

# Computer Networks Overview, Day I

Mark Allman  
*mark.allman@case.edu*

EECS 325/425  
Fall 2018

*“Oh, oh come take my hand,  
We’re ridin’ out tonight to case the promise land...”*

All material copyright 2011—2018  
Mark Allman, All rights reserved.

Acknowledgments:

- Several slides and ideas in this slide set come from Seth Hall.

# Our Scope

# Our Scope

- This is a class in *networking*, which is a **very** broad topic

# Our Scope

- This is a class in *networking*, which is a very broad topic
- We will mostly focus on *an artifact*: the Internet

# Our Scope

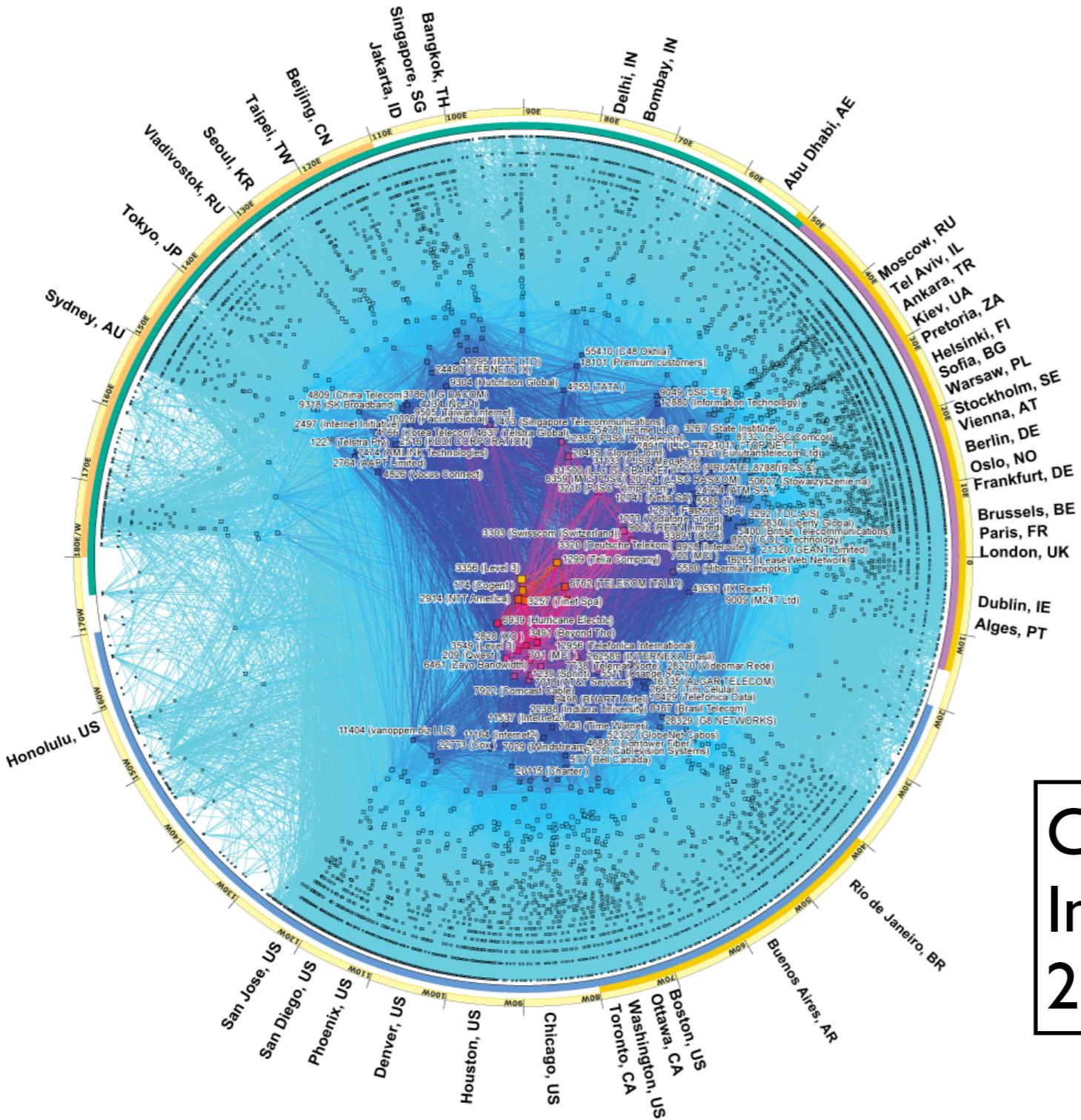
- This is a class in *networking*, which is a very broad topic
- We will mostly focus on *an artifact*: the Internet
- The Internet is not ....
  - .... the only network
  - .... the first network
  - .... some sort of perfect realization of networking theory

# Our Scope

- This is a class in *networking*, which is a very broad topic
- We will mostly focus on *an artifact*: the Internet
- The Internet is not ....
  - .... the only network
  - .... the first network
  - .... some sort of perfect realization of networking theory
- The Internet is the most pervasive and successful network

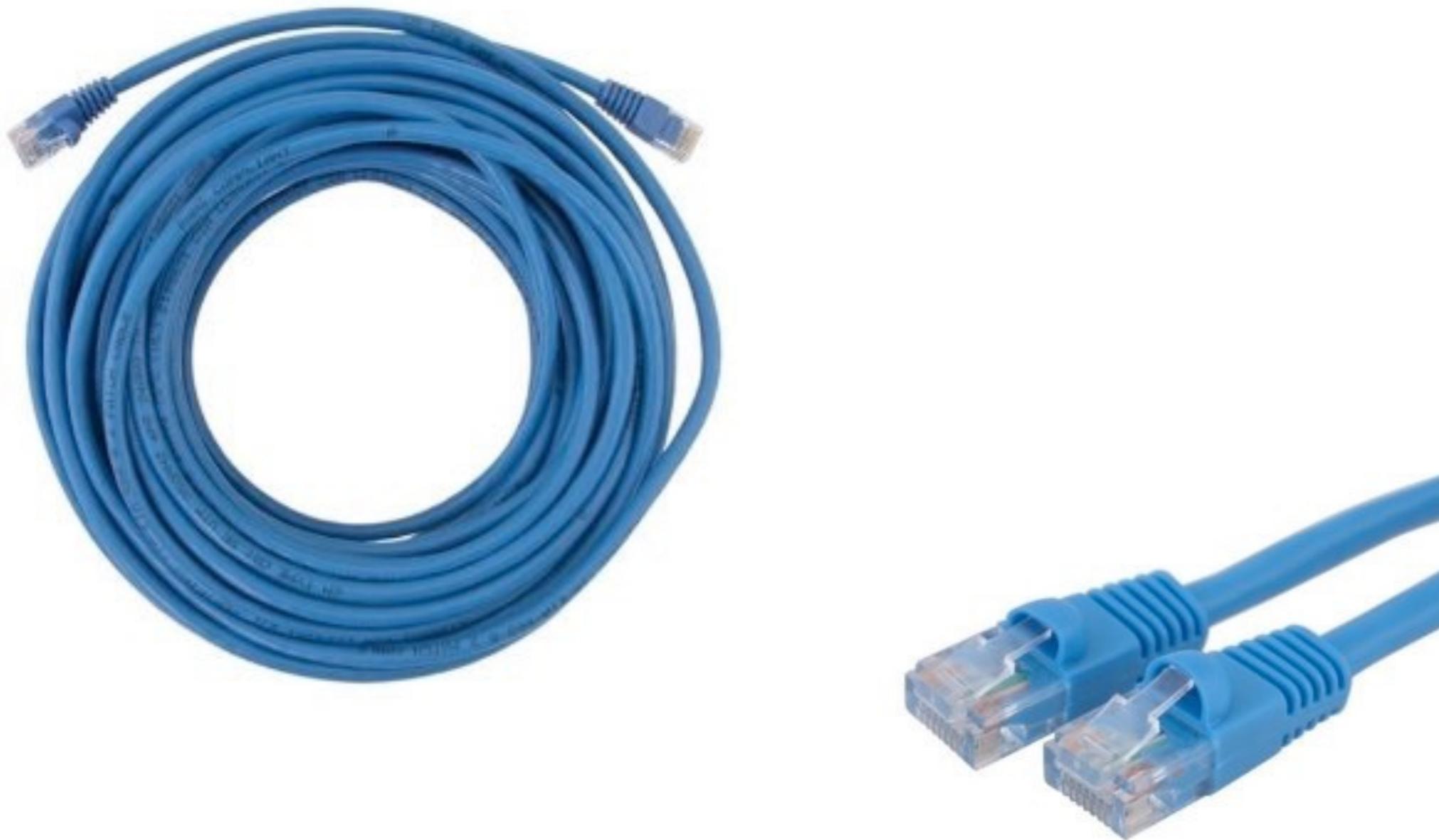
**What Is The Internet  
Anyway?!**

# What is the Internet?



CAIDA's IPv4 AS-level  
Internet Graph, February  
2017

# What is the Internet?



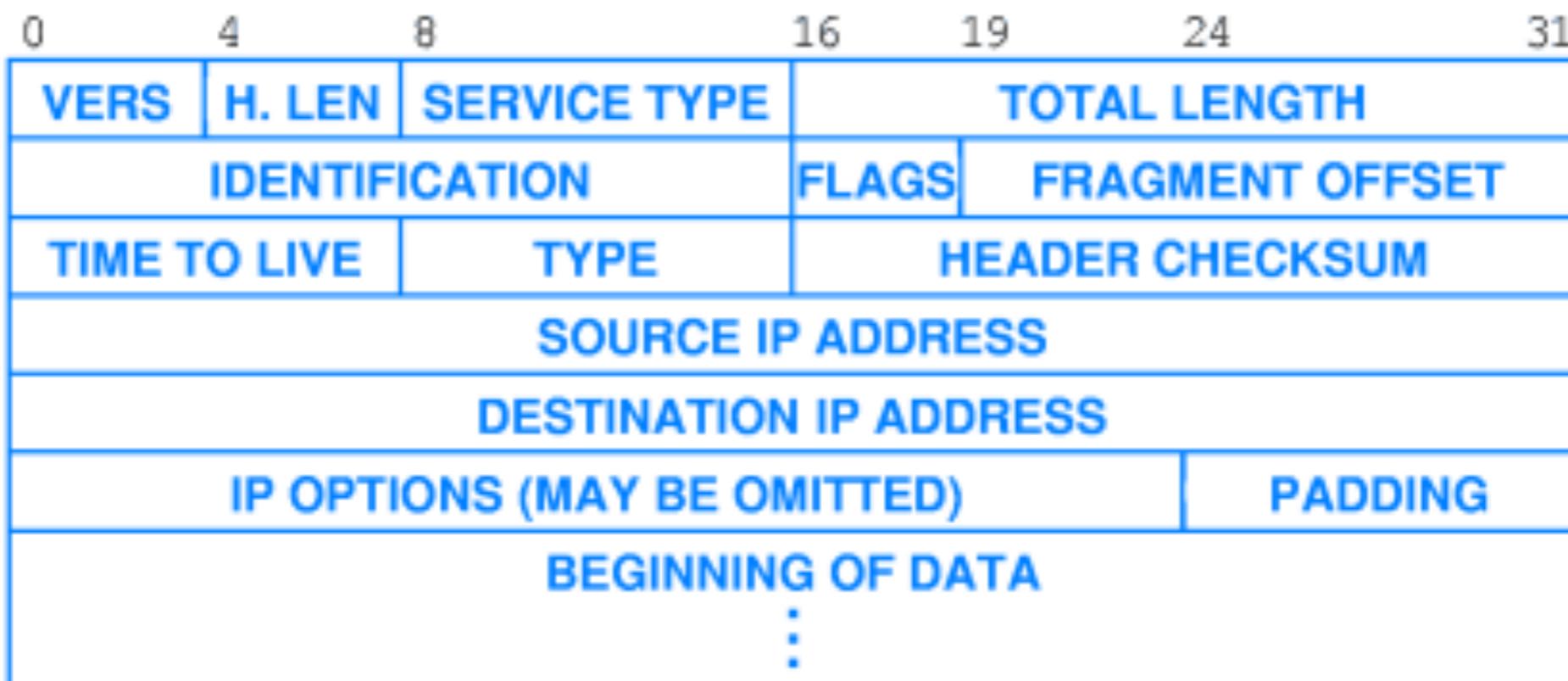
# What is the Internet?



# What is the Internet?



# What is the Internet?



# What is the Internet?



# What is the Internet?



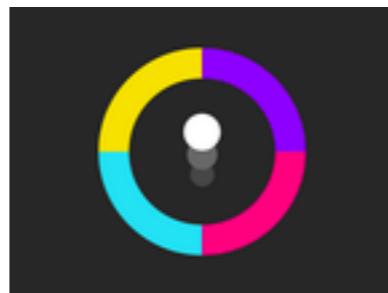
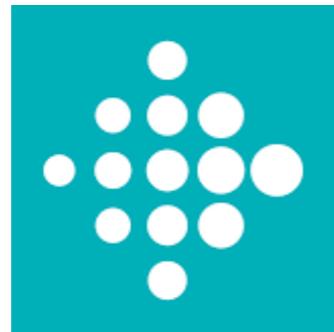
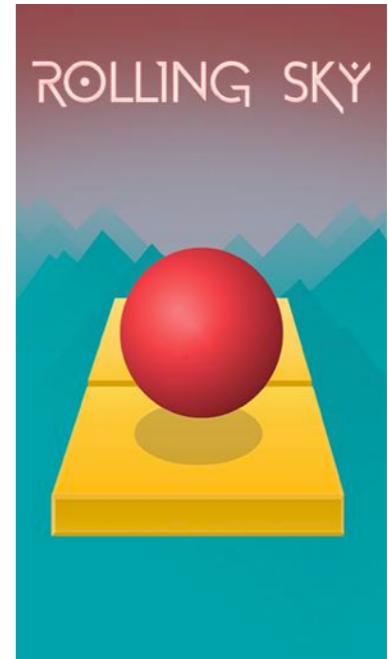
# What is the Internet?



# What is the Internet?



# What is the Internet?



# What is the Internet?



# What is the Internet?



# What is the Internet?



# What is the Internet?

Reply-To: <paul\_yao002@yahoo.co.jp>  
From: "Paul Yao" <paulyao001@yahoo.co.jp>  
Subject: From Paul Yao.....  
Date: Fri, 5 Aug 2011 13:36:48 -0000  
To: undisclosed-recipients:;

From Paul Yao.  
Abidjan Ivory coast

Dear,  
Hope this mail meets you well, please p...  
name is Paul Yao, I am 19 years old  
was a famous cocoa merchant based  
ry Coast ( Cote D'ivoire).

APPEAL FOR

Shady RAT attack emails  
erattacks against 72 organisations has been dissected

Symantec digs into Shady RAT attack emails  
By Tom Espiner, ZDNet UK, 5 August, 2011 17:03

Follow @tomespiner

Topics

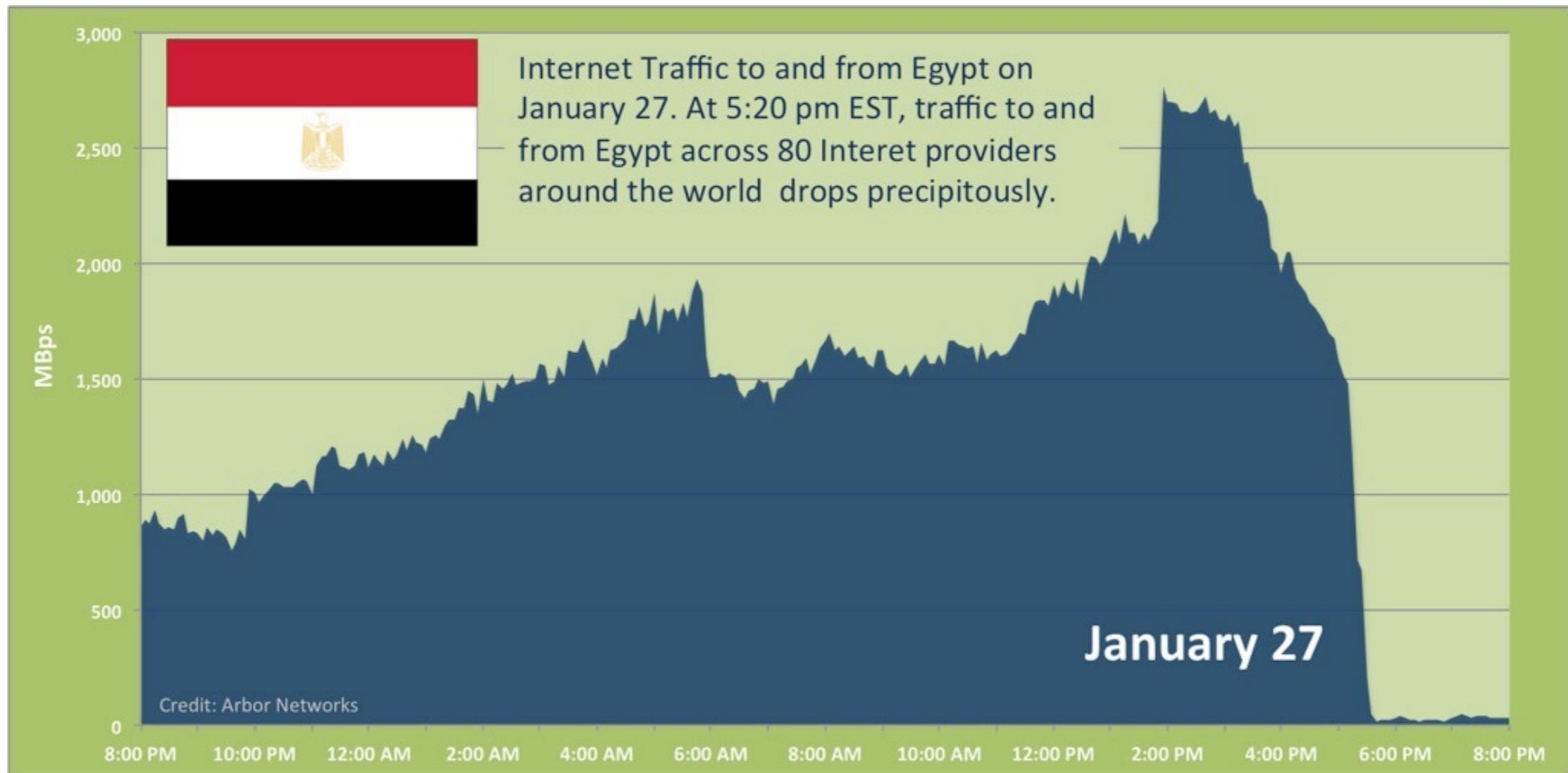
NEWS A long-running se...  
by security company Sy...

LILY HAY NEWMAN SECURITY 10.21.16 1:04 PM

## WHAT WE KNOW ABOUT FRIDAY'S MASSIVE EAST COAST INTERNET OUTAGE



# What is the Internet?

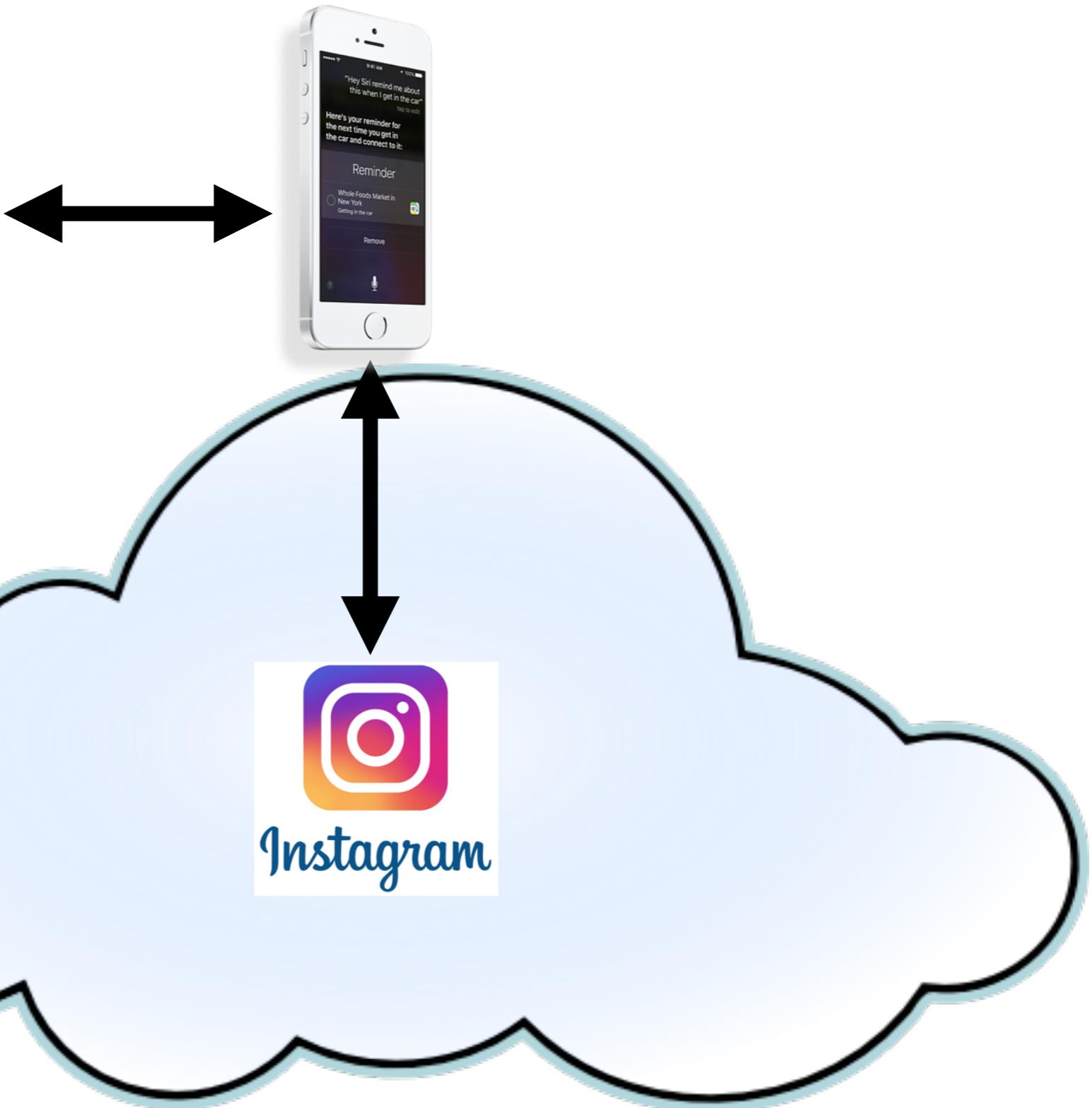


# What is the Internet?

# What is the Internet?



# What is the Internet?



# Scope Revisited

- The scope of *Internet use* is massive
  - IP (v4 / v6)
  - TCP
  - DNS
  - BitTorrent
  - DHCP
  - NAT
  - End-to-end principle
  - Fiber Optics
  - HTTP
  - Email
  - UDP
  - Late binding
- The scope of *Internet technologies* is massive
- We cannot study them all in one semester

# Scope (cont.)

# Scope (cont.)

- Since we cannot cover everything we will focus on two areas.

# Scope (cont.)

- Since we cannot cover everything we will focus on two areas.
  - *Fundamentals:*
    - key abstractions
    - design criteria
    - engineering tradeoffs

# Scope (cont.)

- Since we cannot cover everything we will focus on two areas.
  - *Fundamentals:*
    - key abstractions
    - design criteria
    - engineering tradeoffs
  - *Exemplars:*
    - particular (common & crucial) protocols and services
    - e.g., IP, TCP, DNS, HTTP, etc.

# Scope (cont.)

- We *will not* be studying the nitty gritty of putting together of networks
  - we *will not* learn to setup a cable modem
  - we *will not* learn to configure a Cisco router
  - we *will not* learn to assign static IP addresses to your Windows box
  - we *will not* learn how to properly position your wireless access point
  - we *will not* write web apps

# Scope (cont.)

# Scope (cont.)

- You will end up with a *rough* understanding about how the Internet works

# Scope (cont.)

- You will end up with a *rough* understanding about how the Internet works
  - *nobody* really understands the entire system
    - it is the most complex system mankind has ever engineered

# Scope (cont.)

- You will end up with a *rough* understanding about how the Internet works
  - *nobody* really understands the entire system
    - it is the most complex system mankind has ever engineered
    - expect me to say “*I don’t know*” on occasion
    - or, even on *many occasions!*

# Comm. History

# Comm. History



# Comm. History (cont.)



# Comm. History (cont.)



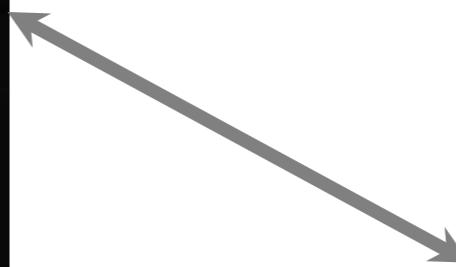
# Comm. History (cont.)



# Comm. History (cont.)



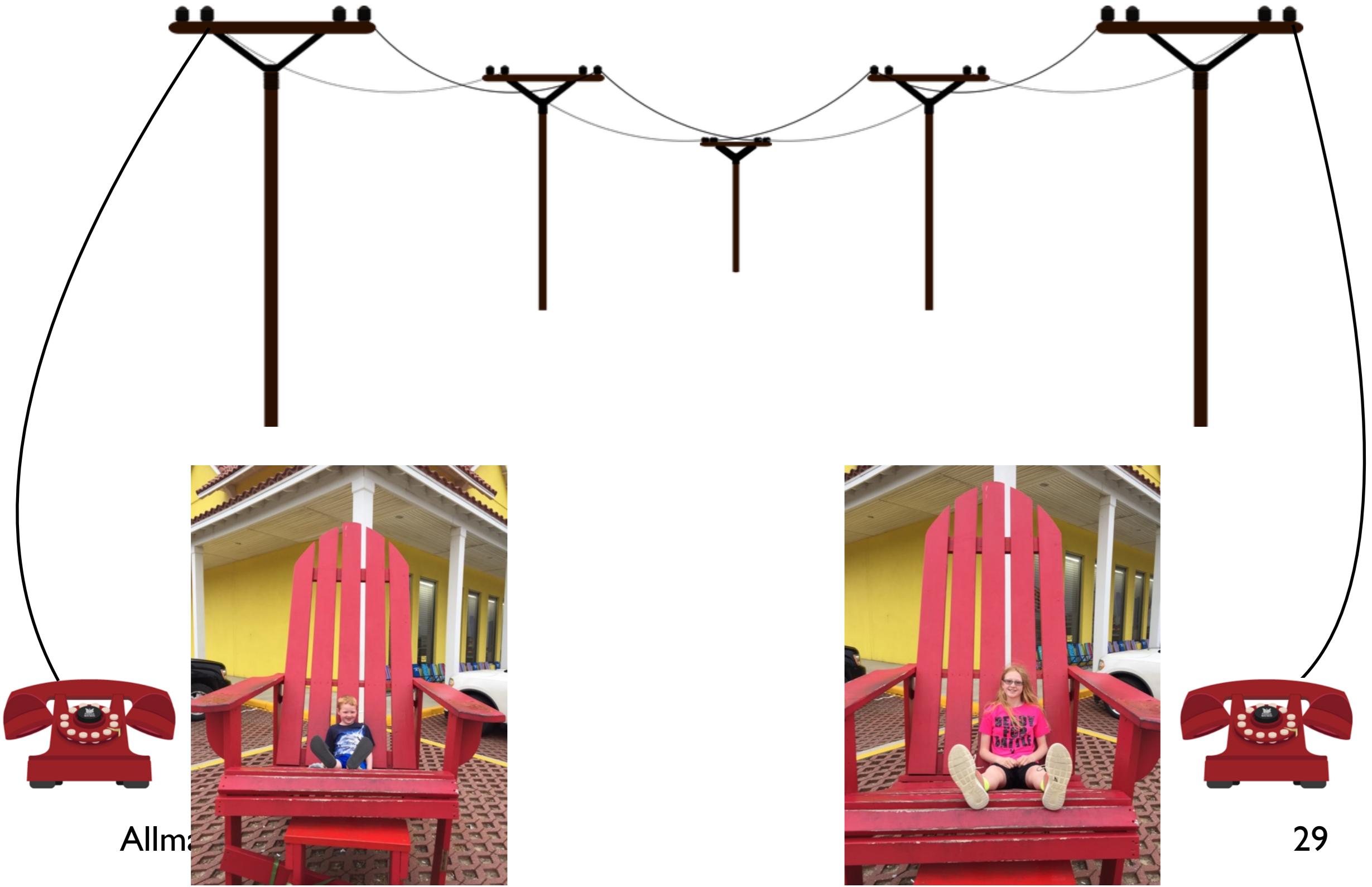
# Comm. History (cont.)



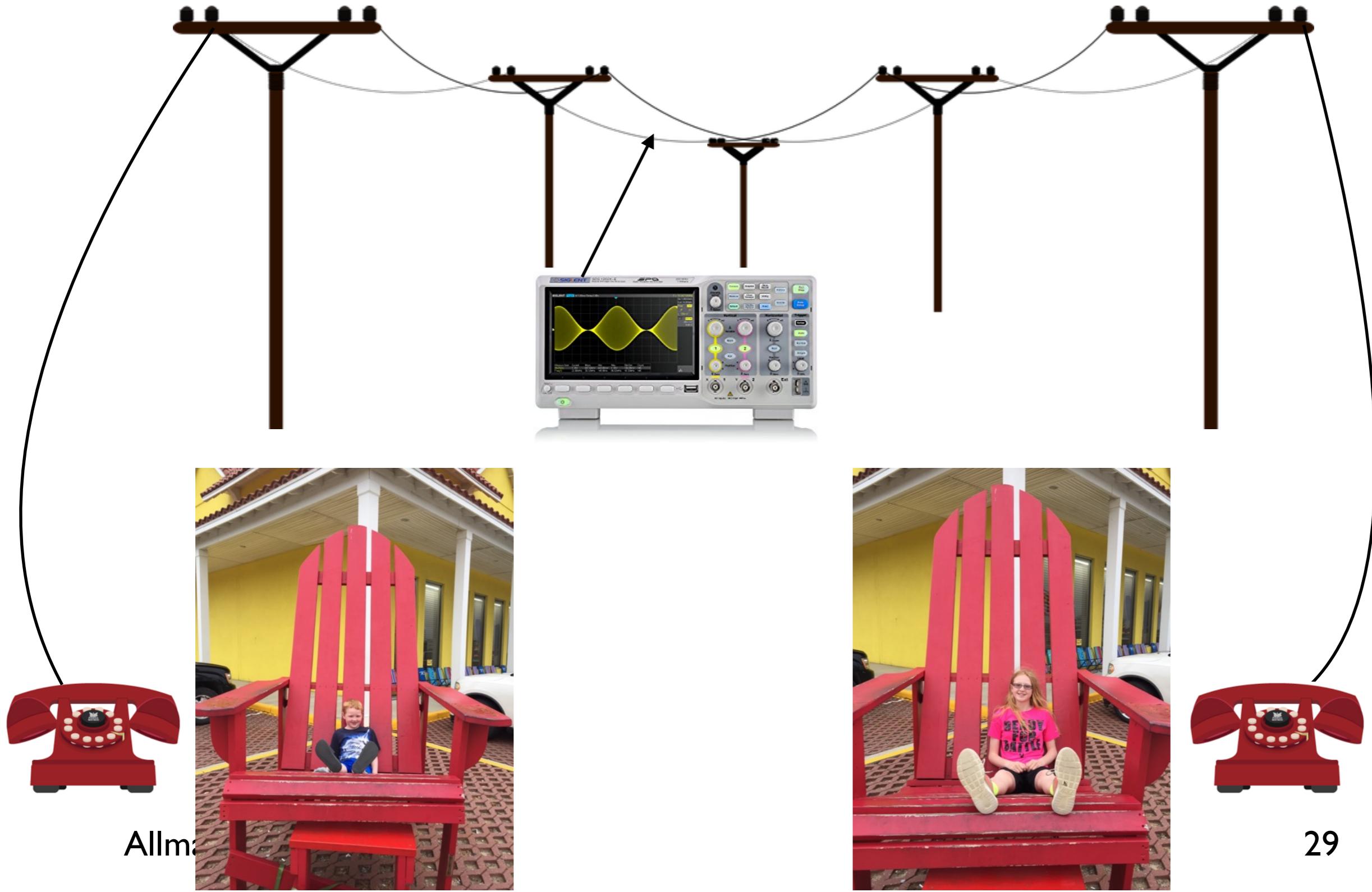
# Comm. History (cont.)



# Circuit Switching



# Circuit Switching



# Circuit Switching



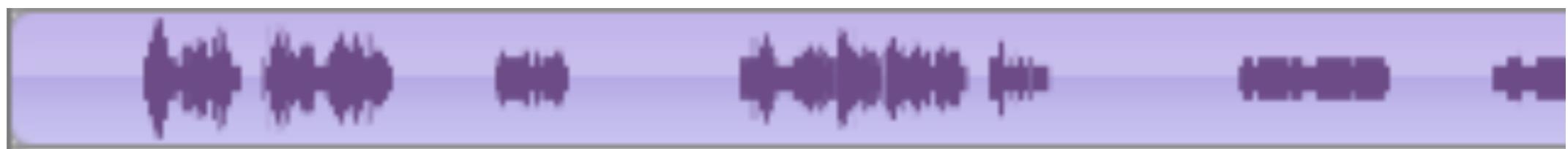
Allman



# Circuits (cont.)



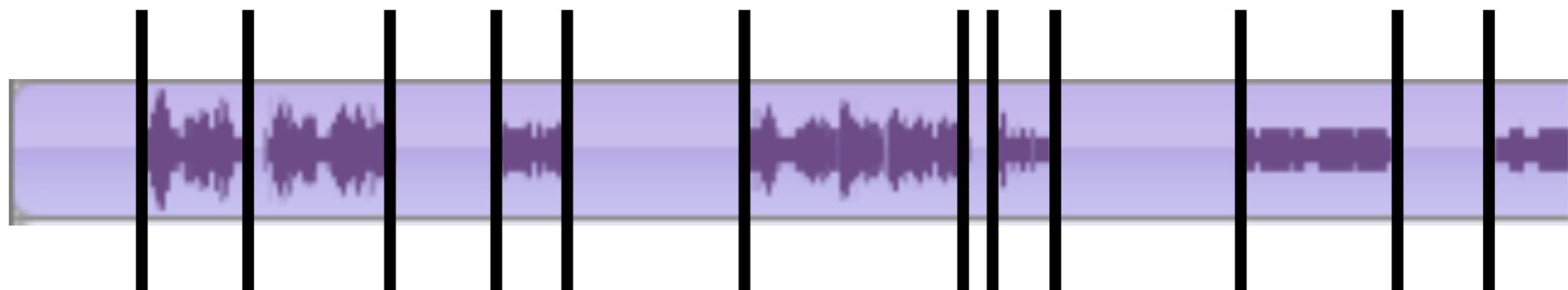
Paul Baran



# Circuits (cont.)



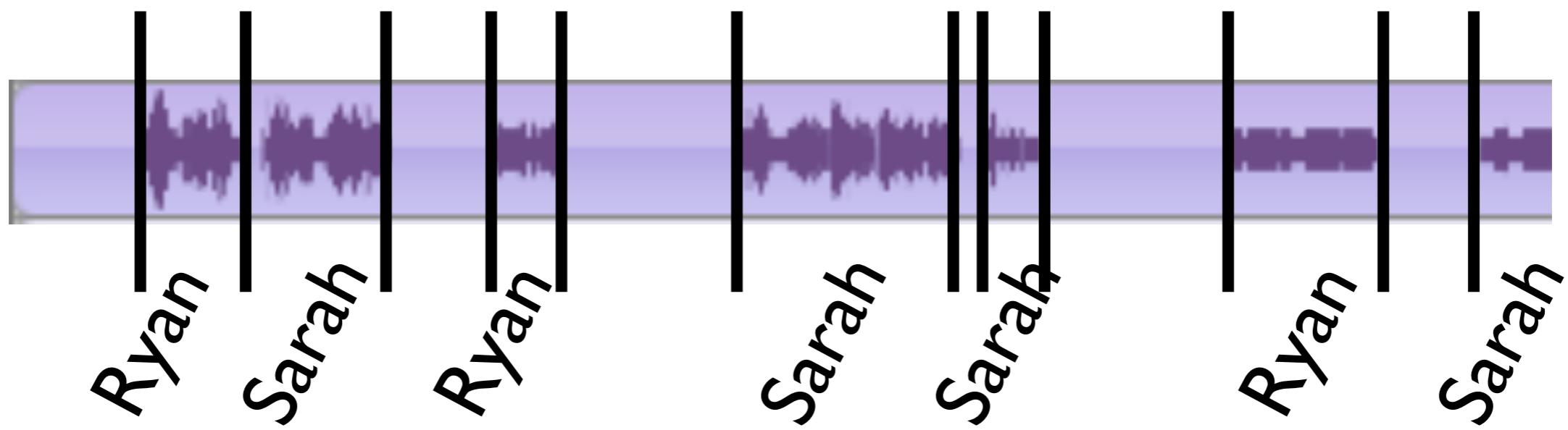
Paul Baran



# Circuits (cont.)



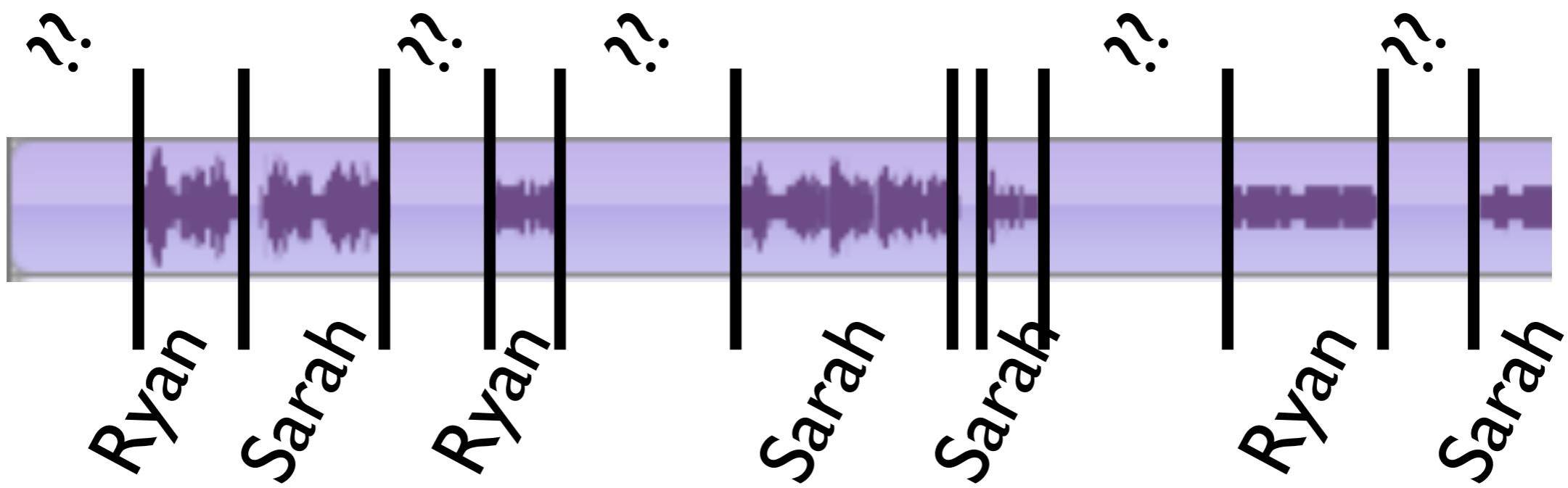
Paul Baran



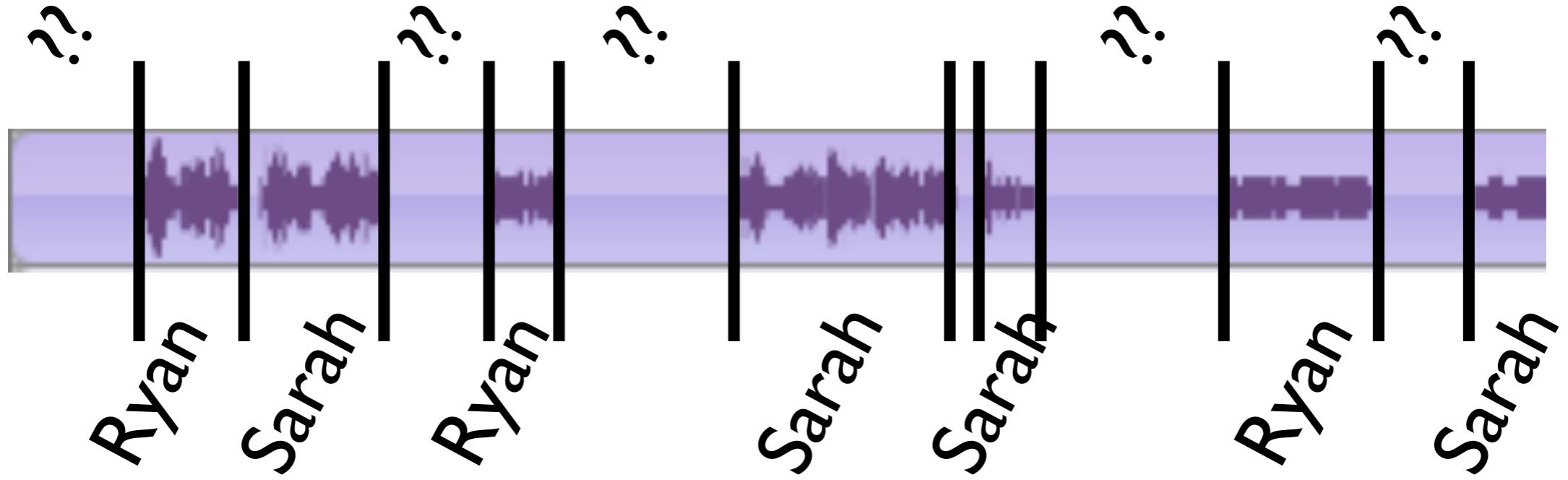
# Circuits (cont.)



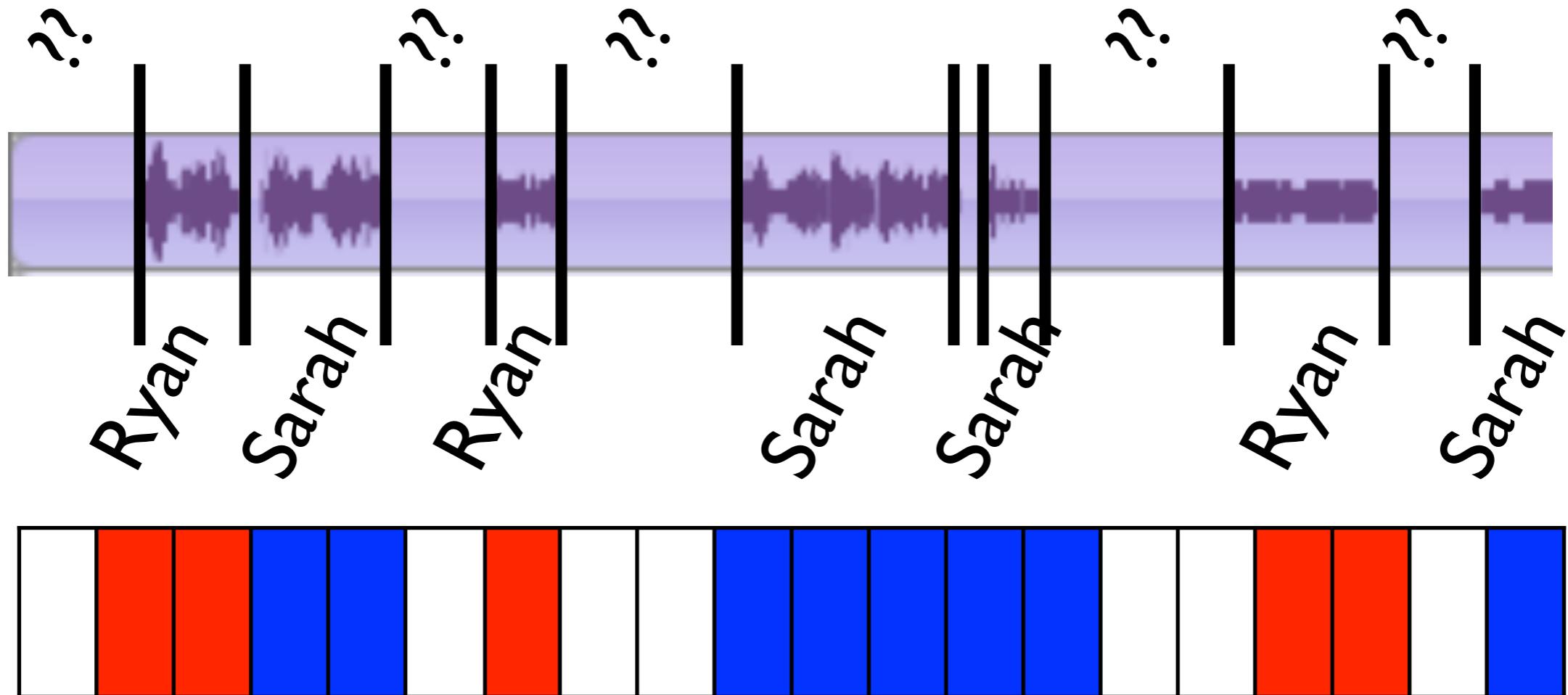
Paul Baran



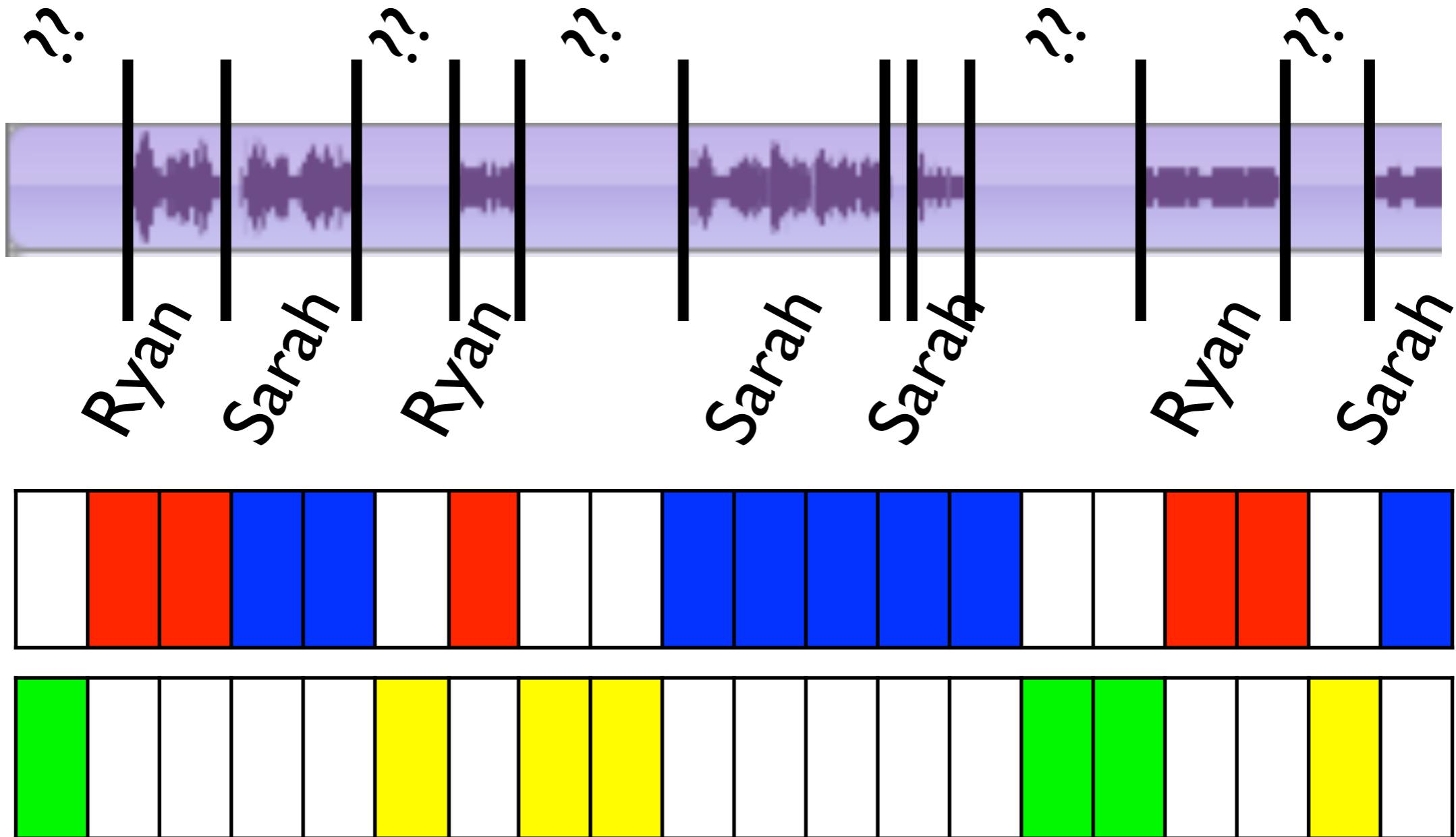
# Circuits-vs.-Packets



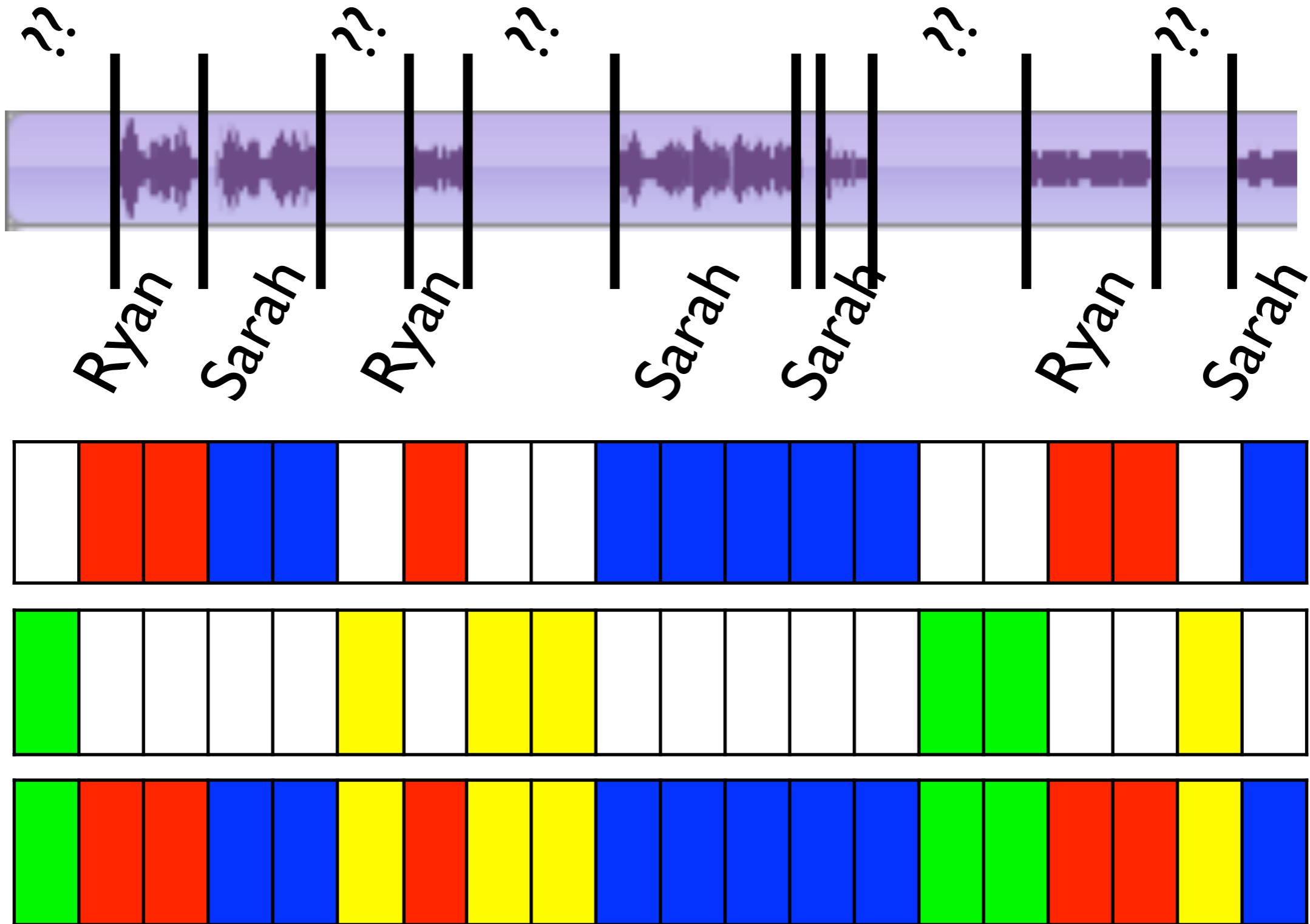
# Circuits-vs.-Packets



# Circuits-vs.-Packets



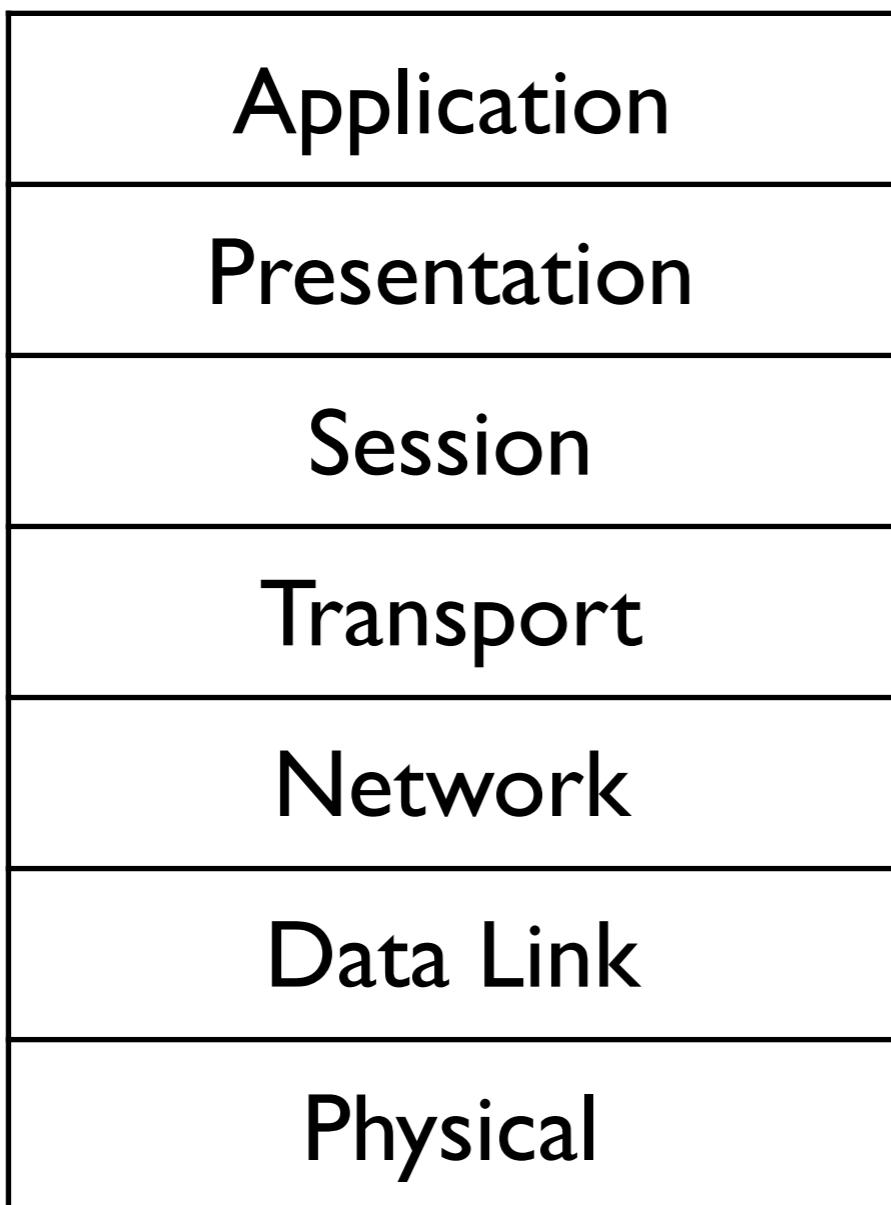
# Circuits-vs.-Packets



# Layering

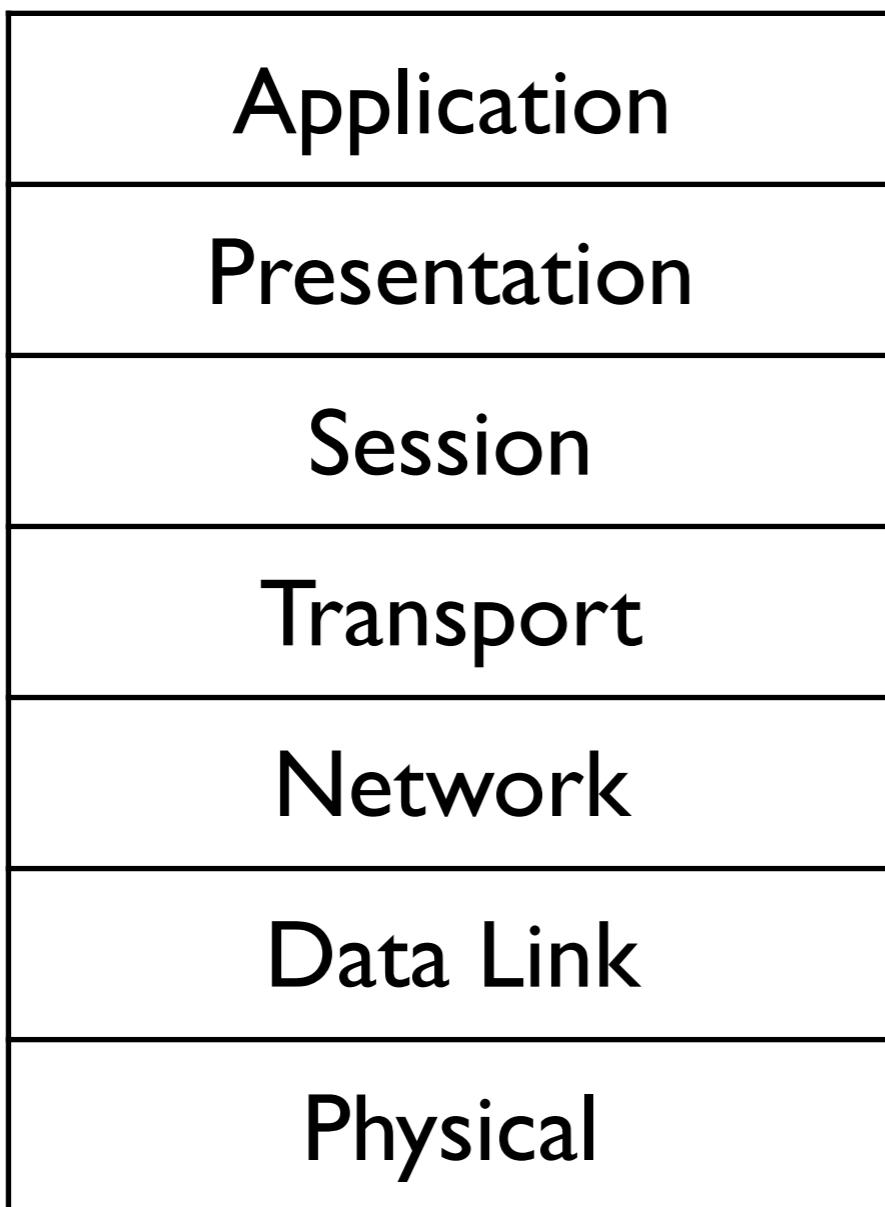
# Layering

## OSI Model

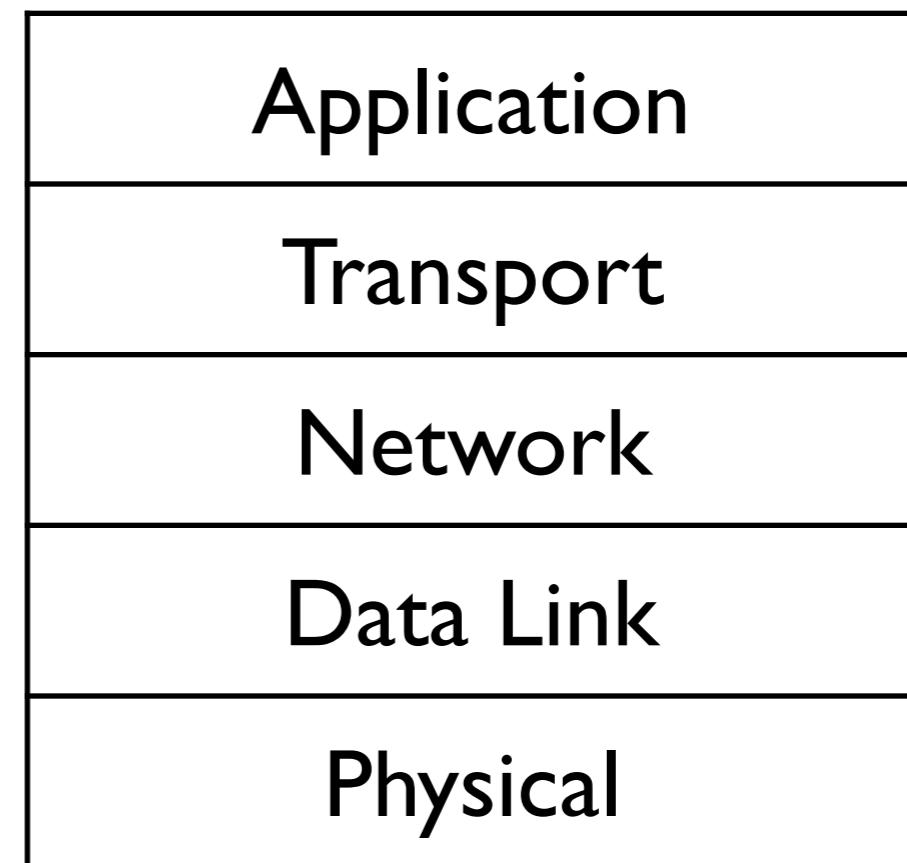


# Layering

OSI Model

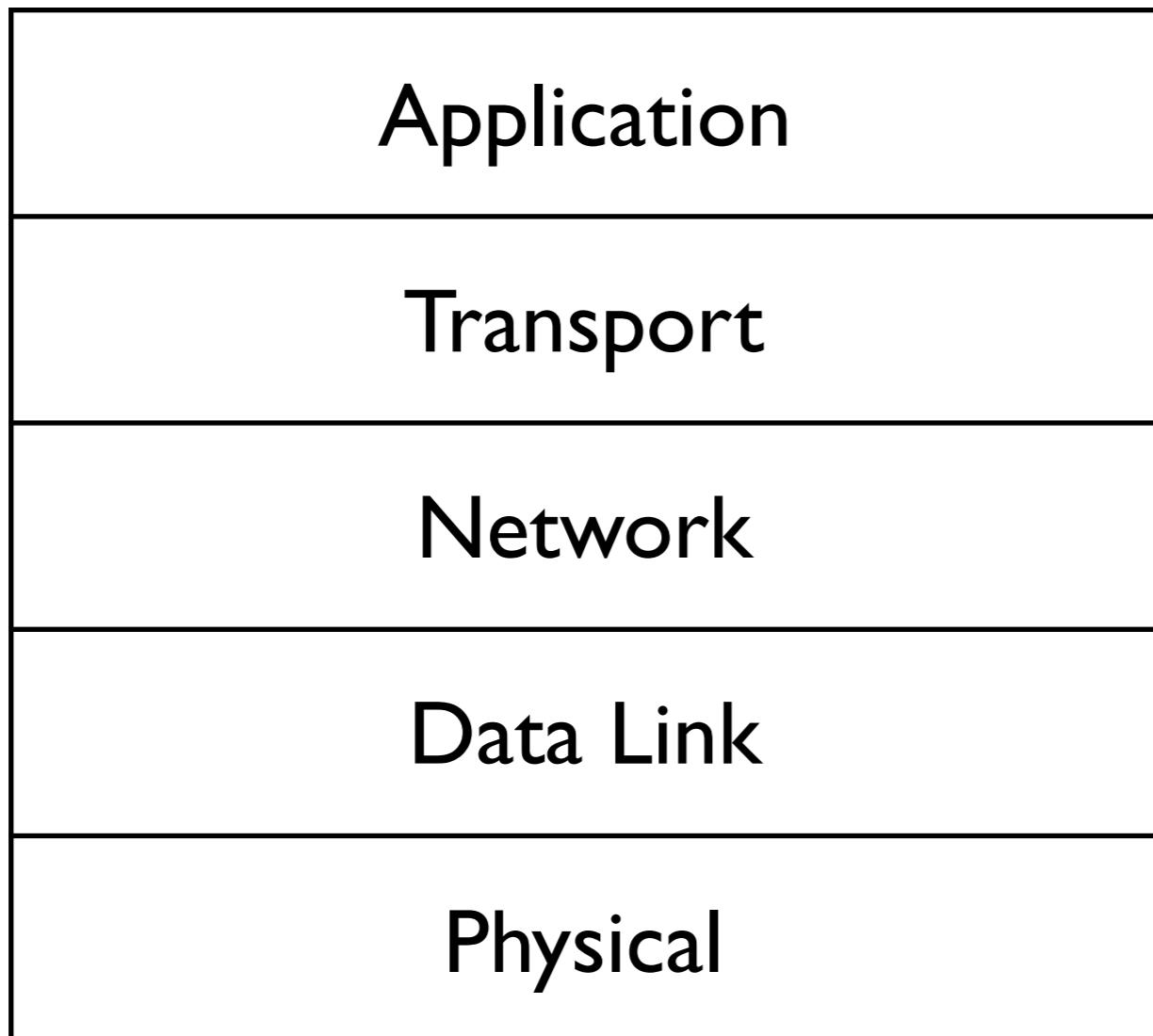


Internet Model

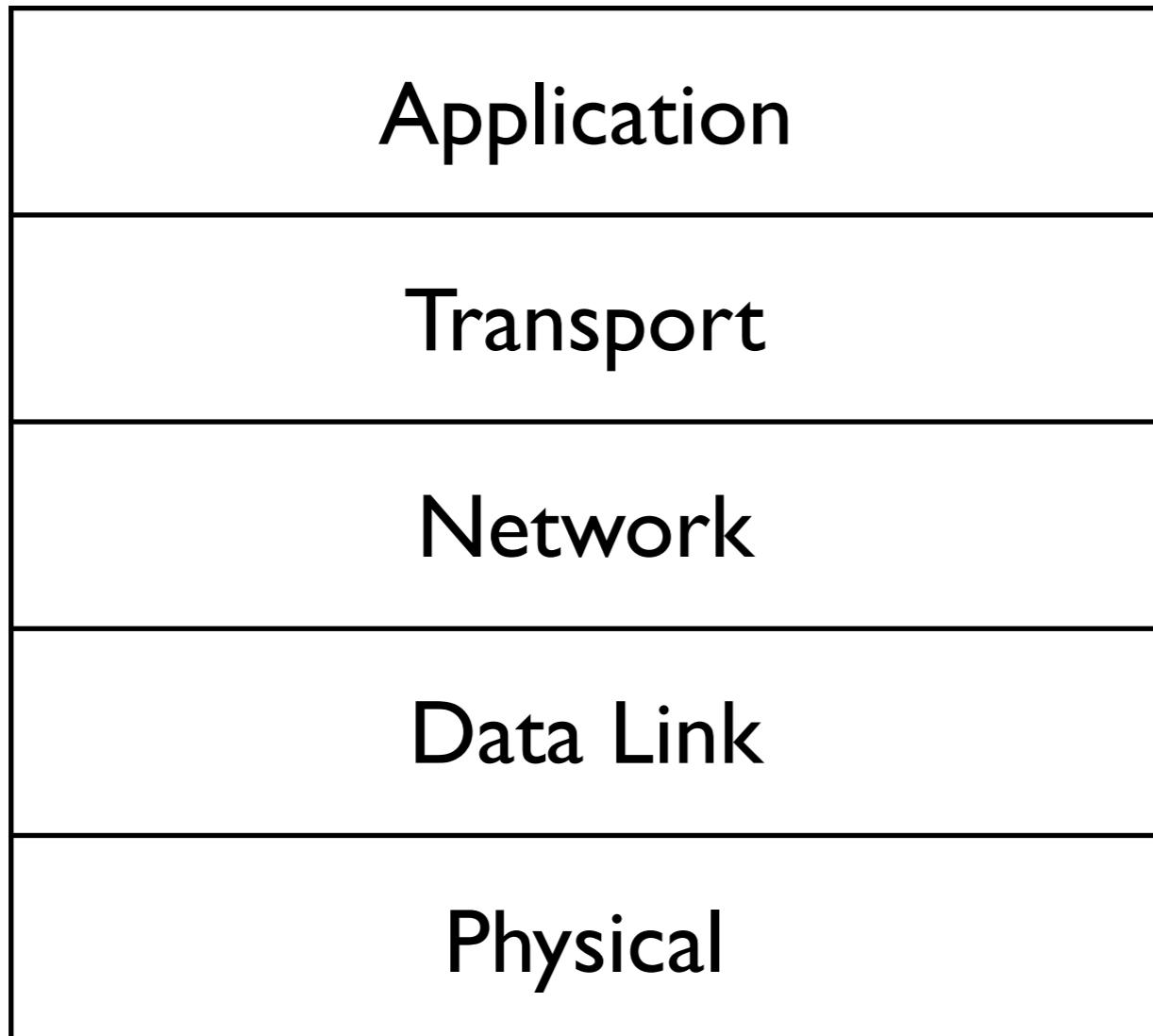


# Layering (cont.)

# Layering (cont.)

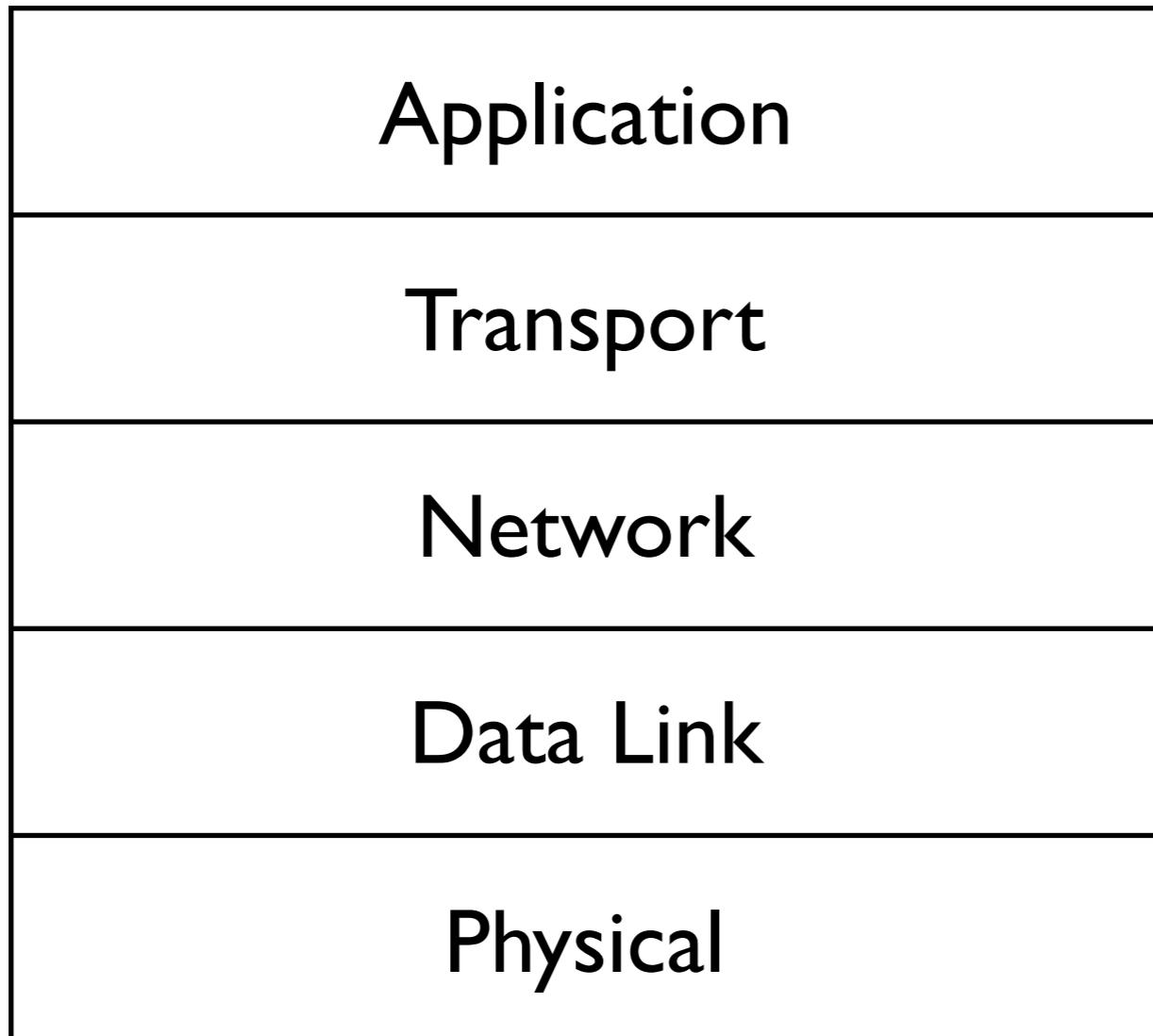


# Layering (cont.)

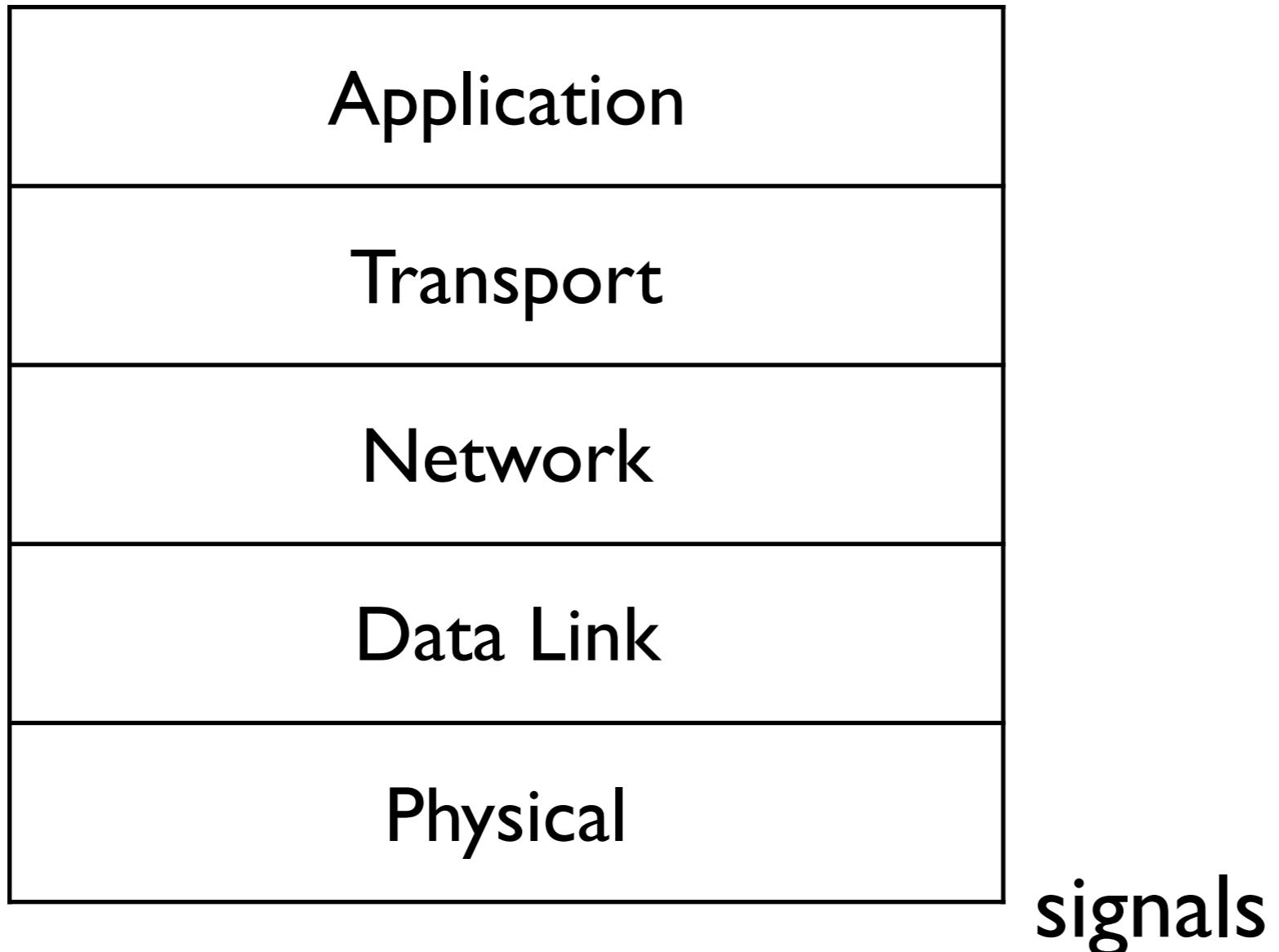


# Layering (cont.)

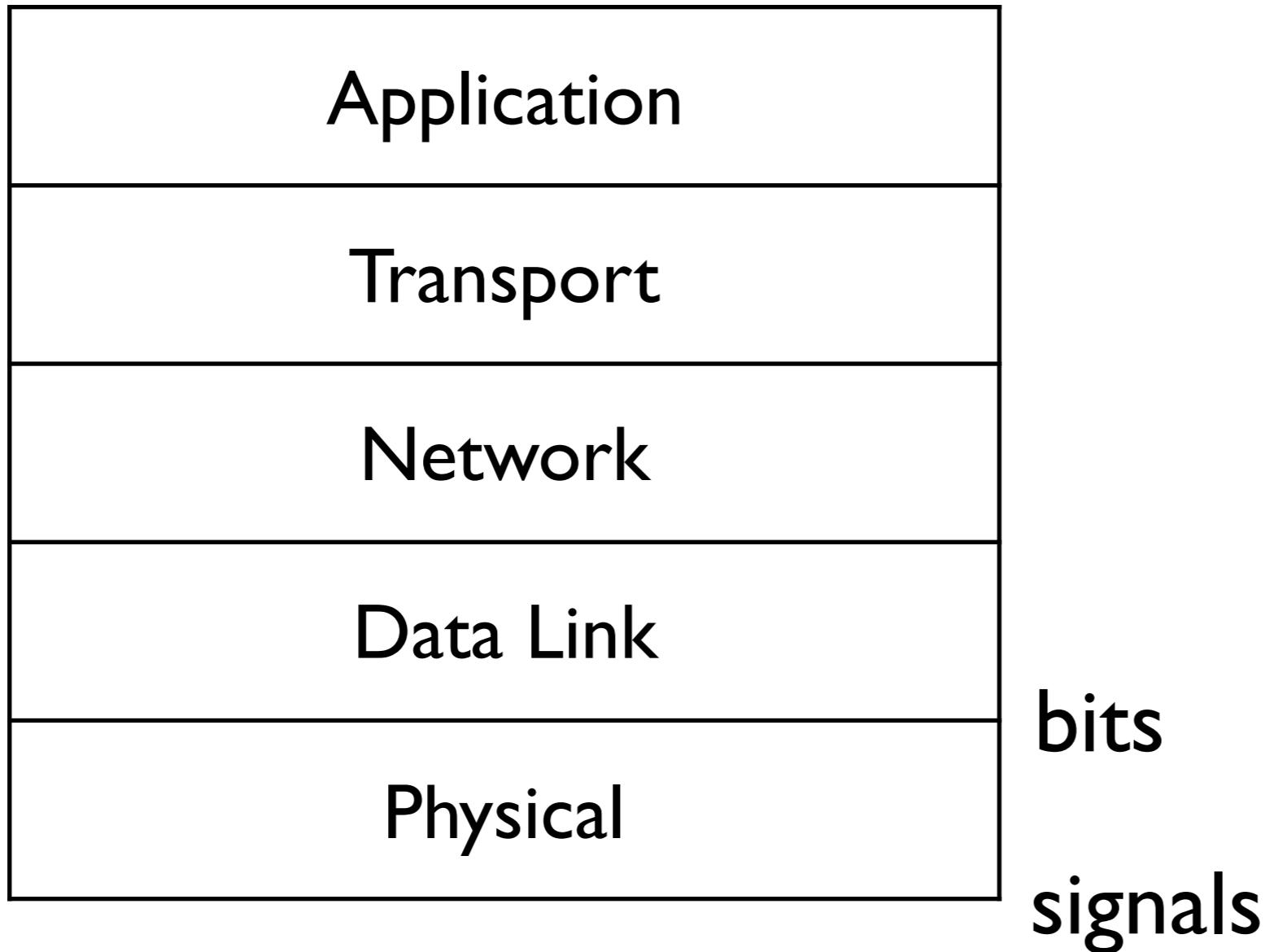
# Layering (cont.)



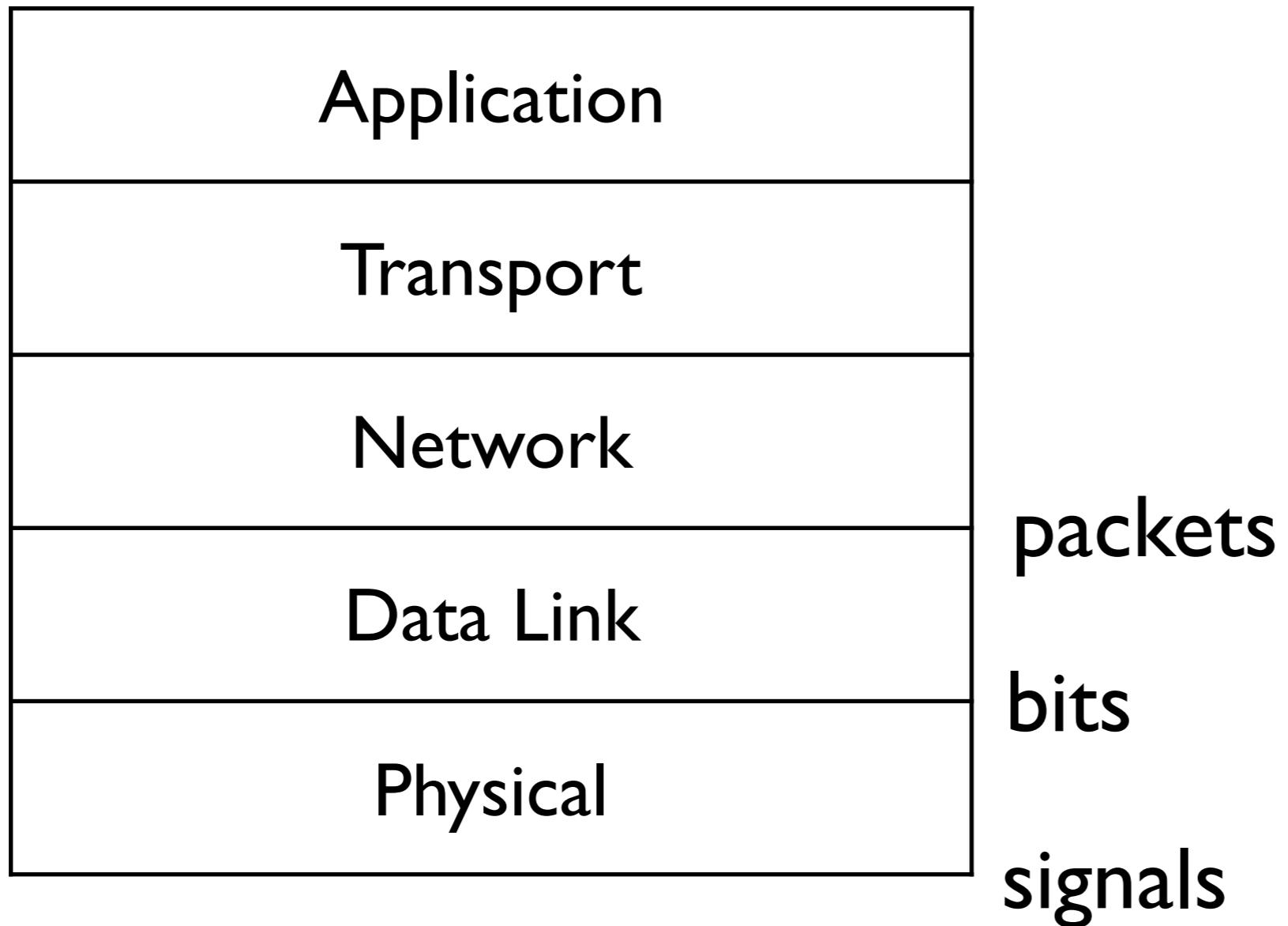
# Layering (cont.)



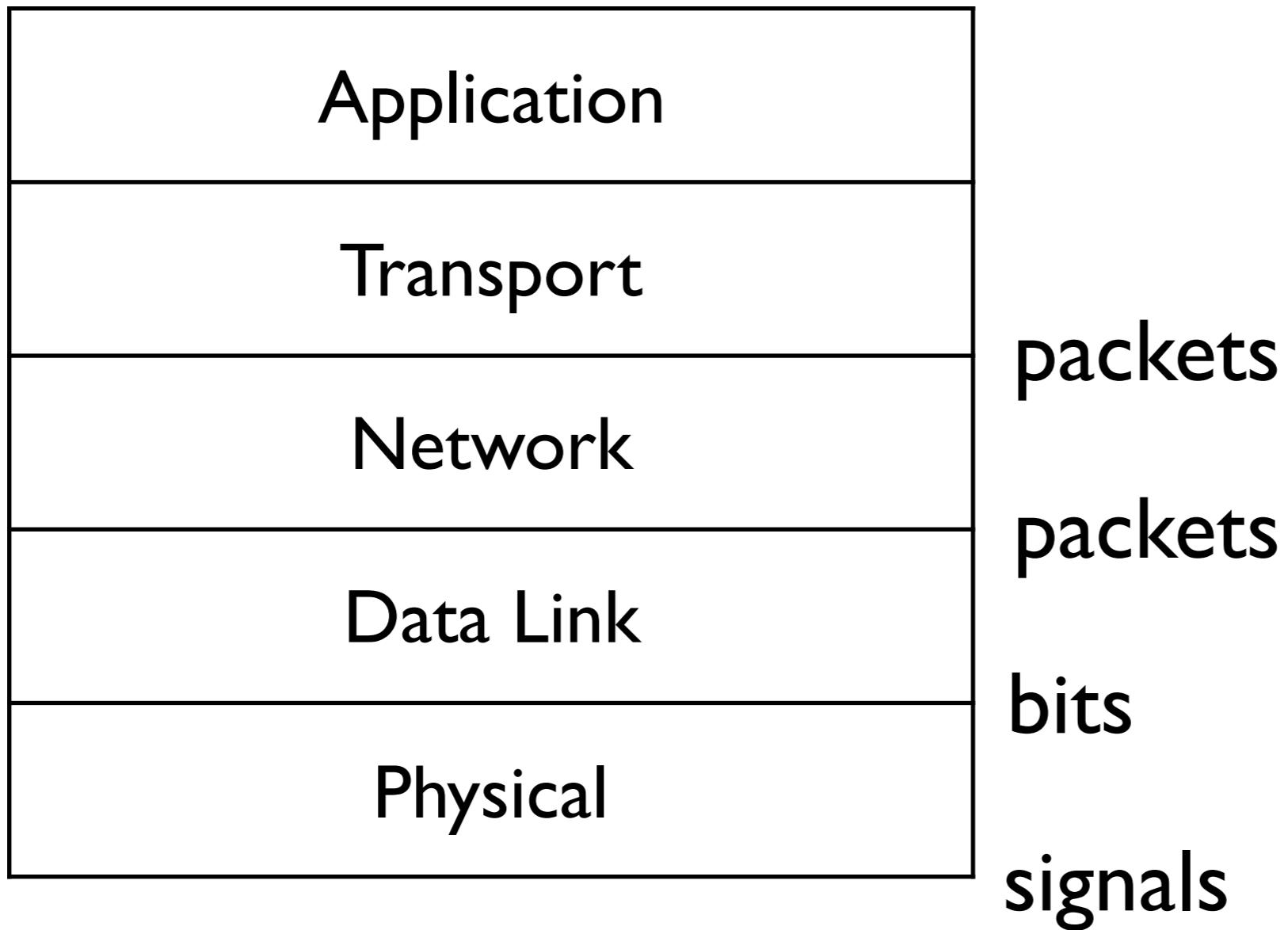
# Layering (cont.)



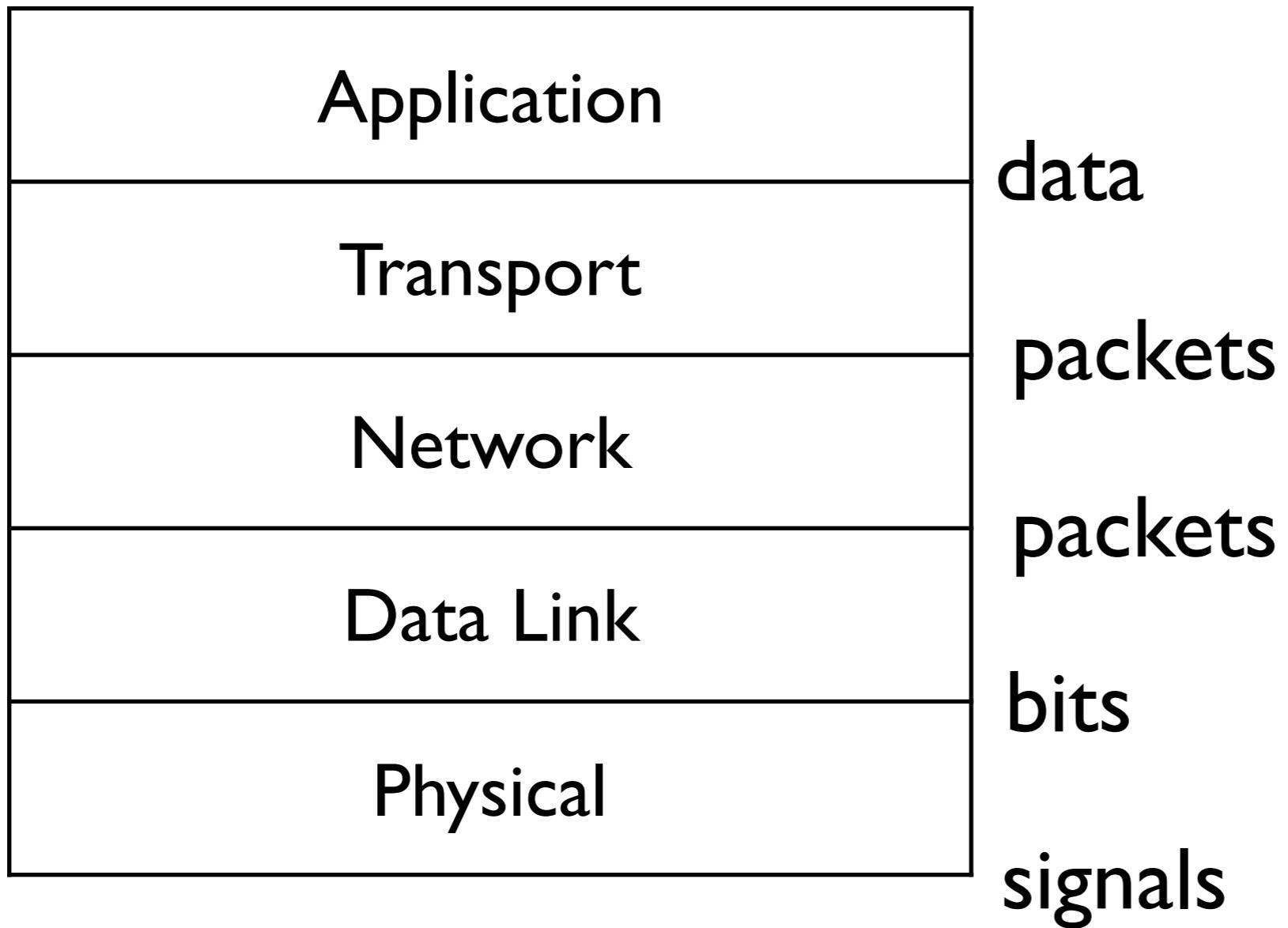
# Layering (cont.)



# Layering (cont.)

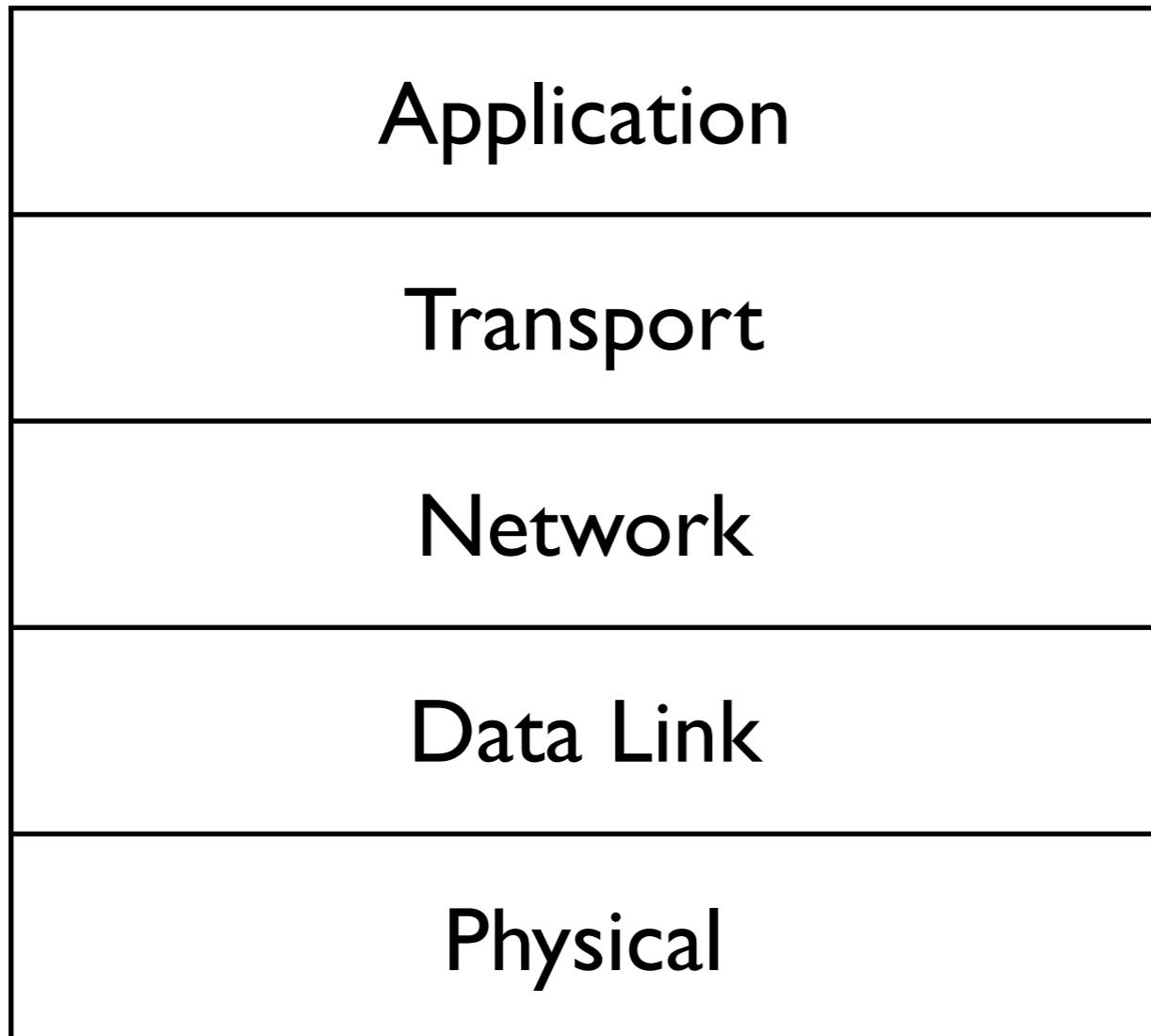


# Layering (cont.)

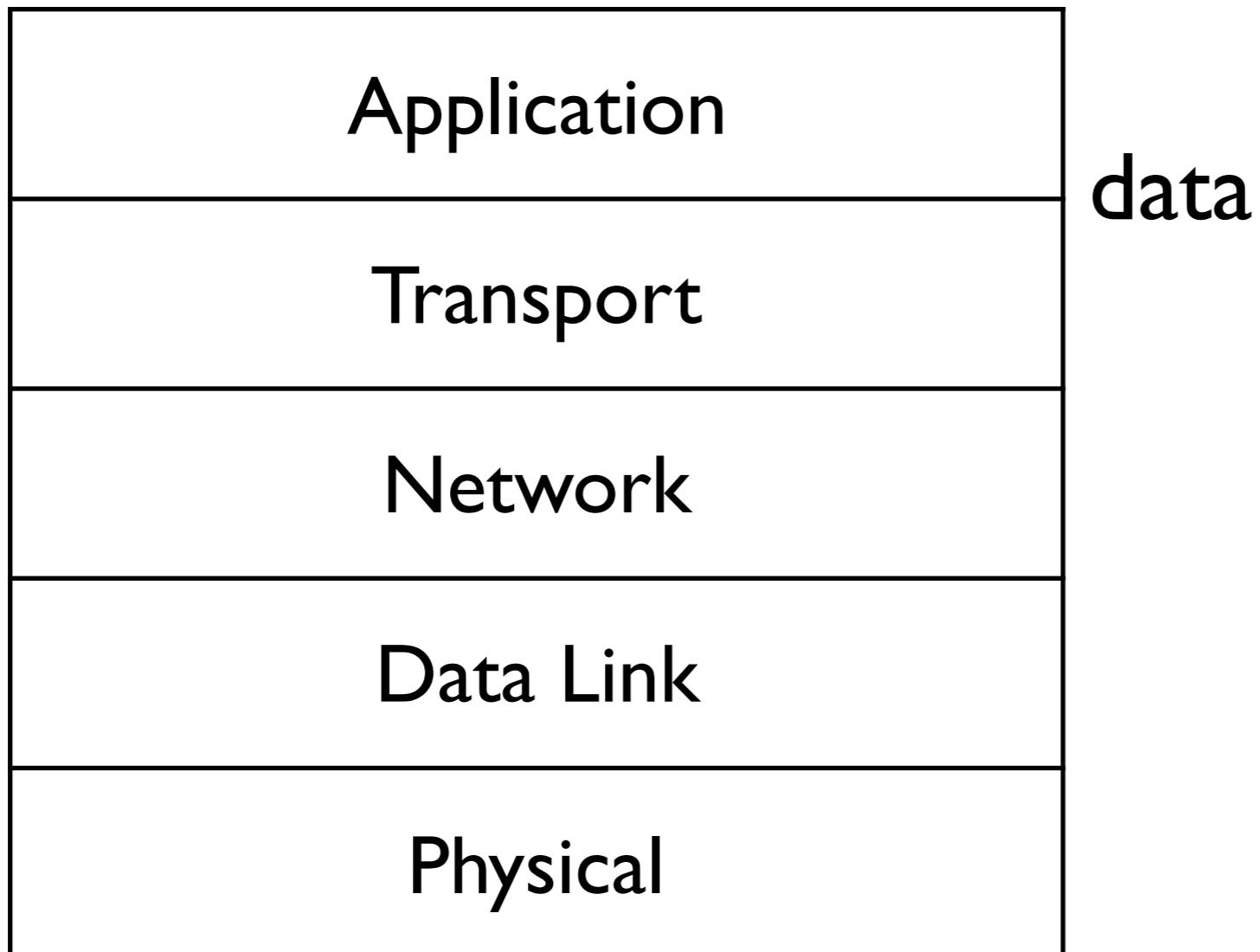


# Layering (cont.)

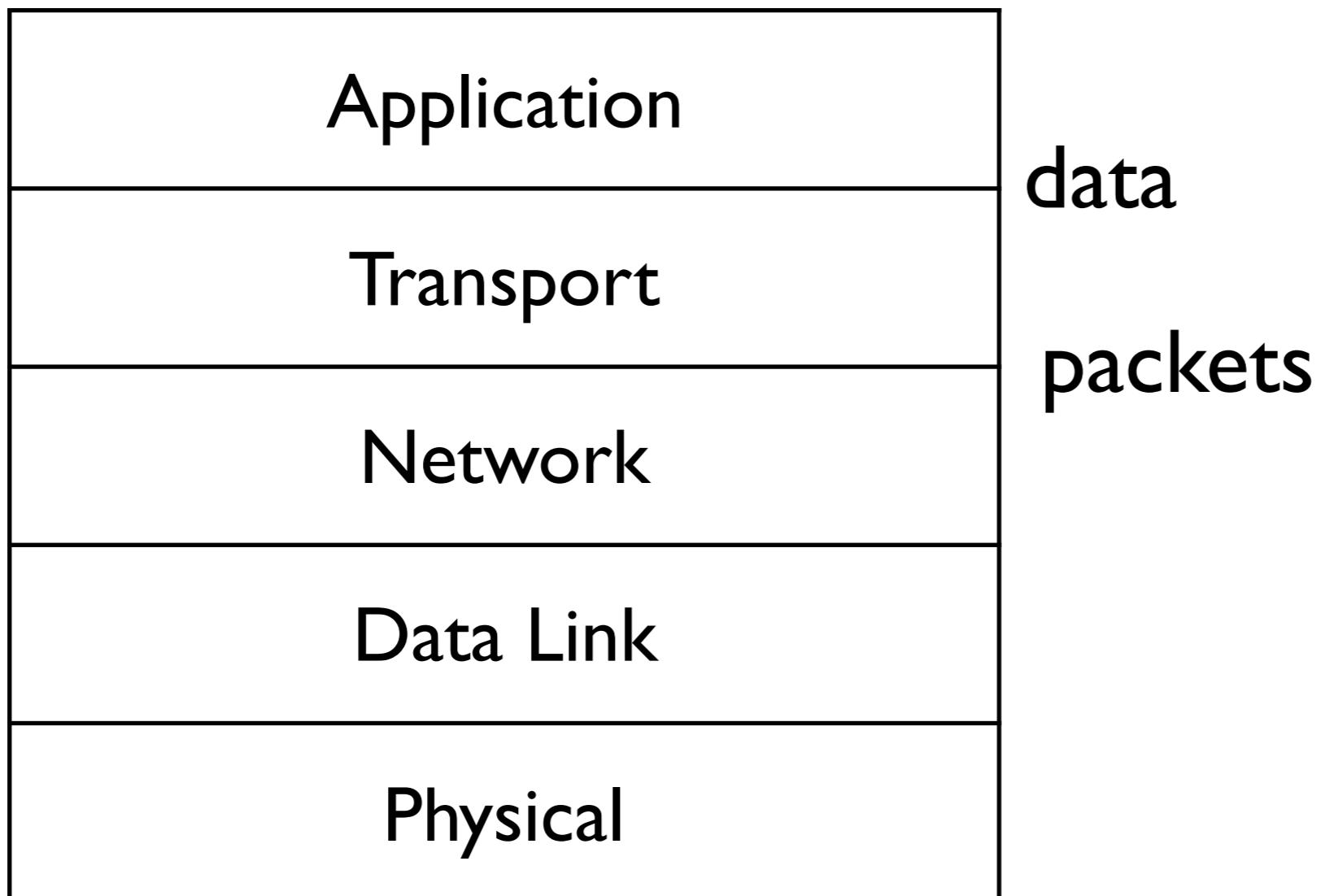
# Layering (cont.)



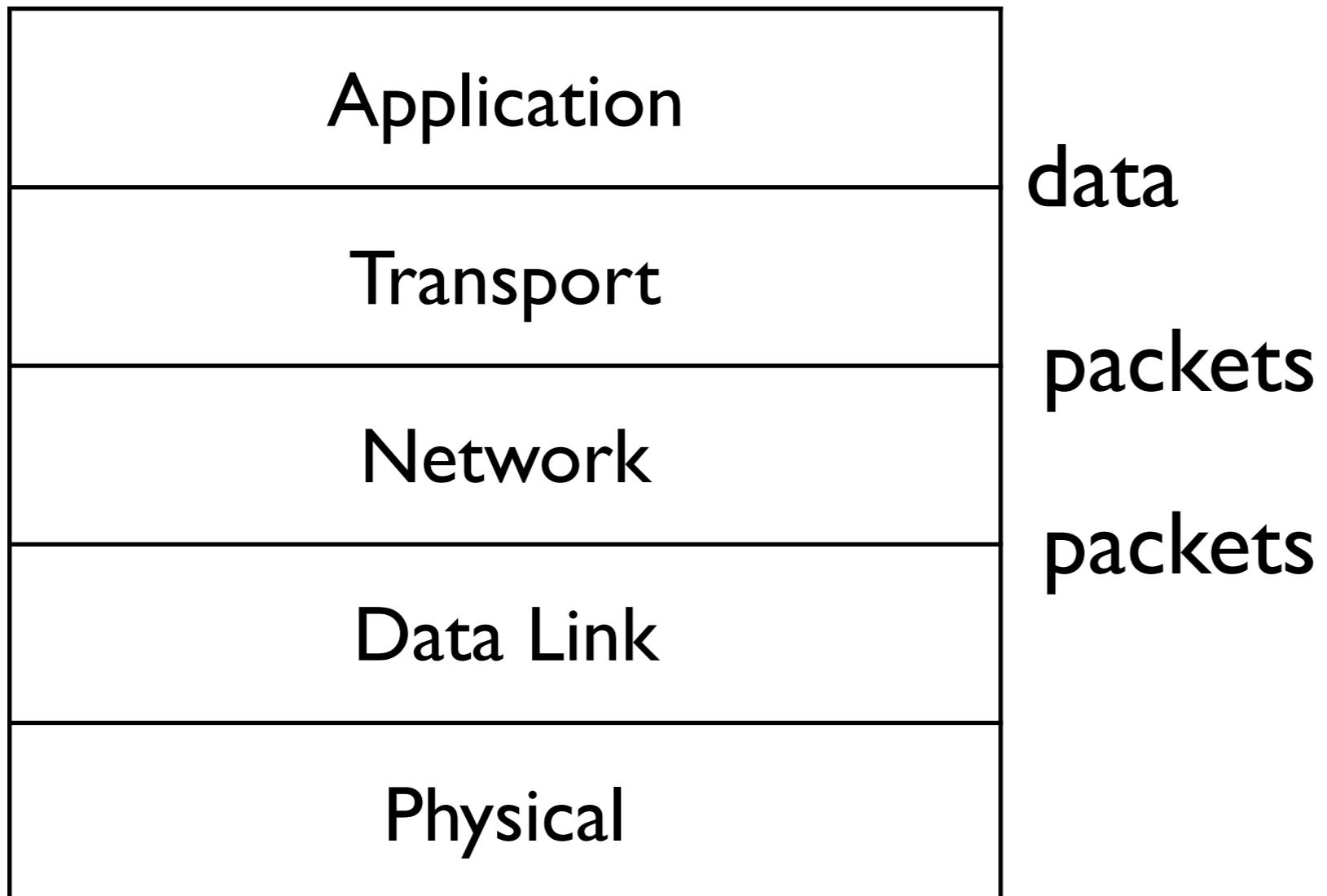
# Layering (cont.)



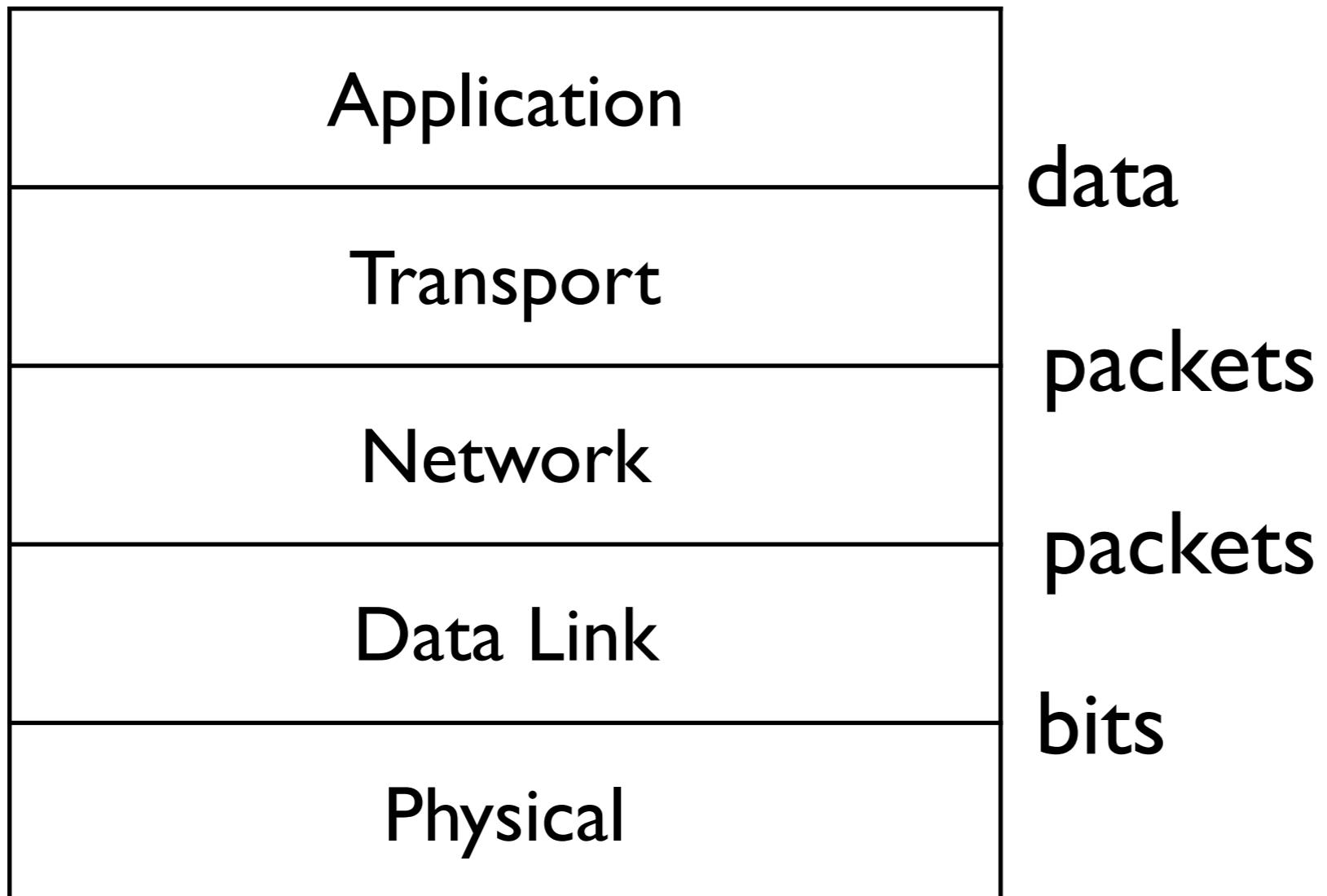
# Layering (cont.)



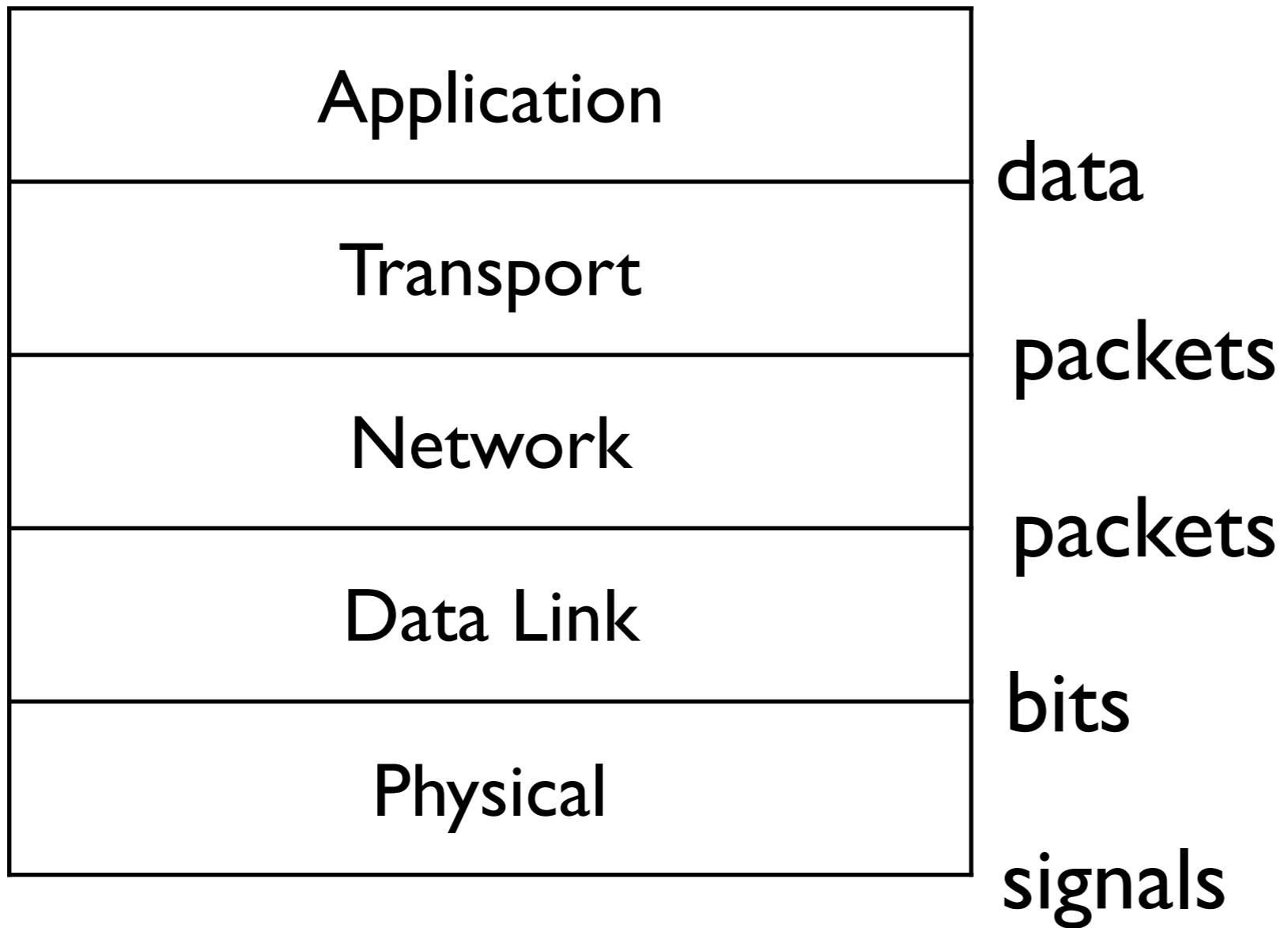
# Layering (cont.)



# Layering (cont.)

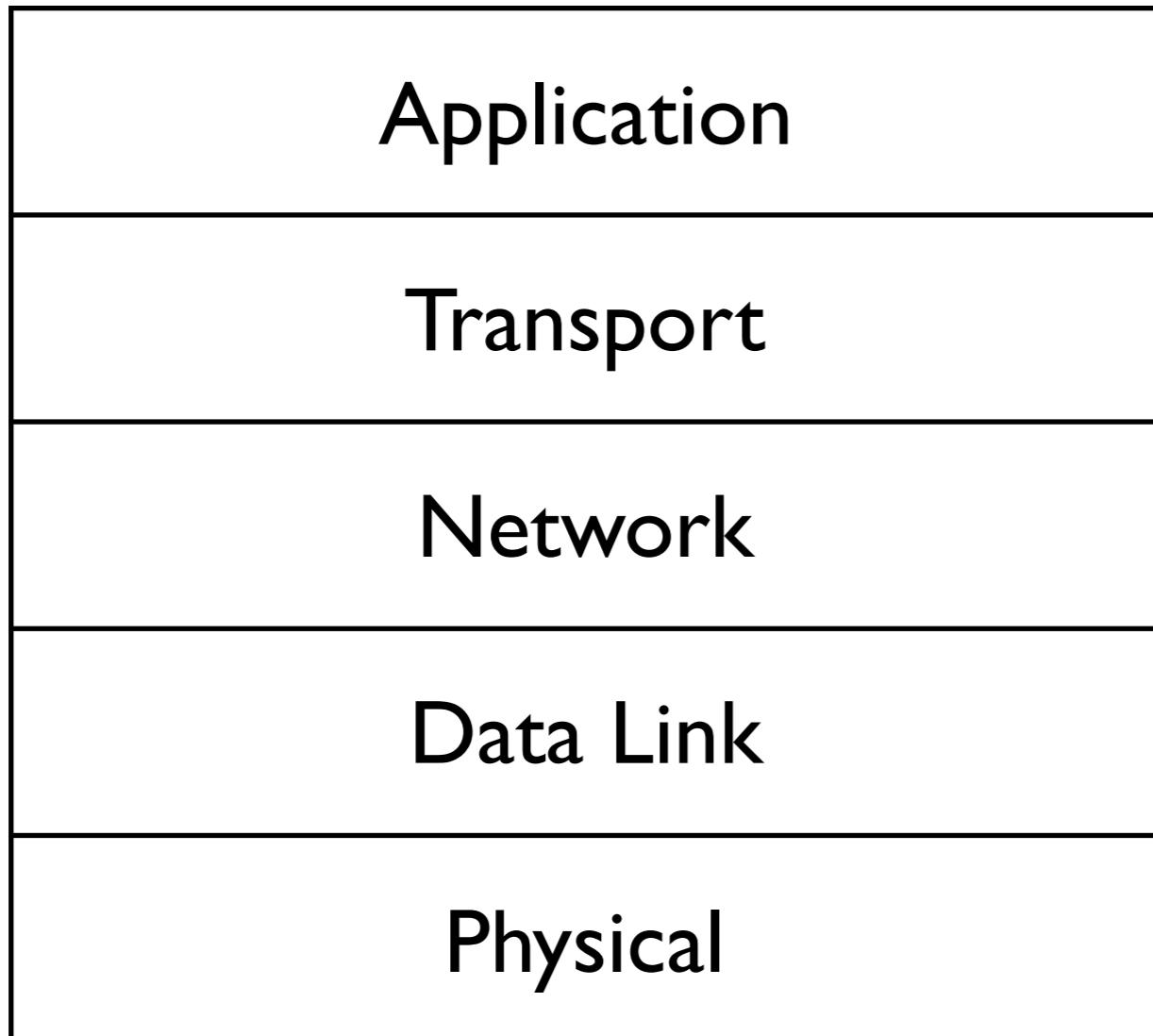


# Layering (cont.)

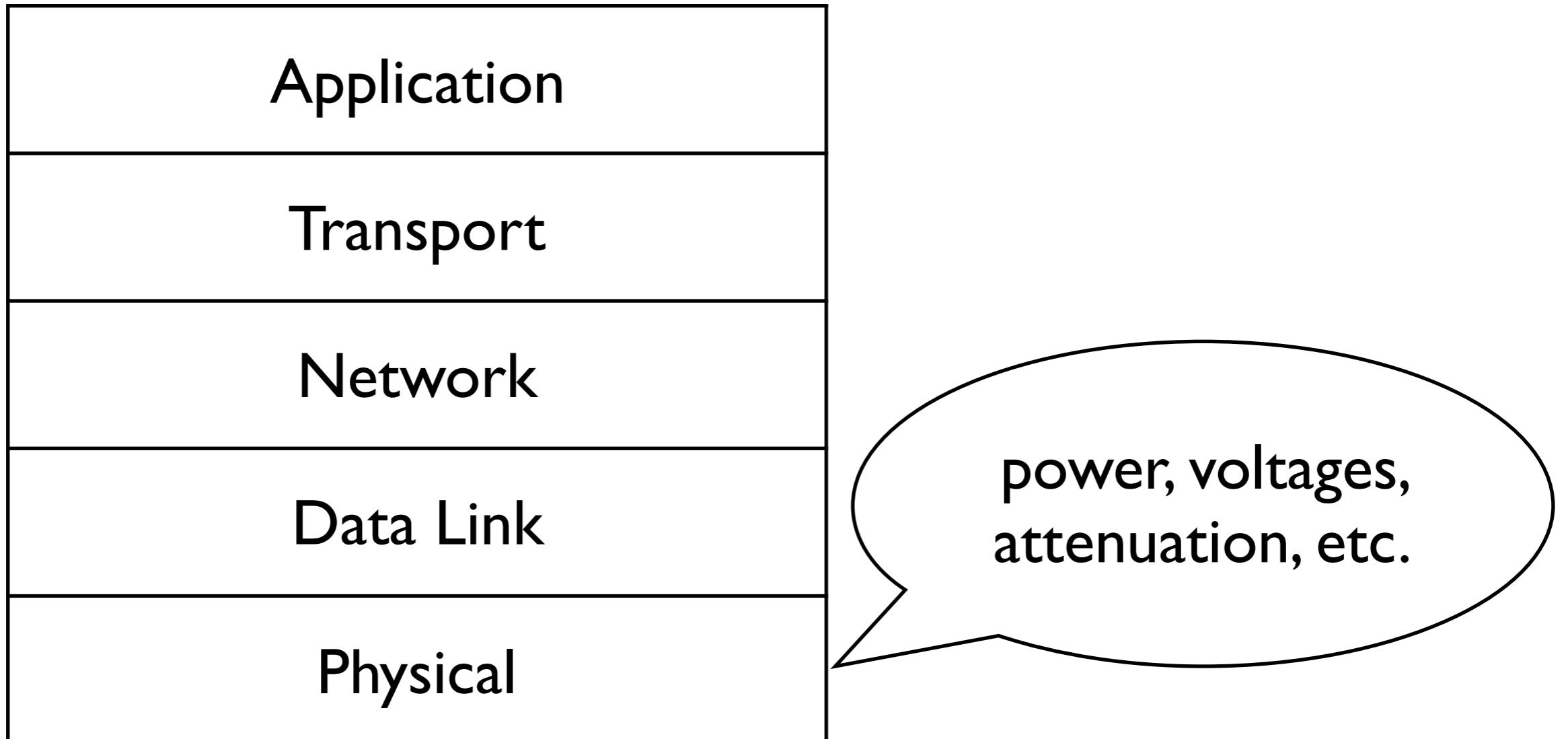


# Layering (cont.)

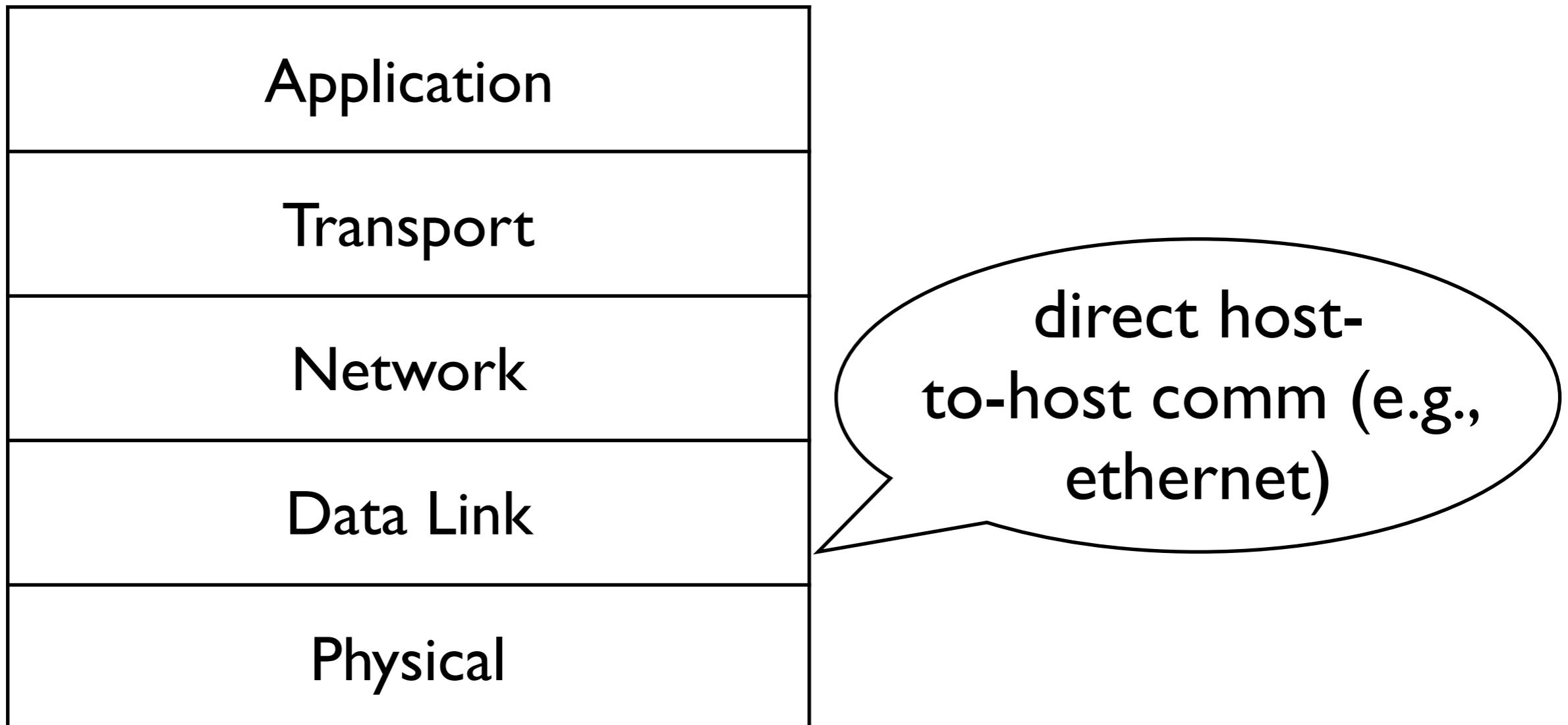
# Layering (cont.)



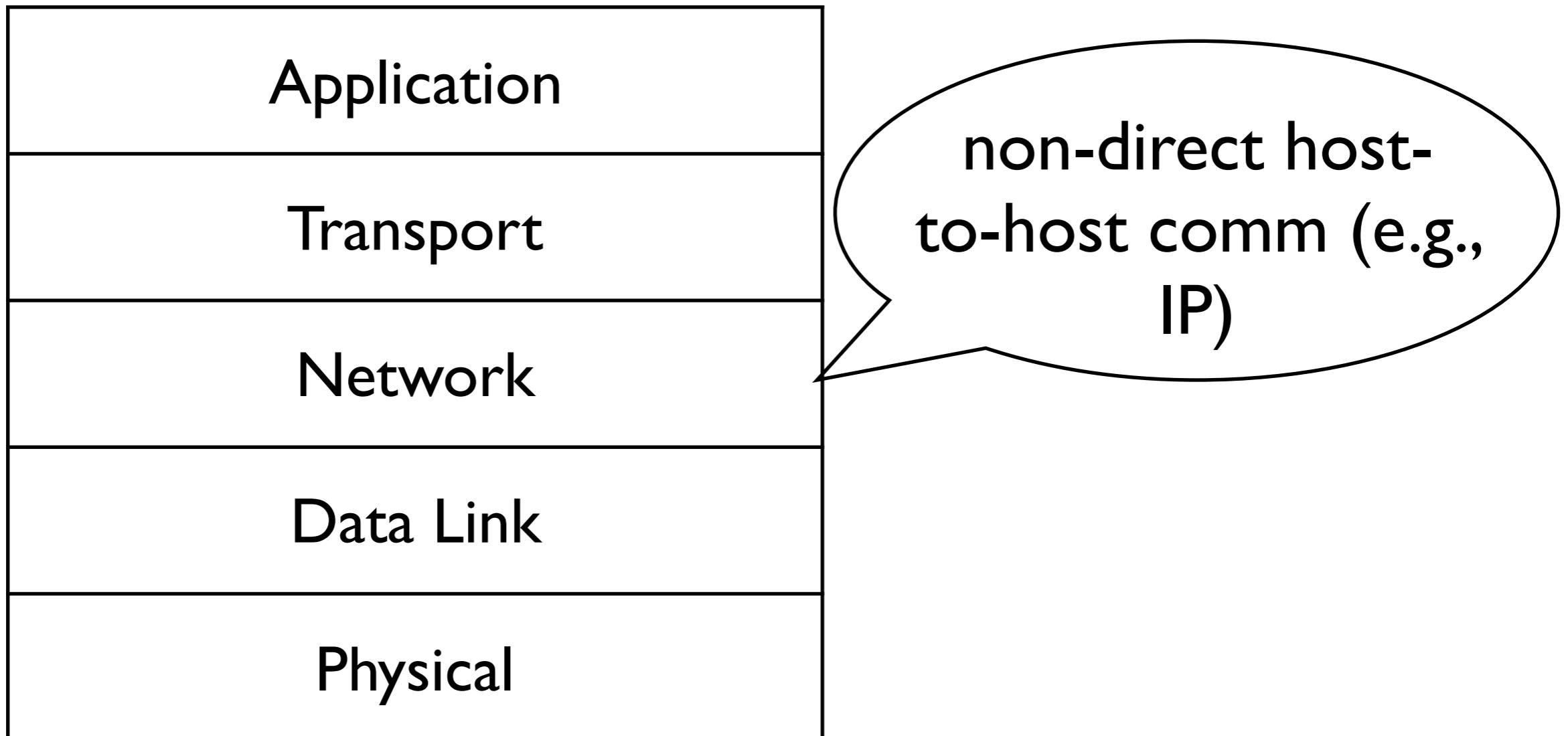
# Layering (cont.)



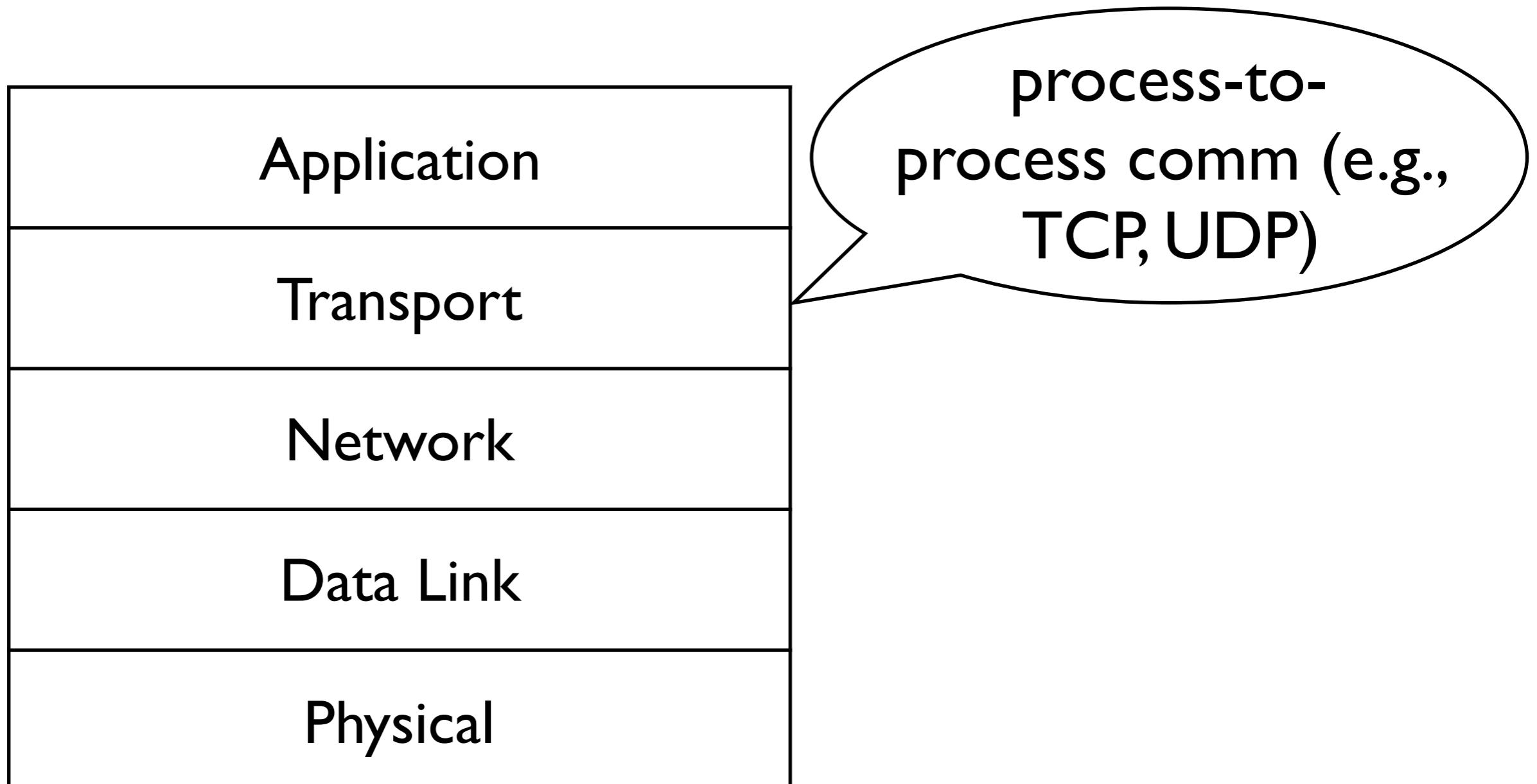
# Layering (cont.)



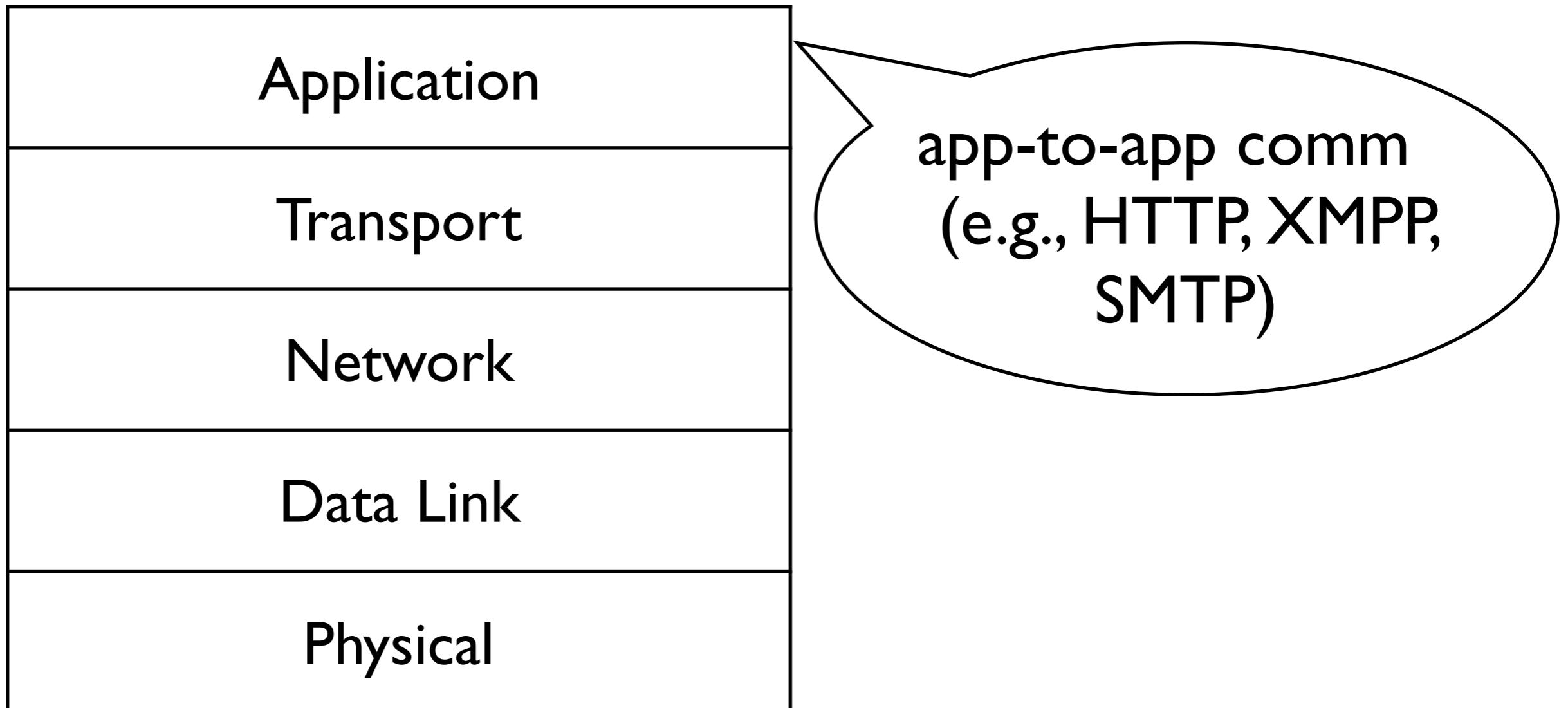
# Layering (cont.)



# Layering (cont.)

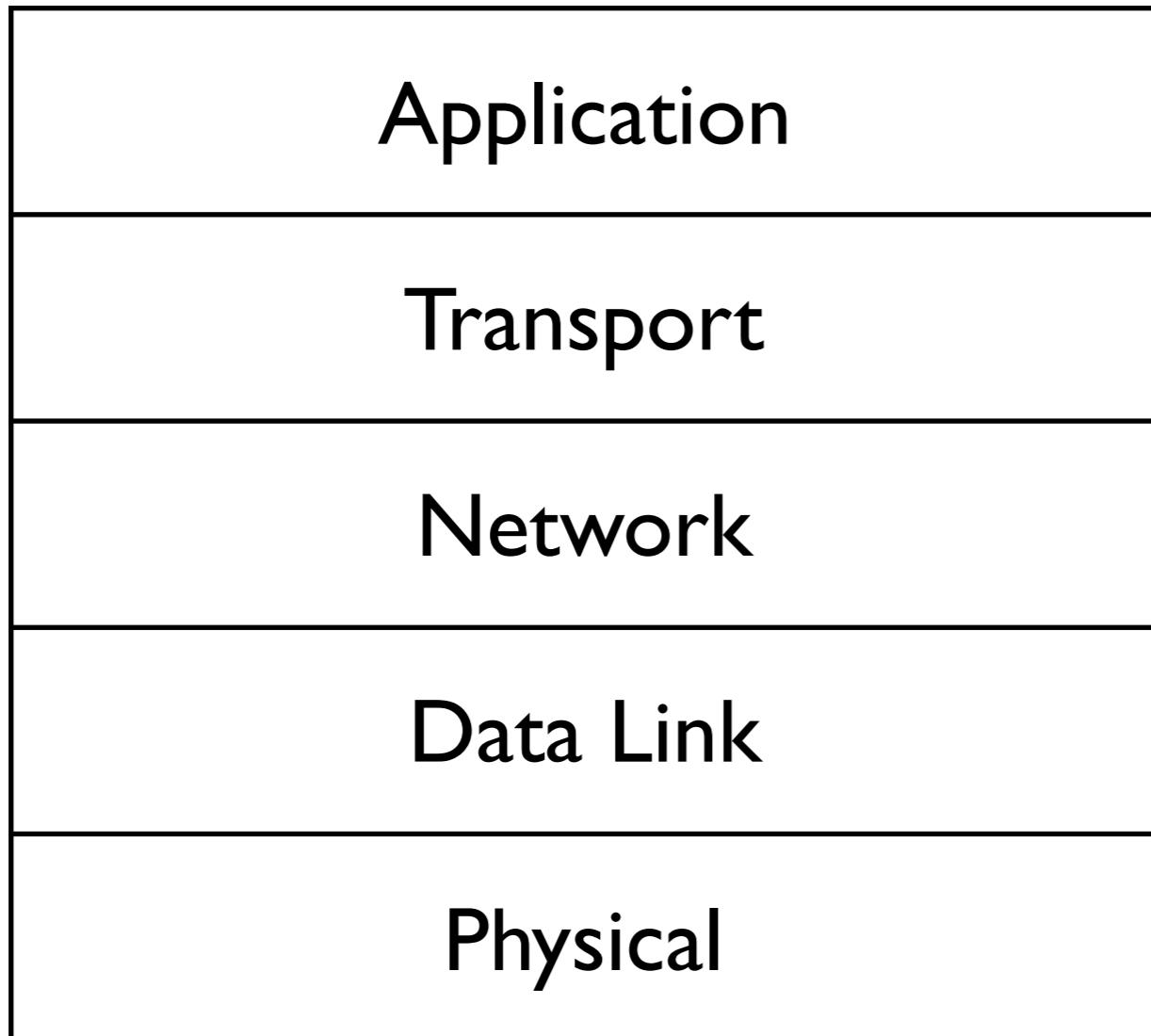


# Layering (cont.)

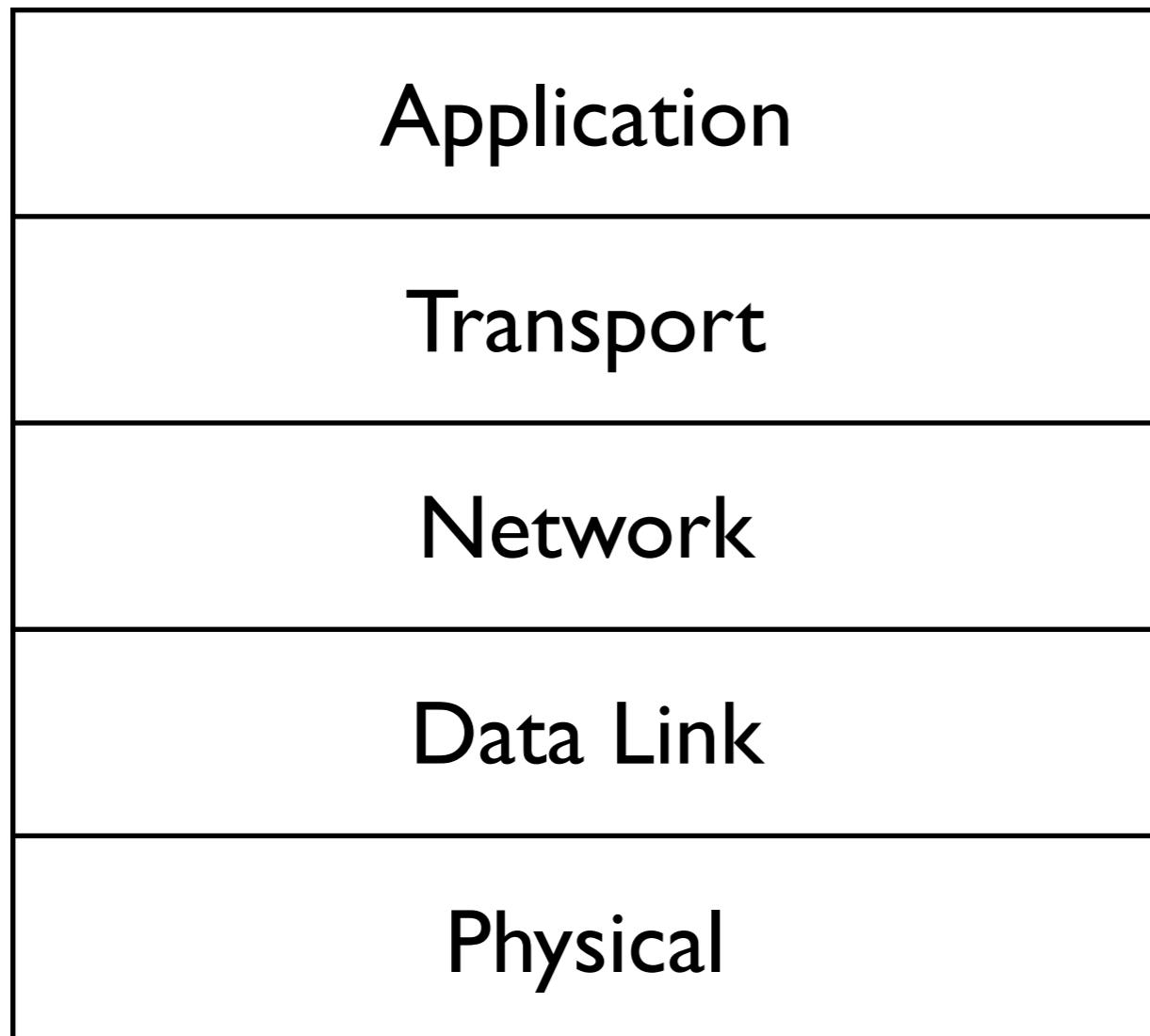


# Layering (cont.)

# Layering (cont.)

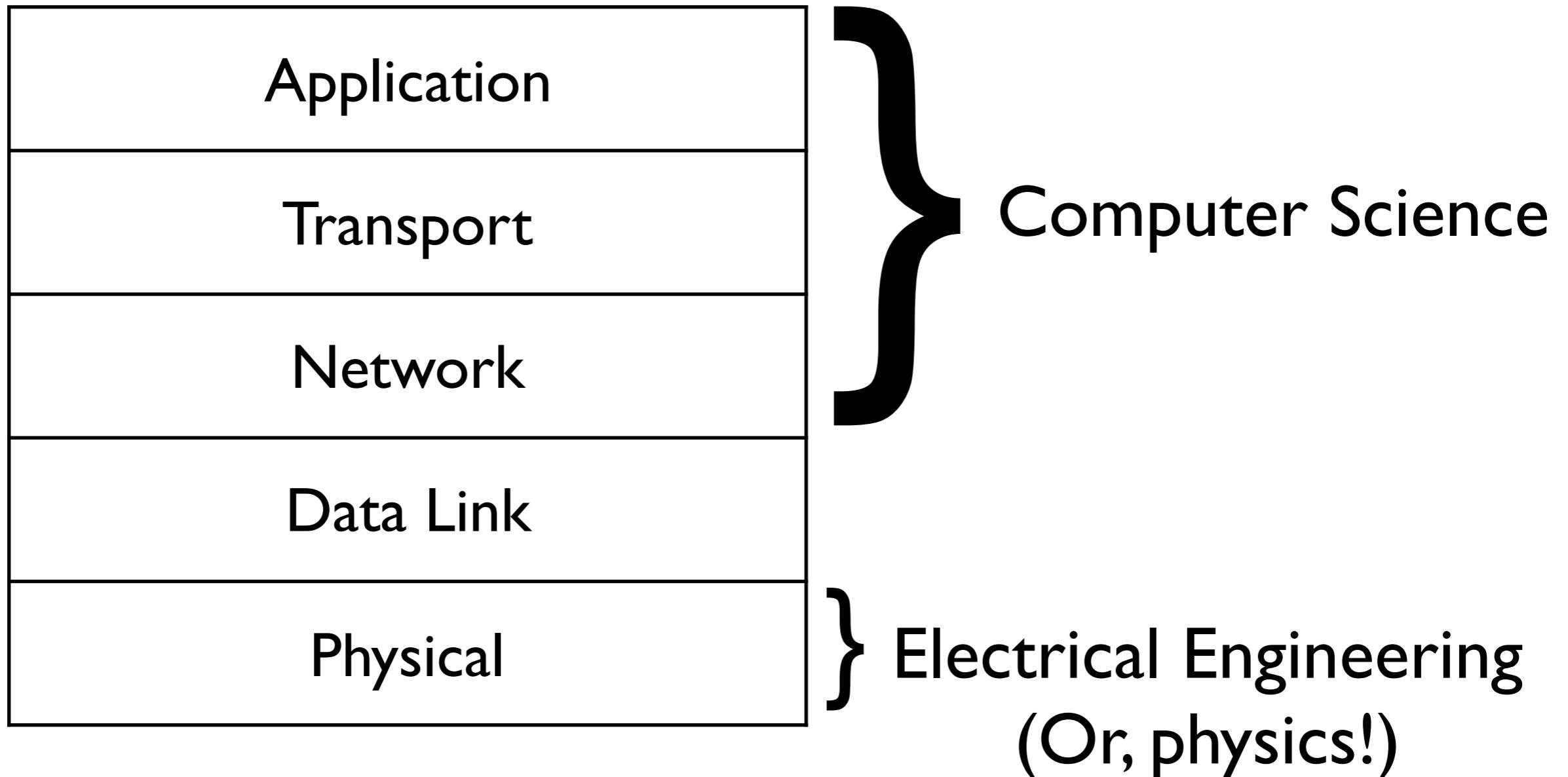


# Layering (cont.)

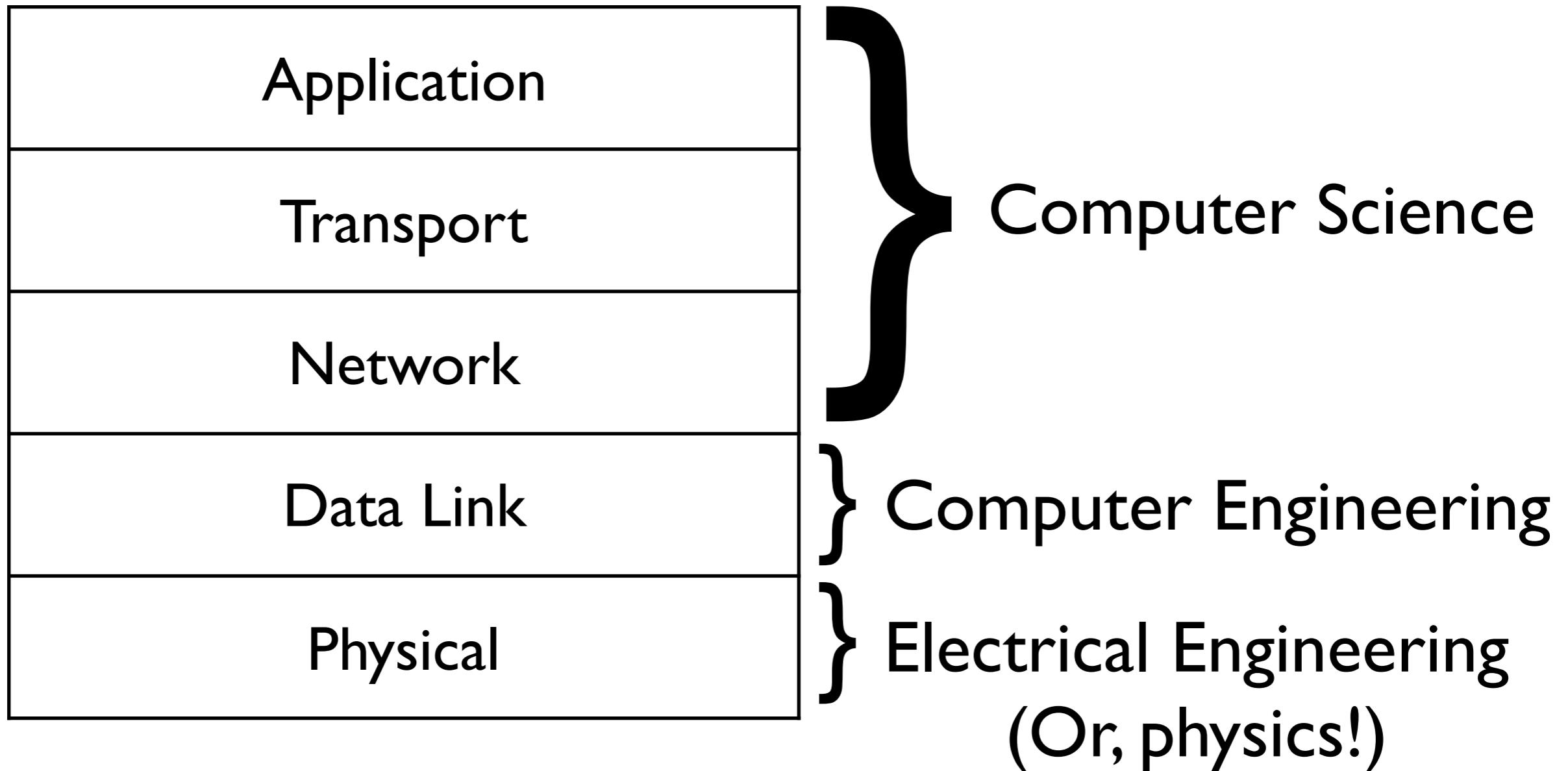


} Electrical Engineering  
(Or, physics!)

# Layering (cont.)

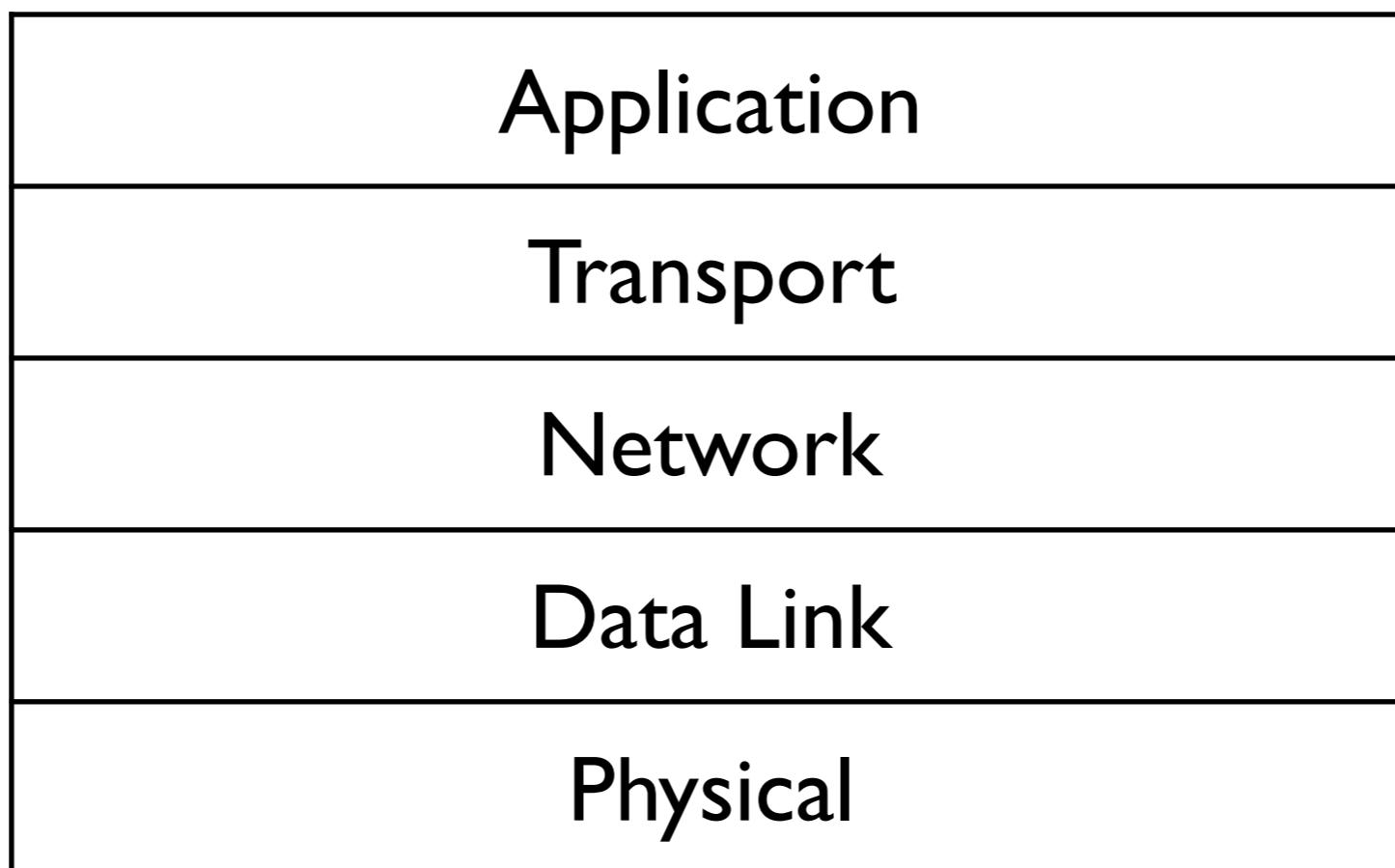


# Layering (cont.)



# Layering (cont.)

# Layering (cont.)



# Layering (cont.)

