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Introduction to Cloud Computing

Cloud Computing and Big Data

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EXPORTING MASTER PROGRAM IN
ENTERPRISE SYSTEMS ENGINEERING
TO JORDAN, SYRIA, TUNISIA AND EGYPT

Overview

- What is cloud computing?

- Cloud Computing Attributes

- Network-centric Computing and Content

- Deployment models: Public, Community, Private and Hybrid.

- Delivery models: Infrastructure, platform and software.

What is Cloud Computing ?

- Cloud Computing is a way to offer Utility Computing through a specific delivery and deployment models.

- Utility Computing is a concentration of hardware and software in large data centers where users pay as they consume computing, storage and communication resources.

Cloud Computing Attributes

- Use of the Internet to offer elastic services.

- Resources are metered and charged per use.

- Maintenance and security ensured by service providers.

- Economy of scale allows efficient operation.

- Cost-effective due to resource multiplexing.

Network-centric Computing and Content

- The web was invented for disseminating data, and afterwards for services around content.

- Grid Computing in the 90s was used primarily for science and engineering specific computing problems. (servers clustering)

- Computer clouds are a consequence of the previous, promoted by companies using a common policy for security, resource management and cost.

Deployment Models

- Public Cloud

- Community Cloud

- Private Cloud

- Hybrid Cloud

Deployment Models

- *Public cloud.* The infrastructure is made available to the general public or a large industry group and is owned by an organization selling cloud services.

- *Community cloud.* The infrastructure is shared by several organizations and supports a specific community that has shared concerns (e.g., mission, security requirements, policy, and compliance considerations).

Deployment Models

- *Private cloud.* The infrastructure is operated solely for an organization, possibly managed by a third party, on or off the premises.

- *Hybrid cloud.* The infrastructure is a composition of two or more clouds (private, community, or public) that remain unique entities but are bound together by standardized or proprietary technology that enables data and application portability.

Parallel vs. Distributed computing*

- Parallel computing generally means:
    - Vector processing of data
    - Multiple CPUs in a single computer
- Distributed computing generally means:
    - Multiple CPUs across many computers

*Adopted from: http://www.umiacs.umd.edu/~jimmylin/cloud-2008-Spring/schedule.html

Parallel vs. Distributed computing*
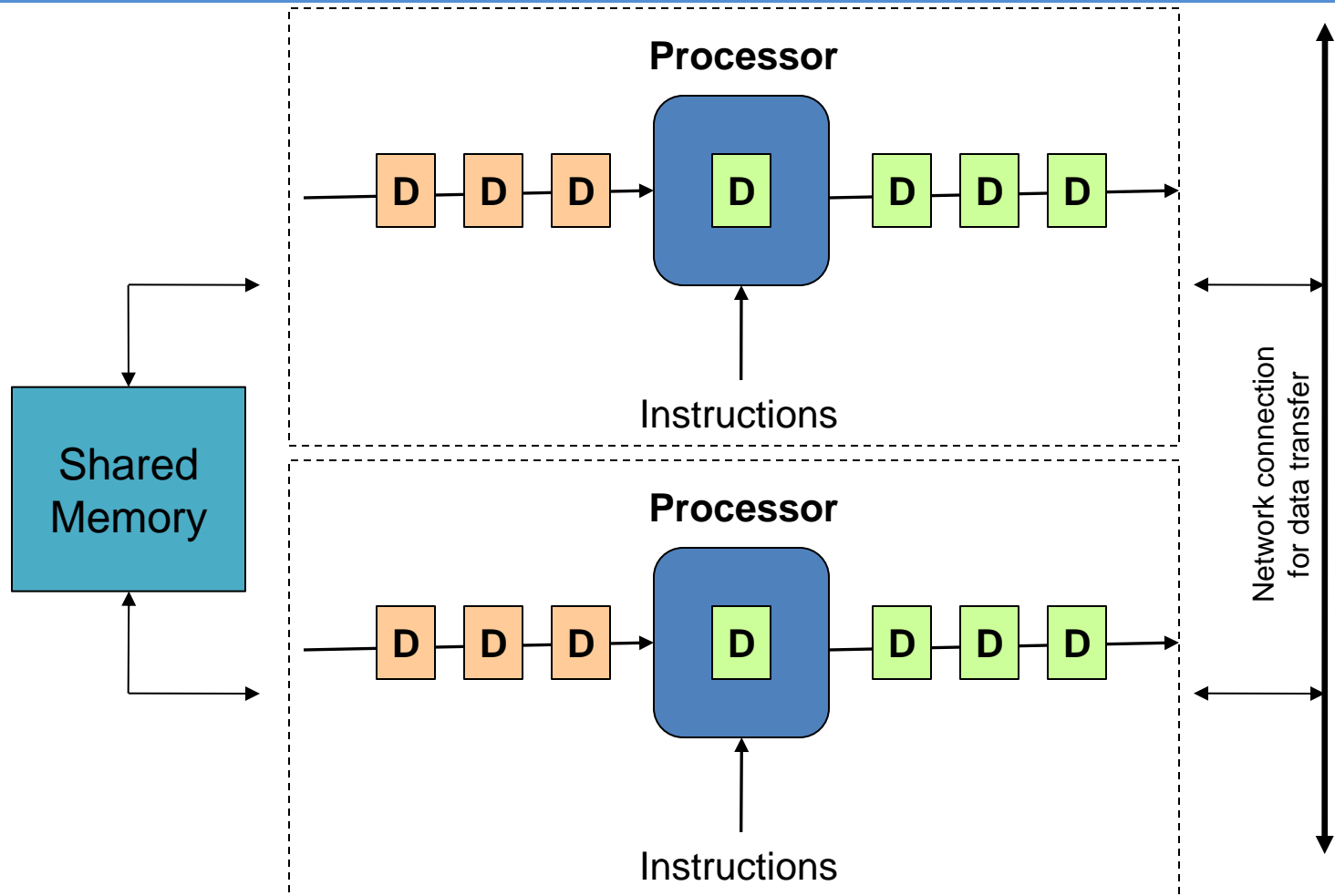
Parallel: Multiple CPUs within a shared memory machine
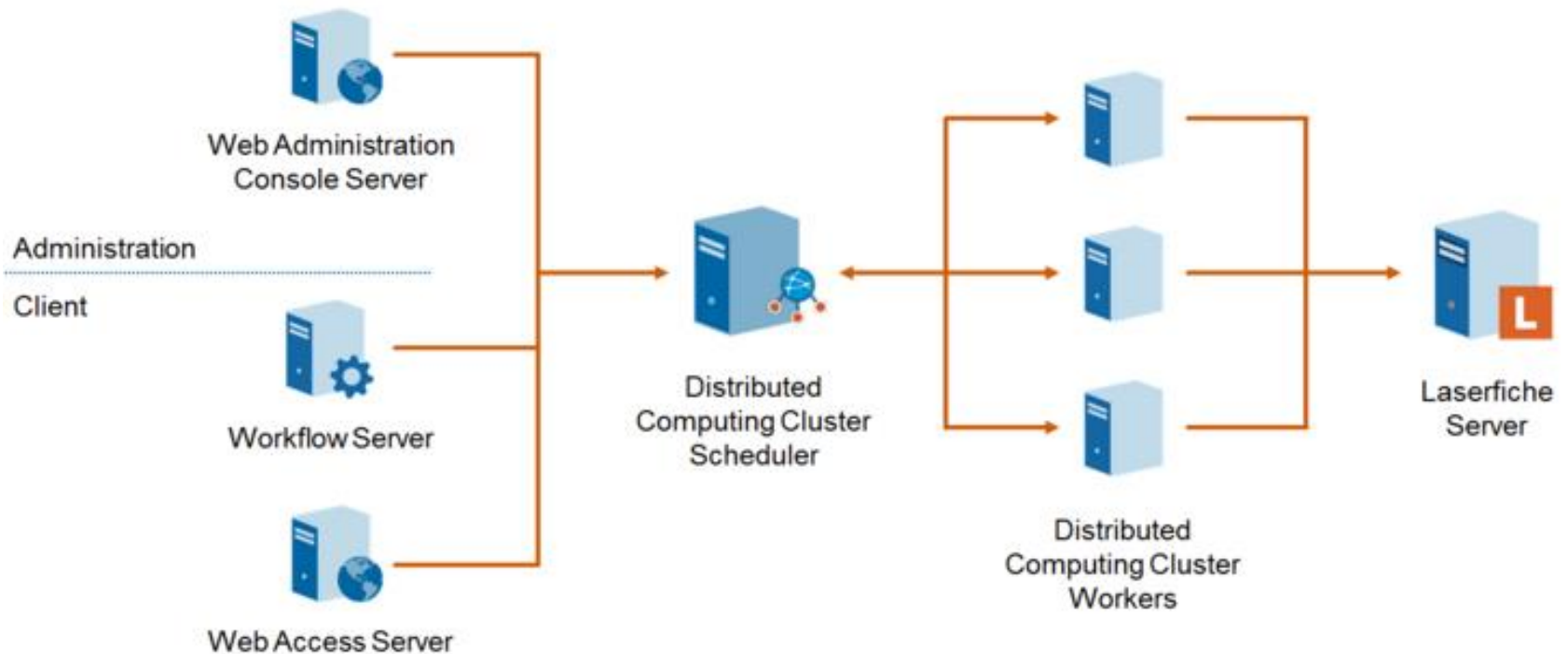
Distributed: Multiple machines with own memory connected over a network

Delivery Models

- Software-as-a-Service (SaaS)

- Platform-as-a-Service (PaaS)

- Infrastructure-as-a-Service (IaaS)

Delivery Model *Software-as-a-Service*

- Client uses the applications provided by the service.

- The applications are accessible from various client devices through a thin-client interface such as a Web browser.
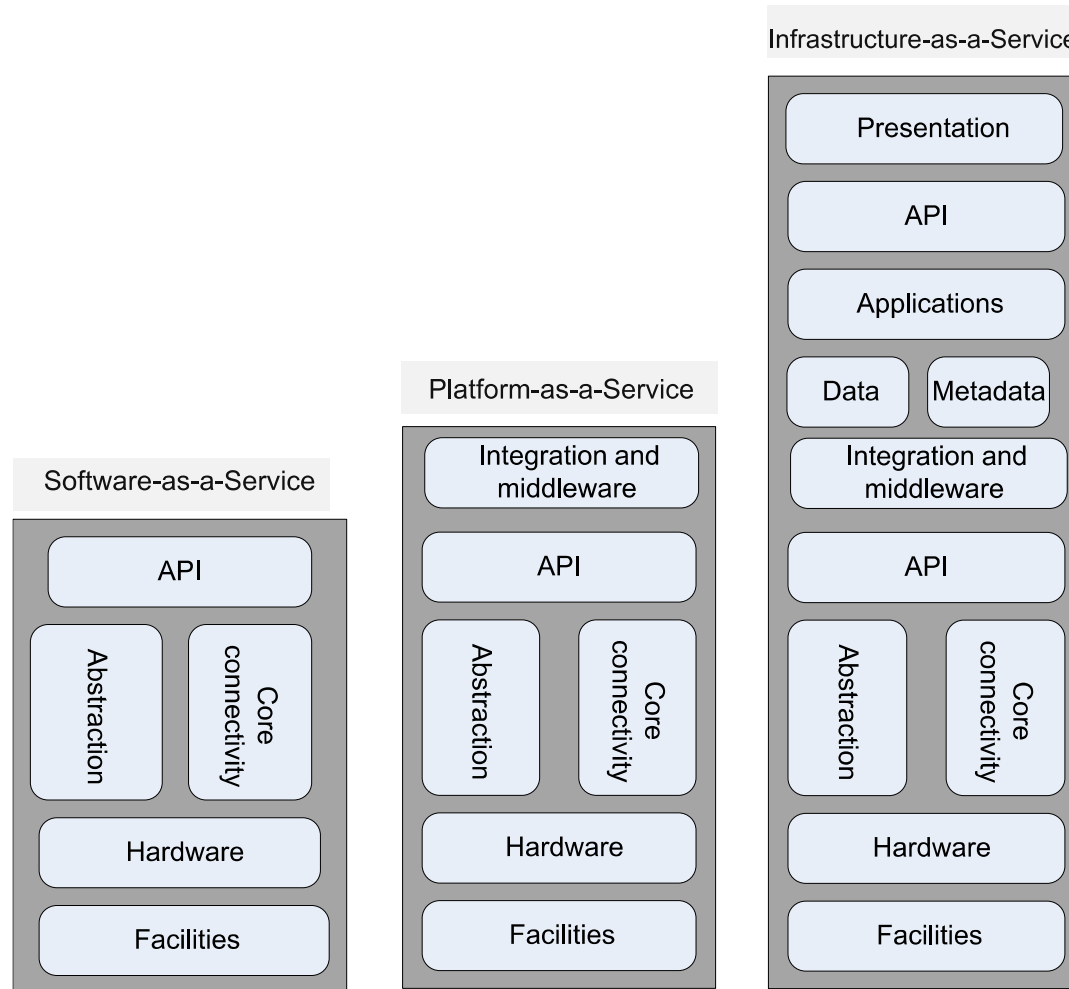
- Example use case: webmail service.

Delivery Model: *Platform-as-a-Service*

- Client can deploy custom applications using programming language supported by the service provider.

- The client does not control the underlying infrastructure, but only the applications and their hosting environment configurations.

- This model is not suitable for portable applications, proprietary programming languages, or specific HW/SW needs.

Delivery Model: *Infrastructure-as-a-Service*

- The client sets the entire software layer, ranging from the operating system and applications.

- The provider controls the basic infrastructure and resources are scaled dynamically.

- Clients pay per resource usage, supporting peak demands without requiring full infrastructure investment.

Delivery Models

Infrastructure-as-a-Service

- Presentation
- API
- Applications
- Data | Metadata
- Integration and middleware
- API
- Abstraction | Core connectivity
- Hardware
- Facilities

Platform-as-a-Service

- Integration and middleware
- API
- Abstraction | Core connectivity
- Hardware
- Facilities

Software-as-a-Service

- API
- Abstraction | Core connectivity
- Hardware
- Facilities

From: *Cloud Computing: Theory and Practice*, Dan Marinescu

Some Challenges

- Security:
  - protect private information in services
  - protect storage data from intruders
  - use of cloud resources to initiate an attack
- Denial-of-Service
  - unpredicted power failures stopping data centers
  - communication failures isolating data centers from clients