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# **Sark Documentation**

*Release 0.1.0*

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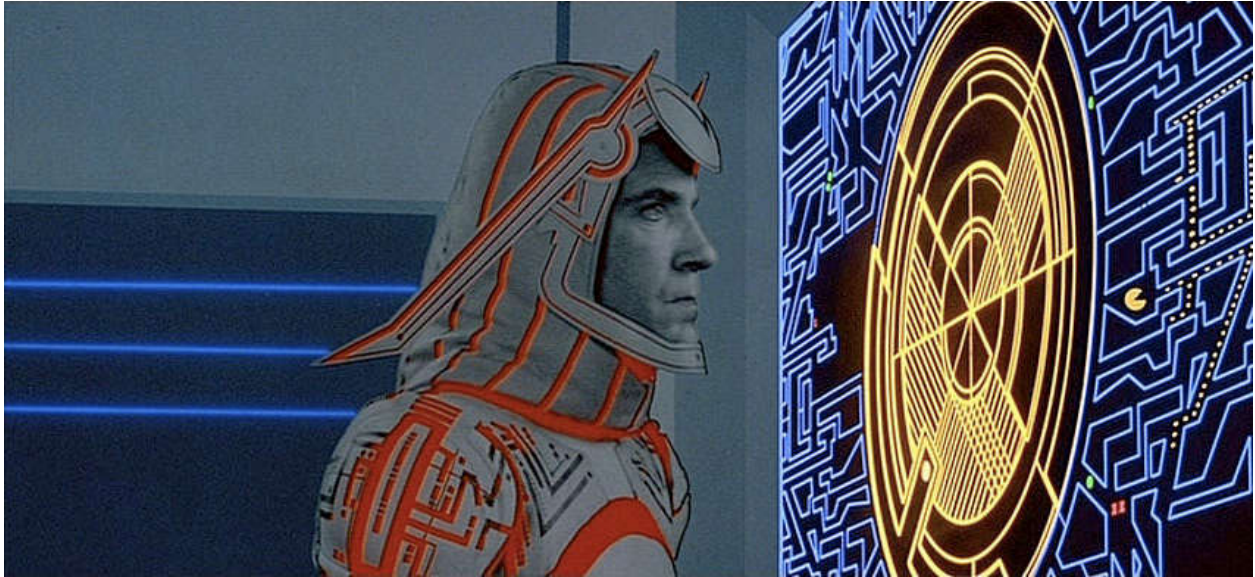
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# Contents

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<b>1</b>	<b>Getting Started</b>	<b>3</b>
<b>2</b>	<b>Table of Contents</b>	<b>5</b>
2.1	Introduction . . . . .	5
2.2	Installation . . . . .	6
2.3	API . . . . .	7
2.4	Examples . . . . .	17
2.5	Plugins . . . . .	20
2.6	Debugging IDAPython Scripts . . . . .	26
2.7	Support . . . . .	29
2.8	How To Contribute . . . . .	30
2.9	Credits . . . . .	30





Sark (named after the notorious Tron villain) is an object-oriented scripting layer written on top of IDAPython. Sark is easy to use and provides tools for writing advanced scripts and plugins.

Sark actively supports IDA7.4 and Python3. For older versions, see *Support*.



# CHAPTER 1

## Getting Started

Install Sark from the command line:

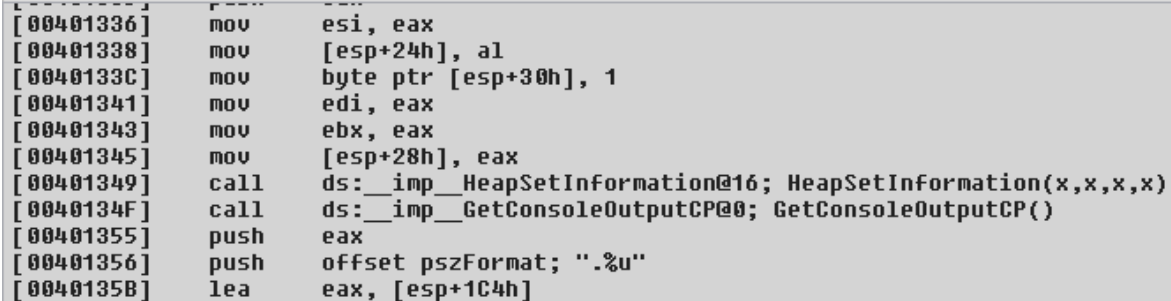
```
pip3 install -U git+https://github.com/tmr232/Sark.git#egg=Sark
```

Import inside IDA, and start having fun!

```
import sark
import idaapi

# Get the current function
func = sark.Function()

# Print all lines in the function
for line in func.lines:
    idaapi.msg("{}\n".format(line))
```



```
[00401336] mov     esi, eax
[00401338] mov     [esp+24h], al
[0040133C] mov     byte ptr [esp+30h], 1
[00401341] mov     edi, eax
[00401343] mov     ebx, eax
[00401345] mov     [esp+28h], eax
[00401349] call    ds:__imp__HeapSetInformation@16; HeapSetInformation(x,x,x,x)
[0040134F] call    ds:__imp__GetConsoleOutputCP@0; GetConsoleOutputCP()
[00401355] push   eax
[00401356] push   offset pszFormat; "%.2u"
[00401358] lea    eax, [esp+1C4h]
```

Python

```
# Mark all the lines containing xrefs outside the function
for xref in func.xrefs_from:
    sark.Line(xref.frm).color = 0x8833FF
```

```
mov     [esp+24h], al
mov     byte ptr [esp+30h], 1
mov     edi, eax
mov     ebx, eax
mov     [esp+28h], eax
call    ds:__imp__HeapSetInformation@16 ; HeapSetInformation(x,x,x,x)
call    ds:__imp__GetConsoleOutputCP@0 ; GetConsoleOutputCP()
push   eax
push   offset pszFormat ; "%.2u"
lea    eax, [esp+1C4h]
push   0Ch
push   eax
call    __StringCchPrintfW
add    esp, 40h
100.00$ (917,400) (728,185) 0000070C 0040130C: _main+3 (Synchronized with Hex View-1)
```



Contents:

### 2.1 Introduction

Even with books like Alexander Hanel's [The Beginner's Guide to IDAPython](#), writing IDA scripts still remains a daunting task. The need to dive into the IDA SDK's header files (all 54 of them), read `idaapi.py`, `idc.py` and `idautils.py`, and preferably some existing plugins as well, wards off many researchers and keeps the script & plugin writing community small.

Being a researcher myself, I wanted to make scripting IDA a bit easier and more intuitive. I wanted to spend the majority of my (scripting) time writing code (be it in a code editor or an [interactive shell](#)) and not reading someone else's (I prefer spending my reading efforts on assembly.) So I created Sark.

Sark, (named after the notorious Tron villain,) is an object-oriented scripting layer written on top of IDAPython to provide ease of use, as well as additional tools for writing advanced scripts and plugins.

This tutorial will show you the basics of Sark, to get you started right away.



## 2.2 Installation

### 2.2.1 For Sark Users

To get the bleeding edge version, use:

```
pip3 install -U git+https://github.com/tmr232/Sark.git#egg=Sark
```

For older versions of IDA (7.3 or lower), use:

```
pip2 install -U git+https://github.com/tmr232/Sark.git@IDA-6.x#egg=Sark
```

And see [Support](#)

Alternatively, you can install Sark directly from PyPI. The Sark version will match the IDA versions, more or less. So for 7.4 or higher, you'll just want the latest:

```
pip3 install sark
```

But for 7.3 or earlier, you'll want a version smaller than 7.4:

```
pip2 install "sark<7.4"
```

That said, installing from the repo is the only way to be sure you get the latest version of Sark.

To install the IDA Plugins (optional) download the entire repository from [GitHub](#) and read [Installing Plugins](#).

### Updates

To update Sark to the latest version, just run the installation command again.

## 2.2.2 For Sark Developers

If you want to help in the development of Sark, follow this.

Clone the Sark repository to get the latest version

```
git clone https://github.com/tmr232/Sark.git && cd Sark
pip3 install -e .
```

### Updates

To update Sark to the latest version (including all *installed* codecs and plugins) simply pull the latest version from the repo

```
git pull
```

## 2.3 API

### 2.3.1 Tutorial Conventions

IDA IPython is used in the examples unless stated otherwise. For brevity, assume the following code precedes any example code.

```
import idaapi, idc, idutils
import sark
```

As Sark is a large, evolving library, the API documentation provided here will be partial and only include what is needed to get you started. However, the Sark code in itself is heavily documented.

### 2.3.2 Lines

Lines are the most basic and intuitive object in Sark. A line in the IDA-View is a line in Sark. Let's have a look.

```
>>> my_line = sark.Line() # Same as `sark.Line(ea=idc.here())`
>>> print(my_line)
[00417401]    mov     ebp, esp

>>> my_line.comments.regular = "The line at 0x{:08X}".format(my_line.ea)
>>> print(my_line)
[00417401]    mov     ebp, esp           ; The line at 0x00417401
```

The `sark.Line` object encapsulates most of the line-relevant functions of IDAPython. Some examples include:

Member	Usage
<code>ea</code>	line's address
<code>comments</code>	line comments
<code>name</code>	the name of the line (if any)
<code>insn</code>	assembly instruction
<code>xrefs_to</code>	cross references to the line
<code>xrefs_from</code>	cross references from the line
<code>bytes</code>	the actual bytes in the line

For the rest, I suggest reading the highly documented code, or using the interactive shell to experiment with the `sark.Line` object.

The line object contains 4 notable members: `comments`, `insn` and the `xrefs_*` pair.

### Line Comments

The `comments` member provides access to all comment types: - Regular comments - Repeating comments - Anterior lines - Posterior lines

It allows you to get, as well as set comments. Each change to the comments will cause the UI to refresh.

```
>>> anterior = my_line.comments.anterior
>>> my_line.comments.regular = "My Regular Comment"
```

### Line Xrefs

Provide access to `Xref` objects describing the line's cross references. `Xref` objects will be discussed later under *Xrefs*.

### Instructions

Provide access to the line's instructions, down to the single operand. `Instruction` objects will be discussed later under *Instructions*.

### Getting Lines

There are several ways to get lines. Either directly or from other objects.

Method	Effect
<b>A Single Line</b>	
<code>sark.Line()</code>	Get the current line
<code>sark.Line(ea=my_address)</code>	Get the line at the given address
<code>sark.Line(name=some_name)</code>	Get the line with the given name
<b>Multiple Lines</b>	
<code>sark.lines()</code>	Iterate all lines in the IDB
<code>sark.lines(start=start_ea, end=end_ea)</code>	Iterate all lines between <code>start_ea</code> and <code>end_ea</code>
<code>sark.lines(selection=True)</code>	Iterate all lines in current selection
<code>sark.lines(reverse=True)</code>	Iterate lines in reverse order

Objects that contain lines, such as functions and code blocks, can return their own set of lines. See `sark.Function().lines` for an example.

## 2.3.3 Functions

Functions are another basic object in Sark. Each one provides access to a single function in IDA.

```

>>> my_func = sark.Function() # The same arguments as `sark.Line`
>>> print(my_func)
Function(name="sub_417400", addr=0x00417400)

>>> my_func.name = "my_func"
>>> print(my_func)
Function(name="my_func", addr=0x00417400)

>>> for line in my_func.lines:
...     print(line.disasm)
push    ebp
mov     ebp, esp
sub     esp, 0DCh
push   ebx
push   esi
.
.
.

```

Like the `sark.Line` objects, they encapsulate relevant API into a single object. Some useful members are:

All similarly named members between `sark.Line` and `sark.Function` work similarly as well to avoid confusion.

## Getting Functions

There are 2 ways to get functions:

1. Using the `sark.Function` class, which accepts the same arguments as `sark.Line`;
2. Using `sark.functions` to iterate over functions. It is the same as `sark.lines`, but does not accept a reverse argument.

### 2.3.4 Xrefs

Cross references are a core concept in IDA. They provide us with links between different objects and addresses throughout an IDB.

```

>>> for xref in sark.Line().xrefs_from:
...     print(xref)
<Xref(frm=0x0041745B, to=0x0041745D, iscode=1, user=0, type='Ordinary_Flow')>
<Xref(frm=0x0041745B, to='loc_4174A4', iscode=1, user=0, type='Code_Near_Jump')>

>>> for xref in sark.Line().xrefs_from:
...     if xref.type.is_jump:
...         print(xref)
<Xref(frm=0x0041745B, to='loc_4174A4', iscode=1, user=0, type='Code_Near_Jump')>

```

Sark xrefs are pretty compact objects:

Member	Usage
<code>frm</code>	xref source address
<code>to</code>	xref destination address
<code>iscode</code>	is code xref
<code>user</code>	is user defined xref
<code>type</code>	XrefType object

## XrefType

To make querying the type of the xref as easy as possible, the `XrefType` object was created:

Member	Usage
<code>name</code>	a string representing the type, mainly for display
<code>type</code>	the numeric type constant, as per IDA SDK
<code>is_call</code>	is the xref a call
<code>is_jump</code>	is the xref a jump
<code>is_*</code>	predicates to check if a specific type applies. Includes all xref types.

Usage is quite simple and looks like plain English (of sorts):

```
>>> if xref.type.is_jump:
...     print("xref is jump.")
```

## Getting Xrefs

Xrefs can be retrieved from lines or functions. Both objects have `xrefs_from` and `xrefs_to` properties that allow retrieval of the relevant xrefs.

### 2.3.5 Instructions

As promised - we arrive to discuss the instruction objects. Instruction objects represent the actual assembly code of each line.

```
>>> line = sark.Line()
>>> insn = line.insn
>>> print(line)
[00417555]    mov     ecx, [eax+8]

>>> print(insn.mnem)
mov

>>> print(insn.operands)
[<Operand(n=0, text='ecx')>, <Operand(n=1, text='[eax+8]')>]
```

Out of their members,

Member	Usage
<code>operands</code>	list of operands
<code>mnem</code>	opcode mnemonic
<code>has_reg</code>	is a reg used in the instruction
<code>regs</code>	the registers used in the instruction

`Instruction.operands` is the most interesting one.

## Operands

Each operand provides the means to analyze individual operands in the code.

```
>>> print(insn.operands[1])
<Operand(n=1, text='[eax+8]')>

>>> print("{0.reg} + {0.offset}".format(insn.operands[1]))
eax + 8
```

Member	Usage
n	operand index in instruction
type	numeric type a-la IDA SDK
size	data size of the operand
is_read	is the operand read from
is_write	is the operand written to
reg	the register used in the operand
text	the operand text, as displayed in IDA
base	the base register in an address-phrase of the form [base + index * scale + offset]
index	the index register in a phrase
scale	the scale in a phrase
offset	the offset in a phrase

## Getting Instructions

The best way to retrieve instruction objects is using the `.insn` member of `sark.Line`.

### 2.3.6 Code Blocks

If you ever looked at a function in the Graph-View, you know what code blocks are. They are the nodes in the function graph, sometimes referred to as a flowchart.

```
>>> block = sark.CodeBlock()
>>> print(list(block.next))
[<CodeBlock(start_ea=0x00417567, end_ea=0x00417570)>,
 <CodeBlock(start_ea=0x0041759E, end_ea=0x004175D4)>]
```

Sark's `CodeBlock` object inherits from the `idaapi.BasicBlock` objects, and adds a few handy members.

Member	Usage
lines	the lines in the block, as a generator
next	successor nodes, as a generator
prev	predecessor nodes, as a generator
color	the background color of the node

These members allow for easy traversal and analysis of nodes in a graph.

## FlowChart

Sark's flowchart, inheriting from `idaapi.FlowChart`, is in every way the same except for returning Sark `CodeBlock` objects instead of `idaapi.BasicBlock` ones. It can be used to quickly fetch all the blocks in a function graph.

## Getting Codeblocks

Codeblocks are created using the `sark.CodeBlock(ea)` class. Flowcharts can be retrieved using the `sark.FlowChart(ea)` class accordingly.

In some cases, you may want to go over more than one function. In those cases, you can use the `sark.codeblocks(start=None, end=None, full=True)` function. The `full` parameter controls the way the blocks are generated. With `full=True`, `FlowChart` objects are generated per function, yielding fully capable `CodeBlock` objects. With `full=False`, a single `FlowChart` is generated for the entire address range. This results in faster iteration, but since the blocks are not associated to their containing functions, it is not possible to get or set block colors (line color will change, though.)

## Advanced Usage

Since the function flowchart is actually a graph, it makes sense to use it as one. To ease you into it, the `sark.get_nx_graph(ea)` function was added.

```
>>> sark.get_nx_graph(idc.here())
<networkx.classes.digraph.DiGraph at 0x85d6570>
```

The function returns a `NetworkX` `DiGraph` object representing the flowchart, with each node being the `start_ea` of a matching block. Using `NetworkX`'s functionality, it is easy to trace routes in the graph.

```
>>> import networkx as nx
>>> func = sark.Function()
>>> graph = sark.get_nx_graph(func.ea)
>>> start_address = sark.get_block_start(func.start_ea) # The `get_block_start(ea)`
↳is short for `get_codeblock(ea).start_ea`
>>> end_address = sark.get_block_start(func.end_ea - 1) # Remember, `end_ea` is
↳outside the function!
>>> path = nx.shortest_path(graph, start_address, end_address)
>>> print("From {} to {}".format(hex(start_address), hex(end_address)))
From 0x417400L to 0x4176a6L

>>>print " -> ".join(map(hex, nx.shortest_path(graph, start, end)))
0x417400L -> 0x41745dL -> 0x417483L -> 0x417499L -> 0x4176a6L
```

### 2.3.7 Segments

Though not as popular as functions and lines, IDA segments include both. In Sark, `Segment` objects allow access to underlying `Function` and `Line` objects.

```
>>> #
>>> # Reference Lister
>>> #
>>> # List all functions and all references to them in the current section.
>>> #
>>> # Implemented with Sark
>>> #
>>> # See reference implementation here: https://code.google.com/p/idapython/wiki/
↳ExampleScripts
>>> #
>>> for function in sark.Segment().functions:
>>>     print("Function %s at 0x%x" % (function.name, function.ea))
```

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```
>>> for ref in function.crefs_to:
>>>     print(" called from %s(0x%x)" % (sark.Function(ref).name, ref))
```

Like the `sark.Line` objects, they encapsulate relevant API into a single object. Some useful members are:

All similarly named members between `sark.Line` and `sark.Segment` work similarly as well to avoid confusion.

## Getting Segments

There are 2 ways to get segments:

1. Using the `sark.Segment` object, using an address in a segment, a segment name, or the index of a segment.
2. Using `sark.segments` to iterate over segments.

### 2.3.8 Switch

The switch-case is a common construct in compiled code, and IDA is doing a great job at analyzing it.

```
>>> switch = sark.Switch(idc.here())
>>> for case, target in switch:
...     print("{} -> 0x{:08X}".format(case, target))
0 -> 0x004224C9
1 -> 0x0042249F
2 -> 0x0042251B
3 -> 0x0042251B
4 -> 0x00422475
5 -> 0x0042251B
6 -> 0x0042251B
7 -> 0x0042251B
8 -> 0x004224F3
9 -> 0x0042251B
10 -> 0x0042251B
11 -> 0x00422448
```

It provides the following members

Member	Usage
<code>targets</code>	switch target addresses
<code>cases</code>	switch case values
<code>pairs</code>	iterator of <code>(case, target)</code> pairs
<code>get_cases</code>	get the cases matching a target

The `sark.Switch` object is similar to a Python dict, mapping cases to targets. `switch[case]` returns the relevant target, and iteration returning the cases.

## Getting Switches

To check if an address is a switch address, use `sark.is_switch(ea)`. To get the switch, use `sark.Switch(ea)`.

## 2.3.9 Enums

Enums in IDA are a great way to name numbers and bit-values for easier reading.

```
>>> for enum in sark.enums():
...     print("{}:".format(enum.name))
...     for member in enum.members:
...         print("    {:<30} = {}".format(member.name, member.value))
...     print()
POOL_TYPE:
    NonPagedPool                = 0
    PagedPool                    = 1
    NonPagedPoolMustSucceed     = 2
    DontUseThisType             = 3
    NonPagedPoolCacheAligned    = 4
    PagedPoolCacheAligned       = 5
    NonPagedPoolCacheAlignedMustS = 6
    MaxPoolType                 = 7

CREATE_FILE_TYPE:
    CreateFileTypeNone          = 0
    CreateFileTypeNamedPipe     = 1
    CreateFileTypeMailslot      = 2
```

The Sark Enum object provides the following members:

Member	Usage
name	the enum name
comments	enum comments, similar to line comments
eid	the enum-id of the enum
bitfield	is the enum a bitfield
members	the enum member constants

Using the Enum object you can easily enumerate and manipulate enums in IDA.

### Enum Members

The `.members` member of `sark.Enum` returns a members object. The members object allows easy enumeration and manipulation of the members:

```
>>> my_enum = sark.add_enum("MyEnum")
>>> my_enum.members.add("first", 0)
>>> my_enum.members.add("second", 1)
>>> my_enum.members.add("third", 2)
>>> my_enum.members.remove("second")
>>> for member in my_enum.members:
...     print("{} = {}".format(member.name, member.value))
first = 0
third = 2
```

Each member provides the following:

Member	Usage
name	the member name
value	the member value
comments	the member comments
enum	the containing enum

## Getting Enums

There are several ways to get an enum. All are summed in the following table:

Code	Explanation
<code>sark.enums()</code>	iterate all the enums in the IDB
<code>sark.Enum("EnumName")</code>	get an existing enum by name
<code>sark.Enum(eid=enum_id)</code>	get an enum using a known id
<code>sark.add_enum("NewEnumName")</code>	create a new enum

### 2.3.10 IDB Graphs

Earlier we discussed codeblock graphs inside functions. Another interesting graph is the call graph connecting all the functions.

As we have already played with graphs earlier, we will not delve into the details.

#### Getting IDB Graphs

To get an IDB graph, use `sark.graph.get_idb_graph()`. The function traverses all xrefs from and to all functions to create a graph of the IDB, with each node being the address of a function's `start_ea`.

### 2.3.11 UI

Sark provides some basic utilities and wrappers for IDA's UI.

#### NXGraph

A natural extension to creating and analyzing graphs, is plotting them. IDA provides a generic API via the `idaapi.GraphViewer` interface. As Sark mainly uses NetworkX digraphs, the `sark.ui.NXGraph` class has been created to provide an easy plotting solution.

```
>>> viewer = sark.ui.NXGraph(graph, title="My Graph", handler=sark.ui.
↳AddressNodeHandler())
>>> viewer.Show()
```

The `NXGraph` constructor takes several arguments:

Argument	Description
graph	the graph to plot
title	(opt.) title for the graph
handler	(opt.) a default handler for nodes
padding	(opt.) visual padding of nodes

After an `NXGraph` is created, use `.Show()` to display it.

## Node Handlers

To allow different types of node data, `NXGraph` uses node handlers. Node handlers inherit from `sark.ui.BasicNodeHandler` and implement the callbacks required for them (all are optional).

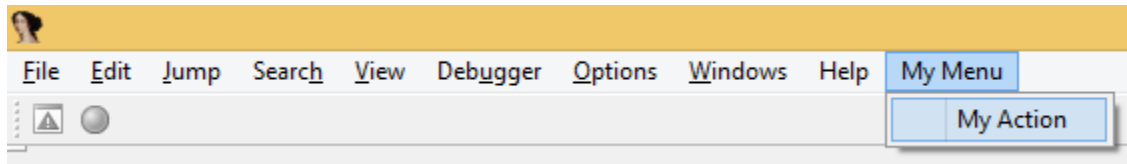
Callback	Usage
<code>on_get_text</code>	returns the text to display for the node
<code>on_click</code>	handles a click on the node. Return <code>True</code> to set the cursor on it.
<code>on_double_click</code>	same as <code>on_click</code>
<code>on_hint</code>	the hint to show
<code>on_bg_color</code>	returns the background color for the node
<code>on_frame_color</code>	returns the frame (border) color for the node

There are 2 existing handlers you can use.

Handler	Info
<code>BasicNodeHandler</code>	The most basic handler. Calls <code>str</code> to get node text, and nothing else. This is the default handler for <code>NXGraph</code> .
<code>AddressNodeHandler</code>	Assumes all nodes are IDB addresses. For node text, it shows the address' name if it exists, or a hex address otherwise. On double click, it jumps to the clicked address.

## Menu Manager

Sark provides a menu-manager class to allow the addition of top-level menus to IDA's GUI. This is done by abusing QT to find the top level menu, but you don't need to worry about that.



```
>>> # Use the manager to add top-level menus
>>> menu_manager = sark.ui.MenuManager()
>>> menu_manager.add_menu("My Menu")
>>> # Use the standard API to add menu items
>>> # Assume the action's text is "My Action"
>>> idaapi.attach_action_to_menu("My Menu/", "SomeActionName", idaapi.SETMENU_APP)
>>> # When a menu is not needed, remove it
>>> menu_manager.remove_menu("My Menu")
>>> # When you are done with the manager (and want to remove all menus you added.)
>>> # clear it before deleting.
>>> menu_manager.clear()
```

As you can see in the above code, the `MenuManager` class only handles the addition of a top-level menu. After that, IDA's own APIs can be used freely with the created menu to add or remove menu items

## 2.3.12 Miscellaneous

Sark also has a lot of functionality outside of the core objects.

Function	Description
<code>sark. fix_addresses(start=None, end=None)</code>	returns a <code>start, end</code> pair, where <code>None</code> is replaced with the start-address and end-address of the IDB accordingly
<code>sark. is_same_function(ea1, ea2)</code>	checks if the addresses are in the same function
<code>sark. get_name_or_address(ea)</code>	returns the name of the address if it exists. Otherwise a hex representation is returned

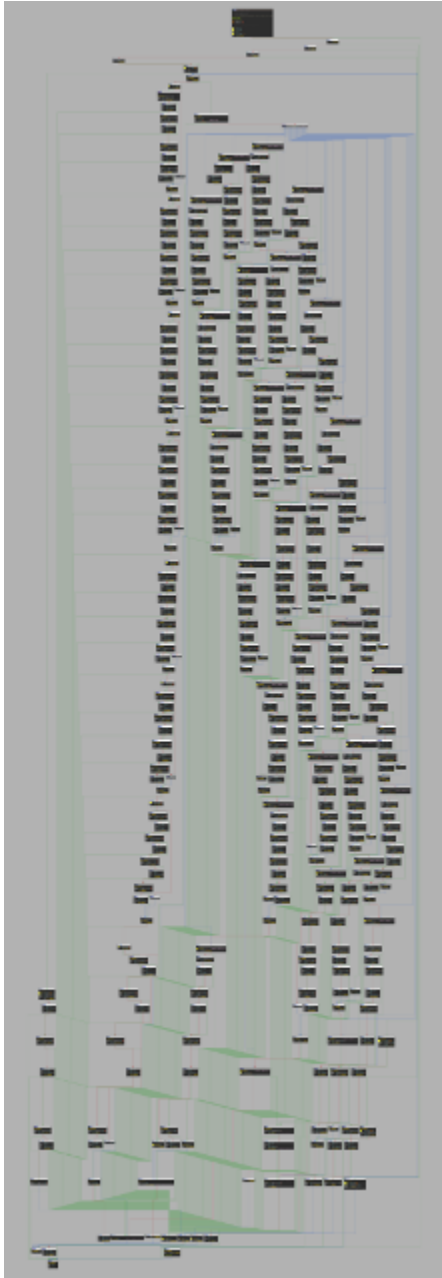
## 2.4 Examples

### 2.4.1 Capture Huge Screenshots

#### Usage

Click on the image for full scale screenshot.

**Warning:** really big image file.



## Code

```
import sark.qt

widget = sark.qt.get_widget("IDA View-A")
sark.qt.resize(widget, 7000, 18000)

# Move the view about a bit to capture the entire function

sark.qt.capture_widget(widget, "huge-screenshot.png")

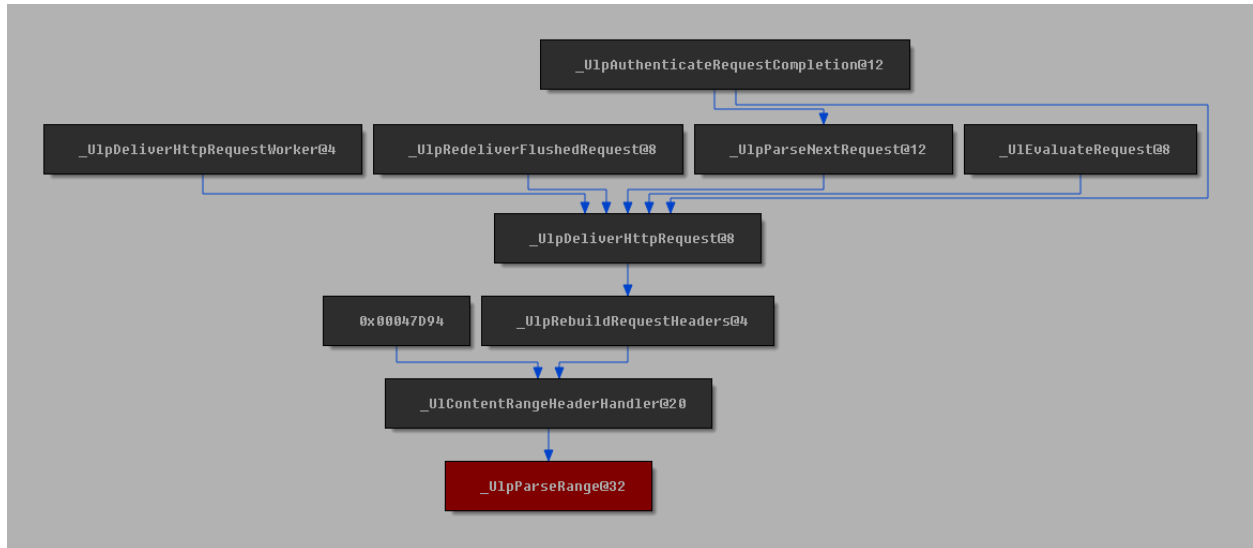
# Crop the image to remove extra background.
```

## 2.4.2 Plotting a Call Graph

### Usage

Using Windows 8.1 http.sys. Before MS15-034.

```
draw_call_graph(sark.Function(name="_UlpParseRange@32").ea, to=True, distance=4)
```



### Code

```

import sark
import networkx as nx

def draw_call_graph(ea, distance=2, to=False):
    # First, get the IDB graph (caching it might be a good idea
    # as this operation can be time consuming on large IDBs)
    idb_graph = sark.graph.get_idb_graph()

    # Get the address of the function to use in the graph
    func_ea = sark.Function(ea).ea

    # Create the call graph
    if to:
        # If we want the calls to our function, we need to reverse
        # the graph
        idb_graph = idb_graph.reverse()

    # Use NetworkX to limit the IDB graph
    call_graph = nx.ego_graph(idb_graph, func_ea, distance)

    # Paint the root node red
    call_graph.node[func_ea][sark.ui.NXGraph.BG_COLOR] = 0x80

    if to:
        # If we reversed it before, we need to reverse it again

```

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```
# to make the links point the right way
call_graph = call_graph.reverse()

# Create an NXGraph viewer
viewer = sark.ui.NXGraph(call_graph, handler=sark.ui.AddressNodeHandler())

# Show the graph
viewer.Show()
```

## 2.5 Plugins

### 2.5.1 Installing Plugins

#### The IDA Way

IDA provides a single way to install plugins - stick them in the `plugins` subdirectory and you're good to go.

While this is great for compiled plugins, as your build scripts can place the newly compiled plugin there for you, it is not as comfortable when using scripted plugins. Forgetting to copy the latest version, or updating the code in the `plugins` directory instead of your repository can both lead to annoying problems and waste precious time.

Moreover, access to the `plugins` directory requires root access.

#### The Sark Way

To combat the limitations of IDA's plugin loading mechanism, Sark provides the `plugin_loader.py` plugin. Once installed (in the classic IDA way) it allows you to define plugin-lists - a system-wide list and a user-specific list - to be loaded automatically.

The lists are simple, consisting of full-paths and line-comments:

```
C:\Plugins\my_plugin.py

# This is a comment. Comments are whole lines.
C:\OtherPlugins\another_plugin.py
```

Both lists are named `plugins.list` and are automatically created by IDA as empty lists at the following locations:

**System-Wide** Under IDA's `cfg` subdirectory. The path can be found using `idaapi.idadir(idaapi.CFG_SUBDIR)`. This list requires root access to modify as it is in IDA's installation directory.

**User-Specific** Under IDA's user-directory. `$HOME/.idapro` on Linux, `%appdata%\HexRays\IDA Pro` on Windows. The path can be found using `idaapi.get_user_idadir()`. Each user can set his own plugins to load, thus eliminating the need for root access.

To install your plugins, just add them to one of the lists. This allows you to easily update plugins as you go without ever needing to copy them.

### 2.5.2 Show Meaningful

When reversing an executable, we often need to deal with a large amount of unknown code. To combat this, we usually look for strings and library functions, and use them as guides as we interpret the code. When those are ample,



we hardly need to look at the assembly code to infer meaning. On the other hand, the need to constantly jump into functions, pan them around to see all the strings, then jump back out is quite time consuming and confusing.

Well, no more!

The “Meaningful” plugin allows you to get all the information you need with a simple hotkey.

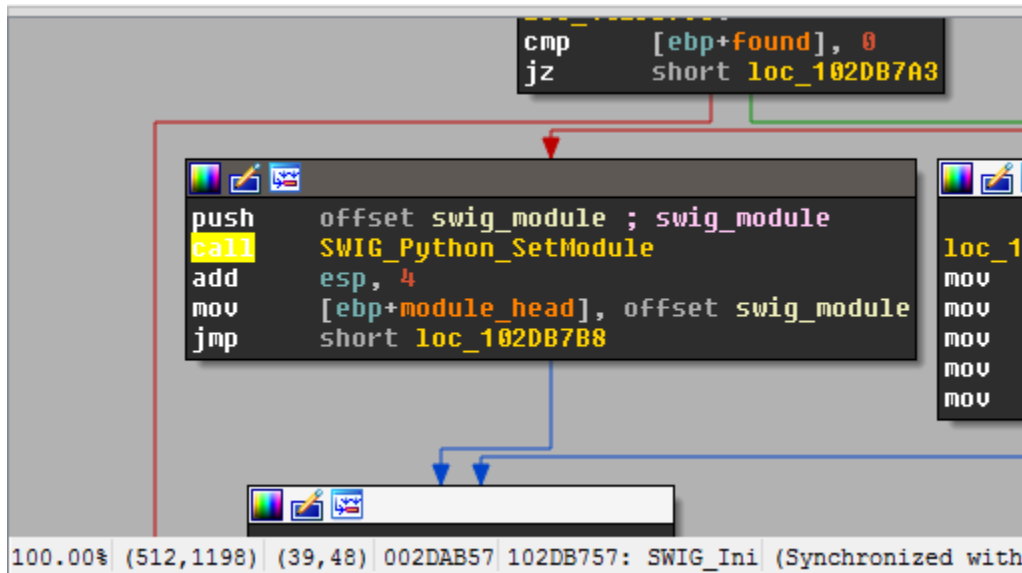
## Usage

Whenever inside a function, just press `Alt + 0` to get a table of all the meaningful objects in it:

Meaningful References in 'py_data_format_to_py_dict' : 0x100DE0A0			
Type	Usage	Address	Object
code	0x100DE0B2	0x1068E7F0	__imp_PyGILState_GetThisThreadState
str	0x100DE0C7	0x10459654	'idaapi.cpp'
str	0x100DE0CC	0x10459660	"""** WARNING: Code at %s:%d should have the GIL, but apparently doesn't ***\n"
code	0x100DE0D1	0x10002045	int __cdecl msg(char const *,...)
str	0x100DE13F	0x104576C4	'hotkey'
str	0x100DE148	0x104576B8	'menu_name'
str	0x100DE151	0x1045769C	'name'
str	0x100DE15D	0x104576EC	'value_size'
str	0x100DE169	0x10457724	'text_width'
str	0x100DE174	0x10457740	'cbsize'
str	0x100DE180	0x10457694	'props'
str	0x100DE185	0x104596AC	'{s:i,s:i,s:i,s:k,s:s,s:s,s:s}'
code	0x100DE18A	0x1068E854	__imp_Py_BuildValue

Since the output is at the *Output window*, a double click on an address will take you to it.

To make things even more agile, you can press `Ctrl + Alt + 0` whenever on a line referencing a function to get the values displayed for that function:



Meaningful References in 'SWIG_InitializeModule' : 0x102DB700			
Type	Usage	Address	Object
code	0x102DB741	0x102DB960	SWIG_Python_GetModule
code	0x102DB757	0x102DB9B0	SWIG_Python_SetModule
code	0x102DB812	0x1001EF70	SWIG_MangledTypeQueryModule
code	0x102DB89A	0x1001EF70	SWIG_MangledTypeQueryModule
code	0x102DB8D7	0x10026E90	SWIG_TypeCheck

Python

### 2.5.3 Quick Copy

The quick copy allows you to easily copy data from the IDB.

#### Usage

##### Copying Addresses

To copy the address of the current line, just press `Ctrl + Alt + C`. It will get copied as a hex number, prefixed with `0x`.

To copy the file offset of the current line, simply press `Ctrl + Alt + O`. It will get copied as a hex number (like line address copying), prefixed with `0x`.

##### Copying Bytes

Pressing `Ctrl + Shift + C` copies the bytes of the current line or selection.

Copying the current line:

```

.text:100DE0FC ; -----
.text:100DE0FC
.text:100DE0FC loc_100DE0FC: ; CODE XREF: py_data
.text:100DE0FC 8B 4D 08 mov ecx, [ebp+arg_0]
.text:100DE0FF 8B 51 14 mov edx, [ecx+14h]
.text:100DE102 89 55 FC mov [ebp+var_4], edx
.text:100DE105
000DD4FC: 100DE0FC: py_data_format_to_py_dict:loc_100DE0FC (Synchronized with Hex View-1)

```

Will result in `8b 4d 08`, while copying a selection:

```

.text:100DE0FC ; -----
.text:100DE0FC
.text:100DE0FC
.text:100DE0FC      loc_100DE0FC:      ; CODE XREF: py_data
.text:100DE0FC      mov     ecx, [ebp+arg_0]
.text:100DE0FF      mov     edx, [ecx+14h]
.text:100DE102      mov     [ebp+var_4], edx
.text:100DE105
000DD4FC 100DE0FC: py_data_format_to_py_dict:loc_100DE0FC (Synchronized with Hex View-1)

```

Will result in 8b 4d 08 8b 51 14.

## 2.5.4 Autostruct

Creating and applying structs in IDA can be quite a hassle.

Go to the structure window, create a structure, define members at specific offsets, go to the disassembly to apply them, go back to the structure view to correct errors, apply other members... And on and on it goes.

The Autostruct plugin does all this work for you, without ever having to leave the IDA view. It automatically creates structs, defines member offsets, and applies them in the disassembly view.

### Usage

1. Select a line (or lines) containing struct references

```

105:      mov     eax, [ebp+arg_0]      ; CODE XREF: py_data_f
      cmp     dword ptr [eax+10h], 0
      jnz     short loc_100DE117
      mov     [ebp+var_8], offset unk_10456CFB
      jmp     short loc_100DE120
000DD508 100DE108: py_data_format_ (Synchronized with Hex View)

```

2. Press Shift + T
3. Set the struct name

Struct Name:

OK Cancel

4. Choose the register holding the struct base for the selected code. Autostruct will automatically suggest the most likely candidate in the selection.

Register:

OK Cancel

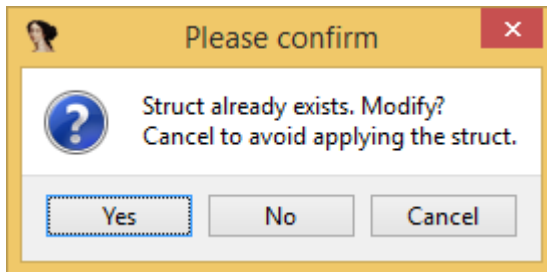
At this point, Autostruct will try and create a new struct, populate it with relevant offsets, and apply it to the selection.

```

105:      mov     eax, [ebp+arg_0]      ; CODE XREF: py_data_f
      cmp     [eax+MyStruct.offset_10], 0
      jnz     short loc_100DE117
      mov     [ebp+var_8], offset unk_10456CFB
      jmp     short loc_100DE120
000DD508| 100DE108: py_data_format_ (Synchronized with Hex View)

```

5. If a structure of the given name already exists, you will need to select whether to modify the existing structure, apply without modification, or cancel.



6. Struct creation and modification happen seamlessly

```

00000000
00000000 MyStruct      struct ; (sizeof=0x1C, mappedto_1609)
00000000      db ? ; undefined
00000001      db ? ; undefined
00000002      db ? ; undefined
00000003      db ? ; undefined
00000004      db ? ; undefined
00000005      db ? ; undefined
00000006      db ? ; undefined
00000007      db ? ; undefined
00000008 offset_8      dd ? ; XREF: py_data_format_
0000000C      db ? ; undefined
0000000D      db ? ; undefined
0000000E      db ? ; undefined
0000000F      db ? ; undefined
00000010 offset_10     dd ? ; XREF: py_data_format_
00000014      db ? ; undefined
00000015      db ? ; undefined
00000016      db ? ; undefined
00000017      db ? ; undefined
00000018 offset_18     dd ? ; XREF: py_data_format_
0000001C MyStruct      ends
0000001C
324. MyStruct:000F

```

## Known Issues

**Misaligned Member Creation** When attempting to create a member at an offset belonging to another member, Autostuct will fail. This usually happens when a previous definition was incorrect (wrong member size) or when

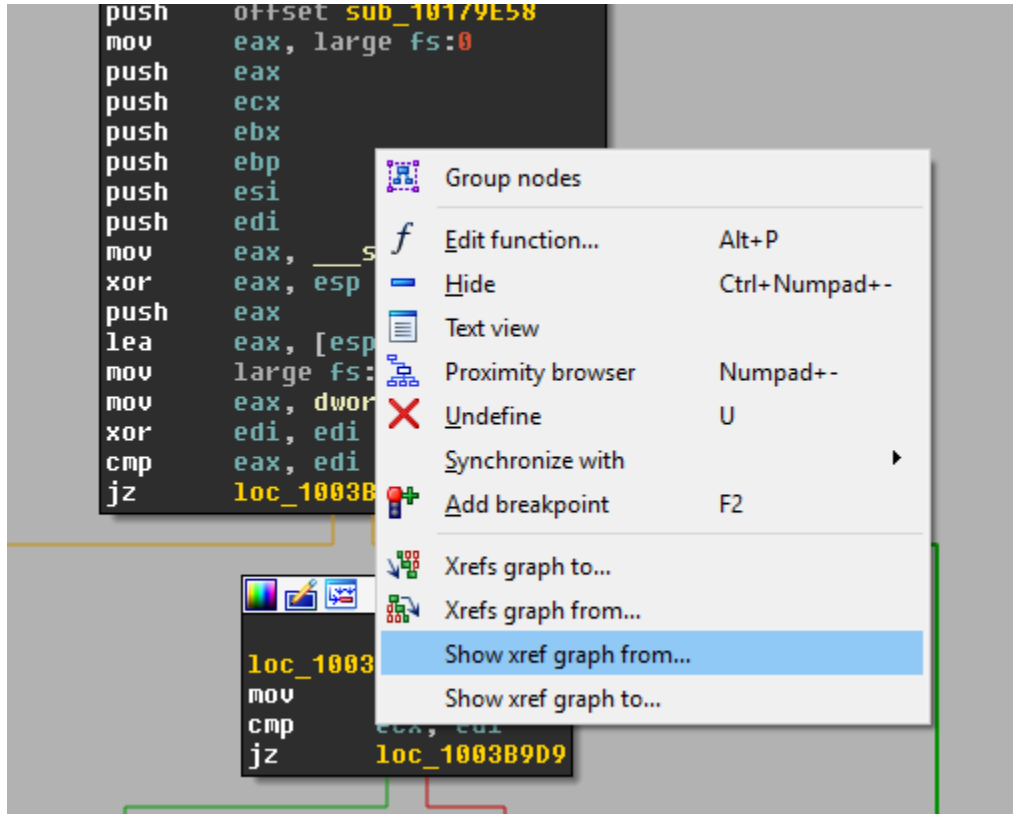
members are unions. At this point, manual handling (redefining the large member as a smaller one) is required.

## 2.5.5 Xrefs Graph

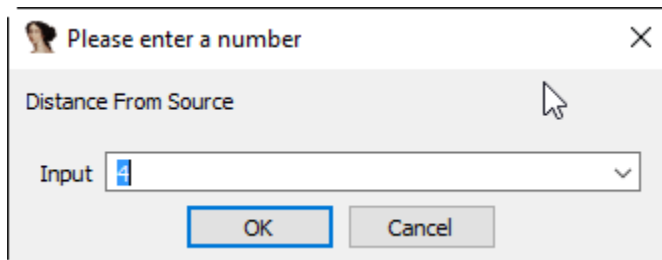
The Xrefs-Graph is used to easily generate interactive xref graphs.

### Usage

Anywhere within the IDA-View, just right-click<sup>1</sup>, and select the desired option:

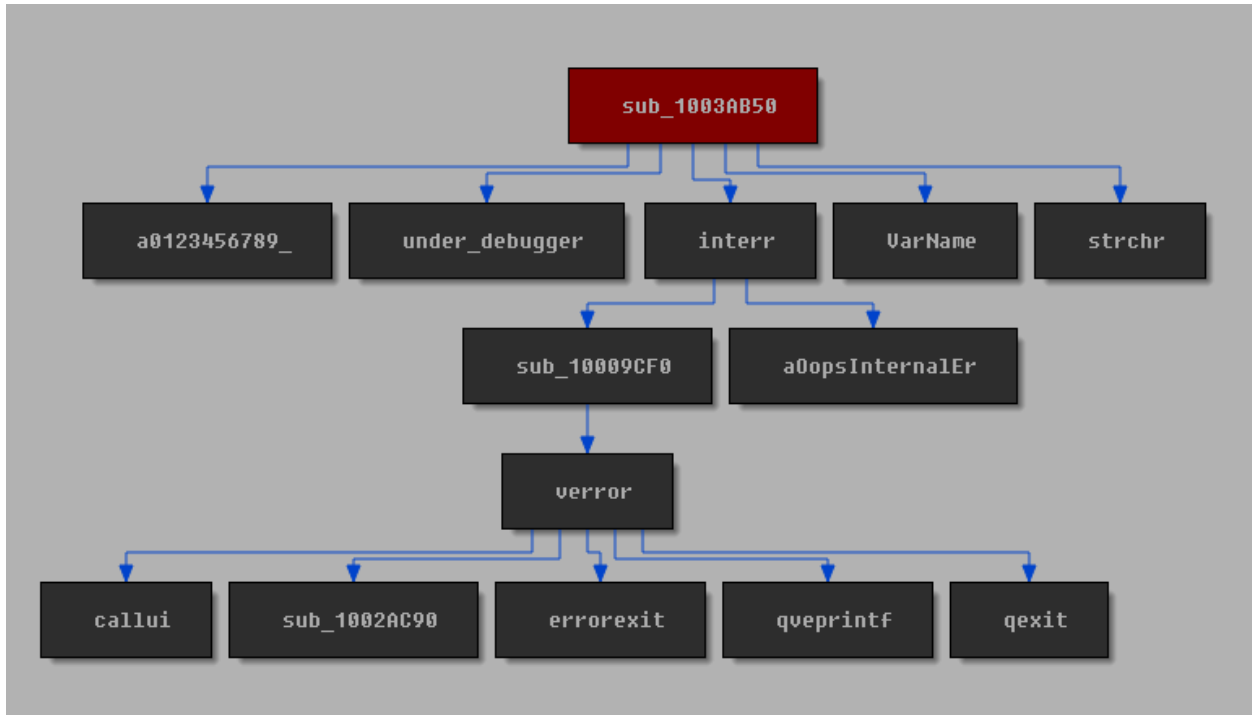


In the popup dialog, enter the distance (recursion level) desired from the source:



Once you press OK, the plugin will generate an interactive xrefs graph:

<sup>1</sup> In IDA 6.6 or earlier, use View/Graph/Xrefs from source or View/Graph/Xrefs to source, as context menus cannot be augmented.



A double-click on any block will take you to the relevant address. Also, names in the blocks will be updated as you rename functions.

### Known Issues

**Node Groups** While creation of node groups *is* possible via IDA's GUI, it is not presently supported in the plugin. Creation of node groups may cause unpredictable errors.

## 2.6 Debugging IDAPython Scripts

While IDAPython is extremely useful, it can be a bit of a hassle to debug IDA Pro plugins. This tutorial will give you started on debugging IDAPython scripts and plugins using Python Tools for Visual Studio.

And yes, it is completely free.

### 2.6.1 The Setup

For this tutorial, we will be using the following software:

1. IDA Pro 6.8
2. Visual Studio Community
3. Python Tools for Visual Studio, documentation can be found [here](#).
4. Python's `ptvsd` module. Install using `pip install ptvsd`.
5. The following plugin:

```

# filename: ptvsd_enable.py

import idaapi
import ptvsd

try:
    # Enable the debugger. Raises exception if called more than once.
    ptvsd.enable_attach(secret="IDA")
except:
    pass

class DebugPlugin(idaapi.plugin_t):
    flags = idaapi.PLUGIN_FIX
    comment = "PTVSD Debug Enable"
    help = "Enable debugging using PTVSD"
    wanted_name = "PTVSD"
    wanted_hotkey = ""

    def init(self):
        return idaapi.PLUGIN_KEEP

    def term(self):
        pass

    def run(self, arg):
        pass

def PLUGIN_ENTRY():
    return DebugPlugin()

```

For the purposes of this tutorial, you can try and debug this plugin:

```

# filename: sample_debuggee.py

import idaapi

def my_debugged_function():
    # Set breakpoint here!
    pass

class SamplePlugin(idaapi.plugin_t):
    flags = idaapi.PLUGIN_PROC
    comment = "Sample Debuggee"
    help = "Sample Debuggee"
    wanted_name = "Sample Debuggee"
    wanted_hotkey = "Shift+D"

    def init(self):
        return idaapi.PLUGIN_KEEP

    def term(self):
        pass

```

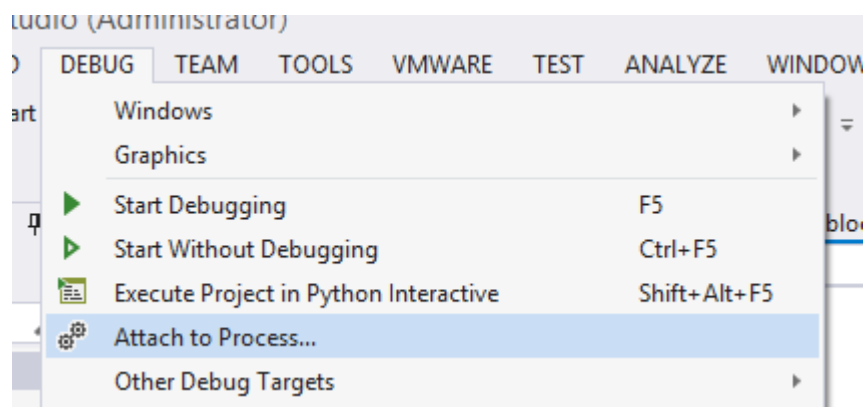
(continues on next page)

```
def run(self, arg):
    my_debugged_function()

def PLUGIN_ENTRY():
    return SamplePlugin()
```

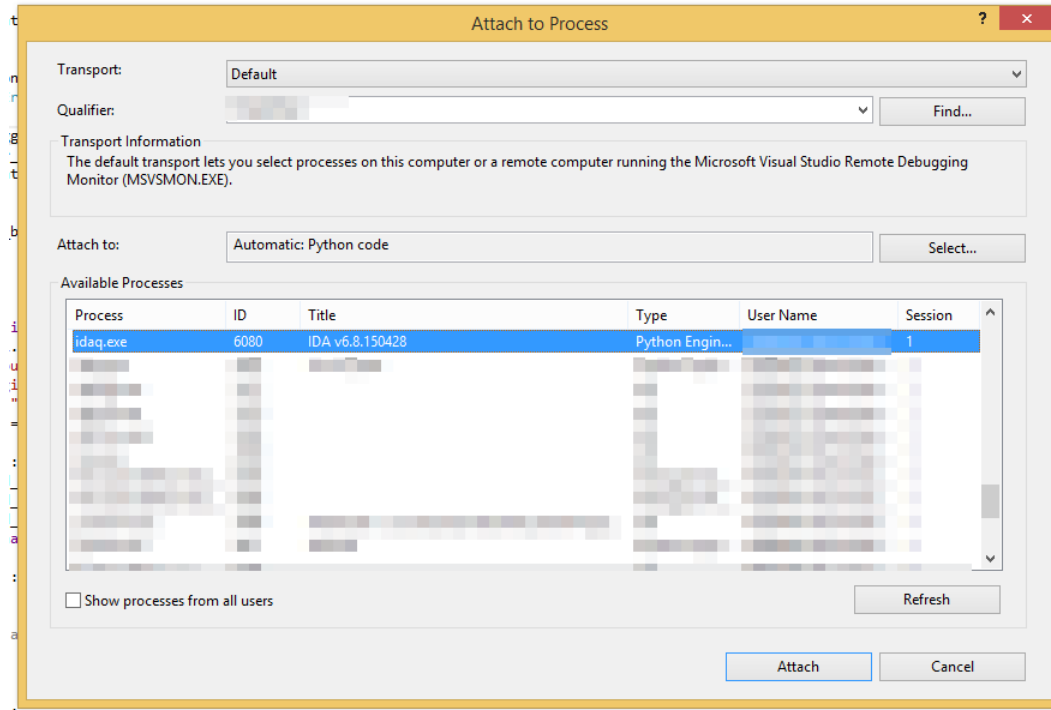
## 2.6.2 Debugging

1. Put `ptvsd_enable.py` (provided above) in IDA's plugins directory. If you want to use the sample debuggee, put it in the plugins directory as well.
2. Start IDA and load an IDB (otherwise weird issues arise)
3. Load the code you want to debug into Visual Studio and set breakpoints.
4. In Visual Studio (with the plugin file open), use `DEBUG->Attach` to process



5. In the dialog, select `idaq.exe` and click `Attach`





6. We are now attached. Once a breakpoint is hit, Visual Studio will break and let you debug.
7. Have fun debugging!

## 2.6.3 Important Notes

1. When debugging (breaking and stepping), IDA will be frozen.
2. Load your IDB prior to attaching the debugger.
3. For easy debug-on-demand, keep `ptvsd_enable.py` in IDA's plugins directory at all times.
4. To set breakpoints, make sure you load into VS the files that are actually loaded by IDA.

If you find any issues with the tutorial, please submit them [here](#).

## 2.7 Support

### 2.7.1 IDA 7.4 & Python 3

Those versions are under active support and expected to receive updates.

IDA 7.4 made 2 significant changes that affect support

1. Python 3 support
2. Python 2: 6.95 compatibility APIs OFF by default

IDA 7.4 release notes

This means that all code breaks by default - be it Python 2 or 3. While adapting Sark to the new APIs & Python 3 I concluded that actively maintaining & developing multiple (IDA 7.4 and lower, Python 2 & 3) versions incurs an

overhead that is too high for me. As a result - Sark will only support Python 3 on IDA 7.4. Older versions of IDA will get bugfixes. IDA 7.4 with Python 2 will receive no support.

If you need Python 2 support on IDA 7.4, please contact me or create an issue on this repo. I am not opposed to adding bugfix-based support.

### 2.7.2 Older Versions

Older versions of IDA (7.3 and lower) using Python 2 are still supported for bugfixes.

The older version is maintained on the [IDA-6.x branch](#).

Installation of the older version follows the same flow as before:

```
pip2 install -U git+https://github.com/tmr232/Sark.git@IDA-6.x#egg=Sark
```

To develop locally, clone the repo & check-out the IDA-6.x branch.

## 2.8 How To Contribute

The Sark project was created to provide an intuitive, easy to use scripting layer for IDA Pro. If something seems like the right-way to do something, it should probably be added to Sark.

If you have something you think is worth adding, either submit a new issue or (preferably) create a pull-request.

When contributing, try and follow these guidelines:

- Add yourself to the [AUTHORS.rst](#) file in alphabetical order. Every contribution shall be credited.
- Each new feature must have a reproducible test-case or usage. If it can't be used, it will not get in.
- Obey [PEP 8](#) and [PEP 257](#).
- All code should be documented. Usage samples and references to the IDASDK headers are a bonus.
- Write meaningful commit messages.
- No change is too small. You are welcome to fix typos, convention violations, or plain ugly code. All contributions are welcome.
- When submitting a fix to a bug, describe the bug being fixed. Include both the bug and the desired results. Creating an issue for the bug is good practice.
- When reporting bugs, make sure you mention your OS and IDA version.
- Sark has tests (though the coverage is bad. . .). When adding features, it is advisable to add matching tests.

If you can't adhere to the guidelines, **submit your pull requests anyway**. Maybe someone else can improve on it.

Thanks for contributing!

## 2.9 Credits

Sark is written and maintained by Tamir Bahar.

## 2.9.1 Contributors

The following people have contributed directly or indirectly to this project:

- [darx0r](#)
- [iamtimmy](#)
- [ynvb](#)
- [OfficialMan](#)

Please add yourself here alphabetically when you submit your first pull request.