Glossary

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2018/10/14

Following are some commonly used terms in the context of Networking.

1 Lecture 2

internet: Any network of interconnected networks.

Internet: Global system of interconnected networks that we use in our day-to-day lives. (examples of the networks that the Internet interconnects are: wifi, ethernet, satellite networks, high-capacity private networks).

Gateways: Another term for routers. The original designers of the internet hoped to connect current and future networks together through the use of gateways.

End-To-End Principle: The idea that for the most part, functionality (besides forwarding data) should be kept on the hosts and not within the network. This was so that the baseline to have a network connect to the internet be kept to a low.

Link-by-Link / Hop-by-Hop Reliability: The idea that each router in a network should reliably forward data to the next router on the path through the acknowledgement receipt of forwarded data.

5 Layers of the Internet:

1. **Application Layer:** Accommodates any application as long as they send and receive data using a uniform interface to the transport layer (e.g. Socket API)
2. **Transport Layer:** Only worries about end-to-end delivery, without caring about how data is transported between beginning and end host.
3. **Routing Layer:** Only focused on Link-by-Link reliability in a global context, such as how data is transmitted from a router in NYC to a router in California
4. **Link Layer:** Only focused on Link-by-Link reliability in a local context, such as how data can be transmitted from Wifi to users laptop
5. **Physical Layer:** Focused on physical encoding, such as voltages on a wire.

Packet Switching: Split data to be sent into multiple packets, each containing a designated header specifying the destination of the package and send data packet at a time.

Circuit Switching: Establishing a network channel before communication between sender and receiver.

Throughput: Amount of data transmitted or receiver per unit time.
Latency: Time between packet is sent at a sender, and received by a receiver.

Transmission Delay: Delay required to transmit a packet of a finite size on a link that can only carry a finite number of bits per second . (Packet size / links capacity)

Propagation Delay: Minimum amount of time required to get information from one point to another. (Distance / speed of light)

Application Delay: Difference of time between when application makes decision to send data, and applications host transmits data via network.

Queuing Delay: Time spent by packet in queue.

Retransmission Delay: Time it takes to retransmit lost packets for protocol that requires in order delivery.

2 Lecture 3

IP Address: address that identifies a host or router on the internet.

Network Address Translator (NAT): Maps one or more private IP Addresses to a single public IP Address for the purpose of communicating with the outside world.

Internet Assigned Number Authority (IANA): Nonprofit, private corporation that assigns public IP addresses.

DNS: Hierarchy of Servers that mirrors the hierarchy found in domain names themselves. (Broken in to the hierarchy of Root Servers, TLD Servers, Authoritative Servers (Facebook, Google)).

Internet Corporation for Assigned Names and Numbers (ICANN): Organization that has the task of creating new top-level domains. They decide who operates the root server, who controls the allocation of domain names in each TLD (known as registries).

3 Lecture 4

TCP (Transmission Control Protocol): Internet protocol that requires reliable, in-order, and error-free delivery of packets.

UDP (User Datagram Protocol): Internet protocol that is low latent but can be an unreliable due to no handshaking.

Reliability Problem: The receiver needs to receive packets in the same order that was sent by the sender regardless of the reordering, duplicating, delaying, or dropping of packets.

Stop and Wait Protocol: A protocol of sending packets where the receiver acknowledges the receiving of a packet from the sender by sending an acknowledgement to the sender (the receiver also maintains a mechanism to ensure in-order deliverability).

ACKs: Another term for acknowledgement

Retransmission Timers: When sender sends a packet to the receiver, it sets a timer to some value and if it hasnt received an acknowledgement from the receiver within that time, it re-sends the packet.

Round Trip Time(RTT): The total time it takes for a packet to be sent from a sender to a receiver and then for an acknowledgement from the receiver to be received by the sender. RTT excludes queuing delays, and is therefore the minimum time it takes for a packet to be sent and received.

4 Lecture 5

Network Utilization: Ratio of throughput to the capacity of the underlying network.

Network's Capacity (C): The maximum rate that data can be transferred over a given network or link.

Window (W) : Packets that are in air and have not been acknowledged by the receiver.

Sliding Window Protocol: Sender sends a set of packets (W) and waits until an acknowledgement for the first packet to then send the next. (more about this in notes)

Packet Conservation Principle: The packet conservation principle says that for a connection to be in equilibrium and for a packet flow to be conservative, a new packet isn't put into the network until an old packet leaves. [1].

5 Lecture 6

Bandwidth Delay Product (BDP): C * RTT, meaning it is the maximum amount of data that can be sent in the shortest time between the sender and receiver (round trip).

Flow: Data transfer between sender and receiver.

Congestion Collapse: Situation where the offered load or the demand for a networks services is increasing, but the overall utility of the network to its users is decreasing.

Utility Function: Quantitatively measures how the flow values high throughput and low latency.

6 Lecture 7

Additive Increase Multiple Increase Algorithm (AIMD): Allows a sliding window sender to adaptively find a window size equal to BDP of network. Composed of Slow Start and Congestion Avoidance.

Slow Start: Allows a sliding window sender to discover the right value of the window size starting from an extremely conservative initial window.

Congestion Avoidance: Allows sliding window sender to remain close to the right value as other senders arrive and depart from network.

Congestion Signal: A sign that something is going wrong in the network and that a corrective action needs to be taken.

7 References

[1]: http://zoo.cs.yale.edu/classes/cs633/Reviews/Jac88.hq9.html