Fragmentation and Assembly

Basic Problem

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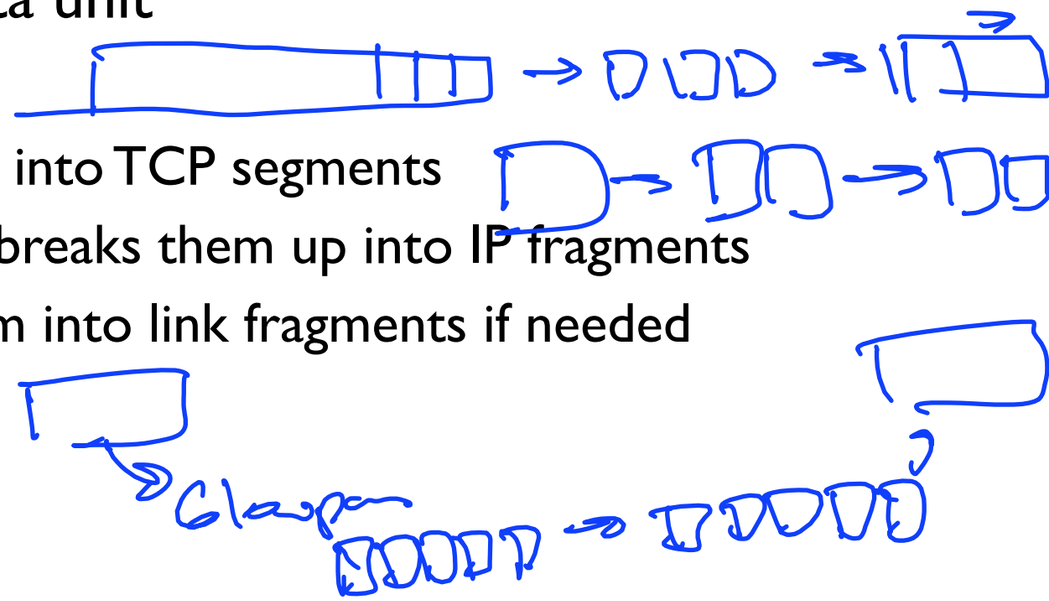
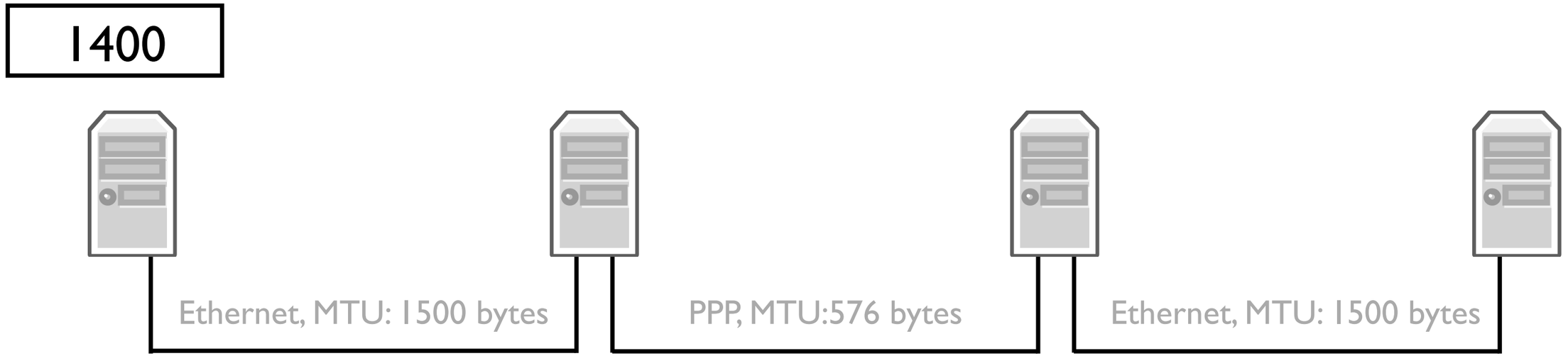
Fragmentation and Assembly

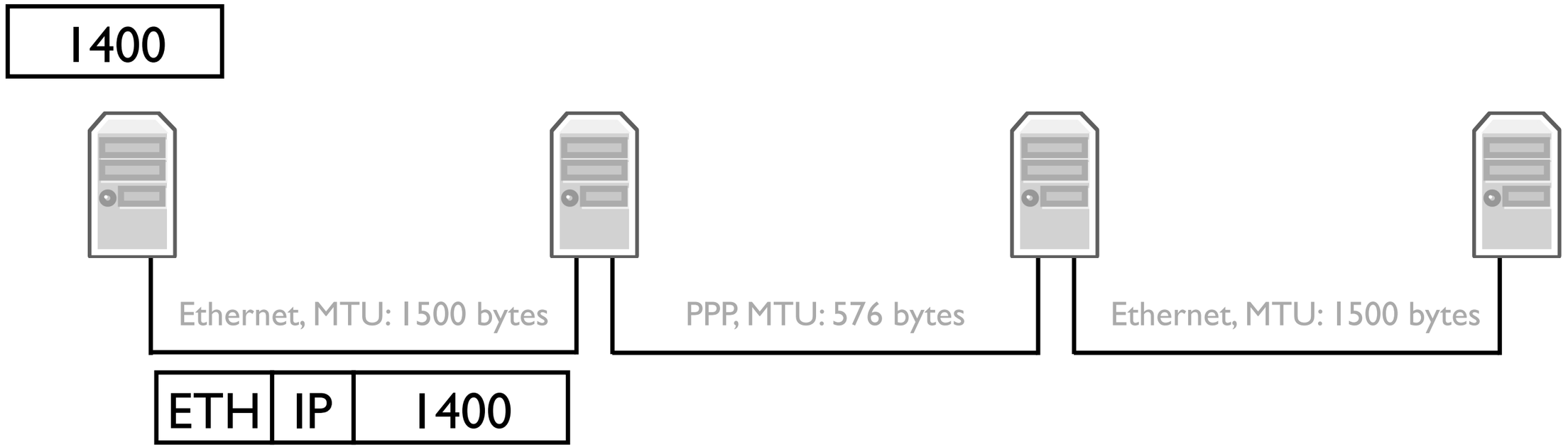
- Problem occurs when higher layer's data unit is too large for lower layer
- Fragmentation: taking a large data unit and breaking it into smaller chunks
- Assembly: combining chunks into original data unit
- Examples:
  - Transport: TCP takes stream of bytes and breaks into TCP segments
  - Network: IP takes packets too big for a link and breaks them up into IP fragments
  - Link: 6lowpan takes IPv6 packets and breaks them into link fragments if needed



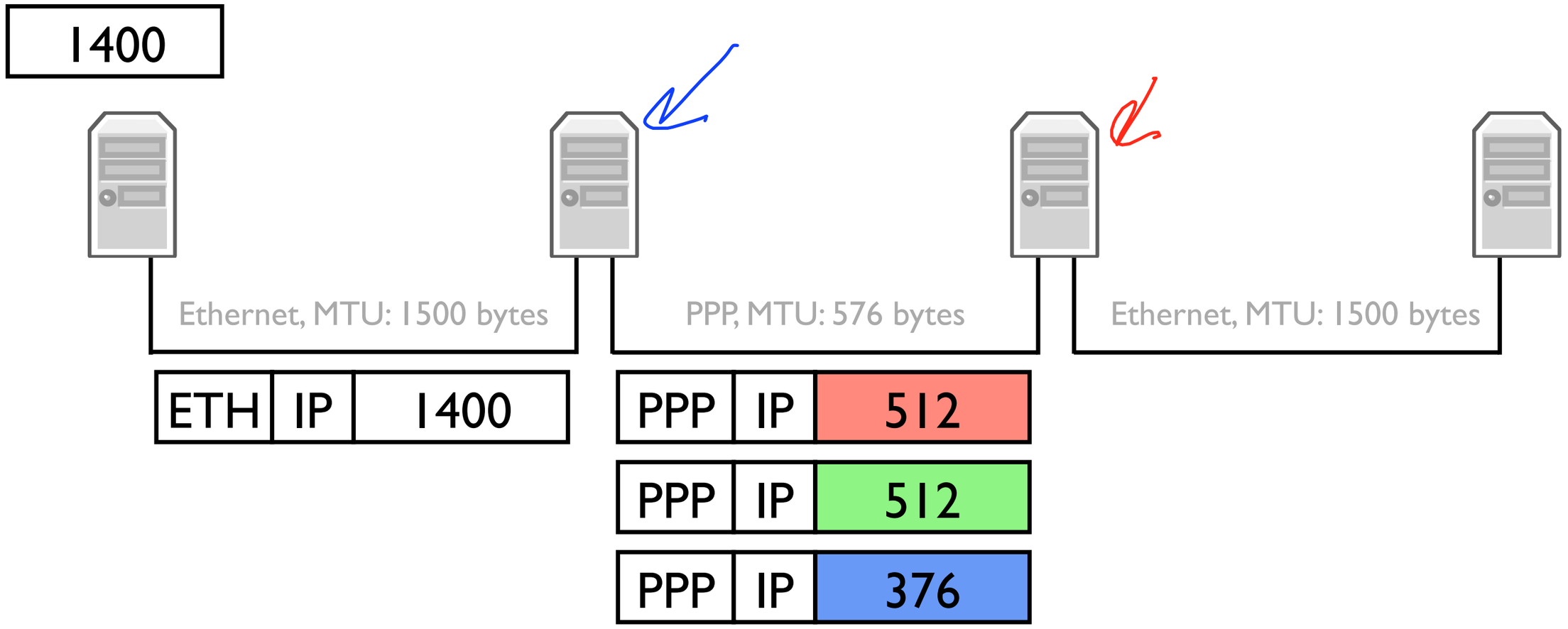
Fragmentation Example: IP



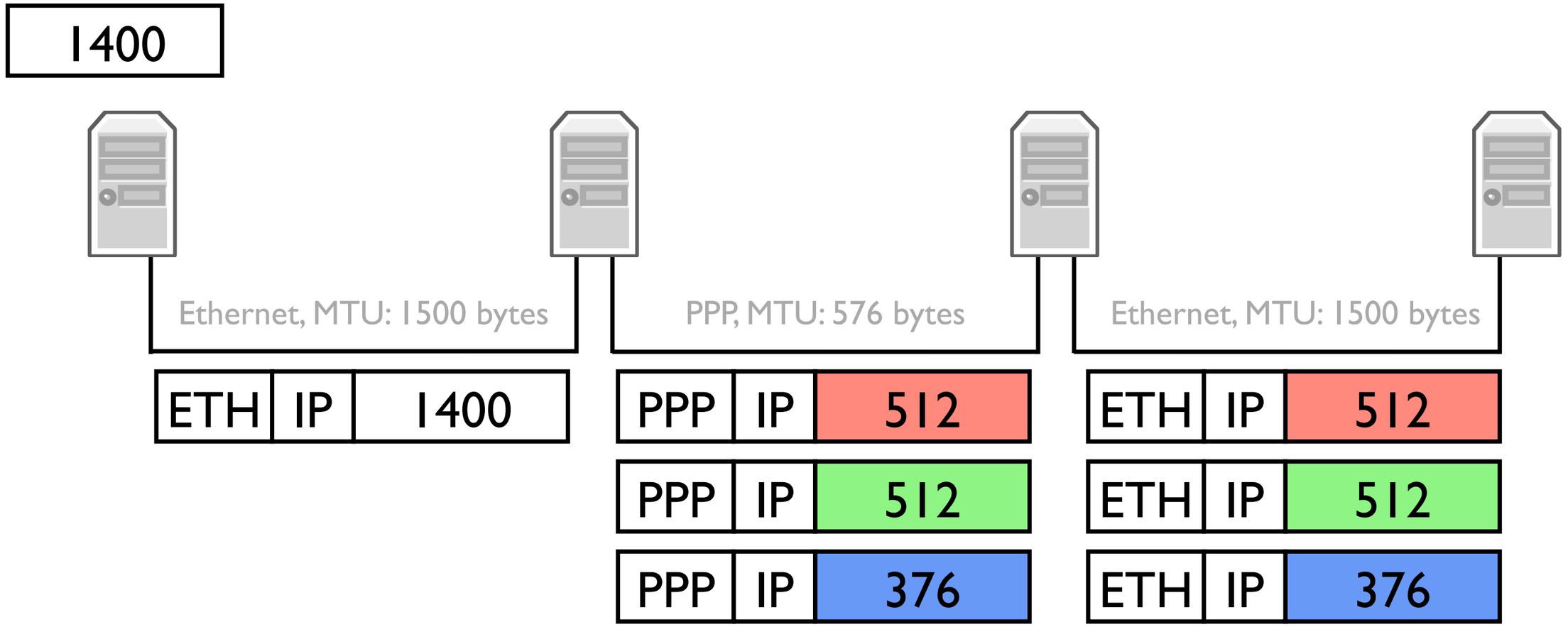
Fragmentation Example: IP



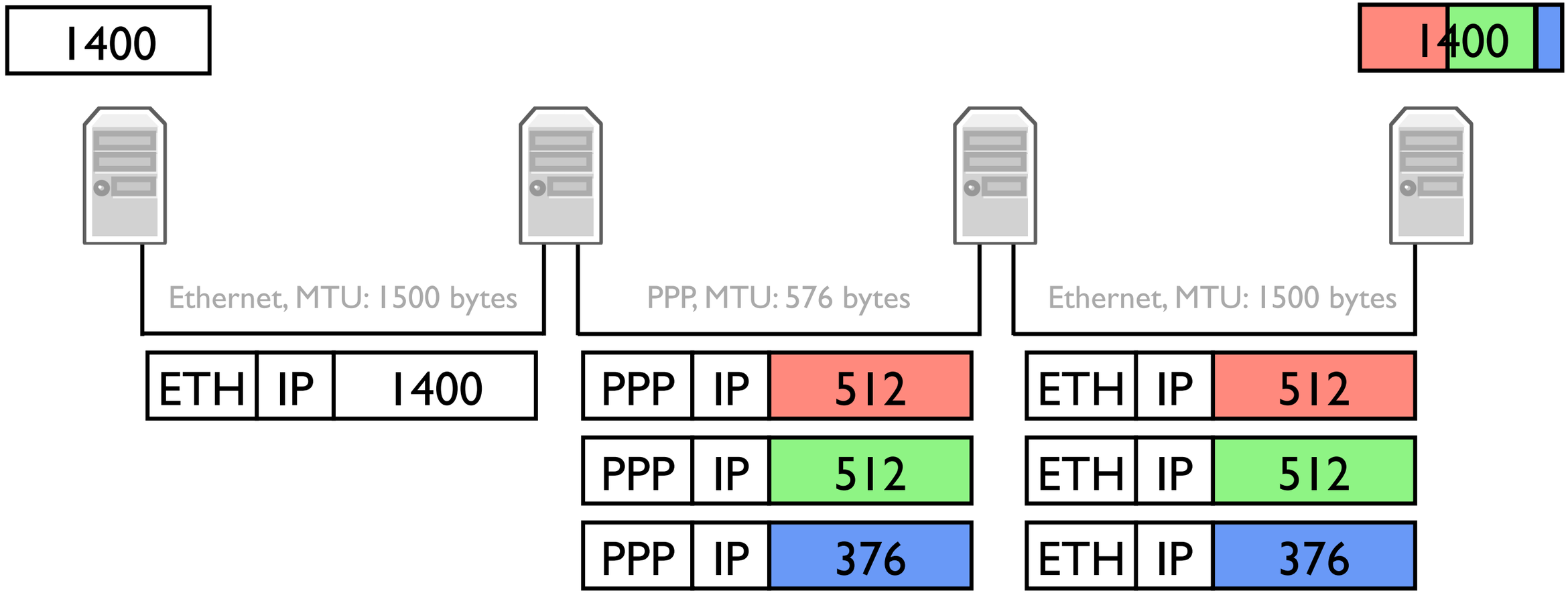
Fragmentation Example: IP



Fragmentation Example: IP

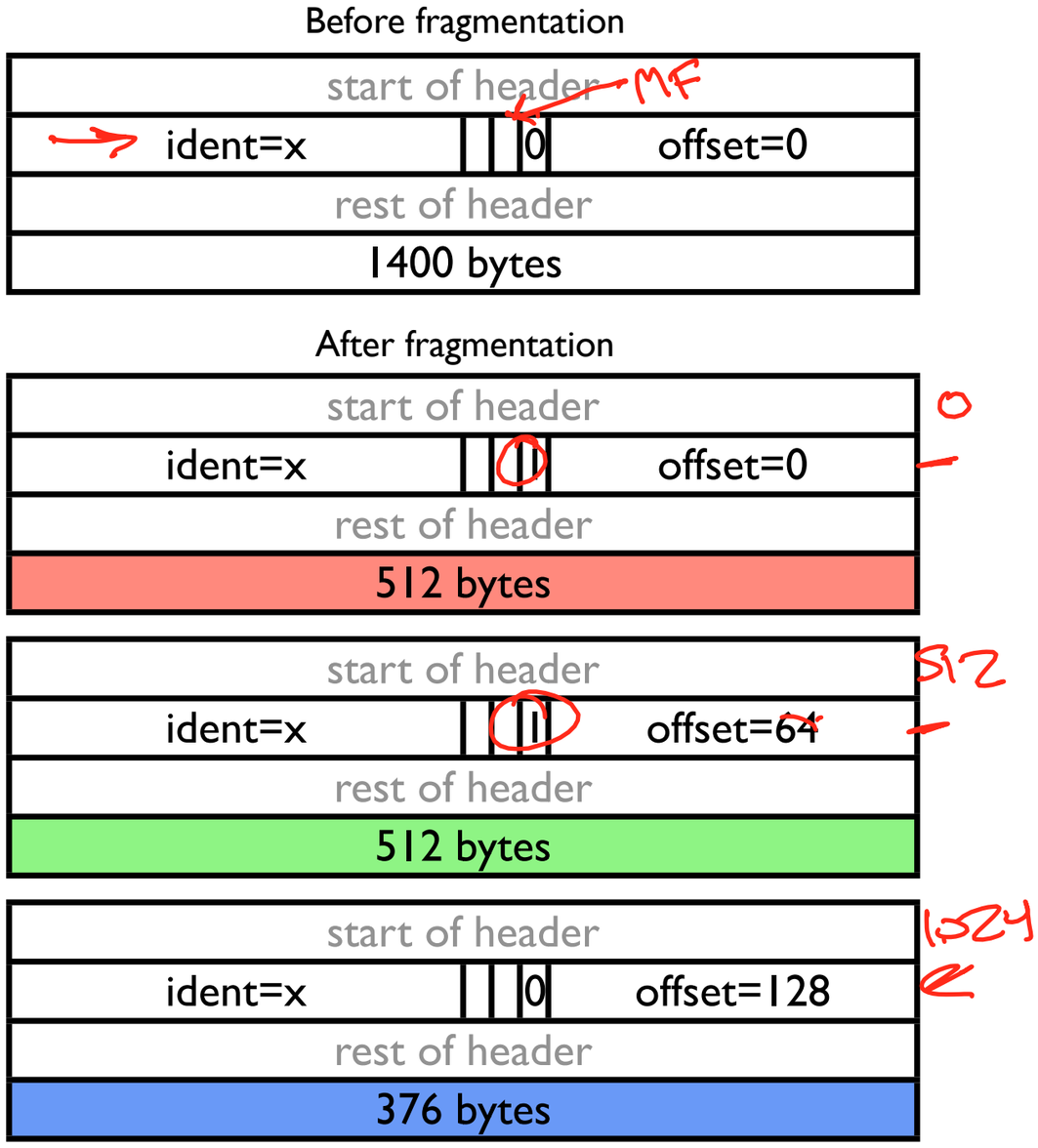


Fragmentation Example: IP



IP Fragmentation

- IP addresses plus ident field identify fragments of a packet
- MF bit is 1 in all but last fragment
- Offset field says location of fragment (in 8 byte chunks)
  - All fragments except last one must be multiple of 8 bytes long



Fragmentation Example: TCP

- General rule: avoid IP fragmentation when you can
- TCP can choose a segment size to avoid fragmentation
- Use DF (don't fragment bit), see if you receive an ICMP error
  - Can binary search for right size (expensive)
  - Try common sizes, such as Ethernet (better)
  - See RFC 1191 for details