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CS 643, Cloud Computing - Homework 1

1. (4 points) Give an example of a traditional mechanism used to detect failures in distributed systems. Give an example of a traditional mechanism used to improve availability in distributed systems.

Answer: Traditional distributed systems use a heartbeat method to identify faults. As a means of indicating to its peers that it is still alive and well, each node in this system sends out periodic "heartbeat" signals. When one node stops transmitting heartbeats, other nodes can detect a problem and take the necessary action, like initiating a failover to a backup node. This helps to maintain the overall health of the system and detect any issues.

The heartbeat approach is often used to create highly available distributed systems.There are many different multi-level heartbeat protocols available; two examples are bidirectional and multipoint heartbeat protocols. The multi-level heartbeat protocol helps avoid single points of failure, which can result in catastrophic system errors, and enables nodes to join and leave the protocol with extreme ease.

Replication is a well-known method. Achieving high availability can be accomplished by duplicating the data across distinct geographically isolated places. The other datacenters will remain accessible even if one region's datacenter is inaccessible.Replication is keeping several copies of the same information or services across different nodes and data centers.

2. (3 points) Is it ever possible to achieve super-linear speedup in parallel computing? If yes, give an example. If no, explain why not.

Answer: Yes, Let us examine an application that has to retrieve data from the disk in order to run. Since the data is so big, it cannot fit in the RAM. As a result, disk access occurs regularly. Now imagine that the identical software is running across 100 dispersed systems. At this point, all of the data can be uploaded to the RAM. The working set of data is thereby readily accessible in memory, negating the need for access to the disk. We are aware that the main memory's performance is more than twice as good as the disk's. Main memory is therefore substantially faster. The program will run considerably more quickly not just because it runs in parallel but also because it doesn't need to contact the disk to get data.

The same holds true for memory to cache. Even greater performance will result from being able to load all necessary data into the cache rather than the main memory when using distributed systems with 100 systems. Thus, super-linear speedup in parallel computing can be accomplished.

3. (3 points) Compare the Auto Scaling mechanism in Amazon Web Services and Google App Engine.

Answer: A technique used in cloud computing to scale (increase/decrease) resources according to load is called auto-scaling.

Amazon Web Services:

- uses EC2 instances with Auto Scaling Groups (ASG).

- links to a number of services, including CloudWatch and Elastic Load Balancing.

- permits policies for both manual and dynamic scaling depending on metrics.

- offers a variety of instance types and configuration choices.

Google App Engine (GAE):

- offers Platform as a Service (PaaS) with Automatic Scaling.

- easily combines with Google Cloud services.

- adapts instances dynamically according to load and traffic.

- ignores infrastructural specifics in favor of concentrating on code development.