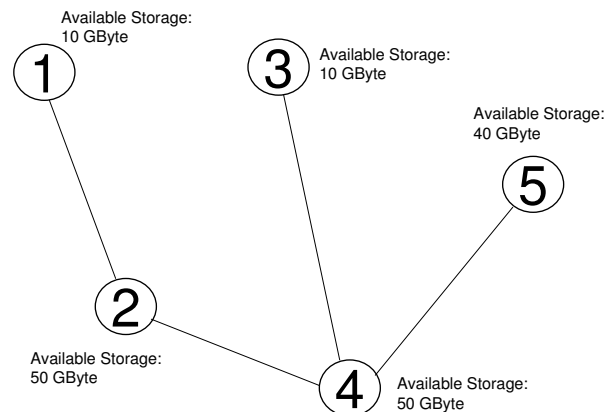


Exercise 6 - Allocation and Replication

The following network topology of nodes in a distributed database system (with according storage resources) is given:



A relation *Customers* is fragmented (horizontally) according to the access characteristics on the different nodes to 3 fragments $Customers_1$ (10 GByte), $Customers_2$ (50 GByte), and $Customers_3$ (40 GByte). Applications on the nodes perform the following number of point queries (PQ), range queries (RQ), and updates (UPD) per minute:

- Node 1: 10 PQ on $Customers_1$, 1 UPD on $Customers_1$
- Node 2: 5 PQ on $Customers_2$, 5 RQ on $Customers_2$
- Node 3: 5 RQ on $Customers_1$, 5 RQ on $Customers_2$, 5 RQ on $Customers_3$
- Node 4: 10 PQ on $Customers_2$, 1 UPD on $Customers_2$
- Node 5: 10 PQ on $Customers_3$, 1 UPD on $Customers_3$

Furthermore, a transfer from one hop (node) to another takes 1 sec/KByte and the related network traffic size is

- UPD: request 100 Byte, result 100 Byte
- PQ: request 100 Byte, result 100 Byte
- RQ: request 100 Byte, result 10 KByte

1. Allocation

What is an optimal non-redundant allocation for the three fragments considering only the transfer costs?

2. Replication

What is an optimal replicated allocation for the three fragments considering only the transfer costs?