

# LiveCode 9.0.0-dp-7 Release Notes

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## Overview

LiveCode 9.0 enables access to libraries and platform APIs written in many other languages thanks to the community-funded 'Infinite LiveCode' project.

This includes a greatly improved LiveCode Builder virtual machine.

LiveCode 9.0 contains many additional improvements to support LiveCode app developers, including:

- A new "spinner" widget
- OAuth2 authentication library for use with web APIs (e.g. Facebook, Google and GitHub)

- A command argument parser library for building command-line standalones
- Updates and performance improvements for existing widgets

## Known issues

- The installer will currently fail if you run it from a network share on Windows. Please copy the installer to a local disk before launching on this platform.
- The browser widget does not work on 32-bit Linux.
- 64-bit standalones for Mac OS X do not have support for audio recording or the revVideoGrabber external.

## Platform support

The engine supports a variety of operating systems and versions. This section describes the platforms that we ensure the engine runs on without issue (although in some cases with reduced functionality).

### Windows

LiveCode supports the following versions of Windows:

- Windows 7 (both 32-bit and 64-bit)
- Windows Server 2008
- Windows 8.x (Desktop)
- Windows 10

**Note:** On 64-bit Windows installations, LiveCode runs as a 32-bit application through the WoW layer.

### Linux

LiveCode supports the following Linux distributions, on 32-bit or 64-bit Intel/AMD or compatible processors:

- Ubuntu 14.04 and 16.04
- Fedora 23 & 24
- Debian 7 (Wheezy) and 8 (Jessie) [server]
- CentOS 7 [server]

LiveCode may also run on Linux installations which meet the following requirements:

- Required dependencies for core functionality:
  - glibc 2.13 or later
  - glib 2.0 or later
- Optional requirements for GUI functionality:

- GTK/GDK 2.24 or later
- Pango with Xft support
- esd (optional, needed for audio output)
- mplayer (optional, needed for media player functionality)
- lcms (optional, required for color profile support in images)
- gksu (optional, required for privilege elevation support)

**Note:** If the optional requirements are not present then LiveCode will still run but the specified features will be disabled.

**Note:** The requirements for GUI functionality are also required by Firefox and Chrome, so if your Linux distribution runs one of those, it will run LiveCode.

**Note:** It may be possible to compile and run LiveCode Community for Linux on other architectures but this is not officially supported.

## Mac

The Mac engine supports:

- 10.9.x (Mavericks) on Intel
- 10.10.x (Yosemite) on Intel
- 10.11.x (El Capitan) on Intel
- 10.12.x (Sierra) on Intel

## iOS

iOS deployment is possible when running LiveCode IDE on a Mac, and provided Xcode is installed and has been set in LiveCode *Preferences* (in the *Mobile Support* pane).

Currently, the supported versions of Xcode are:

- Xcode 6.2 on MacOS X 10.9
- Xcode 6.2 and 7.2 on Mac OS X 10.10
- Xcode 8.2 on MacOS X 10.11
- Xcode 8.3 on MacOS 10.12

It is also possible to set other versions of Xcode, to allow testing on a wider range of iOS simulators. For instance, on MacOS 10.12 (Sierra), you can add *Xcode 6.2* in the *Mobile Support* preferences, to let you test your stack on the *iOS Simulator 8.2*.

We currently support deployment for the following versions of iOS:

- 8.2 [simulator]
- 9.2
- 10.2
- 10.3

## Android

LiveCode allows you to save your stack as an Android application, and also to deploy it on an Android device or simulator from the IDE.

Android deployment is possible from Windows, Linux and Mac OSX.

The Android engine supports devices using ARMv7 or ARMv8 processors. It will run on the following versions of Android:

- 4.1-4.3 (Jelly Bean)
- 4.4 (KitKat)
- 5.0-5.1 (Lollipop)
- 6.0 (Marshmallow)

To enable deployment to Android devices, you need to download the [Android SDK](#), and then use the 'Android SDK Manager' to install:

- the latest "Android SDK Tools"
- the latest "Android SDK Platform Tools"

You also need to install the Java Development Kit (JDK). On Linux, this usually packaged as "openjdk". LiveCode requires JDK version 1.6 or later.

Once you have set the path of your Android SDK in the "Mobile Support" section of the LiveCode IDE's preferences, you can deploy your stack to Android devices.

Some users have reported successful Android Watch deployment, but it is not officially supported.

## HTML5

LiveCode applications can be deployed to run in a web browser, by running the LiveCode engine in JavaScript and using modern HTML5 JavaScript APIs.

HTML5 deployment does not require any additional development tools to be installed.

LiveCode HTML5 standalone applications are currently supported for running in recent versions of [Mozilla Firefox](#), [Google Chrome](#) or [Safari](#). For more information, please see the "HTML5 Deployment" guide in the LiveCode IDE.

# Setup

## Installation

Each version of LiveCode installs can be installed to its own, separate folder. This allow multiple versions of LiveCode to be installed side-by-side. On Windows (and Linux), each version of LiveCode has its own Start Menu (or application menu) entry. On Mac OS X, each version has its own app bundle.

On Mac OS X, install LiveCode by mounting the `.dmg` file and dragging the app bundle to the `Applications` folder (or any other suitable location).

For Windows and Linux, the default installation locations when installing for "All Users" are:

Platform	Path
Windows	<code>&lt;x86 program files folder&gt;/RunRev/LiveCode &lt;version&gt;</code>
Linux	<code>/opt/livecode/livecode-&lt;version&gt;</code>

The installations when installing for "This User" are:

Platform	Path
Windows	<user roaming app data folder>/RunRev/Components/LiveCode <version>
Linux	~/.runrev/components/livecode-<version>

**Note:** If installing for "All Users" on Linux, either the **gksu** tool must be available, or you must manually run the LiveCode installer executable as root (e.g. using **sudo** or **su**).

## Uninstallation

On Windows, the installer hooks into the standard Windows uninstall mechanism. This is accessible from the "Add or Remove Programs" applet in the windows Control Panel.

On Mac OS X, drag the app bundle to the Trash.

On Linux, LiveCode can be removed using the `setup.x86` or `setup.x86_64` program located in LiveCode's installation directory.

## Reporting installer issues

If you find that the installer fails to work for you then please report it using the [LiveCode Quality Control Centre](#) or by emailing [support@livecode.com](mailto:support@livecode.com).

Please include the following information in your report:

- Your platform and operating system version
- The location of your home or user folder
- The type of user account you are using (guest, restricted, admin etc.)
- The installer log file.

The installer log file can be located as follows:

Platform	Path
Windows 2000/XP	<documents and settings folder>/<user>/Local Settings/
Windows Vista/7	<users folder>/<user>/AppData/Local/RunRev/Logs
Linux	<home>/.runrev/logs

## Activating LiveCode Indy or Business edition

The licensing system ties your product licenses to a customer account system, meaning that you no longer have to worry about finding a license key after installing a new copy of LiveCode. Instead, you simply have to enter your email address and password that has been registered with our customer account system and your license key will be retrieved automatically.

Alternatively it is possible to activate the product via the use of a specially encrypted license file. These will be available for download from the customer center after logging into your account. This method will allow the product to be installed on machines that do not have access to the internet.

## Command-line installation

It is possible to invoke the installer from the command-line on Linux and Windows. When doing

command-line installation, no GUI will be displayed. The installation process is controlled by arguments passed to the installer.

Run the installer using a command in the form:

```
<installer> install noui [OPTION ...]
```

where `<installer>` should be replaced with the path of the installer executable or app (inside the DMG) that has been downloaded. The result of the installation operation will be written to the console.

The installer understands any of the following `OPTION`s:

Option	Description
<code>-allusers</code>	Install the IDE for "All Users". If not specified, LiveCode will be installed for the current user only.
<code>-desktopshortcut</code>	Place a shortcut on the Desktop (Windows-only)
<code>-startmenu</code>	Place shortcuts in the Start Menu (Windows-only)
<code>-location LOCATION</code>	The folder to install into. If not specified, the <code>LOCATION</code> defaults to those described in the "Installation" section above.
<code>-log LOGFILE</code>	The file to which to log installation actions. If not specified, no log is generated.

**Note:** the command-line installer does not do any authentication. When installing for "All Users", you will need to run the installer command as an administrator.

As the installer is actually a GUI application, it needs to be run slightly differently from other command-line programs.

On Windows, the command is:

```
start /wait <installer> install noui [OPTION ...]
```

## Command-line uninstallation

It is possible to uninstall LiveCode from the command-line on Windows and Linux. When doing command-line uninstallation, no GUI will be displayed.

Run the uninstaller using a command of the form:

```
<uninstaller> uninstall noui
```

Where is `.setup.exe` on Windows, and `.setup.x86` on Linux. This executable, for both of the platforms, is located in the folder where LiveCode is installed.

The result of the uninstallation operation will be written to the console.

**Note:** the command-line uninstaller does not do any authentication. When removing a version of LiveCode installed for "All Users", you will need to run the uninstaller command as an administrator.

## Command-line activation for LiveCode Indy or Business edition

It is possible to activate an installation of LiveCode for all users by using the command-line. When performing command-line activation, no GUI is displayed. Activation is controlled by passing command-line arguments to LiveCode.

Activate LiveCode using a command of the form:

```
<livecode> activate -file LICENSEFILE -passphrase SECRET
```

where `<livecode>` should be replaced with the path to the LiveCode executable or app that has been previously installed.

This loads license information from the manual activation file `LICENSEFILE`, decrypts it using the given `SECRET` passphrase, and installs a license file for all users of the computer. Manual activation files can be downloaded from the [My Products](#) page in the LiveCode account management site.

It is also possible to deactivate LiveCode with:

```
<livecode> deactivate
```

Since LiveCode is actually a GUI application, it needs to be run slightly differently from other command-line programs.

On Windows, the command is:

```
start /wait <livecode> activate -file LICENSE -passphrase SECRET
start /wait <livecode> deactivate
```

On Mac OS X, you need to do:

```
<livecode>/Contents/MacOS/LiveCode activate -file LICENSE -passphrase SECRET
<livecode>/Contents/MacOS/LiveCode deactivate
```

## Engine changes

### Additional forms of create command (9.0.0-dp-7)

- Create in now works correctly
- You can now create in as well as in

### HTML5 Basic Networking Support (9.0.0-dp-7)

Basic networking support has been added to the HTML5 engine by way of the **load** command. The HTML5 **load** command functions in the same way as the **load** command on mobile platforms, with a

completion message being sent on download, containing the contents of the URL (or any error) and the **urlProgress** message being sent periodically during the request.

**Note: The current HTML5 support for 'load url' is experimental, and will be replaced by a libUrl-like API in a subsequent DP ensuring it has parity with other platforms when 'Internet Library' is used.**

**Note: Only HTTP and HTTPS protocols are supported and URLs can only be fetched from the domain hosting the web page running the HTML5 engine.**

```
command fetchURL pURL
  load URL pURL with "loadComplete"
end fetchURL

on loadComplete pURL, pStatus, pData, pTotal
  -- pURL - The URL being fetched.
  --
  -- pStatus - The status of the URL: One of:
  -- * downloaded
  -- * error
  --
  -- pData - This will be:
  -- * the content of the URL, if pStatus is downloaded
  -- * the error string, if pStatus is error
  --
  -- pTotal - The total size of the URL, in bytes.
end loadComplete

on urlProgress pURL, pStatus, pData, pTotal
  -- pURL - The URL being fetched.
  --
  -- pStatus - The current status of the operation. One of:
  -- * contacted
  -- * requested
  -- * loading
  -- * downloaded
  -- * error
  --
  -- pData - This will be:
  -- * the number of bytes fetched, if pStatus is loading
  -- * the error string, if pStatus is error
  -- * empty in all other cases
  --
  -- pTotal - The total size of the URL, in bytes.
end urlProgress
```

## HTML5 Callbacks - enable calling handlers in LiveCode emscripten standalones from JavaScript (9.0.0-dp-7)

**Note** This is still an experimental feature - details may change as development continues.

## Stack setup

Each stack can be configured to expose its handlers & functions to JavaScript. This is done through a custom property of the stack - `cJavascriptHandlers`. (This will be replaced in the future by a `javascriptHandlers` property which will then be a reserved keyword). The `cJavascriptHandlers` property is a return-delimited list of handler names. The named handlers do not have to be defined at the time the stack is loaded, however calling an undefined handler from JavaScript will result in an error.

## Calling from JavaScript

The standalone engine will create a `liveCode` object on the DOM `document` object. To this object will be attached the `findStackWithName` method that can be called to return a JavaScript stack object. Each stack object will have methods corresponding to the exposed handlers of that stack. For instance, a stack with the `cJavascriptHandlers` property set to :

```
setProperty
getProperty
```

will have methods named accordingly, which when executed will call the corresponding handler with the provided arguments.

## JavaScript Example:

```
``var myStack = document.liveCode.findStackWithName("HTMLTest"); var oldDocTitle =
myStack.getProperty('documentTitle'); myStack.setProperty('documentTitle', 'Important Document');
myStack.performAction('sendEmail');
```

```
## New messageDigest() function with SHA-2 and SHA-3 support (9.0.0-dp-7)
```

A new `messageDigest()` function has been added. It allows access to a variety of cryptographic message digest functions, including SHA-2 and SHA-3. For example, to compute the 256-bit SHA-3 digest of the message "LiveCode", you might use:

```
get messageDigest(textEncode("LiveCode", "UTF-8"), "sha3-256")
```

```
## recordFormats function (9.0.0-dp-7)
```

A new `recordFormats` function has been added that lists the possible record formats supported by the current platform recorder implementation. This will allow users to select supported audio file formats used by 'pluggable' audio recorder implementations in the future.

```
## Update Skia (graphics library) (9.0.0-dp-7)
```

This major Skia update improves both rendering quality and performance. It also opens the door to substantial future improvements and feature additions. In order to allow this, support for certain legacy drawing features has had to be removed. In particular, legacy blend modes (also known as bitmap effects) are no longer supported.

## New array commands `difference` and `symmetric difference` (9.0.0-dp-7)  
 The `difference` command removes all keys from the destination which are present in the source, and leaves all others alone.

The `symmetric difference` command removes all keys from the destination which are present in the source, and adds all keys from the source which are not present in the destination.

Additionally the `into` clause has been added to all array set operations (`union`, `intersect`, `difference`, `symmetric difference`) allowing commands such as:

```
intersect tLeft with tRight into tResult
```

The operation of the commands is the same as the non-into form except that tLeft does not have to be a variable, and the result of the operation is placed into tResult rather than mutating tLeft.

## Cmd-. does not affect modal dialogs (9.0.0-dp-7)  
 Previously using the abort-script keyboard combination (Cmd-. on Mac) would cause an abort error to be thrown. However, this would be silently swallowed by any modal command (or equivalent) meaning that unusable modal dialogs would be uncloseable, requiring the need to restart the IDE / engine.

This has been fixed by making Cmd-. cause an automatic 'close this stack' when it occurs in a modal loop and allowInterrupts is true, and the current stack has cantAbort set to false.

## LiveCode Builder Language (9.0.0-dp-6)  
 ## Foreign bindings to Java

It is now possible to bind to Java class methods and fields in LCB via the Java Native Interface (JNI). Foreign handlers bind to Java class using the existing foreign handler syntax, but with an appropriate binding string.

The Java binding string has the following form:

```
"java:[className>][functionType.]function[!calling]"
```

Where *\*className\** is the qualified name of the Java class to bind to, *\*functionType\** is either empty, or 'get' or 'set', which are currently used for getting and setting member fields of a Java class, and *\*function\** specifies the name of the method or field to bind to. The function 'new' may be used to call a class constructor. *\*function\** also includes the specification of function signature, according to the [standard rules for forming these] (<http://journals.ecs.soton.ac.uk/java/tutorial/native1.1/implementing/method.html>)

when calling the JNI.

*\*calling\** specifies the calling convention which can be one of:

- `instance`
- `static`
- `nonvirtual`

Instance and nonvirtual calling conventions require instances of the given Java class, so the foreign handler declaration will always require a Java object parameter.

### ### Examples

- Binding to a class constructor with no parameters:

```
foreign handler CreateJavaObject() returns JObject binds to
"java:java.lang.Object>new()"
```

- Binding to a class constructor with parameters:

```
foreign handler CreateJavaString(in pBytes as JByteArray) returns JString
binds to "java:java.lang.String>new([B]"
```

- Binding to a class instance method

```
foreign handler JavaStringIsEmpty(in pString as JString) returns CBool binds
to "java:java.lang.String>isEmpty()Z"
```

- Binding to a class static method

```
foreign handler CallJavaAdd(in pLeft as CInt, in pRight as CInt) returns CInt
binds to "java:java.lang.Math>addExact(JJ)J!static"
```

- Binding to a class field

```
foreign handler JavaCalendarSetTime(in pObj as JObject) returns nothing binds
to "java:java.util.Calendar>set.time(J)"
```

```
foreign handler JavaCalendarGetTime(in pObj as JObject) returns CInt binds to
"java:java.util.Calendar>get.time()J"
```

- Binding to a class constant

```
foreign handler GetJavaPi() returns CDouble binds to
"java:java.lang.Math>get.PI()D!static"
```

> **Note:** This feature is still highly experimental. All aspects of the  
> syntax are subject to change. Incorrect binding strings may cause your  
> application to crash, so please ensure you back up your stacks before  
> experimenting.

> **Important:** This feature is currently supported on Android, Mac and  
> Linux. Binding to java classes requires the availability of a Java  
> runtime and access to the appropriate libraries. On Mac,  
> the `JAVA\_HOME` environment variable must be set to the path to your  
> Java installation (usually at  
> `/Library/Java/JavaVirtualMachines/jdk1.7.0\_55.jdk/Contents/Home`).

```
> On Linux, your `LD_LIBRARY_PATH` must be set to the folder containing
> the `libjvm.so` library (usually at ${JAVA_HOME}/jre/lib/amd64/server)
> on 64-bit Linux.
```

```
## LiveCode Builder Tools (9.0.0-dp-6)
```

```
## lc-compile-ffi-java
```

```
* lc-compile-ffi-java is a tool to create LiveCode Builder code which
  provides an interface between LCB modules and the Java Native
  Interface (JNI). It does this by taking a specification of a java
  package written in a domain-specific language and creating an LCB
  module which wraps the necessary foreign handlers which call the
  appropriate JNI methods. See the [documentation for the tool]
  (https://github.com/livecode/livecode/blob/develop/toolchain/lc-compile-ffi-
  java.1.md)
  and the [description of the DSL]
  (https://github.com/livecode/livecode/tree/develop/docs/specs/java-ffi-dsl.md)
  for more details
```

```
## New NFC tag feature on Android (9.0.0-dp-5)
```

It is now possible to access data directly from NFC tags read by Android devices.

The functions **mobileIsNFCAvailable** and **mobileIsNFCEnabled** can be used to test if the device is able to read NFC tags.

The commands **mobileEnableNFCDispatch** and **mobileDisableNFCDispatch** can be used to control whether or not your app intercepts all NFC tags while in the foreground.

The handler **nfcTagReceived** will be sent with the tag data to your app whenever an NFC tag is read by the device.

```
## revvideograbber end-of-life on Mac OS X (9.0.0-dp-5)
```

The revvideograbber external depends on QuickTime in order to operate on Mac OS X. On Mac OS X 10.9 and above, QuickTime is no longer available.

The revvideograbber external remains available for use on Windows, using Video for Windows (DirectShow).

The following revvideograbber commands are now deprecated and have no effect:

- **revVideoGrabSettings**
- **revSetVideoGrabSettings**
- **revVideoGrabIdle**

```
## Specifying local host and port when opening a socket (9.0.0-dp-5)
```

When opening a socket you can now specify the local port and host the socket should use. An example of this is as follows:

```
open socket from ":8080" to "10.2.1.1:8080"
```

See the open socket dictionary entry for full details.

#### ## Message box refactor (9.0.0-dp-5)

The way the message box functions has been refactored:

- the IDE only global property `revMessageBoxRedirect` has been removed
- the IDE only global property `revMessageBoxLastObject` has been removed
- the legacy message box behavior setting the text of the first field of a stack named `Message Box` has been removed
- the `msgChanged` message is now sent to the object that changed the message
- IDE plugin developers should subscribe to `ideMsgChanged` for custom message box development.
- If the `msgChanged` message is not handled the content of the `message box` will be logged to the system log unless the engine is running in no ui (command line) mode which will write the content to STDOUT.

#### ## LCB modules can declare Android app permissions and features (9.0.0-dp-5)

LCB module metadata is now checked for Android permissions which will be added to the manifest when building for Android. For example, a module containing

```
metadata android.features is "hardware.bluetooth,hardware.camera"
metadata android.hardware.camera.required is "false"
metadata android.hardware.bluetooth.required is "true"
metadata android.permissions is "BLUETOOTH_ADMIN"
```

will result in the following lines being added to the Android manifest:

```
<uses-feature android:name="android.hardware.camera"
android:required="false"/>
<uses-feature android:name="android.hardware.bluetooth"
android:required="true"/>
<uses-permission android:name="android.permission.BLUETOOTH_ADMIN" />
```

#### ## Maximum text length on iOS native input fields (9.0.0-dp-4)

It is now possible to set/get the maximum number of characters that can be entered into an ios native single-line field, using

```
mobileControlSet sFieldID, "maximumTextLength", sMaxLength
put mobileControlGet(sFieldID, "maximumTextLength") --> returns sMaxLength
```

#### ## Throw error when changing behavior from behavior script (9.0.0-dp-4)

Previously it was theoretically possible to change the behavior of an object from that object's existing behavior script. This will now result in an execution error

```
parentScript: can't change parent while parent script is executing
```

This change was necessarily as the engine would occasionally crash when changing a behavior this way, and would be guaranteed to crash if stepping over the behavior script line that changes the behavior

stepping over the behavior script line that changes the behavior.

```
## Support for loading multi-module bytecode files (9.0.0-dp-4 - experimental)
The **load extension** command is now able to load LiveCode Builder
bytecode files (`.lcm` files) that contain multiple modules' bytecode.
```

The first module in each `.lcm` file is treated as the "main module" of the module (i.e. the library or widget), and other modules are treated as support modules.

Support modules only remain loaded if they are used by the main module, and support modules must be submodules of the main module. For example, if the main module is "com.livecode.newbutton", then all other modules in the bytecode file must have names like "com.livecode.newbutton.&lt;something&gt;".

<div class="experimental">Important: This feature is currently experimental. This means it may not be complete, or may fail in some circumstances that you would expect it to work. Please do not be afraid to try it out as we need feedback to develop it further.</div>

```
## Calling JavaScript from HTML5 (9.0.0-dp-2)
```

JavaScript has been added to the **\*\*alternateLanguages\*\*** on the HTML5 platform.

It is now possible to call JavaScript code from HTML5 standalones by using the `do <script> as <alternateLanguage>` form of the **\*\*do\*\*** command.

This allows HTML5 standalones to interact with the browser within which they are running. The value of the JavaScript expression will be placed in the **\*\*result\*\*** variable:

```
local tDocTitle do "document.title" as "JavaScript" put the result into tDocTitle ``
```

## Re-written LCB VM (9.0.0-dp-2)

The "virtual machine" used to run LiveCode Builder code has been re-written from scratch. This new VM provides a framework enabling better extensibility, better error reporting and, in future, more comprehensive optimizations.

Most existing LCB code should run without any changes. There may be some code that worked on the previous VM but doesn't in the new VM due to more comprehensive run-time checking; this is usually fixable with only very minor changes to the source code.

## Undocumented multi-file libUrlMultipartFormAddPart removed (9.0.0-dp-2)

Previously, the **libUrlMultipartFormAddPart** command had the undocumented capability to accept multiple file names separated by commas. The handler failed to work for files that had commas in the name, however. The undocumented behaviour has been removed. To add multiple files to a form, call **libURLMultipartFormAddPart** once for each file.

## libURLSetStatusCallback no longer requires a target object for the message (9.0.0-dp-1)

Passing an object reference as a second parameter to `libURLSetStatusCallback` is no longer required. If no object is passed in then the message will be sent to `revLibURL` itself and you can handle the message anywhere in the message path.

## Platform support end-of-life (9.0.0-dp-1)

As [announced on the LiveCode blog](#), running LiveCode on the following platforms is no longer officially supported from LiveCode 9.0 onwards:

- Windows XP
- Windows Server 2003
- Windows Vista
- Android Gingerbread (2.3.3-2.3.7)
- Android Ice Cream Sandwich (4.0)
- OS X Snow Leopard (10.6)
- OS X Lion (10.7)
- OS X Mountain Lion (10.8)
- iOS Simulator 6.1
- iOS Simulator 7.1

## Field tab alignments in `htmlText` and `styledText` (9.0.0-dp-1)

The **`styledText`** and **`htmlText`** of a field now include tab alignment information. The **`htmlText`** uses a new `tabalign` attribute with a list of alignments, e.g.

```
<p tabalign='left,center,right'>left&09;middle&09;right&09;</p>
```

The **`styledText`** stores tab alignment in a "tabalign" key in each paragraph's "style" array, e.g.

```
get tStyledText[1]["style"]["tabalign"]
```

## Specific engine bug fixes (9.0.0-dp-7)

- 11323** New array commands `difference` and `symmetric difference`
- 13102** Update `currentTimeChanged` message docs to state that the message is sent while player is playing.
- 14311** add example to replace command dictionary entry showing it can be used on a chunk within a string.
- 17132** Update engine to use LCMS 2 on Linux
- 18754** Set the it when importing snapshots
- 18848** Ensure error whilst doing subwindow command propagates to caller
- 18922** Added `mobileGetDeviceToken` as related to some `pushNotification*` dictionary entries
- 19083** Added `selectionChanged` association to player object

- 19165** Tweak formatting on choose command doc removing return in browse param to remove word fields from top of param list.
- 19253** Update OpenSSL to version 1.1.0e
- 19271** Increased random function input limit to  $2^{53}$
- 19280** Include core script-only libraries in standalones
- 19318** Fix loading custom properties from pre-7.0 stack formats
- 19349** Fix relayering by layer number
- 19399** Prevent crash on startup of emscripten engine
- 19400** Unmangle java module docs
- 19411** Make sure `combine tArray using column` works as expected
- 19422** Fixed missing parts of `errorMode` entry
- 19429** Fix issue with database driver inclusion in standalones on Desktop
- 19479** `Cmd-.` does not affect modal dialogs
- 19502** Make sure calling LCB library handlers produces correct error stack
- 19570** Updated print command docs ensuring parameters `topLeft` and `bottomRight` were used consistently.
- 19598** Cannot accept and open sockets using the same local port on certain platforms
- 19682** Fixed bug preventing the use of shift to draw straight lines
- 19784** Convert between `stringref` and `jstring` correctly
- 19804** Ensure fonts work in-ui mode on Windows
- 19855** Added cross reference to `trueWord` to the word entry in the dictionary.

## Specific engine bug fixes (9.0.0-dp-6)

- 17318 Fix format of `mobileControlDo` entry

## Specific engine bug fixes (9.0.0-dp-5)

- 16044 Corrected documentation for `dateItems` - Day of the week
- 18245 Message box refactor
- 18403 Support hidden paragraph property in `styledText` arrays
- 18622 Ensure empty maps to empty lists when calling LCB library handlers
- 18850 LCB modules can declare Android app permissions and features
- 18998 Fix go url for script-only stacks
- 19065 Improve error reporting for calling LCB library handlers
- 19180 Crash when cloning an empty `MCOBJECTPROPERTYSET`

## Specific engine bug fixes (9.0.0-dp-4)

- 11039 Throw error when changing behavior from behavior script
- 13150 Ensure `tabStops` property docs describe relationship with indent properties
- 13696 The "volumes" function is only supported on Mac & Windows
- 13880 Fix formatting in `scrollbarWidth` property documentation
- 14172 Clarify that the "combine" command works in lexicographic key order
- 14247 Clarify insertion point location when field is focused

- 14363 The "startup" message is sent to the first card of the initial stack
- 14473 Provide a complete example for revZipAddItemWithData
- 14801 Correct examples in "split" command documentation
- 14867 The tabStops property can't be set to a boolean
- 15117 The "lineOffset" function can search for multiline substrings
- 15470 Correct "tool" property docs to be clear that it is not a stack property
- 15604 Update dictionary links to PCRE pattern documentation
- 16491 Fix bad example of using the menuName property
- 16511 Make examples of "borderPixel" use its main synonym
- 16658 Document the fact that "the environment" may be "server"
- 18853 Support for loading multi-module bytecode files (experimental)

## Specific engine bug fixes (9.0.0-dp-2)

- 12196 Correct documentation for "do" command
- 18147 The scriptExecutionErrors property not listed in dictionary
- 18231 Fixed documentation formatting issues for binaryEncode and binaryDecode
- 18350 Fix spurious type errors for repeat variables in LCB
- 18495 Undocumented multi-file libUrlMultipartFormAddPart removed
- 18651 Ensure "10 garbage" is never a number
- 18743 Fix missing cross-references in "keys" dictionary entry
- 18774 Fix errors in "write to file" dictionary entry
- 18821 Report all LCB stack frames in LCS error info

## Specific engine bug fixes (9.0.0-dp-1)

- 14645 Field tab alignments in htmlText and styledText
- 14651 There is no documentation entry for "currentcard"
- 15865 Fixed Dictionary description for "is not among"
- 16211 Fix compilation errors with MacOSX SDK 10.10 and higher
- 18111 Make PDF user guide typography match dictionary view
- 18125 Fix Dictionary example for is within
- 18254 Improve efficiency of equality operators on binary data
- 18297 Broken references in "filename of stack" dictionary entry
- 18357 dispatch documentation should mention arguments can be arrays
- 18465 Syntax: mouseUp mouseButtonNumber
- 18537 Fix crash when saving stack on OSX ElCapitan
- 18579 Support defaultNetworkInterface for the accept command
- 18588 Fix a crash due to pending messages to deleted objects

## IDE changes

The IDE is now 64-bit by default on Mac (9.0.0-dp-7)

Moreover, the "Build for Mac OS X 64-bit" is checked by default on newly created stacks in the standalone settings for OS X. Existing stacks will retain their current settings.

## Added "Exit on suspend" checkbox in iOS S/B (9.0.0-dp-7)

Users can now set the .plist property of whether their applications should exit when suspended. Added warning as this is still experimental behaviour.

## Added Build Number to iOS Standalone Builder (9.0.0-dp-7)

This will add a Build Number to the plist file of the standalone builder, enabling resubmission of the same build to the app store multiple times

## Show up to 10 nested behavior in the Project Browser (9.0.0-dp-4)

It is now possible to view up to 10 nested behaviors of an object in the PB. The behaviors are shown using oval graphics. Clicking on the graphic takes you to the script of the behavior. The tooltip of the graphic shows the long name of the behavior.

## SVG icon support in the Extension Builder (9.0.0-dp-4)

The 'Extension Builder' now displays LiveCode Builder extensions' SVG icons, if present. You can add an SVG icon to an LCB extension by setting its "svgicon" metadata to an SVG path that could be displayed by the 'SVG Icon' widget.

When an extension provides an SVG icon, packaging the extension no longer requires you to choose bitmap icon files.

## <Shift+Tab> reformats entire script (9.0.0-dp-4)

Holding down the Shift key while pressing the Tab key will reformat the entire script in the Script Editor.

## Specific IDE bug fixes (9.0.0-dp-7)

- 14163** Fixed bug preventing users from adding Build Numbers to S/B's
- 15218** Reduce PI size to available screen space where necessary
- 17583** Allow increased height in inspector windows
- 19384** Set JAVA\_HOME at startup if not set
- 19406** Correctly re-enable debugger when setting Script Debug Mode
- 19491** Allow PI to be resized to smaller than content height
- 19749** Unsubscribe from ideExtensionLog when extension builder closes
- 19821** Set the default of the Mac S/B to 64-bit
- 19832** Format multi-line message box when pasting script
- 19856** Prevent extension builder from duplicating logs

## Specific IDE bug fixes (9.0.0-dp-6)

19339 Fix "Pending Messages" tab of the message box in Business Edition

## Specific IDE bug fixes (9.0.0-dp-5)

- 17851 Add default script to scrollbar
- 18682 Ensure debugger ignores breakpoints and errors if a modal stack is presented
- 18931 Update widget creation docs with extension store instructions
- 19072 Add slider to PI for startAngle and arcAngle for oval graphics

## Specific IDE bug fixes (9.0.0-dp-4)

- 18932 SVG icon support in the Extension Builder
- 18937 <Shift+Tab> reformats entire script
- 18956 Make sure oauth2 library is loaded correctly
- 18966 Remove size limitation for creating graphics

## Specific IDE bug fixes (9.0.0-dp-3)

- 18037 Apply property defaults from metadata when testing widgets
- 18920 Reinstate that a single char can be selected with the mouse in ScriptEditor

## Specific IDE bug fixes (9.0.0-dp-2)

- 18595 Clicking left of text now moves caret to the beginning of text
- 18631 Only use development team preferences when running from the repository
- 18637 Fix searching in "Stack File and its stack files" from the script editor
- 18644 Deactivate breakpoints correctly
- 18835 linkVisitedColor and linkHiliteColor can now be set from property inspector

## Specific IDE bug fixes (9.0.0-dp-1)

- 13997 Fix issue creating breakpoints via the new breakpoint dialog
- 15830 Improve user feedback for invalid breakpoint conditions
- 18043 Add warning about numerical names to user guide.
- 18355 Bring script editor and documentation stacks to front if the stack is already open when navigating to content
- 18475 textFont of control does not get set when tabbing out of textFont comboBox in P.I.

## LiveCode Builder changes

### LiveCode Builder Standard Library

## Sequence operations

- New syntax has been added for reversing the contents of sequence types (`List`, `String` and `Data`). The `reverse <Value>` statement reverses the order of the sequence.

## Java Utilities

Syntax for converting between a `JObject` and `Pointer` have been added to the Java utility library.

- `PointerToJObject` - converts a `Pointer` to a `JObject`
- `PointerFromJObject` - converts a `JObject` to a `Pointer`

These can be used in APIs where `Pointer` is the type of a platform-agnostic parameter whose underlying type is assumed to be `jobject` when used in a platform-specific implementation, for example:

```
-- pView is assumed to be a JObject with underlying type android.view.View
set my native layer to PointerFromJObject(pView)
```

There is now a utility library for manipulating java objects. It contains a type `JObject` which wraps a Java object, some type conversion operations:

- `StringFromJString` - converts a Java string to an LCB String
- `StringToJString` - converts an LCB String to a Java string
- `DataFromJByteArray` - converts a Java byte array to LCB Data
- `DataToJByteArray` - converts LCB Data to a Java byte array

and a utility for determining the class of a given java object:

- `GetJavaClassName` - return an LCB String containing the class name of the given `JObject`

## Foreign function interface

- The machine types `Bool`, `SIntSize`, `UIntSize`, `SIntPtr`, `UIntPtr`, `SInt8`, `UInt8`, `SInt16`, `UInt16`, `SInt32`, `UInt32`, `SInt64` and `UInt64` have been added. These all map to their corresponding foreign counterparts.
- The C types `CBool`, `CChar`, `CShort`, `CChar`, `CUShort`, `CUShort`, `CSInt`, `CUInt`, `CSLong`, `CULong`, `CSLongLong` and `CULongLong` have been added. These all map to their corresponding C counterparts.
- The Java integer primitive types `JBoolean`, `JByte`, `JShort`, `JInt`, `JLong`, `JFloat` and `JDouble` have been added. These map to `int8_t`, `int16_t`, `int32_t`, `int64_t`, `float` and `double`.

## Assertions

- Checks for handler preconditions can now be included using the new `expect` statement. For example, the following statement will throw an error if the value `pProbability` is out of the valid range for probabilities:

```
expect that (pProbability >= 0 and pProbability <= 1) \
  because "Probabilities must be in the range [0,1]"
```

The `that` keyword and the `because <Reason>` clauses are optional.

## LiveCode Builder Tools

### lc-compile

#### Errors

- A new error has been added for identifiers in declaration context that contain `.` - identifiers should always be declared without qualification.
- Parsing of numeric literals, in general, has been tightened up. In particular, the compiler will detect invalid suffixes on numeric literals meaning you cannot accidentally elide a number with an identifier.

```
1.344foo -- ERROR
0xabcdefgh -- ERROR
0b010432 -- ERROR
```

#### Messages

- Errors, warnings and informational messages now display the affected line of code and visually indicate the position where the problem was found. For example, the output might look like:

```
foo.lcb:2:26: error: Identifier 'InvalidExpression' not declared
  constant kBadConstant is InvalidExpression
                        ^
```

### lc-run

- **lc-run** now has the *experimental* ability to load and run bytecode assemblies containing multiple LCB modules. To construct a multi-module bytecode assembly, simply concatenate several `.lcm` module files together. The first module found in a bytecode assembly is treated as its main module.

## LiveCode Builder Language

### Android Listener support

An binding string variant has been added which allows the user to create an interface proxy - that is an instance of a generic Proxy class for a given interface.

This effectively allows LCB handlers to be registered as the targets for java interface callbacks, such as event listeners.

The syntax is as follows:

```
foreign handler _JNI_CreateListener(in pMapping) returns JObject binds to
"java:listener.class.path>interface()"
```

The foreign handler binding to such a function takes a value that should either be a `Handler` or an `Array` - if it is a `Handler`, the specified listener should only have one available callback. If the listener has multiple callbacks, an array can be used to assign handlers to each. Each key in the array must match the name of a callback in the listener. Overloaded methods in the interface are not currently supported.

For example:

```
handler type ClickCallback(in pView as JObject)

foreign handler _JNI_OnClickListener(in pHandler as ClickCallback) returns JObject
binds to "java:android.view.View$OnClickListener>interface()"

foreign handler _JNI_SetOnClickListener(in pButton as JObject, in pListener as
JObject) returns nothing binds to
"java:android.view.View>setOnClickListener(Landroid/view/View$OnClickListener;)V"

public handler ButtonClicked(in pView as JObject)
  -- do something on button click
end handler

public handler SetOnClickListenerCallback(in pButton as JObject)
  unsafe
    variable tListener as JObject
    put _JNI_OnClickListener(ButtonClicked) into tListener
    _JNI_SetOnClickListener(pButton, tListener)
  end unsafe
end handler
```

or

```

handler type MouseEventCallback(in pMouseEvent as JObject)

foreign handler _JNI_MouseListener(in pCallbacks as Array) returns JObject binds
to "java:java.awt.event.MouseListener>interface()"

foreign handler _JNI_SetMouseListener(in pJButton as JObject, in pListener as
JObject) returns nothing binds to
"java:java.awt.Component>addMouseListener(Ljava/awt/event/MouseListener;)V"

public handler MouseEntered(in pEvent as JObject)
  -- do something on mouse enter
end handler

public handler MouseExited(in pEvent as JObject)
  -- do something on mouse enter
end handler

public handler SetMouseListenerCallbacks(in pJButton as JObject)
  variable tArray as Array
  put MouseEntered into tArray["mouseEntered"]
  put MouseExited into tArray["mouseExited"]
  unsafe
    variable tListener as JObject
    put _JNI_MouseListener(tArray) into tListener
    _JNI_SetMouseListener(pJButton, tListener)
  end unsafe
end handler

```

## Identifiers

- Unqualified identifiers are now expected to match `[A-Z0-9_]`. The `.` symbol is interpreted as a namespace operator.

## Namespaces

- Identifiers in LCB can now be qualified, to disambiguate between symbols defined in different namespaces.

## Literals

- Base 2 (binary) integer literals can now be specified by using a "0b" prefix, e.g.

```

0b0000
0b1010

```

- Base 16 (hexadecimal) integer literals can now be specified by using a "0x" prefix. e.g.

```

0xdeadbeef
0x0123fedc

```

## LiveCode Builder Host Library

### Engine Library

- The `execute script` command has been improved and now allows specification of a target object and list of arguments. For example:  
  
variable tScriptObject as ScriptObject resolve script object "this card" into tScriptObject execute script "return param(1) + param(2)" in tScriptObject with [1, 2]
- Library handlers can now access the delimiter properties set in the most recent script context using the `line delimiter`, `the item delimiter`, `the row delimiter` and `the column delimiter`.

## LiveCode Builder Documentation

### Style guide

- Updated naming guide for handlers and types
- Added indentation and wrapping guidelines
- New section with widget-specific recommendations

### Specific LCB bug fixes (9.0.0-dp-7)

- 14861** Add "reverse \_" syntax for sequence types
- 19523** Make sure all created registers are destroyed
- 19779** fix bytecode generation for 'set my native layer' syntax

### Specific LCB bug fixes (9.0.0-dp-6)

- 19066** Improve LCB 'execute script' command.

### Specific LCB bug fixes (9.0.0-dp-5)

- 19046** Ensure error is reported for undeclared identifiers
- 19059** Add access to script delimiters

### Specific LCB bug fixes (9.0.0-dp-4)

- 18107** Do not permit namespace operator in unqualified identifiers.
- 18929** Update LiveCode Builder ABI version for LiveCode 9

### Specific LCB bug fixes (9.0.0-dp-1)

- 18086 Improve and expand LCB style guide
- 18385 lc-run: Load multi-module bytecode assemblies.
- 18463 Show correct error position when source line includes tabs

## LiveCode extension changes

### Spinner widget

#### Spinner widget

A new spinner or activity indicator widget has been implemented. Spinners provide visual feedback to users use when performing an activity for an unknown duration such as processing a large amount of data or presenting a complex user interface.

### Line Graph widget

#### Markers

- The new **markerScale** property controls the size of graph point markers.
- Any named icon from the SVG icon library can now be used as a graph point marker.

### Tree View widget

#### Performance

- Previously when an array was expanded in the Tree View widget, all of the display calculations for were done before the next redraw. Now the keys are sorted (as before) but the display calculations are made for a maximum of 1000 rows. When more rows are needed due to scrolling, another 1000 are calculated at that point.

This provides a near-continuous scrolling experience for arrays with large numbers of keys, and ties the expense of expanding an array to that of sorting its keys.

### Segmented Control widget

#### Appearance and theming

- Dividers between segments are no longer drawn when the **showBorder** property is `false`

#### Properties

- Setting the **itemCount** now updates all other properties immediately, rather than at the next redraw
- All list-like properties now contain exactly **itemCount** items at all times
- The **itemNames** property may now include duplicated and/or empty segment names

## Android Native Button widget

### Android Native Button

A new widget has been added which is a native button view on Android. On all other platforms it presents a placeholder image with the Android logo.

#### Properties

- **enabled** - The enabled state of the button
- **label** - The label to display
- **labelColor** - The color of the button label text
- **textSize** - The size of the button label text

#### Messages

- **mouseUp** - sent when the button is clicked

## JSON Library

### JSON parser improvements

- `JsonImport()` no longer incorrectly accepts garbage at the end of a JSON file.
- `JsonImport()` no longer incorrectly accepts unescaped control characters in strings
- "null" is a valid JSON file, and `JsonImport("null")` no longer throws an error. It returns `nothing` in LCB and the empty string in LiveCode Script.
- A number by itself is a valid JSON file, and `JSONImport("25")` now returns 25, rather than throwing a syntax error.

### JSON parser security fixes

- Some crafted JSON files could cause **jsonImport** to use excessive amounts of CPU time. The **jsonImport** function will now reject inputs with more than 500 levels of structure nesting.

## mime script library

### MIME Library

A new Multipurpose Internet Mail Extensions (MIME) library has been implemented to provide support for common data formats such as multipart email message bodies.

## oauth2 script library

### OAuth2 dialog library

A new library has been implemented for presenting an OAuth2 authorization dialog for any web service that supports OAuth2 Authorization Code Flow

## getopt script library

### Command-line option parsing support

The new **getopt** library provides support for parsing Linux-style command-line options.

## diff script library

### diff library

A new library has been implemented for computing diffs between text sources and applying those diffs to text.

## dropbox script library

### Dropbox API v2 Library

A derivative of Gerard McCarthy's Dropbox API v2 library for LiveCode is now available as a standalone inclusion. The changes to the library include a new command based API with asynchronous callback options for editions of LiveCode that support asynchronous HTTP POST.

## messageauthentication script library

### Message Authentication Support

The new **Message Authentication** library provides support for computing a HMAC (Keyed-Hashing for Message Authentication) using a data using a specified key and message digest type as described in RFC 2104.

## Specific extension bug fixes (9.0.0-dp-7)

**18698** Ensure only well-formed JSON numbers are accepted

## Specific extension bug fixes (9.0.0-dp-6)

**19317** Improved description of attachments parameter for mimeEncodeAsMIMEEmail

## Specific extension bug fixes (9.0.0-dp-3)

**18908** Fix parsing of JSON files containing only a single-digit integer

## Specific extension bug fixes (9.0.0-dp-2)

**18693** Prevent long delays when expanding arrays with many keys

**18697** Fix parsing of "lonely number" JSON files

**18707** Fix possible denial of service via crafted JSON inputs

- 18714 Ensure all `itemNames`, `itemLabels` etc. can be set to empty
- 18779 Do not draw borders when `showBorder` is disabled

## Dictionary additions

- **difference** (*command*) has been added to the dictionary.
- **messageDigest** (*function*) has been added to the dictionary.
- **mobileDisableNFCDispatch** (*command*) has been added to the dictionary.
- **mobileEnableNFCDispatch** (*command*) has been added to the dictionary.
- **mobileIsNFCAvailable** (*function*) has been added to the dictionary.
- **mobileIsNFCEnabled** (*function*) has been added to the dictionary.
- **msgChanged** (*message*) has been added to the dictionary.
- **nfcTagReceived** (*message*) has been added to the dictionary.
- **recordFormats** (*function*) has been added to the dictionary.
- **symmetric difference** (*command*) has been added to the dictionary.

## Previous release notes

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- [LiveCode 8.1.3 Release Notes](#)
- [LiveCode 8.1.2 Release Notes](#)
- [LiveCode 8.1.1 Release Notes](#)
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