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CS-524 A

CS-524A : Introduction to Cloud Computing
Assignment-3

Answer 1

We are given the following information about a token bucket model:-
Token bucket size = b bytes
Token rate = r byte/second
Maximum O/P rate = M byte/second

Therefore the maximum Burst Time T = (M-b)/r seconds

Answer 2

AWS Direct Connect is a networking service provided by Amazon Web Services. It allows users to connect to the AWS Cloud even if they are not connected to the internet. Not only that, but it also has two distinct features: security and low latency, making it perfect for enterprises with large workloads and thus high speed requirements.

a) Pricing of a company availing AWS Direct Connect depends on three components :-

1.Capacity - the maximum rate at which the data is transferred through a connection on a network. This can be in Gbps or Mbps.

2.Port hours- This is not based on usage of a port but on the number of hours a port is provided to the user at the said AWS location. It can further be classified as dedicated or hosted ports. Pricing for both is different. Sitelink hours can also increase the pricing if availed, which can incur a mandatory cost of $0.50 USD.

3.DTO- ‘Data transfer out’ is the total data being sent out of the AWS location to a non AWS location. ‘Data transfer in’ does not cost in any country apart from Japan which has a separate Japanese consumption tax. Sitelink Data transfer rates may also be applied. This would be $0.0900/hour for Osaka, Japan.

Assuming that I own a company with a data center in Sapporo, Japan I would like to avail high speed and security features provided by AWS Direct Connect which is why I will connect to the Asia pacific (Tokyo, Osaka) Direct Connect location in Equinix Inc. Considering the main

branch of the company is in US and there is only 1 data center in Sapporo I will require the following :-

AWS Direct Connect Locations	|	2 Locations
1 port in each location	|	2 Ports
Port type	|	Dedicated
Port Capacity	|	10 Gbps
Port hour rate	|	$2.142/hr
Hours Connected	|	1000 hours

Total pricing = 2*2.142*1000=$4282

QOS guarantees provided by AWS include the following:-

Reliability - Data centers will be equipped with UPS backups in order to retain data.
Power Density- Data centers have robust HVAC systems
Security- Data centers make use of security equipments, technologies in order to maintain surveillance of data.
Recovery - Operation centers and storage spaces are provided in order to maintain data.
High average uptime - an uptime of >99.99999% is provided by the data centers.
Proven expertise
Largest worldwide footprint
More than 1400+ networks

b)
IEEE Standard 802.1q or dot1q is a networking standard that supports VLANs. Virtual LANs are any broadcast domain that are partitioned and networked at Data Link Layer. Consider two VLANs, VLAN1 and VLAN2 which are connected to an ethernet switch. These switches however are not connected and an easy solution without disturbing the physical architecture would be to trunk the switches. Trunking is a term referred to creating a connection between two dot1q compatible devices. This is an example of how dot1q can be used to share a connection.
Public VIFs are virtual interfaces that require access using a public ID, examples of which are SQS and S3 buckets. Private VIFs are virtual interfaces that require access using a private ID such as a VPC (Virtual Private Cloud). By using dot1q we can share a connection between public resources that use a public IP address, such as SQS or S3 bucket and a private resource EC2 and VPC. Even when doing so the difference of environments; public and private is maintained.

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Answer 3

The Amazon Direct Connect Service is a networking solution that allows users to connect to the Amazon Web Services cloud, but it's not just that. Direct Connect can be used to connect offices to data centers, offices to VPCs, and a variety of additional connections. A direct connect gateway is required to establish a connection to a VPC which can be for VPCs in different AWS regions or in the same region. It uses dot1q standard VLANs to connect to VPC using private IP addresses. Because VPC is a private VIF accessible only by the client, it essentially strengthens security. More connections to VPCs can be made for improved availability, which boosts bandwidth throughput and gives the user a better network experience.

An added benefit of using Direct Connect to connect to AWS cloud is that it provides 1Gbps to 10 Gbps data connections which can be dedicated or multiple depending on the user's choice. Furthermore more connections can be made by using sub-1G connections or Link Aggregate Connections. All of which provide higher availability and can be availed by users with high workloads that require faster throughput.

Answer 4

a)
Private NAT (network address translator) gateways provide the option to access the internet outside the VPC at the same time preventing access to outside sources within the VPC. This helps the internal network of the VPC to remain unexposed. The traffic is sent via private gateway without an elastic IP address therefore keeping the network hidden. This is used for connectivity with AWS or AWS User/Partner.
The billing of private NAT is done on the number of hours the gateway is provisioned and the Gbs of data processed. If the link is ended or deleted the charges are not applicable, it is therefore recommended to delete unused private gateways.
I would not recommend the use of NAT with Direct Connect service in case the AWS is not available in the same zone or if the data is significantly high. This is because the charges are per hour and per Gb of data processed.

b)
Each unique destination can accommodate up to 55,000 simultaneous connections using a NAT gateway. Moreover 55000 extra connections can be generated if certain parameters change
Like the destination IP address, destination port, or protocol (TCP/UDP/ICMP) changes.

Answer 5

a)
AWS Direct Connect requires connections to other VPCs in the zone as well as destinations outside of the AWS zone. BGP with an ASN() and an IP prefix is used to leverage AWS Direct Connect with Amazon VPC. When traffic is intended to be delivered to a private VIF, BGP manages the traffic's route preference. It's also utilized for incoming traffic load balancing and route preferencing.

b)
Yes, this can be done. We can use ASN to connect to VPC. In fact, when we connect to a VPC in the same AWS region, we need a virtual private gateway for the VPC. The ASN from the server side (AWS) of the BGP network is an outcome of the virtual private gateway. When we create one virtual private gateway, we can specify our own private ASN.

c)
IP addresses and Autonomous Numbers and Internet Resource Numbers that the RIR manages and distributes. If the data center is located in Sapporo, Japan then the RIR will be APNIC which is the Asia-Pacific Network Coordination Center.

d)
The following are some security concerns with BGP:-

BGP Route Hijacking- If a rogue device offers prefixes for an address, it might cause network mismanagement by changing the rerouting table. If traffic surges on one end, this might cause networks to become congested, leaving data unencrypted.

BGP D-o-S (Denial of Service)- If a malicious device sends a significant amount of data to the user, it might induce a network bottleneck, resulting in resource depletion. As a result, BGP traffic will come to a standstill.

BGP Route Manipulation- A network's routing table must be consistent with the network. This means that every change in the network's design, such as the breaking or reconnecting of links, should be reported. If a malicious device alters the content of the BGP table, the router will fail frequently, consuming all available resources.

Answer 6

If there are two dogs Alpha and Beta, both carrying 3 disks of 7Gb each, covering a distance of 5.5 Km at the speed of 18 Kmph then in one sided trip they will cover the following

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3*7*1000=21000 Mb of data in one side by the two dogs
18/5.5 = 18.3 minutes
Rate of data transfer = 21000/1100 = 19 Mbps

Rate of data transfer of pipes is given to be 150 Mbps. The dogs will not be able to transfer the data at the required rate.

Resources

https://aws.amazon.com/getting-started/hands-on/connect-data-center-to-aws/faq/
https://aws.amazon.com/directconnect/pricing/?nc=sn&loc=3
https://www.nro.net/about/rirs/
https://docs.aws.amazon.com/directconnect/latest/UserGuide/routing-and-bgp.html
https://aws.amazon.com/blogs/networking-and-content-delivery/how-aws-is-helping-to-secure-internet-routing/
https://www.networkcomputing.com/network-security/improving-bgp-security-6-quick-tips
https://securityintelligence.com/bgp-internet-routing-what-are-the-threats/
https://arxiv.org/pdf/0907.4815.pdf