

# Kathará

A container-based framework for experimenting computer networking

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<b>Web</b>	<a href="http://www.kathara.org/">http://www.kathara.org/</a>
<b>Description</b>	An introduction to the architecture, setup and usage of kathará – based on a similar presentation of Netkit

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# About computer networks

- computer networks are quite complex
  - several devices (computers, routers, etc.)
  - several interfaces
  - several protocols running
  - physical interconnections originate complex topologies

# How to perform experiments?

- performing experiments may be unfeasible
- the currently used network cannot be exploited for experiments
  - it hosts services that are critical for the company
  - it would be necessary to coordinate different departments of the company
- network equipment is expensive
  - sometimes, even for performing simple experiments, several equipment should be available in the same test bed

# Simulation vs. emulation

- emulation and simulation systems put at user's disposal a virtual environment that can be exploited for tests, experiments, measures
- **simulation systems** aim at reproducing the **performance** of a real-life system (latency time, packet loss, etc.)
  - e.g.: ns, real, ...
- **emulation systems** aim at accurately reproducing the **functionalities** of a real-life system (configurations, architectures, protocols), with limited attention to performance

# Kathará

a system for emulating  
computer networks

# Emulating a network

- basic idea:
  - several containers are created inside a single host machine
  - containers are connected to virtual collision domains and thus can communicate with each other
- each container can be configured as a device that plays the role of a regular host, of a router, of a switch, ....

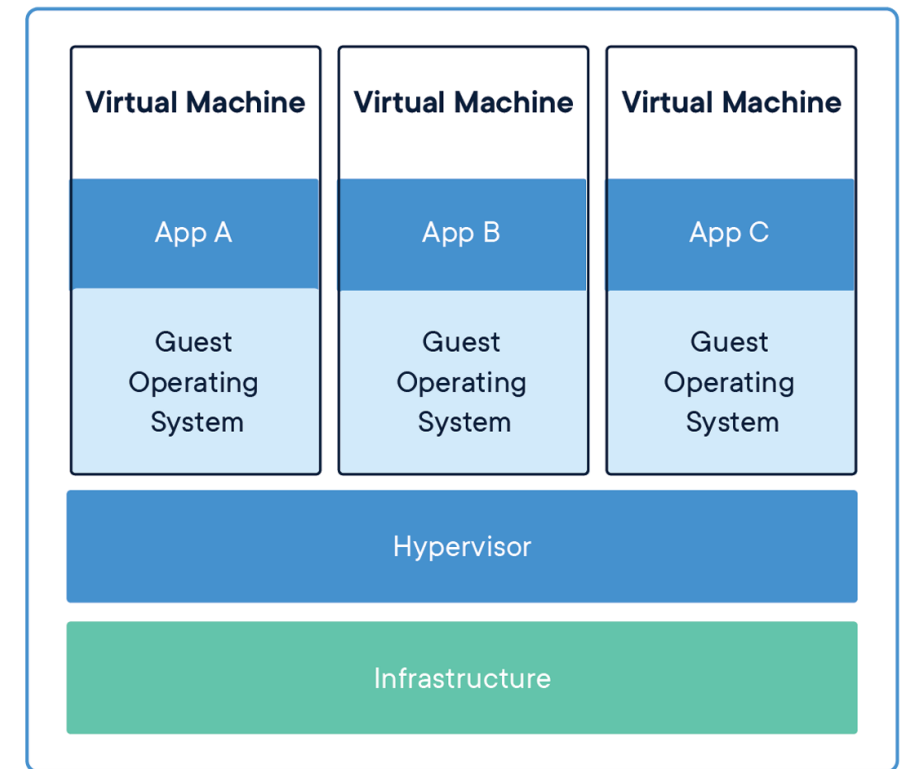
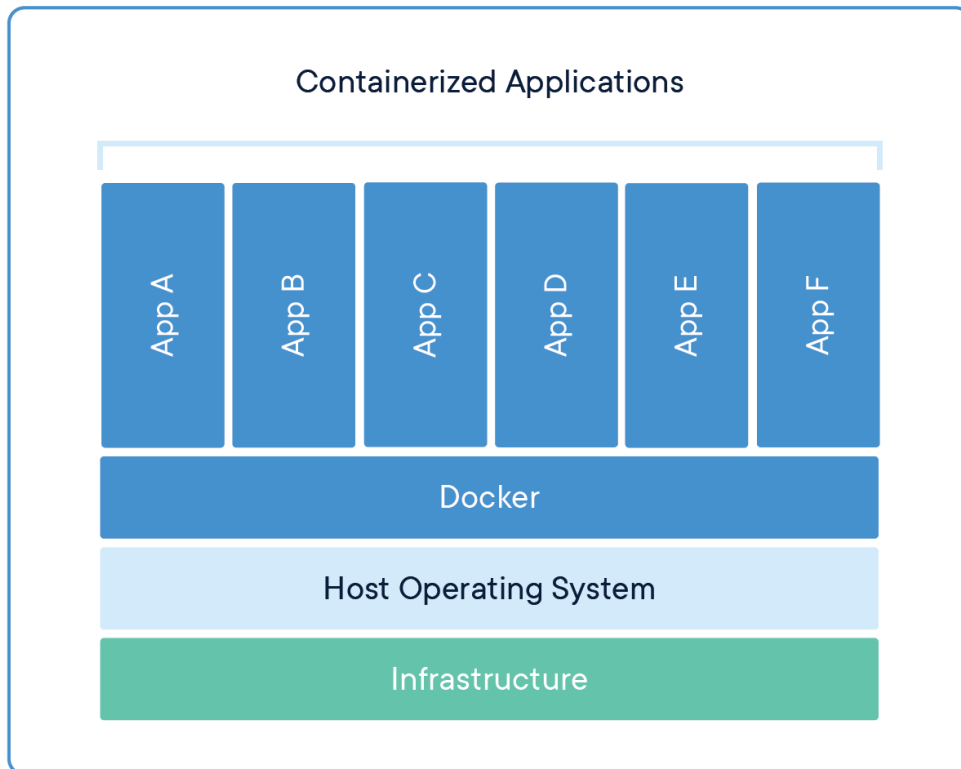
# Kathará

- based on Docker
- each emulated network device (in what follows *device*) is a container
- note: several container images available, e.g.:
  - Base (DNS, Web Server, network utilities)
  - Quagga (standard routing protocols)
  - FRRouting (standard routing protocols + EVPN + MPLS)
  - Open vSwitch (Open Flow enabled switch)
  - Behavioral Model (software implementation of a P4 switch)



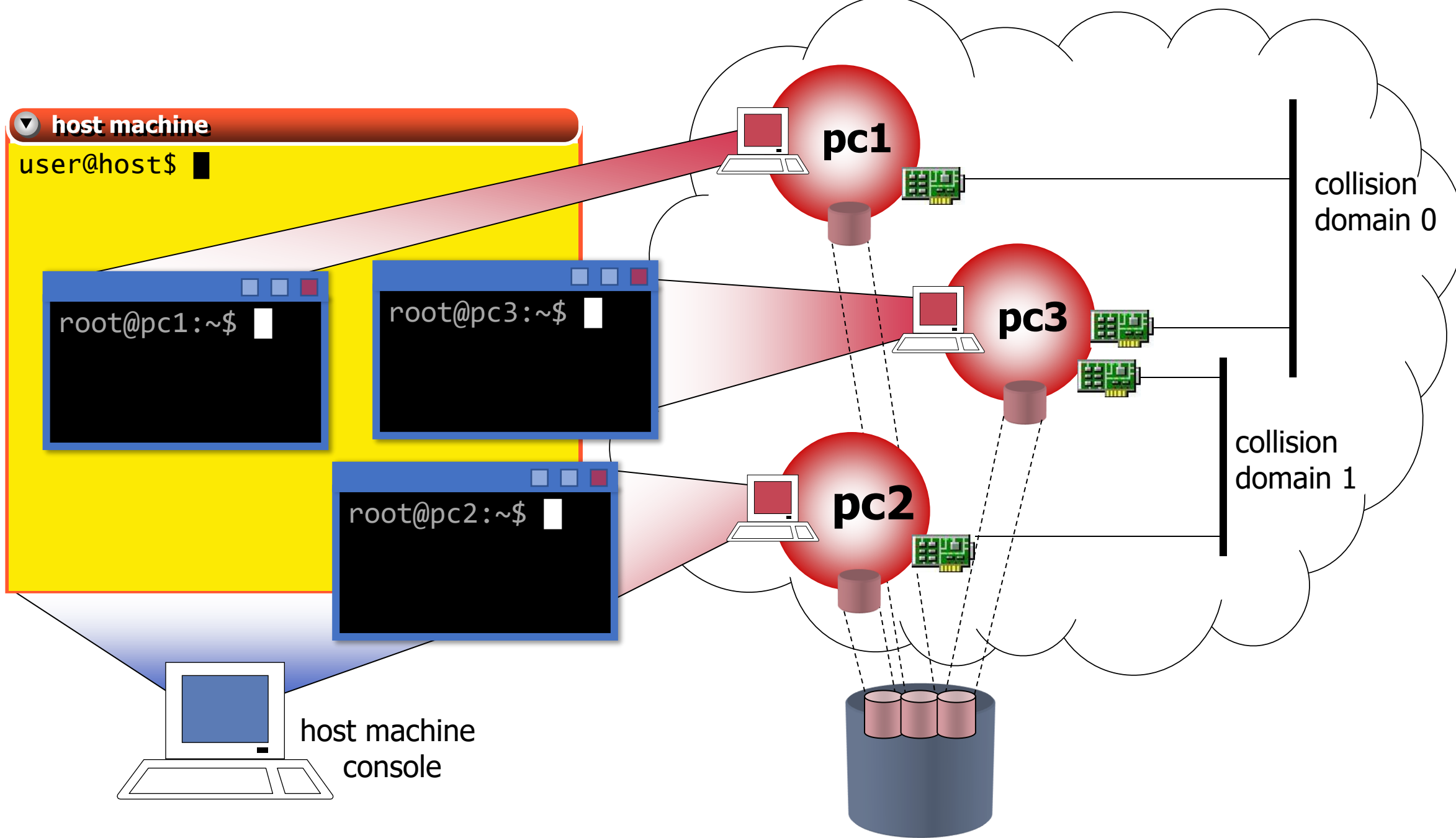
# Docker and containers

A container is a standard unit of software that packages up code and all its dependencies, so the application runs quickly and reliably from one computing environment to another.



# Emulated network devices

- each device has:
  - a console (a terminal window)
  - a memory
  - a filesystem
  - (zero, one or more) network interfaces
- each network interface can be connected to a (virtual) collision domain
- each virtual collision domain can be connected to several interfaces



# Setting up Kathará

## Setup manual

# Setting up Kathará

- available for:
  - Windows 10 Pro
  - Linux
  - MacOS
- download at <http://www.kathara.org/>
- follow the wiki

# Using Kathará

# Kathará commands

- kathará provides users with three sets of commands
  - v-prefixed commands (v-commands)
  - l-prefixed commands (l-commands)
  - global commands
- v-commands act as low-level tools for configuring and starting up a single device
- l-commands provide an easier-to-use environment to set up complex labs consisting of several devices
- global commands are mainly management commands

# Kathará v-commands

- allow to startup a single device with arbitrary configurations (network interfaces, etc.)
  - **vstart**: starts a new device
  - **vconfig**: attaches network interfaces to a running device
  - **vclean**: halts a device



# Kathará I-commands

- ease setting up complex labs consisting of several virtual machines
  - **Istart**: starts a Kathará lab
  - **Iclean**: halts all the devices of a lab
  - **Irestart**: halts all the devices of a lab and start them again
  - **linfo**: provides information about a lab

# Kathará global commands

- management commands
  - **check**: Check your system environment
  - **connect**: Connect to a running Kathará machine
  - **list**: Show all running Kathará machines of the current user
  - **settings**: Show and edit Kathará settings
  - **wipe**: Delete all Kathará machines and links, optionally also delete settings

# Share files between the host and the devices

- there are two ways to share files between the host filesystem and the device filesystem:
  - the `/shared` directory inside a device directly points to the `shared` directory inside the lab
    - by default it is **ENABLED**, you can disable it in the settings
    - read/write access is allowed
  - the `/hosthome` directory inside a device directly points to the **home directory** of the current user of the host
    - by default it is **DISABLED**, you can enable it in the settings
    - read/write access is allowed

# Testing Kathará

# Testing Kathará

- To test if your setup works correctly run:
  - `kathara check`
    - This command will run automatic tests to your environment
  - `kathara vstart -n pc1 --eth 0:A`
    - This command will start a new device called **pc1** and connected to the virtual collision domain **A**
    - A terminal window will open allowing to run commands inside the device
  - `kathara vclean -n pc1`
    - This command will stop the previous started device

# Preparing a Kathará lab

# Kathará lab

- a **Kathará lab** is a set of preconfigured devices that can be started and halted together
- a basic Kathará lab is a directory tree containing:
  - a **lab.conf** file describing the network topology
  - a set of **subdirectories** that contain the configuration settings for each device
  - **<device\_name>.startup** files that describe actions performed by devices when they are started

# lab.conf

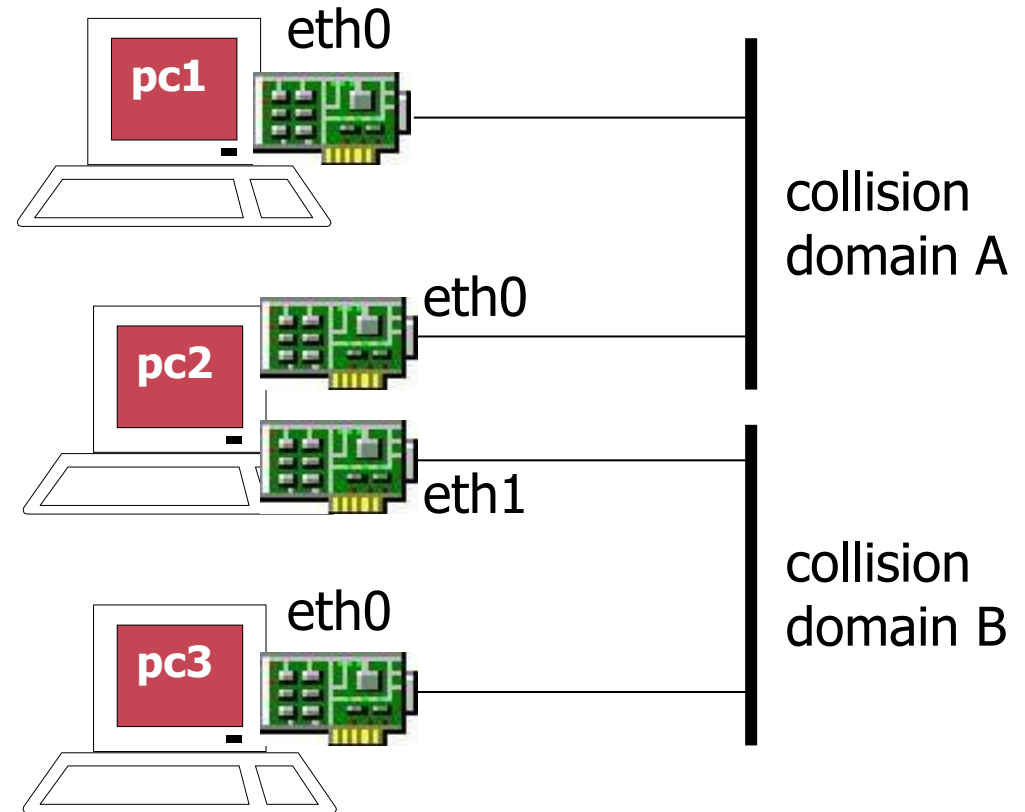
- describes:
  - the settings of the devices that make up the lab
  - the topology of the network that interconnects the lab's devices
- contain a list of **machine[arg]=value** lines where:
  - **machine** is the name of the device (e.g. pc1)
  - if **arg** is a number, then **value** is the name of a collision domain to which **etharg** should be attached
  - if **arg** is not a number, then it must be an option and **value** the argument



# lab.conf

## ■ example

```
pc1 [0]=A  
  
pc2 [0]=A  
pc2 [1]=B  
  
pc3 [0]=B
```



# lab subdirectories

- Kathará starts a device for every device specified in lab.conf file and every subdirectory of the lab folder
- the contents of subdirectory **device** are copied into the root (/) of the device named **device** filesystem
  - for example, **pc1/foo/file.txt** is copied to **/foo/file.txt** inside the device **pc1**

# startup files

- shell scripts that are executed inside a device right after its startup
- typical usage of a `.startup` file is to configure network interfaces and/or start network services
  - for example:

```
ifconfig eth0 10.0.0.1/24 up  
/etc/init.d/zebra start
```

# launching/halting a lab

- open a terminal
- enter the lab directory (`cd lab_directory`)
- launch a Kathará I-command
  - where I-command could be one of the following
    - `kathara lstart`, to start the lab
    - `kathara lclean`, to stop the lab
    - `kathara lrestart`, to restart the lab

# more information

- further information can be found:
  - on GitHub's Kathará wiki
  - on the official website <http://www.kathara.org>
  - inside Kathará man pages
    - you can start from `man kathara`
    - available only on Linux and MacOS