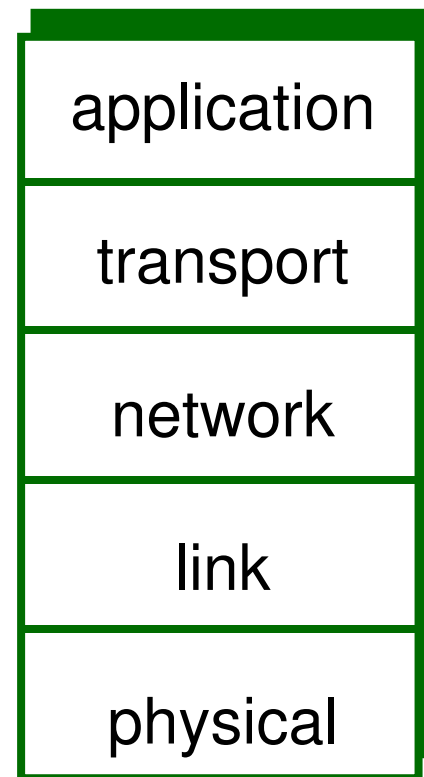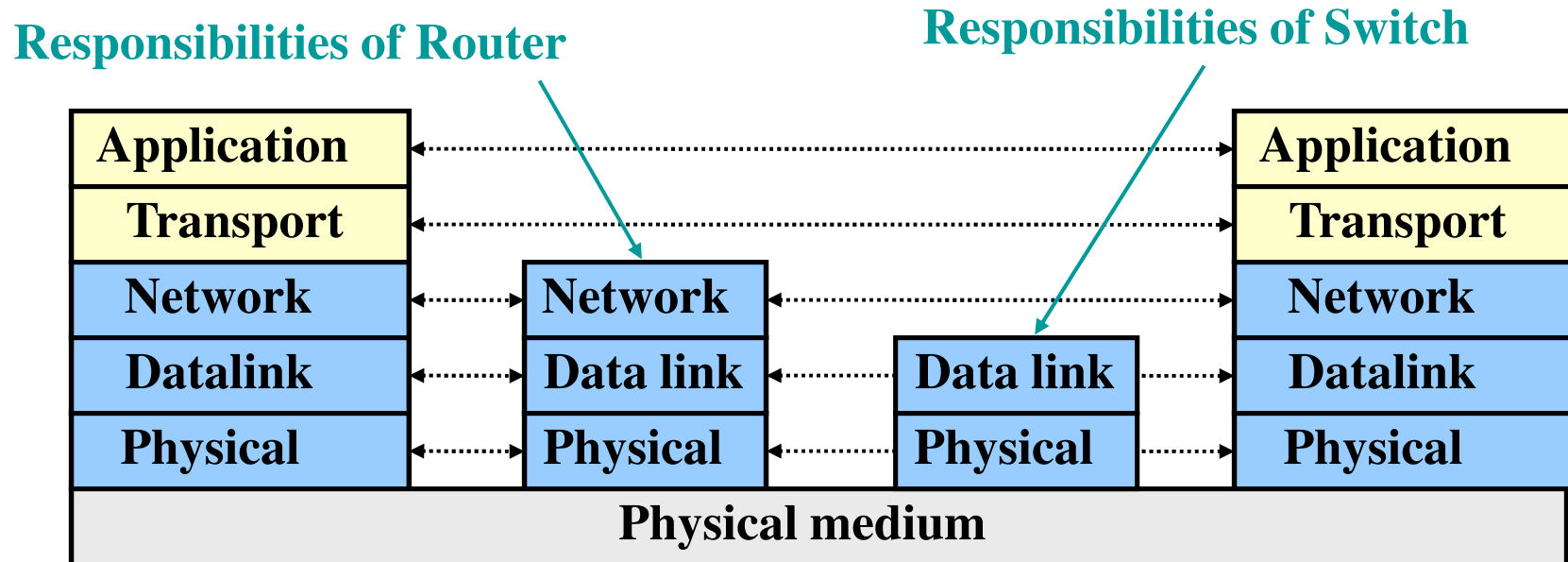# Exercise 1

Narisu Tao

narisu.tao@informatik.uni-goettingen.de

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 ;), cannot optimize across layers

application
transport
network
link
physical

1. The five layers

2. Google private network

o The Google owns 30 to 50 data centers all around the worlds.

o Data centers are all interconnected via Google's private TCP/IP network.

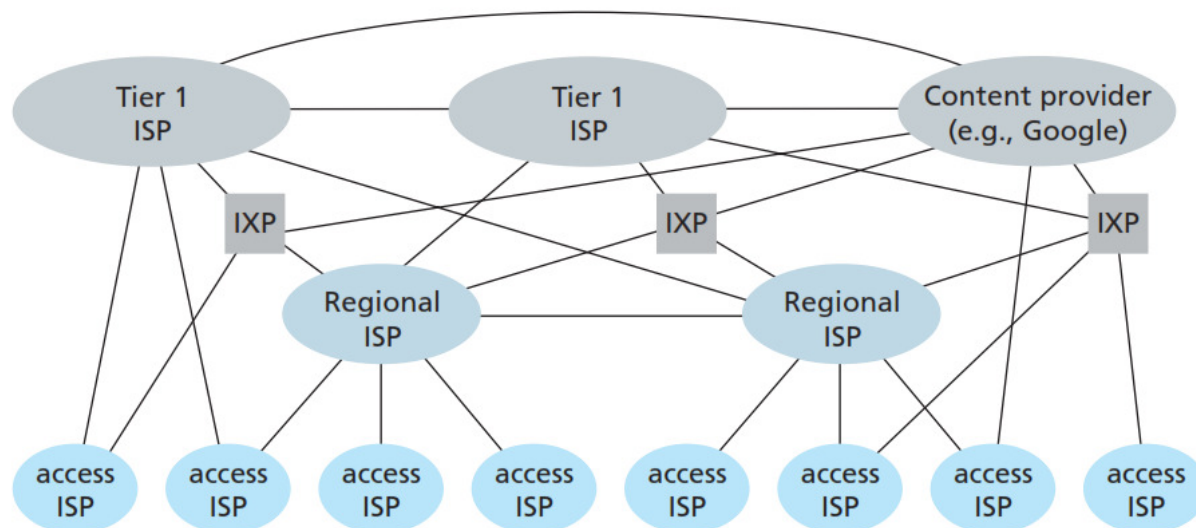o Google's private network spans the entire globe but is nevertheless separate from the public Internet.

Fig 1.15 from *Computer networking a top down approach, 6 edition.*

2. Google private network

○ Google private network only carries traffic to/from Google servers.

○ By creating its own network, a content provider not only reduces its payments to upper-tier ISPs, but also has greater control of how its services are ultimately delivered to end users.

3.Four Sources of packet delay

1. Nodal processing: Error checks and link determination

2. Queuing: Congestion at router? Time wait at output link (e.g. when shared channel is busy)

3. Transmission delay: Writing data to the link

4. Propagation delay: Typically the speed of light and level 1 processing.

4. Circuit vs. Packet switching

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

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

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

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

5. FDMA and TDMA

o Only in shared media, Multiple Access protocols to guarantee resource allocation via channel partitioning

o Divides a shared channel in fixed timeslots or frequency slots.

FDMA and TDMA are used in circuit switching.

6.Circuit vs. Packet switching II

a) 20 users can be supported

b) P = 0.1

c) $P = \binom{n}{120} p^n (1 - p)^{120-n}$

d) $P = 1 - \sum\limits_{n=0}^{20} \binom{n}{120} p^n (1 - p)^{120-n} = 1 - 0.997$

$= 0.003$