CS3200: Computer Networks

Lecture 21

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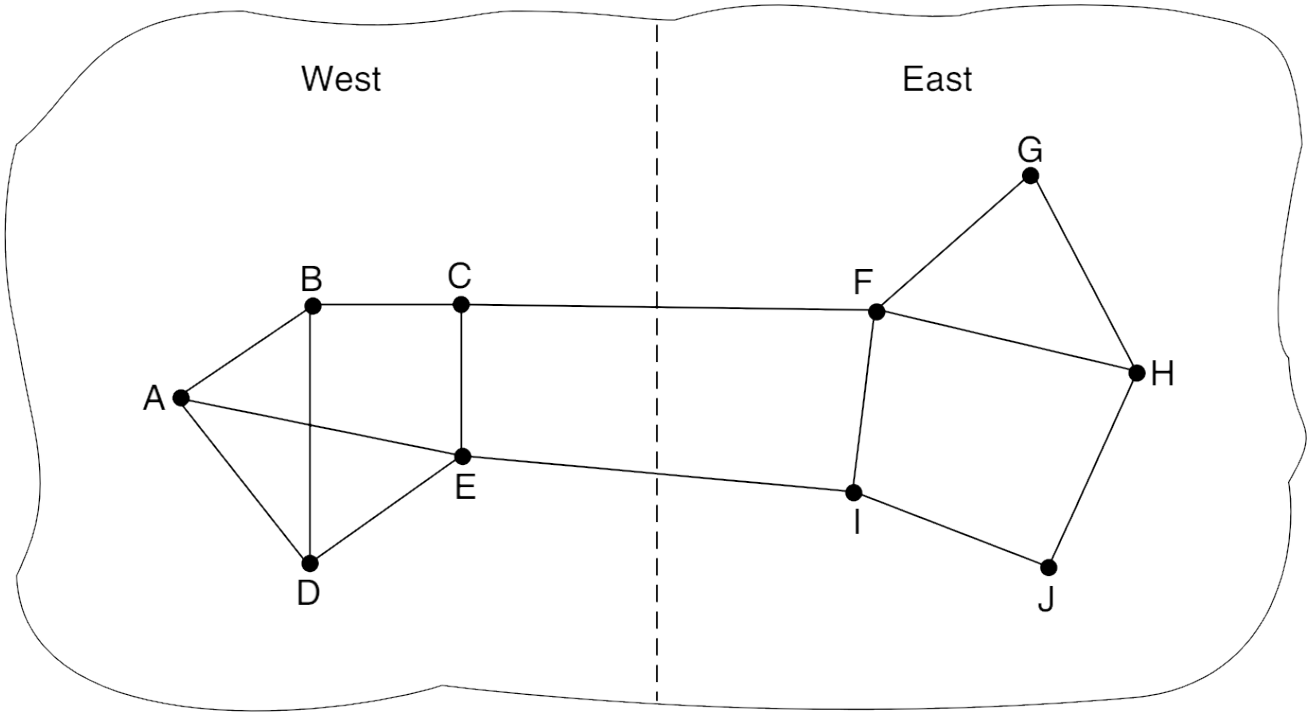
Perils of Traffic-aware Routing

The most direct way to do this is to set the link weight to be a function of the (fixed) link bandwidth and propagation delay plus the (variable) measured load or average queuing delay. Least-weight paths will then favor paths that are more lightly loaded, all else being equal.



Disadv: Oscillation

Traffic Throttling

- Senders adjust their transmissions to send as much traffic as the network can readily deliver.
- Networks aims to operate just before the onset of congestion.
- When congestion is imminent, it must tell the senders to throttle back their transmissions and slow down. This is knows as **congestion avoidance**.

like disable network layer.

- Queueing delay inside routers is a good indication of congestion, and should be low most of time, but will jump when there is a burst of traffic that generates a backlog. To maintain a good estimate of the queueing delay, d, a sample of the instantaneous queue length, s, can be made periodically and d updated according to

$$d_{new} = \alpha d_{old} + (1 - \alpha)s$$

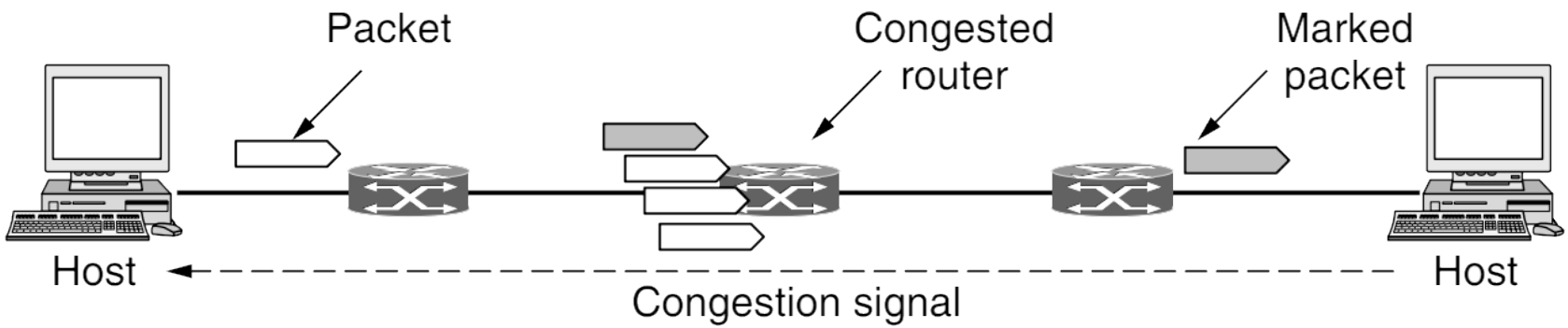
this helps in smoothening the fluctuations.

Explicit Congestion Notification

- A router can tag any packet it forwards (by setting a bit in the packet's header) to signal that it is experiencing congestion.
- When the network delivers the packet, the destination can note that there is congestion and inform the sender when it sends a reply packet.

Aliter: router selects a congested packet and sends a choke packet back to the source host, giving it the destination found in the pac

- The sender can then throttle its transmissions.



Load Shedding

- **Load shedding** is a fancy way of saying that when routers are being inundated by packets that they cannot handle, they just throw them away.

because other side is maintaining a buffer for it.

- Which packet to drop? For a file transfer, an old packet is worth more than a new one. For real-time media, a new packet is worth more than an old one.

- More intelligent load shedding requires cooperation from the senders. E.g., packets carrying routing information, algorithms for compressing video.

- To implement an intelligent discard policy, applications must mark their packets to indicate to the network how important they are.

Quality of Service (QoS)

- There are applications (and customers) that demand stronger performance guarantees from the network than "the best that could be done under the circumstances."
- An easy solution to provide good quality of service is to build a network with enough capacity for whatever traffic will be thrown at it. The name for this solution is **overprovisioning**.
- This solution is an expensive one.
- Quality of service mechanisms let a network with less capacity meet application requirements just as well at a lower cost.

QoS of Some Applications

Application	**Bandwidth**	**Delay**	**Jitter**	**Loss**
Email	Low	Low	Low	Medium
File sharing	High	Low	Low	Medium
Web access	Medium	Medium	Low	Medium
Remote login	Low	Medium	Medium	Medium
Audio on demand	Low	Low	High	Low
Video on demand	High	Low	High	Low
Telephony	Low	High	High	Low
Videoconferencing	High	High	High	Low

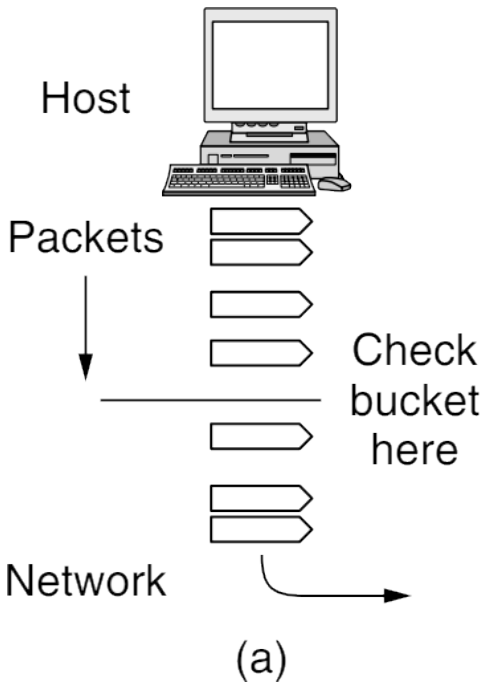
The variation (i.e., standard deviation) in the delay or packet arriva

Traffic Shaping

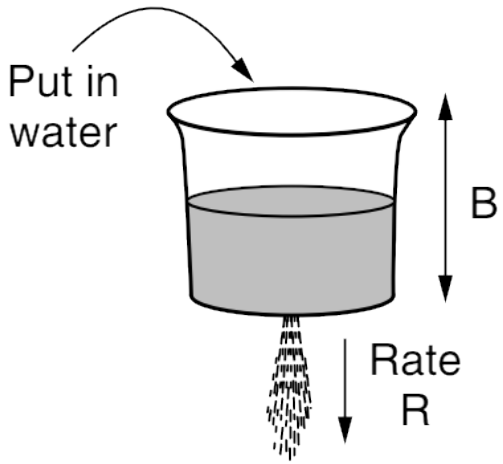
- Before the network can make QoS guarantees, it must know what traffic is being guaranteed.
- Traffic in data networks is bursty. It typically arrives at nonuniform rates.
- Bursts of traffic are more difficult to handle than constant-rate traffic because they can fill buffers and cause packets to be lost.
- **Traffic shaping** is a technique for regulating the average rate and burstiness of a flow of data that enters the network.
- Packets in excess of the agreed pattern might be dropped by the network, or they might be marked as having lower priority. Monitoring a traffic flow is called **traffic policing**.

because of traffic policing we get our limited mbps.

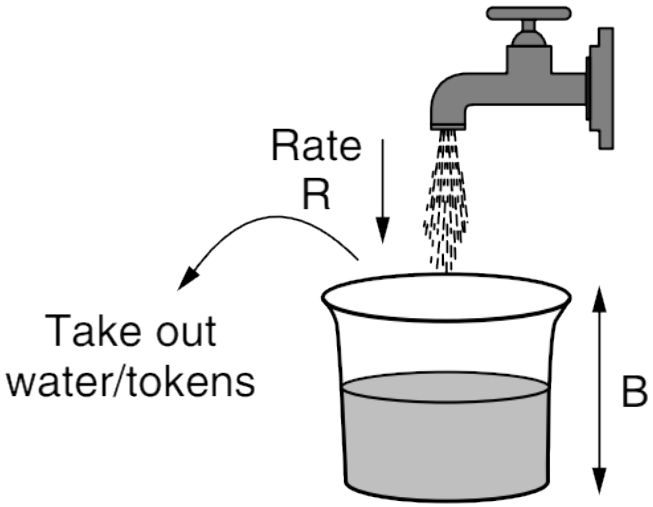
Leaky and Token Buckets



(a)



(b)



(c)

An Illustration of Token Bucket

125 * 8 = 1000, 125 * 2^10 * 125 * 10^{-3} = 16000.R denotes that for bu

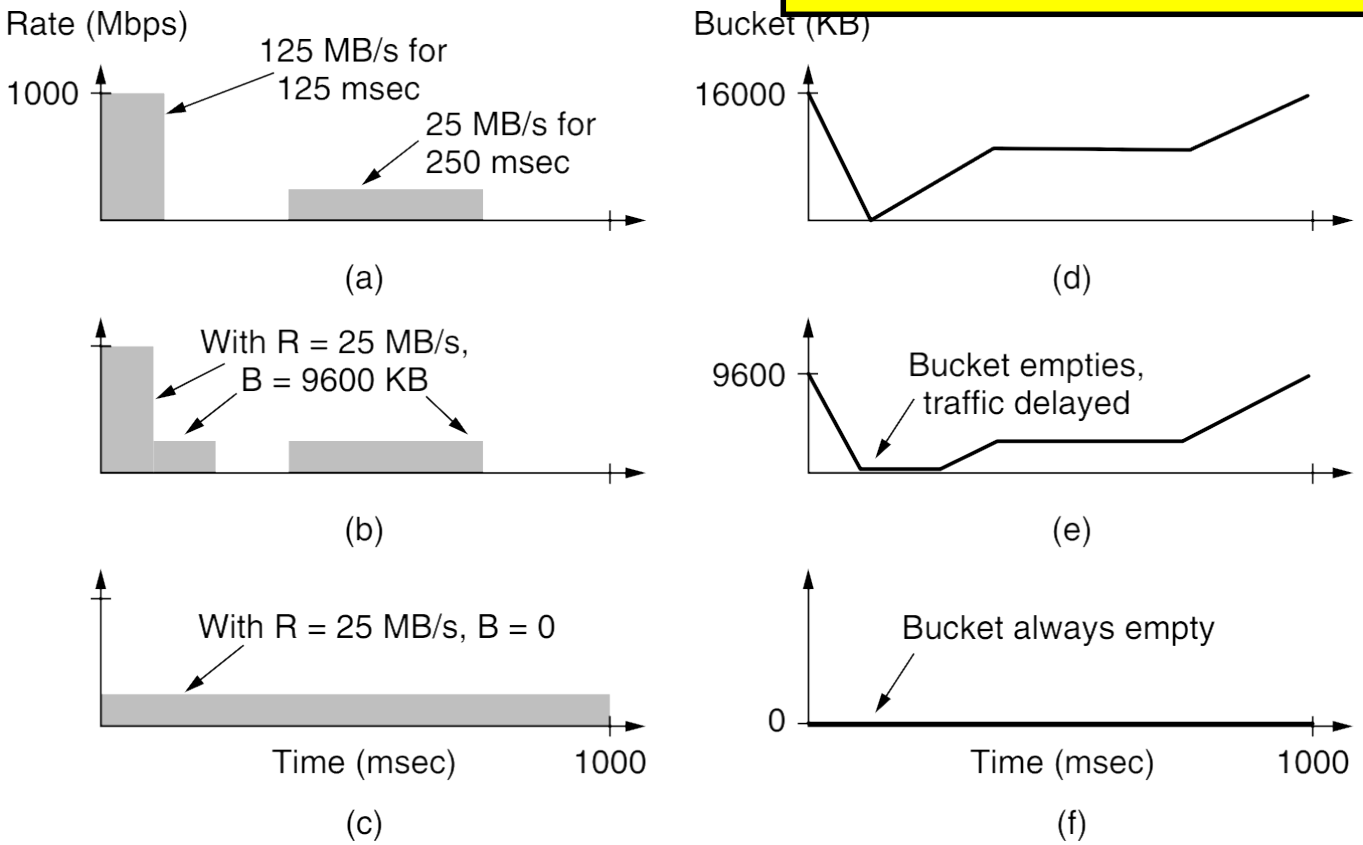


Figure: (a) Traffic from a host. Output shaped by a token bucket of rate 200 Mbps and capacity (b) 9600 KB and (c) 0 KB. Token bucket level for shaping with rate 200 Mbps and capacity (d) 16,000 KB, (e) 9600 KB, and (f) 0 KB.