Cloud Computing Architectures

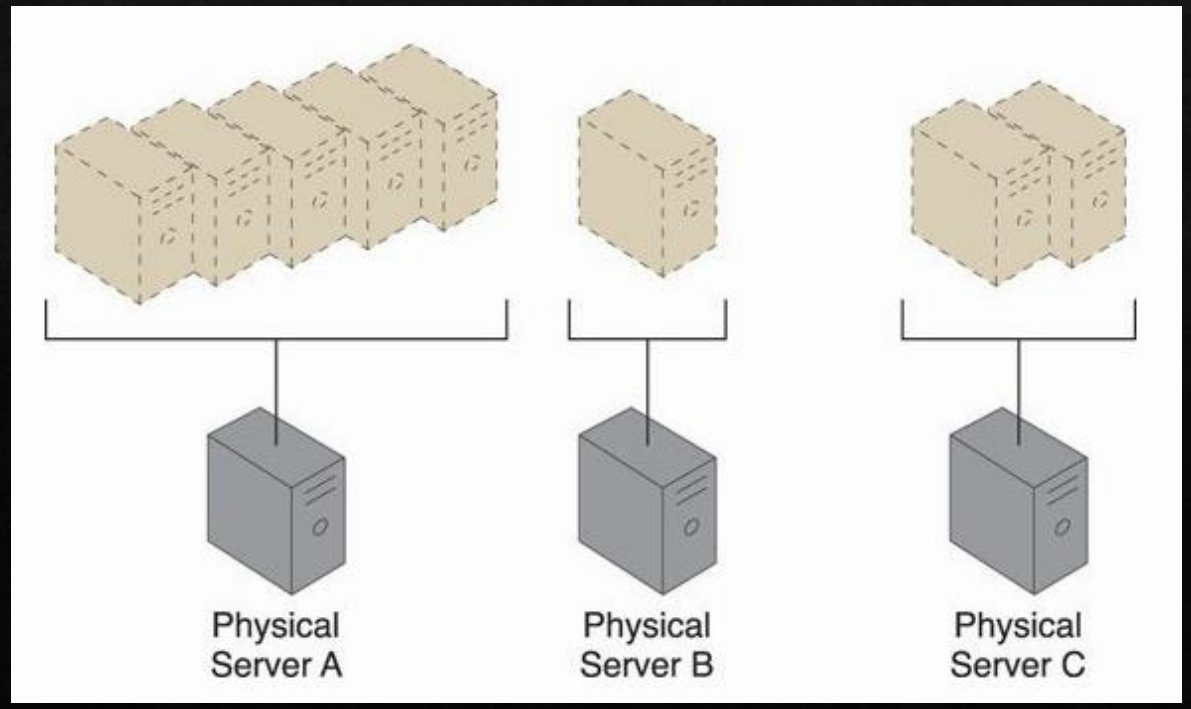
Advanced Cloud Architectures

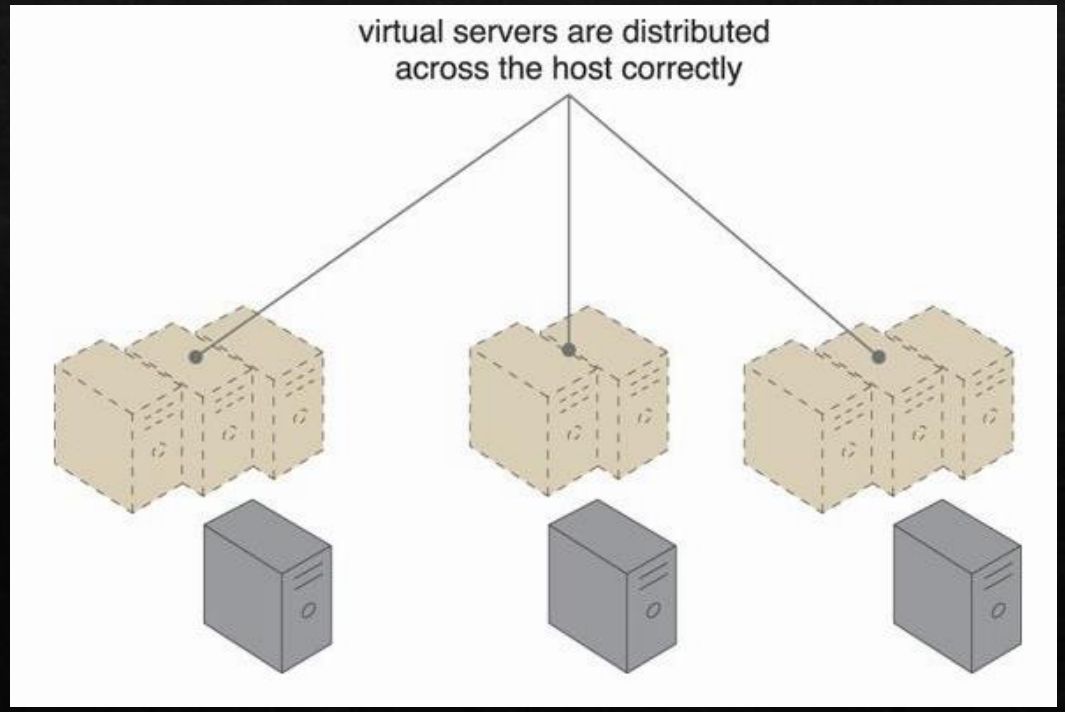
Advanced Cloud Architectures

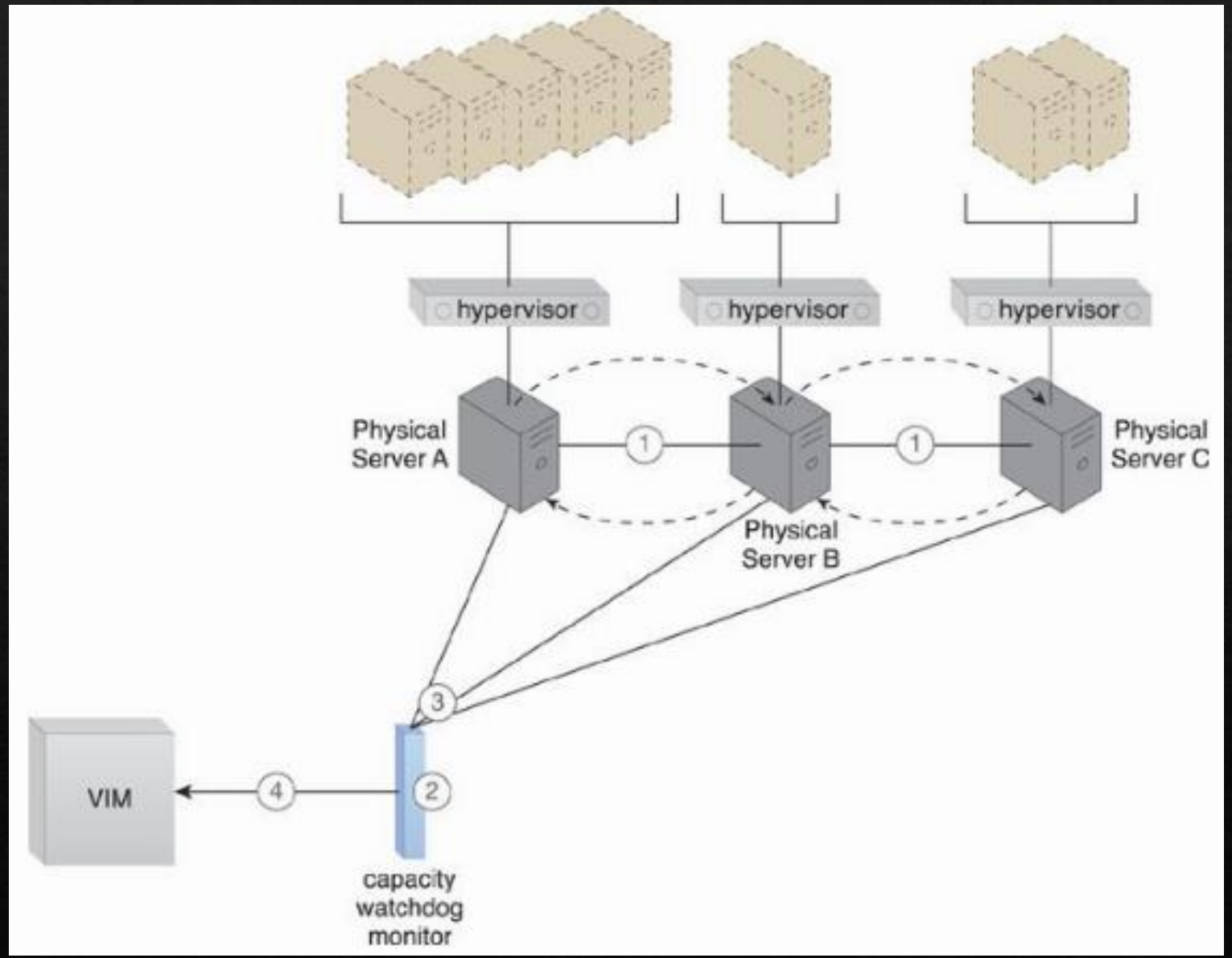
- Load Balanced Virtual Server Instances Architecture
- Non-Disruptive Service Relocation Architecture
- Zero Downtime Architecture
- Cloud Balancing Architecture
- Dynamic Failure Detection and Recovery Architecture
- Bare-Metal Provisioning Architecture
- Rapid Provisioning Architecture
- Storage Workload Management Architecture

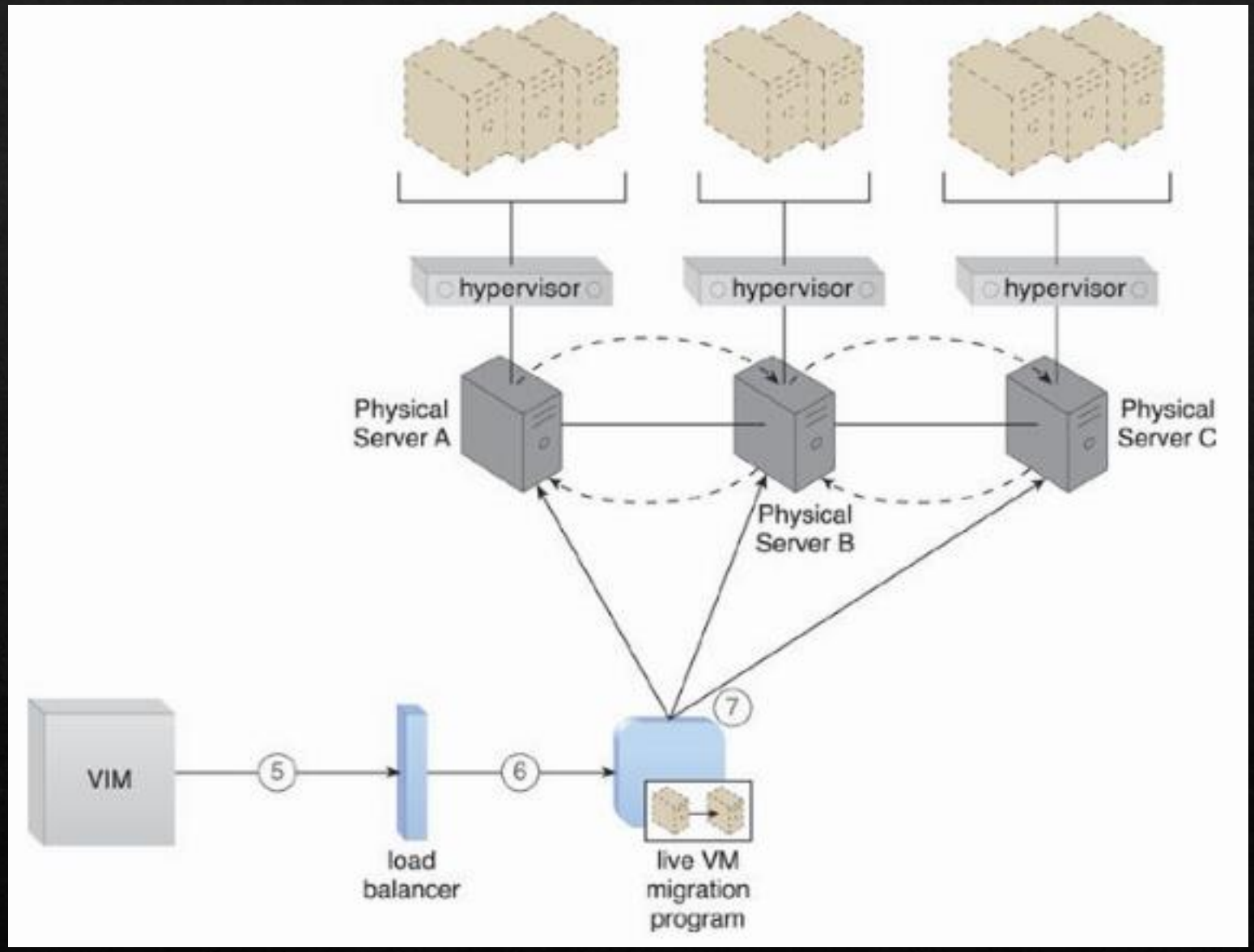
Load Balanced Virtual Server Instances Architecture

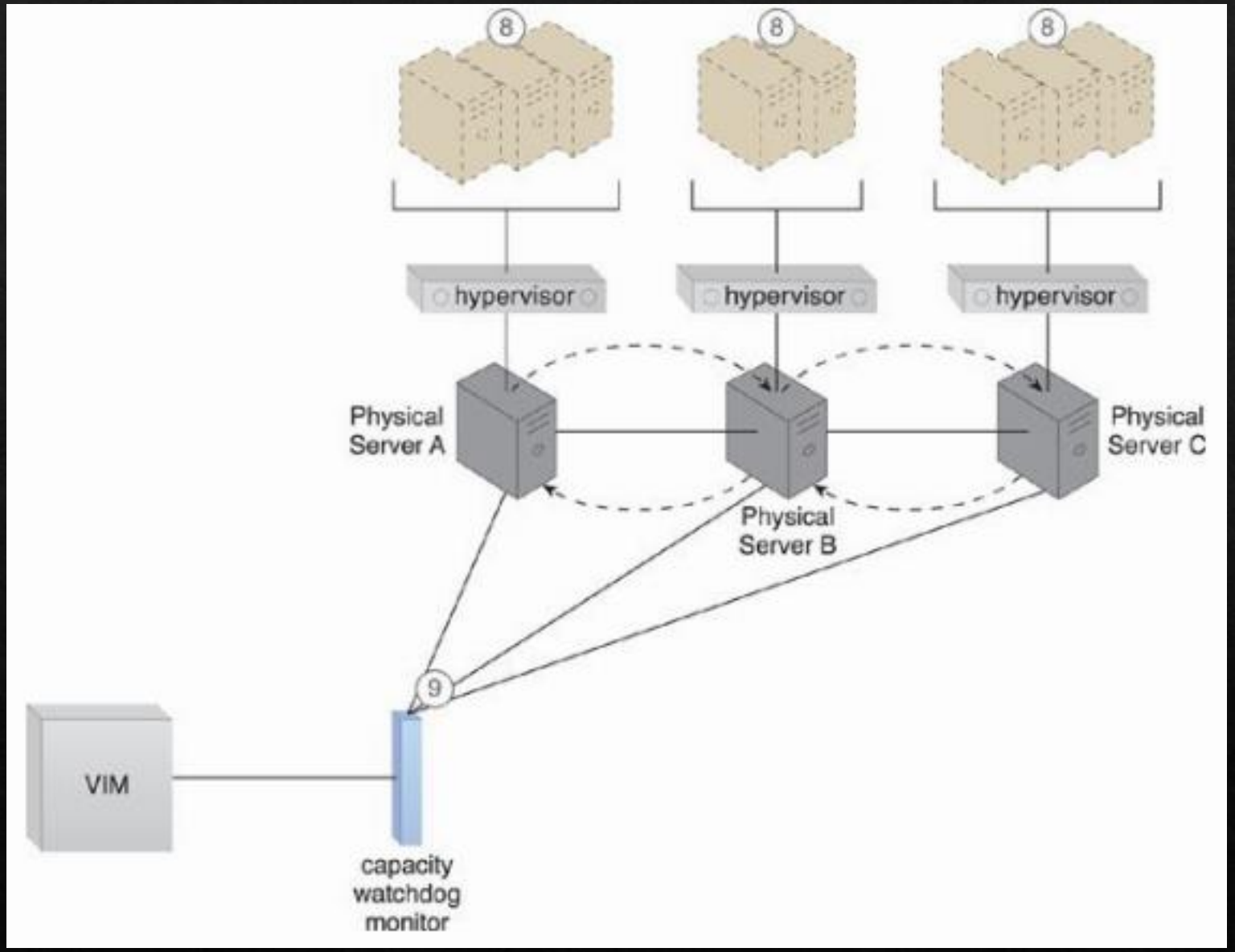
- Uneven virtual server instances on physical servers become challenging as this easily causes under-utilized and/or over-utilized servers conditions.






hypervisor
hypervisor
hypervisor
Physical
Server A
Physical
Server B
Physical
Server C
1
1
3
VIM
4
2
capacity
watchdog
monitor


hypervisor
hypervisor
hypervisor
Physical
Server A
Physical
Server B
Physical
Server C
VIM
5
load
balancer
6
7
live VM
migration
program

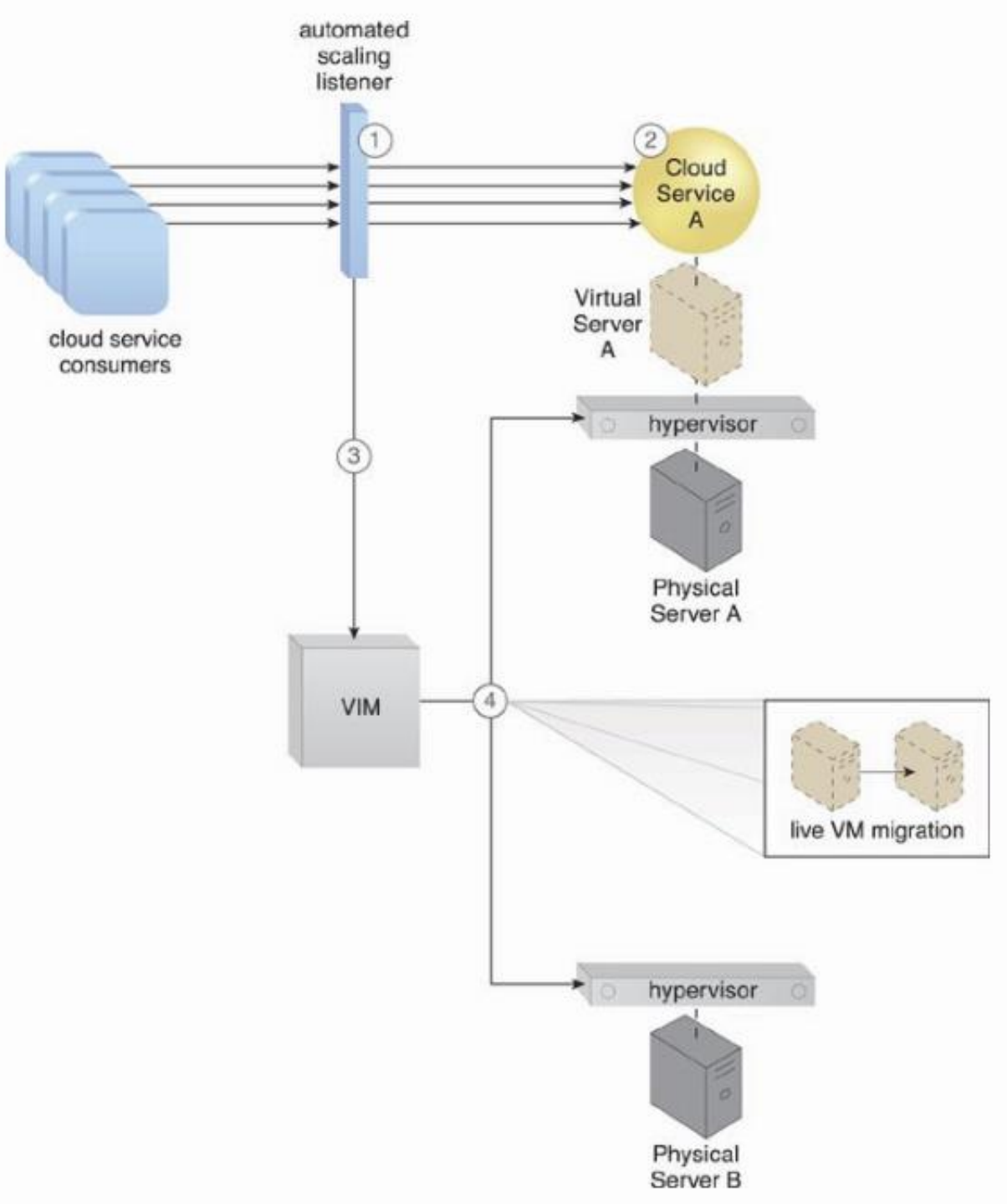

8
8
8
hypervisor
hypervisor
hypervisor
Physical
Server A
Physical
Server B
Physical
Server C
9
VIM
capacity
watchdog
monitor

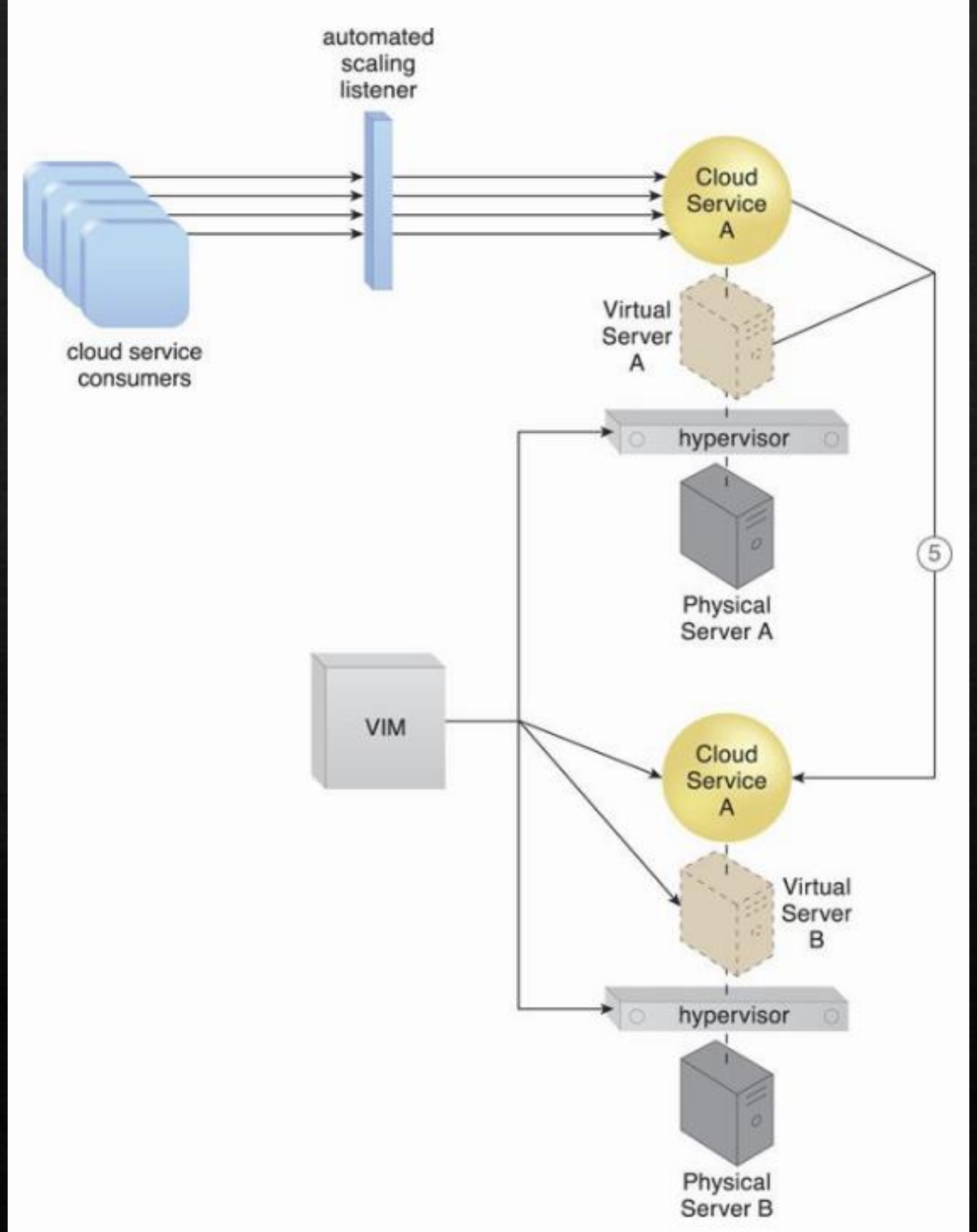
Load Balanced Virtual Server Instances Architecture (2)

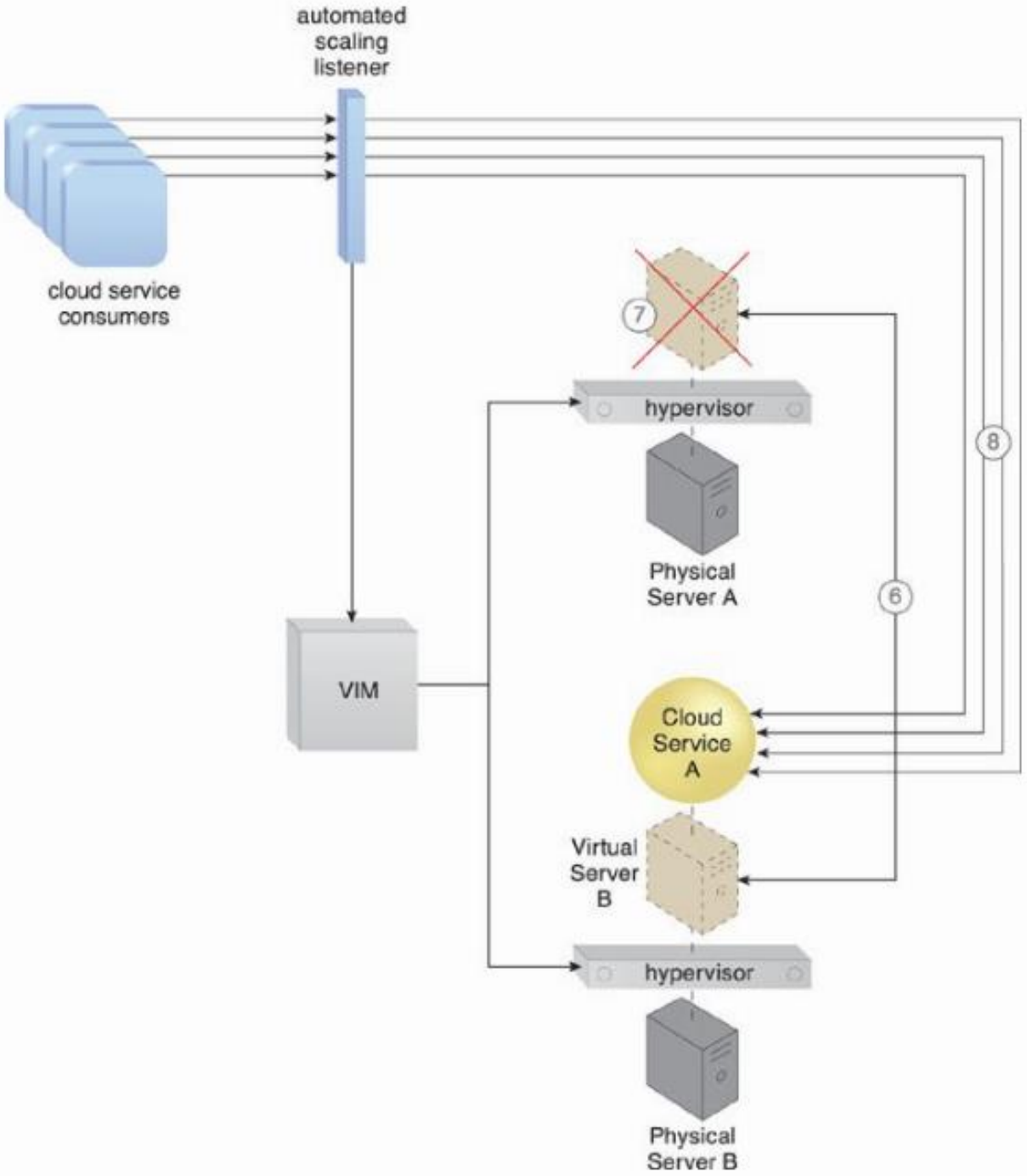
- Additional mechanisms to this architecture
  - Automated scaling listener
  - Load balancer
  - Logical network perimeter
  - Resource replication

Non-Disruptive Service Location Architecture

- Reasons lead to unavailable services in the cloud computing:
  - Runtime usage demands exceed its processing capacity.
  - Maintenance update (a temporary outage).
  - Permanent migration to a new physical server host.
- This architecture establishes a system by which a predefined event triggers the duplication or migration of a cloud service implementation at runtime, thereby avoiding any disruption.
- Key aspect – new cloud service is able to handle requests before the original cloud service is deactivated/removed.
- Common approach – live VM migration.


automated
scaling
listener
1
2
Cloud
Service
A
cloud service
consumers
Virtual
Server
A
hypervisor
3
Physical
Server A
VIM
4
live VM migration
hypervisor
Physical
Server B


automated
scaling
listener
cloud service
consumers
Cloud
Service
A
Virtual
Server
A
hypervisor
Physical
Server A
5
VIM
Cloud
Service
A
Virtual
Server
B
hypervisor
Physical
Server B


automated
scaling
listener
cloud service
consumers
7
hypervisor
8
Physical
Server A
6
VIM
Cloud
Service
A
Virtual
Server
B
hypervisor
Physical
Server B

Two ways of Virtual Server Migration

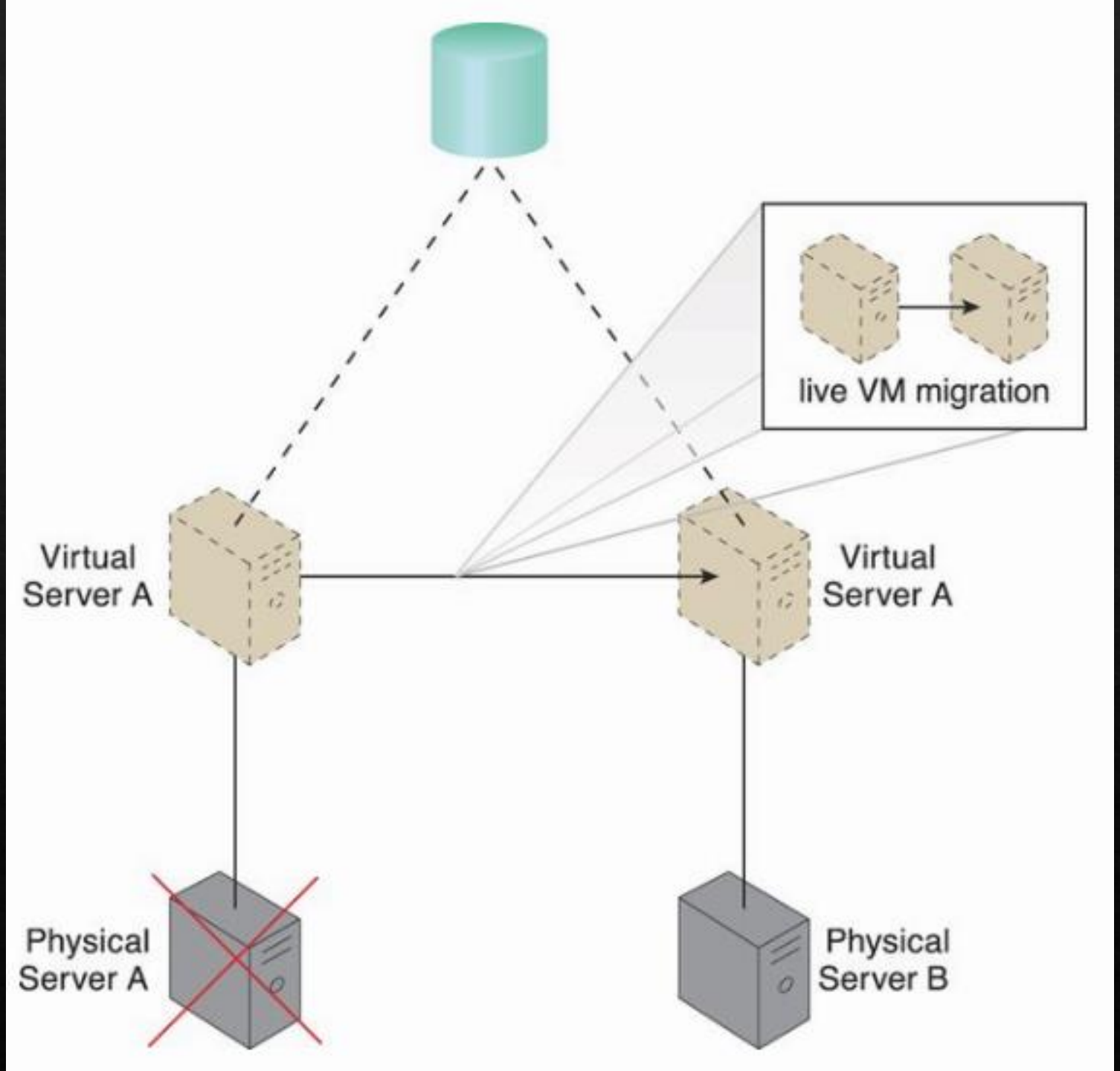
- A copy of the virtual server disks is created on the destination host, if the virtual server disks are stored on a local storage device or non-shared remote storage devices attached to the source host.
- Copying the virtual server disks is unnecessary if the virtual server's files are stored on a remote storage device that is shared between origin and destination hosts.

Non-Disruptive Service Location Architecture

- Additional mechanisms:
  - Cloud usage monitor
  - Pay-per-use monitor
  - Resource replication
  - SLA management system
  - SLA monitor

Zero Downtime Architecture

- A physical server naturally acts as a single point of failure (that is why we have a clustering technology).
- Failure or compromised servers affect cloud service availability. The issuance of zero downtime is quite challenging.
- This 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.

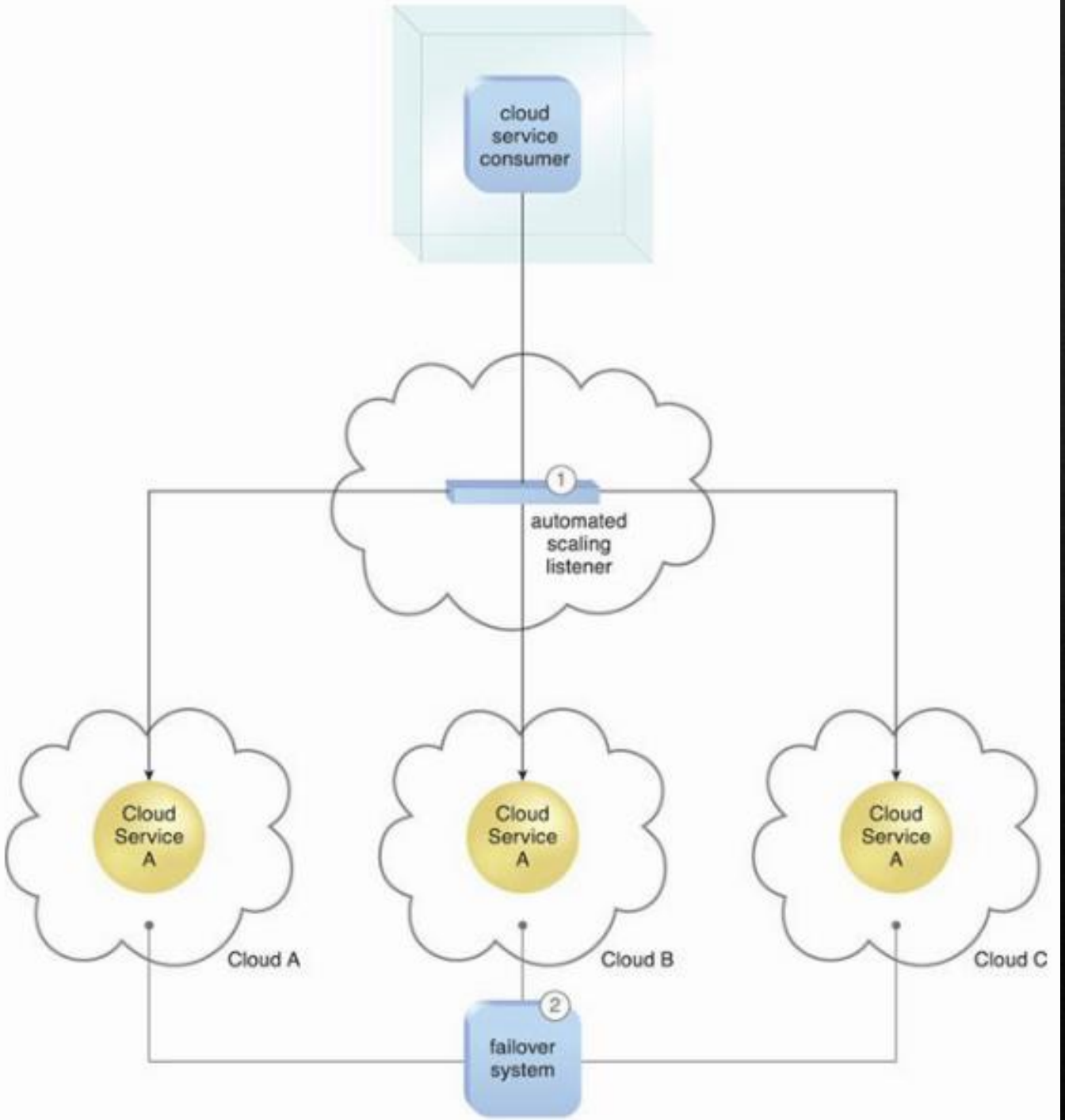

live VM migration
Virtual
Server A
Virtual
Server A
Physical
Server A
Physical
Server B

Zero Downtime Architecture (2)

- Additional Mechanisms:
  - Audit monitor – check if a host is relocated to a prohibited location.
  - Cloud usage monitor
  - Hypervisor
  - Logical network perimeter
  - Resource cluster
  - Resource replication

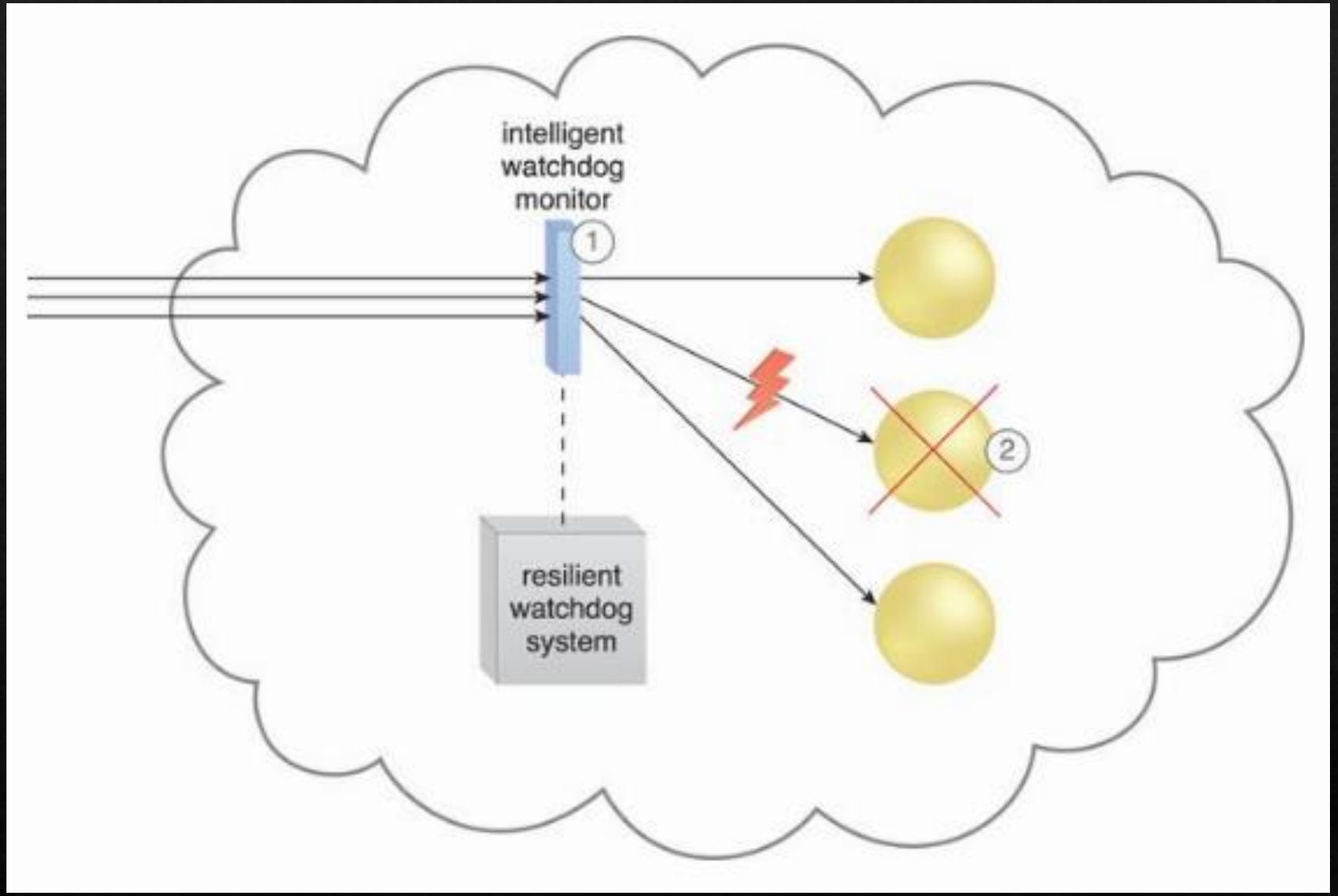
Cloud Balancing Architecture

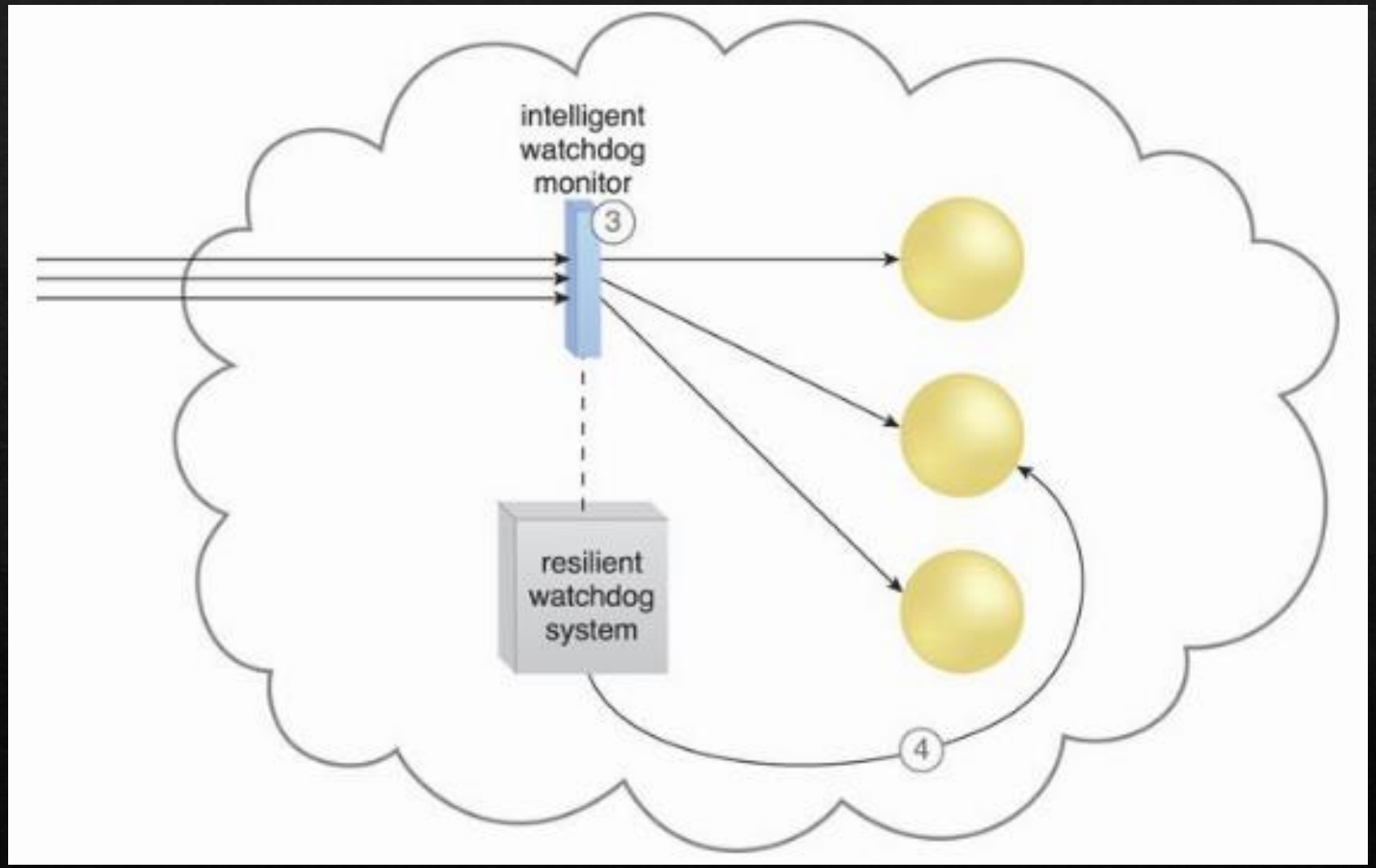
- This established a specialized load-balancing model in which IT resources can be load-balanced cross multiple clouds.
  - Improve the performance and scalability of IT resources.
  - Increase the availability and reliability of IT resources.
  - Improve load-balancing and IT resource optimization.
- Cloud balancing – based on the combination of the automated scaling listener and failover system mechanisms.


cloud service consumer
1
automated scaling listener
Cloud Service A
Cloud Service A
Cloud Service A
Cloud A
Cloud B
Cloud C
2
failover system

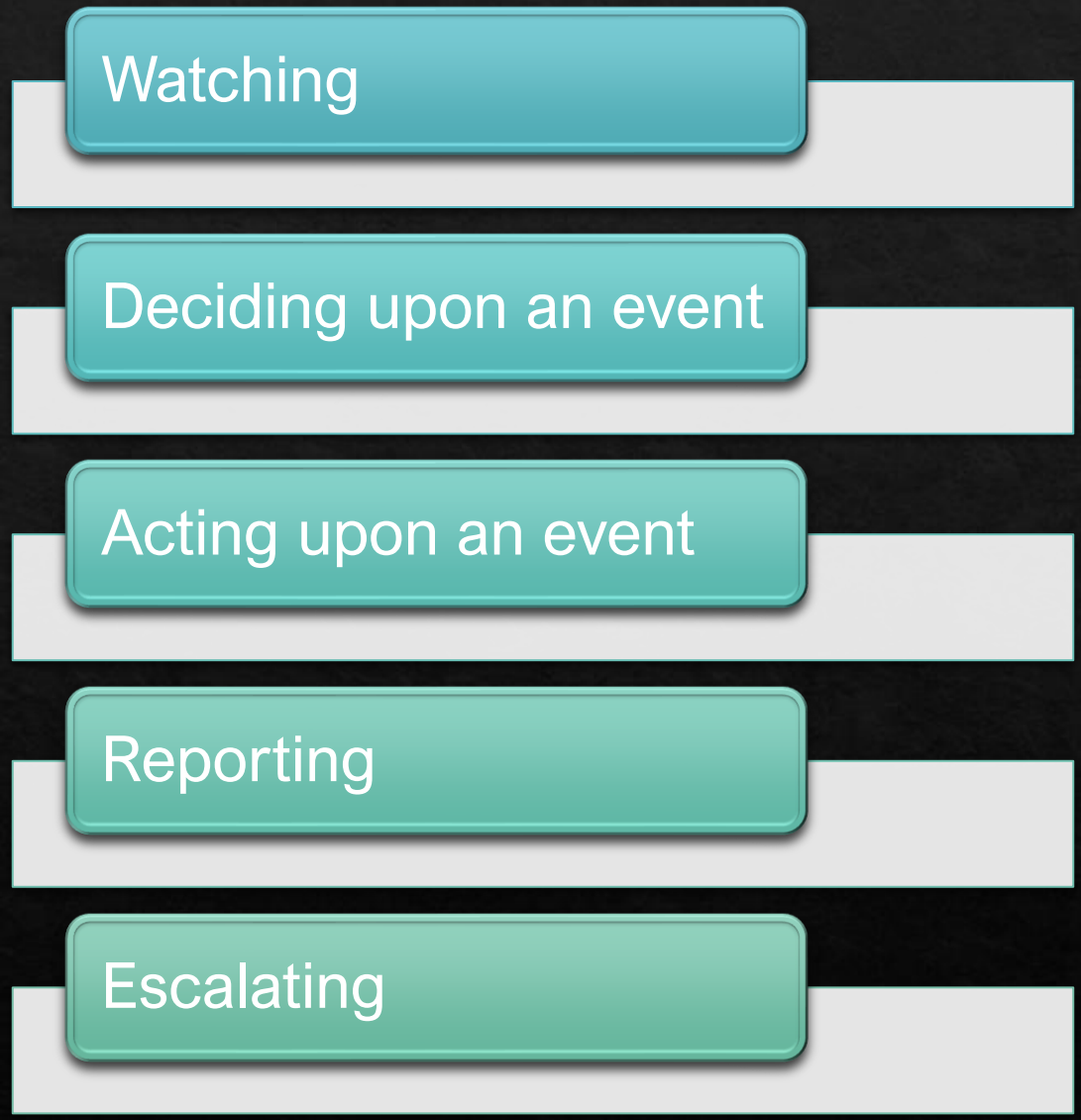
Dynamic Failure Detection and Recovery Architecture

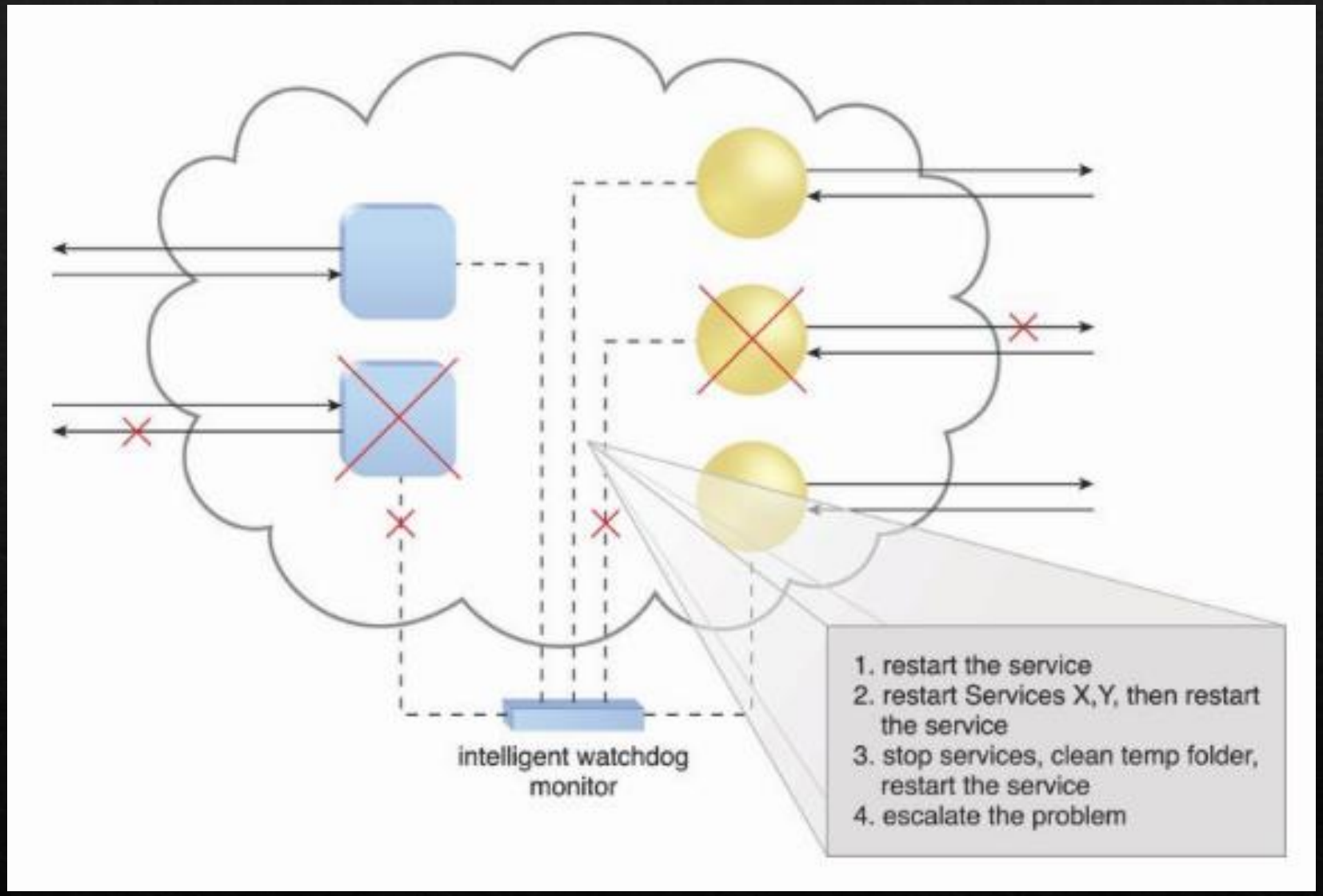
- This architecture establishes a resilient watchdog system to monitor and respond to a wide range of pre-defined failure scenarios.
- It notifies and escalates the failure conditions that it cannot automatically resolve itself.
- Specialized agent called the Intelligent Watchdog Monitor.


intelligent
watchdog
monitor
1
2
resilient
watchdog
system


intelligent
watchdog
monitor
3
resilient
watchdog
system
4

Resilient Watchdog Functionalities




intelligent watchdog monitor
1. restart the service
2. restart Services X,Y, then restart the service
3. stop services, clean temp folder, restart the service
4. escalate the problem

Dynamic Failure Detection and Recovery Architecture

- Additional Mechanisms:
  - Audit monitor – to track whether data recovery is carried out in compliance with legal or policy requirements.
  - Failover system
  - SLA management system
  - SLA monitor

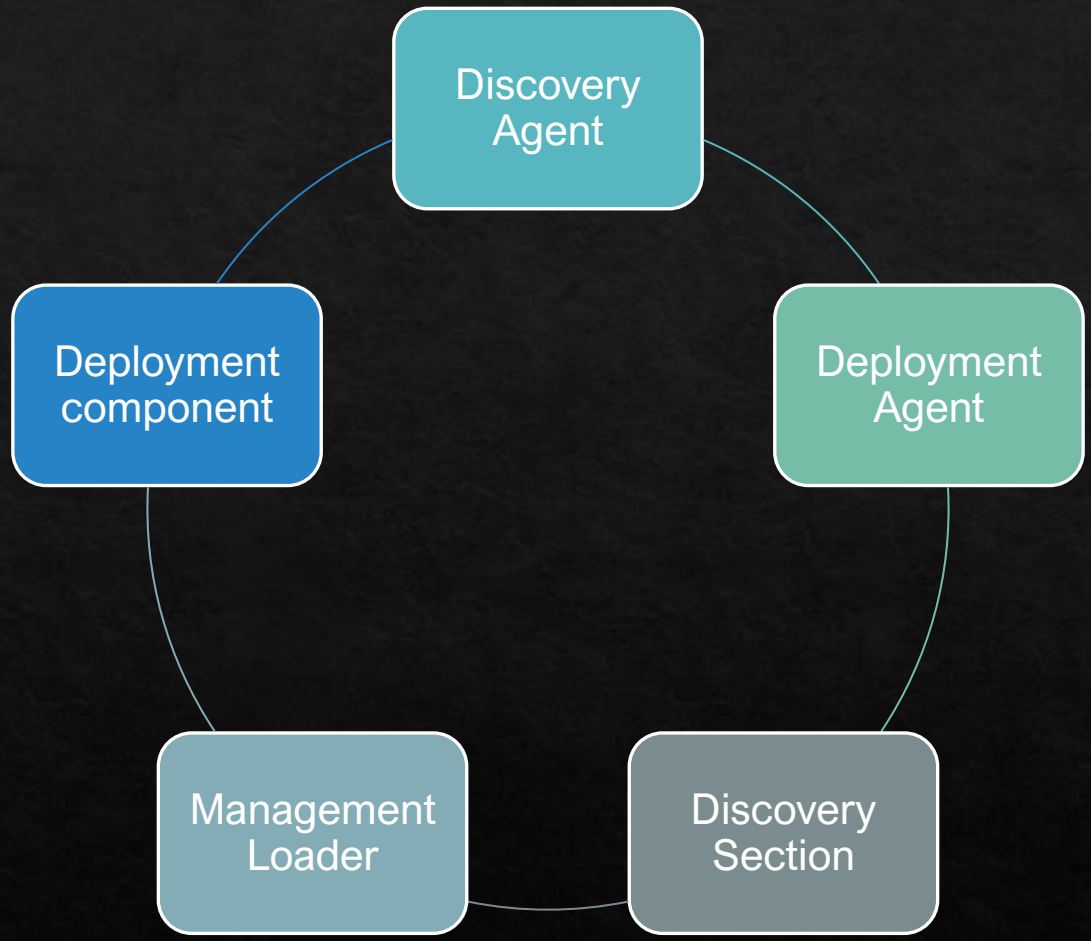
Bare-Metal Provisioning Architecture

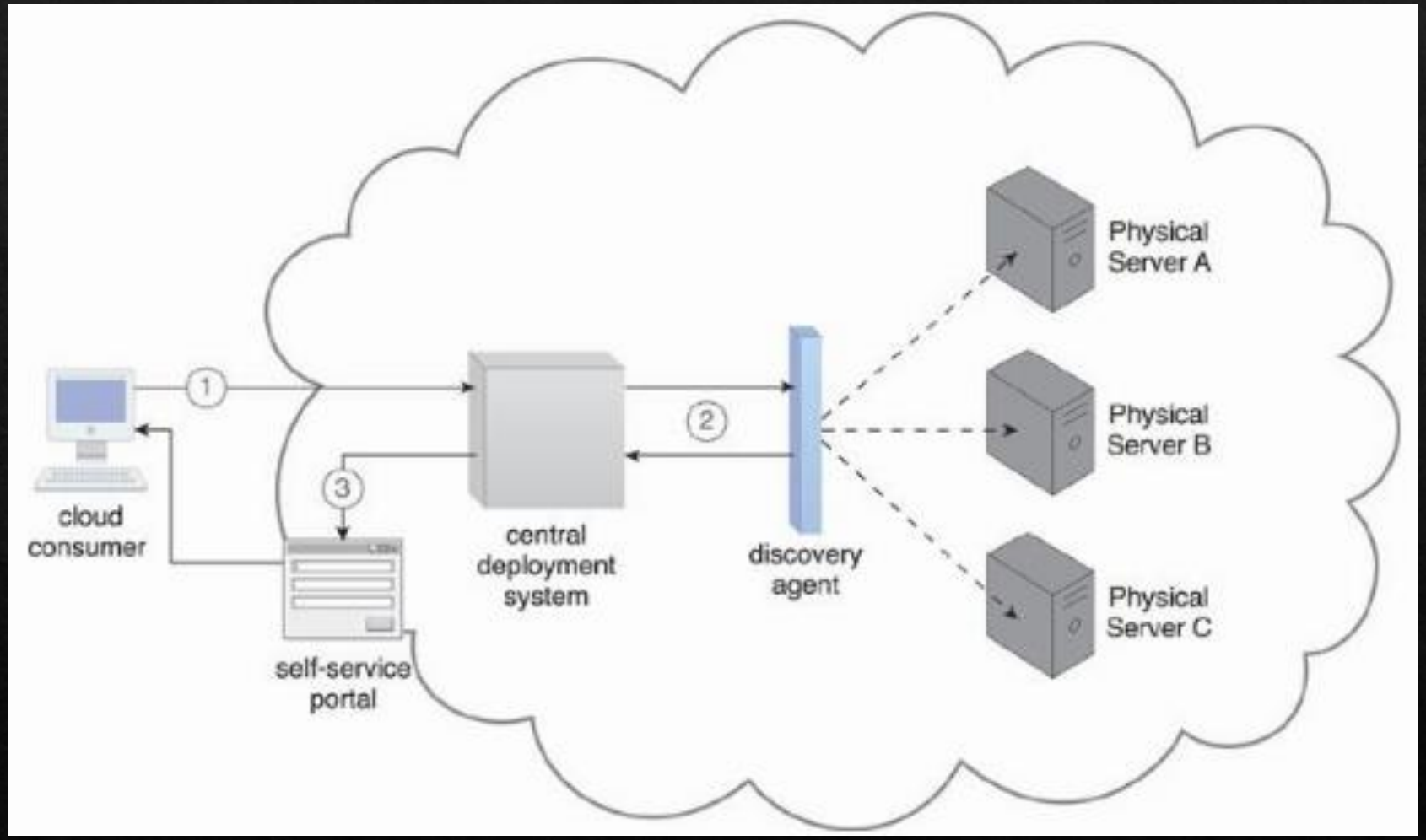
- Remote provisioning on bare-metal servers is unavailable due to uninstalled OS.
- This architecture establishes a system that utilizes this feature with specialized service agents, which are used to discover and effectively provision entire operating systems remotely.
- Installation of remote management support in the servers' ROM.

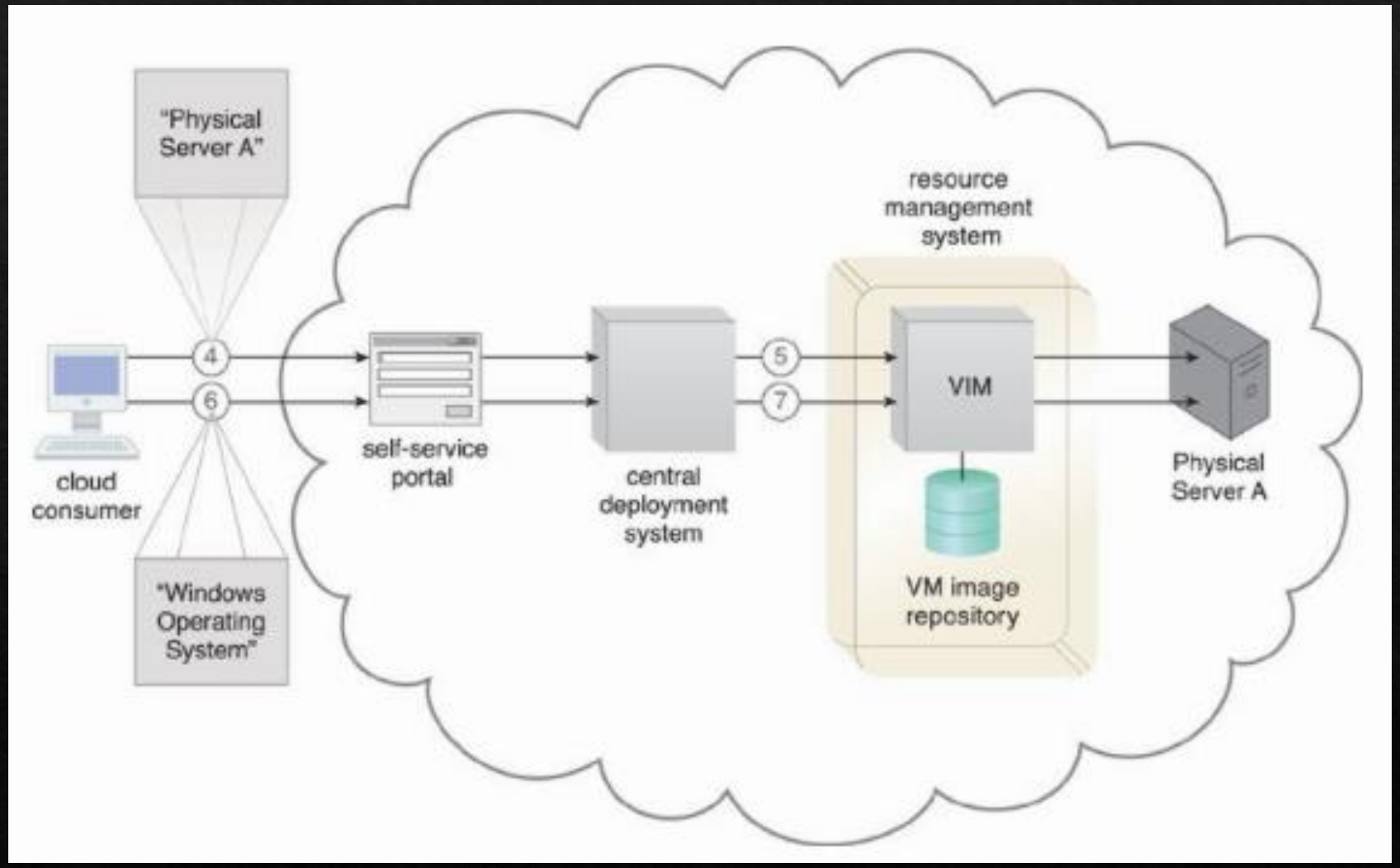
Bare-Metal Provisioning Architecture (2)

- Remote management software (in ROM) enables connections to physical server consoles but
  - Manual deployments on multiple servers – vulnerable to human and config. errors.
  - Time-intensive and significant runtime IT resource processing.

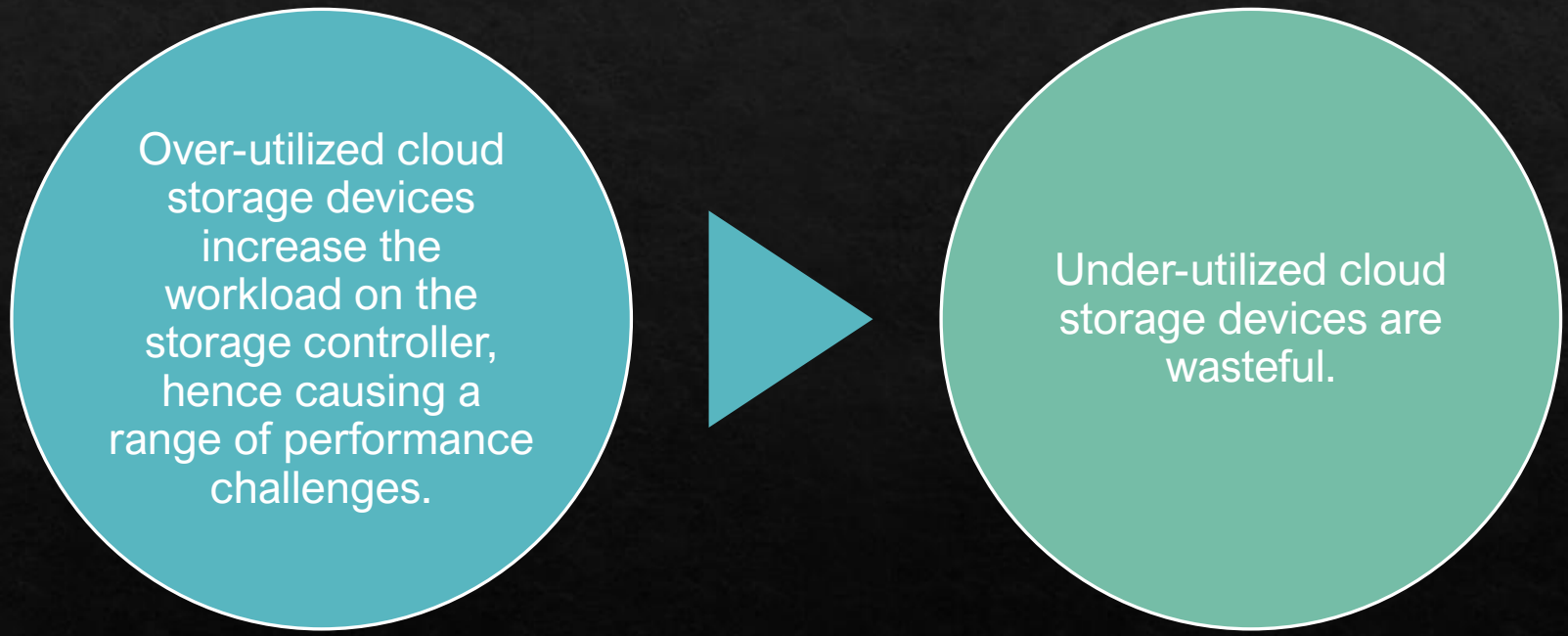
Bare-Metal Provisioning System

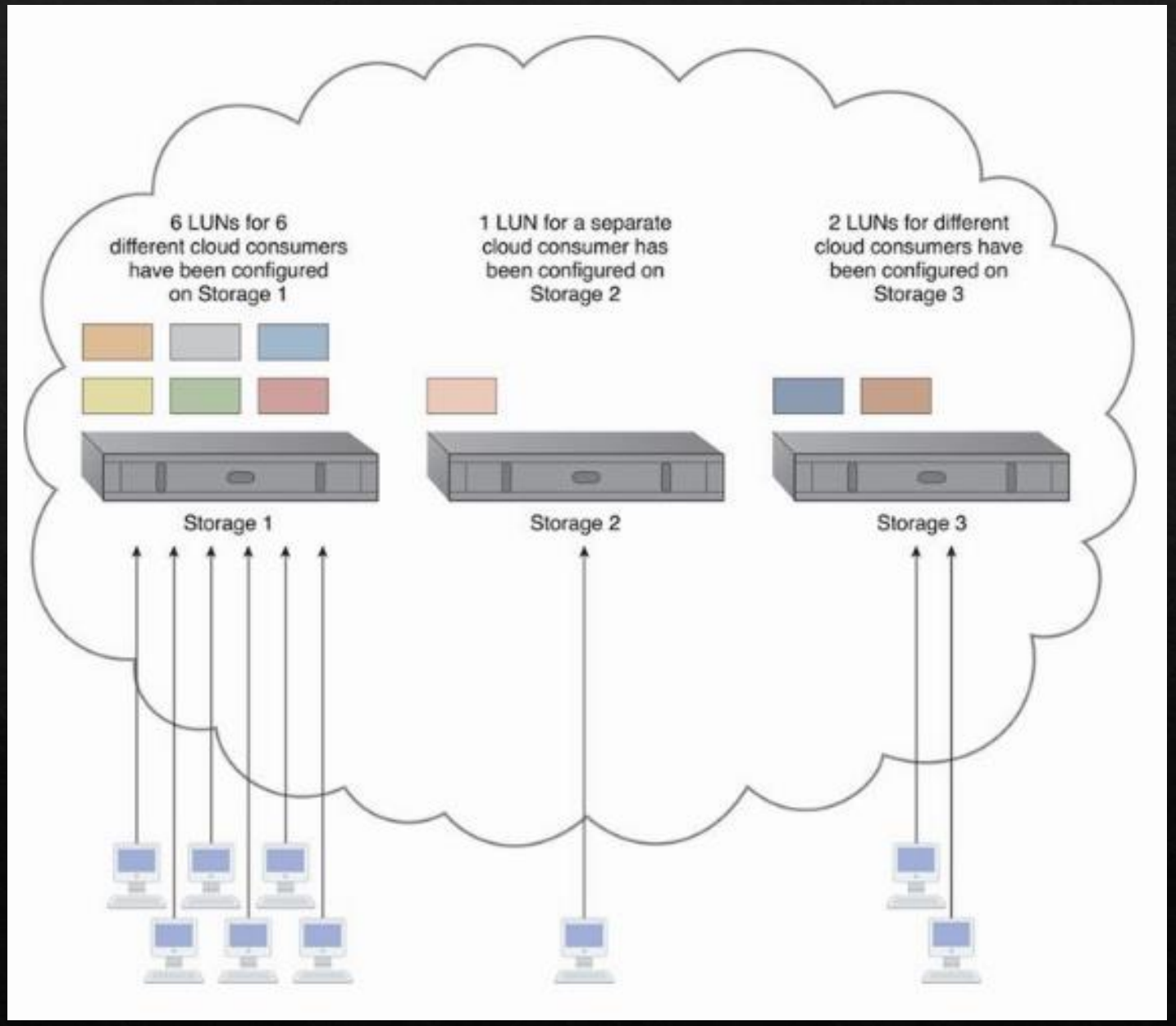



Physical
Server A
Physical
Server B
Physical
Server C
1
2
3
cloud
consumer
central
deployment
system
discovery
agent
self-service
portal

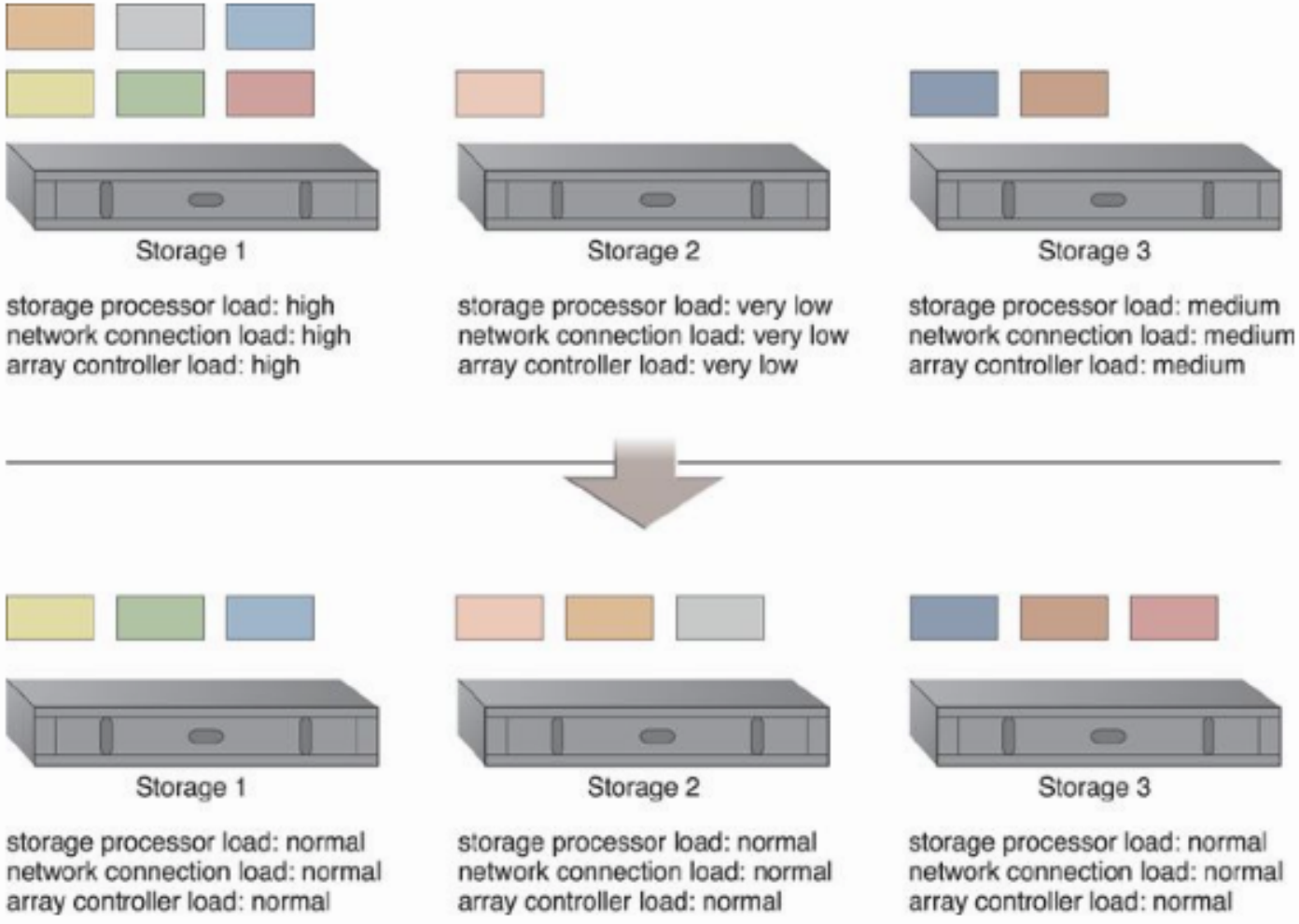

"Physical Server A"
resource management system
4
6
5
7
VIM
cloud consumer
self-service portal
central deployment system
Physical Server A
VM image repository
"Windows Operating System"

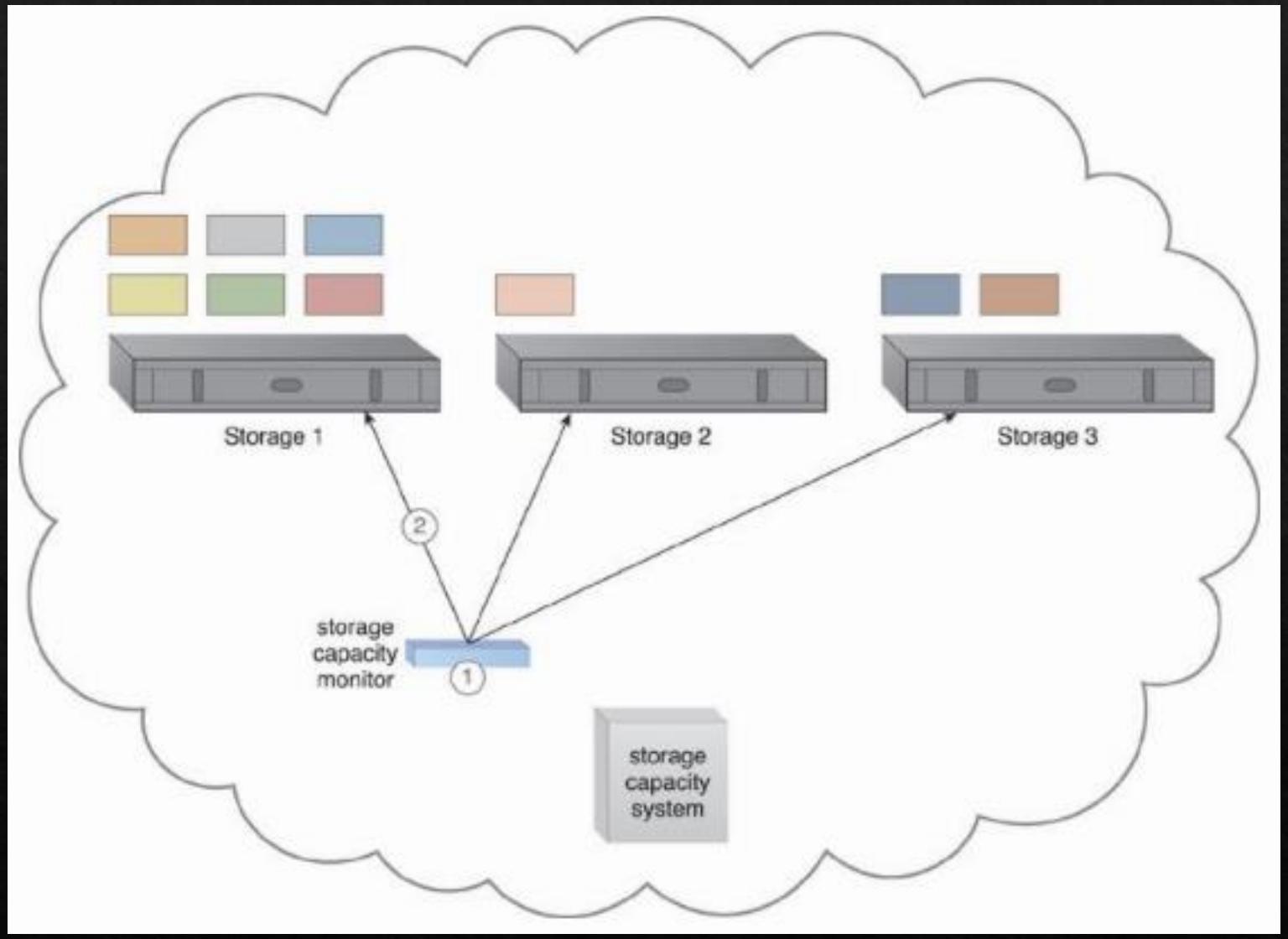
Storage Workload Management Architecture

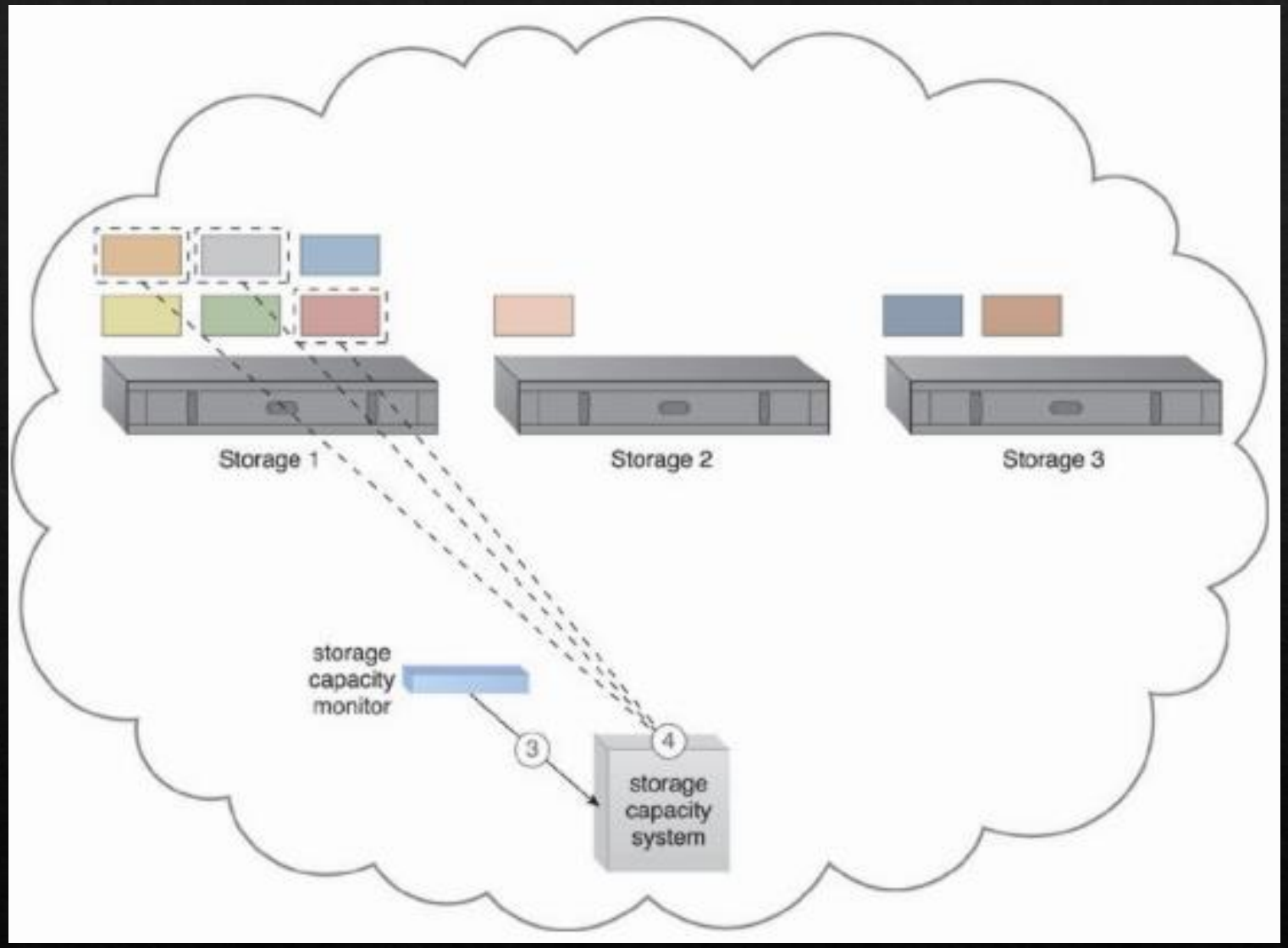


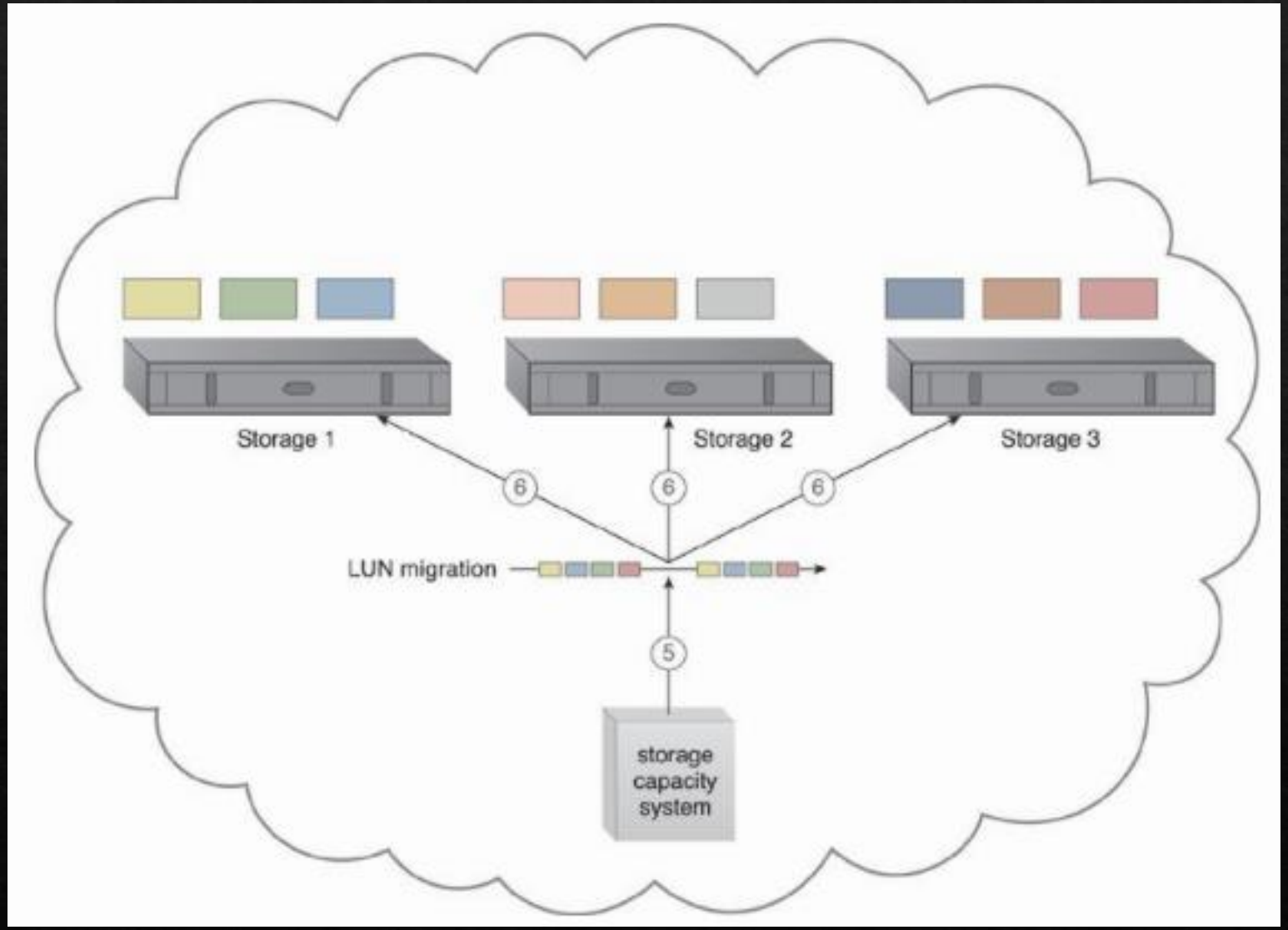

6 LUNs for 6 different cloud consumers have been configured on Storage 1
1 LUN for a separate cloud consumer has been configured on Storage 2
2 LUNs for different cloud consumers have been configured on Storage 3
Storage 1
Storage 2
Storage 3

The *storage workload management architecture* enables LUNs to be evenly distributed across available cloud storage devices, while a storage capacity system is established to ensure that runtime workloads are evenly distributed across the LUNs (Figure 12.27).




Storage 1
Storage 2
Storage 3
2
storage
capacity
monitor
1
storage
capacity
system


Storage 1
Storage 2
Storage 3
storage capacity monitor
3
4
storage capacity system


Storage 1
Storage 2
Storage 3
6
6
6
LUN migration
5
storage capacity system