NEWS for R version 3.2.4 Revised (2016-03-16 r70336)

CHANGES IN R 3.2.4 patched

BUG FIXES:

- `format.POSIXlt()` behaved wrongly, e.g., `format(as.POSIXlt(paste0(1940:2000,"-01-01"), tz="CET"),usetz=TRUE)` ended in two `"CEST"` time formats.

CHANGES IN R 3.2.4

NEW FEATURES:

- `install.packages()` and related functions now give a more informative warning when an attempt is made to install a base package.
- `summary(x)` now prints with less rounding when `x` contains infinite values. (Request of PR#16620.)
- `provideDimnames()` gets an optional `unique` argument.
- `shQuote()` gains `type = "cmd2"` for quoting in `cmd.exe` in Windows. (Response to PR#16636.)
- The `data.frame` method of `rbind()` gains an optional argument `stringsAsFactors` (instead of only depending on `getOption("stringsAsFactors")`).
- `smooth(x, *)` now also works for long vectors.
- `tools::texi2dvi()` has a workaround for problems with the `texi2dvi` script supplied by **texinfo 6.1**.
  It extracts more error messages from the LaTeX logs when in emulation mode.

UTILITIES:

- `R CMD check` will leave a log file '`build_vignettes.log`' from the re-building of vignettes in the '`.Rcheck`' directory if there is a problem, and always if environment variable `_R_CHECK_ALWAYS_LOG_VIGNETTE_OUTPUT_` is set to a true value.

DEPRECATED AND DEFUNCT:

- Use of '`SUPPORT_OPENMP`' from header '`Rconfig.h`' is deprecated in favour of the standard OpenMP define '`_OPENMP`'.
  (This has been the recommendation in the manual for a while now.)
- The `make` macro `AWK` which is long unused by R itself but recorded in file '`etc/Makeconf`' is deprecated and will be removed in R 3.3.0.
- The C header file '`S.h`' is no longer documented: its use should be replaced by '`R.h`'.

BUG FIXES:

- `kmeans(x, centers = <1-row>)` now works. (PR#16623)
- `Vectorize()` now checks for clashes in argument names. (PR#16577)
- `file.copy(overwrite = FALSE)` would signal a successful copy when none had taken place. (PR#16576)
- `ngettext()` now uses the same default domain as `gettext()`. (PR#14605)
- `array(.., dimnames = *)` now warns about non-`list` dimnames and, from R 3.3.0, will signal the same error for invalid dimnames as `matrix()` has always done.
- `addmargins()` now adds dimnames for the extended margins in all cases, as always documented.
- `heatmap()` evaluated its `add.expr` argument in the wrong environment. (PR#16583)
- `require()` etc now give the correct entry of `lib.loc` in the warning about an old version of a package masking a newer required one.
- The internal deparser did not add parentheses when necessary, e.g. before `[]` or `[[]]`. (Reported by Lukas Stadler; additional fixes included as well).
- `as.data.frame.vector(*, row.names=*)` no longer produces 'corrupted' data frames from row names of incorrect length, but rather warns about them. This will become an error.
- `url` connections with `method = "libcurl"` are destroyed properly. (PR#16681)
- `withCallingHandler()` now (again) handles warnings even during S4 generic's argument evaluation. (PR#16111)
- `deparse(..., control = "quoteExpressions")` incorrectly quoted empty expressions. (PR#16686)
- `format()`ting datetime objects (`"POSIX[cl]?t"`) could segfault or recycle wrongly. (PR#16685)
- `plot.ts(<matrix>, las = 1)` now does use `las`.
- `saveRDS(*, compress = "gzip")` now works as documented. (PR#16653)
- (Windows only) The `Rgui` front end did not always initialize the console properly, and could cause R to crash. (PR#16998)
- `dummy.coef.lm()` now works in more cases, thanks to a proposal by Werner Stahel (PR#16665). In addition, it now works for multivariate linear models (`"mlm"`, `manova`) thanks to a proposal by Daniel Wollschlaeger.
- The `as.hclust()` method for `"dendrogram"`s failed often when there were ties in the heights.
- `reorder()` and `midcache.dendrogram()` now are non-recursive and hence applicable to somewhat deeply nested dendrograms, thanks to a proposal by Suharto Anggono in PR#16424.
- `cor.test()` now calculates very small p values more accurately (affecting the result only in extreme not statistically relevant cases). (PR#16704)
- `smooth(*, do.ends=TRUE)` did not always work correctly in R versions between 3.0.0 and 3.2.3.

- `pretty(D)` for date-time objects `D` now also works well if `range(D)` is (much) smaller than a second. In the case of only one unique value in `D`, the pretty range now is more symmetric around that value than previously.
  Similarly, `pretty(dt)` no longer returns a length 5 vector with duplicated entries for `Date` objects `dt` which span only a few days.
- The figures in help pages such as `?points` were accidentally damaged, and did not appear in R 3.2.3. (PR#16708)
- `available.packages()` sometimes deleted the wrong file when cleaning up temporary files. (PR#16712)
- The `X11()` device sometimes froze on Red Hat Enterprise Linux 6. It now waits for `MapNotify` events instead of `Expose` events, thanks to Siteshwar Vashisht. (PR#16497)
- `[dpqr]nbinom(*, size=Inf, mu=.)` now works as limit case, for 'dpq' as the Poisson. (PR#16727)
  `pnbinom()` no longer loops infinitely in border cases.
- `approxfun(*, method="constant")` and hence `ecdf()` which calls the former now correctly "predict" `NaN` values as `NaN`.
- `summary.data.frame()` now displays `NA`s in `Date` columns in all cases. (PR#16709)

CHANGES IN R 3.2.3

NEW FEATURES:

- Some recently-added Windows time zone names have been added to the conversion table used to convert these to Olson names. (Including those relating to changes for Russia in Oct 2014, as in PR#16503.)
- (Windows) Compatibility information has been added to the manifests for '`Rgui.exe`', '`Rterm.exe`' and '`Rscript.exe`'. This should allow `win.version()` and `Sys.info()` to report the actual Windows version up to Windows 10.
- Windows `"wininet"` FTP first tries EPSV / PASV mode rather than only using active mode (reported by Dan Tenenbaum).
- `which.min(x)` and `which.max(x)` may be much faster for logical and integer `x` and now also work for long vectors.
- The 'emulation' part of `tools::texi2dvi()` has been somewhat enhanced, including supporting `quiet = TRUE`. It can be selected by `texi2dvi = "emulation"`.
  (Windows) MiKTeX removed its `texi2dvi.exe` command in Sept 2015: `tools::texi2dvi()` tries `texify.exe` if it is not found.
- (Windows only) Shortcuts for printing and saving have been added to menus in `Rgui.exe`. (Request of PR#16572.)
- `loess(..., iterTrace=TRUE)` now provides diagnostics for robustness iterations, and the `print()` method for `summary(<loess>)` shows slightly more.
- The included version of PCRE has been updated to 8.38, a bug-fix release.
- `View()` now displays nested data frames in a more friendly way. (Request with patch in PR#15915.)

INSTALLATION and INCLUDED SOFTWARE:

- The included configuration code for `libintl` has been updated to that from `gettext` version 0.19.5.1 — this should only affect how an external library is detected (and the only known instance is under OpenBSD). (Wish of PR#16464.)
- `configure` has a new argument '`--disable-java`' to disable the checks for Java.

- The `configure` default for `MAIN_LDFLAGS` has been changed for the FreeBSD, NetBSD and Hurd OSes to one more likely to work with compilers other than `gcc` (FreeBSD 10 defaults to `clang`).
- `configure` now supports the OpenMP flags '`-fopenmp=libomp`' (clang) and '`-qopenmp`' (Intel C).
- Various macros can be set to override the default behaviour of `configure` when detecting OpenMP: see file '`config.site`'.
- Source installation on Windows has been modified to allow for MiKTeX installations without `texi2dvi.exe`. See file '`MkRules.dist`'.

BUG FIXES:

- `regexpr(pat, x, perl = TRUE)` with Python-style named capture did not work correctly when `x` contained `NA` strings. (PR#16484)
- The description of dataset `ToothGrowth` has been improved/corrected. (PR#15953)
- `model.tables(type = "means")` and hence `TukeyHSD()` now support `"aov"` fits without an intercept term. (PR#16437)
- `close()` now reports the status of a `pipe()` connection opened with an explicit `open` argument. (PR#16481)
- Coercing a list without names to a data frame is faster if the elements are very long. (PR#16467)
- (Unix-only) Under some rare circumstances piping the output from `Rscript` or `R -f` could result in attempting to close the input file twice, possibly crashing the process. (PR#16500)
- (Windows) `Sys.info()` was out of step with `win.version()` and did not report Windows 8.
- `topenv(baseenv())` returns `baseenv()` again as in R 3.1.0 and earlier. This also fixes `compilerJIT(3)` when used in '`.Rprofile`'.
- `detach()`ing the **methods** package keeps `.isMethodsDispatchOn()` true, as long as the methods namespace is not unloaded.
- Removed some spurious warnings from `configure` about the preprocessor not finding header files. (PR#15989)
- `rchisq(*, df=0, ncp=0)` now returns `0` instead of `NaN`, and `dchisq(*, df=0, ncp=*)` also no longer returns `NaN` in limit cases (where the limit is unique). (PR#16521)
- `pchisq(*, df=0, ncp > 0, log.p=TRUE)` no longer underflows (for ncp $>$ ~60).
- `nchar(x, "w")` returned -1 for characters it did not know about (e.g. zero-width spaces): it now assumes 1. It now knows about most zero-width characters and a few more double-width characters.
- Help for `which.min()` is now more precise about behavior with logical arguments. (PR#16532)
- The print width of character strings marked as `"latin1"` or `"bytes"` was in some cases computed incorrectly.
- `abbreviate()` did not give names to the return value if `minlength` was zero, unlike when it was positive.
- (Windows only) `dir.create()` did not always warn when it failed to create a directory. (PR#16537)
- When operating in a non-UTF-8 multibyte locale (e.g. an East Asian locale on Windows), `grep()` and related functions did not handle UTF-8 strings properly. (PR#16264)

- `read.dcf()` sometimes misread lines longer than 8191 characters. (Reported by Hervé Pagès with a patch.)
- `within(df, ..)` no longer drops columns whose name start with a `"."`.
- The built-in `HTTP` server converted entire `Content-Type` to lowercase including parameters which can cause issues for multi-part form boundaries (PR#16541).
- Modifying slots of S4 objects could fail when the **methods** package was not attached. (PR#16545)
- `splineDesign(*, outer.ok=TRUE)` (**splines**) is better now (PR#16549), and `interpSpline()` now allows `sparse=TRUE` for speedup with non-small sizes.
- If the expression in the traceback was too long, `traceback()` did not report the source line number. (Patch by Kirill Müller.)
- The browser did not truncate the display of the function when exiting with `options("deparse.max.lines")` set. (PR#16581)
- When `bs(*, Boundary.knots=)` had boundary knots inside the data range, extrapolation was somewhat off. (Patch by Trevor Hastie.)
- `var()` and hence `sd()` warn about `factor` arguments which are deprecated now. (PR#16564)
- `loess(*, weights = *)` stored wrong weights and hence gave slightly wrong predictions for `newdata`. (PR#16587)
- `aperm(a, *)` now preserves `names(dim(a))`.
- `poly(x, ..)` now works when either `raw=TRUE` or `coef` is specified. (PR#16597)
- `data(package=*)` is more careful in determining the path.
- `prettyNum(*, decimal.mark, big.mark)`: fixed bug introduced when fixing PR#16411.

CHANGES IN R 3.2.2

SIGNIFICANT USER-VISIBLE CHANGES:

- It is now easier to use secure downloads from '`https://`' URLs on builds which support them: no longer do non-default options need to be selected to do so. In particular, packages can be installed from repositories which offer '`https://`' URLs, and those listed by `setRepositories()` now do so (for some of their mirrors).
  Support for '`https://`' URLs is available on Windows, and on other platforms if support for `libcurl` was compiled in and if that supports the `https` protocol (system installations can be expected to do). So '`https://`' support can be expected except on rather old OSes (an example being OS X 'Snow Leopard', where a non-system version of `libcurl` can be used).
  (Windows only) The default method for accessing URLs *via* `download.file()` and `url()` has been changed to be `"wininet"` using Windows API calls. This changes the way proxies need to be set and security settings made: there have been some reports of '`ftp:`' sites being inaccessible under the new default method (but the previous methods remain available).

NEW FEATURES:

- `cmdscale()` gets new option `list.` for increased flexibility when a list should be returned.
- `configure` now supports `texinfo` version 6.0, which (unlike the change from 4.x to 5.0) is a minor update. (Wish of PR#16456.)

- (Non-Windows only) `download.file()` with default `method = "auto"` now chooses `"libcurl"` if that is available and a '`https://`' or '`ftps://`' URL is used.
- (Windows only) `setInternet2(TRUE)` is now the default. The command-line option `--internet2` and environment variable `R_WIN_INTERNET2` are now ignored.
  Thus by default the `"internal"` method for `download.file()` and `url()` uses the `"wininet"` method: to revert to the previous default use `setInternet2(FALSE)`.
  This means that '`https://`' URLs can be read by default by `download.file()` (they have been readable by `file()` and `url()` since R 3.2.0).
  There are implications for how proxies need to be set (see `?download.file`).
- `chooseCRANmirror()` and `chooseBioCmirror()` now offer HTTPS mirrors in preference to HTTP mirrors. This changes the interpretation of their `ind` arguments: see their help pages.
- `capture.output()` gets optional arguments `type` and `split` to pass to `sink()`, and hence can be used to capture messages.

C-LEVEL FACILITIES:

- Header '`Rconfig.h`' now defines `HAVE_ALLOCA_H` if the platform has the '`alloca.h`' header (it is needed to define `alloca` on Solaris and AIX, at least: see 'Writing R Extensions' for how to use it).

INSTALLATION and INCLUDED SOFTWARE:

- The `libtool` script generated by `configure` has been modified to support FreeBSD >= 10 (PR#16410).

BUG FIXES:

- The HTML help page links to demo code failed due to a change in R 3.2.0. (PR#16432)
- If the `na.action` argument was used in `model.frame()`, the original data could be modified. (PR#16436)
- `getGraphicsEvent()` could cause a crash if a graphics window was closed while it was in use. (PR#16438)
- `matrix(x, nr, nc, byrow = TRUE)` failed if `x` was an object of type `"expression"`.
- `strptime()` could overflow the allocated storage on the C stack when the timezone had a non-standard format much longer than the standard formats. (Part of PR#16328.)
- `options(OutDec = s)` now signals a warning (which will become an error in the future) when `s` is not a string with exactly one character, as that has been a documented requirement.
- `prettyNum()` gains a new option `input.d.mark` which together with other changes, e.g., the default for `decimal.mark`, fixes some `format()`ting variants with non-default `getOption("OutDec")` such as in PR#16411.
- `download.packages()` failed for `type` equal to either `"both"` or `"binary"`. (Reported by Dan Tenenbaum.)
- The `dendrogram` method of `labels()` is much more efficient for large dendrograms, now using `rapply()`. (Comment #15 of PR#15215)
- The `"port"` algorithm of `nls()` could give spurious errors. (Reported by Radford Neal.)
- Reference classes that inherited from reference classes in another package could invalidate methods of the inherited class. Fixing this requires adding the ability for methods to be "external", with the object supplied explicitly as the first argument, named `.self`. See "Inter-Package Superclasses" in the documentation.

- `readBin()` could fail on the SPARC architecture due to alignment issues. (Reported by Radford Neal.)
- `qt(*, df=Inf, ncp=.)` now uses the natural `qnorm()` limit instead of returning `NaN`. (PR#16475)
- Auto-printing of S3 and S4 values now searches for `print()` in the base namespace and `show()` in the **methods** namespace instead of searching the global environment.
- `polym()` gains a `coefs = NULL` argument and returns class `"poly"` just like `poly()` which gets a new `simple=FALSE` option. They now lead to correct `predict()`ions, e.g., on subsets of the original data.
- `rhyper(nn, <large>)` now works correctly. (PR#16489)
- `ttkimage()` did not (and could not) work so was removed. Ditto for `tkimage.cget()` and `tkimage.configure()`. Added two Ttk widgets and missing subcommands for Tk's `image` command: `ttkscale()`, `ttkspinbox()`, `tkimage.delete()`, `tkimage.height()`, `tkimage.inuse()`, `tkimage.type()`, `tkimage.types()`, `tkimage.width()`. (PR#15372, PR#16450)
- `getClass("foo")` now also returns a class definition when it is found in the cache more than once.

CHANGES IN R 3.2.1

NEW FEATURES:

- `utf8ToInt()` now checks that its input is valid UTF-8 and returns `NA` if it is not.
- `install.packages()` now allows `type = "both"` with `repos = NULL` if it can infer the type of file.
- `nchar(x, *)` and `nzchar(x)` gain a new argument `keepNA` which governs how the result for `NA`s in `x` is determined. For `nzchar()` in general and `nchar()` in the R 3.2.x series, the default remains `FALSE` which is fully back compatible. From R 3.3.0, `nchar()`'s default will change to `keepNA = NA` and you are advised to consider this for code portability.
- `news()` more flexibly extracts dates from package '`NEWS.Rd`' files.
- `lengths(x)` now also works (trivially) for atomic `x` and hence can be used more generally as an efficient replacement of `sapply(x, length)` and similar.
- The included version of PCRE has been updated to 8.37, a bug-fix release.
- `diag()` no longer duplicates a matrix when extracting its diagonal.
- `as.character.srcref()` gains an argument to allow characters corresponding to a range of source references to be extracted.

BUG FIXES:

- `acf()` and `ccf()` now guarantee values strictly in $[-1, 1]$ (instead of sometimes very slightly outside). PR#15832.
- `as.integer("11111111111")` now gives NA (with a warning) as it does for the corresponding numeric or negative number coercions. Further, `as.integer(M + 0.1)` now gives `M` (instead of NA) when M is the maximal representable integer.
- On some platforms `nchar(x, "c")` and `nchar(x, "w")` would return values (possibly `NA`) for inputs which were declared to be UTF-8 but were not, or for invalid strings without a marked encoding in a multi-byte locale, rather than give an error. Additional checks have been added to mitigate this.
- `apply(a, M, function(u) c(X = ., Y = .))` again has dimnames containing "X" and "Y" (as in R $<$ 3.2.0).

- (Windows only) In some cases, the `--clean` option to `R CMD INSTALL` could fail. (PR#16178)
- (Windows only) `choose.files()` would occasionally include characters from the result of an earlier call in the result of a later one. (PR#16270)
- A change in `RSiteSearch()` in R 3.2.0 caused it to submit invalid URLs. (PR#16329)
- `Rscript` and command line `R` silently ignored incomplete statements at the end of a script; now they are reported as parse errors. (PR#16350)
- Parse data for very long strings was not stored. (PR#16354)
- `plotNode()`, the workhorse of the `plot` method for `"dendrogram"`s is no longer recursive, thanks to Suharto Anggono, and hence also works for deeply nested dendrograms. (PR#15215)
- The parser could overflow internally when given numbers in scientific format with extremely large exponents. (PR#16358)
- If the CRAN mirror was not set, `install.packages(type = "both")` and related functions could repeatedly query the user for it. (Part of PR#16362)
- The low-level functions `.rowSums()` etc. did not check the length of their argument, so could segfault. (PR#16367)
- The `quietly` argument of `library()` is now correctly propagated from `.getRequiredPackages2()`.
- Under some circumstances using the internal PCRE when building R from source would cause external libs such as `-llzma` to be omitted from the main link.
- The .Primitive default methods of the logic operators, i.e., `!`, `&` and `|`, now give correct error messages when appropriate, e.g., for `` `&`(TRUE) `` or `` `!`() ``. (PR#16385)
- `cummax(x)` now correctly propagates `NA`s also when `x` is of type `integer` and begins with an `NA`.
- `summaryRprof()` could fail when the profile contained only two records. (PR#16395)
- HTML vignettes opened using `vignette()` did not support links into the rest of the HTML help system. (Links worked properly when the vignette was opened using `browseVignettes()` or from within the help system.)
- `arima(*, xreg = .)` (for $d \geq 1$) computes estimated variances based on a the number of effective observations as in R version 3.0.1 and earlier. (PR#16278)
- `slotNames(.)` is now correct for `"signature"` objects (mostly used internally in **methods**).
- On some systems, the first string comparison after a locale change would result in `NA`.

CHANGES IN R 3.2.0

NEW FEATURES:

- `anyNA()` gains a `recursive` argument.
- When `x` is missing and `names` is not false (including the default value), `Sys.getenv(x, names)` returns an object of class `"Dlist"` and hence prints tidily.
- (Windows.) `shell()` no longer consults the environment variable `SHELL`: too many systems have been encountered where it was set incorrectly (usually to a path where software was compiled, not where it was installed). `R_SHELL`, the preferred way to select a non-default shell, can be used instead.
- Some unusual arguments to `embedFonts()` can now be specified as character vectors, and the defaults have been changed accordingly.
- Functions in the `Summary` group duplicate less. (PR#15798)

- (Unix-alikes.) `system(cmd, input = )` now uses 'shell-execution-environment' redirection, which will be more natural if `cmd` is not a single command (but requires a POSIX-compliant shell). (Wish of PR#15508)
- `read.fwf()` and `read.DIF()` gain a `fileEncoding` argument, for convenience.
- Graphics devices can add attributes to their description in `.Device` and `.Devices`. Several of those included with R use a `"filepath"` attribute.
- `pmatch()` uses hashing in more cases and so is faster at the expense of using more memory. (PR#15697)
- `pairs()` gains new arguments to select sets of variables to be plotted against each other.
- `file.info(, extra_cols = FALSE)` allows a minimal set of columns to be computed on Unix-alikes: on some systems without properly-configured caching this can be significantly faster with large file lists.
- New function `dir.exists()` in package **base** to test efficiently whether one or more paths exist and are directories.
- `dput()` and friends gain new controls '`hexNumeric`' and '`digits17`' which output double and complex quantities as, respectively, binary fractions (exactly, see `sprintf("%a")`) and as decimals with up to 17 significant digits.
- `save()`, `saveRDS()` and `serialize()` now support `ascii = NA` which writes ASCII files using `sprintf("%a")` for double/complex quantities. This is read-compatible with `ascii = TRUE` but avoids binary->decimal->binary conversions with potential loss of precision. Unfortunately the Windows C runtime's lack of C99 compliance means that the format cannot be read correctly there in R before 3.1.2.
- The default for `formatC(decimal.mark =)` has been changed to be `getOption("OutDec")`; this makes it more consistent with `format()` and suitable for use in print methods, e.g. those for classes `"density"`, `"ecdf"`, `"stepfun"` and `"summary.lm"`.
  `getOption("OutDec")` is now consulted by the print method for class `"kmeans"`, by `cut()`, `dendrogram()`, `plot.ts()` and `quantile()` when constructing labels and for the report from `legend(trace = TRUE)`.
  (In part, wish of PR#15819.)
- `printNum()` and hence `format()` and `formatC()` give a warning if `big.mark` and `decimal.mark` are set to the same value (period and comma are not uncommonly used for each, and this is a check that conventions have not got mixed).
- `merge()` can create a result which uses long vectors on 64-bit platforms.
- `dget()` gains a new argument `keep.source` which defaults to `FALSE` for speed (`dput()` and `dget()` are most often used for data objects where this can make `dget()` many times faster).
- Packages may now use a file of common macro definitions in their help files, and may import definitions from other packages.
- A number of macros have been added in the new '`share/Rd`' directory for use in package overview help pages, and `promptPackage()` now makes use of them.
- `tools::parse_Rd()` gains a new `permissive` argument which converts unrecognized macros into text. This is used by `utils:::format.bibentry` to allow LaTeX markup to be ignored.
- `options(OutDec =)` can now specify a multi-byte character, e.g., `options(OutDec = "\u00b7")` in a UTF-8 locale.
- `is.recursive(x)` is no longer true when `x` is an external pointer, a weak reference or byte code; the first enables `all.equal(x, x)` when `x <- getClass(.)`.
- `ls()` (aka `objects()`) and `as.list.environment()` gain a new argument `sorted`.

- The `"source"` attribute (which has not been added to functions by R since before R version 2.14.0) is no longer treated as special.
- Function `returnValue()` has been added to give `on.exit()` code access to a function's return value for debugging purposes.
- `crossprod(x, y)` allows more matrix coercions when `x` or `y` are vectors, now equalling `t(x) %*% y` in these cases (also reported by Radford Neal). Similarly, `tcrossprod(x,y)` and `%*%` work in more cases with vector arguments.
- Utility function `dynGet()` useful for detecting cycles, aka infinite recursions.
- The byte-code compiler and interpreter include new instructions that allow many scalar subsetting and assignment and scalar arithmetic operations to be handled more efficiently. This can result in significant performance improvements in scalar numerical code.
- `apply(m, 2, identity)` is now the same as the matrix `m` when it has *named* row names.
- A new function `debuggingState()` has been added, allowing to temporarily turn off debugging.
- `example()` gets a new optional argument `run.donttest` and `tools::Rd2ex()` a corresponding `commentDonttest`, with a default such that `example(..)` in help examples will run `\donttest` code only if used interactively (a change in behaviour).
- `rbind.data.frame()` gains an optional argument `make.row.names`, for potential speedup.
- New function `extSoftVersion()` to report on the versions of third-party software in use in this session. Currently reports versions of `zlib`, `bzlib`, the `liblzma` from `xz`, PCRE, ICU, TRE and the `iconv` implementation.
  A similar function `grSoftVersion()` in package **grDevices** reports on third-party graphics software.
  Function `tcltk::tclVersion()` reports the Tcl/Tk version.
- Calling `callGeneric()` without arguments now works with primitive generics to some extent.
- `vapply(x, FUN, FUN.VALUE)` is more efficient notably for large `length(FUN.VALUE)`; as extension of PR#16061.
- `as.table()` now allows tables with one or more dimensions of length 0 (such as `as.table(integer())`).
- `names(x) <- NULL` now clears the names of call and `...` objects.
- `library()` will report a warning when an insufficient dependency version is masking a sufficient one later on the library search path.
- A new `plot()` method for class `"raster"` has been added.
- New `check_packages_in_dir_changes()` function in package **tools** for conveniently analyzing how changing sources impacts the check results of their reverse dependencies.
- Speed-up from Peter Haverty for `ls()` and `methods:::.requirePackage()` speeding up package loading. (PR#16133)
- New `get0()` function, combining `exists()` and `get()` in one call, for efficiency.
- `match.call()` gains an `envir` argument for specifying the environment from which to retrieve the `...` in the call, if any; this environment was wrong (or at least undesirable) when the `definition` argument was a function.
- `topenv()` has been made `.Internal()` for speedup, based on Peter Haverty's proposal in PR#16140.
- `getOption()` no longer calls `options()` in the main case.

- Optional use of `libcurl` (version 7.28.0 from Oct 2012 or later) for Internet access:
  - `capabilities("libcurl")` reports if this is available.
  - `libcurlVersion()` reports the version in use, and other details of the `"libcurl"` build including which URL schemes it supports.
  - `curlGetHeaders()` retrieves the headers for '`http://`', '`https://`', '`ftp://`' and '`ftps://`' URLs: analysis of these headers can provide insights into the 'existence' of a URL (it might for example be permanently redirected) and is so used in `R CMD check --as-cran`.
  - `download.file()` has a new optional method `"libcurl"` which will handle more URL schemes, follow redirections, and allows simultaneous downloads of multiple URLs.
  - `url()` has a new method `"libcurl"` which handles more URL schemes and follows redirections. The default method is controlled by a new option `url.method`, which applies also to the opening of URLs *via* `file()` (which happens implicitly in functions such as `read.table`.)
  - When `file()` or `url()` is invoked with a `https://` or `ftps://` URL which the current method cannot handle, it switches to a suitable method if one is available.
- (Windows.) The DLLs '`internet.dll`' and '`internet2.dll`' have been merged. In this version it is safe to switch (repeatedly) between the internal and Windows internet functions within an R session.
  The Windows internet functions are still selected by flag '`--internet2`' or `setInternet2()`. This can be overridden for an `url()` connection *via* its new `method` argument. `download.file()` has new method `"wininet"`, selected as the default by '`--internet2`' or `setInternet2()`.
- `parent.env<-` can no longer modify the parent of a locked namespace or namespace imports environment. Contributed by Karl Millar.
- New function `isNamespaceLoaded()` for readability and speed.
- `names(env)` now returns all the object names of an `environment env`, equivalently to `ls(env, all.names = TRUE, sorted = FALSE)` and also to the names of the corresponding list, `names(as.list(env, all.names = TRUE))`. Note that although `names()` returns a character vector, the names have no particular ordering.
- The memory manager now grows the heap more aggressively. This reduces the number of garbage collections, in particular while data or code are loaded, at the expense of slightly increasing the memory footprint.
- New function `trimws()` for removing leading/trailing whitespace.
- `cbind()` and `rbind()` now consider S4 inheritance during S3 dispatch and also obey `deparse.level`.
- `cbind()` and `rbind()` will delegate recursively to `methods::cbind2` (`methods::rbind2`) when at least one argument is an S4 object and S3 dispatch fails (due to ambiguity).
- (Windows.) `download.file(quiet = FALSE)` now uses text rather than Windows progress bars in non-interactive use.
- New function `hsearch_db()` in package **utils** for building and retrieving the help search database used by `help.search()`, along with functions for inspecting the concepts and keywords in the help search database.
- New function `.getNamespaceInfo()`, a no-check version of `getNamespaceInfo()` mostly for internal speedups.
- The help search system now takes '`\keyword`' entries in Rd files which are not standard keywords (as given in '`KEYWORDS`' in the R documentation directory) as concepts. For standard keyword entries the corresponding descriptions are additionally taken as concepts.

- New `lengths()` function for getting the lengths of all elements in a list.
- New function `toTitleCase()` in package **tools**, tailored to package titles.
- The matrix methods of `cbind()` and `rbind()` allow matrices as inputs which have 2^{31} or more elements. (For `cbind()`, wish of PR#16198.)
- The default method of `image()` has an explicit check for a numeric or logical matrix (which was always required).
- `URLencode()` will not by default encode further URLs which appear to be already encoded.
- `BIC(mod)` and `BIC(mod, mod2)` now give non-NA numbers for `arima()` fitted models, as `nobs(mod)` now gives the number of "used" observations for such models. This fixes PR#16198, quite differently than proposed there.
- The `print()` methods for `"htest"`, `"pairwise.htest"` and `"power.htest"` objects now have a `digits` argument defaulting to (a function of) `getOption("digits")`, and influencing all printed numbers coherently. Unavoidably, this changes the display of such test results in some cases.
- Code completion for namespaces now recognizes all loaded namespaces, rather than only the ones that are also attached.
- The code completion mechanism can now be replaced by a user-specified completer function, for (temporary) situations where the usual code completion is inappropriate.
- `unzip()` will now warn if it is able to detect truncation when unpacking a file of 4GB or more (related to PR#16243).
- `methods()` reports S4 in addition to S3 methods; output is simplified when the `class` argument is used. `.S3methods()` and `methods:::.S4methods()` report S3 and S4 methods separately.
- Higher order functions such as the `apply` functions and `Reduce()` now force arguments to the functions they apply in order to eliminate undesirable interactions between lazy evaluation and variable capture in closures. This resolves PR#16093.

INSTALLATION and INCLUDED SOFTWARE:

- The `\donttest` sections of R's help files can be tested by `make check TEST_DONTTEST=TRUE` .
- It is possible to request the use of system `valgrind` headers *via* `configure` option '`--with-system-valgrind-headers`': note the possible future incompatibility of such headers discussed in the 'R Installation and Administration' manual. (Wish of PR#16068.)
- The included version of `liblzma` has been updated to `xz-utils` 5.0.7 (minor bug fixes from 5.0.5).
- `configure` options '`--with-system-zlib`', '`--with-system-bzlib`' and '`--with-system-pcre`' are now the default. For the time being there is fallback to the versions included in the R sources if no system versions are found or (unlikely) if they are too old.
  Linux users should check that the `-devel` or `-dev` versions of packages **zlib**, **bzip2**/**libbz2** and **pcre** as well as **xz-devel**/**liblzma-dev** (or similar names) are installed.
- `configure` by default looks for the `texi2any` script from **texinfo** 5.1 or later, rather than the `makeinfo` program. (`makeinfo` is a link to the Perl script `texi2any` in **texinfo** 5.x.)
- `R CMD INSTALL` gains an option '`--built-timestamp=STAMP`' allowing 100% reproducible package building, thanks to Dirk Eddelbuettel.

UTILITIES:

- There is support for testing the `\dontrun` and `\donttest` parts of examples in packages.
  `tools::testInstalledPackage()` accepts new arguments `commentDontrun = FALSE` and `commentDonttest = FALSE`.
  `R CMD check` gains options '`--run-dontrun`' and '`--run-donttest`'.
- The HTML generated by `tools::Rd2HTML()` and `tools::toHTML()` methods is now 'XHTML 1.0 Strict'.
- The **compiler** package's utility function `setCompilerOptions()` now returns the old values invisibly. The initial optimization level can also be set with the environment variable `R_COMPILER_OPTIMIZE`.
- `R CMD build` adds a '`NeedsCompilation`' field if one is not already present in the '`DESCRIPTION`' file.
- `R CMD check` gains option '`--test-dir`' to specify an alternative set of tests to run.
- `R CMD check` will now by default continue with testing after many types of errors, and will output a summary count of errors at the end if any have occurred.
- `R CMD check` now checks that the '`Title`' and '`Description`' fields are correctly terminated.
- `R CMD check --as-cran` now:
  - checks a '`README.md`' file can be processed: this needs `pandoc` installed.
  - checks the existence and accessibility of URLs in the '`DESCRIPTION`', '`CITATION`', '`NEWS.Rd`' and '`README.md`' files and in the help files (provided the build has `libcurl` support).
  - reports non-ASCII characters in R source files when there is no package encoding declared in the '`DESCRIPTION`' file.
  - reports (apparent) S3 methods exported but not registered.
  - reports overwriting registered S3 methods from base/recommended packages. (Such methods are replaced in the affected package for the rest of the session, even if the replacing namespace is unloaded.)
  - reports if the `Title` field does not appear to be in title case (see 'Writing R Extensions': there may be false positives, but note that technical words should be single-quoted and will then be accepted).

  Most of these checks can also be selected by environment variables: see the 'R Internals' manual.

C-LEVEL FACILITIES:

- New C API utility `logspace_sum(logx[], n)`.
- Entry points `rbinom_mu`, `rnbinom_mu` and `rmultinom` are remapped (by default) to `Rf_rbinom_mu` etc. This requires packages using them to be re-installed.
- `.C(DUP = FALSE)` and `.Fortran(DUP = FALSE)` are now ignored, so arguments are duplicated if `DUP = TRUE` would do so. As their help has long said, `.Call()` is much preferred.
- New entry point `R_allocLD`, like `R_alloc` but guaranteed to have sufficient alignment for `long double` pointers.
- `isPairList()` now returns `TRUE` for DOTSXP.

WINDOWS BUILD CHANGES: A number of changes to the Windows build system are in development. The following are currently in place.

- Installation using external binary distributions of **zlib**, **bzip2**, **liblzma**, **pcre**, **libpng**, **jpeglib** and **libtiff** is now required, and the build instructions have been revised.

- A new `make` target `rsync-extsoft` has been added to obtain copies of the external libraries from CRAN.
- Building the manuals now requires `texi2any` from **texinfo** 5.1 or later. CRAN binary builds include the manuals, but by default builds from source will not, and they will be accessed from CRAN. See the comments in '`src/gnuwin32/MkRules.dist`' for how to specify the location of `texi2any`.
- (Windows) Changes have been made to support an experimental Windows toolchain based on GCC 4.9.2. The default toolchain continues to be based on GCC 4.6.3, as the new toolchain is not yet stable enough. A change to a new toolchain is expected during the R 3.2.x lifetime.

PACKAGE INSTALLATION:

- (Windows) The use of macro `ZLIB_LIBS` in file '`src/Makevars.win`' (which has not been documented for a long time) now requires an external '`libz.a`' to be available (it is part of the 'goodies' used to compile Windows binary packages). It would be simpler to use `-lz` instead.
- The default for option `pkgType` on platforms using binary packages is now `"both"`, so source packages will be tried if binary versions are not available or not up to date. There are options for what `install.packages(type = "both")` (possibly called *via* `update.packages()`) will do if compilation of a source package is desirable: see `?options` (under **utils**).
  If you intend not to accept updates as source packages, you should use `update.packages(type = "binary")`.

DEPRECATED AND DEFUNCT:

- `download.file(method = "lynx")` is defunct.
- Building R using the included versions of `zlib`, `bzip2`, `xz` and PCRE is deprecated: these are frozen (bar essential bug-fixes) and will be removed for R 3.3.0.
- The `configure` option '`--with-valgrind-instrumentation=3`' has been withdrawn, as it did not work with recent `valgrind` headers: it is now treated as level 2.
- The `MethodsList` class in package **methods** had been deprecated in R 2.11.0 and is defunct now. Functions using it are defunct if they had been deprecated in R 2.11.0, and are deprecated now, otherwise.

BUG FIXES:

- Fixed two obscure bugs in pairlist subassignment, reported by Radford Neal as part of pqR issue 16.
- Fixes for bugs in handling empty arguments and argument matching by name in `log()`.
- `all.equal()` gains methods for `environment`s and `refClass`es.
- `[<-` and `[[<-` gain S4 `data.frame` methods to avoid corruption of S4 class information by the S3 methods.
- `callNextMethod()` should now work within a `.local` call when `...` is absent from `formals(.local)`.
- `dput(pairlist(x))` generates a call to the `pairlist` constructor instead of the `list` constructor.
- Fix `missing()` when arguments are propagated through `...` . (PR#15707)
- `eigen(m)` now defaults to `symmetric = TRUE` even when the dimnames are asymmetric if the matrix is otherwise symmetric. (PR#16151)
- Fix issues with forwarding `...` through `callGeneric()` and `callNextMethod()`. (PR#16141)

- `callGeneric()` now works after a `callNextMethod()`.
- Subclass information is kept consistent when replacing an ordinary S4 class with an "old class" *via* the `S4Class` argument to `setOldClass()`. Thus, for example, a `data.frame` is valid for a `list` argument in the signature, and a `factor` is valid for `vector` arguments.
- In `qbeta()` the inversion of `pbeta()` is much more sophisticated. This works better in corner cases some of which failed completely previously (PR#15755), or were using too many iterations.
- Auto-printing no longer duplicates objects when printing is dispatched to a method.
- `kmeans(x, k)` would fail when `nrow(x) >= 42949673`. (Comment 6 of PR#15364)
- 'Abbreviated' locale-specific day and month names could have been truncated in those rare locales where there are the same as the full names.
- An irrelevant warning message from updating subclass information was silenced (the namespace would not be writable in this case).

CHANGES IN R 3.1.3

NEW FEATURES:

- The internal method of `download.file()` can now handle files larger than 2GB on 32-bit builds which support such files (tested on 32-bit R running on 64-bit Windows).
- `kruskal.test()` warns on more types of suspicious input.
- The `as.dendrogram()` method for `"hclust"` objects gains a `check` argument protecting against memory explosion for invalid inputs.
- `capabilities()` has a new item `long.double` which indicates if the build uses a `long double` type which is longer than `double`.
- `nlm()` no longer modifies the callback argument in place (a new vector is allocated for each invocation, which mimics the implicit duplication that occurred in R $< 3.1.0$); note that this is a change from the previously documented behavior. (PR#15958)
- `icuSetCollate()` now accepts `locale = "ASCII"` which uses the basic C function `strcmp` and so collates strings byte-by-byte in numerical order.
- `sessionInfo()` tries to report the OS version in use (not just that compiled under, and including details of Linux distributions).
- `model.frame()` (used by `lm()` and many other modelling functions) now warns when it drops contrasts from factors. (Wish of PR#16119)
- `install.packages()` and friends now accept the value `type = "binary"` as a synonym for the native binary type on the platform (if it has one).
- Single source or binary files can be supplied for `install.packages(type = "both")` and the appropriate type and `repos = NULL` will be inferred.
- New function `pcre_config()` to report on some of the configuration options of the version of PCRE in use. In particular, this reports if regular expressions using '`\p{xx}`' are supported.
- (Windows.) `download.file(cacheOK = FALSE)` is now supported when '`internet2.dll`' is used.
- `browseURL()` has been updated to work with Firefox 36.0 which has dropped support for the '`-remote`' interface.

INSTALLATION and INCLUDED SOFTWARE:

- The included version of PCRE has been updated to 8.36.

- `configure` accepts '`MAKEINFO=texi2any`' as another way to ensure **texinfo** 5.x is used when both 5.x and 4.x are installed.

UTILITIES:

- `R CMD check` now checks the packages used in `\donttest` sections of the examples are specified in the '`DESCRIPTION`' file. (These are needed to run the examples interactively.)
- `R CMD check` checks for the undeclared use of GNU extensions in Makefiles, and for Makefiles with a missing final linefeed.
  `R CMD build` will correct line endings in all Makefiles, not just those in the '`src`' directory.
- `R CMD check` notes uses of `library()` and `require()` in package code: see the section 'Suggested packages' of 'Writing R Extensions' for good practice.

DEPRECATED AND DEFUNCT:

- The `configure` option '`--with-valgrind-instrumentation=3`' is deprecated and will be removed in R 3.2.0.

BUG FIXES:

- (Windows.) `Rscript.exe` was missing a manifest specifying the modern style for common controls (e.g., the download progress bar).
- If a package had extra documentation files but no vignette, the HTML help system produced an empty index page.
- The parser now gives an error if a null character is included in a string using Unicode escapes. (PR#16046)
- `qr.Q()` failed on complex arguments due to pre-3.0(!) typo. (PR#16054)
- `abs()` failed with named arguments when the argument was complex. (PR#16047)
- `"noquote"` objects may now be used as columns in data frames. (PR#15997)
- Some values with extremely long names were printed incorrectly. (PR#15999)
- Extremely large exponents on zero expressed in scientific notation (e.g. `0.0e50000`) could give `NaN`. (PR#15976)
- `download.file()` reported downloaded sizes as 0KB if less than 1MB, only for R 3.1.2 and only on big-endian platforms.
- `prompt()` did not escape percent signs in the automatically generated usage section of help files.
- `drop.terms()` dropped some of the attributes of the object it was working with. (PR#16029)
- (Windows.) The command completion in `Rgui.exe` messed up the console. (PR#15791)
- (Windows.) The `choose.files()` command returned a blank string when the user asked for a single file but cancelled the request. (PR#16074)
- `Math2` S4 group generics failed to correctly dispatch `"structure"`- and `"nonStructure"`-derived classes.
- `loadNamespace()` imposed undocumented restrictions on the `versionCheck` parameter. (Reported by Geoff Lee.)
- Rare over-runs detected by AddressSanitizer in `substr()` and its replacement version have been avoided.
  Inter alia that fix gives the documented behaviour for `substr(x, 1, 2) <- ""` (subsequently reported as PR#16214).

- Loading packages incorrectly defining an S4 generic followed by a function of the same name caused an erroneous cyclic namespace dependency error.
- Declared vignette encodings are now always passed to the vignette engine.
- Port Tomas Kalibera's fix from R-devel that restores the `loadMethod()` fast path, effectively doubling the speed of S4 dispatch.
- `power.t.test()` and `power.prop.test()` now make use of the `extendInt` option of `uniroot()` and hence work in more extreme cases. (PR#15792)
- If a package was updated and attached when its namespace was already loaded, it could end up with parts from one version and parts from the other. (PR#16120)
- `tools:::.Rdconv()` didn't accept `--encoding=` due to a typo. (PR#16121)
- Unix-alike builds without a suitable `makeinfo` were documented to link the missing HTML manuals to CRAN, but did not.
- `save(*, ascii=TRUE)` and `load()` now correctly deal with `NaN`'s. (PR#16137)
- `split.Date()` retains fractional representations while avoiding incomplete class propagation.
- '`R_ext/Lapack.h`' had not been updated for changes made by LAPACK to the argument lists of its (largely internal) functions `dlaed2` and `dlaed3`. (PR#16157)
- `RShowDoc("NEWS", "txt")` had not been updated for the layout changes of R 3.1.0.
- The `xtfrm()` method for class `"Surv"` has been corrected and its description expanded.
- `mode(x) <- y` would incorrectly evaluate `x` before changing its mode. (PR#16215)
- `besselJ(1, 2^64)` and `besselY(..)` now signal a warning, returning `NaN` instead of typically segfaulting. (Issue 3 of PR#15554)
- HTML conversion of '`\href`' markup in '`.Rd`' files did not remove the backslash from '`\%`' and so gave an invalid URL. In a related change, the '`\`' escape is now required in such URLs.

CHANGES IN R 3.1.2

NEW FEATURES:

- `embedFonts()` now defaults to `format = "ps2write"` for '`.ps`' and '`.eps`' files. This is available in Ghostscript 9.x (since 2010) whereas the previous default, `format = "pswrite"`, was removed in Ghostscript 9.10.
- For consistency with `[dpqr]norm()`, `[dp]lnorm(sdlog = 0)` model a point mass at `exp(mulog)` rather than return `NaN` (for an error).
- `capabilities()` now reports if ICU is compiled in for use for collation (it is only actually used if a suitable locale is set for collation, and never for a `C` locale).
- (OS X only.) Package **tcltk** checks when loaded if it is linked against the CRAN X11-based Tcl/Tk and if so that the Tcl/Tk component and the X11 libraries are installed. This allows more informative error messages to be given advising the installation of the missing component or of XQuartz.
  The `X11()` device and X11-based versions of the data editor and viewer (invoked by `edit()` and `View()` for data frames and matrices from command-line R) check that the X11 libraries are installed and if not advises installing XQuartz.
- `icuSetCollate()` allows `locale = "default"`, and `locale = "none"` to use OS services rather than ICU for collation.
  Environment variable `R_ICU_LOCALE` can be used to set the default ICU locale, in case the one derived from the OS locale is inappropriate (this is currently necessary on Windows).

- New function `icuGetCollate()` to report on the ICU collation locale in use (if any).
- `utils::URLencode()` was updated to use unreserved and reserved characters from RFC 3986 (http://tools.ietf.org/html/rfc3986) instead of RFC 1738.
- `unique(warnings())` and `c(warnings())` are now supported.
- The Bioconductor 'version' used by `setRepositories()` now defaults to `3.0`. (It can be set at runtime *via* environment variable `R_BIOC_VERSION`.)
- Omegahat is no longer listed as providing Windows binary packages, e.g. by `setRepositories()`. It has no binary packages available for R 3.1.x and those for earlier versions were 32-bit only.

INSTALLATION and INCLUDED SOFTWARE:

- The `configure` script reports on the more important capabilities/options which will not be compiled in.
  More types of external BLAS are recognized by name in that report.
- When building R as a shared library, the '`-L${R_HOME}/lib${R_ARCH}`' flag is placed earlier in the link commands used during installation and when packages are installed: this helps ensure that the current build has priority if an R shared library has already been installed by e.g. `install-libR` in a library mentioned in `LDFLAGS` (and not in 'your system's library directory' as documented). (Wish of PR#15790.)
- LaTeX package **upquote** is no longer required for R's use of **inconsolata**.
- (Windows only) If both 32- and 64-bit versions of R are installed, the '`bin/R.exe`' and '`bin/Rscript.exe`' executables now run 64-bit R. (To run 32-bit R, overwrite these files with copies of '`bin/i386/Rfe.exe`'.)

UTILITIES:

- Running `R CMD check` with `_R_CHECK_DEPENDS_ONLY_` true now makes the '`VignetteBuilder`' packages available even if they are listed in '`Suggests`', since they are needed to recognise and process non-Sweave vignettes.
- `R CMD check` now reports empty `importFrom` declarations in a '`NAMESPACE`' file, as these are common errors (writing `importFrom(`*Pkg*`)` where `import(`*Pkg*`)` was intended).
- `R CMD check` now by default checks code usage directly on the package namespace without loading and attaching the package and its suggests and enhances. For good practice with packages in the '`Suggests`' field, see §1.1.3.1 of 'Writing R Extensions'. For use of lazy-data objects in the package's own code, see `?data`.

BUG FIXES:

- `dmultinom()` did not handle non-finite probabilities correctly.
- `prettyNum(x, zero.print=*)` now also works when `x` contains `NA`s.
- A longstanding bug exhibited by `nlminb()` on Windows was traced to a compiler bug in gcc 4.6.3; a workaround has been put in place. (PR#15244 and PR#15914).
- Rendering of `\command` in HTML versions of help pages has been improved: this is particularly evident on the help page for `INSTALL`.
- `as.hexmode(x)` and `as.octmode(x)` now behave correctly for some numeric `x`, e.g., `c(NA, 1)` or `c(1, pi)`.
- `drop1()` failed if the `scope` argument had no variables to drop. (PR#15935)
- `edit()` (and hence `fix()`) failed if an object had a non-character attribute named `"source"` (an attribute that had been used in R prior to version 2.14.0).
- `callGeneric()` could fail if the generic had `...` as a formal argument. (PR#15937).

- Forking in package **parallel** called C entry point `exit` in the child. This was unsafe (`_exit` should have been called), and could flush `stdin` of the main R process (seen most often on Solaris).
  As good practice, `stdout` is now flushed before forking a child.
- R objects such as `list(`a\b` = 1)` now print correctly.
- `getAnywhere("C_pbinom")` now returns correctly a single object (rather than unlisting it).
- The `confint()` method for `nls()` fits failed it these has specified parameter limits despite using an algorithm other than `"port"`. (PR#15960)
- Subclassing an S4 class failed if the class required arguments to the generator, through its `initialize()` method.
- `removeSource()` did not properly handle expressions containing arguments that were supplied as missing, e.g. `x[i,]`. (PR#15957)
- `as.environment(list())` now works, and `as.list()` of such an environment is now the same as `list()`.
- Several **tcltk** functions failed when run in unusual environments. (PR#15970)
- `options(list())` now works (trivially). (PR#15979)
- `merge(<dendrogram>, ..)` now works correctly for two 'independent' dendrograms (PR#15648), and still compatibly via `adjust = "auto"` e.g. for two branches of an existing dendrogram.
- The `plot` method for `"hclust"` objects gets an optional argument `check`; when that is true (the default) it checks more carefully for valid input.
- (Windows only) If a user chose to install 64 bit R but not 32 bit R, the '`bin/R`' and '`bin/Rscript`' executables failed to run. (PR#15981)
- Various possible buffer overruns have been prevented, and missed memory protection added. (PR#15990)
- `Rscript` no longer passes `--args` to `R` when there are no extra ("user") arguments.
- objects like `getClass("refClass")@prototype` now `print()` and `str()` without error.
- `identical()` now also looks at the S4 bit.
- `hist(x, breaks)` is more robust in adding a small fuzz to few breaks when some are very large. (PR#15988)
- `sub()` and `gsub()` did not handle regular expressions like `"\s{2,}"` properly if the text contained `NA` or non-ASCII elements in a UTF-8 locale. Part of this was due to a bug in the TRE library. (PR#16009)
- `RShowDoc("NEWS")` now displays the PDF version.
- Matrices and arrays with last dimension zero did not print at all or incompletely. (PR#16012)
- `plot.histogram()` and hence `hist()` now respect the `xaxs`, `yaxs` and `lab` graphics parameters. (PR#16021)
- `bw.SJ(x)` and other bw.*() no longer segfault when `x` contains non-finite values. (PR#16024)
- `R CMD Rd2pdf` unintentionally ignored its '`--os`' option.
- The internal method of `download.file()` was not reporting file sizes and progress correctly on files larger than 2GB (inherited from `libxml2`). This is corrected for 64-bit builds (32-bit platforms may not support such files, but where possible will be supported in future versions of R).
- Work around a bug in OS X Yosemite where key environment variables may be duplicated causing issues in subprocesses. The duplicates are now removed on R startup (via Rprofile). (PR#16042)

- Adjust X11 auto-launch detection in DISPLAY on OS X to recognize latest XQuartz.

CHANGES IN R 3.1.1

NEW FEATURES:

- When `attach()` reports conflicts, it does so compatibly with `library()` by using `message()`.
- `R CMD Sweave` no longer cleans any files by default, compatibly with versions of R prior to 3.1.0. There are new options '`--clean`', '`--clean=default`' and '`--clean=keepOuts`'.
- `tools::buildVignette()` and `tools::buildVignettes()` with `clean = FALSE` no longer remove any created files. `buildvignette()` gains a `keep` argument for more cleaning customization.
- The Bioconductor 'version' used by `setRepositories()` can now be set by environment variable `R_BIOC_VERSION` at runtime, not just when R is installed. (It has been stated that Bioconductor will switch from 'version' 2.14 to 'version' 3.0 during the lifetime of the R 3.1 series.)
- Error messages from bugs in embedded '`Sexpr`' code in Sweave documents now report the source location.
- `type.convert()`, `read.table()` and similar `read.*()` functions get a new `numerals` argument, specifying how numeric input is converted when its conversion to double precision loses accuracy. The default value, `"allow.loss"` allows accuracy loss, as in R versions before 3.1.0.
- For some compilers, integer addition could overflow without a warning. R's internal code for both integer addition and subtraction is more robust now. (PR#15774)
- The function determining the default number of knots for `smooth.spline()` is now exported, as `.nknots.smspl()`.
- `dbeta(, a,b)`, `pbeta()`, `qbeta()` and `rbeta()` are now defined also for $a = 0$, $b = 0$, or infinite a and b (where they typically returned `NaN` before).
- Many package authors report that the RStudio graphics device does not work correctly with their package's use of `dev.new()`. The new option `dev.new(noRStudioGD = TRUE)` replaces the RStudio override by the default device as selected by R itself, still respecting environment variables `R_INTERACTIVE_DEVICE` and `R_DEFAULT_DEVICE`.
- `readRDS()` now returns visibly.
- Modifying internal logical scalar constants now results in an error instead of a warning.
- `install.packages(repos = NULL)` now accepts '`http://`' or '`ftp://`' URLs of package archives as well as file paths, and will download as required. In most cases `repos = NULL` can be deduced from the extension of the URL.
- The warning when using partial matching with the `$` operator on data frames is now only given when `options("warnPartialMatchDollar")` is `TRUE`.
- Package help requests like `package?foo` now try the package `foo` whether loaded or not.
- General help requests now default to trying all loaded packages, not just those on the search path.
- Added a new function `promptImport()`, to generate a help page for a function that was imported from another package (and presumably re-exported, or help would not be needed).

INSTALLATION and INCLUDED SOFTWARE:

- `configure` option '`--with-internal-tzcode`' can now be used with variable `rsharedir`.
- The included version of PCRE has been updated to 8.35.
- There is a new target `make uninstall-libR` to remove an installed shared/static '`libR`'.
  `make install-libR` now works if a sub-architecture is used, although the user will need to specify `libdir` differently for different sub-architectures.
- There is more extensive advice on which LaTeX packages are required to install R or to make package manuals (as done by `R CMD check`) in the 'Writing R Extensions' manual.
- Compilers/linkers were handling the visibility control in '`src/extra/xz`' inconsistently (and apparently in some cases incorrectly), so it has been simplified. (PR#15327)
- (Windows) There is updated support for the use of ICU for collation: see the 'R Installation and Administration Manual'.

BUG FIXES:

- `dbinom(x, n)`, `pbinom()`, `dpois()`, etc, are slightly less restrictive in checking if `n` is integer-valued. (Wish of PR#15734.)
- `pchisq(x, df, ncp, log.p = TRUE)` is more accurate and no longer underflows for small `x` and `ncp < 80`, e.g, for `pchisq(1e-5, df = 100, ncp = 1, log = TRUE)`. (Based on PR#15635 and a suggestion by Roby Joehanes.)
- The `s` ("step into") command in the debugger would cause R to step into expressions evaluated there, not just into functions being debugged. (PR#15770)
- The C code used by `strptime()` rejected time-zone offsets of more than `+1200` (`+1245`, `+1300` and `+1400` can occur). (PR#15768)
- (Windows only.) `png(type = "cairo", antialias = "gray")` was not accepted. (PR#15760)
- Use of `save(..., envir=)` with named objects could fail. (PR#15758)
- `Sweave()` mis-parsed '`Sexpr`' expressions that contained backslashes. (PR#15779)
- The return value from `options(foo = NULL)` was not the previous value of the option. (PR#15781)
- `enc2utf8()` and `enc2native()` did not always mark the encoding of the return values when it was known.
- `dnbinom(x, size = <large>, mu, log = TRUE)` no longer underflows to -Inf for large `mu`, thanks to a suggestion from Alessandro Mammana (MPI MolGen, Berlin).
- `pbeta(x, a, b, log = TRUE)` no longer behaves discontinuously (in a small x-region) because of denormalized numbers. Also, `pbeta(1-1e-12, 1e30, 1.001, log=TRUE)` now terminates "in real time".
- The `"CRAN"` filter (see `available.packages()`) no longer removes duplicates other than of packages on CRAN, and does not fail if there is no CRAN repository in `getOption("repos")`.
- The device listing from `dev2bitmap()` and `bitmap()` was truncated to 1000 characters: modern versions of GhostScript on most platforms have many more devices.
- (Windows.) Commands such as `Sys.which()` and `pipe()` which needed to find the full path to a command could segfault if the 'long' path name was much longer than the 'short' path name (which `Sys.which()` returns), as the behaviour of the Windows API call had changed.

- `R CMD build` will fail with an error if one of the packages specified in the '`VignetteBuilder`' field is not installed. (Without loading those packages it cannot be ascertained which files are intended to be vignettes. This means that the '`VignetteBuilder`' packages have to be installed for package checking too.) (Wish of PR#15775.)
- Misguided attempts to use `chull()` with non-finite points now give an error (related to PR#15777).
- For a formula with exactly 32 variables the 32nd variable was aliased to the intercept in some C-level computations of terms, so that for example attempting to remove it would remove the intercept instead (and leave a corrupt internal structure). (PR#15735)
- `anyDuplicated()` silently returned wrong values when the first duplicate was at an index which was too large to be stored in an integer vector (although a lot of RAM and patience would have been needed to encounter this).
- `tools::Rd2ex(commentDontrun = FALSE)` failed if the block had only one line.
- Hexadecimal constants such as `0x110p-5L` which were incorrectly qualified by `L` were parsed incorrectly since R 3.0.0, with a slightly garbled warning. (PR#15753)
- `system()` returned success on some platforms even if the system was unable to launch a process. (PR#15796)
- (Windows `Rgui` console.) Unbuffered output was sometimes not output immediately if the prompt was not on the last line of the console.
- The built-in help server did not declare the encoding for the '`DESCRIPTION`' or other text files to be the package encoding, so non-ASCII characters could be displayed incorrectly.
- R is now trying harder to not cleanup child processes that were not spawned by `mcparallel()` on platforms that provide information about the source process of the `SIGCHLD` signal. This allows 3rd party libraries to manage the exit status of children that they spawn without R interfering.
- `mcmapply()` was only parallelizing if the number of jobs was bigger than the number of cores. It now parallelizes if the number of jobs is more than one.
- Auto-printing would re-evaluate its argument when trying to dispatch to a print method. This is now avoided when possible.
- Unserializing (including `load()` and `readRDS()`) could silently return incorrect numeric values from ASCII saves if there was a read error.
- `getParseData()` could return incorrect values for the parents of some elements. (Reported by Andrew Redd.)
- Attempting to use data frames of 2^31 or more rows with `merge()` or to create a merged data frame of that size now gives a clearer error message.
- `parse()` did not check its `file` argument was a connection if it was not a character string, so e.g. `parse(FALSE)` attempted to read from `stdin`.
  Nor did `dump()` and `dput()`.
- The `"help.try.all.packages"` option was ignored when the shortcut syntax for help was used, e.g. `?foo`.
- A potential segfault in string allocation has been fixed. (Found by Radford Neal.)
- Potential memory protection errors in `sort()` and `D()` have been fixed. (Found by Radford Neal.)
- Fixed a lack of error checking in graphics event functions. (Found by Radford Neal; a different patch used here than the one in pqR.)
- `numericDeriv()` sometimes miscalculated the gradient. (PR#15849, reported originally by Radford Neal)

CHANGES IN R 3.1.0

NEW FEATURES:

- `type.convert()` (and hence by default `read.table()`) returns a character vector or factor when representing a numeric input as a double would lose accuracy. Similarly for complex inputs.
  If a file contains numeric data with unrepresentable numbers of decimal places that are intended to be read as numeric, specify `colClasses` in `read.table()` to be `"numeric"`.
- `tools::Rdiff(useDiff = FALSE)` is closer to the POSIX definition of `diff -b` (as distinct from the description in the `man` pages of most systems).
- New function `anyNA()`, a version of `any(is.na(.))` which is fast for atomic vectors, based on a proposal by Tim Hesterberg. (Wish of PR#15239.)
- `arrayInd(*, useNames = TRUE)` and, analogously, `which(*, arr.ind = TRUE)` now make use of `names(.dimnames)` when available.
- `is.unsorted()` now also works for `raw` vectors.
- The `"table"` method for `as.data.frame()` (also useful as `as.data.frame.table()`) now passes `sep` and `base` arguments to `provideDimnames()`.
- `uniroot()` gets new optional arguments, notably `extendInt`, allowing to auto-extend the search interval when needed. The return value has an extra component, `init.it`.
- `switch(f, ...)` now warns when `f` is a factor, as this typically happens accidentally where the useR meant to pass a character string, but `f` is treated as integer (as always documented).
- The parser has been modified to use less memory.
- The way the unary operators (`+ - !`) handle attributes is now more consistent. If there is no coercion, all attributes (including class) are copied from the input to the result: otherwise only names, dims and dimnames are.
- `colorRamp()` and `colorRampPalette()` now allow non-opaque colours and a ramp in opacity via the new argument `alpha = TRUE`. (Suggested by Alberto Krone-Martins, but optionally as there are existing uses which expect only RGB values.)
- `grid.show.layout()` and `grid.show.viewport()` get an optional `vp.ex` argument.
- There is a new function `find_gs_cmd()` in the **tools** package to locate a GhostScript executable. (This is an enhanced version of a previously internal function there.)
- `object.size()` gains a `format()` method.
- There is a new family, `"ArialMT"`, for the `pdf()` and `postscript()` devices. This will only be rendered correctly on viewers which have access to Monotype TrueType fonts (which are sometimes requested by journals).
- The text and PDF news files, including '`NEWS`' and '`NEWS.2`', have been moved to the '`doc`' directory.
- `combn(x, simplify = TRUE)` now gives a factor result for factor input `x` (previously user error). (Related to PR#15442.)
- Added `utils::fileSnapshot()` and `utils::changedFiles()` functions to allow snapshots and comparison of directories of files.
- `make.names(names, unique=TRUE)` now tries to preserve existing names. (Suggestion of PR#15452.)
- New functions `cospi(x)`, `sinpi(x)`, and `tanpi(x)`, for more accurate computation of `cos(pi*x)`, etc, both in R and the C API. Using these gains accuracy in some cases, e.g., inside `lgamma()` or `besselI()`. (Suggested by Morten Welinder in PR#15529.)

- `print.table(x, zero.print = ".")` now also has an effect when `x` is not integer-valued.
- There is more support to explore the system's idea of time-zone names. `Sys.timezone()` tries to give the current system setting by name (and succeeds at least on Linux, OS X, Solaris and Windows), and `OlsonNames()` lists the names in the system's Olson database. `Sys.timezone(location = FALSE)` gives the previous behaviour.
- Platforms with a 64-bit `time_t` type are allowed to handle conversions between the `"POSIXct"` and `"POSIXlt"` classes for date-times outside the 32-bit range (before 1902 or after 2037): the existing workarounds are used on other platforms. (Note that time-zone information for post-2037 is speculative at best, and the OS services are tested for known errors and so not used on OS X.)
  Currently `time_t` is usually `long` and hence 64-bit on Unix-alike 64-bit platforms: however in several cases the time-zone database is 32-bit. For R for Windows it is 64-bit (for both architectures as from this version).
- The `"save.defaults"` option can include a value for `compression_level`. (Wish of PR#15579.)
- `colSums()` and friends now have support for arrays and data-frame columns with 2^{31} or more elements.
- `as.factor()` is faster when `f` is an unclassed integer vector (for example, when called from `tapply()`).
- `fft()` now works with longer inputs, from the 12 million previously supported up to 2 billion. (PR#15593)
- Complex `svd()` now uses LAPACK subroutine `ZGESDD`, the complex analogue of the routine used for the real case.
- Sweave now outputs '`.tex`' files in UTF-8 if the input encoding is declared to be UTF-8, regardless of the local encoding. The UTF-8 encoding may now be declared using a LaTeX comment containing the string `%\SweaveUTF8` on a line by itself.
- `file.copy()` gains a `copy.date` argument.
- Printing of date-times will make use of the time-zone abbreviation in use at the time, if known. For example, for Paris pre-1940 this could be '`LMT`', '`PMT`', '`WET`' or '`WEST`'. To enable this, the `"POSIXlt"` class has an optional component `"zone"` recording the abbreviation for each element.
  For platforms which support it, there is also a component `"gmtoff"` recording the offset from GMT where known.
- (On Windows, by default on OS X and optionally elsewhere.) The system C function `strftime` has been replaced by a more comprehensive version with closer conformance to the POSIX 2008 standard.
- `dnorm(x, log = FALSE)` is more accurate (but somewhat slower) for $|x| > 5$; as suggested in PR#15620.
- Some versions of the `tiff()` device have further compression options.
- `read.table()`, `readLines()` and `scan()` have a new argument to influence the treatment of embedded nuls.
- Avoid duplicating the right hand side values in complex assignments when possible. This reduces copying of replacement values in expressions such as `Z$a <- a0` and `ans[[i]] <- tmp`: some package code has relied on there being copies.
  Also, a number of other changes to reduce copying of objects; all contributed by or based on suggestions by Michael Lawrence.
- The `fast` argument of `KalmanLike()`, `KalmanRun()` and `KalmanForecast()` has been replaced by `update`, which instead of updating `mod` in place, optionally returns the updated model in an attribute `"mod"` of the return value.

- `arima()` and `makeARIMA()` get a new optional argument `SSinit`, allowing the choice of a different **s**tate **s**pace initialization which has been observed to be more reliable close to non-stationarity: see PR#14682.
- `warning()` has a new argument `noBreaks.`, to simplify post-processing of output with `options(warn = 1)`.
- `pushBack()` gains an argument `encoding`, to support reading of UTF-8 characters using `scan()`, `read.table()` and related functions in a non-UTF-8 locale.
- `all.equal.list()` gets a new argument `use.names` which by default labels differing components by names (if they match) rather than by integer index. Saved R output in packages may need to be updated.
- The methods for `all.equal()` and `attr.all.equal()` now have argument `check.attributes` after `...` so it cannot be partially nor positionally matched (as it has been, unintentionally).
  A side effect is that some previously undetected errors of passing empty arguments (no object between commas) to `all.equal()` are detected and reported.
  There are explicit checks that `check.attributes` is logical, `tolerance` is numeric and `scale` is `NULL` or numeric. This catches some unintended positional matching.
  The message for `all.equal.numeric()` reports a `"scaled difference"` only for `scale != 1`.
- `all.equal()` now has a `"POSIXt"` method replacing the `"POSIXct"` method.
- The `"Date"` and `"POSIXt"` methods of `seq()` allows `by = "quarter"` for completeness (`by = "3 months"` always worked).
- `file.path()` removes any trailing separator on Windows, where they are invalid (although sometimes accepted). This is intended to enhance the portability of code written by those using POSIX file systems (where a trailing `/` can be used to confine path matching to directories).
- New function `agrepl()` which like `grepl()` returns a logical vector.
- `fifo()` is now supported on Windows. (PR#15600)
- `sort.list(method = "radix")` now allows negative integers (wish of PR#15644).
- Some functionality of `print.ts()` is now available in `.preformat.ts()` for more modularity.
- `mcparallel()` gains an option `detach = TRUE` which allows execution of code independently of the current session. It is based on a new `estranged = TRUE` argument to `mcfork()` which forks child processes such that they become independent of the parent process.
- The `pdf()` device omits circles and text at extremely small sizes, since some viewers were failing on such files.
- The rightmost break for the `"months"`, `"quarters"` and `"years"` cases of `hist.POSIXlt()` has been increased by a day. (Inter alia, fixes PR#15717.)
- The handling of `DF[i,] <- a` where `i` is of length 0 is improved. (Inter alia, fixes PR#15718.)
- `hclust()` gains a new method `"ward.D2"` which implements Ward's method correctly. The previous `"ward"` method is `"ward.D"` now, with the old name still working. Thanks to research and proposals by Pierre Legendre.
- The `sunspot.month` dataset has been amended and updated from the official source, whereas the `sunspots` and `sunspot.year` datasets will remain immutable. The documentation and source links have been updated correspondingly.
- The `summary()` method for `"lm"` fits warns if the fit is essentially perfect, as most of the summary may be computed inaccurately (and with platform-dependent values). Programmers who use `summary()` in order to extract just a component which will be reliable (e.g., `$cov.unscaled`) should wrap their calls in `suppressWarnings()`.

INSTALLATION and INCLUDED SOFTWARE:

- The included version of LAPACK has been updated to 3.5.0.
- There is some support for parallel testing of an installation, by setting `TEST_MC_CORES` to an integer greater than one to indicate the maximum number of cores to be used in parallel. (It is worth specifying at least 8 cores if available.) Most of these require a `make` program (such as GNU `make` and `dmake`) which supports the `$MAKE -j nproc` syntax.
  Except on Windows: the tests of standard package examples in `make check` are done in parallel. This also applies to running `tools::testInstalledPackages()`.
  The more time-consuming regression tests are done in parallel.
  The package checks in `make check-devel` and `make check-recommended` are done in parallel.
- More of `make check` will work if recommended packages are not installed: but recommended packages remain needed for thorough checking of an R build.
- The version of '`tzcode`' included in '`src/extra/tzone`' has been updated. (Formerly used only on Windows.)
- The included (64-bit) time-zone conversion code and Olson time-zone database can be used instead of the system version: use `configure` option '`--with-internal-tzcode`'. This is the default on Windows and OS X. (Note that this does not currently work if a non-default `rsharedir configure` variable is used.)
  (It might be necessary to set environment variable `TZ` on OSes where this is not already set, although the system timezone is deduced correctly on at least Linux, OS X and Windows.)
  This option also switches to the version of `strftime` included in directory '`src/extra/tzone`'.
- `configure` now tests for a C++11-compliant compiler by testing some basic features. This by default tries flags for the compiler specified by '`CXX`', but an alternative compiler, options and standard can be specified by variables '`CXX1X`', '`CXX1XFLAGS`' and '`CXX1XSTD`' (e.g., '`-std=gnu++11`').
- R can now optionally be compiled to use reference counting instead of the `NAMED` mechanism by defining `SWITCH_TO_REFCNT` in '`Rinternals.h`'. This may become the default in the future.
- There is a new option '`--use-system-tre`' to use a suitable system **tre** library: at present this means a version from their `git` repository, after corrections. (Wish of PR#15660.)

PACKAGE INSTALLATION:

- The `CRANextra` repository is no longer a default repository on Windows: all the binary versions of packages from CRAN are now on CRAN, although `CRANextra` contains packages from Omegahat and elsewhere used by CRAN packages.
- Only vignettes sources in directory '`vignettes`' are considered to be vignettes and hence indexed as such.
- In the '`DESCRIPTION`' file,

  ```
  License: X11
  ```

  is no longer recognized as valid. Use '`MIT`' or '`BSD_2_clause`' instead, both of which need '`+ file LICENSE`'.
- For consistency, entries in '`.Rinstignore`' are now matched case-insensitively on all platforms.
- Help for S4 methods with very long signatures now tries harder to split the description in the '`Usage`' field to no more than 80 characters per line (some packages had over 120 characters).

- `R CMD INSTALL --build` (not Windows) now defaults to the internal `tar()` unless `R_INSTALL_TAR` is set.
- There is support for compiling C++11 code in packages on suitable platforms: see 'Writing R Extensions'.
- Fake installs now install the contents of directory '`inst`': some packages use this to install e.g. C++ headers for use by other packages that are independent of the package itself. Option '`--no-inst`' can be used to get the previous behaviour.

DEBUGGING:

- The behaviour of the code browser has been made more consistent, in part following the suggestions in PR#14985.
- Calls to `browser()` are now consistent with calls to the browser triggered by `debug()`, in that *`Enter`* will default to `n` rather than `c`.
- A new browser command `s` has been added, to "step into" function calls.
- A new browser command `f` has been added, to "finish" the current loop or function.
- Within the browser, the command `help` will display a short list of available commands.

UTILITIES:

- Only vignettes sources in directory '`vignettes`' are considered to be vignettes by `R CMD check`. That has been the preferred location since R 2.14.0 and is now obligatory.
- For consistency, `R CMD build` now matches entries in '`.Rbuildignore`' and '`vignettes/.install_extras`' case-insensitively on all platforms (not just on Windows).
- `checkFF()` (called by `R CMD check` by default) can optionally check foreign function calls for consistency with the registered type and argument count. This is the default for `R CMD check --as-cran` or can be enabled by setting environment variable `_R_CHECK_FF_CALLS_` to '`registration`' (but is in any case suppressed by '`--install=no`'). Because this checks calls in which `.NAME` is an R object and not just a literal character string, some other problems are detected for such calls.
  Functions `suppressForeignCheck()` and `dontCheck()` have been added to allow package authors to suppress false positive reports.
- `R CMD check --as-cran` warns about a false value of the '`DESCRIPTION`' field '`BuildVignettes`' for Open Source packages, and ignores it. (An Open Source package needs to have complete sources for its vignettes which should be usable on a suitably well-equipped system).
- `R CMD check --no-rebuild-vignettes` is defunct:
  `R CMD check --no-build-vignettes` has been preferred since R 3.0.0.
- `R CMD build --no-vignettes` is defunct:
  `R CMD build --no-build-vignettes` has been preferred since R 3.0.0.
- `R CMD Sweave` and `R CMD Stangle` now process both Sweave and non-Sweave vignettes. The `tools::buildVignette()` function has been added to do the same tasks from within R.
- The flags returned by `R CMD config --ldflags` and (where installed) `pkg-config --libs libR` are now those needed to link a front-end against the (shared or static) R library.
- '`Sweave.sty`' has a new option '`[inconsolata]`'.
- `R CMD check` customizations such as `_R_CHECK_DEPENDS_ONLY_` make available packages only in '`LinkingTo`' only for installation, and not for loading/runtime tests.

- `tools::checkFF()` reports on `.C` and `.Fortran` calls with `DUP = FALSE` if argument `check_DUP` is true. This is selected by `R CMD check` by default.
- `R CMD check --use-gct` can be tuned to garbage-collect less frequently using `gctorture2()` *via* the setting of environment variable `_R_CHECK_GCT_N_`.
- Where supported, `tools::texi2dvi()` limits the number of passes tried to 20.

C-LEVEL FACILITIES:

- (Windows only) A function `R_WaitEvent()` has been added (with declaration in header'`R.h`') to block execution until the next event is received by R.
- Remapping in the '`Rmath.h`' header can be suppressed by defining '`R_NO_REMAP_RMATH`'.
- The remapping of `rround()` in header '`Rmath.h`' has been removed: use `fround()` instead.
- `ftrunc()` in header '`Rmath.h`' is now a wrapper for the C99 function `trunc()`, which might as well be used in C code: `ftrunc()` is still needed for portable C++ code.
- The never-documented remapping of `prec()` to `fprec()` in header '`Rmath.h`' has been removed.
- The included LAPACK subset now contains `ZGESDD` and `ZGELSD`.
- The function `LENGTH()` now checks that it is only applied to vector arguments. However, in packages `length()` should be used. (In R itself `LENGTH()` is a macro without the function overhead of `length()`.)
- Calls to `SET_VECTOR_ELT()` and `SET_STRING_ELT()` are now checked for indices which are in-range: several packages were writing one element beyond the allocated length.
- `allocVector3` has been added which allows custom allocators to be used for individual vector allocations.

DEPRECATED AND DEFUNCT:

- `chol(pivot = TRUE, LINPACK = TRUE)` is defunct.
  Arguments `EISPACK` for `eigen()` and `LINPACK` for `chol()`, `chol2inv()`, `solve()` and `svd()` are ignored: LAPACK is always used.
- `.find.package()` and `.path.package()` are defunct: only the versions without the initial dot introduced in R 2.13.0 have ever been in the API.
- Partial matching when using the `$` operator *on data frames* now throws a warning and may become defunct in the future. If partial matching is intended, replace `foo$bar` by `foo[["bar", exact = FALSE]]`.
- The long-deprecated use of `\synopsis` in the '`Usage`' section of '`.Rd`' files has been removed: such sections are now ignored (with a warning).
- `package.skeleton()`'s deprecated argument `namespace` has been removed.
- Many methods are no longer exported by package **stats**. They are all registered on their generic, which should be called rather than calling a method directly.
- Functions `readNEWS()` and `checkNEWS()` in package **tools** are defunct.
- `download.file(method = "lynx")` is deprecated.
- `.C(DUP = FALSE)` and `.Fortran(DUP = FALSE)` are now deprecated, and may be disabled in future versions of R. As their help has long said, `.Call()` is much preferred. `R CMD check` notes such usages (by default).
- The workaround of setting `R_OSX_VALGRIND` has been removed: it is not needed in current valgrind.

BUG FIXES:

- Calling `lm.wfit()` with no non-zero weights gave an array-overrun in the Fortran code and a not very sensible answer. It is now special-cased with a simpler answer (no `qr` component).
- Error messages involving non-syntactic names (e.g., as produced by `` `\r` `` when that object does not exist) now encode the control characters. (Reported by Hadley Wickham.)
- `getGraphicsEvent()` caused 100% usage of one CPU in Windows. (PR#15500)
- `nls()` with no `start` argument may now work inside another function (scoping issue).
- `pbeta()` and similar work better for very large (billions) `ncp`.
- Where time zones have changed abbreviations over the years, the software tries to more consistently use the abbreviation appropriate to the time or if that is unknown, the current abbreviation. On some platforms where the C function `localtime` changed the `tzname` variables the reported abbreviation could have been that of the last time converted.
- `all.equal(list(1), identity)` now works.
- Bug fix for pushing viewports in **grid** (reported by JJ Allaire and Kevin Ushey). NOTE for anyone poking around within the graphics engine display list (despite the warnings not to) that this changes what is recorded by **grid** on the graphics engine display list.
- Extra checks have been added for unit resolution and conversion in **grid**, to catch instances of division-by-zero. This may introduce error messages in existing code and/or produce a different result in existing code (but only where a non-finite location or dimension may now become zero).
- Some bugs in TRE have been corrected by updating from the `git` repository. This allows R to be installed on some platforms for which this was a blocker (PR#15087 suggests Linux on ARM and HP-UX).
- `?` applied to a call to an S4 generic failed in several cases. (PR#15680)
- The implicit S4 generics for primitives with `...` in their argument list were incorrect. (PR#15690)
- Bug fixes to `methods::callGeneric()`. (PR#15691)
- The bug fix to `aggregate()` in PR#15004 introduced a new bug in the case of no grouping variables. (PR#15699)
- In rare cases printing deeply nested lists overran a buffer by one byte and on a few platforms segfaulted. (PR#15679)
- The dendrogram method of `as.dendrogram()` was hidden accidentally, (PR#15703), and `order.dendrogram(d)` gave too much for a leaf `d`. (PR#15702)
- R would try to kill processes on exit that have pids ever used by a child process spawned by `mcparallel` even though the current process with that pid was not actually its child.
- `cophenetic()` applied to a `"dendrogram"` object sometimes incorrectly returned a `"Labels"` attribute with dimensions. (PR#15706)
- `printCoefmat()` called from quite a few `print()` methods now obeys small `getOption("width")` settings, line wrapping the '`"signif. codes"`' legend appropriately. (PR#15708)
- `model.matrix()` assumed that the stored dimnames for a matrix was `NULL` or length 2, but length 1 occurred.
- The clipping region for a device was sometimes used in base graphics before it was set.

CHANGES IN R 3.0.3

NEW FEATURES:

- On Windows there is support for making '`.texi`' manuals using `texinfo` 5.0 or later: the setting is in file '`src/gnuwin32/MkRules.dist`'.
  A packaging of the Perl script and modules for `texinfo` 5.2 has been made available at http://www.stats.ox.ac.uk/pub/Rtools/.
- `write.table()` now handles matrices of 2^{31} or more elements, for those with large amounts of patience and disc space.
- There is a new function, `La_version()`, to report the version of LAPACK in use.
- The HTML version of 'An Introduction to R' now has links to PNG versions of the figures.
- There is some support to produce manuals in ebook formats. (See '`doc/manual/Makefile`'. Suggested by Mauro Cavalcanti.)
- On a Unix-alike `Sys.timezone()` returns `NA` if the environment variable `TZ` is unset, to distinguish it from an empty string which on some OSes means the '`UTC`' time zone.
- The backtick may now be escaped in strings, to allow names containing them to be constructed, e.g. `` `\`` ``. (PR#15621)
- `read.table()`, `readLines()` and `scan()` now warn when an embedded nul is found in the input. (Related to PR#15625 which was puzzled by the behaviour in this unsupported case.)
- (Windows only.) `file.symlink()` works around the undocumented restriction of the Windows system call to backslashes. (Wish of PR#15631.)
- `KalmanForecast(fast = FALSE)` is now the default, and the help contains an example of how `fast = TRUE` can be used in this version. (The usage will change in 3.1.0.)
- `strptime()` now checks the locale only when locale-specific formats are used and caches the locale in use: this can halve the time taken on OSes with slow system functions (e.g., OS X).
- `strptime()` and the `format()` methods for classes `"POSIXct"`, `"POSIXlt"` and `"Date"` recognize strings with marked encodings: this allows, for example, UTF-8 French month names to be read on (French) Windows.
- `iconv(to = "utf8")` is now accepted on all platforms (some implementations did already, but GNU **libiconv** did not: however converted strings were not marked as being in UTF-8). The official name, `"UTF-8"` is still preferred.
- `available.packages()` is better protected against corrupt metadata files. (A recurring problem with Debian package **shogun-r**: PR#14713.)
- Finalizers are marked to be run at garbage collection, but run only at a somewhat safer later time (when interrupts are checked). This circumvents some problems with finalizers running arbitrary code during garbage collection (the known instances being running `options()` and (C-level) `path.expand()` re-entrantly).

INSTALLATION and INCLUDED SOFTWARE:

- The included version of PCRE has been updated to 8.34. This fixes bugs and makes the behaviour closer to Perl 5.18. In particular, the concept of 'space' includes '`VT`' and hence agrees with POSIX's.

PACKAGE INSTALLATION:

- The new field '`SysDataCompression`' in the '`DESCRIPTION`' file allows user control over the compression used for '`sysdata.rda`' objects in the lazy-load database.
- `install.packages(dependencies = value)` for `value = NA` (the default) or `value = TRUE` omits packages only in `LinkingTo` for binary package installs.

C-LEVEL FACILITIES:

- The long undocumented remapping of `rround()` to `Rf_fround()` in header '`Rmath.h`' is now formally deprecated: use `fround()` directly.
- Remapping of `prec()` and `trunc()` in the '`Rmath.h`' header has been disabled in C++ code (it has caused breakage with `libc++` headers).

BUG FIXES:

- `getParseData()` truncated the imaginary part of complex number constants. (Reported by Yihui Xie.)
- `dbeta(x, a, b)` with `a` or `b` within a factor of 2 of the largest representable number could infinite-loop. (Reported by Ioannis Kosmidis.)
- `provideDimnames()` failed for arrays with a 0 dimension. (PR#15465)
- `rbind()` and `cbind()` did not handle list objects correctly. (PR#15468)
- `replayPlot()` now checks if it is replaying a plot from the same session.
- `rasterImage()` and `grid.raster()` now give error on an empty (zero-length) raster. (Reported by Ben North.)
- `plot.lm()` would sometimes scramble the labels in plot type 5. (PR#15458 and PR#14837)
- `min()` did not handle `NA_character_` values properly. (Reported by Magnus Thor Torfason.)
- (Windows only.) `readRegistry()` would duplicate default values for keys. (PR#15455)
- `str(..., strict.width = "cut")` did not handle it properly when more than one line needed to be cut. (Reported by Gerrit Eichner.)
- Removing subclass back-references when S4 classes were removed or their namespace unloaded had several bugs (e.g., PR#15481).
- `aggregate()` could fail when there were too many levels present in the `by` argument. (PR#15004)
- `namespaceImportFrom()` needed to detect primitive functions when checking for duplicated imports (reported by Karl Forner).
- `getGraphicsEvent()` did not exit when a user closed the graphics window. (PR#15208)
- Errors in vignettes were not always captured and displayed properly. (PR#15495)
- `contour()` could fail when dealing with extremely small z values. (PR#15454)
- Several functions did not handle zero-length vectors properly, including `browseEnv()`, `format()`, `gl()`, `relist()` and `summary.data.frame()`. (E.g., PR#15499)
- `Sweave()` did not restore the R output to the console if it was interrupted by a user in the middle of evaluating a code chunk. (Reported by Michael Sumner.)
- Fake installs of packages with vignettes work again.
- Illegal characters in the input caused `parse()` (and thus `source()`) to segfault. (PR#15518)
- The nonsensical use of `nmax = 1` in `duplicated()` or `unique()` is now silently ignored.
- `qcauchy(p, *)` is now fully accurate even when p is very close to 1. (PR#15521)

- The `validmu()` and `valideta()` functions in the standard `glm()` families now also report non-finite values, rather than failing.
- Saved vignette results (in a '`.Rout.save`' file) were not being compared to the new ones during `R CMD check`.
- Double-clicking outside of the list box (e.g., on the scrollbar) of a Tk listbox widget generated by `tk_select.list()` no longer causes the window to close. (PR#15407)
- Improved handling of edge cases in `parallel::splitindices()`. (PR#15552)
- HTML display of results from `help.search()` and `??` sometimes contained badly constructed links.
- `c()` and related functions such as `unlist()` converted raw vectors to invalid logical vectors. (PR#15535)
- (Windows only) When a call to `system2()` specified one of `stdin`, `stdout` or `stderr` to be a file, but the command was not found (e.g., it contained its arguments, or the program was not on the `PATH`), it left the file open and unusable until R terminated. (Reported by Mathew McLean.)
- The `bmp()` device was not recording `res = NA` correctly: it is now recorded as 72 ppi.
- Several potential problems with compiler-specific behaviour have been identified using the 'Undefined Behaviour Sanitizer' in conjunction with the `clang` compiler.
- `hcl()` now honours `NA` inputs (previously they were mapped to black).
- Some translations in base packages were being looked up in the main catalog rather than that for the package.
- As a result of the 3.0.2 change about 'the last second before the epoch', most conversions which should have given `NA` returned that time. (The platforms affected include Linux and OS X, but not Windows nor Solaris.)
- `rowsum()` has more support for matrices and data frames with 2^{31} or more elements. (PR#15587)
- `predict(<lm object>, interval = "confidence", scale = <something>)` now works. (PR#15564)
- The bug fix in 3.0.2 for PR#15411 was too aggressive, and sometimes removed spaces that should not have been removed. (PR#15583)
- Running R code in a **tcltk** callback failed to set the busy flag, which will be needed to tell OS X not to 'App Nap'.
- The code for date-times before 1902 assumed that the offset from GMT in 1902 was a whole number of minutes: that was not true of Paris (as recorded on some platforms).
- Using `Sys.setlocale` to set `LC_NUMERIC` to `"C"` (to restore the sane behavior) no longer gives a warning.
- `deparse()` now deparses complex vectors in a way that re-parses to the original values. (PR#15534, patch based on code submitted by Alex Bertram.)
- In some extreme cases (more than 10^{15}) integer inputs to `dpqrxxx()` functions might have been rounded up by one (with a warning about being non-integer). (PR#15624)
- Plotting symbol `pch = 14` had the triangle upside down on some devices (typically screen devices). The triangle is supposed to be point up. (Reported by Bill Venables.)
- `getSrcref()` did not work on method definitions if `rematchDefinition()` had been used.
- `KalmanForecast(fast = FALSE)` reported a (harmless) stack imbalance.
- The count of observations used by `KalmanRun()` did not take missing values into account.
- In locales where the abbreviated name of one month is a partial match for the full name of a later one, the `%B` format in `strptime()` could fail. An example was French

on OS X, where 'juin' is abbreviated to 'jui' and partially matches juillet. Similarly for weekday names.

- pbeta(x, a, b, log.p = TRUE) sometimes underflowed to zero for very small and very differently sized a, b. (PR#15641)
- approx() and approxfun() now handle infinite values with the "constant" method. (PR#15655)
- stripchart() again respects reversed limits in xlim and ylim. (PR#15664)

CHANGES IN R 3.0.2

NEW FEATURES:

- The 'NEWS' files have been re-organized.
  This file contains news for R >= 3.0.0: news for the 0.x.y, 1.x.y and 2.x.y releases is in files 'NEWS.0', 'NEWS.1' and 'NEWS.2'. The latter files are now installed when R is installed. An HTML version of news from 2.10.0 to 2.15.3 is available as 'doc/html/NEWS.2.html'.
- sum() for integer arguments now uses an integer accumulator of at least 64 bits and so will be more accurate in the very rare case that a cumulative sum exceeds 2^{53} (necessarily summing more than 4 million elements).
- The example() and tools::Rd2ex() functions now have parameters to allow them to ignore \dontrun markup in examples. (Suggested by Peter Solymos.)
- str(x) is considerably faster for very large lists, or factors with 100,000 levels, the latter as in PR#15337.
- col2rgb() now converts factors to character strings not integer codes (suggested by Bryan Hanson).
- tail(warnings()) now works, via the new `[` method.
- There is now support for the LaTeX style file 'zi4.sty' which has in some distributions replaced 'inconsolata.sty'.
- unlist(x) now typically returns all non-list xs unchanged, not just the "vector" ones. Consequently, format(lst) now also works when the list lst has non-vector elements.
- The tools::getVignetteInfo() function has been added to give information about installed vignettes.
- New assertCondition(), etc. utilities in **tools**, useful for testing.
- Profiling now records non-inlined calls from byte-compiled code to BUILTIN functions.
- Various functions in **stats** and elsewhere that use non-standard evaluation are now more careful to follow the namespace scoping rules. E.g., stats::lm() can now find stats::model.frame() even if **stats** is not on the search path or if some package defines a function of that name.
- If an invalid/corrupt .Random.seed object is encountered in the workspace it is ignored with a warning rather than giving an error. (This allows R itself to rely on a working RNG, e.g. to choose a random port.)
- seq() and seq.int() give more explicit error messages if called with invalid (e.g., NaN) inputs.
- When parse() finds a syntax error, it now makes partial parse information available up to the location of the error. (Request of Reijo Sund.)
- Methods invoked by NextMethod() had a different dynamic parent to the generic. This was causing trouble where S3 methods invoked via lazy evaluation could lose track of their generic. (PR#15267)

- Code for the negative binomial distribution now treats the case `size == 0` as a one-point distribution at zero.
- `abbreviate()` handles without warning non-ASCII input strings which require no abbreviation.
- `read.dcf()` no longer has a limit of 8191 bytes per line. (Wish of PR#15250.)
- `formatC(x)` no longer copies the class of `x` to the result, to avoid misuse creating invalid objects as in PR#15303. A warning is given if a class is discarded.
- Dataset `npk` has been copied from **MASS** to allow more tests to be run without recommended packages being installed.
- The initialization of the regression coefficients for non-degenerate differenced models in `arima()` has been changed and in some examples avoids a local maximum. (PR#15396)
- `termplot()` now has an argument `transform.x` to control the display of individual terms in the plot. (PR#15329)
- `format()` now supports `digits = 0`, to display `nsmall` decimal places.
- There is a new read-only `par()` parameter called `"page"`, which returns a logical value indicating whether the next `plot.new()` call will start a new page.
- Processing Sweave and Rd documents to PDF now renders backticks and single quotes better in several instances, including in '`\code`' and '`\samp`' expressions.
- `utils::modifyList()` gets a new argument `keep.null` allowing `NULL` components in the replacement to be retained, instead of causing corresponding components to be deleted.
- `tools::pkgVignettes()` gains argument `check`; if set to `TRUE`, it will warn when it appears a vignette requests a non-existent vignette engine.

UTILITIES:

- `R CMD check --as-cran` checks the line widths in usage and examples sections of the package Rd files.
- `R CMD check --as-cran` now implies '`--timings`'.
- `R CMD check` looks for command `gfile` if a suitable `file` is not found. (Although `file` is not from GNU, OpenCSW on Solaris installs it as `gfile`.)
- `R CMD build` (with the internal `tar`) checks the permissions of '`configure`' and '`cleanup`' files and adds execute permission to the recorded permissions for these files if needed, with a warning. This is useful on OSes and file systems which do not support execute permissions (notably, on Windows).
- `R CMD build` now weaves and tangles all vignettes, so suggested packages are not required during package installation if the source tarball was prepared with current `R CMD build`.
- `checkFF()` (used by `R CMD check`) does a better job of detecting calls from other packages, including not reporting those where a function has been copied from another namespace (e.g., as a default method). It now reports calls where `.NAME` is a symbol registered in another package.
- On Unix-alike systems, `R CMD INSTALL` now installs packages group writably whenever the library (`lib.loc`) is group writable. Hence, `update.packages()` works for other group members (suggested originally and from a patch by Dirk Eddelbuettel).
- `R CMD javareconf` now supports the use of symbolic links for `JAVA_HOME` on platforms which have `realpath`. So it is now possible to use

  ```
  R CMD javareconf JAVA_HOME=/usr/lib/jvm/java-1.7.0
  ```

  on a Linux system and record that value rather than the frequently-changing full path such as '`/usr/lib/jvm/java-1.7.0-openjdk-1.7.0.25.x86_64`'.

- (Windows only.) `Rscript -e` requires a non-empty argument for consistency with Unix versions of R. (Also `Rterm -e` and `R -e`.)
- `R CMD check` does more thorough checking of declared packages and namespaces. It reports
  - packages declared in more than one of the '`Depends`', '`Imports`', '`Suggests`' and '`Enhances`' fields of the '`DESCRIPTION`' file.
  - namespaces declared in '`Imports`' but not imported from, neither in the '`NAMESPACE`' file nor using the `::` nor `:::` operators.
  - packages which are used in `library()` or `requires()` calls in the R code but were already put on the search path *via* '`Depends`'.
  - packages declared in '`Depends`' not imported *via* the '`NAMESPACE`' file (except the standard packages). Objects used from '`Depends`' packages should be imported to avoid conflicts and to allow correct operation when the namespace is loaded but not attached.
  - objects imported *via* `:::` calls where `::` would do.
  - objects imported by `::` which are not exported.
  - objects imported by `:::` calls which do not exist.

  See 'Writing R Extensions' for good practice.
- `R CMD check` optionally checks for non-standard top-level files and directories (which are often mistakes): this is enabled for '`--as-cran`'.
- LaTeX style file `upquote.sty` is no longer included (the version was several years old): it is no longer used in R. A much later version is commonly included in LaTeX distributions but does not play well with the `ae` fonts which are the default for Sweave vignettes.
- `R CMD build` makes more use of the '`build`' sub-directory of package sources, for example to record information about the vignettes.
- `R CMD check` analyses `:::` calls.

INSTALLATION and INCLUDED SOFTWARE:

- The macros used for the texinfo manuals have been changed to work better with the incompatible changes made in `texinfo 5.x`.
- The minimum version for a system `xz` library is now 5.0.3 (was 4.999). This is in part to avoid 5.0.2, which can compress in ways other versions cannot decompress.
- The included version of PCRE has been updated to 8.33.
- The included version of `zlib` has been updated to 1.2.8, a bug-fix release.
- The included version of xz utils's `liblzma` has been updated to 5.0.5.
- Since `javareconf` (see above) is used when R is installed, a stable link for `JAVA_HOME` can be supplied then.
- Configuring with '`--disable-byte-compilation`' will override the '`DESCRIPTION`' files of recommended packages, which typically require byte-compilation.
- More of the installation and checking process will work even when `TMPDIR` is set to a path containing spaces, but this is not recommended and external software (such as `texi2dvi`) may fail.

PACKAGE INSTALLATION:

- Installation is aborted immediately if a `LinkingTo` package is not installed.
- `R CMD INSTALL` has a new option `--no-byte-compile` which will override a '`ByteCompile`' field in the package's '`DESCRIPTION`' file.

- License 'BSD' is deprecated: use 'BSD_3_clause' or 'BSD_2_clause' instead.
  License 'X11' is deprecated: use 'MIT' or 'BSD_2_clause' instead.
- Version requirements for LinkingTo packages are now recognized: they are checked at installation. (Fields with version requirements were previously silently ignored.)
- The limit of 500 S3method entries in a NAMESPACE file has been removed.
- The default 'version' of Bioconductor for its packages has been changed to the upcoming '2.13', but this can be set by the environment variable R_BIOC_VERSION when R is installed.

C-LEVEL FACILITIES:

- 'Rdefines.h' has been tweaked so it can be included in C++ code after 'R_ext/Boolean.h' (which is included by 'R.h').
  Note that 'Rdefines.h' is not kept up-to-date, and 'Rinternals.h' is preferred for new code.
- eval and applyClosure are now protected against package code supplying an invalid rho.

DEPRECATED AND DEFUNCT:

- The unused namespace argument to package.skeleton() is now formally deprecated and will be removed in R 3.1.0.
- plclust() is deprecated: use the plot() method for class "hclust" instead.
- Functions readNEWS() and checkNEWS() in package **tools** are deprecated (and they have not worked with current 'NEWS' files for a long time).

DOCUMENTATION:

- 'An Introduction to R' has a new chapter on using R as a scripting language including interacting with the OS.

BUG FIXES:

- help.request() could not determine the current version of R on CRAN. (PR#15241)
- On Windows, file.info() failed on root directories unless the path was terminated with an explicit ".". (PR#15302)
- The regmatches<-() replacement function mishandled results coming from regexpr(). (PR#15311)
- The help for setClass() and representation() still suggested the deprecated argument representation=. (PR#15312)
- R CMD config failed in an installed build of R 3.0.1 (only) when a sub-architecture was used. (Reported by Berwin Turlach.)
- On Windows, the installer modified the 'etc/Rconsole' and 'etc/Rprofile.site' files even when default options were chosen, so the MD5 sums did not refer to the installed versions. (Reported by Tal Galili.)
- plot(hclust(), cex =) respects cex again (and possibly others similarly). (Reported by Peter Langfelder.)
- If multiple packages were checked by R CMD check, and one was written for a different OS, it would set --no-install for all following packages as well as itself.
- qr.coef() and related functions did not properly coerce real vectors to complex when necessary. (PR#15332)
- ftable(a) now fixes up empty dimnames such that the result is printable.
- package.skeleton() was not starting its search for function objects in the correct place if environment was supplied. (Reported by Karl Forner.)

- Parsing code was changing the length field of vectors and confusing the memory manager. (PR#15345)
- The Fortran routine `ZHER2K` in the reference BLAS had a comment-out bug in two places. This caused trouble with `eigen()` for Hermitian matrices. (PR#15345 and report from Robin Hankin)
- `vignette()` and `browseVignettes()` did not display non-Sweave vignettes properly.
- Two warning/error messages have been corrected: the (optional) warning produced by a partial name match with a pairlist, the error message from a zero-length argument to the `:` operator. (Found by Radford Neal; PR#15358, PR#15356)
- `svd()` returned `NULL` rather than omitting components as documented. (Found by Radford Neal; PR#15360)
- `mclapply()` and `mcparallel()` with `silent = TRUE` could break a process that uses `stdout` output unguarded against broken pipes (e.g., `zip` will fail silently). To work around such issues, they now replace `stdout` with a descriptor pointed to '`/dev/null`' instead. For this purpose, internal `closeStdout` and `closeStderr` functions have gained the `to.null` flag.
- `log()`, `signif()` and `round()` now raise an error if a single named argument is not named `x`. (PR#15361)
- `deparse()` now deparses raw vectors in a form that is syntactically correct. (PR#15369)
- The `jpeg` driver in Sweave created a JPEG file, but gave it a '`.png`' extension. (PR#15370)
- Deparsing of infix operators with named arguments is improved. (PR#15350)
- `mget()`, `seq.int()` and `numericDeriv()` did not duplicate arguments properly. (PR#15352, PR#15353, PR#15354)
- `kmeans(algorithm = "Hartigan-Wong")` now always stops iterating in the QTran stage. (PR#15364).
- `read.dcf()` re-allocated incorrectly and so could segfault when called on a file with lines of more than 100 bytes.
- On systems where `mktime()` does not set `errno`, the last second before the epoch could not be converted from `POSIXlt` to `POSIXct`. (Reported by Bill Dunlap.)
- `add1.glm()` miscalculated F-statistics when df > 1. (Bill Dunlap, PR#15386).
- `stem()` now discards infinite inputs rather than hanging. (PR#15376)
- The parser now enforces C99 syntax for floating point hexadecimal constants (e.g., `0x1.1p0`), rather than returning unintended values for malformed constants. (PR#15234)
- `model.matrix()` now works with very long LHS names (more than 500 bytes). (PR#15377)
- `integrate()` reverts to the pre-2.12.0 behaviour: from 2.12.0 to 3.0.1 it sometimes failed to achieve the requested tolerance and reported error estimates that were exceeded. (PR#15219)
- `strptime()` now handles '`%W`' fields with value 0. (PR#15915)
- R is now better protected against people trying to interact with the console in startup code. (PR#15325)
- Subsetting 1D arrays often lost dimnames (PR#15301).
- Unary `+` on a logical vector did not coerce to integer, although unary `-` did.
- `na.omit()` and `na.exclude()` added a row to a zero-row data frame. (PR#15399)
- All the (where necessary cut-down) vignettes are installed if R was configured with '`--without-recommended-packages`'.

- `source()` did not display filenames when reporting syntax errors.
- Syntax error reports misplaced the caret pointing out the bad token.
- (Windows only) Starting R with `R` (instead of `Rterm` or `Rgui`) would lose any zero-length strings from the command line arguments. (PR#15406)
- Errors in the encoding specified on the command line via `--encoding=foo` were not handled properly. (PR#15405)
- If `x` is a symbol, `is.vector(x, "name")` now returns `TRUE`, since `"name"` and `"symbol"` should be synonyms. (Reported by Hervé Pagès.)
- `R CMD rtags` works on platforms (such as OS X) with a XSI-conformant shell command `echo`. (PR#15231)
- `is.unsorted(NA)` returns false as documented (rather than `NA`).
- `R CMD LINK` did not know about sub-architectures.
- `system()` and `system2()` are better protected against users who misguidedly have spaces in the temporary directory path.
- `file.show()` and `edit()` are now more likely to work on file paths containing spaces. (Where external utilities are used, not the norm on Windows nor in `R.app` which should previously have worked.)
- Packages using the **methods** package are more likely to work when they import it but it is not attached. (Several parts of its C code were looking for its R functions on the search path rather than in its namespace.)
- `lgamma(-x)` is no longer `NaN` for very small x.
- (Windows) `system2()` now respects specifying `stdout` and `stderr` as files if called from `Rgui`. (PR#15393)
- Closing an `x11()` device whilst `locator()` or `identify()` is in progress no longer hangs R. (PR#15253)
- `list.dirs(full.names = FALSE)` was not implemented. (PR#15170)
- `format()` sometimes added unnecessary spaces. (PR#15411)
- `all.equal(check.names = FALSE)` would ignore the request to ignore the names and would check them as attributes.
- The symbol set by `tools::Rd2txt_options(itemBullet=)` was not respected in some locales. (PR#15435)
- `mcMap()` was not exported by package **parallel**. (PR#15439)
- `plot()` for `TukeyHSD` objects did not balance `dev.hold()` and `dev.flush()` calls on multi-page plots. (PR#15449)

CHANGES IN R 3.0.1

NEW FEATURES:

- `chooseCRANmirror()` and `chooseBioCmirror()` gain an `ind` argument (like `setRepositories()`).
- `mcparallel` has a new argument `mc.interactive` which can modify the interactive flag in the child process. The new default is `FALSE` which makes child processes non-interactive by default (this prevents lock-ups due to children waiting for interactive input).
- `scan()` now warns when end-of-file occurs within a quoted string.
- `count.fields()` is now consistent with `scan()` in its handling of newlines in quoted strings. Instead of triggering an error, this results in the current line receiving `NA` as the field count, with the next line getting the total count of the two lines.

- The default method of `image()` will plot axes of the class of `xlim` and `ylim` (and hence of `x` and `y` if there is a suitable `range()` method). Based on a suggestion of Michael Sumner.
- `load()` now has a `verbose` argument for debugging support, to print the names of objects just before loading them.
- When loading a serialized object encounters a reference to a namespace which cannot be loaded, this is replaced by a reference to the global environment, with a warning.
- `pairs()` gains a `line.main` option for title placement.
- The remaining instances in which serialization to a raw vector was limited to 2GB have been unlimited on a 64-bit platform, and in most cases serialization to a vector of more than 1GB will be substantially faster.

UTILITIES:

- `R CMD config` now make use of personal '`Makevars`' files under '`~/.R`' and a site file '`Makevars.site`', in the same way as `R CMD SHLIB` and `R CMD INSTALL`. This makes the utility more useful in package `configure` scripts.
  On Windows finding the personal files may require the environment variable `HOME` set. The old behaviour can be obtained with the new options '`--no-user-files`' and '`--no-site-files`'.

PACKAGE INSTALLATION:

- Alternatives to the site and user customization files '`Makevars.site`' and '`~/.R/Makevars`' can be specified *via* the environment variables `R_MAKEVARS_SITE` and `R_MAKEVARS_USER` respectively. These can be used to suppress the use of the default files by setting an empty value (where possible) or a non-existent path.

BUG FIXES:

- `sys.source()` did not report error locations when `keep.source = TRUE`.
- `as.POSIXct.numeric` was coercing `origin` using the `tz` argument and not `"GMT"` as documented (PR#14973).
- The active binding to assign fields in reference classes has been cleaned up to reduce dependence on the class' package environment, also fixing bug in initializing read-only fields (inspired by a report from Hadley Wickham).
- `str(d)` no longer gives an error when `names(d)` contain illegal multibyte strings (PR#15247).
- Profiling of built-in functions with `line.profiling=TRUE` did not record the line from which they were called.
- `citation(pkg)` dropped the header and footer specified in the '`CITATION`' file (PR#15257).
- Quotes were handled differently when reading the first line and reading the rest, so `read.table()` misread some files that contained quote characters (PR#15245).
- `cat()` with `sep` a character vector of length greater than one and more than one argument was using separators inconsistently (PR#15261).
- On Windows in R 3.0.0, `savePlot()` failed because of an incorrect check on the argument count.
- `unzip(list = TRUE)` returned `Names` as a factor and not a character vector (as documented) for the internal method. (Noticed by Sean O'Riordain.)
- `contourLines()` now checks more comprehensively for conformance of its `x`, `y` and `z` arguments (it was used incorrectly in package **R2G2**).

- Saved graphics display lists are R version-specific. Attempting to load workspaces containing them (or some other version-specific objects) aborted the load in R 3.0.0 and earlier; now it does a partial load and generates a warning instead.
- In R 3.0.0, `identify()` and `locator()` did not record information correctly, so replaying a graph (e.g., by copying it to another device) would fail. (PR#15271)
- Calling `file.copy()` or `dirname()` with the invalid input `""` (which was being used in packages, despite not being a file path) could have caused a segfault.
  `dirname("")` is now `""` rather than `"."` (unless it segfaulted).
- `supsmu()` could read/write outside its input vectors for very short inputs (seen in package **rms** for `n = 4`).
- `as.dendrogram()`'s `hclust` method uses less memory and hence gets considerably faster for large (n ~ 1000) clusterings, thanks to Daniel Müllner. (PR#15174)
- The return value when all workers failed from `parallel::mclapply(mc.preschedule = TRUE)` was a list of strings and not of error objects. (Spotted by Karl Forner and Bernd Bischl.)
- In R 3.0.0, when `help()` found multiple pages with the same alias, the HTML display of all the selections was not produced. (PR#15282)
- `splinefun(method="monoH.FC")` now produces a function with first argument named `x` and allows `deriv=3`, as documented. (PR#15273)
- `summaryRprof()` would only read the first `chunksize` lines of an `Rprof` file produced with `line.profiling=TRUE`. By default, this is the first 100 seconds. (PR#15288)
- `lsfit()` produced an incorrect error message when argument `x` had more columns than rows or `x` had a different number of rows than `y`. (Spotted by Renaud Gaujoux.)
- Binary operations on equal length vectors copied the class name from the second operand when the first had no class name, but did not set the object bit. (PR#15299)
- The `trace()` method for reference generator objects failed after those objects became function definitions.
- `write.table()` did not check that factors were constructed correctly, and so caused a segment fault when writing bad ones. (PR#15300)
- The internal HTTP server no longer chokes on POST requests without body. It will also pass-through other request types for custom handlers (with the method stored in Request-Method header) instead of failing.

CHANGES IN R 3.0.0

SIGNIFICANT USER-VISIBLE CHANGES:

- Packages need to be (re-)installed under this version (3.0.0) of R.
- There is a subtle change in behaviour for numeric index values 2^{31} and larger. These never used to be legitimate and so were treated as `NA`, sometimes with a warning. They are now legal for long vectors so there is no longer a warning, and `x[2^31] <- y` will now extend the vector on a 64-bit platform and give an error on a 32-bit one.
- It is now possible for 64-bit builds to allocate amounts of memory limited only by the OS. It may be wise to use OS facilities (e.g., `ulimit` in a `bash` shell, `limit` in `csh`), to set limits on overall memory consumption of an R process, particularly in a multi-user environment. A number of packages need a limit of at least 4GB of virtual memory to load.
  64-bit Windows builds of R are by default limited in memory usage to the amount of RAM installed: this limit can be changed by command-line option '`--max-mem-size`' or setting environment variable `R_MAX_MEM_SIZE`.

- Negative numbers for colours are consistently an error: previously they were sometimes taken as transparent, sometimes mapped into the current palette and sometimes an error.

NEW FEATURES:

- `identical()` has a new argument, `ignore.environment`, used when comparing functions (with default `FALSE` as before).
- There is a new option, `options(CBoundsCheck=)`, which controls how `.C()` and `.Fortran()` pass arguments to compiled code. If true (which can be enabled by setting the environment variable `R_C_BOUNDS_CHECK` to '`yes`'), raw, integer, double and complex arguments are always copied, and checked for writing off either end of the array on return from the compiled code (when a second copy is made). This also checks individual elements of character vectors passed to `.C()`.
  This is not intended for routine use, but can be very helpful in finding segfaults in package code.
- In `layout()`, the limits on the grid size have been raised (again).
- New simple `provideDimnames()` utility function.
- Where methods for `length()` return a double value which is representable as an integer (as often happens for package **Matrix**), this is converted to an integer.
- Matrix indexing of data frames by two-column numeric indices is now supported for replacement as well as extraction.
- `setNames()` now has a default for its `object` argument, useful for a character result.
- `StructTS()` has a revised additive constant in the `loglik` component of the result: the previous definition is returned as the `loglik0` component. However, the help page has always warned of a lack of comparability of log-likelihoods for non-stationary models. (Suggested by Jouni Helske.)
- The logic in `aggregate.formula()` has been revised. It is now possible to use a formula stored in a variable; previously, it had to be given explicitly in the function call.
- `install.packages()` has a new argument `quiet` to reduce the amount of output shown.
- Setting an element of the graphics argument `lwd` to a negative or infinite value is now an error. Lines corresponding to elements with values `NA` or `NaN` are silently omitted. Previously the behaviour was device-dependent.
- Setting graphical parameters `cex`, `col`, `lty`, `lwd` and `pch` in `par()` now requires a length-one argument. Previously some silently took the first element of a longer vector, but not always when documented to do so.
- `Sys.which()` when used with inputs which would be unsafe in a shell (e.g., absolute paths containing spaces) now uses appropriate quoting.
- `as.tclObj()` has been extended to handle raw vectors. Previously, it only worked in the other direction. (Contributed by Charlie Friedemann, PR#14939.)
- New functions `cite()` and `citeNatbib()` have been added, to allow generation of in-text citations from `"bibentry"` objects. A `cite()` function may be added to `bibstyle()` environments.
- A `sort()` method has been added for `"bibentry"` objects.
- The `bibstyle()` function now defaults to setting the default bibliography style. The `getBibstyle()` function has been added to report the name of the current default style.
- `scatter.smooth()` now has an argument `lpars` to pass arguments to `lines()`.

- `pairs()` has a new `log` argument, to allow some or all variables to be plotted on logarithmic scale. (In part, wish of PR#14919.)
- `split()` gains a `sep` argument.
- `termplot()` does a better job when given a model with interactions (and no longer attempts to plot interaction terms).
- The parser now incorporates code from Romain Francois' **parser** package, to support more detailed computation on the code, such as syntax highlighting, comment-based documentation, etc. Functions `getParseData()` and `getParseText()` access the data.
- There is a new function `rep_len()` analogous to `rep.int()` for when speed is required (and names are not).
- The undocumented use `rep(NULL, length.out = n)` for `n > 0` (which returns `NULL`) now gives a warning.
- `demo()` gains an `encoding` argument for those packages with non-ASCII demos: it defaults to the package encoding where there is one.
- `strwrap()` converts inputs with a marked encoding to the current locale: previously it made some attempt to pass through as bytes inputs invalid in the current locale.
- Specifying both `rate` and `scale` to `[dpqr]gamma` is a warning (if they are essentially the same value) or an error.
- `merge()` works in more cases where the data frames include matrices. (Wish of PR#14974.)
- `optimize()` and `uniroot()` no longer use a shared parameter object across calls. (`nlm()`, `nlminb()` and `optim()` with numerical derivatives still do, as documented.)
- The `all.equal()` method for date-times is now documented: times are regarded as equal (by default) if they differ by up to 1 msec.
- `duplicated()` and `unique()` gain a `nmax` argument which can be used to make them much more efficient when it is known that there are only a small number of unique entries. This is done automatically for factors.
- Functions `rbinom()`, `rgeom()`, `rhyper()`, `rpois()`, `rnbinom()`, `rsignrank()` and `rwilcox()` now return integer (not double) vectors. This halves the storage requirements for large simulations.
- `sort()`, `sort.int()` and `sort.list()` now use radix sorting for factors of less than 100,000 levels when `method` is not supplied. So does `order()` if called with a single factor, unless `na.last = NA`.
- `diag()` as used to generate a diagonal matrix has been re-written in C for speed and less memory usage. It now forces the result to be numeric in the case `diag(x)` since it is said to have 'zero off-diagonal entries'.
- `backsolve()` (and `forwardsolve()`) are now internal functions, for speed and support for large matrices.
- More matrix algebra functions (e.g., `chol()` and `solve()`) accept logical matrices (and coerce to numeric).
- `sample.int()` has some support for $n \geq 2^{31}$: see its help for the limitations.
  A different algorithm is used for `(n, size, replace = FALSE,prob = NULL)` for `n > 1e7` and `size <= n/2`. This is much faster and uses less memory, but does give different results.
- `approxfun()` and `splinefun()` now return a wrapper to an internal function in the **stats** namespace rather than a `.C()` or `.Call()` call. This is more likely to work if the function is saved and used in a different session.
- The functions `.C()`, `.Call()`, `.External()` and `.Fortran()` now give an error (rather than a warning) if called with a named first argument.

- `Sweave()` by default now reports the locations in the source file(s) of each chunk.
- `clearPushBack()` is now a documented interface to a long-existing internal call.
- `aspell()` gains filters for R code, Debian Control Format and message catalog files, and support for R level dictionaries. In addition, package **utils** now provides functions `aspell_package_R_files()` and `aspell_package_C_files()` for spell checking R and C level message strings in packages.
- `bibentry()` gains some support for "incomplete" entries with a '`crossref`' field.
- `gray()` and `gray.colors()` finally allow `alpha` to be specified.
- `monthplot()` gains parameters to control the look of the reference lines. (Suggestion of Ian McLeod.)
- Added support for new `%~%` relation ("is distributed as") in plotmath.
- `domain = NA` is accepted by `gettext()` and `ngettext()`, analogously to `stop()` etc.
- `termplot()` gains a new argument `plot = FALSE` which returns information to allow the plots to be modified for use as part of other plots, but does not plot them. (Contributed by Terry Therneau, PR#15076.)
- `quartz.save()`, formerly an undocumented part of `R.app`, is now available to copy a device to a `quartz()` device. `dev.copy2pdf()` optionally does this for PDF output: `quartz.save()` defaults to PNG.
- The default method of `pairs()` now allows `text.panel = NULL` and the use of `<foo>.panel = NULL` is now documented.
- `setRefClass()` and `getRefClass()` now return class generator functions, similar to `setClass()`, but still with the reference fields and methods as before (suggestion of Romain Francois).
- New functions `bitwNot()`, `bitwAnd()`, `bitwOr()` and `bitwXor()`, using the internal interfaces previously used for classes `"octmode"` and `"hexmode"`.
  Also `bitwShiftL()` and `bitwShiftR()` for shifting bits in elements of integer vectors.
- New option `"deparse.cutoff"` to control the deparsing of language objects such as calls and formulae when printing. (Suggested by a comment of Sarah Goslee.)
- `colors()` gains an argument `distinct`.
- New `demo(colors)` and `demo(hclColors)`, with utility functions.
- `list.files()` (aka `dir()`) gains a new optional argument `no..` which allows to exclude `"."` and `".."` from listings.
- Multiple time series are also of class `"matrix"`; consequently, `head()`, e.g., is more useful.
- `encodeString()` preserves UTF-8 marked encodings. Thus if factor levels are marked as UTF-8 an attempt is made to print them in UTF-8 in `RGui` on Windows.
- `readLines()` and `scan()` (and hence `read.table()`) in a UTF-8 locale now discard a UTF-8 byte-order-mark (BOM). Such BOMs are allowed but not recommended by the Unicode Standard: however Microsoft applications can produce them and so they are sometimes found on websites.
  The encoding name `"UTF-8-BOM"` for a connection will ensure that a UTF-8 BOM is discarded.
- `mapply(FUN, a1, ..)` now also works when `a1` (or a further such argument) needs a `length()` method (which the documented arguments never do). (Requested by Hervé Pagès; with a patch.)
- `.onDetach()` is supported as an alternative to `.Last.lib`. Unlike `.Last.lib`, this does not need to be exported from the package's namespace.
- The `srcfile` argument to `parse()` may now be a character string, to be used in error messages.

- The `format()` method for `ftable` objects gains a `method` argument, propagated to `write.ftable()` and `print()`, allowing more compact output, notably for LaTeX formatting, thanks to Marius Hofert.
- The `utils::process.events()` function has been added to trigger immediate event handling.
- `Sys.which()` now returns `NA` (not `""`) for `NA` inputs (related to PR#15147).
- The `print()` method for class `"htest"` gives fewer trailing spaces (wish of PR#15124).
  Also print output from `HoltWinters()`, `nls()` and others.
- `loadNamespace()` allows a version specification to be given, and this is used to check version specifications given in the '`Imports`' field when a namespace is loaded.
- `setClass()` has a new argument, `slots`, clearer and less ambiguous than `representation`. It is recommended for future code, but should be back-compatible. At the same time, the allowed slot specification is slightly more general. See the documentation for details.
- `mget()` now has a default for `envir` (the frame from which it is called), for consistency with `get()` and `assign()`.
- `close()` now returns an integer status where available, invisibly. (Wish of PR#15088.)
- The internal method of `tar()` can now store paths too long for the '`ustar`' format, using the (widely supported) GNU extension. It can also store long link names, but these are much less widely supported. There is support for larger files, up to the '`ustar`' limit of 8GB.
- Local reference classes have been added to package **methods**. These are a technique for avoiding unneeded copying of large components of objects while retaining standard R functional behavior. See `?LocalReferenceClasses`.
- `untar()` has a new argument `restore_times` which if false (not the default) discards the times in the tarball. This is useful if they are incorrect (some tarballs submitted to CRAN have times in a local time zone or many years in the past even though the standard required them to be in UTC).
- `replayplot()` cannot (and will not attempt to) replay plots recorded under R < 3.0.0. It may crash the R session if an attempt is made to replay plots created in a different build of R >= 3.0.0.
- Palette changes get recorded on the display list, so replaying plots (including when resizing screen devices and using `dev.copy()`) will work better when the palette is changed during a plot.
- `chol(pivot = TRUE)` now defaults to LAPACK, not LINPACK.
- The `parse()` function has a new parameter `keep.source`, which defaults to `options("keep.source")`.
- Profiling via `Rprof()` now optionally records information at the statement level, not just the function level.
- The `Rprof()` function now quotes function names in in its output file on Windows, to be consistent with the quoting in Unix.
- Profiling via `Rprof()` now optionally records information about time spent in GC.
- The HTML help page for a package now displays non-vignette documentation files in a more accessible format.
- To support `options(stringsAsFactors = FALSE)`, `model.frame()`, `model.matrix()` and `replications()` now automatically convert character vectors to factors without a warning.

- The `print` method for objects of class `"table"` now detects tables with 0-extents and prints the results as, e.g., '`< table of extent 0 x 1 x 2 >`'. (Wish of PR#15198.)
- Deparsing involving calls to anonymous functions has been made closer to reversible by the addition of extra parentheses.
- The function `utils::packageName()` has been added as a lightweight version of `methods::getPackageName()`.
- `find.package(lib.loc = NULL)` now treats loaded namespaces preferentially in the same way as attached packages have been for a long time.
- In Windows, the Change Directory dialog now defaults to the current working directory, rather than to the last directory chosen in that dialog.
- `available.packages()` gains a `"license/restricts_use"` filter which retains only packages for which installation can proceed solely based on packages which are guaranteed not to restrict use.
- New `check_packages_in_dir()` function in package **tools** for conveniently checking source packages along with their reverse dependencies.
- R's completion mechanism has been improved to handle help requests (starting with a question mark). In particular, help prefixes are now supported, as well as quoted help topics. To support this, completion inside quotes are now handled by R by default on all platforms.
- The memory manager now allows the strategy used to balance garbage collection and memory growth to be controlled by setting the environment variable `R_GC_MEM_GROW`. See `?Memory` for more details.
- ('For experts only', as the introductory manual says.) The use of environment variables `R_NSIZE` and `R_VSIZE` to control the initial (= minimum) garbage collection trigger for number of cons cels and size of heap has been restored: they can be overridden by the command-line options `--min-nsize` and `--min-vsize`; see `?Memory`.
- On Windows, the device name for bitmap devices as reported by `.Device` and `.Devices` no longer includes the file name. This is for consistency with other platforms and was requested by the **lattice** maintainer.
  `win.metafile()` still uses the file name: the exact form is used by package **tkrplot**.
- `set.seed(NULL)` re-initializes `.Random.seed` as done at the beginning of the session if not already set. (Suggestion of Bill Dunlap.)
- The `breaks` argument in `hist.default()` can now be a function that returns the breakpoints to be used (previously it could only return the suggested number of breakpoints).
- File '`share/licenses/licenses.db`' has some clarifications, especially as to which variants of 'BSD' and 'MIT' is intended and how to apply them to packages. The problematic licence 'Artistic-1.0' has been removed.

LONG VECTORS: This section applies only to 64-bit platforms.

- There is support for vectors longer than $2^{31} - 1$ elements. This applies to raw, logical, integer, double, complex and character vectors, as well as lists. (Elements of character vectors remain limited to $2^{31} - 1$ bytes.)
- Most operations which can sensibly be done with long vectors work: others may return the error 'long vectors not supported yet'. Most of these are because they explicitly work with integer indices (e.g., `anyDuplicated()` and `match()`) or because other limits (e.g., of character strings or matrix dimensions) would be exceeded or the operations would be extremely slow.
- `length()` returns a double for long vectors, and lengths can be set to 2^{31} or more by the replacement function with a double value.

- Most aspects of indexing are available. Generally double-valued indices can be used to access elements beyond $2^{31} - 1$.
- There is some support for matrices and arrays with each dimension less than 2^{31} but total number of elements more than that. Only some aspects of matrix algebra work for such matrices, often taking a very long time. In other cases the underlying Fortran code has an unstated restriction (as was found for complex `svd()`).
- `dist()` can produce dissimilarity objects for more than 65536 rows (but for example `hclust()` cannot process such objects).
- `serialize()` to a raw vector is unlimited in size (except by resources).
- The C-level function `R_alloc` can now allocate 2^{35} or more bytes.
- `agrep()` and `grep()` will return double vectors of indices for long vector inputs.
- Many calls to `.C()` have been replaced by `.Call()` to allow long vectors to be supported (now or in the future). Regrettably several packages had copied the non-API `.C()` calls and so failed.
- `.C()` and `.Fortran()` do not accept long vector inputs. This is a precaution as it is very unlikely that existing code will have been written to handle long vectors (and the R wrappers often assume that `length(x)` is an integer).
- Most of the methods for `sort()` work for long vectors.
  `rank()`, `sort.list()` and `order()` support long vectors (slowly except for radix sorting).
- `sample()` can do uniform sampling from a long vector.

PERFORMANCE IMPROVEMENTS:

- More use has been made of R objects representing registered entry points, which is more efficient as the address is provided by the loader once only when the package is loaded.
  This has been done for packages `base`, `methods`, `splines` and `tcltk`: it was already in place for the other standard packages.
  Since these entry points are always accessed by the R entry points they do not need to be in the load table which can be substantially smaller and hence searched faster. This does mean that `.C` / `.Fortran` / `.Call` calls copied from earlier versions of R may no longer work – but they were never part of the API.
- Many `.Call()` calls in package **base** have been migrated to `.Internal()` calls.
- `solve()` makes fewer copies, especially when `b` is a vector rather than a matrix.
- `eigen()` makes fewer copies if the input has dimnames.
- Most of the linear algebra functions make fewer copies when the input(s) are not double (e.g., integer or logical).
- A foreign function call (`.C()` etc) in a package without a `PACKAGE` argument will only look in the first DLL specified in the '`NAMESPACE`' file of the package rather than searching all loaded DLLs. A few packages needed `PACKAGE` arguments added.
- The `@<-` operator is now implemented as a primitive, which should reduce some copying of objects when used. Note that the operator object must now be in package **base**: do not try to import it explicitly from package **methods**.

PACKAGE INSTALLATION:

- The transitional support for installing packages without namespaces (required since R 2.14.0) has been removed. `R CMD build` will still add a namespace, but a `.First.lib()` function will need to be converted.
  `R CMD INSTALL` no longer adds a namespace (so installation will fail), and a `.First.lib()` function in a package will be ignored (with an installation warning for now).

As an exception, packages without a 'R' directory and no 'NAMESPACE' file can still be installed.

- Packages can specify in their 'DESCRIPTION file' a line like

  ```
  Biarch: yes
  ```

  to be installed on Windows with '--force-biarch'.
- Package vignettes can now be processed by other engines besides Sweave; see 'Writing R Extensions' and the tools::vignetteEngine help topic for details.
- The '*.R' tangled source code for vignettes is now included in tarballs when R CMD build is used to produce them. In R 3.0.0, '*.R' files not in the sources will be produced at install time, but eventually this will be dropped.
- The package type "mac.binary" now looks in a path in the repository without any Mac subtype (which used to be 'universal' or 'leopard'): it looks in 'bin/macosx/contrib/3.0' rather than 'bin/macosx/leopard/contrib/2.15'). This is the type used for the CRAN binary distribution for OS X as from R 3.0.0.
- File 'etc/Makeconf' makes more use of the macros $(CC), $(CXX), $(F77) and $(FC), so the compiler in use can be changed by setting just these (and if necessary the corresponding flags and FLIBS) in file '~/.R/Makevars'.
  This is convenient for those working with binary distributions of R, e.g. on OS X.

UTILITIES:

- R CMD check now gives a warning rather than a note if it finds calls to abort, assert or exit in compiled code, and has been able to find the '.o' file in which the calls occur.
  Such calls can terminate the R process which loads the package.
- The location of the build and check environment files can now be specified by the environment variables R_BUILD_ENVIRON and R_CHECK_ENVIRON, respectively.
- R CMD Sweave gains a '--compact' option to control possibly reducing the size of the PDF file it creates when '--pdf' is given.
- R CMD build now omits Eclipse's '.metadata' directories, and R CMD check warns if it finds them.
- R CMD check now does some checks on functions defined within reference classes, including of .Call() etc calls.
- R CMD check --as-cran notes assignments to the global environment, calls to data() which load into the global environment, and calls to attach().
- R CMD build by default uses the internal method of tar() to prepare the tarball. This is more likely to produce a tarball compatible with R CMD INSTALL and R CMD check: an external tar program, including options, can be specified *via* the environment variable R_BUILD_TAR.
- tools::massageExamples() is better protected against packages which re-define base functions such as cat() and get() and so can cause R CMD check to fail when checking examples.
- R CMD javareconf has been enhanced to be more similar to the code used by configure.
  There is now a test that a JNI program can be compiled (like configure did) and only working settings are used.
  It makes use of custom settings from configuration recorded in 'etc/javaconf'.
- The '--no-vignettes' argument of R CMD build has been renamed to the more accurate '--no-build-vignettes': its action has always been to (re)build vignettes and never omitted them.
  R CMD check accepts '--no-build-vignettes' as a preferred synonym for '--no-rebuild-vignettes'.

DEPRECATED AND DEFUNCT:

- The `ENCODING` argument to `.C()` is defunct. Use `iconv()` instead.
- The `.Internal(eval.with.vis)` non-API function has been removed.
- Support for the converters for use with `.C()` has been removed, including the oft misused non-API header '`R_ext/RConverters.h`'.
- The previously deprecated uses of `array()` with a 0-length `dim` argument and `tapply()` with a 0-length `INDEX` list are now errors.
- '`Translation`' packages are defunct.
- Calling `rep()` or `rep.int()` on a pairlist or other non-vector object is now an error.
- Several non-API entry points have been transferred to packages (e.g., `R_zeroin2`) or replaced by different non-API entry points (e.g., `R_tabulate`).
- The 'internal' graphics device invoked by `.Call("R_GD_nullDevice", package = "grDevices")` has been removed: use `pdf(file = NULL)` instead.
- The `.Fortran()` entry point `"dqrls"` which has not been used by R since version 2.15.1 is no longer available.
- Functions `traceOn()` and `traceOff()` in package **methods** are now defunct.
- Function `CRAN.packages()` is finally defunct.
- Use of `col2rgb(0)` is defunct: use `par("bg")` or `NA` instead.
- The long-defunct functions `Rd_parse()`, `anovalist.lm()`, `categpry()`, `clearNames()`, `gammaCody()`, `glm.fit.null()`, `lm.fit.null()`, `lm.wfit.null()`, `manglePackageNames()`, `mauchley.test()`, `package.contents()`, `print.coefmat()`, `reshapeLong()`, `reshapeWide()`, `tkclose()`, `tkcmd()`, `tkfile.dir()`, `tkfile.tail()`, `tkopen()`, `tkputs()`, `tkread()`, `trySilent()` and `zip.file.extract()` have been removed entirely (but are still documented in the help system).
- The unused `dataPath` argument to `attachNamespace()` has been removed.
- `grid.prompt()` has been removed: use `devAskNewPage()` instead.
- The long-deprecated `intensities` component is no longer returned by `hist()`.
- `mean()` for data frames and `sd()` for data frames and matrices are defunct.
- `chol(pivot = FALSE, LINPACK = TRUE)`, `ch2inv(LINPACK = TRUE)`, `eigen(EISPACK = TRUE)`, `solve(LINPACK = TRUE)` and `svd(LINPACK = TRUE)` are defunct: LAPACK will be used, with a warning.
- The `keep.source` argument to `library()` and `require()` is defunct. This option needs to be set at install time.
- Documentation for `real()`, `as.real()` and `is.real()` has been moved to 'defunct' and the functions removed.
- The `maxRasters` argument of `pdf()` (unused since R 2.14.0) has been removed.
- The unused `fontsmooth` argument has been removed from the `quartz()` device.
- All the (non-API) EISPACK entry points in R have been removed.
- `chol(pivot = TRUE, LINPACK = TRUE)` is deprecated.
- The long-deprecated use of `\synopsis` in the '`Usage`' section of '`.Rd`' files will be removed in R 3.1.0.
- `.find.package()` and `.path.package()` are deprecated: only the public versions without the dot have ever been in the API.
- In a package's '`DESCRIPTION`' file,

  ```
  License: X11
  ```

  is deprecated, since it includes 'Copyright (C) 1996 X Consortium' which cannot be appropriate for a current R package. Use 'MIT' or 'BSD_2_clause' instead.

CODE MIGRATION:

- The C code underlying base graphics has been migrated to the **graphics** package (and hence no longer uses `.Internal()` calls).
- Most of the `.Internal()` calls used in the **stats** package have been migrated to C code in that package.
  This means that a number of `.Internal()` calls which have been used by packages no longer exist, including `.Internal(cor)` `.Internal(cov)`, `.Internal(optimhess)` and `.Internal(update.formula)`.
- Some `.External()` calls to the `base` package (really to the R executable or shared library) have been moved to more appropriate packages. Packages should not have been using such calls, but some did (mainly those used by `integrate()`).

PACKAGE parallel:

- There is a new function `mcaffinity()` which allows getting or setting the CPU affinity mask for the current R process on systems that supports this (currently only Linux has been tested successfully). It has no effect on systems which do not support process affinity. Users are not expected to use this function directly (with the exception of fixing libraries that break affinity settings like OpenBLAS) – the function is rather intended to support affinity control in high-level parallel functions. In the future, R may supplement lack of affinity control in the OS by its own bookkeeping via `mcaffinity()` related to processes and threads it spawns.
- `mcparallel()` has a new argument `mc.affinity` which attempts to set the affinity of the child process according to the specification contained therein.
- The port used by socket clusters is chosen randomly: this should help to avoid clashes observed when two users of a multi-user machine try to create a cluster at the same time. To reproduce the previous behaviour set environment variable `R_PARALLEL_PORT` to `10187`.

C-LEVEL FACILITIES:

- There has been some minor re-organization of the non-API header files. In particular, '`Rinternals.h`' no longer includes the non-API header '`R_exts/PrtUtil.h`', and that no longer includes '`R_exts/Print.h`'.
- Passing `NULL` to `.C()` is now an error.
- `.C()` and `.Fortran()` now warn if `"single"` arguments are used with `DUP = FALSE`, as changes to such arguments are not returned to the caller.
- C entry points `R_qsort` and `R_qsort_I` now have `start` and `end` as `size_t` to allow them to work with longer vectors on 64-bit platforms. Code using them should be recompiled.
- A few recently added C entry points were missing the remapping to `Rf_`, notably `[dpq]nbinom_mu`.
- Some of the interface pointers formerly available only to `R.app` are now available to front-ends on all Unix-alikes: one has been added for the interface to `View()`.
- `PACKAGE = ""` is now an error in `.C()` etc calls: it was always contrary to the documentation.
- Entry point `rcont2` has been migrated to package **stats** and so is no longer available.
- `R_SVN_REVISION` in '`Rversion.h`' is now an integer (rather than a string) and hence usable as e.g. `#if R_SVN_REVISION < 70000`.
- The entry points `rgb2hsv` and `hsv2rgb` have been migrated to package **grDevices** and so are no longer available.

- `R_GE_version` has been increased to `10` and `name2col` removed (use `R_GE_str2col` instead). R internal colour codes are now defined using the typedef `rcolor`.
- The `REPROTECT` macro now checks that the protect index is valid.
- Several non-API entry points no longer used by R have been removed, including the Fortran entry points `chol`, `chol2inv`, `cg`, `ch` and `rg`, and the C entry points `Brent_fmin`, `fft_factor` and `fft_work`.
- If a `.External` call is registered with a number of arguments (other than `-1`), the number of arguments passed is checked for each call (as for other foreign function calls).
- It is now possible to write custom connection implementations outside core R using '`R_ext/Connections.h`'. Please note that the implementation of connections is still considered internal and may change in the future (see the above file for details).

INTERNATIONALIZATION:

- The management of translations has been converted to R code: see `?tools::update_pkg_po`.
- The translations for the R interpreter and `RGui.exe` are now part of the **base** package (rather than having sources in directory '`po`' and being installed to '`share/locale`'). Thus the **base** package supports three translation domains, `R-base`, `R` and `RGui`.
- The compiled translations which ship with R are all installed to the new package **translations** for easier updating. The first package of that name found on `.libPaths()` at the start of the R session will be used. (It is possible messages will be used before `.libPaths()` is set up in which case the default translations will be used: set environment variable `R_TRANSLATIONS` to point to the location of the intended **translations** package to use this right from the start.)
- The translations form a separate group in the Windows installer, so can be omitted if desired.
- The markup for many messages has been changed to make them easier to translate, incorporating suggestions from Łukasz Daniel.

INSTALLATION:

- There is again support for building without using the C 'long double' type. This is required by C99, but system implementations can be slow or flawed. Use `configure` option '`--disable-long-double`'.
- `make pdf` and `make install-pdf` now make and install the full reference index (including all base and recommended packages).
- The 'reference manual' on the Windows GUI menu and included in the installer is now the full reference index, including all base and recommended packages.
- R help pages and manuals have no ISBNs because ISBN rules no longer allow constantly changing content to be assigned an ISBN.
- The Windows installer no longer installs a Start Menu link to the static help pages; as most pages are generated dynamically, this led to a lot of broken links.
- Any custom settings for Java configuration are recorded in file '`etc/javaconf`' for subsequent use by `R CMD javareconf`.
- There is now support for `makeinfo` version 5.0 (which requires a slightly different '`.texi`' syntax).
- The minimum versions for '`--use-system-zlib`' and `--use-system-pcre` are now tested as 1.2.5 and 8.10 respectively.
- On Windows, the stack size is reduced to 16MB on 32-bit systems: misguided users were launching many threads without controlling the stack size.

- `configure` no longer looks for file '`~/.Rconfig`': '`~/.R/config`' has long been preferred.

BUG FIXES:

- When `R CMD build` is run in an encoding other than the one specified in the package's '`DESCRIPTION`' file it tries harder to expand the `authors@R` field in the specified encoding. (PR#14958)
- If `R CMD INSTALL` is required to expand the `authors@R` field of the '`DESCRIPTION`' file, it tries harder to do so in the encoding specified for the package (rather than using ASCII escapes).
- Fix in package **grid** for pushing a viewport into a layout cell, where the layout is within a viewport that has zero physical width OR where the layout has zero total relative width (likewise for height). The layout column widths (or row heights) in this case were being calculated with non-finite values. (Reported by Winston Chang.)
- `solve(A, b)` for a vector `b` gave the answer names from `colnames(A)` for `LINPACK = TRUE` but not in the default case.
- `La.svd()` accepts logical matrices (as documented, and as `svd()` did).
- `legend()` now accepts negative `pch` values, in the same way `points()` long has.
- Parse errors when installing files now correctly display the name of the file containing the bad code.
- In Windows, tcltk windows were not always properly constructed. (PR#15150)
- The internal functions implementing `parse()`, `tools::parseLatex()` and `tools::parse_Rd()` were not reentrant, leading to errors in rare circumstances such as a garbage collection triggering a recursive call.
- Field assignments in reference class objects via `$<-` were not being checked because the magic incantation to turn methods on for that primitive operator had been inadvertently omitted.
- `setHook(hookname, value, action="replace")` set the hook to be the value, rather than a list containing the value as documented. (PR#15167)
- If a package used a '`NEWS.Rd`' file, the main HTML package index page did not link to it. (Reported by Dirk Eddelbuettel.)
- The primitive implementation of `@<-` was not checking the class of the replacement. It now does a check, quicker but less general than `slot<-`. See the help.
- `split(x, f)` now recycles classed objects `x` in the same way as vectors. (Reported by Martin Morgan.)
- `pbeta(.28, 1/2, 2200, lower.tail=FALSE, log.p=TRUE)` is no longer `-Inf`; ditto for corresponding `pt()` and `pf()` calls, such as `pt(45, df=5000, lower.tail=FALSE,log.p=TRUE)`. (PR#15162)
- The Windows graphics device would crash R if a user attempted to load the graphics history from a variable that was not a saved history. (PR#15230)
- The workspace size for the `predict()` method for `loess()` could exceed the maximum integer size. (Reported by Hiroyuki Kawakatsu.)
- `ftable(x, row.vars, col.vars)` now also works when the `*.vars` arguments are (integer or character vectors) of length zero.
- Calling `cat()` on a malformed UTF-8 string could cause the Windows GUI to lock up. (PR#15227)
- `removeClass(cc)` gave "node stack overflow" for some class definitions containing `"array"` or `"matrix"`.

CHANGES in previous versions

- Older news can be found in text format in files '`NEWS.0`', '`NEWS.1`' and '`NEWS.2`' in the '`doc`' directory. News in HTML format for R versions from 2.10.0 to 2.15.3 is in '`doc/html/NEWS.2.html`'.