Congestion

- ***Total offered load exceeds what network can handle.***
- ***Congestion collapse****:*
  - *When congestion occurs, packets get dropped.*
  - *Due to packet loss, packets get retransmitted.*
  - *Congestion gets worse and worse!*
    - *“Snow ball” effect.*

Congestion Control

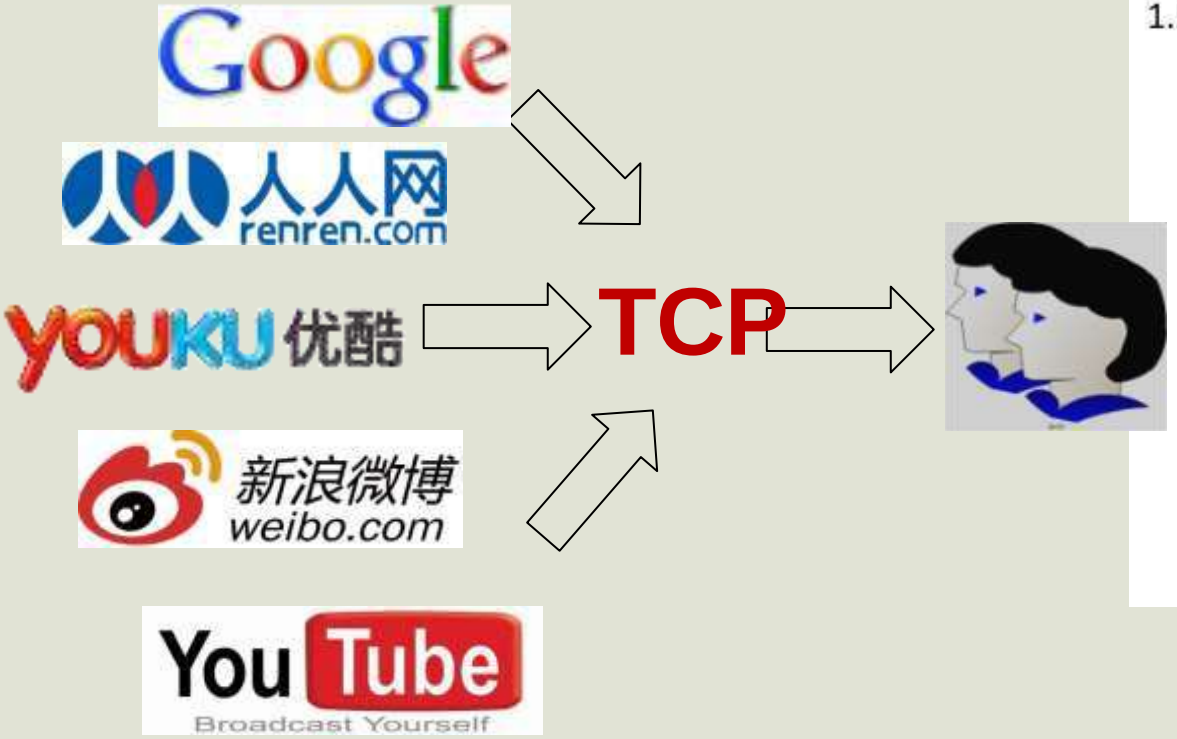
- Why do it at the transport layer?
  - Real fix to congestion is to slow down sender.
- How to?
  - Use law of “conservation of packets”.
  - Keep number of packets in the network constant.
  - Don’t inject new packet until old one leaves.
- What is the congestion indicator?
  - packet loss.

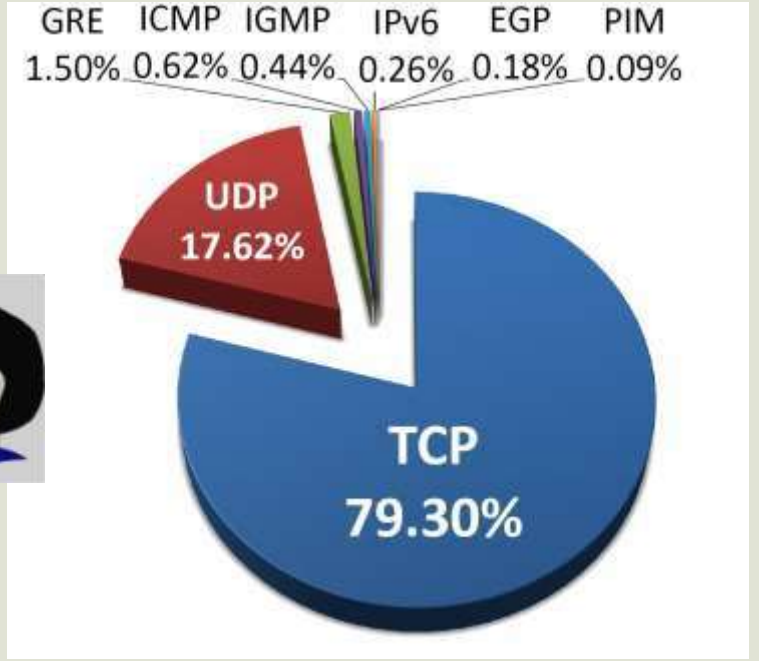
Congestion Control

- *Interprets packet loss as an indicator of congestion*
  - *When it senses packet loss, it slows down the rate of packet transmission*
  - *When packets are received correctly, sends packets faster*
    - *Still within the limits of the sliding window*

TCP Congestion Control

- TCP协议的重要性
  - **互联网中近80%的数据流量由TCP协议进行传输**





互联网流量协议分析

TCP Congestion Window

- Data already sent and acknowledged
- Data already sent but not yet acknowledged
- Data permitted to send
- Data not permitted to send

TCP Congestion Control

- 确保各流享用带宽的公平性。
- 动态发现当前可利用的带宽。
- 拥塞避免及控制机制以避免拥塞崩溃（congestion collapse）的发生。

TCP Congestion Control

- 3 phases
  - Slow-start
    - Probing for initial congestion level.
  - Congestion Avoidance
    - Additive Increase, Multiplicative Decrease
  - Fast Retransmission/Recovery
    - Optimizations

Slow-Start

- 当建立新的TCP连接时，拥塞窗口（congestion window，cwnd）初始化为一个数据包大小。
- 源端按cwnd大小发送数据，每收到一个ACK确认，cwnd就增加一个数据包发送量
- cwnd就将随着回路响应时间（Round Trip Time，RTT）呈指数增长，源端向网络发送的数据量将急剧增加。

以上内容仅为本文档的试下载部分，为可阅读页数的一半内容。如要下载或阅读全文，请访问：https://d.book118.com/246054124054010101