A HANDS-ON TUTORIAL

BUILDING RASPBERRY PI SUPERCOMPUTERS

FEDERICO LUCIFREDI
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
SOFTWARE

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user setup

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give the root user a password

```bash
# passwd
```

rename the picocluster user to your liking

```bash
# groupmod -n federico picocluster
# usermod -l federico picocluster
# usermod -d /home/federico federico  #update home directory
# cd /home; mv picocluster federico
```

```bash
# vi /etc/password
$ passwd  #update password
```

```bash
$ 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

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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
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:

```bash
$ 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:

```bash
$ 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 Picoccluster 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
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**

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**Pimoroni Blinkt** libraries need to be pre-installed.

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

then, inevitably, the Cylons arrive:

```
$ cd Pimoroni/blinkt/examples

$ larson.py

$ parallel-ssh -h ~/nodes /export/larson.py

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

perhaps a better example:

```
$ cpu_load.py

$ stress -c 2
```
CONCLUSION
resources

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
- serialpi.c

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QUESTIONS

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