WEBVIEW2

AUTOIT UDF - DEVELOPER GUIDE

WebView2 developer guide

Chromium inside an AutoIt window, with no file to ship: the COM model, the ABI traps and the diagnostics, explained from the source.

AutoIt 3.3.16+ | No loader to ship | 76 functions | 297 checks | 31 handlers

```
#include "WebView2.au3"

Local $hView = _WV2_Create($hGui)
_WV2_Navigate($hView, "https://example.com")
_WV2_WaitNavigation($hView)

Local $sTitle = _WV2_ExecuteScript($hView, "document.title")
```

One .au3 file. No DLL, no OCX, no installer.

THE WHOLE DEPENDENCY LIST

VERSION	RUNTIME	LICENCE
0.6.0	AutoIt 3.3.16+	MIT

THE STACK



BY THE NUMBERS

public functions	76
self-test checks	297
handler slots	31
concurrent views	16
files to ship	0

The runtime is already on the machine. This package ships no browser, no DLL, no installer: one include, and the engine Windows carries.

COLOPHON

Typeset with PDFX 1.4.0, the author's other UDF.

PDFX - forum topic 213930

Numeric1 - forum profile 118605

Version 0.6.0 - October 2026

HOW TO USE THIS DOCUMENT

Contents & bearings

Eight chapters. Read 1 to 4 to understand the machinery, 5 to 8 to change it without breaking what already works.

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Every entry is clickable; every heading is also a bookmark.

THE PACKAGE IN BRIEF

One AutoIt file embeds the Edge engine that Windows already carries: 75 functions, no DLL, no OCX, no installer. This guide is its maintenance manual.

76
PUBLIC FUNCTIONS
pure AutoIt, no loader

297
SELF-TEST CHECKS
no network, no dialog

31
HANDLER SLOTS
one fake vtable each

0
FILES TO SHIP
nothing to register

READING PATHS

Understand the machinery	01 - 02 - 03 - 04
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What this document is not

Neither an API reference nor a beginner's tutorial. It is the maintenance manual of the UDF: the machinery, the traps, and the checks that keep both honest.

THREE RULES before touching the code

1. **Measure, do not assume**
   The header says by value; the 64-bit wire says pointer. Test the shape, then read the effect.
2. **The header is the fact**
   Slot numbers come from WebView2.h, never from memory or a summary page.
3. **hr = 0 is not proof**
   S_OK says the call arrived. Find an observable consequence before believing it.

0.6

THE THREE LOTS THIS GUIDE DESCRIBES

What 0.4, 0.5 and 0.6 add

The 0.3 edition of this guide described a wrapper over the base interface and eight event kinds. The two lots that followed took the UDF to the versioned interfaces: your script now answers the page instead of only watching it, and the objects the engine returns are kept, steered and released by the same global heap this guide explains. Lot 0.6 added no interface at all: it took the work out of the close path and put a guard on it.

From 0.3 to 0.6, measured

	0.3.0	0.5.0	0.6.0
Public functions	40	75	76 - _WV2_DestroyAll
Handler slots per view	14	31	31 - unchanged
Pointer cells in the heap	1 120	2 480	2 480 - unchanged
Event kinds	8	17	17 - unchanged
Error codes	12	13 - $WV2_ERR_BUSY added	13 - unchanged
Self-test checks	111	280 over 35 sections	297 over 37 sections
Audited slot and IID constants	60	227, against WebView2.h	227 - unchanged
Concurrent views	16	16	16 - unchanged

Lot 0.4 - the page asks, your script answers

- **Resource handler** _WV2_SetResourceHandler names one AutoIt function that sees every request the page makes - uri, method, headers - and either lets it through or answers it from memory with a status, headers and a body. No web server, no temporary file, no network.
- **Virtual host** _WV2_SetVirtualHostNameToFolderMapping serves a folder under an invented host such as https://app.local/, which gives the page a real web origin: storage, workers, fetch and CORS behave as they do online.
- **Filters** _WV2_AddResourceFilter and _WV2_RemoveResourceFilter take a uri pattern and a $WV2_RES_* kind, so a handler is entered only for what it cares about.
- **Re-entrancy** A call that would pump messages from inside a handler is refused with $WV2_ERR_BUSY. This is the reason the teardown figure in chapter 7 begins with the resource handler.

Mechanically, lot 0.4 is one handler family and two raw ranks the base tag never reached. The subscription is ICoreWebView2::add_WebResourceRequested at slot 55, the filters are calls 57 and 58, and the body your function returns travels through an IStream whose Read and Seek are slots 3 and 5 of the Windows SDK - not of WebView2.h. Chapter 3 lists them, chapter 5 walks one through end to end.

Lot 0.5 - the versioned interfaces, one by one

- **Find in page** _WV2_FindStart drives the search object reached through _28::get_Find, with case and whole-word options and highlights; _WV2_FindNext and _WV2_FindPrevious step, _WV2_FindCount and _WV2_FindActive read, _WV2_FindStop closes.
- **Cookies** _WV2_GetCookies, _WV2_SetCookie and _WV2_DeleteCookie work on the cookie manager and its cookie objects - name, value, domain, path, expiry, SameSite, HttpOnly, Secure.
- **Printing** _WV2_PrintSettingsCreate builds an ICoreWebView2PrintSettings and _WV2_PrintSettingsSet fills it; _WV2_PrintToPdfEx prints with it, _WV2_PrintToPdfStream returns the PDF in memory, _WV2_ShowPrintUI opens the preview.
- **Downloads** _WV2_GetDownloadCount and _WV2_GetDownload read uri, path, state, bytes and interrupt reason of the eight downloads each view remembers; _WV2_DownloadPause, _WV2_DownloadResume and _WV2_DownloadCancel steer them.
- **Dialogs, keys, menus** _WV2_SetDialogHandler answers alert, confirm, prompt and beforeunload; _WV2_SetAcceleratorHandler sees Ctrl+P before the browser does; _WV2_SetContextMenuHandler takes the menu of the page. All three are handler objects in the same heap.
- **Favicon and profile** _WV2_GetFaviconUri and _WV2_GetFavicon read what _15 declares and bring the picture as PNG or JPEG bytes; _WV2_ClearBrowsingData goes through the _13 profile and takes cookies, cache, history and download records.
- **DevTools protocol** _WV2_CallDevToolsProtocolMethod calls any CDP method and returns its JSON; _WV2_SetDevToolsProtocolEvent subscribes to one CDP event, delivered as $WV2_EVENT_DEVTOOLS.
- **Typed scripts** _WV2_ExecuteScriptEx reads ICoreWebView2ExecuteScriptResult and its exception object, so a script that throws reports the text instead of a null to decode.

Lot 0.6 - the close path

Lot 0.6 adds no face of the engine. It takes work out of the one path a user feels, and puts a guard on it. The measurements are in chapter 7.

- **No delete on the way out** _WV2_Destroy used to DirRemove the temporary user-data folder it owned: 15 542 ms, measured, inside the call, with the window still on the screen. __WV2_Free now queues it and __WV2_SweepStale collects it at the end of the next _WV2_Create, together with the folders of runs that were killed. A folder the caller named is never touched.
- **Adaptive pumps** The fixed pairs of 100 ms pumps in the teardown became __WV2_PumpDrain($iCap, $iQuiet): it returns after $__WV2_DRAIN_QUIET = 20 ms of silence and stops at $__WV2_DRAIN_CAP = 100 ms whatever happens.
- **_WV2_DestroyAll, and no exit handler** The net a script with several views wants is a call in the message loop, not a function registered with OnAutoItExitRegister: a handler runs after the loop the runtime answers through, and the same teardown measured 113 ms in the loop costs 1.4 to 2.7 s there.
- **The guardrails** $WV2_TEST_DESTROY_CAP puts a ceiling on every close in the self test, and section 34 checks the property behind it - the count of this process's profile folders does not change across a close - because a duration can be waved by a busy disk and a property cannot. The ceilings know they are durations: the first create of the run is timed, and past $WV2_TEST_SLOW_MACHINE (12 s, where an idle machine needs 3 to 7) each one reports instead of judging, because a close measured 22 446 ms on this machine with 84% of its memory taken. Sections 36 and 37 cover a profile the application owns and two views released at once.

Nine new kinds in the queue

EVENT	WHAT _WV2_GETEVENT CARRIES
$WV2_EVENT_RESOURCE_REQUESTED (9)	uri; $iValue 1 answered, 0 let through, 2 the handler failed
$WV2_EVENT_FIND (10)	match count as $sData; $iValue the active index, -1 for none
$WV2_EVENT_DOWNLOAD_STATE (11)	uri; a $WV2_DL_* state
$WV2_EVENT_DOWNLOAD_PROGRESS (12)	"received/total"; the download index
$WV2_EVENT_SCRIPT_DIALOG (13)	the message; a $WV2_DIALOG_* kind
$WV2_EVENT_ACCELERATOR (14)	the virtual key; a $WV2_KEYEVENT_* kind
$WV2_EVENT_CONTEXT_MENU (15)	empty; the command id the handler answered with, -1 for none
$WV2_EVENT_FAVICON_CHANGED (16)	the address the page declares
$WV2_EVENT_DEVTOOLS (17)	the event parameters as JSON

WHAT DID NOT CHANGE

The ABI rules, the pump, the four-way error plumbing and the sixteen slots of the instance table are the ones 0.3 shipped. Every chapter that follows describes the machinery common to the three versions; where a chapter shows a slot number, it is the one the current source uses.

01

THE MINIMAL COM MODEL

The COM model in AutoIt

One pointer, one table of function pointers, and two ways to call them.

Everything in this UDF rests on one fact: a COM interface pointer is the address of a pointer to a table of function pointers. Calling a method is calling table[slot] with the interface pointer as the first argument.

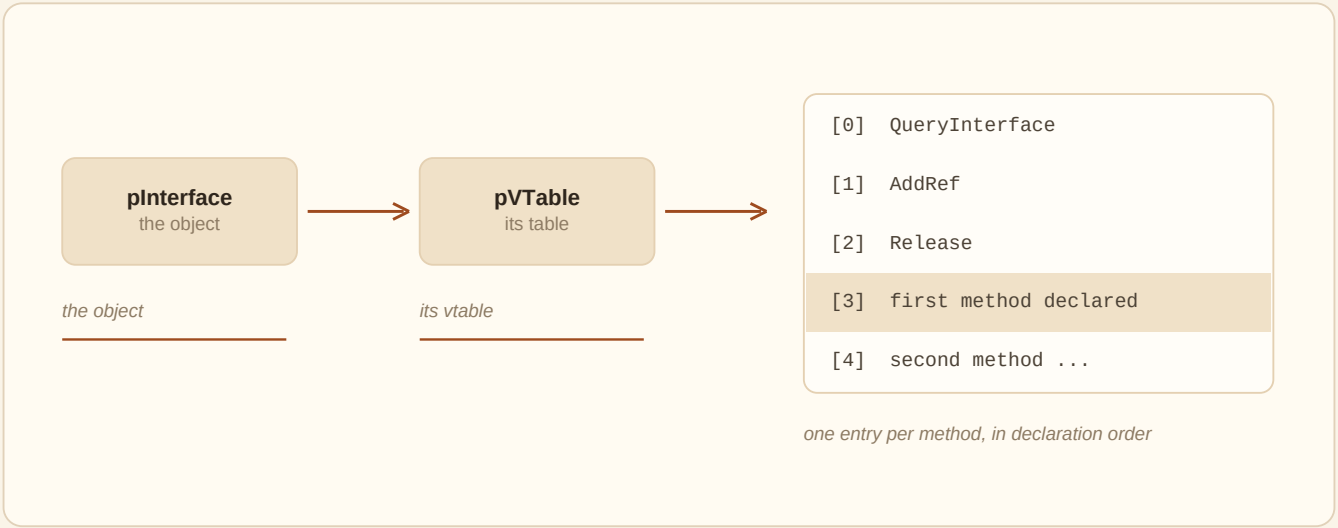


Figure 1. *Two dereferences: the object points at a table, the table points at code. Slot 3 is the first real method; slots 0 to 2 are always QueryInterface, AddRef and Release.*

Two ways to walk the table

ObjCreateInterface($p, $sIID, $sTag, $bCreate) builds a wrapper object whose methods you call with normal AutoIt syntax. The tag lists the methods in vtable order, starting at slot 0. That is the pleasant path, and it is what the UDF uses for the interfaces it speaks to constantly:

```
$__WV2_oCtl[$i] = ObjCreateInterface($pCtl, $WV2_IID_CTL, $__WV2_TAG_CTL, False)
; later, plain AutoIt:
Local $hr = $__WV2_oCtl[$i].put_ZoomFactor($fZoom)
```

The fourth argument is the one that matters most. With $bCreate = False the wrapper does not add a reference and does not own the pointer: it is a view of a reference somebody else holds. Every pointer the runtime hands to a callback is borrowed in exactly that way, which is why every wrapper here is built with False.

DllCallAddress("long", $pFn, "ptr", $pObj, ...) calls a raw slot, with $pFn read out of the table:

```
Func __WV2_VtFn($pObj, $iSlot)
    If $pObj = 0 Or $iSlot < 0 Then Return 0
    If $__WV2_iPtrSize = 0 Then
        $__WV2_iPtrSize = DllStructGetSize(DllStructCreate("ptr"))
    Local $pVTable = DllStructGetData(DllStructCreate("ptr", $pObj), 1)
    If @Error Or $pVTable = 0 Then Return 0
    Local $pFn = DllStructGetData( _
            DllStructCreate("ptr", $pVTable + $iSlot * $__WV2_iPtrSize), 1)
    If @Error Or $pFn = 0 Then Return 0
    Return $pFn
EndFunc
```

Reading a vtable is three lines: dereference the object, add slot times sizeof(pointer), read the entry. The UDF uses it for two jobs: methods that exist only on a newer version of an interface (chapters 3 and 5), and Release on pointers owned by the operating system, because wrapping those with ObjCreateInterface crashed the process in this build.

The environment is not created through COM

There is no CoCreateInstance in this UDF. The environment is built by a plain export of the runtime's own DLL, called through DllCall:

```
Local $aCE = DllCall($sDll, "long", _
        "CreateWebViewEnvironmentWithOptionsInternal", _
        "bool", 1, "int", 0, "wstr", $sUserDataFolder, "ptr", 0, _
        "ptr", $__WV2_pObj[$i][$__WV2_H_ENV])
```

Five arguments: should the runtime create a feedback handler, an options word, the user data folder, a reserved pointer, and the address of the callback object that will receive the environment. This is the call the official WebView2Loader.dll makes on your behalf. Making it directly is what removes the last file from the distribution - and it is the one undocumented thing in the package. Only this line depends on it.

Anatomy of _WV2_Create

Seven steps, in this order, and the order is not negotiable:

1. **Parent window** Validate it, then take a free slot (1 to 16).
2. **Runtime** Locate it: the registry key Microsoft\EdgeUpdate\Clients\{F3017226-...}, then EdgeWebView\Application. Bitness matters: a 32-bit AutoIt loads the 32-bit DLL.
3. **Apartment** CoInitializeEx(NULL, COINIT_APARTMENTTHREADED), once per script. The UDF never calls CoUninitialize, so a COM-aware script keeps working after a view is destroyed.
4. **Handlers** Build the thirty-one handler objects of the slot (chapter 2).
5. **Environment** Call CreateWebViewEnvironmentWithOptionsInternal and pump until the environment callback answers, with a 15 s default timeout.
6. **Controller** The environment callback immediately asks for a controller, which arrives as a second callback; the controller is wrapped, put_Bounds and put_IsVisible(1) are sent.
7. **Ready** Subscribe NavigationCompleted, read the browser version, mark the handle ready.

If any step fails, __WV2_Fail tears down whatever exists, the slot returns to the table, and _WV2_Create returns 0 with @error and @extended set. Nothing is left half-alive.

NEXT CHAPTER 02 Handler objects in a global heap

02

FAKE VTABLES IN MEMORY

Handler objects in a global heap

The runtime does not pull events: it calls back. AutoIt has to grow an object.

The runtime calls an ICoreWebView2XxxEventHandler whose only real method is Invoke. AutoIt cannot create a COM object, so the UDF manufactures one out of memory: one block of five pointers per instance and per slot.



Figure 2. *The object is the last cell; its one field points back at the first, which is the vtable. That is exactly the layout COM expects, built with DllStructSetData.*

The object address is block + 4 pointers. Its first field points at the vtable that begins at block, which is exactly what COM expects. __WV2_BuildHandler writes the five entries:

```
Func __WV2_BuildHandler($i, $iSlot)
    Local $b = __WV2_BlockBase($i, $iSlot)
    DllStructSetData($__WV2_tHeap, "data", DllCallbackGetPtr($__WV2_hCbQI), $b + 1)
    DllStructSetData($__WV2_tHeap, "data", DllCallbackGetPtr($__WV2_hCbAddRef), $b + 2)
    DllStructSetData($__WV2_tHeap, "data", DllCallbackGetPtr($__WV2_hCbRelease), $b + 3)
    DllStructSetData($__WV2_tHeap, "data", _
            DllCallbackGetPtr($__WV2_hCbInv[$iSlot]), $b + 4)
    Local $pBase = DllStructGetPtr($__WV2_tHeap)
    DllStructSetData($__WV2_tHeap, "data", $pBase + $b * $__WV2_iPtrSize, $b + 5)
    $__WV2_pObj[$i][$iSlot] = $pBase + ($b + 4) * $__WV2_iPtrSize
EndFunc
```

WHY A GLOBAL STRUCT

One global DllStruct owns all the memory: 1120 pointers, allocated once on first use and never resized. A global struct has no copy semantics, so the addresses stay valid for the life of the script - a callback running while AutoIt reallocated a local array would be a use-after-free waiting to happen.

One callback set, thirty-one entry points

There is no per-instance AutoIt function. There is one QueryInterface, one AddRef, one Release and one Invoke per slot, registered once with DllCallbackRegister. The Invoke receives $pThis, and __WV2_FindInst maps that pointer back to (instance, slot):

```
Func __WV2_FindInst($pThis)
    Local $i, $j
    For $i = 1 To $__WV2_MAX
        If $__WV2_aUsed[$i] Then
            For $j = 1 To $__WV2_SLOT_COUNT
                If $__WV2_pObj[$i][$j] = $pThis Then Return SetError(0, $j, $i)
            Next
        EndIf
    Next
    Return SetError(1, 0, 0)
EndFunc
```

A linear scan of at most 496 comparisons, against a callback that fires on a user action: the cost is irrelevant, and it buys a completely uniform callback set. It also lets the Invoke signatures differ per slot, because the argument list is registered from $__WV2_aInvArgs: a two-argument completion handler (this, hr) and a three-argument event handler (this, sender, args) live in the same block.

QueryInterface is a gate, not a formality

Each slot answers for IUnknown and for the handler interface of its own slot, and nothing else. Claiming an interface whose vtable you do not carry is the fastest way to kill the process: the runtime would call Invoke at a slot your object does not have.

```
If $bKnown And ($sIID = $WV2_IID_UNKNOWN _
        Or $sIID = $__WV2_aInvIID[$iSlot]) Then $pOut = $pThis
DllStructSetData(DllStructCreate("ptr", $pPPV), 1, $pOut)
If $pOut = 0 Then Return $__WV2_HR_E_NOINTERFACE
Return 0
```

AddRef returns 1 and Release returns 0, both without touching memory. These objects live in the UDF heap and are freed by __WV2_FreeHandlers, never by the runtime. The counters are deliberately meaningless: a fake object that released itself would dangle the moment the runtime kept a pointer. __WV2_FindInst failing is a normal outcome - a late callback after teardown - and every Invoke returns early in that case.

Subscribing: the token is the receipt

add_Xxx(handler, ByRef token) returns an EventRegistrationToken (int64) that remove_Xxx needs. __WV2_Attach and __WV2_Detach keep one token per instance and slot and refuse to subscribe twice. The method name cannot be built at run time in AutoIt, so each slot gets its own Case: a little repetition standing in for a dispatch mechanism AutoIt does not have. NavigationCompleted is subscribed by _WV2_Create itself, because _WV2_WaitNavigation waits on it.

NEXT CHAPTER 03 Vtable ranks and WebView2.h

03

COUNTED FROM THE HEADER

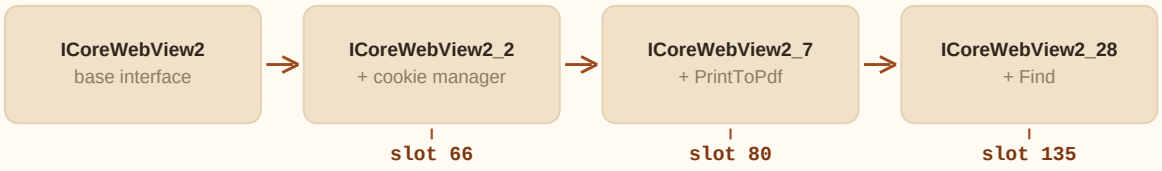
Vtable ranks and WebView2.h

Slot 3 is the first real method; everything after it is a count.

The numbering rule

Slot 0 is QueryInterface, 1 is AddRef, 2 is Release. The first method an interface declares is at slot 3. A versioned interface inherits the whole chain: its first own method sits right after the last method of every earlier version.

```
slot(method) = 3 + number of methods declared before it in the chain
```



The chain is counted, never guessed: the versions in between are _3, _4, _11, _13, _15, _16 and _21.

Figure 3. *Four of the ranks this UDF walks, from the base interface to the one that carries the search object.*

That count must be taken from the official header - never from memory, never from a summary page. The SDK's WebView2.h is the only authoritative order.

The slots this UDF calls raw

INTERFACE	SLOT	WHAT THE RAW CALL BUYS
IUnknown	0, 2	QueryInterface and Release on a pointer the system owns
IStream	3, 5	Read and Seek: the PDF of _WV2_PrintToPdfStream, the bytes of a favicon
ICoreWebView2Controller	6	put_Bounds - the ABI trap of chapter 4
ICoreWebView2Controller3	19, 20	add_ and remove_AcceleratorKeyPressed
ICoreWebView2	36, 42	CallDevToolsProtocolMethod and its event receiver
ICoreWebView2	55 to 58	the resource layer: the two event slots and the two filter slots
ICoreWebView2_2	66	get_CookieManager, the door to every cookie call
ICoreWebView2_3	71, 72	the folder served under a real host name, and its Clear
ICoreWebView2_4	75, 76	add_ and remove_DownloadStarting
ICoreWebView2_7	80	PrintToPdf

INTERFACE	SLOT	WHAT THE RAW CALL BUYS
ICoreWebView2_11	100, 101	add_ and remove_ContextMenuRequested
ICoreWebView2_13	105	get_Profile, what _WV2_ClearBrowsingData works on
ICoreWebView2_15	109 to 112	the favicon: two event slots, get_FaviconUri, GetFavicon
ICoreWebView2_16	113 to 115	Print, ShowPrintUI, PrintToPdfStream
ICoreWebView2_21	122	ExecuteScriptWithResult, the typed answer
ICoreWebView2_28	135	get_Find
ICoreWebView2Environment6 / _15	14 / 29	CreatePrintSettings and CreateFindOptions
ICoreWebView2Find	3 to 12	the two counters, their events, Start, FindNext, FindPrevious, Stop
ICoreWebView2CookieManager	3 to 10	CreateCookie, GetCookies, AddOrUpdateCookie, DeleteAllCookies
ICoreWebView2Cookie	3 to 16	name, value, domain, path, expiry, SameSite, HttpOnly, Secure
The resource and download args	3 to 9	the uri, the method, the headers, the answer put back

That table is a digest, not the list. The list is one hundred and fifty-eight named constants, each one spelling its own interface and method - $__WV2_SLOT_ICoreWebView2_16_Print - and Tools/gen_interfaces.py --audit recounts every one of them, the interface identifiers with them, against the header: 227 constants, zero differences on SDK 1.0.4314.35. The 0.3 edition of this chapter listed thirteen raw calls; the growth of that number is what the last two versions cost, and the audit is what makes it payable.

Every number was counted from the header, then confirmed at run time by calling the slot and checking the HRESULT - and, where the method has an observable effect, by looking at the effect (chapter 4).

A tag may stop early; it may not skip

$__WV2_TAG_WV stops at get_DocumentTitle. That is legal: a tag describes the methods you intend to call, and a wrapper only knows the ones you declared. What is not legal is a tag that skips a method in the middle: the wrapper counts positions, so a missing entry shifts everything after it by one and the call lands on the wrong function.

That is the whole reason PrintToPdf, at slot 80, is not in a tag. A complete ICoreWebView2_7 tag would carry hundreds of lines for one call, and the wrapper would gain nothing: DllCallAddress needs the same arguments and one constant.

QI is the version check

Asking for ICoreWebView2_7 on a runtime older than that interface returns E_NOINTERFACE (0x80004002) - not a crash, not a silent failure. __WV2_QiView converts the textual IID with CLSIDFromString, calls slot 0 on the raw view pointer, and keeps the answer; __WV2_ViewIf asks once per version per instance, and the pointers are released with the view. The distinction it makes matters:

- **E_NOINTERFACE** becomes $WV2_ERR_CALL with that HRESULT: the machine's runtime is older than the feature. The caller degrades; the UDF does not lie about it.
- **Any other failure** becomes a COM error: the UDF's own bookkeeping is wrong.

04

THE ABI TRAP

x86 and x64: put_Bounds

The header says by value. The 64-bit runtime reads a pointer. One function carries the difference.

ICoreWebView2Controller::put_Bounds takes a RECT by value. On x86 (stdcall) the four longs are pushed on the stack, and the wrapper tag put_Bounds hresult(long;long;long;long) describes exactly that. It works.

On x64 the first four arguments travel in RCX, RDX, R8 and R9, and a structure that does not fit in eight bytes is never passed by value: the caller passes its address. The header still says by value; the wire says pointer. Give the callee four longs and it reads left as a pointer and dereferences it - that is the crash.

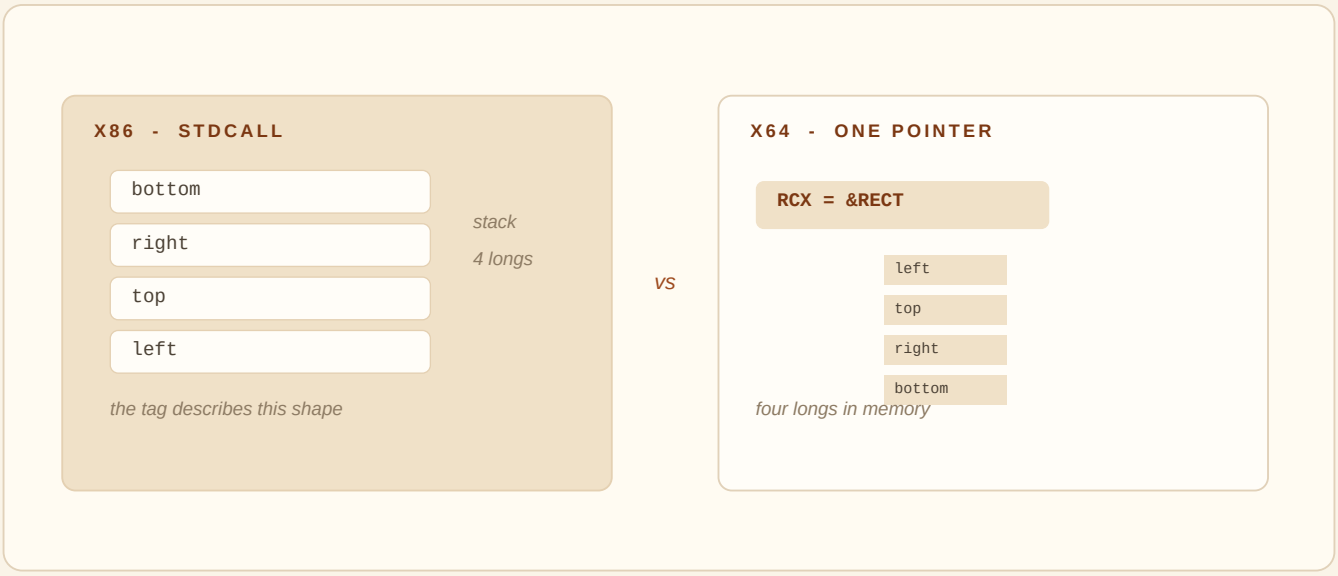


Figure 4. *The same declaration, two wire formats. Giving the callee four longs on x64 makes it dereference the first one as an address: the process terminates.*

What was measured

Four shapes were tried on the 64-bit runtime, in a scratch script that logged each step to a file, because a crash truncates the console but not a flushed file:

ARGUMENT SHAPE	RESULT
Four long in a tag (the correct x86 shape)	process terminates
Two int64 (the sixteen bytes in two registers)	process terminates
AutoIt's by-value struct	process terminates
ptr to a DllStruct of four long, through the vtable	hr = 0, bounds applied

The fourth becomes the only 64-bit path:

```
Func __WV2_PutBounds($i, $iLeft, $iTop, $iRight, $iBottom)
    If Not @AutoItX64 Then
        Return __WV2_Result( _
            $__WV2_oCtl[$i].put_Bounds($iLeft, $iTop, $iRight, $iBottom), _
            "ICoreWebView2Controller::put_Bounds")

    Local $pFn = __WV2_VtFn($__WV2_pCtl[$i], $__WV2_SLOT_ICoreWebView2Controller_put_Bounds)
    If $pFn = 0 Then
        __WV2_SetErr($WV2_ERR_COM, 0, "__WV2_VtFn")
        Return 0
    EndIf
    Local $tRc = DllStructCreate("long l; long t; long r; long b")
    DllStructSetData($tRc, "l", $iLeft)
    DllStructSetData($tRc, "t", $iTop)
    DllStructSetData($tRc, "r", $iRight)
    DllStructSetData($tRc, "b", $iBottom)
    Local $aCall = DllCallAddress("long", $pFn, "ptr", $__WV2_pCtl[$i], _
            "ptr", DllStructGetPtr($tRc))
    If @Error Or Not IsArray($aCall) Then
        __WV2_SetErr($WV2_ERR_COM, 0, "ICoreWebView2Controller::put_Bounds")
        Return 0
    EndIf
    Return __WV2_Result($aCall[0], "ICoreWebView2Controller::put_Bounds")
EndFunc
```

No single tag can be correct on both bitnesses here, which is why the function branches instead of carrying one declaration.

hr = 0 is not proof

The first version of the 64-bit fix returned S_OK and did nothing visible. S_OK only means the call arrived; it says nothing about what the callee did with the arguments. The fix was accepted only after three independent proofs:

- **Pixel** GetPixel on the parent window: inside the browser area the pixel is the page colour, outside it is the GUI background.
- **Resize** The boundary moved when the window was resized and _WV2_SetBounds was called again.
- **Read back** get_Bounds returned exactly the rectangle that had been sent.

Apply that rule to every raw call you add: find an observable consequence and check it.

The other shapes you will meet

VALUE	AUTOIT TYPE	NOTE
HRESULT	long	negative failure values; @extended keeps it
BOOL	int	32-bit, never bool (one byte)
long / DWORD	long	32-bit on both bitnesses (LLP64 on x64)
EventRegistrationToken	int64	by value on remove_*, by pointer on add_*
LPWSTR returned	wstr*	allocated with CoTaskMemAlloc
interface out-parameter	ptr*	carries a reference of its own

A text returned by the runtime is copied and freed by __WV2_WStrProp. A returned interface pointer is released with __WV2_ReleaseExternal unless it is wrapped and becomes the UDF's property.

05

A WORKED EXAMPLE

Adding a method in six steps

Worked example: the two calls behind _WV2_ClearCookies.

get_CookieManager lives on ICoreWebView2_2 at slot 66; DeleteAllCookies lives on ICoreWebView2CookieManager at slot 10. Neither is in a tag, and the six steps that brought them into the UDF are the same for any other method.

1. Find the declaration

Open WebView2.h from the SDK and locate the interface that declares the method. Note the exact parameter list and the return type of every argument. A method found on a documentation page is a hint; the header is the fact.

2. Turn the position into a slot

Count every method declared before it in the whole inheritance chain, add 3. Record the number as a named constant next to the others, with the interface name in the comment: a bare 66 in the middle of a function is unreviewable.

```
Global Const $__WV2_SLOT_ICoreWebView2_2_get_CookieManager = 66
Global Const $__WV2_SLOT_ICoreWebView2CookieManager_DeleteAllCookies = 10
```

3. Ask the view for that interface version

```
Local $p2 = __WV2_ViewIf($iHandle, $__WV2_IF_2)
If $p2 = 0 Then Return SetError($__WV2_iLastError, $__WV2_iLastHR, 0)
```

If $p2 is 0 because of E_NOINTERFACE, the runtime is older than the feature. __WV2_SetErr has already recorded that, and the public function propagates it unchanged.

4. Write the call shape

Four helpers cover most methods; anything else goes through DllCallAddress directly.

HELPER	SIGNATURE IT CALLS
__WV2_CallNoArg($pObj, $slot)	hr Method()
__WV2_CallBool($pObj, $slot, $v)	hr Method(BOOL)
__WV2_CallWStr($pObj, $slot, $s)	hr Method(LPCWSTR)
__WV2_WStrProp($pObj, $slot)	hr get_X(LPWSTR*) - returns the text

get_CookieManager is none of these: it returns an interface pointer, so it is written out. Three checks follow every raw call - @error, the HRESULT, and a non-null pointer:

```
Local $tOut = DllStructCreate("ptr")
Local $aCall = DllCallAddress("long", $pFn, "ptr", $p2, _
        "ptr", DllStructGetPtr($tOut))
If @Error Or Not IsArray($aCall) Then
    __WV2_SetErr($WV2_ERR_COM, 0, "ICoreWebView2_2::get_CookieManager")
    Return SetError($__WV2_iLastError, $__WV2_iLastHR, 0)
EndIf
If $aCall[0] <> 0 Then
    __WV2_SetErr($WV2_ERR_CALL, $aCall[0], "ICoreWebView2_2::get_CookieManager")
    Return SetError($__WV2_iLastError, $__WV2_iLastHR, 0)
EndIf
Local $pCookie = DllStructGetData($tOut, 1)
```

5. Own what comes back

An interface returned through an out-parameter carries its own reference; QueryInterface and every getter that hands out an object do this. Either wrap it and release it with the rest of the instance, or release it as soon as you are done:

```
Local $hr = __WV2_CallNoArg($pCookie, $__WV2_SLOT_ICoreWebView2CookieManager_DeleteAllCookies)
__WV2_ReleaseExternal($pCookie)
```

Text is different: it is CoTaskMemAlloc'd, so it is copied (__WV2_CopyWStr) and then freed with CoTaskMemFree - never handed to the caller as-is.

6. Wrap it, then prove it

```
Func _WV2_ClearCookies($iHandle)
    $__WV2_sLastFunc = "_WV2_ClearCookies"
    If Not __WV2_Guard($iHandle) Then
        Return SetError($__WV2_iLastError, $__WV2_iLastHR, 0)
    ...
    Local $bOk = __WV2_Result($hr, _
            "ICoreWebView2CookieManager::DeleteAllCookies")
    Return SetError($__WV2_iLastError, $__WV2_iLastHR, $bOk)
EndFunc
```

Then add a check to WebView2_Example_GUI.au3 (--auto) that exercises the new call and asserts its effect, not its return value. The suite is the specification of what must keep working; a feature without a check there is a feature that will silently break.

When to extend a tag instead

If the interface is fully declared in the tag up to the method you need, and you expect to call several of its methods, extending the tag is cheaper and type-checked by AutoIt's own argument conversion. The rule of thumb: one call, raw slot; a family of calls, tag.

NEXT CHAPTER 06 Diagnosing a failure

06

TWO INTEGERS AND A LABEL

Diagnosing a failure

Two integers and a label; a crash that prints nothing; the calls that answer later.

The error plumbing

Every failure goes through one function: __WV2_SetErr stores the category, the raw HRESULT and the label. The public function returns SetError($__WV2_iLastError, $__WV2_iLastHR, value), so @error carries the category and @extended the HRESULT. _WV2_GetLastErrorMessage turns both into one line:

```
Method call failed in ICoreWebView2_7::PrintToPdf (HRESULT 0x80070005)
```

Three habits make that usable:

- **Never Return f().** SetError does not survive a plain Return; every public function sets @error and @extended explicitly. This was a real bug in an earlier version, invisible on the success paths.
- **Label the call site** ICoreWebView2_7::PrintToPdf tells you which method failed; PrintToPdf does not.
- **No output** The UDF never prints and never shows a dialog. A script can run in a service or under a scheduler with no console. Diagnostics are values, not output.

Reading an HRESULT

VALUE	NAME	USUAL CAUSE HERE
0x80004001	E_NOTIMPL	the runtime does not implement this method
0x80004002	E_NOINTERFACE	runtime older than the interface version
0x80004005	E_FAIL	the call was made, the runtime refused
0x80070002	ERROR_FILE_NOT_FOUND	a path handed to the runtime does not exist
0x80070005	ERROR_ACCESS_DENIED	profile or output folder not writable
0x80070057	E_INVALIDARG	wrong argument shape - suspect the ABI

A crash that prints nothing

A wrong slot or a wrong argument shape does not return an HRESULT: the process disappears, and the console loses whatever was buffered. Bisect like this:

- **Flush** Write a scratch script with ConsoleWrite and FileWriteLine on a handle opened with $FO_APPEND, flushed after each line.
- **Last call** Call the suspect method last, with everything else already proven.
- **Remove it** Comment out the call: if the script completes, the call is the killer.
- **One variable** Vary one thing at a time - the slot, then each argument type, then the order of the returned value and the release.
- **Prove it** When a shape succeeds, do not stop: prove the effect.

Two less obvious traps. A wrong-arity call to your own AutoIt function is a runtime fatal, not a compile error:

Au3Check passes and the script exits 1 with a truncated log, so count the arguments before suspecting COM. And ObjCreateInterface on a pointer the operating system owns crashed the process in this build, while reading Release from the vtable does not: when a wrapper is not yours, do not wrap it.

Asynchronous methods

ExecuteScript, AddScriptToExecuteOnDocumentCreated, CapturePreview and PrintToPdf answer through a handler, later. The pattern is the same for every waiting call - the 0.5 lot added ExecuteScriptWithResult, GetCookies, ClearBrowsingData, PrintToPdfStream, Start, GetFavicon and CallDevToolsProtocolMethod to that family, each with a slot of its own in the $__WV2_H_* table:

```
__WV2_BeginOp($iHandle, $__WV2_H_PRINT)       ; clear the state
Local $aCall = DllCallAddress(...)             ; start
__WV2_WaitOp($iHandle, $__WV2_H_PRINT, $iMs)   ; pump until it answers
Local $iDoneHR = $__WV2_iOpHR[$iHandle][$__WV2_H_PRINT]
```

__WV2_WaitOp pumps the message queue in 20 ms slices, so the GUI keeps repainting while the script waits. Three distinct failures must stay distinguishable, and _WV2_PrintToPdf shows all three: the call itself fails (WV2_ERR_CALL with its HRESULT), the handler reports an HRESULT (WV2_ERR_CALL with that HRESULT), or the call succeeds and the handler answers FALSE (WV2_ERR_FILE, because a PDF that was not written is not a method failure).

The event queue

Events are pushed into a 64-entry ring per instance and dropped oldest-first when the script does not drain them; $__WV2_iEvtDrop keeps the count. _WV2_GetEvent on an empty queue returns 0 with @error = 0: empty is not an error, and a loop must tell the two apart. _WV2_WaitEvent waits for one specific type and leaves the others in the queue.

NEXT CHAPTER 07 Threading and the message pump

07

ONE APARTMENT, ONE PUMP

Threading and the message pump

One apartment, one thread, and nothing happens without a pump.

One apartment, one thread

CoInitializeEx(NULL, COINIT_APARTMENTTHREADED) runs once per script, on the thread that called _WV2_Create. The browser is created in that apartment and delivers every event on that thread, through the Windows message queue. Consequences:

- **One thread** A view belongs to the thread that created it. Calling it from another thread is undefined behaviour; no marshalling is done.
- **No pump, no events** Nothing arrives until messages are dispatched: no pump, no events, no completion handlers, no navigation progress.
- **Waiting still paints** _WV2_Create and every waiter pump while they wait, which is why a script can block on a page load and still repaint.

The pump

```
Func __WV2_Pump($iMs)
    Local Static $tMsg = DllStructCreate( _
        "ptr hwnd;uint message;ptr wParam;ptr lParam;dword time;long x;long y")
    Local $tEnd = TimerInit()
    While TimerDiff($tEnd) < $iMs
        Local $aPM = DllCall("user32.dll", "bool", "PeekMessageW", _
            "ptr", DllStructGetPtr($tMsg), "ptr", 0, _
            "dword", 0, "dword", 0, "dword", 1)
        If @Error Or Not $aPM[0] Then
            Sleep(2)
        Else
            DllCall("user32.dll", "bool", "TranslateMessage", _
                "ptr", DllStructGetPtr($tMsg))
            DllCall("user32.dll", "lresult", "DispatchMessageW", _
                "ptr", DllStructGetPtr($tMsg))
        EndIf
    WEnd
EndFunc
```

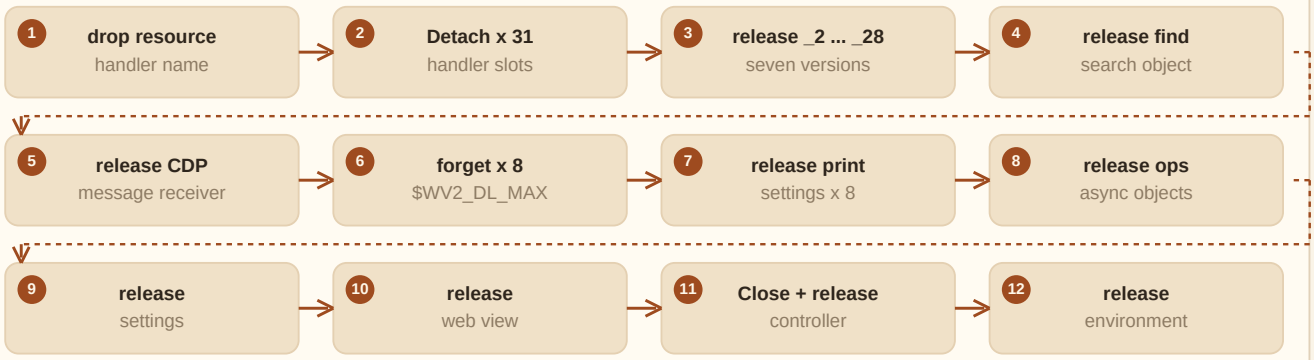
PM_REMOVE (1), every message, no filtering: the runtime posts its work as ordinary window messages, and filtering them out would starve it. Sleep(2) when the queue is empty keeps a waiter from spinning a core.

Inside a GUI loop

The pattern that works: do not wait inside GUIGetMsg handlers. Either wait before entering the loop, or let the main loop pump - it already does - and read events with _WV2_GetEvent. A long _WV2_WaitNavigation inside a button handler freezes the toolbar for as long as the page takes: correctly, visibly, and avoidably.

Teardown order

_WV2_Destroy runs __WV2_Teardown: twelve releases in a fixed order, because an interface must outlive every pointer taken from it. The versioned interfaces, the search object, the CDP receiver, the remembered downloads and the print settings all point into the same runtime object as the view, so they go first; the environment, which created the controller, goes last. Two adaptive drains, __WV2_PumpDrain(100, 20), separate the controller from the environment, so the runtime can retire its own references before the last one goes - and return after twenty milliseconds of silence instead of on a timer.



An adaptive drain returns after 20 ms of silence and never runs past 100 ms, so an idle close does not pay for a timer it has no use for.

Figure 5. *The twelve steps of __WV2_Teardown, read left to right. Inverting the second and the tenth leaves the runtime holding an interface into freed memory - and the crash shows up at exit, far from the cause.*

What a close does not do

Two things were taken out of this path, both because of what the user feels. The temporary profile folder is not deleted here: the browser process holds it for seconds after the controller closes, so a delete on the way out is fifteen seconds of walking a tree it cannot finish - measured, 15 542 ms, with the window frozen on screen. __WV2_Free queues the folder instead, and __WV2_SweepStale collects it, with the rubbish of the runs that were killed, at the end of the next _WV2_Create. Only a folder the UDF built itself is ever queued or swept ($__WV2_bTempUser, and __WV2_IsOurProfile), and never one whose process is still alive.

And nothing is registered with OnAutoItExitRegister. An exit function runs after the message loop is gone, which is exactly where a teardown needs the loop: the same work, one view, the window closed from outside, measured from the click to the moment the process stops existing.

WHAT THE SCRIPT DOES WHEN THE USER CLOSES	WINDOW OFF SCREEN	PROCESS GONE
Destroy in the message loop	252 - 376 ms	295 - 521 ms
nothing at all (the script forgot)	254 - 275 ms	286 - 1 935 ms
exit handler: Close on the controller	252 - 254 ms	664 - 680 ms
exit handler: release controller and environment	256 - 257 ms	393 - 827 ms
exit handler: full teardown, pumps left in	251 - 263 ms	1 705 - 2 702 ms
exit handler: full teardown, pumps taken out	260 - 261 ms	1 387 - 2 109 ms

A net placed in an exit handler would make closing three to six times slower and would protect nothing: the folders a forgotten destroy leaves behind carry the pid that made them, the next create recognises them as rubbish, and the browser processes leave on their own. The net the UDF does offer is _WV2_DestroyAll - every live view, one call, in the loop where the runtime can still answer.

DESTROY IS REFUSED INSIDE A CALLBACK

A resource, dialog, key or menu handler is walking the runtime's own COM objects while it runs. Releasing them from there - or pumping messages, which would deliver the next request inside this one - would deadlock. _WV2_Destroy checks the two re-entrancy flags of the instance and answers $WV2_ERR_BUSY instead; set a flag and tear the view down from the main loop.

The browser is a window, not a control

_WV2_Create($hParent, ...) puts a real child window inside $hParent. It covers every AutoIt control whose rectangle overlaps its own, and GUICtrlSetResizing does not apply - it has no control identifier. Either reserve a band of the client area for the toolbar, or call _WV2_FitToParent or _WV2_SetBounds from the resize handler.

NEXT CHAPTER 08 Limits, pitfalls, references

08

WHAT IT COSTS, WHERE TO LOOK

Limits, pitfalls, references

What the wrapper bounds, what the runtime decides, and where to read more.

Limits of the wrapper

LIMIT	VALUE	WHERE IT COMES FROM
Concurrent views	16	$__WV2_MAX
Handler slots per view	31	$__WV2_SLOT_COUNT
Pointer cells in the heap	2 480	16 x 31 x 5, one DllStruct
Queued events per view	64	$__WV2_QCAP, oldest dropped
Downloads remembered per view	8	$WV2_DL_MAX
Profile folders waiting for the sweep	64	$__WV2_MAX x 4, released by the next create
Live print settings objects	8	$WV2_PRINT_SETTINGS_MAX
Create / navigation timeout	15 s / 30 s	$WV2_CREATE_TIMEOUT, $WV2_NAV_TIMEOUT
Script, find / print timeout	5 s / 30 s	$WV2_EXEC_TIMEOUT, $WV2_PRINT_TIMEOUT
Zoom range	0.2 to 10	validated by _WV2_SetZoom

Pitfalls worth knowing before they cost a day

- **Undocumented entry point** The loaderless call is stable in practice and confined to one DllCall in _WV2_Create. If a future runtime ever moved it, the fallback is to ship WebView2Loader.dll and change that one call - nothing else touches it.
- **A profile outlives the view** The browser process holds the folder for a few seconds after _WV2_Destroy, which cannot always delete it; the next _WV2_Create on the same slot does. Pass your own folder when the profile must survive or be audited.
- **Cookies need an origin** A file:// page or NavigateToString has a null origin and cannot store a cookie: document.cookie stays empty by design, and that is not a bug in the bridge. The virtual host mapping described on the previous page gives your own content a real origin.
- **Four kinds, not five** _WV2_ClearCookies wipes the jar. _WV2_ClearBrowsingData takes history, downloads, cookies and cached files - the four kinds of ICoreWebView2Profile2 - and localStorage is not one of them. Clear it from the page.
- **One download per page** Chromium allows one automatic download per page. A second scripted download is dropped silently and raises no event. A redirected download reaches the disk 0 to 3 s after DownloadStarting: wait for the file instead of concluding it failed.
- **A blob download never finishes** A download made from a blob URL stays in the running state while the page that made it lives, and the size it reports stays unknown. Poll the file, not the state, and let the page go before expecting the transfer to close.
- **Filter needs the event** _WV2_SetNavigationFilter needs $WV2_EVENT_NAVIGATION_STARTING enabled. The filter is applied by that handler; without the subscription there is nothing to cancel.
- **ExecuteScript returns JSON** document.title comes back as "Hello" with quotes, a number as 42, and a script that

throws as null with @error = 0. Test for "null" rather than for failure, or call _WV2_ExecuteScriptEx, which reports the exception text.

- **The first search is the slow one** The search object is built on the first _WV2_FindStart of a view, and that one call can exceed the 5 s default while the engine wakes up. Pass a longer timeout for the first search, or run it once when the page loads.
- **Destroy is refused inside a handler** _WV2_Destroy answers $WV2_ERR_BUSY while a resource, dialog, key or menu handler of that view is running. Set a flag and destroy from the main loop - chapter 7 explains why re-entering the runtime from there deadlocks it.
- **BOOL is four bytes** bool in a DllCall is one byte and corrupts the stack on the way back. Every BOOL in this UDF is int.

Testing

WebView2_Example_GUI.au3 --auto runs 297 checks over the whole API in 37 sections without network access (file://, NavigateToString and a virtual host). It writes only in @TempDir, in folders named after the process that made them: the profile folders its views release are taken back by the sweep of chapter 7, and the two scratch folders of sections 21 and 36 are removed at the end of the run - a browser process that has not let go of the second one is reported, not failed on. Read the first line of section 2 before you trust a failure: when the machine says it is loaded, the four duration ceilings report instead of judging, and a FAIL on one of them is the machine's memory, not your change - the property checks never bend. It passed on AutoIt 3.3.16.1 in x86. The 0.4, 0.5 and 0.6 checks have not been measured on x64: the x64 entry point is not installed on the author's machine, and the README says so. Use the self-test as the regression gate for any change described in chapter 5, and add the new check before the implementation when you can.

References

- **WebView2 API reference**
  https://learn.microsoft.com/microsoft-edge/webview2/reference/win32/
- **ICoreWebView2Controller**
  https://learn.microsoft.com/microsoft-edge/webview2/reference/win32/icorewebview2controller
- **WebView2.h, WebView2 SDK (NuGet, MIT)**
  the authoritative vtable order
- **Microsoft x64 calling convention**
  https://learn.microsoft.com/cpp/build/x64-calling-convention
- **Forum thread: Microsoft Edge - WebView2**
  https://www.autoitscript.com/forum/topic/204362-microsoft-edge-webview2/
- **Ralle1976/Autoit-WebView2-UDF**
  https://github.com/Ralle1976/Autoit-WebView2-UDF
- **Numeric1 on the AutoIt forum**
  https://www.autoitscript.com/forum/profile/118605-numeric1/
- **PDFX, the UDF that typeset this guide**
  https://www.autoitscript.com/forum/topic/213930-udf-pdfx/

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