Department Computer Science
VU University

Distributed Systems
11.02.2010

MAKE SURE THAT YOUR HANDWRITING IS READABLE

1a Explain what access transparaency is and give an example of a middleware mechanism that achieves it. *5pt*

1b Give an example in which the *degree* of distribution transparency needs to be traded off against another desirable feature of distributed systems. *5pt*

1c Explain how code migration can help in achieving sclability. *5pt*

2a What is the essential difference between an event-based and a shared data-space architectural style? *5pt*

2b Shared data spaces are difficult to scale across dispersed networks. Why? *5pt*

2c Sketch an implementation of a replicated JavaSpace server. *5pt*

3a Give a general framework for a push-pull anti-entropy information dissemination network. *5pt*

3b Consider an epidemic-based application with N peers in which peer i has a local variable $x_i \geq 0$. When peer i gossips with peer j, $x_i, x_j \leftarrow (x_i + x_j)/2$. Show that, eventually, x_i converges to $\frac{1}{N}\sum_{k=1}^{N} x_k$. *5pt*

3c There are two important assumptions we need to make for convergence in (b) to take place. What are these? *5pt*

4a Explain how iterative name reolution in DNS works and why it may incur high latency costs. *5pt*

4b When resolving name www.distributed-systems.net, DNS will return an address, but not when trying to resolve distributed-systems.net. How can this be? *5pt*

4c Sketch a Chord-based implementation of DNS. What would you see as the main drawback of such an implementation? *5pt*

5a When applying a primary-backup protocol for replicating a service, we may actually experience a *scale down* in performance. Why is this so? *5pt*

5b Consider a quorum-based replication scheme with N servers. Show how inconsistency may be introduced if the write quorum $N_{write} \leq N/2$. *5pt*

5c If the read-write ratio in a quorum-based replication scheme is high, what should the write-quorum N_{write} be? Explain your answer. *5pt*

6a Web applications can be replicated following an edge-server architecture. What does this architecture look like? *5pt*

6b In an edge-server architecture, it is important that a client is always redirected to the same edge server. Why? *5pt*

6c How can a client transparently "discover" its most appropriate edge server? *5pt*

Grading: *The final grade is calculated by accumulating the scores per question (maximum: 90 points), and adding 10 bonus points. The maximum total is therefore 100 points.*