

CS 4037
Introduction to Cloud
Computing
Lecture 12

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Advanced Cloud Architectures

Lecture's Agenda

- **Hypervisor Clustering Architecture**
- Load Balanced Virtual Server Instances Architecture
- Zero Downtime Architecture
- Dynamic Failure Detection and Recovery Architecture



Hypervisor Clustering Architecture

- The hypervisor clustering architecture establishes a **high-availability cluster** of hypervisors across multiple physical servers.
- If a given hypervisor or its underlying physical server becomes unavailable, the hosted virtual servers can be **moved** to another physical server or hypervisor to maintain runtime operations.

Hypervisor Clustering Architecture (Cont.)

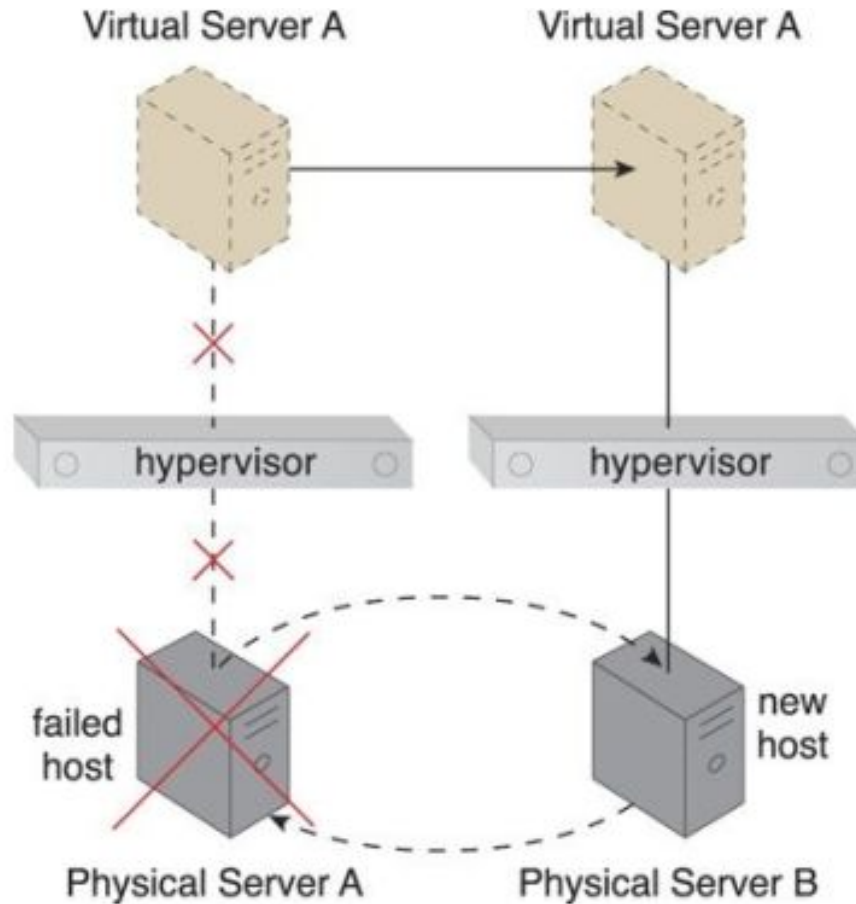


Figure 12.2. Physical Server A becomes unavailable and causes its hypervisor to fail. Virtual Server A is migrated to Physical Server B, which has another hypervisor that is part of the cluster to which Physical Server A belongs.

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Load Balanced Virtual Server Instances Architecture

- The load balanced virtual server instances architecture establishes a **capacity watchdog system** that dynamically calculates virtual server instances and associated workloads, before distributing the processing across available physical server hosts.

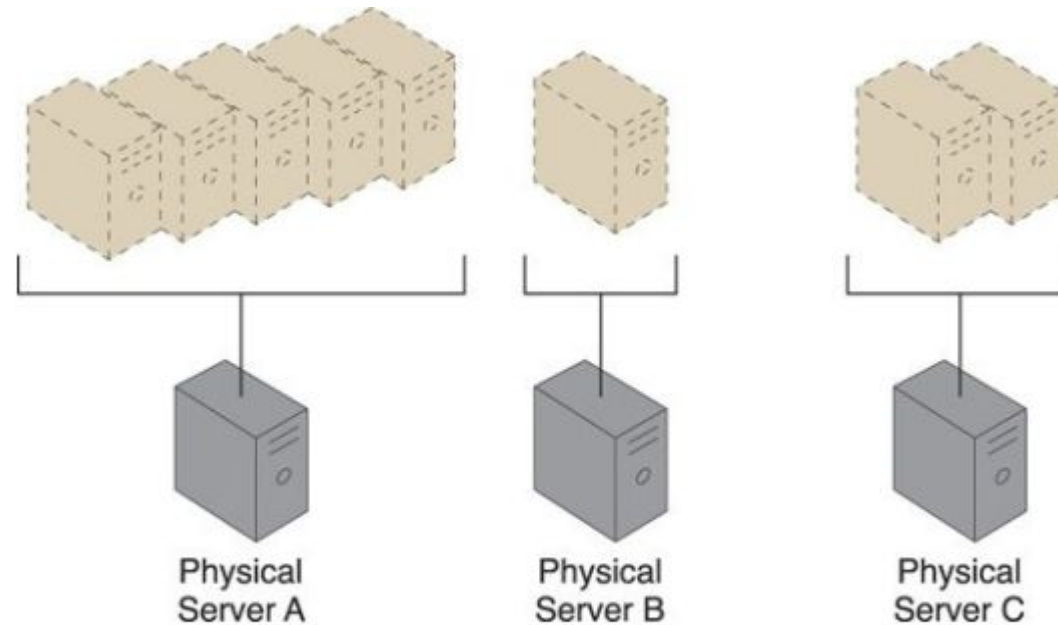


Figure 12.7. Three physical servers have to host different quantities of virtual server instances, leading to both over-utilized and under-utilized servers.

Load Balanced Virtual Server Instances Architecture (Cont.)

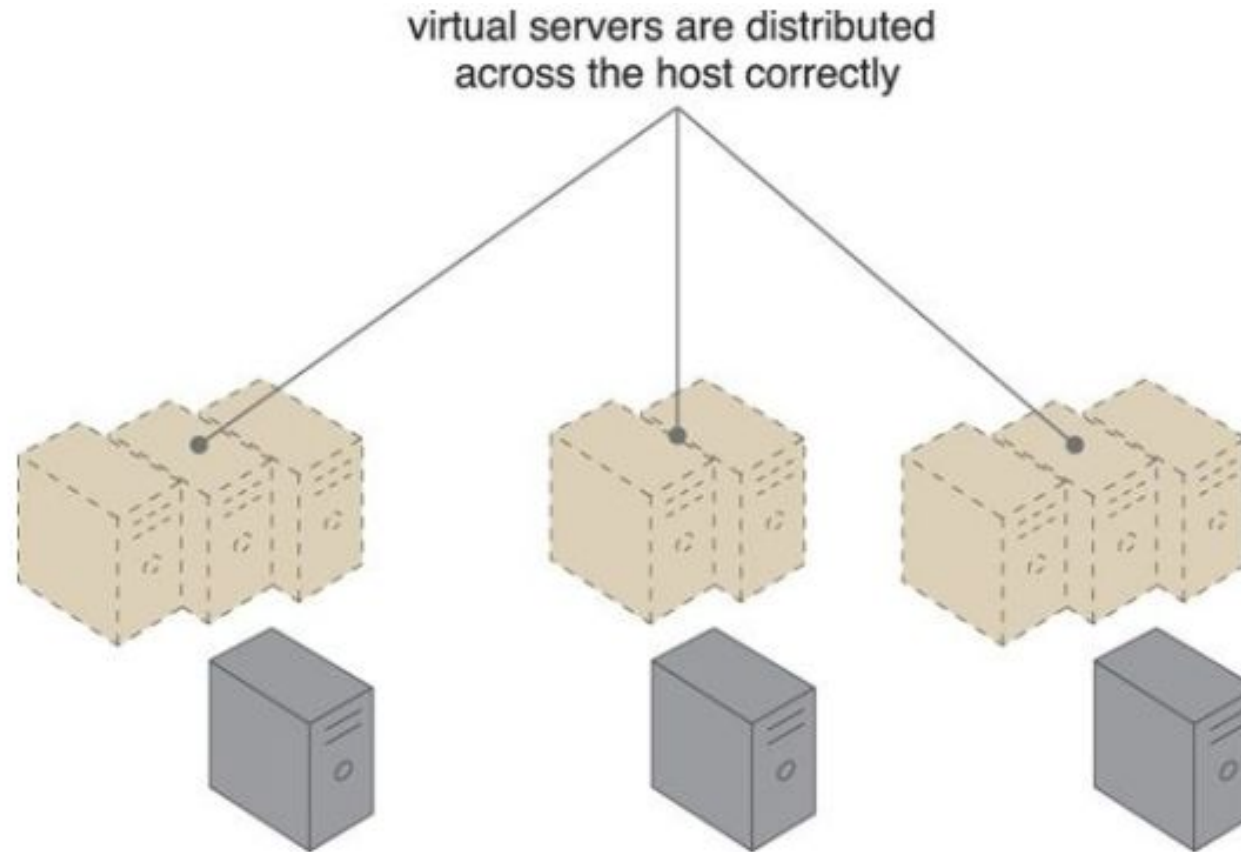


Figure 12.8. The virtual server instances are more evenly distributed across the physical server hosts.

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Zero Downtime Architecture

- The zero downtime architecture establishes a **sophisticated failover system** that allows virtual servers to be dynamically moved to different physical server hosts, in the event that their original physical server host fails.

Zero Downtime Architecture (Cont.)

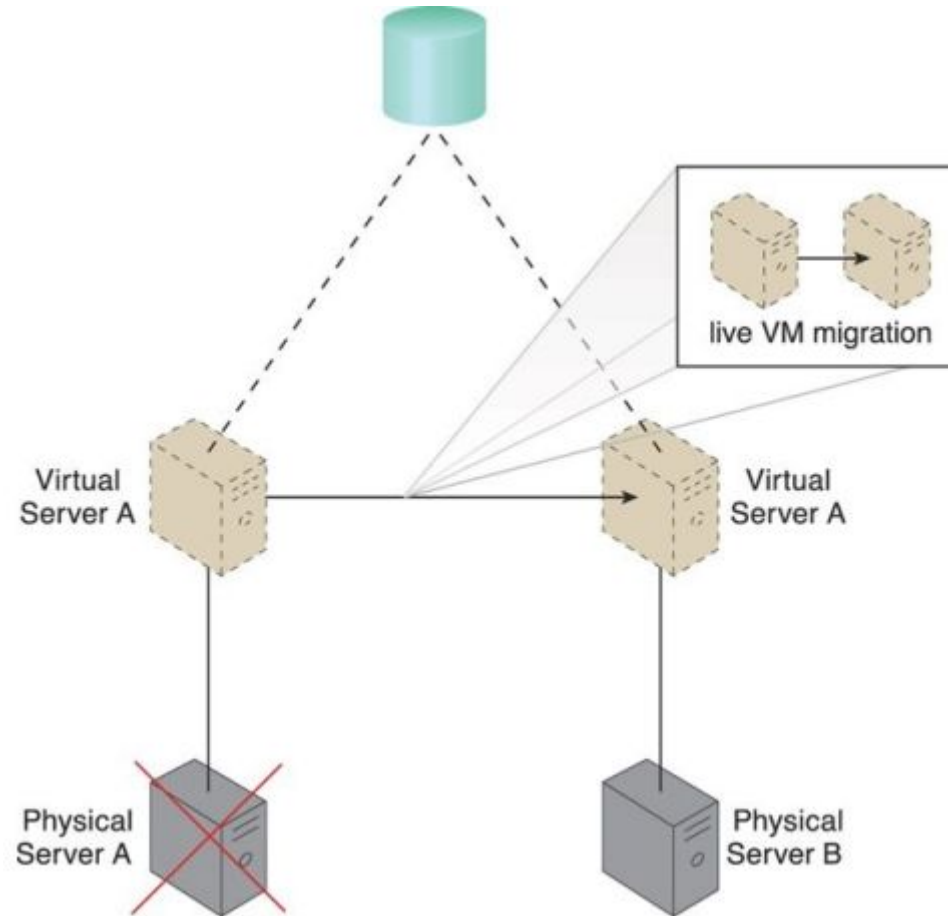


Figure 12.15. Physical Server A fails triggering the live VM migration program to dynamically move Virtual Server A to Physical Server B.

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Dynamic Failure Detection and Recovery Architecture

- The dynamic failure detection and recovery architecture establishes a **resilient watchdog system** to monitor and respond to a wide range of pre-defined failure scenarios.
- This system notifies and **escalates** the failure conditions that it cannot automatically resolve itself.
- It relies on a specialized cloud usage monitor called the intelligent watchdog monitor to actively **track IT resources and take pre-defined actions** in response to predefined events.

Dynamic Failure Detection and Recovery Architecture (Cont.)

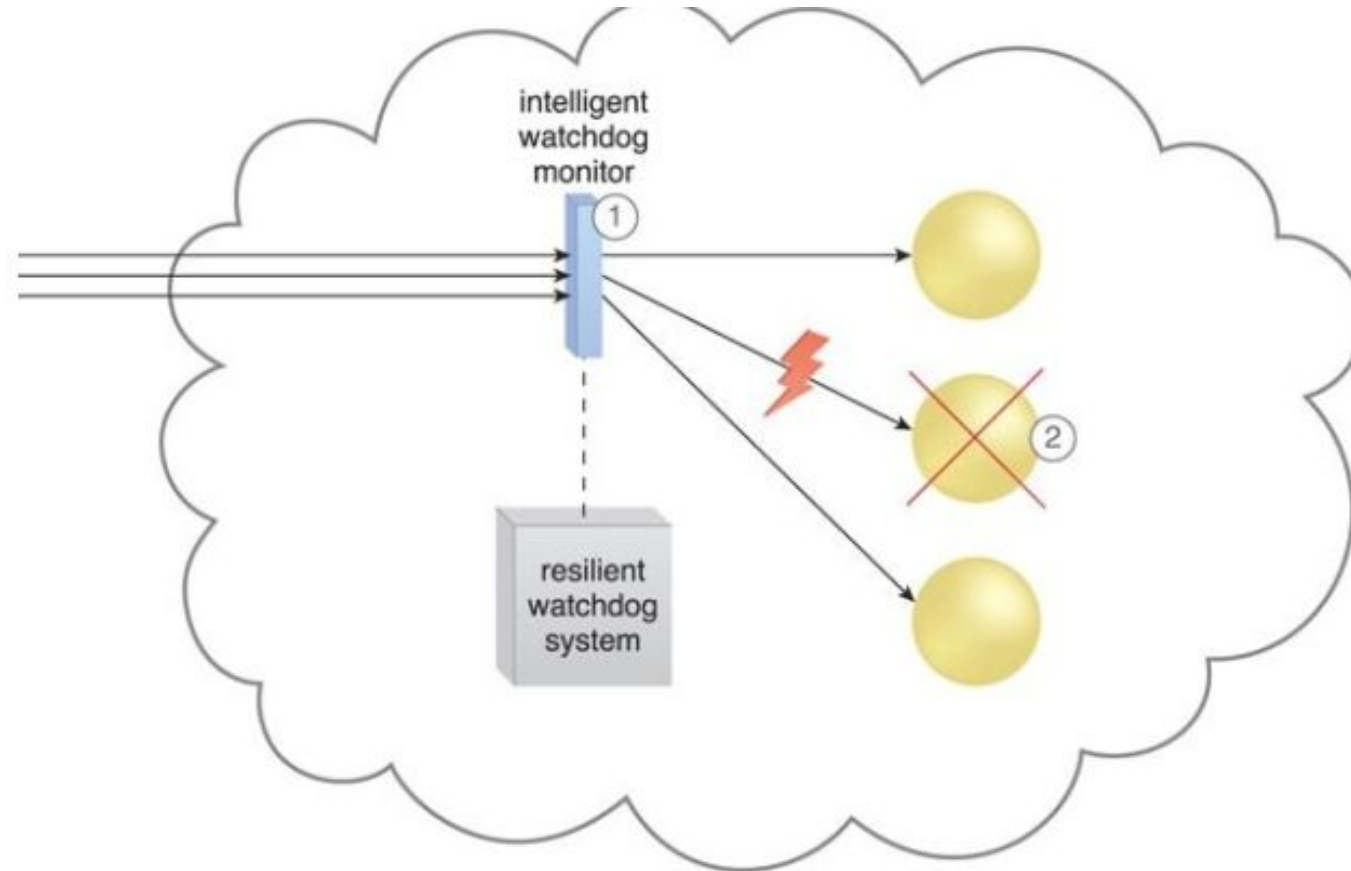


Figure 12.20. The intelligent watchdog monitor keeps track of cloud consumer requests (1) and detects that a cloud service has failed (2).

Dynamic Failure Detection and Recovery Architecture (Cont.)

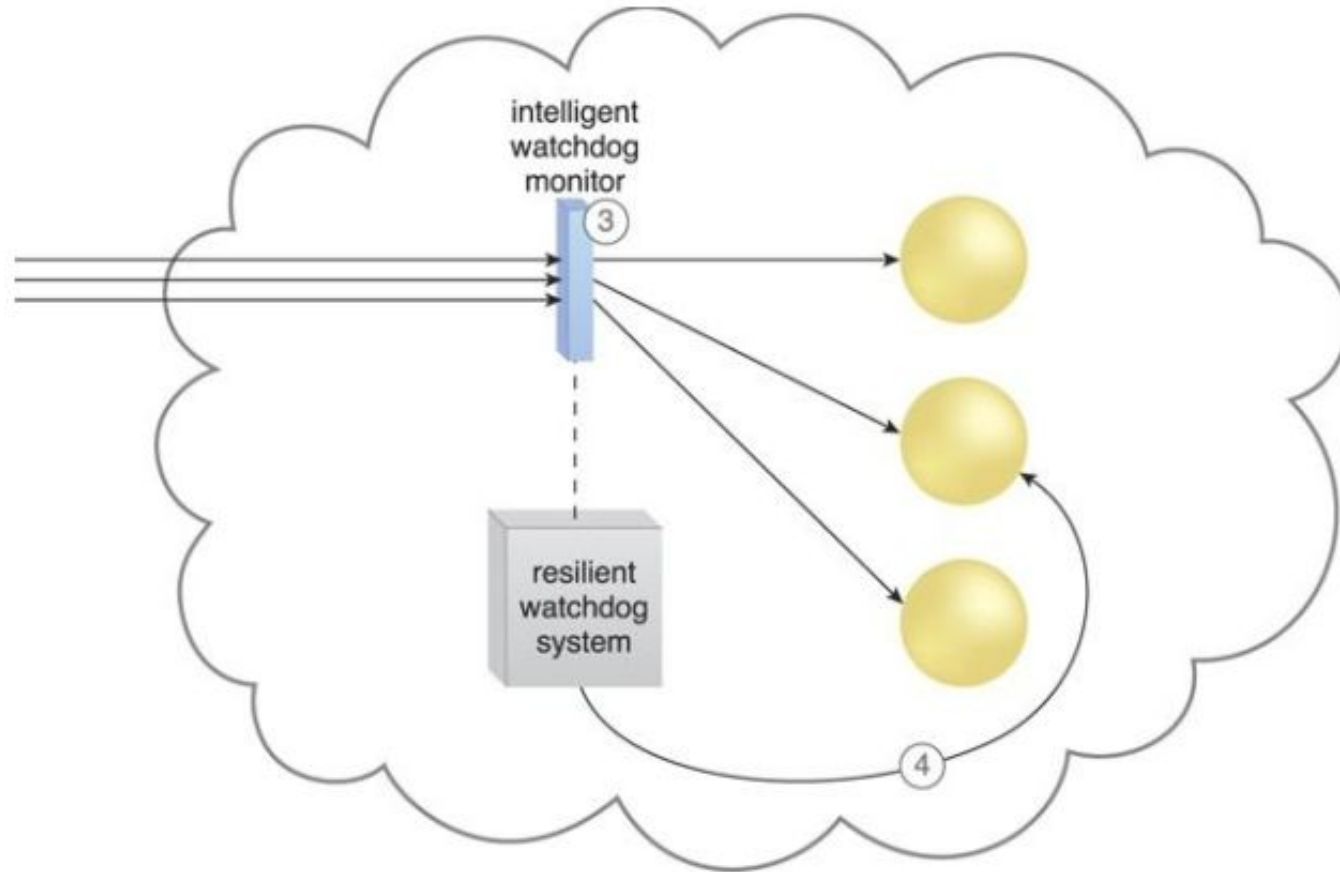


Figure 12.21. The intelligent watchdog monitor notifies the watchdog system (3), which restores the cloud service based on pre-defined policies. The cloud service resumes its runtime operation (4).

Additional Resources

- **Cloud Computing – Concepts, Technology, and Architecture** by Thomas Erl, Zaigham Mahmood, and Ricardo Puttini

□ Chapter 12: Advanced Cloud Architectures

Questions?