6.033 Spring 2015
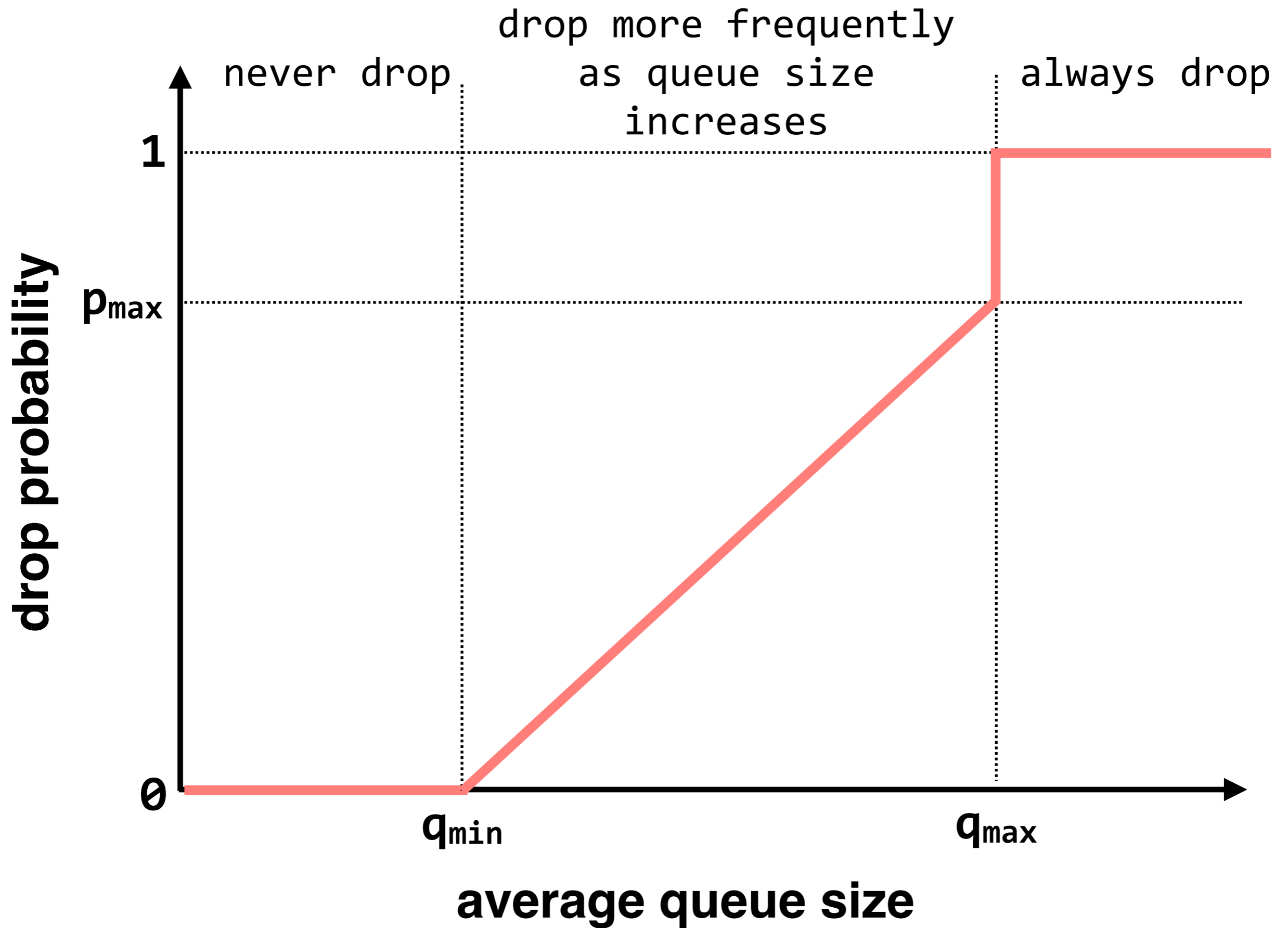## Lecture #12

- **In-network resource management**
  - **Queue management schemes**
  - **Traffic differentiation**

Katrina LaCurts | lacurts@mit | 6.033 2015

last time: TCP congestion control

Katrina LaCurts | lacurts@mit | 6.033 2015

possible problem: TCP reacts to drops, and packets aren't dropped until queues are full

Katrina LaCurts | lacurts@mit | 6.033 2015

possible solution: drop packets before queues are full

never drop

drop more frequently as queue size increases

always drop

drop probability

1

p_{max}

0

q_{min}

q_{max}

average queue size

are RED and ECN better than DropTail?

what if we want to give latency guarantees to certain types of traffic?

(or at least try to prioritize latency-sensitive traffic)

what if we want to allocate different amounts of bandwidth to different types of traffic?

1. round-robin

provides no mechanism to weight traffic differently, and can't handle variable packet sizes

2. weighted round-robin

can set weights and deal with variable packet sizes

Weighted Round Robin

```
in each round:

  for each queue q:
    q.norm = q.weight / q.mean_packet_size

  min = min of q.norm's over all flows

  for each queue q:
    q.n_packets = q.norm / min

  send q.n_packets from queue q
```

1. round-robin

provides no mechanism to weight traffic differently, and can't handle variable packet sizes

2. weighted round-robin

can set weights and deal with variable packet sizes, but needs to know mean packet sizes

3. deficit round-robin

Deficit Round Robin

```
in each round:
  for each queue q:
    q.credit += q.quantum
    while q.credit > size of next packet p:
      q.credit -= size of p
      send p
```

1. round-robin

provides no mechanism to weight traffic differently, and can't handle variable packet sizes

2. weighted round-robin

can set weights and deal with variable packet sizes, but needs to know mean packet sizes

3. deficit round-robin

doesn't need mean packet sizes. near-perfect fairness and low packet processing overhead

traffic differentiation: a good idea?

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- **Queue management schemes**
  Active queue management schemes, such as **RED** or **ECN**, drop or mark packets before a queue is full, in hopes of getting TCP senders to react earlier to congestion. They are difficult to get to work on the Internet-at-large, but the ideas can be useful in other types of networks.

- **Traffic differentiation**
  Traffic differentiation requires a scheduling discipline, such as **weighted round robin** or **deficit round robin**. The goal of these schemes is to give weighted fairness in the face of variable packet sizes while having low processing overhead

- Both of these are examples of **in-network resource management**