Rexx LA Virtual Symposium 2020
A Survey of Linux Distros for the RPi4

Documentation of Installation Experiences, System Use Findings and Recommendations for Implementing a Rexx Desktop Development Environment on the Raspberry Pi 4 Model B Single Board PC.

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Overview of Presentation

- **Objectives for R Pi4 Desktop Environment**

- **Hardware Utilized with Findings and Recommendations**

- **Linux Distros Selected with Installation Details, Findings, References and Recommendations**

- **Linux Packages Installed as Rexx Pre-Requisites**

- **Open Object Rexx Installation Details for Distros**

- **Net Rexx Installation Details & Findings for Distros**

- **BSF4ooRexx Installation Details for Distros**

- **Checking the R Pi's Temperature**

- **Backing Up the R Pi's SD Card Image on Another Linux PC**

Linux Distros Selected - I

Linux Distro Selection Criteria

Easily Implemented from a Linux or Windows Base Workstation

No Additional Hardware Required Other Than The Raspberry Pi 4 Board, Keyboard, Mouse, Display, Power Supply, microSD Card, Cat 5 Intenet Connection and a Base Linux Workstation for setup and backup storage

A Distro that has a good base of Installation Software Packages (Debian, Ubuntu, Arch Linux, Mint, Manjaro, CentOS, Fedora and openSuSE to name the possible candidates)

Stability in the Distro

Linux Based with a reliable GUI Desktop and stable File Manager

Linux Distros Considered and Implemented

Desktop Linux Distros Implemented

Debian Family

Raspberry Pi OS

Sparky Linux (Stripped down Debian implementation for reduced Resource demands)

Ubuntu Family

Xubuntu based on Ubuntu Server v18.04 LTS (Xfce Desktop)

Ubuntu Mate based on Ubuntu Server v20.04 (Mate Desktop)

Arch Linux Family

Manjaro Xfce Updated Desktop

Manjaro KDE Plasma Desktop

Arch Linux Xfce Legacy Desktop (Similar to Debian Buster v10 Xfce Desktop)

Objectives for Rpi4 Desktop Environment

Implement a GUI Based Desktop Workstation to Develop ooRexx, NetRexx and BSF4ooRexx code

Create a Workstation that is faster than a Windows 10 Implementation

Workstation Image will be Easier and Faster to Backup than my Windows 10 Workstation

Complete Backup of System Image not Just The Files

Workstation will have enough Storage Space to Implement a Good Number of Development Software Products (Web Servers, Libre Office Suite, Editors, IDEs, Several Programming Languages in addition to REXX)

Hardware Utilized with Findings and Recommendation - I

Raspberry Pi Board

Version 4 Model B with 4GB RAM Memory

Keyboard and Mouse

Official Raspberry Pi Keyboard and Hub

Official Raspbery Pi Mouse

Cases with Cooling Fans

Canakit Acrylic Premium Case – Available in Black, White or Clear (Fits together without use of any Screws)

Vilros Aluminum Case (4 Screws Used To Put Together Halves of Case Shell) Available Colors: Black and Silver

I Uniker Pi Enclosure for Pi 4 (Colors: White, Black and Clear; 4 Screws used to Fit R Pi Board to bottom half of Case)

Hardware Utilized with Findings and Recommendation - II

Fan Installation in Case

All of the 3 Cases provided Documentation for the GPIO pins to use for Connecting the Fan Wires.

I Uniker Pi Enclosure Case had options for Faster or Slower Fan Speed Installation

Canakit Kit Case Fan Snaps in to the Top of The Case without need for Screws

I Uniker Pi Enclosure and Vilros Aluminum Allow Cases provided 4 Screws for Fan Installation

The Vilros Case and I Uniker cases provided a Screwdriver for Installing the Very Small Screws

Hardware Utilized with Findings and Recommendation - III

Heat Sinks for the Raspberry Pi 4 Board

The I Uniker Pi Enclosure Case had 4 Aluminum Heat Sinks

The Canakit Premium Case had 3 Heat Sinks

The Vilros Case had 2 Heat Sinks (CPU and RAM Chips)

Heat Dissipation

All of the 3 Cases had either 4 installed or installable Rubber Feet for the bottom of the case

The Vilros Aluminum Case was coolest to the touch after extended use

All R Pi Cases performed well in a 86 degree Fahrenheit room

Hardware Utilized with Findings and Recommendation - IV

Canakit Premium Acrylic Case
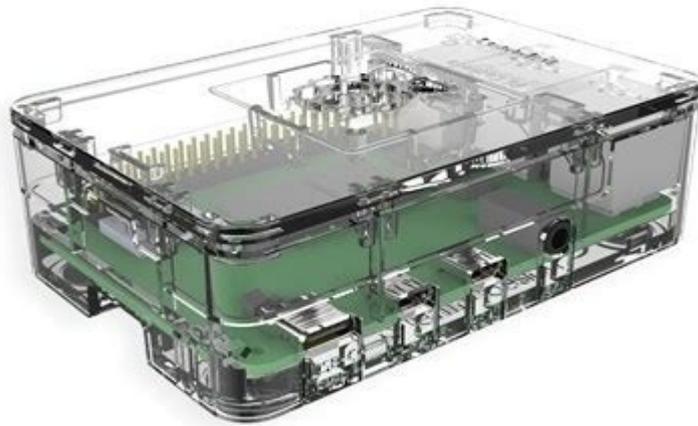
Hardware Utilized with Findings and Recommendation - V

Canakit Fan and Heat Sinks

Hardware Utilized with Findings and Recommendation - VI

Vilros Heavy Duty Aluminum Case

Hardware Utilized with Findings and Recommendation - VII

I Uniker Pi Enclosure Acrylic Case

Web Site References for Case Screenshots

Canakit Premim Acrylic Case

https://www.canakit.com/raspberry-pi-4-case-clear.html

Vilros Heavy Duty Aluminum Alloy Case

https://vilros.com/products/vilros-raspberry-pi-4-basic-starter-kit-with-fan-cooled-heavy-duty-aluminum-alloy-case?variant=31425736310878

I Uniker Pi Enclosure Acrylic Case

https://www.iunikerpi.com/raspberryi-4-case-iuniker-raspberryi-4-fan-abs-case-with-cooling-fan-raspberryi-4-heatsink-simple-removable-top-cover-fori-4-model-b-4b-p0058.html

Basic Starter Kit Recommendation

Vilros Aluminum Alloy Case Basic Starter Kit ($84.99 USD on Amazon)

Pros:

Case has better heat dissipation over the Acrylic Cases

Very Good Strong Fan that is fairly quiet compared to my Intel CPU PCs

Getting Started Documentation is well done

Screwdriver Provided was Great for Fan and Case Installation

Power Supply Has On/Off Switch; Canakit Power Supply did not

A lot of other Aluminum Alloy cases do not provide Heat Syncs or Fans

Cons:

Very Small Screws; use the Screwdriver Provided with the Kit if you don't have a good quality small Phillips head screwdriver

You have to Install the Fan and the Heat Syncs; not that Big of a Challenge

Exercise caution when Installing the SD Card; it can slip into the Case

Only 2 Heat Sinks for CPU and RAM Storage Chips

Other Recommendations - I

SD Card Storage

If you are planning to store a great deal of info on the Card; consider getting a 64GB or larger card.Most R Pi 4 kits currently have 32 or 64 GB cards

After installing nearly 2500 Debian Packages several of most SDXC Cards have utilized nearly 40% of the Storage space on a 64 GB Card.

Opt for a high quality micro SDXC UHS-I card for improved storage, durability and performance. R Pi 4 may not boot if a poor quality micro-SD card is used

Personally I used the Samsung EVO Plus or Select 64Gb cards for my storage

Maker.Pro – What Micro SD Card is Best for a Raspberry Pi 4?

Other Recommendations - II

Raspberry Pi 4 Board

Use the 4 GB or 8 GB Versions of the R Pi Board for an effective Desktop PC so that your memory intensive applications run well

Software Examples that require Memory

- **Libre Office**
- **Apache Web Server with Web Apps**
- **Web Browsers such as Firefox and Chromium**
- **MongoDB Server**

Raspberry Pi 4 8 GB Board Does Generate a bit more heat

Fan cooling Recommended

Other Recommendations - III

Monitor

Personal taste and budget truly influence your choice here

I decided to go with the Eviciv Monitor as it was the right size (7 Inches Diagonal) and configuration for my limited desktop space (Currently about $77 USD on Amazon)

Amazon Link:

https://www.amazon.com/dp/B07L6WT77H?tag=duckduckgo-d-20&linkCode=osi&th=1&psc=1

What may influence your choice is your need for the size of your displayed visual information

Other Recommendations - IV

Monitor Recommendation Screenshot

Other Recommendations - V

Monitors to Evaluate:

[Top 10 Best Raspberry PI Monitors 2020 Review](#)
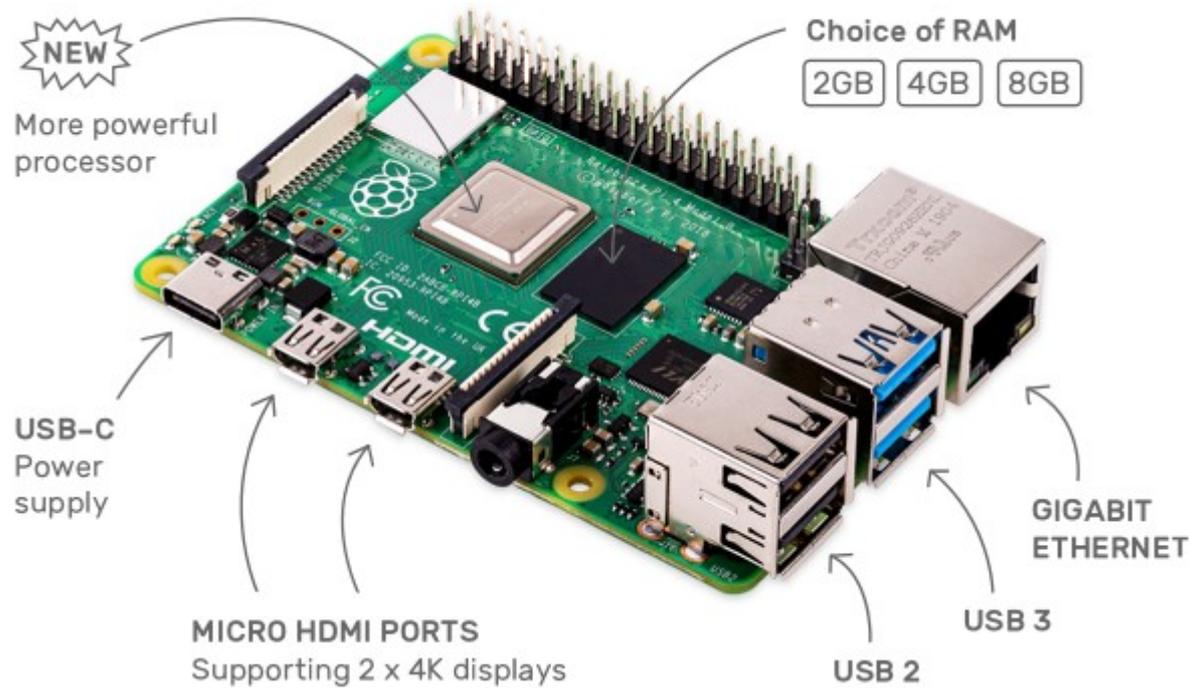
Cabling:

Use the leftmost smaller HDMI port immediate to the right of the Power Supply port to connect the Display HDMI cable

The rightmost smaller port did not yield any video output when I attempted to use that HDMI port for the EVICIV 7 Display

Raspberry Pi 4 Model B Board

Screenshot Source (raspberrypi.org)

Linux Distros Selected and Rejected

Criteria for Distro Selection

Stable Distro with a large Package Base; Easy to Install and Configure

Candidates Evaluated

Recommended Choice for Distro Family Group ...

Raspberry Pi OS (formerly Raspbian) – Implemented

Sparky Linux – Implemented

Xubuntu for Raspberry Pi 4 – Implemented

Ubuntu Mate for Raspberry Pi 4 – Implemented

Manjaro Xfce Desktop – Implemented

Manjaro KDE Plasma Desktop – Implemented

Arch Linux Xfce Desktop – Implemented

Balena OS – Rejected

CentOS – Rejected

Alpine Linux – Rejected

Reasons for Linux Distros Rejected

Balena OS

Concept for OS is based upon Docker Containers; currently my knowledge of Docker is too limited to consider a Docker container based OS solution. I do love the Balena Etcher Card Flash utility. More later.

Alpine Linux

Difficult to implement a GUI Desktop Manager solution on the R Pi 4.

After efforts to create both a writeable /usr and /home directory, I could never accomplish both; just one or the other.

CentOS

Their development of their existing Raspberry Pi 2/3 Distros has not evolved enough for a easy to install Raspberry Pi 4 solution. In the case of CentOS, only version 7 is available for the R Pi 4 with a limited base of outdated GPG signed packages. Their development repository does have a fair number of unsigned packages for installation.

Linux Distros Selected - II

Debian Family

Raspberry Pi OS (formerly Raspbian) – based on Debian Buster Distro

Sparky Linux – Debian based distro with Openbox Desktop Manager

Ubuntu Family

Xubuntu – Updated Xfce Desktop based on Ubuntu Server 18.04 LTS

Ubuntu Mate – Mate Desktop based on Ubuntu Server 20.04 LTS

Linux Distros Selected - III

Arch Linux Family

Manjaro Linux Xfce Desktop – Based on Arch Linux v 20.05 – Updated Xfce Deskto

Manjaro KDE Plasma Desktop – Based on Arch Linux v 20.05 – KDE Plasma Desktop (a bit slow on a 4 GB R Pi4 board; more later)

Arch Linux – Xfce Legacy Desktop – Similar to Debian Buster v10.4 Xfce Desktop

Debian Family Installs – Raspberry Pi OS

<mark>Raspberry PI OS</mark> (Raspbian)

If you purchased a Raspberry Pi 4 Kit chances are you received a NOOBS SD Card (likely 32GB; go $Bigger or go $HOME)

NOOBS can also be downloaded using the Raspberry Pi Imager from the following link:

https://www.raspberrypi.org/downloads/

This page also contains links for copying images to an SD card

Currently, Raspberry Pi OS is armv71 32 bit architecture

Work is underway for a 64 bit architecture (<mark>Beta available for download</mark>)

Desktop is one of the more stable implementations and response time on this distro is quite good

This is the easiest Linux distro to implement; good GUI response

Debian Family Installs -- Sparky Linux

Sparky Linux

V5.12 is the latest implementation based upon Debian Buster

armv71 architecture (32 Bit)

Openbox Desktop GUI is less polished than the Raspberry OS distro Desktop

Very fast and quite stable; good response on a 4 GB Raspberry Pi 4 board

As of this writing, the older Java OpenJDK v8 is still available for installation from the Sparky/Debian package repository

The Raspbian Version of the ooRexx .deb Package can be used to install ooRexx

This version requires a bit more work to implement vs. Raspberry Pi OS

Vast Library of Installable Packages for the Debian based distros

Fastest response time of all the implementations surveyed

Arch Linux Family Installs – Manjaro Xfce

Manjaro Linux Xfce Desktop

Manjaro Installs are 64 bit aarch Architecture

Manjaro Images are the easiest to Install Images

Download the image file

Use Balena Etcher to burn the downloaded image to the SD card

Link to Download Manjaro Xfce

https://www.manjaro.org/downloads/arm/raspberry-pi-4/arm8-raspberry-pi-4-xfce/

Balena Etcher can be used to transfer a downloaded image to a SD card

Website link for Balena Etcher (Downloads for Linux, Windows and Mac OS)

https://www.balena.io/etcher/

Current Version: 20.06 (July 2020)

Xfce Desktop works well on a 4GB Raspberry Pi 4B Board

Arch Linux Family Installs – Manjaro KDE Plasma

Manjaro Linux KDE Plasma Desktop

Manjaro Installs are 64 bit aarch Architecture

KDE Plasma is the Slickest Desktop IMHO; it is slower than the Xfce Version of Manjaro

Recommend getting the 8 GB R Pi4 for this distro

Manjaro Images are the easiest to Install Images

Download the image file

Use Balena Etcher to burn the downloaded image to the SD card

Link to Download Manjaro KDE Plasma

https://www.manjaro.org/downloads/arm/raspberry-pi-4/arm8-raspberry-pi-4-kde-plasma/

Balena Etcher can be used to transfer a downloaded image to a SD card

Website link for Balena Etcher

https://www.balena.io/etcher/

Current Version: 20.06 (July 2020)

KDE Desktop is sluggish on a 4GB Raspberry Pi 4B Board; Dolphin file Manager is buggy

Arch Linux Family Installs – Arch Linux Xfce

Arch Linux Xfce Desktop

Arch Linux Install chosen was 32 bit armv71 Architecture

Arch Linux armv8 Architecture images are Available for Download

Most difficult distro to install; a great deal of additional customization is required to implement a GUI Desktop and Start the GUI

Still haven't figured out how to autostart the Xfce Window Manager, Use **startx** to start the X Window Manager afer logging in with your Used Id and password.

Customization required to Implement the GUI Display Manager

Arch Linux Images are the toughest to Install Images

File and Web Link for Download of ARMv7 Raspberry P i4 Image:

File: ArchLinuxARM-rpi-4-latest.tar.gz

https://archlinuxarm.org/about/downloads

Link to Website for Arch Linux Install; Select the **Installation** Tab:

https://archlinuxarm.org/platforms/armv8/broadcom/raspberry-pi-4#installation

Ubuntu Family Installs – Ubuntu Mate Linux

Xubuntu Server for R Pi 4 with Mate Desktop

Download and Etch Ubuntu Server R Pi4 20.04 Image

Install the Ubuntu Server First

Then Install the Mate Desktop (this takes a while)

Setup requires a bit more work than a Raspbian or Manjaro Install

Great Detailed Web Blog Article for Complete A-Z Setup of Ubuntu Mate

Coverage includes audio and firewall setup considerations (| more)

Home Network Guy Web Link:

[How to Install Ubuntu MATE 20.04 LTS (64-bit) on the Raspberry Pi 4](#)

Ubuntu Family Installs – Ubuntu Xfce Linux

Xubuntu Server for R Pi 4 with Xfce Desktop

- Downloaded and Etched Ubuntu Server R Pi4 18.04 LTS Image
- Install the Ubuntu Server First
- Then Install the Xfce Desktop (this takes a while)
- Setup requires a bit more work than the Raspbian or Manjaro Installs, but not as much work as an Arch Linux install
- Web Source for Details of Ubuntu Xfce Setup

Ubuntu Web Link for Installation of Ubuntu on the R Pi:

[Ubuntu.com -- Tutorials -- How to Install Ubuntu on Your Raspberry Pi](#)

Linux Packages Installed as Rexx Pre-Requisites - I

Debian Family Distros (Raspberry Pi OS & Sparky Linux)

ooRexx

Given that most Linux Distros have **libc** installed, you can download the Debian Raspbian package for ooRexx and install it. Recommend ooRexx v4.2 for an easier installation using the Raspbian Dev package. If Installing ooRexx 5.0 rom a build Source, **g++**, **cmake** and **subversion** Linux Development packages are required for code checkout with subversion and build using cmake.

NetRexx and BSF4ooRexx Pre-requisite

If your Debian Distro no longer offers the **openjdk-8-jdk:armhf** package, you will need to install a Oracle Java SE 8 Package; most Debian repositories currently offer Open JDK version 11 installs, but I would recommend installing the Open JDK or Java SE Version 8, which still allows the use of Jar Files vs. Modules (Account Registration required to download from the Oracle Website)

Website link for Linux Oracle Java SE Development Kit 8 Downloads:

Oracle Java JDK v8 Downloads

Linux Packages Installed as Rexx Pre-Requisites - II

Arch Linux Family Distros (Arch Linux & Manjaro Linux)

ooRexx

Although there is an ooRexx Pacman package available in the AUR (Auxiliary Package Repo), I would recommend building ooRexx from a Subversion Release checkout. Use the **gcc** Pacman package as there is no **g++** Pacman package available for installation.

NetRexx and BSF4ooRexx Pre-requisite

If your Arch Linux Distro no longer offers the **jdk-openjdk8** (Currently still available as of July 2020) Pacman package, you will need to install a Oracle Java SE JDK 8 Package. Most Pacman repositories currently offer Open JDK version 8 Package installs

Website link for Linux Oracle Java SE Development Kit 8 Downloads::

Oracle Java JDK v8 Downloads

Linux Packages Installed as Rexx Pre-Requisites - III

Ubuntu Linux Family Distros (Ubuntu Mate & XUbuntu)

ooRexx

I would recommend building ooRexx from a Subversion Release checkout.

NetRexx and BSF4ooRexx Pre-requisite

If your Arch Linux Distro no longer offers the **jdk-openjdk8** (Currently still available as of July 2020) Pacman package, you will need to install a Oracle Java SE JDK 8 Package. Most Pacman repositories currently offer Open JDK version 8 Package installs

Website link for Linux Oracle Java SE Development Kit 8 Downloads::

Oracle Java JDK v8 Downloads

Debian Family Distros

Install the ooRexx Raspbian Debian Package Available on Source Forge

Alpine Linux & Ubuntu Linux Family Distros

Check Out the Subversion Release and Build ooRexx from Source with the following Linux Commands

1. Install **gcc**, **subversion**, **ncurses** and **cmake** Library Packages with their dependencies using "**pacman**

   1. **Example: sudo pacman -S subversion**

2. From a Linux Shell Checkout the subversion ooRexx build from Source Forge:

   1. **svn checkout svn://svn.code.sf.net/p/oorexx/code-0/main/trunk oorexx-code-0**

   2. **cd oorexx-code-0**

   3. **cmake . (use sudo if in a root protected directory such as /usr or /opt)**

   4. **sudo make install**

3. Test the results of your build with the command: **rexx -V**

Recommendation

I prefer to run the nrxInstall Jar setup file and install the Net Rexx files to the '**/opt/netrexx/**' directory of my workstation using **sudo** (Net Rexx Version 3.03GA). The .zip files can be downloaded and used if a newer version of Net Rexx is desired. <mark>I have implemented v 3.08 GA on a few of the Distros.</mark>

These details apply to all Linux Distros; the only pre-requisite is an install of a java jre or jdk (in my case I used Open JDK 8)

Location of NetRexx Jar Install File

http://netrexx.org/downloads.nsp

File: nrxInstall-3.03GA.jar

Install Net Rexx v3.03 with the Following Command:

sudo java -jar nrxInstall-3.03GA.jar

Select '/opt/netrexx' for the installation directories; accept all default options

Copy Net Rexx Files to JRE Library Extensions Directory

I am lazy about setting a Java **$CLASSPATH** Environment …

So I create a **$JAVA_HOME** Environment Variable in my **.bashrc** file

    export JAVA_HOME=/usr/lib/jvm/<jdk-base-dir>

    export JAVAHOME=/usr/lib/jvm/java-8-openjdk # Arch & Manjaro Linux

    export JAVA_HOME=/usr/lib/jvm/java-8-openjdk-armhf

      # Sparky Linux & Raspbian (32 Bit)

    export JAVA_HOME=/usr/lib/jvm/java-8-openjdk-arm64

      # Ubuntu Linux Server (64 Bit)

Copy the Net Rexx '/opt/netrexx/lib/*.jar' and '/opt/netrexx/runlib/*.jar' files to the $JAVA_HOME/jre/lib/ext Directory

This allows the JDK **javac** compiler and the JRE **java** runtime the ability to find the Jar files without defining a $CLASSPATH

BSF4ooRexx Version Selected

Same Installation .Zip file Used for All Linux Distros

Initially Filename: BSF4ooRexx_install_v641-20200130-beta.zip

Revised Filename: <mark>x-deprecated-BSF4ooRexx_install_v641-20200130-beta.zip</mark>

Debian Family Distros (Raspbian and Sparky 32 Bit)

From a Bash Shell …

Copy and unzip the downloaded BSF4ooRexx Zip archive

cd to the **./install/linux** Directory

From a su logion or via sudo run:

sh ./install.sh

Copy file: **bsf4ooRexx-v641-20200130-bin.jar** to

$JAVA_HOME/jre/lib/ext directory

Copy file: **BSF.CLS** to your Source code directory

Arch Linux Distro (32 Bit)

From a Bash CommandShell ...

Copy and unzip the downloaded BSF4ooRexx Zip archive

cd to the **./install/linux** Directory

From a su logion or via sudo run:

sh ./install.sh

Copy file: **bsf4ooRexx-v641-20200130-bin.jar** to

$JAVA_HOME/jre/lib/ext directory

Copy file: **BSF.CLS** to your Source code directory

Ubuntu and Manjaro Linux Distros (64 Bit)

From a Bash Shell

Unzip the downloaded BSF4ooRexx Zip archive

Recommendation:: use a sub-directory under your $HOME directory

Cd to the ./install/linux Directory

From a **su** logion or via **sudo** run:

sh ./install.sh

Copy file: **bsf4ooRexx-v641-20200130-bin.jar** to

$JAVA_HOME/jre/lib/ext directory

Copy the file: **BSF.CLS** to your Source Code directory

Plus More Additional Steps to Build a 64 bit Version of the **libBSF4ooRexx.so** Library …

Ubuntu and Manjaro Linux Distros (64 Bit)

Build a 64 bit Version of the libBSF4ooRexx.so Library …

Create a build sub-folder name of your choosing on your home directory (I used the sub-folder **build** from my $HOME/bsf4oorexx directory)

Install the Manjaro Linux Package: **subversion** and any dependencies for this package using the command line utility **pacman**:

sudo pacman -S subversion

Checkout the latest BSF4ooRexx Source Code

URL: https://sourceforge.net/p/bsf4oorexx/code/HEAD/tree/

Use **svn** to Checkout the Current BSF4ooRexx Source Package

cd $HOME/bsf4oorexx/build

svn checkout https://svn.code.sf.net/p/bsf4oorexx/code/trunk bsf4oorexx-code

You should have a directory path similar to what follows:

$HOME/bsf4oorexx/build/bsf4oorexx-code/bsf4oorexx.dev/source_cc

Ubuntu and Manjaro Linux Distros (64 Bit)

Build a 64 bit Version of the libBSF4ooRexx.so Library …

Change to that directory …

cd $HOME/bsf4oorexx/build/bsf4oorexx-code/bsf4oorexx.dev/source_cc

Copy the 32 Bit Linux Arm Make to a new File for 64 Bit Mods…

cp Makefile-32-linux-arm Makefile-64-linux-arm

Modify the following information in the 64 Bit Makefile using a Text Editor:

JDK BASE=/usr/lib/jvm/java-8-openjdk   # JDK v8 for Ubuntu, Manjaro and Alpine Linux

BITNESS = 64 # Was BITNESS = 32

Run the following **make** command to build the 64 Bit Arm Shared Library File:

make -f Makefile-64-linux-arm all {rebuild can be used as an alternative to all}

Copy the built Library file to the Base Library Directory:

cp $HOME/bsf4oorexx/build/bsf4oorexx-code/bsf4oorex.dev/source_cc/lib/libBSF4ooRExx.so-64-arm /usr/lib/libBSF4ooRexx.so {OK to overwrite the existing file in this case}

Make Sure to chmod the destination file so that it is executable

sudo chmod +x /usr/lib/libBSF4ooRexx.so

Run **ldconfig** to refresh the Linux Shared Library cache using sudo:

sudo ldconfig

Possibly the Build of the 64 Bit Library May Not Be Required in the Future ...

A subsequent release of BSF4ooRexx after the v641-20200130 Beta Release is Likely to Include the 64 Bit Arm Library in the Standard Linux Install Setup

Then the build exercise in the preceding slides can be omitted

Testing: I used the **JavaVersion.rex** sample program in an older release of the BSF4ooRexx Samples to verify the version of Java that I intended to run as a simple test. There are numerous code samples available in the BSF4ooRexx package available for testing purposes.

Checking the R Pi's CPU Temperature - I

CPU Temperature Can Be Measured on the R Pi with the Following Shell Command

cat /sys/class/themal/thermal_zone0/temp

The resulting value divided by 1000 is the temperature in Celsius

Typically the R Pi 4 CPU will run around 39-49 degrees Celsius for a desktop use session of 2-3 hours

The Next Slide will provide a Sample ooRexx Program to Encapsulate this Linux OS Command

I had to have at least one Rexx Code Sample :-)

Checking th R Pi's CPU Temperature - II

Sample Run Bash Shell Screenshot
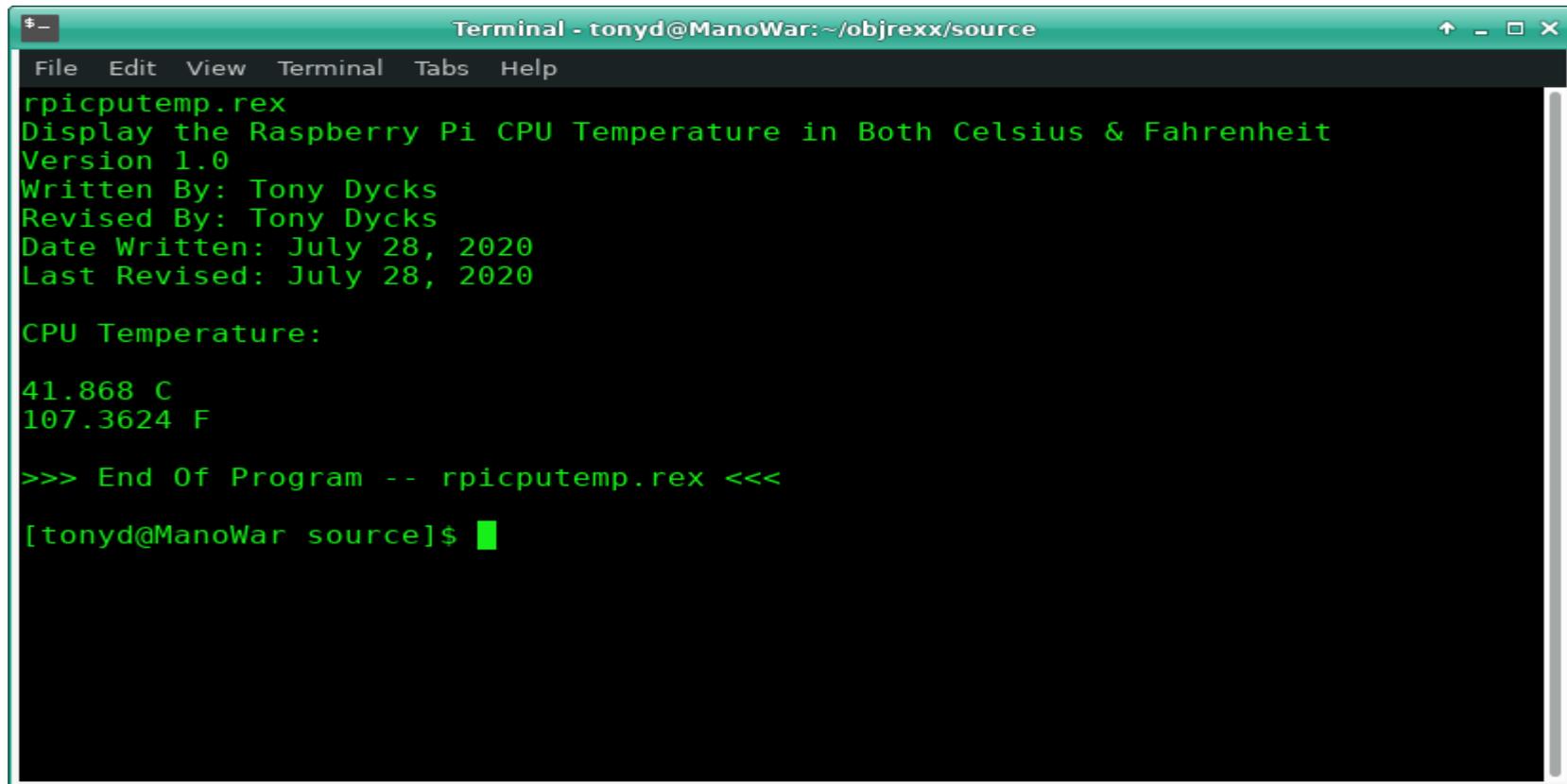
```
rpicputemp.rex
Display the Raspberry Pi CPU Temperature in Both Celsius & Fahrenheit
Version 1.0
Written By: Tony Dycks
Revised By: Tony Dycks
Date Written: July 28, 2020
Last Revised: July 28, 2020

CPU Temperature:

41.868 C
107.3624 F

>>> End Of Program -- rpicputemp.rex <<<

[tonyd@ManoWar source]$
```
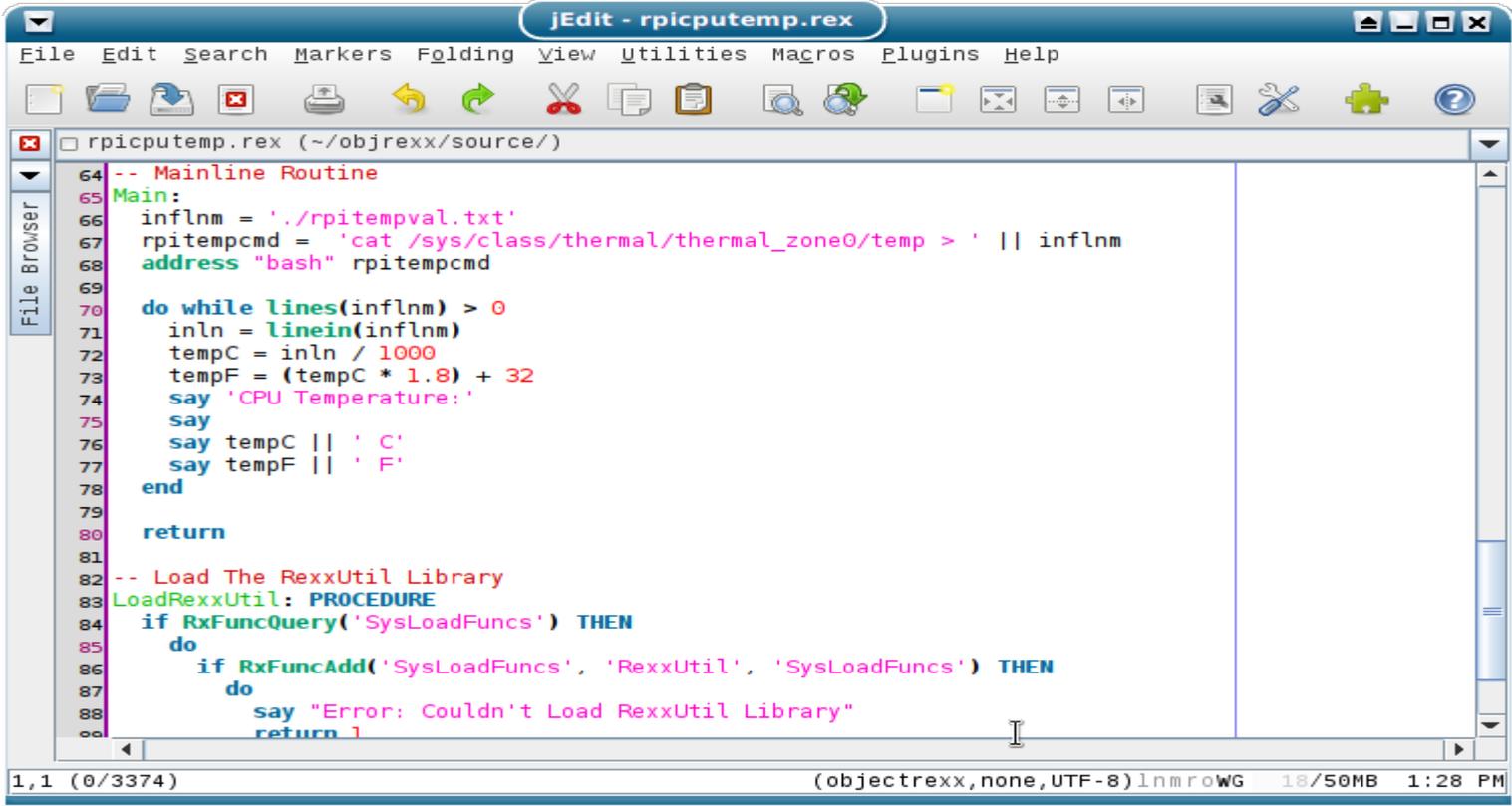
Core ooRexx Code for Utility


```
-- Mainline Routine
Main:
  inflnm = './rpitempval.txt'
  rpitempcmd =  'cat /sys/class/thermal/thermal_zone0/temp > ' || inflnm
  address "bash"  rpitempcmd

  do while lines(inflnm) > 0
    inln = linein(inflnm)
    tempC = inln / 1000
    tempF = (tempC * 1.8) + 32
    say 'CPU Temperature:'
    say
    say tempC || ' C'
    say tempF || ' F'
  end

  return

-- Load The RexxUtil Library
LoadRexxUtil: PROCEDURE
  if RxFuncQuery('SysLoadFuncs') THEN
    do
      if RxFuncAdd('SysLoadFuncs', 'RexxUtil', 'SysLoadFuncs') THEN
        do
          say "Error: Couldn't Load RexxUtil Library"
          return 1
```

Backing Up The R Pi's SD Card Image - I

The Linux lsblk Utility Can Be Used to Verify the SD Card Image Device Id Mounted on Another Linux PC

Preparation:

- Shutdown and Power Off the R Pi Workstation You Wish to Backup

- Remove the SD Micro Card from the R Pi's slot (tweezers can help out here)

- If Your Destination PC has a miniSD slot ... Insert the microSD Card into the SD Adapter card and then insert the miniSD card in the miniSD Slot

- Otherwise you may need a USB microSD Card Adapter; Insert the Adapter in a USB Port of the PC You Wish to Hold the Backup Image

- Verify the microSD Card is mounted; You can use **lsblk** to List Mounted Volumes

- Card is usually mounted on a secondary or tertiary device

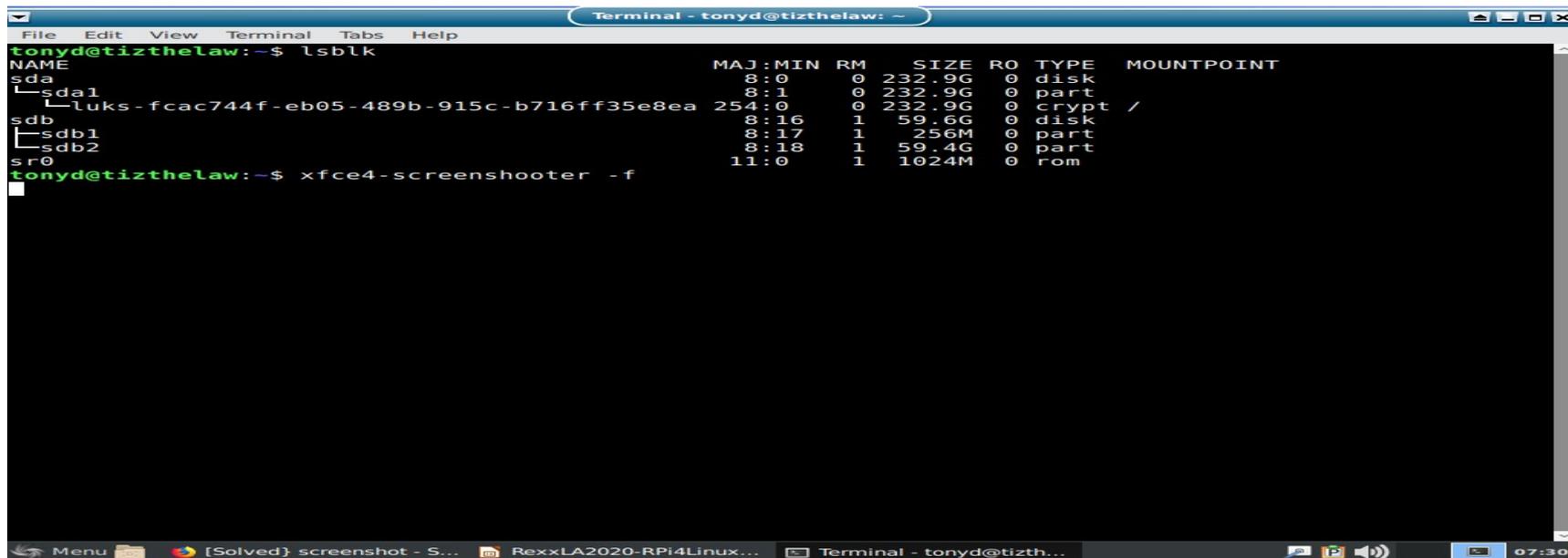- **/dev/sdb** *or* **/dev/sdc (/dev/sda is usually the Linux PC`s Main Hard Drive)**

Syntax:

lsblk

Sample Output of lsblk

In this example

'/dev/sda' is my 250Gb Hard Drive of my Destination Linux PC

'/dev/sdb' is my Auto Mounted 64Gb microSD Card from my Raspberry Pi 4 PC

```
tonyd@tizthelaw:~$ lsblk
NAME                                       MAJ:MIN RM    SIZE RO TYPE  MOUNTPOINT
sda                                          8:0    0  232.9G  0 disk
└─sda1                                       8:1    0  232.9G  0 part
  └─luks-fcac744f-eb05-489b-915c-b716ff35e8ea 254:0  0  232.9G  0 crypt /
sdb                                          8:16   1   59.6G  0 disk
├─sdb1                                       8:17   1    256M  0 part
└─sdb2                                       8:18   1   59.4G  0 part
sr0                                         11:0    1   1024M  0 rom
tonyd@tizthelaw:~$ xfce4-screenshooter -f
```

Backing Up The RPi's SD Card Image - III

The Linux dd Utility Can Be Used to Write the SD Card Image to a File on the Linux PC's Hard Drive

Preparation:

From a Terminal Display; Create a Folder in the Home Directory of your Linux Destination PC to Hold Your R Pi 4 Backup Images Files

For Example:

cd $HOME

mkdir Rpi4

cd Rpi4

mkdir backups

cd backups

Syntax Example (Image File name of your choosing):

dd if=/dev/sdb of=$HOME/Rpi4/backups/rpi4-sdimage.img bs=1M status=progress

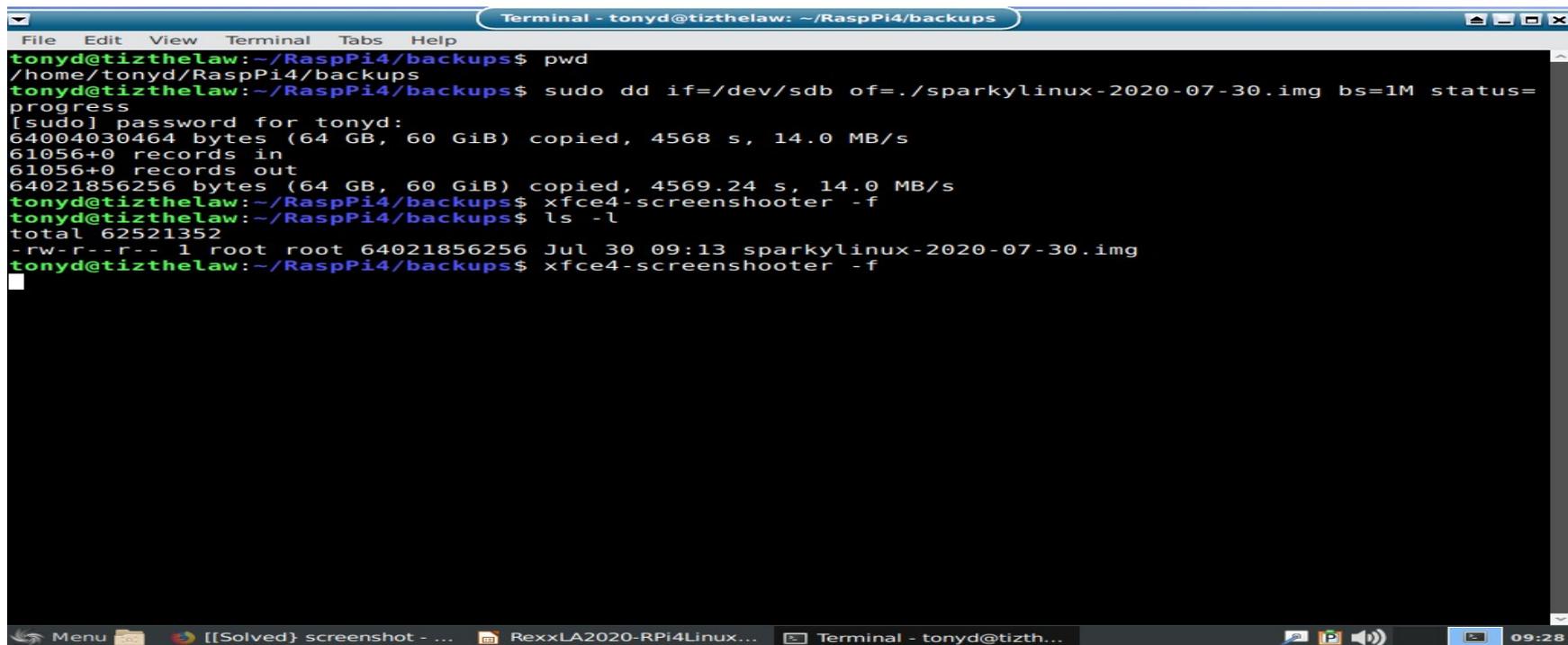## Sample Output of dd

In this example:

cd $HOME/RaspPi4/backups

sudo dd if=/dev/sdb of=./sparkylinux-2020-07-30.img bs=1M status=progress

Backing Up The RPi's SD Card Image - V

Restoring the Backup Image

The Balena Etcher Utility can be used to Flash the Backup Image to a new SD Card from the Linux, Windows or Mac Workstation that holds the Backup .img File

If Reusing a Previously Used Card that may have become Corrupted, it is Recommended that you Reformat and Possibly Repartition the Card based upon the Degree of Use and the Nature of the Corruption (For Example: A Card that is not Bootable)

Or Use the dd Utility to Write The Image File to a New Formatting Card (Linux Workstation)

dd if=$HOME/Rpi4/backups/rpi4-sdimage.img of=/dev/sdb bs=1M

status=progress

Wrapping It Up ...

Acknowledgments ...

Special Thanks for Rene` Jansen and Rony Flatscher for getting me up to speed on the specifics for the ooRexx and BSF4Rexx source code Subversion Checkouts, Makefiles and Code Builds

Sample ooRexx Program

rpicputemp.rex – Will be made available with the PDF of the Presentation Slides

Appendix A: Key Website References for This Presentation

Appendix B: List of Key Technologies Referenced

Questions? Thanks for Your Time & Interest

Appendix A: List of References

Reference(s):

Article	Author	URL	Notes
Top 10 Best Raspberry Pi Monitors 2020 Review	by "Pansy" April 20, 2020	https://reviewbest1.com/best-raspberry-pi-monitors/	Cites Eviciv 7" Inch Touchscreen Monitor as Top Choice; Durability
Raspberry Pi Imager Download	Not Applicable	https://www.raspberrypi.org/downloads/	Downloads for Raspberry Pi OS
Download Sparky Linux Stable Edition	Not Applicable	https://sparkylinux.org/download/stable/	Download of Sparky Linux v5.12 Armhf with Openbox
Balena Etcher	Not Applicable	https://www.balena.io/etcher/	Downloads of Balena Etcher Card Image Flashing Utility
Arch Linux Armhf Image Download	Not Applicable	https://archlinuxarm.org/about/downloads	ArchLinuxARM-rpi-4-latest.tar.gz Image Used

Appendix A: List of References+

Reference(s):

Article	Author	URL	Notes
Raspberry Pi 4 Arch Linux ARM Installation	Not Applicable	https://archlinuxarm.org/platforms/armv8/broadcom/raspberry-pi-4#installation	How to Install Arch Linux ARM for R Pi4 on an SD Card
Home Network Guy – How to InstallUbuntu Mate 20.04 on The Raspberry Pi 4	Dustin Casto April 29, 2020	https://homenetworkguy.com/how-to/install-ubuntu-mate-20-04-lts-on-raspberry-pi-4/	Complete A-Z Article on Setting Up Ubuntu Mate on the R Pi 4
Canonical Tutorial -- How to Install Ubuntu on Your Raspberry Pi 4	Not Applicable	https://ubuntu.com/tutorials/how-to-install-ubuntu-on-your-raspberry-pi#1-overview	Paged Tutorial on Setting Up Ubuntu Server and a Desktop on the Raspberry Pi
Java SE Development Kit 8 Downloads	Not Applicable	https://oracle.com/java/technologies/javase/javase-jdk8-downloads.html	Oracle Java SE JDK 8 Development Kit Downloads
nixCraft -- How to find out Raspberry Pi GPU and ARM CPU temperature on Linux	Vivek Gite December 7, 2018	https://www.cyberciti.biz/faq/linux-find-out-raspberry-pi-gpu-and-arm-cpu-temperature-command/	How to Measure GPU and CPU Temperature on the Raspberry Pi

Appendix A: List of References++

Reference(s):

Article	Author	URL	Notes
Maker.Pro – What Micro SD Card is Best for a Raspberry Pi 4?	Karissa Mansle June 28, 2019	https://maker.pro/raspberry-pi/tutorial/what-micro-sd-card-is-best-for-a-raspberry-pi-4	Aricle Covering Best microSD Card Selections for Fasest Option, Largest Storage and Lowest Cost
Maker.Pro – OS Options for the Raspberry Pi 4	Eduardo Pecina July 9, 2019	https://maker.pro/raspberry-pi/tutorial/os-options-for-raspberry-pi-4	One of the few Web Articles that filters the coverage of OS choices specifically for the Raspberry Pi 4

Appendix B: List of Technologies

Summary of Linux Distro Technologies Installed:

Software	Version	Architecture	Notes / Comments
Raspbian Linux	10 (Buster)	Armv71 32 Bit	Raspberry Pi OS Installed with Noobs (Xfce Like Desktop?)
Sparky Linux	5.12	Armv71 32 Bit	Based on Debian w. Openbox Desktop (Very Fast & Lean)
Manjaro Linux Xfce	2020-06-11	Aarch 64 Bit	Rolling Distro 20.05 (New Xfce; Best Choice for Desktop)
Manjaro Linux KDE	2020-06-11	Aarch 64 Bit	Rolling Distro 20.05 (KDE Plasma; If Choice go 8Gb on your Rpi 4 Board)
Arch Linux Xfce	2020-07-15	Armv71 32 Bit	Rolling Distro Rpi4 Latest (Old Xfce)
Xubuntu Linux	18.04 LTS	Aarch 64 Bit	Xubuntu Install on Ubuntu Server (New Xfce)

Appendix B: List of Technologies +

Software	Version	Architecture	Notes / Comments
Ubuntu Mate	Server 20.04 LTS	Aarch 64	Mate Desktop Install on Ubuntu Server
Java Open JDK	8	To Match Distro Arch	Install Debian Package Otherwise Download & Install From Oracle Site
ooRexx	4.2 or 5.0	To Match Distro Arch	For 32 Bit Distro the Raspbian .Deb File Works Well; For 64 Bit Distros Build From SVN Checkout
NetRexx	3.03 GA or Later	Pick a Jar or Zip Archive	I prefer the .Jar File Installation
BSF4ooRexx	641 Beta	Arm 32 and 64	Matches Well with 4.2 or 5.0 ooRexx