PYTHON

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What is PYTHON ?

. Modern programming language

. Author Guido van Rossum, university of Amsterodam

. Comes from C, C++ and Modula-3

. Is platform independent (UNIX, Windows, MacOS X, OS/2, etc.)

. Is very productive -> fast application prototyping

. Well integrated with other languages C, C++ (CPython), .NET (Iron Python)
a JAVA (Jython) !!!

. Lots of available modules

. Multi paradigm: simple procedural programming, object-orientation and functional programming.

. Easy to learn :-)

Structure of source code

```c
int c;
float a,b;
a=2.584;
c=1;
while (c<100) {
        ++c;
        b=a*c;
}
```

C

Pascal

```pascal
var c: integer;
        a,b: real;
a:=2.584;
c:=1;
while (c<100) do begin
        c:=c+1;
        b:=a*c;
end
```

PYTHON

```python
a=2.584
c=1
while c<100:
    c+=1
    b=a*c
```

Python sources

- **Homepage http://ww.python.org**
- **Official documentation http://docs.python.org**

- **Currently there are two branches**
  Python, version 2 and 3.

Python shell = IDLE

Delete, C-d	**delete right character from cursor**
Backspace	**delete left character from cursor**
C-w	**cut**
C-y	**paste**
M-w	**copy**
M-p	**last command from history**
M-n	**next command from history**
C-z	**undo**
M-z	**redo**
M-/	**expansion**

Comments

```
# My first program
a=2.584                 # a is input variable
c=1
while c<100:
        c+=1
        b=a*c
```

Data Types – Built-In Types

- **integer – a=10, b=0xa, c=012**
- **long integer – a=88888L, b=-777777L**
- **float – a=1.0, b=-1.5e3**
- **complex number – a=1+2j, b=1.5-2.58j**

(moduls ***decimal*** and ***fractions***)

- **boolean – True, False**

- **string – a="Hi", b='Bye', c="""Hello"""**
- **tuple – a=("one","two",3,4)**
- **list – a=["one","two",3,4]**
- **set – a={"one","two",3,4}**
- **dictionary – a={"one":1, "two":2}**

Mutable and immutable data types

Imutable types : **integer, long integer, float, complex number, string, tuple.**

Mutable types : **list, set, dictionary.**

Operations on Numbers

+	...	add
-	...	minus
*	...	multiplication
**	...	exp
/	...	division
%	...	modulo, operator for string format

Python accepts shortcuts: +=, -=, *=, ...

Comparators

== ... value equality
!= ... unequal
< ... less then
> ... greater then
<= ... less then equal
>= ... greater then equal
in ... in sequence ***(not in)***
is ... Object equality***(is not)***

Boolean operations

and ... Logical and
or ... Logical or
not ... Negotiation

Binary operators

& ... AND
| ... OR
^ ... XOR
~ ... NOT

Numbers

```
1, -10, 458                    # integers
0xff12, -0x14                  # integers (hexadecimal)
0717, -01                      # integers (octal)
1.0, -5.5e3                    # floating-point
9999999L                       # long integers
1j, 5+4j, 2+5.4j               # complex
```

Math functions *abs, min, max, round, . . .*
More of them are in module *math.*
Math functions for complex numbers in module *cmath.*

Strings

r = ‘String with new line at the end\n'

r = " String with new line at the end \n"

r = '''Three single quotes'''

r = """Three double-quotes"""

r = r“raw string no escape treated\n"

r = u"unicode string\n"

Work with strings through tuples. Basic functions *chr*, *ord*, *len*.
More in module *string*

Strings – escape sequences

\n ... New line
\t ... Tab
\\ ... Backslash
\' ... Single quote
\" ... Double quote

\nnn ... Octal ASCII char
\xnn ... Hex ASCII char

Strings – UNICODE

r = u"Řetězec UNICODE. Umožňuje používat unicode escape sekvence."

unicode ('ščšč','iso8859-2')
unicode ('ščšč','iso8859-1')
unicode ('ščšč','ascii')

'ČŠČČŘ'.decode('iso8859-2') **…** method ***decode*** makes same as function ***unicode***

'příšera'.encode('utf-8')
'příšera'.encode('base64')

Strings – conversion

str (object) - string

int (string) – number of type ***integer***
long (string) – number of type ***long integer***
float (string) – number of type ***float***
complex (string) – number of type ***complex***

Strings– format

formatString % object
formatString % (object1, object2, ...)
formatString % dictionary

```
a=10
print “Variable has value %d" % a
```

String format operators :

s ... String presentation of object
d ... integer
f ... float

Strings – more operations

Methods of object *string* :

find (s,substring)
join (seznam)
lower(s)
upper(s)
replace(s,substring,replace)
split(s,separator)
strip(s)
lstrip(s)
rstrip(s)

.....

Lists (arrays)

x=[] ... Constructs empty list
x=[1,2+3j,“next",4] ... Creates and fills list
[1,2] + [“three",“four"] ... **[1,2,“three",“four"]**
2 * [1,2] ... **[1,2,1,2]**

list ('gopas') ... **['g','o','p','a','s']** ... List from sequence
list ([1,85,96]) ... **[1,85,96]** ... List from sequence

len (['g','o','p','a','s']) = 5 ... Number of items

List – access to items, slicing …

x=[1 , 2 , 3 , 4 , 5 , 6]

x[2] ... **3**
x[-3] ... **4**
x[1:4] ... **[2,3,4]**
x[:-2] ... **[1,2,3,4]**
x[3:] ... **[4,5,6]**

x[:] ... **[1,2,3,4,5,6]** *(copy)*

Lists - modifications

x=[1,2,3,4,5,6]
y=[“two","three",“four"]

x[1]=“two" ... [1,“two",3,4,5,6]
x[1] = y ... [1, [“two", “three", “four"], 3, 4, 5, 6]
x[1:3] = y ... [1,“two","three",“four",4,5,6]
x.append(7) ... [1,2,3,4,5,6,7]
x.insert(0,“zero") ... [“zero",1,2,3,4,5,6]
x.remove(5) ... [1,2,3,4,6]
del x[1] ... [1,3,4,5,6]
del x[2:4] ... [1,2,5,6]

Lists – more operations

x=[2,4,1,5,6,3,3]

x.sort() ... [1,2,3,3,4,5,6]

3 in x ... True
2 not in x ... False

min(x) ... 1
max(x) ... 6

x.index(1) ... 2 (index of item in list)
x.count(3) ... 2 (number of item in list)

Tuples

x=() ... Empty tuple
x=(1,) ... One item tuple
x=(1,2+3j,"dalsi",4) … Creates tuple
(1,2) + ("three",“four") ... (1,2,“three",“four")
2 * (1,2) ... (1,2,1,2)

tuple ('gopas') ... ('g','o','p','a','s') tuple from sequence
tuple ([1,85,96]) ... (1,85,96) ... Tuple from list

len (('g','o','p','a','s')) ... 5 ... Number of items

Tuples - access

x=(1,2,3,4,5,6)

x[2] ... 3
x[-3] ... 4
x[1:4] ... (2,3,4)
x[:-2] ... (1,2,3,4)
x[3:] ... (4,5,6)

Sets

x=set() ... Empty set
x={1,2,3} ... Creates and fills set

len(x) ... Number of items in set
x.add(4) ... Adds next item to set
x.remove(4) ... Removes item from set (if not present, creates exception)
x.discard(4) ... Removes item from set
x.clear() ... Clears set
x.copy() ... *shallow copy*

Dictionary

Associative array, hash array

x={} ... Creates empty dictionary
x={"cerveny":"red","zeleny":"green"} ... Creates dictionary
x["bily"]="white" ... Adds key to dictionary

len(x) ... **3** ... Number of keys
x.keys() ... **["cerveny","zeleny","bily"]** ... List of keys
x.values() ... **["red", "white", "green"]** ... List of values
x.items() ... **[('cerveny', 'red'), ('bily', 'white'), ('zeleny', 'green')]**
x.clear() ... Clears dictionary
x.copy() ... *(shallow copy)*

Reference and copy I.

```
a=[[0,1],2,3,4]

b=a
b[0][1]=“one"
print (a,b)
```

Reference and copy II.

```
a=[[0,1],2,3,4]
```

Shallow copy (container objects, creates references for source objects) :

```
b=a[:]
b.append(5)
print a,b
b[0][1]= "one"
print (a,b)
```

Deep copy (creates object and recursively copies and creates new objects) :

```
import copy
b=copy.deepcopy(a)
b.append(5)
print a,b
b[0][1]= "one"
print (a,b)
```

Conditionals: if-else Statements

```
if (condition):
    block of statements 1
else:
    block of statements 2
```

More if-elif-else

```
if (condition1):
        block of statements 1
elif (condition2):
        block of statements 2
elif (condition3):
        block of statements 3
......
else:
        block of statements
```

While loop

```
while (condition):
        block of statements 1
else:
        block of statements 2
```

For loop

for *variable* in *sequence*:
    block of statements 1
else:
    block of statements 2

Commands : **range**, **break** a **continue**

Functions and procedures

```
def name (parameter1, parameter2, ...)
    """Documentation string"""
    body
    return value
```

Functions and procedures

```
def greeting ( ):
        """Prints greeting"""
        print ("Hello")

greeting ( )
```

```
def add (a,b):
        """Sum of two numbers"""
        c=a+b
        return c

x=add (3,2)
print (x)
```

Lambda Expressions

```
toUpper = lambda r : r.upper()

print (toUpper(‘hello, how are you ?'))
```

Functions and procedures – default parameters

```
def exp (z,e=2):
        """Counts exponent"""
        x=z
        while e>1:
                x=x*z
                e=e-1
        return x

print (exp(2,3))
print (exp(2))
```

Functions and procedures – named parameter passing

```
def exp (z,e=2):
        """Counts exponent"""
        x=z
        while e>1:
                x=x*z
                e=e-1
        return x

print exp (2,3)
print exp (e=3,z=2)
```

Functions and procedures – variable list of parameters

```
def maximum (*cisla):
        """Counts max"""
        m=cisla[0]
        for n in cisla[1:]:
                if n>m:
                        m=n
        return m

print (maximum(1,5,4,2))
print (maximum(1,5,4,2,23,23))
```

Functions and procedures – variable list of parameters

```
def example (**params):
        print (params)

example (a=1,b=2,c=3)
```

Functions and procedures – mutable objects as arguments

```
def example (n, list1, list2):
        """“Mutable objects"""
        list1.append(‘Black')
        list2=[3,2,1]
        n+=1

a=1
b=[‘Joe']
c=[1,2,3]
example(a,b,c)
print(a,b,c)
```

Functions and procedures – namespaces, scope of vars

```
def example ():
        """Namespace"""
        a=1
        b=2



a=10
b=20
example()
print(a,b)
```

Functions and procedures – namespaces, scope of vars

```
def example ():
        """Local/global variables"""
        print(a)
        b=2


a=10
b=20
example()
print(a,b)
```

Global vars are automatically read-only!!!

Functions and procedures – sequences

```
def add (a,b):
        return (a+b)

first=[1,2,3]
second=[4,5,6]

print (map(add,first,second))
```

map: return a list containing the result of some function applied to each object in a collecti

Functions and procedures – work with sequences

```
def even (a):
        return not (a%2)

numbers=range(20)

print (filter(even,numbers))
```

filter: retain only elements for which the function returns True.

Modules I.

modul.py

```
"""Test module"""
a=10
def sum (x,y):
        """Sum of numbers"""
        s=x+y
        return s
```

```
import modul

print (modul.a)
result=modul.sum(2,3)
print (result)
```

Modules I.

modul.py

```
"""Test module"""
a=10
def sum (x,y):
        """Sum of numbers"""
        s=x+y
        return s
```

```
import modul as m

print (m.a)
result=m.sum(2,3)
print (result)
```

Modules II.

modul.py

```
"""Test module"""
a=10
def sum (x,y):
        """Sum of numbers"""
        s=x+y
        return s
```

```
from modul import *

print (a)
result=sum (2,3)
print (result)
```

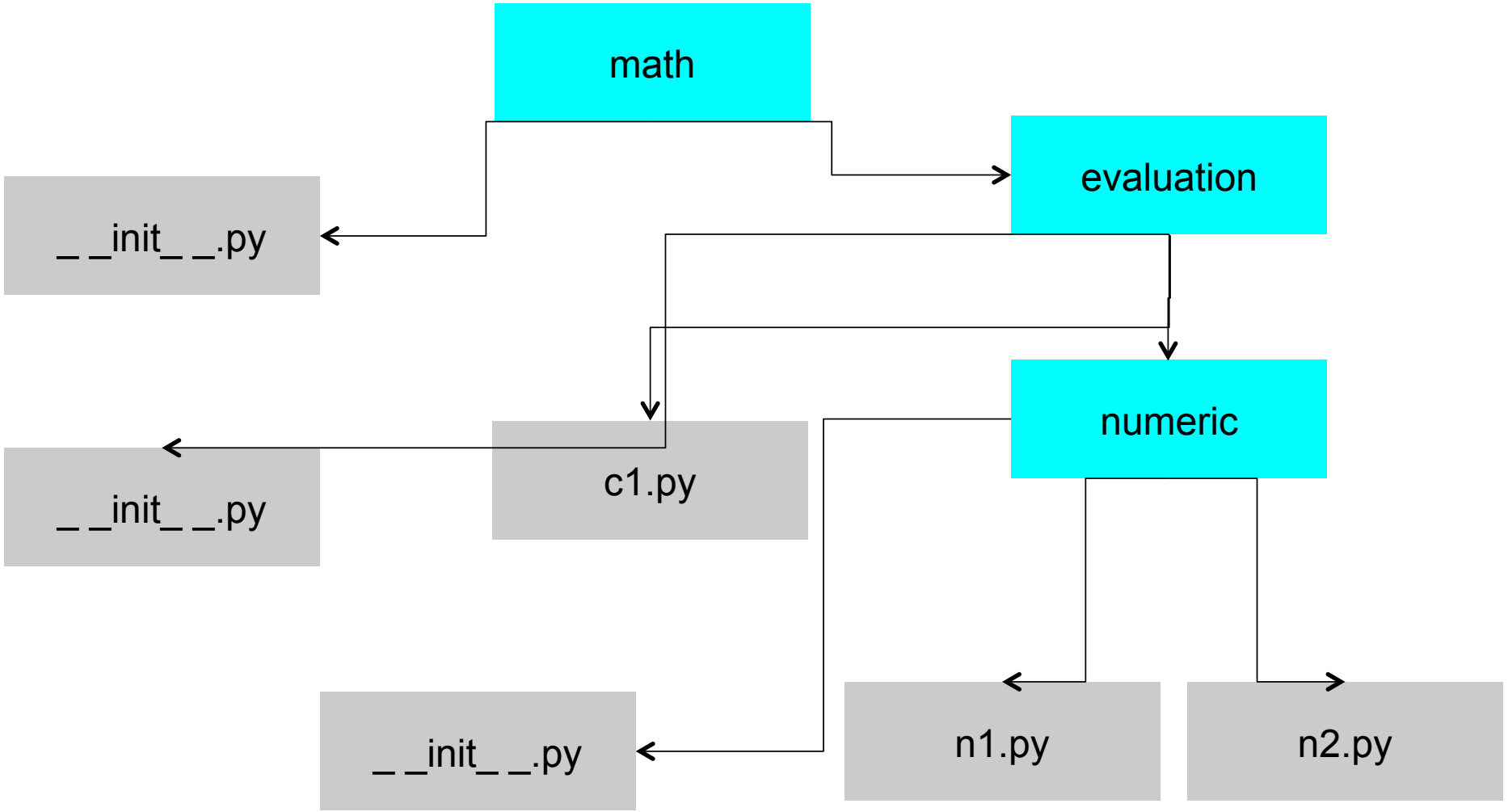
Modules III. (protected names)

modul.py

```
"""Test module"""
a=10
_b=20
def sum (x,y):
        """Sum of numbers"""
        s=x+y
        return s
```

```
from modul import *

print (a)
print (_b)
result=sum (2,3)
print (result)
```

Packages


math
evaluation
_ _init_ _.py
numeric
c1.py
_ _init_ _.py
_ _init_ _.py
n1.py
n2.py

Errors and exceptions I.

1) We ignore errors

2) Watch results of all I/Ooperations
(just like in Pascal, C, ...)

3) Exceptions handling
(like in JAVA, PYTHON, RUBY, ...)

Errors and exceptions II.

function getFromServer

try *execute following code*
openNetworkConnection....
sendHTTPrequest....
closeNetworkConnection....

except *if any error occurred, trap exception*

Errors and exceptions III.

```
try:
        print (1/0)

except ZeroDivisionError:
        print ("Division by zero !!!")
```

Errors and exceptions IV.

```
try:
   file = open(“data.txt","r")
except IOError, ex:
    if (ex.errno==2): # file not exists
       print ("File doesn’t exists")
    else:
       print ("File exists: %d : %s" % (ex.errno,
                    ex.strerror))
```

Errors and exceptions V.

```
def division (a,b):
        if b==0:
                raise ZeroDivisionError, " Division by zero"
                return 0
        v=a/b
        return v

try:
        v=division(4,0)
        print (v)
except ZeroDivisionError,text:
        print (text)
```

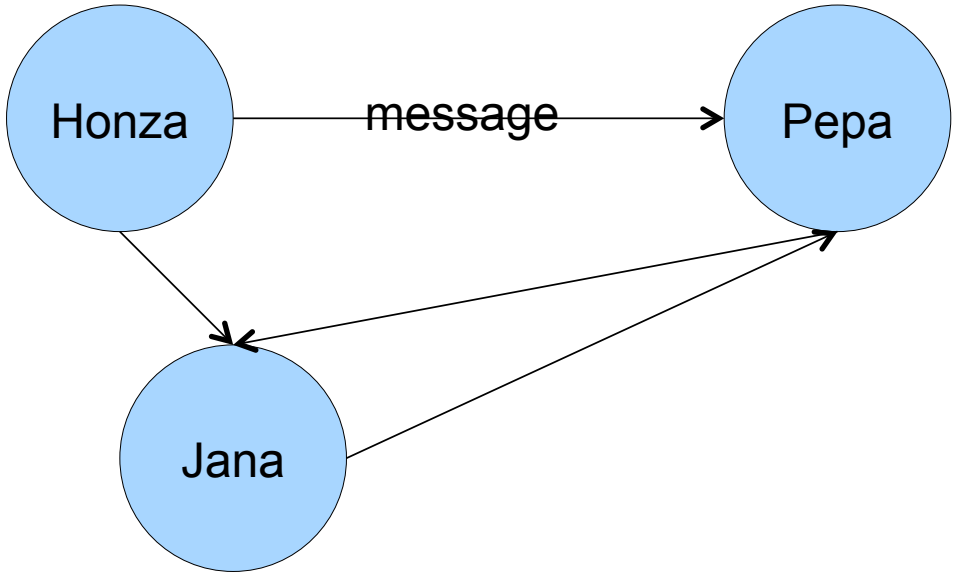
Errors and exceptions VI.

```
Exception
   +-- SystemExit
   +-- StopIteration
   +-- StandardError
   |    +-- KeyboardInterrupt
   |    +-- ImportError
   |    +-- EnvironmentError
   |    |    +-- IOError
   |    |    +-- OSError
   |    |         +-- WindowsError
   |    +-- EOFError
   |    +-- RuntimeError
   |    |    +-- NotImplementedError
   |    +-- NameError
   |    |    +-- UnboundLocalError
   |    +-- AttributeError
   |    +-- SyntaxError
   |    |    +-- IndentationError
   |    |         +-- TabError
   |    +-- TypeError
   |    +-- AssertionError
   |    +-- LookupError
   |    |    +-- IndexError
   |    |    +-- KeyError
   |    +-- ArithmeticError
   |    |    +-- OverflowError
   |    |    +-- ZeroDivisionError
   |    |    +-- FloatingPointError
   |    +-- ValueError
   |    |    +-- UnicodeError
   |    |         +-- UnicodeEncodeError
   |    |         +-- UnicodeDecodeError
   |    |         +-- UnicodeTranslateError
   |    +-- ReferenceError
   |    +-- SystemError
   |    +-- MemoryError
   +---Warning
             +-- UserWarning
             +-- DeprecationWarning
             +-- PendingDeprecationWarning
             +-- SyntaxWarning
             +-- RuntimeWarning
             +-- FutureWarning
```

Object oriented programming (OOP)

Goal of OPP is make programming closer to real world problem.

OO program is network of connected and communicating objects.



Object oriented programming (OOP)

Classes:

User defined types of objects (including their methods, attributes, relations to other objects).
Can be instantiated into an object / is a ‘blueprint’ that describes how to build an object.

Python does not enforce OOP (unlike Java), but we need to understand at least what is going on.

Class definitions contain methods (which are functions defined in the class’ scope), class attributes, and a docstring.

Object oriented programming (OOP)

Basic terms:

- **Class**
- **Instance**
- **Instance variable, method**
- **Atribut**
- **Inheritance**
- **Encapsulation**
- **Polymophism**

Object oriented programming (OOP)

```
class Trida:
        '''Doc string'''
        body

instance=Trida()
```

Object oriented programming (OOP)

```
class Person:
    pass

pepa=Person()
pepa.name="Josef"
pepa.prijmeni="Novak"

lojza=Person()
lojza.name="Alois"
lojza.prijmeni="Novy"
```

Object oriented programming (OOP)

(instance variables, methods)

```
class Person:
    def printall(self):
        print ("Name : %s, age : %d" % (self.name,self.age))

pepa=Person()
pepa.name="Josef"
pepa.age=20
pepa.printall()
```

Object oriented programming (OOP)

(magic methods)

Python obsahuje velkou množinu speciálních metod, které jsou automaticky provedeny, pokud s objektem provádíme nějakou konkrétní činnost :

- **creation/destroy of objects**
- **aritmetic operations**
- **logic operations (comparisions)**
- **work with sequences**
- **work with attributes**
- **....**

Note.: www.rafekettler.com/magicmethods.html

Object oriented programming (OOP)

(magic methods)

```
class Person:
    def __init__(self,name='',age=0):
        self.name=name
        self.age=age
    def printall(self):
        print ("Name : %s, age : %d" % (self.name,self.age))

pepa=Person("Josef",20)
pepa.printall()
```

Object oriented programming (OOP)

(magic methods)

```
class Person:
    def __init__(self,name='',age=0):
        self.name=name
        self.age=age
    def __str__(self):
        return(self.name)
    def printall(self):
        print ("Name : %s, age : %d" % (self.name,self.age))

pepa=Person("Josef",20)
pepa.printall()
print(str(pepa))
```

Object oriented programming (OOP)

(magic methods)

```
class Person:
    def __init__(self,name,age):
        self.name=name
        self.age=age
    def __str__(self):
        return(self.name)
    def __gt__(self,other):
        if (self.age>other.age):
            return True
        return False
    def printall(self):
        print ("Name : %s, age : %d" % (self.name,self.age))

pepa=Person("Josef",20)
lojza=Person("Alois",19)
print(pepa>lojza)
```

Object oriented programming (OOP)

(magic methods)

```
class Person:
    def __init__(self,name,age):
        self.name=name
        self.age=age
    def __str__(self):
        return(self.name)
    def __gt__(self,other):
        if (self.age>other.age):
            return True
        return False
    def __add__(self,other):
        return self.age+other.age
    def printall(self):
        print (“Name : %s, age : %d" % (self.name,self.age))

pepa=Person("Josef",20)
lojza=Person("Alois",19)
print(pepa+lojza)
```

Object oriented programming (OOP)

(class variables)

```
class Person:
    Person_id=1

    def __init__(self,name,age):
        self.name=name
        self.age=age
        self.cid=Person.Person_id
        Person.Person_id+=1

    def printall(self):
        print ("Name : %s, age : %d, id : %d" % (self.name,self.age,self.cid))

pepa=Person("Josef",20)
lojza=Person("Alois",19)

pepa.printall()
lojza.printall()
```

self.__class__.Person_id

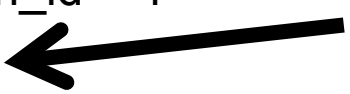
Object oriented programming (OOP)

(class methods)

```
class Person:
    Person_id=1

    def __init__(self,name,age):
        self.name=name
        self.age=age
        self.cid=Person.Person_id
        Person.Person_id+=1

    def resetPerson(cls):
        cls.Person_id=1

    resetPerson=classmethod(resetPerson)

    def printall(self):
        print ("Name : %s, age : %d, id : %d" % (self.name,self.age,self.cid))

pepa=Person("Josef",20)
pepa.resetPerson()
lojza=Person("Alois",19)

pepa.printall()
lojza.printall()
```

Object oriented programming (OOP)
(class methods)

```
class Person:
    Person_id=1

    def __init__(self,name,age):
        self.name=name
        self.age=age
        self.cid=Person.Person_id
        Person.Person_id+=1

    @classmethod
    def resetPerson(cls):
        cls.Person_id=1

    def printall(self):
        print ("Name : %s, age : %d, id : %d" % (self.name,self.age,self.cid))

pepa=Person("Josef",20)
pepa.resetPerson()
lojza=Person("Alois",19)

pepa.printall()
lojza.printall()
```



Decorator

Object oriented programming (OOP)

(inheritance)

```
class Person:
    def __init__(self,name,age):
        self.name=name
        self.age=age
    def printall(self):
        print ("Name : %s, age : %d" % (self.name,self.age))

class Student(Person):
    def __init__(self,name,age,school):
        Person.__init__(self,name,age)
        self.school=school
    def printall(self):
        Person.printall(self)
        print("School : %s" % self.school)


pepa=Student("Josef",20,“basic")
pepa.printall()
```

Object oriented programming (OOP)

(private names)

```
class trida:
        def __init__(self):
                self.x=1
                self.__y=2
        def printall(self):
                print self.x
                print self.__y

t=trida()
t.printall()
print t.x
print t.__y
```

I/O operations I.

myfile=open ("/tmp/myfile.txt","r") ... Open file for read
myfile.close() ... Close file

File open modes:

r ... read
w ... write
a ... append

I/O operations II.

Read from file

```
myfile=open ("/etc/passwd","r")
count=0
while myfile.readline() != "":
        count+=1
myfile.close()

print “In system are %d users" % count


import string
myfile=open ("/etc/passwd","r")
rows=myfile.readlines()
for a in rows:
        print string.rstrip(a)
myfile.close()
```

I/O operations III.

Write to file

```
myfile=open ("/tmp/myfile.txt","w")
myfile.write(“First row\n")
myfile.write(“Second row\n")
myfile.close()
```

```
myfile1=open ("/etc/passwd","r")
rows=myfile1.readlines()
myfile1.close()
myfile2=open ("/tmp/passwd.bak","w")
myfile2.writelines(rows)
myfile2.close()
```

I/O operations IV.

operating system

import os
print os.name ..... nt, posix, mac
print os.getcwd() ..... /home/pepa
print os.listdir('/tmp') ..... List of files from directory
os.chdir('/tmp') ..... Directory change

print os.path.join('home','honza') ..... home/honza

print os.path.exists('/tmp') ..... Finds if file exists

print os.path.isfile('/etc/passwd') ..... Finds if myfile ***regular file***
print os.path.isdir('/etc/passwd') ..... Finds if myfile ***directory***

User input

```
a = input(“Input number a : ")
b = input(“Input number b : ")
print “Sum %d + %d = %d" % (a,b,a+b)
```

Method: *raw_input*

Stdin, stdout, stderr

In module *sys exists three file objects :*

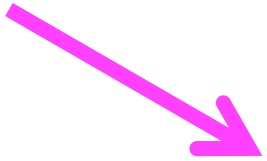
sys.stdin ... standard input
sys.stdout ... standard output
sys.stderr ... standard error output

Stdin implements methods ***readline***, ***readlines*** a ***xreadlines***
Outputs implement ***write*** a ***writelines***

Persistance of objects

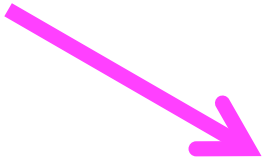
(with files)

Write to file



```
import pickle
a="This is my text"
b=[1,2,4,5,6]
myfile=open("/tmp/stav","w")
pickle.dump(a,myfile)
pickle.dump(b,myfile)
myfile.close()
```

Read from file



```
import pickle
myfile=open("/tmp/stav","r")
a=pickle.load(myfile)
b=pickle.load(myfile)
myfile.close()
print a
print b
```

Modul shelve

```
import shelve
adresar=shelve.open("/tmp/adresy")
adresar["policie"]=["Statni policie","158"]
adresar["hasici"]=["Hasicsky sbor","150"]
adresar.close()
```

```
import shelve
adresar=shelve.open("/tmp/adresy")
print adresar["policie"]
print adresar["hasici"]
adresar.close()
```

Scripts I.

```
#! /usr/bin/python

def main():
        print “This is our script !!!"

if __name__ == '__main__':
        main()
```

Scripts II.

Arguments from command line

```
#! /usr/bin/python

import sys
def main():
        print sys.argv

main()
```

Scripts III.

modul getopt

```
#! /usr/bin/python

import sys,getopt
def main():
        (options,agruments)=getopt.getopt(sys.argv[1:],"a:b:c")
        print (options)
        print (agruments)

main()


./pokus.py -a1 -b 2 -c arg1 arg2
```

Network communication

Python is supported with number of modules for socket oriented communications and communication protocol implementations:

- **socket**
- **httplib**
- **ftplib**
- **urllib**
- **smtplib**
- **nntplib**
- **poplib**
- **imaplib**
- **.....**

HTTP client/server communication

Server part

```
import BaseHTTPServer

class reply(BaseHTTPServer.BaseHTTPRequestHandler):
    def do_GET(self):
        self.send_response(200)
        self.send_header("Content-type","text/plain")
        self.send_header(“Joe",“Black")
        self.end_headers()
        self.wfile.write(“Reply from web server")
        h=self.headers
        print h.getheader("Data")

server = BaseHTTPServer.HTTPServer(('',8000),reply)
server.serve_forever()
```

HTTP client/server communication

Client part

```
import httplib

def request ():
    c=httplib.HTTP("localhost:8000")
    c.putrequest("GET","/index.html")
    c.putheader("Data",“This is input data")
    c.endheaders()
    errcode,errmsg,headers = c.getreply()
    telo=c.getfile()
    print headers[‘Joe']
    return (errcode)

request()
```

Remote procedure calls XML-RPC

XML-RPC request

```
import xmlrpclib
xmlrpclib.ServerProxy('http://sortserver/RPC').searchsort.sortList([10, 2], True)
```

```
<?xml version='1.0'?>
<methodCall>
 <methodName>searchsort.sortList</methodName>
 <params>
  <param>
   <value>
    <array>
     <data>
      <value><i4>10</i4></value>
      <value><i4>2</i4></value>
     </data>
    </array>
   </param>
  <param><value><boolean>1</boolean></value></param>
 </params>
</methodCall>
```

Remote procedure calls XML-RPC

XML-RPC reply

```
<?xml version='1.0'?>
<methodResponse>
 <params>
  <param>
   <value>
    <array>
     <data>
      <value><i4>2</i4></value>
      <value><i4>10</i4></value>
     </data>
    </array>
   </value>
  </param>
 </params>
</methodResponse>
```

Remote procedure calls XML-RPC

Client part

```
import xmlrpclib

server = xmlrpclib.ServerProxy("http://time.xmlrpc.com")

currentTimeObj = server.currentTime
currtime = currentTimeObj.getCurrentTime()

print currtime.value
```

Remote procedure calls XML-RPC

Server part

```
import calendar, SimpleXMLRPCServer

class Calendar:
    def getMonth(self, year, month):
        return calendar.month(year, month)

    def getYear(self, year):
        return calendar.calendar(year)

calendar_object = Calendar()
server = SimpleXMLRPCServer.SimpleXMLRPCServer(("", 8888))
server.register_instance(calendar_object)

server.serve_forever()
```

Remote procedure calls XML-RPC

Client part

```
import xmlrpclib

server = xmlrpclib.ServerProxy("http://localhost:8888")

month = server.getMonth(2007, 10)

print (month)
```

GUI

1) dialog, cdialog, xdialog

2) wxPython

3) Tkinter

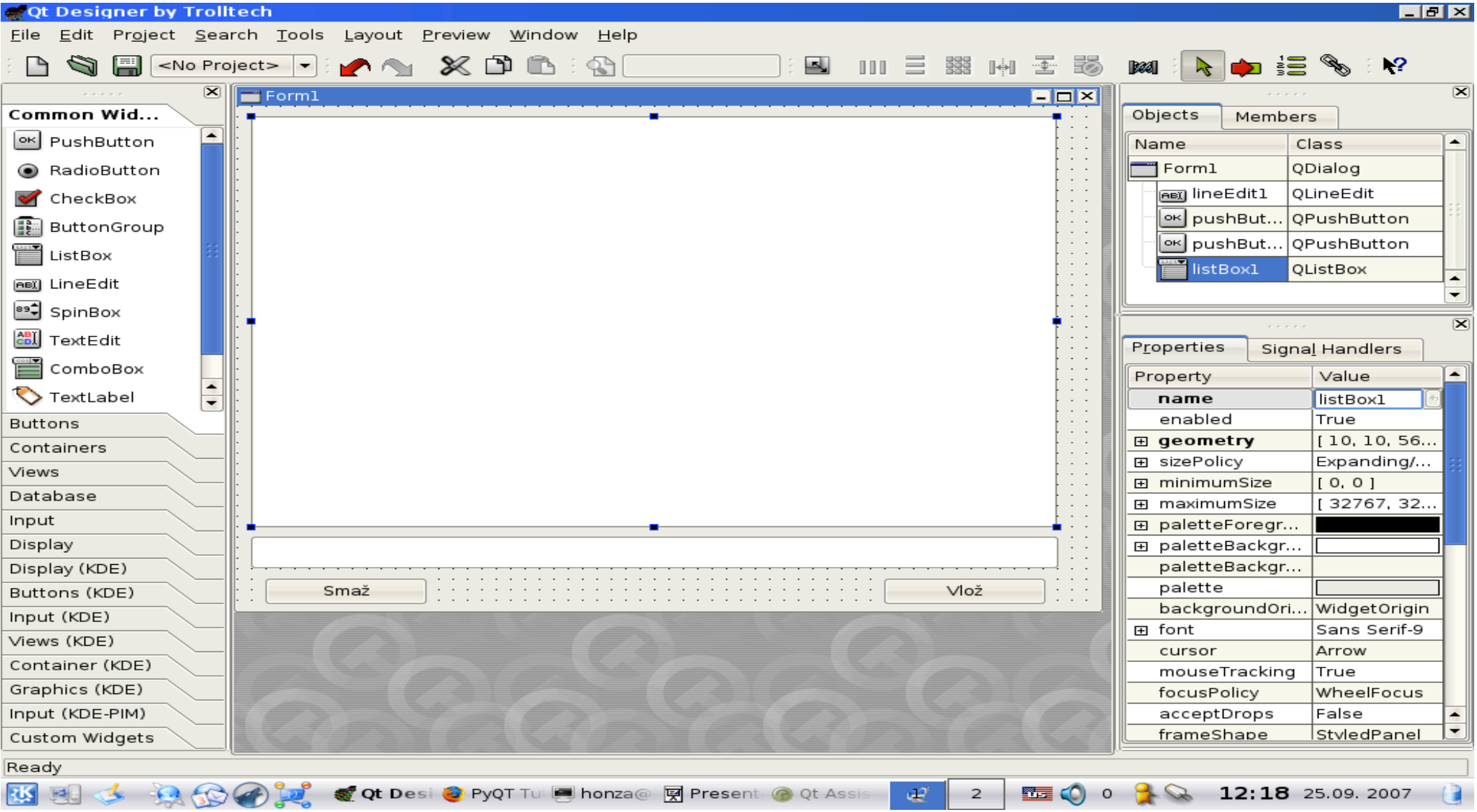
4) PyGTK

5) PyQT !!!!!

6) PyGame

GUI

Qt and PyQt – Qt Designer



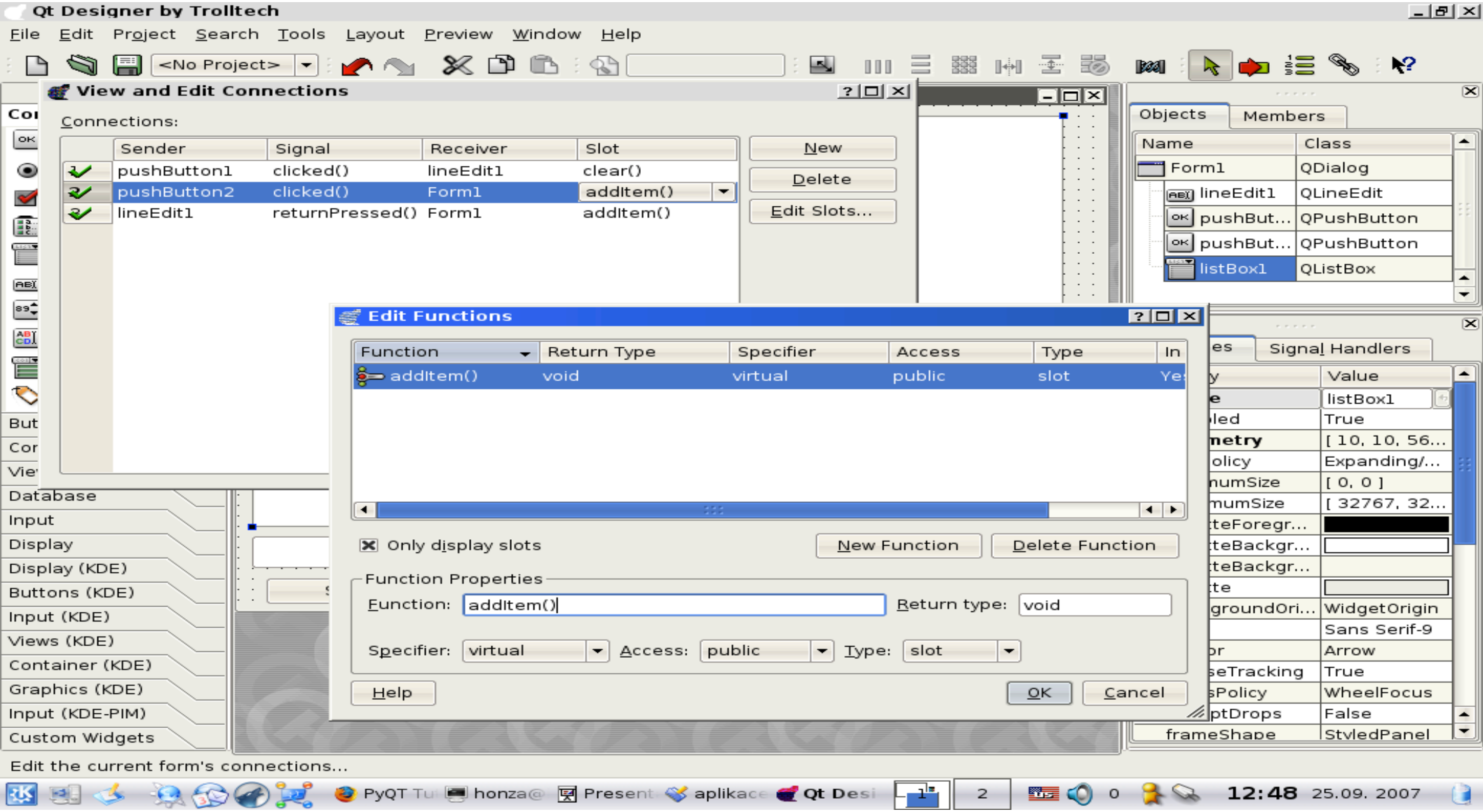
GUI
Qt and PyQt – Qt Designer

Qt Designer is the Qt tool for designing and building graphical user interfaces. It allows you to design widgets, dialogs or complete main windows using on-screen forms and a simple drag-and-drop interface. It has the ability to preview your designs to ensure they work as you intended, and to allow you to prototype them with your users, before you have to write any code.

Qt Designer can be extended by writing plugins. Normally this is done using C++ but PyQt4 also allows you to write plugins in Python. Most of the time a plugin is used to expose a custom widget to Designer so that it appears in Designer's widget box just like any other widget. It is possibe to change the widget's properties and to connect its signals and slots.

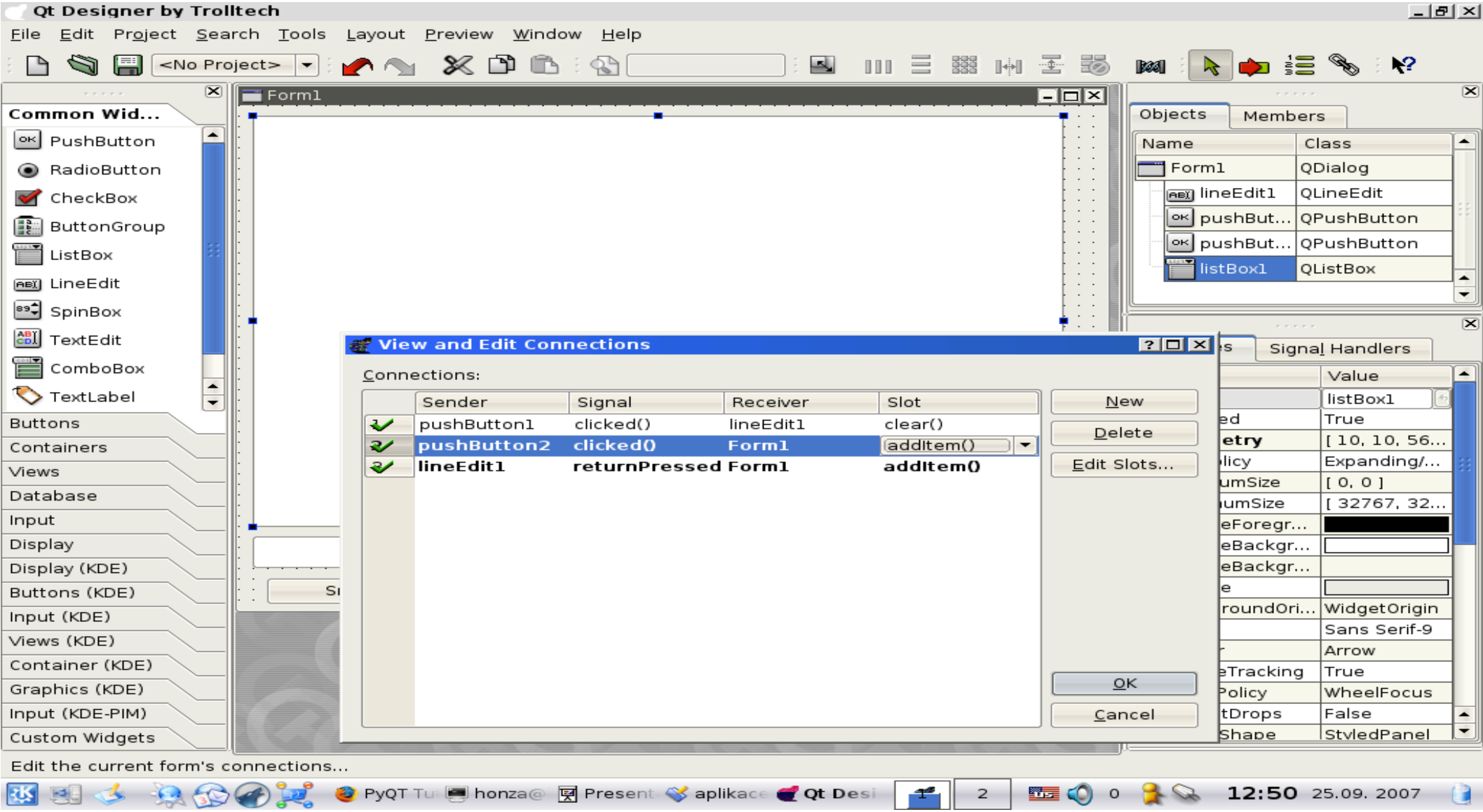
GUI

Qt and PyQt – Qt Designer



GUI

Qt and PyQt – Qt Designer



GUI
Qt and PyQt

Qt Designer uses XML .ui files to store designs and does not generate any code itself. Qt includes the uic utility that generates the C++ code that creates the user interface. Qt also includes the QUiLoader class that allows an application to load a .ui file and to create the corresponding user interface dynamically.

PyQt4 does not wrap the QUiLoader class but instead includes the **uic** Python module. Like QUiLoader this module can load .ui files to create a user interface dynamically. Like the **uic** utility it can also generate the Python code that will create the user interface. PyQt4's **pyuic4** utility is a command line interface to the **uic** module.

GUI
Qt and PyQt

```
#! /usr/bin/python

from qt import *
from form1 import *
import sys

class Form(Form1):
 def addItem(self):
   text=self.lineEdit1.text()
   self.listBox1.insertItem(text)
   self.lineEdit1.clear()

if __name__ == "__main__":
   app = QApplication(sys.argv)
   f = Form()
   f.show()
   app.setMainWidget(f)
   app.exec_loop()
```

Work with databases

Python defines Python Database API Specification v2.0

Relational databases are the most widely used type of database, storing information as tables containing a number of rows.

Example SQlite

Work with databases

```
import sqlite3

conn=sqlite3.connect(“phones.sqlite")
cursor=conn.cursor()
cursor.execute("select * from phones")

for record in cursor.fetchall():
    print("Name : %s, phone number : %s" %(record[0],record[1]))

conn.close()
```

Work with databases

```
import sqlite3

conn=sqlite3.connect(“phones.sqlite")
cursor1=conn.cursor()
cursor2=conn.cursor()

cursor1.execute("insert into phones values (‘Police','158')")
conn.commit()
cursor2.execute("select * from phones")

for record in cursor2.fetchall():
    print("Name : %s, cislo : %s" %(record[0],record[1]))

conn.close()
```

PyPI

- The Python Package Index is a repository of software for the Python programming language.

- There are currently **48184** packages here

- Management tool ***pip***.