Exercise No. 8
Communication Networks I
Summer Term 2015

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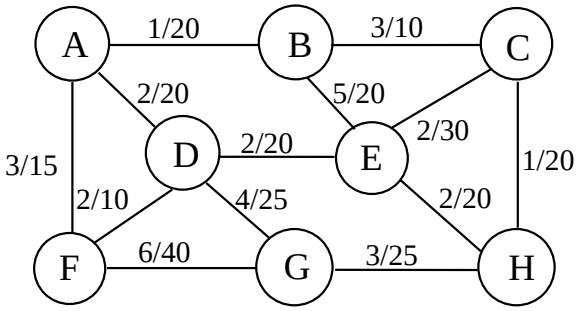
General Remarks

Welcome to the exercise for Communication Networks I. Please adhere to the following general remarks regarding the organization of the exercise during this summer term.

- One week before the tutorial, a new exercise will be published at the Exercise area of the KN1 Moodle (`https://moodle.tu-darmstadt.de/course/view.php?id=5268`)
- The exercise serves as your hands-on experience in addition to the lecture and as a preparation for the exam
- The questions in the exercise can be discussed at the tutorial date
- The sample solution for the exercise is available at the Exercise area of KN1 Moodle in addition to the corresponding tutorial. Nevertheless, we encourage students to try to solve the exercise themselves before the tutorial date without looking into the solution as a good practice to understand the subject of the lecture

Problem 1 - Flow based Routing

Use the following network topology for tasks a-c:



The first number indicates a metric for the distance of 2 nodes. The second number denotes the data rate in Kbits/sec.

a) The following traffic is given :

Source \ Target	A	B	C	D	E	F	G	H
A		3 AB	7 ABC	4 AD	2 ADE	5 AF	2 ADG	5 ADEH
B	3 BA		3 BC	7 BAD	3 BE	4 BAF	3 BADG	4 BCH
C	7 CBA	3 CB		7 CED	5 CE	3 CEDF	5 CHG	3 CH
D	4 DA	7 DAB	7 DEC		2 DE	9 DF	2 DG	9 DEH
E	2 EDA	3 EB	5 EC	2 ED		3 EDF	1 EHG	2 EH
F	5 FA	4 FAB	3 FDEC	9 FD	3 FDE		1 FG	9 FDEH
G	2 GDA	3 GDAB	5 GHC	2 GD	1 GHE	1 GF		1 GH
H	5 HEDA	4 HCB	3 HC	9 HED	2 HE	9 HEDF	1 HG	

Note: The paths for the message transmissions shown in the matrix have been already selected to achieve the shortest distances by applying a different routing algorithm.

I) Is it essential to consider the entire matrix for the calculation of the total delay or is the half sufficient? Why?

II) Calculate the mean total delay of this network. The mean packet size is 400 bit.

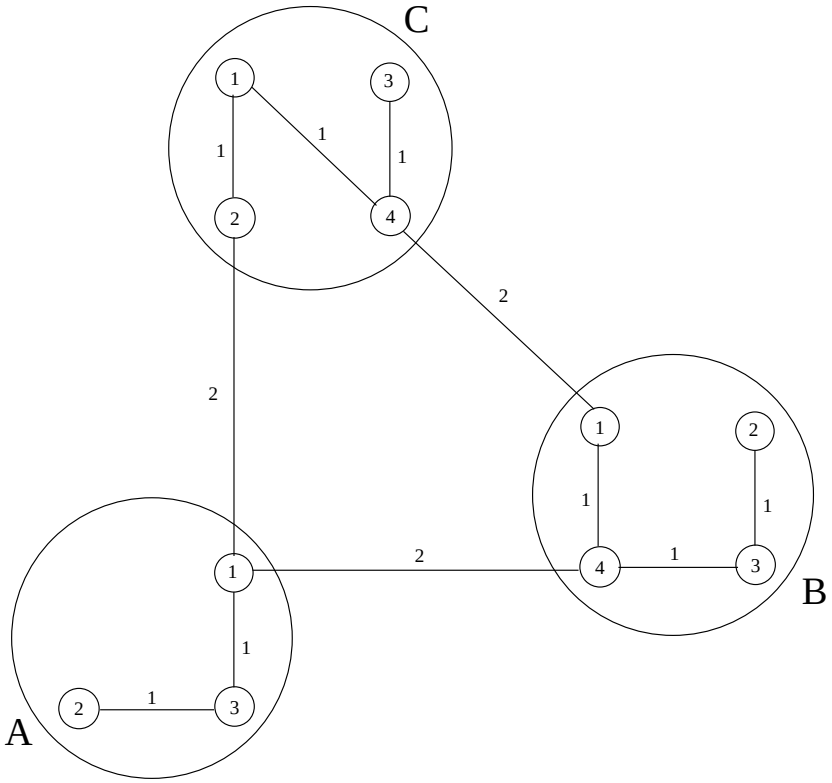
III) How could the underlying routing table be changed so that a significant improvement of the mean total delay is achieved. What can be inferred from this regarding the optimized routing table?

b) Briefly state how a calculation of the mean delay can be used for routing.

c) Determine a Multicast-Tree for sender C, with the group being A,F,G,H. Is the tree optimal with regard to the given distances?

Problem 2 - Hierarchical Routing

Given is the following structured network topology:

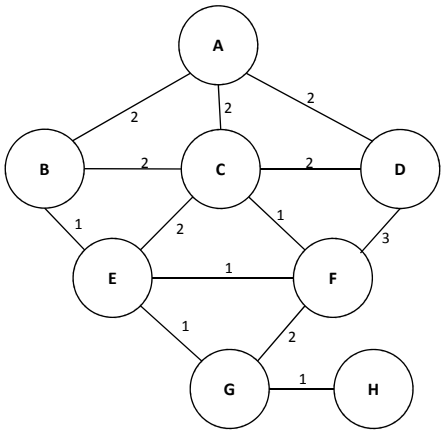


The numbers on the lines indicate a metric for the distance of two nodes.

In this network, hierarchical routing is used. How do the routing tables of the nodes C1 and B2 look like?

Problem 3 - Broadcast and Mulitcast

a) In the following topology vertex A does a broadcast using reverse path forwarding. Name for each message which is sented during the broadcast the sender, the receiver and whether it is forwarded or dropped by the receiver. Use the following notation (sender, receiver, drop) or (sender, receiver, forward). How many messages are sent in total for the broadcast? Assume every IS knows the best possible path to A.



From A: (A, B, forward), (A, C, forward), (A, D, forward)

b) How many messages would be needed for a broadcast from vertex A when a spanning tree is used for broadcasting? Draw the spanning tree.

c) What is the purpose of IGMP and DVMRP?