Exercise 3

Exercises Peer-to-Peer-Systems and Security (SS2011)

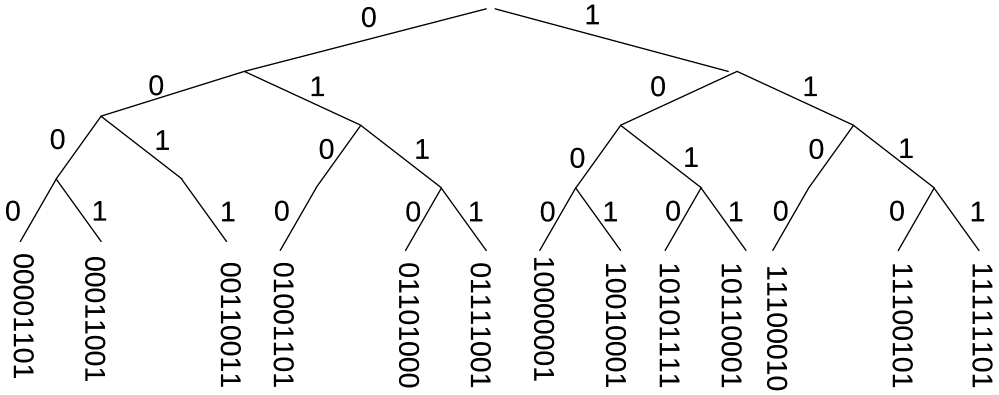
Monday 6.6 2011
Hand-in: Thursday 16.6. 2011 in lecture or per mail
Exercise: Monday 20.6. 2011

Dr. Heiko Niedermayer
Lehrstuhl für Netzarchitekturen und Netzdienste
Technische Universität München

Rules: There will be five exercise sheets. You have to hand-in 70 % of the assignments, attend atleast 3 exercise courses and present a solution in the exercise course to get the 0.3 bonus..

Task 1 Kademlia

Now, we simulate the operation of Kademlia. Bucket size is k=2. Alpha is 2. The IDs are 8 bit long.

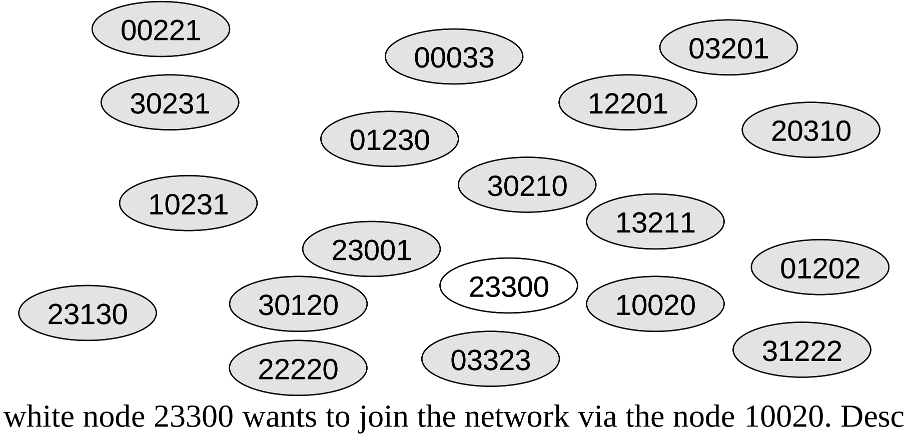


a) You want to store item 01000001. Calculate the distance (in bits and decimal notation) according to the XOR metric to the nodes 00110011, 01001101 and 10101111. Which node is responsible for the item?

b) Node 11010101 joins the network. Node 00110011 is the rendezvous peer that node 11010101 uses to join. Describe the operations of the join operations over time including the filling of the buckets.

Task 2 Pastry

This task is about Pastry. The figure is a snapshot with the current nodes (dark) and the new node (white) and how they are positioned in the underlay. If they are close in the figure they are close in the underlay (short message delay). Assume that the size of L and M is 2.



a) The white node 23300 wants to join the network via the node 10020. Describe the join process step-by-step and state the corresponding routing information seen and stored by the white node. What is the routing table of 23300 at the end? (Hint: There is no need to calculate each routing table, but simply make reasonable assumptions.)

b) Now, send a message from 23300 to ID 03023. For the first step use the routing table from a) and then make reasonable assumptions.

Task 3 Key-based-Routing-API

Please, briefly describe your idea first, before you write pseudocode. Use a pseudocode that avoids unnecessary details. Assume that you have a structure Peer-to-Peer system that implements the Key-based Routing-API. All messages are processed recursively (e.g. no iterative lookup):

a) *Ping and Pong:* a node A pings (sends “Ping”) a node B via the KBR network by sending message to its ID. Node B replies to the ID of node A with a “Pong”. Give the code for the send and receive operation.

b) *Counter:* implement a counter that counts the number of messages that the node forwards.

Task 4 CoolSpots – specific structure

Propose a structured network that is not a DHT for the CoolSpots network. It should be possible to

- efficiently look-up / store a GPS coordinate
- efficiently support range queries like all spots close to the coordinates on the way from Garching Forschungszentrum to Munich Marienplatz. It should be efficient in the sense that the cost is dominated by either the look-up (O(logn)) or the number of responsible nodes for the area (all nodes holding relevant data for the range query).
- the state for the routing should be O(logn)
- the required state for replication of a spot or similar measures should be below a small constant k per spot (e.g. k = 10).

Describe

a) the structure

b) the look-up operation and the storage operation

Task 5 CoolSpots – specific structure

On the basis of your proposal from task 4, describe

a) a maintenance operation for the structure

b) an example range query for GPS coordinates from Garching to Munich Marienplatz