



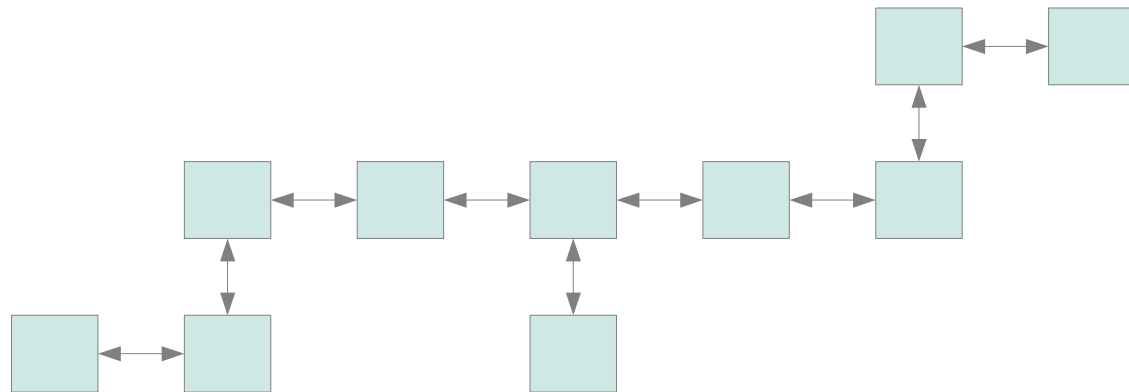
IPv6 Internet Protocol version 6

“Internet Protocol (IP) is the primary protocol for routing datagrams across network boundaries”
– Wikipedia

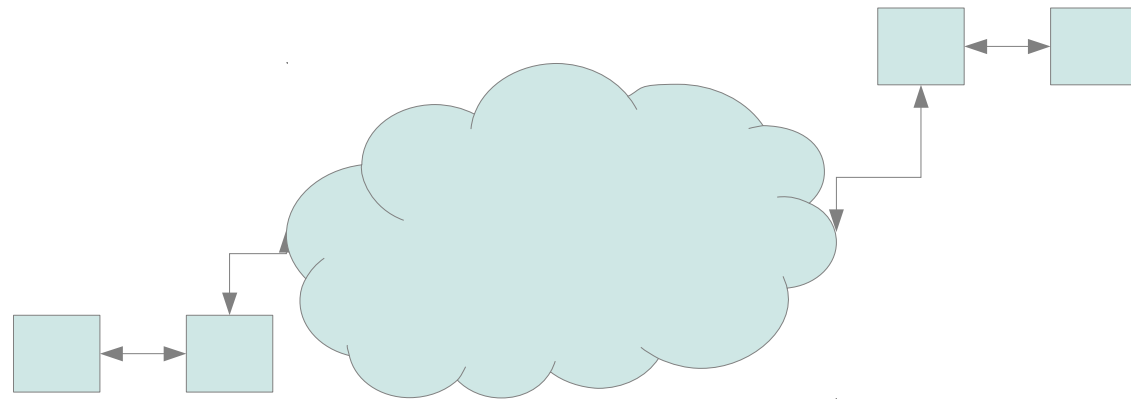


Internet connections involve multiple different players

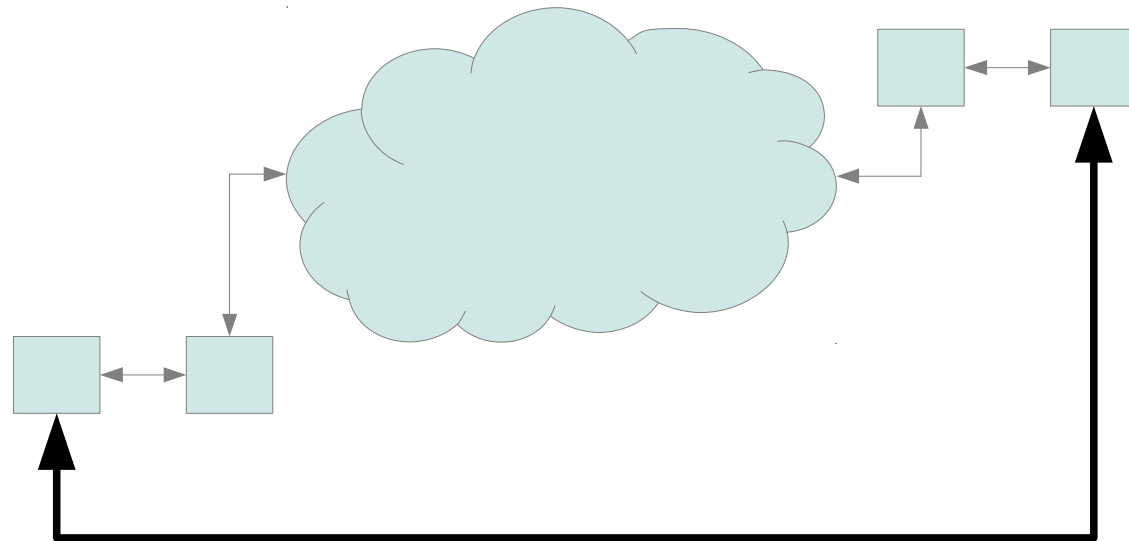
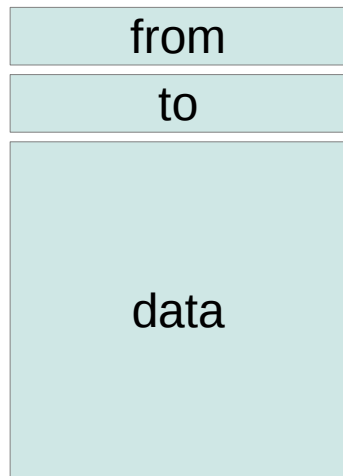
- university departments
- telecom companies
- local exchanges
- international cables



For most of us,
all this complexity
just looks like this :



The header of each packet contains the address of the recipient and sender.



These act like sending SMS text messages between phones using telephone numbers.

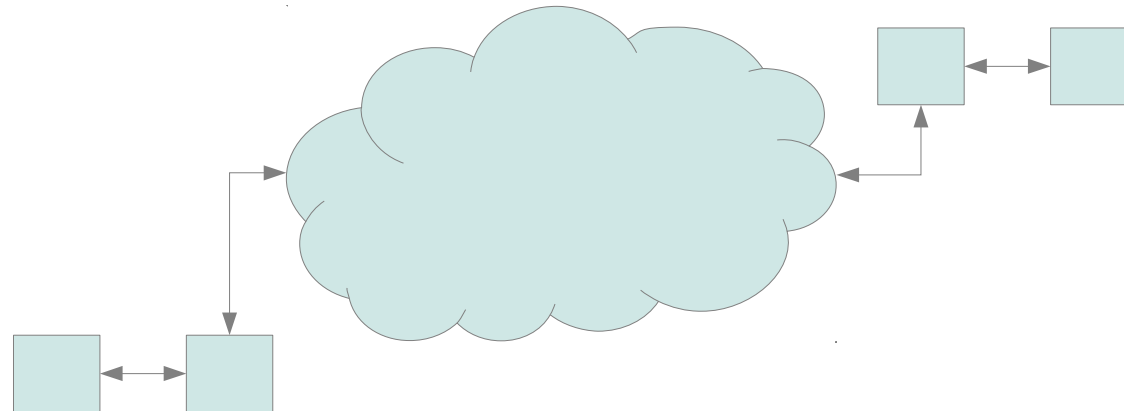


Designed in 1981,
Internet Protocol version 4 (IPv4)
uses 32bit numbers to route traffic.



32bit number gives us a theoretical space of 4294967296 (2^{32}) addresses.

Rapid growth in the 1990's used up the
available addresses faster than anticipated.



**As of now, all of the available
blocks have been allocated.**





IPv6 uses 128-bits, giving a theoretical space of 3.4×10^{38} addresses.

34 0000000 0000000000 0000000000 0000000000

Expectation is allocation will be sparse,
with only a few addresses used in each block.

Example, a department may be allocated a full /48 block.

48 of the 128 bits are used to identify the department,
leaving 80 bits for routing within the department.





80 bits for routing within the department

8 bits for 256 buildings in the department

8 bits for 256 floors per building

8 bits for 256 rooms per floor

8 bits for 256 racks per room

8 bits for 256 machines per rack

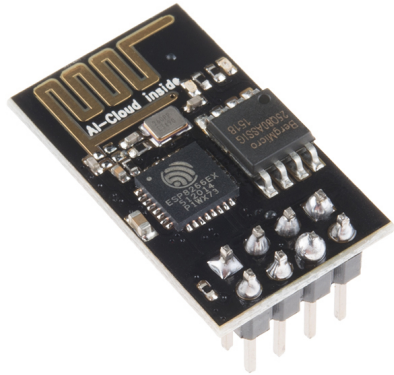
16 bits for 65536 virtual machines per physical machine

16 bits for 65536 containers per virtual machine

= 72 bits



Sounds crazy but



ESP8266

- WIFI enabled
- Runs Python
- Costs \$5

If you want to play a movie
on a tower block ..

.. every light bulb has to have
an address.





So what is not to like ?

- Huge address space
- Simplified routing
- Lots of public addresses

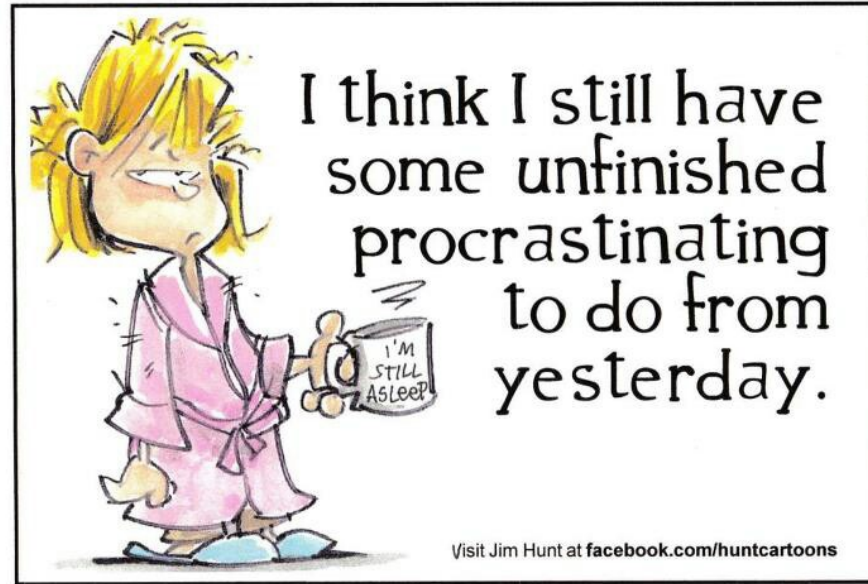
IP version 6 was invented in 1998.

What have we been doing for the last 19 years ?





If no one else has IPv6.
If I upgrade my network to IPv6 ..
.. no one will use it.



As long as some of my users only have IPv4 ..
.. I still need to publish everything via IPv4.

We can make do for now.



Until .. one day

Most of the major institutes have IPv6.

Most new services are published on IPv6.

Limited access to legacy services via IPv4





What we can do now :



Check for hard coded IPv4 style addresses

178.79.157.93

IPv6 addresses are longer, have different delimiters

2a01:7e00::f03c:91ff:fedf:f8b

All the major OSs support IPv6

All the main virtual machine technologies work with IPv6

Most of the commercial cloud compute platforms support IPv6

Docker containers don't support IPv6 .. yet

Some residential ISPs support IPv6

