

Networks

The OSI Model

The seven OSI layers are

1. Physical
2. Data Link
3. Network
4. Transport
5. Session
6. Presentation
7. Application

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The OSI Model: Physical Layer

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Generally, anything to do with choices regarding hardware

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A typical MAC layer sends the data as a sequence of *frames* (recall the packet nature of the Internet). A frame is a chunk of bytes, maybe tens or thousands of bytes long

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In real implementations, this layer is often strongly intertwined with the physical layer

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And *quality of service*: e.g., ensuring there is always enough bandwidth to stream a video

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Curiously, reliability is not always a requirement of a network!

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In general, a session is just some logically connected set of exchanges that have some unified identity

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This may have been through deliberate choice; but it's equally likely they just didn't think about it

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In particular, it decides on representations of data, such as characters, integers and floating point values, so that the source and destination can agree on the data communicated

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The OSI Model: Presentation Layer

So if the source wants to send the number 42, the presentation layer deals with encoding this in a suitable way as (say) some bits, which are then transmitted (passed to layer 5)

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And the destination presentation layer can determine that this particular sequence of bits it has just received represents the number 42

They can agree on “42” regardless of how each host chooses to represent integers internally

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Built on top of these protocols are the applications that the users see, e.g., Firefox or Chrome for the Web, Outlook or Thunderbird for email

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Layering Models

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And in a way that it can be untransformed back again

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- do some arbitrarily complicated manipulation

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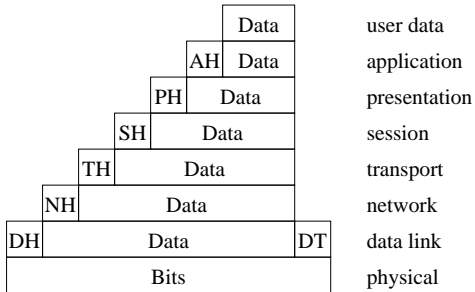
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- put items in a standard form, e.g., integers into a well-known format
- do some arbitrarily complicated manipulation
- do nothing at all!

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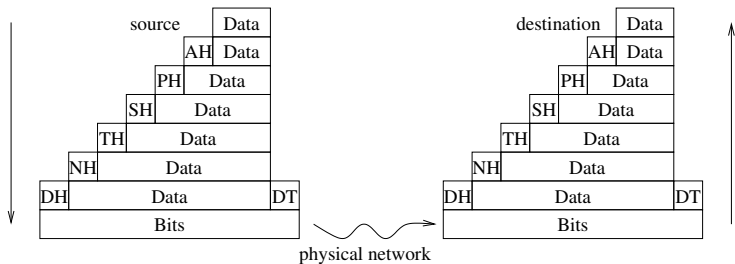
Layering Models



A possible (but unlikely) OSI encapsulation

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Layering Models



Data is encoded and decoded

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Encapsulation

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E.g., value 4 might mean “end of transmission” and the modem should drop the connection

What do you do if your data happens to contain the value 4?

You can't just send it, as the modem would interpret the data as a command and end the connection

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Encapsulation

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This is why encapsulation is necessary: so data can be transmitted accurately, even if you are using weird hardware

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The “DB” is called an *escape character*, and its presence in the datastream means the next character is encoded, so special action must be taken

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With byte stuffing, we exchange some expansion of the data for the correct transmission of that data

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Of course, modern hardware doesn't act like early modems, but the principle remains

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Eventually, the physical layer transmits some bits

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So why do this as it seems so wasteful?

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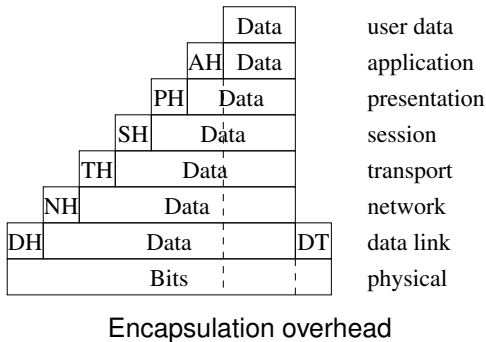
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It also gives flexibility

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And we can slot in the implementation for the new hardware in exactly the same way

We don't have to rewrite our email application (and Web browser, and all our other applications) because of the upgrade

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Exercise Read RFC1149

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This enables useful tricks like *tunnelling*, which we shall look at later