**********DRAFT**********

Single Value Decomposition SVD using threads
RaspBian & Ultibo bare metal
07/03/19

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https://github.com/develone/master_slave.git
master.c (main raspbian) & ultibo_th_svd.c (test_svd ultibo) is a procedure
called by the Pascal svd_FS_Rpi2.lpr.
The Ultibo version provides a remote shell using telnet, tftp, and webstatus webpage.
Creates thread that reads and image and performs the Single Value Decomposition
SVD. The singular values and the reconstructed image are written in files
that can be read by octave to display the results.
The master or ultibo_th_svd use two structures (FILEs & th_var)
found in master_slave.h
to pass infomation to the thread.

The image is read into a 2 Dim array

```
pi@mypi3-1:~/master_slave/examples $ ./build_svd.sh
Compiling master_svd
pi@mypi3-1:~/master_slave/examples $ ./master
In main red.bin Sred.bin rcred.bin 0 0
In main grn.bin Sgrn.bin rcgrn.bin 0 0
In main blu.bin Sblu.bin rcblu.bin 0 0
name: Allen
age: 20
0x0

 1st thread processing th_id[0] 0x76d67470
In mysvd input_file: red.bin
In mysvd first_output: Sred.bin
In mysvd second_output: rcred.bin
In mysvd status: 0
In mysvd num_bytes_rd: 0

In mysvd status input file read: 1 num_bytes_rd 65535
grn.bin th0.len1 = 65535
len = 263168 th0.len2 = 263168 th0.len3 = 263168 th0.len4 = 263168
setting up ptrs with malloc
pa 0x7637e408 ppa 0x7637e008
pv = 0x76526408 ppv = 0x76526008
pvt = 0x762fc408 ppvt = 0x762fc008
pds = 0x7633d408 ppds = 0x7633d008
puds = 0x763bf408 ppuds = 0x763bf008
pudsvt = 0x7627a408 ppudsvt = 0x7627a008
U row = 256 col = 256
Singular Values
V row = 256 col = 256
V' row = 256 col = 256
```

Call mul u * s
UDS row = 256 col = 256
Call mul u * ds * vt
USDVT row = 256 col = 256
ps converted from float to int 0x76440478
# of data written 0x10000

2nd thread processing th_id[1] 0x76d67470
In mysvd input_file: grn.bin
In mysvd first_output: Sgrn.bin
In mysvd second_output: rcgrn.bin
In mysvd status: 0
In mysvd num_bytes_rd: 0

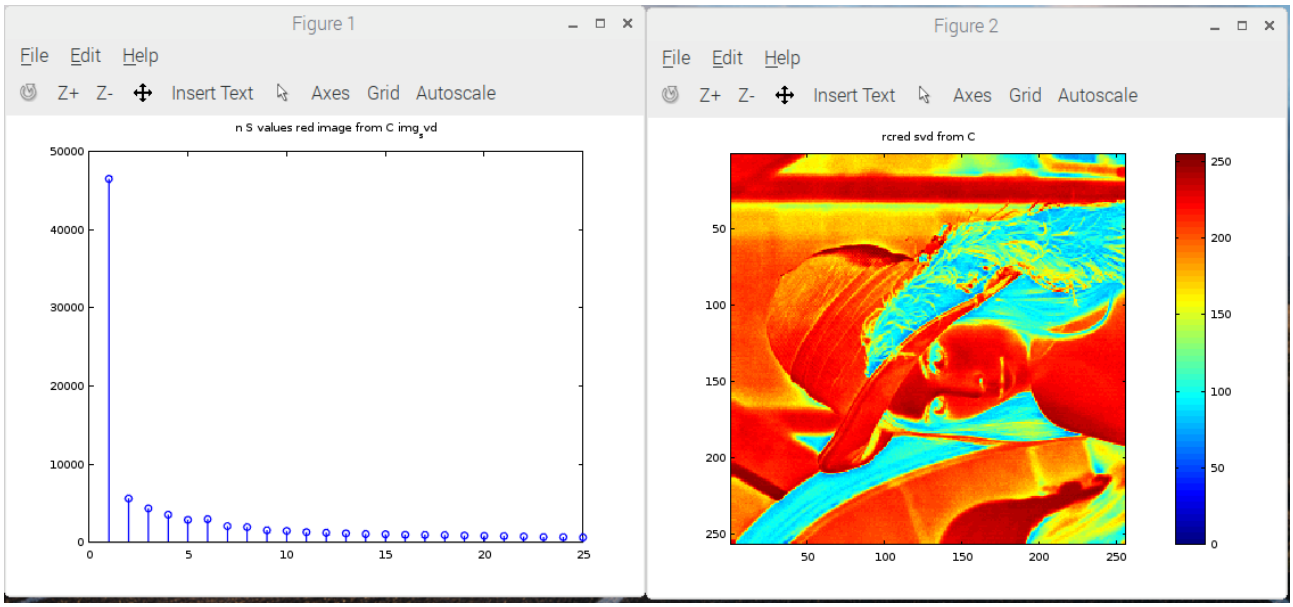
In mysvd status input file read: 1 num_bytes_rd 65535
grn.bin th1.len1 = 65535
len = 263168 th1.len2 = 263168 th1.len3 = 263168 th1.len4 = 263168
len = 263168 th1.len2 = 263168 th1.len3 = 263168 th1.len4 = 263168
setting up ptrs with malloc
pa 0x76240820 ppa 0x76240420
pv = 0x76480880 ppv = 0x76480480
pvt = 0x76000418 ppvt = 0x76000018
pds = 0x76280c28 ppds = 0x76280828
puds = 0x76200418 ppuds = 0x76200018
pudsvt = 0x76080c28 ppudsvt = 0x76080828
U row = 256 col = 256
Singular Values
V row = 256 col = 256
V' row = 256 col = 256
Call mul u * s
UDS row = 256 col = 256
Call mul u * ds * vt
USDVT row = 256 col = 256
ps converted from float to int 0x762c0c30
# of data written 0x10000

3rd thread processing th_id[2] 0x76d67470
In mysvd input_file: blu.bin
In mysvd first_output: Sblu.bin
In mysvd second_output: rcblu.bin
In mysvd status: 0
In mysvd num_bytes_rd: 0

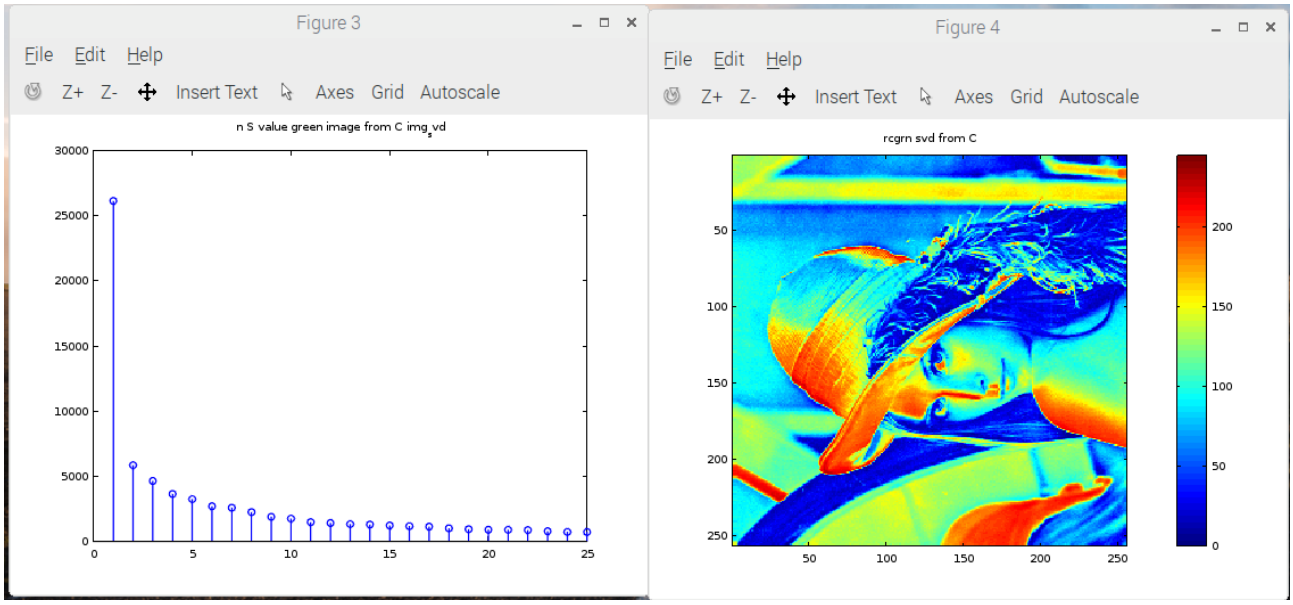
In mysvd status input file read: 1 num_bytes_rd 65535
grn.bin th2.len1 = 65535
len = 263168 th2.len2 = 263168 th2.len3 = 263168 th2.len4 = 263168
len = 263168 th1.len2 = 263168 th1.len3 = 263168 th1.len4 = 263168
setting up ptrs with malloc
pa 0x76040820 ppa 0x76040420
pv = 0x76480880 ppv = 0x76480480
pvt = 0x76100418 ppvt = 0x76100018
pds = 0x76080c28 ppds = 0x76080828

puds = 0x76000418 ppuds = 0x76000018
pudsvt = 0x76180c28 ppudsvt = 0x76180828
U row = 256 col = 256
Singular Values
V row = 256 col = 256
V' row = 256 col = 256
Call mul u * s
UDS row = 256 col = 256
Call mul u * ds * vt
USDVT row = 256 col = 256
ps converted from float to int 0x760c0c30
# of data written 0x10000
all threads joined
In main status 4 num_bytes_rd 65535
In main status 4 num_bytes_rd 65535
In main status 4 num_bytes_rd 65535

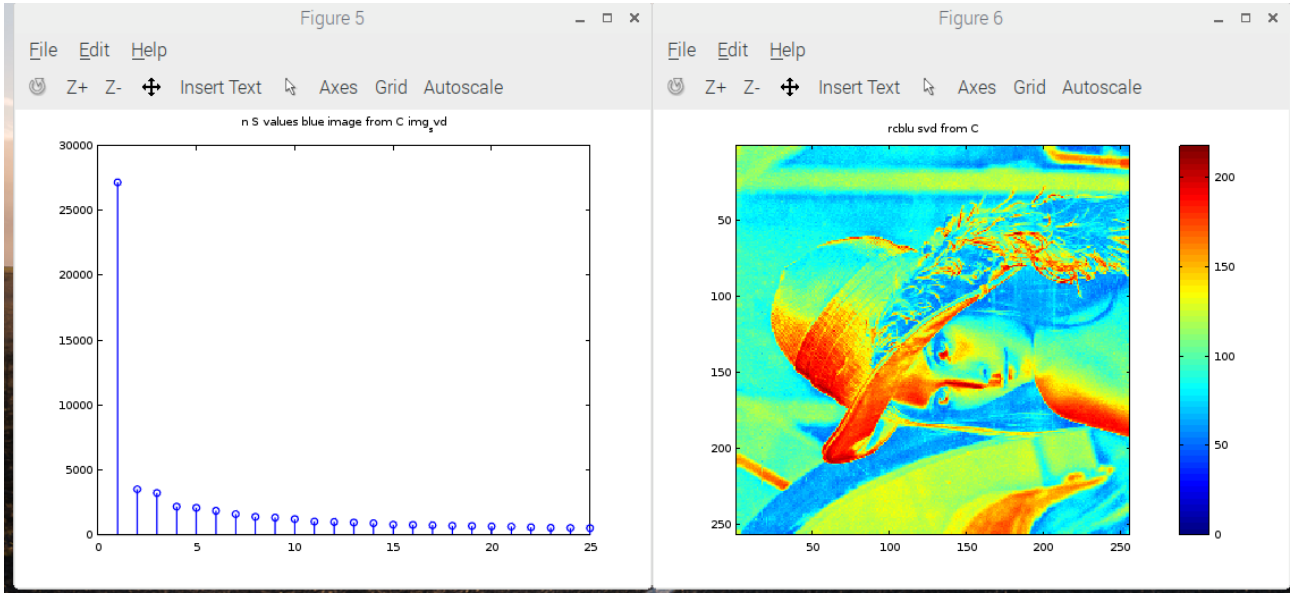
First 5 of 256 values from svd of red image 4.6490e+04 5.5967e+03 4.3327e+03 3.5266e+03 2.8699e+03



First 5 of 256 values from svd of grn image 2.6137e+04 5.8601e+03 4.6489e+03 3.6501e+03 3.2528e+03



First 5 of 256 values from svd of blu image 2.7159e+04 3.5082e+03 3.2195e+03 2.1732e+03 2.0808e+03



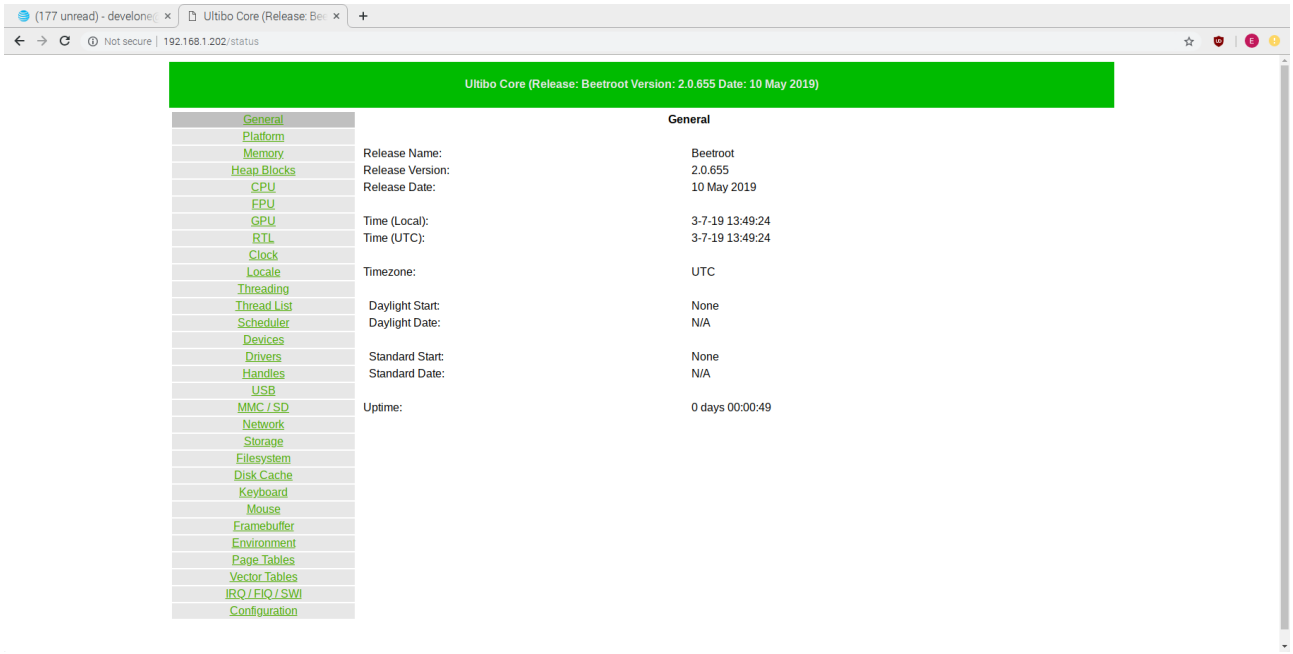
export PATH=/home/pi/ultibo/core/fpc/bin:$PATH

pi@mypi3-1:~/master_slave/examples $ ./buildlib.sh
Compiling example ultibo_th_svd
pi@mypi3-1:~/master_slave/examples $ fpc -vi -B -Tultibo -Parm -CpARMV7A -WpRPI2B @/home/pi/ultibo/core/fpc/bin/RPI2.CFG -O4 svd_FS_RPi2.lpr
Free Pascal Compiler version 3.1.1 [2019/05/15] for arm
Copyright (c) 1993-2015 by Florian Klaempfl and others
Target OS: Ultibo
Compiling svd_FS_RPi2.lpr
Compiling uTFTP.pas
Assembling utftp
svd_FS_RPi2.lpr(40,2) Note: Local variable "MyPLoggingDevice" not used

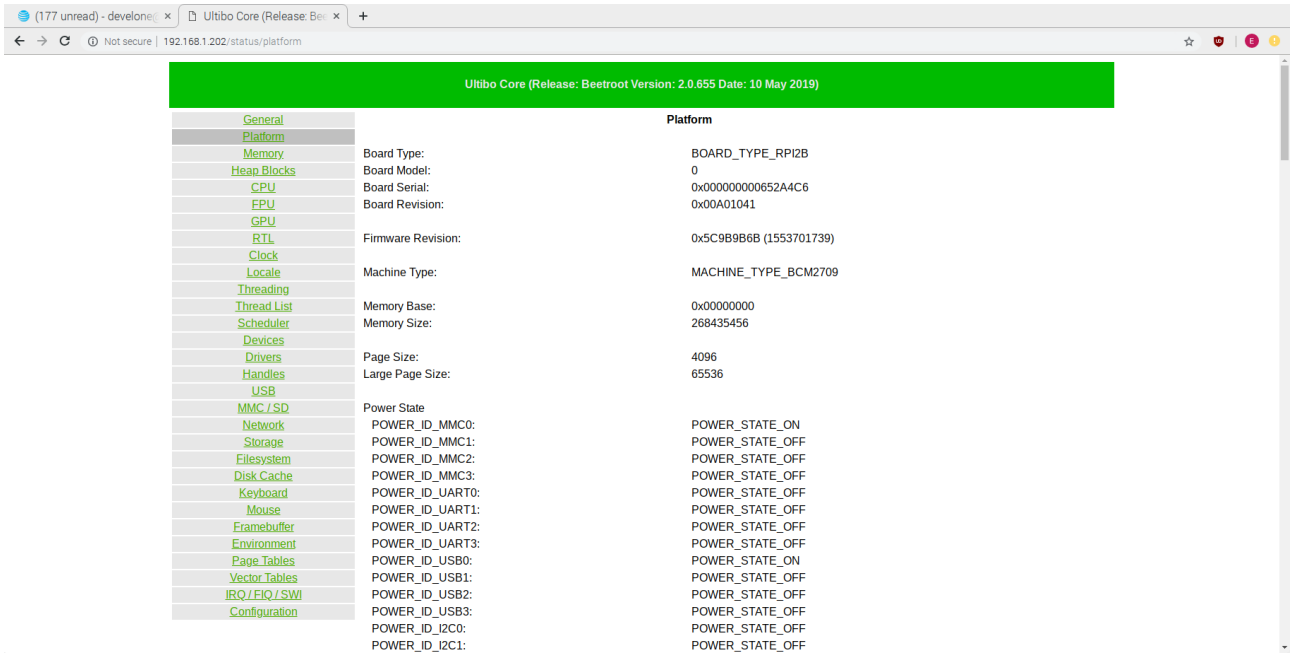
svd_FS_RPi2.lpr(42,2) Note: Local variable "Handle1" not used
svd_FS_RPi2.lpr(43,2) Note: Local variable "Handle3" not used
svd_FS_RPi2.lpr(45,2) Note: Local variable "Window" not used
Assembling svd_fs_rpi2
Linking svd_FS_RPi2
687 lines compiled, 5.5 sec, 2831536 bytes code, 91356 bytes data
4 note(s) issued

pi@mypi3-1:~/master_slave/examples $ tftp 192.168.1.202 < cmdstftp
tftp> tftp> Sent 2897352 bytes in 33.5 seconds

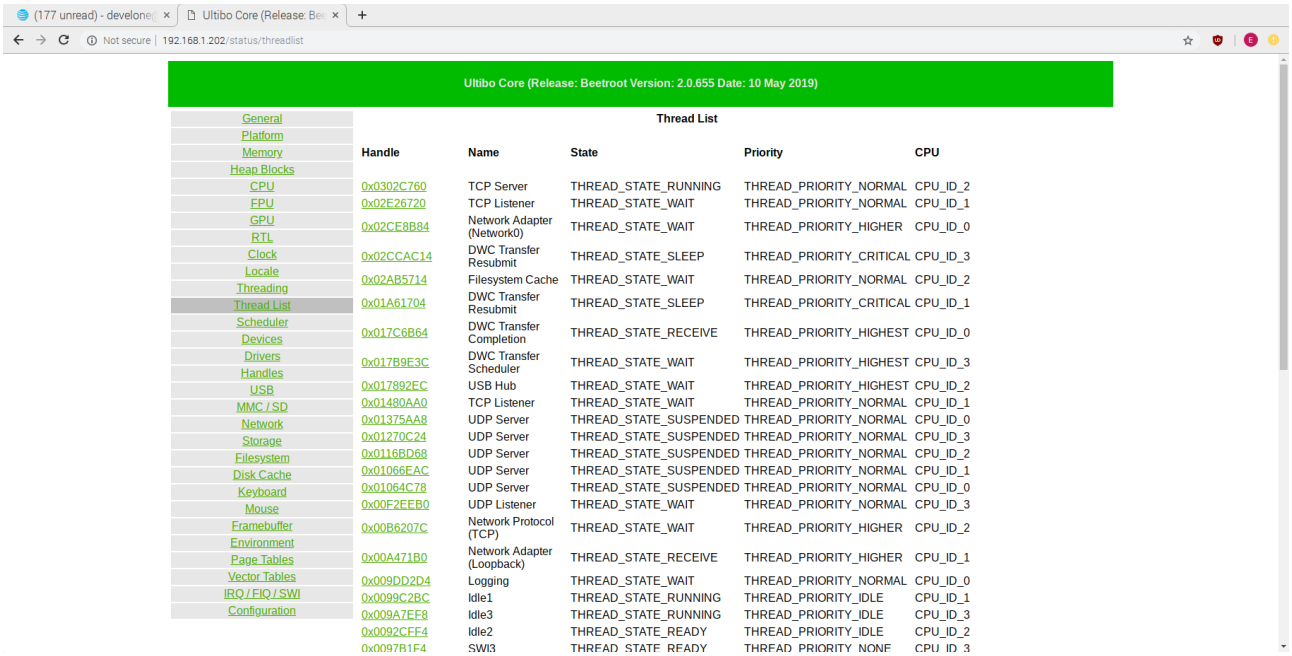
Home page



Platform



Thread List



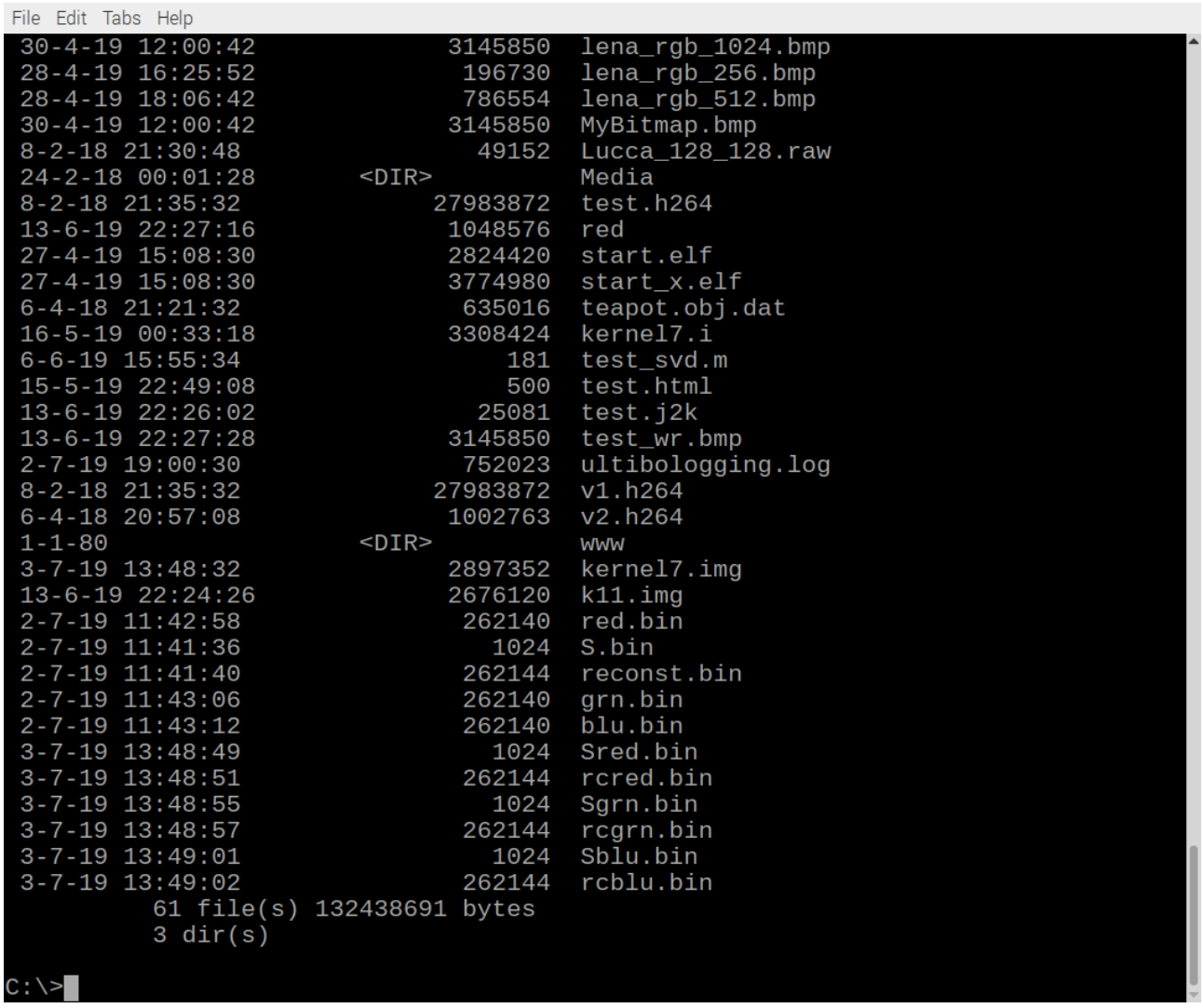
Ultibo Core (Release: Beetroot Version: 2.0.655 Date: 10 May 2019)

General | Platform | Memory | Heap Blocks | CPU | FPU | GPU | RTL | Clock | Locale | Threading | Thread List | Scheduler | Devices | Drivers | Handles | USB | MMC / SD | Network | Storage | Filesystem | Disk Cache | Keyboard | Mouse | Framebuffer | Environment | Page Tables | Vector Tables | IRQ / FIQ / SWI | Configuration

Thread List

Handle	Name	State	Priority	CPU
0x0302C760	TCP Server	THREAD_STATE_RUNNING	THREAD_PRIORITY_NORMAL	CPU_ID_2
0x02E26720	TCP Listener	THREAD_STATE_WAIT	THREAD_PRIORITY_NORMAL	CPU_ID_1
0x02CE8B84	Network Adapter (Network0)	THREAD_STATE_WAIT	THREAD_PRIORITY_HIGHER	CPU_ID_0
0x02CCAC14	DWC Transfer Resubmit	THREAD_STATE_SLEEP	THREAD_PRIORITY_CRITICAL	CPU_ID_3
0x02AB5714	Filesystem Cache	THREAD_STATE_WAIT	THREAD_PRIORITY_NORMAL	CPU_ID_2
0x01A61704	DWC Transfer Resubmit	THREAD_STATE_SLEEP	THREAD_PRIORITY_CRITICAL	CPU_ID_1
0x017C6B64	DWC Transfer Completion	THREAD_STATE_RECEIVE	THREAD_PRIORITY_HIGHEST	CPU_ID_0
0x017B9E3C	DWC Transfer Scheduler	THREAD_STATE_WAIT	THREAD_PRIORITY_HIGHEST	CPU_ID_3
0x017892EC	USB Hub	THREAD_STATE_WAIT	THREAD_PRIORITY_HIGHEST	CPU_ID_2
0x01480AA0	TCP Listener	THREAD_STATE_WAIT	THREAD_PRIORITY_NORMAL	CPU_ID_1
0x01375AA8	UDP Server	THREAD_STATE_SUSPENDED	THREAD_PRIORITY_NORMAL	CPU_ID_0
0x01270C24	UDP Server	THREAD_STATE_SUSPENDED	THREAD_PRIORITY_NORMAL	CPU_ID_3
0x0116BD68	UDP Server	THREAD_STATE_SUSPENDED	THREAD_PRIORITY_NORMAL	CPU_ID_2
0x01066EAC	UDP Server	THREAD_STATE_SUSPENDED	THREAD_PRIORITY_NORMAL	CPU_ID_1
0x01064C78	UDP Server	THREAD_STATE_SUSPENDED	THREAD_PRIORITY_NORMAL	CPU_ID_0
0x00F2EEB0	UDP Listener	THREAD_STATE_WAIT	THREAD_PRIORITY_NORMAL	CPU_ID_3
0x00B6207C	Network Protocol (TCP)	THREAD_STATE_WAIT	THREAD_PRIORITY_HIGHER	CPU_ID_2
0x00A471B0	Network Adapter (Loopback)	THREAD_STATE_RECEIVE	THREAD_PRIORITY_HIGHER	CPU_ID_1
0x009DD2D4	Logging	THREAD_STATE_WAIT	THREAD_PRIORITY_NORMAL	CPU_ID_0
0x0099C2BC	Idle1	THREAD_STATE_RUNNING	THREAD_PRIORITY_IDLE	CPU_ID_1
0x009A7EF8	Idle3	THREAD_STATE_RUNNING	THREAD_PRIORITY_IDLE	CPU_ID_3
0x0092CFF4	Idle2	THREAD_STATE_READY	THREAD_PRIORITY_IDLE	CPU_ID_2
0x0097B1F4	SWI3	THREAD_STATE_READY	THREAD_PRIORITY_NONE	CPU_ID_3

Remote Shell



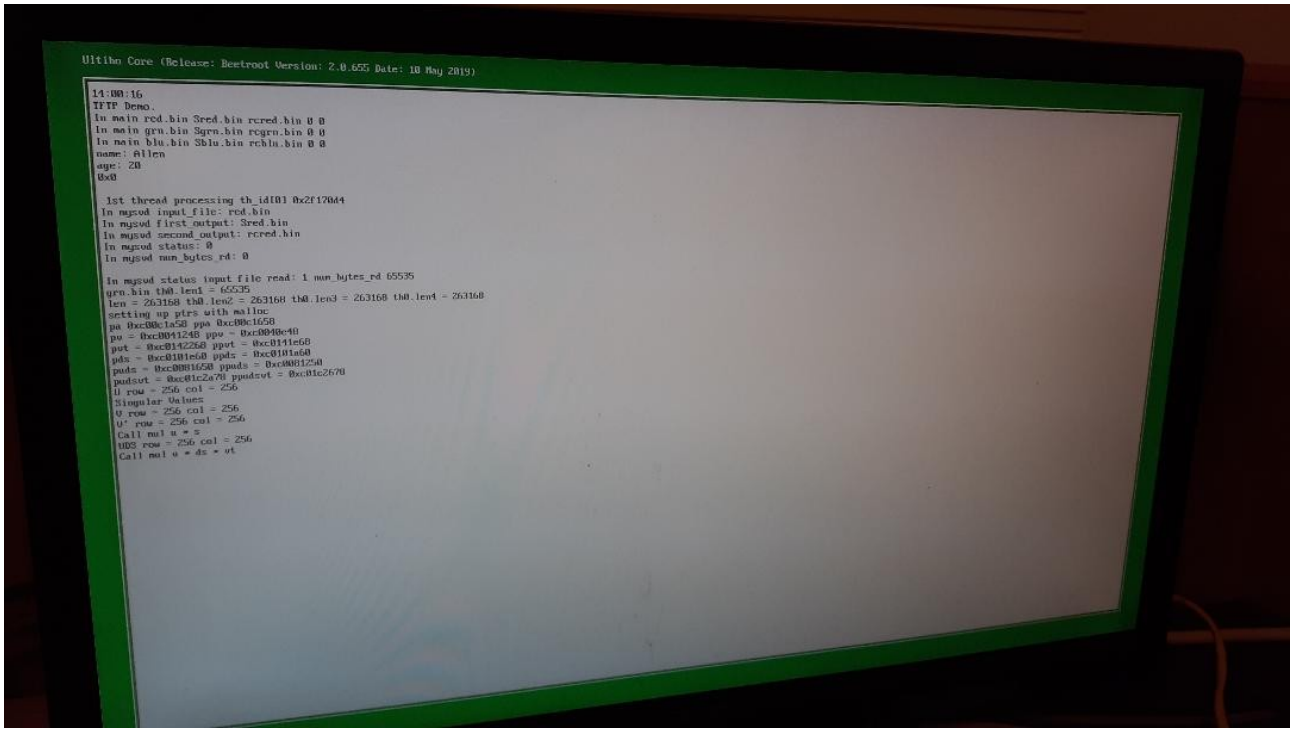
```
File  Edit  Tabs  Help
 30-4-19  12:00:42            3145850  lena_rgb_1024.bmp
 28-4-19  16:25:52             196730  lena_rgb_256.bmp
 28-4-19  18:06:42             786554  lena_rgb_512.bmp
 30-4-19  12:00:42            3145850  MyBitmap.bmp
 8-2-18  21:30:48               49152  Lucca_128_128.raw
 24-2-18  00:01:28       <DIR>         Media
 8-2-18  21:35:32            27983872  test.h264
 13-6-19  22:27:16            1048576  red
 27-4-19  15:08:30            2824420  start.elf
 27-4-19  15:08:30            3774980  start_x.elf
 6-4-18  21:21:32              635016  teapot.obj.dat
 16-5-19  00:33:18            3308424  kernel7.i
 6-6-19  15:55:34                 181  test_svd.m
 15-5-19  22:49:08                500  test.html
 13-6-19  22:26:02              25081  test.j2k
 13-6-19  22:27:28            3145850  test_wr.bmp
 2-7-19  19:00:30              752023  ultibologging.log
 8-2-18  21:35:32            27983872  v1.h264
 6-4-18  20:57:08            1002763  v2.h264
 1-1-80                  <DIR>         www
 3-7-19  13:48:32            2897352  kernel7.img
 13-6-19  22:24:26           2676120  k11.img
 2-7-19  11:42:58             262140  red.bin
 2-7-19  11:41:36               1024  S.bin
 2-7-19  11:41:40             262144  reconst.bin
 2-7-19  11:43:06             262140  grn.bin
 2-7-19  11:43:12             262140  blu.bin
 3-7-19  13:48:49               1024  Sred.bin
 3-7-19  13:48:51             262144  rcred.bin
 3-7-19  13:48:55               1024  Sgrn.bin
 3-7-19  13:48:57             262144  rcgrn.bin
 3-7-19  13:49:01               1024  Sblu.bin
 3-7-19  13:49:02             262144  rcblu.bin
         61 file(s) 132438691 bytes
         3 dir(s)

C:\>
```

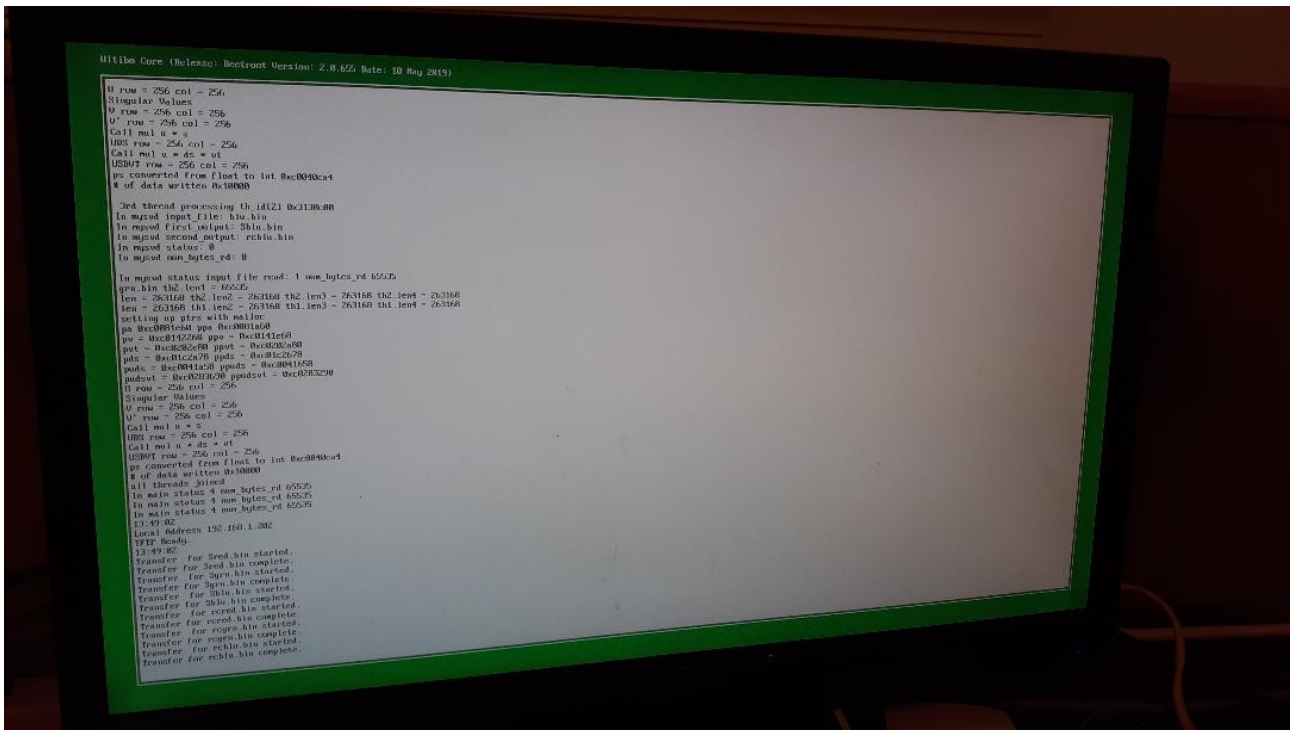
pi@mypi3-1:~/master_slave/examples $ tftp 192.168.1.202

tftp> binary
tftp> get Sred.bin
Error code 5: 52531
Received 1024 bytes in 5.0 seconds
tftp> get Sgrn.bin
Error code 5: 37941
Received 1024 bytes in 5.0 seconds
tftp> get Sblu.bin
Error code 5: 47595
Received 1024 bytes in 5.0 seconds
tftp> get rcred.bin
Error code 5: 40661
Received 262144 bytes in 6.0 seconds
tftp> get rcgrn.bin
Error code 5: 51602
Received 262144 bytes in 6.4 seconds
tftp> get rcblu.bin
Error code 5: 54316
Received 262144 bytes in 6.0 seconds
tftp> quit

Reboot



Transfer of Files.



First 5 of 256 values from svd of red image 4.6490e+04 5.5965e+03 4.3319e+03 3.5266e+03 2.8700e+03

First 5 of 256 values from svd of grn image 2.6137e+04 5.8596e+03 4.6487e+03 3.6502e+03 3.2528e+03

First 5 of 256 values from svd of blu image 2.7159e+04 3.5077e+03 3.2194e+03 2.1732e+03 2.0808e+03