viewQuitScript`. The design of the callback function is up to here is an example:

```
pickerDef.EditDone := func(nameRef, context)
begin
   local valid = :Validate(tapInfo.nameRef, tapInfo.editPaths) ;
   if (Length(valid) > 0) then
   begin
      // Something failed. Try and revert back to original
      if NOT :ValidatePager(nameRef) AND
         self.('[pathExpr: savedPagerValue, nameRef]) = nameRef
   then
            nameRef.pager := savedPagerValue.pager;

      context:Tapped(nil);    // Remove the checkmark
   end;
   else
      // The nameRef is valid, so select it.
      context:Tapped('select);

   // Clear the saved value for next time.
   savedPagerValue := nil;
end;
```

---

## **NEW**: How to Change the Font in ProtoListPicker (4/22/96)

Q: How do I set a different font for the items in the protoListPicker?

A: There is a way to change the font in the Newton 2.0 OS, however, we intend to change the mecha in the future. Eventually, you will be able to set a `viewFont` slot in the `protoListPicker` its and have that work (just like you can set `viewLineSpacing` slot now). In the meantime, you nee piece of workaround code. Warning: you must set the viewFont of the listPicker AND include this workaround code in the `viewSetupDoneScript`:

```
func()
   begin
   if listBase exists and listBase then
      SetValue(listBase, 'viewFont, viewFont) ;

      inherited:?viewSetupDoneScript();
   end;
```

This will set the `viewFont` slot of the listBase view to the `viewFont` of the `protoListPick`
You cannot rely on the listbase view always being there, hence the test for its existence.

---

Q: If I put name references in the `selected` array of a `protoListPicker`, it throws a `-48402` erro
How do I preselect items?

A: You are probably setting up the `selected` array in your `viewSetupFormScript` or `viewSetupChildrenScript`. Use the `viewSetupDoneScript` to set up the `selected` array, then send the `Update` message to `protoListPicker` to tell it to update the display.

Note that due to a bug in the Newton 2.0 OS, the items must have a `sortOn` slot that is a string,
else the preselection will fail.

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## **CHANGED:** Picker List is Too Short (4/29/96)

Q: I have items in my picker list with different heights that I set using the `fixedHeight` slot. Wh
bring up the picker, it is not tall enough to display all the items. Worse, I cannot scroll to the extr
items. What is going on?

A: The `fixedHeight` slot is used for two separate things. Any given pick item can use the `fixedHeight` slot to specify a different height. This works fine.

However, the code in Newton 2.0 OS that determines how big the list should be also uses the `fixedHeight` slot of the first pick item (in other words, `pickItems[0]`) if it exists. It is as if t
following code executes:

```
local itemHeight := kDefaultItemHeight;
if pickItems[0].fixedHeight then
   itemHeight := pickItems[0].fixedHeight;
local totalHeight := itemHeight * Length(pickItems);
```

This total height is used to figure out if scrolling is required. As you can see, this can cause probler
your first item is not the tallest one. The solution is to make sure the first item in your `pickItem`
array has a `fixedHeight` slot that is sufficiently large to make scrolling work correctly. This n
be fixed in future revisions of the Newton OS.

Note that there will be similar problems if your pick items contain icons. The system will use the
default height unless you specify a `fixedHeight` slot in your first item. The default height is n
tall enough for most icons. In other words, if you have icons in your pick items, you must have a `fixedHeight` slot in the first item that is set to the height of your icon.

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## **NEW**: Tabs Do Not Work With ProtoTextList (5/8/96)

Q: I tried to use tabs to get columns in a `protoTextList` but they do not appear. How do I get colum

A: The text view in `protoTextList` is based on a simple text view which does not support tabs. If y
want scrolling selectable columns you can use shapes to represent the rows. If you need finer contro
the `LayoutTable` view method.

# Controls and Other Protos

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## **NEW**: How to Set the Letter in AZTab Protos (3/26/96)

A: You can use the `SetLetter` method of the AZTab protos:

```
protoAZTabs.SetLetter(newLetter, NIL)
```

Set the tab to the character specified by newLetter and update the hiliting. Note that this meth does not send a `pickLetterScript` message.

```
Example:

// set myProtoAZTabs to the letter "C"
myProtoAZTabs:SetLetter($c, nil) ;

protoAZVertTabs.SetLetter...
see protoAZTabs.SetLetter
```

# Text and Ink Input and Display

## ProtoPhoneExpando Bug in Setup1 Method (2/6/96)

Q: I am having a problem using `protoPhoneExpando` under Newton 2.0 OS. Something is going wro in the `setup1` method. Is this a known bug?

A: This is a known bug. `protoPhoneExpando` (and the entire expando user interface) have been deprecated in the Newton 2.0 OS, and are only supported for backward compatibility. If possible should redesign your application to avoid the expandos.

The problem seems to be that the expando shell is sending the `setup1` and `setup2` messages to template in the `lines` array. These methods in `protoPhoneExpando` rely on information tha isn't created until the view is actually opened.

We're investigating solutions to this problem. You can usually hack around the problem by placir `labelCommands` slot in the template which has an array of one element, that element being the label you want to appear in the phone line. For example: `labelCommands: ["phone"]`.

This hack works only if your `protoPhoneExpando` doesn't use the `phoneIndex` feature. If it d you'll have problems that are harder to work around.

## Pictures in clEditViews (2/6/96)

Q: Is there a API or procedure that allows an application to write objects such as shapes, PICTs, or bitmaps to a note in the Notes application?

A: There is no API for Notes specifically. The Notes "Note" view is basically a plain old `clEditVi` and `clEditViews` can contain pictures (in addition to ink, polygons, and text) in the Newton 2.0

The Newton 2.0 System NPG in the "Built-In Applications and System Data" chapter, in the sect on "Notes" contains a description of the types of children you can create in the Notes application.

This is really a description of the frames you need to put in the `'viewChildren` slot of a `clEditView` to create editable items. `'para` templates are text and ink text, `'poly` templates a drawings and sketch ink, and `'pict` templates are images.

viewChildren array (and open the view or call RedoChildren) or use the AddView method to it to an existing view (then Dirty the view.) See the item "Adding Editable Text to a clEditVie elsewhere in the Q&As for details.

The template for pict items needs to contain these slots:

| | |
|---|---|
| viewStationery: | Must have the symbol 'pict |
| viewBounds: | A bounds frame, like RelBounds(0,0,40,40) |
| icon: | A bitmap frame, see clPictureView docs |

For other slots, see the documentation for the clPictureView view class.

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## Horizontal Scrolling, Clipping, and Text Views. (2/7/96)

Q: I want to draw 80 columns in a clParagraphView that's inside a smaller view and be able to scr back and forth. When I try this, it always wraps at the bounds of the parent. How can I create a horizontal scrolling text view?

A: Normal paragraph views are written so that their right edge will never go beyond their parent. is done to avoid the circumstance where a user could select and delete some text from the left part paragraph in a clEditView, leaving the rest of it off screen and unselectable.

What happens is the viewBounds of the clParagraphView are modified during creation of th view so that the view's right edge is aligned with the parent's right edge. After that, wrapping automatic.

The so-called "lightweight" text views do not work this way. You can force a paragraph to be lightweight by: 1) Making sure the viewFlag vReadOnly is set, 2) making sure vCalculateBou and vGesturesAllowed, are OFF, and 3) not using tabs or styles. Lightweight text views are editable, but you can use SetValue to change their text slots dynamically.

If you must use an editable clParagraphView or if tabs or styles are required, there is another workaround. The code to check for clipping only looks one or two levels up the parent chain, so yo could nest the paragraph in a couple of otherwise useless views which were large enough to preve clipping, and let the clipping happen several layers up the parent chain.

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## **NEW:** How to Intercept Keyboard Events (5/6/96)

Q: How do I intercept hardware keyboard events or "soft" keyboard events?

A: You can implement view methods that are called whenever the user presses a key on software or external (hardware) keyboards.. There are two keyboard-related methods associated with view based on the clParagraphView view class:

- the viewKeyDownScript message is sent when a key is pressed.
- the viewKeyUpScript message is sent when a key is released.

Both methods receive two arguments: the character that was pressed on the keyboard and a keyb flags integer. The keyboard flags integer encodes which modifier keys were in effect for the key event, the unmodified key value, and the keycode. The layout of the keyboard flags integer is sh in the section below, "Keyboard Flags Integer". The modifier key constants are shown in the secti "Keyboard Modifier Keys".

ViewKeyUpScript and ViewKeyDownScript are currently called using parent inheritance. D rely on this behavior; it may change in future ROMs.

If you want the default action to occur, these method must return `nil`. The default action for `ViewKeyDownScript` is usually to insert the character into the paragraph. (There may be othe default actions in the future.) If you return a non-nil value, the default action will not occur.

You must include the `vSingleKeyStrokes` flag in the `textFlags` slot of your view for the sys to send the `ViewKeyDownScript` or `ViewKeyUpScript` message for every key stroke. If you dc specify `vSingleKeyStrokes`, keyboard input may be dropped if a lot of key strokes are coming i

The hard keyboard auto repeats with the following event sequence:

keydown -- keydown -- keydown -- keydown...

The soft keyboard auto repeats with this sequence:

keydown -- keyup -- keydown -- keyup -- keydown -- keyup...

Do not rely on this order, it may change in future ROMs.

**ViewKeyDownScript**

`ViewKeyDownScript(char, flags)`
This message is sent to the key view when the user presses down on a keyboard key. This applies hardware keyboard or an on-screen keyboard.

`char` The character that was entered on the keyboard. Note that if a modifier key is the o key pressed (for example, the Shift key), this value will be 0.

`flags` An integer that specifies which modifier keys were pressed, the unmodified key valu and the keycode. The modifier key constants are shown in the section "Keyboard Modifier Keys".

**ViewKeyUpScript**

`ViewKeyUpScript(char, flags)`
This message is sent to the key view whenever the user releases a keyboard key that was depress This applies to a hardware keyboard or an on-screen keyboard.

`char` The character that was entered on the keyboard. Note that if a modifier key is the o key pressed (for example, the Shift key), this value will be 0.

`flags` An integer that specifies which modifier keys were pressed, the unmodified key valu and the keycode. The modifier key constants are shown in the section "Keyboard Modifier Keys".

**Keyboard Flags Integer**

| Bits | Description |
|---|---|
| 0 to 7 | The keycode. |
| 8 to 23 | Original keycode. The 16-bit character that would result if none of the modifier keys were pressed. |
| 24 | Indicates that the key was from an on-screen keyboard. (kIsSoftKeyboard) |
| 25 | Indicates that the Command key was in effect. (kCommandModifier) |
| 26 | Indicates that the Shift key was in effect. (kShiftModifier) |
| 27 | Indicates that the Caps Lock key was in effect. (kCapsLockModifier) |
| 28 | Indicates that the Option key was in effect. (kOptionsModifier) |
| 29 | Indicates that the Control key was in effect. (kControlModifier) |

**Keyboard Modifier Keys**

You use the keyboard modifier key constants to determine which modifier keys were in effect whe
keyboard event occurs.

| Constant | Value |
|---|---|
| `kIsSoftKeyboard` | (1 << 24) |
| `kCommandModifier` | (1 << 25) |
| `kShiftModifier` | (1 << 26) |
| `kCapsLockModifier` | (1 << 27) |
| `kOptionsModifier` | (1 << 28) |
| `kControlModifier` | (1 << 29) |

# Stroke Bundles

# Recognition

## Opening the Corrector Window (12/8/95)

Q: I want the corrector window available for the user at specific times, can I open it from within my application?

A: Yes, below is the code you should use to open the corrector window. For compatibility, you should always make sure the corrector exists. The corrector itself requires that a valid keyView exists.

```
local correctView := GetRoot().correct;
if correctView and GetKeyView() then
   correctView:Open();
```

## Custom Recognizers (2/8/96)

Q: Can I build recognizers for gestures and objects other than those built into the Newton system?

A: In Newton 2.0 OS, thereÕs no support to add custom recognizers using the Newton Toolkit. Stay tu
for more information concerning this.

Some recognition engines can work in a window separate from the edited text. For instance, writin
"w" in a special view might causes "w" to appear in the currently edited text view (the key view
This type of recognition system can be implemented as a keyboard. If you want to use this approa
you might want to use a function in the Newton 2.0 Platform file that allows your keyboard to rep
the built-in alphanumeric "typewriter" keyboard. See the Platform File Notes for more informat
on the `RegGlobalKeyboard` function.

## **NEW**: How to Limit Choices in ProtoRecToggle (2/22/96)

Q: How do I limit the choices visible in the picker opened by `protoRecToggle`?

A: The `protoRecToggle` picker choices are controlled by `the _recogPopup` slot in supported symbols are `'recogText`, `'recogInkText`, `'recogShapes`, `'recogSketches`. Additionally, you can supply the symbol `'pickSeparator` to display a separator line, and the symbol `'recToggleSettings` to open the recognition preferences slip.

## **NEW**: How to Save and Restore Recognition Settings (4/9/96)

Q: Can I capture a user's recognition settings which then may later be restored?

A: Yes, the global functions `GetUserSettings`, `SetDefaultUserSettings` and `SetUserSetti` allow you to manipulate recognition-related user preference data. These functions can allow an application to keep and manage recognition settings for multiple users. These functions only mana information about the recognition settings, and no other user preference settings.

`GetUserSettings()`
This function returns a frame of the current user recognition settings; this frame is the argument fo SetUserSettings. Do not modify the frame this function returns. Do not rely on any values, as the frame may change in future releases.

`SetDefaultUserSettings()`
This function sets recognition-related user preference settings to default values.

`SetUserSettings(savedSettings)`
Sets user preferences for recognition as specified.
savedSettings - Recognition preferences frame returned by the `GetUserSettings` function.

# Data Storage (Soups)

## FrameDirty is Deep, But Can Be Fooled. (8/19/94)

Q: Does the global function `FrameDirty` see changes to nested frames?

A: Yes. However, `FrameDirty` is fooled by changes to bytes within binary objects. Since strings are implemented as binary objects, this means that `FrameDirty` will not see changes to individual characters in a string. Since `clParagraphViews` try (as much as possible) to work by manipulati the characters in the string rather than by creating a new string, this means that `FrameDirty` ca easily fooled by normal editing of string data.

Here is an NTK Inspector-based example of the problem:

```
s := GetStores()[0]:CreateSoup("Test:PIEDTS", []);
e := s:Add({slot: 'value, string: "A test entry", nested: {slot:
'notherValue}})
#4410B69  {slot: value,
           String: "A test entry",
           nested: {slot: notherValue},
           _uniqueID: 0}
FrameDirty(e)
#2        NIL

e.string[0] := $a; // modify the string w/out changing its reference
FrameDirty(e)
#2        NIL
```

```
e.string := "A new string";     // change the string reference
FrameDirty(e)
#1A       TRUE

EntryChange(e);
e.nested.slot := 'newValue;     // nested change, FrameDirty is deep.
FrameDirty(e)
#1A       TRUE

s:RemoveFromStore()  // cleanup.
```

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## Limits on Soup Entry Size (2/12/96)

Q: How big can I make my soup entries?

A: In practice, entries larger than about 16K will significantly impact performance, and 8K should b considered a working limit for average entry size. No more than 32K of text (total of all strings, keeping in mind that one character is 2 bytes) can go in any soup entry.

There is no size limit built into the NewtonScript language; however, another practical limit is there must be space in the NewtonScript heap to hold the entire soup entry.

There is a hard upper limit of 64K on Store object sizes for any store type. With SRAM-based stor there is a further block size limit of 32K. Trying to create an entry larger than this will result in `evt.ex.fr.store` exceptions. These limits are for the encoded form that the data takes when written to a soup, which varies from the object's size in the NS heap.

Newton Backup Utility and Newton Connection Kit cannot handle entries larger than 32K.

Note that Virtual Binary Objects (VBOs) in Newton 2.0 are no subject to the same restrictions. If y can store large objects as VBOs, you can store more information in your soup entries by referencing t VBOs.

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## **NEW:** Choosing EntryFlushXMit and EntryChangeXMit (4/17/96)

Q: What is the difference between the functions `EntryFlushXMit` and `EntryChangeXMit`?

A: The most important criterion when choosing between `EntryFlushXMit` and `EntryChangeXMit` what will be done with the entry after the flush or change.

When an entry is added or changed, the system ensures that a cached entry frame exists in the NewtonScript heap. The system then writes the data in the frame to the store, skipping `_proto` slots. The result is that the data will be written to the store, and a cached frame will exist. Ofte this is exactly what is desired because the entry is still needed since it will soon be accessed or modified.

In some cases, the data will be written to the soup with no immediate access afterwards. In other words, the data will not be used after being written to the soup. In these cases creating or keeping cached entry frame in the NewtonScript heap is unnecessary and just wastes space and time. In th situations, `EntryFlushXMit` is a better option; it writes the data to the soup without creating t cached entry.

If any code accesses an entry that was just flushed, a new cached frame will be read in from the so just like when an existing entry is read for the first time.

The rule of thumb is: if an entry will be used soon after saving to the soup, then use `AddXMit` or `EntryChangeXMit`. If the entry will not soon be used again (so it doesn't need to take up heap spa with the cached frame), then use `AddFlushedXmit` or `EntryFlushXMit`.

Some examples of good usage:

```
while entry do
begin
  entry.fooCount := entry.fooCount + 1;
  // nil appSymbol passed so don't broadcast
  EntryFlushXMit(entry, nil);
  entry := cursor:Next();
end;                           // Could broadcast now


foreach x in kInitialData do   // if new, may not need broadcast
 soup:AddFlushedXmit(Clone(x), nil);
```

## **NEW:** How to Avoid VBOs Causing Resets (5/21/96)

Q: When writing large amounts of information to virtual binary objects (VBOs), my Newton device sometimes resets. What is going wrong?

A: The problem happens because of how the Newton OS manages the memory for VBOs. Due to a bug writing to VBOs in low memory conditions can sometimes cause the device to reset.

To work around this problem, periodically call the previously undocumented global function `ClearVBOCache` when modifying VBOs. This function takes a VBO as an argument and frees up system memory used by that VBO. Note that it does not commit the changes to the VBO.

In all versions of the Newton 2.0 OS released to date, VBOs (including packages) are managed in pages. When you write to a VBO, the "dirty" pages can remain in the system heap, taking up spa `ClearVBOCache` moves the dirty pages for a given VBO to the store, freeing up the system memo

The likeliness of the problem depends on the amount of system memory currently available and h many pages of VBOs are modified. We recommend you modify no more than about 32 pages of VB before calling `ClearVBOCache`. For example, modifying 32K of contiguous data, or a single byte i different pages of one VBO, or even a single byte in 32 different VBOs. Calling `ClearVBOCache` repeatedly for modifications to the same page of a VBO or when there are only a few modified pa can actually hurt performance without preventing the reset, so don't call it more often than neces

If you are experiencing this problem, you might consider redesigning your application to minimiz amount of uncommited VBO data. When finished with a VBO, commit it to a soup entry as soon a possible or let it become unreferenced.

# Drawing and Graphics

## Drawing Text on a Slanted Baseline (9/15/93)

Q: Is it possible in the Newton OS to draw text on a slanted baseline? I don't mean italics, but actua drawing a word at a 45 or 60 degree angle and so on. For example, can text be drawn along a line t goes from 10,10 to 90,90 (45 degrees)?

A: Like QuickDraw in the MacOS operating system, the drawing package in the Newton OS support

the bits; you can do the same on a Newton device. In the Newton OS, we even provide calls to rot
bitmap in 90 degree increments.

You might consider creating a font having characters that are pre-rotated to common angles (such
30 or 45 degrees) so that applications could just draw characters rather than actually having to r
a bitmap.

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## LCD Contrast and Grey Texture Drawing (11/10/93)

Q: An artist working with me did a wonderful job rendering a 3D look using several different grey textures. The problem is that when her image is displayed on a Newton display everything on th screen dims. Is it possible that the image causes too much display current to maintain contrast?

A: What you're seeing is a well-known problem with LCD displays, and there's not a lot you can do about it. It's especially aggravated by large areas of 50% gray (checkerboard) patterns, but the l gray and dark gray patterns also cause some of it.

The user interface of the Newton OS deliberately avoids 3D and 50% grays as much as possible fo this reason. If you know your application is going to display large gray areas, you can adjust the contrast yourself on some hardware devices. There's a global function, `SetLCDContrast`, to do jus that. However, changing the contrast with no end user control is not considered a good user-interfa practice.

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## Destination Rectangles and ScaleShape (3/11/94)

Q: What is a valid destination rectangle for the 2nd argument to ScaleShape?

A: Like the MacOS QuickDraw architecture, the destination rectangle must be at least 1 pixel wide 1 pixel high. Each element of the bounds frame must have values that fit in 16 bits, -32768...3276 width/height and negative width/height bounding boxes may appear to work in some cases, but not supported.

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## Difference Between LockScreen and RefreshViews (6/17/94)

Q: In the NPG, it states that sending a view the `view:LockScreen(nil)` message forces an "immediate update". How is this different from calling `RefreshViews`?

A: When you post drawing commands (for example, `DrawShape`) the system normally renders the sl on the screen immediately. `:LockScreen(true)` provides a way to "batch up" the screen upda for multiple drawing calls. Sending `:LockScreen(nil)` "unplugs" the temporary block that ha been placed on the screen updater, causing all the batched drawing changes to be rendered on the l

`RefreshViews` tells the system to execute the commands needed to draw every view that has a dirty region. You can think of it as working at a level "above" the screen lock routines. When you send the message `Dirty`, it does not immediately cause the system to redraw the dirtied view, instead it adds the view to the dirty area for later redrawing.

You could lock the screen, dirty a view with a `SetValue`, call `RefreshViews` (and not see an upd draw a few shapes, and then, when you unlock the screen, the refreshes to the dirty regions and yo shapes will all appear all at once.

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Q: What is the format for bitmap binary objects in the Newton OS?

A: There are several bitmap formats used in the Newton OS. The Newton OS provides routines for creating and manipulating bitmaps at runtime, and uses other formats for displaying bitmaps fror developer packages.

If you want to create a bitmap object at compile time, below is a description of the format of a sim bitmap object. If you want to create a bitmap at run time, we strongly encourage you to use `MakeBitmap` and copy data into the bitmap.

**Simple Bitmaps**

Normally, bitmaps are created at compile time using Newton Toolkit picture editors or functions ( example, GetPICTAsBits). If you want to create bitmaps dynamically at compile time, you can cr a simple bitmap object with the following format.

*Warning*: Different formats may be used by images or functions in future ROMs. This format will be supported for displaying images. This format does *not* describe images created by other applications nor any images provided or found in the Newton ROM. You can use the following for information to create and manipulate your own bitmaps -- preferably at compile time:

```
{
 bounds: <bounds frame>,
 bits:   <raw bitmap data>,
 mask:   <raw bitmap data for mask - optional>
}

<raw bitmap data> - class 'bits
 Binary object
 bytes    data-type descr
 0-3      long      ignored
 4-5      word      #bytes per row of the bitmap data
                    (must be a multiple of 4)
 6-7      word      ignored
 8-15     bitmap rectangle - portion of bits to use--see IM I
 8-9      word      top
 10-11    word      left
 12-13    word      bottom
 14-15    word      right
 16-*     bits      pixel data, 1 for "on" pixel, 0 for off
```

The bitmap rectangle and bounds slot must be in agreement regarding the size of the bitmap.

**MakeBitmap Shapes**

If you want to create bitmap data at run time or extract bitmap data from a bitmap created with `MakeBitmap` global function, use the `GetShapeInfo` function to get the bitmap and other slots required to interpret the meaning of the bitmap created by `MakeBitmap`.

*Warning*: the following information applies only to bitmaps of depth 1 (black and white bitmaps created by your application with MakeBitmap. Do *not* rely on `GetShapeInfo` or the following sl for images created by other applications, images stored in the Newton ROM, images created witl functions other than MakeBitmap, nor images with a depth other than 1.

If you created a bitmap using `MakeBitmap` of `depth` 1, the return value of `GetShapeInfo` contair frame with information you can use to interpret the bitmap data.

This frame includes a `bits` slot referencing the bitmap data for the bitmap. This bitmap data car manipulated at run time (or copied for non-Newton use), using other slots in the return value of `GetShapeInfo` to interpret the bitmap binary object: `scanOffset`, `bitsBounds`, and `rowBytes` instance, the first bit of the image created with `MakeBitmap` can be obtained with code like:

```
bitmapInfo := GetShapeInfo(theBitmap);
firstByte := ExtractByte(bitmapInfo.bits, bitmapInfo.scanOffset);
firstBit := firstByte >> 7; // 1 or 0, representing on or off
```

Note that `rowBytes` will always be 32-bit aligned. For instance, for a bitmap with a `bitsBounc` having width 33 pixels, `rowBytes` will be 8 to indicate 8 bytes offsets per horizontal line and 31 of unused data at the end of every horizontal line.

## **NEW:** How to Rotate Bitmaps Left (3/5/96)

Q: When I rotate a bitmap left using `MungeBitmap`, it sometimes shifts the data. How can I rotate correctly?

A: There is a bug in the Newton 2.0 OS that manifests when the row size of the unrotated bitmap is r an even byte boundary. The result can be a shift of data up to 7 pixels.

You can work around this bug most efficiently by replacing the left rotation with three calls to `MungeBitmap` using these operations: `'flipHorizontal`, `'flipVertical`, and `'rotateRigh` (`'rotateRight` three times will work as well, but it is less efficient bacause flips are faster thar rotates.)

Remember: "Three Rights (or Two Flips and a Right) Make a Left".

# Sound

# System Services, Find, Filing

## ViewIdleScripts and clParagraphViews (8/1/95)

Q: Sometimes a `clParagraphView`'s `viewIdleScript` is fired off automatically. (For example, a operation which results in the creation or changing of a keyboard's input focus within the view w trigger the viewIdleScript.) Why does this happen and what can I do about it?

A: The `clParagraphView` class internally uses the idle event mechanism to implement some of its features. Unfortunately, any `viewIdleScripts` provided by developers also execute when the system idle events are processed. Only the "heavyweight" views do this, "lightweight" paragr views (in other words, simple static text views) do not.

There is no workaround available in the Newton 1.x OS or Newton 2.0 OS. You can either accept

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## Preventing Selections in the Find Overview (2/5/96)

Q: When I use `ROM_compatibleFinder` in Newton 2.0, the overview of found items contains checkboxes for each item, allowing the user to attempt to route the found items. Since my found it are not soup items, various exceptions are thrown. How can I prevent the checkboxes?

A: What you do depends on how you want to handle your data. There are basically two cases. The fi case is when you want no Routing to take place (Routing refers to Delete, Duplicate, and the abili move the data using transports like Beam or Print). The second case is when you want some or all the Routing to occur.

The first case is easy. Just add a `SelectItem` slot to the result frame, set to `nil`. For example:

```
AddArraySlot(results,
     {_proto: ROM_compatibleFinder,
      owner: self,
      title: mytitle,
      SelectItem: nil,   // prevents checkboxes
      items: myresults});
```

The second case is more complex. The problem is that there are many variants. The best strategy i override the appropriate methods in your finder to gain control at appropriate points. This may b simple of overriding `Delete` to behave correctly, or as complex as replacing `GetTarget` and ad appropriate layouts. See the DTS Q&A "Creating Custom Finders" for more information.

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## Creating Custom Finders (2/5/96)

Q: My application uses more than one soup, so `ROM_soupFinder` is not appropriate, but `ROM_compatibleFinder` seems to throw many exceptions. Which should I use?

A: The answer depends on how much modification you will make. What you need is documentation o how they work and what you can override:

Each of the finder base protos (soupFinder and compatibleFinder) are magic pointers, so can creat your own customizations at compile time.

So to do a soupFinder based item you could do something like:

```
DefConst('kMySoupFinder, {
   _proto: ROM_soupFinder,

   Delete: func()
   begin
      print("About to delete " & Length(selected) && "items") ;
      inherited:Delete() ;
   end,
}) ;
```

Most of these routines are only callable by your code. They should not be overwritten. Those routir that can be safely overriden are specified.

Some of methods and slots are common to both types of finders:

An array of selected items stored in an internal format. All you can do with this array is figure ou
number of selected items by taking the Length of this array.

`finder:Count()`
Returns an integer with the total number of found items.

`finder:ReSync()`
Resets the finder to the first item.

`finder:ShowFoundItem(item)`
Displays the item passed. item is an overview item that resides in the overview's items array.

`finder:ShowOrdinalItem(ordinal)`
Display an item based on the symbol or integer passed in ordinal:
- `'first` - the first found item
- `'prev` - the previous item
- `'next` - the next item
- `<an-integer>` - display the nth item based on the integer.

Under no circumstances should you call or override:

```
finder:MakeFoundItem
finder:AddFoundItems
```

**ROM_SoupFinder**

SoupFinder has the following methods and slots:

All the documented items from the simple use of soupFinder as documented in the Newton Programmer's Guide 2.0.

`soupFinder:Reset()`
Resets the soupFinder cursor to the first found entry. In general, you should use the ReSync method to reset a finder.

`soupFinder:ZeroOneOrMore()`
Returns 0 if no found entries, 1 if one found entry or another number for more than one entry.

`soupFinder:ShowEntry(entry)`
causes the finding application to display entry. This may involve opening the application and moving it to that item.
This does not close the findOverview.

`soupFinder:SelectItem(item)`
mark the item as selected.
If this method is set to `nil` in the soupFinder proto, items will not have a checkbox in front of the
(not selectable).

`soupFinder:IsSelected(item)`
Returns true if the item is selected.

`soupFinder:ForEachSelected(callback)`
Calls callback function with each selected item. The callback function has one argument, the entr
from the soup cursor.

```
soupFinder:FileAndMove(labelsChanged, newLabel,
    storeChanged, newStore)
```

`newLabel` is the new label if and only if `labelsChanged` is `true.`
`newStore` is the new store if and only if `storeChanged` is `true.`

Developers can override this, though they may want to call the inherited routine to do that actu work. Note that `FileAndMove` can be called even if no items are selected. If you override this method you MUST check if there are selected items by doing:

```
if selected then
   // do the work
```

`soupFinder:FileAs(labels)`
Deprecated. Do not use.

`soupFinder:MoveTo(newStore)`
Deprecated. Do not use.

`soupFinder:Delete()`
Deletes all selected items from read/write stores.

Developer can override. Note: if you override this, the crumple effect will still happen. There is no way to prevent the ability to delete the items or prevent the crumple effect at this time.

`soupFinder:GetTarget()`
Returns a cursor used by routing.

The following methods should not be called or modified:
```
soupFinder.MakeFoundItem
soupFinder.AddFoundItems
```

**ROM_CompatibleFinder**

`compatibleFinder:ShowFakeEntry(index)`
Show the `index`'th item from the found items. Note that items will likely be an array of the four items.

`ShowFakeEntry` should behave just like `ShowFoundItem`. In other words, it should open the application then send a `ShowFoundItem` to the application.

`compatibleFinder:ConvertToSoupEntry(item)`
Return a soup entry that corresponds to the item. item is an item from the found items array.

The following methods are defined to be the same as the soupFinder:
```
FileAs, MoveTo, Delete, IsSelected, SelectItem,
ForEachSelected, GetTarget, FileAndMove
```

Note that this causes problems in some cases: most notably, the `ForEachSelected` call is expec to return an array of soup entries. The chances are you will need to override most of those methods `soupFinder` for a description of what the methods are supposed to do.

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## **NEW:** How to Interpret Return Value of BatteryStatus (5/6/96)

Q: I am trying to determine whether the Newton device is plugged in and to obtain other battery sta information. Many slots have a `nil` value in the frame returned by the `BatteryStatus` global function. How do I interpret these values?

Some hardware is limited in the amount of information that it can return. Future hardware may in more slots with authoritative non-nil values.

## **CHANGED:** How to Create Application-specific Folders (5/14/96)

Q: I would like to programatically create folders so that they are available as soon as the applicati open. What is the best approach to add application-specific folders?

A: You can use the global functions `AddFolder` and `RemoveFolder` to modify the folder set for a giv application.

```
AddFolder(newFolderStr, appSymbol)
    newFolderStr - string, the name of the new folder
    appSymbol - symbol, application for local folder
    result - symbol, the folder symbol of the newly added folder.
```

`AddFolder` takes a folder name and creates a new folder for the application.

`AddFolder` returns the symbol representing the tag value for the new folder. Please note that th symbol may be different from the value returned by using `Intern()` on the string. In particular, folder names with non-ASCII folders are supported. If a folder with the name already exists, th symbol for the pre-existing folder is returned and a new folder is not created.

There is a limit on the number of unique folders an application can support. If the limit is exceede `AddFolder` returns `NIL` and a new folder is not added. With the Newton 2.0 OS, the current limi twelve global folders and twelve local folders.

```
RemoveFolder(folderSym, appSymbol)
    folderSym - symbol, the folder symbol of the folder to remove
    appSymbol - symbol, the application for which to remove the folder
    result - undefined; do not rely on the return value of this function.
```

`RemoveFolder` can be used to remove a folder from the available list for an application. If items exist in a folder that is removed, the only way users can see the items is by selecting "All Items" f the folder list.

# Intelligent Assistant

# Built-In Apps and System Data

## There Is No ProtoFormulasPanel (2/5/96)

Q: The current documentation says to use `protoFormulasPanel` for `RegFormulas`, but there does r appear to be such a template.

A: You are correct, there is no such template. You use a `protoFloatNGo` as your base and add your

1. There must be an `overview` slot that contains the text to show in the formula's overview.

2. `viewbounds.bottom` must be the height of your panel.

3. There must be a `protoTitle` whose `title` slot is the name of the formula panel.

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## ProtoPrefsRollItem Undocumented Slots (2/6/96)

Q: When I try to open my own system preference, I get a -48204 error. The preference registers OK wi the `RegPrefs` function.

A: The documentation on `protoPrefsRollItem` is incomplete. You must define an `overview` slot which is the text to show in the overview mode. You can optionally define an `icon` slot which is icon for the title in the non-overview mode (a title icon). Note that title icons are much smaller t normal icons.

____________________________________________________

## SetEntryAlarm Does Not Handle Events (2/6/96)

Q: I tried to set the alarm of an event using the `SetEntryAlarm` calendar message, but the alarm is set.

A: It turns out that `SetEntryAlarm` will not find events. You need to use a new Calendar API callec `SetEventAlarm`. This function is provided in the Newton 2.0 Platform File. See the Platform Fi Notes for more information.

____________________________________________________

## **NEW:** How to Avoid CardFile Extensions "Still needs the card" (5/9/96)

Q: I have a package that registers a data definition and view definition for a new card type for the Names application. If the package is installed on a card and the card is removed, the user gets tl following error message:

"The package <The package name> still needs the card you removed. Please insert it now, or information on the card may be damaged."

How can I avoid this problem?

A: Currently, the cardfile `AddLayout` method requires that the symbol in the layout is internal. T bug will be fixed in a future ROM. To work around this, do the following:

```
local newLayout := {_proto: GetLayout("A Test Layout")};
newLayout.symbol := EnsureInternal (newLayout.symbol);
GetRoot().cardfile:AddLayout(newLayout);
```

For more information about issues for applications running from a PCMCIA card, see the article "T Newton Still Needs the Card You Removed"

# Localization

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Q: When passed a string with seconds, for example "12:23:34", `StringToDateFrame` and StringToT
don't seem to work. `StringToDateFrame` returns a frame with NIL for all the time & day slots
`StringToTime` returns NIL.

A: To correctly handle strings with seconds, seconds must be stripped from the string. If the applicat
might be used outside the US, check for the Locale time delimiter. Here is a function which prep
a string for `StringToDateFrame` and `StringToTime`:

```
PrepareStringForDateTime := func (str)
begin   // str is just a time string, nothing else belongs
   local newStr := clone (str);
   local tf:= GetLocale().timeFormat;
   local startMin := StrPos (str, tf.timeSepStr1, 0);
   local startSec := StrPos (str, tf.timeSepStr2, startMin+1);
   // If a time seperator for seconds, then strip out seconds
   if startSec then
    begin
         local skipSecSep := startSec + StrLen (tf.timeSepStr2);
         local remainderStr := SubStr (
             str, skipSecSep, StrLen (str) - skipSecSep);
         local appendStr := StringFilter (
             remainderStr, "1234567890", 'rejectBeginning);
         newStr := SubStr (str, 0, startSec) & appendStr;
     end;
     return newStr;
end;
```

# Utility Functions

## What Happened to FormattedNumberStr (2/12/96)

Q: The Newton 1.x documentation and OS included a `sprintf`-like function for formatting numbers
called `FormattedNumberStr`. The Newton Programmer's Guide 2.0 First Edition (beta) says thi
function is no longer supported. How do I format my numbers?

A: You may continue to use `FormattedNumberStr`. Here is the `FormattedNumberStr`API that is
supported. `FormattedNumberStr` should be considered to have undefined results if passed
arguments other than those specified here.

`FormattedNumberStr(number, formatString)`
Returns a formatted string representation of a real number.

| | |
|---|---|
| `number` | A real number. |
| `formatString` | A string specifying how the number should be formatted. |

This function works similar to the C function `sprintf`. The `formatString` specifies how the rea
number should be formatted; that is, whether to use decimal or exponential notation and how ma
places to include after the decimal point. It accepts the following format specifiers:

| | |
|---|---|
| `%f` | Use decimal notation (such as "123,456.789000"). |
| `%e` | Use exponential notation (such as "1.234568e+05"). |
| `%E` | Use exponential notation (such as "1.234568E+05"). |

You can also specify a period followed by a number after the % symbol to indicate how many plac
show following the decimal point. (`"%.3f"` yields `"123,456.789"` for example.)

separator and decimal characters and settings.  The example strings above are for the US English locale.

**Known Problems**
*Other specifiers*
Do not use other `formatStrings`.  Previous releases of the documentation listed `%g` and `%G` as supported specifiers.  The behavior of these specifiers has changed with the Newton 2.0 OS.  Giv the similarities to the `sprintf` function, it may occur to you to try other sprintf formatting characters.   Specifiers other than above have an undefined result and should be considered undocumented and unsupported.

*Large numbers*
`FormattedNumberStr` does not work properly for numbers larger than `1.0e24`.  If the number is large the function can cause the Newton device to hang.

*Small numbers or long numbers*
If more than 15 characters of output would be generated, for example because you are using `%f` wit large number or a large number of digits following the decimal, `FormattedNumberStr` has unde results, and can cause the Newton device to hang.

*Rounding*
`FormattedNumberStr` does not guarantee which direction it will round.  In the Newton 2.0 OS, i rounds half cases down rather than up or to an even digit.  If you need a precisely rounded number should use the math functions `Ceiling`, `Floor`, `NearbyInt`, or `Round` with suitable math.

*Trailing decimals*
In early releases of the Newton 1.0 OS, there was a bug in `FormattedNumberStr` that caused a trailing decimal character to be added when zero decimal positions was specified.  That is, `FormattedNumberStr(3.0, "%.0f")` resulted in `"3."` not `"3"`.  To properly test for and remo this unwanted extra character you must be sure to use the character specified in the Locale setting and not assume the decimal character will be a period.

## **NEW:** Backlight API (4/19/96)

Q: What is the API to check for and use the backlight?

A: There are 3 relevant pieces of information:

**Checking for the backlight**

To check if the backlight is there, use the `Gestalt` function as follows:

```
// define this somewhere in your project
// until the platform file defines it (not in 1.2d2)
constant kGestalt_BackLight :=
     '[0x02000007, [struct,boolean], 1] ;

local isBacklight := Gestalt(kGestalt_BackLight) ;

if isBacklight AND isBacklight[0] then
   // has a backlight
else
   // has not got one
```

**Status of the backlight**

`BackLightStatus()`
return value - nil or non-nil
returns current state of backlight, non-nil is on, NIL is off

**Changing backlight status**

To turn the backlight on or off, use the following function:
`BackLight(state)`
return value - unspecified
state - nil or non-nil

Turns the backlight on or off depending on the value of state; non-nil turns the backlighht on,
turns the backlight off.

# Errors

# Digital Books

## BookMaker Page Limitations? (11/19/93)

Q: Does the Newton BookMaker have limitations concerning the size of books or page count?

A: The current page limitation of BookMaker is 16 million pages, a very unlikely size to be exceeded
However, since the entire book is held in memory during the build process, you need to have enou
application heap space allocated to the BookMaker desktop application. If there is not enough I
available on your desktop computer to process a book, you can divide it into smaller parts and linl
them with the `.chain` command.

# Routing

## Not all Drawing Modes Work with a PostScript Printer (3/8/94)

Q: It seems that not all drawing modes work with printing. Is that true?

A: Yes. PostScript behaves like layers of paint; you can not go back and change something. Anything
that uses an invert mode (like XOR, and possibly ModeNot* (to be tested)), will not work.

Note: If you want to get the effect of white text on a black/filled background, use bit clear mode fo
drawing the text.

## PICT Printing Limitations (6/9/94)

A: The current PostScript printing system in the Newton ROMs is unable to print extremely large individual bitmap frames, the kind of pictures created using the NTK Picture editor or the GetPictAsBits routine. This is because in order to print these, the Newton must copy the bitmaps i an internal buffer. Thus the GetPictAsBits case fails (current limitation is a 168K buffer, but do nc rely on a specific number for other Newton devices).

Using the `GetNamedResource(..., 'picture)` routine, you can use PICT resources to be drawr clPictureViews. MacOS PICT resources often contain multiple opcodes (instructions). For single-op PICTs, compression is done for the whole picture. You can check *Inside Macintosh* documentation f specifications of the PICT format. If you are using very large bitmaps which you will print, you should use PICT resources composed of many smaller 'bitmap copy' opcodes because they will prin much faster and more reliably on PostScript printers. This is because very large PICT opcodes prir to LaserWriters must be decompressed on the printer. The printer's decompression buffer is someti too small if the opcodes represent large bitmaps. Check your MacOS graphics application documentation for more information on segmenting your large PICTs into smaller pieces. For some applications, you might have two versions of the PICTs, one for displaying (using `GetPictAsBit` for faster screen drawing), and a large tiled PICT for printing.

Note that the PICT2 (color) picture format is not currently supported by the Newton drawing syst

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## Printing Fonts with a PostScript Printer (7/26/94)

Q: When printing from my application on the Newton to a PostScript Laser printer, I noticethat the are being substituted. Printing always looks fine on a QuickDraw printer like the StyleWriter.

A: Yes, this is true.The additional System font (Espy Sans) or any custom Newton font created with Newton Font Tool is not printed directly to a LaserWriter because the fonts are missing in the PostScript font versions. Just printing Espy Sans (Newton system fonts) is currently not possible on LaserWriter, but is possible on faxes and bitmap printer drivers, since the rendering for those is dc inside the Newton.

For the built-in Espy font, the troublesome characters are the Apple-specific ones, starting with I FC. The filled diamond is one of these characters, the specific tick box arrow is another.

For printing, you might need to include bitmaps for special characters or words in your applicatior order to print them (that is, if the normal LaserWriter fonts are unacceptable)

Note that if you want a monospaced font, check out the Monaco DTS sample. That includes a font which will print as the monospaced Courier font.

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## Printing Resolution 72DPI/300DPI (2/8/94)

Q: I've tried to print PICT resources; the picture was designed in Illustrator and copied to the clipboa as a PICT. The picture printed correctly but at a very low resolution. Is there any way of printing PICTs with a higher resolution?

A: Currently the only supported screen resolution for PICT printing is 72dpi. This may change in futu platforms, so stay tuned for more information.

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## Printing Does Not Have Access to My Application Slots (11/27/95)

Q: Why can't I find my application slots from my print format?

application, so it cannot rely on the parent inheritance chain. All viewDefs should be designed sc that they do not rely on your application being open or rely on state-specific information in your application. The application may be closed, or the user may continue to work in your application while the print/fax transport is imaging.

Print format does have access to the `target` variable (it will contain the "body" of the data sent don't use `fields`.body). Note that if mulitiple items are sent, the value of `target` will change a the print format iterates over the list. Try to put the real "data" for the routing in the target usin the view method `GetTargetInfo`.

If, for some reason, you need to access slots from your application, you can access them using `GetRoot().(yourAppSymbol).theSlot`.

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## How to Open the Call Slip or Other Route Slips (12/19/95)

Q: How do I open the call slip (or other Route Slips) programatically?

A: Use the global function `OpenRoutingSlip`. Create a new item with the transport's `NewItem` method and add routing information such as the recipient information in the `toRef` slot. For the slip, the transport symbol will be `'|phoneHome:Newton|`, but this approach will work for other transports. (For transports other than the call transports, you will also provide the data to route the `item.body` slot.)

**Determining the value of the toRef slot**

The `toRef` slot in the item frame should contain an array of recipients in the form of nameRefs, which are the objects returned from `protoPeoplePicker` and other `protoListPicker`-based choosers. Each nameRef can be created from one of two forms: a cardfile soup entry, or just a frame data with minimal slots. (The required slots vary depending on the transport. For instance, the current call transport requires only phone, name, and country.)

1. Cardfile entry:
```
 entry := myCursor:Entry();
```

2. Create your own pseudo-entry:
```
  entry := {
    phone:"408 555 1234",
    name: {first: "Glagly", last: "Wigout"},
    country: "UK",
    };
```

Make the entry into a "nameRef" using the nameRef's registered datadef -- an object which descri how to manipulate nameRefs of a specific class. Note that every transport stores its preferred nameRef class symbol in its `transport.addressingClass` slot. (Examples are `'|nameRef.phone|` and `'|nameRef.email|`).

```
local class := '|nameRef.phone|;
local nameRef := GetDataDefs(class):MakeNameRef(myData, class);
```

**Setting up the targetInfo Frame**

Your `GetTargetInfo` view method should return a `targetInfo` frame, consisting of `target` a `targetView` slots. Alternatively, you can create a frame consisting of these slots and pass it to `OpenRoutingSlip`. As a workaround to a ROM bug, you must also supply an `appSymbol` slot in multiple item target (see the `CreateTargetCursor` documentation for more info.)

**Opening The Slip**

You can use `OpenRoutingSlip` to open the slip after setting up slots such as `toRef` and `cc` wit
the item. You can use code such as the following:

```
/* example using Call Transport */
local item, entry, class, nameRef;

// just for testing, get an Name...
entry := GetUnionSoup("Names"):Query(nil):Entry();

item := TransportNotify('|phoneHome:Newton|, 'NewItem, [nil]);
if item = 'noTransport or not item then
      return 'noTransport;


class := '|nameRef.phone|;
nameRef := GetDataDefs(class):MakeNameRef(entry, class);
item.toRef :=  [nameRef];
targetInfo := {
   targetView: getroot(),
   target: {}/* for non-CALL transports, add your data here! */,
   appsymbol: kAppSymbol
   };

// returns view (succeeded), or fails: nil or 'skipErrorMessage
OpenRoutingSlip(item, targetInfo);
```

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## **NEW**: Routing Multiple Items (5/15/96)

Q: How can my application route multiple items at one time?

A: The target must be a "multiple item target" created with the `CreateTargetCursor` function. F
instance, your application could use a `GetTargetInfo` method like:

```
func(reason)
begin
   local t := CreateTargetCursor(kDataClassSymbol, myItemArray);
   local tv := base; // the targetView

   return {target: t, targetView: tv};
end;
```

The first argument to `CreateTargetCursor` is used as the class of the target, which is used to
determine what formats and transports are available. You must register formats on that data clas
symbol in your part's `InstallScript` function.

The item array passed to `CreateTargetCursor` can contain any items, including soup entries or s
entry aliases. If you include soup entry aliases, they will automatically be resolved when accessi
items using the `GetTargetCursor` function.

Print formats that have their `usesCursors` slot set to `nil` will automatically print items on
separate pages -- print formats must use the target variable to image the current item. To print
multiple items, set the format `usesCursors` slot to `true` and use `GetTargetCursor(target`
`nil)` to navigate through the items.

If either the format (the `usesCursors` slot) or the transport (the `allowsBodyCursors` slot) c
not support cursors, the system will automatically split the items into separate Out Box items.

# Transports

## Adding Child Views to a ProtoTransportHeader-based View (1/19/96)

Q: How can I add child views to a `protoTransportHeader`-based view?

A: First, you need to specify an `addedHeight` slot. The height of the transport header will be increased by this amount.

Next, add the following code to the `viewSetupFormScript` method of your `protoTransportHeader` view. This works around a bug with `protoTransportHeader:`

```
        self.stepChildren := SetUnion( self._proto.stepChildren,
              self._proto._proto.stepChildren, true );
```

Finally, use NTK as you normally would to create the child views.

## **NEW:** How to Omit Default Transport Preference Views (5/6/96)

Q: I want to omit some transport preferences that appear automatically. If I specify `nil` for the `sendPrefs`, `outboxPrefs`, or `inboxPrefs` slots in my transport preferences template, opening slip throws -48204. What is going wrong?

A: The documentation states if you donÕt want to include `sendPrefs`, `outboxPrefs`, or `inboxPre`
in your preferences dialog to set those slot to `nil`. Due to a bug in the cooresponding views for thos
preference items, -48204 is thrown when an attempt is made to open the views. This will be fixed
future ROM.

# Endpoints & Comm Tools

## Maximum Speeds with the Serial Port (3/8/94)

Here are some rough estimates of the speeds attainable with the Newton serial port in combination 
various kinds of flow control. These numbers are rough estimates, and depending on the protocol and amount of data (burst mode or not) you might get higher or lower transmission speeds. Experiment un
you have found the optimal transmission speed.

- 0 to 38.4 Kbps
  No handshaking necessary for short bursts, but long transmissions require flow control (either hardware or XON/XOFF).

- 38.4 Kbps to 115 Kbps
  Require flow control, preferably hardware, but XON/XOFF should also work reasonably reliabl

- 115 Kbps +
  You will encounter problems with latency and buffer sizes. Speeds in this range require an error

Both hardware and XON/XOFF flow control can be set with the `kCMOInputFlowControlParms` a `kCMOOutputFlowControlParms` options. In the case of hardware handshaking (RTS/CTS) you sh use the following options:

```
{     label:      kCMOInputFlowControlParms,
      type:       'option,
      opCode:     opSetRequired,
      data:       {     arglist: [
                              kDefaultXonChar,
                              kDefaultXoffChar,
                              NIL,
                              TRUE,
                              0,
                              0,
                        ],
                        typelist: [
                              'struct,
                              'char,
                              'char,
                              'boolean,
                              'boolean,
                              'boolean,
                              'boolean,
                        ],
                  },
},

{     label:      kCMOOutputFlowControlParms,
      type:       'option,
      opCode:     opSetRequired,
      data:       {     arglist: [
                              kDefaultXonChar,
                              kDefaultXoffChar,
                              NIL,
                              TRUE,
                              0,
                              0,
                        ],
                        typelist: [
                              'struct,
                              'char,
                              'char,
                              'boolean,
                              'boolean,
                              'boolean,
                              'boolean,
                        ],
                  },
}
```

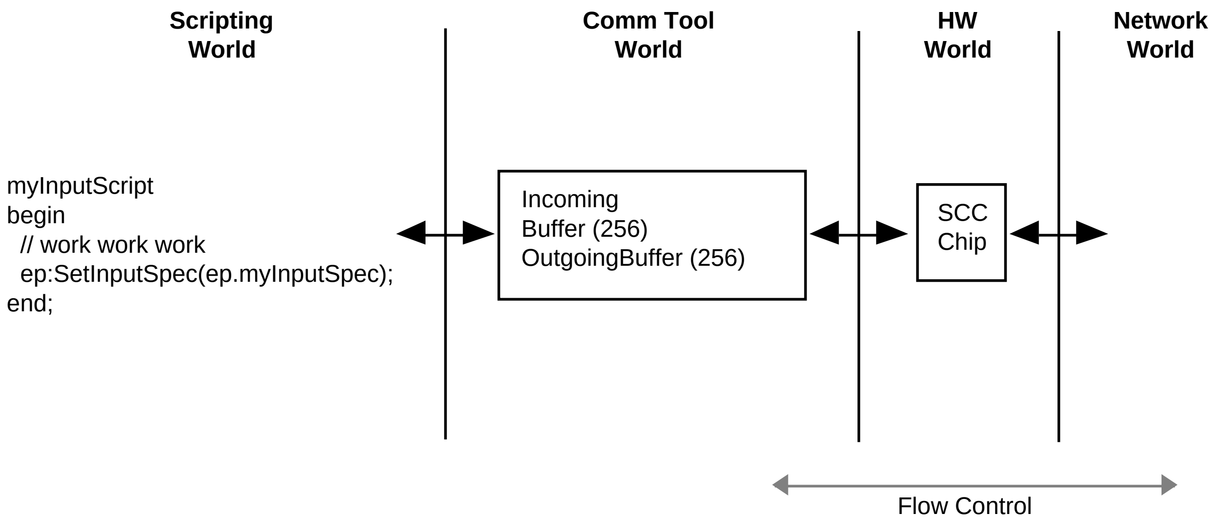
## What is Error Code -18003? (3/8/94)

Q: What is error code -18003?

A: This signal is also called SCC buffer overrun; it indicates that the internal serial chip buffer fill and the NewtonScript part didn't have time to read the incoming information. You need to either introduce software (XON/XOFF) or hardware flow control, or make sure that you empty the buff periodically

You will also get -18003 errors if the underlying comms tool encounters parity or frame errors. Note that there's no difference between parity errors, frame errors, or buffer overruns; all these errors a mapped to -18003.

Here's an explanation of what is going on concerning the serial chip, the buffers and the scripting world:



The SCC chip gets incoming data, and stores it in a 3-byte buffer. An underlying interrupt handler purges the SCC buffer and moves it into a special tools buffer. The comms system uses this buffer t scan input for valid end conditions (the conditions which cause your inputSpec to trigger). Note t you don't lose data while you switch inputSpecs; it's always stored in the buffer during the switc

Now, if there's no flow control (XON/XOFF, HW handshaking, MNP5), the network side will slowly fill the tool buffer, and depending on the speed the buffer is handled from the scripting w sooner or later the comms side will signal a buffer overrun.   Even if flow control is enabled, you m still receive errors if the sending side does not react fast enough to the NewtonÕs plea to stop send data.   In the case of XON/XOFF, if you suspect that one side or the other is not reacting or sendin flow control characters correctly, you may want to connect a line analyzer between the Newton an the remote entity  to see what is really happening.

If  you have  inputScripts that take a long time to execute, you might end up with overrun problem possible, store the received data away somewhere, quickly terminate the inputSpec, then come b and process the data later.  For instance, you could have an idleScript which updates a text view based on data stored in a soup or in a slot by your inputSpec.

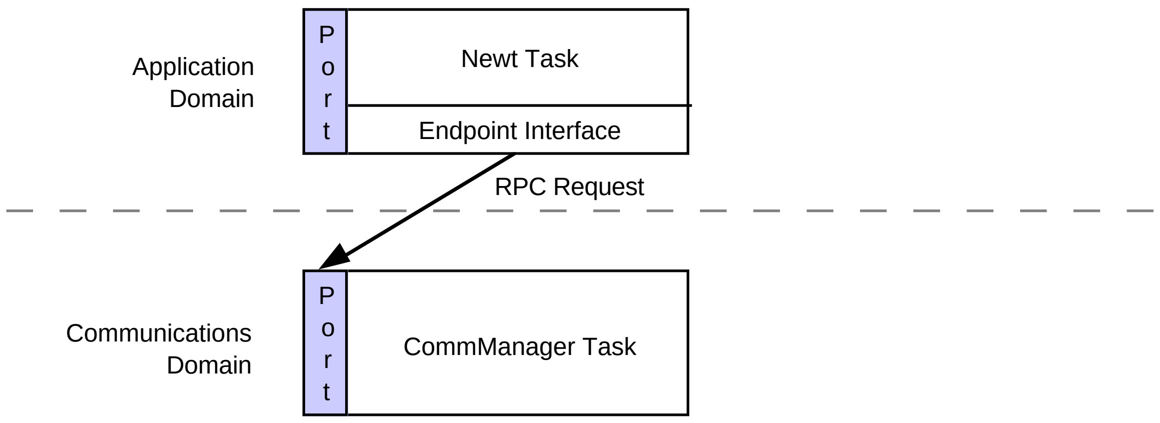
## What Really Happens During Instantiate & Connect  (6/14/94)

Q:  Does `Instantiate`, `Bind`  or `Connect`  touch the hardware?

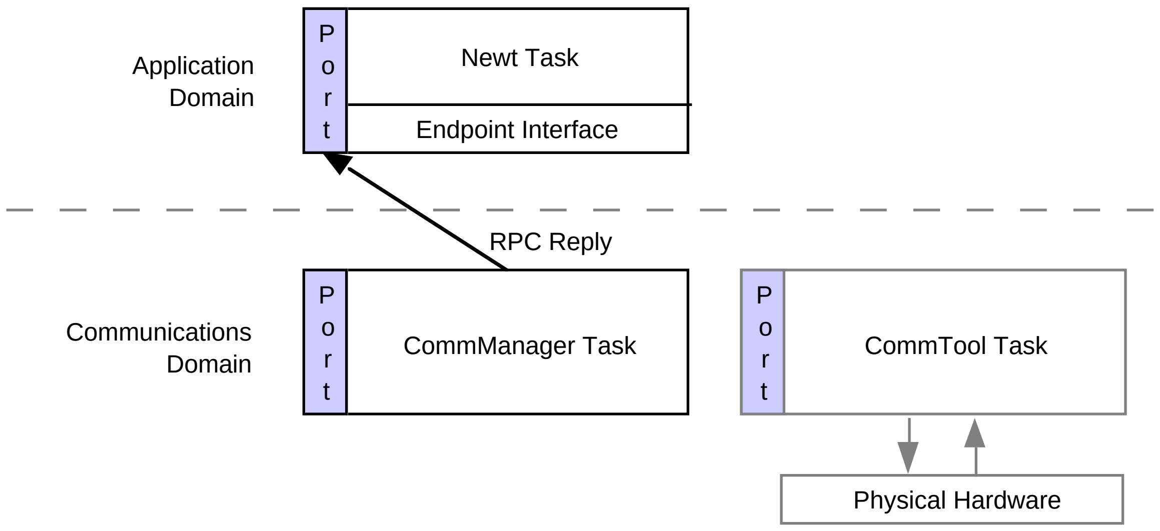
A:  Exactly what happens depends on the type of endpoint being used.  In general:

The endpoint requests one or more communications services using endpoint options like this:

```
{
  type:  'service,
}
```

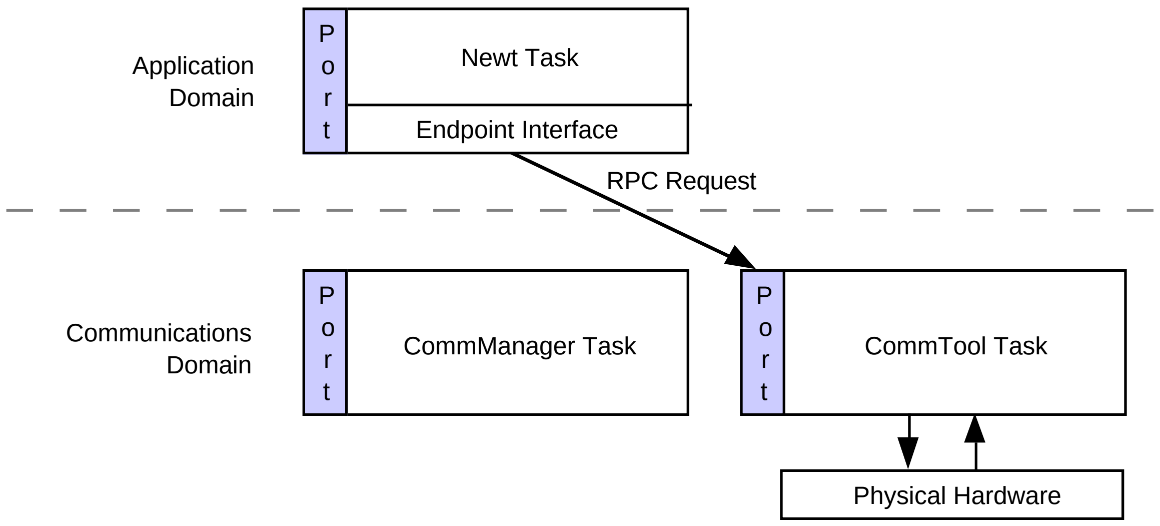


The CommManager task creates the appropriate CommTool task(s) and replies to the communica service request. Each CommTool task initializes itself . In response to the `Bind` request the CommTool acquires access to any physical hardware it controls, such as powering up the device. endpoint is ready-to-go.

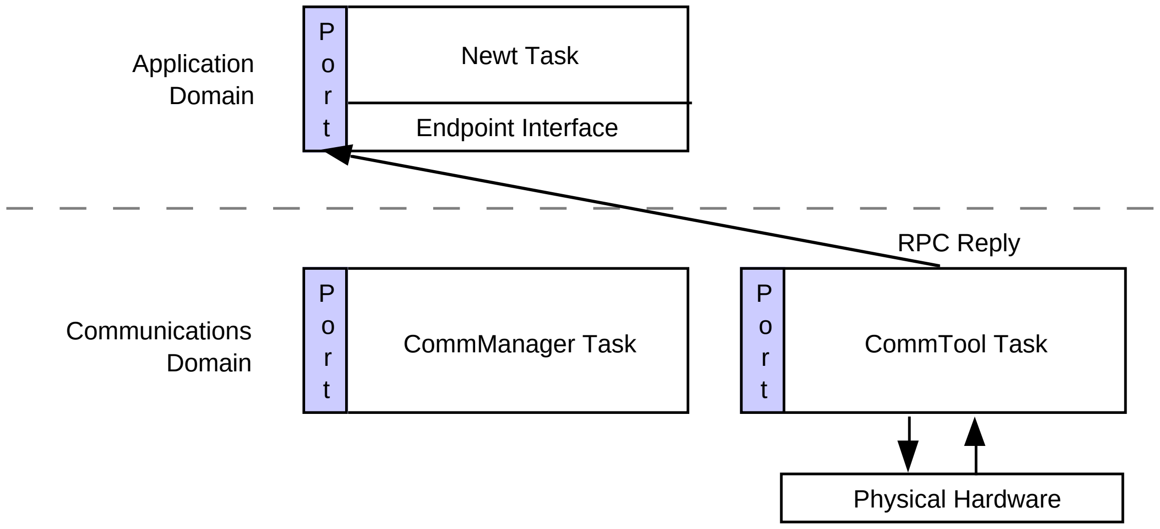


An endpoint may use multiple CommTool tasks, but there will be a single NewtonScript endpoint reference for them.

When the endpoint requests a connection, the CommTool interacts wih the physical hardware (o lower level CommTool) as necessary to complete the connection, depending on the type of communications service. For example, ADSP will use the endpoint address frame to perform an N lookup and connection request. MNP will negotiate protocol specifications such as compression an error correction.



The CommTool completes the connection and replies to the connection request. Note that if this is done asynchronously, the Newt task continues execution, giving the user an option to abort the connection request.



`Disconnect` functions similarly to `Connect`, moving the endpoint into a disconnected state. `Unl` releases any hardware controlled by the CommTool. `Dispose` deallocates the CommTool task.

## Newton Remote Control IR (Infra-red) API (6/9/94)

NTK 1.0.1 and future NTK development kits contain the needed resources to build applications tl control infrared receive systems, consumer electronics systems and similar constructs.

This development kit is fairly robust, and will produce send-only applications.

Note: The NTK 1.1 platforms file is required to produce code that will execute correctly on the MessagePad 100 upgrade units.

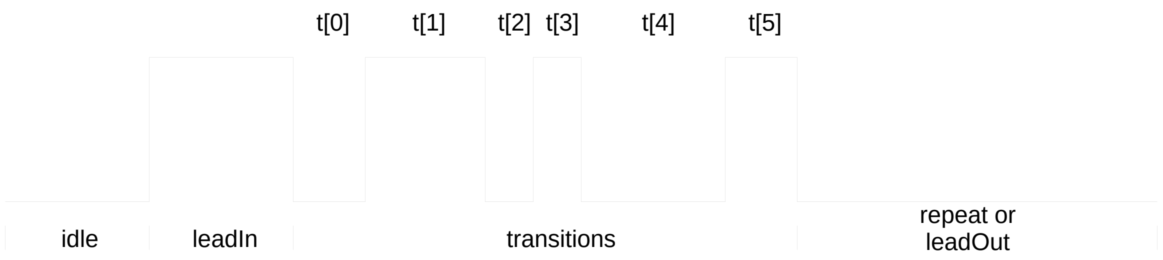
```
cookie := OpenRemoteControl();
```

Call this function once to initialize the remote control functions. It returns a magic cookie that mu passed to subsequent remote control calls, or nil if the initialization failed.

`OpenRemoteControl`. Always returns `nil`. cookie is invalid after this call returns.

`SendRemoteControlCode(cookie, command, count);`

Given the cookie returned from `OpenRemoteControl`, this function sends the remote control comn (see below for format of data). The command is sent count times. count must be at least 1. Returns the command has been sent (or after the last loop for `count` > 1).



Each command code has the following structure:

```
struct IRCodeWord {
   unsigned long name;
   unsigned long timeBase;
   unsigned long leadIn;
   unsigned long repeat;
   unsigned long leadOut;
   unsigned long count;
   unsigned long transitions[];
};
```

| | |
|---|---|
| name | identifies the command code; set to anything you like |
| timeBase | in microseconds; sets the bit time base |
| leadIn | duration in timeBase units of the lead bit cell |
| repeat | duration in timeBase units of the last bit cell for loop commands |
| leadOut | duration timeBase units of the last bit cell for non-loop commands |
| count | one-based count of transitions following |
| transitions[] | array of transition durations in timeBase units |

Note that the repeat time is used only when the code is sent multiple times.

See Remote.π, Sony.r, RC5.r, and RemoteTypes.r files for examples. The .rsrc files have templates ResEdit editing of the Philips and Sony resources. See Remote IR Sample code for more details.

**Things To Know Before You Burn The Midnight Oil:**

If the Newton goes to sleep, the IR circuits are powered down, and any subsequent sends will fail. you want to override this, you need to have a powerOffhandler close the remote connection, and w Newton wakes up the application could re-open the connection.

If two applications are concurrently trying to use the IR port (beaming and remote control use for instance), this will cause a conflict.

**Sample Code**

The Remote IR Sample is part of the DTS Sample code distribution, you should find it on AppleLi and on the Internet ftp server (ftp.apple.com).

bound to the index (ircode inside the application base view).

You specify the constant that is an index to the array, get the resource using the NTK function `GetNamedResource` and when you send data, use the constant as the resource used.

`OpenRemoteControl` is called in `viewSetupFormscript`, and `closeRemoteControl` is cal in `viewQuitScript`. Note that these are methods, not global functions; same is true of `SendRemoteControlCode`.

**More Information**

Consult the IR samples available on ftp.apple.com (Internet) and on the Newton Developer CDs.

The following sites have more information about other infrared protocols:

nada.kth.se:home/d89-bga/hp/remote/remotes (Internet, ftp)
flash.ecel.uwa.edu.au (Internet, ftp)

## Communications With No Terminating Conditions (6/9/94)

Q: How do I handle input that has no terminating characters and/or variable sized packets?

A: Remember that input specs are specifically tied to the receive completion mechanism. To deal wi the situations of no terminating characters or no set packet sizes, you need only realize that one receive completion is itself a complete packet. Set the byteCount slot of your input spec to the minimum packet size. In your input script, call Partial to read in the entire packet, and then call FlushInput to empty everything out for your next receive completion.

If this is time-delay-based input, you may be able to take advantage of partialScripts with partialFrequencies. Call the Ticks function if necessary to determine the exact execution time of apartialScript.

## Unicode-ASCII Translation Issues (6/16/94)

Q: How are out-of-range translations handled by the endpoints? For example, what happens if I try output "\u033800AE\u Apple Computer, Inc."?

A: The first Unicode character (0338) is mapped to ASCII character 255 because is it out of the range valid translations, and the second Unicode character (00AE) is mapped to ASCII character A8 because the Mac character set has a corresponding character equivalent in the upper-bit range.

All out-of-range translations, such as the 0338 diacritical mark above, are converted to ASCII character 255. However, the reverse is not true! ASCII character 255 is converted to Unicode character 02C7. This means you will need to escape or strip all 02C7 characters in your strings bef sending them if you want to use ASCII character 255 to detect out-of-range translations. Characte 255 was picked over character 0 because 0 is often used as the C-string terminator character.

The built-in Newton Unicode-ASCII translation table is set up to handle the full 8-bit character used by the MacOS operating system. Although `kMacRomanEncoding` is the default encoding system for strings on most Newtons, you can specify it explicitly by adding one of the following encoding slots to your endpoint:

```
encoding:  kMacRomanEncoding; // Unicode<->Mac translation
encoding:  kWizardEncoding ;    // Unicode<->Sharp Wizard
```

```
encoding:  kShiftJISEncoding ;    // Unicode<->Japanese ShiftJIS
                                  // translation
```

For kMacRomanEncoding, the upper 128 characters of the MacOS character encoding are sparse-mapped to/from their corresponding unicode equivalents. The map table can be found in Appendi of the NewtonScript Programming Language reference. The upper-bit translation matrix is as foll

```
   short gASCIIToUnicode[128] = {
  0x00C4, 0x00C5, 0x00C7, 0x00C9, 0x00D1, 0x00D6, 0x00DC, 0x00E1,
  0x00E0, 0x00E2, 0x00E4, 0x00E3, 0x00E5, 0x00E7, 0x00E9, 0x00E8,
  0x00EA, 0x00EB, 0x00ED, 0x00EC, 0x00EE, 0x00EF, 0x00F1, 0x00F3,
  0x00F2, 0x00F4, 0x00F6, 0x00F5, 0x00FA, 0x00F9, 0x00FB, 0x00FC,
  0x2020, 0x00B0, 0x00A2, 0x00A3, 0x00A7, 0x2022, 0x00B6, 0x00DF,
  0x00AE, 0x00A9, 0x2122, 0x00B4, 0x00A8, 0x2260, 0x00C6, 0x00D8,
  0x221E, 0x00B1, 0x2264, 0x2265, 0x00A5, 0x00B5, 0x2202, 0x2211,
  0x220F, 0x03C0, 0x222B, 0x00AA, 0x00BA, 0x2126, 0x00E6, 0x00F8,
  0x00BF, 0x00A1, 0x00AC, 0x221A, 0x0192, 0x2248, 0x2206, 0x00AB,
  0x00BB, 0x2026, 0x00A0, 0x00C0, 0x00C3, 0x00D5, 0x0152, 0x0153,
  0x2013, 0x2014, 0x201C, 0x201D, 0x2018, 0x2019, 0x00F7, 0x25CA,
  0x00FF, 0x0178, 0x2044, 0x00A4, 0x2039, 0x203A, 0xFB01, 0xFB02,
  0x2021, 0x00B7, 0x201A, 0x201E, 0x2030, 0x00C2, 0x00CA, 0x00C1,
  0x00CB, 0x00C8, 0x00CD, 0x00CE, 0x00CF, 0x00CC, 0x00D3, 0x00D4,
  0xF7FF, 0x00D2, 0x00DA, 0x00DB, 0x00D9, 0x0131, 0x02C6, 0x02DC,
  0x00AF, 0x02D8, 0x02D9, 0x02DA, 0x00B8, 0x02DD, 0x02DB, 0x02C7
   };
```

# Sharp IR Protocol (12/2/94)

(Distilled from source dated 10/14/1992)

## 1 Serial Chip Settings

| | |
|---|---|
| Baudrate | 9600 |
| Data bits | 8 |
| Stop bits | 1 |
| Parity | Odd |

## 2 Hardware Restrictions

The IR hardware used in the Sharp Wizard series (as well as Newtons and other devices) require brief stablizing period when switching from transmitting mode to receiving mode. Specifically, i not possible to receive data for two milliseconds after transmitting. Therefore, all device should three milliseconds after completion of a receive before transmitting.

## 3 Packet Structure

There are two kinds of Packets: "Packet I" and "Packet II". Because the IR unit is unstable at the of a data transmission, DUMMY (5 bytes of null code (0x00)) and START ID (0x96) begin both packet t At least two null bytes must be processed by the receiver as DUMMY before the START ID of a packet considered. After this (DUMMY, START ID) sequence the PACKET ID is transmitted. Code 0x82 is the packet ID for a PACKET I transmission, and code 0x81 is the packet ID for a PACKET II transmission

### 3.1 Packet I

This packet type is used to transmit the following control messages:

| | | |
|---|---|---|
| 3.1.1 | Request to send | ENQ (0x05) |
| 3.1.2 | Clear to send | SYN (0x16) |
| 3.1.3 | Completion of receiving data | ACK (0x06) |
| 3.1.4 | Failed to receive data | NAK (0x15) |
| 3.1.5 | Interruption of receiving data | CAN (0x18) |

The format of this packet type is as follows:

| | Byte length | Set value in transmission | Detection method in reception |
|---|---|---|---|
| DUMMY | 5 | 0x00 * 5 | Only 2 bytes are detected when received. |
| START ID | 1 | 0x96 | |
| PACKET ID | 1 | 0x82 | |
| DATA | 1 | above mentioned data | |

Packet I example:

| DUMMY | START ID | PACKET ID | DATA |
|---|---|---|---|
| 0x00, 0x00, 0x00, 0x00 | 0x96 | 0x82 | 0x05 |

### 3.2 Packet II

This packet type is used to transmit data. The maximum amount of data that may be transmi in one packet is 512 bytes. If more than 512 bytes is to be transmitted, it is sent as several consecutive 512-byte packets. The last packet need not be padded if it is less than 512 bytes ar distinguished by a BLOCK NO value of 0xFFFF.

The format of this packet type is as follows:

| | Byte length | Set value in transmission | Detection method in reception |
|---|---|---|---|
| DUMMY | 5 | 0x00 * 5 | Only 2 bytes are detected. |
| START ID | 1 | 0x96 | |
| PACKET ID | 1 | 0x81 | |
| VERSION | 1 | 0x10 | Judge only bit 7-4 |
| BLOCK NO | 2 (L/H) | 0x0001 ~ 0xFFFF | |
| CTRL CODE | 1 | 0x01 | Don't judge |
| DEV. CODE | 1 | 0x40 | Don't judge |
| ID CODE | 1 | 0xFE | Don't judge |
| DLENGTH | 2 (L/H) | 0x0001 ~ 0x0200 | |
| DATA | 1 ~ 512 | | |
| CHKSUM | 2 (L/H) | | |

BLOCK NO in last block must be set to "0xFFFF".

CHKSUM is the two-byte sum of all of the data bytes of DATA where any overflow or carry is discar immediately.

Send all two-byte integers lower byte first and upper byte second.

Packet II example:

| DUMMY | START ID | PACKET ID | VERSION | BLOCK NO | | CTRL CODE |
|---|---|---|---|---|---|---|
| 0x00, 0x00, 0x00, 0x00 | 0x96 | 0x81 | 0x10 | Low | High | 0x01 |

| DEV CODE | ID CODE | DLENGTH | | data | CHECKSUM | |
|---|---|---|---|---|---|---|
| 0x40 | 0xFE | Low | High | ???? | Low | High |

## 4 Protocol

Data will be divided into several blocks of up to 512 bytes each. These blocks are transmitted usir type I and II packets as follows:

4.1.1 The initiating device (A) begins a session by sending an ENQ (type I) packet. The receiv device (B) will acknowledge the ENQ by transmitting a SYN packet.

4.1.2 When (A) receives a SYN packet, it goes to step 4.1.4 below.

4.1.3 When (A) receives a CAN packet, or when 6 minutes have elapsed without a SYN packet reply to an ENQ packet, (A) terminates the session. If (A) receives any other packet, no packet, or an incomplete packet, it begins sending ENQ packets every 0.5 seconds.

4.1.4 When (A) receives a SYN packet, it transmits a single type II data packet, then awaits ACK packet from (B).

4.1.5 When (A) receives an ACK packet, the transmission is considered successful.

4.1.6 If no ACK packet is received within 1 second from completion of step 4.1.4, or if any othe packet is received, (A) goes to step 4.1.1 and transmits the data again. Retransmission i attempted once. The session is terminated if the second transmission is unsuccessful.

**4.2 Reception Protocol**

4.2.1 The receiving device (B) begins a session by waiting for an ENQ (type I) packet. If no ENQ packet is received after 6 minutes (B) terminates the session.

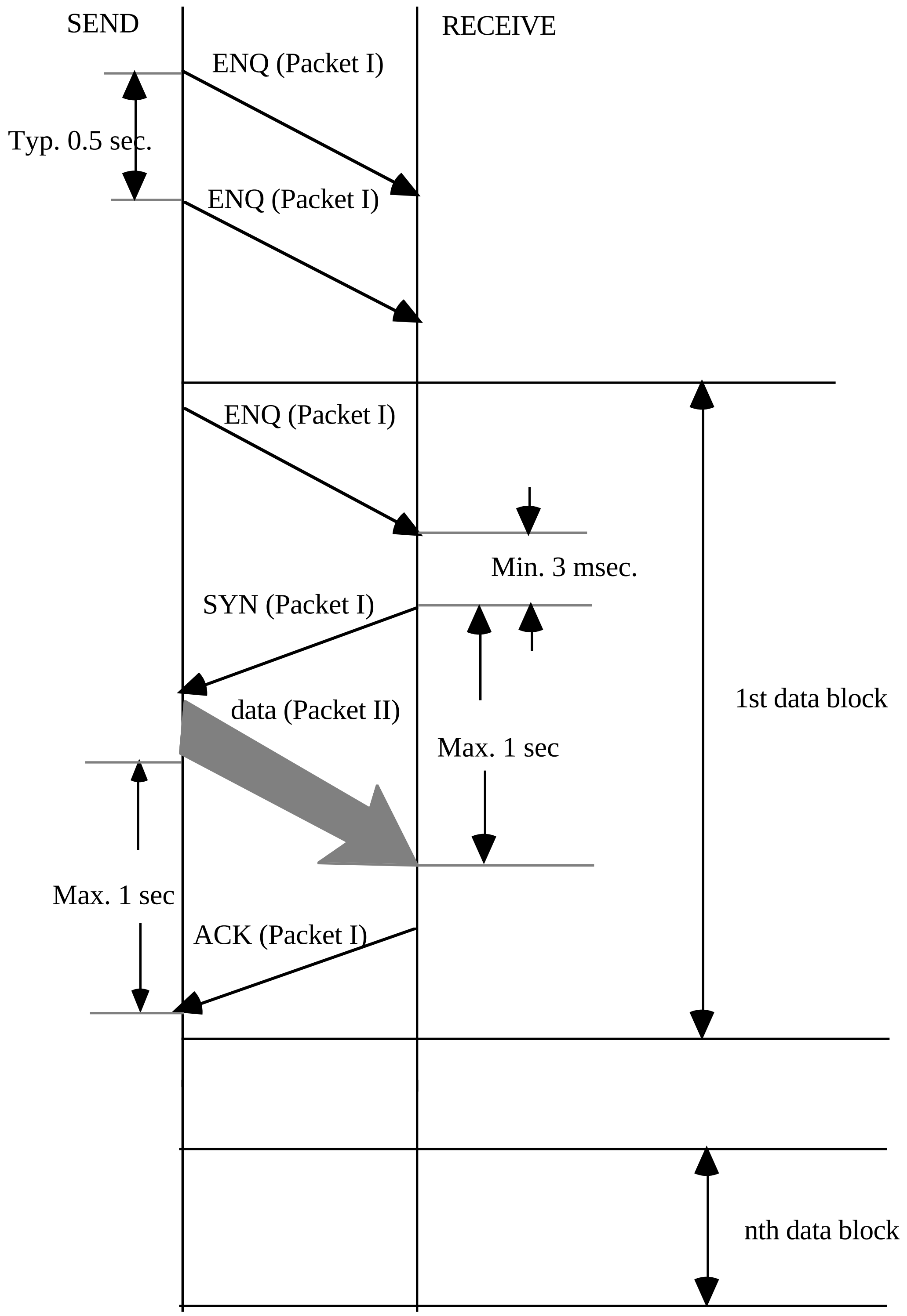
4.2.2 When (B) receives an ENQ packet, (B) transmits either a SYN packet to continue the sess or a CAN packet to terminate the session.

4.2.3 When (B) receives a valid type II packet (eg. the checksum and all header fields appea be correct), (B) transmits an ACK packet.

4.2.4 If one or more header fields of the data packet are not correct, or if the time between da bytes is more than 1 second, (B) goes to step 4.2.1 and does not transmit the ACK packet ( will cause (A) to retransmit the packet after a one second delay).

4.2.5 If the header fields of the data packet appear to be correct but the checksum is incorrec (B) transmits a NAK packet (this will cause (A) to retransmit the packet immediately).

Because of the restriction in hardware mentioned in item 2 above, it is not possible to receive data for milliseconds after a data transmission. Please wait three milliseconds before transmitting a response the other device.



## How To Specify No Connect/Listen Options (2/1/96)

Q: How do I specify that there are no options for the `Connect` and `Listen` methods of `protoBasicEndpoint`?

A: Different endpoint services use the options parameter differently. Some check for `nil` before attempting to access the array, while others assume they will always be passed an array of optio Some also assume that the array will always contain at least one element.

The correct work-around for this unspecified behaviour is to pass an array containing a single nil element. This works for all endpoint service types. For example:

```
ep:Connect([nil], nil);
```

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## Why Synchronous Comms Are Evil (2/1/96)

Q: Why does the following loop run slower and slower with each successive output? If the data vari contains a sufficiently large number of items, the endpoint times out or the Newton reboots before the data is transmitted.

```
data := [....];
for item := 0 to Length(data) - 1 do
   ep:Output(data[ item ], nil, nil);
```

A: When `protoBasicEndpoint` performs a function synchronously, it creates a special kind of "sul task" to perform the interprocess call to the comm tool task. The sub-task causes the main NewtonScript task to suspend execution until the sub-task receives the "operation completed" response from the comm tool task, at which time the sub-task returns control to the main NewtonScript task, and execution continues.

The sub-task, however, is not disposed of until control returns to the main NewtonScript event loo effect, each and every synchronous call is allocating memory and task execution time until control returned to the main NewtonScript event loop! For a small number of sucessive synchronous operations, this is fine.

A fully asynchronous implementation, on the other hand, is faster, uses less machine resources, al the user to interact at any point in the loop, and is generally very easy to implement. The above l can be rewritten as follows:

```
ep.fData := [....];
ep.fIndex := 0;
ep.fOutSpec := {
   async:      true,
   completionScript:
      func(ep, options, error)
      if ep.fIndex >= Length(ep.fData) - 1 then
         // indicate we're done
      else
         ep:Output(ep.fData[ ep.fIndex := ep.fIndex + 1 ],
                   nil, ep.fOutSpec )
   };
ep:Output(ep.fData[ ep.fIndex ], nil, ep.fOutSpec );
```

Of course, you should always catch and handle any errors that may occur within the loop (`completionScript`) and exit gracefully. Such code is left as an excercise for the reader.

# Modem Setup

# Desktop Connectivity (DILs)

## Differences between MNP, Modem, Modem-MNP, and Real Modems (2/5/96)

Q: I want to just connect to a Newton device over a cable from a MacOS or Windows machine - what d need to use to get reliable communications?

Q: I want to have the DILs answer an incoming call over a modem. How can I do that?

Q: What's the difference between the "Serial" and "Modem" Mac connection types?

A: In release 1.0 of the DILs, the best way to connect to a Newton device is by using a MNP connection over a serial cable. This is what you're using when you set connection type "Modem" on MacOS computers and "MNP" on Windows computers. This actually has nearly nothing to do with moder such; it means you're connecting over a serial cable using MNP error correction and compression. (A on Windows, it's the only supported option at this time.)

Currently you cannot use a true modem with the DILs to connect to a Newton device.

In general, you will never use the "Serial" connection type on a MacOS computer; that connects ov serial cable (like "Modem" does) but offers no error detection. Therefore, you would have to write own code to check that data arrived safely.

## CDPipeInit Returning -28102 on MacOS Computers (2/13/96)

Q: When I call the DILs function `CDPipeInit`, it returns a -28102 error (Communication tool not foun I've checked that the tool is installed properly, and the DIL sample application works fine. Wh wrong?

A: A common cause of this error code is that the CSTR resources haven't been linked into your final executable. Those resources are used to find the filenames of the communications tools. Add the CSTR.rsrc file to your project and see if that fixes things.

## Getting Serial Port Names on MacOS Computers (2/13/96)

Q: Different MacOS computers have different numbers of ports, different names for the ports, and th port names are translated into other languages in non-English MacOS System Software. How can what serial ports are available?

A: You can use the Communications Toolbox to get the list of available serial ports. This code has be added to version 2 of the SoupDrink sample code - see the `SetupPortMenu` function in SoupDrin for an example.

## **NEW**: Corruption of Some Binary Objects (5/13/96)

Q: Sometimes when I send a binary object (including a real) from the Newton device, it is corrupted v I read it with the FDILs on the desktop. What's going on?

A: When FDILs 1.0 receive a binary object, they must "guess" whether it is a string or not. This guess algorithm has a flaw which can result in non-string binary objects being treated as strings, and thu the Unicode conversion process is performed on them, which results in corruption of the desktop bi object.

The easiest ways to avoid this problem are to either receive the data with the CDIL (in other wo don't include them in the frame), or else to ensure that either the first two or the last two bytes of binary object are non-zero. This workaround will not be necessary in future versions of the DIL libraries.

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## NEW: Error -28801 or -28706 from FDget (5/13/96)

Q: Why does the `FDget` function return error -28801 (Out of heap memory) or -28706 (Invalid parameter)? I don't think I'm out of memory, and I don't always get this error code so my paramet must be right. What is wrong?

A: Sometimes these error codes are accurate and indicate that not enough memory could be allocated that a parameter was invalid. Sometimes they are the result of a bug caused by having multiple copies of a rectangle slot inside a frame.

The protocol which is used to send frames can perform an optimization for certain rectangle frame which transmits them in a compact form (5 bytes instead of up to 60). However, if a given frame h the exact same rectangle frame in more than one slot, the data will not be handled correctly and w either result in one of these error codes, or alternatively it might substitute some other object in pl of the frame, or might possibly crash.

This is a relatively uncommon problem, since all of the values in the frame must be between 0 and and the frame must have the same rectangle in it twice - two frames with equivalent data would n trigger the problem. For example, frame "A" would cause the problem, but frames "B", "C" and "I would not.

```
A:={first: {left:3, right: 30, top:10, bottom:90}};
A.second := A.first;        // triggers the problem

B:={first: {left:3, right: 30, top:10, bottom:90}};
B.second := clone(B.first);    // cloning avoids the problem

C:={first: {left:3, right: 30, top:10, bottom:90, foo: nil}};
C.second := C.first;           // no problem since C.foo exists

D:={first: {left:3, right: 30, top:10, bottom:1000}};
D.second := D.first;       // no problem since D.bottom is >255
```

To work around this problem, you can clone the frame (as in frame "B") or add another slot to the frame (as in frame "C") or ensure that the values are not between 0 and 255 (frame "D").

# User Interface

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# Hardware & OS

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## IR Port Hardware Specs (6/15/94)

Q: What are the hardware specifications for the Newton IR port?

A: In the Apple MessagePad 100, 110, and 120, the Sharp ExpertPad, and the Motorola Marco, the II transmitter/receiver is a Sharp Infrared Data Communication Unit model RY5BD11 connected to channel B of a Zilog 85C30 SCC. Data is communicated along a 500 KHz carrier frequency at 9600 19200 baud, 8 data bits, 1 stop bit, odd parity. The IR hardware requires a minimum of 5 milliseco settling time when transitioning between sending and receiving. Sharp's CE-IR2 wireless interfa unit may be used to connect the Newton to MacOS or DOS machines, with the appropriate softwa

The Newton supports four IR software data modes:
- Sharp encoding, NewtIR protocol (specifications are NOT releaseable)
- Sharp encoding, SharpIR protocol
- Plain Serial
- 38 KHz encoding ("TV Remote Control")

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## IR Hardware Info (9/6/94)

Q: How does the Newton send "Remote Control" codes?

A: This information is hardware dependent, and is only valid for the Original Message Pad, Messag Pad 100, and Message Pad 110 products.

The IR transmitter/reciever is a Sharp IR Data Communication Unit connected to the second chan of a built-in SCC. When in "Remote Control" mode, the SCC is not used. Instead, a carrier freque of 38KHz is transmitted, and the CPU toggles a register to generate the data pattern.

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## Serial Cable Specs (8/9/94)

Q: I want to make my own serial cable. Which wires and which connector pins do I use?

A: To create a hardware flow control capable cable for Mac-to-Newton or Newton-to-Newton communications (also called a "null-modem" cable) all you need are two mini-din-8 connectors anc seven wires connected as follows:

```
Ground (4) -> Ground (4)  (also connect to connectors' shrouds)
Transmit+ (6) -> Receive+ (8)
Transmit- (3) -> Receive- (5)
Receive+ (8) -> Transmit+ (6)
Receive- (5) -> Transmit- (3)
Data Term Ready (1) -> Clear To Send (2)
Clear To Send (2) -> Data Term Ready (1)
```

You should use twisted pairs for 6/3, 8/5, and 1/2, to improve signal quality and reduce attenuatic especially in long cables. You can use side-by-side pairs, as in telephone hookup cable, for short c runs.

Remember that because RS-422 uses a differential signal for transmit and receive, you always nee two transmit and two receive pairs, and a break of either wire will cause communications in that direction to fail. The advantage, however, is significantly longer and more reliable cable runs th

If you don't use hardware flow control, you can eliminate the 1/2 pair, but that's not recommendec unless you know this cable will be used only in software flow control situations.

Q: What's the pin mapping on the Newton-to-PC (DIN-to-DB9) cable?

A: Here it is:

Note that the pin numbers shown are as defined above.

| **PC (DB9)** | **Newton (DIN)** |
|---|---|
| 1 | 1 |
| 2 | 3 |
| 3 | 5 |
| 4 | 7,2 |
| 5 | 4,8 |
| 6 | 1 |
| 7 | N/C |
| 8 | N/C |
| 9 | N/C |

N/C=not connected.

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## How Much Power Can a PCMCIA Card Draw? (3/31/95)

Q: How much power can I draw through the PCMCIA slot?

A: The current rating depends on which Newton you are using and the type of batteries in use. Alkal batteries provide less current than NiCad due to higher internal resistance. There is also a 'semi' artifical limit in the ROM. Currently any card who's CIS indicates more than 200 mA current dra will be rejected by the CardHandler. Other than that, here's the run down by hardware:

```
Apple MessagePad 100:     50 mA
Apple MessagePad 110:   ~160 mA
Apple MessagePad 120:   ~300 mA
```

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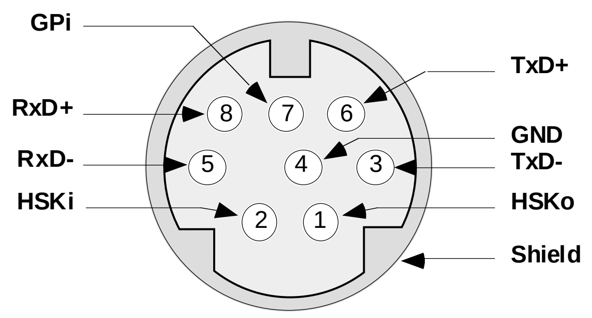
## **CHANGED**: Serial Port Hardware Specs (5/23/96)

Q: What are the hardware specifications for the serial port?

A: In the Apple MessagePad 100, 110, 120, 130, the Sharp ExpertPad, and the Motorola Marco, the s port is an EIA standard RS-422 port with the following pinout (as viewed looking at the female I DIN-8 socket on the side of the Newton device):



| | | |
|---|---|---|
| Pin **1** | HSKo | /DTR |
| Pin **2** | HSKi | /CTS |
| Pin **3** | TxD- | /TD |
| Pin **4** | GND | Signal ground connected to both logic and chassis ground. |
| Pin **5** | RxD- | /RD |
| Pin **6** | TxD+ | (see below) |
| Pin **7** | GPi | General purpose input received at SCC's DCD pin. |
| Pin **8** | RxD+ | (see below) |

All inputs are:
Ri 12K ohms
minimum Vih 0.2v, Vil -0.2V
maximum tolerance Vih 15V, Vil -15V

All outputs are:
Rl 450 ohms
minimum Voh 3.6V, Vol -3.6V
maximum Voh 5.5V, Vol -5.5V

No more than 40mA total can be drawn from all pins on the serial port. Pins 3 & 6 tri-state when SCC' /RTS is not asserted.

The EIA RS-422 standard modulates its data signal against an inverted (negative) copy of the same signal on another wire (twisted pairs 3/6 & 5/8 above). This differential signal is compatable with RS-232 standards by converting to EIA standard RS-423, which involves grounding the positive side the RS-422 receiver, and leaving the positive side of the RS-422 transmitter unconnected. Doing so, however, limits the usable cable distance to approximately 50 feet, and is somewhat less reliable.

# NewtonScript

## NewtonScript Object Sizes (6/30/94)

These desciptions document current OS formats only, we reserve the right to extend or change the implementation in future releases.

**Generic**

NewtonScript objects are objects that reside either in the read-write memory, in pseudo-ROM memory, inside the package or in ROM. In MessagePad platforms, these objects are aligned to 8-b boundaries. Alignment causes a very small amount of memory to be wasted, usually less than 2%.

**wrs**: In 2.0, objects are aligned to 4-byte boundaries in the heap. NTK can align package objects to

The Newton Object System has four built-in primitive classes that describe an object's basic type: immediates, binary objects, arrays, and frames. The NewtonScript function `PrimClassOf` will re an object's primitive type.

**Immediates**

Immediates (integers, characters, TRUE and NIL) are stored in a 4-byte structure containing up to bits of data and 2 bits of primitive class identification.

**Referenced Objects**

Binaries, arrays and frames are stored as larger separate objects and managed through references. reference is a four- byte object. The binary objects, frames, or arrays themselves are stored separa as objects containing a so-called Object Header.

**Object Header**

Every referenced object has a 12-byte header that contains information concerning size, flags, clas lock count and so on. This information is implementation-specific.

**Symbols**

A symbol is a binary object that contains a four-byte hash value and a name, which is a null-terminated ASCII string. Each symbol uses 12 (header) + 4 (hash value) + length of name + 1 (nul terminator) bytes.

**Binary Objects**

A binary object contains a 12- byte header plus space for the actual data (allocated in 8 -byte chu

**Strings**

Strings are binary objects of class (or a subclass of) `String`. A string object contains a 12-byte head plus the Unicode strings plus a null termination character. Note that Unicode characters are two- values. Here's an example:

```
"Hello World!"
```

This string contains 12 characters, in other words it has 24 bytes. In addition we have a null termination character (24 + 2 bytes) and an object header (24 + 2 + 12 bytes), all in all the object is bytes big. Note that we have not taken into account any possible savings if the string was compres (using the NTK compression flags).

**Rich Strings**

Rich strings extend the string object class by embedding ink information within the object. Withi unicode, a special character `kInkChar` is used to mark the position of an ink word. The ink data i stored after the null termination character. Ink size varies depending on stroke complexity.

**Array Objects**

Array objects have an object header (12 bytes) and additional four bytes per element which hold either the immediate value or a reference to a referenced object. To calculate the total space used an array, you need to take into account the memory used by any referenced objects in the array.

Here's an example:

```
[12, $a, "Hello World!", "foo"]
```

We have a header (12 bytes) plus four bytes per element (12 + (4 * 4) bytes). The integer and character are immediates, so no additional space is used, but we have 2 string objects that we refe so the total is (12 + (4*4) + 38 + 20 bytes) 86 bytes. We have not taken into account savings concerni compression. Note that the string objects could be referred by other arrays and frames as well, so t 38 and 20 byte structures are stored only once per package.

**Frame Objects**

We have two kinds of frames: frames that don't have a shared map object; and frames that do ha shared map object. We take the simple case first (no shared map object).

The frame is maintained as two array-like objects. One, called the frame map, contains the slot names, and the other contains the actual slot values. A frame map has one entry per symbol, plus additional 4 -byte value.

The frame map uses a minimum of 16 bytes. If we add the frame's object header to this, the minim size of a frame is 28 bytes. Each slot adds 8 bytes to the storage used by the frame (two array entr Here's an example:

```
{Slot1: 42, Slot2: "hello"}
```

We have a header of 28 bytes, and in addition we have two slots, for a total of (28 + (2 * 8)) 48 by This does not take into account the space used for each of the slot name symbols or for the string ob (The integer is an immediate, and so is stored in the array.)

Multiple similar frames (having the same slots) could share a frame map. This will save space, reducing the space used per frame (for many frames all sharing the same map) to the same as used an array with the same number of slots. (If just a few frames share the frame map, we need to take into account the amortized map size that the frames share. So the total space for N frames sharir map is N*28 bytes of header per frame, plus the size of the frame map, plus the size of the values the N frames.

Here's an example of a frame that could share a map with the previous example:

```
{Slot1: 56, Slot2: "world"}
```

We have a header of 12 bytes. In addition, we have two slots (2 * 4), and additional 16 bytes for t size of a map with no slots Ñ all in all, 36 bytes. We should also take into account the shared ma which is 16 bytes, plus the space for the two symbols.

When do frames share maps?

1. When a frame is cloned, both the copy and the original frame will share the map of the origin frame. A trick to make use of this is to create a common template frame, and clone this template v duplicate frames are needed.

2. Two frames created from the same frame constructor (that is, the same line of NewtonScript coc will share a frame map. This is a reason to use `RelBounds` to create the `viewBounds` frame, anc means there will be a single `viewBounds` frame map in the part produced.

Note: These figures are for objects in their run-time state, ready for fast access. Objects in transit o storage (packages) are compressed into smaller stream formats. Different formats are used (and different sizes apply) to objects stored in soups and to objects being streamed over a communication protocol.

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## Nested Frames and Inheritance (10/9/93)

Unlike C++ and other object oriented languages, NewtonScript does not have the notion of nested frames obtaining the same inheritance scope as the enclosing frame.

This is an important design issue, because sometimes you want to enclose a frame inside a frame fo name scoping or other reasons. If you do so you have to explicitly state the messages sent as well a explicitly state the path to the variable:

Here's an example that shows the problems:

```
myEncloser := {
   importantSlot: 42,
   GetImportantSlot := func()
      return importantSlot,

   nestedSlot := {
      myInternalValue: 99,

      getTheValue := func()
      begin
         local foo;
         foo :=  :GetImportantSlot();           // WON'T WORK
         /* actually creates an undefined slot */
         foo :=  myEncloser:GetImportantSlot(); // MAY WORK

         importantSlot := 12;                   // WON'T WORK
         myEncloser.importantSlot := 12;        // MAY WORK

      end
   }
};

myEncloser.nestedSlot:GetTheValue();
```

The workaround is to give the nested frame a _parent or _proto slot that references the enclosing frame. Nesting the frame is not strictly necessary in this case, only the _proto or _parent referenc are used.

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## Symbol Hacking (11/11/93)

Q: I would like to be able to build frames dynamically and have my application create the name of slot in the frame dynamically as well. For instance, something like this:

```
MyFrame:= {}; tSlotName := "Slot_1";
```

At this point is there a way to then create this ?:

```
MyFrame.Slot_1
```

A: The function `Intern` takes a string and returns a symbol. There is also a mechanism called path expressions (see the NewtonScript Reference), that allows you to specify an expression or variabl evaluate, in order to get the slot name. You can use these things to access the slots you want:

```
MyFrame := {x: 4};
theXSlotString := "x" ;

MyFrame.(Intern(theXSlotString)) := 6

tSlotName := "Slot_1";
MyFrame.(Intern(tSlotName)) := 7;

// myFrame is now {x: 6, Slot_1: 7}
```

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## Performance of Exceptions vs Return Codes (6/9/94)

Q: What are the performance tradeoffs in writing code that uses try/onexception vs returning and

A: We did a few trials to weight the relative performance. Consider the following two functions:

```
thrower: func(x) begin
   if x then
      throw('|evt.ex.msg;my.exception|, "Some error occurred");
   end;

returner: func(x) begin
   if x then
      return -1;  // some random error code,
   0; // nil, true, whatever.
   end;
```

Code to throw and and handle an exception:

```
   local s;
   for i := 1 to kIterations do
      try
         call thrower with (nil);
      onexception |evt.ex.msg;my.exception| do
         s := CurrentException().data.message;
```

Code to check the return value and handle an error:

```
   local result;
   local s;
   for i := 1 to kIterations do
      if (result := call returner with (nil)) < 0 then
         s := ErrorMessageTable[-result];
```

Running the above loops 1000 times took about 45 ticks for the exception loop, and about 15 ticks fo the check the return value loop. From this you might conclude that exception handling is a waste time. However, you can often write better code if you use exceptions. A large part of the time spe the loop is setting up the exception handler. Since we commonly want to stop processing when exceptions occur, we can rewrite the function to set up the exception handler once, like this:

```
   local s;
   try
      for i := 1 to kIterations do
         call thrower with (nil);
   onexception |evt.ex.msg;my.exception| do
      s := CurrentException().data.message;
```

This code takes only 11 ticks for 1000 iterations, an improvement over the return value case, wher we'd have to check the result after each call to the function and stop the loop if an error occurred.

Running the same loops, but passing `TRUE` instead of `NIL` so the "error" occurs every time was interesting. The return value loop takes about 60 ticks, mostly due to the time needed to look up t error message. The exception loop takes a whopping 850 ticks, mostly because of the overhead in `CurrentException`() call.

With exceptions, you can handle the error at any level up the call chain, without having to worr about each function checking for and returning error results for every sub-function it uses. This wi produce code that performs much better, and will be easier to maintain as well.

With exceptions, you do not have to worry about the return value for successful functio completio is occasionally very difficult to write functions that both have a return value and generate an err code. The C/C++ solution is to pass a pointer to a variable that is modified with what should otherwise be the return value of the function, which is a technique best avoided.

code to string (or whatever) mapping table, which is another boon to maintainability. (You can s
use string constants and so on to aid localization efforts. Just put the constant in the throw call.)

Finally, every time an exception occurs you have an opportunity to intercept it with the NTK inspector. This is also a boon to debugging, because you know something about what's going wrong you can set the `breakOnThrows` global to stop your code and look at why there's a problem. Wit result codes you have a tougher time setting break points. With a good debugger it could be arguec that you can set conditional break points on the "check the return value" code, but even when you c this you'll have lost the stack frame of the function that actually had the problem. With except and `breakOnThrows`, all the local context at the time the exception occurred is still available fo you to look at, which is an immense aid.

Conclusion: Use exceptions. The only good reason not to would be if your error handler is very loc and if you expect it to be used a lot, and if that's true you should consider rewriting the function.

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## Symbols vs Path Expressions and Equality (7/11/94)

Q: While trying to write code that tests for the existance of an index, I tried the following, which di not work. How can I compare path expressions?

```
   if value.path = '|name.first| then ...    // WRONG
```

A: There are several concerns. `'|name.first|` is not a path expression, it is a symbol with an escap period. A proper path expression is either `'name.first` or `[pathExpr: 'name, 'first]`. T vertical bars escape everything between them to be a single NewtonScript symbol.

The test `value.path = 'name.first` will always fail, because path expressions are deep obje (essentially arrays) the equal comparison will compare references rather than contents. You will have to write your own code to deeply compare path expressions.

This code is further complicated by the fact that symbols are allowed in place of path expression that contain only one element, but the two syntaxes produce different NewtonScript objects with different meanings. That is, `'name = [pathExpr: 'name]` will always fail, as the objects are different.

A general test is probably unnecessary in most circumstances, since you will be able to make assumptions about what you are looking for. For example, here is some code that will check if a g path value from a soup index is equivalent to `'name.first`.

```
if ClassOf(value.path) = 'pathExpr and Length(value.path) = 2
   and value.path[0] = 'name and value.path[1] = 'first then ...
```

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## Function Size and "Closed Over" Environment (7/18/94)

Q: I want to create several frames (for soup entries) that all share a single function, but when I try to store one of these frames to a soup, I run out of memory. Can several frames share a function and s be written to a soup? My code looks like this:

```
...
local myFunc := func(...) ...;
local futureSoupEntries := Array(10, nil);
for i := 0 to 9 do
   futureSoupEntries[i] := {
      someSlots: ...,
      aFunction: myFunc,
   };
...
```

paramaters) and message context (self) are "closed over" into the function body. When NewtonSc searches for a variable to match a symbol in a function, it first searches the local scope, then any lexically enclosing scopes, then the message context (self), then the _proto and _parent chains fro the message context, then finally the global variables.

Functions constructed within another function, as in your example, will have this enclosing lexica scope, which is the locals and parameters of the function currently being executed, plus the messa context (self) when the function is created. Depending on the size of this function and how it's constructed, this could be very large. (Self might be the application's base view, for example.)

A `TotalClone` is made during the process of adding an entry to a soup, and this includes the funct body, lexical scopes, and message context bound up within any functions in the frame. All this car take up a lot of space.

If you create the function at compile time (perhaps with `DefConst('kMyFunc, func(...) .` it will not have the lexically enclosing scope, and the message context at compile time is defined an empty frame, and so cloning such a function will take less space. You can use the constant `kMyF` within the initializer for the frame, and each frame will still reference the same function body. (Additionally, the symbol `kMyFunc` will not be included in the package, since it is only needed a compile time.)

If the soup entries are only useful when your package is installed, you might consider instead replacing the function body with a symbol when you write the entry to the soup. When the entry read from the soup, replace the symbol with the function itself, or use a `_proto` based scheme instead. Each soup entry will necessarily contain a complete copy of the function, but if you can guarantee that the function body will always be available within your application's package, it might be unnecessarily redundant to store a copy with each soup entry.

# Debugging NewtonScript

## Check for Application Base View Slots (3/6/94)

Here's a simple function that will print out all the slots and the slot values in an application bas view. This function is handy if you want to check for unnecessary slots stored in the application b view; these eat up the NewtonScript heap and eventually cause problems with external PCMCIA RAM cards.

```
call func()
begin
   local s,v;
   local root := GetRoot();
   local base := root.|YourApp:YourSIG|; // name of app
   local prot := base._proto;

   foreach s,v in base do
   begin
      if v and v <> root AND v <> base AND v <> prot then
      begin
         Write ("Slot:" && s & ", Value: ");
         Print(v);
      end;
   end;
end with ()
```

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## TrueSize Incorrect for Soup Entries (2/6/96)

Q: When I use `TrueSize` to get the size of a soup entry I get results like 24K or even 40K for the size That can't be right. What's going on?

A: `TrueSize` "knows" about the underlying implementation of soup entries. A soup entry is really a special object (a fault block) that contains information about how to get an entry and can contain a cached entry frame. In the information about how to get an entry, there is a reference to the soup, various caches in a soup contain references to the cursors, the store, and other (large) NewtonScrip objects. `TrueSize` is reporting the space taken up by all of these objects. (Note: calling `TrueSi` on a soup entry will force the entry to be faulted in, even if it was not previously taking up space i NewtonScript heap.)

The result is that `TrueSize` is not very useful when trying to find out how much space the cache frame for an entry is using. A good way to find the space used for a cached entry frame is to call gc `stats();` record the result, then call `EntryUndoChanges(entry); gc(); stats()`. The difference between the two free space reports will be the space used by the cached frame for a giv entry.

`EntryUndoChanges(entry)` will cause any cached frame to be removed and the entry to return the unfaulted state. Gc() then collects the space previouly used by the cached entry frame.

If you want the `TrueSize` breakdown of the types of objects used, you can `Clone` the entry and `TrueSize` on the copy. This works because the copy is not a fault block, and so it does not referen the soups/cursors/stores.

# Newton ToolKit

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## NTK, Picture Slots and ROM PICTs (12/19/93)

Q: How can I use a PICT in ROM from the Picture slot handler in NTK?

A: You have to use an NTK `AfterScript` to set the appropriate slot in the view to point to the RO based PICT (assuming that the constant for the PICT is defined in the NTK definitions file). Something like this in the `AfterScript`:

```
thisView.icon := ROM_routedeleteicon;
```

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## Recognition Problems with the Inspector Window Open (3/8/94)

Q: When I have the Inspector window open and I debug the application, recognition does not work properly and the Newton complains about lack of memory. However, when I disconnect the Inspe recognition works fine. What is going on?

A: The NTK inspector window uses system memory on the Newton side; the Toolkit App itself makes of MNP in the Newton, which uses a buffer taken from a space shared with the recognition workin memory.

Different releases of the Newton OS have different amounts of memory allocated for this shared

options:
- Disconnect the Inspector when testing the recognition side.
- Use the keyboard for text input while testing the code.
- Write shorter text items.

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## Accessing Views Between Layout Windows (6/7/94)

Q: I have problems setting a `protoStaticText` text slot that is in one linked layout window from button that is in another linked layout window. I tried to allow access to the base view from both linked layouts, but this didn't help. I even tried to allow access from the base view to both layou but this didn't help, either. What should I do?

A: There is no way to declare views across the artifical boundary imposed by the linked layouts. U this feature of NTK is implemented, you must either create the link yourself at run time, or decla the button to the top level of the linked layout, and then declare the link.

For example, consider a view called textThatChanges which a child of a view called changingContainer and is declared to changingContainer with the name textThatChanges. ChangingContainer is the base view for a layout which is linked into the main layout, and the li (in the main layout) is declared as changingContainerLink. Code in the main layout can change t text of the textThatChange view like so:

```
SetValue(containerLink.whatToDo, 'text, "Turn and face the...")
```

To do the equivalent of the declare yourself:

1) In the `viewSetupFormScript` script of the `'buttonThatChanges` button, set the value c the base view's slot `'theTextView` to `self`, as in the following code fragment:

```
func()
begin
      base.theTextView := self;
end
```

2) In the `buttonClickScript` script of the `'buttonThatSetsText` button, use the global function `SetValue` to store new text in the text slot of the `'buttonThatChanges` button, as in t following code fragment:

```
func()
begin
   SetValue(base.theTextView, 'text, "Now something happened!");
end
```

Note that this example assumes the self-declared view called `base`. In your application, you ma access your base view in a different way.

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## Dangers of StrCompare, StrEqual at Compile Time (6/9/94)

Q: I've noticed that `StrCompare` can return different results at compile time than it does at run tim What gives?

A: While many functions, like `StrCompare`, are present in NTK at compile time, they should not be considered documented or supported unless explicitly defined in the Newton ToolKit User's Guide other material from Apple Computer.

In this case, the sort order for strings within the NTK NewtonScript environment is different fron ordering used on the Newton (and different from other commonly used desktop machine sort order The differences are only apparent if you use characters outside the ASCII range, for instance, acce characters.

If it is necessary to pre-sort accented strings at compile time, you can write your own function that return the same results as `StrCompare` on an given Newton unit. Here is one such function for En releases of the Newton OS (which assumes strings using only page 0 of the unicode table):

```
constant kNSortTable :=
'[0,1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,
28,29,30,31,32,33,34,35,36,37,38,39,40,41,42,43,44,45,46,47,48,49,50,51,5
3,54,55,56,57,58,59,60,61,62,63,64,65,66,67,68,69,70,71,72,73,74,75,76,77
,79,80,81,82,83,84,85,86,87,88,89,90,91,92,93,94,95,96,65,66,67,68,69,70,
72,73,74,75,76,77,78,79,80,81,82,83,84,85,86,87,88,89,90,97,98,99,100,101
2,103,104,105,106,107,108,109,110,111,112,113,114,115,116,117,118,119,120
1,122,123,124,125,126,127,128,129,130,131,132,133,161,157,135,136,165,149
8,137,143,141,152,159,158,144,140,170,134,146,147,148,142,150,138,168,171
1,153,160,153,154,155,156,174,174,174,174,65,65,145,67,175,69,175,175,176
6,176,176,162,78,177,177,177,79,79,164,79,178,178,178,85,166,167,139,65,6
5,65,65,65,145,67,69,69,69,69,73,73,73,73,169,78,79,79,79,79,79,163,79,85
,85,85,172,173,89];

// function to compare strings (only page 0 characters)
// with the same order as Newton does.
DefConst('kNewtonStrCompare, func(s1, s2)
begin
   local l1 := StrLen(s1);
   local l2 := StrLen(s2);
   local l := Min(l1, l2);
   local i := 0;
   while i < l and
      (r := kNSortTable[ord(s1[i])] - kNSortTable[ord(s2[i])]) = 0 do
         i := i + 1;
   if i = l then
      l1-l2
   else
      r;
end);
```

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## Profiler and Frames of Functions (7/10/95)

Q: Using the profiler with a large frame of functions gives confusing results. The profiler labels eacl function by the name of the frame and a number, but the numbers don't seem to correspond to the or in which I defined the functions. Moving the functions around doesn't change the profiler labels. How can I figure out which function is which?

A: If frames have less than than a certain number of slots (20 in the current release), the slots are kep the order they were defined or added. If there are more than 20 slots in the frame, the slots are reordered. (This improves slot lookup operations.) The profiler in NTK 1.5 labels the functions b their position in the final, possibly reordered, frame.

To determine which function is in which position, you need to look at the frame after the reorderi has occurred. You can do this by printing the frame after it's been defined. At compile time you ca use a print statement in the slot editor or afterScript. After the package has been downloaded you use the inspector. Then count (starting from one) through the slots to find your function.

Here's a little inspector snippet that will print the slots in a frame in order with their numbers:

```
      local i := 0;
      foreach slot, value in theFrame do begin
         print(i && ': && slot);
         i := i + 1;
      end
   end with (<the reordered frame>)
```

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## NTK 1.6 Heap/Partition Memory Issues (11/24/95)

Q: How do I set the build heap, main heap, and miltifinder partition sizes in NTK 1.6 so I can build 1
package without running out of memory?

A: Here is an explanation of how NTK makes uses of the various heaps. Understanding this will all
you to set your sizes for optimal performance.

**Main Heap**

The Main heap holds your frame data while you're working in NTK. Its size is set through the Toolkit Preference dialog. You must quit and restart NTK for changes to take effect.

The Main heap is allocated when NTK starts up. It is not disposed off until you quit NTK. If NTK
can't allocate the Main heap it reports the problem and quits. As a result, if you can start NTK, M
heap allocation has completed.

We have no rule of thumb for setting the Main heap size. You need to experiment keeping the following in mind:

1) If the Main heap is insufficient, NTK will tell you so.
2) Reducing the Main heap size reduces overall RAM requirements.
3) The Main heap is garbage collected (GC). Increasing its size may improve performance by redu
GC activity. This will affect build time, and to a lesser degree the time it takes to open a project
Please note that the gains in build time are nonlinear and quickly reach a plateau, as shown in th
following example:

```
   Main     Build time
heap size      (+/- 0.5 sec)

   1250K                     Main heap ran out of memory...
   1275K          32.7 sec
   1300K             26.4 sec
   1400K       22.3 sec
   1500K       19.2 sec
   1600K       17.5 sec
   2000K       16.0 sec
   3000K       15.2 sec
```

Experiment with Main heap size by measuring build time until you find a reasonable compromise between build time and memory requirements for your particular project.

If you are curious about GC activity, do the following:

1) Add the following line to your `GlobalData` file (in the NTK folder) and restart NTK:

```
   protoEditor:DefineKey({key: 65}, 'EvaluateSelection);
```

This allows you to use the period key on the numeric keypad to evaluate selected text in the Inspe and then evaluated by the Newton device when you hit the Enter key.) See the NTK User's Guid details on the `GlobalData` file.

2) Type `VerboseGC(TRUE)` in the Inspector window, select, and hit the keypad-period key. Eac time the GC kicks in, a line will be displayed in the Inspector window. By watching the frequenc GCs, you can get some idea of how your main heap is being used.

3) Use `VerboseGC(FALSE)` to turn this feature off. Please note that `VerboseGC` is available o in the NTK build-time environment. The function does not exist on the Newton device itself. It should be used only for debugging and optimization.

**Build Heap**

The Build heap holds your package frame data during the last part of the build. Its size is set through the Toolkit Preference dialog. Changes take effect immediately.

The Build heap is allocated only when the Build Package command is issued. It is released as soo the resulting file is written to disk. As a result Build heap allocation is a recurring issue.

The rule of thumb is to set the Build heap to the size of your package (on the MacOS computer ha disk, not on the Newton device). If the Build heap is insufficient, NTK will tell you so.

There is nothing to be gained by setting the Build heap larger than necessary.

NTK first attempts to allocate the Build heap from MultiFinder memory. If that fails, NTK tries allocate the Build heap from NTK's partition.

To verify that you have enough memory for the Build heap you need to look at the About Macinto dialog just prior to issuing the build command.

1) If the "Largest Unused Block" exceeds the Build heap requested size, the Build heap will be allocated from MultiFinder memory.

2) If 1 failed and NTK's partition bar shows enough free memory to accommodate the request, the Build heap will be allocated in NTK's partition.

3) If both 1 and 2 failed, the build will fail. Try to increase MultiFinder free memory by quitting other open application, or increase the free memory in NTK's partition by closing some or all of N open windows. Then try building again.

To prevent fragmentation of MultiFinder memory launch NTK first, and DocViewer, ResEdit, etc. afterwards. Whenever possible, quit those other applications in the reverse order .

Note: You can use Balloon help to see how much memory an application is actually using. Simply select the Show Balloons menu item and position the cursor on the application partition bar in th About Macintosh dialog. This feature is missing from PowerPC-based MacOS computers.

**NTK Partition Size**

For NTK 1.6 the rule of thumb for the "smallest useful" partition size for small projects is:
 (3500K + Main heap size) for a 680x0 MacOS computer
 (5500K + Main heap size) for a PowerPC MacOS computer with Virtual Memory off.

These rules do not include space for the Build heap.

The "smallest useful" partition size is defined by the following example: Using NTK default Mai and Build heaps, open the Checkbook sample. Open one browser and one layout window for each displayed in the search results window. Build and download again.

For serious work, increase the partition size by at least 256K for small projects, more for large ones you routinely perform global searches that produces many matches, see the next section.

On a PowerPC-based MacOS computer with Virtual Memory on, NTK's 2.7 Meg of code (the exact number is shown in the Finder Info dialog) stays on the hard disk, reducing memory requirements the expense of performance.

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## NTK Search and Memory Hoarding (11/24/95)

Q: I sometimes run out space after working with a project for a while. How can I avoid this?

A: NTK 1.6 is built with the MacApp application framework, which brings with it certain memory requirements. Understanding the way NTK uses memory can help avoid running out of memory.

Most of user interface elements you see when using NTK are pointer-based MacApp objects. Alloca a large number of pointers in the application heap causes fragmentation. To prevent that, MacAp has its own private heap where it manages all these pointers.

This heap expands when necessary, but in the current implementation it never shrinks. This memo is not lost, but it may be wasted, effectively reducing free memory in the application partition.

During a single NTK session, build requirements are relatively constant. Partition size requiremen will thus be mostly affected by the maximum number of NTK windows open at the same time. If yo keep this number reasonable, relative to the partition size you can afford, there should be no prob

The fact that MacApp's objects heap never shrinks can, however, become an issue when performin searches. The problem is not the search itself, but the number of matches. Each line you see in the Search Results window is a MacApp object occupying 500 to 800 bytes. If your search results in a la number of matches, you may run out of memory.

To reduce such occurrences:
1) Perform more focused searches to keep the number of matches per search reasonable.
2) Close the Search Results window as soon as you are done with it, preferably before doing ano search.

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## NTK Stack Overflow During Compilation (11/24/95)

Q: When I build my project which has very deeply nested statements, NTK runs out of memory and q What's going wrong?

A: The deep nesting in your project is causing the compiler to overflow the stack space available in N NTK 1.6 is more likely than than NTK 1.5 to suffer this problem due to new compiler code which r deeper while parsing if-then-else statements, causing the stack to overflow into the application heap.

If you see an inadvertent crash in NTK during a save operation or a package build:

1) If you are familiar with MacsBug, examine the stack. This particular case will show up in the stack as several calls to the same function before the actual crash.
2) Otherwise, temporarily reduce the number of "else" branches and rebuild the package. If the problem disappears, stack overflow is the prime suspect.

time:
1) Re-arrange the 'else' statements to resemble a balanced tree
2) Instead of If-then-else statements use:
   An array of functions (with integers as selectors)
   A frame of functions (with symbols as selectors)
3) Finally, as a temporary work around, you can increase the stack size using the ResEdit application.

**Re-arrange the 'else' statements to resemble a balanced tree**

This solution is the simplest to implement if you need to change existing code. It accommodates no contiguous integer selectors, and in most cases is faster.

For example, the following code:

```
if x = 1 then
    dosomething
else
    if x = 2 then
        doSomethingElse
    else
        if x = 3 then
            doYetAnotherThing
        else
            if x = 4 then
                doOneMoreThing
            else
                if x = 5 then
                    doSomethingSimple
                else
                    if x = 6 then
                        doThatThing
                    else
                        if x = 7 then
                            doThisThing
                        else // x = 8
                            doTheOtherThing
```

can be rewritten like this...

```
if x <= 4 then
    if x <= 2 then
        if x = 1 then
            doSomething
        else // x = 2
            doSomethingElse
    else
        if x = 3 then
            doYetAnotherThing
        else // x = 4
            doOneMoreThing
else
    if x <= 6 then
        if x = 5 then
            doSomethingSimple
        else // x = 6
            doThatThing
    else
       if x = 7 then
            doThisThing
       else // x = 8
```

Note that the if/then/else statement nesting is "unusual" to illustrate the nesting that the comp
must makeÑeach statement is nested as the compiler would process it.

**Use an array of functions with integer selectors**

Replace a long if-then-else statement with an array of functions. The code is more compact and readable. For a large set of alternatives, the faster direct lookup should compensate for the extra function call. This approach is most useful for a contiguous range of selector values (e.g., 11 to 65). can accommodate a few "holes" (e.g., 11 to 32, 34 to 56, 58 to 65). It is not practical for non-contiguo selectors (e.g., 31, 77, 256, 1038...)

For example, the following code:

```
if x = 1 then
   dosuchandsuch;
else
   if x = 2 then
      dosomethingelse;
   else
      if x = 3 then
         andsoon;
```

can be rewritten like this...

```
cmdArray := [func() dosuchandsuch,
             func() dosomethingelse,
             func() andsoon];

call cmdArray[x] with ();
```

**Use a frame of functions with symbols for selectors**

This alternative provides the flexibility of using symbols for selecting the outcome.

For example, the following code:

```
if x = 'foo then
   dosuchandsuch;
else
   if x = 'bar then
      dosomethingelse;
   else
      if x = 'baz then
         andsoon;
```

can be rewritten like this...

```
cmdFrame := {foo: func() dosuchandsuch,
             bar: func() dosomethingelse,
             baz: func() andsoon};

call cmdFrame.(x) with ();
```

**Increase NTK's stack size using the ResEdit application**

Open the Newton Toolkit application with ResEdit.

Double-click on the "mem!" resource icon

Double-click on resource ID 1000 named "Additional NTK Memory Requirements"

Change the fifth (and last) value. This is an hexadecimal number. In NTK 1.6, you should see "00 8000" which is 98304 bytes (or 96k) to add to the total stack size. For example, to increase this value to 128k = 131072 bytes change the hexadecimal value to "0002 0000".

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## Unit Import/Export and Interpackage References (11/25/95)

Q: How can I reference information in one part or package from another (different) part or package?

A: Newton 2.0 OS provides the ability for packages to share informations by exporting or importing units. Units are similar to shared libraries in other systems.

A unit provides a collection of NS objects (unit members.) Units are identified by a name, major version number, and minor version number. Any frame part can export or import zero or more units.

A unit must be declared, using `DeclareUnit`, before it's used (imported or exported.) See the docs `DeclareUnit` below for details.

To export a unit, call `DefineUnit` and specify the NS objects that are exported.

To import from a unit, simply reference its members using `UnitReference` (or UR for short.)

### Unit Usage Notes

- Units can also be used to share objects among parts within a single package. This avoids the r to resort to global variables or similar undesirable techniques.

- A part can export multiple units. To achieve some degree of privacy, you can partition your objects into private and public units. Privacy is achieved by not providing the declaration fo unit.

- References to units are resolved dynamically whenever a package is activated or deactivate For example, a package can be loaded before the package providing the units it imports is loa There will be no problem as long as the provider is loaded prior to actually using the importe members.

  Conversely, it's possible for the provider to be deactived while its units are in use. The part frame methods, RemovalApproval and ImportDisabled, provide a way to deal with this situation.

  Robust code should ensure that the units it imports are available before attempting to use the members. It should also gracefully handle the situation of units being removed while in use. the DTS sample "MooUnit" for an example.

### Unit Build-Time Functions

These functions are available in NTK at build-time only:

`DeclareUnit(unitName, majorVersion, minorVersion, memberIndexes)`
    `unitName` - symbol - name of the unit
    `majorVersion` - integer - major version number of the unit
    `minorVersion` - integer - minor version number of the unit

return value - unspecified

A unit must be declared by `DeclareUnit` before it's used (imported or exported.) The declaratio
maps the member names to their indexes. A typical declaration looks like:

```
   DeclareUnit('|FastFourierTransforms:MathMagiks|, 1, 0, {
      ProtoGraph:     0,
      ProtoDataSet:   1,
   });
```

Typically, the declarations for a unit are provided in a file, such as "FastFourierTransforms.unit
that is added to an NTK project (similar to `.h` files in C.)

When resolving imports, the name and major version specified by the importer and exporter must
match exactly. The minor version does not have to match exactly. If there are units differing only
minor version, the one with the largest minor version is used.

Typically, the first version of a unit will have major version 1 and minor version 0. As bug fixes
releases are made, the minor version is incremented. If a major (incompatible) change is made, th
the major version number is incremented.

Note: When a unit is modified, the indexes of the existing members must remain the same. In othe
words, adding new members is safe as long as the indexes of the existing members don't change. If
change a member's index it will be incompatible with any existing clients (until they're recompil
with the new declaration.)

`DefineUnit(unitName, members)`
   `unitName` - symbol - name of the unit
   `members` - frame - unit member name/value pairs (slot/value)
   return value - unspecified

`DefineUnit` exports a unit and specifies the value of each member. Immediates and symbols are
allowed as member values. A typical definition looks like:

```
   DefineUnit('|FastFourierTransforms:MathMagiks|, {
      ProtoGraph:     GetLayout("foo.layout"),
      ProtoDataSet:   { ... },
   });
```

A unit must be declared before it's defined. The declaration used when exporting a unit with `n`
members must contain `n` slots with indexes `0..n-1`. The definition must specify a value for every
declared member (this is important.)

`UnitReference(unitName, memberName)`
  or
`UR(unitName, memberName)`
   `unitName` - symbol - name of a unit
   `memberName` - symbol - name of a member of unit
   return value - a reference to the specified member

To use a unit member call `UnitReference` (`UR` for short) with the unit and member name.

The unit name `'ROM` can be used to refer to obects in the base ROM. For example:
   `UR('ROM, 'ProtoLabelInputLine)`.

Note: references to objects in the base ROM are sometimes called "magic pointers" and have
traditionally been provided in NTK by constants like `ProtoLabelInputLine` or
`ROM_SystemSoupName`

In Newton 2.0 OS, there may also be packages in the ROM. These ROM packages may provide un
Their members are referenced just like any other unit, using `UR`, the unitName, and the memberNa
This is the mechanism by which licensees can provide product-specific functionality.

`AliasUnit(alias, unitName)`
- `alias` - symbol - alternate name for unit
- `unitName` - symbol - name of a unit
- return value - unspecified

`AliasUnit` provides a way to specify an alternate name for a unit. Since unit names must be uniq
they tend to be long and cumbersome. For example:

```
    AliasUnit('FFT, '|FastFourierTransforms:MathMagiks|);
```

so that you could write:

```
    local data := UR('FFT, 'ProtoDataSet):New(points);
```

instead of:

```
    local data := UR('|FastFourierTransforms:MathMagiks|,
      'ProtoDataSet):New(points);
```

`AliasUnitSubset(alias, unitName, memberNames)`
- `alias` - symbol - alternate name for unit
- `unitName` - symbol - name of a unit
- `memberNames` - array of symbols - list of unit member names
- return value - unspecified

`AliasUnitSubset` is similar to `AliasUnit`, except that it additionally specifies a subset of th
units members which can be used. This helps restrict code to using only certain members of a unit.

**Unit Part Frame Methods**

These methods can optionally be defined in a part frame to handle units becoming unavailable.

`RemovalApproval(unitName, majorVersion, minorVersion)`
- `unitName` - symbol - name of the unit
- `majorVersion` - integer - major version number of the unit
- `minorVersion` - integer - minor version number of the unit
- return value - `nil` or string

This message is sent to a part frame when an imported unit is about to be deactivated. It may a ret
a string to be shown to the user as a warning about the consequences of deactivating the package in
For example:

```
"This operation will cause your connection to fooWorld to be dropped."
```

Note: do not assume that the user is removing the package. Other operations such as moving a
package between stores also cause package deactivation.

This message is only a warning. The user may decide to proceed and suffer the consequences. If the
proceeds, the `ImportDisabled` message (see below) will be sent.

If the removing the unit is not a problem (for example, your application is closed), then
`RemovalApproval` can return `nil` and the user will not be bothered.

`unitName` - symbol - name of the unit
`majorVersion` - integer - major version number of the unit
`minorVersion` - integer - minor version number of the unit
return value - unspecified

This message is sent to a part frame after an imported unit has been deactivated. The part should deal with the situation as gracefully as possible. For example, use alternative data or put up a Notify and/or close your application.

**Unit-Related Glue Functions**

These functions are available in the Newton 2.0 Platform file.

`MissingImports(pkgRef)`
return value - `nil` or an array of frames (see below)
glue name - `kMissingImportsFunc`

`MissingImports` lists the units used by the specified package that are not currently available. `MissingImports` returns either nil, indicating there are no missing units, or an an array of fram
the form:

```
{
   name: symbol  - name of unit desired
   major: integer - major version number
   minor: integer - minor version number

   <other slots undocumented>
}
```

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## **NEW**: Store parts and PowerPC-native NTK (5/15/96)

Q: When I build a store part with NTK 1.6 or 1.6.2 on my PowerPC MacOS computer, text searches (fo example mySoup:Query({words: "pizza"}) don't sucessfully find the entries. Why?

A: On PowerPC MacOS computers only, there is a bug in 1.6 and 1.6.2 wherein building store parts wi cause this behavior. The workaround is building the store part on a 680x0-based Macintosh.

If you don't have a 680x0 machine available, you might try any of various third-party applicatio which remove the PowerPC-native code from an application which contains 680x0 code and Powe code, thus forcing it to run the 680x0 code instead. Before doing this, be sure to backup your copy o NTK!

# Miscellaneous

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## Unicode Character Information (9/15/93)

Q: Where can I find more about Unicode tables?

A: The following book provides a full listing of the world wide (non-Kanji) Unicode characters:

*The Unicode Standard*
*WorldWide Character Encoding*
*Version 1.0 Volume 1*
*ISBN-0-201-56788-1*

## **CHANGED**: Current Versions of MessagePad Devices (5/15/96)

Q: What are the versions of the Apple Newton MessagePad device?

A: This answer will change as product versions are released. To find the version number, open the Ex Drawer. In the Newton 1.x OS, open the Prefs application and look at the number in the bottom middle of the screen. In the Newton 2.0 OS, choose Memory Info from the Info button.

As of May 15, 1996 the latest versions are:

| | |
|---|---|
| English Newton 2.0 OS | |
| MessagePad 120 | 2.0 (515299) |
| MessagePad 130 | 2.0 (526060) |
| German Newton 2.0 OS | |
| MessagePad 120 | D-2.0 (536030) |
| English Newton 1.x OS | |
| MessagePad | 1.05 |
| MessagePad | 1.11 |
| MessagePad 100 | 1.3 (415333) |
| MessagePad 110 | 1.3 (345333) |
| MessagePad 120 | 1.3 (465333) |
| German Newton 1.x | |
| MessagePad | D 1.11 |
| MessagePad 100 | D 1.3 (435334) |
| MessagePad 120 | D 1.3 (435334) |
| French Newton 1.x | |
| MessagePad 100 | F 1.3 (424112) |
| MessagePad 110 | F 1.3 (424112) |
| MessagePad 120 | F 1.3 (455334) |

**End of DTS Q&As**