



Full Circle

THE INDEPENDENT MAGAZINE FOR THE UBUNTU LINUX COMMUNITY

LIBREOFFICE SERIES SPECIAL EDITION VOLUME 6

LIBREOFFICE SERIES
SPECIAL EDITION



LIBREOFFICE
Volume Six Parts 42-48

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I didn't have to work for very long in Calc before I needed to use cell names to reference values in different cells. This need was followed by those same reference names failing to do what I was expecting from them. While referencing cells is not complicated, it sometimes requires a little thought about what you're trying to accomplish.

At its heart, there are two reference types: relative and absolute. Relative references refer to a set of offsets from the current cell. Absolute references refer to the exact (or fixed) cell, column, or row. With these two types we can show references in four different ways. Cell references can even cross between sheets.

Sometime, you will need to reference more than one cell. This is done with cell ranges. You can make a cell range relative or absolute just like the cell reference. You can even name a cell range.

RELATIVE REFERENCES

A relative cell reference is a set of offsets from the current cell. If you put a reference to C4 in cell D6, the reference is to the cell one column to the left and two rows up. If you copy this reference to other cells, say D7, it will refer to the cell C5, which is one column to the left and two rows up from D7.

Let's create an example to clear up any confusion. Create a new Spreadsheet document. In the cells B3 and B4 put the values 15 and 46. In the cells C3 and C4 put in the values 11 and 14. Select cell B5 and enter the following formula (yes, the equal sign [=] is necessary):

=B3+B4

When you press enter, it will show a total of 61, the sum of the two values in B3 and B4. Now, right-click B5 and copy. Select C5, right-click, and paste. In C5 you get the total 25, the sum of the two values in C3 and C4. See how the reference shifted to the new column? Since we didn't change rows, the row references stayed the same. However, if we did, the

relative cell reference would have shifted to accommodate the change.

So, when we make a relative reference, it will move positions, keeping the same offsets, when copied to a new location.

ABSOLUTE REFERENCES

An absolute cell reference is fixed. If you make an absolute reference to cell C1, then no matter where you copy that reference, it always refers to C1. We create absolute references by adding the dollar sign (\$) before the column or row we want to remain absolute. For example \$C\$1 is an absolute reference to the cell C1.

Let's do another example to illustrate absolute references. Imagine we need to multiply a group of numbers by a factor. In cell D1 we put 0.75. This is our factor. In D2, D3, and D4 we put 10, 20, and 30. In the E column, we will put our calculations. In cell E2 put the formula:

=D2*D1

This will give us the answer 7.5, which is correct. However, if we copy the formula in E2 to E3 and E4, we get answers of 200 and 600, which are wrong. If you look at the copied formulas, the references shifted. This is because we used a relative reference. We do want the first number to shift when we copy, but we need D1 to stay fixed. Edit the formula in E2 and change it to

=D2*\$D\$1

We still have the right answer in E2. Now, copy the formula in E2 to E3 and E4. We get the answers 15 and 22.5, which are the correct answers. If you look at the copied formulas in E3 and E4, you find the reference to D1 remained fixed.

FOUR WAYS TO REFERENCE CELLS

With this in mind, this gives us four different ways we can reference a cell. They are relative, absolute, and two partially absolute references.



- D1 – Relative, from cell E3, it is one column left and two rows up
- \$D\$1 – Absolute, from any position references cell D1
- \$D1 – Partially absolute, column D is fixed but the row is relative
- D\$1 – Partially absolute, column is relative but the row is fixed to 1

REFERENCE CELL IN ANOTHER SHEET

To reference a cell in another sheet, we use dot notation to add the sheet name to the reference. For example, Sheet1.A1. This is handy if you need to carry a calculation or figure from one sheet to another. To illustrate, we will rename our current sheet, add a new one, and create a reference from one to the other.

Right-click on the tab for the current sheet and select “Rename Sheet.” When prompted, name the sheet MyData and click OK. To create a new sheet, click on the plus (+) at the end of the sheet tabs. Select cell A1 in the new sheet. Type in

`=MyData.E2`

which will pick up the value of 7.5

from the cell E2 in the MyData sheet.

NOTE: If the sheet name contains spaces, surround the name with single quotes, as in 'My Sheet'.C3.

Just like other references, the reference to the sheet is absolute or relative depending on whether we put the dollar sign (\$) in front of it.

CELL RANGES

Sometimes, you need to reference a group of cells rather than just one. For such cases, we use cell ranges. A cell range is created by separating two cell references with a colon (:). The left cell references the upper left corner of the cell range, and the right cell references the lower

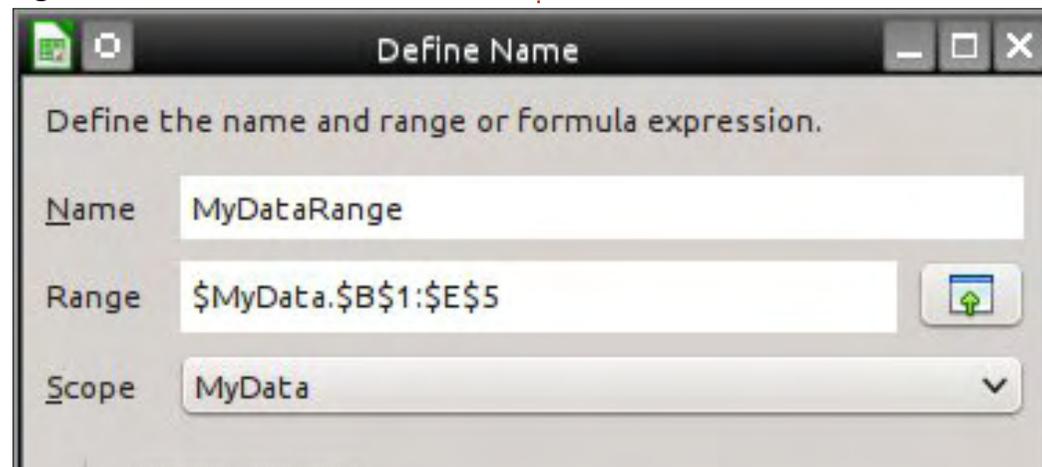
right corner of the cell range. For example A1:C2 represents a range of six cells: A1, A2, B1, B2, C1, and C2. However, the range can also represent just one column or row as in C2:C100 or B3:H3.

The same rules for relative and absolute references apply to cell ranges. You can create a full or partial absolute reference. You can even apply a range across sheets. Let's say you need a cell range of all the A1 cells on all the sheets named Sheet1 through Sheet10. You would use the cell range Sheet1.A1:Sheet10.A1.

For convenience, you can name a range. To name a range, select a range of cells in the sheet. Insert > Names > Define brings up the “Define Name” dialog. Give the range a name. Keep in mind that

cell range names can contain only letters, numbers, and underscore (_). Note the use of absolute references in the Range field. You can adjust your range as needed, manually or by clicking the range button and selecting the range with the mouse or cursor. The Scope field allows you to define whether the named range applies to the entire document or just a certain sheet. Click OK to save the range with the new name.

Cell references and ranges are fundamental when you begin to work on more complex sheet layouts, functions, and formulas in Calc documents. Understanding how relative and absolute references work can save time and prevent mistakes when copying formulas and references. While simple, incorrect use of references can lead to the wrong answer.

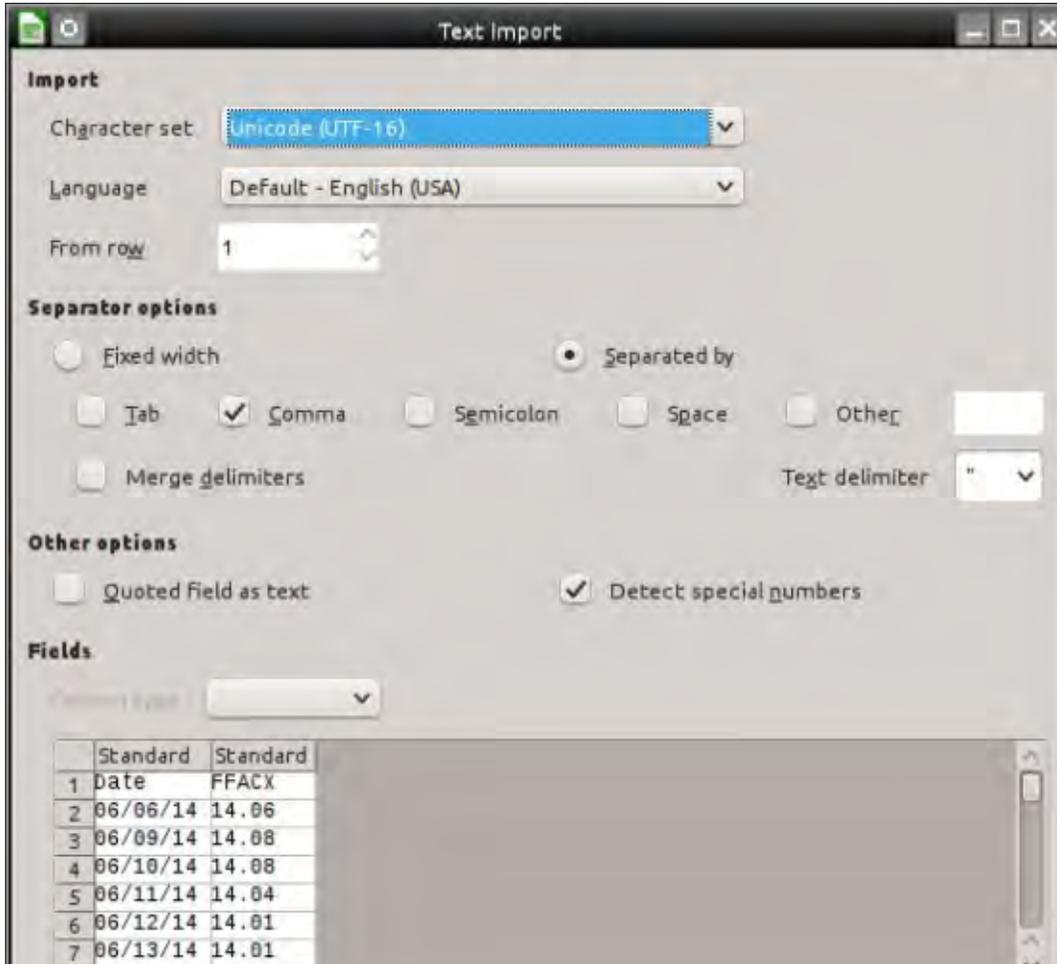


Elmer Perry's history of working, and programming, computers involves an Apple][E, adding some Amiga, a generous helping of DOS and Windows, a dash of Unix, and blend well with Linux and Ubuntu. He blogs at <http://eeperry.wordpress.com>



Spreadsheets are good for collecting data like temperatures, stock prices, and sports data. However, the data on its own does us little good. We need ways to analyze the data. LibreOffice Calc provides us with built-in functions to do this. In this

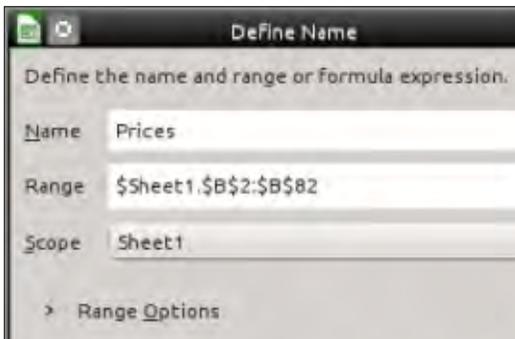
article, we will look at a few of the simple statistical functions built into Calc. This is not meant as a thorough examination of all the functions, but more an exercise to get you comfortable using functions.



IMPORTING THE DATA

For our data, I have collected a few months worth of stock prices on the mutual fund FFACX. You can find the data at <http://pastebin.com/AeLcyM1t>. The data is laid out as comma-delimited plain text. Copy the data from Pastebin. Make sure that you copy from the "Raw Paste Data" text box. Create a new Calc document. Right-click on cell A1 and select Paste. The Text Import dialog will show. Under Separator Options, select "Separated by" and check Comma. Click OK. You now have two columns of data, the date and the price. Save the sheet.

CREATING A NAMED CELL RANGE



Throughout this article we will use the prices as our data range. Since we will use the range several times, we will name it to make the references easier. Select all the prices (cells B2:B82). The easiest way to select all the cells is to type the range B2:B82 into the cell name box on the formula toolbar and press Enter on the keyboard. Insert > Names > Define, and the "Define Name" dialog shows. Name the range "Prices". Notice the absolute reference in the Range text box (\$Sheet1.\$B\$2:\$B\$82). Names apply to a specific group of cells, so the reference is absolute. Under the Scope, we will restrict the use of this name to just Sheet1. Click Add to create the range name.

Now, in any formula or function where we use the name "Prices", it is the same as typing the cell range \$Sheet1.\$B\$2:\$B\$82.

MAX AND MIN

The first two statistical functions we will look at are MAX and MIN. Both functions accept a

list of values or range(s). MAX returns the maximum (or largest) value in the list. MIN does just the opposite, returning the minimum (or smallest) value in the list.

Move your cursor to D4. Type in "Highest." In the cell E4, type in the formula

=MAX(Prices)

You should get the result 14.16. If you look through the list of prices, you will discover this is the largest number in the list.

In D5 put "Lowest." The formula for E5 is

=MIN(Prices)

The result is 13.57, the lowest number in the list.

It is also possible to use these, or any Calc function, as an operand in a formula. For example, if we wanted to know the difference between the highest and lowest price, we could use the formula

=MAX(Prices) - MIN(Prices)

in cell E6. In the formula, the results of the functions are

calculated first. MAX(Prices) becomes 14.16, and MIN(Prices) becomes 13.57. Then the result of 14.16-13.57 is placed in the cell E6. Place the text "Difference" in the cell D6 as a label.

AVERAGE, MEDIAN, AND MODE

In statistics there are many ways to determine just what is the typical value for a set of numbers. Among these are the arithmetic average, the median, and the mode. The arithmetic average, known to most people as simply the average, is the sum of a series of numbers divided by the number of items in the series. In Calc we use the AVERAGE function to get the arithmetic average.

The median ranks the numbers from the lowest to the highest. If the number of items in the series is an odd number, it takes the one in the middle. If it is even, the median is the arithmetic average of the two center numbers. Calc uses the MEDIAN function to calculate the median for you.

Mode is the number that repeats most often. If there is a tie,

it uses the smallest number. Calc uses the MODE function to get the mode for you.

We can see the results of these three functions by putting the following formulas in the cells E7, E8, and E9.

=AVERAGE(Prices)

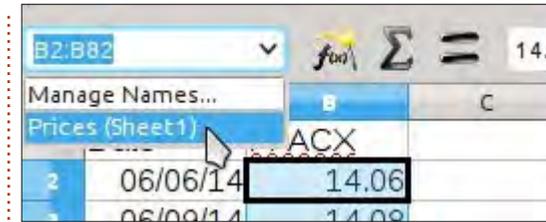
=MEDIAN(Prices)

=MODE(Prices)

You will notice that the results are within a few hundredths of each others. This is not true in all cases. Numbers that are much larger or much smaller than all the others can affect the average. In those cases, the mode or median might better suit your needs for a typical value.

The Calc statistical functions help us to analyze the data in a Calc spreadsheet. We touched on only a few of the statistical functions. Calc has over 70 statistical functions. This is just one of many categories of functions available to us in Calc. You can get a list of all the Calc functions in the help documentation.

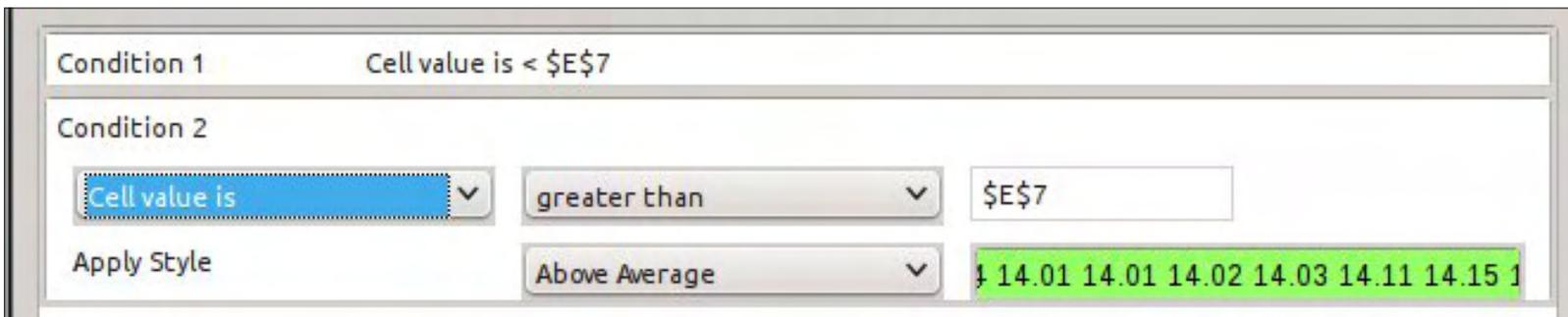
CONDITIONAL FORMATTING



In our data set, the top and bottom are pretty close together, so the average will work good for us as the typical value for this data set. We can use conditional formatting to mark each of the prices as either above or below the average.

Start by selecting all the prices in the B column (B2:B82). Since we named the range B2:B82, a quick way to select all the prices is by using the drop down arrow for the cell name box on the formula toolbar and selecting the name "Prices(Sheet1)."

Format > Conditional Formatting > Condition will bring up the Conditional Formatting dialog. Select "Cell value is" from the left drop-down list. From the drop-down list in the center, select "less than." Enter \$E\$7 in the text box to the right. If you want to use the median or mode for the



comparison, you can use \$E\$8 or \$E\$9. We are using an absolute reference here because we want to reference the same cell regardless of what row we are formatting.

For the Apply Style, select “New Style” from the drop-down list. The Cell Style dialog will open. On the Organizer tab, name the style “Below Average.” Switch to the Background tab and select the Red color swatch. Click OK to close the dialog and save the new style. You will see “Below Average” is now selected as the Apply Style.

Click Add to add a second condition. This time select “greater than” instead of “less than.” Use the same absolute reference, \$E\$7, \$E\$8, or \$E\$9, as you used in the less than condition. Once again select “New Style” for the Apply Style. Give the new style the name “Above Average”, and make the background green instead of red.

OK to save the new style.

OK in the Conditional Formatting dialog will save the settings. Prices that are over the average will highlight in green, and the prices below the average will highlight in red.

NOTE: You can create your style for conditional formatting before creating the condition. In such a case, you would just select the style to use.

I hope this article has helped you to understand the use of the statistical functions demonstrated and functions in general. We saw how to use named ranges to identify cell ranges being used repeatedly. We used functions by themselves and as operands in a formula. Using conditional formatting, we highlighted certain cells to show visually the status of the cell's value. This eliminates the

need to scroll back up the sheet to check the average value. Until next month, look up some functions in the help and put them to work for you. Also, play with some of the features of the conditional formatting and see what other visuals you can create.

Next time, I will show you how to validate cell values.



Elmer Perry's history of working, and programming, computers involves an Apple][E, adding some Amiga, a generous helping of DOS and Windows, a dash of Unix, and blend well with Linux and Ubuntu. He blogs at <http://eeperry.wordpress.com>



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When you begin to create formulas in Calc, you soon realize that the wrong kind of data in a cell referenced by your formula can throw the results off. Calc does its best to interpret the data entered according to the formatting style of the cell. If you format the cell as a date type, Calc does its best to translate the input in that cell as a date. At times it is successful and other times not. Fortunately, Calc comes with validity options built in to help you design your spreadsheet in such a way as to give the user help with the input or even force them to enter the data type needed for the cell. In this article, we will look at the validity options and its capabilities.

SHEET SETUP

Before we get to the validity options of Calc, we need to set up a spreadsheet where we will use the options. The spreadsheet is a time sheet for showing the hours worked during a week. The time sheet works well for our example because on a given day, the next

time input must have a greater value than the previous entry.

We will start by creating our title and column headers. In cell A1, enter "Time Sheet". On row 2, fill in columns A-F with the following titles: DAY, IN, OUT, IN, OUT, TOTALS. Now for the row headers. In cell A3, type in "Sunday". Making sure that cell A3 is highlighted, click on the small square in the lower right corner of the highlighted cell. The cursor will

become a crosshair. Drag down to A9. When you release mouse button, the rest of the weekday names are filled in. This happens because the days of the week are one of the default sort lists. You can see all the lists and add your own at Tools > Options > LibreOffice Calc > Sort Lists.

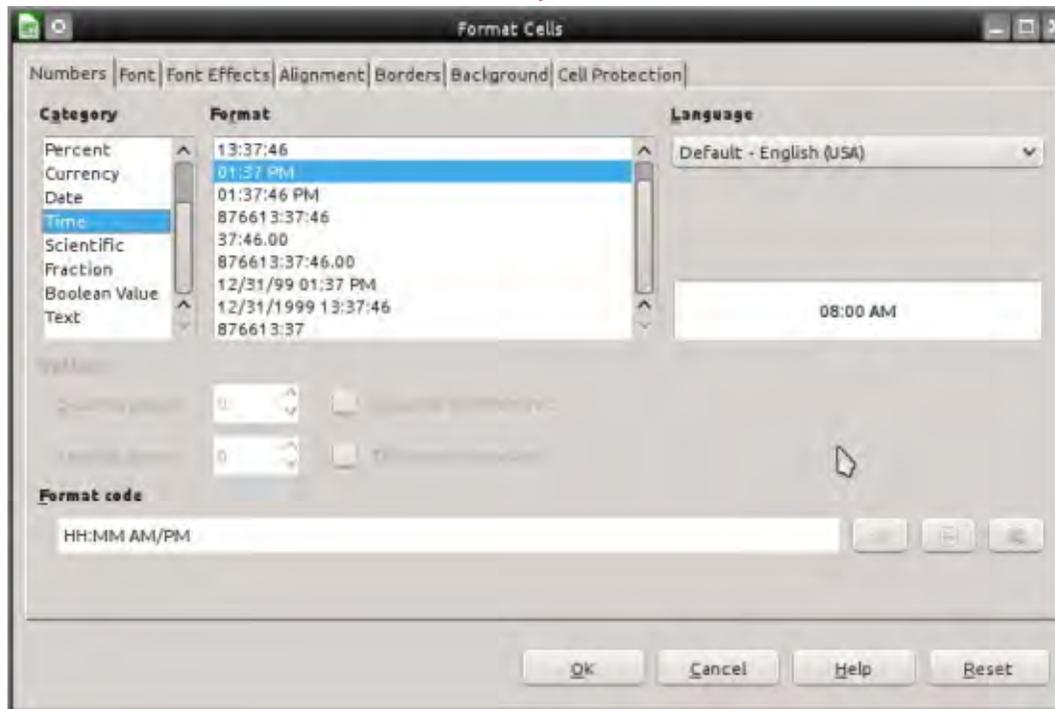
Now let's format the cells. Select B3:E9, right-click, and select Format Cells. Click the Numbers tab. From the Category list box,

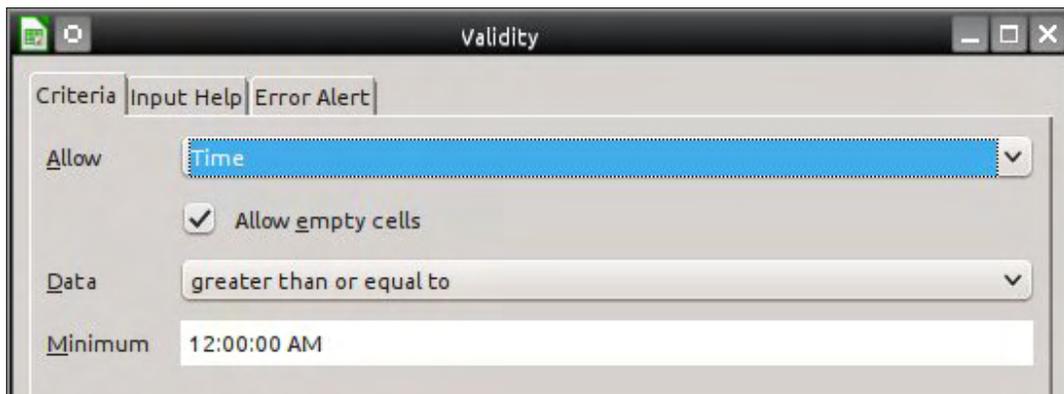
select Time. If you normally use a 12-hour clock, select the "01:37 PM" option under format. However, for a 24-hour clock, select "13:37." Click OK to save the options. Column F is the totals. We will need to select a time format, at least for the last one, that can go beyond 24 hours. Select cells F3:F10, right-click, select Format Cells. Again, on the Numbers tab, select the Time category, but for the format, select "876613:37." This will allow for totals that are greater than 24 hours. Click OK to save the settings.

If you haven't yet, you might want to save your sheet.

SETUP VALIDATION

We will need to check the validity of the time inputs. We will want them in a Calc-acceptable time format. This is the only requirement for valid data in the B column. For the other columns (C-E), we will need to also make sure the input is greater than the input before it.





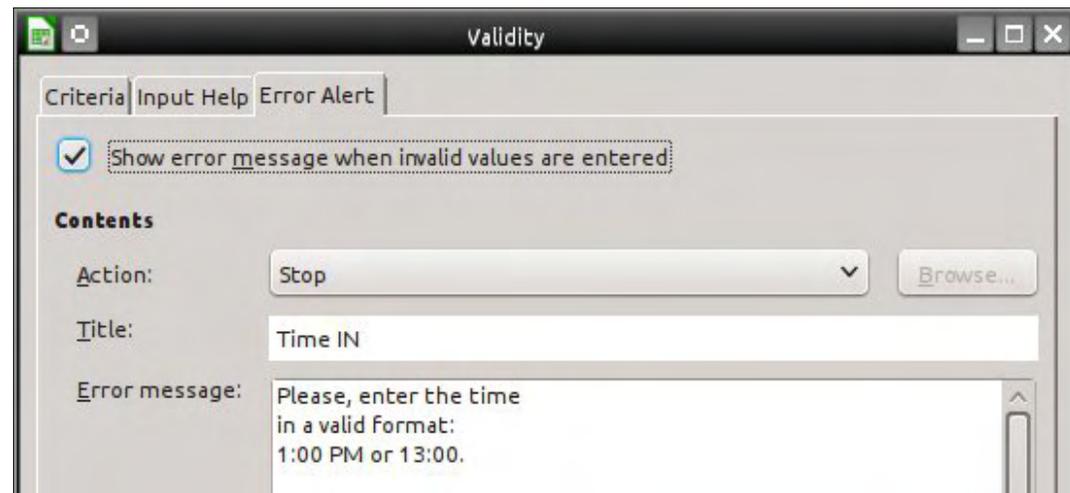
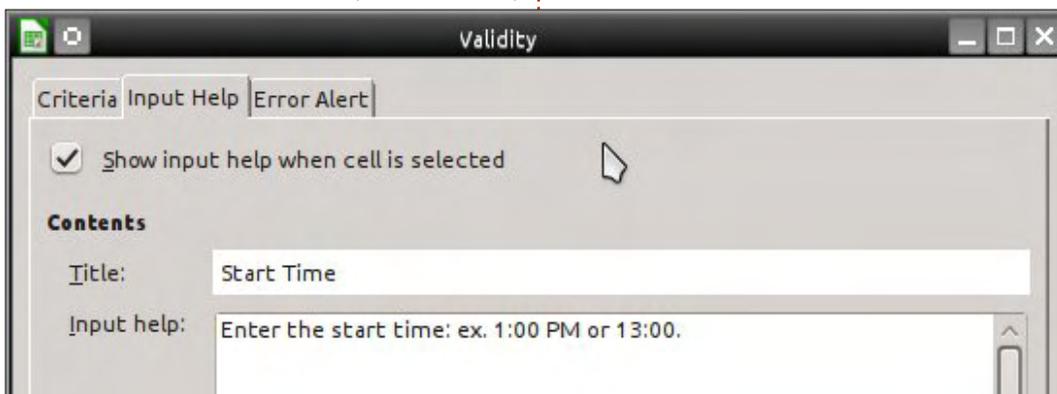
Select cell B3, then Data > Validity. The Validity dialog will appear.

The Criteria tab (above) is where we control what constitutes valid data. The Allow drop-down list defines the type of data that is acceptable. The default is All Values. The other types are Whole Numbers, Decimal, Date, Time, Cell Range, List, and Text Length. The choices for the different types are basically the same except for Cell Range and List. With the cell Range, you define a cell range and the cell must contain a value that is in one of those cells. The defined range must consist of only one column or one row. With the List option, you define a list of acceptable values. With both the List and Cell Range options, you get a drop-down list box with the acceptable values. For our

purposes, we need Allow set to Time.

Check the box for “Allow empty cells” to allow cells to remain empty. This will allow us to start with a blank time sheet.

The Data drop-down list allows you to select the comparative operator to use for this validation. The choices are equal, less than, greater than, less than or equal to, greater than or equal to, not equal, valid range, and invalid range. Each one asks for a minimum, maximum,



or value to compare, except for the two range choices. The range choices require a minimum and maximum. For our purpose, we need the greater than operator. In the minimum text box, enter 12:00 AM or 00:00.

Click on the Input Help tab (below). The settings on this tab are optional. The idea is to provide the user with information about what to enter into the cell as a tip

box that pops up when the cell is selected. To activate, click the checkbox for “Show input help when cell is selected.” Create a title for the tip box by typing it in the Title text box. For us, we could use the title “Start Time”. The Input Help text box is where you put the actual help tip like “Enter the start time: ex. 1:00 PM or 13:00”.

Switch to the Error Alert tab (above). Here we can set the validation to display a message when invalid data is entered. To activate the setting, check the checkbox for “Show error message when invalid values are entered”. There are four choices for the Action drop-down list, Stop, Information, Warning, and Macro. Stop, the one we will use, prompts with a dialog and rejects the input

when invalid data is entered. For Information and Warning, they prompt with a dialog containing OK and Cancel buttons when invalid data is entered. If the user clicks OK, the input is left as it is. If the user clicks Cancel, the input is rejected. Macro will allow you to select a macro to run when invalid data is entered. The Title and Error Message is the title and message for the dialog box. We could set them to "Invalid Time" and "Enter in time format: 13:00 or 1:00 PM".

Once you have everything set, click OK to save the Validity dialog settings.

We will copy cell B3 to cells B4:B9. Right-click cell B3 and select Copy. Select cells B4:B9, right-click, and select Paste. This will copy the validity settings to the cells. The whole column will have the same requirements for input.

For columns C, D, and E, we will do almost the same thing. We will go through the steps on C, and you can repeat for D and E. Select cell C3, Data > Validity. On the Criteria tab of the Validity dialog, select Time from the Allow drop-down list. Check to allow empty cells. Set Data to greater than, and set the

minimum value to B3. Notice that we use a relative cell reference here. This will allow us to copy it to the other cells and have the reference translate. These criteria tell Calc that the cell requires a value greater than the value in cell B3. Do what you want with the help and error tabs. I do recommend using at least Information or Warning messages for invalid data. The messages could mention needing a greater value (or a later time). Right-click cell C3 and copy the cell, then paste it into cells C4:C9.

You can repeat for columns D and E. You can also just copy C3 to D3:D9 and E3:E9, but you will need to adjust the text in the dialogs for help and error.

TOTAL FORMULAS

Now that we have our validation set up, we need to create the formulas to give us our totals. We will start with the daily totals. Select cell F3. Enter the formula

= (C3-B3) + (E3-D3)

which will give us the total for Sunday's times. Right-click F3 and

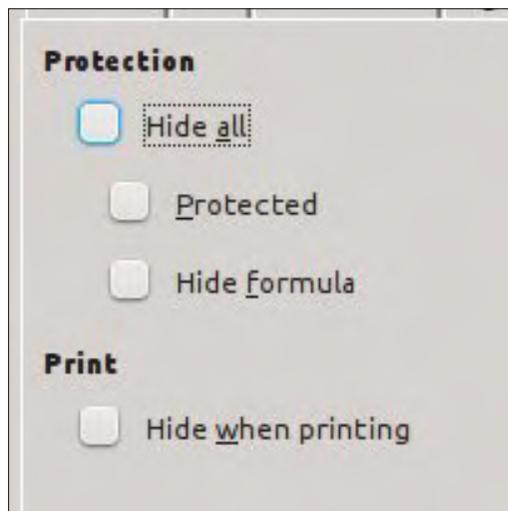
Copy. Select cells F4:F9, right-click, and Paste.

For the weekly total in F10, we will just sum the daily totals. Here is the formula:

=SUM(F3:F9)

PROTECT CELLS

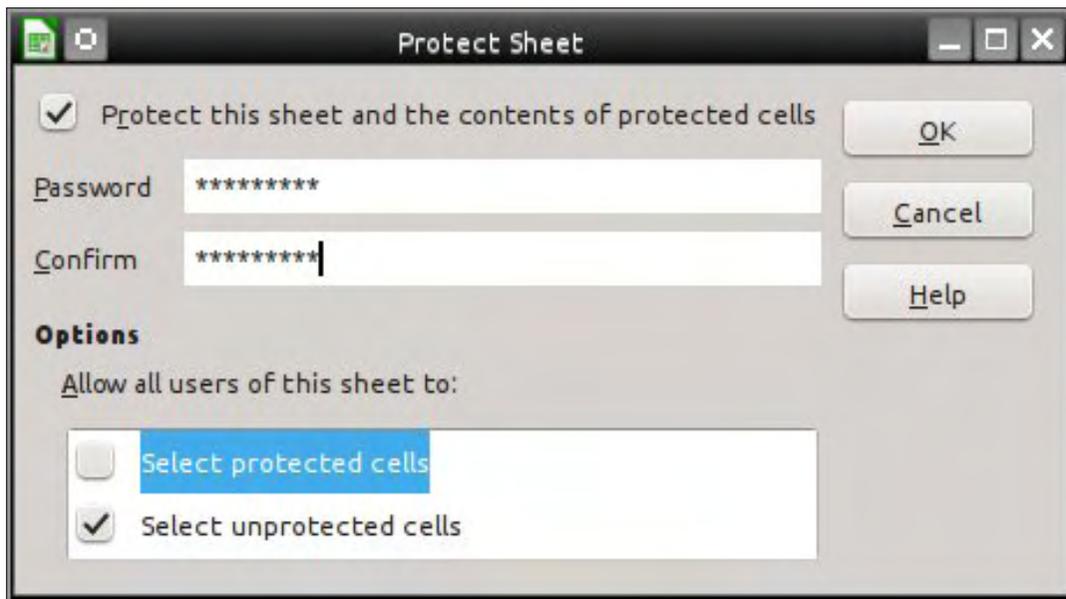
Once you have a sheet set up the way you like, you may want to protect the parts of the sheet you don't want changed like the labels and formulas. First, you need to tell Calc whether the cell is protected or not. Then you add protection to the sheet or document once everything is finished. In the case of our time sheet, we need to protect everything except for the cells where the user enters their times, B3:E9.



By default, the Protect option is turned on for all cells. To change the protection setting for the input cells, select B3:B9, Format > Cells, and the Format Cells dialog appears. Click on the Cell Protection tab and uncheck Protected.

At this point, you can still edit any cell because the sheet or document is not protected. To turn on protection for the sheet or document, Tools > Protect Document > Sheet (or Document). The Protect Sheet or Protect Document dialog will appear depending on which option you selected. Enter and confirm a password in the dialog. The options will allow you to check whether the user can select protected or unprotected cells. If you do not enter a password, then no password is required to remove protection from the sheet or document.

To remove protection from a sheet or document, Tools > Protect Document > Sheet (or Document). If a password was used when protection was set, enter the password used to protect the sheet or document.



MARK INVALID DATA WITH DETECTIVE

If you selected Warning or Information from the Action drop-down list in the Validity dialog, a user could enter invalid data and click OK to keep the invalid input. This may generate strange results in your totals or an error. Tools > Detective > Mark Invalid Data will mark the invalid data. Once the user corrects the data, Tools > Detective > Mark Invalid Data should clear the marks, unless the data is still invalid. Notice from my sample that invalid data can cause other cells data to show as invalid.

The Calc Validity options are a great way to set up sheets for use by other people, or to keep you from entering invalid data on a complicated sheet. You can set it up to reject the invalid data outright, or for the user to make a choice about keeping the input. Once you have the sheet set the

Time Sheet					
DAY	IN	OUT	IN	OUT	TOTALS
Sunday	08:00 AM	01:15 PM	02:15 PM	05:00 PM	08:00
Monday	08:00 AM	09:00 AM	12:00 PM	05:00 PM	06:00
Tuesday	09:00 AM	12:00 PM	01:00 PM	05:00 PM	07:00
Wednesday	08:00	05:00	13:00	12:00	20:00
Thursday	09:00	12:00	text	17:00	#VALUE!
Friday	08:00	12:00	13:00	16:00	07:00
Saturday	09:00	11:00	12:00	18:00	08:00
Total					#VALUE!

way you want it, you can protect the sheet from unwanted changes. This is a good way to protect formulas and labels. Finally, the Detective tool allows the user to mark invalid data they entered.



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In my last article, I showed you how to use the Mark Invalid Data tool in Calc's Detective tools. This time, I am going to discuss the rest of the tools in the Detective menu that help us trace the cells used in formulas. Through these tools, we can learn what cells affect the result of a formula, what formulas a cell affects, and what cells are involved in a formula that results in an error. The sheet we will use is small to help you understand how they work, but these tools are most helpful in a large sheets with complicated formulas.

SETTING UP THE SHEET

Create a new, blank sheet. In cell A1, enter the value 13. Select cells A1:A6. Edit > Fill > Series to bring up the Fill Series dialog. For

1	13	14	15	16	58
2	14	15	16	17	62
3	15	16	17	18	66
4	16	17	18	19	70
5	17	18	19	20	74
6	18	19	20	21	78
7	93	99	105	111	816
8	Complete Sample Sheet				

the Direction, select Down, and for the Series type, select AutoFill. Click OK, and the cells are filled with sequential numbers. Select cells A1:D6. Edit > Fill > Series. This time, select Right for the Direction, but again select AutoFill for the Series type. Click OK and the cells to the right are filled with sequential numbers.

Create totals for the rows and columns by selecting the blank cell at the end of the row or column. Click the SUM button on the formula toolbar. The cells to the left for rows, and above for the columns, are automatically selected. Press the Enter / Return key on the keyboard to accept the results. Repeat for each of the rows and columns.

Cell E7 will sum the totals of

both the rows and the columns. The formula is

`=SUM(A7:D7, E1:E6)`

TRACE PRECEDENTS

The Trace Precedents function (bottom right) shows the cells used by the formula in the current cell. Traces are displayed on the sheet with blue arrows and blue frames around cell ranges. This is true for all the trace functions.

Select cell E7. Tools > Detective > Trace Precedents. Blue arrows and frames show the cells used by the formula. If you entered the formula correctly, this includes all the totals for the rows and columns. To clear the trace markings off the sheet, select Tools > Detective > Remove

1	13	14	15	16	58
2	14	15	16	17	62
3	15	16	17	18	66
4	16	17	18	19	70
5	17	18	19	20	74
6	18	19	20	21	78
7	93	99	105	111	816
8	Trace Precedents				

Precedents.

TRACE DEPENDENTS

Trace Dependents (next page, top left) draws arrows to the cells containing formulas that rely on the currently active cell. If you select C4 then Tools > Detective > Trace Dependents, you get arrows pointing to C7 and E4. Both of these cells contains formulas that reference C4 in their range. Just as with the Trace Precedents, the ranges of the two formulas are surrounded by a blue box. To clear the trace markers, Tools > Detective > Remove Dependents.

COMMON CALC ERRORS

Before we talk about Trace Error, let's take a quick look at

	A	B	C	D	E
1	13	14	15	16	58
2	14	15	16	17	62
3	15	16	17	18	66
4	16	17	18	19	70
5	17	18	19	20	74
6	18	19	20	21	78
7	93	99	105	111	816
8	Trace Dependents				

some common errors you will see in Calc.

#DIV0! – The formula is trying to divide a number by zero. As we learned in elementary mathematics a long time ago, you can't divide a number by nothing. Some functions, like VARP and STDEV, will give this error when you fail to use the minimum required arguments.

#REF – The cell or range reference is invalid. This mostly happens when you mistype your reference or you reference a cell or range that no longer exists. For example you have a reference to a sheet that has been deleted.

#VALUE – The input was a type other than what was expected. This is often caused by referencing a cell with text in a mathematical

function or formula.

Err:510 – A variable is missing from the formula. This can happen when you type two operators together, like =1 +* 3.

TRACE ERROR

Trace Error draws trace arrows to all the precedent cells which caused an error in the currently selected cell's formula. To demonstrate this, we will need to generate an error. #DIV0 is

20		74
21		78
111		816
Trace Error		0
		#DIV/0!

probably the easiest to generate. Enter the formula =C3-D2 in cell E8. The result is zero. In cell E9

enter the formula =E7/E9. This will generate a #DIV0 error.

To trace the error, select cell E9. Tools > Detective > Trace Error. A trace arrow is drawn through the cells involved in the formula. In our case, it is just two cells. You can change the minus to a plus and the arrow will clear and the error will go away, but for now, let's leave it the way it is. I have one more thing I want to show you. The only way to clear an error trace without correcting the error is Tools > Detective > Remove All Traces.

COMBINING TRACES

Tracking down a problem or an error is not always as simple as just using one of the trace tools. You might need to combine them to find the real issue. Let's take our error for example. We can select the cell E9, and run the error trace, and see that the formula uses the two cells above it. However, once you realize that both cells contain formulas as well, you can trace the precedents on cell E8 to see if you can find the problem. You then realize that the two cells used in the formula are the same value. Then it hits you; you meant to use

C6 – not C3. Change C3 to C6 in the formula in E8, and the error and the error trace arrow go away. Also note that the precedents traces move with the change of the formula.

With the detective's trace tools in Calc, you can trace the cells used in a formula and determine why you didn't get the results you expected. Trace Precedents shows you the cells used by the formula in the current cell. Use Trace Dependents to show the cells containing formulas that use the currently selected cell. If you are trying to determine why a formula is generating an error in the current cell, you use the Trace Error tool. Finally, you can combine the different trace tools to get a broader view of what is happening, or not happening, in your sheet.

	C	D	E
4	15	16	58
5	16	17	62
6	17	18	66
7	18	19	70
8	19	20	74
9	20	21	78
9	105	111	816
	Combining Traces		
			0



In past articles, I have discussed and used functions to illustrate other functionality in Calc, but today, I am going to show you three different ways to enter functions. I'll show you the structure of a function; we will create data for a spreadsheet; then I will apply each of the input methods: Function Wizard, Function List, and manual entry.

STRUCTURE OF A FUNCTION

It helps to understand the structure of functions if you plan to use them. I will use the following function for my discussion of function structure:

=PRODUCT (B5, A1:A6, 0.25)

Functions are always a part of a formula. When you use any formula or function, it must begin with an equals sign (=). If you use multiple functions, the equals sign is required only at the beginning.

The start of a function is the function name. By tradition, function names are entered in all

upper-case letters, but Calc will recognize them in lower or mixed case letters. Keeping with the tradition, I usually enter function names in all capitals. The name of our function in the example is PRODUCT. PRODUCT is to multiplication what SUM is to addition, it multiplies all its arguments into a final total.

After the function name is the argument list, separated by commas, and surrounded by parenthesis. This is the (B5, A1:A6, 0.25) part of our sample function. Arguments can come in several forms, and the function will usually expect a certain type in each position of the arguments. Arguments can take the form of numbers (9), "Quoted text", cell reference (C3), cell range (C3:C10), comparisons (C3 > C1), or another function. Note that quotes around a number, "9", defines the argument as text – and not a number.

SETTING UP THE SHEET

I work with installers of

controlled access systems. When setting up a new system, it is necessary to calculate how many power supplies are needed in order to power the equipment for the site. We use a formula for calculating the voltage drop at each device. The calculation involves the input voltage, the current draw of the device plus the current draw of any devices after it, multiplied by the resistance of the length of wire to the device. The basic formula is

$$V_{out} = V_{in} - I(DR)$$

where V_{in} is the input voltage, I is the current draw of the device and any devices after it, D is the length of wire (in feet), and R is the resistance of the wire per foot. Let's set up a sheet to help us calculate the voltage at each device.

Start with the label "Start Volts" in cell A1. In cells A2:E2 put the following column headings: Device, Amps, Distance, Ohms/Foot, and Voltage. In cell B1 put 13.2 for your starting voltage. In A3:A5 put 1, 2, 3 for the devices. B3:B5 are the current draw for each device. Use 0.3, 0.25, and 0.5. The three distances for the wire are 75, 110, and 120. For the Ohms/Foot, use 0.00639 for all three. This is the approximate Ohms per foot for 16 AWG (US). Leave the Voltage column blank. This is where we will enter our formulas.

FUNCTION WIZARD

The function wizard is the most complete method for entering formulas with functions. It is also the slowest because of the many options. The wizard is a great way

	A	B	C	D	E
1	Start Volts	13.2			
2	Device	Amps	Distance	Ohms/Foot	Voltage
3	1	0.3	75	0.00639	
4	2	0.25	110	0.00639	
5	3	0.5	120	0.00639	

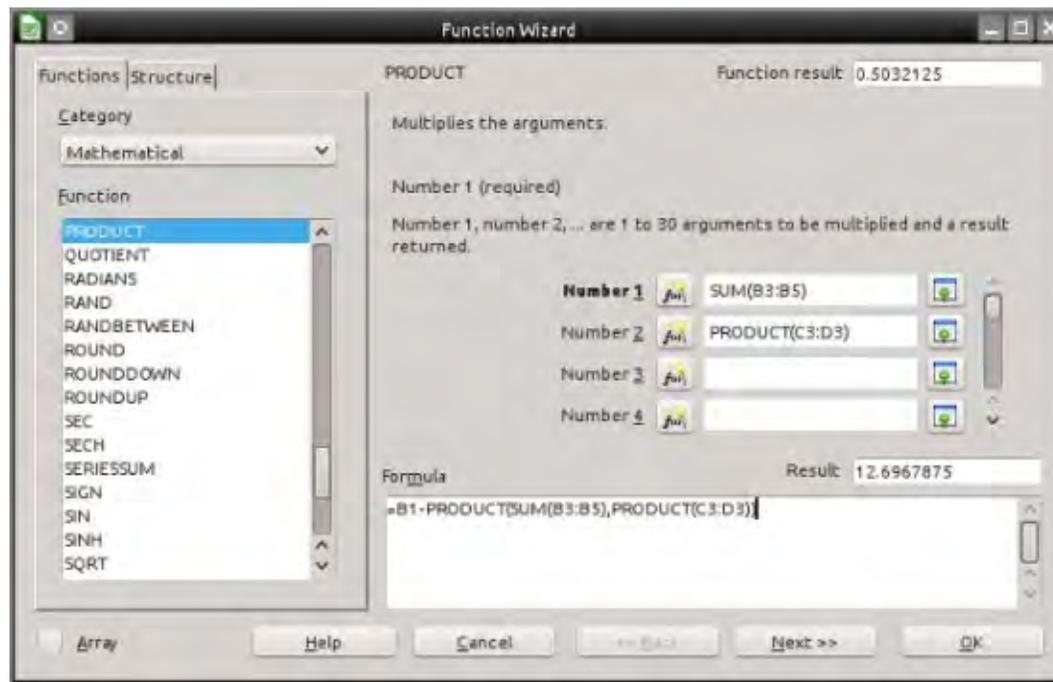
to work through the set up of a complicated formula by allowing you to deal with individual pieces of information one at a time. We will use the wizard to create the voltage formula for the first device.

There are three ways to access the Function Wizard. Select cell E3 and do one of the following:

- Click the Function Wizard button on the formula toolbar.
- Insert > Function...
- CTRL + F2



The Function Wizard displays a function list box to the left. The Category drop-down list allows you to narrow the functions in the list to the selected category. There is also a Last Used category for selecting recently used functions. If you single-click on a function name, it displays a short description of the function to the right. When you double-click on a function, it inserts the function into the formula text box on the bottom right. Notice that the wizard has already inserted the equals sign for you. The right center displays text boxes for entering the arguments for the function. Above the argument



boxes, it displays the short description and a list of the arguments and their type. The top right shows the results of the current formula and the formula result is displayed above the formula edit box.

Our formula starts with the voltage coming into the device. For the first device this is 13.2 from cell B1, so click into the formula text box at the bottom and type "B1-". From the category drop down list select Mathematical. Scroll down the list and double-click PRODUCT. The PRODUCT function is added to the formula.

Click into the Number 1 text box. The first argument is the sum of all the amps for all the devices. Click on the Function Wizard button to the left of the Number 1 text box. This gives you a blank function wizard screen. Note that you now have Back and Next buttons at the bottom. Select Mathematical from the category list, but this time double-click the SUM function. Click into the Number 1 text box. Use your mouse to select cells B3:B5. The range is added to the Number 1 text box for SUM.

Click Back twice to return to the PRODUCT function we started with. Notice that the SUM function is now in the Number 1 text box. Select the Number 2 text box. Double-click on PRODUCT again. In the Number 1 text box for the second PRODUCT function, enter or select the range C3:D3.

We are now finished with our formula. The final formula should look like

```
=B1-PRODUCT(SUM(B3:B5),PRODUCT(C3:D3))
```

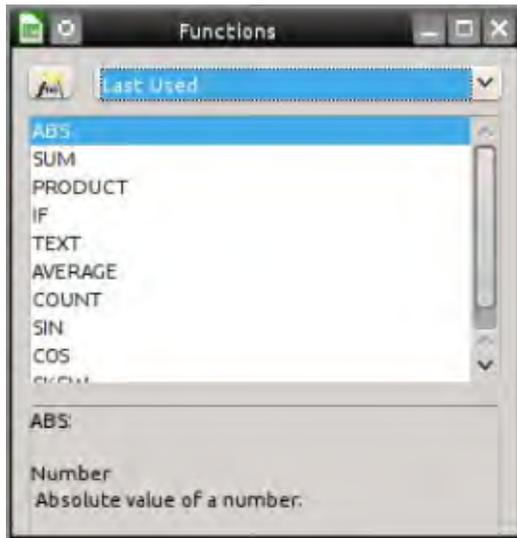
Click OK to finish the wizard.

NOTE: I could have used the multiplication operator (*) to accomplish the same thing in the PRODUCT function, but I used the function in order to illustrate the ability to use functions as arguments to other functions.

FUNCTION LIST

The Function List is the wizard without the bells and whistles. In fact, it is just the function list portion of the wizard. The idea behind it is to help you in adding functions directly into the cells.

You can bring up the Function List by using the menus, Insert > Function List, or by clicking the Functions icon in the sidebar. When you select a function name in the list, a short description appears at the bottom of the list. The Function List also has a category item called Last Used, containing a list of the functions you have used



recently.

Let's use it to create the formula for the second device. Select the cell E4. Select the Input Line text box on the function toolbar. This is the best place to enter functions using the function list. For this device, we need the ending voltage of the previous one, so start the formula with "=E3-". You should see PRODUCT

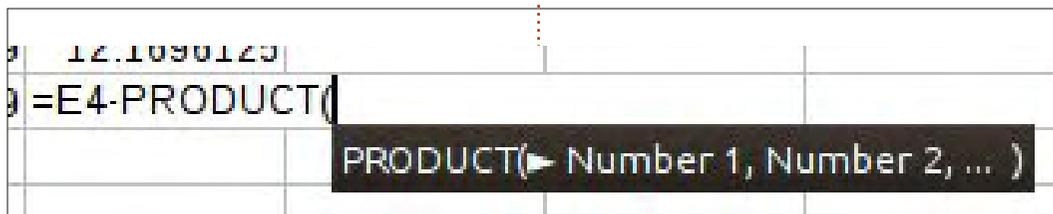
listed on your Last Used list. Double-click PRODUCT to add it to the formula. With the cursor between the parenthesis, double-click SUM, which should also show in the Last Used list. Select cell range B4:B5. Click into the formula and use the arrow keys to move the cursor outside SUM's parenthesis. Type a comma then double-click PRODUCT again. Type in or select the range C4:D4. Press Enter.

The final result should look like

```
=E3-  
PRODUCT (SUM (B4 : B5) , PRODUCT (C4 : D4) )
```

MANUAL ENTRY

Manual entry is just that, typing the formula directly into the cell from memory. The formula for the last device is the easiest because you no longer need the sum of device currents because it is the only one left. Select cell E5 and type in



```
=E4-PRODUCT (B5 ,  
PRODUCT (C5 : D5) )
```

and press Enter. While you are typing in the functions, Calc will show you a hint balloon of the function and its arguments.

Calc gives you three different methods for entering functions into a cell. Use the Function Wizard when you need as much guidance as possible, or when entering a complicated formula for the first time. The Function List gives you a list and short descriptions to aid you in using the correct arguments and functions in your formula. The manual method is great for entering short formulas, using functions you are familiar with, or repeating a formula you have used before.



Elmer Perry's history of working, and programming, computers involves an Apple][E, adding some Amiga, a generous helping of DOS and Windows, a dash of Unix, and blend well with Linux and Ubuntu. He blogs at <http://eeperry.wordpress.com>



HOW-TO

Written by Elmer Perry

LibreOffice Pt.47 - Linking To The Web

Spreadsheets are a great place to collect data. The web is a great resource for data and much of that data is dynamic. You may even want to collect this data into a spreadsheet and make the spreadsheet mirror the dynamic nature of the web data. Calc allows us to link to external data sources, including web pages, and it will surprise you how easy it is.

Many people trade stocks. Trading requires diligently tracking the stocks. In the past, I have shown this done manually, but today, I am going to show you a way to use a Calc spreadsheet to track the top 100 stocks as compiled by the web site barchart.com.

Like so many things, there is more than one way to do this. I'm going to show the method I feel is the easiest for discovering and getting exactly the information

you want. You will import the web page using the Web Page Query filter. Once imported, you can examine the elements of the page to find the data you want to extract. You will then create your sheet of 100 stocks by pulling from your imported source file.

SETTING UP THE SOURCE SHEET

When you import the source using the Web Page Query filter, you are not actually working with a local copy, but a link to the page on the Internet. You will not save this import (but you could). Instead, you are using it as a reference to the actual page on the barchart.com web site.

From the menus, File > Open. In the Open dialog, you will find the file type filter drop-down list at the bottom of the dialog. All the

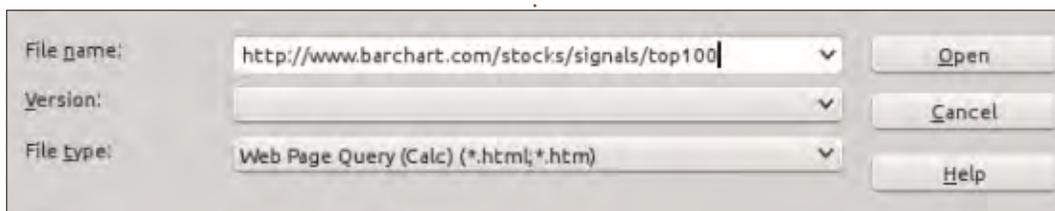
different file types recognized by LibreOffice are listed here. Scroll through and find the filter named "Web Page Query (Calc)". This will help you create your link to the web page. In the "File name" text box, enter (or copy and paste) the following URL:

<http://www.barchart.com/stocks/signals/top100>

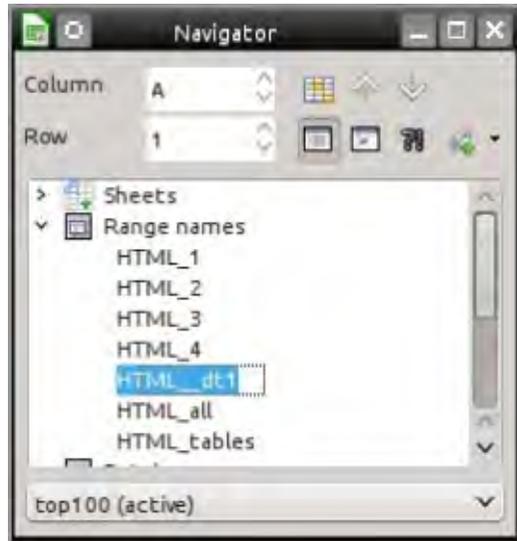
Click the Open button. Calc will take a few seconds then come up with the Import Options dialog. The Automatic option will import the web page "as is." Custom allows you to select another language for importing the page. I recommend using Automatic as it has the greatest chance for proper interpretation. The "Detect special numbers (such as dates)" checkbox

does what you think it does. When checked, it will detect dates, times, etc, and format them appropriately in the sheet. We do not have special numbers we are concerned about, so we don't need it. Click OK to accept the options. Depending on your Internet connection, computer speed and memory, Calc will take a few seconds to import the web page. Notice that it imports the entire web page minus the images.

NOTE: This is a link to the actual web page. Nothing has been saved on your local computer at this point.



THE NAVIGATOR



We will use the Navigator to examine the imported page and link the data to our new document. The Navigator shows you the elements and structure of a document and changes depending on the type of document you have open. Not only is it good for our purposes here, but for navigating and manipulating a document, especially a large document. Currently, there are four ways to open the Navigator:

- Press F5 on your keyboard
- View > Navigator
- Navigator tab on the sidebar
- Navigator button on the standard toolbar

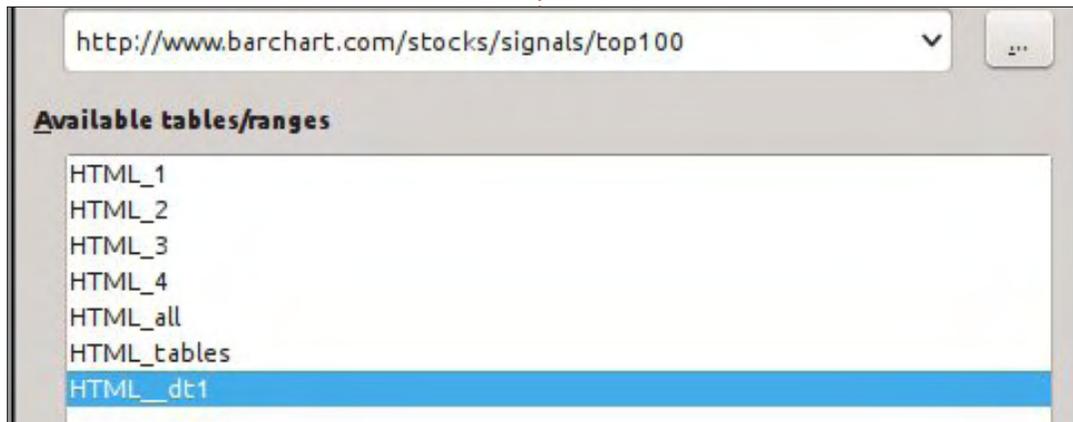
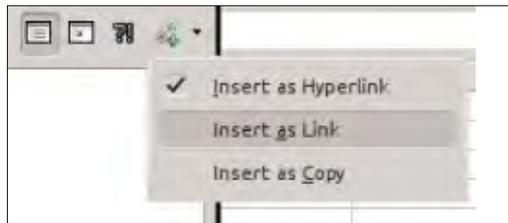
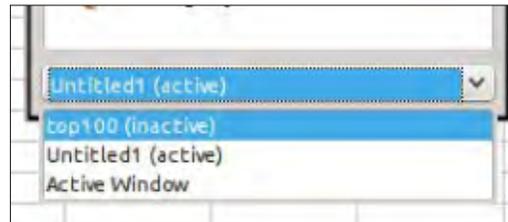
EXAMINE THE SOURCE

When a web page is imported, several range-names are created, as well as importing named tables on the web page. The prefix HTML_ is added to any names imported from the page. The filter creates two special ranges, HTML_all and HTML_tables. HTML_all allows you to select the entire document. HTML_tables allows you to select all the tables. The problem you run up against is the creator of the web page probably wasn't thinking about you importing his page into Calc. Imported table names were for the creator's reference not yours.

If you open the Navigator using one of the methods listed above, in our source document, you will discover a list of names under the "Range-names" item in the Navigator. Double-click on a range-name to highlight it in the document. As you go through the list, you soon discover that the names HTML_4 and HTML_dt1 both contain the table with our stock data. You will use one of these to create your stocks document.

IMPORT TABLE TO NEW SHEET

Now that you know what range-name to import for the stocks data, it's time to create the sheet you want to save and keep. You will import from the source document into a new document. Remember that your source document is just a link to the actual web page, nothing has been saved to your local computer yet.



From the menus, File > New > Spreadsheet. Use any of the four methods discussed above to open the Navigator. From the documents list at the bottom of the Navigator window/panel, select the source document, top100. Click on the drag-mode icon in the Navigator toolbar and change the setting to "Insert as link." Expand the entries under the "Range names." Select either HTML_4 or HTML_dt1, drag it to cell A1 in the new document, and release. After a few seconds, depending on your internet and computer speeds, the stocks data will appear in your new sheet. Save the new document. You can now close the source document. There is no need to save it. Your new document is actually linked to the page on the web site and not the source document.

You can close your new document, and when you open it, you are prompted about whether to update the links in the file. If you answer Yes, Calc will retrieve a fresh version of the page and update the data in your sheet. You can set the file to update periodically when it is opened. In the menus, Edit > Links brings up the Edit Links dialog. With the link selected, click on the Modify button to bring up the External Data dialog. Check the "Update every..." check box, and fill in the number of seconds between every update. For example, every five minutes is 300 seconds, ten minutes is 600 seconds, and an hour is 3,600 seconds. Click OK to save your changes and Close to close the Edit Link dialog.

Importing dynamic data from a web page in Calc is pretty simple. Use the Web Page Query filter to link the page to a sheet. With the Navigator, you can examine the page to determine which range-name contains the data you need. Once you know the range you need to use, you use the Navigator to drag the range-name into a new sheet and save the new document. The new document will prompt you to update every time you open

the document or periodically, should you assign an update period to it.



Elmer Perry's history of working, and programming, computers involves an Apple][E, adding some Amiga, a generous helping of DOS and Windows, a dash of Unix, and blend well with Linux and Ubuntu. He blogs at <http://eeperry.wordpress.com>



Linking to data on the web is often useful, but, sometimes you need to just get data from a sheet in another Calc file. You can just import or link the whole sheet from another file. You do this through the Insert Sheet dialog. Another choice, with a little more power, is to create named ranges of the data you need to link to your new sheet. You can do this through the Navigator as we did with the web data, but there is another method for inserting through the External Data dialog.

DIFFERENCE BETWEEN INSERT AND LINK

Since our main topic concerns linking data from other sheets, you need to know the difference between inserting a sheet and linking a sheet. When a sheet is inserted, you can change the cells in both sheets and changes in one will not affect the other. However, when you create a link in sheet 2 to sheet 1, changes to cells in sheet 1 will override changes in sheet 2 when sheet 2 is updated. Changes

in sheet 2 have no effect on sheet 1.

LINK/ INSERT WHOLE SHEET

Sometimes, you just need the entire sheet from a spreadsheet file in your new spreadsheet file. If you want to make changes to the sheet, and have those changes stay, you will need to import the

sheet. However, if you need any changes to the original sheet to apply to the new sheet also, you need to create a link. From the menus, Insert > Sheet will bring up the Insert Sheet dialog.

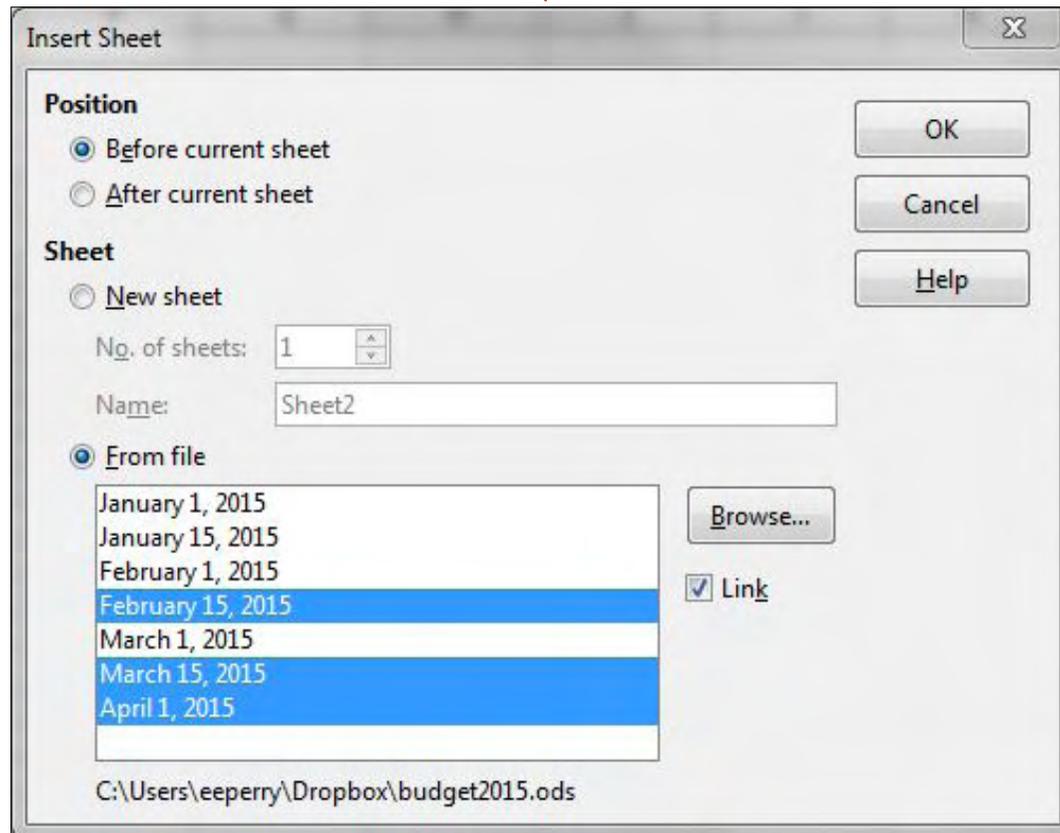
You have two choices for the position of the new sheet within the spreadsheet file. You can place it before or after the currently

selected sheet. The Position options allows you to select where you want the imported / linked / new sheet(s) located.

You have the choice of creating new blank sheet(s) or select an existing sheet from another file. The settings under "New Sheet" allows you to create one or more new blank sheets. The settings under "From sheet" let you import, and optionally link, a sheet from another file.

For the "New sheet" options, you can specify a number of sheets to add and a name for the sheet (if you're adding one sheet). If you are creating more than one sheet, the option for the name is grayed out. The sheets are created with the default sheet prefix and a numeric iteration. You can set the default sheet prefix in Tools > Options > LibreOffice Calc > Defaults.

For the "From file" options, you use the Browse button to locate the file containing the sheet(s) you want to import into your new spreadsheet file. Once you open



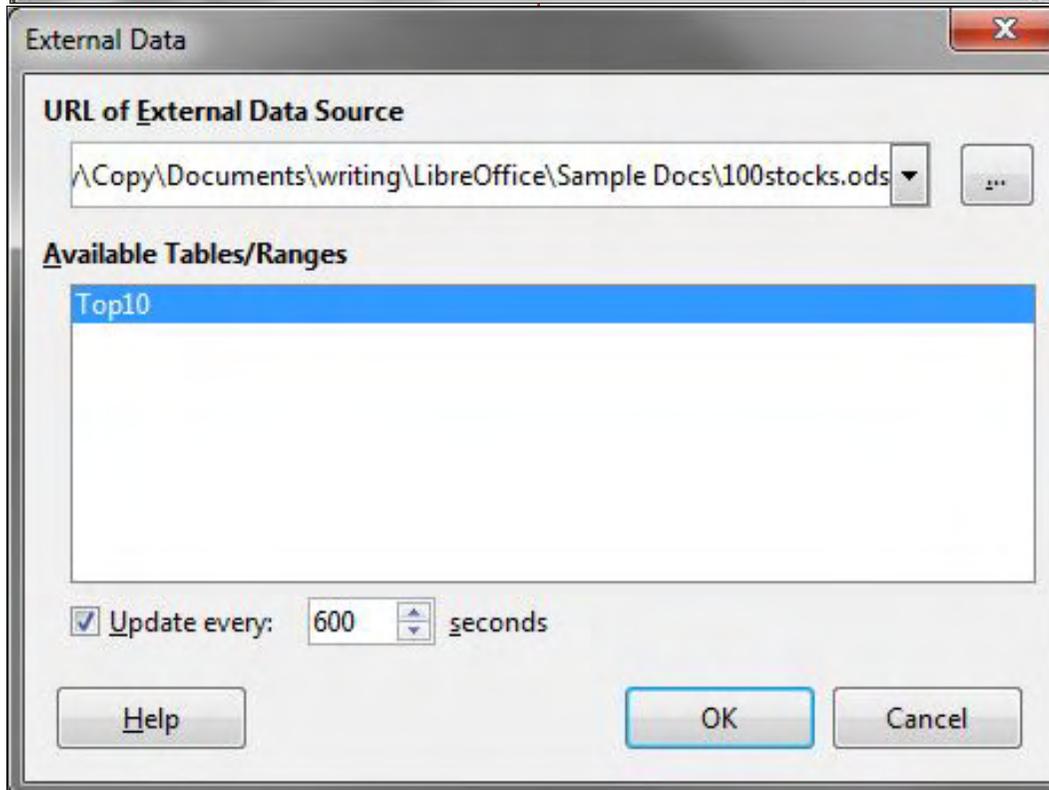
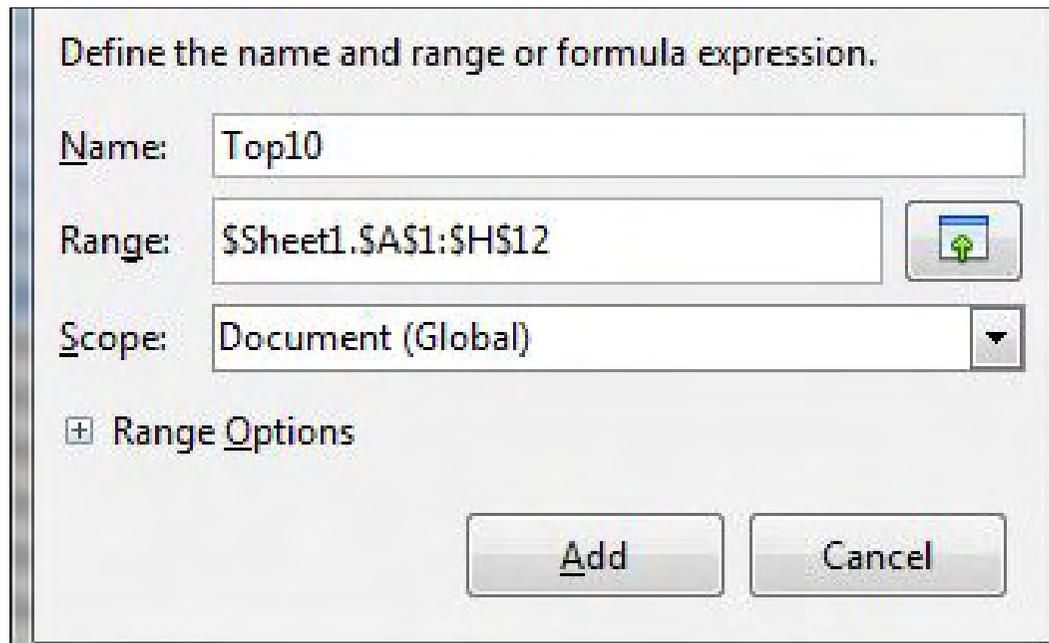
the file containing the sheets you want to use, a list of sheets will appear in the list box. Select the sheet(s) you want in your new file. To select sequential sheets, click on the first one, then hold SHIFT while clicking on the last one. To select non-sequential sheets, click on the first one, then hold CTRL while clicking on the others. Once you have your sheets selected, you can check the Link check box to link to the sheet(s) rather than just import a copy of them. Remember, when linked, the data will update from the original sheet.

Click the OK button to import / create the sheets using the options you have selected.

LINK PART OF A SHEET

When I showed you how to link to data on the web, I used the Navigator to link the data. Today, I am going to show you another method for linking data, but this time we will link data from another file rather than from the web.

When linking to just a section of a sheet, you need a way to define the section of the sheet you want to link. This is done by creating a



named range. We discussed named ranges back in part 42 (Full Circle Magazine, issue 90). We will create a named range in order to link to that portion of the sheet.

For example, let's say you want to link to just the top ten stocks from the top 100 stocks we pulled from the web last time. Open up the 100 stocks file linked to the data on the web. Select the range A1:H12. Insert > Name > Define. The Define Name dialog will show. Give the range a name like "Top10". Remember that the name cannot contain spaces. The range should fill in with the range you selected. Leave the scope as "Document (Global)." Click the Add button, and save the file.

Create a new spreadsheet file, File > New > Spreadsheet. We will use the External Data dialog instead of the Navigator this time. Insert > Link to External Data opens the dialog. The drop-down list shows a list of recent documents. Select the top 100 stocks file. If the document you need does not appear in the drop-down list, you can click on the ellipse (...) button to browse to and select the file. Once you select your file, the named ranges appear

in the list box. Select the named range Top10 from the stocks file to link to the top 10 stocks. You can set how often the file should update when open by setting the "Update every" field. Keep in mind the number is in seconds.

Click OK and you now have a link to the top 10 stocks. The data will update from the original sheet every time you open the file or at the specified update interval.

You can link to a web page using the External Data dialog as well. Just type in or paste the URL into the drop down box and press enter. You will get the import data dialog discussed in the last article. You will get a list of link names. Unlike the Navigator method, there is no way to preview which element is the one you need. It becomes a matter of trial and error (mostly error). This is why I recommended the Navigator method as the best for linking to web data.

You can also use the Navigator to link to named ranges in other documents. Just drag the ranged range into your new document.

Not only can we link to data on

the web, but we can also link to data in other Calc files. We can import or link entire sheets using the Insert Sheet dialog. If we need just a portion of a sheet, we can create a named range in the original sheet. In a new sheet, we can link to the named range in the original sheet through the External Data dialog. Always keep in mind the difference between linking and importing. Imported data is not affected by changes in the original, but linked data is affected by changes in the original.



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FCM#100 SURVEY

The question is:

What are your most loved/hated flavors and releases?

Take the quick survey and we'll publish the results in FCM#100.

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