Week 8: Transport Layer Contd

Interne P90007

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What happens when congested?

- Congestion results when too much traffic is offered; performance degrades due to loss/retransmissions
- Goodput (=useful packets) trials offered load

Congestion Control vs Flow Control

- Flow control is an issue for point to point traffic, primarily concerned with preventing sender transmitting data faster than receiver can receive

- Congestion control is a ffecting the ability of the subnet to arry the available traffic, in a global context

Load Shedding

- When congestion control mechanisms fail, load shedding is the key remaining possibility - **drop packets**

- In order to ameliorate i plications can mark certain **packets as priority** to avoid discard policy

What is the key problem if network is not delivering properly:

- Quality of Service becomes low
- **Expected network performance** is an important cr

nge of network ap

- Some **engineering tec** **are available to guarantee QoS** (Quality of Service)

- 4 things to watch out for:

  bandwidth, reliability, delay, jitter

Jitter is Interesting/New for Us

- Jitter is the **variation in packet arrival times**
  - a) high jitter
  - b) low jitter

Mechanisms for Jitter Control

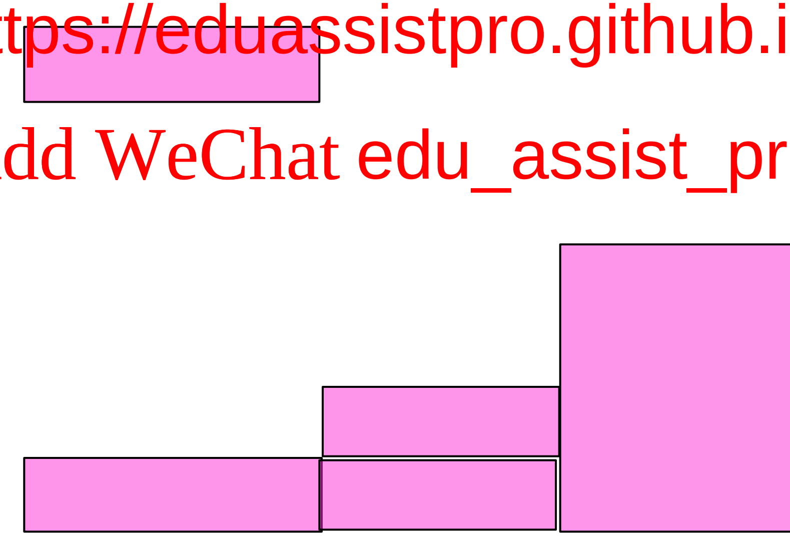
- Jitter is an issue for some applications
- Jitter can be contained by **determining the expected transit time** of a packet

- Packets ca **ch hop in order to mi** er packets sent first, faster packet queue
- For certain applications jitter control is extremely important as it mainly directly affects the **quality perceived by the application user**

QoS Requirements

- Different applications care about different properties
  - We want all applications to get what they need

“High” means demanding the requirement!



Techniques for Achieving QoS

- **Over-provisioning**
  - more than adequate buffer, router CPU, and bandwidth (expensive and not scalable ...)

- **Buffering**
  - buffer received ases delay, but smoothes out j bandwidth

- **Traffic Shaping**

  - regulate the average rate of tran burstiness of transmission
  - **leaky bucket**
  - **token bucket**

Leaky Bucket

Large **<u>bursts</u>** of traffic is buffered and smoothed while sending

e.g. can be done at host sending data

Techniques for Good QoS Contd

- **Resource reservation**
  - reserve bandwidth, buffer space, CPU in advance
- **Admission control**
  - routers can de whether to accept new flows, or r
- **Proportional routing**
  - traffic for same destination split le routes
- **Packet scheduling**
  - Create queue(s) based on priority etc
  - fair queuing, weighted fair queueing

TCP and Congestion Control

- When networks are overloaded, congestion occurs, potentially affecting all layers
- Although lo d network) attempt to a on, in reality **<u>TCP impacts congest</u>** **<u>significantly</u>** because rs best methods to reduce the data rate, and hence reduce congestion itself

Congestion Control: Design

- Two different problems exist
  - network capacity and receiver capacity
  - these should be dealt with separately, but compatibly
- The sender s actually
  - Window described by the r
  - Congestion window
- Each regulates the number of bytes the sender can transmit – the maximum transmission rate is the **minimum of the two windows**

TCP and Congestion Control Contd

- TCP adopts a defensive stance:
  - At connection establishment, a **suitable window size is chosen by the receiver based on its buffer** size
  - If the sender is constrain ize, then **congestion problems will not occur due to buffer overflow** at the receiver itself, but may still **occur due to congestion within the network**

Incremental Congestion Control: Slow Start

- On connection establishment, the **sender initializes the congestion window to a size**, and transmits one segment
- If this segment is acknowledged before the timer expires, **the sender ad** **worth of bytes to the congestio** is two segments
- As **each new segment is ac** **d**, the congestion window is increas **more segment**
- In effect, each set of acknowledgements doubles the congestion window - which **grows until either a timeout occurs or the receiver's specified window is reached**

Ack Clock

Assignment Project Exam Help

https://eduassistpro.github.io/

Add WeChat edu_assist_pro

Slow Start (badly named…)

Additive increase

Internet Congestion Control

Slow start followed by additive increase (TCP Tahoe)
  Threshold is half of previous

Internet Congestion Control Contd

Another one with TCP Reno

Congestion Control And Wireless

- Much harder to deal with
  - Things are increasingly wireless

  - Not everything is wireless, but parts of a path
  - So how do ireless is

  - More variety on wireless ell

  - SNR varies when people
  - Delay is different if it is Wifi vs Satellite
  - This is a hot area of research…

TCP Timer

- A key worry is when timers go out
- Too early means too many resends

- Too late me s with more additional c

- Solutions rely on dyna etwork conditions change
- One needs to measure network performance and adapt timers