



UbuCon Korea 2024

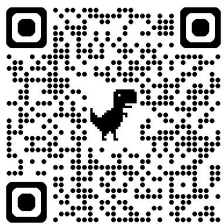
LXD-UI를 이용해 웹에서 VM, 컨테이너 프로비저닝하기

조현우 (Hyeonwoo Jo)



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- 하이퍼커넥트 DevOps Team, Internal Platform Engineer
- 5년여간 스타트업에서 백엔드 개발자와 DevOps 엔지니어로 근무
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Hyeonwoo Jo

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Web Fullstack Engineer. adept in Next.js,
React, NestJS, Kubernetes & Docker.
Passionate about scalable web apps.



1. 기본 배경 설명
 - a. 하이퍼바이저와 가상화 기술
 - b. VM과 리눅스 컨테이너의 개념
2. LXD-UI 프로젝트 소개
 - a. 프로젝트 개요 및 목적
 - b. 주요 기능
3. 설치 방법
4. 활용 사례 및 사용 방법 (Demo)
5. 정리

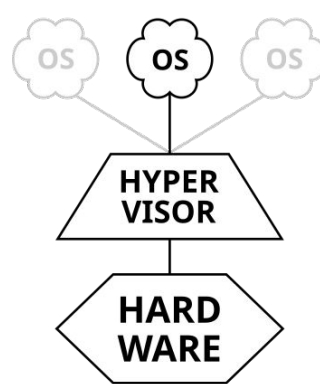


기본 배경 설명



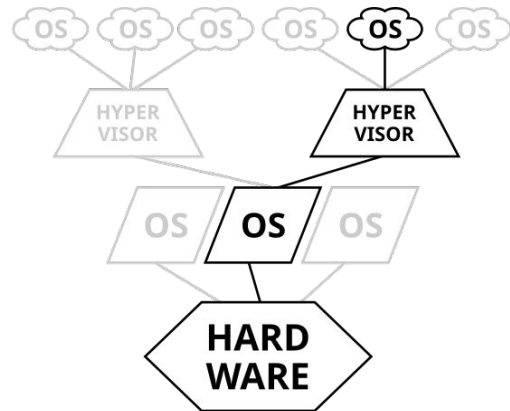
하이퍼바이저

- 물리적인 하드웨어를 여러 개의 가상 머신으로 나누어 사용할 수 있도록 해준다.
- **Type 1** : 하드웨어 위에서 직접 실행되며, 별도의 Host OS 없이 구동된다 (e.g. MS Hyper-V, Xen, VMware ESXi, KVM)
- **Type 2** : Host OS 위에서 실행되며, OS 위에 OS가 실행되는 방식이라 오버헤드가 클 수 있다 (e.g. VMware Workstation, VirtualBox, QEMU)



TYPE 1

*native
(bare metal)*



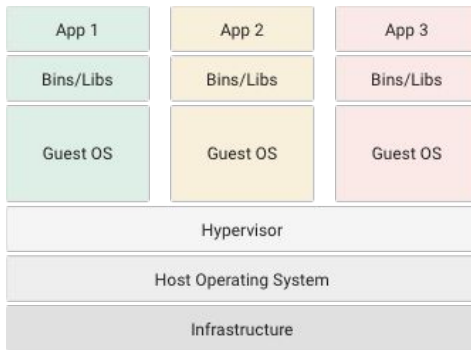
TYPE 2

hosted

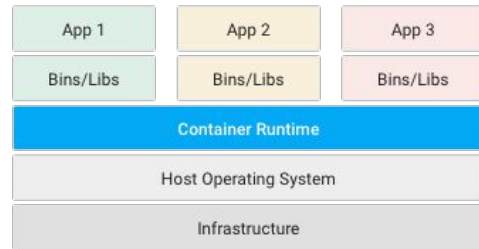


VM (Virtual Machine)

- Type 2 Hypervisor 위에서 동작
- Guest OS를 별도로 띄워야하므로 오버헤드 발생



Virtual Machines



Containers

Container

- Hypervisor, Guest OS 불필요
- Container Runtime이 하이퍼바이저의 역할 대체
- OS, 커널이 포함되어 있지 않아 이미지 용량이 작고 빠르게 프로비저닝 가능



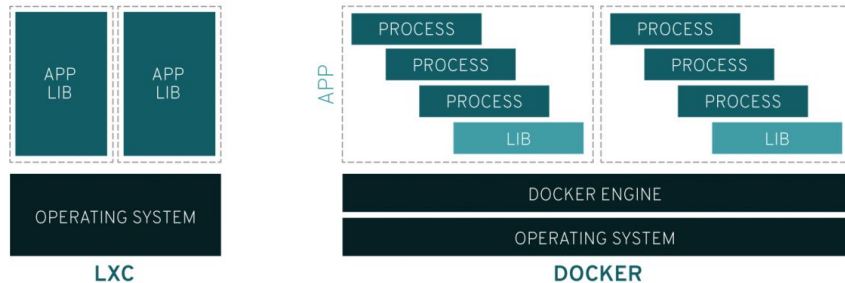
LXC (Linux Container)

- Host OS (Linux) 에 동작하고 있는 프로세스를 격리시켜, 각 프로세스마다 독자적인 리눅스 시스템 환경 구축
- 운영체제 수준의 가상화를 통해 여러 리눅스 배포판을 하나의 호스트에서 격리 실행 가능
- Host의 커널을 공유하고 Cgroups, Namespaces 등 기술을 사용하여 격리, 제어한다

LXC vs Docker?

- LXC는 더 완전한 운영 체제 수준의 격리를 제공,
Docker는 애플리케이션 수준의 격리에 중점을 두고 있다

Traditional Linux containers vs. Docker





LXD-UI 프로젝트 소개



- LXD

- Open-source solution for managing virtual machines and system containers.
- Provides a secure and scalable environment with minimal overhead.

LXD CLI

LXD offers an intuitive and crisp CLI for easy operations. To control LXD, you typically use two different commands: `lxd` and `lxc`. The `lxd` command is used to control the daemon and is typically used only for initialisation and debugging. The `lxc` command is the command-line client that you use to interact with your instances. See `lxc --help` for an overview of all available subcommands.

[Get started with the LXD CLI >](#)

LXD REST API

All communication between LXD and its clients happens using a RESTful API over HTTP. This means you can easily integrate LXD with any other tool you use for managing your infrastructure, and you can easily set up scripts as needed. LXD implements a single REST API for both local and remote access.

[Learn more about the LXD REST API >](#)

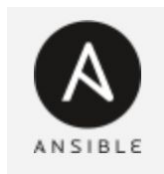
LXD graphical user interface (UI)

Starting with LXD 5.21.0 LTS, an official LXD UI tool is now available by default. The UI supports most of the functionalities surrounding managing instances. More features coming soon.



- LXD

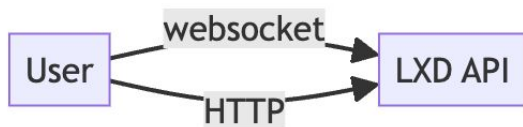
- 다양한 Thirdparty Integration 지원
- IaC 도구와 REST Api를 통합하면 Platform Engineering 관점에서 활용 가치가 높을 것으로 기대





- LXD-UI

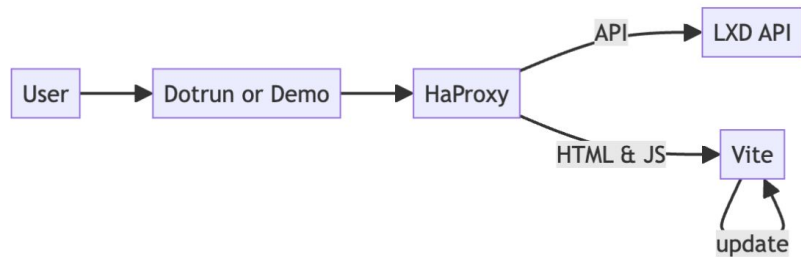
- LXD 프로젝트에 포함되어 CLI나 API뿐 아니라 'Web Interface'로도 LXD의 기능들을 이용할 수 있음
- 기술적으로는 Modern web frontend 기술을 이용해 만들어짐 (React.js, Typescript)
- Frontend는 SPA 형식의 Static Website로 구성되어 있고, LXD API를 Websocket/HTTP 방식으로 호출하여 사용함
- Web Frontend Engineer도 Ubuntu와 그 생태계에 기여할 수 있는 좋은 아이템!



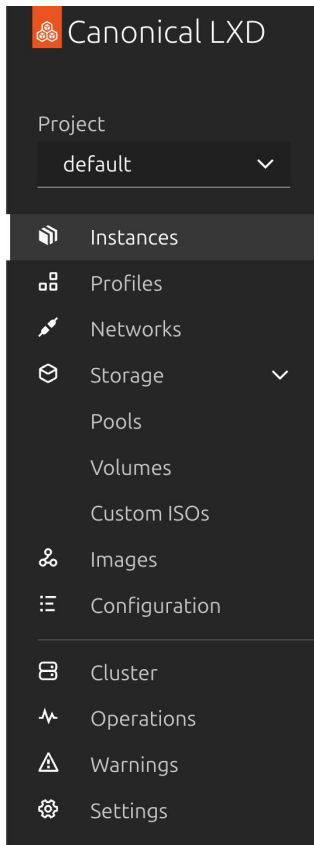
출처 : LXD-UI GitHub



Dev setup




출처 : LXD-UI GitHub



- Project 설정 : 프로젝트별 Resource limit 설정 가능
- Instance 배포 : VM, LXC 인스턴스 생성/관리
- Profile 설정 : Configuration Options 저장 용도로 활용
- Network 설정 : Network Interface 관리/설정, Port Forwarding
- Storage 설정 : Storage Pool, Volume 관리/설정, Custom ISO
- Image 목록 조회
- Clustering 옵션

LXD-UI 프로젝트 소개

주요 기능











Howtos and Tutorials

LXD
동영상 67개 조회수 15,446회 최종 업데이트: 2023. 6. 14.

모두 재생 | 서플

This includes all our videos featuring both step by step tutorials and deep dives into specific features or setups.

-  **Terraform and LXD**
LXD · 조회수 4,6천회 · 1년 전
-  **LXD backup and disaster recovery**
LXD · 조회수 1,8천회 · 1년 전
-  **LXD REST API**
LXD · 조회수 1,4천회 · 1년 전
-  **LXD nic devices**
LXD · 조회수 1,4천회 · 1년 전
-  **Early look at the LXD web UI**
LXD · 조회수 1,6만회 · 1년 전
-  **MicroCloud, now with OVN!**
LXD · 조회수 7,1천회 · 1년 전
-  **LXD proxy devices**
LXD · 조회수 1,5천회 · 1년 전
-  **LXD infiniband devices**
LXD · 조회수 580회 · 1년 전

- Youtube LXD 계정에 Howto, Tutorials 관련 영상이 67개나 업로드되어 있음
- 직접 따라해보면서 실행해볼 수 있도록 만들어져있어서 초심자에게 추천



설치 방법

설치 방법



1. `snap install lxd`
2. `lxd init`
3. `lxc config set core.https_address :8443`



Login

Certificate selection

Create a new certificate

Or [use an existing certificate](#) already added to your browser



Setup LXD UI

1. Generate

Create a new certificate

Generate

2. Trust

Download `lxd-ui.crt` and add it to the LXD trust store

```
$ lxc config trust add Downloads/lxd-ui.crt
```

3. Import

Firefox Chrome (Linux) Chrome (Windows) Edge macOS

Download `lxd-ui.pfx`

Paste into the address bar:

```
chrome://settings/certificates
```

Click the `Import` button and select the `lxd-ui.pfx` file you just downloaded. Enter your password, or leave the field empty if you have not set one.

Restart the browser and open LXD-UI. Select the LXD-UI certificate.

13. Done

Enjoy LXD UI.



Add existing certificate

 A client certificate must be present and selected in your browser

1. **Create token** Generate a token on the command line

```
$ lxc config trust add --name lxd-ui
```

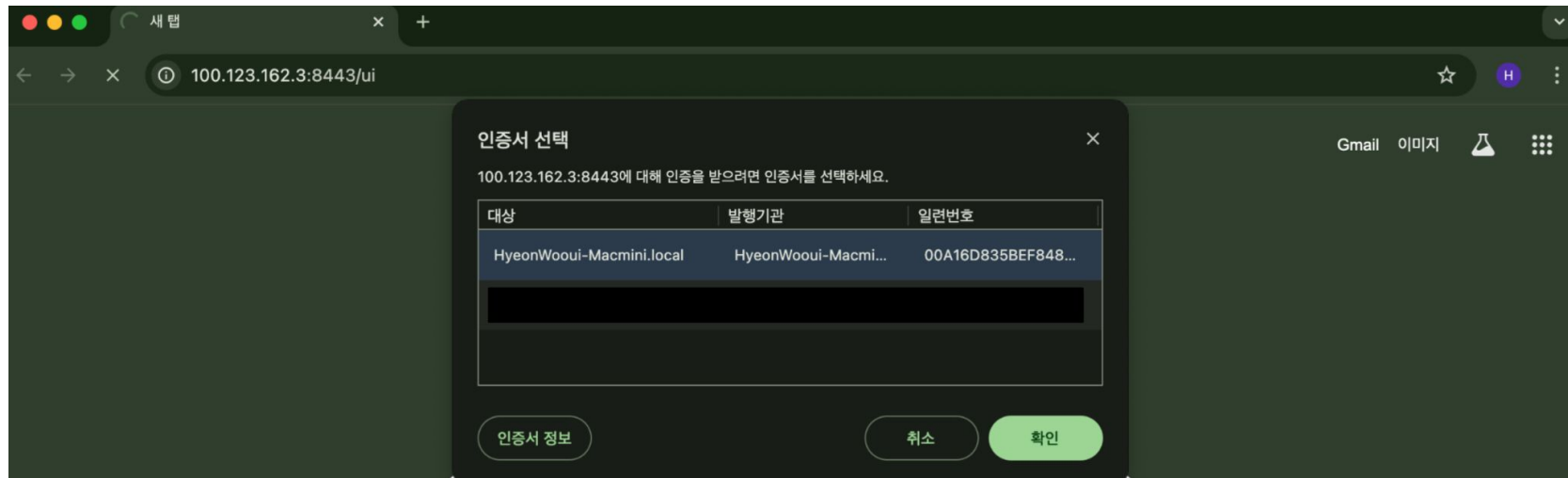
2. **Import** Paste the token from the previous step

Paste your token here

Import

3. **Done** Enjoy LXD UI.

설치 방법



설치 방법



Canonical LXD

Project
default ▾

- Instances
- Profiles
- Networks
- Storage >
- Images
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Instances ⓘ



No instances found

There are no instances in this project. Spin up your first instance!

[How to create instances](#)

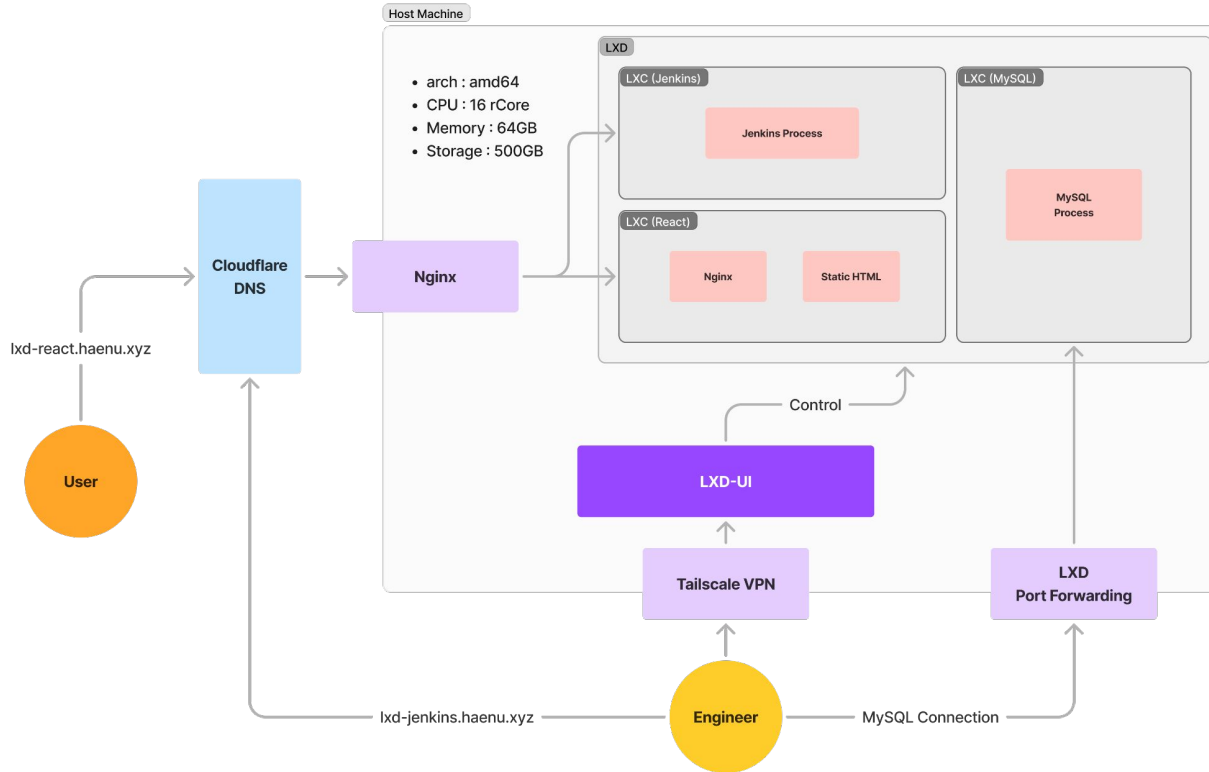
Create instance



활용 사례 및 사용 방법

활용 사례 및 사용 방법

Demo 기본 구조





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Instances

Create instance

Showing all 3 instances

< 1 of 1 > 50/page

<input type="checkbox"/>	NAME	TYPE	DESCRIPTION	IPV4	IPV6	SNAPSHOTS	STATUS	
<input type="checkbox"/>	jenkins	Container		10.206.204.176	fd42:e472:f942:423d:216:3eff:fed5:6e20	0	Running	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
<input type="checkbox"/>	react	Container		10.206.204.106	fd42:e472:f942:423d:216:3eff:feb7:cf57	0	Running	
<input type="checkbox"/>	test	Container		10.206.204.30	fd42:e472:f942:423d:216:3eff:fecc:4fb9	0	Running	



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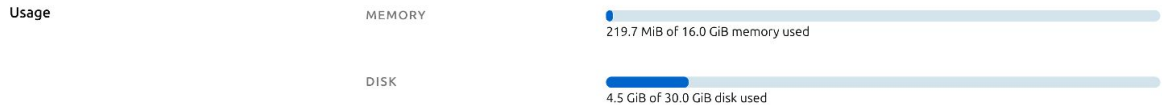
Report a bug

Instances /jenkins *Running*

Delete instance

Overview Configuration Snapshots Terminal Console Logs

General	
BASE IMAGE	ubuntu 24.04 LTS amd64 (release) (20240806)
DESCRIPTION	-
TYPE	Container
IPV4	10.206.204.176 (eth0)
IPV6	fd42:e472:f942:423d:216:3eff:fed5:6e20 (eth0) fe80::216:3eff:fed5:6e20 (eth0)
ARCHITECTURE	x86_64
LOCATION	-
PID	141787
DATE CREATED	2024년 8월 10일 오전 01:01
LAST USED	2024년 8월 10일 오전 01:01



Networks			
NAME	INTERFACE	TYPE	MANAGED
lxdbro	eth0	bridge	Yes



Canonical LXD

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Instances /jenkins *Running* ▶ ⏪ || ⏩

Delete instance

Overview **Configuration** Snapshots Terminal Console Logs

Main configuration	CONFIGURATION	INHERITED	OVERRIDE
<ul style="list-style-type: none"> Advanced <ul style="list-style-type: none"> Disk devices Network devices Resource limits Security policies Snapshots Migration Cloud init YAML configuration 	Exposed CPU limit Which CPUs to expose to the instance	- From: LXD (container)	2
	Memory limit Usage limit for the host's memory	- From: LXD (container)	16GIB
	Memory swap (Containers only) Whether to encourage/discourage swapping less used pages for this instance	Allow From: LXD	
	Disk priority Priority of the instance's I/O requests	5 From: LXD	
	Max number of processes (Containers only) Maximum number of processes that can run in the instance	- From: LXD	

Edit instance



Canonical LXD

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Instances/jenkins *Running* ▶ ↺ ⏸ □ Delete instance

Overview Configuration Snapshots Terminal Console Logs Reconnect

```

root@jenkins:~# systemctl status jenkins
● jenkins.service - Jenkins Continuous Integration Server
   Loaded: loaded (/usr/lib/systemd/system/jenkins.service; enabled; preset: enabled)
   Active: active (running) since Fri 2024-08-09 16:06:41 UTC; 3h 13min ago
   Main PID: 3661 (java)
     Tasks: 48 (limit: 76992)
    Memory: 142.3M (-)
   CGroup: /system.slice/jenkins.service
           └─3661 /usr/bin/java -Djava.awt.headless=true -jar /usr/share/java/jenkins.war --webroot=/var/cache/jenkins/war --httpPort=8080

Aug 09 16:11:56 jenkins jenkins[3661]: 2024-08-09 16:11:56.662+0000 [id=303] INFO jenkins.InitReactorRunner$1#onAttained: Listed all plugins
Aug 09 16:11:56 jenkins jenkins[3661]: 2024-08-09 16:11:56.664+0000 [id=302] INFO jenkins.InitReactorRunner$1#onAttained: Prepared all plugins
Aug 09 16:11:56 jenkins jenkins[3661]: 2024-08-09 16:11:56.694+0000 [id=302] INFO jenkins.InitReactorRunner$1#onAttained: Started all plugins
Aug 09 16:11:56 jenkins jenkins[3661]: 2024-08-09 16:11:56.695+0000 [id=300] INFO jenkins.InitReactorRunner$1#onAttained: Augmented all extensions
Aug 09 16:11:56 jenkins jenkins[3661]: 2024-08-09 16:11:56.739+0000 [id=302] INFO jenkins.InitReactorRunner$1#onAttained: System config loaded
Aug 09 16:11:56 jenkins jenkins[3661]: 2024-08-09 16:11:56.740+0000 [id=302] INFO jenkins.InitReactorRunner$1#onAttained: System config adapted
Aug 09 16:11:56 jenkins jenkins[3661]: 2024-08-09 16:11:56.753+0000 [id=302] INFO jenkins.InitReactorRunner$1#onAttained: Loaded all jobs
Aug 09 16:11:56 jenkins jenkins[3661]: 2024-08-09 16:11:56.754+0000 [id=303] INFO jenkins.InitReactorRunner$1#onAttained: Configuration for all jobs updated
Aug 09 16:11:56 jenkins jenkins[3661]: 2024-08-09 16:11:56.943+0000 [id=302] INFO jenkins.InitReactorRunner$1#onAttained: Completed initialization
Aug 09 16:11:56 jenkins jenkins[3661]: 2024-08-09 16:11:56.944+0000 [id=74] INFO h.m.UpdateCenter$CCompleteBatchJob#run: Completed installation of 89 plugins in 3 min 20 s
lines 1-19/19 (END)
    
```



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Create an instance

Main configuration

Advanced

- Disk devices
- Network devices
- Resource limits
- Security policies
- Snapshots
- Migration
- Cloud init

YAML configuration

Instance name

test-instance

Description

Enter description

Base Image*

Ubuntu noble 24.04



Instance type

Container

Profiles

default



Remove

Add profile

Cancel

Create

Create and start



Select base image



Distribution

Any ▾

Release

Any ▾

Variant

Any ▾

Architecture

amd64 ▾

Type

Any ▾

Search an image

DISTRIBUTION	RELEASE	VARIANT	TYPE	ALIAS	SOURCE	
Ubuntu	24.04 LTS	noble	all	default	Ubuntu	<input type="button" value="Select"/>
Ubuntu	23.10	mantic	all	mantic	Ubuntu	<input type="button" value="Select"/>
Ubuntu	23.04	lunar	all	lunar	Ubuntu	<input type="button" value="Select"/>
Ubuntu	22.10	kinetic	all	kinetic	Ubuntu	<input type="button" value="Select"/>
Ubuntu	22.04 LTS	jammy	all	jammy	Ubuntu	<input type="button" value="Select"/>
Ubuntu	21.10	impish	all	impish	Ubuntu	<input type="button" value="Select"/>
Ubuntu	21.04	hirsute	all	hirsute	Ubuntu	<input type="button" value="Select"/>
Ubuntu	20.10	groovy	all	groovy	Ubuntu	<input type="button" value="Select"/>
Ubuntu	20.04 LTS	focal	all	focal	Ubuntu	<input type="button" value="Select"/>
Ubuntu	19.10	eoan	all	eoan	Ubuntu	<input type="button" value="Select"/>
Ubuntu	19.04	disco	all	disco	Ubuntu	<input type="button" value="Select"/>
Ubuntu	18.10	cosmic	all	cosmic	Ubuntu	<input type="button" value="Select"/>
Ubuntu	18.04 LTS	bionic	all	bionic	Ubuntu	<input type="button" value="Select"/>



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Create an instance

- Main configuration
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 - Resource limits**
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- YAML configuration

CONFIGURATION	INHERITED	OVERRIDE
Exposed CPU limit Which CPUs to expose to the instance	- From: LXD (container)	<input checked="" type="radio"/> number <input type="radio"/> fixed ✕ <input type="text" value="2"/> Total number of CPU cores: 16
Memory limit Usage limit for the host's memory	- From: LXD (container)	<input checked="" type="radio"/> absolute <input type="radio"/> percentage ✕ <input type="text" value="8"/> GiB ▾ Total memory: 64 GiB
Memory swap (Containers only) Whether to encourage/discourage swapping less used pages for this instance	Allow From: LXD	✎
Disk priority Priority of the instance's I/O requests	5 From: LXD	✎
Max number of processes (Containers only) Maximum number of processes that can run in the instance	- From: LXD	✎

Cancel

Create

Create and start



Canonical LXD

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lock lxd-ui

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CONFIGURATION	INHERITED	OVERRIDE
Snapshot name pattern Template for the snapshot name	snap%d From: LXD	✎
Expire after When snapshots are to be deleted	- From: LXD	✎
Snapshot stopped instances Whether to automatically snapshot stopped instances	No From: LXD	✎
Schedule Schedule for automatic instance snapshots	- From: LXD	<input type="radio"/> Cron syntax ✕ <input checked="" type="radio"/> Choose interval Daily

Cancel

Create

Create and start



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CONFIGURATION

INHERITED

OVERRIDE

Network config

Network configuration for `cloud-init`

```
1 DHCP on
   eth0
```

From: LXD

User data

User data for `cloud-init`

```
1 #cloud-
   config
```

From: LXD

Vendor data

Vendor data for `cloud-init`

```
1 #cloud-
   config
```

From: LXD

Cancel

Create

Create and start



Canonical LXD

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Networks

See map

Create network

NAME	TYPE	MANAGED	IPV4	IPV6	DESCRIPTION	FORWARDS	USED BY	STATE
lx-dbr0	bridge	Yes	10.206.204.1/24	Fd42:e472:f942:423d::1/64		1	4	Created
lo	loopback	No				-	0	
eth0	physical	No				-	0	
eth1	physical	No				-	0	
virbr0	bridge	No				-	0	
virbr0-nic	unknown	No				-	0	
tailscale0	unknown	No				-	0	



Canonical LXD

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lxid-ui

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Networks / lxdbr0

Delete network

Overview Configuration Forwards

General	
NAME	lxdbr0
DESCRIPTION	-
TYPE	bridge
STATE	Created
IPV4	10.206.204.1/24
IPV6	fd42:e472:f942:423d::1/64

Status	
RX	13.0 MiB (108421 packets)
TX	806.5 MiB (158959 packets)
MAC ADDRESS	00:16:3e:84:fa:27
MTU	1500

Usage (4)	
INSTANCES (3)	jenkins react test
PROFILES (1)	default

활용 사례 및 사용 방법

Demo



Canonical LXD

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default

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Networks / lxdbr0

Delete network

Overview Configuration Forwards

Main configuration

Advanced

Bridge

DNS

IPv4

IPv6

YAML configuration

* Type

Bridge

OVN needs to be configured. [Learn how to set up OVN](#)

* Name

lxdbr0

Click the name in the header to rename the network

Description

Enter description

CONFIGURATION

INHERITED

OVERRIDE

IPv4 address

-

10.206.204.1/24

IPv4 address for the bridge

From: LXD

IPv4 NAT

false

true

Whether to use NAT for IPv4

From: LXD

IPv6 address

-

fd42:e472:f942:423d::1/64

IPv6 address for the bridge

From: LXD

IPv6 NAT

false

true

Whether to use NAT for IPv6

From: LXD

Edit network



Canonical LXD

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Edit a network forward

Network information

Name: lxdbr0
IPv4: 10.206.204.1/24
IPv6: fd42:e472:f942:423d::1/64

* Listen address

Any address routed to LXD.

Default target address

Fallback target for traffic that does not match a port specified below.
Must be from the network lxdbr0.

Description

* LISTEN PORT	* PROTOCOL	* TARGET ADDRESS	TARGET PORT	
<input type="text" value="3306"/>	TCP	<input type="text" value="10.206.204.30"/>	<input type="text" value="3306"/>	<input type="button" value="🗑"/>

e.g. 80,90-99.

Must be from the network lxdbr0.

Same as listen port if empty

Cancel



Canonical LXD Custom ISOs

Project: default

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No custom ISOs found in this project
Custom ISOs will appear here
[Learn more about storage](#)

[Upload custom ISO](#)

Upload custom ISO

ⓘ Some image formats need to be modified in order to work with LXD.
[Windows ISO images](#)

Local file: 선택된 파일 없음

Alias:

Storage pool: default



정리



- LXD는 VM, LXC를 쉽게 프로비저닝하고 관리할 수 있도록 만들어진 소프트웨어
- LXD-UI는 LXD를 Web 기반으로 쉽게 사용할 수 있도록 만들어진 툴
- 소규모 홈서버를 운영할 때 편하게 활용 가능할 걸로 예상
- 클러스터링 & 여러 서드파티 통합을 이용하면 **Enterprise** 수준에서도 활용 가능
- REST API & IaC 도구를 활용하여 **Platform Engineering**까지도 연결?



Q&A



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감사합니다!