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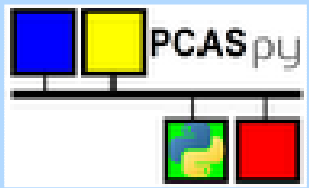
PSI

Wir schaffen Wissen – heute für morgen



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Portable Channel Access Server in Python

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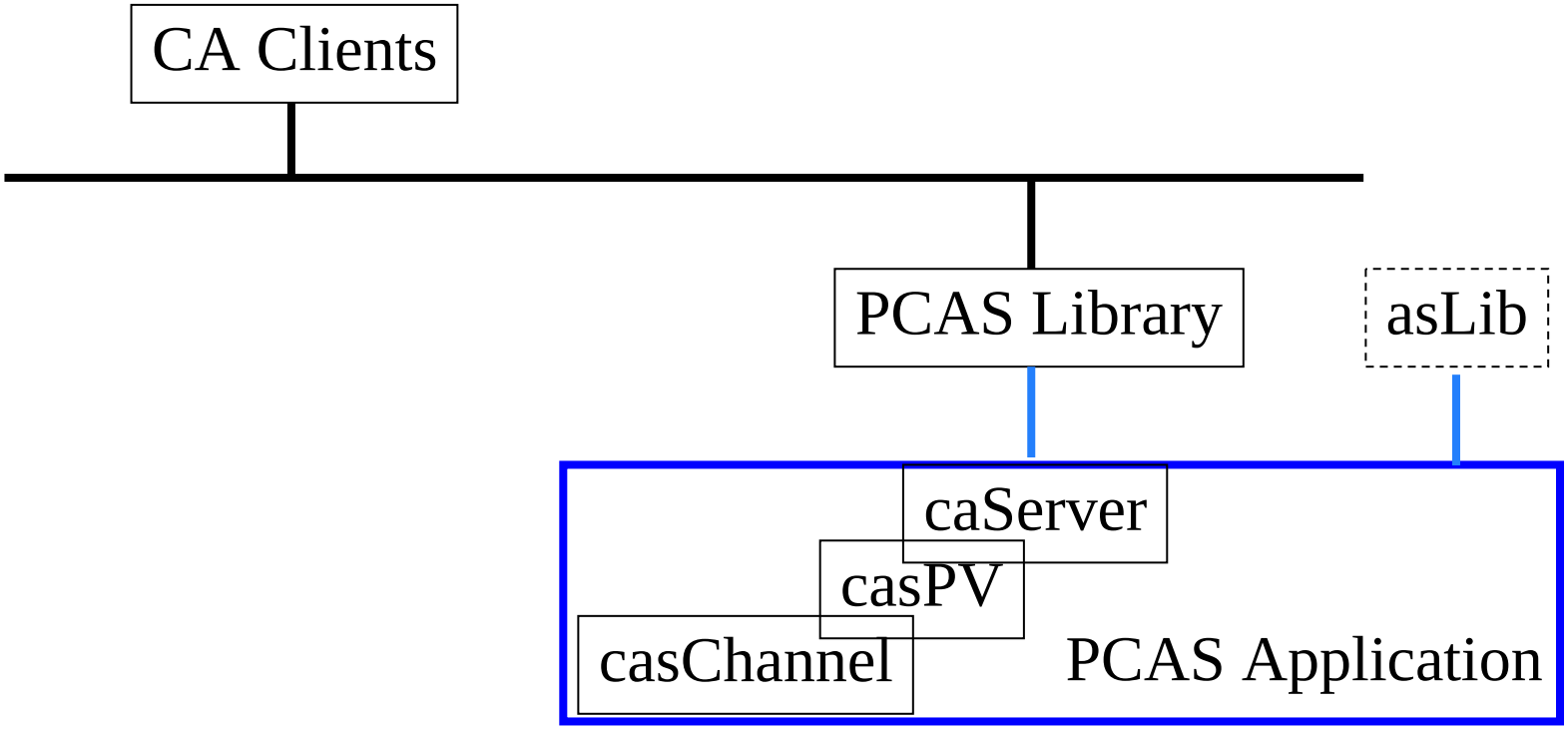
Motivation

- Device/Experiment integration during beamline support
- Device driver and PCAS in C++ are not mastered by every developer
- Python
  - has an (arguably) elegant syntax, easy to learn and maintain
  - has rich built-in modules
  - has extensive 3rd party modules
  - plays well with others through extensions

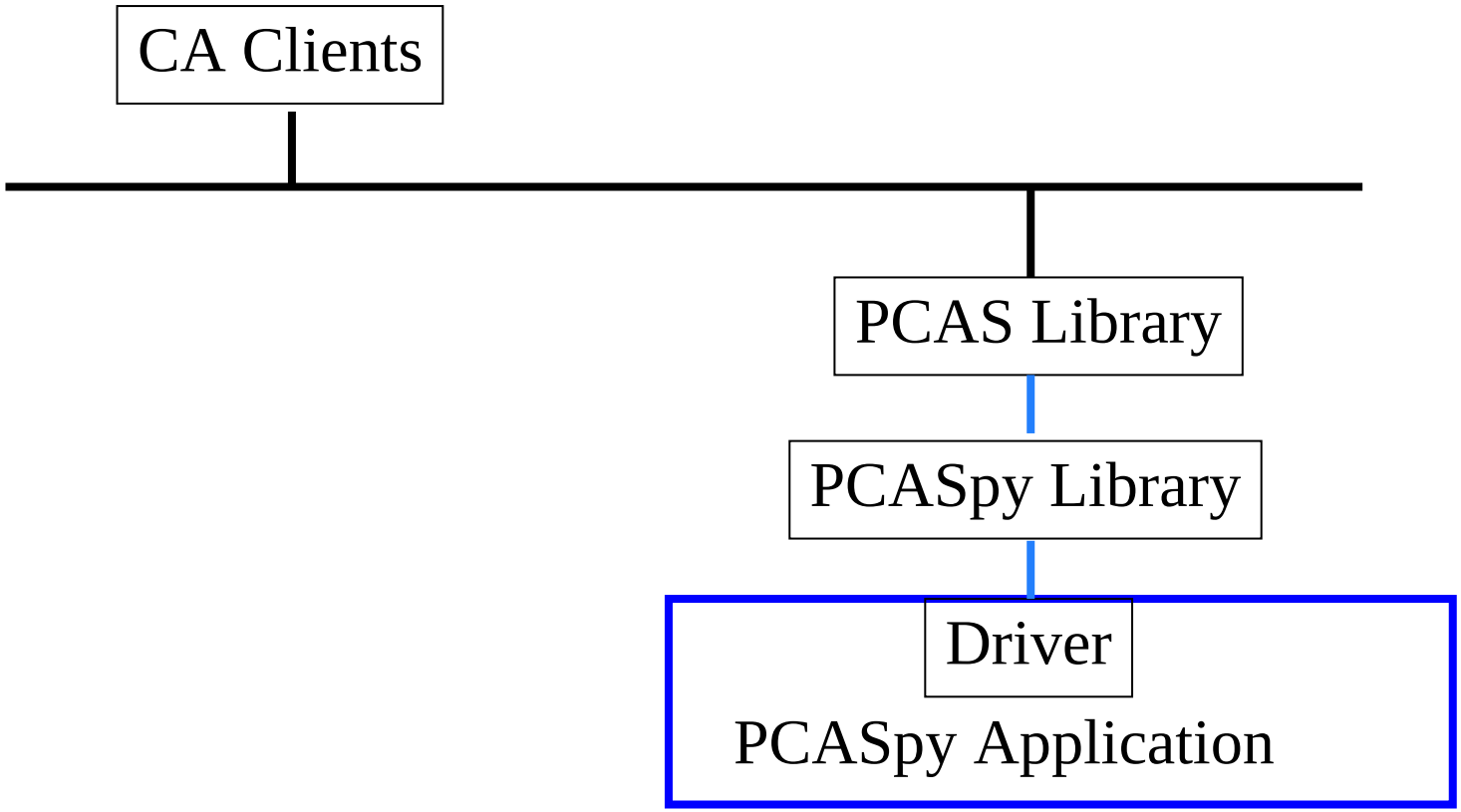
Portable Channel Access Server

- C++ portable channel access server library
  - –*EPICSBASE*/src/cas
  - –caServer, casPV, casChannel to interact with PCAS applications.



PCASpy

- PCAS in Python
  - –Single Driver interface.
  - –PV attributes are configured in Python dict.
  - –Access security control configurable as in EPICS IOC.



PCASpy

- Driver
  - –Methods to override:
    - – read(reason): user requests the value of PV with base name **reason**
    - – write(reason, value): user puts **value** to PV with base name **reason**
  - – Helper methods:
    - – setParam(reason, value): store the value
    - – getParam(reason): get the value
    - – updatePVs(): inform server about value changes
    - – callbackPV(reason): infor server about asynchronous completion
- SimpleServer
  - – createPV(prefix, pvdb)
  - – process(secs)
  - – initAccessSecurityFile(filename, **subst)
- http://code.google.com/p/pcaspy/wiki/API

WinSpec CCD Driver Example – WinSpec Class

- WinSpec/32 COM interface

```
1  import sys
2  # COINIT_MULTITHREADED = 0
3  sys.coinit_flags = 0
4  from comtypes.client import CreateObject, Constants
5
6  class WinSpec(object):
7      def __init__(self, show = True):
8          self.app = CreateObject("WinX32.Winx32App")
9          self.app.Visible = show
10         self.exp = CreateObject("WinX32.ExpSetup")
11         self.const = Constants(self.exp)
12
13     def getTemperature(self):
14         return self.exp.SGetParam(
15                 self.const.EXP_TEMPERATURE)[1]
16
17     def acquire(self):
18         self.exp.Start2()
19
20     def abort(self):
21         self.exp.Stop()
22
```

```
23     def running(self):
24         return self.exp.SGetParam(
25                 self.const.EXP_RUNNING)[1]
26
27     def save(self, filename):
28         doc = self.exp.GetDocument()
29         try: doc.SaveAs(filename)
30         except: return False
31         else: return True
32
33     def getImage(self, n = 1):
34         doc = self.exp.GetDocument()
35         if doc: return doc.GetFrame(n)
36         else: return None
37
38     def setExposure(self, seconds):
39         self.exp.SetParam(
40                 self.const.EXP_EXPOSURE,
41                 seconds)
42
43
44
```

WinSpec CCD Driver Example – PV Database

- PV database

```
 9 prefix = 'MTEST:'
10 pvdb = {
11     'FileName'      : {'type':'char', 'count':128, 'value':'test.TIF'},
12     'Temperature'   : {'prec':1, 'units':'deg', 'scan':5},
13     'AcquireTime'   : {'prec':1, 'units':'s', 'value':5},
14     'Acquire'       : {'type':'enum','enums':['Stop', 'Start'],
15                        'asyn':True, 'asg':'test'},
16     'WriteFile'     : {'type':'enum','enums': ['None', 'Save']},
17     'ArrayData'     : {'count': 1000000},
18 }
```

- Access security file “access.as”

```
1 UAG(me)   {wang_x1}
2 ASG(test) {
3     RULE(1, WRITE) {
4         UAG(me)
5     }
6 }
```

- More on database fields: http://code.google.com/p/pcaspy/wiki/DefineDatabase

WinSpec CCD Driver Example - Driver

- Driver - read

```
20 class myDriver(Driver):
21     def __init__(self):
22         super(myDriver, self).__init__()
23         self.spec = WinSpec(True)
24         self.eid  = threading.Event()
25         tid = threading.Thread(target = self.poll)
26         tid.setDaemon(True)
27         tid.start()
28
29     def read(self, reason):
30         if reason == 'Temperature':
31             value = self.spec.getTemperature()
32         else:
33             value = self.getParam(reason)
34         return value
35
```

WinSpec CCD Driver Example - Driver

- Driver - write

```
36      def write(self, reason, value):
37          status = True
38          if reason == 'Acquire':
39              if value == 1:
40                  if self.spec.running():
41                      status = False
42                  else:
43                      self.eid.set()
44              else:
45                  self.spec.abort()
46                  self.setParam(reason, value)
47                  self.callbackPV(reason)
48          elif reason == 'AcquireTime':
49              self.spec.setExposure(value)
50          elif reason == 'WriteFile':
51              self.spec.save(self.getParam('FileName'))
52          if status:
53              self.setParam(reason, value)
54
55          return status
```

WinSpec CCD Driver Example - Driver

- Driver – poll thread

```
57      def poll(self):
58          while True:
59              if not self.getParam('Acquire'):
60                  self.eid.wait()
61                  self.eid.clear()
62              # Run
63              self.spec.acquire()
64              while self.spec.running():
65                  time.sleep(1)
66
67              # Image data
68              data = numpy.asarray(self.spec.getImage())
69              self.setParam('ArrayData', data.flatten())
70
71              # Inform clients about acquisition finish
72              self.setParam('Acquire', 0)
73              self.callbackPV('Acquire')
74
75              # Inform clients about PV changes
76              self.updatePVs()
```

WinSpec CCD Driver Example – Run and Test

```
78 if __name__ == '__main__':
79     server = SimpleServer()
80     server.initAccessSecurityFile('access.as')
81     server.createPV(prefix, pvdb)
82     driver = myDriver()
83
84     while True:
85         # process CA transactions
86         server.process(0.1)
```

```
C:\epics>caput -c -w 10 MTEST:Acquire 1
Old : MTEST:Acquire                    Stop
New : MTEST:Acquire                    Stop

C:\epics>caput -S MTEST:FileName "C:\\Temp\\test.tif"
Old : MTEST:FileName                   test.TIF
New : MTEST:FileName                   C:\\Temp\\test.tif

C:\epics>caput  MTEST:WriteFile 1
Old : MTEST:WriteFile                  None
New : MTEST:WriteFile                  Save

C:\epics>caget -#10 MTEST:ArrayData
MTEST:ArrayData 10 4095 4095 4095 4095 4095 4095 4095 4095 4095 4095
```

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Random Notes

- More tutorials: http://code.google.com/p/pcaspy/wiki/UserDocuments

- Advices
  - Don't block read/write methods
  - Protect your code with try…catch… when interface with external libraries
  - Write modular code
  - No abuse

- Share
  - http://code.google.com/p/pcaspy/wiki/Success

- EPICS 3.15 and V4?

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References

PCAS: http://www.aps.anl.gov/epics/extensions/cas/index.php

PCASpy: http://code.google.com/p/pcaspy/

Portable Channel Access Server

- Example application *EPICSBASE*/makeBaseApp/top/caServerApp
  - exServer, subclass caServer
    - pvExistTest – respond to CA search request
    - pvAttach – give the PV object
  - exPV, subclass casPV
    - read/write – respond to CA read/write request
    - Asynchronouse? exAsyncPV
    - Array data? exVectorPV
  - casChannel, subclass casChannel
    - readAccess/writeAccess – read/write access control
- Connection to data source depends on specific applications.