Unprivileged GPU containers on a LXD cluster

GPU-enabled system containers at scale

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What are system containers?

01 They are the oldest type of containers
*BSD jails, Linux vServer, Solaris Zones, OpenVZ, LXC and LXD.*

02 They behave like standalone systems
*No need for specialized software or custom images.*

03 No virtualization overhead
*They are containers after all.*
LXD

System container manager

isa nova-lxd, command line tool, or your own client/script?

LXD REST API

LXD

LXC

Linux kernel

Host A

LXD

LXC

Linux kernel

Host B

LXD

LXC

Linux kernel

Host C

LXD

LXC

Linux kernel

Host ...

Host A

Host B

Host C

Host ...
What LXD is

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

02 Fast
Image based, no virtualization, direct hardware access.

03 Secure
Safe by default. Combines all available kernel security features.

04 Scalable
From a single container on a laptop to tens of thousands of containers in a cluster.
What LXD isn’t

01

Another virtualization technology

*LXD offers an experience very similar to a virtual machine.*

*But it’s still containers, with no virtualization overhead and real hardware.*

02

A fork of LXC

*LXD uses LXC’s API to manage the containers behind the scene.*

03

Another application container manager

*LXD only cares about full system containers.*

*You can run whatever you want inside a LXD container, including Docker.*
LXD

Main components

- Certificates
- Cluster
- Containers
- Events
- Images
- Networks
- Operations
- Projects
- Storage pools

Backups

Snapshots

Storage volumes

Aliases

Snapshots
LXD clustering

01 Built-in clustering support
No external dependencies, all LXD 3.0 or higher installations can be instantly turned into a cluster.

02 Same API as a single node
Clients that aren’t clustering aware just see it as a very large LXD instance.

03 Scales to thousands of containers on dozens of nodes
Uses a built-in distributed database and cross-connections between the nodes to offer a consistent view to clients and load-balance containers.
Wide selection of images
Updated daily
GPUs in LXD containers

01 Support for all GPU vendors
02 Integration with NVIDIA container (libnvidia-container)
03 Share a GPU with multiple containers
04 Fine grained selection of GPU
Demo time!
Let’s recap

01 System containers as alternative to virtual machines
Very similar workflow to virtual machines or cloud instances.
Without overhead, with direct hardware access and no need for virtualization support.

02 Large scale management with clustering
Single entity to manage, highly available and easily scalable.
Combined with CEPH, allows for fault tolerance.

03 Direct hardware access
No virtualized hardware, directly pass your devices to your containers.

04 Safe and fast
State of the art container security and isolation.

05 Production ready
Long term support releases with 5 years of support.
LXD has been around for over 4 years, LXC for over a decade.
Questions?

Website: https://linuxcontainers.org/lxd
Code: https://github.com/lxc/lxd
Online demo: https://linuxcontainers.org/lxd/try-it

We have stickers, come get them in front!

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