Development of a virtualization framework with LXD

Òscar Pérez Castillo

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Universitat Politècnica de Catalunya

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Outline

Introduction

Using Linux Containers, develop a framework on top of existing containerization solutions (LXC/LXD) improving:

- Containers organization
- Containers set up
- Containers distribution

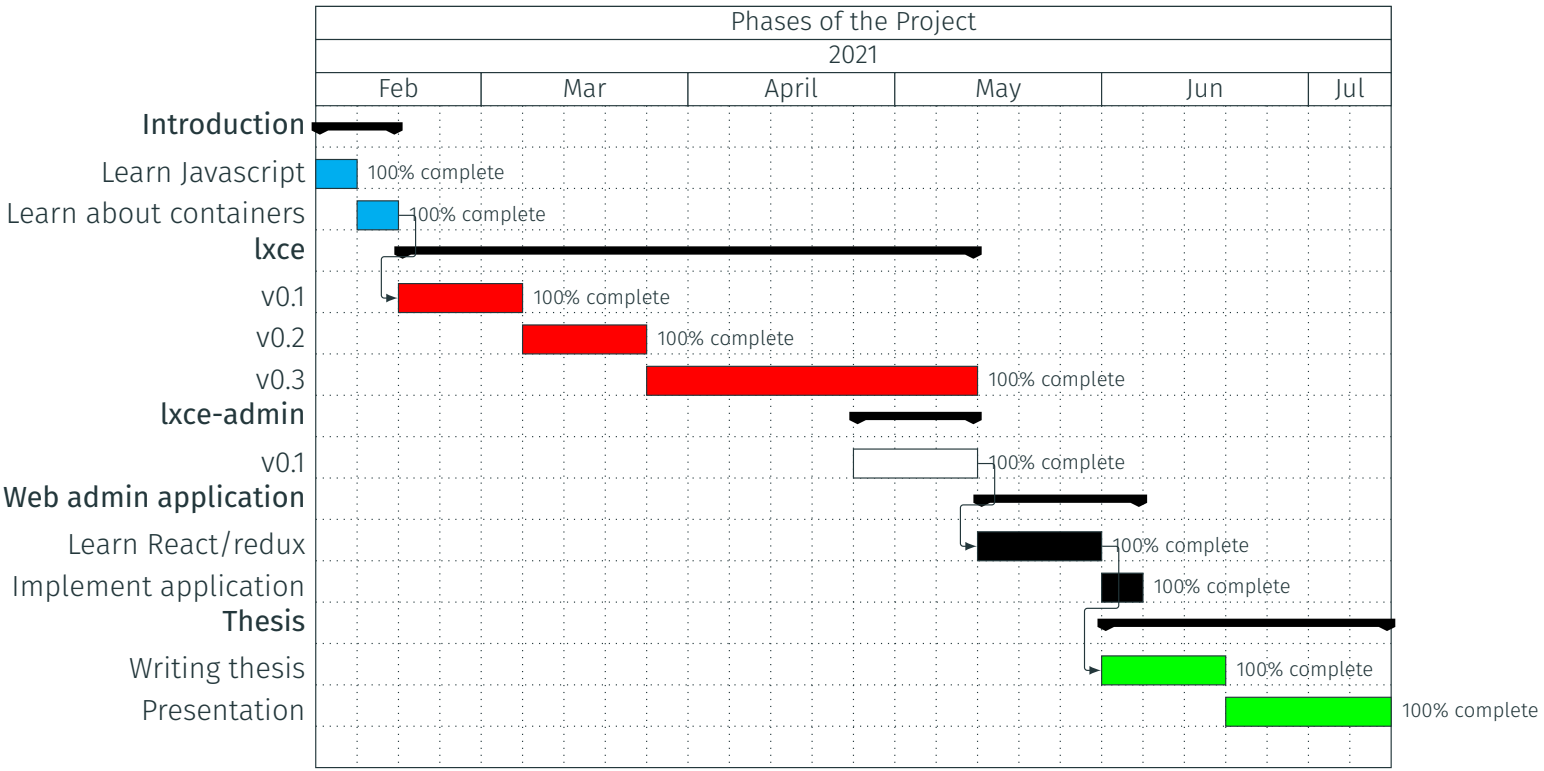
Introduction

Developing a set of tools:

- lxce: command line tool
- lxce-admin: admin command line tool
- web application

Outline

Project organization



Outline

Concepts

Project based on:

- Containers technology
- LXC
- LXD

Concepts: Containers

Virtualization vs Containers

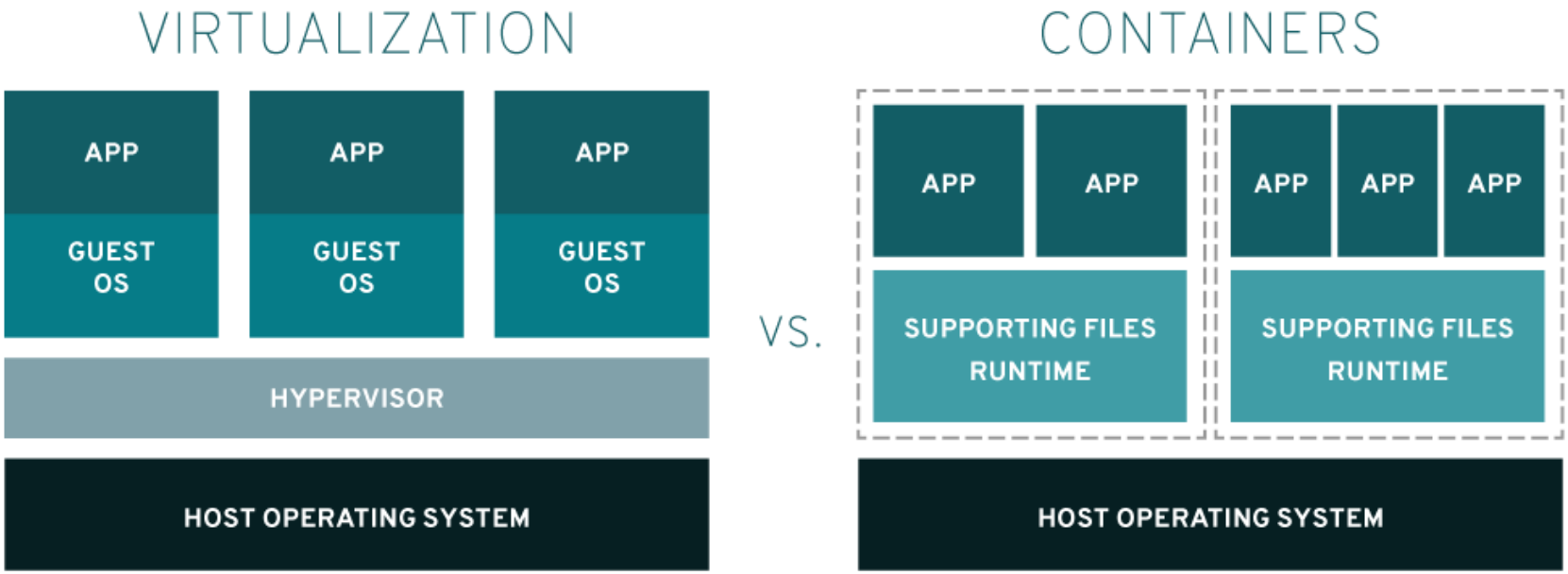


Figure 1: ref: link

Concepts: Containers

Abstracion created by the Linux Kernel:

- Namespaces
- Cgroups

which provides:

- Lightweight solution
- Isolation and control of resources

Concepts: LXC

- C library (liblxc)
- Programming language bindings
- Tools for controlling containers
- Linux Distribution templates

Concepts: LXD

- Build on top of LXC
- REST API
- New command line tool ”lxc”
- Integration with containers services and other advanced features

Concepts: LXD

Examples:

```
# Launch container
lxc launch ubuntu:20.04 box

# Launch a bash inside container
lxc exec box bash

# Add mapped proxy to the container
lxc config device add box testport80
↪  listen=tcp:0.0.0.0:80 connect=tcp:127.0.0.1:80

# Share host folder with container
lxc config device add box device www disk source=/www
↪  datapath=/var/www/html
```

Outline

Development

Objective to develop a framework:

- Improve existing ”lxc” command line tool - lxce
- Develop an admin tool - lxce-admin
- Develop a visual alternative to command line tool - web-admin

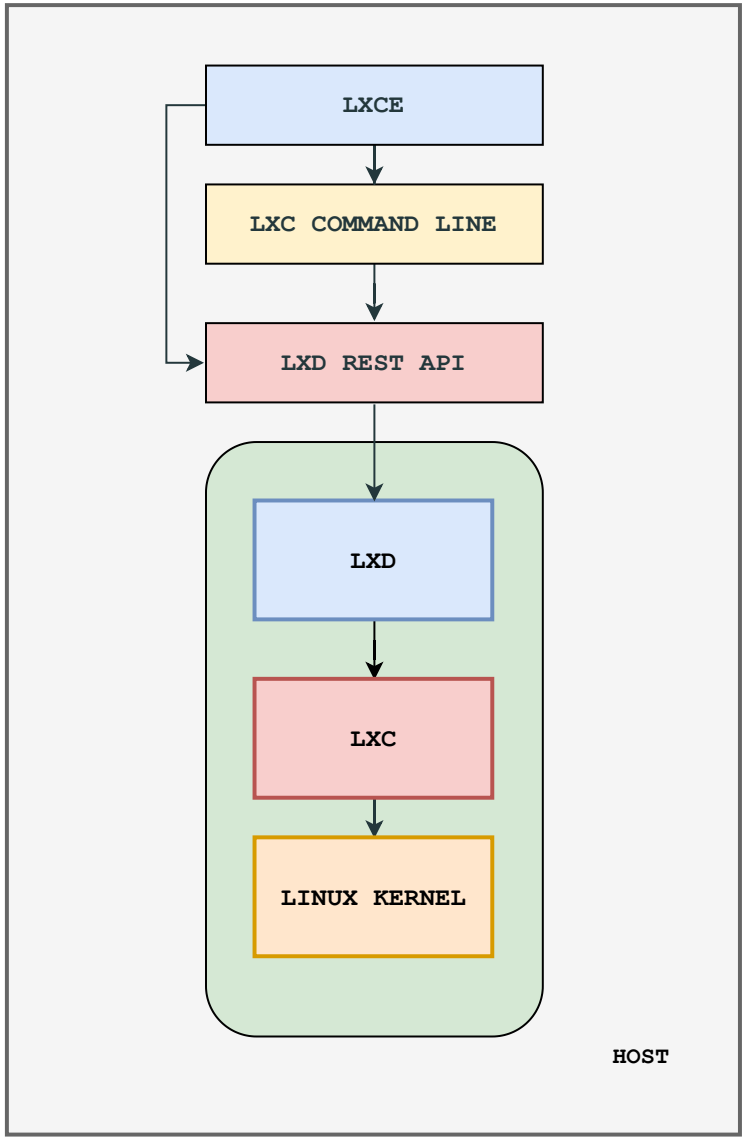
Development: lxce

lxce command line tool:

- Manage containers by configuration files.
- Organize containers by “domains”.
- Organize containers by aliases.
- Configure proxies and shared folders by a configuration file.
- Generate SSH and VNC configuration files to be distributed.

Development: lxce

Architecture:



Development: lxce

Commands:

- lxce init
- lxce alias
- lxce delete
- lxce launch
- lxce list
- lxce pass
- lxce proxy
- lxce rebase
- lxce show
- lxce start
- lxce stop
- lxce uninstall

Development: lxce

Configuration files:

```
/etc/lxce
|--- container.conf.d
|   |--- default
|   |   '--- voiceless-blue
|   '--- derecho
|       '--- relieved-beige
|--- container_default.conf
|--- lxce.conf
|--- remmina
|   |--- default
|   |   '--- oscar-vm.default.voiceless-blue.remmina
|   '--- derecho
|       '--- oscar-vm.derecho.relieved-beige.remmina
'--- ssh
    |--- default
    |   '--- voiceless-blue.conf
    '--- derecho
        '--- relieved-beige.conf
```

Development: lxce

Default configuration file:

```
{
  "name": "",
  "alias": "",
  "user": "",
  "id_domain": 0,
  "id_container": 0,

  "domain": "default",
  "base": "ubuntu:20.04",
  "userData": "/datasdd",

  "proxies": [
    {
      "name": "ssh",
      "type": "tcp",
      "listen": "0.0.0.0",
      "port": 22
    },
    {
      "name": "test",
      "type": "tcp",
      "listen": "0.0.0.0",
      "port": 3000
    }
  ],
}
```

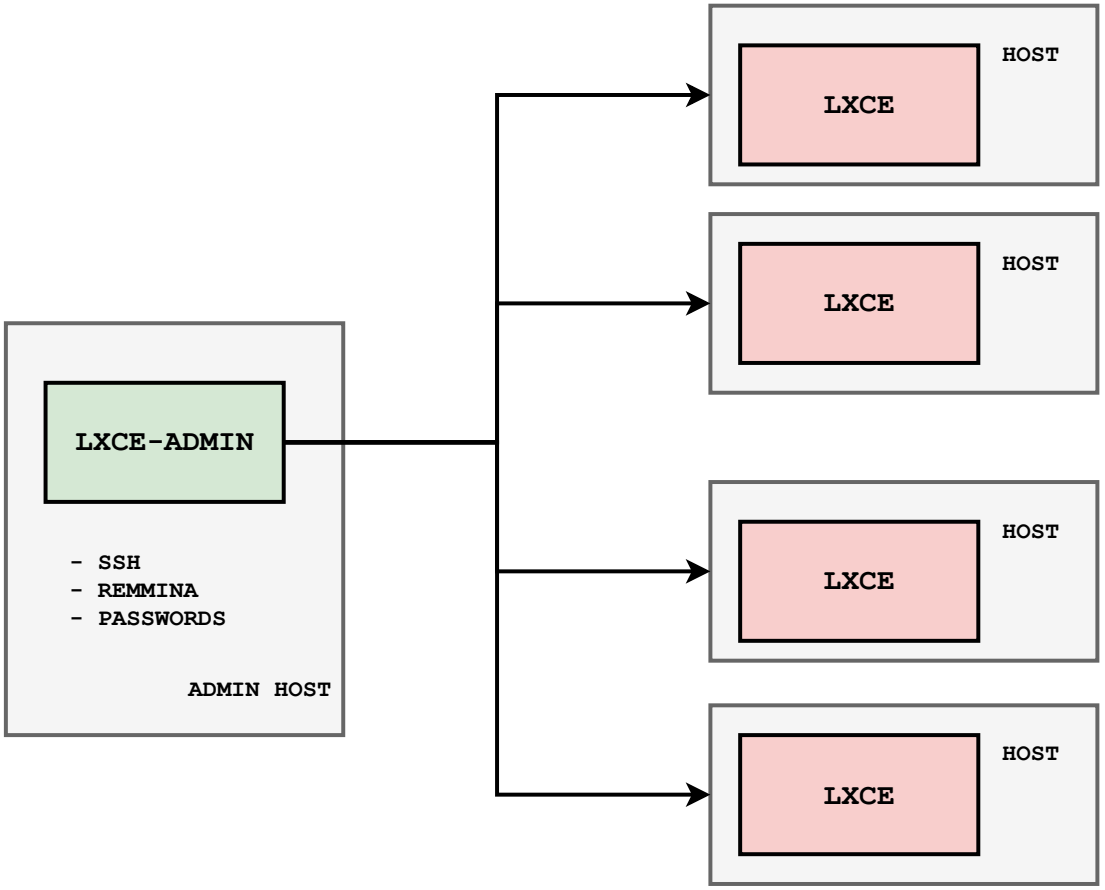
Development: lxce-admin

lxce-admin command line tool:

- Complete view of all container across different hosts
- Access to SSH and VNC configuration files
- VNC clients integrated
- Compute passwords for each container

Development: lxce-admin

Architecture:



Development: lxce-admin

Commands:

- lxce-admin config add
- lxce-admin config list
- lxce-admin config remove
- lxce-admin config update
- lxce-admin pass
- lxce-admin remmina
- lxce-admin vnc

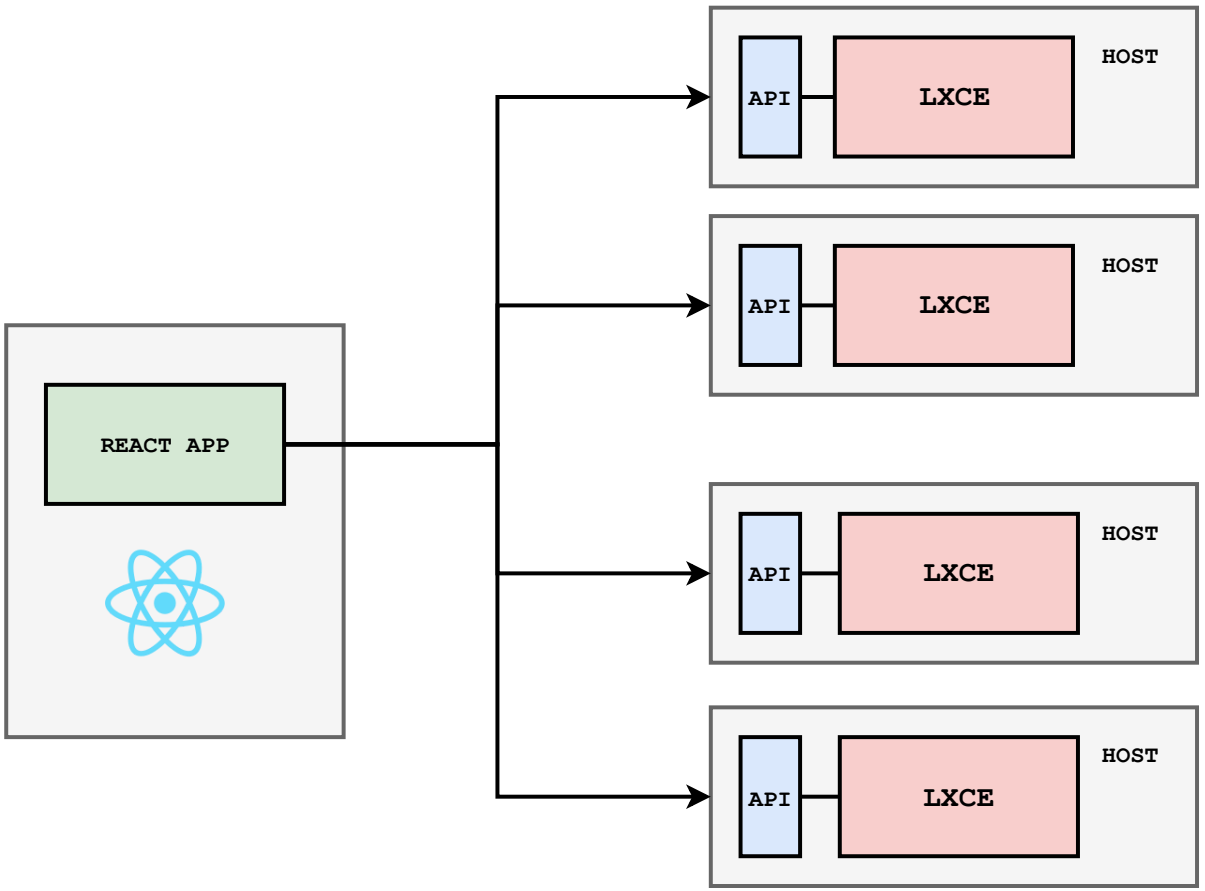
Development: web-admin

web admin React web application:

- Visualize all current containers from each host
- Served along an API for each host
- Possibility to be extended

Development: web-admin

Architecture:



Outline

Future work

Possible improvements:

- Add nginx and certificates functionality
- Extend API to provide more functionalities

Outline

Conclusion

Learnt:

- Javascript/Typescript
- Containers
- Web development
- Systems administration

Thanks!