Communication Networks 2
Exercise 9 - Peer-to-Peer Networking

TECHNISCHE UNIVERSITÄT DARMSTADT

Multimedia Communications Lab
TU Darmstadt

Problem 1 P2P Gnutella

Which routing scheme does Gnutella use?
◯ (A) Flooding
◯ (B) Random walk
◯ (C) Greedy routing
◯ (D) Bubblecast
◯ (E) Broadcast

Problem 2 P2P DHT Interface

Which of the following P2P methods are part of a typical DHT interface?
I: `void insert(key, data)`
II: `data getElementAt(index)`
III: `void remove(key)`
IV: `data lookup(key)`
V: `boolean contains(key)`
◯(A) I, III, V
◯(B) all except I
◯(C) II, V
◯(D) I, IV
◯(E) II

Problem 3 P2P DHT Concept

Which of the following P2P networks are based on the DHT concept?
I: Gnutella
II: Chord
III: Kademlia
IV: Freenet
V: CAN
◯(A) II, III, V
◯(B) all except I
◯(C) II, V
◯(D) I, IV
◯(E) II

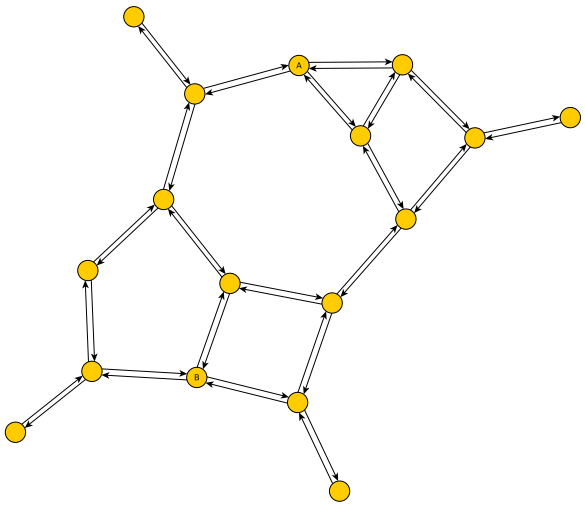
Problem 4 Gnutella Messages

Please indicate all the different message types which are used by the Gnutella 0.4 protocol and explain their purpose.

Message Type	Purpose

Problem 5 Gnutella TTL

Given the Gnutella network as shown in the figure below. Assume that Peer A wants to search for a file which is only located on Peer B. What is the minimum TTL needed in order to find the file?



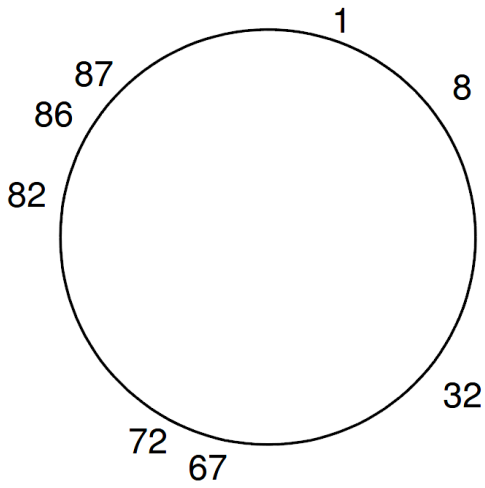
Problem 6 Gnutella Scalability

The Gnutella 0.4 protocol has proven not be scalable. Please explain why and give two possible solutions to improve the scalability of the system.

Problem 7 Chord Network

Consider the Chord network shown in the figure. In this network, 8 nodes participate having the following Globally Unique Identifiers (GUIDs):
1, 8, 32, 67, 72, 82, 86, 87.

How many fingers are needed if the GUID range is between 0 and 99? Which formula provides the ith finger of node n? Provide the fingers table for node 82.



Problem 8 Chord Network-Cont.1

What is the responsibility area of node 82 in this Chord network?

Problem 9 Chord Network-Cont.2

Node 82 is performing a lookup request with input value 7. How many steps are needed assuming that the network is stabilized? Show the followed path until the destination.

Problem 10 kademlia

In the following task we will have a look at the routing table construction of Kademlia. We use a 5-bit long identifier space. The bucket-factor is $k = 2$. The alpha factor is $\alpha = 2$. We assume all nodes being online and available. Please construct the routing table for node 11001 for the following sequence of nodes being introduced:
10001, 00110, 11100, 01100, 00010, 10101, 11101, 10111, 11111, 11011.

Problem 11 kademlia-Cont.1

Assume, we want to route a message from node 11001 to the nodes closest to ID 10111. Which nodes are selected from the routing table during the first routing step?

Problem 12 kademlia-Cont.2

How large is the distance between the node 11001 and the nodes selected in the task before measured in the Kademlia distance metric?