***********Draft***********

Custom Raspbian Image
image_2018-02-07-RaspbianUltibo.zip
Created with pi-gen
Testing Lazarus/FPC
Comparing number files needed
for VideoCore Apps
Raspbian & Ultibo
02/13/18

***********Draft***********

Introduction:
The overall goal is to create a bootable micro sd card ready to start developing Ultibo applications using Lazarus IDE (Ultibo Edition).with Free Pascal Compiler FPC. This was made possible with creation of the ***"ultiboinstaller.sh"*** found at https://github.com/ultibohub/Tools/blob/master/Installer/Core/Linux/ultiboinstaller.sh by Gary from Ultibo, ***"pi-gen"*** and the ***"Stretch Raspbain release"*** make this possible. Ultibo releassed an installer script "utiboinstaller.sh" that installs Lazarus and Free Pascal Compiler
FPC on the Raspberry Pi. This marks a milestone in the Ultibo Bare Metal development providing an Intregrated Development Enviornment (IDE). The Strech Raspbian release still needs serveral dependencies to install Lazarus IDE (Ultibo Edition).with Free Pascal Compiler FPC. In addition, other tools such as arm-none-eabi tools, telnet, tftp, gitk, diffuse, hexedit are desired.
This is why pi-gen was used to get the system up quickly.

The target system is Linux based since the Linux firmware plus the
kernel7.img or kernel.img are what make ultibo run on the RPi hardware.
We currenty have a Lazarus/FPC executeable that runs on Windows System.
This still requires the binutils and arm-none-eabi compiler.

Creating the boot & rootfs in zip file that can be transferred to the micro sd card:
This requred several steps found in ***Appendix A: Notes during pi-gen testing***

Comparing number files needed for VideoCore Apps Raspbian & Ultibo.

Ultibo only requires a few files.
bootcode.bin
start.elf
fixup.dat

kernel.img RPi Zero or kernel7.img (RPi2B or RPi3B)

test.h264 needed for hello_videocube.bin

On Raspbian stretch requires
1313 packages
1400 packages with Ultibo dependencies

1420 packages with Ultibo & tools
Several thousand files are needed with an O/S
Below are the numbers of the main directories.

/usr/bin
1 directory, 1411 files
/usr/lib
3632 directories, 33202 files
sudo su
First need to compile the libraries
cd /opt/vc/src/hello_pi/libs/ilclient
make
cd /opt/vc/src/hello_pi/libs/vgfont
make

Next compile and test the apps

cd ../../hello_videocube/
make
./hello_videocube.bin

cd ../hello_tiger/
make
./hello_tiger.bin

The following 4 images were complied on Rpi2B for a Rpi Zero. The first 2 are 2D image of Rotating Tiger and 3rd & 4th are of a Rotating cube.

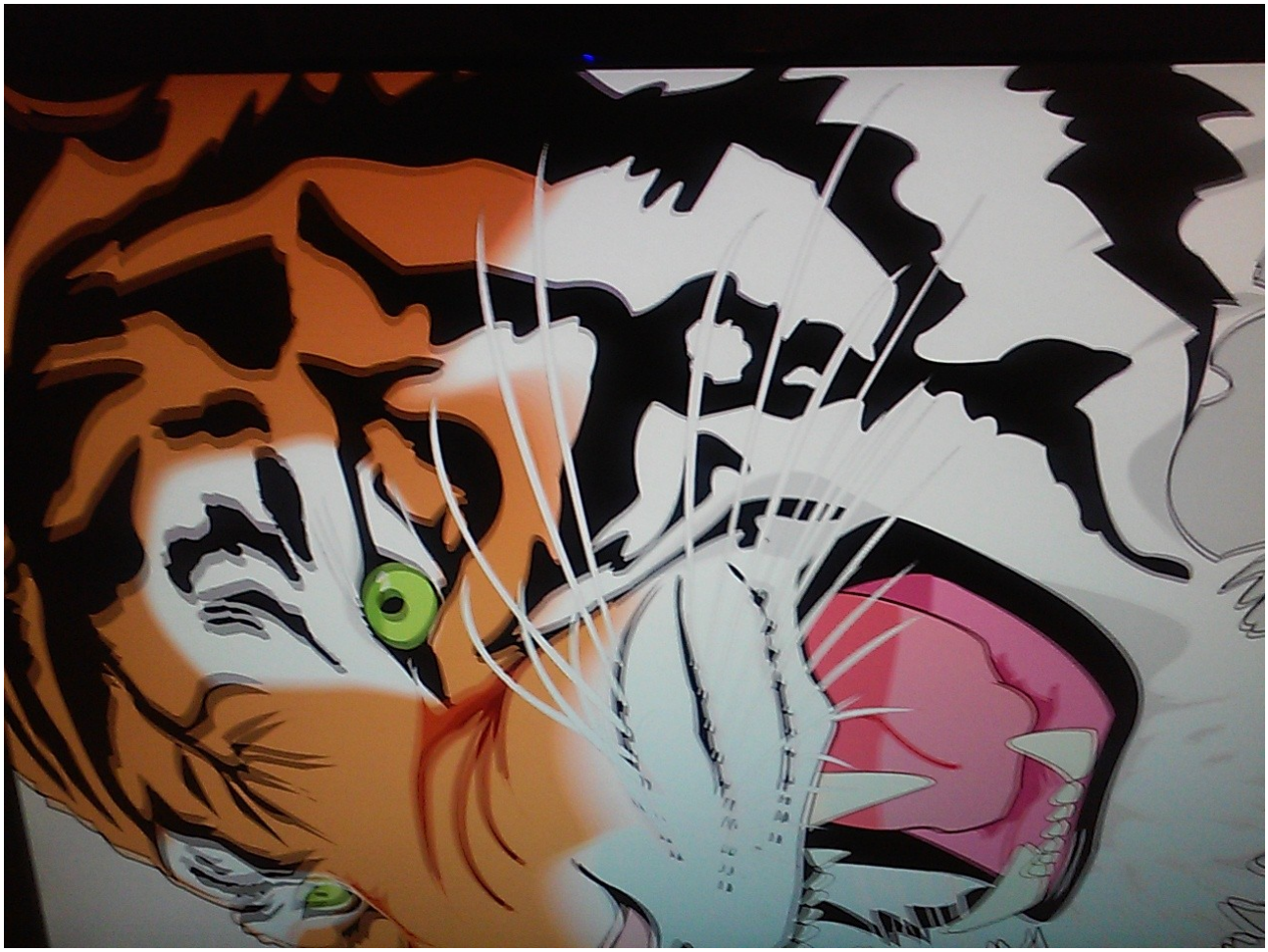


Image 1

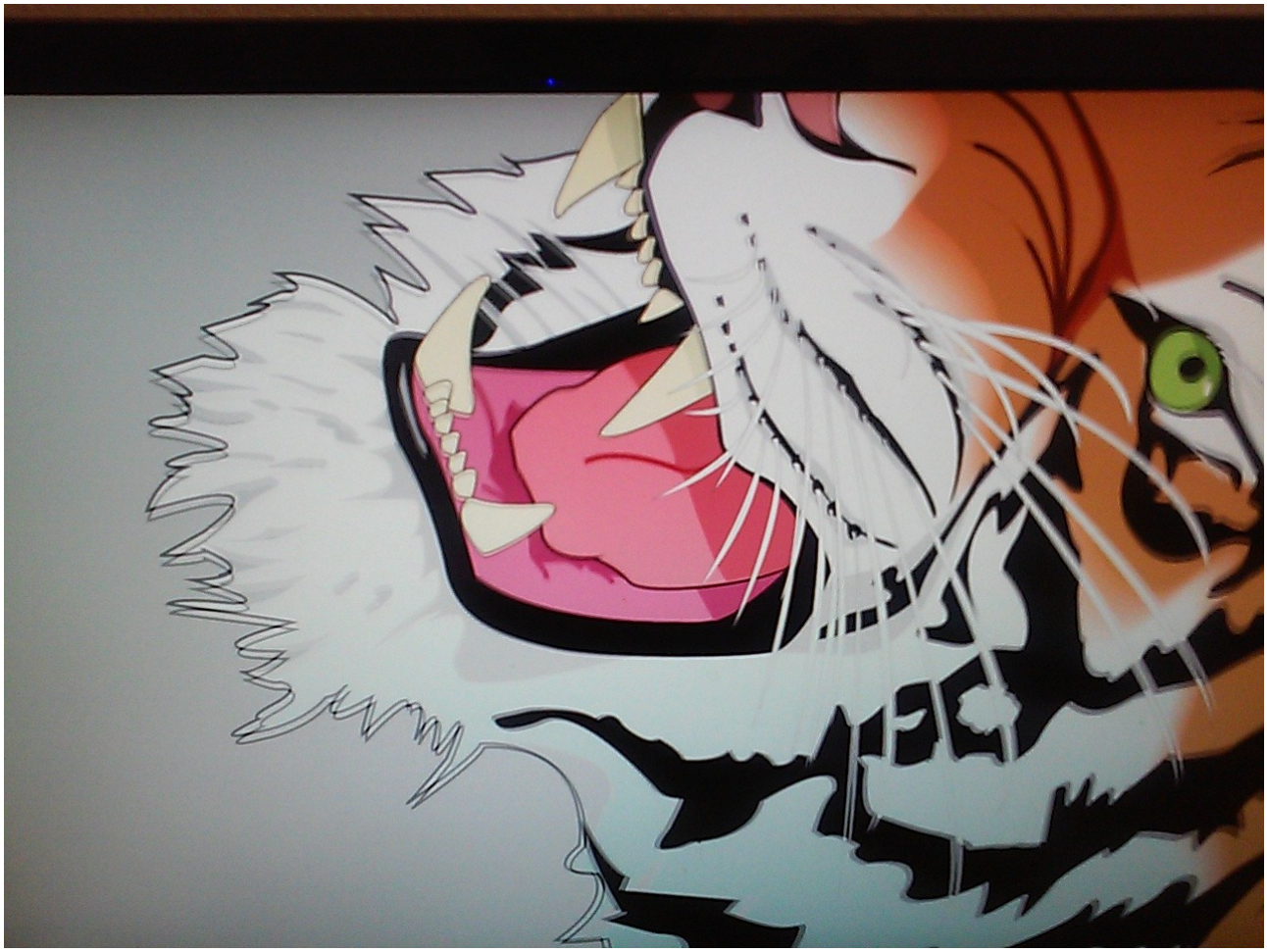


Image 2

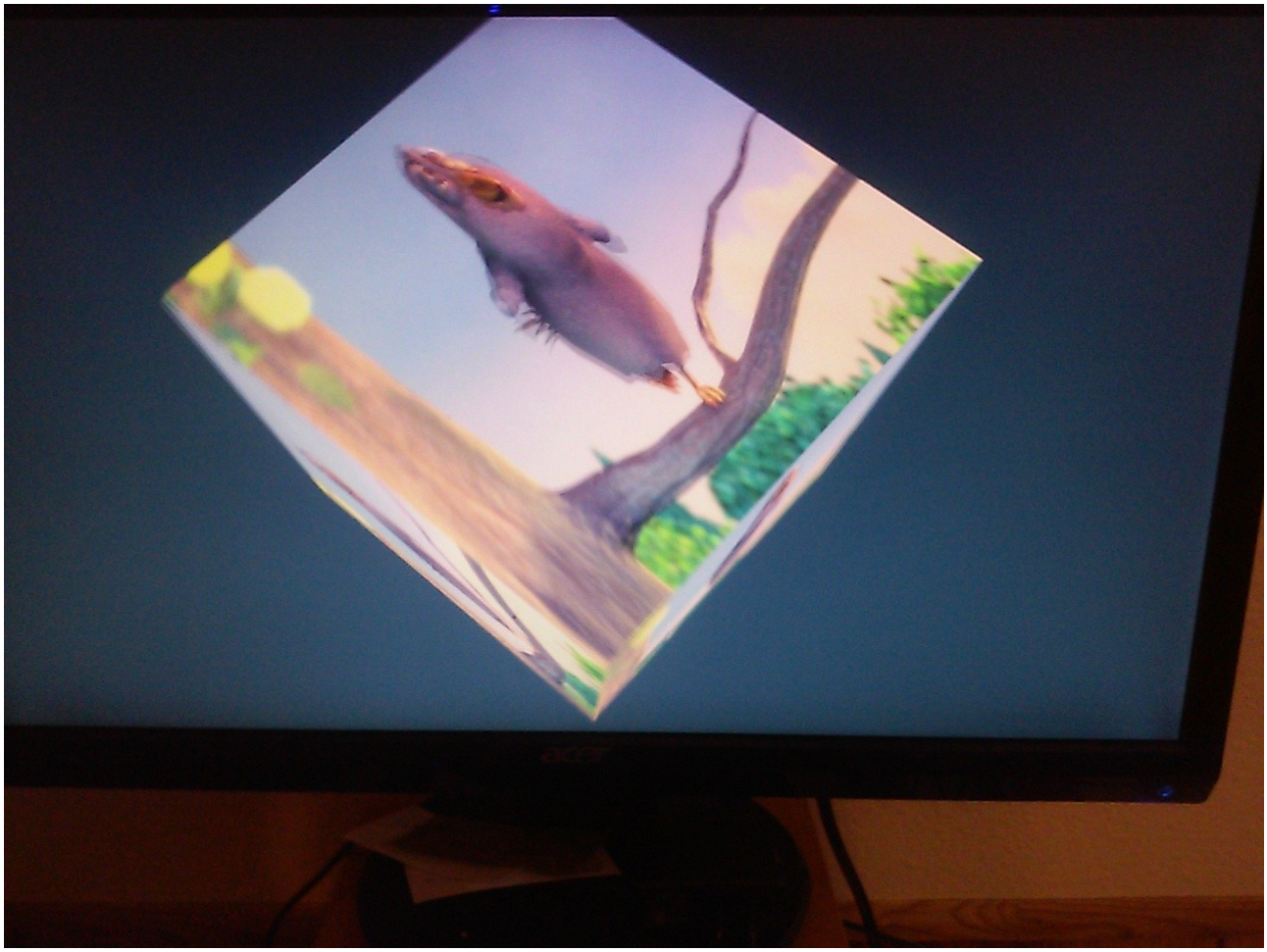


Image 3

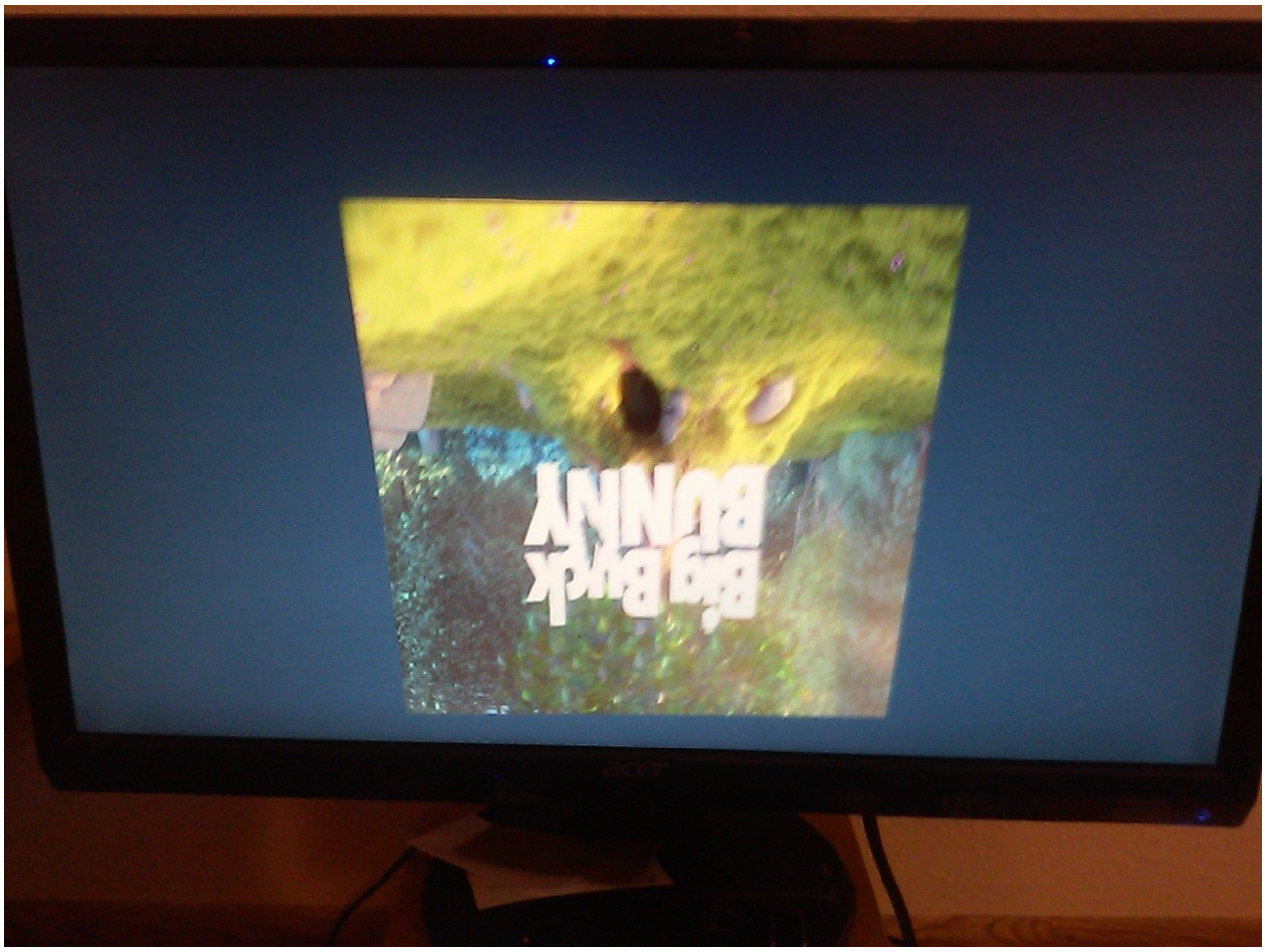


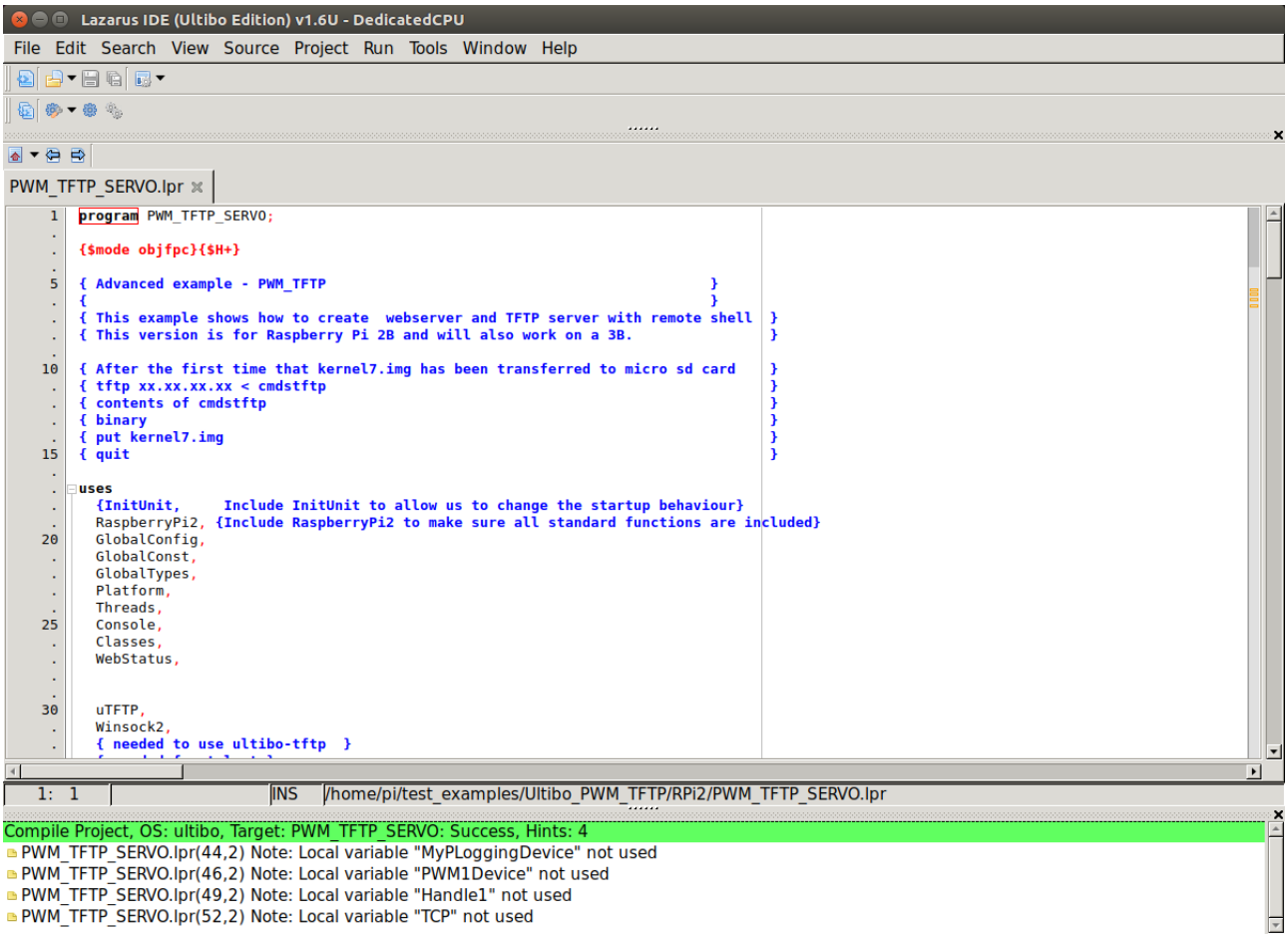
Image 4
Testing:
pi@raspberrypi:~ $ ***mkdir test_examples***
pi@raspberrypi:~ $ ***cd test_examples/***
pi@raspberrypi:~/test_examples $ ***git clone https://github.com/develone/Ultibo_PWM_TFTP.git***

note
pi@raspberrypi:~ $ ***ultibo/core/startlazarus*** was the command used to start the Lazarus IDE (Ultibo Edition).
This was required since a tar file ***-rw-r--r-- 1 vidal vidal 329724698 Feb 7 17:19 ultibo.tgz*** was used to install lazarus
pi@raspberrypi:~ $ time tar xfz ultibo.tgz

real 5m0.582s
user 1m24.990s
sys 0m44.640s
ultibo
2123 directories, 32499 files

From the Raspberry Pi/Programming/Lazarus IDE (Ultibo Edition)

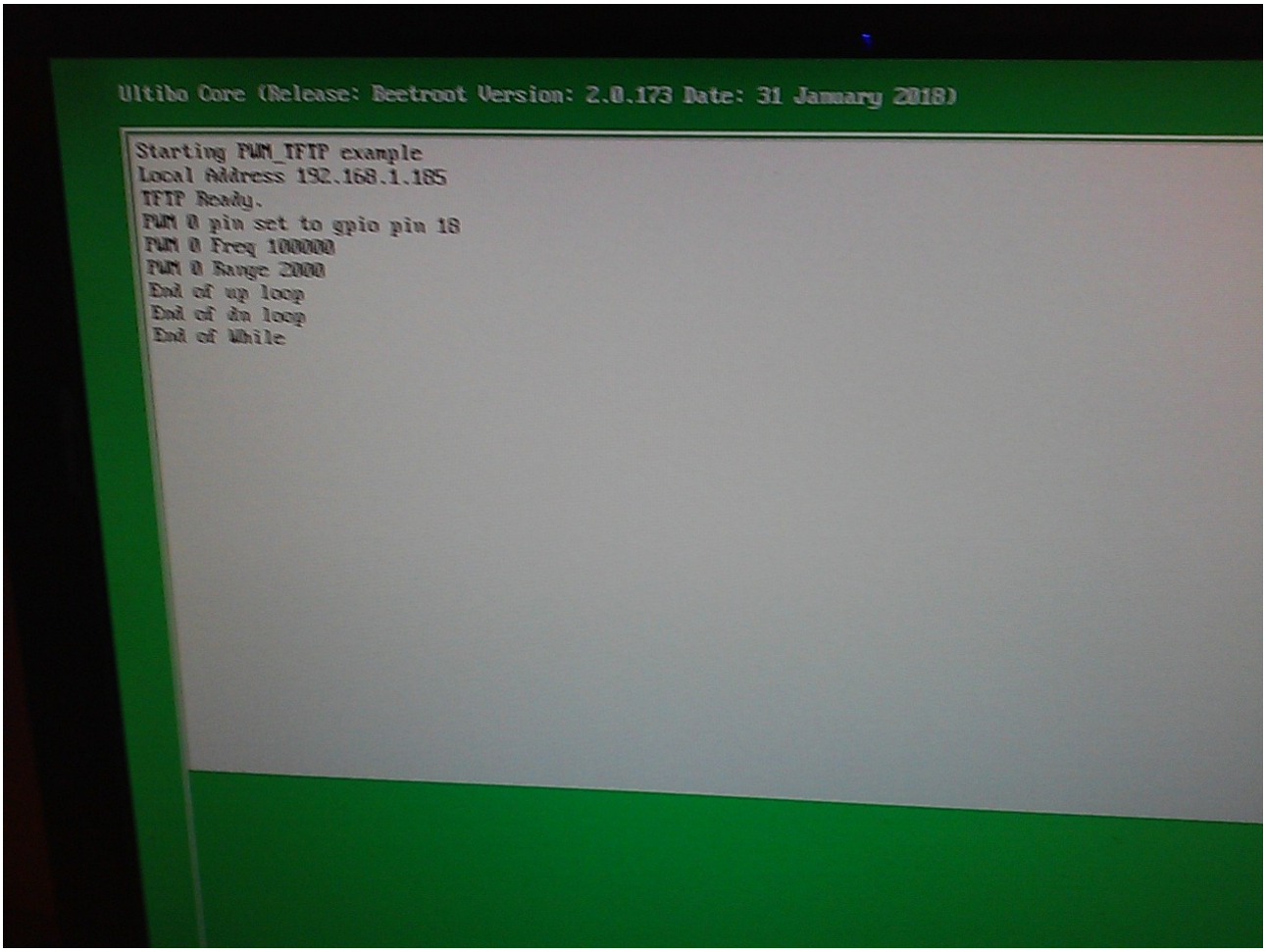
If the PWM_TFTP_SERVO project was the current project Run/Compile



Success Compile
If the compile works without errors a green bar wil appear as seen above.

Transferring the kernel7.img and firmware files displays the following when booting.

The Core was updated
ULTIBO_RELEASE_DATE = '31 January 2018';
ULTIBO_RELEASE_NAME = 'Beetroot';
ULTIBO_RELEASE_VERSION = '2.0.173';
The recently built target matches the values found in ultibo/core/fpc/source/rtl/ultibo/core/globalconst.pas



pi@raspberrypi:~/test_examples/Ultibo_PWM_TFTP/RPi2 $ cp kernel7.img /media/pi/6FCF-2BFD/

Rpi-Zero
prior to boot installed ultiboinstaller.sh and modified the dphys-swapfile

cd /media/vidal/rootfs/home/pi
cp /home/vidal/raspbian-pi-gen/ultiboinstaller.sh .
cd ../cd etc/
cp dphys-swapfile dphys-swapfile.orig
nano dphys-swapfile
diff dphys-swapfile dphys-swapfile.orig
16c16
< CONF_SWAPSIZE=1000

> CONF_SWAPSIZE=100

pi@raspberrypi:~ $ dpkg -l | wc
  1420   14441 203159
chg passwd for pi
setup wifi
128 GPU
enable ssh

Rpi-Zero running the ultiboinstaller.sh

date > st.txt; ./ultiboinstaller.sh ; date > en.txt
pi@raspberrypi:~ $ date > st.txt; ./ultiboinstaller.sh ; date > en.txt

Linux installer for Free Pascal and Lazarus (Ultibo edition)

This installation will download the sources for:
  Ultibo core
  Ultibo examples
  Free Pascal (Ultibo edition)
  Lazarus (Ultibo edition)

Then it will build all of the above, this will take several
minutes to complete depending on the speed of your system.

The installation will not interfere with any existing
development environments including other installations
of Free Pascal and Lazarus.

Continue (y/n)? y

\

Free Pascal and Lazarus (Ultibo edition) prerequisites

Installing and building Free Pascal requires several tools
from the build essentials package including make, ld and as
as well as the unzip utility.

These can be installed on Debian based distributions using:

sudo apt-get install build-essential unzip

Lazarus requires the GTK2 and X11 dev packages which can
be installed on Debian based distributions by using:

sudo apt-get install libgtk2.0-dev libcairo2-dev \

```
  libpango1.0-dev libgdk-pixbuf2.0-dev libatk1.0-dev \
  libghc-x11-dev
```

Cross compiling Ultibo applications from Linux requires the arm-none-eabi build of the binutils package, this can be installed on Debian based distributions using:

sudo apt-get install binutils-arm-none-eabi

Press return to check for these prerequisites

make found
gdb found
unzip found
libgtk2.0-dev found
libcairo2-dev found
libpango1.0-dev found
libgdk-pixbuf2.0-dev found
libatk1.0-dev found
libghc-x11-dev found
arm-none-eabi-as found
arm-none-eabi-ld found
arm-none-eabi-objcopy found

Enter an installation folder or press return to accept the default install location

[/home/pi/ultibo/core]:
The install folder will be:
/home/pi/ultibo/core

Continue? (y,n): y

After install do you want a shortcut created in:
/home/pi/.local/share/applications (y/n)? y

After install do you want a shortcut created in:
/home/pi/.local/share/applications (y/n)? y
Downloading FPC minimal stable 3.0.2
Extracting FPC minimal stable 3.0.2
Downloading Ultibo core
Downloading Ultibo examples
Downloading Free Pascal (Ultibo edition)

This installer compiles many packages needed for Ultibo Edition.
Start: Thu 8 Feb 18:45:17 UTC 2018
Finish: Thu 8 Feb 20:53:29 UTC 2018
Takes twice as long on Rpi Zero as Rpi2B

Free Pascal and Lazarus (Ultibo edition) install complete

Launch Lazarus from the application shortcut or by using
  /home/pi/ultibo/core/lazarus.sh
from the command line

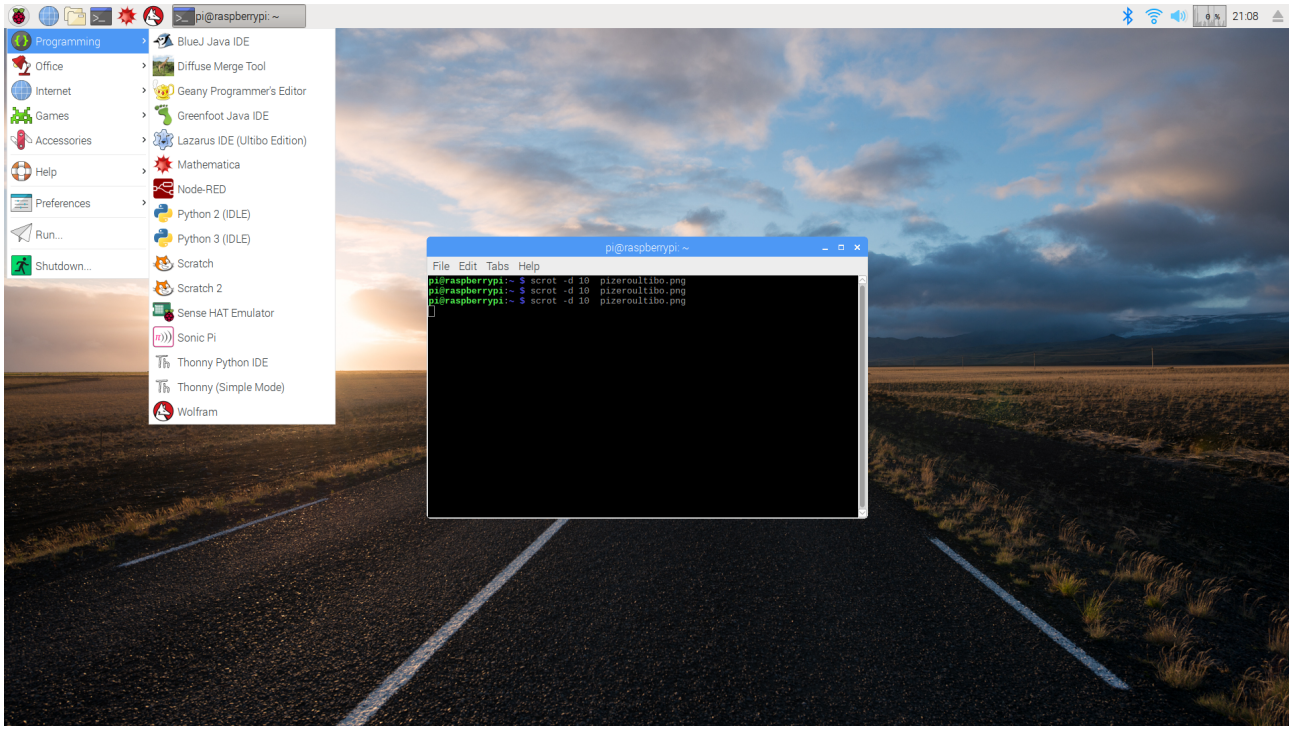
Thu 8 Feb 20:01:10 UTC 2018

[11%] Compiled package fcl-xml
Start compiling package chm for target arm-ultibo.
    Compiling chm/BuildUnit_chm.pp
    Compiling ./chm/src/chmbase.pas
    Compiling ./chm/src/chmtypes.pas
    Compiling ./chm/src/chmspecialfiles.pas
    Compiling ./chm/src/paslznonslide.pas
    Compiling ./chm/src/paslzxcomp.pas
    Compiling ./chm/src/fasthtmlparser.pas
    Compiling ./chm/src/htmlutil.pas
    Compiling ./chm/src/htmlindexer.pas
    Compiling ./chm/src/chmfiftimain.pas
    Compiling ./chm/src/chmwriter.pas
    Compiling ./chm/src/chmsitemap.pas
    Compiling ./chm/src/lzxcompressthread.pas
    Compiling ./chm/src/chmfilewriter.pas
    Compiling ./chm/src/paslzx.pas
    Compiling ./chm/src/chmreader.pas

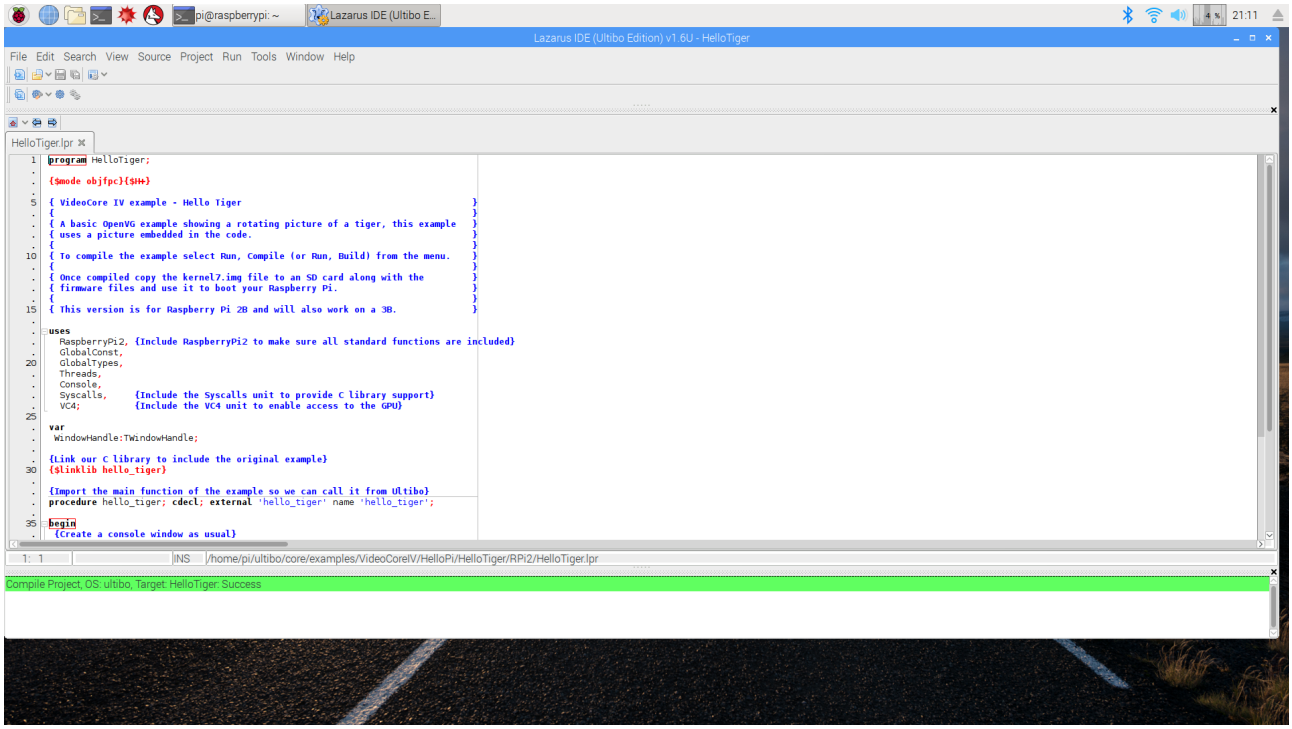
```
    Compiling ./chm/src/itolitlstypes.pas
    Compiling ./chm/src/itsftransform.pas
    Compiling ./chm/src/itolitlsreader.pas
[ 12%] Compiled package chm
[ 12%] Skipped package cocoaint which has been disabled for target arm-ultibo
[ 14%] Skipped package dbus which has been disabled for target arm-ultibo
[ 15%] Skipped package dts which has been disabled for target arm-ultibo
Start compiling package fastcgi for target arm-ultibo.
    Compiling fastcgi/src/fastcgi.pp
[ 15%] Compiled package fastcgi
[ 16%] Skipped package fcl-async which has been disabled for target arm-ultibo
Start compiling package sqlite for target arm-ultibo.
    Compiling sqlite/BuildUnit_sqlite.pp
    Compiling ./sqlite/src/sqlite3.pp
    Compiling ./sqlite/src/sqlite3db.pas
[ 17%] Compiled package sqlite
Start compiling package fcl-json for target arm-ultibo.
    Compiling fcl-json/BuildUnit_fcl_json.pp
    Compiling ./fcl-json/src/fpjson.pp
    Compiling ./fcl-json/src/jsonscanner.pp
    Compiling ./fcl-json/src/jsonparser.pp
    Compiling ./fcl-json/src/jsonconf.pp
    Compiling ./fcl-json/src/fpjsonrtti.pp

Thu  8 Feb 20:24:17 UTC 2018
[ 82%] Compiled package regexpr
[ 82%] Skipped package rexx which has been disabled for target arm-ultibo
Start compiling package rtl-unicode for target arm-ultibo.
    Compiling rtl-unicode/BuildUnit_rtl_unicode.pp
    Compiling ./rtl-unicode/src/inc/unicodeducet.pas
    Compiling ./rtl-unicode/src/collations/buildcollations.pas
    Compiling ./rtl-unicode/src/collations/collation_de.pas
    Compiling ./rtl-unicode/src/collations/collation_es.pas
    Compiling ./rtl-unicode/src/collations/collation_fr_ca.pas
    Compiling ./rtl-unicode/src/collations/collation_ja.pas
    Compiling ./rtl-unicode/src/collations/collation_ko.pas
    Compiling ./rtl-unicode/src/collations/collation_ru.pas
    Compiling ./rtl-unicode/src/collations/collation_sv.pas
```

Rpi-Zero Starting Lazarus

From the Raspberry Pi/Programming/Lazarus IDE (Ultibo Edition)



Starting Lazarus

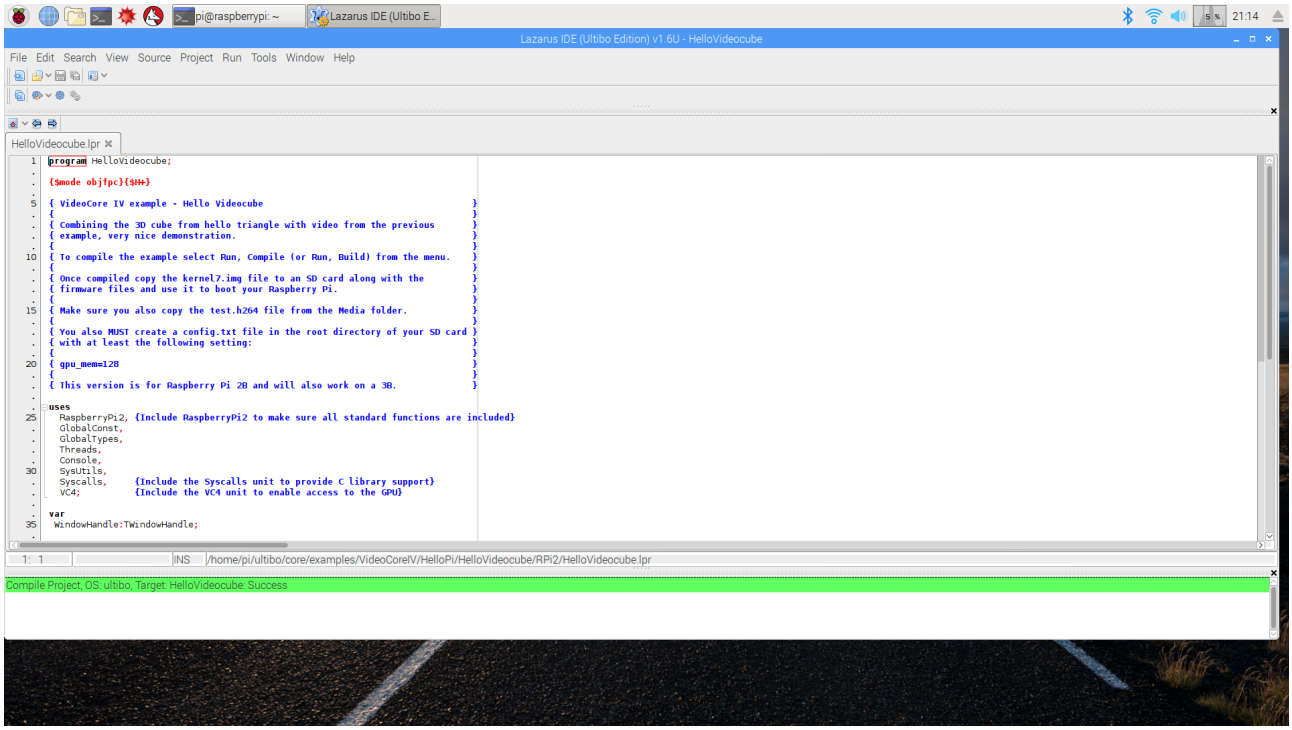


Compiling HelloTiger on Rpi-Zero

Success Compile

If the compile works without errors a green bar wil appear as seen above.

pi@raspberrypi:~/ultibo/core/examples/VideoCoreIV/HelloPi/HelloTiger/RPi2 $ cp kernel7.img /media/pi/6FCF-2BFD/



Compiling HelloVideocube on Rpi-Zero
Success Compile
If the compile works without errors a green bar wil appear as seen above.

pi@raspberrypi:~/ultibo/core/examples/VideoCoreIV/HelloPi/HelloVideocube/RPi2 $ cp kernel7.img /media/pi/6FCF-2BFD/
pi@raspberrypi:~/ultibo/core/examples/VideoCoreIV/HelloPi/Media $ cp test.h264 /media/pi/6FCF-2BFD/

Both of examples created on the Rpi Zero ran correctly with on a few files running Ultibo.

Note:
Even on the RRI Zero the compile was very quick for the HelloTiger & HelloVideocube projects.

Appendix A: Notes during pi-gen testing

pi-gen Tool used to create the raspberrypi.org Raspbian images.

Forked pi-gen https://github.com/RPi-Distro/pi-gen
commit 066eb03d52868290661e813738a9a66eda263aa9
Author: Ben Pirt <ben@pirt.co.uk>
Date: Wed Jan 3 12:48:31 2018 +0000

Allow image building to be skipped for stages (#137)

pi-gen
GitHub - RPi-Distro/pi-gen: Tool used to create the raspberrypi.org ...
https://github.com/RPi-Distro/pi-gen

README.md. pi-gen. Tool used to create the raspberrypi.org Raspbian images.
Dependencies. pi-gen runs on Debian based operating systems. Currently it
is only supported on either Debian Stretch or Ubuntu Xenial and is known
to have issues building on earlier releases of these systems. To install
the required

On a Ubuntu 16.04 added pi-gen dependencies.
sudo apt-get install quilt parted realpath qemu-user-static debootstrap zerofree pxz zip dosfstools bsdtar libcap2-bin grep rsync xz-utils

Linux sim2 4.4.0-112-generic #135-Ubuntu SMP Fri Jan 19 11:48:36 UTC 2018 x86_64 x86_64 x86_64 GNU/Linux
AMD FX(tm)-4130 Quad-Core Processor
cpu MHz		: 1800.000

Steps create the pi-gen/work/2018-02-07-RaspbianUltibo tree.

1.0)
git clone https://github.com/develone/pi-gen.git
2.0)
cd pi-gen/
3.0)
cp ~/raspbian-pi-gen/config .
4.0)
cp ~/raspbian-pi-gen/stage4/00-install-packages/02-packages stage4/00-install-packages/
5.0)
date > t1.txt; sudo ./build.sh ; date > t2.txt
Wed Feb 7 14:05:03 MST 2018
Wed Feb 7 16:45:38 MST 2018

Note: The 2 hours and 40 min could be reduced with the use of local repository.
du -s local-apt-repo/
***1513164	local-apt-repo/***
The download of required packages takes considerable time.
cd deploy/
fdisk /dev/sdb
date > ../st.time ; sudo gzip -dc image_2018-02-07-RaspbianUltibo.zip | dd bs=16M of=/dev/sdb; date > ../end.time
0+137615 records in
0+137615 records out
6366953472 bytes (6.4 GB, 5.9 GiB) copied, 1124.77 s, 5.7 MB/s
Wed Feb 7 16:45:56 MST 2018
Wed Feb 7 17:04:41 MST 2018

The stretch build has 1313 pkgs installed
The 2018-02-07-RaspbianUltibo build has 1420 pkgs installed

ssh -Y pi@192.168.1.185
uname -a
Linux raspberrypi 4.9.59-v7+ #1047 SMP Sun Oct 29 12:19:23 GMT 2017 armv7l GNU/Linux

Testing new build with the dependencies need to install the Lazaraus/FPC

Added a file pi-gen/stage4/00-install-packages/02-packages
libgtk2.0-dev
libcairo2-dev
libpango1.0-dev
libgdk-pixbuf2.0-dev
libatk1.0-dev
libghc-x11-dev
binutils-arm-none-eabi
gcc-arm-none-eabi

Added a file pi-gen/config
#!/bin/bash
export IMG_NAME=RaspbianUltibo

./build.sh
Creates the pi-gen/work/2018-02-06-RaspbianUltibo tree.
vidal@sim2:~$ ls pi-gen/work/2018-02-07-RaspbianUltibo/stage0/rootfs/var/cache/apt/archives/*.deb | wc
   220   220   15327
vidal@sim2:~$ ls pi-gen/work/2018-02-07-RaspbianUltibo/stage1/rootfs/var/cache/apt/archives/*.deb | wc
    15   15   1613
vidal@sim2:~15   15   1043$ ls pi-gen/work/2018-02-07-RaspbianUltibo/stage2/rootfs/var/cache/apt/archives/*.deb | wc
   214   214   15221
vidal@sim2:~$ ls pi-gen/work/2018-02-07-RaspbianUltibo/stage3/rootfs/var/cache/apt/archives/*.deb | wc
   427   427   30630
vidal@sim2:~$ ls pi-gen/work/2018-02-07-RaspbianUltibo/stage4/rootfs/var/cache/apt/archives/*.deb | wc
   536   536   38434
 vidal@sim2:~$ ls pi-gen/work/2018-02-07-RaspbianUltibo/stage5/rootfs/var/cache/apt/archives/*.deb | wc
     9   9   664
1421 packages are required

pi@raspberrypi:~ $ dpkg -l | wc
  1420   14224 200233
pi@raspberrypi:~ $ uname -a
Linux raspberrypi 4.9.59-v7+ #1047 SMP Sun Oct 29 12:19:23 GMT 2017 armv7l GNU/Linux

date > t1.txt;./ultiboinstaller.sh ; date > t2.txt
Tue 6 Feb 23:47:19 UTC 2018
Wed 7 Feb 00:52:52 UTC 2018

Free Pascal and Lazarus (Ultibo edition) prerequisites

Installing and building Free Pascal requires several tools

from the build essentials package including make, ld and as
as well as the unzip utility.

These can be installed on Debian based distributions using:

```
sudo apt-get install build-essential unzip
```

Lazarus requires the GTK2 and X11 dev packages which can
be installed on Debian based distributions by using:

```
sudo apt-get install libgtk2.0-dev libcairo2-dev \
  libpango1.0-dev libgdk-pixbuf2.0-dev libatk1.0-dev \
  libghc-x11-dev
```

Cross compiling Ultibo applications from Linux requires the
arm-none-eabi build of the binutils package, this can be
installed on Debian based distributions using:

```
sudo apt-get install binutils-arm-none-eabi
```

Press return to check for these prerequisites

```
make found
gdb found
unzip found
libgtk2.0-dev found
libcairo2-dev found
libpango1.0-dev found
libgdk-pixbuf2.0-dev found
libatk1.0-dev found
libghc-x11-dev found
arm-none-eabi-as found
arm-none-eabi-ld found
arm-none-eabi-objcopy found
```

Enter an installation folder or press return to
accept the default install location

```
[/home/pi/ultibo/core]:
```

The install folder will be:
/home/pi/ultibo/core

```
Continue? (y,n): y
```

After install do you want a shortcut created in:
/home/pi/.local/share/applications (y/n)? y

Downloading FPC minimal stable 3.0.2
Extracting FPC minimal stable 3.0.2
Downloading Ultibo core
Downloading Ultibo examples
Downloading Free Pascal (Ultibo edition)

Next step required

Need to create a ultibo-laz-fpc.deb file.
This will based on ultibo tree,