Xen Hypervisor on Embedded Systems

Why real folk like it and how we can play video games in the lab

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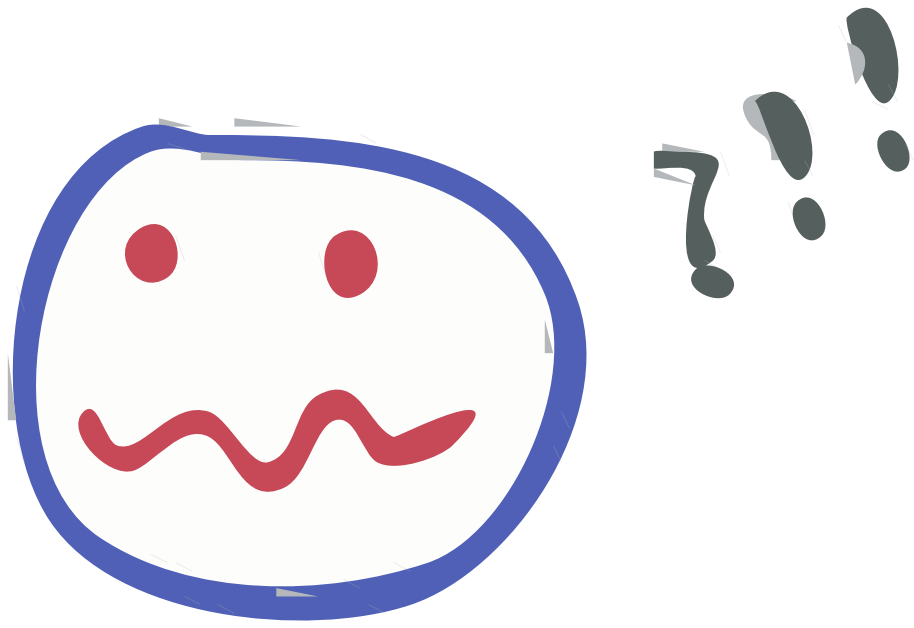
What is Xen?



What is Xen?

It’s a bare-metal hypervisor.

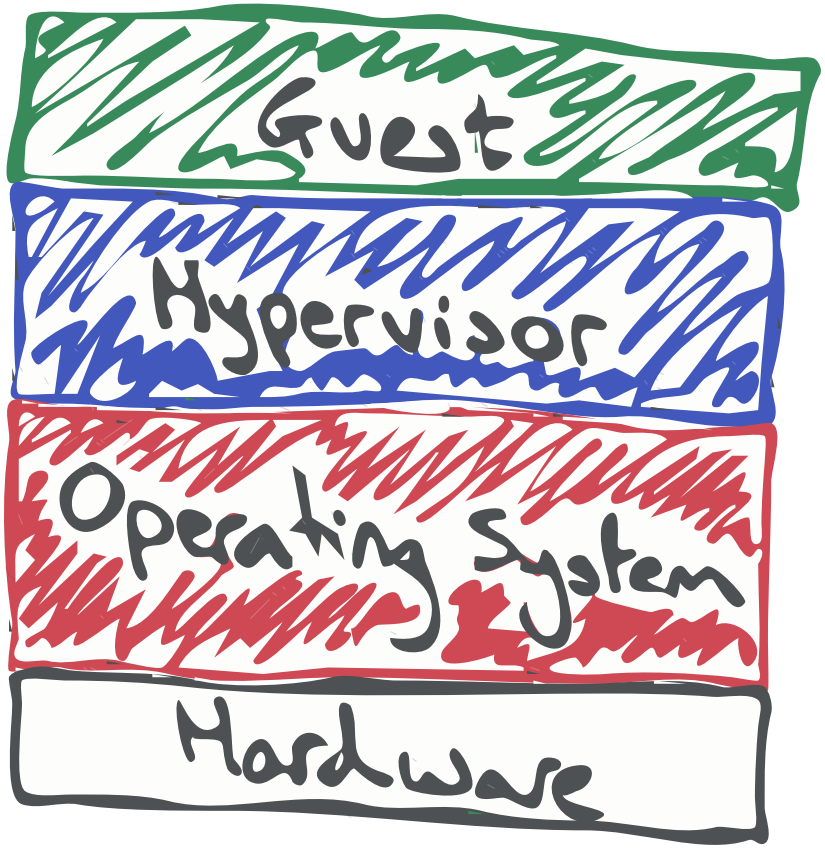
End of presentation. Click to exit.

Really Though...

- We use a hypervisor to run virtual machines
- Xen does this is a neat way
- Low overhead $\rightarrow$ OK on embedded

Traditional Virtualisation

Hypervisors such as VirtualBox look like this...

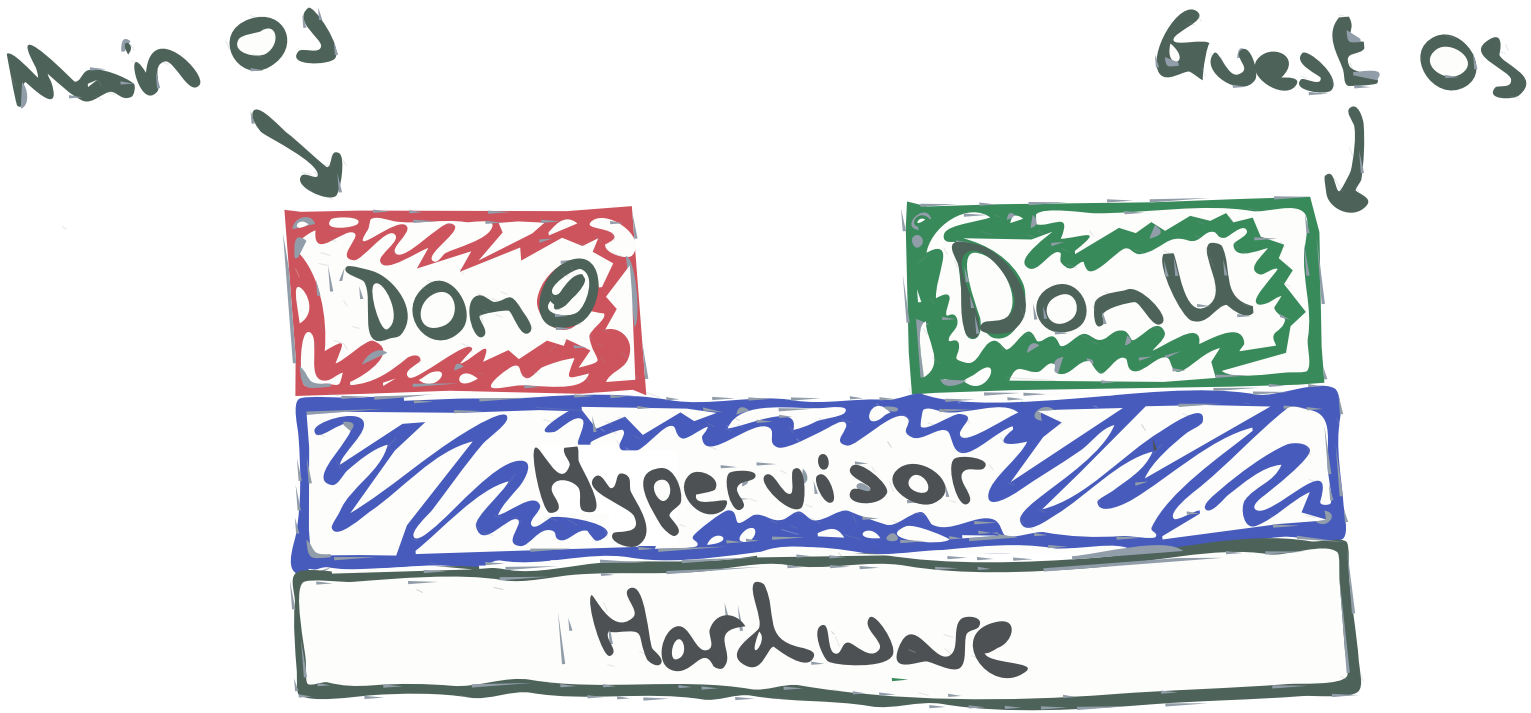


...but less charming

Xen Virtualisation

Remember ”bare-metal” hypervisor?

Xen sits on the bare-metal

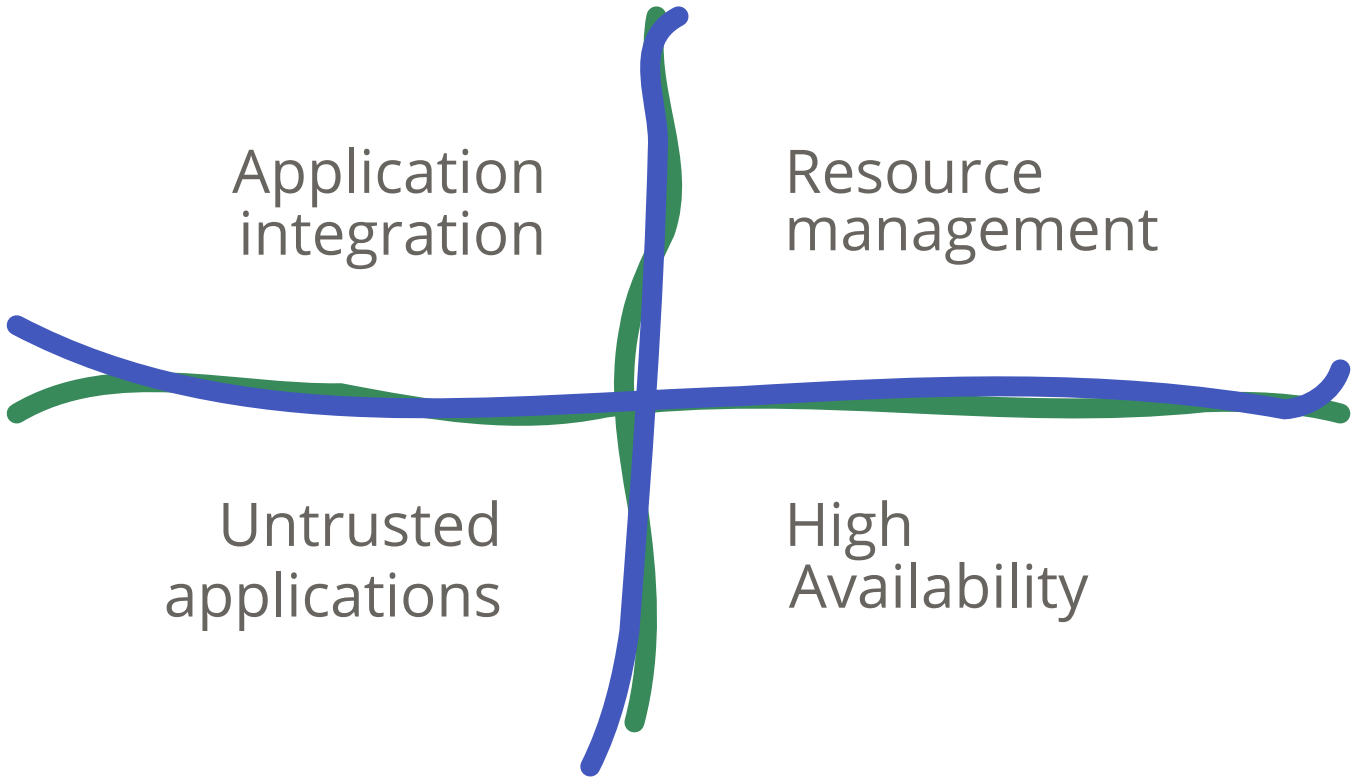


DomU is the guest.
Dom0 is always needed.

Dom = Domain
TO DO: Clean up these gray bits

Why should I care?

- Moore's law $\rightarrow$ Now we can!
- But why should we?



How it works: Linux Guests

- Dom0 loads totally normal Linux image as a DomU
  - At most, it has Xen aware drivers
- Linux knows it's living a lie
  - "Paravirtualised" or PV
- Anything hard to virtualise?
  - Pass it off to Xen via kernel hooks
- PV gives *much* better performance

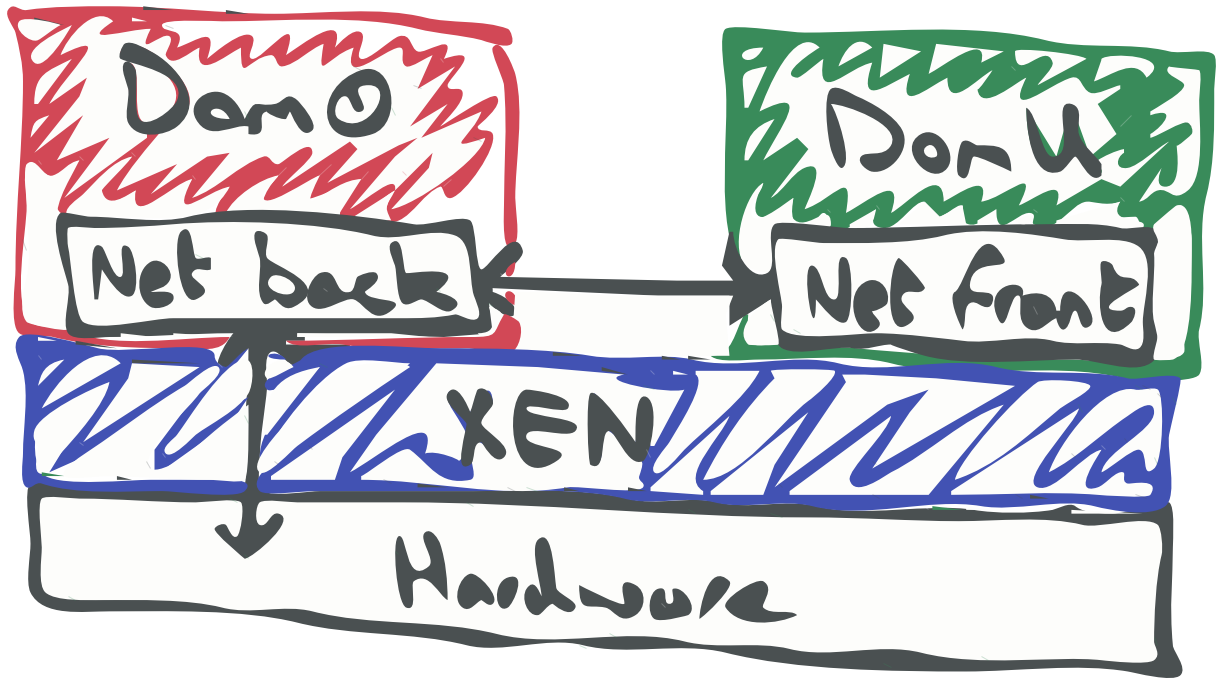
TO DO: ADD SLIDE WITH EXAMPLE XEN CONF

How it works: Using Hardware

- Resource sharing problems!
  - Like parent arbitrating a toy box
- Option to loan device to one guest excusively
- But some devices need to be shared by many guests!
  - Networking, disk access, etc...

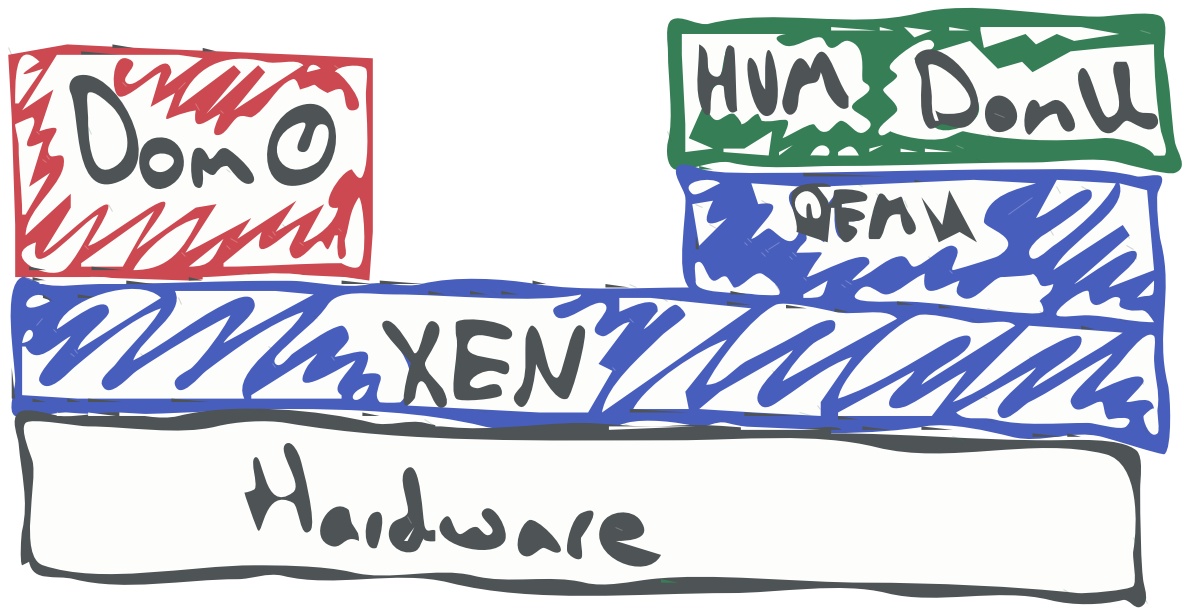
How it works: Using Hardware

- Peripheral is owned by ONE dom but driver is split driver into:
  - ”Front” for non-owner to request use
  - ”Back” for owner to arbitrate access



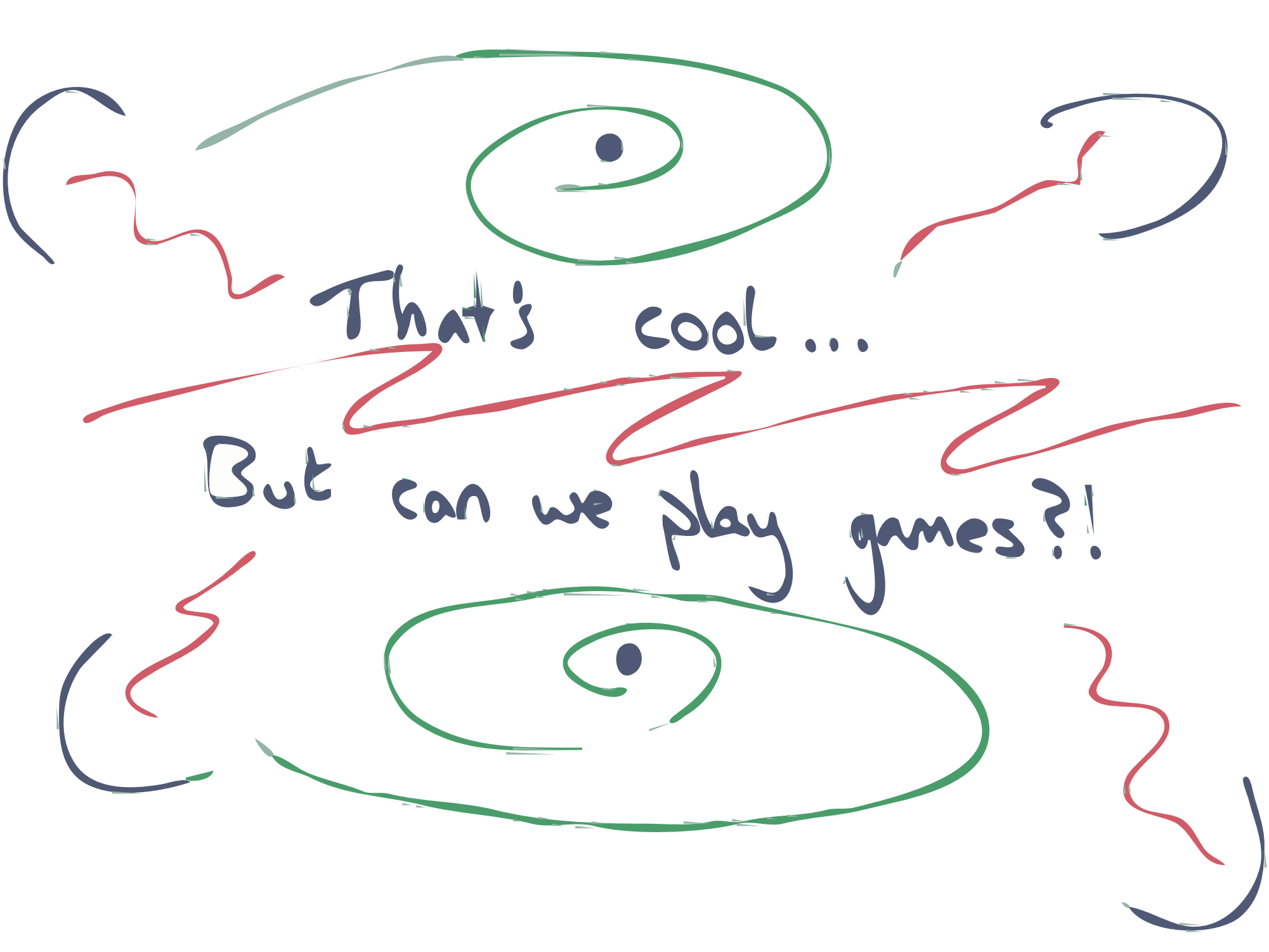
How it works: Dumber Guests

- Can also run legacy/non-PV guests
- Usually a euphamism for Windows
- Fully virtualised via QEMU emulation layer

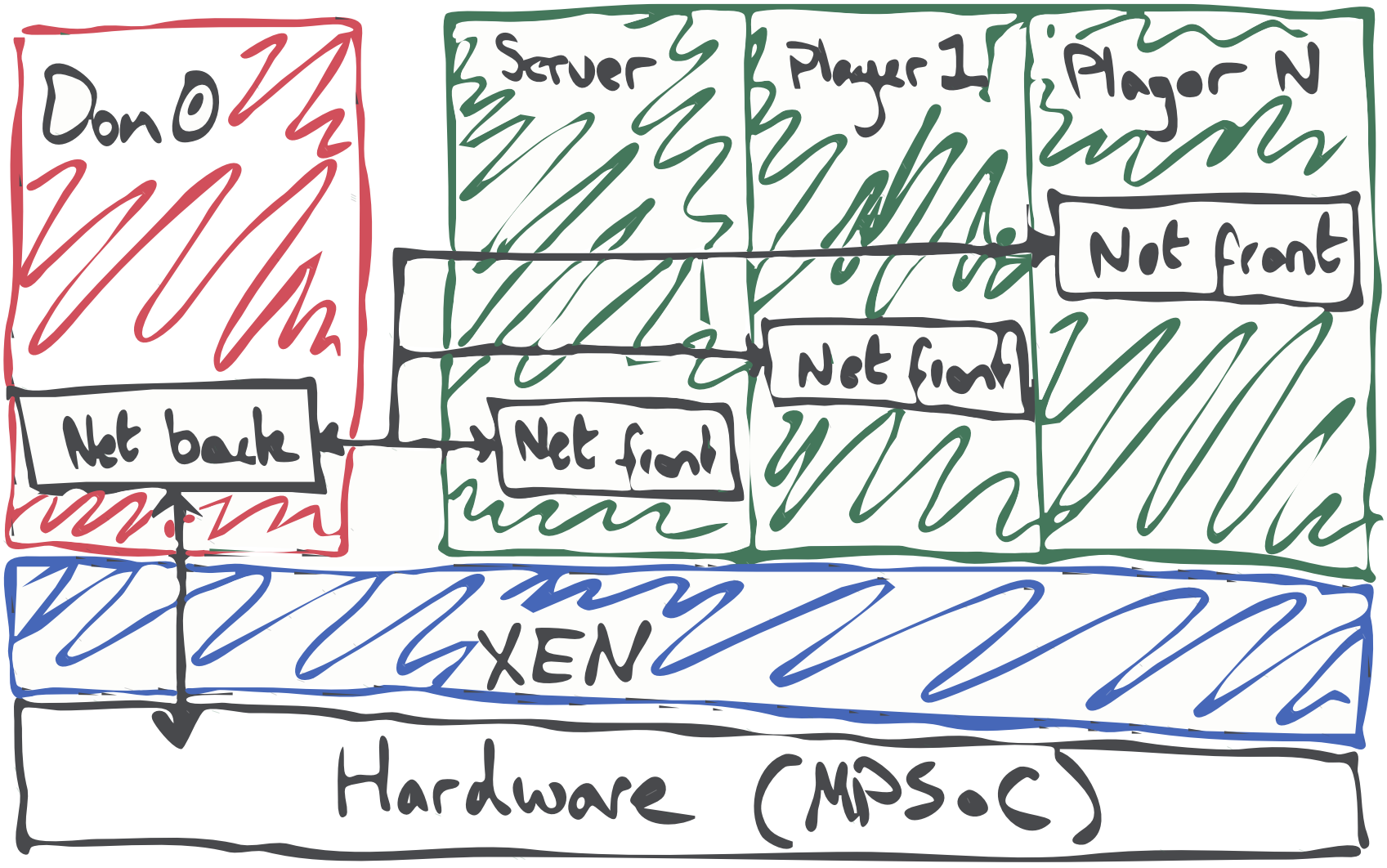


How it works: Scheduling

- Can have > 1 DomU
- Need to share CPU time
- Uses ”proportional fair share” algorithm:
  - # virtual CPUs $=$ mapped to real CPUs
  - weight $=$ proportional to CPU time
  - cap $=$ upper limit on CPU time

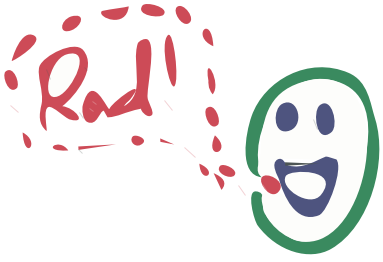

That's cool...
But can we play games?!

Demo


Dom 0
Server
Player 1
Player N
Net back
Net front
Net front
Net front
XEN
Hardware (MPSoC)

Performance Stigma

- ”That was cool, but virtualisation is really slow, right?”
- This laptop is running many XEN VMs right now
  - Including the presentation, for building the demo, Netflix, etc...



- Paravirtualisation is quite good.

Summary

- Xen is a bare-metal hypervisor
- We now know what that means
- Useful in embedded for app integration, security and resource management
- Will be important for larger embedded systems
- Good excuse for some terrible old games!