DevOps (1/2)

Martin Kellogg

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Today's agenda:

- Operations, Toil, and the DevOps philosophy
- Ops challenge example: deployment
- Achieving reliability
  - the service reliability hierarchy + SLAs/targets
  - monitoring
  - incident/emergency response
  - post-mortems + learning from failure

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- deploying new versions of the software

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  - other advantages: easy to staff for, off-the-shelf tooling, etc.

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Traditional approach to operations can work in either of these models!

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- But, they are serious concerns for modern systems with high release cadences, especially those that are:
  - microservices
  - delivered via the web
  - use “continuous delivery”

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- encourage operators to automate **toil**
- may still have some dedicated ops roles (e.g., SREs at Google)

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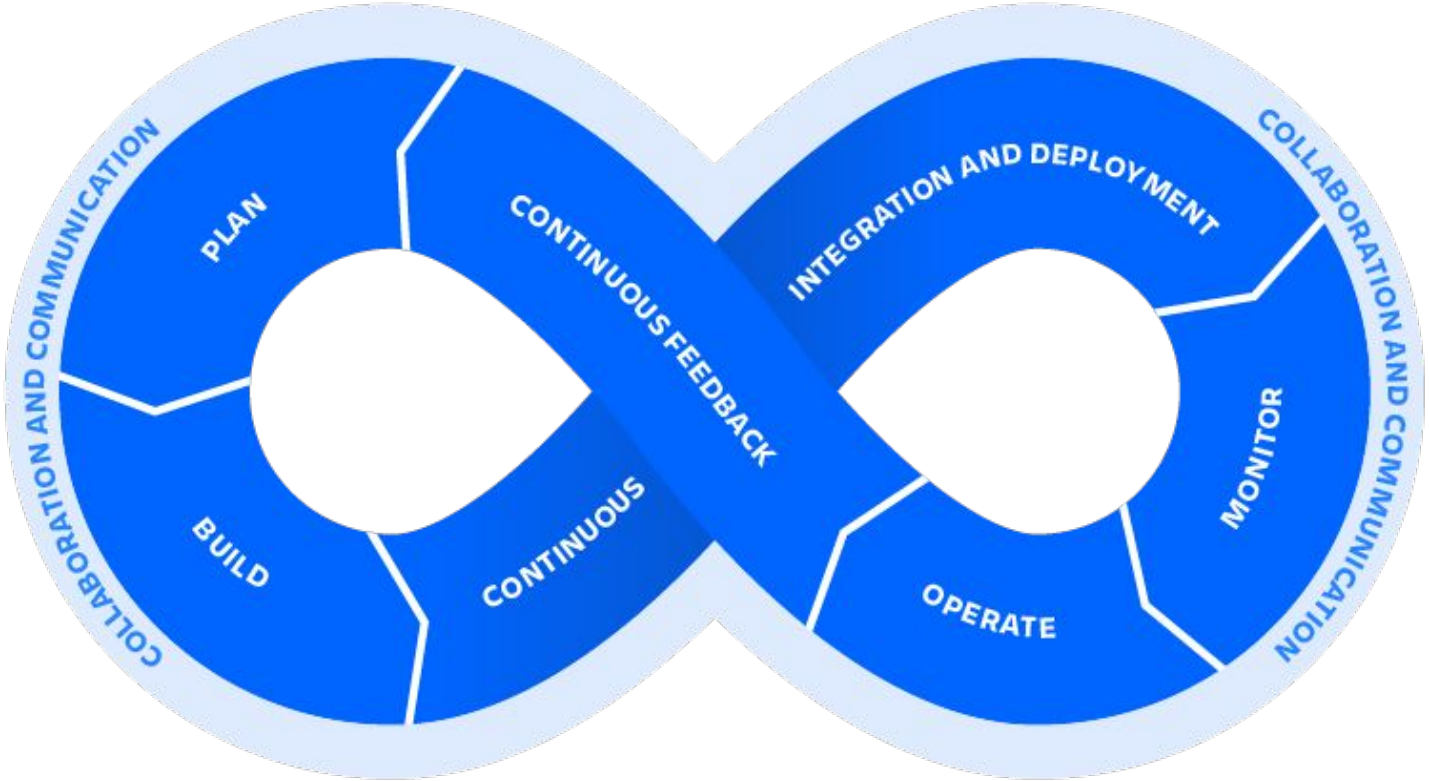

figure credit: Atlassian

Operations: toil

> *If a human operator needs to touch your system during normal operations, you have a bug. The definition of normal changes as your systems grow.*
>
> Carla Geisser, Google SRE

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A key advantage of DevOps is that it encourages **removing** toil

- if operators are separate from devs, devs have no incentive to avoid toil

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- **repetitive**: if you're performing a task for the first time ever, or even the second time, this work is not toil
- **automatable**: if human judgment is essential for the task, there's a good chance it's not toil

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- **O(n) with service growth**: if the work involved in a task scales up linearly with *service size*, *traffic volume*, or *user count*, that task is probably toil

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A task doesn't need to have **all** of these attributes to be toil. But, the more closely work matches one or more of these descriptors, the **more likely** it is to be toil.

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  - tasks like team meetings, setting and grading goals, and HR paperwork (that are not tied to operations) are overhead

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- career stagnation (it doesn't get you promoted)
- lowers morale (it's boring)
- creates confusion (easy to forget to do a manual task!)
- slows progress (could be doing useful work instead)
- sets precedent (avoid letting toil become normal!)
- promotes attrition ("I want to work on something interesting!")

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Despite all this, a **little bit** of toil is often okay. After all, engineers only have so many productive hours in every day, and sometimes a **mental break** is nice :)

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- SRE motto: “Hope is not a strategy”

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    - makes technical debt riskier to take on (why?)

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- The key challenge in deployment is **predictability**: we want to make sure that the software behaves as expected when deployed
  - i.e., we want to avoid “it works on my machine” syndrome
- Other challenges:
  - may need to run on a wide variety of servers
  - may need to run on servers you don’t control/own
  - may need to safely share secrets (e.g., ssh keys)

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  - pay someone else to host it ("***cloud*** deployment")
    - within the general cloud deployment category, you may get to choose whether to rent whole servers, share time on servers, or even pretend not to have a server at all (this is called "***function-as-a-service***", e.g., via AWS Lambda)

Deployment: cloud vs on-prem

- Advantages of on-prem deployment:

- Advantages of cloud deployment:

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- Advantages of on-prem deployment:
  - you have total control of the system, which might have reliability and security benefits
  - can choose exactly the right hardware
  - no “vendor lock-in”
- Advantages of cloud deployment:
  - cloud providers usually have better ops than you do
  - ability to add more servers quickly (“**auto-scaling**”)
  - easy access to datacenters in multiple regions

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  - ideally, you want all of your servers to have the **same environment** (so that if there is a problem, you only need to debug it in one context)
  - in practice, this is achieved via ***virtualization***

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- we can use virtualization to present a system that **appears the same** to our software, regardless of the underlying hardware
- three major kinds:
  - Full virtualization (a.k.a. ***emulation***)
  - ***Paravirtualization***/OS virtualization
  - ***Container*** virtualization

Deployment: virtualization: emulation

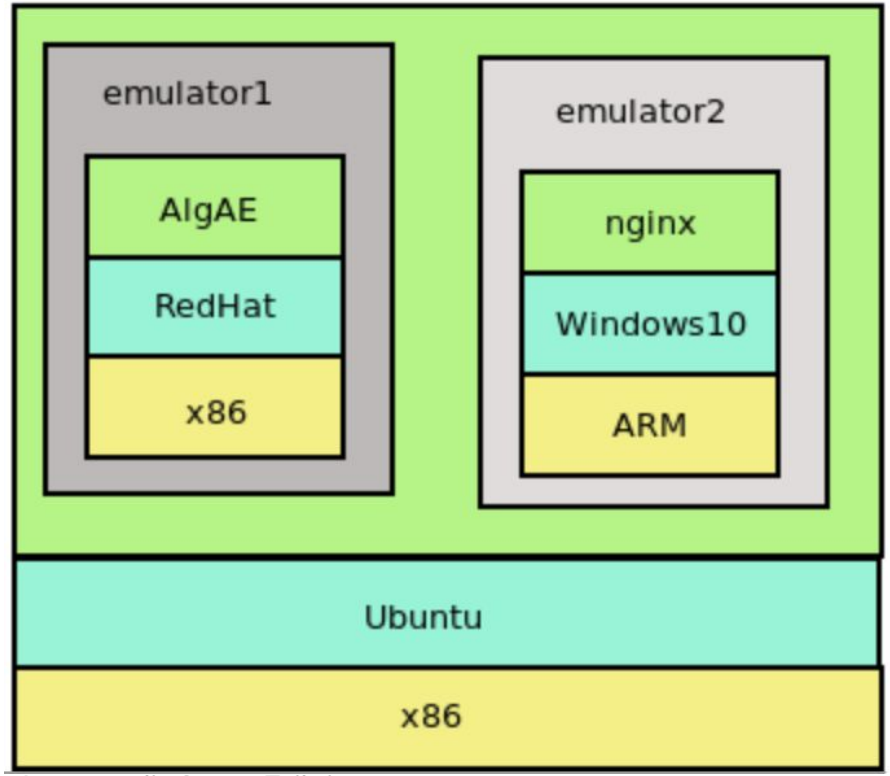

Image credit: Steven Zeil via
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Deployment: virtualization: emulation

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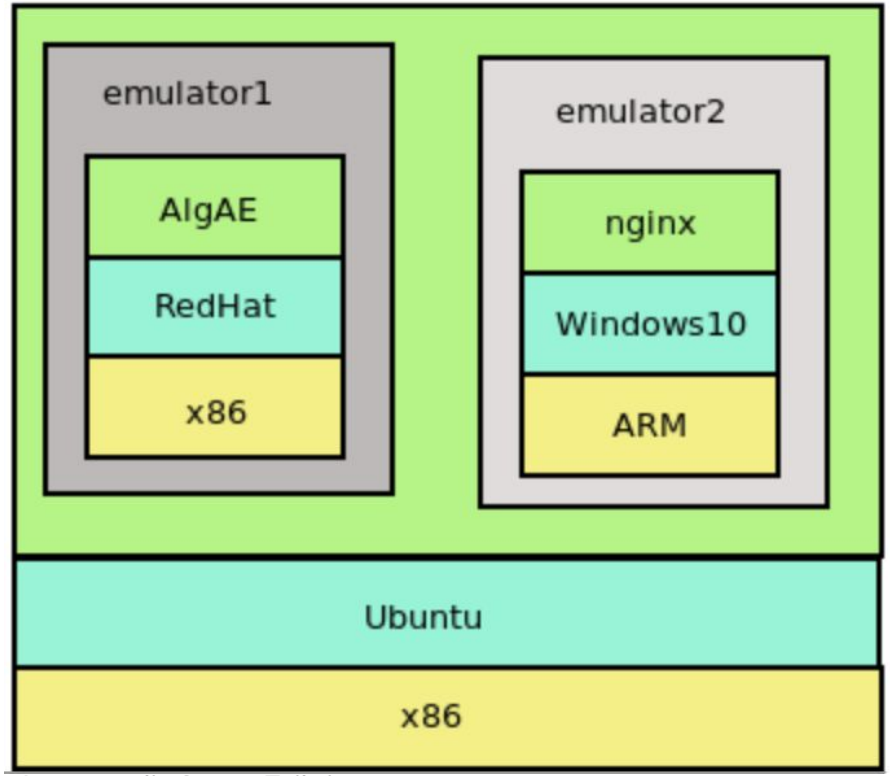

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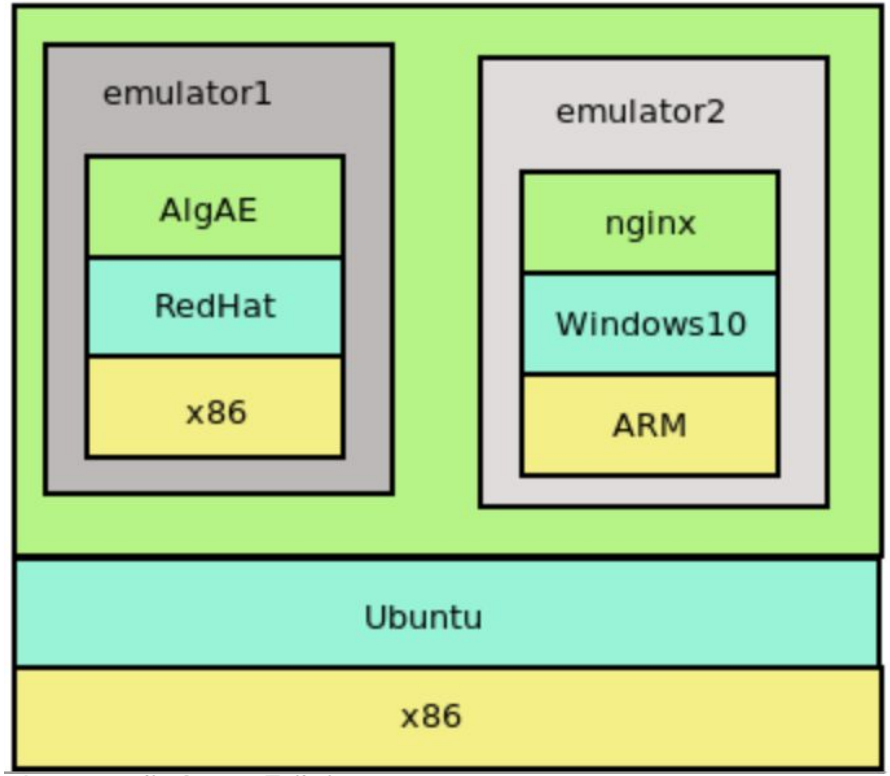

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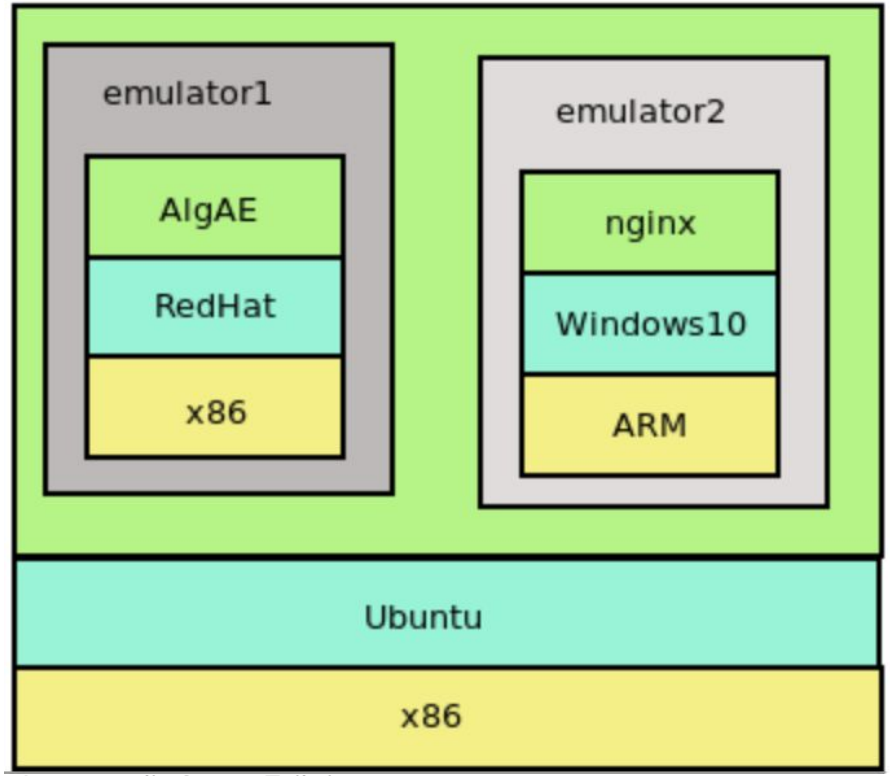
- Examples: the JVM, game console emulators



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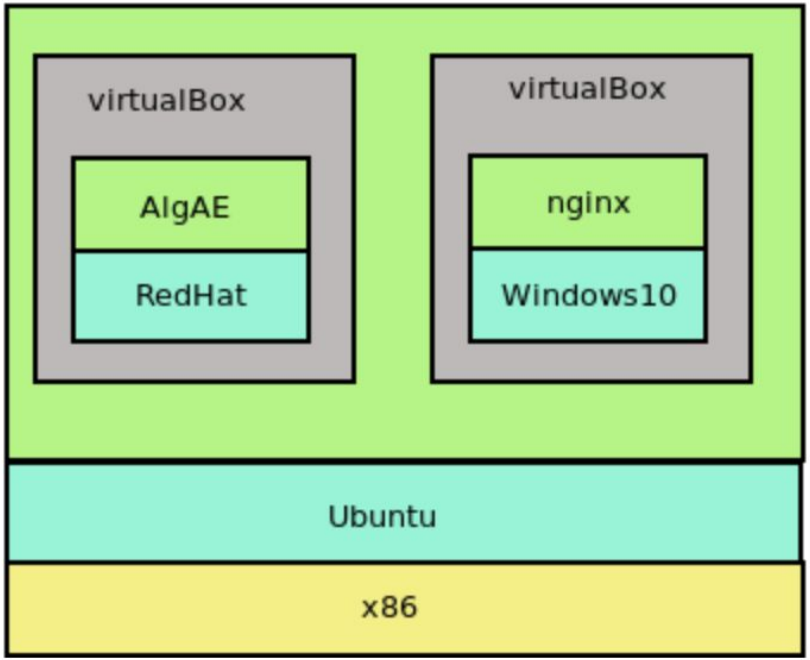

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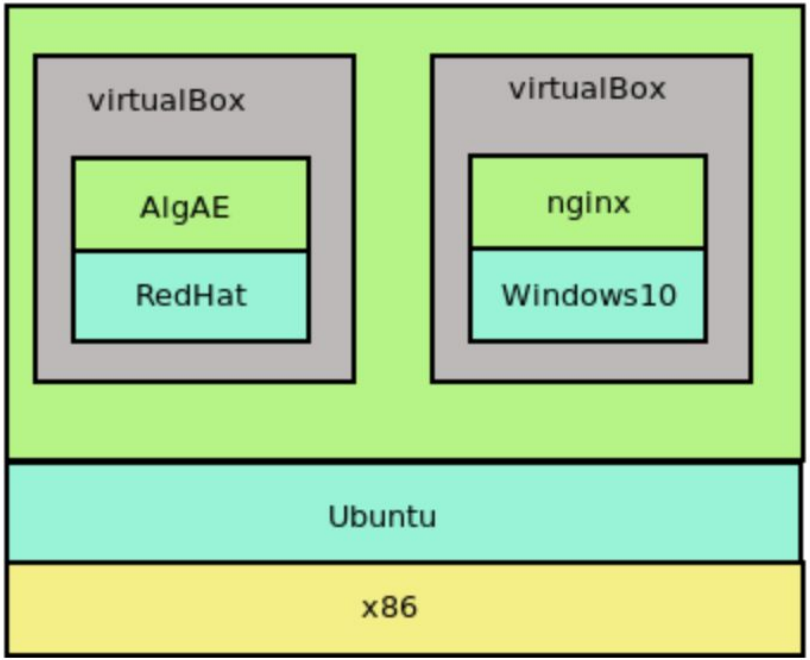

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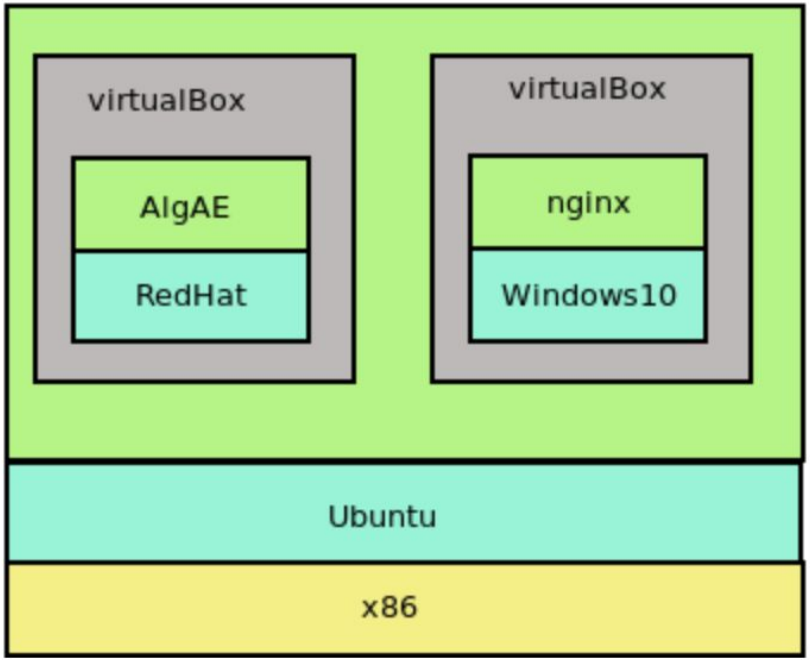

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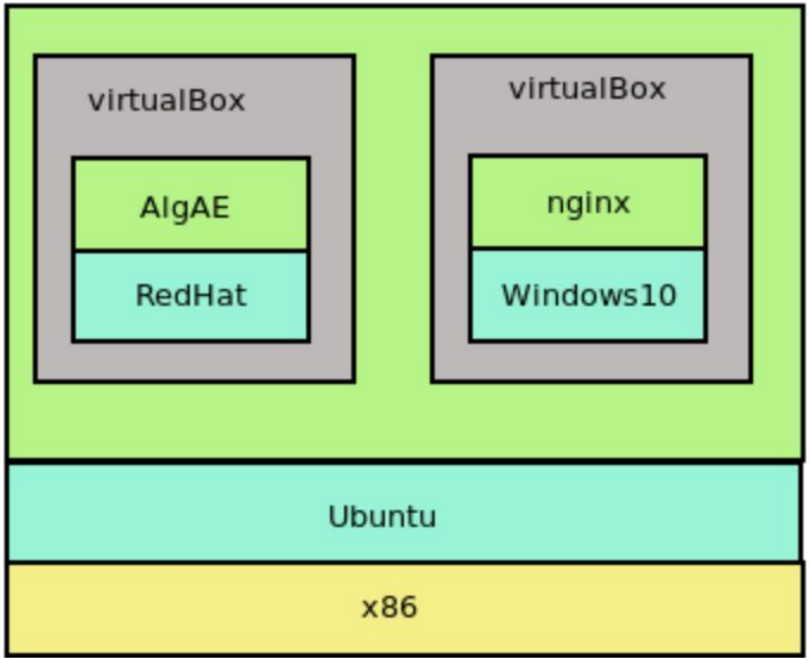
- Many devices are simulated



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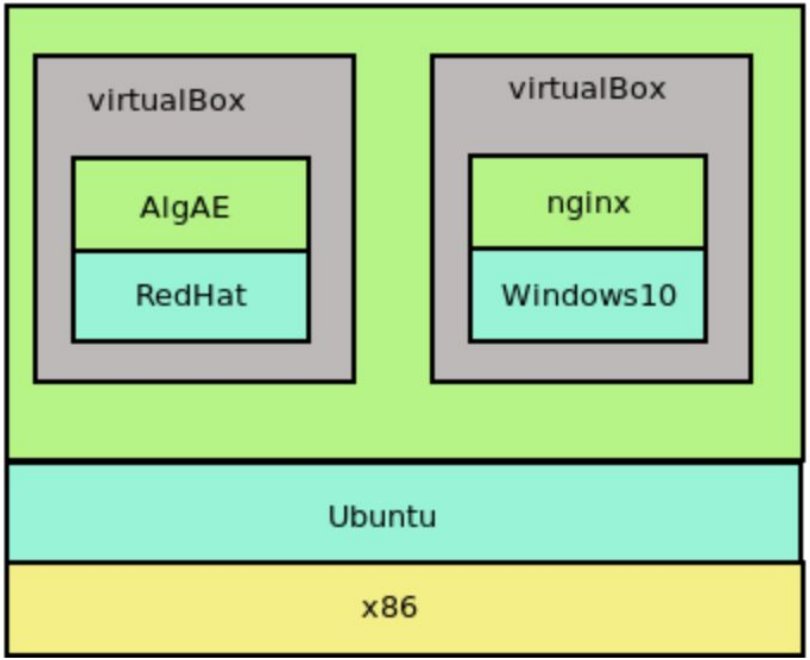

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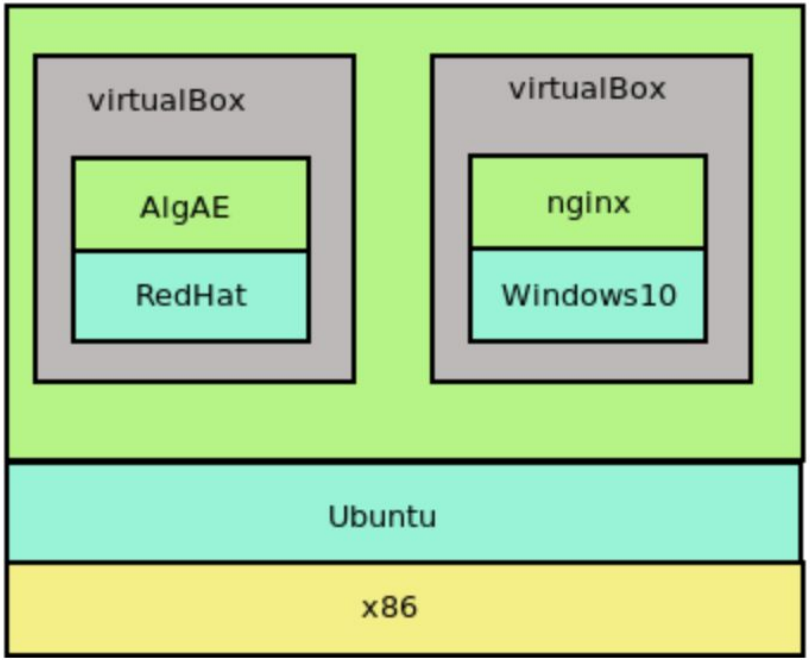

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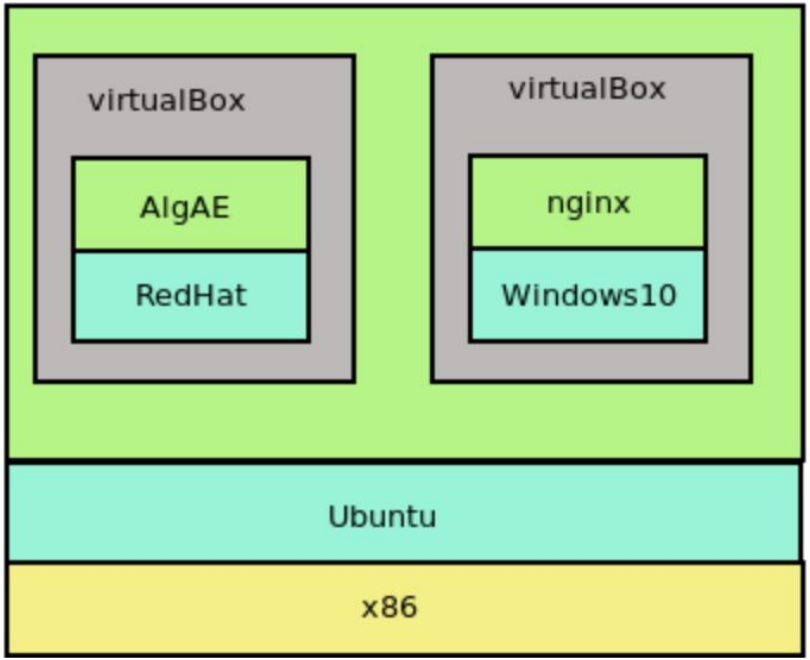

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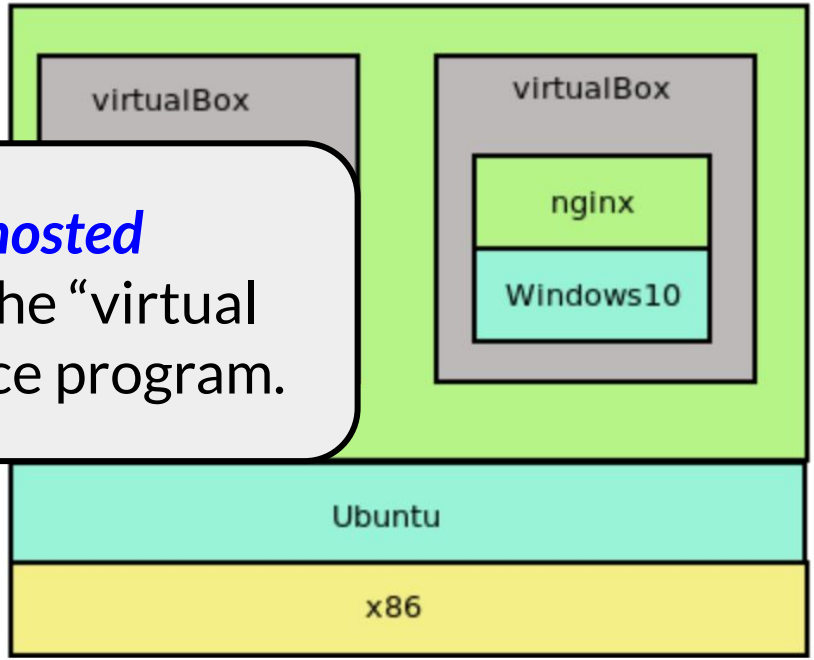
As described so far, this is ***hosted*** paravirtualization, where the “virtual machine” is just a user-space program.



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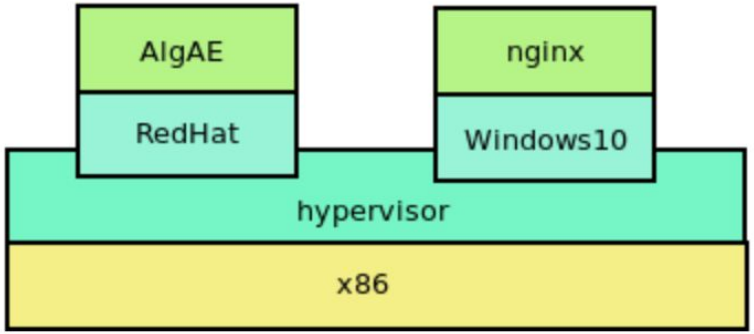

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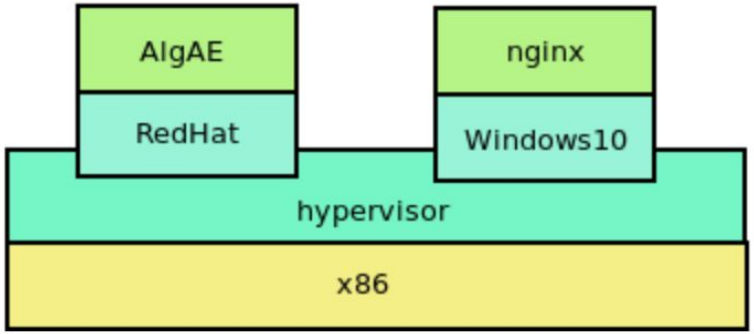

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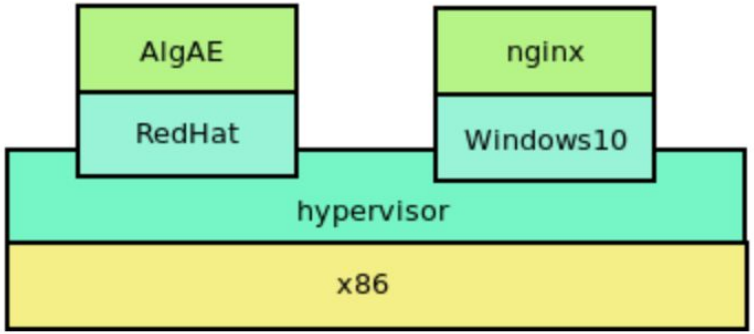

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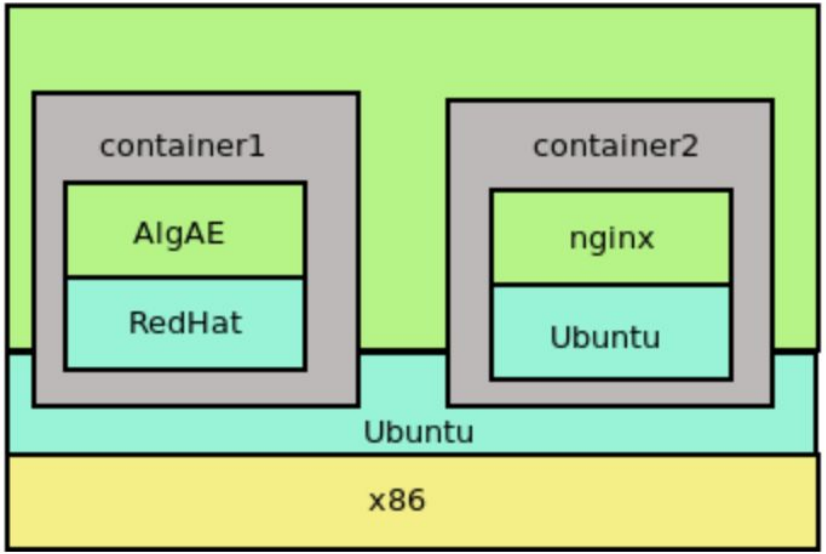

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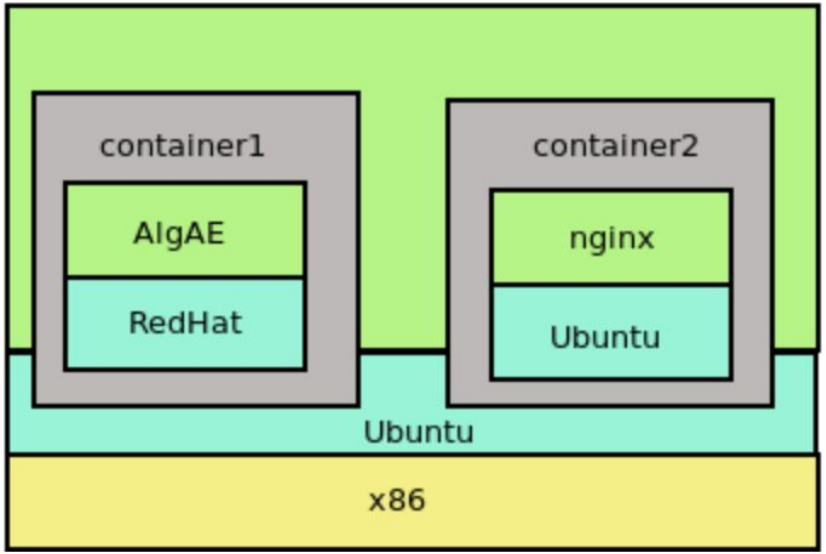

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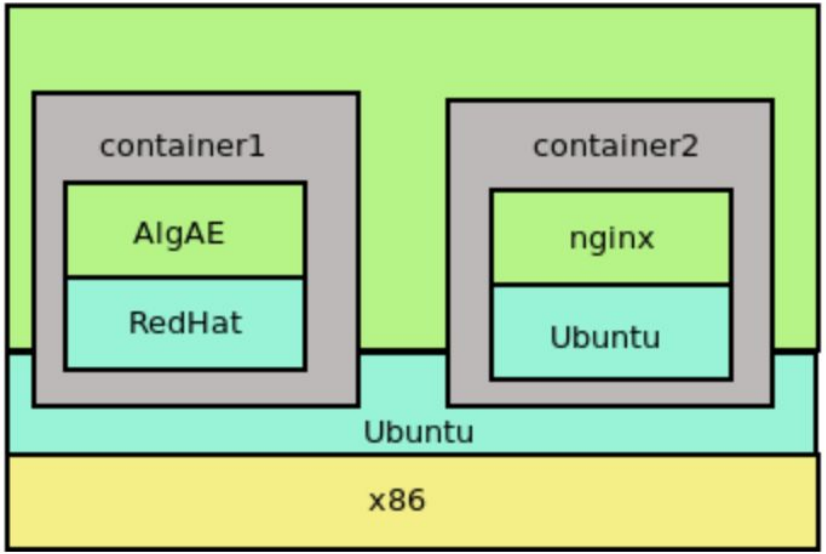

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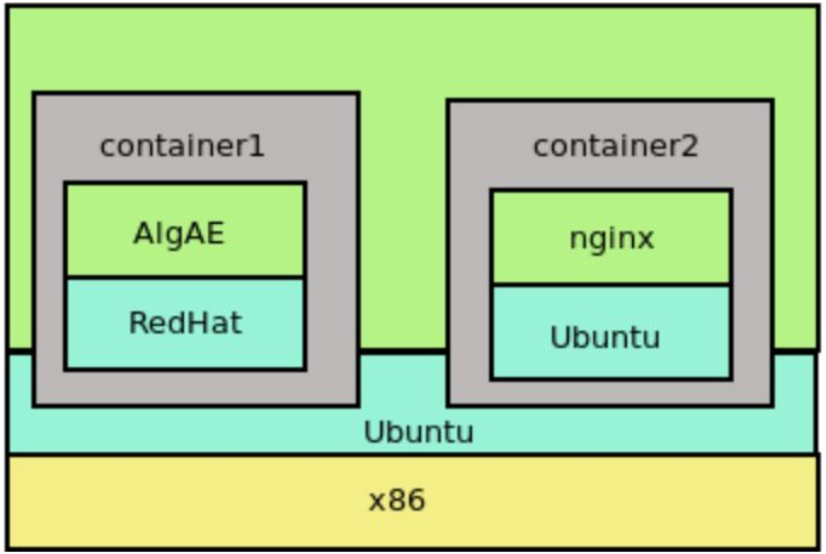

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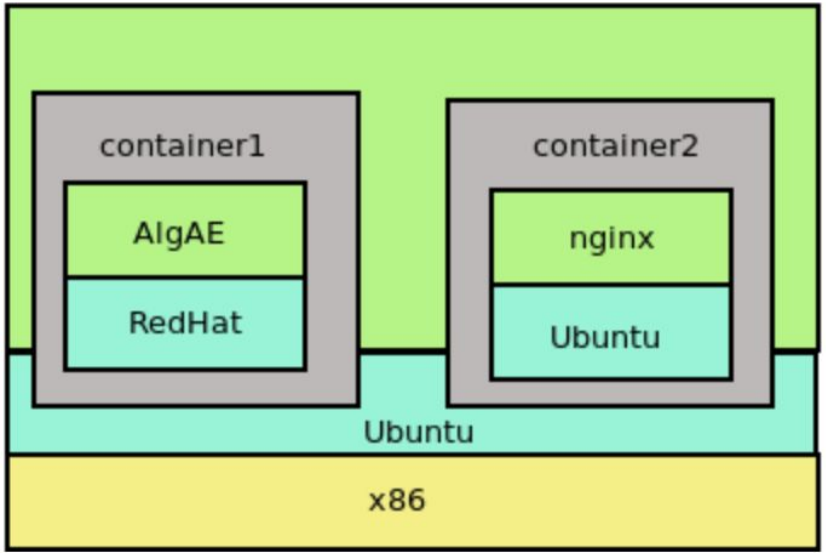

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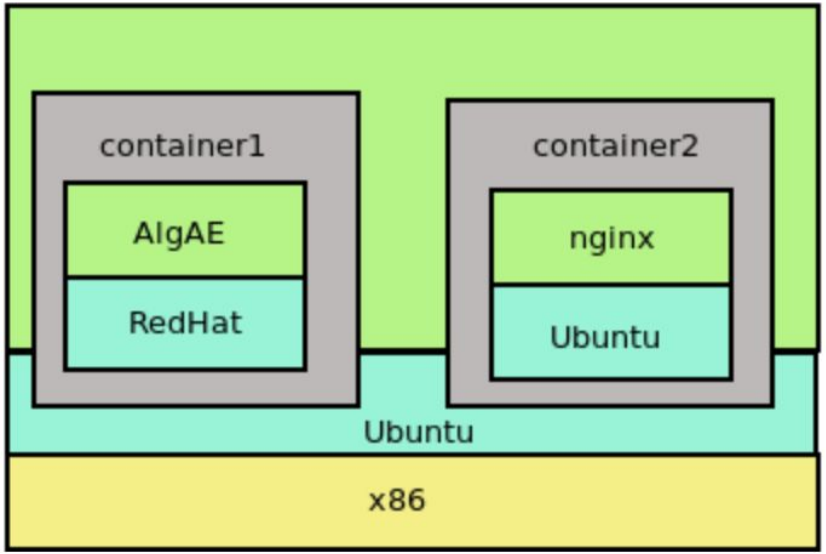

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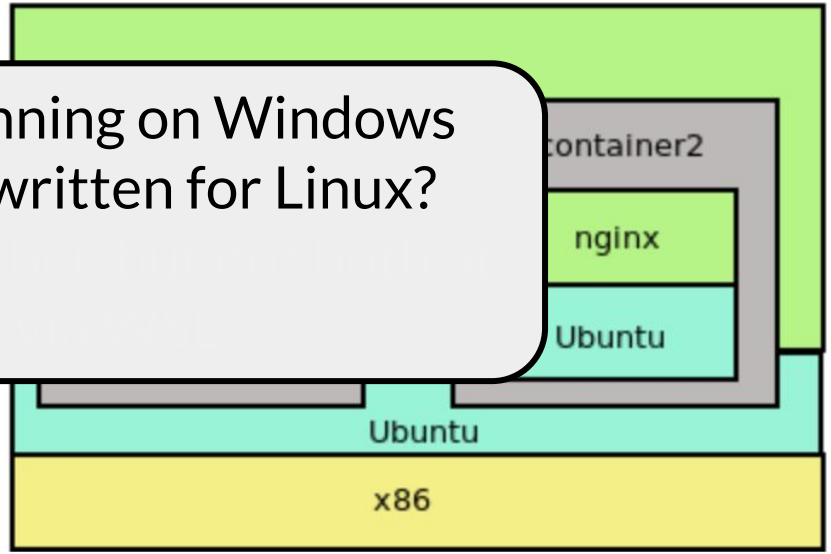

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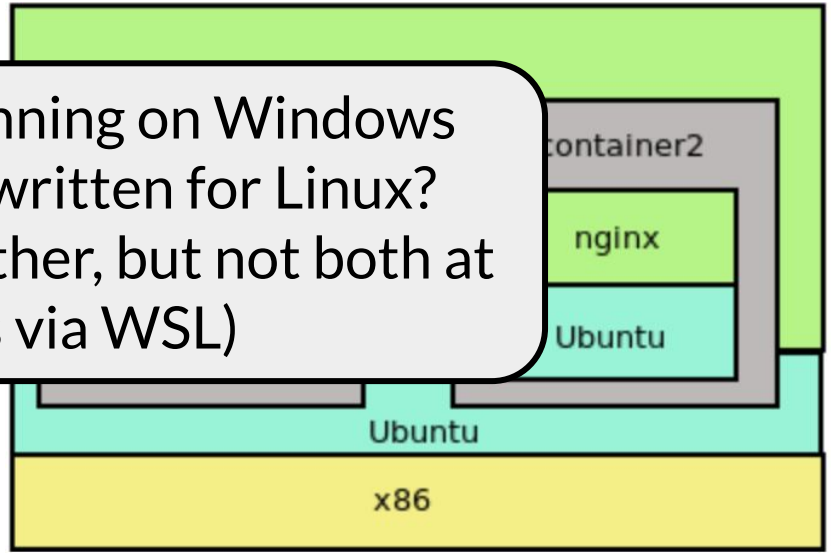
- Answer: one or the other, but not both at the same time (works via WSL)



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