

A HANDS-ON TUTORIAL

# BUILDING RASPBERRY PI SUPERCOMPUTERS

FEDERICO LUCIFREDI

LINUXCONFAU  
ONLINE 2021

# ME ME ME

## THINGS I WORKED ON

RED HAT CEPH STORAGE  
UBUNTU SERVER  
LANDSCAPE  
SUSE STUDIO  
SLES  
SMT  
XIMIAN RED CARPET  
MAN (I)



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# DISCLAIMER

WHILE THE FOLLOWING WAS  
CONSCIENTIOUSLY RESEARCHED AND  
VERIFIED, NEITHER THE ORGANIZERS  
NOR THE AUTHOR WILL ACCEPT ANY  
LIABILITY IF YOU RENDER YOUR  
ORGANIZATION INOPERABLE AS A  
RESULT OF THESE INSTRUCTIONS.

PROCEED AT YOUR OWN RISK.

# ASSEMBLY

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# HARDWARE

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# SOFTWARE

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# user setup

---

give the root user a password

```
# passwd
```

rename the picocluster user to your liking

```
# groupmod -n federico picocluster
```

```
# usermod -l federico picocluster
```

```
# usermod -d /home/federico federico #update home directory
```

```
# cd /home; mv picocluster federico
```

```
# vi /etc/passwd
```

```
$ passwd #update password
```

```
$ rm .XAuthority #force new xauth
```

# users

---

users set up on the system

federico	(you)	# sudo capable
root	(just in case)	# no SSH access

make sure you can become a superuser

```
# vi /etc/sudoers  
federico ALL=(ALL) NOPASSWD: ALL
```



# runlevels

---

nodes other than the master node (pc0) need not run X:

```
# systemctl set-default multi-user.target
```

# network

---

ethernet wired network for local intra-cluster communication:

pc0	eth0	(head node)	10.1.10.240	# HDMI interface
pc1	eth0		10.1.10.241	
pc2	eth0		10.1.10.242	

wifi network for external connectivity and downloads:

pc0	wlan0	(head node)	DHCP
pc1	wlan0		DHCP
pc2	wlan0		DHCP

# WiFi

---

```
/etc/network/interfaces
```

```
# interfaces(5) file used by ifup(8) and ifdown(8)
```

```
# Include files from /etc/network/interfaces.d:  
source-directory /etc/network/interfaces.d
```

```
auto wlan0
```

```
allow-hotplug wlan0
```

```
iface wlan0 inet dhcp
```

```
wpa-conf /etc/wpa_supplicant/wpa_supplicant.conf
```

```
auto eth0
```

```
iface eth0 inet static
```

```
address 10.1.10.240
```

```
netmask 255.255.255.0
```

```
gateway 10.1.10.1
```

```
dns-nameservers 10.1.10.1 8.8.8.8
```

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# connections

---

automatically joining known wireless networks:

```
/etc/wpa_supplicant/wpa_supplicant.conf  
ctrl_interface=DIR=/var/run/wpa_supplicant GROUP=netdev  
update_config=1  
country=US
```

```
network={  
    ssid="Red Hat Guest"  
    psk="Shadowman33"  
}
```

```
network={  
    ssid="scale-public-fast"  
    psk="pasadena"  
}
```

# access keys

---

use SSH keys to enable rapid, secure access between nodes:

```
$ ssh-keygen -t rsa -P '' -f ~/.ssh/id_rsa  
$ cat ~/.ssh/id_rsa.pub >> ~/.ssh/authorized_keys
```

authorize the key on every node of the cluster

```
$ ssh-copy-id -i .ssh/id_rsa.pub federico@pc0  
$ ssh-copy-id -i .ssh/id_rsa.pub federico@pc1  
$ ssh-copy-id -i .ssh/id_rsa.pub federico@pc2
```

[genKeys.sh](#) in the PicoCluster image set

[ssh-import-id](#) on GitHub

# cluster management

---

some handy scripts are part of the Picocluster base system:

[restartAllNodes.sh](#)

[stopAllNodes.sh](#)

[testAllNodes.sh](#)

[resize\\_rpi.sh](#)

# parallel SSH

---

for one-time tasks, parallel SSH is the way to go:

```
$ parallel-ssh [-l user] [-h file | -H hosts] [--inline] <command>
```

some examples:

```
$ parallel-ssh -h nodes "cat /etc/hosts"
```

```
$ parallel-ssh -h nodes --inline "cat /etc/hosts"
```

```
$ parallel-ssh -h nodes "ping -c 1 10.1.10.240"
```

```
$ parallel-ssh -h nodes --inline "ping -c 1 -W 5 www.mit.edu"
```

```
$ parallel-ssh -h nodes -i "vcgencmd measure_temp"
```

# time

---

give the cluster a reliable source for timestamps:

```
# timedatectl                                # get status  
# timedatectl set-ntp true
```

set the correct timezone

```
# timedatectl list-timezones | grep America  
# timedatectl set-timezone America/New_York
```

time source is defined in `/etc/systemd/timesyncd.conf`



# shared folder

---

NFS file share setup on primary node:

```
$ sudo apt install nfs-kernel-server
```

```
# mkdir /export
```

```
# chown federico:federico /export
```

```
# vi /etc/exports
```

```
/export 10.1.10.0/24(rw,sync)
```

```
$ sudo systemctl restart nfs-server      # update shares
```

# mounts

---

NFS mount on secondaries:

```
# mkdir /export  
# chown federico:federico /export
```

you can now `$ sudo mount pc0:/export /export`

```
$ sudo vi /etc/fstab  
pc0:/export      /export nfs      defaults      0      0
```

# blinkenlights

---

Pimoroni Blinkt libraries need to be pre-installed.

```
$ curl https://get.pimoroni.com/blinkt | bash
```

then, inevitably, the Cylons arrive:

```
$ cd Pimoroni/blinkt/examples
```

```
$ laron.py
```

```
$ parallel-ssh -h ~/nodes /export/laron.py
```

```
$ clear_all.py      # clear any residual state
```

perhaps a better example:

```
$ cpu_load.py
```

```
$ stress -c 2
```

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# CONCLUSION

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# resources

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Picocluster

[genKeys.sh](#)

[restartAllNodes.sh](#)

[stopAllNodes.sh](#)

[testAllNodes.sh](#)

[resize\\_rpi.sh](#)

Additional tools

`apt install wolfram-engine`

Dustin Kirkland

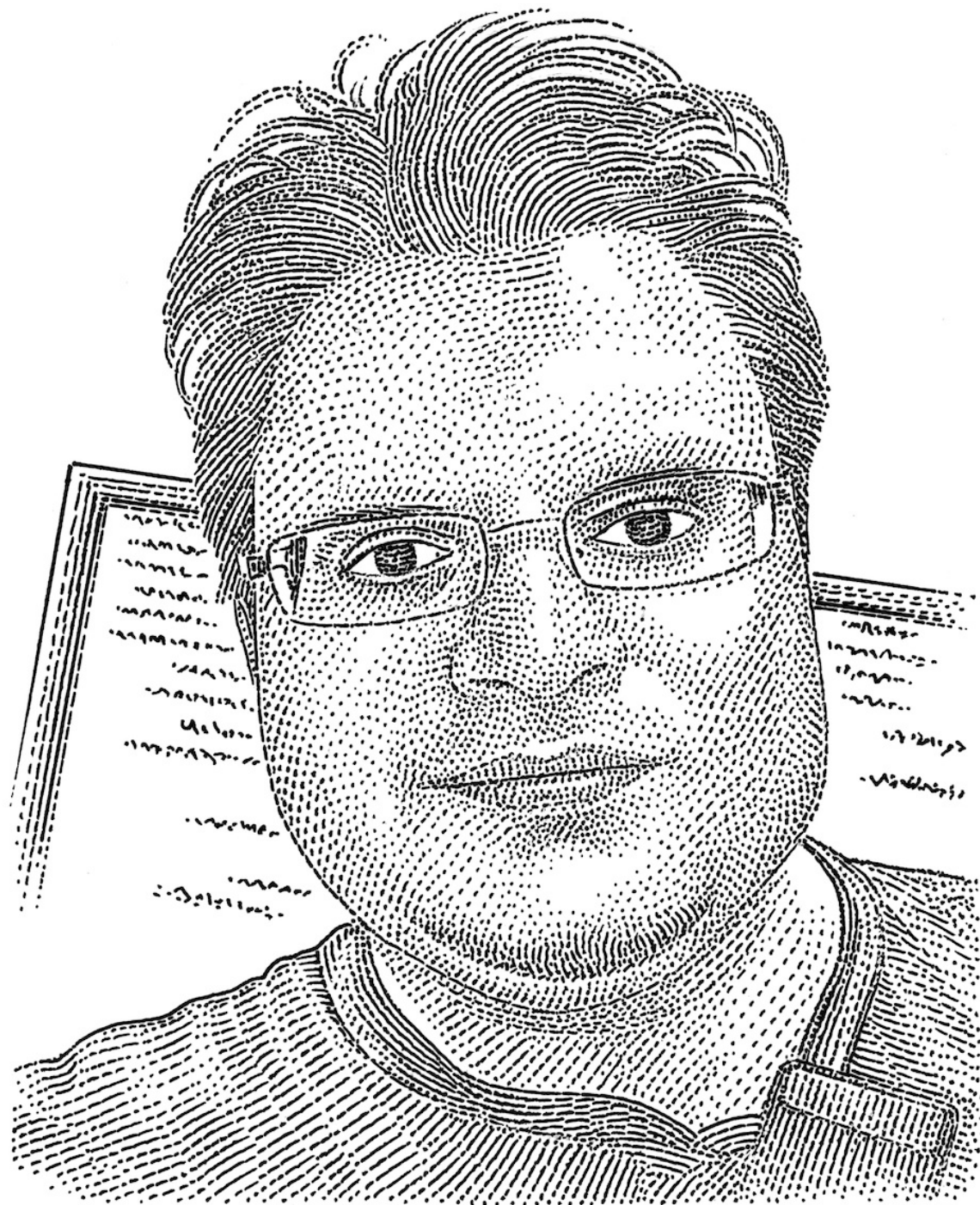
[ssh-import-id](#)

Carlos Morrison

Oak Ridge National Lab

[serialpi.c](#)

# QUESTIONS



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