Memory protection in Android using KVM

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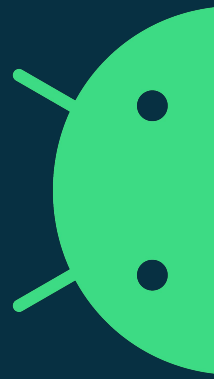
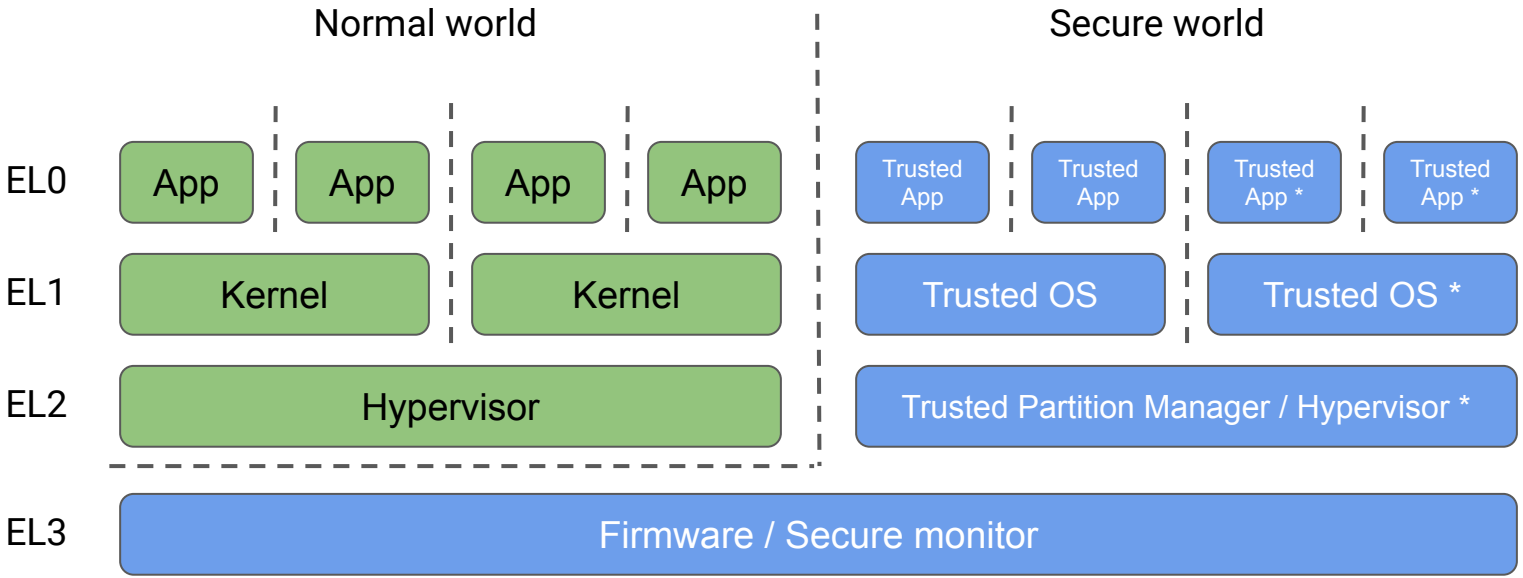


android

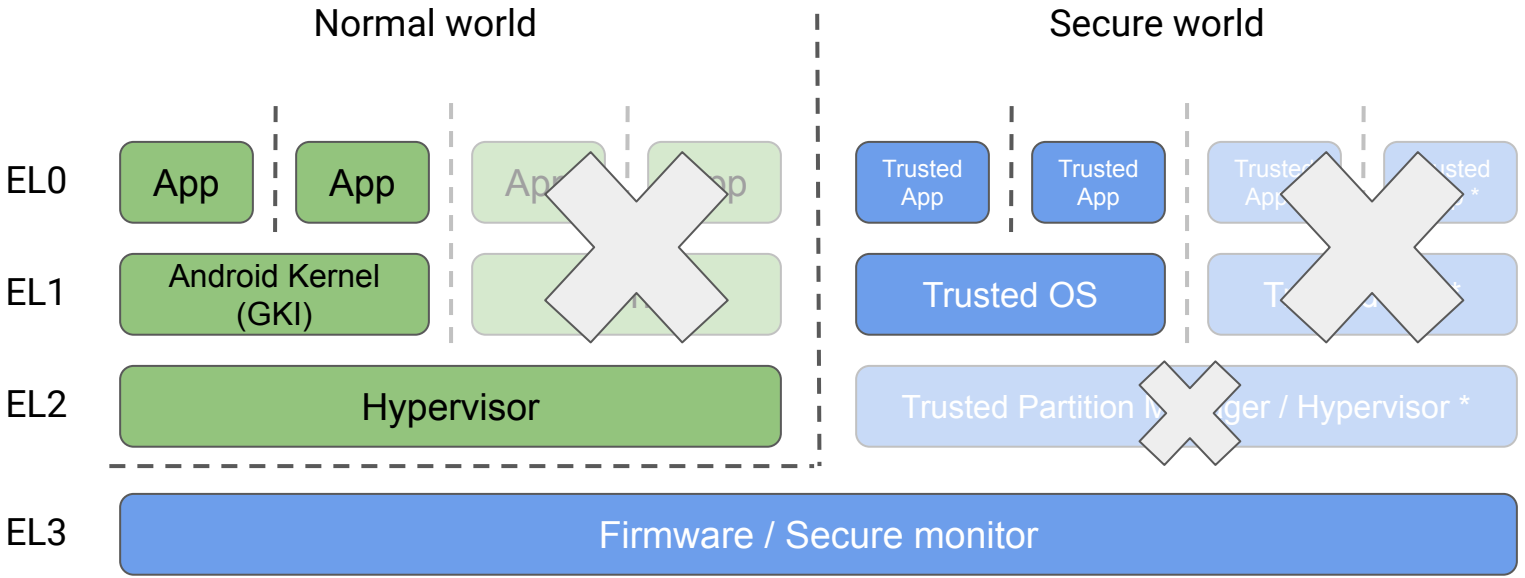
Why ?

Exception levels on arm64, architecturally



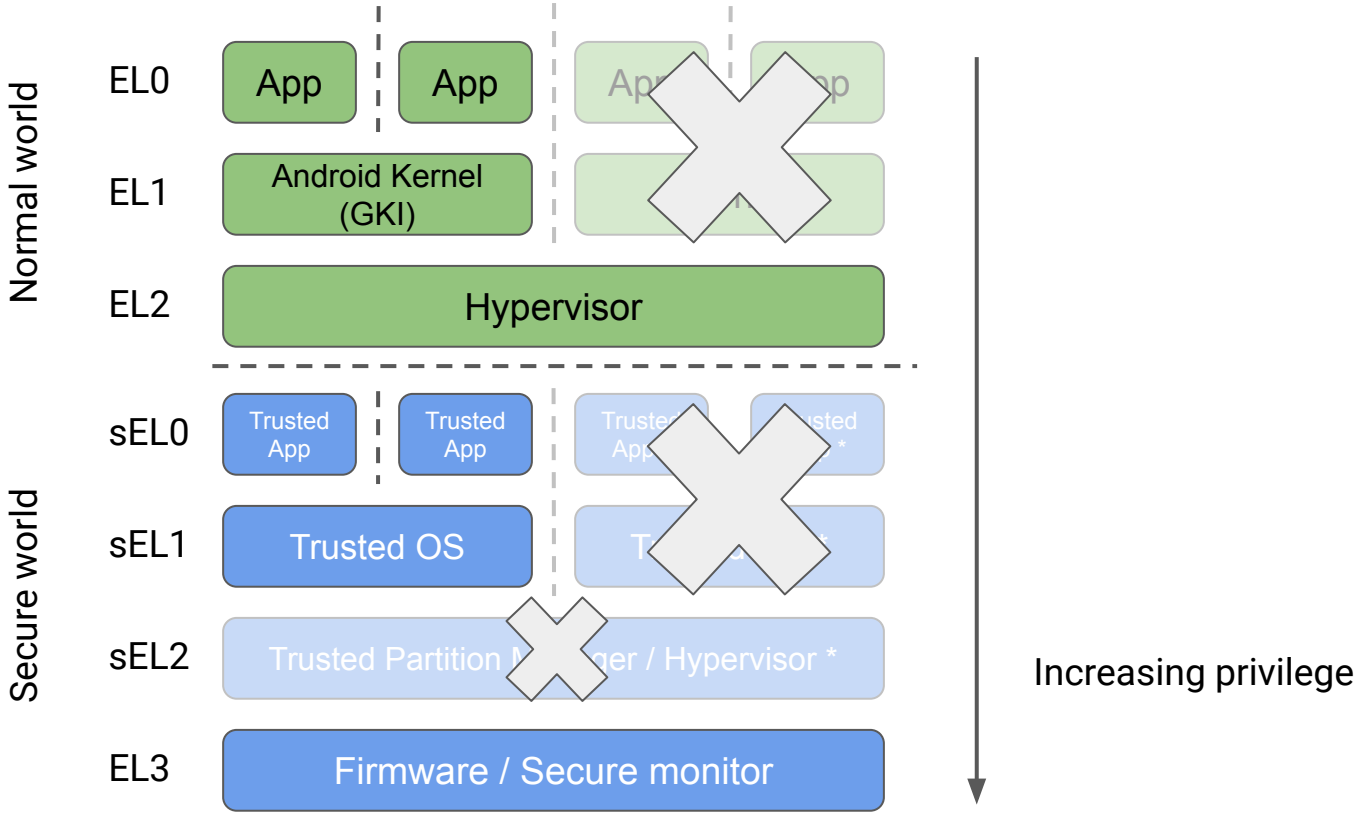
* From Arm v8.4A

Exception levels on arm64, in Android

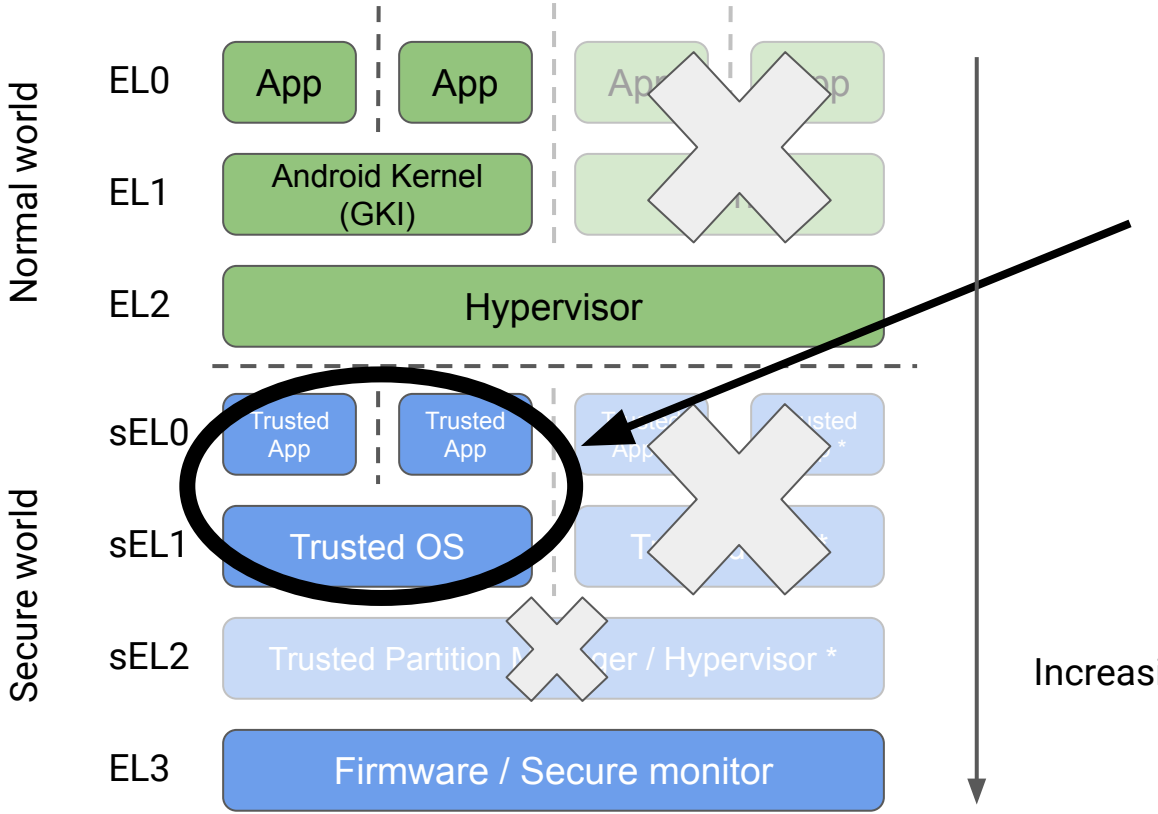


* From Arm v8.4A

Exception levels on arm64, by privilege

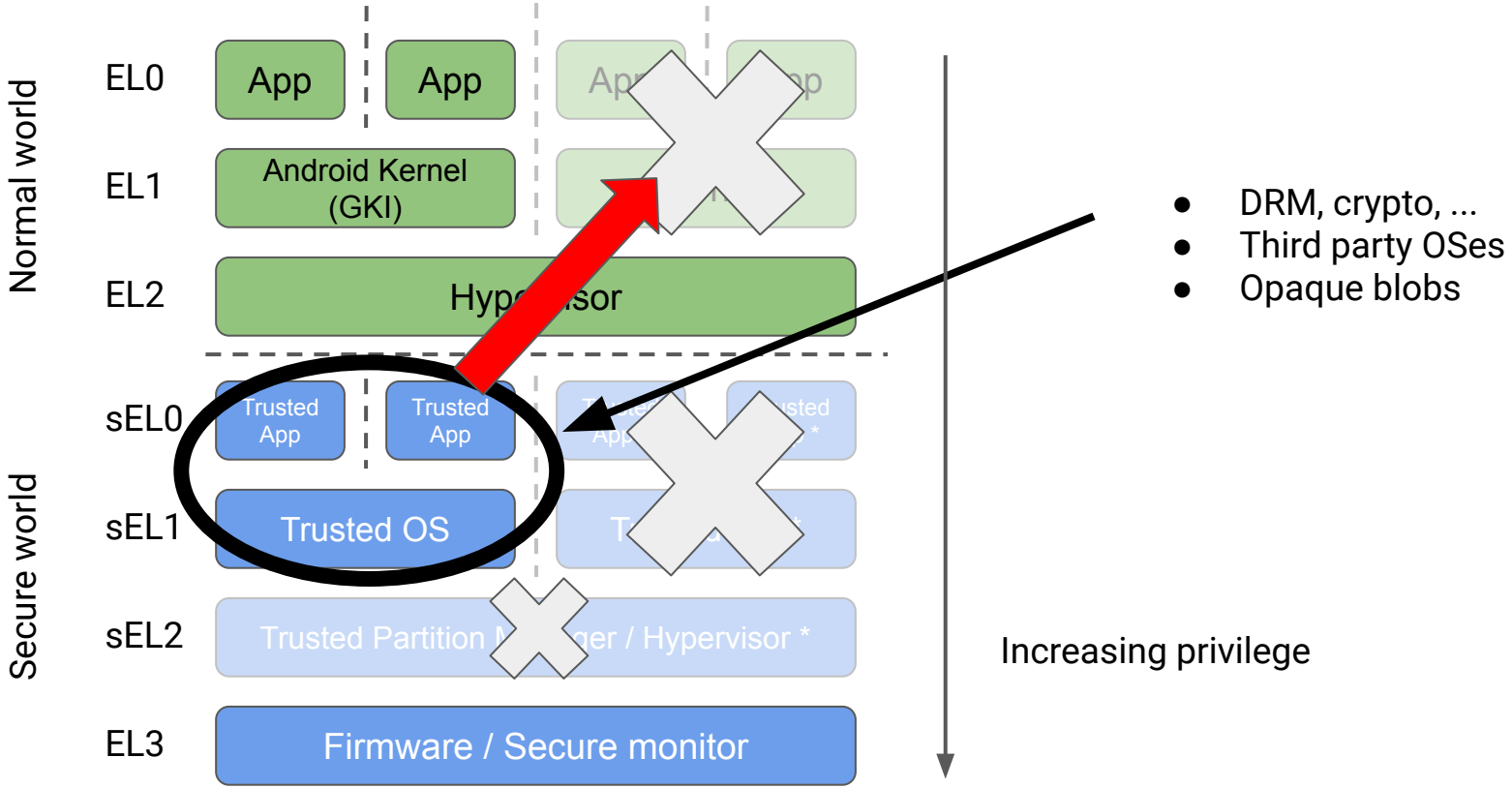


Exception levels on arm64, in Android today, by privilege



- DRM, crypto, ...
- Third party OSes
- Opaque blobs

Exception levels on arm64, in Android today, by privilege



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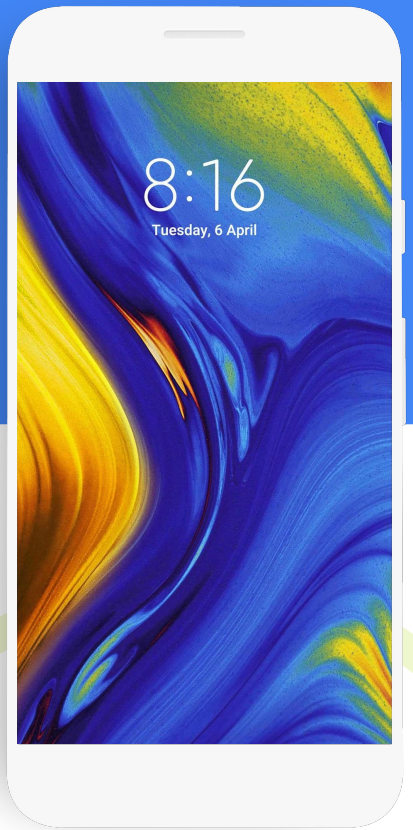
What ?

What do we need?

We need a hypervisor that is:

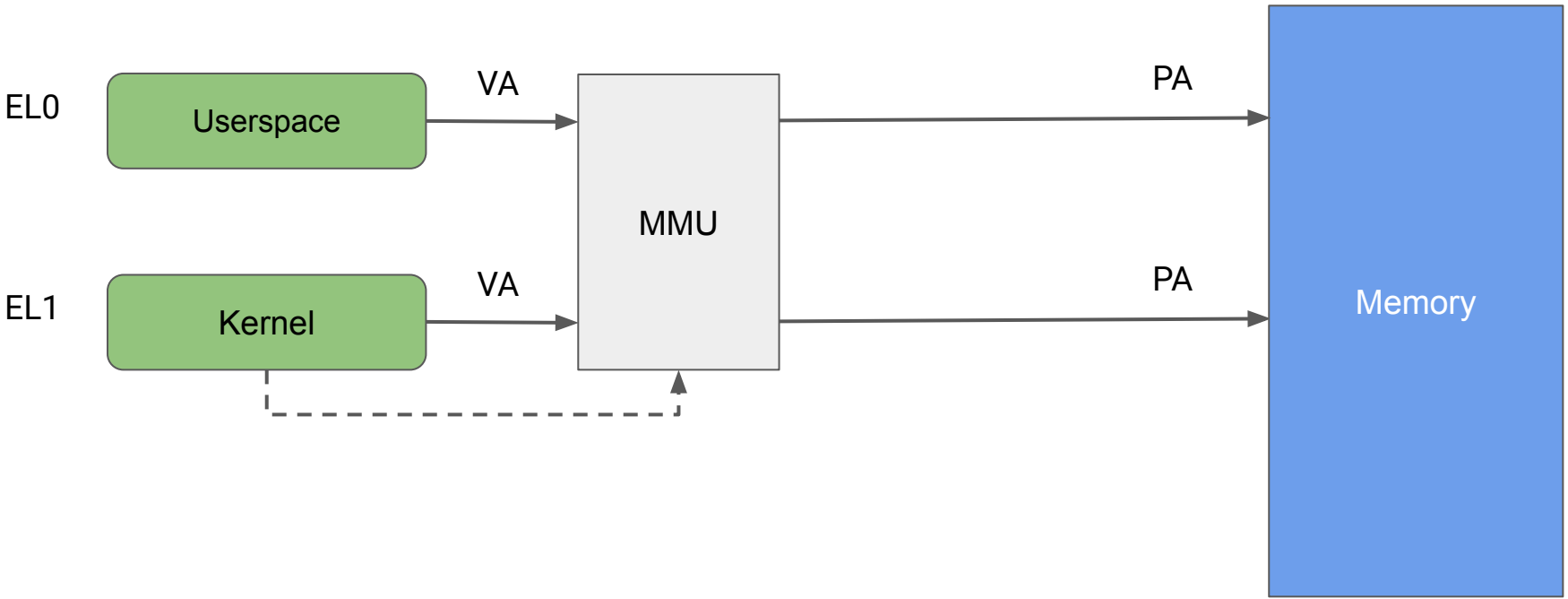
1. open source
2. easy to ship and update
3. supports guest memory protection
4. trustworthy

KVM as part of GKI is a very good fit with the right extensions.

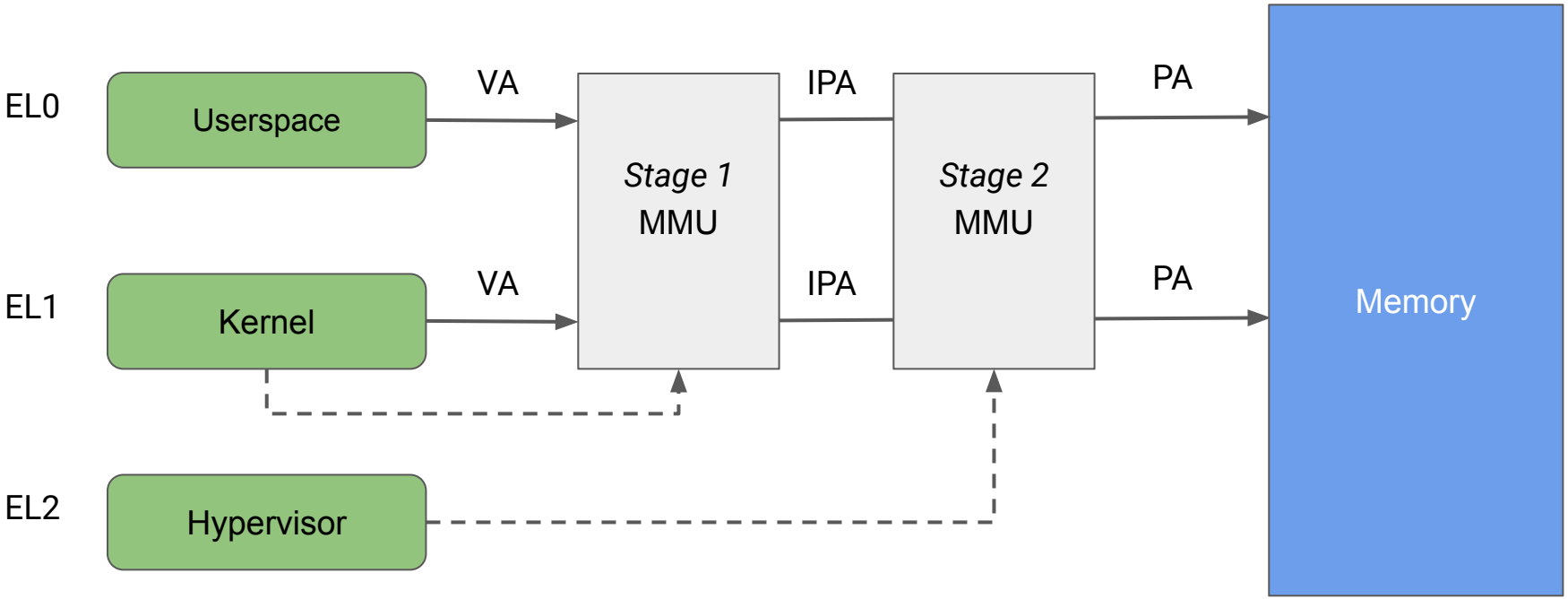


How ?

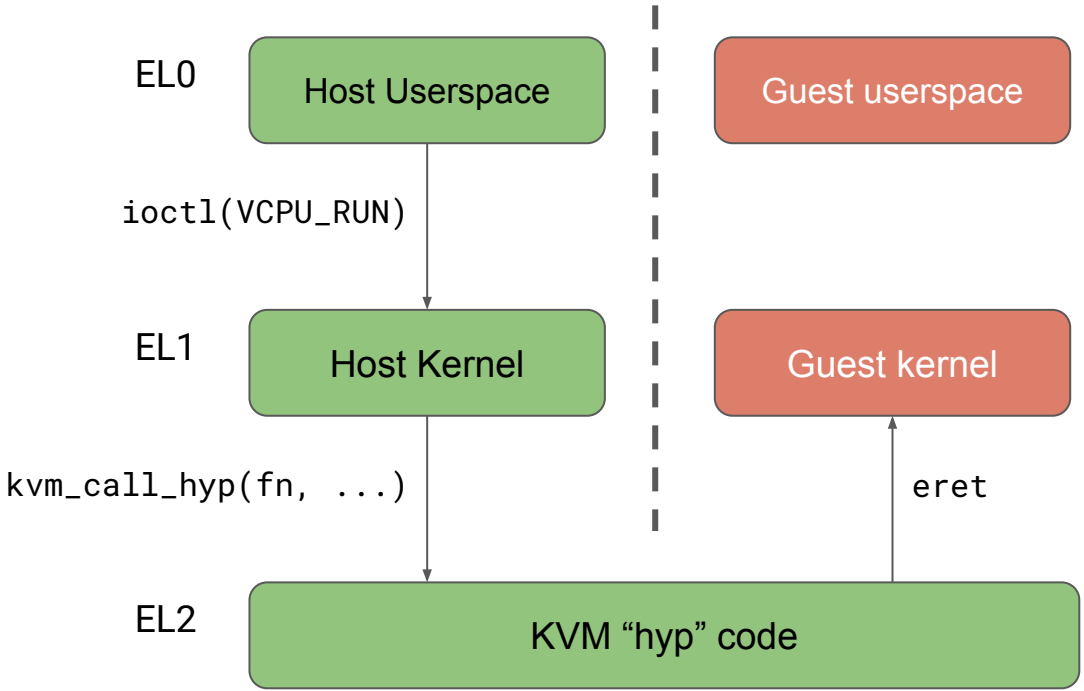
Virtual memory on arm64



Stage 2 memory translation

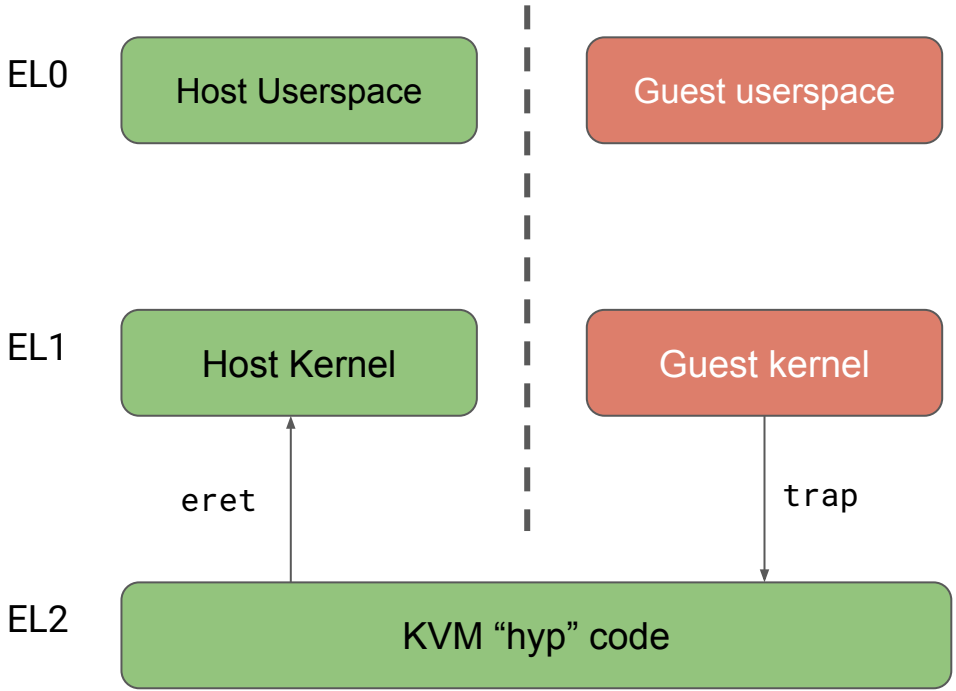


KVM port on armv8.0A (nVHE)



- Switches context
- Installs host-provided stage 2 page-table

KVM port on armv8.0A (nVHE)



- Switches context
- Uninstalls stage 2 page-table

Proposal

- Install a ***stage 2 page-table over the host***
  - Elevate stage 2 page-table management at EL2
  - Requires basic mm at EL2
- Elevate ***hyp stage 1*** page-table management ***at EL2***
- Clean ***split between host and hyp*** code
  - Separate ELF section for hyp code: `.hyp.text`
  - “Proper” HVC interface between host and hyp
- ***Guest memory and state unaccessible*** from host kernel and VMM
  - Message passing to setup shared memory regions (PSA-FFA + Virtio)
  - Minimal guest bootloader, which verifies guest payload signature
- ***Formal verification*** of the code running at EL2

Get the code

The repo is public:

https://android-kvm.googlesource.com/linux/

And there are patches on the list:

https://lore.kernel.org/kvmarm/20200730132519.48787-1-dbrazdil@google.com/
https://lore.kernel.org/kvmarm/20200722164424.42225-1-dbrazdil@google.com/
https://lore.kernel.org/kvmarm/20200721094445.82184-1-dbrazdil@google.com/
https://lore.kernel.org/kvmarm/20200625131420.71444-1-dbrazdil@google.com/
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https://lore.kernel.org/kvmarm/20200818132818.16065-1-will@kernel.org/

...

Thanks.

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