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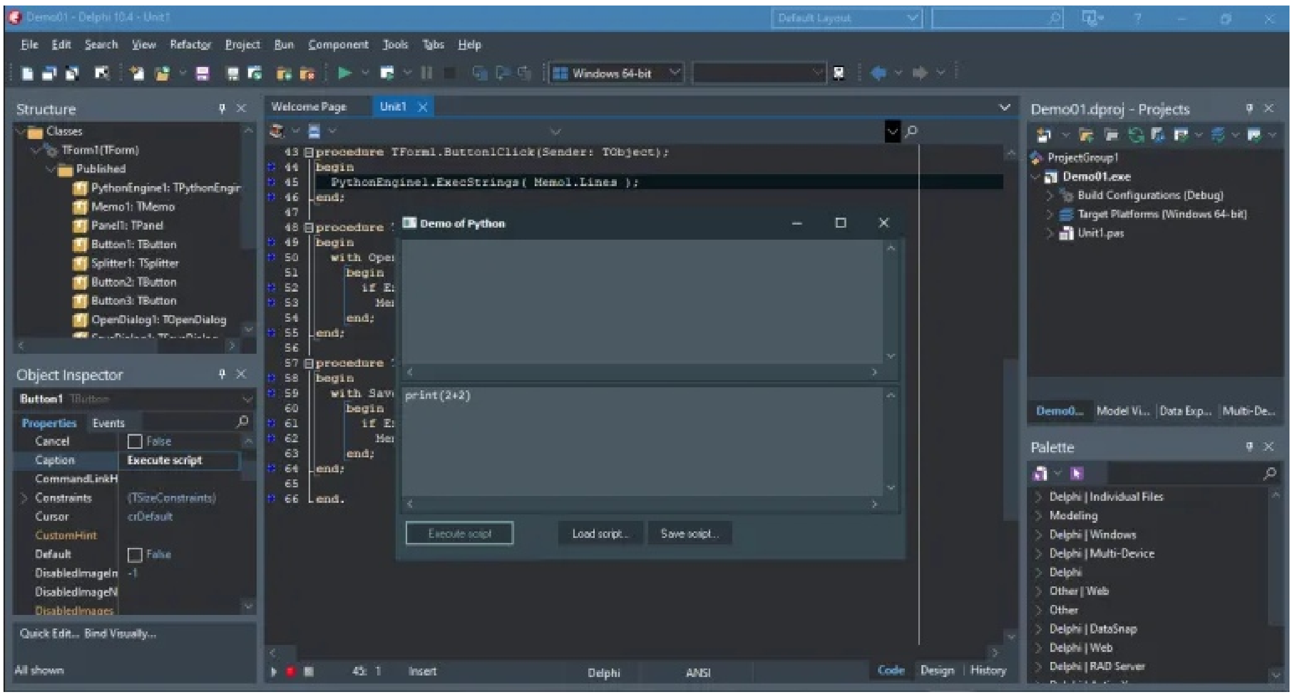
Python4Delphi II

maXbox Starter86_2 – Code with Python4Delphi

Be yourself; Everyone else is already taken. — Oscar Wilde.

In the last Article we have seen that P4D is a set of free components that wrap up the Python DLL into Delphi and Lazarus (FPC). For the next section I want to show more practical implementations. Let's start with P4D in Delphi:

```
First create a new Form
Drop a TMemo (or a TRichEdit)
Drop a TPythonGUIInputOutput for displaying Python's results
Drop a TMemo for source code
Drop a TPythonEngine
Connect the attribute IO of the TPythonEngine to
                                    TPythonGUIInputOutput.
Connect the attribute Output of TPythonGUIInputOutput to
                                    TRichEdit.
Drop a TButton and call it "Execute script"
Double-click on the button and add:
     PythonEngine1.ExecStrings(Memo1.Lines);
That's almost all!
Compile and execute.
Write in the Memo1: print(2+3)
Click on the Execute button
You should see in the Output as Memo2 window: 5
```



```
procedure TForm1.Button1Click(Sender: TObject);
begin
  PythonEngine1.ExecStrings( Memo1.Lines );
end;
```

```
print(2+2)
```

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As we can see the memo-control manifests the Python-script as input in memo1 and output in memo2:

```
object Memo1: TMemo
 ...
  Font.Pitch = fpVariable
  Font.Style = []
  Lines.Strings = (
            'print(2+3)')
  ParentFont = False
  ScrollBars = ssBoth
  TabOrder = 1
end

object PythonGUIInputOutput1: TpythonGUIInputOutput

  UnicodeIO = True

  RawOutput = False

  Output = Memo2

  Left = 64

end
```

So in a more complicated script we do have a same memo-control but simply with more lines:

```
    Lines.Strings = (
      'import sys'
      'print ("Version:", sys.version)'
      'import spam'
      'print (spam.foo('#39'hello world'#39', 1))'
      'p = spam.CreatePoint( 10, 25 )'
      'print ("Point:", p)'
      'p.x = 58'
      'print (p.x, p)'
      'p.OffsetBy( 5, 5 )'
      'print (p)'
      'print ("Current value of var test is: ", test)'
      'test.Value = "New value set by Python"'
      'print (spam.getdouble())'
      'print (spam.getdouble2())')
    ParentFont = False
```

You do also have the evaluation of an expression. But the evaluation of an expression works only for arithmetic expressions and not for instructions ! The use of variables and functions is of course possible but constructs like for, def, catch, class, print, import... are not implemented, you use for this *ExecStrings()* and not *EvalStrings()*.

Using Delphi methods as Python functions

What would be if we use in a internal Python-script some Delphi-methods like in the above script methods of the import module spam? First we had to initialize the module **spam**, we just need to add our new methods:

```
procedure TForm1.PythonModule1Initialization(Sender: TObject);
begin
  with Sender as TPythonModule do
    begin
      AddDelphiMethod( 'foo',
                       spam_foo,
                       'foo' );
      AddDelphiMethod( 'CreatePoint',
                       spam_CreatePoint,
                       'function CreatePoint'+LF+
                       'Args: x, y'+LF+
                       'Result: a new Point object' );
      AddDelphiMethod( 'getdouble',
                       spam_getdouble,
                       'getdouble' );
      AddDelphiMethod( 'getdouble2',
                       spam_getdouble2,
                       'getdouble2' );
    end;
end;
```

Ans here's the example of functions defined for the module spam in this context the function *spam_foo* with forms caption return:

```
function TForm1.spam_foo(pself, args : PPyObject): PPyObject; cdecl;
begin
  with GetPythonEngine do
    begin
      ShowMessage( 'args of foo: '+PyObjectAsString(args) );
      ShowMessage( 'Form''s caption = ' + Caption );
      Result := ReturnNone;
    end;
end;
```

Handshaking with Python arrays or tuples layout does have some complications. Normal Python arrays (as for standard CPython) are normally called “Lists”. A numpy.array type (or a mutable list) in Python is a special type that is more memory and layout efficient than a normal Python list of normal Py floating point objects.
If you want to use Delphi and access Numpy.array or list, I really suppose that the straightest way to do it would be to implement a way to export some simple straight C functions that access the Numpy.array type.
Numpy.array wraps a standard block of memory that is accessed as a native C array type. This in turn, does NOT map cleanly to Delphi array types as created by a Delphi method to Python.

Let me go deeper in that point, converting a Delphi-array or list to for example a list goes in the end with a dll-function from the Python library ('PyList_SetItem'):

```
function TPythonEngine.ArrayToPyList(const items: array of const) : PPyObject;
var
  i : Integer;
begin
  Result := PyList_New( High(items)+1 );
  if not Assigned(Result) then
    raise EPythonError.Create('Could not create a new list object');
  for i := Low(items) to High(items) do
    PyList_SetItem( Result, i, VarRecAsPyObject( items[i] ) );
end;

PyList_SetItem:function (dp:PPyObject;idx:NativeInt;item:PPyObject):integer;
cdecl;

PyList_SetItem:= Import('PyList_SetItem');
```

The other way round, as I said we can't map cleanly Python lists to Delphi array types, we get the data sort of as the base type strings from *PyObjectAsString*:

```
procedure TPythonEngine.PyListToStrings(list: PPyObject; strings: TStrings );
var
  i : Integer;
begin
  if not PyList_Check(list) then
    raise EPythonError.Create('the python object is not a list');
  strings.Clear;
  for i:= 0 to PyList_Size( list )- 1 do
    strings.Add( PyObjectAsString( PyList_GetItem( list, i ) ) );
end;
```

I think the common base type in Delphi (to export) is the array and the common base type in Python (to import) is the list. So this we can see as a proof of concept code:

```
function PythonToDelphi(obj : PPyObject ) : TPyObject;
begin
  if IsDelphiObject( obj ) then
    Result := TPyObject(PAnsiChar(obj)+Sizeof(PyObject))
  else
    raise EPythonError.CreateFmt( 'Python object "%s" is not a Delphi class',
                                   [GetPythonEngine.PyObjectAsString(obj)] );
end;
```

This exporting of Delphi-methods to use in Python-scripts works also with the creation of a dll as Demo09 Making a Python module as a dll explains (I'll show that in the Tutor III).

The Demo for the AddDelphiMethod concept you find at:

https://github.com/maxkleiner/python4delphi/blob/master/Demos/Demo07/test.py
http://py4d.pbworks.com/w/page/9174535/Wrapping%20Delphi%20Objects

More or less some external files as normal Python-scripts is also on your way. For example we call the script **test.py** and we import explicit the module spam, previously generated in Delphi:

```
import sys
print "Win version:", sys.winver
import spam
print (spam.foo('hello world', 1))
p = spam.CreatePoint( 10, 25 )
print ("Point:", p)
p.x = 58
print (p.x, p)
p.OffsetBy( 5, 5 )
print (p)
print ("Current value of var test is: ", test)
test.Value = "New value set by Python"
print (spam.getdouble())
```

You do also have helper functions in the unit **PythonEngine.pas** as Global Subroutines to test the environment:

- GetPythonEngine (Returns the global TPythonEngine)
- PythonOK
- PythonToDelphi
- IsDelphiObject
- PyObjectDestructor
- FreeSubtypeInst
- PyType_HasFeature

```
function  GetPythonEngine : TPythonEngine;
function  PythonOK : Boolean;
function  PythonToDelphi( obj : PPyObject ) : TPyObject;
function  IsDelphiObject( obj : PPyObject ) : Boolean;
procedure PyObjectDestructor( pSelf : PPyObject); cdecl;
procedure FreeSubtypeInst(ob:PPyObject); cdecl;
procedure Register;
function  PyType_HasFeature(AType : PPyTypeObject; AFlag : Integer): Boolean;
function  SysVersionFromDLLName(const DLLFileName : string): string;
procedure PythonVersionFromDLLName(LibName: string; out MajorVersion,
                                                   MinorVersion: integer);
```

For example the *PythonOK*:

```
function  PythonOK : Boolean;
begin
  Result := Assigned( gPythonEngine ) and
            (gPythonEngine.Initialized or gPythonEngine.Finalizing);
end;
```

To run python code integrated in a maXbox, Free Pascal, GNU Pascal or whatever script you need to import just the 3 dll functions[1], above all *PyRun_SimpleStringFlags* or without flags:

```
Const PYDLLPATH = 'C:\maXbox\EKON25\decimals';
      PYDLLNAME = 'python37.dll';
      PSCRIPTNAME = 'initpy.py';
```

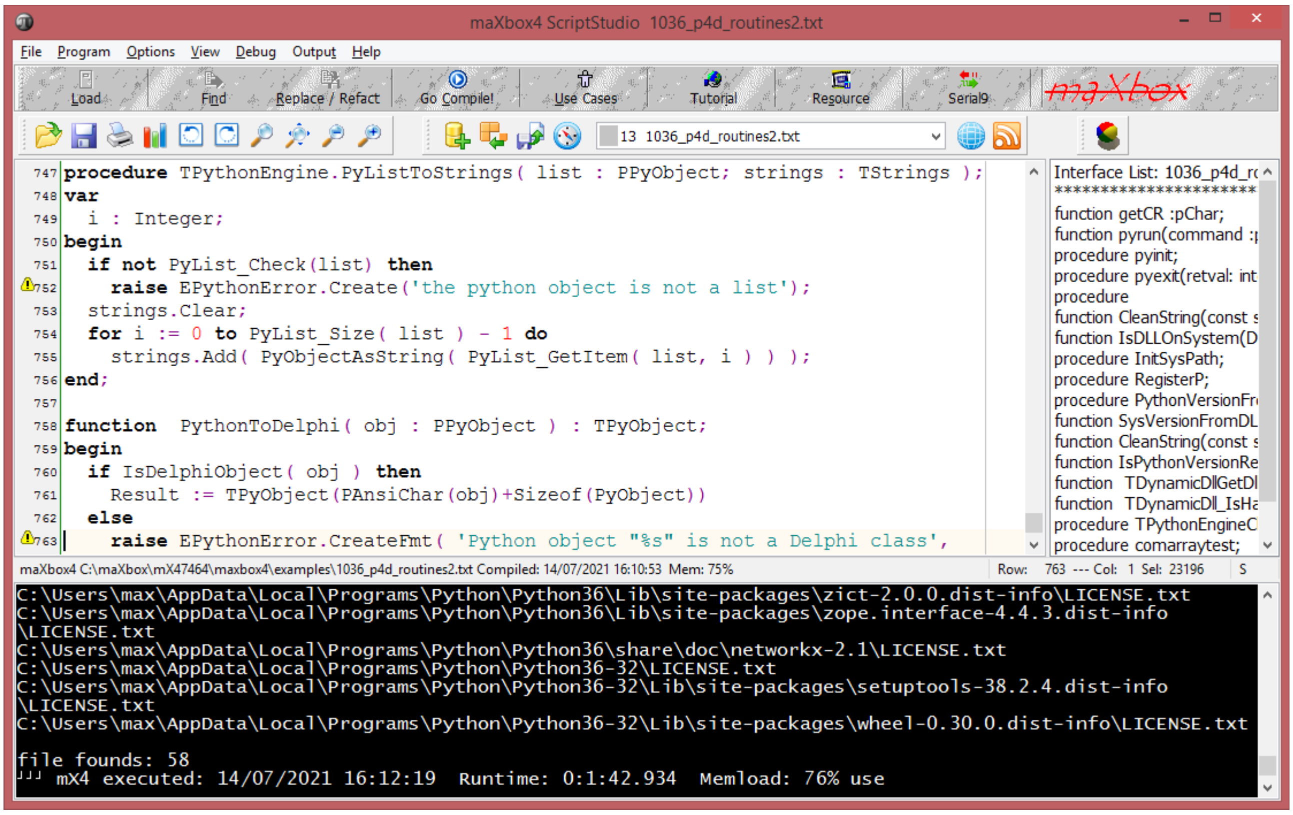
1 Independent from imports and site-packages

This is a simplified interface to PyRun_SimpleString leaving the PyCompilerFlags* argument set to NULL. Normally the Python interpreter is initialized by Py_Initialize() so we use the same interpreter as from a shell, command or terminal.

In P4D you do have the mentioned memo with ExeStrings:

```
procedure TForm1.Button1Click(Sender: Tobject);
begin
  PythonEngine1.ExecStrings( Memo1.Lines );
end;
```

This explains best the code behind, to evaluate, run or execute an internal Python expression.



maXbox4 ScriptStudio 1036_p4d_routines2.txt
File Program Options View Debug Output Help
Load Find Replace / Refact Go Compile! Use Cases Tutorial Resource Serial9
maXbox
13 1036_p4d_routines2.txt

```
procedure TPythonEngine.PyListToStrings( list : PPyObject; strings : TStrings );
var
  i : Integer;
begin
  if not PyList_Check(list) then
    raise EPythonError.Create('the python object is not a list');
  strings.Clear;
  for i := 0 to PyList_Size( list ) - 1 do
    strings.Add( PyObjectAsString( PyList_GetItem( list, i ) ) );
end;

function  PythonToDelphi( obj : PPyObject ) : TPyObject;
begin
  if IsDelphiObject( obj ) then
    Result := TPyObject(PAnsiChar(obj)+Sizeof(PyObject))
  else
    raise EPythonError.CreateFmt( 'Python object "%s" is not a Delphi class',
```

```
Interface List: 1036_p4d_r
**********************
function getCR :pChar;
function pyrun(command :
procedure pyinit;
procedure pyexit(retval: int
procedure
function CleanString(const s
function IsDLLOnSystem(D
procedure InitSysPath;
procedure RegisterP;
procedure PythonVersionFr
function SysVersionFromDL
function CleanString(const s
function IsPythonVersionRe
function  TDynamicDllGetDl
function  TDynamicDll_IsHa
procedure TPythonEngineC
procedure comarraytest;
```

```
maXbox4 C:\maXbox\mX47464\maxbox4\examples\1036_p4d_routines2.txt Compiled: 14/07/2021 16:10:53  Mem: 75%    Row:  763 --- Col:  1  Sel:  23196    S
```

```
C:\Users\max\AppData\Local\Programs\Python\Python36\Lib\site-packages\zict-2.0.0.dist-info\LICENSE.txt
C:\Users\max\AppData\Local\Programs\Python\Python36\Lib\site-packages\zope.interface-4.4.3.dist-info
\LICENSE.txt
C:\Users\max\AppData\Local\Programs\Python\Python36\share\doc\networkx-2.1\LICENSE.txt
C:\Users\max\AppData\Local\Programs\Python\Python36-32\LICENSE.txt
C:\Users\max\AppData\Local\Programs\Python\Python36-32\Lib\site-packages\setuptools-38.2.4.dist-info
\LICENSE.txt
C:\Users\max\AppData\Local\Programs\Python\Python36-32\Lib\site-packages\wheel-0.30.0.dist-info\LICENSE.txt

file founds: 58
⅃⅃⅃ mX4 executed: 14/07/2021 16:12:19  Runtime: 0:1:42.934  Memload: 76% use
```

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The unit *PythonEngine.pas* is the main core-unit of the framework. Most of the Python/C API is presented as published/public member functions of the engine unit.

```
  ...
  Py_BuildValue            := Import('Py_BuildValue');
  Py_Initialize            := Import('Py_Initialize');
  PyRun_String             := Import('PyRun_String');
  PyRun_SimpleString       := Import('PyRun_SimpleString');
  PyDict_GetItemString     := Import('PyDict_GetItemString');
  PySys_SetArgv            := Import('PySys_SetArgv');
  Py_Exit                  := Import('Py_Exit');
  ...
```

Wiki & EKON P4D topics

- https://entwickler-konferenz.de/delphi-innovations-fundamentals/python4delphi/
- http://www.softwareschule.ch/examples/weatherbox.txt

Learn about Python for Delphi

- Tutorials
- Demos https://github.com/maxkleiner/python4delphi

Note: You will need to adjust the demos from github accordingly, to successfully load the Python distribution that you have installed on your computer.

Docs: https://maxbox4.wordpress.com/blog/

http://www.softwareschule.ch/download/maxbox_starter86.pdf

http://www.softwareschule.ch/download/maxbox_starter86_1.pdf

http://www.softwareschule.ch/download/maxbox_starter86_2.pdf