Trinity School Raspberry Pi Specification

Hardware

- 10 x Raspberry Pi (RPi) each with:
  - Power supply
  - Case preferably transparent
  - [USB memory stick]
  - 8GB SD card with operating system preconfigured (by PVT)
    - Operating system uses about 2-3 GB
    - x 15 to provide some spares
  - Ethernet network cable
- 1 x local control kit for problem determination, performance analysis, and multimedia applications
  - HD TV with HDMI input
    - Or monitor with HDMI input and either inbuilt sound or separate powered speakers
  - Basic wired USB keyboard
  - Basic wired USB mouse
  - SD card reader/writer?
- 1 x RPi network
  - 16 port Ethernet switch
  - Ethernet network cable to interconnect with school network
  - Dedicated backup device for student work on RPi?
- 1 x RPi power system
  - Power distribution of 12 x 13A sockets

Software on RPi

- Raspbian "wheezy" operating system - Optimised version for RPi of Debian GNU/Linux
- Python 3 programming language
- PyGame toolkit for Python - which adds useful classes for game making in particular
- VNC Server - to allow another computer to drive it remotely
- Adobe Chromium Browser

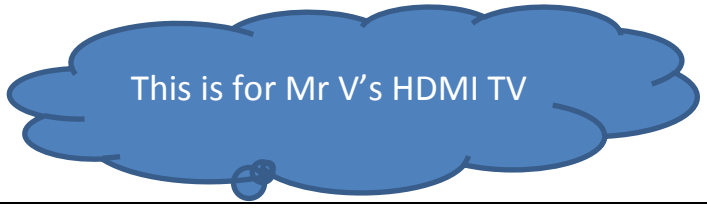
Software on [some] School Windows Computers

- Python 3 – ensure is exactly same version as on RPi computers, 3.2.3 at present
  - http://www.python.org/download/
  - e.g. Python 3.2.3 Windows x86 MSI Installer (python-3.2.3.msi)
  - Do not use 64 bit version as this is not compatible with PyGame
  - Beware there are two current versions of Python (2 and 3), we want latest Python 3.something
- PyGame (Windows) – ensure is exactly same version as on RPi computers
  - http://www.pygame.org/download.shtml
  - Be careful that filename has correct version of Python
    e.g. pygame-1.9.2a0.win32-**py3.2**.msi 6.4MB
- SSH Client (emergency Telnet access to a RPi)
  - Download PuTTY from http://www.putty.org/ (putty.exe) Runs from here, just needs shortcut
- VNC Client (normal xWindow remote control of RPi)
  - Download and install Tightvnc Viewer only
  - www.tightvnc.com version 2.5.2
- If SD cards to be "burned" on suitable reader/writer
  - Download Image Writer for MS Windows 0.6 (r46)
    - https://launchpad.net/win32-image-writer
    - Pre-req is QT for Windows SDK (a big install!) - http://qt.nokia.com/downloads/
  - Download sha1sum.exe to allow image checksum to be verified
    - http://downloads.raspberrypi.org/verifying_an_image.html

RPi Operating System Build

- Base = **Raspian "Wheezy"** Linux (2012-07-15-wheezy-raspbian.img)
- **config.txt** Adjust for HDMI monitor/TV provided for maintenance
  Note: Can be edited from Windows machine with SD card reader, but use either **Wordpad** or a specialised editor – **not** Notepad:

```
disable_overscan = 0
overscan_left = 16
overscan_right = 16
overscan_top = -4
overscan_bottom = -4
hdmi_drive = 2
```



- **SSH** Secure Shell allows access to the RPi console using a secure channel.
  - Enabled on the RPI by default so can use PuTTY from Windows for initial setup and maintenance.
  - Start PuTTY and use DHCP-assigned IP address (which you have to find out) to connect to the RPi.
- **Static IP Address** Using SSH – if required
  - This is the default network configuration in the /etc/network/interfaces file which allow the RPi to search for a DHCP server to allocate it a temporary IP address. It can be used in this configuration, especially if later SAMBA configuration is allowed as it will replace the address with a symbolic NetBios name which can be used for SSH and VNC connections instead. If not, then this is where static IP addresses for the Raspberry Pi computers might make sense.

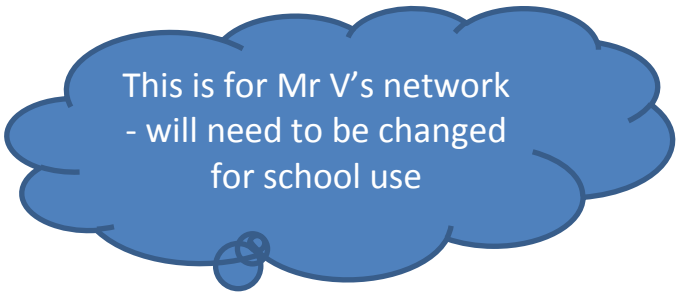
```
auto lo

iface lo inet loopback
iface eth0 inet dhcp
```

  - This is the procedure to change the RPi to use a static IP address:
    - The use of **sudo** in front of a command gives the user "pi" root (super user) authority.
    - Permission to use sudo by the user pi is separately authorised in the user setup.
    - # in the file means a comment line.

`sudo cp /etc/network/interfaces /etc/network/interfaces.sav`	Make backup first!
`sudo nano /etc/network/interfaces`	Edit interfaces file

```
# The loopback interface
auto lo
iface lo inet loopback
# Ethernet port
#iface eth0 inet dhcp
auto eth0
iface eth0 inet static
address 192.168.0.100
# Router
gateway 192.168.0.1
netmask 255.255.255.0
# VINNTEC network
network 192.168.0.0
broadcast 192.168.0.255
```



  - Check **VERY CAREFULLY** before saving – mistakes can leave the RPi unable to communicate on SSH!

`Ctrl-Z`	To exit the editor
`Y`	"Save modified buffer" (or "N" to discard)
`ENTER`	"File Name to Write:" to keep existing name
`sudo /etc/init.d/networking restart`	Start using the changes

- **RASPI-CONFIG** Make basic configuration decisions from SSH.

sudo raspi-config	Edit using simple editor

Info	Information about the tool
Expand_rootfs	Expand root partition to fill SD disk
Overscan	Enabled
Configure_keyboard	Layout of keyboard provided [only if connected]
Change_pass	Leave password for pi as default raspberry!
Change_locale	GB by default but hard to work out from these menus!
Change_timezone	Europe – London
Memory_split	192 192 MIB for ARM (RAM), 64 MIB for VideoCore (video)
SSH	Enable to allow console access remotely for maintenance
Boot_behaviour	No to start desktop on boot
Update	Try to upgrade RASPI-CONFIG - should usually be done first

- **INSTALLED PACKAGES**

sudo apt-get update	Resynchronise distribution
sudo apt-get upgrade	Upgrade distribution with any released changes

- **FIRMWARE** Used to boot the RPi – only use the **rpi-update** command when directed!

```
sudo uname –a
sudo /opt/vc/bin/vcgencmd version
sudo wget http://goo.gl/1BOfJ -O /usr/bin/rpi-update
sudo chmod +x /usr/bin/rpi-update
```

FIRST TIME ONLY

  - First response should be similar to **Linux raspberrypi 3.1.9+ …**
  - Second response should be similar to **July 14 2012 Version 325444**
  - The last two commands should only be done **the first time** as they install the rpi-update command

- **VNC Server** – see http://www.penguintutor.com/linux/tightvnc for details. Virtual Network Computing (VNC) allows remote access to the RPi's graphical desktop.

sudo apt-get update	Resync distribution
sudo apt-get install tightvncserver	Install VNX Server
/usr/bin/tightvncserver	Set remote login password for user pi

  - Use the **sudo vncpasswd** command at any time to change this password later.
  - Make the VNC configuration file using the simple Nano editor:

```
sudo nano /etc/init.d/tightvncserver
```

```
#!/bin/sh
# /etc/init.d/tightvncserver
# Start tightvncserver at boot time.

VNCUSER='pi'

case "$1" in
  start)
    su - $VNCUSER -c '/usr/bin/tightvncserver :1 –geometry 1024x768 –depth 24'
    echo "Starting TightVNC Server for $VNCUSER "
    ;;

  stop)
    pkill Xtightvnc
    echo "Stopping TightVNC Server"
    ;;

  *)
    echo "Usage: /etc/init.d/tightvncserver {start|stop}"
    exit 1
    ;;
esac

exit 0
```

Beware of the first "-"

- **NOTE: `su - $VNCUSER`**... will give you the same environment as pi. If the first dash is missed out then it will still work but you will see root's environment (but with pi's authority).

`sudo chmod 755 /etc/init.d/tightvncserver`	Make procedure above executable
`sudo update-rc.d /etc/init.d/tightvncserver defaults`	Enable dependency based boot sequence
`sudo update-rc.d tightvncserver defaults`	If previous command gives errors
`sudo shutdown -r 0`	Reboot to fire it up

- Try and make a connection from a school computer with VNC Client installed.

- **SAMBA** – advertise the RPI's SD card to school network as a disk
  - Install Samba

```
sudo apt-get install samba
sudo apt-get install samba-common-bin
```

  - Edit the samba configuration file using the Nano editor

```
sudo nano /etc/samba/smb.conf
```

```
[global]
  workgroup = VINNTEC
  netbios name = RASPPI
  security = share
  domain master = yes
  local master = yes
  preferred master = yes
  os level = 65
[public]
  comment = Data
  path = /
  read only = No
  force user = pi
  force group = users
  guest ok = Yes
[boot]
  comment = Emergency access to config.txt
  path = /boot
  read only = No
  force user = pi
  force group = users
  guest ok = Yes
```

This is what it will advertise itself on the network as

This is for Mr V's workgroup network - will need to be changed for school use

  - Define password for accessing the disk

```
sudo smbpasswd -a pi
New SMB Password: raspberry
Retype new SMB password: raspberry
```

  - Restart Samba – give it a few minutes and see if the SD card is visible to the school computers

```
sudo /etc/init.d/samba restart
```

- **PYTHON 3**
  - Version 3.2.3 pre-installed. First ensure it is up to date

```
sudo apt-get install python3
```

- **PYGAME** (check latest instructions at http://www.pygame.org/wiki/compileUbuntu?parent=index)

```
sudo apt-get install python3-dev libsdl-image1.2-dev libsdl-mixer1.2-dev
sudo apt-get install libsdl-ttf2.0-dev libsdl1.2-dev libsmpeg-dev sudo
sudo apt-get install python-numpy subversion libportmidi-dev ffmpeg
sudo apt-get libswscale-dev libavformat-dev libavcodec-dev
hg clone https://bitbucket.org/pygame/pygame
cd pygame
python3 setup.py build
sudo python3 setup.py install
```

- **Make Python 2 invisible** as we will only be using Python 3
  - Delete the **IDLE** and **Python Games** icons from the desktop (right-click then delete)
  - Remove **IDLE** from the menu system

```
cd /usr/share/applications
sudo mv idle.desktop /usr/share/idle.desktop
sudo mv idle-python2.7.desktop /usr/share/idle-python2.7.desktop
sudo mv python2.7.desktop /usr/share/python2.7.desktop
```

- **Adobe Chromium Web Browser** A better browser than the default ones but still limited

```
sudo apt-get install chromium-browser
```

- **OMXPLAYER** Simple multimedia player able to play full motion 1080p HD videos
  - Cannot be used across the network
  - Command below assumes HDMI vision + sound being used
  - Very little control once it is started
  - Run from console or xwindow or add command to MP4 files in file manager

`omxplayer –o hdmi "filename"` (if playing sound up HDMI cable)

  - Might need to be reinstalled if it doesn't work

`apt-get install omxplayer`

- **USB Memory Stick**
  - Should mount automatically when in desktop environment
  - Outside desktop, if required:

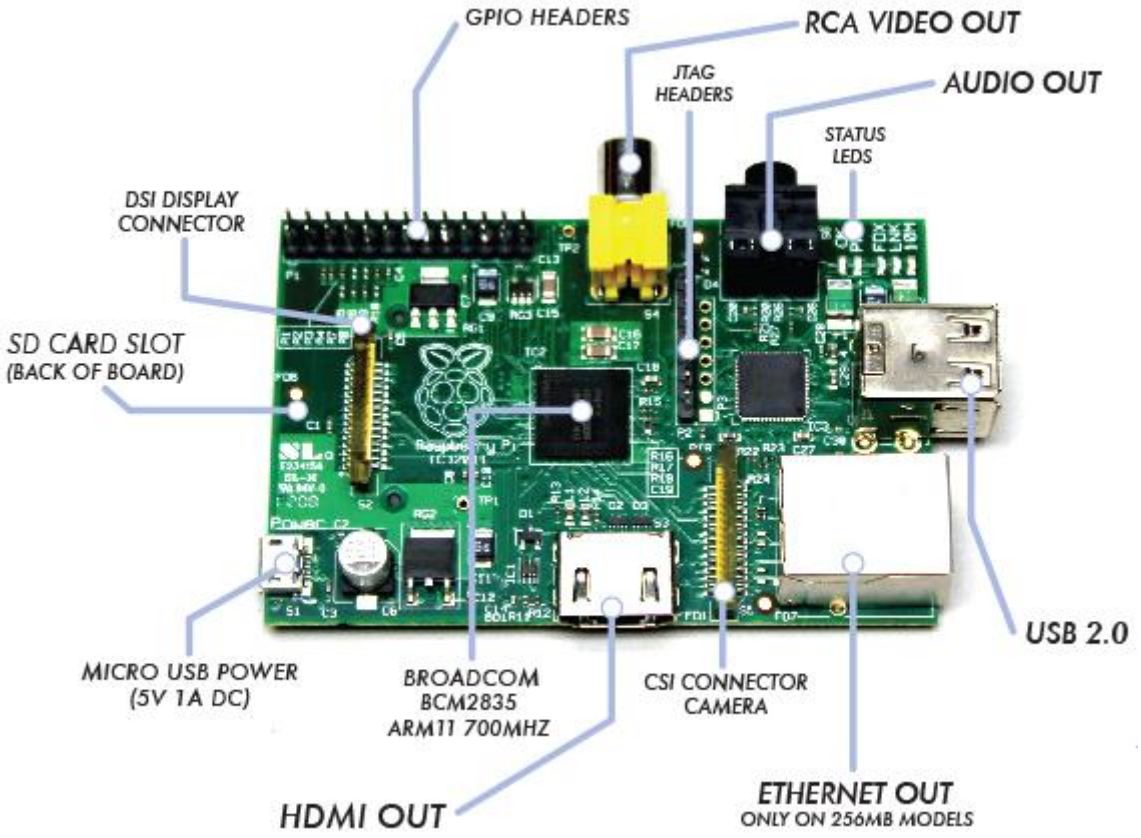
`sudo fdisk –l`	List drives, look for /dev/sdxn (sda1 usually)
`sudo mkdir /media/external-drive`	Make mount point
`sudo chgrp –R users /media/external-drive`	Change ownership to be for any users
`sudo chmod –R g+w /storage`	Give read write access

Raspberry Pi Reference

Raspberry Pi Status LEDs

Looking left to right:

• **10M**	Ethernet running at 100 Mbps	Continually on
• **LNK**	Ethernet being used	Flashes
• **FDX**	Ethernet running full duplex	Continually on
• **PWR**	5V power supply present on mini-USB port	Continually on
• **OK**	SD card being used	Should normally be off



Specification

- **Broadcom BCM2835 700MHz ARM1176JZFS** processor with FPU and **Videocore 4 GPU** which provides Open GL ES 2.0, hardware-accelerated OpenVG, and 1080p30 H.264 high-profile decode. The GPU is capable of 1G pixel/s, 1.5 Gtexel/s or 24 GFLOPs with texture filtering and DMA infrastructure.
- **256MB RAM** (not upgradeable)
- **SD card socket** – the system boots from an SD card, running a version of the Linux operating system
  - Operating system takes up about 2GB
  - 8GB cards are probably most appropriate for the school
- **10/100 BaseT Ethernet** socket
- **Monitor** connections consisting of HDMI video socket and RCA composite video socket
  - Only one can be used
  - HDMI is best option as carries video + sound.
- 3.5mm **audio out jack**
- **2 x USB 2.0** sockets
- Powered by a **5V supply** into a microUSB socket