GPU, USB, NICs and other physical devices in your containers

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System containers

What are they?

- The oldest type of containers
  *BSD jails, Linux vServer, Solaris Zones, OpenVZ, LXC and LXD.*

- Behave like standalone systems
  *No need for specialized software or custom images.*

- No virtualization overhead
  *They are containers after all.*
Device passthrough

Why would you need physical devices?

- **Computation**
  
  CUDA/OpenCV based GPU computation

- **Very fast networking**
  
  40/100Gb/s networking including RDMA

- **Interacting with devices**
  
  Cell phones, scientific equipments, HSMs, phone cards, …

- **Dedicated block storage**
  
  Physical disks or partitions
Device passthrough

How is it done?

- Device access is handled by the host kernel
  *So the hardware doesn’t need any special capabilities.*

- Device nodes are identified and passed to the container
  *So the workload doesn’t need to be container-aware.*

- Devices can be shared very efficiently
  *The same device can be passed to multiple containers, allowing for simultaneous access, so long as the kernel driver allows it.*

- Devices can be attached and detached on the fly
  *They are just files or kernel constructs so can be moved around, added and removed as needed without requiring a reboot of the host or container.*
Let’s look at LXD

What it **IS**

➔ Simple
   *Clean command line interface, simple REST API and clear terminology.*

➔ Fast
   *Optimized storage and image management.*

➔ Secure
   *Safe by default. Combines all available kernel security features.*

➔ Scalable
   *From a single container on a developer’s laptop to thousands of containers per host in a datacenter.*
Let’s look at LXD

Device types

➔ nic
A network interface. Physical device or virtual interface.

➔ disk
A mounted block device or filesystem path.

➔ gpu
A physical GPU, available as DRI render nodes and CUDA interfaces.

➔ usb
A USB device that can be used by libusb.

➔ unix-char/unix-block
A raw unix char/block device.
Demo time!
Physical devices in containers

Let’s recap

➔ Just about any device can be attached to a container
  *So long as the host kernel supports the device.*

➔ No special hardware or OS configuration required
  *No need for VFIO or virtual devices and no overhead.*

➔ Devices can easily be shared with multiple containers
  *The exact same device can be attached to any number of containers and in some cases (like GPUs) can be used by all of them simultaneously.*
Questions?

Try LXD at: https://linuxcontainers.org/lxd/try-it
Stickers are available in front!