Multimedia Systems
WS 2010/2011

20.12.2010

M. Rahamatullah Khondoker (Room # 36/410)
University of Kaiserslautern
Department of Computer Science
Integrated Communication Systems ICSY
http://www.icsy.de

Outline

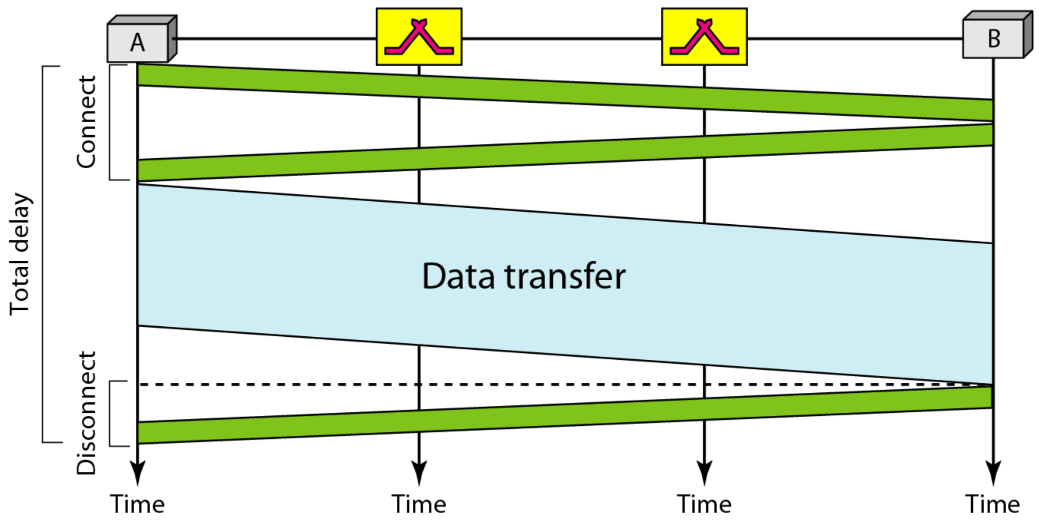
- Sheet 4: Circuit and Packet Switching

Circuit and Packet Switching

1. A path in a digital circuit-switched network has a data rate of 1 Mbps. The exchange of 1000 bits is required for the setup and teardown phases. The distance between two parties is 3000 km. Answer the following questions if the propagataion speed is 2×10^8 m/s:
   a. What is the total delay if 1000 bits of data are exchanged during the data transfer phase?
   b. What is the total delay if 100,000 bits of data are exchanged during the data transfer phase?
   c. What is the total delay if 1,000,000 bits of data are exchanged during the data transfer phase?
   d. Find the delay per 1000 bits of data for each of the above cases and compare them. What can you infer?

Circuit and Packet Switching

- Total delay (t) = delay of setup and tear down (d1) + delay of data transfer (d2)



- Delay of setup and tear down (d1) = (3 * propagation delay) + (3 * transmission delay)
- Delay of data transfer = propagation delay + transmission delay

1. Delay of setup and tear down (d1)

   = (3 * propagation delay) + (3 * transmission delay)

   $$= 3\left[\frac{3000\ km}{(2\times10^{8}\ m/s)}\right] + 3\left[\left(\frac{1000\ bits}{1\ Mbps}\right)\right]$$

   $$= (3 \times 15)\ ms + (3 \times 1)\ ms$$

   $$= 48\ ms$$

Lets assume, data transmission is in one direction

a. $Total\ delay\ (t) = d1 + d2$
   $= 48\ ms + propagation\ delay + transmission\ delay\ = 48\ ms + 15\ ms + 1\ ms = 64\ ms$

b. $Total\ delay\ (t) = d1 + d2$
   $= 48\ ms + propagation\ delay + transmission\ delay\ = 48\ ms + 15\ ms + 100\ ms = 163\ ms$

Circuit and Packet Switching

c. $Total\ delay\ (t) = d1 + d2$
$= 48\ ms + propagation\ delay + transmission\ delay\ = 48\ ms + 15\ ms + 1000\ ms = 1053\ ms$

d. For a, we have 64 ms, for b, we have, $\frac{163}{100}$= 1.63 ms, for c, we have, $\frac{1053}{1000}$= 1.053 ms. The ratio for the case of 3 is the smallest because of using one setup and tear down phase for sending more data

Circuit and Packet Switching

2. Five equal-size datagrams belonging to the same message leave for the destination one after another. However, they travel through different paths as shown in the following table

Datagram	Path Length	Visited Switches
1	3200 Km	1,3,5
2	11,700 Km	1,2,5
3	12,200 Km	1,2,3,5
4	10,200 Km	1,4,5
5	10,700 Km	1,4,3,5

We assume that the delay for each switch (including waiting and processing) is 3, 10, 20, 7, and 20 ms respectively. Assuming that the propagation speed is 2×10^8 m/s, find the order the datagrams arrive at the destination and the delay for each. Ignore any other delays in transmission.

Circuit and Packet Switching

2. Assuming that the transmission time is negligible (i.e., all datagrams start at time 0). The arrival times are calculated as

$$First: \left(\frac{3200\ Km}{2\times\ 10^8\ m/s}\right) + 3 + 20 + 20 = 59\ ms$$

$$Second: \left(\frac{11700\ Km}{2\times\ 10^8\ m/s}\right) + 3 + 10 + 20 = 91.5\ ms$$

$$Third: \left(\frac{12200\ Km}{2\times\ 10^8\ m/s}\right) + 3 + 10 + 20 + 20 = 114\ ms$$

$$Fourth: \left(\frac{10200\ Km}{2\times\ 10^8\ m/s}\right) + 3 + 7 + 20 = 81\ ms$$

$$Fifth: \left(\frac{10700\ Km}{2\times\ 10^8\ m/s}\right) + 3 + 7 + 20 + 20 = 103.5\ ms$$

Switch	Delay (ms)
1	3
2	10
3	20
4	7
5	20

The order of the arrival is $3 \rightarrow 5 \rightarrow 2 \rightarrow 4 \rightarrow 1$

Thanks for your attention

Any questions, comments or concerns?

M. Rahamatullah Khondoker, M.Sc.

Integrated Communication Systems ICSY

University of Kaiserslautern
Department of Computer Science
P.O. Box 3049
D-67653 Kaiserslautern

Phone: +49 (0)631 205-26 43
Fax: +49 (0)631 205-30 56

Email: khondoker@informatik.uni-kl.de
Internet: http://www.icsy.de

TECHNISCHE UNIVERSITÄT KAISERSLAUTERN