Mixed system containers & VMs

Introducing LXD virtual machine support

Stéphane Graber
LXD project leader

@stgraber
https://stgraber.org
stephane.graber@canonical.com

CANONICAL ubuntu

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 **Low overhead, easy management**
Thousands can be run on one system, as easy to manage as a bunch of processes.

What are virtual machines?

01 **Virtualized hardware & firmware**

Behaves in many ways like a physical system.

02 **Hardware accelerated**

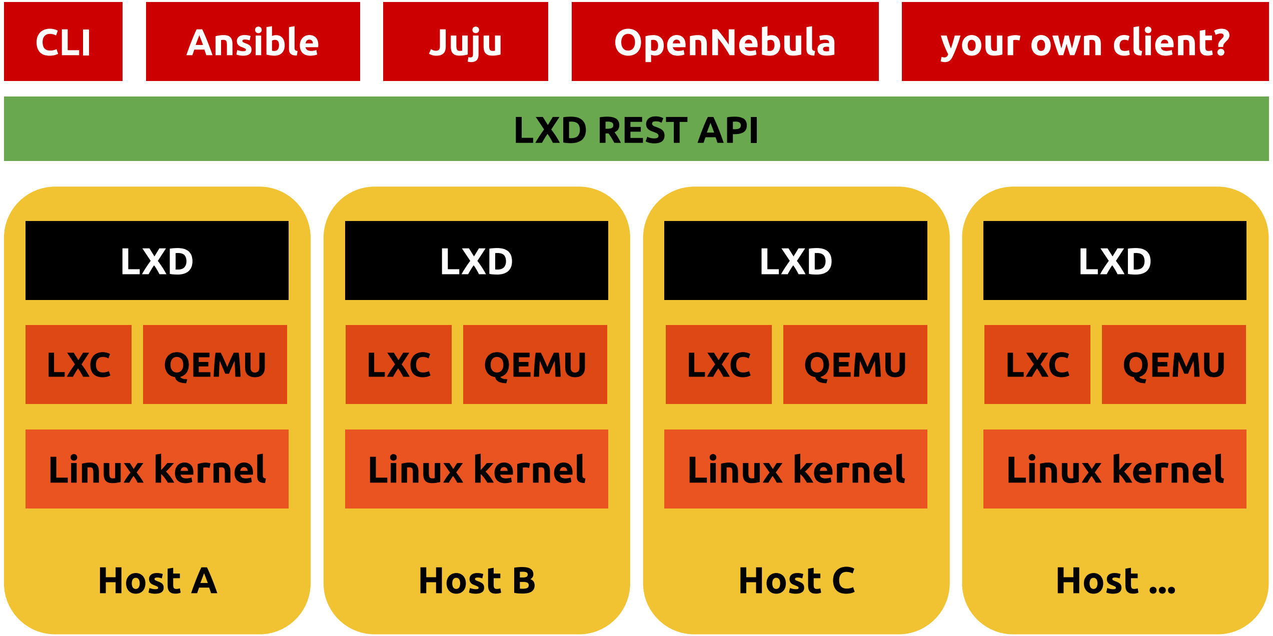
Useful virtualization requires hardware support, additional performance gain comes from using virtualization-aware devices (e.g. virtio).

03 **Can run just about any OS**

Not constrained to Linux only.

LXD

System container
& VM manager

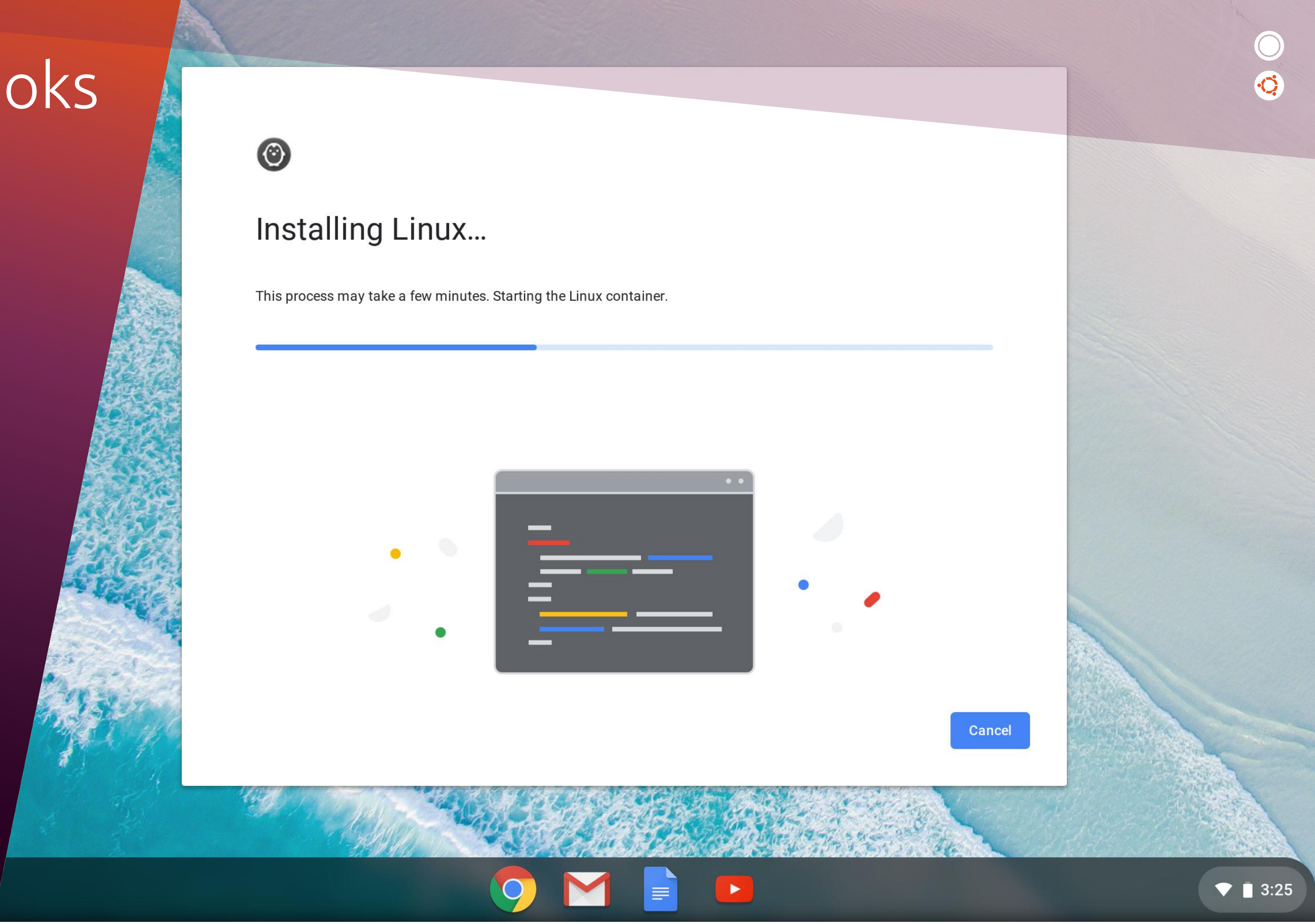


CLI | Ansible | Juju | OpenNebula | your own client?

LXD REST API

Host A	Host B	Host C	Host ...
LXD	LXD	LXD	LXD
LXC, QEMU	LXC, QEMU	LXC, QEMU	LXC, QEMU
Linux kernel	Linux kernel	Linux kernel	Linux kernel

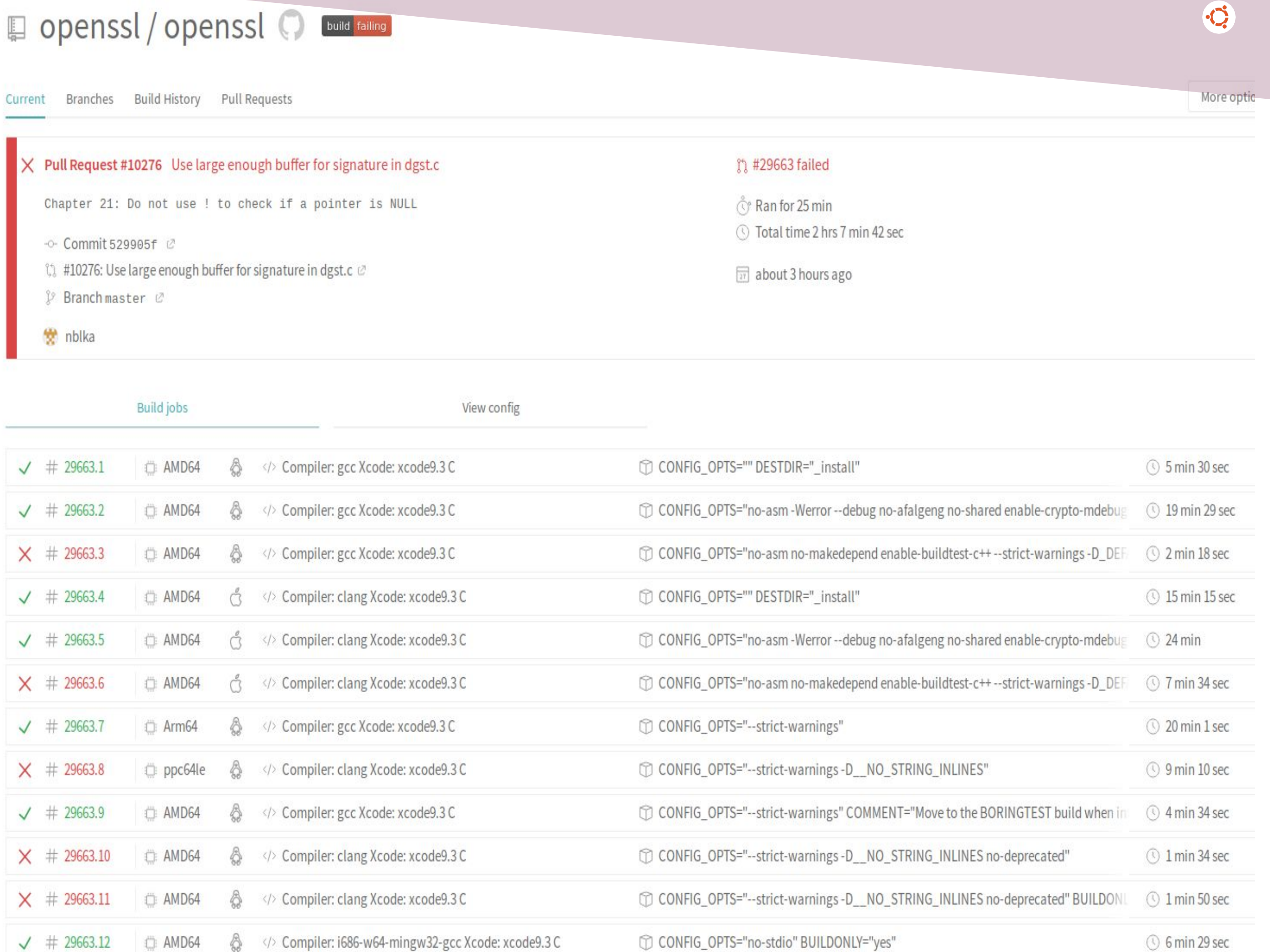
Chromebooks



Installing Linux...

This process may take a few minutes. Starting the Linux container.

Travis-CI



openssl / openssl

✗ Pull Request #10276 Use large enough buffer for signature in dgst.c

Chapter 21: Do not use ! to check if a pointer is NULL

Commit 529905f

#10276: Use large enough buffer for signature in dgst.c

Branch master

nblka

#29663 failed

Ran for 25 min

Total time 2 hrs 7 min 42 sec

about 3 hours ago

✓	# 29663.1	AMD64	Compiler: gcc Xcode: xcode9.3 C	CONFIG_OPTS="" DESTDIR="_install"	5 min 30 sec
✓	# 29663.2	AMD64	Compiler: gcc Xcode: xcode9.3 C	CONFIG_OPTS="no-asm -Werror --debug no-afalgeng no-shared enable-crypto-mdebug	19 min 29 sec
✗	# 29663.3	AMD64	Compiler: gcc Xcode: xcode9.3 C	CONFIG_OPTS="no-asm no-makedepend enable-buildtest-c++ --strict-warnings -D_DEF	2 min 18 sec
✓	# 29663.4	AMD64	Compiler: clang Xcode: xcode9.3 C	CONFIG_OPTS="" DESTDIR="_install"	15 min 15 sec
✓	# 29663.5	AMD64	Compiler: clang Xcode: xcode9.3 C	CONFIG_OPTS="no-asm -Werror --debug no-afalgeng no-shared enable-crypto-mdebug	24 min
✗	# 29663.6	AMD64	Compiler: clang Xcode: xcode9.3 C	CONFIG_OPTS="no-asm no-makedepend enable-buildtest-c++ --strict-warnings -D_DEF	7 min 34 sec
✓	# 29663.7	Arm64	Compiler: gcc Xcode: xcode9.3 C	CONFIG_OPTS="--strict-warnings"	20 min 1 sec
✗	# 29663.8	ppc64le	Compiler: clang Xcode: xcode9.3 C	CONFIG_OPTS="--strict-warnings -D__NO_STRING_INLINES"	9 min 10 sec
✓	# 29663.9	AMD64	Compiler: gcc Xcode: xcode9.3 C	CONFIG_OPTS="--strict-warnings" COMMENT="Move to the BORINGTEST build when in	4 min 34 sec
✗	# 29663.10	AMD64	Compiler: clang Xcode: xcode9.3 C	CONFIG_OPTS="--strict-warnings -D__NO_STRING_INLINES no-deprecated"	1 min 34 sec
✗	# 29663.11	AMD64	Compiler: clang Xcode: xcode9.3 C	CONFIG_OPTS="--strict-warnings -D__NO_STRING_INLINES no-deprecated" BUILDONL	1 min 50 sec
✓	# 29663.12	AMD64	Compiler: i686-w64-mingw32-gcc Xcode: xcode9.3 C	CONFIG_OPTS="no-stdio" BUILDONLY="yes"	6 min 29 sec

What LXD is

01 **Simple**

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

02 **Fast**

Image based, optimized storage & migration, direct hardware access.

03 **Secure**

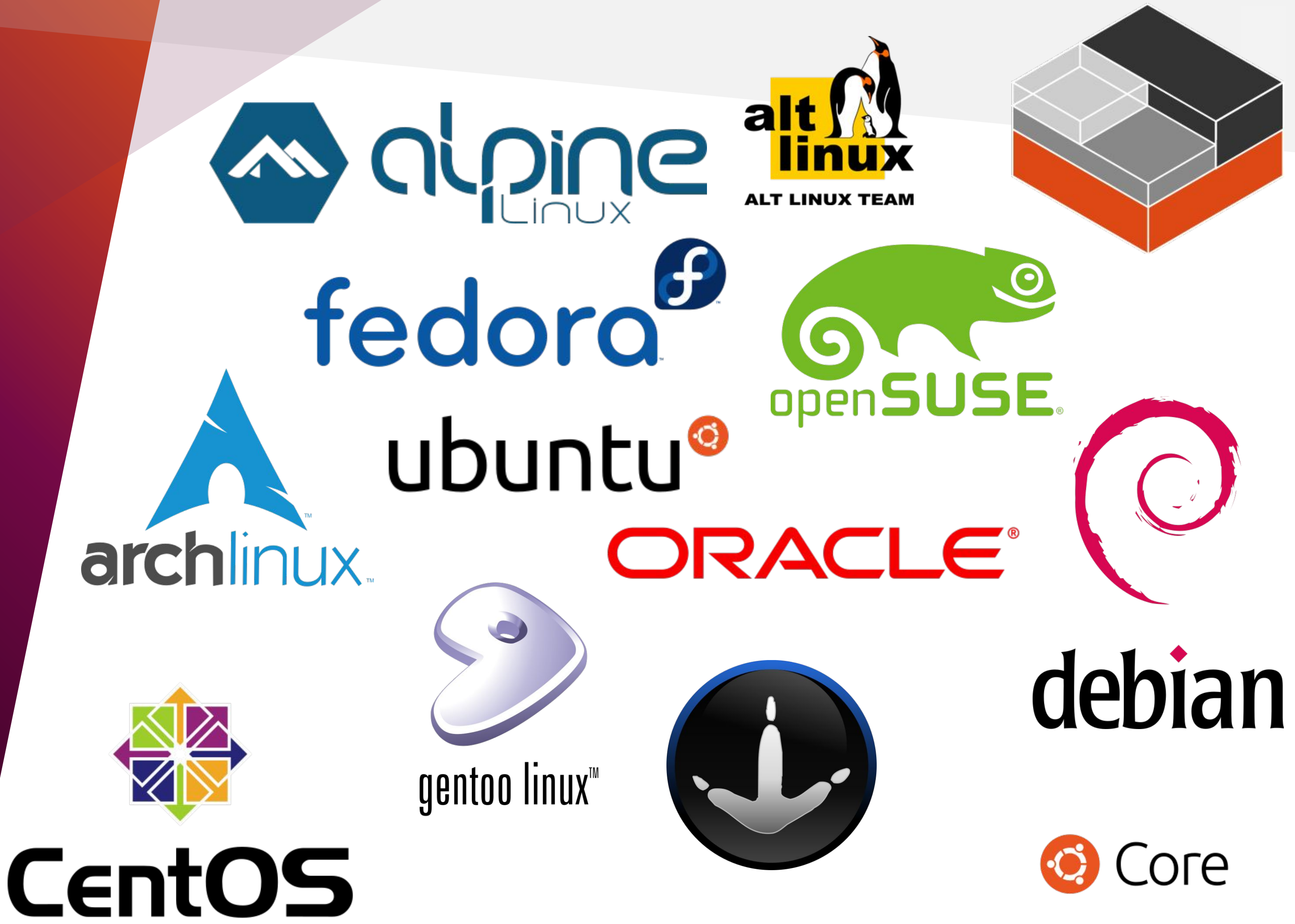
Safe by default. Combines all available kernel security features.

04 **Scalable**

From a single instance on a laptop to tens of thousands of instances in a cluster.

Wide selection of images

Updated daily



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.

LXD virtual machines

01 **Modern machines**

UEFI with Secure Boot (where available), virtio devices only, based on QEMU 4.2.

02 **Same API and semantics as our containers**

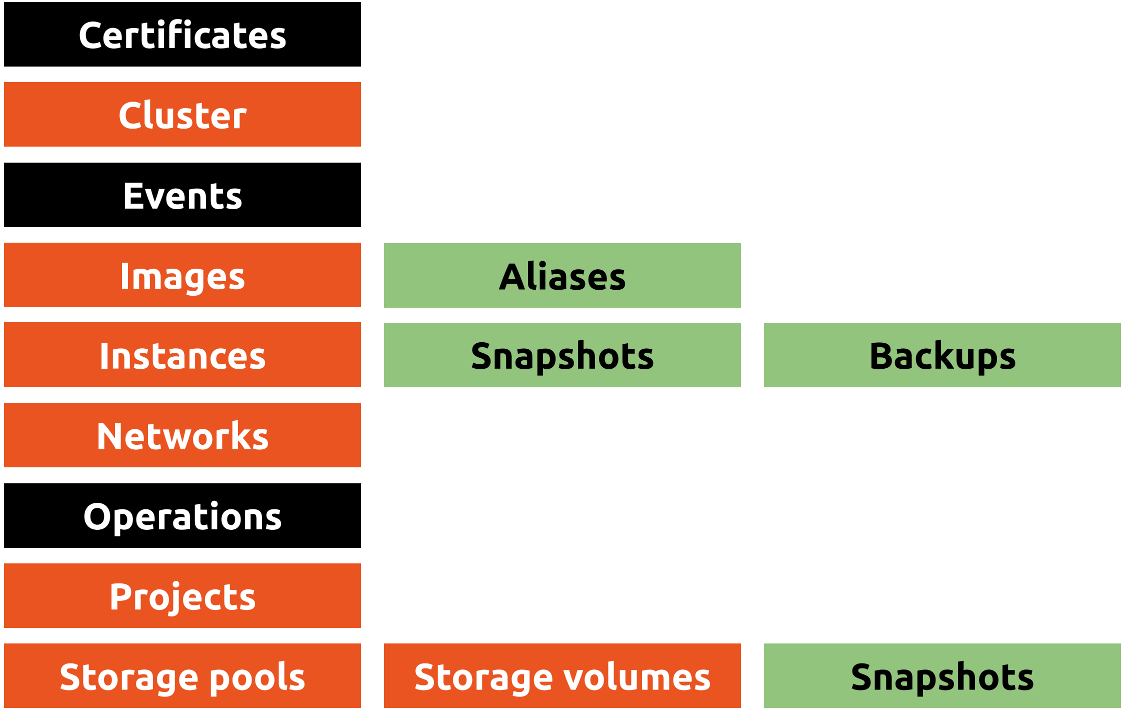
No particular VM knowledge needed by existing clients.

03 **Integrates seamlessly with LXD networks, storage, projects, profiles, …**

All existing configuration can be shared between containers and virtual machines, profiles with resource limits or devices can apply to both types.

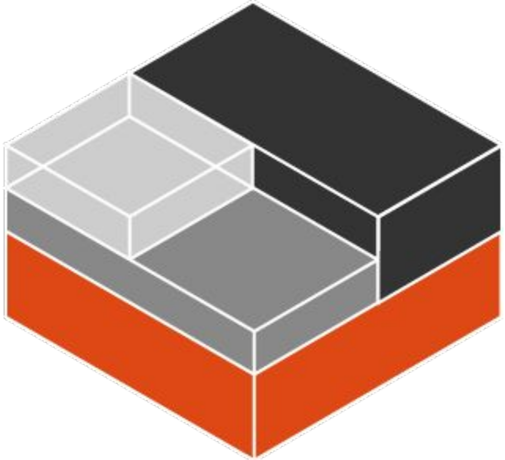
LXD

Main components



Certificates		
Cluster		
Events		
Images	Aliases	
Instances	Snapshots	Backups
Networks		
Operations		
Projects		
Storage pools	Storage volumes	Snapshots

Demo time!



What’s next

01 **Images for more distributions**

Get feature parity with our set of container images, done by adding VM image building capability to Distrobuilder and having those images built as part of our normal pipeline.

02 **Live update of VM configuration**

Device hotplug, live adjustments of resource restrictions, …

03 **Security**

Integrate with our existing AppArmor and Seccomp generators.

04 **Close feature gap with containers**

Publishing, backups, migration, filesystem passthrough, usb devices, GPUs, …

05 **Agent on other operating systems**

Port the VM agent to using newly implemented virtio-vsock driver for Windows.

LXD everywhere

Linux

snap install lxd

requires snapd on a supported Linux distribution

Native packages

available for some releases on Alpine, ArchLinux, Fedora, Gentoo, OpenSUSE and Ubuntu

On your Chromebook

Search for “Terminal” in your app launcher

MacOS

brew install lxc

requires Homebrew on current MacOS

Windows

choco install lxc

requires Chcoolatey on current Windows 10

Contributing to LXD

01 **Written in Go**

With low level logic in C through a variety of libraries.

02 **Fully translatable client**

An easy way to contribute to LXD, translate our CLI in your language!

03 **API client libraries**

Official ones for Go and Python
Additional ones in Ruby, Node, Java, Haskell, ...

04 **Apache2 licensed**

Re-use and improve any of our Go packages in your own projects.

05 **No copyright assignment**

Easy contributions, no legal paperwork, just send a pull request.

06 **Online user community**

Very active discussion forum with active experts in container networking, security and more.

git clone https://github.com/lxc/lxd

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!

Stéphane Graber
LXD project leader

@stgraber
https://stgraber.org
stephane.graber@canonical.com