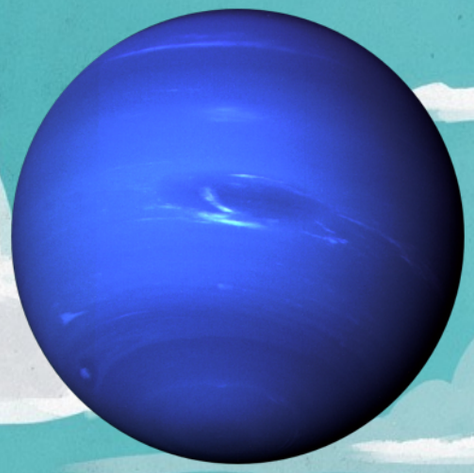
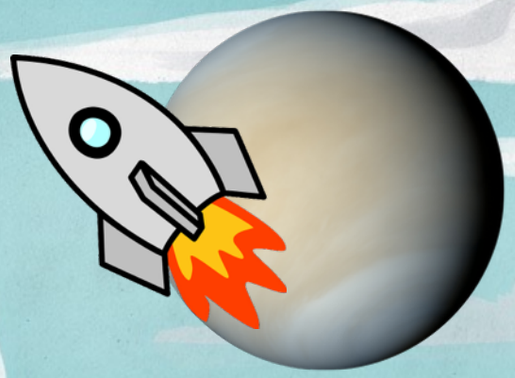


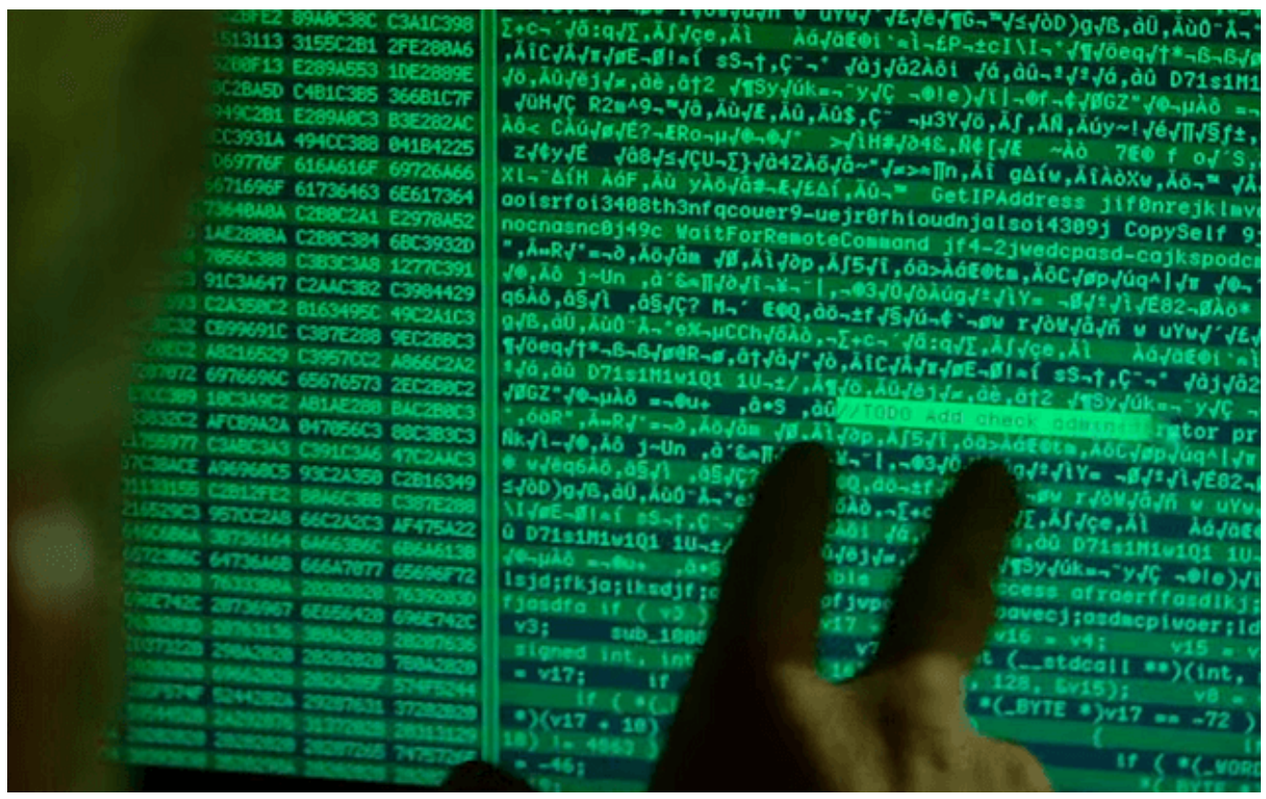

# 0X3E9 WAYS TO DIE



Check Point®
SOFTWARE TECHNOLOGIES LTD.

# Who am I?

- Yaniv Balmas (@ynvb)
- Security Researcher @ Check Point Software Technologies
- Malware Research
- Vulnerability Research
- Spend most of my day staring at assembly code and binary files.



# What is the problem?

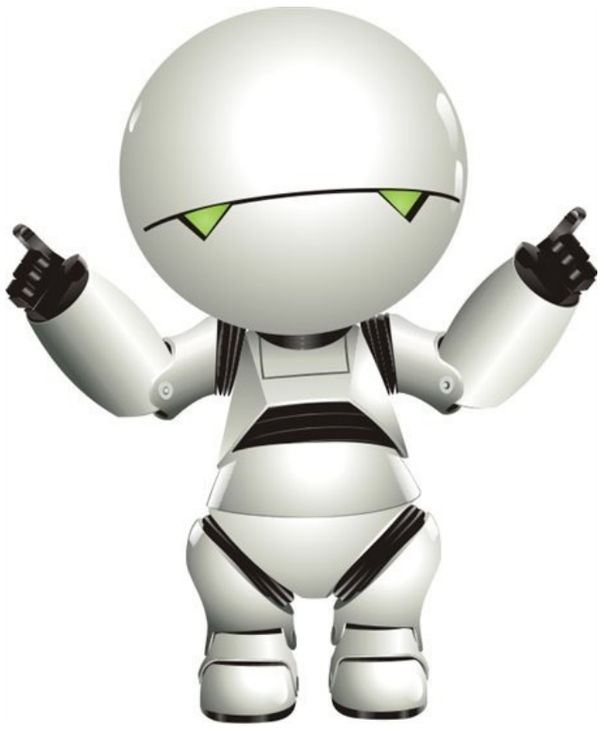
- Static analysis tools contain a lot of useful data about binary files.
- Dynamic analysis tools (e.g Debuggers) contain all execution flow related data.
- It seems trivial to bridge those two approaches.

"Well I wish you'd just tell me rather than try to engage my enthusiasm."
–*Marvin*

# PREVIOUS SOLUTIONS

# IDA-Splode

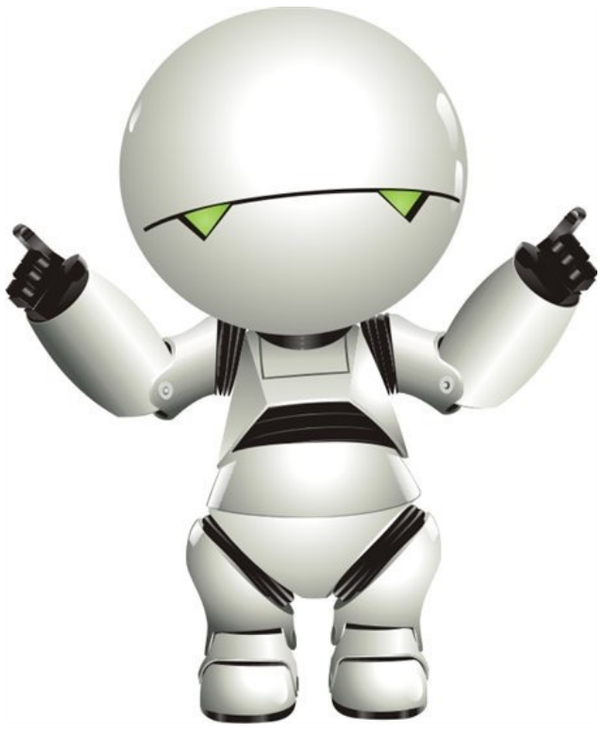
- 2014, Zach Riggle
- Uses Intel PIN framework



- Very extensive tracing
- Branch Statistics
- Data is stored as .IDB comments
- Only works on INTEL archs and is designed mainly for Windows.

# Funcap

- 2013, Andrzej Derezowski
- Uses IDA Debugging API



- Very intuitive solution
- Parses ASCII\Unicode string values
- New threads are not being followed
- Argument offsets are calculated “manually”

# What is missing?

- The extracted dynamic data is not indexed and searching through it can be a *pain*.
- Entry level for adding custom functionality is relatively high.

**NO REFERENCE TO VALUE TYPES!!**

# DON'T PANIC

( And Prepare to DIE... )

# Howto DIE?

- DIE - “Dynamic IDA Enrichment”
- Collect context from function calls & returns only.
- Parse argument values and present them in a “Human Readable” format.
- Smart interaction between static & dynamic data.
- Use as much IDA-API Magic as possible.

# Implementation Challenges

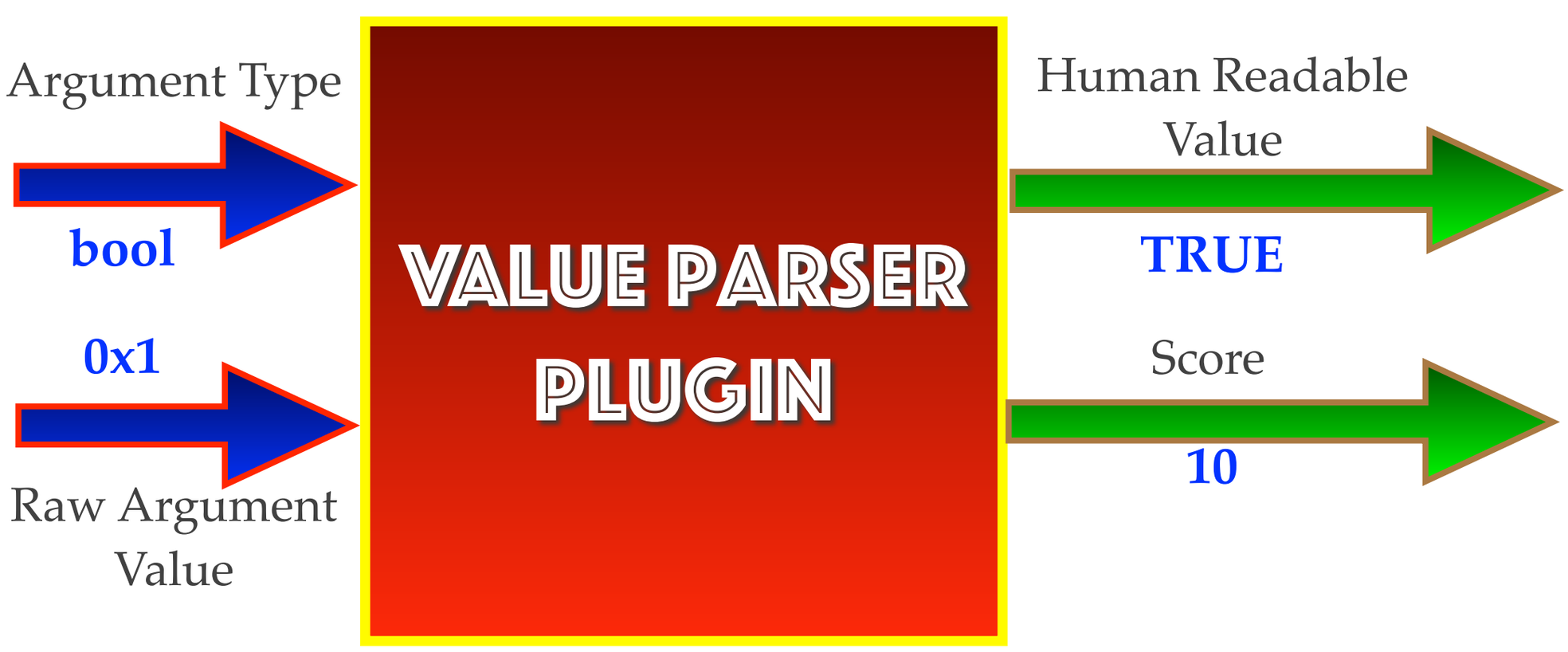
- How can we query IDA for function argument types?
- Once we have the argument values, how do we parse them? which values should we parse?
- How do we parse complex data types? (structs, unions, pointers, etc)?

# Function Arguments

- After hours of fun reading IDA-API, it turns out there are some objects we can actually use.
- tinfo_t objects holds a ridiculous amount of information about data types.
- Digging even deeper into tinfo_t object reveals the func_type_data_t, func_arg_t and arg_loc_t objects which store everything we need to parse function arguments.

# Parsing Argument Values

- Impossible to think of all parsing options!
- Makes more sense to create an open source plugin framework.



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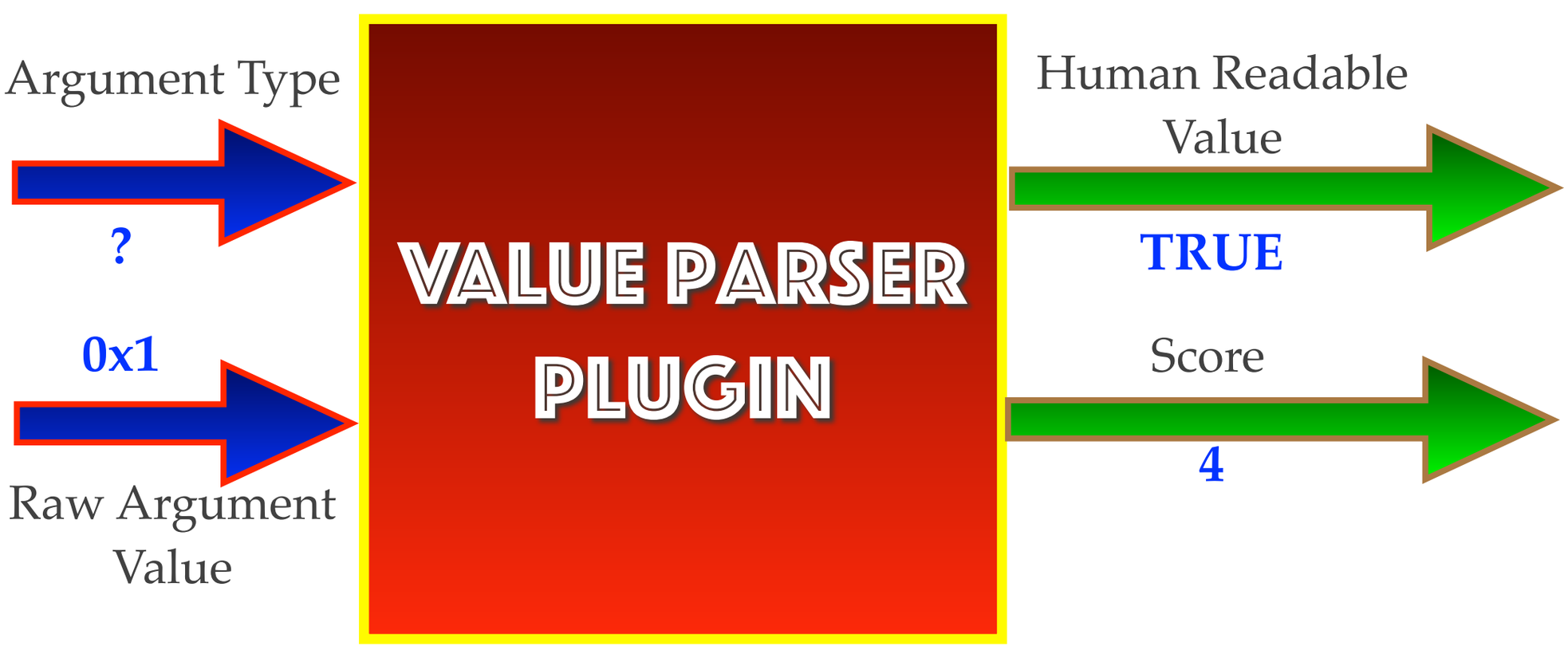


# Complex Data Types

- What do we do when we encounter a complex data type?
- Simple. Break it up until we reach the simple types.

**STRUCTS \ UNIONS**

```
udt = udt_idaapi.udt_type_data_t
type_info.get_udt_details(udt)
```

**ARRAYS**

```
arr = idaapi.array_type_data_t()
type_info.get_array_details(arr)
```

**REFERENCES**

```
type_info.get_pointed_object()
```

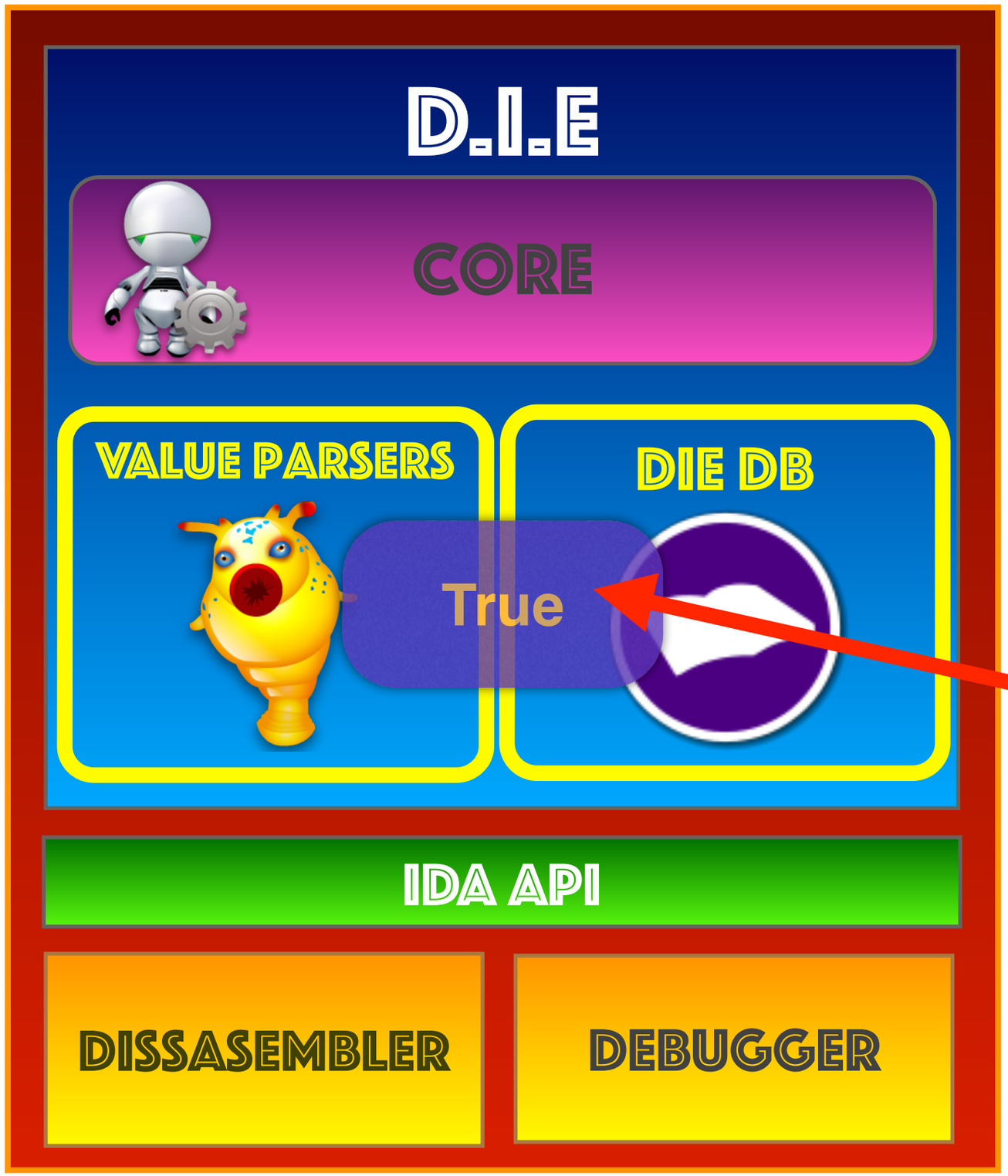

```
__cdecl main (int argc, char **argv)
proc near

push    1
lea     eax, ds:string ; “Str1”
push    eax
call    func_1
add     esp, 8
lea     eax, ds:string ; “Str1”
push    eax
call    unknown
```


```
; bool __cdecl func_1(char *a, int b)
proc near
```

CHAR *a

int b

```
push    ebp
mov     esp, ebp
sub     esp, 0C0h
mov     eax, [ebp+name]
push    eax
call    _strcmp
ret
```

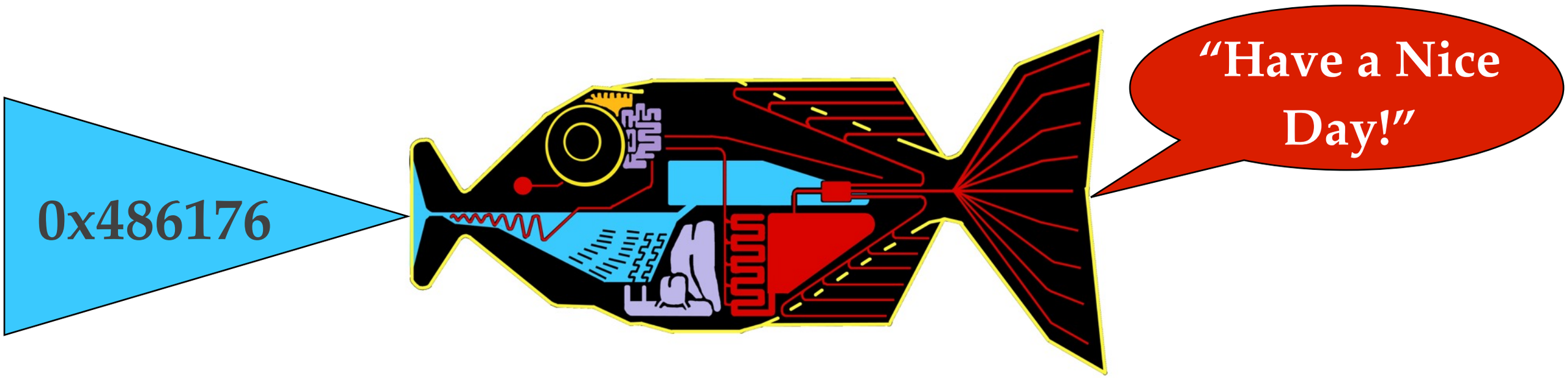



```
__cdecl main (int argc, char **argv)
proc near

push    1
lea     eax, ds:string ; “Str1”
push    eax
call    func_1
add     esp, 8
lea     eax, ds:string ; “Str1”
push    eax
call    unknown
```


```
; int __cdecl unknown(int)
proc near

push    ebp
mov     esp, ebp
sub     esp, 0C0h
mov     ebx, edx
mov     [ebp+var_4], ecx
push    esi
xor     esi, esi
cmp     ebx, esi
jle     loc_XXXXXX
ret
```

int

# VALUE PARSERS



# Simple Value Parsers

| | |
|---|---|
| **STRING PARSER** | Uses idc.GetString to parse ASCII, Unicode, Pascal and other strings |
| **BOOL PARSER** | Returns TRUE for 0x1 and FALSE for 0x0. (Duh!) |
| **FUNCTION PARSER** | Returns the referenced function name. |
| **MODULE PARSER** | Returns the referenced module name. |

# Advanced Parser – Handles

- Works on Windows systems with local debugger (currently).
- Uses DuplicateHandle() to duplicate the handle associated with the raw value from the current running process.
- Uses NtQueryObject() on the local handle to retrieve the handles details.
- Returns the handle name and type.

# Advanced Parser – STD String

```
0:000:x86> dt str1a+4 std::_String_val<std::_Simple_types<char> >::_Bxty
BasicString!std::_String_val<std::_Simple_types<char> >::_Bxty
   +0x000 _Buf             : [16]  "Hello "
   +0x000 _Ptr             : 0x6c6c6548  "--- memory read error at address 0x6c6c6548 ---"
   +0x000 _Alias           : [16]  "Hello "
0:000:x86>
0:000:x86>
0:000:x86>
0:000:x86> dt test+4 std::_String_val<std::_Simple_types<char> >::_Bxty
BasicString!std::_String_val<std::_Simple_types<char> >::_Bxty
   +0x000 _Buf             : [16]  "P???"
   +0x000 _Ptr             : 0x00669d50  "I am the king of the world!!!"
   +0x000 _Alias           : [16]  "P???"
```

- Great example of an ad-hoc parser.
- Check if the value pointed by offset 4 of raw address is either a string or references a string.
- Also, make sure raw value is not a string.

# DEMO TIME

"Demos, don't talk to me
about demos…"
*-Marvin*

# Bypass Password Protection

## YOUR ORDERS:

Watch The DEMO

Assigned By:

Agent M

### Target Application:

ATEN Firmware Upgrade Utility

### Mission:

Bypass password protection

**Quickly!**

# Defeat C++ Code

## YOUR ORDERS:

Watch The DEMO

Assigned By:

Agent M

### Target Application:

7zip cli (32-bit version)

### Mission:

Get a complete code analysis

**Quickly!**

# String De-Obfuscation

## YOUR ORDERS:

Watch The DEMO

Assigned By:

Agent M

### Target Application:

Explosive Trojan

### Mission:

Find the string de-obfuscation function

**Quickly!**

# #TODO

- Thunk Functions
- Complex function parsers
- Better GUI
- (Much) Better DB
- Solve (very) dramatic crashes

# Looks cool, Can I have it?

- Yes.
- DIE is an open source tool.
- https://github.com/ynvb/DIE
- If you like it, contribute.

# SARK

## IDA Python Made Easy

- Simple
- Intuitive
- Object Oriented API

- Docs: sark.rtfd.org
- Code: github.com/tmr232/sark
- Written by Tamir Bahar @tmr232

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@ynvb