



Computer Networks Overview, Revisited

Mark Allman

mark.allman@case.edu

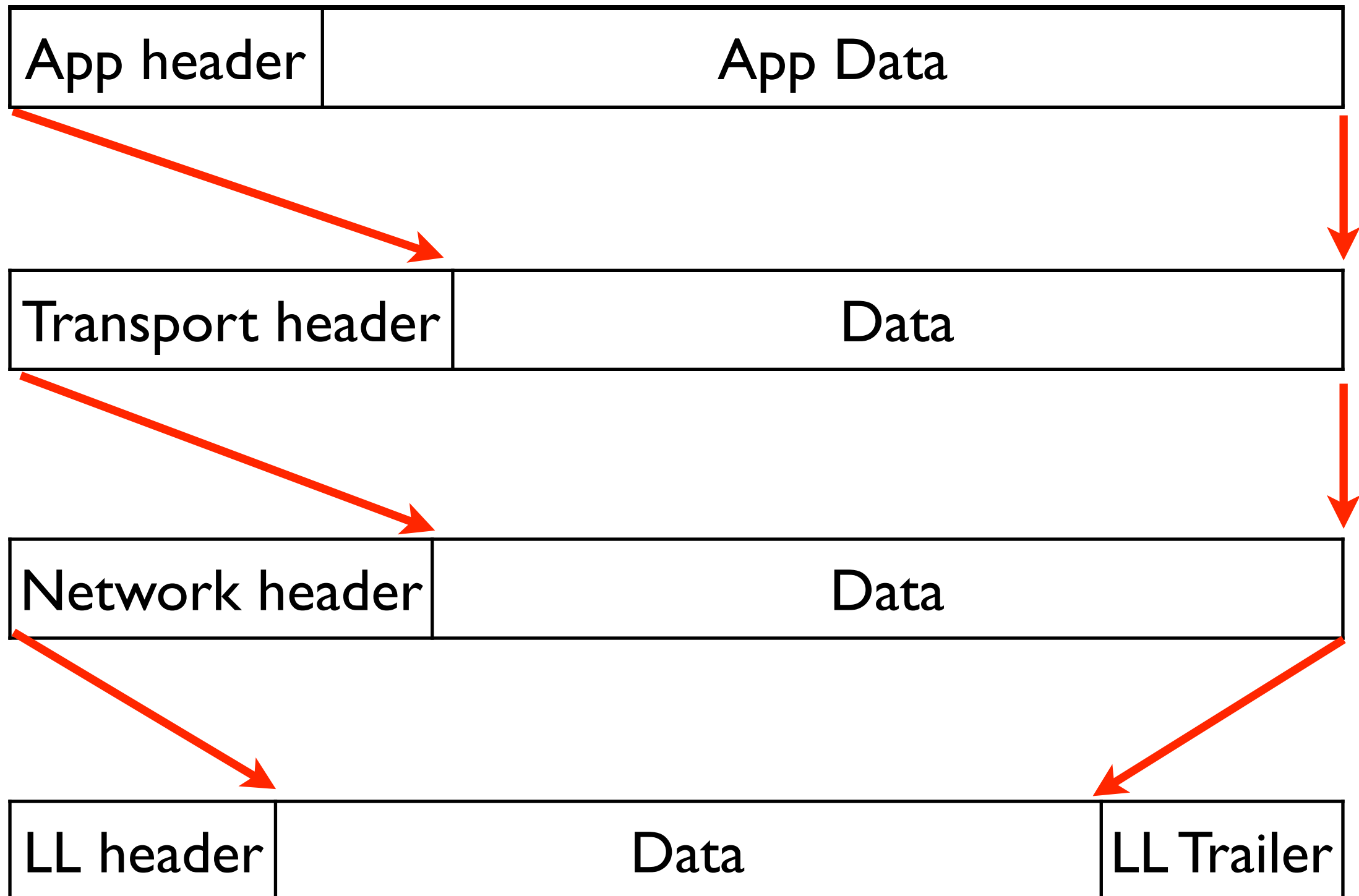
EECS 325/425

Fall 2018

*"Ain't nobody here,
Who can cause me pain or raise my fear ..."*


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

A Packet



Overhead / Data Flow

Overhead / Data Flow



process,
e.g., Apache

Overhead / Data Flow



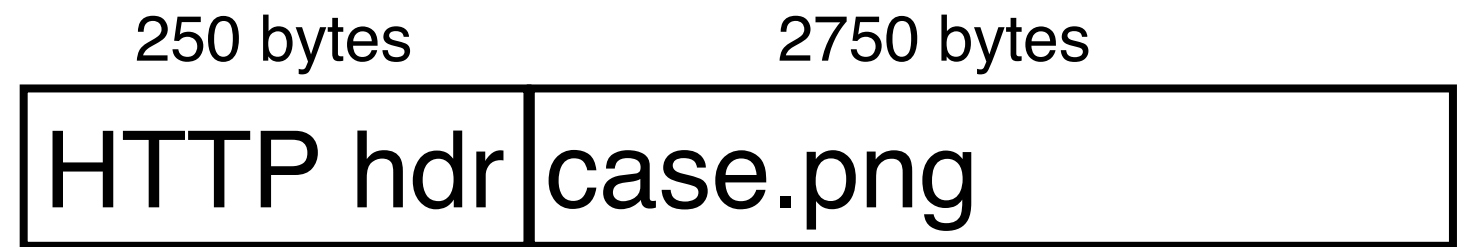
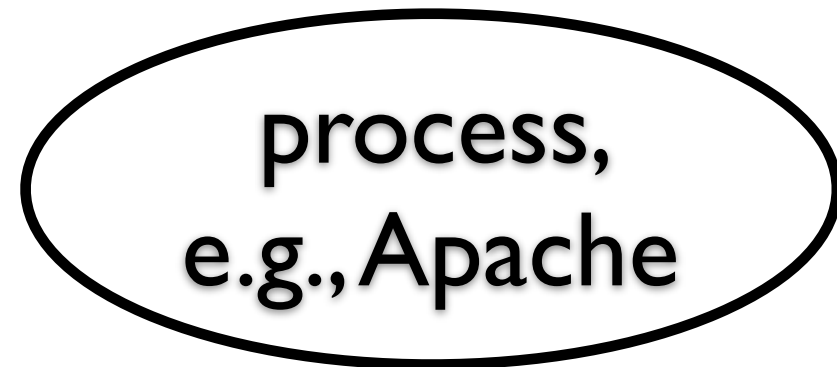
process,
e.g., Apache

The diagram illustrates a data flow from a process to a file. On the left, an oval contains the text "process, e.g., Apache". On the right, a rectangular box contains the text "case.png". Above the box, the text "2750 bytes" indicates the size of the data being transferred.

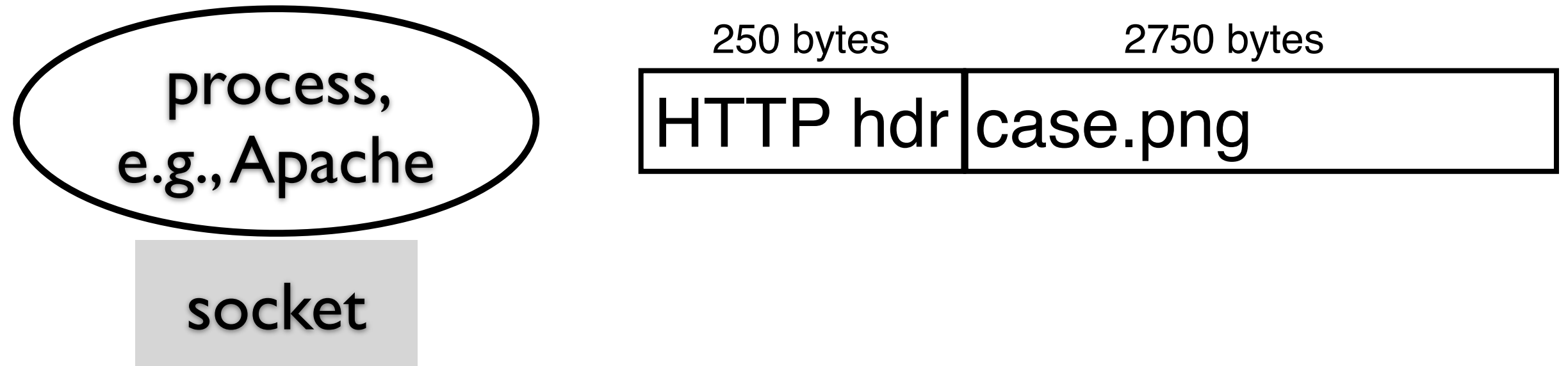
2750 bytes

case.png

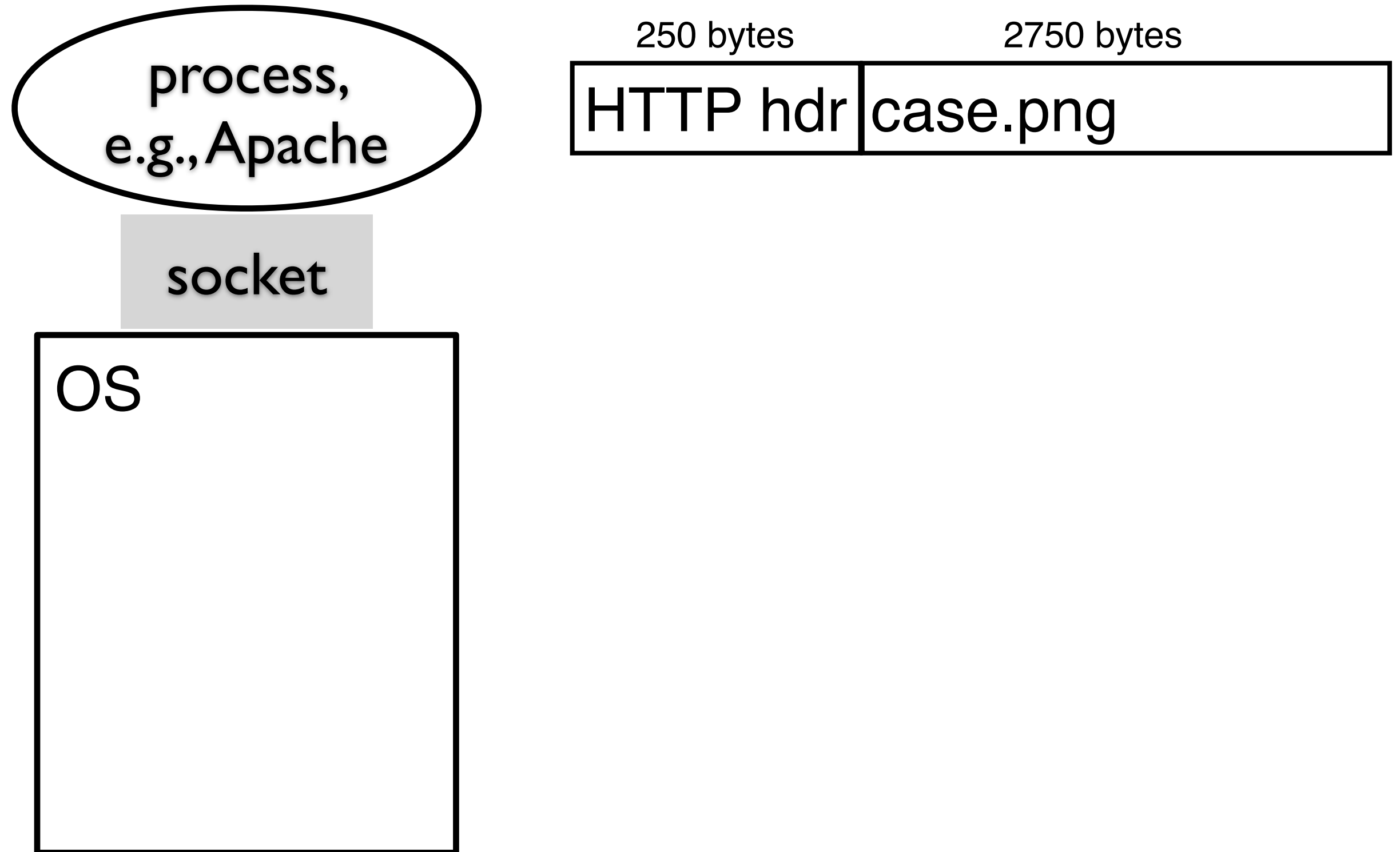
Overhead / Data Flow



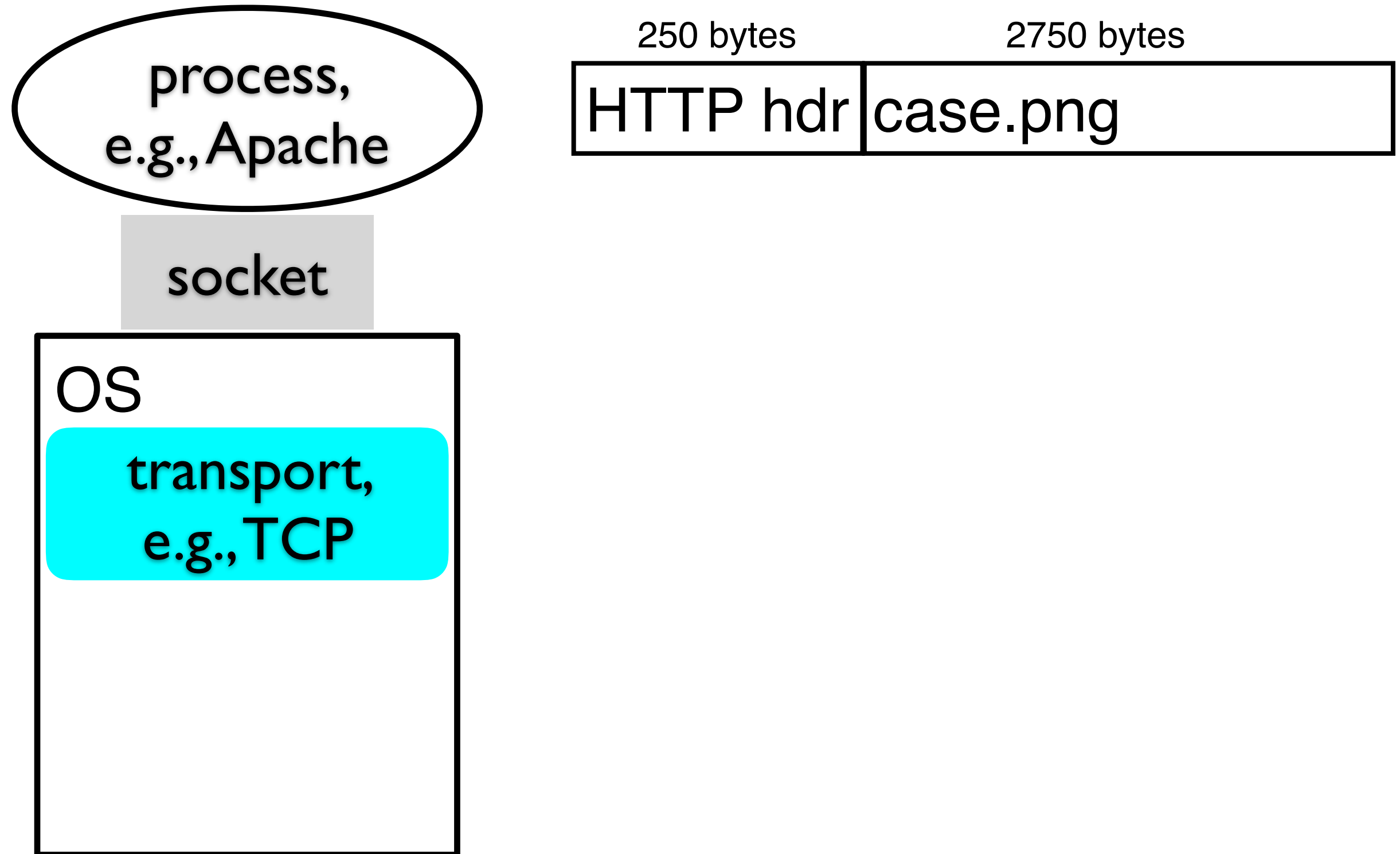
Overhead / Data Flow



Overhead / Data Flow



Overhead / Data Flow



Overhead / Data Flow

process,
e.g., Apache

socket

OS

transport,
e.g., TCP

network,
e.g., IP

250 bytes

2750 bytes

HTTP hdr	case.png
----------	----------

Overhead / Data Flow

process,
e.g., Apache

socket

OS

transport,
e.g., TCP

network,
e.g., IP

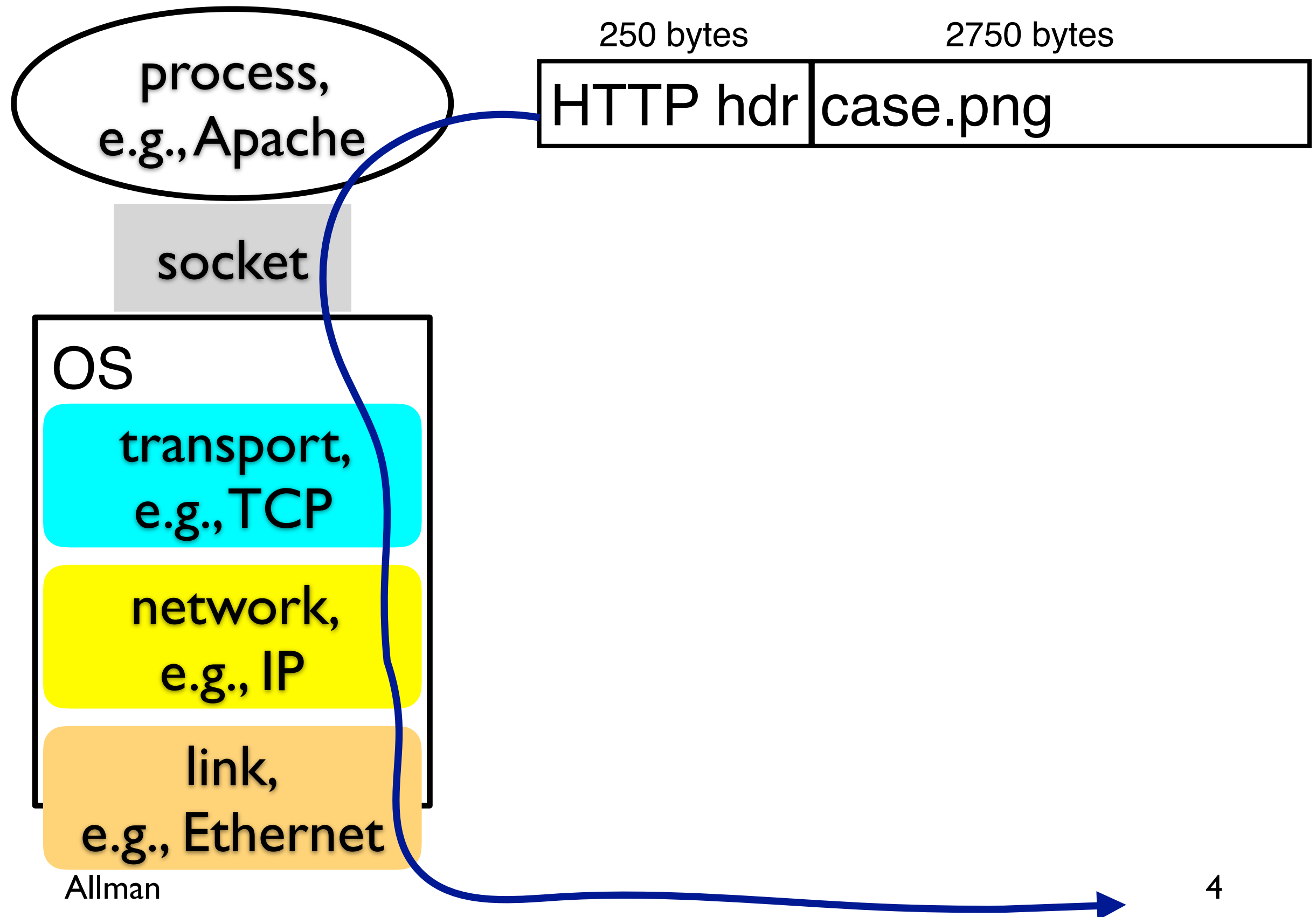
link,
e.g., Ethernet

250 bytes

2750 bytes

HTTP hdr	case.png
----------	----------

Overhead / Data Flow



Overhead / Data Flow

process,
e.g., Apache

socket

OS

transport,
e.g., TCP

network,
e.g., IP

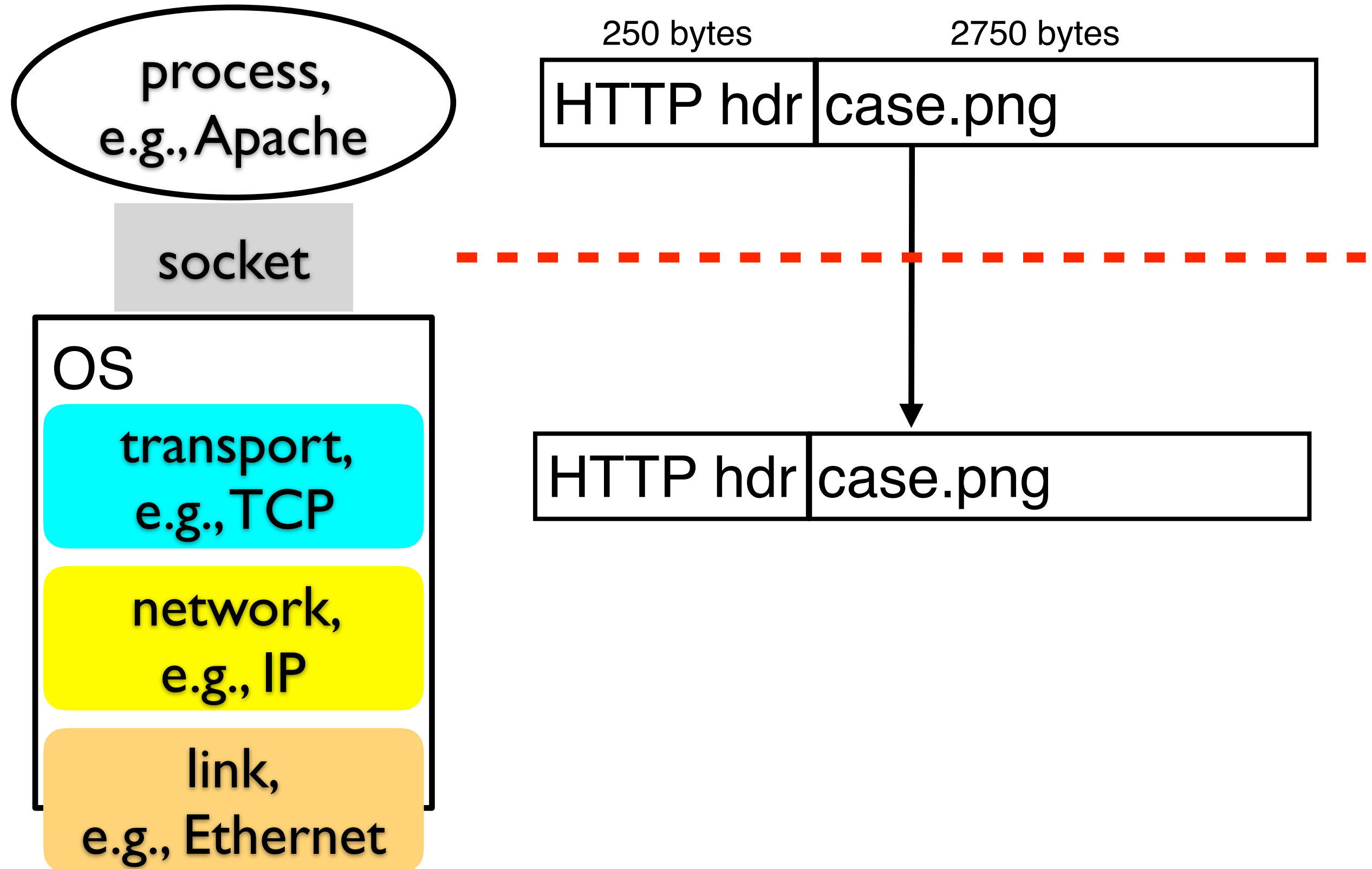
link,
e.g., Ethernet

250 bytes

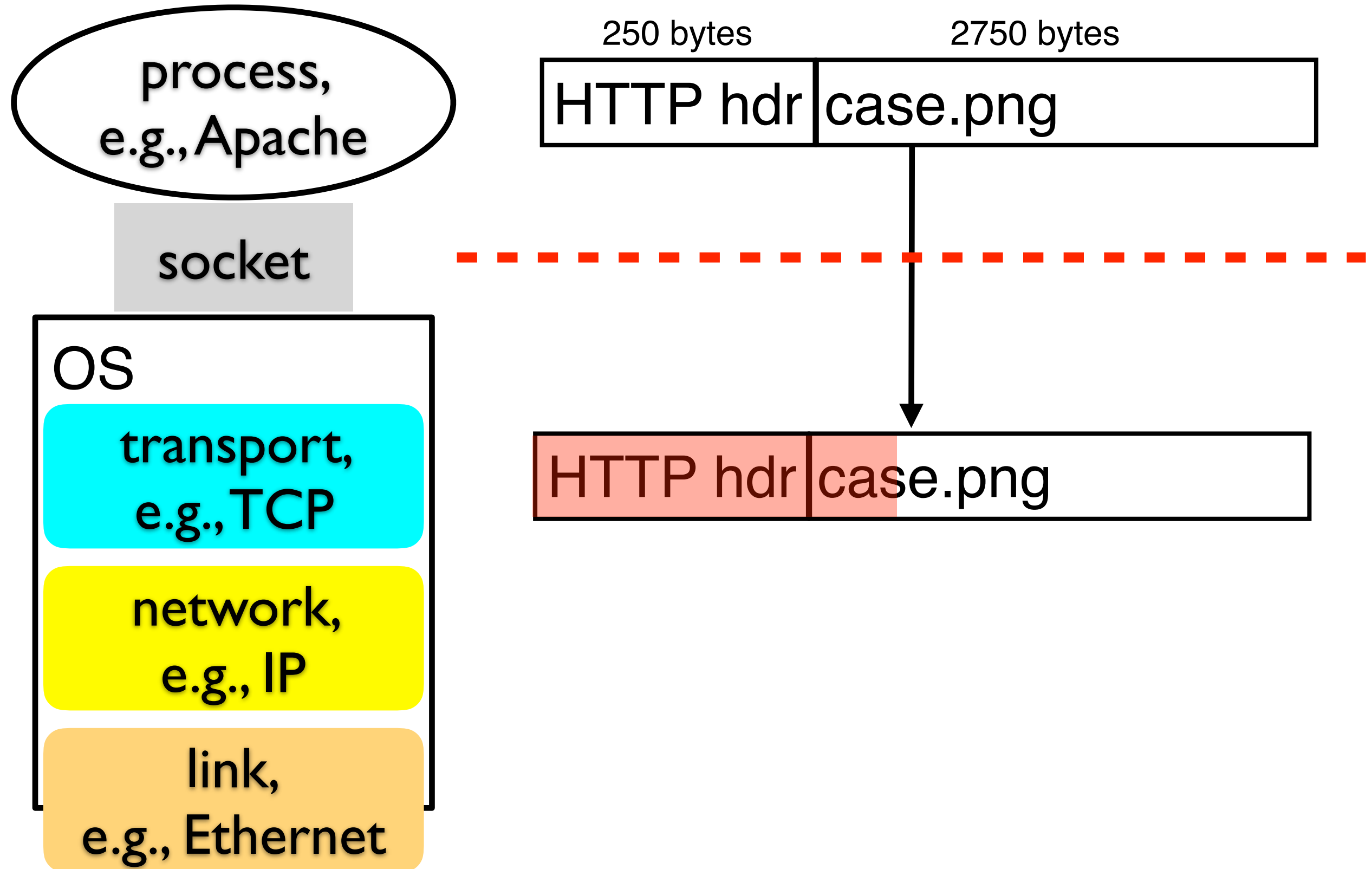
2750 bytes

HTTP hdr	case.png
----------	----------

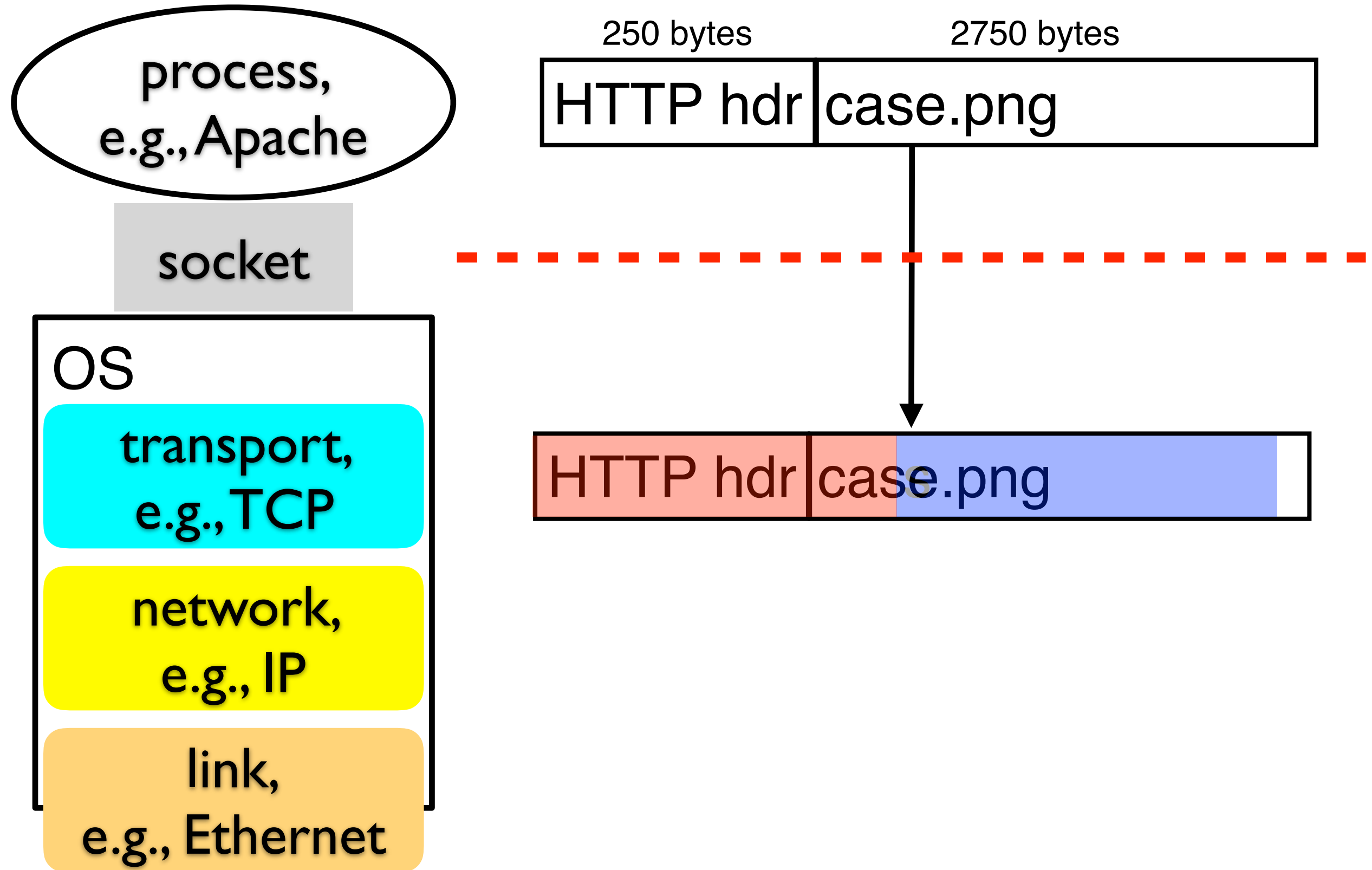
Overhead / Data Flow



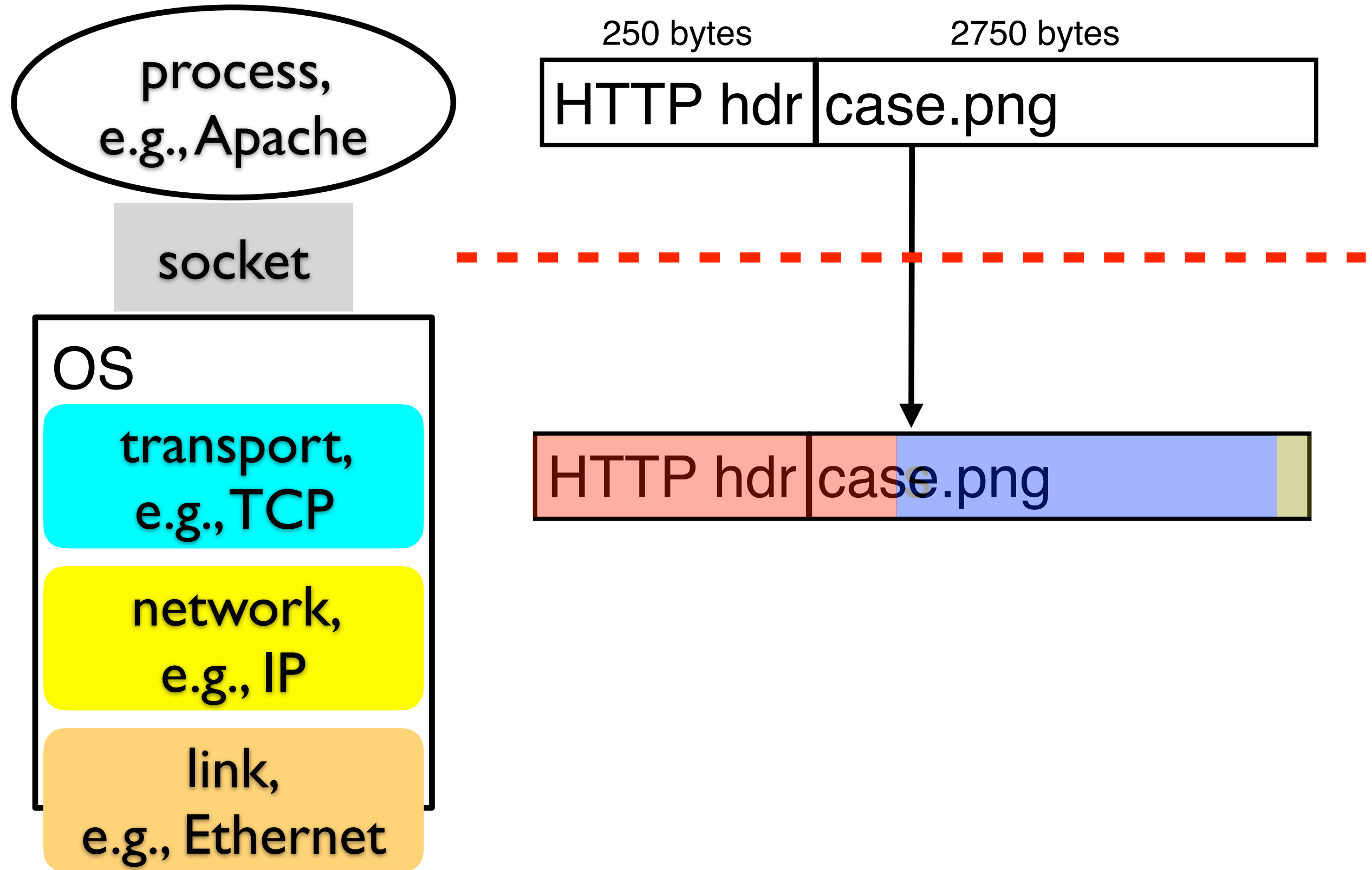
Overhead / Data Flow



Overhead / Data Flow



Overhead / Data Flow



Overhead / Data Flow

process,
e.g., Apache

socket

OS

transport,
e.g., TCP

network,
e.g., IP

link,
e.g., Ethernet

250 bytes

HTTP hdr

2750 bytes

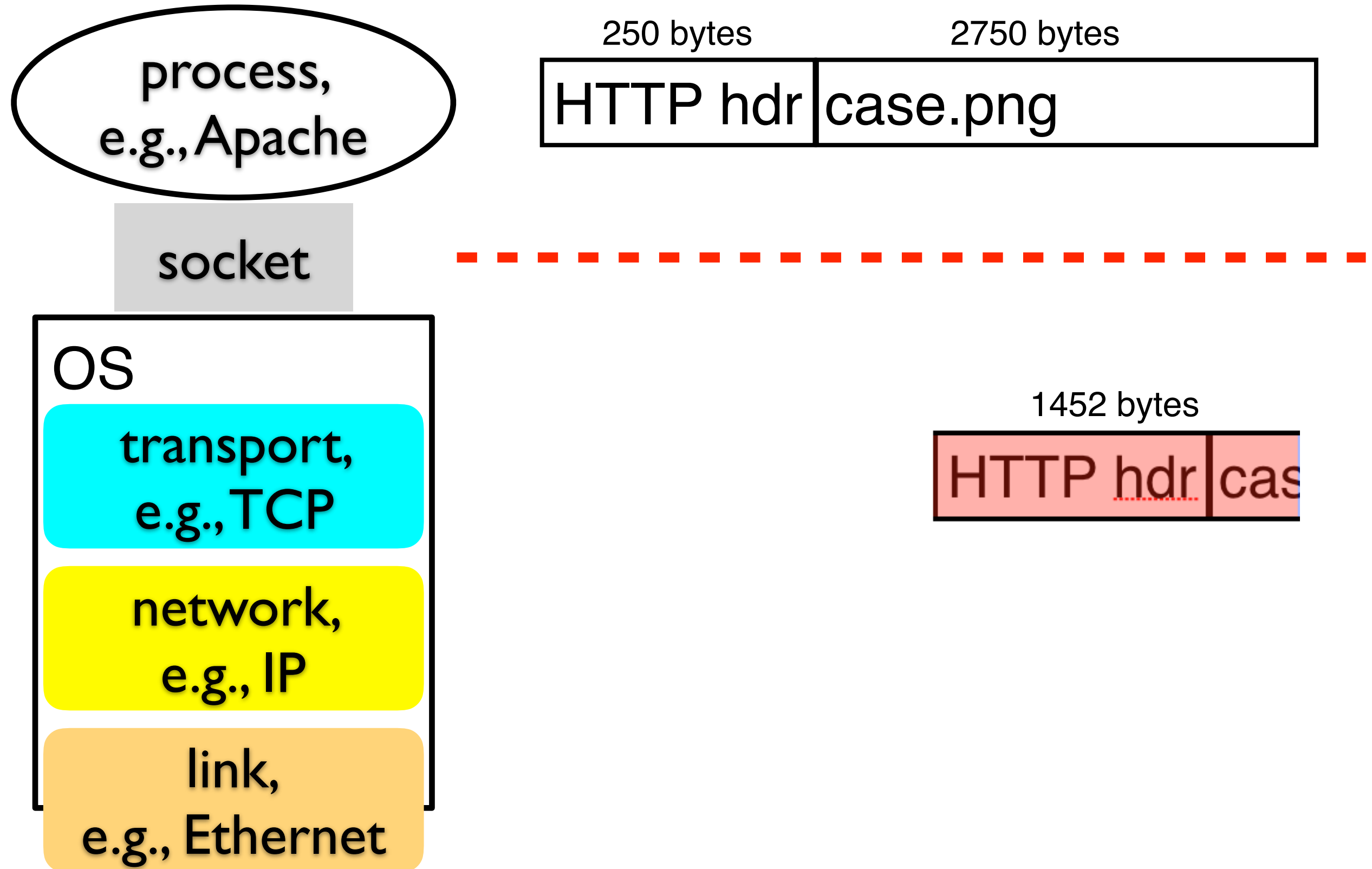
case.png



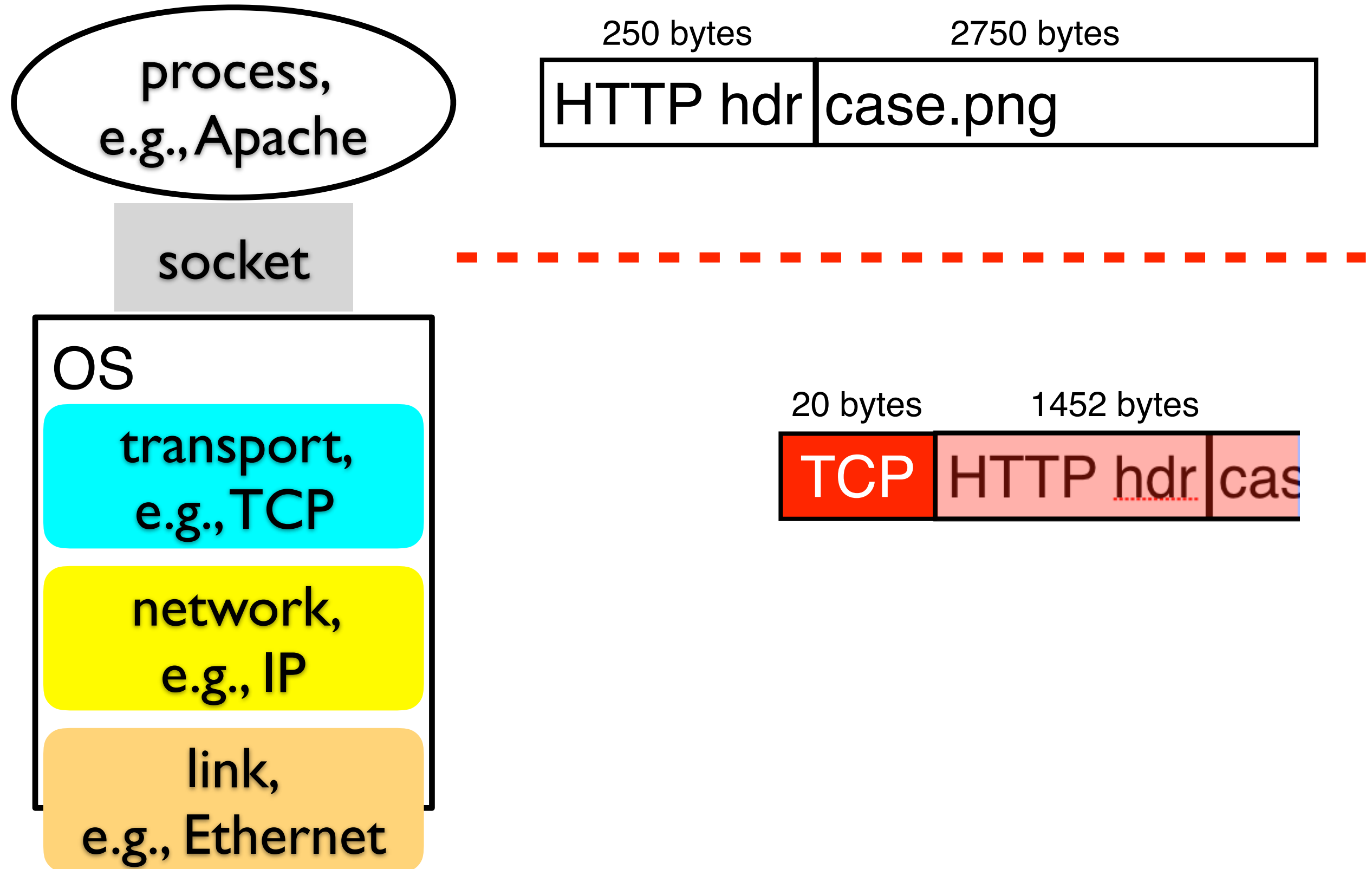
HTTP hdr

case.png

Overhead / Data Flow



Overhead / Data Flow



Overhead / Data Flow

process,
e.g., Apache

socket

OS

transport,
e.g., TCP

network,
e.g., IP

link,
e.g., Ethernet

250 bytes

HTTP hdr

2750 bytes

case.png

20 bytes

TCP

1452 bytes

HTTP hdr

cas

Overhead / Data Flow

process,
e.g., Apache

socket

OS

transport,
e.g., TCP

network,
e.g., IP

link,
e.g., Ethernet

250 bytes

HTTP hdr

2750 bytes

case.png

20 bytes

TCP

1452 bytes

HTTP hdr

cas

20 bytes

TCP

1452 bytes

HTTP hdr

cas

Overhead / Data Flow

process,
e.g., Apache

socket

OS

transport,
e.g., TCP

network,
e.g., IP

link,
e.g., Ethernet

250 bytes

HTTP hdr

2750 bytes

case.png

20 bytes

TCP

1452 bytes

HTTP hdr

cas

20 bytes

IP

20 bytes

TCP

1452 bytes

HTTP hdr

cas

Overhead / Data Flow

process,
e.g., Apache

socket

OS

transport,
e.g., TCP

network,
e.g., IP

link,
e.g., Ethernet

Allman

250 bytes

2750 bytes

HTTP hdr | case.png

20 bytes

1452 bytes

TCP

HTTP hdr | cas

20 bytes

20 bytes

1452 bytes

IP

TCP

HTTP hdr | cas

Overhead / Data Flow

process,
e.g., Apache

socket

OS

transport,
e.g., TCP

network,
e.g., IP

link,
e.g., Ethernet

Allman

250 bytes



2750 bytes



20 bytes



1452 bytes

20 bytes

20 bytes

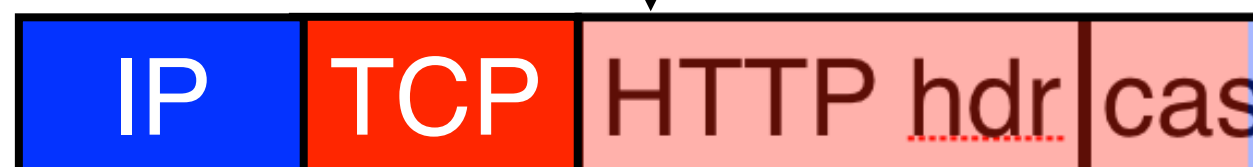
1452 bytes



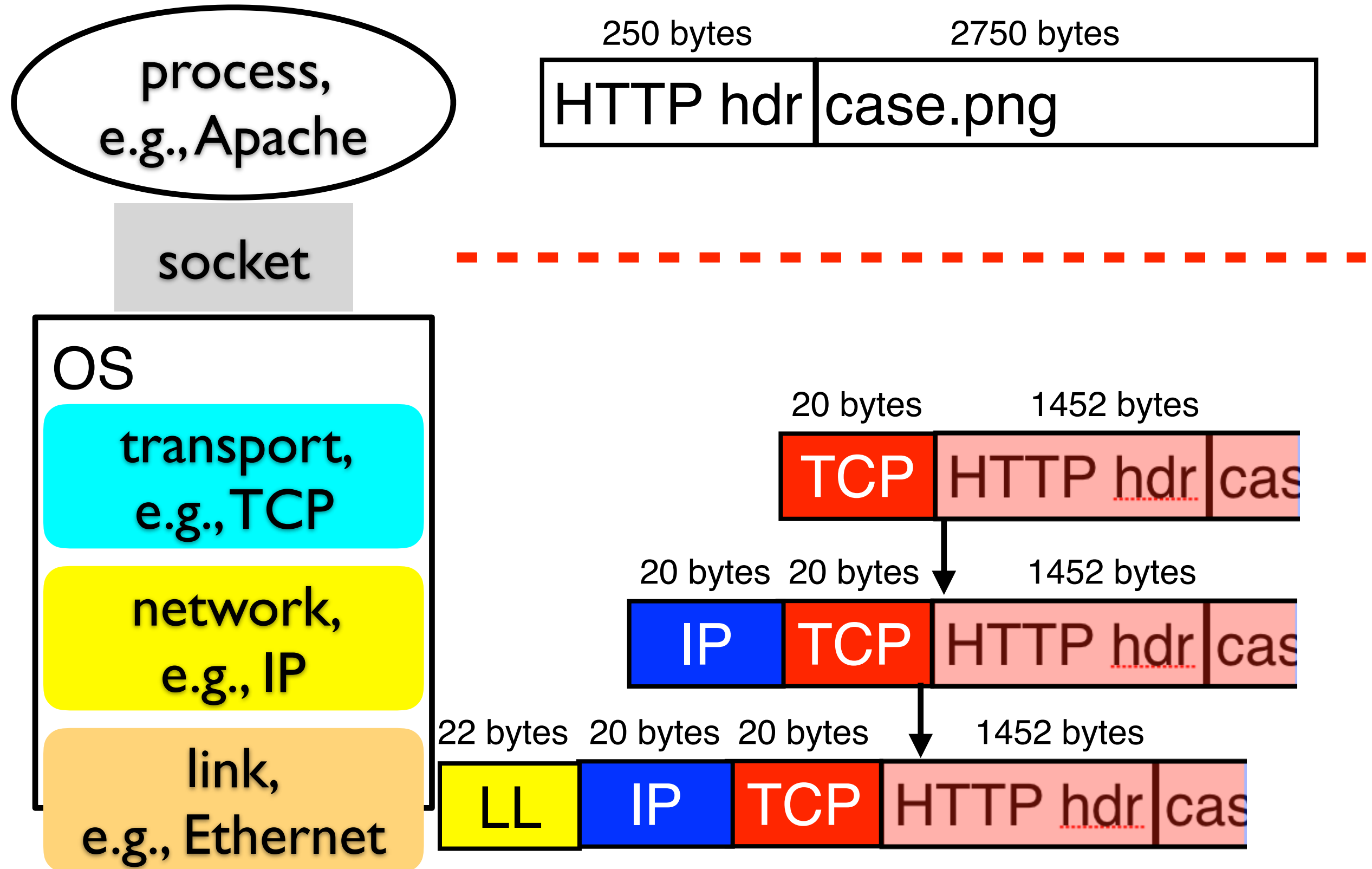
20 bytes

20 bytes

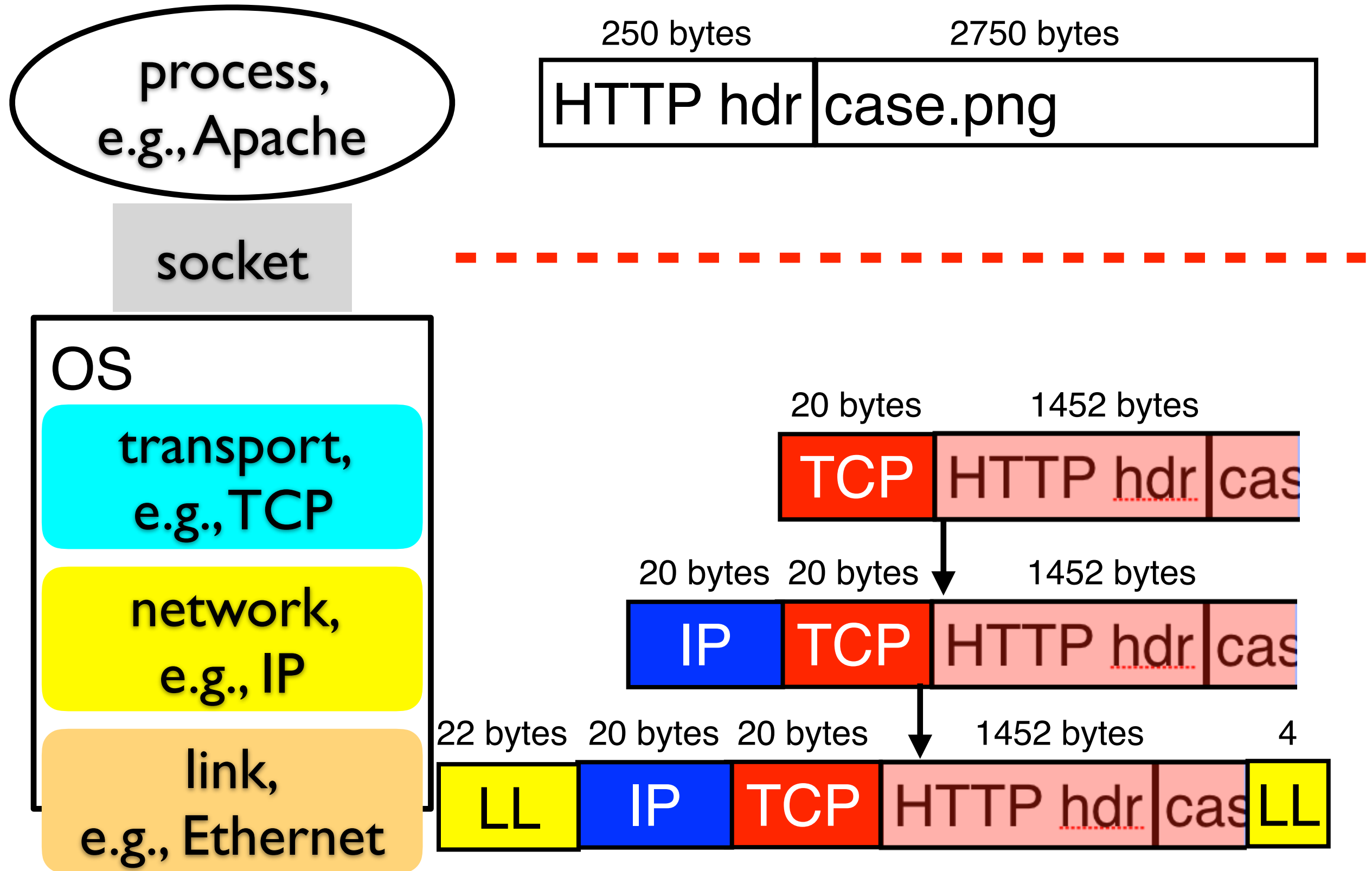
1452 bytes



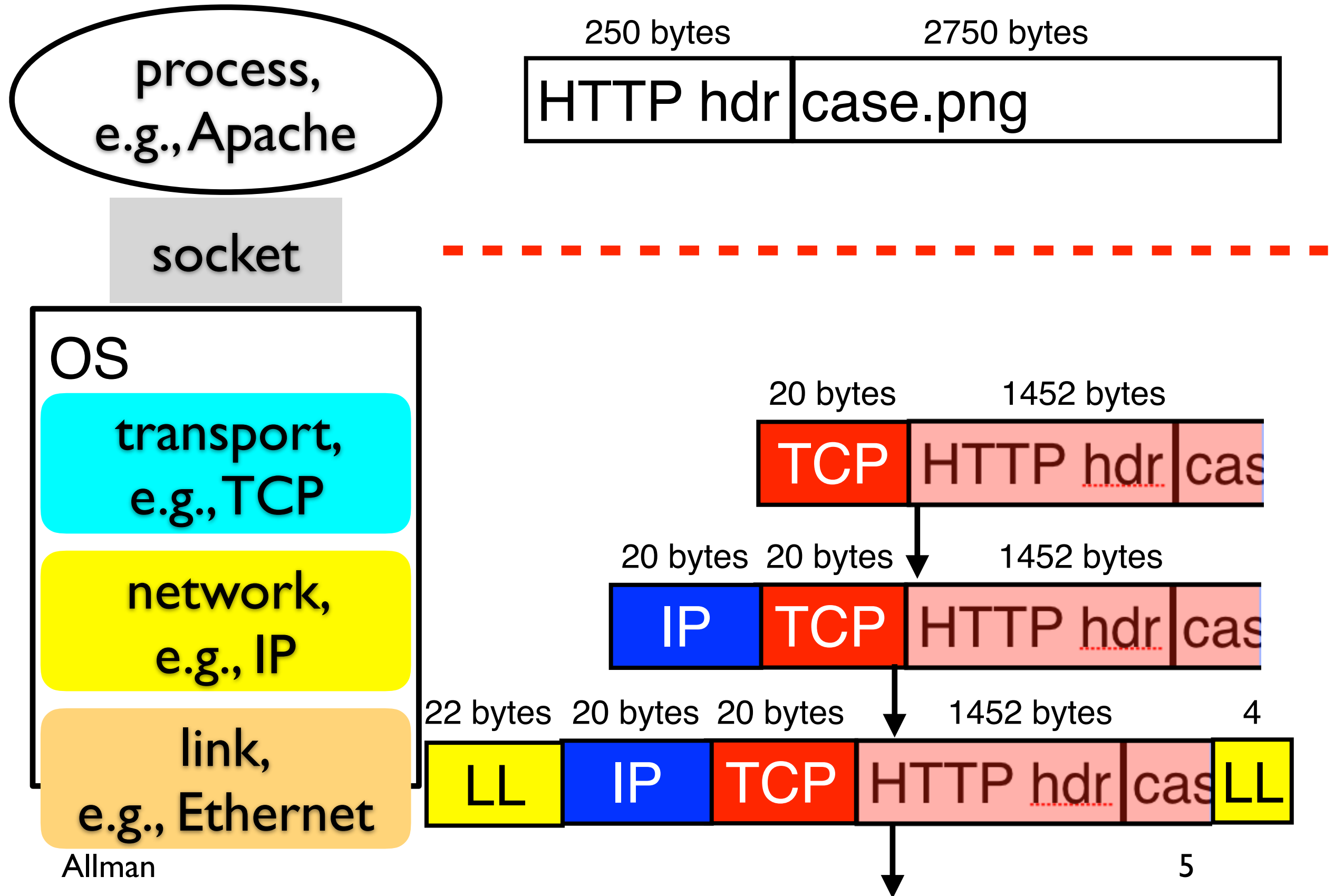
Overhead / Data Flow



Overhead / Data Flow



Overhead / Data Flow



Overhead / Data Flow

process,
e.g., Apache

socket

OS

transport,
e.g., TCP

network,
e.g., IP

link,
e.g., Ethernet

250 bytes

HTTP hdr

2750 bytes

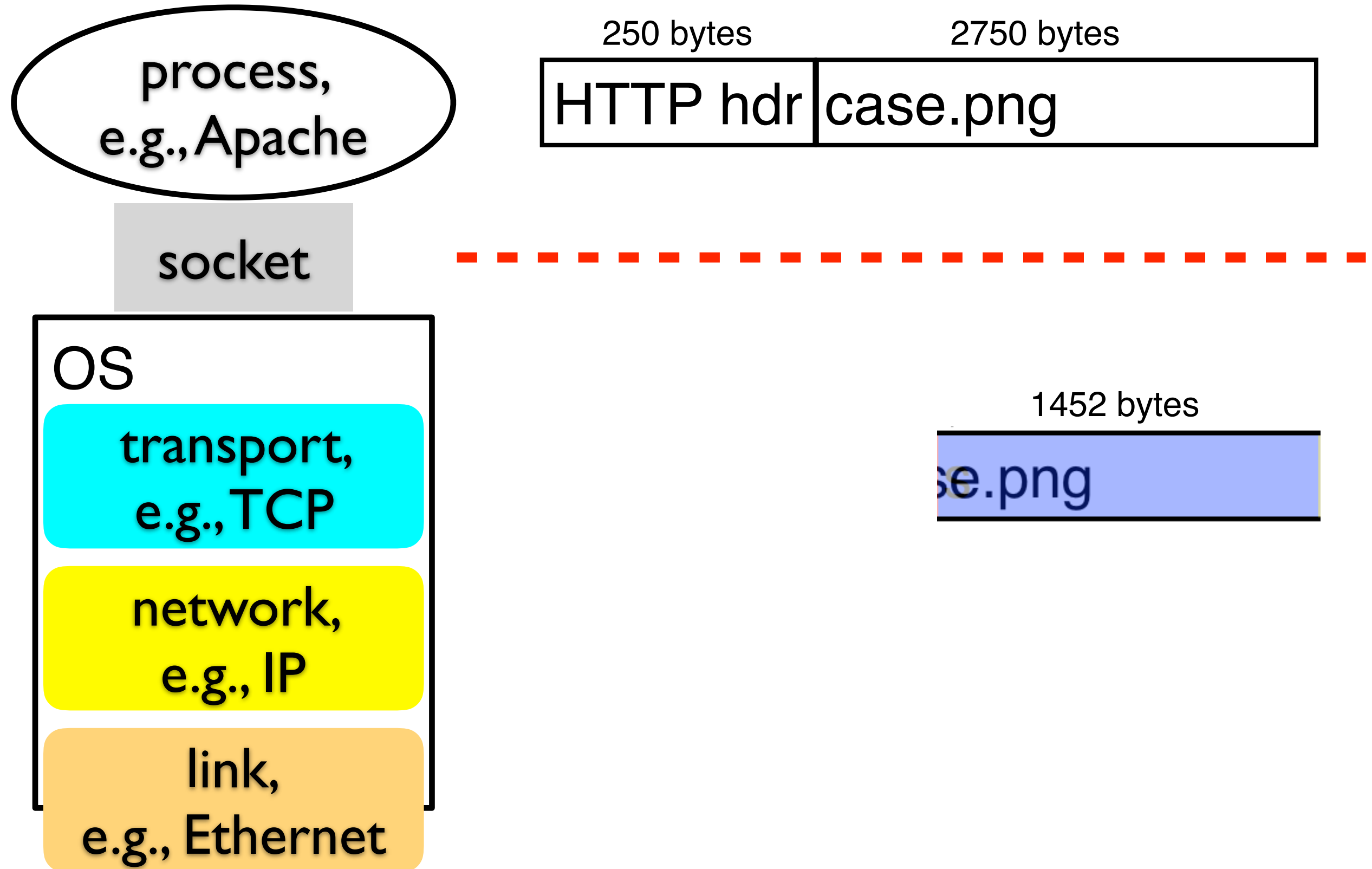
case.png



HTTP hdr

case.png

Overhead / Data Flow



Overhead / Data Flow

process,
e.g., Apache

socket

OS

transport,
e.g., TCP

network,
e.g., IP

link,
e.g., Ethernet

250 bytes

HTTP hdr

2750 bytes

case.png

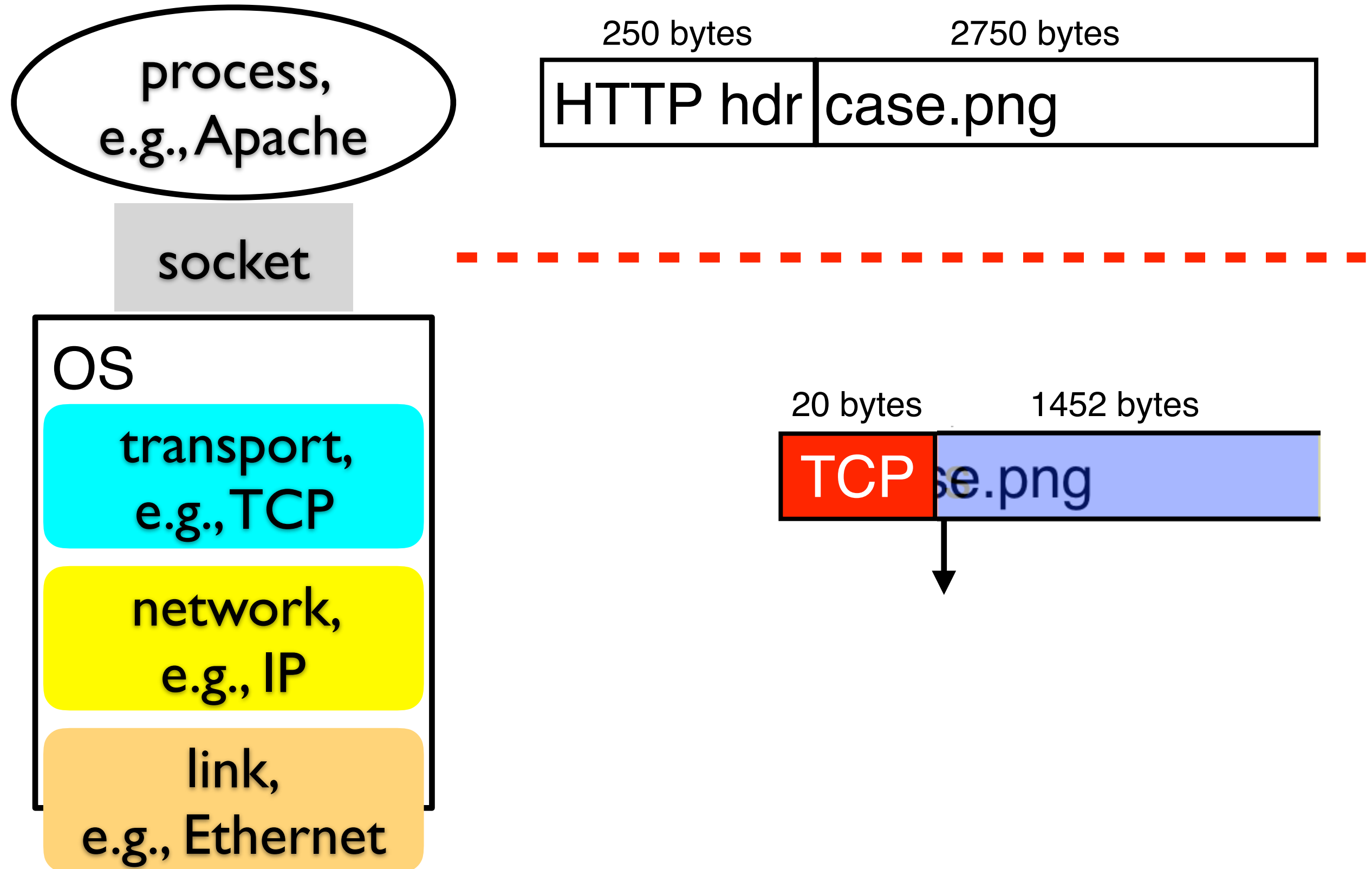
20 bytes

TCP

1452 bytes

se.png

Overhead / Data Flow



Overhead / Data Flow

process,
e.g., Apache

socket

OS

transport,
e.g., TCP

network,
e.g., IP

link,
e.g., Ethernet

250 bytes

HTTP hdr

2750 bytes

case.png

20 bytes

TCP

1452 bytes

se.png

20 bytes

TCP

1452 bytes

se.png

Overhead / Data Flow

process,
e.g., Apache

socket

OS

transport,
e.g., TCP

network,
e.g., IP

link,
e.g., Ethernet

250 bytes

HTTP hdr

2750 bytes

case.png

20 bytes

TCP

1452 bytes

se.png

20 bytes

IP

20 bytes

TCP

1452 bytes

se.png

Overhead / Data Flow

process,
e.g., Apache

socket

OS

transport,
e.g., TCP

network,
e.g., IP

link,
e.g., Ethernet

Allman

250 bytes

HTTP hdr

2750 bytes

case.png

20 bytes

TCP

1452 bytes

se.png

20 bytes

IP

20 bytes

TCP

1452 bytes

se.png

Overhead / Data Flow

process,
e.g., Apache

socket

OS

transport,
e.g., TCP

network,
e.g., IP

link,
e.g., Ethernet

Allman

250 bytes

HTTP hdr

2750 bytes

case.png

20 bytes

TCP

1452 bytes

se.png

20 bytes

IP

20 bytes

TCP

1452 bytes

se.png

20 bytes

IP

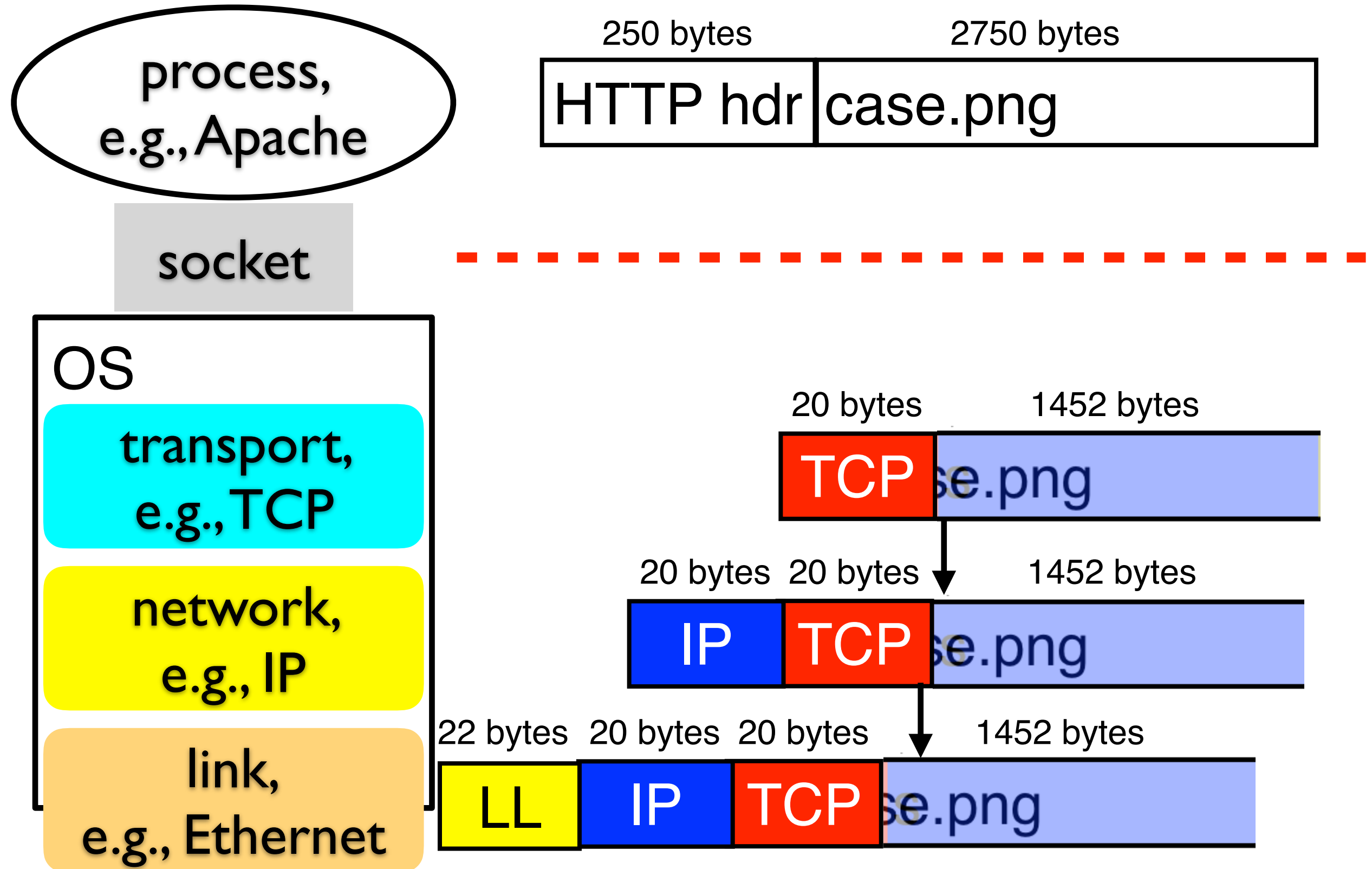
20 bytes

TCP

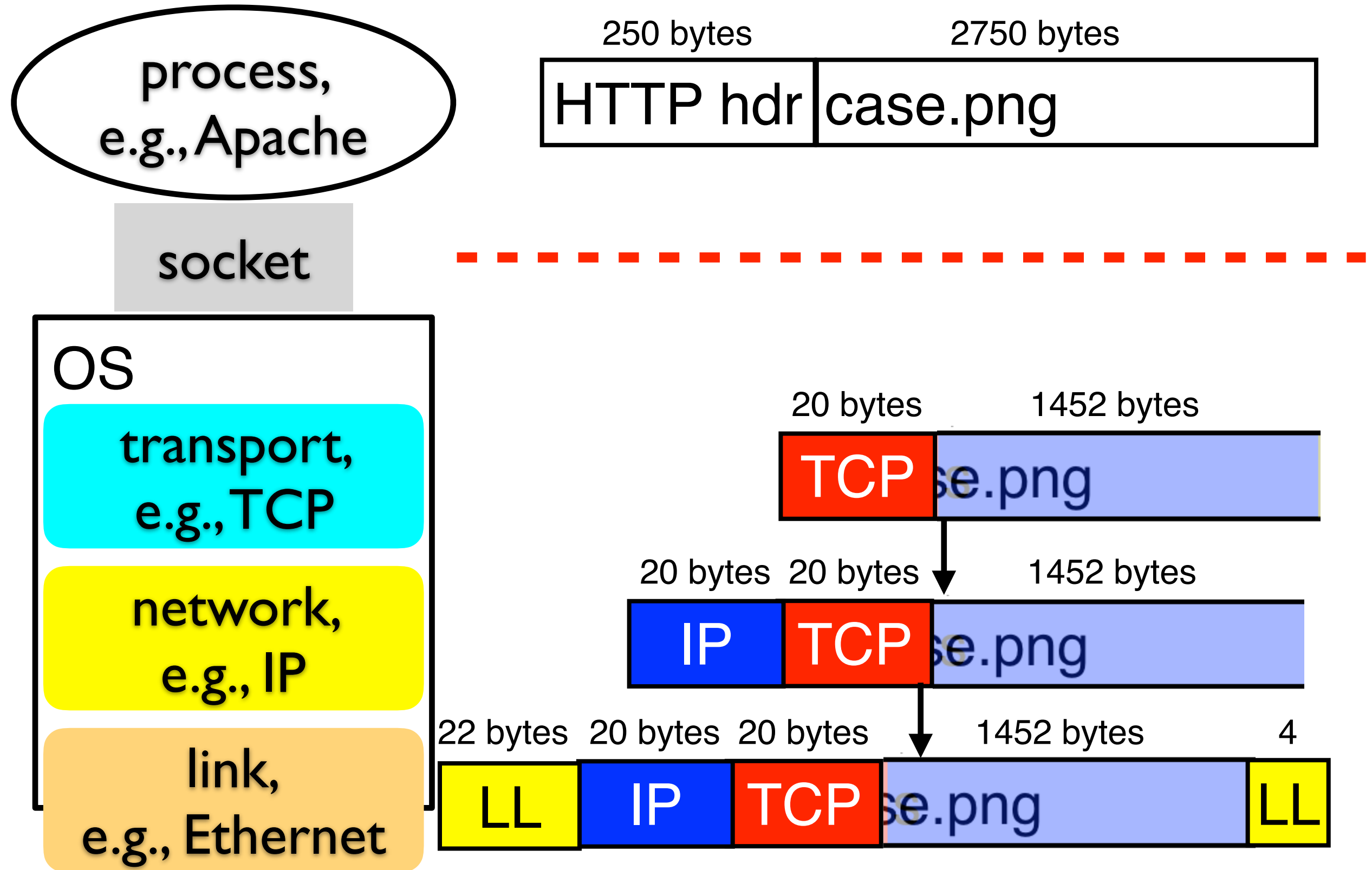
1452 bytes

se.png

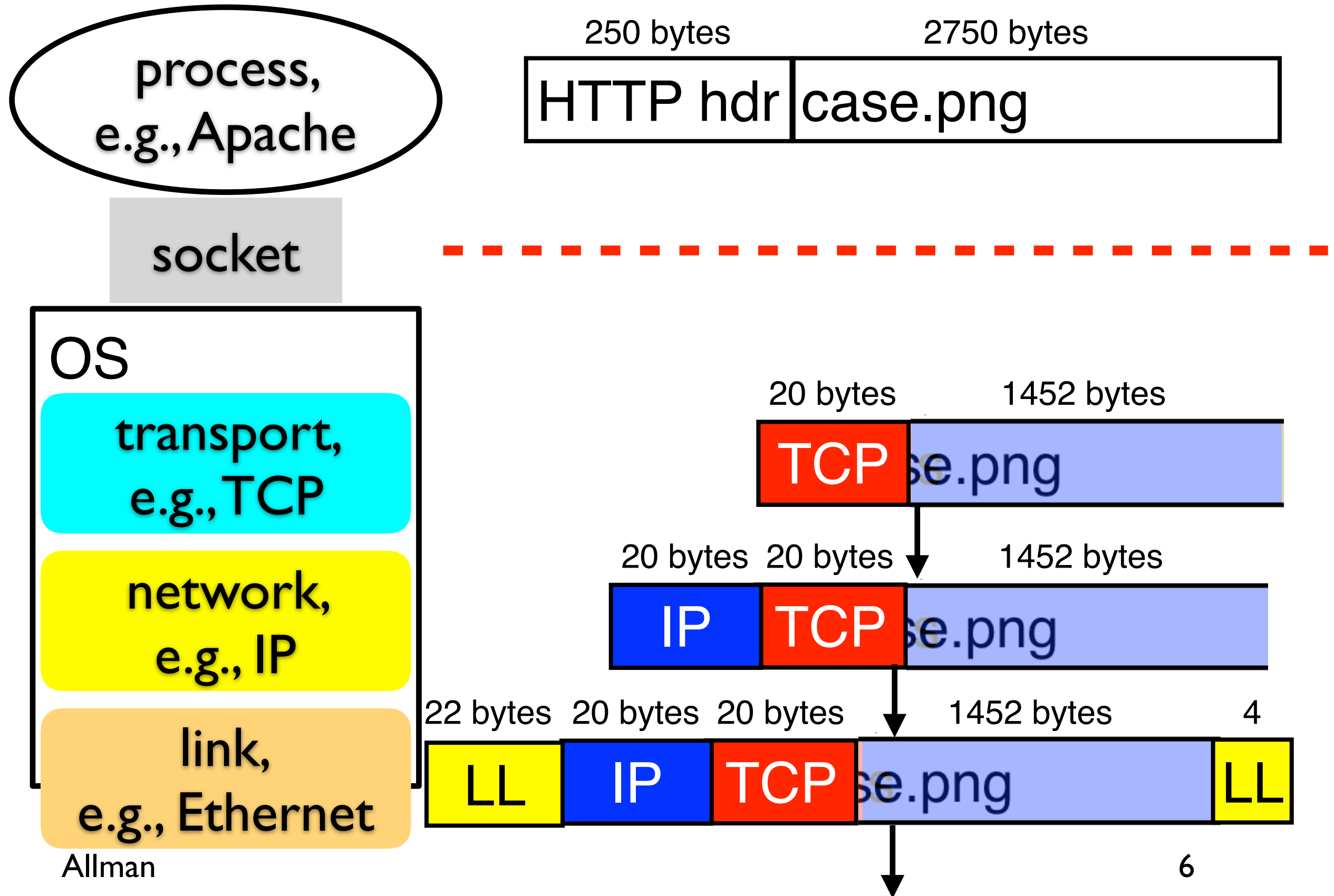
Overhead / Data Flow



Overhead / Data Flow



Overhead / Data Flow



Overhead / Data Flow

process,
e.g., Apache

socket

OS

transport,
e.g., TCP

network,
e.g., IP

link,
e.g., Ethernet

250 bytes

HTTP hdr

2750 bytes

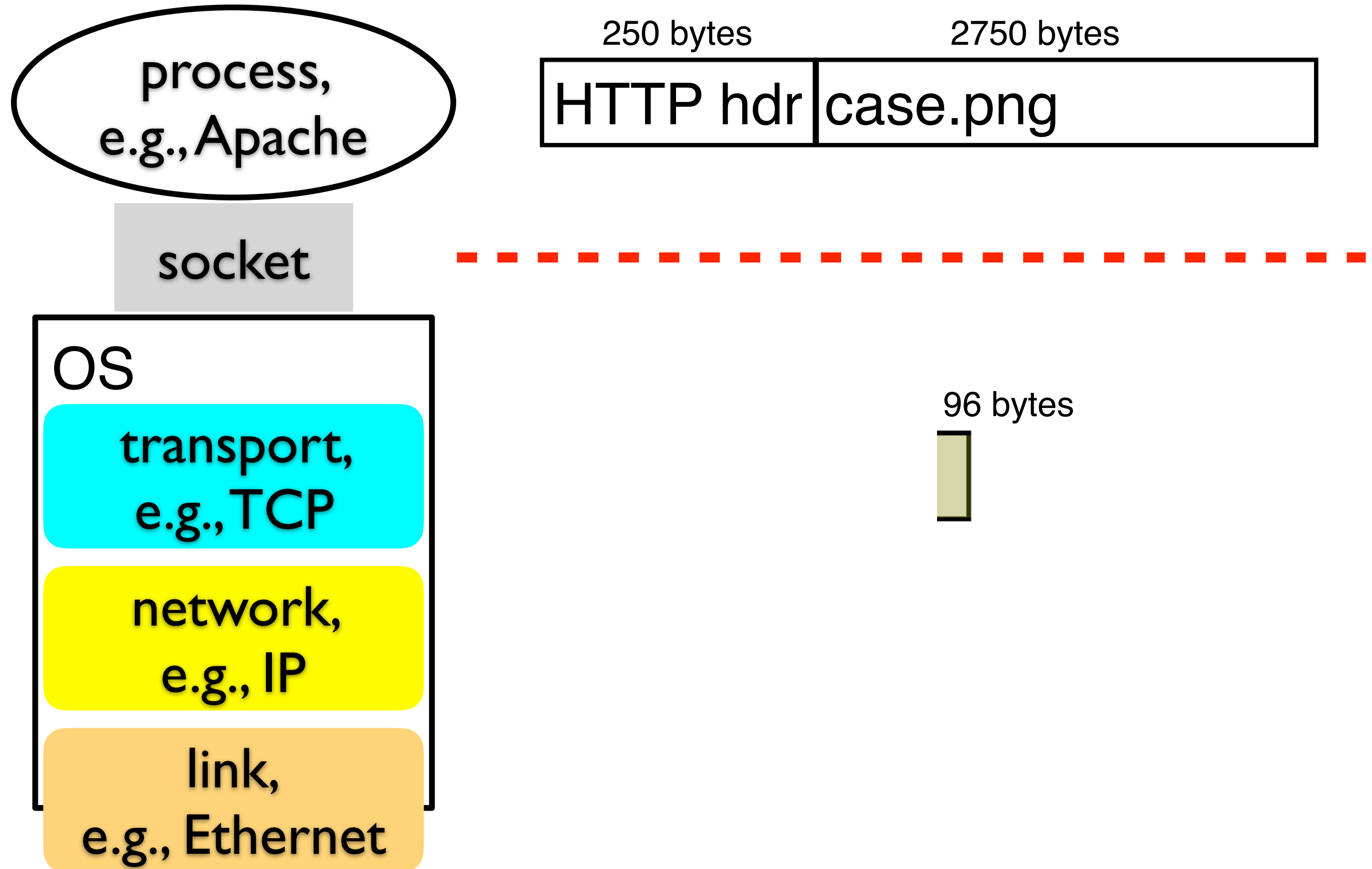
case.png



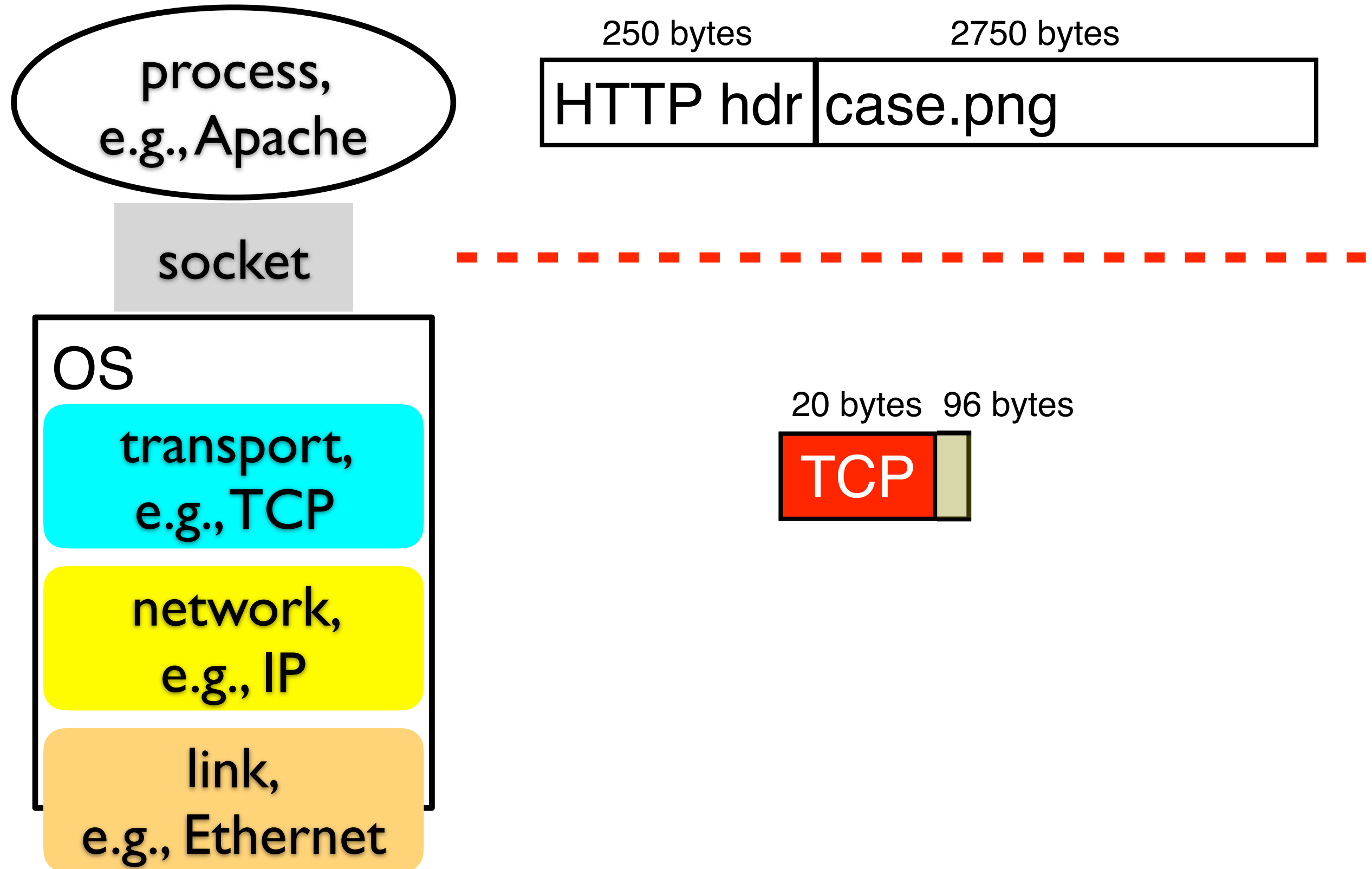
HTTP hdr

case.png

Overhead / Data Flow



Overhead / Data Flow



Overhead / Data Flow

process,
e.g., Apache

socket

OS

transport,
e.g., TCP

network,
e.g., IP

link,
e.g., Ethernet

250 bytes

HTTP hdr

2750 bytes

case.png

20 bytes 96 bytes

TCP

Overhead / Data Flow

process,
e.g., Apache

socket

OS

transport,
e.g., TCP

network,
e.g., IP

link,
e.g., Ethernet

250 bytes

HTTP hdr

2750 bytes

case.png

20 bytes 96 bytes

TCP

20 bytes 96 bytes

TCP

Overhead / Data Flow

process,
e.g., Apache

socket

OS

transport,
e.g., TCP

network,
e.g., IP

link,
e.g., Ethernet

Allman

250 bytes

2750 bytes

HTTP hdr | case.png

20 bytes 96 bytes

TCP

20 bytes 20 bytes 96 bytes

IP

TCP

Overhead / Data Flow

process,
e.g., Apache

socket

OS

transport,
e.g., TCP

network,
e.g., IP

link,
e.g., Ethernet

Allman

250 bytes

2750 bytes

HTTP hdr

case.png

20 bytes 96 bytes

TCP

20 bytes 20 bytes 96 bytes

IP

TCP

Overhead / Data Flow

process,
e.g., Apache

socket

OS

transport,
e.g., TCP

network,
e.g., IP

link,
e.g., Ethernet

Allman

250 bytes

2750 bytes

HTTP hdr

case.png

20 bytes 96 bytes

TCP

20 bytes 20 bytes 96 bytes

IP

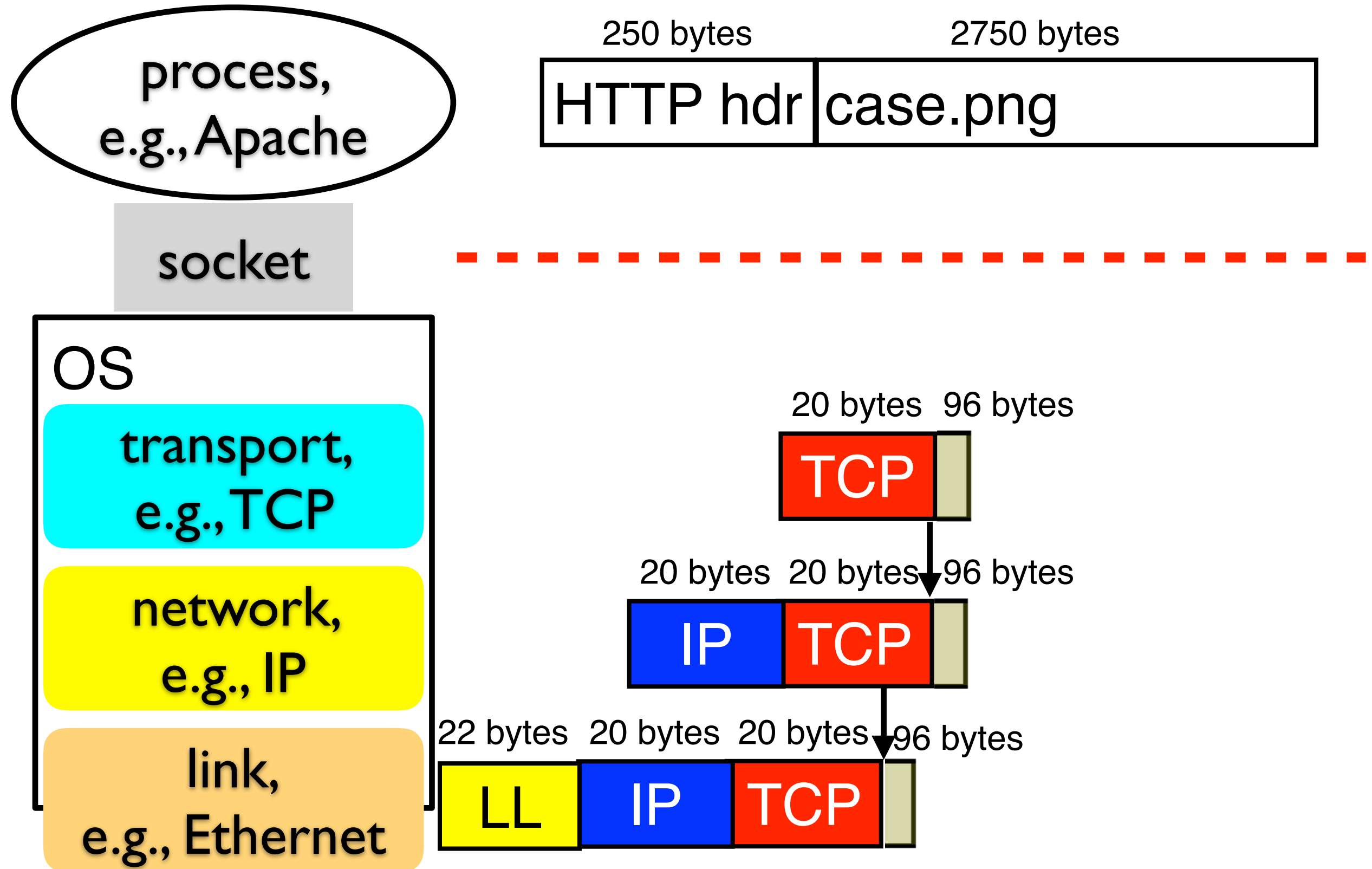
TCP

20 bytes 20 bytes 96 bytes

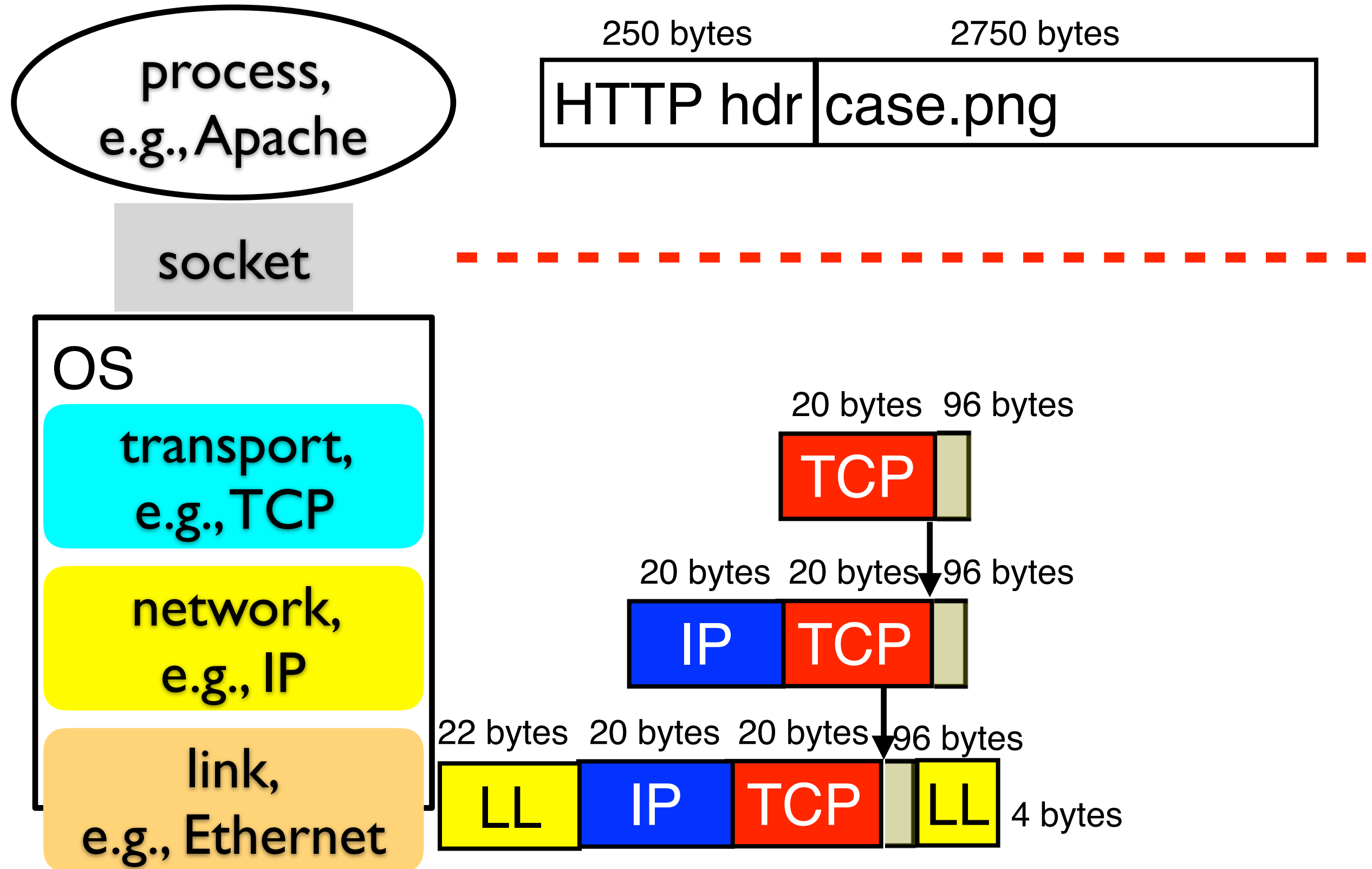
IP

TCP

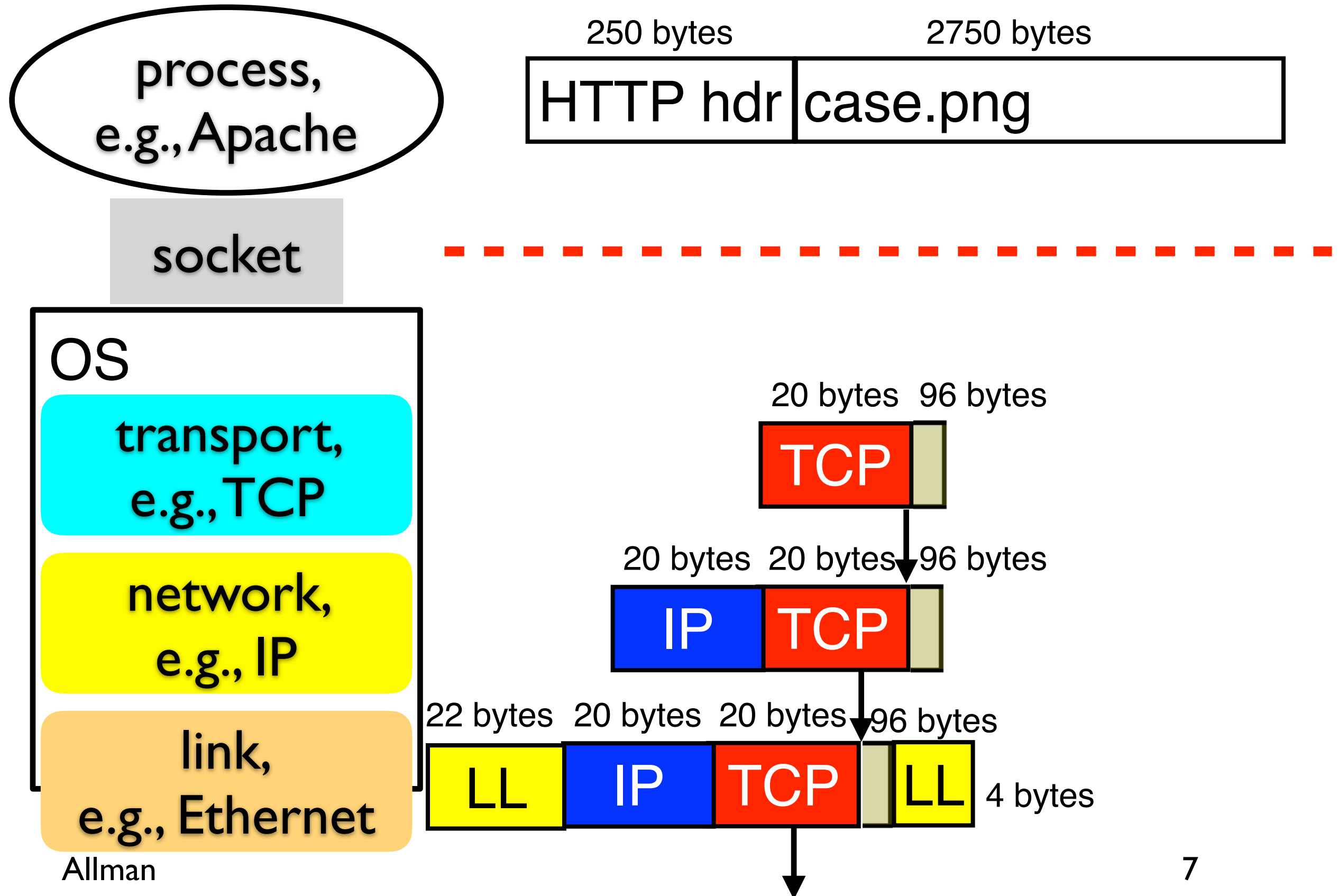
Overhead / Data Flow



Overhead / Data Flow



Overhead / Data Flow



Overhead / Data Flow

Overhead / Data Flow

- Overhead:
 - $(66 \text{ bytes} \times 3 \text{ packets}) + 250 \text{ bytes} = 448 \text{ bytes}$

Overhead / Data Flow

- Overhead:
 - $(66 \text{ bytes} \times 3 \text{ packets}) + 250 \text{ bytes} = 448 \text{ bytes}$
- Payload:
 - 2750 bytes (size of case.png)

Overhead / Data Flow

- Overhead:
 - $(66 \text{ bytes} \times 3 \text{ packets}) + 250 \text{ bytes} = 448 \text{ bytes}$
- Payload:
 - 2750 bytes (size of case.png)
- Cost:
 - $448 / (448 + 2750) = \sim 14\%$