Homework 5

Answer 1

1. Read and Write for both A and B => R = W = 2

|  |  |  |  |
| --- | --- | --- | --- |
| V0 | X | Y | Z |
| A | 300 | 300 | 300 |
| B | 500 | 500 | 500 |

Client has access to X and Y only

read quorum(Nr) = 1+1 = 2 for A and B  
write quorum(Nw) = 1+1 = 2 for B   
  
N = 3,   
Nw + Nr = 4 which is > N(3)  
Nw is greater than N/2.

operation:

client Reads A from X or Y  
client Writes to B at X and Y

|  |  |  |  |
| --- | --- | --- | --- |
| V0 | X | Y | Z |
| A | 300 | 300 | 300 |
| B | 300 | 300 | 500 |

1. Client can access only server Z:   
    read quorum(Nr) = 1 which is <2, so client cannot read B,   
    write quorum(Nw) = 1 which is <2, so client cannot write A,

N = 3,   
Nw + Nr = 2 which is less than N(3)  
Nw is not greater than N/2.  
  
therefore neither operation takes place.

1. since in (a) the client had access only to X and Y so Z could be out of sync

|  |  |  |  |
| --- | --- | --- | --- |
| V1 | X | Y | Z (V0) |
| A | 300 | 300 | 300 |
| B | 300 | 300 | 500 |

Now, the client has access to X and Z and since Z is out of sync, Z will get the latest values of A and B from X

|  |  |  |  |
| --- | --- | --- | --- |
| V1 | X | Y | Z (V1) |
| A | 300 | 300 | 300 |
| B | 300 | 300 | 300 |

read quorum(Nr) = 1+1 = 2 for B  
N = 3,   
Nw + Nr = 4 which is > N(3)   
operation:

client Reads B from X or Z

Answer 2

The ACMS acceptance algorithm consists of 2 phases **Replication** and **Agreement**. The **quorum protocol** plays a key role in replication where when a storage point(SP) receives a submission update from a publisher it tries to send the file to as many SPs and when the majority of the SPs acknowledge the request, it establishes a quorum that majority of the storage points are aware of the update and then the **agreement** phase is initiated where the storage point that received the submission update sends a vector message (Vector Exchange [VE]).

Vector Exchange (VE) is a bit vector with a bit corresponding to the quorum (majority of the Storage Points) and a 1-bit indicates that the corresponding Storage Point knows of a given update. Just like vector timestamp, when a node/SP initiates VE it sets its bit vector to 1 and other bits to 0 and broadcasts it and any SP that sees the VE, it sets its own bit vector to 1 and re-broadcasts the modified VE. When a majority of the bits are set to 1, we say that an agreement is established, and it is safe for any SP (that sees the majority of the bits set) to upload this latest update i.e. once the agreement is established (majority of the bit vectors are 1 (quorum)), the SP copies the file to a permanent location on its HTTP server where it is available for download.

Note - Each storage point saves its VE so that it is not lost due to network failure/restart.