CALL A C API FROM PYTHON BECOMES MORE ENJOYABLE WITH CFFI

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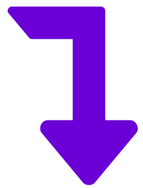
WHY PYTHON EXTENSION ?

WHY PYTHON EXTENSION ?

ACCESSING LOW-LEVEL API
OPENGL / VULKAN



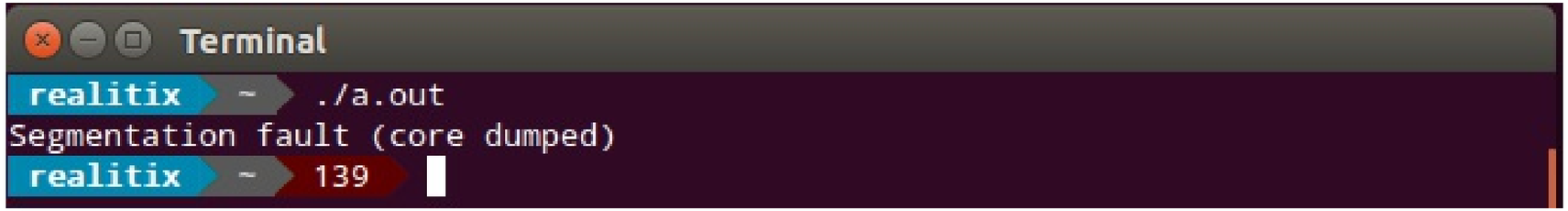
WHY PYTHON EXTENSION ?

LINKING TO EXISTING C LIBRARY

WHY PYTHON EXTENSION ?

IMPROVING PERFORMANCE

OUR GOOD FRIEND IS ALWAYS HERE !




I'M TOTALLY LOST
WITH
CPYTHON API

APPLICATION **PROGRAMMING**

INTERFACE

APPLICATION **BINARY** *INTERFACE*

WHY ABI ?

CYTHON

CYTHON

INCREMENTAL OPTIMIZATION

PY++

CYTHON

```
def fib(int n):
    cdef int a = 0
    cdef int b =  1
    while b < n:
        print(b)
        a, b = b, a + b
```

CYTHON

ABI / API

CTYPES

BUILT-IN / ABI ONLY

CTYPES

```
from ctypes import cdll, Structure, c_int, c_double

lib = cdll.LoadLibrary('./vector.so')

# ctypes Point structure
class Point(Structure):
    _fields_ = [('x', c_int), ('y', c_int)]

# Initialize Point[2] argument
points_array = (Point * 2)((1, 2), (3, 4))

# Get vector_size from library
vector_size_fn = lib.vector_size
vector_size_fn.restype = c_double

# Call vector_size with ctypes
size = vector_size_fn(points_array)
print('out = {}'.format(size))
```


CFFI ENLIGHTENED
IN-LINE : IMPORT TIME
OUT-OF-LINE : INSTALL TIME

ABI / IN-LINE

```
from cffi import FFI
ffi = FFI()

ffi.cdef("int printf(const char *format, ...);")

C = ffi.dlopen(None)

arg = ffi.new("char[]", "world")
C.printf("hello %s\n", arg)
```

ABI / IN-LINE

DEMO

API / OUT-OF-LINE

```
from cffi import FFI
ffibuilder = FFI()

ffibuilder.set_source("_example",
   r"""#include <sys/types.h>
       #include <pwd.h>
    """)

ffibuilder.cdef("""
    struct passwd {
        char *pw_name;
        ...;
    };
    struct passwd *getpwuid(int uid);
""")

if __name__ == "__main__":
    ffibuilder.compile(verbose=True)
```

API / OUT-OF-LINE

RUNNING


REBUILD

STATISTICS

VULKAN API

C HEADER : 5088 LOC

XML DESCRIPTION : 6461 LOC

STATISTICS

C WRAPPER

GENERATED C FILE : 62705 LOC

GENERATOR : 1057 PY-LOC / 1141 C-LOC

STATISTICS

CFFI WRAPPER

GENERATED PYTHON FILE : 4859

LOC

GENERATOR : 692 PY-LOC

HOW IT WORKS ?

JINJA2 TEMPLATE

JINJA2 TEMPLATE

C EXTENSION

```
├── converters.c -> 423
├── custom_functions.c -> 103
├── custom_structs.c -> 59
├── extension_functions.c -> 32
├── functions.c -> 8
├── header.c -> 11
├── init.c -> 68
├── init_unions
│   ├── vkclearcolorvalue.c -> 69
│   └── vkclearvalue.c -> 36
├── macros.c -> 111
├── main.c -> 122
├── objects.c -> 99
└── jfilter.py -> 542
Total: 1683
```

JINJA2 TEMPLATE

CFFI EXTENSION

```
vulkan.template.py -> 340
```

ONLY ONE SMALL FILE

SHOW ME THE CODE !

CONSTANTS

C EXTENSION

```
PyModule_AddIntConstant(module, {{name}}, {{value}});
```

CFFI EXTENSION

```
{{name}} = {{value}}
```

OBJECTS

OBJECTS

C EXTENSION

NEW (MALLOC)

DEL (FREE)

INIT

GET (FOR EACH MEMBER)

OBJECTS

CFFI EXTENSION

```
def _new(ctype, **kwargs):
    _type = ffi.typeof(ctype)

    ptrs = {}
    for k, v in kwargs.items():
        # convert tuple pair to dict
        ktype = dict(_type.fields)[k].type
        if ktype.kind == 'pointer':
            ptrs[k] = _cast_ptr(v, ktype)

    init = dict(kwargs,  **{k: v for k, (v, _) in ptrs.items()})
    return ffi.new(_type.cname + '*', init)[0]
```


FAST API MODE

SHADERC WRAPPER

FOLDER DESIGN

```
├── _cffi_build
│   ├── pyshaderc_build.py
│   └── shaderc.h
├── pyshaderc
│   └── __init__.py
└── setup.py
```

DEFINITION

```
ffi = FFI()
with open('shaderc.h') as f:
    ffi.cdef(f.read())
```

BUILDING

```
ffi = FFI()
with open('shaderc.h') as f:
    source = f.read()

ffi.set_source('_pyshaderc', source, libraries=['shaderc_combined'])

if __name__ == '__main__':
    ffi.compile()
```

USE

USE

```
from pyshaderc._pyshaderc import ffi, lib
```

USE

```
def compile_into_spirv(raw, stage, suppress_warnings=False):
    # initialize compiler
    compiler = lib.shaderc_compiler_initialize()

    # compile
    result = lib.shaderc_compile_into_spv(compiler, raw, len(raw), stage, b"main")
```

USE

```
length = lib.shaderc_result_get_length(result)
output_pointer = lib.shaderc_result_get_bytes(result)

tmp = bytearray(length)
ffi.memmove(tmp, output_pointer, length)
spirv = bytes(tmp)

return spirv
```

SETUPTOOLS INTEGRATION

```
setup(
    ...
    cffi_modules=["_cffi_build/pyshaderc_build.py:ffi"]
)
```

DEMO TIME !

GIVE A TRY TO CFFI !

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