

KUBERNETES ON RASPBERRY PI

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CHRIS WRAITH

Twitter: @jacksonps4

LinkedIn: <https://www.linkedin.com/in/chriswraith/>

Instagram: @jacksonps4

GitHub: @jacksonps4

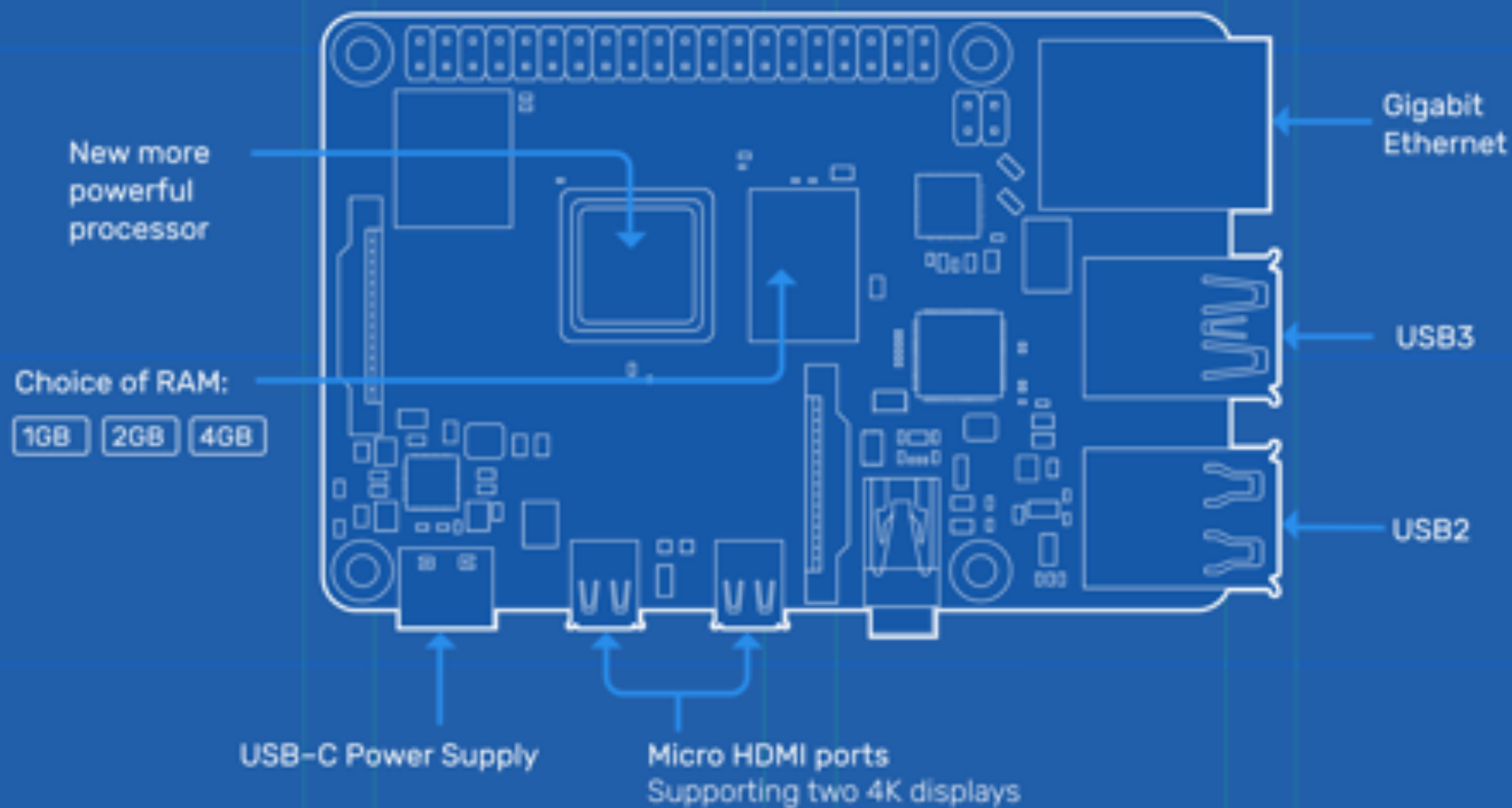
2001



2019



Raspberry Pi 4 Tech Specs



	Raspberry Pi 4 model B	Compaq Proliant ML370
CPU(s)	Broadcom BCM2711, Quad core Cortex-A72 (ARM v8) 64-bit SoC @ 1.5GHz	Up to 2 Intel Pentium III single core 32-bit @ 1.0GHz
Memory	choice of 1GB / 2GB / 4GB	Up to 4GB
Storage	Largest SD card you can find (typically 1TB)	Up to 500GB SCSI disks
Networking	Gigabit Ethernet	100Mbits Ethernet
Cost	Raspberry Pi £54 Power supply £8 SD card £10	£5,000 - £10,000
Weight	45g	~ 30kg
Power consumption	~ 15W = £18 / year	~ 400W = £360 / year

STORAGE

SanDisk Extreme 32 GB microSDHC Memory Card + SD Adapter with A1 App Performance + Rescue Pro Deluxe, Up to 100 MB/s, Class 10, UHS-I, U3, V30

Buying for work? Discover Amazon Business, for business-exclusive pricing, downloadable VAT invoices and more. [Create a FREE account](#)

by SanDisk



30,956 ratings | 313 answered questions

Amazon's Choice

for "micro sd card class 10 u3"



Was: £10.35

Price: **£10.22** ✓prime FREE One-Day

You Save: **£0.13 (1%)**

Pay ~~£10.22~~ **£0.00**: get a £20 Amazon Gift Card on approval for the Amazon Platinum Mastercard. Terms apply.

Note: Available at a lower price without Prime delivery from [other sellers](#).

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[New & Used \(32\)](#) from **£9.33** ✓prime FREE Delivery

Size Name: **32 GB**

1 TB

32 GB

64 GB

128 GB

256 GB

400 GB

512 GB

Card Reader

Style Name: **Extreme microSD**

[Click to open expanded view](#)

STORAGE



Roll over image to zoom in

SanDisk Extreme 1 TB microSDXC Memory Card + SD Adapter with A2 App Performance + Rescue Pro Deluxe, Up to 160 MB/s, Class 10, UHS-I, U3, V30

[£5 off your first Treasure Truck order](#)

by [SanDisk](#)

★★★★★ [30,956 ratings](#) | [312 answered questions](#)

Was: ~~£447.11~~

Price: **£385.84** + £5.95 delivery

You Save: **£61.27 (14%)**

[Pay ~~£385.84~~ £365.84: get a £20 Amazon Gift Card on approval for the Amazon Platinum Mastercard. Terms apply.](#)

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[New \(6\) from £385.84 + £5.95 Shipping](#)

Size Name: **1 TB**

1 TB

32 GB

64 GB

128 GB

256 GB

400 GB

512 GB

Card Reader

Style Name: **Extreme microSD**

SOME APPLICATIONS FOR RASPBERRY PI

- Broadband router and firewall
- Home sensor project
- Security camera
- Control system
- Media centre
- Git repository
- Lightweight database server
- Project or support dashboard
- Meeting room booking / availability screen
-



kubernetes

Why do I need it?

Application

Just run a process

Build for a VM

Dependencies

Large processes

Can be slower

Shared state

More at

<https://kubernetes.io>

KUBERNETES GIVES YOU

- Container orchestration:
 - Define your executable code in containers
 - Inject storage, configuration, secrets at runtime
 - Storage orchestration: provide the appropriate storage class
 - Efficient resource usage: automatic bin packing of containers onto nodes
 - Auto-rollout and rollback
 - Self-healing



kubernetes

Containers and
pods

Ephemeral storage

Horizontal concerns

Declarative
configuration and
management

Availability / scaling

Resources / config

Scaling

Load balancing

Right sizing

Dispensable
servers and apps

Health checks

Remove failures

SOME APPLICATIONS THAT SUIT KUBERNETES ON PI HARDWARE WELL

- DNS server
- Web server
- Web proxy
- Application server
-

STATELESS APPLICATIONS

- Kubernetes is an excellent choice for STATELESS applications.
- Stateful applications work too and have plenty of built in support but require more design and planning.

REMEMBER

Kubernetes is a framework which provides basic, fundamental services.

You will need to build on top of it to meet all of your platform and application needs.

How to create a Kubernetes cluster?



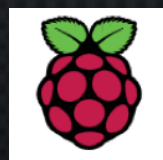
Amazon EKS



Google Kubernetes Engine (GKE)



Azure Kubernetes Service (AKS)



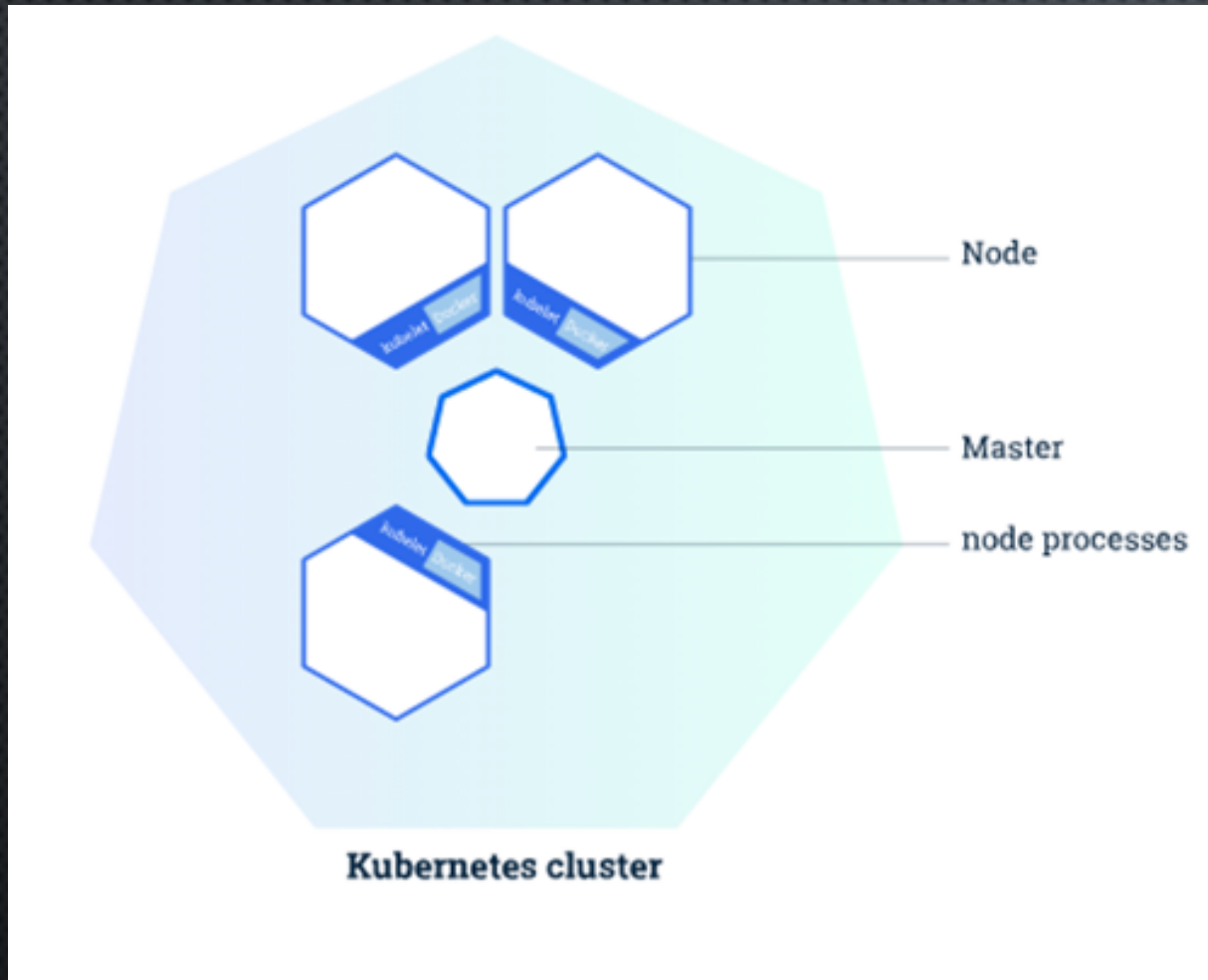
Bare metal



WHY ON EARTH WOULD YOU DO THIS ON RASPBERRY PI?

- COST vs Google GKE or Amazon EKS
- LEARNING and EXPERIMENTATION
- Your performance needs are modest
- Uses very little power – so it can be left running without using lots of electricity.

What is a Kubernetes Cluster?

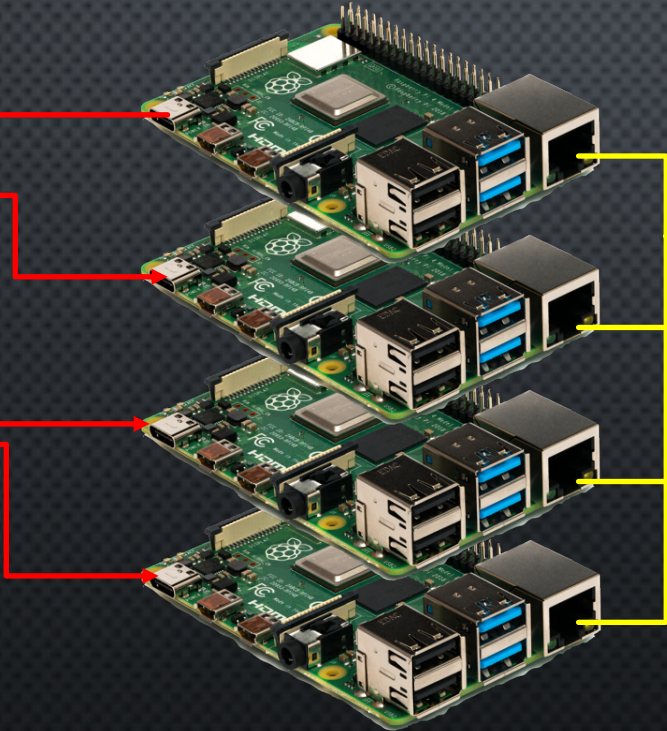


- **Master node:** coordinates and orchestrates workloads.
- **Worker nodes:** run workloads.
- **Networking:** Container Network Interface (CNI) allows software defined networks to run within the cluster. Can define policies at this level.
- **Security:** all communication via HTTPS API secured with PKI and certificate authentication

WHAT DOES A RASPBERRY PI CLUSTER LOOK LIKE?



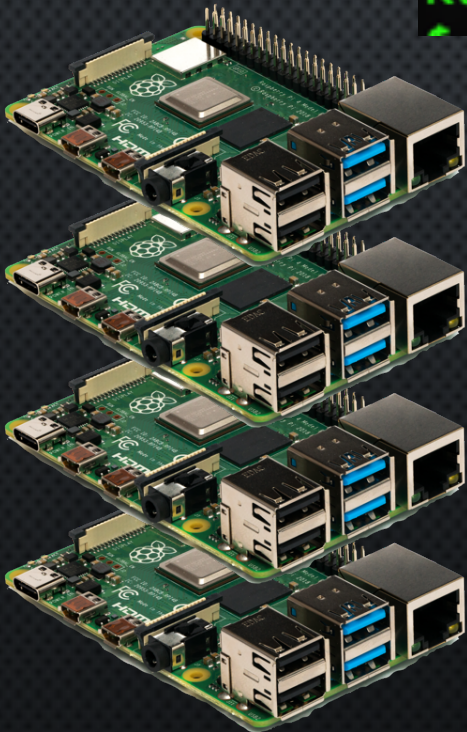
Power source



Networking

HOW DO YOU SET UP A CLUSTER?

```
$ kubectl get nodes
NAME           STATUS    ROLES    AGE   VERSION
kube-master    Ready    master   52d   v1.15.1
kube-node1     Ready    <none>   52d   v1.15.1
kube-node2     Ready    <none>   52d   v1.15.1
kube-node3     Ready    <none>   52d   v1.15.1
```



<https://gist.github.com/jacksonps4/9c887b0ed0dd6f8854bc1a6d2d6564a8>

DEMO: HOW DO I RUN SOMETHING ON IT?

LEARNINGS: ISSUES WITH KUBERNETES ON PI

- CLOCK SYNC: NETWORKING WILL FAIL IF THE CLOCKS OF ANY NODE ARE NOT IN SYNC
- LATEST IPTABLES VERSION CAUSING NETWORK ISSUES ON PI
 - SWITCH TO LEGACY VERSION USING ALTERNATIVES ON RASPBIAN
- SPECIFIC VERSIONS OF KUBERNETES / DOCKER / RASPBIAN SOMETIMES MATTER

LEARNINGS

- BUY A CONSOLE CABLE!
 - SERIAL CONSOLE ON YOUR LAPTOP: GREAT FOR TROUBLESHOOTING HEADLESS DEVICES
 - ALSO A HANDY WAY OF POWERING A PI (BUT SEE NEXT SLIDE)
- HAVE SOME SPARE SD CARDS, POWER SUPPLIES.

LEARNINGS: TYPICAL ISSUES WITH RASPBERRY PI

- WON'T BOOT?
 - CAN THE POWER SUPPLY PROVIDE 3A @ 5VDC
 - CHECK THE SD CARD AS THEY SOMETIMES FAIL.
- PERFORMANCE / NON-DETERMINISTIC BEHAVIOUR?
 - CHECK THE POWER SUPPLY!

Sponsors



{ } NDC Conferences



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QUESTIONS?

RESOURCES

- PROLIANT SPECS:
[HTTPS://H20195.WWW2.HPE.COM/V2/GETDOCUMENT.ASPX?DOCNAME=C04282251](https://h20195.www2.hp.com/v2/GetDocument.aspx?docname=c04282251)
- KUBERNETES: [HTTPS://KUBERNETES.IO](https://kubernetes.io)
- KUBERNETES API DOCS: [HTTPS://KUBERNETES.IO/DOCS/CONCEPTS/](https://kubernetes.io/docs/concepts/)
- RASPBERRY PI: [HTTPS://WWW.RASPBERRYPI.ORG/](https://www.raspberrypi.org/)
- KUBERNETES THE HARD WAY (KELSEY HIGHTOWER):
[HTTPS://GITHUB.COM/KELSEYHIGHTOWER/KUBERNETES-THE-HARD-WAY](https://github.com/kelseyhightower/kubernetes-the-hard-way)