



# DeviceAnywhere Enterprise

## Best Practices for Object Scripting

Release 6.1

DeviceAnywhere Enterprise Monitoring 6.1

DeviceAnywhere Enterprise Automation 6.1

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## Notice

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# 1 Overview

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DeviceAnywhere Enterprise 6.0 has new automation capabilities that vastly simplify script creation and management.

- ◆ Script recording—you can now record scripts out of the box by interacting directly with a device. And you can always edit a recorded script to add commands or branches.
- ◆ Object-level commands—you can work directly with web elements or native objects to create scripts that operate across multiple devices and are not sensitive to changes in your app UI. Object-level commands enable you to create and maintain fewer scripts.

Read on for best practices and information on [recording scripts](#), [general tips for testing mobile apps](#), and specific tips on testing [web apps](#) or [native apps](#).

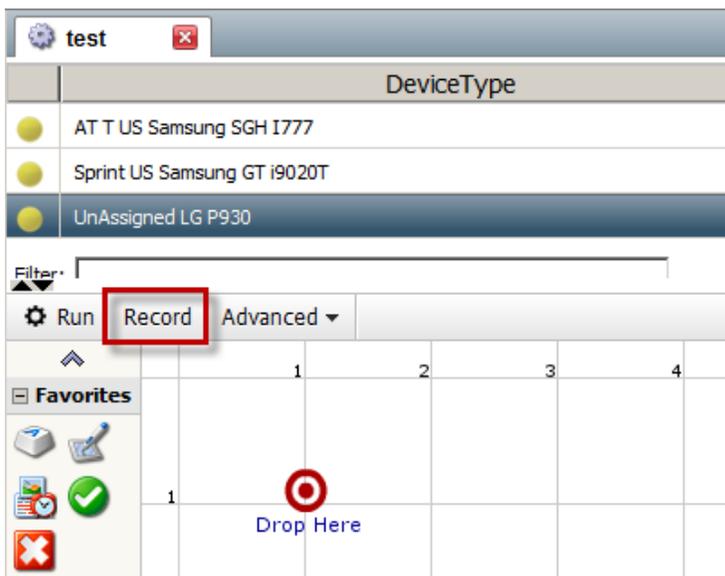
## 2 Script Recording

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### Many Ways to Script

With the script recorder and the ability to work with objects, there are now several ways to create automated scripts in DeviceAnywhere Enterprise:

- ◆ Record scripts
  - The quickest way to create a script is to record simple, device-specific (or partitioned) implementations.
  - You can record unpartitioned web object scripts in Web Mode.



- ◆ Use UI-based commands—you can drag and drop commands onto the script canvas to work with the text or images on your device screen. Because of the differences in device UIs, these scripts are generally partitioned by device model. With DeviceAnywhere Enterprise's visual scripting language, even those with little or no scripting experience can create implementations very quickly.



- ◆ Use Web or Object commands—instead of working with the visual content of a device screen, you work with the underlying web elements or native objects. These scripts are unpartitioned and can operate across devices and remain robust through UI changes.
  - Drag and drop commands onto the script canvas.
  - Record Web commands in Web Mode.



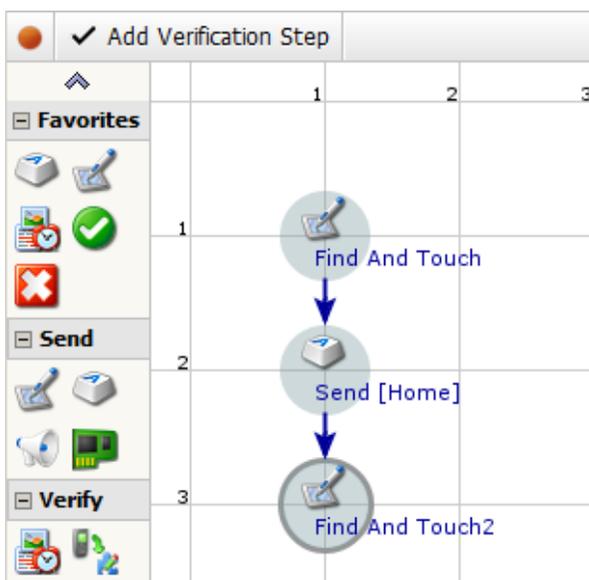
### When to Use Recording

If you want to create a simple, single-branch script, recording is the way to go. For example, your script might consist of swiping the device screen and pressing a button. Recording is also useful to create a baseline script that you can modify later. You can always edit recorded scripts to add commands and make them more complex.

Recording creates a script with the following commands:

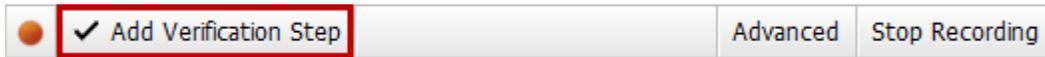
- ◆ Find and Touch commands—for touches and swipes
  - Hold the Ctrl key and drag your mouse to swipe the device screen.
- ◆ Send Keys commands—for key presses and data entry
- ◆ Web Touch and Web Element commands when recording in Web Mode

Figure 1 Recording a Script



While recording, you can insert non-recordable commands:

- ◆ Click **Add Verification Step** to define text-, image-, or other types of screen verifications.



- ◆ Drag and drop any other command from the toolbar, e.g., to call a variable.

Recorded scripts are saved automatically.

### Choosing a Recording Option

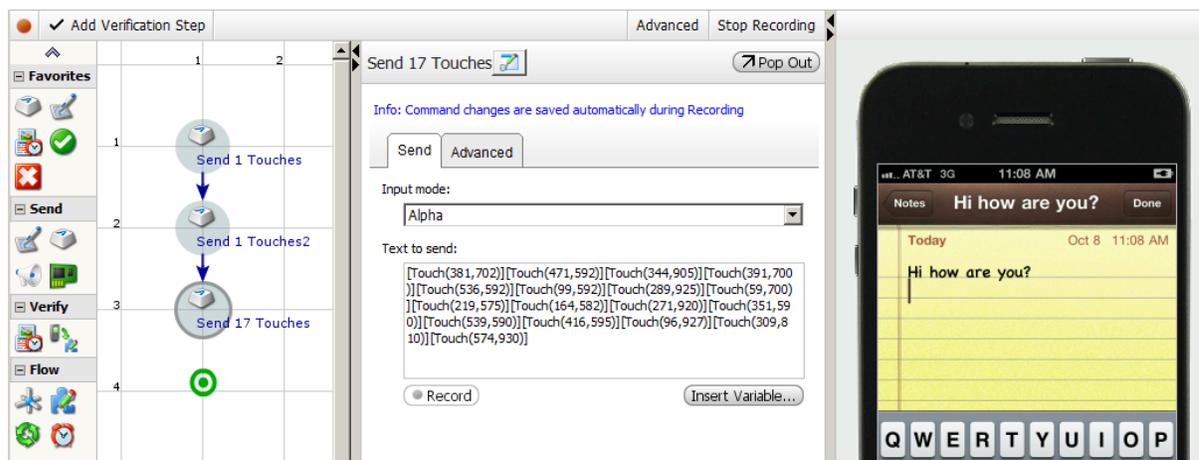
After you have acquired a device and clicked **Record** above the script canvas, you can choose recording options—**Advanced**. You can switch recording options as you record a script.

Figure 2 Recording Options



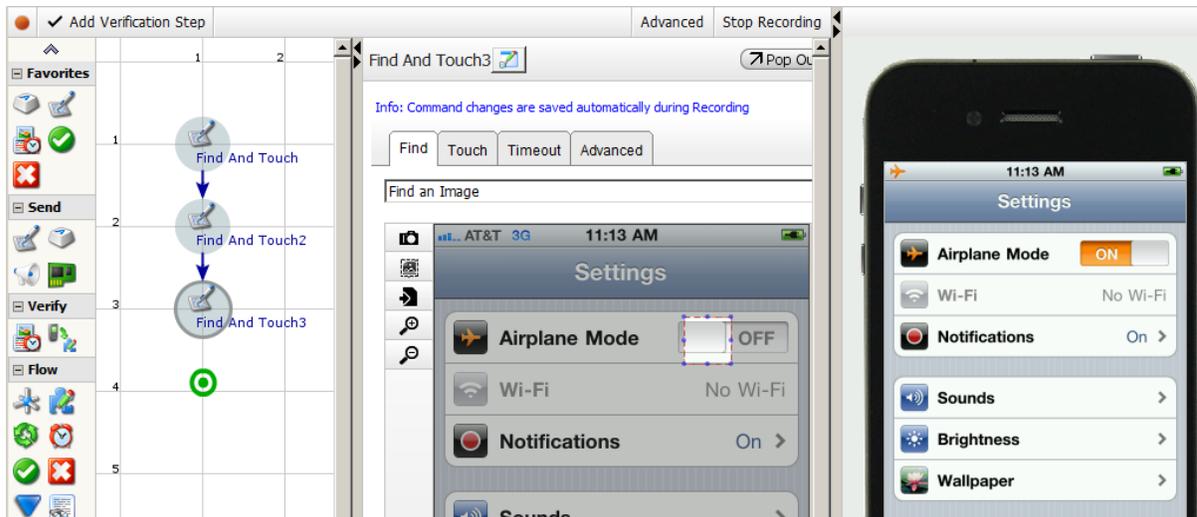
- ◆ Record consecutive touches in the same command. Consecutive key presses or screen taps are recorded into a single Send Keys command. If there is delay between presses/taps, they are recorded into separate Send Keys commands. Screen taps are defined in terms of the x and y coordinates, e.g., [ Touch ( 51 , 146 ) ].

Use this option when it makes sense to have consecutive key presses in one command, e.g., when entering content into a text message or a note.

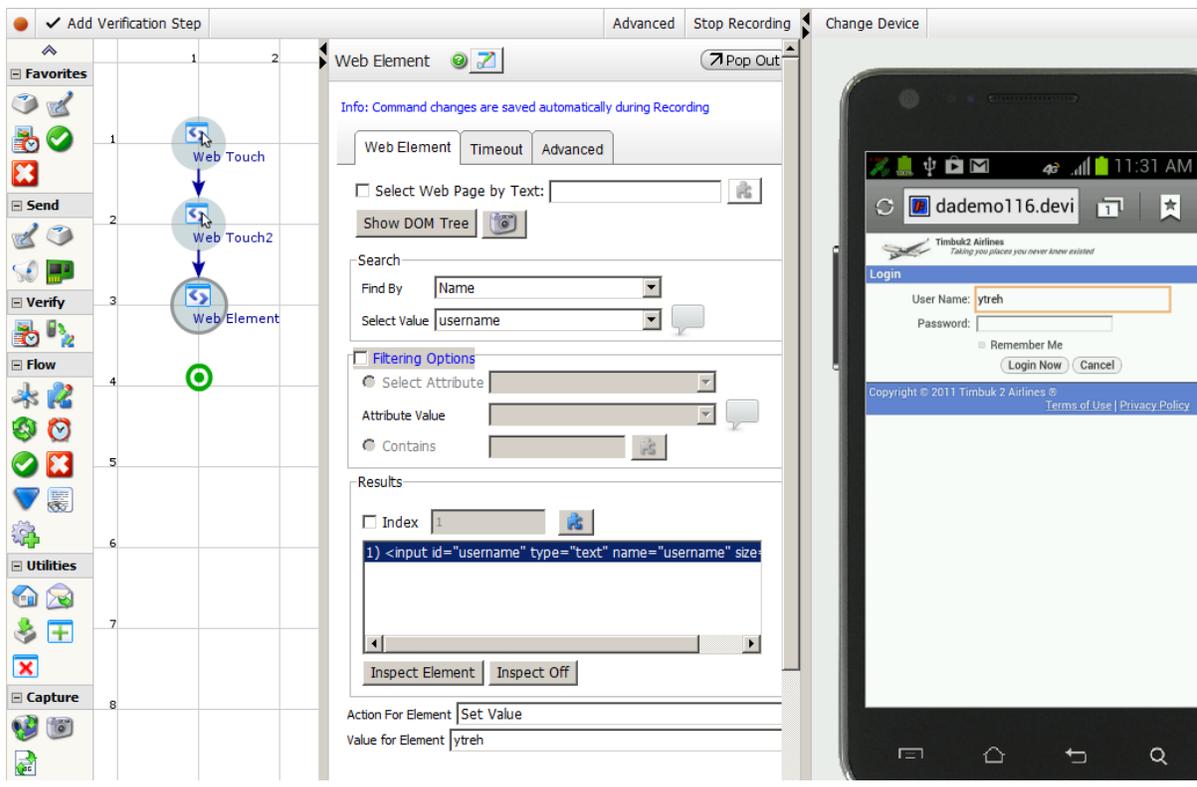


- ◆ Record consecutive touches in separate commands (default). Each key press or screen tap is recorded into a separate command, Find and Touch for touchscreen taps and swipes, Send Keys for device key presses. Touchscreen taps and swipes are defined in terms of captured screen images.

Use this mode when it's important to have visual information in your command, e.g., when moving from one application page to another, or when enabling or disabling important settings.



- ◆ **Record in Web Mode**—use to capture Web commands when interacting with a web app.



**NOTES** You will need to launch your browser before turning on Web Mode. Web Mode captures Web Element and Web Touch commands inside a web page or application.

As Web commands interact directly with web elements, it is best not to mix Web commands and UI-based commands in the same script—see [General Tips for Testing Mobile Apps](#) below.

## Recording Tips

- ◆ When recording, as when writing a script, think about repeatability—know the path you wish to take on the device and record only that. Remember, once you click **Record**, any device interaction is recorded into your script. Any extraneous clicks recorded will interfere with expected results.
- ◆ Start recording from a known place such as the device home screen. Then after recording, run your script from the same place, e.g., the home screen.
- ◆ Before recording, have the values that you want to enter into fields handy.
- ◆ If recording Web commands, make sure that your devices meet the requirements for doing so (review the [DeviceAnywhere Enterprise Automation User Guide](#)).

## 3 General Tips for Testing Mobile Apps

### Comparing Visual and Object-Level Scripts

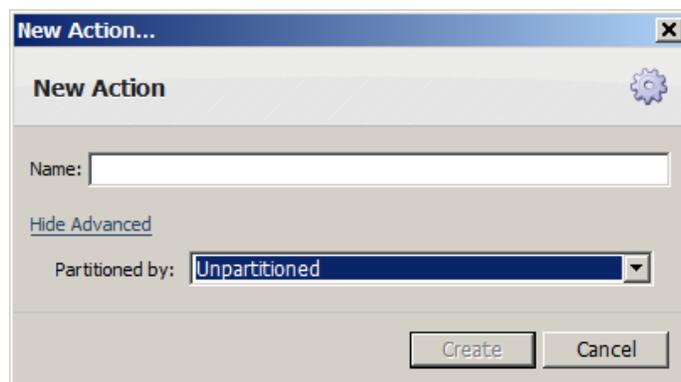
Table 1 Visual vs. Object-Level Scripts

	Visual Scripts	Object-Level Scripts
<b>Commands</b>	Use UI-based commands in any application.	Use Web commands for web applications. Use Object commands for native applications.
<b>UI Changes</b>	Impacted by UI changes; image or text matching commands will need to be updated.	Reliable across UI changes.
<b>Partitioned/ Unpartitioned</b>	Typically requires device-specific actions with implementations per device model to account for UI differences.	Scripts operate across devices (native scripts operate across devices in the same OS family).
<b>Verifications</b>	Script verification based on UI (device image or text).	Verification based on finding elements/objects.

### Making the Most of Unpartitioned Scripts

With web or native object-level commands, instead of working with the visual content of a device screen, you work with the underlying web elements or native objects. Depending on how you set up your applications, underlying elements stay relatively stable across changes to the UI. In turn, you can set up unpartitioned scripts that work across all devices in your project. You need not partition a script to account for differences in how your application is displayed on different devices.

Figure 3 Creating an Unpartitioned Action



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**NOTE** Once a script is set up as partitioned or unpartitioned, it cannot be reversed.

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If your application behaves differently on say, iPhones and Android devices, create separate projects for scripts and devices for each platform. You could then create unpartitioned scripts in each project to work across all platform devices.

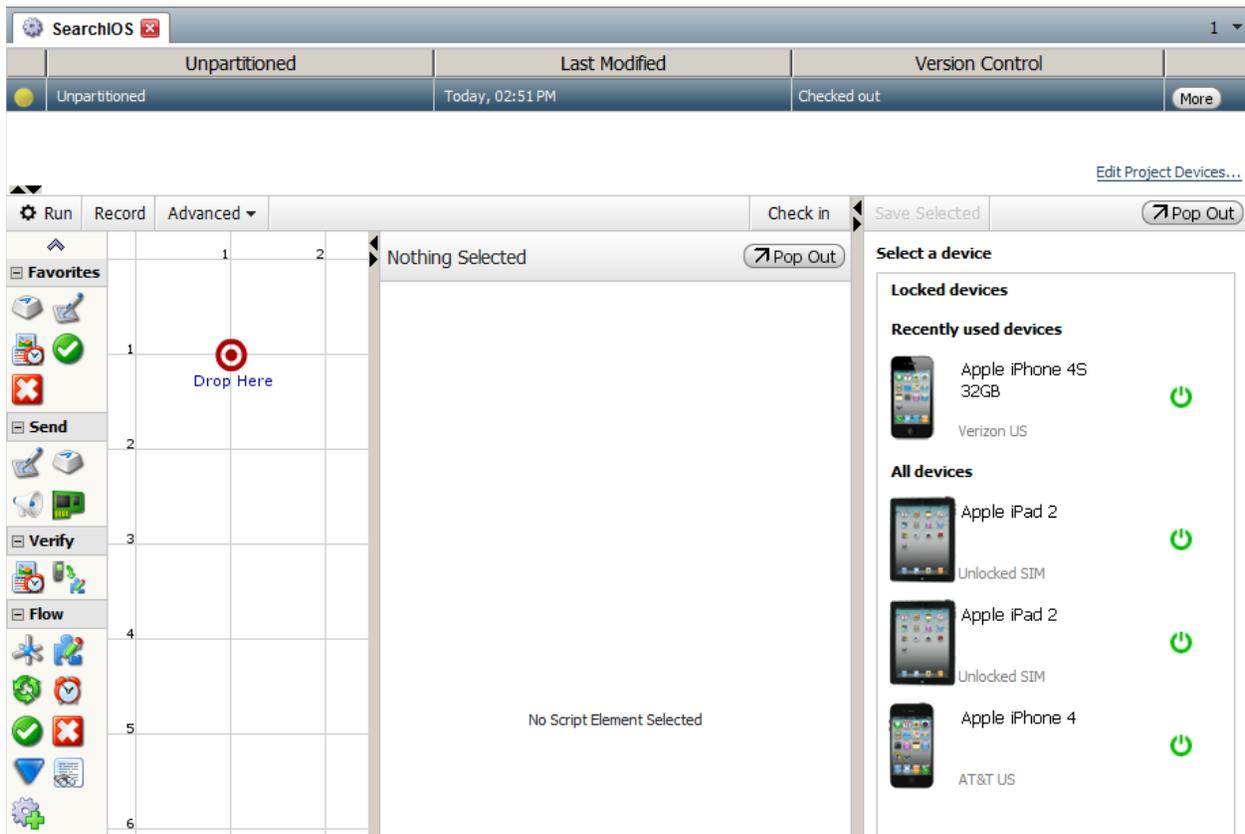
The image below shows a new, unpartitioned script that can work across all iOS devices shown in the right pane. You can select any device to interact with it in order to write or record your script.

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**NOTE** As object-level commands interact directly with web or native elements, it is best not to mix them with UI-based commands in the same script.

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Figure 4 Unpartitioned Script Canvas



## Accounting for Pop-Ups and Other One-Time Application Behavior

Applications and devices display one-time behaviors that are often not scripted for. You must account for these behaviors and the points at which they occur in your scripts and reference points.

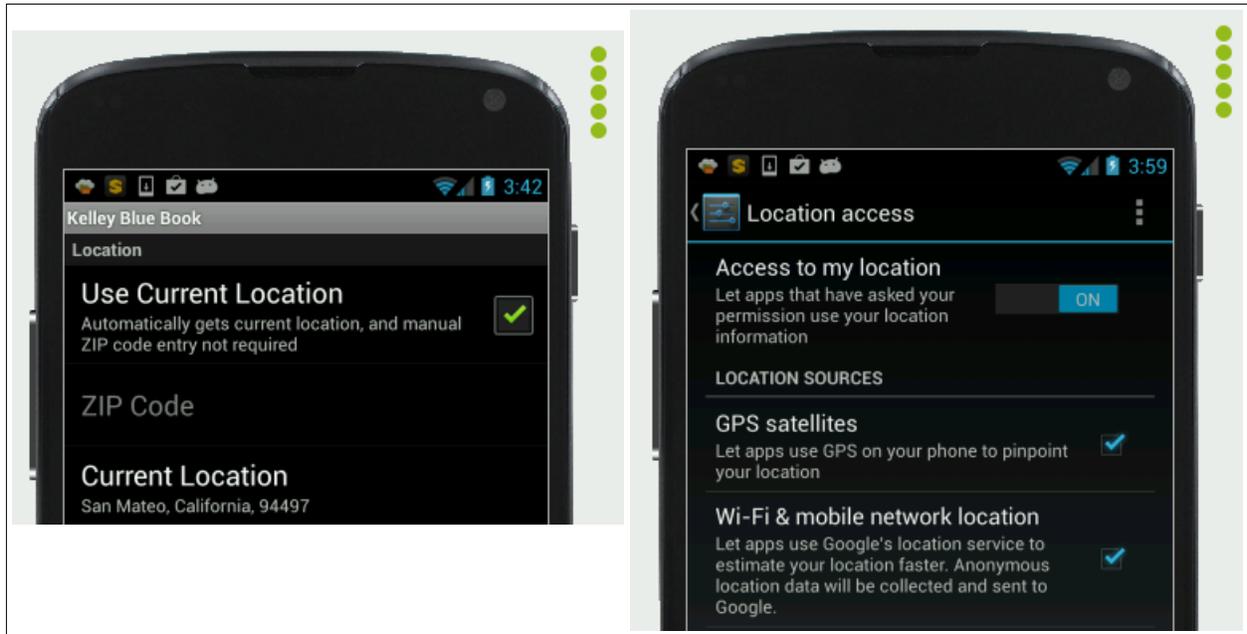
For example, the first time you log in to a banking application, you might be required to sign an agreement. Or when you navigate to the store locator in an application, it asks to use your current location. These screens only appear again when a user resets the device or application, reinstalls the application, clears the browser cache, changes application location settings, or changes a device's use of GPS data.

The images below show the location sharing screen of the Kelly Blue Book application and the GPS settings on an Android device. Any change to these settings can cause a change in how your web or

native application behaves. Before you run a script, check that these settings have not changed, or build scripts that check such device settings.

If these settings are likely to change, you should create branches for the one-time application screens that appear, e.g., asking you to set a location or sign a user agreement.

Figure 5 Settings That Change Application Behavior



## Using Object vs. Image or Text Verification

You can use different types of reference points to verify script outcomes. Each kind of reference point has unique benefits and can serve different uses.

- ◆ Image- or text-based reference points allow you to choose text or an image from the device screen that must be matched at runtime. As these reference points are UI based, they must be defined separately for each device in your project.
- ◆ Web element- or native object-based reference points use underlying structures to verify a script outcome on an application page. These reference points can be defined for all devices in a project (web) or for all devices on a platform (native object).

Use UI-based reference points to check the actual appearance of something, for example:

- ◆ Company branding
- ◆ To check that the correct image is displayed
- ◆ The color and size of an image
- ◆ Actual text (with a strict margin of error) that appears on the screen

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**NOTE** As UI-based reference points are device specific, be sure to use them only in partitioned scripts (action implementations), not combined with other Web and Object commands.

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Use object-based reference points when the appearance or content of an element doesn't matter so much, for example:

- ◆ To verify that you are on an application page by the presence/absence of an element
- ◆ To verify a certain outcome by the presence/absence of an element on a page

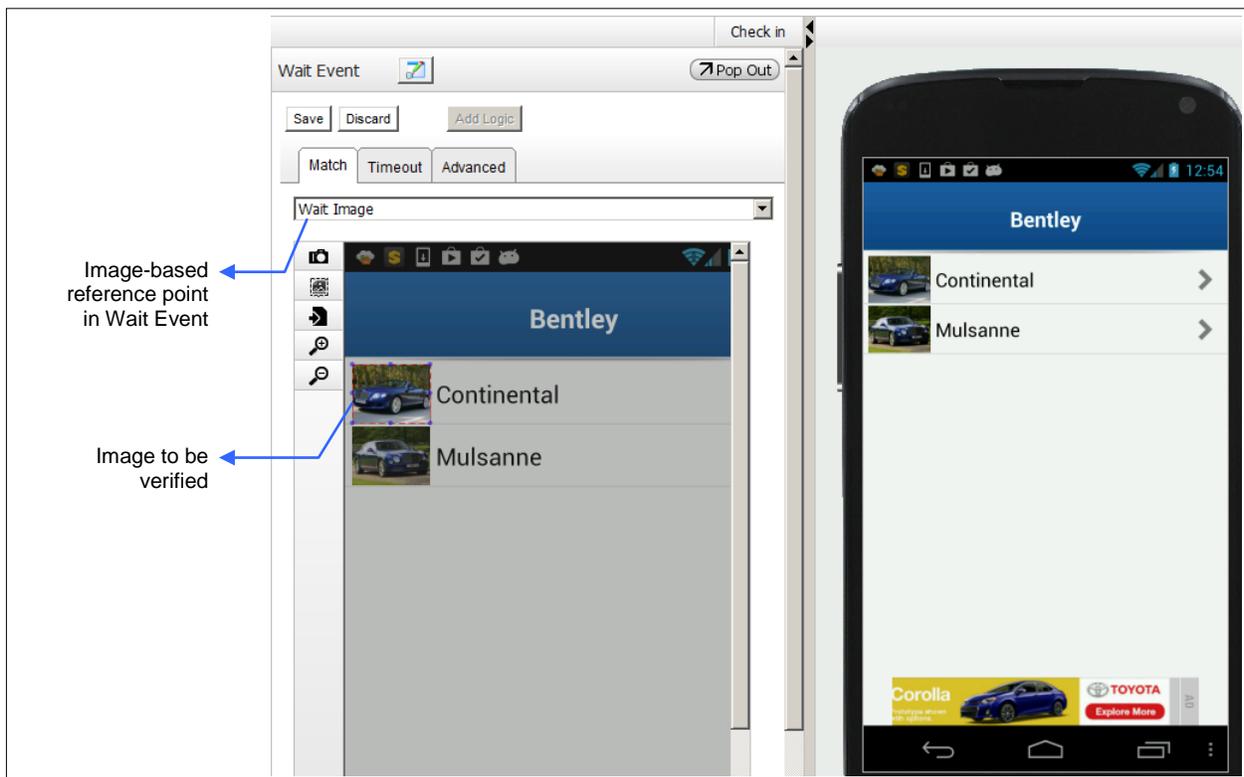
The table below compares visual and object-level reference points so you can choose which to use based on your needs:

Table 2 Visual vs. Object-Level Reference Points

	Visual Reference Points	Object-Level Reference Points
<b>Based on</b>	Pixel-to-pixel matching of a screen area or text extracted using character recognition	Web element or native object <ul style="list-style-type: none"> <li>• You can select any web element as a reference point.</li> <li>• You can select a native object that has text associated with it as a reference point.</li> </ul>
<b>Commands</b>	Wait Event and states	Web Wait (web elements) Wait Event and states (native objects)
<b>UI Changes</b>	Impacted by UI changes.	Reliable across UI changes.
<b>Use for</b>	Verifying exact display of an image or text	Verifying existence of an object or element on a page but not its appearance
<b>Partitioned/ Unpartitioned</b>	Use in partitioned scripts. Or define in a state for all project devices and call from an unpartitioned script.	Can use in both partitioned and unpartitioned scripts.

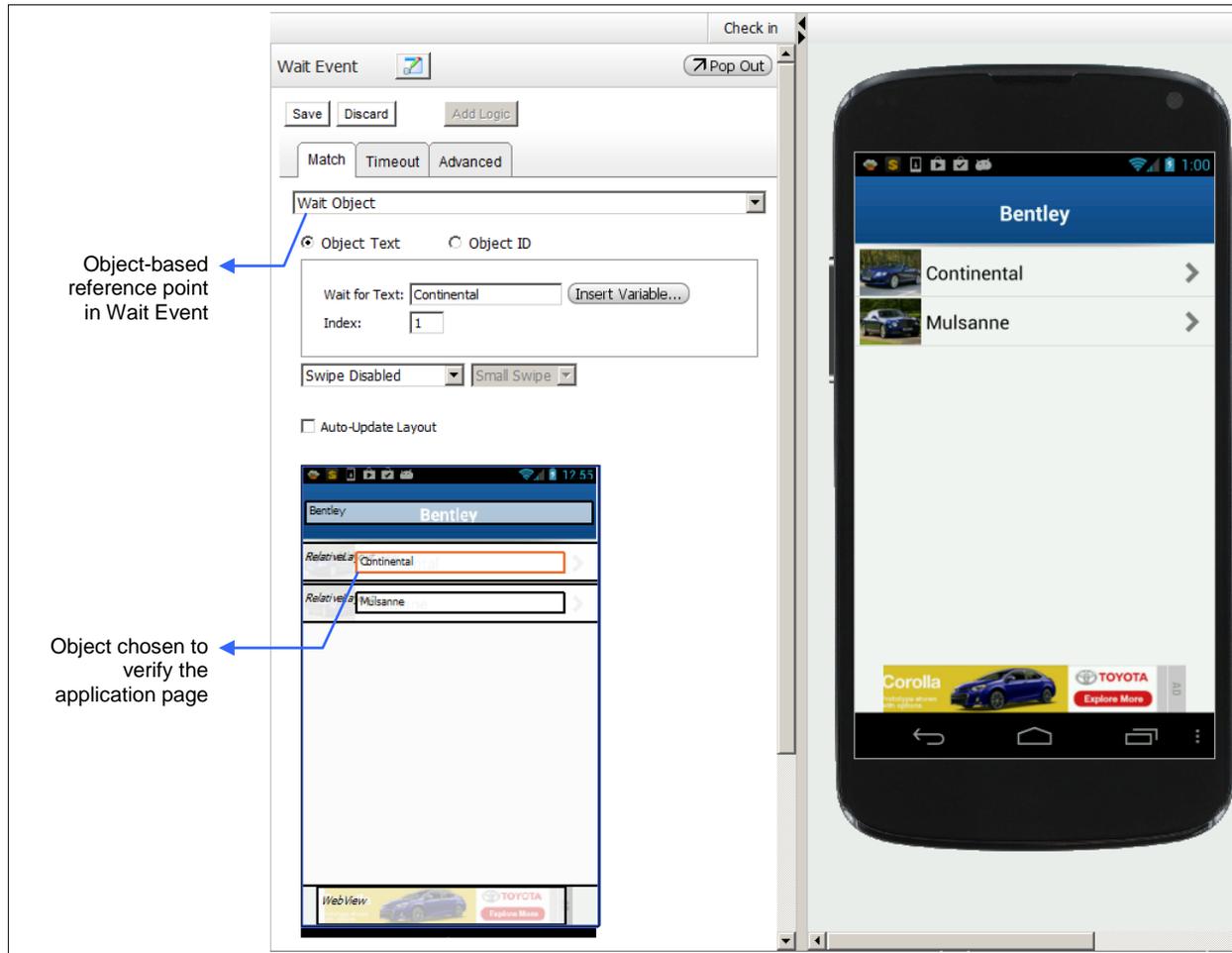
The images below show different reference points on the same page of a native application. In the image below, the scripter wants to verify that the image of a Bentley Continental is matched exactly at runtime.

Figure 6 Verifying an Image in a Native Application



In this object-level reference point, an object is used to verify the same application page.

Figure 7 Verifying an Object in a Native Application



## 4 Tips for Testing Web Apps

### Benefits of Using Web Commands

Commands in the **Web** category offer the most direct and robust way to interact with web content in web or hybrid applications on Android, iOS, and BlackBerry devices.

With Web commands, you can create unpartitioned scripts, work with elements that are not visible on the device screen, fill out and submit entire forms quickly, open and close the native browser from anywhere on the device.

- ◆ Web Element—Selects an element from the web page and performs an appropriate action.
- ◆ Web Wait—Verifies a web element.
- ◆ Web Form—Fills values in fields and submits a web form.
- ◆ Web Touch—Finds and touches/clicks a web element.

- ◆ Additionally, the Browser Open  and Close All Browser Sessions  utilities enable you to open and close native browser sessions.

Figure 8 Web Commands



## Opening and Closing Browsers Quickly

Use the Browser Open and Close All Browser Sessions shortcut commands in the **Utilities** category to speed up mobile web testing.

 **Browser Open**—Launches the native device browser from anywhere on the device and directly navigates to a desired URL.

 **Close All Browser Sessions**—Closes all open native browser sessions from anywhere on the device.

Both commands also give you the option of clearing browser cache when you open or close the native browser. Browser Open and Close All Browser Sessions work on Android and iOS devices and require the DeviceAnywhere Agent.

To close Android browser sessions, use:

- ◆ The Close All Browser Sessions command (check **Clear browser cache**) on Android 4.0.x devices
- ◆ The Open Browser command with **Clear browser cache** checked (this closes any open native browser sessions and opens a fresh session at the URL specified)

You can also open and close native and non-native device browsers in these other ways:

- ◆ Use the Launch App and Close App commands (used for native applications).
- ◆ Use the Find and Touch command.

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**NOTES** These other methods to open/close browsers do not automatically clear the cache or [register the device MCD with the DeviceAnywhere DOM Server](#) for web testing.

Find and Touch is a UI-based command and should not be combined with object-level commands in an unpartitioned script.

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## Pointers for Selecting the Correct Web Element

In order to interact with a web element, you must first search for it and select it in a Web command.

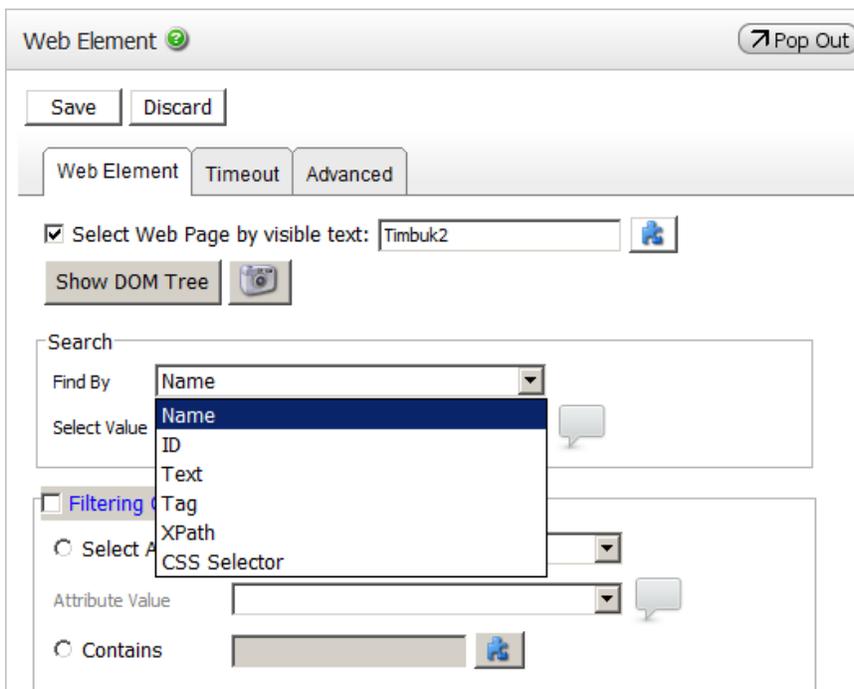
DeviceAnywhere Enterprise Web commands make it easy to select the right type of element.

- ◆ For example, only clickable elements are presented in Web Touch and only `<form>` elements in Web Form. Web Wait and Web Element allow you to choose and work with any element.
- ◆ Additionally, you can select any element shown in a Web command, even those not visible on device screen. You do not have to implement a swipe to work with an element that only appears when you scroll the page.

Web commands allow you to search for an element by any of these criteria:

- ◆ **Name**—the name attribute of an element
- ◆ **ID**—the id attribute of an element
- ◆ **Text**—the text between opening and closing tags of an element
- ◆ **Tag**—the tag applied to an element
- ◆ **XPath**—the path expression identifying the element in the DOM
- ◆ **CSS Selector**—the CSS Selector location of the element

Figure 9 Search Criteria for Web Elements



Whenever possible, search for an element by **Name**, **ID**, **Text**, and **Tag**. If an element's location in the markup is changed, its XPath and CSS selector expressions can change. Even if markup remains unaltered, XPath location can change from one device to another or when you change orientation on the same device.

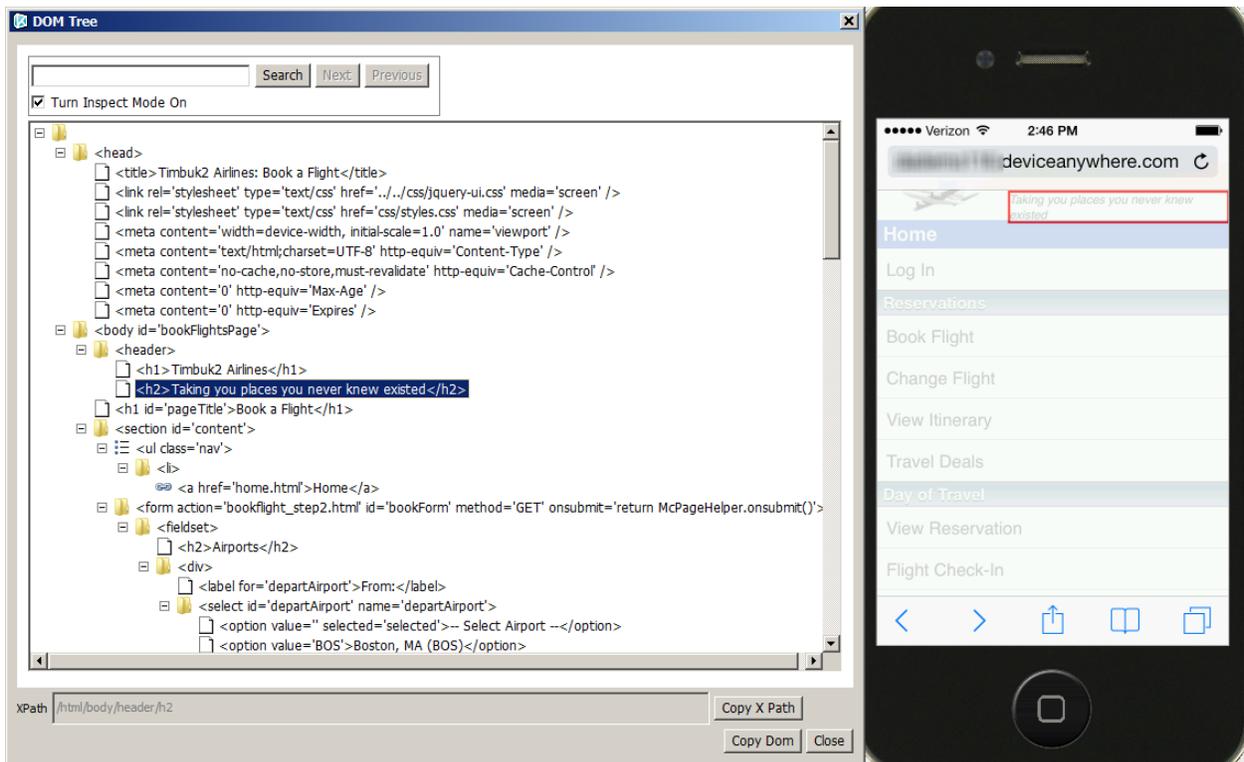
If you cannot find an element using a particular search criterion, try another.

The web page DOM viewer is another powerful tool that helps you locate an element and its path expression.

When you launch the DOM viewer in a command (**Show DOM Tree**), you can enable inspect mode (**Turn Inspect Mode On.**) When click on the device, the corresponding element is highlighted on both the device screen and in the DOM tree. Likewise, when you select an element in the tree, it is also highlighted on the screen, helping you locate the element you want.

The **XPath** location of any selected element is also displayed in the DOM viewer.

Figure 10 Inspect Mode in the DOM Viewer



## Tools for Narrowing Down Element Search Results

If you have many search results and need to narrow them down, you can:

- ◆ Use the additional search filters in **Filtering Options**.

**Filtering Options**

Select Attribute

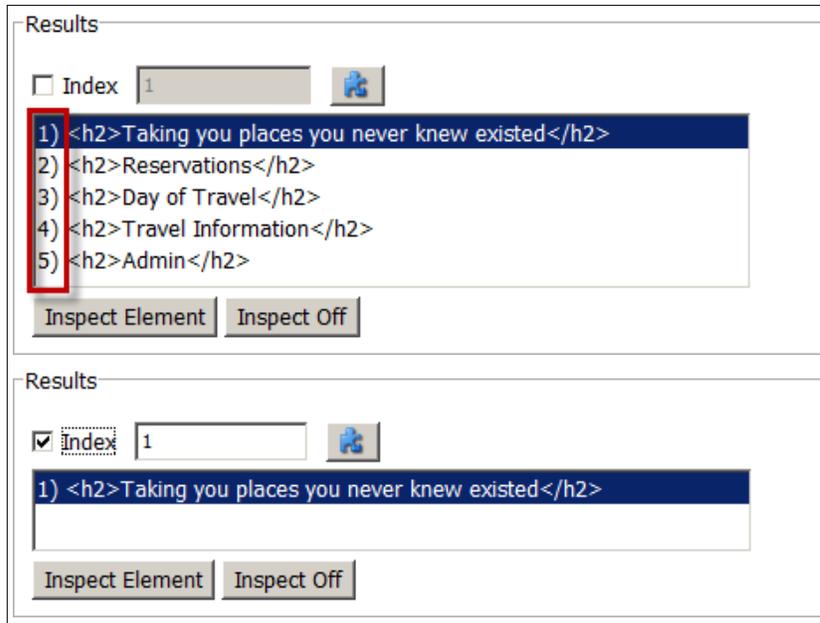
Attribute Value

Contains

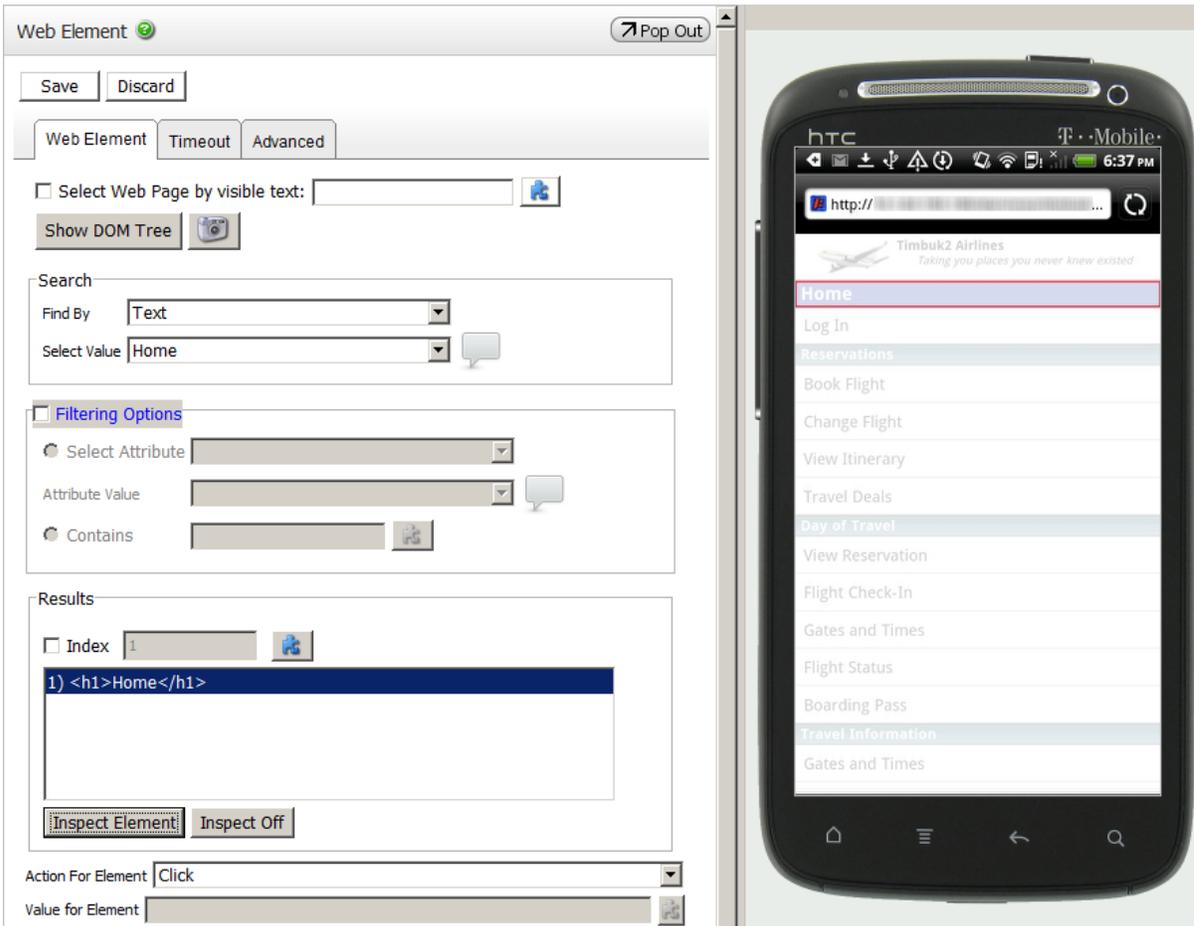
- ◆ Select a search result by **Index** number.

Note that the index number is not intrinsic to an element. The order of an element in search results can change depending on the search criteria you use or the credentials you use to log in to a web page. An element's position in search results can also change from one device to another or when you change device orientation. Source code can also be altered to change the relative position of an element in the markup.

The images below show search results before and after filtering by index number.



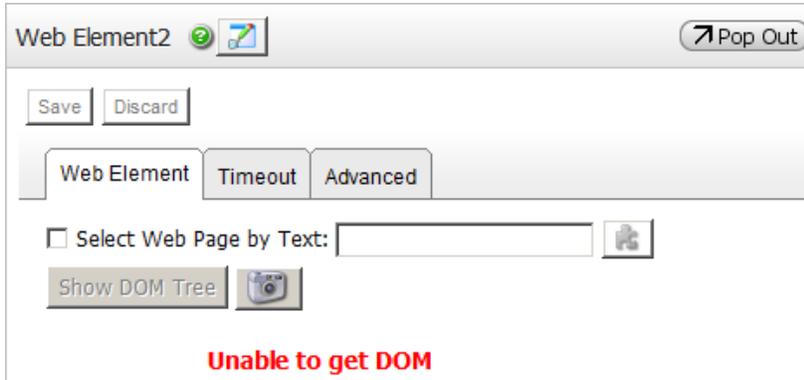
- ◆ Select a search result and then click **Inspect Element**. The element is highlighted on the device screen. **Inspect Element** is a powerful tool that simultaneously highlights an element in a command and on the device screen, helping you locate the element you want.



## Troubleshooting Empty Web Commands

If you open a Web command and it does not fill out with information, you will see the following message:

Figure 11 Unable to Process Web Command



There are several things you could check to troubleshoot this issue:

- ◆ If you have a private, on-premise environment, check that your DOM Server is configured correctly.
- ◆ Check that your device meets all the requirements for web testing.
- ◆ Check that your device is acquired.
- ◆ Check that your device is on a test web page with the required JavaScript tag.
- ◆ Check that your device [MCD is registered with the DOM Server](#).

## Options for Setting the Device MCD for Testing Web Apps

To use Web commands on a device, you must register the device MCD with the DOM Server at the start of a device session. The best practice is to register the device MCD automatically using the Browser Open command.

You might still need to register the MCD manually, e.g., if you are using a non-native device browser. Navigate to the registration page ([http://<DOMServerAddress>/ da/views/mcd.html](http://<DOMServerAddress>/da/views/mcd.html)) and enter the MCD. You must do so from each device browser you plan to use.

In on-premise environments, you have the option to be prompted if the device MCD is not automatically detected (i.e., when using the Browser Open command). This option must be enabled when you install the DOM Server—check **Prompt MCD** in the DOM Server installation screen below (Figure 12).

The prompt to enter an MCD will be seen whenever the device cannot be registered automatically, even by manual testers in your environment. To avoid this, you can install separate systems for manual and automated testing. Also ensure that you script for this prompt in your automated scripts. And if you are not able to test your hybrid application after enabling this prompt, contact your Keynote Solutions Consultant.

Being prompted for an MCD is not recommended in production systems.

Figure 12 Enabling a Prompt to Register the Device MCD

DeviceAnywhere WebTest Setup

**DeviceAnywhere WebTest Configuration**  
Please enter your information.

Configuration

Web Host

Please enter the external address and the HTTP port of DeviceAnywhere WebProxy

Server Address:

Port:  SSL Port:

Prompt MCD

Next > Cancel

InstallShield

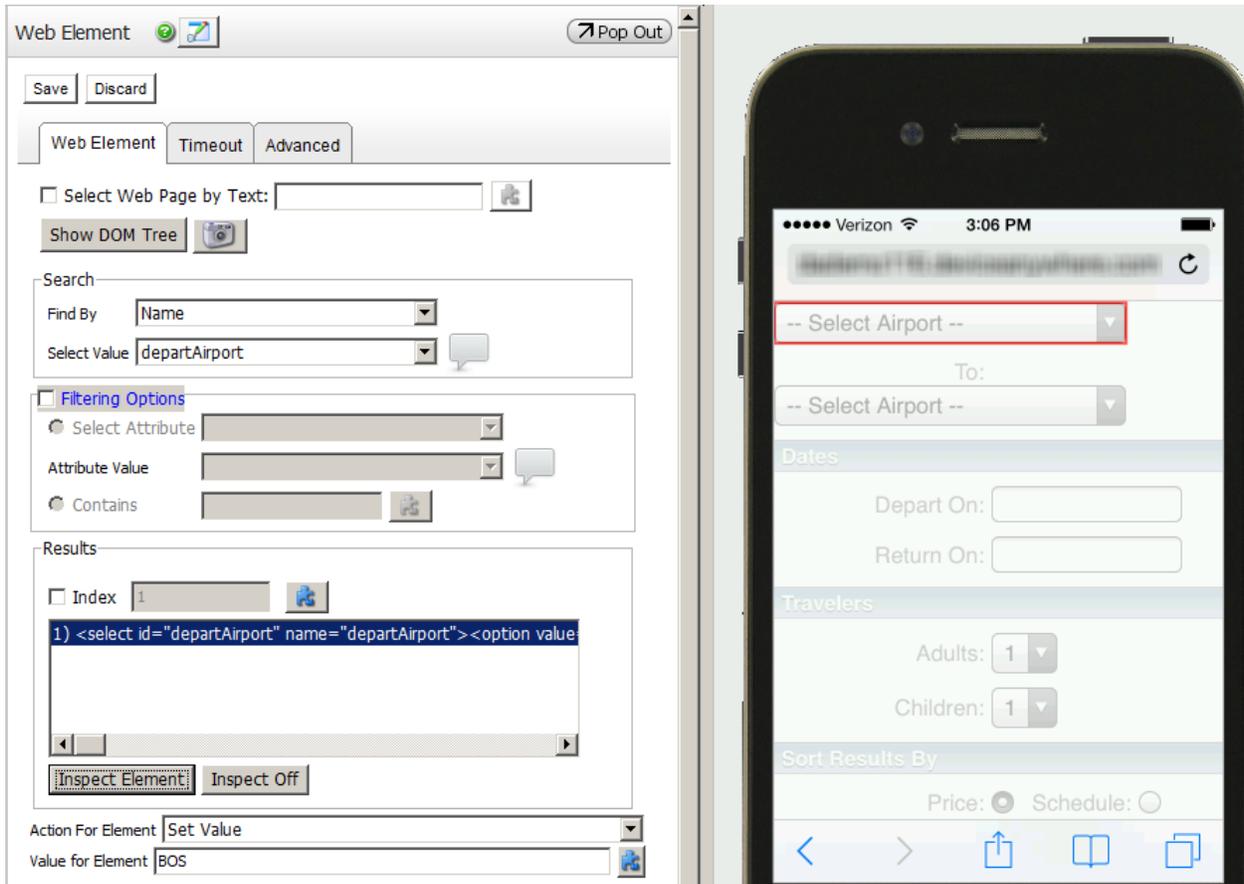
keynote DeviceAnywhere  
Mobile App Lifecycle Management™

## One-Step Values for Web Elements

When you work with Web commands, you can select an element such as a drop-down list and choose a value for it in one go. In other words, you don't need to have one command for setting focus in a field and another for entering a value. You can set a value for an element using the Web Element or Web Form commands.

The image below shows how to select a field and set a value for it in a single Web Element command.

Figure 13 Setting Element Value in Web Element



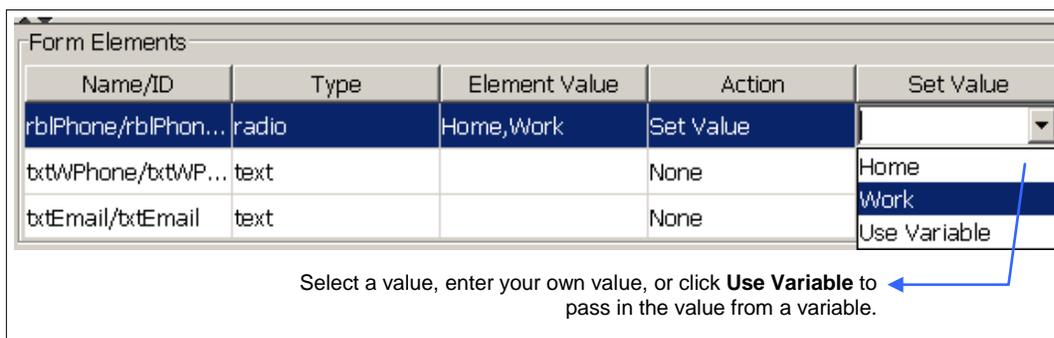
### One-Step Form Entry and Submission

The Web Form command allows you to select a form, set a value for all fields (including fields not visible on the device screen), and submit the form.

When you select a form (<form> element) in the Web Form command, all fields in the form are displayed, and you can set a value for each of them.

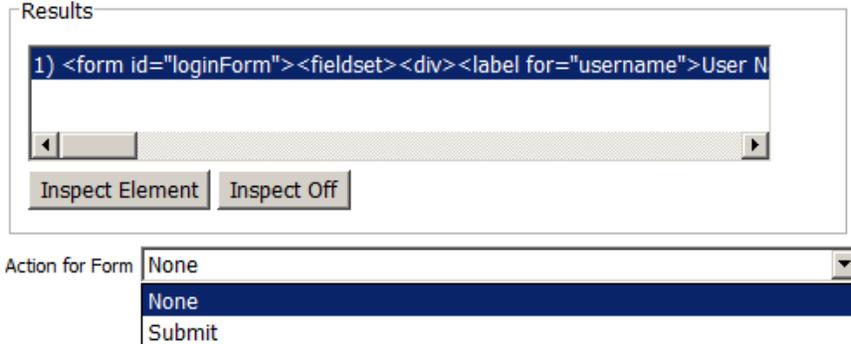
The image below shows how to enter data into several form fields in the Web Form command.

Figure 14 Entering Data in Form Fields—Web Form



Submit buttons for the form as a whole are *not* listed with other form elements. To click a submit button after filling out form fields, choose the **Submit** action for the form as a whole.

Figure 15 Actions for a Form in Web Form



Any other buttons at the bottom of your form are listed with form elements, e.g., the “Next” button at the bottom of the first page of a three-page form. Do not choose any action for this button. Instead, use a Web Touch command after the Web Form command to click the button. This ensures that the button is clicked after all form fields are filled out.

## 5 Best Practices for Testing Native Apps

### Benefits of Using Object Commands

Commands in the **Object** category enable you to create unpartitioned scripts for native applications on Android 4.0.4 devices or higher. A beta release of these commands is available for iOS devices. Devices must be configured for this feature to work—please contact your Keynote Solutions Consultant.

As Object commands work directly with native application objects, your scripts operate across device models and are not sensitive to application UI changes. You also have powerful tools to launch or close native application sessions from anywhere on the device.

Figure 16 Object Commands



- ◆ Launch App—Open a native application.
- ◆ Close App—Close a native application.
- ◆ Object Touch—Find and click an object (identified by associated text).
- ◆ Object Edit—Enter data into an object.
- ◆ Object Extract Text—Extract text from an object to a variable.
- ◆ To use a native object for script verification, select **Wait Object** in a state or the Wait Event command.

## Pointers on Selecting the Correct Native Object

In order to interact with a native object, you must first select it in an Object command.

Unlike [Web commands](#), Object commands display the visual layout of native objects on an application page, with a slight difference—only objects visible on the device screen are displayed. You can only select and work with an object shown in the layout.

### Objects That Are Partially Inside the Layout

In some application pages, objects in the layout appear outside the edges of the device screen. The object you select must at least be partially contained within the layout or it will not be correctly selected during run time.

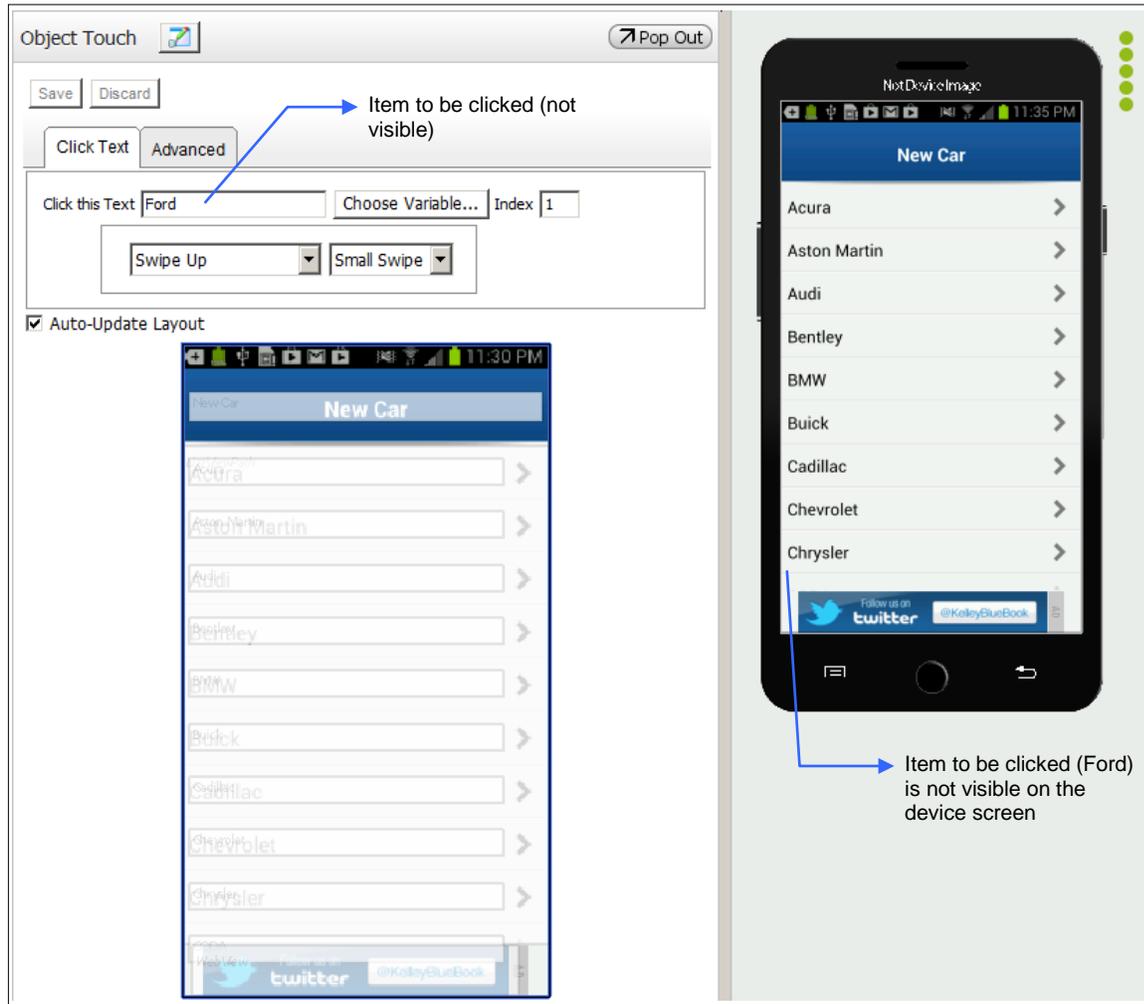
Figure 17 Selecting a Native Object

The screenshot shows the 'Object Touch' interface with a 'Pop Out' button in the top right. Below the title bar are 'Save' and 'Discard' buttons. The main area has 'Click Text' and 'Advanced' tabs. Under 'Click Text', there is a text input field, a 'Choose Variable...' button, and an 'Index' field set to '1'. Below this are two dropdown menus: 'Swipe Disabled' and 'Small Swipe'. A checkbox for 'Auto-Update Layout' is checked. The central part of the interface displays a mobile application layout with various UI elements labeled: 'ImageButton', 'Button', 'ImageButton', 'Top Stories', 'U.S.', 'World', 'Politics', 'Justice', 'Entertainment', 'FrameLayout', 'Snowden claims online Obama fell short', 'LIVE: Erin Burnett OutFront', 'WATCH LIVE TV', 'RelativeLayout', 'Victim's grandson helps free killer', 'RelativeLayout', 'FBI searching Michigan field for Hoffa', 'RelativeLayout', and 'Shark attacks Texas teen in waist-deep water'. Two blue arrows point to specific elements: one points to a 'FrameLayout' element that is partially cut off by the right edge of the screen, with the annotation 'Do not select objects that lie off screen'; the other points to a 'FrameLayout' element that is partially cut off by the bottom edge of the screen, with the annotation 'Object that lies partially on screen—test to ensure it is selected correctly during execution'.

### Scrolling to Make an Object Visible

You can, however, work with an object that becomes visible after you scroll up/down or left/right. On the page shown below, you need to swipe the screen up before you can see the carmaker “Ford.” In a command, you must implement a swipe so that the object you want becomes visible. Choose the same swipe direction as your finger would move if you were physically controlling the device.

Figure 18 Before Scrolling

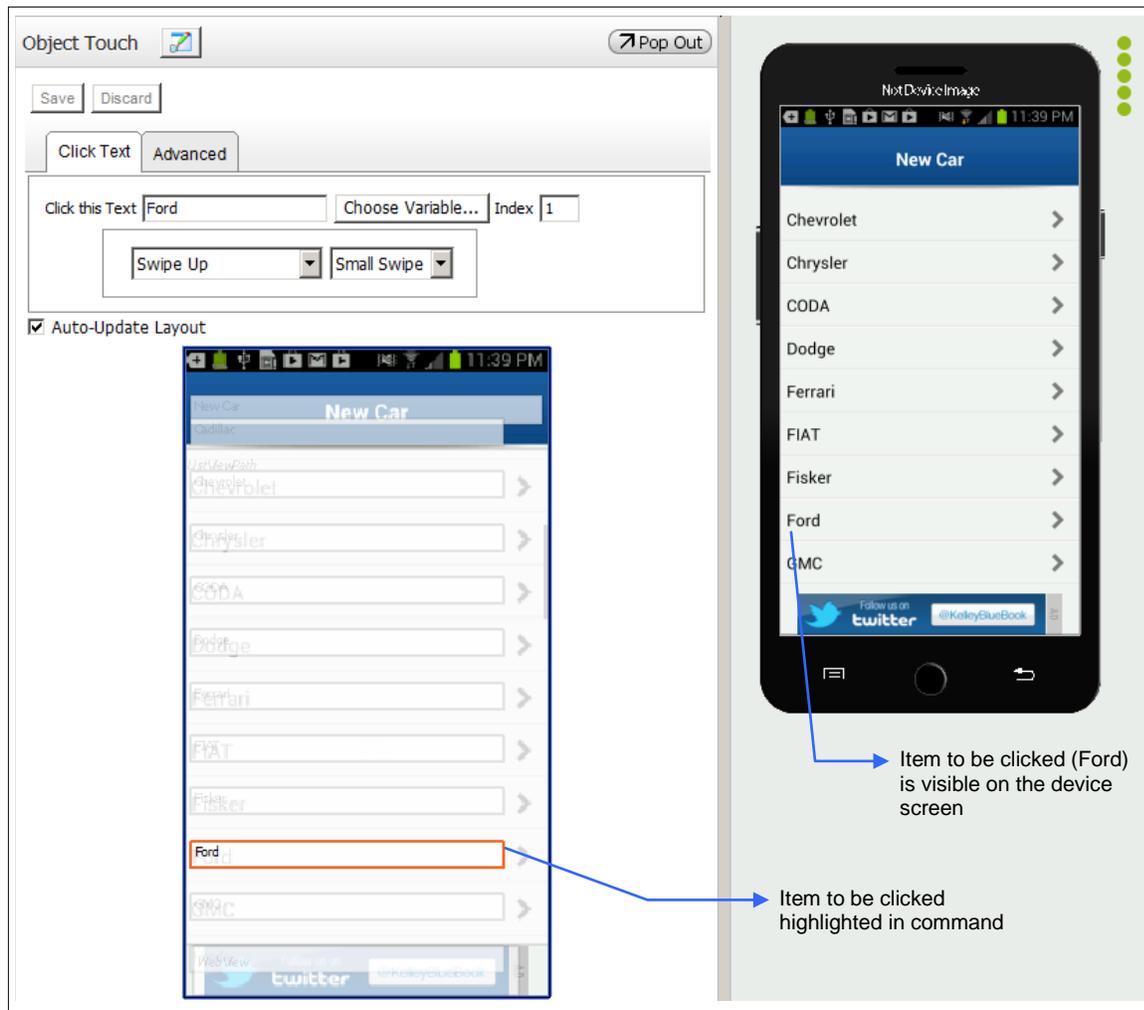


At run time, the screen is scrolled until the object is found or until the command times out.

If you scroll the device screen to view the item you want (with **Auto-Update Layout** checked), you will see the object selected correctly in the command.

If implementing a scroll to bring an object into view, increase the command **Timeout**.

Figure 19 After Scrolling



### Selecting an Object by Text

- ◆ In the Object Touch command (see Figure 18 and Figure 19 above), you select an object by specifying associated text. You can also pass in this value from a variable.
- ◆ When you select an object with no visible text, its class ID is displayed instead. If there are several objects that match the class ID, they are all displayed. You can then use the **Index** number to indicate which of the displayed objects you want to select.

### Web Frames Within Native Application Pages

Object commands cannot be used on web pages or on nested web pages within a native application. These web frames are usually marked as **Web View** in an Object command.

Figure 20 Object Commands Cannot Work on Web Content

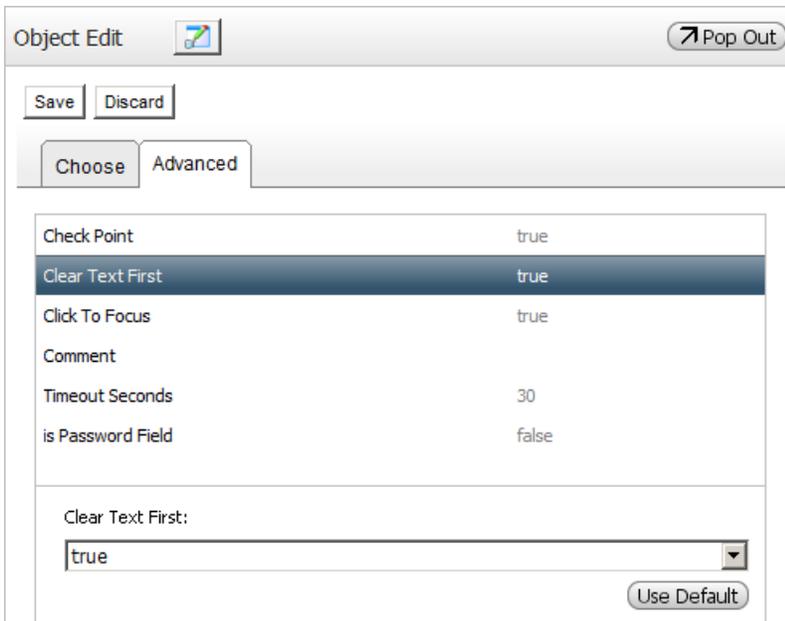


### One-Step Values for Native Objects

You can use the Object Edit command to enter data into a native object. When you select an object field:

- ◆ DeviceAnywhere Enterprise sets focus in the field automatically. (You can change this setting in the **Advanced** tab.)
- ◆ You can also clear existing text automatically—set **Clear Text First** to true in the **Advanced** tab.

Figure 21 Options for Object Data Entry



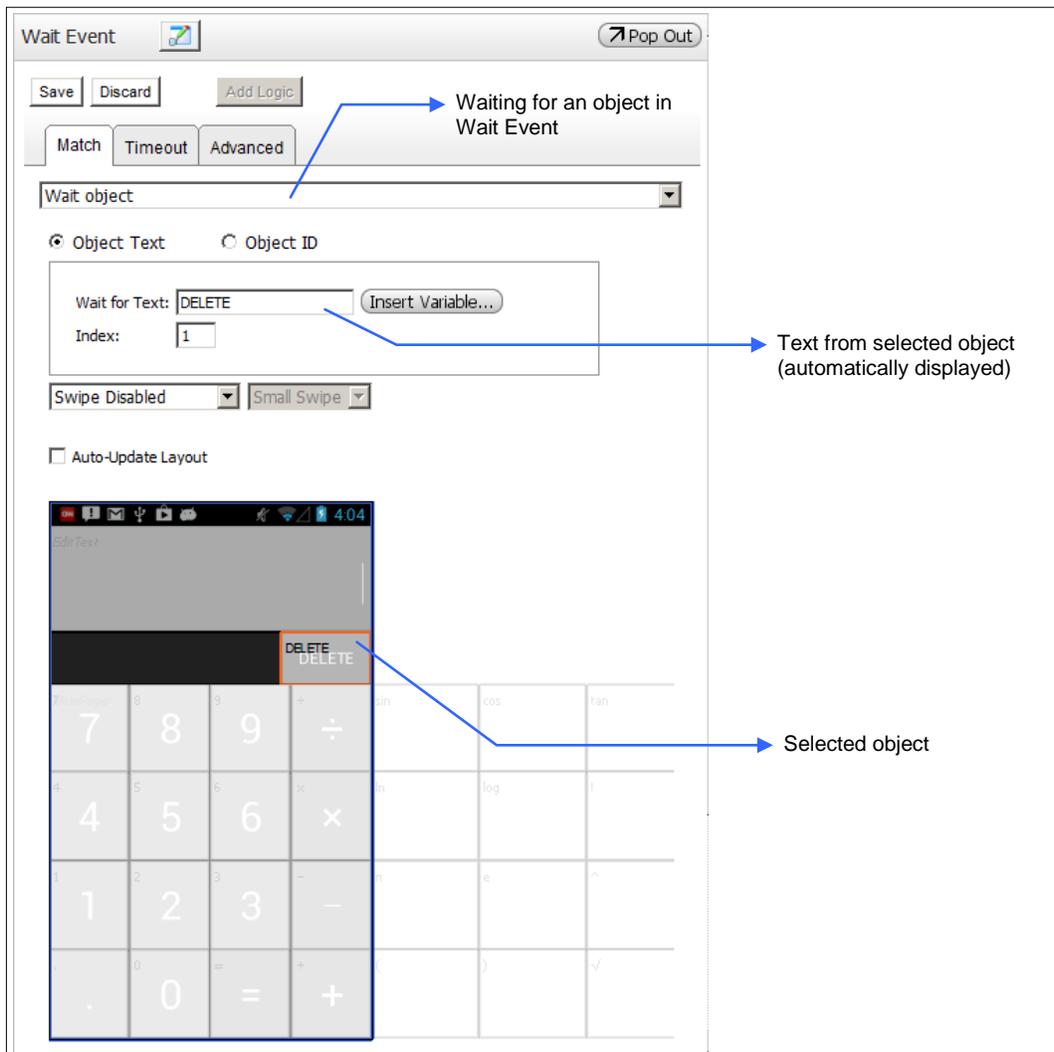
## Implementing Native Object Verification

Use the Wait Object option in a state or the Wait Event command to implement object-based script verification. You can select an object to wait for by its associated text or by its ID.

- ◆ When selecting an object, choose an object that uniquely identifies the application page.
- ◆ Whenever possible, select **Object Text** over **Object ID**. Object ID includes an index number of the object's relative position on the application page. This value is not an intrinsic characteristic of an object and can change over time.

The image below shows selecting an object by its associated text. If many objects have the same text, you can choose a specific object by selecting its **Index** number. Whenever possible, choose object text that is unique to an object; the index number is not an intrinsic property of an object and can change over time.

Figure 22 Waiting for an Object

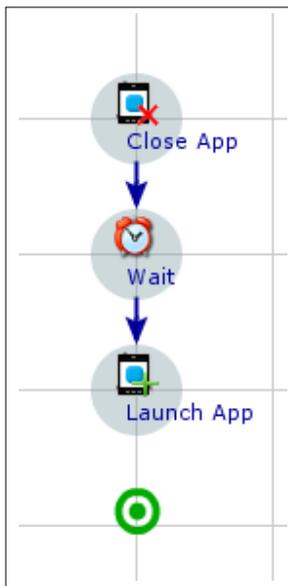


## Best Practice Opening Scripts for Every Object Test Case

To start off an object test case, especially a scheduled test case:

- ◆ Begin your test case by checking if the device is asleep, and if required, restart the device—many Android devices have sleep timers that cannot be disabled.
- ◆ To start using your application in a known state:
  - Reset the application using Close App.
  - Insert a brief Wait time.
  - Open the application using Launch App.

This clears data from the previous application session and opens it on the home page.



## Integrating Native App Testing with Other Systems

DeviceAnywhere's command line utility for uploading and managing applications, `cliAppManager`, can be integrated with standard build systems to automate application installation. If you enable test cases or test cycles to be scheduled, you can combine application installation with kicking off your daily tests.