Raspberry Pi Clusters - Hands-On

HPCC Presentation 10-16-23

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Overview

- Pi OS Setup
- Installing Packages
- Master Setup
- Nodes Setup

Ask any questions as you have them!

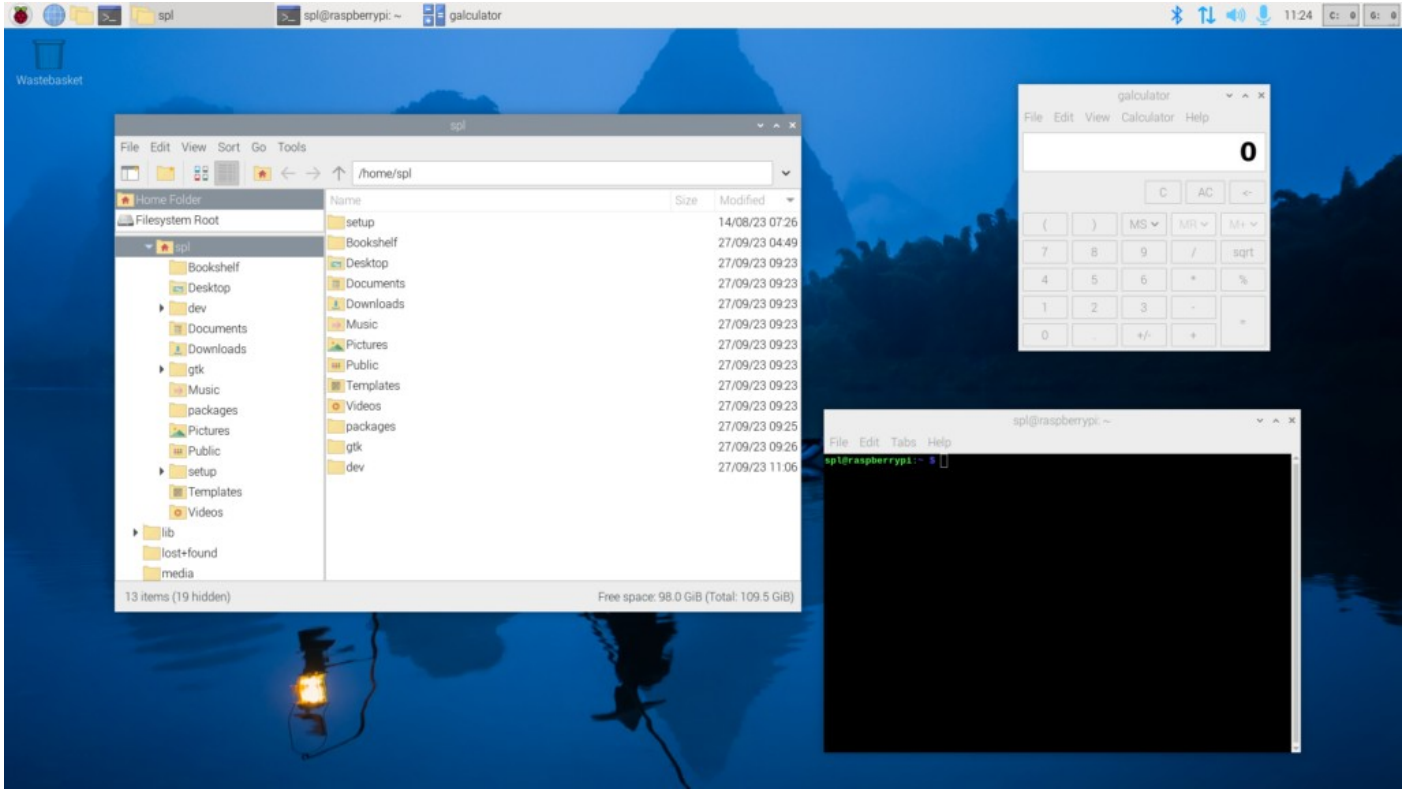
Pi OS Setup

- **Pi OS is Raspberry Pi's official Debian distribution**
  - Made for Raspberry Pi, including a lot of helpful tools for deployments
- **To get it, we can use Raspberry Pi's custom imaging utility from their website**
  - https://www.raspberrypi.com/software/

Pi OS Setup


Raspberry Pi Imager v1.6
Raspberry Pi
Operating System
CHOOSE OS
Storage
CHOOSE STORAGE
WRITE

Pi OS Setup


spl
spl@raspberrypi: ~
galculator
11:24
Wastebasket
File Edit View Sort Go Tools
/home/spl
Home Folder
Filesystem Root
Name
Size
Modified
setup 14/08/23 07:26
Bookshelf 27/09/23 04:49
Desktop 27/09/23 09:23
Documents 27/09/23 09:23
Downloads 27/09/23 09:23
Music 27/09/23 09:23
Pictures 27/09/23 09:23
Public 27/09/23 09:23
Templates 27/09/23 09:23
Videos 27/09/23 09:23
packages 27/09/23 09:25
gtk 27/09/23 09:26
dev 27/09/23 11:06
13 items (19 hidden)
Free space: 98.0 GiB (Total: 109.5 GiB)
File Edit View Calculator Help
0
File Edit Tabs Help
spl@raspberrypi:~ $

Installing Packages

- **Python**
  - sudo apt install python-pip python-dev
- **MPI**
  - sudo apt install mpich
  - sudo pip install mpi4py

Master Setup

- **DNS / DCHP**
  - sudo apt dnsmasq
  - Static IP address
    - Edit /etc/dhcpd.conf

      interface eth0

      static ip_address=192.168.0.10/24

      static routers=192.168.0.1

      static domain_name_servers=192.168.1.1 8.8.8.8
      - Write down this IP adress for later
    - Reboot

Master Setup

- **DNSMasq Configuration**
  - Add the following to /etc/dnsmasq.conf

```
interface=eth0
bind-dynamic
domain-needed
bogus-priv
dhcp-range=192.168.1.100,192.168.1.200,255.255.255.0,1d
```

  - Restart dnsmasq
    - sudo service restart dnsmasq

Master Setup

- **SSH Key Generation**
  - ssh-keygen
    - Default values are fine

Nodes Setup

- **Plug the master into the switch first**
- **Plug all the nodes into the switch after the master has started up**
  - We need the nodes to use the master as it’s DCHP server

Nodes Setup

- **Python**
  - sudo apt install python-pip python-dev
- **MPI**
  - sudo apt install mpich
  - sudo pip install mpi4py

Nodes Setup

- **Get the nodes IP addresses**
  - ip a
    - Record the IP address and hostname
- **Test ping the master**
  - nmap -sP IP.*
  - ping -c 3 MASTER_IP
    - Where MASTER_IP is the IP address of the master

Nodes Setup

- **On the master:**
  - Make a file in /home/pi named HOSTFILE
  - Edit /home/pi/HOSTFILE
    - Write localhost, followed by a list the IP addresses of the nodes, separated by a new line
  - Edit /etc/hosts (optional)
    - At the end of the file, type the IP addresses of the nodes followed by an alias for them (hostname)

Nodes Setup

- **On the master:**
  - Test SSH to the nodes
    - ssh pi@NODE_IP
      - Where NODE_IP is the IP address of a node
  - Copy over the SSH key over to each node
    - ssh-copy-id -i .ssh/id_rsa.pub
  - Edit ~/.bashrc (optional)
    - Add alias HOSTNAME='ssh pi@NODE_IP' for each node

Testing

- **Test MPI without a script**
  - mpiexec -hostfile HOSTFILE hostname
    - The hostfile option tells MPI where a hostfile is located, and within that file is a list of our IP address for MPI to execute off of
    - Hostname is the command we are running, in this case it should identify the hostname of the system it is running on
    - If successful, there should be 3 different hostnames present (master and two nodes)

Testing

- **Test MPI with a script**
  - …for a later date