Week 10 Discussion
FAQ

• Q: When and where is the final exam?
• A: 8 am, 11/12 on Wednesday. Center Hall 113.

• Q: Are we allowed to bring cheat sheets?
• A: Yes, one 8.5x11 doubled sided cheat sheet is allowed.

• Q: What will be covered in the final exam?
• A: Everything in lecture slides and assigned readings.
FAQ

• Q: Will there be a final review session?
  • A: Yes, during the last lecture on Friday.

• Q: Will there be any TA office hours in the final week?
  • A: Yes, we will update the schedule on piazza soon.

• Q: Do we have practice finals?
  • A: Yes, we will post practice finals later this week.
Aloha Protocol

Goal: distributed access control over a shared broadcast channel

Fact: only one transmission at a time is allowed in shared broadcast channel

Algorithm:
If a node has data to send:
    try to send the data
while failed:
    delay for some random time interval
    resend the data
Suppose there are two nodes A and B in a channel. All frames transmitted by A and B have identical length $L$, and take the same amount of time $T$ to transmit from one node to the other.

a. If node A starts to transmit a frame $F_1$ at time $t_1 = 0$, and node B starts to transmit a frame $F_2$ at time $t_2 = 0.5T$. Which transmission(s) will be successful?

b. If node A wants to successfully transmit a frame $F_1$ starting from $t_1 = T$, give a time range that node B cannot start to transmit any frames.
Slotted Aloha

(1) Time is divided into equal size slots
(2) Time slots should be synchronized across all nodes in the channel
(3) Each node can transmit only at the beginning of a time slot.
(4) Retransmissions occur at the nearest next slot
Slotted Aloha

- Suppose there are $n$ nodes in a channel, and each node has a transmission probability $p$.

- The probability that node $n_1$ successfully transmits data in its first try is:
  $$S(n_1 \text{ success}) = p \cdot (1-p)^{(n-1)}$$

- The probability that there exists one node (among $n$ nodes) that successfully transmits data in the first try is:
  $$S(\text{any one node in } n \text{ success}) = np(1-p)^{(n-1)}$$
Slotted Aloha Example

Suppose two stations A and B use the slotted Aloha protocol to send frames in the same channel. For each time slot of T ms, station A and B have transmission probability $P_a$ and $P_b$, respectively. Assume station A and B have infinite number of frames to transmit, and at $t = 0$, station A sends a frame $F_a$ and simultaneously station B sends a frame $F_b$; both $F_a$ and $F_b$ have size less than maximum transmission unit (MTU).

a. What is the probability that station A successfully transmits $F_a$ at $t = 0$?

b. What is the probability that station A successfully transmits $F_a$ at $t = T$?

c. What is the probability that station A successfully transmits $F_a$ at $t = 2T$?
Slotted Aloha Example

Suppose two stations A and B use the slotted Aloha protocol to send frames in the same channel. For each time slot of T ms, station A and B have transmission probability $P_a$ and $P_b$, respectively. Assume station A and B have infinite number of frames to transmit, and at $t = 0$, station A sends a frame $F_a$ and simultaneously station B sends a frame $F_b$; both $F_a$ and $F_b$ have size less than maximum transmission unit (MTU).

Now suppose $P_a = 2P_b$, and at $t = T$, the probability of either $F_a$ or $F_b$ is successfully transmitted is 0.56. What is the value of $P_a$?
Border Gateway Protocol (BGP)

True or False

a. One vulnerability of BGP is that packets might be lost during transmission.

b. BPG routing decisions are made based on shortest AS path (number of hops).

c. Routers running BPG should frequently exchange keepalive messages with each other.

d. Internal BGP (iBGP) is established between routers that are adjacent, but within the same Autonomous System.
Interior Border Gateway Protocol (iBGP)

BGP table for the AS

<table>
<thead>
<tr>
<th>Prefix</th>
<th>BGP Next Hop</th>
</tr>
</thead>
<tbody>
<tr>
<td>190.160 /16</td>
<td>A</td>
</tr>
<tr>
<td>150.200 /16</td>
<td>E</td>
</tr>
</tbody>
</table>

IPG table for router C

<table>
<thead>
<tr>
<th>Router</th>
<th>IGP Path</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>B</td>
</tr>
<tr>
<td>B</td>
<td>B</td>
</tr>
<tr>
<td>D</td>
<td>D</td>
</tr>
<tr>
<td>E</td>
<td>D</td>
</tr>
</tbody>
</table>
Interior Border Gateway Protocol (iBGP)

Combined table for router C

<table>
<thead>
<tr>
<th>Prefix</th>
<th>IGP Path</th>
</tr>
</thead>
<tbody>
<tr>
<td>190.160 /16</td>
<td>B</td>
</tr>
<tr>
<td>150.200 /16</td>
<td>D</td>
</tr>
</tbody>
</table>
Questions?