Notes on Units in Grid

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This document describes the reasons behind the implementation of units in Grid (at the R level).

Initially, units were specified as an additional argument. For example, `grid.lines(x=c(1, 1), y=c(2, 2), units="inches")`. This has the disadvantage of units not being strongly linked syntactically or visually with their corresponding values. Also, if we ever intend to implement "unit arithmetic", it would be a nightmare trying to specify units on operands in an arithmetic expression.

Two other options were considered:

1. something like `grid.lines(x=inch(1, 1), y=inch(2, 2))`. This is good for unit arithmetic (e.g., `cm(1) + inch(2) + 3`), but has name-space problems because the units names are too likely to be used by others (in fact `cm()` has already been taken.

2. something like `grid.lines(x=unit(c(1, 1), "inch"), y=unit(c(2, 2), "inch"))`. This is ok for unit arithmetic (e.g., unit(1, "cm") + unit(2, "inch") + 3) and avoids name-space problems.

In both of these two approaches, the idea would be for the function to produce an object object of class "unit". This would allow us to write a `Math.unit` function for doing simple arithmetic.

The other thing we thought about was being able to define a vector of units at once. In the first option above, it would have been nice to allow something like `c(1, cm(2))` (i.e., allow the user to specify implicit units; defaults to "npc" for example). We could write a `c.unit` method which would work for `c(cm(1), 2)`, but it wouldn't work for `c(1, cm(2))` because the method dispatch occurs only on the first argument so the result would be just a numeric vector (with no class or attributes). NOTE that this is not a problem for `Math.unit` because method dispatch in that case checks all (both) arguments. This means that we have to go with the second option and do something like `unit(c(1, 2), c("npc", "inch"))` (i.e., NOT allow implicit units). It should, however, be possible to specify a whole vector of values with implicit units (e.g., `llines(c(1, 2))`) and have the function take the numeric vector and create a unit object with default units.