PART1:

9.9

A

Disk access requests may arrive at any time, and thus those requests far from the disk arm might be never serviced.

B

A timer is also associated with the request. Whenever the time reaches certain limit, he request will be reintroduced in front of queue.

C

To avoid long response time so that the user felt he is the only one using it.

D

During a page fault, the OS needs to load the page from disk to memory asap.

System initiated I/O take precedence over user initiated I/O.

I/O requests for real-time processes should have higher priority.

9.11

FCFS: 2150, 2069, 1212, 2296, 2800, 544, 1618, 356, 1523, 4965, 3681

SSTF: 2150, 2069, 2296, 2800, 3681, 4965, 1618, 1523, 1212, 554, 356

SCAN: 2150, 2296, 2800, 3681, 4965, 2069, 1618, 1523, 1212, 544, 356

PART2:

1

Type 1 hypervisor: In bare-metal virtualization, the hypervisor runs directly on the host’s hardware. Multiple guest operating systems could then run on top of this hypervisor. Type 1 hypervisors are typically more efficient because they have direct access to the underlying hardware and can deliver superior performance as compared to their Type 2 counterparts.

Type 2 hypervisor:  In hosted virtualization, the hypervisor runs as an application on the host operating system. Then multiple guest operating systems could run as VMs on top of this hypervisor. Type 2 hypervisors support a wider range of platforms and I/O devices, because they run on top of a standard operating system such as Microsoft Windows or Red Hat Linux. Therefore, Type 2 hypervisors have been popular in clients such as PC/laptops/tablets, where support for a wide variety of I/O devices is an important factor.

2

Certain x86 instructions cannot effectively be virtualized, and the difficulty in trapping and translating these sensitive and privileged instruction requests at runtime was a significant challenge for x86 architecture virtualization, full-virtualization (using binary translation) and para-virtualization to resolve this challenge. Hardware-assisted virtualization, which enables efficient full virtualization using help from hardware capabilities, primarily from the host processors. Here an unmodified guest operating system executes in complete isolation. With hardware-assisted virtualization, the hypervisor can efficiently virtualize the entire x86 instruction set by handling those sensitive and difficult-to-virtualize instructions using a classic trap-and-emulate model in hardware, as opposed to software.

3

**Server consolidation:** Applications running on servers typically use less than 20 percent of the available capacity. Server virtualization allows multiple VMs to run on the same physical server, thus increasing the utilization of the servers. This results in fewer physical servers in the data center, with correspondingly lower maintenance costs.

**Reduced carbon footprint:** With server virtualization reducing the number of physical boxes needed, a data center with a smaller space can suffice. This results in reduced electricity and cooling costs and a greener data center.

**Automation and agility:** Server virtualization enables the creation, modification and de-allocation of a variety of operating system environments, rapidly and with ease. This allows IT to respond with agility to the needs of the business. Adding new capacity is as simple as starting up a few VMs, which can take minutes instead of hours and days. Other IT tasks such as workload balancing and failure recovery become relatively easier to automate as well.

**Business continuity:** In post-disaster scenarios, the task of restoring systems and migrating applications to the new environment is expedited by server virtualization. This enables the business to rapidly return back to normalcy.

**Multi-operating system testing:** Server virtualization speeds up engineering processes, including development and test, because it makes it easier to create different operating system environments. Virtualization allows developers to test and to compare application feature and application performance across different operating environments.

4

On one hand, network virtualization includes logically segmenting a physical network into multiple virtual networks; on the other hand, it also includes consolidating multiple physical networks into one virtual network! We would be dealing only with virtual network services and can therefore expect virtualization related benefits such as increased agility and flexibility, improved network resource utilization, and reduced capital and operating costs.