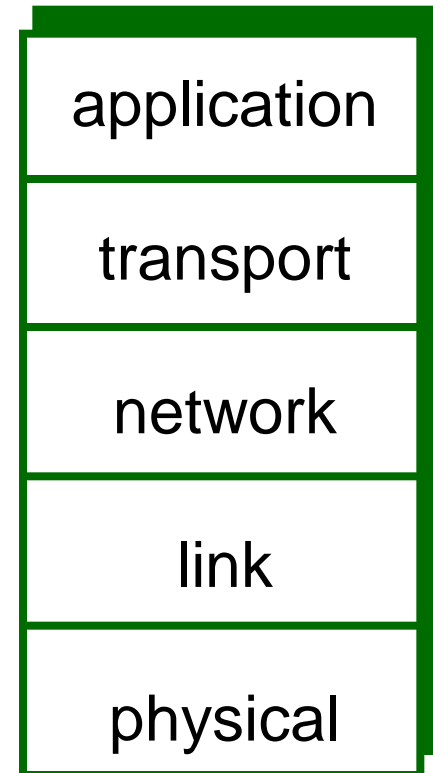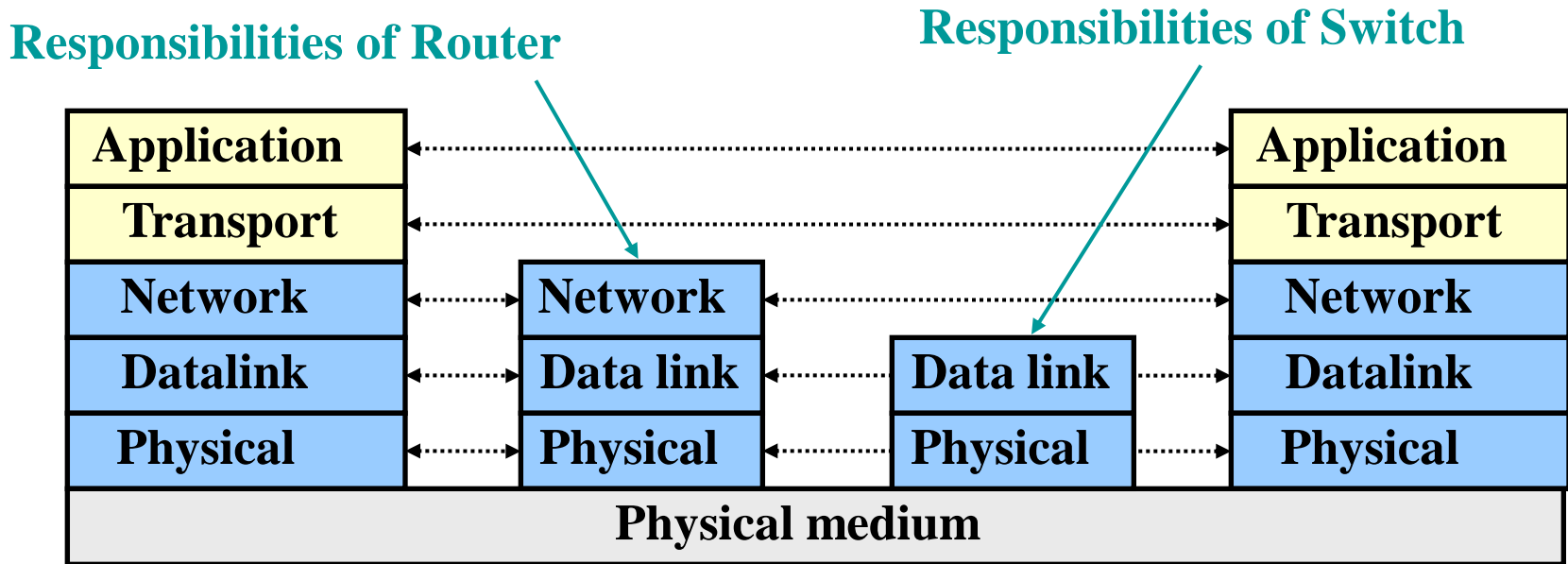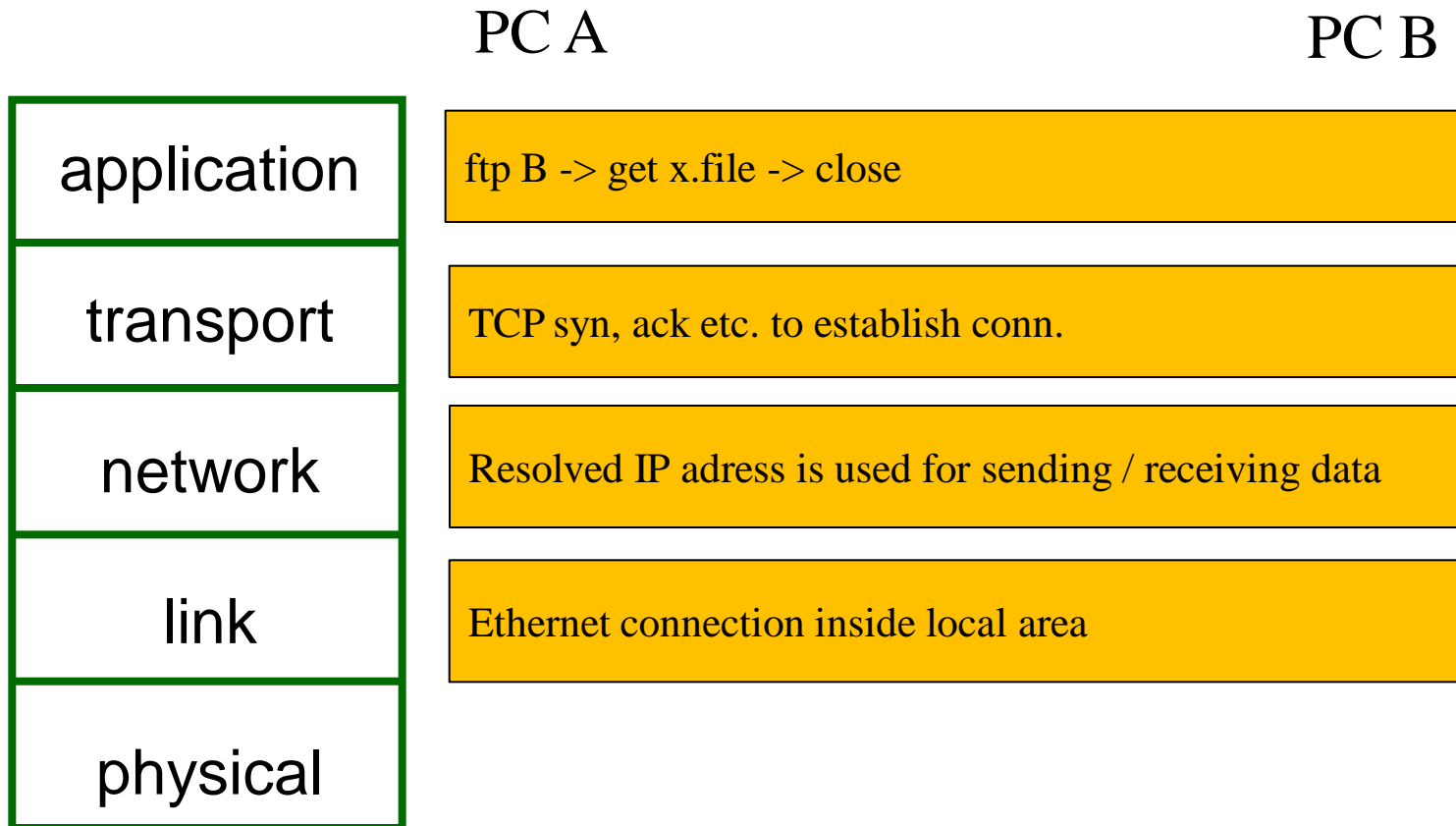# Exercise 1

Florian Tegeler

1. The five layers

o A switch processes up to layer 2. It uses the physical and the link layer.

o Advantages: Isolation, transparent to changes in other layers

o Disadvantages: Isolation ;)

application
transport
network
link
physical

1. The five layers

2. Protocol exchange

PC A   PC B

application

ftp B -> get x.file -> close

transport

TCP syn, ack etc. to establish conn.

network

Resolved IP adress is used for sending / receiving data

link

Ethernet connection inside local area

physical

3. Circuit vs. Packet switching

○ If sources are bursty they do use the bandwidth only for short timeslots. The burst-process is randomly

  ○ Randomness: Hard to deal with in circuit switching but easy to do with packet switching

  ○ Circuit switching has lots of wasted bandwidth with bursty sources, packet switching scales better

○ Even if the sources are bursty, QoS reason can make it indispensible to use circuit switching

4. Transmission time

o Quite easy:

$$D = \frac{L}{R} + \frac{d}{P} = \frac{4096 Byte}{1\dfrac{MBit}{s}} + \frac{1.500 km}{2,5 \cdot 10^8 \dfrac{m}{s}}$$

$$= \frac{4096 \cdot 8 Bit}{1.000.000 \dfrac{Bit}{s}} + \frac{0,015 \cdot 10^8 m}{2,5 \cdot 10^8 \dfrac{m}{s}}$$

$$\approx 0,033s + 0,006s \approx 0,039s = 39ms$$

Realtek RTL8168C/8111C PCI-E Gigabit Ethernet NIC: Capturing - Wireshark

File   Edit   View   Go   Capture   Analyze   Statistics   Telephony   Tools   Help

Filter: http   ▼   Expression... Clear Apply

No. .	Time	Source	Destination	Protocol	Info
101	12.602603	10.10.2.37	195.71.11.67	HTTP	GET / HTTP/1.1
118	12.670704	10.10.2.37	195.71.11.67	HTTP	GET /layout/js/http/javascript-v200910-2_2_6-1.js HTTP/1.1
285	12.807366	195.71.11.67	10.10.2.37	HTTP	HTTP/1.0 200 OK (text/javascript)
287	12.811083	10.10.2.37	195.71.11.67	HTTP	GET /layout/js/http/netmind-v200910-2_2_6-1.js HTTP/1.1
310	12.828743	195.71.11.67	10.10.2.37	HTTP	HTTP/1.0 200 OK (text/html)
335	12.856712	195.71.11.67	10.10.2.37	HTTP	HTTP/1.0 200 OK (text/javascript)
344	12.857716	10.10.2.37	195.71.11.67	HTTP	GET /layout/css/http/style-v200910-2_2_6-1.css HTTP/1.1
345	12.857815	10.10.2.37	195.71.11.67	HTTP	GET /favicon.ico HTTP/1.1
352	12.880827	10.10.2.37	195.71.11.67	HTTP	GET /static/sys/pixel.gif HTTP/1.1
363	12.882397	195.71.11.67	10.10.2.37	HTTP	HTTP/1.0 200 OK (image/x-icon)
389	12.893049	10.10.2.37	194.64.250.200	HTTP	GET /RealMedia/ads/adstream_mjx.ads/www.spiegel.de/homepage/center/12
391	12.903365	195.71.11.67	10.10.2.37	HTTP	HTTP/1.0 200 OK (GIF89a)
533	12.997923	195.71.11.67	10.10.2.37	HTTP	HTTP/1.0 200 OK (text/css)
568	13.126931	194.64.250.200	10.10.2.37	HTTP	HTTP/1.1 200 OK (application/x-javascript)
573	13.168215	10.10.2.37	194.64.250.200	HTTP	GET /images/activex_mn2.js HTTP/1.1
578	13.202834	194.64.250.200	10.10.2.37	HTTP	HTTP/1.1 200 OK (application/javascript)
582	13.285069	10.10.2.37	195.71.11.67	HTTP	GET /static/sys/v9/bg/bg_wrapper.jpg HTTP/1.1
583	13.285192			HTTP	GET /static/sys/v9/bg/bg_header_homepage.jpg HTTP/1.1

⊞ Frame 101 (524 bytes on wire, 524 bytes captured)
⊞ Ethernet II, Src: Asiarock_89:62:77 (00:19:66:89:62:77), Dst: AsustekC_55:17:59 (00:0e:a6:55:17:59)
⊞ Internet Protocol, Src: 10.10.2.37 (10.10.2.37), Dst: 195.71.11.67 (195.71.11.67)
⊞ Transmission Control Protocol, Src Port: 54256 (54256), Dst Port: http (80), Seq: 1, Ack: 1, Len: 470
⊟ Hypertext Transfer Protocol
  ⊞ GET / HTTP/1.1\r\n
    User-Agent: Opera/9.80 (Windows NT 6.1; U; en) Presto/2.2.15 Version/10.00\r\n
    Host: www.spiegel.de\r\n
    Accept: text/html, application/xml;q=0.9, application/xhtml+xml, image/png, image/jpeg, image/gif, image/x-xbitmap, */*;q=0.1\r\n
    Accept-Language: de-DE,de;q=0.9,en;q=0.8\r\n
    Accept-Charset: iso-8859-1, utf-8, utf-16, *;q=0.1\r\n
    Accept-Encoding: deflate, gzip, x-gzip, identity, *;q=0\r\n
    Connection: Keep-Alive, TE\r\n
    TE: deflate, gzip, chunked, identity, trailers\r\n
    \r\n

```
0000  00 0e a6 55 17 59 00 19  66 89 62 77 08 00 45 00   ...U.Y.. f.bw..E.
0010  01 fe 7b 80 40 00 80 06  00 00 0a 02 25 c3 47       ..{.@... .....%.G
0020  0b 43 d3 f0 00 50 4e 2b  9d 56 e8 2c 7f 4e 50 18   .C...PN+ .V.,.NP.
0030  40 29 dc a9 00 00 47 45  54 20 2f 20 48 54 54 50   @)....GE T / HTTP
0040  2f 31 2e 31 0d 0a 55 73  65 72 2d 41 67 65 6e 74   /1.1..Us er-Agent
0050  3a 20 4f 70 65 72 61 2f  39 2e 38 30 20 28 57 69   : Opera/ 9.80 (Wi
0060  6e 64 6f 77 73 20 4e 54  20 36 2e 31 3b 20 55 3b   ndows NT  6.1; U;
0070  20 65 6e 29 20 50 72 65  73 74 6f 2f 32 2e 32 2e    en) Pre sto/2.2.
0080  31 35 20 56 65 72 73 69  6f 6e 2f 31 30 2e 30 30   15 Versi on/10.00
0090  0d 0a 48 6f 73 74 3a 20  77 77 77 2e 73 70 69 65   ..Host:  www.spie
00a0  67 65 6c 2e 64 65 0d 0a  41 63 63 65 70 74 3a 20   gel.de.. Accept:
00b0  74 65 78 74 2f 68 74 6d  6c 2c 20 61 70 70 6c 69   text/htm l, appli
00c0  63 61 74 69 6f 6e 2f 78  6d 6c 3b 71 3d 30 2e 39   cation/x ml;q=0.9
00d0  2c 20 61 70 70 6c 69 63  61 74 69 6f 6e 2f 78 68   , applic ation/xh
00e0  74 6d 6c 2b 78 6d 6c 2c  20 69 6d 61 67 65 2f 70   tml+xml,  image/p
00f0  6e 67 2c 20 69 6d 61 67  65 2f 6a 70 65 67 2c 20   ng, imag e/jpeg,
0100  69 6d 61 67 65 2f 67 69  66 2c 20 69 6d 61 67 65   image/gi f, image
0110  2f 78 2d 78 62 69 74 6d  61 70 2c 20 2a 2f 2a 3b   /x-xbitm ap, */*;
0120  71 3d 30 2e 31 0d 0a 41  63 63 65 70 74 2d 4c 61   q=0.1..A ccept-La
0130  6e 67 75 61 67 65 3a 20  64 65 2d 44 45 2c 64 65   nguage:  de-DE,de
```

● Frame (frame), 524 bytes   Packets: 1819 Displayed: 338 Marked: 0   Profile: Default