Introduction to virtualization

CONTAINERIZATION AND VIRTUALIZATION CONCEPTS

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Course goals

- Chapter 1
  - Define virtualization

  - Define containerization

  - Comparing containerization and virtualization

- Chapter 2
  - Explain containerization with Docker

  - Define container orchestration

  - Explain container orchestration with Kubernetes

Computers empowering our lives

- Personal computers in our daily lives

- Servers enabling business applications

[1] Images by istockphoto.com

Components of a computer system

- Hardware
  - Central Processing Unit (CPU)
  - Storage
  - Motherboard
  - Etc.

- Software
  - Operating system (OS)
  - Application software
  - Etc.

Limitations of physical machines

- Costly

- Maintenance and downtime

- Inflexible and hard to scale

Introducing virtual machines

- Abbreviation: VM

- A simulated computer system within another computer

- Each VM operates independently

= COMPUTER
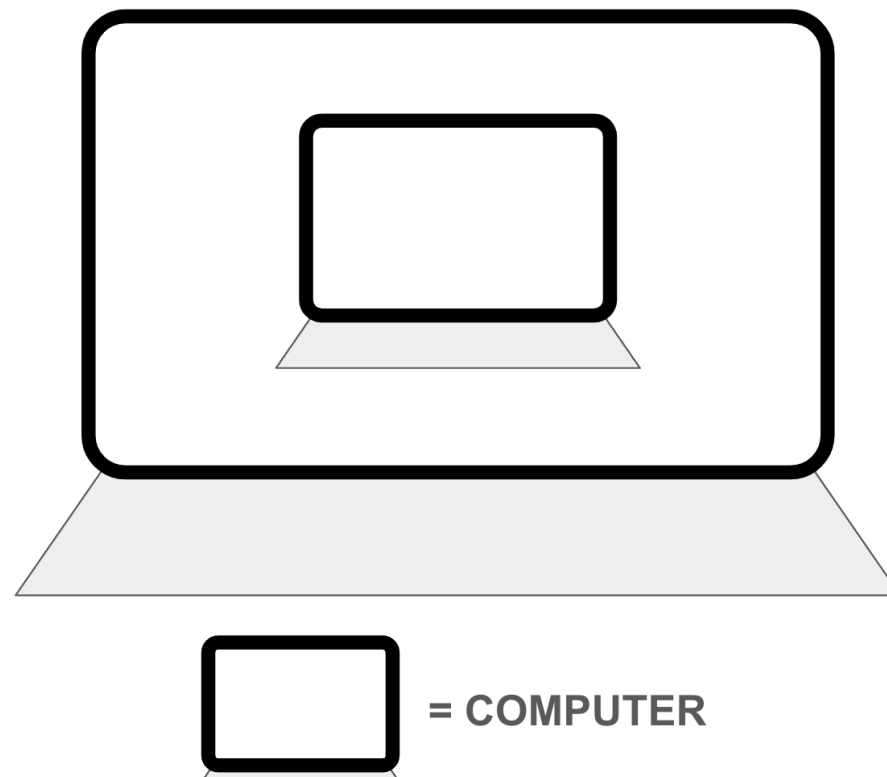
Benefits of virtual machines

- Resource optimization
  - Cost efficiency

  - Sustainability

- Scalability and flexibility

- Isolation and security

- Platform independence

Definition of virtualization

- Process of creating a virtual version of a computer resource

- Full virtualization:
  - Virtualizing the entire computer system

  - Results in VM

Let's practice!

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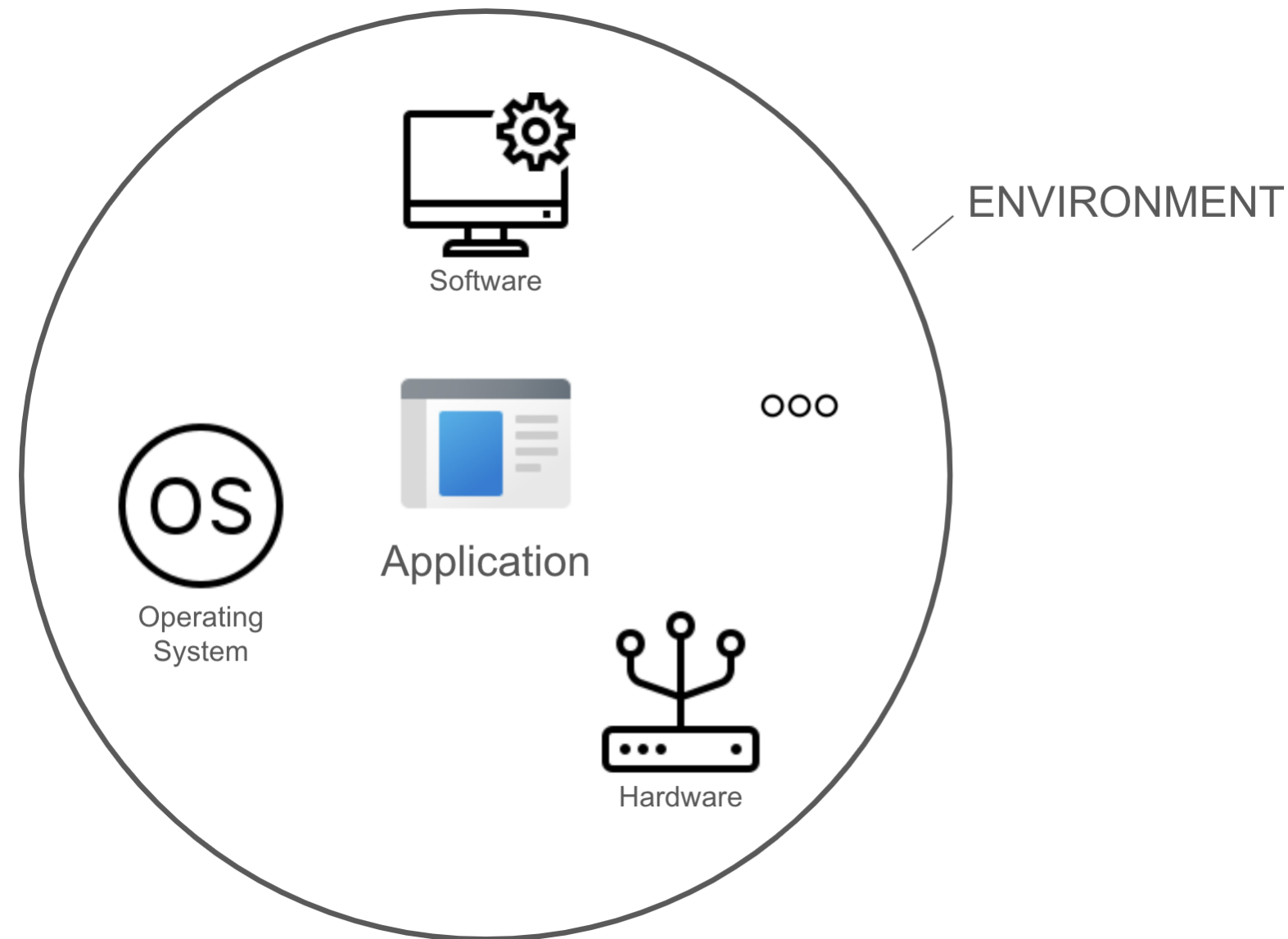
Introduction to containerization

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Environments in computing

- Environment: System surrounding an IT application

[1] Icons by icons8.com

OS-level virtualization

- Virtualizing the Operating System (OS)

- Not virtualized:
  - Hardware

  - OS kernel

- Virtualized:
  - Isolated user spaces

Introducing containers

- OS-level virtualization = containerization

- Isolated user spaces = containers

- Containers
  - Isolated environment

  - Includes application and all dependencies

Application Dependencies   Application   Application Settings
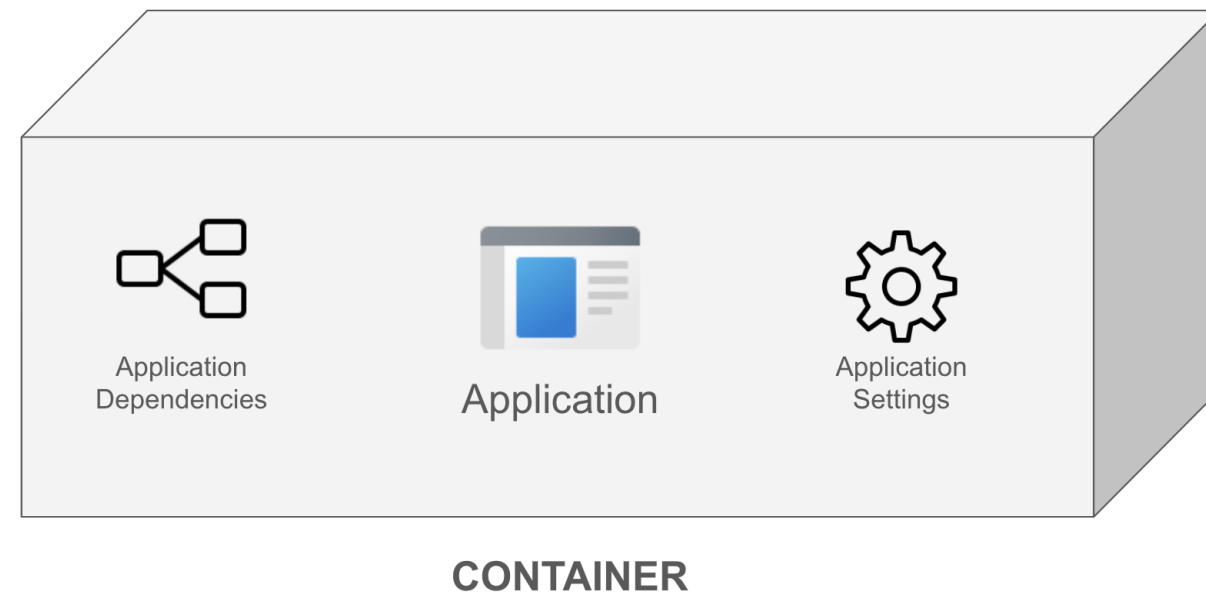
CONTAINER

Definition of containerization

- Virtualization at OS-level

- Packaging an application and its dependencies into a container
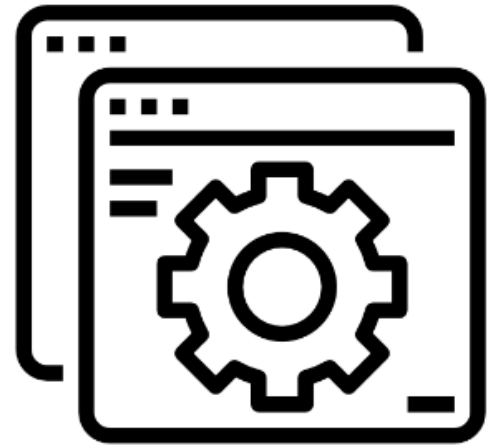
Application → Container
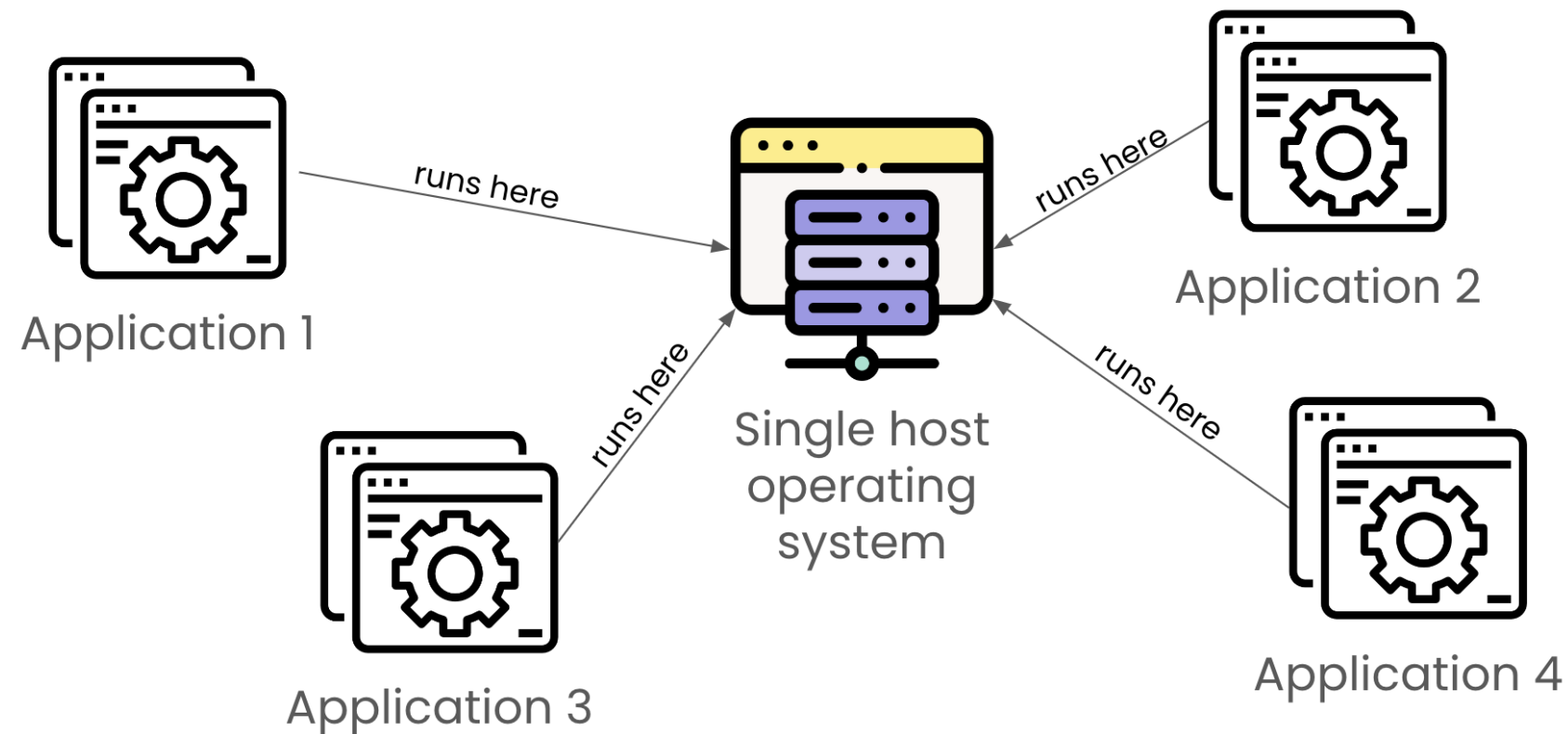
Characteristics when using containers

- Reliably running multiple applications on a single host

- Each application in its own container

- Overview of application dependencies

[1] Icons by icons8.com

Benefits of containers

- Isolation between applications

- Portability & reproducibility

- Fast startup times

Let's practice!

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Virtualization and containerization

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Recap: Virtualization vs. containerization

Virtualization

- Creates a virtual version of a computing resource

- Full virtualization

- VM: Simulated computer system inside another computer

Containerization

- Packages application and dependencies into isolated environment

- OS-level virtualization

- Container: Isolated application environment

Software tools for containerization

- Container management: **Docker**

- Container orchestration: **Kubernetes**

[1] Logos by Docker & Kubernetes

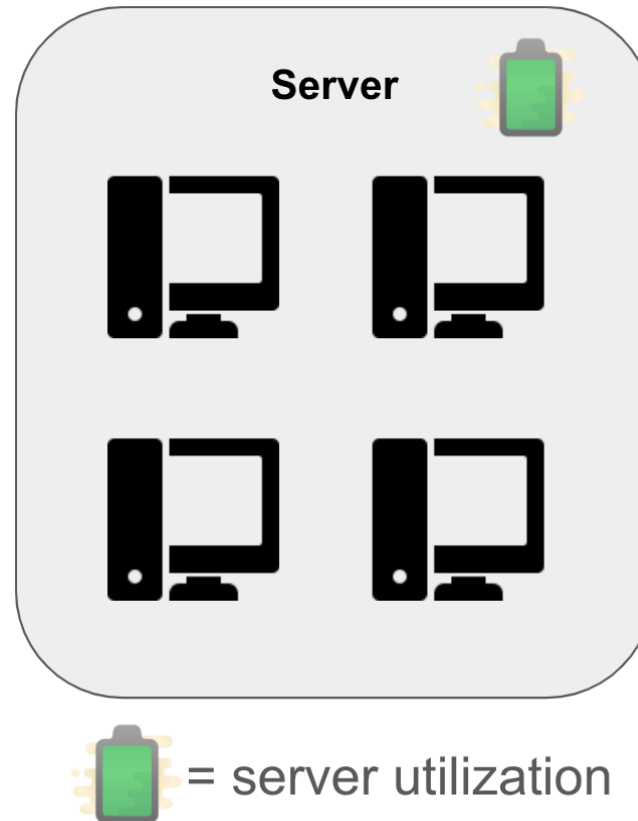# Software tools for virtualization

- Oracle VM VirtualBox

- VMware

Use cases of virtualization

Use cases of virtualization

- Server consolidation

Use cases of virtualization

- Server consolidation

- Legacy applications

Use cases of containerization

Use cases of containerization

- Microservice architecture

Use cases of containerization

- Microservice architecture

- Container orchestration

[1] Image by istockphoto.com

Benefits of containers vs. virtual machines

Factor	Container	Virtual machine	Physical machine
Isolation	**	***	*
Security	**	***	*
Space	***	**	*
Scalability	***	**	*
Costs	***	**	*
Flexibility	**	***	*

Let's practice!

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