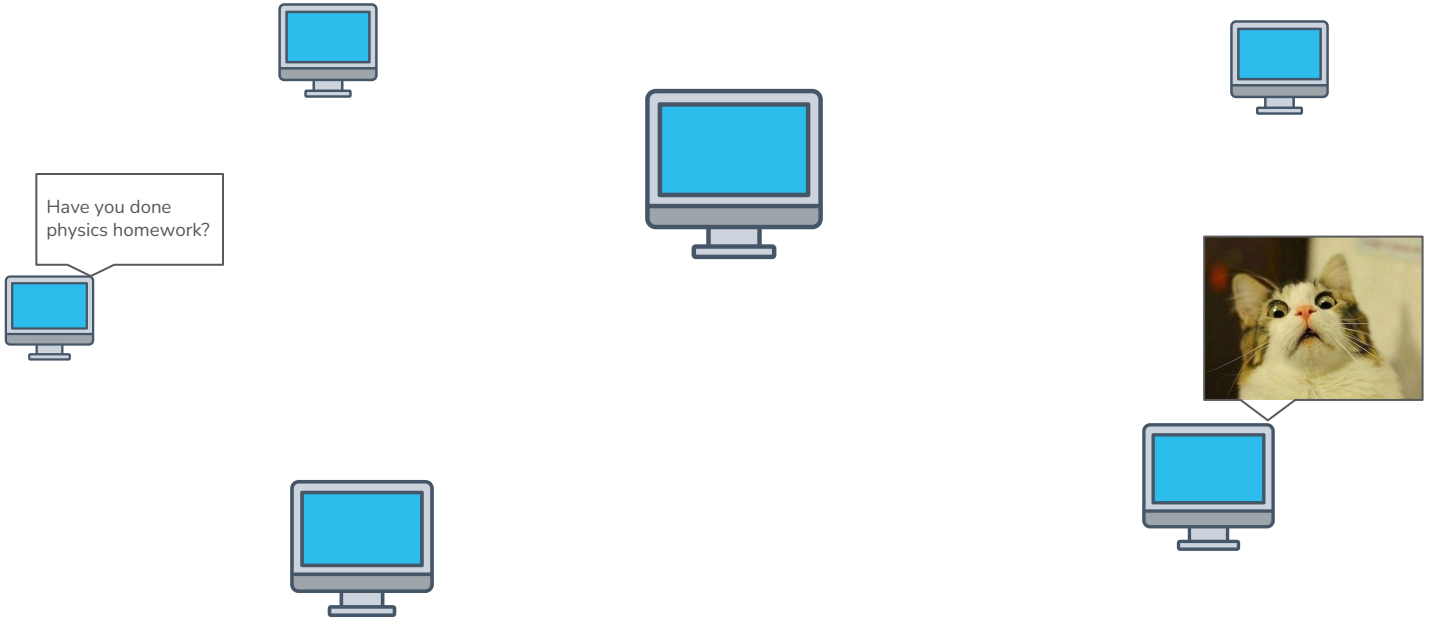
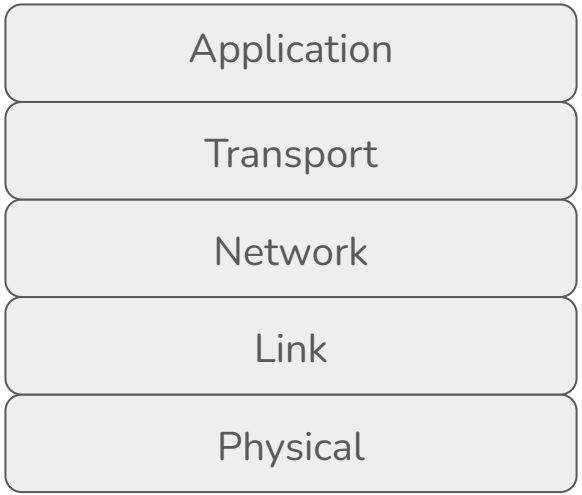

Some ideas behind the workings of the internet

In the beginning there was one computer...

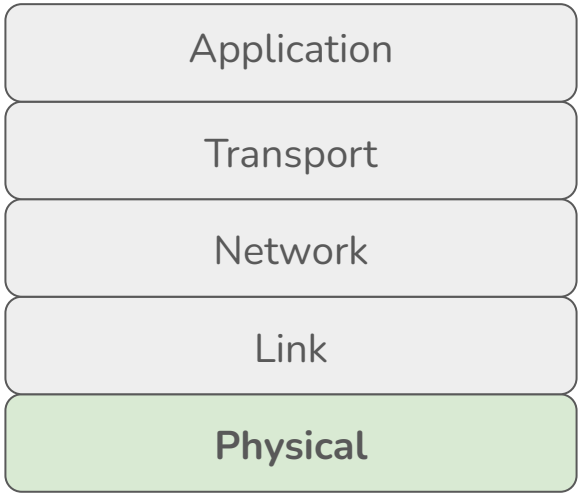
Now there are billions, each ‘talking’ to each other



How do we send and receive data between any two devices?



How do we physically send data (between two computers)?

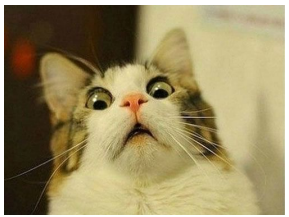


How do we physically send data (between two computers)?

Need a way to represent data - binary digits!

Have you done physics homework?

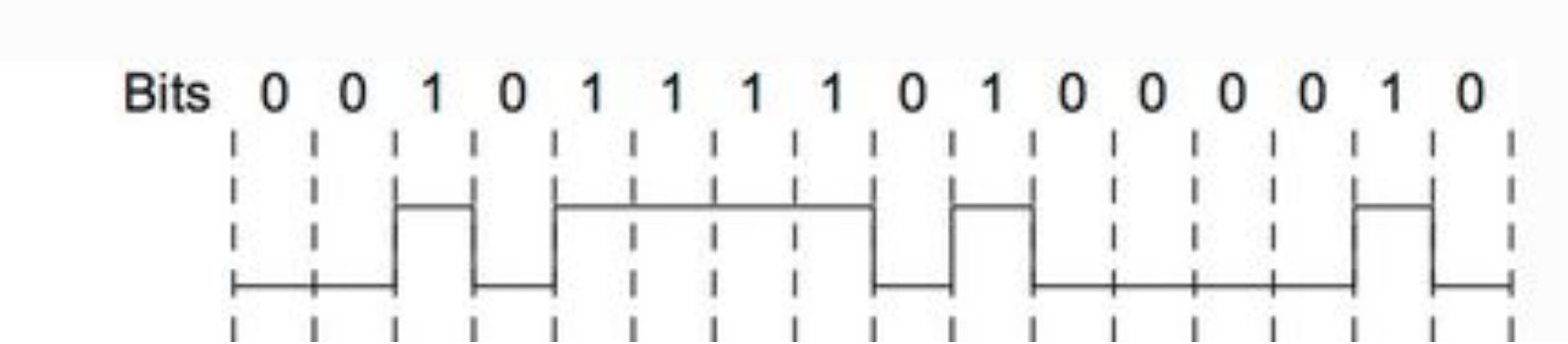
```
00000000: 01001000 01100001 01110110 01100101 00100000 01111001  Have y
00000006: 01101111 01110101 00100000 01100100 01101111 01101110  ou don
0000000c: 01100101 00100000 01110000 01101000 01111001 01110011  e phys
00000012: 01101001 01100011 01110011 00100000 01101000 01101111  ics ho
00000018: 01101101 01100101 01110111 01101111 01110010 01101011  mework
0000001e: 00111111 00001010                                      ?.
```



```
00000000: 01010010 01001001 01000110 01000110 00010010 00100110  RIFF.&
00000006: 00000101 00000000 01010111 01000101 01000010 01010000  ..WEBP
0000000c: 01010110 01010000 00111000 00100000 11001000 01111111  VP8 ..
00000012: 00000011 00000000 10110000 00111000 00001000 10011101  ...8..
00000018: 00000001 00101010 00000000 00000100 00000000 00000100  .*....
0000001e: 00111110 00110001 00010110 10001001 01000011 00100010  >1..C"
00000024: 00100001 00100001 00100001 10100110 00010001 00111100  !!!..<
0000002a: 11110000 01000000 00000110 00001001 01001100 10101001  .@..L.
```

How do we physically send data (between two computers)?

Need some physical medium to represent binary digits

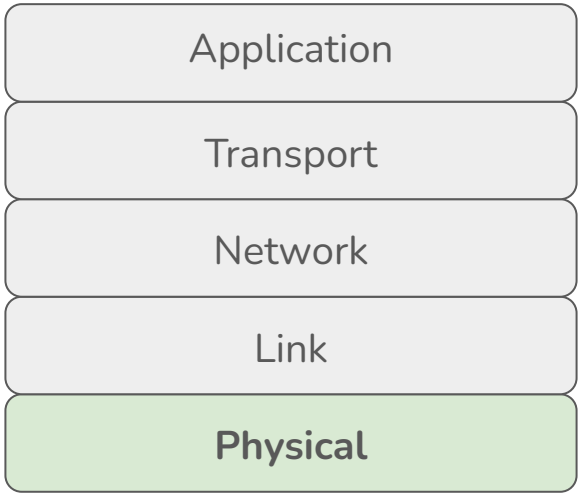


How do we physically send data (between two computers)?

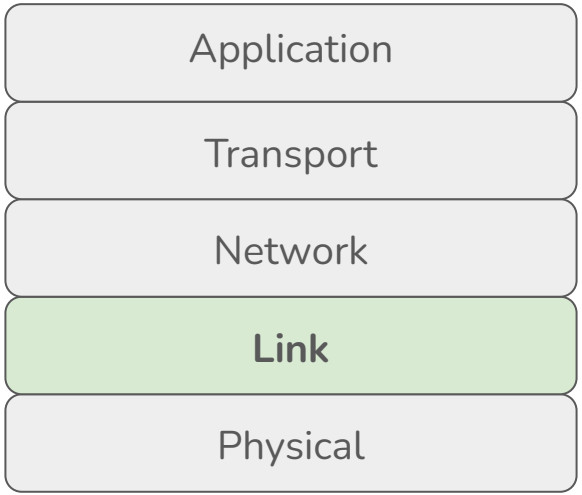
Need two nodes to be connected physically

How do we physically send data (between two computers)?

- Need a way to represent data - binary digits
- Need some physical medium to represent binary digits
- Need two nodes to be connected physically



How do we make sure everything sent from one node arrives at another?



How do we make sure everything sent from one node arrives at another?

Error detection/correction (when things go wrong)

1D parity bit

11010110 1
00110110 0
00010010 0

2D parity bits

11010110 1
00110110 0
00010010 0

1111001

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Resending data (when things go really wrong)

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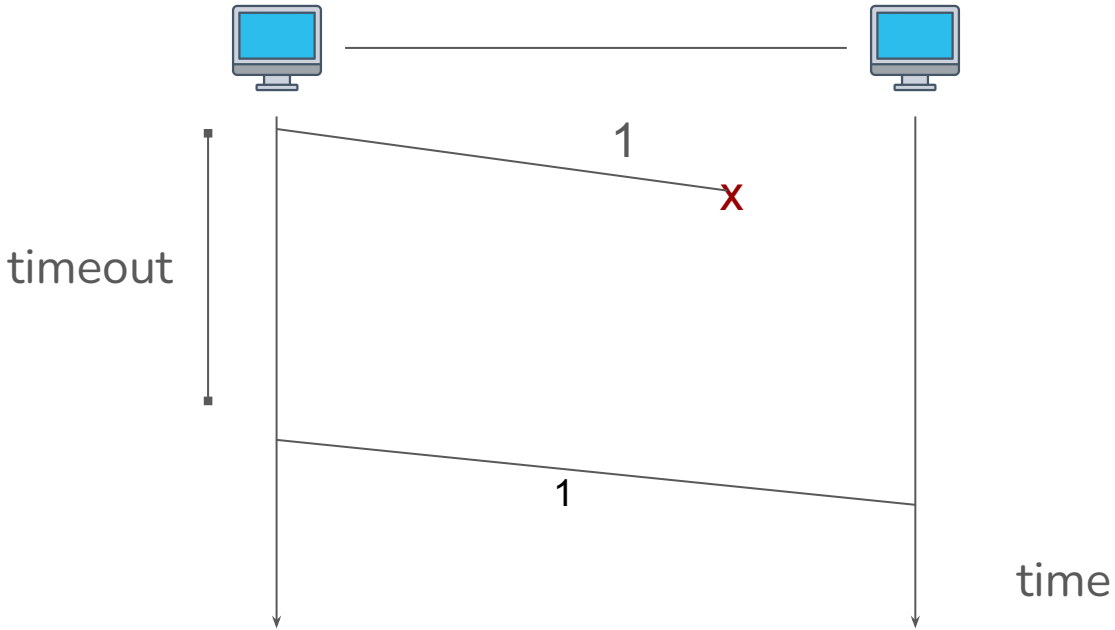

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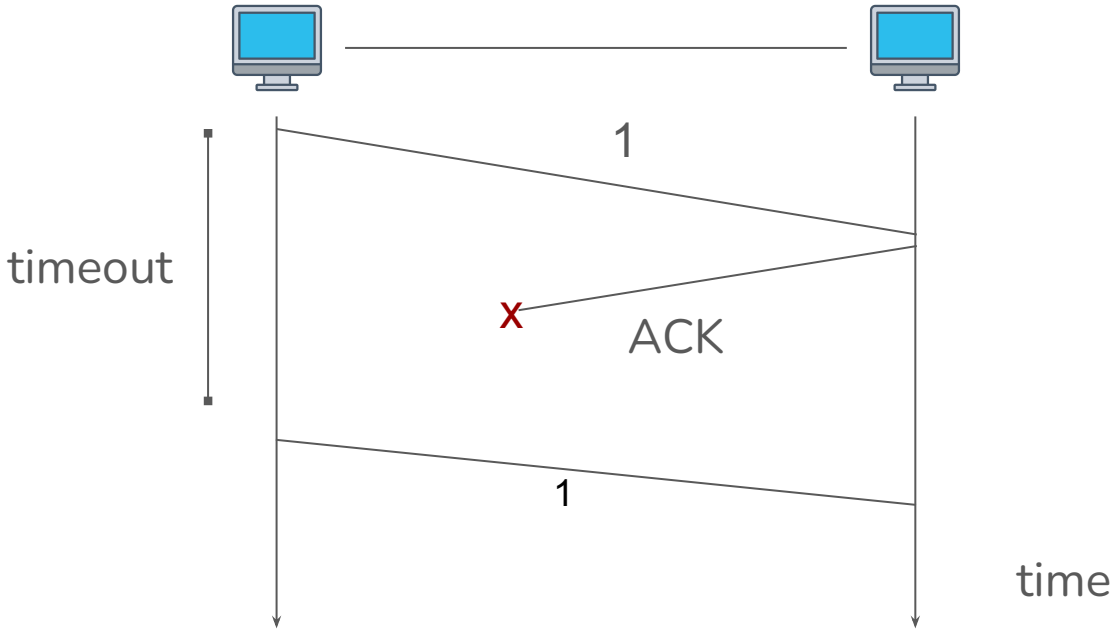

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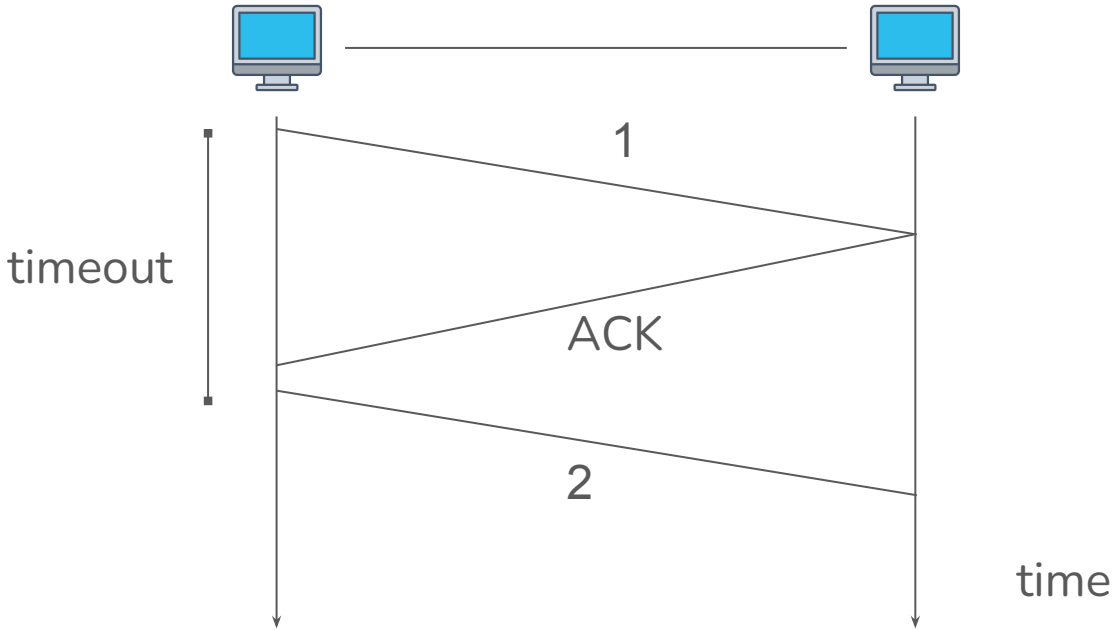

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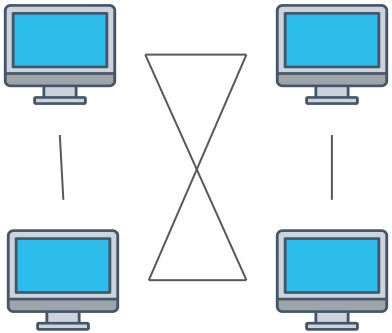
Sharing links



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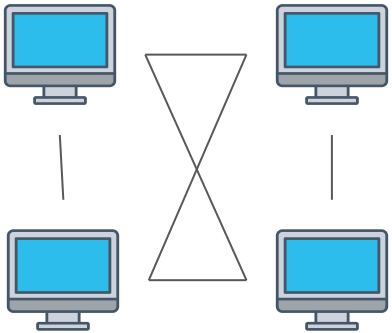

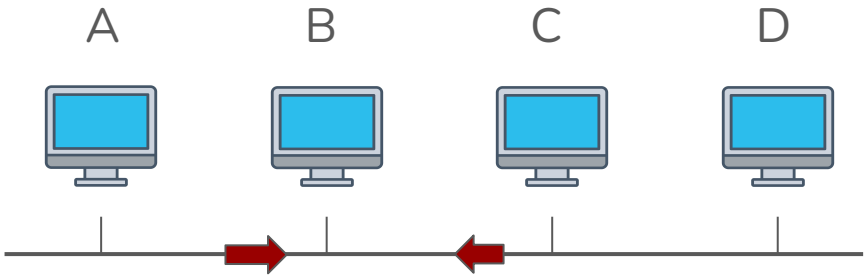

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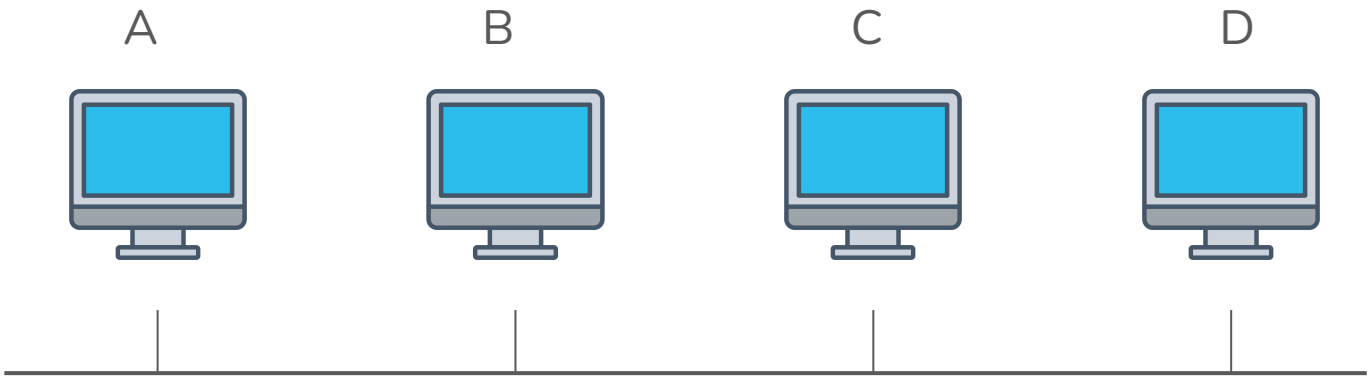
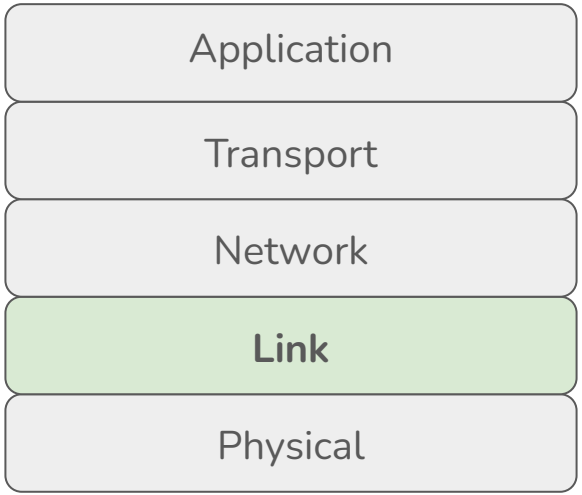
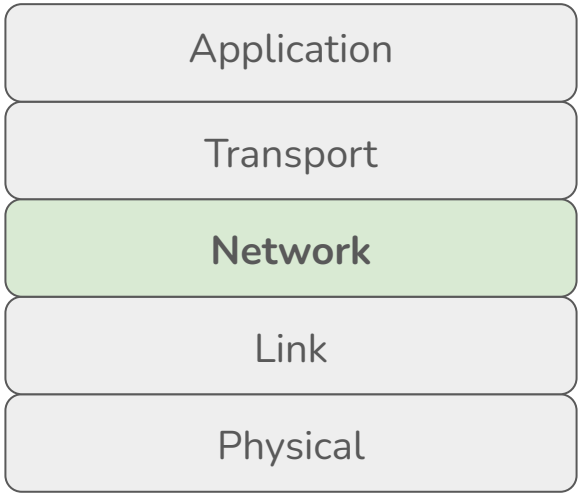


How do we make sure everything sent from one node arrives at another?

- Error detection/correction
- Resending data
- Sharing links

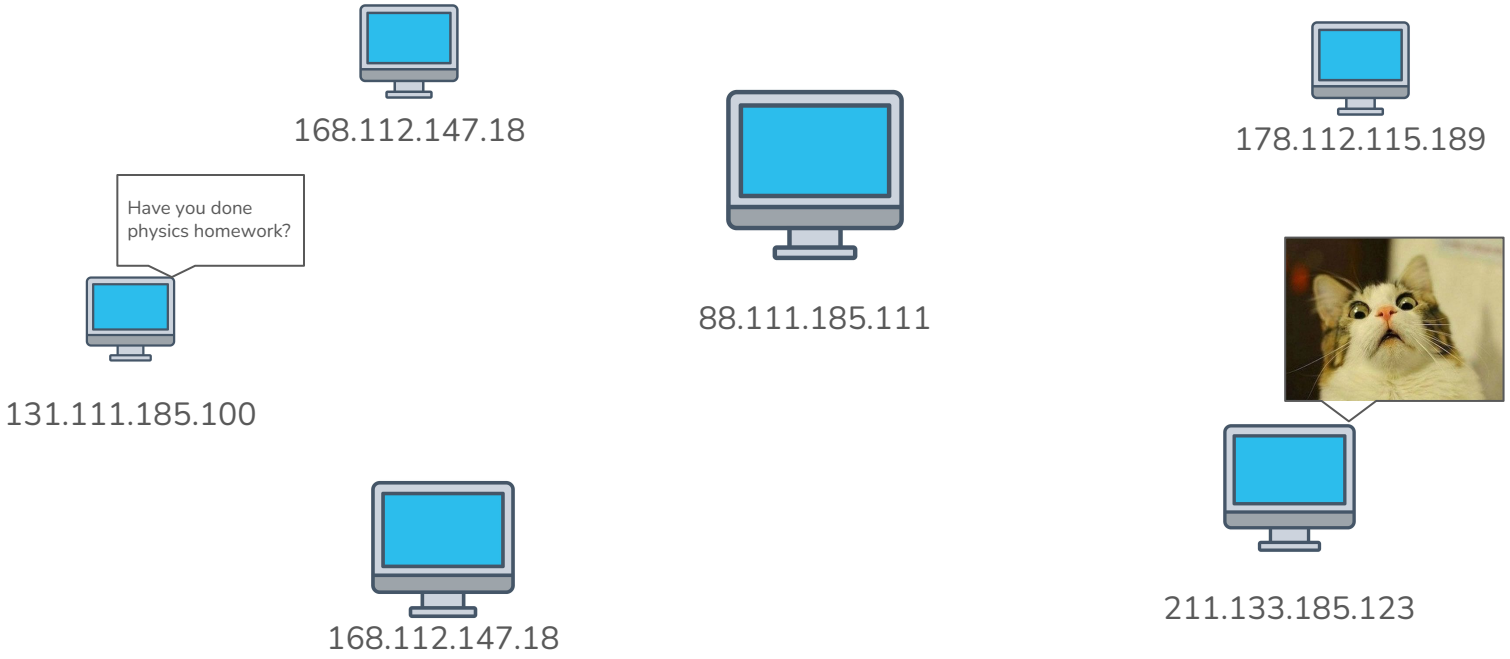


How do we get from one place on the internet to another?



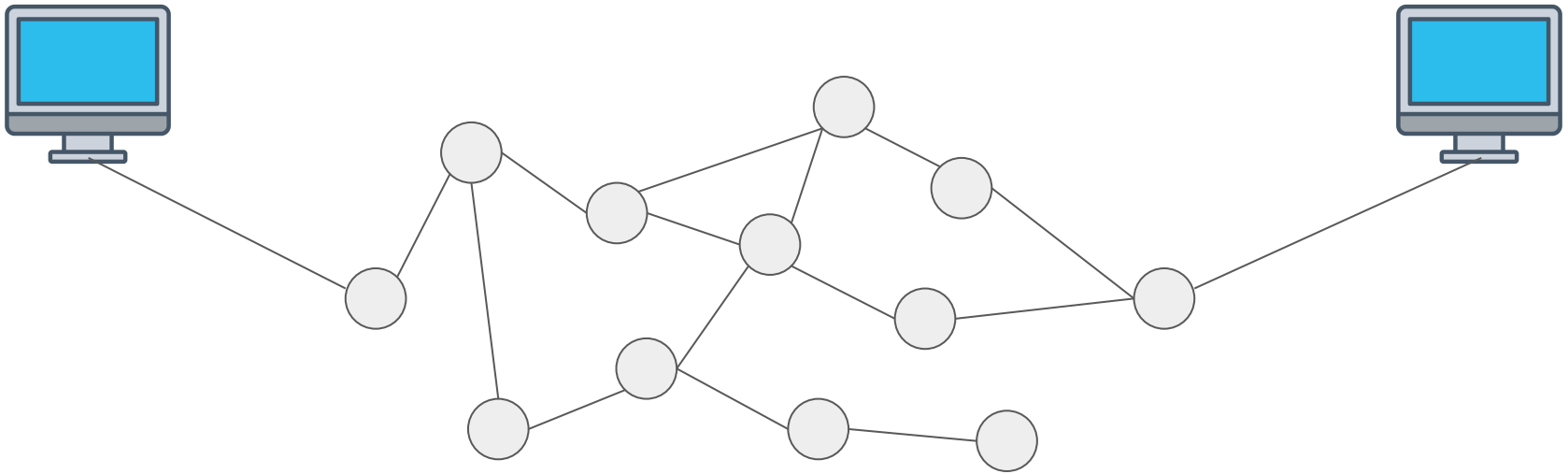
How do we get from one place on the internet to another?

Addressing - IP addresses



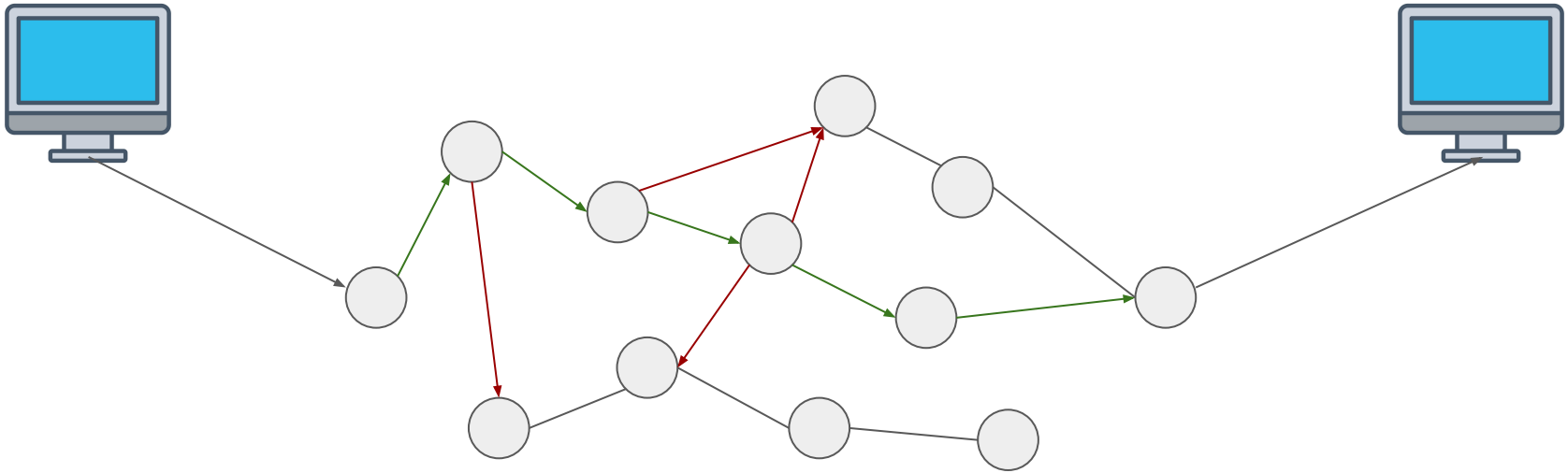
How do we get from one place on the internet to another?

Find a path (routing)



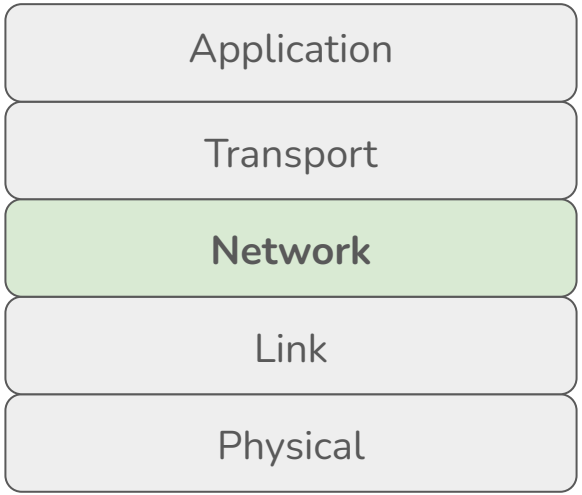
How do we get from one place on the internet to another?

Following data along a path (forwarding)

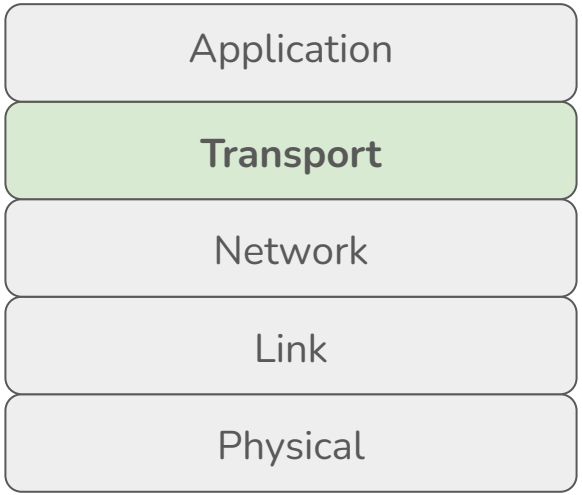


How do we get from one place on the internet to another?

- Addressing
- Routing
- Forwarding



How do we ensure everything sent from one place on the Internet arrives at the other place



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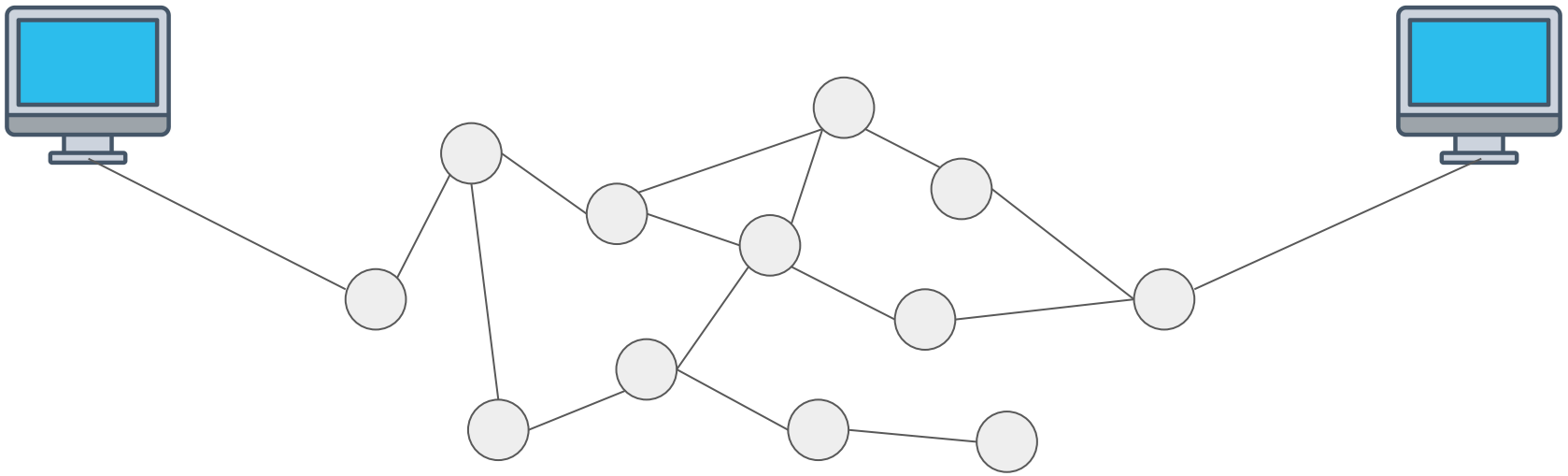

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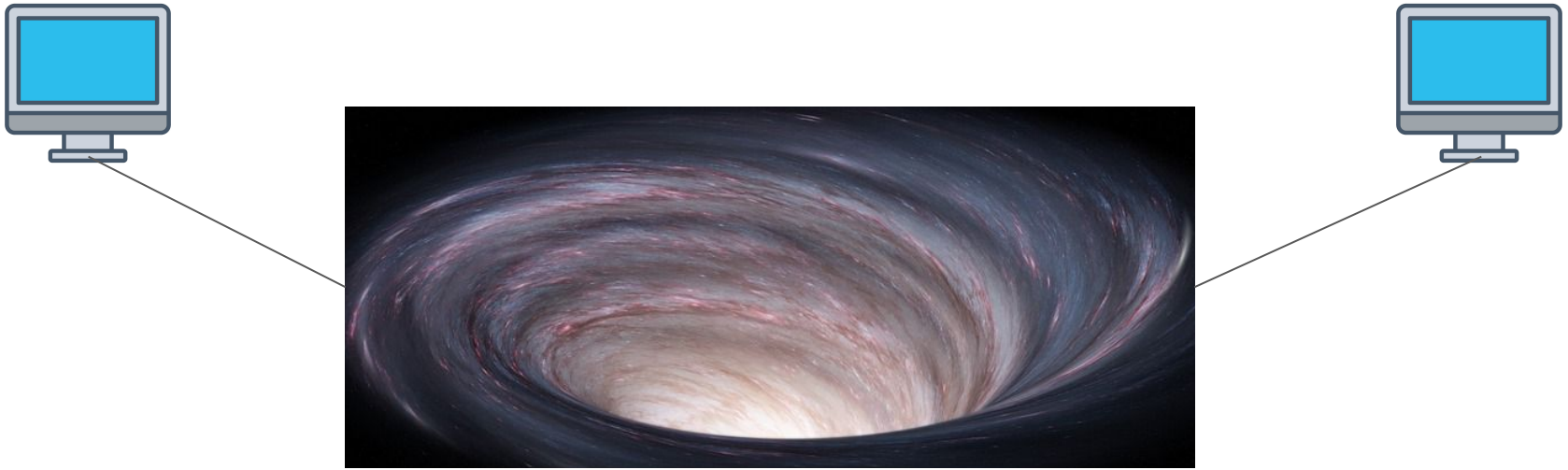
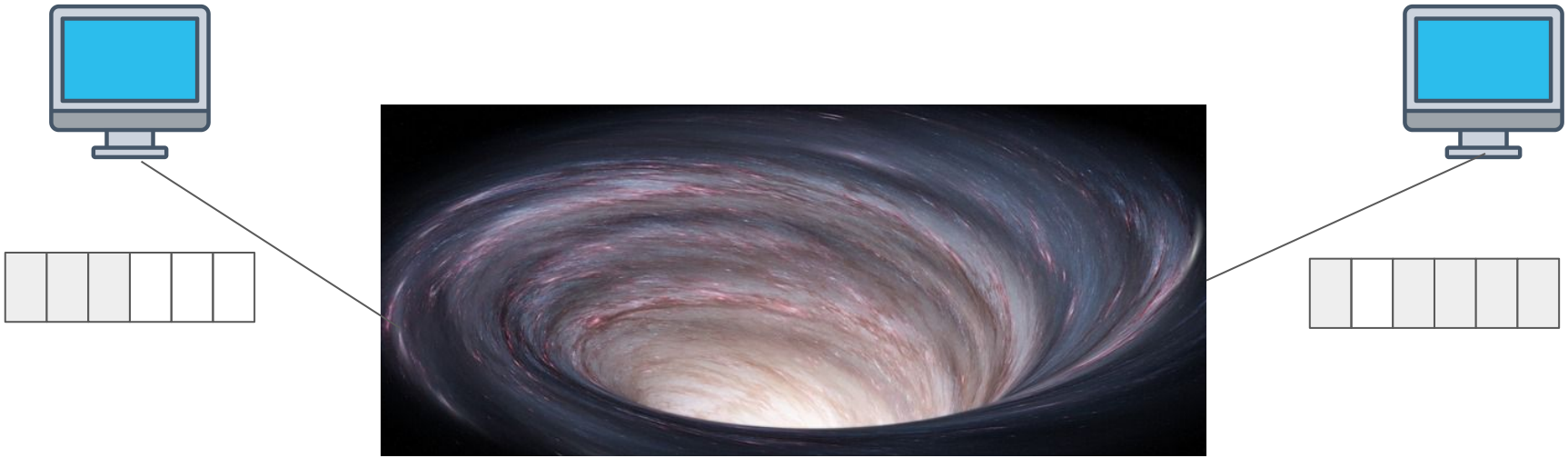


How do we ensure everything sent from one place on the Internet arrives at the other place

Flow control - sending speed, due to receiver conditions



How do we ensure everything sent from one place on the Internet arrives at the other place

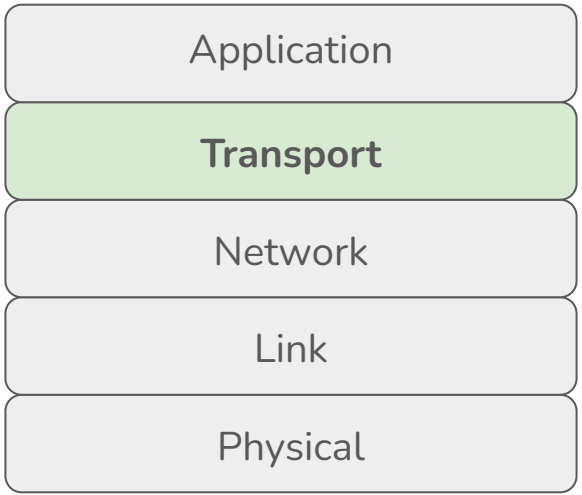
Congestion control - sending speed, due to network conditions

How do we ensure everything sent from one place on the Internet arrives at the other place

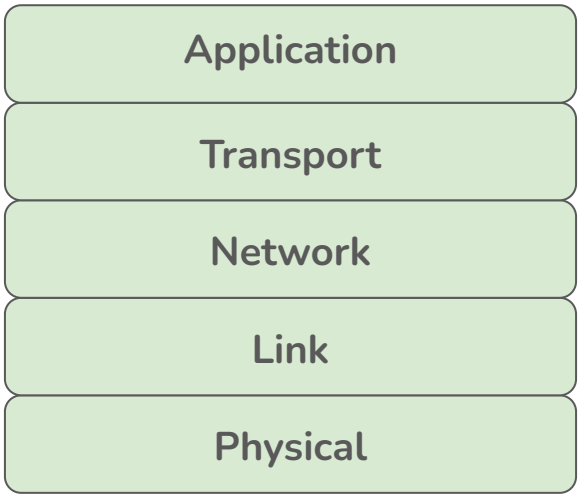
Multiple applications sharing a single node - ports!

How do we ensure everything sent from one place on the Internet arrives at the other place

- Flow control
- Congestion control
- Multiple applications sharing a single node



Recap - How do we send and receive data between any two devices?



How do we ensure everything sent from one place on the Internet arrives at the other place?

How do we get from one place on the internet to another?

How do we make sure everything sent from one end of a link arrives at the other end?

How do we physically send data (between two nodes)?


Some ideas behind the workings of the internet