



Daniele Polencic — @danielepolencic@hachyderm.io
@danielepolencic



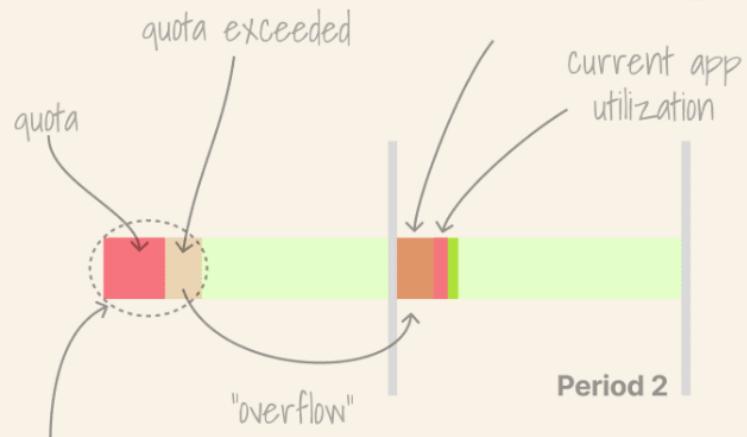
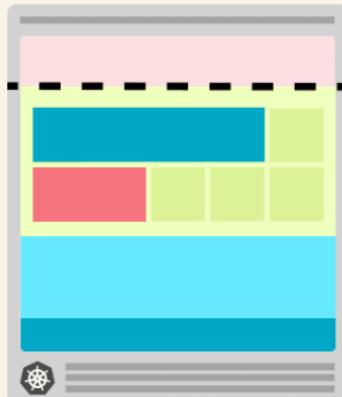
In Kubernetes, what should I use as CPU requests and limits?

Popular answers include:

- Always use limits!
- NEVER use limits, only requests!
- I don't use either; is it OK?

Let's dive into it

CPU REQUEST+LIMIT in KUBERNETES



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@danielepolencic



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In Kubernetes, you have two ways to specify how much CPU a pod can use:

- ① "Requests" are usually used to determine the average consumption
- ② "Limits" set the max number of resources allowed

CPU IN KUBERNETES

1 CPU Request

Average CPU consumption

2 CPU Limit

Max CPU allocated to the container

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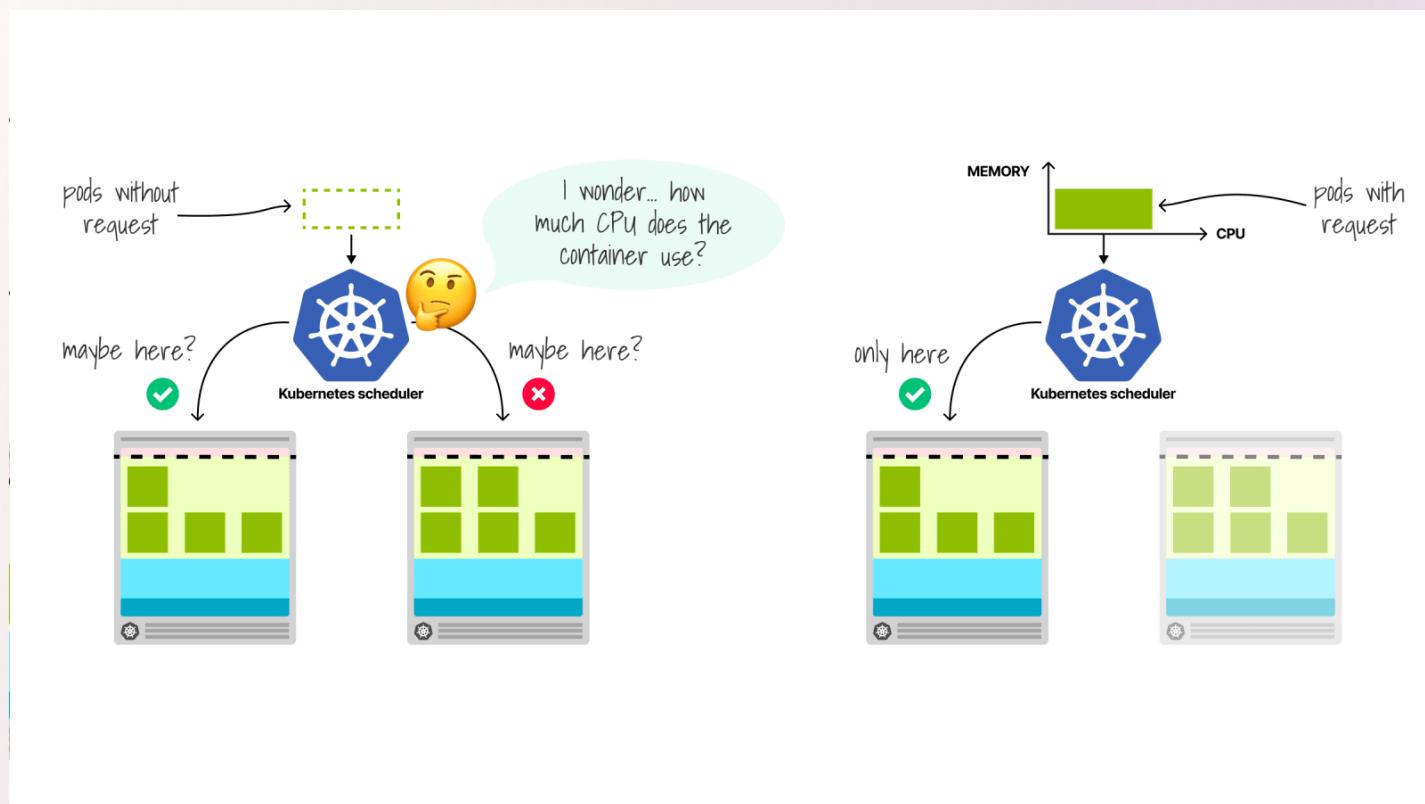


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The Kubernetes scheduler uses requests to determine where the pod should be allocated in the cluster

Since the scheduler doesn't know the consumption (the pod hasn't started yet), it needs a hint

But it doesn't end there



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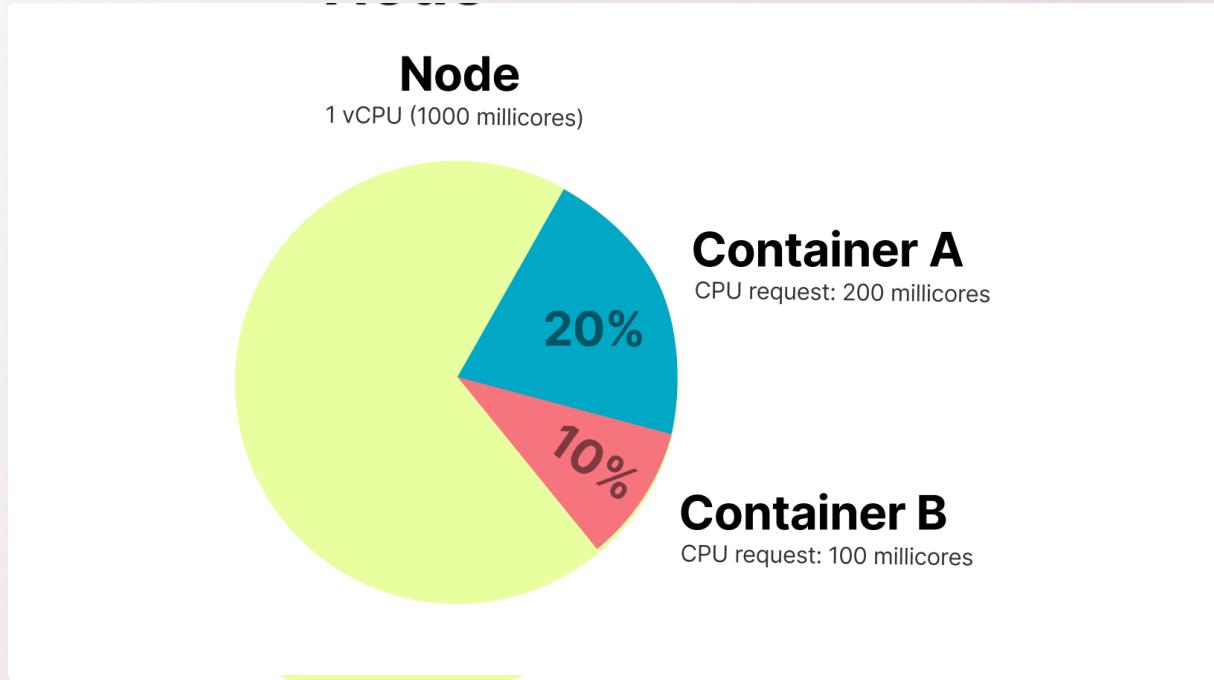
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CPU requests are also used to report the CPU to your containers

Example:

- A node has a single CPU
- Container A has requests = 0.1 vCPU
- Container B has requests = 0.2 vCPU

What happens if both containers end up using 100% CPU?



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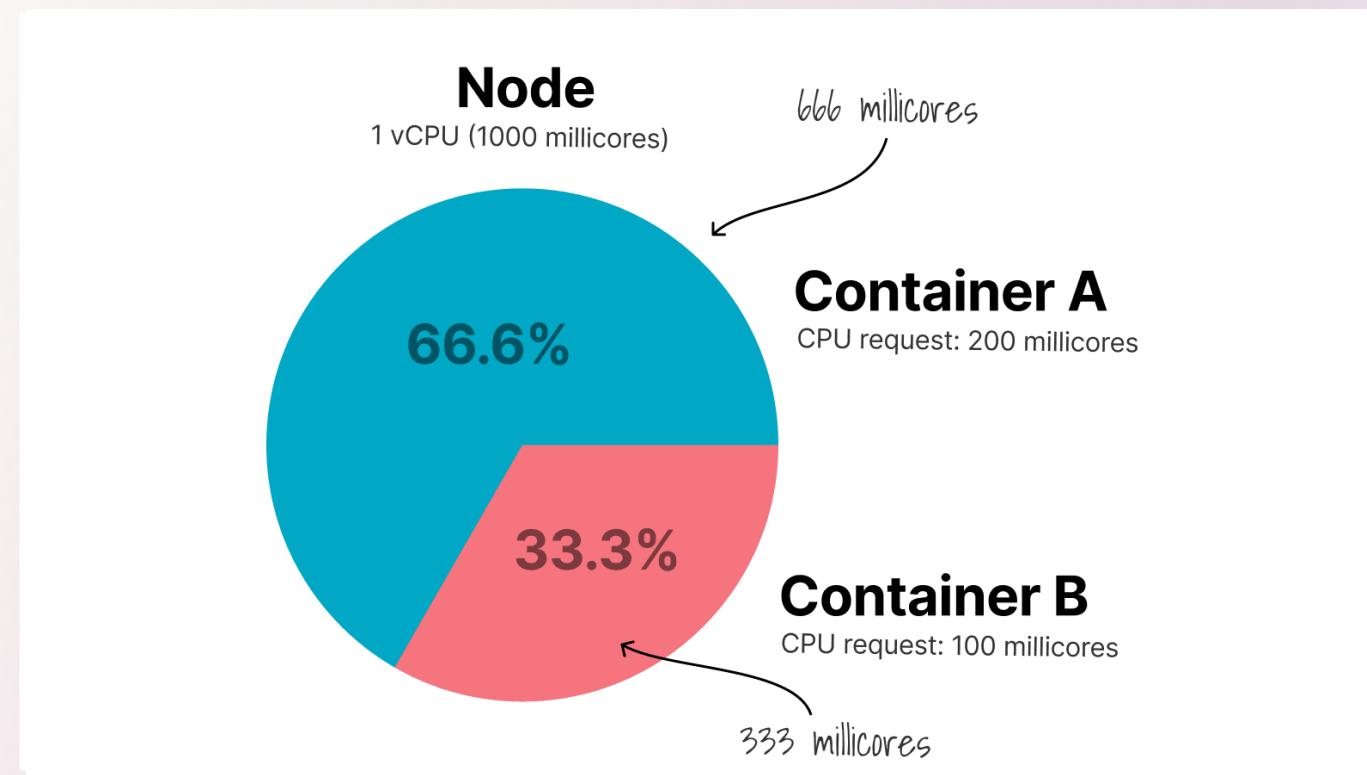


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Since the CPU request doesn't limit consumption, both containers will use all available CPUs

However, since container B's request is doubled compared to the other, the final CPU distribution is:

Container 1 uses 0.3vCPU and the other 0.6vCPU (double)



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@danielepolencic



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Requests are suitable for:

- Setting a baseline (give me at least X amount of CPU)
- Setting relationships between pods (this pod A uses twice as much CPU as the other)

But do not help set hard limits

For that, you need CPU limits

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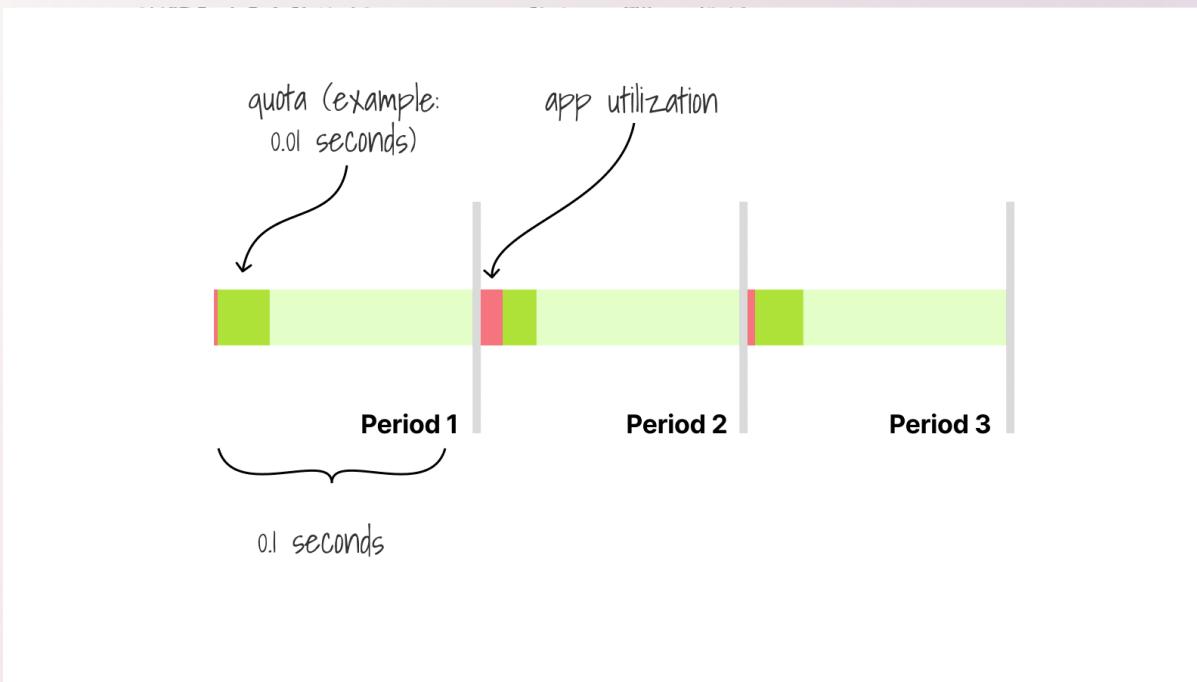
When you set a CPU limit, you define a period and quota

Example:

- period: 100000 microseconds (0.1s)
- quota: 10000 microseconds (0.01s)

I can only use the CPU for 0.01 seconds every 0.1 seconds

That's also abbreviated as "100m"



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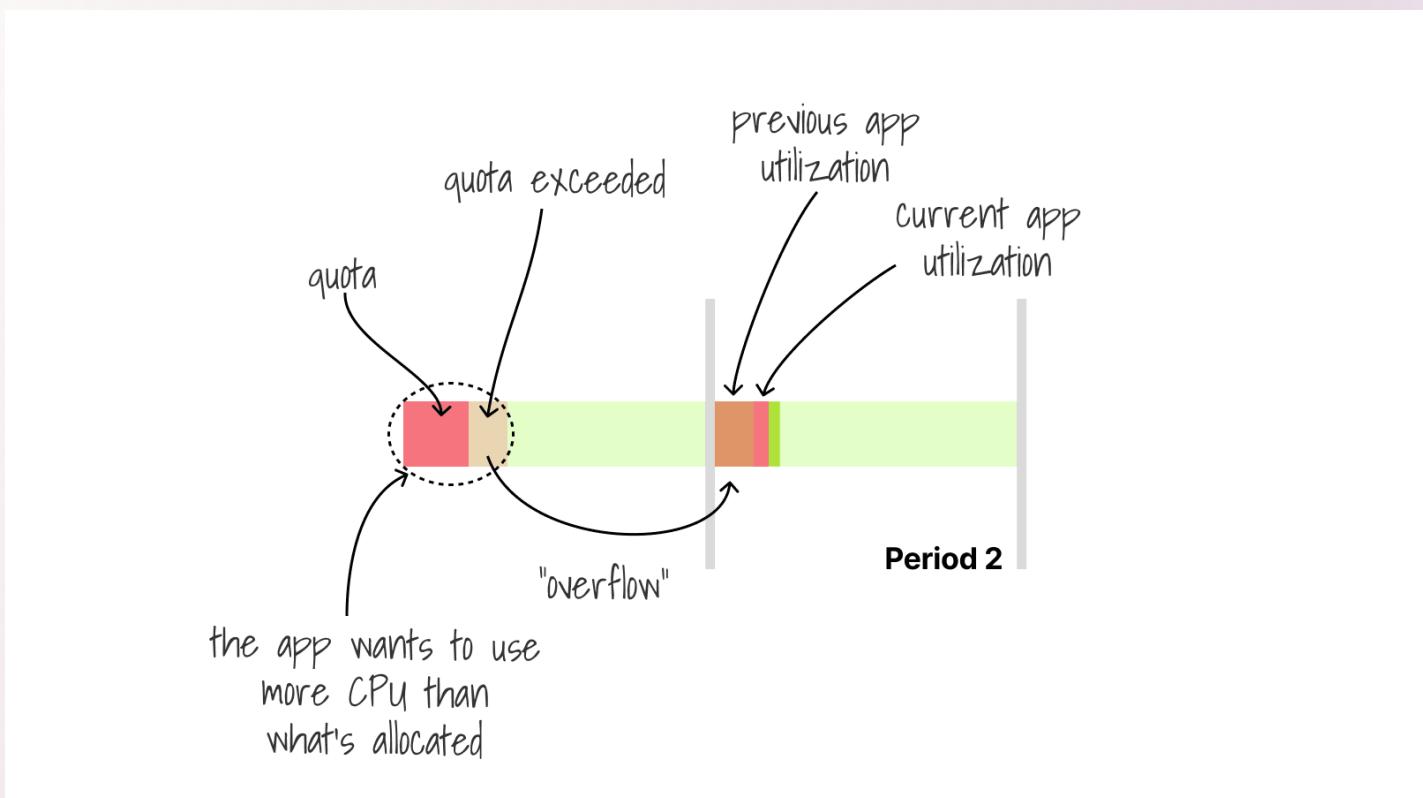


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If your container has a hard limit and wants more CPU, it has to wait for the next period

Your process is throttled

So what should you use as CPU requests and limits in your Pods?



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A simple (but not accurate) way is to calculate the smallest CPU unit as:

```
REQUEST = NODE_CORES * 1000 /  
MAX_NUM_PODS_PER_NODE
```

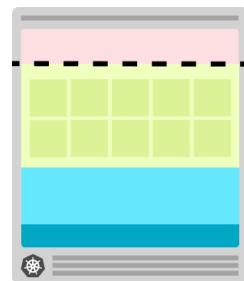
For a 1 vCPU node and a limit of 10 Pods, that's $1 * 1000 / 10 = 100\text{Mi}$ request

Assign the smallest unit or a multiplier of it to your containers

```
REQUEST (unit) = NODE_CORES * 1000 / MAX_NUM_PODS_PER_NODE
```

Node

Max pods: 10
Total CPUs: 1



Request unit

100m

100m

300m

700m

you can have
pods in multiples
of the unit

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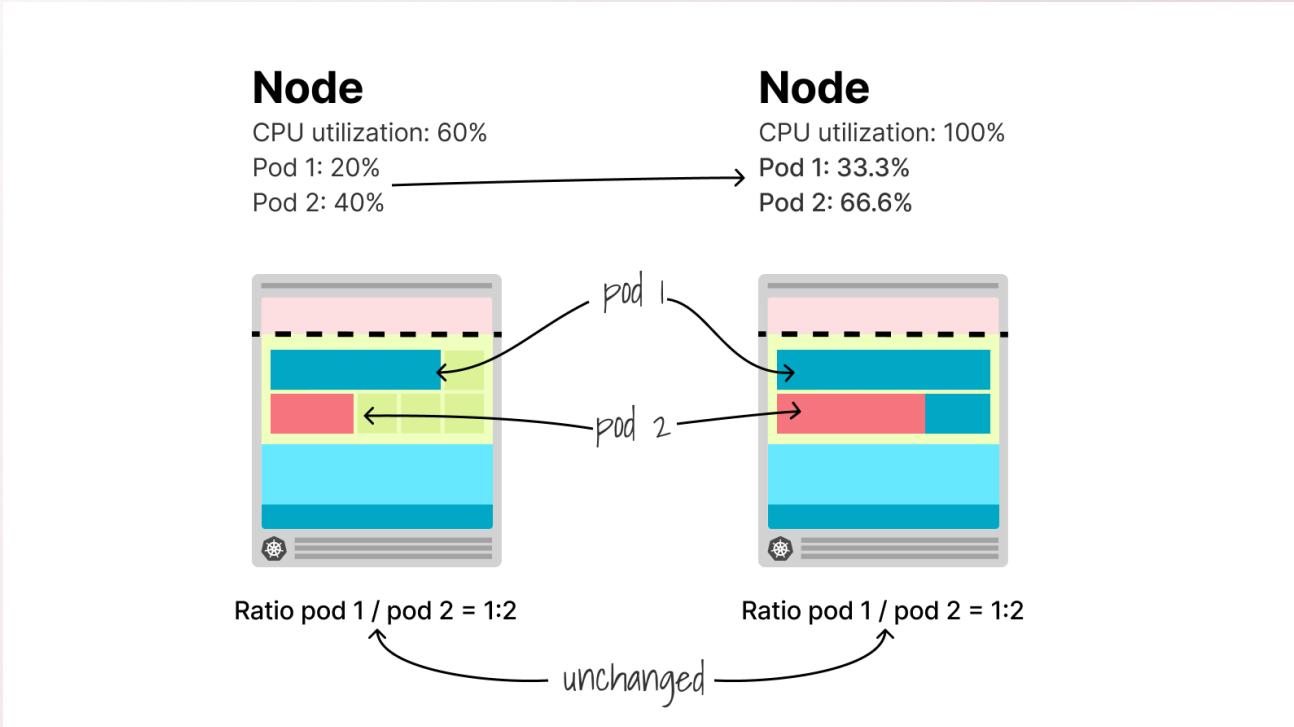


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For example, if you don't know how much CPU you need for Pod A, but you identified it is twice as Pod B, you could set:

- Request A: 1 unit
- Request B: 2 units

If the containers use 100% CPU, they repart the CPU according to their weights (1:2)



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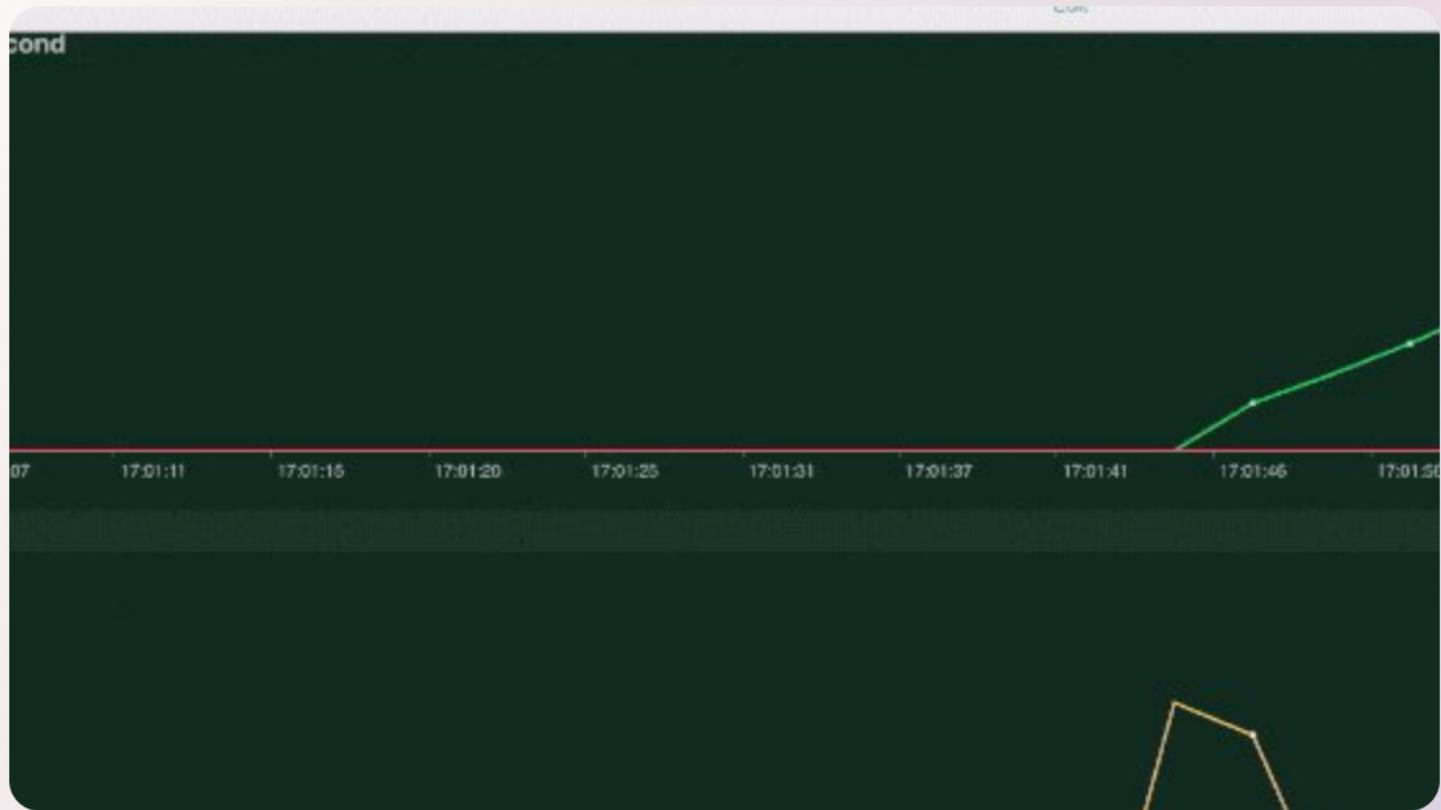
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A better approach is to monitor the app and derive the average CPU utilization

You can do this with your existing monitoring infrastructure or use the Vertical Pod Autoscaler to monitor and report the average request value



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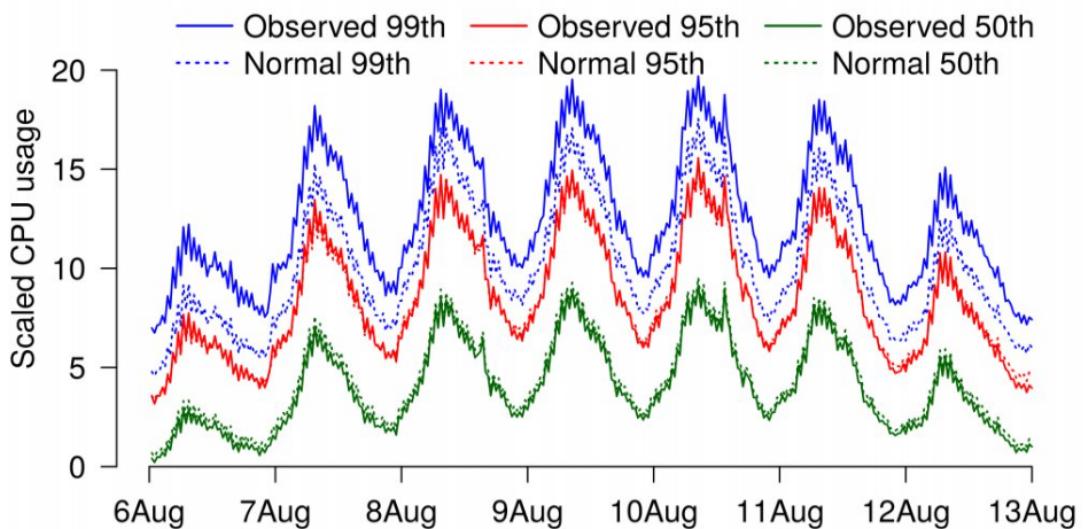


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How should I set the limits?

- ① Your app might already have "hard" limits. (Node.js is single-threaded and uses up to 1 core even if you assign 2)
- ② You could have: limit = 99th percentile + 30-50%

You should profile the app (or use the VPA) for a more detailed answer



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Should you always set the CPU request?

Absolutely yes

This is a standard good practice in Kubernetes and helps the scheduler allocate pods more efficiently

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Should you always set the CPU limit?

This is a bit more controversial, but, in general, I think so

The answer is longer than a tweet, and you can find it here: [dnastacio.medium.com/why-you-should...](https://dnastacio.medium.com/why-you-should-set-the-cpu-limit)

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Also, if you want to dig in more a few relevant links:

- [learnk8s.io/setting-cpu-me...](#)
- [@betz.mark/und..."](#)

[target="_blank">>medium.com/@betz.mark/und...](#)

- [nodramadevops.com/2019/10/docker...](#)

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And finally, if you've enjoyed this thread, you might also like:

- The Kubernetes workshops that we run at Learnk8s
learnk8s.io/training
- This collection of past threads
- The Kubernetes newsletter I publish every week
learnk8s.io/learn-kubernetes-newsletter

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