

Ubuntu/ZCU106

ZCU111 と同じようにビルド .

スクリプト化した . <https://github.com/miyo/build-zcu106-linux>

あとは必要なものを SD カードに書くだけ .

SD カードの用意

先頭に 200M くらいの FAT 領域 , 残りに ext4 領域を作る

FAT 領域のタイプは c(W95 FAT32 (LBA)) , ext4 の方は 83(Linux) にセットする .

で ,

```
mkfs.vfat -F 32 -n boot /dev/sdX1
mkfs.ext4 -L root /dev/sdX2
```

などとしてフォーマット . X のところは自分の環境にあわせる .

コピー

あとは , SD カードの先頭に作った FAT パーティションに \${WORK}/image の中身をコピー .

二番目のパーティションには QEMU で作ったルートパーティションを展開

USB-UART

Linux だと /dev/ttyUSB{0,1,2,3} が見える . /dev/ttyUSB0 に接続する .

(ZCU111 は /dev/ttyUSB1 だったので注意)

rftool をビルドしてみよう

petalinux なプロジェクトから rftool を実機にコピーしてビルドしてみることに

- "rfdc.h" を求められるので <rfdc.h> に書き換え
- rfdc のヘッダファイルを /usr/local/include/rfdc にコピー
- Makefile に CFLAGS = -I/usr/local/include/rfdc

を追加 . これで , とりあえずビルドはできた .

fpgautil がない

rftool を動かしてみようとおもったら fpgautil がなかった .

```
git clone https://github.com/Xilinx/meta-xilinx-tools.git
```

で ,

```
cd meta-xilinx-tools/recipes-bsp/fpga-manager-script/files
make fpgautil
```

でよかった .

ZCU106 のベンチマーク

とりあえず BYTE UNIX Benchmarks

Benchmark Run: Thu Dec 03 2020 05:46:53 - 06:14:57
4 CPUs in system; running 1 parallel copy of tests

Dhrystone 2 using register variables	6372358.5	lps	(10.0 s, 7 samples)
Double-Precision Whetstone	1156.6	MWIPS	(9.8 s, 7 samples)
Execl Throughput	1674.6	lps	(30.0 s, 2 samples)
File Copy 1024 bufsize 2000 maxblocks	168388.8	KBps	(30.0 s, 2 samples)
File Copy 256 bufsize 500 maxblocks	50505.4	KBps	(30.0 s, 2 samples)
File Copy 4096 bufsize 8000 maxblocks	438224.3	KBps	(30.0 s, 2 samples)
Pipe Throughput	397549.8	lps	(10.0 s, 7 samples)
Pipe-based Context Switching	73965.6	lps	(10.0 s, 7 samples)
Process Creation	4355.1	lps	(30.0 s, 2 samples)
Shell Scripts (1 concurrent)	2905.9	lpm	(60.0 s, 2 samples)
Shell Scripts (8 concurrent)	963.4	lpm	(60.0 s, 2 samples)
System Call Overhead	608372.4	lps	(10.0 s, 7 samples)

System Benchmarks Index Values	BASELINE	RESULT	INDEX
Dhrystone 2 using register variables	116700.0	6372358.5	546.0
Double-Precision Whetstone	55.0	1156.6	210.3
Execl Throughput	43.0	1674.6	389.4
File Copy 1024 bufsize 2000 maxblocks	3960.0	168388.8	425.2
File Copy 256 bufsize 500 maxblocks	1655.0	50505.4	305.2
File Copy 4096 bufsize 8000 maxblocks	5800.0	438224.3	755.6
Pipe Throughput	12440.0	397549.8	319.6
Pipe-based Context Switching	4000.0	73965.6	184.9
Process Creation	126.0	4355.1	345.6
Shell Scripts (1 concurrent)	42.4	2905.9	685.3
Shell Scripts (8 concurrent)	6.0	963.4	1605.7
System Call Overhead	15000.0	608372.4	405.6

System Benchmarks Index Score =====
430.0

Benchmark Run: Thu Dec 03 2020 06:14:57 - 06:43:02
4 CPUs in system; running 4 parallel copies of tests

Dhrystone 2 using register variables	25487070.9	lps	(10.0 s, 7 samples)
Double-Precision Whetstone	4627.6	MWIPS	(9.8 s, 7 samples)
Execl Throughput	6123.9	lps	(30.0 s, 2 samples)
File Copy 1024 bufsize 2000 maxblocks	318714.5	KBps	(30.0 s, 2 samples)
File Copy 256 bufsize 500 maxblocks	88220.4	KBps	(30.0 s, 2 samples)
File Copy 4096 bufsize 8000 maxblocks	914718.4	KBps	(30.0 s, 2 samples)
Pipe Throughput	1596831.6	lps	(10.0 s, 7 samples)
Pipe-based Context Switching	287838.8	lps	(10.0 s, 7 samples)
Process Creation	12114.5	lps	(30.0 s, 2 samples)
Shell Scripts (1 concurrent)	7948.9	lpm	(60.0 s, 2 samples)
Shell Scripts (8 concurrent)	1031.4	lpm	(60.1 s, 2 samples)
System Call Overhead	2331185.6	lps	(10.0 s, 7 samples)

System Benchmarks Index Values	BASELINE	RESULT	INDEX
Dhrystone 2 using register variables	116700.0	25487070.9	2184.0
Double-Precision Whetstone	55.0	4627.6	841.4
Execl Throughput	43.0	6123.9	1424.2
File Copy 1024 bufsize 2000 maxblocks	3960.0	318714.5	804.8
File Copy 256 bufsize 500 maxblocks	1655.0	88220.4	533.1
File Copy 4096 bufsize 8000 maxblocks	5800.0	914718.4	1577.1
Pipe Throughput	12440.0	1596831.6	1283.6
Pipe-based Context Switching	4000.0	287838.8	719.6
Process Creation	126.0	12114.5	961.5
Shell Scripts (1 concurrent)	42.4	7948.9	1874.8
Shell Scripts (8 concurrent)	6.0	1031.4	1719.0
System Call Overhead	15000.0	2331185.6	1554.1

System Benchmarks Index Score =====
1187.7

user@zcu106: /byte-unixbench/UnixBench\$

STREAM は、

```
user@zcu106: /STREAM-master$ gcc -DSTREAM_ARRAY_SIZE=4000000 -O2 -fopenmp -o stream stream.c
user@zcu106: /STREAM-master$ ./stream
```

STREAM version \$Revision: 5.10 \$

```

-----
This system uses 8 bytes per array element.
-----
Array size = 4000000 (elements), Offset = 0 (elements)
Memory per array = 305.2 MiB (= 0.3 GiB).
Total memory required = 915.5 MiB (= 0.9 GiB).
Each kernel will be executed 10 times.
The *best* time for each kernel (excluding the first iteration)
will be used to compute the reported bandwidth.
-----
Number of Threads requested = 4
Number of Threads counted = 4
-----
Your clock granularity/precision appears to be 1 microseconds.
Each test below will take on the order of 119349 microseconds.
(= 119349 clock ticks)
Increase the size of the arrays if this shows that
you are not getting at least 20 clock ticks per test.
-----
WARNING -- The above is only a rough guideline.
For best results, please be sure you know the
precision of your system timer.
-----
Function    Best Rate MB/s  Avg time     Min time     Max time
Copy:       9058.9         0.071932    0.070649    0.074034
Scale:      7858.5         0.084209    0.081440    0.090125
Add:        7354.7         0.131362    0.130529    0.132072
Triad:      5933.6         0.162834    0.161791    0.163859
-----
Solution Validates: avg error less than 1.000000e-13 on all three arrays
-----
user@zcu106: /STREAM-master$ OMP_NUM_THREADS=1 ./stream
-----
STREAM version $Revision: 5.10 $
-----
This system uses 8 bytes per array element.
-----
Array size = 4000000 (elements), Offset = 0 (elements)
Memory per array = 305.2 MiB (= 0.3 GiB).
Total memory required = 915.5 MiB (= 0.9 GiB).
Each kernel will be executed 10 times.
The *best* time for each kernel (excluding the first iteration)
will be used to compute the reported bandwidth.
-----
Number of Threads requested = 1
Number of Threads counted = 1
-----
Your clock granularity/precision appears to be 1 microseconds.
Each test below will take on the order of 298444 microseconds.
(= 298444 clock ticks)
Increase the size of the arrays if this shows that
you are not getting at least 20 clock ticks per test.
-----
WARNING -- The above is only a rough guideline.
For best results, please be sure you know the
precision of your system timer.
-----
Function    Best Rate MB/s  Avg time     Min time     Max time
Copy:       4044.8         0.163095    0.158229    0.170722
Scale:      2209.2         0.291470    0.289698    0.293948
Add:        2277.1         0.421664    0.421598    0.421831
Triad:      1804.5         0.532179    0.532003    0.532374
-----
Solution Validates: avg error less than 1.000000e-13 on all three arrays
-----
user@zcu106: /STREAM-master$ OMP_NUM_THREADS=2 ./stream
-----
STREAM version $Revision: 5.10 $
-----
This system uses 8 bytes per array element.
-----
Array size = 4000000 (elements), Offset = 0 (elements)
Memory per array = 305.2 MiB (= 0.3 GiB).
Total memory required = 915.5 MiB (= 0.9 GiB).
Each kernel will be executed 10 times.
The *best* time for each kernel (excluding the first iteration)
will be used to compute the reported bandwidth.
-----
Number of Threads requested = 2
Number of Threads counted = 2
-----
Your clock granularity/precision appears to be 1 microseconds.

```

Each test below will take on the order of 160329 microseconds.
(= 160329 clock ticks)
Increase the size of the arrays if this shows that
you are not getting at least 20 clock ticks per test.

WARNING -- The above is only a rough guideline.
For best results, please be sure you know the
precision of your system timer.

Function Best Rate MB/s Avg time Min time Max time
Copy: 7377.2 0.090815 0.086754 0.093672
Scale: 4324.7 0.150540 0.147987 0.152486
Add: 4442.9 0.216218 0.216074 0.216463
Triad: 3487.0 0.276336 0.275306 0.277016

Solution Validates: avg error less than 1.000000e-13 on all three arrays
