NEWS for R Under development (unstable) (2015-12-15 r69777)

NEWS

R News



CHANGES IN R-devel

SIGNIFICANT USER-VISIBLE CHANGES:

- nchar(x, *)'s argument keepNA governing how the result for NAs in x is determined, gets a new default keepNA = NA which returns NA where x is NA, except for type = "width" which still returns 2, the formatting / printing width of NA.
- All builds have support for 'https:' URLs in the default methods for download.file(), url() and code making use of them.

 Unfortunately that cannot guarantee that any particular 'https:' URL can be accessed. For example, server and client have to successfully negotiate a cryptographic protocol (TLS/SSL,...) and the server's identity has to be verifiable via the available certificates. Different access methods may allow different protocols or use private certificate bundles: we have experienced a 'https:' CRAN mirror which can be accessed by one browser but not another nor by download.file() on the same Linux machine.

NEW FEATURES:

- The print method for methods() gains a byclass argument.
- New functions validEnc() and validUTF8() to give access to the validity checks for inputs used by grep() and friends.
- Experimental new functionality for S3 method checking, notably isS3method(). Also, the R 'language element' names are exported as tools::langElts.
- str(x) now displays "Time-Series" also for matrix (multivariate) time-series, i.e. when is.ts(x) is true.
- (Windows only) The GUI menu item to install local packages now accepts '*.tar.gz' files as well as '*.zip' files (but defaults to the latter).
- New programmeR's utility function chkDots().

• D() now signals an error when given invalid input, rather than silently returning NA. (Request of John Nash.)

- formula objects are slightly more "first class": e.g., formula() or new("formula", y ~ x) are now valid. Similarly, for "table", "ordered" and "summary.table". Packages defining S4 classes with the above S3/S4 classes as slots should be reinstalled.
- New function strrep() for repeating the elements of a character vector.
- rapply() preserves attributes on the list when how = "replace".
- New S3 generic function sigma() with methods for extracting the estimated standard deviation aka "residual standard deviation" from a fitted model.
- news() now displays R and package news files within the HTML help system if it is available. If no news file is found, a visible NULL is returned to the console.
- as.raster(x) now also accepts raw arrays x assuming values in 0:255.
- Subscripting of matrix/array objects of type "expression" is now supported.
- type.convert("i") now returns a factor instead of a complex value with zero real part and missing imaginary part.
- Graphics devices cairo_pdf() and cairo_ps() now allow non-default values of the cairographics 'fallback resolution' to be set.
 - This now defaults to 300 on all platforms: that is the default documented by cairographics, but apparently was not used by all system installations.
- file() gains an explicit method argument rather than implicitly using getOption("url.method", "default").
- Thanks to a patch from Tomas Kalibera, x[x != 0] is now typically faster than x[which(x != 0)] (in the case where x has no NAs, the two are equivalent).
- read.table() now always uses the names for a named colClasses argument (previously names were only used when colClasses was too short). (In part, wish of PR#16478.)
- (Windows only) download.file() with default method = "auto" and a 'ftps://' URL chooses "libcurl" if that is available.
- The out-of-the box Bioconductor mirror has been changed to one using 'https://': use chooseBioCmirror() to choose a 'http://' mirror if required.
- The data frame and formula methods for aggregate() gain a drop argument.
- available.packages() gains a repos argument.
- The undocumented switching of methods for url() on 'https:' and 'ftps:' URLs is confined to method = "default" (and documented).
- smoothScatter() gains a ret.selection argument.
- qr() no longer has a ... argument to pass additional arguments to methods.
- [has a method for class "table".
- It is now possible (again) to replayPlot() a display list snapshot that was created by recordPlot() in a different R session.
 - It is still not a good idea to use snapshots as a persistent storage format for R plots, but it is now not completely silly to use a snapshot as a format for transferring an R plot between two R sessions.
 - The underlying changes mean that packages providing graphics devices (e.g., Cairo, RSvgDevice, cairoDevice, tikzDevice) will need to be reinstalled.

Code for restoring snapshots was contributed by Jeroen Ooms and JJ Allaire. Some testing code is available at https://github.com/pmur002/R-display-list.

- tools::undoc(dir = D) and codoc(dir = D) now also work when D is a directory whose normalizePath()ed version no longer ends in the package name, e.g. from a symlink.
- abbreviate() has more support for multi-byte character sets it no longer removes
 bytes within characters and knows about Latin vowels with accents. It is still only
 really suitable for (most) European languages, and still warns on non-ASCII input.
 abbreviate(use.classes = FALSE) is now implemented, and that is more suitable
 for non-European languages.
- match(x, table) is faster, sometimes by an order of magnitude, when x is of length one and incomparables is unchanged, thanks to Haverty's PR#16491.
- More consistent, partly not back-compatible behavior of NA and NaN coercion to complex numbers, operations less often resulting in complex NA (NA_complex_).
- lengths() considers methods for length and [[on x, so it should work automatically on any objects for which appropriate methods on those generics are defined.
- The logic for selecting the default screen device on OS X has been simplified: it is now quartz() if that is available even if environment variable DISPLAY has been set by the user.
 - The choice can easily be overridden via environment variable R_INTERACTIVE_DEVICE.
- On unixy platforms (with the getline C library function), system(*,intern=TRUE) no longer truncates (output) lines longer than 8192 characters, thanks to Karl Millar's PR#16544.
- rank() gains a ties.method = "last" option, for convenience (and symmetry).
- regmatches(invert = NA) can now be used to extract both non-matched and matched substrings.
- data.frame() gains argument fix.empty.names; as.data.frame.list() gets new cut.names, col.names and fix.empty.names.
- plot(x ~ x, *) now warns that it is the same as plot(x ~ 1, *).
- recordPlot() has new arguments load and attach to allow package names to be stored as part of a recorded plot. replayPlot() has new argument reloadPkgs to load/attach any package names that were stored as part of a recorded plot.
- S4 dispatch works within calls to .Internal(). This means explicit S4 generics are no longer needed for unlist, is.unsorted and as.vector.
- Only font family names starting with "Hershey" (and not "Her" as before) are given special treatment by the graphics engine.
- S4 values are automatically coerced to vector (via as.vector) when subassigned into atomic vectors.

UTILITIES:

- R CMD check has a new option '--ignore-vignettes' for use with non-Sweave vignettes whose 'VignetteBuilder' package is not available.
- R CMD check --as-cran now checks code usage (via codetools) with only the base package attached, so that functions from default packages other than base which are used in the package code but not imported are reported as undefined globals. It now also checks DOIs in package 'CITATION' and Rd files.

DEPRECATED AND DEFUNCT:

• The previously included versions of zlib, bzip2, xz and PCRE have been removed, so suitable external (usually system) versions are required (see the 'R Installation and Administration' manual).

- The unexported and undocumented Windows-only devices cairo_bmp(), cairo_png() and cairo_tiff() have been removed. (These devices should be used as e.g. bmp(type = "cairo").)
- (Windows only) Function setInternet2() has no effect and will be removed in due course. The choice between methods "internal" and "wininet" is now made by the method arguments of url() and download.file() and their defaults can be set via options. The out-of-the-box default remains "wininet" (as it has been since R 3.2.2).
- [<- with an S4 value into a list currently embeds the S4 object into its own list such that the end result is roughly equivalent to using [[<-. That behavior is deprecated. In the future, the S4 value will be coerced to a list with as.list.

INSTALLATION and INCLUDED SOFTWARE:

- Support for very old versions of valgrind (e.g., 3.3.0) has been removed.
- The included libtool script (generated by configure) has been updated to version 2.4.6 (from 2.2.6a).
- libcurl version 7.28.0 or later with support for the https protocol is required for installation (except on Windows).
- BSD networking is now required (except on Windows) and so capabilities("http/ftp") is always true.
- configure uses pkg-config for PNG, TIFF and JPEG where this is available. This should work better with multiple installs and with those using static libraries.
- The minimum supported version of OS X is 10.6 ('Snow Leopard'): even that has been unsupported by Apple since 2012.
- The configure default on OS X is '--disable-R-framework': enable this if you intend to install under '/Library/Frameworks' and use with R.app.
- The minimum preferred version of PCRE has since R 3.0.0 been 8.32 (released in Nov 2012). Versions 8.10 to 8.31 are now deprecated (with warnings from configure), but for now still accepted.

C-LEVEL FACILITIES:

- The API call logspace_sum introduced in R 3.2.0 is now remapped as an entry point to Rf_logspace_sum, and its first argument has gained a const qualifier.

 Code using it will need to be reinstalled. (PR#16470)
- Use of 'SUPPORT_OPENMP' from header 'Rconfig.h' is deprecated in favour of the standard OpenMP define '_OPENMP'.
- R_GE_version has been increased to 11.
- New API call R_orderVector1(), a faster one-argument version of R_orderVector().

BUG FIXES:

• C-level asChar(x) is fixed for when x is not a vector, and it returns "TRUE"/"FALSE" instead of "T"/"F" for logical vectors.

• The first arguments of .colSums() etc (with an initial dot) are now named x rather than X (matching colSums()): thus error messages are corrected.

- A coef() method for class "maov" has been added to allow vcov() to work with multivariate results. (PR#16380)
- method = "libcurl" connections signal errors rather than retrieving HTTP error pages (where the ISP reports the error).
- xpdrows.data.frame() was not checking for unique row names; in particular, this affected assignment to non-existing rows via numerical indexing. (PR#16570)
- tail.matrix() did not work for zero rows matrices, and could produce row "labels" such as "[1e+05,]".
- Data frames with column name "stringsAsFactors" now format and print correctly. (PR#16580)
- 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)



CHANGES IN R 3.2.3 patched

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.)

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)



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'.

- 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.



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.



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 NAs 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.

- 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 NAs 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 $d \ge 1$) 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 to Title Case () in package tools, tailored to package titles.
- The matrix methods of cbind() and rbind() allow matrices as inputs which have 2³¹ 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.

- Fixed two obscure bugs in pairlist subassignment, reported by Radford Neal as part of paR issue 16.
- Fixes for bugs in handling empty arguments and argument matching by name in log().

- all.equal() gains methods for environments and refClasses.
- [<- 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.

- (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 $substr(x, 1, 2) \leftarrow "" (subsequently reported as <math>PR\#16214$).
- 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.



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.

- dmultinom() did not handle non-finite probabilities correctly.
- prettyNum(x, zero.print=*) now also works when x contains NAs.
- 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'.

- 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 2³¹ 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)



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 bessell(). (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 "POSIXIt" 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 2³¹ 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 "POSIX1t" 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 state space 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.POSIX1t() 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,

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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.

- 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 aggregrate() 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 2³¹ 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", "POSIX1t" 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).

- 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 2³¹ 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)



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 2⁵³ (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 POSIX1t 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)



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.



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 2³¹ 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 ≥ 2³¹: 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., ''. (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 2³¹ 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 2³¹ 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 2³⁵ 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.
- \bullet 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'.