What is IP ?

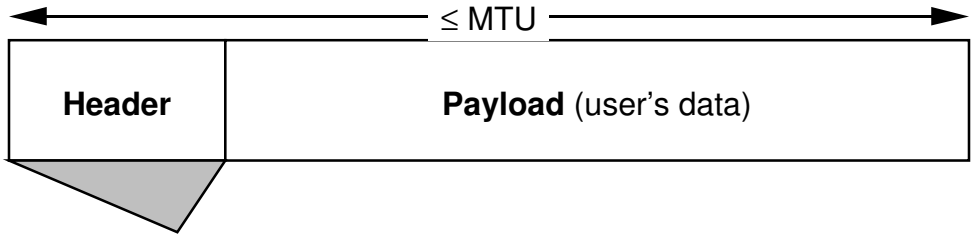
"A connectionless, unreliable, datagram delivery network"

- **Network**

  Links computers. Each computer ("host") is identified by a unique **IP number**

- **Datagram delivery**

  Transfers units of data ("datagrams") up to a certain maximum size, called the Maximum Transfer Unit (MTU)



Source IP number	– Where it came from
Destination IP number	– Where it's going to
Protocol Identifier	– What higher-level protocol is in payload
Time To Live	– How many hops before we throw it away
Fragmentation Info	– How to reassemble if had to be fragmented
Checksum	– Ensures header not corrupted

- **Unreliable**

  Does not guarantee that datagrams will be delivered in sequence, within a particular time, or even at all

- **Connectionless**

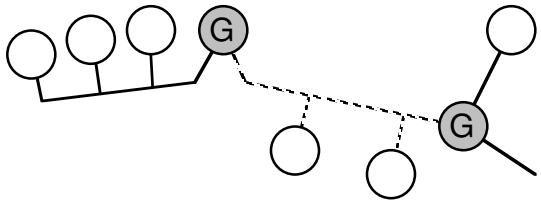
  Datagrams are delivered independently, with no relationship to preceeding or following datagrams

Rather like sending postcards through the mail.
How would you send a novel through the mail using only postcards?

How does IP work ?

- **Networks joined by “gateways”**

  A gateway is a host which is connected to two or more networks and is able to transfer data from one to another



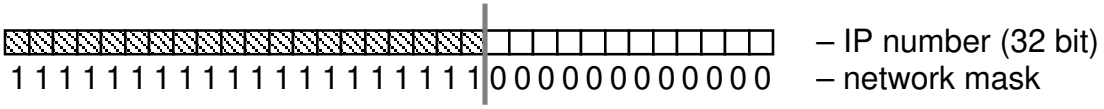
  (Known as “routers” to everyone else)

- **Routing tables**

  Gateway decides on the next ‘hop’ (perhaps direct to destination, otherwise via another gateway) by looking up the destination IP number in a table

- **Network numbers**

  IP numbers are split into two parts: the **Network Number** (left part) and **Host Number** (right part)



  IP numbers must be allocated so that all hosts on the same physical network have the same Network Number (and different Host Numbers)

  Therefore, a routing table needs only ONE entry to route to ALL hosts on the same network

- **Routing protocols**

  Gateways exchange information with each other to automatically keep their routing tables up to date

How does IP work ? (2)

- **Encapsulation**

  Datagrams are forwarded by sending them inside packets of the underlying network (e.g. ethernet, localtalk, token ring etc)

  If this network has its own numbering system, an Address Resolution Protocol is used to convert the IP number to the appropriate address (e.g. Ethernet: 48 bit MAC address)

  ARP is a **different** protocol to IP

- **Fragmentation**

  If a datagram encounters a network with a smaller MTU than its own size, it is split into suitably-sized **fragments** (each a datagram in its own right) which remain separate until they reach their final destination, where they are reassembled