

CC Week 5

QUESTION 1:

_____ is a formal contract between a Service Provider (SP) and a Service Consumer (SC).


- A. SLO
- B. SLA
- C. KPI
- D. Utility Premium


Correct Option: B

Detailed Answer: SLA (Service Level Agreement) is a formal contract between a Service Provider (SP) and a Service Consumer (SC) in slide 2 of SLA. So the correct option is B.

QUESTION 2:

 **Statement 1:** SLA contains SLO.

Statement 2: Multiple KPIs are aggregated to SLA.  

- A.  Statement 1 is TRUE and Statement 2 is FALSE
- B. Statement 2 is TRUE and Statement 1 is FALSE
- C. Both statements are TRUE
- D. Both statements are FALSE

Correct Answer: A

Detailed Solution: SLA contains SLO. Multiple KPIs are aggregated to SLO. So statement 1 is correct and statement 2 is incorrect.

QUESTION 3:

If demand is flat, the penalty will be linear.

A. TRUE

B. FALSE

Correct Answer: B

Detailed Solution: If demand is flat, the penalty will be zero.

VM Management

- Monitor Cloud usage and load.
- When **load** decreases:
 - Live migrate VMs to more utilized nodes.
 - Shutdown unused nodes.
- When **load** increases:
 - Use WOL to start up waiting nodes.
 - Schedule new VMs to new nodes.

QUESTION 4:

What is/are the correct statement(s) regarding VM load management?

- ☒ A. When load increases, new VMs should be scheduled to new nodes.
- ☒ B. When load decreases, use WOL to start up waiting nodes.
- ☒ C. When load increases, use WOL to start up waiting nodes.
- ☒ D. When load decreases, live migrate VMs to more utilized nodes.

Correct Option: A, C, D

Detailed Answer: When load decreases, VMs should be live migrated to more utilized nodes. When load increases, WOL should be used to start up waiting nodes and new VMs should be scheduled to new nodes.

QUESTION 5:

A company XYZ needs to support a spike in demand when it becomes popular followed potentially by a reduction once some of the visitors turn away. The company has two options to satisfy the requirements which are given in the following table:

Expenditure	In-house server (INR)	Cloud server (INR)
Purchase cost	1,80,000	—
Cost/hour (over three-year span)	—	32
Efficiency	60%	80%
Power and cooling (cost/hour)	25	—
Management cost (cost/hour)	10	2

Select the correct statement(s) regarding the value(s) of (total-cost/effective-hour) for both the options.

- A. Total-cost / Effective-hour for in-house server is 81.42 INR over three years.
- B. Total-cost / Effective-hour for cloud server is 42 INR.
- C. Total-cost / Effective-hour for in-house server is 46.42 INR over three years.
- D. Total-cost / Effective-hour for cloud server is 40 INR.

Correct Answer: B, C

Detailed Solution: For in-house server:

Cost/hour = $1,80,000 / (3 \times 365 \times 24) = 6.849$ INR (Time is given as a three year span.)

Cost/Effective-hour = Cost/hour * (1/efficiency) = $6.849 \times (100/60) \sim 11.42$ INR

Total cost/Effective-hour = $11.42 + 25 + 10 = 46.42$ INR

Power and cooling and management cost should not be multiplied with efficiency.

For cloud server:

Cost/hour = 32 INR

Cost/Effective-hour = Cost/hour * (1/efficiency) = $32 * (100/80) = 40$ INR

Total cost/Effective-hour = $40 + 2 = 42$ INR.

QUESTION 6:

A third-party application runs in the cloud for 12 hours/day. At the end of one month [30 days], it was found that the cloud service suffered 5 outages of durations: 1 hour 30 minutes, 30 minutes, 2 hours 15 minutes, 1 hour 45 minutes and T hours, each on different days over the service period. Suppose a cloud guarantees service availability for 97% of time. What are the possible value(s) of T that SLA negotiation gets honored in terms of service availability?

- A. 3 hours
- B. 6 hours
- C. 12 hours
- D. 8 hours

$$\text{uptime} = \frac{\text{downtime}}{1 - \text{availability}}$$

Correct Option: A

Explanation: Total Outage: (6+T) hours, application runs for 360 hours in a month. Availability = $1 - (\text{downtime}/\text{uptime})$. For availability: $[1 - \{(6+T)/(360-T)\}] \geq 0.97$, $T \leq 4.48$. Option A is correct.

Resource Management - Objectives

- Scalability
- Quality of service
- Optimal utility
- Reduced overheads
- Improved throughput
- Reduced latency
- Specialized environment
- Cost effectiveness
- Simplified interface

QUESTION 7:

Which of the following is/are objective(s) of Resource Management?

- A. Increased latency
- B. Scalability
- C. Improved throughput
- D. Improved security

Correct Option: B, C

Which of the following is/are resource allocation approaches in resource management?

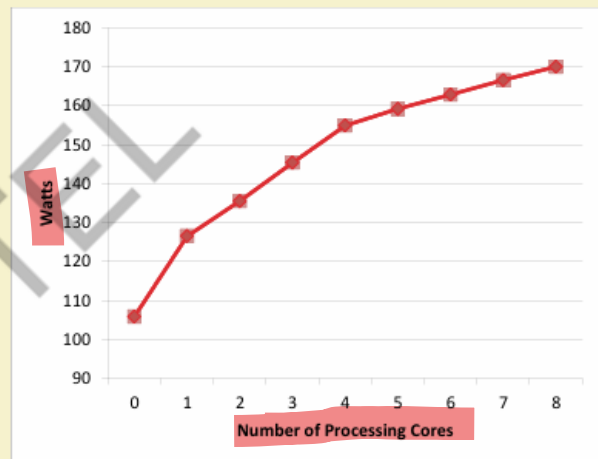
- ☒ A. Energy-aware resource allocation
- B. Reinforcement learning guided control policy
- C. Network queueing model
- ☒ D. Intelligent multi-agent model

Correct Answer: A, D

Detailed Solution: Energy-aware resource allocation and intelligent multi-agent model are resource allocation approaches. Network queueing model is a resource provisioning approach and reinforcement learning guided control policy is a resource adaptation approach..

VM scheduling on Multi-core Systems

- There is a nonlinear relationship between the number of processes used and power consumption
- We can schedule VMs to take advantage of this relationship in order to conserve power



Power consumption curve on an Intel Core i7 920 Server

QUESTION 10:

In computing, there is a nonlinear relationship between the number of processing cores used and power consumption

A. TRUE

B. FALSE

Correct Option: A

Detailed Answer: Refer to slide 10 of resource management-I.

QUESTION 1:

Multiple KPIs are aggregated to SLA.

A. TRUE

B. FALSE

Correct Option: B

Detailed Answer: KPIs are aggregated to SLO.

QUESTION 2:

Statement I: In resource management, resource allocation is the allocation of a service provider's resources to a customer

Statement II: Resource mapping is correspondence between resources required by the users and resources available with the provider.

Which of the options is/are correct?

- A. Statement I is TRUE and Statement II is FALSE
- B. Statement I is FALSE and Statement II is TRUE
- C. Both statements are TRUE
- D. Both statements are FALSE

Correct Option: B

Detailed Answer: Refer slide 10 in Resource Management - II. In resource management, resource allocation is the distribution of resources economically among competing groups of people or programs. Statement II is true. Hence, option B is correct.

QUESTION 4:

In a MapReduce framework, the HDFS block size is 64 Mb. We have 3 files of size 65 Kb, 64 Mb and 128 Mb. How many blocks will be created by the Hadoop framework?

- A. 2
- B. 3
- C. 4
- D. 5

Correct Option: C

Detailed Answer: For 65 Kb and 64 Mb, 1 block is created. For 128 Mb, 2 blocks are created.

QUESTION 6:

Which of the following is/are the objective(s) of Resource Management?

- ☒ A Improved Quality of Service (QoS)
- ☒ B Scalability
- ☒ C Increased overhead
- ☒ D Increased throughput

Correct Option: A, B, D

Detailed Answer: From definition of resource management. Reduced overhead is an objective.

QUESTION 7:

In computing, Performance/Watt follows Moore's law

A. TRUE

B. FALSE

Correct Option: B

Detailed Answer: In computing, Performance/Watt does not follow Moore's law. Refer slide 7 of Resource Management-I.

Green Computing ?

- Advanced scheduling schemas to reduce energy consumption.
 - Power aware
 - Thermal aware
- Performance/Watt is not following Moore's law.
- Data center designs to reduce Power Usage Effectiveness.
 - Cooling systems
 - Rack design

QUESTION 8:

Which of the following part(s) of the MapReduce is responsible for processing one or more chunks of data and producing the output results?

A. Mapper

B. Reducer

C. Map task

D. Task execution

Correct Option: C

Detailed Answer: Map Task is responsible for processing one or more chunks of data and producing the output results.

QUESTION 9:

Consider that the peak computing demand for an organization is 200 units. The demand as a function of time can be expressed as $D(t) = 3(1+t)$. Baseline (owned) unit cost is 120 and cloud unit cost is 125.

Cloud is costlier than owning for a period of 150 time units.

- A. TRUE
- B. FALSE

Correct Option: A

Detailed Answer: Total baseline cost $B_T = P \times B \times T = 200 \times 120 \times 150 = 36,00,000$ units.

Total cloud cost $C_T = \int_0^T C * D(t) dt = \int_0^{150} 125 * 3(1 + t) dt = 375 * \left[t + \frac{t^2}{2} \right]_0^{150} = 375 * 150 * 76 = 42,75,000$ units.

Utility function $U_T = (C_T/B_T) = (4275000/3600000) = 1.19 > 1$. Therefore, cloud is costlier than owning.

For owning:

Total baseline cost = Peak computing demand \times Baseline unit cost \times Time period

$$P \times B \times T = 200 \times 120 \times 150$$

For the cloud:

Total cloud cost = Integral of Cloud unit cost over the time period

$$C_T = \int_0^{150} (125 \times (3(1 + t))) dt$$

Now, let's calculate these values:

1. Total baseline cost:

$$P \times B \times T = 200 \times 120 \times 150 = 3,600,000$$

2. Total cloud cost:

$$C_T = \int_0^{150} (125 \times (3(1 + t))) dt$$

$$C_T = \int_0^{150} (375 + 125t) dt$$

$$C_T = [375t + \frac{125}{2}t^2]_0^{150}$$

$$C_T = [(375 \times 150) + \frac{125}{2} \times (150)^2] - 0$$

$$C_T = (56250 + 1406250)$$

$$C_T = 1462500$$

Now, let's compare the costs:

Baseline cost = \$3,600,000

Cloud cost = \$1,462,500

$$\text{Utility function} = \frac{\text{Cloud cost}}{\text{Baseline cost}} = \frac{1462500}{3600000} \approx 1.19$$

Since the utility function value is greater than 1, it means the cloud is costlier than owning. Hence, the statement is TRUE (Option A).



QUESTION 10:

Which of the following is/are resource provisioning approaches?

- A. Intelligent multi-agent model
- B. Network queueing model
- C. Adaptive resource provisioning
- D. Reinforcement learning guided control policy

Correct Option: B, C

Detailed Answer: Network queueing model and adaptive resource provisioning are resource provisioning approaches. The Intelligent multi-agent model is a resource allocation approach. Reinforcement learning guided control policy is a resource adaptation approach.

Resource Management

Type	
Resource provisioning	Allocation of a service
Resource allocation	Distribution of resour
Resource adaptation	Ability or capacity of
Resource mapping	Correspondence betw
Resource modeling	Resource modeling is participating in the ne Attributes of resourc Resource modeling h
Resource estimation	A close guess of the s
Resource discovery and selection	Identification of list
Resource brokering	It is the negotiation o time to complete the
Resource scheduling	A resource schedule i planned during these (1) duration, (2) pre

Resource Provisioning

Approach	
Nash equilibrium approach using Game theory	Run time distributed resource allocation to achieve successful completion of tasks
Network queuing model	Presented a queueing model for resource allocation in cloud computing environment. It is sufficient to handle the idiosyncrasy of the cloud environment
Prototype provisioning	Employed a prototype to provision the server resources
Resource (VM) provisioning	Uses virtual machines (VMs) and (SEDF) to provision resources. The shared resources are used to provision the VMs
Adaptive resource provisioning	Automatically adjusts the cloud resources while running the application
SLA oriented methods	Handling the SLA oriented provisioning of resources
Dynamic and automated framework	A dynamic and automated framework for resource provisioning
Optimal cloud resource provisioning (OCRP)	The de facto standard for resource provisioning in cloud computing

Resource Allocation

Approach	
Market-oriented resource allocation	Considers the supply and demand of resources, particularly, the market-based control (MBC) approach.
Intelligent multi-agent model	An intelligent multi-agent model for resource allocation.
Energy-Aware Resource allocation	Resource allocation based on the shortest path algorithm.
Measurement based analysis on performance	Focuses on the performance of the system throughput and concurrent execution.
Dynamic resource allocation method	Dynamic resource allocation method for one or more resources.
Real time resource allocation mechanism	Designed for real-time operational resource allocation and migrating of resources.
Dynamic scheduling and consolidation mechanism	Presents the ability to dynamically schedule and consolidate cloud resources.

Resource Mapping Approaches

Approach	
Symmetric mapping pattern	Symmetric mapping pattern providers match and engage place supplied resource con
Load-aware mapping	Explores how to simplify VM caching/reusing. Load-Awar
Minimum congestion mapping	Framework for solving a na online approximation algorith
Iterated local search based request partitioning	Request partitioning approa requests among eligible Clo
SOA API	Designed to accept different
Impatient task mapping	Batch mapping via genetic a
Distributed ensembles of virtual appliances (DEVAs)	Requirements are inferred b used to obtain approximate
Mapping a virtual network onto a substrate network	An effective method (using l computed virtual networks : traffic constraints.

Resource Adaptation Ap

Approach	
Reinforcement learning guided control policy	A multi-input learning to ad
Web-service based prototype	A web-service under differer
OnTimeMeasure service	Presents an ap dynamic reso delivering sati
Virtual networks	Proposes virtu and facilitatin services
DNS-based Load Balancing	Proposes a sy containers), b
Hybrid approach	Proposes a mo multi-tier app technique tha

QUESTION 3:

In MapReduce model __ make remote procedure call requests to the ____ to fetch the files.

- a. Mappers, Reducers
- b. Reducers, Mappers
- c. Master, Reducers
- d. Master, Mappers

Correct Answer: b

Detailed Solution: In MapReduce model reducers make remote procedure call requests to the mappers to fetch the files.

QUESTION 4:

Suppose a cloud guarantees service availability for 97% of time. Let a third party application runs in the cloud for 10 hours/day. At the end of one month, it was found that total outage is 8 hrs.

- SLA has violated the initial availability guarantee.
- SLA has NOT violated the initial availability guarantee
- Cannot be determined

Correct Answer: b

Detailed Solution:

Total time guaranteed = $10 * 30 = 300$ hrs

Outage time = 8hrs

Therefore, service duration = $300 - 8 = 292$

% availability = $1 - 8/292 = 97.26\%$

Final service availability > Initial service guarantee, therefore option b is correct

QUESTION 2:

If demand is exponential ($D(t)=e^t$), any fixed provisioning interval (t_p) according to the current demands will fall linearly behind.

A. TRUE

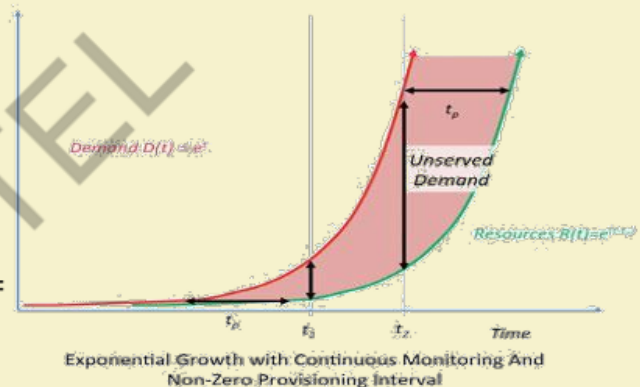
B. FALSE

Correct Option: B

Detailed Answer: If demand is exponential ($D(t)=e^t$), any fixed provisioning interval (t_p) according to the current demands will fall exponentially behind.

Penalty Costs for Exponential Demand

- Penalty cost $\propto \int |D(t) - R(t)| dt$
- If demand is exponential ($D(t)=e^t$), any fixed provisioning interval (t_p) according to the current demands will fall exponentially behind
- $R(t) = e^{t-t_p}$
- $D(t) - R(t) = e^t - e^{t-t_p} = e^t(1 - e^{-t_p}) = k_1 e^t$
- Penalty cost $\propto c.k_1 e^t$



Sl No	Question
1	<p>Which of the following indicates that cloud is cheaper than owning of computer infrastructures? Where U is Utility Premium, P is Peak Demand, and A is Average Demand</p> <p>(a) $U > (P/A)$ (b) $U < (P/A)$ (c) $U > (A/P)$ (d) $U < (A/P)$</p> <p>Ans: b</p>
2	Which of the following part of the MapReduce is responsible for processing one or more chunks of data
3	<p>Which of the following function is responsible for consolidating the results produced by each of the Map() functions/tasks?</p> <p>a) Map b) Reducer c) Reduce d) None of the above</p> <p>Ans: c</p>
4	<p>Which of the following is/are TRUE for Map phase?</p> <p>(a) Files are sorted by a key and stored to the local file system (b) Each mapper writes computation results in one file per reducer (c) Each mapper reads approximately 1/M of the input from the global file system (d) None of the above</p> <p>Ans: a,b,c</p>
5	<p>Which of the following way(s) help(s) to save energy in computing?</p> <p>(a) Reduced boot times (b) Increase time to perform live-migration (c) Reduce image size (d) All of the above.</p> <p>Ans: a,c</p>
7	<p>Which of the following is/are aspect(s) of Resource Management?</p> <p>(a) Resource allocation (b) Resource provisioning (c) Resource discovery (d) Resource modeling</p> <p>Ans: a,b,c,d</p>
8	<p>Challenges of resource management is/are</p> <p>(a) Memory (b) Storage (c) Workstations (d) None of the above</p> <p>Ans: a,b,c</p>

9 _____ is the negotiation of the resources through an agent to ensure that the necessary resources are available at the right time to complete the objectives.

- (a) Resource estimation
- (b) Resource brokering
- (c) Resource scheduling
- (d) None of the above

Ans: b

10 Performance metrics for resource management are

- (a) Ease of deployment
- (b) QoS
- (c) Delay
- (d) None of these

Ans: a,b,c

2) Which of the following is not a type of virtual private cloud (VPC).

- ☐ Default
- ☐ Auto
- ☐ Custom
- ☒ Regional