Multi-threading QEMU

or Ingo might be right.. sort of

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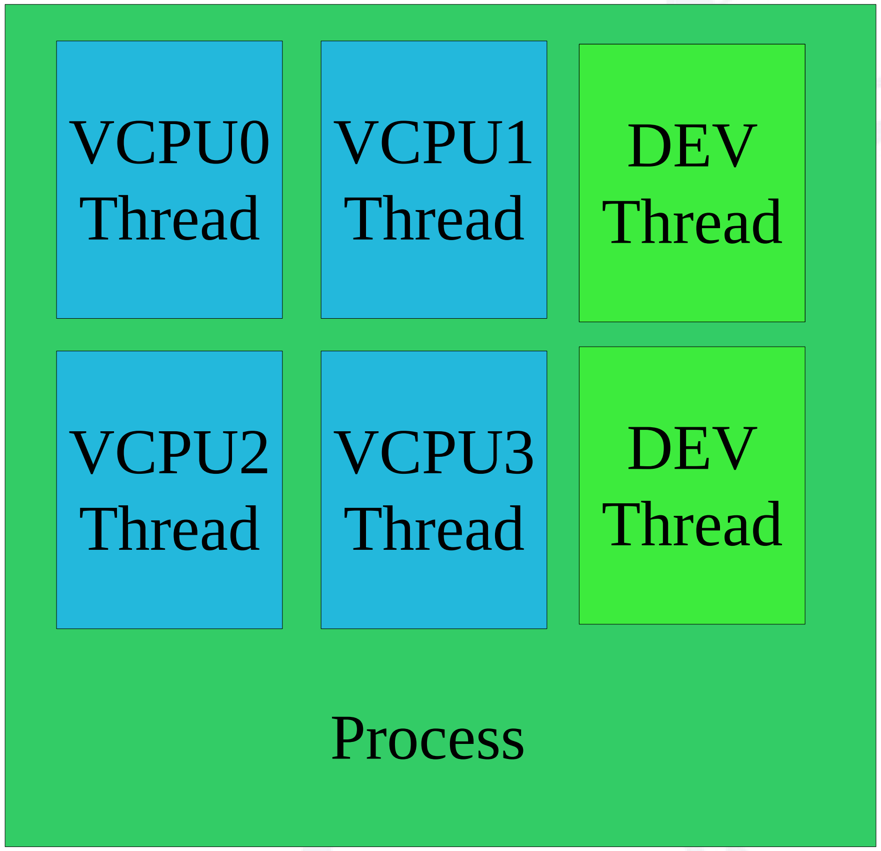
Ideal KVM Architecture



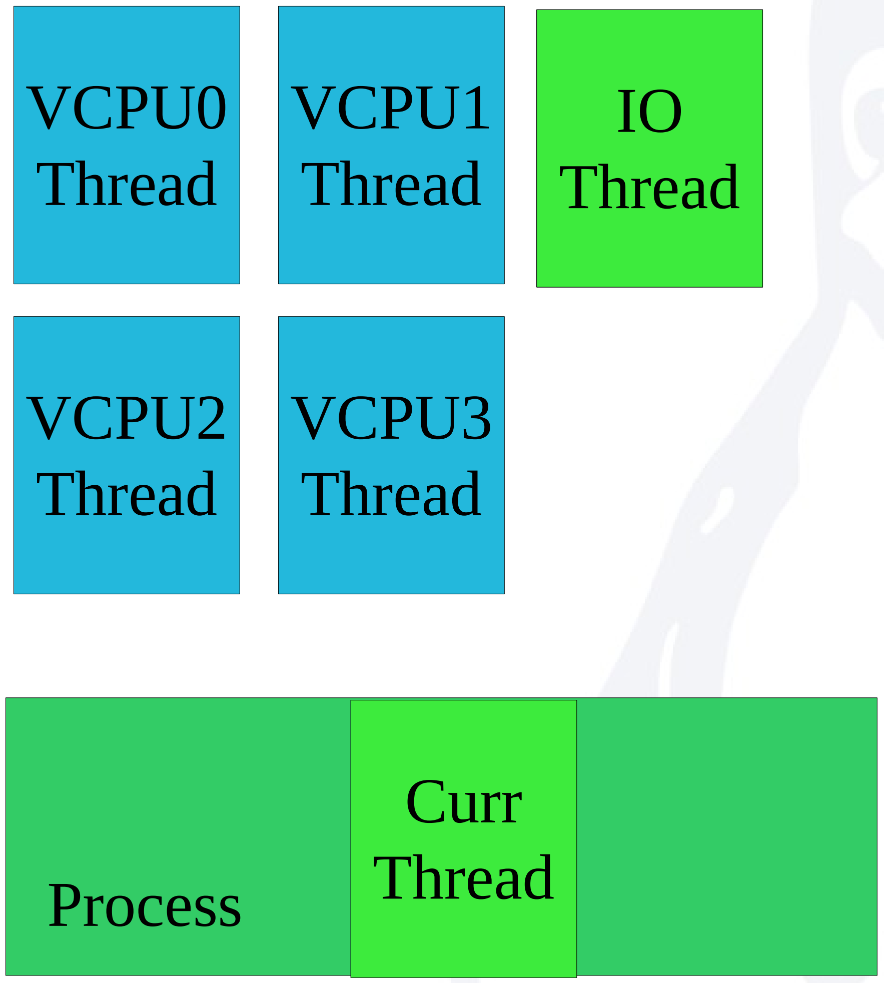
Design

- One thread per-VCPU
- Device models run concurrent in VCPU thread
- Long running operations run in additional device thread

Goals

- Maximize CPU affinity
- Minimize PIO/MMIO latency

QEMU/KVM Architecture



Design

- One thread per-VCPU
- One I/O thread
- All threads run in lock step protected by qemu_mutex

Goals

- Avoid rewriting QEMU
- Find a TCG-compat design

TCG Considerations

- Tiny Code Generator (TCG) is the emulator part of QEMU
- Cannot preserve atomicity of instructions
  - Due to design issues
  - Due to architectural issues (PPC vs. x86)
- QEMU's single thread design is ideal for TCG
- Device models are unlikely to ever run in parallel with TCG emulation

Evolving QEMU

- I/O thread gets our foot in the door
- Reduce granularity of locking
    - Push qemu_mutex out of kvm-all.c, exec.c, apic.c, ...
- Add locking to common infrastructure
    - Push qemu_mutex out of vl.c, async.c, block/*
- Start adding device specific threads

Easy, right?

Worlds Colliding

KVM

TCG

Two different worlds

KVM

- Performance
- Scalability
- Reliability
- External tooling

TCG

- Functionality over quality
- Performance doesn't matter
- All-in-one tool

- We want to continue to share code
- Supporting multiple use-cases and architectures makes our code better
- We struggle to accommodate both worlds

Time for a change

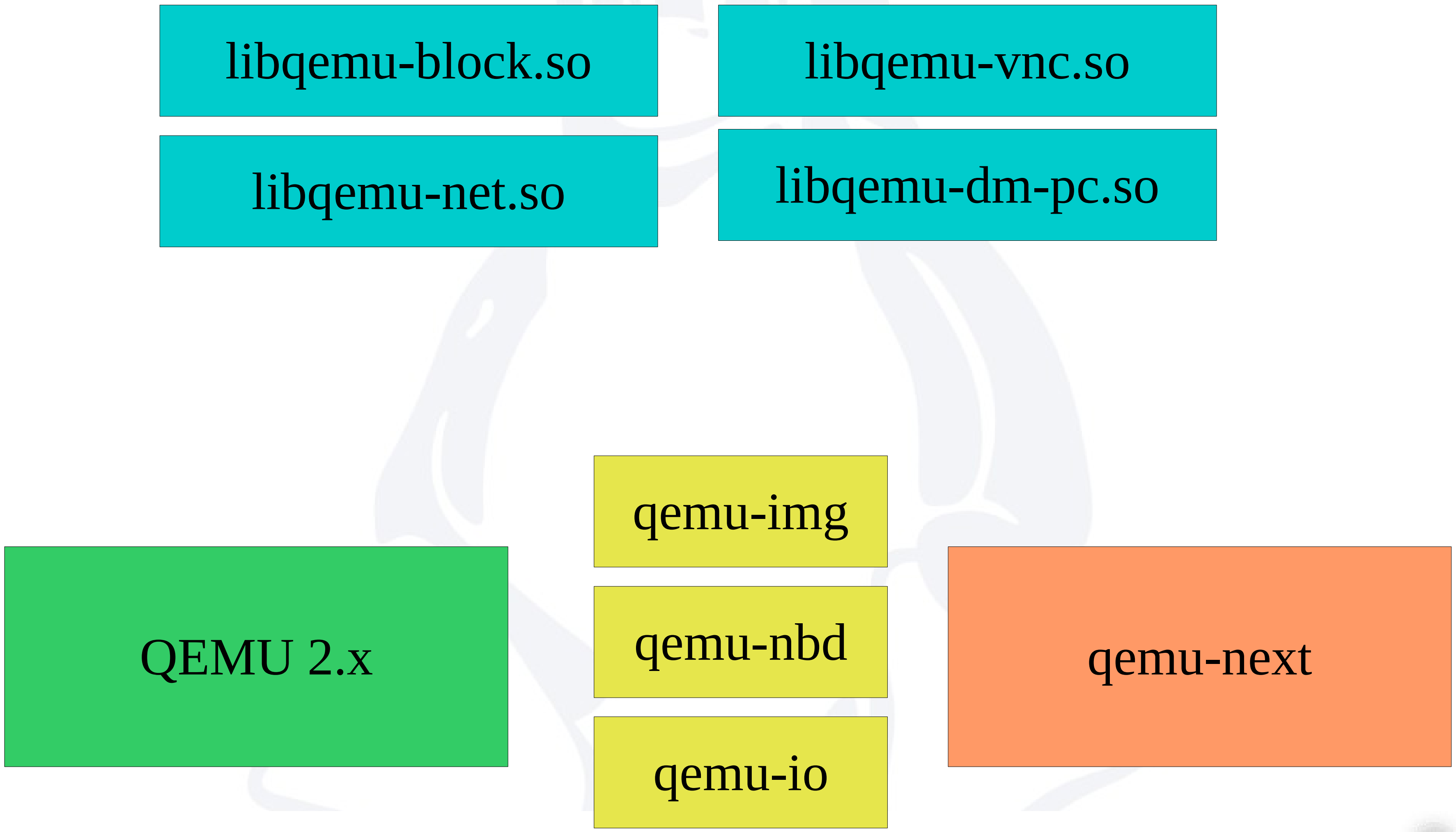
- QEMU is bloated with lots of useful features
- We struggle to scale in every possible way

- VNC server
- virtual disk formats
- network interconnects
- generic transports
- multi-architecture device mode
- multi-architecture CPU emulation
- ....

libqemu-*.so

- Much of qemu would be better suited as libraries maintained as separate projects
- Let KVM develop a stand alone userspace that fits it's architecture model
- Multiple libraries to accommodate different architectures
  - With different emphasis on quality/features
- Continue to share code when it make sense
- Open QEMU code base to a wider audience

QEMU 2.x


libqemu-block.so
libqemu-vnc.so
libqemu-net.so
libqemu-dm-pc.so
qemu-img
qemu-nbd
qemu-io
QEMU 2.x
qemu-next

libqemu-block.so

- qemu-img is very popular outside of QEMU
- Many tools have developed over the years with a few making it into QEMU (qemu-nbd, qemu-io)
- These tools should be separate projects to allow other communities to contribute

- Patches on the list

libqemu-dm-pc.so

- Fork internal device models
  - Improve interfaces
  - Extensive unit tests
- As device models improve, we can replace the internal device models
- Experiment with radical to difficult problems
  - Migration
  - Versioning

- Some prototypes will be available soon

Other considerations

- Major concerns of split
  - KVM community ignores TCG; this is the point
  - QEMU has historically avoided dependencies
- Does fit general direction of QEMU
  - Single executable with pluggable CPU translation
- Split will not be successful without major changes
  - Test driven development
  - Rely more on external code

Questions

- Questions?