Internet, Principes et Protocoles (IPP)

1. Introduction

FYI

- Les slides sont basees sur celles de Olivier Bonaventure.

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A network

A network is a set of hardware and software that enables the transmition of information from one sender to one or more receivers.

- Examples:
  - Plain Old Telephone System (POTS)
  - GSM
  - Broadcast networks (TV, Radio,..)
  - Computer Networks (Internet, home networks, proprietary networks)

Classifications

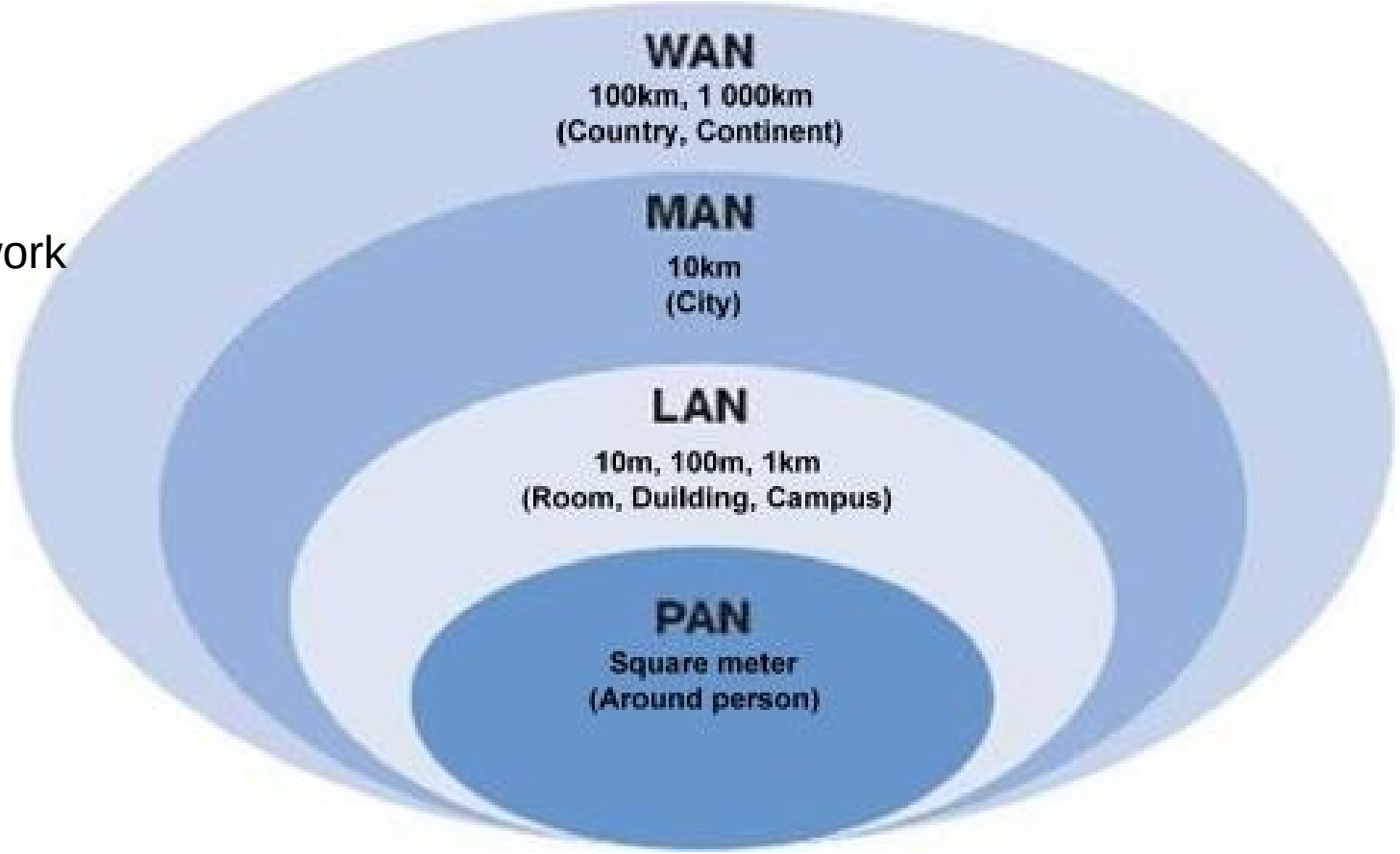
Based on range

Wide Area Network

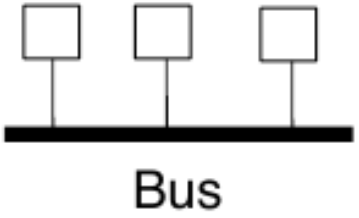
Metropolitan Area Network

Local Area Network

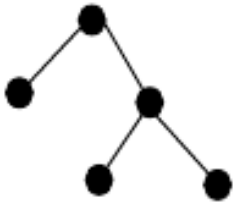
Personal Area Network



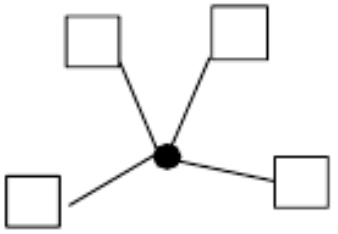
Based on topologies



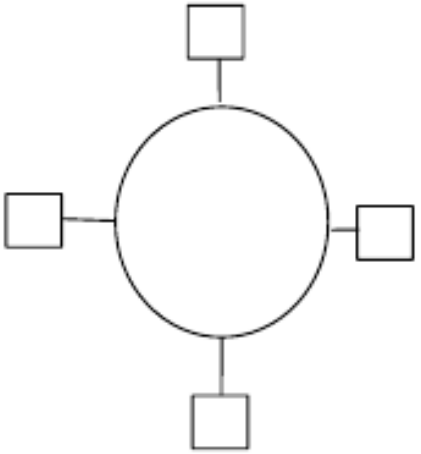
Bus



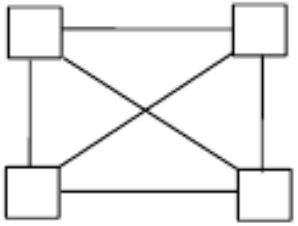
Tree



Star



Ring



Full-mesh

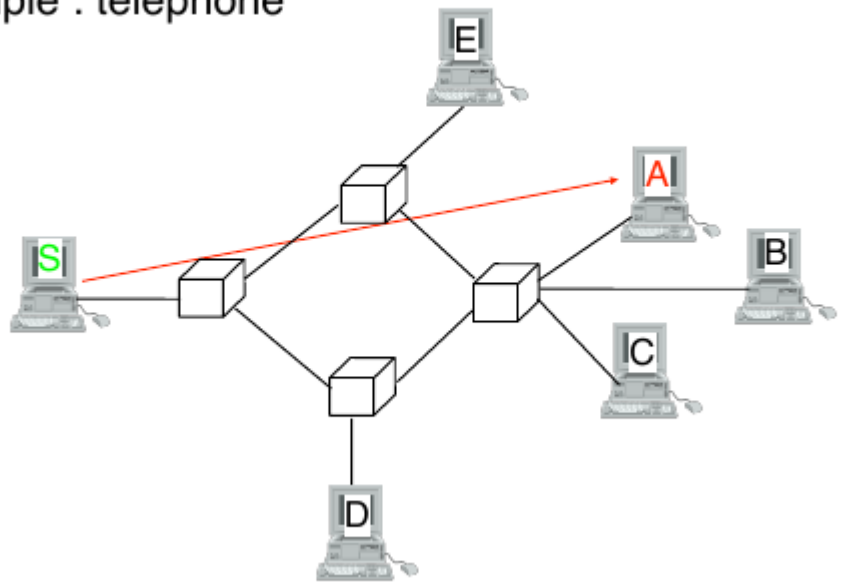
Future

- Connected Fridge tells the connected TV to show adds about tomato sauce because the high consumption of that.
- You control your house’s lights with your phone.
- Usage and connected machines is expected to grow exponentially.

Transmission Modes

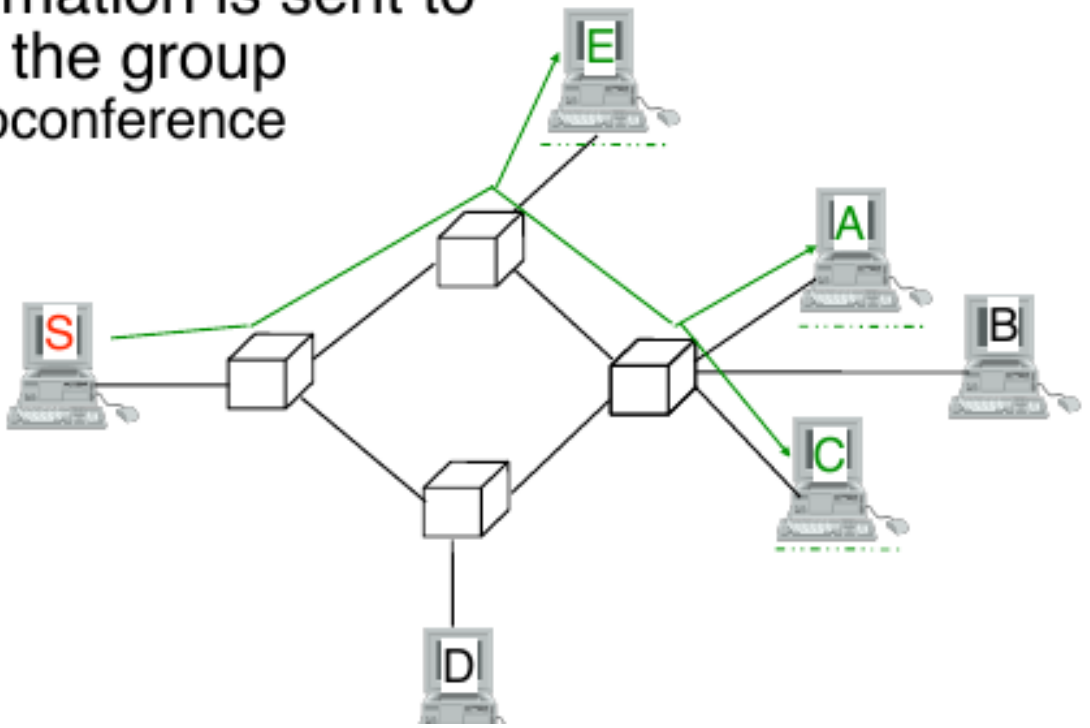
- Unicast (Point-to-Point)

one sender
one receiver
example : telephone



Transmission Modes

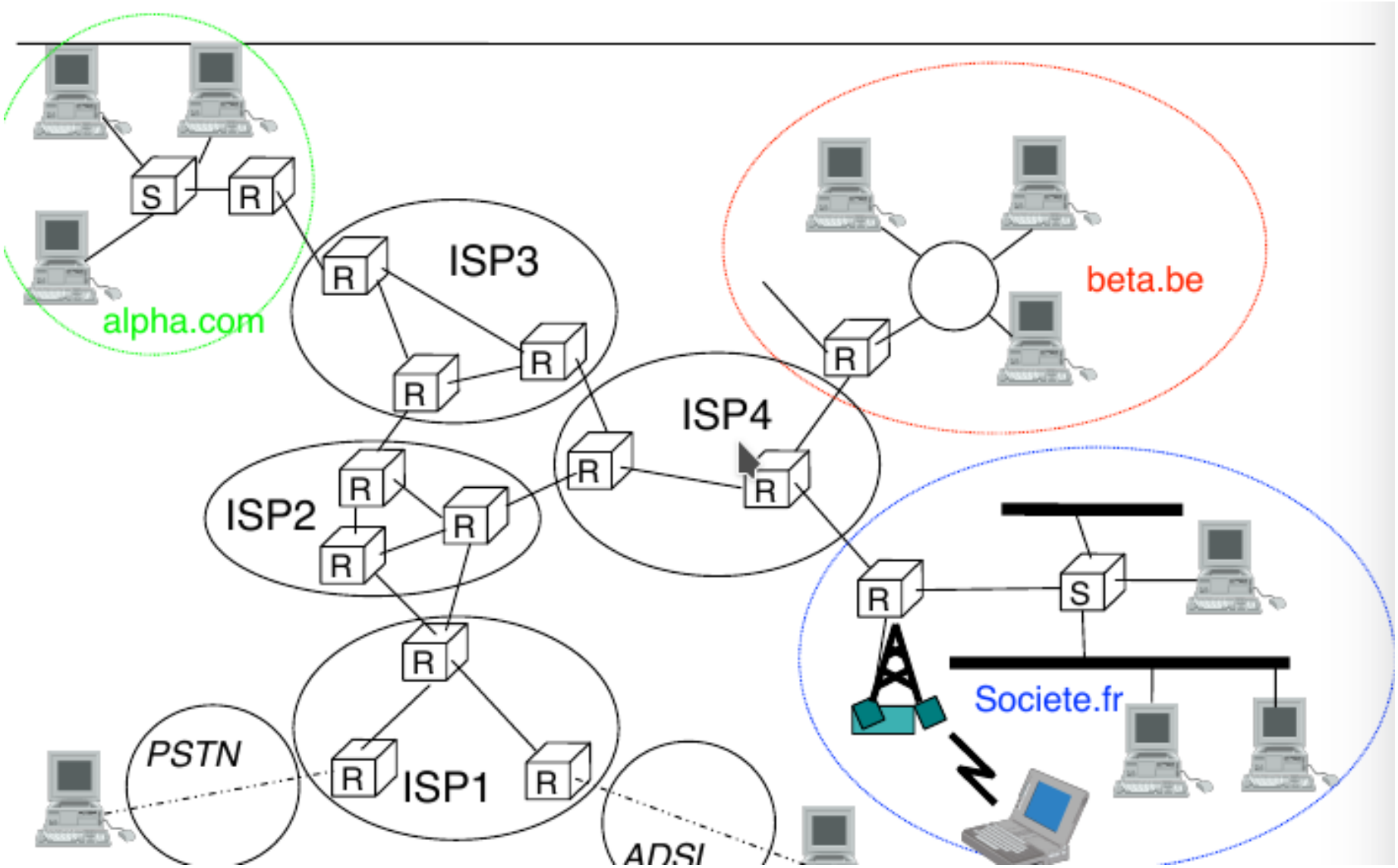
- Mulitcast (Point-to-multipoints)
  - one sender
  - a group of receivers
  - The same information is sent to all members of the group
    - example : videoconference



Transmition modes

- Broadcast
  - The same information is sent to everyone reachable on the network.
  - Example: the radio
- Anycast
  - The information is sent from one sender to one receiver, among a group of possible receivers.

Sketch of the internet



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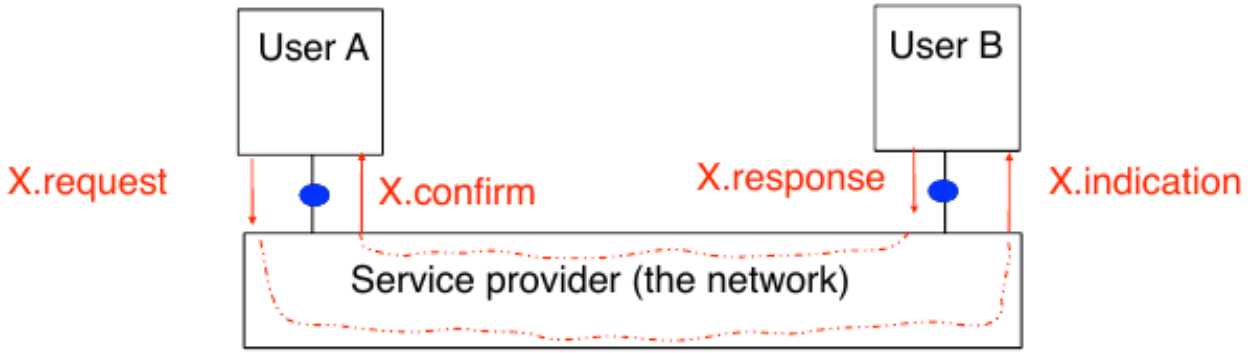
Service Provider: connection-oriented / connectionless

- Before reaching the targeted receiver, the data goes through a network provider (ISPs).



- X.request
  - request from a user to a service provider
- X.indication
  - primitive generated by the network provider to a user (often related to an earlier and remote X.request primitive)
- X.response
  - primitive used to answer to an earlier X.indication primitive
- X.confirm
  - primitive generated by the network provider to a user (related to a remote X.response primitive)

Service Provider: connectionless

Goal

Allow a sender to quickly send a message to one receiver

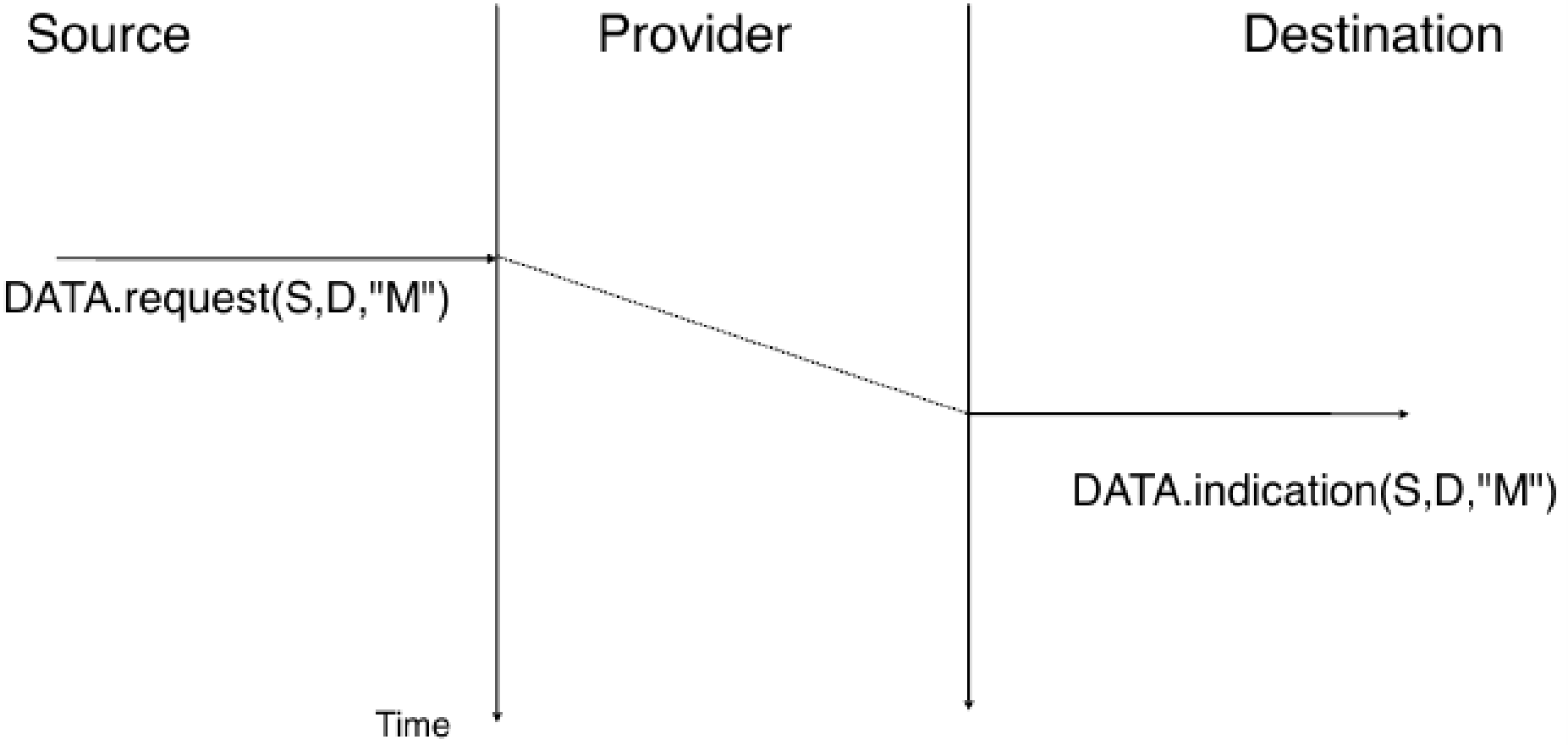
Principle

The sender places the message to be transmitted in a DATA.req primitive and gives it to the network provider
The network provider carries the message and delivers it to the receiver by using a DATA.ind primitive

Utilisation

useful to send short-length messages
example : post office

Service Provider: connectionless



Service Provider: Variations

confirmation

primitive DATA.confirm delivered by provider to sender to confirm (acknowledge) that some message has been delivered to destination

reliability

- reliable connectionless service (no errors)
- unreliable connectionless service (errors are possible)

protection against transmission errors

service may or may not detect/correct errors

protection against losses

the service may or cannot lose messages

in sequence delivery

The service may or not guarante in-sequence delivery for all messages sent by one source

Service Provider: connection-oriented

- Goal

  Create a logical binding (connection) between two users to allow them to efficiently exchange messages

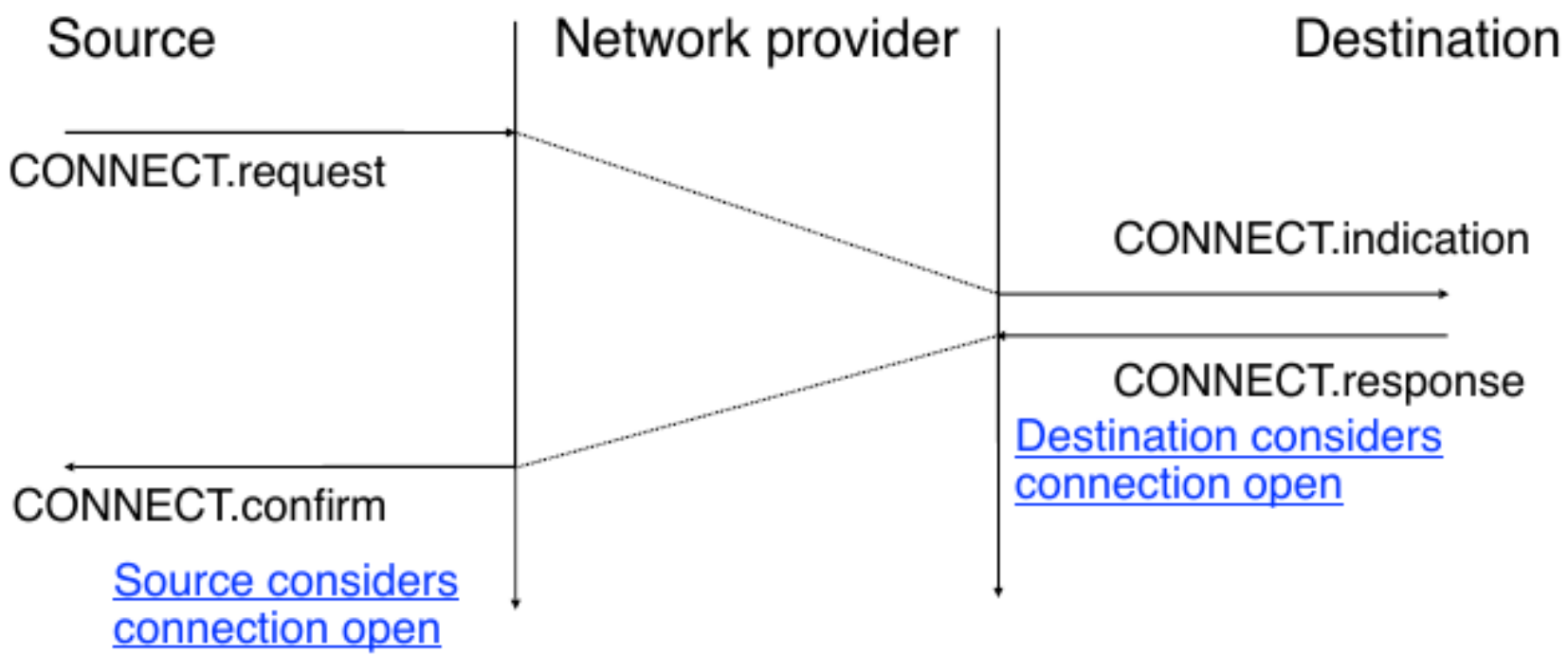
- Main phases of service
  - Connection establishment
  - Data transfer: both users can send and receive messages over connection
  - Connection release
- Utilisation
  - useful when the two users either
    - must exchange a large number of messages
    - need a structured exchange
- example : telephone

Service Provider: connection-oriented

Connection establishment

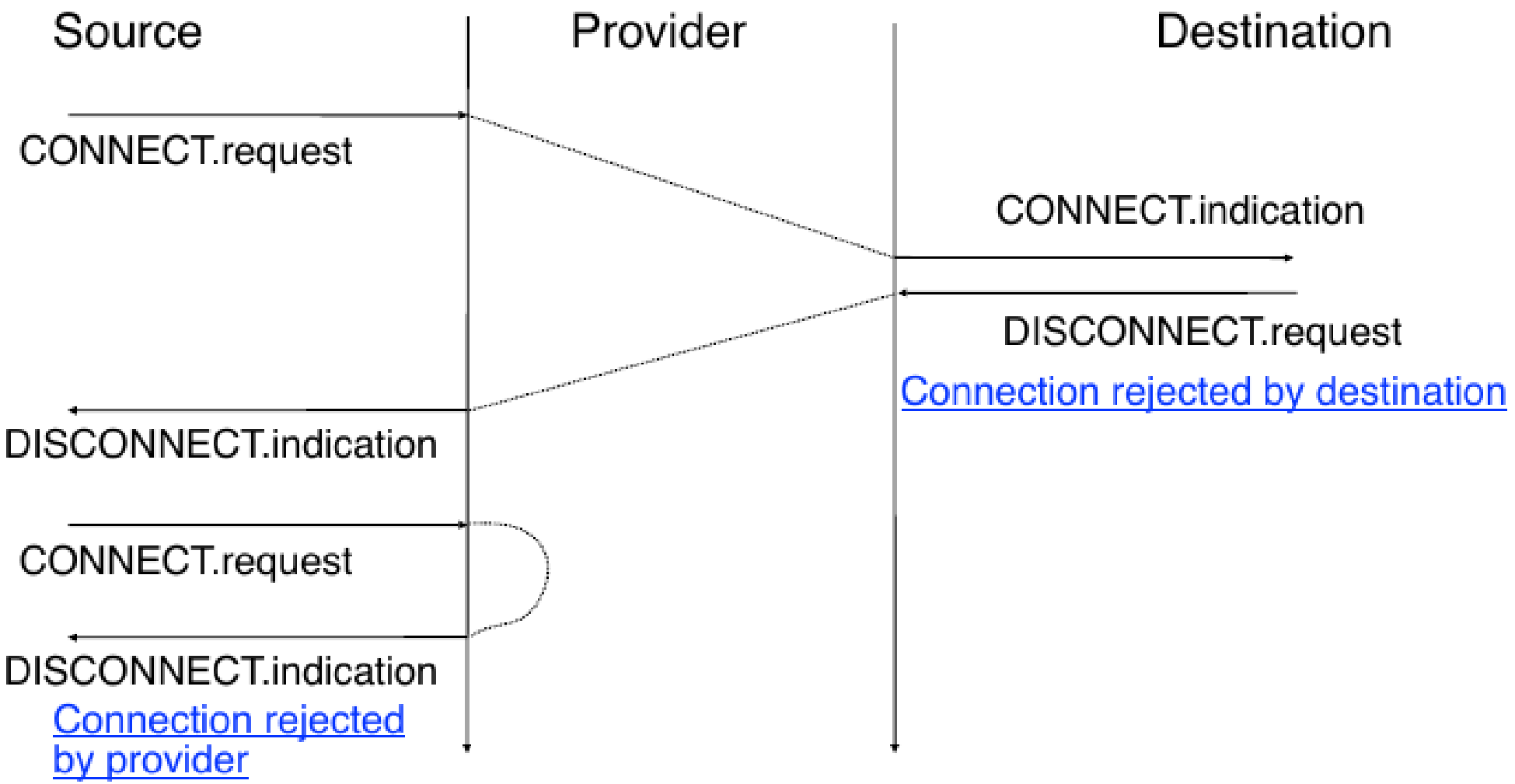
Primitives

- CONNECT.request
- CONNECT.indication
- CONNECT.response
- CONNECT.confirm



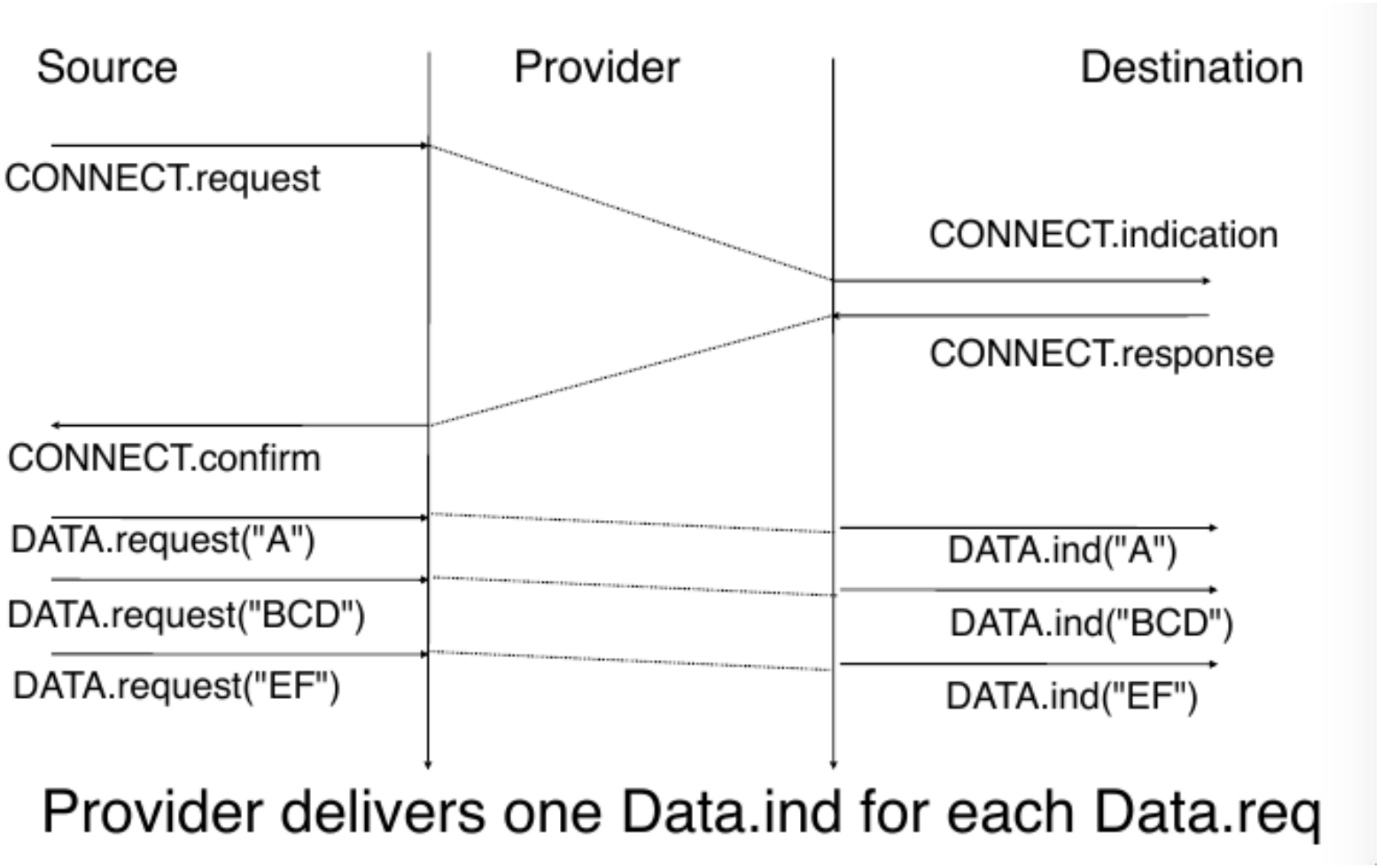
Service Provider: connection-oriented

Connection can be rejected



Service Provider: connection-oriented

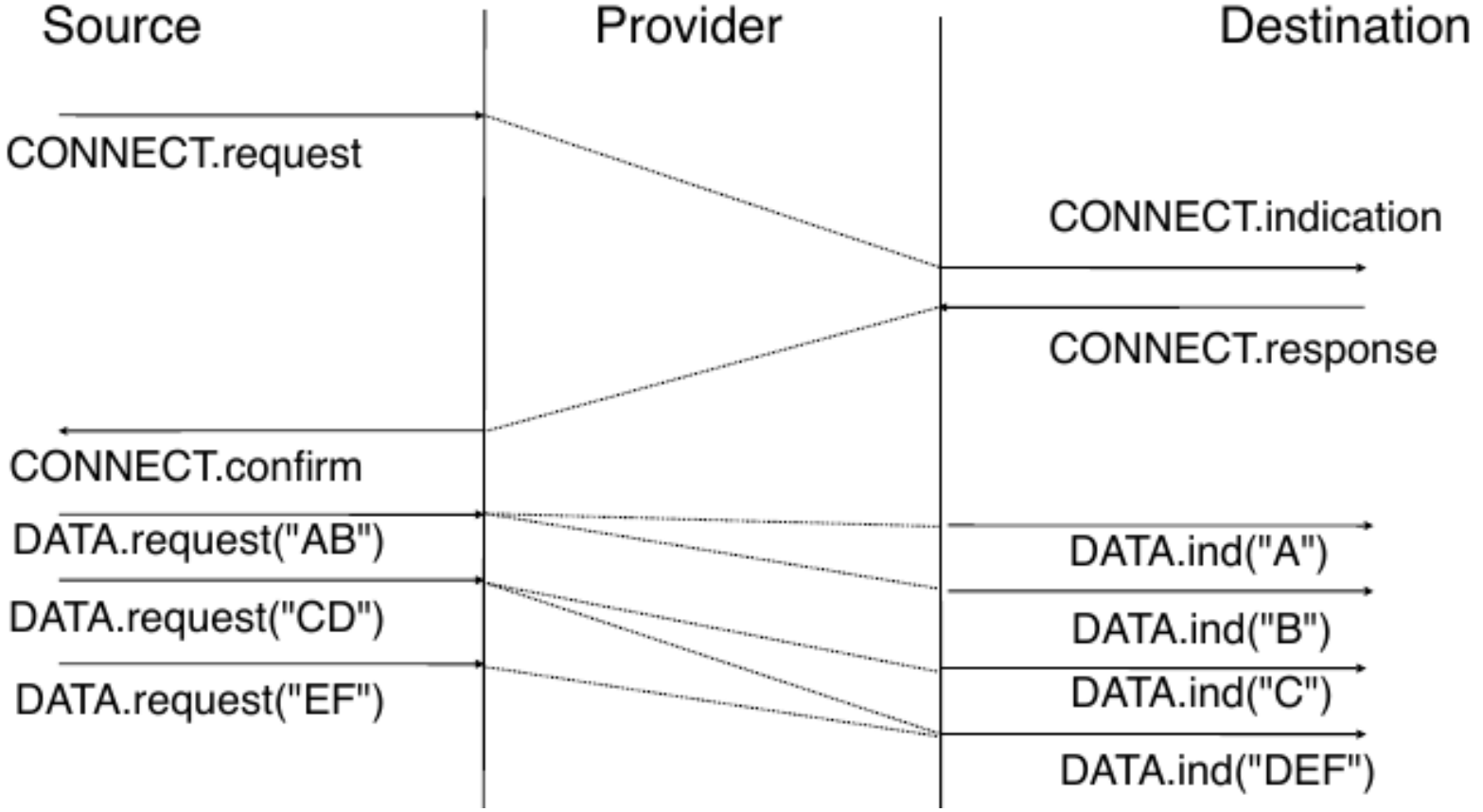
Message Mode



Service Provider: connection-oriented

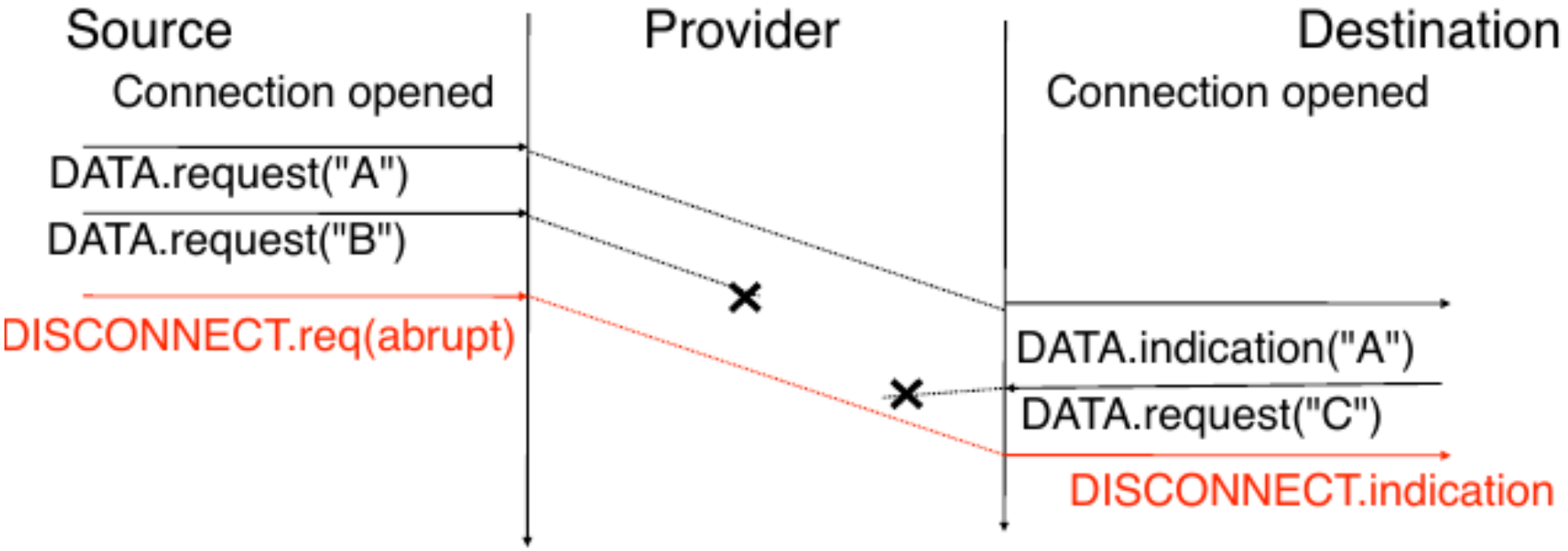
Stream Mode

The providers delivers a stream of characters from source to destination



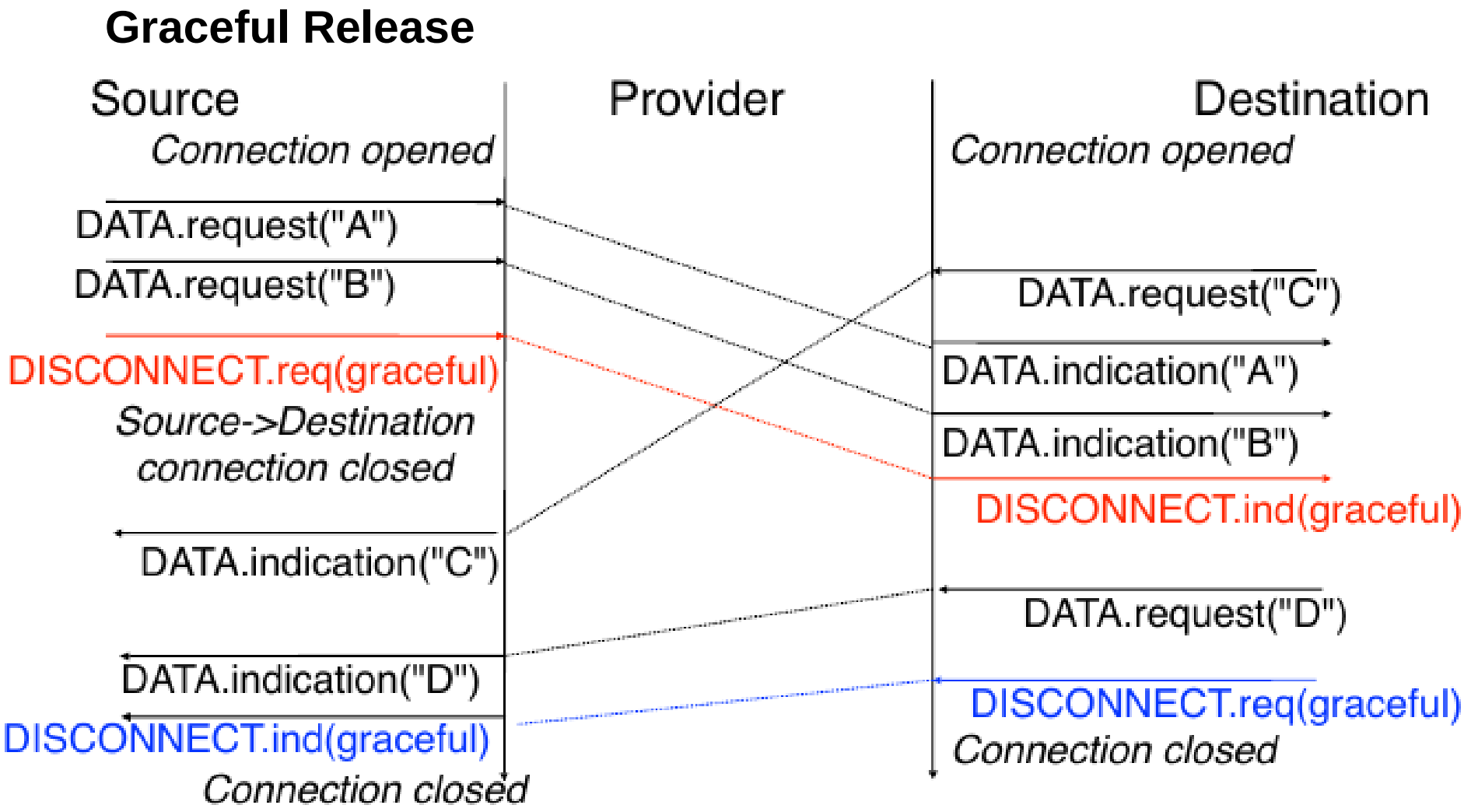
Service Provider: connection-oriented

Abrupt Release



Such an abrupt connection release can be caused by the network provider or by the users

Service Provider: connection-oriented



Service Provider: connection-oriented

Possible Characteristics

- Bidirectional flow
- Reliability
  - Delivery in sequence
  - No losses
  - Data integrity
- Message or stream mode
- Abrupt or Graceful release

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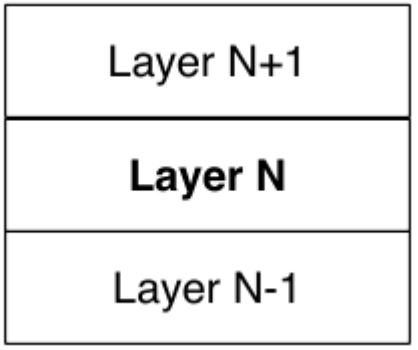
OSI Model

Problem

How is it possible to reason about complex systems such as computer networks or the Internet ?

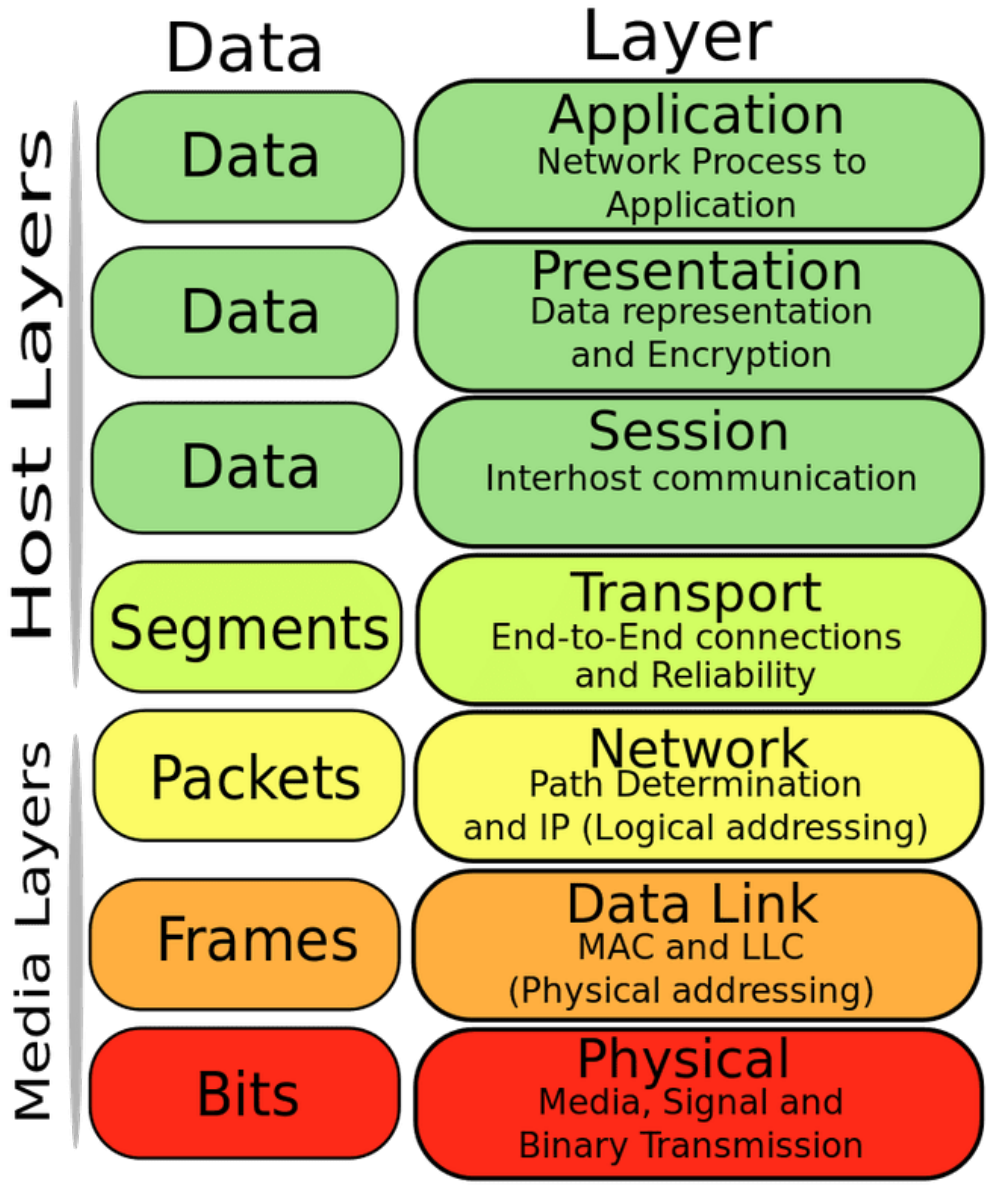
Solution

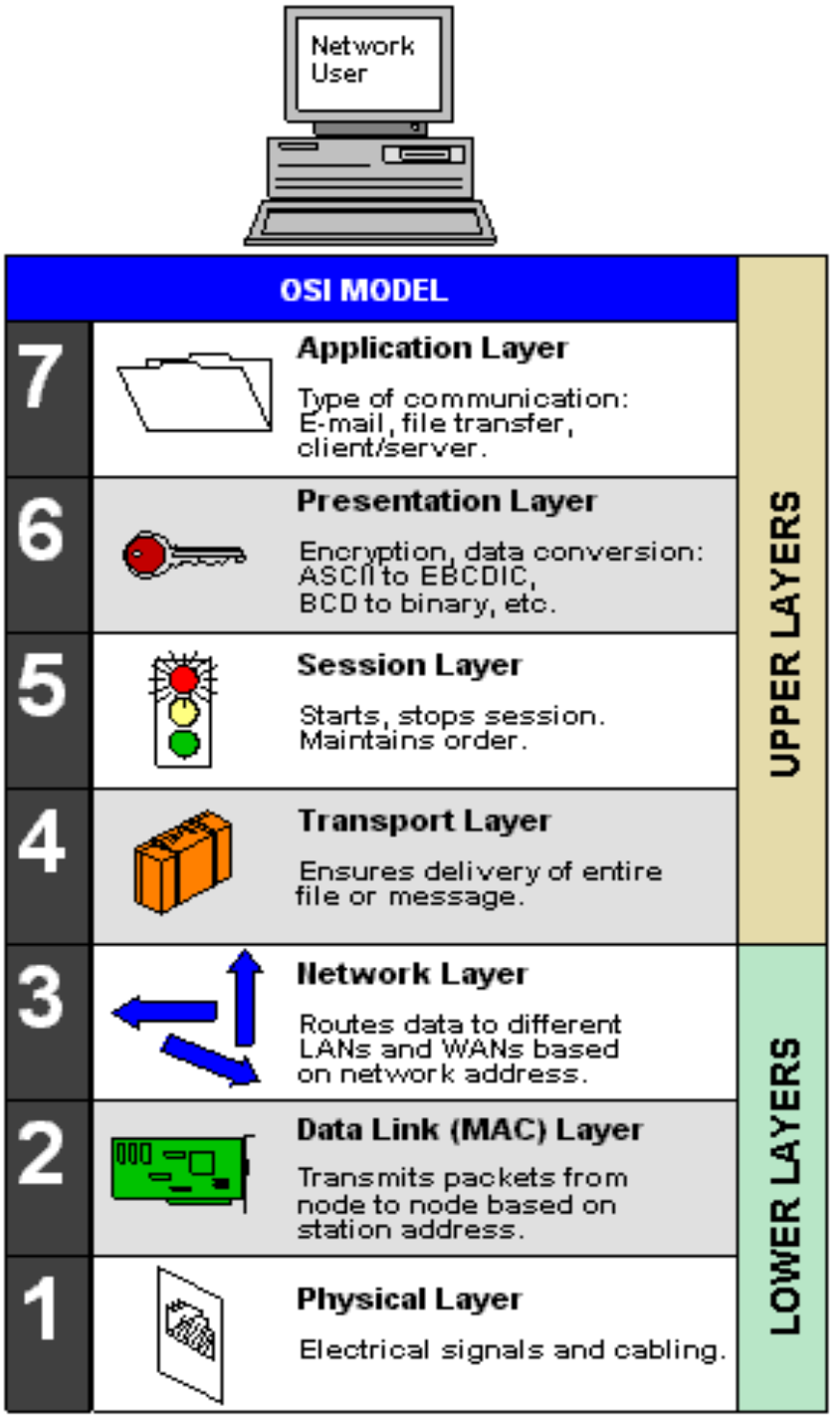
Divide the network in layers.
Layer N provides a well defined service to layer N+1 by using the service provided by layer N-1.
Each N Layer only “talks” to Layer N-1 and Layer N+1



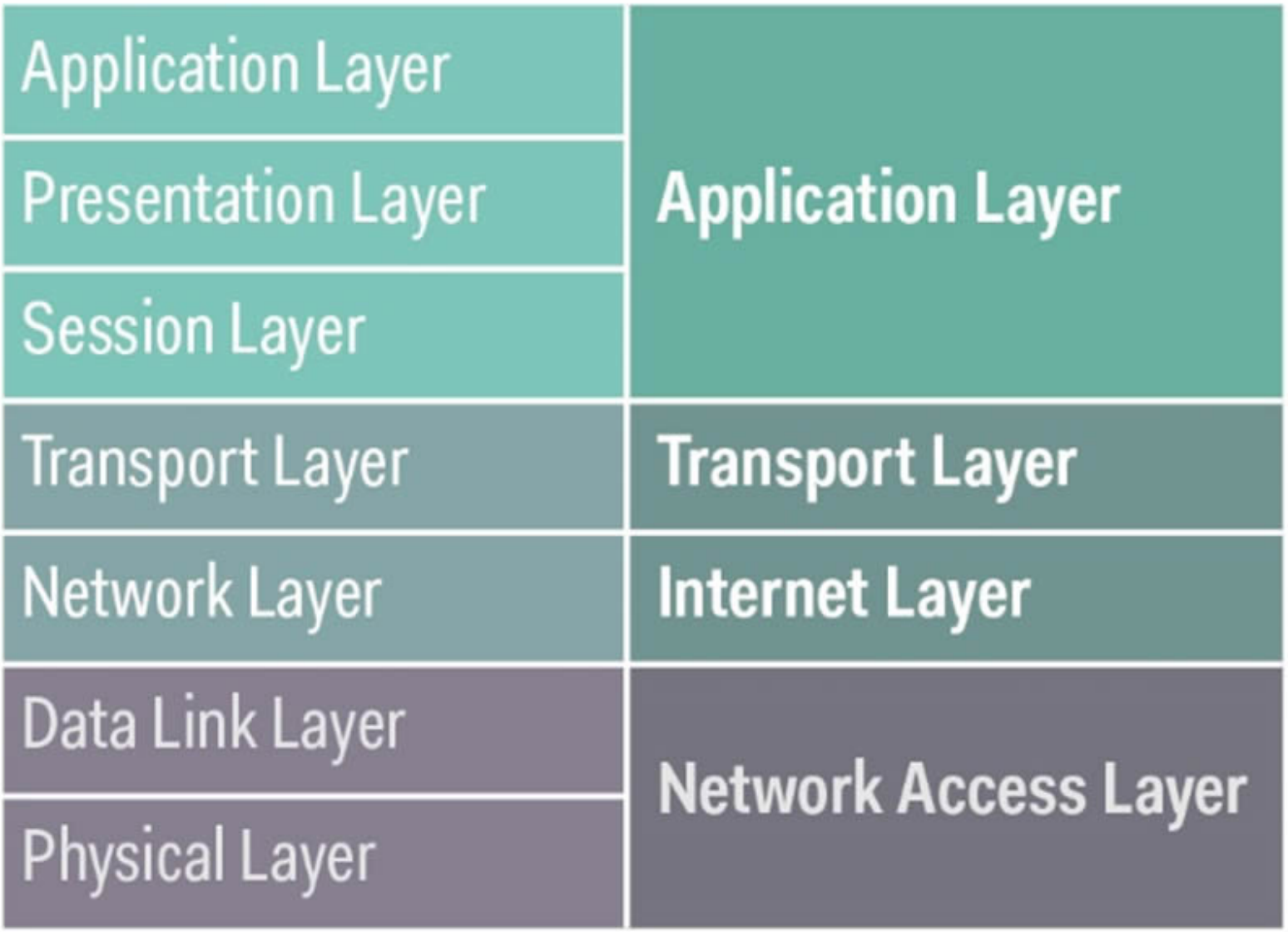
Network models

OSI Model

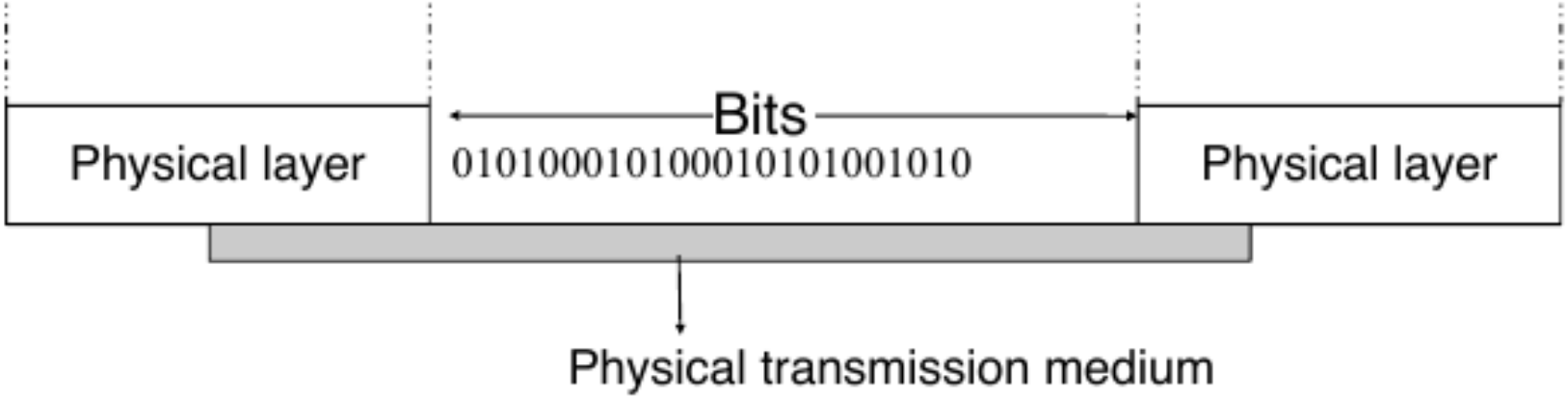




OSI and TCP/IP Model



Physical Layer



Goal

Transmit bits between two physically connected devices

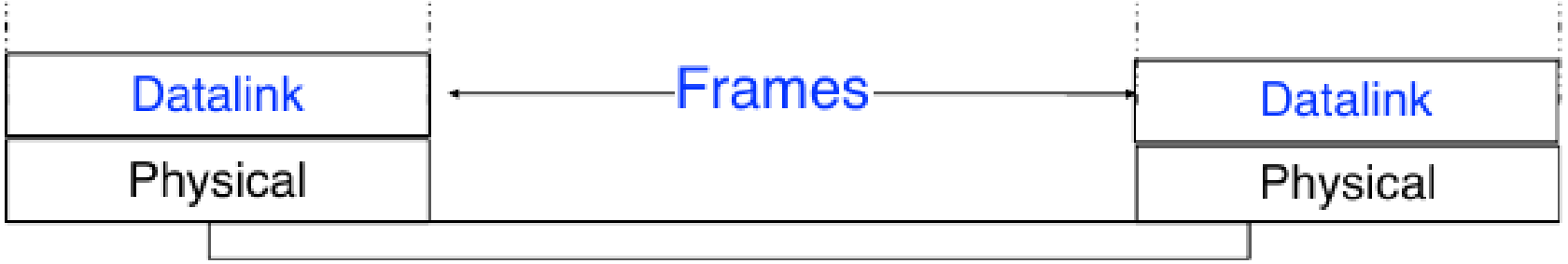
Service provided by physical layer

bit transmission and reception

unreliable service

- The receiver may decode a 1 while the sender sent 0
- Some transmitted bits may be lost
- The receiver may decode more bits than the bits that were sent by the sender

Datalink Layer



Goals

Provide a service that allows the exchange of frames

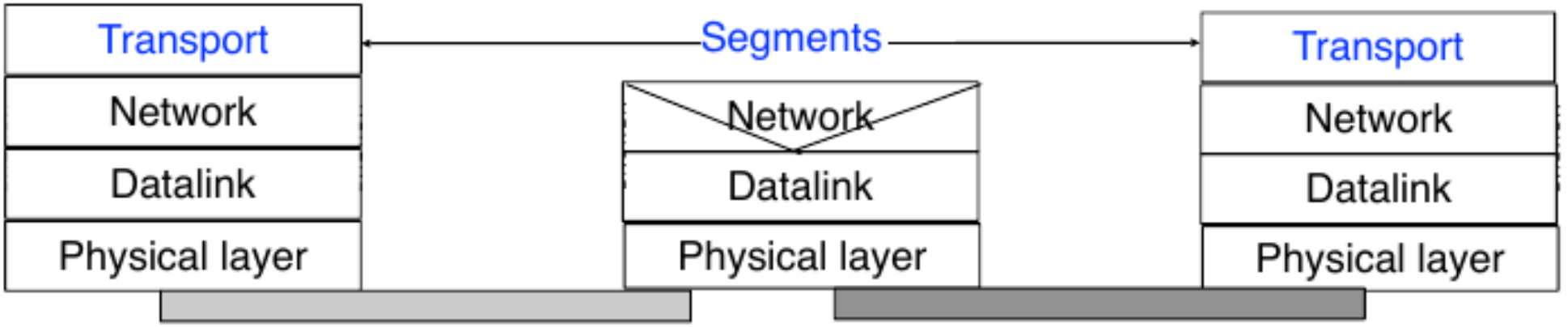
Frame: structured group of bits

Support local area networks

Services

- Reliable connection-oriented service
- Unreliable connectionless service

Transport Layer



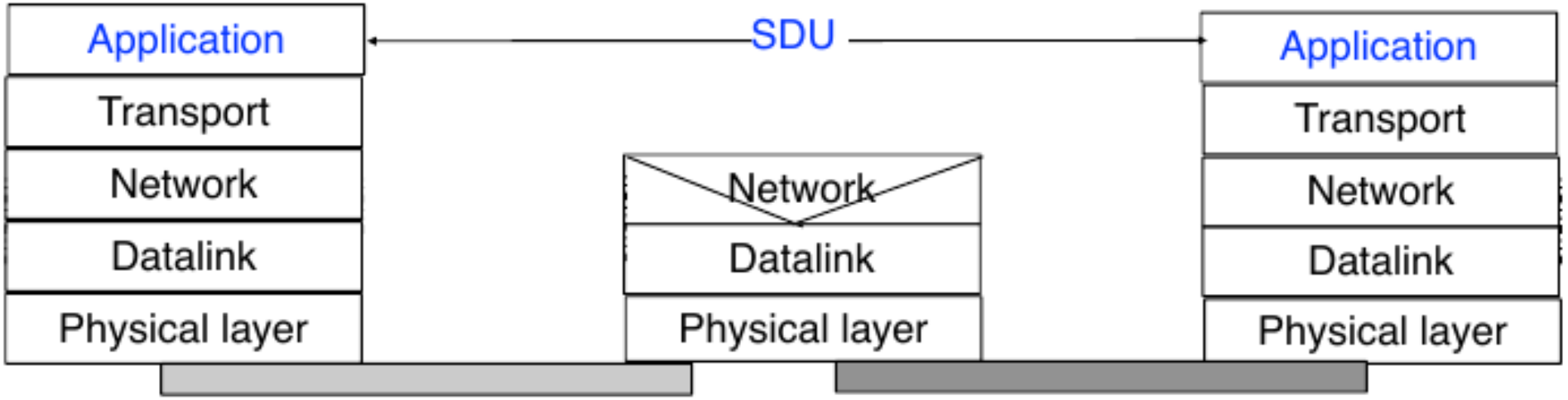
Goals

Ensure a reliable exchange of data between endsystems even if the network layer does not provide a reliable service

Services

Unreliable connectionless service
Reliable connection-oriented service

Application Layer



Goals

Exchange useful information between applications by relying on the transport layer that hides the complexity of the network

Unit of information

Service Data Unit, SDU

Remarks

- People tend to use “packet” as unit of information, if the information transits online (even if the correct term might be “frame” or “segment”)

Sources

- http://networking.layer-x.com/p050000-1.html
- Previous slides
- https://cdn-images-1.medium.com/max/1200/1*17Zz6v0HWIzgiOzQYmO6lA.jpeg
- http://common.ziffdavisinternet.com/encyclopedia_images/OSI.GIF