

## Homework assignment (cnt'd)

Calculate the total delay to transfer a **10 Mb** file from the host 1 to the host 2 (from the beginning until the host 2 receives the last bit of the file) using circuit switching, message switching and datagram switching networks. Datagram size is 65 kb. The following is known:

The **distance** between the two hosts is 4000 km.

There are 3 routers (nodes) at the same distance in between the hosts.

**Propagation speed** is 200 000 km/s.

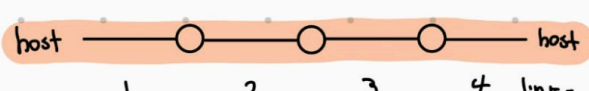
Transmission **bandwidth** is 100 Kbps.

Node **processing delay** is 100 ms.

Neglect processing delays in hosts.

Comment on the obtained results.

**Propagation delay**  $\frac{\text{Distance}}{\text{Propagation speed}} = \frac{4000 \text{ km}}{200,000 \text{ km/s}} = 20 \text{ ms}$



host — 1 — 2 — 3 — 4 km — host  $\Rightarrow 20 \text{ ms} \times 4$   
 $\Rightarrow 80 \text{ ms}$

**Transmission delay**  $\frac{\text{Size}}{\text{Bandwidth}} = \frac{10 \text{ mb}}{100 \text{ kbps}} = 100 \text{ s}$

**Processing delay**  $3 \text{ nodes} \times 100 \text{ ms} = 300 \text{ ms}$   
 $\downarrow$   
Processing delay

Circuit switching = Transmission delay + Propagation delay = 100,08 s

Message switching

Delay per hop = 100,12 s

> 4 hops \* time per hop

Transmission delay

Propagation delay

Processing delay

+

100,12 ms

= 4 \* 100,12 s

= 400,48 s

Datagram switching

Number of packets =  $\frac{\text{file}}{\text{Datagram size}} = \frac{10\text{Mb}}{65\text{Kb}} = 153,85 \text{ packets}$

- Transmission delay =  $\frac{65\text{Kb}}{100\text{Kbps}} = 0,65 \text{ seconds}$

- Propagation delay per packet = 80 ms

- Processing delay at each router = 100 ms per router \* 3 = 300 ms = 0,3 seconds

0,3 s + 0,65 s + 80 ms = 1,03 s / packet

1,03 \* 153,85 = 158,47 s