Specialized Cloud Architectures

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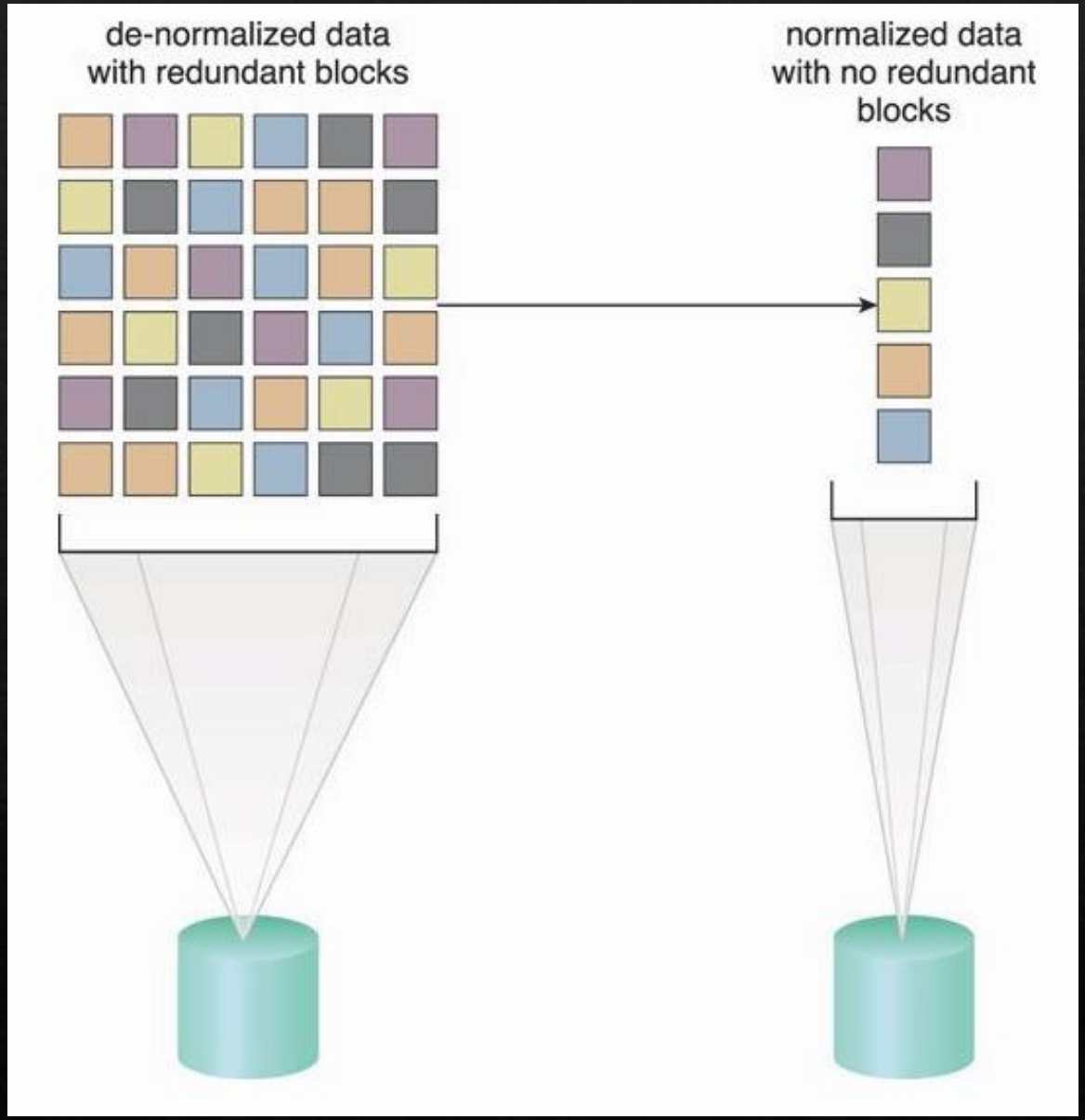
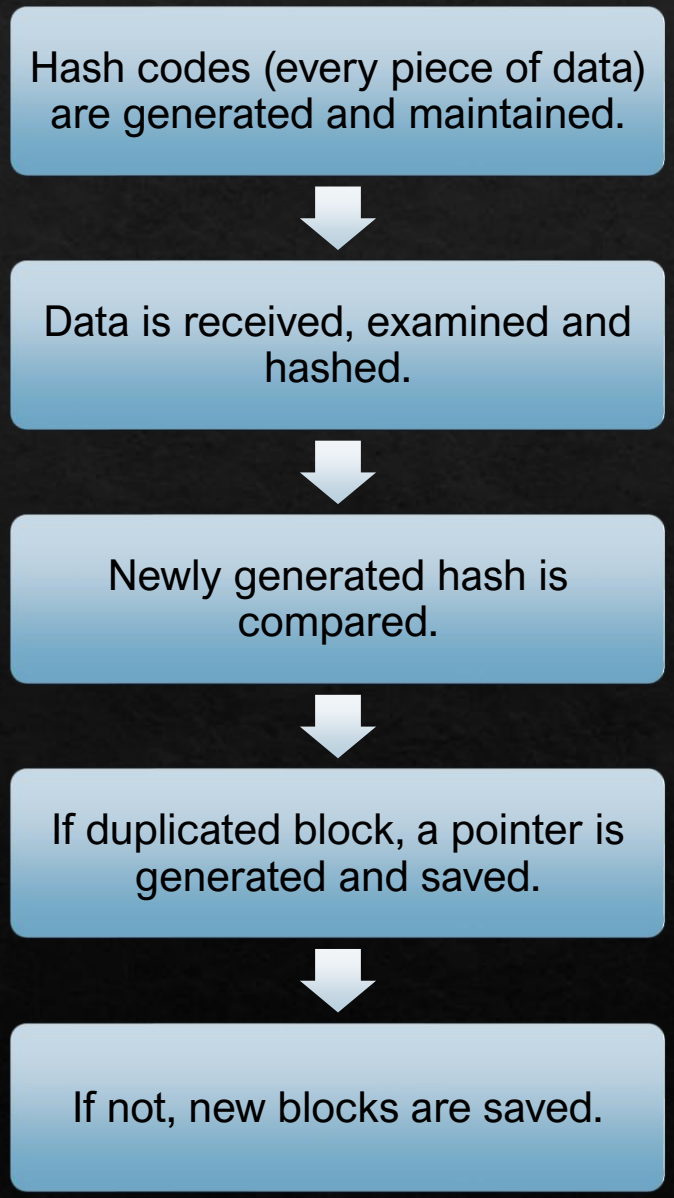
- Dynamic Data Normalization Architecture
- Elastic Network Capacity Architecture
- Cross-Storage Device Vertical Tiering Architecture
- Intra-Storage Device Vertical Data Tiering Architecture
- Persistent Virtual Network Configuration Architecture
- Storage Maintenance Window Architecture

Dynamic Data Normalization Architecture

- Issues of having redundant data in cloud-based environment:
  - ✓ Increased time required to store and catalog files
  - ✓ Increased required storage and backup space
  - ✓ Increased costs due to increased data volume
  - ✓ Increased time required for replication to secondary storage
  - ✓ Increased time required to backup data
- Data normalization architecture establishes a de-duplication system.

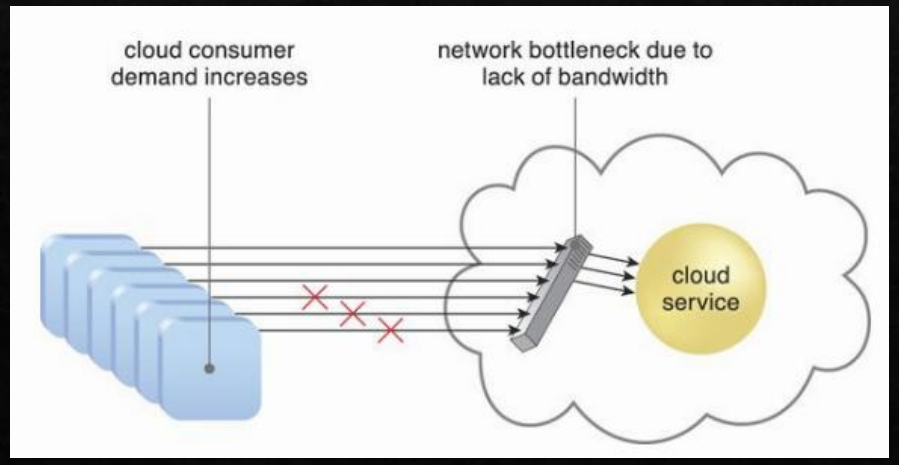

de-normalized data
with redundant blocks
normalized data
with no redundant
blocks

De-Duplication System



Elastic Network Capacity Architecture

- Although IT resources may be scaled on-demand, performance and scalability may be inhibited (held back) by limited network bandwidth.
- This architecture dynamically allocates additional bandwidth when cloud consumer demand increases (to avoid network bottlenecks).
- Additional bandwidth and/or network ports are allocated when required.

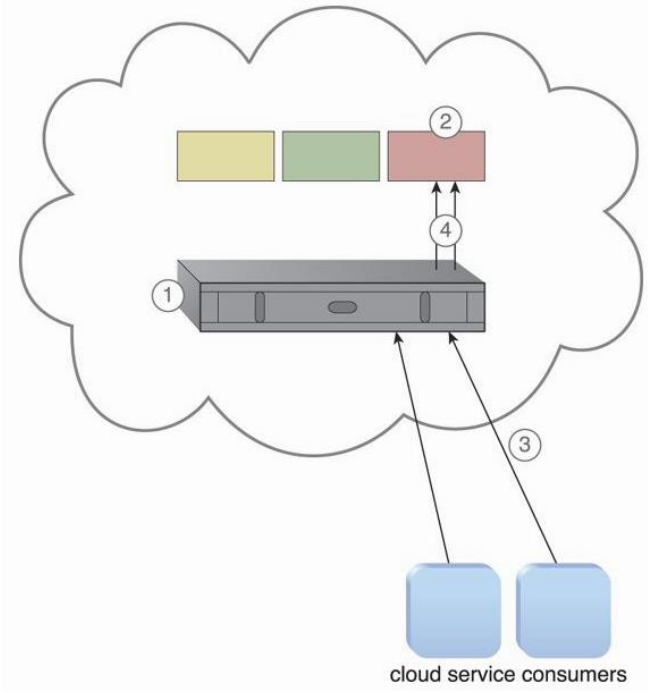


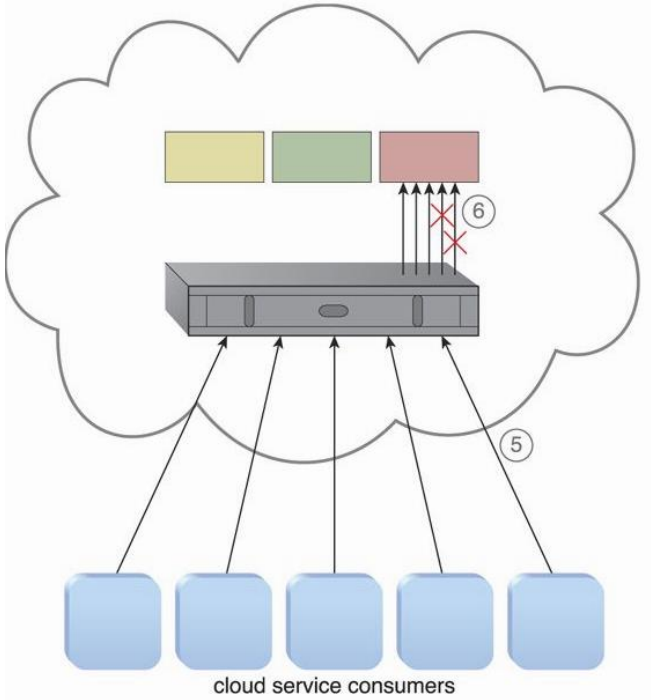
Other Mechanisms

- Automated scaling listener
- Intelligent automation engine – run scripts to modify number of allocated ports
- Cloud usage monitor
- Logical network perimeter
- Pay-per-use monitor
- Resource replication – add additional network ports

Cross-Storage Device Vertical Tiering Architecture

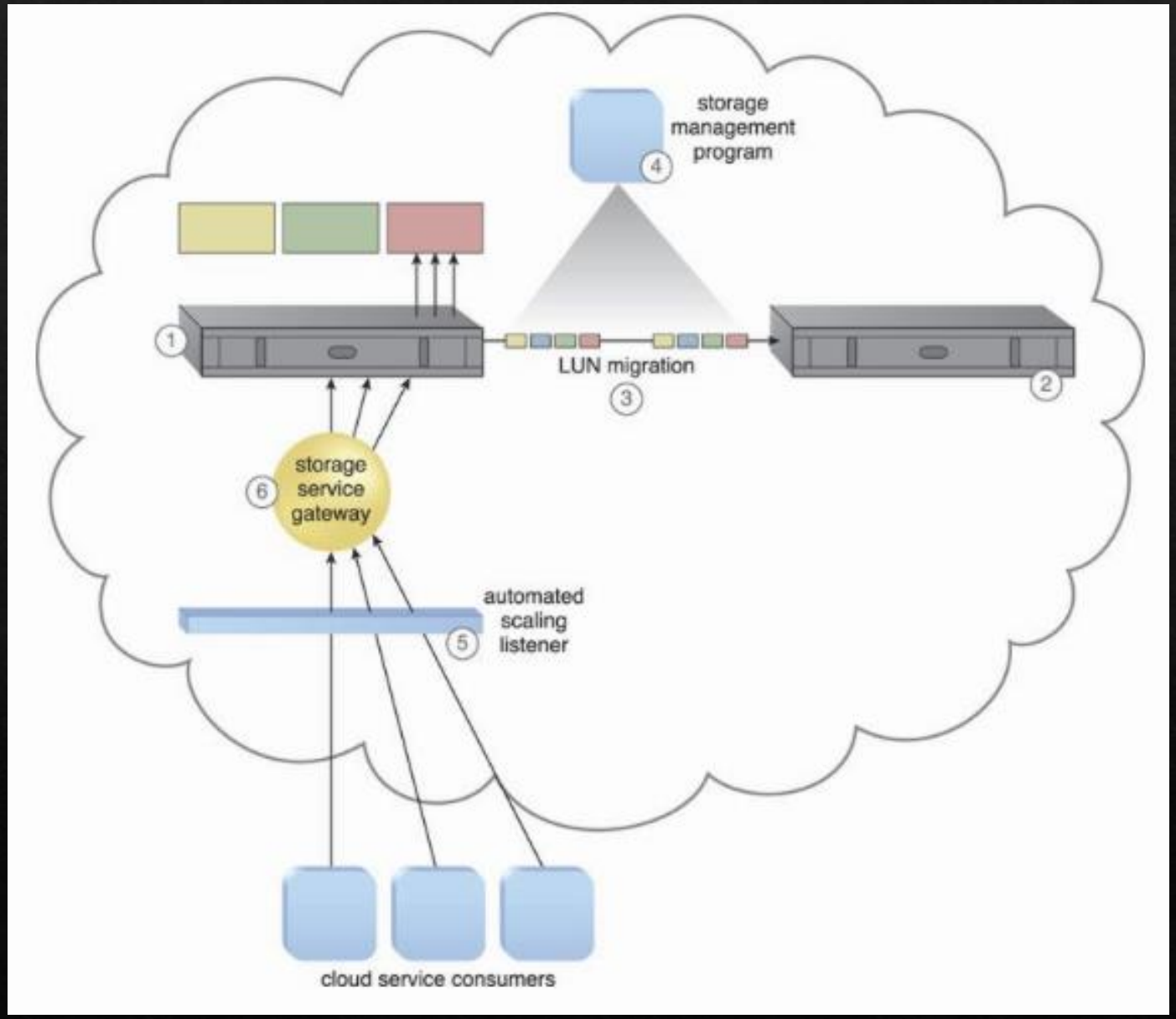
- Cloud storage sometimes cannot handle increasing performance requirements (IOPS), and needs to scale-up.

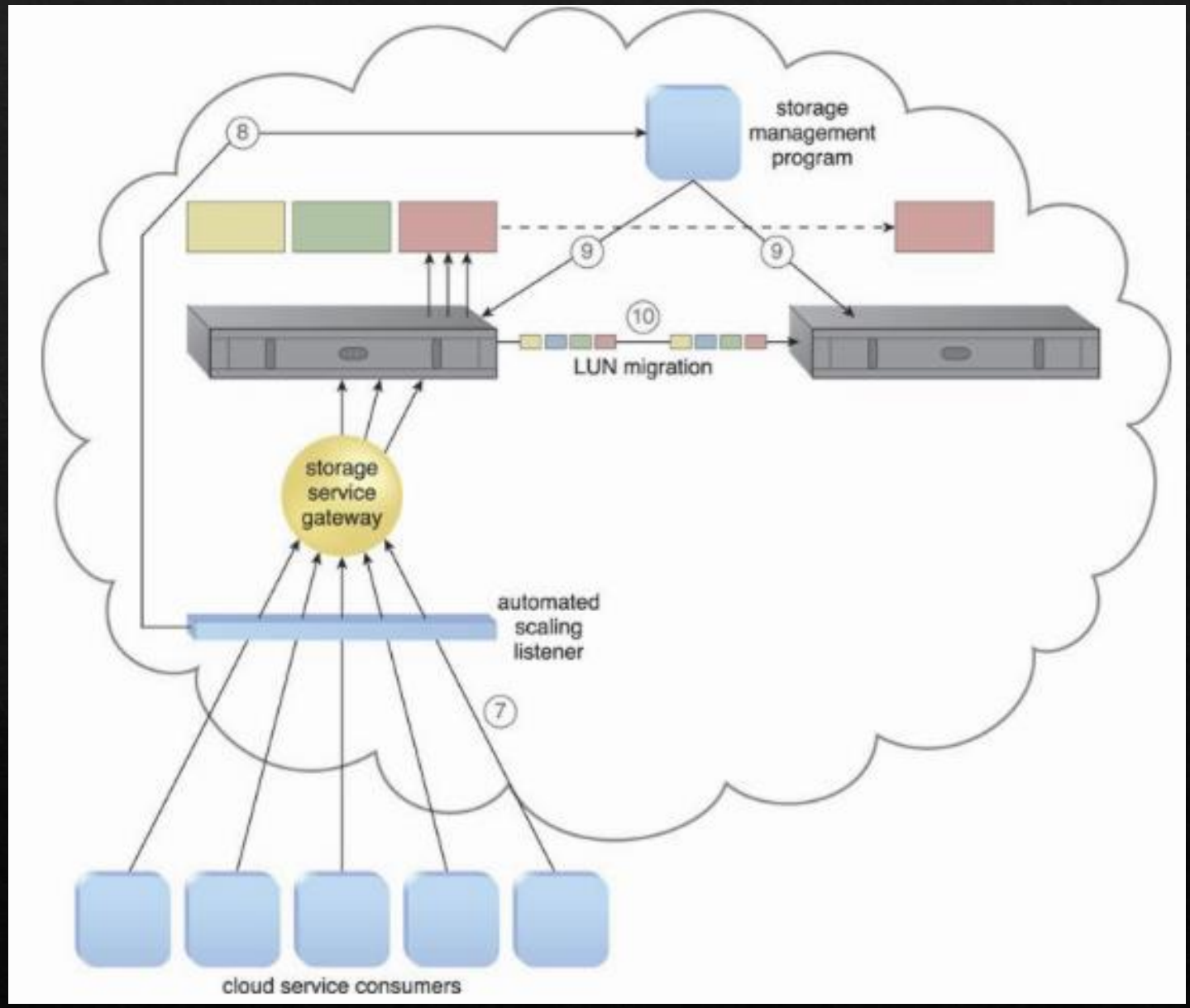


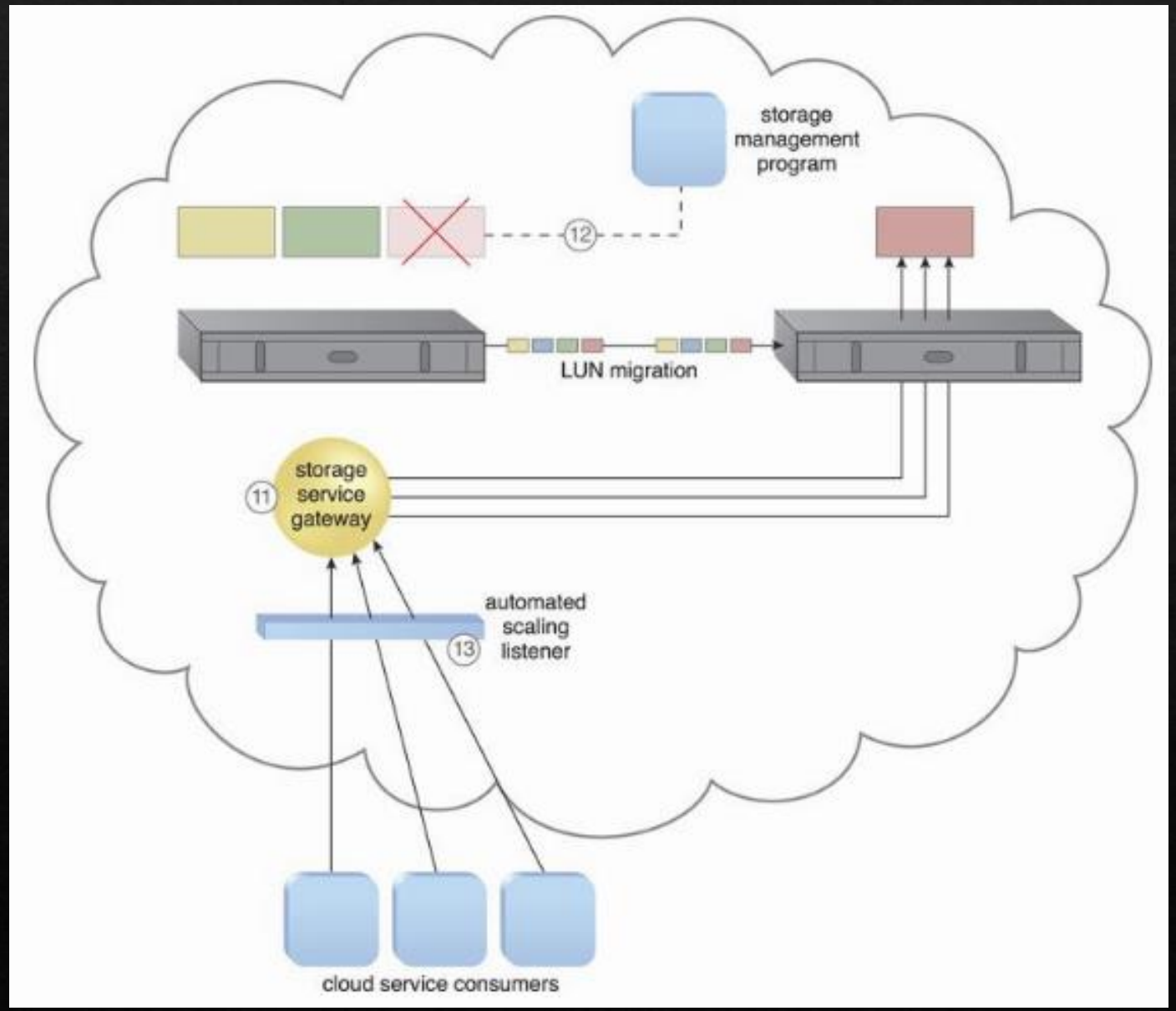


Cross-Storage Device Vertical Tiering Architecture (2)

- This architecture establishes a system that survives bandwidth and data processing power scaling by scaling between storage devices that have different capacity.
- LUNs can automatically scale up and down across multiple devices (e.g., between traditional hard drives and SSDs).
- Automated scaling listener monitors the requests and signals the storage management program to move LUN to a higher capacity (both bandwidth and processing power) when the requests increase.


storage
management
program
4
1
LUN migration
3
2
storage
service
gateway
6
automated
scaling
listener
5
cloud service consumers


storage
management
program
8
9
9
10
LUN migration
storage
service
gateway
automated
scaling
listener
7
cloud service consumers

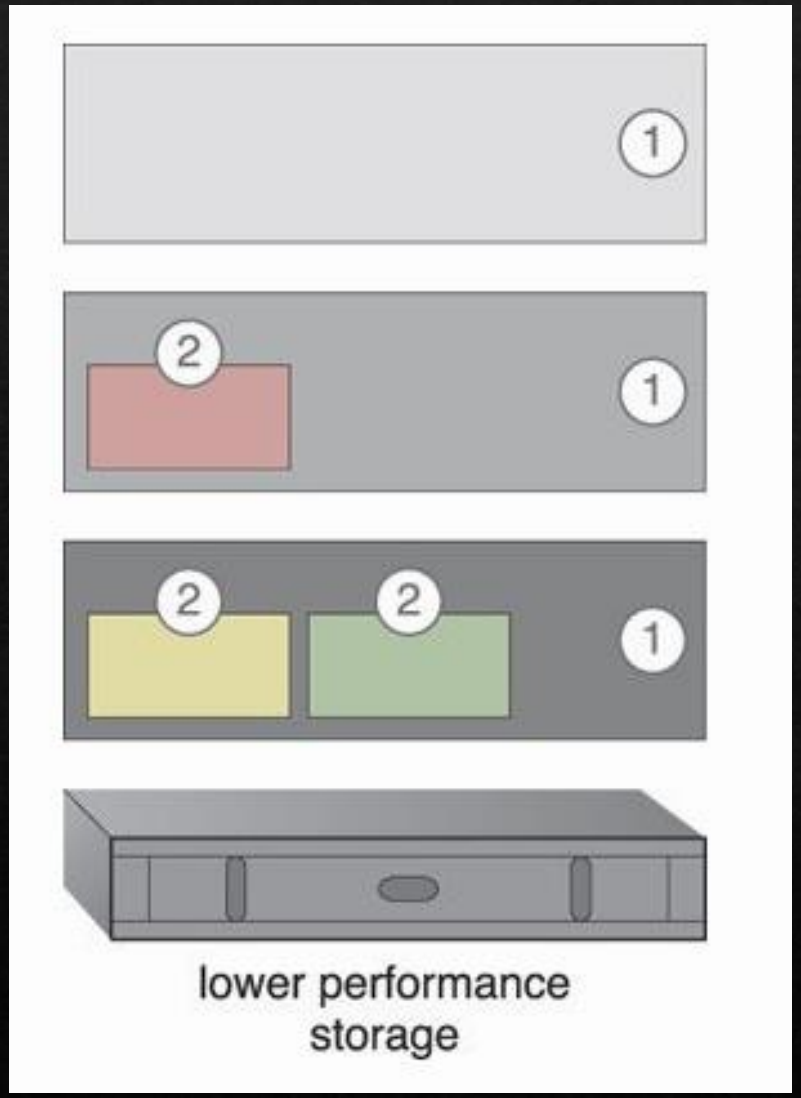


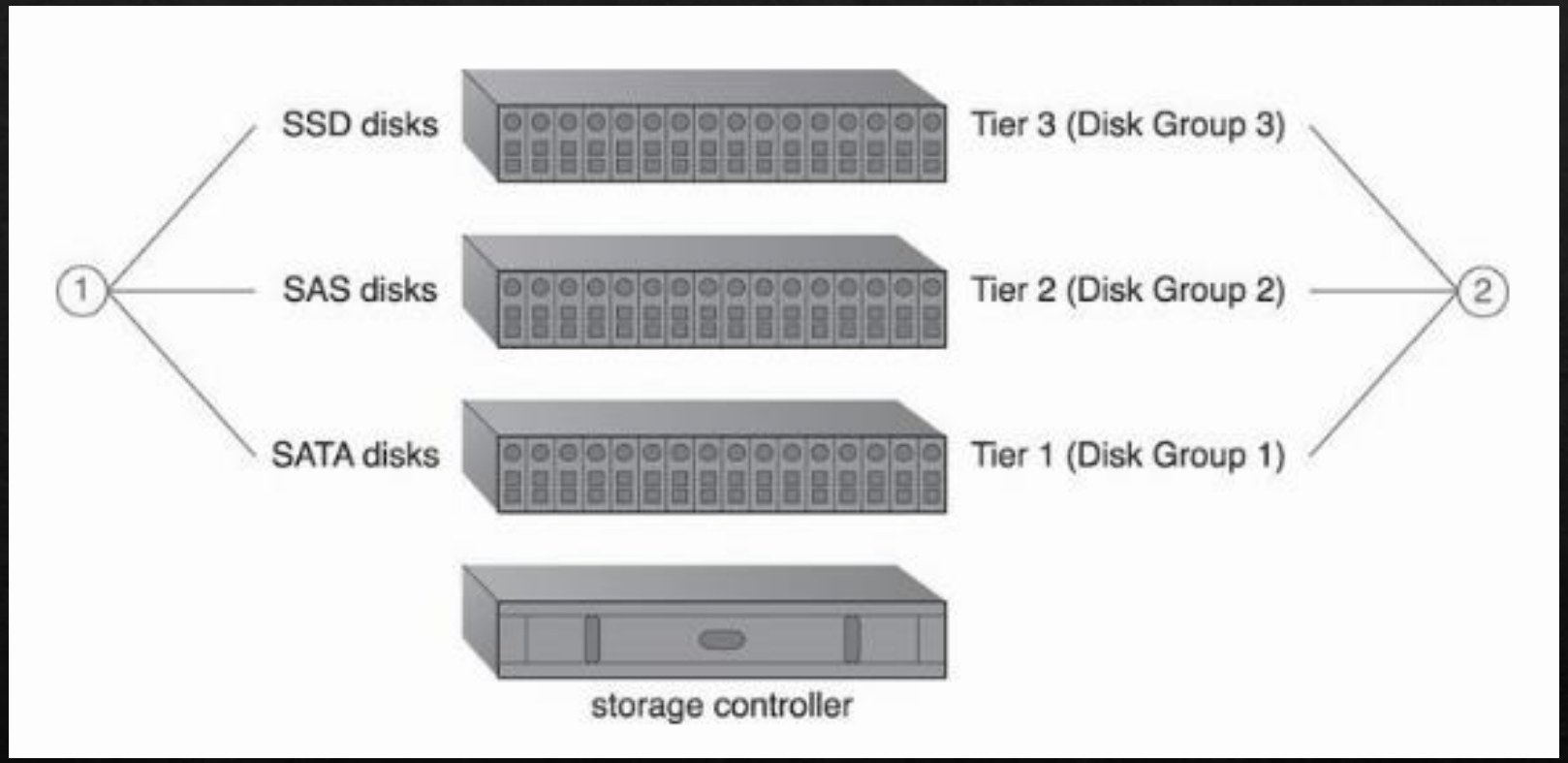
Other mechanisms:

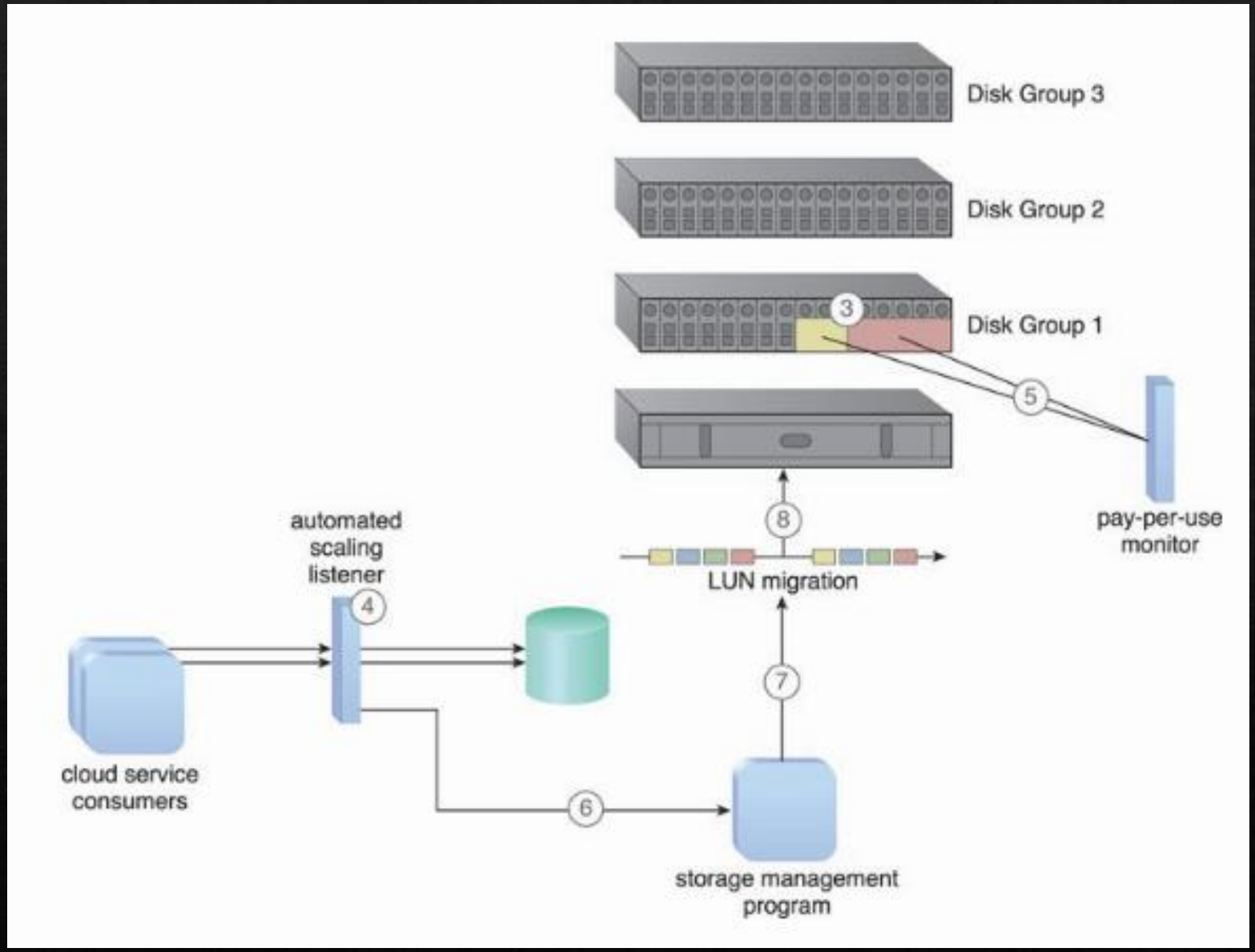
- Audit monitor
- Pay-per-use
- Cloud usage

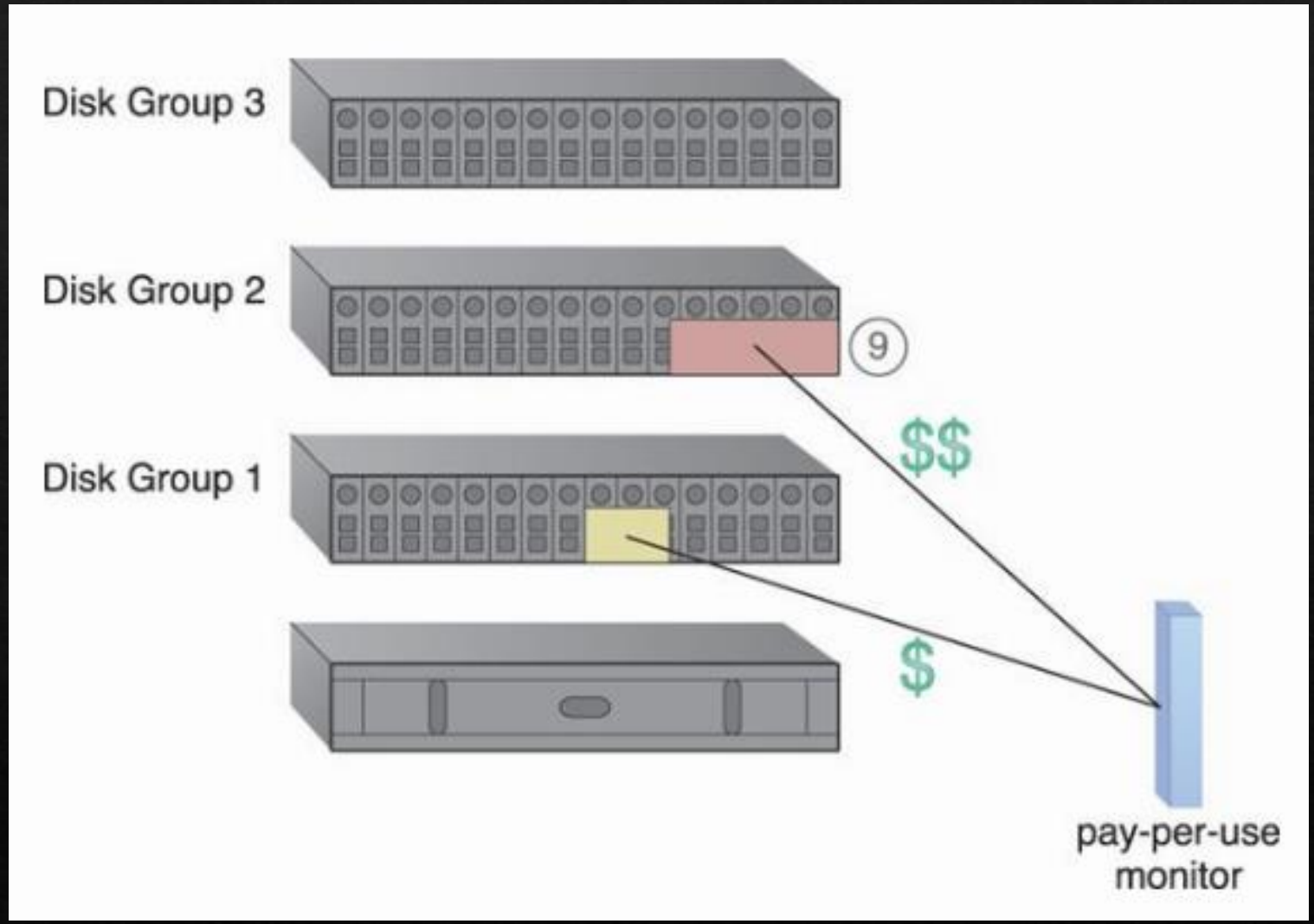
Intra-Storage Device Vertical Data Tiering Architecture

- In certain scenarios, cloud consumers may have distinct data storage requirements (security, privacy, legal requirements) restricting the data physical's location to a single cloud storage device.
- This limitation may pose severe scalability limitations (cascade to any cloud services or apps that are dependent upon the use of the cloud storage.
- This architecture establishes a system to support vertical scaling within a single cloud storage device.
- Intra-device scaling system optimizes the availability of different disk types with different capacities.


1
2
1
2
2
1
lower performance
storage

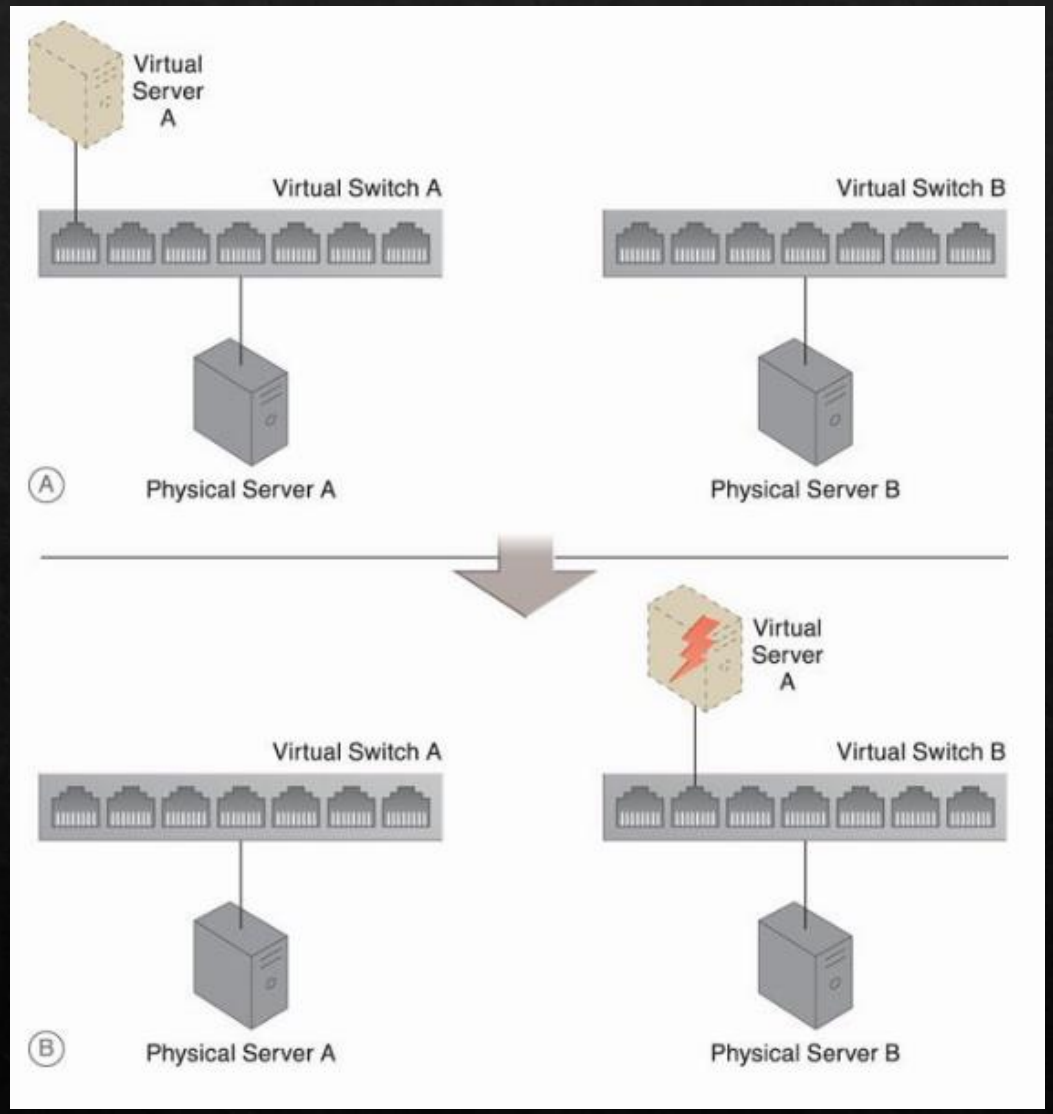

SSD disks
SAS disks
SATA disks
Tier 3 (Disk Group 3)
Tier 2 (Disk Group 2)
Tier 1 (Disk Group 1)
1
2
storage controller


Disk Group 3
Disk Group 2
Disk Group 1
3
5
pay-per-use
monitor
8
LUN migration
automated
scaling
listener
4
cloud service
consumers
7
6
storage management
program


Disk Group 3
Disk Group 2
9
Disk Group 1
$$
$
pay-per-use
monitor

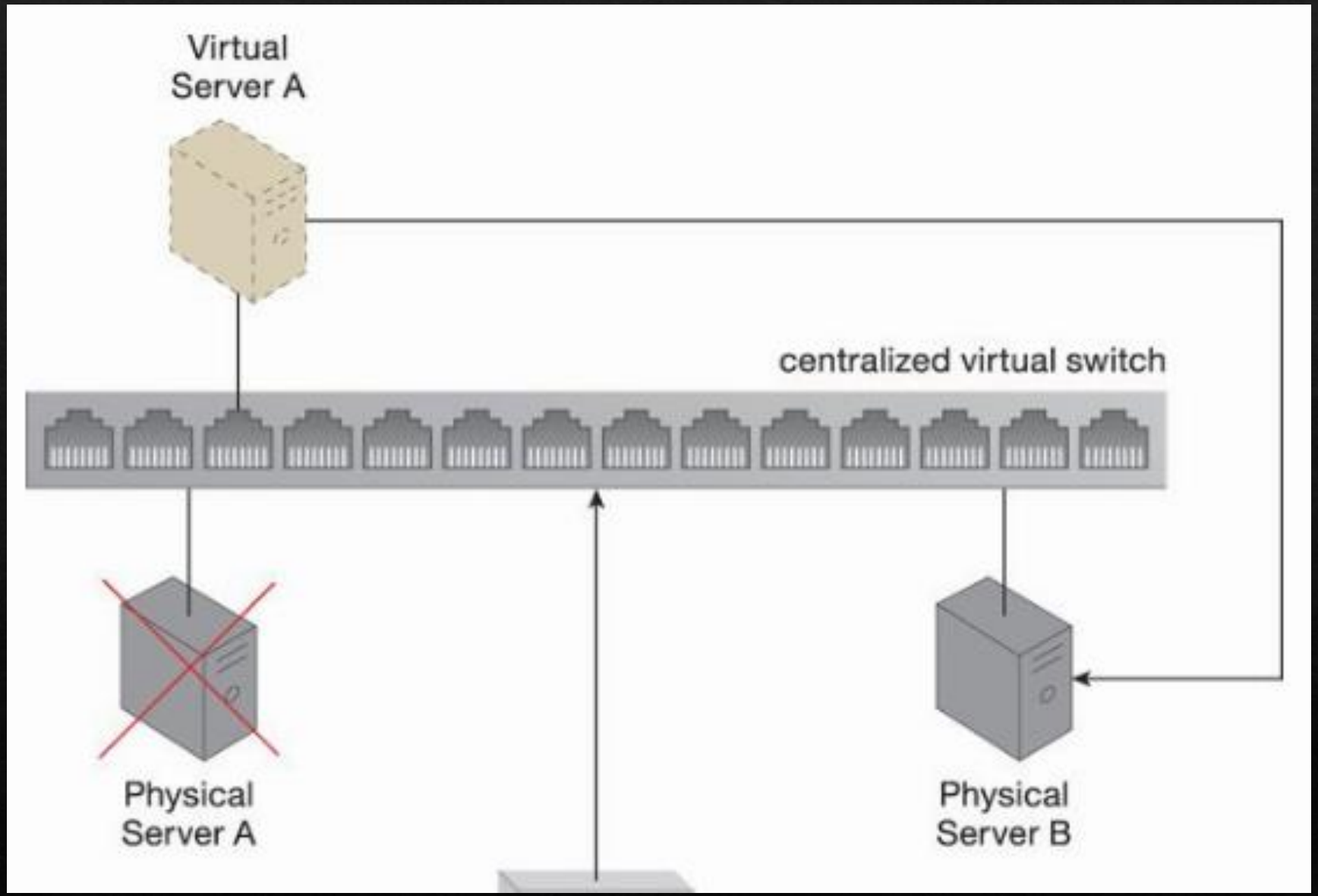
Persistent Virtual Network Configuration Architecture

- Network configurations and port assignments for virtual servers are generated during the creation of the virtual switch on the host physical server and the hypervisor hosting the virtual server.
- These configurations and assignments reside in the virtual server's immediate hosting environment, meaning a virtual server that is moved or migrated to another host will lose network connectivity because destination hosting environments do not have the required port assignments and network configuration information.


Virtual Server A
Virtual Switch A
Virtual Switch B
A
Physical Server A
Physical Server B
Virtual Server A
Virtual Switch A
Virtual Switch B
B
Physical Server A
Physical Server B

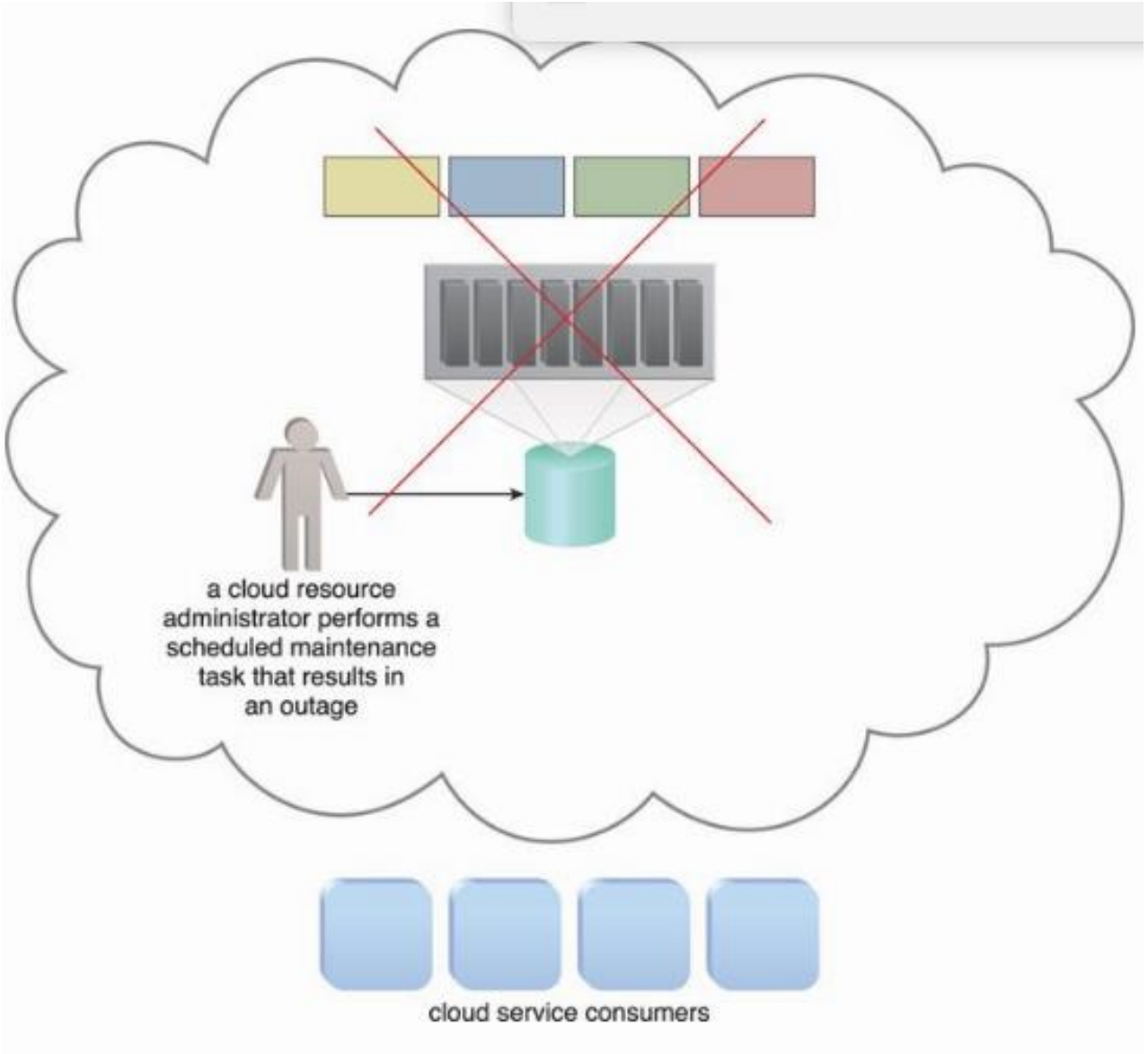
Persistent Virtual Network Configuration Architecture (2)

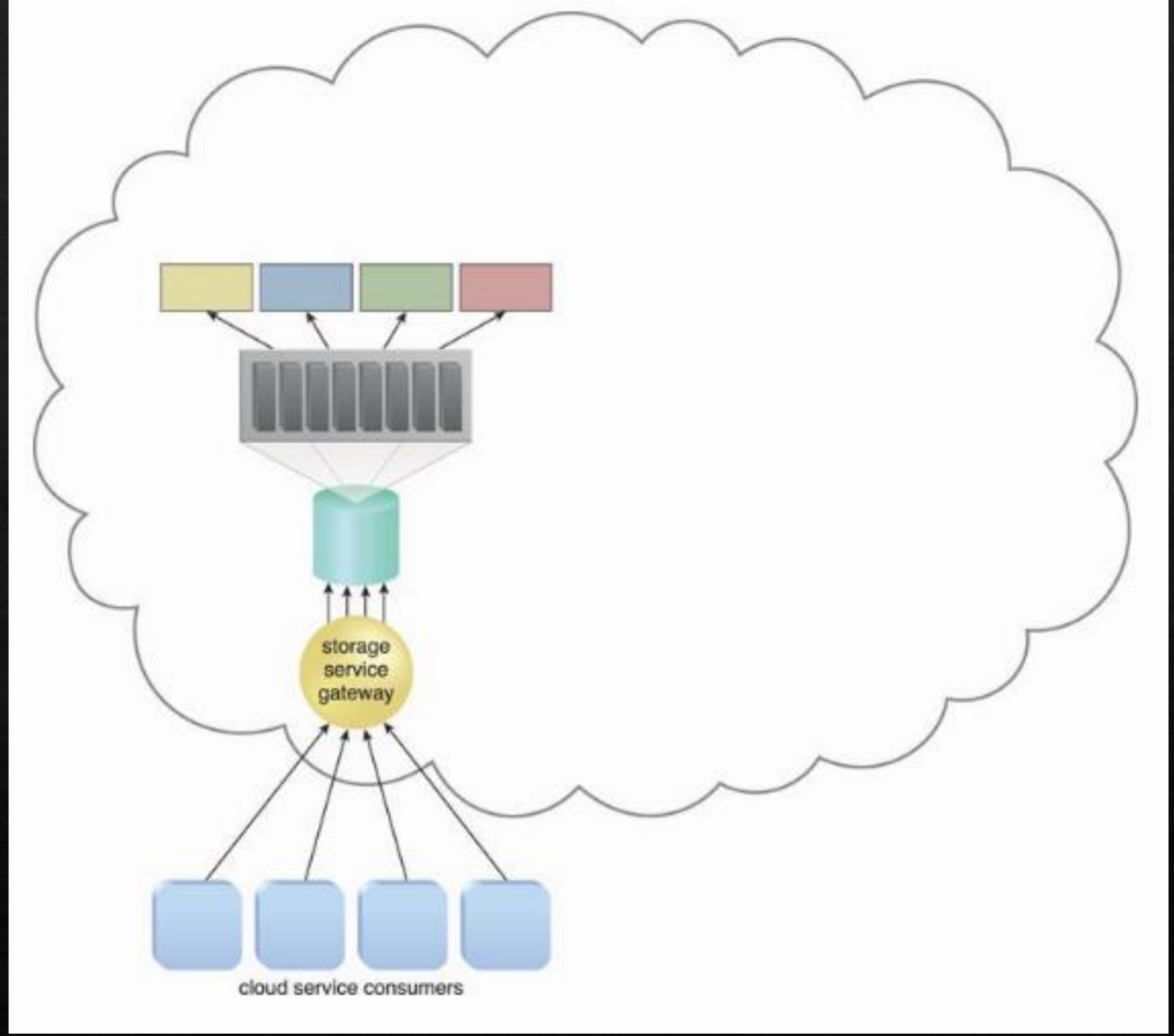
- In this architecture, network configuration information is stored in a centralized location and replicated to physical server hosts. This allows the destination host to access the configuration information when a virtual server is moved from one host to another.
- The system established with this architecture includes a centralized virtual switch, VIM, and configuration replication technology. The centralized virtual switch is shared by physical servers and configured via the VIM, which initiates replication of the configuration settings to the physical servers.

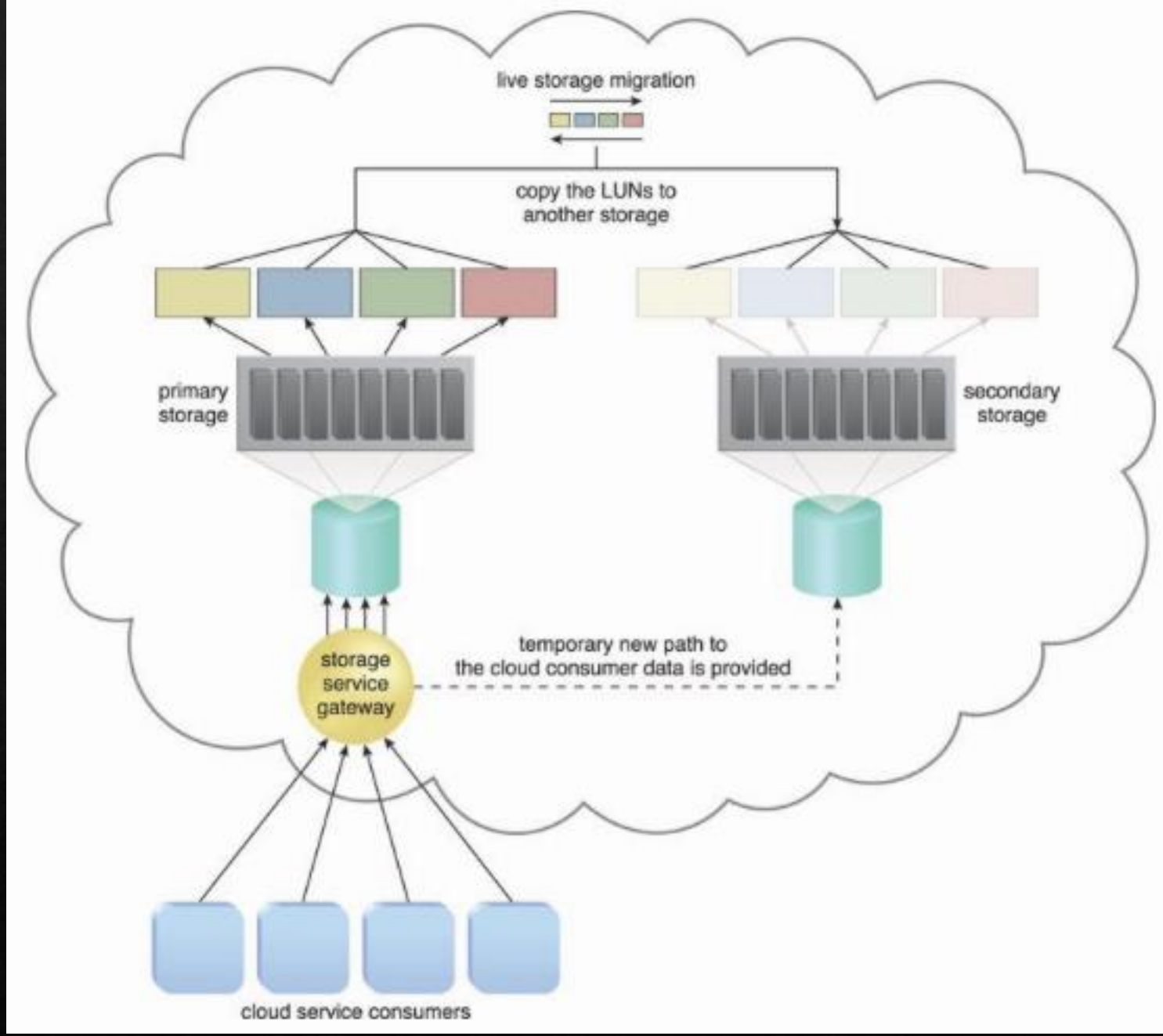

Virtual
Server A
centralized virtual switch
Physical
Server A
Physical
Server B

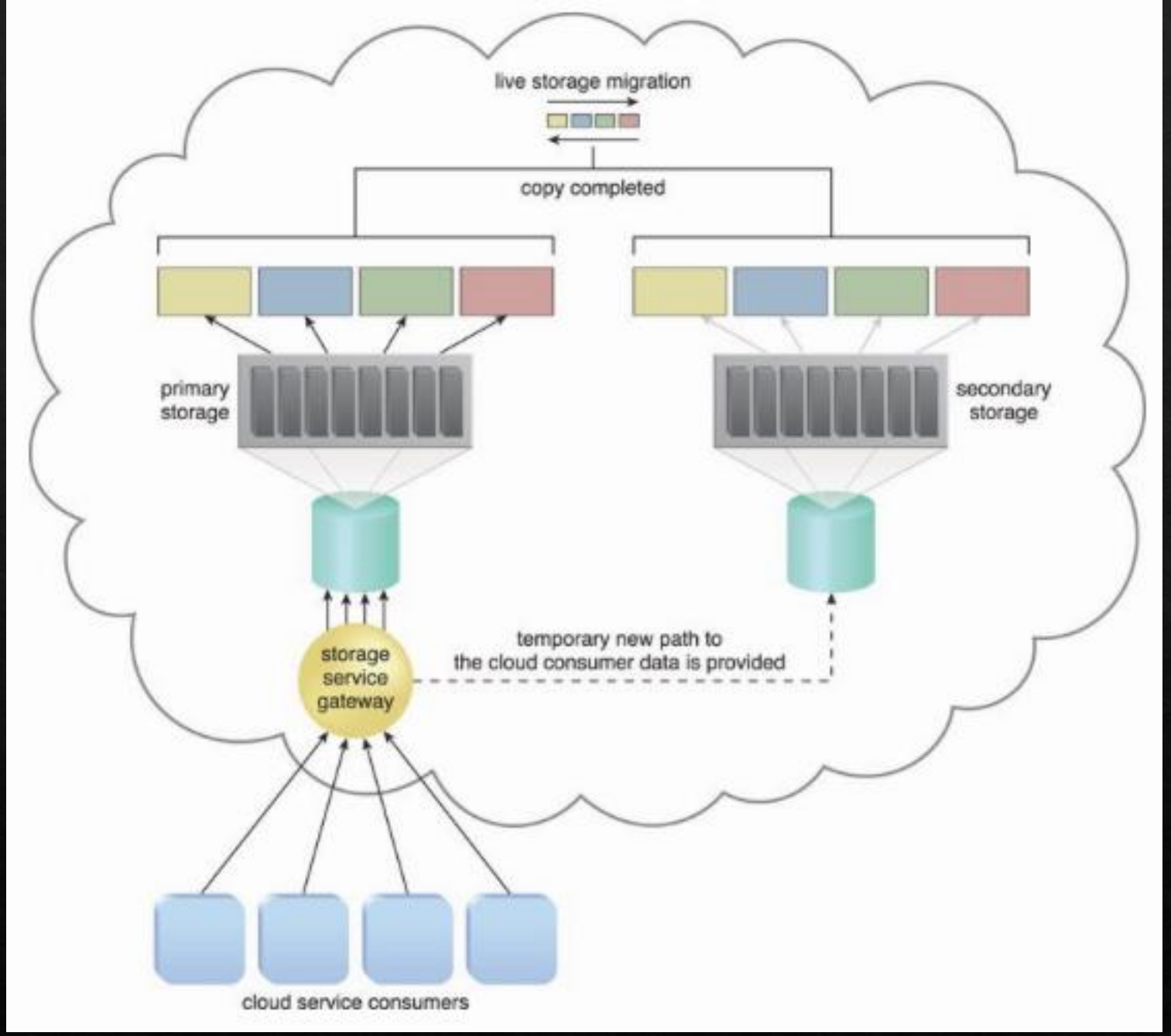
Storage Maintenance Window Architecture

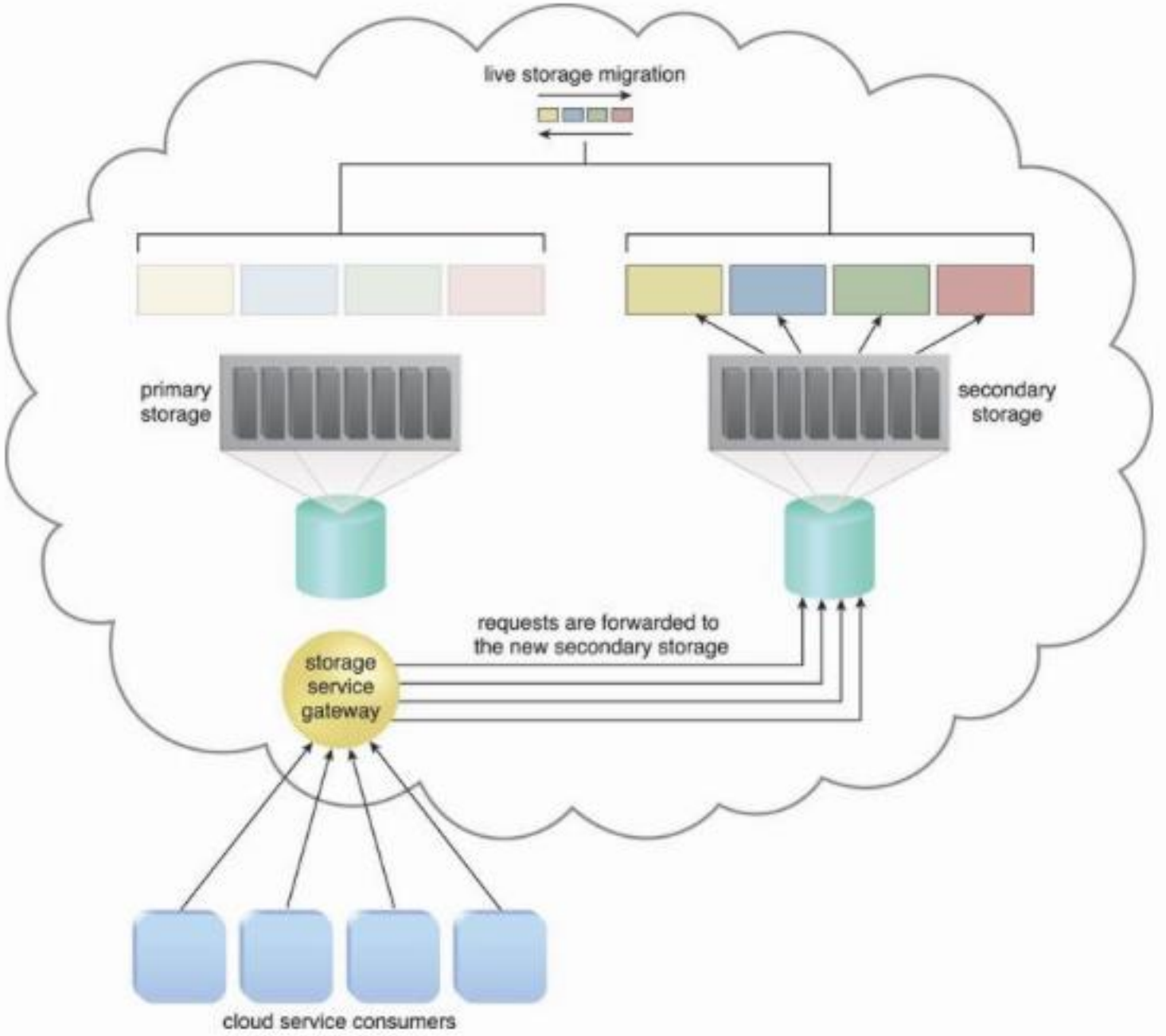
- Cloud storage devices that are subject to maintenance and administrative tasks sometimes need to be temporarily shut down, meaning cloud service consumers and IT resources consequently lose access to these devices and their stored data.
- The storage maintenance window architecture enables cloud service consumers to be automatically and transparently redirected to the secondary cloud storage device, without becoming aware that their primary storage device has been taken offline.

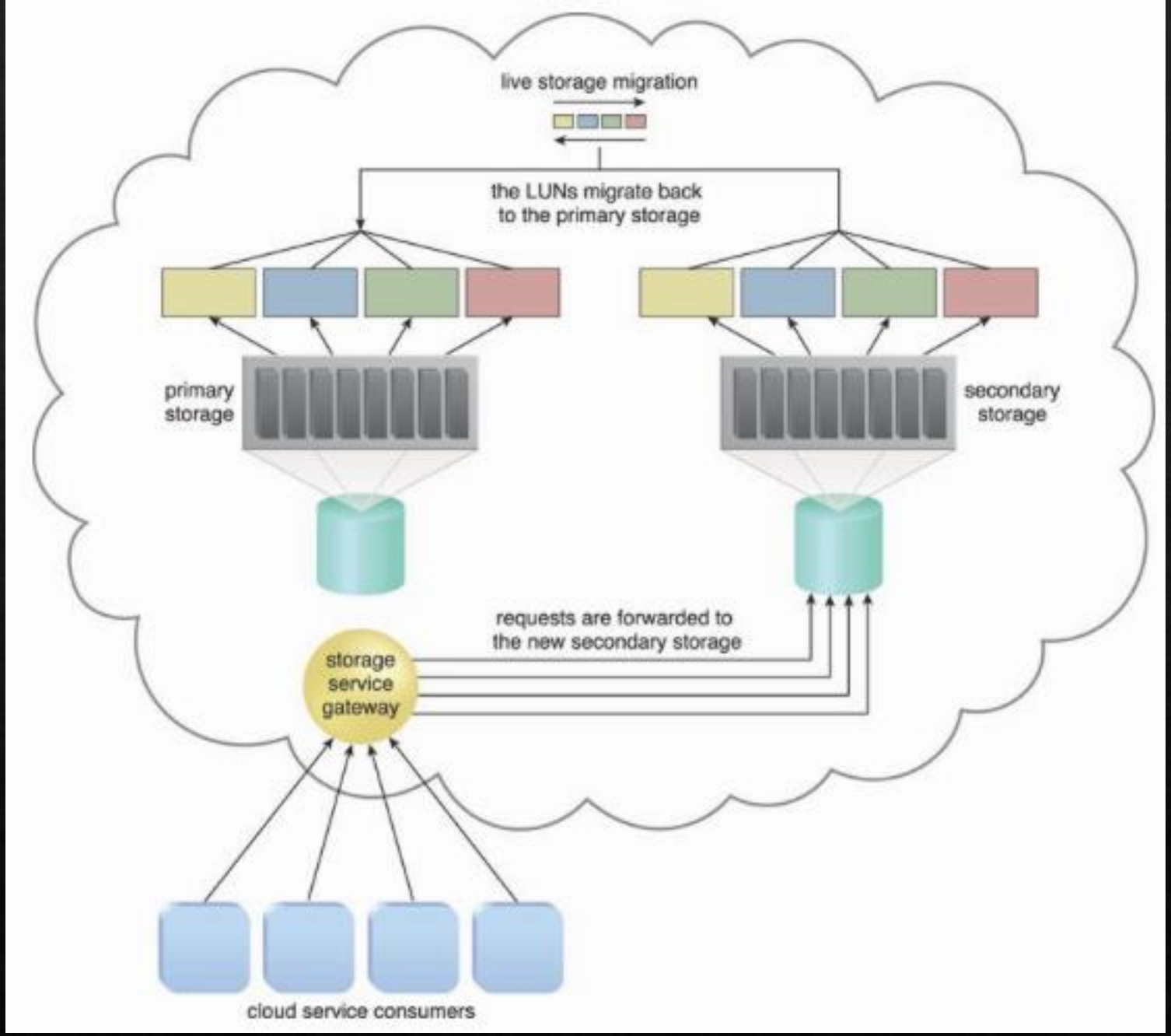


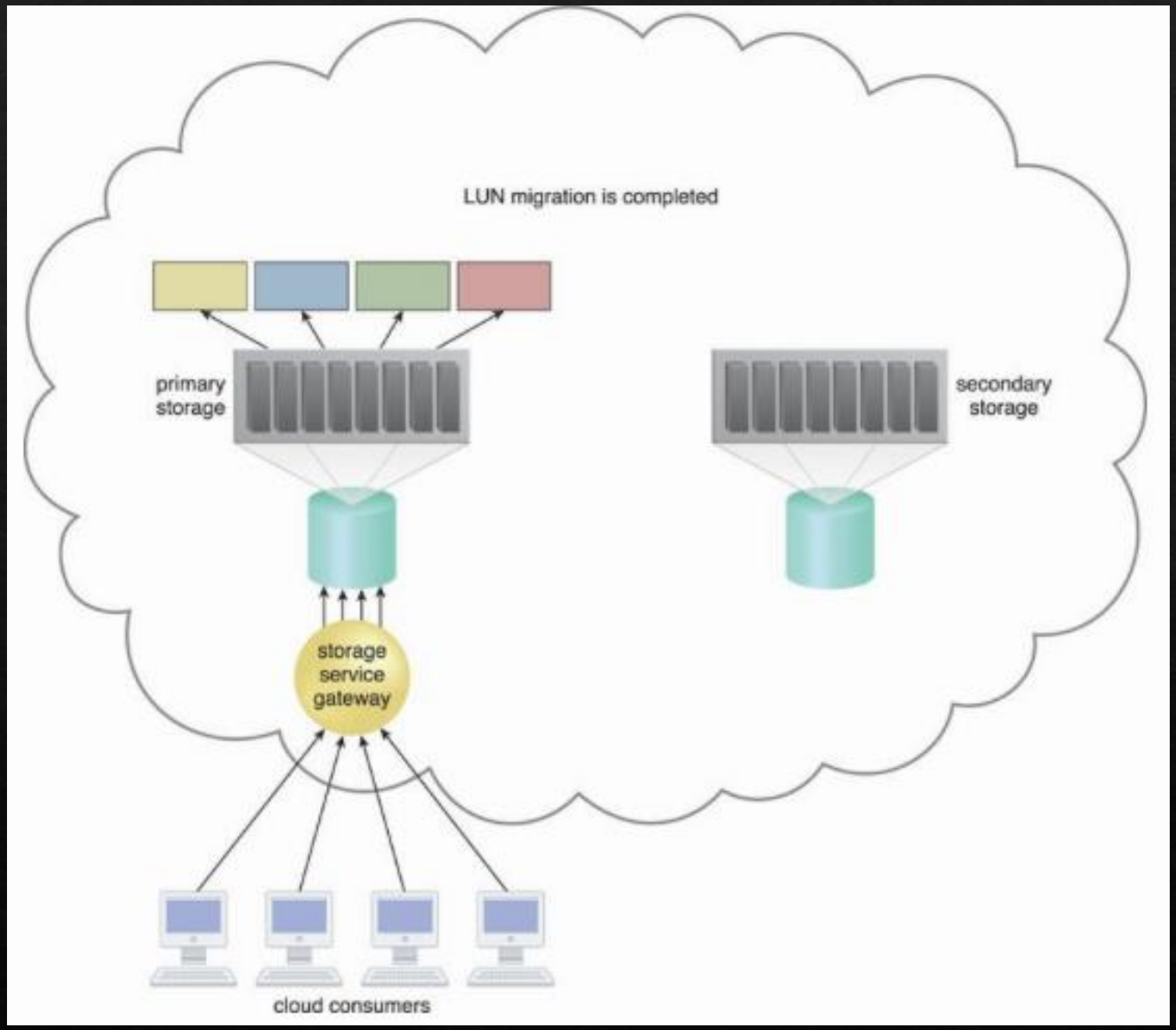

storage
service
gateway
cloud service consumers


live storage migration
copy the LUNs to another storage
primary storage
secondary storage
storage service gateway
temporary new path to the cloud consumer data is provided
cloud service consumers


live storage migration
copy completed
primary storage
secondary storage
storage service gateway
temporary new path to the cloud consumer data is provided
cloud service consumers


live storage migration
primary storage
secondary storage
requests are forwarded to the new secondary storage
storage service gateway
cloud service consumers


live storage migration
the LUNs migrate back
to the primary storage
primary
storage
secondary
storage
requests are forwarded to
the new secondary storage
storage
service
gateway
cloud service consumers


LUN migration is completed
primary storage
secondary storage
storage service gateway
cloud consumers