TINE Release 5.x.x News

(Nov 13, 2019: inching toward perfection …)

"**Remember**: *Only the dead fish go with the flow …*"

Release 5.1.2

- Fixes, Features, and Issues …
  - the *powers that be* have decided that adweb.desy.de shall now be winweb.desy.de
    - http://tine.desy.de is (was) auto-redirected to https://adweb.desy.de/mcs/tine
    - this breaks not only a good many cached links but necessitates :
      - replacing *all internal references* within the tine web site (done)
      - replacing *all help references* in the TINE Studio applications (Jaka is doing it/has done it)
      - and probably something else someone will notice down the line …

Release 5.1.2

- Fixes, Features, and Issues …
  - **C-Lib Client side**:
    - always suppress a link queue if linked to a tagged structure
      - Leads to problems (*think crash*) if the structure is *not internally aligned* and an incoming linked gets queued.
    - ignore **.bak** files when **SRVLOGFILE** accesses a non **.log** file. (e.g. .csv)
      - i.e. does not append contents of last rotated file ..
      - this stock property can be used to read/write any text file …

Release 5.1.2

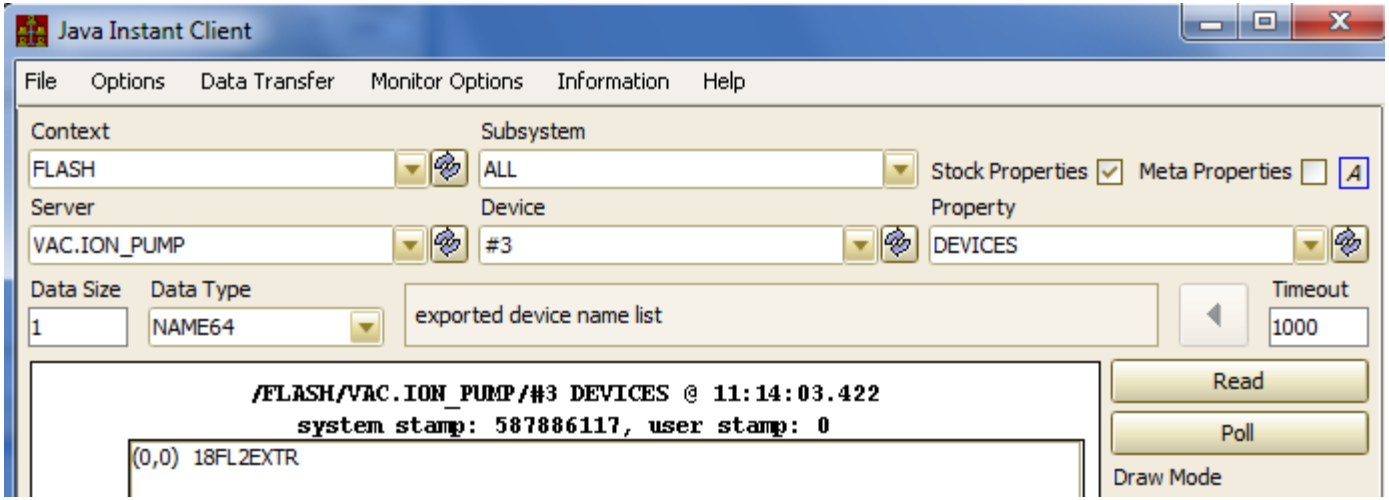
- Fixes, Features, and Issues …
  - **C-Lib:** new functions
    - **SetDieFunction**(void(*)(const char *)fcn)
      - will call the provided function with the reason for exiting as a message string
    - **RemoveDevice**(char *eqm,char *device)
      - removes device from device list
      - does not remove the device slot or affect device capacity.
    - **RemoveProperty**(char *eqm,char *property)
      - Removes property from the registered properties list

Release 5.1.2

- Fixes, Features, and Issues …
  - **Remove Property Issue**: the buffered services windows DLL **missed** the *build all* and was not updated until later …
    - 3-week period from mid-September.
    - e.g. LabView Servers were reporting illegal_format on any call …
    - Apologies to Uwe R. and Uwe H.

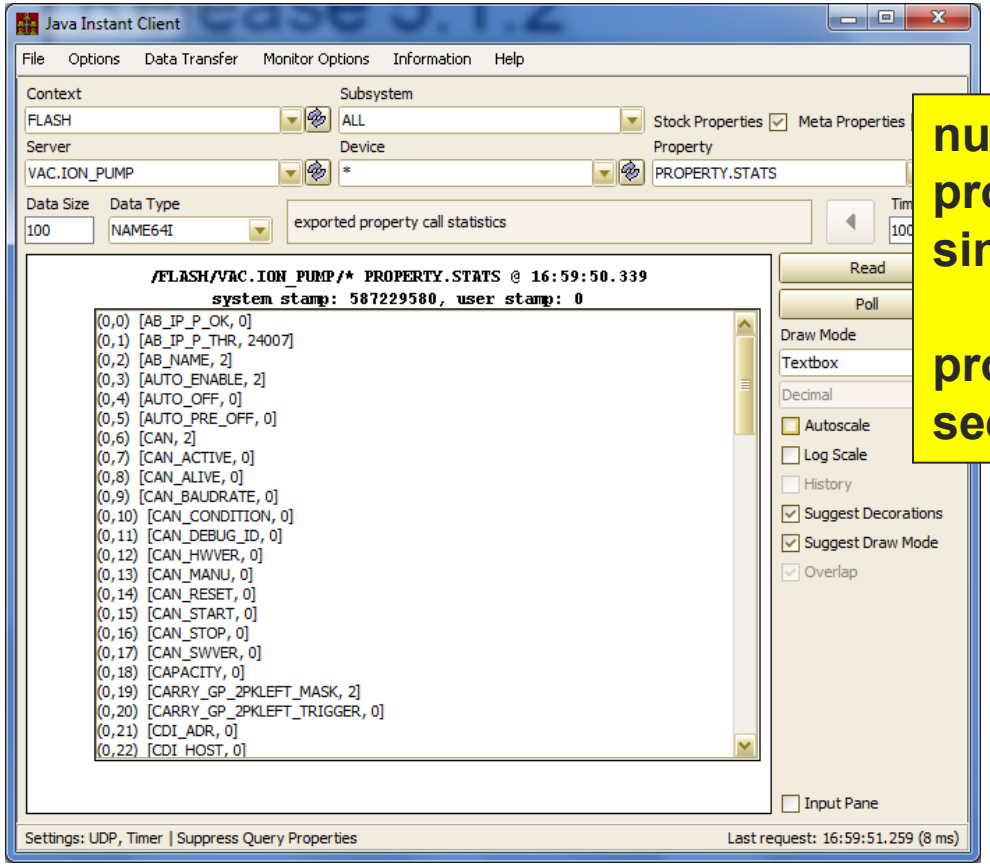
Release 5.1.2

- Fixes, Features, and Issues …
  - **removeDevice** issue: (**Java side**)
    - *long standing java bug was also fixed* :
      - query to '**DEVICES**' with device name target #3 should return the device name associated with device #3.
      - Was always returning device name for #0 !
  - exposed issues related to device name registration strategies fixed by Tobias …



Release 5.1.2

- Fixes, Features, and Issues …
  - New Stock Property : "**PROPERTY.STATS**"



number of times a property has been called since server startup …

property AB_IP_P_THR seems to be popular …

Release 5.1.2

- Fixes, Features, and Issues …
  - Offer the doocs data type **CF_GSPECTRUM** (to accommodate archive requests)
    - like a spectrum with more header information.
    - spectrum array can be a doubly dimensioned array.
    - Arthur will incorporate it into the doocs2tine layer when TINE Release 5 is integrated into doocs.

Release 5.1.2

- Fixes, Features, and Issues …
  - Stock Property **DEVLOCATION** now accepts WRITE-only transactions
    - jddd does not offer WRITE/READ and …
    - it's silly to *force* the caller READ back what he is writing if he doesn't want to …

Release 5.1.2

- Remaining Release 5 vs. Release 4 issues ?
  - **Case study A:**
    - A Rel. 4 server rolls *up* to Rel. 5 *with running clients with multiple links.*
      - If downtime long enough, a Rel. 5 java client *learns* that the server now speaks Rel. 5 but due to a bug (fixed!) it used a *Rel. 5 packet header with a Rel. 4 request header*
        - server did **NOT** like this!
      - Server now protects against this (should there still be a java client out there that didn't get a newer jar file)!

Release 5.1.2

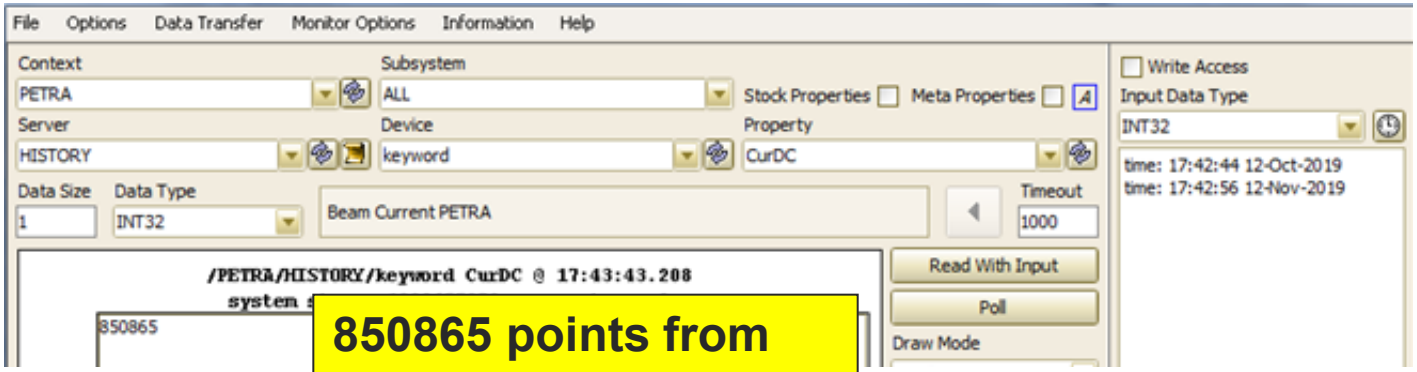
- Remaining Release 5 vs. Release 4 issues ?
  - **Case study B:**
    - a Rel. 5 server rolls *back* to Rel. 4 *with running clients with multiple links*.
      - clients begin to receive illegal_protocol from the server and then *react* by *decrementing the communication protocol* and :
        - *for any and all link associated with the target FEC*.
      - if there were multiple links (especially in single-threaded mode) then the next illegal_protocol continues to decrement until there's no option but to close the link!

Archiving & Archive Retrieval

- both **Central** and **Local Archiving** offer **API**s for :
  - determining the *number of stored points in an interval*
  - specifying a desired *sampling raster*
    - not given ? => find the *best* raster value for the time range specified in the call !
      - this is how you do ‘optical zooming’ !
      - (and is not ‘garbage in/garbage out’)

Archiving & Archive Retrieval

- How to get ‘all the stored points’ in an interval ?
  - **Method 1:**
    - get the number of points in the interval
    - ask for that many points in the archive call.

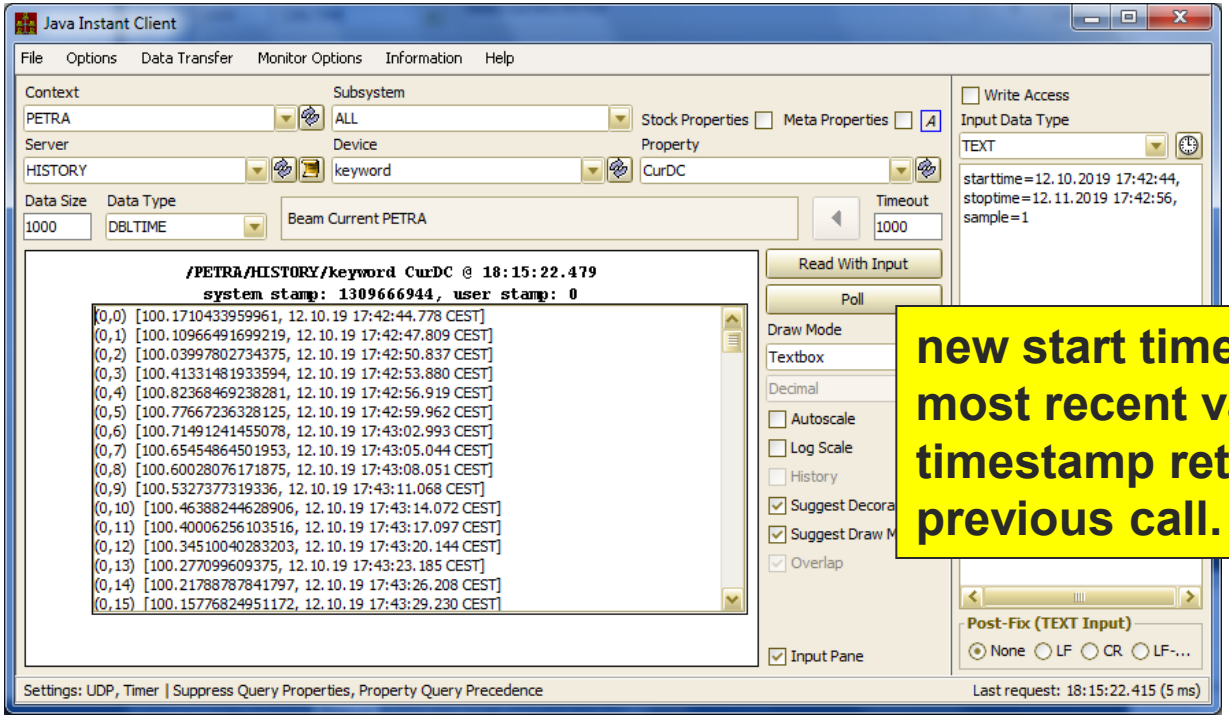


850865 points from Oct. 12 to Nov. 12 :

Wow! That’s quite a few points …

Archiving & Archive Retrieval

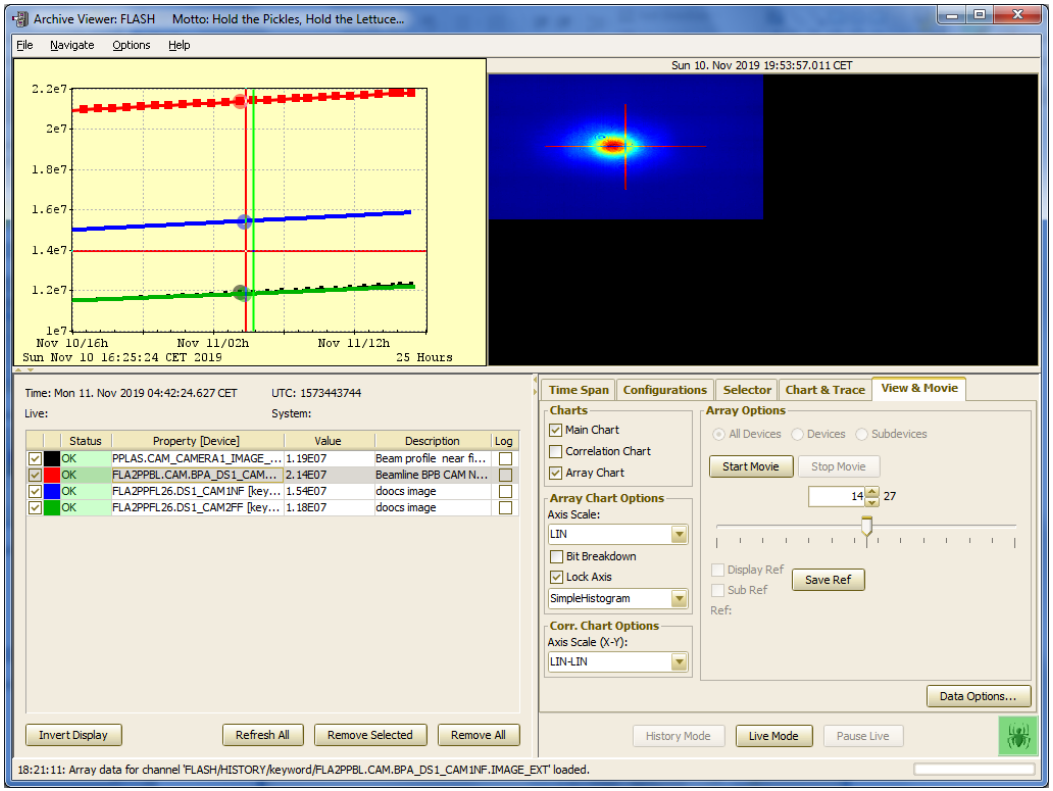
- How to get ‘all the stored points’ in an interval ?
  - **Method 2:**
    - specify a *reasonable number* of points, but give a *sampling raster of 1*
    - move the *start* of the interval along and keep repeating the call …



new start time = time of most recent valid archive timestamp returned in previous call.

Archiving & Archive Retrieval

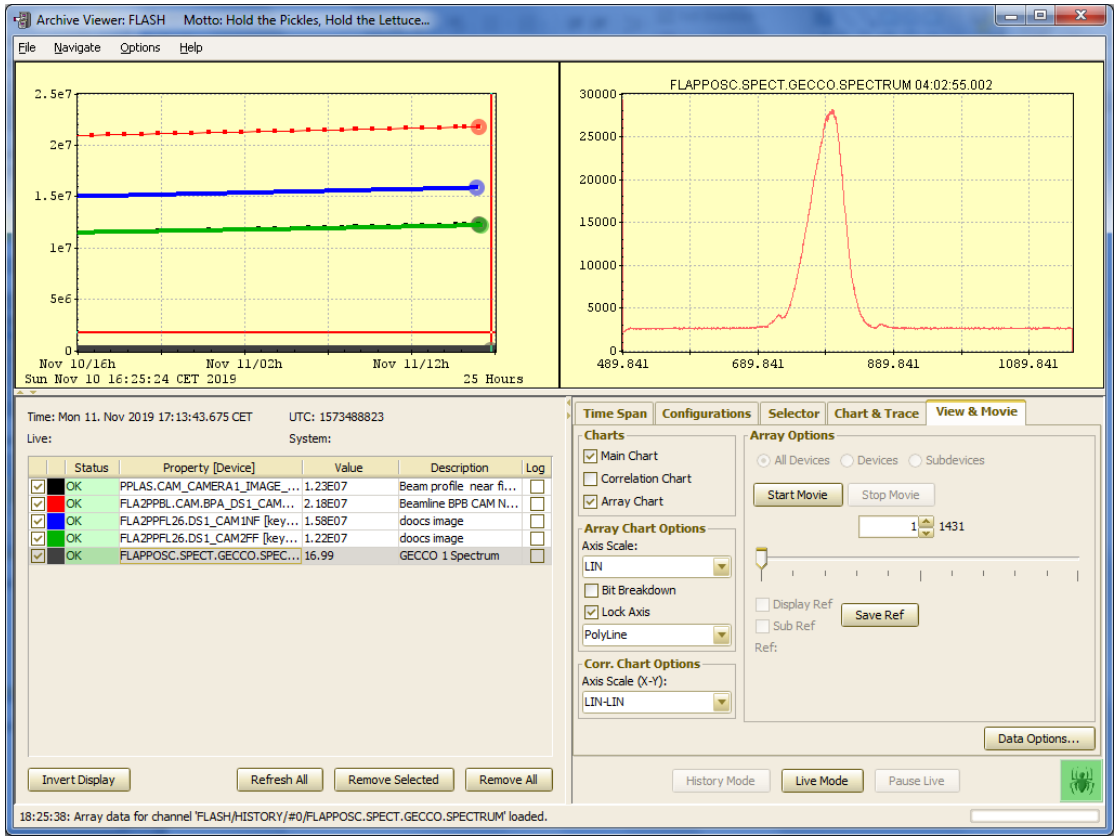
- Archiving Images and large waveforms …



Size of a stored record can be large …

Archiving & Archive Retrieval

- Pay attention to tolerances and filtering criteria



Records stored only when warranted :
Out of tolerance
All filter criteria met (e.g. BEAM, RUNNING, etc.)

There is a possibility of post facto reducing the stored data …

Archiving & Archive Retrieval

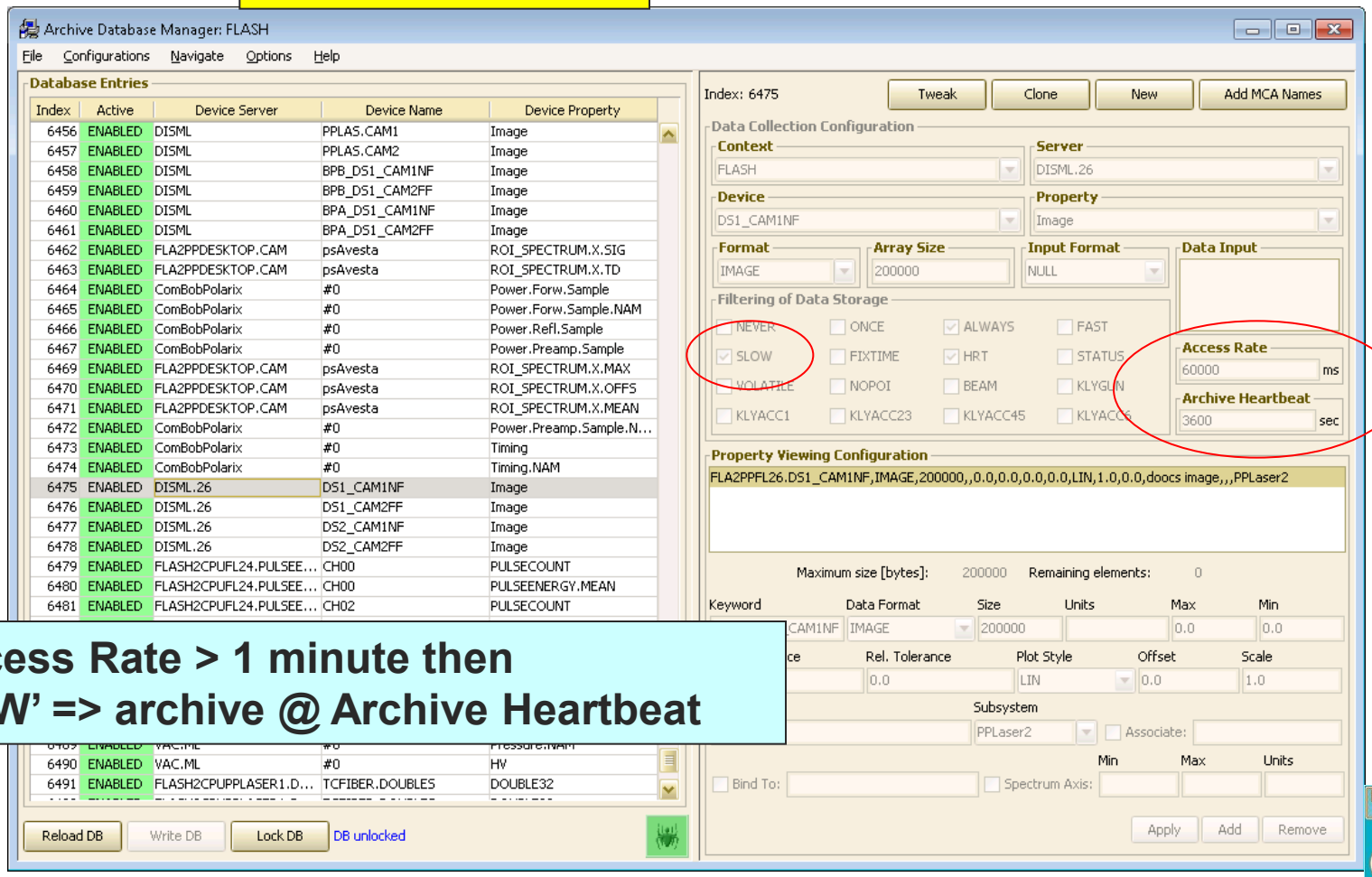
- *massaging* stored data with **dbscan** …

```
./dbscan

scans and massages the targeted archive data file

Usage : dbscan /f=<database file name> (/k=<archive keyword> or /r=<record>)
        [/y=<year> /m=<month> /x=<scale correction> /o=<offset correction>
         /d=<start::stop - deletes all records found in range>
         /s=<TRUE: scan only (don't create 'fix' file)>
         /v=<TRUE: dump scanned contents> /l=<dump array length>
         /b=<TRUE: bailout on error> /a=<TRUE: add '-fix' extension>
         /n=<new record length> /i=<TRUE: scan POI file>
         /p=<prune data skip raster>]

e.g. dbscan /f=datapetr.csv /r=1791 /y=2018 /m=10 /p=10

        scans record 1791 of the 'datapetr.csv' database from October 2018 and prunes the
                data by taking every 10th stored value
```

Next: post facto tolerance application …

Archiving & Archive Retrieval

Archive Filters …



If Access Rate > 1 minute then ‘SLOW’ => archive @ Archive Heartbeat

Python News

- **PyTINE API** offers *asynchronous* interface
  - PyTine.attach()

```
>>> import PyTine as pt
>>>
>>> def cb(id,cc,d):
...     print(d['timestring'])
...     print(d['data'])
...
>>>
>>> lid=pt.attach(address='/PETRA/Idc/Buffer-0',property='I',callback=cb)
>>> 30.05.15 11:50:13.413 CDT
100.5762939453125
30.05.15 11:50:14.297 CDT
100.57471466064453
30.05.15 11:50:15.401 CDT
```

  - + PyTine.detach()

Callbacks and GUI operations …

TINE and Python

From a 2015 TINE Users Meeting

- PyQt callback paradigm:

```
import pyqtgraph as pg
import pyqtgraph.exporters
from pyqtgraph.Qt import QtCore, QtGui

from PyQt4.QtCore import QObject, pyqtSignal, pyqtSlot

import os
import threading
import ctypes as C
import numpy as np

import PyTine as tine
import time

class Update(QObject):
    update = pyqtSignal();
    def __init__(self):
        QObject.__init__(self);
    def do_update(self):
        self.update.emit();
```

```
@pyqtSlot()
def on_update():
    p1.setData(y=yd, x=xd);

upd = Update();
upd.update.connect(on_update);


xd = np.arange(0,32768);
yd = np.arange(0,32768);

def ptrain_cb(a,b,c):
  global yd
  yd = c['data'][0:32768];
  upd.update.emit();
```

Matplotlib + callbacks

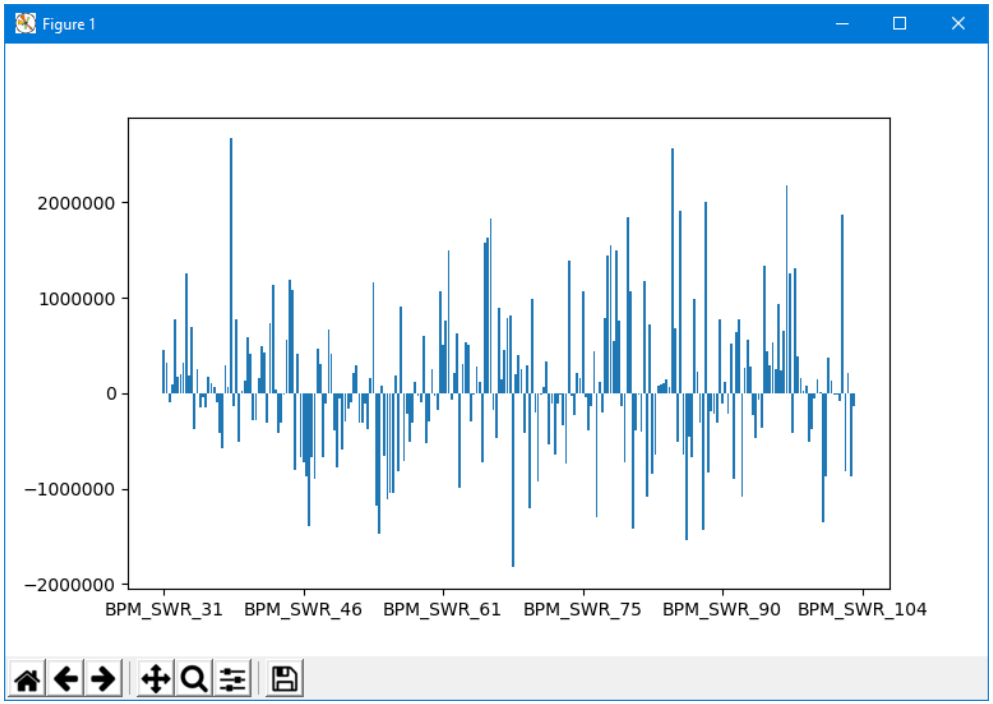
```
import matplotlib.pyplot as plt
import matplotlib
import threading
import time
import queue
import functools
import copy
import PyTine as pt


#ript(Run In Plotting Thread) decorator
def ript(function):
    def ript_this(*args, **kwargs):
        global send_queue, return_queue, plot_thread
        if threading.currentThread() == plot_thread: #if called from the plotting
            return function(*args, **kwargs)
        else: #if called from a diffrent thread -> send function to queue
            send_queue.put(functools.partial(function, *args, **kwargs))
            return_parameters = return_queue.get(True) # blocking (wait for re
            return return_parameters
    return ript_this

#list functions in matplotlib you will use
functions_to_decorate = [[matplotlib.axes.Axes,'plot'],
                         [matplotlib.axes.Axes,'bar'],
                         [matplotlib.axes.Axes,'hist'],
                         [matplotlib.figure.Figure,'savefig'],
                         [matplotlib.backends.backend_tkagg.FigureCanvasTkAgg,'draw'],
                         [matplotlib.lines.Line2D,'set_ydata'],
                         ]
#add the decorator to the functions
for function in functions_to_decorate:
    setattr(function[0], function[1], ript(getattr(function[0], function[1])))

# function that checks the send_queue and executes any functions found
def update_figure(window, send_queue, return_queue):
    try:
        callback = send_queue.get(False)  # get function from queue, false=doesn't block
        return_parameters = callback() # run function from queue
        return_queue.put(return_parameters)
    except:
        None
    window.after(10, update_figure, window, send_queue, return_queue)
```

```
# function to start plot thread
def plot():
    # we use these global variables because we need to access them from within the decorator
    global plot_thread, send_queue, return_queue
    return_queue = queue.Queue()
    send_queue = queue.Queue()
    plot_thread=threading.currentThread()
    # we use these global variables because we need to access them from the main thread
    global ax, fig
    fig, ax = plt.subplots()
    # we need the matplotlib window in order to access the main loop
    window=plt.get_current_fig_manager().window
    # we use window.after to check the queue periodically
    window.after(10, update_figure, window, send_queue, return_queue)
    # we start the main loop with plt.plot()
    plt.show()

q = queue.Queue(10)

def cb(id,cc,d):
    global q
    q.put(copy.copy(d))
```

Some helper functions …

Matplotlib + callbacks

```
def cb(id,cc,d):
    global q
    q.put(copy.copy(d))

def main():
    #start the plot and open the window
    thread = threading.Thread(target=plot)
    thread.setDaemon(True)
    thread.start()
    time.sleep(1) #we need the other thread to set 'fig' and 'ax' before we continue
    lid = pt.attach('/PETRA/BPM/#0','Orbit.X',callback=cb)
    names = pt.list(context='PETRA',server='BPM')
    global ax, fig, q, plotted, l1
    plotted = False
    while thread.isAlive():
        if not q.empty():
            d = q.get()
            if not plotted:
                #p1, = ax.plot(d['data'])
                b1 = ax.bar(range(len(d['data'])),d['data'])
                ax.set_xticklabels(names['devices'])
                plotted = True
            else:
                #p1.set_ydata(d['data'])
                for r, h in zip(b1, d['data']):
                    r.set_height(h)
            fig.canvas.draw()
        else:
            time.sleep(1)
    print('Done')
    #thread.join() #wait for user to close window
main()
```



PyTine Synchronous API

- Avoid the callback issues by using synchronous calls ?
  - **PyTine.get()** read a value without input
  - **PyTine.call()** read (and/or write) a value with/without input
  - unless the option **SYNC** is specified, the call will start an *asynchronous listener* from the buffered service layer
    - 'reflected memory'
  - make your call and update your GUI …
- **BUT**:
  - built in latency
  - don't know when the data are fresh (when is a good time to call PyTine.get() ?
- Potential issue with a listener :
  - *when does it stop listening?*
    - **deadband** of 5 minutes (without a get()) will stop the listener.
      - (larger payloads have a smaller deadband)

PyTine Synchronous API

- What if a **GUI** client changes an address (*e.g. a device in a combo box*) and *knows* that it won't call the old address again?
  - waiting for a large payload to disappear via the **deadband** can lead to unnecessary network and cpu load.
    - e.g. video frames or large waveforms
- New call : **PyTine.stop_get()**
  - with same parameters as the original get() will stop the listener.

PyTine news

- **Orbit correction** :
  - that old orbit correction/optics server (from 1993) can still be used !
    - uses (non-tagged) structures (we didn't have tagged structures back in 1993)
- New **PyTine** calls :
  - **register_type()**
    - puts a user-defined tagged structure in the TINE structure registry
  - **structure_to_bytes()**
    - Gets an array of bytes from a structure
  - **byes_to_structure()**
    - Makes a structure from an array of bytes

Orbcore Python example:

```
import PyTine as pt
hdr = {
  'Machine':{'char*8':'hera'},
  'Year':{'char*4':'2007'},
  'Text1':{'char*60':' '},
  'Text2':{'char*60':' '},
  'DateTime':{'char*32':' '},
  'filename':{'char*80':' '},
  'Optic':{'char*16':' '},
  'Opticflag':{'char*16':' '},
  'particleType':{'short':0},
  'dummy':{'BYTE':0},
  'CorrClass':{'BYTE':0},
  'errorStr':{'char*32':' '},
  'Energy':920.0,
  'Arr_mon':{'short':0},
  'Arr_cor':{'short':0},
  'Arr_il':{'short':0},
  'Arr_jl':{'short':0},
  'Hdr_Size':{'short':0},
  'Spez_Hdr_Size':{'short':0},
  'Arr_Size':{'short':0},
  'MonNum':{'short':[0,0]},
  'CorNum':{'short':[0,0]},
  'LatNum':{'short':0},
  'EleNum':{'short':0},
  'OpticNum':{'short':0},
  'SpezNum':{'short':0},
  'Counter':{'short':0},
  'Qtheory':[0.0,0.0],
  'mom_comp':0.0,
  'Circumference':{'double':0.0},
  'NGDebug':{'short':0},
  'HPDebug':{'short':0},
  'Index':{'short':0},
  'Version':{'short':0}
}

pt.register_type('OptHdr', hdr)
```

```
bumpHdr = {
  'CoilName':{'char*16':''},
  'Strength':0.0,
  'Current':0.0,
  'dK':0.0,
  'dI':0.0,
  'dKmax':0.0,
  'dKmin':0.0,
  'Coil_MopsIndex':{'short':0},
  'Coil_CorMIndex':{'short':0},
  'kIMinMax':{'short':0},
  'ErrorFlag':{'short':0},
}

pt.register_type('BmpHdr',bumpHdr)

b = pt.structure_to_bytes('OptHdr',hdr)

output = pt.call(address='/Common/OPTICL3/pe14_p3x_v23', property='HEADER',size=len(b),
input=b,inputsize=len(b),format='STRUCT.BYTES',inputformat='STRUCT.BYTES', mode='READ|WRITE')
```

Orbcore Python example

```
psName = ["PKV_NOR_43","PKVSX_SOR_89","PKVSU_SL_68", "PKH_NOR_40", "PKHW_WL_31", "PCV_NWL_13",
          "PCVM_NWL_31", "PKDK_SWR_27", "PKPDA_NOR_45", "PCH_NWL_9", "PKVW_WL_25", "QS_W1"]  # an array to test
strength = [0.0005,0.0005,0.0005,0.0005,0.0005,0.0005,0.0005,0.0005,0.0005,0.0005,0.0005,0.0005]


for n, s in zip(psName, strength):
    bumpHdr['CoilName'] = n
    bumpHdr['Strength'] = s
    b = b + pt.structure_to_bytes('BmpHdr',bumpHdr)  #add all the bytes together …

for i in range(len(psName), 400):
    b = b + pt.structure_to_bytes('BmpHdr',bumpHdr)  #add all the bytes together …

output = pt.call(address='/Common/K2I2KL3',property='GET-CURRENT',size=len(b),input=b,inputsize=len(b),format=
'STRUCT.BYTES',inputformat='STRUCT.BYTES',mode='READ|WRITE')

b1=output['data'][:376]   # split the returned byte blob up into known quantities …
b2=output['data'][376:424]

h1=pt.bytes_to_structure('OptHdr',b1)
h2=pt.bytes_to_structure('BmpHdr',b2)
```

Bare bones orbit correction, but Gajendra is writing some nice wrappers …