Medical Compute with ChRIS on the MOC

PowerPC & x86_64 GPU Usage & Benchmarking

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Quick Review

An open source platform for medical analysis

The goal is to democratize application development for medical analysis applications

Last Sprint:
Our next step

- ✓ Integrating **Object-Detection**
- ✓ Test plugins through **ChRIS instance**
- ✓ Test plugins through **ChRIS GUI**
- ✓ **Benchmarking** plugin result

Sprint 5 Overview:

Debugging Object Detection App on PowerPC

Successfully Registered Matrixmultiply to ChRIS

Made App runnable on ChRIS instance

What we have learned:

REST API

Complexity working with PowerPC

Compatibility of working environment

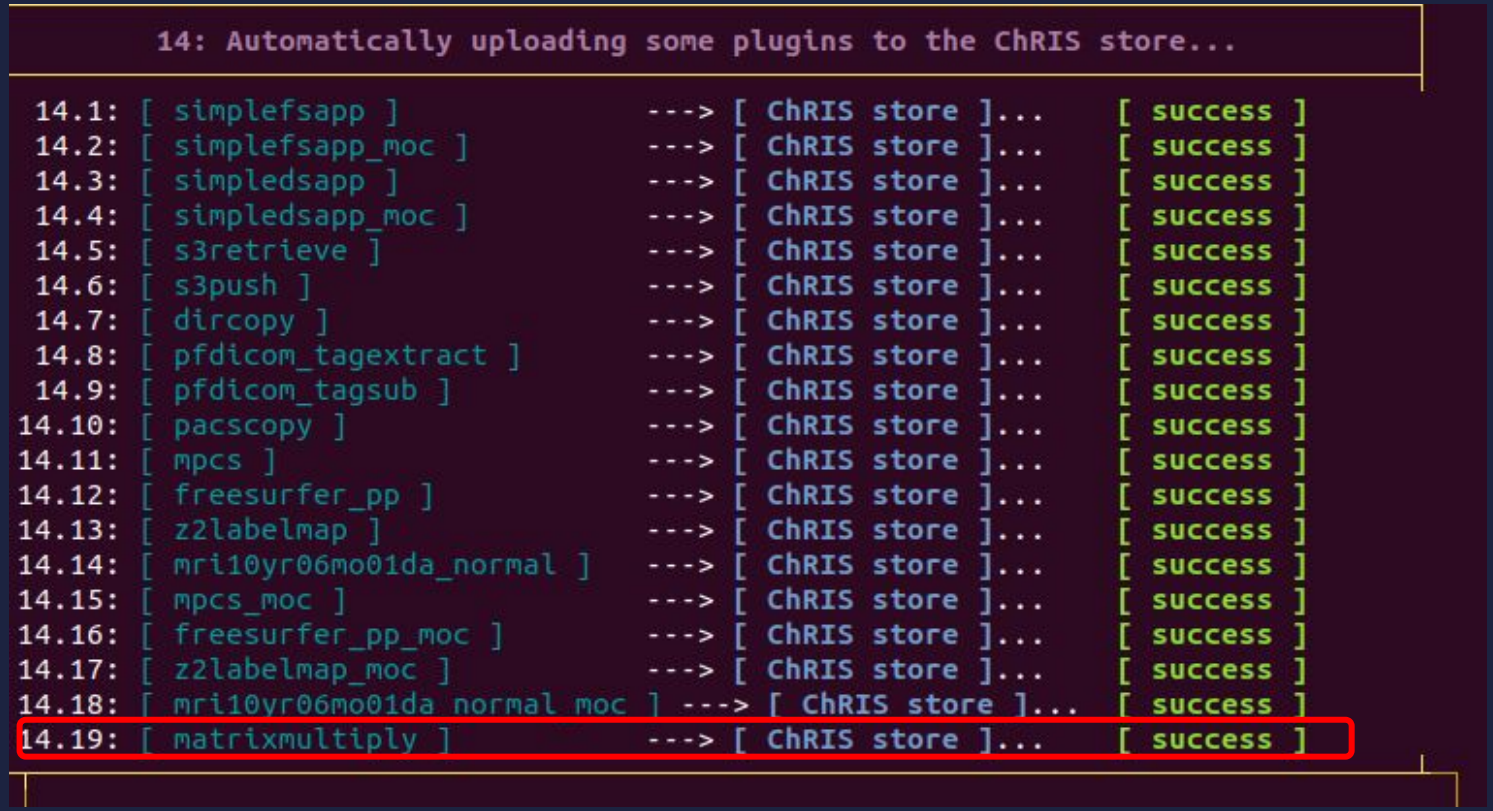
Recap: 2 ways to run a plugin

- Run it through Docker containers
  - Successfully build 3 images(local, x86_moc, ppc_moc).
  - maintained on Dockerhub under FNNDSC repo.
- Run it through Chris Instance
  - What does that means?

ChRIS Instance

- Register runnable plugin to Chris store.
- Fire up a ChRIS instance.
  - instantiated as Django-mysql project
  - offering a collection+json REST API.

Register to ChRIS



```
(chrisapp_env) [chris-local@titan:x86_64-Linux]..._ultron_backend(master@9515-00
19-)$>pfurl --auth chris:chris1234 --http ${HOST_IP}:8000/api/v1/plugins/19
--quiet --jsonpprintindent 4
{
    "status": true,
    "data": {
        "collection": {
            "version": "1.0",
            "href": "http://10.72.76.39:8000/api/v1/plugins/19/",
            "items": [
                {
                    "data": [
                        {
                            "name": "id",
                            "value": 19
                        },
                        {
                            "name": "name",
                            "value": "matrixmultiply"
                        },
                        {
                            "name": "dock_image",
```

Workflow

FS Plugin: #14
mri10yr06mo01da_normal

DS Plugin: #19
matrixmultiply

```
Django version 2.1.4, using settings 'config.settings.local'
Starting development server at http://0.0.0.0:8000/
Quit the server with CONTROL-C.
[15/Apr/2020 19:20:56] "POST /api/v1/plugins/14/instances/ HTTP/1.1" 201 1206
[15/Apr/2020 19:21:11] "GET /api/v1/plugins/instances/1/ HTTP/1.1" 200 1284
[15/Apr/2020 19:21:41] "GET /api/v1/plugins/instances/1/ HTTP/1.1" 200 1284
[15/Apr/2020 19:22:33] "POST /api/v1/plugins/19/instances/ HTTP/1.1" 201 1309
[15/Apr/2020 19:23:26] "GET /api/v1/plugins/instances/2 HTTP/1.1" 301 0
[15/Apr/2020 19:23:26] "GET /api/v1/plugins/instances/2/ HTTP/1.1" 200 1387
[15/Apr/2020 19:27:24] "GET /api/v1/plugins/instances/2/files HTTP/1.1" 301 0
[15/Apr/2020 19:27:24] "GET /api/v1/plugins/instances/2/files/ HTTP/1.1" 200 2042
```

```
(chrisapp_env) [chris-local@titan:x86_64-Linux]..._ultron_backend(master@9515-0019-)$>pfurl --auth chris:chris1234
>       --verb GET                                                  \
>       --http ${HOST_IP}:${HOST_PORT}/api/v1/plugins/instances/2/files \
>       --content-type application/vnd.collection+json              \
>       --quiet --jsonpprintindent 4
```

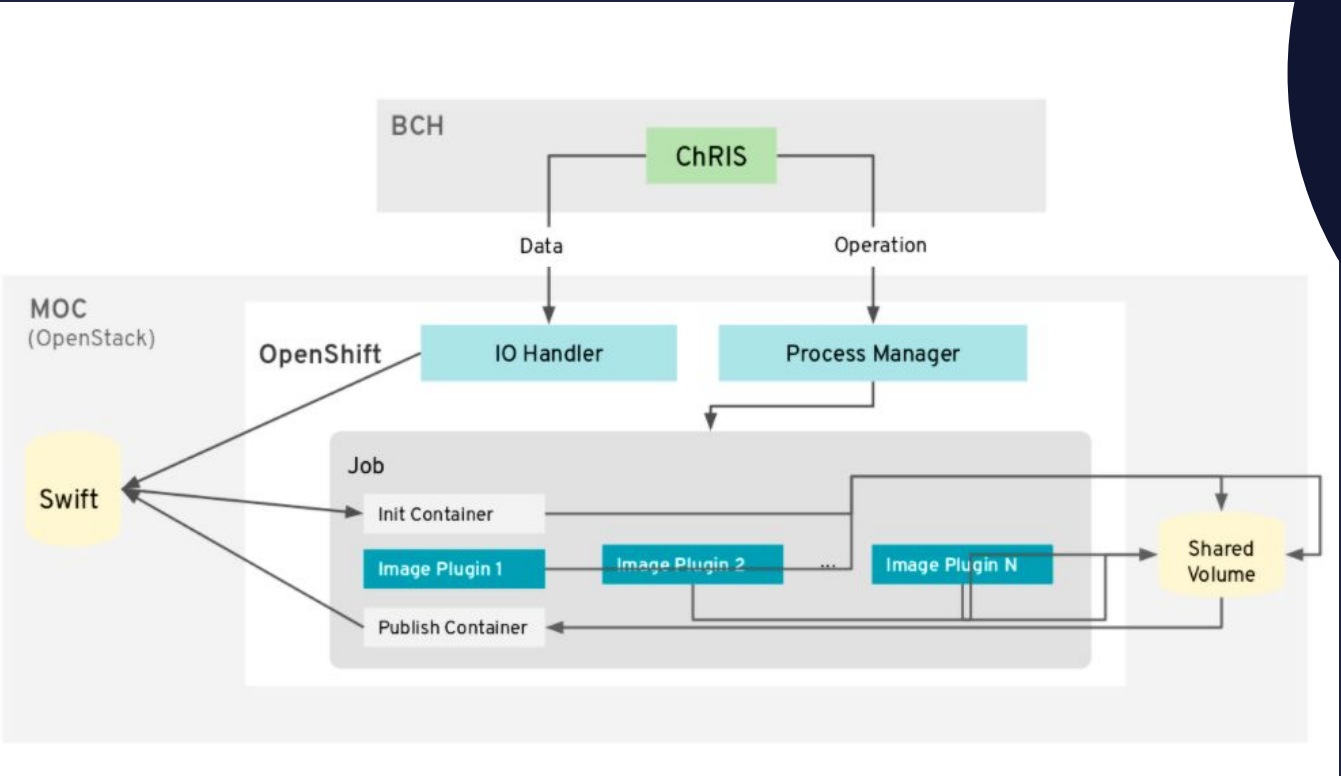

```
{
    "status": true,
    "data": {
        "collection": {
            "version": "1.0",
            "href": "http://10.72.76.39:8000/api/v1/plugins/instances/2/files/",
            "items": [
                {
                    "data": [
                        {
                            "name": "id",
                            "value": 189
                        },
                        {
                            "name": "fname",
                            "value": "chris/feed_1/mri10yr06mo01da_normal_1/matrixmultiply_2/data/MultiplyRecord.csv"
                        },
                        {
                            "name": "feed_id",
                            "value": 1
                        },
                        {
                            "name": "plugin_inst_id",
                            "value": 2
                        }
                    ],
                    "href": "http://10.72.76.39:8000/api/v1/files/189/",
                    "links": [
                        {
                            "rel": "file_resource",
                            "href": "http://10.72.76.39:8000/api/v1/files/189/MultiplyRecord.csv"
                        },
                        {
```

Result

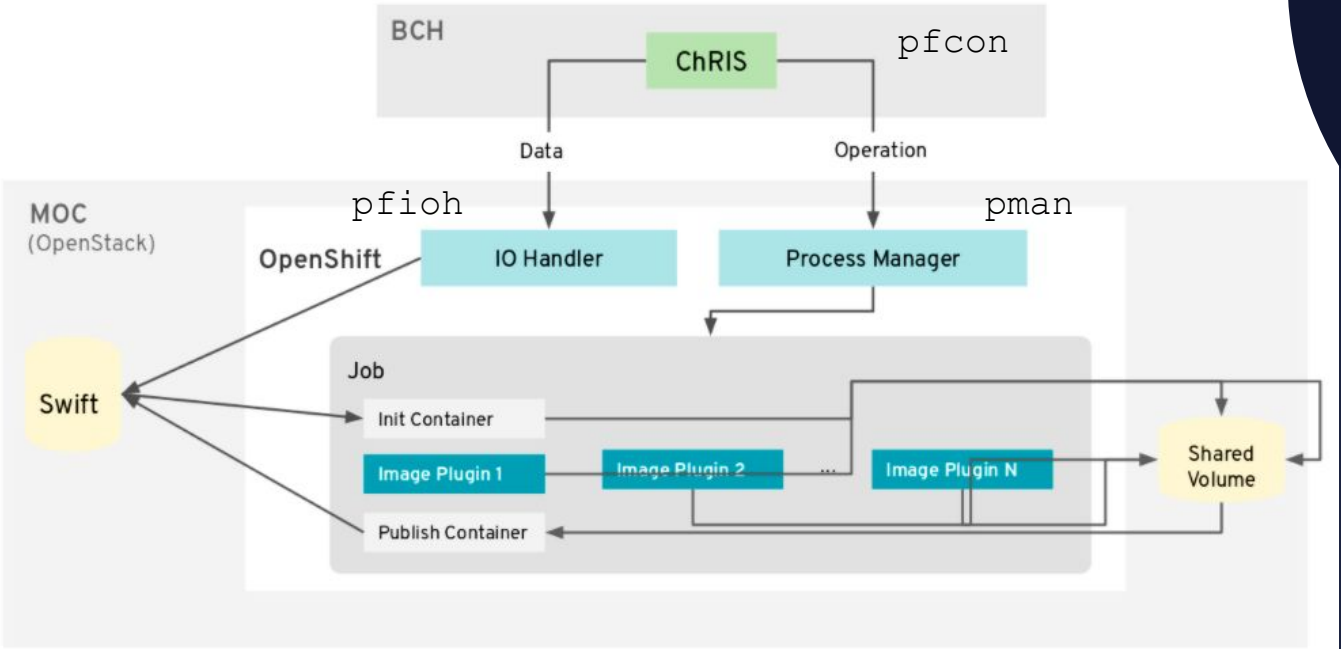
```
(chrisapp_env) [chris-local@titan:x86_64-Linux]..._ultron_backend(master@9515-0019-)$>http -a chris:chris1234 --download http://10.72.76.39:8000/api/v1/files/193/Multip
lyRecord.csv
HTTP/1.1 200 OK
Allow: GET, HEAD, OPTIONS
Connection: keep-alive
Content-Length: 321
Content-Type: */*
Date: Wed, 15 Apr 2020 20:04:08 GMT
Proxy-Connection: keep-alive
Server: WSGIServer/0.2 CPython/3.6.5
Via: 1.1 isdsecwsabdc3.tch.harvard.edu:80 (Cisco-WSA/11.7.1-020)
X-Frame-Options: SAMEORIGIN

Downloading 321.00 B to "MultiplyRecord.csv-1"
Done. 321.00 B in 0.00057s (551.75 kB/s)
(chrisapp_env) [chris-local@titan:x86_64-Linux]..._ultron_backend(master@9515-0019-)$>ls
chris_backend/   docker-compose_dev.yml*  docker-entrypoint_dev.sh*  docker-make.sh*  --http*          MultiplyRecord.csv    requirements/
chris_dev.env*   docker-compose.yml*      docker-entrypoint.sh*      docs/            --jsonwrapper*   MultiplyRecord.csv-1  SAG-anon/
--content-type*  docker-deploy.sh*        Dockerfile*                files            LICENSE*         --quiet*              utils/
decorate.sh*     docker-destroy.sh*       Dockerfile_dev*            [redacted]/      Matmultiply.json  README.md*
(chrisapp_env) [chris-local@titan:x86_64-Linux]..._ultron_backend(master@9515-0019-)$>more MultiplyRecord.csv-1
Matrix_Size,Start_Time,Finish_Time,Elapse_Time
1048576.0,1586980604.8279586,1586980605.4869623,0.659003734588623
4194304.0,1586980605.4876544,1586980605.6453953,0.15774083137512207
9437184.0,1586980605.6458883,1586980606.0912654,0.4453771114349365
16777216.0,1586980606.0923328,1586980607.0525713,0.9602384567260742
```

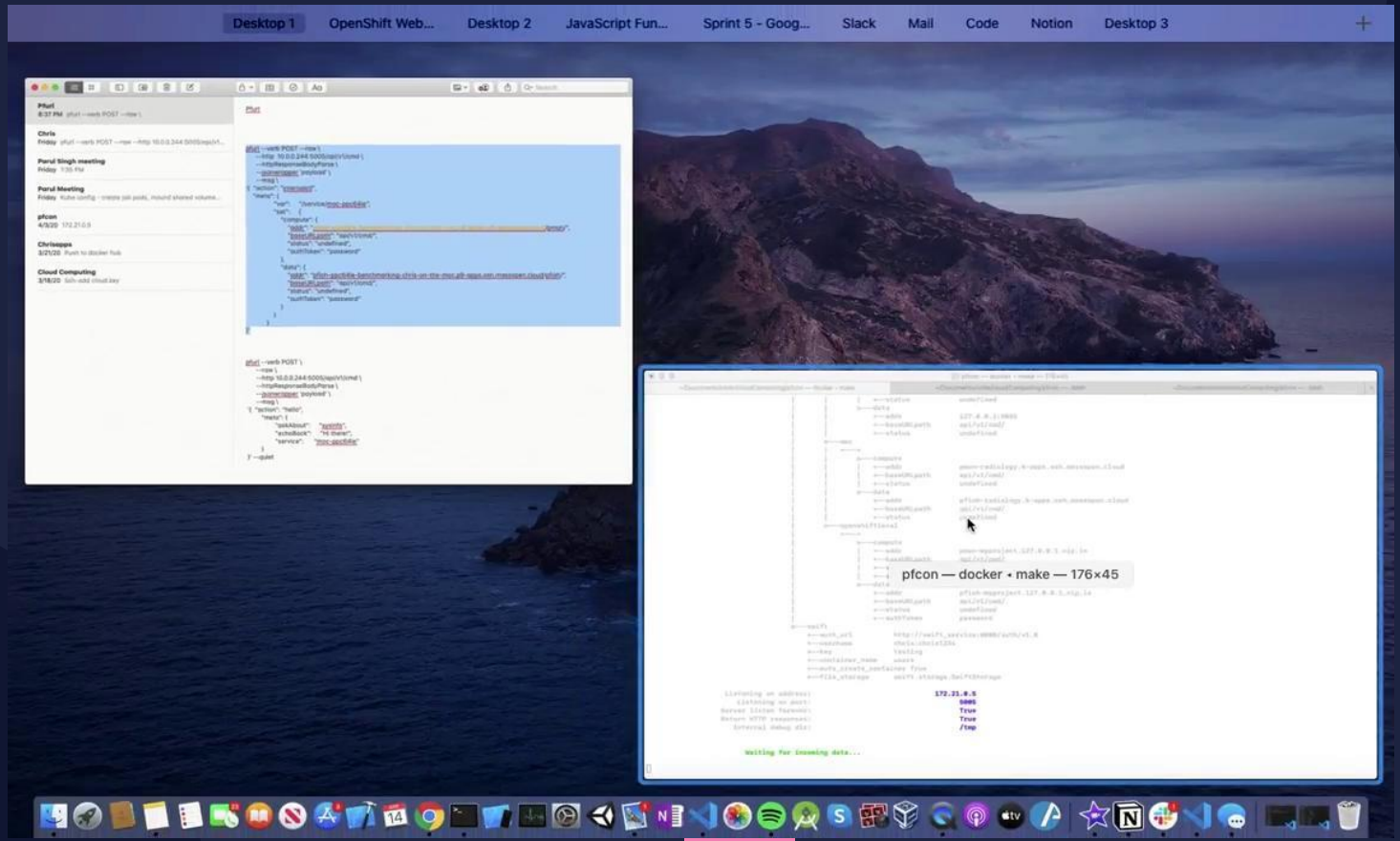
ChRIS Architecture



ChRIS Architecture



Using `pfcon` send data to `pman` and `pfioh` on MOC



Debug, rebuild, searching...

Slow, painful, time-consuming process.....

Status on Object Detection Plugin_ppc64le- lots of dependencies issue

```
Determining if the function pthread_create exists in the pthreads failed with the following output:
Change Dir: /workspace/TensorRT-OSS/build/CMakeFiles/CMakeTmp

Run Build Command(s):/usr/bin/make cmTC_9ec8c/fast && /usr/bin/make  -f CMakeFiles/cmTC_9ec8c.dir/build.make CMakeFile
make[1]: Entering directory '/workspace/TensorRT-OSS/build/CMakeFiles/CMakeTmp'
Building CXX object CMakeFiles/cmTC_9ec8c.dir/CheckFunctionExists.cxx.o
/usr/bin/g++    -Wno-deprecated-declarations  -DBUILD_SYSTEM=cmake_oss -DCHECK_FUNCTION_EXISTS=pthread_create   -std=c
SS/build/CMakeFiles/CheckLibraryExists/CheckFunctionExists.cxx
Linking CXX executable cmTC_9ec8c
/usr/local/bin/cmake -E cmake_link_script CMakeFiles/cmTC_9ec8c.dir/link.txt --verbose=1
/usr/bin/g++  -Wno-deprecated-declarations  -DBUILD_SYSTEM=cmake_oss -DCHECK_FUNCTION_EXISTS=pthread_create    CMakeFi
/usr/bin/ld: cannot find -lpthreads
collect2: error: ld returned 1 exit status
CMakeFiles/cmTC_9ec8c.dir/build.make:106: recipe for target 'cmTC_9ec8c' failed
make[1]: *** [cmTC_9ec8c] Error 1
make[1]: Leaving directory '/workspace/TensorRT-OSS/build/CMakeFiles/CMakeTmp'
Makefile:141: recipe for target 'cmTC_9ec8c/fast' failed
make: *** [cmTC_9ec8c/fast] Error 2
```

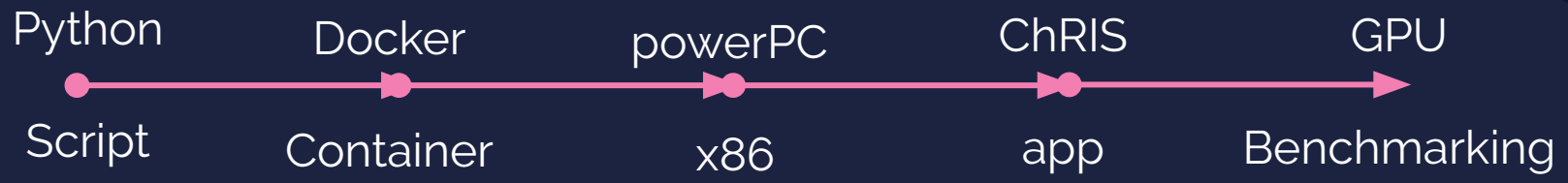
```
root@938b17d86e68:/workspace/TensorRT-OSS/build# ldconfig -p | grep pthread
        libpthread.so.0 (libc6,64bit, OS ABI: Linux 3.10.0) => /lib/powerpc64le-linux-gnu/libpthread.so.0
root@938b17d86e68:/workspace/TensorRT-OSS/build# cmake --version
cmake version 3.17.1-ge14386d
```

Status on Object Detection Plugin_ppc64le- lots of dependencies issue

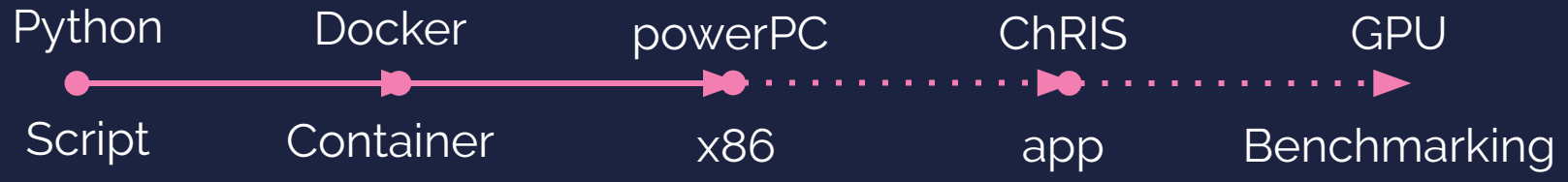
```
IALIZATION=1 -DBOOST_PYTHON_SOURCE=1 -Dboost=pycudaboost -DBOOST_THREAD_DONT_USE_CHRONO=1 -DPYGPU_PACKAGE=pycuda -DPYGPU_PYCUDA=1 -DHAVE_CURAND=1 -Is
mlce/lib/python3.7/site-packages/numpy/core/include -I/opt/anaconda/envs/wmlce/include/python3.7m -c src/cpp/cuda.cpp -o build/temp.linux-ppc64le-3.7
  In file included from src/cpp/cuda.cpp:4:0:
  src/cpp/cuda.hpp:14:10: fatal error: cuda.h: No such file or directory
   #include <cuda.h>
            ^~~~~~~~
  compilation terminated.
  error: command 'gcc' failed with exit status 1
  ----------------------------------------
  ERROR: Failed building wheel for pycuda
  Running setup.py clean for pycuda
Failed to build pycuda
```

Status in General

Matrix Multiplication



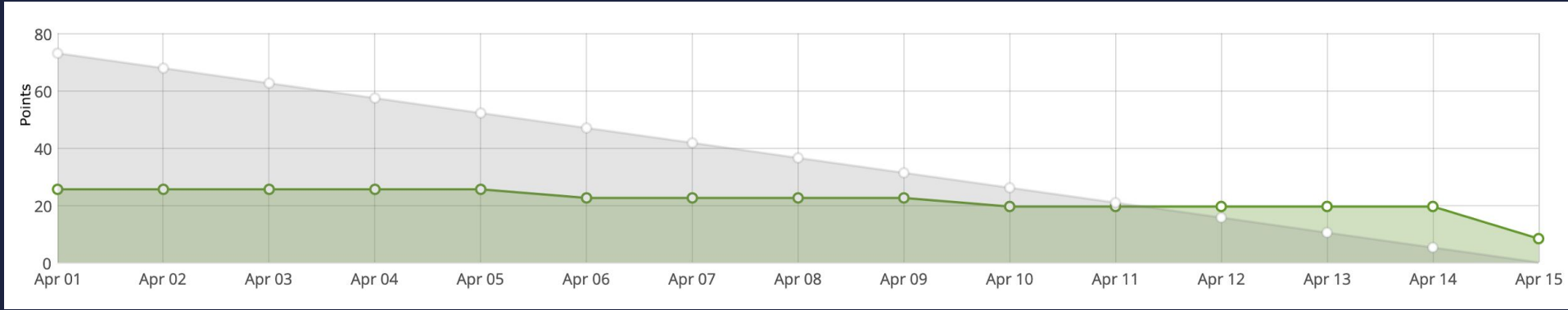
Object Detection



Next Step

- *Debugging, Debugging, Debugging!!! Fix Object Detection*
- *Test Matrix Multiplication plugin on MOC with ChRIS*

BURNDOWN CHART



THANKS

Any questions?